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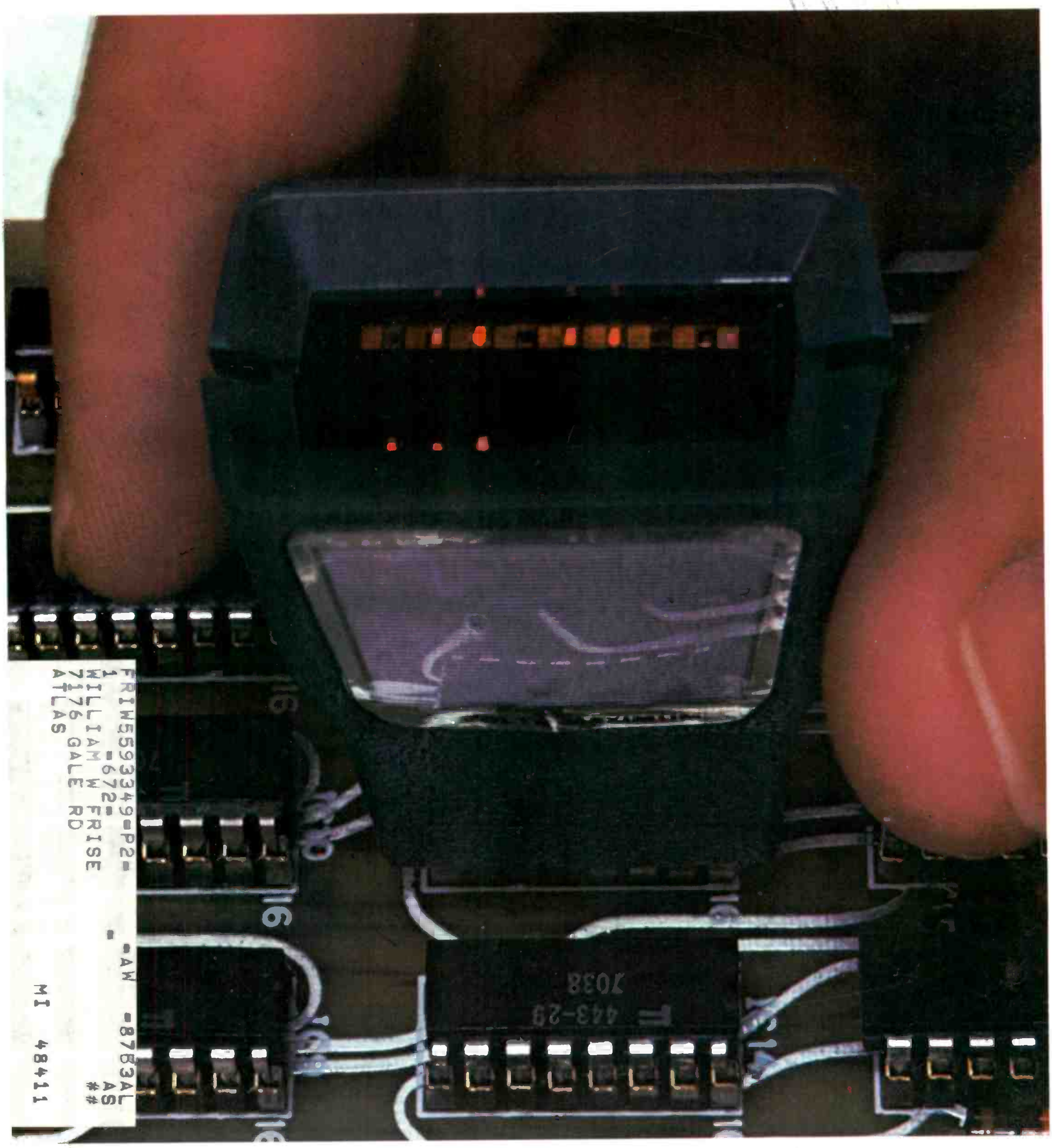

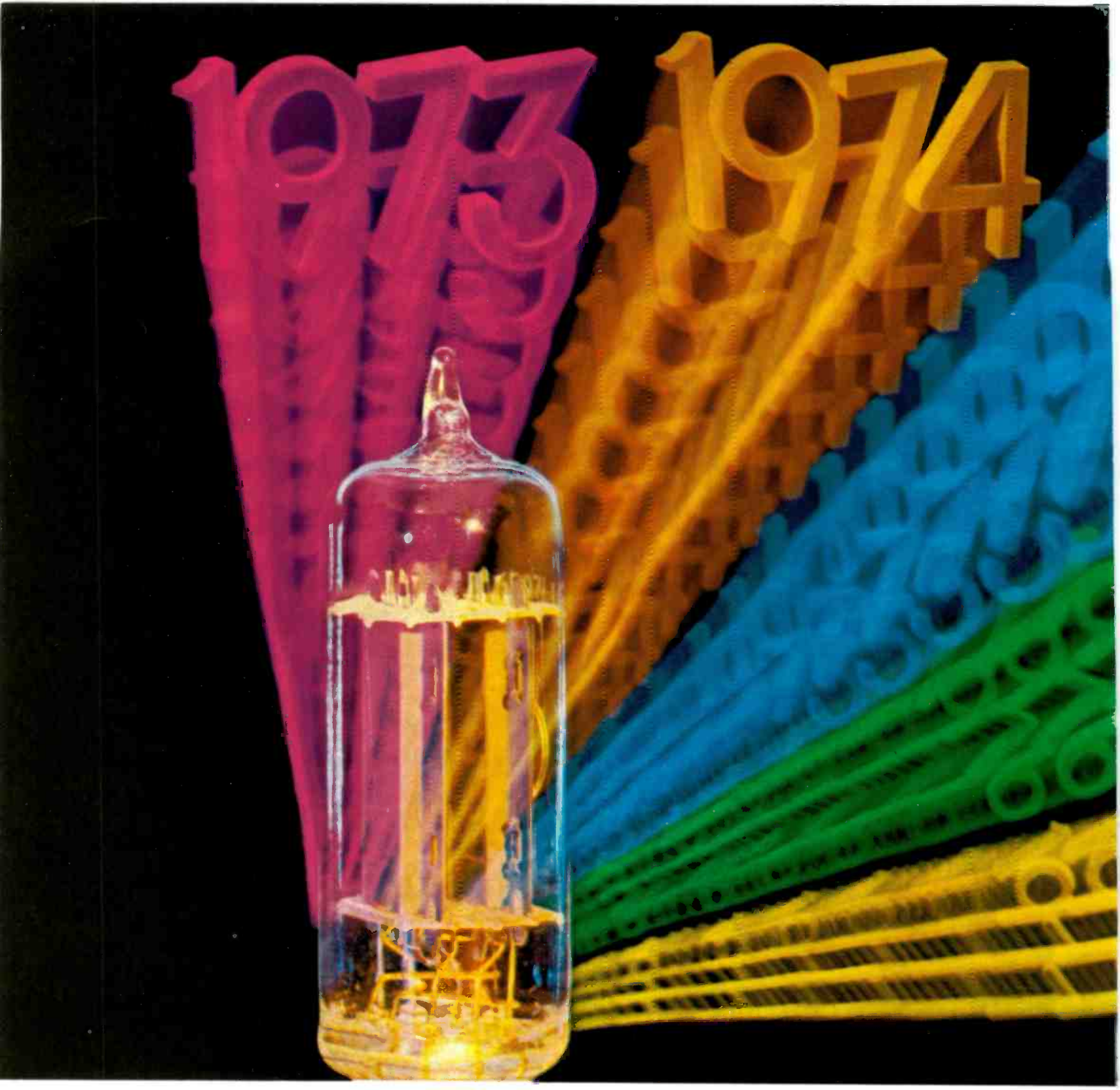

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JULY 1973 • VOLUME 95 NUMBER 7

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This month's cover photo, taken by your editor, provides a close-up view of the Logic Clip used to describe digital circuit functions in the article beginning on page 40.

FEATURES

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EDITORIAL

They CAN Do Without You!

I am certain that we have all experienced peak business periods when everything is going so very **good** that we can't stand it any longer! Contradiction? No!

All too frequently we forget that we are mere mortals with minds and bodies that must occasionally slow down or they'll break down. Unfortunately our own egos fail to acknowledge this very important fact until it becomes too late. By being too late, I mean that we really "goof" and unjustly criticize and lose a faithful employee, we tell a normally good customer "where to get off," we accidentally knock the neck off a color-picture tube, our wife stops speaking to us, or we just have a heart attack.

Past editorials have given considerable praise to the independent self-employed electronic technician or service dealer (the majority of our readers), sometimes (unintentionally) at the expense of the electronic technician or salesman that is employed by some large company. The latter group, although unable to express quite the same self pride as the individualist that sets up his own business, at least (normally) has the advantage of a definite vacation plan. (There is still for them the well justified pride of a satisfied customer and an interesting job well done.) And generally he is forced to take that vacation time, knowing that unless he does, he'll lose it and in effect be working from a day to a few weeks on his own time for the boss without any extra pay to justify it.

We may be proud to be individuals capable of starting our own business and making it a success. There is a great deal of self satisfaction in knowing that we are our own boss and that it is our own brains, sweat and tears that are now generating financial success. But in doing so we also tend to develop the belief that we will lose considerable business by being away from the shop for but a day, and that within a week everything will fold in our absence. If our business is actually built on such shaky ground, the best solution may be to just bolt up our doors today and quit!

It may make us feel like some "big shot" to believe that all will fold without us, but it doesn't make much sense. What if we were to be hit by a car tomorrow? We might have insurance to cover our medical costs, but we must also have entirely different insurance to cover our absence from our business. Self pride may cause us to refrain from telling our wife or a trusted employee the facts needed to run the business in our absence, but it isn't so "smart" to think we are the only intelligent ones around. If this means hiring some additional help, then we must do so! Consider that the premium for our second insurance policy, and soon that extra "insurance" will be paying dividends in increased business revenue.

Then, don't wait until that heart attack, try the system out!

We might take a Monday off and just work around the house, leaving instructions that we're to be phoned **only** if it is an **extreme** emergency. After an occasional Monday away, we might become more daring and actually leave town for a few days—possibly visiting relatives or boating.

At last year's Joint Convention in New Orleans, I met the owner of a one-man shop who was attending his first national convention with some fear and hesitation. He had never been out of town for any length of time before —after (as I recall) 15 years in business. He kept asking himself if he would be able to maintain his business with just his wife home answering the phone. Some weeks later I phoned him. He was elated. He had never realized how loyal his customers had become. They actually said that they would wait an extra week or so for him to fix their TV set. (Such loyalty **can** be generated as we develop a reputation for honesty and efficiency in our work.) Next time I hope he hires an answering service—they are not really that expensive—and takes his wife along with him. Business will still be good!

For some of us our job has become our life—occupation and hobby—our sole interest. We are simply bored being away from the shop. Then maybe the answer is attending the NATESA, NEA, and ISCET Conventions in Kansas City, Mo. next month. One doesn't have to join any of these associations to attend. In fact, why not wait until we can see how the proposed merger develops at the convention (see page 18) before making any decision on that matter. Even if one is not an association man, there is still a lot to be gained by attending the JESUP Program (a short course on servicing new circuitry) or Business Management School, by getting acquainted with men from shops like ours and exchanging tips on servicing or customer relations, or just tax loopholes. Those not believing in associations will have an opportunity to "spout off." Those not believing in merger can also express their views.

Whether or not we choose to take a week off and go to Kansas City, let us at least grit our teeth and make the plunge. Dig in the garden (that's what I do when I get "mad," having almost completed the job before I broke the spade in the heavy-clay soil—the metal part at that!). We all need some outside interests—**besides electronics**—and this is a beautiful summer to develop them!

Phillip Dahlen, CET

LETTERS

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

Circuit Modification Does Wonders

A customer brought us an Airline Modular Hi-Fi containing Chassis #902-06800 0.

The output transistors were blown out of both channels. We replaced them with 10a plastic ECG units—along with adding the emitter resistors, which had been omitted in production. We took both speaker cases apart to discover that open splicing in production left the possibility of shorting the outputs.

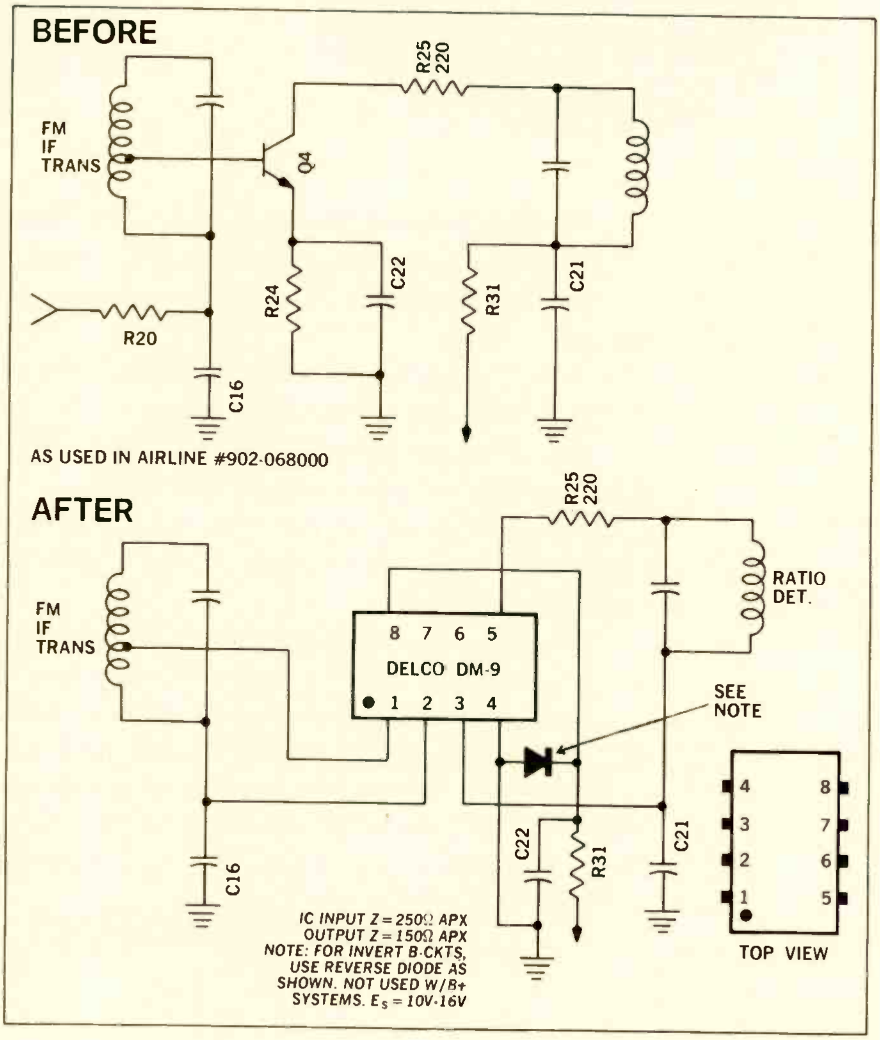
But that is not why we are writing you. This set played poorly on both AM and FM. The AM problem was that the rod antenna was mounted vertically in the cabinet. The FM problem was that it had only one IF transistor, Q4.

Replacing transistor Q4 with Delco integrated circuit DM-9 was like an aphrodisiac. We are enclosing a before and after drawing of this modification. Notice that no new parts are necessary, and after trimming back the foil, this unit can be mounted feet down on the bottom of the board (that is with the feet facing away from the board). Notice that R20 bias is disconnected from C16, as is R31 from C21.

The DM-9 has tremendous gain, excellent limiting, and the set is very stable without any further modification. For driving and being driven by Ceramic Filters, the DM-9 has internal resistors across terminals 1 and 2, and across 3 and 5. Terminals 6 and 7 are not used—one is a regulated power supply output and the other is apparently a feedback connection.

The diode in the diagram is used where PNP devices would be used in a B– invert-feed system, and is not needed in this particular case. Where the B supply exceeds 16v, a divider is recommended. The set went from 1.5 stations to 15, which speaks exceedingly well for the DM-9.

ROBERT HENNESSEY
WILKS & ASSOCIATES



Voices Support Of May Editorial

Thank you for your May editorial. Were all involved in the merger to regularly take a similar humanitarian stand rather than that of spreading suspicions and enmity, the cause of merger would be advanced.

I noted, too, the letter from Tom Ging in the same issue, and it brought back recollections. As he said, NESDA died quickly if it in fact ever really existed. There was no follow-up at the time and I was surprised to note that some one, especially one who obviously was not bent on mischief, remembered.

FRANK J. MOCH
EXECUTIVE DIRECTOR, NATESA

Completely Appropriate The Day of Publication

When an editorial written possibly a number of weeks ago is completely appropriate on the day of publication, and in all probability as apropos several months hence—such an editorial reflects good judgment and intelligent analysis.

I refer to your editorial on page 9 of the May 1973 issue of ELECTRONIC TECHNICIAN/DEALER.

Your basic interpretation of the attitudes of the various segments of the Independent Electronic Service Industry clearly defines the problems that face the Joint Merger Committee. Quite obviously there is certainly personal involvement and individual security entwined into the merger project. As Chairman of the Joint Merger Committees, we have steadfastly tried to recognize the understandable difference of opinions and objectives. Our plan from the very beginning was to endeavor to find a series of common denominators that would make merger agreeably acceptable to both NEA and NATESA, and if at all possible, favorably consider the special interests of "paid personnel."

I feel that your excellent editorial will help enlighten not only the general membership of NATESA and NEA, but also and equally important the large group of service dealers and service technicians who are not affiliated and who unhappily fail to recognize the great value of powerful, intelligent organization and action at the national level. We are truly dedicated to this eventual accomplishment and pay honorable recognition to your efforts and support.

MORRIS L. FINNEBURGH, SR., E.H.F.
CHAIRMAN JOINT MERGER COMMITTEES

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continued from page 9

There Can be Exceptions To the Rule on Manners

I have just read the article "Customers Expect Good Business Manners" by Ernest Fair and am somewhat amazed that Mr. Fair does not tell us that there can be an exception to the rule.

I think his article deserves criticism and am enclosing mine. Hope it isn't too lengthy for publication.

We hear all the time that the customer is always right. (I have yet to see the evidence.) After reading the article in the May issue of ET/D, I am still not convinced. I wonder if Mr. Fair is a service technician? If so, surely he never ran into one type of customer that welcomed my tube caddy into his home. Let me explain this experience with the question, "What would you have done?"

About 20 years ago I was working for a small shop owner and was sent on a call (a new customer) and was greeted at the door very pleasant-like by the gentleman of the house. He directed me to a Magnavox that had no sync, overloading, plus lack of width. While I was substituting 6SN7's, 6BQ6's, 5U4's, etc., the man sat back in his recliner, very friendly in conversation, talking about the weather and anything that came to mind. After substituting the suspected tubes with no success, I raised myself up from behind the TV set and (as Mr. Fair suggests) looked the customer directly in the eye and said, "Sir, it appears your TV will have to be taken to the shop." He replied, "Get your %#$ behind that TV and fix it!" Thinking he was joking, I asked him if he wanted it taken in. Again he blasted, "You heard what I said, get your %#$ behind that TV and fix it, nobody takes my TV set to the shop!" I tried to explain that it could not be repaired in the home, but his answer was, "He knew a @+"& side better and I'd better get the job done!"

I reckon then I lost my cool and asked, "If you knew so @+"%#* much about it, how come you didn't fix it yourself, etc., etc., etc."

To cut the story short, I wrote out the bill for the call and handed it to him, knowing what was coming, and it did. Such cussing you never heard. He wasn't going to pay it, etc., etc. About this time his wife came in from the kitchen asking, "What was going on?" He explained his viewpoint to her and she replied, "You should have known better than to call him anyway." After I stood toe to toe demanding payment for the call, she said, "Pay the man and let him get the %&$" out of here." Although the above sounds incredible, the facts are true, I swear. Getting back to the shop, I explained it all to the boss and all he said was, "Ha, ha, ha."

Soon after this I went in business for myself and since have been the "boss," sort of independent some might say. I realize that most customers should be treated with courtesy, respect and good manners, as Mr. Fair suggests; but now and then there is an "exception," which according to Mr. Fair does not exist. This "exception" I do not desire for a customer and anyone that does is headed for a "padded cell." When Mr. Fair says, "Always practice courtesy for there never is a time when we should act otherwise"—I wonder if he is mouse or man?

Mr. Fair says, "No one likes to be bullied." Shouldn't that include the service shop operator? When one performs a service to the public, is he required to stand pat while every nut in town pounces on him? Not me! On few occasions I've had an "exception" say, "I'll never be back here any more." My answer always is, "Good, I hope not!"

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LETTERS . . .

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One thing Mr. Fair is not aware of is that during the daily grind of putting on good business manners a certain amount of animosity is stored up within a shop owner and this must be released somehow. Rather than let it out on the wife and kids, I wait until some nut comes along that says he is going to call the BBB because I charged him $2.50 for repairing a radio. This has happened, and after I hand him the phone and suggest he vacate my premises, then I am in a pretty fair mood.

When Mr. Fair says, "The customer's beliefs are the important one in all business matters," I doubt his sincerity, that is unless his address is "The Snake Pit." My belief is that anyone following Mr. Fair's advice soon will reside in some snake pit, stark-raving mad! About 99½% percent of my customers get the Red Carpet; the other fraction I don't want for a customer and for the life of me I see no reason why I should be courteous to a nut that threatens to punch me in the nose.

You will recall recently here in Peoria a shop owner's wife was gunned down by a dissatisfied customer while she was in the process of returning his money. I am curious as to how Mr. Fair would have handled this situation.

I have been a subscriber to ET/D for many years and couldn't do without it.

H. E. PENNINGTON

In Response to Letter Printed in April Issue

In response to the letter in the April 1973 issue of ELECTRONIC TECHNICIAN/DEALER, "What Would You Do?" I have this to say:

I would replace the defective picture tube free of charge. Next, I would recheck the seven other tubes using the same tube tester I had used before in the presence of the magistrate and the customer and show them the improvement the seven new tubes made in the set's performance. We all know that most of those drug store testers are not accurate, or the customer does not know that a tube that tests good but has leakage or is gassy is not good at all.

I have made it a habit to call the customer of any set that will be exorbitant to fix before I go ahead and fix it. I also tell him that he is free to take his set to another shop if he wishes,

continued on page 52

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TECHNICAL LITERATURE

Tools

A 16-page catalog, No. SD-168, entitled "Tools & Fixin' Things for the Contemporary Market" illustrates an unusual selection of screw holding drivers, nut drivers, reversible drivers, offset drivers, magnetic drivers, wire stripping tools, tapping tools, crimping tools, impact screw drivers, refrigeration wrenches, hex-key wrenches, electrical testers, solderless terminals, alligator clips, snap rings and pliers, pow'rivets, and many more. Vaco Products Co., 510 North Dearborn St., Chicago, Ill. 60610.

Test Procedures for High-Voltage Power Supplies

A 16-page bulletin, No. STP-473, entitled "Standard Test Procedures for High Voltage Power Supplies" describes high-voltage power supply loading methods for both constant and changing load; test set-ups and procedures for voltage calibration and test set-ups, plus methods for both static and dynamic output voltage regulation, ripple, temperature coefficient and stability. Spellman High Voltage Electronics Corp., 1930 Adee Ave., Bronx, N.Y. 10469.

Antenna Rotators

A new brochure is available on all weather antenna rotators. The new rotators feature "Automatic Command" for exacting synchronized antenna positioning to pick up normally weak signals or neighboring state TV transmissions. Saxton Products, Inc., 21 N. Rt. 303, Congers, N.Y. 10920.

Alarm Equipment

A new 80-page equipment catalog, designated the M-73, describes over 400 intrusion and fire alarm products. The alarm equipment offered ranges from relatively simple kits with instructions to the latest ultrasonic, radar, and infrared intrusion detectors. Stockroom supplies also are available. Major product categories include Intrusion Systems, Fire Systems, Fire and Intrusion Detectors (Radar, Infrared, Ultrasonic, CCTV, Switches, Heat, Smoke), Remote Controls, Annunciators (Bells, Horns, Sirens, Oscillators, Lights), Telephone Dialers, Lock Specialties, Tools and Books. Products are described in some detail regarding application, principle of operation and specifications to allow skilled technicians to make the right choices. Mountain West Alarm Supply Co., 4215 North 16th St., Phoenix, Ariz. 85016.

Antenna and Mounting Supplies

An Antenna and Mounting Supplies catalogue, No. 100, features Antulized antennas custom colored in many colors. Also listed is antenna mounting hardware, pre-assembled chimney mounts, tools, staple guns, tars and caulking compound, anchor bolts for towers, signs, fishing wire, clamps, mounts, nails and drill bits. Also featured are coax cables and combo coax and rotor wire in one outer jacket and in colors. Antul, 3549 North Elston Ave., Chicago, Ill. 60618.

Rental Electronics Equipment

A 1973 Instrument Rental Catalog is available containing prices and specifications of the complete line of equipment, nearly 1300 different types and models offered for rental, including amplifiers, computers, meters, oscilloscopes, power supplies, recorders and many other instruments from a large variety of respected manufacturers. The catalog also includes specific rental terms and conditions, plus helpful guidelines to follow when making the important rent, lease, or buy decision. Complete information is available from Rental Electronics, Inc., Corporate Headquarters, 99 Hartwell Ave., P.O. Box 223, Lexington, Mass. 02173.

Communication Tubes

An 8-page price list, brochure No. CT-373, lists prices for more than 1900 types of klystrons, magnetrons, special purpose tubes, cathode-ray tubes, receiving tubes, vidicons, image orthicons, solid-state tube replacements and microwave diodes. JSH Electronics, Inc., 8549 Higuera St., Culver City, Calif. 90230.

Antennas

A 16-page Citizens Band Communications Catalog is available featuring the firm's complete line of base-station and mobile antennas. Also included are trunk lid and deck mounts, co-phasing harness kits and other mobile accessories. Avanti Research & Development, Inc., 33 W Fullerton Ave., Addison, Ill. 60101.

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Schematic Wanted

I need the schematic for a Play-Mate II Model AFP 66M AM/FM car radio made in Japan.

THOMAS J. MORRISON
31133 Minton
Livonia, Mich. 48150

I would like to obtain a schematic and operating instruction for a Precision Signal Generator Model E-200C.

PAUL W. ABELQUIST
5504 Norlina Rd.
Virginia Beach, Va. 23455

I need Set-up Charts for testing TV picture tubes with the Model CRA 12 pin and Model CRA110 7 and 8 pin adapters for an EICO Model 666 Tube Tester.

D. M. HAMMOND
56 E. Beechwood Ave.
Dayton, Ohio 45405

I would like to obtain circuit diagrams for an Omega Tuner Model 1650 and Amplifier Model 1600 manufactured by Omega Electronics Corp., Phoenix, Ariz.

ROBERT E. MOORE
2922 Portage St.
Kalamazoo, Mich. 49001

I would like to obtain early Tekfax schematics to No. 1217.

CLARENCE PITARI
Verndale, Minn. 56481

I would like to obtain a schematic for a Multimeter Model 858, manufactured by Precision Apparatus Co. Inc., Elmhurst, N.Y.

DANIEL A. SARLES
P.O. Box 245
Othello, Wa. 99344

I would like to obtain a schematic for a Model 546 Hickok Tube Tester.

HUMBERTO HURTADO
26996 Q Drive No.
Albion, Mich. 49224

I need the schematic for a Paralan Model T90 Stereo Amplifier. It was manufactured by Paralan Electronic Corp., 54 S. Long Beach Rockville Center.

K. J. MODESTE
377 Winona Dr.
Toronto 10, Ontario

Information Needed

I would like help and information from readers that are familiar with Lakeside Industries Picture Tube Rebuilding Equipment.

ROBERT L. NELSON
3602 Mt Aclare Ave.
San Diego, Calif. 92111

I am writing a biography about the Radio-TV Service Business (non-technical) covering the past 30 years. I could use anecdotes and information about wages and hours, unusual employers, strange customer situations, working conditions, likes and dislikes, etc. No names or addresses will be used.

WILLIAM BURGESS
1254 N. Wheeling
Mt. Prospect, Ill. 60056

A Strange Circuit Characteristic

I have twice now come up with a real problem with series-string color-TV sets and have found no solution. The set operates normally for the first five minutes and then the plate of the horizontal-output tube gets red and blows the breaker. The grid of the output starts pulling positive and the yoke and flyback are okay—proved by replacement. Several different 23JS6 tubes were tried.

I put in a filament transformer and the proper size resistor to substitute for the 23JS6A heater and replaced that tube with a 6JE6.

That's what I call a real band aid, but that was the only thing that seemed to fix it. Even a black-and white output worked (6BQ6).

The two sets were a 1969-70 Sylvania and a 1970 Morse.

Maybe one of your readers has a fix for this. I spent three months on and off with that bloody set.

BRUCE BAUR
16200 S. E. Harold Ave.
Milwaukie, Ore. 97222

Manuals Needed

I need the operating manuals for the following instruments: 6-Meter Heathkit Model HW-29, Jackson Audio Oscillator Model 652, Hewlett Packard VTVM Model 410-B, and Hickok VTVO Milliameter Model

OBQ-1-USNAVY.

PIERRE R. TURCHI
1420 Maple Avenue
Haddon Height, N.J. 08035

I would like to obtain some Sams AR Manuals (used) to complete a set. I also have two Atwater-Kent radios and old radio and TV tubes for sale.

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

I need a manual or other data on a Philco Visual Alignment Generator Model 7008.

J. HAUPT
5401 S. 12th
Tacoma, Wash. 98465

I need an instruction manual for a Precise Oscilloscope Model 300B.

EARL D. KENT
Box 182
Neah Bay, Wash. 98357

Equipment Wanted

I would like to purchase a used picture tube rebuilding machine.

J. T. BISHOP
1017 Wilson St.
Tupelo, Miss. 38801

I need a Hickok Model 156 Type Indicating Tacometer (1938-1941) and a Hickok Model 860 Injecto-Tracer, Signal Tracer.

ARO ELECTRONICS SERVICE
735 Mills St.
Kalamazoo, Mich. 49001

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Poplar Bluff, Mo. 63901

I have ELECTRONIC TECHNICIAN/DEALER Magazines from the year of 1965 through 1972, except the May 1966 issue. Make offer.

NELSON W. BECK
125 Chippewa Dr.
Beaver Falls, Pa. 15010

NEWS OF THE INDUSTRY

Special Report Released by Joint Merger Committees

The following special report was released by the Joint NATESA/NEA Merger Committees meeting at the Sheraton Airport Motor Inn in St. Louis, Mo. on May 18-20, 1973.

In Attendance (Voting)

NATESA	NEA
LeRoy Ragsdale, Chairman (Secretary)	Norris Browne, Chairman
Gerald Hall	Charles Couch, Jr.
Cliff Shaw	Virgil Gaither
George Weiss	Paul Dontje
Edward Gorman	Emmett Hughes

In Attendance (Non-Voting)

Leo P. Shumavon
West Correll
Bob Harrison

NATESA temporary (replacement) appointee (for Ed Gorman) 5/20/73 Otto Horak

Joint Committees Chairman

Morris L. Finneburgh, Sr., E.H.F.

Many delegates arrived Friday evening, May 18, 1973, and met in groups (and together) all evening in informal discussions.

The conference was called to order Saturday, 9:00 a.m., May 19, 1973, and as a broad set of guidelines used the agenda of the Merger Meeting held at Memphis, Tenn. on Sept. 30, 1972 (plus subsequent developments).

Primary procedure was the meticulous, thorough study and "preliminary" finalization of the "ARTICLES OF AGREEMENT," coupled with "TENTATIVE" BYLAWS. Messrs. Bob Harrison and West Correll were effectively able to answer all questions and did importantly help solve, as well as tentatively finalize, acceptable interpretations by the Joint Committees. Decisions were reached on important subjects such as:

- Procedures
- New association name
- Membership and classifications—dues
- Governing body—Board of Representatives
- Constitution—Articles of Incorporation
- Officers classifications—Executive Committee
- Executive Staff Chiefs—Executive Officers
- Emblem—Logo—Voting System
- Articles of Arbitration—Preliminary Bylaws
- Hawaii Convention—Merger Celebration—1974, etc.

While there were divergent views about the "Articles of agreement for consolidation (merger)"—nevertheless, a "package" of approximately 60 separate articles of agreement for NATESA/NEA consolidation (merger) covering *all* MAJOR ISSUES were generally agreed to with few reservations. The great majority of motions and resolutions were passed unanimously. *Dissenting votes* were few and usually based upon minor differences rather than on definite strong, contrary opinions; thus, leaving the feeling that agreement was well within reach and that *serious* roadblocks to possible "consolidation" of NATESA and NEA had been removed.

To accomplish these results, the Joint Committees kept foremost in mind the BEST INTERESTS OF THE SERVICE INDUSTRY. However, aggressive discussion—a true spirit of GIVE and TAKE and 28 hours of intensive conferring (all within less than 48 hours Friday evening through Sunday afternoon)—were necessary in order to reach the often referred to COMMON DENOMINATORS necessary for eventual consolidation (merger) at the Joint NATESA/NEA Convention in Kansas City, Mo., August 23-26, 1973 at the Crown Center Hotel.

Incidentally, the amazing progress accomplished at this Merger Committee Meeting should be a great and inspiring incentive for *EVERY* NATESA and NEA member to be on hand at the Kansas City Joint Convention—to express his views, to voice his opinions, and to be a part of a truly historical convention, and to celebrate the now quite possible consolidation (merger) of NATESA and NEA.

Merger is at this time NOT a POSITIVE conclusion, but with the anticipated and understanding cooperation between the officers, Executive Vice President, Executive Director and the Joint Merger Committees, the ultimate goal is in view.

A special sub-committee, consisting of Messrs. Virgil Gaither and George Weiss, was appointed to negotiate certain delicate matters and to report back to the Merger Committee Chairman at an early date. There of course still remains many "loose ends" and these will hopefully be finalized before the Joint NATESA/NEA Convention August 23-26, 1973.

(L to R) Morris L. Finneburgh, Sr., E.H.F., Joint Committees Chairman; West Correll, Bylaws Author; Leo P. Shumavon, President of NATESA; Cliff Shaw; and Edward Gorman.

(L to R) Charles Couch, Jr., President of NEA; Edward Gorman; Cliff Shaw; Virgil Gaither; West Correll; Paul Dontje; Norris Browne; and Emmett Hughes. (Lower Right) George Weiss and Jerry Hall. *Photos courtesy of Bob Harrison, also Bylaws Author.*

Due to an early departure time by Committee Member Edward G. Gorman, Mr. Otto Horak (NATESA), who was available, was appointed as a "temporary" member of the NATESA Merger Committee by NATESA President Leo P. Shumavon.

The Chairman and both Committees expressed very special recognition and appreciation for the intelligent and untiring efforts of its "guest specialists" on bylaws—Messrs. Bob Harrison and West Correll. They *continue* with the heavy (and time consuming) burden of finalizing the bylaws, articles of agreement and other procedures—all necessary for the anticipated presentation of a *consolidation (merger) package* to the upcoming Joint Convention.

The Chairman is truly proud to pay high compliment and recognition to *both* committees for their untiring efforts—patience—liberal understanding of the "other fellow's problems and points of view." As often stated: Merger CAN, and in reasonable probability, WILL be accom-

continued on page 22

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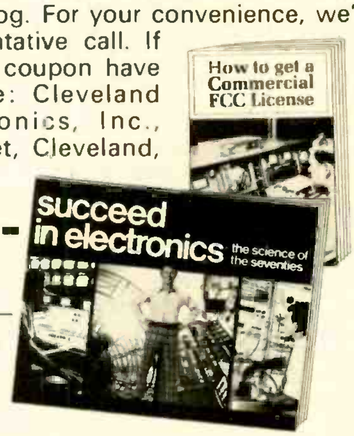

Joseph E. Perry of Cambridge, Massachusetts passed his license exam and got a new job with 40% more pay. "I'm now an Engineering Specialist with National Radio Company, Inc., testing prototype equipment. CIE training gave me the electronics technology I needed to pass the exam for First Class FCC License.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

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

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NEWS . . .

continued from page 18

plished—now that divergent opinions and roadblocks have been discussed without reservations and in a spirit of compromise, fairness and a mutual determination to serve above all else—the BEST INTERESTS OF ALL INDEPENDENT TV SERVICE.

There is the possibility that still another Joint Merger Committee Meeting may be necessary well before the Joint Convention in August. However, due to the amazing accomplishments and progress of this (St. Louis) meeting, only a Joint Merger Committees Meeting (a day or two) before the Kansas City Joint NATESA/NEA Convention will probably be necessary to prepare for the presentation of the final consolidation (merger) package. However, there is the probability of special meetings (in the meantime) between the General Chairman, Committee Chairman, Bylaws and Article of Agreement Specialists and the Special Sub-Committee.

By coincidence, the Missouri Electronic Service Assn. (MESA) was in annual session at the same St. Louis Motor Inn, and they supplied the coffee breaks for the Merger Committees. Further, MESA invited the 13-member Merger Committee attendants to their Saturday night banquet. Merger Committee Chairman Morris L. Finneburgh, Sr., addressed the group on the subject "Affiliation—The Key to Security." MESA added cooperation and much warmth to a long and seriously strenuous Merger Conference.

We hope that the Press will cooperate by featuring this release—thus encouraging the entire NATESA/NEA membership to attend the Joint NATESA/NEA Convention in Kansas City, August 23-26, 1973, and to emphasize the importantly needed support of the manufacturer and wholesale distributor segments of our great industry.

Submitted with the approval of the NATESA/NEA Joint Merger Committees in session at St. Louis, Mo., May 18-20, 1973.

Morris L. Finneburgh, Sr., E.H.F.
Chairman Joint Merger Committees

N.Y.C. Board of Education Offers Electronics Courses

Free courses in basic electronics, radio, B/W-TV, Color-TV, and solid-state devices, sponsored by the New York City Board of Education, will be offered at the William E. Grady Evening Trade School, located at 25 Brighton 4th Road, Brooklyn, N.Y. 11235, telephone DE2-5000.

Courses are designed to upgrade the technical competency of adults employed in the electronic field. Persons interested may register at the school on Thursday and Monday, September 6 and 10, 1973, from 7:00 p.m. to 9:00 p.m.

Electronics Technicians Assn. Convenes in Shreveport, La.

The Electronics Technicians Assn. of Louisiana will have their 1973 convention and trade show July 20-22, 1973, at the Sheraton Bossier Motor Inn in Shreveport, La. According to A. J. Nicholson, General Convention Chairman, some 400 are expected to attend. For further details contact Phillip Byram, 2739 Linwood Ave., Shreveport, La., telephone 635-4394.

Parallel to the convention and trade show, the regular July meeting of the Radio and Television Technicians Licensing Board of the State of Louisiana will be held at the convention site instead of the regular location in Baton Rouge.

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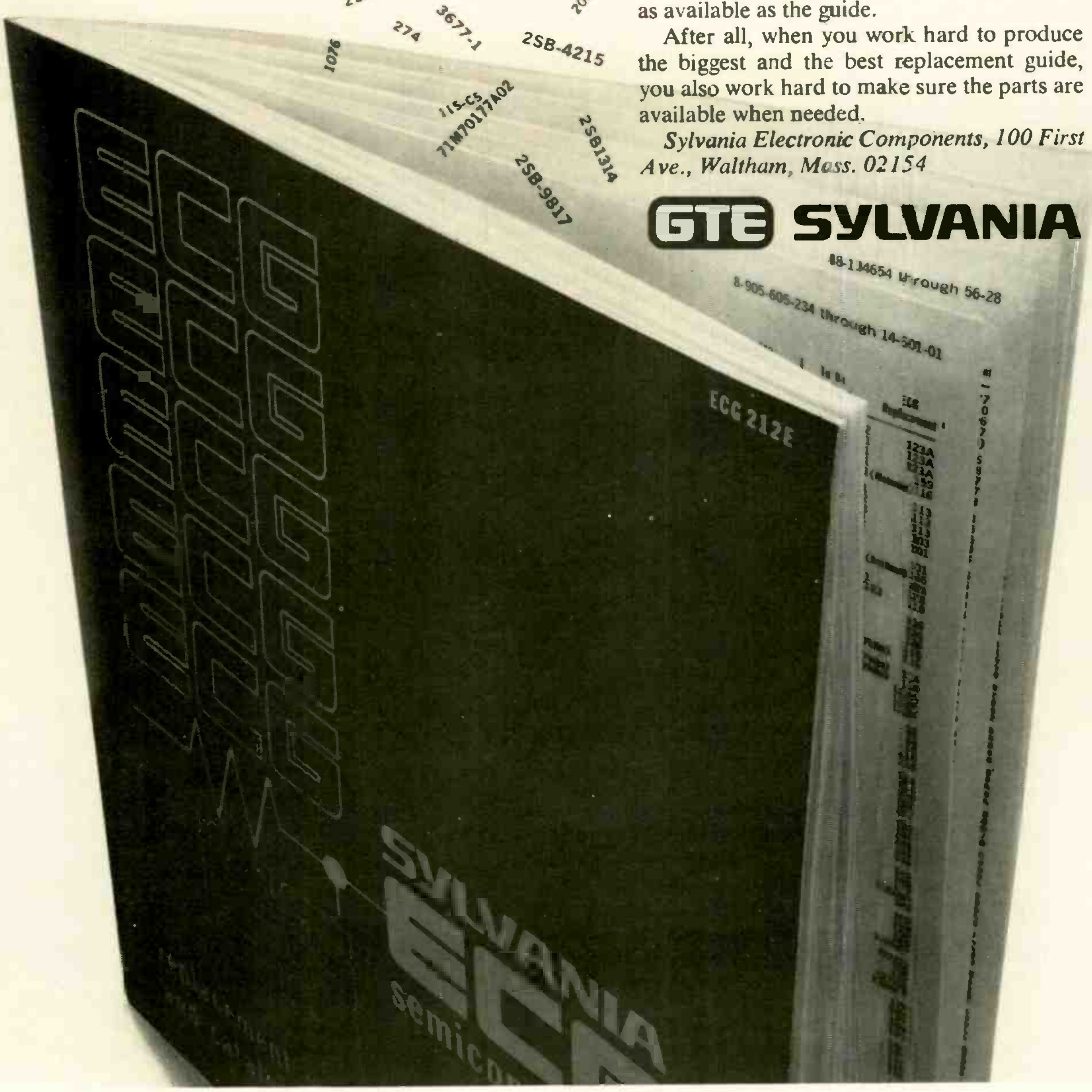

NEW AND NOTEWORTHY

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

FOR MORE NEW PRODUCTS SEE PAGE 49

COLOR GENERATOR 700

Can be used to check VHF and UHF channels

Introduced is a new Color King color generator, Model CG169, that generates a signal on all VHF channels plus 7 UHF channels. The FET type digital integrated circuitry reportedly permits operation in temperatures as high as 180°F and as low as -70°F. The low temperature operation and humidity dry-out are backed by the company's temperature control that automatically turns ON at temperatures under 30°F. The instrument reportedly has an industry first with an RF attenuation firing simulator control, which allows the technician to check the color-TV set down to a 100μv signal to assure proper color circuit functions in fringe areas. Sencore, Inc.

HF GENERATOR 701

Pushbutton selection of nine frequency ranges

A new low-cost HF Generator, Model PM5324, features pushbutton selection of nine frequency ranges from 100kHz to 110MHz as well as of modulation functions and calibration frequencies. It is expected to cover wide applications in AM, FM and multiplex stereo equipment servicing. The frequency stability is reportedly 1% and internal crystal calibration accuracy is 0.1%. Electronic stabilization provides accurately known output amplitudes in five ranges from 5μv rms full scale to 50mv rms full scale. Output impedance is 75Ω on all scales and at all frequencies. The unit has three special bandspread ranges to simplify the alignment of radio equipment.
Test & Measuring Instruments Inc.

ANTENNA ROTATOR 702

Eliminates the noisy click-clack sound

The Selecta-Channel Model 10W606 Antenna Rotator features a moving direction indicator light synchronized with antenna movement to show the antenna position. The drive unit has a heavy duty precision worm gear drive that reportedly provides a strong turning force and locks the antenna in position preventing any chance of windmilling. The unit eliminates noisy click-clack sound when operating. RCA.

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-CONTENTS-

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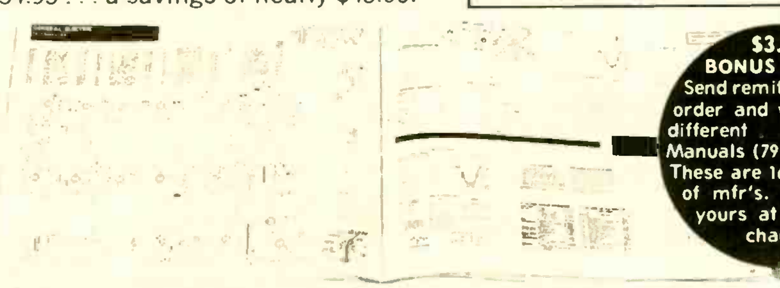

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TEKLAB REPORT

Panasonic's Model CT-701 Modular Color-TV Set

by Joseph Zauhar

This well-designed chassis includes handles on modules for easy removal, thus reducing chances of component damage

■ Panasonic is now included in the growing number of manufacturers with modular solid-state color-TV chassis. The TV set was given a very high rating for accessibility and serviceability by an independent service review panel using the NEA (National Electronic Associations, Inc.) rating form for all solid-state modular color-TV chassis.

Called "Quatrecolor" the chassis is all solid-state with the exception of the picture tube. A large majority of the components are mounted on five individual modular circuit boards. The boards are designed to snap in and out of the chassis, making component replacements simpler and faster for the service technician—minimizing customer problems.

We received for lab purposes a Panasonic portable color-TV set, Model CT-701, employing the ETA-1 chassis. The set has a 17-in. (measured diagonally) Pana-Matrix picture tube. Each of the red, green and blue dots are individually surrounded by jet black, improving the contrast of the picture.

There are a number of important features simplifying the tuning of the TV set for the customer: A 70-channel click-stop tuner is now employed making UHF tuning as easy and convenient as VHF tuning. A Panalock AFT (Automatic-Fine Tuning) circuit is employed; and by pushing the Panalock key a better signal is locked in electronically.

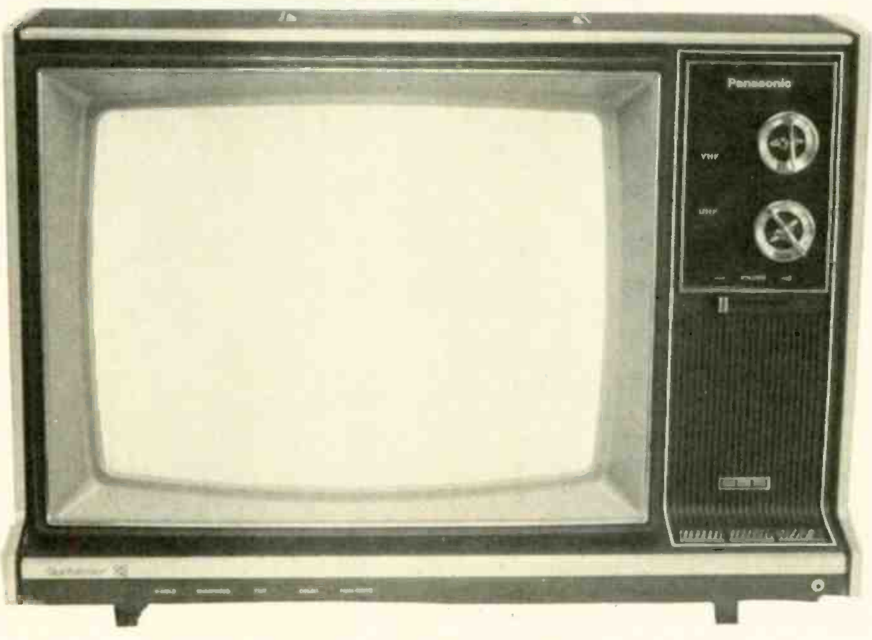
The BRIGHTNESS, CONTRAST and COLOR SATURATION are simultaneously controlled by a PANA-BRITE control knob located on the front control panel.

A Q-Lock circuit is used to lock the function of the COLOR, TINT, BRIGHTNESS and CONTRAST controls, by pressing a button on the control panel for a pleasing picture; or if you prefer, they can be adjusted manually.

As we disassembled the TV set, we noted a number of time saving features for the service technician: Upon removing the back cover of the TV set, all sides of the chassis are completely exposed, making up-front components, such as the tuner, easy to reach if service is required. If the chassis is laid on its side, the complete underside of the main circuit panel is completely exposed. Tilting of the chassis for easier component removal is accomplished by loosing two screws on the right and left side of the chassis. If complete removal of the chassis is desired, just remove two of the screws and unplug the connectors to the chassis.

The chassis employs five vertically mounted boards with edge pin connectors. A convenient plastic loop handle is placed on the board, providing a lock to hold the board in place and a grip for removal. The boards slide into a groove like a drawer for support and positive connector pin alignment. Unlike many color-TV sets, both male and female connectors are provided, rather than

Panasonic's Model CT-701 Color-TV set employing the ETA-1 chassis.



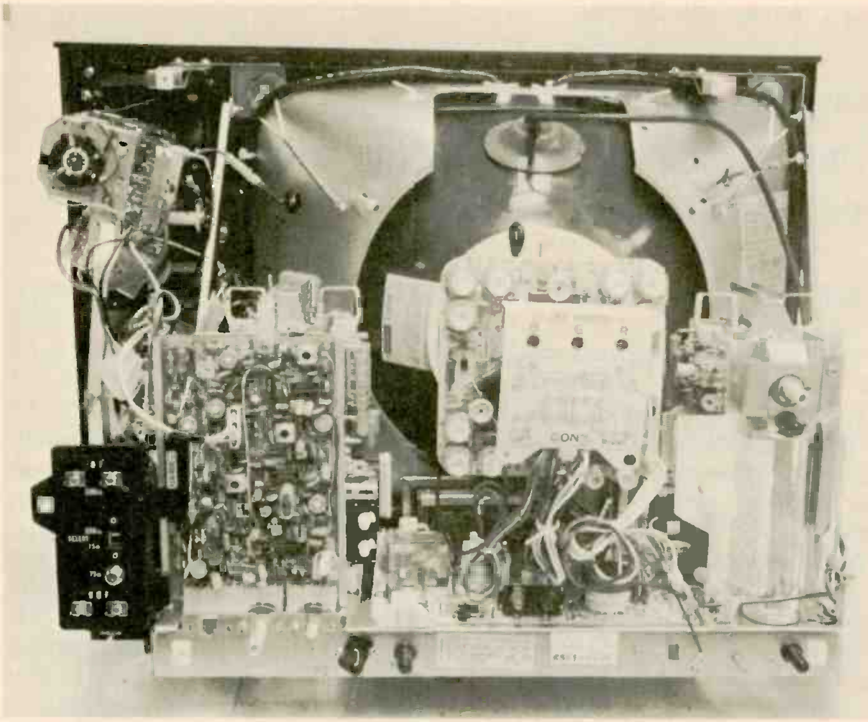
attempting connector-type contact directly to the printed-circuit boards. The metal module guides provide a heat sink for a few of the large output transistors.

As we cover some of the important circuits employed in this chassis, they may be followed in this month's TEKFAX Schematic No. 1481 or the simplified schematics used in the review.

Power Supply Voltage Regulator

The power supply is regulated by a thyristor-controlled circuit incorporating transistor TR801 as a saw-tooth generator with full-wave rectified voltage applied to its base. The pulse generated at its collector is converted into the sawtooth waveform voltage through a network consisting of resistors R806 and R808, plus capacitor C807. Detector transistor TR804 compares the output dc voltage change with a zener diode at its emitter, and its collector is connected to the emitter of transistor TR802 through resistor R813. The sawtooth waveform voltage generated by TR801 is applied to the base of transistor TR802 and the change of the emitter potential of TR802 changes the phase of the pulse at point C. The rectangular waveform voltage is differentiated by capacitor C808 and resistor R811 and applied to the base of transistor TR803.

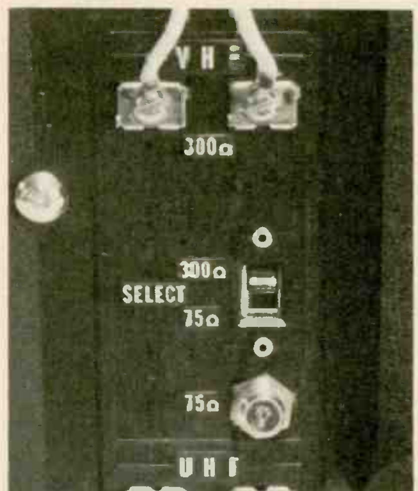
Of the differentiated waveform,



Rear view of the chassis showing service controls and the vertically mounted modules. An additional board is mounted horizontally on the main chassis.

The front control panel has an illuminated channel indicator window for the VHF and 70-channel click-stop UHF tuner. Also included are a lever throttle type VOLUME control and key type switches for Q-Lock, AFT and ON/OFF.

Tilting of the chassis for easier component removal, if required, is accomplished by loosening two screws on each side of the chassis.



The antenna terminal board includes both 300Ω twin-lead and 75Ω coaxial input connectors with a slide switch for antenna selection.

only the positive going pulse applied to the base of transistor TR803 is amplified. The fullwave rectified voltage is stored in capacitor C853 and at the same time applied to the load. If the parabolic waveform voltage applied to the anode of the thyristor becomes lower than the potential of its cathode, no current flows into the thyristor and the thyristor stops conducting.

An Active Power Filter (APF) circuit consisting of transistors TR806 and TR851 is employed to eliminate the undesirable ripples across capacitor C853 and prevents the picture from fluttering because of abrupt change of ac power.

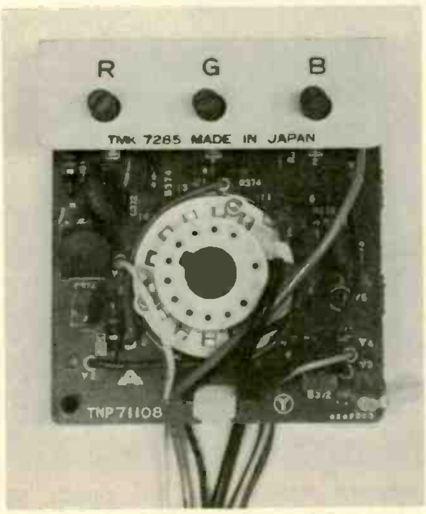
DC Tint Circuit

The DC Tint circuit used in this chassis employs two transistors, TR601 and TR602, which compose a differential amplifier; and a part of the CW signal obtained from Terminal 14 of IC602 is applied to the emitters of both transistors through the phase-sifter transformer, T603. A fixed potential is applied to the base of transistor TR-601. The collector CW signal of TR602 is added to the collector signal of TR601 through coil L607, capacitors C641 and C643. The TINT control, R691, also controls this signal by varying the base potential of transistor TR602.

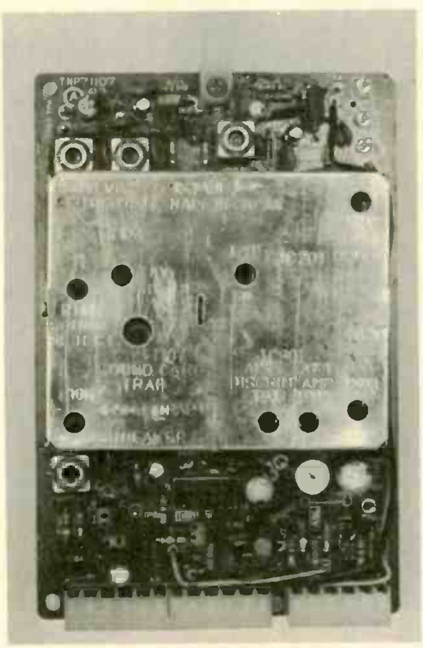
The CW signal obtained from the collector of transistor TR602 is applied to Terminal 3 of IC603 as a reference R-Y signal, while part of this same signal is also shifted 90° in phase by coil L606, capacitor C639 and resistor R631 and then supplied to Terminal 4 of IC603 as a reference B-Y signal.

Pana-Brite Circuit

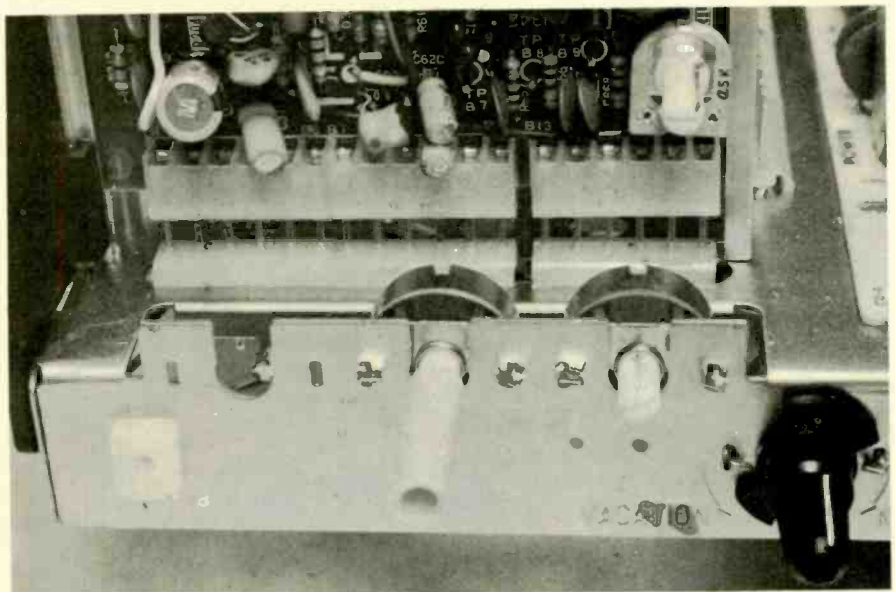
The Pana-Brite circuit simultane-



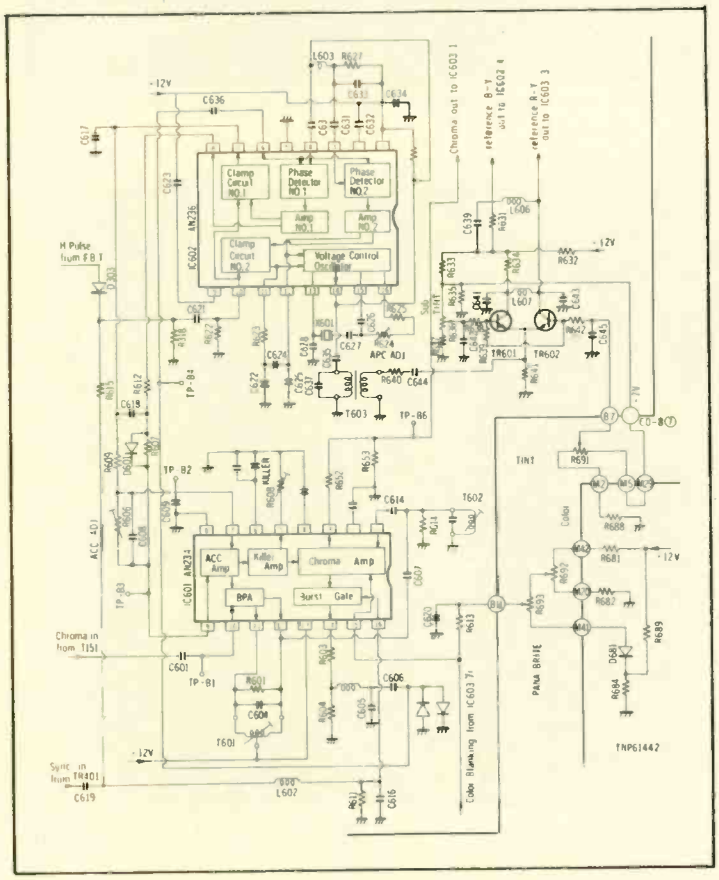
The COLOR SCREEN controls are now mounted on the picture tube socket, reducing the number of wires to the chassis.



Module Board "A" contains the Video IF and Video Amplifier circuits.



The modules employ pin type edge connectors and are mounted vertically in rigid metal guides.



A simplified schematic of the color process and color oscillator circuits. *Courtesy of Panasonic.*

ously controls three functions, brightness, contrast and color saturation with the PANA-BRITE control knob.

The brightness and contrast can be controlled by changing the gain of the video signal with resistor R694, connected to the emitter of the third video transistor, TR303, through diode D302, resistor R319 and capacitor C331.

Color saturation can be controlled by resistor R693, coupled with resistor R694, varying the potential of IC601 Terminal 15.

When switches SW681A, SW-681C and SW681E are in the ON position, the Pana-Brite circuit is locked to a narrow variable range.

Luminance Circuit

The luminance circuit employs the second video transistor, TR301, the blanking amplifier transistor, TR302, the third video transistor, TR303, and the video drive transistor, TR304.

The video signal obtained from Terminal 13 of the video jungle, IC151, is fed to the base of transistor TR301 through peaking coil L156, delay line coil TD301 and resistors R303 and R305. The resulting video signal from the emitter of TR301 is then fed to the base of transistor TR303 through resistor R316 and coil LC301, and that obtained from the collector of TR303 is fed to the base of transistor TR304 through resistor R323. The luminance output signal from the emitter of TR304 is fed to the emitters of the R-G-B chrominance output transistors, TR351, TR352 and TR353.

Vertical and horizontal blanking pulses are amplified by transistor TR302 and then mixed with the luminance signal when fed to the base of transistor TR303 through

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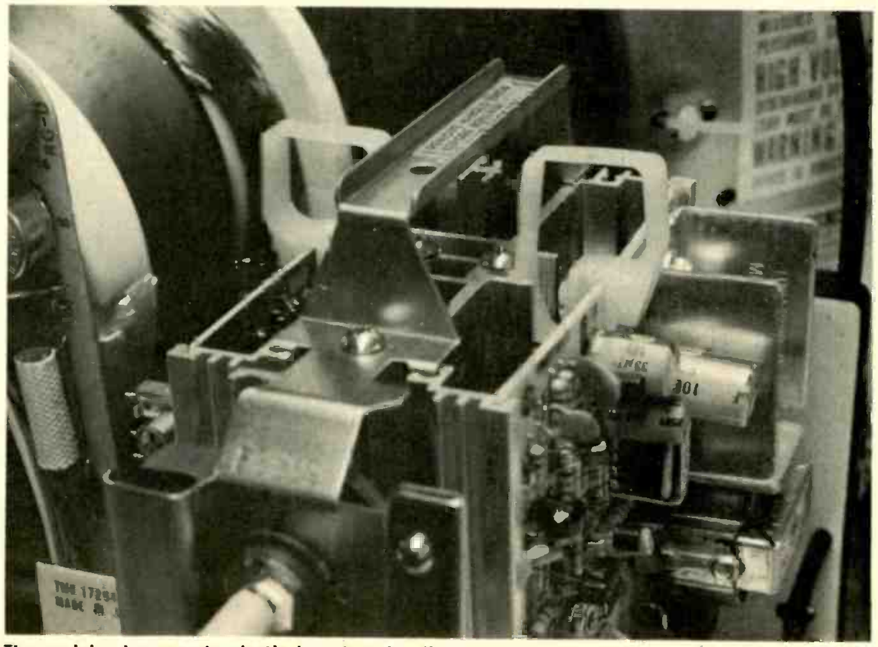
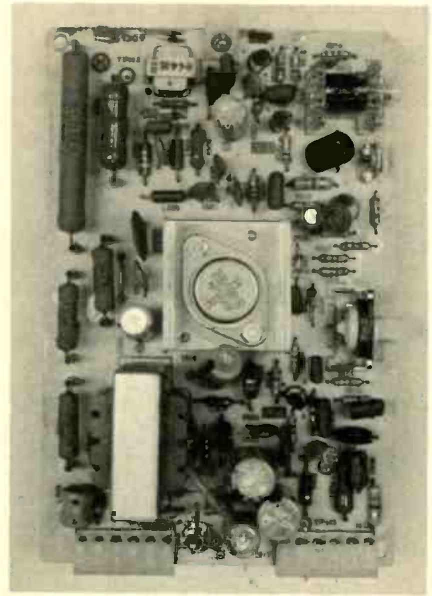
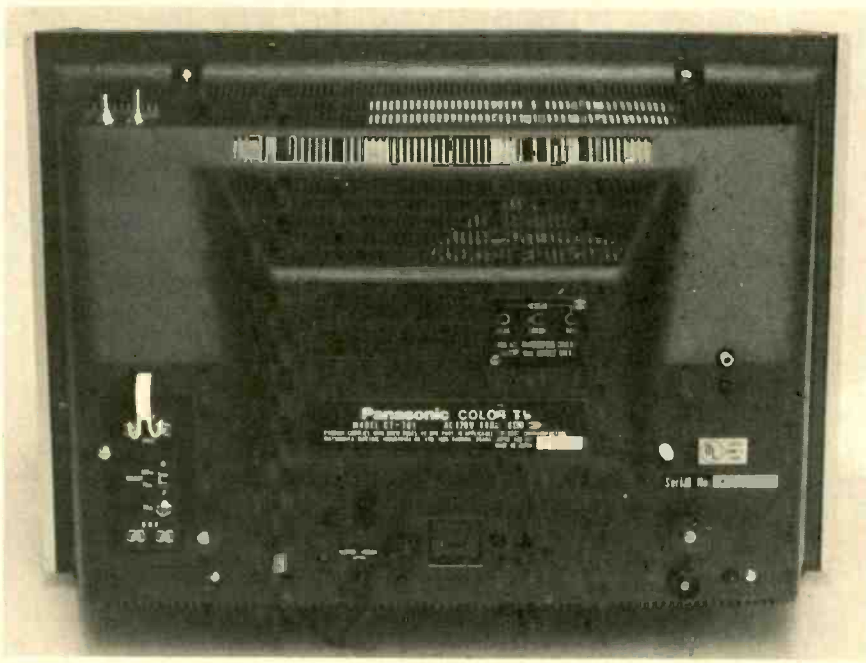


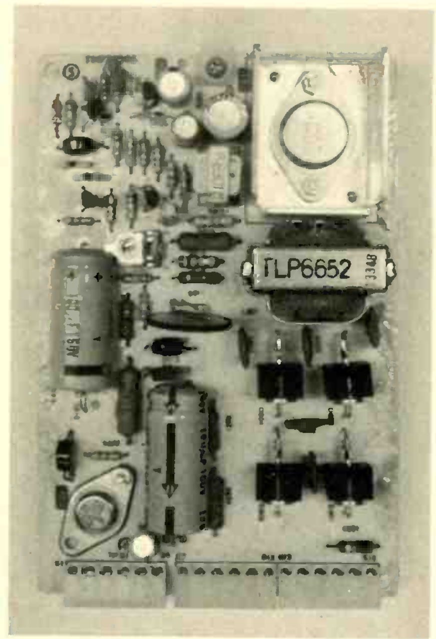
The modules incorporate plastic loop type handles for easy removal and reduce chances of component damage.



Horizontal oscillator and drive circuits are found on the "H" Board. The horizontal drive transistor, TR504, is located in the center of the module.



The back cover, sides and top of the cabinet are one piece. When removed, the complete chassis is exposed for servicing.



Low-voltage power supply circuits are found on the "S" Board.

Transistor Biasing, from the Technician's Point of View

By Lambert C. Huneault, CET

About 15 years ago, while operating a radio-TV service business, the author saw the writing on the wall, decided that semiconductors were here to stay and enrolled in a correspondence course on transistors. Prior to this, customers had been politely turned away when they brought their transistor radios to the shop for repairs. It was a case of **unfamiliarity** breeding contempt.

■ Lesson four of the course changed all that. After studying the lesson, the author felt he understood those transistor circuits at last, and was now anxious to have a go at the next transistor radio that came in to the shop! What was the subject of the lesson which made all that difference? . . . Transistor Biasing! After teaching electronics for a decade, the writer feels even more strongly than ever about the importance of biasing circuits. When it comes to troubleshooting transistorized equipment, be it audio, radio or TV, and whether the symptom is distortion, lack of gain or a dead stage, half the battle is already won if the technician understands biasing theory and related circuitry.

Much has been written about transistor biasing in magazine articles and textbooks, but all too often the literature on this subject involves so many formulas and calculations that the average technician quickly loses interest. This article attempts to present a simplified view of biasing and classifies the various methods and circuits used.

The Biasing Problem

Bipolar transistors are two-junction devices; in most circuits, the emitter-to-base junction requires forward bias, while the collector-to-base junction must be reverse biased. The transistors may be either PNP or NPN, some equipment actually using both types. The dc supply features either a positive or negative ground; yet, a *single* battery or power supply must usually fulfill all biasing requirements. In each stage, the bias circuitry must not only supply the quiescent base current necessary to turn ON the transistor, but it must also result in a stable operating point in order to provide the required amount of gain, keep signal distortion at an acceptable level and maintain power dissipation within the transistor's maximum ratings.

Because parameters such as current gain (h_{FE}), leakage current (I_{CBO} and I_{CEO}), and internal base-to-emitter resistance (R_{BE}), vary widely from one transistor to another—even if the transistors are of the same type (have the same number) and also vary considerably with temperature changes—the biasing circuitry should be capable of compensating for such variations. All in all, then, bias plays an important role in the proper and safe operation of transistor circuits. Since the majority of transistors are connected in the common-emitter (C-E) configuration, this article is mainly concerned with C-E circuits, for which there are basically six different methods of providing dc bias.

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Simple, Fixed Bias

Fig. 1 shows how the base-to-emitter forward bias and collector-to-base reverse bias can be achieved with a single dc voltage source (V_{CC}) in an NPN transistor amplifier circuit. Recall that forward bias means *N*egative voltage on the *N* side of the junction and *P*ositive voltage on the *P* side. Base current (I_B) flows from the negative terminal of V_{CC} into the emitter through the emitter-base junction, out of the base through base bias resistor R_B, and back to the positive terminal of the supply. This current flow produces a voltage drop (V_{EB}) across the emitter-base junction resistance. The polarity of V_{EB} is negative on the N-type emitter and positive on the P-type base; therefore the emitter-base junction is forward biased and the transistor turns ON. For germanium transistors, V_{EB} should be approximately 0.1v to 0.3v, and for silicon transistors about 0.5v to 0.7v.

How much base current does it take to bias a transistor properly? This varies widely and depends on the nature of the device. In small-signal amplifier transistors, the desired operating point might call for a very small base current in the order of only a few *microamperes,* while in a power output transistor a base current of tens or hundreds of *milliamperes* may be required! The base bias resistor, R_B, determines the amount of quiescent base current. R_B is in series with the internal emitter-base junction resistance of the transistor; therefore V_{EB}, plus the voltage drop across R_B, must equal the supply voltage, V_{CC}.

If in the more detailed circuit of Fig. 2 we assume that V_{EB} = 0.6v (silicon transistor) and V_{CC} = 12v, R_B must then drop 11.4v. Assuming that the desired operating point (base current) for this particular transistor is 100μa, the resistance of R_B can be calculated from Ohm's law: $R = \frac{E}{I} = \frac{11.4v}{100 \times 10^{-6}a} = 114{,}000\Omega$ or 114K. (A 120K resistor would probably do the trick.)

With the transistor turned ON, collector current flows from the negative terminal of V_{cc} into the emitter, through the transistor, out of the collector, through load resistor R_L and back to the plus side of the power supply. How much collector current flows? This depends on the h_{FE} (static beta) of the transistor. h_{FE} is defined as the ratio of collector current to base current; therefore, $I_C = h_{FE} \times I_B$. Modern transistors are likely to have betas anywhere from less than 10 up to several hundred. In Fig. 2, let us assume a transistor with $h_{FE} = 50$. Therefore, collector current $= 50 \times 100 \times 10^{-6} = 5{,}000\mu$a or 5 ma. This I_C produces a 5v drop across the 1K collector load resistor, leaving a potential difference of 7v between collector and emitter. With the collector 7v positive in relation to the emitter and the base 0.6v positive relative to the emitter, it follows that the collector is 6.4v positive in relation to the base; and since the collector is made of N-type material, while the base is P-type, it becomes readily apparent that this V_{CB} of 6.4v constitutes a *reverse* bias.

If the transistor is PNP instead of NPN, the polarity of the V_{cc} supply must be reversed; the rest of the circuit remains unchanged, as shown in Fig. 3. Note that in a PNP transistor, base current flows *into* the base and the collector current *into* the collector from the V_{cc} supply. Emitter current flows *out* of the emitter, back to the positive terminal of V_{cc}. Inside the transistor, of course, *holes* flow from the emitter through the base region to the collector. Assuming identical parameters, the voltage distribution in Fig. 3 will be identical to that in Fig. 2, except that voltage polarities are reversed.

In summary, then, the collector current depends on the transistor's current gain (beta) and on the base current; the latter, in turn, depends on the resistance of R_B. Therefore R_B is an all-important resistor. Should it become defective, it should be replaced with a resistor of the same value. If these considerations were the only criteria to be concerned with, the simple, fixed biasing circuits in Fig. 1 and 3 would be adequate, and this article would end right here! But the situation unfortunately is not all that simple.

Base Bias Voltage Divider

As mentioned previously, parameters do tend to vary widely in semiconductors. For example, a manufacturer's data sheets might show that a certain type of transistor has a nominal beta of 60, but the actual value for any specific transistor of that type might in reality be as low as 25 or as high as 100. Likewise, the base-to-emitter junction resistance (R_{BE}) of a transistor can vary over a wide range, from unit to unit, and also with temperature.

Obviously, mass produced radio and TV receivers call for biasing circuits that can minimize the effects of these wide spreads in transistor parameters. One of these circuits uses a voltage divider network to establish the emitter-to-base voltage—see Fig. 4. Here, a resistor R_V, has been added. With R_B, it forms a voltage divider across the V_{cc} supply. R_V is in parallel with the internal R_{BE} of the transistor. If the resistance of R_V is made substantially lower than R_{BE}, the external R_V rather than the internal junction resistance becomes the controlling factor, and the bleeder current (I_V) through the R_V-R_B divider network determines the operating point of the transistor; i.e., even if R_{BE} varies from transistor to transistor, or varies with heat, the emitter-to-base voltage remains relatively constant. The stabilized operating point keeps the transistor operating within the linear region of its characteristics, and distortion is kept at a minimum.

It can be shown mathematically that the lower the resistance of R_V and R_B, the greater the bias stability;

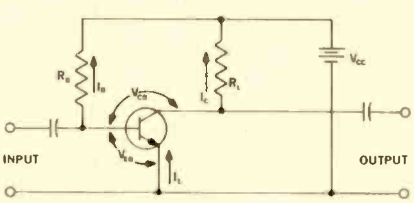

Fig. 1—Biasing an NPN transistor with a single battery.

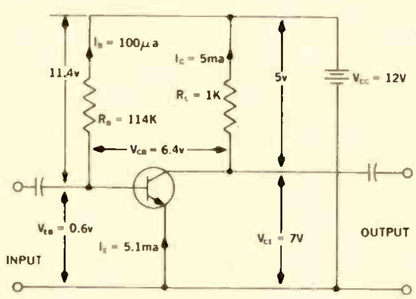

Fig. 2—Voltage distribution in the circuit.

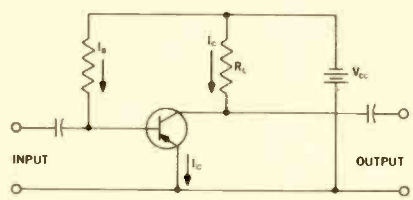

Fig. 3—PNP transistor biasing.

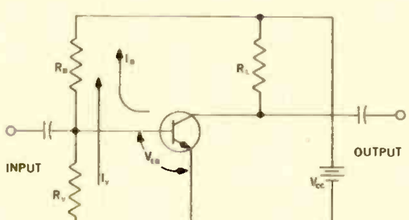

Fig. 4—Stabilizing resistor R_V forms a voltage divider with R_B.

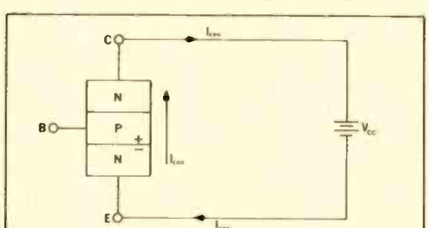

Fig. 5—Leakage current tends to forward bias the E-B junction.

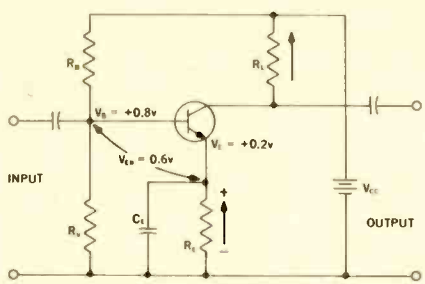

Fig. 6—Emitter stabilizing resistor prevents thermal runaway.

unfortunately, the greater also the current drain on the V_{CC} supply! In practice, the values selected for R_V and R_B represent a compromise between bias stability and current drain. And in portable radios, for example, battery drain is an important factor.

As most technicians know, heat is enemy number one of transistors! This presents another problem. As the temperature increases, covalent bonds break down within the semiconductor crystals, generating increasing numbers of minority carriers (holes in N-type semiconductor material and electrons in P-type) which, in turn, result in leakage currents such as I_{cbo} and I_{ceo}. Of particular interest in the common-emitter configuration is the leakage current that flows between collector and emitter, even if the base circuit is open ($I_{c\infty}$). As seen in Fig. 5, this leakage current flows through the base region and produces a voltage drop across the emitter-base junction. The polarity of this voltage drop (as shown in the figure) is such as to *increase* the forward bias that is normally present across that junction (provided by the external base circuit). As a result, collector current increases, the increase in I_C being equal to beta times the increase in leakage current. The increased I_C produces more power dissipation (heat), further raising the temperature of the transistor. In turn, this causes a further increase in leakage current, forward biasing the E-B junction even more. . . . Obviously, if this process is not checked, I_C will increase so much that the maximum power dissipation rating will be exceeded, and the transistor will self-destruct! Where this sort of thermal runaway is a distinct possibility, a further improvement in biasing circuitry is obviously called for.

Emitter Bias Resistor

Thermal runaway can be prevented by inserting a resistor (R_E) in the emitter circuit of the transistor—see Fig. 6. R_E looks like the familiar cathode bias resistor used in vacuum tube circuits. Unlike the cathode bias resistor, which supplies self-bias to the tube, however, R_E alone cannot bias the transistor because it produces a *reverse* bias, tending to make the N-type emitter more positive in relation to the P-type base. Instead, R_E simply produces a small stabilizing voltage (usually a few tenths of a volt) which only *partially* opposes the E-B bias. The forward base voltage applied by the R_B-R_V network is always greater than the bucking emitter voltage. In the circuit shown, R_E makes the emitter potential 0.2v above the common bus, while the voltage divider puts the base at a potential of 0.8v above common. The potential difference (forward bias) across the E-B junction is therefore 0.6v.

Should the transistor start heating up due to collector dissipation or because of a rise in ambient temperature, increased leakage current within the transistor will cause the collector current to increase. Since I_C must also flow through the emitter resistor, the voltage drop across R_E increases, causing V_E to rise to, say +0.3v. V_{EB} thus decreases to 0.5v, forcing I_C to decrease and thus offset the original rise in collector current due to heat.

Thus, slow changes in collector and emitter current due to heat are fed back as a dc correction to the emitter-base bias. In other words, R_E provides dc negative feedback, which stabilizes bias and prevents thermal runaway. R_E is quite popular in all sorts of amplifier and oscillator circuits, but is particularly desirable in power output stages where the danger of thermal runaway is greater.

Emitter bypass capacitor C_E is necessary if ac negative feedback is to be avoided, but may be omitted if the benefits of degeneration (less distortion and a better frequency response) are desired. In some circuits, R_V is omitted, the combination of R_B and R_E providing the required degree of bias stability.

Self-Biasing (Collector-to-Base Bias Loop)

Another biasing method sometimes used is illustrated in Fig. 7. R_V may or may not be used in this self-biasing arrangement. Note that base bias resistor R_B is connected to the collector instead of directly to the V_{CC} supply. This dc negative feedback loop stabilizes the base bias against the effects of temperature variations. Should leakage current—and therefore collector current—increase due to heat, R_L drops more voltage, lowering the positive voltage at the collector. Since the collector acts as the source of dc voltage for the R_B-R_V base bias network, the base voltage likewise drops, forcing I_C to decrease. This collector-to-base feedback loop also provides signal feedback (ac negative feedback). If degeneration is not desired, maximum gain can be achieved by modifying the circuit as per Fig. 8. R_B is split in two (R_{B1} + R_{B2}), and a bypass capacitor C_B is connected between their junction and the emitter.

Thermistor Bias Stabilization

A further improvement in bias stabilization can be achieved by using a thermistor. A number of biasing arrangements are possible but the one shown in Fig. 9 is most widely used. Here, negative temperature coeffi-

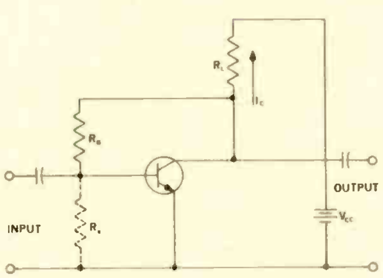

Fig. 7—Self-biasing method.

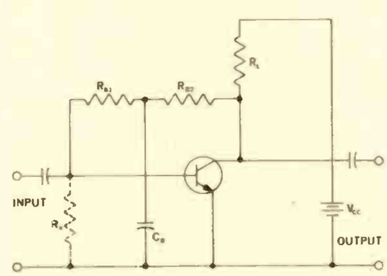

Fig. 8—Self-biasing circuit with C_B preventing ac negative feedback.

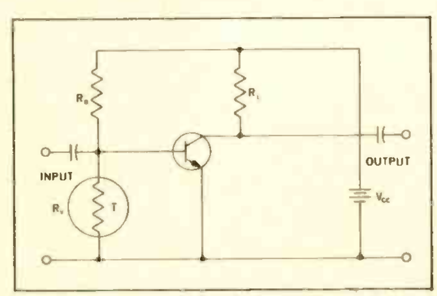

Fig. 9—Thermistor bias stabilization.

cient thermistor R_V is part of the base bias voltage divider network. As the temperature rises, the I_C of the transistor tends to increase. However, the resistance of R_V simultaneously *decreases,* causing the base voltage to drop, effectively reducing forward bias and forcing I_C to decrease. The thermistor is often located in physical contact with or in close proximity to the transistor. It can thus "monitor" the temperature of the transistor quite effectively. In audio amplifiers, output stages often feature thermistor bias stabilization. In these circuits, the thermistor is frequently shunted with an additional fixed resistor, the parallel combination in series with R_B resulting in a more accurate selection of the operating point and better temperature compensation. An example is shown in Fig. 10. Note that bias is further stabilized by R_E in this circuit. This is desirable in power amplifiers.

Diode Stabilizing Circuit

While the use of a thermistor brings about a much improved bias stabilization, a further improvement can be achieved by using a stabilizing diode, see Fig. 11. Here, D_1 replaces the R_V portion of the voltage divider network. Compare Fig. 9 and 11. The negative temperature coefficient of the semiconductor diode and of the transistor can be made to "track" very well, achieving excellent bias stability even under very high temperature conditions. As the temperature increases, the junction resistance of D_1 decreases because thermal energy generates more electron-hole pairs in the forward biased diode. The resulting decrease in base voltage stabilizes the collector current in the same manner as did the thermistor in Fig. 9.

In solid-state home entertainment equipment, the biasing method using the emitter bias resistor with the base bias voltage divider is most popular, while simple fixed bias is the least frequently used. Anyone of them is likely to be encountered, however, and the technician should be able to recognize the circuits for what they are.

Positive Ground vs Negative Ground

In the schematic diagrams discussed so far, *ground* symbols were purposely avoided—ground is not needed to explain any circuit! In practice, however, most diagrams make use of the ground symbol to indicate connections to the chassis or the "common" side of the power supply. In vacuum tube equipment, "ground" virtually always refers to the B-minus side of the power supply. In transistorized equipment, however, either the positive or the negative terminal of the power supply may be connected to "ground." This may tend to confuse the uninitiated!

Let us look at Fig. 6 again. If the *negative* terminal of the V_{CC} supply is connected to ground, then so are the bottom leads of R_E, C_E and R_V; R_B and R_L are both returned to $V_{CC}+$. The circuit may then be redrawn as in Fig. 12. This is sometimes known as the *"conventional"* configuration. Note the dc voltages (relative to ground) at the three electrodes of the transistor.

Now, referring again to Fig. 6, assume that the *positive* terminal of the supply is ground. This means that both R_B and R_L are returned to ground, and that R_V, C_E and R_E are connected to the negative V_{CC} terminal, as illustrated in Fig. 13—a configuration sometimes referred to as *"inverted."* As far as the transistor is concerned, Fig. 13 is identical to Fig. 12—currents are the same, voltage drops across the resistors are identical, and potential differences across the transistor junctions are the same, i.e., V_{EB} = 0.6v (forward bias) and V_{CB} = 5.2v (reverse bias) in both figures.

Insofar as electrode voltages *in relation to ground* are concerned, however, the two circuits differ drastically. This the technician must understand because he usually *measures* transistor voltages *relative to ground.* Note that base and emitter voltages are both low (close to 0v) and positive in Fig. 12, but they are both high (close to the full supply voltage) and negative in Fig. 13. The collector load drops 3v in both cases, but the collector voltage actually reads +6v in one case and −3v in the other. Should the collector load happen to be a low-resistance coil, such as an IF transformer primary, the dc voltage drop across it would be negligible; this means that in Fig. 12 the collector voltage would measure +9v, whereas in Fig. 13 it would read *0v*! To the oldtimer accustomed to working with vacuum tubes, 0v on the plate would definitely indicate a defect (e.g., an open coil), but in transistor circuitry, as we have just seen, 0v on the collector may or may not indicate an entirely normal condition.

NPN and PNP Transistors in the Same Circuit

NPN and PNP transistors are sometimes featured in the same equipment. If there is only one power supply or a single battery, one type of transistor must obviously be connected in the "inverted" configuration,

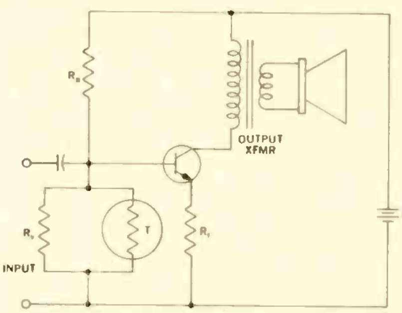

Fig. 10—Bias stabilization of an AF power-output stage.

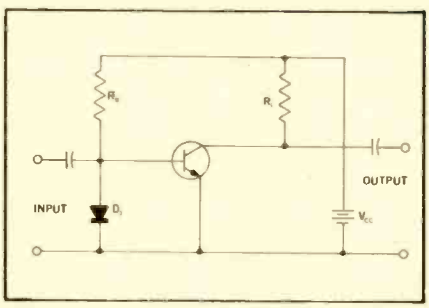

Fig. 11—Diode bias stabilization.

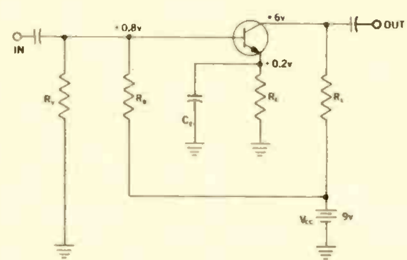

Fig. 12—Conventional configuration for an NPN transistor.

while the other type is hooked up in the "conventional" configuration. Fig. 14 shows such a circuit featuring a couple of germanium transistors and a positive ground. Transistor Q_1 is "conventional" and transistor Q_2 is "inverted." From a troubleshooting standpoint, it is important to note that the relative positions of the "R_B" and "R_V" voltage divider resistors are switched around in these two configurations. Thus, R_2 corresponds to R_5 (essential "R_B" base bias resistors) and R_1 serves the same function as R_6 ("R_V" voltage divider bias stabilizing resistors). Thus, the all-important "R_B," without which the transistor could not turn ON, is R_2 that returns the base to the power supply in stage Q_1, whereas in stage Q_2 it is R_5 that returns the base to ground!

We had it so good before transistors came along! . . . Good old vacuum tubes!

Series-Fed vs Shunt-Fed Bias

When a signal is transformer-coupled to the base of a transistor, the dc base bias can be applied either in series with the signal source, i.e., through the transformer secondary, or in parallel with it. Fig. 15 illustrates an audio output stage with series-fed bias. The R_B-R_V network establishes a dc voltage of 1v at point "A." From that point, the voltage is applied through the secondary of the driver transformer to the base of the transistor. The base current flowing through the low-resistance winding causes an additional drop of 0.1v. R_E raises the emitter voltage to 0.3v, resulting in a forward bias voltage of 0.6v across the emitter-base junction. Bypass capacitor C_1 effectively returns the bottom of the secondary to the emitter, thus preventing degeneration.

Fig. 16 shows an IF amplifier stage with shunt-fed bias. The bias voltage (from the junction of R_B and R_V) and the signal voltage (from the IF transformer secondary) are fed in parallel to the base. Coupling capacitor C_1 is necessary to prevent the dc voltage (−0.7v) from being shorted to ground through the transformer secondary. A PNP germanium transistor is illustrated here, with a V_{EB} of 0.2v. Both methods find widespread application, but series-fed bias is the more popular of the two.

Common-Base and Common-Collector Circuits

All amplifier circuits discussed so far were hooked up in the popular common-emitter configuration. Oc-

continued on page 46

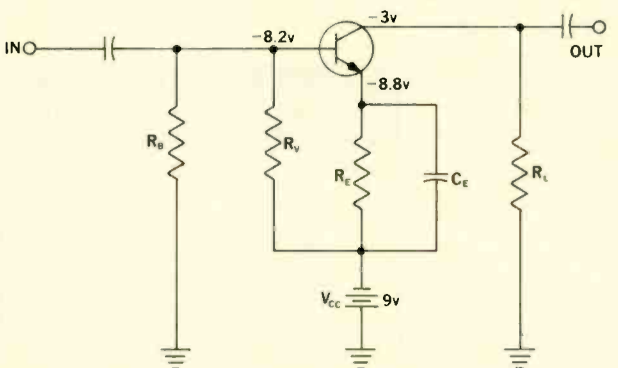

Fig. 13—Inverted configuration for an NPN transistor.

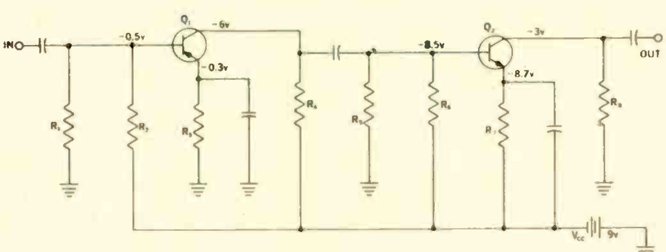

Fig. 14—PNP and NPN transistors in the same circuit.

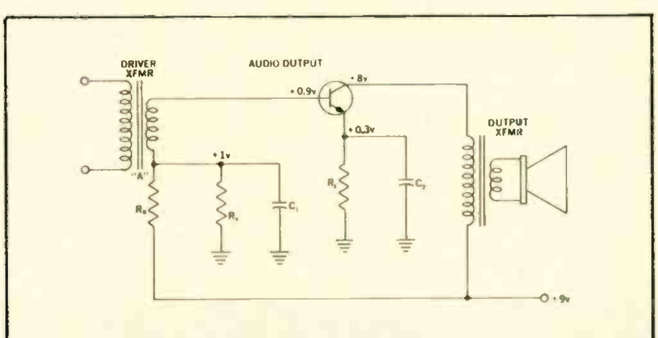

Fig. 15—Series-fed bias.

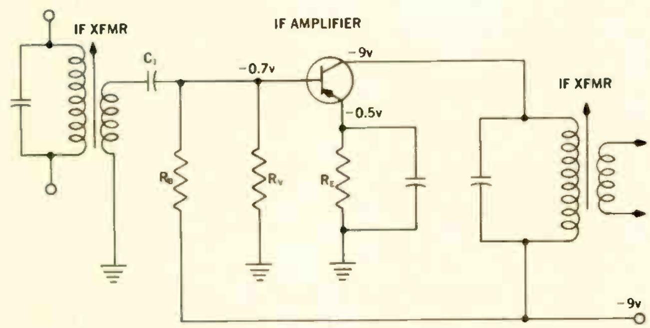

Fig. 16—Shunt-fed bias.

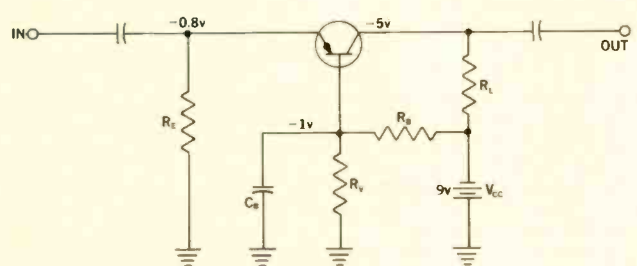

Fig. 17—Common-base amplifier.

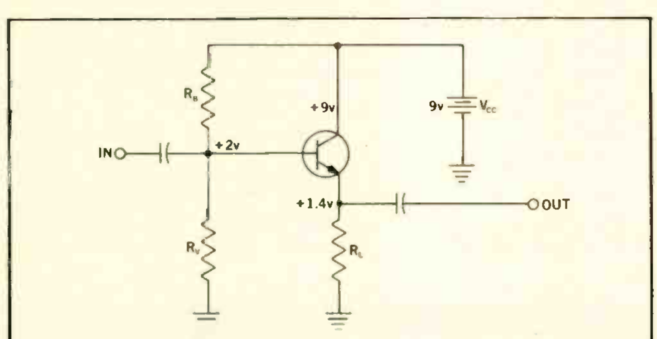

Fig. 18—Common-collector circuit (emitter follower).

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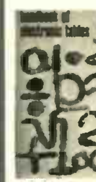

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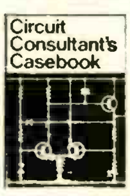

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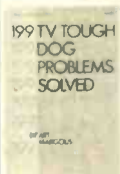

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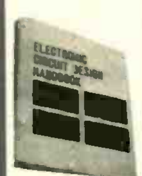

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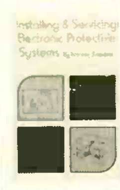

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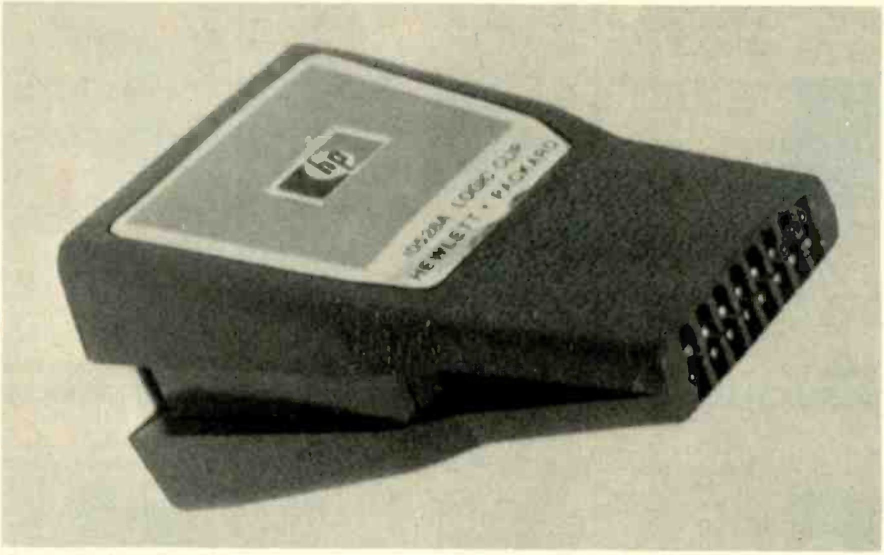


Fig. 1—Hewlett Packard's 10528A Logic Clip, used for observing digital-signal conditions present in the integrated circuits.

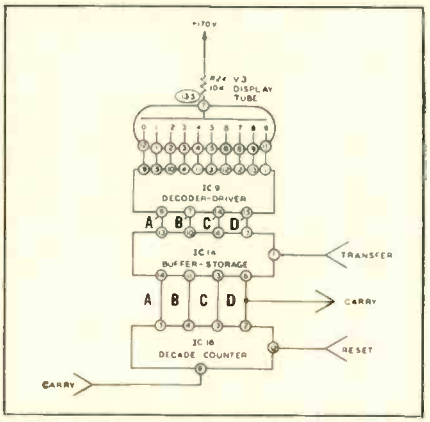


Fig. 2—Partial schematic showing connections between Decade Counter IC, Buffer-Storage IC, Decoder-Driver IC and display tube in Heath's IB101 Frequency Counter. *Courtesy of Heath Co.*

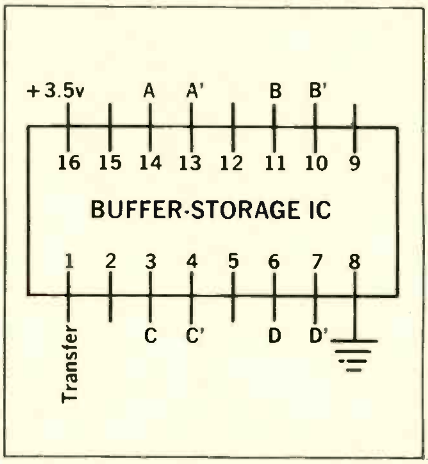


Fig. 3—Terminals of the Buffer-Storage IC as viewed from the top.

Basic Digital Circuitry

This, the sixth and last in a series of articles on digital circuitry, is concerned with buffer-storage and decoder circuits by Phillip Dahlen

■ This series of articles has been primarily concerned with the function of Heath's IB101 Frequency Counter and has covered its processing of applied signals for digital application (page 56, November 1972), the use of flip-flop circuits for decade counting (page 45, December 1972), obtaining time constants (page 48, January 1973), and sequencing the *reset*, *gate* and *transfer* regulating pulses for proper control of circuit functions during the *1kHz* mode (page 30, February 1973) and the *1Hz* mode (page 36, May 1973) of operation. This month we conclude the series by showing how the Buffer-Storage circuitry functions for maintaining the digital readout during the counting interval, plus showing the function of the display decoder circuitry.

Buffer-Storage Circuitry

All of the Buffer-Storage IC's in this instrument (IC12, 13, 14, 15 and 16) function in the same manner (Fig. 2). Many binary numbers are fed to their inputs as the decade counters complete their count. However, only after the count is completed is a *transfer* pulse applied to these Buffer-Storage IC's, causing them to accept the applied count occurring coincidental with this pulse. Thus flip-flop circuits within each IC are allowed to switch to an output state corresponding to the final

Table I	
Comparing Two Systems for Counting from 0 to 15	
Base 10	Base 2
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

Table II—Buffer-Storage Conditions

Applied Base-10 No.	Binary Input (IC Pin No.) 6	3	11	14	Binary Output (IC Pin No.) 7	4	10	13
0	0	0	0	0	0	0	0	0
1	0	0	0	A	0	0	0	A′
2	0	0	B	0	0	0	B′	0
3	0	0	B	A	0	0	B′	A′
4	0	C	0	0	0	C′	0	0
5	0	C	0	A	0	C′	0	A′
6	0	C	B	0	0	C′	B′	0
7	0	C	B	A	0	C′	B′	A′
8	D	0	0	0	D′	0	0	0
9	D	0	0	A	D′	0	0	A′
10 or 0	0	0	0	0	0	0	0	0

input state (there being four inputs and outputs for each IC). The output then remains unchanged until another *transfer* pulse permits the acceptance of an updated count.

As a review, Table I (previously printed in the December 1972 article) compares binary and decade numbers from 0 through 15—although none of the individual circuits within this instrument handles any number greater than 10, which is generally treated as zero. This information can be applied to the data in Table II, which is used for comparing binary inputs and outputs at the buffer-storage IC as different numbers are applied. (The letters A, B, C and D, and A′, B′, C′

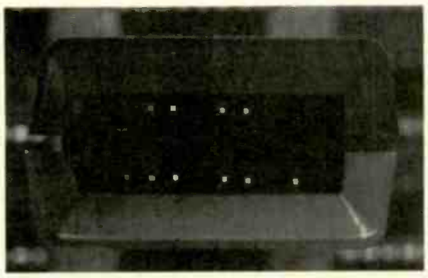


Fig. 4—Clip readout when Buffer-Storage IC digital output is *zero*.

Fig. 5—Clip readout when Buffer-Storage IC digital output is *one*.

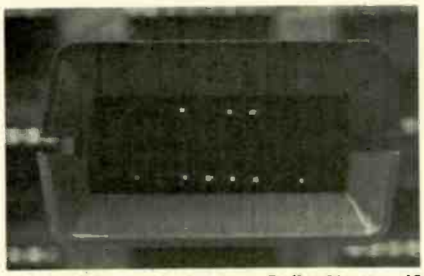


Fig. 6—Clip readout when Buffer-Storage IC digital output is *two*.

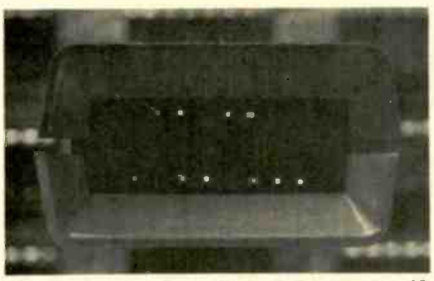


Fig. 7—Clip readout when Buffer-Storage IC digital output is *three*.

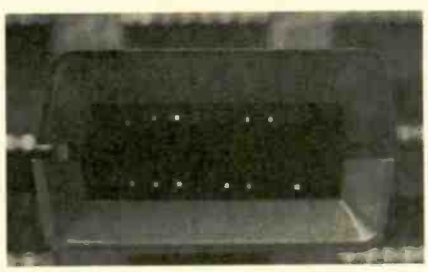


Fig. 8—Clip readout when Buffer-Storage IC digital output is *four*.

and D′ are used merely to help identify the components of each binary number when applied to the IC in Fig. 3).

Some of these signal conditions can be determined at a glance with the use of Hewlett Packard's

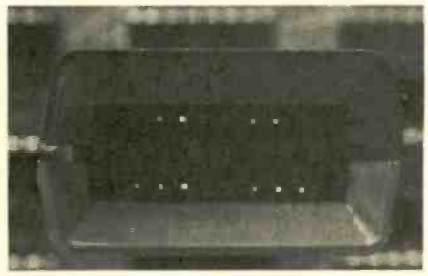


Fig. 9—Clip readout when Buffer-Storage IC digital output is *five*.

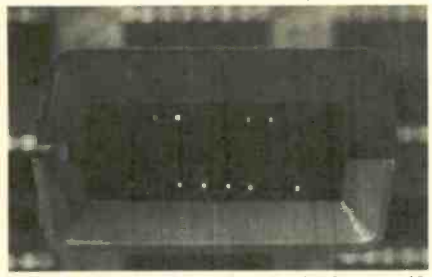


Fig. 10—Clip readout when Buffer-Storage IC digital output is *six*.

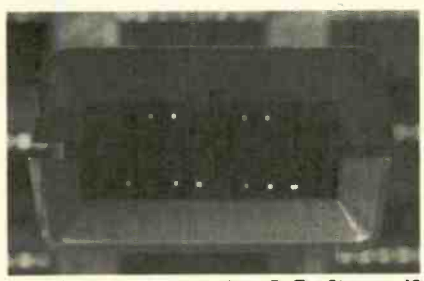


Fig. 11—Clip readout when Buffer-Storage IC digital output is *seven*.

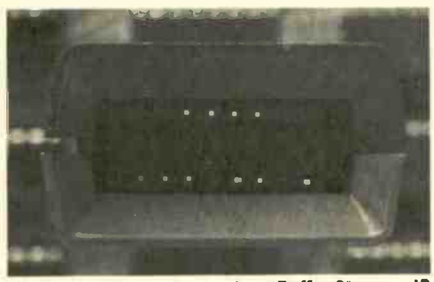


Fig. 12—Clip readout when Buffer-Storage IC digital output is *eight*.

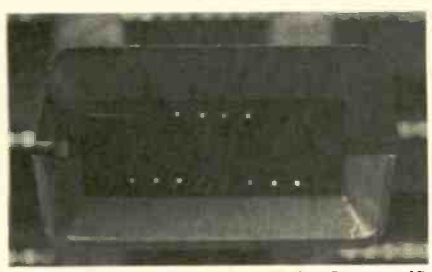


Fig. 13—Clip readout when Buffer-Storage IC digital output is *nine*.

10528A Logic Clip (Fig. 1). This extremely small instrument (also shown on this month's cover) contains 16 light-emitting diode indicators and a set of 16 electrical contacts. When clipped over an integrated circuit (like a clothes

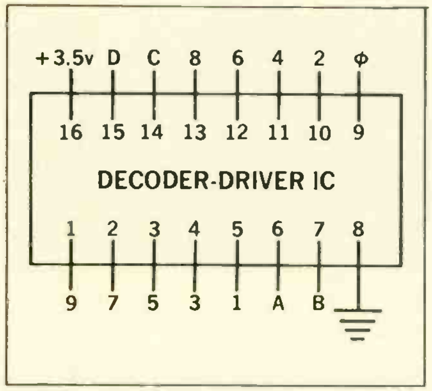


Fig. 14—Terminals of the Decoder-Driver IC as viewed from the top.

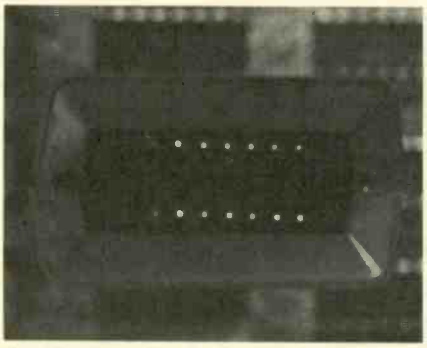


Fig. 15—Since the Logic Clip is unable to handle voltages in excess of 7.0v, placing it across excess voltages on the Decoder-Driver IC causes most of its digital readouts to glow.

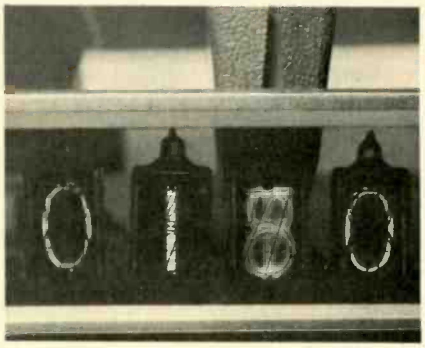


Fig. 16—The loading effect of the Logic Clip, when excess voltages are applied, causes all numerals in the neon indicator lamp to glow simultaneously.

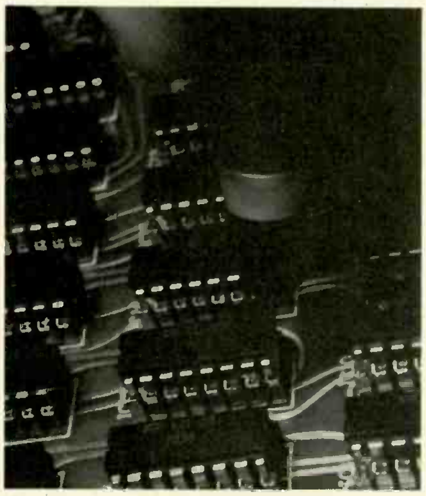


Fig. 17—No light is emitted by the Logic Probe when IC terminal voltages are less than +1.5v.

Fig. 18—Light is emitted by the Logic Probe when IC terminal voltages are greater than +1.5v.

Fig. 19—Rapidly pulsating digital signals cause the Logic Probe light to either appear to flicker or glow less brightly, depending upon the pulse rate.

Table III—Decoder-Driver Truth Table

Binary Input (IC Pin No.)				Output (IC Pin No.)									
15	14	7	6	1	13	2	12	3	11	4	10	5	9
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	A	0	0	0	0	0	0	0	0	1	0
0	0	B	0	0	0	0	0	0	0	0	2	0	0
0	0	B	A	0	0	0	0	0	0	3	0	0	0
0	C	0	0	0	0	0	0	0	4	0	0	0	0
0	C	0	A	0	0	0	0	5	0	0	0	0	0
0	C	B	0	0	0	0	6	0	0	0	0	0	0
0	C	B	A	0	0	7	0	0	0	0	0	0	0
D	0	0	0	0	8	0	0	0	0	0	0	0	0
D	0	0	A	9	0	0	0	0	0	0	0	0	0

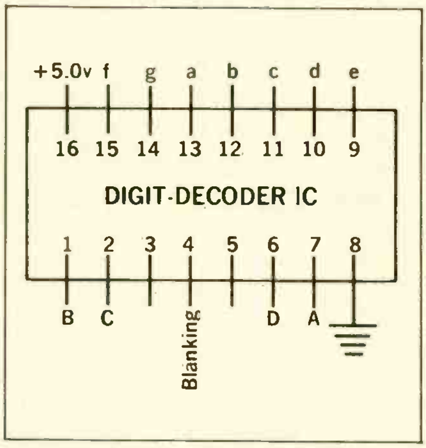
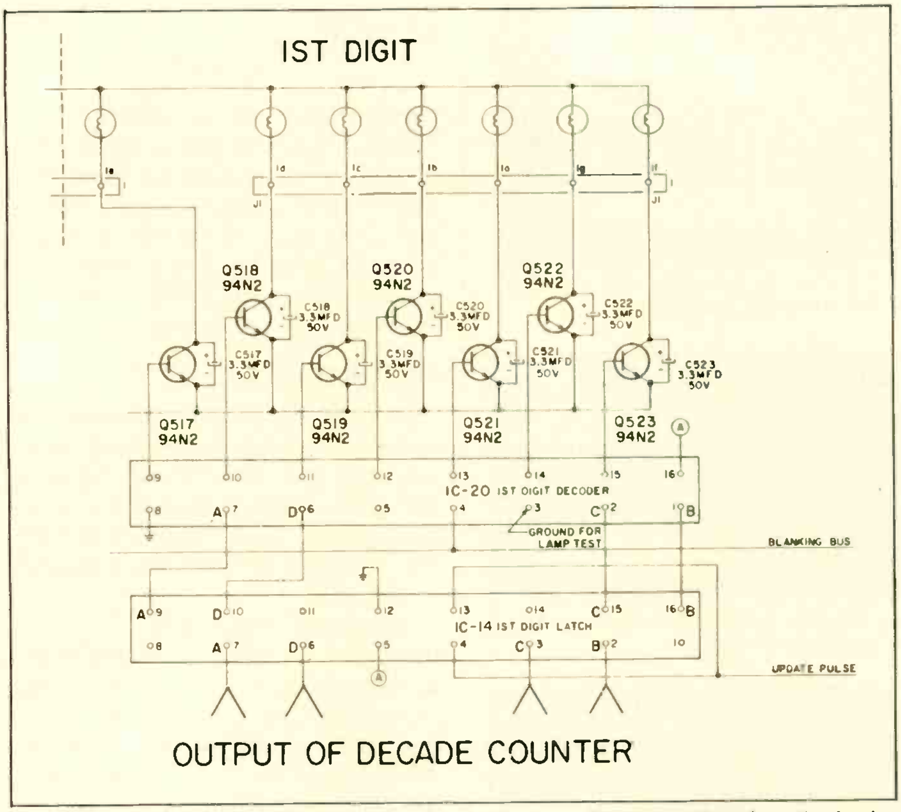


Fig. 21—Terminals of the Digital-Decoder IC as viewed from the top.

pin), the light emitted by the diodes indicates the presence of digital signal voltages (as well as bias voltages) within the integrated circuit. The instrument obtains its power from the IC circuit under test by automatically locating the V_{cc} and ground pins of the IC, and will produce a "high" glow if the IC pin under test is +2.0v and a "low" glow if the IC pin under test is below +0.8v.

By clamping the Logic Clip on one of the Buffer-Storage IC's, we can observe the presence of binary numbers zero through nine at its output (Fig. 4 through 13), although in each case the inputs appear to indicate the binary number 15. Actually, the Logic Clip is displaying the hundreds (or possibly thousands) of binary numbers applied to the input during the counting interval, the count occurring so fast that all the diodes corresponding to input signal conditions appear to glow simultaneously. Thus, there is nothing wrong with the Logic Clip, one must merely understand the signal conditions observed.



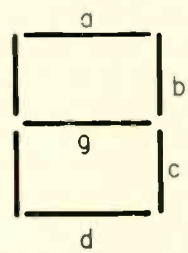


Fig. 22—Lamp configuration in the digital readout of Magnavox's Model 1500 DTI Receiver. *Courtesy of Magnavox.*

Table IV—Indicator Lamp Conditions

Number Observed	Lamps Illuminated						
0	a	b	c	d	e	f	
1		b	c				
2	a	b		d	e		g
3	a	b	c	d			g
4		b	c			f	g
5	a		c	d		f	g
6			c	d	e	f	g
7	a	b	c				
8	a	b	c	d	e	f	g
9	a	b	c		e	f	
10 or 0	a	b	c	d	e	f	

Decoder Circuitry

The Decoder-Driver IC shown in Fig. 14 is designed to conduct current between ground and any one of its 10 output terminals—depending upon the corresponding binary number applied to its input. A "truth" table showing its inputs and related outputs is provided in Table III.

Fig. 20—Partial schematic showing connections between Digital-Latch IC, Digital-Decoder IC and indicator lamp circuits in Magnavox's 1500 DTI Receiver. *Courtesy of Magnavox.*

Table V—Digit-Decoder Truth Table

Applied Base 10 No.	Input (IC Pin No.) 6	2	1	7	Output (IC Pin No.) 13	12	11	10	9	15	14
0	0	0	0	0	a	b	c	d	e	f	0
1	0	0	0	A	0	b	c	0	0	0	0
2	0	0	B	0	a	b	0	d	e	0	g
3	0	0	B	A	a	b	c	d	0	0	g
4	0	C	0	0	0	b	c	0	0	f	g
5	0	C	0	A	a	0	c	d	0	f	g
6	0	C	B	0	0	0	c	d	e	f	g
7	0	C	B	A	a	b	c	0	0	0	0
8	D	0	0	0	a	b	c	d	e	f	g
9	D	0	0	A	a	b	c	0	0	f	g
10	0	0	0	0	a	b	c	d	e	f	0

With this circuit we must also understand the limitations of the Logic Clip. Although designed so that it will not normally load down an integrated circuit, this c) is unable to handle voltages greater than +7.0v—voltages that do occur in these integrated circuits as they drive the neon indicator lamps. When such misuse of the Clip is attempted, 14 of the 16 light-emitting diodes are observed to glow simultaneously (Fig. 15) and the resulting load causes the corresponding display tube to simultaneously indicate all numbers—zero through nine (Fig. 16).

In order to obtain a visual indication of circuit functions, we substituted Hewlett Packard's 10525A Logic Probe (shown being used in Fig. 17, 18 and 19.) This instrument operates in the same basic manner as the Logic Clip, but relies on an external 7v power supply and uses an incandescent lamp near its tip to indicate the presence of voltages in excess of +1.5v. Although the instrument is shown being used in another portion of the frequency counter, it can also be used to observe which IC output is driving the neon display tube, and the corresponding binary input condition.

Another Decoder

Up to now we have restricted this series of articles to those circuits found within Heath's IB101 Frequency Counter. However, we feel that it might be useful to conclude this series with a practical application in one of the consumer products that you may be called upon some day to service—Magnavox's Model 1500 DTI Receiver, featured in our July 1972 issue (page 40). This receiver contains Digit-Latch IC's (Fig. 20) much like the Buffer-Storage IC's described previously in this month's article, which feed their signal to digit decoders. Unlike the Decoder-Driver IC in Fig. 14, which has one output for each number, this IC (Fig. 21) is designed to provide outputs that, upon amplification, drive lamps to form the shape of the decade numeral fed it in binary form. (These lamps and the patterns that they produce are shown on page 44 of the July 1972 issue.)

Fig. 22 contains a sketch of the bars that, if all illuminated at once, form a figure eight. Table IV lists the lamps that must be lit to form the numerals zero through nine. With the information in this table, plus our knowledge of binary numbers, we can compile a "truth" table (Table V) showing the output conditions that will result with the application of various binary numbers. All of this data is confirmed in Fig.

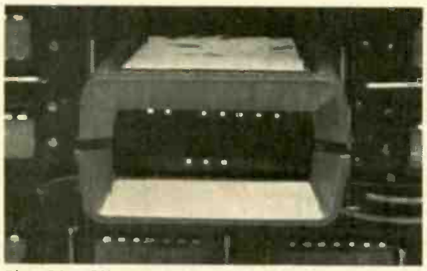


Fig. 23—Clip readout when input and output of Digital-Decoder IC are *zero*.

Fig. 24—Clip readout when input and output of Digital-Decoder IC are *one*.

Fig. 25—Clip readout when input and output of Digital-Decoder IC are *two*.

Fig. 26—Clip readout when input and output of Digital-Decoder IC are *three*.

Fig. 27—Clip readout when input and output of Digital-Decoder IC are *four*.

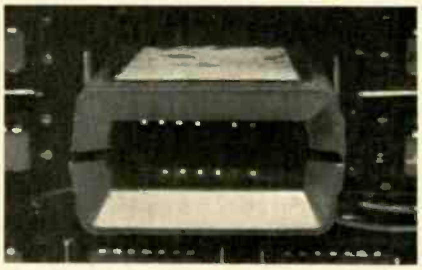


Fig. 28—Clip readout when input and output of Digital-Decoder IC are *five*.

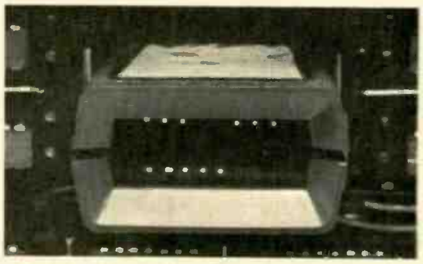


Fig. 29—Clip readout when input and output of Digital-Decoder IC are *six*.

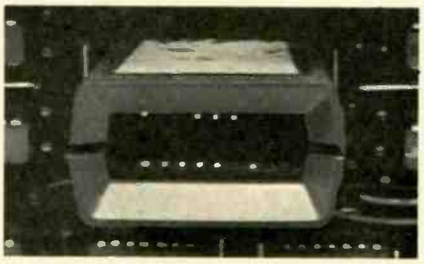


Fig. 30—Clip readout when input and output of Digital-Decoder IC are *seven*.

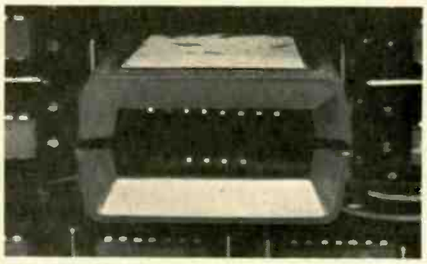


Fig. 31—Clip readout when input and output of Digital-Decoder IC are *eight*.

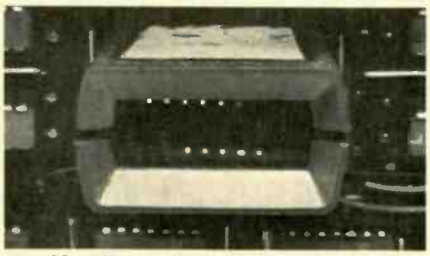


Fig. 32—Clip readout when input and output of Digital-Decoder IC are *nine*.

23 through 32 with the use of the Logic Clip.

Conclusion

There are so very many digital circuit applications now in use that this series of articles has barely "scratched the surface." However, we hope that these fundamentals have at least provided a helpful introduction to a rapidly growing area of electronics. We expect to print future articles, from time to time, which will expand upon these applications using the fundamentals described in this series. ■

TEKLAB . . .

continued from page 30

resistor R313 and coil LC301.

The brightness and contrast can be controlled simultaneously by the BRIGHTNESS control, R694, which varies the gain of the video signal with the blanking pulse, while the SHARPNESS control, R332, changes the video frequency response.

ACC and Color Killer

A burst signal from Terminal 6 and a CW output signal from Terminals 4 and 14 of IC602 have a 90° phase difference and are supplied to the phase detector circuit No. 1 (shown in simplified schematic of IC602).

An output signal from phase detector No. 1, which is proportional to the amplitude of the burst signal, is amplified by amplifier No. 1. A part of the amplified signal for the ACC control signal is obtained from Terminal 8 and is smoothed by resistor R612 and capacitor C618. Also, the amplified ACC reference signal is obtained from Terminal 7 through the clamp circuit No. 1 where the amplified signal is clamped at the reference standard level. The ACC standard reference signal and ACC signal are supplied to the ACC amplifier through Terminals 7 and 9 of IC601 respectively.

One of the output signals of the ACC amplifier, which varies in proportion to the amplitude of the burst signal, controls the gain of the chrominance BPA, the other signal of the ACC amplifier is used for functioning killer action in the chrominance amplifier through the color-killer amplifier.

CW Oscillator

The voltage controlled oscillator (VCO) produces the continuous wave oscillation with a 3.58MHz crystal and is controlled in phase and frequency by the burst signal, called AFPC (Automatic Frequency and Phase Control).

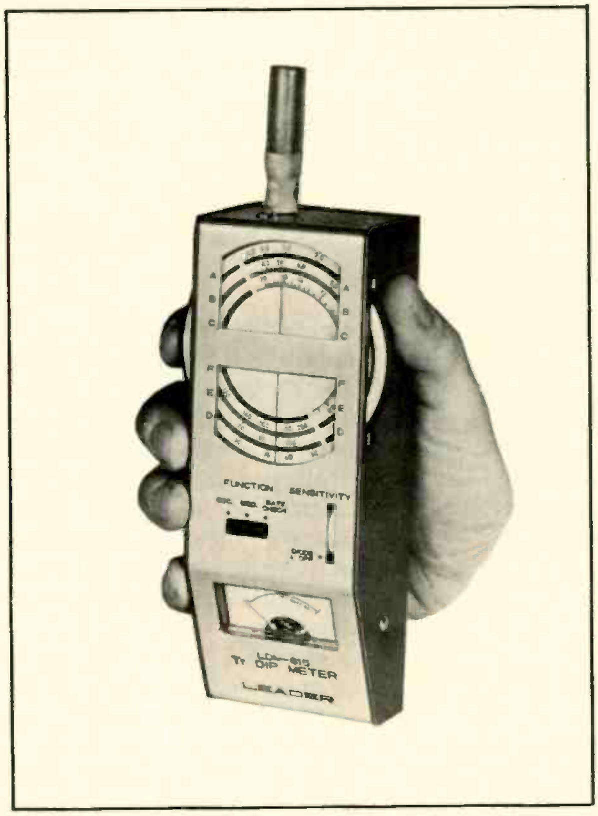
The VCO output is obtained from Terminal 14 of IC602 which is 90° different from the burst signal in phase. A part of the output CW signal from this terminal is shifted 90° in phase through coil L603, capacitor C633 and resistor R627, then supplied to Terminal 3 of

continued on page 47

Leader's Model LDM-815 Dip Meter

by Phillip Dahlen

Puts to modern use an old basic instrument design



Leader's Model LDM-815 Portable Transistorized Dip Meter. For more details circle 900 on the Reader Service Card.

■ In our rush to make use of some of the more complex instruments being developed, we sometimes tend to forget the many practical applications available with the use of some of the early stand-by circuits developed for electronic servicing. One such instrument was the old grid-dip meter, which has long been used by some veteran electronic technicians as both a signal generator and a frequency meter. A modern adaptation of such a basic instrument is the Model LDM-815 Transistorized Dip Meter.

An explanation of such an instrument is probably in order for some of the newer electronic technicians not experienced with such an instrument. When using the instrument as a frequency meter, one exposes it to a signal of unknown frequency and then tunes the instrument oscillator until it is functioning at precisely the same frequency—that is when the two signals of the same frequency "beat" together to cause a dip in the reading of a meter included in the instrument. The audio beat frequencies produced while tuning to match RF frequencies can also be heard with a pair of earphones—the volume being greatest and the pitch lowest as the unknown frequency is approached.

In a similar manner this instrument can be used to determine the resonant frequencies of antenna systems and other tuned circuits—including LC network circuits and wave traps.

This RF test instrument is said to be ideal for short-wave applications as well as TV and radio service work and is offered in a sturdy, punishment-proof case. It is also said to facilitate easy, rapid checking of receivers, transmitters and antennae in the 1.5 to 250MHz range. Other applications reportedly include use for receiver alignment and the location of parasitic oscillations.

Specifications indicate that the LDM-815 has a 310° calibrated dial, an indicating meter, six preadjusted plug-in coils, a three-position function switch, SENSITIVITY control and an earphone for modulation monitoring. The instrument utilizes a 9v battery, weighs 1.2 lb and measures 7 in. H by 2⅝ in. W by 2 in. D. ■

COLORFAX

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

MAGNAVOX

Color-TV Chassis T952—Service Tips

The March issue of Magnavox Service News contained a service tip regarding replacing flyback transformers on the T952 color-TV chassis. The information was incorrect regarding the chassis versions in which each of the two flybacks were used. The T952 chassis is used with two types of picture tubes—the bi-potential type and the Einzel-lens type. The bi-potential picture tube requires 25kv anode voltage and about 5kv focus voltage. The Einzel-lens type picture tube uses a lower anode voltage and a much lower focus voltage.

Two parts lists are contained in the Color-TV chassis T952 service literature (Manual 7328)—Sections 5.1 and 5.2. The chassis versions shown in Section 5.1 use the No. 361385-1 transformer, a 31LQ6 horizontal output tube and an Einzel picture tube. The chassis versions shown in Section 5.2 use the No. 361461-2 transformer, a 30MB6 horizontal output tube and a bi-potential picture tube.

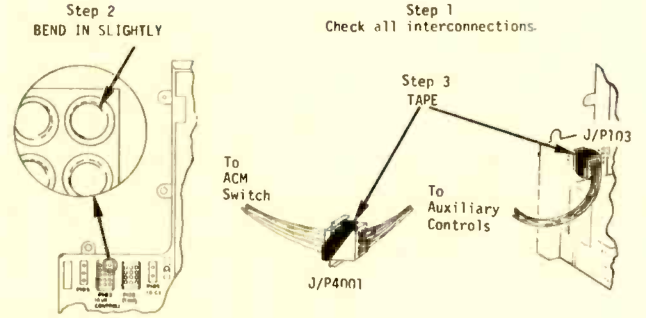
If the wrong transformer is installed in the T952 chassis using the bi-potential tube, the high-voltage rectifier will receive too much filament voltage and fail in a short time. In addition, the picture tube anode voltage will be too low. If the wrong transformer is used in the chassis with the Einzel tube, a condition of "no high voltage" will exist because of too little heater voltage applied to the high-voltage rectifier tube. Obviously, the correct transformer must be used in both instances to obtain proper and safe operation.

RCA CORP.

Color-TV Chassis CTC48—Intermittent Color as Control Bin is Opened or Closed

In those instances where intermittent color is encountered as the auxiliary control bin is opened or closed, the following procedures are suggested:

Examine wiring between chassis, auxiliary control assembly and ACM switch (J/P103 and J/P4001) for intermittent connections.



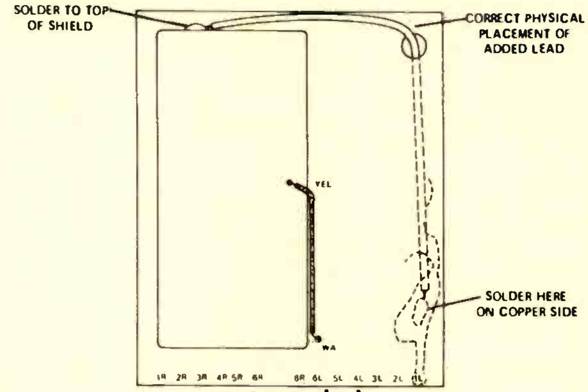
Ensure positive plug and jack connections by bending (slightly) the female pins in P103 (auxiliary control assembly-to-chassis) and P4001 (auxiliary control assembly-to-ACM switch).

Tape the mentioned plugs to their respective jacks.

PHILCO-FORD

Color-TV Chassis 3CS90/3CY90—Video Ringing in Weak Signal Areas

In the event a condition of video ringing appears in weak or fringe signal areas, the addition of a ground lead to the ACTC module (B) (Part No. 69-1000), between the top of the shield and terminal (1L) should correct the problem.



ACTC (B)
TOP COMPONENT VIEW

TRANSISTOR BIASING...

continued from page 35

casionally, however, the technician runs across common-base circuits, such as VHF RF amplifiers in FM and TV receivers. In this role, C-B amplifiers are popular because of their stability—they do not tend to oscillate, even without neutralization. Technicians are also likely to run into common-collector circuits (usually referred to as emitter followers). For example, the video amplifier circuitry of color-TV sets and the output circuitry of FM tuners sometimes feature emitter followers. They are used chiefly as impedance-matching devices.

How are these C-B and C-C amplifiers biased? To complete our survey of transistor biasing circuitry, let us have a quick look at a couple of these circuits. As seen in Fig. 17 and 18, the same biasing resistors are used as in C-E amplifiers. In the C-B circuit, R_E provides emitter bias stabilization in addition to serving as the input resistance of the circuit. C_B returns the base to ground, for ac signals. In the C-C configuration, note that the collector is tied directly to the power supply; the emitter resistor serves as the output load and also provides bias stabilization.

Conclusion

Although understanding of transistor biasing circuits is the first step toward faster and more efficient troubleshooting, and it is hoped that this review of the subject will help some readers to achieve that goal, here is a final suggestion: The next time you look at a schematic diagram, examine the transistor circuits and try and decide which of the six biasing methods are used, and also whether the transistors are hooked up in the conventional or inverted configuration. A little time spent practicing may prove rewarding. The TEKFAX Schematics attached to this issue are handy, so why not start right now? . . . . Good luck! ■

TEKLAB . . .

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IC602 through capacitor C631. A part of this CW signal and the burst signal from Terminal 6 are supplied to the phase detector circuit No. 2 in the IC, where the phase of both signals are compared. The output signal from phase detector No. 2 is amplified by the amplifier No. 2 and obtained from Terminal No. 12, where it is smoothed and then supplied to the VCO. A part of this output signal is supplied to the VCO through the clamp circuit No. 2, where the signal is clamped at the reference standard level. The first input signal to the VCO varies from the reference standard level in accordance with frequency difference between the burst signal and the CW signal. Therefore, the output signal of the VCO (CW signal) is compensated in phase and frequency by both of the input signals of the VCO.

Chrominance Circuit

The three IC's perform the following functions: Integrated circuit IC601 includes a chrominance signal band-pass amplifier, a color killer amplifier, an ACC amplifier and a burst gate circuit. Integrated circuit IC602 functions as a color process circuit (a CW oscillator with phase and frequency controller and an ACC drive signal generator) and IC603, functions as a chrominance demodulator.

Chrominance Signal Band-Pass Amplifier

The chrominance signal is fed to Terminal 10 of IC601 and the amplified signal is obtained from Terminal 11 and 12 through a differential-type chrominance signal BPA (Band-Pass Amplifier). Chrominance signal from Terminal 12 is then supplied to Terminal 1 which is the input Terminal of the chrominance amplifier through transformers T601 and T602. The output chrominance signal of the chrominance amplifier is obtained from Terminal 3.

The color saturation control system differs from a conventional circuit because of the dc control. DC "color" saturation control is accomplished by changing the dc bias voltage of one transistor in an IC differential amplifier by variable resistors R692 and R693 connected to Terminal 15. Sync pulse from the collector of the sync amplifier transistor TR401, is fed to Terminal 16 of IC601 through resistor R403, capacitor C619 and coil L602. The horizontal pulse is then shifted in

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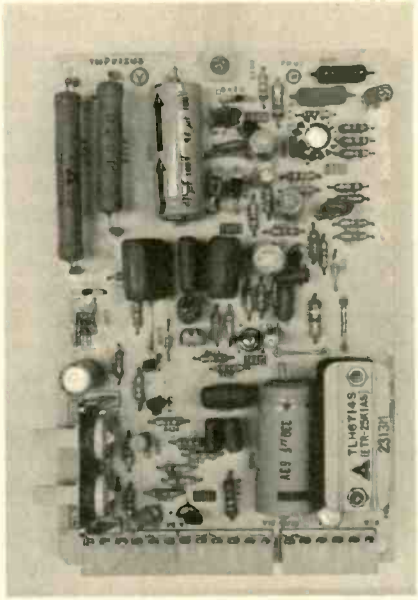


The "V" Board contains the vertical oscillator and drive circuits.

TECHNICAL DIGEST

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

SYLVANIA

15,700Hz Visual Whistle Detector

On occasion there are complaints from consumers that they are being "driven out of their bird" by a loud squeal or whistle emanating from their color TV receiver. Some cannot hear this "squeal", and consequently may think the customer is some kind of a nut, and the "squeal" is only a figment of his imagination or something that is concocted in the dark, deep recesses of his "demented" mind.

Actually, most customers are not "nuts", and the "squeal" (15,750Hz) is real and not imagined.

Since some of us cannot hear this 15.75kHz whistle or squeal, it is difficult, if not impossible, to determine its source and come up with a solution to the problem.

This whistle or squeal is usually due to a mechanical, sympathetic vibration somewhere in the horizontal circuit of the TV set. It may emanate from any one of a number of sources such as: (a) flyback transformer, (b) pincushion transformer, (c) deflection yoke, (d) damper tube, (e) chassis-support rails, (f) RF chokes in damper circuit and associated high-voltage wiring and components, or the (g) tripler.

If we can find the source of the whistle, we may be able to correct the problem.

Since the writer has difficulty in hearing this whistle, he experimented a bit and found a simple way of testing for it.

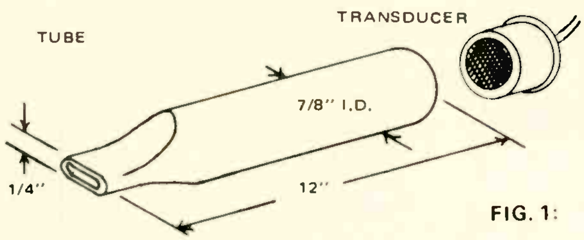


FIG. 1:

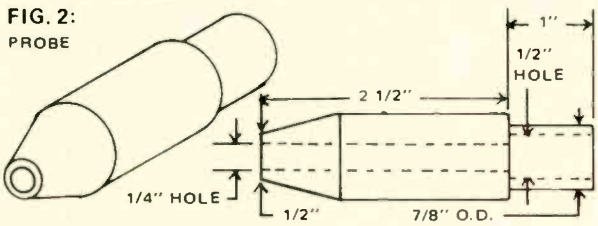


FIG. 2:

The device used is nothing more than a transducer (used in Sylvania remote systems) part number 12-23768-1, mounted in the end of a ⅞ in. ID tube which has been flattened on one end to make it directional.

A metal tube was used (because it was conveniently laying around in the junk box). The tube was wrapped with Mylar insulating material to make it shock proof, since it will be used to probe around the high-voltage section. A plastic tube would be better for safety purposes. The end of the plastic tube can be fitted with a cone shape head to make the unit directional.

The transducer output is fed into the scope's vertical input using approximately .1v/cm or .2v/cm calibration. Take off the 10:1 attenuator and use direct feed. The 15.750kHz can now be seen on the screen. The 15.750kHz will be evident on the scope even when the "whistle" or "squeal" cannot be heard. However, when the whistle is audible (due to mechanical vibration) the amplitude of the signal displayed on the CRT screen increases considerably. The visual whistle detector will help pinpoint the source of the whistle, since it is quite directional.

The transducer probe, as previously noted, may be fed directly into the scope. However, if you want to add sophistication to the unit, and happen to have an old remote control receiver laying around, it is fairly simple to change the resonant frequency of one of the tank circuits to bring the frequency down to 15.75kHz.

A RC-11 remote receiver (part number 02-33669-2) was used. Using the VOLUME down driver circuit (Q1062) . . . volume up or channel driver could have also been used . . . C1068 (680$\mu\mu$f) was removed and replaced by a 3,000pf (.003μf) Mial capacitor. The coil (L1054) was then resonated at 15.75kHz. The output signal to the scope's vertical input can be monitored across the common emitter resistor, R1080 (18Ω). Of course, with amplification of the signal, the scope vertical attenuation will necessarily have to be increased.

Once the source of the squeal has been located, the next problem is the cure. Below are listed some possible sources of whistle and some possible cures:

SOURCE OF SQUEAL	POSSIBLE CURES
a) Flyback Transformer	1) Tighten flyback clamp retaining nuts on flyback at chassis mounting bracket. 2) Wedge a sliver of wood between flyback core and winding. 3) "Drip" hot glue from a "hot glue gun" between core and winding. 4) Shock mount flyback on cork pad or rubber grommets. 5) Change flyback.
b) Pincushion Transformer (mounted on convergence board)	1) Resolder tabs holding transformer to board. 2) Replace transformer.
(mounted on chassis)	1) Tighten hold down screws. 2) Replace transformer.
c) Deflection Yoke	1) Tighten yoke clamp. (Be Careful! Don't overtighten. Those CRT's are expensive.) 2) Replace yoke.
d) Damper Tube	Replace tube with one of the new solid state direct plug in devices.
e) Chassis Support Rails	Bend tabs where they protrude through chassis, and solder to chassis.
f) RF Choke on Damper Tube	Reposition.
High Voltage Wiring	Reposition.
g) Tripler	1) Mount cork pads between tripler and chassis. 2) Replace tripler.

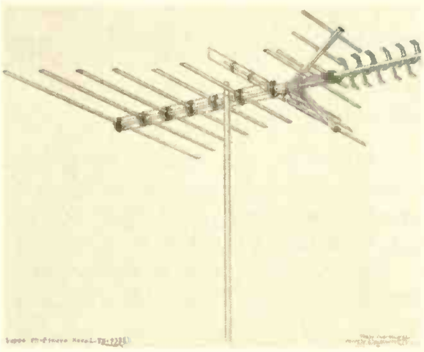
NEW PRODUCTS

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

ANTENNA 703

TV/FM antenna designed specifically for color

Introduced is a new series of high-gain all-channel TV/FM antennas designed specifically for color. Called Super VU-Finders, the antennas are said to provide more gain and flatter response, which is essential in providing top-quality color reception on all VHF and UHF channels. Reportedly



made of heavy gauge aluminum with a golden armor coating to minimize corrosion, they are easy to mount because they employ positive locking fold out elements, a single U-Bolt mast locking assembly and center-of-gravity balance. An especially important feature of the antennas is that they are electrically grounded to the mast. This provides a safety factor and makes it easier for technicians to test downlead continuity. Jerrold Electronics Corp.

FREQUENCY COUNTER 704

Frequency range from 5Hz to 175MHz

A six-digit electronic frequency counter, Model EC-175, is said to enable the operator to measure crystal

frequencies without mathematical computation. The counter reportedly reads out frequencies ranging from 5Hz to 175MHz. A five position range switch—with gate times of 1ms, 10ms, 100ms, 1sec and 10sec—reportedly allows direct measurement of any in-range frequencies to within .1Hz. The six-digit LED display is said to feature automatic blanking, automatic decimal point positioning, and leading zero suppression. There is an overrange LED indicator for readings over six digits and a separate LED indicator for count rate. A built-in 100kHz harmonic generator for direct calibration to WWV is reportedly incorporated. Other features are said to include a 10.7MHz crystal oscillator for AFC locking and IF alignment work, and a built-in MOSFET preamp that provides a sensitivity of 100mv at 100MHz. The unit measures 6½ by 2⅝ by 9½ in. and weighs 4½ lb. Regency Electronics, Inc.

TEST JIG ADAPTERS 705

Assortment of yoke adapters and convergence loads for test jigs

A yoke adapter package, called Redi-Rack, is a recommended assortment of yoke adaptors and convergence loads used in color-TV service work in conjunction with reportedly any make of test jig. The package

offers ready access to an adaptor in the shop or on the bench, saving shopping time and delivery waiting time for a particular adaptor. The package is complete with mounting boards, hooks and complete cross reference to thousands of color-TV chassis. TeleMatic.

DESOLDERING IRON 706

Features power indicating light

A Model 510 pencil desoldering iron with safety power indicating light features a three-way on-idle-off switch, and supporting bracket to insure prop-

continued on page 50

NEW PRODUCTS...

continued from page 49

er alignment. The iron reportedly operates at 40w and idles at 20w for longer tip life. The built-in light indicates operation at both heats with a different intensity for each. Other features are said to include a cool, unbreakable polycarbonate handle, flexible, burn-resistant neoprene cord and eight tip sizes to handle virtually any job. Enterprise Development Corp.

MATCHING TRANSFORMER 707

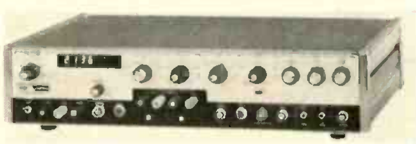
Combines economy with interference rejection

A 75Ω-to-300Ω matching transformer is developed for use in Master Antenna TV (MATV), Cable TV and home TV antenna systems. Reportedly capable of handling UHF, VHF and FM frequencies, the Model T-4000 matching transformer is said to be superbly balanced (40dB) to reject direct pickup. An important mechanical feature is that it provides an exclusive connector which mates with standard F fittings as well as the new snap-fit SF-9 connector. The transformer insertion loss is reportedly less than 0.6dB at VHF and 1dB at 500MHz. The unit is said to provide ac/dc blocking of up to 500v. Jerrold Electronics Corp.

TEST INSTRUMENT 708

Eight of the most commonly used test instruments

The Versatester 1 is designed to take the place of eight commonly used test bench instruments in one unit. Pulses, sinewaves and squarewaves are

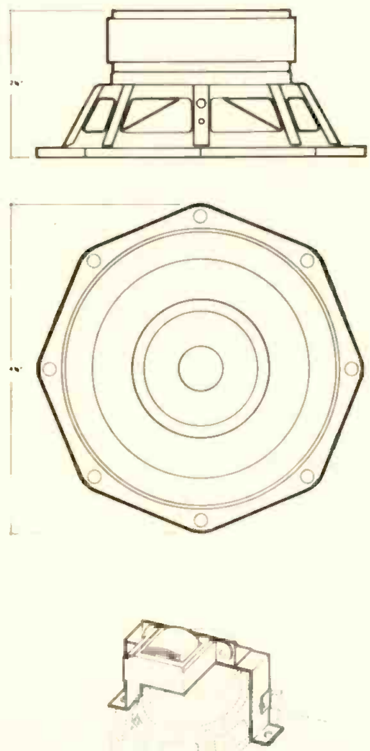


reportedly signals generated by the instrument, plus dc power. Signal frequency, dc voltage and dc resistances can be measured. The following functions may reportedly be selected for display on the instrument's four-digit readout. Totalized count of externally applied random events without dimension; frequency of externally applied repetitive signals in Hz, kHz or MHz, with autoranging; amplitude of externally applied signals in dc or ac volts; or dc resistance of an externally applied unknown in Kohms or Mohms; the frequency of its pulse, sine or squarewave output; its rms amplitude sinewave output; polarity and amplitude of the upper level (top of positive-going pulse or baseline of negative-going) or the amplitude of the lower level (top of negative-going pulse or baseline of positive-going pulse) of its pulse or squarewave output. The unit measures 3½-in high by 16¾-in. wide by 16¾-in. deep. Systron-Donner Corp.

SPEAKER 709

Features a 90° angle of distribution

A Model FC-104 speaker has a specially designed ceramic magnet with a reported flux density of 10,500 Gauss; high compliance for fine, low-frequency reproduction; and a consistently smooth extended frequency response



that could only be previously achieved with much larger speakers. The speaker is said to feature a 90° angle of distribution, making economical placement of speakers possible. The speaker is 4⅜ in. square by 2⅛ in. deep. Soundolier, Inc.

OSCILLOSCOPE 710

A portable instrument weighing just 3.4 lb

A portable dual-trace, 500kHz scope, Model 212, is said to be double insulated, permitting safer high-voltage measurements. Integral 1M probes

are reportedly stored in specially designed compartments when not in use. These probes are color-coded with the vertical deflection controls to minimize measurement error. Trigger controls are said to be simplified to one rotary control. Up to 5 hrs. of operation are reportedly provided from rechargeable internal batteries. The scope measures 3 by 5¼ by 9 in. and weighs 3.4 lb. Tektronix.

TUNER CLEANING PADS 711

Continuously cleans and polishes strip-type TV tuners

A new innovation in tuner care products is introduced called P.P.P. (Permanent Polish Pads). Placed in

the cover of each can of the company's Blue Stuff is a strip of self-adhesive pad, enough for two tuner applications. After mounting, a generous amount of Blue Stuff for tuners is saturated into the pad. As the tuner drum is rotated, the treated pad cleans and polishes the contacts of the tuner. Tech Spray.

TAPE TENSION GAUGE 712

Measures tension of moving or stationary magnetic tape

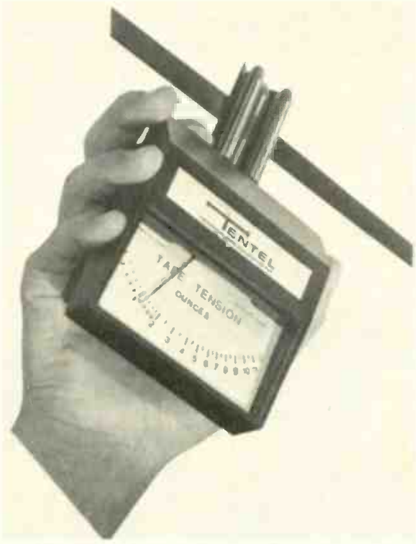
A hand-held Tape Tension Gauge which measures tension of moving or stationary magnetic tape, is said to lend itself to nearly all applications for measurement of tape tension. Two models, currently available, accommodate ⅛ in. to 2 in. tape widths and are reported to be easily inserted onto the tape. Ranges presently offered are 3, 12 and 20 oz (100, 350 and 600

continued on page 52

NEW PRODUCTS...

continued from page 51

gram) full-scale configurations. Logarithmic scales provide improved

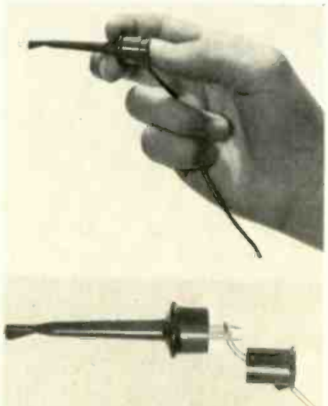


readability for low tensions; reading of ±.05 oz at 1 oz are said to be easily obtained on the 12 oz model. Tentel.

TEST CLIP 713

Permits assembling of test leads for specific requirements

A do-it-yourself "Grabber" has been added to the popular series of



Mini Test Clips. The product, Model 3925, permits the user to quickly assemble his own test leads for specific testing requirements. The unit is completely field serviceable and will, reportedly accept any wire up to .090 in. in diameter. The unit features a plunger-action contact hook designed to connect with and firmly hold components leads or terminals without damage. The specially constructed probe tip slips down over a .025 in. square Wire-Wrap pin to make positive connection. The body and cap are said to be molded of Lexan polycarbonate to provide greater strength and resistance to melting while soldering. Pomona Electronics, Co.

TEKLAB...

continued from page 47

phase by an integral circuit consisting of resistor R611 and capacitor C616 to form the burst gate pulse. A burst signal is made from a part of the output signal of the chrominance amplifier by a burst gate pulse in the burst gate circuit. A burst signal is obtained from Terminal 14 of IC601 and applied to Terminal 6 of the color oscillator IC602.

Horizontal Deflection and High-Voltage Rectifier Circuits

The horizontal oscillator circuit and driver stages employed in this chassis are quite similar to other conventional transistorized color-TV receivers.

The horizontal-output transformer is connected to the collector of the horizontal-output transistor TR551. Capacitors C554 and C555 regulate the high voltage and may be open circuited at the collector of the horizontal-output transistor when the high voltage is less than 26.5kv at no beam current.

A full-wave solid-state tripler D554 is used for high-voltage rectification.

Summary

We felt that the chassis is well designed for serviceability. The modules are vertically mounted in rigid board guides to allow for a compact chassis and yet easily removed. We found the handles on the modules an excellent feature for easy removal reducing chances of component damage, the first we encountered on a modular chassis.

The excellent picture, screen size and the features found on this color-TV set should place it in popular demand. ■

LETTERS...

continued from page 12

because I anticipate that he will become suspicious in such a case—especially if he is a new customer.

I agree with what you told the technician about there being no release that would have protected him from such a situation. What the technician should have done was to phone the customer and let him know how much it was going to cost to fix his set and get his approval before going ahead with the repair.

Louis Montoya

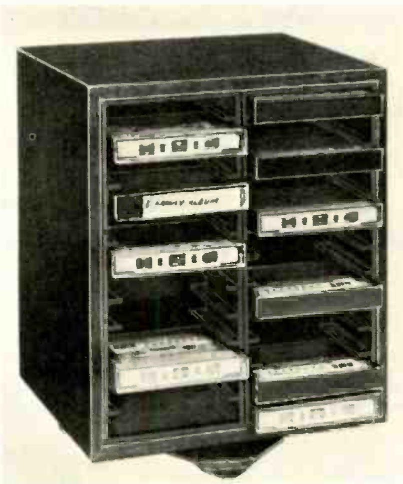
DEALER SHOWCASE

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

TAPE STORAGE 714

Cases revolve on swivel bases

A tape turntable storage unit, Model 1505, is designed for holding 48 cassettes. The unit is said to be finished in a walnut grain decor and made of molded plastic with deep compartment trays to store and protect tapes. The cases revolve on ball bearing swivel bases. RMS Electronics, Inc.



STEREO HEADPHONES 715

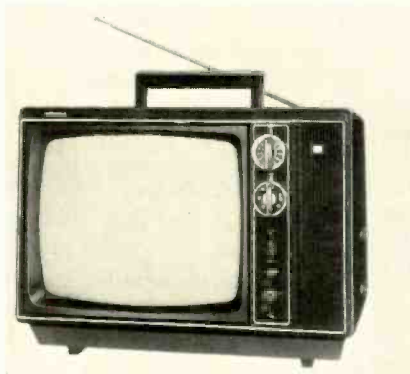
Features wind-up self-storing cord

A pair of stereo headphones has been introduced that is designed to combine listening pleasure with an exclusive new feature—a wind-up reel which stores a 9-ft cord inside the earcup. The cord pulls out to desired length and is said to be easily retracted into the earcup with a hand crank to eliminate tangled, untidy cords when the headset is not in use. The Model HS-2000D Stereo Headphones reportedly have all the features of top-quality headsets, including reflex ports for flat bass response, well padded earcups and headband, slide VOLUME controls and attractive appearance. Pfanstiehl.

TV MONITOR 716

Will operate on ac/dc power

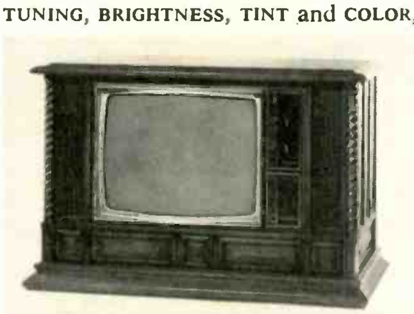
A new 12-in (measured diagonally) B/W TV receiver/monitor comes equipped with built-in EIA-J-Type connector and will reportedly receive VHF and UHF as well as closed-circuit signals. For remote use, the Model P-43 will operate on a car or boat battery or from an optional battery pack, as well as on ac. Hitachi Sales Corp.



COLOR-TV CONSOLE 717

Features module design concept

Introduced is the Model San Diego color-TV set featuring a solid-state chassis (with the new super module design concept) and an Electromatic control series for AUTOMATIC TUNING, BRIGHTNESS, TINT and COLOR, plus CENTER/DETENT controls for customer-preference tuning. The 26-in. screen (measured diagonally) console highlights Spanish styling in its cabinetry. Electrohome.

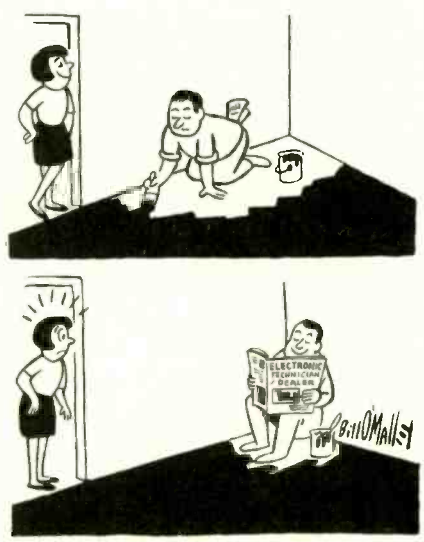


READERS SERVICE INDEX

ADVERTISER'S INDEX

NEW PRODUCTS

TEST INSTRUMENT



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102	110	118	126	134	142	150
103	111	119	127	135	143	151
104	112	120	128	136	144	152
105	113	121	129	137	145	153
106	114	122	130	138	146	154
107	115	123	131	139	147	155
108	116	124	132	140	148	156

TEST INSTRUMENTS

900	908	916
901	909	917
902	910	918
903	911	919
904	912	920
905	913	921
906	914	922
907	915	923

NEW PRODUCTS

700	708	716	724	732	740
701	709	717	725	733	741
702	710	718	726	734	742
703	711	719	727	735	743
704	712	720	728	736	744
705	713	721	729	737	745
706	714	722	730	738	746
707	715	723	731	739	747

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C. ☐ Retailer with Electronic Service Dept.
D. ☐ Electronics, Radio, TV Manuf
E. ☐ Industrial Electronic Service
F. ☐ Wholesale, Jobber, Distributor
G. ☐ Other (Specify)..........

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ELECTRONIC TECHNICIAN/DEALER TEKFAX

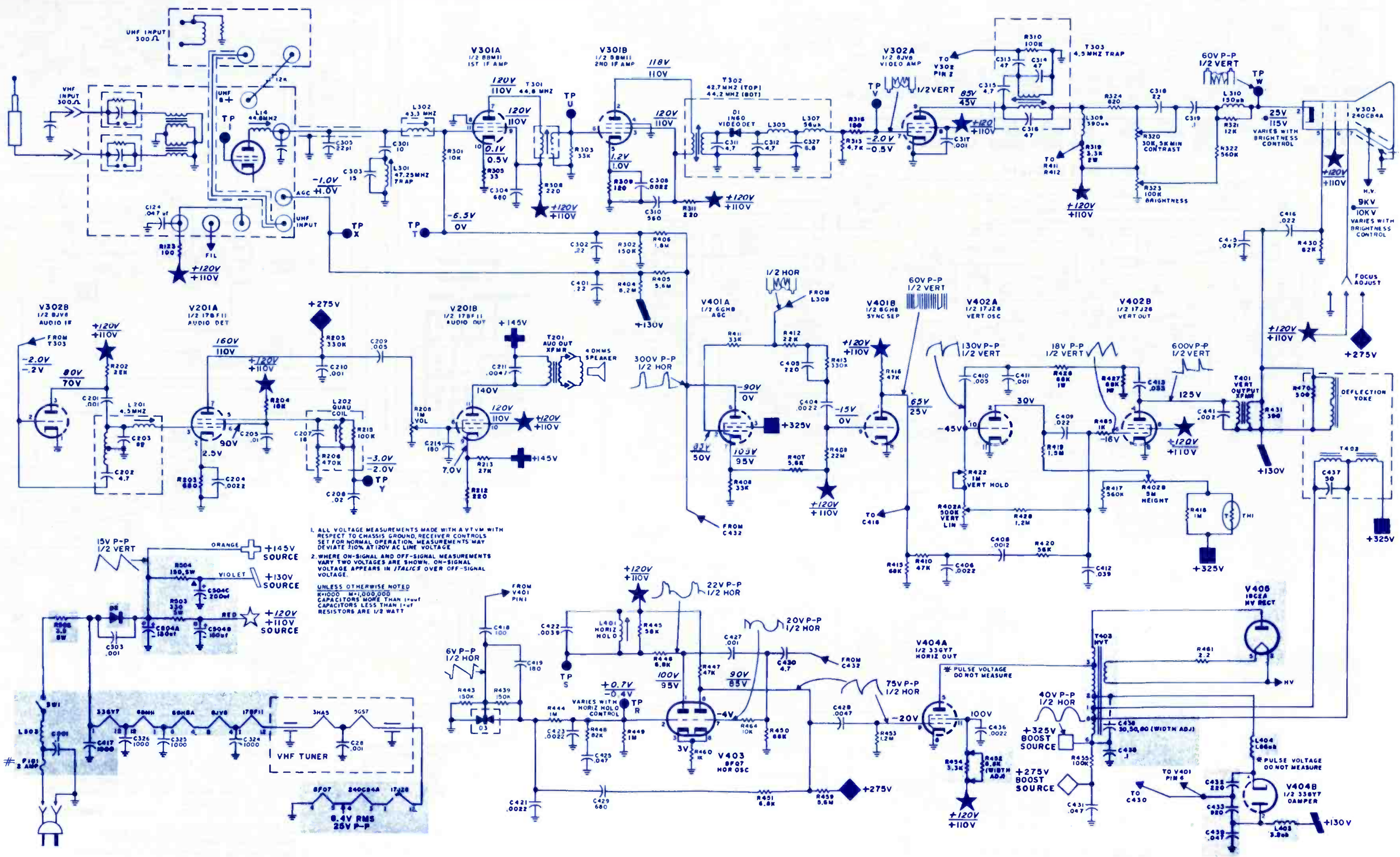
COMPLETE MANUFACTURER S' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 4 NEW SETS

GROUP 251

1478
GENERAL ELECTRIC
TV Chassis W-1

JULY • 1973

SYMBOL — DESCRIPTION	GENERAL ELECTRIC PART NO.
R502—3.9 Ω	ES14X17
R503—330 Ω, ±5%, 5w	ES14X18
R504—150 Ω, ±5%, 5w	ES14X19
C504—capacitor, electro, 150 μf, 165v, 150μf, 150v, 200 μf, 150v	ES31X26
C725—470P, ±20%, 1.4kv dc, 150vac	EP18X3
control, vert lin & vert ht	ES49X36
D3—diode, dual, horiz AFC	ES57X6
L202—coil, quad	ES36X49
L301—coil, 47.25MHz trap	ES36X50
L401—coil, horiz, stab	ES36X56
T201—xformer, audio output	ES64X8
T302—xformer, video 1F detect	ES61X7
T303—xformer, audio 1F	ES61X8
T401—xformer, vert output	ES64X9
T403—xformer, horiz output	ES77X9
deflect yoke	ES76X4
fuse, 2a	ES10X9 (F101)
thermistor (TH 1)	ES14X15
tuner, UHF	ES85X7
tuner, VHF	ES86X7



1. ALL VOLTAGE MEASUREMENTS MADE WITH A VTVM WITH RESPECT TO CHASSIS GROUND, RECEIVER CONTROLS SET FOR NORMAL OPERATION. MEASUREMENTS MAY DEVIATE ±10% AT 120V AC LINE VOLTAGE.
2. WHERE ON-SIGNAL AND OFF-SIGNAL MEASUREMENTS VARY TWO VOLTAGES ARE SHOWN. ON-SIGNAL VOLTAGE APPEARS IN *ITALICS* OVER OFF-SIGNAL VOLTAGE.

UNLESS OTHERWISE NOTED
K=1000 M=1,000,000
CAPACITORS MORE THAN 1=uuf
CAPACITORS LESS THAN 1=uf
RESISTORS ARE 1/2 WATT

1479

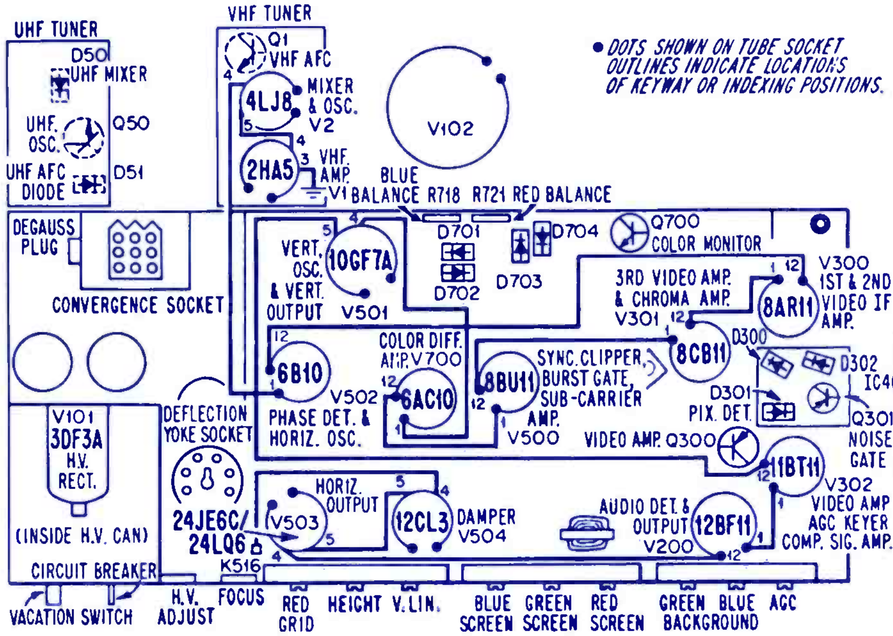
ADMIRAL

Color-TV Chassis
8K18

ELECTRONIC TECHNICIAN/DEALER TEKFAX

JULY • 1973

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 4 NEW SETS



SYMBOL	DESCRIPTION	ADMIRAL COLOR-TV PART NO.
R109	75K, horiz, hold-coarse	75A177-2
R110	20K, horiz hold-fine	75A177-2
R112	500K, high voltage, adjust	75A159-12
R121	12M, focus control	75A157-14
R123	750K, vert hold control	75A135-46
R127	volume control	75A135-46
R509	3.4M, vert lin, triple cont	75A155-8
R517	100K, vert height, triple cont	75A155-8
R734	100K, red grid, triple cont	75A155-8
R739	1.5M, blue screen, triple cont	75A155-1
R740	1.5M, green screen, triple cont	75A155-1
R741	1.5M, red screen, triple cont	75A155-1
RV101	VDR	61A52-2
RV102	VDR	61A46-13
RT101	thermistor (degauss)	61A57-5
RV500	varistor, vert	61A65-1
C109A	80 n, 175v, electro	67A15-410
C109B	100 n, 400v, electro	67A15-410
C109C	30 n, 400v, electro	67A15-410
C109D	10 n, 150v, electro	67A15-410
C110A	120 n, 400v, electro	67A15-409
C110B	20 n, 400v, electro	67A15-409
C110C	100 n, 150v, electro	67A15-409
C110D	4 n, 300v, electro	67A15-409
L105	filter choke	74A31-1
L106	yoke, deflect	94A379-4
L201	sound quad coil	72A366-1
L306	4.5MHz trap coil	72A367-1
L501A, B	horiz freq sinewave coil	72A373-1
T101	power xformer	80C116-1
T102	vert output xformer	79D153-5
T103	horiz output xformer	79D162-2
T200	4.5MHz driver xformer	72A361-1
T201	audio output xformer	79A151-1
T700	chroma take-off xformer	72A368-1
CB101	circuit breaker	84A17-16
F101	4a fuse	84A7-12
F102	.35a fuse	84A28-8

RUN CHANGES

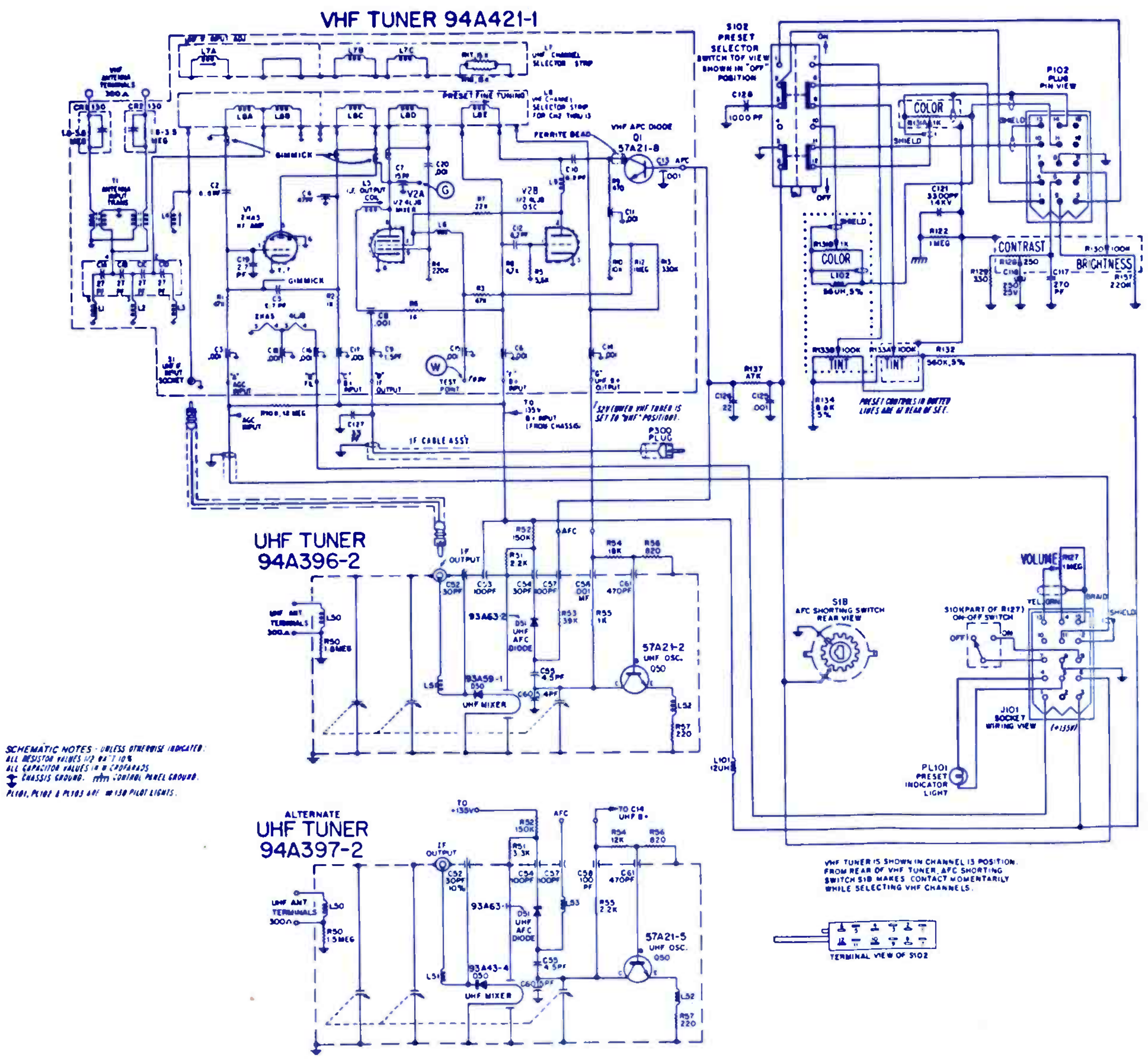
(16) Start of production

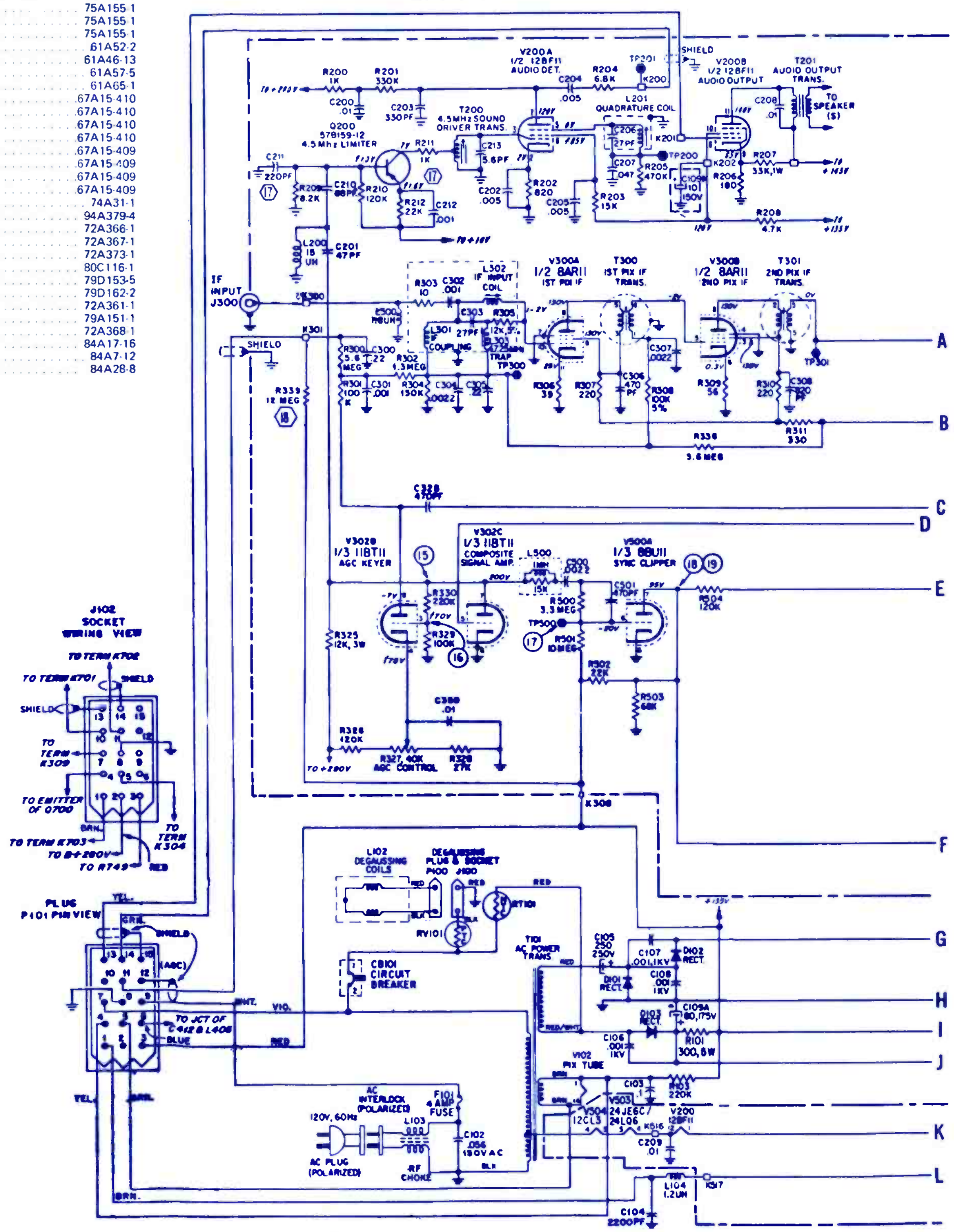
(17) 4.5MHz limiter circuitry added. See inset at right for 4.5MHz Sound Driver and Audio Detector in Run 16 sets.

(18) To simplify circuitry 12 meg resistor removed from tuner cluster & connected from point K301 to K308 as R339.

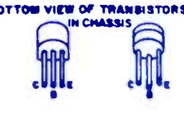
(19) No service significance.

(20) L318 was added to eliminate possibilite of "tweet in some areas.



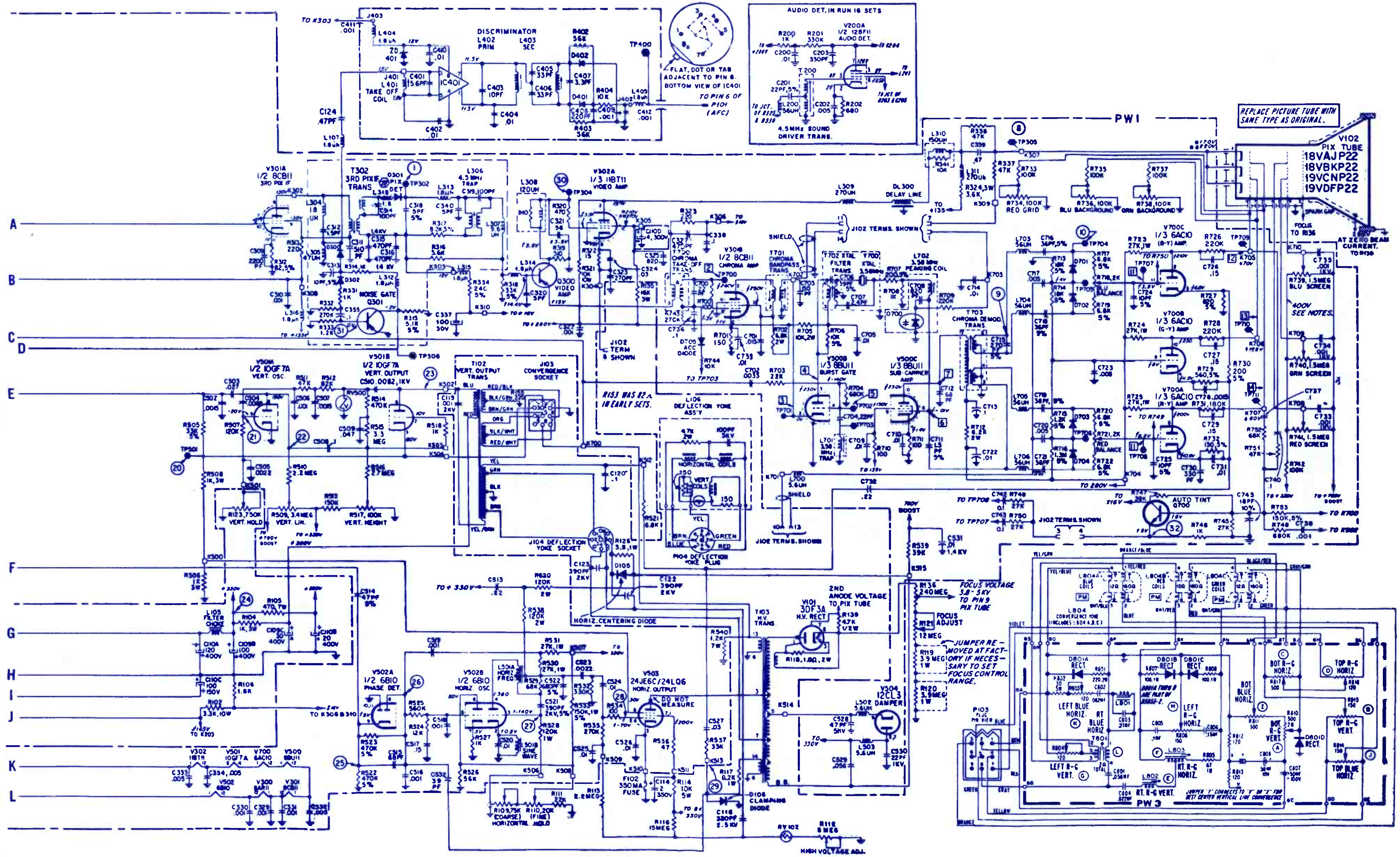


BOTTOM VIEW OF TRANSISTORS IN CHASSIS



NOTES:
1. ALL RESISTORS ARE 1/2 WATT, 10%, UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS ARE IN MFD, UNLESS OTHERWISE NOTED.
3. CAUTION: USE ISOLATION TRANS WHEN WORKING ON CHASSIS.
4. DC VOLTAGES MEASURED WITH "VTVM" PLACED BETWEEN POINTS INDICATED & CHASSIS GRN, WITH NORMAL SIGNAL INPUT.
(*) INDICATES VOLTAGE READING TAKEN WITH BRIGHTNESS CONT AT MAXIMUM ROTATION (FULL CW).
(*)(*) INDICATES VOLTAGE READINGS TAKEN WITH BRIGHTNESS CONT AT MINIMUM ROTATION (FULL CCW).
† INDICATES VOLTAGE READING TAKEN WITH COLOR BAR GENERATOR PRODUCING 3V PP AT TP303.
5. WAVEFORMS ARE TAKEN WITH NORMAL SIGNAL INPUT.

ADMIRAL
Color-TV Chassis
8K18



6. LINE VOLTAGE INPUT SET AT 120V AC.
7. (/) INDICATES THE VOLTAGE WILL VARY WITH FINE TUNING SETTING FROM 0V TO ±3V.
VOLTAGE AT PINS 4,5 & 6 OF PICTURE TUBE WILL VARY WITH SETTING OF SCREEN CONTROLS.
NUMBERS IN CIRCLES OR SQUARES IDENTIFY WAVEFORM OBSERVATION LOCATIONS.
CONDITIONS FOR TAKING WAVEFORM MEASUREMENTS ARE GIVEN WITH WAVEFORM PHOTOGRAPHS.
INDICATES VOLTAGES WILL VARY WITH VIDEO CONTENT OF PICTURE RECEIVED & ARE AVERAGE READINGS.
(○) INDICATES VOLTAGES WILL VARY WITH BACKGROUND CONTROL SETTINGS.

SAFETY NOTICE

A

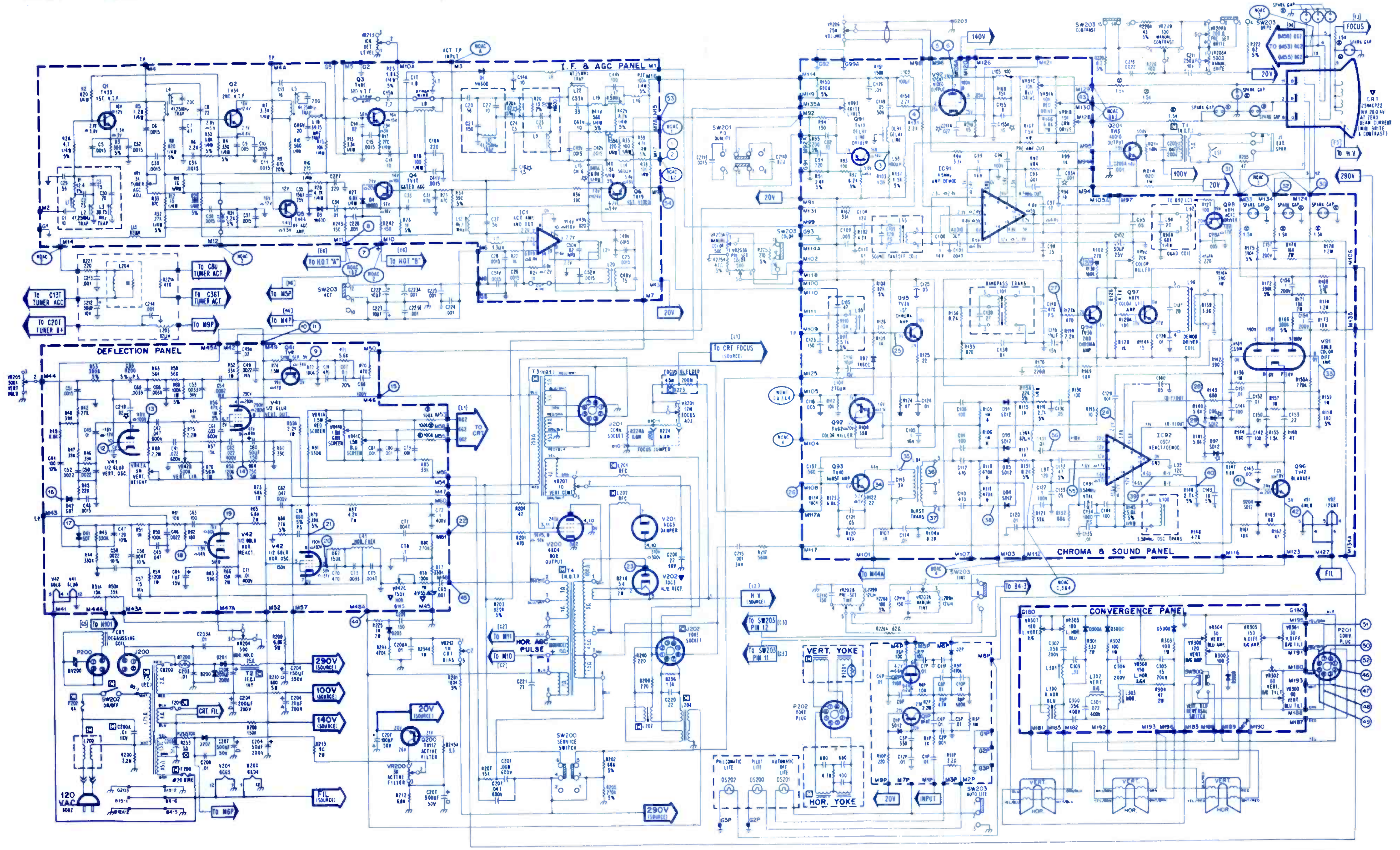
THE DESIGN OF THIS RECEIVER CONTAINS MANY CIRCUITS AND COMPONENTS INCLUDED SPECIFICALLY FOR SAFETY PURPOSES. FOR CONTINUED PROTECTION, NO CHANGES SHOULD BE MADE TO THE ORIGINAL DESIGN. REPLACEMENT PARTS MUST BE IDENTICAL TO THOSE USED IN THE ORIGINAL CIRCUIT. SERVICE SHOULD BE PERFORMED BY QUALIFIED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

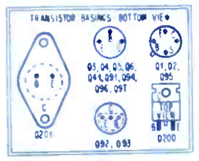
1480
PHILCO-FORD
Color-TV Chassis
3CY80

JULY • 1973

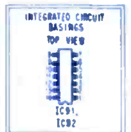
ELECTRONIC TECHNICIAN/DEALER TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 4 NEW SETS

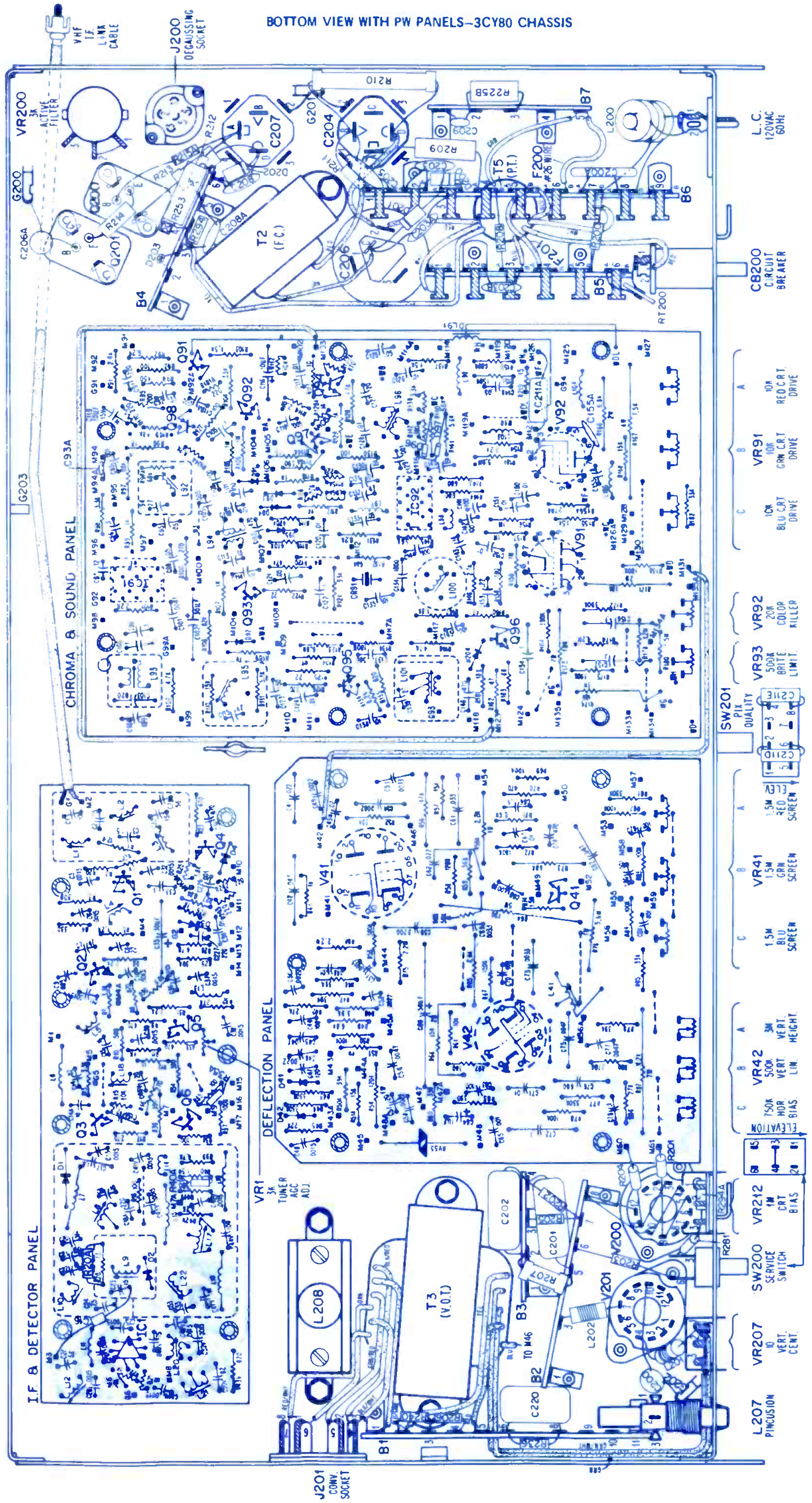




NOTES:
- ALL VOLTAGES TAKEN WITH B & K MODEL 175VTVM WITH SECONDARY CONTROLS SET FOR NORMAL PROGRAM
- VOLTAGES ARE NOMINAL AND CAN VARY 10%
- NO SIGNAL CONDITIONS
  - LINE VOLTAGE (120VAC)
  - ACTIVE FILTER (+20VDC)
  - VR1 (MID-RANGE POSITION)
  - TUNER LINK DISCONNECTED AT VHF TUNER (TAPE CENTER CONDUCTOR TO PREVENT ACCIDENTAL GROUNDING)
- [ ] INDICATES GRAPH LOCATION ON SCH OF LUG CONNECTIONS
- SIGNAL CONDITIONS
  - LINE VOLTAGE (120 VAC)
  - ACTIVE FILTER (+20VDC)
  - VR1 (SET FOR MIN. SNOW APPROX. 4.9V AT TUNER AGC
  - TUNER (CH. 3 WITH 2K MICRO-VOLTS AIR SIGNAL NO BURST)
- ◊ WILL VARY WITH BRIGHT. CONTROL (AVERAGE READING)
- •• WILL VARY WITH HEIGHT & LIN CONTROL SETTINGS
- □ WILL CHANGE WITH COLOR CONTROL SETTING
- DO NOT MEASURE VOLTAGES AT PINS OF IC91 AND IC92. MEASURE VOLTAGES AT COMPONENT NEAREST PIN
- LATE PROD ONLY WHEN USING R253 FUSISTOR WITH 32-10190-1 POWER TRANSFORMER SET ACTIVE FILTER TO 19V.
- PART OF CRT SOCKET ASSEMBLY
- RESISTANCES ARE MEASURED WITH YOKE & CONV. PANEL DISCONNECTED
- * ASTERISK INDICATES MATCHED PAIR OF RESISTORS
- STAR INDICATES COMPONENT ON COPPER SIDE OF PANEL
- CRITICAL SAFETY (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST)
- ▽ FEDERAL REGULATION (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST)
- PERMA CIRCUIT PANEL GROUND
- CHASSIS GROUND

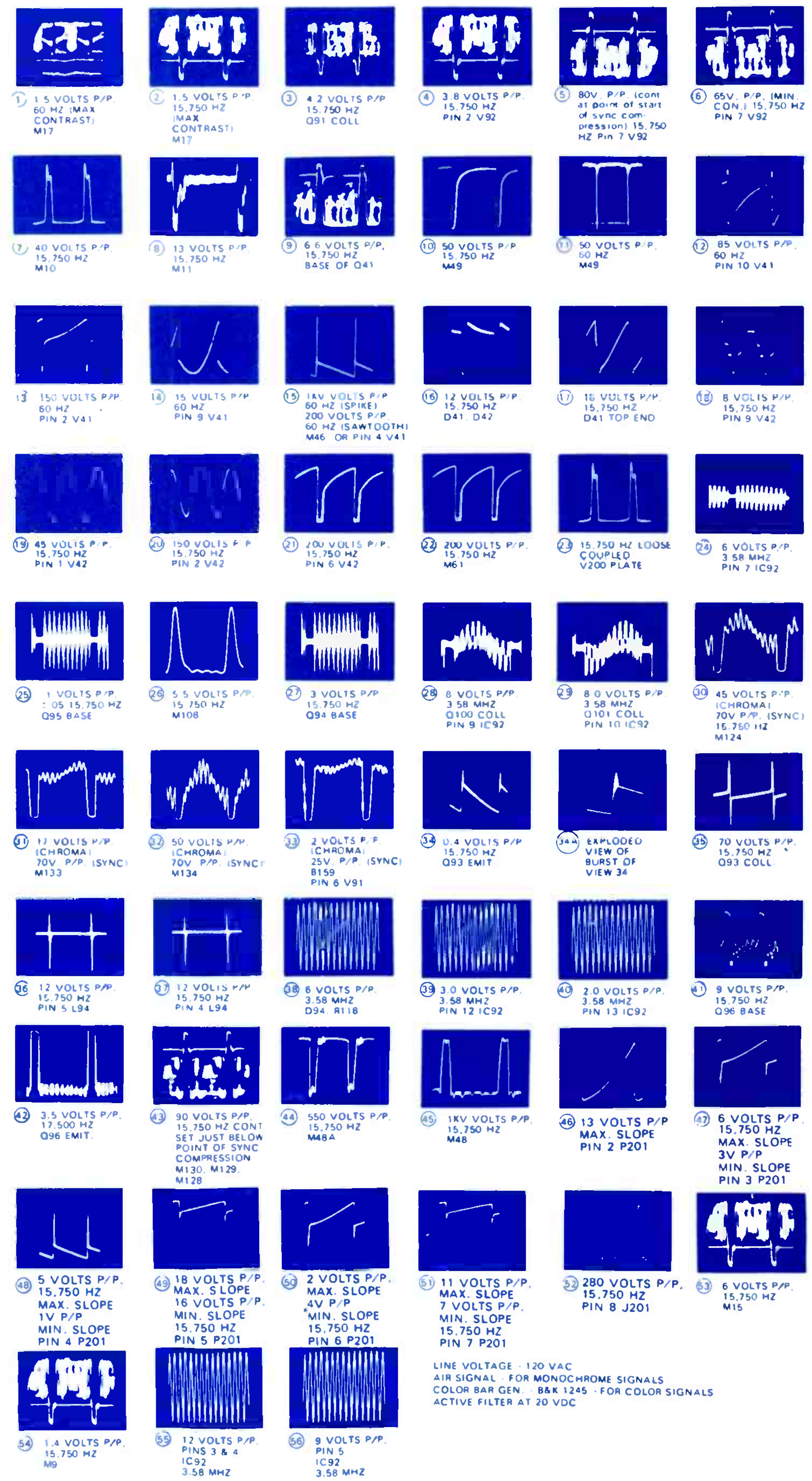


BOTTOM VIEW WITH PW PANELS–3CY80 CHASSIS



OSCILLOSCOPE WAVEFORM PATTERNS

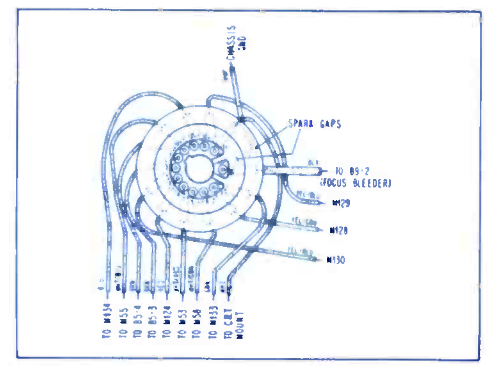
These waveforms were taken with the receiver AGC control adjusted for an approximate peak-to-peak output of two volts at the video detector, using an air signal. Do not reset AGC control when using color bar generator. All monochrome voltages taken with average air signal and all chroma voltages taken with a color bar generator connected to the antenna input terminals. The chroma peak-to-peak voltages were taken with the chroma control set for 0.3V peak-to-peak at center tap of chroma control or M102 and the tint control set for proper color bars (approximately mid-range), color bar generator output set for +1.5 VDC at M109, all other controls set for normal viewing. The frequencies shown are those of the waveforms . . . not the sweep rate of the oscilloscope. All voltages taken with a wide band scope having a 5 MHz bandwidth similar to B&K Model 1450. Line voltage 120V.



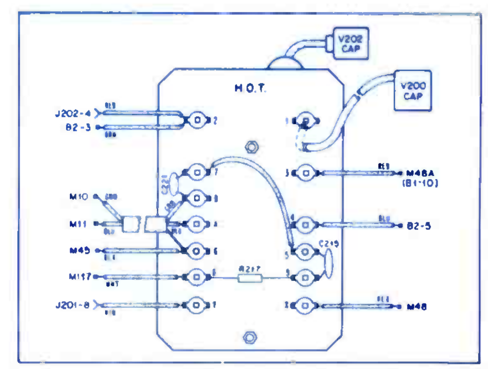
LINE VOLTAGE - 120 VAC
AIR SIGNAL - FOR MONOCHROME SIGNALS
COLOR BAR GEN. - B&K 1245 - FOR COLOR SIGNALS
ACTIVE FILTER AT 20 VDC

PHILCO-FORD
Color-TV Chassis
3CY80

SYMBOL	DESCRIPTION	PHILCO-FORD PART NO.
C204A thru D	200µ f/200v, 150µ f, 350v, 20µ f/200v, 50µ f/200v, B+ filter	30-2616-11
CB200	power ac circuit breaker	42-2136-10
IC91	IC-8, aud/IF/det	46-5002-8
IC92	IC-21 osc/react/det	46-5002-21
L17	4.5MHz trap	32-4869-3
L41	Horiz hold	32-4891-2
L92	sound quad	32-4876-1
L94	burst trans	32-4931-1
L95	chroma TO	32-4878-3
L101	bandpass	32-4929-1
RT200	degaussing	33-1376-6
RV55	horiz bias	38-1379-2
T1	audio output	32-10174-1
T3	vert output	32-10157-1
T4	horiz output (E.P.)	32-10130-5
T4	horiz output (L.P.)	32-10147-1
T5	power (E.P.)	32-10154-1
VR92	color killer	33-5628-6
VR201	12M, focus adj	33-5631-24
VR202	2.5K, tint, preset & A&B manual	33-5644-14
VR205A	500K, vert. hold 500 Ω horiz hold	33-5644-16
VR206	25K, volume	33-5656-1
VR207	10 Ω, vert cent	33-5609-1
VR208	500 Ω, preset & A&B manual bright	33-5644-13
VR209	100 Ω, contrast	33-5655-5
VR212	CRT bias, 1M	33-5649-30
	yoke assy	76-14303-8



CRT SOCKET WIRING–3CY80 CHASSIS



H.O.T. WIRING–3CY80 CHASSIS

1481

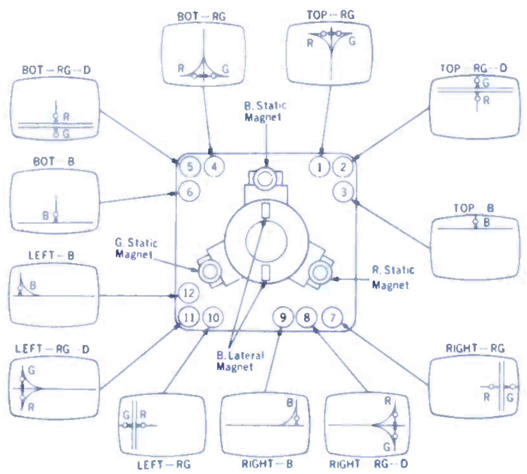
PANASONIC

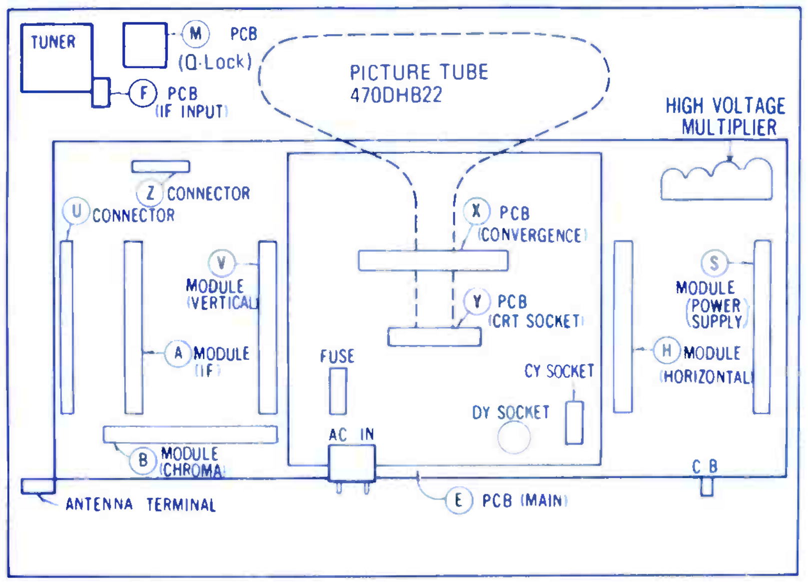
Color-TV Chassis
ETA-1

JULY • 1973

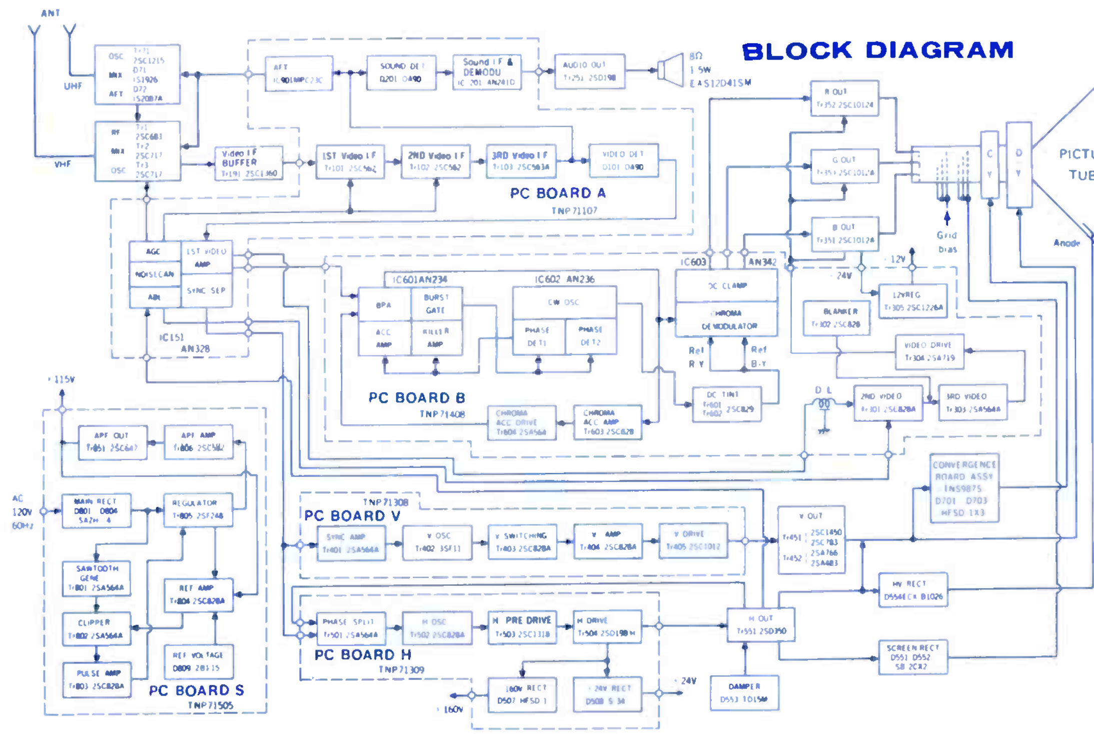
ELECTRONIC TECHNICIAN/DEALER TEKFAX

COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 4 NEW SETS

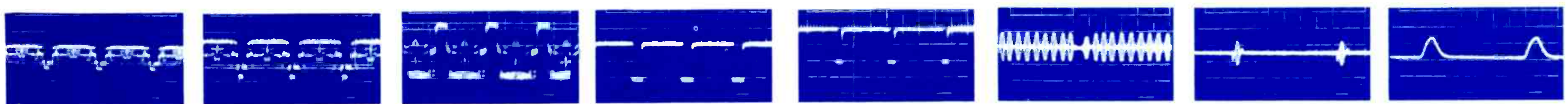




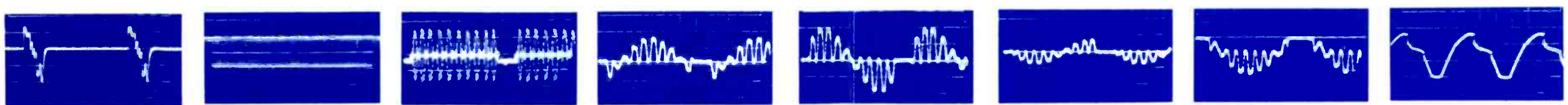
BLOCK DIAGRAM



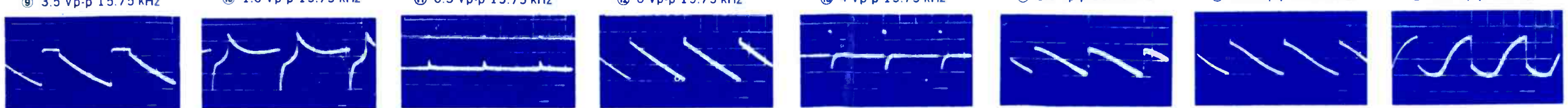
These waveforms were taken with the receiver AGC control adjusted for peak-to-peak output of 1.8 Volts at the test point of TP-A6. All monochrome voltages were taken with normal signal and all chroma voltages were taken with a color bar generator connected to antenna input terminals. Chroma peak-to-peak voltages were taken with the color control set for 1/3 turn (approximately) of its control range, tint control set for proper color bars (approximately) mid-range and all other controls set for normal viewing.



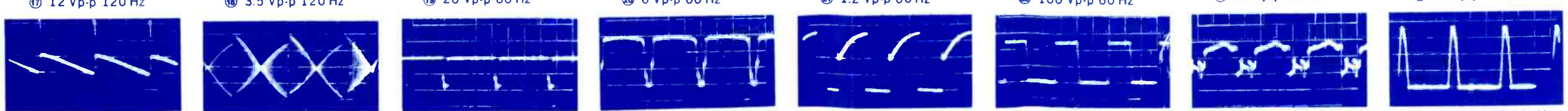
① 1.5 Vp-p 15.75 kHz
② 3 Vp-p 15.75 kHz
③ 5 Vp-p 15.75 kHz
④ 10 Vp-p 15.75 kHz
⑤ 20 Vp-p 15.75 kHz
⑥ 0.1 Vp-p 15.75 kHz
⑦ 0.5 Vp-p 15.75 kHz
⑧ 1.5 Vp-p 15.75 kHz



⑨ 3.5 Vp-p 15.75 kHz
⑩ 1.0 Vp-p 15.75 kHz
⑪ 0.3 Vp-p 15.75 kHz
⑫ 6 Vp-p 15.75 kHz
⑬ 4 Vp-p 15.75 kHz
⑭ 1.6 Vp-p 15.75 kHz
⑮ 100 Vp-p 15.75 kHz
⑯ 140 Vp-p 120 Hz



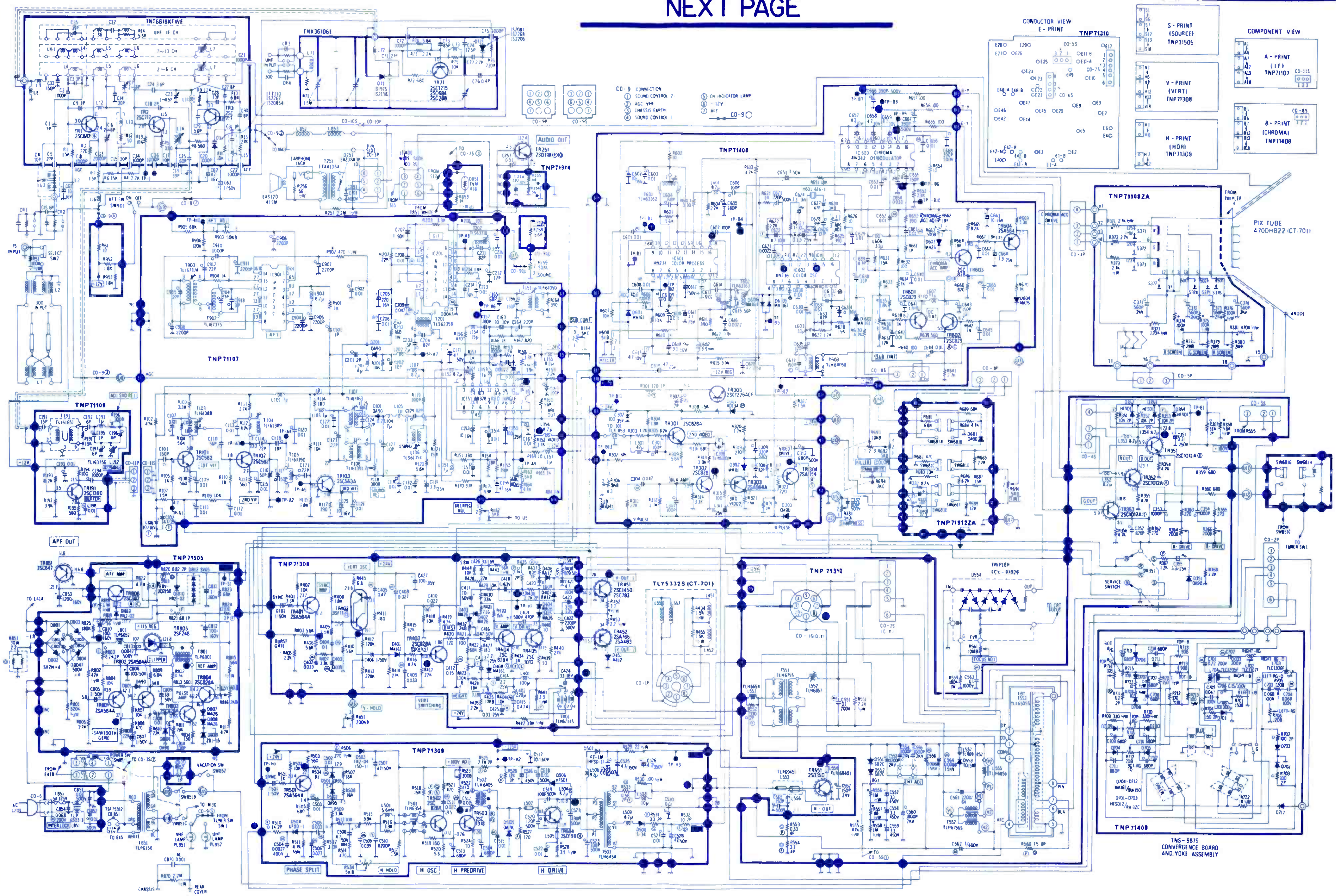
⑰ 12 Vp-p 120 Hz
⑱ 3.5 Vp-p 120 Hz
⑲ 20 Vp-p 60 Hz
⑳ 6 Vp-p 60 Hz
㉑ 1.2 Vp-p 60 Hz
㉒ 100 Vp-p 60 Hz
㉓ 10 Vp-p 60 Hz
㉔ 40 Vp-p 60 Hz

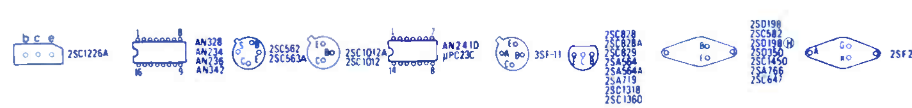


㉕ 100 Vp-p 60 Hz
㉖ 80 Vp-p 60 Hz
㉗ 10 Vp-p 15.75 kHz
㉘ 150 Vp-p 15.75 kHz
㉙ 35 Vp-p 15.75 kHz
㉚ 250 Vp-p 15.75 kHz
㉛ 15 Vp-p 15.75 kHz
㉜ 800 Vp-p 15.75 kHz

ADDITIONAL INFORMATION NEXT PAGE

PANASONIC
Color-TV Chassis
ETA-1



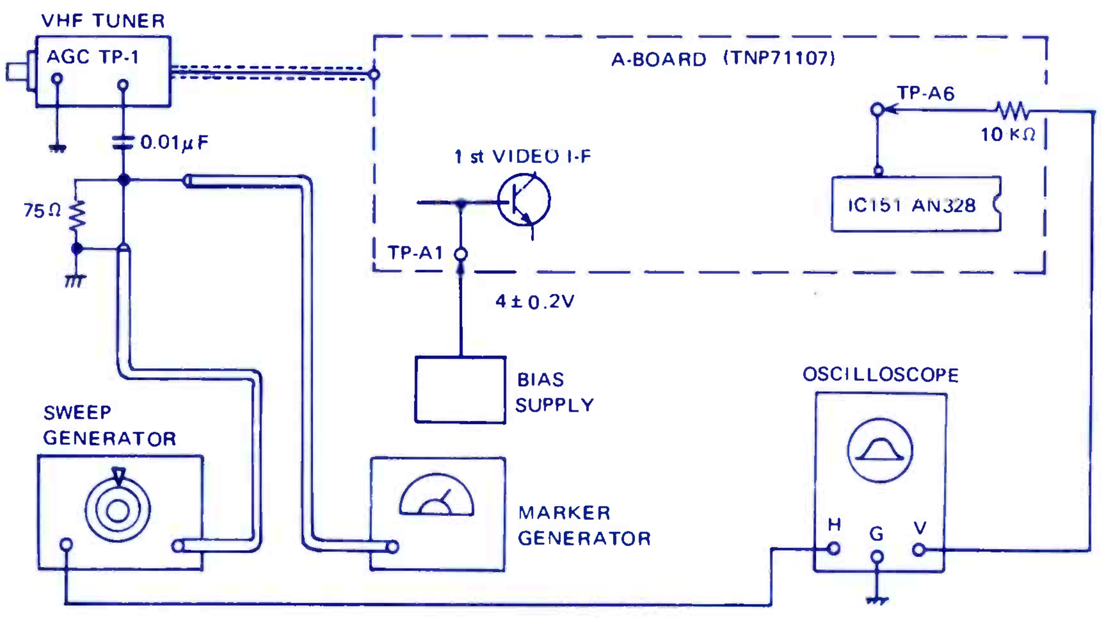


1. All resistance value in ohm
   K = 1,000 M = 1,000,000
2. All resistors are carbon ½ watts resistor unless otherwise noted the following marks
   ● Solid Resistor
   Metal Oxide Resistor
   Wire Wound Resistor
   F Non Flame Resistor
3. Capacitors the following marks
   M Polyester Capacitor
   Ceramic Capacitor
   S Polystyren Capacitor
4. Voltage measurements: Taken from point indicated to chassis a VTVM when receiving color bar signal.

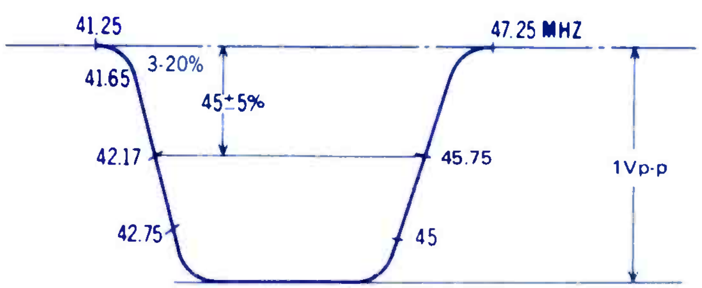
SWEEP ALIGNMENT OF VIDEO I-F

PREPARATION STEP

1. Set channel selector to an unused channel.
2. Connect oscilloscope, sweep and marker generator as shown in figure 28.
3. Supply bias voltage 4±0.2 V between TPA1 (Positive side) and ground on A-Board (See figure 28 and 63).
4. Connect the TV power source to outlet and set the power switch to "ON" position.
5. Adjust sweep generator's output level by attenuator to get the appropriate waveform, about 1 Vp-p/16 cm, on oscilloscope.



(Fig. 28)



(Fig. 29)

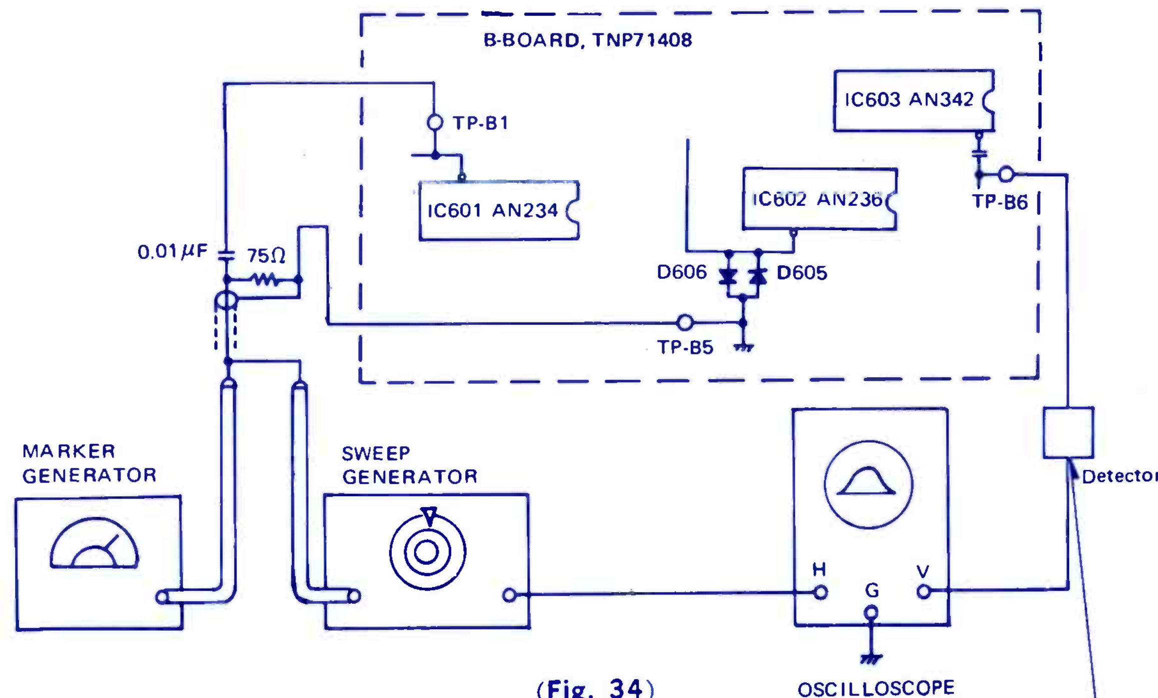
ALIGNMENT PROCEDURE

1. Adjustment of T103, T104 and T105 (See figure 63).
2. Adjustment of T191 on A-Board (TNP71107).
   The three cores in T191 can change the maximum gain and incline of waveform. Normally, T191 does not need realigen, if it not replaced.
3. Adjustment of traps.
   T106 is trap for 41.25 MHz and L192 is for 47.25 MHz.

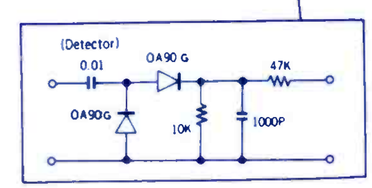
CHROMA BAND-PASS ALIGNMENT

PREPARATION STEP

1. Set channel selector to an unused channel.
2. Set Q-Locke switch to OFF position.
3. Set KILLER control (R608) in B-Board fully conter clockewis (See figure 61).
4. Set PANA-BRIGHT control fully clockwise.
5. Set COLOR control fully clockwise.
6. Connect jumper between TPB2 and TPB3 (See figure 61).
7. Supply bias voltage 4±0.2 V between TPA1 (Positive) and ground (See figure 63).
8. Connect oscilloscope at TPB6, detector, sweep and marker generator at TPB1 as shown in figure 34.
9. Connect the TV power source to outlet and set power switch to "ON" position.



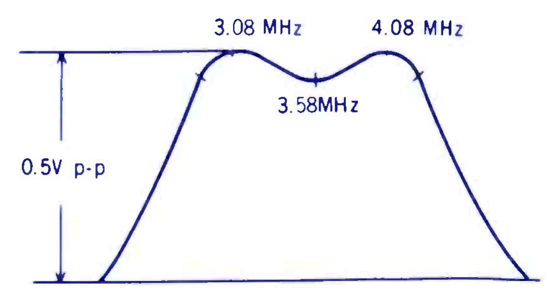
(Fig. 34)



(Fig. 35)

ALIGNMENT PROCEDURE

1. Adjust T601 and T602 on B-Board (See figure 61) for response as shown in figure 36. 3.08 MHz and 4.08 MHz markers are almost equal and maximum gain.
2. Observe that the waveform disappears, when control is in clockwise position. Turn the color killer control (R608) clockwise, then return it to its original position.



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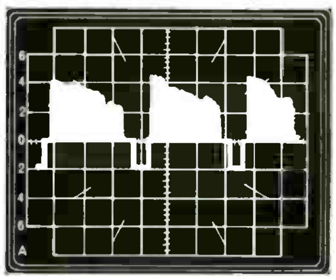
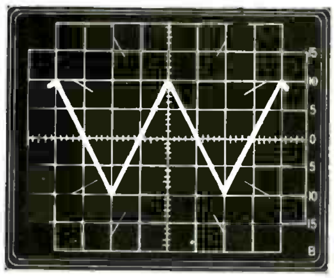


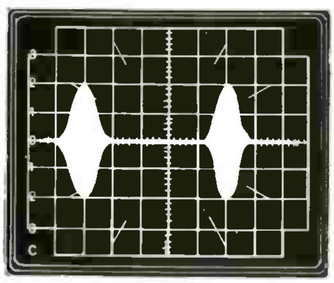
- **"A" Scale**

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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