MARCH 1973 • 75 CENTS A HARCOURT BRACE JOVANOVICH PUBLICATION

ELECTRONIC TECHNICIAN/DEALER

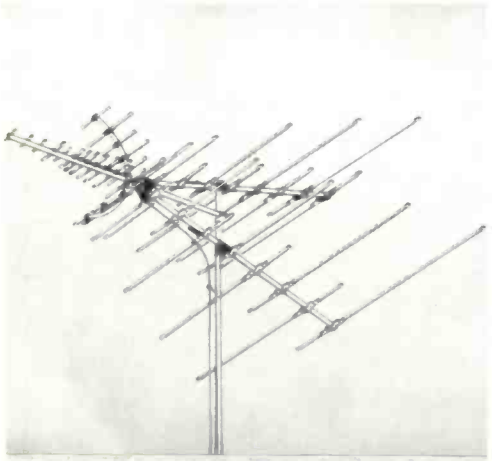
WORLD'S LARGEST TV-RADIO SERVICE & SALES CIRCULATION

The Best TV Signal—Compared to What?

Troubleshooting Intermittent Circuitry

SSB Marine Radiotelephones

WINEGARD HAS PULL!



Pull enough to bring in those distant stations—those hard-to-get channels—pull enough to feed more than one set! Try Winegard's CW-980 Color-Wedge VHF-UHF-FM model, with its optional antenna-mounted solid state preamplifier, for the ultimate in TV reception.

Or, for strong-signal areas, try one of Winegard's smaller models. They offer the same high quality, the same protective gold finish, the same two-year replacement policy. If the Winegard name is on the box, you can be confident it's an antenna with real "pull"—and that's the name of the game!

Winegard Antennas For Trailers and Boats

SR-20T

Specially designed SENSAR solid-state antenna for boats & recreational vehicles—extra strong construction.

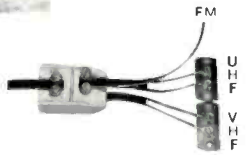
Winegard Accessories For Complete Systems...

BC-782 BOOSTER-COUPLER
Solid-State Booster-Couplers for all-channel TV and FM signals to 2 to 4 sets.

CC-282 COUPLER
All-Channel non-amplified couplers to connect two sets to one antenna.

HA-130

Winegard's new "Hideaway" Travel antenna for trailers, boats, campers, folds like an umbrella for travel!



CS-380 BAND SEPARATOR
Band separators to connect 75 or 300 ohm downlead to 300 ohm UHF, VHF & FM terminals.

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TV outlets in a variety of models for all-channel TV and FM reception plus rotor.

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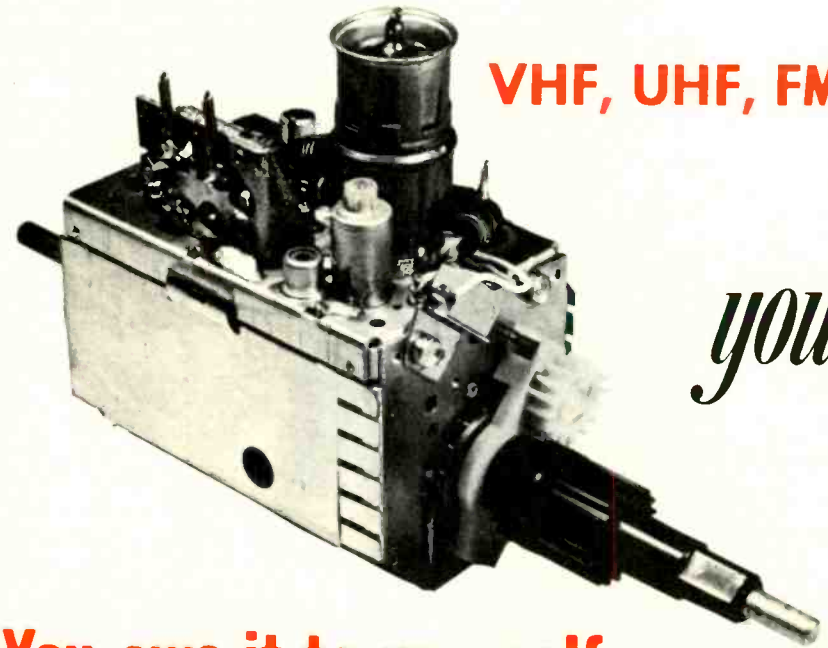
Winegard Company—3000 Kirkwood Street · Burlington, Iowa 52601

. . . for more details circle 136 on Reader Service Card

TV TUNER SERVICE



VHF, UHF, FM or IF-Subchassis. . .
. . . All Makes

you get...

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You owe it to yourself

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6. **Friendly, helpful personalized service!**

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.. Precision Tuner Service

PTS

VHF-UHF-FM	$ 9.95
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CUSTOMIZED REPLACEMENTS AVAILABLE FOR $12.95 UP (NEW OR REBUILT)

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SOUTHWEST—	P. O. Box 7332—Longview, Tex. 75601	Tel. 214/753-4334
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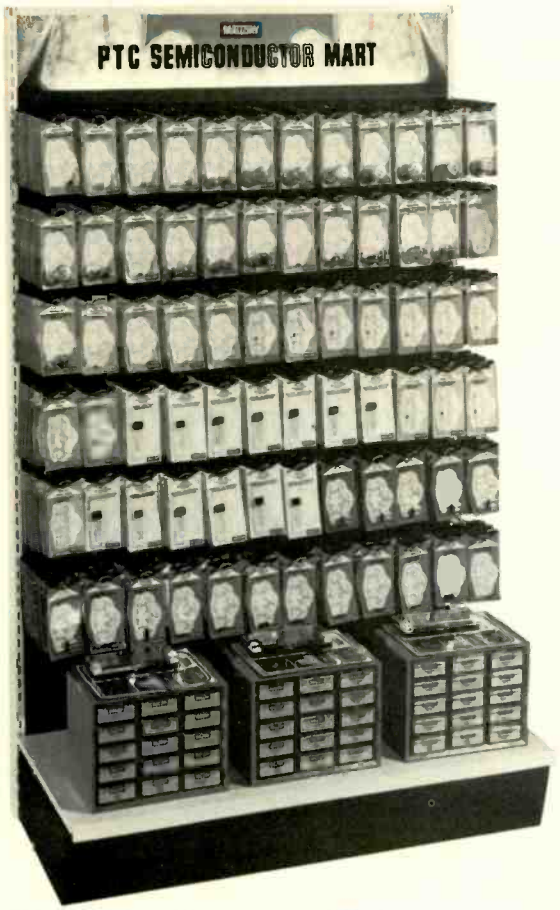
Look for the PTC *Please The Customer* Semiconductor Mart at your Mallory Distributor's.



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ELECTRONIC TECHNICIAN/DEALER

MARCH 1973 • VOLUME 95 NUMBER 3

This month's cover photo, courtesy of the Winegard Co., shows a technician from Alpha-Omega Applied Electronics, Inc. of Bellevue, Nebr., installing a new antenna system.

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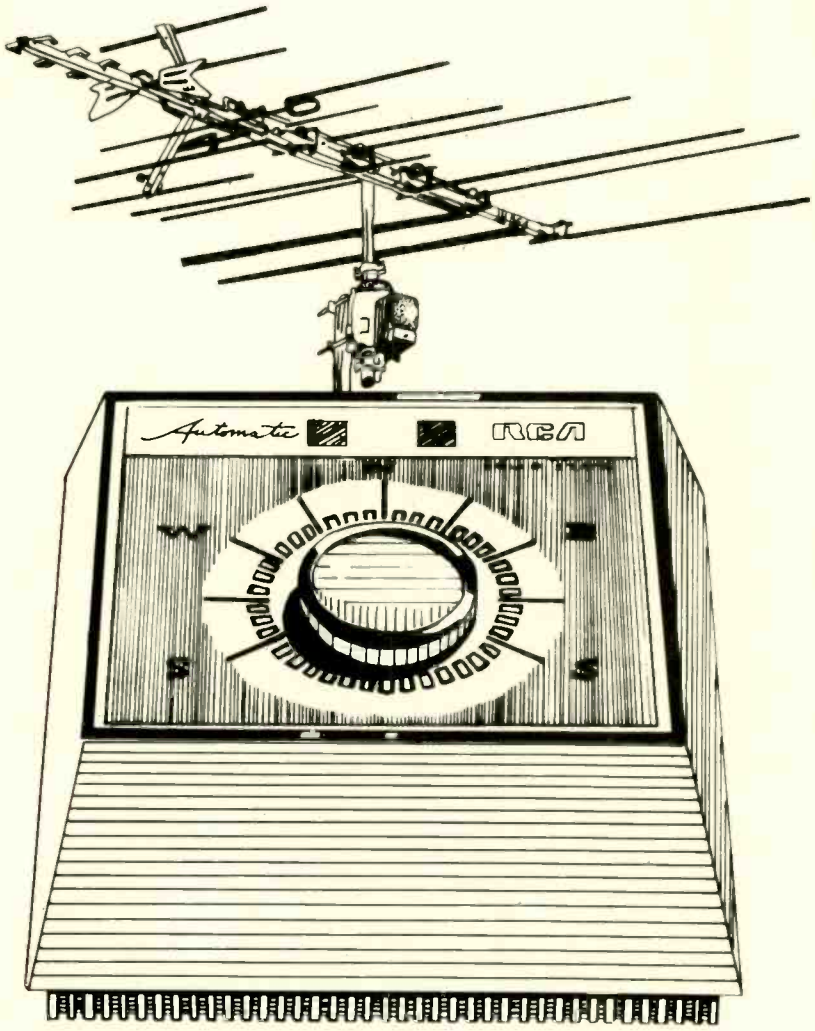

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RCA

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Burning Our Bridges

Being as human as everyone else, I am, of course, somewhat sensitive to criticism. . . but *never* to such a degree that I will run away from a good fight!

From a comment such as this, some readers that do not know me personally might jump to the false conclusion that I might be one of those out-spoken characters with an oppressive personality that dominates every situation and conversation. However, those that have met me report quite the opposite, indicating that I spend so much time just listening that they wonder if I am ever going to present a personal view. (So much for wasted space concerning my own personality.)

Occasionally your editor receives a friendly chiding from association people—particularly from those involved in the CET program—complaining about our publication of letters critical of their goals. We also print an occasional letter that is critical of your editor and the contents of this magazine. Such a letter has been included in this month's issue, and we expect to continue our policy of printing the majority of the responsible letters received—whether or not they agree with the views of your editor. To do otherwise would be to impose a sort of censorship that would be a discredit to our publication. We might not agree with what all our readers say, but we will certainly defend their right to say it.

This publication has been extremely strong in its support of our professional associations (particularly in the monthly Editorials, which need not represent the views of anyone *but* your editor). In fact, such support has been so strong that one friend at a recent board meeting suggested that it might be safer if these Editorials were printed on asbestos. However, despite our strong support, we realize that there is another side to every position . . . a side that can be presented in our Letters to the Editor Column.

Your editor feels that basically this world contains but three groups of people: Those that support a particular concept or its adaptation, those that oppose it, and those that appear devoid of any serious convictions. (We would define a neutralist as one that supports a seemingly neutral position, rather than devoid of any position.) The so-called "silent majority" (as defined prior to its use by Vice President Agnew) in this country or the "masses" in Russia represent the unconcerned that allow themselves to be directed like sheep. These are the people that make a Hitler possible.

At one time I was the editor of a publication that was basically for engineers in another field. Those subscribers used to exasperate me for their failure to respond—quite unlike the readers of this publication. As a deliberate plot to provoke them into expressing at least some personal viewpoint, I reprinted a speech concerned with the Supreme Court's failure to allow a decision that would have permitted the flow of more natural gas to California. The author of that speech spoke of this as an "Alice in Wonderland" situation. I supplemented the article with appropriate illustrations of Supreme Court Justices using line drawings from a 19th Century edition of the original novel. *Not one engineer was provoked into a response!*

In regard to an editorial that displeased some of his readers, the editor of another publication that also serves our industry gave the excuse that "his girl" wrote it and there wasn't time for him to read it prior to publication. Such is *not* the case with the editor of this publication. Every Editorial bearing my signature is written by *me*. Not only do I write it, I personally proofread it in galley, dummy and page-proof form. Thus, except for some unforeseen printer's error, every word attributed to me is my own—and I have had every opportunity to change it. It is *my fault* if it is wrong. Thus I *do* burn my bridges behind me. There can be no excuse that I did not know exactly what I said!

Your editor makes no claim of always being on the right side of every issue. He merely claims that "this is the 'truth' as he sees it!" Every attempt is made to be accurate, fair and in the best interest of the majority of our readers. However, it is our readers who must digest this information and make the final judgement.

Despite some *very minor* reader opposition, we do intend to continue our efforts to improve the technical competency of the electronic technician, the business skills of the service dealer, and to support the professional trade associations that are dedicated to this same purpose. It is your editor's belief that those readers not benefiting from all three of these goals will be adequately enough served by the remaining two to warrant their continued use of our publication.

We cannot possibly all have the same needs and opinions. But, whatever our opinions, let us hope that they are formulated out of reason rather than from blind prejudice or for merely selfish ends. And let us be willing to exchange viewpoints with others of different positions. It is far better that we express our views, that we work to achieve the goals that we believe in and burn a few bridges behind us—even when in error—than it is to be like the man who's gravestone read: "Here lies a man who displeased no one. Born: January 1, 1859. Died: ?"

Phillip Dahlen, CET

LETTERS

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

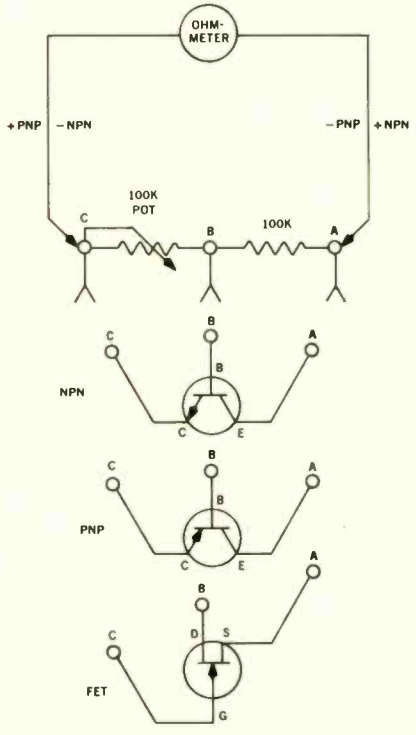
Simple Transistor Tester Worth Passing Along

I came across a simple transistor tester that may be worth passing along.

Almost every transistor checker that I have come across has too many functions for the working technician that wants to know if the thing is good or bad. When in the field, I couldn't care less about I_{CO}, I_{CCO}, I_{CES}, I_{EO}, h_{fe}, etc.

In the Navy we used a VOM connected from collector to emitter to obtain a reading, and then shorted the base to the emitter. If the resistance went up, the transistor was good. This was an excellent, easy way to test transistors—at least germanium transistors. Most silicon transistors have too high an emitter-to-collector resistance.

But I have found that with just two resistors and an ohmmeter almost any



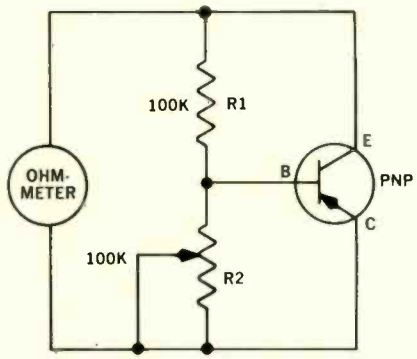
transistor or FET can be accurately tested. And with some experience, gain can be approximated, transistors can be matched, etc.

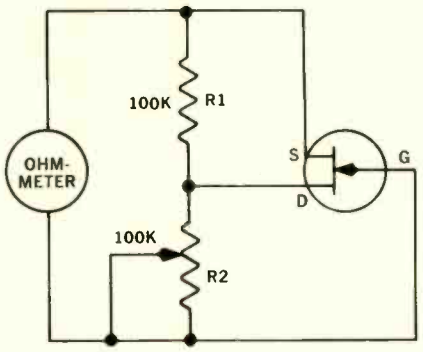
No batteries or switches are necessary since current is obtained from the ohmmeter.

Varying potentiometer R2 causes the transistor to go from saturation to cutoff, the ohmmeter reads the "transfer" of "resistance"—a high resistance at cutoff and a low resistance at saturation.

For an FET, the procedure is similar. The bias is varied in the drain lead, but the results are similar.

BARRY ANDERSON, CET





More Satellite Information

I read with interest your November editorial titled "Space Age Neighbor," concerning "Anik," the Canadian Domestic Satellite. Since you invited readers to send in any available information on reception of the TV signals, types of antennas used, signal frequencies, etc., I thought you might be interested in some of the following:

1. The communications system operates in the 6GHz band on the up-path and 4GHz band on the down-path.
2. The available bandwidth is divided into 12 separate RF channels spaced 40MHz apart, each channel having a useful bandwidth of 36MHz. There will be 10 channels normally in operation, with the remaining two used for stand-by operation.
3. The 12 channels in the satellite "receive band" start with Channel 1 on a center frequency of 5945MHz, Channel 2 is on 5985MHz . . . and so on up to Channel 12 with a center frequency of 6385MHz.
4. The satellite "transmit band"

continued on page 10

This tube has a 1-Year Warranty.
This tube has a 2-Year Warranty.
This tube has a 3-Year Warranty.

The choice is up to you.

Now, you're the one to decide the best type of customer warranty for Sylvania Color Bright 85® replacement tubes.

The one-year warranty is basic. GTE Sylvania gives you that.

But, through your distributor, you can offer a 2- or 3-year warranty for just a little extra cost.

No matter which warranty you offer, it's backed up all the way.

The whole idea of this program is to give you and your customers an added incentive for using Color Bright 85 replacement tubes.

Now, you can offer your customer the warranty that suits both of you best.

Or better yet, you can offer him all three.

Talk to your GTE Sylvania distributor to get full details.

Sylvania Electronic Components, 100 First Ave., Waltham, Mass. 02154

GTE SYLVANIA

LETTERS . . .

continued from page 8

channels have center frequencies of 3720MHz (Channel 1), 3760MHz (Channel 2), . . . up to 4160MHz (Channel 12).

5. The system utilizes *FREQUENCY MODULATION* for all communication services. Eventually, pulse coded modulation (PCM) may be used for analog voice channels.
6. The satellite features a minimum effective radiated power of 33dBw per RF channel in a beam covering the whole of Canada (and the northern U.S.A., as you indicated). In order to allow the use of non-tracking antennas at the earth stations, close control of the satellite's position is provided (±0.1° longitudinal drift control).
7. Initial plans call for the placing of two satellites in orbit, with a third one launched when required to replace a failed satellite or accommodate system growth.
8. As I understand, seven of the 10 available channels are already in customer service, some of the customers being the CBC (three channels: two in English and one in French), CN/CP, and Bell Canada.
9. TV service is provided both to network stations in southern Canada and to remote areas in northern Canada; while message traffic service is provided between main centers in southern Canada and between remote communities in northern Canada.
10. Each RF channel is capable of supporting up to 960 one-way voice circuits or one color-TV video signal and two 5kHz audio circuits.
11. *Network TV stations* provide for the transmission and reception of TV signals of sufficient high quality to be used by the CBC domestic network. There are six stations of this type located near St. John's, Newfoundland; Halifax, Nova Scotia; Montreal, Quebec; Winnipeg, Manitoba; Regina, Saskatchewan; and Edmonton, Alberta. Each of these stations is equipped with a 33.3-ft dish antenna that provides over 50dB of gain. The antenna feeds a parametric amplifier.
12. *Remote TV stations* provide for the reception of TV signals in remote communities that are not connected into the terrestrial microwave relay network. These remote communities are usually equipped with a low-power TV transmitter which provides limited coverage of the surrounding area. There are 24 stations of this type, and they make available to remote centers the same TV programming as is available in the larger population centers. Each station is equipped with a 26-ft diameter dish antenna and parametric amplifier. Antenna gain is 48.5dB.
13. Because the ERP from the satellite is only 33dBw (transmitter power of 7dBw, i.e. 5w, augmented to 33dBw by the antenna gain), and because the satellite is so distant (22,000 miles above the equator), it appears to me that actual signal strength on the earth is too weak for citizens to pick up directly with limited facilities. And even with high-gain antennas and high-gain low-noise front ends giving an acceptable s/n ratio, there would still be the problem of converting the 36MHz wide frequency-modulated microwave signal into a standard 6MHz channel with the usual AM picture carrier and FM sound carrier for ordinary VHF or UHF receivers.
14. So it appears that our domestic satellite was not meant for direct signal pick-up by the public, but for reception by elaborate ground stations from which the TV signals can be distributed by local re-broadcasting or by cable TV to nearby communities, or put on the national network for coast-to-coast distribution.

I hope that the above information answers some of your questions. Further data on the Telesat system may be obtained by writing to Ottawa, Ontario and asking for a copy of "TelSat" (Technical Pamphlet TC-72-005, Issue No. 1, December 1972). It is an excellent 60-page publication which contains a wealth of data on our domestic satellite system, the spacecraft, satellite control, earth stations and communication networks, complete with several maps and photographs. The address is:

TeleSat Canada
333 River Road
Ottawa, Ontario
K1L 8B9

Much of the data in the 14 points above was obtained from this brochure.

LAMBERT C. HUNEAULT, CET

Educational TV Satellite

I am following the TV satellite development with great interest and hope you stay on top of this subject.

We understand that some five intermountain states have set up a fund—this includes Idaho—for a satellite for educational purposes. So the public will be served. It's about time.

I have followed the CATV situation for years. They have their limitations, but I do not like their attitude toward the public.

ED PRATT

Every Coin Has Two Sides

I could ignore this and be one of the silent majority, but since I have been a subscriber to ELECTRONIC TECHNICIAN/DEALER for 23 years, I feel I have to get this off my chest. ELECTRONIC TECHNICIAN was the best there was for many years, but I am sorry to say that I no longer feel that way.

I am interested in technical information, not some "Archie Bunker" wasting space telling me how great some organization or CET program is, or how great it is to be independent. These things are fine for some but not for everyone.

Many years ago I belonged to a union but I did not feel independent. I want to be judged on how well I do my job, not what a union president can get for me. Unions are fine for some, but I prefer merit. OK?

As for CET, I could add a page of letters after my name but what good would it do? I think it is performance that counts—if you are independent or work for a large company. It is how fast and how well you do your work, not how many degrees you have, that rings the cash register.

As for being independent, or should we say self employed, what is so great about it? Are the independents really that independent? I don't think so. I have worked for both and I will take the company owned service. Again I say, this is not for everyone, but let's compare.

I work a 40-hr week with 1½ time for all overtime—where before it was can to can't. I get paid holidays with my family, where before it was not unusual to be called out on these days. I now get four weeks of vacation. What independent can close for four weeks and still get paid for it? I now have a paid retirement plan and insurance, where there had been none before. I now work on only one brand, not every make or model that may come in. I have company paid training, not just what I could get on my own. My pay is as good, not counting my benefits, as I could get in a small shop. Job security is better as I don't worry about the owner selling the business or retiring, or maybe turning it over to someone who doesn't like the way I look.

What I am trying to point out is that every coin has two sides. I have good friends who are independent. Some belong to organizations, some have college degrees, but I don't condemn them and they don't condemn me—so why should you? There is more than enough service business for everyone, so there is no reason for anyone to be for or against any person, company or brand. Friendly competition is the way it should be, and to each his own way.

N. N. JONES

There Has Been Considerable Improvement

There has been considerable improvement in ELECTRONIC TECHNICIAN/DEALER since you took over as Editor. Especially I appreciate the listing of the authors of your articles, something that wasn't done prior to your editorship. Personally I am much more apt to read an article on most any subject by an author I know and respect, than I am to read an article on a subject of immediate interest and concern written anonymously or by a completely unknown author (unknown, that is until he establishes a reputation).

BURTON HOLLEY

A Few Words of Praise

Just a few words of praise for the fine work and service of ELECTRONIC TECHNICIAN/DEALER magazine to those engaged in the electronics field. Personally, I congratulate you for your stand on satellite TV systems and on your continuous effort to upgrade the television technician's image to the public.

Working in a television station for the Spanish speaking people here in San Antonio, Texas and holder of a First Class Radiotelephone license, I support and believe in the CET Program. No matter how you look at the issue, it is a proof of reliability, skill and professionalism of the individual holding the certification. Keep up the good work.

I am preparing myself for the CET Examination. Also, I would like to see in your magazine an article on transistorized ignition systems.

JUAN S. SANCHEZ

MOVING?

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

READERS' AID

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

For Sale

I have a Hewlett-Packard Model 3445A AC/DC Range unit plug-in for H-P 3439A-3440A, and 3434A, in new condition for sale.

S. K. GIBSON
P.O. Box 324
Waltham, Mass. 02154

I have for sale, a Sencore Transistor/FET Tester, Model TF-151, which was purchased recently. Make an offer.

BYRON LADUE
13 Revere Dr.
Rochester, N.Y. 14624

I have for sale picture-tube rebuilding equipment. All accessories included for B/W and color tubes.

EASTERN C.R.T.
73 Selden Blvd.
Centereach, N.Y. 11720

I have Riders Radio Manuals, Volumes 8 to 21 with index for sale. Make me an offer.

STANLEY TROCH
290 Main St.
Spotswood, N.J. 08884

I have 35 assorted copies of Wallace Telaides from the years 1946 to 1958. No reasonable offer refused.

STANLEY TROCH
290 Main St.
Spotswood, N.J. 08884

Business for Sale

I am planning to retire and have a TV/radio sales and service shop for sale. The cement block building is 40 by 30 ft with full basement. I have been a Zenith dealer for 15 years with a good service business. Write for particulars.

HUBERT SINGLETON
Box 74
Albion, Ind. 46701

Solution Wanted

We have a persistent problem that no one in our area has solved satisfactorily. Perhaps a reader has a prac-

continued on page 60

Sliding Door

Swinging Door

Sales leader for 12 straight years.

Same Price

Only Ford vans have so many better ideas that make vans easier to drive, to service, to use.

Ford offers you a choice of conventional swinging doors or, at the same price, a sliding side door for cargo handling in cramped alleys and beside loading docks. Three separate tracks—at top, bottom and center—give bridge-like support for solid, smooth one-hand operation and tight door seal.

Shorter outside, easier to park. Compared to other makes with similar loadspace, Econolines have significantly less overall length for better maneuverability in city-delivery operations.

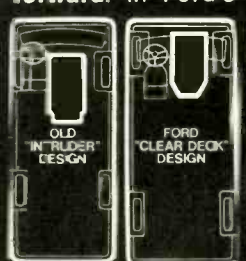
Easy, out-front servicing. Routine service points are right at hand under convenient outside hood: water, oil, battery, wiper motor, voltage regulator master cylinder, and many others.

Strong, Twin-I-Beam Independent Front Suspension—Ford's exclusive design smooths the going for both load and driver. Two forged steel I-beam axles provide strength and durability; wide wheel stance means stability in cross winds.

Wider at top for built-ins. Body sides are more vertical, wider apart at top than other vans. Built-in units fit better.

Big payloads. Three series, in two lengths, offer maximum payload of over two tons.

Engine clear forward. In Ford's van design engine is all the way out of the cargo area. Over 8½ ft. clear floor behind driver's seat, over 10 ft. in the SuperVan



FORD ECONOLINE VANS

FORD DIVISION Ford

Availability may be subject to Environmental Protection Agency certification

. . . for more details circle 115 on Reader Service Card

TECHNICAL LITERATURE

Antenna Systems

A 48-page catalog of antennas, accessories and electronic reception aids is said to be the most complete product guide to antenna system installation ever published. It provides data on several hundred different models of indoor and outdoor antennas for VHF, UHF and FM; antenna kits; mounts and mounting hardware; guy wire; transmission wire; masting; chemicals; rotators; UHF converters; antenna amplifiers; color boosters; home system amplifiers and distribution systems; couplers and passive networks. MATV antennas are also featured. Sales Manager, Channel Master Div. of Avnet, Inc., Ellenville, N.Y. 12428.

Electronic General Line

Nearly 5000 items in seven different product lines are featured in the new FR-73-74 general line catalog. Included in the 312-page catalog are the following product divisions: GC Electronics, Walsco, Electrocraft, Ultron-Magic Color, Telco, Audiotex and Calectro. GC Electronics, Division of Hydrometals, Inc., 400 S. Wyman, Rockford, Ill.

Adhesives

A 6-page bulletin describes a new line of improved alpha cyancacrylate adhesives called Super Instant Weld. The literature gives detailed information on four different types of the quick-setting, permanent bond adhesives. Also included is a two-page chart of specifications concerning setting time, appearance, viscosity, refractive index, flash point, etc., as well as application data as to the best type for use on various materials and combination of materials. Oneida Electronic Mfg. Co., Inc., P.O. Box 558, Meadville, Pa. 16335.

Electronic Instrumentation

This 52-page catalog provides detailed descriptions and specifications for the manufacturer's complete line of design and lab instrumentation. Included in the catalog is a new series of VHF counters; a complete line of scopes, generators, power supplies and digital voltmeters. Digital instrumentation reportedly includes the lowest

continued on page 58

Which color TV needs fewest repairs?

TV servicemen say Zenith.

Here are the questions and answers from a 175-city survey of independent TV service shops.

QUESTION: "In general, of the brands you are familiar with, which one would you say requires the fewest repairs?"

ANSWERS:	**Zenith**	**30%**
	Brand A	11%
	Brand B	9%
	Brand C	5%
	Brand D	4%
	Brand E	3%
	Brand F	2%
	Brand G	2%
	Brand H	2%
	Brand I	1%
	Other Brands	3%
	About Equal	21%
	Don't Know	11%

QUESTION: "In general, of the brands you are familiar with, which one would you say is easiest to repair?"

ANSWERS:	**Zenith**	**34%**
	Brand A	25%
	Brand B	11%
	Brand D	5%
	Brand F	4%
	Brand E	4%
	Brand C	3%
	Brand I	1%
	Other Brands	3%
	About Equal	18%
	Don't Know	1%

QUESTION: "If you were buying a new color TV set for yourself today, which brand would you buy?"

ANSWERS:	**Zenith**	**35%**
	Brand A	21%
	Brand B	12%
	Brand D	7%
	Brand E	5%
	Brand C	4%
	Brand F	4%
	Brand G	3%
	Brand H	1%
	Brand I	1%
	Other Brands	6%
	Don't Know	9%

NOTE: Answers total more than 100% because some servicemen named more than one brand.

How the survey was made.

One of the best-known research firms in America conducted this study of independent TV servicemen's attitudes toward brands of color television. Telephone interviews were conducted with TV servicemen themselves in April, 1972, in 175 cities from coast to coast. To eliminate the factor of loyalty to a single brand, the study included only shops which serviced more than one brand of TV.

We want to hear from you.

We're proud of our record of building dependable, quality products

But if it should ever happen that a Zenith product doesn't live up to your expectations—or if you would like additional details of the servicemen's survey—we want to hear from you. Write to the Vice President, Consumer Affairs, Zenith Radio Corporation, 1900 N. Austin Ave., Chicago, Ill. 60639. We'll give your request our personal attention.

At Zenith, *the quality goes in before the name goes on.*®

Simulated TV picture.

ZENITH®

The quality goes in before the name goes on®

NEWS OF THE INDUSTRY

Association Merger Meeting Again Postponed by Chairman

The rescheduled special "sub-committee" meeting called by Morris L. Finneburgh, Sr., E.H.F., Chairman of the Joint Merger Committee [the revised scheduling and substance of this committee was covered in the news story on page 14 of the February 1973 issue], was to have been held following the rescheduled NATESA Executive Council Meeting, held February 3rd and 4th in Kansas City, Mo.

Mr. Finneburgh, Sr., reports that as a result of his not receiving any response from either Leo Shumavon, President of NATESA, or Frank Moch, Executive Secretary of NATESA, this second attempt to hold a special meeting was again postponed.

At its meeting, the NATESA Executive Council went on record as still being in favor of merger, but declared that before future Joint Merger Committee Meetings be held (like the one held in Memphis, Tenn., last September and described on page 25 of our November 1972 issue) a "By-Laws" be developed by NATESA for comparison and analysis with the similar accomplished project by NEA. The council appointed Bob Harrison as Chairman of NATESA's "By-Laws" Development Committee.

In speaking with your editor, Mr. Finneburgh, Sr., indicated that it is his belief that due to the many contradictory statements that have been made concerning their positions in regard to merger, and the need for more details concerning how they would wish to relate to an association resulting from merger; a meeting of these leaders is definitely a must in order to clear the way for an effective meeting of the Joint Merger Committee. He has therefore announced his intention to contact both Mr. Schumavon and Mr. Moch, requesting that they advise him where and when they would agree to attend such a sub-committee meeting. The leaders of NEA have already indicated their willingness to attend a meeting as called by the Chairman of the Joint Merger Committee—Mr. Finneburgh, Sr., [note the news story just below this one].

Mr. Finneburgh, Sr. has requested that we publish his appeal that all members of both associations write their association presidents requesting that immediate action be taken to implement an honorable merger. They are: Mr. Charles Couch, Jr., CET, President of NEA, 608 N. Main, Gainesville, Fla. 32601; and Mr. Leo Shumavon, President of NATESA, 1716 Tyrone Blvd., St. Petersburg, Fla. 33710 (Winter) or 375 Geneva Ave., Dorchester, Mass. 02122 (Summer).

Official News Release States NEA'S Position Regarding Merger

The following official news release was prepared by the NEA Board to clarify its current position concerning NEA/NATESA merger. (Due to the current delicate merger situation, all of our future news concerning NEA merger will be issued by the Chairman of the Joint Merger Committee—Mr. Morris L. Finneburgh, Sr., E.H.F.)

Phoenix, Ariz., January 27, 1973

At the August 1972 Convention in New Orleans, a resolution was passed supporting a merger between NEA and NATESA. This was followed at the October NEA Board Meeting in Omaha with a resolution endorsing its Merger Committee and authorizing that committee to take a vote of the NEA membership to complete a merger with NATESA prior to the next Joint Convention with NATESA in Kansas City, Mo., in August 1973.

At today's NEA Board Meeting the NEA Merger Committee offered the following resolution:

"NEA is awaiting action from NATESA's Executive Council regarding the anticipated merger. NEA strongly feels that it is to the best interest of service association members and the industry as a whole, that NEA and NATESA continue to work cooperatively on current and future industry problems including the coming August joint convention in Kansas City, and that NEA and NATESA continue to seek ways of combining into a single representative organization."

The NEA Board cast a unanimous vote in support of the above resolution, supplementing it also with the following resolution:

"We endorse the Leaders and Staff of NEA and the functions and actions of our Merger Committee. We encourage a meeting of these people with NATESA Leaders as scheduled by the Chairman of the Joint Merger Committee."

Statistics Compiled Regarding CET Exam and ISCET Membership

Some interesting statistics were recently compiled at the NEA/ISCET Headquarters concerning the number of people in various states that have taken the CET Exam and the number of CET's that have joined ISCET as of December 31, 1972.

Since these statistics indicate the state or nation in which one passes the exam, and not where a CET is residing, you will note that in some areas it would appear as though there were more members of ISCET than CET's—a situation which cannot exist—some CET's having merely taken their examination elsewhere or having moved.

The extremely low percentage of ISCET members in California is currently due to a problem that has been experienced in getting the California State Electronics Assn. to approve ISCET Members. This is a problem that we expect to see resolved in the relatively near future.

State	CET's	ISCET Dues Paid	ISCET Dues Not Paid
Alabama	31	5	0
Alaska	2	2	0
Arizona	74	12	4
Arkansas	4	1	0
California	1132	36	14
Colorado	57	13	2
Connecticut	34	8	1

continued on page 18

Introducing the expensive digital multimeter that doesn't cost a lot.

The B&K Precision Model 281. A solid-state, lab-quality portable instrument that measures AC/DC voltage, current and resistance.

The state-of-the-art Model 281 shows readings on a large, clear, 2½-digit numeric display. It also has positive over-range and reverse-polarity indication. There's no need to switch leads. You can reverse polarity at the flick of a switch.

Model 281 readings are faster and more accurate than analog-type meters. Unlike hard-to-see needle indicators, you can read the large, illuminated numerals—inclucing the decimal point—from a distance.

Featured are 26 ranges: five DC voltage, 100mV to 1000V, with 1% accuracy and 10 megohms input impedance; five AC voltage, 100mV to 1000V RMS, five DC current, 100μ A to 1A; five AC current, 100μ A to 1A; and six resistance, 10 ohms to 10 megohms.

With built-in protection, the 281 can't be harmed by overload. And for safety's sake, it has a three-line AC grounded cord.

Everything about the 281 says expensive—except the pirce.

Call your B&K distributor.
Or write Dynascan Corporation.

Very good equipment at a very good price. B&K

$169.95

Product of Dynascan Corporation, 1801 West Belle Plaine Avenue, Chicago, Illinois 60613

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NEWS...

continued from page 16

State	CET's	ISCET Dues Paid	ISCET Dues Not Paid
Delaware	14	4	0
District of Columbia	2	0	0
Florida	173	23	2
Georgia	42	7	3
Hawaii	8	0	0
Idaho	45	7	1
Illinois	143	17	7
Indiana	306	31	13
Iowa	137	25	3
Kansas	124	17	0
Kentucky	123	15	3
Louisiana	33	6	2
Maine	34	4	2
Maryland	39	9	1
Massachusetts	20	6	1
Michigan	45	8	0
Minnesota	15	3	0
Mississippi	16	3	0
Missouri	45	8	0
Montana	3	4	0
Nebraska	124	11	2
Nevada	20	3	0
New Hampshire	2	1	0
New Jersey	32	11	0
New Mexico	3	2	0
New York	80	17	2
North Carolina	68	6	1
North Dakota	2	0	0
Ohio	180	37	7
Oklahoma	4	1	1
Oregon	353	28	14
Pennsylvania	87	22	3
Rhode Island	8	0	0
South Carolina	11	1	1
South Dakota	5	3	0
Tennessee	21	3	1
Texas	223	21	6
Utah	23	2	0
Vermont	1	1	0
Virginia	52	7	3
Washington	161	14	6
West Virginia	17	3	0
Wisconsin	46	7	1
Wyoming	4	2	0
Argentina	13	0	0
Bermuda	1	0	0
Canada	13	0	0
Chili	1	0	0
Germany	3	0	0
Guam	2	0	0
Mexico	0	1	0
Puerto Rico	1	0	0
South Africa	1	1	0
South Korea	2	0	0
South Vietnam	5	1	1
Thailand	1	0	0
Turkey	1	0	0
Uruguay	1	0	0

continued on page 42

It's like having a license to live better!

More money, better jobs, greater opportunities...a Government FCC License gives you a big edge, and CIE has the course you need to get it...backed by a Money-Back Warranty.*

Compare what you're doing now—auto mechanics, assembly line, shop work—with the exciting new opportunities you can have as a *licensed* service technician!

In just 10 years the number of licensed communications *stations* has grown from 100,000 to over 2,000,000—including those for police and fire departments, airlines, merchant marine, pipeline companies, telephone companies, taxicabs, railroads, trucking firms, delivery services! And according to Federal law, no one is permitted to operate or service such communications equipment without a Commercial FCC License or without being under the direct supervision of a licensed operator.

Industry needs licensed technicians

In addition to communications stations, TV and radio, think of the opportunities in big industry. At leading companies like Burroughs Corporation, for example, "The licensed man is the one called upon to handle the challenging assignments."

Start your own business

If you don't want to work for somebody else, you can open your own shop or service business. The basic principles of Electronics you learn in preparing for your Government FCC License exam will give you the know-how—and your License will *prove* it to everybody!

CIE training really works

Why not start preparing for your FCC License right now . . . in your spare time . . . at home . . . with a licensing course from Cleveland Institute of Electronics? CIE's training has proven so effective that in a recent survey of 787 CIE graduates, better than *9 out of 10* CIE grads passed the Government FCC License exam! That's why CIE can offer their famous Money-Back Warranty:

* When you complete any FCC Licensing course, you will be able to pass your FCC exam or be entitled to a full refund of all tuition paid. This warranty is valid during the entire completion time allowed for your course—you get your FCC License OR YOUR MONEY BACK!

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All CIE career courses are approved for educational benefits under the G.I. Bill. If you are a Veteran, or in service now, check box on reply card or coupon for G.I. Bill information.

Send for FREE book today

Mail the reply card or coupon today and we'll send you, absolutely free, our information book on how to get an FCC License. And we'll *include* our FREE illustrated school catalog. For your convenience, we'll try to have a representative call. If the reply card and the coupon have been removed, write: Cleveland Institute of Electronics, Inc., 1776 East 17th Street, Cleveland, Ohio 44114.

Joseph E. Perry of Cambridge, Massachusetts passed his license exam and got a new job with 40% more pay. "I'm now an Engineering Specialist with National Radio Company, Inc., testing prototype equipment. CIE training gave me the electronics technology I needed to pass the exam for First Class FCC License. I'm already earning 40% more than I could without my CIE training."

Ralph E. Butler, Columbus, Ohio, signed up for CIE's First Class FCC License course and completed it while in the Navy. "Now I'm responsible for transmitter operations at both WSPO-AM and WVKO-FM. CIE meant so much to me, I talked two of my Navy buddies into taking courses."

CIE Cleveland Institute of Electronics, Inc.

1776 East 17th Street, Cleveland, Ohio 44114
Accredited Member National Home Study Council

Please send me your two FREE books:

1. Your book on "How To Get A Commercial FCC License."
2. Your illustrated school catalog, "Succeed in Electronics."

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Address_____

City_____ State_____ Zip_____

☐ Veterans and Servicemen: Check here for G.I. Bill information. ET-65

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NEW AND NOTEWORTHY

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

FIELD STRENGTH METER 700

Offers laboratory features for field use

An all solid-state portable field strength meter has been specifically designed for the professional antenna installer. The Model FSM-4 meter includes separate VHF and UHF tuners—providing continuous coverage from 54 to 216MHz and from 470 to 890MHz—used for obtaining signal-strength readings in dBmv and microvolts that are reportedly accurate from 10μv to 100,000μv. Features that are said to be normally associated only with laboratory or bench models include audio output jack; gold-plated, accurately calibrated attenuator switches; and 75Ω type F connector for signal input. The meter is calibrated to read average signal strength and the entire unit operates on four standard 9v batteries. Accuracy of readings in the VHF band are reportedly ±3dB while UHF readings are accurate to within ±4dB. The unit measures 9 in. by 6½ in. by 4 in. Blonder-Tongue.

FOR MORE NEW PRODUCTS SEE PAGE 49

SWEEP GENERATOR 701

Checks alignment on each VHF TV channel when used with scope

The Model SMG-12 Sweep Generator has been designed to be used in conjunction with the manufacturer's SMG-39 or other equivalent generator. The combination of the two instruments permits checking of alignment on each of the VHF TV channels. Also supplied as part of the alignment package is the Model SMG/UHF balanced detector. This device permits alignment checks on each of the UHF channels from 14 through 83. The unit is reportedly supplied with all necessary cables and probes. Lectrotech Inc.

DIGITAL MULTIMETER 702

Highly accurate portable unit

Introduced is a low-cost portable multimeter that is said to be highly accurate. The Model 4442 DMM, a battery operated 3½ digit portable instrument, is small enough to be carried in a standard attache case and reportedly features an accuracy of .05%. The instrument is designed specifically for field use. It is reportedly light weight and shock-proofed, and can be carried anywhere. A self-contained rechargeable battery pack reportedly provides up to 12 hr of continuous operation. Some 20 ranges cover 200mv (100μv resolution) to 1000v ac/dc, 200Ω (0.1Ω resolution) to 20M, plus ac and dc current. Accessory plug-in shunts are available to extend the ac and dc current ranges. The unit features solid-state LED readouts, a dual slope high impedance bipolar A/D converter, a single MOS LSI plug-in chip for all of the logic circuitry, auto-polarity, automatic blanking of unused digits to conserve battery life and high impact case. The instrument is said to be supplied with four nickel cadmium "C" cells and a battery charger. Weight 2½ lb. Weston Instruments.

As you can see, your Sylvania distributor has 200 picture tubes in stock.

And they're all in just five Sylvania cartons.

Because our line of five color bright 85XR® OEM-quality tubes gives maximum coverage of 19V, 21V, and 25V diagonal sets with a minimum of stock.*

It also means faster service because these Sylvania picture tubes are direct replacements. You replace a kimcode with a kimcode, a bonded with a bonded.

And then, there is the biggest advantage of all: You can count all your large-screen color tube needs on the fingers of one hand.

See your local GTE Sylvania distributor for a complete replacement list. With needs that you can count on one hand, you can bet he has the tube you want in his hands.

Sylvania Electronic Components, 100 First Ave., Waltham, Mass. 02154.

*XR23VANP22/
SRE25BGP22 ..... Replaces 53 types
XR23VAQP22/
SRE25BHP22 ..... Replaces 27 types
XR19VABP22 ..... Replaces 22 types
XR18VAHP22 ..... Replaces 82 types
XR18VADP22 ..... Replaces 16 types

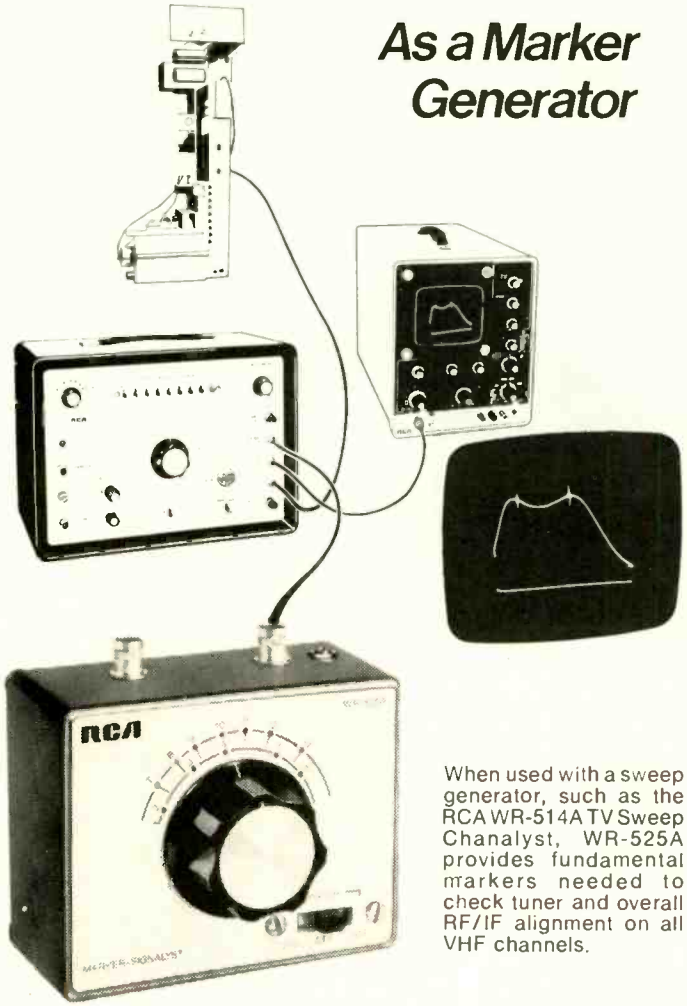
GTE SYLVANIA

New! RCA WR-525A Marker/ Signalyst

$46.50

Optional Distributor Resale Price
(not including RCA VS323 or equiv. 9-V battery)

As a Marker Generator



When used with a sweep generator, such as the RCA WR-514A TV Sweep Chanalyst, WR-525A provides fundamental markers needed to check tuner and overall RF/IF alignment on all VHF channels.

As a Signalyst

Modulated with an external video signal, such as the output of the RCA WR-515A Master Chro-Bar Color Bar Generator, WR-525A provides test patterns on all VHF and many UHF channels. Use these patterns to check tuner operation and receiver performance. Also use them to check CATV and MATV systems, as well as closed-circuit RF distribution systems and their amplifiers, line-splitters, and other components.

See your RCA Distributor for more information. Or write RCA Test Equipment Headquarters, Harrison, N.J. 07029.

RCA
Electronic Components

. . . for more details circle 130 on Reader Service Card

The Best TV Signal—Compared to What?

by Donald K. Collins

Manufacturers are making antennas better than ever before. They ought to—there hasn't been a single earth-shaking development in the TV antenna field in years.

Joe Barno, Denver area MATV contractor, connects a down-lead to the test antenna in preparation for determining the available TV signal at an installation site.

■ For at least five years, progress in TV antenna design has been a steady refinement of known principles. Certainly, there have been many ingenious applications of these principles, among them the twin-boom or "truss design" antennas that use the booms as feedlines instead of using phasing harnesses to connect end-fired elements.

Such developments, however, are fundamentally structural and do not reflect any startling increase in signal capture or gain.

Others have developed configurations, such as the wedge, that simultaneously increase the signal capture area and add structural strength and rigidity. Still others have tackled the UHF reception problem with parabolic planar arrays and corner reflectors.

The author is Technical Editor for the Winegard Company.

In yet another corner of the antenna vineyard, a small group of true believers has been laboring to adapt the log-periodic design to TV reception. To date, the term "log-periodic" remains only a fancy name for a configuration. Indeed, no manufacturer makes a *true* log-periodic antenna for TV use at this time. That makes sense, because almost everyone knows that a true log-periodic antenna is broadband, but has only moderate gain. Even the design patent met defeat at the hands of the Supreme Court in 1969.

In a garage somewhere, another John Winegard may be laboring to produce another "Electro-Lens," but don't hold your breath. For one thing, the attention of most manufacturers has shifted from the development of really new antennas to the improvement of whole head ends. Since antenna technology is far ahead of the rest of head-end development, most are aiming to bring head-end equipment up to the level of the antennas they already manufacture. Preamplifiers, impedance matching transformers, down-lead and splitters are all under scrutiny — as are mixer-equalizers, band splitters and the like. So, in the near future, any startling developments are more apt to come in these components than in antennas.

Meanwhile, the technician faces a multitude of problems that won't go away, and, indeed, that are getting worse every day.

One of the biggest is interference, principally from FM, but also from a variety of other sources. A leading manufacturer recently recognized the problem with the introduction of a TV antenna line that claims a high "interference rejection

The collapsible mast in the foreground fits handily in the service truck, ready for use wherever Joe Barno goes. The 5-ft. sections of mast permit quick, convenient height adjustments of the test antenna.

Up goes the top section as Joe Barno prepares to test signal strength with an antenna cut to Channel 9. The home owner at this location has had a weak signal problem on this channel.

Rough orientation, once the test antenna is up, is the first step in determining the direction for best signal reception.

factor." It is unimportant that this turns out to be a different way of interpreting front-to-back ratio—the significant fact is that this manufacturer, among others, recognizes that interference is a problem for the technician who bears the responsibility of getting his customer a good picture.

That, after all, is the name of the game—a quality picture on the customer's screen. All the fancy equipment in the world isn't worth two cents unless it improves the picture beyond what the TV-set owner could get with a pair of rabbit ears.

So, with the level of radiation pollution steadily rising, most manufacturers who are aware of the technician's problems, and are concerned about them, are striving to alleviate these problems through the meticulous design and manufacture of their antennas. Not only are they getting as much gain as possible, they are choosing design methods that enhance such criteria as directivity, impedance matching and front-to-back ratio. Sure, some manufacturers play the numbers game, stating higher gain figures by comparing their antennas to an isotropic radiator. But that's on a level with the old gag that goes: "How's your wife?" and the other guy says, "Compared to what?"

What are some of the problems that plague technicians, and what can they do about them?

One of the most bothersome is "ghosting." There is an almost infinite variety of causes of ghosts. This kind of interference is a headache because the TV-set owner can see it. He might live with a moderate amount of cross-modulation or a little noise in the picture, because he can ignore them. But when it comes to ghosts, they bother his vision and he complains.

There is one big reason why ghosts are more prevalent today than they were several years ago. There are more high-rise buildings and more sources for multi-path reception. Almost every metropolitan area has more sources for multi-path reception than it did 10 years ago. A glance at the skyline of San Francisco or Chicago will support that. There are more potential sources of re-radiation, too.

To the technician, though, the kind of restrictive covenant that prevails in many new housing developments today, the one that requires no TV antennas on the roof, is nothing but pain. It means that the antenna must look through some attenuating substance that makes up the roof. And those foil-backed insulating batts do a great job of conserving heat, but they are absolutely opaque to RF signals. If you have to put the antenna inside, you had better ask about the insulation.

The plain truth is that builders do not know what they're doing to TV reception. What's more, they don't generally care. (In order to care, they would have to understand RF characteristics, but their attention is riveted on their own problems.) Combine them with the environmentalists who are forcing more and more antennas under cover, and the technician often faces a real test of his technical knowledge and resourcefulness.

Caught between these forces and the TV set owner who laid out a bundle for a new color-TV set and now wants a good picture, what weapons can the technician lay his hands on?

Phillip Dahlen, editor of this publication, has suggested "peaking up" an antenna for maximum gain and interference rejection ("The Best Antenna," ELECTRONIC TECHNICIAN/DEALER, August, 1972.) It takes a fair amount of expertise to perform this kind of surgery, and it should be noted that there are very few distributors and/or manufacturers who will accept such a modified antenna if it is returned for credit.

Mr. Dahlen also mentioned that most manufacturers will tailor-make a "special" to fit peculiar reception conditions. Most special antennas are made

Connecting down-lead to the field strength meter, Joe Barno prepares to take readings.

While rotating the mast and antenna with his left hand, Joe Barno watches the field strength meter to find the direction from which maximum signal strength is received.

The field strength meter shows 1800μv of signal available on Channel 9 with the antenna at optimum orientation. Even with system losses, Joe Barno calculates that this should be sufficient to give a good picture on the TV set without additional amplification.

to eliminate rotors and to solve directivity problems. As far as gain is concerned, they do not usually work any better than a good standard broadband antenna.

The rub comes with that term "proper processing." How you, as a technician, treat or mistreat that signal after the antenna has captured it is a matter of deep concern to most manufacturers. That is why Winegard Company, among others, runs 14 seminars a year, plus numerous clinics, to help the technician keep up with the state of the signal-processing art.

Still using 300Ω twin-lead for down-lead? If you are, you risk direct-signal pick-up, and ghosts that you cannot get rid of. Not only that, but since most FM signals are both horizontally and vertically polarized, any long vertical run of twin-lead is likely to pick up FM interference. Are you doing anything about considerable differences in received signal strengths? If not, you run a strong risk of cross-modulation and adjacent-channel interference.

What constitutes an acceptable signal? As long as the signal-to-noise ratio is good, very weak signals can be made available to TV-set users. In the Omaha area, for instance, Alpha Omega Applied Electronics technicians regularly make an acceptable picture by TASO standards out of 70μv of Channel 12—a fringe signal received from Lincoln, Neb. Their customers are pleased and proud to show off their TV sets to friends and neighbors. Isn't that the kind of referred business we all can use? They do not use "special" antennas, either; just standard Winegard models from the SC Series.

Another weapon the technician can use is his field strength meter. With an FSM in your hand, there is no guess work about how much signal the antenna is gathering. After all, what difference does it make what the manufacturer claims for his Super-Duper Signal Sucker? The only important thing to the man who has to work with it is the signal he can get from it, right? All the wild claims in the world will not put a picture on the front of that tube—only microvolts coming off that antenna will!

Proper antenna pointing is another reason to use your FSM. For the best picture, you need the strongest signal you can get on every available channel. You must determine the best orientation for your antenna—and using a field strength meter is really the only accurate way to determine this.

If you can mount the antenna above the roof, so much the better—you have an opportunity to walk the rooftop and find out where you get the best signal. Sometimes even a shift of a foot or two will make an appreciable difference in signal, especially at UHF frequencies. Walk the roof with a test antenna (even a test dipole will do) and your FSM to determine the proper placement for your antenna. This location may not be the most convenient one—you may not be able to use an eaves mount for your mast, or a chimney strap. But if you are sincerely concerned about getting the best signal for your customer, you will tailor the mounting to the location where the best signal is available.

You can also "walk" in-

continued on page 34

CABLE ATTENUATION

Type of Cable	Cable Loss per 100 Feet				
	Channel 2	Channel 13	Channel 14	Channel 48	Channel 83
RG-59/U	2.6dB	5.4dB	8.4dB	10.5dB	12.0dB
RG-59/U Foam	2.1dB	4.1dB	5.8dB	7.1dB	8.0dB
RG-11/U	1.4dB	3.2dB	4.8dB	5.8dB	6.8dB
RG-11/U Foam	1.1dB	2.3dB	3.5dB	4.3dB	5.1dB

RINGING a Versatile Tool for the Technician

by Roland Fetzer

A great amount of service time is often spent needlessly locating a defective coil or transformer. Ohmmeter checks are frequently inconclusive and do not show up shorted turns, especially in windings with low resistance. Replacing unmarked coils can also represent problems. In many instances just knowing the dc resistance is not enough. It may be necessary to know the Q and the ac resistance (reactance) of the coil.

■ Checking a suspected coil or transformer usually involves replacing it with a known good one—a time consuming procedure, possible only if you have the proper coil on hand. If you had a laboratory bridge or Q meter you could measure the coil parameters and determine if it is defective, but most service shops do not have such equipment.

Ringing will not only solve these problems, it can be used to check the complete horizontal deflection system in a TV set—from the horizontal output transformer to the yoke—without disconnecting one wire or component (Fig. 1). Best of all, you already have the necessary test equipment in your shop—your scope.

Every coil is in effect also a tuned circuit. The layers of wire on a coil have capacitance between each other. Therefore, each coil represents a tuned circuit with inductance and some capacitance across it. Schematically we could show a coil as a parallel resonant circuit as in Fig. 2.

Every tuned circuit has a resonant frequency. If we inject energy of the correct frequency into it, then the energy will be passed back and forth between the inductance and the capacitance. It will act in a manner similar to a ball on a string swinging back and forth.

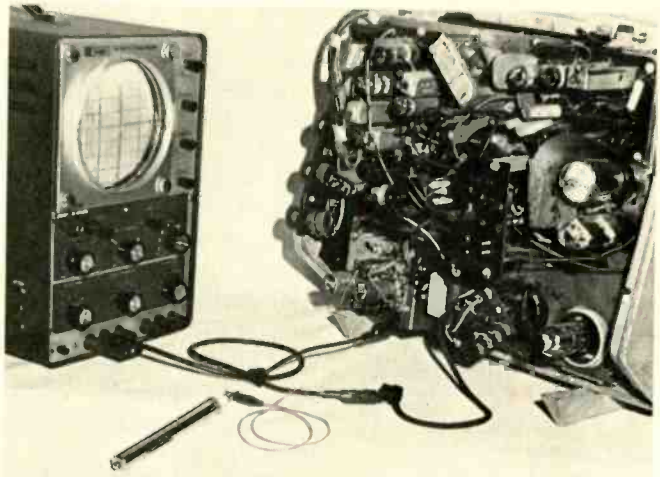


Fig. 1—Ringing test of a horizontal-output transformer using a pencil-type signal injector.

This exchange of energy in the resonant circuit would go on for ever if we had no resistance. Just as the ball would stop swinging if it did not receive a push, the energy in the coil must also be replenished. We can use this principle of a tuned circuit to test coils, audio and power transformers, IF transformers, chokes, loopstick antennas and horizontal-output transformers. We can also use this principle to determine some characteristics of a coil or a tuned circuit.

Just as we can watch a ball swing back and forth, we can also observe the exchange of energy in a coil. The wave train that we see on the scope is the energy exchange in the form of sine waves—decreasing in amplitude and dying out as the energy is used up.

Pulse Take-off Points on the Scope

Many service-type scopes have a pulse output terminal, while others do not. However, it is very easy to install such a terminal yourself if your scope doesn't have one (Fig. 3).

One of the most useful pulse waveforms in your scope comes from the blanking amplifier. Since the cathode of the scope CRT usually receives the blanking pulse, you can generally trace the cathode circuit back to the blanking amplifier (Fig. 5).

To obtain a high-level pulse, attach a mica capacitor of about 15pf to the plate of the blanking amplifier and bring it out to a binding post on the front of your scope (see Fig. 3). In this manner, you can obtain the steepest pulse consistent with the highest amplitude. Typical pulse voltages range from 600 to 800v p-p. For a low-level pulse, you can attach a similar capacitor to the cathode of the blanking amplifier.

Another source of pulse voltage is the horizontal circuit of your scope. As a matter of fact, this circuit provides a signal that is very handy to have available at the front of your scope. To obtain this signal, attach a .5mf, 600v dc-blocking capacitor to one of the horizontal deflection plates (in push-pull circuits either plate will do) and bring it out to a binding post on the front of your scope. You will thus obtain a saw-tooth wave that is variable in both amplitude and frequency. Its maximum amplitude can reach approximately 250v p-p, while its frequency can be determined by the horizontal-sweep frequency of the scope. This saw-tooth wave can be used in ringing, plus (in some TV sets) as a substitute for either the horizontal or

vertical oscillator for TV servicing.

In order to use this saw-tooth wave for ringing, make up a lead and connect a 15pf mica capacitor in series with it (Fig. 4). This "sharpens" the waveform so that you receive a very steep pulse.

Another source of test pulses is the cathode of the sweep oscillator. RCA Sales Corp. does furnish these points on its scopes, recommending a 680pf, 600v capacitor between the source and the binding post for the following models:

WO 91 A, B
Pin 3 or 8 of V9, 12AX7
WO 88 A
Pin 3 or 8 of V8 12AU7
WO 78 A, B
Pin 3 or 8 of V14, 6BQ7
WO 58 A
Pin 3 or 6 of V8, 6SL7GT
WO 56 A
Pin 3 or 8 of V10, 12AU7

If you do not want to use your scope as a pulse generator, you can instead use an external source such as a square-wave generator. A satisfactory pulse may also be obtained from an inexpensive pencil-type signal generator such as the one shown in Fig. 1. It will give you a square-wave pulse of about 50v p-p at about 3kHz.

Fig. 3—Pulse output terminals on a scope showing the "sweep" and "blanking" pulse binding posts.

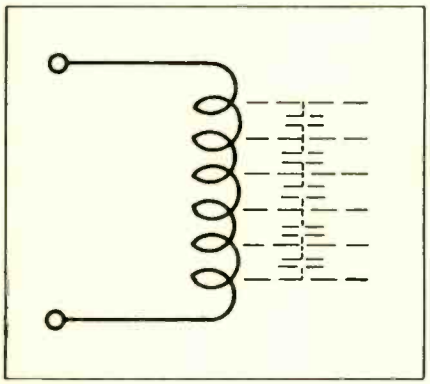


Fig. 2—A coil represented schematically to show capacitance between layers of wire.

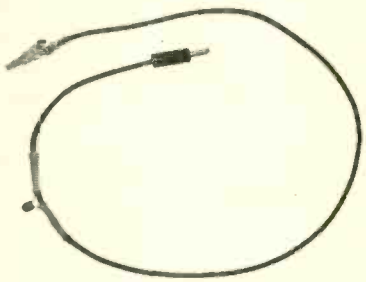


Fig. 4—Ringing lead made up by putting a 15pf capacitor in series with a wire and terminating it with an alligator clip.

How to Use Ringing Tests

If your pulse voltage is of the saw-tooth type, use a lead with the 15 pf capacitor in it (as shown in Fig. 4). Connect the lead to the top of the coil to inject the pulse (Fig. 6). At the same time, connect the vertical input of your scope to the same test point while connecting the scope ground lead to the bottom of the coil. Then move the VERTICAL GAIN control to its most sensitive position, and vary the SWEEP FREQUENCY control until you see the familiar damped wave train. You will then have to readjust your VERTICAL GAIN control for the proper height of the display (Fig 7).

You can also inductively couple the pulse voltage to the coil by winding a few turns of insulated wire, or gimmick, around one of the leads of the coil. Although you will then lose some of the amplitude of the pulses and your wave train will be somewhat smaller, you eliminate adding capacity to the circuit.

If you use a pencil-type signal injector as a pulse source, put a clip lead on the tip of the signal injector and clip the other end to the top of the plate cap of the TV set's horizontal-output tube. (If instead you hold the signal generator in your hand, the frequency tends to drift slightly, making it difficult to synchronize the wave-

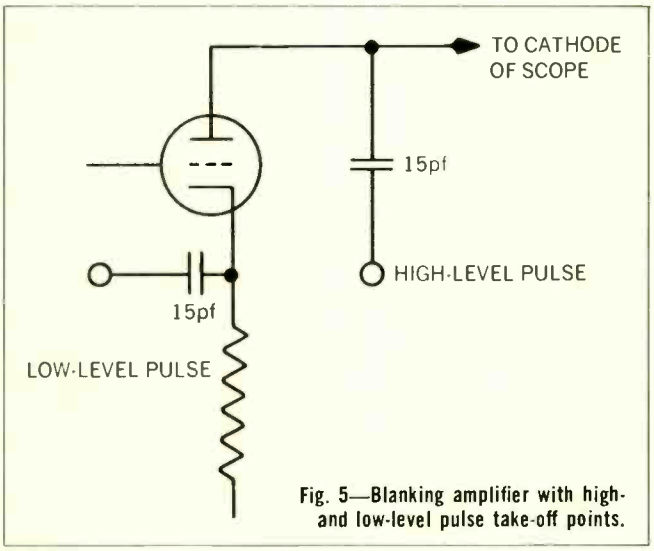


Fig. 5—Blanking amplifier with high- and low-level pulse take-off points.

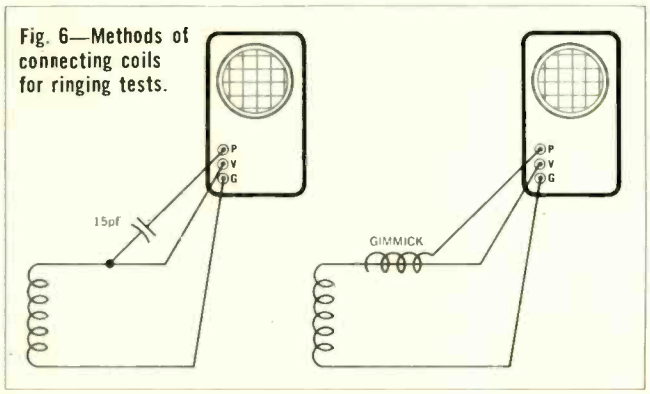


Fig. 6—Methods of connecting coils for ringing tests.

train on the scope.) The vertical input of the scope is also connected to this cap, while the ground clip of the scope is attached to the chassis, or B— in ac/dc sets. This arrangement of components (as first shown in Fig. 1) produces very satisfactory ringing patterns (Fig. 8).

A shorted turn in any of the sweep components —from the horizontal section of the yoke to the horizontal output transformer—will produce a very short damped wavetrain or no wavetrain at all (Fig. 9). After a few tests, you will quickly spot a defective component by its ringing pattern.

When testing components, the frequency of the scope should be set as indicated in the table shown below.

To individually test yoke windings, auxiliary components such as capacitors, resistors and thermistors must be disconnected in order to get the damped wave train.

Ringing patterns vary with the type of coil being tested. One example is the ringing in the horizontal-output transformer (Fig. 10). There you will note small oscillations riding on top of the ringing—indicating that it has more than one winding and each winding is coupled to the other. Since each winding has a different resonant frequency, we will not obtain a pure sinewave.

The pattern obtained from the 455kHz transformer illustrated in Fig. 11 indicates that we have two coils tuned to the same frequency. However, even there the primary and secondary coil have two slightly different nominal ringing frequencies and we thus obtain this RF modulated wavetrain. If we were to instead ring out a tightly coupled coil, we would not obtain these zero beat points because the coupling coefficient is then small and the two nominal frequencies of the coil would be so close that the zero beat points would die out before they could appear on the scope.

The waveform in Fig.

Component Under Test	Sweep Rate
Width coil	1kHz to 10kHz
Horizontal-linearity coil	1kHz to 10kHz
Horizontal-output transformer	100Hz to 1kHz
Deflection yoke	1kHz to 10kHz
Deflection circuit with yoke connected	1kHz to 10kHz
Deflection circuit with yoke disconnected	100Hz to 1kHz
Power transformers and chokes	100Hz to 1kHz

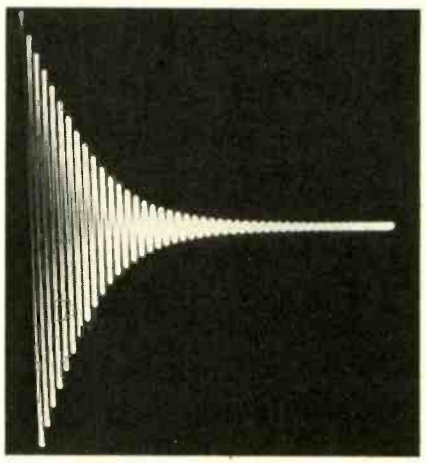


Fig. 7—Wave train of a horizontal-output transformer, using a pulse voltage obtained from the scope.

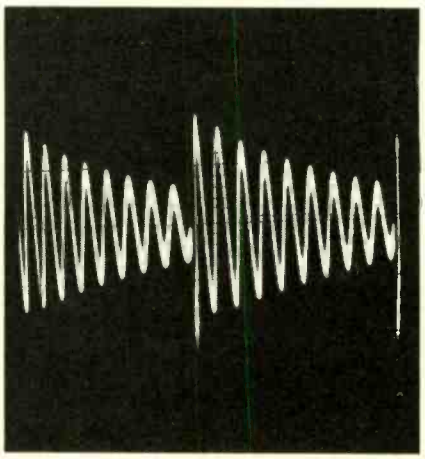


Fig. 8—Wave train of a good horizontal-output transformer using a pencil-type signal injector as a pulse source.

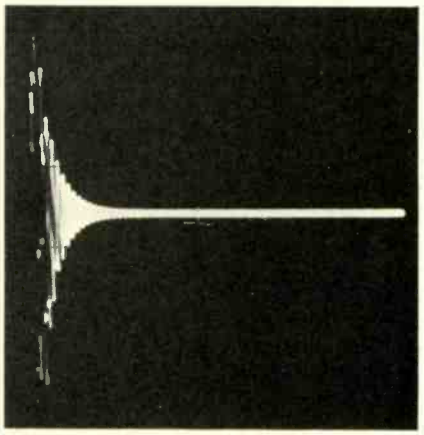


Fig. 9—A defective horizontal-output transformer. Note the very short wave train.

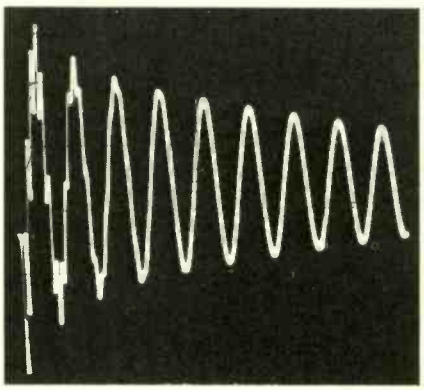


Fig. 10—This expanded trace of ringing in a horizontal-output transformer shows oscillations riding on top of the wave train.

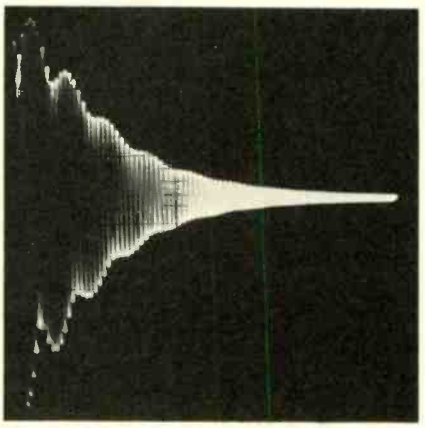


Fig. 11—The wave train of a 455kHz IF transformer.

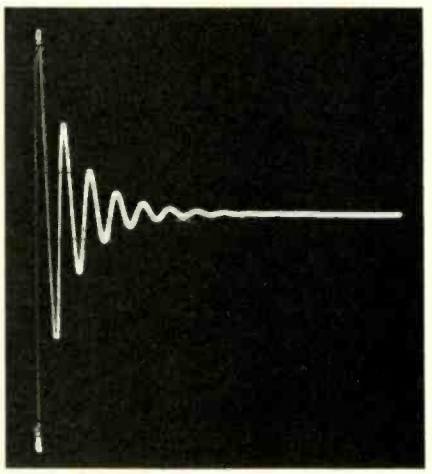


Fig 12—The wave train of a choke.

12 shows the damped wave train from a choke. Most iron-core transformers exhibit similar wavetrains. These devices have a relatively low Q and therefore show only a few cycles of the wavetrain.

Using Ringing to Measure Characteristics of a Coil

In servicing Two-Way Radio and in Amateur Radio work, it is sometimes necessary to determine if the Q of a coil or tuned circuit has changed due to moisture, age or dirt. It is fairly easy to determine the Q factor using ringing tests and the equation: $Q = 4.54 \times N$. N is equal to the number of cycles required for the wavetrain to decay to 50 percent of its initial amplitude (as in Fig. 13).

To measure the ac resistance of a coil at its ringing frequency (Fig. 14), we note the number of cycles needed to reach the 50 percent amplitude point of the wavetrain. We then connect a carbon potentiometer in series with the coil and adjust it until we reach the 50 percent amplitude point in half the number of cycles. The resulting potentiometer setting is then the equivalent to the ac resistance of the coil at its ringing frequency.

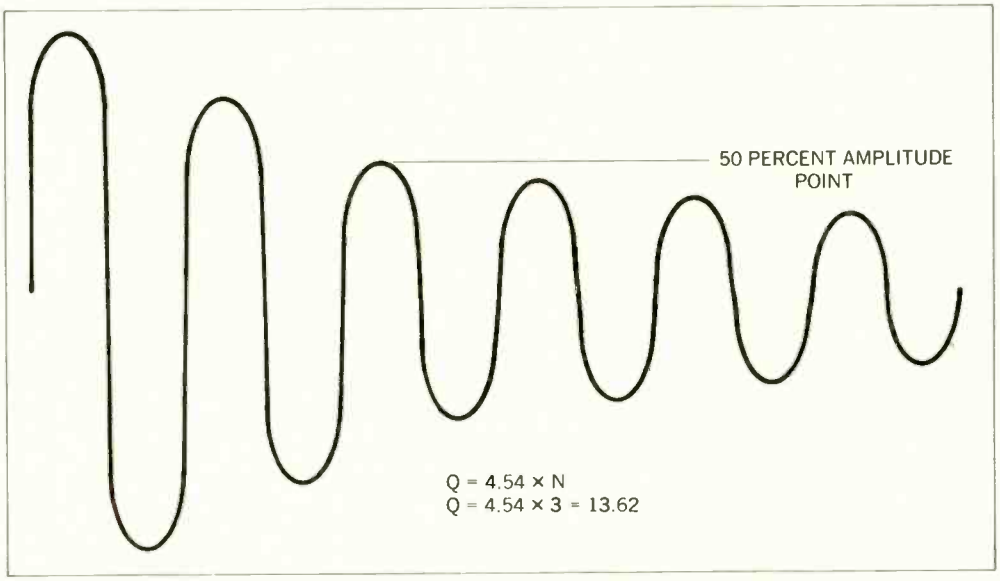


Fig. 13—The wave train may be used to determine the Q of a coil. In the equation, N equals the number of cycles up to the 50 percent point.

Fig. 14—An electronic technician is shown measuring the resistance of a potentiometer to determine the ac resistance of the coil.

This ac resistance, of course, changes with the frequency of the applied signal. If you are interested in a particular frequency, connect a capacitor across the coil until the coil rings at the frequency of interest and then repeat the procedure for measuring ac resistance. [*However, in this instance the resulting resistance does include the reactance of the capacitor that was added to the circuit. Ed.*]

When measuring Q and ac resistance, it is suggested that the pulse voltage be coupled to the circuit by means of a gimmick winding—this, in effect, eliminating the capacity of the signal source. Although the input capacity of the scope, of course, is also across the tuned circuit, in most cases it is so small that this does not matter.

Ringing tests of coils are so sensitive that if you short the filament winding of a horizontal-output transformer you will obtain the characteristic effect of a shorted winding and a damped wavetrain. A coil containing only 10 turns of wire will give you a good ringing pattern even if it won't even "tickle" your ohmmeter—having a resistance possibly as low as 0.1Ω.

Ringing is indeed a versatile tool for the electronic technician. It will save time and provide a means for testing components that have otherwise frequently defied testing. And it can be used as a

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Troubleshooting Intermittent Circuitry: A Logical Approach

by Lew Christy

Almost all of us have been harrassed by the very TV sets that we have attempted to service—the new and the old, but especially the new! Many of these new TV sets suffer from the "intermittents," a common phrase for a receiver that "sometimes" loses color, goes black, loses sound, etc.

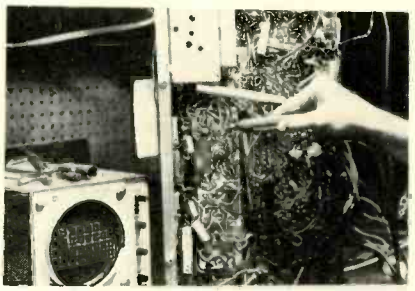
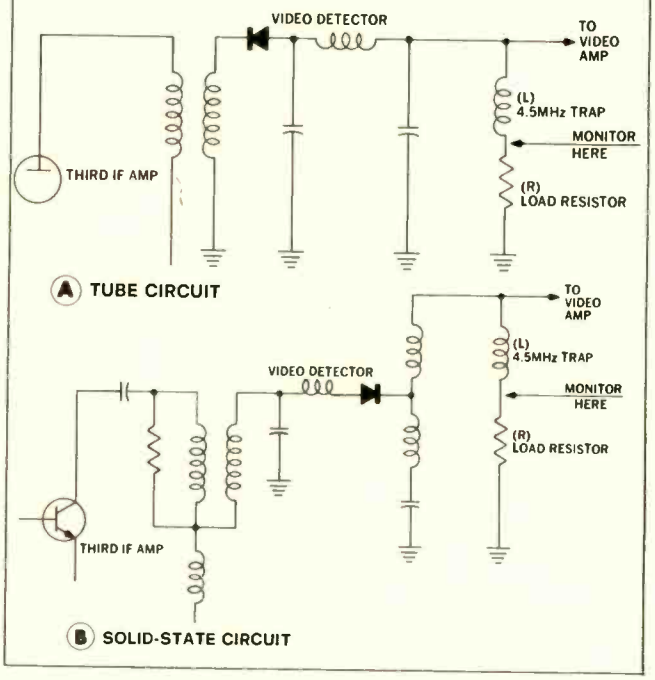


Fig. 1—We can monitor the detector output stage with a scope.



■ Many man hours are lost in trying to locate intermittents, which eventually become very annoying to both the electronic technician and the consumer. Once the problem is found and corrected, it is safe to assume that the TV set will not be back in the shop for a while.

Instead of trying to remedy their problems, some manufacturers are now trying to revolutionize their TV sets with gadgets such as electronic tuners (no moving parts), electronic color-tint circuits, and other sophisticated devices that tend to have sales appeal. Naturally, this adds to the burden of service techniques and causes a TV set to be more susceptible to a larger failure-frequency rate.

One large manufacturer, in trying to keep pace with its counterparts, began to encounter such a high rate of minor and major problems with its TV sets that it decided once and for all to eliminate the cause of the problems. It ceased production (literally) of its TV sets and is now exclusively producing household appliances and other fine products. However, we certainly do not recommend that other manufacturers follow suit.

To cite an example of the servicing dilemma, one TV-set manufacturer during the early summer of 1970 was evidently trying to bolster the U.S. economy by selling over one-million dollars worth of its warehouse stock to a nationwide discount department-store chain. This discount chain passed the savings on to the consumer by offering these TV sets, stereos and radios at a very low price.

Many service agencies suddenly found themselves very bogged down in their work load. The vast majority of these electronic devices found their way into the repair shop! One service company alone had almost 300 of these sets piled up waiting for repair.

The problems encountered with the greater portion of these sets were faulty wiring, defective tube sockets (and receiving tubes), poor circuit-board solder connections, broken switches and countless numbers of parts that were defective. Fortunately, most of the problems were detected before the sets were sold to the consumer.

But, many of the sets that were delivered to the customers' homes broke down within a matter of a few days. Many disappointed people had to wait for weeks while their "new" set was being repaired or waiting for new parts from this specific manufacturer.

Cases such as this are totally unwarranted. The only possible and conceivable means of producing a relatively trouble-free product is for the manufacturer to account for

100 percent quality inspection of components and workmanship. Random inspection of finished products in many cases seems to be the present standard.

Now, all this boils down to one specific area: Servicing the intermittent. This is one phase of TV servicing that will continue to haunt us for some time to come.

When making a service call to the home, the complaint may not even show up. In this case, the customer will be the best source of information in trying to localize the problem. Don't be afraid to give your customer the third degree. You are the sleuth, and you are being paid to track down the culprit. "Mrs. Jones, how often does this problem occur? Does the set act up after it warms up? How long after it warms up? Describe to me exactly what is happening on the screen when the problem occurs."

Diagnostic questions such as these will be very helpful in two areas: First, it will give you an idea of what stage (video, horizontal, vertical, etc.) the trouble may be occurring in. Secondly, you will be able to determine whether the set can be repaired in the home or in the shop.

Before the intermittent drives you from the battleground, you must equip yourself with the following combat equipment: a flameproof blanket, rubber mallet, soldering gun and a can of freeze spray. You will find that these items are the most time saving in locating an intermittent circuit. On top of this, of course, you must have both your VTVM and scope on full alert.

A large percentage of the intermittent problems occur in the video IF stage—loss of video (and sound) after warmup, no video until the set warms up, pulsating video, etc. However, such symptoms may fail to leave a clue as to whether the problem is before or after the video detector stage. To solve this, we can monitor the detector output stage with a scope (Fig. 1).

By monitoring between the video detector load resistor (R) and the 4.5MHz trap (L), we can determine by the distortion of the waveform whether the problem is before or after this stage. If the scope does not detect any distortion while the problem occurs, then we must look elsewhere. The next likely source will be the cathode circuit of the picture tube.

If such problems are localized to the video IF stage, and it is a solid-state circuit, the best signal source to check is the third IF amplifier. This circuit can cause several different symptoms. Usually the base-to-emitter junction will open up. By freezing this component, it will generally begin to conduct again.

For the intermittent that occurs after warm up (sometimes up to hours), it is best to place a flameproof blanket over the chassis (Fig. 2). If the problem seems to be a thermal one, it should show up much faster this way. Under such a heat condition (with the blanket over the chassis), the problem will usually be prolonged—thus making troubleshooting much easier.

In some cases the intermittent may be due to faulty joints (cold solder) or solder splashes over a pair of wires, barely shorting together. This is where the rubber mallet comes in handy. With the chassis operating in an upright position, gently tap the chassis in several locations. The problem will usually intensify as you tap closer to its source.

As shown in Fig. 3, heating a suspect component with the tip of your soldering gun can also tell you if it is defective. If the component does not seem to be the cause of the problem, it can be quickly cooled down to its normal operating temperature by using the freeze spray.

In the case of an intermittent vertical roll, place your soldering gun next to the suspect parts and heat them above room temperature, if necessary. Don't be surprised if the picture begins to roll—you've just hit the right component! This same procedure can be used in locating defective parts in the sync, chroma and other circuits.

A component that may have a slight leakage, such as capacitors or diodes, may be subject to over heating. The "freezing procedure" will quickly locate this type of failure.

It is totally unnecessary to use sophisticated and expensive test instruments in troubleshooting intermittent problems. A good reliable VTVM and scope, when used properly, will do a remarkable job for you. A VTVM can also be used in monitoring B+, AGC and audio circuits.

A point to remember: A chassis, while operating in the cabinet, is within its own environment. In other words, if an intermittent only occurs while the chassis is intact in the cabinet, you can be sure that you are experiencing a thermal problem. After the chassis has been removed from its environment, the components will operate much cooler and will undoubtedly operate normally. A blanket over the chassis, as explained previously, will act as a "temporary environment" in forcing the problem to occur.

After replacing the sus-

Fig. 2—For the intermittent that occurs after warm up, it is best to place a flameproof blanket over the chassis.

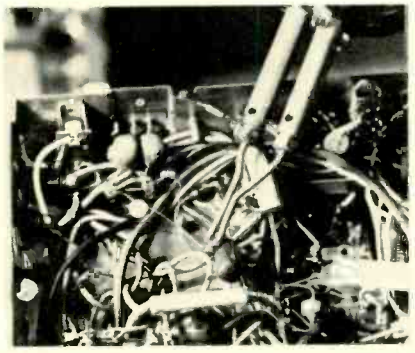


Fig. 3—Heating a suspect component with the tip of your soldering iron may indicate if it is defective.

continued from page 33

pect component(s), what can be more aggravating than to return the set, collect the bill and have the customer call up again with the same problem? The trick is to be sure you have corrected the problem in the first place.

Most people are very understanding. If you have any question or doubt as to whether you have actually cured the initial problem, explain to the customer that you would like to keep their set running in the shop for a couple of extra days or so. This will be sufficient time to "cook" the set and periodically glance at it while you do other work. If the set has been operating normally during this period, then it is safe to assume that it is free of any more defects.

Some intermittent problems can be cured in the home—loss of color, "snow," and occasional streaks through the picture. Complaints such as these give you a clue. The first thing to do is to inspect the antenna lead-in wire at the back of the cabinet and at the tuner. Many times I have found one strand of lead-in wire barely shorting against the opposite terminal.

There are no instruments on the market that will automatically locate intermittent problems for you. It takes patience, common sense and the ability to operate your test equipment in a professional manner.

Of course, we like the sets to be dead, have no vertical sweep, no sound or just plain loss of video! These problems we can tolerate. Where did those old-fashioned problems disappear to? ■

BEST TV SIGNAL . . .

continued from page 27

side the roof if there is attic space. Admittedly, the space is somewhat more restricted, but that is the very reason why you should seek the location where the strongest signal is available and locate the antenna there, properly pointed for best reception.

Chances are good that, if you picked the best location, you may have a necessary horizontal run of down-lead. This is no place to use twin-lead, because of the possibility of direct-signal pickup. If the length of your horizontal run of twin-lead is anywhere near a multiple of one channel's wavelength (and how can you miss?), you are almost certain to get direct pickup and, consequently, a strong ghost or less signal due to cancellation on that channel.

So you need to run coaxial cable for your down-lead. It is the best insurance you have—particularly the kind with a foil shield around the dielectric—against direct pickup and the ghosts it causes. This may mean that you have got to go back to the antenna output and match the antenna impedance with the cable impedance. Unless you have a 75Ω antenna, this is a necessary step; be sure of this point. (Winegard Company, for example, has recently converted its cut-to-channel Yagis to 75Ω, and several other companies list antennas with 75Ω impedance.) With such an antenna, no matching transformer is needed.

For very weak signals, you will probably need a preamplifier when you come off the antenna. But take care, if you have one or two very strong nearby signals, that the preamp you select has a total input rating higher than the total of the signals on all channels that you propose to put into it. Otherwise, you will go into cross modulation right there. Your aim is to equalize channels as much as possible, assuming an acceptable signal-to-noise ratio. You will never have a better S/N ratio than you have coming off the antenna.

This is also the time to get rid of any FM interference, if there is a history of such interference in your locality. Switchable (in-out) FM traps are standard equipment on Winegard preamplifiers, as well as many other makes. Or, if you are not using a preamp, buy and install an FM trap ahead of the matching transformer.

So, coming off your antenna, this is the order of signal processing:

1. **Preamplifier**—establishes the signal-to-noise ratio at the antenna and overcomes down-lead losses.
2. **FM Trap** — attenuates any FM signals that the antenna may have picked up by about 20dB, enough in most cases so that they will not cause those funny herringbone patterns, particularly on Channel 6 and the high band.
3. **Matching Transformer**—provides the proper impedance between your 300Ω impedance antenna and your 75Ω coaxial-cable down-lead.
4. **Down-lead**—Coaxial cable shields and protects your precious signal from interference until you can get it to the TV set. Use caution: coax has more signal loss than twin-lead, particularly at higher frequencies. If you are not accustomed to working with it, you had better check the table on page 27. Because cable loss and tilt problems are much greater at UHF frequencies, Winegard Company recommends RG-11/U foam type for all down-leads and trunk lines, and RG-59/U foam for feeder lines. Coax does have advantages, however; you can tape it right to the antenna mast if you want to—something you had better not try with twin-lead. ■

FOR THE TECHNICIAN . . .

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comparison method of testing—since you can compare the ringing that you know a properly functioning component should produce against the ringing of the component under test. With a little practice the alert electronic technician will resort to ringing before replacing a coil or a transformer. ■

SSB Marine Radiotelephones

by Leo G. Sands

It is a whole new ball game in Marine Radio. As of last January, the FCC will no longer license new AM Marine radios in the 2-3MHz band. To operate on the Marine radio channels, a boat must be equipped with a VHF/FM Marine radio for operation in the 156-162MHz band. In addition, a boat may be equipped with an SSB Marine radio for operation in the 2-3MHz and other Marine Bands below 25MHz. The VHF Marine radio is for short-range communications, while the SSB Marine radio is for boats that have need for communicating over distances greater than the capability of a VHF Marine radio.

■ The main reason for switching from AM to SSB in the MF and HF marine bands is frequency conservation. An SSB signal takes up less than half the band space of an AM signal. And it provides better communication . . . up to 9dB of improvement over AM.

SSB (single sideband) is not new. Hams and commercial radio systems have been using SSB for many years. It dates back to about 1923 when Lloyd Espenschied developed the technique while working for the Bell System. SSB did not become popular until recently because of the requirement for very good transmitter and receiver frequency stability. Also, it costs more than AM or FM equipment.

An SSB transmitter radiates no carrier signal. Only one sideband is transmitted. An AM transmitter, on the other hand, radiates the carrier plus two sidebands—the upper and lower. Each of the two sidebands contains the same intelligence. Therefore, only one is required. The carrier conveys no intelligence and is therefore not required.

When an AM transmitter is 100 percent modulated by a sine wave, the RF output increases 50 percent. For example, if the transmitter produces 100w of carrier signal, it also produces two sidebands with 25w of power in each. Thus, only 25w of the total available power is effectively utilized. On the other hand, an SSB transceiver can be designed to utilize all of the available power for transmitting intelligence.

An SSB signal, however, cannot be demodulated by an AM receiver unless it is equipped with a BFO (beat frequency oscillator). The signal,

A 10-channel SSB marine radio. *Courtesy of Airmarc Marine Products.*

which exists only when modulation is present, is intercepted by the receiver and is amplified. But, it must be restored into an AM signal before it can be demodulated. The BFO re-inserts the carrier that was suppressed at the transmitter. If the frequency of the suppressed carrier is 2MHz, for example, and the transmitter is modulated by a 2.5kHz tone, the upper sideband at 2002.5kHz will be transmitted. If, instead, the lower sideband is transmitted, it will be at 1997.5kHz. If the receiver employs a 455kHz IF amplifier, the 2002.5kHz signal will be translated within the receiver to 452.5kHz—provided the local oscillator is operating at 2455kHz.

To demodulate this signal, the BFO operates at 455kHz. This 455kHz signal is heterodyned within the receiver with the 452.5kHz signal to produce the 2.5kHz tone. If the frequency of the local oscillator and the frequency of the BFO are not stable, the frequency of the resulting tone will not remain constant. When voice is transmitted, frequency variations of the transmitter, receiver local oscillator and BFO will cause the recovered speech to be off pitch or seriously distorted.

In the transmitter, the unmodulated oscillator signal, which represents the carrier, is fed to a balanced modulator. The audio modulating signal is also fed to the balanced modulator. There the two signals are heterodyned to produce upper and lower sidebands, and the carrier signal is balanced out. Remaining at the output of the balanced modulator are the two sidebands but no carrier. One of the sidebands is removed by a filter, while the remaining SSB signal is fed to a frequency converter whose local oscillator determines the transmitting frequency.

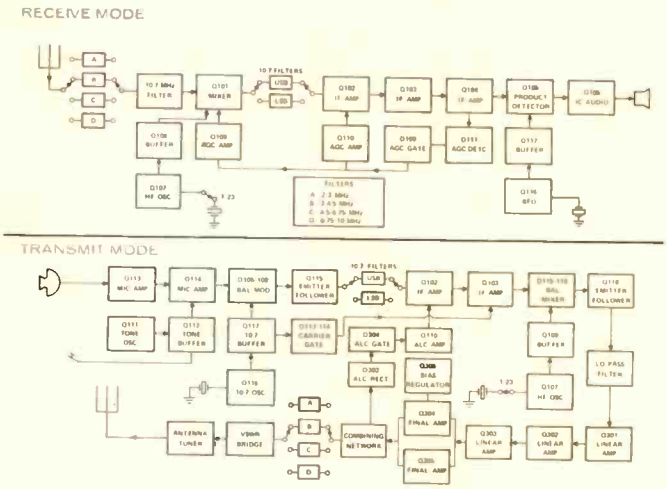
If the oscillator operates at 455kHz, for example, and the local oscillator of the frequency converter operates at 2637kHz, the frequency of the translated suppressed carrier will be at 2182kHz—the frequency of the safety and calling channel. If the audio modulating signal consists of frequencies within the 300-2500Hz range and if the upper sideband is transmitted, the radiated signal will occupy the frequency space between 2182.3kHz and 2184.5kHz. Since the carrier is not transmitted, the band occupancy of the signal will be only 2200Hz. On the other hand, if AM were used, the band occupancy would be at least 5000Hz.

An SSB transmitter can be equipped with a control to enable transmission of the upper sideband (USB), lower sideband (LSB) or compatible AM. In the compatible AM mode, one sideband and the carrier are transmitted. This signal can be demodulated by an AM receiver without requiring a BFO.

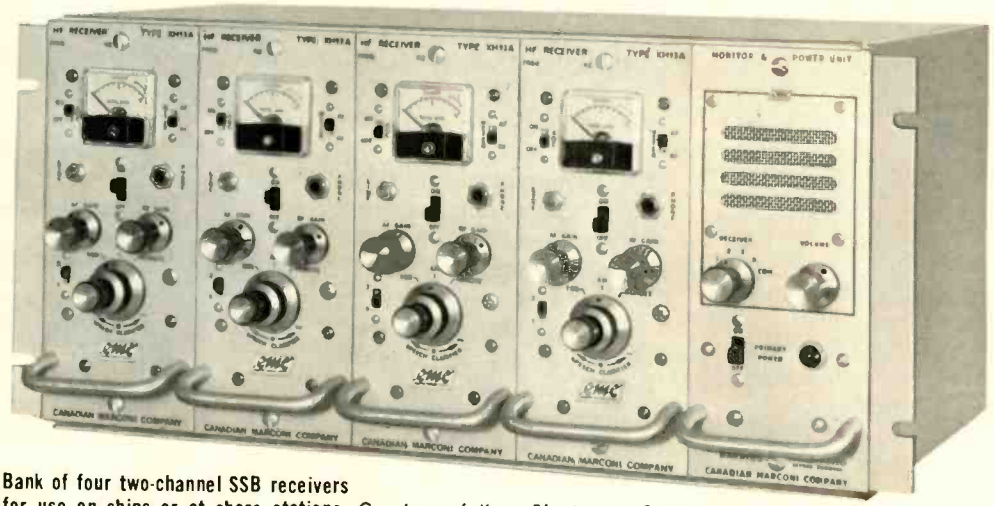
A typical SSB marine radio, such as the SBA-75 made by Sideband Associates, has a rated RF output of 50w PEP in the SSB mode and 25w in the AM mode. (The power input and output of an SSB transmitter is rated in terms of PEP, which stands for "peak envelope power.") It cannot be rated in terms of rms power since the signal varies widely in amplitude and exists only when modulation is actually present.

For use on pleasure craft, the SSB marine radio is usually operable on up to six channels within the 1.6-4.5MHz range. Those used on large seagoing commercial vessels will operate at higher frequencies.

Within the 2-3MHz band there are channels for ship-to-ship, ship-to-shore and safety communications. The ship-to-shore channels include Marine Telephone Service channels. Unlike the land mobile radio services, mo-



Block diagrams of an SSB transceiver shown in the receive and transmit modes. This particular equipment uses a 10.7MHz IF system although it operates in the 2-10MHz range. *Courtesy of Southcom International, Inc.*



Bank of four two-channel SSB receivers for use on ships or at shore stations. *Courtesy of Kaar Electronics Corp.*

bile stations (ship stations) can be licensed to operate on all marine channels that are required for safety, navigation, operational and telephone service communications.

For efficient transmission in the 2-3MHz band, a good ground connection is required. This may be the metal hull of the vessel or a metal plate attached to the bottom of the hull. In some cases, the ground consists of a metal plate or screen attached to the inside of the hull which depends upon capacitance to the water instead of direct contact.

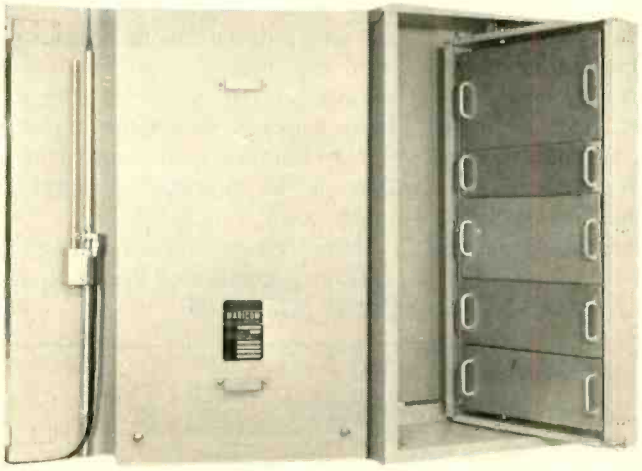
The antenna is usually a loaded vertical radiator mounted to the side of the hull or to a bulkhead. In most cases, the antenna transmission line is a piece of insulated wire, instead of coaxial cable. And unlike coaxial cable, it is part of the radiating system. When coaxial cable is used for feeding the antenna system, an antenna matcher is used at the base of the antenna. This antenna matcher must be automatically or manually retuned when changing channels in order to maintain maximum efficiency.

A long-wire antenna is more efficient. But, on most boats there is not room for a wire antenna of sufficient length. Although the efficiency of the typical vertical rod antenna system is only about 10 percent, it is more practical to use.

There are numerous SSB marine radios on the market in various power ratings and channel capacities. Communications Associates, Inc., for example, produces a 40-channel model for use on commercial vessels and at coast stations.

In addition to a transmitter-receiver or transceiver, a ship can also be equipped with one or more fixed-tuned monitor receivers to enable standing by on various channels. Kaar, for example, manufactures an assembly containing four two-channel receivers which can be used for monitoring any four of eight available channels simultaneously.

Servicing SSB equipment requires higher skills and more test equipment than servicing AM marine radios. Frequency meters must have much better tolerance and a scope is required for measuring RF power output.



Marine radiotelephone system for larger vessels. Rack contains both VHF/FM and MF-HF/SSB transmitters and receivers. *Courtesy of COMCO, a subsidiary of E. F. Johnson Co.*

Portable SSB transceiver. *Courtesy of Kaar Electronics Corp.*

Existing, currently licensed AM marine radios may be continued in service for a limited time. Then, they must be replaced with a VHF marine radio. The installation of SSB equipment is optional.

Most of the marine SSB activity will be confined to vessels operating in saltwater, the Great Lakes and on the Mississippi-Missouri River system where fairly great range is required. Elsewhere, most of the activity will be in the VHF Marine Band and on the Citizens Band.

When the FCC establishes the proposed 220-225MHz Class E Citizens Band, it can be expected that many boat owners will install Class E CB equipment. At present, according to an FCC official, about 300,000 boats are equipped with 27MHz Class D CB radios. CB is most widely used in areas that are not as yet served by Limited Coast, Public Coast and Coast Guard stations.

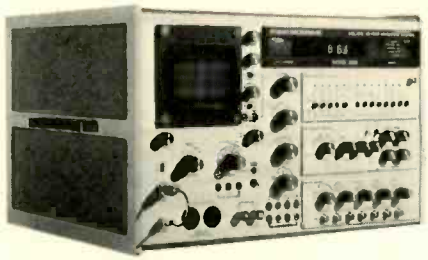
Unlike CB equipment, radiotelephones licensed for operation on marine channels may not be used on shore, only on the specified boat — except when operated under a Limited Coast Station license. A Limited Coast Station does not have to be installed at a fixed location. It may be installed in a motor vehicle.

The greatest market for marine radio is in the VHF field since its range is adequate for most pleasure craft operators. However, there are many who will also want an SSB marine radio for longer range communications and to avoid the congestion that is likely to develop on the VHF marine band. ■

McAdam's Model 2000 Digital Audio Analyzer System

by Philip Dahlen

This is one of the few audio instruments designed for making almost any measurement of quality audio systems—including four-channel units



McAdam's Model 2000 Digital Audio Analyzer System. For more details, circle 900 on the Reader Service Card.

■ One of the problems facing electronic technicians servicing some of the more sophisticated audio systems now on the market is the extremely stringent specifications for the circuitry under test. In some of the less qualified shops, technicians are actually testing and adjusting these products with the use of test instruments having specifications far inferior to the circuits under test. Thus one may be faced with a situation nearly as preposterous as attempting to aim a rocket to the moon by aligning it with one eye and a thumb. This instrument contains oscillators, meters, transformers, circuitry and controls for measuring such parameters as harmonic distortion, IM distortion, RMS power and true RMS voltage. These readings are said to appear as absolute numerical values on the digital display—no calculations being required.

The instrument is designed to regulate the power supplied to any ac-only audio systems under test. And being designed for four-channel use, it is said to be able to provide any of several possible combinations of four-channel signals—load resistors also being provided for simultaneous measurement all four audio outputs of amplifiers under test.

Manufacturer specifications for various segments of the instrument are as follows: ■

Distortion Comparator

Frequency: 20Hz to 20kHz
Range: 100%, 10%, 1% full scale
Sensitivity: 0.01% T.H.D.
Resolution: 0.001% T.H.D.
Accuracy of Measurement: ±0.5% of reading ±0.5% of full scale
Input level: 1v rms = 100% set level (200v rms maximum input)

Distortion Twin "T" Filters

Frequency: 20Hz to 20kHz
Range: 100%, 10%, 1% full scale
Sensitivity: 0.05% T.H.D.
Resolution: 0.005% T.H.D.
Rejection: 70dB notch depth <1dB attenuation of second harmonic
Accuracy: ±0.5% of reading ±0.5% of full scale
Input level: 1v rms = 100% set level (200v maximum)

Signal Generators Oscillator

Frequency Range: 20Hz, 50Hz, 100Hz, 500Hz, 1kHz, 3kHz, 10kHz, 15kHz, 20kHz, 50kHz and 100kHz
Output voltage: 0 to 3v rms at 600Ω output impedance
Distortion and noise: <0.05% of output at any frequency
Square wave: 10v p-p
Output: rise and fall time <250ns

I M Oscillators

Frequencies: 60Hz and 7kHz
Mix ratio: 4:1 (SMPTE)
Distortion and noise: <0.05% of output
Output voltage: 0 to 3v rms at 600Ω output impedance

AC Voltmeter

Ranges: 20mv, 200mv, 2v, 20v, 200v full scale (250v rms maximum input on any range)
Frequency: 10Hz to 100kHz
Accuracy: ±0.25% of reading ±0.25% of full scale to 20kHz <—1dB at 100kHz
Resolution: 100μv
True rms readings even with aperiodic waveforms.

Wattmeter

Amplifier Output Power Measurements
Ranges: 2w, 20w, 200w, 500w full scale
Frequency: 10Hz to 100kHz
Accuracy: ±0.1dB 20Hz to 20kHz
<—2dB at 100kHz
Resolution: 10mw
Power in rms watts ($I \times E \cos \theta$) independent of load resistance variance.

AC line power consumption
Ranges: 20w, 200w and 2kw full scale
Accuracy: ±1dB
Resolution: 100mw

Monitor Scope

Sensitivity: 20mv/cm to 10v/cm calibrated in nine steps ±3% accuracy
Bandwidth: dc or 2Hz to 10MHz
Risetime: 35ns
Input impedance: 1M shunted by 33pf (600v maximum input)
Time base: sweeps 1μs to 0.2sec. in 17 steps (±5% accuracy), plus ×5 magnifier
Trigger level: 20mm vertical display (2 minor divisions)

Variable Transformer

Range: 0 to 150v ac
(0 to 280v ac for export)
Output wattage: 1000kva maximum
Resolution: 0.1%

General

Dimensions: 14 in. H by 22 in. W (+ 2 in. handles) by 17 in. D (+ 1½ in. heat sink)
Power: 115v or 230v, 50 or 60Hz
Weight: 95 lb.

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COLORFAX

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ADMIRAL

Color-TV Chassis K19 Series—Failure of Horizontal Oscillator Tube, 5JW8

Preliminary investigation of reports of cracked 5JW8 (horizontal oscillator tube) envelopes in the K19 series chassis has revealed that a small metal prong located between pins 1 and nine on the socket is the probable cause of breakage. This prong by contacting the glass envelope of the tube causes a temperature difference which results in a crack in the glass envelope. This prong was originally added to the socket to ground a shield but is not used for this in the K19 chassis. It should be bent back so that it does not contact the tube.

Color-TV Chassis K18/K19—Service Hints

There has been reports of slight video bend or tear with changes in the CONTRAST level on some models that use the K18 and K19 series chassis. The following hints should enable you to correct such problem:

Chassis K-18—Run 16 and below: Redress the orange lead away from the delay line. This lead connects between resistor R538, 120K, 3w and resistor R529, 68K, ½w.

Chassis K-18—Run 17 and higher: Redress the orange lead as above. Also change the value of capacitor C201 from 120pf to 47pf.

Chassis K-19—Change the value of capacitor C201, from 120pf to 47pf (note upper left of this month's Tekfax Schematic No.1461). No lead dress change is required because a different oscillator is used.

MAGNAVOX

Color-TV Chassis T958 and T974—Elimination of Capacitors in Yoke

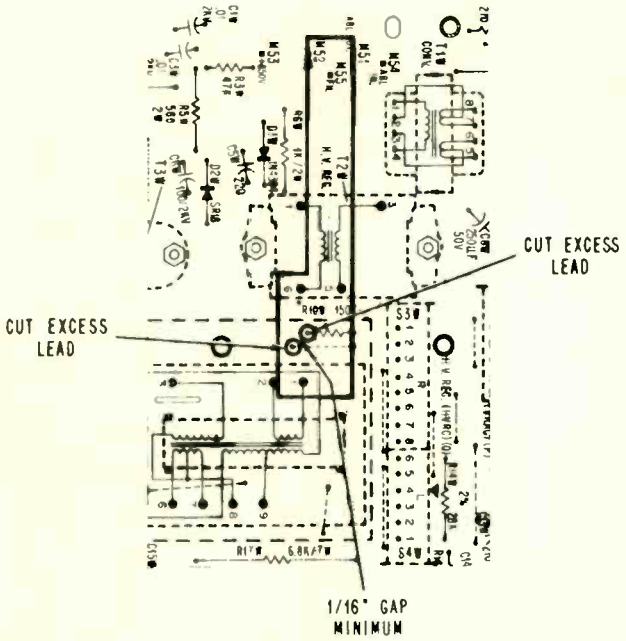
The deflection yoke used in the new T974 chassis and also in the later T958 versions has been designed to eliminate the capacitors normally connected across the yoke windings from the yoke assembly. These components are now mounted on a terminal board at the top rear of the high-voltage cage. When you are using one of these chassis with a Magnavox test fixture for troubleshooting, the capacitors on the TV chassis will be paralleling those on the test fixture yoke and as a result some overscan will occur.

PHILCO-FORD

Color-TV Chassis 3CS90/91, 3CY90/91—Picture-Tube Filament Failure

Should an open picture-tube filament be encountered in any of the color modular chassis, a possible cause of failure may be the closeness of solder points between the picture-tube filament and the 150v point located on the deflection mother board (W). Any leakage or short between these two points could destroy the picture-tube filament.

Upon referring to the drawing you will note that the points in question are between one end of resistor R10W and the copper strip going to pin 6 of the high-voltage regulator transformer, T2W. Check the spacing between these two points. There should be a minimum spacing of 1/16 in. free of foreign material. Also, any excess leads that extend through the two points should be cut off. Therefore, before replacing a picture tube which exhibits an open picture-tube filament, check the two points as indicated.

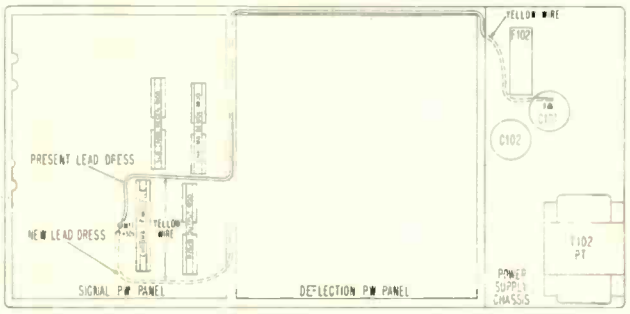


It is strongly recommended that should any of the subject chassis come in for shop service regardless of reason, check the two points in order to prevent any possible future failure.

Color-TV Chassis 3CS90/91, 3CY90/91—Video Ringing on Right Side of Raster

In the event a condition of video ringing (gray bars) is noted on the right side of the raster, a change in lead dress of the 30v line from the power supply to the 30v lug M37 on the signal mother board may help in reducing or eliminating the gray bars.

Refer to the drawing to locate the 30v yellow lead. The



lead dress can be performed without removing the chassis or extending the lead length.

It is recommended that when service is required on any of the subject chassis, the 30v lead dress be checked and redressed if required.

Color-TV Chassis 3CS90/3CS91/3CY90/3CY91—Service Adjustments UHF Tuner 70 Position (Detent)

Chassis employing the 70 position detent UHF tuner (76-14326-1) may require readjustment of the FINE TUNING control when changing channels. This is characteristic of this tuner and should not be classified as a defective tuner.

NEWS . . .

continued from page 18

The following questions are representative of those included in Section 10 of the CET Exam.

Section X

AM-FM Audio and Monochrome

1. What is the approximate peak-to-peak voltage from the video detector?
2. 60Hz hum in a TV picture is usually caused by what? 120Hz hum?
3. A sync separator is normally biased Class A. (True/False)
4. What frequency is the subcarrier of a stereo-FM broadcast when observed at the output of the FM detector in an FM receiver?
5. In an AM radio, the IF stage can be analyzed with a normal service-type scope. (True/False)

Explanation

1. The video signal is normally from 1v to 5v p-p from the video detector.
2. 60Hz hum is usually caused by a heater-to-cathode short or leakage. Since most power supplies in TV sets have full-wave rectifiers, the ripple frequency is 120Hz from the power supply. Therefore, a bad filter in the power supply is the most likely cause of 120Hz hum in the picture.
3. False. Sync separators pass only sync pulses. The normal signal applied to the sync separator is the full video signal. So the separator must be biased so that only the sync pulses turn-on the separator. This is class C bias.
4. It is 19kHz. The radio then doubles this frequency to 38kHz for stereo decoding.
5. True. Since AM radio normally uses a 455kHz (or 265kHz) IF section, the service-type scope can easily handle the frequency. And most service-type scopes have enough sensitivity to "see" this frequency even from the tuner mixer stage.

Secretary of Commerce Petitions FCC To Change Rules for TV Broadcasts

Commerce Secretary Peter Peterson has petitioned the FCC to change the TV broadcasting rules to permit sending time, frequency and other information over the nation's TV network services.

The petition, in behalf of the Department of Commerce's National Bureau of Standards, was sent to FCC Commissioners on December 22. It would allow the networks to broadcast encoded information on one line of the blanking interval, and only viewers with special equipment on their TV sets would receive this information.

The NBS "TvTime" system was developed by scientists and engineers at the National Bureau of Standards Boulder, Colo., laboratories. In addition to time and frequency, the signals will provide a means of captioning TV programs for the deaf or for foreign-speaking audiences. Channel identification, weather and disaster information, plus other important information, could also be transmitted by the NBS TvTime system.

As provided by the TV station, hour-minute-second time of day information, channel identification and captions would be displayed as small numbers and letters on the TV screen. The time display is accurate to a few thousandths of a second. Time-of-day information accurate to one millionth of a second would be available with an optional high-accuracy decoder. A frequency reference at 1MHz, accurate to one part in 100 billion, is also available at the receiver.

Continued on page 48

TECHNICAL DIGEST

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

SYLVANIA

Hi-Fi Terms and Their Meanings

Receivers are made up of two basic sections: The amplifier and the tuner. The terms associated with the amplifier will be explained first.

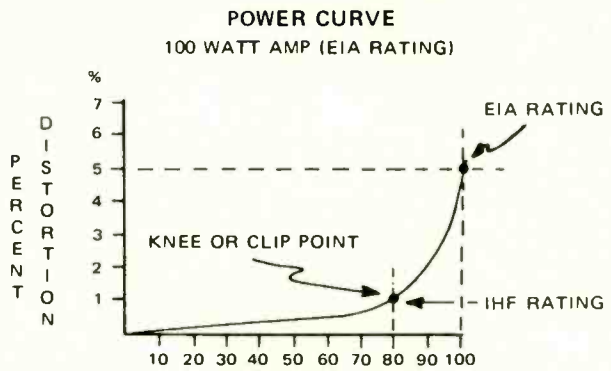
How does an engineer arrive at all the different ratings? The whole thing is done by looking at a music power curve. By running a signal through an amplifier, increasing the power until distortion occurs, then analyzing the amplifiers action with a distortion analysis.

There are two ways amplifiers are rated. EIA (Electronic Industry Association) and IHF (Institute of High Fidelity). The difference between the two rating techniques, EIA and IHF, is the point of reference for the analysis.

An amplifier rated in both methods is still the same amplifier and only the reference point for the analysis has changed.

The IHF rating would seem more desirable because the percentage of distortion is less. Power-wise, the EIA rating would make the amplifier seem more powerful. Look at it this way: IHF is like relating a car's cruising speed to its top speed (EIA). Somewhere the added output will cost more in gas consumption. Likewise, a higher audio power output will generate additional distortion.

IHF ratings are read or taken at the clip point of the knee of the power curve. This rating is more desirable, as



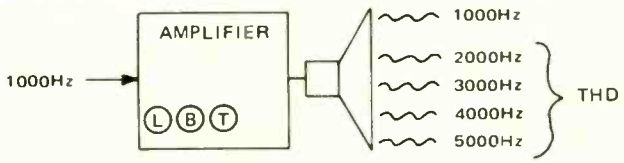
there is always less distortion though the number will always be less than EIA figure.

RMS—This means root mean square and is the more meaningful rating of an amplifier's ability. RMS is also the continuous power performance and is measured by running a sustained tone through at a prescribed wattage output and without discernable distortion. For example, an amplifier EIA rated at 100w with 5% distortion can handle a continuous wave (CW) signal power of 50w total.

Instantaneous Peak Power is not a rating that is measured by a manufacturer. It is just a term used to make an amplifier look better. The IPP rating (when given) is arrived at by doubling the EIA rating. A 100w EIA rated amplifier would be rated at 200w IPP.

Total Harmonic Distortion (THD)

Nonlinear amplifiers produce harmonic distortion by mishandling the applied signal. This simply means that you don't get out what you put in. For example, when a signal is run through the amplifier and is mishandled by the nonlinear quality, the input signal and integral harmonics are present in the output.

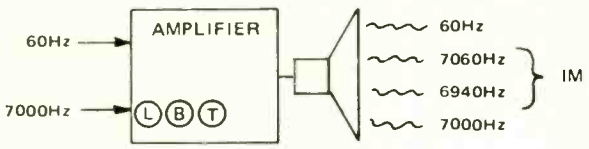


An amplifier rated at a low percentage of THD is good. The lower the percentage, the better the amplifier.

Intermodulation Distortion (IM)

Intermodulation distortion is somewhat similar to THD as it occurs as a result of nonlinear performance. The difference between IM and THD, is that IM results in sum and difference frequencies when two signals are fed to the amplifier.

The nonlinearity in the amplifier mixes the two input signals resulting in the two input signals plus two other



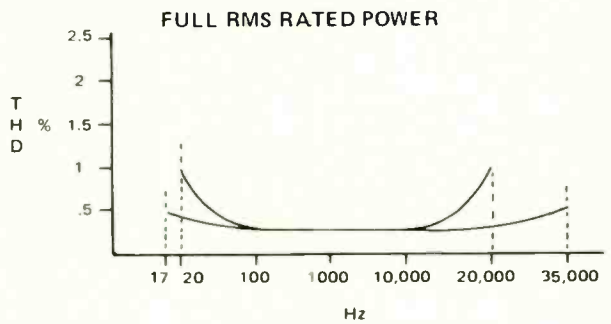
signals—the sum of 60Hz and 7000Hz, and the difference of 7000Hz minus 60Hz. Here again, the lower the percent of IM, the better the amplifier performance.

Frequency Response

The exceptional human ear can hear frequencies from about 40Hz to 17000Hz. Amplifiers are designed to handle an audio range from 17 to 35000Hz, and the wider the range of sound amplification, the better the amplifier.

Power Bandwidth

The power bandwidth is the range of frequencies over which an amplifier can produce half its rated continuous



power (RMS) without exceeding its rated distortion set by the IHF standard.

Damping Factor

The damping factor is the degree of loading provided by an amplifier to overcome the tendency of a speaker to vibrate after the signal from the amplifier changes or ceases. The higher this rating number, the better the unit—a number of 10 or better is good.

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Here is a new and unique handbook that will sharpen your electronics troubleshooting ability. Yes, you can learn to whip those tough dogs and prepare yourself for any electronic gear that comes your way with the "inside" information presented in this handbook. You'll be surprised how simple and logical the professional techniques really are. Begins with an analysis of what troubleshooting really is; to condition your thinking (which is part of the secret), the author begins with the analysis of troubleshooting logic; then he tells you how to think like a tough-dog expert. Also logical service approaches to DC circuits, tube circuits, and transistor circuits. 256 pps., 138 illus. Hardbound.

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Here is one of those rare books which successfully bridges the gap between design and production technologies, thereby providing guidelines for choosing the best design to achieve the least expensive and most reliable product. The content provides information on material and methods employed in mass production, giving the designer in-depth knowledge of the broad range of processes he should consider in evolving a final product concept. Not only does the content define the best materials for each given application, and detail the best choice for fabricating but it also points out incompatibilities which may evolve between design and production. 208 pages. Hardbound.

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General Electric Color TV Service Manual - Vol. 2

This second volume picks up where Vol. 1 left off. Covers the new solid-state JA chassis plus H-2, H-3, H-4, N-1, N-2, KE-11, C-2, L-2, and LT-2 chassis. Provides complete setup, alignment, troubleshooting, and adjustment procedures for all these receivers, plus Parts Lists for uncommon components. The foldout section provides complete, large-size schematics for the 10 chassis mentioned above. 212 pps., including 36-page schematic foldout section. Leatherette cover.

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AN EXTRAORDINARY OFFER...

NEWS . . .

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The TvTime System can transmit up to 600 words per minute, which is more than that required for captions. The excess capacity will be available for other purposes, such as communications between network and affiliate.

Channel Master "Sportenna" System Overcomes Sports TV Blackouts

Channel Master's new "Sportenna" system makes it possible for viewers to obtain long-distance reception of locally blacked-out sporting events while eliminating adjacent-channel, FM and other forms of interference commonly experienced in such installations.

Each "Sportenna" consists of an outdoor TV antenna and selected components specially engineered for a particular reception area. The key accessory is a new Channel Master factory-tuned trap that blocks out adjacent-channel interference—the principal obstacle to good reception in installations of this type.

Comments from our readers are always welcome.

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NEW PRODUCTS

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

VHF BROADBAND AMPLIFIER

Designed to operate under a variety of signal conditions **703**

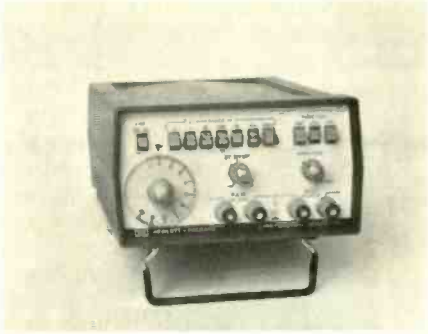
A versatile VHF (Channel 2 through 13) broadband modular amplifier, Model DA-5110, is designed to operate under a variety of signal conditions. The specifications indicate that the unit provides up to 48dBmv

output per channel on each of the seven VHF channels at 0.5% cross modulation. For the input signal, a plug-in attenuator pad reportedly provides up to —20dB of attenuation in 3dB steps. A special transistor is said to provide a low noise figure below 4.3dB to insure good color and B/W reproduction while a fixed FM trap reduces strong local FM signals, lessening the possibility of overload. An outstanding feature of the unit is reportedly the 29dB typical gain—sufficient to operate most systems in major market areas. The amplifier is constructed of solid-state components on printed-circuit boards and is powered by an electronically regulated power supply which maintains a 12v supply over a wide range of line voltages at less than 6mv ripple. Winegard Co.

FUNCTION GENERATOR **704**

Provides better than 25ns rise time

The Model 3311A Function Generator is available which has sine, square, triangle and positive pulse outputs, as well as a number of other features not generally found in low-cost instruments. With a better than 25ns rise time, the pulses are useful for clocking logic breadboards or as synchronization signals. An external voltage-controlled oscillator (VCO) input is provided for phase-locked loop and swept-frequency applications. The output of the unit is 10v p-p into 600Ω for sine, square and triangle waveforms. An internal dc offset of ±5v into 600Ω is continuously variable and independent of amplitude control. Complete dc isolation between the instrument case and earth



ground reduces grounding problems and loops. Seven decades of frequency from 0.1Hz to 1MHz are said to be selected by pushbuttons. Dial accuracy is reportedly ±5% of full scale with sine-wave amplitude flatness within ±3% of 10kHz reference (maximum output amplitude) to 100kHz, ±6% at 1MHz. Sine-wave total harmonic distortion at maximum output amplitude is less than 3%. The unit measures 3½ in. high by 6¼ in. wide by 9¾ in. deep. Hewlett-Packard Co.

continued on next page

NEW PRODUCTS...

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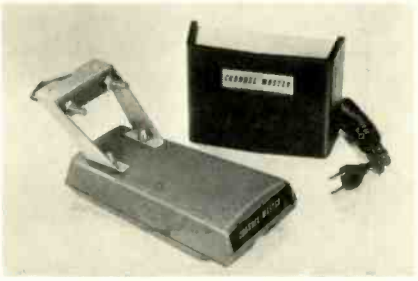
ANTENNA AMPLIFIER 705

Solves major fringe-area reception problems

The Spartan series antenna amplifiers are designed combining advanced low-noise solid-state components with new approaches to circuit design that utilize up to three transistors. Covering VHF/FM and UHF/VHF/FM for fringe and near fringe reception areas, the amplifiers are high-gain units reportedly featuring flat gain up to 20dB, while fully protected against overload. Most models incorporate

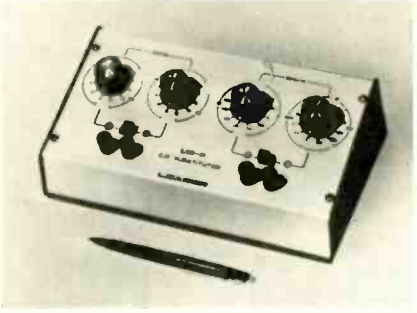


both switchable and tunable traps to eliminate FM interference. Specifications indicate that a three-section rejection filter can be switched in that attenuates the FM band by an average of 25dB; or an independent tunable trap, just 1MHz wide, can provide additional attenuation wherever needed within the FM band. Special feed-back circuitry reportedly provides exceptional stability in temperatures ranging from −22° F to 140° F. Channel Master.

RC SUBSTITUTION BOX 706

Provides the most needed resistor and capacitor values

Introduced is the Model LSB-41 RC Substitution Box which provides many of the most often needed resistor and capacitor values. The box offers switch selection of high or low resistance values, and reportedly has the substitution capacity of 24 EIA standard 10%, 1w resistors from 10Ω to 10M. Any of 22 standard capacitors from 100pf to 1,000μf (100pf to 0.47μf at 500wv; 100μf to 1,000μf at 50wv) can reportedly also be selected.



The compact 3.5 lb unit is also said to preclude the necessity for working with unmarked or illegible color coded resistors or capacitors. It measures 3½ in. H by 9½ in. W by 6¾ in. D. Leader Instrument Corp.

COLD GALVANIC PRIMER 707

Protects metal from rust and a primer for paint

Introduced is a zinc-rich cold galvanic primer for metal surfaces called Zinc-It, which forms a tough, flexible coating of zinc metal and bonding electrochemically with any base metal. Through its special galvanic action, this coating reportedly protects the base metal against rust and rust creepage, even when scratched or abraded. The product provides nearly the same protection as a hot dip galvanized coating

to protect the metal and can be applied on the job in the field. Its application is as wide-ranging as the uses for hot dip galvanizing. It can be used to impede rust and corrosion in air conditioning units, metal electrical enclosures, metal floors and roofs, radio and TV transmission towers and other applications to prevent rust. The product is available in 5-oz brush-top cans, 16-oz. aerosol containers and one gallon pails. CRC Chemicals.

VOLT-OHM MILLIAMETER 708

Features resettable overload protection

The Model 120P VOM features a rating of 20k/v sensitivity and 2% accuracy on dc. The unit is also said to offer a .25v dc range and a 50μa dc current range. The meter movement is a taut-band, self-shielding annular type that reportedly withstands shock and vibration. A TRANSIT position on the range switch protects the instrument in portable use. Ranges covered by the instrument are as follows—DCV: 0-1000v in eight ranges. DC current: 0-10a in six ranges. ACV: 0-1000v rms, with 3% accuracy and frequency response of ± 1dB to 100kHz through 50v ac, to 20kHz on 250v ac range. AC output volts:

0-250v ac in four ranges. Ohms: R × 1, R × 100, R × 10,000. All ranges except the 10a and 1000v dc ranges are protected by the electronic overload system and the relay contacts are protected by a 3a fuse in the input circuit. The unit measures 5¼ by 7 by 3⅛ in. deep and weighs 3 lb. Dynascan Corp.

VOM/TRANSISTOR TESTER 709

VOM designed to also measure capacitance and transistor parameters

A compact instrument which combines all the functions of the VOM

continued on next page

NEW PRODUCTS . . .

continued from page 51

with the added capability of measuring capacitance and transistor parameters, is introduced. The Model

HM-310, VOM/Transistor Tester is a self-contained three-in-one VOM/Transistor/Capacitance Tester featuring 100K per volt, taut-band movement, 3-in. mirrored scale and burn-out protection. Measurement capabilities include: AC and dc volts, resistance, ac and dc current, dB, and capacitance transistor alpha, beta and leakage current. The unit measures 2½ by 5 1/16 by 6½ in. and weighs 2 lb. hme Electronics Inc.

HIGH-VOLTAGE RECTIFIER 710

Replaces stick-type high-voltage rectifiers in color-TV sets

A solid-state high-voltage rectifier, R-12C, has been designed for direct replacement of Motorola, Electrohome, Zenith and GE "stick" rectifiers in color-TV sets. The rectifiers replaced by the Solid-Tube solid-state high-voltage rectifier are said to be manufactured as original equipment under the following designations: Motorola P/N 48D69723A01 and 48S137397 (D6C); Electrohome P/N 28-31-00; Zenith P/N 103-215 and GE EP57X3. Ratings for the high-voltage rectifier reportedly include a peak inverse voltage of 45kv,

NEW PRODUCTS...

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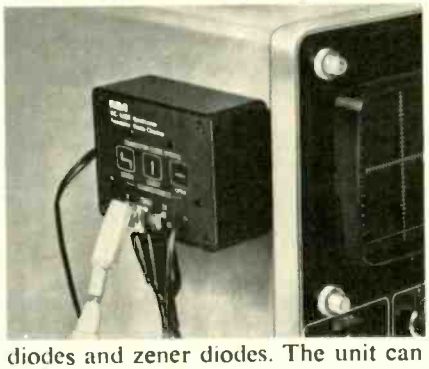
peak repetitive forward current of 200ma, an average forward current of 5ma and voltage drop of 75v at 50ma. EDI Electronic Devices, Inc.

TRANSISTOR/DIODE CHECKER 711

Permits quick in-circuit or out-of-circuit checks

One of the most useful, convenient and simple attachments for the solid-state electronic oscilloscope is designed. The Model WC-528B Quick-tracer Transistor/Diode Checker permits quick in-circuit or out-of-circuit checks of transistors (except FET'S),

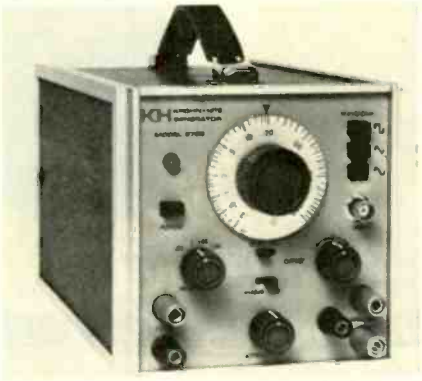


diodes and zener diodes. The unit can be attached to the oscilloscope. RCA Electronic Components.

FUNCTION GENERATOR 712

Provides sine, square or triangular waveforms

A low-cost Function Generator, Model 5700, provides sine, square and triangular waveforms over a wide frequency range of from 0.002Hz to 2MHz. Frequency accuracy is reportedly to ±5% of reading for the entire



1000:1 tuning range of the dial. Output is said to be controlled by a two-position dB step attenuator and amplitude vernier, providing both a 50Ω single ended and a 600Ω balanced output. The outputs reportedly provide 15v p-p and 30v p-p respectively, plus a 1v auxiliary output. Krohn-Hite Corp.

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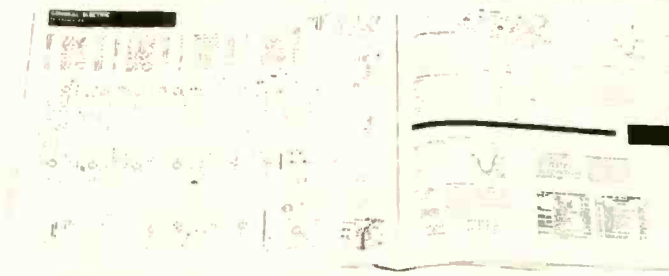

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DEALER SHOWCASE

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RECORD CHANGER 713

Features jam-resistant changer mechanism

A three-speed automatic record changer, Model CA950, features a jam resistant changer mechanism for high reliability. It is said to include a

full-size 11 in. turntable, deluxe tubular tone arm, cueing control for precise tone arm placement and adjustable counterweight for lightweight stylus tracking, plus a pilot light and convenience outlet. General Electric.

COLOR-TV SET 714

Compact cabinet moderately priced

A portable color-TV set, the Model 18T130 Sportster, is designed for people who have been "color holdouts"

because of price. This 18-in. (measured diagonally) portable color-TV set reportedly offers a picture large enough for family viewing in a space-saving cabinet measuring only 24½ in. wide. It is said to feature a Super-Brite picture tube, built-in antenna, sturdy handle and Super-Scope all-channel VHF/UHF tuning system for excellent reception in weak signal areas. Admiral.

AUDIO CABLE 715

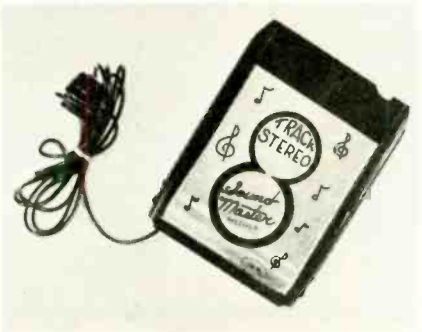
Designed for use with headphones and stereo speakers

A 12-ft. stereo cable, Model 44-359, is said to include a three-wire connector cable and a standard three-way phone plug to a standard three-way in-line jack. The cable is designed for use as a headphone and stereo speaker extension cable for tape recorders, receivers or eight-track cassette tape players. Weltron Co.

INDUCTIVE AUDIO COUPLER 716

Applies theater sound tracks or telephone to tape deck

A new Sound Master receiver is designed to enable drive-in theater soundtracks, telephone conversations



and car or transistor radio broadcasts to be played through stereo speakers. For drive-in movie sound tracks, insert the unit into the car's eight-track stereo tape deck and clip the connecting wire to the speaker cable. Sound is reportedly then induced through the stereo speaker system. The easy connect/disconnect clip will reportedly not damage the speaker cable. The unit can also be used at home or the office to enable everyone in the room to hear both ends of a telephone conversation by inserting the unit into any home eight-track cartridge tape player and the connecting wire clipped to the telephone receiver cord. By clipping the connecting wire to a radio speaker and inserting the unit into any eight-track tape deck, music comes through the stereo speakers. Alexco Mfg. Co.

continued on next page

DEALER SHOWCASE...

continued from page 55

AM/FM STEREO RECEIVER 717

Features automatic circuit protection

A solid-state AM/FM stereo receiver, Model TX-555, is rated at 2μv of FM sensitivity and 40dB of stereo separation. The unit is furnished in a walnut finished cabinet and has reportedly an IHF rated music power output of 140w into 4Ω and 120w into 8Ω, both channels driven. It features automatic, transistorized circuit protection to guard against speaker damage and dc leakage. The unit reportedly has a directly coupled differential amplifier plus a FET and four variable

capacitors in the tuner front end, a six-element ceramic IF filter and FM muting circuitry. Total harmonic distortion in the amplifier is reportedly 0.3% of rated power with a frequency response of 10Hz to 35KHz. Specifications indicate that the intermodulation distortion is 0.4% of rated power while the power bandwidth is 15 to 35,000Hz. The tuner section of the receiver is said to feature a sensitivity of 2μv with a capture ratio of 1.5dB, image rejection ratio of 70dB and a harmonic distortion at 0.5%. Rated tuner frequency response is 30 to 15,000Hz (± 0.5dB). It measures 5½ in H by 18⅜ in. W by 15⅛ in. D. Onkyo.

MARINE RADIO TELEPHONE

Delivers 2.2w of power from a ni-cad battery 718

A portable, hand-held, battery-operated marine radio, called Aqua-Com, is said to be a compact combination mike/speaker and double conversion receiver that provides two-way communication with palm of the hand convenience. Three controls operate the unit: ON/OFF/VOLUME, SQUELCH and SELECTOR switch for up to five channels. Completely solid state, the radio-telephone is reportedly all weatherized against air and water damage. The printed circuit boards are sealed with a special silicon compound to prevent corrosion. Optional

equipment includes a recharging unit, earphone/microphone with plug-in cord, flexible antenna, 15v ni-cad battery, 13v mercury battery and simulated leather carrying case with shoulder strap. Regency Electronics, Inc.

EIGHT-TRACK TAPE PLAYER

Features straight-line stepping-cam head mounting 719

The Model TD8SW Tape Player features an output LEVEL control so that the tape volume may be matched to other inputs in a stereo system. The unit is reportedly designed with the tape head mounted on a stepping cam so that there is intimate contact between the tape and head on all tracks. The positive head mounting design of

the tape player also reportedly prevents "cross-talk" from adjacent tracks, which is a problem common to other tape decks. Other features include automatic and manual track

shifting with illuminated program indicators, synchronous ac motor and a dust protector on cartridge slot. Full output is rated at 750mw and connecting cables are said to be provided. BSR (USA) Ltd.

AUTO TAPE PLAYER 720

Auto horn protects player from theft

Introduced is an eight-track car stereo cartridge player, Model 6292, that incorporates an anti-theft alarm.

Any attempt to remove the unit reportedly sets off the auto horn. Other features include slide controls, fine tuning, fast forward, repeat, automatic and manual track change, plus 16w of audio power. Channel Master.

FM/AM/VHF RADIO 721

Features continuous squelch to filter out static

A new public-service band portable radio, Model RF-1060, features a con-

tinuous SQUELCH control that is designed to filter out the static generally received between stations and between intermittent public band transmitters. An Automatic Frequency Control (AFC) reportedly locks in the signal on FM stations and eliminates station drift. A tuning meter indicates signal strength as well as battery life. Panasonic.

FM/AM/FM STEREO RADIO 722

Utilizes FET circuitry to squelch interference

The Model SP-2950, FM/AM/FM Stereo radio is said to come with a discrete 4/2-channel, eight-track stereo cartridge player. The unit reportedly also includes four two-way air suspension speakers and a built-in illuminated balance display, targeting the best listening position. Each speaker enclosure is said to contain a 6½-in. woofer and a 2-in. tweeter. The FM front end utilizes FET circuitry

to squelch interference. An optional remote control four-channel balancer is available. Hitachi.

Technical Literature . . .

continued from page 14

cost patchable mini-computer interface system on the market; complete digital systems for design, research and teaching; individual modules; and a wide variety of plug-in circuit cards for functions in both the analog and digital domains. Heath/Schlumberger Scientific Instruments, Benton Harbor, Mich. 49022.

Antenna Equipment

A 24-page revised consumer products catalog, No. CP-2, illustrates and describes more than 230 products. Included are TV and FM antennas, preamplifiers, couplers, band separators, wire, etc. Winegard Co., 3000 Kirkwood St., Burlington, Iowa 52601.

Tape Recording Guide

A 50-page booklet covers the popular formats for magnetic recording and explains the differences between types of tapes produced for various recording applications. Included is a complete listing of the company's audible range tapes. Recorder types are described, tape editing techniques explained and a glossary of terms is provided. 3M Company, Dept. Ma3-9, Box 33600, St. Paul, Minn. 55133.

Connectors and Terminals

A two-color, 16-page catalog listing nearly 500 terminals and connectors with complete electrical, mechanical and application information included. Separately classified for ease of ordering are the .093-in. and .062-in. diameter pin and socket crimp-type or solder tail terminals. The special-purpose connectors cataloged includes housings for .093-in. diameter terminals that satisfy European and Japanese requirements and for tube and socket connections. Also listed are open-end terminals and connectors for relays and miniature snap-action switches, .25-in. flat-blade terminals and connectors. Molex Inc., 2222 Wellington Court, Lisle, Ill. 60532.

Speakers

A brochure describing a full line of Auralinear speaker systems is available. These speakers are said to feature radically new ultra-wideband electrostatic radiators with thinner membranes for greater efficiency and acoustic output for realistic sound pressure levels. Unlike systems with

separate tweeter and midrange speakers, there is no high frequency crossover with the extended range electrostatics. Power requirements for all models is 115v, 60Hz, 3w. The enclosures are of genuine oiled walnut matched with black grill cloth. Crown International, Div. of International Radio and Electronics Corp., 1718 W. Mishawaka Rd., Elkhart, Ind. 46514.

Antennas

A nine-page catalog, No. AC-73, describes a complete line of antenna rods. The catalog includes a cross referenced center fold-out listing replacements rods for portable AM/FM radios and TV sets, walkie-talkies, indoor FM antennas, UHF antennas, car radios and scanners. Illustrations for most rods and assemblies, plus an application chart, are included in the brochure. Russell Industries, Inc., 96 Station Plaza, Lynbrook, N.Y. 11563.

Tools

A 28-page full-line tool catalog, No. W30, lists over 300 styles of hand tools including pliers, snips, wrenches, nippers and specialized tools. The most popular tools are mounted on skin-pack cards for retail selling, and six new dealer displays for these cards are also described. Diamound Tool and Horseshoe Co., P.O. Box 6246, Duluth, Minn. 55806.

TV and Radio Master Index

A totally new, up-to-date, 48-page "Master Index" is issued covering all existing monochrome and color-TV manuals and all radio manuals back to the 1926-38 issue. It is a great convenience for looking up material in the Supreme manuals and is an aid in determining the year of manufacture or for comparing chassis and model numbers. Instructions on how to obtain material needed in manuals or as single diagram service data is also given. Price 50¢, postpaid. Supreme Publications, 1760 Balsam Rd., Highland Park, Ill. 60035.

Antennas

A two-page color brochure describes a new Target Color Combo antenna line. Included are specifications for the 39-element, Model CVU-50 antenna; 32-element, Model CVU-40; 28-element, Model CVU-30; 22-element, Model CVU-20; and 18-element, Model CVU-10. S & A Electronics, West Florence St., Toledo, Ohio 43605.

READER'S AID . . .

continued from page 12

tical solution. When installing stereo tape speakers in an auto, how can a 5 in. or similar hole be easily cut in a metal car body? We have used a sabre saw, round saw, and a hand held nibbling tool, none of which proved to be entirely satisfactory.

T. M. KIMBALL
Whitaker at 43rd St.
Savannah, Ga. 31401

Information Wanted

I would like to obtain the address of the Superior Instrument Co., or information on how I can obtain a tube chart for a tube tester Model TV-12.

RICHARD ROTH
17 So. Martin
Waukegan, Ill. 60085

I would like to have the correct address of Seco Electronics Inc., a division of the Di-Acro Corp.

VANCE I. JONES
Rt. 2, Box 90
Tulelake, Calif. 96134

I am in need of a schematic and service information for a combination Receiver TV/AM/FM Radio Phono Model 440. The unit was manufactured by Victor Co. of Japan. I also need the address of a U.S. representative or the Japanese manufacturer.

GENE NICHOLS
1910 Harvey Rd.
Seminole, Okla. 74868

I recently acquired a Capcitester, Model CT335, without operating instructions. The unit was manufactured by the TeleTest Instrument Corp. of N.Y. Can anyone provide me with the complete address of the company or operating instructions?

DONALD RICE
84 Guilford St.
Buffalo, N.Y. 14212

Wanted

I would like to obtain a schematic diagram for a Motorola TV set, Model 10VT12R.

FOSTER J. KINNEAR
Pioneer Acres, Beaver Dam Road
Box 147, R.D. 2
Selkirk, N.Y. 12158

I would like to purchase a Hickok Model 6000A Tube Tester, Capacitor Checker.

ROBERT JOSTOCK, JR.
2229 Pinewood Rd. S.E.
Rochester, Minn. 55901

I would like to purchase a Jenkins Radio Visor or other type of scanning TV for a display.

W. HARDER
911 Northrup W.
Lansing, Mich. 48910

I would like to obtain used Sams AR manuals to complete a set, also a Hewlett-Packard 410B Meter.

PAULMER WILLIAMS
106 S. Jefferson St.
Lewisburg, W. Va. 24901

I need General Electric's ETR2208 Profitable Service Management Course.

BORDEN c/o FLICKTRONIX
1362 Prospect Ave.
Bronx, N.Y. 10459

I would like to buy, in any condition, vertical amplifiers for a Hewlett-

Packard scope, Model 150-A. I need the following vertical plug-in amplifiers: Model HP151, dc to 10MHz; HP-152 Dual Trace amplifier; HP153 Differential amplifier; and a HP154VIF amplifier.

DOUGLAS T. DAVIS
4835 K T Pike
S. Charleston, W. Va. 25309

I need the tube set-up chart or manual to use with the Model TD-55 Tube Tester manufactured by the Superior Instruments Co. of New York.

THOMAS J. ZORUMSKI
819 Greeley Ave.
Webster Groves, Mo. 63119

Schematic Needed

I would like to obtain a schematic for an Eric Stereo Amplifier, Model 5761MX, Chassis No. RF5054. The unit was manufactured by Eric Elec., Santa Monica, Calif.

PATRICK CROOKS
456 Schenectady Ave.
Brooklyn, N.Y. 11203

I need a power transformer or information on how I might obtain a schematic and operating instructions for a Model 622A Hycon Oscilloscope.

EDDY'S ELECTRONIC SERVICE
Rt. #1, N. Brinton Ave.
Dixon, Ill. 61021

I am in need of a schematic for a vacuum tube volt meter, Model 909, Serial Number 3598, made by the Precise Development Corp., Oceanside, N. Y.

CHARLES P. REHBERGER
267 Midland Ave.
South Amboy, N. J. 08879

I need a manual showing the removal of a 1968 Chrysler Newport AM/FM radio, plus the schematic.

ANTHONY BOCHICHIO
45 Andrews St.
Staten Island, N.Y. 10305

I need the schematic and operating instructions for the Precision Series E-400 Sweep Generator. I would be happy to pay for any reproduction costs incurred.

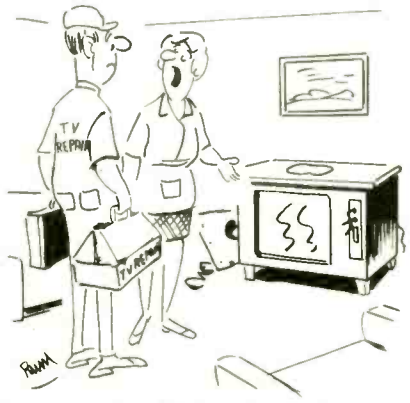
BARRY L. SCHWARTZ
RD 2, Box 146
Havre De Grace, Md. 21078

READERS SERVICE INDEX

ADVERTISER'S INDEX

NEW PRODUCTS

TEST INSTRUMENT



"Your competitor didn't want to fix it after he found out my husband tried."

ELECTRONIC TECHNICIAN/DEALER

TEKFAX

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

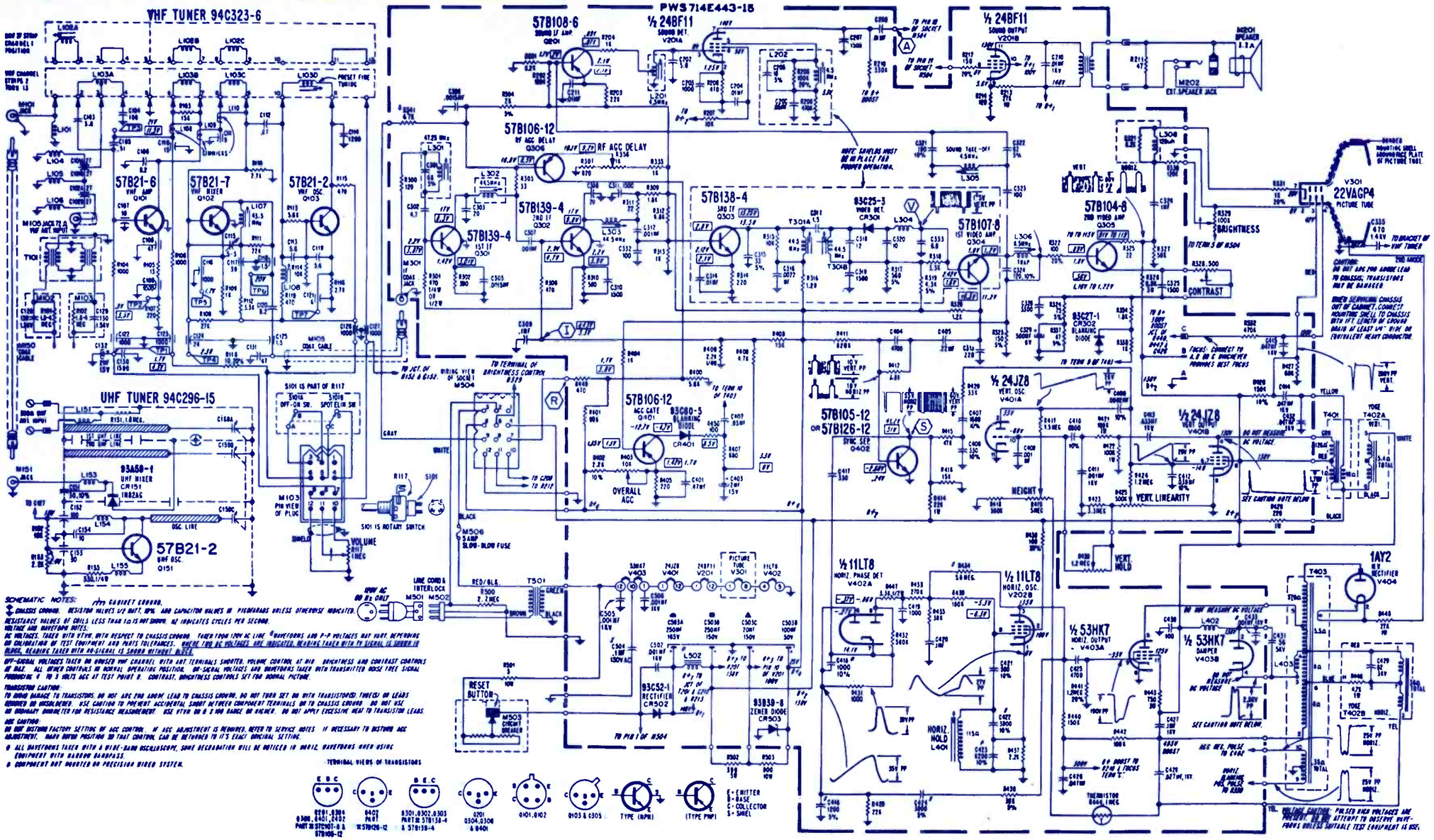
GROUP 247

SCHEMATIC NO.		SCHEMATIC NO.	
ADMIRAL Color-TV Chassis K19	1461	PHILCO-FORD Color-TV Chassis 3CY91	1463
EMERSON TV Chassis 11H5	1460	ZENITH Color-TV Chassis 25DC57	1462

1460
EMERSON
TV Chassis
11H5

MARCH • 1973

SYMBOL	DESCRIPTION	EMERSON PART NO.
R117	1M, volume control for Model 19FP05W	75A-182
R328	500Ω, contrast control	75A1-181
R329	100K, bright control	75A1-183
R336	1K, RF-AGC delay control	970695
R342	voltage dependent resistor, 1ma @ 60v	61A46-6
R403	10K, overall AGC control	970696
R419	5M, height control	970001
R425	500K, vert hold control	970002
R430	1.2M, vert hold control	75A1-180
R444	1M, thermistor	61A41-2
C503A	elect, 250μf, 165v	67A30-14
C503B	elect, 250μf, 150v	67A30-14
C503C	elect, 20μf, 150v	67A30-14
C503D	elect, 100μf, 50v	67A30-14
L201	sound 1F coil (includes C202)	970705
L202	quad coil, (R208 and C205)	970013
L301	47.25MHz trap	72A316-4
L305	4.5MHz sound take off coil	72A303-9
L306	4.5MHz trap	72A303-9
L401	horiz lock coil	94A17-19
L502	filter choke	74A18-45
T201	audio output xformer	970917
T401	vert output xformer	970708
T402	deflect yoke assembly	970800
T403	horiz output xformer	970915
M503	circuit breaker (2.2a)	84A17-4



1461

ADMIRAL

Color-TV Chassis
K19

MARCH • 1973

ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

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

NOTES: UNLESS OTHERWISE SPECIFIED: RESISTANCE VALUES ARE IN OHMS, 10%, 1/2 WATT; CAPACITANCE VALUES 1 OR HIGHER ARE IN PF; CAPACITANCE VALUES LESS THAN 1 ARE IN UF; INDUCTANCE VALUES ARE IN UH. ⏚ INDICATES CHASSIS GROUND, ⏚ CABINET GROUND. Hz = CYCLES PER SECOND.

DC VOLTAGES ARE MEASURED WITH VTVM PLACED BETWEEN POINTS INDICATED & CHASSIS GROUND, LINE VOLTAGE SET AT 120V AC & ALL CONTROLS SET FOR NORMAL PICTURE UNLESS OTHERWISE INDICATED. VOLTAGE READINGS ARE TAKEN WITHOUT SIGNAL, WITH VHF TUNER SET AT UNUSED CHANNEL. VOLTAGES SHOWN IN BRACKETS ( ) ARE MEASURED WITH RECEIVER TUNED TO A COLOR SIGNAL.
‡ INDICATES THESE VOLTAGES MAY VARY WITH VIDEO CONTENT OF THE PROGRAM BEING RECEIVED AND ARE AVERAGE READINGS.

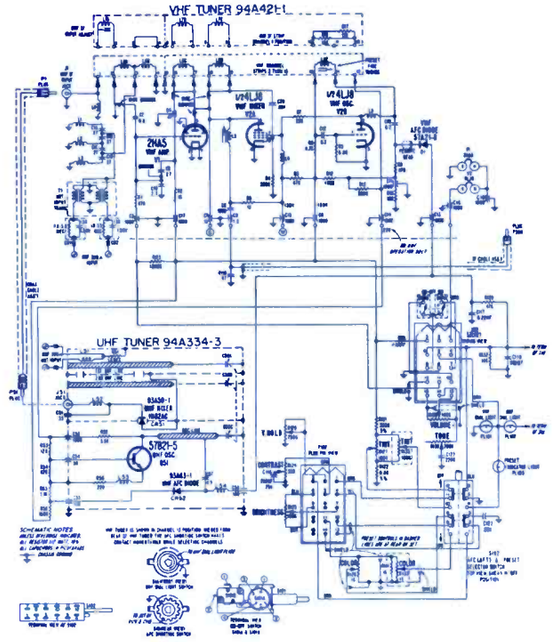
TRANSISTOR CAUTION: TO AVOID DAMAGE TO TRANSISTORS, DO NOT OPERATE CHASSIS WITH PICTURE TUBE DAG DISCONNECTED FROM CHASSIS GROUND. DO NOT TURN SET ON WITH TRANSISTOR(S), TUBE(S) OR LEADS REMOVED OR UNSOLDERED. DO NOT ARC 2ND ANODE LEAD TO CHASSIS GROUND. DISCHARGE 2ND ANODE ONLY TO PICTURE TUBE DAG OR DAG GROUND. USE CAUTION TO PREVENT ACCIDENTAL SHORT BETWEEN COMPONENT TERMINALS OR TO CHASSIS GROUND. DO NOT APPLY EXCESSIVE HEAT TO TRANSISTOR LEADS. DO NOT USE AN ORDINARY OHMMETER FOR RESISTANCE MEASUREMENT, USE VTVM ON Rx100 RANGE OR HIGHER.

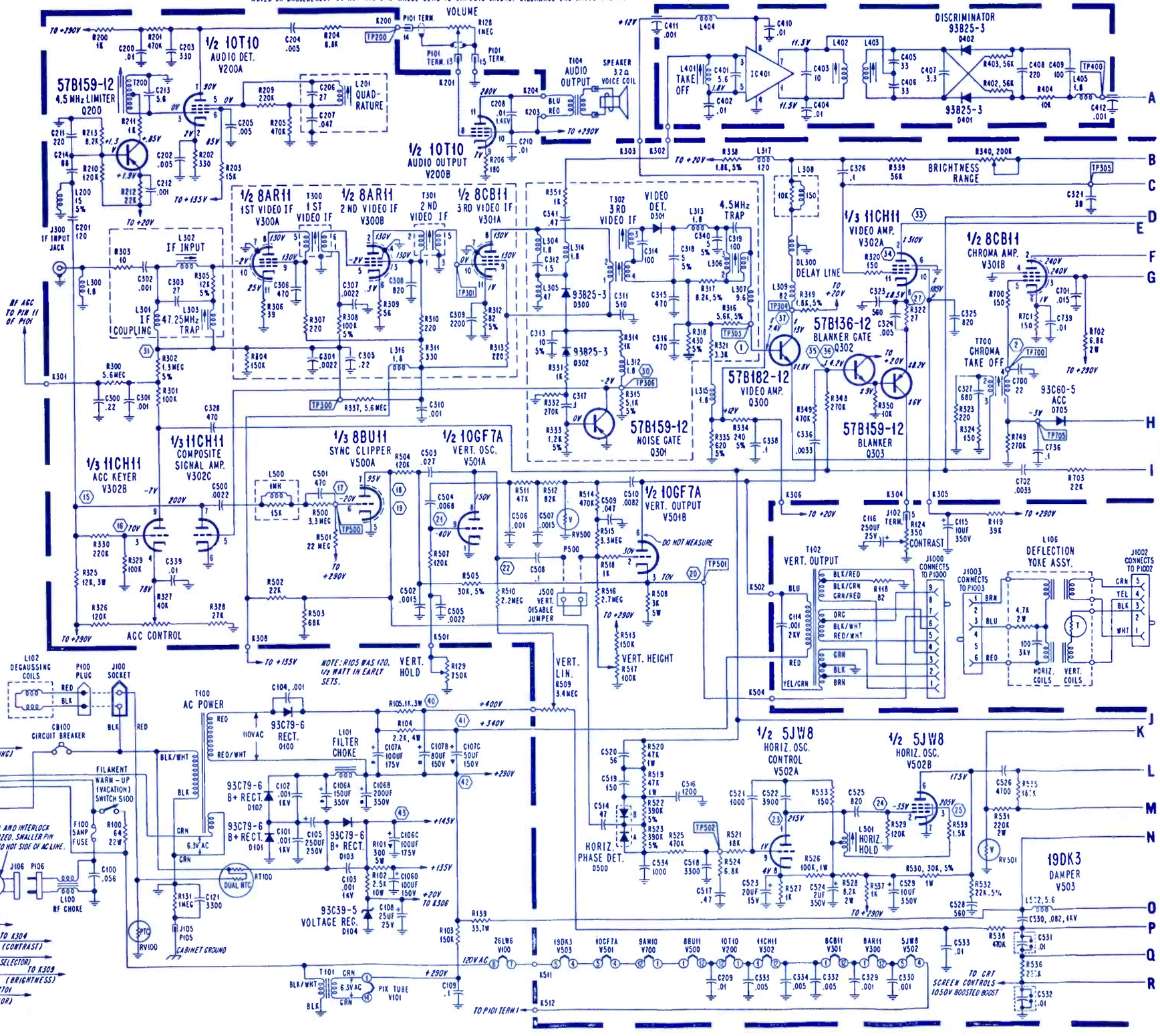
(10) RUN NUMBER INDICATES CHANGE(S) INCORPORATED AS GIVEN UNDER THAT RUN NUMBER, AS WELL AS ALL LOWER RUN CHANGES.

TP SYMBOLS IN RECTANGLES INDICATE TEST POINT CONNECTIONS.

(1) HEXAGONS IDENTIFY WAVEFORM OBSERVATION LOCATIONS. CONDITIONS FOR TAKING WAVEFORM MEASUREMENTS ARE GIVEN WITH WAVEFORM PHOTOS.

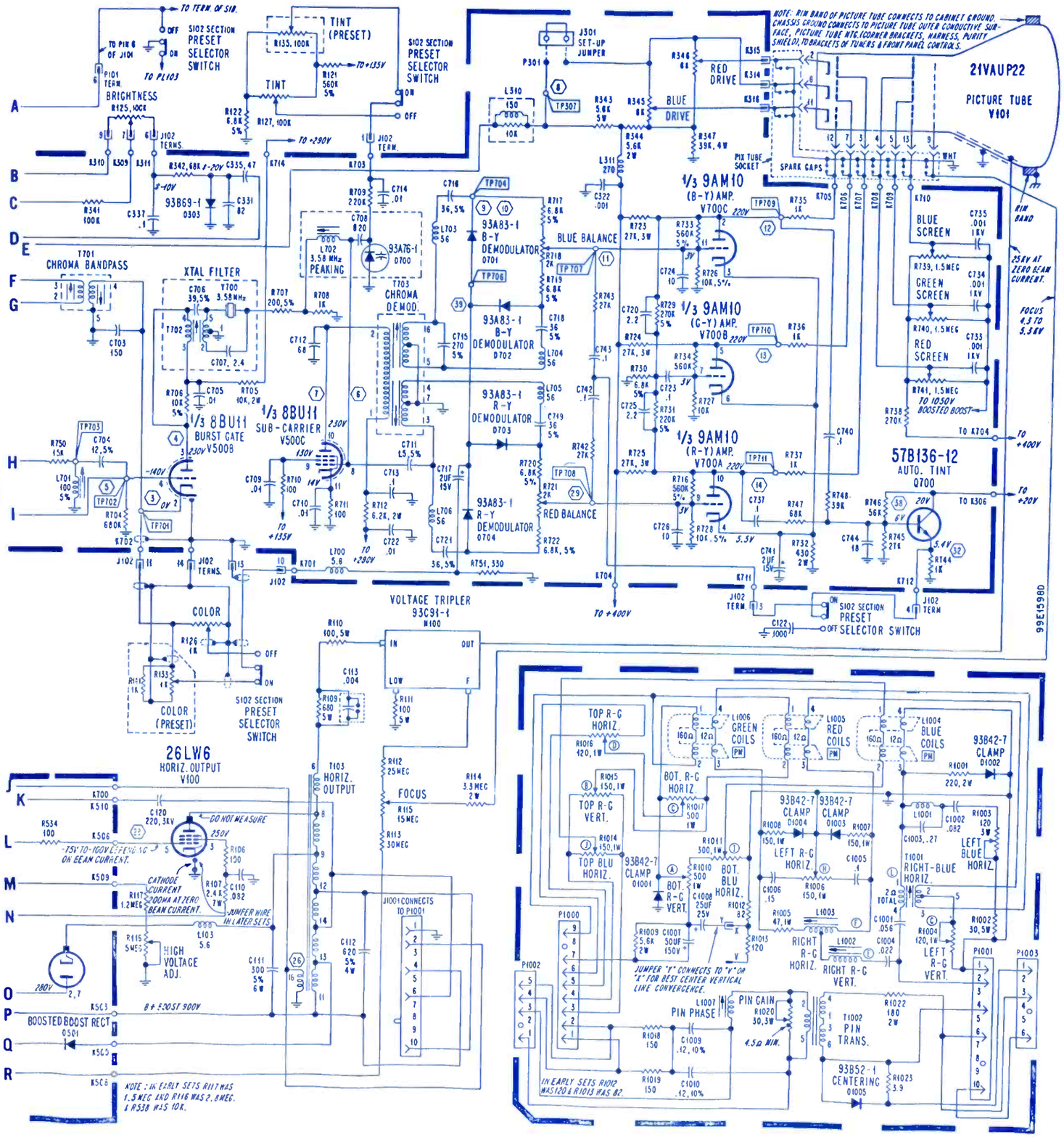
WARNING: CHASSIS IS CONNECTED DIRECTLY TO ONE SIDE OF AC POWER LINE. USE AN ISOLATION TRANSFORMER WHEN SERVICING TO AVOID THE POSSIBILITY OF ACCIDENTAL ELECTRICAL SHOCK & DAMAGE TO TEST EQUIPMENT.

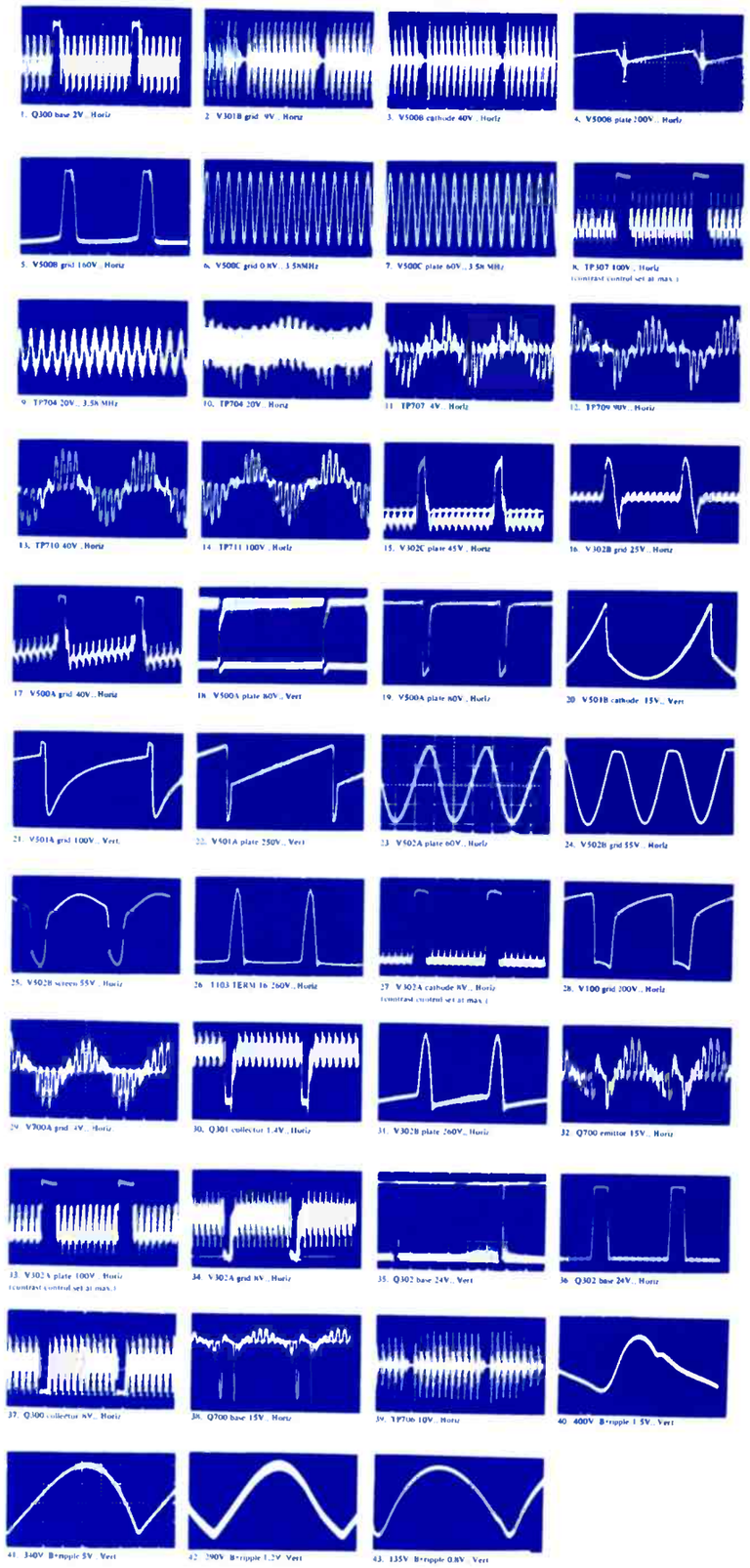




SYMBOL	DESCRIPTION	ADMIRAL PART NO.
R115	15M focus cont	75A108-7
R116	5M high volt cont	75A135-48
R129	750K vert hold cont, K-19	75A186-1
R129	750K vert hold cont, 2K19	75A134-28
R327	40K AGC cont	75A155-9
R340	200K bright range cont	75A155-10
R718	2K blue balance cont	75A101-40
R739	1.5M blue screen cont	
R740	1.5M green screen cont	75A155-1
R741	1.5M red screen cont	
RT100	dual thermistor, NTC	61A53-3
RV500	varistor	61A65-1
C106A	150μf, 250v, electr	
C106B	200μf, 350v, electr	67A15-412
C106C, D	100μf, 175v, electr	
C107A	100μf, 175v, electr	
C107B	80μf, 150v, electr	67A15-511
C107C	50μf, 150v, electr	
L100	line choke	73A31-16
L201	quadrature coil	72A366-1
L303	47.25MHz trap	72A359-3
L306	4.5MHz trap	72A367-1
L501	horiz hold coil	94A351-1
L702	3.58MHz peaking coil	72A364-1
T100	power xformer	80A116-3
	deflection yoke	94A377-12
	VHF tuner	94A421-1
T101	CRT filament xformer	80A119-1
T102	vert output xformer	79A153-4
T103	horiz output xformer	79A164-1
T104	audio output xformer	79A88-7
T200	45MHz driver xformer	72A303-17
T700	chroma take-off xformer	72A368-1
T701	chroma bandpass xformer	72A358-1
T703	chroma demodulator xformer	72A357-1
M100	high volt tripler	93A91-1
F100	5a fuse	84A7-13

ADMIRAL
Color-TV Chassis
K19





1462

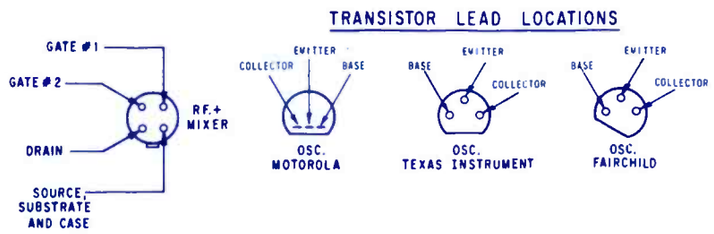
ZENITH

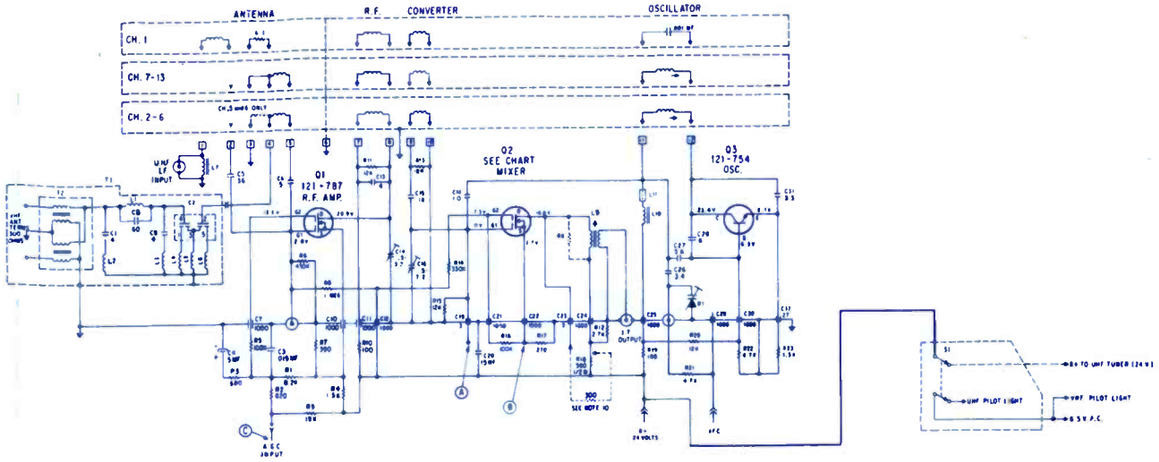
Color-TV Chassis
25DC57

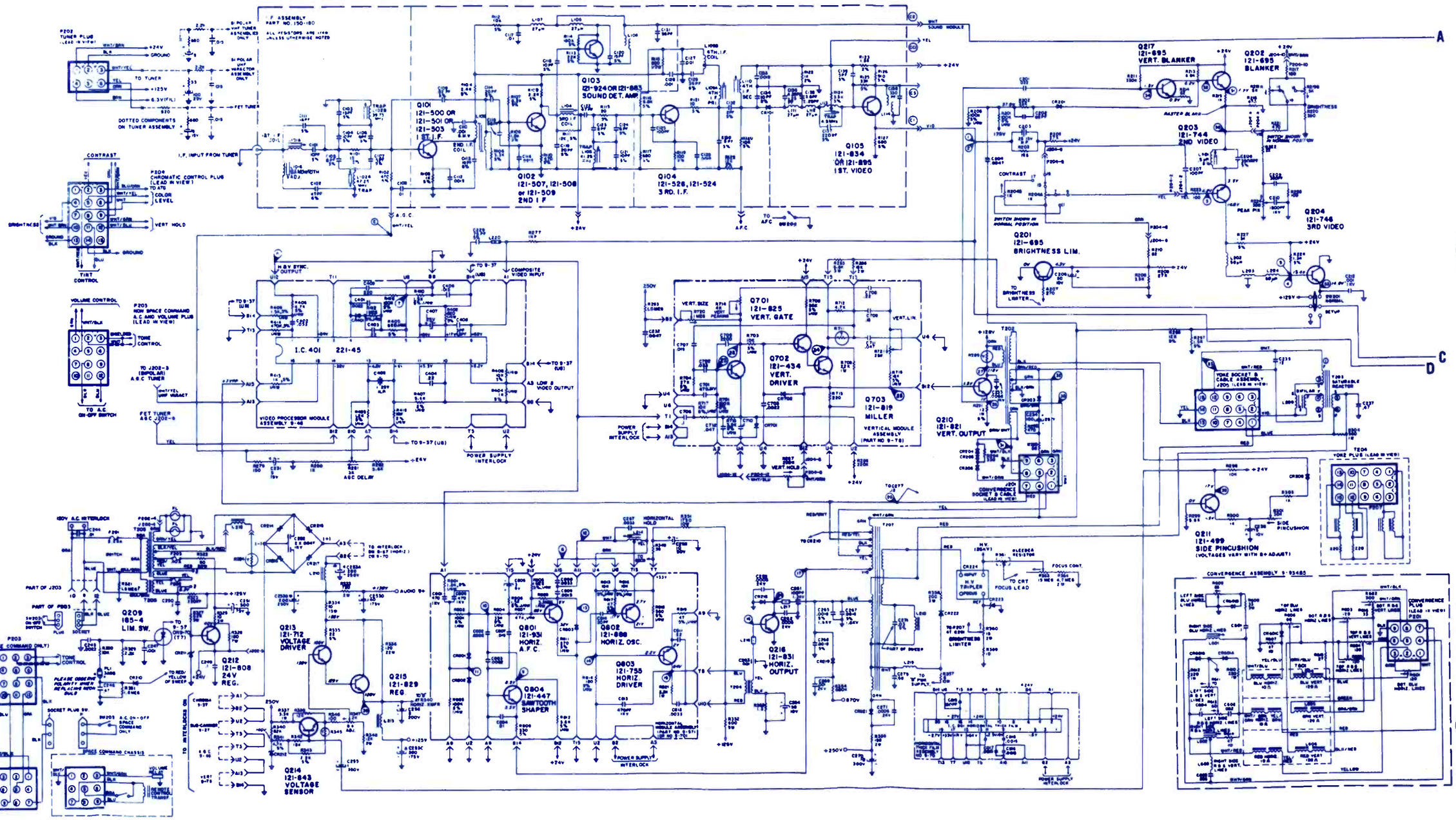
MARCH • 1973

ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

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

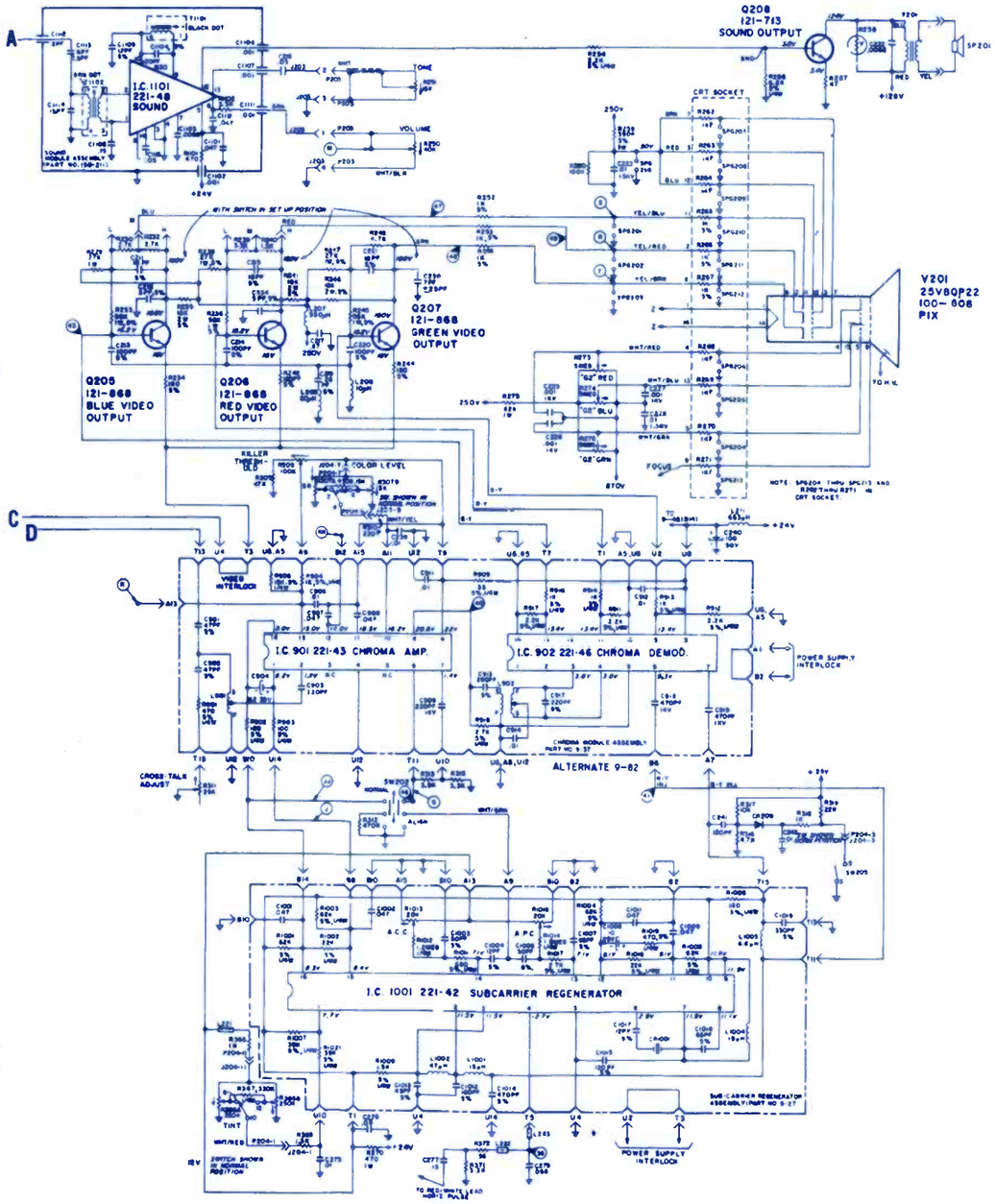






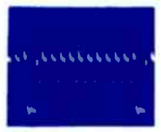
ZENITH
Color-TV Chassis
25DC57

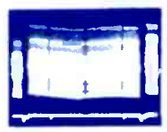
SYMBOL	DESCRIPTION	ZENITH PART NO.
C263A	280 µf electr cap 250 v	22-6346
C263B	200 µf electr cap 250v	
C263C	300 µf electr cap 175v	
C263D	40 µf electr cap 175v	
R324	thermistor	63-8687
R363	15M, focus control	63-9967
R711	thermistor	63-8788
R1013	20K, A.C.C. control	63-8576
L105	41.25MHz trap	20-3287
L113	4.5MHz trap	20-3289
L201	3.58MHz trap coil	20-1838
L213	filter choke (125v)	95-2894
L214	horiz osc coil	S-56875
L901	chroma take-off coil	95-2982
T201	audio output xformer	95-2883
T202	vert output xformer	95-3072
T204	deflection yoke (not interchangeable)	95-2880 or S-93256
T205	power xformer	95-2954
T207	horiz sweep xformer	S-93297
T208	filament xformer	95-2953-01
A701	integrator unit	87-11
F201	2.25 a bel-fuse	13892
F202	heater fuse link 2½ min. loop of No. 24 AWG copper wire	91-2061
F203	400 ma bel-fuse	138-99
	VHF tuner	175-1810

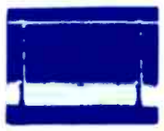


*** FOR WAVEFORMS 43 THROUGH 49, BYPASS TEST POINT "D" WITH 1.0 MF CAPACITOR.**


1. 1.7V P-P 60 Hz
3.8V O-P 60 Hz

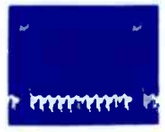

2. 1.7V P-P 15.75 KHz
3.8V O-P 15.75 KHz

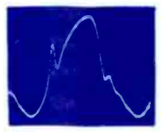

3. .9V P-P 60 Hz

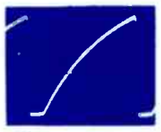

4. 14V P-P 60 Hz

5. NOT USED

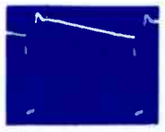

6. 24V P-P 15.75 KHz

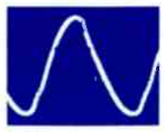

7. 3V P-P 15.75 KHz

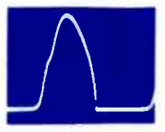

8. 29V P-P 15.75 KHz


9. 18V P-P 15.75 KHz

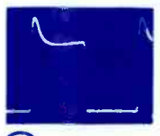

10. 18V P-P 15.75 KHz


11. 11V P-P 15.75 KHz

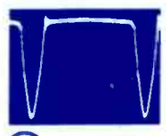

12. 76V P-P 15.75 KHz


13. 27V P-P 15.75 KHz

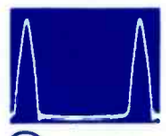

14. 3.5V P-P 15.75 KHz

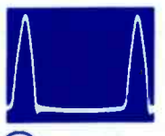

15. 155V P-P 15.75 KHz


16. 12V P-P 15.75 KHz


17. 50V P-P 15.75 KHz


18. 22V P-P 15.75 KHz


19. 215V P-P 15.75 KHz


20. 7V P-P 15.75 KHz


21. 22V P-P 60 Hz

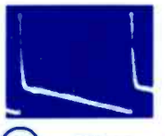

22. 5V P-P 60 Hz


23. 2V P-P 60 Hz

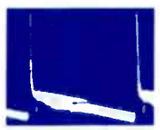

24. 27V P-P 60 Hz


25. 5V P-P 60 Hz

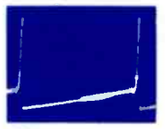

26. 3V P-P 60 Hz

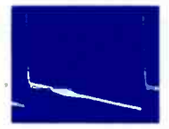

27. 500V P-P 60 Hz

28. NOT USED


29. 75V P-P 60 Hz

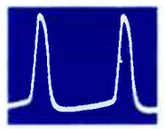

30. 10V P-P 60 Hz


31. 64V P-P 60 Hz

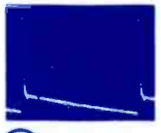

32. 8.4V P-P 60 Hz


33. 68V P-P 60 Hz


34. 2.4V P-P 60 Hz

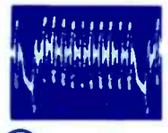

35. 4.2V P-P 15.75 KHz

36. NOT USED


37. 90V P-P 60 Hz

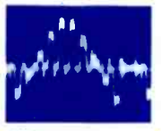
38. NOT USED

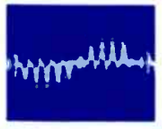
39. NOT USED


40. .5V P-P 15.75 KHz


41. 1.5V P-P 15.75 KHz


42. 1.5V P-P 15.75 KHz


* 43. 4V P-P 15.75 KHz


* 44. 2V P-P 15.75 KHz

* 45. 4V P-P 15.75 KHz

* 46. 1.2V P-P 15.75 KHz

* 47. 120V P-P 15.75 KHz

* 48. 60V P-P 15.75 KHz

* 49. 130V P-P 15.75 KHz

50. 1.5V P-P 60 Hz

51. 20V P-P 60 Hz

52. 24V P-P 60 Hz

53. 5V P-P 60 Hz

54. 1030V P-P 15.75 KHz

55. NOT USED

56. NOT USED

1463

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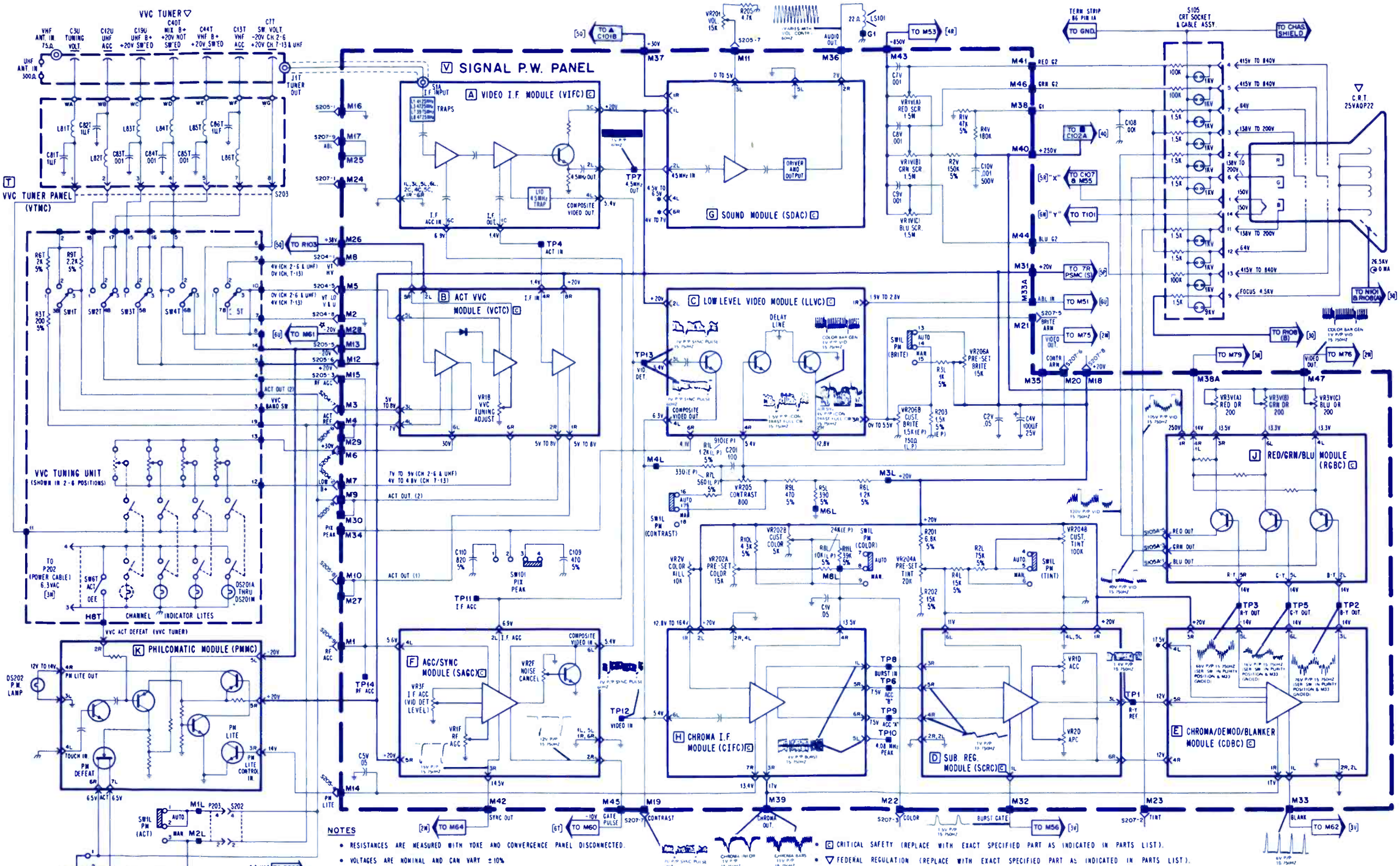

NOTES

- RESISTANCES ARE MEASURED WITH YOKE AND CONVERGENCE PANEL DISCONNECTED.
- VOLTAGES ARE NOMINAL AND CAN VARY ±10%
- VOLTAGES INDICATED ARE WITH SIGNAL (3000 MICRO-VOLTS), PHILCOMATIC SWITCH (SW1L) SET FOR "ON/AUTOMATIC" OPERATION, CUSTOMER COLOR AND TINT CONTROLS SET FOR NORMAL.
- FOR NO SIGNAL VOLTAGES AND VOLTAGES WITH MODULES REMOVED, REFER TO VOLTAGE CHART IN THIS SECTION.
- [ ] INDICATES GRAPH LOCATION ON SCHEMATIC WHERE LUG CONNECTIONS ARE LOCATED.
- COMPONENTS AND LUGS ON SCHEMATIC WHICH END IN "L", SUCH AS R1L, M1L, ETC., ARE LOCATED ON THE PHILCOMATIC SWITCH PANEL.

- C CRITICAL SAFETY (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- ▽ FEDERAL REGULATION (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- ⊙VVC DOOR CLOSED - SW202 CONTACTS 4 AND 5 CLOSED.
- ⊙VVC DOOR OPEN - SW202 CONTACTS 1 AND 2 CLOSED, CONTACTS 3 AND 4 CLOSED.
- PHILCOMATIC SWITCH (SW1L) SHOWN IN "ON/AUTOMATIC" POSITION.
- * NO CONNECTION - FACTORY USE ONLY.
- ☆ -20V NOMINAL. NORMALLY -15V ±20%.

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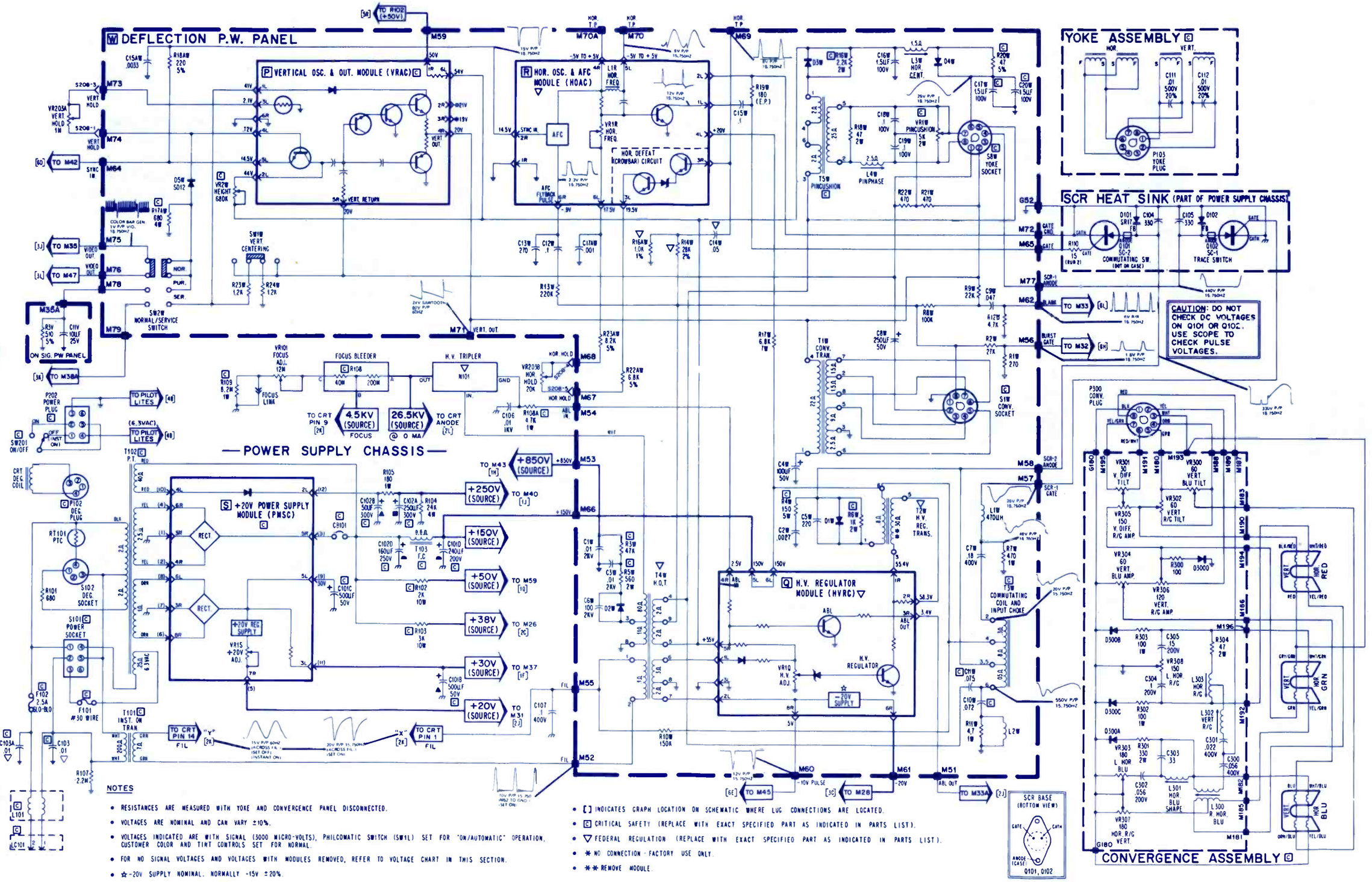

NOTES

- RESISTANCES ARE MEASURED WITH YOKE AND CONVERGENCE PANEL DISCONNECTED.
- VOLTAGES ARE NOMINAL AND CAN VARY ±10%.
- VOLTAGES INDICATED ARE WITH SIGNAL (3000 MICRO-VOLTS), PHILCOMATIC SWITCH (SW1L) SET FOR "ON/AUTOMATIC" OPERATION, CUSTOMER COLOR AND TINT CONTROLS SET FOR NORMAL.
- FOR NO SIGNAL VOLTAGES AND VOLTAGES WITH MODULES REMOVED, REFER TO VOLTAGE CHART IN THIS SECTION.
- ☆ -20V SUPPLY NOMINAL. NORMALLY -15V ±20%.
- [ ] INDICATES GRAPH LOCATION ON SCHEMATIC WHERE LUG CONNECTIONS ARE LOCATED.
- Ⓒ CRITICAL SAFETY (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- ▽ FEDERAL REGULATION (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- ✱ NO CONNECTION - FACTORY USE ONLY.
- ✱✱ REMOVE MODULE.

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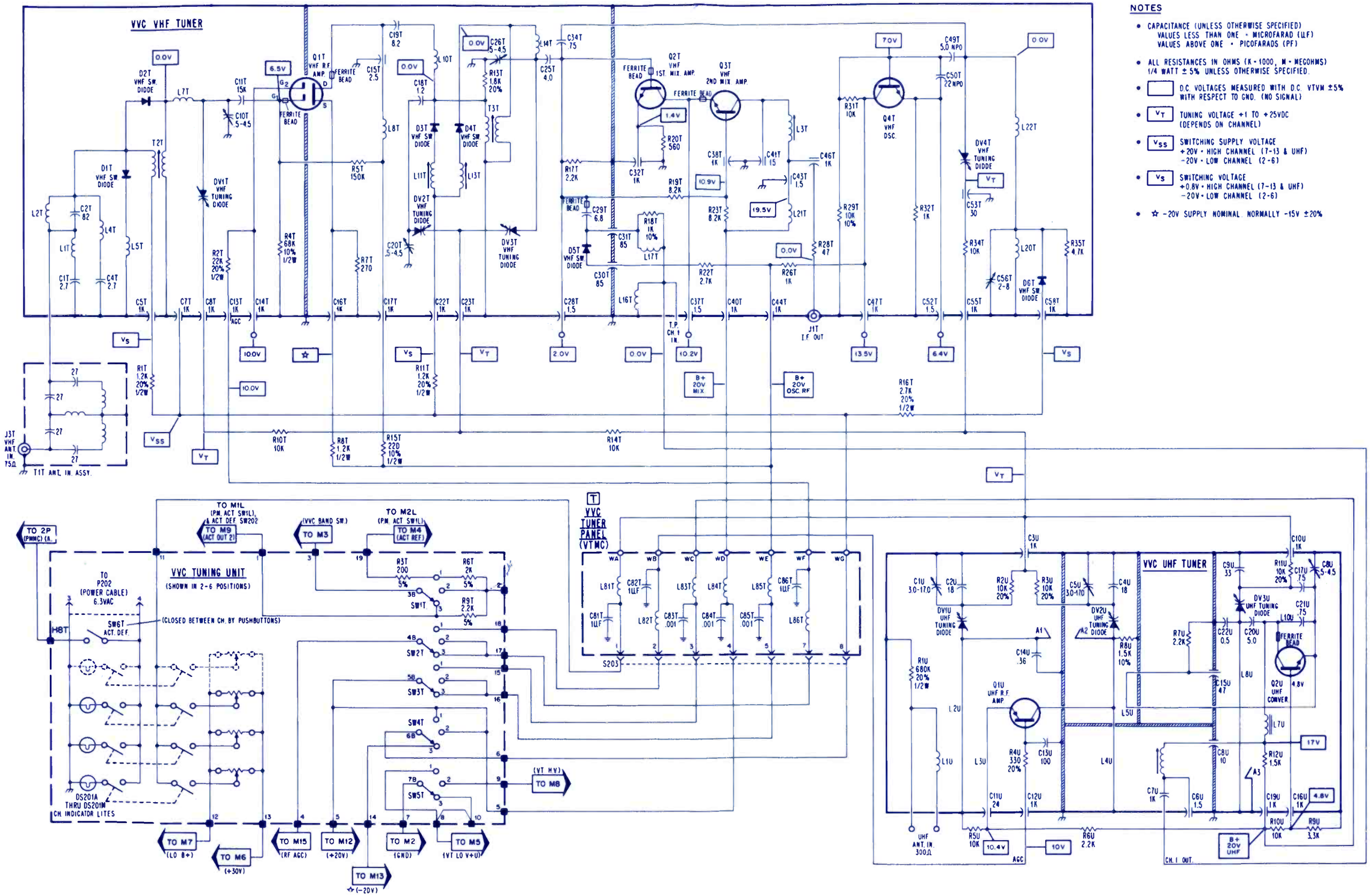

NOTES

- CAPACITANCE (UNLESS OTHERWISE SPECIFIED) VALUES LESS THAN ONE = MICROFARAD (MF) VALUES ABOVE ONE = PICOFARADS (PF)
- ALL RESISTANCES IN OHMS (K = 1000, M = MEGOHMS) 1/4 WATT ± 5% UNLESS OTHERWISE SPECIFIED.
- [ ] D.C. VOLTAGES MEASURED WITH D.C. VTVM ±5% WITH RESPECT TO GND. (NO SIGNAL)
- [V_T] TUNING VOLTAGE +1 TO +25VDC (DEPENDS ON CHANNEL)
- [V_{SS}] SWITCHING SUPPLY VOLTAGE +20V = HIGH CHANNEL (7-13 & UHF) −20V = LOW CHANNEL (2-6)
- [V_S] SWITCHING VOLTAGE +0.8V = HIGH CHANNEL (7-13 & UHF) −20V = LOW CHANNEL (2-6)
- ☆ −20V SUPPLY NOMINAL NORMALLY −15V ±20%

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