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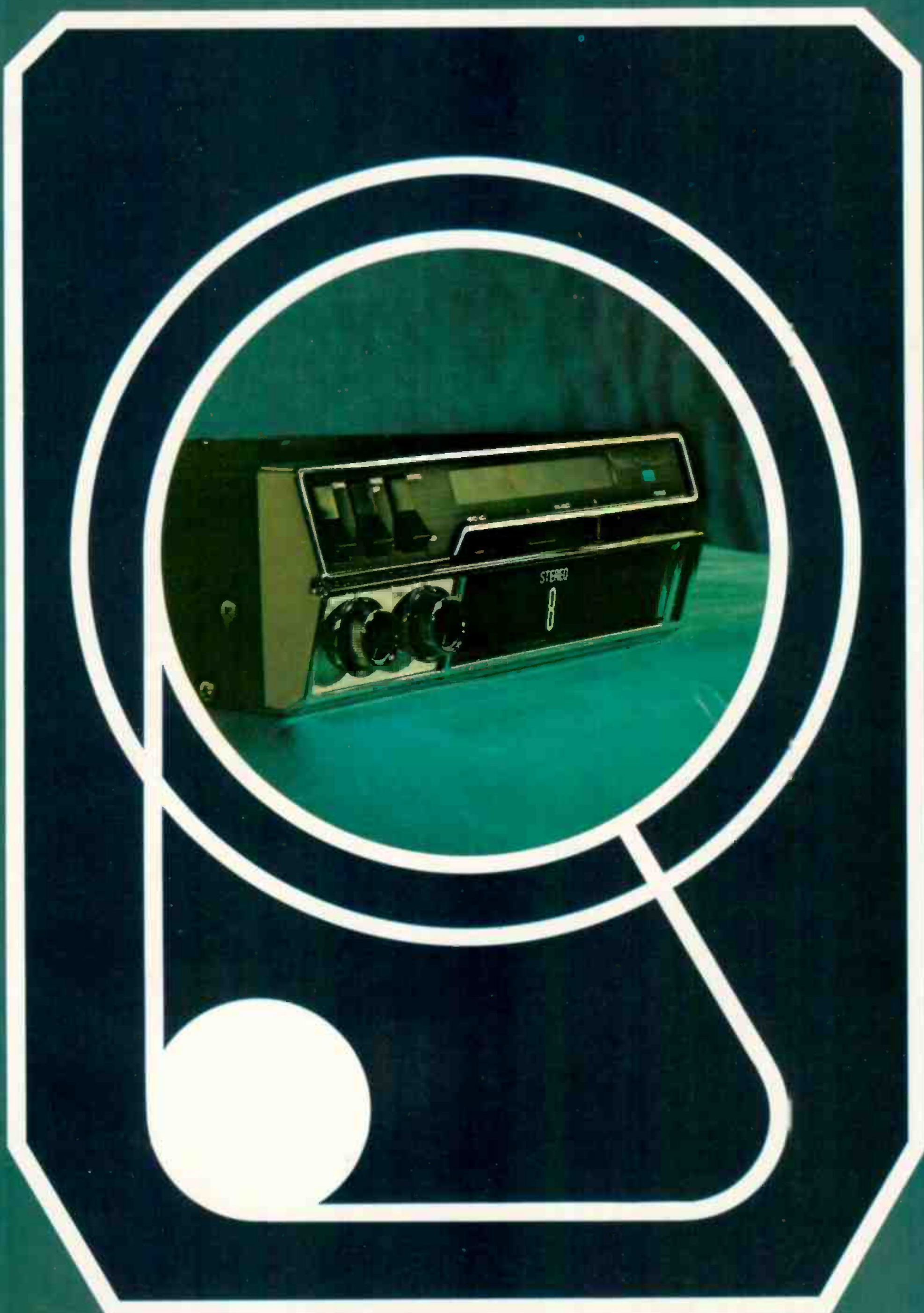

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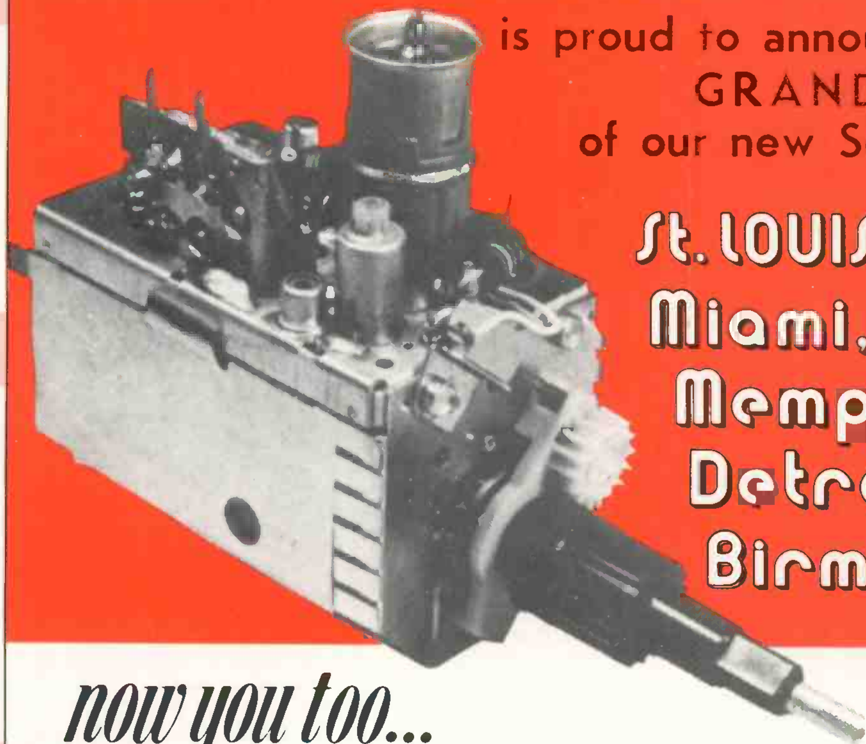

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JULY 1974 • VOLUME 96 NUMBER 7

FEATURES

DEPARTMENTS

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NEWS OF THE INDUSTRY

Motorola and Matsushita (Panasonic) Close Purchase Agreement

Motorola, Inc. and Matsushita Electric Industrial Co., Ltd. announced on May 28 the closing of an agreement for the purchase by Matsushita of the operating assets of Motorola's home television receiver business in the United States and Canada.

The closing consummates the agreement signed by Matsushita and Motorola on March 22 of this year. Matsushita will operate the acquired assets through a new company called Quasar Electronics Corporation, which will be a subsidiary of Matsushita Electric Corporation of America. The new corporation will market its products under the *Quasar* brand.

The transaction includes the purchase of Motorola's television facilities at Franklin Park, Pontiac and Quincy, Ill., and the leased assembly plant in Markham, Ontario, and related inventories in the United States and Canada. Motorola will continue certain of its automotive operations at the Quincy plant for a period of time until title to the Quincy plant passes to Matsushita.

According to a report of the closing of the purchase agreement by Matsushita, no change is contemplated in the present Motorola distribution system. The new corporation will also fulfill Motorola's Consumer Product Warranty obligations and will have replacement parts available for an extended period of time.

Matsushita's "Panasonic" brand products will continue to be marketed through their established distribution systems in the United States, Canada and Puerto Rico. The Panasonic plants in Puerto Rico and Canada will not be affected.

RCA Earnings Down First Quarter, Color TV Share Up

Although its 1974 first-quarter sales increased seven percent above those of the first quarter of 1973, RCA reports that its earnings for the first quarter of this year decreased 17 percent.

Despite the reduced earnings, resulting from what RCA Chairman Robert W. Sarnoff calls a cost-price squeeze, RCA's share of the domestic color TV market reportedly increased.

Admiral President Predicts Sharp Increase of Home Entertainment Prices

A sharp rise in prices of home entertainment electronic products was predicted by Ross D. Siragusa, Jr., president of the Admiral Group of Rockwell International, in a speech to Admiral distributors in Las Vegas on May 22.

Siragusa stated that the predicted price increases will be caused by "skyrocketing material costs." Speaking at the Admiral distributor meeting, Siragusa said, "Prices are going up substantially on all products, yet they are not enough to keep pace with the increasing costs of materials with which we are being inundated on a daily basis. But we are not alone. Everybody's prices are rising, too. And the way costs are going, we will be lucky to keep prices at the levels announced here today."

Siragusa then pointed to the fact that approximately 75 to 85 percent of these increases will be caused by increased prices of materials, which are not estimated costs but are increases already announced.

The Admiral Group is a full-line manufacturer of consumer electronic products and major home appliances. The group was known as Admiral Corporation until this April, when it became part of Rockwell's Consumer Operations.

Additional UHF TV Frequencies Not Needed by Land Mobile, Says NAB

The National Association of Broadcasters (NAB) recently told the Federal Communications Commission that "it is time to put an end to the land mobile practice of crying for additional use of UHF TV frequencies each time some of their channels become congested."

The NAB statement was issued in response to a request by land mobile interests that additional urban land mobile users be allowed to share UHF TV channels 14-20 with TV broadcasters. The land mobile interests contend that the additional 115 MHz of spectrum already designated for land mobile use will not be adequate to meet their needs.

The NAB said that, until there is a nationwide system of efficient frequency management techniques, the Commission should use mobile vans for local monitoring to determine the actual occupancy of land mobile channels. Such a system, the NAB said, "would reveal the use level of land mobile frequencies in areas of alleged congestion. Reassignments could then be made from the more heavily used frequencies to those which show little or no occupancy." ■

ELECTRONIC ASSOCIATION DIGEST

Information about the activities of national, state and local associations of electronic servicers, dealers and manufacturers. Material for publication in this department should be addressed to: Service Association Digest, ET/D, 1 East First St., Duluth, Minn. 55802.

New York Association Elects Officers

The Empire State Federation of Electronic Technicians Association, Inc. (ESFETA), at a meeting in Albany, New York, on May 4, elected the following new officers: Warren Baker, CET, president; Richard Jones, vice president; Kenneth Parese, CET, recording secretary; Ronald Palluth, corresponding secretary, and Robert Ocasio, treasurer.

ESFETA is a state-wide association which offers membership to all electronic technicians within the State of New York.

NESDA Increases Annual Dues to $48

The House of Representatives of the National Electronic Service Dealers Association (NESDA), in a meeting in San Antonio, Texas, on April 22-23, voted to increase NESDA annual membership dues from $36 to $48. The last NESDA dues increase was in 1971.

Virginia Association Blocks Sales, Service and Leasing of TV by CATV Operators in Norfolk Area

Members of the Tidewater Chapter of the Virginia Electronics Association (VEA) have been successful in their efforts to have a Norfolk, Virginia CATV ordinance amended to prevent CATV operators in that area from selling, servicing or leasing television receivers.

Representatives of ten TV servicing firms in the Norfolk area appeared before the Norfolk City Council on April 2 to present their views on the CATV ordinance then being considered by the Council. Speaking for the ten service firms and members of the Tidewater Chapter of the VEA, W. S. Harrison, Director of Consumer Affairs for the Association, made the following statement:

"The rules and requirements of this proposed ordinance show considerable thought and concern and generally provide adequate protection for the citizens of Norfolk.

"Our concern is with one apparent oversight which would permit the cable company to also engage in the leasing of television receivers. Though the ordinance specifically prohibits consumer sales and service, the allowance of leasing would effectively permit the cable company to actually engage in *both* sales and service.

"We feel that the effect would be detrimental in two respects: First, we are concerned about the spectre of unfair competition to the independent service businesses which have served this city and its surrounding areas so well for so many years. The competition would be unfair because of the guaranteed access to the home of the consumer that any cable company would have, and the very fact that the financial bigness of such a company could and probably would create schemes to subsidize such sales and service rentals at a loss in the early stages in order to gain a large share of the market.

"Secondly, we are concerned with the ultimate effect this would have upon the citizens of Norfolk. Should such loss-subsidization occur or, for any other reason, should a major portion of the independent dealers be driven out of business, the prices for such captive service would skyrocket or the cable rental fees would be adjusted to recover the losses which eventually must be recovered by any business.

"We feel that a well-operated cable system, if properly regulated, can be beneficial to the citizens of our city. Therefore, we do not oppose the proposed ordinance. We ask only that Section 27 (c) be amended by the addition of the words 'rent or lease' to read: 'The grantee shall not repair, maintain, sell, rent or lease or recommend any television or radio receivers or recommend radio and television repairmen'."

The amendment proposed by the Association was adopted by the Council, which, at the same meeting, also passed the CATV ordinance.

NATESA Publishes Service Contract Manual

The National Alliance of Television & Electronic Service Associations (NATESA) recently announced the publication of a 100-page manual titled *Television Service Contract Cookbook*. Authored by George Weiss, president, NATESA–Chicagoland, the manual explains why a servicer should sell service contracts; why people buy them; how to sell them by mail, on service calls and by phone; how to overcome objections to service contracts; contract formats and sales, or use, tax considerations.

The manual can be purchased for $15 from NATESA, 5908 S. Troy St., Chicago, Illinois 60629. ■

Comments from our readers are always welcome.
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TV Receiver Products Dept., Portsmouth, Va.

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TECHNICAL LITERATURE

Hard-to-Find Tools

A 60-page catalog features 76 new products in addition to the other extremely useful items sold by the firm. Most products listed in this catalog are rarely sold by industrial distributors or found in other catalogs. This unique collection includes unusual craftsman's hand tools and small power tools. Brookstone Co., 6927R Brookstone Building, Peterborough, New Hampshire 03458.

Communications Oscillator

A new color technical data and specifications sheet is available for the company's Model 416A Communications Oscillator. Bowmar Instrument Division, 531 Main Street, Acton, Mass. 01720.

EMI Filters

A 16-page EMI filter and service brochure provides technical information on filters for residential, commercial and industrial use, feed through styles, light-duty and heavy-duty vehicular units, PI circuit-tubular and rectangular styles, dual circuit rectangular styles, communication and signal line styles, power line and shielded enclosure types and multiple circuit units. Both electrical and mechanical specifications are included on all models. Cornell Dubilier Electronics, 150 Avenue L, Newark, N.J. 07101.

Circuit Design and Breadboarding Equipment

A 20-page catalog of circuit design and breadboarding equipment is available. All of the items listed allows the designer to go from circuit concept to working hardware in minutes. A new power supply designer, low cost power supplies and pulse generators are only a few pieces of equipment listed. Specifications for all instruments are listed. E & L Instruments, Inc., 61 First Street, Derby, Conn. 06418.

Closed-Circuit TV

A 16-page brochure on closed-circuit TV is available. The brochure titled "The Executive's Guide to Closed-Circuit Television" tells businessmen how closed-circuit television can help them save money in operations while adding to their security and their efficiency. Included in the book are descriptions of types of closed-circuit television systems, equipment needed and actual installations. A separate chapter is devoted to the use of closed-circuit TV equipment in producing videotapes for training and educational programs. Publications Department, GBC Closed Circuit TV Corp., 74 Fifth Ave., New York, N.Y. 10011.

Metric Tools

Specifications and prices on a variety of new metric tools and sets recently added to the tool line are given in Bulletin 274, a supplement to the regular catalog, which is now available. Xcelite Incorporated, Atten: Mr. Frederick L. Davis, General Sales Manager, Xcelite, A Division of Cooper Industries, Orchard Park, N.Y. 14127.

Technical Books

A 36-page, 1974 catalog describes over 300 current and forthcoming Tab books, plus 14 of the firm's unique Electronic Book/Kits. The catalog features full-color covers. TAB BOOKS, Blue Ridge Summit, Pa. 17214.

Handling and Storage Equipment

This spring catalog contains 144 pages picturing trucks, dollies, racks, shelving and shop equipment. Complete prices and specifications are included along with technical and engineering information. Standard Handling Devices, 2 Sycamore Ave., Medford, Mass. 02155.

Speaker

A fully illustrated bulletin provides complete electrical and mechanical specifications of the company's weatherproof QualiComp RH-12 speaker, plus appropriate application information. International Importers, Inc., 2242 South Western Ave., Chicago, Ill. 60608.

Semiconductors

A 64-page manual, K-500A, listing over 38,000 of the most popular domestic and foreign OEM semiconductor part numbers and their recommended replacement with just 137 Sprague RT, TVCM, and ZT series semiconductors is now available. All listings are alpha-numerical to make the manual simple to use. Also included is a comprehensive product guide section which contains package, pinning and salient electrical information on bipolar, small-signal transistors; power transistors; field-effect transistors; silicon rectifiers; zener diodes; optoelectronic circuits and linear integrated circuits. Sprague Products Co., Marshall St., North Adams, Mass. 01247.

Speakers

A color-coded wall chart, which allows the selection of the proper horn, speaker and related component for a particular sound application by a simple glance, is now available. The best indoor or outdoor application for each speaker and horn is clearly defined. The chart also indicates specific frequency responses, sound distribution and dispersion limits, sound pressure levels, power handling capacities, and impedance specifications for all units. Price $1.00. University Sound Marketing Services Dept., 1515 S. Manchester Ave., Anaheim, Ca. 92803.

VOM

A new data sheet describing Triplett's new 3-in-1 Model 615 V-O-M, for television, appliance, residential, industrial, and commercial maintenance and similar wide ranging usage applications, is now available. The literature provides detailed information on measurement ranges, accuracies, and construction features, and has a full listing of optional accessories, including ammeter adapter, line separator, probes, and carrying case. Dept. PR, Triplett Corp., Bluffton, Ohio 45817. ■

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Schematic for a Grunow Radio, Model 6J.
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Middletown, Ohio 45042

Schematic diagram for a Channel Analyzer (single trace), Model KT-

30, by General Electronic Distributions Co. Also, I would like to purchase an Electronic Analyzer, Model 769, by Weston and an Electronic Analyzer, Model 640, by Moss Electronic Distributions.
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Operating and maintenance manual for Research Mfg. Co. Geiger Counter, Model MOJAVE, SN. B510-56.
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Power transformer for a Bell Amplifier, Model BE10, Part No. 32B-188.
LARRY VOGLER
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Advance, N.C. 27006

Schematic diagram and parts list for a Granda, 15 transistor, deluxe AM/FM/AC/DC portable radio. The model number is unknown, but the FM tuner number is 2V20HB, and was made in Hong Kong.
MICHAEL MCHARRA
2512 A Street
Liberty Boro
McKeesport, Pa. 15133

Schematic for an 8-Track Stereo Recorder and Player. Toyo Model CHR-404.
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SCR's and Power Transistors

Theory of operation, testing and replacement

by B. B. Dee

■ Although silicon controlled rectifiers (SCR's) have been with us in industrial equipment for many years, their use in television receivers is quite new. As a result, they now are of direct interest to the service technician. Unfortunately, most descriptions of SCR applications and associated service literature are still industry oriented. This article describes the SCR from the *servicer's* point of view.

Similarly, the new developments in power transistors, such as Darlingtons, are discussed, along with some new applications for old devices in the TV and hi-fi fields.

THE SCR

If you were to hook up a PNP and an NPN transistor in the circuit of Fig. 1, and raise the supply voltage *slowly* from zero to twelve volts, you would observe that no current was flowing in the circuit, so long as the switch is open. This is because the transistors have no base drive, since each transistor is off. (We are assuming modern, silicon, low-leakage devices.) This circuit will stimulate the action of an SCR.

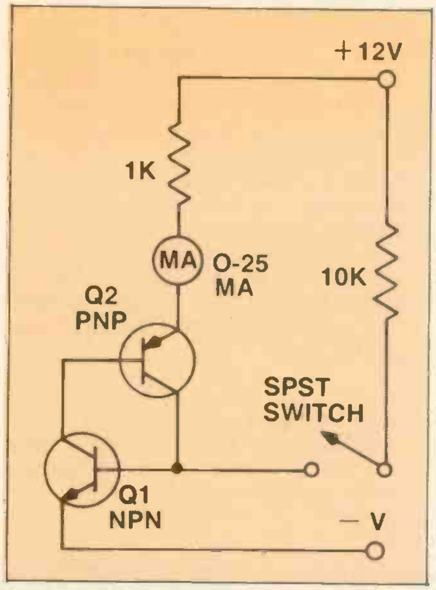


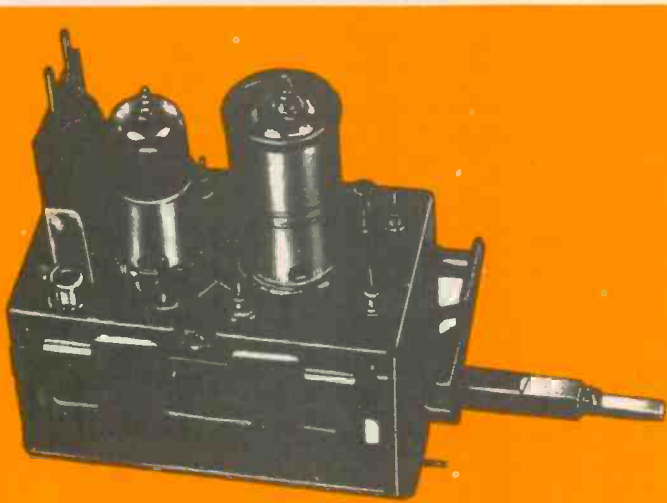
Fig. 1—Conventional bipolar transistors connected as shown here simulate the operation of a silicon controlled rectifier (SCR).

When the switch is closed, NPN transistor Q1 receives base drive from the positive supply terminal via R2, and turns on. Since the base of PNP transistor Q2 is connected to the collector of Q1, it also receives base drive, and turns on. And since the collector of Q2, in turn, is connected to the base of Q1, drive is provided to the base of Q1, holding it on, *even after the switch is opened.* Simply stated, DC regenerative feedback occurs, and the circuit is latched in a fully saturated state. When transistors are used as saturated switches, there is very little voltage drop across them; therefore, this circuit makes a good "latching switch" when driven by a small, momentary pulse. Further, since the circuit is either on or off, two sets of conditions prevail: 1) In the off state, the full supply voltage is applied to the transistors, but no current flows; consequently, the power dissipated by the devices is zero. 2) When the circuit is on, current flows and is limited primarily by the load, but the voltage across the transistors is very low; therefore, the power dissipated by the devices is very small compared to the power handled by the load. From this, we can draw two conclusions about SCRs: 1) They have a very high power gain because a small momentary pulse can control quite a bit of power. 2) The usual limitations on device rating interpretation do not apply. By this we mean that a power transistor rated at 10 amperes maximum and 60 volts maximum *cannot* be used normally at 10 amperes under most conditions of operation. This is true because a transistor is a linear amplifier and has a varying collector voltage (output signal). Thus, the transistor would dissipate very large amounts of power. The SCR, on the other hand, can be used at full rated current at any applied voltage up to the rated maximum, and, therefore, can handle considerably more power than a similarly rated transistor.

You will recall that we had to raise the power supply voltage from zero *slowly*. A very rapid rate of increase, or fast transient, is capable of turning on such a circuit. The rate of rise is usually given in volts per microsecond and is termed *dv/dt*, or, somewhat simplified, *change in volts divided by the change in time*. Thus, a fast spike might turn on some SCR's. Fortunately, many SCR's available today are rated in dv/dt, and the technician can obtain a suitable SCR for use at higher frequencies than the slow 60-Hz line rate.

A further problem with SCR's is that, once latched, they stay latched, as did our simulator circuit. Of course, we can turn the circuit off, or "reset" it, by momentarily turning off the power supply until the current drops to zero. Similarly, with SCR's we must insure that the current drops to zero for whatever length of time is required to "reset" the SCR. We can do this in a number of ways—by reversing the supply voltage (which happens every half cycle on AC), by interrupting the circuit, by placing a short across the SCR long enough to unlatch it, etc.

Now let us see how an SCR compares to the circuit in Fig. 1. Fig. 2A shows the junctions of transistors Q1 and Q2 (with both polarities and



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... for more details circle 132 on Reader Service Card terminals labeled) wired as in the circuit of Fig. 1. Figure 2B is the same circuit but with the interconnections omitted by placing the transistor junctions in direct contact. Fig. 2C completes the "evolution" of this circuit to that of an SCR by simply making a four junction device, avoiding the duplication of the center N and P junctions. Fig. 2D is the standard symbol used to indicate an SCR.

Troubleshooting SCR Circuits

Now that we have cleared up the mystery of what's inside the SCR, we can apply what we have learned to servicing equipment using SCR's. SCR's are rated in terms of *reverse voltage,* as are most rectifiers, but they are also rated for *maximum forward voltage,* since they must *not* conduct in the forward direction until they receive the signal to do so at the signal input terminal. If no turn-on signal is received, the SCR does not conduct in the forward direction. It *never* conducts in the reverse direction. Fig. 2D shows the standard symbol for an SCR, with the terminals labeled and polarities indicated for operation in the forward direction. Normally, the input signal is applied between the gate and the cathode, with a voltage of one or two volts positive, a current of a few milliamperes, for a duration of several microseconds, to insure turn-on. Larger SCR's require more gate input, smaller ones less input. Note that the input signal must be present long enough to insure turn-on, since all semiconductors take a specific time to turn on or off, as we learned in our discussion on diodes and junctions in an earlier issue.

Since some color TV sets use SCRs in the high-voltage and horizontal-output circuits, it would seem desirable that we go into the details of those circuits, but that is unnecessary because the basics of operation and troubleshooting are the same for the SCR's in all circuits.

The following checklist provides the first steps in pinpointing SCR problems:

1) Is the SCR turning on and off? If so, it is probably good. It might not be turning on and off at the right times, as in horizontal circuits where the horizontal oscillator driving the SCR gate might be running at the wrong frequency, but that is not the fault of the SCR.

2) If the SCR is not turning on and off, then we must determine if it is *on* continuously or *off* continuously, since it must be in one of these two states.

3) If it is off, check to see if there is gate drive, using an oscilloscope. It might be necessary to disconnect the lead to the gate, to insure that a short does not exist between the gate and the cathode of the SCR. The gate pulse then should be at least 1 volt (or as indicated in the service literature) and must have a duration of several microseconds (or, again, as indicated in the service literature). Usually, a short pulse will cause a change in the anode voltage as the SCR tries to turn on but fails to latch up. Too short a pulse is a very possible cause of failure of the SCR to turn on. Another cause of failure to turn on is the gate pulse arriving out of phase with the polarity of the voltage on the anode. Remember, the gate pulse must arrive when the anode is positive. The SCR will not latch up when the anode is negative (reverse biased). And, of course, there must be a source of current flow sufficient to permit latchup.

Under certain conditions, current cannot flow because the load is open or, in a high-inductance load, current increases so slowly that for some time there is no appreciable current flow immediately following the closing of the circuit. In such cases, a capacitor, or some other device, supplies current for a short time. If that "alternate" current source is open, the SCR might not have time to latch up before the gate turn-on signal ends. If all of the preceding check out, the SCR might be open or the gate might be defective.

4) If the SCR is latched on, check the anode-to-cathode voltage. Remember, the SCR turns off only when the current through it decreases to zero for several microseconds. A scope will tell you if the voltage across the SCR decreases to zero or reverses for the required time. Normally, there will be some small voltage across a latched SCR.

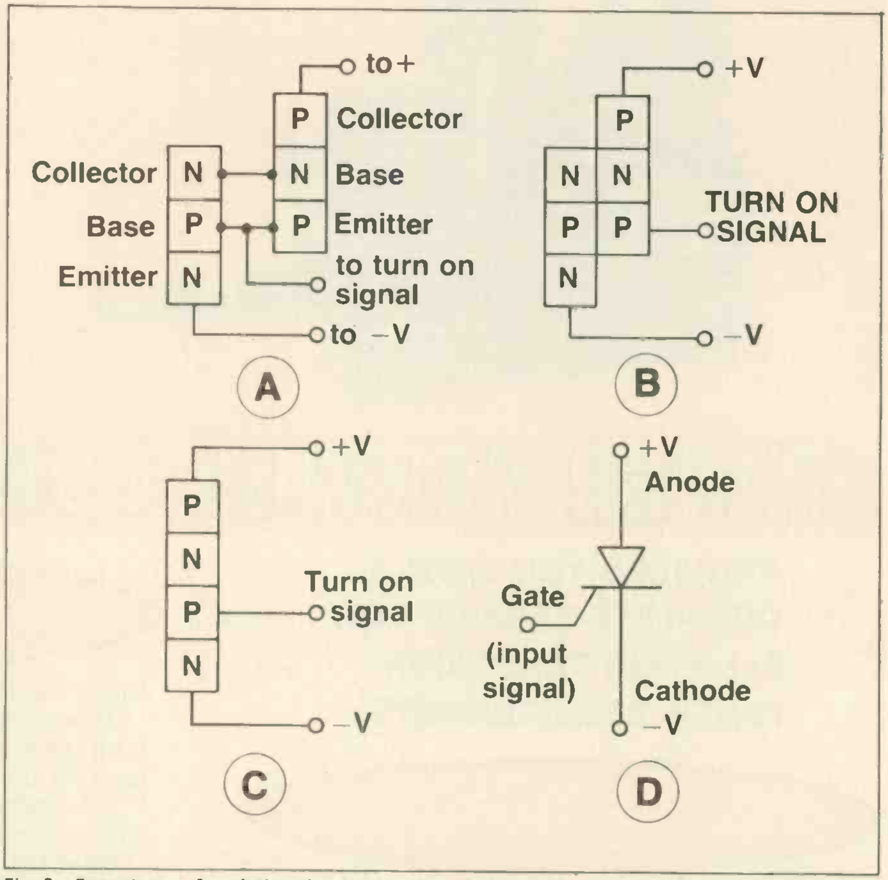

Fig. 2—Four stages of evolution showing how the circuit of Fig. 1 evolves into an SCR. See text for description.

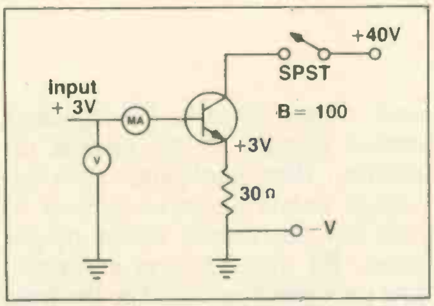

Fig. 3—Conventional bipolar power transistor connected in a common-emitter configuration has a relatively small input resistance because 1) the transistor has a relatively small gain and 2) the emitter resistor must be small to handle the large currents.

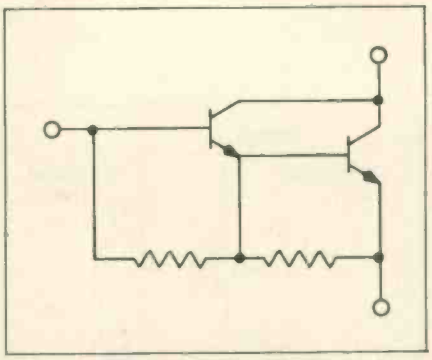

Fig. 4—A Darlington power amplifier, shown here, has higher gain and a larger input impedance than a conventional bipolar power transistor.

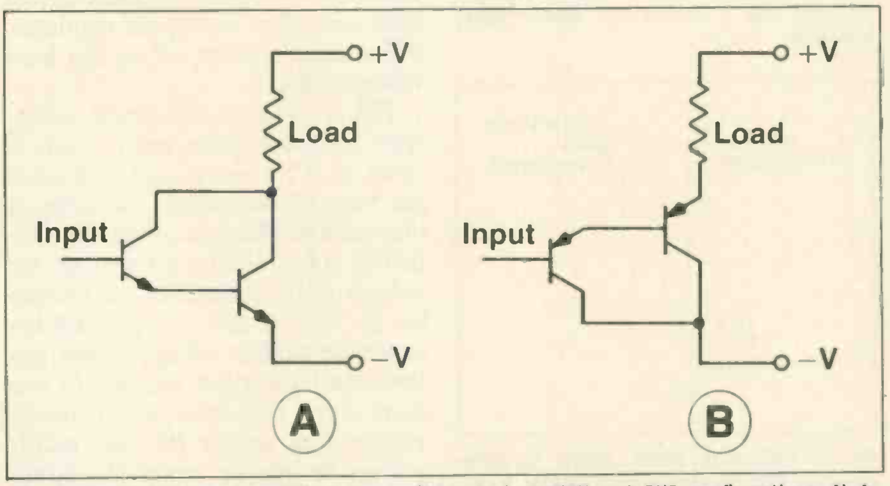

Fig. 5—Darlington power amplifiers are available in both NPN and PNP configurations. A) An NPN Darlington in a common-emitter configuration and B) a PNP Darlington in a common-collector configuration.

(In this context, zero means 0.0 volts, or reverse polarity, not 0.7 volts.) If the voltage across the SCR does go to zero, the SCR is defective, because it should unlatch on zero or reverse voltage. Most likely, it is shorted.

The above checklist, viewed with hindsight, is self-obvious. The important point is that understanding a few simple facts about the SCR enables you to reason through its proper or improper operating conditions, because it is basically an on or off device. Testing an SCR is something else, because things like dv/dt are not easy to set up. While we are on that subject, it is a good time to make a final comment about the susceptibility of SCR's to fast rise times and transients. Whenever you examine the waveforms applied to an SCR, look carefully for spikes, or waveforms with excessively fast rise times, which can cause spurious triggering of the SCR. Occasionally, fast wavefronts are slowed with capacitors, inductors, diode clamps, etc. I have run across sets which had such components defective, omitted or removed by other technicians. They can be a real headache, because they are visible only by very careful inspection with a fast oscilloscope.

SCR's used in 60-Hz power supplies can usually be substituted with a reasonable likelihood of success. But those used in 16-KHz and other high-frequency circuits should be replaced only with identical components, when available, or with parts characterized specifically for such use.

DARLINGTON POWER TRANSISTORS

Darlington power devices have become popular, especially in high-fidelity systems, and rightly so, because they solve an old problem. To understand this problem, we need to study Fig. 3. We will make one assumption: that this is a *perfect* transistor with zero voltage drop across the base-to-emitter junction.

If we apply +3 volts to the base of the transistor, we also will immediately measure +3 volts at the emitter, because there is no drop across the base-emitter junction. (You can also view this as "emitter follower" action.) Because there is a 30-ohm resistor in the emitter circuit, the current through the resistor must be 100 ma (by ohms law, I = E/R, which is 3V/30 ohms). Now, what must the input current to the base be? With the switch open, all the current comes from the 3-volt base source, and the milliameter also reads 100 ma; therefore, the input resistance is R = E/I, which equals 3V/0.1A, which equals 30 ohms. And, of course, that is what we would expect. But with the switch closed, we suddenly have a new set of figures.

Because the transistor has a current gain of 100, with 100 milliamperes of emitter current, only 1 milliampere will be contributed by the base, the rest coming via the collector. Thus the input resistance is, again, E/I or, in this case, 3V/.0001A, or 3000 ohms. To put it simply, the emitter resistance is multiplied by the current gain to obtain the input resistance. Unfortunately, power transistors do not have super gains, and the emitter resistors must be small because of the large currents handled. Because power transistors have very low input resistances, they are hard to drive, which, in turn, creates other problems.

The Darlington amplifier, shown in Fig. 4, eliminates these troubles because the base of the output transistor is in the emitter circuit of the input transistor. Consequently, the input impedance is increased by the current gain of the first stage multiplied by the current gain of the second stage, and, therefore, is quite large. As a result, the input is relatively sensitive, a fact which is mentioned because most technicians run simple tests to determine sensitivity, and the Darlington, being a three-terminal device, can be confused with a simple transistor. Also, because both emitter-base junctions are in series, the input base voltage is *twice as large* as that of a bipolar power transistor. Another fact worth noting is that sometimes the resistors shown in Fig. 4 are included in the package with the device, and might or might not be shown on the schematic. Nevertheless, they are an important consideration in making substitutions.

There is another confusing fact about Darlingtons because of their use in complementary output stages, often referred to as OTL (output transformerless) circuitry. They now come in both NPN and PNP polarities, and are used in both the common-emitter configuration, Fig. 5A, and the common-collector configuration, Fig. 5B. Because both are three-terminal devices, it would be easy to assume A was B, or vice versa, leading to confusion during circuit tracing. Without a schematic, it would be quite easy to assume that the circuit of Fig. 5B was an NPN Darlington with a collector load, instead of a PNP with an emitter load.

Conventional Bipolar Power Transistors

Last, but not least, we will make a few comments about the old, reliable, bipolar power transistor, which has been with us for so long. In too many cases, output pairs are matched, to obtain low distortion in class AB push/pull stages. When you replace one of these (unless it is a special part from the set manufacturer), you might have to replace the pair. Negative feedback does a great job in helping to suppress the symptoms of an unbalanced output stage, but it can't do the whole job.

Many references to simple good/bad testing of power transistors specify an ohmmeter test of the forward and reverse characteristics of the emitter-base junction and the collector-base junction, with the premise that if both have forward and reverse characteristics, the transistor is okay. *This is not so.* Both junctions can read good, but there can be a short between collector and emitter. This has happened often enough for me to recommend that the collector-emitter junction be tested for shorts, in addition to the other tests.

Because of rising prices and material shortages, plastic-encased power transistors are encountered more commonly today. Unlike earlier products, these plastics are very good. Many servicemen found it good practice to replace plastic power transistors with metal case units to reduce callbacks, especially in au-

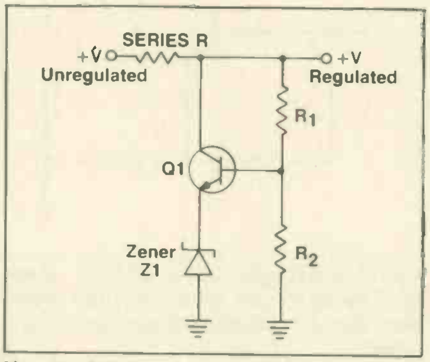

Fig. 6—Shunt-type power supply regulator equipped with a conventional bipolar power transistor.

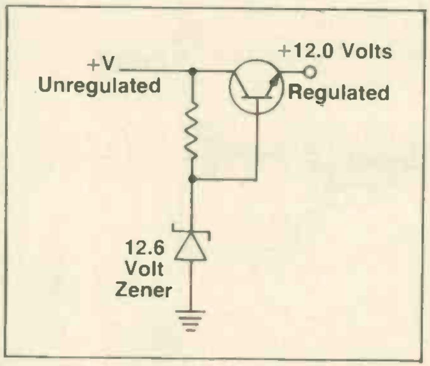

Fig. 7—Series-type power supply regulator equipped with a conventional bipolar power transistor. A short circuit in the regulated line of this type of regulator usually destroys the transistor.

to radio service. But these new devices are, in many cases, adequate for the duty required.

High-voltage transistors are encountered in some TV high-voltage and deflection circuits, with ratings in the kilovolt range. This is still a sensitive application for transistors, and any abnormal condition might be enough to destroy them. I suggest, therefore, that arcing the high voltage, to determine its presence or amplitude, should definitely be avoided. The first arc to ground might destroy several expensive devices, and fast. In any event, voltage tripler and quadrupler type rectifiers boost the voltage, and the actual high-voltage AC into the rectifier might be only a deceptively low-appearing 8Kv.

One application where power transistors keep cropping up, despite integrated circuits, is in power supply regulation. Both series- and parallel- (shunt) type regulators are encountered, and destroyed, quite frequently. Fig. 6 shows the dependable shunt-type regulator. When the load current changes, the regulator current changes in the opposite direction, thus providing sufficient voltage across the series resistor to maintain the output within proper limits. R1 and R2 form a divider, and their junction is tied to the base of the power transistor. The emitter is tied to zener Z1, and, if the base voltage rises, the transistor draws more current. The output voltage is thus "compared" with the emitter (reference) voltage. A short circuit does not affect the shunt regulator, which simply shuts off as the base voltage falls.

Fig. 7 illustrates a simple series-type regulator. The zener diode is rated at 12.6 volts, and maintains the base of the power transistor at that voltage. Because of the approximately 0.6-v emitter-base drop, the voltage at the emitter of the transistor is 12.0 v, and is regulated because the emitter voltage closely follows the base input voltage. *In this case, short circuiting the regulated voltage line causes the full supply voltage to appear across the power transistor. The power involved soon destroys the transistor.* New integrated circuit voltage regulators with short-circuit protection are now available, so, hopefully, this circuit will soon be extinct. Meantime, when replacing power transistors in voltage regulators, don't pick a better device than you need in terms of frequency response or current gain. If they have good gain at high frequencies, they often oscillate at high frequencies, defeating the regulating action. The high-frequency oscillations get into all the circuits and create weird effects, which are hard to understand. So stick to a "nearest choice" type of replacement.

Defective transistors with shorts and opens are easy to locate in voltage regulators, but the device often appears to be working, but poorly, because the output is not well regulated and has ripple. In such cases, the input voltage might have fallen to, or below, the required output voltage because of a faulty filter or rectifier in the power supply or excessive current drain. Always check the input versus the output voltage in a regulator circuit. The input should be several volts higher for proper operation. ■

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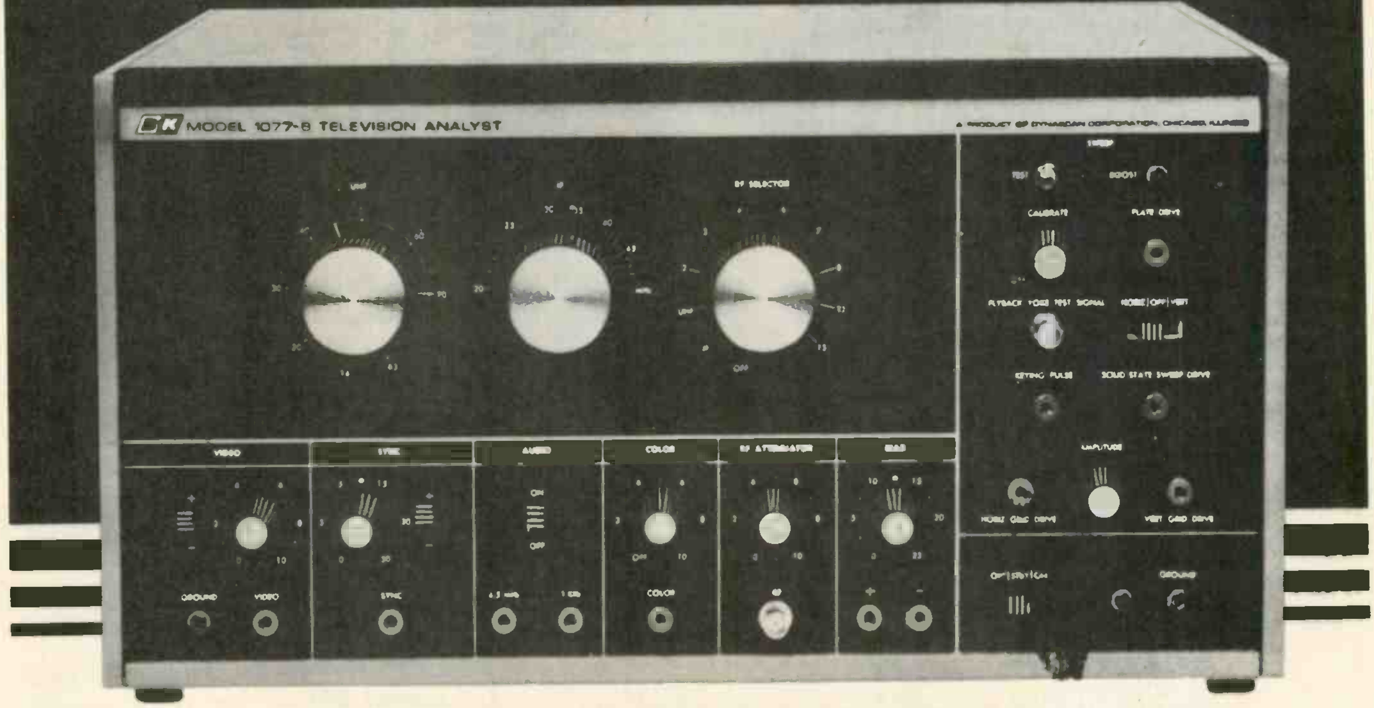

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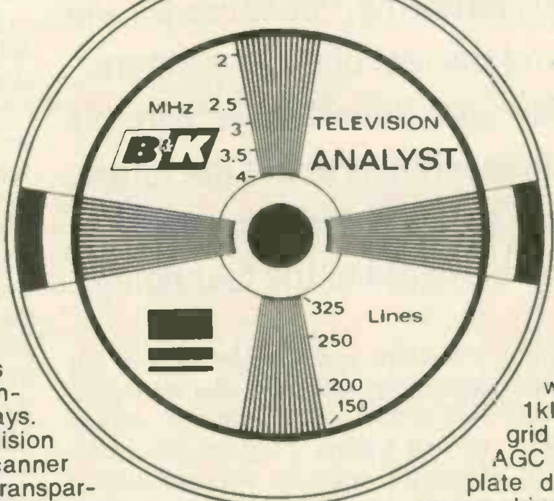

Remember the test pattern? Here's how to use that old standby to cut your troubleshooting time in half.

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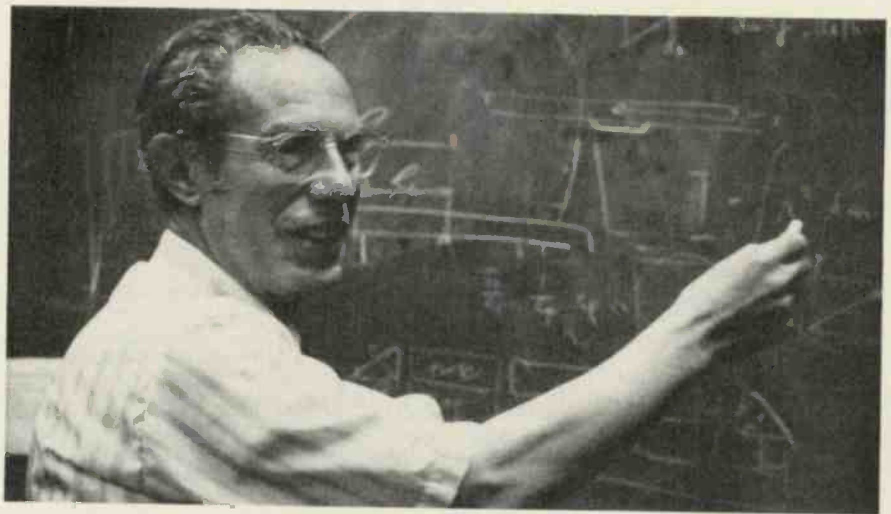


"Making predictions is a risky business."

DOES SERVICING HAVE A FUTURE?

"We should all be concerned about the future," said Charles Kettering, "because we will all have to spend the rest of our lives there." The following interview with Robert Adler, Zenith's vice president of research, is about the future. Specifically, it is about the future of the electronic service industry with regard to the technology.

■ Many in the service industry are uneasy about the future, and with apparent good cause. Manufacturers are designing for maximum reliability . . . manufacturers are designing for minimum service, etc. All this designing leaves service people with the feeling that they're being designed out of the picture.

In the Fall 1973 issue of ServiceWorld, Dick Wilson addressed a similar topic in an article titled "Is There a Crisis in Servicing?" Robert Adler now tackles this topic in the light of the new technologies and new products.

Dr. Adler is well qualified. He received his Ph.D. in Physics from the University of Vienna in 1937. His inventions and developments in the technology are many. For television, he invented the ultrasonic remote control system, the gated-beam tube for sound and color demodulation, a widely used synchronizing circuit that improves color reception, and a projected television picture that utilizes a laser beam modulated by ultrasonic diffraction. For the communications and radar field, he developed a high-frequency magnetostrictive oscillator, an electromechanical filter, and the low-noise beam-type amplifier known as the Adler Tube.

He received the Inventor of the Year Award from George Washington University in 1967, and the IEEE Outstanding Achievement Award in 1970. He became vice president and director of research at Zenith in 1963. He is a Fellow of the Institute of Electrical and Electronic Engineers and the American Association for the Advancement of Science and a member of the National Academy of Engineering.

Is the service industry about to become a victim of the technology? Let's see what Bob Adler has to say about that.

SERVICEWORLD: Many service people feel that they are being "designed out of the picture," as they put it. Is this apprehension justified?

ADLER: On the face of it, it would seem so. All manufacturers of consumer electronic products are trying awfully hard to design their products for 100 percent reliability. If we all achieve this level, service of course would no longer be needed.

SW: Then should the service industry prepare to go out of business?

ADLER: Hardly. There are many good reasons why service will be around for a long time.

SW: I'm sure our readers would like to hear some of those reasons.

ADLER: For one thing, it is difficult to close our eyes to the fact that products in the home have become more and more complicated through the years. To keep our customers coming back to Zenith, we must continually add new features and conveniences. Television has progressed from black-and-white to color, and the color TV set is the most complex device ever mass-produced. Radio too has progressed from the simple five-tube AM set to FM and FM stereo. Stereo is of course merely a duplication of channels with a balancing network, but now multichannel devices are coming into use which have quite complicated decoding systems. Quadraphonic FM broadcasting is especially complex.

SW: Will this trend continue?

ADLER: Extrapolating from experience—yes. New products such as the video disc player will involve some fairly precise and complex mechanical equipment. Also, if it turns out to be an optical system, it will have optics which have never played a role in consumer electronic equipment, and is likely to involve some little tricks that are completely different from anything done before.

Robert Adler, Ph.D., Vice President, Research, Zenith Radio Corp.

"The job of servicing is definitely going to become more intellectual."

"There will be plenty for all of us to do."

"Perhaps in a hundred years we'll no longer need service people."

SW: What about flat-panel television?

ADLER: The panel itself, like the present picture tube, probably will not be serviceable. However, the peripheral electronics promise to be a relatively complicated array of a great many circuits arranged on PC boards, or in some other integrated form. These will require occasional servicing.

SW: But it's a known fact that reliability has increased greatly, and will continue to increase. Won't this factor eliminate the need for service?

ADLER: As reliability has increased, so has complexity. So complexity offsets reliability. Reliability per active device is quite a bit better than with vacuum tube circuits. It may not seem that way, but instead of four or five vacuum tubes as we had in a simple radio set, now we are likely to have many integrated circuits in our new products. In a flat panel display, that number could be several hundred devices, corresponding to thousands of individual transistors. So it has become a race between the reliability of individual components and the complexity of the assemblies of those components.

It is well that reliability has increased—if it had not, the situation would be hopeless: these complicated new products would never operate.

SW: How will all this affect servicing?

ADLER: The job of the service technician is not going to change fundamentally. I think that the job will become in a way more challenging in that he will have to be much more of a detective to find out what is wrong. Most servicing has to be done right in the home if the operation is to be profitable. The service technician is going to be faced with many types of products; no two will be exactly alike, nor exactly like what he saw last week. He will have to use his brain to find the trouble quickly—he won't be able to spend all day plugging in one board after another. Rather than such a machine-like approach, he will have to rely on his experience, intuition, and his ability for intelligent deduction.

SW: In short then, he's not going to be just a parts changer?

ADLER: There will be some of that, but not in the purely mechanical sense. The job of servicing is definitely going to become more intellectual and less physical—that is, less tinkering, less soldering will be needed.

SW: You stated that everything will be a great deal more complex. Will it be necessary for the technician to learn how these complex devices operate?

ADLER: In most cases, not in detail. Take a very complicated IC for example: understanding its operation is a real challenge for almost anyone. However, if not the theory of that particular IC, the technician *will* have to understand its function in the circuit, and its effect on the whole system if it develops a fault. Learning those functions alone is a big challenge, for there are a great many IC's, and the number is increasing.

Besides—a great many technicians will try to understand as much as they can. That's in the nature of the man who makes a career of electronics—that curiosity about how things operate is what brings him into the field, and if he doesn't have that inborn curiosity, he won't go very far in the technical end of the business.

SW: Service dealers are advised to plan for the future. To help them plan, can you provide some fairly firm dates as to when the new products will appear in the homes of the consumer?

ADLER: Making predictions is a risky business. If you're correct, nobody notices; if you turn out to be wrong, somebody takes great pains to point it out. Logical arguments which show that something cannot possibly happen have a particularly poor track record.

SW: Take a chance. What about three-dimensional TV done with holography?

ADLER: The difficulties are enormous—too great even for the most optimistic. Perhaps sometime in the millenium that begins with that magic year 2001.

SW: And flat-panel TV . . .?

ADLER: There we can be a little more optimistic. Many ideas for flat displays are being worked on. Yet there

continued on page 45

MATV Taps—Selection and Use

by James E. Kluge

When laying out an MATV system you're going to use more taps than any other component. For this reason, it's important that you know what's available, for what applications, and how and where they should be used.

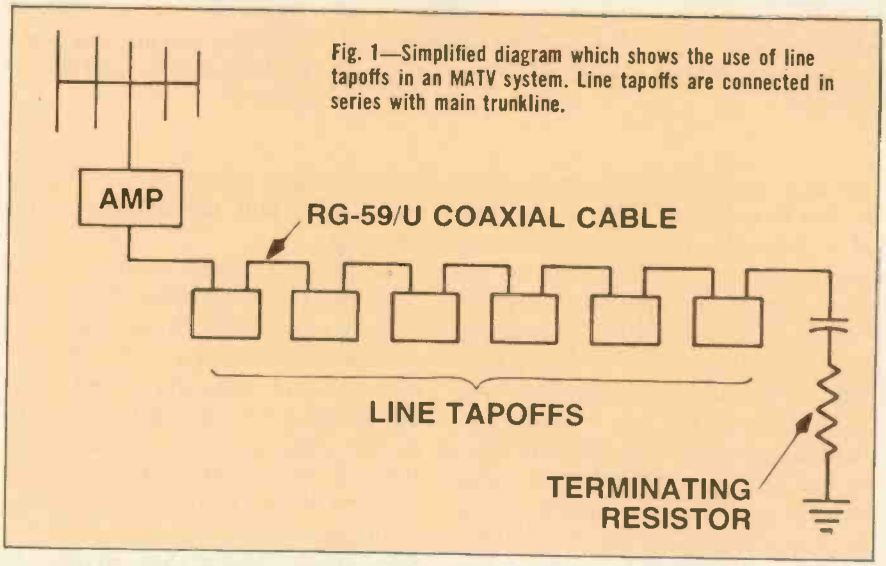


Fig. 1—Simplified diagram which shows the use of line tapoffs in an MATV system. Line tapoffs are connected in series with main trunkline.

The author is technical editor for the Winegard Company, Burlington, Iowa.

■ If you've ever tried to design and price out a large master antenna television (MATV) system, you already realize how significant the total initial cost of the taps can be. Initial cost, however, is not the only consideration when it comes time to choose taps for the job. Performance, insertion loss, isolation, future system expansion and ease of installation also must be considered.

When to use the right tap in the right place needn't be difficult if you sufficiently understand the characteristics and intended functions of the different kinds of taps.

Most MATV manufacturers offer a wide variety of tapoff devices that meet every requirement for jobs large and small, home and commercial. There are tapoffs, drop taps and wall outlets; flush or surface mounted; 300-ohm or 75-ohm inputs and outputs; brown or ivory; fixed or variable isolation; VHF or UHF; directional or nondirectional. Virtually any variety you could ever need are available, and of course, capable of passing all 82 TV channels.

There are three basic types of taps: 1) the line tapoff (or loop-to-loop system), which is the most common; 2) the line drop tap, which is least understood; and 3) the pressure tap, which probably is used least. Let's take them one at a time, see what makes them different, and learn how they can best be applied.

LINE TAPOFFS

Line tapoffs derive their name from the way they are connected into a long trunkline. By cutting the trunkline and connecting the tap in *series* with it (Fig. 1), a small portion of the trunkline voltage is tapped off and appears at the output. A short section of coaxial cable then applies this voltage to the antenna terminals of the TV set. In addition to the tap output which connects to the antenna terminals of the TV set, there is a trunkline input and output connection, so that the trunkline signal can pass on through the tap. The trunkline is routed from tap to tap.

At the time the cable is installed, the trunkline is drawn out of the wall, through the roughed in opening, to form a loop. The loop is then cut and the tap connected in series with it. The excess cable is then pushed back into the wall, the tap mounted in the opening, and a finished cover plate installed over the tap.

Insertion Loss

Each tap inserted in series with the cable has *insertion loss*, which is dependent on frequency and the degree of isolation. Insertion loss causes a voltage drop across the tap from input to output. With many taps connected into a long trunkline, the total voltage drop accumulates as you move down the trunkline toward the last tap. At some point along the trunkline, the signal voltage will drop below a certain minimum level. It will then be necessary to insert an amplifier in the line, to raise the signal level again,

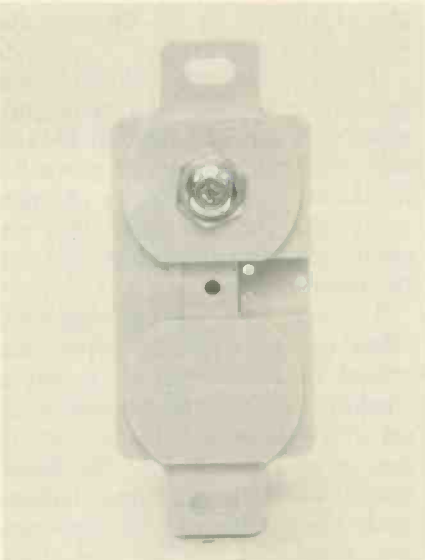
The amount of insertion loss depends, to a large degree, on the chosen value of isolation. Generally speaking, *the lower the isolation, the higher the insertion loss.*

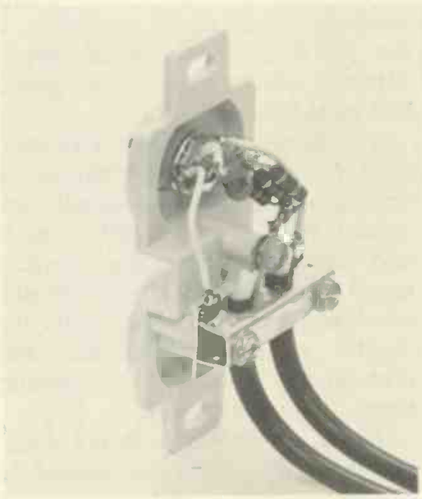
Isolation Loss

Isolation prevents a TV set that is connected to a tapoff from affecting another set connected to another tapoff up or down the trunkline. TV sets not only generate undesirable signals but they also cause reflections of incoming signals. These reflections cause smears and ghosts on the screens of other sets connected to the trunkline. A minimum of 10 dB of isolation at each tap will provide at least 20 dB of isolation between sets (2 times the isolation of one tap). This is usually adequate.

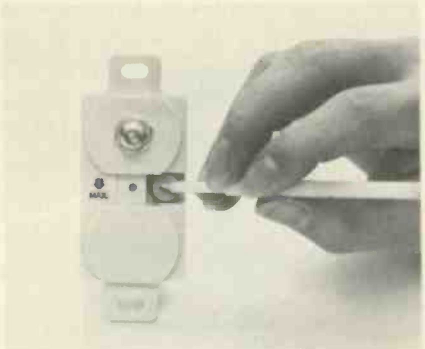
However, higher values of isolation are not only desirable but they also produce lower values of inser-

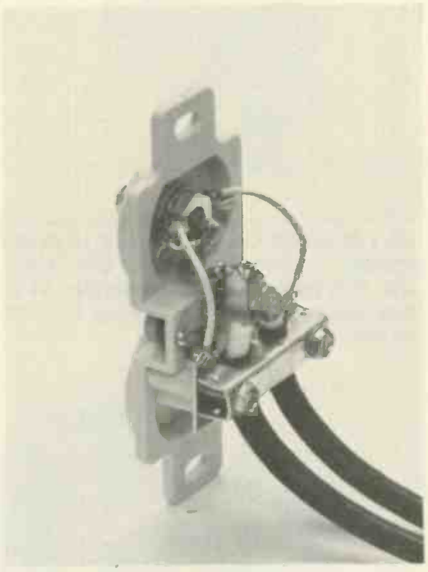
* *0 dBmv = 1000 microvolts = 1 mv = 0.001v*



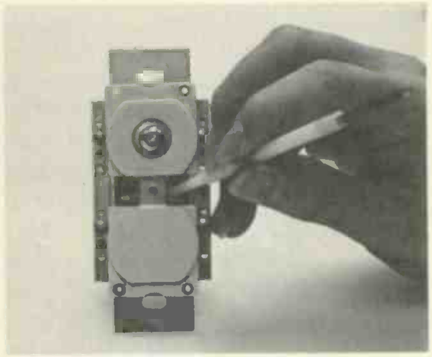


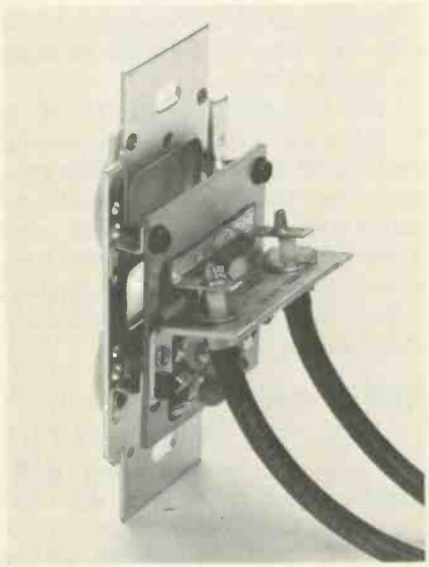
SLT-77 Selectable-isolation, 82-channel Line Tapoff employs three equal-valued resistors connected in parallel. By clipping out one or two of the three resistors, the isolation value can be selected in discrete steps of approximately 10, 15 and 20 dB. Selectable feature allows MATV installer to stock just one tap instead of three.





VTF-77 Variable-Isolation, 82-channel Line Tapoff employing RC components is effective but nondirectional. It cannot distinguish between incident signals from trunkline Input and reflections from trunkline output. Isolation adjustment, made from the front with cover plate removed, is voltage divider that controls the proportion of trunkline signal delivered to TV set and, at the same time, the impedance between the TV set and trunkline. Variable feature permits stocking of only one tap and allows easy resetting of the isolation value at a later time. Also available with 300-ohm output, no-strip screw terminals (VTF-73).





UVF-87 Variable-Isolation, 82-channel Line Tapoff features independent and separate VHF and UHF isolation adjustments. Two wiper arms, accessible from front of tap, allow isolation to be varied continuously between 10 and 25 dB. Isolation network on PC board is attached to back side of tap.

tion loss. Isolation loss shows up as a voltage drop across the impedance existing between the trunkline and the TV set. A rule of thumb prescribes that you use the highest value of isolation available commensurate with the existing voltage level on the trunkline.

Tap Must Deliver Sufficient Voltage to Set

The voltage delivered to the set (at the tap output) should be 1000 microvolts (0 dBmv)* or more. With 10 dB of isolation loss, there will have to be at least +10 dBmv on the trunkline. With 15 dB isolation, there will have to be +15 dBmv or more and, likewise, with 20 dB isolation, there will have to be +20 dBmv on the trunkline.

So, the amount of tap isolation should never be less than 10 dB and as much as the trunkline signal level will permit. This approach will guarantee minimum insertion loss to the trunkline signal as it progresses from tap to tap down the trunkline.

Choosing the Correct Amount of Tap Isolation

Almost all taps provide either fixed, selectable or variable isolation.

Fixed-isolation means that the tap is manufactured with a fixed value of isolation that cannot be conveniently changed. These taps are manufactured with either 10, 15, or 20 dB of isolation. The principal disadvantage of this tap is that it requires an inventory of three different taps.

Selectable isolation means that one tap can provide three selectable values of isolation in one tap. The Winegard SLT series of taps provides either 12 dB, 15 dB or 20 dB of isolation by merely clipping out one or two of three fixed, parallel resistors. This tap solves the problem of multiple inventory, but once the resistors have been clipped out you cannot easily change the isolation value back again to a lower value.

The *variable isolation* tap provides a continuously adjustable amount of isolation. In the Winegard VTF series, the adjustment is easily accessible underneath the wall cover plate. With this adjustment, you can vary the isolation anywhere between 10 and 25 dB. It can conveniently be set to *exactly* the value needed and then *changed* to a new value whenever it becomes necessary to readjust part of the system, add on taps or generally upgrade the system. Doing any of these will produce changes in voltage levels at the taps which, in turn, require resetting of isolation values.

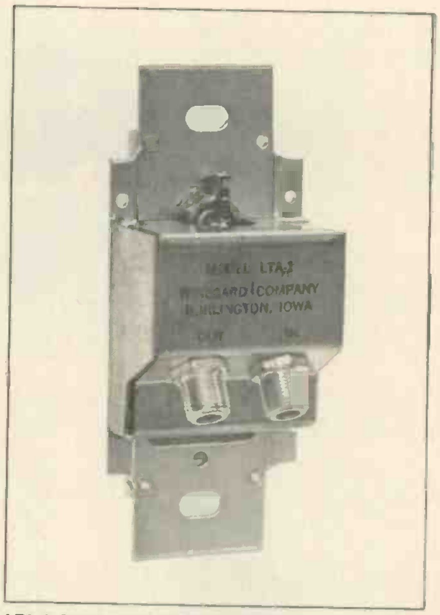
The Winegard Model UVF-87 is a conventional, variable-isolation line tapoff except that it incorporates separate, independent isolation adjustments for both VHF and UHF channels. This feature offers added economy in large systems where VHF and UHF line levels are significantly different.

UHF Amplified Tapoff

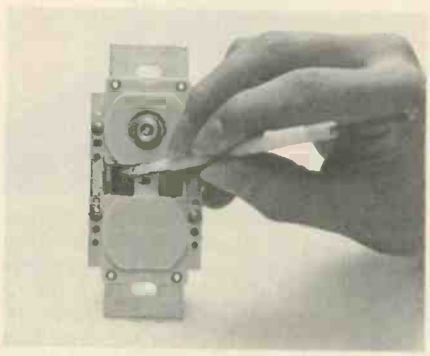
Another tapoff device, the LTA-1 has a built-in, line-extender UHF amplifier which compensates for high UHF cable losses in the trunkline. The amplifier has 10 dB of gain at UHF, with 2 dB of insertion loss at VHF, and isolation to the tap is fixed at 14 dB. The tapoff is powered by —12v DC from the trunkline.

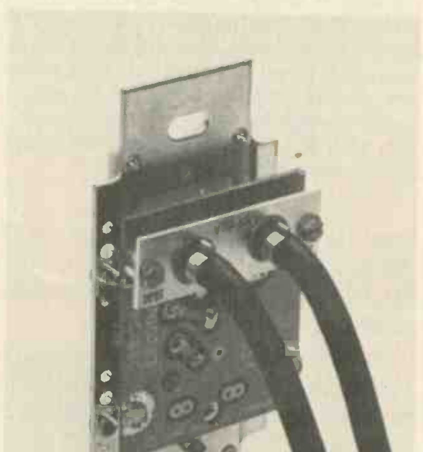
Directional Tapoffs Offer Best Picture Quality

There is one more type of tapoff that deserves mention: *the directional line tapoff*. Although a bit more costly than the others, it has a number of advantages. The line tapoffs we've discussed previously have employed resistive voltage-divider networks to achieve the necessary isolation. In addition to resistive isolation networks, the directional line tapoff also employs transformer action, which isolates the set from extraneous signals *coming back up* the trunkline, preventing them from getting to the tap. In other words, directional tapoffs are designed to pass signals only from the direction of the antenna or headend to the tap output; i.e., only in one direction, from the *input* connector to the tap outlet. Signals trying to reach the tap outlet from the output connector



LTA-1 82-channel Line Tapoff uses a 10 dB UHF amplifier to offset high losses at UHF frequencies. Unit bypasses VHF while providing 14 dB fixed isolation. Amplifier is powered by —12V on trunkline.





VTD-68 Variable-Isolation, 82-channel Tapoff features directional properties with 15 to 40 dB of variable isolation. In addition to isolation, directional action attenuates reflected signals from trunkline output by 25 dB.

are attenuated by 25 dB plus the isolation of the tap.

This directional characteristic prevents reflections and extraneous signals, usually generated in TV sets and other devices farther down the trunkline, from getting to the taps (and thus the TV sets) that are connected to the trunkline *ahead* of the disturbance.

Likewise, this tap has very little effect on the trunkline when connected in series with it. It has a trunkline voltage standing-wave ratio (VSWR) of 1.1:1 and a return loss of at least 26 dB. The backmatch, which the set "sees" looking back toward the tap, is also very low (typically 1.3:1), thus eliminating the possibility of having standing waves at the terminals of the TV set. Standing waves are a common cause of multiple ghosts and picture smear.

The result of all this is a cleaner, clearer, sharper picture devoid of smears and ghosts that usually are caused by the undesirable signals and reflections that many conventional tapoffs cannot completely discriminate against. If you desire the highest system performance and thus quality pictures, then consider using directional tapoffs.

If you do choose to install directional tapoffs, you'll be pleased to discover that they offer continuously variable isolation. Additionally, they are separately adjustable (from under the wall plate) over a range from 15 to 40 dB at VHF and 17 to 50 dB at UHF. Insertion loss is 0.5 dB at channel 2 and increases to 2.0 dB at channel 83.

TV WALL OUTLETS

There is another group of devices called *TV wall outlets* that cannot be classified as taps but yet bear a very close similarity to them, at least in appearance. TV wall outlets have no built-in isolation; they do *not* tap off a portion of the voltage on a trunkline. They are merely wall-mounted connectors that *physically* terminate a length of coaxial cable having its origin either at an antenna, a line-drop tap, a multiset coupler or a booster coupler. Because wall outlets have no isolation, they provide a direct interconnection between the end of a coaxial feeder

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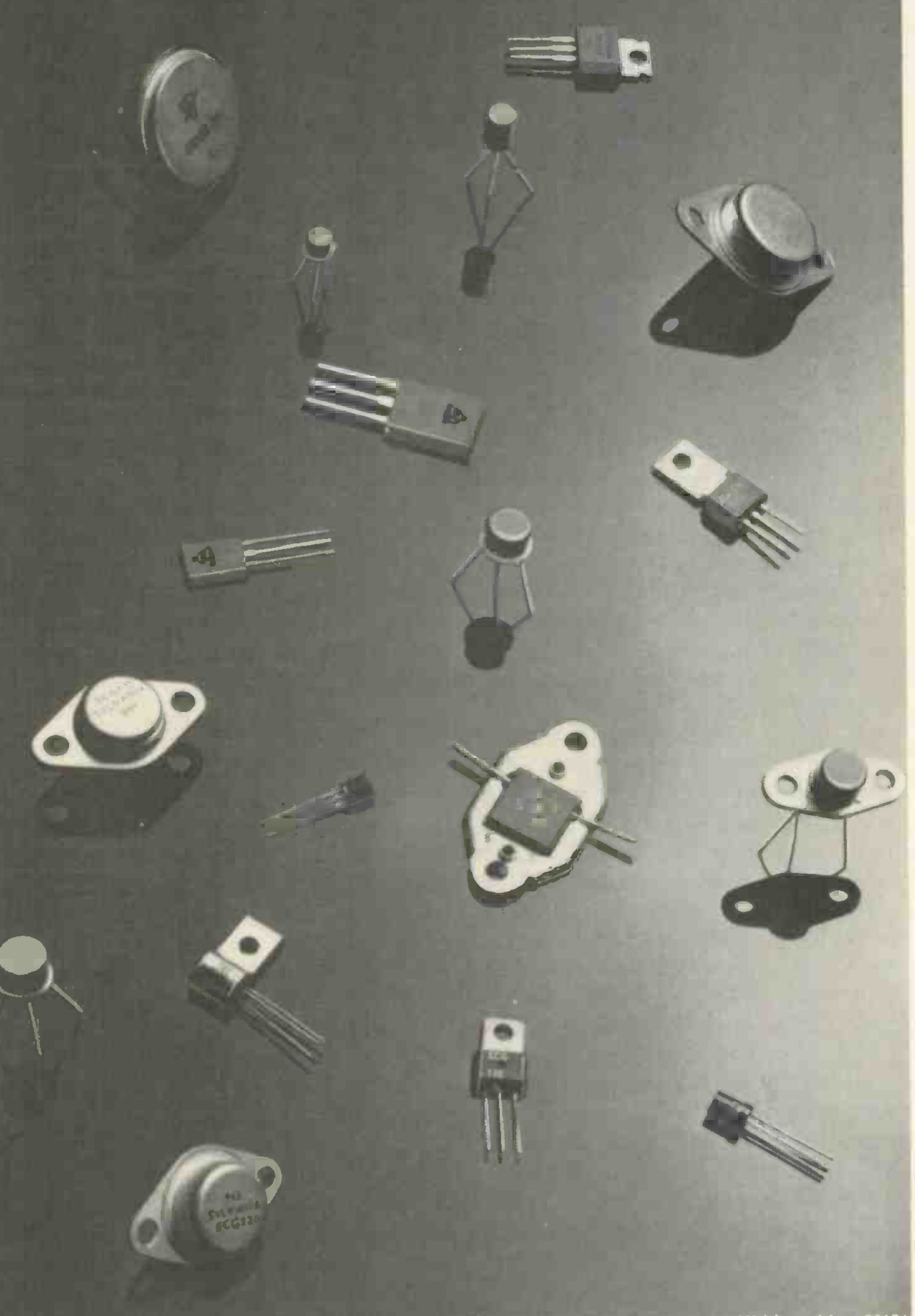

GTE SYLVANIA

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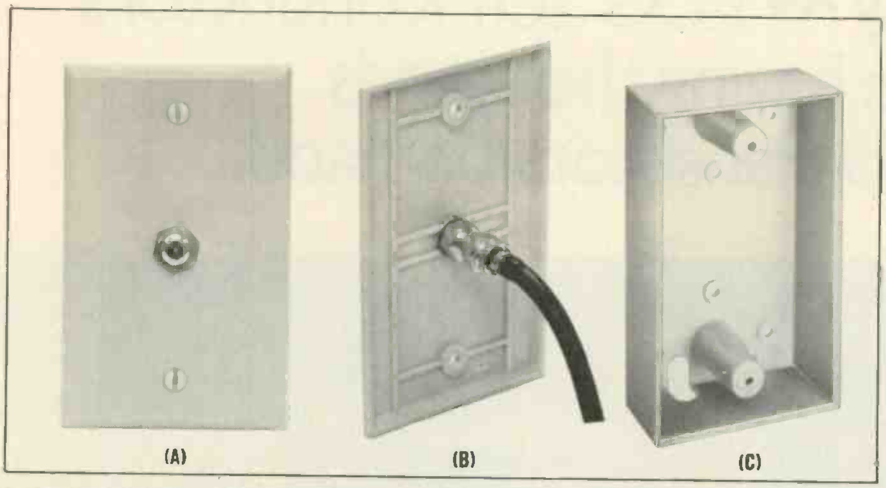
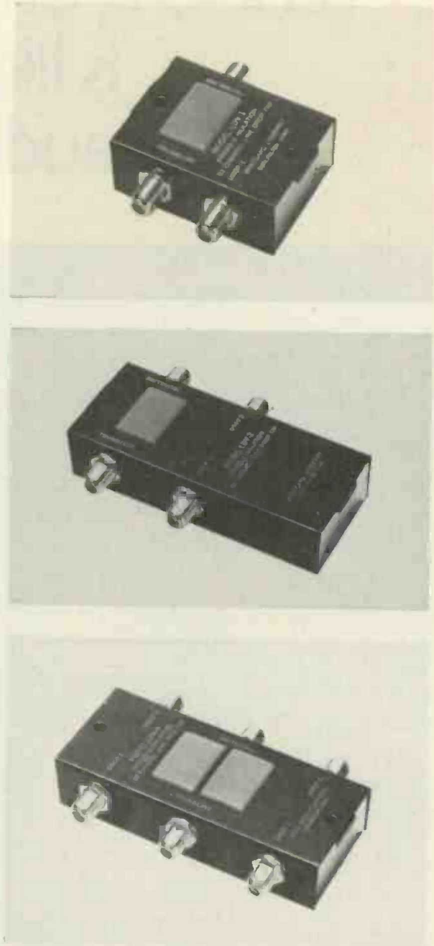


TV wall outlets have no built-in isolation and, consequently, are used only in MATV systems which utilize set couplers, booster couplers and/or line drop taps, all of which provide isolation between their outputs. A and B) T-77A Wall Outlet consists of wall plate and double-ended F connector to bring cable neatly through the wall. C) SM-1 Low-profile surface-mounting box for mounting TV wall outlets or line tapoffs in locations where flush mounting is not practical.



LDV-1, -2 and -4 Variable-Isolation, 82-channel Line Drop Taps offer continuously variable independent isolation adjustment for each individual drop tap. Wiper adjustments are concealed under snap-on, plastic hole covers.

cable and the TV set. To look at it another way, they merely serve to connect the cable inside the wall to the one attached to the TV set in the room. They mount neatly in the wall, as do tapoffs.

WALL MOUNTING

Line tapoffs and TV wall outlets come in a variety of configurations. They usually are available in two colors—brown and ivory—to match either room decor or the AC power receptacles that are also mounted in the walls of the room.

They can be mounted in any standard electrical box, for a flush wall mount, or in a compact, plastic, low-profile box, for surface mounting. The latter type is recommended for installations where wire or cable must be run on the surface of the wall or along the baseboard and/or where you are unable to cut holes in walls for flush-mounting boxes. Both types are available with either 300-ohm or 75-ohm input connections, with no-strip, screw-type terminals for 300-ohm input and F-type coaxial connectors for 75-ohm input. The outputs come with 75-ohm F-type connectors, 300-ohm no-strip screw-type terminals or a nylon disconnect plug for TV/FM, UHF, rotor or a combination of TV/FM plus UHF or TV/FM plus rotor.

LINE DROP TAPS

Line drop taps (Fig. 2) serve as a junction box for several coaxial cables radiating outward, each of which terminates in a wall outlet or passes directly through a wall plate to a TV set. The line drop tap consists of a metal box having several connectors, and is installed in a concealed, out-of-the-way location, such as the service area or the attic of a building. Electrically, it is connected into a trunkline like a tapoff and may have one, two or four separately isolated outputs feeding signals, via feeder lines, to wall outlets or directly to the antenna terminals of the TV sets.

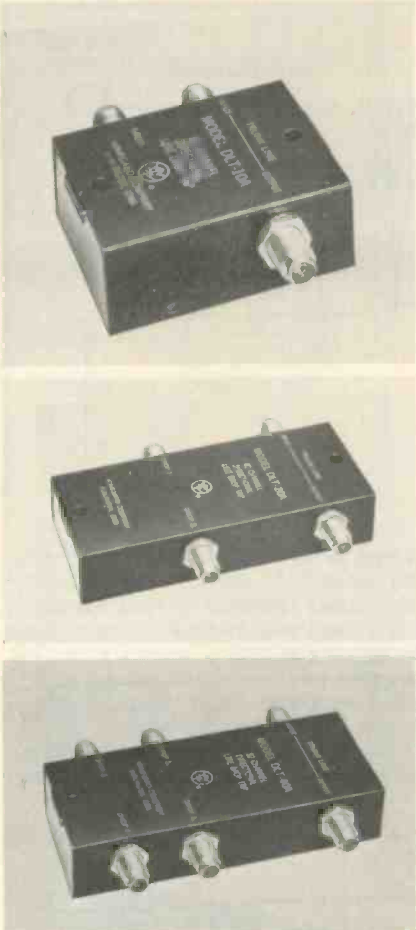
Drop Taps Eliminate Cable Loops

The advantages of using line drop taps instead of wall tapoffs is that the typically large trunkline cable does not have to be run the additional distance to each individual wall tapoff with its loop and, additionally, suffer the resulting feed-thru loss. Instead, the trunkline can be run in an approximately straight line, with the smaller feeder lines radiating outward to carry the signal to the wall outlets. This simplifies the installation, reduces the cost and, in addition, requires, where only one set is connected to a feeder, only simple, less-expensive wall outlets instead of tapoffs. The required isolation is built into the line drop tap in a manner so that it can be adjusted, and, as an additional benefit, the feeder line may be connected or disconnected without having to enter a private apartment, restricted or otherwise inaccessible area.

Drop Taps Offer Neater Installations

Line drop taps are especially handy in applications in which there are several outlets close together, as in a dealer's showroom, a service shop, a mobile-home park or in garden apartments.

Where cable must be exposed or run along a wall surface, drop taps eliminate the necessity of cable loops going to and coming from a wall outlet or tapoff. As a safety feature, Winegard drop taps, like Winegard tapoffs and outlets, help isolate from the trunkline AC/DC sets with "hot" chassis. (Always keep in mind, however, that the shield (outer conductor) of a coaxial cable is not in any way isolated from "hot" chassis receivers.)



DLT-1DA, -20A and -40A Directional Line Drop Tap attenuates reflected signals to tap outlet, entering from trunkline output, by 27 dB average. Each drop supplies a single wall outlet or a feeder line to several wall tapoffs.

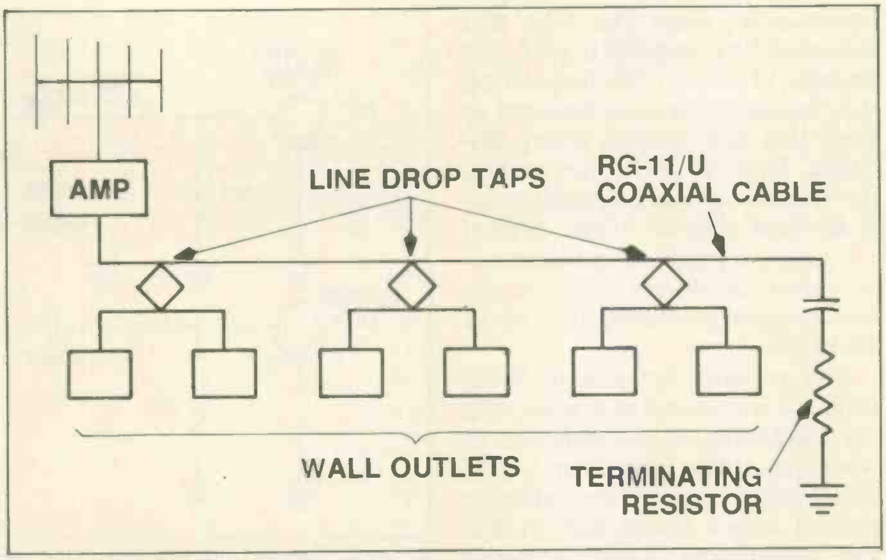


Fig. 2—Simplified diagram which illustrates the use of line drop taps in an MATV system. Line drop taps typically are available with one, two or four outlets which are connected via feeder cables to wall outlets. Line drop taps also make it possible to control the amount of signal taken from the trunkline to insure that each TV receiver receives sufficient signal, and without excessive feed-thru loss. The isolation provided by the line drop tap prevents interaction between TV sets connected to the system and blocks AC from receivers with "hot" chassis.

Variable Isolation and Directional Types

Two different basic types of 82-channel line drop taps are available: the variable line drop tap and the directional line drop tap. The variable type offers variable isolation, so that the signal to each feeder line can be adjusted to provide each TV on the line an adequate signal with minimum insertion loss of the trunkline signal.

Unlike directional tapoffs, the directional line drop tap (Fig. 3) typically has approximately 15 dB of fixed isolation. Being directional, it maintains a relatively high-quality of color signal on the feeder line and on the trunkline. Directional line drop taps permit a "free flow" of the signal, originating either at the antenna or the headend, to the TV set.

Any unwanted signals originating after the tap, such as reflections or spurious signals generated by other equipment "downstream," are isolated from the feeder lines by the directional properties of the tap. Likewise, the individual tap outputs have virtually infinite isolation between them, thus preventing any interaction between sets connected to the line drop tap as well as very high reverse isolation between the tap output and the trunkline. Because of this, VHF and UHF signals can be tapped off the trunkline with almost no change in the trunkline VSWR. And because the backmatch (VSWR looking back at the tap from the drop line or wall outlet) is less than 1.3:1, ghost-causing standing waves on the drop line are virtually eliminated.

Directional line drop taps give the system designer and installer the additional flexibility often needed to solve layout and installation problems in MATV systems and still provide acceptable pictures on every set at minimum cost. "Natural" applications include systems in which TV service is offered by subscription and systems in which subscribers' taps must be *remotely* serviced (connected, disconnected, and reconnected) as tenants move in and out. Equally as important, the directivity of the tap insures higher quality color signals by attenuating reflections and spurious signals on the trunkline.

BOOSTER COUPLERS

Booster couplers are nothing more than line splitters with built-in voltage gain. They usually are equipped with amplifiers which are designed to offset splitter and line losses. Although splitters and booster couplers do not fall in the same category as taps, they are worth mentioning because they frequently are employed like a line drop tap instead of like a splitter; i.e., the outputs are terminated in a wall outlet or are fed directly to the antenna terminals of TV receivers.

In a small system, if you don't need the gain provided by booster couplers, we advise you to use line drop taps.

PRESSURE TAPS

Another kind of tap is the *pressure tap*. It usually is used in outdoor applications. You'll find them installed in mobile-home parks and for house drops from an aerial or pole-line cable, as in CATV systems.

There are three types of pressure taps. The difference among the three is the method by which they achieve isolation. One uses transformer action, another uses resistor networks and the third employs capacitive coupling. Those that use transformer action or resistor networks are capable of handling all

82-channels, while the type that uses capacitive coupling is good only through VHF. At UHF frequencies, the capacitive reactance becomes so small that there is little, if any, isolation. Even at VHF frequencies, the isolation is reduced substantially between channel 2 and channel 13. Isolation provided by transformer action or resistor networks remains relatively constant over all 82 channels.

The pressure tap gets its name from the way it makes contact with the conductors of the trunkline or feederline cable. The outer jacket, shield and dielectric of the cable are pierced with a boring tool so that the pressure-tap inner conductor (stinger) may extend into the feeder cable and make a pressure contact with the center conductor of the cable. The tap then is clamped around the outer jacket, conductor and shield.

Pressure taps may be attached anywhere on a feeder cable, and the cable need not be cut. The big advantage is that they may be attached to the cable in the *middle* of a span. Most pressure taps are equipped with a strain relief for the drop cable and include a provision for clamping the strain relief to a steel messenger wire, to remove any strain from the feeder cable.

As you might expect, moisture and other elements "attack" the feeder cable where the outer jacket has been pierced, and the pressure contact at the inner conductor leaves something to be desired in terms of reliability and integrity of the signal. Pressure taps are available, but, for obvious reasons, are not highly recommended for MATV applications by some manufacturers.

TAP EVALUATION GUIDELINES

Next time you layout an MATV system, look carefully at the type of taps available and ask yourself: Is this tap the most efficient type to use in terms of:

1) Cost of tap vs. other system materials cost?
2) Cable routing versatility?
3) Installation ease (labor cost)?
4) Future system expansion?
5) Integrity of signals?
6) Compatible with present and future CATV requirements?

As you can see, there are many tradeoffs to be considered when choosing the proper tap for the job.

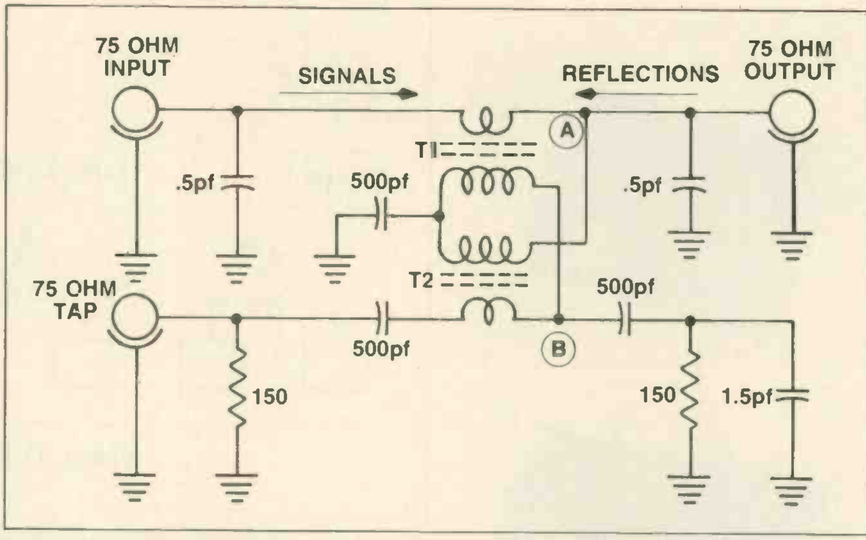
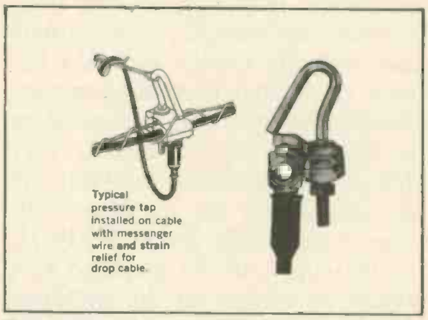
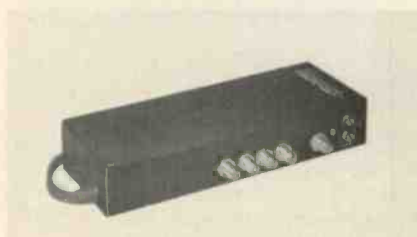


Fig. 3—Directional Line Drop Tap passes signal from input to tap but attenuates trunkline reflections trying to pass from output to tap. Transformer action in T1 and T2 imparts directional properties to tap. T1 primary, in series with trunkline, senses reflections as being opposite in direction to incident signals. T2 primary, connected to a single point on trunkline, cannot sense direction. Signals and/or reflections on the trunkline appearing at point A induce a voltage into T2 secondary between point B and ground. Trunkline signals and/or reflections incident upon T1 also induce voltages into T2 secondary between point B and ground. Signal voltages at point B are in phase and reinforce each other. Reflected voltages at point B are out of phase and tend to cancel each other. AC/DC blocking-capacitor (500 pF) reactance can be considered negligible at frequencies above 5 MHz. Small capacitors and resistors provide proper match at input/output and tap.



The pressure tap is an outdoor-type tap primarily for use in trailer courts and neighborhood cable systems. Hook-type tap attaches easily to RG-11/U foam or solid-core cable, with or without messenger wire. Pressure tap drops RG-59/U branch line to house or trailer. One F-59 connector included with tap. Isolation values of 10, 15, and 20 dB are available.



BC-274 Booster Coupler divides the input signal four ways and provides 6 dB gain to each of the 75-ohm outputs. Its high-level input (0.2 volt) allows it to operate as an amplified 4-way splitter following a distribution amplifier. It is designed to supply signals to four TV sets, usually via wall outlets.

MATV DESIGN ASSISTANCE

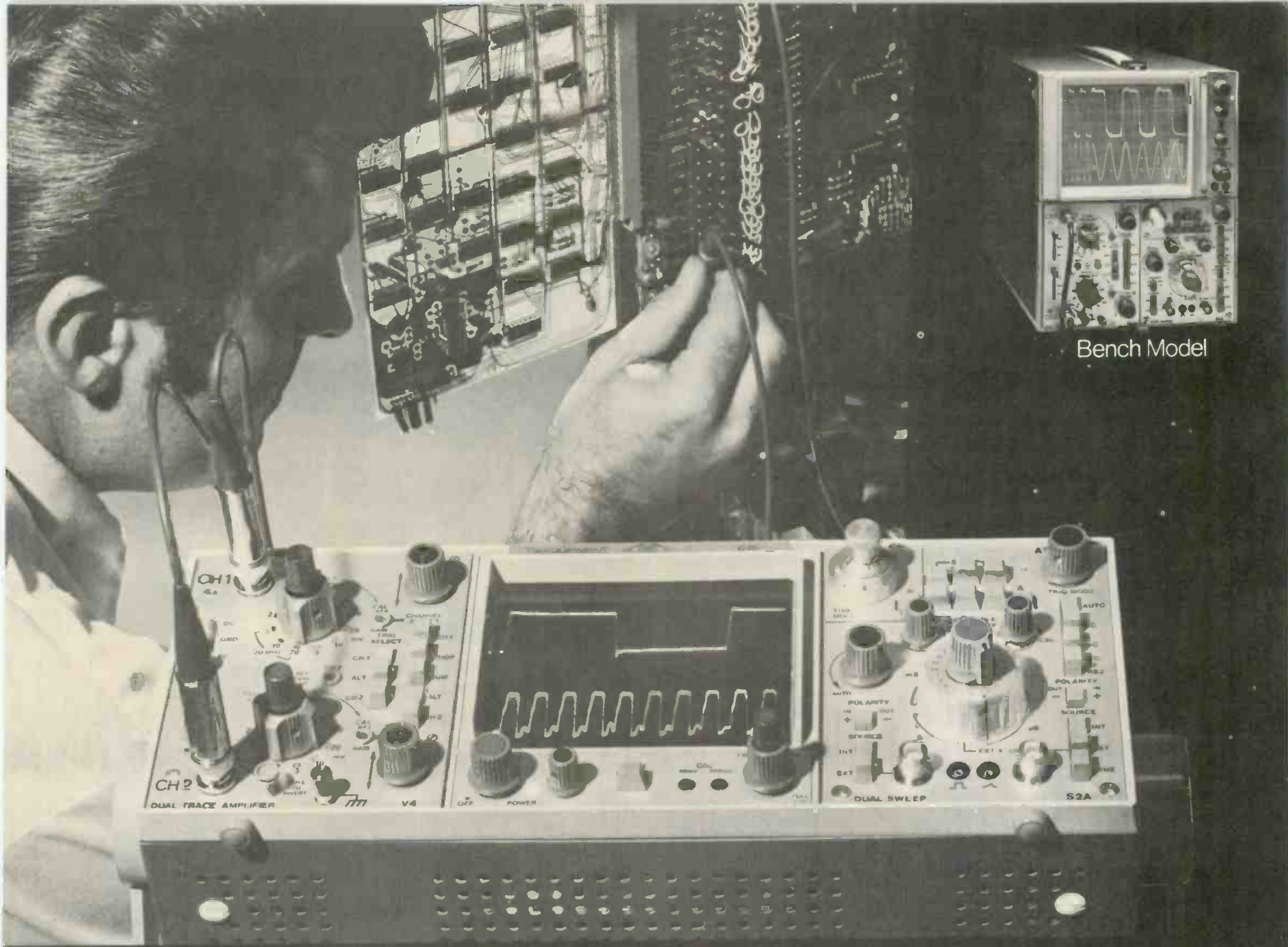
If you need design assistance, take advantage of the MATV systems-layout service offered by some antenna system manufacturers.

Whether the system is a hospital, school, mobile-home park, apartment or hotel, a complete layout and design of a system is provided to the installer by the Winegard Company for a nominal fee of $15.00. This fee, fully redeemable in the form of a credit check, may be applied directly to your invoice for Winegard equipment purchased for the system. Even as a check against your own design layout, it is a very cost-effective service, if you value your time.

LEARN MATV DESIGN AT 3-DAY SEMINAR

One other valuable service offered by the Winegard Company is their MATV Home and Commercial Seminars held throughout the U.S. about twelve times a year. These are 3-day seminars covering

continued on page 45



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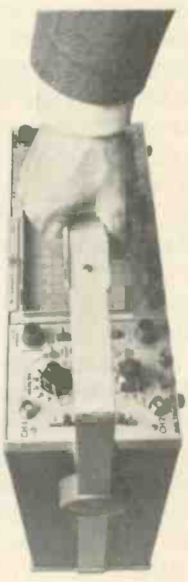

The Telequipment D75 was designed with the electronic serviceman in mind. It trades the D83's plug-in changeability for easy portability. It's lightweight, rugged, and easy to hand-carry onto an airplane. The tilt handle snaps to thirteen different angles to conveniently position the instrument. The D75 costs only $1375 with the same dual-trace amplifier and dual time base as the D83.

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TEST INSTRUMENT REPORT

Leader Model LCG-395 Universal Color Bar Pattern Generator

by J. W. Phipps

Leader Model LCG-395 Universal Color Bar Pattern Generator. For more information, circle number 900 on Reader Service Card.

Close-up view of front panel of Leader Model LCG-395 pattern generator.

■ The Leader Model LCG-395 is a relatively compact, all-solid-state TV pattern generator with a combination of unique patterns and "extra" features which make it, in the truest sense of the phrase, a versatile test instrument for color and black-and-white TV servicing.

FEATURES

Screen Patterns

The Model LCG-395 produces five screen patterns, four of which are considerably different than those produced by other color bar generators. The patterns are selected by five pushbuttons on the front panel of the generator.

Color bar pattern—The three-part color bar pattern produced by the Model LCG-395 is shown in Fig. 1. It consists of a nonkeyed rainbow pattern across the top third of the screen, ten conventional keyed rainbow color bars spaced at 30-degree intervals across the center third of the screen, and three color bars spaced at 90-degree intervals across the bottom two-thirds of the screen. Fig. 2 illustrates the phase relationships of the keyed rainbow color bars.

Convergence pattern—The multifunction, single convergence pattern produced by the Model LCG-395, shown in Fig. 3, is a combination of crosshatch (10 horizontal and 8 vertical lines); dots (11 horizontal and 7 vertical); center dot; broken horizontal and vertical lines, for centering of the raster and to indicate overscan limits; plus a corner marker consisting of 7 short horizontal lines, for determining whether or not the yoke windings are connected in the proper polarity. If the yoke connections are correct, the corner marker will appear at the lower right of the pattern, as shown in Fig. 3. If the corner marker appears at the upper right of the pattern, the yoke vertical connections are reversed; if it appears at the lower left, the yoke horizontal connections are reversed; and if it appears at the upper left, both the yoke horizontal and vertical connections are reversed.

Window pattern—This pattern, shown in Fig. 4A, consists of a white raster covering about one-half of the area of the picture tube screen surrounded by a black raster area. The purpose of this pattern is to reveal, by visual symptoms on the screen and by waveforms analysis, defects in the video IF and video amplifier sections. For example, incorrect frequency response and/or excessive gain in a video stage will be revealed by blurring of the vertical edge of the white raster area or spurious vertical lines along the edge of the white raster area and/or shading in the black raster area. The waveform which produces this pattern is shown in Fig. 4B.

Staircase pattern—The principal purpose of this pattern is to check the white balance (gray scale) and linearity of the video amplifier section of a TV, video tape recorder or antenna amplifier. As shown in Fig. 5, the pattern consists of a black stripe across the top of the screen, which represents zero video level, and five vertical stripes below it,

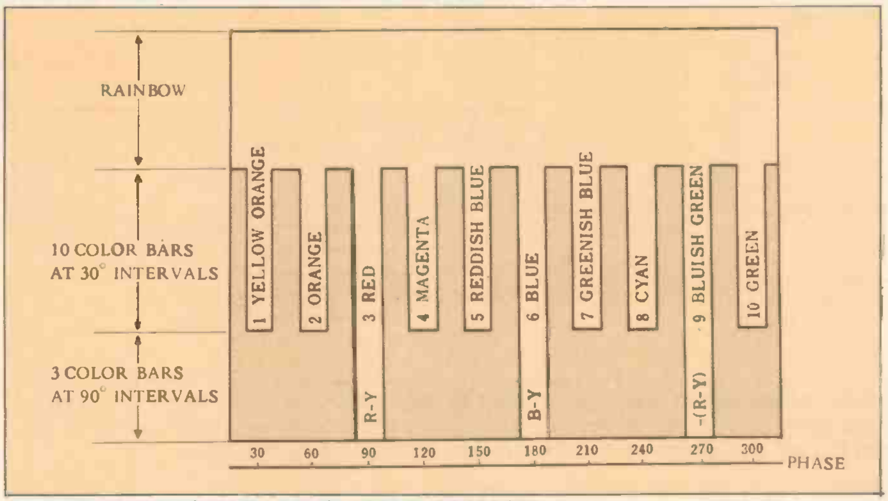

Fig. 1—Three-part color pattern produced by Model LCG-395.

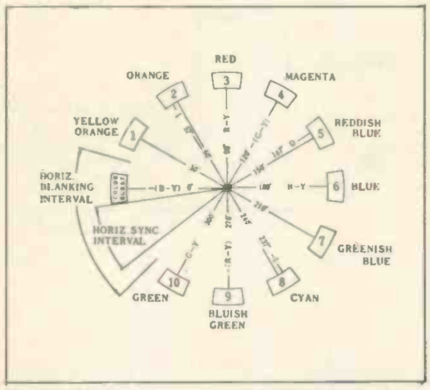

Fig. 2—Vector diagram which illustrates phase relationships of bars in color pattern produced by Model LCG-395.

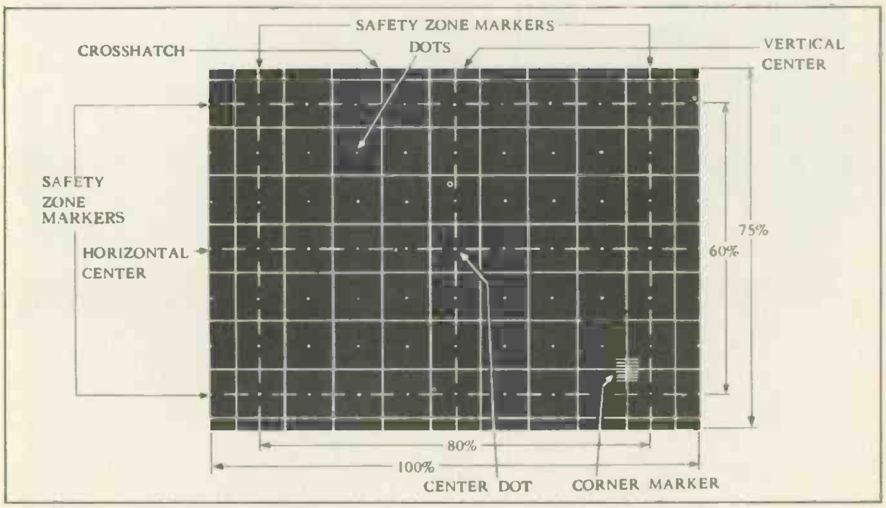

Fig. 3—Multi-function convergence pattern produced by Model LCG-395.

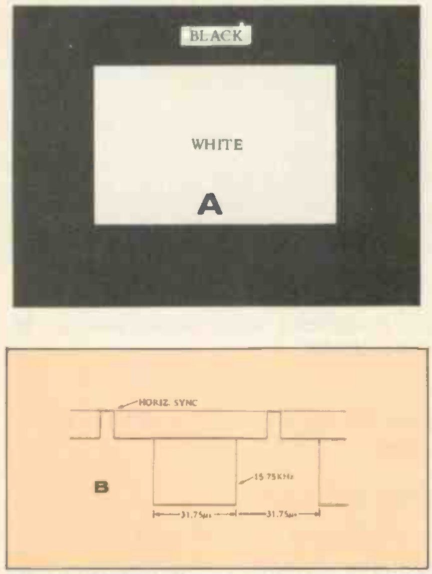

Fig. 4—Window display produced by Model LCG-395. A) Pattern. B) Waveform.

varying from gray (20 percent video level) on the left to white (100 percent video level) on the right. The staircase waveform which produces this screen pattern is shown in Fig. 6A and B along with the waveform of the sync signals from the Model LCG-395. Viewing both the staircase and sync waveforms simultaneously on a dual-beam or dual-trace scope, as shown in Fig. 6A and B, permits evaluation of the horizontal and vertical sync action as well as white balance and linearity.

White raster pattern—A 100-percent white, noise-free raster also is produced by the Model LCG-395 for purity checking and adjustment.

RF Output

The Model LCG-395 produces three RF outputs—video IF, Channel 5 and Channel 6—all of which can be modulated by any of the five pattern signals. The three RF outputs are selected by the lever-type CHANNEL switch, on the bottom right of the front panel, and are available at the front panel from either a 300-ohm, balanced twin plug-in connection or a 75-ohm, unbalanced BNC connector.

The unit comes equipped with a cord with 300-ohm plug-in connectors on one end and alligator clips on the other end, for attachment to the 300-ohm antenna terminals of the receiver. A coaxial cable with BNC connectors is available as an option. The RF output voltage can be varied, by the RF LEVEL control, from 1mv (1000 microvolts) to 10mv. This permits evaluation of the AGC action of the TV receiver. (1000 microvolts is considered the minimum RF signal level required for production of an acceptable picture on most TV receivers.)

Video Output

The Model LCG-395 also produces a composite video signal for evaluation of the video amplifiers in TV receivers and video tape recorders. The composite video signal consists of horizontal and vertical sync pulses, blanking pulses and the video signal for whichever of the five screen patterns is selected. The VIDEO LEVEL control, on the front panel of the generator, permits selection of either positive- or negative-going video signals, so that the video polarity can be changed to produce normal screen patterns regardless of where the video signal is applied in the video section. The VIDEO LEVEL control also varies the amplitude of the video signal from zero at the MIN position to +3V at +MAX position or −3V at the −MAX position. The video signal is available at a 75-ohm, BNC-type

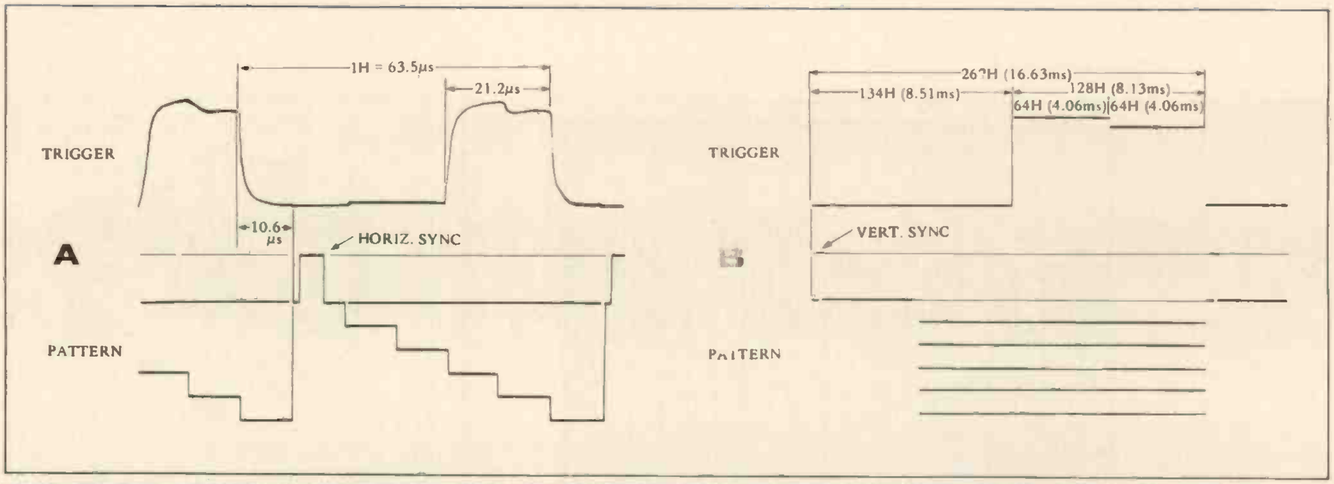

Fig. 6—Waveforms of staircase screen pattern and horizontal and vertical sync pulses produced by Model LCG-395, shown as they would appear on a dual-beam or dual-trace scope. A) Top, horizontal sync pulse; bottom, staircase waveform at horizontal sync rate. B) Top, vertical sync pulse; bottom, staircase waveform at vertical sync rate. Model LCG-395 also produces composite horizontal/vertical/blanking sync pulse.

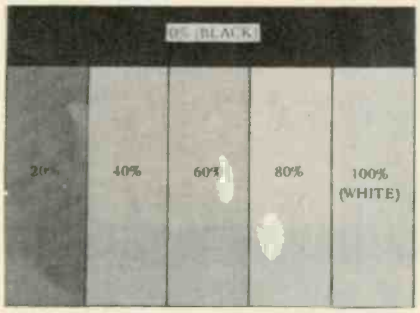

Fig. 5—Staircase screen pattern produced by Model LCG-395.

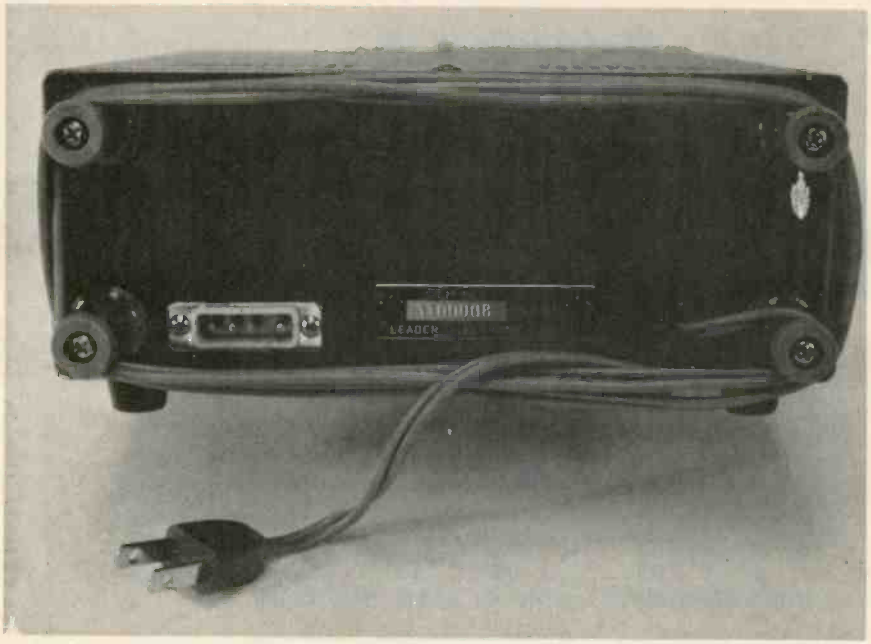

Fig. 7—Rear view of Leader Model LCG-395 pattern generator. Four-prong jack on lower left side is for gun killer cable.

jack on the left center of the front panel.

Trigger Output

Horizontal and vertical sync signals, for externally synchronizing the horizontal sweep of an oscilloscope with the pattern signals of the generator during waveform analysis, are available at a BNC type jack on left bottom of the front panel. Three types of sync signals are available—either horizontal, vertical or a composite of the two—and are selected by the lever-type TRIGGER switch on the front panel of the generator. The sync signals are particularly useful for stable display of chroma circuit waveforms which have the horizontal sync pulses blanked or keyed out and, consequently, usually are difficult to "lock in" on the scope screen.

Gun Killers

The Model LCG-395 is equipped with a built-in picture tube gun killer circuit which, when any of the three GUN KILLER pushbuttons on the front panel are depressed, disable the respective picture tube gun(s) by connecting the associated control grid(s) to ground via a 100K-ohm resistor. This feature usually is used, in conjunction with the white raster pattern, for purity evaluation and adjustment. Connection of the gun killers to the three control grids of the color picture tube is accomplished by a four-lead, color-coded, plug-in cable, which is supplied with the generator. (The black lead is for grounding the generator to the TV chassis.) The cable is plugged into a jack on the back of the generator (Fig. 7).

Variable Pattern Brightness

The brightness (and, consequently, contrast) of all screen patterns produced by the generator, with the exception of the staircase pattern, can be varied from zero to 100 percent by adjustment of the BRIGHTNESS control, on the front panel of the generator. The brightness levels of the staircase pattern are fixed.

CONCLUSION

Leader's Model LCG-395 Universal Color Bar Generator might seem to be overdesigned, and, consequently, overpriced, to those technicians who use a color bar generator only for color TV setup procedures or go/no-go tests to determine the presence or absence of color. However, its "extra" features should be appealing to those technicians who are proficient at bench servicing procedures involving video and chroma waveform analysis. The only "extra" feature I found missing in the Model LCG-395 is a 4.5-MHz sound carrier, which, in my opinion, makes accurate fine tuning of the TV receiver much easier.

SPECIFICATIONS

PATTERNS
Color Bars:
Rainbow (offset type), ten bars at 30-degree intervals, and three bars at 90-degree intervals, each pattern occupying one-third of the screen
Chroma level: 0-200%, continuously adjustable
Convergence:
A single, composite pattern consisting of crosshatch, 10(H) and 7(V); dots, 11(H) and 7(V); center dot marker; safety zone (margin) markers; corner marker, at lower right; brightness control, 0-100% continuously adjustable
Raster:
White (noiseless); brightness, 0-100% continuously adjustable
Window:
White rectangular pattern with black border; white brightness 0-100%, continuously adjustable
Staircase:
Black level (0%) across upper one-third of CRT screen; gray scale across lower two-thirds at approximately 20%, 40%, 60%, 80%, and 100% levels from left to right

RF OUTPUT
Three switch-selectable frequencies:
Video IF: 45.75MHz ±0.5%
Channel 5: 77.25MHz ±0.5%
Channel 6: 83.25MHz ±0.5%
Output Voltage: 1 to 10mv, continuously adjustable, at open circuit
Output Impedance: 75 ohm, unbalanced, and 300 ohm, balanced

VIDEO OUTPUT
Output Voltage: −3 to +3v, continuously adjustable, at open circuit
Output Impedance: Approximately 75 ohms
Trigger Output
Three switch-selectable signals:
Horizontal pulse (15.75KHz)
Vertical pulse (60.11Hz)
Composite (Blanking for horizontal and vertical)
Output Voltage: Approximately 3v p-p, at open circuit
Output Impedance: 10 K ohm

TYPE OF SYNCHRONIZATION
Crystal controlled progressive scanning (Horiz., 15.75 KHz, and vertical, 60.11Hz)

RETURN TRACE BLANKING
Both horizontal and vertical

GUN KILLERS
Three separate switches, for grounding via 100K-ohm resistors

POWER REQUIREMENTS
105-125v AC, 50/60Hz

SIZE
Approximately 3⅛ inch high by 7⅞ inch wide by 9⅞ inch deep

WEIGHT
5.5 pounds

PRICE
$299.95

ACCESSORIES
Included in price:
RF output cable, 300 ohm
Gun killer cable with plug
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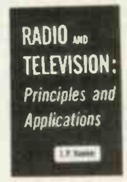

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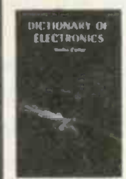

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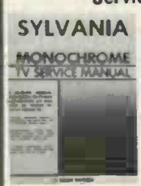

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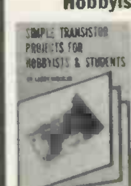

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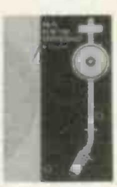

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Electronic Adjustments In Auto Tape Players

■ Electronic adjustments in a tape player are normally required only when a critical component has been replaced; for example, a tape head, or any component that can affect the unit's operation. In some instances, parts values change, which may also dictate readjustment in playback or record circuitry. Then, too, there are instances where service adjustments are necessitated by customer tampering. In either case, several examples of typical adjustment procedures are outlined in this article, to serve as a guide for most of the electronic adjustments you will encounter in auto stereo tape units. A list of cassette and eight-track test tapes is also provided.

Overall Check

As a means of providing the technician with a quick, effective overall check of an eight-track tape player, the following procedure is outlined. A Nortronics AT-820 test cartridge was used. This test cartridge, which runs for approximately eight minutes, provides the frequencies and voice material as shown in Figure 1. Program and channel identification are produced by sequence A with a one-minute voice identification on all four programs. The voice signals identify left and right channels. If the left and right signals do not correspond to the test tape indications, change the speaker connections. The program indicator on the tape player should also agree with the voice signals.

(From Chapter 6, AUTO STEREO SERVICE & INSTALLATION, by Paul Dorweiler & Harry Hansen, TAB BOOKS, Copyright 1974. A review of the complete book follows this article.)

Sequence B on the test tape is silent on track 2, program 2, left channel. If the heads are perfectly aligned, the output from track 2 will be silent. If the heads are out of alignment, some crosstalk from the 125 Hz signals on tracks 1 and 3 will be evident, indicating that head height adjustment is required. Adjust the tape head to eliminate any 125 Hz signal from the left speaker on program 2, sequence B. Refer to the head alignment section of this article.

An 8 kHz tone for head azimuth test and adjustment is provided on track 6, sequence B, which is the right channel of program 2. A properly aligned head will produce the best high-frequency response. To check the azimuth setting, connect an AC VTVM across the right speaker with the tape player balance control set to give maximum output at this speaker. While playing sequence B of program 2, adjust the tape head azimuth screw for a maximum meter reading. Check to be sure you are not on a false peak. The correct peak is the one producing maximum output.

Tracks 4 and 8 of sequence B, program 4, contain three tones of 100, 400, and 5000 Hz for checking frequency response and speaker phasing. These tones run for 30 seconds, 10 seconds for each tone. They are repeated five times during sequence B.

To check the frequency response, connect an AC VTVM across the left speaker. Set the tape player tone control to midrange for a flat response and the balance control to favor the left speaker. Play program 4, sequence B. The meter reading should remain the same for all three frequencies. If the frequency test tones indicate poor frequency response, the tape head may have oxide contamination, or it may be misaligned, Figure 2, magnetized, or the head may be defective.

Speaker phasing is checked by setting the balance and tone controls to midrange while playing program 4. Turn the tape player volume up and lis-

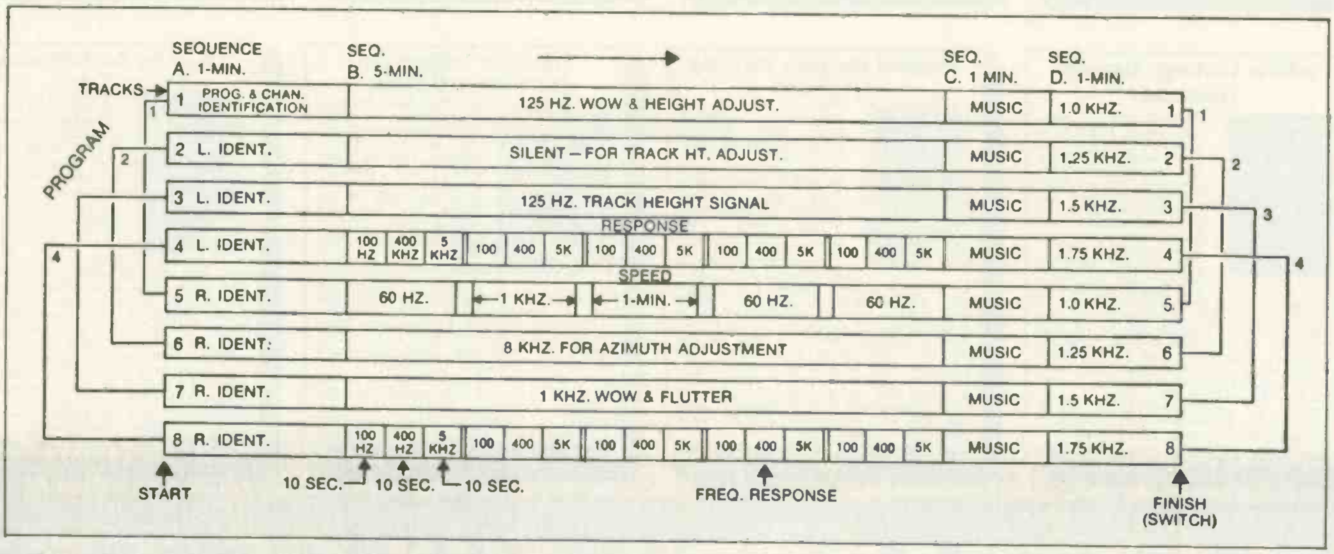


Fig. 1—Program chart of an eight-track test tape (Nortronics At-820).

ten to the 100 Hz tone. When the speakers are correctly phased, the 100 Hz tone will sound the loudest. If it is necessary to change the phasing, reverse the speaker leads on only one speaker.

A signal of 60 Hz is recorded on track 5, which is the right channel of program 1 in sequence B to check tape speed. There are also four short bursts of 1 kHz signals spaced exactly one minute apart and superimposed on the 60 Hz recording. To check the tape speed, connect the vertical input of an oscilloscope across the right speaker and the horizontal input to the output of an audio oscillator. The objective, of course, is to obtain a Lissajous pattern formed by the audio oscillator signal and the 60 Hz signal on the test tape. Play program 1 and set the tape player balance control to favor the right speaker. Set the audio oscillator frequency to obtain a stationary pattern on the oscilloscope and note the frequency. If the oscillator frequency is lower than the 60 Hz test tape signal, the tape speed is low. For a more exact frequency reading, a frequency counter may be used. As an alternate check, a stop watch can be used to time the intervals between the 1 kHz bursts, which are recorded exactly one minute apart.

A 1 kHz signal for checking wow and flutter is recorded on track 7, which is the right channel of program 3. By listening to this signal, any variations detected in the frequency indicates the presence of wow or flutter.

Other test signals on the tape can be used to check crosstalk by switching from program to program. The overall system can also be checked by playing sequence C, which contains four different programs of stereo music.

Head Alignment

Tape player head alignment on both eight-track and cassette players is usually required after the playback head has been replaced or because some critical mechanical part of the tape head assembly was replaced or misaligned. There are generally two types of head alignment: head height and azimuth. The diagram in Fig. 2 shows the head movement caused by each adjustment. Misalignment of head height can cause reduced output and increased crosstalk, while poor azimuth can result in a loss of high-frequency response.

Incidentally, if a customer complains of poor high-frequency response, be sure to check for oxide buildup on the tape head itself. Clean the head and recheck the frequency response before blaming the problem on poor azimuth alignment. Oxide buildup occurs gradually with use and often the customer will not notice the degradation of sound until it becomes extremely bad.

Another common cause of poor tape reproduction is head magnetization. This is usually accompanied by a higher than normal background noise level. Demagnetize the tape head prior to alignment.

Head alignment should be made while using the manufacturer's recommended test tape designed specifically for that unit. If a particular test tape is not recommended, use one of the test tapes made for head alignment; they are available from several sources. A list of test tapes is provided for your convenience in this article.

There are many types of tape head alignment systems in use. A number of these variations are presented in this section; those shown are representative of the most common types of adjustments you are likely to encounter in servicing.

As a general rule, tape head alignment starts with the tape head height adjustment, followed by azimuth. The tape head should be demagnetized and cleaned prior to any adjustment. The test equipment required is the rec-

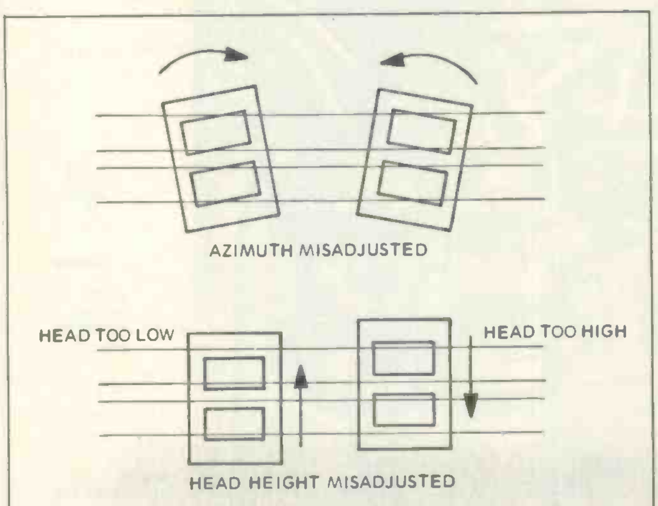


Fig. 2—These drawings show misadjustment of tape head height and azimuth.

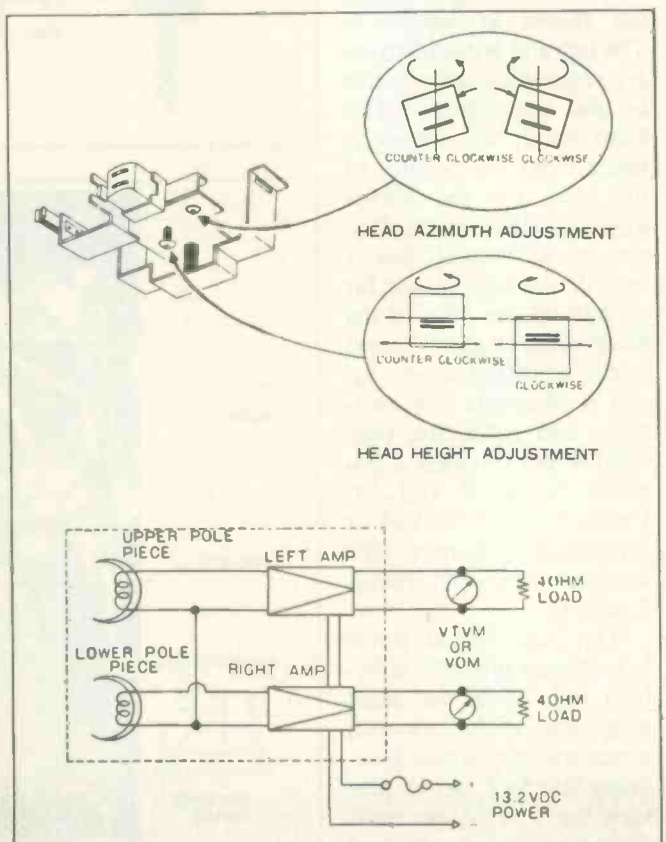


Fig. 3—Head alignment diagram for a Blaupunkt eight-track player.

ommended cassette or eight-track test tape, and an AC VTVM or oscilloscope for measuring the level across the speaker (or appropriate load resistor).

The diagram in Figure 3 shows the head adjustments for a Blaupunkt eight-track player. In this unit, adjusting the head height involved aligning the bottom edge of the tape head pole piece with the bottom of the tape guides. Azimuth alignment is made by using a test tape and adjusting the azimuth screw from maximum output measured across the speaker (or 4-ohm load resistor). The tape head alignment is then checked by playing all four programs and repeating the adjustments if necessary for uniform output.

The head adjustments for a Motorola eight-track, four-channel tape player are shown in Figure 4. The top and bottom covers are removed to gain access to the adjustments. The head height adjustment is made from the bottom of the unit, but the player must be right side up. One way to accomplish this is to slide the tape player far enough off the edge of the workbench to allow access to the adjusting screw. Insert a Motorola test cartridge and index the tape head to the program 2 position (tracks 2 and 6). Connect an AC VTVM or oscilloscope across the left-channel output (track 2 signal).

The head height screw is locked in place by a ¼-inch nut. Hold the head height adjusting screw with a screwdriver while loosening this lock nut to prevent the screw from accidentally turning. A tool can be made for this type of adjustment as shown in Figure 5. Once the lock nut is loose, turn the head height screw to move the head up or down as necessary to obtain a null on the AC VTVM. The reason for adjusting for a null is that the 1 kHz information is recorded on the tracks adjacent to track 2 on the Motorola test tape. This adjustment will greatly reduce the possibility of crosstalk. To be sure that the head height adjustment is properly made, check for a peak on either side of the null. Once the null is

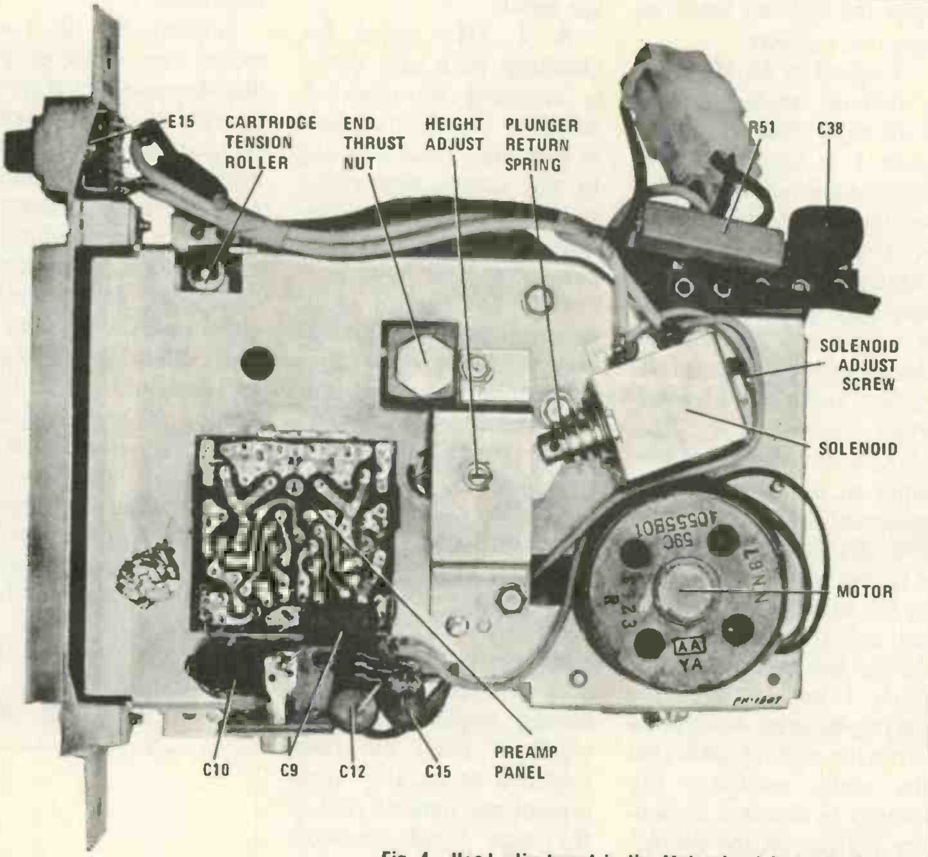


Fig. 4—Head adjustment in the Motorola eight-track player.

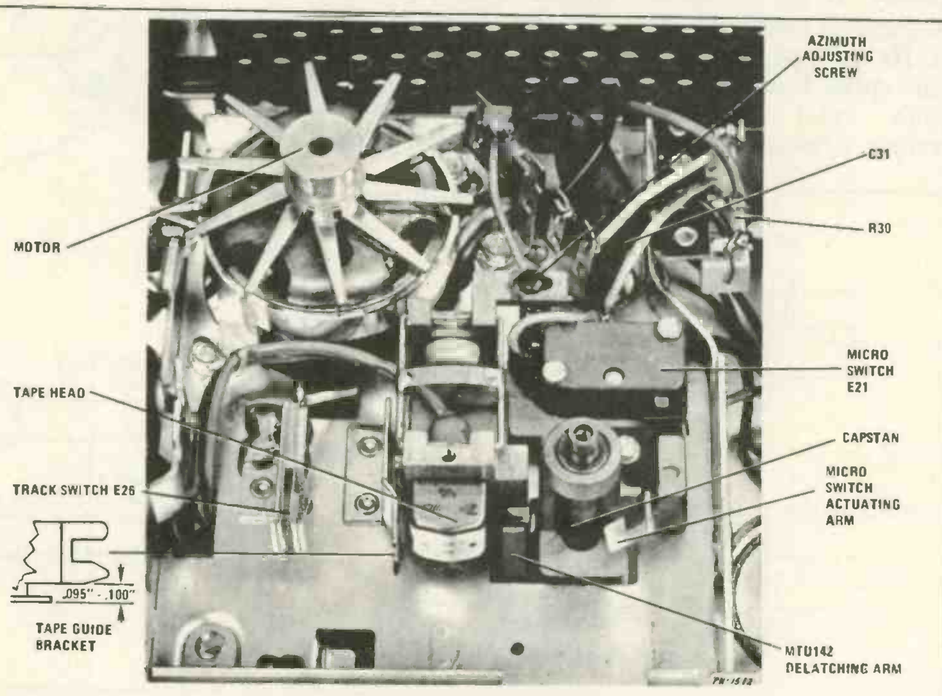


Fig. 6—Azimuth adjustment in the Motorola eight-track player.

achieved, tighten the adjusting screw lock nut while holding the screw in place.

The azimuth adjustment, Figure 6 on this unit, is used to obtain maximum output. The AC VTVM (or oscilloscope) is reconnected across the right-channel output (track 6 signal) to monitor the 8 kHz signal. Repeat the adjustments for optimum output. Glyptal or some other type of nonhardening cement should be used to secure the screw in place when the adjustment is completed.

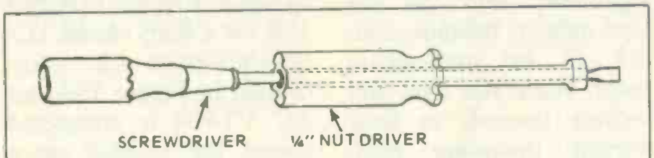


Fig. 5—Tape head alignment tool.

The diagram in Figure 7 shows the head adjustments for a Panasonic eight-track, four- and two-channel player. In this unit, head azimuth is adjusted first by inserting a Panasonic test tape (VTT-801) and setting the player for program 2. The head azimuth adjusting screw, accessible at the top of the unit, is turned to provide maximum output from the right-channel speaker. An AC VTVM connected across the speaker is the normal means of measuring this output. An alternate method of adjusting the head azimuth, when no test tape is available, is to use a music tape with lots of treble and adjust the tape head for maximum treble response from the speaker. Obviously, the best and surest azimuth alignment requires a test tape.

The head height adjustment on this tape player is made in the same manner as previously described, except that the head height adjusting nut is turned to produce maximum output at the left-channel speaker. As shown by the eight-track configuration diagram in Figure 8, aligning the tape head in the program 2 mode results in pickup from tracks 2 and 6. When adjusting the head height, be sure to check for any crosstalk when changing from two-channel to four-channel operation.

An RCA eight-track player tape head adjustment diagram is shown in Figure 9. This unit is equipped with an antitamper head height adjustment which requires a special tool. The tool can be easily made as shown in Figure 10. Connect an AC VTVM or oscilloscope across one of the speakers and insert an RCA No. 314 test tape at the 1 kHz signal portion.

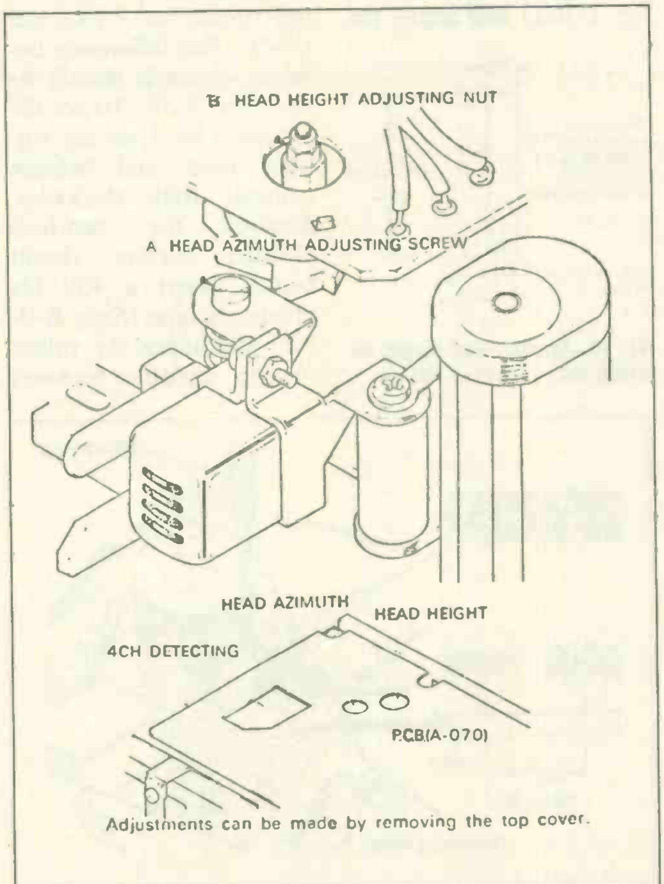


Fig. 7—Panasonic Model CX601EU eight-track, two/four-channel player head alignment diagram.

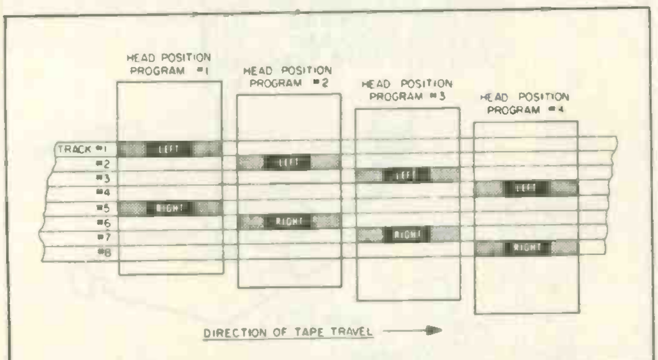


Fig. 8—Various head positions in an eight-track tape configuration. *(Courtesy Telex.)*

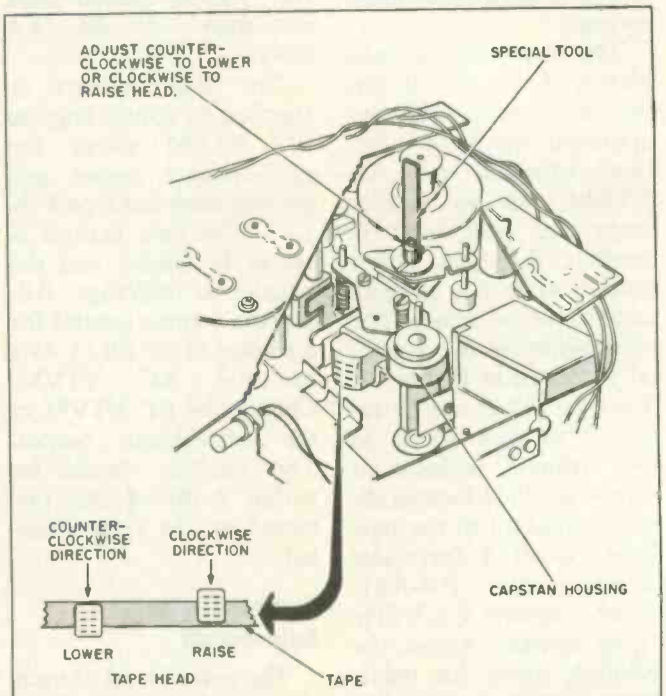


Fig. 9—Tape head height adjustment diagram for an RCA eight-track player.

Using the special tool, adjust the head height for maximum output on all four program positions.

The azimuth adjustment for the RCA eight-track player is shown in Figure 11. An AC VTVM (or oscilloscope) is connected across one of the speakers and the 8 kHz portion of the RCA No. 314 test tape is played. The azimuth adjustment screw is turned either clockwise or counterclockwise as necessary to produce maximum output. An access hole for this adjustment is also provided in the top of the player case.

The azimuth adjustment for an RCA cassette is illustrated in Figure 12. The procedure is basically the same as indicated for the eight-track unit in that an AC VTVM or oscilloscope is used to monitor the output. An RCA No. 1-102 or 1-103 test cassette is used to provide an 8 kHz signal. The azimuth adjustment screw is then turned either clockwise or counterclockwise as required to obtain maximum output.

The Sony cassette tape player, Model TC-20, utilizes a somewhat different approach to adjust the head azimuth. An AC VTVM and an oscilloscope are both used to monitor the tape player output while the azimuth adjustments are made. The test equipment is connected as shown in Figure 13. The tape player case is removed to gain access to the azimuth adjustment screw, which is located directly adjacent to the tape head. Insert a Sony test cassette, No. P-4-A81, which contains a 6.3 kHz signal source. Adjust the azimuth screw for maximum output on the AC VTVM and to obtain the Lissajous pattern shown on the oscilloscope. To confirm the azimuth adjustment, insert a Sony test cassette No. P-4-L81. Set the tone control to H (high) and the balance control to midrange. Play the test cassette. The AC VTVM should read more than +14 dB (3.8V) on each channel.

To check frequency response, set the tone control to H, balance control to midrange, and insert the P-4-L81 test tape. Play the tape and adjust the volume control for +5 dB (1.4V) on the AC VTVM. Remove this tape and play back the P-4-A81 test tape. The AC VTVM should now read zero, plus or minus 3 dB, or 0.5 to 1.1V. Turn the tone control to the L (low) position. The AC VTVM should read −15, plus or minus 3 dB or 0.09 to 0.19V. The signal-to-noise ratio is checked in the same way for the same reading up to the point of inserting the P-4-A81 test tape. In its place, a blank cassette is inserted and the AC VTVM should read less than −45 dB (4.4 mV).

The level balance is checked by connecting the AC VTVM across the right-channel output and playing Sony test tape P-4-L81. The tone control is set to H (high) and the balance to midrange. Adjust the volume control for a reading of +5 dB (1.4V) on the AC VTVM. Change the AC VTVM to the left-channel output. The reading should be within 2 dB of that obtained on the right channel.

Playback Level Adjustment

The output level of each channel should be adjusted for maximum and both outputs should be equal. As shown in Figure 14, the left and right output level adjustments on this RCA cassette unit are easily accessible by removing the mounting bolts on the right-hand side. Set the tape player balance control to its midrotation point. Place the tone and volume controls in their normal operating positions. Insert a standard reference level, 400 Hz full-track cassette (RCA No. 1-101) and adjust the right- and left-channel amplifier output levels for a maximum, equal signal level from each channel.

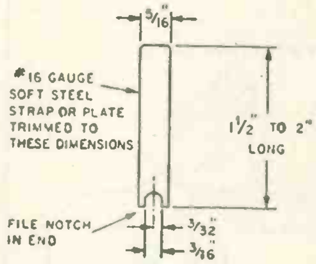


Fig. 10—Special head height adjusting tool. *(Courtesy RCA.)*

Another type of playback level adjustment is shown in Figures 15A and 15B for a Sony Model TC-84, eight-track unit. As indicated in Figure 15A, an AC VTVM is connected across the speaker or a 3.2-ohm load. The standard output reference level measured across each output should be +14.3 dB (4V). The difference between channels should be less than 3 dB. To set the playback level, set the volume, tone, and balance controls fully clockwise. Remove the two-four channel selector circuit board. Insert a 400 Hz alignment tape (Sony R-9-L1) and adjust the values of the variable resistors

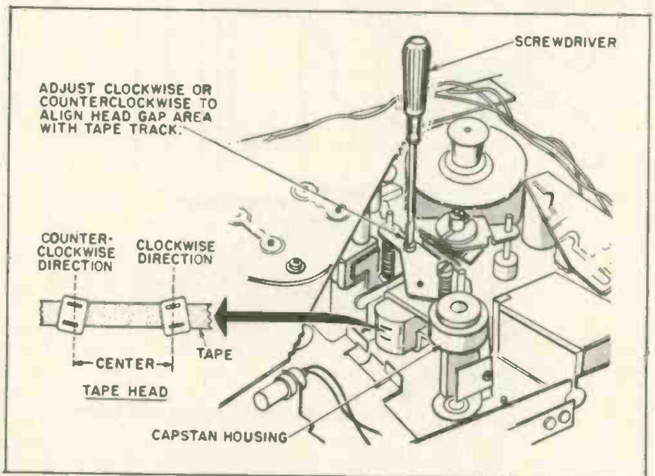


Fig. 11—Tape head azimuth adjustments for an RCA eight-track player.

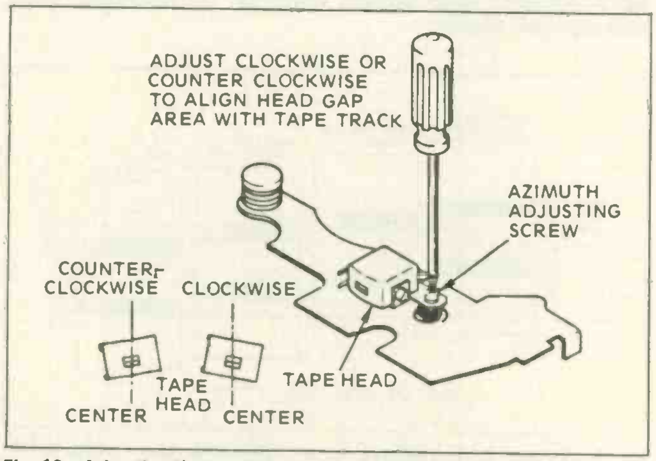


Fig. 12—Azimuth adjustment for an RCA cassette player.

VR101, 201, 151, and 251 (shown in Figure 15B) to obtain the required output of +14.3 dB (4V) on each channel. If the specified output cannot be obtained, select appropriate resistor connections as shown in Figure 15B. Note: Lowering the resistance increases the output.

Record Level Adjustment

Record levels are normally factory preset, but may require readjustment due to parts replacement in critical circuits. The diagram in Figure 16 illustrates the test equipment setup for adjusting the record level on an RCA Model 12R100/200 cassette player. However, the same basic approach can be followed on many tape player-recorders.

To set the record level, remove the cabinet covers to gain access to the record printed-circuit board. Disable the bias oscillator circuit. In this unit, the bias oscillator is disabled by unsoldering the lead connected to the +B2 terminal and temporarily connecting it to the +B1 terminal as shown in Figure 17. Temporarily disable the automatic level control (ALC) circuit by connecting a short jumper wire as shown in Figure 17). Connect a 333 Hz sine-wave signal at 250 mV through a 60 dB pad to the microphone input jack. The 60 dB pad may be assembled as indicated and wired directly to the microphone plug if desired. Connect an AC VTVM between one of the shield connections at the record head and the minus terminal on the record printed-circuit board (Figure 17). Connecting the AC VTVM here provides an indication of the voltage developed across the 10-ohm resistors (R22 and R72 on the schematic). While holding the record pushbutton in a depressed position, insert a blank cassette tape in the unit and adjust the record adjustment (R218) on the record circuit board for 0.5 mV on the meter. This reading should correspond to 50 microamperes of head current. Depress the eject button to remove the cassette. Remove test equipment, reconnect leads, and replace covers.

Bias Trap Adjustment

The purpose of the bias trap is to prevent stray signals from interfering with the operation of the ALC circuit. One method of bias trap adjustment can be illustrated by again referring to the RCA unit in Figure 17. Remove the record printed-circuit board and connect a high-impedance VTVM or oscilloscope between terminal T and the minus terminal. Disconnect the micro-

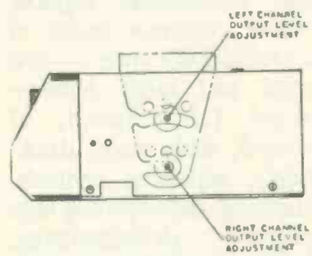


Fig. 14—Left- and right-channel level adjustment locations on the RCA Model 12R100 cassette player.

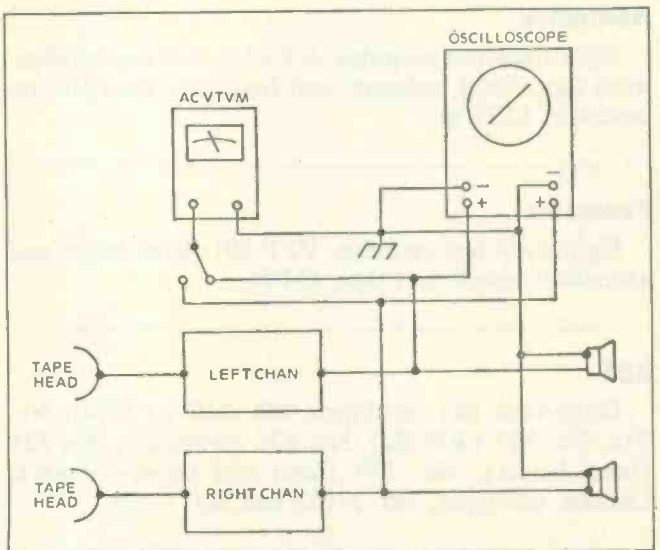


Fig. 13—Test equipment connections for the lissajous pattern azimuth alignment technique.

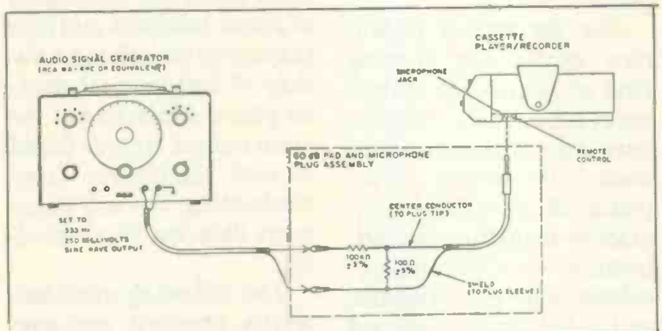


Fig. 16—Record level test equipment setup. *(Courtesy RCA.)*

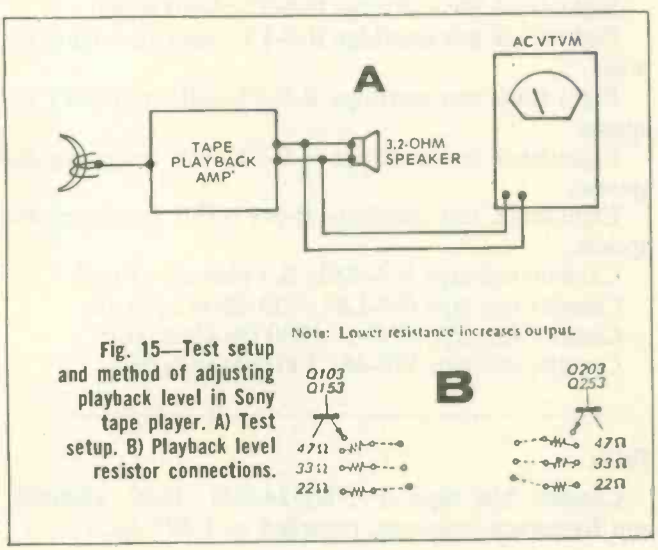


Fig. 15—Test setup and method of adjusting playback level in Sony tape player. A) Test setup. B) Playback level resistor connections.

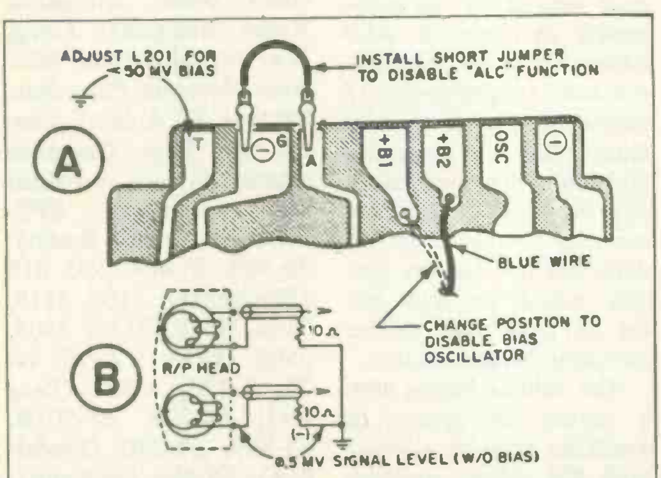


Fig. 17—Record circuit board test terminal locations on an RCA Model 12R100/200 cassette player.

phone. While depressing the record pushbutton on the tape unit, adjust the core of L201 on the record printed-circuit board for a minimum reading on the meter. The reading should be less than 50 mV RMS. Disconnect the test equipment and replace the circuit board. ■

TECH BOOK REVIEW

Title: Auto Stereo Service & Installation (TAB BOOK No. 694)
Author: Paul L. Dorweiler & Harry E. Hansen
Price: $8.95, hardbound
$5.95, paperback
Published: April, 1974
Size: 252 pages, 258 illustrations

■ A one-stop source of service information for *all* types of automotive stereo equipment, plus detailed installation procedures for FM radios, 8-track cartridge units, and cassette players.

For the service technician eyeing the growing field of auto stereo system installation and service, here is an extremely useful book. It covers every phase of installation, including mounting and adjustment of FM stereo receivers and tape players, and it tells how to get rid of troublesome interference caused by the automotive environment. Also included are 48 complete schematics representing 13 major manufacturers, plus many other servicing diagrams and sketches. Actually, the book is a veritable one-stop source of service data, not just for the specific models covered, but for all units with similar operating characteristics.

The volume begins with a survey or review of available popular units—both FM stereo receivers and tape players—and one of the most lucid descriptions of magnetic-tape theory ever published. Readers will find it useful not only for their own servicing needs, but as an aid in getting their customers to understand those aspects they ask about most often. The text on the art of installation is very thorough and detailed—even to the point of explaining and showing how to make a hole in carpeting!

But the largest part of the book is devoted to servicing. The subject of general maintenance covers the mechanical aspects, which consume much of a technician's time — dial cord and lamp replacement (illustrated, of course, with many drawings), replacing controls, cleaning and adjusting tape players, demagnetizing, and tape splicing.

Without going into unessential basics, the authors cover the electronics of stereo receivers and tape players by examining a variety of complete schematics plus a smattering of the more unique circuits found in such equipment. Troubleshooting tips and alignment data are also included.

The following manufacturer's products are covered in this service technician's book: Automatic Radio, Blaupunkt, Craig, Lear Jet, Medallion, Midland, Motorola, Panasonic, Peerless, RCA, Sony, Tenna, and Toyo. Complete schematics are provided for these models: SPE-5004 (Automatic Radio); 30-629, 9 404 230 018 (Blaupunkt); 3108, 3119, 3126, 3129, 3132, 3505, 3506 (Craig); A-25, A-75, A-125, A-225 (Lear Jet); 65-500, 65-501B, 65-509, 65-240 (Medallion); 65-486 (Midland); ARIP, CTZMX, PCZMX, TF802S, TM204S, TM-920S, TP10, TP14 (Motorola); CJ-81REUEN, CQ-909EU, CR-008EU, CX-131EU, CX-601EU, RS-248S (Panasonic); CS-532, CS-700B, CSR-977 (Peerless); 12R200, 12R-301, 12R600, 12R800 (RCA); TC-10, TC-20, TC-84 (Sony); R203 (Tenna); CS-300, CS-304, CS-721, CS-722 (Toyo). In addition, there are many partial schematics, and drawings that show specific receiver circuits, mechanical functions, and adjustments—over 150 in all, plus over 80 photos, for a total of almost 250 illustrations!

CONTENTS: Auto Stereo Equipment — Accessories — Installation — General Maintenance — Servicing FM Stereo Receivers — Servicing Tape Players — Glossary — Index. ■

MANUFACTURERS' TEST TAPE LIST

Motorola

Eight-track test cartridge, P/N99P43309A01: head height and azimuth.

Nortronics

Eight-track test cartridge, AT-820, and cassette alignment tape: level, azimuth, and frequency response; recorded at 1.875 ips.

Panasonic

Eight-track test cartridge, VTT-801: head height and azimuth. Cassette test tape, C-FD.

RCA

Eight-track test cartridges, NO. 312 (3 kHz), No. 314, No. 323 (400 Hz), No. 326 (azimuth), No. 328 (head height), No. 339 (level and signal-to-noise). Cassette test tapes, No. 1-102 and No. 1-103.

Sony

Eight-track test cartridge R-9-T1: head height.
Eight-track test cartridge R-9-L1: level and signal-to-noise.
Eight-track test cartridge R-9-F1-200: frequency response.
Eight-track test cartridge R-9-F1-400: frequency response.
Eight-track test cartridge R-9-F1-SK: frequency response.
Cassette test tape P-4-A81: 6.3 kHz at −10 dB.
Cassette test tape P-4-L81: 333 Hz at zero dB.
Cassette test tape SPC-4: 1000 Hz at zero dB.
Cassette test tape WS-48: 3 kHz at zero dB.

Telex

Cassette test tape, P/N86524-005: level, azimuth, and frequency response; recorded at 1.875 ips.

SERVICING FUTURE...

continued from page 21

is no device so far that produces a bright, snappy picture in color, even in the laboratory. When that lab device is perfected—call it "time t_o"—add a few years to learn how to manufacture it, and a few more to make it competitive.

SW: Which adds up to?—

ADLER: T_o hasn't arrived yet, so let's say 1983 for flat panel TV. I think it will be quite a revolution when the panel really takes over. Also, don't forget that the flat screen will be wider than the picture tube. More detail, more information can be placed on it. A lot of people will want to use it this way. But to do so, new transmission facilities with higher resolution capabilities would have to be set up. Signals could be transmitted on cable or over the air with millimeter waves. All this will take time to develop and put into operation; also, a great deal of money.

SW: What about the video disc player?

ADLER: Let's just say that we're a little closer to this one. There'll be the usual sorting out of systems, of course.

SW: Projection TV gets talked up in the news occasionally. What are its possibilities?

ADLER: The perennial difficulty is getting enough light for daylight viewing. We demonstrated a laser system some years ago, but it was impractical because of low laser efficiency. Other systems are now trying to make the grade. I don't really know whether or not the public would accept a projection system.

SW: So it could be said that, except for the video disc player, there will be no radically new products on the market within the next few years?

ADLER: That's quite an exception, you know. It will keep us all busy for awhile.

And with any new product, there is a long time lag from the first appearance of that product in the market-place until the time when the designers can make it essentially service-free. Television has been in homes for nearly 30 years and no manufacturer has yet achieved a service-free set.

SW: Would you like to sum up the situation?

ADLER: Perhaps in a hundred years everything will work so dependably that we'll no longer need service people. Of course, at that time we won't need engineers either, or scientists like myself. Computers linked to production machines will do everything, including having babies, I suppose.

In the meantime, though, there will be plenty for all of us to do. ■

MATV TAPS...

continued from page 28

all aspects of MATV design, and are arranged to assist the novice as well as the experienced installer. The seminar costs $35.00 and includes lunches and refreshments for three days plus the necessary instructional materials. Upon completion of the seminar you will receive a certificate of completion, and you will be able to lay out a complete MATV system. This training, coupled with the systems layout service, will start you on your way to a successful career in MATV systems design and installation, and, equally as important, your television-viewing customers will enjoy sharper, clearer and more colorful TV pictures. ■

TECHNICAL DIGEST

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

ADMIRAL

Product Safety Maintenance

Although your primary responsibility as an electronics service technician is to correct a reported product defect, your responsibility does not end there.

Before you release a product repair to the customer, you should perform a safety inspection. You should not only thoroughly inspect your work, to make sure that you have not inadvertently created an unsafe condition, but you should also make a general inspection to uncover any hazards that may have been created by previous sloppy service by an unqualified technician (or do-it-yourself customer). Carelessness, ignorance and/or the use of improper replacement parts can defeat even the best built-in safety features.

Before servicing a product, make sure that you are familiar with the service notes contained in the service manual covering the specific product that you are servicing, particularly those specifically related to product safety.

After you have corrected the original service complaint, you should make a visual check of the following items:

1) No insulated lead or component should touch a receiving tube, resistor rated at 1 watt or higher, or any other hot surface. Tight lead dress around protruding metal corners or edges must be avoided. All original insulating materials, strain relief devices, shields, etc., must be properly reinstalled.

2) All solder connections should be inspected for cold solder joints, sharp solder points, solder splashes, frayed leads, damaged insulation, etc. Remove all loose foreign particles.

3) Never release a repair until all ground straps, shields and other hardware have been reinstalled as originally designed.

4) Any components showing physical evidence of damage or deterioration should be replaced.

5) Only factory approved replacement fuses, circuit breakers, receiving tubes, solid-state devices, coils and transformers should be used. If you spot any unapproved substitutes, remove them and replace them with factory approved parts.

Do not use bare wire or solder to short across a fuse or circuit breaker while troubleshooting! When you find it necessary to temporarily bypass any component, especially fuses and breakers, use only clip-equipped test leads of sufficient length to make their presence obvious and do not operate the product in this manner any longer than is necessary for analysis.

Fuses and circuit breakers are selected during product design for maximum circuit protection. The original device was incorporated into the product as a built-in safeguard; do not replace it with anything other than the factory specified replacement.

Fusible resistors (Fusistors) are used as a combination fuse and surge resistor. These devices have special characteristics—a standard resistor of equal value and wattage is not a suitable replacement, even as a temporary measure.

Wire fuse links must be replaced only with the exact size and length specified to maintain product safety. Fuse holders should be inspected for loose contacts and/or corrosion when fuses are replaced. We do not approve the use of "piggy-back" clip-on fuse mounts for replacement of soldered-in pigtail fuses. The added weight of this type of mounting can cause the original supporting leads to sag or move sufficiently to create a short-circuit hazard.

Radio Model YH401—Volume Control

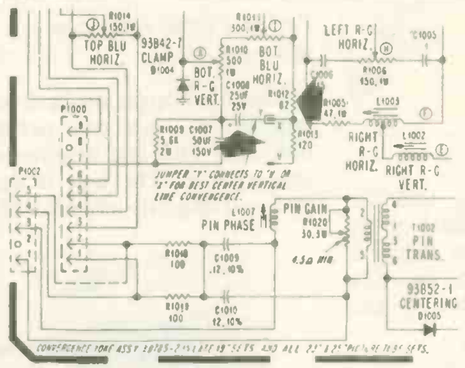
The 2075A89-24 volume control for the YH401 radio (Service manual S1064) is no longer available. However, if a broken black shaft is the only problem, a replacement black shaft can be supplied—order Part No. 2033A642-197.

Color TV Chassis 3K19—Service Hint

If you encounter a symptom of insufficient or no vertical sweep, resistor R1012 overheated, and capacitor C1008 with the end blown out, the possible cause is as follows:

You will likely find filament-to-cathode leakage in the 10GF7A vertical-output tube. (Output section; pin 3 to pins 4 and 5).

With filament-to-cathode leakage in this tube, AC volt-



SECTION OF 3K19 CONVERGENCE BOARD SCHEMATIC

age is connected into the convergence assembly.

Replace the 10GF7A tube, resistor R1012 (82 ohm, ½ w) and capacitor C1008 (25 mfd, 25 v). The replacement should be made with Part No. 67A200-250-7.

MAGNAVOX

Record Changer Model W712—Stalled or Slow Speed Turntable

Record changer operational problems in the Model W712 record changer are usually related to the turntable drive mechanism, resulting in stalled or slow speed turntables.

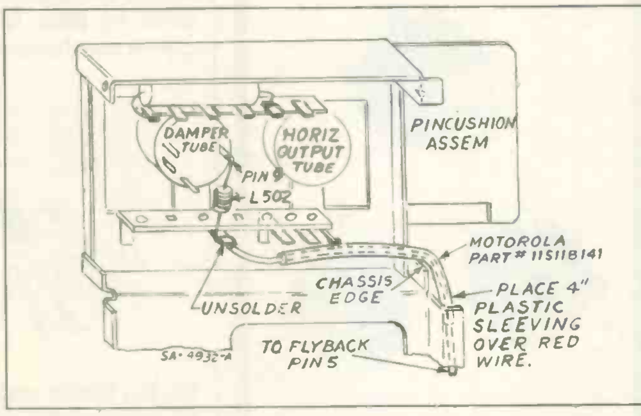
Magnavox has improved the efficiency of the turntable drive mechanism and is now supplying replacement turntable/idler wheel kits for all orders received for either the turntable or the idler wheel.

The part number of the kit is 171341-1, and as noted in the kit instructions, until further notice full credit is offered for all defective turntables with idler wheels returned to the Magnavox District Parts Center from which the replacement was ordered.

MOTOROLA

Color TV Chassis TS-934—Thin Vertical Line Near Left Edge of Screen

RF radiation may be caused by damaged insulation on the red wire between pin 5 of the high-voltage transformer



and pin 9 of the damper tube. Place plastic sleeving over the wire, to prevent leakage to the chassis edge, as shown in the accompanying illustration. ■

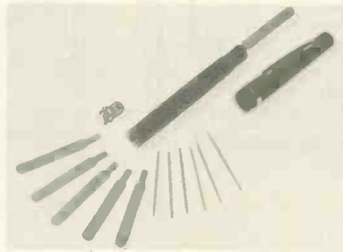
NEW PRODUCTS

Descriptions and specifications of the products included in this department are provided by the manufacturers. For additional information, circle the corresponding numbers on the Reader Service Card in this issue.

BURNISHING TOOL 700

Includes six flat blades and six ball-ended rods

A pocket-type burnishing tool for cleaning relay contacts is added to the line of specialized equipment tools offered by **Utica Tool Company, Inc.** The case is constructed of dielectric plastic.



Six flat blades and six ball-ended rods, all conveniently stored in the handle, are supplied with the pocket burnisher. The non-residual blades do not leave grit or dust on contacts.

VOLTAGE REGULATOR 701

Controls tip-temperatures on desoldering and soldering tools

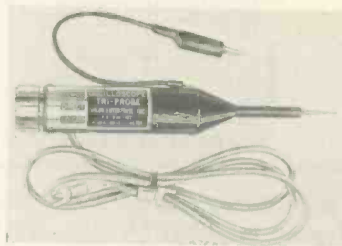
A lightweight voltage regulator for controlling tip-temperature on desoldering and soldering tools is developed by **Air-Vac Engineering Co.** Measuring 2 inches by 3 inches by 4 inches, the molded plastic module is self-extinguishing and features in-line male and female connections, for fast, sure connect and disconnect. Numerical dial allows operator to "dial-in" selected

variable voltage, with individual set-point calibration provided with each unit. Pilot light indicates "on-off," and replaceable fuse protects critical components. Maximum continuous power limit is 100 watts restricted load. Price is $27.75.

OSCILLOSCOPE PROBE 702

Perform three functions with one probe

This lightweight probe from **Valor Enterprise, Inc.**, lets you perform three functions with one easy-to-use oscilloscope probe. The unit is designed to give you fingertip selection of demodu-

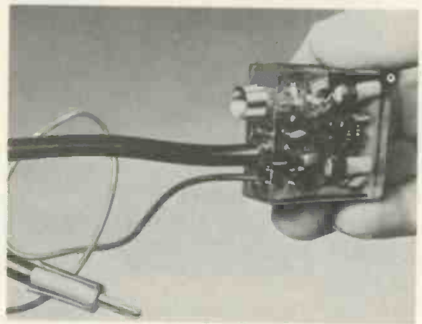


lation, direct or low capacity mode of operation for simplified use of your oscilloscope. The insulation piercing prod makes quick, positive contact through wire insulation, solder flux of MIL conformal coatings. The probe works with any oscilloscope and shielded signal cable is available with PL-259, BNC, banana plugs, or forked lugs to fit any oscilloscope.

AUTO FM/AM STEREO PREAMPLIFIER 703

Provides 20 dB of signal boost

The Model ASC-100 FM/AM Stereo Preamplifier is introduced by **ASCOM Products.** The device, which can be installed between the radio receiver



and broadcast antenna, is an FM/AM stereo preamplifier which provides 20 dB of signal boost. There is no degradation of radio performance in close-in areas, yet full quieting is provided at distances where the signal is not ordinarily discernible. Instead of a conventional "black box" container, the entire circuit board is imbedded in transparent lucite, with a safety LED which glows if the device is properly connected. It measures 2 inches by 1½ inches by ⅜ inch.

DISTRIBUTION AMPLIFIER 704

Includes two built-in FM traps

Antennacraft is introducing a completely new solid-state, 20-dB home distribution amplifier. This compact

unit has two built-in FM traps and a lighted on/off switch. Rated at 75 ohms, the Model UVF-1520 has a front-mounted fuse for easy replacement.

MICROPHONE GAIN CONTROL 705

Eliminates most background noise

Shure Brothers Inc. announces a new device that can be used to eliminate most of the background noises that plague multiple microphone tape recording and public-address installations. This unit, called the Model M625 Voicegate, is a voice-activated microphone gain controller with a response-shaped "voice-frequency" sensor. Functioning between the microphone and the mixer, the unit attenuates the microphone output signal by approximately 16 dB until the microphone is excited by a voice. It then removes the attenuation almost instantaneously, allowing the unattenuated microphone signals to enter the mixer. The unit is designed especially for improving the combined output from sound reinforcement systems employing multiple microphones, particularly

when recorders are used in the system. The gain controller is available in two models: The Model M625 is AC-powered and also can be powered by either a 9 or 30 v external DC source. The Model M625AM is a "modular unit" which receives its power from the M625. The price is $120 for the Model M625 and $97.50 for the Model M625AM.

FM INTERFERENCE TRAP 706

Can be tuned to eliminate strong local FM interference

A tunable trap that eliminates FM interference from TV sets is announced by **Jerrold Electronics.** Designated Model RFT-300, the trap connects to the 300-ohm antenna terminals on the back of any TV receiver or indoor amplifier. The unit can be tuned to any industrial radio (72 to 76 MHz) or FM broadcast (88 to 108 MHz) frequency. The user simply watches the TV screen and turns the knob until the FM interference disappears. The tunable notch is 0.25 MHz wide and 18 dB deep. Price is $3.95. ■

DEALER SHOWCASE

Descriptions and specifications of the products included in this department are provided by the manufacturers. For additional information, circle the corresponding numbers on the Reader Service Card in this issue.

MULTI-BAND RADIO 707

Tune in on police, fire and other emergency calls

Tune in on police, fire and other emergency calls at the touch of a button with this Public Service Band-equipped Magnavox Model 3090, multi-band portable radio. The PSB band enables you to receive ambulance, taxi

and a special government weather broadcast. In addition to standard FM/AM bands, you can receive ground-to-aircraft, aircraft-to-ground and ship-to-shore, shore-to-ship transmissions on the set's VHF-air and marine bands. Price is $57.95.

DISPLAY ADVERTISEMENTS 708

Suitable for yellow page and newspaper advertising

The General Electric Co. is currently offering a variety of professionally-

prepared display advertisements to service dealers. The display advertisements are part of a new, national yellow pages program currently being offered to authorized distributors. The display ads, which are suitable for the service dealer's yellow pages and newspaper advertising, stress "any make and model" service capability. Dealers desiring to use the display ads need only have a printer add the dealer's name, address and phone number before placement.

ANTENNA COUPLER 709

Couples up to five bands without special antenna

A multi-band antenna coupler, Model GLC 1079, is designed to enable the use of your standard car radio antenna to monitor 20-70MHz, 148-175MHz and 250-470MHz, as well as your AM/FM car radio fre-

quencies. It can reportedly couple up to 5 bands without a new or special antenna. Two cables are included for easy hook-up. Gold Line.

TAPE HEAD CLEANERS 710

Provides polishing action to remove dust and oxide

Included in 3M's tape accessory line are these new Scotch brand head cleaners, which are inserted into cassette and 8-track cartridge units in the

same manner as regular tapes. The cleaners provide a polishing action which removes accumulations of dust and oxide from capstans, rollers and magnetic heads. Price is $1.75 for the cassette and $3.00 for the cartridge. ■

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-CONTENTS-

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Covers all 1965 models for: Admiral, Airline, Andrea, Coronado, Curtis Mathes, Dumont, Electrohome, Emerson, Firestone, General Electric, Magnavox, Motorola, Muntz, Olympic, Packard-Bell, Philco, RCA Victor, Sears-Silvertone, Setchell-Carlson, Sylvania, Truetone, Westinghouse, and Zenith . . . plus all color sets 1960-1965, at no extra cost!
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CONTENTS 1966 MODELS
Covers all 1966 color and B & W models of: Admiral, Airline, Andrea, Coronado, Curtis Mathes, Dumont, Emerson, General Electric, Hoffman, Magnavox, Motorola, Olympic, Packard-Bell, Philco, RCA Victor, Sears-Silvertone, Setchell-Carlson, Sonora, Sylvania, Truetone, Westinghouse, and Zenith.
PUBLISHER'S LIST PRICE $19.90

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PUBLISHER'S LIST PRICE $19.90

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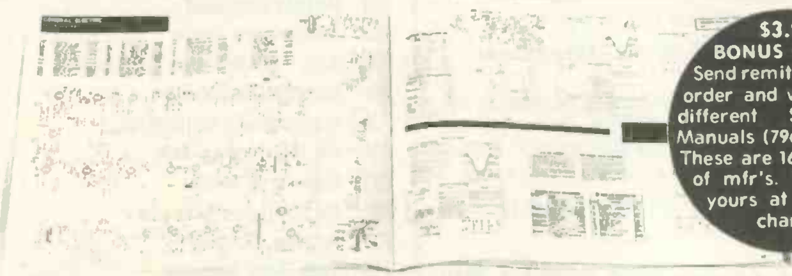
PUBLISHER'S LIST PRICE $19.90



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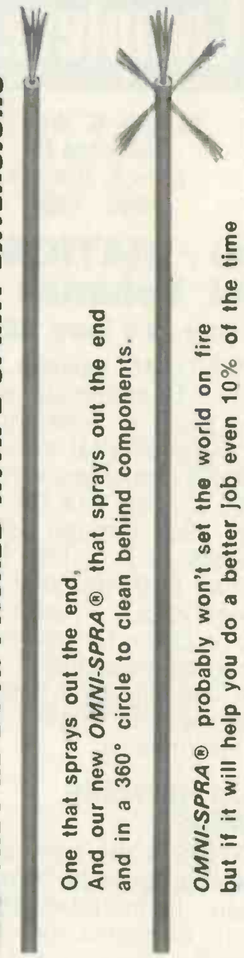
. . . for more details circle 102 on Reader Service Card

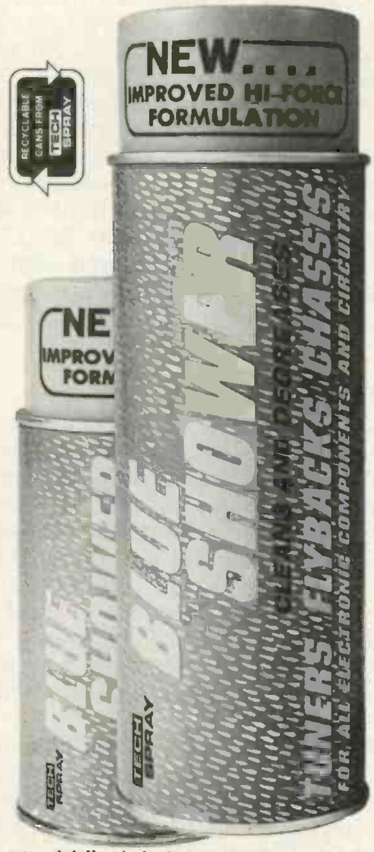
READERS SERVICE INDEX

ADVERTISER'S INDEX

NEW PRODUCTS

TEST INSTRUMENT





ELECTRONIC TECHNICIAN/DEALER

TEKFAX

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

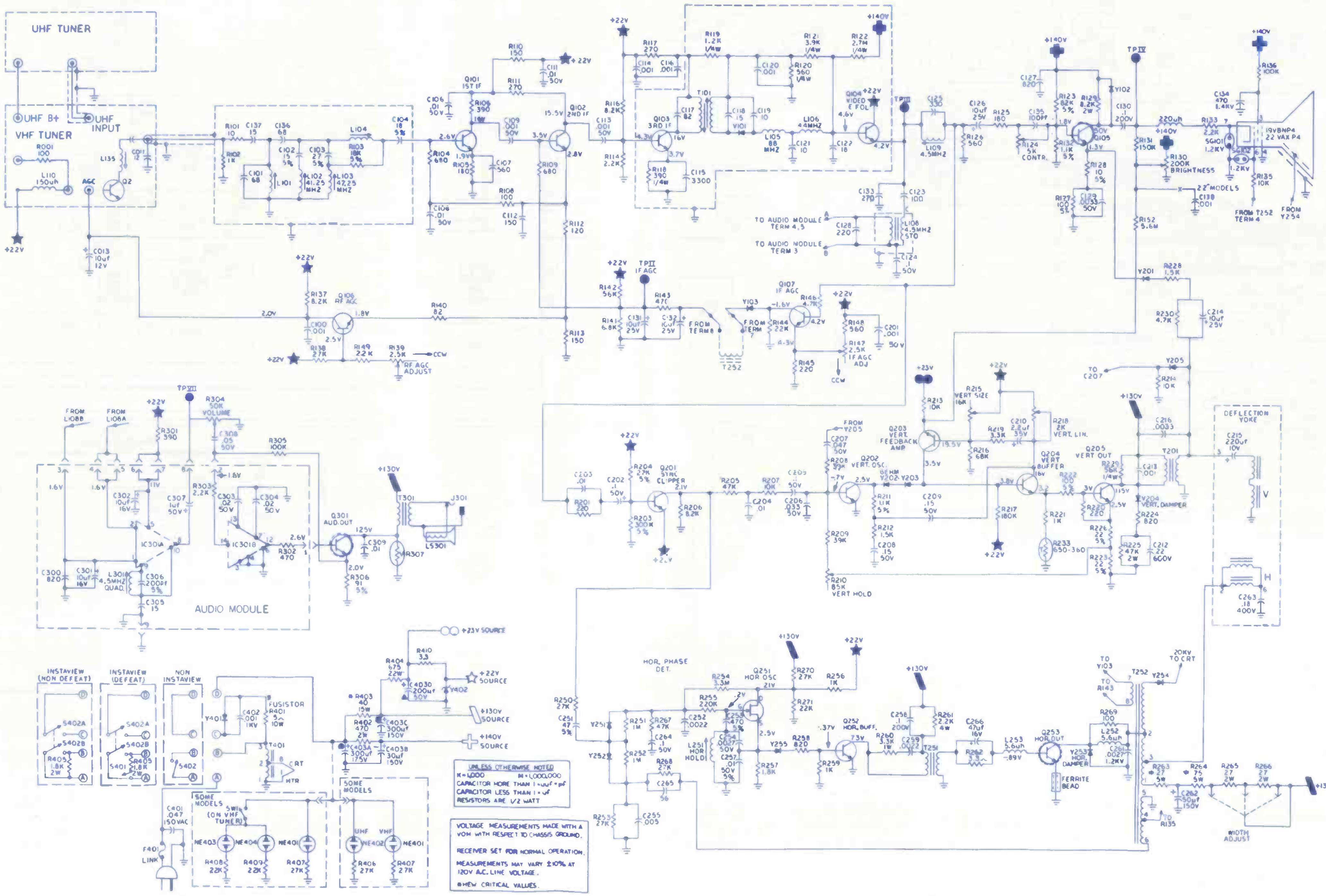
GROUP 263

1534

GENERAL ELECTRIC

TV Chassis UB

JULY • 1974



1535

ADMIRAL

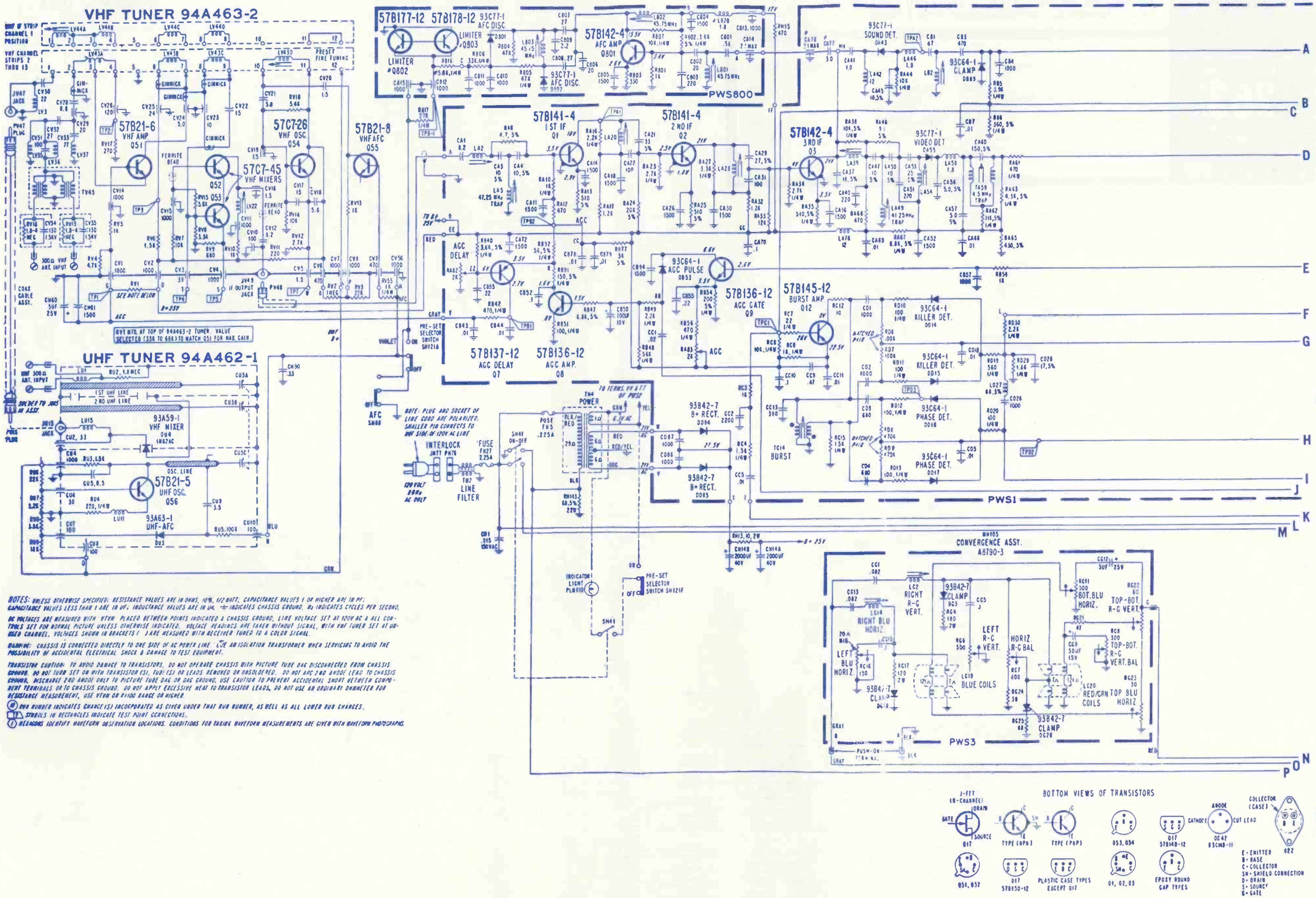
Color TV Chassis
T41K10, T42K10

ELECTRONIC TECHNICIAN/DEALER TEKFAX

JULY • 1974

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

SYMBOL — DESCRIPTION	ADMIRAL PART NO.
RA82—2K AG Delay	75A101-31
RA83—2K AGC Control	75A101-31
RC64—10K Color Killer Control	75A101-18
RD38—400Ω, Reactance Control	75A101-35
RE54—Vertical Size Control / RE55—Vertical Hold / RE56—Vertical Line Cont., 300K (Triple Cont.)	75A95-18
RH28—2K, Brightness Control	75A140-25
RH29—350Ω, Contrast Control	75A140-26
RH34—500Ω, Side Tint Control	75A140-17
RH39—500Ω, Color Slide Control	75A140-18
RH39—Dual Control-Contrast & Color (T43K10-1A)	75A194-2
RH39—Dual Control-Contrast & Color (T42K10-1A)	75A194-3
RH42—50K, Volume On/Off Control	75A140-24
RH69—Voltage Dependent Resistor	61A46-7
RH103—Color Control, 1K, 20%, Preset	75A135-52
RH104—Tint Control 500K, 20%, Preset	75A135-51
RH117—Preset Contrast Control, 350Ω	75A135-54
RH118—Preset Brightness Control, 2K	75A135-53
RH125—High Voltage adj 5 M, Control	75A135-57
RH128—VDR	61A46-15
RH132—VDR	61A46-15
RH133—VDR	61A46-15



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

DC VOLTAGES ARE MEASURED WITH VTVM PLACED BETWEEN POINTS INDICATED & CHASSIS GROUND, LINE VOLTAGE SET AT 120V AC & ALL CONTROLS SET FOR NORMAL PICTURE UNLESS OTHERWISE INDICATED. VOLTAGE READINGS ARE TAKEN WITHOUT SIGNAL, WITH VHF TUNER SET AT UNUSED CHANNEL. VOLTAGES SHOWN IN BRACKETS ( ) ARE MEASURED WITH RECEIVER TUNED TO A COLOR SIGNAL.

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

TRANSISTOR CAUTION: TO AVOID DAMAGE TO TRANSISTORS, DO NOT OPERATE CHASSIS WITH PICTURE TUBE DAG DISCONNECTED FROM CHASSIS GROUND. DO NOT TURN SET ON WITH TRANSISTOR (S), TUBE (S) OR LEADS REMOVED OR UNSOLDERED. DO NOT ARC 2ND ANODE LEAD TO CHASSIS GROUND. DISCHARGE 2ND ANODE ONLY TO PICTURE TUBE DAG OR DAG GROUND. USE CAUTION TO PREVENT ACCIDENTAL SHORT BETWEEN COMPONENT TERMINALS OR TO CHASSIS GROUND. DO NOT APPLY EXCESSIVE HEAT TO TRANSISTOR LEADS. DO NOT USE AN ORDINARY OHMMETER FOR RESISTANCE MEASUREMENT, USE VTVM ON R×100 RANGE OR HIGHER.

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

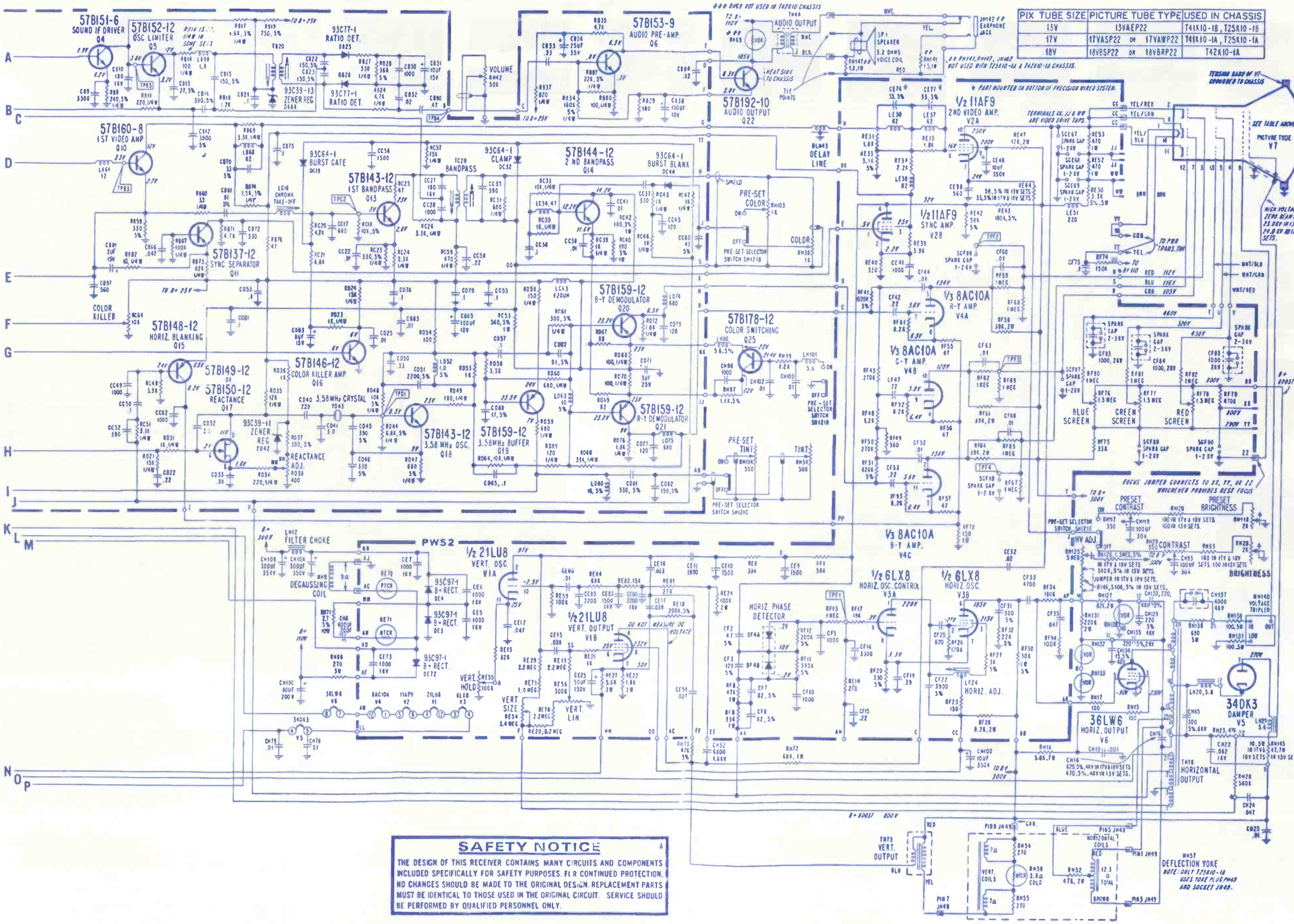
SYMBOLS IN RECTANGLES INDICATE TEST POINT CONNECTIONS.

HEXAGONS IDENTIFY WAVEFORM OBSERVATION LOCATIONS. CONDITIONS FOR TAKING WAVEFORM MEASUREMENTS ARE GIVEN WITH WAVEFORM PHOTOGRAPHS.

CH10A—300 µf, 350V
CH10B—300 µf, 350V
CH10C—80 µf, 350V
CH10D—10 µf, 350V
Electrolytic 67A15-415
LC16—Chroma Input Coil 72A329-1
LF24—Horiz. Hold Control 94A351-1
TA59—4.5MHz Trap 72A216-7
TB20—Ratio xformer 72A318-1
TC14—Burst xformer 72A325-3
TC29—Bandpass xformer 72A327-1
TH2—Line Choke 73A31-16
TH4—Power xformer (T41K10-1A, T41K10-1B) 80A108-13
TH4—Power xformer (T43K10-1A, T42K10-1A) 80A108-14
TH18—Horiz. Output xformer (T41K10-1A, T43K10-1A, T42K10-1A) 79A169-1
TH18—Horiz. Output xformer (T41K10-1B) 79A169-2
TH44—Audio Output xformer (T41K10-1A, T41K10-1B) 79A121-1
TH44—Audio Output xformer (T43K10-1A, T42K10-1A) 79A141-4
TH73—Vertical Output Xformer 79A165-1
FH5—.225 a Fuse 84A28-12
FH27—2.25 a Fuse 84A28-16
MH140—Tripler, HV 93A91-3

ADMIRAL
Color TV Chassis
T41K10, T42K10

PIX TUBE SIZE	PICTURE TUBE TYPE	USED IN CHASSIS
13V	13VAEP22	T41K10-1B, T25K10-1B
17V	17VASP22 OR 17VAWP22	T41K10-1A, T25K10-1A
18V	18VBSP22 OR 18VBRP22	T42K10-1A



SAFETY NOTICE

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

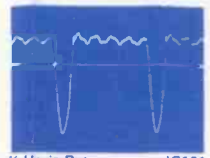
1536

GENERAL ELECTRIC

Color TV Chassis 16QA

ELECTRONIC TECHNICIAN/DEALER TEKFAX

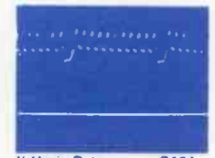
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS



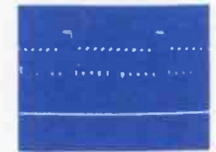
½ Horiz Rate 11 VPP (1) IC101 Pin 5

½ Horiz Rate 1 VPP (2) IC101 Pin 10

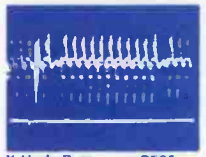
½ Horiz Rate 3 VPP (3) Q105 Emitter



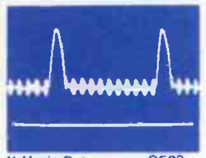
½ Horiz Rate 1.25 VPP (4) Q104 Emitter



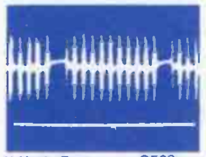
½ Horiz Rate 4 VPP (5) Q104 Collector



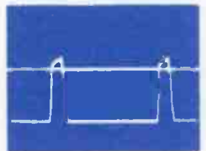
½ Horiz Rate 1.25 VPP (15) Q501 Collector



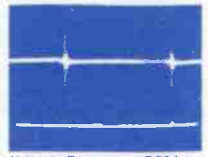
½ Horiz Rate 2.0 VPP (16) Q503 Emitter Sets with R568 only



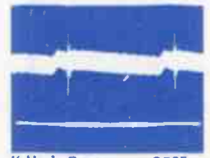
½ Horiz Rate 1.0 VPP (17) Q503 Collector Varies with Color control



½ Horiz Rate 10 VPP (18) Q504 Base

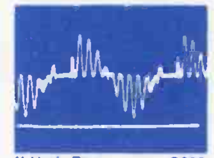


½ Horiz Rate 4 VPP (19) Q504 Collector

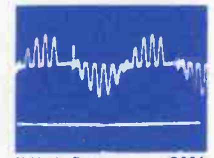


½ Horiz Rate 0.3 VPP (20) Q505 Emitter

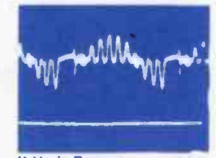
½ Horiz Rate 7 VPP (21) T502 Pin 3



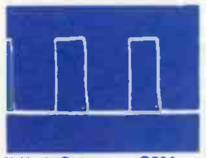
½ Horiz Rate 4 VPP (22) Q600 Base



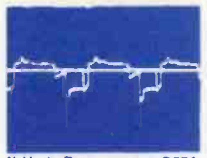
½ Horiz Rate 6 VPP (23) Q604 Base



½ Horiz Rate 2 VPP (24) Q606 Base



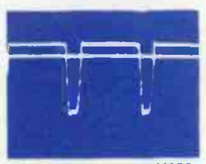
½ Horiz Rate 10 VPP (36) Q204 Collector



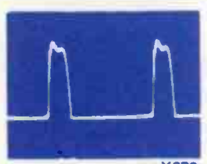
½ Horiz Rate 2.5 VPP (37) Jct. R251, L204

½ Vert Rate 1 VPP (38) Q262 Base

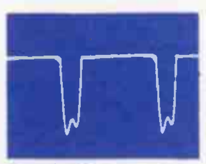
½ Vert Rate 1 VPP (39) Q262 Collector



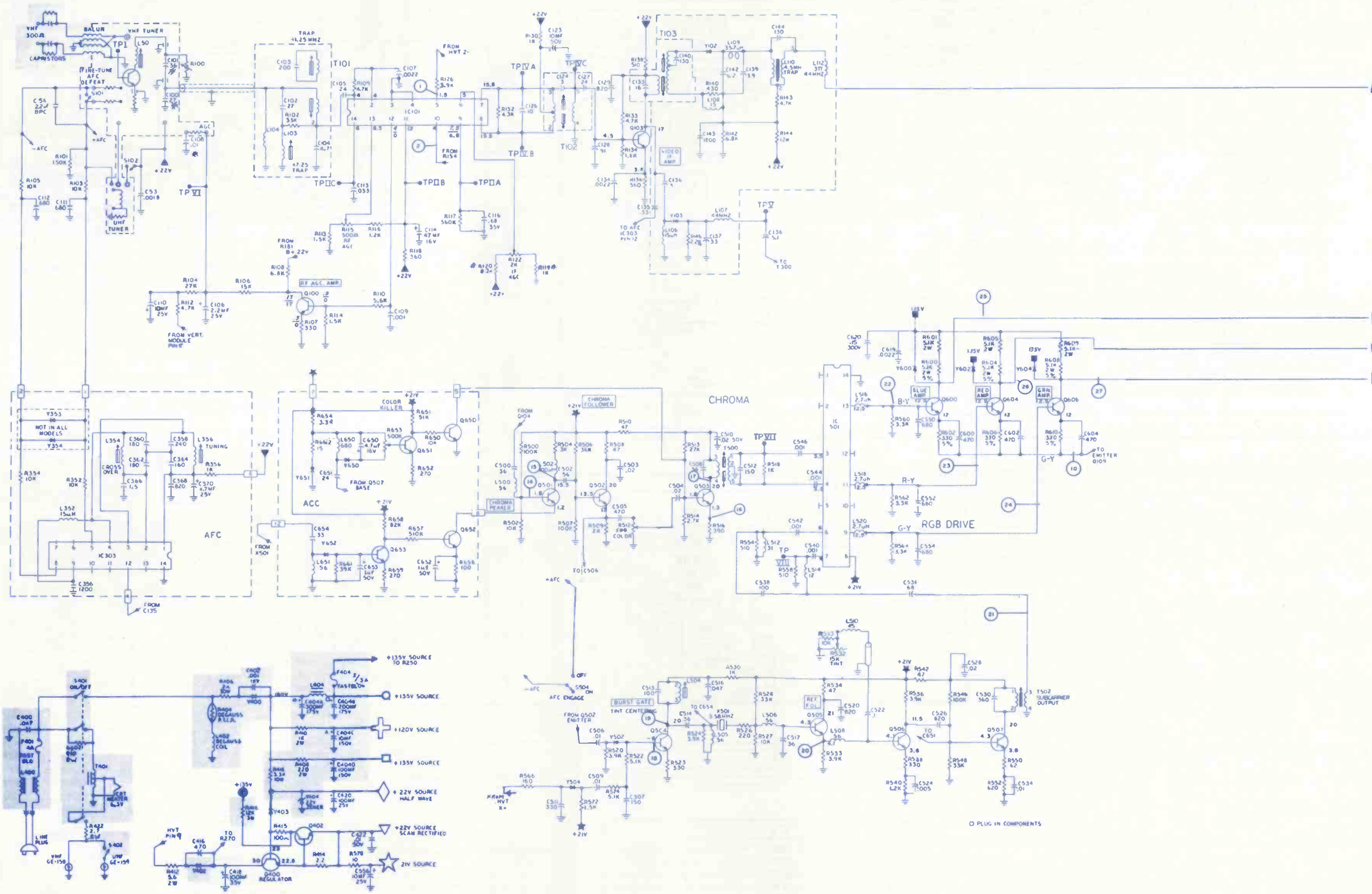
½ Horiz Rate 60 VPP (40) Y268 Anode



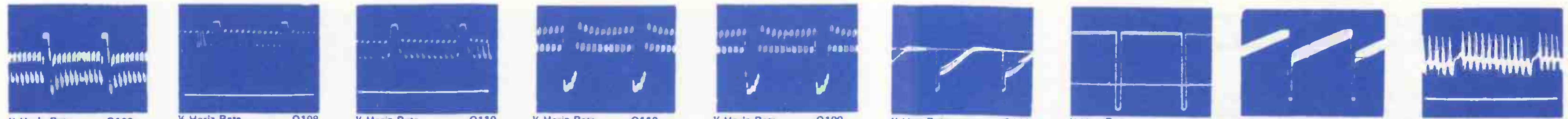
½ Horiz Rate 60 VPP (41) Y270 Cathode



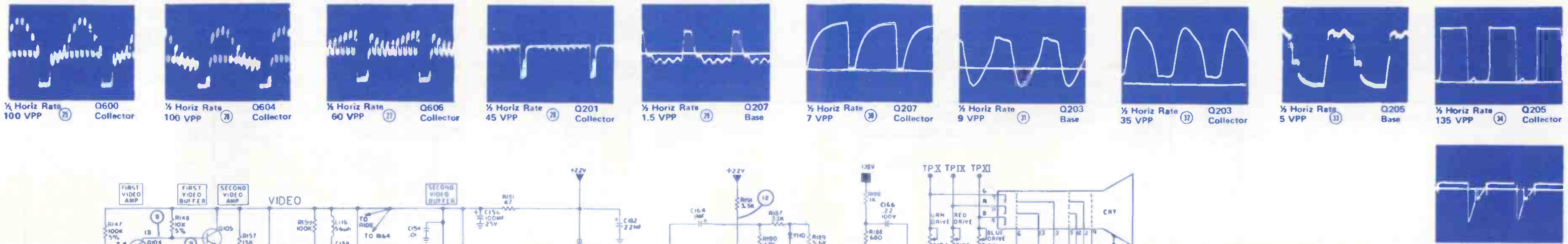
½ Horiz Rate 180 VPP (42) R412



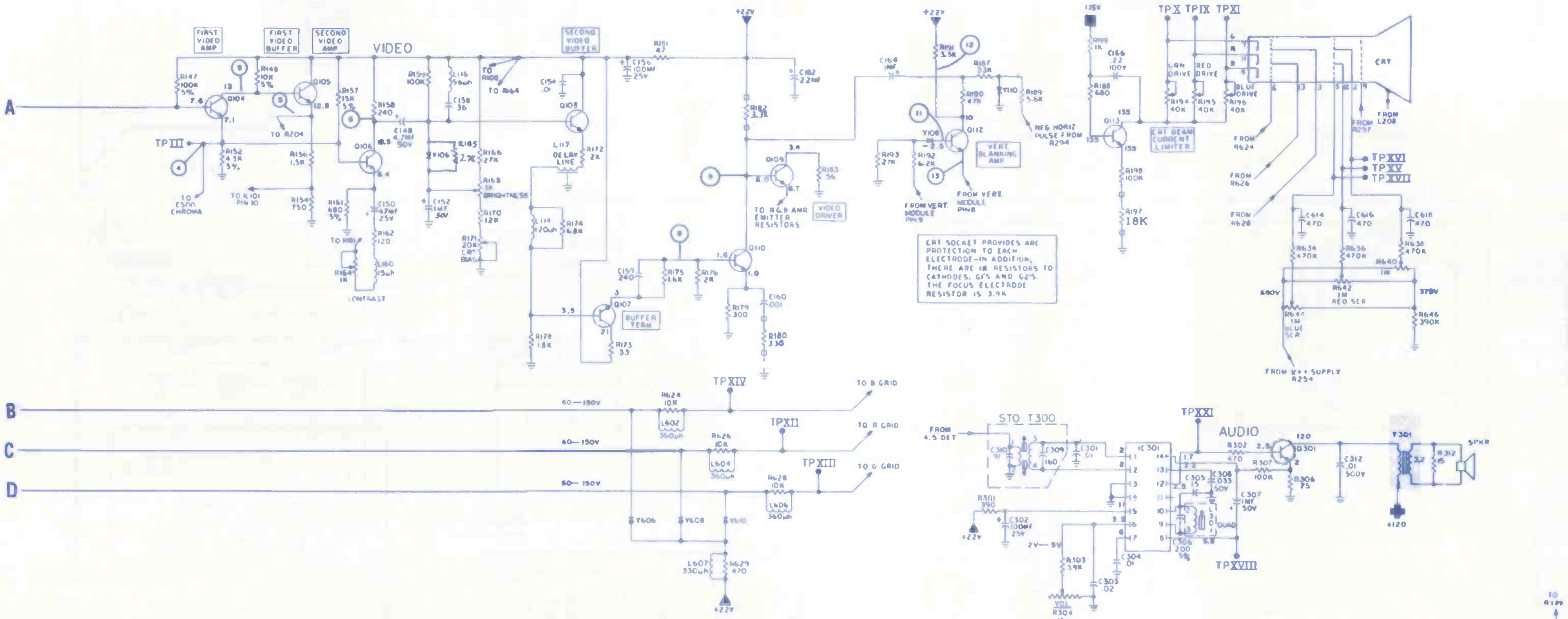
GENERAL ELECTRIC
Color TV Chassis
16QA



½ Horiz Rate 1.5 VPP (6) Q106 Collector
½ Horiz Rate 1.5 VPP (7) Q108 Base
½ Horiz Rate 0.5 VPP (8) Q110 Base
½ Horiz Rate 5 VPP (9) Q110 Collector
½ Horiz Rate 5 VPP (10) Q109 Emitter
½ Vert Rate 30 VPP (11) Q112 Base
½ Vert Rate 50 VPP (12) Q112 Collector
½ Vert Rate 40 VPP (13) Q112 Emitter
½ Horiz Rate 0.3 VPP (14) Q501 Base



½ Horiz Rate 100 VPP (25) Q600 Collector
½ Horiz Rate 100 VPP (26) Q604 Collector
½ Horiz Rate 60 VPP (27) Q606 Collector
½ Horiz Rate 45 VPP (28) Q201 Collector
½ Horiz Rate 1.5 VPP (29) Q207 Base
½ Horiz Rate 7 VPP (30) Q207 Collector
½ Horiz Rate 9 VPP (31) Q203 Base
½ Horiz Rate 35 VPP (32) Q203 Collector
½ Horiz Rate 5 VPP (33) Q205 Base
½ Horiz Rate 135 VPP (34) Q205 Collector
½ Horiz Rate 5 VPP (35) Q204 Base



PRODUCT SAFETY SHOULD BE CONSIDERED WHEN A COMPONENT REPLACEMENT IS MADE IN ANY AREA OF A RECEIVER. THE SHADED AREAS OF THIS SCHEMATIC DIAGRAM AND THE PARTS LIST DESIGNATE COMPONENTS IN WHICH SAFETY CAN BE OF SPECIAL SIGNIFICANCE. IT IS PARTICULARLY RECOMMENDED THAT GENERAL ELECTRIC CATALOGED PARTS BE USED FOR COMPONENT REPLACEMENT IN THE SHADED AREAS OF THIS PARTS LIST. USE OF
USE OF SUBSTITUTE REPLACEMENT PARTS WHICH DO NOT HAVE THE SAME SAFETY CHARACTERISTICS AS RECOMMENDED IN FACTORY SERVICE INFORMATION MAY CREATE SHOCK, FIRE OR OTHER HAZARDS.

# Indicates to see Production Changes.

UNLESS OTHERWISE NOTED
K=1,000 M=1,000,000
CAPACITORS MORE THAN 1=mf=pf
CAPACITORS LESS THAN 1=mf
RESISTORS ARE 1/2 WATT

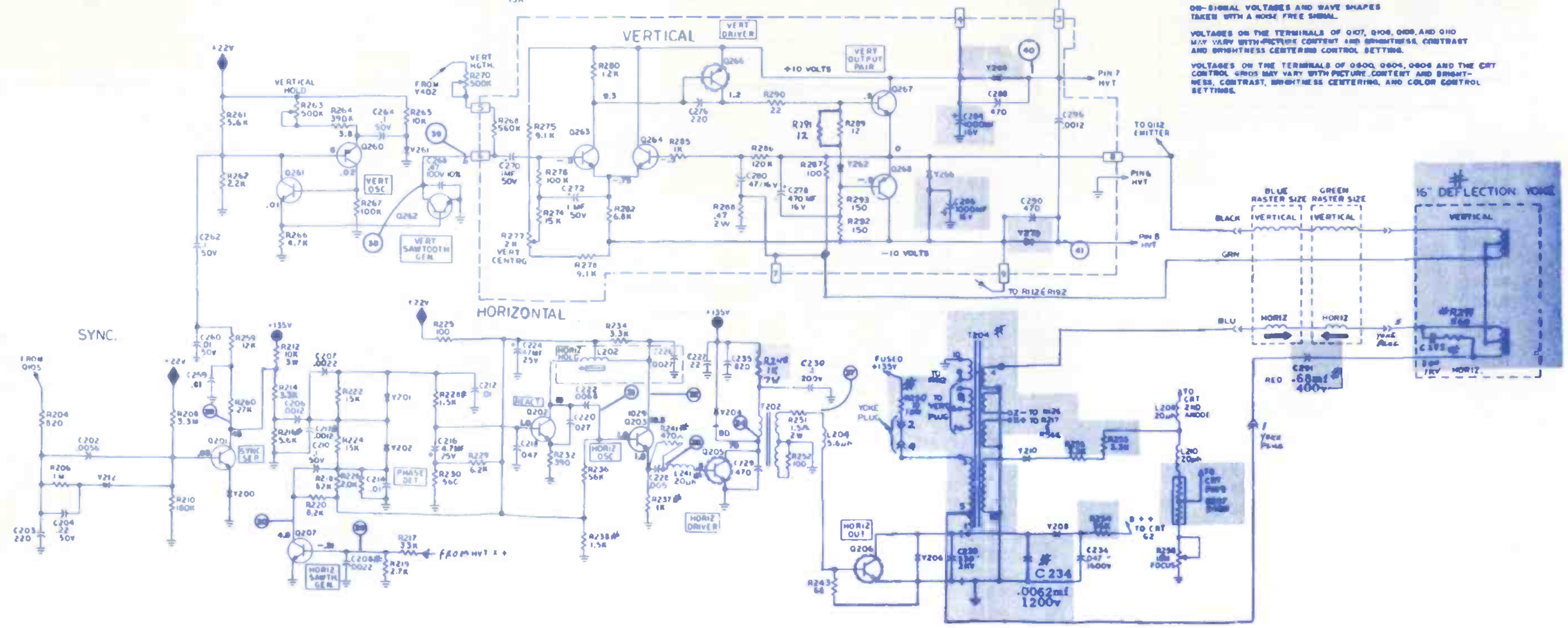
VOLTAGE MEASUREMENTS MADE WITH A VTVM WITH RESPECT TO CHASSIS. RECEIVER SET FOR NORMAL OPERATION. MEASUREMENTS MAY VARY ±10% AT 120V AC LINE VOLTAGE.

WHERE ON-SIGNAL AND OFF-SIGNAL MEASUREMENTS DIFFER, ON-SIGNAL VOLTAGE APPEARS IN *ITALICS* OVER OFF-SIGNAL VOLTAGE.

ON-SIGNAL VOLTAGES AND WAVE SHAPES TAKEN WITH A NOISE FREE SIGNAL.

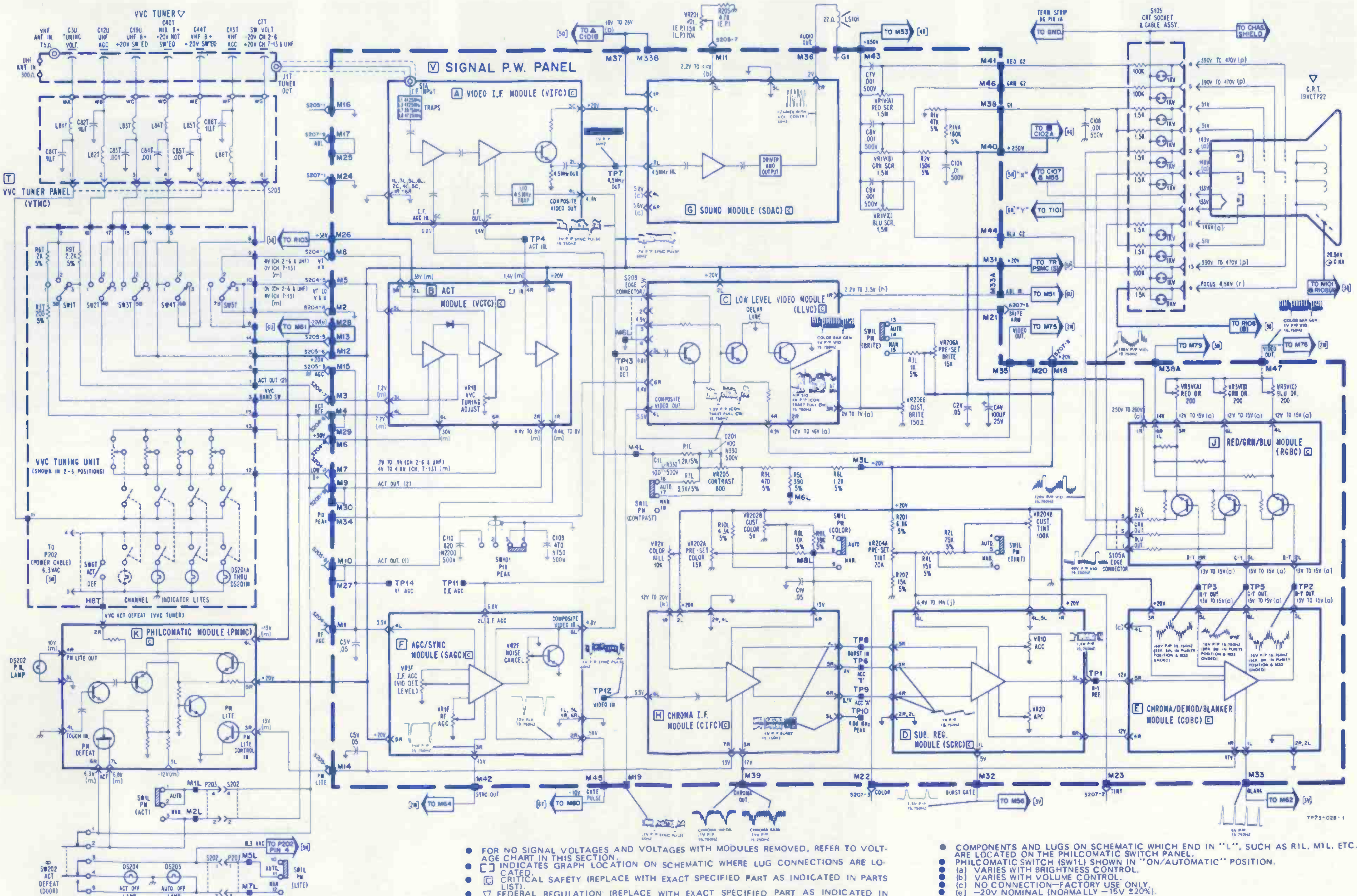
VOLTAGES ON THE TERMINALS OF Q107, Q108, Q109, AND Q110 MAY VARY WITH PICTURE CONTENT AND BRIGHTNESS, CONTRAST AND BRIGHTNESS CENTERING CONTROL SETTING.

VOLTAGES ON THE TERMINALS OF Q600, Q604, Q606 AND THE CRT CONTROL GRIDS MAY VARY WITH PICTURE CONTENT AND BRIGHTNESS, CONTRAST, BRIGHTNESS CENTERING, AND COLOR CONTROL SETTINGS.



SYMBOL DESCRIPTION	GENERAL ELECTRIC PART NO.
R115–RF AGC, 500Ω	EP49X92
——Dual Control	
R122–IF AGC, 2K	
R171–CRT Bias, 20K	EP49X96
R180–Sharpness, 5K	EP49X125
——Dual Control	EP49X97
R258–Focus, 15 M	
——Dual Control	EP49X95
R263–Vertical Hold, 500K	
R270–Vertical Height, 500K	
R277–Vertical Centering, 2K	EP49X90
R653–Color Killer, 500K	ES49X535
C404A–300 µf, 175V	EP31X28
C404B–200 µf, 175V	
C404C–10 µf, 150V	
C404D–100 µf, 150V	
L110–Coil, 4.5 Trap Asm. w/Core	EP61X13
L112–Coil, 44MHz Trap	EP36X4
——Defl. Yoke & Plug Asm.	EP76X15
L202–Coil, Horiz, Osc.	EP36X55
L301–Coil, Quadrature	EP36X83
T204–H.V. xformer, w/Air Gap	EP77X19
T301–xformer, Audio Output	ET64X105
T401–xformer, Filament	EP64X20
T500–xformer, Chroma Bandpass	EP61X14
IC101–Integrated Ckt., IF, AGC	EP84X1
IC301–Integrated Ckt., Audio	EP84X2
IC303–Integrated Ckt., AFC Module	EP84X4
IC501–Integrated Ckt. Demod.	EP84X3

ELECTRONIC TECHNICIAN/DEALER TEKFAX
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS
JULY • 1974

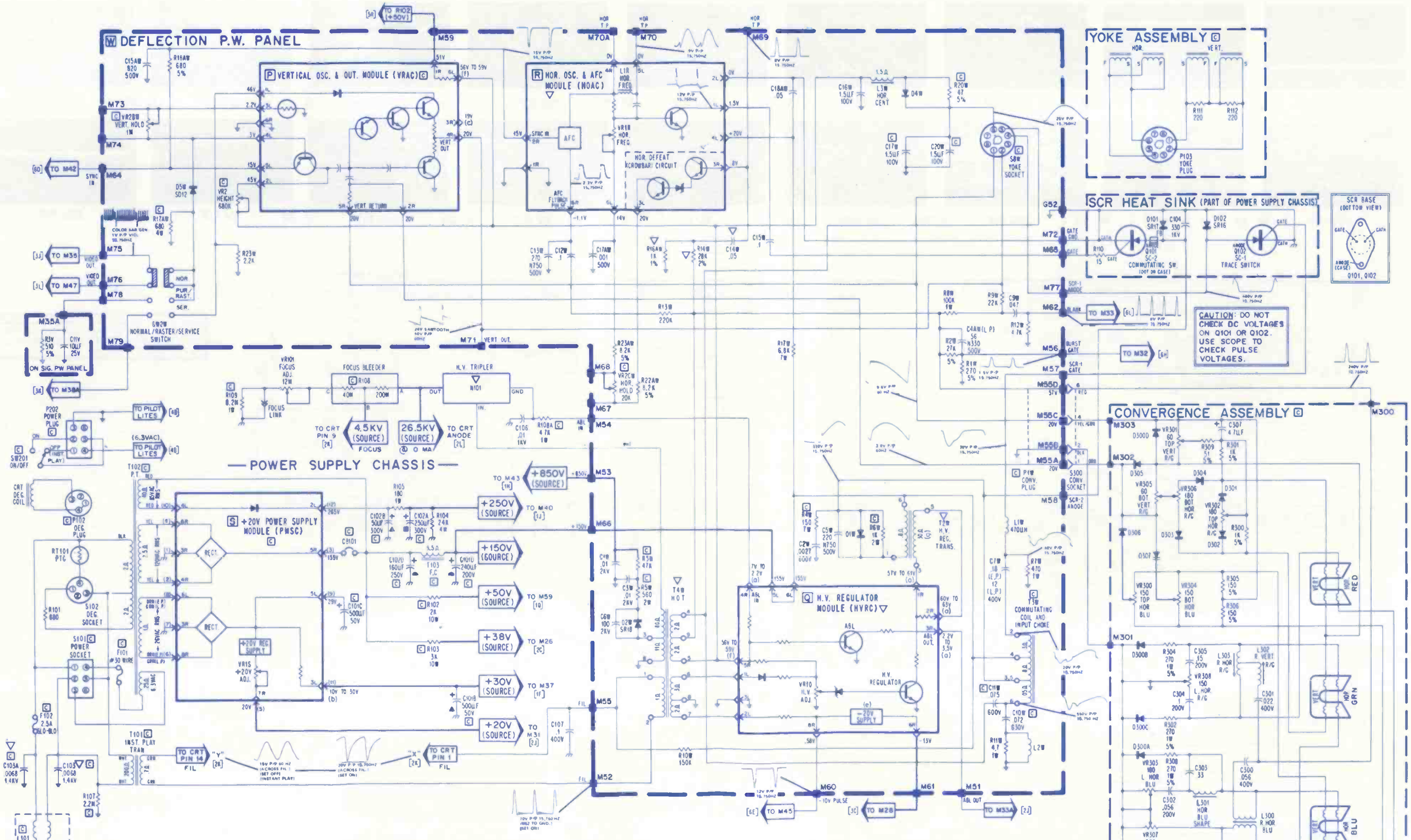


NOTES:

- USE HIGH IMPEDANCE V.T.V.M. FOR VOLTAGE MEASUREMENTS.
- RESISTANCES ARE MEASURED WITH YOKE AND CONVERGENCE PANEL DISCONNECTED.
- VOLTAGES ARE NOMINAL AND CAN VARY ±10%.
- VOLTAGES AND WAVEFORMS ARE WITH SIGNAL (5000 MICRO-VOLTS). PHILCOMATIC SWITCH (SW1L) SET FOR "OFF/MANUAL OPERATION, EXCEPT WHERE INDICATED OTHERWISE. CUSTOMER COLOR AND TINT CONTROLS SET FOR NORMAL.
- FOR NO SIGNAL VOLTAGES AND VOLTAGES WITH MODULES REMOVED, REFER TO VOLTAGE CHART IN THIS SECTION.
- [ ] INDICATES GRAPH LOCATION ON SCHEMATIC WHERE LUG CONNECTIONS ARE LOCATED.
- Ⓒ CRITICAL SAFETY (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- ▽ FEDERAL REGULATION (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- COMPONENTS AND LUGS ON SCHEMATIC WHICH END IN "L", SUCH AS R1L, M1L, ETC., ARE LOCATED ON THE PHILCOMATIC SWITCH PANEL.
- PHILCOMATIC SWITCH (SW1L) SHOWN IN "ON/AUTOMATIC" POSITION.
- (a) VARIES WITH BRIGHTNESS CONTROL.
- (b) VARIES WITH VOLUME CONTROL.
- (c) NO CONNECTION—FACTORY USE ONLY.
- (e) −20V NOMINAL (NORMALLY −15V ±20%).
- (h) VARIES WITH BRIGHTNESS, CONTRAST AND COLOR CONTROLS FROM ALL CCW TO ALL CW.
- (j) VARIES WITH TINT CONTROL.
- (k) VARIES WITH COLOR KILLER CONTROL.
- (m) PHILCOMATIC SWITCH SET FOR "ON/AUTOMATIC" OPERATION.
- (p) VARIES WITH SCREEN CONTROL.
- (r) VARIES WITH FOCUS CONTROL.

SCHEMATIC DIAGRAM—SIGNAL PW PANEL & VVC TUNER—4CS73 (19") CHASSIS

PHILCO-FORD
Color TV Chassis
4CS73



NOTES:

- USE HIGH IMPEDANCE V.T.V.M. FOR VOLTAGE MEASUREMENTS.
- RESISTANCES ARE MEASURED WITH YOKE AND CONVERGENCE PANEL DISCONNECTED.
- VOLTAGES ARE NOMINAL AND CAN VARY ±10%.
- VOLTAGES AND WAVEFORMS ARE WITH SIGNAL (5000 MICRO-VOLTS). PHILCOMATIC SWITCH (SW1L) SET FOR "OFF/MANUAL OPERATION, EXCEPT WHERE INDICATED OTHERWISE. CUSTOMER COLOR AND TINT CONTROLS SET FOR NORMAL.
- FOR NO SIGNAL VOLTAGES AND VOLTAGES WITH MODULES REMOVED, REFER TO VOLTAGE CHART IN THIS SECTION.
- [ ] INDICATES GRAPH LOCATION ON SCHEMATIC WHERE LUG CONNECTIONS ARE LOCATED.
- Ⓒ CRITICAL SAFETY (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- ▽ FEDERAL REGULATION (REPLACE WITH EXACT SPECIFIED PART AS INDICATED IN PARTS LIST).
- (a) VARIES WITH BRIGHTNESS CONTROL.
- (b) VARIES WITH VOLUME CONTROL.
- (c) NO CONNECTION—FACTORY USE ONLY.
- (e) −20V NOMINAL (NORMALLY −15V ±20%).
- (f) VARIES WITH BRIGHTNESS AND CONTRAST CONTROLS.
- (g) REMOVE MODULE.

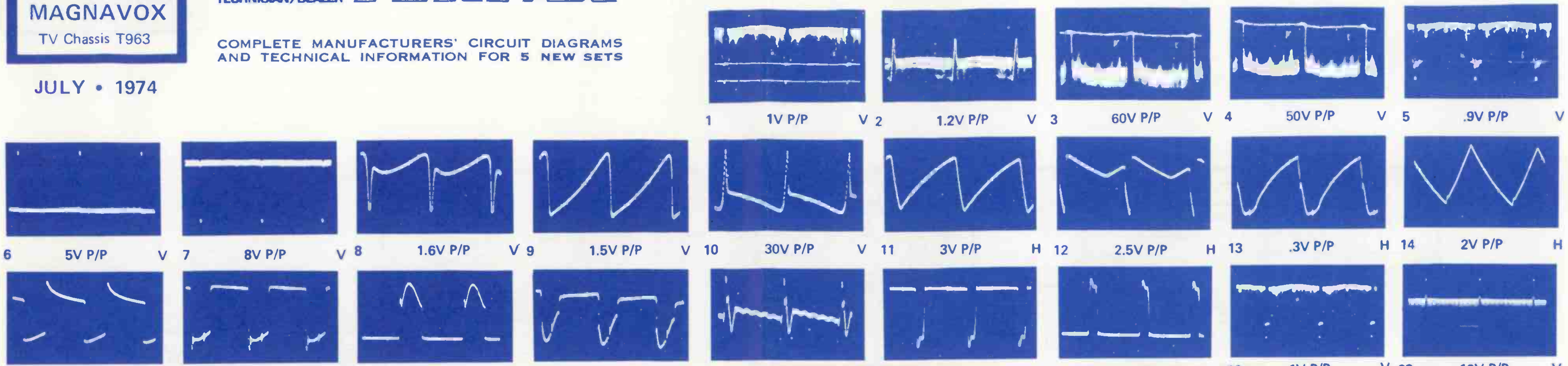
1538

MAGNAVOX
TV Chassis T963

JULY • 1974

ELECTRONIC TECHNICIAN/DEALER TEKFAX

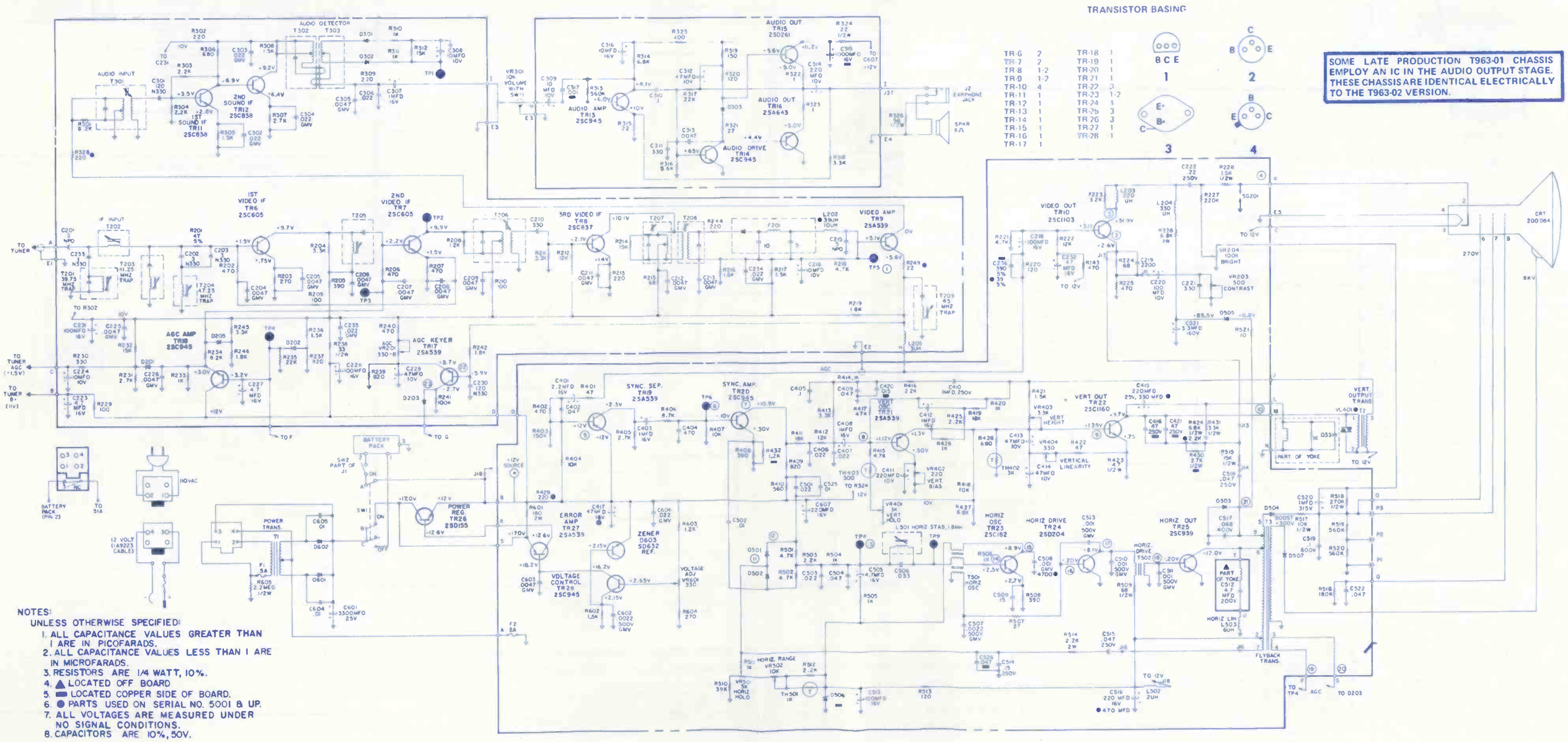
COMPLETE MANUFACTURERS' CIRCUIT DIAGRAMS AND TECHNICAL INFORMATION FOR 5 NEW SETS



1 1V P/P V · 2 1.2V P/P V · 3 60V P/P V · 4 50V P/P V · 5 .9V P/P V

6 5V P/P V · 7 8V P/P V · 8 1.6V P/P V · 9 1.5V P/P V · 10 30V P/P V · 11 3V P/P H · 12 2.5V P/P H · 13 .3V P/P H · 14 2V P/P H

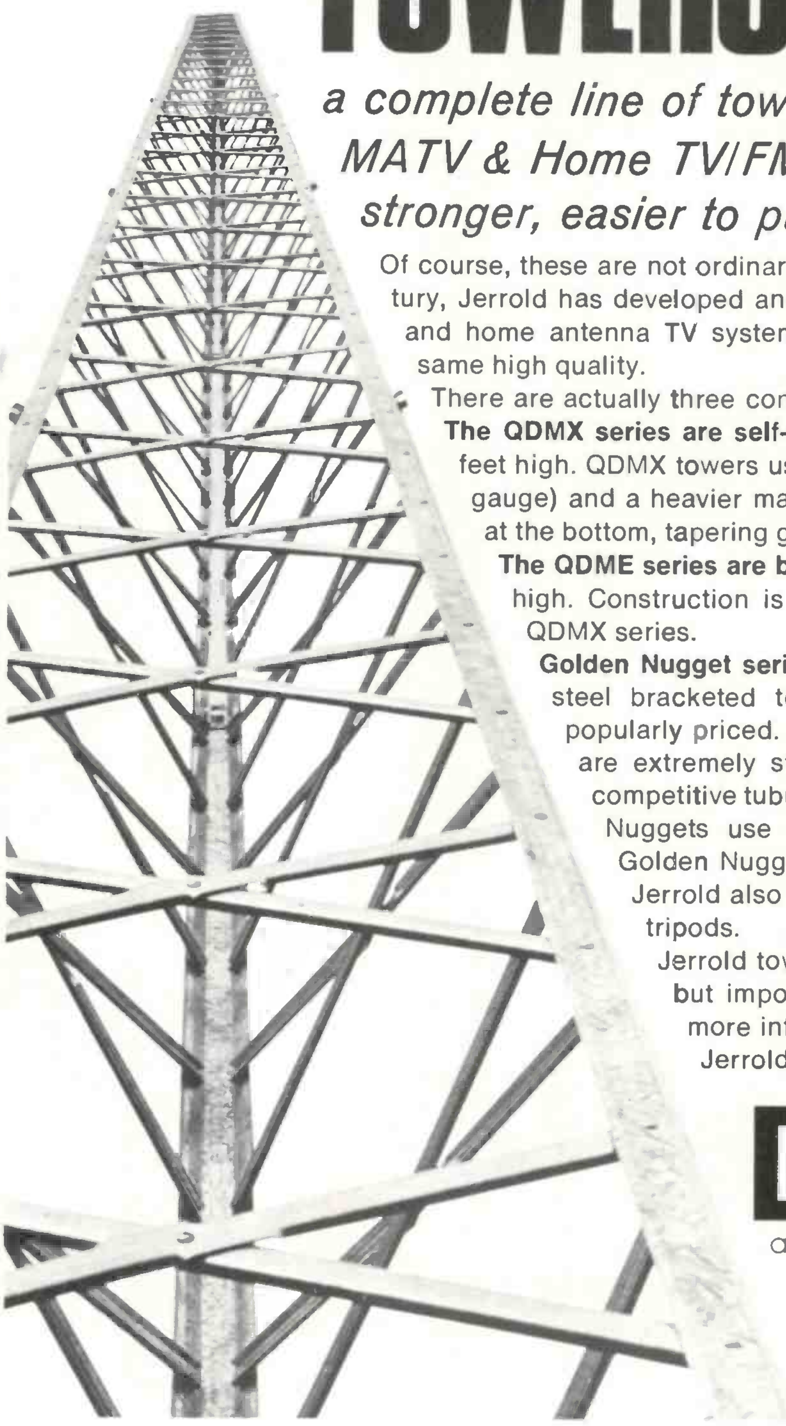
15 11V P/P H · 16 3V P/P H · 17 25V P/P H · 18 6V P/P H · 19 .1V P/P H · 20 19V P/P H · 21 80V P/P H · 22 1V P/P V · 23 16V P/P V



SOME LATE PRODUCTION T963-01 CHASSIS EMPLOY AN IC IN THE AUDIO OUTPUT STAGE. THESE CHASSIS ARE IDENTICAL ELECTRICALLY TO THE T963-02 VERSION.

NOTES:
UNLESS OTHERWISE SPECIFIED:
1. ALL CAPACITANCE VALUES GREATER THAN 1 ARE IN PICOFARADS.
2. ALL CAPACITANCE VALUES LESS THAN 1 ARE IN MICROFARADS.
3. RESISTORS ARE 1/4 WATT, 10%.
4. ▲ LOCATED OFF BOARD
5. ▬ LOCATED COPPER SIDE OF BOARD.
6. ● PARTS USED ON SERIAL NO. 5001 & UP.
7. ALL VOLTAGES ARE MEASURED UNDER NO SIGNAL CONDITIONS.
8. CAPACITORS ARE 10%, 50V.

Look up to Jerrold's new line of TOWERS



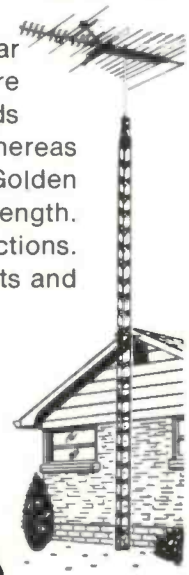
a complete line of towers for MATV & Home TV/FM Antennas that are stronger, easier to put up and last longer.

Of course, these are not ordinary towers. For more than a quarter of a century, Jerrold has developed and produced the finest equipment for MATV and home antenna TV systems. Our towers are proven designs of the same high quality.

There are actually three complete lines of Jerrold towers.

The QDMX series are self-supporting concrete-base towers, 28 to 68 feet high. QDMX towers use heavier steel (12 to 16 gauge vs. 14 to 18 gauge) and a heavier mast than competitive towers. They are wider at the bottom, tapering gracefully to the top.

The QDME series are bracketed towers, ranging from 20 to 52 feet high. Construction is of straight sections similar to that of the QDMX series.



Golden Nugget series towers are the finest tubular steel bracketed towers available, and they are popularly priced. Unique "Golden Nugget" welds are extremely strong and will never rust. Whereas competitive tubular towers use 18 gauge legs, Golden Nuggets use 16 gauge legs for extra strength. Golden Nuggets are available in 10-foot sections.

Jerrold also offers a full line of slip-up masts and tripods.

Jerrold towers are priced competitively, but impossible to match in value. For more information, contact your local Jerrold Distributor.

JERROLD
a GENERAL INSTRUMENT company

JERROLD ELECTRONICS CORPORATION
Distributor Sales Division
P.O. Box 350
200 Witmer Road, Horsham, Pa. 19044

. . . for more details circle 116 on Reader Service Card

A new 310-Type 3. Made to take a fall.

The rugged new "drop-resistant," hand size Triplett Model 310, Type 3 is priced at just $48.

(Actual Size)

The latest addition to the rugged Triplett 310, general purpose, multi-range V-O-M family—the Model 310, Type 3—has impressive new features. Its case and clear front are made of high impact-resistant plastic.

The low Ohms range Rx1 has been fused to protect against damaging overloads. These two improvements should eliminate over half of all repair requirements resulting from field use damage.

But that's not all. The case of the new Triplett 310, Type 3 sports an elegant new non-slip "finger-tread" surface finish. The meter movement brackets and pointer feature a new rugged design as well as newly designed lead jacks and Model 10 jack. Added to this, the front range and tester dial markings are changed to read easier when used with Triplett's Model 10 Clamp-on-Ammeter.

Outstanding features:

1. **Drop-resistant, hand size V-O-M with high impact thermoplastic case.**
2. **20,000 Ohms per Volt DC and 5,000 Ohms per Volt AC; diode overload protection with fused Rx1 Ohms range.**
3. **Single range switch; direct reading AC Amp range to facilitate clamp-on AC Ammeter usage.**

The durable new 310, Type 3, self-shielded for checking in strong magnetic fields, is an extra-rugged, high-torque, bar-ring instrument with spring back jewels. An interchangeable test prod fits into the top of the tester, making it a common probe and freeing one hand. All this for only $48.

For more information or a free demonstration, call your Triplett distributor or sales representative. For the name of the representative nearest you, dial toll free (800) 645-9200. New York State, call collect (516) 294-0990. Triplett Corporation, Bluffton, Ohio 45817.

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

Triplett. The easy readers.

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