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Sav-a-Tab '75 ends at midnight, Nov. 30, so get your catalog of treats right now. See your local Sylvania distributor or write Sylvania Award Headquarters, P.O. Box 1000, Fenton, Missouri 63026.

GTE SYLVANIA

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THE COVER: A stacked antenna array which is used to increase signal strength and eliminate reflected signal pickup in the Colorado Rockies. Courtesy of the Winegard Company.

FEATURES

TEKFAX—Admiral color TV Ch. T43K10 and T44K10; Admiral b-w TV Ch. T6R2-1A, 2A; Admiral color TV Ch. T50K10-4B; Airline b-w TV Model GAI-11235A/B; and Airline color TV Model GAI-12635A.

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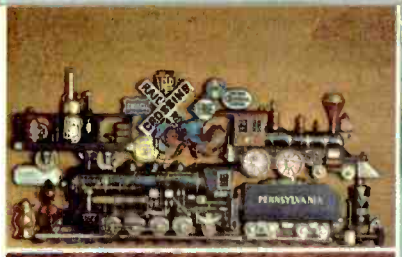

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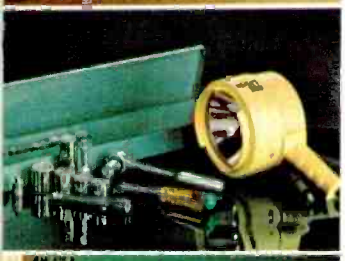

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Tear 'n Share

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LETTERS

"Noisy" Transistors and The Effects of Temperature

The term "noisy transistor" is used in the article titled *Testing Bipolar Transistors In and Out of Circuit* (page 12, January 1975 ET/D). What does it mean?

Also, I am aware of how warmer temperatures affect a transistor's operating characteristics, but I have not been able to find any information about how colder temperatures (such as zero degrees F) affect transistors. I know that after a period of operation the temperature increases. But what about the transistor's operating characteristics until it does?

For example, I recently encountered a Delco Model 32BPB2 auto radio which, after the car in which it is installed sets out overnight in below-freezing temperatures, produces no volume. If the volume control is rotated to the normally maximum position, the receiver goes into oscillation. After about a twenty minute warmup period, the receiver operates normally.

Hugh F. Sweeney
Stoneham, Mass.

(Mr. Sweeney's letter was forwarded for reply to Bernard Daien, the author of the article to which Mr. Sweeney refers in his letter. Following is Mr. Daien's reply:)

The term "noisy transistor" is used to describe a defective transistor which internally generates low-level, random, wide-band, spurious signals. When viewed on a scope screen, these signals look like waving grass. Such "noise" signals produce audio which sounds like steady frying or hissing. The same type of noise signals produce a "snowy" effect on the screen of a TV receiver which has a low signal-to-noise ratio. Sometimes "noisy" transistors internally generate random bursts of higher-than-usual noise signals which produce audio that sounds somewhat like popcorn popping.

Experience has proven that "noisy" semiconductor devices have a much shorter life and are not as stable as "non-noisy" semiconductors.

Regarding the effects of colder temperatures on transistors: As pointed out on page 15 of the January 1975 issue of ET/D, the emitter-to-base junction of a transistor has a negative temperature coefficient. In other words, as the temperature of the junction decreases, the amount of forward bias voltage required to turn on the transistor increases. To compensate for this effect, auto radio manufacturers select semiconductors whose junction characteristics remain stable throughout the relatively extreme range of temperatures to which the devices will be exposed. However, occasionally a particular transistor which fails to meet this criteria will find its way into a group of a type being used.

However, there are also other causes of the "cold weather" problem you describe. For example, a printed circuit might be alternately opening and closing as a result of contraction and expansion caused by the extremes of temperatures, or the capacitance of an electrolytic might be decreasing as the electrolyte nears freeze-up.–Bernard Dain ■

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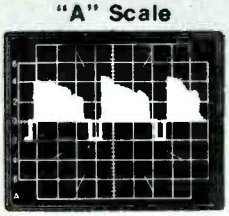
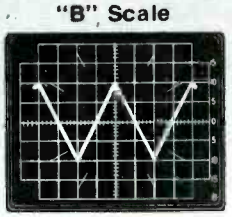
"A" Scale



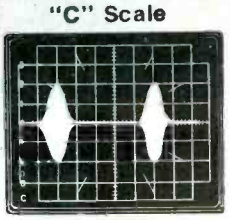
For readings in multiples of 2, from 0 to 6 (+ and −) peak to peak.

"B" Scale



For readings in multiples of 5, from 0 to 15 (+ and −) peak to peak.

"C" Scale



For readings in multiples of 1, from 0 to 3 (+ and −) peak to peak.

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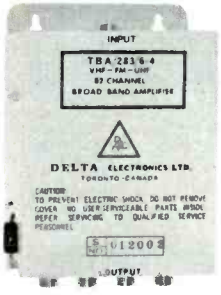

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NEWS OF THE INDUSTRY

First-Quarter TV Sales To Dealers Down Over 30 Percent; Phono Sales Up 8 Percent

Total TV unit sales to dealers during the first quarter of 1975 were down 30.6 percent from sales during the same period in 1974. Color TV sales were off the most, registering a decline of 31.4 percent, while monochrome TV sales were down 29.5 percent.

The one positive sales-to-dealers statistic among those recently released by the Marketing Services Department of the Electronic Industries Association (EIA) is the 8.5 percent gain registered by the combined portable, table, compact and component phonograph category.

(UNITS) PRODUCT	FIRST QUARTER 1975	1974	PERCENTAGE Change
TELEVISION			
Monochrome	1,060,794	1,504,403	– 29.5
Color	1,358,266	1,980,973	– 31.4
TOTAL TELEVISION	2,419,060	3,485,376	– 30.6
RADIO			
AM	1,246,869	2,133,016	– 41.5
FM	2,657,967	3,288,127	– 19.2
TOTAL	3,904,836	5,421,143	– 28.0
AUTOMOBILE	1,933,368	2,570,451	– 24.8
TOTAL RADIO	5,838,204	7,991,594	– 27.0
PHONOGRAPH			
Portable, Table, Audio Compact and Component Systems	672,595	620,169	+ 8.5
Console	113,695	188,200	– 39.6
TOTAL PHONOGRAPH	786,290	808,369	– 2.7

FTC Establishes Tighter Rules About Disclosure Of TV and Radio Cabinet Materials

In a revision of Rule 6 of the Trade Practice Rules for the Radio and TV Industry, the Federal Trade Commission (FTC) has tightened up the disclosure procedures and terminology which manufacturers and dealers must use in describing the composition of TV and radio cabinets.

The revision, which went into effect on June 11, requires "affirmative" disclosure by manufacturers and dealers of any simulated wood materials or veneers used in cabinets whose actual appearance or advertising representation might lead a consumer to believe that the material is wood in its natural form.

Such affirmative disclosures must be included on the cabinet or on a prominently displayed tag or label attached to the cabinet, and in advertising in which a photo or drawing of the cabinet might mislead consumers about the composition of the cabinet.

The revised FTC rule also provides examples of descriptive terminology which can and cannot be used, and makes it illegal for dealers to remove or alter manufacturers' hang tags and labels which disclose information about the construction and composition of cabinets.

PTS Opens New Service Centers In Washington and Virginia

PTS Electronics, Inc., Indiana-base TV tuner repair company, recently opened new TV tuner repair centers in Seattle, Washington (432 Yale Avenue) and in Norfolk, Virginia (3118 E. Princess Anne Road).

Various Models of Five Brands Of Color TV Receivers Ordered Recalled By FDA's BRH

Since mid-December 1974, the Food and Drug Administration's Bureau of Radiological Health has ordered 55 models of five brands of color TV receivers recalled for corrective action which the Bureau deems is necessary to reduce the possibility that these receivers, under certain conditions, will emit excessive levels of x-radiation.

The five brands involved in the recalls are Panasonic, Penncrest (J.C. Penney) and Bradford (W.T. Grant), all of which were manufactured by Matsushita Electronic Corporation (the parent firm of Panasonic), and Quasar and Toshiba.

The recall orders cover approximately 409,000 color TV receivers, including about 306,000 Panasonic receivers, about 103,000 Penncrest receivers, about 15,000 Bradford receivers, about 2400 Quasar receivers and about 2500 Toshiba receivers. Specific models of these brands are listed below.

All of the firms involved reportedly have or are now in the process of informing affected consumers and dealers, and have established procedures for making the required corrections.

Each of the recalled receivers which has received corrective action is supposed to be marked on the back with a white circular label containing either the notation "C" or "REV 75." Dealers and technicians who encounter any of the following makes and models which do not have this label are advised to contact the respective manufacturer or marketer for processing instructions.

Panasonic

201	398	701A	314	993
300E	252	398A	324	994
300V	253	911	704	944
701	253A	912	910	2514
702	254	911E(VTR)	924	2524
772	256	911V(VTR)	934	2534
396				

Penncrest

2888	2876	2915	2875A	2878A
2868	2877	2874	2876A	
2875	2878	2901	2877A	

Bradford

79343	79350	79301

Quasar

WP5532LW*	WP5538LS*	WP5540	WP5016
WP5534LW*	HP552	WP5546	

Toshiba

C945

* Only serial numbers X()5002 through X()5047

Zenith Holds Fourth Annual Technician's Advisory Council

Seventeen independent TV service technicians from the U.S. and Canada attended Zenith's Fourth Annual Technician's Advisory Council in Chicago on April 7-8.

Zenith executives directly involved with product planning, quality, reliability and service of the company's consumer electronics products met with the service technicians during the two-day meeting to discuss various aspects of product development, engineering, product reliability, service and parts.

"These are real down-to-earth meetings," Nathan W. Aram, Zenith's vice president-consumer affairs, said. "We generally have pretty good ideas on where serviceability of our products might be improved from various sources throughout the year, but the technicians and managers who attend these Councils provide valuable help in reinforcing specific areas where they feel our product could be made better."

Every Zenith distributor in the United States and Canada was asked to recommend one representative for membership on the Advisory Council. Each year's Council involves a small group of these representatives, with all nominees to participate eventually. All members are long-time technicians or managers who are qualified by experience to discuss every phase of servicing Zenith products.

Oregon Considering The Banning Of Aerosol Tuner Cleaners

Just before press time we learned that during the past week (May 19-23) the Oregon House Committee On Environment And Energy has been holding hearings on a proposed bill which, if passed, will ban the sale of all types of aerosol products in that state, including the aerosol tuner cleaners, lubricants and coolants used by electronic technicians.

Dick Pavek, president of Tech Spray, a Texas-based manufacturer of aerosol products used by electronic technicians, on May 20 appeared before the Oregon House Committee to present information which he believed refutes the claims of the sponsors and other proponents of the bill. According to Pavek, the proposed bill, if enacted, will become effective one year from this July, although there is some support among Committee members to delay the effective date until two years from this July. ■

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And here are 22 hardworking reasons why it'll stay there.

1. Smaller 6 and V8 engines. Dodge is very big on a couple of small engines. The 225-cubic-inch Slant Six. And the 318-cubic-inch V8. Both have plenty of power and make it on very little gas. (And they're smaller than any engine Ford or Chevy's got.)

2. Great fuel economy. Tradesman's gas-sipping Slant Six will give you a real run for your money. In recent EPA tests, it went farther on a gallon than any other van. In stop-and-go city driving or out on the open road, you can count on Tradesman to go easy on the gas.

3. Big standard fuel tank. Dodge gives you a standard gas tank that holds 23 gallons. (Chevy's tank holds only 21.) If you really want to fill 'er up, you can opt for our big 36-gallon tank.

4. Easier side loading. Tradesman lets you take in business on the side with a standard side door that's a big 49¼ inches wide. (Bigger than either Ford's or Chevy's.) And because our passenger seat's in an out of the way place, there's plenty of room to load cargo, too.

5. Lighter curb weights for payload. Dodge Tradesman weighs less and can carry more than either Ford or Chevy. On comparable models, it weighs 524 pounds less than Ford and 140 less than Chevy. With Dodge Tradesman, you go in weighing less, so you can come out carrying more. It's as simple as that.

6. Better maneuverability. Tradesman's easy handling and compact size let it literally run rings **inside** Ford and Chevy. Curb to curb, its turning diameter is over three feet shorter than either of them. So, you can U-turn a Tradesman without a lot of backing and filling.

7. B300 short wheelbase. With a Tradesman B300 (short 109-inch wheelbase), you can jockey up to a ton of stuff into tight areas that a van with a longer wheelbase couldn't get into. So you can take care of all the little ins and outs that a Ford (138-inch) can't.

8. In-cab hood release. It keeps strangers from poking around in your engine. Once you've locked your doors, you've locked your hood, too. (And it's an option that only Dodge has.)

9. Biggest van in the business. With 18 extra inches of overall length, the Dodge Maxivan is the biggest van on the road. You can count on Maxivan to handle all the big stuff that other vans can't even close their doors on.

10. Smaller standard tires. Because Tradesman weighs less than any other van, it can go on smaller tires, too. (Tires that could save you up to 40 bucks at replacement time.)

11. Wide choice of engines. With Tradesman, you've got three engines to choose from on every model. There's a thrifty 225 Slant Six (plenty of power but economical, too). A 318 V8. Plus the muscle of a 360 V8.

12. Automatic speed control. Tradesman's optional automatic speed control makes it easy to take it easy. Cruising at a constant speed not only saves on gas, it saves on the driver, too. (Available on both Dodge V8's, but only on Ford's biggest V8.)

13. Single rear door. Tradesman's optional single rear door has a big panoramic rear window. No one else has it. (Standard are two swing-out doors.) What about getting in and out on the side? You can go with our swing-out doors. Or you can opt for one that slides.

14. Air conditioning. More than likely, a lot of long hard days are also going to be long hot days. So, you can opt for air conditioning on every Tradesman model. (But not on every Ford.)

15. Proven Electronic Ignition. When it comes to Electronic Ignition, Dodge was off to a fast start years ago. Today, we've got the kind of proven performance you know you can count on for surer starts and fewer tune-ups.

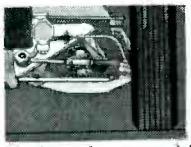
16. Glove box. Dodge gives you a car-style glove box (with an optional door) in the instrument panel. In Ford and Chevy, the glove box is only a bin in the engine cover.

17. Auxiliary rear heater. Dodge offers an auxiliary rear compartment heater on every Tradesman model. (Chevy doesn't have one at all. And Ford's 124-inch WB doesn't have one either.) So with Tradesman, working in back is a lot nicer in cold weather.

18. Largest selling van chassis. Look underneath most mini motor homes and you'll find a Dodge van chassis. (It supports more families than anyone else in America.) And it comes with great features such as "Thumpless" tires, a choice of either 127- or 145-inch wheelbase, and a maximum GVW of 10,500 pounds.

19. Larger parking brake linings. Dodge has beefed up its parking brake linings (they're bigger than Ford's). Because the bigger they are, the longer they'll last. Which means less money to shell out for replacements.

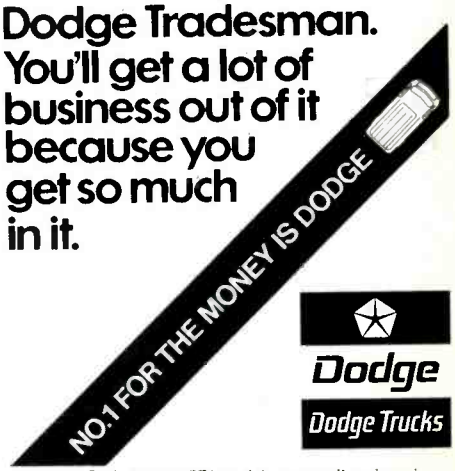
20. Easier front wheel alignment. Dodge's independent front suspension gets the bumps before they get you. But sooner or later, the bumps get to any suspension. On a Dodge, realignment's an easy matter. Not so on a Ford. Their suspension can't be realigned on anything but special (and sometimes hard-to-find) truck alignment equipment.



21. Lower overall vehicle height and shorter length—garageability. Tradesman is more compact than Chevy, and up to a foot shorter than Ford. And that can mean a lot when you're short on space. Especially if you've got more than one van.

22. Standard two-stage front door check. Dodge has put a stop to slamming doors. In two positions. If you're in a hurry, check the door half-way. If you're lugging a load, Tradesman's doors will open wide. And stay there.

Dodge Tradesman. You'll get a lot of business out of it because you get so much in it.



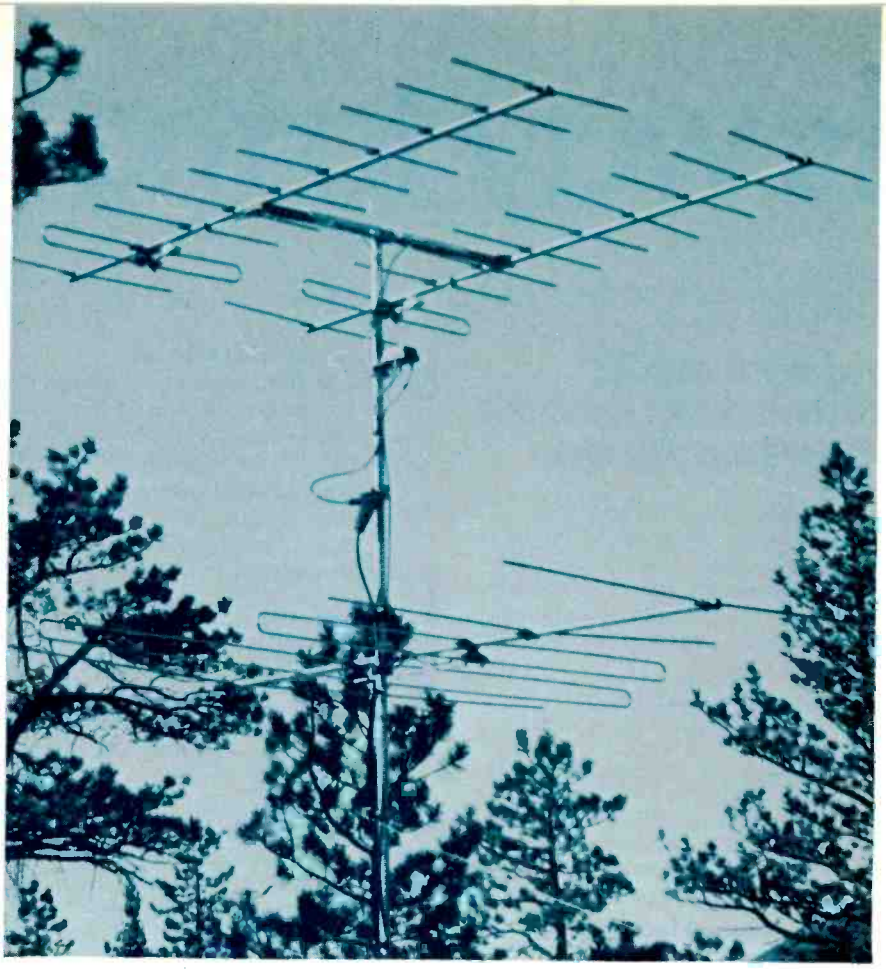
*Based on R. L. Polk's 1974 model year retail registrations for Tradesman vans and van chassis.

...for more details circle 106 on Reader Service Card

Stacking TV Antennas

By James E. Kluge*

The improved directivity achieved by stacking antennas can significantly reduce or eliminate many types of television interference



■ Multiple TV-antenna arrays, reminiscent of the '50s, are making a reappearance around the country. Today, however, the principal reason for stacking antennas is not only to achieve increased gain out in the fringe areas, but also to solve interference problems through the use of highly directional antenna arrays.

Many urban areas today are plagued with multiple high-rise buildings and heavy users of electrical power, both of which cause television interference (TVI) problems. Typical TVI problems include ghosts, electrical noise and interfering radio signals which usually arrive from a direction slightly off axis from that in which the antenna is pointed. Ground reflections, ignition noise and reflections off moving ground or airborne reflectors, such as trucks and large aircraft, arrive from above or below and cause picture breakup.

Proper stacking of today's highly sophisticated TV antennas can significantly improve directivity and selectivity, as well as gain.

*The author is a technical editor in the Engineering & Research Division of the Winegard Company.

OPERATION OF A SINGLE YAGI

The Yagi antenna, the most commonly used type for TV, "sees" electromagnetic radio waves in a manner similar to the way we see. Our eyes see in the general direction in which our head is pointed. Similarly, the Yagi antenna "sees" in the general direction in which its boom is pointed. When viewed from above (Fig. 1), the Yagi antenna's outline more or less resembles an arrowhead because it tapers out from front to rear. The taper is more pronounced in broad-band antennas than in single-channel antennas. The arrowhead formed by the antenna should, generally speaking, point in the direction from which the desired signal is arriving; i.e., toward the TV transmitter.

Ideally, a TV receiving antenna should "look" in a straight-line path toward the transmitting antenna and "see" nothing above, below or to either side. Not being ideal, of course, even the best TV antennas "see" a considerable amount of undesirable signals arriving from an angle off the axis of the antenna, just as our eyes have some side vision. These signals can cause ghosts and other interference patterns on the TV screen.

A Yagi antenna is made up of many parallel elements arranged along a common axis in a horizontal plane and all oriented toward the signal source. The length, spacing and phasing of each element relative to that of the others determines how the voltages induced in individual elements reinforce (add) at the antenna terminals. The elements are arranged and spaced so that the signal wavefront arrives at each element *sequentially* and so that the voltage induced in each antenna element combines at the antenna terminals with voltages from the other elements, to yield an optimized voltage which produces maximum gain over the desired bandwidth.

If the signal arrives from a source *above or below* the horizontal plane of the antenna, it will arrive at *all* of the Yagi elements simultaneously instead of sequentially. Under these conditions, the combined voltage at the antenna terminals will be something less than the optimum for which the antenna was designed.

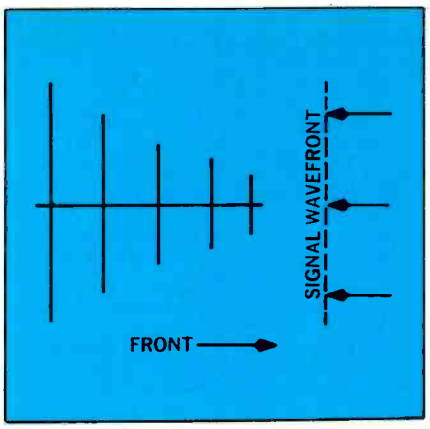


Fig. 1—Top view of a typical Yagi antenna.

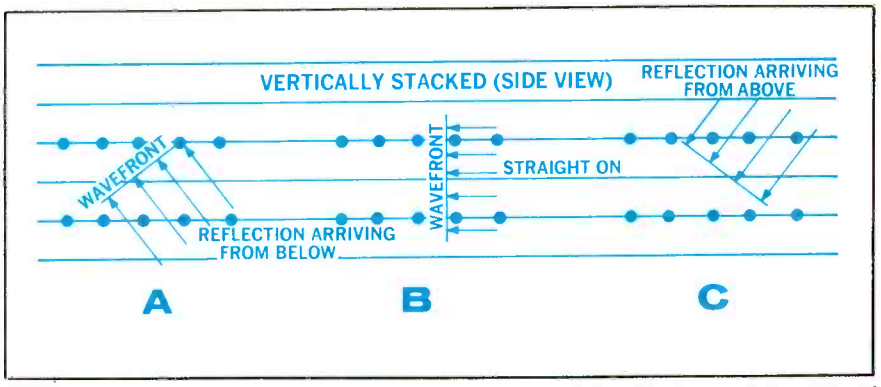


Fig. 2—Side views of vertically stacked Yagi antennas showing relationship of antenna elements and arriving signals. A) Signal reflected from below. B) Signal received straight from source. C) Signal reflected from above.

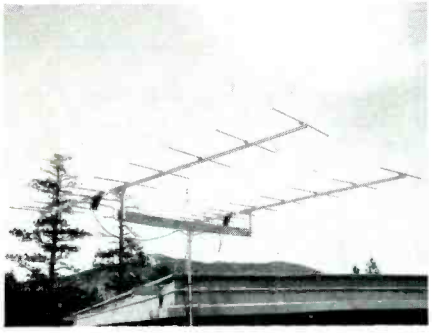


Fig. 3—Horizontal stack consisting of two Winegard Model SCX-10 ten-element, Channel 10 Yagi antennas.

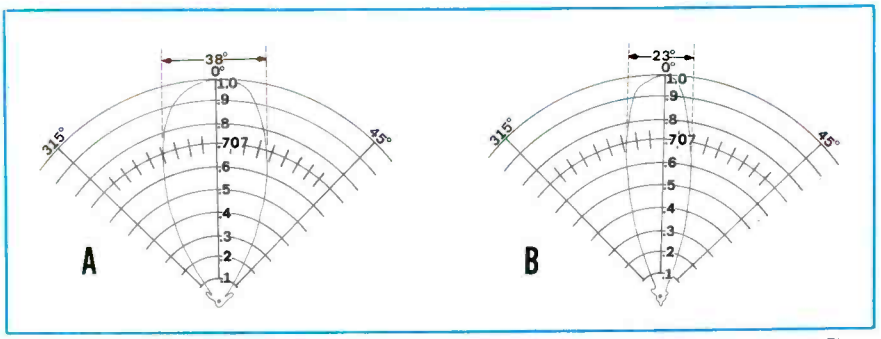


Fig. 4—Polar patterns which illustrate the effect of horizontally stacking the antennas shown in Fig. 3. A) This is the pattern for a single Winegard Model SCX-10 Yagi. B) Narrower pattern produced by horizontally stacking two Winegard SCX-10 Yagis one wavelength apart.

VERTICAL STACKING

Stacking two identical antennas on a common vertical mast significantly narrows the *vertical* beam-width angle. That is, vertically stacked antennas more effectively reject those interfering signals arriving from *above or below* their horizontal plane than does a single antenna. It's as though they were looking through a horizontal venetian blind. Because there's nothing mounted to the side of either antenna, their side-to-side vision is virtually uneffected. In the process, gain increases about 2.5 dB over that of a single antenna.

Vertical stacking improves both gain and vertical directivity. This helps reduce airplane flutter and attendant picture roll, and certain types of ground noise and ground reflections.

The basic principle of stacked antennas involves the difference in the time of arrival, and therefore the phase, of signals intercepted by the antenna combination. If a pair of identical Yagi antennas are mounted one above the other, a wavelength apart, on a common vertical mast and are oriented identically (pointed) toward the signal source, any TV signals traveling horizontally and arriving from any direction will be intercepted simultaneously by both antennas.

Those signals arriving on axis from the direction in which the antenna is pointed (Fig. 2B) will be strongest.

Because the antennas are identical, the generated signal voltages arriving at the output terminals shared by the antennas will be in phase, causing them to add directly. Theoretically, there should be a 3 dB increase (double) in signal power over that of a single antenna, but, because of losses in the coupler and cable, the actual gain increase will be somewhat less than 3 dB.

An important point to remember is that, regardless of the azimuth angle between the antenna orientation and the signal source, the arriving signal will strike any given identical points on the two antennas simultaneously. However, if the signal is arriving from a source *above or below* the horizontal plane of the antenna, the previous statement is no longer true. For example, if the wavefront is from a source *below* the plane of the antenna (Fig. 2A), the signal will arrive first at the lower antenna and the signal voltage from the top antenna will lag the signal from the lower antenna. The signal voltages at the antenna output terminals will no longer be in phase, and partial cancellation will take place. The opposite is true if the signal arrives from above (Fig. 2C).

The angle of arrival and the resultant difference in arrival time causes a phase difference which reduces the magnitude of the combined voltages. You should begin to see now why two vertically stacked, identical antennas have a more restricted "vision" to signals arriving from a point above or below the horizontal plane than does a single antenna.

HORIZONTAL STACKING

Stacking two identical antennas side by side in a horizontal plane (Fig. 3) significantly narrows the *horizontal* beam-width angle, as shown in Fig. 4. That is, the antenna combination, like a horse wearing blinders, "sees" fewer interfering signals arriving from the sides while its vision up and down (in a vertical plane) is virtually unaffected. In the process, gain increases approxi-

mately 1.2 dB over that of a single antenna.

If two identical antennas are arranged side by side in a horizontal plane and the signal wavefront arrives directly from the front (Fig. 5B), each antenna "sees" the same wave or field at the same time. If the wavefront arrives from a source above or below, the same is still true, except that the individual antennas are not operating as efficiently. However, if the wavefront arrives from *one side or the other* (Fig. 5A and C), the antenna on the side from which the signal is arriving will "feel" the signal first, causing the voltages induced in each antenna to be out of phase. This, in turn, causes partial cancellation of the antenna voltages when they are combined.

The up and down (vertical) "vision" of a horizontal stack is comparable to that of a single antenna, but its side-to-side "vision" is more restricted.

QUAD STACKS

Stacking four identical antennas, two vertically and two horizontally in a rectangular or diamond pattern, restricts the vision of this combination in all directions off the axis. Called a *quad stack,* it "sees" as though it were looking through a tube pointed in the direction of the transmitting antenna. Gain is increased approximately 4 to 5 dB over that of a single antenna.

GENERAL TECHNIQUES

Before you start putting up an array, you should be aware of the following basic considerations which apply to dual and quad stacking of antennas:

1) Stack only identical antennas

2) Maintain approximately one wavelength spacing (at lowest channel frequency) between antennas

3) Cut phasing lines or connecting cables to *equal* lengths

4) Length and phase of twinlead interconnecting harnesses is critical

5) Horizontal supports should be nonmetallic

6) Avoid running interconnecting cables horizontally.

Vertical stacking is easier than horizontal stacking simply because in vertical stacks the antennas mount on a common vertical mast and spacing is easily adjusted.

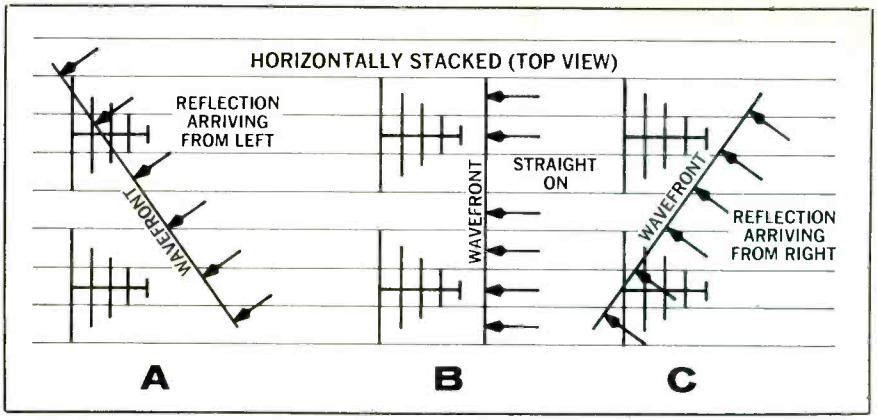


Fig. 5—Top views of horizontally stacked Yagi antennas showing relationships of antenna elements and arriving signals. A) Signal arriving from left side. B) Signal received straight from source. C) Signal arriving from right side.

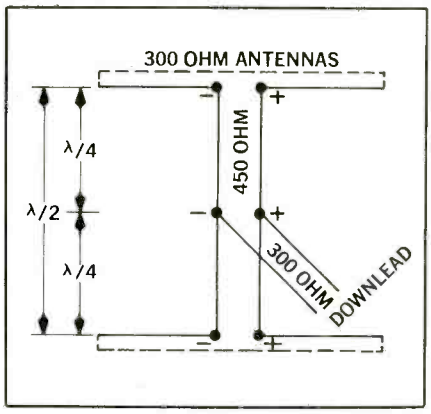


Fig. 6—Harness arrangement for vertical stacking. Using a phasing harness to couple 300-ohm stacked antennas eliminates a coupler and avoids losses but can only be optimized for one channel. A harness is also susceptible to noise and is more time consuming to install. Phasing harnesses, made from balanced transmission line, must be precisely dimensioned, properly phased and carefully positioned to achieve satisfactory performance. Vertically stacked single-channel 300-ohm antennas are connected in parallel using two quarter-wave lengths or 450-ohm transmission line. Phasing polarities must be strictly observed. In absence of polarity marking on antenna, consider corresponding right and left terminals on identical antennas as same polarity.

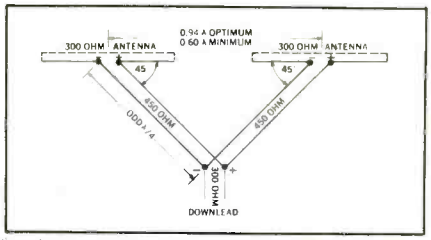


Fig. 7—Harness arrangement for horizontal stacking. Two horizontally stacked, 300-ohm, single-channel antennas require two equal lengths of 450-ohm balanced transmission line cut to an odd multiple of a quarter wavelength at the center frequency of the channel to be received and positioned at 45 degrees to the horizontal. Phasing polarity must be strictly observed. (For the purpose of connecting a phasing harness, a quad stack (2 x 2) can be envisioned as two separate vertical stacks, each preconnected and arranged in a horizontal-stacking pattern. Connect the output of each vertical stack as you would each output of identical antennas in a horizontal stacking arrangement.

However, with the excellent gain and high directivity of most Yagis today, vertical stacking is seldom necessary. If additional gain is needed, two vertically stacked identical antennas spaced more than ½ wavelength apart will increase signal power by 3dB compared to that of one antenna. However, part of the increased gain will be lost in the connecting cables and the coupler.

Horizontally stacked antennas also must be spaced so that their booms are separated by a distance equal to more than ½ wavelength of the lowest channel frequency. This spacing is needed to prevent the tips of the longest reflector elements from touching. Also, the horizontal supports must be *nonmetallic;* redwood or cedar 2' x 4's are commonly used.

The severe ghosts caused by high-rise buildings, water towers and mountains can be reduced or eliminated by horizontally stacking two Yagis. However, the wavelength of a channel 2 signal exceeds 17 feet, making such an array for channel 2 unwieldly, heavy and subject to damage from ice and/or high wind. Fortunately, ghosting is more of a problem at high-band channels, and high-band antenna dimensions are significantly smaller. For these reasons, usually only high-band Yagis are stacked horizontally.

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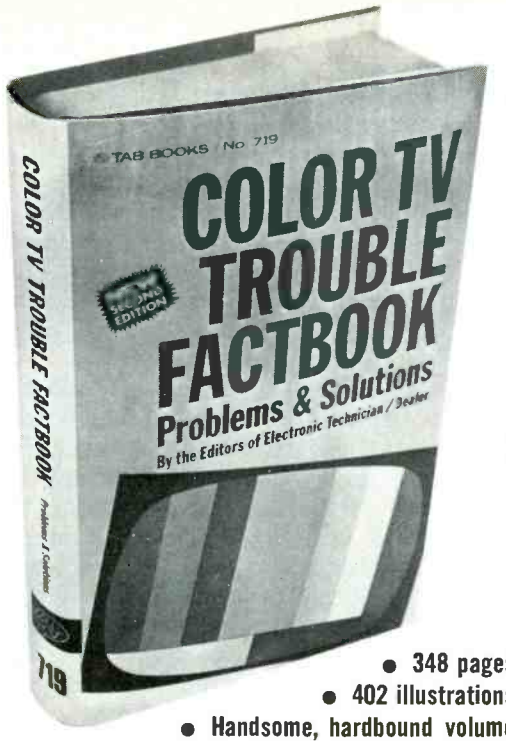

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Twice the size of the bestselling original, this newly updated edition is a fully indexed all-in-one reference guide to color-set troubles and recommended solutions, manufacturers' service notes, and production change data—all alpha-numerically arranged by manufacturer and model. This low-cost handbook contains service tips, troubleshooting data, and special problem-solving aids for all the more popular U.S. and Canadian color TV makes and models, from A (Admiral) to Z (Zenith).

But that's not all! Included also are details concerning repetitive troubles, field-factory changes, new and unusual circuits and descriptions of how they work, special adjustment procedures and other such pertinent service information. Of particular importance are the manufacturer's production changes —this book includes a detailed accounting of such changes where they might logically affect set performance and where the technician might replace a "factory" component with an unsuitable substitute.

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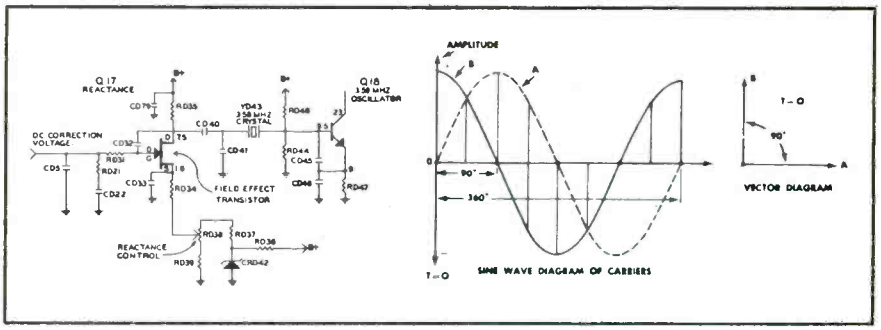

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AN EXTRAORDINARY OFFER...

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stacked antennas must be properly spaced. If you do not space vertically and horizontally stacked antennas more than ½ wavelength apart, they will adversely "load" each other. Loading is caused by the elements of one antenna re-radiating some of their received energy into the element of the other antenna, with consequent reinforcement and cancellation of fields and voltages. *Optimum* and *minimum* spacing is *0.94* and *0.50* wavelength, respectively, at the lowest frequency received. Spacing exceeding one wavelength reduces the performance of the stack.

In a horizontal stack in which the elements are tip-to-tip and the longest element is something over .5 wavelength long, the minimum practical spacing will be some distance over .5 wavelength, to prevent the *longest* element of one antenna from touching the tip of the corresponding element of the other antenna. Recommended spacing is 0.94 wavelength between booms at the lowest channel involved.

Because of restrictions on space (usually height), there will be times when it is impractical to space antennas a full wavelength apart. In such cases it might be necessary to reduce the spacing to something less than a wavelength, but it should never be less than .5 wavelength. No physical damage will be caused by spacings closer than one wavelength, but as spacing is reduced, performance will deteriorate. At less than .5 wavelength, all of the advantages of multiple-stacked antennas are lost.

All portions of the antenna supporting structure should be made of wood or plastic. Horizontal metallic supports act like antenna elements, absorbing and reradiating the received energy in an unpredictable manner which causes unusual voltage/frequency effects from the antenna array. Where wood supports are subjected to adverse weather, redwood or cypress lumber is recommended, for extended life.

Stacked antennas should be identical. They can be broad-band, single-band or single-channel antennas, but they must be *identical*. If not, the phase of the voltages from the two antennas, when combined, will not produce the optimum signal level.

Interconnections

Connecting the antennas properly is as important as spacing and orienting them. Getting the individual voltages from each antenna to the point where they are combined without 1) combining them out of phase and 2) without adding extraneous signals and noise requires careful positioning, dimensioning and coupling of the antennas, the harness and/or the connecting cables.

Antennas may be coupled by a phasing harness made from balanced transmission line (Figs. 6 and 7) or they may be coupled with a hybrid antenna coupler (Figs. 8, 9 and 10). Antenna couplers are simpler to hook up and are less critical and more durable than phasing harnesses. Harnesses must be cut to the precise length for a single channel frequency, must be kept straight and untwisted and, for horizontal stack-

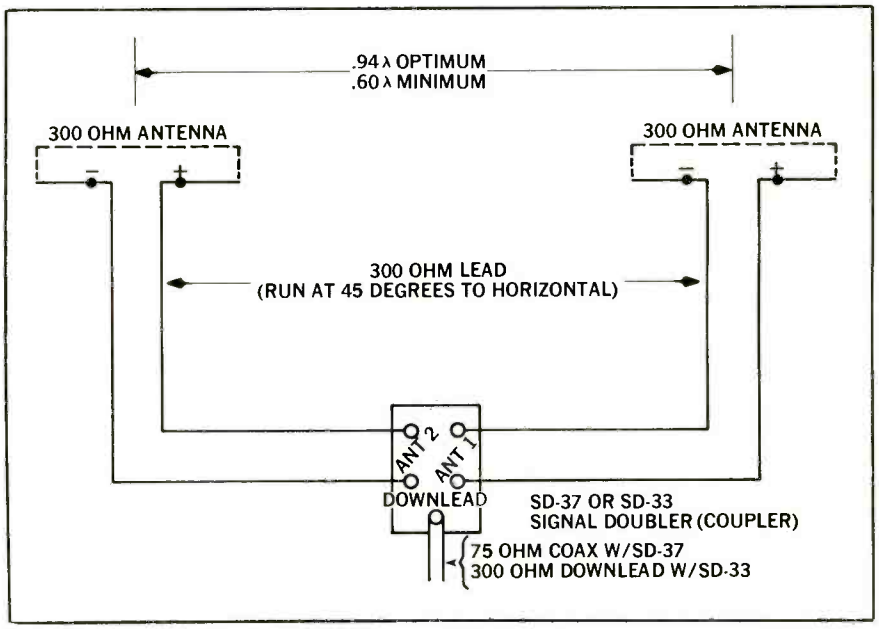
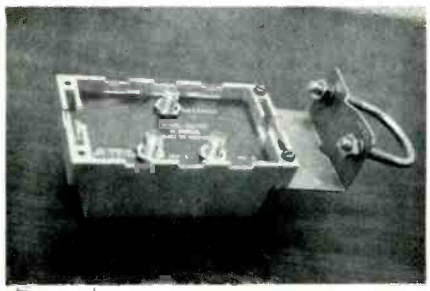


Fig. 8—Method of using SD signal doublers to couple horizontally stacked antennas.



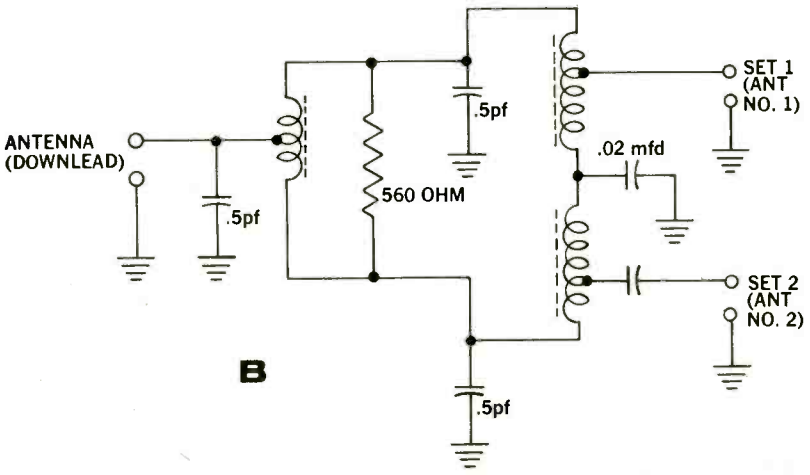


Fig. 9—Photo (A) and schematic diagram (B) of a Winegard Model CC-787 two-set coupler which, although designed and used principally for connecting two TV receivers to a single downlead, can be used to combine the outputs of two stacked antennas.

ing, must be installed and maintained at a 45-degree angle to the horizontal. Also, the harness connections at the antenna and the combining point must be phased properly or the performance will be less than that from only a single antenna.

Along the length of any transmission line there will be voltage maximums and minimums. If the lines are to be interconnected, cut and connect them at points at which the voltages are maximum, or at odd multiples of a quarter wavelength. If the transmission lines are of different lengths, connect them at a point where their signals are in phase (multiples of a whole wavelength, longer or shorter) so that the voltages will add.

Because wavelength changes with frequency, wiring harnesses are only practical for single-channel antennas. Multiple-band and wide-band antennas should always be connected with *broadband hybrid couplers.*

Antenna couplers simplify the interconnection of stacked antennas with 75-ohm coaxial cable, as shown in Fig. 10. Because of cable loss, the cables should be kept as short as possible and of equal lengths. They can be taped to the metal boom or mast. However, because cable is a metallic conductor, horizontal lengths parallel to antenna elements should be avoided; the cable shield might act as an antenna element, re-radiating energy into the antenna and thereby causing cancellation and ghosts.

Most MATV companies manufacture a variety of couplers to simplify combining the individual signals from stacked antennas. The Winegard Company offers two different series for stacking applications: the SD signal doubler and the CC multiset couplers. CC multiset couplers, although designed and sold principally for coupling two TV sets to a single antenna downlead, also function well as antenna couplers.

As shown in Fig. 8, SD signal doublers combine signals from any two identical 300-ohm antennas and provide either a balanced 300-ohm output (the SD-33) or a coaxial 75-ohm output (the SD-37).

Because SD's have only 300-ohm inputs, they are not recommended as highly for horizontal stacking as the CC's, which have 75-ohm inputs.

When connecting stacked antennas, correct phasing must be achieved or a null signal (no picture) will be produced at the coupler. If a null is observed, put a half twist in *one* of the 300-ohm lines to reverse the phase at the coupler terminals.

Series-CC 82-channel multiset couplers (Figs. 9 and 10) are preferred over SD's for coupling identical, stacked antennas. When used as antenna couplers, the individual antennas are coupled into the "TV-set" (output) terminals of the CC and the output is taken from the "antenna downlead" (input) terminal. The device simply separates or combines signals. It doesn't know its input from its output and is only concerned with the *impedance* of the devices connected to its terminals. It doesn't know and doesn't care in which direction the signal is passing through it.

CC couplers have an 82-channel bandpass and are available with both 300-ohm and 75-ohm input/outputs. CC couplers also have two or four inputs, for both dual and quad stacks, and are enclosed in a weatherproof housing equipped with universal mast-mounting brackets.

Because 75-ohm coaxial cable is recommended for interconnecting stacked antennas, and for downlead as well, the logical coupler choices are the CC-787 two-set coupler, for dual stacks, and the CC-997 four-set coupler, for quad stacks.

Cautions to be observed when coupling stacked antennas include cutting the coaxial interconnecting cables into equal lengths, observing the correct phase, and dressing cables away from the antenna elements.

If 300-ohm antennas are used, impedance-matching transformers, such as the T-28M (Fig. 10), are recommended to adapt the an-

continued on page 47

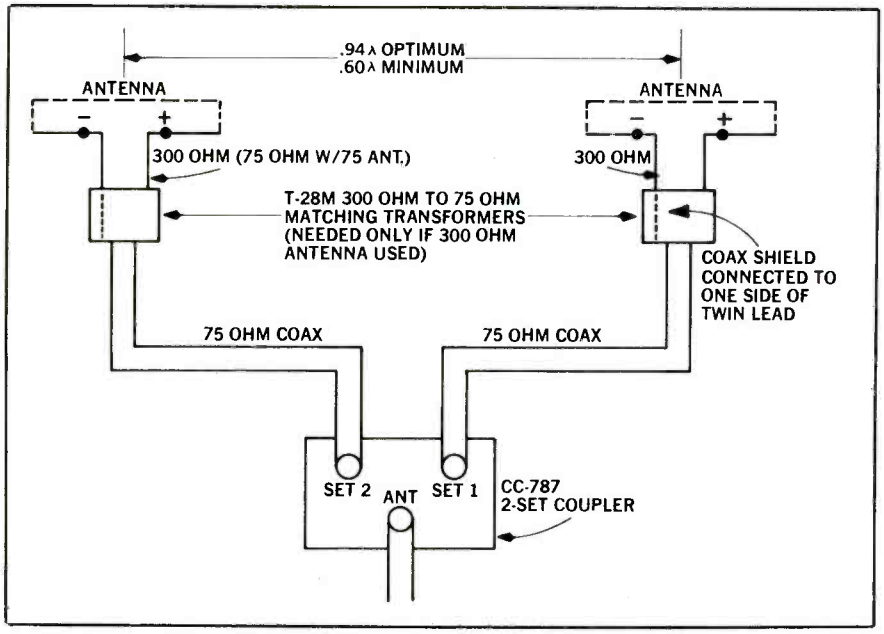


Fig. 10—Method of using the Model CC-787 two-set coupler to combine the outputs of two horizontally stacked antennas. Coupling stacked antennas with a hybrid coupler and 75-ohm coaxial cable simplifies the installation. Coaxial cable routed along the boom and metal supports causes no adverse effects. Phasing need not be considered except to insure that the coax shield be directly connected through the matching transformer to corresponding antenna terminals. A simple ohmmeter check on the matching transformer will disclose which side of the 300-ohm output lead is directly connected to the coax shield. Connecting antennas to a coupler using 300-ohm transmission line (alternate method) does require careful attention to phasing.

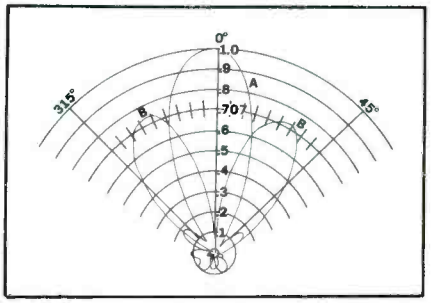
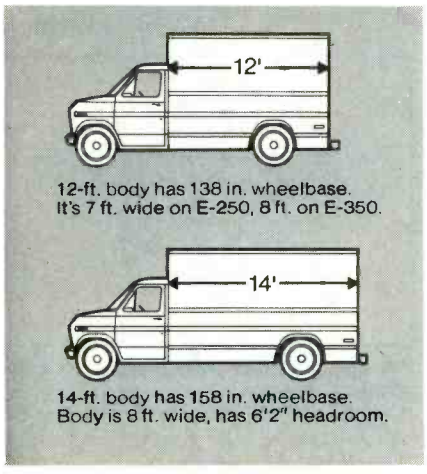
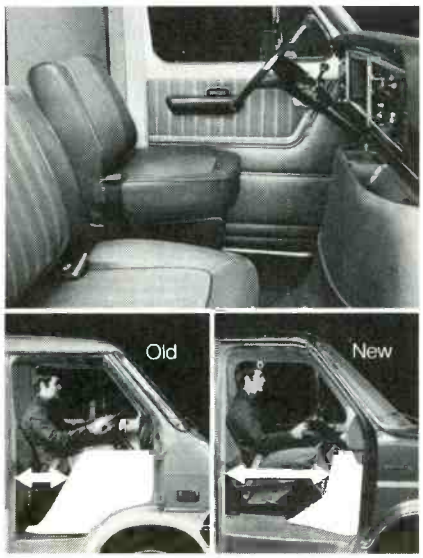


Fig. 11—Composite polar graph showing the difference between the polar pattern (A) of two in-phase horizontally stacked Yagi high-band TV antennas and the polar pattern (B) of the same two antennas out of phase.

New capacity to 10,725 lbs. GVW

Now you can consider compact Ford Parcel Vans for jobs previously too big or too heavy for this type of truck. New 14-ft. body is 8 ft. wide, offers 40% more cube than Ford's biggest '74 model. GVW's to 10,725 lbs. boost payloads, too. For easy loading, hinged rear doors are almost body wide. Doors swing open all the way against body sides...have slam-shut latches, provision for locking. Options include roll-up doors, cab partitions with or without walk-thru, roof vents, rub rails.



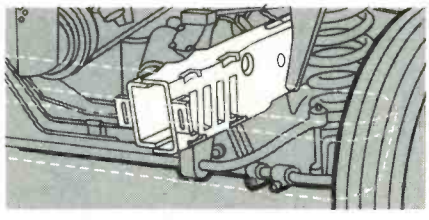


New driver room and comfort

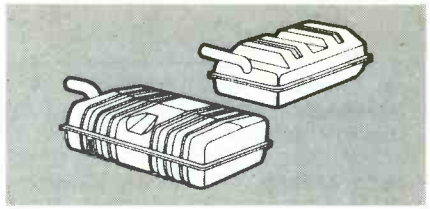
Ford gives the driver what he needs to get more done with less effort. Big, wide cab doors make getting in and out easy. Because the engine is forward out of the way, driver can easily step back into the load area—or across to the curbside cab door. Both driver and helper have good legroom and footroom. Thick, insulated engine cover has handy pockets on top.

New durability engineering

Separate body with frame, the only American van with this construction, provides a strong foundation for the entire vehicle. Frame rails are designed to help cushion impact from the front. To resist corrosion, key components are galvanized and the entire cab is primed by deep-dip Electrocoat. These vans are built to keep their value. Cruise-O-Matic, power front disc brakes, 300 Six are standard.



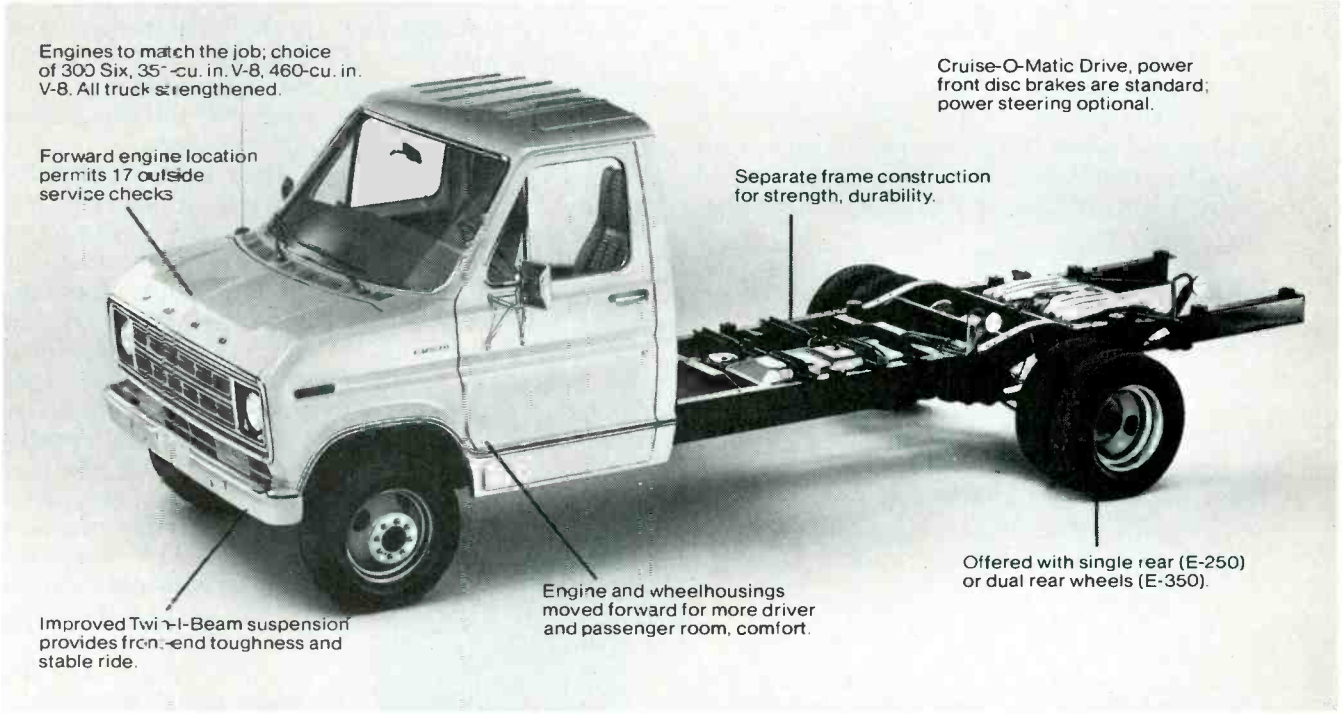
Energy-absorbing frame rails help cushion front impact. Frame is the first in any American van.



Standard and auxiliary fuel tanks are located between the frame rails, total up to 42.6 gallons.

For '75, Ford redesigns the Parcel Delivery Van.

New high-capacity Econolines offer bodies to 14 ft. long, over 40% more cube, new efficiency for delivery operations.



Econoline Vans: Four series with GVW's to 10,000 lbs.

Virtually all of the advantages of Ford Parcel Vans, like strong body-frame construction, apply to regular '75 Ford Econoline Vans. You also get a greater choice of models and options to match your needs, new highs in weight capacity, 12 in. longer center load length than last year, new 54-in. wide rear doors, sliding or hinged side cargo doors. See your Ford Dealer now.

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FORD ECONOLINE VANS

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Troubleshooting No Chroma

Because of the close interaction and interdependency between the sync and chroma reproduction circuits many chroma problems cannot be isolated by the visual symptoms displayed

By Joseph Zauhar

■ The chroma circuits receive transmitted color information and then reconstruct the hues of the picture being telecast on the screen of the TV set. The number and types of circuits employed will vary, but what takes place to recover the color information is important when troubleshooting the color circuits.

Many of the sources of color problems can be recognized by the symptoms displayed on the screen of the TV set; however, because of the interaction and interdependency between the sync stages and those of the chroma amplifier and demodulator sections, not all color problems can be isolated simply by analysis of the visual symptoms.

Problems such as insufficient chroma can be misleading because, for the proper operation of the chroma circuits, the front end of the TV set must be also functioning properly. So before troubleshooting the chroma circuits, make sure the front-end AGC loop is operating properly.

A quick check for the proper operation of the chroma circuits is to observe the screen of the TV set. If the chroma circuits are functioning properly, colored snow of all colors and of high saturation will be displayed when switching the TV set channel selector knob to an unused channel or to the UHF position and the color killer circuit has been defeated for conduction of the second chroma stage.

Determine if the problem is noticeable on a b/w picture by turning the *color* control intensity all the way down, then observe the raster. If you cannot obtain a uniform gray raster and it shows signs of color impurity, the problem is usually associated with the picture tube circuitry rather than the color section of the TV receiver.

If the raster is normal, we can assume the problem is associated with the color sync or color reproduction circuits.

Practically all chroma problems which are found in the chroma circuits can be placed in one of the following categories: A) No chroma, insufficient, or an overabundance of the chroma. B) Malfunctioning color killer operation. C) Improper gray scale and/or brightness. D) Improper color sync. E) Improper color tint.

A typical block diagram representing the functional operation of the color circuits is shown in Fig. 1.

Before troubleshooting the color section of a

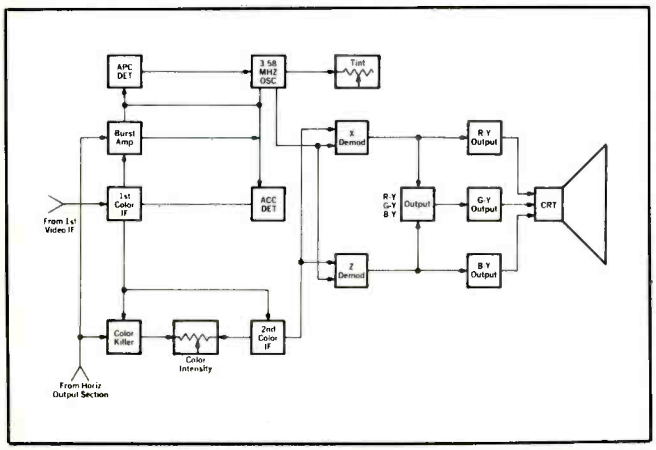


Fig. 1—Typical block diagram representing the functional operation of the color circuits used in many color TV sets.

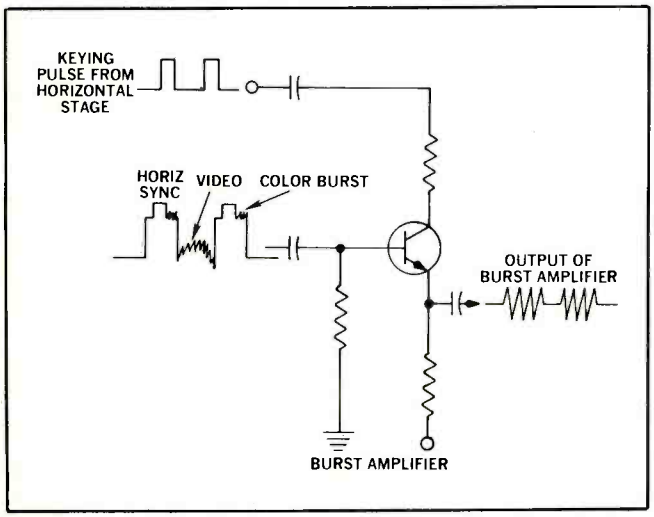


Fig. 3—Simplified schematic diagram of a typical solid state burst amplifier circuit.

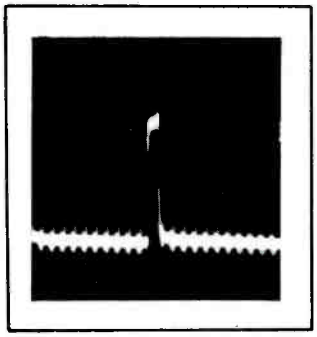


Fig. 2—Waveform obtained at the emitter of the 1st Video Amplifier transistor, the color take-off point, found in RCA's color TV chassis CTC51, 52.

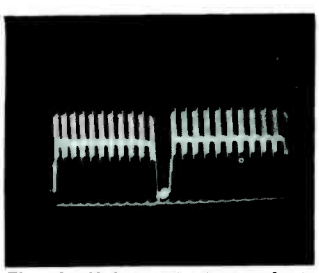


Fig. 4—Video output waveform produced by the color bar generator with the oscilloscope set at 7.875 KHz horizontal rate.

color TV receiver, a careful study of the schematic for the particular chassis should be made, then use the circuit voltages and oscilloscope waveforms provided to isolate the malfunctioning circuit.

To properly troubleshoot the color circuits, a color bar generator and a good wide-band oscilloscope make a good combination. Use a high impedance low-capacity oscilloscope probe when checking the high impedance circuits in the chroma sections of the color TV set.

No Color or Weak Color Symptom

A no color or weak color symptom can be caused by a circuit problem in the color IF amplifier, color burst stage, ACC circuit, or the color killer circuit. If the symptom is a loss of chroma, it would not likely be caused in stages in the front end of the TV set. However, if the symptom was low chroma gain, check on the alignment of the tuner and video IF circuits, especially the 41.25 MHz traps which are a common cause of insufficient chroma.

The oscilloscope and color bar generator make one of the best test instrument combinations for the isolation of no chroma problems in the chroma circuits. First check the waveform at the stage where the color signal is obtained from the video circuits. A typical oscilloscope waveform received at this point is shown in Fig. 2. If we obtain the proper waveform at this point, we can assume the problem is in one of the color stages in color section. Next, we should observe the waveform at the output of the bandpass amplifier, it should be very similar to the waveform found at the input of the color section with increased amplitude. If the waveform is not of the proper amplitude, the defective component will usually be found in the bandpass amplifier or its control circuit.

Burst Amplifier Circuit Problems

A problem in the burst amplifier circuit can cause out of sync (no lock-in) color condition if the amplifier is not operating properly, or weak lock-in, depending on the color signal received, when the burst amplifier operates continously rather than being triggered on by a keying pulse. When measuring the voltage waveform at the burst take-off point, only the amplified burst waveform is obtained as shown in Fig. 3.

In some cases a poor color sync condition can be corrected by making a (AFPC) alignment.

Color Sync Circuit Problems

A color bar generator can be used very effectively to determine if the color sync circuits lock-in properly. Connect the color bar generator to the antenna terminals of the TV set and select the color bar pattern which provides a video signal output waveform as shown in Fig. 4. Turn the *chroma level* control of the generator up to approximately the 200 percent chroma position, then slowly rotate the control down towards the zero position. If the color sync circuits are operating properly, the color sync will stay locked-in until the chroma level begins to disappear and the color-killer action cuts off the chroma circuits in the TV receiver. If the color sync does not stay locked-in, in most cases the problem will be found in the color sync circuits.

If the chassis is equipped with an *automatic chroma* control (ACC), this fading may not be noticeable until the *chroma level* control is turned down low enough to produce snow on the TV screen.

If the reactance stage, as well as the 3.58 MHz oscillator are working properly, the color can be brought back into sync by adjusting the reactance or oscillator coil on the chassis.

Shown in Fig. 5 is a typical solid state color oscillator circuit which is phase-locked at the color sync amplifier.

Possible problems in the color sync circuits include: defective transistor, crystal, open reactance coil or a misaligned or defective transformer. If the 3.58 MHz oscillator is not functioning, only magenta and green hues are reproduced on both a snowy raster or on a color signal with the *color killer* control overridden.

A no-color problem can also be caused by a defective 3.58 MHz reactance stage or IC. If the 3.58 oscillator goes far

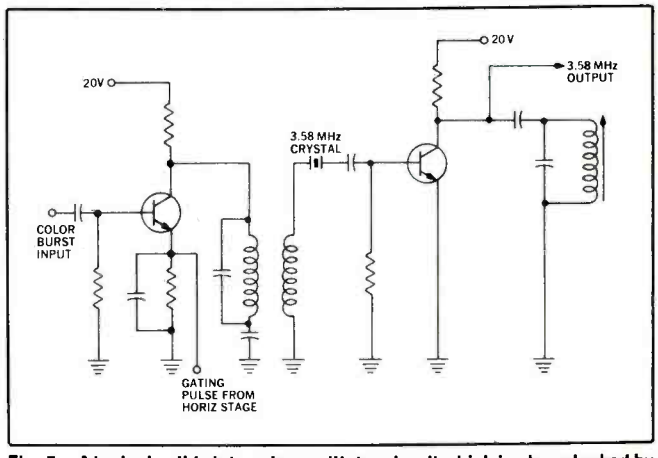


Fig. 5—A typical solid state color oscillator circuit which is phase locked by the color sync amplifier, and does not require a phase detector circuit.

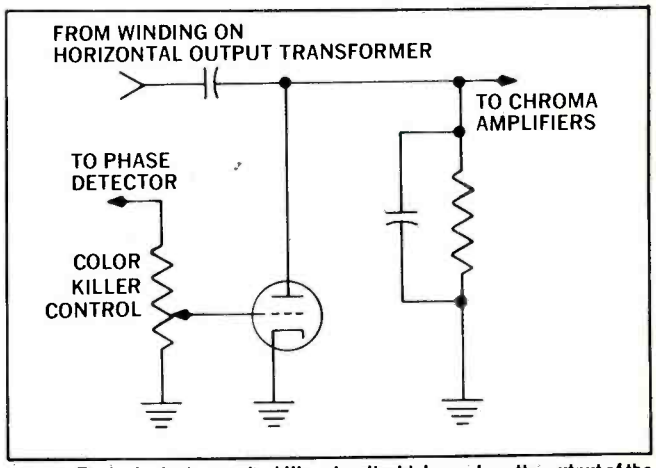


Fig. 6—Typical tube type color killer circuit which employs the output of the phase detector to determine whether or not a color telecast signal is being received.

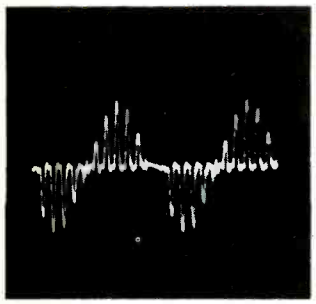


Fig. 7—The waveform obtained at the R-Y control grid of RCA's CTC 51 and 52 color TV chassis. The oscilloscope was set at the horizontal rate, 6 volts P-P.

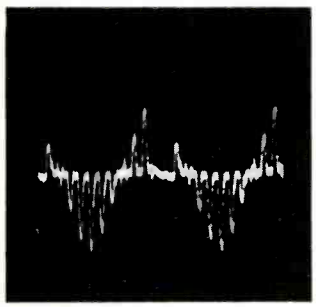


Fig. 8—The waveform obtained at the B-Y control grid of RCA's CTC 51 and 52 color TV chassis. The oscilloscope was set at the horizontal rate, 6 volts P-P.

enough off frequency, we will not be able to obtain color. This condition can be isolated by turning the tuner to an off channel position and color snow will be present.

Color Killer Circuit

The color killer circuit which is employed on most color TV sets functions to kill any color amplifier noise during a b/w television station signal. A typical simplified tube type color killer circuit is shown in Fig. 6. The color killer circuit biases the one or more color amplifiers to cut off or saturate. In some TV sets the killer voltage is applied to the color demodulators.

Malfunctions in the color killer circuits cause no or insufficient color killer action or the opposite condition of too much action which either holds the second chroma at cutoff at all times or reduces its gain substantially.

During a color broadcast the color killer circuit is actually not needed.

One of the most common problems in the color killer stage is the misadjustment of the *color killer* control. Almost all killer circuits have a method to adjust the amount of bias applied to the circuit so that it will correctly respond to a b/w or color signal.

To adjust the *killer control,* turn it until colored hash appears in the picture of the TV set, then back off on the control until the colored snow just disappears, but no further.

If the color killer control did function properly to remove the colored hash, the trouble will likely be limited to the voltage divider circuit in which the color killer control is located.

Check the transistors in the circuit and make sure the resistors are within tolerance or specified values.

The bias on the killer amplifier should go negative when a color signal is received, then check the collector voltage of the transistor which should go positive when a signal is received.

Improper Tint Problems

In a sense, improper tint problems can be placed in two categories. One is the ability of the TV set to produce only two hues. If the picture tube is used for matrixing, there are three possible combinations of two hues only problems in color TV sets. The first combination we will find the hues produced in color TV sets. The first combination we will find the hues produced near red and cyan, the second combination we have blue and yellow hues and the third is a magenta and green combination of hues produced.

If the hues produced are near red and cyan, the problem can be caused by no B-Y demodulator output, if the hues produced are blue and yellow, it is the absence of the R-Y demodulator output, while the magenta and green hues can only be caused by the same output from the R-Y and B-Y demodulators. This problem can be caused by a malfunctioning 3.58 MHz oscillator circuit. To be able to view this condition we must defeat the color killer operation, because the automatic color killer circuitry would not allow the second chroma stage to amplifier signals without the 3.58 MHz reference signal.

Other improper tint problems include more than two hues, but they are produced incorrectly. A quick observation of the TV screen can be made to determine what hues are weak or lacking by defeating the color killer function and turning the tuner to an off-channel position or UHF which produces snow (noise). If the color circuitry is functioning normally, the snow should contain equal amplitudes of the primary colors.

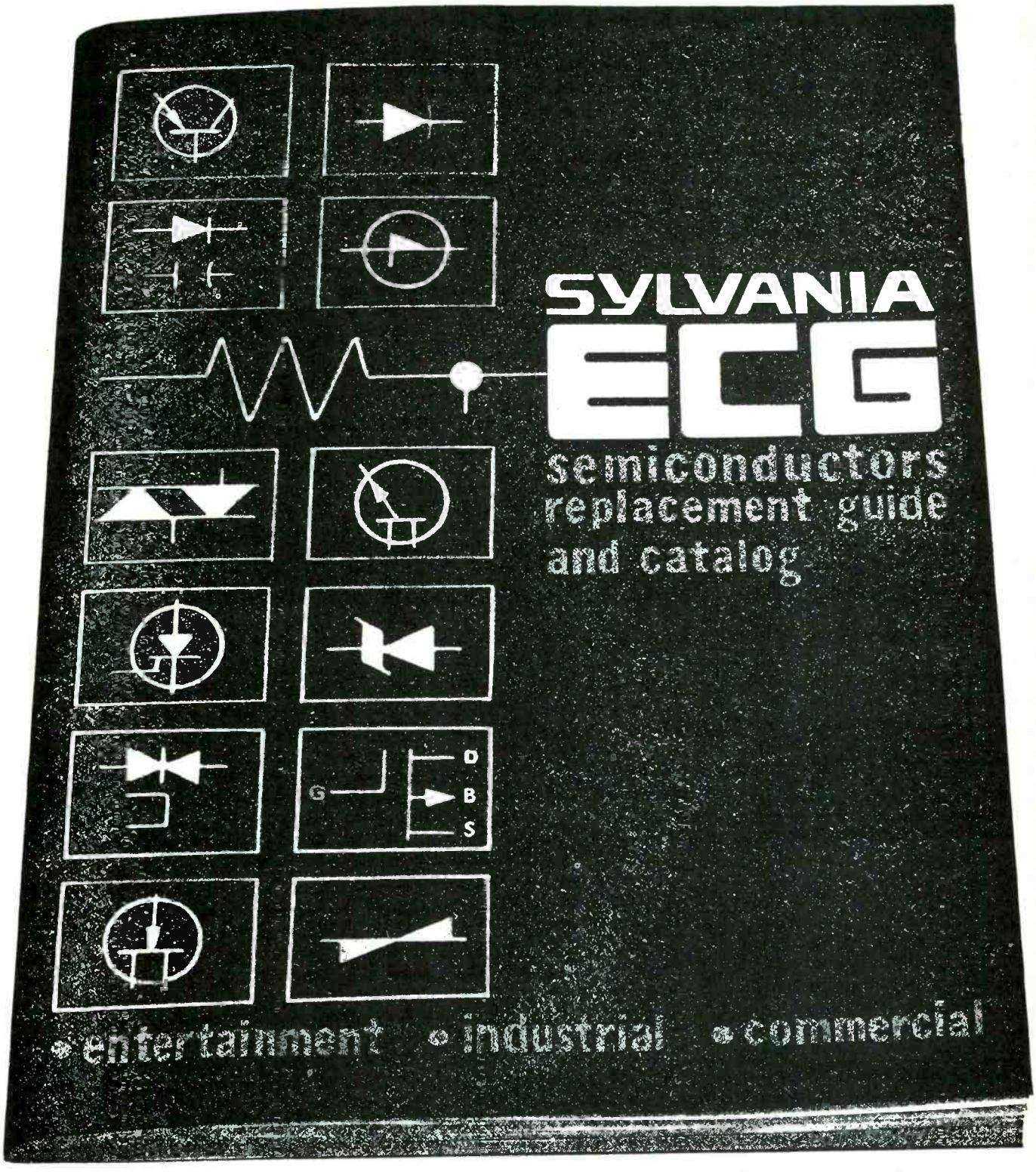
Typical waveforms found at R-Y and B-Y control grids are shown in Fig. 7 and Fig. 8.

Another check for the proper operation of the R-Y and B-Y color circuits from the outputs of the demodulators to the picture tube can be made by shorting the "X" and "Y" demodulator outputs together with a .1 mfd capacitor. The color information on the picture tube screen will then become magenta and green—magenta when the signals are negative at the picture tube red and blue grids.

Improper color reproduction can also be caused by phase shift in color sideband information, phase shift of the reinserted 3.58 MHz carrier or its improper amplitude, and improper demodulation. Feed the video outputs from a color bar generator into each stage to isolate phase shift in the first and second stage and proper demodulation in the "X" and "Z" demodulators. Troubleshooting time can be shortened by employing an oscilloscope to measure the amplitude of the 3.58 MHz reinserted carrier and color difference signals.

Use a color bar generator to isolate improper hues and observe the color bars on the screen of the TV set. If the problem is ahead of the demodulator, the R-Y and B-Y color bars as well as other bars displayed have incorrect hues. If the trouble is beyond the demodulators, the R-Y and B-Y bars appear normal, but the others are incorrect.

To properly center the tint control range, make a slight adjustment of the transformer in the burst amplifier output circuit. If the problem is not corrected, use the manufacturers service manual and make the AFPC adjustments.■



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GTE SYLVANIA

Medical Electronics — A Healthy New Field For Servicers — Part 2

By Joseph J. Carr, ET/D Contributing Editor

■ Last month we demonstrated how the electrocardiograph (ECG) signal was generated, picked up, and displayed. Also shown were several other examples of typical patient monitoring equipment.

Fig. 1 is an example of a bedside cardiac monitoring system frequently encountered in emergency rooms, operating rooms, and intensive or coronary care units (ICU/CCU). This is the Hewlett-Packard integrated ECG amplifier/heart-rate meter and scope combo unit, which also was shown last month. The blook pressure monitor to the right consists of two quarter-rack modules, shown displaying a patient's blood pressure of 152/94. A Model 7826B strip chart recorder can be connected to ECG or arterial blood pressure signals through either unit-to-unit wiring or through a wiring yoke contained within the mounting platform.

MORE MONITOR SCOPES

Another widely used type of instrument is the 8-channel monitor scope, which allows a nurse at a central point to monitor up to eight patients. Three popular types are shown in Figs. 2, 3 and 4.

Fig. 2 is the H-P Model 1309. It is a conventional chopped-trace type of multi-channel scope which displays up to four full-screen (all the way across the CRT face) or eight split-screen traces. An internal switch selects the type of display.

The scopes in Figs. 3 and 4 are memory, or non-fade, types. Some manufacturers use CRT-storage similar to that of lab/bench scopes, but most medical scopes use a computor-like memory. An analog-to-digital (A/D) converter digitizes the analog waveform. Digital "words" representing the amplitude of the waveform at the instant it was sampled are sequentially stored in solid-state memory positions. The "words" can be non-destructively read out and fed through a D/A converter for display on the screen of the CRT. If the sample rate is high enough, the waveform will appear continuous to the eye. The advantage of this is that the screen will display recent ECG history for several seconds. Many medically significant ECG features are transient in nature and cannot be economically recovered without some sort of memory system.

There are also several other types of scope memory systems available. Some are internal like those in the scopes in Fig. 3 and 4, while others are external but still computor-like. American Optical even offers a genuine minicomputor system, with CRT terminal and strip chart recorder for readout.

In less sophisticated installations an endless loop tape is used to store ECG history for one minute. If an alarm is issued by the bedside monitor, or if the nurse watching the central monitor wants a written record of some transient waveform, the tape can be played out on a strip chart. When the alarm is issued, the recorder stops recording 10 seconds after the alarm signal is generated. This saves data for 50 seconds prior to and 10 seconds during any cardiac incident which might occur.

No tape recorder can record a 1-Hz signal such as an ECG because of the lower limit on the recorder 20-40Hz bandwidth. To overcome this, the ECG signal frequency modulates a 6000-Hz audio carrier, which can be recorded on tape. Consequently, a memory recorder includes a voltage-controlled oscillator (VCO) driven by the ECG, a pulse counting FM demodulator, and a tape cartridge transport.

Most medical equipment manufacturers use tape transports made by other companies. American Optical, for example, has used the popular Telex Model 35 tape deck in a special configuration. This transport is well known to broadcast engineers and those audio people who do certain types of commercial work. it is similar to the 4-track mechanism used in early consumer tape systems. In fact, the pinch roller swing-up mechanism is the same. American Optical memories are equipped with the 6-inch Fidelipak cartridge.

Keep in mind that a CCU memory must run 24 hours a day, every day, as long as there are patients in the ward. Operating any tape

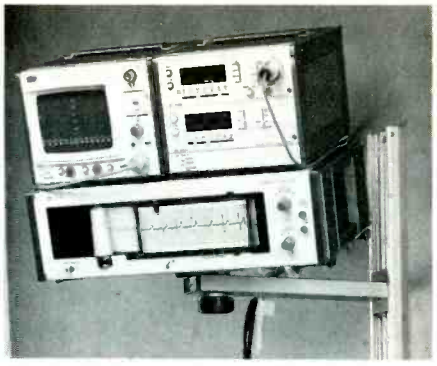

Fig. 1—Typical, modern, solid-state bedside monitoring system by Hewlett-Packard. This installation is capable of ECG and blood-pressure monitoring.

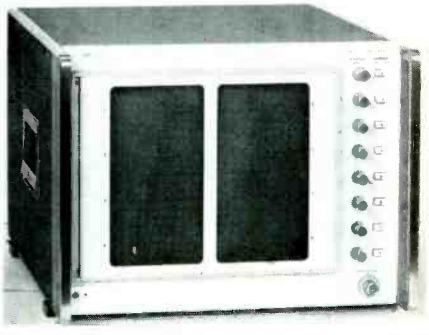

Fig 2—Eight-channel monitor scope used at central nursing stations to monitor vital signs of up to eight patients.

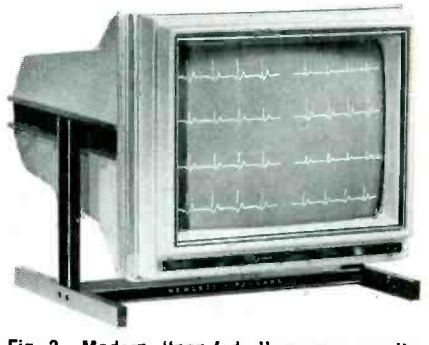

Fig. 3—Modern, "non-fade," memory monitor scope is actually an adaptation of a CRT graphics terminal normally associated with computors.

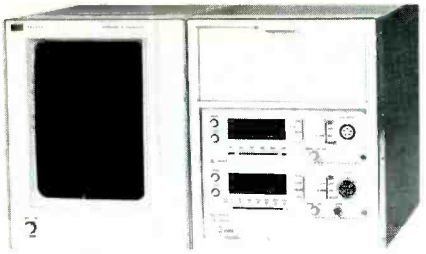

Fig. 4—"Non-fade" monitor scope installed with both ECG/heart-rate meter and venous/arterial blood-pressure modules.

Fig.5—An exercise ECG installation in which a patient's ECG is radioed by a VHF or UHF FM transmitter to a special receiver on the counter.

player for such extended periods means a lot of service problems. It might be possible to arrange with a local hospital which uses tape memory, a service contract whereby you perform regularly, on a non-emergency basis, preventive maintenance on these machines. By replacing the pinch-roller every two weeks or so and doing an overhaul every month or six weeks, you probably can eliminate almost all emergency downtime.

I have never had to make an electronic repair (printed-circuit board change or head replacement) in the American Optical tape players which I have serviced. However, I have replaced dozens of pinch rollers and drive belts.

Parts for American Optical and any other tape memory equipment which uses the Telex basic deck can be ordered from either American Optical or Telex. You should stock rubber drive belts, pinch rollers, nylon capstan bearings and a few motors—all of the parts typically needed for tape machine repair.

TELEMETRY EQUIPMENT

Other aspects of medical electronics include patient telemetry and exercise testing, both of which are shown in Fig. 5.

Most medical authorities believe that the *exercise* ECG is more revealing than the resting ECG. For the exercise ECG, a patient walks on a treadmill while his ECG is monitored. In most cases, standard ECG leads, brought down from the ceiling, are attached to the patient. In Fig. 5, though, a Hewlett-Packard telemetry transmitter connected to the patient is used to radio the ECG signal to a receiver on the ECG counter.

Many coronary care facilities also use telemetry so that post-heart-attack patients can get out of bed and walk a little while remaining under monitored supervision. In such facilities, each patient is equipped with a small, portable transmitter which includes an ECG preamplifier in the FM modulator circuitry. These also use the audio FM scheme employed by tape machines, as described previously. Because both the radio carrier and the audio subcarrier are FM, these transmitters are called *FM/FM telemetry*. The ECG is radioed back to a central nursing station which is equipped with a receiver for each channel, a multi-channel scope, and a strip chart recorder. Patients are allowed to roam about a restricted are in which signal reception is good and emergency help is immediately available.

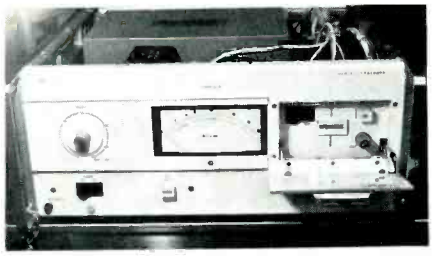

Fig. 6—Hewlett-Packard's Model 7802 defibrillator/cardioverter with cover removed. Large gray "box" inside machine cover is the energy storage capacitor.

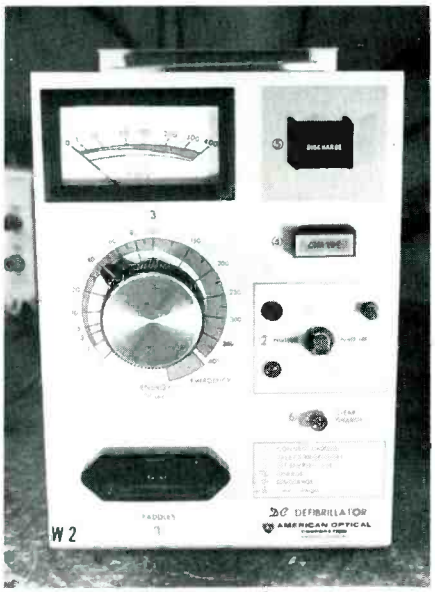

Fig. 7—American Optical's 262010 defibrillator/cardioverter.

DEFIBRILLATORS AND CARDIOVERTERS

Of all medical electronic devices, none are more awesome than defibrillators and cardioverters. These are the machines used dramatically on TV to shock a patient's heart back into proper operation. Figs. 6 and 7 show two popular models used in a large number of U.S. hospitals: The Hewlett-Packard Model 7802 and American Optical Model 262010, respectively.

The front-panel features of the model in Fig. 7 are typical. There is a high-voltage connector labeled *PADDLES* into which the patient paddles cable is plugged; a control knob labeled *ENERGY* which adjusts the capacitor charge level; a meter which indicates the level of the stored charge; and various other control switches. Among these are a *CHARGE* switch which initiates the charge cycle, a *DISCHARGE* switch (often shunting a similar switch on the patient paddles), and a *CLEAR CHARGE* switch which opens the field coil circuit of a relay that connects a bleeder resistor (10K, 50 watt) across the capacitor. The relay is normally energized; when power is removed, the relay drops out and connects the bleeder resistor across the capacitor.

Fig. 8 is a simplified but relatively complete schematic diagram of a typical DC defibrillator. The energy control on this type is actually a variac (T1) in the primary of the high-voltage transformer (T2). The rectifier, D1, might be either a solid-state type or a vaccum tube of the 1B3/1AD2 class. The charge is stored in capacitor C1, which in most modern machines is a high-voltage, oil-filled type with a capacitance of 16 mfd. An idea of the size of a typical defibrillator capacitor can be gained from Fig. 9.

Although the charge meter is calibrated in *watt-seconds* (joules), from its connection in the circuit in Fig. 8 you can see that it is real-

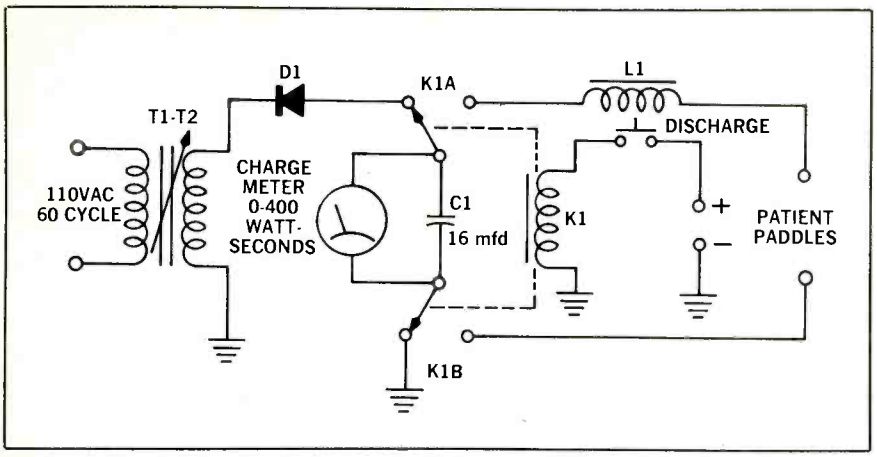

Fig. 8—Simplified, schematic of a typical defibrillator circuit. DC is applied to charge the capacitor through contacts of relay K1. When the DISCHARGE button is pressed, K1 connects the capacitor to the patient cable and disconnects the power supply. Relay K1 is usually a vacuum type because of the high voltages used.

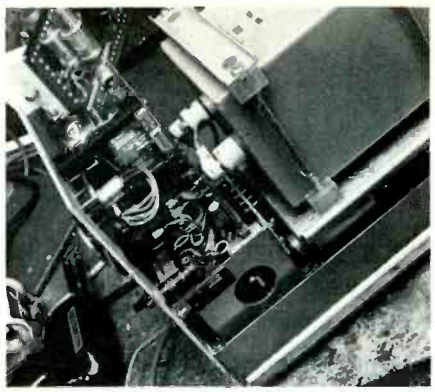

Fig. 9—Inside view of American Optical's portable defibrillator, Model 262010. This module is used both in portable and "crash cart" models.

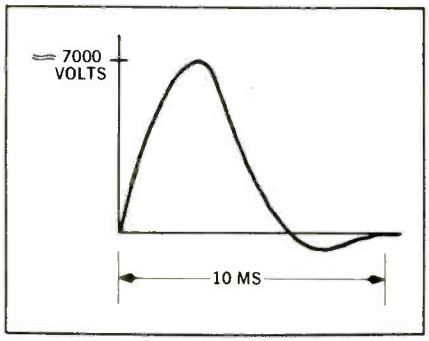

Fig. 10—Output waveform produced by the defibrillator circuit in Fig. 8. When the DISCHARGE button is pressed, the voltage across the output rapidly rises to maximum (near 700 volts of 400-watt seconds is used). It then decays almost exponentially. The small negative voltage after initial charge is cause by collapse of the magnetic field around the output damping inductor.

ly only a voltmeter. You can check meter calibration by making voltmeter readings across the capacitor and applying the formula: watt – seconds = ½ C x V^2. Actual *delivered output* energy is a little lower (typically 70 percent of stored) and can be measured on a defibrillator tester. Such instruments include a 75-100 ohm dummy load and an integrating voltmeter.

A defibrillator output waveform is shown in Fig. 10. Actual delivered energy is equal to the algebraic sum of the instantaneous voltages occuring during the 10 millisecond period in the voltage-vs-time graph of Fig. 10. This is why an integrating voltmeter is needed. These sell for about $400.

An alternative method of measuring output is to discharge the defibrillator into a dummy load connected through a 1000:1 dropping network to an oscilloscope with either storage capability or a camera. (Polaroid sells a portable scope camera for less than $200.)

Many defibrillator testers include an *attenuated* signal output for connection to a scope. The waveform method measuring output is good because certain relay and choke defects in the defibrillator cause only minor output deterioration during the early stages of failure, yet can cause worse trouble a few weeks later, possibly when someone's life depends on the instrument. The waveform easily reveals such subtle indications of impending failure.

Whatever work you do on or inside a defibrillator or cardioverter, keep one thing in mind at *all* times: They are at least as dangerous as a loaded pistol. If you "plug" 400 watt-seconds and 1.6 x 10^5 Farad (16 mfd) into the formula given previously, you will see that the capacitor will be charged to 7070 volts (7.07 Kv). A 16-mfd capacitor charged to that level of voltage can create enough current to *kill* you. Carelessness with these machines, like carelessness with a loaded gun, can be fatal.

Cardioverters are little more than defibrillators which have their discharge function synchronized to the patient's ECG waveform. When a patient suffers an attack of *ventricular fibrillation,* there is little or no *rhythm* to his cardiac activity. Under such circumstances, a large bolt of electricity is applied to the patient by the doctor.

Certain other cardiac problems also are treated with a massive electric shock even though a clear ECG waveform is present. However, if the electric shock to the heart muscle is applied during the t-wave interval of the ECG waveform (see Fig. 2 in Part 1 of this series), ventricular fibrillation can occur. For this reason, the cardioverter form of defibrillator has a synchronizer which inhibits firing until the patient's ECG is on the down slope of the QRS complex.

Common service problems on these machines include open conductors in the cable to the paddles, bad switches, pitted relay contacts which require replacement of the vacuum relay, and, if tubes are used, weak rectifiers. Other problems also will be found, but these are the most common.

RF DEVICES

Surgeons use powerful RF generators, with up to several hundred watts output, as *electronic scalpels.* As shown in Fig. 11, one pole of the floating RF output is connected to a large metal plate beneath and touching the patient. The other pole of the output is connected to an *active electrode* which actually is used to do the cutting. Because the current in the "active" and "patient" electrodes are equal but the amount of their respective conducting areas are so different, a large difference in current density exists when both electrodes are in contact with the patient. A very high density of current exists at the sharp point of the "active" electrode, and this is used to cut tissue. Sine-wave RF power easily cuts tissue.

RF is also frequently used for *hemastasis,* or *coagulation* (also called *cautery).* This electrically closes off the minor blood vessels normally servered during surgery. The current required for this is a complex waveform gener-

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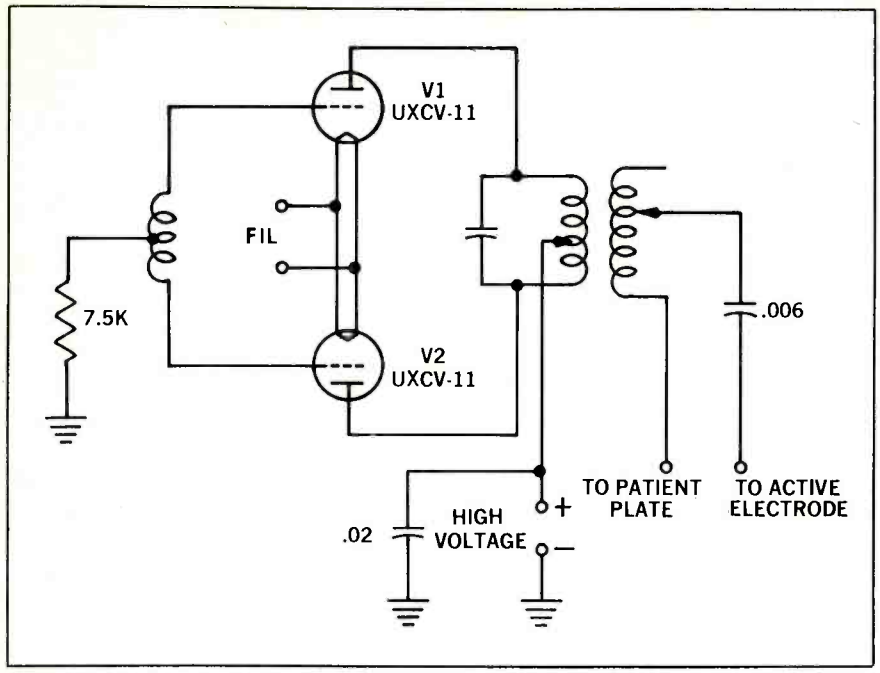

Fig. 11—Push/pull RF power oscillator typically used to develop sine-wave power for electrosurgery. Half-wave rectified but unfiltered DC power is applied to the plates of the UXCV-11 tubes. Although modern types use solid-state rectifiers, there are still many machines in use which employ 866, 966 or 3B28 mercury vapor rectifiers.

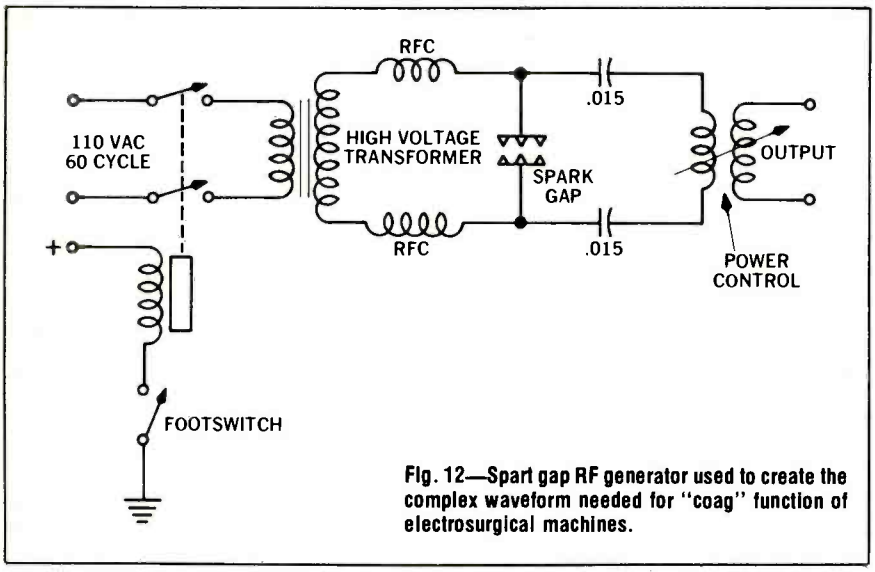

Fig. 12—Spart gap RF generator used to create the complex waveform needed for "coag" function of electrosurgical machines.

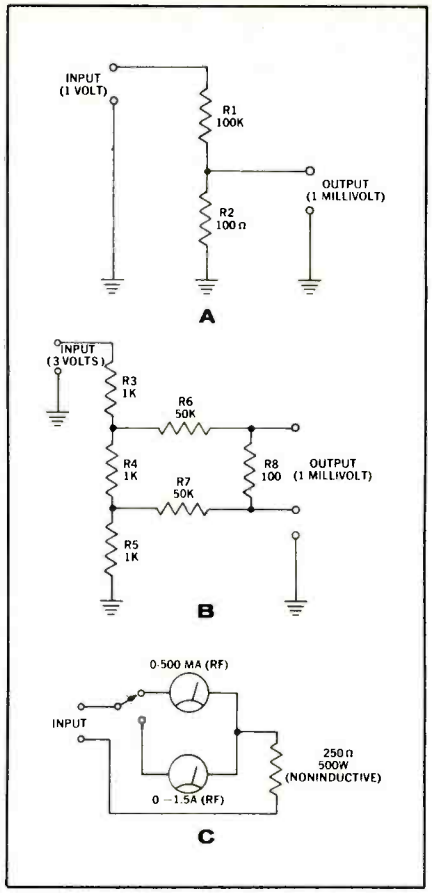

Fig. 13— Examples of handy probe adapters used in the testing of medical electronics equipment. The circuit in (A) reduces 1.0 volt signal to .001 volts. (B) A balanced voltage divider for use with differential amplifiers. (C) Circuit used to check the output of electrosurgical machines.

ated by, of all things, an RF spark gap similar to that used in transmitters of an era most of us never knew. An example of a typical spark gap circuit is shown in Fig. 12. The wide-band output signals, covering dozens of KHz, which caused the FCC to outlaw spark transmitters before WW II, are used in "coag" sections of electrosurgical machines. Today's solid-state electrosurgical machines use a low-frequency (20-50 Hz) square wave to over modulate the 500-1500 KHz "cut" signal when the device is in "coag" mode.

Most service problems encountered in electrosurgical machines are actually mechanical damage to controls, footswitch cables, etc. Testing for output is done on a 250-ohm, 500-watt dummy load in series with an RF ammeter. Two with different full-range capabilities are often needed: a 500-ma (RF) and 1500-ma (RF) unit. I made a 250-ohm dummy load out of two 500-ohm, 250-watt resistors (non-inductive) I purchased from a "surplus electronics" dealer.

TOOLS AND TEST EQUIPMENT

It surprises many consumer and communications electronic technicians that medical equipment servicing requires about the same type of test equipment they already use. Only a few "special" pieces are needed.

A multimeter is needed, of course. Keep in mind, though, that a field servicer usually quickly regrets the purchase of a digital or FET type if he services certain types of medical electronic equipment. FET types, for example, cannot be used around electrosurgical apparatus or certain medical scopes which use TV-type-flyback high-voltage power supplies, because the high RF field interferes with their operation. Also, digital types indicate overrange when a defibrillator is fired close to them. Traditional "powerless" (except for the ohmmeter battery) VOM types are preferred. If you anticipate servicing a significant amount of solid-state equipment in the field, use a VOM with a sensitivity greater than 100,000 ohms/volt. Otherwise, your old, maligned, 20,000 ohms/volt VOM is ample, and even preferred.

Your service scope need have

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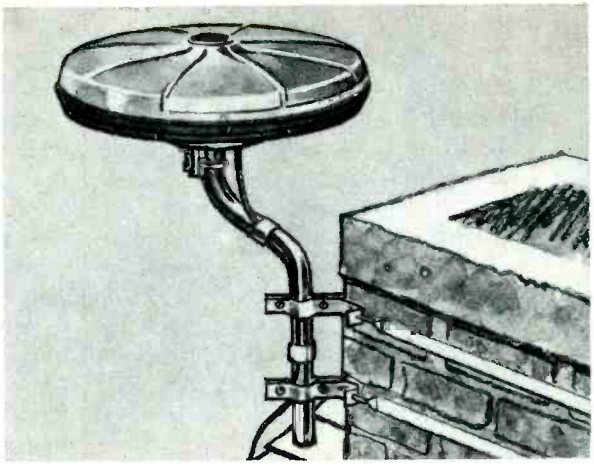

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Plastic Repair For Servicers

Types of repair cements and how they should be used

By Bernard B. Daien, ET/D
Contributing Editor

■ Remember the last time you replaced a plastic gear in a dial mechanism? Or replaced a tuner with a slipping wafer switch? Or cracked a piece off a cabinet? Or broke the rib into which was threaded the self-tapping screw which held the back on a cabinet?

Broken plastic parts frequently pose problems for the repair shop. But many plastic repairs can be made in less time than would be required to identify parts numbers and order a replacement.

TYPES OF PLASTICS

Although many different plastics are used in electronics, for our purposes we need only to divide them into two main categories: *thermosetting* plastics, which, once formed, are permanently set and do not resoften when heated, and *thermoplastics,* which can be resoftened and remolded with the application of heat.

Both types are used either plain or filled with materials which increase rigidity, strength, heat resistance or otherwise modify the basic characteristics in a desired way.

From Tables 1 and 2, you can see that each of these two general types of plastic has its own particular characteristics which provide advantages in different applications.

The type of repair cement you should use depends on whether you are dealing with a thermoplastic or a thermosetting plastic. To determine which kind of plastic you are dealing with, touch the tip of a clean soldering iron to an inconspicious area of the material. If it quickly melts, it is thermoplastic; if not, it is thermosetting. Thermoplastics generally cannot endure temperatures of 200 degrees F, while thermosetting plastics can. Of course, if you hold a very hot iron on most plastics for an appreciable time, they will deteriorate, but with a little practice on some scrap material you will quickly acquire the necessary "feel".

TYPES OF CEMENTS

Cements can be categorized into three types: *solvents, dopes,* and *chemicals.*

Solvents dissolve plastic surfaces, the surfaces then fuse together, the solvent evaporates, and the joint is complete. Solvents are useful for clean cracks, where there are no voids to be filled. You should be able to determine which solvent is best for the particular plastic with which you are working.

Dopes are solvents into which a little plastic has been dissolved. Dopes can fill small chipped areas, but present the same problem as solvents.

Chemical cements are manmade, as opposed to such "glues" as casein (from milk solids), "horse glue", etc. Chemical cements are available in two types useful to electronic technicians: cyanocrylates, such as Eastman 910, and epoxies, which are made by a variety of companies.

All types of cements can be used for repair of thermoplastics, but only *chemical* cements can be used for repair of *thermosetting* plastics.

For the electronic service shop, I recommend a small bottle (one ounce or less) of cyanocrylate and a few ounces of a two-part, clear, epoxy type of rapid-setting cement.

Cyanocrylate

Cyanocrylate is available in different viscosities from Loctite. Their Super Bonder No. 04E bonds closely matched parts, showing only a hairline crack. It sets up in 30 seconds. Loctite No. 150 is thicker, bonds irregular or porous surfaces which would normally absorb thinner cements, and sets up in two minutes. Oneida makes "Super Instant Weld", which is a cyanocrylate that is packaged and distributed by electronic suppliers and which is useful for closely matched parts and general adhesive use. Eastman makes the original No. 910, and also No. 910EM, which is better for acrylics, nylon and vinyl.

All cyanocrylates bond within a few seconds of the mating of the parts. Because the bond is activated by pressure, it is important to squeeze the parts together for the time recommended by the manufacturer. Surface preparation consists of cleaning with a solvent if the joint has been handled or exposed to air for any length of time. I use lighter fluid as a cleaner. Because it is flammable, use only a very small quantity, and remember that a static spark will set it off. If the joint is visible, use the cleaner solvent only in the surfaces to be patched, and do not spill it on other areas.

Cyanocrylate cement is tricky to use. If you get a speck on your finger, your finger will quickly stick to anything it touches. Don't get it on your skin, and wash your hands thoroughly after using it.

Solvents for cleaning up chemical cements are: acetone, benzene, methyl ethyl ketone (MEK), and toluene. I use lighter fluid (naptha) or non-oily nail polish remover (acetone).

Epoxies

Epoxies are the most versatile of cements. They can be used on almost anything, come in various viscosities, and can be filled with various materials to match the material being patched. Buy the clear kind, which is available in two grades: *liquid,* which works fine on well matched surfaces; and *thixotropic* (thick, nonrunny).

Armstrong makes an epoxy paste (No. A36) which cures in five minutes at room temperature. A similar non-thixotropic epoxy is their No. A38.

Many other suppliers can provide similar products. The thing to remember is that you want clear, unfilled epoxy, which tends to work best in most uses. You can always add a small amount of dry powder dye, etc., as needed. Suppliers of epoxies also supply

"surface conditioners" which improve adhesion on difficult substances, such as vinyl.

Epoxies must be mixed before using and, particularly in the case of the quick-cure epoxy, must be used promptly. Measure quantities carefully, as directed, if you wish to get good results. Mild heat hastens setting, but also tends to make epoxy watery and runny. I prefer to mix epoxy well, which makes fast-setting types set even faster. I gently heat slow-setting epoxy just before applying it; this tends to make it also set up faster.

EXAMPLES OF PLASTIC REPAIRS

Tuner Gear Tooth

To repair a broken tuner gear tooth in a dial selector, I removed the tuner from its mounting assembly and let it hang out of the set, then twice cleaned the gear of all lubricant with lighter fluid and let it dry. With Scotch tape, I masked off the front and side of the gear. With the tuner layed over on its "nose", the Scotch tape on two sides and the adjacent teeth on the gear formed a "mold" into which I poured quick-setting epoxy. A few minutes later, I peeled off the tape. An hour later I filed the outline of the tooth into the solid epoxy with a fine, triangular file. (The hour delay permitted hardening of the epoxy). Because epoxy can be filed easily, the job was completed in ten minutes. I then applied fresh lube to the gear assembly and replaced the tuner. The total time required to fix the gear was about 20 minutes. I could not have obtained a replacement in that interval.

Cabinet Back Retaining Support

After repairing a portable TV, while tightening the back cover screws I broke off the rib on the bottom of the case into which fitted the long, self-threading screw. Because it was a clean, fresh break, a little cyanocrylate, applied as directed, bonded it back on in a minute. I let it stand for a few hours before stressing it, and then eased the screw back in, with a little soap on the threads to make things easier.

Cabinet Chip

To a corner chip on a plastic radio, I applied a small amount of thick cyanocrylate. After the cement dried, all that was left was a hairline which appeared to be a light scratch. I used the cement sparingly so that it did not "bead up" at the joint. I allowed the cement to dry without wiping it, to avoid smearing it.

Printed-Circuit Board

A printed-circuit board had a section broken out of it. Masking tape was put across the bottom of the area where the section was broken out and thixotropic epoxy was troweled into the area with an old knife. Fifteen minutes later the masking tape was scraped off the bottom, and copper wire was jumpered across where the old printed-circuit conductors had been broken away. It took half an hour to repair the board, which would have been very expensive and time consuming to replace. My profit was higher and the customer's cost lower than had I replaced the board.

GENERAL PRECAUTIONS

If you use heat, use it carefully. Heat can bubble the cement and ruin a job. Be neat. Cement can smear and eat into the surface in visible areas. Store cement in the refrigerator, away from light, and make sure it is tightly stoppered. Do not use cement that is over a year old—it's unreliable.

Parts should be kept in alignment by light pressure during the setting time. *Before* you apply the cement, it is important that you figure out how you are going to "jig-up" the parts to keep them aligned. A supply of various sizes of rubber bands is useful for this, along with some thin copper wire and small wood blocks for securing and propping.

If you are using epoxy, don't throw away the unused, mixed cement until the repair is completed. Keep an eye on it. When the extra cement is set hard, the cement in the joint will be set too. This will keep you from poking an unset joint to find out what "the status quo" is.

Try to get joints positioned right on the first try. Moving the parts around once they are joined results in a weakened bond. Work slowly and carefully, planning ahead.

Finally, try not to inhale the fumes of these cements. They are potent. Use them only in a well ventilated area. ■

TABLE 1
THERMOPLASTICS

TYPE	*CHARACTERISTICS AND COMMON USES IN ELECTRONICS*
Nylon	Tuner gears and similar low-friction applications.
Polystyrene	Low-loss, high-frequency components.
Polyethylene	Flexible, impact-and abrasion-resistant housings.
Vinyl	Decorative coverings on cabinets.
Polyvinylchloride (PVC)	Insulating materials.
Polycarbonate	High-impact, low-moisture-absorbent, fire-resistant connectors and components.
Acrylics	Illuminated dials. (Good light conductivity.)

TABLE 2
THERMOSETTING PLASTICS

TYPE	*CHARACTERISTICS AND COMMON USES IN ELECTRONICS*
Epoxy	High-strength parts and high-quality printed-circuit boards.
Phenolic (Bakelite)	Low-cost insulation and knobs. (Brittle).
Melamine	Sockets, small parts and connectors.
Alkyd	Terminal strips and small parts in TV tuners. (Good impact resistance, rigid, and can be precisely molded.)
Silicones	High resistance to heat and chemicals, but expensive.
Polypropylene	Good plastic with characteristics that make it applicable to many uses.

TEST INSTRUMENT REPORT

HEWLETT-PACKARD MODEL HP970A DIGITAL MULTIMETER

■ The most interesting features of this instrument are its compact size and self-contained power supply. The unit is small enough to be put in your shirt pocket or in your tube caddy for use in the field. The instrument's rugged construction adds to its portability for practically any application in the servicing field. It weighs less than seven ounces and displays a high accuracy 3-½ digit readout.

General Features

There are three tips available for most any service application; a 1½ -inch tip for general uses; 5-inch tip for those hard-to-reach components, and a 2-inch concave point for good mechanical contact on test point or wire-wrap terminals. The probe tip socket can be partially pulled out of its socket to alter its length. The tip detents into three working positions as well as a folded storage position. A standard banana plug with a clip lead can be plugged into the probe tip socket for measurements requiring two clip leads.

The instrument employs a five-digit LED (Light Emitting Diode) cluster in its readout, so that all probe voltage readings are in volts, and resistance readings in kilohms. There are no scales to misinterpret and the decimal placement is automatic. Overrange is indicated by a series of dashes (— —).

Operating Procedure

To use the instrument, set the function selector to (AC volts, DC volts or K ohm). The *power* switch can be placed in one of these three positions: On 1) continuous when positioned toward the display; 2) press-to-read center position and 3) off when positioned away from the display. The press-to-read position conserves battery energy. Ground the unit with the recoiling ground lead and touch the probe tip voltage is positive with respect to the clip lead. Then press the *push-to-read bar,* and the readout automatically displays the correct reading and polarity. When measuring ohms or DC volts it takes approximately two seconds to range and settle to a proper reading.

The display is close to the point of measurement. A user working in crowded circuits can hold the probe in one hand without having to look away from the circuit to read the meter. If the unit is held upside down just slide the display switch and the display electronically inverts for easy reading, eliminating the chance of error.

Specifications

DC voltage from .1000 volt full scale to 500 volts is read to an accuracy of ± (0.7 percent of reading + 0.2 percent of range). Full scale ranges are 0.1, 1, 10, 100, 1000 volts (500 volts maximum).

AC voltages from 1 volt through the highest range, (500 volt rms maximum) from 45 Hz to 1 KHz, are read to ± (2 percent of reading +0.5 percent of range). Accuracy from 1 KHz to 3.5 KHz is ± (3 percent of reading +0.5 percent of range). On the 0.1 volt range and below, accuracy from 45 Hz to 1 KHz to 1 KHz is ± (2 percent of reading +0.5 percent of range). On these same ranges, accuracy from 1 KHz to 3.5 KHz is ± (5 percent of reading +0.5 percent of range).

Resistance measurement accuracy is ± (1.5 percent of reading +0.2 percent of range). Ohms ranges are 1 kilohm full scale (1 ohm resolution through 10 megohms. Maximum test current will not exceed 10 mA.

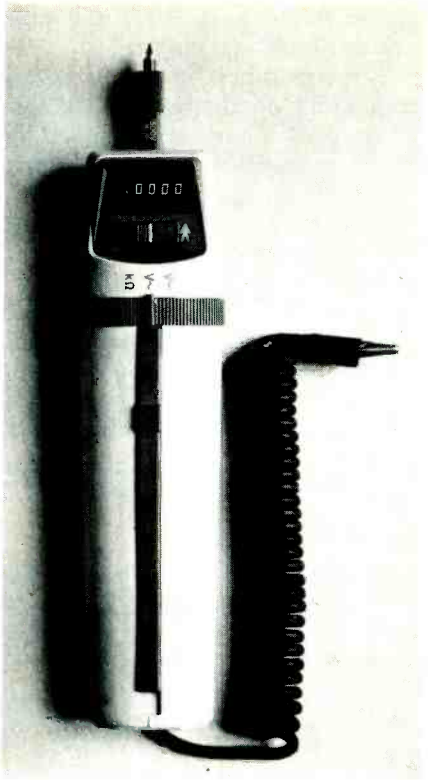
Input resistance on the voltage ranges is 10 megohms. Input capacitance on AC is less than 30 pf. The meter is protected on all ranges to 1000 volts peak. The probes input measuring resistance, is fuse protected up to 250 volts rms for up to 10 seconds. The fuse is clip mounted.

Optional/Bench Cradle

The Current Shunt/Bench Cradle will convert the multimeter into a five-function bench instrument, which will add five ranges of AC/DC current measurement capability.

A six-position manual switch selects current ranges of 100 µa, 1 ma, 10 ma, 100 ma and 1 amp or a straight through position to measure AC and DC volts and ohms.

Two general purpose binding posts accept wrap-around, screw-down clip-on banana plug terminations. Price is $45.

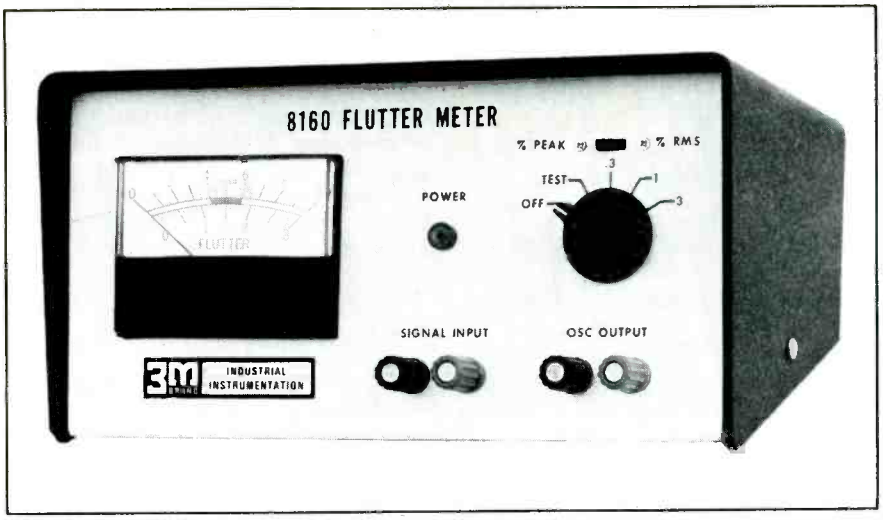


Hewlett-Packard Model HP970A Digital Multimeter. For more information about this test instrument, circle 100 on the READER SERVICE CARD.

Rechargeable Power Supply

The multimeter operates from a Nickel-Cadmium rechargeable battery pack which provides approximately two to three hours of continuous operation. The batteries will normally last for 2000 readings if the *press-to-read* bar is used. A battery charger is included with the unit which provides the proper charging current for the rechargeable battery pack. Indefinite charging will not damage the battery. The battery charger is plugged directly into a wall outlet and does not require a power cord. A completely discharged battery will be fully charged after overnight charging.

Included with the instrument is the battery charger, one battery pack, a belt-clip carrying case, sun hood, three probe tips, and an operating manual housed in a hard, compartmentalized case.



3 M Model 8160 Audio Flutter Meter. For more information about this instrument, circle 101 on the READER SERVICE CARD.

The instrument measures 6½ inches long by 1⅝ inches wide by 1¼ inches high. Price is $275.

3 M MODEL 8160 AUDIO FLUTTER METER

The Model 8160 Audio Flutter Meter is a compact, solid state instrument for measuring weighted flutter over a frequency range of 0.5 to 200 Hz. The bandpass response is weighted in accordance to ANSI, IEEE, DIN, CCIR, and IEC standards. Also, it provides a compabible test signal suitable for making flutter test recordings. (The test signal is available on the front panel of the instrument). The meter is portable and offers many operator conveniences. *A power selector source* switch is located on the rear panel of the instrument configures the instrument to operate from a 115 or 230 volt 60 Hz power source.

The accuracy of the instrument is ± 5 percent at the full scale meter indication for each of three (.3 percent, 1 percent or 3 percent) sensitivity ranges. The flutter signal provided by the meter is available for monitoring or recording purposes. The readout of the meter is in weighted peak flutter, however, an rms equivalent readout is provided by means of a % PEAK-% RMS *selector* switch. The acceptability of the input signal can be confirmed through a TEST position on the *function selector* switch. If the input signal frequency and amplitude are satisfactory, the meter will indicate center scale. A green zone is provided on the face of the meter to indicate acceptable limits. It also provides a check on the operating speed (drift) of the system under test. The test zone has been calibrated to represent a ± 3 percent frequency deviation around center (3150 Hz). Because of the direct interaction between the frequency of a signal reproduced from a prerecorded tape and the operating speed of the system reproducing it, the green zone also represents a ± 3 percent variation for the system under test.

Making Flutter Measurements

The following instructions describe the procedures to make flutter measurements. They are presented for tape recorders, but can be applied to other types of equipment such as film drivers and turntables, etc.

1) A speed check of the system under test is automatically made concurrent with the input signal check with the *function* switch turned to the *test* position. (2) To obtain the correct weighting characteristic at the flutter output terminals located on the rear panel of the instrument, use a 100 K ohm load.

The flutter measurement procedure using prerecorded test signals is as follows:

1) Connect the source of the signal to be evaluated for flutter content to the *signal input* of the flutter meter. 2) Set the *function selector* switch to the *test* position. 3) Set the % PEAK—% RMS selector switch to the % PEAK position. 4) The flutter meter shall indicate within the green zone on the meter face if the input signal is within acceptable frequency and amplitude limits. 5) Advance the *function selector* switch through the sensitivity ranges until an on-scale indication is obtained. 6) Measure the weighted peak flutter for each significant operating condition and record the data as indicated in the following manner:

Weighted peak flutter of the recorder: + _____%, or weighted peak flutter of the reproducer: + _____ percent, or weighted peak flutter of the recording/reproducing system: + _____ percent.

If an equivalent rms reading is desired, move the % PEAK/% RMS *selector* switch to the % RMS position.

1) Connect the record input of the recorder/reproducer to the *osc output* of the flutter meter. 2) Connect the reproduce output of the recorder/reproducer to the signal input of the flutter meter. 3) Record the test signal produced by the flutter meter oscillator. This signal is obtained at the *osc output* jack whenever power is applied to the flutter meter and the function selector switch is not in the *off* position. 4) Rewind the tape. 5) Repeat steps 2 through 6 of the procedure for measuring flutter using a prerecorded tape. 6) Reproduce the recording several times recording the resultant flutter reading each time. Average the individual readings to obtain a representative reading.

Specifications

Test Signal Input

Frequency: 315 Hz ± 5 percent. Frequency centering can be offset over a range of 2500 Hz to 3500 Hz. Input level: 100 mV rms, minimum. Input Impedance: 300 kilohms, unbalanced. Minimum Signal-To-Noise Ratio: 15 dB to maintain basic accuracy.

Internal Test Oscillator

Test Frequency: 3150 Hz, ± 0.2 percent. Output Voltage: 4 volts peak-to-peak square wave. Source Impedance: 3300 ohms, unbalanced.

General Features

The instrument measures 9-1/16 inches wide by 7⅛ inches deep by 4⅞ inches high. Weight 4 lbs. Price is $395.■

TECHNICAL LITERATURE

Semiconductor Guide

A 1975 ECG Semiconductor Replacement Guide No. ECG212-F is now available. It includes 32,000 more types than the previous edition and is the largest and most complete in the industry. Designed for quick and easy reference, the guide lists consumer, industrial and commercial devices, including such discrete components as transistors, diodes, power rectifiers, and silicon control rectifiers; digital and linear integrated circuits; and hybrid modules for imported and domestic consumer products. Price is $2.95. *GTE Sylvania* Advertising Services Center, 70 Empire Drive, West Seneca, NY. 14224.

Serviceman/Technician Catalog

A 48-page illustrated, discount mail-order catalog is now available. This catalog has been specifically designed as a quick reference ordering guide for use by radio/TV servicemen, electronic technicians and hobbyists. Included are tools, service and repair kits, tubes and microphones, antennas, components and many other servicing aids of various major manufacturers. All products are shown with their discounted prices. *Fordham Radio Supply Co.,* 558 Morris Ave., Bronx, NY. 10451.

Communication Equipment

A new full-line 20-page brochure entitled, "Personal Communications", is now available. The full-color brochure includes pictures, and general descriptive information on the firm's entire up-dated market offering of personal portable products. Among the many products featured are the HT-220 Handie-Talkie protable radio series, the Converta-Com portable/mobile radio, the Pageboy II radio pager, paging encoders and terminals. *Motorola Communications and Electronics,* Inc., 1301 East Algonquin Road, Schaumburg, IL. 60172.

Microphone Selection/Application Guide

Tips from leading sound engineers on how to select and use microphones, plus guidelines for on-stage miking situations, have been compiled in a new brochure, The Music-Maker's Manual of Microphone Mastery, is now available. It describes in non-technical terms how to professionally mike voices and instruments, with listings of soundman-proved techniques for handling especially troublesome sound pick-up situations. Also featured are recommended microphones for specific instrumental and vocal styles, microphone positioning hints and descriptions of a variety of accessories that professional entertainers find helpful in performances. *Shure Brothers Inc.,* 222 Hartrey Avenue, Evanston, IL. 60204.

Flat Cable Mount

A bulletin FCM-1 is available which describes the new Flat Cable Mount providing efficient mounting and bundling of flat cable. The mount is an economical alternative to present mounting/bundling methods. It can be used to secure stacked cables, folds and breakouts while retaining the inherently uniform transmission characteristics of flat cable. The Panduit Flat Cable Mount is used with Pan-ty intermediate cross-section cable ties and accommodates stacking of cable up to 5¼ inches high. The mount is 100 percent nylon for added strength. Two types of bases are available: one for screw-mounting and one used with commercial adhesives. The design of the device permits easy removal and reuse. *Panduit Corp.,* 17301 Ridgeland Avenue, Tinley Park, IL. 60477.

Test Instruments

A 8-page Test Instrument catalog is available describing 36 different models including Function Generators, Phase Generator, Pulse/Sweep Function Generators, Frequency Synthesizers and Complex Waveform Synthesizers. This catalog also contains a model capability cross-reference chart and references. *Dana Exact Electronics, Inc.,* Box 160, Hillsboro, OR. 97123.

Solid-State Replacement Guide

An upadated, 156-page guide to RCA solid-state products for replacement use is now available. "RCA Solid State Replacement Guide", SPG-202R, lists more than 103,000 industry types which can be replaced with only 250 RCA SK devices. The guide includes 32 new SK devices currently available from RCA as standard commercial products. Significant ratings and characteristics data are given for each type to aid in the selection of the optimum device for a particular application. The guide shows dimensional outlines of device packages and terminal diagrams including a revised semiconductor hardware replacement directory. *RCA Solid State Division,* Box 3200, Somerville, NJ. 08876■

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TECHNICAL DIGEST

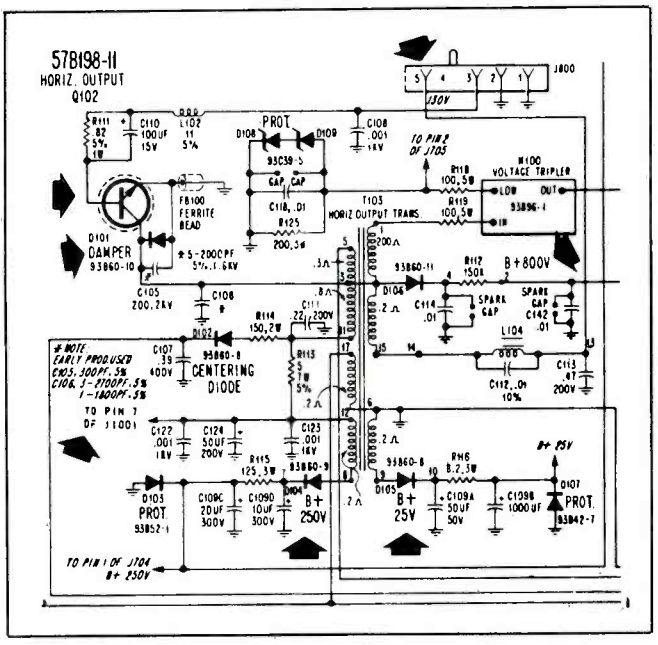
The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

ADMIRAL

Horizontal Oscillator Module M800 (A8924-1)

The DC voltage at pin 5 of contact terminals J800 should be 20v. The M25 production horizontal oscillator modules did not use R809 (5.6K, 3w). This resistor is on the power supply module as R909.

In earlier schematics the arrow above C122 pointed to pin 6 of J1001; it should be pin 7.



The 25v, 250v and 800v supplies are derived from the horizontal pulse produced by the high voltage transformer. When the horizontal system is inoperative, the 25v supply will be missing and the 250v and 800v supplies will read approximately 130v.

Color TV Chassis M24/M25/M30—Convergence Extension Cable

Your Admiral distributor can supply a cable assembly to extend the leads from the chassis to the convergence assembly on the M24, M25, and M30 color TV chassis.

Note that this is an extension cable, not an adaptor cable. It will not adapt these chassis to a bench setup made for tube - type chassis.

The part number of this cable assembly is BP276; the suggested user price is $11.25.

GENERAL ELECTRIC

TV Chassis XA — Sound Distortion

If the XA TV chassis has a symptom of distorted sound on some stations, especially on cable installations and the alignment of coils L300 and 301 does not eliminate the problems make the following changes:

Replace coils L300 and capacitor C313 with the new ES36X129 sound take-off coil kit. The new kit will now include a new double tuned coil, a 220 pf capacitor, and an instruction sheet.

To make this change, proceed as follows:

Measure 100 µV to 40 kV ...for less than $200!

Now it's possible to get just about all the voltage measurement capability you'll ever need. With these new instruments from Heath — The IM-2202 Portable Digital Multimeter and the IM-5210 High Voltage Probe Meter — you can have DC voltage measurement capability over a 166 dB dynamic range, for a total cost of only $197.90* for both instruments.

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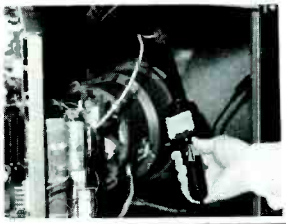

New Heathkit probe meter measures TV tube voltages to 40 kV... only $17.95*

TV tube voltage measurements are fast and easy with the IM-5210 Probe Meter. You just attach the ground clip to the TV chassis, place the probe tip against the tube's high voltage connector and switch on the meter. It's an easy kit to build, taking about an hour to assemble. With a kit-form price of $17.95*, it's just about the best high voltage measurement value on the market. Also available assembled, only $24.95*.

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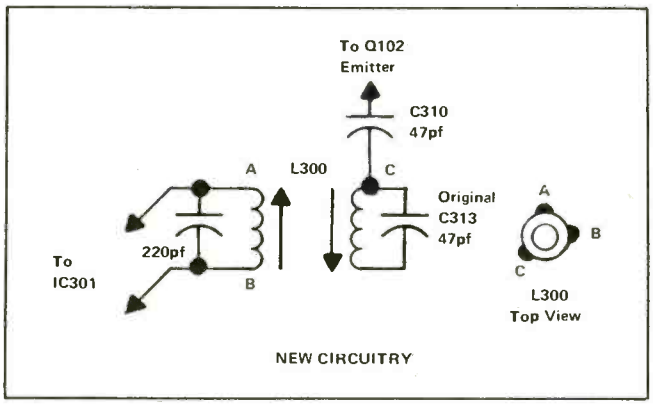
1) Remove the original coil L300 and discard. 2) Remove capacitor C313 and install it across terminals C and B of the new coil (in parallel) on the coil form mounting lugs. 3) Install the 220 pf capacitor in the board where the original capacitor C313 was located. 4) Adjust both top and



bottom coils slugs for maximum undistored audio. Be sure to adjust on a weak signal by disconnecting antenna (or some equivalent).

Receivers with Serial Numbers beginning 5V2T and higher were built with this modification.

Color TV Chassis C1/L1—Increasing Color Gain

The color gain in the "C" and "L" chassis can be increased substantially by making the following production change.

This production change was incorporated in all "CD" chassis starting with serial numbers 5S1P and later.

Move the gray wire connected to the emitter of transistor Q301 on the IF board to the emitter of Q303. There is an unused hole at the end of the copper island to which the emitter of Q303 is connected. This step effectively adds another stage of chroma amplification.

Check to insure the set does not exhibit a 920 KHz beat. Any 920 KHz beat problems should be corrected by adjusting the 41.25 MHz and 4.5 MHz traps.

Color TV Chassis CD—Improved Video Response (Sharpness)

If the TV set operates normally, but a critical customer may complain of poor focus or lack of detail, make the following changes.

1) Optimize the focus, high voltage, brightness limit, and AGC adjustment. If minimal improvement is noted and customer is still dissatisfied, proceed to the next step.

2) Replace capacitor C174 which is a 470pf, 10%, 500 volt capacitor with an EP22X5 680 pf, 10%, 500 volt capacitor.

3) Remove resistor R176, an 18K, ½ watt resistor, and install a buss wire in its place.

This change is incorporated in production starting with Serial Number 5R3T and higher.

MAGNAVOX

Color TV Chassis T989—Vertical-Output Failure

Overtightening the mounting bolts on the vertical - output transistors can cause an intermittent or complete loss of vertical deflection in the T989 chassis. A hole in the collector tab of the transistors aligns with a hole in the heat sink and a bolt secures each transistor to the heat sink through these holes. Variations in transistor lead length sometimes caused intermittent lead contact in the transistor sockets. Therefore, the mounting holes in the heat sink were changed to slots, to allow each transistor room to seat well into its socket. Because of these mounting slots in the heat sink, it is now possible to overtighten the mounting bolts and bend the collector tab of the transistors enough to

open the collector connection inside the transistor. The field solution for this problem is to add an aluminum washer (Part No. 101857-44) behind the transistors, between the collector tab and the mica insulator. Use a small amount of silicon grease on both sides of the washer. This washer prevents the transistor's collector tab from bending when the mounting bolt is tightened.

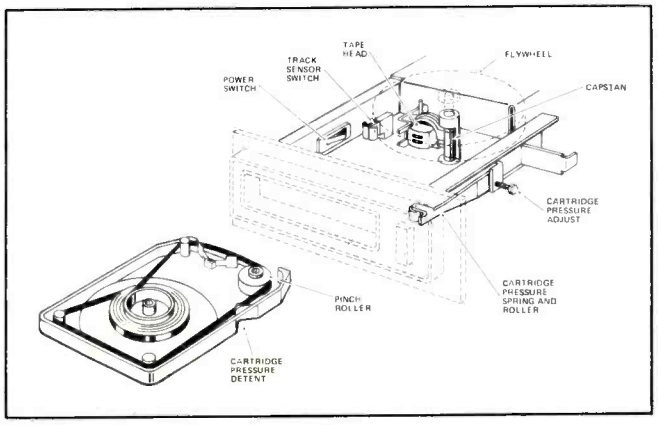
This solution also applies to a similar problem with audio drive transistors Q15 and Q19 in the R231 radio chassis.

Color TV Chassis T981/2/7—CRT Burn Spots

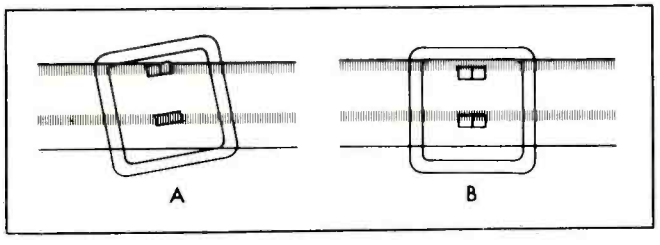
A burn may occur at the center of the screen on these chassis, if the high voltage is interrupted three or four times in rapid succession. Intermittent malfunctions in the horizontal circuitry are the type of malfunctions most likely to produce this symptom. The Horizonal Oscillator/Driver module contains a socket which mounts to stakes on the master PC board. Before replacing a burned CRT in these chassis, be sure to resolder these stakes to the master PC board. Other possibilities which can cause intermittent interruption of the high voltage are loose solder connections on the module socket or loose solder connections of components on the module.

Tape Player Adjustments and Maintenance

The most common service adjustments on a tape player are head height and azimuth. These adjustments should be



made using a test tape. The illustration exaggerates an azimuth error in drawing A and a height error in drawing B. An azimuth error in head alignment reduces the high frequency response because the net effect is the same as a wider gap width in the head. The head azimuth adjustment is usually made to peak the output from a test tape as a

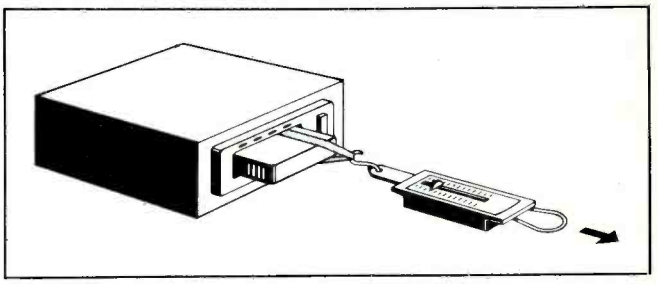


continuous high frequency tone is played.

A misadjustment in head height causes crosstalk distortion. That is, the head picks up the signal from the adjacent track. In drawing B the head is too low for program one. In this case, some of program two would be heard in the output. The head height adjustment is usually made to peak the output from a test tape recorded on only one track.

Another important adjustment is the cartridge pressure adjustment. This adjustment determines how hard the pinch roller is pressed against the capstan. If the pressure is too light, the capstan may slip on the tape and cause slow speed. If the pressure is too high, the capstan may be too hard to rotate or the cartridge may be difficult to remove from the player.

One method used to adjust the cartridge pressure spring is to insert a cartridge into the player and attach a loop of electrical tape or packing tape to the cartridge directly opposite the pinch roller as shown in illustration.



Hook a spring scale through the loop. While the tape is playing, pull on the scale and note the pull force necessary to distort the music. The cartridge pressure adjust screw should be adjusted to obtain a 3 to 5 pound pull force for this measurement.

Other maintenance of a tape player generally includes cleaning, lubrication, belt replacement, and head replacement. Cleaning should be done with methanol alcohol (not rubbing alcohol) and a lint free cloth or swab. All surfaces which contact the tape should be cleaned, such as the head, track sensor switch, and capstan. Required lubrication on an 8 track tape player is minimal. Factory lubrication is usually sufficient. However, the capstan bearings and motor bearings can be lubricated with a drop of clear mineral base oil (not common household oil). Excess oil should

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be removed with methanol alcohol. Moving mechanical parts are lubricated with a light grease, such as Lubriplate. Ensure that no lubrication comes in contact with drive surfaces.

The drive belt must be in good condition for proper operation. A worn or stretched belt can cause slow or erratic speed which causes distortion. Replace the belt if it appears worn or stretched. Head replacement also is occasionally necessary. As the head wears, the high frequency response is reduced. A typical 8 track tape head should last approximately 2000 playing hours.

As the popularity and quantity of 8 track players increase, the service technician can expect to be servicing more of these products. Using his basic understanding of tape recording and becoming familiar with 8 track features such as cartridge construction, tape transport system, and tape player adjustments and maintenance, he can expect to successfully fulfill his service responsibilities with increased efficiency and profit.

Color TV Chassis T981/2/7—Power Supply Diode Failure

Early production runs of this chassis series used 1 Amp power supply diodes (PN 530162-1). Two package sizes were used, one small and one large. However, both the small and the large 530162-1 diodes are electrically equivalent and both are subject to early failure under stress conditions. For this reason, the power supply diodes were replaced with 3 Amp devices (PN 530180-1). The following steps will minimize power supply diode failure:

1. Use the 3 Amp 530180-1 diodes as replacements. Whenever a defective 530162-1 diode is encountered, replace all four power supply diodes with the 3 Amp devices. Use care when forming the diode leads. Some 3 Amp diodes were found to have failed due to fractures incurred during the lead forming process.
2. Ensure that the CRT filament leads are not dressed against the thermistor, RV200.
3. Always use an isolation transformer when servicing.

Color TV Chassis T995—Audio Pop at Turn Off

The initial production of the T995 chassis uses a Sound module, Part No. 703727-1, which contains two IC's. When using this sound module an audio "pop" may occasionally be heard in the speaker when the set is turned off, with the volume at minimum. The loudness of the pop varies and will not be heard every time the set is turned off. The symptom can be eliminated by adding a series RC network across the AC switch. Use a 22 ohm, ½w resistor and a .047 mfd, 150 VAC capacitor (Part No. 250661-4770).

Star TV Systems — Rapid On Off Operation

When a STAR set is turned Off and then On again several seconds later, the channel which was last selected will reappear. However, if the unit is turned Off and On again very rapidly, the station may be detuned. To regain the original channel, reselect the channel or turn the set Off for several seconds and then back On. This condition is normal.

Color TV Chassis T960 — Vertical Jitter

This B/W chassis may exhibit vertical jitter due to distortion of the vertical sync pulses in the Video IF module. The module can be modified by connecting the ground lead of capacitor C10 directly to the ground lead of capacitor C12. To modify the module:

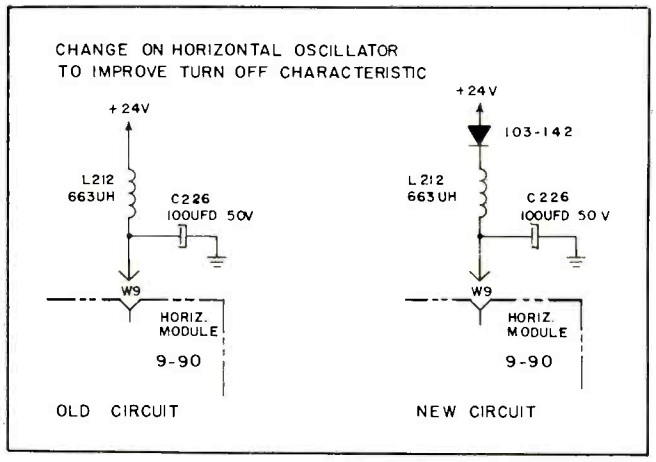
1. Remove the electrolytic capacitor, C10.
2. Install a new axial lead type 10 mfd 25 v electrolytic capacitor to the foil side of the module PC board. PN 270117-1135 is a 35 v 10 mfd axial lead capacitor which may also be used. Solder the negative lead of the new capacitor directly to the ground lead of C12. Connect the positive lead to the original C10 positive connection.

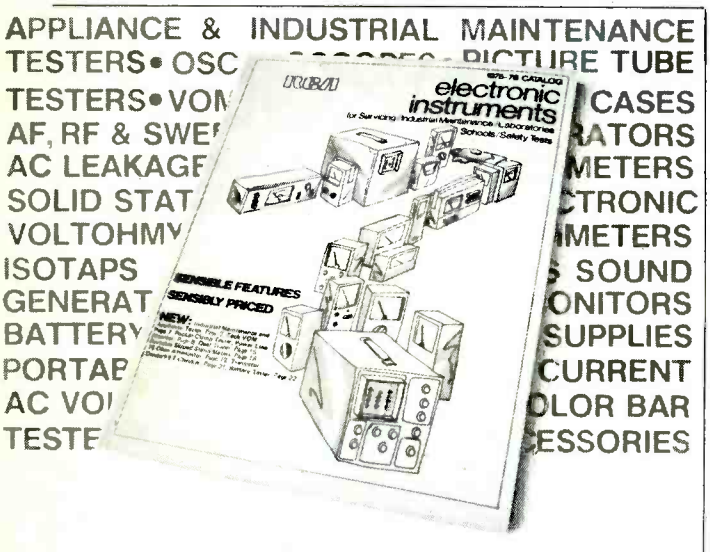
Production is now using 703428-7 Video IF module. The new module does not require modification.

ZENITH

Color TV Chassis 17/19EC45—Improved Horizontal Turn - Off Characteristics

In some receivers a bright vertical spot could be seen on the screen as the receiver is turned off. This could be caused by the horizontal scan decaying at a faster rate than the vertical scan. A 103 - 142 diode was added as shown in the illustration to insure the 100 mfd capacitor (C226) discharges into the module rather than into the 24 volt supply, increasing the decay time of the horizontal system. ■





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NEW PRODUCTS

POWER SUPPLY 129

A solid state power supply which enables you to enjoy your automotive stereo tape player, CB rig, etc. at home

is introduced by *Eico Electronic Instrument Co. Inc.* The Model 1040 Power Supply enables operating 12 VDC electronic equipment from 120 VAC lines. The unit makes it possible to check out equipment on the test bench before actually installing it in your car or on your boat. It can also be used as a battery charger for 12 - volt batteries. It provides an output of 12 VDC at 4 amps continuous. Price is $19.95.

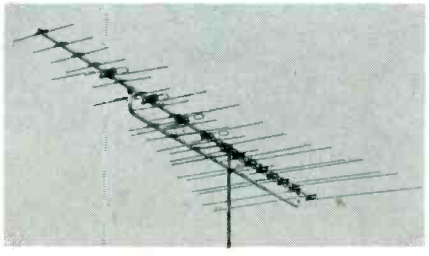
DIGITAL VOM 130

A solid - state digital VOM designed and engineered for a broad spectrum of measuring and testing applications is introduced by *Simpson Electric Co.* The Model 360 VOM has a 3½ digit, non - blinking, 0.33 - inch LED display with bright red numerals. Polarity selection is automatic, with an appropriate "+" or "—" indication. Overrange indication also is automatic. An

overrange measurement will cause the lower half of the "1" to flash while the remaining three digits register the amount of overrange, linear to 250 counts beyond maximum. An analog indicator, located just beneath the digital display, is useful for quickly scanning nulls and peaks. The instrument features 29 AC, DC and resistance ranges, including "low - power ohms." An analog output jack on the front panel makes it easy to interface with recorders and other instruments. Maximum full - scale response time to within rated accuracy is two seconds on DC, five seconds on AC. The VOM operates from rechargeable batteries or AC line.

VHF/FM ANTENNA 131

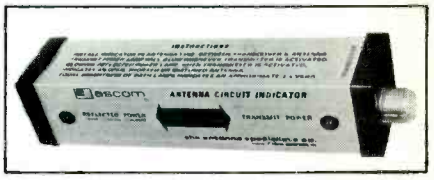
A new Permacolor VHF/FM outdoor antenna, specifically engineered for deep - fringe situations, has been announced by *RCA Parts and Accessories Division.* The Model 3BG37 was designed for deep fringe VHF color and black and white TV and FM reception. Its perma - tuned circuits provide full range VHF reception, which is



maintained throughout the life of the antenna by means of solidly riveted permanent connections of flexible aluminum between elements and feed lines. The antenna is coated with a blue and gold finish for long - lasting weather protection. It also has RCA's special polypropylene insulators, V - shaped mast clamps and FM reception control elements. The antenna includes eight FM reception control elements and 37 perma - tuned circuits, each active on one or more of the VHF bands. It measures 203 inches overall length and 108 inches wide and a turning radius of 117 inches for rotation. It is constructed with a double boom for strength and rigidity. Price is $95.

VHF ANTENNA CIRCUIT INDICATOR 132

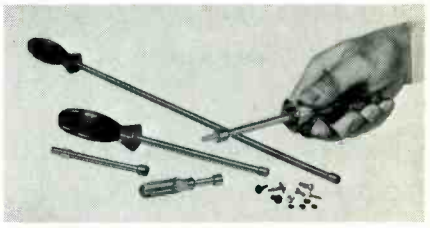
A new automatic indicating device designed to warn VHF communications equipment operators of antenna problems is announced by *Ascom Electronic Products*, a division of *The Antenna Specialists Co.* Recognizing the fact that mobile communications antennas are often subjected to some degree of damage, and that the problem is usually not immediately detected by the operator, the indicator, Model ASM 104, fills the need for an alerting device. It also helps prevent damage to equipment by eliminating long periods of transmission into extremely high VSWR. The antenna circuit indicator is designed for easy mounting under the vehicle dash. Two lights are



used to give the operator instant indication of the system's operation. When transmitting, one light indicates the normal condition of RF power being transmitted, the second indicator light, showing reflected RF power, alerts the operator to antenna problems that could affect communications capability. The unit requires 10 w or more of RF energy and operates over a frequency range of 144 - 174 MHz. It is installed in the antenna line.

NUTDRIVERS 133

Four styles of magnetic fixed - handle nutdrivers, each in two sizes, are available from *Xcelite.* The magnetic line also includes two sizes of interchangeable shanks which fit all their Series 99 handles, both regular and ratchet types. The permanent alnico magnet in the insulated socket



holds fasteners firmly for easy, one - hand driving or retrieving upon removal. Styles range from a 3½ inch

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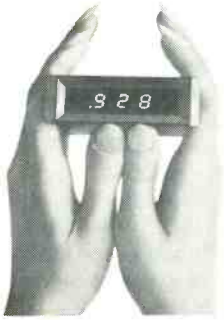

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overall midget pocket clip to a super long 20¾ inch driver, all in ¼ inch and 5/16 inch hex openings. Intermediate lengths are 7 inches and 10 inches. The comfort - contoured plastic handles, color - coded red or amber for easy hex opening identification, are designed for maximum torque with minimum pressure.

TOOL CASE 134

Platt Luggage, Inc., has introduced a new Tool Case Model 610, which is strong, lightweight, and practical, plus a five year guarantee on the case and pallets. The pockets on the pallet are molded without any seams, stitches or rivets to form a one - piece unit. The case itself is built of Platt's softside with a unique, new construc-

tion and combines the rugged lightweight qualities of their molded cases with the rich looks of a soft case. It has a skin of belting leather brown expanded vinyl backed with nylon and Texon, reinforced by a thick layer of ABS Thermoplastic.

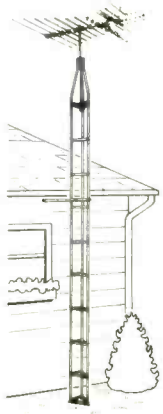
RECHARGEABLE SOLDERING STATION 135

Ungar, Div., of Eldon Industries, Inc., announces the availability of a portable rechargeable soldering station. The design of the iron allows the operator unrestricted freedom for hard - to - reach intricate assemblies and repair. The No. 194 Soldering Station consists of a rechargeable iron, which is nickel cadmium battery powered. Two interchangeable tips and charging holder with tip cleaning

sponge receptacle. The unit is a well balanced lightweight pencil iron, with indicator light, convenient easy touch operating trigger control with interlock "off" switch. The built - in lamp illuminates the tip and work area. Two quick heating, interchangeable element tips are available, pretinned in chisel and micro spade configuration. The complete station is molded in high impact plastic and is rated at 120 volts AC input, 3.2 volts AC at 120 ma output.

ANTENNA TOWERS 136

A new line of antenna towers is introduced by *Jerrold Electronics*. The line includes three series of towers. The top of the line is the QDMX series of six complete nested towers, ranging in height from 28 to 68 feet and are made for installation on a concrete base. The towers are made sturdy by open channel leg construction. All sections are made of 12 to 16 gauge, galvanized steel. Each section is



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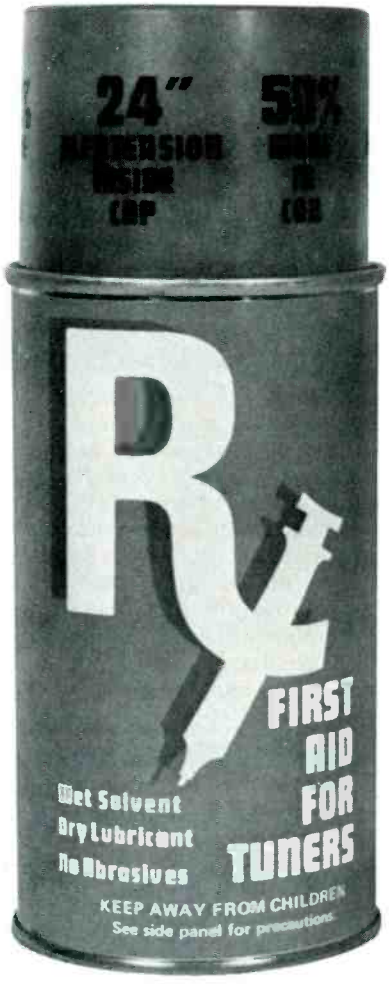

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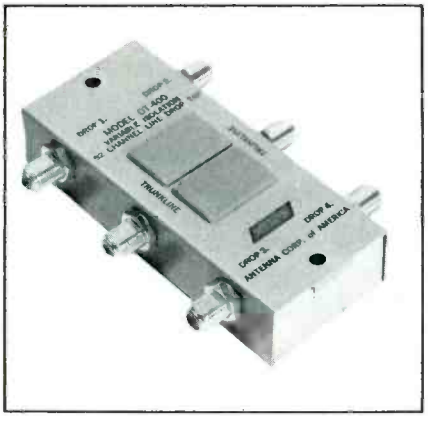
cross braced, with sections and braces riveted together and do not require guy wires. The QDME series of towers is somewhat similar to the QDMX line, but not as large. The towers are available from 14 to 52 feet and are made to be bracketed against the house. The final series in the line is called the Golden Nugget series, using spot welds to join the cross braces to the tower legs. The legs of the towers are made of 16 gauge by 1¼ inch pre-galvanized steel. The tower is also supported by house brackets and each section is ten feet high.

MATV TAPS 137

ACA has added three new MATV products to its line to simplify installation of MATV systems. The drop taps, Models DT100, 200 and 300, allow the system designer to lay out trunk lines in a straight line and operate outlets in remote or other locations with feeder lines instead of wiring in and out of each outlet. This arrangement



reduces the amount of cable used and the losses involved with excessive cable. The drop taps also have variable isolation, eliminating the stocking of different values and simplifying the figuring of losses in a system. The DT100 furnishes one drop, the DT200 two drops, and the DT400 four drops. All models are 82 channel and have low insertion loss.

DIGITAL MULTIMETER 138

MOS circuitry is used throughout *Philips* new multimeter to combine low cost with high reliability and accuracy. To make the lifetime accuracy as high as possible, the Model PM2522 multimeter uses an analog - to - digital conversion technique which eliminates the need for filters and rejects series - mode signals down to 0.1% of their original value. The 3½ - digit LED display is easy to read and has an automatic decimal point as well as polarity and overrange indication. All functions and controls are push - button selected and there is no need for

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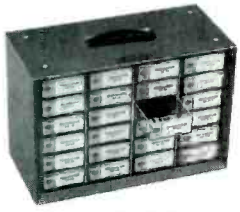
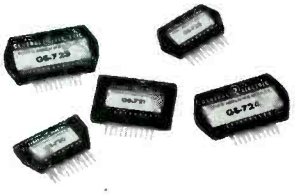


Transistor kit for foreign sets



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lead changing when going from voltage to resistance measurements. Up to 1000 volts can be applied to the voltage ranges while the current ranges

are fuse - protected. The DC voltage range is 200.0 mv to 1000 v; AC voltage 200.0 mv to 600 v; AC/DC current ranges 200.0 μa to 2 amp and resistance ranges 200.0 ohm to 20 ohm. Frequency range is 30 Hz to 30 KHz. Price is $335.

UNIVERSAL COUNTER 139

Systron - Donner announces the introduction of a new precision 50 MHz Counter - Timer, Model 6250A, that combines both low cost with high performance features. The instrument

performs frequency, multiple period, time interval, ratio, and totalizing measurements. It includes an autoranging function that selects a maximum display resolution, both preset and manual trigger level selection, leading zero suppression, 25 mv RMS input sensitivity, an 8-digit display, and BCD output of all measurements. Each input channel has selectable attenuator and slope controls. Price is $740.

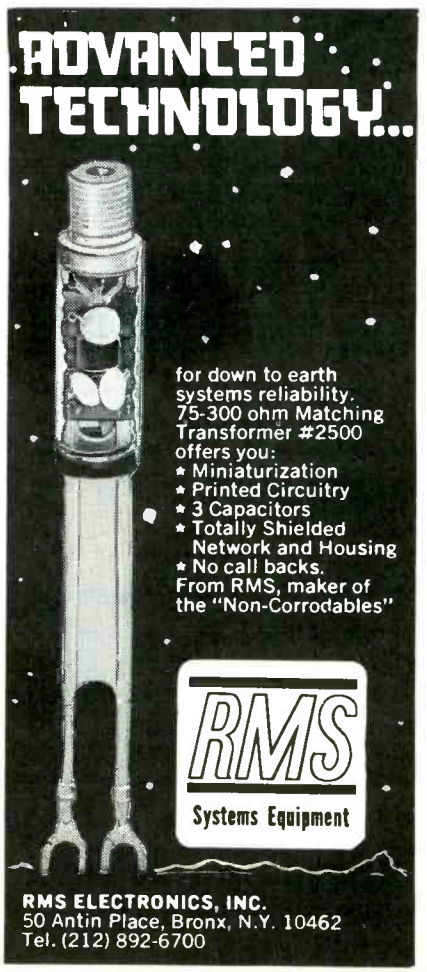
SOLDER 140

Multicore Solders has introduced HMP alloy, a specially formulated high melting point solder for applications where soldered components are subjected to relatively high temperatures during their working life. It also prevents reflow where multiple joints must be made close to each other. Alloyed of 5% tin, 93.5% lead, and 1.5% silver, the solder has an exceptionally high creep strength both at normal and elevated temperatures. It also has much greater overall strength at all temperatures than low content tin alloys because of the silver addition. Available with five - cores of rosin flux wire solder, MHP has a melting temperature range of between 565° and 574°F and is considered a eutectic alloy for all practical purposes.

VHF SINGLE CHANNEL AMPLIFIER 141

The Finney Company has added to its Greenline MATV product line, the Model G-120, VHF Single Channel Pre - Strip Amplifier. It is designed to be placed directly ahead of a single channel distribution amplifier to increase an otherwise "weak signal", to a level useful to the distribution amplifier. Quite often, even though

the weak signal is pre - amplified at the antenna, there is not enough signal available at the input of the single channel distribution amplifier, to achieve maximum output or to maintain AGC regulation. This amplifier with its 30 dB gain and 1 volt maximum output will provide the single channel distribution amplifier with more than sufficient signal to overcome the problem. ■



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STACKING TV ANTENNAS

continued from page 21

tenna output to the 75-ohm coaxial cable.

If you choose to use the T-28M or some other matching transformer, correct *phasing* on the *300-ohm* side must be observed. The easiest way to do this is to measure for continuity between the threaded (shield) portion of the coaxial connector and one conductor on the 300-ohm side. The conductor thus determined should then always be connected to a corresponding, right or left, screw terminal on each of the identical antennas for in-phase connections, or reversed for out-of-phase connections.

The effect of incorrectly phased horizontally stacked antennas is illustrated in Fig. 11.

BEYOND DUAL OR QUAD STACKS

Not much improvement in eliminating ghosting or man-made noise is gained by stacking more than two antennas horizontally or two vertically. If more than two in either direction seems to be required, then the advice of an experienced TV antenna installer or antenna engineer should be sought.

There are techniques other than conventional stacking that can reduce TVI. Stagger stacking, tri-stacking, and phasing harnesses can be useful, but all require a high level of knowledge and experience.

One source of such help or advice is the technical staff of an antenna manufacturer such as the Winegard Company. They might have a special antenna design (called an *area special*) which will overcome the particular problems in your area and, if not, they might be willing to help you or a Winegard dealer/installer in your area "design" a special antenna array which will solve the problem. ■

MEDICAL ELECTRONICS

continued from page 32

only 500-KHz bandwidth, but greater bandwidth won't hurt anything. One scope feature that is needed for *field servicing* is *portability*. Most operating room monitor scopes must be mounted higher than five feet off the floor to prevent explosion of the flammable anesthesia gases which are sometimes used. The first time you try balancing your 35-pound "portable" (portable by virtue of a plastic handle) scope while troubleshooting perched on a step ladder, you will understand the wisdom of one of the new, truly portable, AC/battery type scopes now available from several test instrument manufacturers. Such instruments also offer the advantage of fitting inside a tool caddy, and they can be supported by a strap around your neck while you climb up to service an operating room monitor scope.

Back at the shop, you will need a function generator capable of at least sine- and square-wave outputs down to 1 Hz. Although you can buy any number of multi-featured, expensive function generators, an instrument such as the Heath IG-18 is sufficient, and relatively inexpensive. Fig. 13 shows several handy circuits for reducing function generator output to the levels required by medical instruments.

Two *special* test instruments needed for medical electronics testing are a *defibrillator tester* (refer to defibrillator manufacturers) and an ECG waveform simulator. My personal preference of the latter type of instrument is the Park-Davis Model 3150 (Parke-Davis Medical Instruments, Bear Hill Rd., Waltham, Mass.), because its size and shape fit easily into a back pocket or a corner of a handy brief-case-type tool box.

IT MIGHT BE FOR YOU

Medical electronic servicing is a growing but relatively new field which offers enterprising and competent servicers a profitable alternative to consumer electronics. Ten years from now it might be saturated with competition. Today, though, its a "ground floor" opportunity that at least deserves serious consideration. ■

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2N2713	2N3398	2N3845	2N3901	2N5366
2N2714	2N3402	2N3845A	2N4424	2N5367
2N2923	2N3403	2N3854	2N4425	2N5418
2N2924	2N3404	2N3854A	2N5172	2N5419
2N2925	2N3405	2N3855	2N5232	2N5420
2N2926	2N3414	2N3855A	2N5232A	2N5998
2N3390	2N3415	2N3856	2N5249	2N5999
2N3391	2N3416	2N3856A	2N5249A	2N6008
2N3391A	2N3417	2N3858	2N5309	2N6009
2N3392	2N3662	2N3858A	2N5310	2N6076
2N3393	2N3663	2N3859	2N5311	
2N3394	2N3843	2N3859A	2N5354	
2N3395	2N3843A	2N3860	2N5355	

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2N404	2N6126	TIP125	2SC789	ECG198
2N404A	2N6288	TIP126	2SC790	ECG210
2N1303	2N6290	TIP127	2SC1061	ECG211
2N1305	2N6292	SK3041	2SC1173	ECG5400
2N1307	2N5060	SK3054	2SC1377	ECG5401
2N1309	2N5061	SK3084	2SC1410	ECG5402
2N2646	2N5062	SK3119	2SC1419	ECG5403
2N2647	2N5063	SK3120	2SC1514	ECG5404
2N1671	2N5064	SK3121	2SC1516	ECG5452
2N1671A	TIP29A	D40C	2SC1517A	ECG5453
2N5294	TIP30A	D40D	2SD234	ECG5454
2N5296	TIP31A	D40E	2SD235	ECG5455
2N5298	TIP32A	D40K	ECG113	ECG5456
2N5490	TIP41A	D40N	ECG114	ECG5457
2N5492	TIP42A	D40P	ECG115	ECG5461
2N5494	TIP47	D41E	ECG118	ECG5462
2N5496	TIP48	D41K	ECG119	ECG5463
2N6099	TIP49	D42C	ECG120	ECG5465
2N6101	TIP50	D42R	ECG152	ECG5631
2N6103	TIP110	D43C	ECG153	ECG5632
2N6107	TIP111	2SA743	ECG166	ECG5633
2N6109	TIP112	2SA489	ECG167	ECG5634
2N6111	TIP115	2SA490	ECG168	ECG5635
2N6121	TIP116	2SA671	ECG169	ECG5636
2N6122	TIP117	2SA671K	ECG171	ECG6406
2N6123	TIP120	2SA755	ECG186	ECG6407
2N6124	TIP121	2SA779K	ECG187	ECG6408
2N6125	TIP122	2SA780A	ECG196	

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ECG5480	ECG5491	ECG5505	ECG5526	ECG5652
ECG5481	ECG5492	ECG5506	ECG5527	ECG5660
ECG5482	ECG5494	ECG5507	ECG5640	ECG5661
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ECG5484	ECG5501	ECG5522	ECG5642	ECG5663
ECG5485	ECG5502	ECG5523	ECG5643	ECG5664
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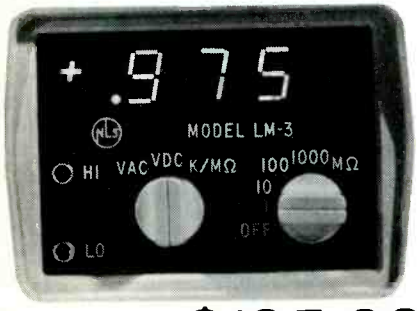

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ELECTRONIC TECHNICIAN/DEALER

TEKFAX

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

GROUP **274**

	SCHEMATIC NO.		SCHEMATIC NO.
ADMIRAL	**1588**	**AIRLINE**	**1592**
TV Chassis T6R2-1A, 2A		TV Models GAI-11235A/B	
ADMIRAL	**1589**	**AIRLINE**	**1591**
Color TV Chassis T43K10, T44K10		Color TV Model GAI-12635A	
ADMIRAL	**1590**		
Color TV Chassis T50K10-4B			

1588

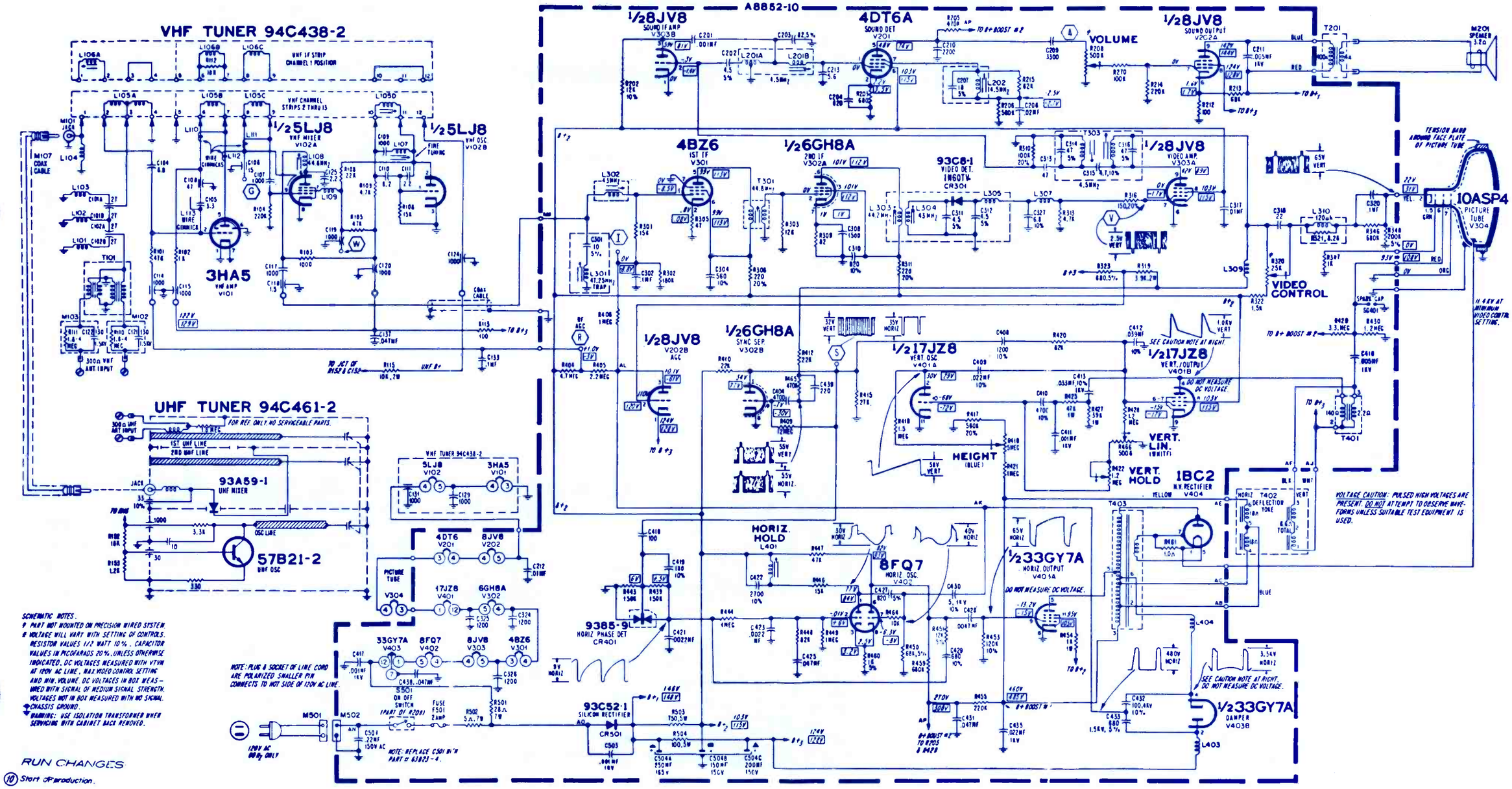
ADMIRAL

TV Chassis
T6R2-1A, 2A

JUNE • 1975

MODEL CHART					
MODEL	FINISH	CRT	VHF	UHF	CHASSIS
9P637	Brown	10ASP4	94A363-2	94A465-2	T6R2-1A
9P637M	Brown	10ASP4	94A438-2	94A461-2	T6R2-2A
SK9P667	Walnut	10ASP4	94A363-2	94A465-2	T6R2-1A
SK9P667M	Walnut	10ASP4	94A438-2	94A461-2	T6R2-2A

SYMBOL	DESCRIPTION		ADMIRAL PART NO.
R208 — 500K, vol con R320 — 25K, video con	w/switch		75A148-2
R418 — height con			75A101-16
R422 — 1.2 M, vert hold con			75A100-8
R466 — vert line con			75A101-17
R502 — 5.5 ohm, fuse type			61A48-1
C504A — 150mf, 165v C5048B — 150mf, 150v C504C — 200mf, 150v	electro		67A30-10
L202 — quad coil			72A132-77
L303,304 — IF xformer			72A296-7
L401 — horiz lock coil			94A17-19
T201 — audio output xformer			79A124-5
T303 — sound takeoff xformer			72A185-5
T401 — vert output xformer			79A139-4
T402 — deflect yoke assy			94A372-1
T403 — horiz output xformer			79A138-29
F501 — 2a fuse, run 11			84A7-8
tuner, VHF			94A363-2



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1589

ADMIRAL

Color TV Chassis
T43K10, T44K10

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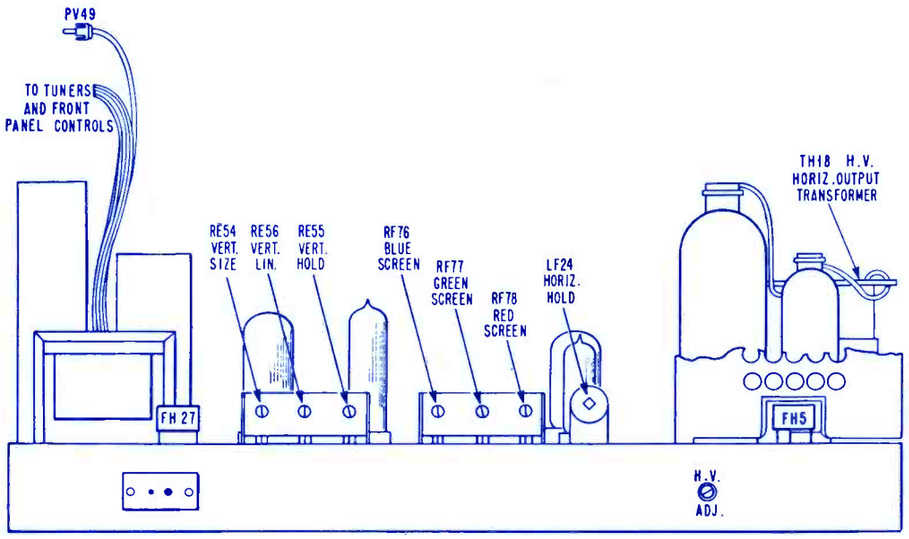
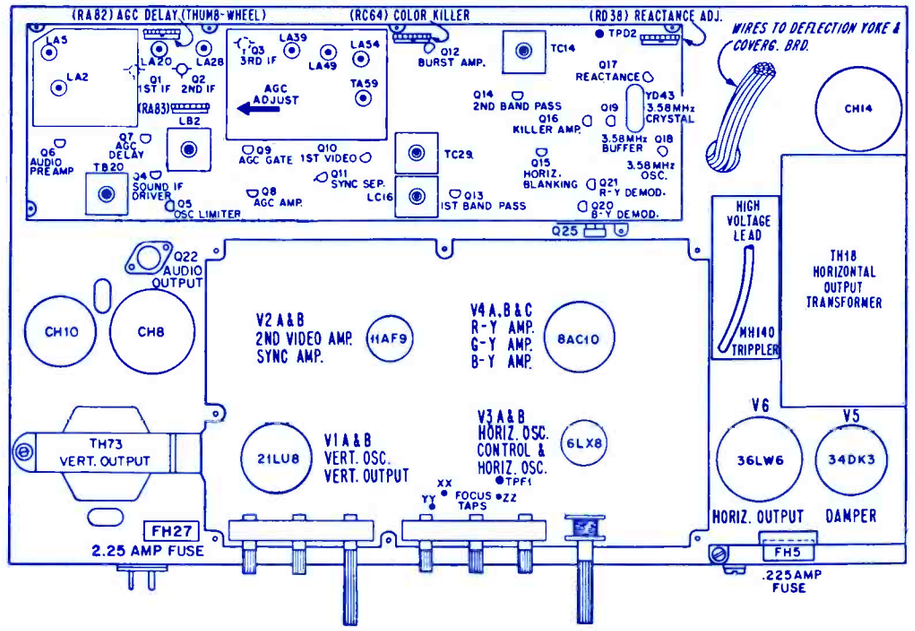
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

SYMBOL	DESCRIPTION	ADMIRAL PART NO.
RA83	2K AGC con	75A101-31
RC64	10K color kill con	75A101-18
RD38	400 ohm, react con	75A101-35
RE54	vert size con	
RE55	vert hold triple control	75A95-18
RE56	vert lin cont, 300K	
RH28,34	dual con-brite & tint T43K10-4A	75A194-1
RH29,39	dual con-contrast & color T43K10-4A	75A194-2
RH34	500 ohm, slide tint con T44K10-4A	75A140-17
RH39	500 ohm, color slide con T44K10-4A	75A140-17
RH125	high vol adj 5 M, con	75A135-57
CH10A	300mf, 350V	
CH10B	300mf, 350V	
CH10C	80mf, 350V	
CH10D	10mf, 350V	
LA20	1st IF xformer	72A316-8
LA28	2nd IF xformer	72A316-10
LA39	3rd IF xformer	72A316-12
LC16	chroma input coil	72A329-1
LF24	horiz hold con	94A351-1
TA59	4.5 MHz trap	72A216-7
TB20	ratio xformer	72A318-1
TC14	burst xformer	72A325-3
TC29	bandpass xformer	72A327-1
TH4	power xformer	80A108-14
TH18	horiz output xformer	79A169-1
TH44	audio output xformer	79A141-4
TH73	vert output xformer	79A165-1
FH5	.225a fuse	84A28-12
FH27	2.25a fuse	84A28-16
MH140	tripler, H.V.	93A91-3



BACK DRAWING OF CHASSIS



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. ≈ INDICATES CYCLES PER SECOND.

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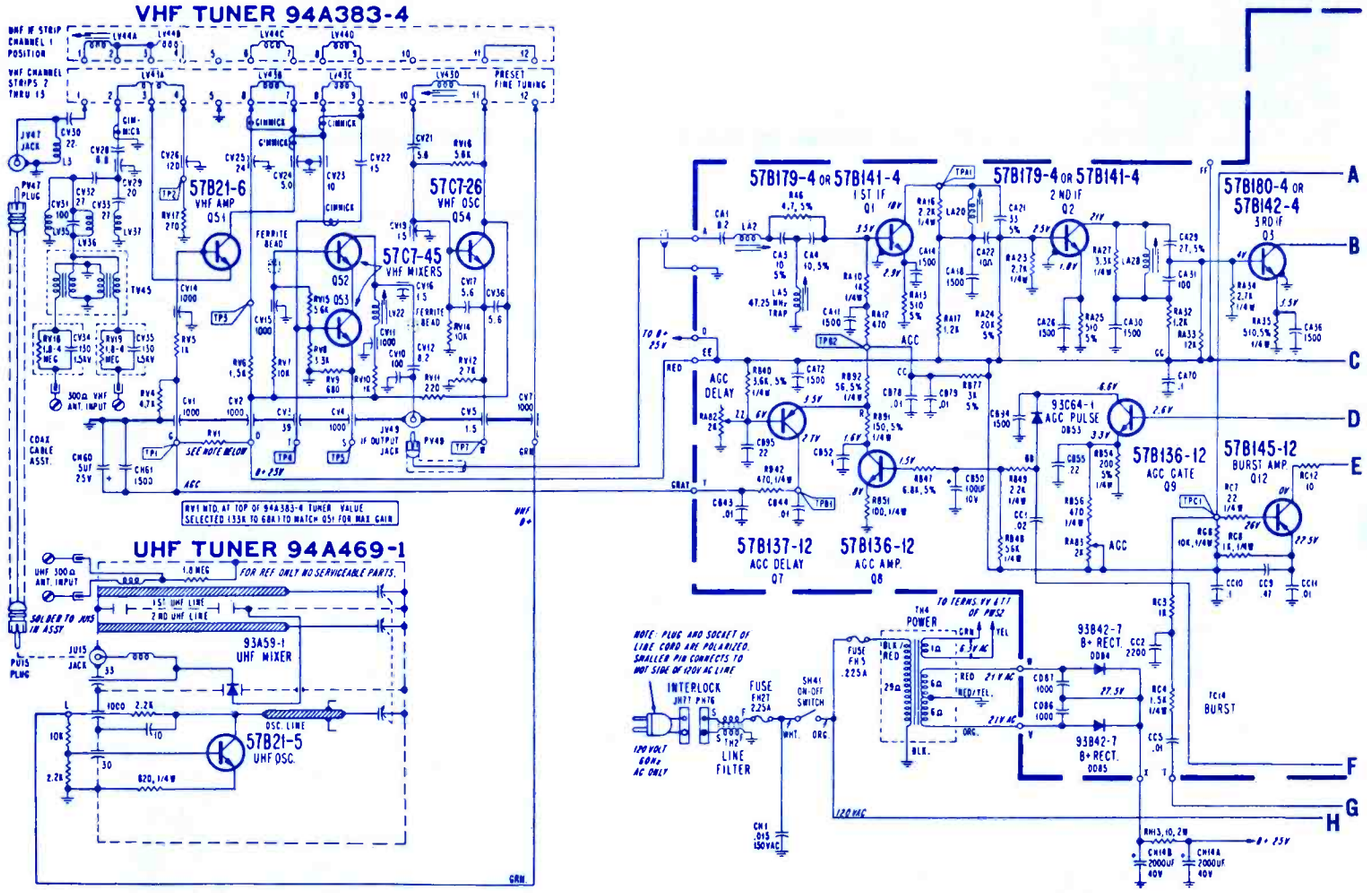
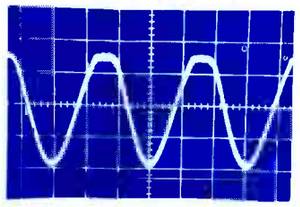
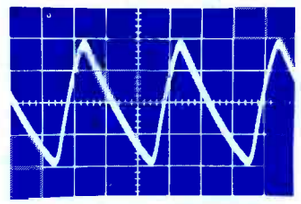
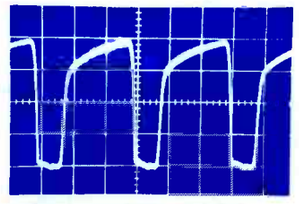




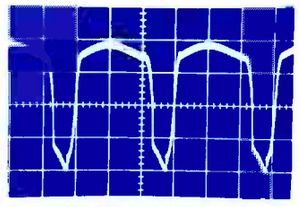
1. Horiz. Osc. V3B, Pin 2, 38V P-P, H



2. Horiz. Osc. Control V3A, Pin 8, 1V P-P, H



3. Horiz. Osc. V3B, Pin 6, 240V P-P, H



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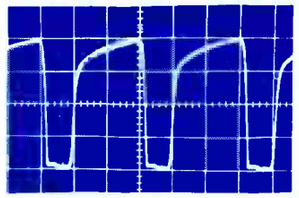
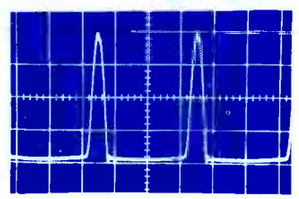
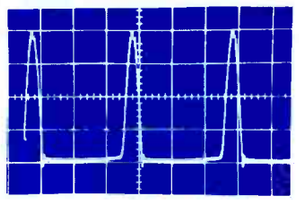


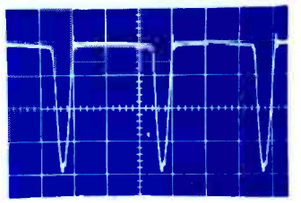
5. Horiz. Output V6, Pin 5, 220V P-P, H



6. Horiz. Output Trans., Pin 27, 290V P-P, H



7. Horiz. Output Trans., Pin 32, 32V, H



8. Horiz. Output Trans., Pin 1, 110V, H

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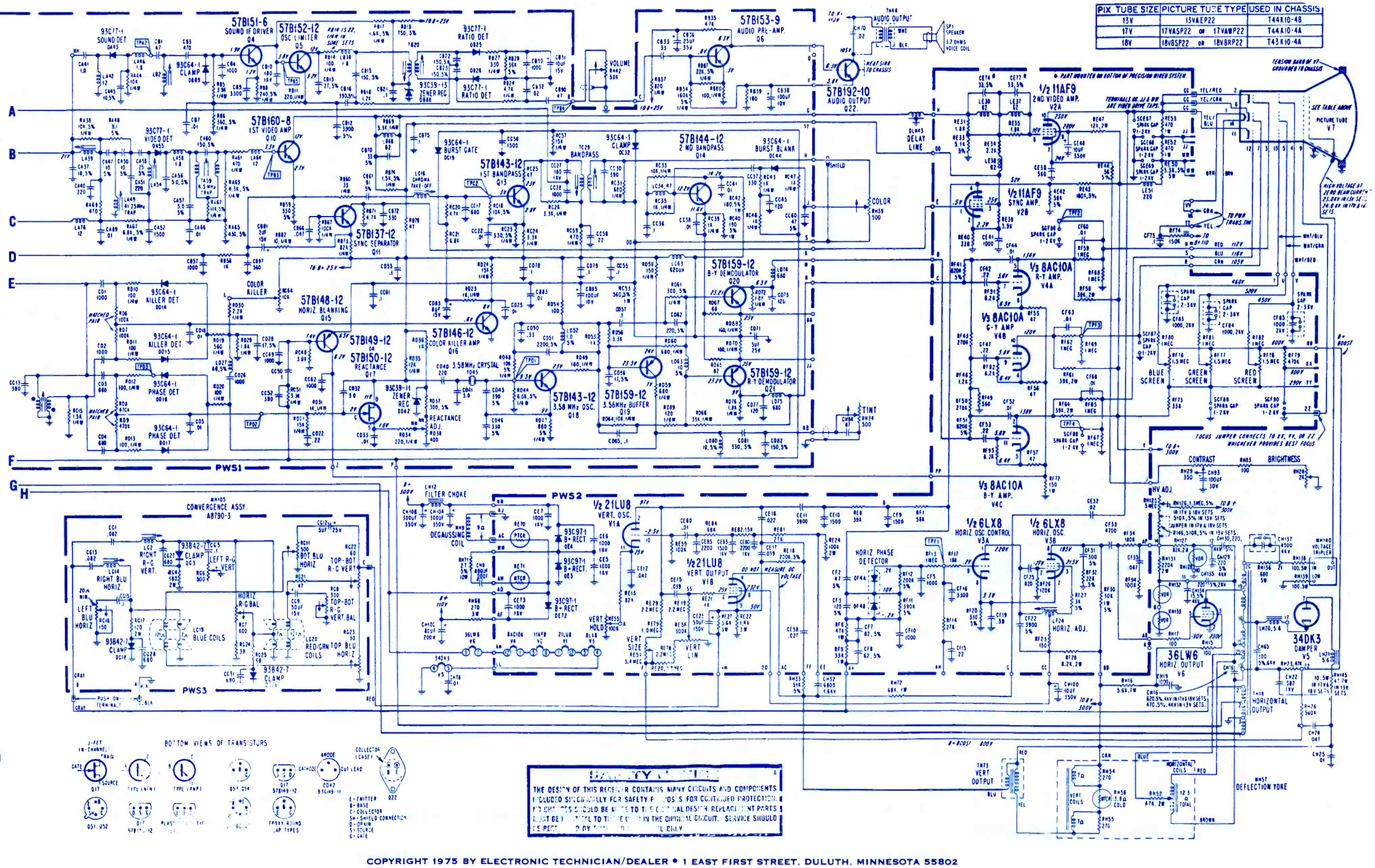
ADMIRAL
Color TV Chassis
T43K10, T44K10

PIX TUBE SIZE	PICTURE TUBE TYPE	USED IN CHASSIS
13V	13VAEP22	T44K10-4B
17V	17VASP22 OR 17VAWP22	T44K10-4A
18V	18VBSP22 OR 18VBRP22	T43K10-4A



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1590

ADMIRAL

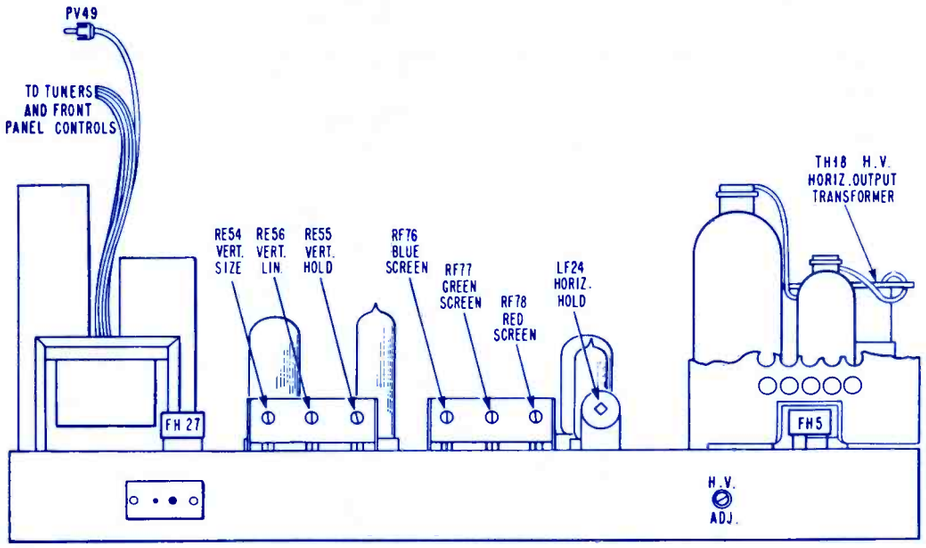
Color TV Chassis
T50K10-4B

ELECTRONIC TECHNICIAN/DEALER TEKFAX

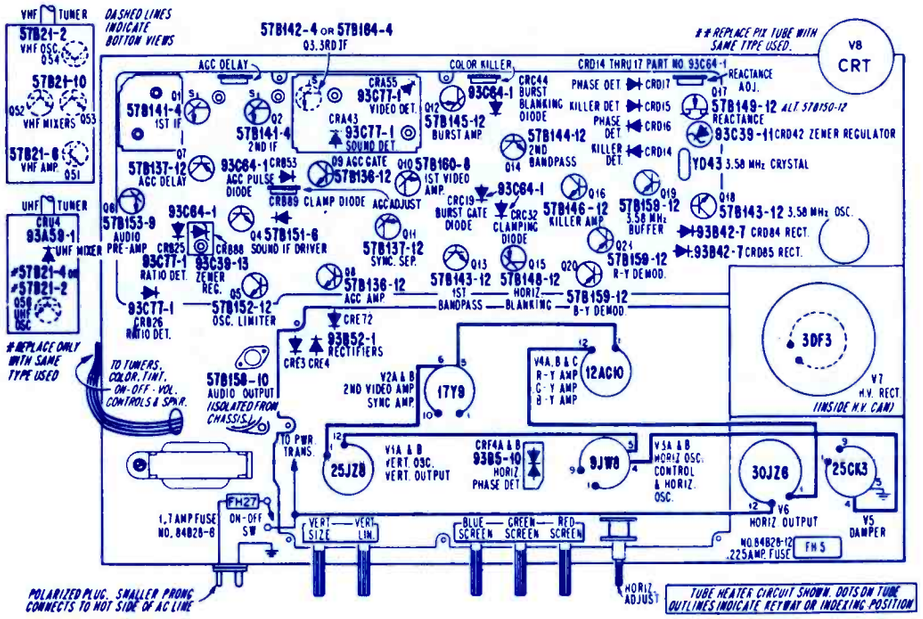
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

JUNE • 1975

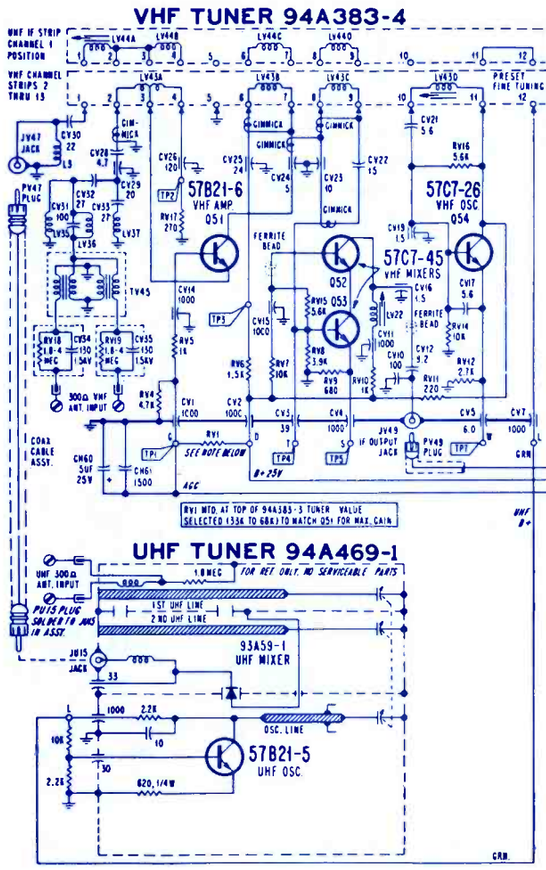
SYMBOL	DESCRIPTION	ADMIRAL PART NO.
CH10A — 200mf, 350		
CH10B — 160mf, 350		
CH10C — 80mf, 350v	v elect	.67A15-403
CH10D — 10mf, 350v		
LC16 — chroma input coil		.72A329-1
LC34 — 47µh, 2nd bandpass coil		.73A55-28
LF24 — horiz hold con		.94A351-1
TA59 — 4.5MHz trap		.72A216-7
TB20 — ratio xformer		.72A318-1
TC14 — burst xformer		.72A325-3
TC29 — bandpass xformer		.72A327-1
TH2 — line choke		.73A31-16
TH4 — power xformer		.80A108-14
TH18 — horiz output xformer		.79A158-3
TH44 — audio output xformer		.79A141-4
TH73 — vertical output xformer		.79A165-1
FH5 — .225a fuse		.84A28-12
FH27 — 1.7a fuse		.84A28-6
	tuner, VHF	.94A383-4
	deflect yoke	.94A379-13



BACK DRAWING OF CHASSIS

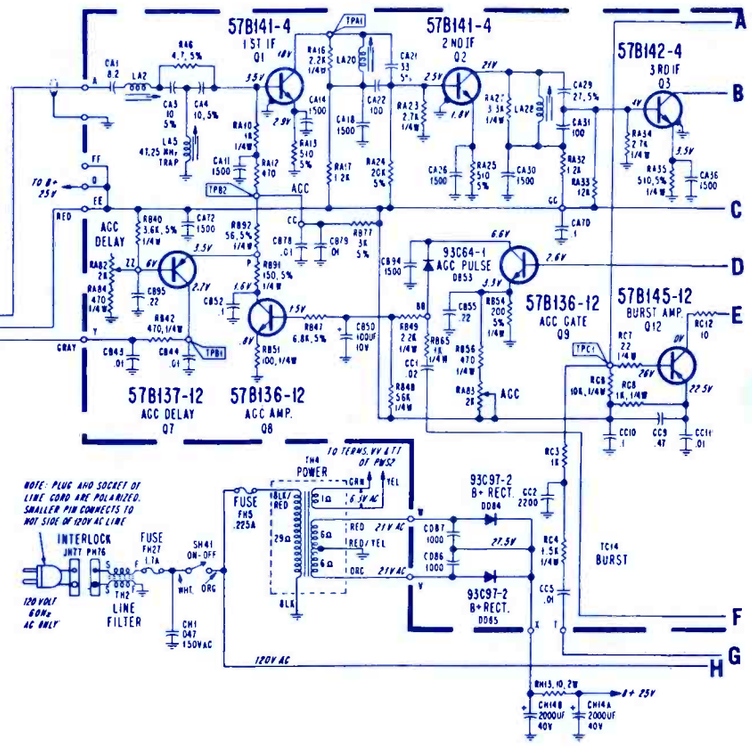


TOP DRAWING OF CHASSIS



RUN CHANGES

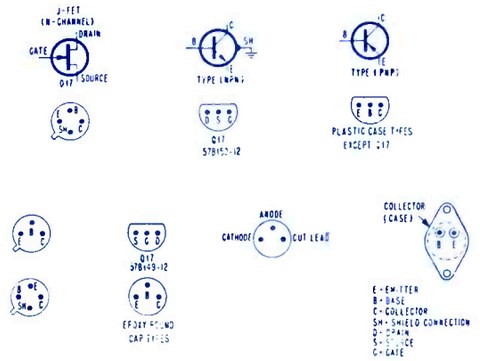
(10) Start of production.



SAFETY NOTICE

THE DESIGN OF THIS RECEIVER CONTAINS MANY CIRCUITS AND COMPONENTS INCLUDED SPECIFICALLY FOR SAFETY PURPOSES. FOR CONTINUED PROTECTION, NO CHANGES SHOULD BE MADE TO THE ORIGINAL DESIGN. REPLACEMENT PARTS MUST BE IDENTICAL TO THOSE USED IN THE ORIGINAL CIRCUIT. SERVICE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

BOTTOM VIEWS OF TRANSISTORS



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. Hz INDICATES 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.

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.

TRANSISTOR CAUTION: TO AVOID DAMAGE TO TRANSISTORS, DO NOT OPERATE CHASSIS WITH PICTURE TUBE G&G DISCONNECTED FROM CHASSIS GROUND. DO NOT TURN SET ON WITH TRANSISTOR Q17, TUBE Q51 OR LEADS REMOVED OR UNSOLDERED. DO NOT ARC 2ND ANODE LEAD TO CHASSIS GROUND. DISCHARGE 2ND ANODE ONLY TO PICTURE TUBE G&G OR G&C 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 OR 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 PHOTOGRAPHS.

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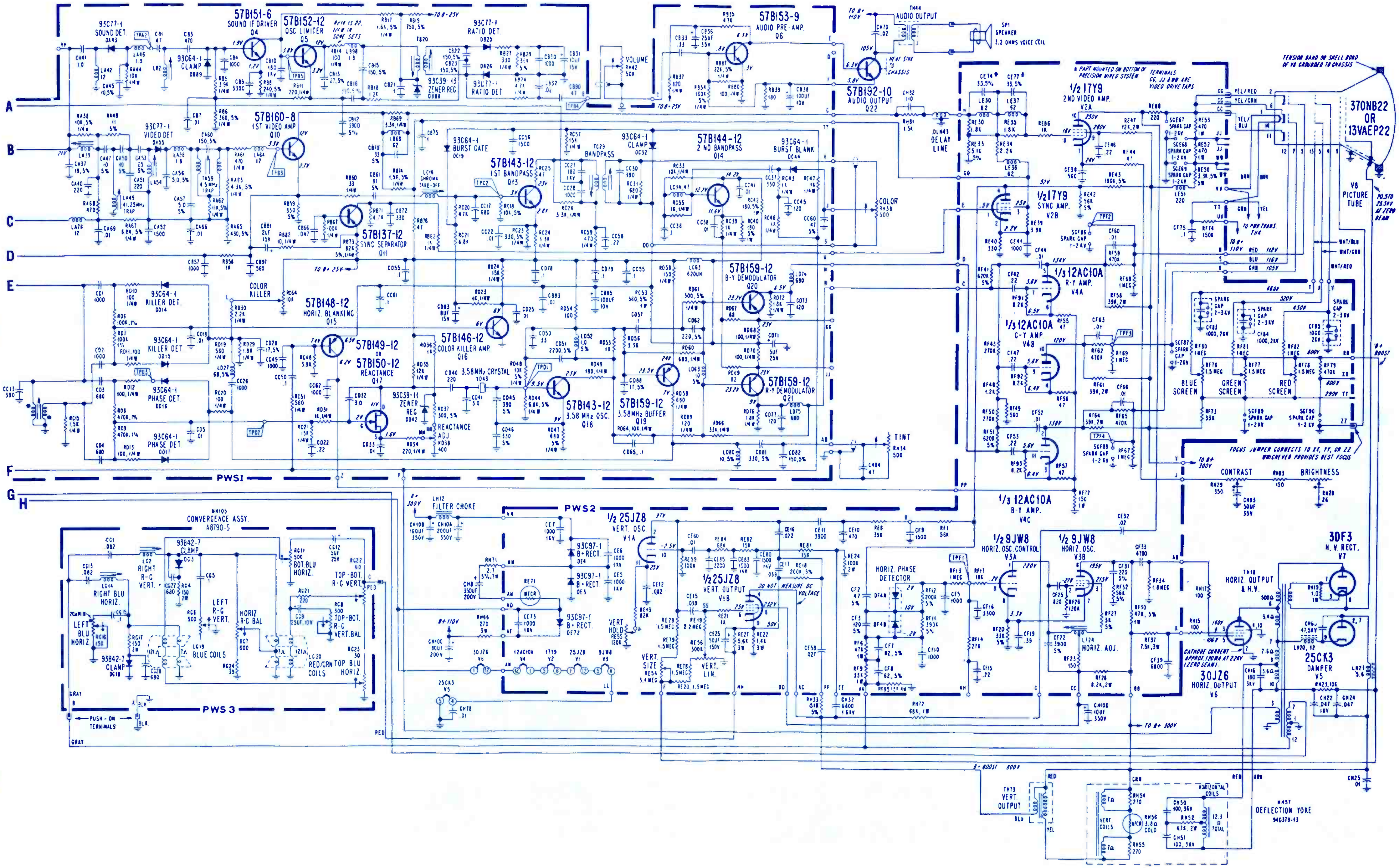
ADMIRAL
Color TV Chassis
T50K10-4B



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1591

AIRLINE

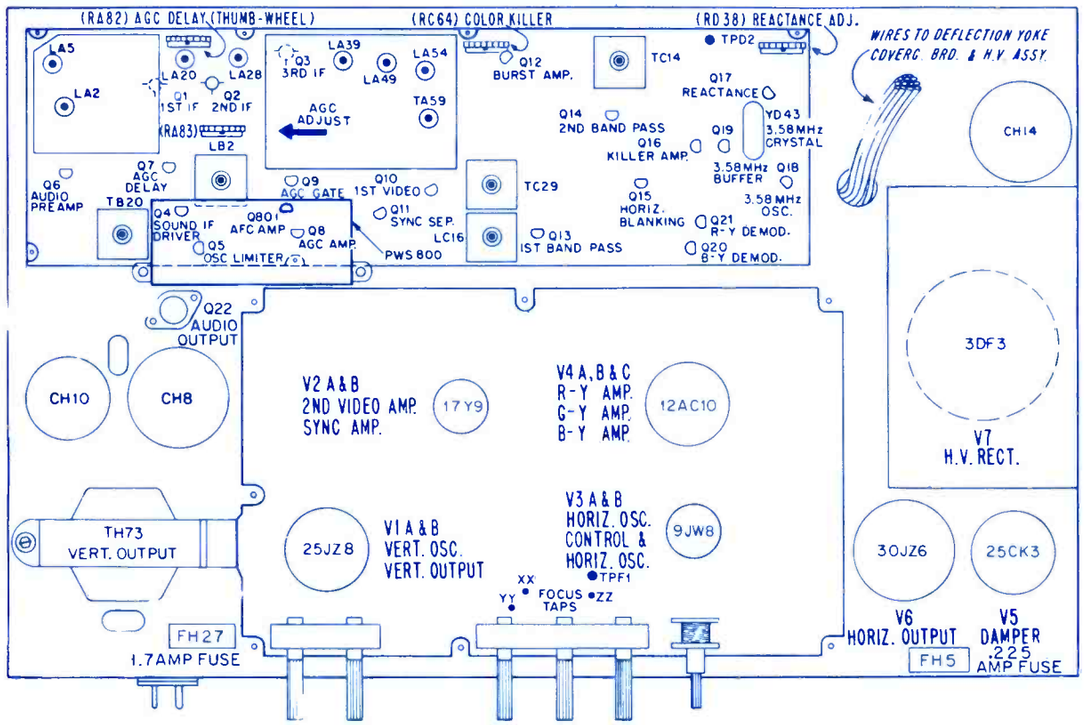
Color TV Model
GAI-12635A

JUNE • 1975

ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

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

INSTALLATION AND SERVICE INSTRUCTIONS



1. BASE, TPB3, 1st VIDEO AMPL. (Q10), 2V P-P, VERT. (PWS1)
2. TPA2, SOUND DETECTOR 0.25V P-P, VERT. (PWS1)
3. COLLECTOR, 1st VIDEO AMPL., (Q10), 8V P-P VERT. (PWS1)
4. GRID, HORIZ. OUTPUT, V6, "AB" 335V P-P HORIZ. (PWS2)
5. PLATE (PIN 10) 2nd VIDEO AMPL., 50% CONTRAST, 100V P-P VIDEO, 150V P-P BLANKING (PWS2)
6. BASE, SYNC. SEPARATOR, (Q11), 7V P-P, VERT. (PWS1)
7. COLLECTOR, SYNC. SEPARATOR, (Q 11), 6V P-P, VERT. (PWS1)
8. PLATE (PIN 4) SYNC. AMPL., (V2), 60V P-P, VERT. (PWS2)
9. RIPPLE at "NN", 18V P-P, VERT. (PWS2)
10. RIPPLE at "EE", 1.6V P-P, VERT. (PWS2)
11. RIPPLE at CH 10C, 0.1V P-P, VERT. UNDERSIDE CHASSIS NEAR TH73 (ON SCHEMATIC)
12. COLLECTOR, B-Y DEMODULATOR (Q20), "M", 8.2V P-P, HORIZ. (PWS1)
13. AGC PULSE, BASE, AGC GATE, (Q9), HORIZ. (PWS1)
14. COLLECTOR, 1st BANDPASS AMPL., (Q13), BURST 8V P-P, CHROMA 4V P-P, HORIZ. (PWS1)
15. JUNCTION RC43 AND CRC 44, 8V P-P, HORIZ. (PWS1)
16. BASE, 2nd BANDPASS, (Q14), CHROMA 0.13V P-P, HORIZ. (PWS1)
17. COLLECTOR, 2nd BANDPASS, (Q14), 0.22V P-P, HORIZ. (PWS1)
18. EMITTER, 2nd BANDPASS AMPL. (Q14), CHROMA 0.18V P-P, HORIZ. (PWS1)
19. EMITTER, B-Y DEMODULATOR (Q20), 0.7V P-P, HORIZ. EMITTER, R-Y DEMODULATOR (Q21), 0.9V P-P, HORIZ. (PWS1)
20. COLLECTOR, R-Y DEMODULATOR (Q21), "N", 1.5V P-P, HORIZ. (PWS1)
21. JUNCTION RF43 AND RF46, 2.2V P-P, OVERALL, HORIZ. (PWS2)
22. OUTPUT R-Y AMPL. V4, 190V., NO COLOR, 90V P-P, HORIZ. (PWS2)
23. OUTPUT R-Y AMPL. V4, 190V., WITH COLOR, 250V P-P, HORIZ. (PWS2)
24. OUTPUT B-Y AMPL., V4, 190V., WITH COLOR, 280V P-P, HORIZ. (PWS2)
25. OUTPUT G-Y AMPL., V4, TP3, WITH COLOR, 150V P-P, HORIZ. (PWS2)
26. COLLECTOR, HORIZ., BLANKER, (Q15), "Z", 3.3V P-P, HORIZ. (PWS1)
27. BASE, HORIZ. BLANKER, (Q15), 5.8V P-P, HORIZ. (PWS1)
28. BASE, BURST AMPL. (Q12), 6V P-P, HORIZ. (PWS1)
29. COLLECTOR, BURST AMPL. (Q12), 45V P-P, HORIZ. (PWS1)
30. COLLECTOR, 3.58 MHz BUFFER, (Q 19), 22V P-P, BASE 2.3V P-P, EMITTER 2.2V P-P, BASE Q20 AND Q21 6V P-P (PWS1)
31. COLLECTOR, 3.58 MHz OSCILLATOR (Q18), 11V P-P (PWS1)
32. CATHODE, BURST GATE DIODE, (CRC 19) 12.5V P-P, HORIZ. (PWS1)
33. 25 VOLT B-RIPPLE at CH14A, 0.025V P-P, VERT. (ON SCHEMATIC)
34. AGC PULSE, TERMINAL P, 28V P-P, HORIZ. (PWS1)
35. BURST AMPL., KEYING PULSE, TERMINAL T (PWS1)
36. PLATE, (PIN 4) VERTICAL OUTPUT (V1AC, 1150V P-P, VERT. (PWS2)
37. CATHODE (PIN 9), VERTICAL OUTPUT V1, 22V P-P, VERT. (PWS2)
38. PLATE (PIN 2), VERTICAL OSCILLATOR V1, 80V P-P, VERT. (PWS2)
39. GRID (PIN 10), VERTICAL OSCILLATOR V1, 95V P-P, VERT. (PWS2)
40. CATHODE (PIN 11), VERTICAL OSCILLATOR V1, 60V P-P, VERT. (PWS2)
41. HORIZ. SCREEN, (PIN 3) V3, 40 P-P, HORIZ. (PWS2)
42. HORIZ. GRID, (PIN 2) V3, 2.2V P-P, HORIZ. (PWS2)
43. HORIZ. CONTROL PLATE, (PIN 1) V3, 57V P-P, HORIZ (PWS2)
44. CONVERGENCE BOARD, JUNCTION CG1 & CG2, 250V P-P HORZ.
45. CONVERGENCE BOARD, JUNCTION CG3 & RG11, 6V P-P VERT.

RUN CHANGES

(M) Start of production

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. ~ INDICATES 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.

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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), TUNER (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 OR RH100 RANGE OR HIGHER.

(R) R OR RUBBER INDICATES CHANGE (S) INCORPORATED AS GIVEN UNDER THAT R OR RUBBER, AS WELL AS ALL LOWER R OR R CHANGES.

SYMBOLS IN RECTANGLES INDICATE TEST POINT CONNECTIONS.

HEXAGONS (OR HTPF) WAVEFORM OBSERVATION LOCATIONS. CONDITIONS FOR TAKING WAVEFORM MEASUREMENTS ARE GIVEN WITH WAVEFORM PHOTOGRAPHS.

* COMPONENT NOT MOUNTED ON PRECISION WIRED SYSTEM.

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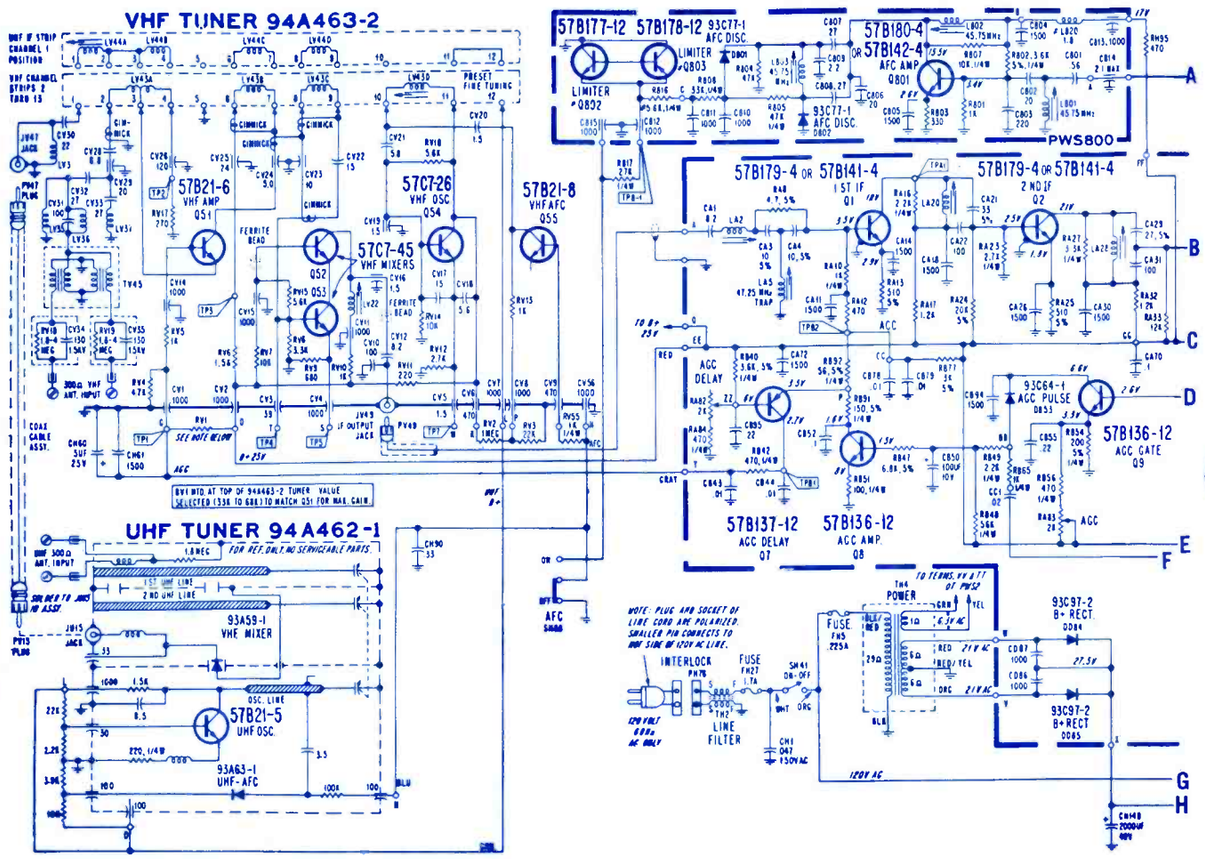

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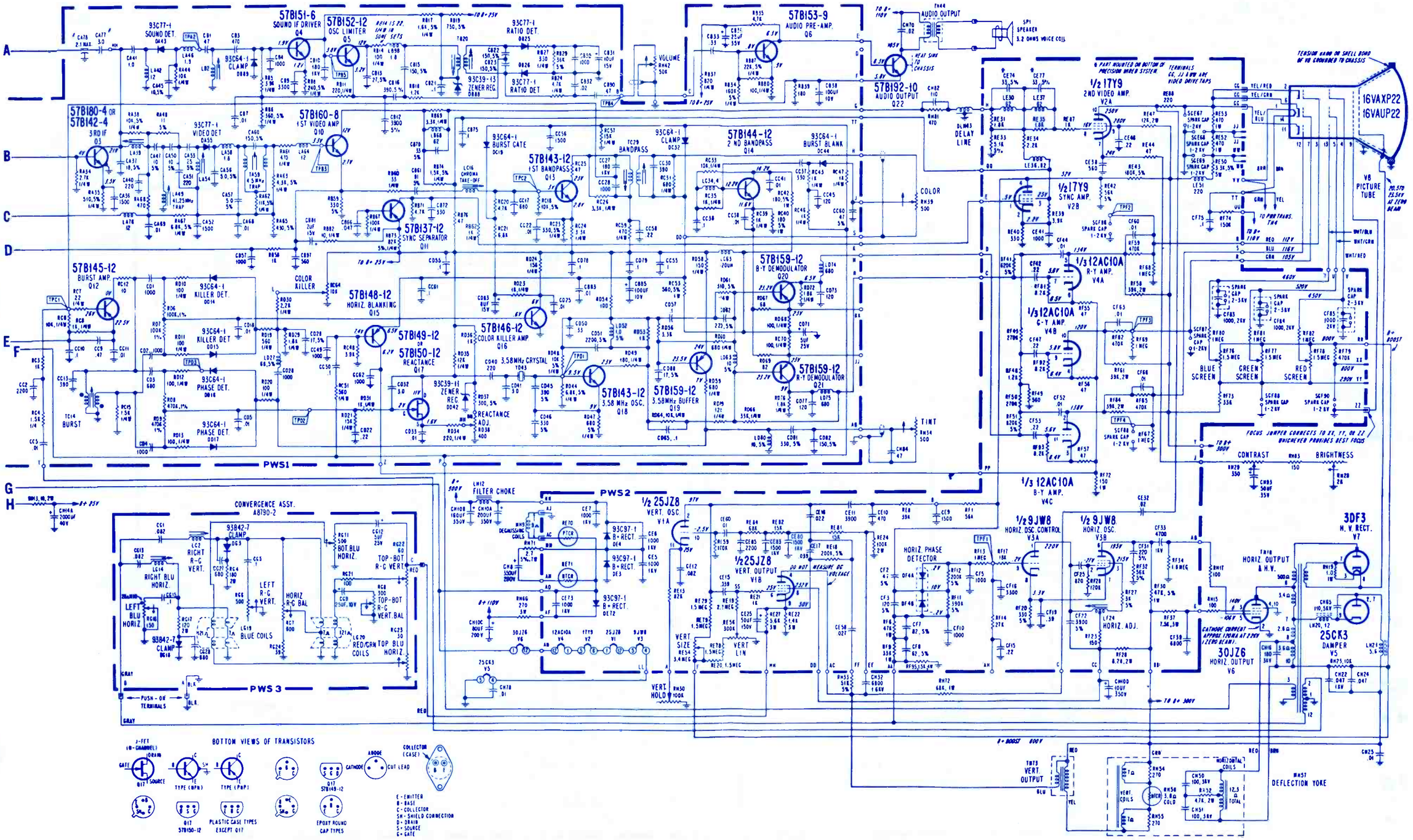
AIRLINE
Color TV Model
GAI-12635A

SYMBOL	DESCRIPTION	AIRLINE PART NO.
CH10A,B,C,D	— 200mf/350v, 100mf/350v, 80mf/200v, 10mf/350v, elect	67A15-403
CH14A,B	— 200mf/40v, 2000mf/40v, elect	67A15-413
RA82	— 2K, AGC delay	75A101-31
RA83	— 2K, AGC	75A101-31
RC64	— 10K, color kill	75A101-18
RE54	— 3.4M, vert size	
RE56	— 300K, vert lin	75A107-4
RF76	— 1.5M, blue screen	
RF77	— 1.5M, green screen	75A95-17
RF78	— 1.5M, red screen	
RH28	— 2K, briteness	75A140-25
RH29	— 350 ohm, contrast	75A140-26
RH30	— 100K, vert hold	75A140-27
RH34	— 500 ohm, tint	75A206-6
RH39	— 500 ohm, color	75A206-6
RH42	— 50K, vol w/on-off switch	75A206-5
LB2	— coil, 4.5MHz	72A317-1
LC16	— coil, chroma takeoff	72A329-1
LF24	— coil, horiz adjust	94A351-1
MH57	— deflect yoke	94A379-13
TA59	— xformer, 4.5MHz trap	72A216-7
TB20	— xformer, ratio detect	72A318-1
TC14	— xformer, burst	72A325-3
TC29	— xformer, bandpass	72A327-1
TH4	— xformer, power	80A108-14
TH18	— xformer, horiz output	79A158-3
TH44	— xformer, audio output	79A141-4
TH73	— xformer, vert output	74A165-1
FH5	— fuse, 225a (chemical)	84A28-12
FH27	— fuse, 1.7a (chemical)	84A28-6
	tuner, VHF	94A463-2
	tuner, UHF	94A462-1



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1592

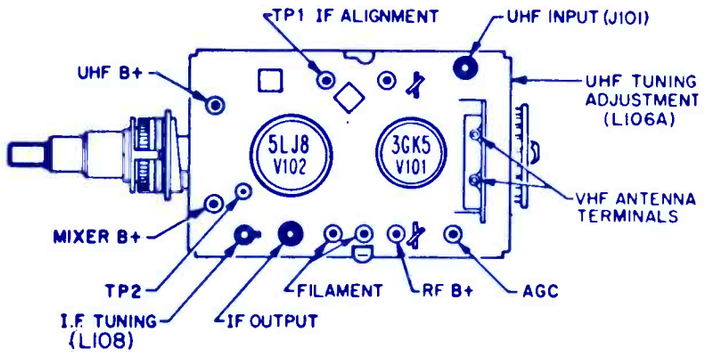
AIRLINE

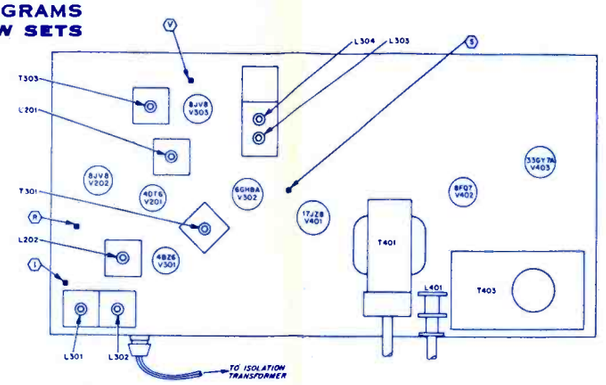
TV Models
GAI-11235A/B

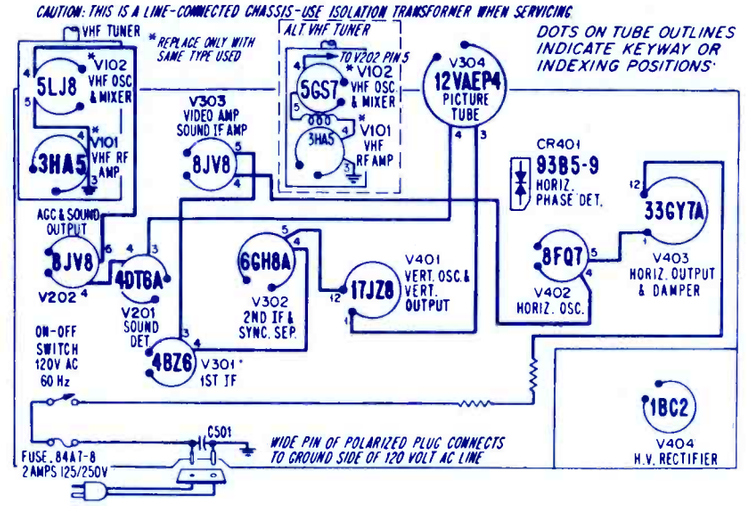
ELECTRONIC TECHNICIAN/DEALER **TEKFAX**

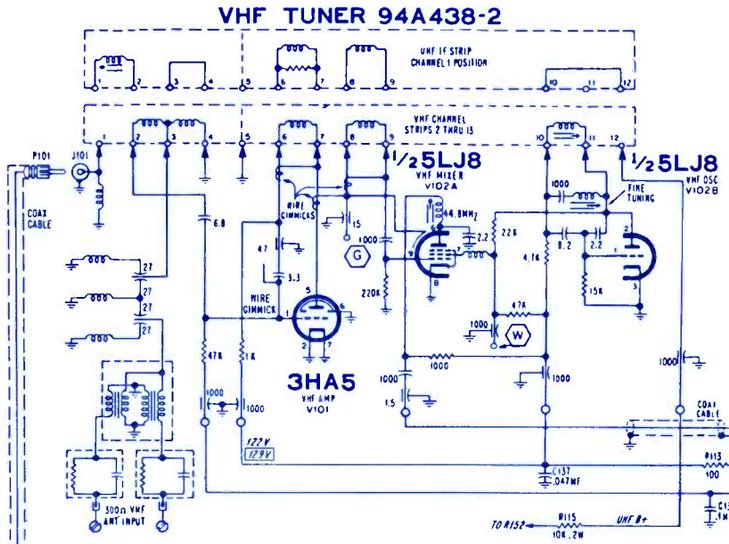
JUNE • 1975

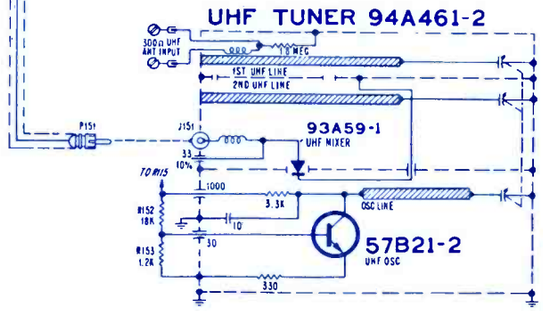
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS

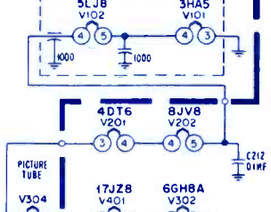


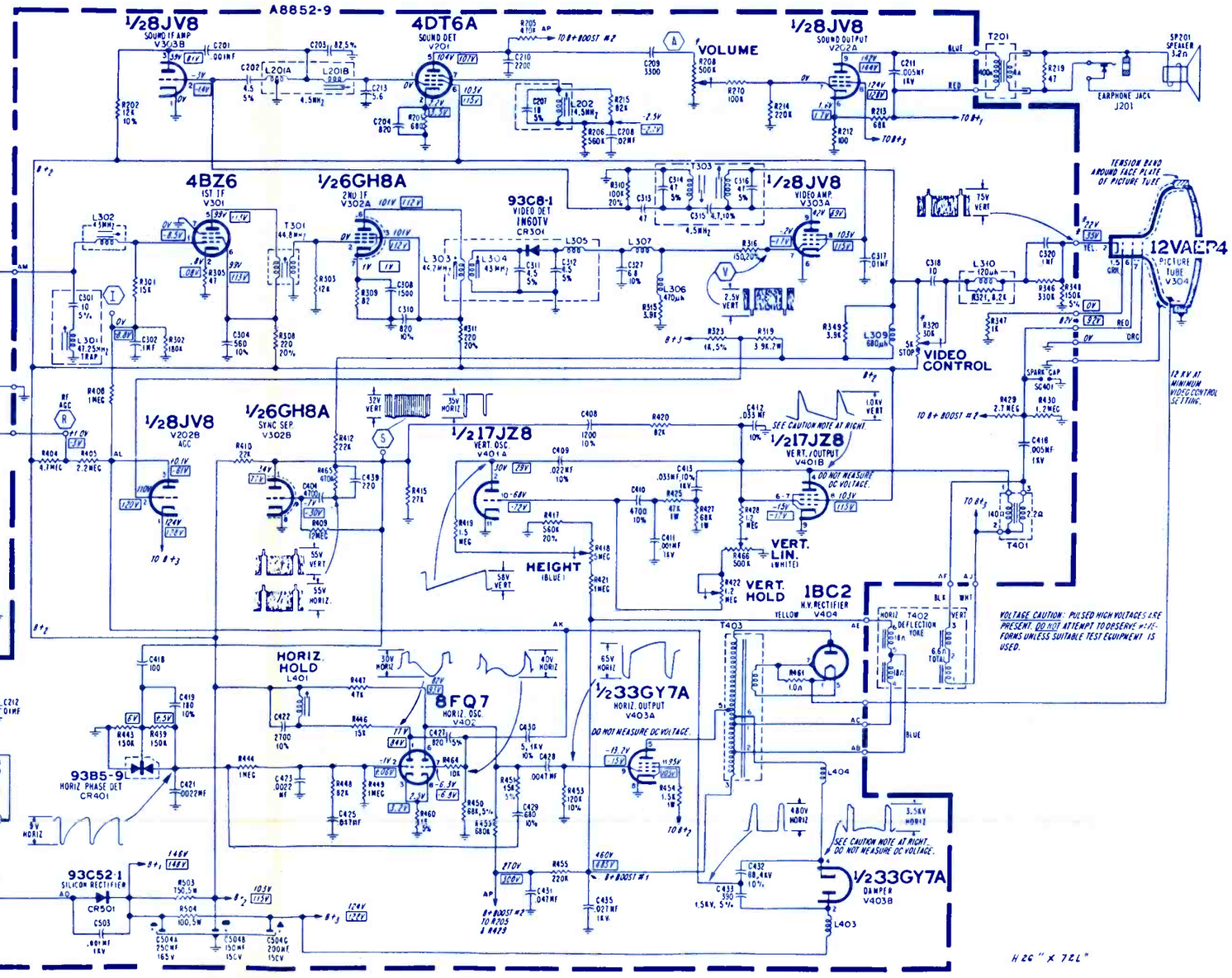












SCHEMATIC NOTES.
PART NOT MOUNTED ON PRECISION WIRED SYSTEM
* VOLTAGE WILL VARY WITH SETTING OF CONTROLS. RESISTOR VALUES 1/2 WATT 10%. CAPACITOR VALUES IN PICOFARADS 20% UNLESS OTHERWISE INDICATED. DC VOLTAGES MEASURED WITH VTVM AT 120V AC LINE. MAX VIDEO CONTROL SETTING AND MIN. VOLUME. DC VOLTAGES IN BOX MEASURED WITH SIGNAL OF MEDIUM SIGNAL STRENGTH. VOLTAGES NOT IN BOX MEASURED WITH NO SIGNAL.
⏚ CHASSIS GROUND.
⏚ WARNING: USE ISOLATION TRANSFORMER WHEN SERVICING WITH CABINET BACK REMOVED.

NOTE: Tuner Schematic Diagrams Shown For Reference Only. See Parts List for Service Replaceable Parts.

H 26" X 72L"

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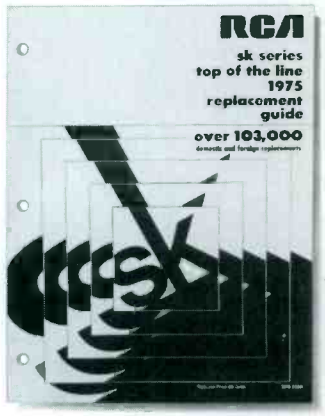
410 to 1 you'll find the devices you need here.

Over 103,200 devices can be replaced by 250 RCA SK Series types. That's 410 to 1! Best ratio in the industry. Which means the odds are, SK is your best, fastest way to get what you need. With minimum inventory. And RCA provides the top quality you'd expect from a top manufacturer of OEM devices. Same strict AQL standards, same strict Director of Quality Assurance. Get SK devices and your free 1975 SK Series Replacement Guide from your local RCA distributor.



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

It's new. It's drop-proof. It's burnout-proof. It's super-safe. The Triplett "extra-plus" Model 60-A.

Besides drop-proof, burnout-proof and super-safe features you can also have such extras as 1½% DC Accuracy and mirrored scale for only $100. All are built-in the new Triplett 60-A.

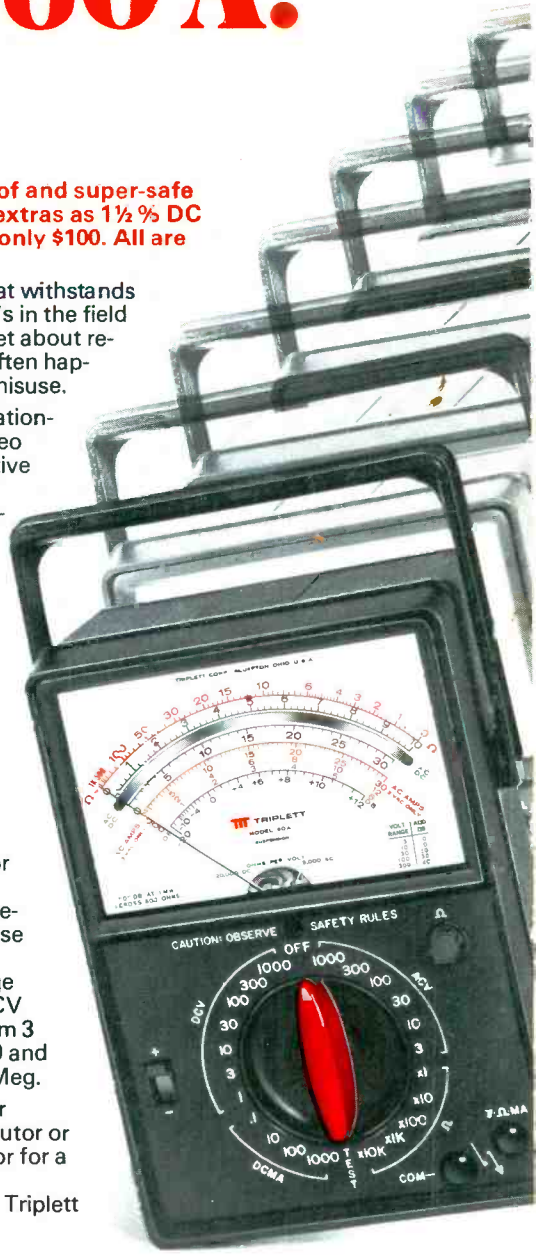
It is a new V-O-M design concept that withstands about 90% of the misuses of V-O-M's in the field and on the test bench. You can forget about repair bills and costly downtime that often happen with conventional testers after misuse.

The new Model 60-A is ideal for vocational training schools, tv, radio and stereo repair shops, appliance and automotive maintenance, electronic/electrical circuit designers, industrial manufacturing quality control and maintenance, and, of course, its accuracy is a must for test and research labs.

With the new Triplett Model 60-A you can forget about such misuses as—cracked cases from accidental drops, burned-out meter movements due to inadvertent range or test function settings. It's also made to be super-safe for the user.

The 28-range, lab accuracy Model 60-A gives you such other "extra-pluses" as: a special "Confidence-Test" position built-into the tester for periodic reassurance checks of its meter; rugged 4½" suspension movement meter, complete in separate case for easy replacement in the field; a polarity reversing switch; single range selector switch used for the eight DCV ranges from 0.3 to 1000, six ACV from 3 to 1000, four DCmA from 0.1 to 1000 and five resistance ranges from 1k to 10Meg.

The new Triplett Model 60-A sells for only $100. See it at your local Distributor or Mod Center. For more information, or for a free demonstration, see him or your nearest Triplett sales representative. Triplett Corporation, Bluffton, Ohio 45817.



1. **DROP-PROOF.** Virtually indestructible for an accidental drop up to a five foot height with deviation from stated accuracy not exceeding ± 4%.

2. **BURNOUT-PROOF.** Protected by diodes and unusual three fuse arrangement including 1/8 Amp, 1 Amp and 2 Amp/1,000 V fuses. Maximum protection level provided by the 2 Amp/1,000 V (20 kW) fuse.

3. **SUPER-SAFE.** Designed to most rigid safety standards to prevent explosive arcs in high energy circuits, up to the 2 Amp/1,000 V (20 kW) fuse capacity; completely insulated unit with newly designed safety leads.

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