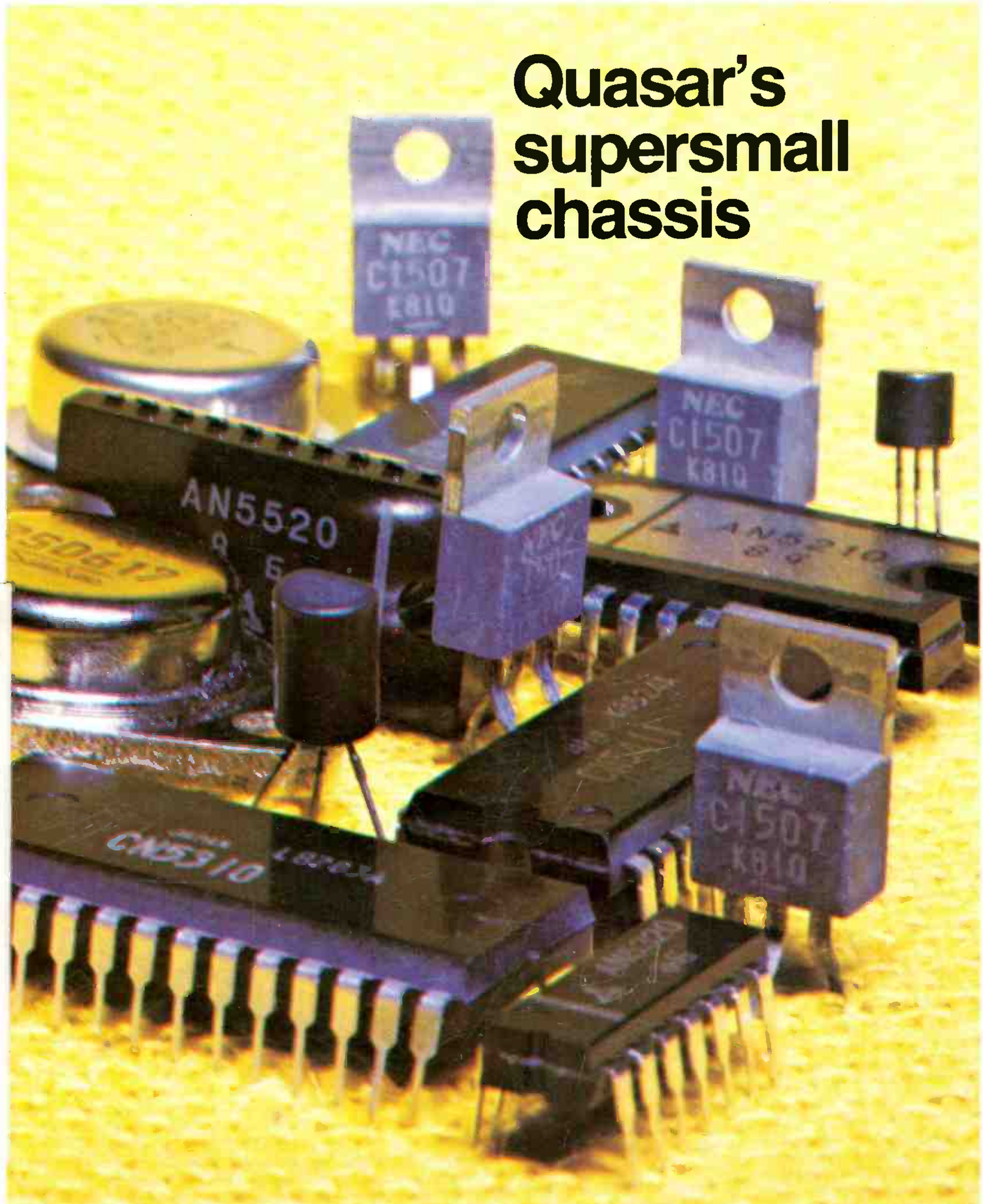
ET/D

FEBRUARY 1979 • $1.00

ELECTRONIC TECHNICIAN/DEALER

LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

Quasar's supersmall chassis



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INDUSTRY REPORT

Admiral Vacates Mexican Market

Admiral, which recently announced plans to close its U.S. television manufacturing operations, has now decided to vacate its Mexican TV facilities also.

In a brief statement from parent Rockwell International, Admiral said it has sold Admiral de Mexico to Grupo Industrial Alfa S.A. of Monterrey, Mexico. The later group will make television sets under the Admiral name.

Admiral de Mexico has been making color and black and white television and stereo systems for the Mexican market.

RCA Marks 50-millionth TV

On the right is the first television set produced by RCA—a 10-inch black and white receiver—in 1946. On the left—some 32 years and 49,999,999 sets

later—is a current version of an RCA 19-inch ColorTrak receiver. On the pricing front, the first set retailed for $375 while the new color chassis sells for $570.

ISCET Battle Expands

Amid charges and countercharges the battle between the NESDA originated ISCET program (International Society of Certified Electronic Technicians) and the dissident ETA (Electronic Technicians Association) continues to grow hotter.

An internal rift within ISCET resulted in NESDA's firing then ISCET officers Jesse B. Leach and Leon Howland and the relieving of ISCET educational director Ron Crow (see ET/D, January).

However, when it was announced by ETA supporters that they planned to sponsor a competing certification program for electronic technicians and that it would be called the International Society of Certified Electronic Technicians, Incorporated, the charges between the officers and the confusion in the ranks became even thicker.

According to a news release received by ET/D, Forest Belt, CET, an electronics industry educator, has been appointed acting ISCET chairman to replace Leach and Larry Steckler, CET, editor of *Radio-Electronics* magazine, will serve as vice chairman.

As chairman, one of Belt's first actions was to disavow any association between ISCET and the competing group. "Our society operates, the way it always has, as a branch of the National Electronics Service Dealers Association." Belt added, "All they can do is tear down or play catch-up. The tear-down game has already damaged their own credibility. As for catch-up, they are lost before they begin. ISCET now has more technical, promotional, and developmental clout and talent than at any time in its history ... we are rising fast."

Meanwhile, Dick Glass, former NESDA executive director and president of the newly formed ETA contends the group already has 300 members and some 150 "proven" test monitors for their certification program. "The response has been really good so far and we were unaware of the strong feelings for such an independent technician's association—or of the large number of employee techs who would join an association that is devoted to something other than TV repair alone."

Glass also announced appointment of additional officers. He said D.C. "Snow" Larson, CET, of Houston, Tex., will serve as vice chairman of ETA, and Crow will head the new group's certification program.

In a statement from ETA headquarters, Crow said the new program is "already underway" with more than 125 monitors through the United States and in some foreign countries. "The break away from NESDA marks the beginning of a new and better era for electronics technicians and is expected to spur the technician certification program ... to much higher levels of recognition and importance to the industry," Crow said.

Gould Announces National Distributor Program

Gould Inc., has announced that it plans to implement a national distributor program for its lower-end osciloscopes.

According to a Gould spokesman, negotiations are now underway with various electronic distributors who would take on the Gould line of scopes in the $595 to $995 price range. Product Sales Manager Richard Bowman said the scopes are portable, general purpose instruments for applications in industrial, radio/television servicing, medical, amateur and advanced hobbyist markets.

Reorganization at Quasar

In a move designed to separate the marketing and production functions of its subsidiary Quasar Electronics Company, the parent Matsushita of Japan

ET/D

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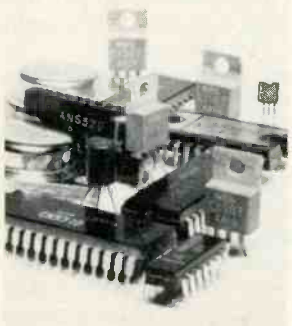
FEBRUARY 1979, VOL. 101, NO. 2

FEATURES

DEPARTMENTS



On the cover: Shown on this month's cover are the six primary integrated circuits, plus the few remaining discreet transistors, which make up Quasar's incredibly small "Dynamodule" chassis for 1979. For a more detailed report on this circuitry see our special report in this issue.

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has created two new operating divisions. They are the Quasar Company—with responsibilities for sales and marketing—and the Matsushita Industrial Company—which will handle consumer product engineering and production.

Still unclear as a result of the organizational change is the impact the move will have on Panasonic, Matsushita's other United States subsidiary, if, in fact, there is any impact on that unit. Quasar Electronics Company, based in Franklin Park, Ill., a Chicago surburb, is the former television business of Motorola, which Matsushita purchased in 1974. Under the new set up, Matsushita Industrial Company will be based in Franklin Park and will operate the color TV plant there as well as a Panasonic speaker plant in Los Angeles.

The move is seen by some as an attempt to expand Quasar's U.S. production output, a strategy most Japanese television manufacturers have taken in recent months as a result of the changing relationship between the Japanese yen and American dollar.

Named head of the new sales and marketing unit is Alex Stone, former Quasar sales and marketing vice president. Richard Kraft, formerly engineering vice president, becomes president and chief exec of Matsushita Industrial, according to spokesmen for the company. ET/D

NEWSLINE

<u>WCES DRAWS RECORD CROWD</u>. They literally came by the thousands to Las Vegas last month to view the cornucopia of consumer electronics ...the Winter Consumer Electronics Show. And if there was any hint of recession outside of the world's most gaudy city, it certainly did not register with the consumer electronics industry. First figures from the show indicate business was brisk, coming off of a record 1978 in many respects, and attendance of over 50,000 in four days set a new WCES records.

<u>VIDEO IS STAR OF SHOW</u>. While audio remains the easy dominant figure out at WCES, there was no question that video is the up and coming star. Over 400,000 VCRs were sold last year, at least 600,000 are conservative sales figures for this year. This goal should be no problem with such an industry giant as RCA jumping in to spend $2-million for VCR promotion in the first quarter. And if that in itself is not worth an award, then surely RCA's theme is -- at least for originality. They're pitching that buying a VCR can help keep peace among family members, especially kids who will no longer mind going to bed early once assured by "mummy" that they'll be able to watch their favorite TV show when they arise in the morning. Whew!

<u>RECORD TV YEAR</u>. There were more color televisions sold last year than ever before, and 1979 -- while not quite matching that figure -- won't be far behind. At least that was the consensus among "experts" out at the WCES last month. EIA figures showed final color TV statistics at 10.25 million. Black and white TV had its second best year with a total 6.1 million units sold, EIA reported.

<u>HOME COMPUTERS COME DOWN TO EARTH</u>. One positive thing coming from the show this year is that the manufacturers of home computers at last seem to have come down to earth. They no longer are touting the number of flip-flops inside their little black boxes, but rather what you can do with these flip-flops. With this important marketing shift to user related applications, the last great barrier toward a really successful industry has been removed.

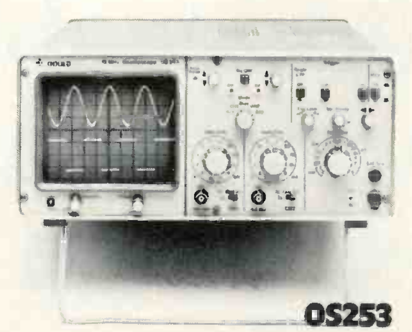
<u>EDS FEATURES INTERNATIONALISM</u>. This year's Electronic Distribution Show (formerly NEWCOM) is expected to draw significant attendance from off-shore manufacturers and distributors. According to a show spokesman there already are a large number of U.S. companies whose products are manufactured off-shore signed up for the show. Additionally, a record attendance of off-shore distributors is expected. This year's show, incidentally, has been expanded into a four-day event from May 1-4.

GOULD PROFESSIONAL OSCILLOSCOPES AT PRICES YOU CAN AFFORD.

Whatever your interest in electronics, you know that a quality oscilloscope with a broad range of features and functions can make your work a lot easier. Gould oscilloscopes are built to solve your problems and priced so you can afford the professional equipment you need right now. All are complete, ready for use, including passive probes, input leads and a comprehensive maintenance and operation manual.


OS245A

The OS245A is a compact, dual trace instrument with a 10MHz bandwidth and 5mV/div sensitivity. It has exceptional trigger performance and a full compliment of facilities for industrial, educational, and field service applications.


OS253

The OS253 is a 12MHz dual-channel scope with all the features of the OS245A plus a larger display area, more sensitivity and channel sum and difference.

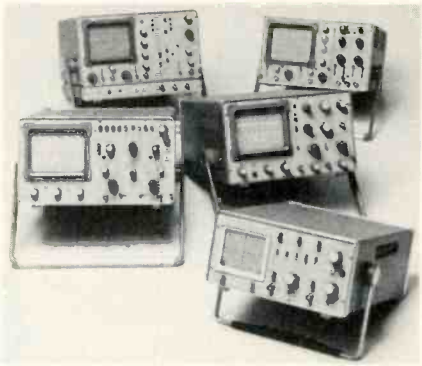
The dual trace OS255 weighs only 15 lbs. yet offers features normally found in more expensive instruments such as flexible triggering facilities and 2mV/cm sensitivity across its full 15MHz bandwidth.


OS255

The dual beam OS260 gives true representation of two separate signals on the same time frame without beam chopping or alternating. Features include a high brightness CRT operating at 10kV allowing a clear display of all waveforms.


OS260

For additional information on this exciting new line of sensibly priced, professional oscilloscopes or for sales locations in your area: call toll free (800) 325-6400 Ext. 77. In Missouri call (800) 342-6600.



Gould also manufactures an additional line of general purpose oscilloscopes for industrial, scientific and laboratory applications.

GOULD

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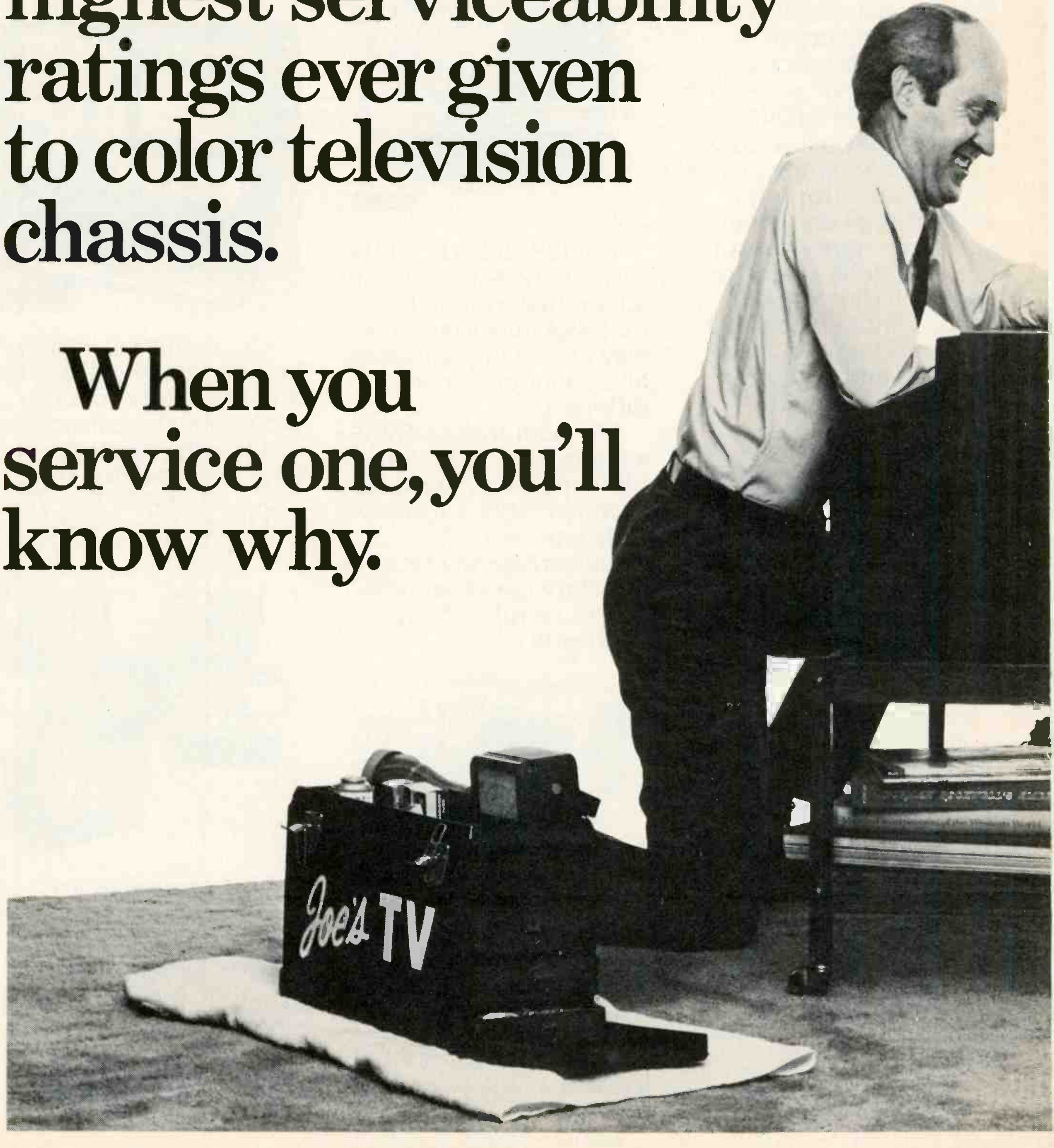
Two of RCA's new XtendedLife Chassis have been awarded the highest serviceability ratings ever given to color television chassis.

When you service one, you'll know why.



FROM THE EDITOR'S DESK

I've just returned from another Consumer Electronics Show, this one in Las Vegas (Jan. 6-9), and as has been my experience each time I view one of these events, I come out of it just a little more confused than when I went in. (A full report on the Winter CES will be carried in next month's issue of ET/D).

To be sure, the show itself has to be the Mecca for electronics gadgetry and household/auto playthings—to say nothing of its value as a centerstage to unveil the sheer marvel of what can be done with and through electronics.

However, without question, CES has become primarily a showcase for stereo components. Each manufacturer, and the sheer number of them is numbing to the senses, is there to display such large array of "systems" and components—each dutifully backed by a list of technical specifications and measurements—that I wonder if any consumer is ever really capable of deciphering all of the technical jargon once it filters down to him at the retail level. I get the feeling that the manufacturer with the best promotion and sales pitch is the one that makes the most sales in the long run.

But this is only the "home stereo" segment of the show. Moving along to "auto sound"—as it is called—we witnessed the presentation of amplifier systems so powerful it seems they would practically blow the roof off of an enclosed vehicle. Is there really a market for these products?

On the television side of things, the manufacturers were there in force to give us glimpses of things to come in video.

Matsushita, for instance, was host to a press reception to unveil in the United States their "television set of the future"...a set complete with printer so the listener can watch a newscast or presidential speech and then go over to the printer to rip off his printed copy of the text!!!

Of course we again saw the picture over a picture by Sharp wherein they superimpose a small black and white picture over the large color picture (in the bottom right hand corner). I've often wondered if it wouldn't be more practical—and perhaps less expensive—just to place a 9- or 12-inch black and white receiver next to your color set if you're interested in watching two programs at once. But, ready for it or not, here it comes down the consumer electronics pipeline.

One television manufacturer even came to promote the superiority of its sound system, having given up the fight to compete with picture quality and esthetic frills.

"Home computer" manufacturers were there too in greater numbers than ever before. The only trouble is they have yet to figure out how to interest the "average" consumer in their product—the latter seemingly totally confused by it.

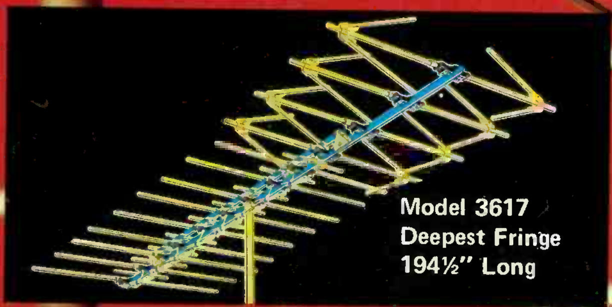
Perhaps the most significant trend to emerge from the whole show was the apparent steady growth of the VCR segment. Not yet by any stretch of the imagination to be considered a boom market, yet definitely growing. Several new models were introduced along with new versions of color and black and white television cameras.

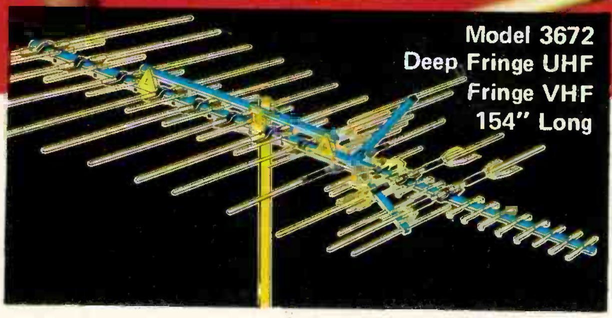
All in all, after considering the magnitude of the new frills added to consumer lines, one left with the definite feeling of—if not confusion—then sincere doubt as to where the consumer electronics market is headed as manufacturers frantically search for new, greener, and lucrative markets to attack.

It seems to me in many cases that the technology of consumer electronics has far outstripped the needs of consumers.

Sincerely

Richard W. Lay

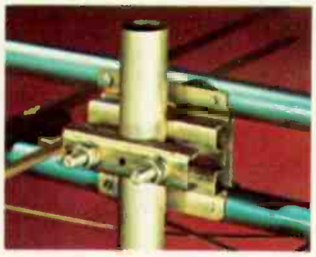




For years, Channel Master's Crossfire series has outsold competition because of its outstanding performance featuring exceptionally high gain and superior interference rejection. Now, new construction features give Crossfire greater strength and durability, plus increased ease of handling for faster installation.

FOR YOU AND YOUR CUSTOMER!

A new one-piece heavy duty nest on all models eliminates wind-milling and fastens quickly to the mast by tightening one set of bolts. Larger models feature a re-inforced truss construction double boom that keeps the entire length of the Crossarm rigid, and allows a rotor to be placed within 6" of the antenna for greater turning power. This new truss construction replaces cumbersome and time consuming boom braces, and eliminates the possibility of misalignment of elements due to boom "droop."



Crossfire's unequalled reception features combine with easier handling and greater durability to make the best an even better buy....for you and your customer!

Channel Master DIVISION OF AVNET, INC.
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STRICTLY BUSINESS

Everybody who is in the service business is in another business at the same time ... we're in the money business.

We all pretty much understand the service business. We have had training in it. We have had a lot of experience in it. We have talked to a lot of other servicers about it. We know how to recognize a good technician, and we know how repairs should be made. We know how to route and dispatch the men, how to buy parts and keep up the inventory and stock the trucks. We know about vehicles and test instruments.

But what do we know about handling money? Often, painfully little. Yet, regardless of how we handle the service end of things, if we do not handle the money successfully, we will end up closing the doors.

The objectives in the money game are threefold ... to guard the assets ... to increase the assets ... and to make money off them. On the service side of the business, we have tools and instruments to help us. We learn how to use them. They help us get the service job done. On the money side, we have tools to help us. We learn how to use them. They help us get the money job done. The tools we use on the money side are the Profit and Loss Statement (it might be referred to as the P & L, or Operating Statement, or Income Statement) and the Balance Sheet. Every service manager or operator should have these tools in his hands every month.

Just as you don't have to know how to build a VTVM in order to use it, neither do you have to know how to build a P & L and a Balance Sheet. That's the accountant's job. All you have to know is how to use the tool when you get it.

So you don't have to be an accountant, but you do have to be able to "take a reading." It's important. That's why, at the NARDA Service Symposium, we spend fully half of our time in learning how to take that reading. And at the NARDA College of Service Management, we spend one full day on financial statements.

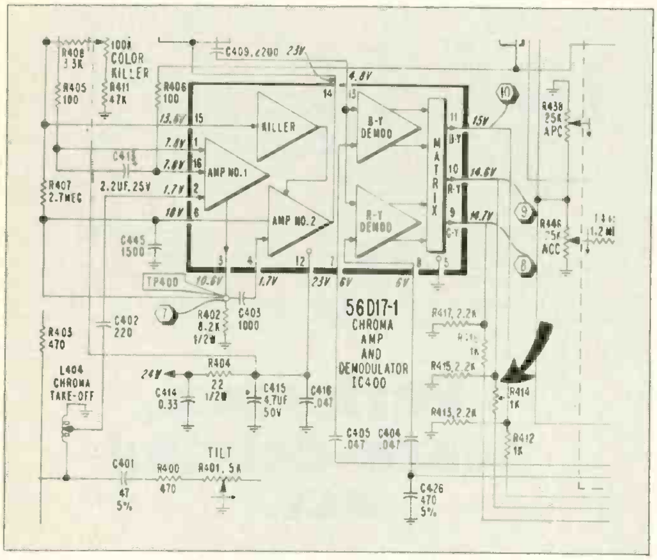
You spend long, long hours every month working for money. Truly, though, the money should be working for you. Learn how to make money work for you. If you don't ... KAPUT.

John Dooley

SERVICE SEMINAR

ADMIRAL

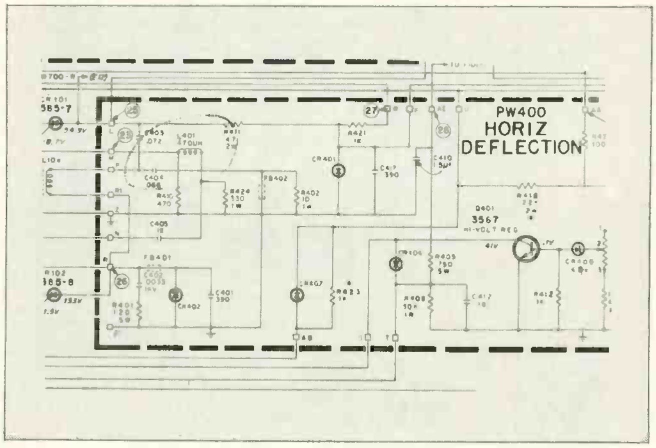
Color TV Chassis 9M46—No raster, sound ok. Possible cause; open R414, 1K ohm, ¼ watt, 5%, from pin 10 of IC 400 to point "AC."



Color TV Chassis 10M55—No vertical sweep. Possible cause: Defective horizontal processing—vertical countdown IC (IC600).

RCA

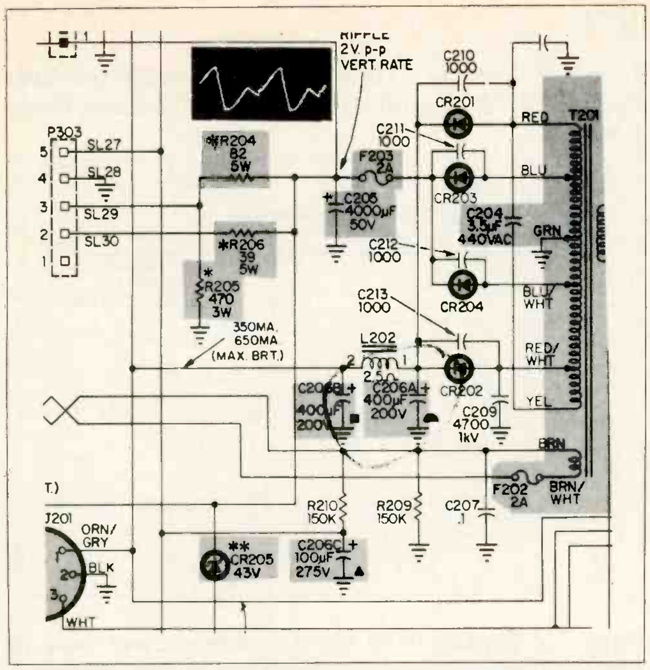
Color TV Chassis CTC 44-Severe horizontal foldover. Possible cause: Open L401 coil, (on PW400 horizontal deflection board).



Color TV Chassis CTC 87—No video—color only on screen. Possible cause: open delay line, or open solder connection between delay line and PC board.

Color TV Chassis CTC 90—No video—sound ok. 210v pulse low, R438 open. Remedy: replace blue/white wire from pin 4 on MDL002, module to R428, defective insulation causes a short to adjacent terminal.

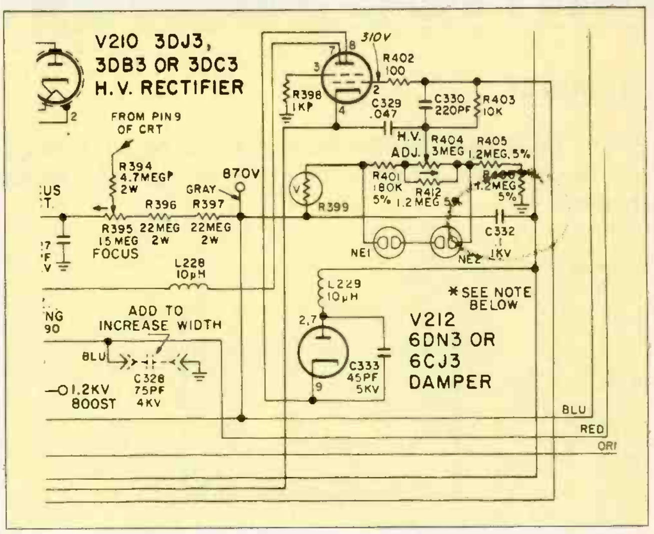
Color TV Chassis CTC81—Bending in raster, relay trips after about 1 minute of operation. Possible cause: Open "A" section in C206.



Color TV Chassis CTC81—Relay chatter, Xmas tree effect at high brightness level. 240v supply measures 225v, 38v supply measures 41v. Possible cause: open C206 filter capacitor. (See previous schematic.)

ZENITH

Color TV Chassis 20CC50—No HV, no boost, damper runs red after a few minutes. A clue: high voltage returns when damper is removed. Cause: shorted C332 in damper plate circuit. **ET/D**



	25-UP	10-24	1-9
2SA102	.29	.34	.39
2SA473	.45	.55	.60
2SA484	1.85	2.05	2.35
2SA495	.25	.30	.35
2SA497	.90	1.15	1.25
2SA509	.30	.35	.40
2SA562	.25	.30	.35
2SA564A	.29	.34	.39
2SA634	.35	.40	.45
2SA636	.80	.85	.90
2SA643	.30	.35	.40
2SA673	.30	.40	.45
2SA678	.40	.50	.55
2SA683	.40	.50	.55
2SA684	.40	.50	.55
2SA695	.40	.50	.55
2SA699A	.50	.60	.65
2SA706	.85	.95	1.05
2SA720	.30	.35	.40
2SA733	.25	.27	.30
2SA747	4.15	4.35	4.85
2SB22	.45	.50	.55
2SB54	.30	.35	.40
2SB77	.30	.40	.45
2SB175	.35	.40	.45
2SB186	.20	.27	.30
2SB187	.20	.27	.30
2SB324	.25	.35	.40
2SB367	1.10	1.20	1.35
2SB405	.25	.30	.35
2SB407	.70	.85	.95
2SB463	1.00	1.05	1.15
2SB474	.70	.80	.90
2SB507	.70	.80	.90
2SB511	.70	.75	.85
2SB557	2.05	2.45	2.75
2SC183	.40	.50	.55
2SC184	.40	.50	.55
2SC372	.20	.27	.30
2SC373	.20	.27	.30
2SC380	.20	.27	.30
2SC382	.30	.40	.45
2SC387A	.30	.40	.45
2SC394	.25	.30	.35
2SC458	.20	.27	.30

	25-UP	10-24	1-9
2SC460	.45	.50	.55
2SC481	1.25	1.35	1.45
2SC482	1.25	1.35	1.45
2SC485	1.25	1.35	1.45
2SC495	.45	.55	.60
2SC509	.30	.40	.45
2SC517	2.90	3.10	3.25
2SC535	.30	.35	.40
2SC620	.45	.50	.55
2SC632A	.35	.40	.45
2SC634A	.40	.45	.50
2SC697A	3.20	3.50	3.90
2SC710	.20	.27	.30
2SC711	.20	.27	.30
2SC712	.20	.27	.30
2SC717	.35	.40	.45
2SC730	2.95	3.15	3.35
2SC732	.20	.25	.30
2SC733	.20	.25	.30
2SC734	.20	.25	.30
2SC735	.20	.25	.30
2SC756	1.45	1.75	1.95
2SC756A	2.00	2.10	2.20
2SC778	2.80	3.10	3.30
2SC781	1.95	2.15	2.45
2SC784	.30	.35	.40
2SC789	.75	.85	.95
2SC793	1.95	2.15	2.45
2SC799	1.95	2.15	2.45
2SC828	.20	.27	.30
2SC829	.20	.27	.30
2SC839	.30	.35	.40
2SC867A	4.00	4.25	4.50
2SC900	.20	.27	.30
2SC930	.20	.27	.30
2SC945	.20	.27	.30
2SC1000BL	.35	.40	.45
2SC1013	.45	.60	.65
2SC1014	.50	.60	.65
2SC1018	.70	.75	.85
2SC1030	1.80	2.05	2.35
2SC1056	4.50	4.70	4.90
2SC1060	.65	.75	.85
2SC1061	.70	.80	.90
2SC1096	.45	.50	.55

	25-UP	10-24	1-9
2SC1114	3.40	3.60	3.80
2SC1116A	3.20	3.45	3.80
2SC1124	.80	.85	.95
2SC1127	.80	.85	.95
2SC1162	.70	.75	.85
2SC1166	.25	.35	.40
2SC1172B	3.10	3.50	3.85
2SC1173	.50	.65	.70
2SC1177	10.90	12.40	13.80
2SC1209	.25	.35	.40
2SC1226	.50	.60	.70
2SC1226A	.50	.60	.70
2SC1237	1.70	1.90	2.15
2SC1239	2.10	2.65	2.85
2SC1306	1.25	1.65	1.85
2SC1307	2.15	2.65	2.85
2SC1318	.30	.40	.45
2SC1364	.30	.40	.45
2SC1383	.30	.40	.45
2SC1384	.30	.40	.45
2SC1424	2.75	2.85	2.95
2SC1448A	1.00	1.10	1.20
2SC1475	.65	.85	.95
2SC1509	.55	.60	.65
2SC1567A	.60	.65	.75
2SC1675	.25	.30	.35
2SC1678	1.25	1.40	1.55
2SC1687	.40	.45	.50
2SC1727	1.20	1.25	1.30
2SC1728	.90	.95	1.00
2SC1760	.85	1.00	1.10
2SC1775	.30	.35	.40
2SC1816	1.45	1.70	1.95
2SC1908	.25	.35	.40
2SC1909	2.00	2.55	2.75
2SC1945	4.40	4.90	5.50
2SC1957	.60	.70	.80
2SC1969	3.50	3.90	4.30
2SC1973	.60	.65	.70
2SC1974	1.25	1.65	1.85
2SC1975	1.25	1.65	1.85
2SC2009	.75	.80	.85
2SC2021	.55	.60	.65
2SC2028	.50	.60	.65
2SC2029	1.45	1.75	1.95

	25-UP	10-24	1-9
2SC2072	3.55	3.75	3.95
2SC2076	.45	.60	.65
2SC2091	.85	1.05	1.15
2SC2092	1.75	1.95	2.20
2SC2098	3.00	3.20	3.45
2SD72	.50	.60	.65
2SD91	1.30	1.40	1.55
2SD92	1.40	1.55	1.75
2SD180	1.55	1.75	1.95
2SD187	.30	.40	.45
2SD218	2.95	3.20	3.45
2SD234	.60	.70	.80
2SD235	.60	.70	.80
2SD261	.30	.35	.40
2SD287	2.50	2.65	2.85
2SD291	2.05	2.45	2.75
2SD313	.60	.65	.70
2SD315	.60	.70	.80
2SD325	.60	.65	.75
2SD330	.69	.79	.89
2SD356	.70	.75	.80
2SD358	.70	.80	.90
2SD359	.75	.85	.95
2SD427	1.75	1.95	2.20
2SD525	.70	1.05	1.15
2SD526	.60	.70	.80
2SK19	.45	.50	.55
2SK23	.80	.95	1.05
2SK30	.40	.45	.50
2SK33	.60	.65	.75
2SK34	.50	.55	.60
2SK41	.50	.55	.60
2SK55	.60	.65	.75
3SK22Y	1.60	1.70	1.80
3SK35	1.20	1.35	1.50
3SK37	1.70	2.00	2.30
3SK40	1.25	1.40	1.55
3SK41	1.25	1.40	1.55
3SK45	1.25	1.40	1.55
3SK48	3.30	3.40	3.70
3SK49	1.25	1.40	1.55
AN115	2.00	2.15	2.25
AN214Q	1.55	1.65	1.85
AN228	4.10	4.30	4.50
AN239	4.10	4.30	4.80

	25-UP	10-24	1-9
AN247P	2.40	2.60	2.90
AN274	1.50	1.70	1.90
AN313	4.20	4.40	4.60
AN315	1.75	1.95	2.20
BA511A	1.70	1.90	2.15
BA521	1.85	2.05	2.35
HA1151	1.45	1.70	1.85
HA1156	1.60	1.75	1.95
HA1306W	1.90	2.10	2.40
HA1322	2.40	2.60	2.90
HA1339	2.45	2.65	2.95
HA1339A	2.45	2.65	2.95
LA1222	2.10	2.30	2.50
LA3101	3.45	3.60	3.75
LA4031P	1.75	1.95	2.20
LA4032P	1.75	1.95	2.20
LA4220	2.25	2.40	2.55
LA4400	1.85	2.05	2.35
LD3141	1.70	1.80	1.90
M5115P	4.85	4.90	4.95
M51513L	1.95	2.15	2.45
MN3001	13.20	14.85	16.50
MN3002	9.25	10.40	11.55
MN3003	5.64	6.34	7.04
PLL01A	4.00	4.15	4.55
PLL02A	4.95	5.20	5.80
PLL03A	7.50	7.90	8.70
SG264A	7.00	7.40	7.80
SG609	4.10	4.30	4.50
SG613	5.20	5.40	5.95
SM5104	7.90	8.40	8.90
STK011	3.55	3.95	4.35
STK013	8.90	10.00	11.10
STK015	4.10	4.30	4.80
STK050	23.10	25.98	28.86
STK415	7.10	7.60	8.10
STK435	4.45	4.95	5.55
STK439	8.00	9.00	10.00
TA7045M	1.95	2.15	2.45
TA7055P	1.95	2.15	2.45
TA7060P	.85	1.05	1.15
TA7061P	.85	1.05	1.15
TA7062P	1.05	1.20	1.35
TA7063P	1.25	1.35	1.50
TA7074P	3.70	3.85	4.00

	25-UP	10-24	1-9
TA7089P	1.95	2.15	2.45
TA7092	9.50	10.00	10.50
TA7120P	1.45	1.65	1.85
TA7139P	1.55	1.75	1.95
TA7153P	5.70	5.90	6.10
TA7203P	2.45	2.60	2.85
TA7204P	1.95	2.10	2.45
TA7205P	1.55	1.75	1.95
TA7214P	3.90	4.20	4.50
TA7310P	1.25	1.40	1.55
TA7607P	5.80	6.00	6.20
TA7609P	4.40	4.60	4.80
TBA8105H	1.85	2.05	2.35
TC5080P	4.80	5.00	5.60
TC5081P	2.90	3.10	3.30
TC5082P	3.30	3.45	3.80
UHIC001	4.90	5.10	5.60
UHIC002	4.90	5.10	5.60
UHIC003	4.90	5.10	5.60
UHIC004	4.90	5.10	5.60
UHIC005	4.90	5.10	5.60
UHIC006	4.90	5.10	5.60
UPC20C	2.00	2.40	2.70
UPC141C	2.30	2.40	2.50
UPC157A	3.25	3.45	3.65
UPC554C	1.60	1.70	1.80
UPC555H	1.60	1.70	1.80
UPC572C	3.70	4.10	3.69
UPC574C	.90	1.08	1.20
UPC575C2	1.25	1.40	1.55
UPC576	1.85	2.05	2.35
UPC592H2	.75	.85	.95
UPC1001H2	1.85	2.05	2.35
UPC1008C	4.85	5.15	5.75
UPC1020H	1.85	2.05	2.35
UPC1025	1.85	2.05	2.35
UPC1028	1.40	1.62	1.80
UPC1031H	2.52	2.74	2.98
UPC1032H	1.70	1.85	2.10
UPC1152H	2.90	3.10	3.30
UPC1156	1.85	2.05	2.35
UPD277C	8.70	8.90	9.10
UPD857C	7.90	8.30	9.40
UPD858C	7.00	7.10	7.20
UPD861C	8.70	8.90	9.10

LETTERS

Help Needed

I need a schematic and any technical info available on a Gran Prix CB, set Model UTR-1000. Inquiries to the company located in St. Louis, MO, have only resulted in negative responses because of time required to locate the info and current work load. I hope this lack of cooperation does not spread through the industry.
Hilaire Rousseau
103 Spriggs Rd., #9
North Little Rock, AR 72118

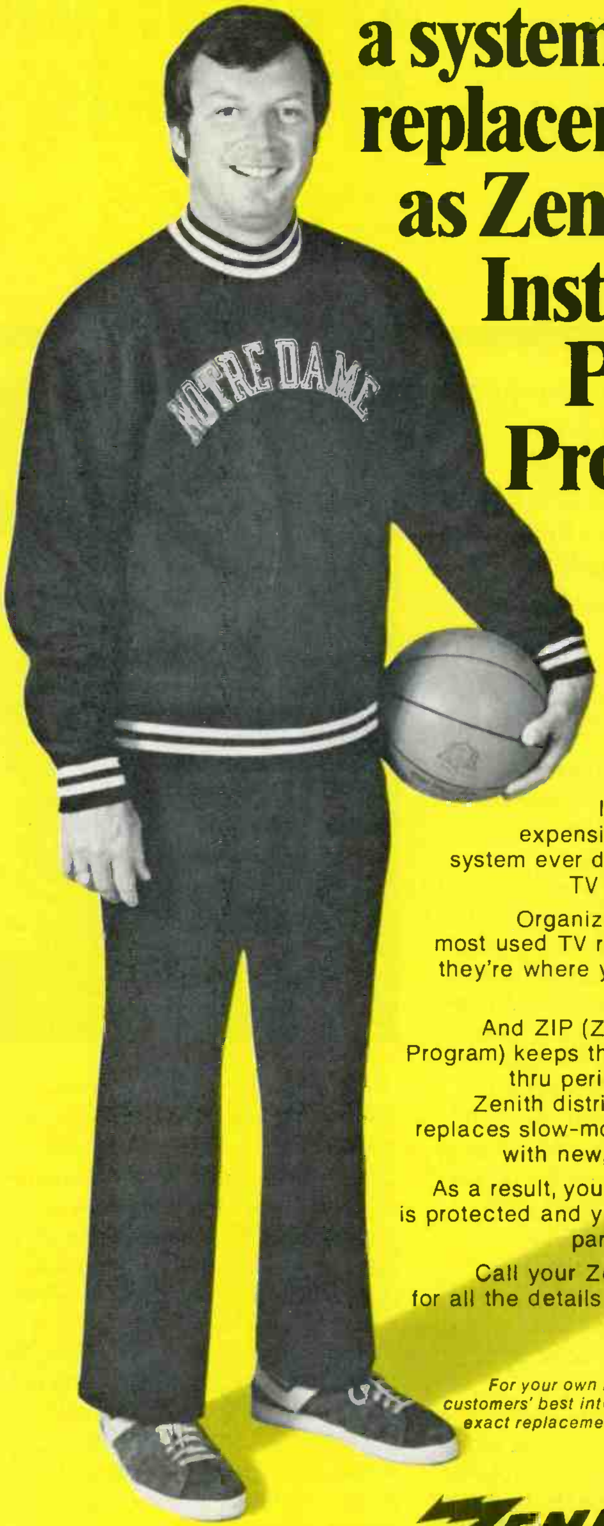
Editor: We contacted Gran Prix Electronics and were informed that they had sold no CBs for two years and could supply nothing for those they had sold previous to that time. This brings up an important point: While some merchandisers may not care, conscientious sales organizations will make sure that the products they sell are backed by the availability of service data and parts and will continue to be for a reasonable time. The CB market, a couple of years ago, with its flood of distressed merchandise under almost any brand name imaginable, was a particularly bad case.

Where can I purchase invoice forms as per your article on page 52 of the October ET/D Magazine? ("Pricing for Profit" by Dick Pavek.) I am especially interested in the Sperry-Tech forms.
John J. Ehrhart
166 Tooker Ave.
Springfield, NJ 07081

Editor: Tech Spray forms are available from Tech Spray distributors. If you cannot find one, write Tech Spray, Box 949, Amarillo, TX 79105. Sperry Tech forms are available from Sperry Tech, Inc., PO Box 5234, Lincoln, NE 68505. Oelrich makes a variety of forms available from distributors. New England Business forms are available from NEBS, Townsend, MA 01470.

Wanted-A 801 B&K Capacity Analyzer or Sprague Tel-Ohmike in good condition.
Ralph Dorough, Instructor
Radio & TV Repair
South Garland High School
600 Colonel Dr.
Garland, TX 75043

ET/D welcomes letters from readers and tries to answer all requests in this column or individually.

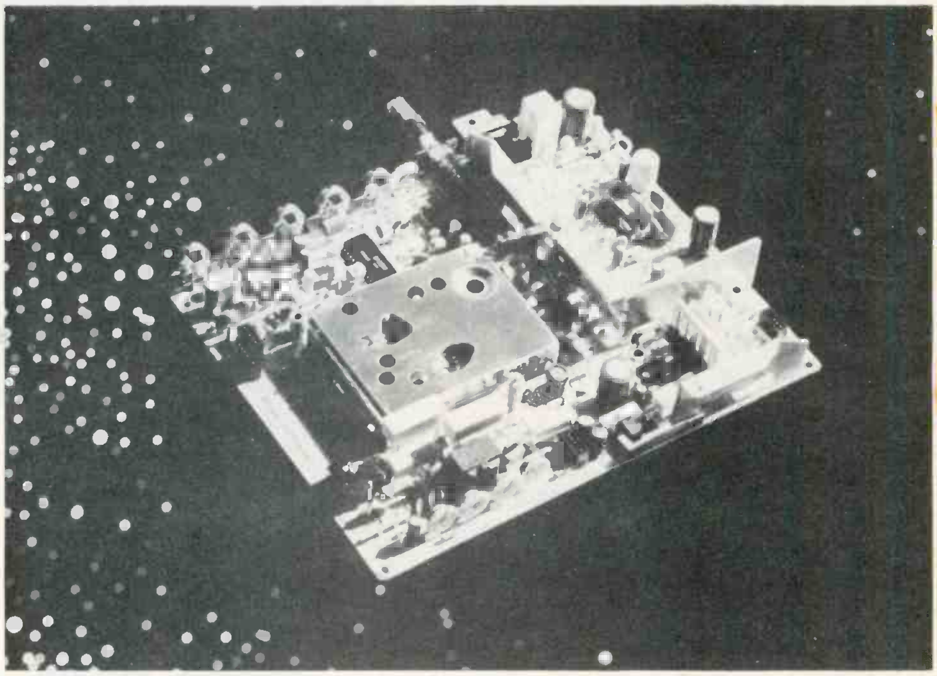


The Quasar "Dynamodule" Chassis

It's new for 1979

This new, highly integrated receiver from Quasar, featuring six completely redesigned ICs as the active signal processing strips, brings it to the forefront of state-of-the-art television.*

By Richard W. Lay



Quasar's "works in a drawer" concept has turned into Quasar's "works on a wafer" with the introduction of its compact, highly integrated, state-of-the-art 1979 chassis line.

A single board, berefit of any resemblance to anyone's television receiver of just a few years ago, the newest of Quasar's offerings is a basic "main board" module some 30 percent smaller than the "Super Module" of previous years and as refined in last year's TS-961/962 chassis. About 90 percent of the functional active circuitry has been "vaporized" into the darkest recesses of those little black boxes commonly referred to as ICs.

The trouble is though, they're all soldered in, which is going to provide some discomfort in IC removal. However, modules are replaceable Quasar says.

But, asides being asides, don't bother looking for a video detector. The fact is, it's inside the video processor IC. And don't try to isolate problems in the first IF amp from the second, because they're all "inside." The plain fact is, you can't even tell—from looking at the schematic—how many stages of IF amplication this receiver contains.

All illustrations courtesy Quasar Electronics Company.

Quite frankly, looking over the schematic of the VTS-967 chassis using this new module—called "Dynamodule" by Quasar's marketing department—there are only nine transistors in all (seven in the TS-968 chassis). This has got be some kind of record for a solid state TV receiver with VIR as of this point in time.

Except for the chroma outputs, the horizontal output and driver, the power supply, flesh control and vertical blanking transistors, every significant active circuit has been placed inside of an IC ... all newly designed by Quasar's parent—Matshushita.

For a basic rundown of what's going on at Quasar for 1979 here's a capsule look:

—You'll find "Dynamodules" inside of Quasar chassis 965 (19-inch), 967 (19-inch), and 968 (25-inch) receivers. The basic difference between the 965 and 967 is the CRT—the 965 using bi-potential, 90-degree, in-lines, and the 967 a tri-potential, 100-degree deflection, in-line. The 968 contains the tri-potential, 100-degree deflection, in-line CRT used in earlier chassis.

—Prefixes to the basic chassis numbers mean the following: LTS, AFT button only; TS, Dynacolor; ETS or EVTS, Dynacolor plus audio spectrum sound; AGTS, remote control with Dynacolor and varactor tuned 18 detent VHF/UHF/tuner; and GTS, featuring Dynacolor, varactor tuners, and 18 detent VHF/UHF manual tuning. (For a description of Dynacolor and Audio Spectrum Sound see ET/D, Feb., 1977, P. 20.)

—The basic design differences between the three Dynamodule chassis are; the TS-965 is not available with VIR;

with the TS-967, some models carry VIR.

Here are some basic design features you'll find in the three new Dynamodule chassis. The 965, no VIR, has a line operated power supply rectified by a single power rectifier. The 967 is available with a separate VIR circuit board and uses a tri-potential CRT—as mentioned earlier. It is line operated with a bridge power supply rectifier. The 968 is available with audio spectrum sound, tri-potential CRT, VIR, and carries a ferro-resonant power supply with AC line isolation.

The basic Dynamodule is complemented by another circuit board which carries the power supply/high voltage/pincushion circuitry (see block diagram, Figure 1). A third board will be found on other models equipped to handle VIR signals and all of the VIR signal processing is handled on it. Set operation is not affected by removal of the VIR board for repair, however, jumpers must be added so that color intensity and hue controls are returned to manual operation during this period.

The Dynamodule also derives its secondary voltages from rectified pulses from the flyback, therefore the loss of any of these secondary sources quickly isolates a problem to the circuit or circuits supplied by a particular source.

Loss of horizontal sweep pulse results in complete shutdown of the set.

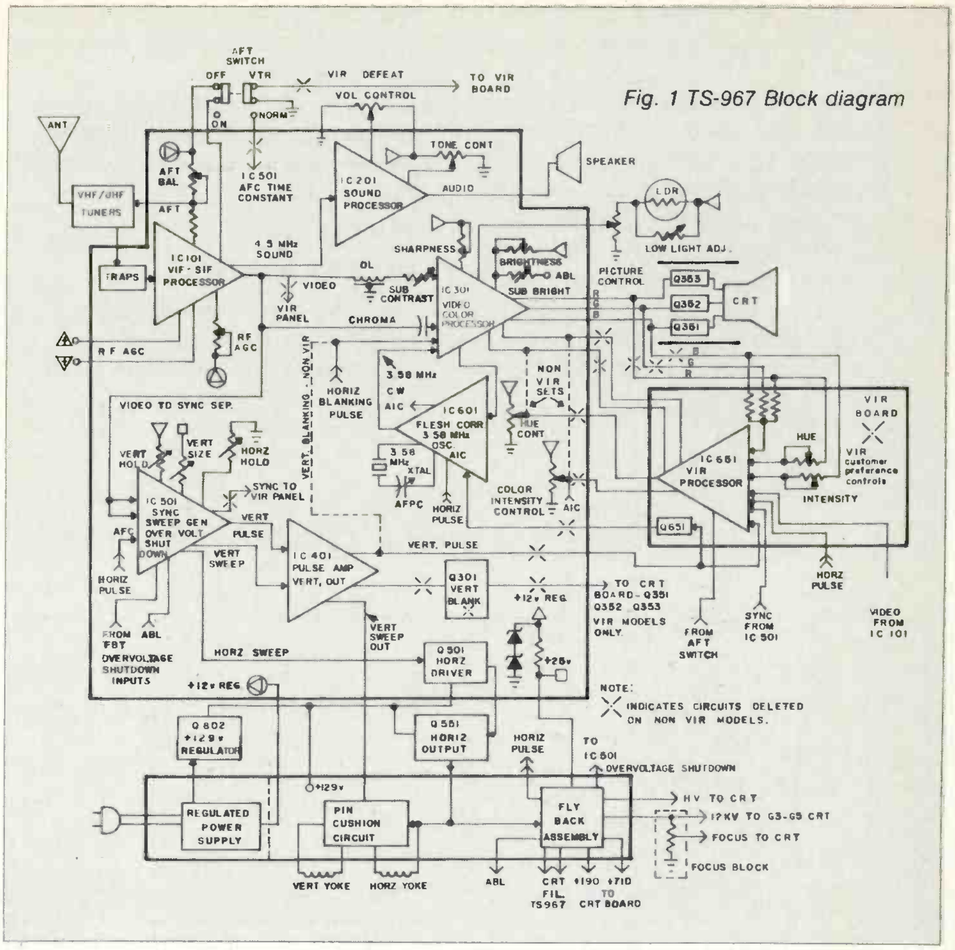


Fig. 1 TS-967 Block diagram

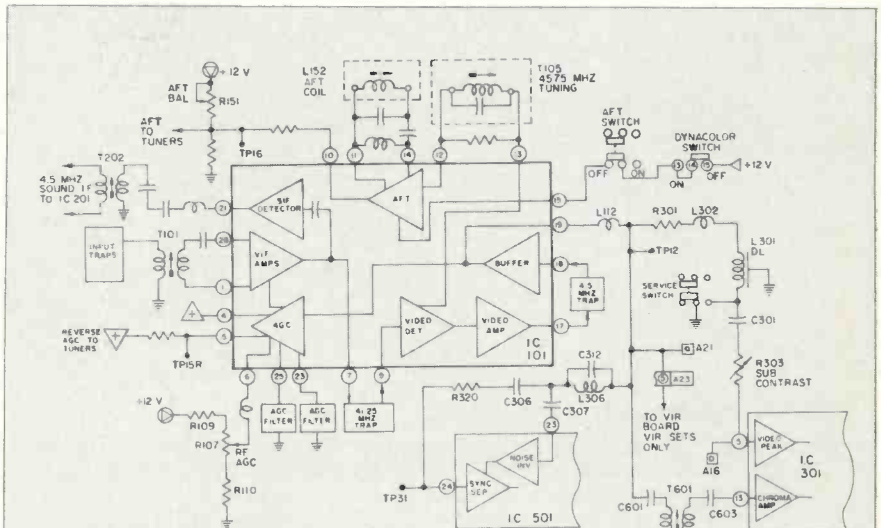


Fig. 2 VIF/SIF Circuit

New ICs

The main feature of the Dynamodule—and the reason for the reduction in the number of discrete components—is the complete redesign of integrated circuits on board.

Starting with IC101 (see Figure 2), here's a rundown of what's inside those ICs. IC101 carries the IF amplifiers, video detector, the video amplifiers, the sound IF detector, the AGC and AFT sections. The tuner IF signal is coupled to pins 1 and 28, the video portion being channeled to Pin 7 where it leaves the IC to pass through a 41.25 Mhz sound trap, and then reentering at Pin 9, the input to the video detector.

An inner tap sends the composite video signal to the Sound IF detector, where it is capacitively coupled, and amplified before leaving the IC at Pin 21 for coupling to the Sound IF IC (IC201) through a tunable interstage transformer, T202.

After detection, the video signal is amplified and sent "outside" once more through a 4.5Mhz trap before feeding a buffer amplifier at Pin 18 of the IC. The output of this buffer feeds IC301, the chroma processor. This source, Pin 19, also feeds the sync separators and noise inverter stages, and in VIR models, the VIR board.

AGC and AFT functions are also internally handled. In the case of AGC, the internal circuitry develops and feeds reverse AGC voltage to Pin 5 and forward AGC to Pin 4 to meet the requirements of different tuners. It is adjustable by a separate voltage divider network on the Dynamodule.

AFT correction voltage is fed to Pin 10 of the IC and it adds to or subtracts from 6.5VDC reference voltage which is fed to both the VHF and UHF tuners.

Sound signal processor

IC201 (Fig. 3) is the sound processor and inside it is the 4.5MHz sound amplifier, the FM quadrature detector, the volume and tone control stages and the audio amplifiers. In addition there is an internal 25-volt shunt regulator in this unit.

As mentioned earlier, the composite video from Pin 21 of IC101 is coupled through T202 to Pins 2 and 3 of the sound processor. There it enters IF amplifiers and is limited before feeding the FM detector and an "outside" quadrature coil. The output of the detector feeds another "outside" de-emphasis network and then reenters the IC for processing through the tone control before being fed to the audio amplifier section of the IC which in turn feeds the speaker.

The 25-volt "inboard" regulator is shunted across the audio amplifier section in order to assure a constant current load for the 25-volt source voltage.

ICs 501 and 401

The sync, vertical sweep, and horizontal sweep circuits of the Dynamodule are carried out within various sections of two ICs, 501 and 401. The video buffer (Pin 19) of IC101 feeds the noise inverter and sync separator stages (vertical/horizontal) of IC501 through capacitors 306 and 307. The noise inverter internally cancels noise pulses that exceed the proper sync amplitude. One of the outputs from the sync separator is sent on to IC301 (color processor) and the VIR circuitry in appropriate models.

Vertical pulse generation is accomplished inside the IC through a vertical sync separator, a vertical oscillator, shaper and pre-driver (see Fig. 4). The vertical waveform leaves IC501 at Pin 17 for direct coupling to the vertical driver and vertical output stages of IC401. This signal is coupled via cables to the yoke and power supply sweep board.

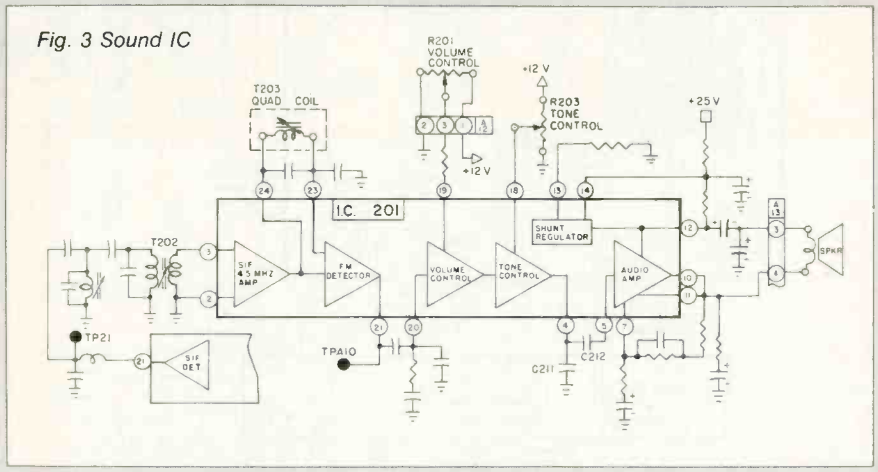


Fig. 3 Sound IC

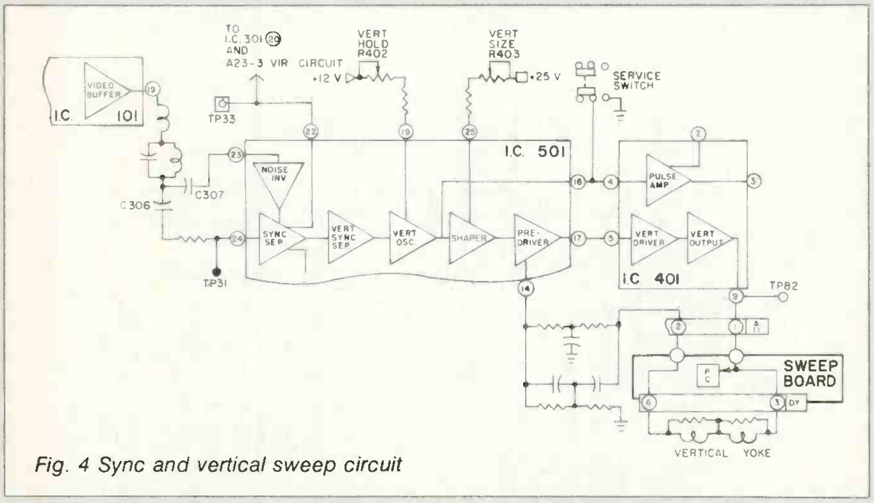


Fig. 4 Sync and vertical sweep circuit

Horizontal

The horizontal sweep function is also located in IC501 (see Fig. 5). This section contains the horizontal sync separator, the pulse shaper, a horizontal AFC circuit, the horizontal oscillator and horizontal pre-driver—plus overvoltage shutdown protection. Essentially, the section receives the horizontal pulse from the flyback, shapes it into a sawtooth voltage via C501 (outside the IC) and sends it on to the horizontal AFC. The AFC section compares this signal with the horizontal signal from the sync separators and makes any necessary adjustment to control the oscillator.

A pulse waveform from the oscillator is fed to the horizontal pre-driver which shapes it into a square wave and this is direct coupled to Q501, the horizontal driver. This collector signal is fed to T501 which drives Q551, the horizontal output.

On VIR models, a section of the AFT switch is used to change the AFC time constant for VTR operation and at the same time to defeat the VIR circuit.

The overvoltage shutdown circuit inside the IC compares rectified DC from the flyback transformer with ABL voltage. Voltage/current levels outside of pre-determined specifications automatically shut off the horizontal pre-driver causing system shutdown.

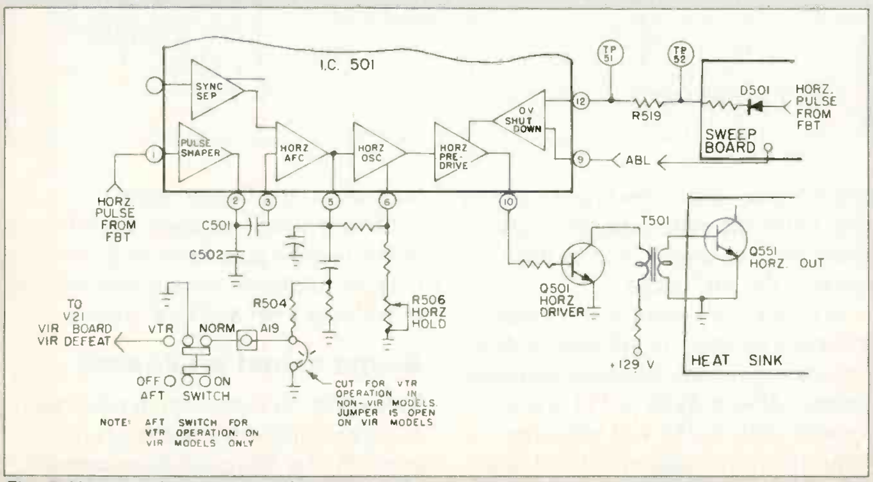


Fig. 5 Horizontal sweep circuit

Vertical blanking

Vertical retrace blanking is accomplished through different methods in the Dynamodule, depending on whether the model is equipped with VIR or not.

In the VIR model, positive pulses are fed from a vertical pulse amplifier in

IC401 to the VIR board and to a special vertical blanking transistor (Q301) which in turn blanks the CRT driver transistors during vertical retrace and allows the VIR signal to be fed to the VIR board.

Non-VIR models eliminate Q301 and its associated circuitry. Blanking occurs in the matrix stage of IC301 in non-VIR models.

IC301

Although IC301 is called the chroma processor, it also contains a video amplifier. Other functions of this IC are: chroma amplification, ACC, color killer, hue and color intensity control, and demodulation matrixing. Other color circuit functions are located on IC601.

The composite video signal from IC101 is connected to the customer adjustable video peaking control on IC301 through the delay line and C301. After amplification it is fed to the video clamp which clamps it at the black level. The Y signal from the output of the clamp is then matrixed in IC301 with the demodulated color difference signals.

With "Dynacolor" on, a light dependent resistor is switched into the circuit and controls the DC voltage on the customer's personal touch control to maintain proper ratios of brightness, contrast, and color intensity.

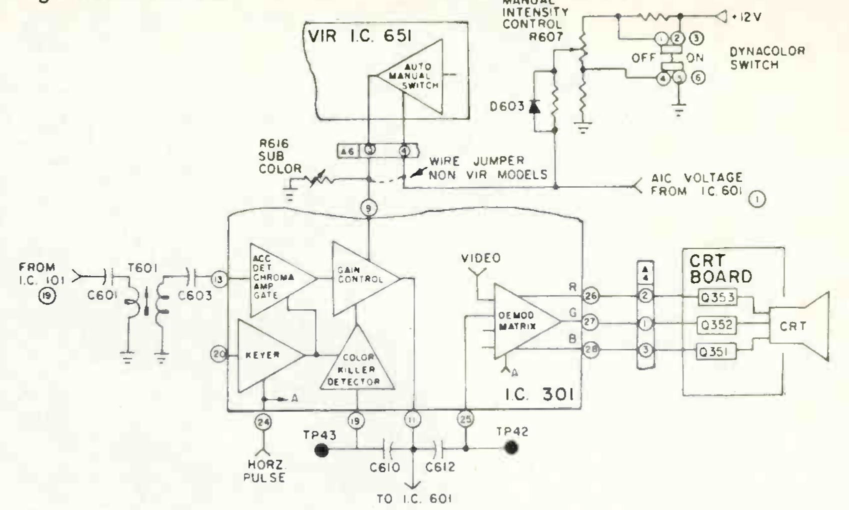
Chroma

The chroma section of IC301 receives the composite video from IC101 through bandpass transformer T601 and C603 at Pin 13, the input to the ACC and chroma amplifier stages of the IC (see Figure 6). After amplification the signal is fed to IC601 (chroma amp, oscillator and flesh control IC) and, through discrete capacitor C612 to the demodulator matrix of IC301. Here the color difference signals are mixed with the Y signal and the color video signal is DC coupled to the red, blue, and green driver transistors on the CRT socket board. Color killer and hue control circuits also are located within IC301. IC601 contains the 3.58Mhz oscillator, APC detector, and flesh control circuitry (Figure 7).

The function of the flesh control is to change yellow/green or purple flesh tones encountered when switching from station to station. Phase correction of these signals is accomplished with minimum effect on the three primary colors and is limited to plus or minus 20 degrees phase change of the original 3.58Mhz CW.

Automatic color intensity control is also accomplished in IC601 through an Automatic Intensity control detector.

Fig. 6 Chroma Circuit



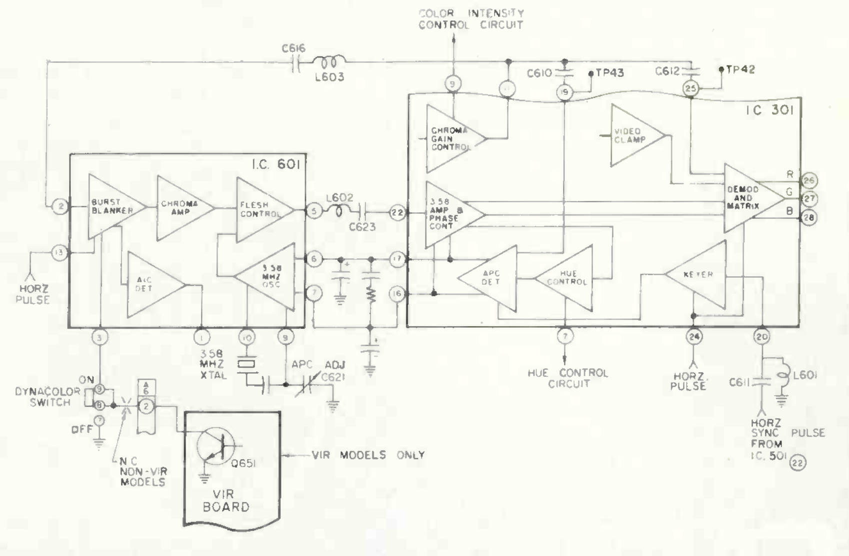


Fig. 7 Flesh control and 3.58Mhz oscillator circuits

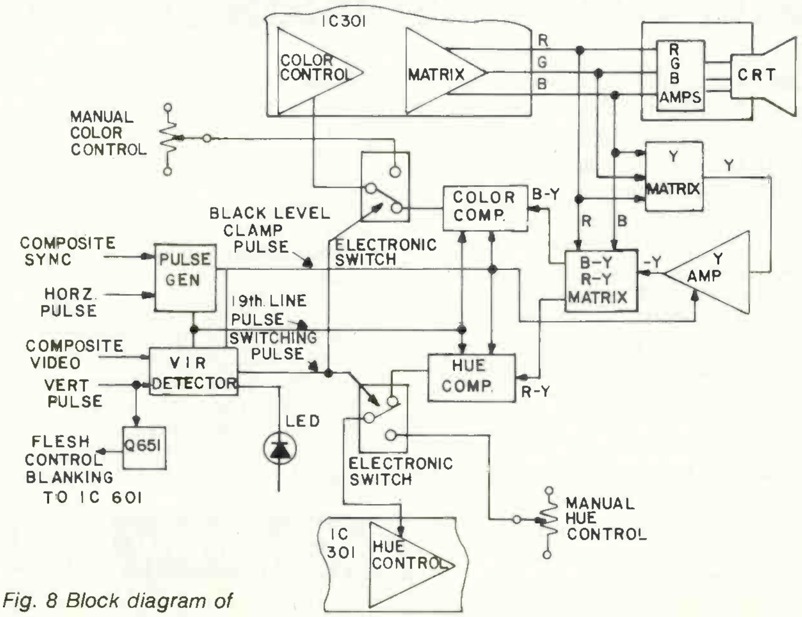


Fig. 8 Block diagram of Quasar's VIR circuit

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This circuit serves to maintain relatively constant color levels, scene to scene and channel to channel. A DC output is applied to the chroma gain control stage of IC 301 and automatic intensity control is achieved independent of the color burst amplitude.

The VIR signal

A separate circuit module used in selected 967 and the 968 Quasar chassis, carries the VIR circuitry. It is connected to the main board by three plug on cables and contains a 24-pin, dual, in-line IC, a flesh control blanking transistor, plus associated components. The VIR board requires horizontal, vertical, video, R-Y and B-Y signal inputs (Figure 8).

The VIR signal (for vertical interval reference) has been used for the past three years by some broadcasters. It is carried on the 19th line of both composite video fields and consists of chroma, luminance and black reference signals, the horizontal sync pulse, and the color burst (see Fig. 9).

Its purpose is to establish identical phase and amplitude relationships inside the television receiver as were broadcast at the transmitter. Thus while phase and amplitude relationships of the VIR signal may vary from broadcast station to broadcast station, the VIR signal recaptured inside the receiver will theoretically be a true reproduction of the VIR signal broadcast by the station to which the receiver is tuned. Thus, through the use of the VIR system, the proper relationships between the color, "Y" and black level will be maintained.

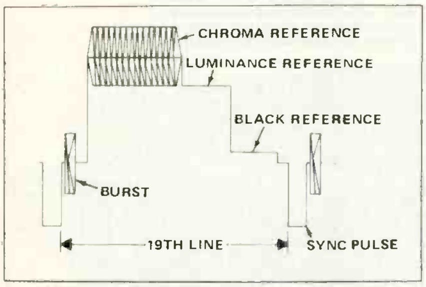

Fig. 9 The VIR signal

Circuit operation

A pulse generator on the VIR board produces signals which key on the VIR and the color and hue detectors during the 19th line of each field (during vertical retrace). Simultaneous clamp pulses clamp the black level of the Y, R-Y and B-Y signals in the Y amplifier, color comparator, hue comparator and the VIR detector.

The VIR detector detects the presence or absence of a VIR signal in the broadcast signal. If present, the detector output activates the auto/manual switches for VIR automatic color and hue control functions and lights a VIR signal LED.

A Y signal matrix is used on the VIR board to combine R, G, B signals to form the Y signal. The output is amplified and clamped to the black level and a minus Y signal is fed to the B-Y/R-Y matrix.

Similarly, R and B video signals are combined in the B-Y/R-Y matrix to form color difference signals which drive the color and hue comparators. B-Y from the matrix is coupled to the color comparator, clamped and stored in a capacitor for one field. The difference between the voltage stored in the capacitor and the clamped pedestal voltage of the VIR B-Y signal is used for error correction at the output of the comparator. This voltage is coupled to the color gain control stage and adds to or detracts as necessary.

The function of the hue control portion of the system is analogous to the operation of the color comparator except that it uses the R-Y signal which is used to control the hue control stage. As

continued on page 45

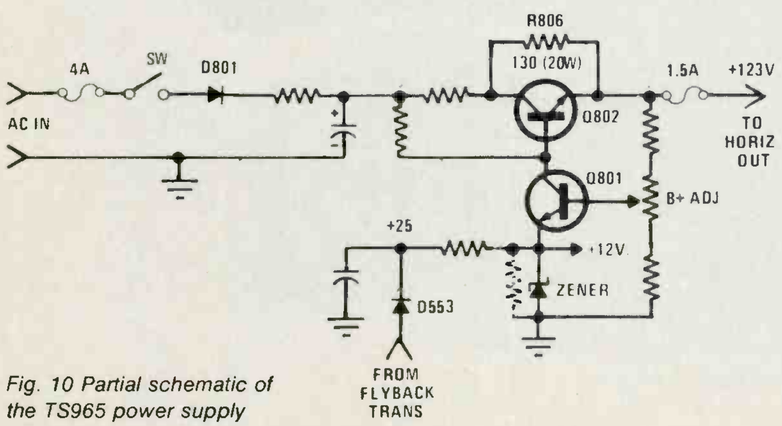

Fig. 10 Partial schematic of the TS965 power supply

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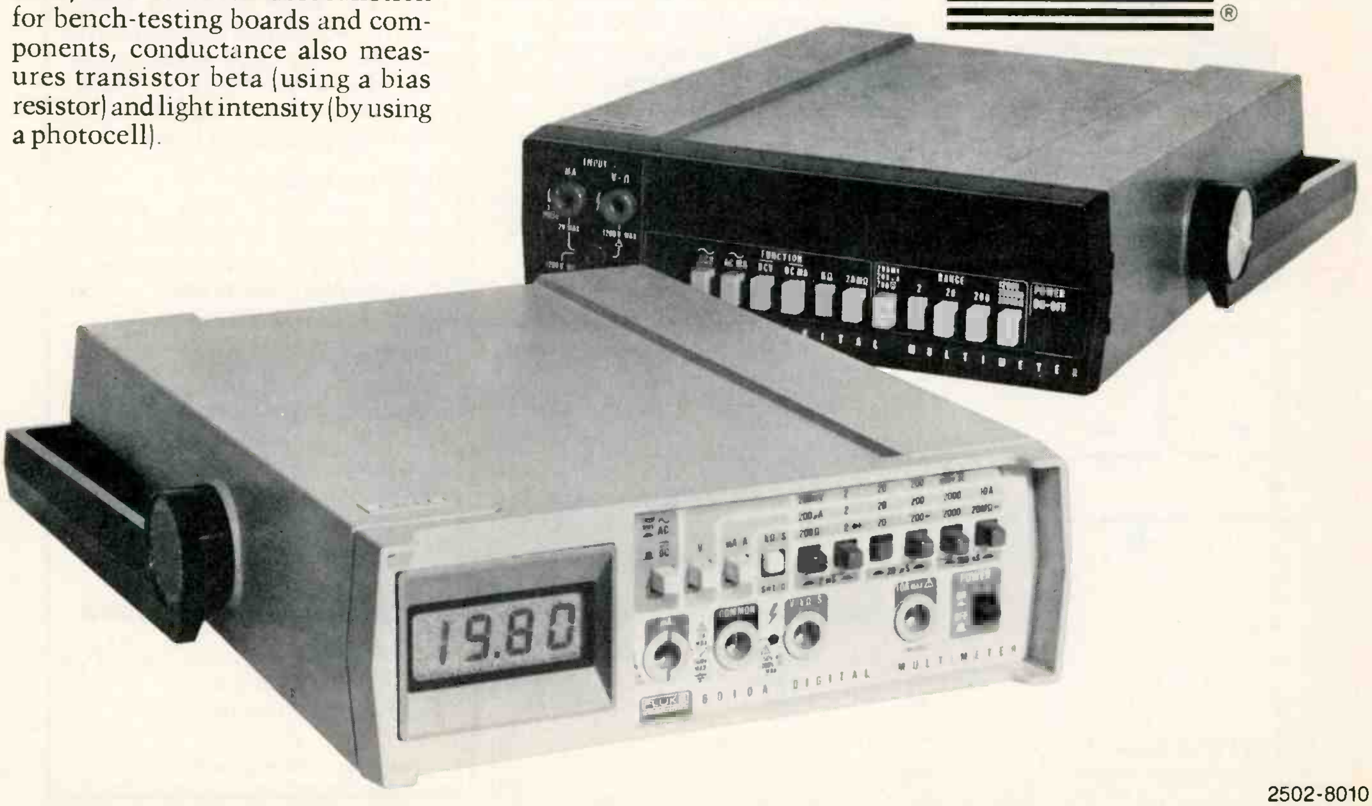

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Ten vertical case histories

Things aren't always what they seem to be.

Here are some hints for handling problems resulting in a lack of vertical sweep. Ten case histories prove they can originate both within and outside of the vertical section.

By Homer Davidson

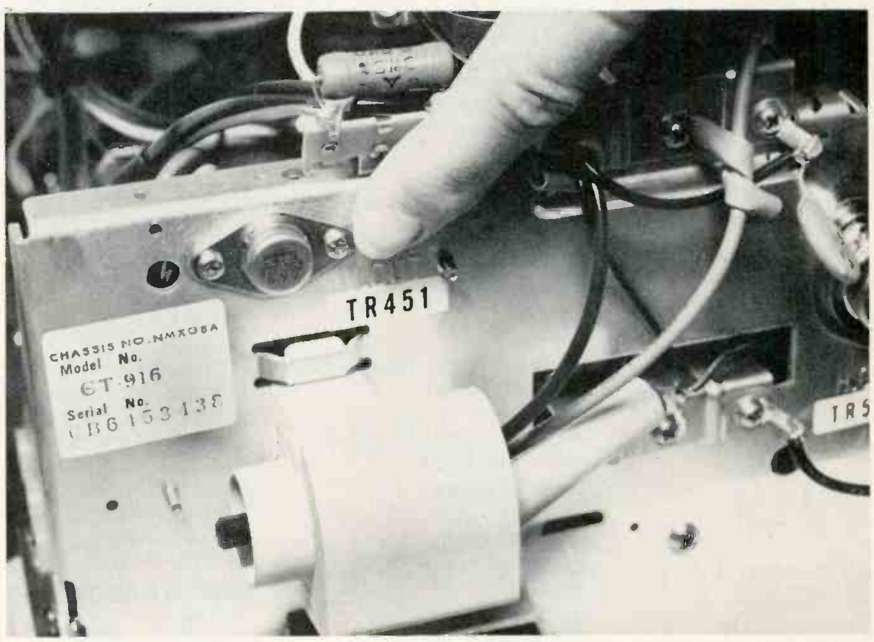

Fig. 1–A photo of a solid-state chassis with all the vertical transistors soldered in except the vertical output transistor.

Eighty-five percent of troubles found in the color and b&w TV chassis are caused by vertical and horizontal circuits. Vertical sweep symptoms may be a horizontal white line, not enough height, excessive foldover, a picture that keeps running or intermittent vertical sweep. One horizontal white line indicates no vertical sweep and may be caused by almost any component in the vertical circuits (Fig. 1). When the screen cannot be completely filled out, check the final vertical output stage for improper vertical sweep. Also, vertical foldover conditions may be caused by the output circuits. The problem of a vertical rolling picture that cannot be locked in is usually found in the sync or vertical oscillator and input circuits. Intermittent vertical problems are usually caused by a tube or transistor, defective capacitor, tube socket or pc board connection.

No vertical sweep

When an RCA CTC40 chassis came in for repairs only a horizontal white line could be seen on the picture tube. Since the chassis was completely solid-state, a voltage check was made on the vertical output transistor (Q101-3564). The vertical collector voltage almost equalled the supply voltage indicating the transistor to be open. A check with a transistor checker confirmed this.

Although vertical sweep was restored when the transistor was replaced, the vertical hold control would not stop the picture from running. Voltage measurements at the vertical switch transistor (3560) turned up improper voltage and indicated a leaky transistor or corresponding components. The vertical switch transistor had a high leakage and was replaced with an SK 3122. When possible, it's best to replace defective transistors with original components, but in most vertical problems, universal transistors do an excellent job of replacement.

Compressed vertical

Only ten inches of the screen was filled out in this GE 19QA chassis. Replacing the vertical input module is one way to see if the trouble is in the input or output circuits. But in our case, the vertical module wasn't available, so the module had to be repaired.

Improper voltage was found at the vertical transistor and a voltage source measurement revealed the actual vertical problem (Fig. 2). In this chassis, a portion of the vertical voltage source is taken from a tapped winding of the flyback transformer. A positive (10.9v) and a negative (29.6v) voltage source feed the vertical circuits and these components are found on the vertical module.

The 10.9 voltage source was normal, but there was no negative voltage. A silicon diode in the negative voltage winding was shorted. It's best to remove one end of each diode to check for leaky or open conditions. When vertical problems are found in this chassis, if any one of the diodes runs warm after replacement, check further into the vertical circuits for possible leaky

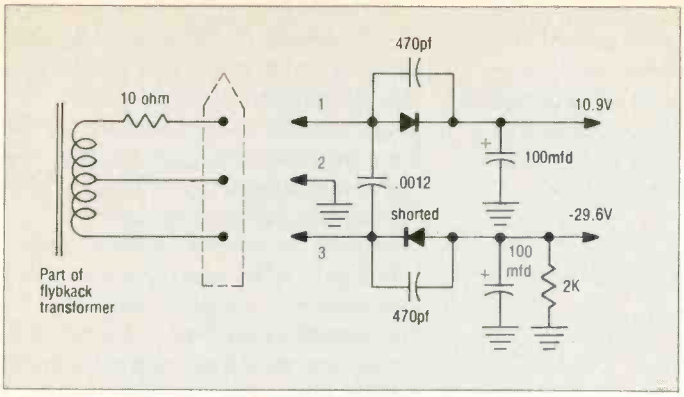

Fig. 2–The power source is at fault in a GE-19Qa chassis.

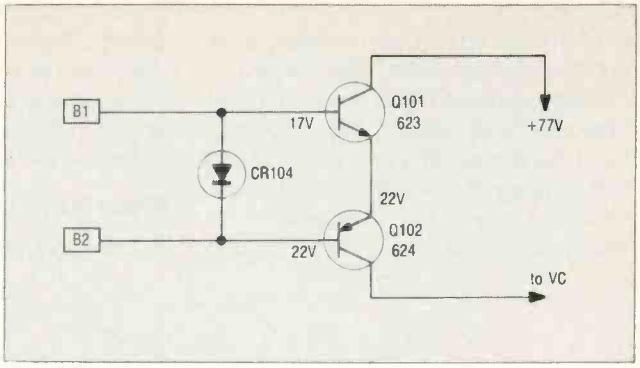

Fig. 4–Intermittent vertical sweep in a RCA CTC49 chassis.

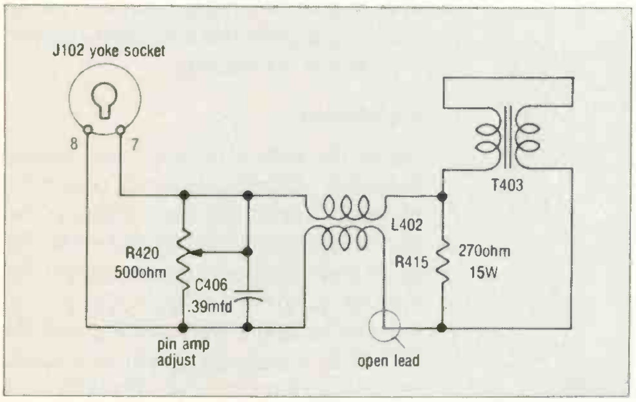

Fig. 3–Only one inch of vertical sweep in an RCA CTC72B solid-state chassis.

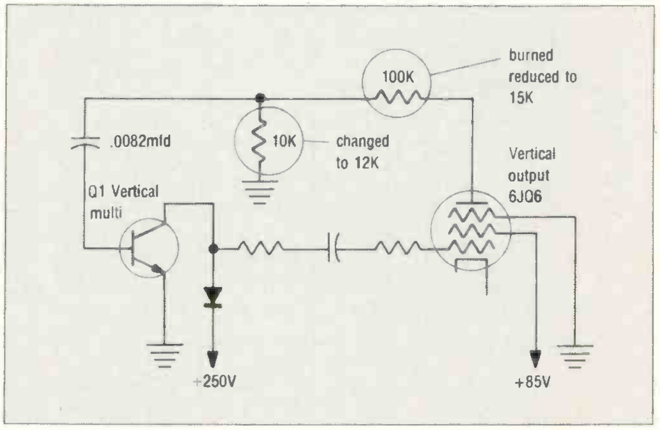

Fig. 5–No vertical lock in a Coronado model TV2-6617A.

components. Also, check for an open 10 ohm resistor in the positive voltage source (10.9v).

Normal voltage—no sweep

In an RCA CTC 72B chassis, only one inch of vertical sweep was noted, although voltages were near normal at all vertical transistors. Remember that vertical problems may be caused by components in other related circuits, such as pin-cushion, yokes and convergence assemblies.

With this particular chassis an open lead on L402 was located in the pin-amp circuits (Fig. 3). Soldering the coil connection solved the poor vertical sweep condition. Another cause could be an open vertical yoke winding. Also, in some chassis check for insufficient vertical sweep caused by a defective electrolytic bypass capacitor on the vertical convergence board.

Intermittent sweep

An intermittent RCA CTC49XA chassis was brought into the shop with a vertical problem. Sometimes the vertical sweep was only two inches high and other times normal. Most of these conditions are caused by tubes, transistors, poor tube and transistor sockets, defective feedback capacitors and poor board connections.

With this chassis, the vertical output transistors were those thin, flat types and these transistors are noted for internal intermittent conditions (Fig. 4). Sometimes, by using an insulated tool, you may move one of the transistor terminals and cause the sweep to collapse. In other circuits, you may end up replacing both transistors. When pushing around on Q101's terminals (623) the vertical sweep became intermittent. After removing the suspected transistor it was tested in a beta transistor tester and we found it opened when moving the emitter element. Sometimes, these transistors will open up when sprayed with a coolant. With the power output transistor out of the circuit, check CR104 for open or leaky conditions.

No vertical lock

When the picture keeps rolling and cannot be locked in, suspect components in the vertical feedback and hold control circuits. If the picture is running both vertically and horizontally, suspect problems in the sync circuits common to both outputs. The picture would roll constantly in a Coronado model TV2-6617A (Fig. 5).

In many cases voltage measurements may not locate a rolling condition component. With this chassis, a transistor was used as the vertical multivibrator and a tube as vertical output. The transistor was tested in the circuit and the beta reading was normal with a high leakage reading. Of course, this leakage reading may be caused by the isolation diode found in the collector circuit. We assume if the transistor was not open and proper vertical sweep was noted, the transistor must be good.

A further check of the components revealed a 100K feedback resistor from the plate of the vertical output tube (6JQ6) appeared warm and overheated. Removing the resistor from the circuit we found the resistance was only 15K. Checking the circuit further, a 10K resistor from the same circuit had increased to 12K ohms. Replacing the feedback capacitor (.0082), 6JQ6 tube, and both resistors restored the set to proper operation.

Half-way up

After an Airline model GEN-12448A was on for a half hour, the picture would pull up about halfway from the bottom (Fig. 6). Adjusting the vertical height and linearity controls helped but the picture was three inches from the bottom of the screen. Replacing the vertical tube (13GF7) gave some improvement, but did not cure it all the way.

This vertical circuit is quite common with a lot of color TV chassis, although you may find another tube with a different filament voltage in other circuits.

A voltage change on the plate (pin 8) of the vertical oscillator tube section may cause insufficient vertical sweep. Check the plate load resistor R521 (2.7 meg) and the vertical size control (5 meg) for an increase in resistance. Insufficient boost or voltage or a change in resistance of the boost voltage dropping resistor may produce a pulled-up picture. These voltages can be monitored when the set is first turned on, recorded and taken again after the picture has pulled way up from the bottom of the screen.

Poor boost

A narrow vertical sweep condition in a Midland model 15-239 was caused by improper boost voltage. In some TV chassis you may find the vertical oscillator plate voltage produced in the boost circuit of the fly-back circuitry. The high boost voltage is fed through the vertical size control and plate load resistor of the vertical oscillator stage.

In Fig. 7, R724 was burned and had increased to 1 megohm. Generally, these resistors are of the one or two watt variety and should be replaced with the original value. You can spot them by looking for a burned white greyish appearance. Improper plate voltage at the vertical oscillator tube may indicate improper boost voltage.

Foldover

Generally, vertical foldover is caused by defective components in the output stage of a tube or transistor chassis. In a Sylvania D09 chassis, replacement of a 6LU8 vertical tube did not solve all of the foldover conditions (Fig. 8). Both cathode resistors were burned with R1 560 ohms increased to 825 ohms and R2 (1K) reduced to only 30 ohms.

The vertical foldover problem was licked after replacing the defective cathode resistors and tube. Other foldover problems may be caused by a leaky coupling capacitor between oscillator and output tube. Check the vertical output tube cathode resistor and electrolytic bypass capacitor for bottom vertical foldover. In transistorized vertical circuits check the vertical output and driver transistors for vertical foldover problems.

Bouncing

In a Zenith chassis 14N22 the picture would begin to bounce and then roll (Fig. 9). The picture would not lock in and two white horizontal lines were seen at the tip of the raster. Adjustment of the height and linearity controls did not help. All voltages found upon the 6FM7 tube

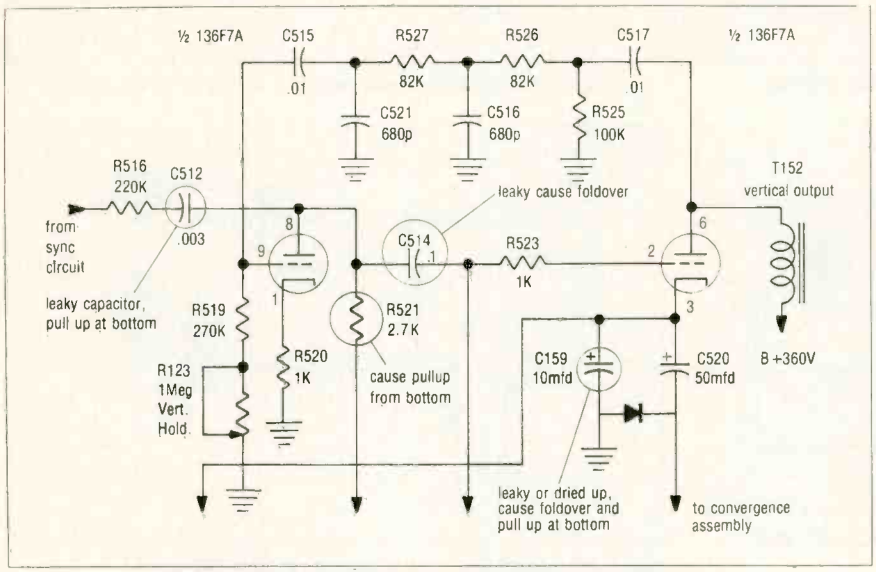

Fig. 6–The picture was pulled half-way up in an Airline GEN-12448A model.

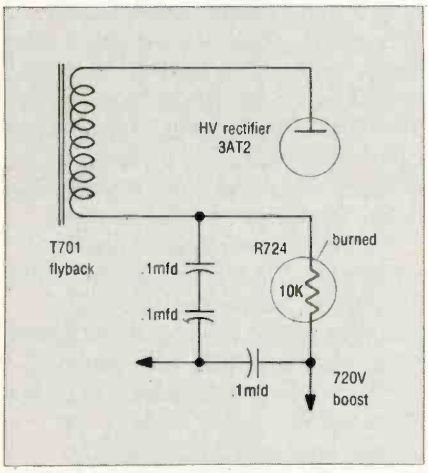

Fig. 7–Poor boost voltage caused poor vertical sweep in a Midland model 15-239.

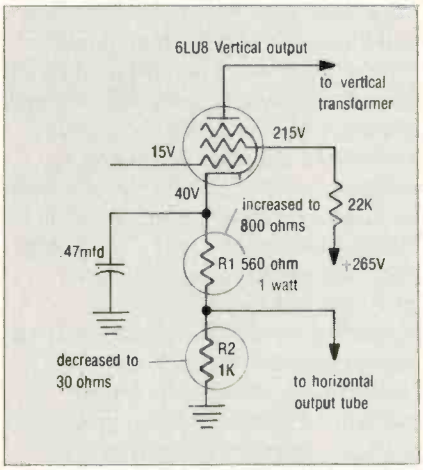

Fig. 8–Excessive vertical foldover was found in a Sylvania D09 chassis.

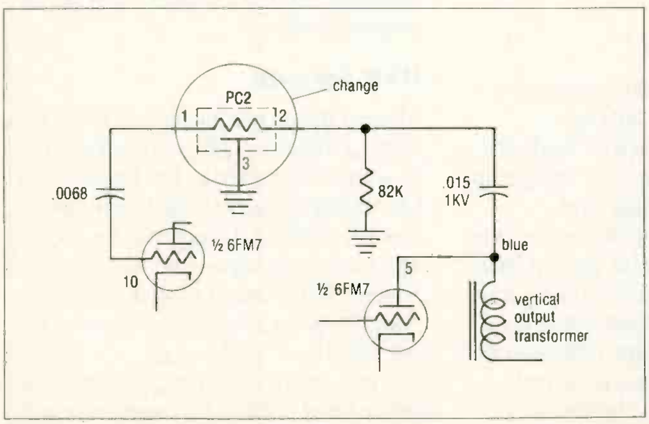

Fig. 9–Excessive bouncing in a Zenith 14N22 chassis was caused with an increase in resistance of PC2.

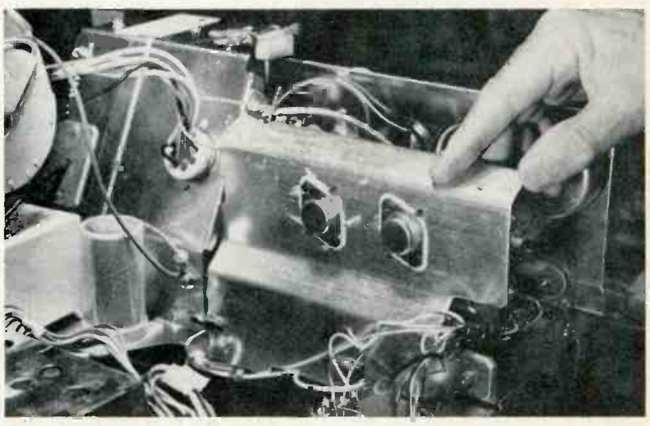

Fig. 10–Wire around the defective socket with wire loops in a RCA color-track chassis.

were near normal.

The vertical feedback component (PC2) was checked for leakage and correct resistance. The resistance had increased to 2 megohms. Eigher replace the PC2 component with a Zenith part number 87-7 or simply connect a 220K ½ watt resistor across terminals 1 and 2. Also, a vertical output transformer with shorted turns will produce a bouncing raster.

Intermittent

An RCA color track portable, model FX475W came in with an intermittent vertical sweep problem. Sometimes the chassis would operate for months and at other times it would collapse to a few inches, three or four times a day. Of course, this type of intermittent problem may not act up when placed on the service bench. But, with the back cover removed, the raster began to collapse on the third day. The intermittent condition would only show up for a few seconds.

With a VTVM connected to the vertical output transistor and left in that position until the set acted up, the culprit finally was located. An output transistor power pin was loose in the transistor socket causing the contact to arc and make a poor contact. Since then several of these chasses have come in with the same problem, replacement of the transistor socket was necessary, or you could wire a shunt wire to the element terminal and socket pin (Fig. 10).

Final hints

First, isolate the vertical symptoms from other sections of the TV chassis. Don't forget to look outside the vertical section for faults producing possible vertical problems. In tube chassis replace the vertical tube even if it tests good and then troubleshoot.

Always replace the vertical module in a transistorized chassis and then check the output section for possible trouble. Remember a defective module may destroy the vertical output transistors. Remove the vertical output transistors from the circuit for normal leakage tests. Don't forget to apply silicone grease when installing a new vertical power output transistor. ET/D

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Curing Hi-Fi Interference

A growing problem

With the number of reported cases of RFI skyrocketing, here are some practical installation guides and troubleshooting tips that can save you time and money.

By Joseph J. Carr, CET

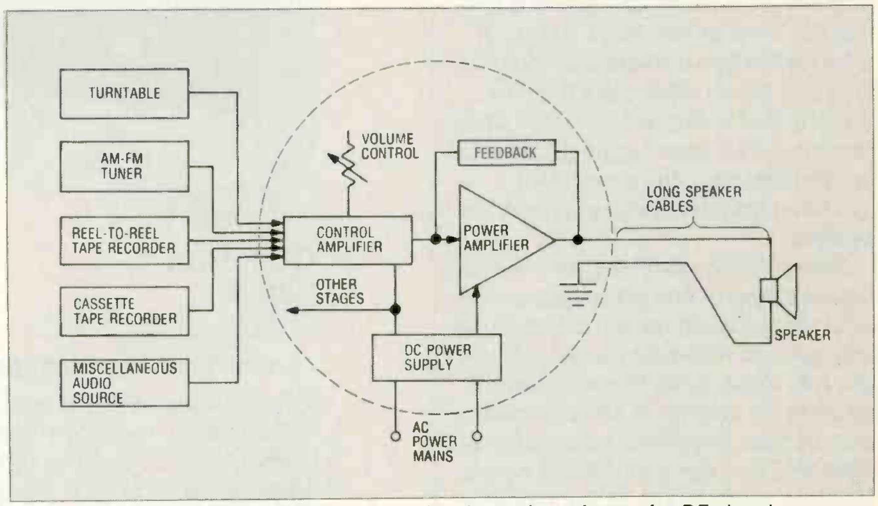


Fig. 1 Block diagram of an audio system showing points of entry for RF signals

By now we are all familiar with many new forms of pollution that were all but unknown to our grandparents. But one form of pollution that the electronic servicer can (profitably) help eliminate is *electro-magnetic interference* (EMI), also sometimes called *radio frequency interference* (RFI). This problem is defined as the interference to other electronic devices or apparatus by a radio or television transmitter.

With an estimated 20 *million* transmitters on the air in CB alone, the situation can only grow worse in the future. The FCC estimates that the number of interference complaints will rise approximately 230 per cent from 45,200 in 1976 to 105,000 this year.

The FCC has claimed that in 46 per cent of the cases where a CB transmitter was at fault, the operator was using an illegal linear amplifier to increase the power level, and that the interference ceased as soon as the illegal amplifier was disconnected. But in many, perhaps most, cases, interference to Hi-Fi equipment due to problems in the audio equipment, or even if the fault of the transmitter, can be eliminated at the "audio end." In this article we will consider Hi-Fi interference.

Many electronic servicers have traditionally shunned handling EMI problems because they can be time consuming, and there is no guarantee of success. But with the proliferation of transmitters, not just CB's, we can no longer ignore the problem and maintain a claim to being professional servicers. Fortunately, much of the myth surrounding Hi-Fi interference problems is overstated.

Audio rectification

Discounting interference that comes through the RF stages of the tuner, which is actually more related to TVI than "Hi-Fi-I," most interference to audio equipment is from a phenomenon called *audio rectification*, i.e. the detection of the RF signal by active components (such as tubes, transistors, ICs, etc.), by diodes, or by poor solder connections acting as impromptu diodes.

The symptoms produced by audio rectification vary with the type of transmitter causing the interference. AM transmitters, for example, will cause the operator's voice or (in broadcast band cases) program material to be surperimposed over the normal signal. In many cases the interfering signal is much louder than the normal material, while in others it is in the background.

A SSB transmitter, on the other hand, will sound garbled and extremely distorted. The customer will probably not even be sure that it is really a voice at all.

FM and TV audio carriers will cause a decrease in volume and, possibly, distortion of the normal signal. The FM carrier will tend to quiet the audio amplifier, but its modulation is not detected. FM carriers may also produce a "frying eggs" sound, and possibly clicks as a two-way transmitter is keyed on and off.

TV video carriers are a form of AM, i.e. vestigial sideband, and are wideband pulses. The type of sound they make when interfering in audio systems, then, is a "ripsaw" buzz that changes as the picture scene also changes.

Where the interference is due to a broadcasting station's transmitter being close by, diagnosis is simple because the signal is continuous. Besides, the station's towers will often be visible at the customer's location!

But where a CB station, ham radio operator, or commercial two-way FM transmitter is involved, then you may have to be present while the station is transmitting before it is possible to diagnose the problem. Of course, where an AM transmitter is involved (mostly CB) you are pretty sure of the problem

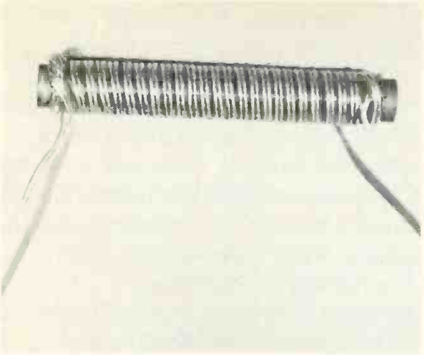


Fig. 2A RF choke wound on ferrite rod using speaker leads

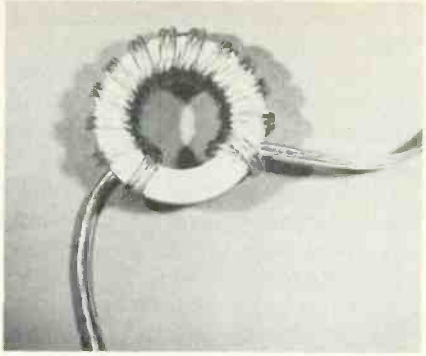


Fig. 2B RF choke wound on toroid ferrite core using speaker leads

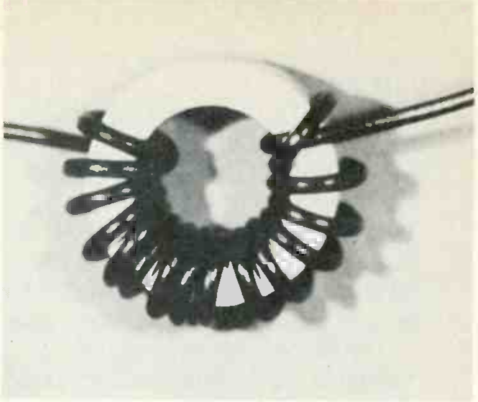


Fig. 2C Toroidal rf choke using hook-up wire

when the customer complains of hearing a specific neighbor's voice, or has been clever enough to write down the station's call-sign!

Customer relations

Unless you are also a two-way radio servicer it is unlikely that you will be involved too closely with the transmitter. You will probably be called in by the audio equipment owner. The local FCC field offices, and sometimes local (volunteer) TVI committees, often refer the audio equipment owner to local service shops once it is determined that the transmitter is being legally operated "in accordance with good engineering practice."

But the Hi-Fi owner is not likely to perceive this as anything but a "raw deal" that will cost money. The view is usually something to the effect "why should *I* have to pay when it is *somebody else's* equipment that is interfering with *my* equipment?" This customer has a valid question, and it is prudent to give a truthful, but tactfully worded, reply ... pressing the following points:

1. *Any electronic device must not only respond to desired signals, but must* also reject *unwanted signals.*
2. *The transmitter is not doing something* wrong *to the audio equipment, but the audio equipment is* improperly responding *to the transmitter's signal.*
3. *The radio station owner is as much entitled to operate as the customer is to use the audio system. In fact, the transmitter is sanctioned by the FCC, while the audio equipment is not.*

How RF enters the system

Fig. 1 shows the block diagram of a home audio system (or at least one channel of the system!) RF signals can go into the audio system through the loudspeaker leads, ac power leads, and the low-level audio leads coming from outboard auxilliary equipment (i.e. phonos, tape units, tuners, etc.).

If RF gets into the speaker leads it can travel around the negative feedback loop to the input stage, or at least an early stage, of the power amplifier. The signal may then be *rectified* by the input stage, and treated as any other ordinary audio signal by the PA stage.

Similarly, it can enter via the ac power cord, and be coupled to the power amplifier either through the dc power supply (especially if the electrolytic filters have deteriorated!) or by capacitive coupling via radiation from power lines to signal wires.

If the RF signal gets on the audio input lines, then it can be detected at the amplifier input stage, and have the entire system gain ahead of the demodulated signal! This problem is especially severe on high impedance inputs used in most home audio equipment, and is less severe on 500-600 ohm inputs typically used on commercial audio equipment.

Troubleshooting

Before we are able to take effective and appropriate action to cure audio rectification, we must locate the RF entrance point. If the loudness of the interfering signal is *not* affected by the set's volume control, then the problem is most likely the speaker leads. But if the loudness *is* affected by the volume control, then look tothe audio inputs as the source. In neither case will this be absolute, but it serves to point the way to a *probable* cause.

If the speaker leads seem to be at fault, then disconnect them and try listening for the interference using headphones (with *short* leads!!). If the problem disappears when the headphones are used, then it is even more likely that the speakers are at fault.

Determining which piece of outboard audio equipment is at fault is done through a process of elimination. Disconnect the sources one-by-one (at the amplifier end of the audio cable) until the interference ceases.

Unfortunately, solutions sometimes come only through a process of trial and error. But there are some "fixes" that work more often than others. You will sometimes find that none of them are effective by themselves, but are effective *in combination* with one or more of the others.

Installation checklist

Speaker Lead Entry: 1. Install a disc ceramic capacitor (i.e. 0.001-0.01 μF) across the speaker terminals on the back of the amplifier. Place the capacitor as close to the chassis as possible.

2. Install an *RF choke* in series with the speaker lead, as close to the amplifier chassis as possible. Do not use a regular RF choke, as these cause too much phase shift even in the audio range. Fig. 2 shows several suitable chokes that you can make. In Fig. 2A we see the speaker leads wrapped around a 100 mm (4 in) ferrite rod. The rod could possibly be salvaged from an old portable radio, or be purchased. The rod shown is the model MU-125 sold by Amidon Associates (12033 Otsego Street, No. Hollywood, CA 91607). Alternatively, a ferrite toroid (also by Amidon) can be used in the same manner (Fig. 2B). An RF choke for use inside of the amplifier can be fashioned using hook-up wire wrapped around a somewhat smaller toroid, (Fig. 2C).

3. Replace the speaker leads with two-conductor shielded wire. Use the internal conductors to carry the audio signal, and ground the outer shield to the amplifier chassis, close to speaker terminals. Do not ground the shield at any other point, or use the shield to carry audio! Speaker leads should be as short as possible, but should not be any integral multiple of a quarter wavelength (i.e. 9 feet × N on 27 mHz CB).

4. Install a good RF ground between the amplifier chassis and actual earth ground. CAUTION: On ac/dc, or any other hot-chassis equipment, use a 0.001-0.01 uF, 1000 WVdc disc ceramic

capacitor in series with the ground lead (see Fig. 3).

Note well that a decent dc ground need not also be a good RF ground! Use short lengths of heavy braid as the ground wire.

Power Line Entry: 1. Install an RF line filter (Fig. 4) in the ac line. This filter must be located as close to the point the ac cord enters the chassis as possible.

The filter in Fig. 4A is usually sufficient, but in more stubborn cases the version in Fig. 4B may be required. *L*1 and *L*2 should have a value between 100 µH and 50 µH, with the lower values being used at higher, i.e. VHF, frequencies. The RF choke must be able to carry the full ac power mains current drawn by the equipment, and be well enough insulated from ground to withstand any voltage likely to appear on the ac line (i.e. upwards of 600 volts, or so, *in-transient*. Several companies manufacture these RF filters already assembled in a shielded case.

2. Ground the chassis, but see the cautionary note given above.

3. Make the ac power cord as short as possible.

4. Install a three-wire power cord in which one wire (i.e. the green wire) is grounded to the chassis (see cautionary note above).

Audio Input Entry: 1. Make sure that all cable shields are intact, and that the connectors at both ends of the cable are tight fitting.

2. Ground all pieces of equipment in the system together (see Fig. 5 for right and wrong ways to ground equipment). See the cautionary note above.

3. Install small value RF choke (i.e. 100 µH) in series with the signal cable (right at the input, preferably inside of the amplifier chassis).

4. Install a small value capacitor (i.e. 50-100 pF) across the audio signal cable (preferably at the connector, just inside of the audio amplifier chassis).

5. Some servicers have reported that slipping 4 or 5 ferrite beads over the input leads, inside of the amplifier chassis, reduces the RF level.

Shielding

Some high quality audio equipment is not properly shielded against RF. This is particularly true of console models in the mid-price range, but is known even in high-priced component systems.

If lack of shielding appears to be a source of the problem (suspect it if none of the remedies given above seem to affect the problem, especially if there is obviously no shielding present), then try to determine whether shielding could be added. Note, however, that such mechanical alterations are time-consuming, so determine whether or not the customer will pay for it beforehand.

Proper shielding materials include sheet aluminum, metal shield boxes (i.e. Bud, LMB, etc), brass or copper foil, and *metallic* (not plastic!) window screen material. These materials are available variously at "home handy man center," and the type of hobby shop that deals a lot with arts & crafts. Which to use in any particular case will depend upon the nature of the set, and how much shielding is necessary. In some cases, for example, it is possible to use only some foil or screening glued or tacked inside of the audio equipment cabinet, while in other cases major (and expensive!) machine work is needed.

Make the job easier

Audio rectification problems may be as intermittent as the two-way radio operator's transmissions. It might help to secure the operator's cooperation, so that transmissions are guaranteed when you need them.

Beware, though, of demanding assistance, or sounding accusatory (or allowing the customer to be so) when asking for assistance. If you put the operator on the defensive, then any cooperation will be hard to obtain. Emphasize that the operator's cooperation will not cost anything, and will probably eliminate the audio interference to the mutual benefit of all concerned parties.

Your job may be made easier by ordering, and offering to the customer and the operator, copies of a U.S. Government pamphlet titled "How to Identify and Resolve Radio-TV Interference Problems" (order from Consumer Information Center, Dept. 051F, Pueblo, CO 81009, @ $1.50 each. Stock No. 004-000-00345-4). This FCC pamphlet is directed to all parties concerned: set owner, transmitter operator/owner, and servicer. Many government pamphlets are next to useless, but this one is different. It has the flavor of having been written by people who have been nailed to the wall solving the problems addressed on more than a few occasions. ET/D

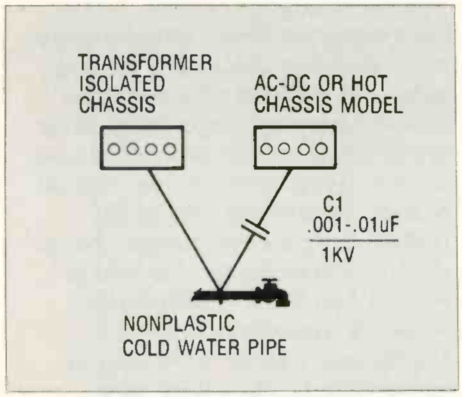


Fig. 3 Proper RF grounding for chassis of amplifier

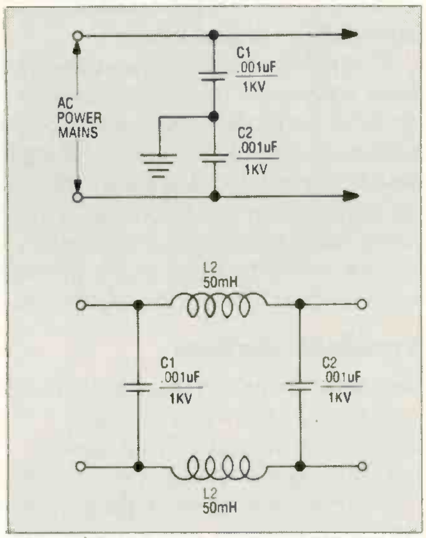


Fig. 4 RF filter for ac power lines

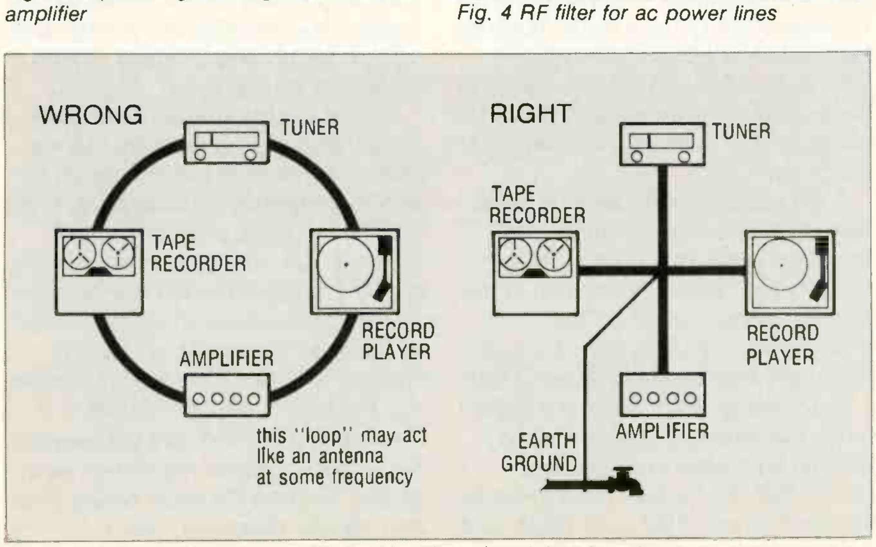


Fig. 5 Right and wrong ways to ground outboard peripheral equipment.

Frequency multipliers revisited

Conduction angle is a key

In this article you'll learn why more than just defective components can affect the output of these sensitive circuits. For a better understanding, read on.

By Bernard B. Daien

Frequency multipliers have been used wherever it is required that the final output frequency be higher than the oscillator frequency. Thus, a crystal oscillator, used for stability, may control a transmitter with an output frequency hundreds of times higher.

Unfortunately, most literature merely supplies a definition of a frequency multiplier, and little else. When the multiplier output drops off, the technician is left to his own devices in determining the factors that affect the multiplier operation.

This article explains the basics of frequency multipliers from the practical point of view, in order to aid the technician who actually works with multipliers, and needs some answers to the questions that inevitably arise.

Harmonics

A frequency multiplier must be a nonlinear amplifier. A linear (Class A) amplifier reproduces the input signal faithfully, which means no distortion ... which means no harmonics. Harmonics are signals in the output which were not in the input, and are called "harmonic distortion" in audio amplifiers. It is obvious that the bill will be filled admirably by using the good old Class C amplifier, which works over less than half of the input cycle.

The output waveshape of a Class C radio frequency amplifier is shown in Figure 1, and is obviously a very non-sinusoidal waveshape. Remember, a sine wave is the *only* waveshape which consists of a single (fundamental) frequency. As we depart from the sine waveshape, increasing distortion is accompanied by more, and larger amplitude, harmonics. The waveshape in Figure 1 is therefore very rich in harmonics ... BUT ... why do we have a non-sinusoidal waveshape to begin with? To answer this we must go back to the definition of the Class C amplifier ... "A Class C amplifier is *biased* so that under the available drive (input), the output conduction angle is less than 180 degrees." The key word is "biased."

If you think about it, the input signal must be biasing the base of the Class C amplifier on for less than 180 degrees ... which means that the input waveshape seen by the Class C amplifier is also distorted, and full of harmonics! So harmonics are generated at both the input, and the output of the frequency multiplier.

As a matter of fact, Figure 1, which is the collector conduction angle could be retitled, "base conduction angle" ... because the collector conducts only when the base conducts. If the base has no input current, neither does the collector.

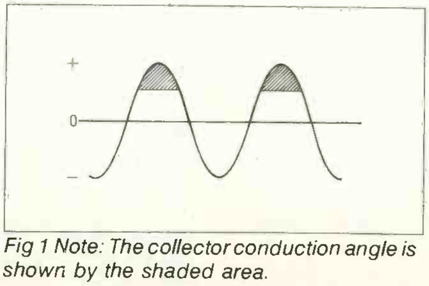


Fig 1 Note: The collector conduction angle is shown by the shaded area.

If the base input conduction angle is changed, so is the harmonic content of the output, *since the input wave shape helps to determine the number, and amplitude, of the various harmonics present in the output.* Specifically, a change in the drive level can drastically affect the output of the multiplier. You see ... we already applying our theory to practice!

Bias plays key role

But the base drive level, or any fixed biasing, has an even more significant effect, as shown in Figure 2. Examine Figure 2A ... note carefully that since the output frequency is twice the input frequency, a conduction angle of 180 degrees in the output is the result of a *90 degree conduction angle at the input* ... a fact which immediately is apparent *after* you think about it!

But a 180 degree conduction angle is Class B operation, and although we get maximum harmonic output at this conduction angle, the efficiency is lower than it would be with Class C operation. At this point we must recall that efficiency is the ratio of input power to output power, so what we are saying is that we have increased the dissipation in the multiplier ... and with power amplifiers we are always trading off efficiency versus power output. Low efficiency means heating, short component life, more current drain, etc. As a result, we seldom operate our multipliers at Class B ... and we are going to look at this a little more closely because it has some important effects.

Well, let's restate this a little differently, to get things into perspective. If the multiplier is to operate Class C, it must run at least 180 degrees conduction ... or, to put it another way ... never more than 180 degrees. But if the

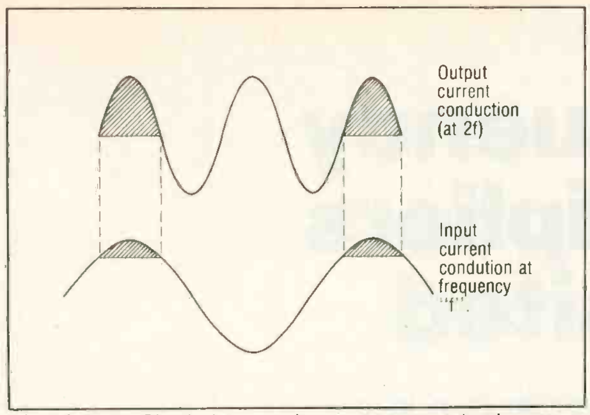


Fig 2A Note: Shaded areas show current conduction

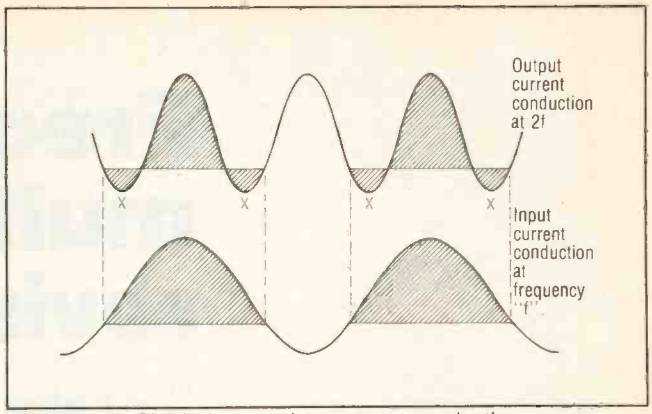


Fig 2B note: Shaded areas show current conduction

output of a frequency doubler is to be 180 degrees or less, the input conduction angle must be 90 degrees or less, as we have previously mentioned. Now what would the conduction angle at the input have to be in a frequency *tripler* if the output is to be 180 degrees or less? Using the same logic ... there are three output cycles for each input cycle ... thus if we have 180 degrees output conduction, we must have 60 degrees or less angle of input conduction.

Critical factors

By now you see the light ... *the higher the output harmonic desired, the less the input conduction angle.* And, since the input conduction angle depends upon the fixed basis, the grid leak bias, and the amplitude of the drive, you are starting to get the picture of what factors can result in low output from a frequency multiplier without actually having a component failure. Just let the drive drop off a bit, due to low efficiency of the driver, or drift in a tuned circuit due to temperature or vibration, or component changes ... and your tripler may want to be a doubler!

But things can get even worse ... look at figure 2B, which is the same as Figure 2A, except the input conduction angle has been increased to more than 90 degrees ... now just look at what has happened to the output conduction! The areas marked "X" represent the points which should be the most negative going parts of the output cycle. Instead, they are being driven into conduction ... positive conduction ... by the fact that the input conduction angle is so long that it is "spilling over" into what should be the negative areas. Let's see what this does ... with the help of a mechanical analogy.

The frequency multiplier is much like a child on a swing. If you give the swing a little shove, just as it starts its downward

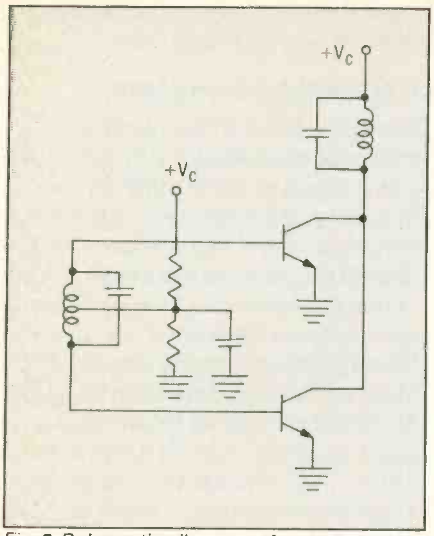


Fig 3 Schematic diagram of a common "doubler" circuit.

swing, everything goes along smoothly. As a matter of fact, you don't have to shove the swing every oscillation, instead you can shove it every second time (doubler), third time (tripler), etc. BUT ... you must shove it *on the downswing.* If your timing is wrong, and you hit it on the upswing, the swing stops. That is exactly what happens when the input conduction angle gets too large, the output is trying to swing negative while the current conduction is trying to swing it positive, and the output falls off rapidly.

The tuned tank circuit in the output provides the "flywheel effect" which simulates the swing, and the transistor collector provides the "shove." The shove has to be of the right time and duration (conduction angle).

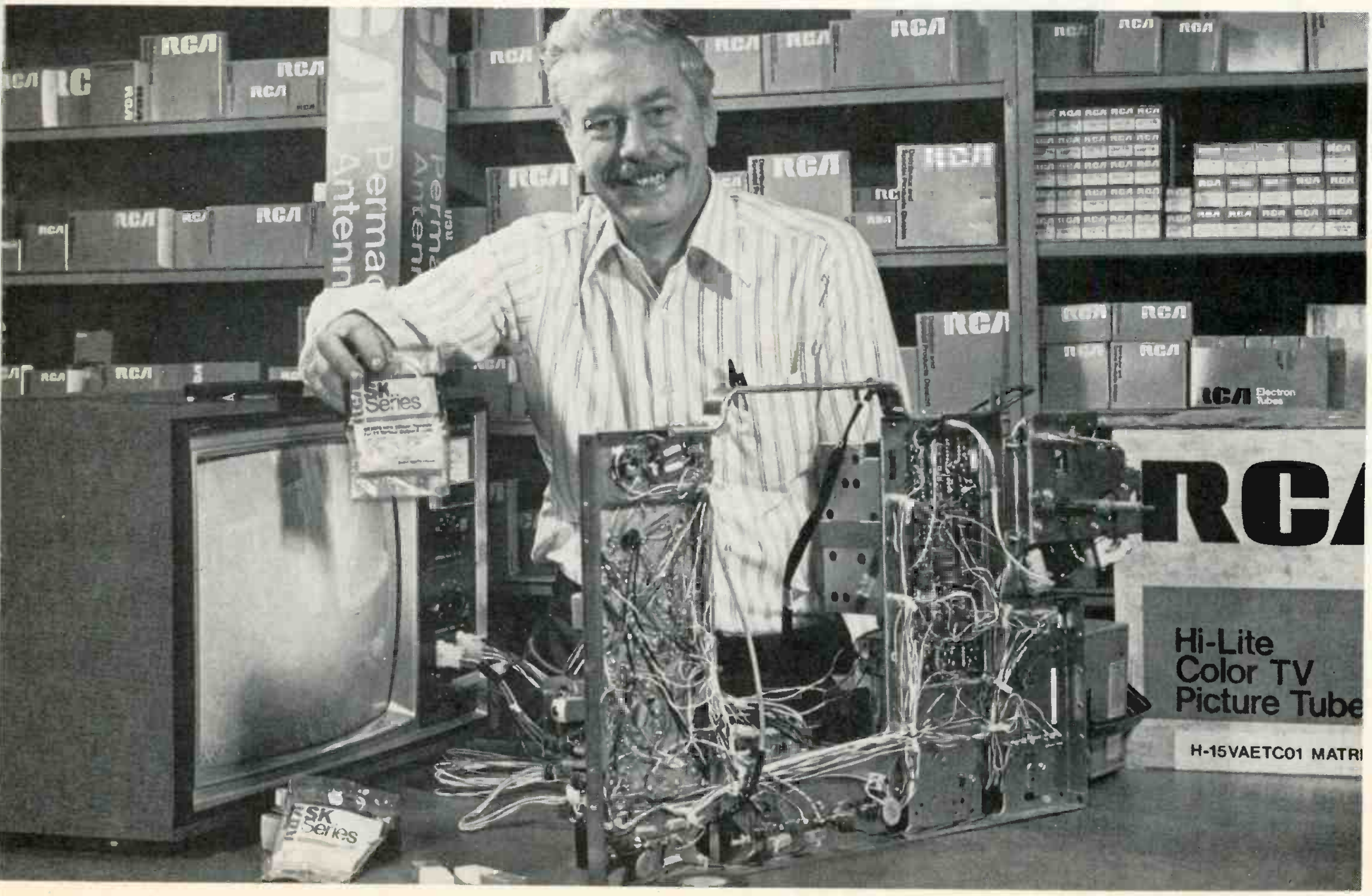
More factors

We all know that feedback can lead to problems ... positive feedback results in oscillation. What conditions are required to make a tuned grid, tuned plate oscillator? The input must be tuned to a lower frequency than the output, there must be power gain, and feedback. We already have two conditions present in the multiplier, gain, and input tuned lower than the output ... therefore it is quite possible to have problems with feedback. Even if the circuit doesn't oscillate, it may be regenerative, and that can be a very touchy problem with unregulated power sources.

But that's the minor half of the feedback problem. What if there is negative feedback (degeneration)? You know that negative feedback *reduces* harmonic distortion ... and harmonic distortion is exactly what we want in a frequency multiplier. So, degeneration often reduces the harmonic output. What produces degeneration? Just one example ... any impedance in the emitter lead of the transistor produces severe degeneration. (The same principle as an unbypassed resistor in the emitter circuit in an audio amplifer). As a matter of fact, there are many ways to produce degeneration at high frequencies, and *any* of them are murder in a frequency multiplier ... so be careful of lead dress and part placement in making repairs. Again, use exact replacement parts, as *internal* leads are not visible ... neither are capacitances. It is extremely mysterious to have a multiplier circuit, in which everything *seems* normal, yet output is way down. A very little degeneration is all it takes. Remember, according to classic feedback theory, if we had a gain of ten, with only 2% negative feedback, the gain would drop to about 3! If the original gain were 20, the reduced gain would only be 4.

Effects of "Q"

Loading has a strong effect on the output. The tank circuit must have a reasonable "Q" in order to achieve the selectivity necessary to discriminate effectively between the harmonics,



suppressing the unwanted ones to avoid spurious frequencies. Unfortunately, a loaded tuned circuit has a low "Q" and cannot achieve this objective. On the other hand, if the multiplier is not loaded, there is little power gain. Again, we have a trade off, which is more critical than the usual broad band straight through amplifier. Thus tuneup is more critical, and manufacturers alignment procedure must be followed extra carefully. Attempts to get "more drive" in an effort to hop-up transmitters by "tweaking" the tuning usually results in getting *more* harmonics but less of the desired one.

Figure 3 shows a very efficient doubler circuit, known as a "push-push" doubler. The inputs are driven in push pull, while the outputs are in parallel. This circuit operates much the same as the conventional full wave rectifier which delivers 120 cycle ripple from a 60 cycle line, each transistor alternately contributing a pulse to the output. The difference is that there is power gain in this circuit. Since only one transistor operates at a time because the inputs are out of phase, the transistor that is turned off acts like a neutralizing capacitor for the other transistor, and the circuit behaves like a well neutralized amplifier if matched transistors are used. This is a good circuit, and has been around for a long time.

Harmonic generators

Another technique that has been employed successfully is to generate a stable signal at some relatively low frequency, then clip it with a good high frequency diode, into a square wave. Since a square wave has a large number of odd harmonics, a tuned amplifier is used to select the desired one, followed by the necessary power amplification. This has been used mainly in low power applications, such as receivers and signal generators, and is a little puzzling the first time encountered, since the circuit diagram doesn's seem to make sense with a diode labeled "harmonic generator" or some similar title.

Other ingenious schemes have been used for frequency multiplication from time to time. A saturated core inductor produces a distorted wave shape full of harmonics, and has been used at low frequencies where frequency multiplication poses some very special problems. Varactors have also been used, since the ability to change capacitance very rapidly provides the basis for low noise amplifiers and

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CONTINUING EDUCATION REPORT

The consumer electronics technician who is still trying to ignore digital electronics technology has a limited time left in the industry. With digital techniques becoming more and more common—on some sort of exponential curve—it is apparent that without a good working knowledge of digital electronics he already has problems and shortly will find large areas of consumer electronics a mystery, let alone understand and repair his own test equipment.

The Heathkit Digital Techniques Course, book, and trainer. Circle number 162 on the Reader Service Card in this issue for more information.

Heath-kit Digital Techniques Program EE-3201

It's almost painless

By Walter H. Schwartz

Digital control of TV tuners, microprocessor control of tape decks, digital processing of sync and sweep signals in TV sets, microprocessors in appliance control, digital schemes for superimposing one picture on another on the television screen are here and much more is coming.

Unfortunately not all of us are in a position to conveniently return to the classroom for training in the basics of digital electronics. So we must look for alternatives; books, or home study programs. One such alternative is Heath's "Digital Techniques" individual learning program, one of Heath's Continuing Education Series.

The program consists of two volumes divided into ten sections covering the various aspects of digital electronics. It includes records (or optional at extra cost, cassettes) to be played before beginning each of the ten units. It also includes eighteen IC's, a seven segment LED display and assorted miscellaneous components with which to perform a total of twenty-four experiments with the Heath Kit Trainer Digital Design Experimenter, ET-3200, Kit form, or ETW-3200, assembled. The trainer includes a breadboard socket, power supplies, + and − 12 volts, and +5 volts, a clock generator, logic and data switches, and LED logic indicators. It or its equivalent is very important as the experiments are essential elements of the program. While the trainer is a separate cost item it is versatile enough for general use in breadboarding both analog and digital circuits for other purposes.

According to the course objectives, after finishing the kit, one should be able to; discuss the advantages and benefits of using digital techniques and name their major applications in electronics; convert between binary and decimal number systems and recognize the most commonly used binary codes; understand how the various components operate in digital circuits such as logic gates; discuss the characteristics and operation of the more commonly used integrated circuit logic families; use Boolean Algebra to express logic operations and minimize logic circuits in design; understand flip-flops and the operation and application of binary and BCD counters, shift registers and other sequential logic circuits; understand and design combinational and sequential logic circuits for a given application from definition and concept to the selection of the integrated circuits; discuss digital counters in time and frequency measurements, digital computer organization and operation and discuss microprocessors, operation and application.

The program begins with a discussion of the advantages of digital techniques, the binary number system and semiconductors as applied to digital electronics. It covers basic logic circuits in discrete component form and in various integrated circuit versions. The program discusses Boolean Algebra, the special language of digital logic circuits, its laws, truth tables, and Boolean rules, such as DeMorgan's Theorem. The flip-flop, the most common logic element for storing one bit of binary data is discussed in its various forms, RS, D, and JK.

Sequential logic circuits, counters and shift registers, both made up of flip-flops are discussed along with the clocks which sequence them. Digital design examples are worked through and experiments verify the results. The final section of the program explains typical applications, the frequency counter, its control, counting and display functions and the digital computer, types, orginiza-

(continued on page 45)

BULLETIN BOARD

A new pocket size guide for "REN" replacement semiconductors for home entertainment equipment is available from *Raytheon Company*. The guide contains complete type-number cross references for all major semiconductor brands, including universal devices, and gives suggested list prices for the more than 350 devices in the "REN" line. Copies of the new replacement guide are free at authorized Raytheon distributors.

The 1979 Kulrod Mobile Antenna and Accessory Catalog is now available from *Larsen Electronics*. This forty page catalog features a broad selection of low-band, high-band and UHF mobile antennas with a variety of mounting options for each, Larsen Kulduckies for hand helds, and several base station antennas. Several selection charts correlate the various mobile antennas and the many mounts available. For a free copy write: Larsen Antennas, John Beaman, General Mgr., P.O. Box 1686, Vancouver, WA 98663.

A self-teaching microprocessor design manual, reportedly written for the beginner, the interested person who simply wants to know more about the subject, and the expert, the engineer who is doing advanced microprocessor design work, alike, has recently been published by *Texas Instruments, Incorporated*.

The "9900 Family Systems Design and Data Book" is stated to be the first of a "microprocessor series" of technical references and offers a more than 1000 page selection of educational and applications information to "help users develop a deeper understanding of the complex technology and tremendous potential available in microprocessors."

The "9900 Design Book" starts at the beginning, discussing the semiconductor technology on which microprocessors are based, covers the complete TI 9900 family of microprocessors, accessories and support materials, moves step by step through a "first encounter" with a 9900, describing basic concepts in an introductory application. Later chapters cover hardware and software design, architecture and interfacing techniques, programming methods and the instruction set, and reference materials to develop software systems. Also covered are technical specifications on the 9900 family and its real world uses.

The "9900 Family Systems Design and Data Book" is available through TI's Learning Center, Mail Station 54, Box 225012, Dallas, TX 75265. The cost is $9.95.

A new wire and cable catalog is now available from *Columbia Electronic Cables*. Featured in the 96 page catalog is an introduction to each major product section and all of the company's UL and CSA approvals for its various product groups. The catalog covers Columbia's, audio, CATV, intercom, microphone, power, and television cables, and recently introduced products including computer, control, teflon-covered coaxial, booster and ribbon cables. The catalog features conduit capacity charts and a more in-depth technical section than previously. For a free copy of the catalog write; Columbia Electronic Cables, 11 Cove St., New Bedford, MA 02744.

A new catalog of test equipment has recently been issued by *Triplett*. It covers their line of V-O-M's, the Models

3300 and 3400 as well as clamp on ammeter accessories, test leads, and carrying cases. It concludes with a comparison chart of the complete line of Triplett V-O-M's. Catalog 1978-A is available from Triplett distributors or Triplett Corporation, Bluffton, OH 45817.

"Home Audio Systems Schematic/ Servicing Manuals" Volumes 1, 2 and 3 are a new series from *TAB BOOKS*. These three manuals TAB BOOK No's 1024, 1025, 1026 cover well over 100 different model numbers of Capehart, Coronado, Channel Master, Admiral, Automatic Radio, Hitachi, Midland, Sharp, and Zenith stereos, tuners, phonographs and tape recorders. These manuals show schematics and parts lists and also show circuit board layouts dialcord stringing diagrams and exploded views of mechanical components, cabinets, tape decks and changers, with parts lists—no more finding a mechanical part damaged and not knowing what to order. Each volume measures 7 by 10 in., contains 200 pages and sells for $8.95 in leatherette or $5.95 in paper from TAB BOOKS, Blue Ridge Summit, PA 17214.

A 34-page information packet for prospective purchasers of oscilloscopes is available from *Tektronix, Inc.* Data sheets with photographs, specifications and selection criteria are included for the 200, 300, 400 and T900 series Tektronix portable oscilloscopes. Pricing and ordering information is also included. For this information package "Portable Oscilloscopes, (AX3797)" write: Julie Schmit, Delivery Station 76-260, Tektronix, Inc., P. O. Box 500, Beaverton, OR 97077.

An expanded catalog, Land Mobile Antennas, for commercial two-way communications systems, has recently been published by *Antenna, Incorporated.* The catalog features an easy to read chart format for low-band and high-band, 3dB gain high band antennas, 5dB gain UHF antennas, heavy duty models, disguise cowl mount antennas, and base station antennas. Copies of the catalog are available free. Write on letterhead to: Antenna Incorporated, 26301 Richmond Road, Cleveland, OH 44146. ET/D

TEST INSTRUMENT REPORT

The incidence of CB service is expected to rise and then level off in a few years to become a more stable and significant area of service for the independent shop. Here as in the rest of the consumer electronics service field, speed is important, and given the nature of the CB customer, being convincing is also sometimes important.

Fig. 1–The Sencore CB49. For more information about this instrument circle number 150 on the Reader Service Card in this issue.

Sencore's CB 49 Portable CB Analyzer and Performance Tester

Simplified checkout.

By Walter H. Schwartz

There are presently available several integrated test systems for CB work, all intended to increase the convenience, speed and accuracy of CB service. The CB49 is perhaps the only complete, portable, instrument suitable for extensive check out of a CB transceiver out of the shop, for checking both base and mobile installations.

With its multi-scale meter the CB49 allows the technician to accurately and convincingly check power, modulation, and frequency of the transmitter, and sensitivity, frequency, and audio power output of the receiver. It contains among other things, an R.F. generator, R.F. and Audio dummy loads, test speaker, modulation, power and SWR meters, a frequency meter, and an audio generator.

To begin to run through the complete series of tests possible with the CB49 first connect it to the CB radio—only three connections are necessary—(See Figure 1) and proceed with the SWR test. The CB49 manual states, *"It does not matter where the switches and controls on the CB49 are set at the beginning of the tests. It is not possible to damage the CB49 or the transeiver under test with any combination of switch settings as long as the radio complies with FCC specifications."* To make the SWR test, switch to SWR, switch TRANSMITTER LOAD to "Antenna", and press the push to talk switch. The SWR is read directly on the meter, no power or calibrate settings are necessary.

The remainder of the transmitter tests are made using the "50 ohm load" position of the TRANSMITTER LOAD switch. To check RF power output of an AM radio, swich to "RF Watts Average," key the transmitter and read the power output. A test for downward modulation, reduced output under conditions of full modulation, can be performed here also. Switch the CB SPEAKER SUB switch to "Dummy load and 1kHz tone." Turn the TONE LEVEL control until a tone is heard from the speaker on the side of the CB49. Place the microphone on the rubber pad over the speaker and key the transmitter. Increase the tone level while watching the meter. The power output will decrease slightly in most transmitters but more than a 25% decrease indicates a problem in the output stage if the power supply voltage is constant. A "talk power" test can be made by setting up as for the downward modulation test but setting the switch to "RF watts, PEP." Advancing the TONE LEVEL control should increase the power output reading from the carrier power of 4 watts or so, to the carrier and sideband peak power of as much as 12-16 watts/PEP. ET/D's old Hy-Gain V showed about 3.5 watts carrier and kicked up to 15-16 watts with the 1kHz tone or a whistle.

A most important test of course is transmitter frequency, which can be read directly as "Percent Off Channel" with the CB49. For SSB a 1Khz tone is used, injected by means of the microphone—and the CB49 compensates for the offset thus produced and reads "Percent Off Channel" as on AM. The procedure takes 4 or 5 seconds per channel; we were able to check through a 40 channel AM transceiver in just about 3 minutes, since unlike using a counter there are no limits to remember and compare.

Sencore recommends testing the receiver section for "Audio Watts," outupt, first, as an indicator of receiver operation. Set the FUNCTION switch to "RF Generator and Audio Watts, turn the CB volume control to maximum and turn the MICRO VOLT OUTPUT control for maximum output. Most CB's use the same audio output stages for receive and transmit; the output should be at least 2 watts; ETD's Hy-Gain V showed over 3.

Receiver sensititivty—the 10dB signal plus noise to noise ratio—can be checked by an automatic, patent/pending, method which pulses the signal and measures and compares the signal and the noise, to allow the sensitivity to be read directly from the MICROVOLT OUTPUT controls. The sensitivity should be better than 5 microvolts and should vary only slightly from channel to channel.

Other functions that can be tested with the "RF Generator" are squelch sensitivity, AGC and adjacent channel rejection. The accessory NL204 noise pulse simulator permits checking the effectiveness of ANL and ANB circuits.

Most of the tests as described are for AM operation. SSB tests differ only slightly; complete check out for SSB transmit and receive is as easy.

The CB49 comes with a full set of cables for use with radios using UHF coaxial connectors. The alligator clips furnished on the test leads have an insulation piercing pin for easy connection to insulated power and speaker wires. Optional accessories include coaxial adapters for use in Ford or Chrysler cars, and an ac power adapter, (the automatic shut off is disabled when the CB49 is used on ac). The instruction manual is very complete. The checkout section is written in terms that would allow the non-technical person to easily check the operation of a CB Transceiver. A condensed manual with details on all test setups is included inside the cover of the CB49 for field use.

The CB49 is also intended for bench use. Auxilliary equipment necessary would be a bench power supply and a multimeter. Under some conditions an oscilloscope would be required. The accessory NL204 EIA Noise Pulse Simulator would be useful for servicing noise limiters and blankers and the SB214 40dB 27MHz signal booster can boost the RF signal level by a factor of 100 where needed. The CB49 frequency converter allows any 1MHz scope be used when viewing transmitter output signal.

The bench servicing section of the manual is almost a short course in CB repair. Equipment applications and stage by stage troubleshooting are covered. Oscilloscope applications are outlined and the appendix explains basic CB transceiver theory with excellent block diagrams.

The cost of the CB49 is $695. The AC Power Adapter costs $14.95, the CB49 scope frequency converter is $75 and the NL204 EIA Noise Pulse Simulator sells for $45.

We found the CB49 to be adequate for almost everything one could encounter when used with the auxilliary equipment listed above. It would be the only special item of equipment an otherwise well equipped shop would need to do an effective job of CB servicing. It makes complete checkout a quite rapid process and importantly the technician can show the skeptical CB'er a convincing indication of his radio's performance. ETD

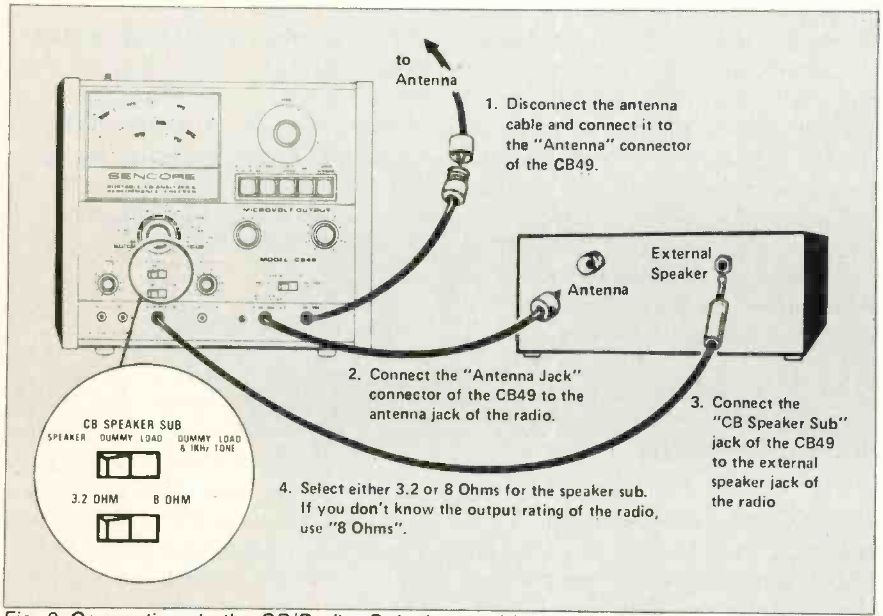


Fig. 2–Connections to the CB/Radio. Only three cables are required for complete testing. (Courtesy Sencore)

DEALER'S SHOWCASE

Microprocessor Controlled CB

Circle No. 142 on Reader Inquiry Card

Robyn's new "Computer-Based Base" includes a microprocessor, programmable memories, automatic channel scanning, and keyboard control. The model SB-540D's microprocessor has five programmable memories for instant return to favorite channels, automatic scanning at either 240 msec/ch or 2 sec/ch. and is programmed by a 15 push button keyboard. Other features are a computer designed PPL synthesizer, LED channel readout, LED clock, dual tuning meters, dual gate MOSFET front end, and a 70 dB adjacent channel rejection is specified. Power necessary is 12Vdc or 117Vac. The list price is $529.95.

Mobile CB Antenna

Circle No. 143 on Reader Inquiry Card /

The American Antenna K40 is, the manufacturer states, the first base loaded CB mobile antenna to equal the performance of a full length, nine foot whip. The secret reportedly lies in the coil design, the largest machine-wound coil in the CB industry, which is permanently molded into a single heterogenous metal/plastic assembly. The standard K40 is priced at $38.50 and mounts to trunk lip or thru the roof. The optional Uni-Mount for luggage racks, gutter mounting etc., is priced at $8.95. The Magnamount magnetic mount is priced at $15.95.

Record De-warper

Circle No. 144 on Reader Inquiry Card

ELPA Marketing Industries, Inc., is now importing from Europe the "Record Puck." Simply slip it over the turntable spindle and it flattens warped records.

ELPA also offers a new dust and static sweeper which consists of a ball bearing gimbal suspended arm supporting a silky fiber and copper microbristle brush to pick up both dust and static electricity. The "Record Puck" is priced at $5.00, the "Audio-Mate Grime Fighter" is priced about $30.00.

Car Stereo Cassette

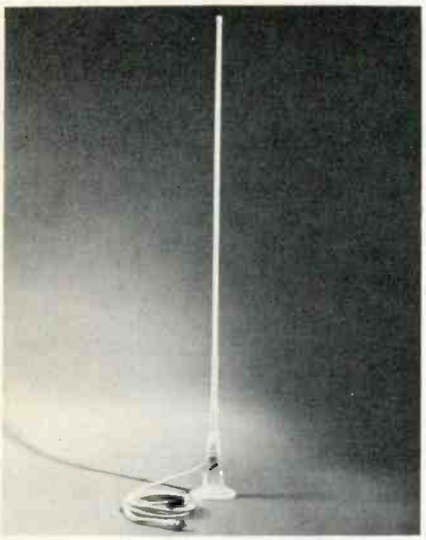
Circle No. 145 on Reader Inquiry Card

Arthur Fulmer has introduced, reportedly, the first after market car stereo to use pushbuttons for control of volume, balance, fader and tone, as well as manual or automatic scan station tuning. The Ultra II Model 16-6800 has a micro-processor to center tune and recall preset stations—up to 14 stations can be pre-programmed and recalled at the touch of a pushbutton. The manufacturer's specifications include 12 watts RMS per channel, up or down scan on manual tuning, auto reverse, locking fast-forward/rewind, LED readout and the company's Ultra warranty which warrants it to be free from defects in materials and workmanship as long as the original purchaser owns the vehicle in which it is installed.

Marine CB Antenna

Circle No. 146 on Reader Inquiry Card

Antler Antenna has introduced a new marine model CB antenna, the "Sea-Sprite" which requires no ground plane. This feature allows its use on fiberglass,



wood or metal boats. The "Sea-Sprite" is a long-filament fiberglass stick precision wound and enclosed in a vinyl sheath. The base hinges 180° for out of the way storage and locks upright for use. The suggested retail is $28.95.

Microprocessor Telephone Answering System

Circle No. 147 on Reader Inquiry Card

The ASAP 35 from *Command Communications,* a computerized alerting system will page or call, in succession, up to fifteen different numbers, at eight minute intervals, until the message is picked up. The system then resets to the first number in memory to await a new message. It will dial a combination of rotary and tone and will accept a paging terminal's go ahead signal, before proceeding with the additional tones required to select the proper pager.

TV Sound Tuner

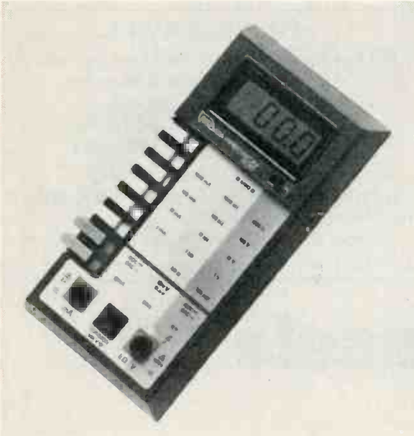
Circle No. 148 on Reader Inquiry Card

The Finney Company has just announced the TELETUNER, Model T-82, a television sound tuner designed for use with a stereo hi-fi system, to produce better quality sound. No electrical connection is required between the unit and the TV set. An antenna, ie. a few feet of wire, rabbit ears, or connection to the TV antenna system through a two-set splitter is needed. The suggested price is $179.95

Circle No. 133 on Reader Inquiry Card

Circle No. 121 on Reader Inquiry Card

NEW PRODUCTS



DMM
Circle No. 151 on Reader Inquiry Card

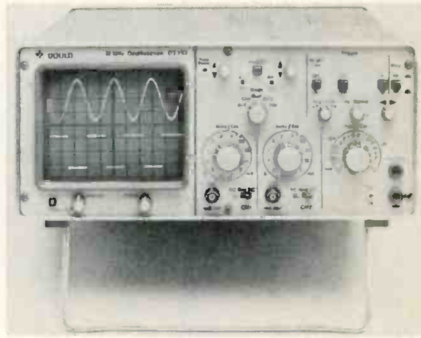
A handheld, LCD, digital multimeter intended for field use has been introduced by *Data Precision*. The Model 935 is small and rugged yet offers 3½ digits and 0.1% accuracy, states the manufacturer. Twenty-nine ranges of ac and dc voltage and current and resistance measurement are available via pushbutton switches arranged for one hand operation. A 9V alkaline transistor battery will power the 935 for over 200 hours of continuous use and an ac adapter is available for bench use. Calibration interval is indicated to be one year. The Model 935 is priced at $149.00 including test leads, battery, instruction manual and one-year warranty.

Wiring Pencil Kit
Circle No. 152 on Reader Inquiry Card

Vector Electronic Co. offers a wiring pencil kit with a variety of tools and breadboarding hardware at significantly less cost than that of the individual items purchased separately. The kit includes the P187-1 wiring pencil with a 400 ft spool of 36 gauge insulated wire, the insulation of which melts away when

soldered with a 750° iron. Also included are a wire cutting chisel tool, a terminal instalation tool, 120 ft of bare 30 gauge wire, 100 terminals, 20 wire spacers, 4.5 by 8 in. Vector board and four pedestal feet for the board. The kit is priced at $13.90 and the P178-1 pencil is available separately for $7.95.

Dual Trace Oscilloscope
Circle No. 153 on Reader Inquiry Card



Gould, Inc. now offers a new low cost 12MHz portable oscilloscope. The OS253 offers dual trace and X-Y display capability, 2 mv. sensitivity, Z-axis input and an 8×10 cm display, ranges from 500 ns/cm to .2 s/cm plus X5 expand. Triggering is dc coupled from an internal or external source with positive or negative slope selection and level control. The OS253 carries a 2 year warranty, weighs less than 13¼ lb and sells for $695.

Digital Multimeter

Circle No. 154 on Reader Inquiry Card

The ME-521DX digital multimeter from *Soar Electronics* is a 3½ digit, five function, automatic zero, automatic polarity, overload protected, unit, with high and low power on all ohmmeter ranges. Low current drain battery operation and light weight, mean convenient portability. Measurement ranges are up to 100Vdc and 600Vac, 100mA ac and dc and resistance to 20 Megohms. Accuracy is stated to be typically 0.5%.

Concealed UHF Radio Antenna

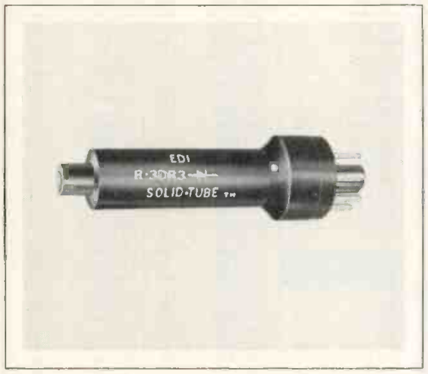
Circle No. 155 on Reader Inquiry Card

A totally concealed UHF communications antenna with performance, reportedly, equivalent to external antennas has been announced by *The Antenna Specialists Co*. The ASP-1000 is similar in design to antennas designed for jet aircraft. It produces a vertically polarized

radiation pattern and is made to fit the space originally intended for mounting a 6×9 in. rear deck speaker. The power rating is 125 watts, the bandwidth is stated to be 5 MHz with tuning coverage of the 406 to 512 MHz range.

Solid State Rectifier
Circle No. 156 on Reader Inquiry Card

Electronic Devices, Inc. has increased its line of solid state replacement vacuum tube rectifiers with the addition of the EDI R3DR3 Solid Tube. These have all the advantage of solid state rectifiers along with, reportedly, a higher mark-up for greater profit.



Dust Removal Spray
Circle No. 157 on Reader Inquiry Card

Projector Recorder Belt Corporation has recently introduced Dust-Away, a new service aid for removing dust, lint and other foreign materials from surfaces too delicate for the use of other liquid, chemical or mechanical methods. Dust-Away is a non-toxic, non-flammable aerosol gas; 1300 seconds of one second blasts per container can be expected, the manufacturer states, at a cost of $1.55 for a 10 oz can.

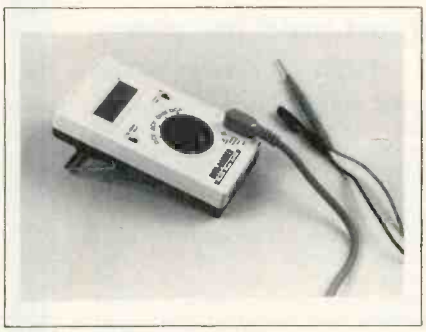
Test Cassettes
Circle No. 158 on Reader Inquiry Card

ORA Electronics offers a line of cassettes for a variety of tests and measurements in cassette decks. Model PTC-1 is a 300Hz tone recorded −10dB for playback level tests. PTC-2 is a 1KHz

tone (0dB) for signal to noise measurement tests. PTC-3 is a 3KHz tone (0dB) for speed drift, wow and flutter tests. PTC-4 is a 6.3KHz full track −10dB tone for tape head azimuth and phase alignment. PTC-5 is a multi-tone tape for frequency response tests.

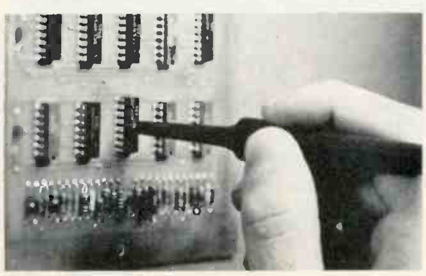
Digital Multimeter
Circle No. 159 on Reader Inquiry Card

The Model 2000A is a new portable auto-ranging digital multimeter from *Alco Electronic Products, Inc.* This DMM features minimal controls and a 3½ digit LCD readout. It has autozeroing, auto-polarity sensing 1mV resolution with full auto ranging to 1000 V, dc



or ac, 2000K ohms and 200mA at a stated .3% accuracy. The suggested price is $195.00.

DVM Temperature Probe
Circle No. 160 on Reader Inquiry Card



A solid state temperature probe for use with digital or analog voltmeters is now available from *B&K Precision*. The Model 7P-28 gives accurate temperature readings, within 1.7° C, over the range of −50° to +150° C, of liquid, gas or solid, according to the manufacturer. It can be used to locate hot spots or measure the temperature of individual components. The TP-28 will operate for over 120 hours on a 9V transistor battery. The user price is $75.00.

Nickel Cadimum Battery Discharge Analyzer
Circle No. 161 on Reader Inquiry Card

Nickel-cadimum batteries exhibit a memory effect. Shallow charge discharge cycles result in the battery's loss of ability to be fully charged. *Reliable Measurements Systems* new Nicadalyzer reportedly precisely discharges Ni-cads sufficiently to allow them to take a full charge at each recharging.

QUASAR

continued from page 21

mentioned earlier, in the absence of a VIR signal, the circuit reverts to either manual or Dynacolor operation.

Q651, the flesh control blanker, disables the flesh control circuit in IC601 during vertical blanking to permit passage of the VIR signal on the 19th line of each field.

Power supplies

While the TS-965 power supply is similar to those used in other Quasar chassis, most other line operated chassis use a bridge rectifier. However, the 965 has a single power diode as a half wave rectifier. The filtered DC is then applied to Q802 which maintains a regulated +123VDC (see Fig. 10). Q801 is a reference amplifier which controls the conduction of Q801.

In the TS968 chassis a ferroresonant power transformer provides line isolation and regulation of the B-plus supply voltage with line voltage variations. The transformer's secondary is tuned to resonance by a 6.8 mfd capacitor. The Q of the tuned circuit varies inversely with load variations to maintain a constant output voltage. ET/D

MULTIPLIERS

continued from page 34

frequency multipliers at very high frequencies. Although varactors are very interesting devices it is beyond the scope of this article to examine them. It is suggested that the reader look at varactors as an intriguing subject in the texts available elsewhere.

Although frequency synthesizers have reduced the need for multipliers in some equipment, there is still a very important role for them at high frequencies and powers, and anyone working with communications equipment should have a good basic understanding of what makes them tick.

Summary

Anything that affects the input conduction angle makes a big difference in the output of the multiplier, this includes the supply voltage, if the bias comes from the supply (which it usually does) ... and the drive level, which also depends on the supply voltage as well as the previous stage and the input tuning. Output tuning and loading are critical, as well as parts placement and lead dress. Lead length in the emitter, emitter bypassing, and bypassing in general are critical, since negative feedback has a very bad effect on multiplier performance. Replacing the transistor involved with a "substitute" with slightly different internals is also a bad risk. Tuneup must be according to the book, since we are not tuning for fundamental but rather a harmonic which is always a trickier job. Changes in resistors which affect biasing can markedly affect the performance, although the voltage readings all look OK ... we are simply trying to put out a different harmonic content, or altering efficiency ... and that doesn't show very readily except in poor performance. ET/D

CONTINUING EDUCATION

continued from page 35

tion, and operation and simple programming.

I found the program to be extremely well organized, each unit building on the previous. I would strongly recommend that the material be followed as presented. Read everything carefully, do each problem, answer each question and do every experiment step by step. Heath has crammed a maximum of training into this program and everything is essential.

The cost of the Digital Techniques Learning Program is $59.95. The optional cassettes, which duplicate the records in a more convenient form, cost $6.95. The trainer cost is $79.95 as a kit and $129.95 assembled. The program complete with kit trainer is $129.95. ET/D

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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

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F. C. C. 1st, 2nd, 3rd questions, answers, "explanations" compiled from technical schools, colleges, avionics companies. $11.00. S. Mager, Box 26151, Los Angeles, CA 90026.

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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.

ET/D TEKFAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

1776

MIDLAND

B & W TV Model 15-035

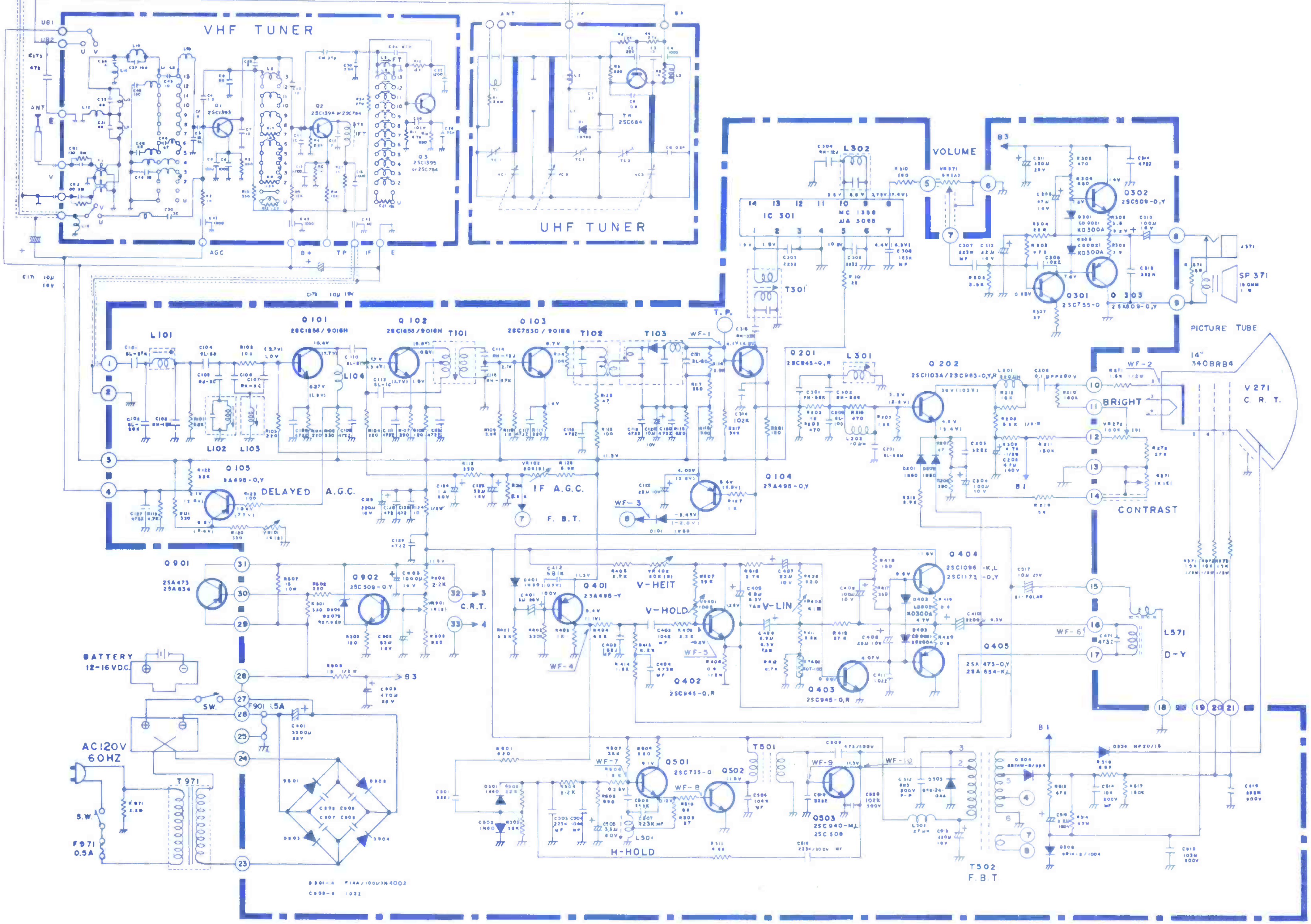
FEBRUARY • 1979

NOTES

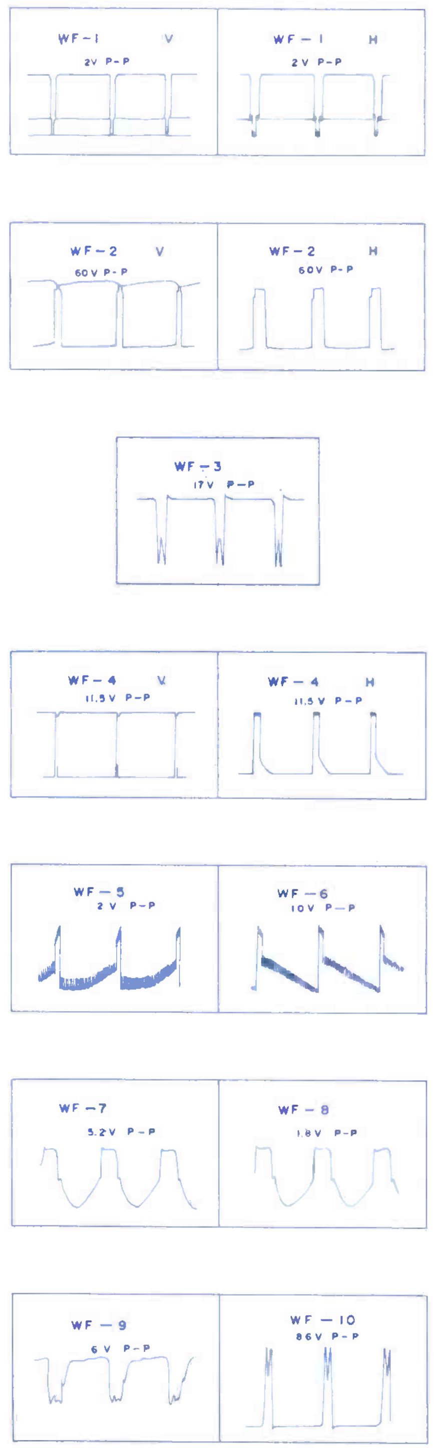
1. All resistance values in ohms K=1,000 M=1,000,000
2. All capacitors not noted in schematic diagram are in pF. The 3rd numeral of capacitance value indicates 10's multiplier (Ex 683=68,000 pF)
3. Voltage reading taken with "VTVM" from point indicated to chassis ground, tuner on unused channel, contrast at maximum, AGC fully clockwise, other controls at normal.
4. DC voltages in ( ) are values for normal signal input
5. Voltage reading may vary ±20%
6. Slight variations between set and schematic diagram may be noted due to production improvement

∗IMPORTANT SAFTY NOTICE

THE SHADE AREA ON THIS SCHEMATIC DIAGRAM X-INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURER'S SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE SHADED AREAS OF THE SCHEMATIC.



WAVEFORMS



1777

SANYO
Color TV Model
91C82

ET/D TEKFAX

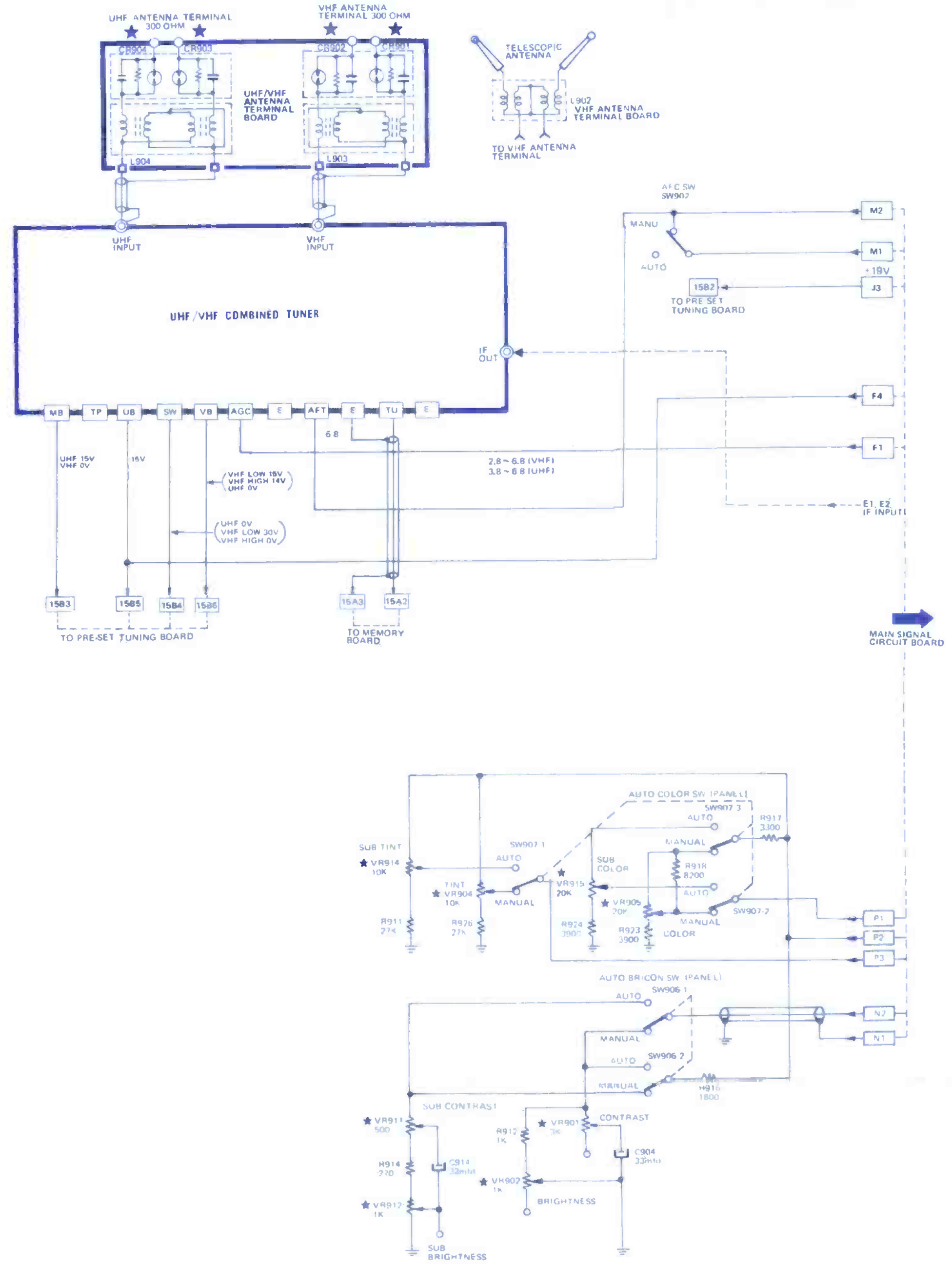
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

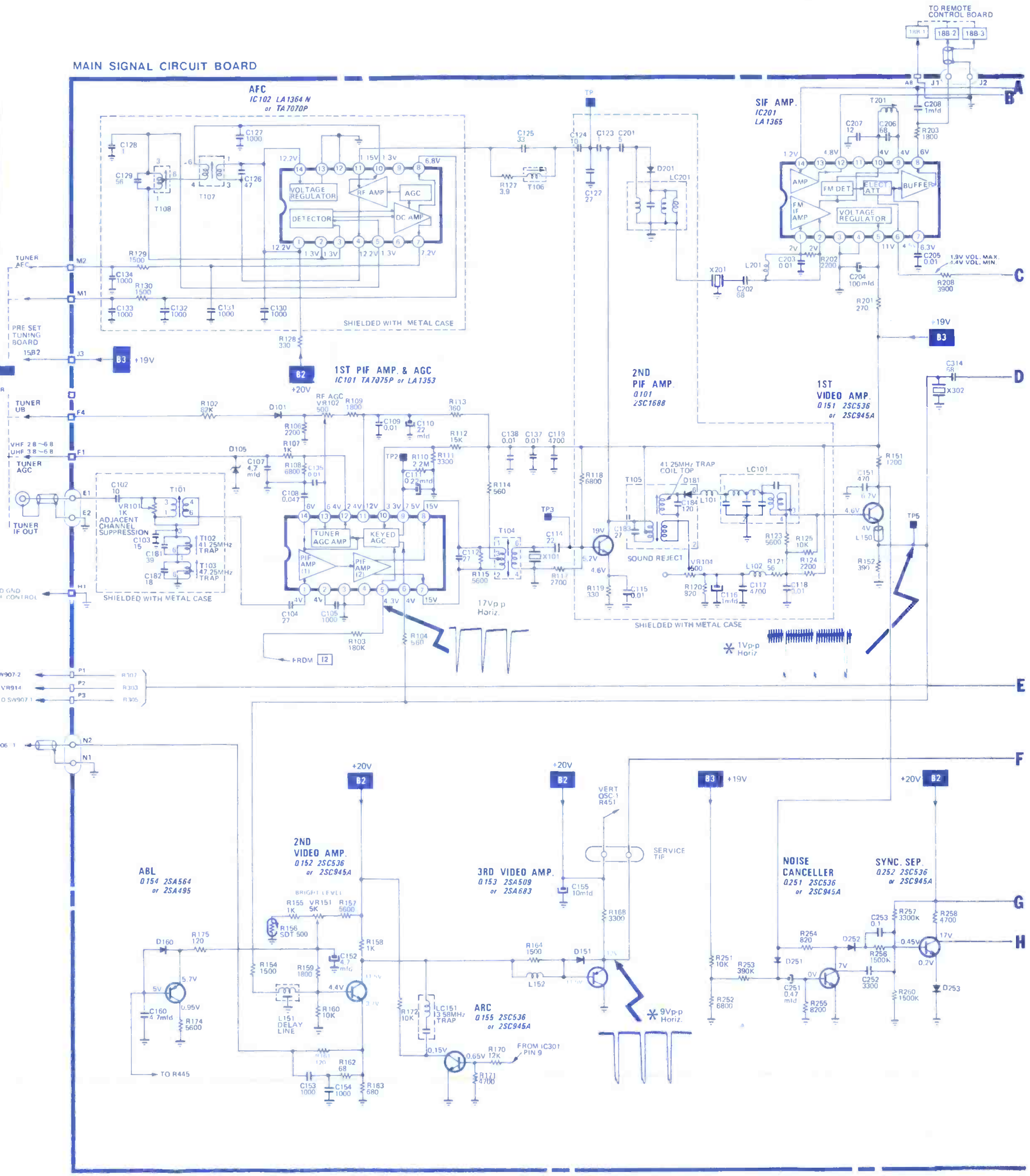
FEBRUARY • 1979

PRODUCT SAFETY NOTICE: The components designated by a star (★) in this schematic diagram designates components whose value are of special significance to product safety. Should any component designated by a star need to be replaced, use only the part designated in the Parts List. Do not deviate from the resistance, wattage and voltage ratings shown.

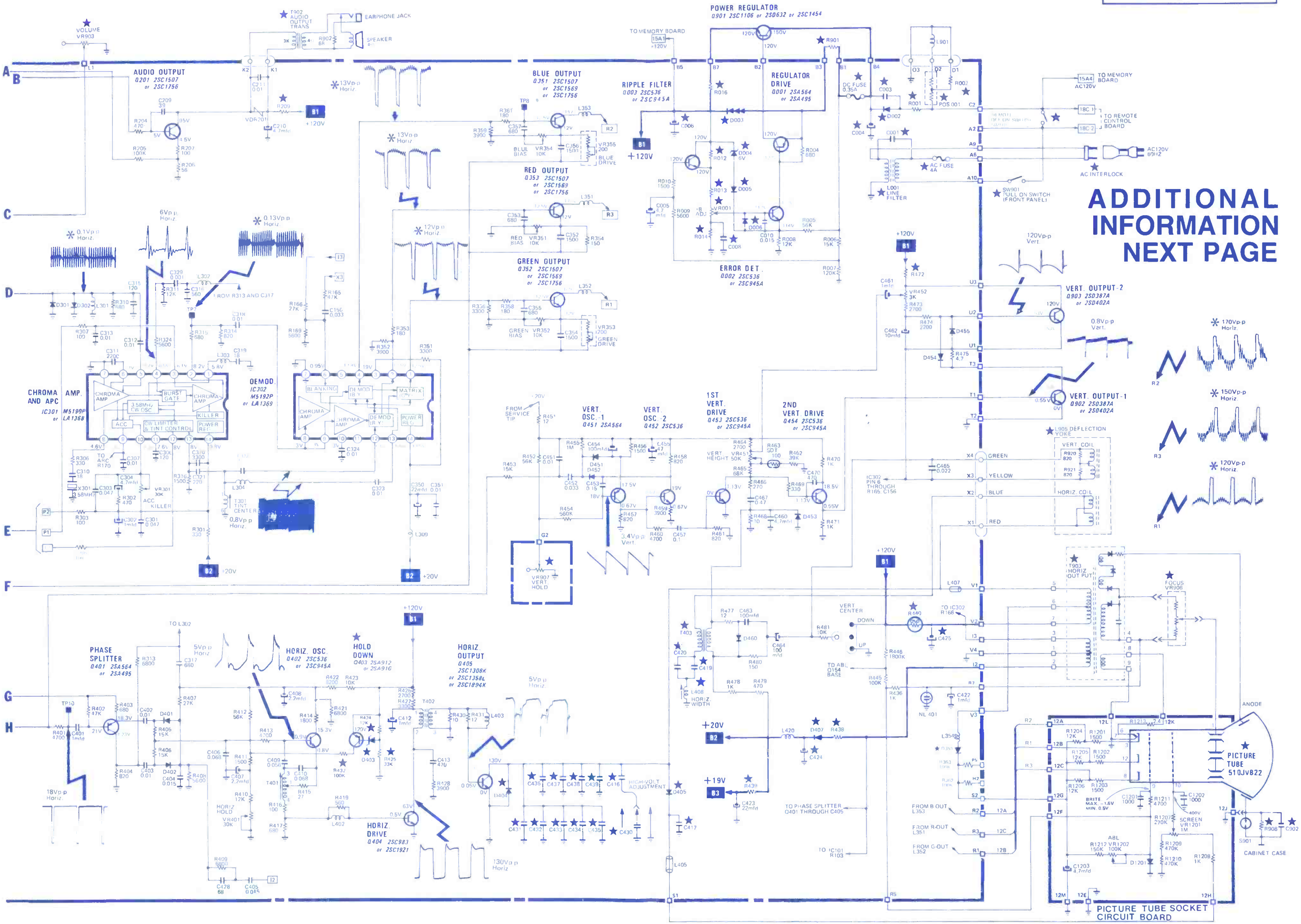
NOTES:

1. All resistance values in ohms K=1,000, M=1,000,000.
2. Unless otherwise noted in schematic all capacitor values less than 1 are expressed in mfd, and the values more than 1 are in pF.
3. Voltage reading taken with "VTVM" from point indicated to chassis ground. Voltage reading taken using a color bar signal VHF channel 11, all controls at normal, AFT, AUTO-BRICON and AUTO-COLOR switches in "OFF" position, line voltage 120 volts. Some voltage may vary with signal strength.
4. Waveforms were taken with color bar signal and controls adjusted for normal picture. Waveforms marked with * may vary with signal strength.
5. The symbol (fusible resistor symbol) indicates fusible resistors. They protect the circuit from possible damage by short circuits.





SANYO
Color TV Model
91C82



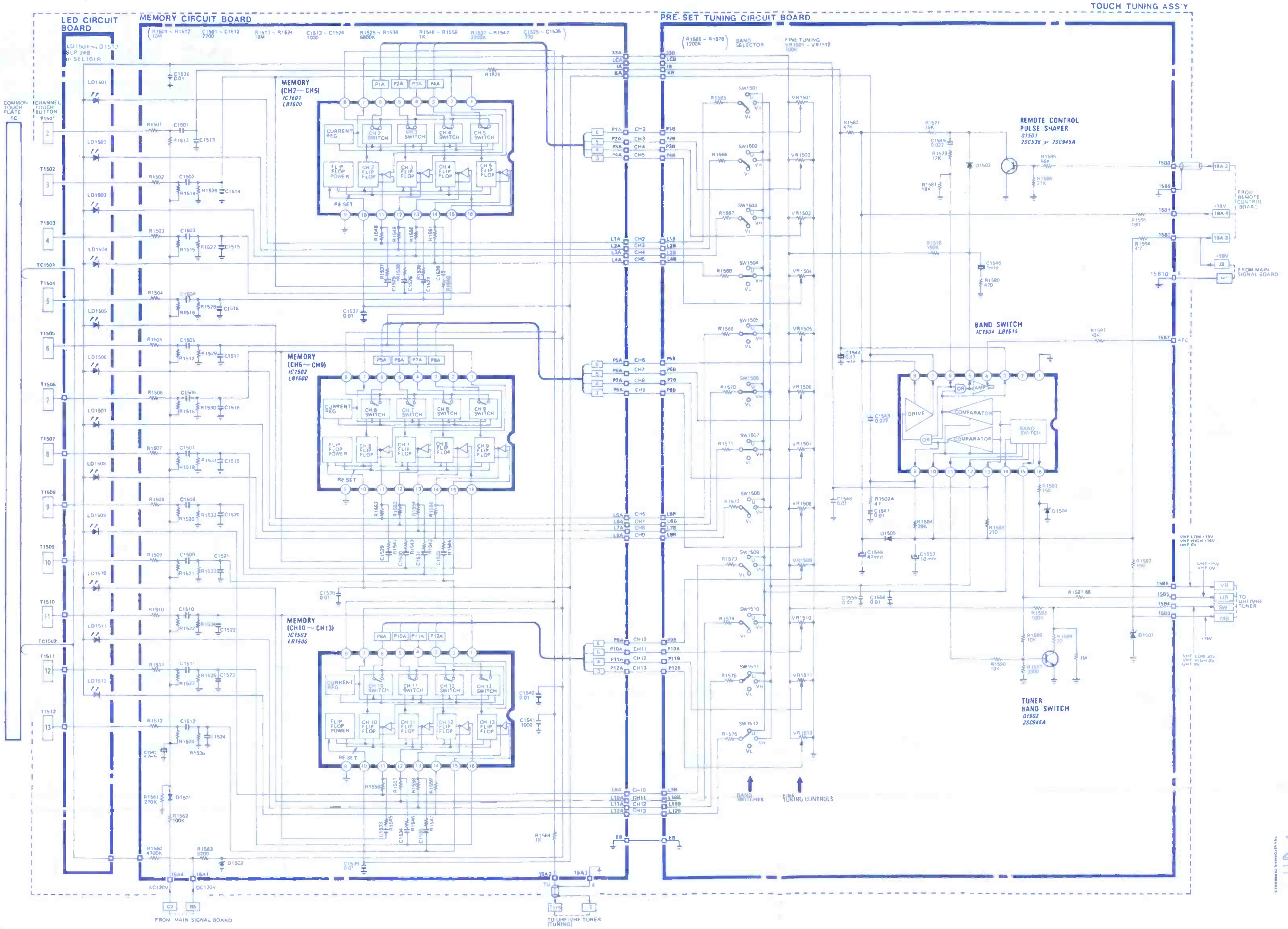
ADDITIONAL INFORMATION NEXT PAGE

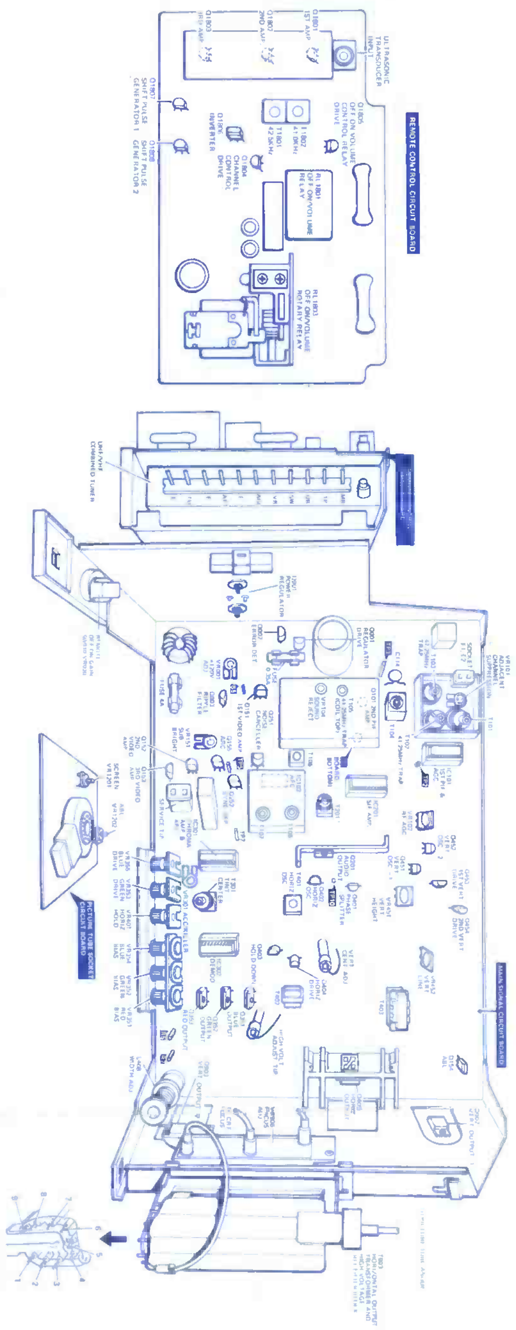
SANYO
Color TV Model
91C82

MEMORY AND PRE-SET TUNING CIRCUIT

Related Terminals with channel

CHANNEL	2	3	4	5	6	7	8	9	10	11	12	13
TERMINALS	2,6,11	1,5,12	16,4,13	15,3,14	2,6,11	1,5,12	16,4,13	15,3,14	2,6,11	1,5,12	16,4,13	15,3,14
DEVICE	IC1501				IC1502				IC1503			





ADDITIONAL INFORMATION NEXT PAGE

ET/D TEKFAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

1778

SYLVANIA
Color TV Chassis
E49-2

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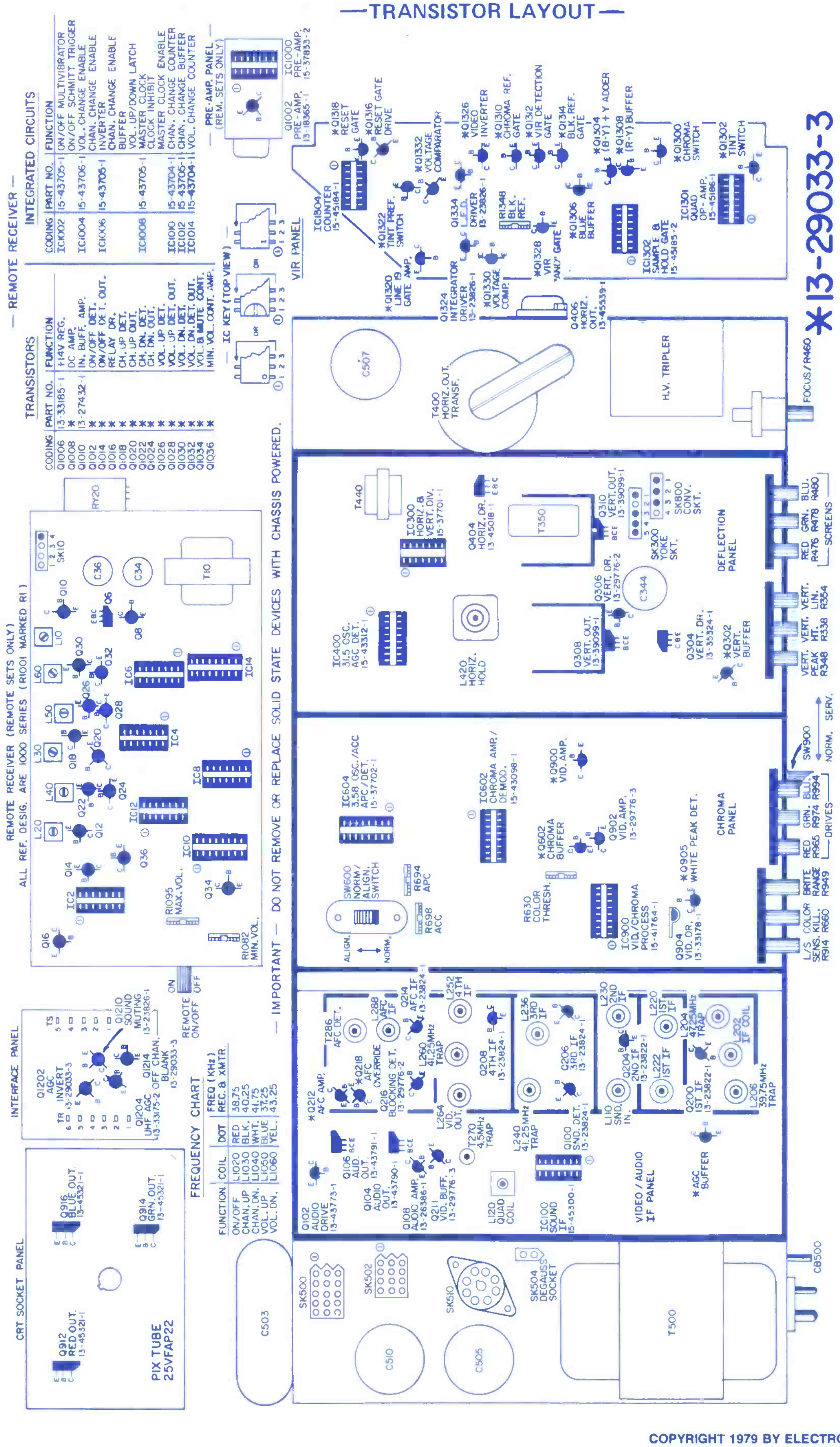
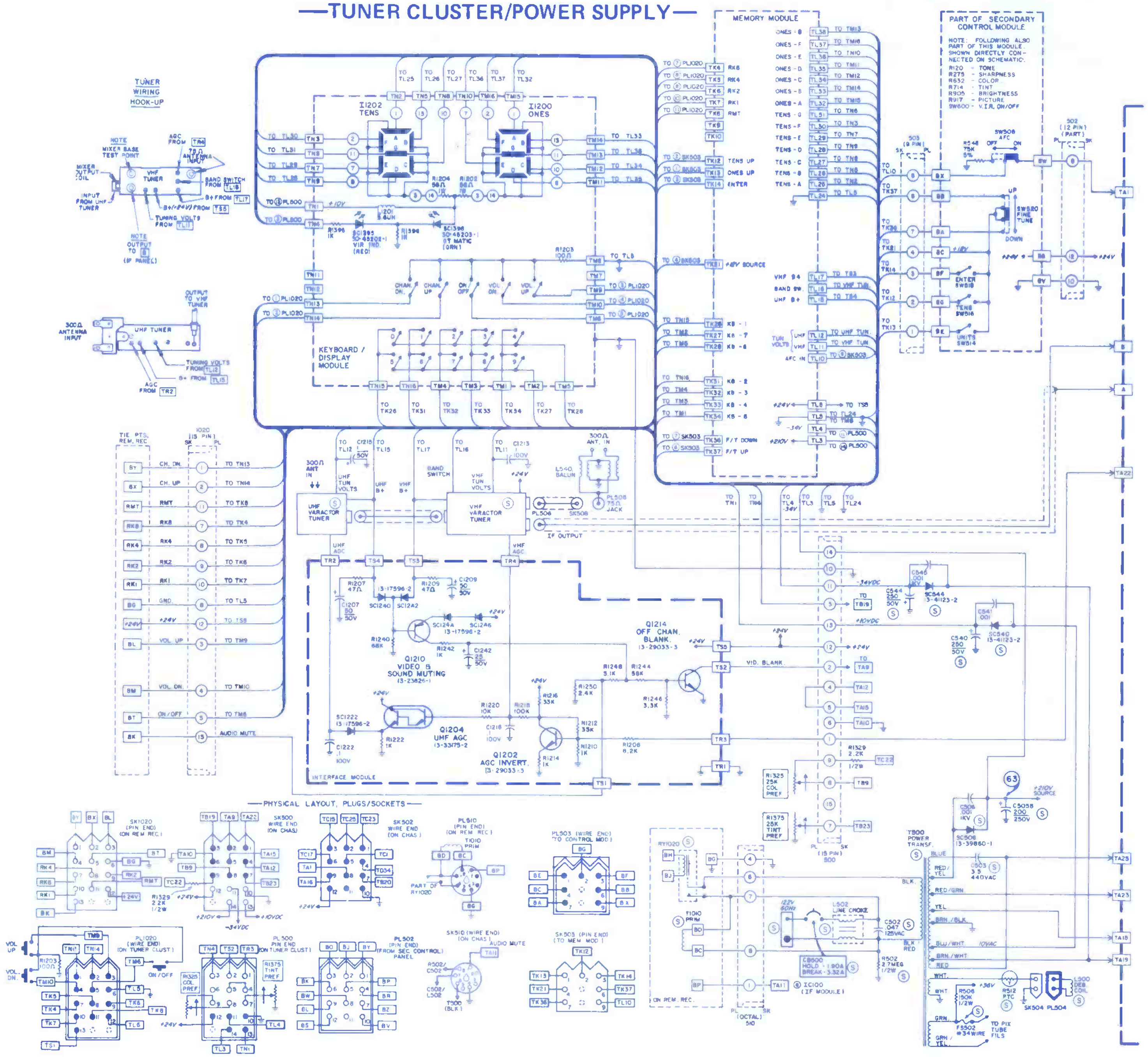
—TRANSISTOR LAYOUT—



—TUNER CLUSTER/POWER SUPPLY—

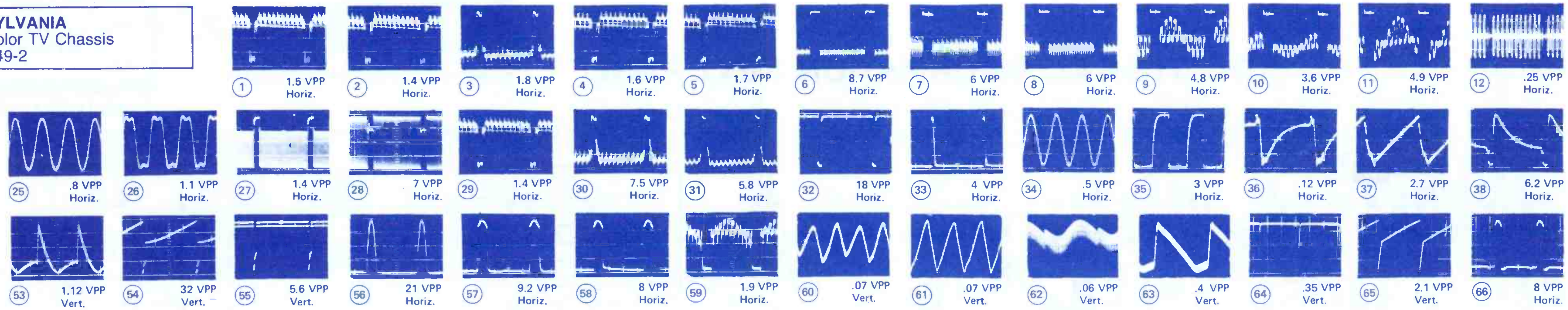


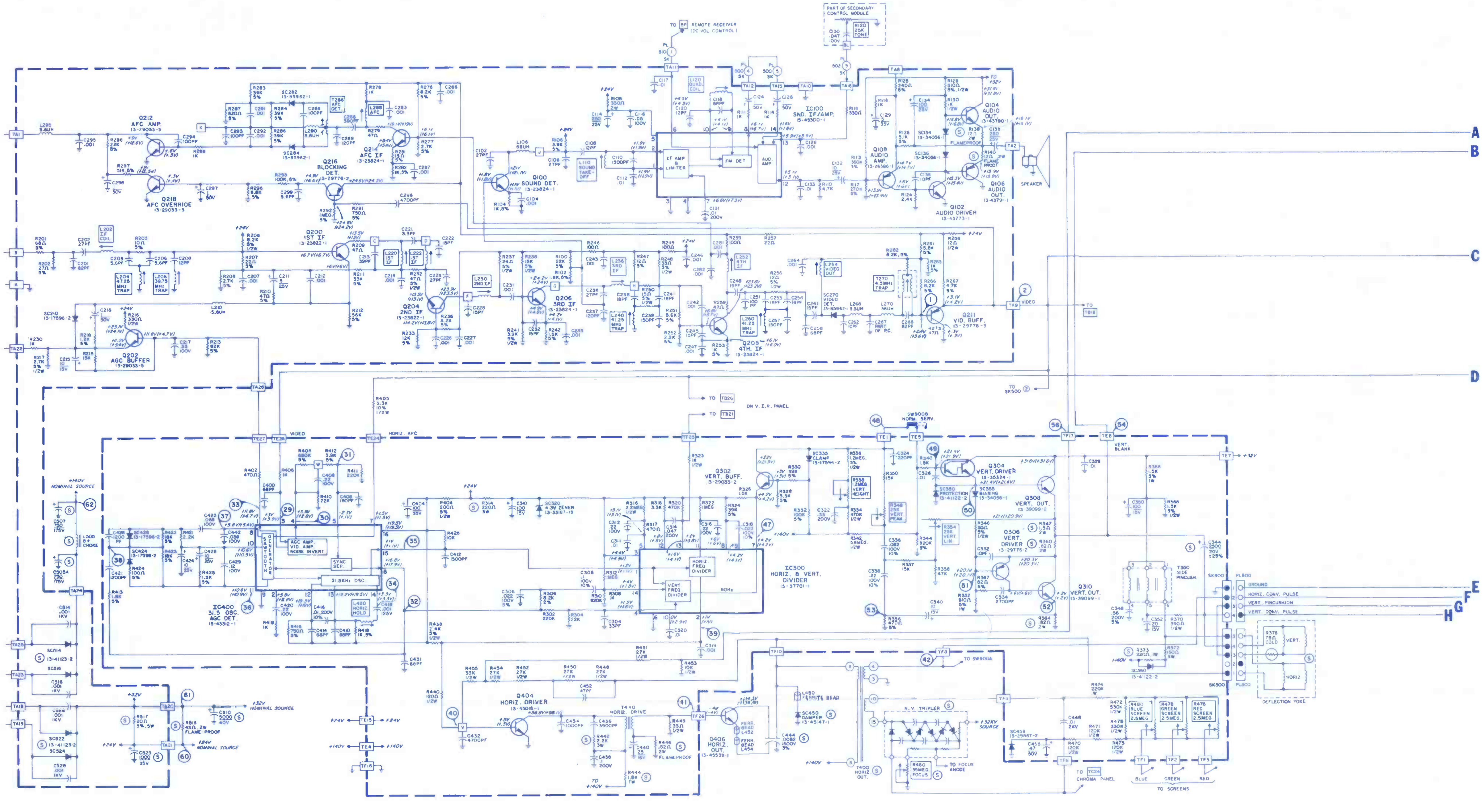
TUNING VOLTAGE CHART (MEMORY MODULE) —— (ALL IN DC VOLTS)

	CH. 2	CH. 3	CH. 4	CH. 5	CH. 6	CH. 7	CH. 8	CH. 9	CH. 10	CH. 11	CH. 12	CH. 13	CH. 14	CH. 38	CH. 83
TL10 AFC	2.2	3.4	4.8	7.4	9.5	7.0	7.6	8.3	9.1	10.0	11.2	12.9	1.2	4.8	13.4
TL11 VHF TUN. VOLTS	3.5	5.6	7.8	12.1	15.5	11.4	12.4	13.5	14.7	16.3	18.3	21.0	2.0	7.9	21.9
TL12 UHF TUN. VOLTS	3.6	5.7	8.0	12.3	15.9	11.6	12.6	13.8	15.1	16.6	18.7	21.5	2.1	8.1	22.4
TL16 BANDSWITCH	-3.4	-4.0	-4.4	-4.6	-4.6	24.3	24.4	24.4	24.4	24.3	24.1	24.4	24.2	24.2	24.2

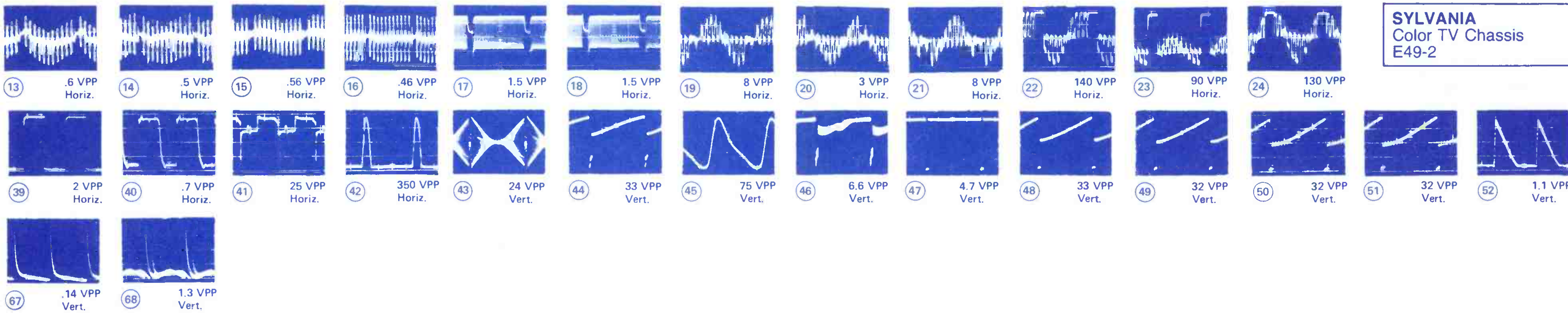
NOTE: Voltages shown are average readings. Local broadcast used as signal source. AFC Switch - OFF.

SYLVANIA
Color TV Chassis
E49-2





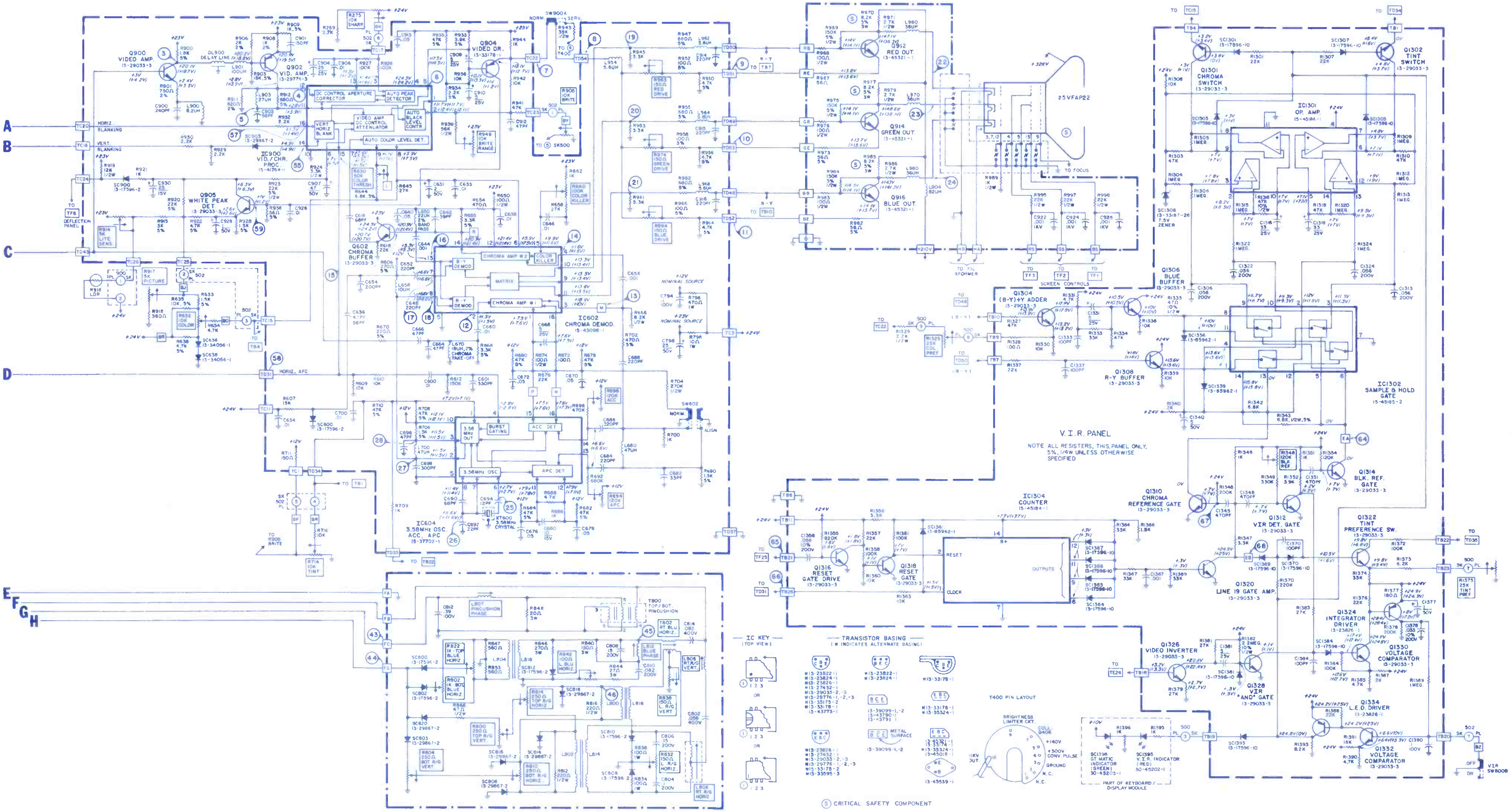
SYLVANIA
Color TV Chassis
E49-2



(13) .6 VPP Horiz. (14) .5 VPP Horiz. (15) .56 VPP Horiz. (16) .46 VPP Horiz. (17) 1.5 VPP Horiz. (18) 1.5 VPP Horiz. (19) 8 VPP Horiz. (20) 3 VPP Horiz. (21) 8 VPP Horiz. (22) 140 VPP Horiz. (23) 90 VPP Horiz. (24) 130 VPP Horiz.

(39) 2 VPP Horiz. (40) .7 VPP Horiz. (41) 25 VPP Horiz. (42) 350 VPP Horiz. (43) 24 VPP Vert. (44) 33 VPP Vert. (45) 75 VPP Vert. (46) 6.6 VPP Vert. (47) 4.7 VPP Vert. (48) 33 VPP Vert. (49) 32 VPP Vert. (50) 32 VPP Vert. (51) 32 VPP Vert. (52) 1.1 VPP Vert.

(67) .14 VPP Vert. (68) 1.3 VPP Vert.



1779

SONY
B & W TV Model
TV970

FEBRUARY • 1979

ET/D TEKFAX

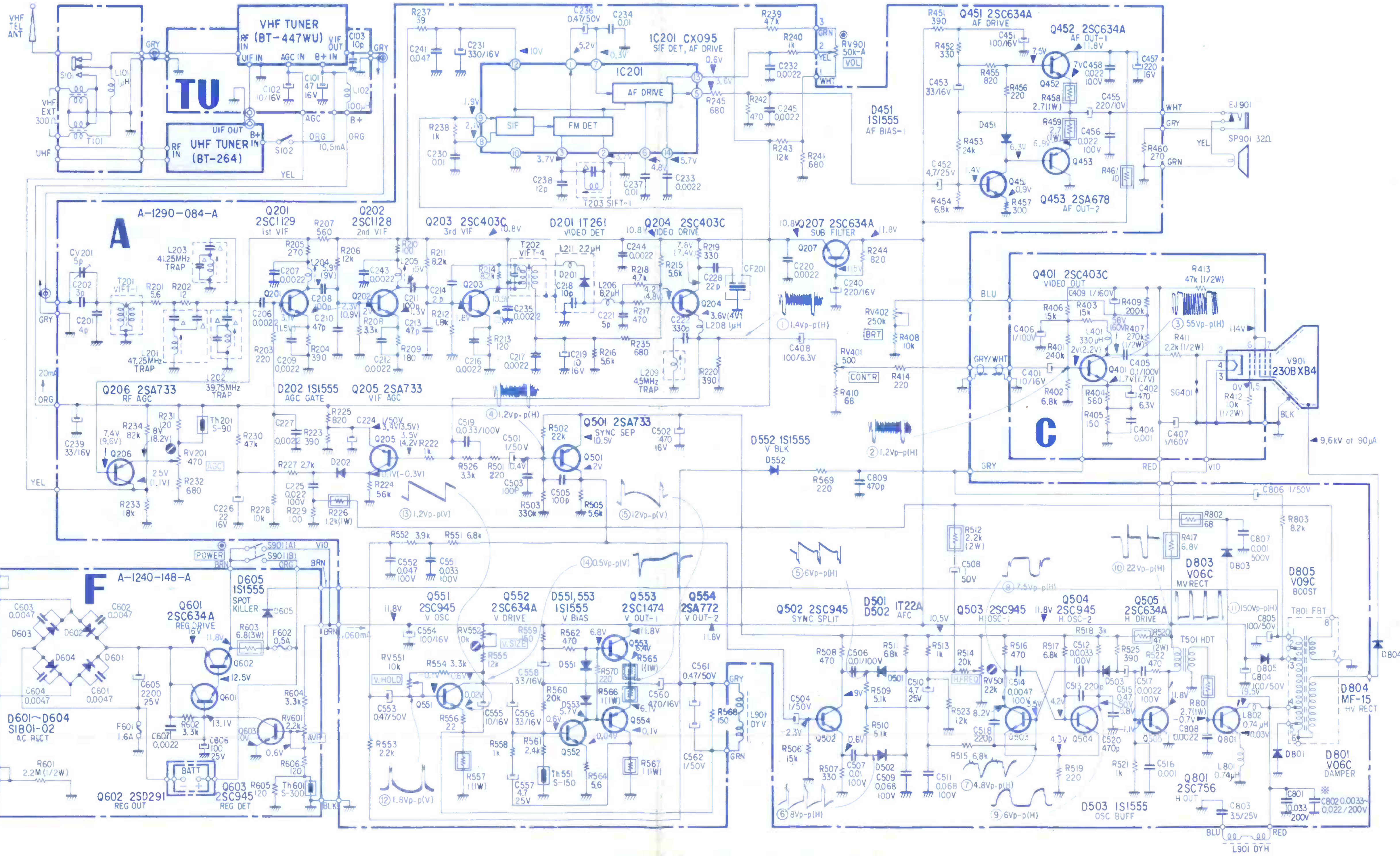
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

Note:

1. All capacitors are in μF unless otherwise noted. pF = μμF
   50 WV or less are not indicated except for electrolytics.
2. All resistors are in ohms, ¼W unless otherwise noted.
   kΩ = 1000 Ω, MΩ = 1000 kΩ
3. △ : internal component.
4. ✱ : selected to yield optimum performance.
5. ⊏WW⊐ : nonflammable resistor.
6. ▭ : panel designation.
   : adjustment for repair.
7. Voltages are measured from chassis to point indicated by using a VOM (20 kΩ/V).
   Readings in ( ) : taken with no signal input
   (BRT control ...... MAX ↻
   CONTR control ... MIN ↺)
   Voltage variations may be noted due to normal production tolerances.
8. ◉ : S901 is ganged to RV901.
9. All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
10. S102 is mounted on VHF tuner.
11. ● : adjustable without removing cabinet.

This set is equipped with a polarized AC power cord plug (one blade of the plug is wider than the other). When replacing the AC power cord, be sure to use it having the specified part number and connect it as shown in this diagram.

Note: The components identified by shading are critical for safety. Replace only with part number specified.



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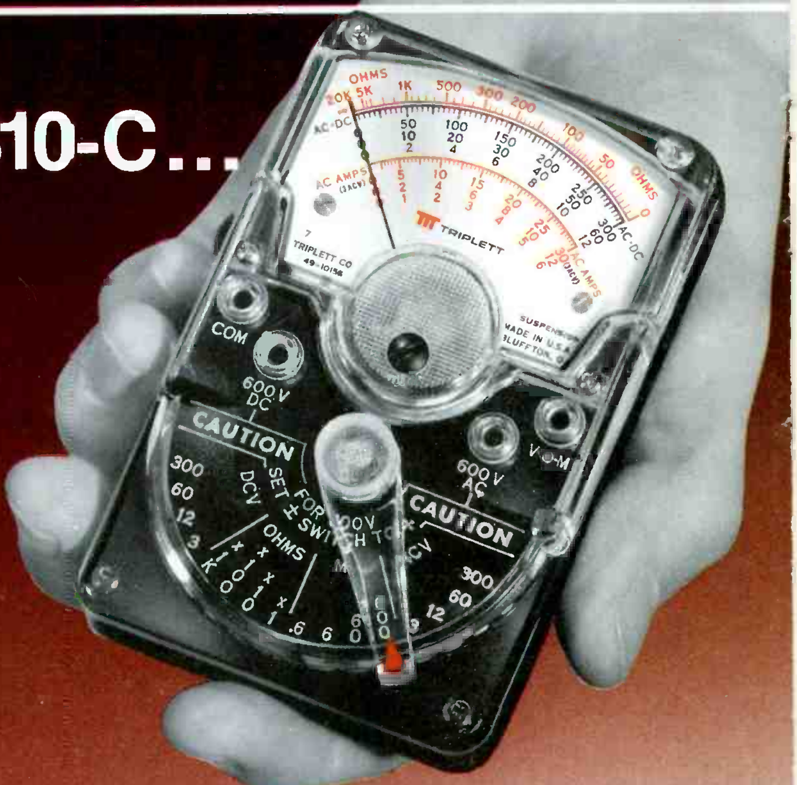

Hand-size, but big on performance, the drop-resistant Model 310 VOM with high impact thermoplastic case is a boon to field servicemen, as well as circuit designers, technicians, electrical maintenance engineers, and the price is right on for vocational and hobby use.

MODEL 310 (with 18 ranges) . . . Only $60.

1. Drop-resistant, hand-size VOM with high impact thermoplastic case.
2. 20,000 Ohms per volt DC and 5,000 Ohms per volt AC; diode overload protection with fused R x 1 Ohms range.
3. Single range switch; direct reading AC Amp range to facilitate clamp-on AC Ammeter usage.

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Versatility of the Model 310 and 310-C increases with the use of optional accessories like the Model 10/10-C clamp-on ammeter and the Model 101 line separator. They both come complete with 42" leads, insulated screw-on alligator clips, batteries and instruction manual.

For a demonstration, contact your Triplett distributor, Mod Center or representative.

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