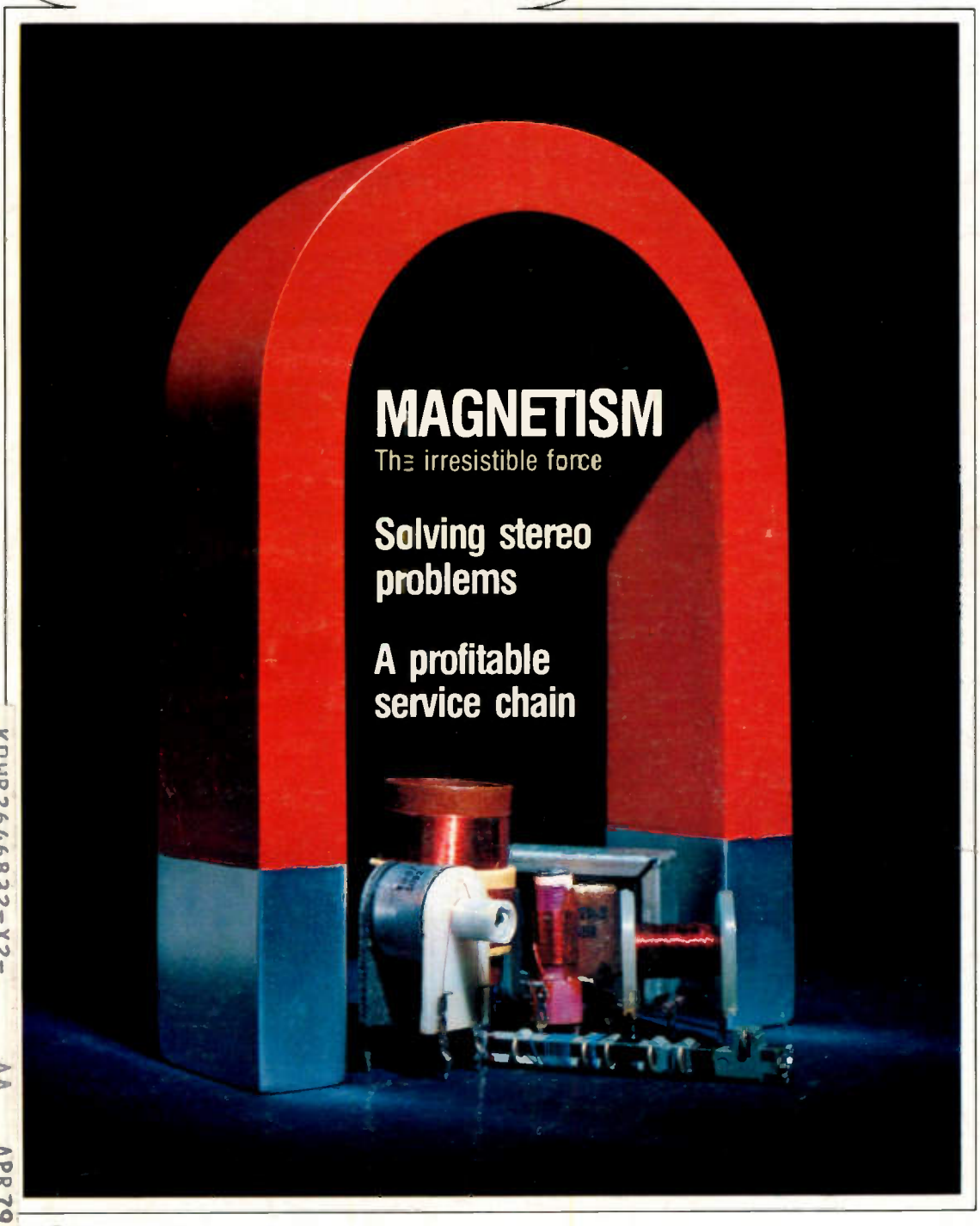
ET/D

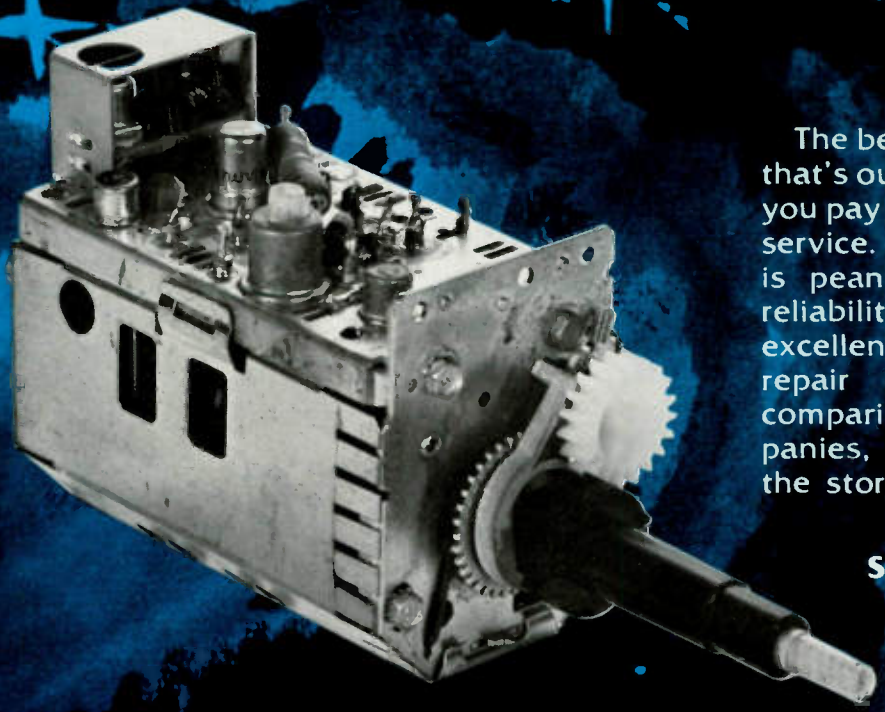
MAY 1978 • $1.00

ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS



A HARCOURT BRACE JOVANOVICH PUBLICATION

The Best of Everything Has It's Price... Even Tuner Service!



The best tuner repair service . . . that's our goal. You get only what you pay for even with tuner repair service. The price you pay at PTS is peanuts when you consider reliability and the standards of excellence we apply to every repair order. When you are comparing tuner service companies, price alone doesn't tell the story.

SAME DAY SERVICE

ORIGINAL OR SUPERIOR PARTS

ONE YEAR LIMITED WARRANTY

We Repair Them **All** . . . Any Make Or Model . . . Color, Black & White, Tube, Transistor or Electronic/Varactor!

PTS®

PTS ELECTRONICS, INC.

THERE'S A PTS SERVICENTER IN MOST MAJOR METROPOLITAN AREAS.
CHECK THE LIST AT THE RIGHT FOR THE ONE NEAREST YOU!

Circle No. 102 on Reader Inquiry Card

INDUSTRY REPORT

Zenith Eliminates Vertical and Horizontal Hold Controls in Late Model J-Line Chassis

Newly designed vertical and horizontal sweep sections with phase locked looped synchronization, a new high voltage arrangement, and elimination of horizontal and vertical hold controls are the new features in Zenith's late model J-Line receivers.

According to Zenith's service division, a new master scan oscillator operating at 32 times the horizontal frequency (503KHz) is beat down to the proper operating frequencies in the vertical and horizontal sections and is controlled by external phase-locked loop circuitry.

Advantages of the system, Zenith said, are better performance and greater picture stability through reduction of co-channel or adjacent channel interference, airplane flutter and ghosts.

In addition, Zenith reports, the horizontal and vertical hold controls are eliminated, although a factory adjusted horizontal oscillator will perform the horizontal hold control function.

Also new, Zenith said, is the horizontal output transformer—and, in the late model J-Lines, a revamped high voltage tripler section.

In the new circuit arrangement, three tertiary coils and their associated diodes successively amplify and rectify 10, 20 and 30KV spikes. The inductances of the tertiary coils and their distributed capacitance are important factors in developing the 30KV high voltage. The advantage of this system, Zenith said, is the elimination of capacitors in the high voltage system.

Electron Tube Market Tightening

On a worldwide basis the electron tube market should remain strong for the next five years. Additionally, while tube prices will escalate at the rate of 5 to 7 per cent each year, significant shortages now being experienced will continue.

At least that's the opinion of one world wide distributor-importer, Robert P. Grossman, president of Electron Tubes International. ETI is now introducing a new "Pro/Comm" line of electron tubes.

Grossman, who maintains an inventory of some 4 million (mostly imported) tubes at his Farmingdale, N.Y., headquarters and at other plant locations, said although certain facilities will maintain an inventory of some 500 tube types, "basically we should look at the top 200 types (in popularity) ... these types must be made available to the industry." Essentially, these types will cover some 3,000 consumer and industrial replacement applications, he said.

A fairly accurate feel for the tube business may be garnered simply by looking at some basic industry figures. According to Grossman, 15 years ago some 15 major electron tube manufacturers were in the business. Today there are "less than" half that number. "During this period, sales of electron tubes in the U.S. for the OEM and replacement market totaled over 300 million a year ... currently ... there are less than 100 million sold," he said.

However, some basic trends tending to indicate a strong tube market dollar-wise during the next five to six years are the advent of video display games in the U.S. and the tendency of residents of comparatively underdeveloped countries to retain older home entertainment electronic devices such as television sets and tube type stereos.

Regarding video games, Grossman said he has discovered a tendency on the part of the viewing public to retain older type black and white television receivers, many of them tube types, for use with such video games.

Moreover, he said, "there are hundreds of millions of tube sockets in equipment manufactured over the past 10 to 15 years in sophisticated products such as hybrid color TV, tuners, scopes, instrument and test equipment ... these are expensive devices, and we shouldn't expect them to be scrapped for the sake of a tube replacement."

Tube quality and interchangability will increasingly become a more significant problem in the future as demand and supply, through the attrition of manufacturers, continue to decrease. This is one reason, Grossman said, why ETI plans to import only one high grade "industrial quality" product.

For instance, Grossman contends, the dual triodes—12AX7-12 AU7-12AT7—are generally listed as being interchangeable with the European made ECC83-ECC82-ECC81. These dual triodes were widely used in home entertainment and industrial applications. Yet the American made versions, Grossman said, were manufactured with a hairpin type heater as opposed to the coiled heaters in the European versions and subsequently produced higher hum and noise levels than the European versions.

Grossman, whose firm supplies OEM, distributor and supplement brands manufactured by American tube manufacturers, said with the Pro/Comm line the user will be assured of an industrial grade tube capable of a broader range on a type for type basis.

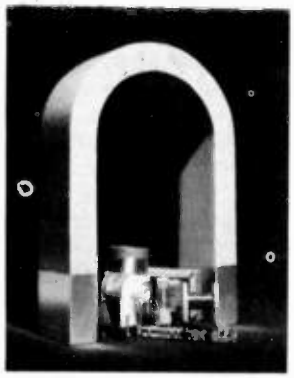
Summer CES Set for June 11-14

The sponsoring Electronic Industries Association says it expects some 800

ET/D

ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

MAY 1978, VOL. 100, NO. 5



On the cover: The first evidence many of us had of the forces of magnetism was gained from playing with an old 'horseshoe' magnet. Here—it is a symbol of magnetically-activated electronic components. (See 'Magnetism', page 20).

FEATURES

DEPARTMENTS

A HARCOURT BRACE JOVANOVICH PUBLICATION ABP ABC EIA

HARCOURT BRACE JOVANOVICH PUBLICATIONS. Robert L. Edgell, Chairman, Richard Moeller, President/Treasurer, Lars Fladmark, Senior Vice President, Joe Bilderbach, Vice President, James Gherna, Vice President, George Glenn, Vice President, Thomas Greney, Vice President, Ezra Pincus, Vice President, Harry Ramaley, Vice President, Lois Sanders, Vice President.

ELECTRONIC TECHNICIAN/DEALER is published monthly by Harcourt Brace Jovanovich Publications. Corporate offices: 757 Third Avenue, New York, New York 10017. Advertising offices: 757 Third Avenue, New York, New York 10017 and 43 East Ohio Street, Chicago, Illinois 60611. Editorial offices: 43 East Ohio Street, Chicago, Illinois 60611. Accounting, Advertising Production and Circulation offices: 1 East First Street, Duluth, Minnesota 55802. Subscription rates: one year, $9, two years, $15, three years, $19 in the United States and Canada. All other countries: one year, $20, two years, $35, three years, $45. Single copies: $1 in the United States and Canada; all other countries: $3. Second class postage paid at Duluth, Minnesota 55806 and at additional mailing offices.

POSTMASTER: Send Form 3579 to ELECTRONIC TECHNICIAN/DEALER, P.O. Box 6016, Duluth, MN 55806.

AVAILABLE NOW! ONLY $5.90

JAPANESE TRANSISTOR SUBSTITUTION MANUAL

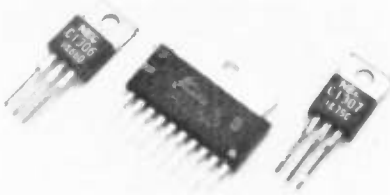
An invaluable Japanese to Japanese substitution guide for approximately 3000 transistors.

- Covers the 2SA, 2SB, 2SC, and 2SD series.
- Introduction includes a guide to understanding Japanese transistors.
- A 90-page, 8½" by 11", soft cover book.

MAY SPECIAL

ORDER NOW

LIMITED Q'TY



2SC1306	$1.90	REG $2.90
2SC1307	$2.90	REG $3.90
TA7205P	$1.90	REG $2.90

NO FURTHER DISCOUNT ON SPECIAL OFFER

Seeking Original Japanese Replacement Parts for CB, TV and Stereo Repair Use?

2SA

2SA 49	.59
2SA 52	.59
2SA 53	.59
2SA 70	1.10
2SA 101	.45
2SA 102	.59
2SA 234	.59
2SA 235	1.00
2SA 240	.90
2SA 329	.70
2SA 342	.90
2SA 353	.70
2SA 377	2.00
2SA 440	.90
2SA 473	.70
2SA 483	3.00
2SA 484	2.50
2SA 485	2.00
2SA 489	1.60
2SA 490	.90
2SA 493	.59
2SA 495	.45
2SA 496	1.10
2SA 497	1.60
2SA 505	1.20
2SA 509	.70
2SA 525	.70
2SA 530	1.30
2SA 537A	2.25
2SA 539	.59
2SA 545	.59
2SA 561	.59
2SA 562	.59
2SA 564A	.59
2SA 565	1.10
2SA 566	3.40
2SA 606	1.60
2SA 607	1.60
2SA 624	1.10
2SA 627	3.60
2SA 628	.59
2SA 634	.70
2SA 640	.59
2SA 643	.70
2SA 653	2.80
2SA 659	.59
2SA 661	.70
2SA 663	4.90
2SA 666	.70
2SA 672	.70
2SA 673	.70
2SA 678	.70
2SA 679 SUB 2SA 744	
2SA 680 SUB 2SA 744	
2SA 682	1.50
2SA 683	.70
2SA 684	.70
2SA 695	.70
2SA 697	.70
2SA 699A	.90
2SA 705	.70
2SA 706	1.60
2SA 715	1.40
2SA 719	.59
2SA 720	.59
2SA 721	.59
2SA 725	.59
2SA 726	.59
2SA 733	.59
2SA 738	.70
2SA 740	2.65
2SA 743A	1.60
2SA 744	4.90
2SA 745R	4.90
2SA 747	5.80
2SA 748	1.00
2SA 750	.59
2SA 755	1.60
2SA 756	3.70
2SA 758	5.80
2SA 764	4.40
2SA 774	.59
2SA 777	1.00
2SA 794A	1.00
2SA 798	.70
2SA 810	1.40
2SA 814	1.90
2SA 815	1.00
2SA 816	.70
2SA 818	1.30
2SA 839	2.15
2SA 841	.59
2SA 844	.59
2SA 847	.59
2SA 850	.59
2SA 872A	.59
2SA 885	.70
2SA 908	11.00
2SA 913	1.20

2SB

2SB 22	.59
2SB 54	.59
2SB 55	.59
2SB 75	.45
2SB 77	.45
2SB 173	.45
2SB 175	.45
2SB 176	.45
2SB 178	.70
2SB 186	.45
2SB 187	.45
2SB 202	1.60
2SB 220	.70
2SB 303	.59
2SB 324	.70
2SB 337	1.60
2SB 346	.70
2SB 367	1.50
2SB 368	2.15
2SB 379	1.10
2SB 381 SUB 2SB 415	
2SB 400	.59
2SB 405	.59
2SB 407	1.40
2SB 411 DISC BY MFR.	
2SB 415	.59
2SB 434	1.20
2SB 435	1.40
2SB 440	1.00
2SB 449	1.60
2SB 461	1.20
2SB 463	1.20
2SB 471	1.60
2SB 472	2.80
2SB 473	1.20
2SB 474	1.00
2SB 481	1.20
2SB 492	1.00
2SB 507	1.60
2SB 509	1.60
2SB 511	1.10
2SB 514	1.90
2SB 523	1.00
2SB 526C	1.30
2SB 527	1.60
2SB 528D	1.60
2SB 529	.90
2SB 530 SUB 2SB 541	
2SB 531	3.40
2SB 536	1.60
2SB 537	1.60
2SB 539	4.90
2SB 541	4.40
2SB 554	10.00
2SB 556	4.90
2SB 557	3.40
2SB 561B	.70
2SB 564	.70
2SB 566	2.80
2SB 595	1.90
2SB 596 SUB 2SB 507	
2SB 600A	7.00

2SC

2SC 183	.59
2SC 184	.59
2SC 281	.59
2SC 283 SUB 2SC 458	
2SC 284	1.20
2SC 317	1.20
2SC 352A	2.50
2SC 353A	2.50
2SC 367	.90
2SC 369	.59
2SC 371	.59
2SC 372	.45
2SC 373	.45
2SC 374	.59
2SC 377	.70
2SC 380	.59
2SC 381	.59
2SC 382	.59
2SC 383	.90
2SC 387A	.59
2SC 388A	1.00
2SC 394	.59
2SC 403	.50
2SC 430	.90
2SC 454	.59
2SC 458	.59
2SC 460	.59
2SC 461	.59
2SC 478	1.10
2SC 481	1.60
2SC 482	1.50
2SC 484 SUB 2SC 756	
2SC 485	1.60
2SC 486	1.60
2SC 493	3.90
2SC 495	.90
2SC 497	1.60
2SC 509	.70
2SC 515A	1.40
2SC 517	3.95
2SC 535	.59
2SC 536	.59
2SC 537	.59
2SC 538A	.70
2SC 562	.70
2SC 563	1.10
2SC 605	.70
2SC 619	.59
2SC 620	.59
2SC 627	2.25
2SC 631	.90
2SC 632A	.45
2SC 634A	.59
2SC 642A	5.90
2SC 644	.45
2SC 645	.70
2SC 650	1.30
2SC 665H	8.50
2SC 668	.45
2SC 680	2.80
2SC 681A	5.80
2SC 684	1.10
2SC 693B	.59
2SC 696	1.95
2SC 708	1.90
2SC 710	.45
2SC 711	.45
2SC 712	.59
2SC 717	.59
2SC 727	1.90
2SC 730	4.40
2SC 731	5.80
2SC 732	.59
2SC 733	.59
2SC 734	.59
2SC 735	.59
2SC 738	.59
2SC 756	2.80
2SC 756A	3.00
2SC 763	.59
2SC 772	.45
2SC 773	.70
2SC 774	2.00
2SC 775	1.95
2SC 776	2.65
2SC 777	3.50
2SC 778	3.60
2SC 781	2.65
2SC 783R	3.60
2SC 784	.59
2SC 785	.59
2SC 789	1.00
2SC 793	2.80
2SC 799	3.60
2SC 802 SUB 2SC 799	
2SC 815	.59
2SC 828	.45
2SC 829	.45
2SC 830H	5.90
2SC 838	.59
2SC 839	.59
2SC 867	4.25
2SC 870	.59
2SC 871	.59
2SC 897	3.40
2SC 898	4.40
2SC 900	.45
2SC 923	.45
2SC 929	.45
2SC 930	.45
2SC 941	.59
2SC 943	.70
2SC 945	.45
2SC 959	1.50
2SC 971	1.00
2SC 982	.90
2SC 983	1.00
2SC 984	.90
2SC 994	3.90
2SC 996	3.40
2SC 1000BL	.59
2SC 1012	1.50
2SC 1013	1.10
2SC 1014	1.10
2SC 1017	1.40
2SC 1018	1.20
2SC 1030C	2.80
2SC 1047	.70
2SC 1051	4.40
2SC 1060	1.40
2SC 1061	1.40
2SC 1080	4.40
2SC 1096	1.00
2SC 1098	1.10
2SC 1111	3.40
2SC 1114	3.70
2SC 1115	4.40
2SC 1116	4.90
2SC 1116A	6.60
2SC 1124	1.30
2SC 1127	1.40
2SC 1161	1.90
2SC 1162	1.10
2SC 1166	.59
2SC 1167	6.60
2SC 1170B	6.60
2SC 1172B	8.50
2SC 1173	.90
2SC 1175	.90
2SC 1177	14.00
2SC 1189	1.20
2SC 1209	.70
2SC 1211D	.59
2SC 1212A	1.40
2SC 1213	.70
2SC 1215	.70
2SC 1222	.45
2SC 1226A	1.00
2SC 1237	4.25
2SC 1239	3.90
2SC 1279	.70
2SC 1306	2.90
2SC 1307	3.90
2SC 1310	.59
2SC 1312	.59
2SC 1313G	.59
2SC 1317	.45
2SC 1318	.45
2SC 1325A	7.60
2SC 1327	.59
2SC 1330	.70
2SC 1335	.70
2SC 1342	.59
2SC 1344	.59
2SC 1345D	.59
2SC 1346	.70
2SC 1347	.70
2SC 1358	5.90
2SC 1359	.59
2SC 1360	1.00
2SC 1362	.59
2SC 1364	.70
2SC 1377	4.90
2SC 1383	.59
2SC 1384	.59
2SC 1396	.70
2SC 1398	1.10
2SC 1400	.59
2SC 1402	4.90
2SC 1403	4.90
2SC 1407	.90
2SC 1419	1.10
2SC 1444	2.80
2SC 1447	1.60
2SC 1448	1.60
2SC 1449	1.00
2SC 1451	2.25
2SC 1452	1.60
2SC 1475	1.40
2SC 1478S	.70
2SC 1509	1.10
2SC 1567	1.10
2SC 1567A	1.10
2SC 1569	1.40
2SC 1584	8.50
2SC 1586	7.60
2SC 1624	1.30
2SC 1626	1.10
2SC 1628	1.30
2SC 1647	1.00
2SC 1669	1.60
2SC 1674	.59
2SC 1675	.59
2SC 1678	2.25
2SC 1679	4.25
2SC 1681	.70
2SC 1682	.45
2SC 1684	.59
2SC 1687	.70
2SC 1688	.70
2SC 1708	.59
2SC 1728	1.90
2SC 1730	.59
2SC 1756	1.40
2SC 1760	1.90
2SC 1765	8.80
2SC 1775	.45
2SC 1816	3.90
2SC 1846	.70
2SC 1885	.70
2SC 1908	.59
2SC 1909	3.90
2SC 1913	1.20
2SC 1945	5.60
2SC 1951	1.10
2SC 1957	1.20
2SC 1969	4.90
2SC 1973	1.10
2SC 1974	1.90
2SC 1975	4.40
2SC 2028	.90
2SC 2029	3.90
2SC 2076	.59
2SC 2091	2.80
2SC 2092	3.90
2SC 2098	4.90

2SD

2SD 16	5.90
2SD 28	2.50
2SD 72	1.10
2SD 75 SUB 2SD 187	
2SD 77	.90
2SD 81	3.00
2SD 90	1.60
2SD 91	1.60
2SD 92	1.90
2SD 93	2.80
2SD 118	4.40
2SD 130	1.20
2SD 141	1.40
2SD 142	2.00
2SD 143	2.80
2SD 178	1.10
2SD 180	2.50
2SD 187	.59
2SD 188	3.00
2SD 201	3.40
2SD 205	1.40
2SD 213	5.90
2SD 217	4.40
2SD 218	3.40
2SD 220	2.50
2SD 223	1.90
2SD 224	1.90
2SD 226	1.60
2SD 227	.45
2SD 234	1.00
2SD 235	1.00
2SD 261	.60
2SD 287	3.70
2SD 288	1.40
2SD 300	5.60
2SD 313	1.10
2SD 314	1.20
2SD 315	1.20
2SD 325	1.10
2SD 330	1.00
2SD 341	5.60
2SD 350	5.90
2SD 352	.90
2SD 356D	1.10
2SD 357D	1.00
2SD 358	1.30
2SD 359	1.00
2SD 360	1.20
2SD 361	1.00
2SD 370 SUB 2SD 427	
2SD 371S	2.80
2SD 380	7.60
2SD 382	1.40
2SD 388	3.40
2SD 388A	4.40
2SD 389	.90
2SD 390	1.00
2SD 424	8.50
2SD 425	6.50
2SD 426	4.60
2SD 427	3.00
2SD 525	1.60
2SD 526	1.10
2SD 555A	6.60
2SD 610	1.90
SG 613 (TV)	5.95

FET

2SK 19BL	.90
2SK 23	1.10
2SK 30	.70
2SK 33	1.10
2SK 34	1.10
2SK 40	.70
2SK 41	1.10
2SK 49	1.30
2SK 58	3.60
2SK 61	1.40
2SK 68	1.30
3SK 22Y	2.55
3SK 35	2.25
3SK 37	3.00
3SK 39	2.25
3SK 40	2.25
3SK 41	2.50
3SK 45	2.50
3SK 48	5.90
3SK 49	2.50
MK 10	2.00

IC

AN 203	2.50
AN 211	2.50
AN 2140	3.00
AN 217	1.90
AN 234	4.90
AN 239	7.00
AN 240	2.15
AN 241	2.80
AN 245	4.90
AN 247	4.40
AN 264	2.00
AN 274	3.40
AN 2778	2.40
AN 288	6.60
AN 315	3.00
AN 328	3.90
AN 348	3.70
AN 362	3.00
BA 511	2.90
BA 521	2.90
UPD858C	9.50
HA 1137	4.90
HA 1138	4.40
HA 1149	5.60
HA 1151	4.40
HA 1156	3.00
HA 1158	5.30
HA 1159	5.80
HA 1196	4.90
HA 1197	3.90
HA 1201	1.50
HA 1202	2.25
HA 1211	1.50
HA 1306W	3.70
HA 1312	3.90
HA 1322	4.40
HA 1339	4.40
HA 1339A	4.40
HA 1342A	4.40
HA 1452	3.40
LA 1111P	2.50
LA 1201	2.50
LA 1221	2.80
LA 1364	4.40
LA 3300	3.00
LA 3301	3.00
LA 4030P	3.40
LA 4031P	3.00
LA 4032P	3.40
LA 4051P	3.70
LA 4400	3.70
LD 3120	2.50
M 5111AP	2.80
M 5112	7.00
M 5115PR	4.90
M 51513L	4.90
M 5152L	2.50
M 51841P	2.80
M 5320 OP	2.25
M 5327 3P	2.80
M 53274P	2.50
M 54730 P	8.80
M 53393	7.60
STK 011	7.60
STK 014	9.50
STK 015	6.60
STK 016B	8.50
STK 022	11.00
STK 032	14.00
STK 435	8.50
STK 437	9.80
STK 439	11.00
STK 502	8.80
STK 503	9.60
TA 7027M	3.70
TA 7045M	3.00
TA 7054P	2.50
TA 7055P	3.00
TA 7060P	1.60
TA 7061AP	1.90
TA 7062P	1.90
TA 7063P	1.60
TA 7064P	1.90
TA 7066P	2.00
TA 7074P	4.90
TA 7075P	4.90
TA 7076P	4.90
TA 7089P	3.00
TA 7092P	4.90
TA 7102	5.80
TA 7106P	4.90
TA 7108P	1.90
TA 7109P	3.40
TA 7120P	1.90
TA 7120PC	2.15
TA 7122AP	1.90
TA 7124P	1.60
TA 7129P	1.90
TA 7130P	2.80
TA 7136P	1.30
TA 7146P	4.20
TA 7150P	4.40
TA 7159P	2.50
TA 7200P	4.60
TA 7201P	4.60
TA 7203P	3.70
TA 7204P	3.40
TA 7205P	2.90
TA 7310P	3.95
TA 78005M	5.80
TA 8005P	5.80
TA 78012M	6.60
TA 78012P	5.80
TA 78015M	6.50
TA 78015P	5.80
TBA 810SH	3.70
TD 3505AP	8.50
UPC 41C	3.70
UPC 554C	2.80
UPC 555H	2.25
UPC 566H	1.60
UPC 575C	2.80
UPC 576	3.70
UPC 577H	2.25
UPC 592HZ	1.60
UPC 1001H	4.90
UPC 1008C	7.00
UPC 1016C	3.00
UPC 1020H	3.70
UPC 1025	4.40
UPC 1026C	3.70
UPC 1032	2.25
UPC 1156	3.00
UPC 1152H	3.40
PLL 01A	8.80
PLL 02A	8.80
SN 7400	19
SN 7490	.60

DIODES

IS 84	.60
IS 188	.25
IS 332	.45
IS 953	.25
IS 1007	.45
IS 1209	.45
IS 1211	.45
IS 1555	.25
IS 1588	.25
IS 1885	.25
IS 2076	.25
IS 2093	.45
IS 2473	.25
IN 34	.25
IN 60	.25
10D1	.40
10D10	.60
VO6B	.40
VO6C	.40
WZ 050	.45
WZ 052	.45
WZ 061	.45
WZ 070	.45
WZ 075	.45
WZ 081	.45
WZ 192	.45
WZ 260	.45
WZ 280	.45

PRICES MAY CHANGE WITHOUT NOTICE COD ORDERS WELCOMED Less than $500 no deposit required

Minimum order $5.00 Ohio residents add 4% sales tax Add $1.00 postage and handling
Quantity discount prices Ask For Our Complete Price List Manufacturer inquiries Welcomed
ALL PARTS GUARANTEED AGAINST FACTORY DEFECT

IMMEDIATE DELIVERY WITHIN 48 HOURS ON ALL TRANSISTORS IN STOCK

TOLL FREE TELEPHONE

Nationwide 800/543-1607 LOCAL 513/874-0220
Ohio 800/582-1630 874-0223
Hours: Mon.-Fri. 10-7 Sat. 11-5

FUJI-SVEA ENTERPRISE

a Division of Fuji-Svea Incorporated
Dept. ET
P.O. Box 40325 Cincinnati, Ohio 45240
Telex - 21-4732

Circle No. 121 on Reader Inquiry Card

exhibitors to fill more than 400,000 feet of floor space at Chicago's McCormick Place for the annual Summer Consumer Electronics Show (CES).

Exhibitors already lined up for the summer event include 250 high fidelity related manufacturers, 75 from the TV and video area, 300 radio, audio and compact type exhibitors, 200 auto sound, CB and telephone exhibitors, and some 100 personal computer, calculator and watch exhibitors.

An EIA spokesman said attendance is expected to match last year's 50,000 figure.

According to a news release, completely new to the show will be afternoon retail workshops covering such areas as advertising and promotion, in-store display, financial management, and salesman and service technician training.

In addition to McCormick Place, the CES will also house exhibit areas in the nearby McCormick Inn and the Pick Congress Hotel.

Electro '78 Expects 25,000

Some 25,000 engineers, scientists, technicians and manufacturers are expected to attend the three-day Electro/78exhibition in Boston May 23-25.

The counterpart of WESCON, which alternates each year between Los Angeles and San Francisco, and MIDCON, which fluctuates between Chicago and Dallas, Electro 78 will feature state of the art electronics technology and products.

These shows, coupled with NEWCOM (coverage of which will appear in the July issue of ET/D) are critically important to the consumer and industrial service and design markets in that much of the new test equipment that will be showing up in shops and plants in the near future is unveiled for the first time.

Electro's theme this year is "Look Ahead" and seminars such as "high density packaging in equipment design," "bridging the gap between analog and digital electronics," and "microprocessor applications in instrumentation" are scheduled for Boston's Hynes Auditorium.

Keynote speaker for the event will be Bernard Gordon, president of Analogic Corporation.

CB Import Tariffs: Too Little Too Late?

Conspicuous by its absence in a recent Electronic Industries Association news release on CB was the word "profit." Under the headline, "1977 A Big Year for CB License Applications," was a rather unemotional story indicating that CB license activity in 1977 had dropped off from the more than 5 million issues in 1976, though not by much.

That's why the Administration's recent move to impose stiffer tariffs on CB imports by most standards would be con-

ET/D

Richard W. Lay, *Editor (Chicago)*

Don W. Mason, *Managing Editor (Duluth)*

Alfred A. Menegus, *Publisher (New York)*

David J. Hagelin, *Assoc. Publisher (Chicago)*

Tom Greney, *Group Vice President (Chicago)*

John Paszak, *Graphic Design*

Roni Seger, *Production Manager*

Lillie Pearson, *Circulation Supervisor*

Gene Bailey, *Reader Service*

Dawn Anderson, *Classified Ad Mgr.*

Please submit editorial manuscripts to:
Editor, ET/D, 43 East Ohio St.
Chicago, Ill., 60611

ADVERTISING SALES

Please send all advertising material to:
ET/D,
Production Mgr.
1 East First Street
Duluth, Minn. 55802
(218) 727-8511

East Region
Alfred A. Menegus
757 Third Avenue
New York, N.Y. 10017
(212) 888-4382

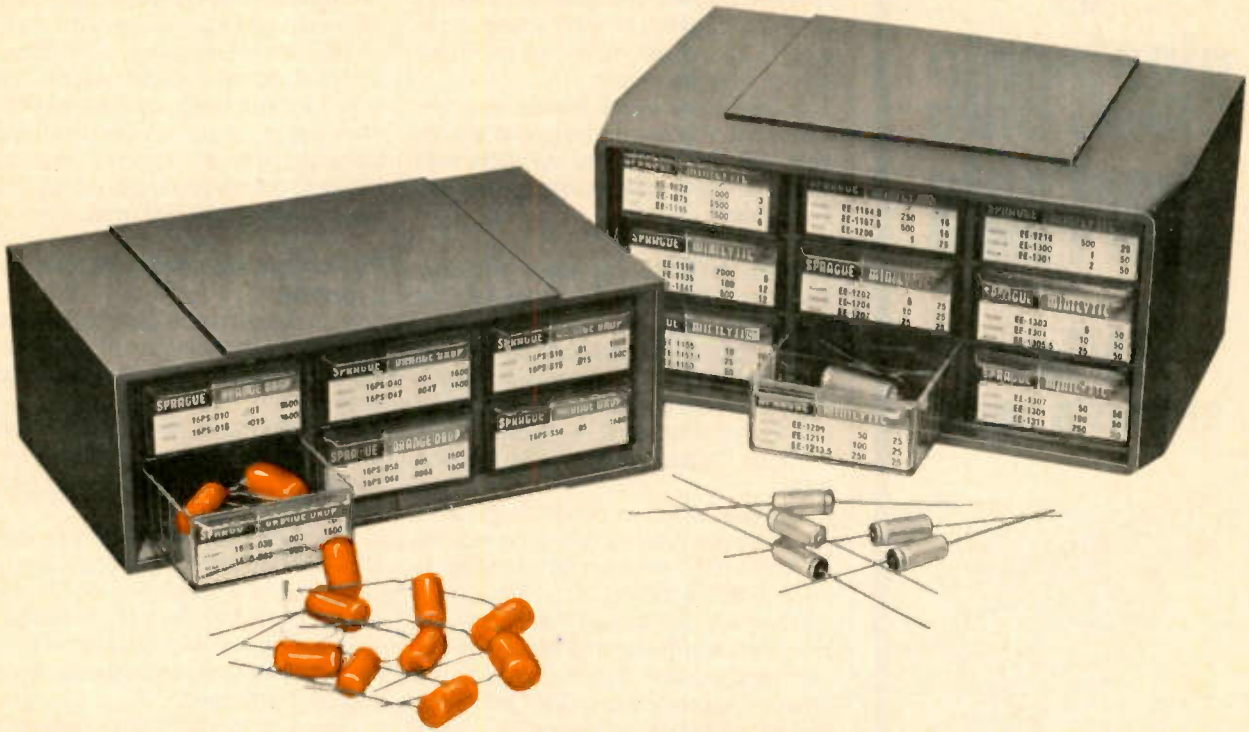
Midwest Region
David J. Hagelin
43 East Ohio Street
Chicago, Ill. 60611
(312) 467-0670

South/West Region
Chuck Cummings
613 N. O'Connor
Irving, TX 75061
(214) 253-8678

HBJ
HARCOURT BRACE JOVANOVICH PUBLICATIONS

Robert L. Edgell, *Chairman*
Richard Moeller, *President/Treasurer*
Lars Fladmark, *Senior Vice President*
Joe Bilderbach, *Vice President*
James T. Gherna, *Vice President*
George A. Glenn, *Vice President*
Thomas Greney, *Vice President*
Ezra Pincus, *Vice President*
Harry D. Ramaley, *Vice President*
Lois Sanders, *Vice President*

Reach for Sprague parts instead of running for them.



Now it's easy for you to build and maintain a practical-sized inventory of capacitors, resistors, transistors, diodes, and switches for service work.

You don't have to buy huge quantities of electronic components to keep on hand the parts you need. With these assortments, you'll save valuable time by having replacement parts within an arm's reach.

All assortments come in 6- or 9-drawer attractive, durable, compact, blue plastic cabinets. Prelabeled drawer fronts identify contents of each drawer. Clear plastic drawers are compartmentalized with adjustable dividers, letting you check your stock in seconds. And you pay for the components only . . . time-saver cabinets are yours at no extra cost!

Component	Assortment Number	Number of Components	Number of Ratings/Types	Net Price
Aluminum Electrolytic Tubular Capacitors	KE-10	25	18	$18.30
Aluminum Electrolytic Tubular Capacitors	KE-11	61	27	44.79
Aluminum Electrolytic Tubular Capacitors	KE-13	18	18	29.19
Aluminum Electrolytic Tubular Capacitors	KE-14	18	18	29.45
Vertical-mounting Tubular Electrolytic Capacitors	KE-16	27	18	16.05
Vertical-mounting Tubular Electrolytic Capacitors	KE-17	61	27	29.90
Miniature Aluminum Electrolytic Tubular Capacitors	KE-19	27	18	13.29
Miniature Aluminum Electrolytic Tubular Capacitors	KE-20	61	27	29.90
Dipped Tubular Radial-lead Film Capacitors	KF-10	80	15	34.17
Dipped Tubular Radial-lead Film Capacitors	KF-11	104	21	46.50
Dipped Tubular Radial-lead Film Capacitors	KF-13	49	10	35.52
Dipped Tubular Radial-lead Film Capacitors	KF-14	20	11	13.92
Dipped Tubular Radial-lead Film Capacitors	KF-16	20	9	13.59
Dipped Tubular Radial-lead Film Capacitors	KF-18	96	13	37.44
Dipped Tubular Radial-lead Film Capacitors	KF-19	136	18	61.56
Mylar-sleeved Axial-lead Film Capacitors	KF-21	45	17	20.55
Polypropylene/Polycarbonate Film Capacitors	KF-28	43	20	38.91
Ultra-miniature Single-ended Film Capacitors	KF-30	115	23	29.25
Film-wrapped Tubular Film Capacitors	KF-31	52	26	59.66
General Application & High-K Ceramic Disc Capacitors	KC-20	110	18	23.40
General Application & High-K Ceramic Disc Capacitors	KC-21	167	27	28.80
Temperature-stable Ceramic Disc Capacitors	KC-22	85	18	18.63
Dipped Radial-lead Mica Capacitors	KM-10	28	14	7.80
Radial-lead Solid Tantalum Capacitors	KT-10	70	16	39.45
Carbon-film Resistors, ¼ Watt	KR-10	130	23	13.00
Carbon-film Resistors, ½ Watt	KR-15	127	24	12.70
Zener Diodes, One-Watt	KS-20	37	18	31.45
Small-signal and Power Transistors	KS-25	40	27	80.94
Toggle & Push-button Switches	KX-11	18	18	40.69

Prices subject to change without notice.

See these assortments at your Sprague Distributor today . . . or . . . write for Assortment Brochure M-946A to Sprague Products Company, 65 Marshall St., North Adams, Mass. 01247.

65-8102

MEMBER EIA

SPRAGUE PRODUCTS COMPANY Distributors' Division of Sprague Electric Co.

AMERICA'S PRIME SUPPLIER OF ELECTRONIC PARTS

SPRAGUE®
THE MARK OF RELIABILITY

a General Cable subsidiary

Circle No. 140 on Reader Inquiry Card

sidered good news.

But you have to wonder, at this stage of the CB game, if the move might not amount to too little too late.

What President Carter's tariff adjustment amounts to is to increase the 6 per cent rate to 21 per cent, immediately. This rate will remain in effect for one year at the end of which time it is scheduled to drop to 18 per cent and then to 15 per cent a year after that.

According to White House sources, the "moderate" moves by Carter will enable U.S. companies to compete with foreign imports while working off excess inventories.

Zenith to Rely on New Picture Tube and Chassis To Stem 1977's Low Financial Results

Zenith Radio Corporation, which last year moved its module/chassis operations to foreign shores and laid off about one-fourth of its U. S. workforce (SEE ET/D,11/77),has reported a $4.7 million loss.

The loss, which amounted to 25 cents per share accrued as operating income for fiscal 1977, fell from $41.4 million in 1976 to $19.8 million.

However, Zenith said, "reductions in overhead and personnel expenses are expected to lower Zenith's costs by an amount approximating $10 per color television receiver produced."

In addition, Zenith said it is expected to begin quantity distribution of its newly designed K-line chassis (introduced this month), which will house its new 25-inch and 19-inch, in-line color picture tubes, sometime during the second half of 1978.

In another move, Zenith is reported to have completed an arrangement with K-Mart stores to supply a line of color and black and white sets of various sizes carrying the Zenith name, but unavailable to other sizes.

Hitachi in with New VCR Offering

Hitachi has unveiled its Model VT 4000 video tape recorder which is scheduled for introduction in this country later this year.

While U.S. pricing plans remained foggy, the unit is retailing in Japan for about $980, some $80 less than another Victor made unit previously marketed by Hitachi there.

The VT 4000 is designed to be compatible with Matsushita's VHS format, which has garnered most of the support of U.S. television manufacturers who have entered the VCR game. It is a two-hour maximum tape format—and a portable color television camera to be sold with the unit is being priced at $1,000 in Japan.

Sony's Earnings Off

Sony Corporation is saying its reported first quarter earnings drop of 50 per cent is largely based on the plunge of the value of the U.S. dollar compared to the Japanese Yen.

Earnings for the fiscal period ending January 31 were $23.5 million, or 11 cents per share of common, compared with some $46.6 million a year earlier.

However, the company also said its television set sales, which accounted for 31 per cent of total sales, were down 4.2 per cent during the first quarter. Video tape recorder sales, on the other hand, were reported up 52 per cent and a company official reported that Sony hopes to double production of VCRs this year to about 600,000 units.

TV Repair Licensing Probe Stopped

The Federal Trade Commission has given up its investigation of state licensing practices of television-radio repair shops.

According to a commission spokesman, "Several states have rejected licensing and there appears to be a trend against it."

The commission's probe was begun in 1975 when an FTC economic analysis concluded the regulation of TV repair shops in California and Louisiana increased consumer costs without providing any substantial safeguards against improper practices.

It was also noted that only seven states currently license television and radio repair persons, fewer than when the investigation was begun three years ago.

GTE to Make TV Parts for Algerian Plant

General Telephone and Electronics Corporation, the parent of GTE Sylvania, has announced receipt of a $35 million contract from Algeria for the manufacture of television components.

The components, CRTs, tuners, speakers, transformers, semiconductors and printed circuit boards, will be used in the making of black and white television receivers at a new Algerian home entertainment manufacturing facility.

Eventually, a GTE spokesman said, the plant will make color televisions, car radios, phonographs, cassette players, and outdoor antennas.

Video Recorders: Changing America's Habits?

And finally, this quote from a recent *Wall Street Journal* article: "The video recorder is seen by many analysts as more than just a hot product. Like the television set itself, it bears the seeds of radical change in the way people spend their leisure time. Industry analysts say that because the machine releases viewers from TV schedules, it will greatly affect television viewing habits over the next decade." ET/D

SPEED
transceiver, audio or broadcast testing...

With HP's new 339A Distortion Measurement Set.

Automatic frequency nulling and auto set level features of the 339A speed your total harmonic distortion measurements (THD). And true-rms detection means accurate measurements as low as 0.0018% (−95 dB) from 10 Hz to 110 kHz. Just select the frequency of the built-in oscillator and the 339A's "turn signal" indicators show you how to make the proper range settings. Whether you're testing transceivers, sophisticated audio equipment or broadcast performance, here's how the 339A, priced at $1900*, can help you make quick and accurate measurements.

Transceiver testing. Automatic setting of the 100% reference level over a 10 dB input range means fewer critical adjustments, saving you a considerable amount of test time. And true-rms detection lets you accurately determine thermal noise and harmonic components in making SINAD measurements.

Audio testing. In addition to the time-saving convenience of auto set level and auto null, you have the benefits of a built-in tracking oscillator. This means you have a low-distortion source for testing high-quality audio equipment and you tune one instrument instead of two.

Broadcast compliance testing. An AM detector, 30 kHz low-pass filter, switchable VU meter ballistics, and a +2 to −12 dBM (600Ω) meter scale let you quickly isolate the cause of out-of-limit readings. And they reduce your set-up time when checking your equipment for compliance with operating regulations.

Contact your local HP field engineer for further details.

For a separate low-distortion oscillator, investigate HP's new 239A, priced at $575. Like the built-in oscillator of the 339A, it provides less than −95 dB THD over the audio range. And it includes a calibrated output attenuator. For details contact your local HP field engineer.

* Domestic U.S.A. price only.

097/53A

HEWLETT hp PACKARD

1507 Page Mill Road, Palo Alto, California 94304

For assistance call: Washington (301) 948-6370, Chicago (312) 255-9800, Atlanta (404) 955-1500, Los Angeles (213) 877-1282

Circle No. 123 on Reader Inquiry Card

NEWSLINE

HIGH POWER TRANSISTOR DEVELOPED BY GE. As reported by GE's research and development department, General Electric has developed "the world's most efficient high power transistor, capable of switching 400 volts and up to 350 amperes on and off in less than a microsecond." And the transistor can be activated with only one-tenth of an amp. The first application of the new transistor will be in two electric prototype cars that GE is producing under a government contract. Not only is the new unit expected to make the GE car cheaper to operate, a Department of Energy official in Washington said that the new transistor will allow longer life for the car's batteries. The two electric cars are scheduled for delivery in the spring of 1979.

RCA'S FIRST QUARTER BEST IN HISTORY. RCA achieved the best first quarter in history in 1978 -- up 13 percent in earnings and 10 percent in sales over the same period a year ago. It was the fifth consecutive quarter of record earnings. Net income for three months ended Mar. 31, was $54.9 million, or 72 cents a common share. Edgar H. Griffiths, president and chief executive officer, said the record was achieved despite the impact of a severe winter, energy cutbacks caused by the coal strike and a decline in earnings by the National Broadcasting Co. The seven operating units of the company earning record profit were: Hertz Corp., RCA Records, Coronet Industries, Oriel Foods Group, Solid State, Commercial Systems and Picture Tubes.

HY-GAIN DECLARED BANKRUPT. After operating for several months under Chapter 11 of the Bankruptcy Law -- but failing in an attempt to get necessary funding -- Hy-Gain Electronics Corp. has been declared bankrupt. Now the four lender banks -- Citibank, Citibank International, Security Pacific National, and Columbia Union National -- can start to sell the CB company's assets to try to get back as much as possible of the $23 million owed. In addition, the company owed about $7 million in unsecured debts. Liquidation value of the firm's assets has been estimated at from $6 to $10 million.

MAGNAVOX IS NOW HIGHLY PROFITABLE. The annual report of North American Philips, parent firm to Magnavox, indicates that it took just one year for North American Philips to convert Magnavox from an unprofitable firm to a money-maker. The major improvement in profitability came in the area of consumer electronics. Sales in that area last year rose 14.4% to $569.3 million.

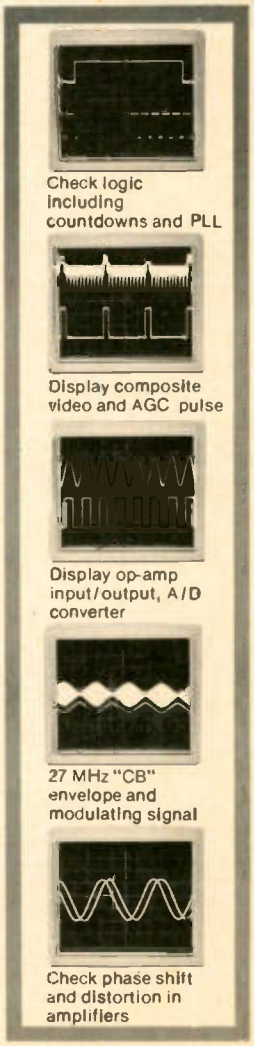
DUTIES IMPOSED ON JAPANESE TV IMPORTERS. Antidumping duties of $46 million have been imposed on importers of Japanese television sets shipped to this country in the years 1972 and 73. Action is a result of a 1971 finding that the sets were dumped in the U.S. at prices below fair market value. The U.S. Treasury is trying to eliminate a five-year backlog of actions. Now, they're working on the years past 1973. Since last July, of course, a Japanese-U.S. accord restricts Japanese imports.

New SIMPSON 5" Dual-Trace 15-MHz Scope

with triggered sweep. Reliable, versatile and easy to use. It's your best scope buy.

MODEL 452 $675

- For design, development and service of digital circuitry, communications, audio, TV equipment . . . in lab, shop or field.
- Differential vertical amplifier stages provide wide DC to 15 MHz bandwidth with smooth rolloff useable thru 27 MHz.
- Reliable integrated circuitry, all-solid-state (except CRT)
- Triggering — internal, external, TVV, TVH, VITS
- Automatically shifts between CHOP and ALTERNATE as you change sweep time.
- 24 nanosecond rise time
- Front-panel X-Y operation, dual matched vertical amplifiers.
- Displays CH A, B, A&B, A + B, A-B
- 0.5V peak-to-peak 1kHz square wave calibrator
- Voltage-calibrated vertical and horizontal inputs (eleven steps in 1-2-5 sequence)
- X5 magnification
- Human-engineered front panel controls



Check logic including countdowns and PLL

Display composite video and AGC pulse

Display op-amp input/output, A/D converter

27 MHz "CB" envelope and modulating signal

Check phase shift and distortion in amplifiers

See Your Local Electronics Distributor or Write for Bulletin T-837.

KATY INDUSTRIES
INDUSTRIAL EQUIPMENT GROUP

Simpson
INSTRUMENTS THAT STAY ACCURATE

SIMPSON ELECTRIC COMPANY
853 Dundee Avenue, Elgin, Illinois 60120
(312) 697-2260 • Cable SIMELCO • Telex 72-2416

Circle No. 139 on Reader Inquiry Card

FROM THE EDITOR'S DESK

As you read this, the editorial staff of ET/D will have just returned from the 1978 version of the New Communications (NEWCOM) show in Las Vegas, Nev. (A full report will be carried in the July issue of ET/D). Next month, we will be visiting the Summer Consumer Electronics Show in Chicago, a report of which will be carried in an upcoming issue, also.

Combined with the three regional industry gatherings (WESCON, MIDCON, and ELECTRO), and the annual meetings of the service industry's two national associations, NATESA and NESDA, these gatherings form the backbone of ET/D's communications link with the electronics industry itself.

Visits to these yearly meetings, ranging as they do from coast to coast, north to south, do not, I assure you, constitute travel for travel's sake.

Rather, this is where we are able to keep our fingers on the pulse of what is happening *now*. At such meetings we are able to talk face-to-face with the owners, the sales reps, even the design engineers of all of the vast array of electronic products and test equipment that is coming into the market and that you—our readers—ultimately will play such a vital role in either accepting or rejecting.

Such meetings, of course, allow us to keep you abreast of the very latest technological developments concerning new test gear and serviceable consumer electronic components. But they also allow us to give you a better insight into how your service business profession may shape up in just a few short years.

Such industry trade shows also serve another purpose—and a very important one—from ET/D's point of view. They allow us, the editorial staff of ET/D, to interface with the manufacturers on a one-to-one basis so that we may tell them exactly what is on your mind as you tell it to us.

This is one reason I consider it very important that ET/D not only relate to you with our editorial feature articles and new product information, but equally important is the fact that it is in your interest to "get through" to ET/D, to let us know what you think through your letters to the editor.

In this way, the staff of ET/D is able to be in a position to keep all of the industry leaders more aware of your concerns and wishes in areas such as new test equipment you would like to see, what types of servicing help you may need, what particular kinds of problems you may be experiencing, etc.

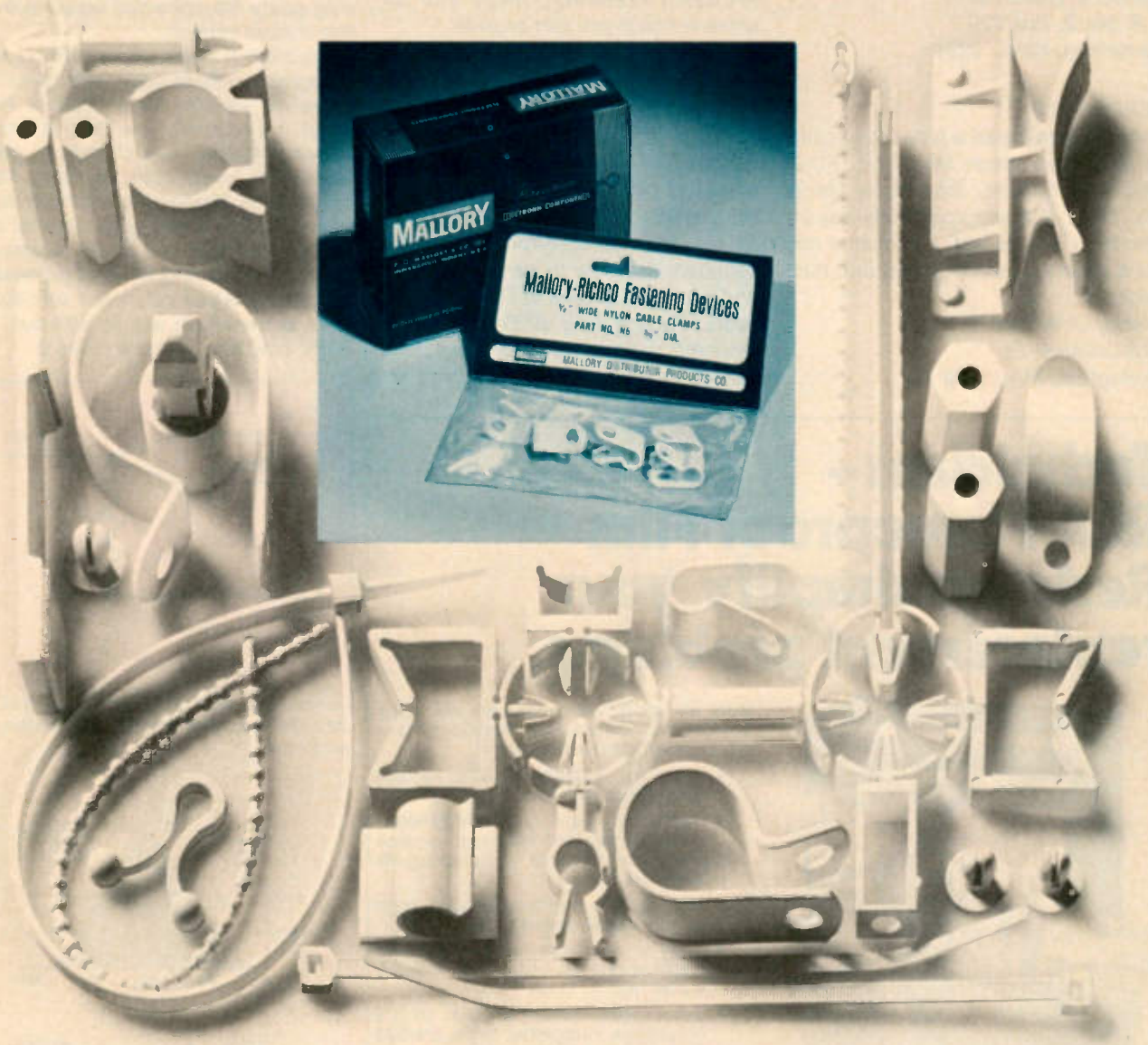
I guess what I am trying to say in a roundabout way is that we at ET/D are eager to hear from all of you who read our pages and we encourage your letters. In this way not only will we be able to understand your problems better, but we'll be in a better position to let your feelings be known directly to those in the electronics industry who can really do something about it ... the manufacturers themselves.

Sincerely

Richard W. Day

Get your fastening act together with Mallory-Richco.

Clamps, clips, wire saddles, spacers, cable hangers, circuit board supports, guides and dozens of other accessories. Your Mallory distributor has them. Packaged the way you want them. See him soon. Or contact Mallory Distributor Products Company, a division of P. R. Mallory & Co. Inc., Box 1284, Indianapolis, Indiana 46206. (317) 856-3731.



(Parts shown actual size.)

Circle No. 127 on Reader Inquiry Card

MALLORY

Capacitors • Controls • Fastening Devices • Resistors • Security Products • Semiconductors • Solderless Terminals • Sonalert® Signals • Switches

LETTERS

WANTS NEW EMPLOYER

According to your magazine and U.S. News & World Report there is a shortage of electronic technicians. I have been operating my own television and radio repair service for about fifteen years and would like to become employed by someone else.

If you can supply me with some names of companies that are in need of technicians, I will appreciate it very much.

Donald E. Simmons
R.R. No. 2, Box 329
Harrisburg, Illinois 62946

NEEDS HELP

I am trying to locate a tube tester chart for a Century tester Model No. FC-2, also for a Superior tube tester Model No. TV-11. I would appreciate any information I could get. If someone has such charts, I would appreciate their address.

Wesley J. Wimes, Sr.
123 Lebanon St.
Springfield, MA 01109

The recent inquiry of Mr. Edward Scribner in your February issue about repair and parts for his voltmeter has prompted this letter. Could you possibly provide me with any information concerning parts and/or repair of a Paco Model S-55 oscilloscope. I understand this was a division of Precision Apparatus Co., Inc. of Glendale, N.Y. Any information will be appreciated.

Carl V. Allen
R.D. #3
Corry, Pa. 16407

I am in need of the complete name and address for the company that manufactures the General Instrument tuners for television receivers. Thank you for whatever help you can provide.

Paul Capito
637 W. 21st St.
Erie, Pennsylvania 16502

We are very pleased that you have begun to put back into the magazine some articles on TV servicing. There are so many innovations–including shortcuts and how to service modular and new type circuits in TV–in the past years. For too long ET/D had all but stopping printing easy to understand service techniques on TV equipment.

The long drawn out theory and circuit articles are of little help. Articles like those in recent issues by Bernard Daien and Paul Shih, written in easy-to-follow-and-understand style is what is needed. More of the same, please. Keep up the good work.

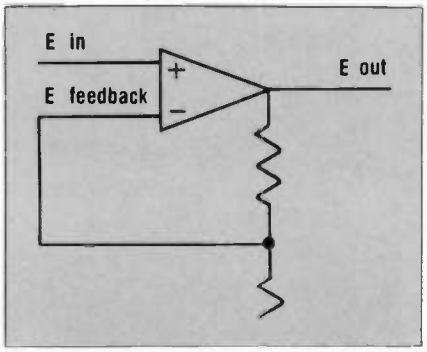
I. Isenberg
428 W. Roosevelt Blvd.
Philadelphia, PA 19120

A CORRECTION

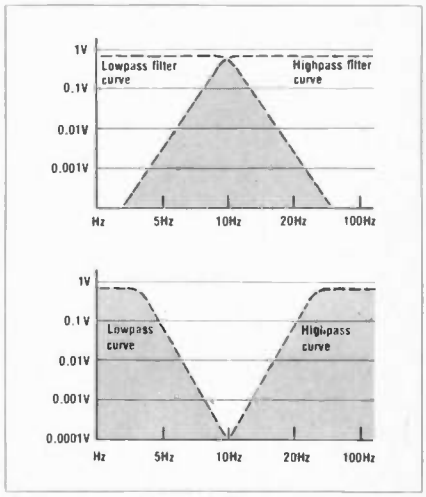
EDITOR'S NOTE: In response to reader questions concerning typographical errors in the January 1978 issue of ET/D (Looking Into Industrial Electronics), the following corrections are being printed.

Readers who are saving their copies may paste the corrected versions over the original version.

Correction to Page 23, column 1, last paragraph, where copy was garbled: "Now we have the ideal amplifier, high input impedance, low output impedance, stability, low distortion, good bandwidth, exact gain, immunity from line voltage changes and temperature changes. The operational amplifier differs only in that it has several stages of gain, and one output terminal (instead of two, as in the true differential amplifier). Let's see what we can do with our "op amp" now that we have made it.

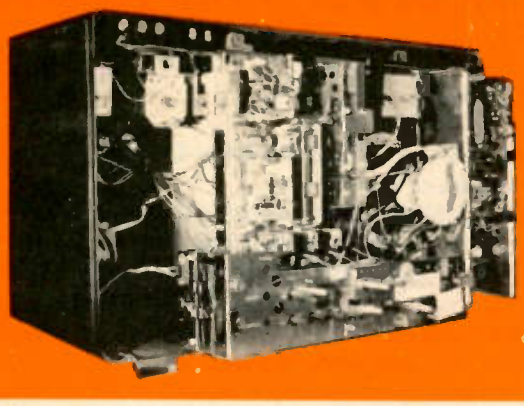


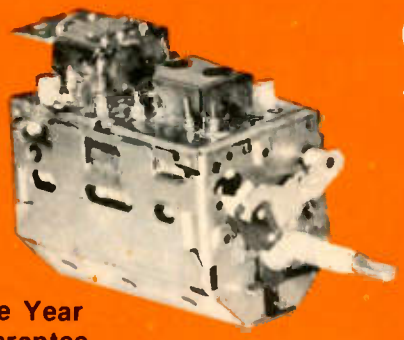
Corrected version of Figure 11, page 22 (changes polarities of input and feedback terminals):



Corrected versions of Figures 12 and 13 (correcting improperly shaded bandpass areas.)

Tuner Service Corporation





$10.95 U.S.A. ONLY

Major Parts and Shipping Charged at Cost.

One Year Guarantee

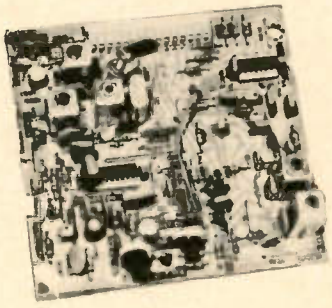
MODULE REPAIRS

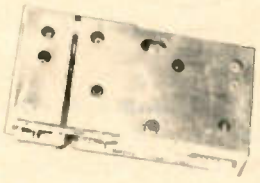
TSC has been repairing private brand TV modules for over 3 years.

Expanded facilities now include modules for

- RCA
- GE
- ZENITH
- W. T. GRANT
- J. C. PENNEY
- WESTERN AUTO
- GAMBLES

as well as Zenith IF subchassis.





For free Price List and complete information write or phone;
TSC HEADQUARTERS, BLOOMINGTON, IND.
or any of the TSC locations listed below.

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

TUNER REPAIRS

VHF OR UHF ANY TYPE ..... (U.S.A. ONLY) $10.95
UHF/VHF COMBINATION ..... (U.S.A. ONLY) $17.95

MAJOR PARTS AND SHIPPING CHARGED AT COST

- Fast, efficient service at any of the conveniently located service centers listed below.

ONLY ORIGINAL FACTORY PARTS USED

- All tuners ultrasonically cleaned, repaired and realigned.

EXACT REPLACEMENT

Exact Replacement Tuners are available at a cost of $14.95 and up. (U.S.A. Only)

- Send in your original tuner for comparison purposes to any of the Centers listed below.

UNIVERSAL REPLACEMENT

UNIVERSAL REPLACEMENT TUNER ..... (U.S.A. ONLY) $13.95

- This price buys you a complete new tuner built specifically for this purpose.
- All shafts have a maximum length of 10½" which can be cut to 1½".
- Specify heater type parallel and series 450mA or 600mA.

FLASH NOW AVAILABLE—TUNER SERVICE PARTS CATALOG OF ALL SARKES TARZIAN VHF AND UHF TUNERS, INCLUDING EXPLODED VIEW DRAWINGS. OVER 200 PAGES. ORDER YOUR COPY TODAY. SEND $2.50 WITH ORDER TO BLOOMINGTON HEAD OFFICE.

TSC

WATCH US GROW

HEADQUARTERS	BLOOMINGTON, INDIANA 47401	537 South Walnut Street	Tel. 812-334-0411
ALABAMA	BIRMINGHAM, ALABAMA 35212	5623 1st Ave., N.	Tel. 205-592-9150
ARKANSAS	LITTLE ROCK, ARKANSAS 72204	4200-C Asher Avenue	Tel. 501-661-0393
CALIFORNIA	NORTH HOLLYWOOD, CALIF. 91601	10654 Magnolia Boulevard	Tel. 213-769-2720
	MODESTO, CALIF. 95351	123 Phoenix Avenue	Tel. 209-521-8051
	SAN MATEO, CALIF. 94402	600 S. Amphlett Blvd.	Tel. 415-348-3292
FLORIDA	TAMPA, FLORIDA 33606	1505 Cypress Street	Tel. 813-253-0324
	FT. LAUDERDALE, FLA. 33309	3516 N.W. 10th Avenue	Tel. 305-566-4882
GEORGIA	ATLANTA, GEORGIA 30310	646 Evans Street S.W.	Tel. 404-758-2232
ILLINOIS	SKOKIE, ILLINOIS 60076	5110 West Brown Street	Tel. 312-675-0230
	URBANA, ILLINOIS 61801	908 E. Main St.	Tel. 217-384-2052
INDIANA	INDIANAPOLIS, INDIANA 46204	112 West St. Clair Street	Tel. 317-632-3493
KENTUCKY	LOUISVILLE, KENTUCKY 40205	2244 Taylorsville Rd.	Tel. 502-452-1191
LOUISIANA	SHREVEPORT, LOUISIANA 71104	2423 Southern Avenue	Tel. 318-221-3027
MASSACHUSETTS	SPRINGFIELD, MASSACHUSETTS 01109	144 Boston Rd.	Tel. 413-788-8206
MISSOURI	ST. LOUIS, MISSOURI 63132	9577 Page Avenue	Tel. 314-429-0633
NEVADA	LAS VEGAS, NEVADA 89102	1114 South Casino Center Blvd.	Tel. 702-384-4235
NEW JERSEY	TRENTON, NEW JERSEY 08638	1139 Pennsylvania Avenue	Tel. 609-393-0999
	JERSEY CITY, NEW JERSEY 07307	454 Central Avenue	Tel. 201-792-3730
NEW YORK	ROCHESTER, NEW YORK 14606	23 Howard Rd.	Tel. 716-647-9180
NO. CAROLINA	GREENSBORO, NO. CAROLINA 27405	2914 E. Market St.	Tel. 919-273-6276
OHIO	CLEVELAND, OHIO 44109	4525 Pearl Road	Tel. 216-741-2314
OREGON	PORTLAND, OREGON 97210	1732 N.W. 25th Ave., P.O. Box 10141	Tel. 503-222-9059
PENNSYLVANIA	PITTSBURGH, PA. 15208	515 Grant Avenue	Tel. 412-821-4004
TENNESSEE	MEMPHIS, TENNESSEE 38111	3158 Barron Avenue	Tel. 901-458-2355
TEXAS	DALLAS, TEXAS 75218	11540 Garland Road	Tel. 214-327-8413
CANADA	ST. LAURENT, QUEBEC H4N-2L7	305 Decarie Boulevard	Tel. 514-748-8803
	CALGARY, ALBERTA T2H-1Y3	P.O. Box 5823, Stn. "A"	Tel. 403-243-0971

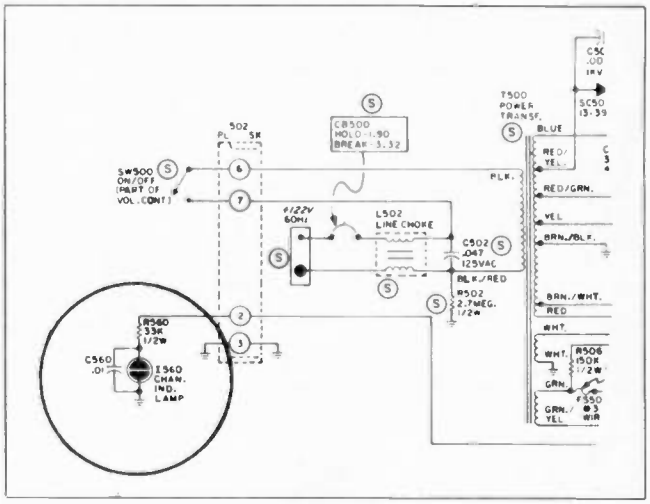
IF YOU WANT TO BRANCH OUT INTO THE TV TUNER REPAIR BUSINESS, WRITE TO THE BLOOMINGTON HEADQUARTERS ABOUT A FRANCHISE.

Circle No. 143 on Reader Inquiry Card

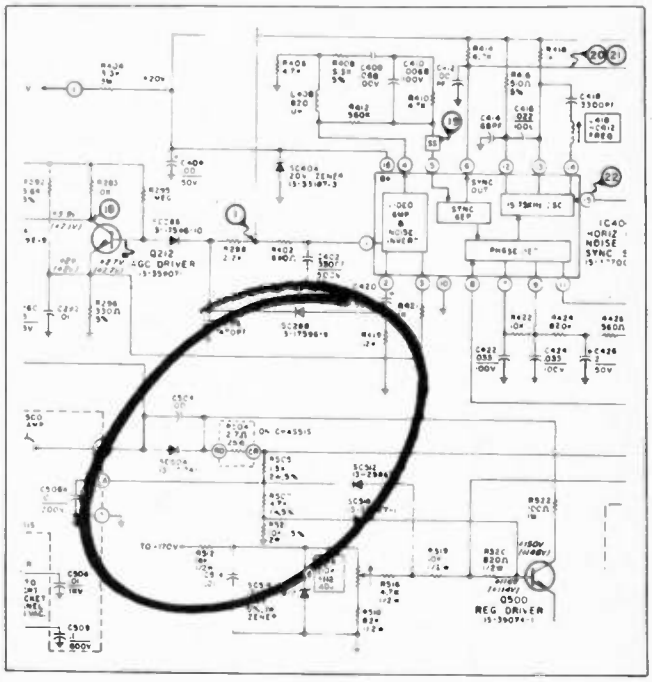
SERVICE SEMINAR

GTE SYLVANIA

Color Chassis E41,E42,E44, and E45—Dial light flickers; low light output, or fails.
Caused when C560.01 capacitor causes a high peak current to the neon bulb. To repair, replace neon bulb with part 30-33062-3. Then remove C560.01 capacitor and replace with a .001/600Vcapacitor, Sylvania part 43-14017-337. The capacitor is located on the tuner cluster. Whenever this set requires service, capacitor C560 should be replaced.



Color TV Chassis E08—The chassis is dead.
Probable cause is an open resistor R504 and/or a shorted B+ Regulator Q502 (not shown). Replace bad component(s).



GENERAL ELECTRIC

Color TV Chassis HE—Picture shifted to right, color shifting or streaking, horizontal hold critical, and high voltage

Carl Meyer
President, A to Z TV Service
Clinton & Harlem Streets
Buffalo, New York 14224

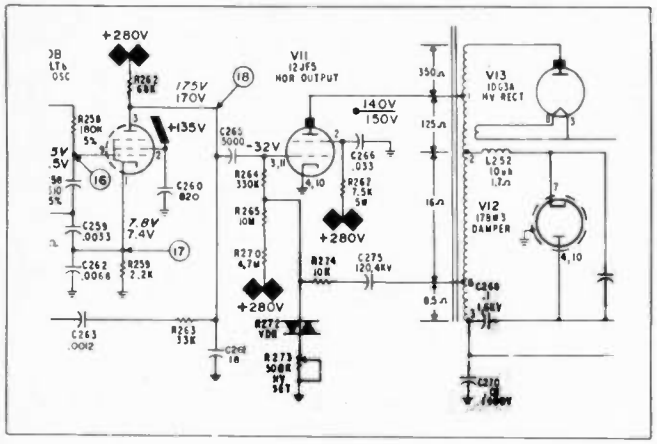
"I buy from the source–GE. They're the world's largest supplier of receiving tubes."

Your reputation is our reputation

Tube Products Department · Owensboro, Kentucky 42301

GENERAL ELECTRIC

lower than normal.
Resistor R264 in horizontal output stage is probably changing value. It should read greater than 150K ohms. Replace with 330K, ½W, carbon resistor.



Color TV Chassis MB-75—A herringbone interference pattern.
First, check for good ground connections and short lead length on the lead from emitter of Q1701 (Hor.Output) to chassis ground, then,

1.) Add a special ferrite bead (EP12X2) to emitter lead if one isn't already there.

2.) Remove any other connections from emitter and connect them to chassis ground.

3.) Remove top cover of IF module.

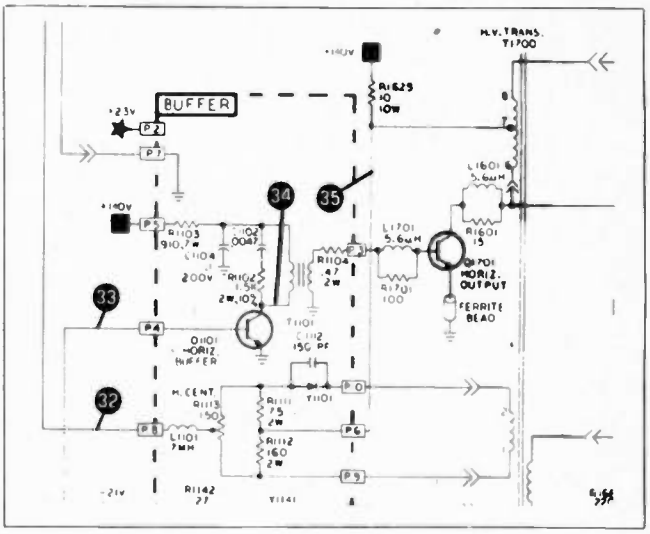
4.) Remove small cover over input circuit, on right side of module.

5.) Solder fold of inside shield to main internal shield which it is touching.

6.) Bend 'fingers' of top cover so they'll make positive contact with all internal shields.

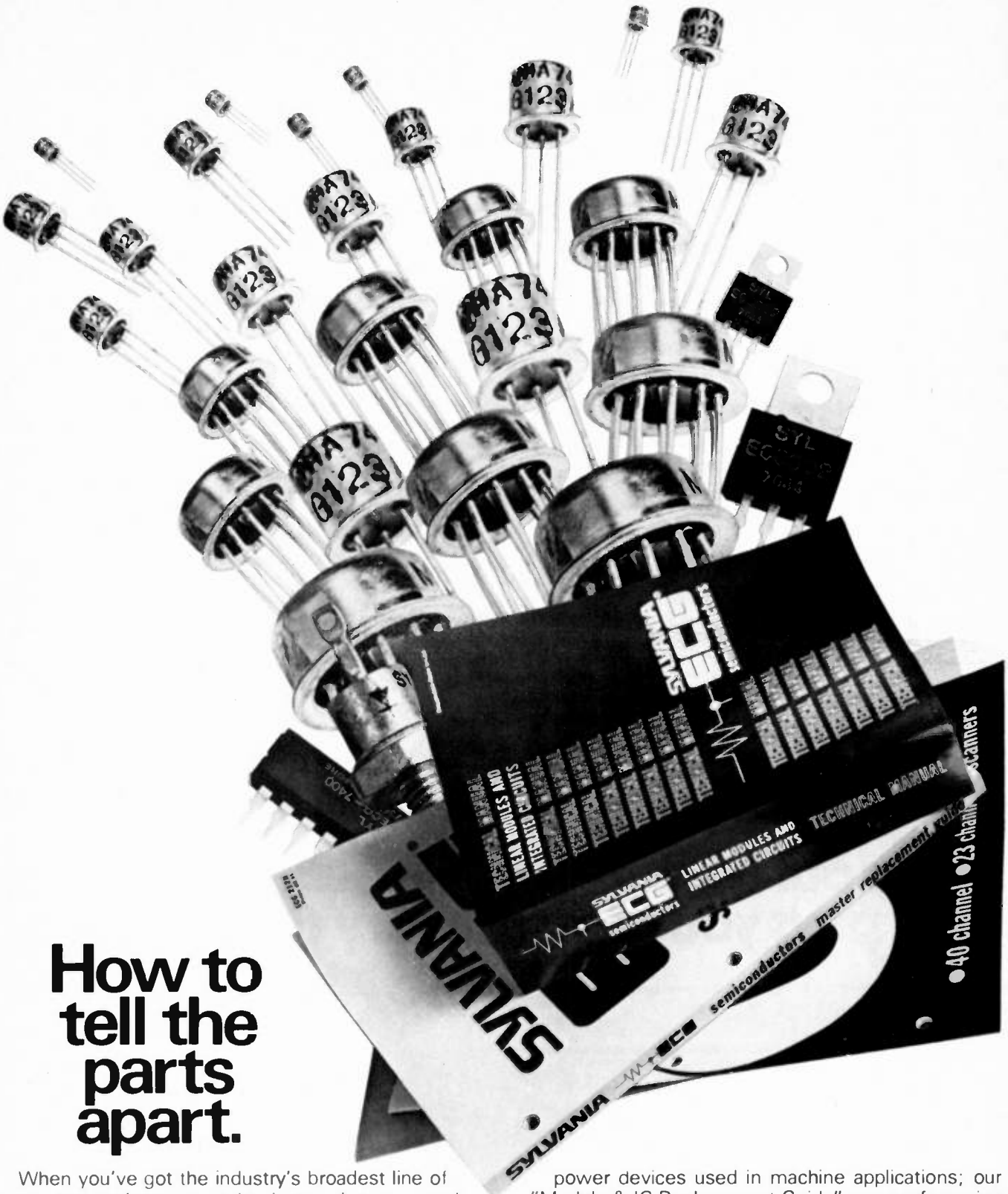
7. Reinstall small cover and top cover.

8.) Do not attempt to align any coils without alignment equipment, except the AFC coil.



Color TV Chassis KE—Power supply diode failures.
Whenever a CR109 or CR110 Power Supply Diode failure occurs, check to see if there is a 1000pf capacitor across the diode. (Early production did not use these capacitors.) If there

GTE Sylvania Distributor and Special Markets Div., 1025 Westminster Dr., Williamsport, PA. 17701



How to tell the parts apart.

When you've got the industry's broadest line of parts, one replacement guide is not always enough. That's why we've got a library.

We've got the book, our "ECG Semiconductor Master Replacement Guide," the most complete handbook available.

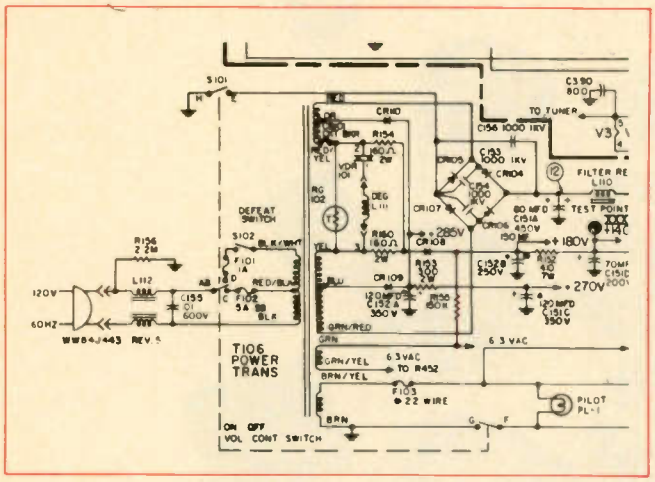
And then there's our specialized manuals: The "CB Replacement Guide" that cross-references more than 5,500 parts for 73 different brands of CB equipment; our "Industrial MRO Replacement Guide" that lists ICs and power devices used in machine applications; our "Module & IC Replacement Guide" cross-referencing 3,000 non-repairable units used in 139 brands of consumer electronics equipment; and the "Linear Modules & IC Tech Manual" that gives 992 pages of design data for linear circuit applications.

You can get them at your local Sylvania distributor.

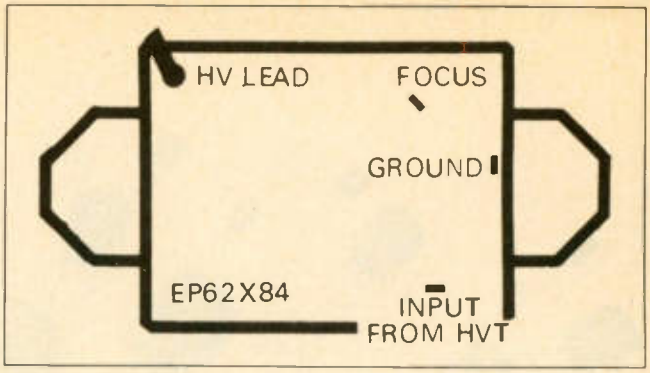
SYLVANIA | GTE

Circle No. 122 on Reader Inquiry Card

are no capacitors in these locations you should add an EP18X81 (1000pf, 1KV) across the replacement diode. The correct part number of these diodes is EP57X4. Addition of the capacitor will provide added protection against voltage surges which might result in future diode failures. Also, certain diodes operating without the added capacitor will develop "switching transients" which appear as a narrow black or gray horizontal bar, which floats up the screen.



Color TV Chassis MB-2—New high voltage multiplier (EP62X84).
The new multiplier is a replacement for EP62X41, but, the terminal placement is slightly different and it doesn't have a connection diagram printed on the side. Connections should be made as shown below.

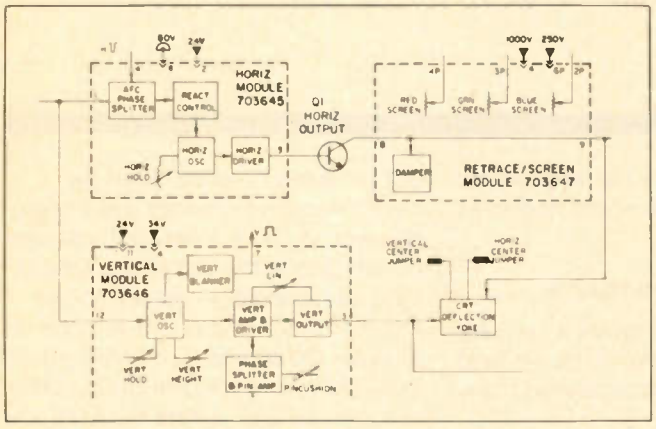


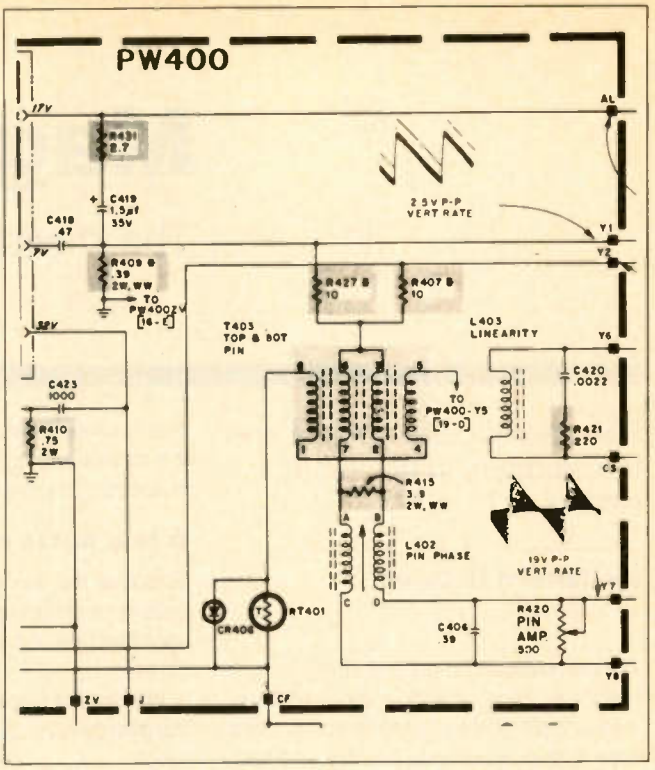
MAGNAVOX

Color TV Chassis T989—Brightness variations.
Replacement B panels (P.N. 703574-11) with clean, lubricated and crimped contacts solve most brightness variation problems in this chassis. However, other components may also cause problems. Also check the following: antenna connection (one lead may be loose); high brightness preset control may be misadjusted or intermittent; LDR may be defective; videomatic switch may have contaminants on contacts; service switch may need to be cleaned or replaced; transistor sockets may need cleaning; or the connector P/J5 may have intermittent pin contacts.

Color TV Chassis T995—An extra pin in vertical output socket.
Damage may occur to some early production T995 chassis if

care is not exercised in replacing the Vertical Output module. In these early production sets, pin 5 was installed in the mother board. In later production, pin 5 was removed and a nylon key was installed in the hole for pin 5. If too much force is applied when installing a module with the key into a set with the extra pin, the mother board can be broken. If one of these sets is encountered, either snip off pin 5 at the board, or remove the key from the module.





RCA

Color TV Chassis CTC 62—Vertical sweep intermittently collapses to four inches and both vertical hold and height act as centering control. Also, unstable vertical size.
To correct, repair open connection, between winding and lug, on L402, and repair open connection at junction of R407, R427, and T403.

ZENITH

Color TV Chassis 19HC55—Shrunken picture (insufficient width).
Solution is to replace R233 in the pincushion circuit.

Magnetism

The irresistable force

The role of coils, chokes and transformers in common circuits

By Bernard B. Daien

I have observed over the years that magnetic components are not always well understood by the technician. Let's face it, the usual texts are dry and fairly difficult to follow. Part of this is due to the fact that many different systems of measurements are used interchangeably; gilberts for ampere turns, webers for maxwells or lines, etc.

This article is intended to remove most of the pain from magnetics, in short, a practical discussion that makes magnetics as easy to understand as ohms law. Such an understanding is important if you consider there are only three passive devices; resistors, capacitors, and inductors.

Failure to understand magnetic devices then constitutes a substantial (33 per cent) gap in our basic knowledge of passive devices. We know the average technician has a reasonable understanding of the capacitor. He knows about voltage ratings, and the characteristics of many different types of capacitors, but usually cannot recite the equivalent characteristics of magnetic devices.

Let's see if we can correct this situation with this article.

Magnetic components cannot be employed to any significant degree inside integrated circuits. The iron cored magnetics are generally large, heavy, and costly. Thus the trend today is towards "active filters" and other circuitry which simulate *some* of the characteristics of inductive circuits. These "synthetic" inductors can shift phase and act like tuned circuits, but they cannot store energy the way an inductor does, and therefore cannot replace magnetic components in power supplies, ignition systems, etc. Despite this, current literature has emphasized the newer active filters, and neglected magnetic devices.

A few basic questions

Suppose we ask ourselves a few very simple questions about things we have taken for granted, and mentioned, many times.

Why is the impedance ratio of a transformer the square of the turns ratio?

Can you define a "henry" in practical terms?

What is "critical inductance"?

If a resistance is put in series with an inductance, will the time constant of the circuit *decrease* if the resistance is increased? These, and many other basic questions are answered in the text that follows. More importantly, the reasons these things act the way they do is made clear.

If we put a coil, a battery, and a switch in series, there is no current flow until we close the switch. Upon closing the switch, current begins to flow. The flow of current causes a magnetic field to start expanding outward. As the field expands outward it cuts the turns of the coil, inducing a counter-electromagnetic-force (CEMF) ... another name for an opposite voltage. The applied EMF and the CEMF oppose each other, thus the actual voltage is quite small. This results in a *small* current flow. But, you say, "I know all this" ... and so you do. But read on a bit more ...

The CEMF is said to be "self induced" for obvious reasons. The property is "self inductance", therefore ... but we always have to shorten or abbreviate terms ... so it becomes simply, "inductance". Now we know what inductance is, so we need practical measurement units for it. As you know, the lines of force of the magnetic field expand outward *when the current increases*. And, when the field expands it produces a CEMF. The measurement unit chosen is *the amount of inductance that produces one volt, when the current through it changes one ampere per second*. Thus, if we start with zero current, and at the end of one second have one ampere, increasing to two amperes at the end of two seconds, 3 amperes at 3 seconds ... continuing thus indefinitely ... we will measure a steady one volt of CEMF across the coil if we have adjusted the turns to have one "henry". (The unit is called the henry after the man who did so much basic work in magnetics.) A very simple definition.

An inductor opposes any change in the current flowing through it because of the CEMF. The CEMF depends upon the number of turns in the coil, and the rate at which the magnetic field cuts the turns ... which depends upon the frequency of the change in the applied current. Since the field expands slowly at *low* frequencies, it takes many turns to produce a useful amount of CEMF. This is why magnetic components for use at low frequencies, such as high fidelity transformers, are larger, heavier, and cost more than public address grade transformers. It also partly explains why you cannot use a PA transformer in a hi fi system.

Stored energy

Energy is stored in the magnetic field. Opening the switch causes the magnetic field to collapse rapidly, cutting the turns of the coil, and inducing a high CEMF, (the principle of the auto ignition coil). The high CEMF causes an arc across the switch contacts, releasing the stored energy in a short time as high peak power, the current through the arc continuing to flow until the stored energy is discharged.

Let's consider the action of a power supply choke input filter in the light of the above. The rectifiers act as switches, turning on and off at the power source frequency.

During the "off" interval, the energy in the reactor discharges as a current flow ... (the reactor acts as a generator during

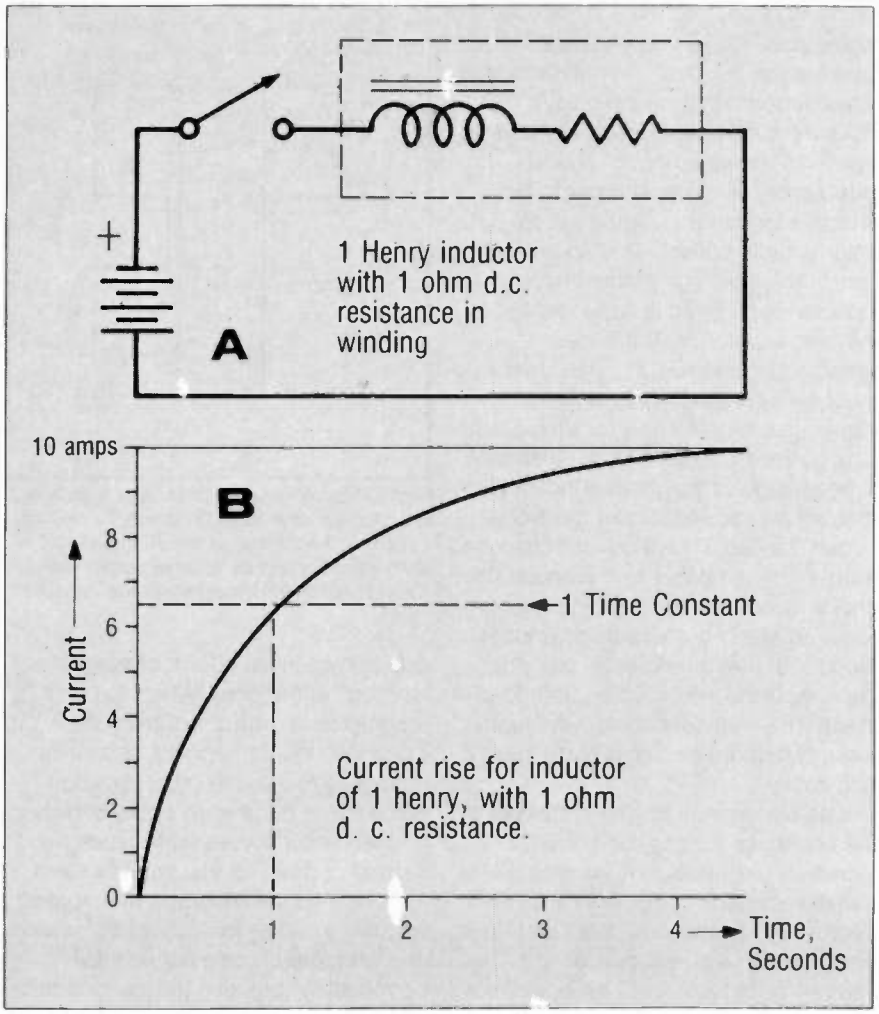


Fig. 1–A) Diagram for inductive circuit capable of maximum current of 10 amps. B) Graphic representation of the current rise in the circuit of 1-A. Note current reaches 63 per cent of maximum in one time constant, or 6.3 amps in 1 second.

this time.) If there is sufficient inductance, *the discharge will continue until the rectifier "switch" closes on the next cycle,* at which time the rectifier will supply current again. If the reactor has insufficient inductance, there will not be enough stored energy, and the reactor's discharge current will drop to zero before the rectifier turns back on ... in which case the current will not be a steady flow, but rather a series of pulses. The amount of inductance required to maintain an uninterrupted flow of current is called the "critical inductance". As a practical point, the amount of inductance required to be "critical" for a full wave 60 cycle supply is given to the formula:

$$\text{Critical L} = \frac{\text{load resistance in ohms}}{1000}$$

Notice that as the load resistance increases, the choke has to be made larger also. This is because a high value of load resistance means a small current, and a small current results in a small magnetic field, which is another way of saying there is very little stored energy in the filter reactor. To put it another way, high currents require less inductance for critical inductance, because high currents result in large amounts of energy storage in the field. But that makes sense when you remember that inductors are current operated devices.

In the power supply filter systems you are familiar with, capacitors are used to store and smooth *voltage* variations. It is advantageous to also store and smooth *current* variations, and this is done in industrial equipment, broadcast apparatus, and other applications where efficiency and performance are important. Where cost, size, and weight are paramount, inductors are omitted. We will continue the discussion of chokes later, but we have to detour a bit first in order to pick up a few more basics.

The electromagnetic force

The magnetic field strength depends upon the number of turns, and the number of amperes flowing. The turns, multiplied by the amperes is referred to as "ampere-turns". Thus ten turns times one ampere is the same as one turn times ten amperes, in field strength. Again we need some practical unit for measurements of this *magnetizing force*. The unit is called the "oersted", and is approximately two ampere-turns per inch of winding length. The symbol for the oersted is the letter, "H".

The above *magnetizing force* creates a magnetic "flux" around the coil, and the concentration of this flux is termed, "flux density", (sometimes also called "magnetic induction"). The *flux density* is measured in units called "gauss" which are defined in the number of magnetic lines induced per square inch of area. When a magnetic core is used, the lines also appear in the core. By definition, approximately 6.5 magnetic lines per square inch of area = one gauss. The symbol for the *flux density* is "B".

To review what we have stated so far, as the magnetizing force (in oersteds) is increased, the resulting flux density (in gauss) also increases. Let's build on that. If we use an *air core,* the relationship is ... a magnetizing force of one oersted (two ampere-turns per inch) produces a flux density of one gauss (6.5 magnetic lines per square inch). If you recall your capacitor theory, different insulating materials between the plates of the capacitor had different dielectric constants. Air had a dielectric constant of 1. By using mica, the dielectric constant was increased by a factor of 5, and the capacitance increased five times. So it is with air as a magnetic core. Air is the "standard" with a "permeability" of 1.

Iron core coils

If we use an iron core, then one oersted produces a flux density of more than one gauss. Air is a poor magnetic core, ... even the cheapest of iron cores results in hundreds of gauss with a magnetizing force of just one oersted. This ability of certain core materials to increase flux density is called, "permeability" and has the symbol "Mu". We can now write a magnetic equivalent of ohms law ... *"The flux density produced = the magnetizing force, multiplied by the permeability of the core",* or B (in gauss) = H (in oersteds) X Permeability. And, like ohms law, it can be rearranged to—

$$\text{Permeability} = \frac{\text{gauss}}{\text{oersteds}}$$

Permeability is the measure of the ease with which flux density can be achieved. It is similar to conductivity in a resistive circuit ... and since resistance is the opposite to conductance, so "reluctance" is the opposite of permeability. Therefore an iron core with

high permeability would have low reluctance. If we insert an air gap in series with the iron core we lower the overall permeability of the series magnetic path, just as placing a resistor in the center of a wire raises the series resistance of the entire circuit. If this is so, why do so many transformers and reactors have gapped cores? The loss of permeability is a deliberate trade-off for other characteristics, as noted below ... so keep this in mind.

Since a high permeability core increases flux density, the CEMF also increases, which increases the inductance. By changing the core material we can therefore change the inductance. If we use an iron core, and steadily increase the current, the flux density also increases ... up to a point! After that, further current increases *do not* result in increased flux density, because the core has become "saturated" ... it can contain only a certain level of gauss and no more.

When saturation is reached there is no further change in flux, without changing flux there is no CEMF, the inductance drops, input current rises sharply and the coil heats. By using a small air gap, core saturation can be prevented at useable current levels. Air has a low permeability, but it does not saturate in normal use. Thus the air gap trades off some of the permeability of the iron core for the ability to handle much higher flux densities without saturation. As a matter of fact, various core materials have widely varying permeabilities, and also vary greatly in their ability to handle higher magnetizing forces without saturating.

For power transformers we need the ability to handle high magnetizing forces without saturating, while for small signal use we may need high permeability. (Since high permeability reduces the need for many turns on a coil, the reduced length of copper wire needed reduces the DC resistance of the coil, which increases the coil "Q", and thus the selectivity of a tuned circuit.

$$Q = \frac{\text{Inductive reactance}}{\text{resistance}}$$

Controlling flux densities

It should be noted that most core materials do not saturate abruptly, but rather approach saturation gradually. The permeability of the core shifts, the inductance starts to fall off, etc. By adjusting the amount of air gap in the core we can deliberately operate in this region, and we do. One example of this is the "swinging choke" used in many *choke input* filtered power supplies. The swinging choke deserves to be used more, since it has many substantial advantages, especially in industrial and other performance oriented uses.

As we mentioned earlier, a choke input filter needs to have "critical" inductance, or more, in order to be effective for current filtering action. But, unfortunately, critical inductance is not a constant factor. The amount of inductance required is dependent upon the load resistance. If the load resistance increases, the inductance must be increased. Thus a fixed inductance is useful only for a fixed load ... or ... the inductance must be chosen to be as large as the greatest inductance that will be required under the worst circumstances. Thus if the load changes from 11 milliamperes to 1 ampere, the choke must have the high inductance required at low current, (high R load), along with the large current carrying capacity of the maximum current (low R load). This means a choke with many turns of heavy wire that is large, heavy and costly.

If we use a small air gap in the core of the choke, so that as the current increases the inductance will drop due to partial saturation ... then as the current *decreases*, the inductance will *increase*. Thus we can use a choke with "swinging" inductance. The inductance changes to meet changing load conditions. When needed, the inductance is high. When the current through it rises, the inductance falls ... but at high currents we do not need much inductance ... (see the formula earlier for critical inductance). By this means we can use a smaller, lighter, cheaper reactor, yet still retain the advantages of a choke input filter with critical inductance.

Transformers

If we apply an AC voltage to an air core coil, a current flow results. When we insert an iron core in the coil, the current flow decreases, because the high permeability of the core causes an increase in the inductance. If we place a secondary winding on the core, we have a transformer, but so long as no load is placed on the secondary, the same small current flows in the primary. This is called the "exciting current" (no load current), and is the amount of current needed to overcome the losses in the core, plus the inductive current due to the primary which acts like any reactor. (This article will not discuss eddy currents in the core, laminations, copper losses, etc.).

Some of the transformer losses are due to hysterisis, a form of magnetic "friction" in the core. When the core is magnetized in one direction by the A.C., it takes work to demagnetize it, and then remagnetize it in the other direction. Since this is done each cycle, at higher frequencies it occurs more times per second ... thus, as you would expect, hysterisis losses increase with applied frequency. Cores for higher frequencies are therefore chosen not only for permeability, but also for low hysterisis losses. This explains why different core materials are used for AF, IR, RF, VHF, UHF, etc. It also makes it plain that a slug from a TV IF coil cannot be used in the horizontal oscillator phasing coil.

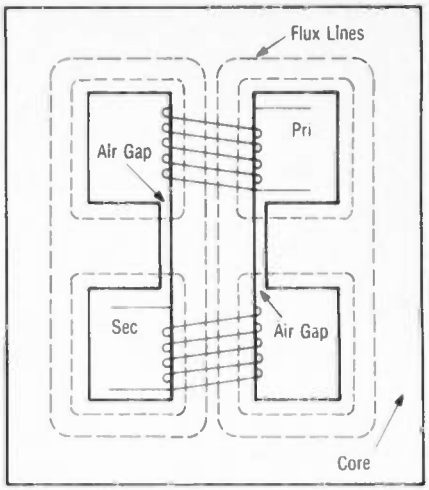


Fig. 2–Representation of voltage regulating transformer now found in some TV power supplies. Secondary is made to saturate early thus limiting its voltage output even through voltage in the primary may increase.

Maximum current

In order to understand the practical considerations relating to core saturation, we need only look at the "time constant" of an inductor. You know that a capacitor and resistor combination require a definite time to charge (or discharge). The time for a capacitor to charge to 63% of the applied *voltage* is stated to be one time constant. When we apply voltage to an inductor and resistor in series, the current rises gradually. The time it takes for *current* to reach 63% of the maximum is also one "time constant", since the inductor is a current operated device.

Note that we have stated, "63% of the maximum current". What is the "maximum current"? If we assume that the voltage source is capable of supplying sufficient current, the limiting factor is the resistance of the coil. Thus if we have ten volts applied, and a coil of one ohm resistance, the maximum current will be 10 amperes. The time for the current to rise to 6.3 amperes is thus

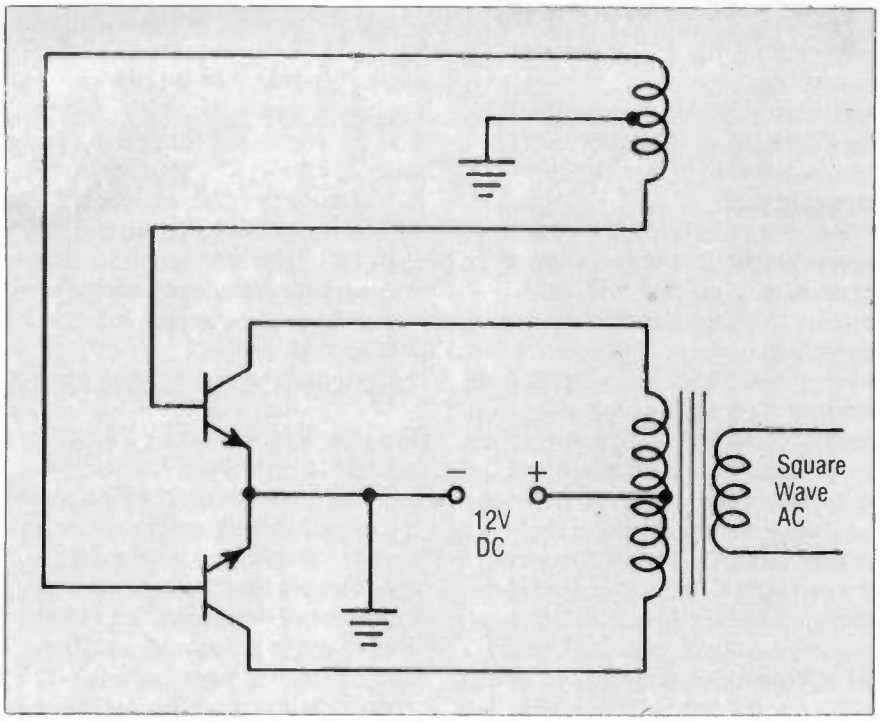


Fig. 3–Typical diagram showing a saturating feedback coil in an oscillator circuit.

one time constant. The circuit is shown in Figure 1A, and the current rise is shown graphically in Figure 1B, for an inductor of 1 henry with 1 ohm of resistance. We can calculate the time for one time constant with the formula:

$$\text{Time Constant} = \frac{\text{Inductance (in henrys)}}{\text{Resistance (in ohms)}}$$

By now you have probably noticed that if the inductance is increased, the time is increased, but if the resistance is increased, the time is *decreased* ... and you may think that is not quite right, since in capacitive circuits, increasing either the capacitance or the resistance gives a longer time constant. This is easily understood if you consider a circuit where the resistance is much greater than the inductance ... such a circuit is practically all resistive. How fast does the current rise in a resistive circuit? You know it rises almost instantly. On the other hand, if we had a purely inductive circuit (no losses) the counter EMF would just about equal the applied EMF, and the current would rise very slowly, (a perfect inductor). So you see, adding resistance actually speeds up the rise time. Remember, capacitors and inductors behave oppositely in a circuit, which further reinforces our argument.

Transformer ratings

Now look at Fig. 1A again. Suppose the iron core saturated at 5 amperes of applied current. The core would saturate long before we reached one time constant. In order to prevent this occurring we can do one of two things with the chosen coil. (1) We can cut off the applied voltage before the current reaches 5 amperes, or, (2) we can reduce the applied voltage to less than 5 volts, which means that we will never reach 5 amperes due to the resistance of the coil. This is exactly what we do with a transformer. We rate the transformer for maximum applied voltage, and we also rate it for applied frequency.

Thus a power transformer would be rated for 60 cycles in the U.S. One cycle at 60 cycles is 16.6 milliseconds, and a half cycle is 8.3 milliseconds. Every 8.3 milliseconds the polarity of the applied voltage reverses. If the transformer core has not saturated in 8.3 milliseconds, it's safe for 60 cycles. But if we try to use it on Canadian power of 50 cycles, where a half cycle is 10 milliseconds, it may saturate. What can we do about that? We can increase the inductance, which increases the time constant (current rises more slowly), so that the core does not saturate in 10 milliseconds. The inductance can be increased by using more turns, or a bigger core, or a core material that can hold more magnetic lines. Thus a 50 cycle transformer is bigger, heavier, and costlier than a 60 cycle one. Also, the 50 cycle transformer can be used on 60 cycles, but not vice versa!

If you examine an AC power transformer you will find no air gap in the core. We simply design it so that it does not saturate in the period of a half cycle. What about an audio output transformer, or an interstage transformer, where there is a *steady D.C. component* due to the fact that the supply source is rectified and filtered D.C.? In that event an air gap is put in the core, which prevents saturation, as we discussed earlier. A little understood point is that the current in both the primary and secondary circuits of a full wave rectifier is A.C., but the secondary current in a half wave rectified circuit, is pulsating D.C. and will saturate the core. Thus a filament transformer can be used with a *full wave bridge rectifier* to provide low voltage D.C., or, a filament transformer with a center tapped secondary can be used with two diodes in a *full wave configuration* ... but ... you cannot successfully use a half wave rectifier with the same transformer. The reason is that it has no air gap, having been designed *for AC use only*. Most transformers will run hot, and be limited to low output currents, unless designed for such half wave use.

Volt regulating transformers

In recent years saturation has been used to accomplish voltage regulation inside the transformer itself, and a number of TV sets have employed such transformers. How this is done is explained with the help of Figure 2. A close examination of Figure 3 reveals that it is different from the usual power transformer in core structure, having two magnetic shunt legs. The magnetic lines in the core, due to the primary, are divided, some taking the short path through the shunt, and some going the "long way" around the entire core path. Only the lines which go the long way link the secondary to the primary. When a load is placed on the secondary, current flows in the secondary, causing lines in the core. As was the case with the primary, *some* of these lines link the primary to the secondary.

Thus, only part of the primary flux links the secondary, and only part of the secondary flux links the primary. If a capacitor is placed across the secondary winding, with the proper capacitance to resonate with the secondary winding inductance at the line frequency, a current will flow in the secondary. This causes the core under the secondary to saturate, but since the primary is not fully coupled to the secondary, the core under the primary does not saturate.

Previously, we learned that reducing the frequency could cause saturation ... at low frequencies we needed a bigger core. Now we see that we can arrange a trade-off. Our 60 cycle transformer cannot work on 50 cycles at a nominal 115 v AC line ... but it can work if we

reduce the line voltage to a nominal 90 volts or so.

Adjusting specifications

Stated another way ... if we raise the frequency applied, we can raise the voltage applied. Experimenters found this out with military surplus transformers. A 400 cycle transformer rated at 120 volts primary and 24 volts secondary, could be used at other frequencies if the voltage applied was adjusted accordingly, ... for audio use down to speech (telephone quality) frequencies of 300 cycles, the voltages would have to be 90 volts on the primary and 18 volts maximum on the secondary ... so using the transformer backwards, as a modulation transformer, or forwards as an output, it worked OK. A practical application of this principle can be utilized when foreign made (50 cycle) equipment is to be repaired. The original transformer may be costly, or unavailable in the U.S., but one of our 60 cycle substitutes will be perfectly OK so long as the equipment is used on 60 cycles only.

Another way saturation is used to advantage is in saturating-core oscillators. Some of the less expensive DC to AC converters use this principle. The output transformer of a push-pull amplifier is arranged so that it will saturate. A feedback winding is placed on the same core (basic circuit configuration shown in Figure 3). When the core reaches saturation the circuit switches similar to the action of a multivibrator, except that the time it takes to saturate is determined by two factors; the transformer design and the applied voltage. A higher input voltage causes more current to flow, and quicker saturation, hence faster switching, resulting in higher output frequency. With proper design, the output is 60 cycles at 12 volts applied from a storage battery (stable source). For auto use, the auto voltage regulator holds the voltage fairly steady, and thus we have the basis for the 12 DC to 120 AC 60 cycle converters seen in many electronic supply houses.

Saturation can be used in other ways very effectively, and one example will be given here ... called a "saturable reactor", a device with high power gain, capable of handling high power at line frequencies. As shown in Figure 4, an inductor is placed in series with a load, across the AC line. At high inductance, very little current will flow to the load, but at low inductance, the circuit will behave as if the reactor is shorted out of the circuit. A secondary winding is placed on the same core, fed from a DC source, through a resistor, so that the DC causes the core to saturate, or partially saturate, when desired, by adjusting the amount of DC applied. If the control winding has many turns, a very small DC current can saturate the un-gapped core, controlling a very heavy current. The dc for the control can be derived by rectifying the AC source, making the device self-sufficient. The same principle is used in "magnetic amplifiers" (magamps). These devices are large, heavy, and take a cycle or two to operate, but are useful where reliability and ruggedness are paramount, and thus are still encountered in industry and utilities.

You can readily see that saturation is an important, if sometimes undesirable phenomenon, which must therefore be considered the same way a technician considers voltage rating in dealing with capacitors.

Charging an inductor

We have already examined the time constant of an LR circuit. Just as a capacitor stores its energy in the dielectric field, so the inductor stores its energy in the magnetic field. This stored energy depends upon the current ... and the current flowing depends upon the time constant curve. How much energy is stored in the coil? The energy is rated in Watt-seconds. One watt for one second is one Watt-second, and ten watts for a tenth of a second is also 1 watt second. Watts times seconds = watt seconds. The energy in a coil, in watt seconds =

$$\frac{\text{Inductance (in henrys)} \times \text{current squared}}{2}$$

Thus the energy is doubled if the inductance is doubled. The energy becomes four times greater if the current is doubled. This also shows the energy storage capability of a reactor used as a power supply filter. You should now appreciate that solid state "active filters" which perform phase shift and tuning functions, do not have the capability of storing this energy, which can be quite large. This is a point that is often confused. We can make complex circuits that "look like" inductances, and have *some* of the characteristics of inductances, but there is no substitute for an inductance when energy storage is a factor.

Impedance matching

Too many technicians know, parrot-like, the formula, impedance ratio = turns squared thus a turns ratio of 3 to 1 results in an impedance ratio of 9 to 1. The question is, why? Let's use a little of the knowledge we already have. We know that impedance equals the voltage divided by the current, $Z = \frac{E}{I}$. We also know that transformers can change voltage and current, but that they do not amplify power. Thus if a transformer has a 3 to 1 ratio, the output voltage will be 3 times *greater* than the input voltage, ... but since the transformer cannot increase the power level, and power = E × I, the available current is *reduced* to one third of the input current. To sum up, as the voltage is increased, the current is decreased *by the same ratio*. Now let's look at our impedance again, with the voltage increased by 3, and the current decreased by 3. $Z = \frac{3E}{I/3}$ which = $\frac{9E}{I}$. Notice that the turns ratio comes up as a multiplier twice, once because the voltage is multiplied, and again because the current is divided.

This same principle holds for transmission line matching by means of "stub" cables, etc. Whenever we use a "passive" (non amplifying) device, the

continued to page 52

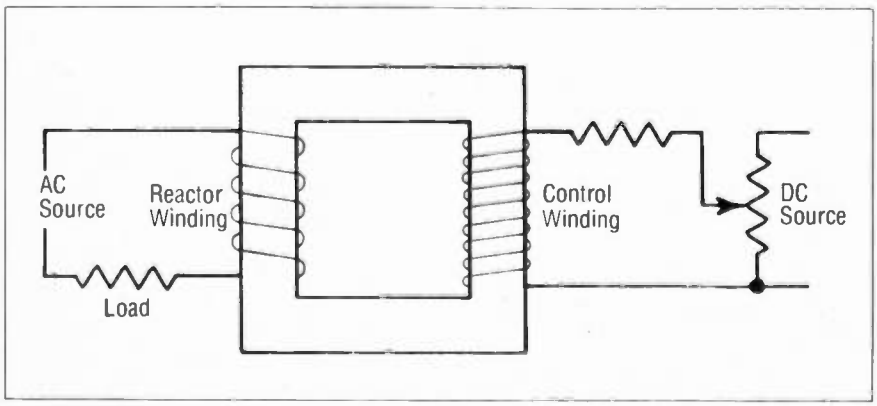
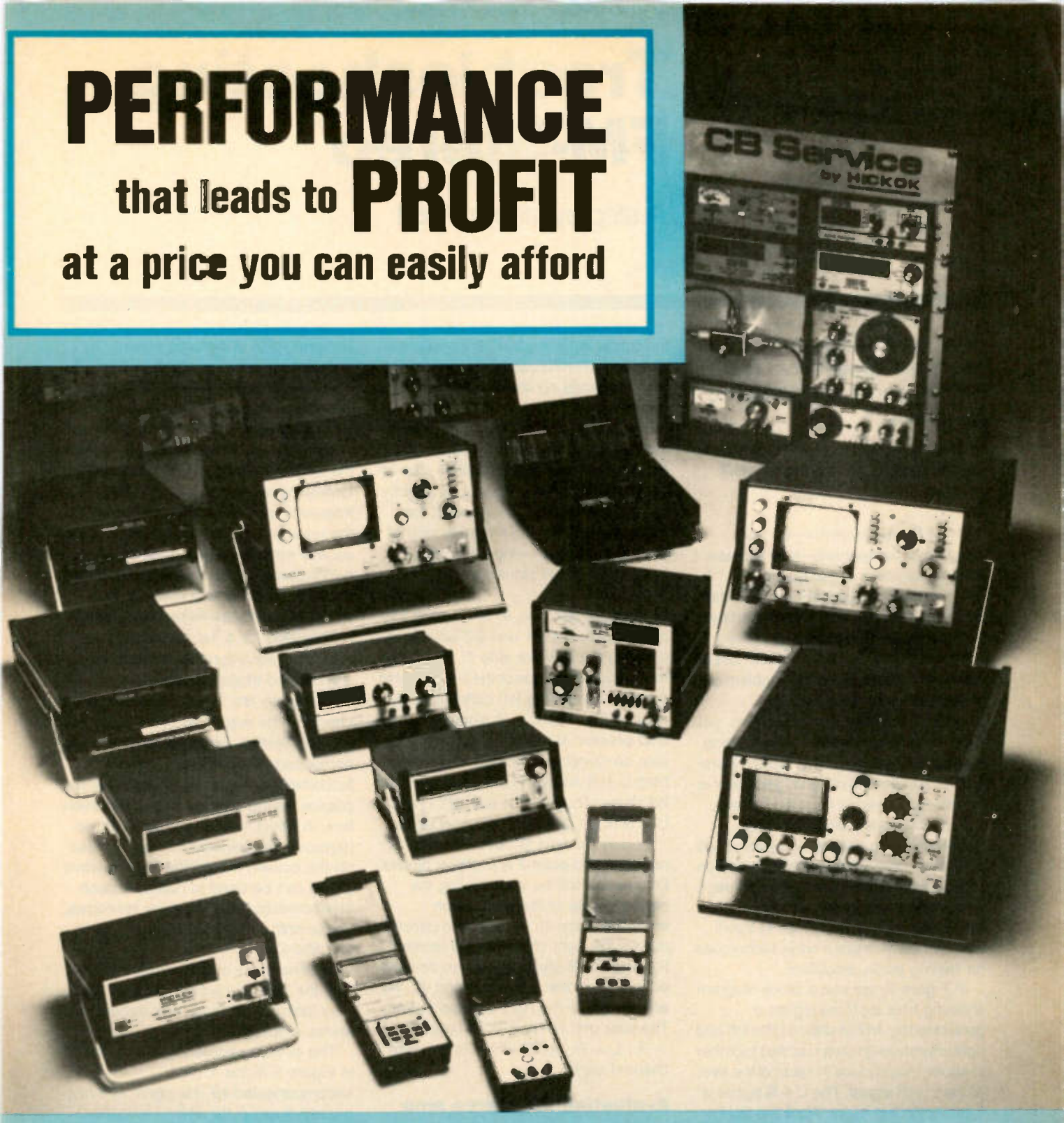


Fig. 4–The typical "saturable reactor" with an inductor in series with a load across the AC line. This circuit is capable of high power at line frequencies.

PERFORMANCE
that leads to PROFIT
at a price you can easily afford



In the home or on the bench, Hickok means more profit per minute. Ask the old timers as well as the "new timers" in your business in your town and they'll tell you . . . Hickok dependability means extra *credibility* for you . . . and that means acceptance of your recommendations to right what's wrong. Write for exciting free catalog of new Hickok test instruments and name of your nearest distributor.

HICKOK

the value innovator

Instrumentation & Controls Division
The Hickok Electrical Instrument Co.
10514 Dupont Avenue • Cleveland, Ohio 44108
(216) 541-8060 • TWX: 810-421-8286

IF YOU ARE OUTSIDE OF OHIO AND YOU DON'T KNOW WHO YOUR LOCAL DISTRIBUTOR IS, CALL US TOLL FREE AT **800-321-4564**

Circle No. 124 on Reader Inquiry Card

Troubleshooting FM-Stereo

A step-by-step method

Here are some diagnostic and alignment procedures based on the use of an FM/Stereo generator.

By Robert L. Goodman, C.E.T.

AM-FM Stereo systems—be they console or component—now represent a large segment of the home entertainment electronics market. Many faults in these systems are caused by a failure in the FM decoder or some component drift. In many cases, just by realigning the receiver, the problem can be located and corrected. To troubleshoot these stereo systems, you must have some means of evaluating their performance. In other words, some type of standard test signal generator is needed to evaluate the total system.

Procedures for alignment and troubleshooting FM stereo systems will be listed in this article, as well as tips on using a special piece of test equipment, in this case, Sencore's SG165 A/FM/Stereo Analyzer (Fig. 1) You'll also see some square-wave techniques for testing audio amplifiers.

In Figure 2, we see a block diagram showing how a stereo signal is generated by an FM station. The left and right channel signals are added together in adder 1 to produce the sum of the two, or the L + R signal. The L + R signal is then fed to the mixer. Next the right channel signal is inverted and added to the left channel signal in adder 2. The result of adder 2 is the L-R signal. The L-R signal is AM modulated on a 38 KHz carrier using a balanced modulator. The output of the balanced modulator (upper and lower sidebands) is then fed to the mixer. A 19 KHz sine wave is generated from the 38 KHz used in the balanced modulator and also fed into the mixer. The output of the mixer, called the composite signal, is then used to modulate the RF carrier.

The composite signal is injected into the center top of the 38 KHz transformer where the 38 KHz carrier is reinstated to the sidebands containing the L-R information.

The result of the carrier reinsertion is the modulation envelope shown in Figure 3. Note that the positive side of the modulation envelope looks exactly like the L-R signal generated at the transmitter, while the negative side of the modulation envelope is a mirror image of the L-R signal, or a -(L-R) signal.

During time A (Fig. 4) when point 1 is positive, diodes D1 and D3 will be on, allowing the positive side of the modulation envelope or the L-R signal to develop across the left channel load resistor R1. The L + R signal which is also present at points 1 and 2, would also be developed across R1, so that both L + R and L - R are present at the left channel output. The sum of L - R and L + R is 2L or the left channel signal.

During the time B—when point 1 is negative and point 2 is positive, diodes D2 and D4 will be on, allowing the negative side of the modulation envelope or the -(L - R) signal to develop across the right channel load resistor R2. The L + R signal would also develop across R2 so that both L + R and -(L - R) are present in the right channel output. The sum. of L + R and -(L - R) would be L + R - L + R, or 2R which is the right channel signal.

Evaluating the stereo amp

Stereo amplifiers can often come up with some very elusive problems, and you need full testing capabilities to locate some of these troubles. Distortion, unbalance between channels, poor frequency response and other faults can require a lot of time to locate. The customer is generally interested in the stereo's output power and tonal quality.

For a complete evaluation of an audio system, some method of determining frequency response, and effectiveness of tone controls is necessary. This evaluation can take the form of a complete plot of the sine wave frequency response, which is time consuming, or the analysis of the stereo amplifiers response to a square-wave test signal input. A 400 Hz square-wave output from a function generator or from the Sencore analyzer is an ideal signal for testing any audio system. High frequency performance is indicated by the response to the leading edge of the square-wave and low frequency performance by the tilt to the top of the square-wave. All tone controls that would affect the audio response should be adjusted for a flat response.

Square-wave tests in conjunction with a wideband triggered-sweeped oscilloscope are a very rapid way of checking the response of an audio or stereo amplifier. Since a square-wave is composed of many harmonics of the fundamental frequency, an amplifier that passes a square-wave without distortion has, in effect, responded to all of the harmonic frequencies that go to make up the square-wave. The square-wave signal can be used to measure such characteristics as frequency response, phase shift and transient response in amplifiers.

Let's now look at a few square-waves, with the help of a scope, and see what they look like as they pass through a stereo amplifier.

The bottom square-waveform shown in Figure 5 is the normal uncompensated 400 Hz signal as it has passed through the stereo amplifier. Note that the square-wave is almost perfect, indicating a flat amplifier response.

The top scope trace in Figure 5 is the same amplifier response, with the treble tone control adjusted for maximum boost. Note that the square-wave has a large spike on the leading edge, indicating the increased amplification to higher frequencies. Also, note that the top of the square wave is flat, indicating normal response to low frequencies.

In the top scope trace of Figure 6 we see the amplifiers response through a

Fig. 1-The Sencore SG165 AM-FM Stereo Analyzer

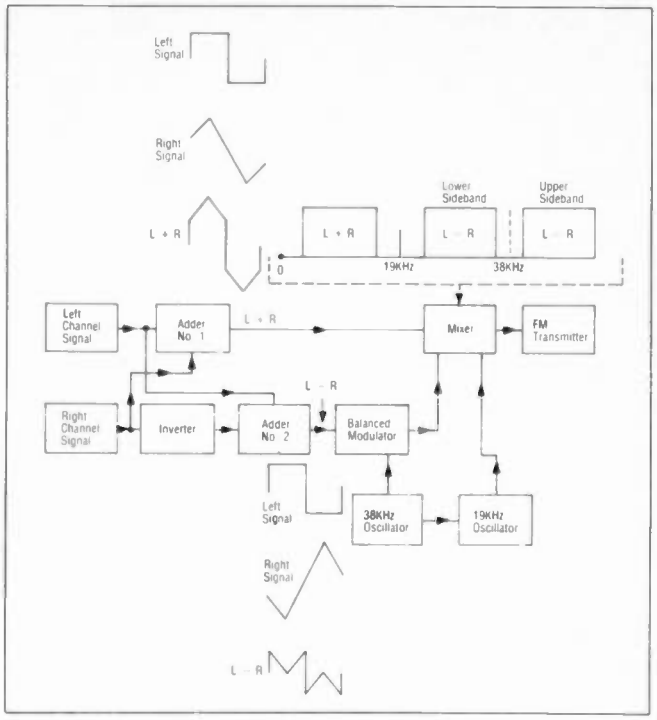


Fig. 2–Block Diagram of FM Stereo Transmitter

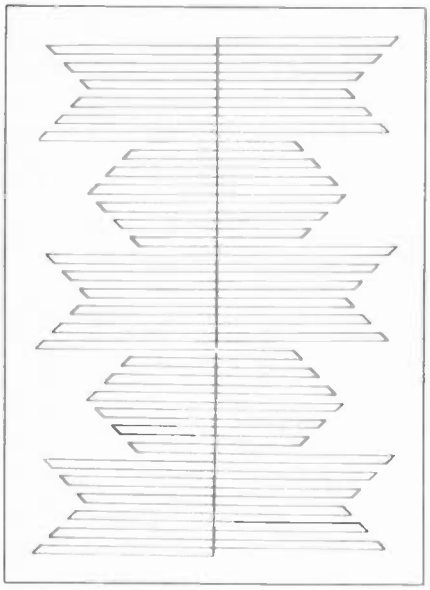


Fig. 3–The 38KHz Modulation Envelope

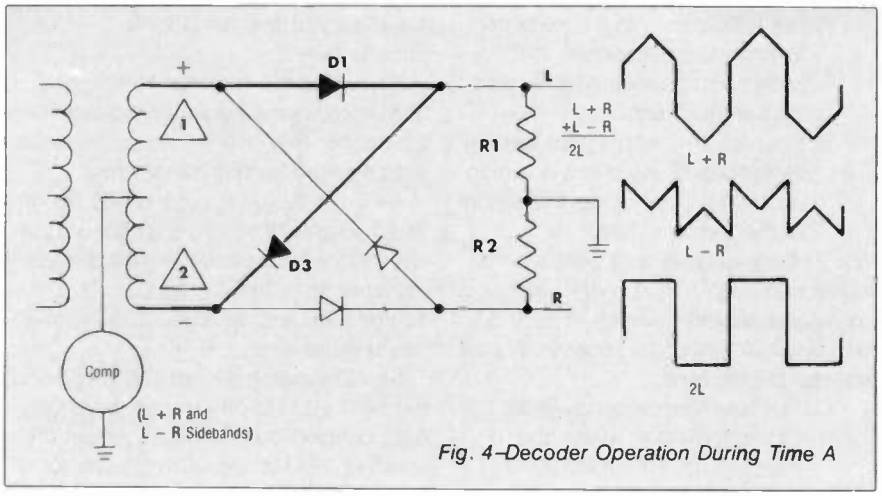


Fig. 4–Decoder Operation During Time A

crystal phono input. Note that the square-wave has the slope of the RIAA playback curve, and that in addition there is a peak on the leading edge. The peak on the leading edge indicates a high frequency boost to compensate for the normally lower high frequency response of the crystal type cartridge.

The bottom square-wave trace in Figure 6 was produced when the stereo amplifier's loudness contour was switched on. Note that the top of the square wave has an upward slope, indicating increased response to low frequencies. Note also that the leading edge of the square-wave retains its normal rise, indicating a normal or slightly increased response to higher frequencies. The loudness contour is intended to compensate for the human ears reduced sensitivity to low frequencies at low volume levels. As the volume control is advanced toward maximum, the effect of this control dimishes until the square-wave pattern returns to normal and indicates a flat amplifier response.

The dual-trace scope sine-wave patterns shown in Figure 7 were taken at the left and right stereo speaker output terminals. The top trace is a normal output, but the bottom trace is caused by a distorting stage or some type of noise. Look for poor solder connections or a noisy transistor stage. Also, an open power supply filter could cause this type trouble, but it will usually appear on both channels.

Now that we've found some ways to determine overall amplifier response, let's take a look at some other problems we may run into.

Stereo separation checks

Many factors can influence a receiver's stereo separation. Signal strength, antenna rotation, IF alignment, stereo decoder alignment, and even power supply faults, may be responsible for poor stereo reproduction. The station air signal is not very good for determining receiver performance so an FM stereo test generator is best for this evaluation. In most cases the chassis will not have to be removed from the cabinet in order to check stereo separation.

1—Remove the antenna from the receiver, but leave the speakers connected. Turn the receiver volume or loudness control up so that even a weak signal is audible, and with the receiver's AFC off, and all other controls set for a

flat audio response, tune the receiver to a quiet spot around 98 MHz.

2—Turn the receiver off, the remove the speakers, and connect the analyzer left and right channel meter leads to receiver speaker jacks. Set for proper speaker match. Now set the meter watts range switch to separation test.

3—Connect generator signal output to antenna terminals of receiver with a matching pad.

4—Adjust microvolt output controls for 500 microvolts.

5—Switch the left and right 400 Hz switches on, and set the pilot 19KHz switch to 10 per cent.

6—Turn receiver on and adjust RF tuning control for a maximum indication on the left and right channel output meters. Reduce receiver volume control as required to keep output meters below full scale.

7—Fine tune the receiver as follows:

A./For receivers with a zero center tuning indicator, adjust the receivers control tuning for zero center indication.

B. For receivers with a peak turning meter, adjust the receiver tuning control for a maximum indication of the tuning meter.

NOTE: On receivers with both a zero center and peak tuning meter, both indications should coincide. If they do not, misalignment of the receiver IF's or detector is indicated.

C. For receivers with no visible tuning indicator, adjust the receiver tuning control for a maximum indication on the SG165 output meters.

8—Adjust the receiver volume and balance control for a full scale (Odb REF.) indication of the left and right channel output meters as seen in Figure 8. If it is necessary to adjust the receiver balance control more than 20% from center, a fault is indicated either in one audio channel, or in the MPX decoder circuit.

9—Alternately turn on and off the left and right 400 Hz switches, and observe the left and right channel output meters. Read the separation directly in db for the channel with the 400 Hz off. Note figure 9. The readings for both channels should be at least 20db, with a maximum difference between readings of 10db.

10—Check the effect of the receiver tuning control on the separation. If better separation is obtained at some tuning point other than that in step 7, *misalignment of the receivers IF's or detector is indicated.*

11—Check the "lock in range" of the receiver MPX circuits by switching the pilot 19 KHz to 5% and observing the effect on receiver separation. A properly operating receiver should produce nearly the same separation with the pilot 19KHz at 5% as it did with 10% pilot. If difficulty is encountered, make stereo separation adjustments as follows.

Separations adjustments

The most common reason for poor stereo separation is misadjustment of the receivers 19KHz and 38KHz circuits. The phase relationship for proper stereo is very important, and even a 10% phase error on the 38 KHz signal will nearly eliminate the stero effect.

1—Hook up the all signals output to the tuner input adjustments.

2—Connect an oscilloscope to measure AC voltage to the output of the secondary of the last 38KHz transformer.

3—Adjust the receiver 19KHz and 38KHz coils for a maximum indication on the scope. Remove the scope from the output of the 38KHz transformer.

4—Turn the analyzer left 400 Hz off and the right 400Hz on, and observe the left channel output meter. Make these adjustments carefully, turning all adjustments a small amount, rather than one a great deal.

5—Now switch the left 400 Hz on and the right 400 Hz off, and observe the right channel output meter. Adjust the receiver 19KHz and 38KHz coils for a minimum meter indication. Make these adjustments carefully, turning all adjustments a small amount.

6—Repeat steps 4 and 5 until equal and maximum separation between channels is obtained.

7—If the receiver has a separation or balance adjustment in the decoder, adjust this control for optimum separation on both channels.

8—If proper separation cannot be obtained, the faulty circuit component must be located and replaced.

Running an FM-IF alignment

For the following IF alignment we will use the sweep and market method which gives the best results.

1—Tune the receiver to a quiet spot on the dial, connect speaker to loads in analyzer in place of the receiver speakers, adjust the receiver volume control to minimum. Set the generator output selector switch to the 10.7 MHz sweep and marker position.

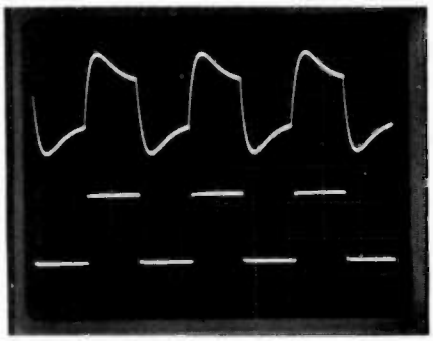


Fig. 5–Upper trace shows treble adjusted for maximum boost; bottom trace is uncompensated 400 Hz square wave.

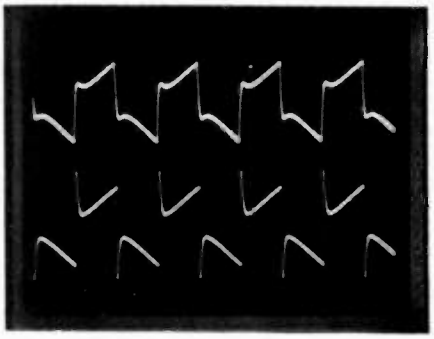


Fig. 6–Amplifier response through a crystal input (top); and with the "loudness contour" switched on.

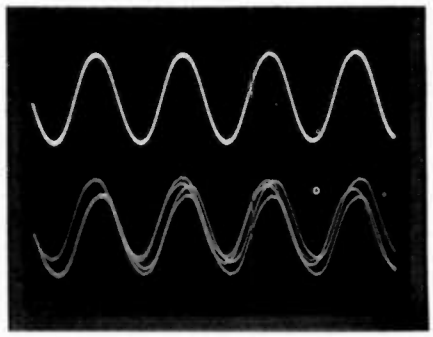
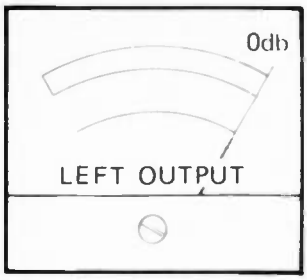


Fig. 7–Dual trace scope pattern at output of speaker terminals. Bottom trace shows evidence of a distorting stage.

2—Use the phone plug and clip lead to connect the - to scope, - jack on the analyzer to the vertical input of a scope, and adjust the scope's vertical gain controls for .2 volts per CM. Set the oscilloscope horizontal frequency switch to the 60 Hz line sweep position, and adjust the scope's line sweep phase control for a pattern with no indication of foldover. Adjust the AM/FM IF rocker to center the markers on the trace. Refer to FM 10.7 MHz IF circuit in Figure 10.

3—Temporarily disconnect the capacitor, C3, from across the detector load resistors. Now connect the detector probe to the cathode output of one of the detector diodes. Plug the detector cable



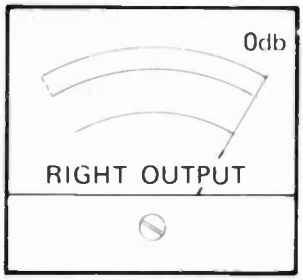
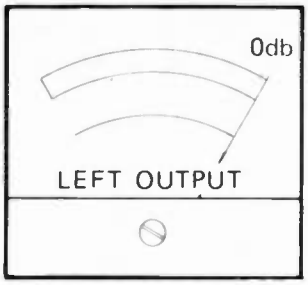


Fig. 8–Both channels on receiver adjusted for reference



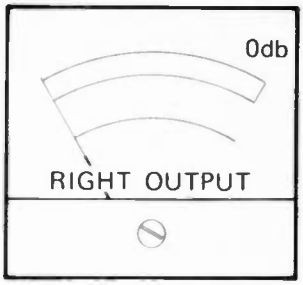


Fig. 9–Right channel off, measure separation

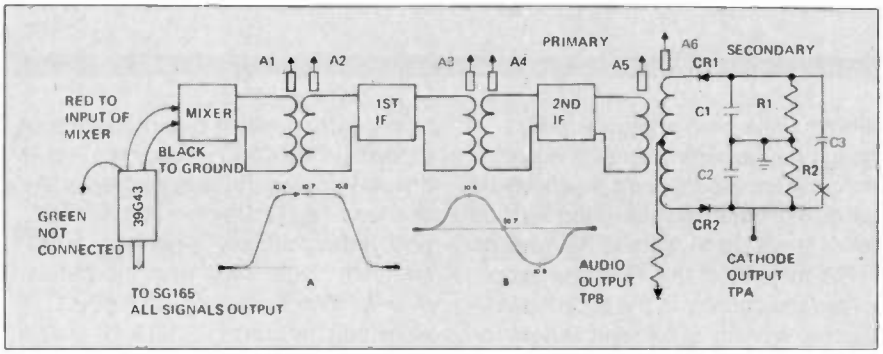


Fig. 10–A typical 10.7MHz IF Circuit

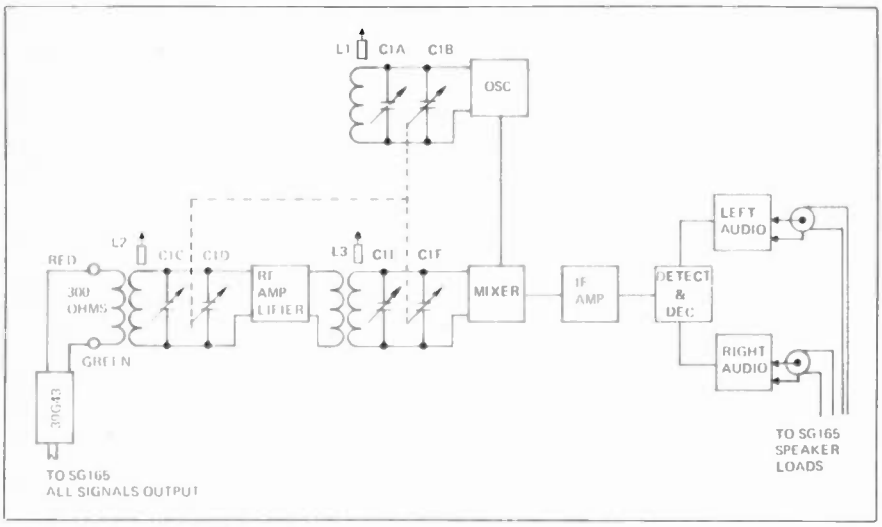


Fig. 11–Typical FM RF Circuit

into the "from detector" jack on the analyzer.

4—Use the matching pad to connect the all signals output to the input of the mixer. Connect the red lead to the input of the mixer and black lead to ground.

5—Adjust the IF interstage transformers, A1 and A4, and the primary of the detector transformer A5, for a response curve as shown in Figure 10-A. The peak of the curve should fall at 10.7 NHz, and the 10.6 MHz and 10.8 MHz limit markers should be at least 90% high on the curve. Adjust the microvolt output controls to inject just enough signal for a noise free response curve.

6—Reconnect the capacitor C3, and connect the red lead of detector probe to the audio output test point (TPB).

7—Adjust the secondary of the detector transformer A6, for the Symetrical "S" Curve as shown in (Fig. 9-14B). Retouch the primary of the detector transformer, A5, to obtain the best possible curve.

FM RF alignment

There are as many variations in FM RF circuits as there are receiver models out in the field. FM RF adjustments are usually located in three places. As you refer to Figure 11, this would be the input to the RF amplifier, the input of the mixer, and the local oscillator. The adjustments take the form of a trimmer capacitor and/or an adjustable coil slug. Either or both forms of adjustments may be found in any of three locations. If both forms of adjustment are present at a given location, the coil should be adjusted at a frequency near the high end of the band. If only one adjustment is present in a given location, it will be necessary to optimize its adjustment for best receiver performance across the band. The following alignment procedure is typical for many FM receiver front ends.

1—Connect generator signal output to the receiver's antenna terminals with the proper matching pad.

2—Connect the speaker loads in place of the receiver speakers and select the proper speaker load resistance. Set the power range switch to the separation test position. Switch the receiver AFC off.

3—Set generator output selector to the FM RF, the FM modulation switch to STD MPX, switch the left and right 400 Hz on, and set the 19 KHz pilot to zero. Use the lowest output setting of the microvolt output control that will produce a usable indication on the output meter.

4—Set FM receiver and analyzer frequency to 108 MHz. Adjust trimmer CIA. Tune for maximum indication on left and right channel output meters.

5—Set FM receiver and analyzer frequency to 88 MHz. Adjust coil L1. Tune for maximum indication on left and right channel output meters.

6—Repeats steps 4 and 5 until the receiver tunes properly at 88 MHz and 108 MHz.

7—Set frequency of FM receiver and analyzer to 108 MHz. Adjust trimmers CIC, CIE for maximum indication on left and right channel output meters.

8—Set frequency of FM receiver and analyzer to 88 MHz. Adjust coils L2, L3 for maximum indication on left and right channel output meters.

9—Repeat steps 7 and 8 until no further improvements can be obtained in the receiver's sensitivity. ETD

Servicing audio components

A bright spot in consumer electronics

Profitability bumps against reliability, but for retail sales centers, service can be the critical factor.

By Dick Glass, C.E.T.

Stereo Components are big business. Quality speaker systems; tape recorders; AM/FM tuners; turntables; auto-sound equipment and other accessories are being bought by the young and old alike. The prices paid for many of the *systems* are well above the cost of a quality color tv console. TV servicers often are found "crying the blues" because tv set owners are unwilling to pay for required service. The set owner in many cases paid less for the TV than it will cost to repair it, so often the set owner chooses to buy a new one and the servicer loses a repair job. The same problem has been prevalent in the CB business. It is tough to perform a $30 to $40 repair job on a CB radio that is selling for $39.95!

One bright spot in the electronics industry is Audio. Reversing the TV-CB trend, the marketers of high quality audio equipment have created an exciting and highly profitable segment of the electronic sales industry. That success in sales should have a beneficial effect on the business of repairing these products. The owner of a thousand dollar stereo system does not hesitate having competent repairs made to his valued equipment. Another plus for service technicians is that since virtually all the audio equipment is solid-state it requires a good technician to repair it. The hi-fi buff of a few years back, who tinkered with the tubes and speakers in his hi-fi gear, is "lost" now when he looks into solid-state stereo components. Where he formerly was able to make simpler repairs even though he had only a smattering of technical knowledge, now he knows he can do more damage than good and had better leave repair work to the experts.

The majority of the TV repair shops across the country in the recent past adopted a policy of refusing service for all those "off-brand" changers and recorders. One reason was that much of this equipment was very low priced and appeared to be unprofitable to service. Then too, parts and service data seemed to be even more difficult problems than they were for TV repair. Coupled with the shortage of good technicians (a shortage caused by too low wages for technicians) the audio component repair business was not considered seriously by many servicers.

Today, service businesses specializing in audio repair are often found to be doing well. In fact most would not trade places with TV or CB servicers. They rarely have burdensome outside work; have very few heavy units to transport; and as a rule have more dollars worth of test equipment than the TV/CB shops. Most of them regularly service dozens of brands and seem to have no major problems doing this.

A look at one large stereo sales/service business may be helpful in understanding how repairs are handled and how good service is used to enhance sales.

CMC stereo centers

CMC STEREO CENTERS are currently located in six major cities: Indianapolis; Kansas City; Atlanta; Memphis; Houston; and the headquarters city: St. Louis. Expansion is planned in other major midwest and southern markets. There are several CMC STEREO CENTERS in each of these cities. Site selection is extremely important so each one of the retail stores is located in heavy traffic areas in suburban sections of town. While CMC's policy is to make the service departments profitable (As opposed to J.C. Penny's "breakeven" policy) the company is primarily sales oriented. I did not ask what the chain of over 47 stores produces in product sales, but my guess is that total annual sales are over $30 million. Each retail location is managed by a professional sales team consisting of a store manager, assistant store manager, several full time and part time audio sales people, and an installation technician who is responsible for installing auto sound and CB products.

Each of these team members is goal oriented—doing all the things it takes for sales success. Among the criteria are: attention getting store front identification; consistent heavy advertising in media; special sound rooms for good demonstrations and comparison; sales award programs and commissions.

The brands you will find at a CMC Stereo Center are: Pioneer, Dual, BOSE, Kenwood, Technicis, Marantz, BIC, Clarion, DLK, plus many others.

All CMC Stereo Centers (except for mall stores) have a well equipped indoor auto-sound installation bay. In-dash and under-dash radios and tape players, CBs, speakers and so forth are installed in cars in this room which is large enough to handle many recreational vehicles.

The repair service department is located in the district office, serving all stores. Store Managers, each of whom have a company van, deliver and receive repair units daily from the district service department.

A typical service department

Twenty-six year old Chuck Norton, a licensed Indiana electronics technician, manages the Service Department

Fig. 1–Distinctive and obvious identification are key factors in attracting new business.

Fig. 2–A typical electronic service department at CMC.

Fig. 3–Complete "Sound Room" displays, speakers plus tuner/amplifiers, permit instant demonstration and comparison.

Fig. 4–The upside down world of auto sound, another CMC service.

located in the District Office, Service and Warehouse facilities which services the six CMC STEREO CENTERS in Indianapolis. Chuck has two part-time technicians who assist him. He has an associate degree in electronics technology from ITT Technical Institute in Indianapolis. He also holds an FCC first class license with radar.

It appeared to me that this was a small crew to handle repairs for six stores. A major reason is that the state-of-the-art reliability of electronic products is high. Yet this service department produces near $50,000 of labor income per year. That amount of labor per year is very good compared with most service businesses. It is doubly good when you consider that nearly one-half of the repair work at CMC is warranty service for manufacturers.

You might assume that this CMC District Service Department would have every piece of audio-tape-tuner test equipment available. After all, to be an efficient technician you cannot get by with one test speaker and a VOM. CMC Stereo Service Departments do have the latest equipment, but it is not, in some cases, immediately available. To procure a distortion analyzer, or a dual trace 30 MHz scope, Chuck must call the St. Louis headquarters and have one sent up the next day. It is borrowed from any one of the five other Service Departments. The various CMC Service Departments share test equipment that is ordinarily used only infrequently.

Typical equipment

The equipment on hand in each center is the ordinary assortment of items you might expect: DMM's; 10 MHz scopes; "control" units with speaker hookups; and antenna hookups; voltage and current meters; Variacs; an Eico 1064S battery eliminator; and a receiver used for testing speakers, turntables and amps. Also a CB SWR-dummy load-output meter; am/fm RF generator; frequency counter; test records and test tapes.

Service data is kept in file cabinets that take up a 6 to 8 foot section of one wall. Complete data on brands sold is kept. Other service data can be obtained through the St. Louis Parts and Service Headquarters in one day.

Trying to obtain parts for any one of the ninety brands CMC might encounter for service could be maddening and could reduce Chuck's productivity. The problem has caused many a good shop to give up servicing some products and some brands. For good or bad, the public seems to be recognizing, more and more, that there are very few places where they can get parts and service for their stereo products. (This may be good for those seriously in the stereo service business.) For CMC Service Departments, parts are all ordered from the headquarters in St. Louis. This might seem, at first, to be a bother. Why not order direct from the manufacturer or from local parts houses, if they exist? CMC's secret is that they have an expert Electronics Technician named Jim Proffitt, in St. Louis, who receives all the parts orders from all of CMC's 19 Service Technicians. He has over 4,000 square feet of space devoted to parts and he specializes in having on hand the part that is needed.

When the St. Louis parts center is out of a part Jim makes a "crash effort" to get it immediately. By virtue of dealing in

large quantities on a regular basis with the various stereo manufacturers, Proffitt has a close relationship with many of the manufacturers and can cut through most of the "red tape" ordinarily associated with small quantity boys. Obviously, by using a large amount of parts, CMC also can receive larger parts discounts than infrequent buyers.

Service's contribution

Since all the service departments are required to be profit centers for CMC, they are good competition for other legitimate service businesses, but they contribute more than service dollars to CMC. They are a vital part of CMC's sales program. CMC has a written and conspicuously posted policy on the floor which reads as follows:

"CMC Stereo Centers hope to offer you not only the best initial value on stero components and systems, but the assurance that you will continue to be satisfied with your CMC system."

And that is not just "sales talk". CMC backs it up with the following: When you purchase a complete stereo system you get:

A. Free parts and labor coverage for 5 years on the receiver and 7 years parts and labor on speakers.

B. Free 1-year speaker exchange (If you want to trade).

C. 90 day exchange privilege on the pieces purchased in a system.

D. 30 day price guarantee–if you find an identical unit elsewhere at a lower price, CMC will refund the difference.

Since the service department has the responsibility to honor warranting the products for much longer than the manufacturer's guarantee, CMC allows the service departments a credit for service performed during this period at the current manufacturer's rate.

Norton averages 48 minutes per repair, counting paperwork. The average labor income-per-repair for the company is $14.00. For the company as a whole, warranty repairs average less than one-half the dollar income-per-repair vs. out-of-warranty repairs. Because of the relatively few shops where customers can have stereo components repaired, and because of CMC's long warranty, the company does count on warranty repair work eventually producing more profitable after-warranty repair work in the future.

Repair turnover

Norton tries to make repairs on a one or two day basis. The customer who leaves a repair product at one of the six CMC Stereo Centers in Indianapolis will be told that it will be approximately 10 working days before the equipment can be expected back from the service department, but in most cases it is back in five days. Occasionally a repair will be made immediately if it is an emergency.

I asked Chuck if he would feel "overpaid" if CMC announced they were going to start paying him $25,000 per year in wages. He said "No". That is a shocking question to point-blank ask a technician, but self-confidence and recognition of technical worth is frequently a quick measure of the enthusiasm and achievement expectations of a good employee.

CET Norton is not being paid that much yet, but CMC does have a good compensation system. A technician is guaranteed a base salary and given commissions on actual billing totals, which together with fringe benefits may average 50% of his labor billings. If he is a Service Manager he may receive additional income depending on the number of technicians working under him. With high productivity and what seems to be low overhead expenses in the service departments, CMC's basic $25.00 per hour "ballpark" service rates and certain manufacturer's warranty payments are all that is standing in the way of above average technician wages at CMC.

CMC will not repair "just anything" or any brand. Certain brands of audio and CBs not sold by CMC must receive service manager authorization first before being accepted for repair. Also the paperwork used is excellent. Customers are alerted to "Customer Repair Information" sheets that spell out the qualification for warranty repair; guarantee; the estimate repair options (of which the customer has five choices); the anticipated repair time; and handling of unclaimed repaired products.

A sheet showing the Estimate/Minimum cost, and the "average" cost of repairs by type, is available for customers and is explained to them by the salespeople who take in the equipment for repair. A written estimate is automatically mailed to the customer if the average repair cost is to be exceeded. That letter must be signed and returned to CMC prior to repair proceeding. (No phone calls).

Does all of this eliminate customer "hassles" and occasional "free" repairs? No. But it does eliminate most of the problems and is an important reason for the success of the CMC Stereo Centers. ETD

Sam M. Patrick
Patrick's TV & Radio, Inc.
227 East Michigan Avenue
Orlando, Florida 32806

"The new GE Replacement Semiconductor Guide is one of the most valuable tools in my shop."

Your reputation is our reputation

Tube Products Department, Owensboro, Kentucky 42301

GENERAL ELECTRIC

BULLETIN BOARD

Packaged Portable Sound Systems are described in a new brochure from Perma Power Electronics. The literature contains a detailed rationale for application and advantages of packaged sound systems and battery powered audio equipment, as well as a detailed summary of the benefits and applications of such units. Products are arranged by category of usage. Free from *Perma Power Electronics, Inc.*, 5615 West Howard Ave., Chicago, Illinois 60648.

An Electronic Work Station is described in detail in literature available now from GTE Sylvania. The three-page brochure describes the construction and features of the firm's new free-standing, self-contained work station which can be used by up to three technicians at one time. It requires only electrical and antenna connections for immediate operation. Features discussed in the brochure include: the unit's rotating microfiche viewing screen; built-in bin stock drawers; isolated and non-isolated outlets for lights, test equipment, and chassis power, and optional equipment such as roll-about carts and test jigs. The brochure is available free at *Sylvania distributors*.

"Methode Briefing", a folder recently published by Methode Electronics, features technical details and application hints for their line of Term-Acon miniature connectors. Problem-solving applications include the use of PC card receptacles, interconnection receptacles and headers, flying lead and cable-to-cable connections, plus wire wrap plugs and receptacles. Available free from *Methode Electronics, Inc.*, 1700 Hicks Road, Rolling Meadows, Ill. 60008.

A Test Accessory Catalog—described as the largest test accessory catalog in the firm's history—is available now from ITT Pomona Electronics. The 86-page catalog lists such products as: molded patch cords, cable assemblies, test socket adaptors, spaced molded accessories, molded test leads, connecting leads, banana plugs and phone plugs. Some 23 new products are incorporated in the color publication that also includes cable and wire description, metric conversion charts and a quantity price discount schedule. Available free from *ITT Pomona Electronics*, 1500 E. Ninth Street, Pomona, California 91766.

Japanese Transistor Substitutions are detailed in a new manual just published by Fuji-Svea Enterprises. The manual cross-references Japanese-to-Japanese transistors in the 2SA, 2SB, 2SC and 2SD series, so that if a technician needs a Japanese transistor which cannot be easily obtained, or has been discontinued in Japan, he can find other Japanese numbers which might be possible substitutes. The manual covers approximately 3000 transistors, and is a guide to understanding Japanese transistors. The 90-page book is available for $5.90 plus $1 for postage and handling from *Fuji-Svea Enterprise*, Dept. ET, P.O. Box 40325, Cincinnati, Ohio 45240.

A Metric/Inch Gear Computer, in convenient, pocket slide rule form, is available free now from PIC Design. The slide rule is capable of indicating 18 different gear functions instantly; inch gear data on one side and metric module data on the other. One quick setting gives simultaneous readings of metric modules, diametral pitch, tooth dimensions and circular pitch plus pitch diameter

and outside diameter for both metric and inch gears. It contains 16 basic gear formulas plus drawings which show tooth size and configuration for both metric module and inch gears with 20° pressure angle. Free from Catalog Dept., PIC Design Div., *Benrus Corp.*, P.O. Box 335, Ridgefield, Connecticut 06877.

Electronic Counters are described and illustrated in a new six-page, four-color guide from Hewlett-Packard. The brochure summarizes the specifications and characteristics of 15 of the firm's counter line. Included are models from simple, low-cost, "frequency only" counters to sophisticated high-speed universal and microwave counters. Described are two new microprocessor controlled models: Model 5342A for automatic measurements to 18 GHz, and the Model 5370A Universal Time Interval Counter with a resolution of ±20 picoseconds. Available free from: Inquiries Manager, *Hewlett-Packard Co.*, 1507 Page Mill Road, Palo Alto, California 94304.

Replacement Belts for tape recorders, video tape recorders & players, projectors and other audio-visual equipment are detailed, illustrated and priced in the latest catalog from Projector-Recorder Belt Corp. The new catalog lists over 1000 types of belts and wheels for over 3500 models, plus a complete line of aerosol chemicals, adhesives and lubricants. The belts are listed by firm name and model number. Available free from *Projector-Recorder Belt Corp,* 200 Clay Street, Box 176, Whitewater, Wisconsin 53190.

Sound System Speakers for public address, background music and general sound system applications are detailed in a new specification sheet from Quam-Nichols Co. The literature describes 11 different eight-inch loudspeakers that cover virtually any performance, installation or price requirement. Included are single cone public address speakers, single and dual cone background music speakers, and flame retardant models. *Free from Quam-Nichols Co.*, 234 E. Marquette Road, Chicago, Illinois 60637.

Coil Replacements are detailed in a new 100-page guide for entertainment electronics and CB equipment that is available from Bell Industries. Replacement Guide No. 178 provides cross-reference for some 32,000 replacement coils for TV, stereos, radio and car radios by over 400 manufacturers. Coils for equipment under 67 CB trade names have been added. Most of the coils listed are available nationwide from local distributors. The guide is free from Jerry Hall, Operations Mgr., *Bell Industries*, J.W. Miller Division, 19070 Reyes Ave., Compton, California 90224.

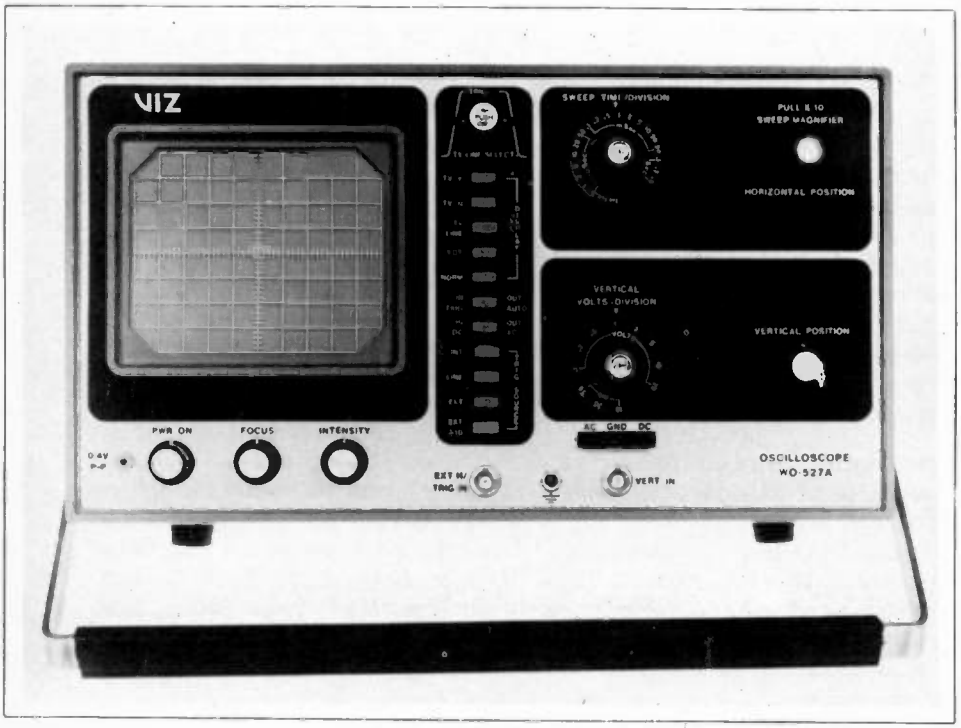
Current, Voltage and Insulation Testers are covered in the latest short form catalog and price sheet from a.w. Sperry Instruments. The catalog contains detailed information and specifications for snap-around ammeters, multi-testers, insulation testers, voltage indicators, and accessories. Free from *a.w. Sperry Instruments, Inc.*, 245 Marcus Boulevard, Hauppauge, N.Y. 11787.

A Personal Communications Catalog, covering the complete CB line from the Turner Division is now available. The new 28-page catalog has sections on microphones, stainless steel antennas, fiberglass antennas and accessories. Also included is a section on the firm's new no-solder microphone connectors. Engineering specifications are included. Available free from *Turner Division*, Conrac Corporation, 716 Oakland Road N.E., Cedar Rapids, Iowa 52402. ET/D

TEST INSTRUMENT REPORT

If ease of operation is what you are looking for in a scope oriented toward television service work, then the VIZ WO-527A single trace oscilloscope may be just what you are looking for. Its pushbutton simplicity make it ideal for locking in standard video patterns instantly.

Equipped with a bandwidth of 15MHz, the WO-527A provides a bright, easily readable, 5-inch, light blue display and there is minus 1,950 volts of CRT acceleration voltage. This was easily capable of pulling in the sometimes elusive broadcast VITS signal, which as you know, can be such a valuable service aid in checking proper IF amplifier response.



For more information about this Instrument, circle 155 on the Reader Service Card in this issue.

The WO-527A oscilloscope by VIZ

Pushbutton convenience

By Richard W. Lay

The WO-527A is a benchtype scope with TV V, TV H, and TV Line sweep rates that eliminate the need for time consuming stability adjustments. Triggering is indicated by the presence of a green LED and whether it occurs on the positive or negative slope is indicated by either of two red LEDs, again by pushbutton action.

The unit is basically controlled through just 14 front panel pushbuttons, plus the horizontal calibrated sweep control, the vertical volts/division control and a "times 10" horizontal magnifier which increases sweep speed ten fold for more critical viewing of waveforms.

In addition to beam centering controls, a special .4 volts P-P square wave may be fed into the vertical input for calibration purposes. This vertical input jack is one of two BNC connectors located on the front panel. A second "Ext H/Trig In" is used for connecting external signals to the horizontal deflection amplifier—such as when working with Lissajous figures—or the sweep triggering circuits. The vertical input, of course, may be used in conjunction with one of three front panel pushbuttons, one for DC coupling to the vertical amp, another for AC coupling, and the third grounds the input signal.

DC bandwidth, incidentally, is rated zero to 15 MHz, minus 3 dB, and the AC amplifier response is 20 Hz to 15 MHz.

The vertical volts/Division knob provides 11 calibrated input ranges: 20, 10, 5, 2 1, .5, .2, .1 volts and 50, 20, and 10 mV.

The horizontal position control knob is set for 19 calibrated sweep speeds, including the very handy TV horizontal and TV vertical sweep rates when the calibration knob is turned fully clockwise. Sweep rates are from .5 second to .5 microsecond.

The eleven function pushbuttons include "TV V" for full viewing of composite video waves triggered at the vertical rate; "TV H" for video waveforms triggered on horizontal pulses; "EXT" which disables the sweep and trigger circuits allowing external signals to be fed into the scope; and "NORM" which may be used in combinations with six other buttons for various triggering modes.

Additionally, the "TV Line" display button allows the full composite video waveform to be viewed one line at a time used in combination with the proper triggering source. This mode is basically the same as the TV V mode except that the trigger signal can be varied. According to the manufacturer, this is accomplished through a comparator circuit which feeds back a portion of the vertical sync pulse and thus generates a ramp voltage for differing triggering points.

The last five main control functions are "In Trig/Out Auto," the DC and AC buttons for coupling to the trigger source, and the "Trig Source" pushbuttons.

When the trigger "In" button is pushed, a trigger signal is required for sweep while sweep will continue in the absence of a signal when the button is in the out position. The "Trig Source" pushbutton allows internal triggering of the vertical amplifiers, line frequency triggering, external triggering and another pushbutton allows 10-fold attenuation of the external source.

continued on page 53

DODGE, NO.1 IN VANS, ANNOUNCES 1978.

AND THE NEWEST, MOST VERSATILE, MOST MANEUVERABLE VANS YOU CAN BUY.

THE NEW DODGE VANS GIVE YOU SOLID REASONS WHY DODGE IS THE NO.1 SELLER OF VANS.

1. ALL-NEW SEATS. They're more comfortable, they're more colorful, and now you can order them in plush fabrics. Mounted on curved tracks, the new seats allow a higher position for the shorter driver and more headroom for the taller driver. Optional high-back Command seats are shown.

2. MORE DOORS MORE WAYS. Now you can have your choice of optional sliding or standard hinged side cargo doors on all our vans. And we offer the only full-width single rear door in the industry. Maxivan with the Vision Van option gives you rear quarter windows that wrap around the corners for ease in backing up.

3. HIGHLY MANEUVERABLE. Our turning circle, tighter than Ford's or Chevy's, gives you greater maneuverability.

4. 23MPG HWY/17MPG CITY. EPA estimates for Dodge Tradesman B100, with standard 225-cubic-inch six-cylinder engine and manual transmission. Not bad for such a hard-working machine. Your mileage may vary according to vehicle condition, equipment, and how it is driven. California mileage lower.

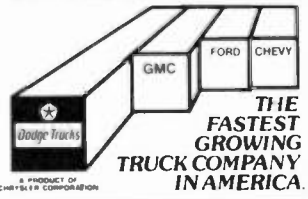
5. HISTORICAL TOUGHNESS. Of all the Dodge trucks registered in the past ten years, 96 out of 100 are still in operation. (Source: *Trucks in Operation.*) That's better than Ford . . . better than Chevy.

6. MORE ROOMINESS. Maxivan is eight inches longer this year for extra cargo space. And all our vans have more room up front this year.

7. SOME NEW OPTIONS. Trailer-towing packages for up to 7000 pounds gross trailer weight. Six different kinds of radios including two units with 40-channel CB. Sky Lite sun roofs, air conditioning, and more.

Buy or lease one or a fleet . . . at your Dodge Dealer's.

237% increase from 1966 to 1976

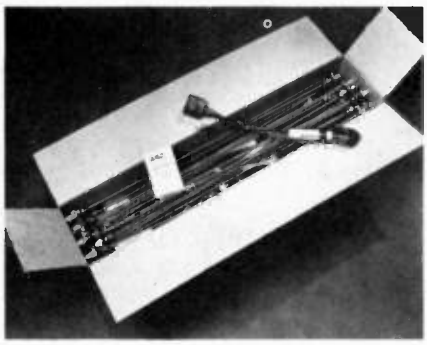


THE FASTEST GROWING TRUCK COMPANY IN AMERICA.

NO.1 IN VANS AND WAGONS.*

* Passenger van-type vehicles known in the industry as wagons.

DEALER'S SHOWCASE



Bulk CB Antennas

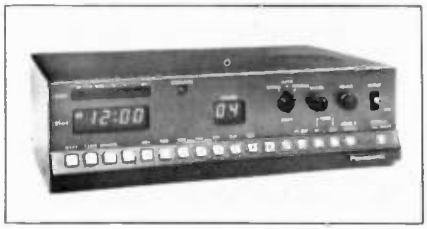
Circle No. 156 on Reader Inquiry Card

Disguise antennas for CB/AM/FM are now available in installer's bulk packages from *Antenna Incorporated*. In addition to lower cost compared to individually packaged units, the bulk packs of 24 disguise antennas are reported to provide the dealer added economy since he saves inventory space and unpacking time. By installing the bulk packaged CB/AM/FM antenna, the installer can give his customer CB capability—for now or later—at no extra cost. The antenna is pre-tuned at the factory for all 40 channels with no field tuning required. It comes pre-assembled with cable harness, PL-259-type connector and phono plug for AM/FM broadcast radios.

Video program system

Circle No. 157 on Reader Inquiry Card

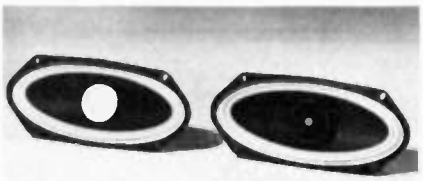
An automatic video programming system utilizing microprocessor control has been introduced by *Panasonic*. The new unit, Model TY-M100P, turns a television set or VTR on and off and repeats a weeklong schedule continuously until modified. Up to 11 channels can be programmed by pushing two buttons. Should an incorrect channel be selected by mistake, the unit automatically tunes the next highest channel. Other features are: lighted digital indicators for channel and time, seven LED lamps corresponding to each day of the week, and an audible time indicator which features a clock that indicates each hour with the appropriate number of electronically-generated chimes.



Small Car speakers

Circle No. 158 on Reader Inquiry Card

A new line of speakers designed to fit the newer, smaller car models being produced is being introduced by *Acoustic Fiber Sound Systems*. Klassic models 2031 and 2032 are 4 inch by 10 inch bulk pack speakers designed to fit where 6 inch by 9 inch speakers used to go. Model 2031 is a dual cone speaker and Model 2032 is coaxial. The new speaker size is said to fit nicely into the rear posts in most station wagons, under the dashboard up front in many cars, truck and RVs, or anywhere in a boat or airplane. Model 2031 retails for $17.50 and 2032 at $24.60.



CB Power Supply

Circle No. 159 on Reader Inquiry Card

A new power supply designed for conversion of mobile CB transceivers into base station units has been introduced by *GTE Sylvania*. The new unit features a custom, heavy-duty transformer with full-wave bridge rectification, FET-zener regulation, and a Darlington output for regulation and thermal characteristics as well as minimum hum and ripple. Large heat-sink areas are incorporated into the heavy gauge aluminum and steel chassis and housing of the unit.

Complete overload protection is provided by a ¾ Amp, plug-in fuse located in the transformer primary winding. Designated Model PS3-AR, the supply is also suitable for powering vehicular amateur radios, tape players, and AM-FM radios.

AM/FM Stereo receiver

Circle No. 160 on Reader Inquiry Card

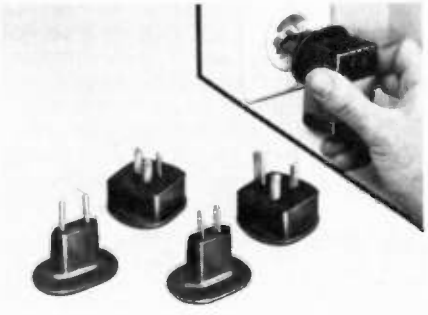
Two new AM/FM stereo receivers which are reported to be improved in performance at a lower cost have been introduced by *Kenwood*. The two models, KR-6030 and KR-5030, utilized what is called a new "currentmirror" type differential amplifier circuitry in the power stage that brings out the full wattage potential without loss of stability. No more than 0.1% total harmonic distortion is

reported, measured into 8 ohms across the frequency range from 20 to 20,000 Hz. Transient response is said to be excellent over the entire dynamic range, and performance quality holds, even at sustained high volume levels over long periods of time. Model KR-6030 retails at $500 and KR-5030 sells for $400.

Foreign Plug Kit

Circle No. 161 on Reader Inquiry Card

For world-wide travelers, a new foreign outlet plug kit is available now from *Dynamic Instrument*. The kit contains four plugs which will adapt to a foreign power converter to fit any electrical outlet in the world, including those in Australia, New Zealand and the Eastern European countries. The plugs themselves do not convert voltage, but are used in conjunction with a converter also available from Dynamic. The kit is packaged on an attractive blister card.



Beta-format videocassettes

Circle No. 162 on Reader Inquiry Card

A new line of Beta-format videocassettes from the *3M Company* are now in national distribution. They include a 30/60minute version (L-250) and a 60/120minute version (L-500). The tape used is of the same quality used in the Scotch video tapes for broadcast and industrial/educational applications. It is made of a specially-formulated high-energy oxide, and features the patented Posi-Trak backing. The L-250 length retails for $12.45 and the L-500 sells for $16.95. ET/D

NEW PRODUCTS

Catalog Tool Case

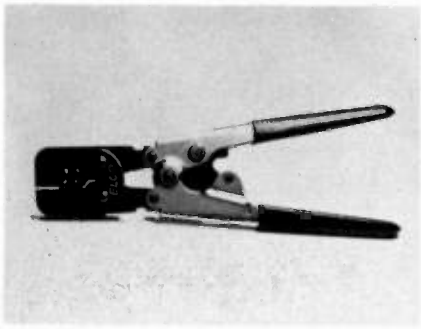
Circle No. 163 on Reader Inquiry Card

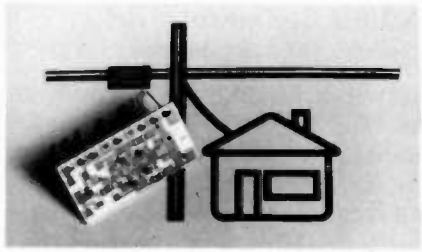
A new type of tool case that will allow the carrying and storing of a large number of tools and parts has been introduced by *Platt Luggage*. Called the 'catalog tool case', the new case features three separate inside sections—two tool pallets and a three-tier tool and parts tray. The pallets are molded into a solid one-piece unit without the use of stitches seams or rivets. The parts tray is easily removed from the case and unfolds horizontally to make tools and parts easy to get at. The case itself is produced by what is called the soft-molding process to give the look of soft covering. A one-pallet or a two-pallet model is available.

Hand Crimping Tool

Circle No. 164 on Reader Inquiry Card

A new hand crimping tool with two cavities for crimping wire sizes AWG No. 18 through AWG No. 26, has been introduced by *Elco*. The upper cavity accepts sizes No. 18 and 20 gauge, while the lower cavity accepts sizes No. 22 through 26. The tool, called the Varilok, is factory set and non-adjustable. It features a solid jaw stop to prevent over crimping, and a cycle-controlled ratchet mechanism. It also has a retainer plate for the insulation tine, a nylon floating contact locator, a metal contact stop plate, and a metal wire stop.





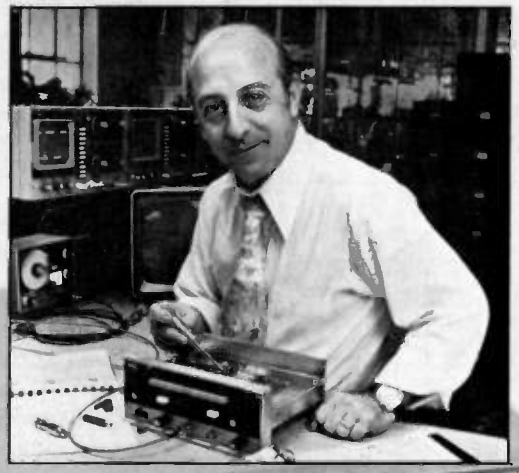
CATV Modules

Circle No. 165 on Reader Inquiry Card

A new series of hybrid CATV modules featuring all-gold metallized transistors, wires and substrates is now available from *Motorola*. Designated the MHW1000 series, the new modules feature improved geometry transistors in the push-pull configuration, reducing 35 channel cross modulation distortion by a factor of 3 dB, and 35 channel composite "triple beat" distortion by 3½ dB. While Noise Figure has been improved by over ½ dB, precise 75 ohm impedances are

Formerly RCA Instruments

"I'm a VIZ circuit tester."



"It seems like some instrument companies expect the customer to do the quality control testing on their instruments. I've heard of a case where someone had to buy three or four DMMs before he got one that worked right. Not so with VIZ.

"We test and calibrate every instrument before it leaves the factory. No company can beat that, and few come close. The circuit-tester seal on each VIZ instrument ensures that you're getting the highest accuracy and long-term stability possible.

"In fact, in the two years since VIZ took over the test instrument business, returns for repair have been almost nonexistent. However, should you have a problem, our nation-wide network of sophisticated service centers guarantees that you'll get your instrument back fast. Check this out with your VIZ distributor — he'll confirm our reputation.

"Because I test all circuits here, you can be confident when you test your circuits with VIZ instruments."

VIZ Test Instruments Group

335 East Price Street Philadelphia, PA 19144 (215) VI-4-2626

The Circuit Tester line
Accuracy and stability assured

7000

Circle No. 144 on Reader Inquiry Card

said to reduce cable reflections. Frequency response flatness are reported to make the series ideal for use in extensive CATV systems, where small irregularities, or "signatures", in a long cascade of identical amplifiers can cause cumulative degradation. Included in the series are Input and Output Trunk Amplifiers, Line Extenders, and a Reverse Amplifier.

Torque Tool

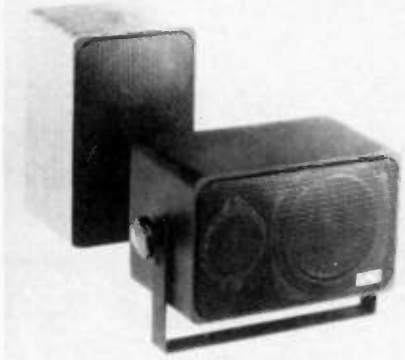
Circle No. 166 on Reader Inquiry Card

A new hand tool designed for loosening those "frozen" screws and screws set with power or impact type drivers is new from *Hunter Tools*. Called the "Tork-it", the tool features a swivel handle that allows it to function also as a standard screwdriver. Tork-It blades are made from special shock resistant alloy tool steel, electronically heat-treated and tempered. All blades are ¼-inch hex drive. The new tool is actually a six-piece set, including the handle, 3 phillips blades and 2 slotted type blades. It comes in a plastic case that can hang on the wall or fit in a tool box.

Extension Speaker

Circle No. 167 on Reader Inquiry Card

A new small extension speaker system for mobile and home use is new from *Electronic Industries*. The system, called the HF7 Goliath, is contained in a damped, hermetically sealed aluminum enclosure and boasts a 4-inch acoustic suspension woofer and a one-inch direct radiating advance design tweeter. Both woofer and tweeter are equipped with a high temperature voice coil. The system has a 30 watts per channel RMS speaker capacity, 50 watts peak, and an impedance level of 4 ohms. Specifications include a 55-22,000 Hz frequency response, a crossover at 2500 Hz with 12 dB per octave slope and an 89 SPL at 1 watt RMS input at 1 meter. Suggested list is $69.95 each, or $139.95 a pair.



Digital Multimeter

Circle No. 168 on Reader Inquiry Card

Two new digital multimeters—the 3-digit Model LM-300 and the 3½-digit Model LM-350—have been added to the *NLS* line. Both instruments feature LCD numeric readouts which are said to provide ease of viewing in bright sunlight. The LCD's also reduce power consumption. Measurements include AC and DC volts, resistance and AC and DC current. Options include a leather carrying case, a tilt stand case, and panel mount flange, a 45kV high voltage probe, an RMS probe, rechargeable batteries and charger unit. LM-300 is priced at $99.50 and Model LM-350 at $125.

Logic Probe

Circle No. 169 on Reader Inquiry Card

A new logic probe for digital testing that accumulates multiple pulses in pulse trains for frequency response greater than 50 MHz has been introduced by *AVR Electronics*. Called the Catch-a-Pulse Experimentor, the new probe features LEDs that will respond to single pulses up to 20 µsec. It is compatible with RTL, DTL, TTL, CMOS, MOS and microprocessors using a 3.5V to 15V power supply. Thresholds are automatically programmed. No adjustments are required, and there is visual indication of

Ford announces the new Super Van.

Ford goes out front in van design again by adding 20 more inches in length!

Advanced design for roomy comfort—the engine's moved forward for more move-around room up front. Even a new tilt steering wheel option! Plus swivel Captain's Chair option.

Body-on-frame construction—built like no other van! Only Ford has this separate frame! Rubber mounts cushion, insulate the body. Engine range: 4.9L (300 CID), 5.8L (351 CID) and 7.5L (460 CID).

Carry cargo you couldn't before—thanks to Super Van's extra length! Long load or heavy load—Ford vans really deliver!

There are more Ford vans on the road today than any other make. Based on cumulative registrations as of 7/1/76.

Built Ford Tough

Of all Ford Trucks registered over the last 12 years, 9 out of 10 are still on the job. (Based on cumulative registrations as of 7/1/76.)

FORD

FORD DIVISION

Ford 75th ANNIVERSARY

Circle No. 113 on Reader Inquiry Card

logic levels, using LEDs to show HI, LO, Bad Level or open circuit logic and pulses. The instrument has shirt-pocket portability, with a protective cap over the tip and a removable coiled cord. Priced at $22.95.

Audio Connectors

Circle No. 170 on Reader Inquiry Card

A new line of audio connectors that feature interchangeable and add-on components has been introduced by *Philips Audio Video Systems*. Manufactured in Switzerland under the name of Neutrik, the connectors feature housings of a zinc, molybdenum, copper and aluminum alloy. Inserts are of fibre-glass reinforced high temperature, hard plastic. They have a matte nickel finish with corrosive-resistant silver plated contacts, with an alternative choice of black finish with gold plated contacts. The new connectors feature a cable collet-type clamp that accepts cables from 4.5 to 7.0 mm in diameter, and interchangeability of components.

Triggered Oscilloscope

Circle No. 171 on Reader Inquiry Card

A new 20 MHz triggered oscilloscope that is reported to offer maximum display stability with minimal adjustments has been introduced by *Leader Instruments*. Designated Mode LBO-507, the new scope is said to offer also a trigger sensitivity over the entire operational range. It offers pushbutton switch selection for all functional demands: 10 mV/cm vertical sensitivity calibrated in 11 steps—in a 1-2-5 sequence up to 50V/cm with variance control; and a 17.5nanoSec rise time to help achieve laboratory grade performance. Accuracy is ±3% with input impedance rated at 1MΩ shunted by 35pF. Bandwidth is DC - 20 MHz (−3dB) and AC—2Hz-20MHz (−3dB). Sweep speed for the LBO-507 is 0.5μSec/cm, 18 steps in a 1-2-5 sequence—up to 500μS/cm with variable control, and with X5 magnification that delivers 100nanoSec/cm maximum speed to facilitate quick precise readings. Priced less than $500.

Frequency Indicator

Circle No. 172 on Reader Inquiry Card

A new "add-on" universal received frequency indicator for RDF's and multiband communication receivers is available from *Gemini Electronics*. Designated Model NM 14-15, the new indicator can be used with any transistorized super-heterodyne receiver with an IF of 455 kHz employing subtractive mixing. A simple two wire connection to the receiver's VFO is the only electric connection required. The indicator can be mounted on the rear of most portable RDFs, or bulkhead mounted for fixed installations. Model NM 14 is a 4 digit unit with a range from 100 kHz to 9.9MHz. Model NM15 is a 5 digit unit with a range from 100 kHz to 35.000 MHz. NM14 is priced at $139.95, and NM15 is priced at $149.95.

Ultrasonic Parts Cleaner

Circle No. 173 on Reader Inquiry Card

A new ultrasonic cleaner for small electronic components is new from the *Branson Company*. Designated Model B-3, the new unit has a one-pint capacity and is reported to remove dirt, tarnish, oils, wax and other residue from small sub-assemblies in seconds. It is a tabletop unit that plugs into any 115 volt out-

SOMETHING YOU ALWAYS WANTED BUT WERE NEVER ABLE TO OBTAIN...

ET/D's Modern Serviceshop Management Manual

. . . It's a textbook for the independent electronics service technician who is actively engaged in consumer and industrial service markets.

Prepared by the editors of ELECTRONIC TECHNICIAN/DEALER, this comprehensive management guide is must reading for all service technicians and dealers who have to cope with the day-by-day problems of running a small business.

ET/D "Modern Serviceshop Management" will focus on three major categories:

- BUSINESS MANAGEMENT — with chapters on basic accounting procedures, ratio analysis, planning for profit in the business environment and current asset management.
- SERVICING OF ELECTRONICS EQUIPMENT — with chapters on troubleshooting transistorized circuits, modern test equipment, digital electronics, industrial control systems and modern serviceshop layout.
- NEW BUSINESS HORIZONS — with chapters on whether to expand your business, contract service, business opportunities in medical electronics and service business opportunities in small industrial settings.

This manual is in the works now, so order your copy now by sending in your order with remittance. No service shop should be without this manual from one of the outstanding book publishing houses in the country.

ET/D

ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

HBJ A Harcourt Brace Jovanovich Publication

CLIP AND MAIL TO:

ET/D MAGAZINE
1 East 1st Street
Duluth, Minnesota 55802

Please send_____copy(ies) of ET/D's Modern Serviceshop Management at $12.95* per copy. Enclosed is a check for $_____to cover the cost of the textbook plus shipping and handling expenses. ET/D Modern Serviceshop Management will be shipped immediately following publication.

NAME _____

COMPANY NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Mail this order blank along with your payment to:
Book Dept. ET/D Magazine
1 East 1st St.
Duluth, Minnesota 55802

*Please add $1.50 per order to cover postage and handling. On multiple copy orders add 25¢ for each additional copy (for example, two copies would cost $1.75 for postage and handling).

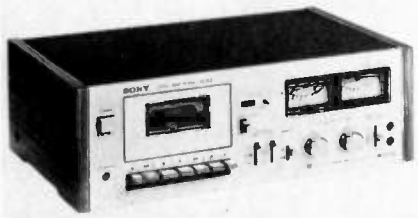
Publication Date: September 1, 1978-Orders will be fulfilled within 60 days of the publication date or within 60 days of the date of order, if received after publication date.

let. It features a stainless steel tank and a shock and flame resistant housing. Common water base cleaning solutions are suitable for use in the B-3, which converts AC current into ultrasonic bubbles that clean the components.

Stereo Cassette Deck

Circle No. 174 on Reader Inquiry Card

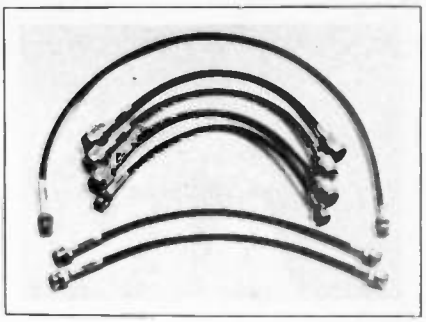
A new stereo cassette deck that features ferrite heads and a Dolby noise-reduction system, has been introduced by *Sony*. Designated Model TC-K3, the new unit also has a DC servo-controlled motor and bias and equalization settings for standard, ferri-chrome and chromium-dioxide tape. The deck has a wow and flutter level of only 0.08%, an S/N ratio of 58db and a wide frequency response of 30Hz (± 3db). The total harmonic distortion is only 1.3%. The TC-K3 also features automatic end-of-tape shut-off, large illuminated VU meters and a removable cassette compartment lid for easy cleaning and demagnetizing. Suggested list price is $220.



Test Cables

Circle No. 175 on Reader Inquiry Card

A new line of test cables for laboratory, service bench and systems use is now available from *Compac*. The new cables come in many different types, including: RG 55, 58, 142, 172, 188, 214 and 223.



Six standard lengths from 12 inches to 72 inches are offered, with other lengths obtainable on order. Various connectors such as type N, BNC, TNC, SMA, SMB, SMC, and UHF are available. These connectors meet MIL-C-39012 specifications, where applicable. Custom semi-rigid cables are also available. Single piece prices range from $12.95 to $17.35.

Small Parts Cabinet

Circle No. 176 on Reader Inquiry Card

A new nine drawer steel parts cabinet that should solve problems of storing, maintaining and organizing stocks of small electronic parts, components, nuts, bolts, etc. is available from *Ready Metal Company*. The new cabinet is 24 inches high, 12½ inches wide and 12

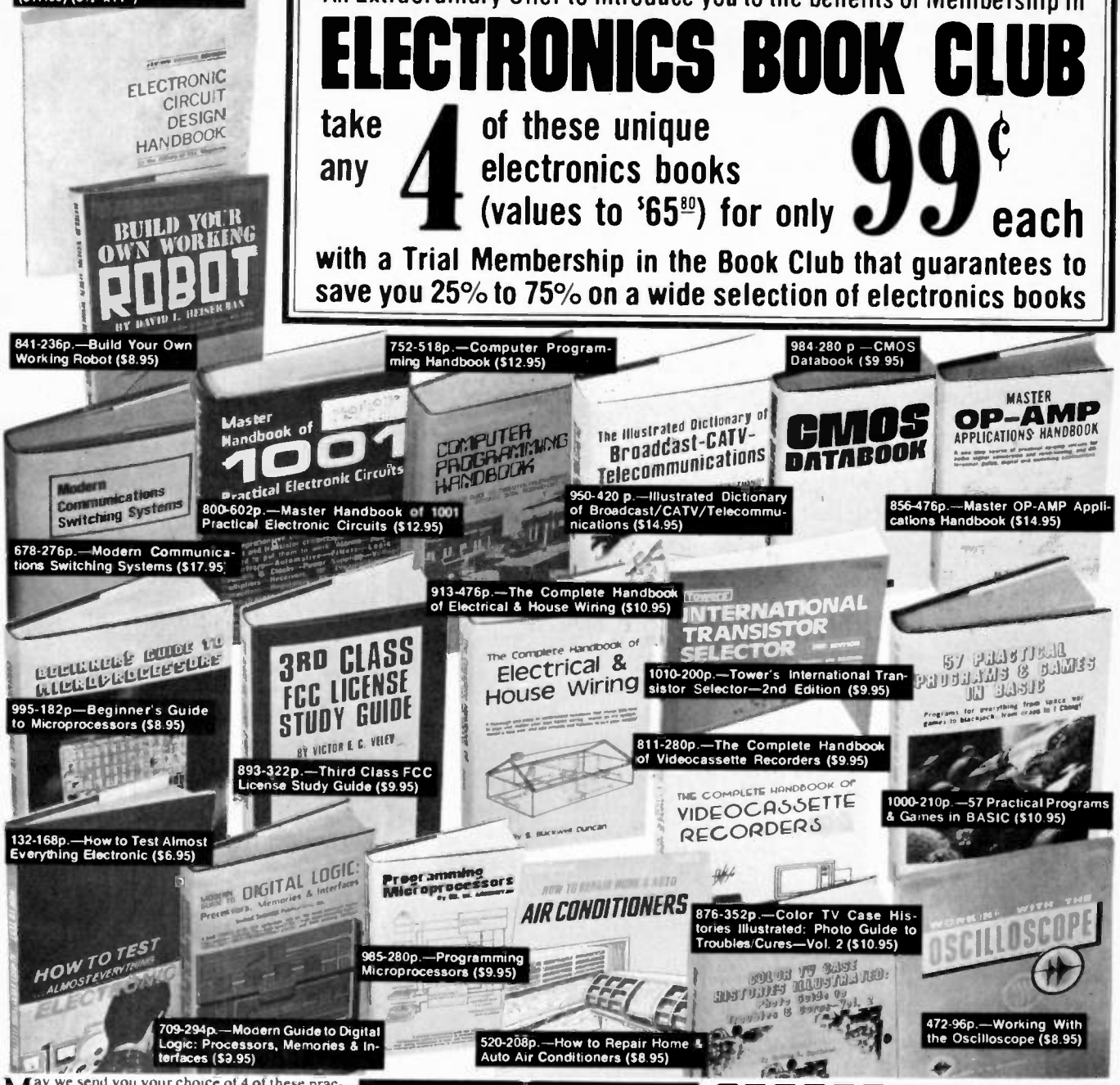
101-416p.—Electronic Circuit Design Handbook—4th Edition ($17.95) (8½"x11")

An Extraordinary Offer to introduce you to the benefits of Membership in

ELECTRONICS BOOK CLUB

take any **4** of these unique electronics books (values to $65.80) for only **99¢** each

with a Trial Membership in the Book Club that guarantees to save you 25% to 75% on a wide selection of electronics books



841-236p.—Build Your Own Working Robot ($8.95)

752-518p.—Computer Programming Handbook ($12.95)

984-280 p.—CMOS Databook ($9.95)

800-602p.—Master Handbook of 1001 Practical Electronic Circuits ($12.95)

950-420 p.—Illustrated Dictionary of Broadcast/CATV/Telecommunications ($14.95)

856-476p.—Master OP-AMP Applications Handbook ($14.95)

678-276p.—Modern Communications Switching Systems ($17.95)

913-476p.—The Complete Handbook of Electrical & House Wiring ($10.95)

1010-200p.—Tower's International Transistor Selector—2nd Edition ($9.95)

995-182p—Beginner's Guide to Microprocessors ($8.95)

893-322p.—Third Class FCC License Study Guide ($9.95)

811-280p.—The Complete Handbook of Videocassette Recorders ($9.95)

1000-210p.—57 Practical Programs & Games in BASIC ($10.95)

132-168p.—How to Test Almost Everything Electronic ($6.95)

876-352p.—Color TV Case Histories Illustrated: Photo Guide to Troubles/Cures—Vol. 2 ($10.95)

985-280p.—Programming Microprocessors ($9.95)

709-294p.—Modern Guide to Digital Logic: Processors, Memories & Interfaces ($9.95)

520-208p.—How to Repair Home & Auto Air Conditioners ($8.95)

472-96p.—Working With the Oscilloscope ($8.95)

May we send you your choice of 4 of these practical time-and-money-saving books as part of an unusual offer of a Trial Membership in Electronics Book Club?

Here are quality hardbound volumes, each especially designed to help you increase your know-how, earning power, and enjoyment of electronics. Whatever your interest in electronics, you'll find Electronics Book Club offers practical, quality books that you can put to immediate use and benefit.

This extraordinary offer is intended to prove to you through your own experience, that these very real advantages can be yours...that it *is* possible to keep up with the literature published in your areas of interest, and to save substantially while so doing. As part of your Trial Membership, you need purchase as few as four books during the coming 12 months. You would probably buy at least this many anyway, without the substantial savings offered through Club Membership.

To start your Membership on these attractive terms, simply fill out and mail the coupon today. You will receive the 4 books of your choice for 10-day inspection. YOU NEED SEND NO MONEY. If you're not delighted, return the books within 10 days and your Trial Membership will be cancelled without cost or obligation.

ELECTRONICS BOOK CLUB, Blue Ridge Summit, Pa. 17214

Facts About Club Membership

- The 4 introductory books of your choice carry publishers retail prices of up to $65.80. They are yours for only 99¢ each (plus postage/handling) with your Trial Membership.
- You will receive the Club News, describing the current Selection Alternates and other books, every 4 weeks (13x times a year).
- If you want the Selection, do nothing, it will be sent to you automatically. If you do not wish to receive the Selection, or if you want to order one of the many Alternates offered, you simply give instructions on the reply form (and in the envelope) provided, and return it to us by the date specified. This date allows you at least 10 days in which to return the form. If, because of late mail delivery, you do not have 10 days to make a decision and so receive an unwanted Selection, you may return it at Club expense.
- To complete your Trial Membership, you need buy only four additional monthly selections or alternates during the next 12 months. You may cancel your Membership any time after you purchase these four books.
- All books—including the Introductory Offer—are fully returnable after 10 days if you're not completely satisfied.
- All books are offered at low Member prices, plus a small postage and handling charge.
- **Continuing Bonus** If you continue after this Trial Membership, you will earn a Dividend Certificate for every book you purchase. Three Certificates plus payment of the nominal sum of $1.99 will entitle you to a valuable Book Dividend of your choice which you may choose from a list provided Members.

ELECTRONICS BOOK CLUB

Blue Ridge Summit, Pa. 17214

Please open my Trial Membership in ELECTRONICS BOOK CLUB and send me the 4 books circled below. I understand the cost of the books I have selected is only 99¢ each, plus a small shipping charge. If not delighted, I may return the books within 10 days and owe nothing, and have my Trial Membership cancelled. I agree to purchase at least four additional books during the next 12 months, after which I may cancel my membership at any time.

101 132 472 520 678 709 752
800 811 841 856 876 893
913 950 984 985 995 1000 1010

Name _____ Phone _____

Address _____

City _____

State _____ Zip _____

(Valid for new Members only. Foreign and Canada add 10%) T-58

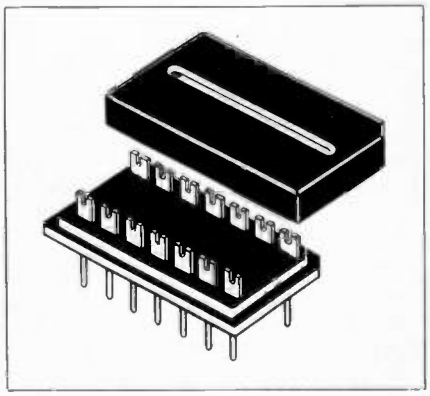
Circle No. 117 on Reader Inquiry Card

inches deep. Each of the nine drawers is divided into three sections, and each section has nine adjustable dividers, providing individual compartments for up to 270 different parts. A bar lock secures all drawers, and the bar includes provision for a padlock to be used for total maximum security. Priced retail at $88.88.

DIP Plugs & Covers

Circle No. 177 on Reader Inquiry Card

For anyone who builds their own interconnect assemblies, new 14 and 16 pin plugs that fit into standard DIP sockets are available from *OK Machine and Tool*. The plugs feature U.L recognized glass-filled thermoplastic bodies and solder lugs on the top side are slotted for easy attachment of cable leads. Rectangular legs assure dependable insertion in DIP socket. The leg/solder lug is

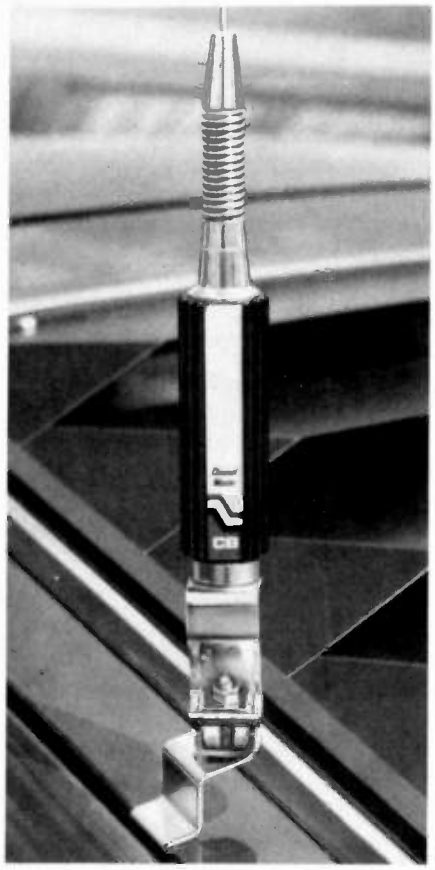


one-piece of gold plated phosphor bronze. Packed two to a package, the plugs come with slotted top-entry covers. Package of two 14-pin units are priced at $1.45, and the 16-pin version is $1.59.

Removable CB Antenna

Circle No. 178 on Reader Inquiry Card

A new hatchback/multi-mount base load CB antenna is now available from *Channel Master*. The new antenna features a Quick Lock removal system that allows the unit to be installed or removed with just a twist of the wrist—handy



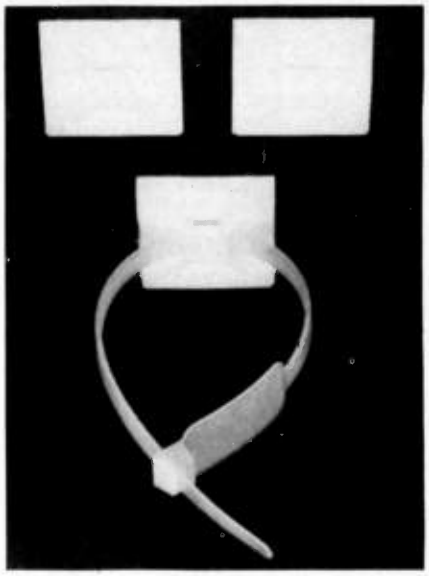
when parking or driving through car washes. Includes an adjustable S-mount for installation of antenna on trunk lip, trunk groove, hatchback or hood groove of most cars. The antenna comes with 17 feet of RG 58U low-loss coaxial cable and a factory installed PL 259 connector. Overall height of complete unit is 46 inches. Retai price is $26.95.

Tie Mounts

Circle No. 179 on Reader Inquiry Card

A new nylon tie mount that is reported to have a pull-away force of a half pound per square inch is new from *Tyton*. The new mount is molded from 6/6nylon and features an adhesive backing with a

Circle No. 133 on Reader Inquiry Card →

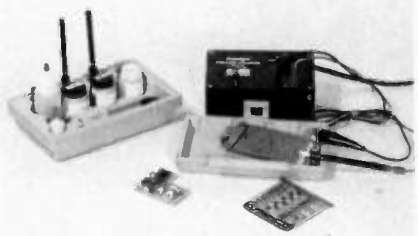


paper backing that is easily peeled off before mounting. The new mounts are available in ¾ inch and 1-⅛ inch sizes. Both sizes have a low-profile head. The ties can be inserted from four sides.

Bench-top Repair System

Circle No. 180 on Reader Inquiry Card

A new portable bench-top repair system for rework, repair and modification of circuits boards and other electronic assemblies is available from *Pace*. Designated Model PRC-150A, the new system has an integral motor pump which

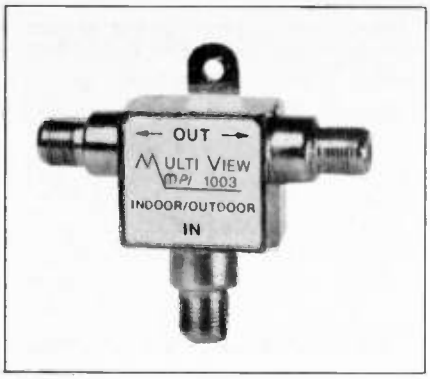


permits controlled desoldering for removal of solder joints via pressure, vacuum and hot air jet. Also provided is a high torque, low RPM output for abrading, milling, drilling, grinding and cutting. A universal power cord is connected to a variable AC output to operate a thermal parting tool and a lap reflow soldering tool. Also an optional Integral Cycle Zero power switch is available which eliminates transients and spikes that can damage C-MOS and MOS/FET devices. Priced at $895.

Two-way Splitter

Circle No. 181 on Reader Inquiry Card

A new two-way splitter for indoor/outdoor use has been introduced by *Multi Products International*. Designated Model 1003, the new splitter fea-

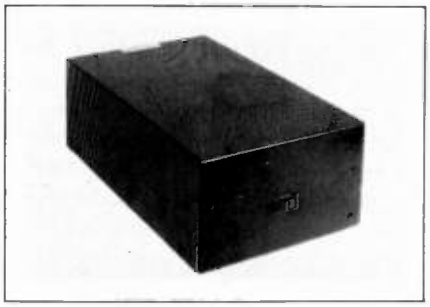


tures a rugged zinc die-cast body with nickel-over-copper plating and fully machined connectors. Model 1003 has a frequency range of from 5 to 100 MHz, and is rated at a 3.5 db insertion loss with a minimum of 30 db of isolation and a return loss of over 20 db.

Power Amplifier

Circle No. 182 on Reader Inquiry Card

A new solid-state power amplifier that delivers 125 watts with less than 2% harmonic distortion from 50 to 15,000 Hz has been introduced by *Bogen*. Designated Model MT-125B, the new amplifier is only 8½ inches wide and can be used in every type of sound reinforcement and paging system, and in industrial applications. Frequency response is ±2 dB from 20 to 20,000 Hz. Hum and noise is at least 85 dB below rated output. Output regulation is better than 2 dB from no load to full load. Only 200 millivolts input is required for full rated output. The MT-125B offers multiple balanced or unbalanced outputs: 4, 8, and 16 ohms; 25 and 70 volt constant voltage; and 110 volts, for industrial applications.



Portable Oscilloscope

Circle No. 183 on Reader Inquiry Card

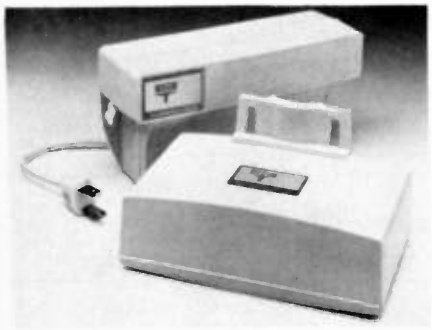
A new portable, dual-trace oscilloscope with triggered sweep is new from *B&K-Precision*. Designated Model 1432, the new scope has a bandwidth of 15MHz with a vertical sensitivity rating of 2 mV per division. Usable response extends

beyond 30MHz. Model 1432 features an optional battery pack that mounts inside the case. A built-in universal power supply provides operation on 117VAC,

234VAC, 12VDC or the optional internal batteries. Both high and low-voltage power supplies are fully regulated, maintaining time base and amplitude accuracy over a wide range of input voltages. Also has capability for algebraic addition and subtraction of channel A and B input signals. Price at $750.

UHF/VHF Preamplifier

Circle No. 184 on Reader Inquiry Card

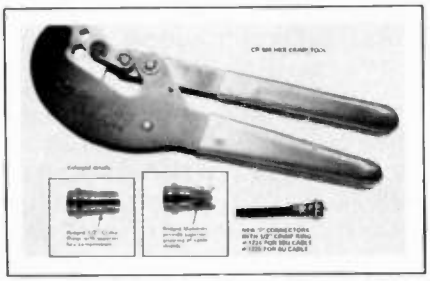


A new solid state UHF/VHF all channel preamplifier with an indoor mounted power supply and two-way splitter is being introduced by *Blonder-Tongue*. Called the Voyager II Dual, the new preamplifier features separate UHF and VHF inputs for service where individual UHF and VHF antennas are installed. Weak signal performance, or noise figure, of the new unit plus the mast mounting feature, is reported to result in a reduction of snow on weak TV channels. Four silicon transistors are used in three independent amplifying sections, and the two-way splitter allows connection to two TV sets with minimum interaction.

Hex Crimp Tool & Connectors

Circle No. 185 on Reader Inquiry Card

A new improved hex crimp tool, No. CR-596, that is said to eliminate problems of misaligned connectors which frequently occur with ratchet type tools, has been introduced by *RMS Electronics*. The lightweight tool fits installers belts for working with one hand. It incorporates a "positive homing action" design that is said to assure a full crimp everytime. Introduced along with the new tool is a line of new 'F' male connectors with an attached one-half inch crimp ring. Both connectors are designed for a secure grip for coaxial cable connections.



Frequency Counter

Circle No. 186 on Reader Inquiry Card

A new six-digit EMI-proof frequency counter with direct count to 225 MHz and a nominal sensitivity over this broad spectrum of 50 mV is new from *Ballantine Labs*. Designated Model 5725C, the new counter has a non-blinking display using jumbo 0.43 inch bright orange LEDS. It has a simple single switch for selection of readings in Hz, kHz, and MHz. The unit provides frequency, totalize and ratio capabilities, with resolution from 1 kHz to 0.1 Hz through four selectable gate times. Case is shock resistant and flame retardant. Priced at $295.

Wide-band Splitter

Circle No. 187 on Reader Inquiry Card

A new wide-band splitter for TV cable systems that is said to eliminate the need for a second cable for video or AM radio signals has been introduced by *Extronix, Inc.* The new unit handles any signal from audio or video through the whole spectrum of AM and FM radio, VHF and UHF television. It has a DC to 890 MHz response which permits combining services on one cable. Model 1502A provides a two-way split for 75-ohm lines, with 6 dB nominal loss and with typical return losses of 30 dB to 300 MHz and 25 dB to 890 MHz. ET/D

MAGNETISM

continued from page 24

power out cannot exceed the power in. Assuming small losses, if we raise the voltage, we lower the current, and vice versa. This results in an impedance ratio which is the square of the transformation ratio. ET/D

This article was intended to take some of the confusion out of practical magnetic device theory, which is neglected in most literature for service technicians. It is beyond the scope of an article of this length to cover magnetics in greater depth, but the reader should find it possible to read more advanced texts, using this article as a "stepping stone." ET/D

Test Instrument

continued from page 36

VIZ's unique trigger level adjustment control utilizes the red LEDs (previously mentioned) for quick identification of either positive or negative triggering. Rotating this trigger control button triggers the sweep—illuminating the green LED for verification—and then simply by centering the vertical and horizontal position controls the beam is brought into full view. Thus, there is no need for beam finders.

The WO-527A is fully compatible with 50/60Hz 115 or 230 volt supplies through a simple back compartment switch and is capable of 600 volts P-P at both the vertical and horizontal amps.

It's also capable of "Z axis" performance through a special connector, also located in the back compartment, when used in conjunction with a second signal source.

The unit retails at $525. ET/D

SPECIFICATIONS

FREQUENCY RESPONSE:
Vertical Amplifier
DC ... DC to 15 MHz (−3db)
AC ... 20 Hz to 15 MHz (-3db)
Horizontal Amplifier
AC ... 50 Hz to 1 MHz
SENSITIVITY:
Vertical Amplifier ... 10mV P-P/cm
Horizontal Amplifier ... 100mV P-P/cm
"Z" Axis typical ..... 5V P-P to cutoff
INPUT IMPEDANCE:
Vertical amplifer, 1 Meg/28pf
with X1 probe, 1 Meg/56pf
with X10 probe, 10 Meg/6.5pf
Horizontal amplifier, 1 Meg/30pf
TRIGGER FUNCTIONS:
Trigger Input ... 1 Meg/30pf
Trigger Modes ... Internal positive
Internal negative
External
External/10
TV V low pass
TV H high pass
TV Line
60 Hz
Trigger Sensitivity ... 10m, DC to 15 MHz
Trigger Stability .... + or − 10 mV
Trigger Adjustment Range ... 20-to-80% P-P
Trigger Display, + or − LED.
SWEEP OSCILLATOR.
Time 0.5 uSec/cm ot 0.5 sec/cm in 19 steps
with + or − 1% accuracy
Oscillator speed is expandable to 10 times.

CLASSIFIED

RATES: 40 cents per word (minimum charge, $10). Bold face words or words in all capital letters charged at 50 cents per word. Boxed or display ads charged at $46 per column inch (one inch minimum). For ads using blind box number, add $5 to total cost of ad. Send ad copy with payment to: Dawn Anderson, ELECTRONIC TECHNICIAN/DEALER, 1 East First Street, Duluth, MN. 55802.

BOX NUMBER REPLIES: Mail box number replies to: ELECTRONIC TECHNICIAN/DEALER, Classified Ad Department, One East First Street, Duluth, MN 55802. Please include box number in address.

WANTED

Wanted—Used picture tube rebuilding equipment. Send description, asking price and phone number to Telcolor, 2600 Crispin Ave., Charlotte NC 28208. 5/78

HELP WANTED

Outside Service Technicians. Paying top wages for best qualified men. Qualifications for position: total honesty, industrious, ten or more years direct television experience, non-drinker, non-smoker, must be able to work without supervision. Present employees grossing over $20,000 yearly. Send resume to American Television Service, 1032 South State, Orem, Utah 84057. 6/78

FOR SALE

REPAIR TV TUNERS-High earnings, Complete Course Details, 12 Repair Tricks, Many Plans, Two lessons, all for $2. Refundable. Frank Bocek, Box 3236, Ent., Redding, CA 96001. T/F

PICTURE TUBE MACHINE
We buy and sell NEW AND USED CRT rebuilding machinery. COMPLETE TRAINING. Buy with CONFIDENCE from the ORIGINAL MFGR. For complete details, send name, address and zip code to:
LAKESIDE INDUSTRIES
3520 W. Fullerton Ave., Chicago, IL 60647
Phone: 312-342-3399 TF

FREE MONTHLY LISTING of IC's, transistors, regulators, opamps at super savings e.g. SN7400-.08, 2N2222A-.08, LM309K-.50, LM709C-.13. Many, many more great buys. Write us to be put on our monthly m/l. Industrial Semiconductors Inc., 97 Rantoul St., Beverly, MA 01915. 9/78

TUBES—Receiving, Industrial and Semiconductors, factory boxed. Free price list. Low, low prices. **TRANSLETERONIC INC.** 1365-39th Street, Brooklyn, N.Y. 11218E 800-221-5802, 212-633-2800. 4/79

WHY PAY MORE? Now buy an original part # (Japanese or American type) for your **ECG, SK, GE, WORKMAN or HEP** transistor needs for 35% to 55% off regular dealer net price. Contact us with your needs and quantities used now and we will quote you immediately. Discounts vary with quantities used.
Bescor, 547 S. Broadway, Hicksville, NY 11801 (516) 822-3988 7/78

TV AND RADIO TUBES .36¢ EA!! Send for free color parts catalog. Your order free if not shipped in 24 hours. Cornell Electronics 4215-17 University San Diego California 92105. TF

THERE'S NO NEED TO BUY ORIGINAL JAPANESE TRANSISTORS WHEN OUR REPLACEMENTS WILL DO THE JOB of many original types. Phyltron's LX123A replaces over 50 Japanese types in our catalog. Don't tie yourself up with excessive inventory, buy Phyltron Electronics replacement transistors and save.
Write for free catalog. One year unconditional guarantee. Phyltron Electronics, 487 Springfield Ave., Summit, NJ 07901. TF

MAKE PC BOARDS. Step-by-step "How-to" manual with build-it-yourself equipment plans, charts, and illustrations. For Polyez and Film-Chemical processes. $4.98 plus 50¢ P&H. Century American Instruments, Dept. 516, Box 1014, Placentia, CA 92670. 5/78

DIRECT ECG REPLACEMENTS

AR Semiconductors replace all ECG transistors and IC's at 50% below regular cost. One year unconditional guarantee. These are all top of the line solid state devices. To order, send in the ECG number and your AR replacement will be promptly shipped. Minimum order $15.00, add $1.00 UPS.
AR SEMICONDUCTORS
P. O. BOX 976
UNION, NJ 07083 TF

IF YOU'RE A PROFESSIONAL, you need a professional Service Invoice. Write for our Catalog of Service Forms, Pricing Guides and Invoices and see why they're better. Tech Spray, Box 949, Amarillo, TX 79105. 7/78

GENUINE SONY SEMICONDUCTORS—CHECK THESE PRICES!!
EG. 1-9/ 10-24—SG613-8.50/7.30-SID 30-15 2.60/2.30, -2SC867A 5.10/4.90-2SC1114 5.50/4.80-2SC1358 6.50/5.70, -2SC1124 1.50/1.30-2SC634A 0.45/0.41.
Contact us for complete list of Japanese semiconductors and pricing information.
Bescor, 547 S. Broadway, Hickville, NY 11801 (516) 822-3988 7/78

Sencore—CB42—analyzer-walk through. Complete test for CB repairs. Regular net $1075.00—will sell for $775.00. 3413 Dempster, Skokie, IL 60076. (312)677-8870. 5/78

SAMS SET FOR SALE! Set contains 1185 of the most current folders. $2370.00 for the complete set. Contact Valley TV Electronics, Box 432, Lamar, CO 81052 5/78

TV-117 NPN same as ECG-196 90 V 7 Amp 50 watt better repl for SK-3054 GE-66 .75—TV-116 PNP complement .75—AC-100 NPN TO-3 case same as ECG-283 excellent vert defl repl 800V 15Amp 100Watt 2.95—2SC1172 Hor output same as ECG-165 ECG-238 121-831 121-1015 SK3115 GE-38 3.99—2SC685A NPN TO-66 repl ECG-124 GE-12 SK-3021 .75—Varo tripler—excellent repl for 221-128 32-33057-4 14.95—Zenith tripler 212-139 8.95 7/78

SEEKING ORIGINAL JAPANESE TRANSISTORS, IC, FET AND DIOES FOR CB AND STEREO REPAIR? See our full page ad in this issue. ORDER TOLL FREE. Write or call for our complete price list and compare prices. FUJI-SVEA ENTERPRISE, Dept. ET, P.O. Box 40325, Cincinnati, OH 45240. 6/78

MATHEMATICS. ELECTRONICS. ADVANCED MATHEMATICS. ENGINEERING MATHEMATICS. INDIANA HOME STUDY, DEPT. TD, BOX 1189, PANAMA CITY, FL 32401. 6/78

TRANSISTOR REPLACEMENT. PHYLTRON ELECTRONICS LX REPLACEMENT LINE REPLACES THE MOST POPULAR REPLACEMENT TYPES AT OR BELOW DISTRIBUTOR COST. One year unconditional guarantee. Buy direct and save. Write for free catalog. Phyltron Electronics, 487 Springfield Ave., Summit, N.J. 07901. TF

BUGGING & WIRETAPPING is a growing public concern. Are you equipped to answer your customers' questions—and get your share of the 'de-bugging' profits? 'ELECTRONIC SPYING' is the most simplified and comprehensive book ever written on the subject of electronic surveillance, and will tell you all you need to know. Order direct from publisher for only $7.95: MENTOR PUBLICATIONS, Dept. 120, 135-53 No. Blvd., Flushing, N.Y. 11354. 7/78

SAVE $$$$. F.M. two way radio equip your vehicles. Do it yourself. We offer top quality at low prices, licensing assistance, technical know how, terms. Write ET/D Box 119. 5/78

REPLACEMENT COLOR YOKES-DEALERS ONLY. Zenith 95-2501-2532-2638-2667-S89633 etc. $16.95. Magnavox 361380-1 $18.95 etc. Sylvania, G.E. etc. $14.95 to $19.95. Request for price list on your letterhead. David Sims Enterprises, Inc., 665 Jerricho Turnpike, Huntington Station, N.Y. 11746 TF

Values of Profit and Loss, Balance Sheets in your Business. $3.00 to Century 22, Box 10516, Phoenix, Arizona 85064. 5/78

BUSINESS OPPORTUNITIES

TV and appliance store and TV repair in beautiful foothill town in the California Sierra Nevada Mountains. Major brand franchises, great lease, fantastic opportunity. Call evenings (209) 736-4421. 6/78

MECHANICALLY INCLINED INDIVIDUALS—BUILD ELECTRONIC DEVICES IN YOUR HOME. GET STARTED IN YOUR SPARE TIME. $300 TO $600/WK POSSIBLE. EXPERIENCE NOT NECESSARY. WRITE FOR FREE LITERATURE. ELECTRONIC DEVELOPMENT LAB., BOX 1535 (B), PINELLAS PARK, FLA., 33565. TF

ELECTRONICS/AVIONICS EMPLOYMENT OPPORTUNITIES. Report on jobs now open. Details **FREE**. Aviation Employment Information Service, Box 240Y, Northport, New York 11768. 8/78

RCA TV Sales & Service, established 21 years, including 1½ bath home on 1⅓ acres in country in northwest Missouri. Gross 40,000+. Potential unlimited. Reply ET/D Box 120. 5/78

COMPUTER FUTURE—We are looking for qualified radio-television and electronic shops to handle our sales, service and supplies. We provide training and a protected area. S/D COMPUTER TECHNOLOGY, P.O. Box 1283, Albany, N.Y. 12201. 9/78

T.V. Business for sale. 20 years in large shopping center in So. Fla. Zenith-Sony-RCA sales and rental service. Year round. Over $100,000 gross. Excellent opportunity. Write to Jeff Cohen, 19B Madeira Ave., Coral Gables, Fla. 33134. TF

Willmar Area Vocational-Technical Institute has Service Electronic Technicians with two years of training specifying in T.V. & Radio Repair available for job placement in June, 1978. For further information, contact Fred Hanson, Placement Coordinator, P.O. Box 1097, Willmar, MN 56201. Telephone no: (612) 235-5114. 5/78

"Rent Lease TV's anyone can!" Easy to start and operate. Even from your home. Send $2.00 for basic information. Perry's TV, P.O. Box 1407, Santa Maria, CA 93454. 5/78

TV SALES & SERVICE—In same southern Oregon location for 19 years. Bldg. 1200 sq. ft. with full basement on 1 acre of land. Zenith dealership. Bldg, land, truck, and inventory $55,000.00. Write ETD, Box 117. 6/78

Busy TV service business—includes shop, 3 bedroom house, 105' frontage on major highway close to downtown Brownwood, Texas. $20,000 total buys business and property. (915) 646-2405. 5/78

ALARM SYSTEMS

DON'T PURCHASE any burglar-fire alarm equipment before getting our free value packed catalog. Super savings on Dialers, master controls, infrared detectors, wireless Automatic panic buttons and much more. No shipping charges. Sasco, 5619-E. St. John, Kansas City, MO 64123. (816) 483-4612. 5/78

send a message...
...write here.

1. Number of insertions: (circle) 1 2 3 6 12
2. Start with (month) _____ issue (Copy must be in by 1st of month preceding)
3. Amount enclosed: $_____.

PAYMENT MUST ACCOMPANY ORDER. WE'LL BILL RATED FIRMS.

NAME_____ COMPANY_____

STREET_____

CITY_____ STATE_____ ZIP_____

MAIL AD COPY TO: DAWN ANDERSON, ELECTRONIC TECHNICIAN/DEALER, 1 EAST FIRST STREET, DULUTH, MN. 55802.

RATES: 40 cents per word(minimum charge, $10). Bold face words or words in all capital letters charged at 50 cents per word. Boxed or display ads charged at $46 per column inch (one inch minimum). For ads using blind box number, add $5 to total cost of ad.

ET/D Classified

Circle No. 112 on Reader Inquiry Card—Unit LM-4A
Circle No. 129 on Reader Inquiry Card—Unit LM-40A

READER SERVICE INDEX

ADVERTISER'S INDEX

This index is furnished for the readers' convenience. However, the publisher can not guarantee its accuracy due to circumstances beyond our control.

Circle No. 116 on Reader Inquiry Card

Circle No. 118 on Reader Inquiry Card

The safest way to get your share of the more than $300 million replacement business in receiving tubes:

Don't get caught short of Zenith Receiving Tubes in your caddy.

You know as well as anyone that the market for receiving tubes, even in this day of solid-state technology, is still sizeable. Not only for all-tube receivers...but even for hybrids.

Capitalizing on this market is not only profitable, but also easy.

One sure way to make the most of it is to stock your caddy with receiving tubes bearing the one TV brand name that for years has won endorsement by top service technicians just like you.

It's the simple, sure-fire way to protect your reputation and insure your customers' satisfaction.

Best of all, you don't have the problem of trying to sneak in an off-brand in a day and age when consumers are as well aware of Zenith quality as you are.

Call your Zenith distributor now for details on Zenith's Receiving Tube program.

For your own reputation and in your customers' best interest, always specify Zenith exact replacement parts and accessories.

ZENITH®

The quality goes in before the name goes on®

Zenith Radio Corporation/Service, Parts & Accessories Division/11000 Seymour Avenue/Franklin Park, Illinois 60131

Circle No. 103 on Reader Inquiry Card

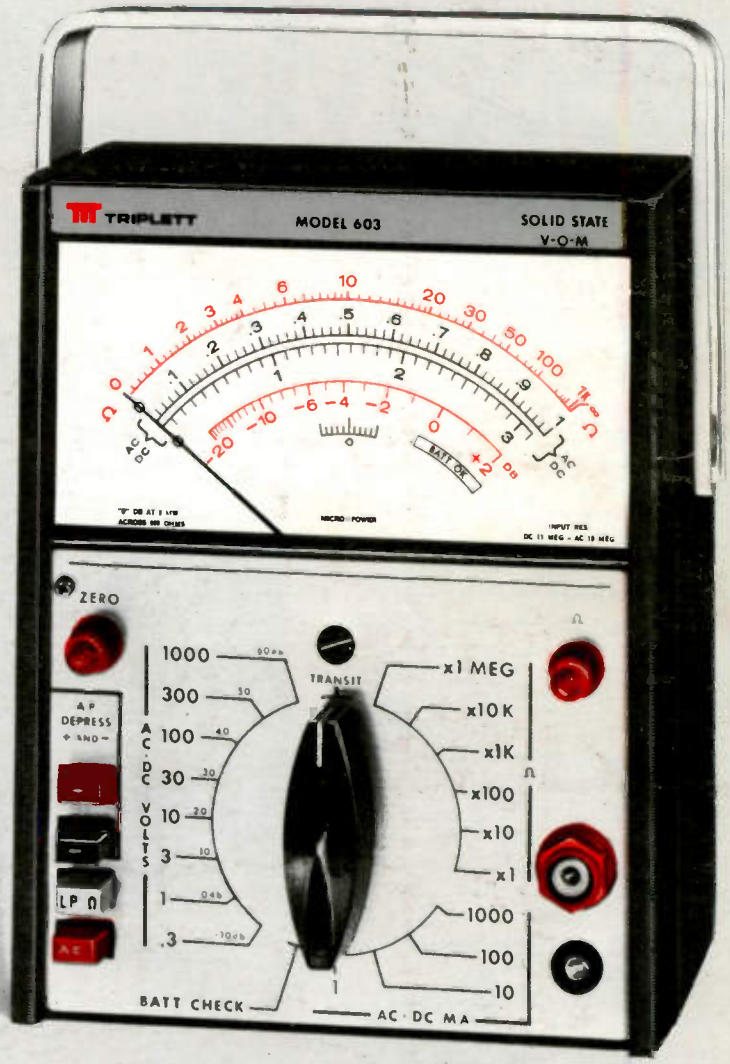
The reader that can stay on, and on, and on. The 603.

The price of the Model 603 V-O-M is only $185.

The one V-O-M you can forget about forgetting to turn off. The incredible Model 603 FET V-O-M with exclusive Triplett Micro-Power™ draws only 10 uA, can stay on indefinitely without impairing performance. Ideal wherever frequent test changes, interruptions, distractions—or gremlins—keep your V-O-M working when you're not.

Truly outstanding features:

1. **Exclusive Triplett Micro-Power (TMP™) provides battery life in excess of a year for carbon batteries with unit left on continuously 24-hours a day.**
2. **Low-Power Ohms (LPΩ™)—6 ranges with 70 mV power source for in-circuit measurements without damage to components.**
3. **FET V-O-M with Patented Auto-Polarity—convenient and time-saving, always reads up scale.**



Accurately measures electric and electronic circuits on production lines, in quality testing, during maintenance, in service shops and on calls, in the laboratory or classroom, in the field.

One range selector switch operates the unit. One probe handles all functions—AC, DC, MA, Ohms—and a simplified scale utilizes only 4 arcs for all 44 ranges. The Low Power Ohm circuit permits fast circuit measurements without biasing semiconductor device junctions. The Model 603 also has a unique, Patented Auto-Polarity circuit: push a button, measure either plus or minus voltages without switching leads. Make very fast voltage checks where polarity is known or doesn't matter.

See for yourself. Try the 603. Have your Triplett distributor or sales representative give you a free demonstration of the tester that can stay on indefinitely without impairing its testing performance. You'll be glad you did. Triplett Corporation, Bluffton, Ohio 45817.

TRIPLETT
ALL YOU'LL EVER NEED IN V-O-M's.

...for more details circle 104 on Reader Service Card
...For FREE demonstration circle 105 on Reader Service Card

Triplett. The easy readers.