ET/D

FEB. 1978 • $1.00

ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND
INDUSTRIAL SERVICE MARKETS

An up front discussion on tuner repair and module rebuilding.

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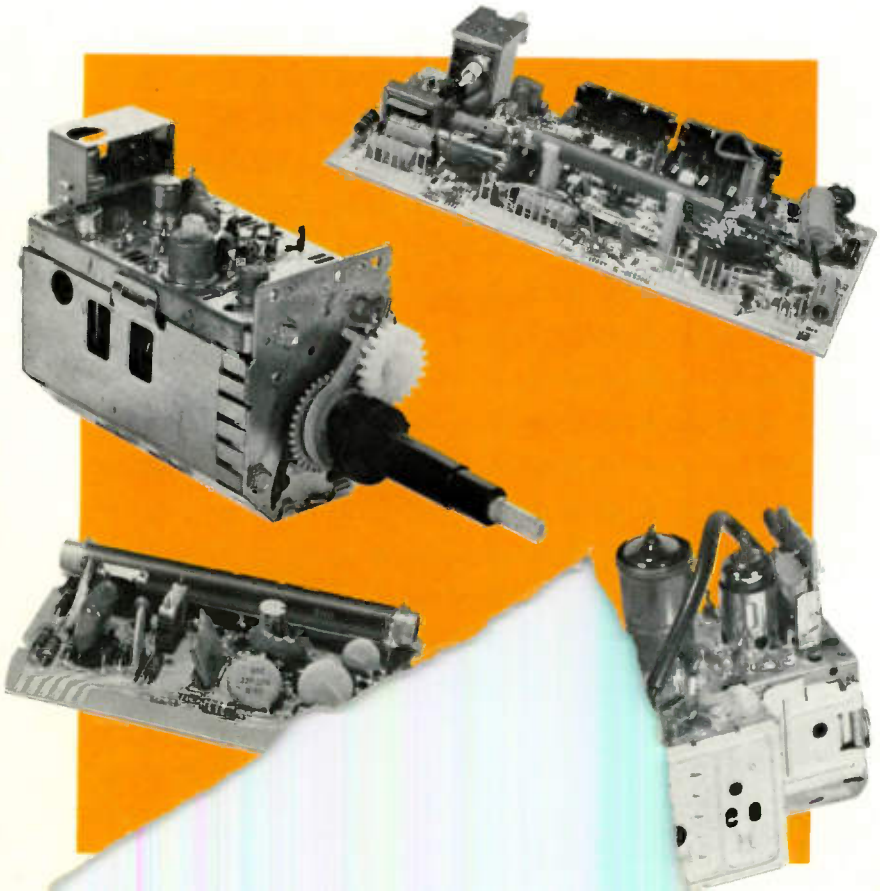

3. Same day service. Your reputation is as much time as it is quality. Same day service isn't a gimmick with us, it's a promise we strive to keep.

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* Acceptable brands are Admiral, GE, Magnavox, Montgomery Ward, Philco, Quasar, RCA, Sylvania, Seors/Warwick, Wells-Gordner and Zenith. PTS reserves the right to reject any or all modules presented for dud value including ceramic encapsulated, broken or cannibalized modules.

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INDUSTRY REPORT

AM Stereo Report Goes to FCC

A special study on three competing AM band stereophonic broadcast systems has been handed over to the Federal Communications Commission for evaluation.

The NAMSRC (National AM Stereophonic Radio Committee) report indicates the three systems tested are capable of transmitting and receiving stereo sound "with fidelity nearly comparable to FM stereo." Additionally, the report indicates, the systems are "basically" compatible with existing radio receivers and radio transmitters.

The systems tested by the committee were developed by Belar Electronics Laboratory, Inc., Magnavox Consumer Electronics Company, and Motorola, Inc. The basic differences between the three systems reportedly are functions of the three companies' design philosophies.

Japanese Invade U.S. TV Market

Continuing the Oriental power sweep around the voluntary curbs on Japanese TV imports to the United States, Toshiba (Tokyo Shibaura Co.) announced it is negotiating for a 100 acre tract near Nashville, Tenn. at which it would manufacture from 120-to-40,000 color television receivers per year.

Sony, Matsushita, Sanyo, and Hitachi already have U.S. factory outlets in the U.S, thus excluding these manufacturers from the import quota restrictions. Toshiba thus joins Mitsubishi (MGA) in announcing plans to seek U.S. production facilities.

Toshiba said it sold 500,000 color television sets in the U.S. in 1976 but expects its 1977 output to be about half that figure.

NATESA Sets 1978 Convention Date

The National Associati[illegible]on of Televis[illegible] and Electronic Servic[illegible]ers of Americ[illegible] (NATESA) has set its 1978 national convention Aug. 24 through the 27th.

According to Frank[illegible] Moch, executive director, this year's m[illegible]eetings and social events will be held a[illegible]t Chateau Louise in Dundee, Ill., a reso[illegible]t facility located 20 minutes from Chica[illegible]go's O'Hare International Airport.

A special gol[illegible] tournement will get things rolling a[illegible]nd will be followed by business and [illegible]chnical oriented seminars plus ma[illegible]ther social events. ET/D

ET/D

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ELECTRONIC TECHNICIAN/DEALER
LEADING THE CONSUMER AND INDUSTRIAL SERVICE MARKETS
FEB. 1978, VOL. 100, NUMBER 2

FEATURES

On the cover:
Two versions of the different home video cassette recorders now on the market—Sylvania's VTR, which uses the Matsushita format, and Zenith's VTR, which uses the Sony format. (See Home Video Recorder, pg. 14)

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NEWSLINE

TV SOUND COULD GET BETTER. If TV set manufacturers follow suit, TV sound reproduction could improve because of a bandwidth conversion just completed by AT & T. All TV network sound facilities including that of affiliates have been converted from the traditional 5,000 kHz to 15,000 kHz. This doesn't include public TV, but they are using satellite transmission for network programs and that has broad audio bandwidth. Thus, with network facilities up to stereo level, it's up to set manufacturers to include stereo sound in their product -- that is, if the consumer will pay for it.

FCC GRANTS 'ONE' CB SALE EXTENSION. Some CB manufacturers could be miffed by the 6-month extension to their Jan. 1 marketing cutoff date for 23-channel sets. The agency has granted an exemption petition filed by Tanner Electronic Systems Technology, Inc. for the marketing of their 23-channel receiver-converters for AM auto radios. Complete explanation of the FCC extension is yet to come.

LAST YEAR 2ND BEST IN TV SALES. With all TV set-sales-to-dealers figures in for 1977, the year winds up as the 2nd best in history for color unit sales. And all-time monthly sales records were broken in April, June, October and November. Total color TV sales to dealers in 1977 was 9,107,000 -- up 18.3% over 1976, and just 1.7% less than the all-time record set in 1973. Black-and-white sales in 1977 were up 8.9% from 1976 for a total of 5,660,000 sets.

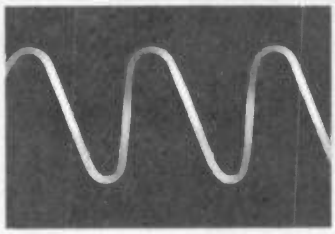
NEW VTR HAS FOUR SPEEDS. A Japanese producer of video tape recorders, the Victor Company, has introduced a new VTR -- Model HR-3600 -- that features four-speed playback -- standard, still, slow and double-speed. Specific pricing information is not yet available, but it is expected to be about $120 higher than their original product which was priced in the U.S. at $1,280. Victor has not yet entered the VTR-pricing-race. Their price is highest on U.S. market -- a four-hour machine for about $1,300.

NEW VIDEODISC PLAYS TWO HOURS. A new optical system developed jointly by Philips and MCA allows the recording of a two-hour movie on two sides of a single disc. This is first for an optical system, although RCA and Matsushita already have a needle-in-groove system that does the same thing. The Philips/MCA system uses a "variable angular velocity" system that allows disc to continually change speed from start to finish with speed kept constant with the laser-beam pickup. Disc plays inside-out, with starting speed at 1,800, dropping to around 600 rpm at end.

WINTER CES BREAKS RECORD. Official attendance figures now in show that 42,676 passed through the doors of the recent Winter CES in Las Vegas. This is 36% higher than attendance at last year's show in Chicago. High attendance continued through to end of show.

ADMIRAL MAY BE NEXT. Admiral may be the next TV set manufacturer to be "caught up in the restructuring wave that is sweeping the industry" according to a speculative story in TV Digest. A spokesman for the parent company, Rockwell, was quoted as saying, "Marketing and manufacturing of TV sets in the U.S. are undergoing significant change and Admiral is evaluating those changes. That evaluation has included discussions with both foreign and American manufacturers."

Two Emmys for VIR. One to the signal. One to General Electric for using it first.



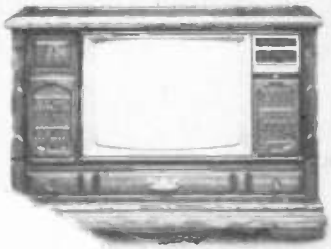
The National Academy of Television Arts and Sciences made two awards last year for outstanding achievement in engineering development.

An Emmy to the Electronic Industries Association committee that developed the VIR signal. And an Emmy to General Electric "for the first application of the Vertical Interval Reference (VIR) signal system to television receivers."

When the VIR signal is added to the picture signal, stations can automatically correct the color balance even though distortions may have occurred on the way. The development of VIR was a big step for color broadcasting.

With the VIR signal system established, the next challenge was to design a TV set that could use it. So General Electric developed the VIR Broadcast Controlled Color System. And won an Emmy of our own.

With computer-like circuitry, GE VIR color sets auto[illegible]atically adjust color and tint—sixty times a second—in accordance with [illegible] signal broadcast with many color programs.



We know you'll be passing on the news of our Em[illegible]ustomers. So will we. In national TV and magazine advertising. [illegible]dealer promotional kit. All highlighting General Electric's [illegible] VIR Broadcast Controlled Color System.

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FROM THE EDITOR'S DESK

In one of my recent editorials I talked to you about some of the home video tape recorder servicing schools which were being held in various sections of the country. I said if your shop is seriously interested in this new opportunity, you should look into attending them.

Not being that familiar with VCR machines, I decided to take a little of my own advice and I checked into a session held by GTE Sylvania's newly reorganized Product Services Division at Batavia, N.Y. This division, under the direction of Rick Polichicchio, is comprised of three formerly separate units—the field service managers, the parts division and the former Sylvania Service Company.

The reason I mention this is because, when I got to Batavia, what I found was a highly professional and very intelligible approach toward spreading service information about a tremendously complex electronic machine.

Sylvania, of course, is marketing the Matsushita VHS unit, which contains nine circuit boards — but nine boards which act as 13, depending on the various speeds (2 or 4 hour) and modes (play or record) being employed.

Quite frankly, in most cases, there is very little chance anyone — short of the design engineer — can look at one of the schematics and follow a particular signal through the various sections.

While I'm not fully aware of what all of the manufacturers are doing concerning instructional sessions, Sylvania's approach to solving this problem is, to say the least, innovative. It was hammered out by Field Service Manager Jack Berquist and co-worker Charles Johnson, both of whom literally spent 16 days and nights closeted with the Japanese engineering staff at Matsushita trying to figure out just what this machine is all about. The results are one of the most complete and informational schematic diagrams I have ever seen.

Not only is the complete electronic schematic included, but a block diagram shows from what board the input to the chrominance panel originates and to what pin it travels. Included are scope photographs of waveforms at easily identifiable tie points.

All in all I believe this approach to be one of the most understandable and easily followed instructional aids I have ever seen. I believe the people at Sylvania's Product Services Division are to be commended for this superior effort at field instruction.

Sincerely

Richard W. Lay

LETTERS

THE LINES ARE TOO FAINT

In ET/D for November, 1977, the schematic for the GE Portable Color TV, Chassis AA, in TEKFAX, No. 1721, was so faint that the schematic was not readable – thus the whole thing is useless. Could you somehow send me a replacement schematic or reprint a good one in the magazine?
H. E. King
Kansas City, Mo.

EDITOR: We've had a number of letters about the GE schematic that reproduced so badly. We will correct the problem by including a useable Chassis AA schematic in the March issue of ET/D. Thanks.

THE RADIO FROM HONG KONG

Please try to help me. I am looking for the name of a firm and address where I can get a schematic and service literature for a radio 'made in Hong Kong' under the name of "Hanimex."
A.C. Cook
Milford, Ohio

EDITOR: We have searched through our reference library for the name and address you need without success. Perhaps an ET/D reader can help. We hope so.

LOOKING FOR METER REPAIR SERVICE

Along with myself I know of several TV/Sound/Radio servicemen who purchased the Amphenol Model 870 FET Voltmeter several years ago. To say that this was a fine, accurate and sensitive meter would be putting it mildly.
Now we have troubles with them and would like to get them repaired. I would appreciate learning where these units are being repaired. There must be hundreds in the field and it would be a shame to see them go by the wayside and not be kept up and in working condition.
Have you any information that would help us out?
Edward Scribner
Schoharie, N.Y.

EDITOR: We checked with Amphenol and found that test instrument parts and repair are now handled through: Aztec Electronics, a division of Commander Communications, 505 G. Harvester Court, Wheeling, Illinois 60090. ET/D

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GTE SYLVANIA

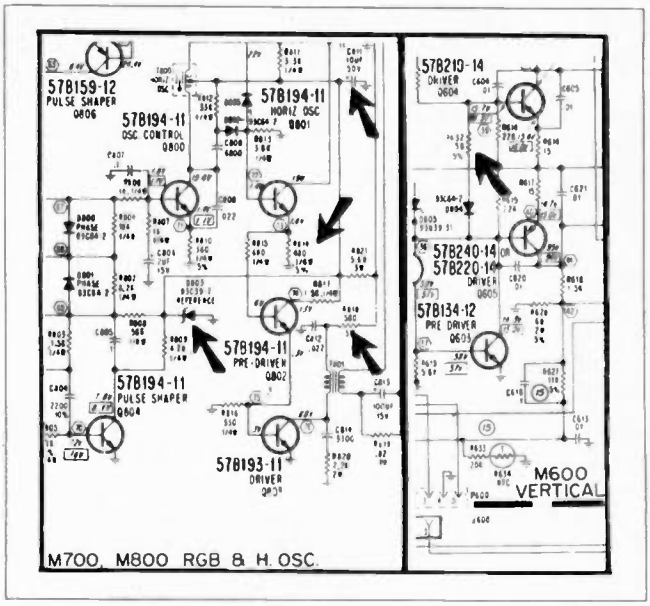
Circle No. 118 on Reader Inquiry Card

SERVICE SEMINAR

ADMIRAL

Color TV Chassis 3M10/4M10—For all symptoms listed see diagram below

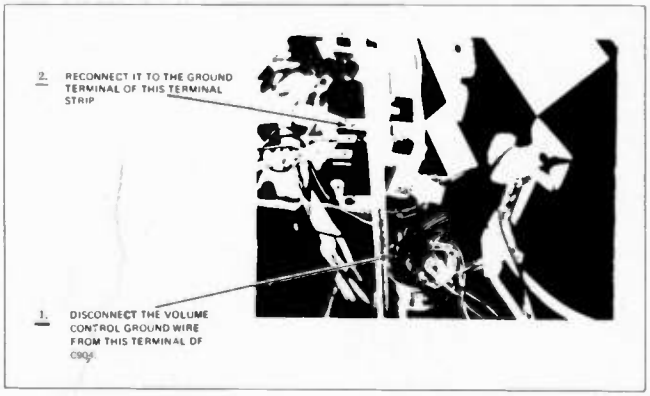
Symptom—Slow start up of horizontal oscillator.
Check value of R814. It should be 430 ohms, 5% ¼W.
Symptom—Poor horizontal sync, HV shutdown and/or "squeak" noise when turning receiver on or off.
Check lytic capacitor, C811, 10mfd, 25V. It could be leaky.
Symptom—No raster, no sound, and no collector voltage (19VDC) on Q801.
It is possible that the Zener reference diode, D803, is shorted.
Symptom—No raster, no sound.
Possibly, the Horizontal Driver, Q803, is shorted, which could also take out R818, 560 ohm, 3W.
Symptom—The horizontal scan line in the center of the picture is missing.
Check the value of R632. It should be 56 ohms, 5%, ¼W.

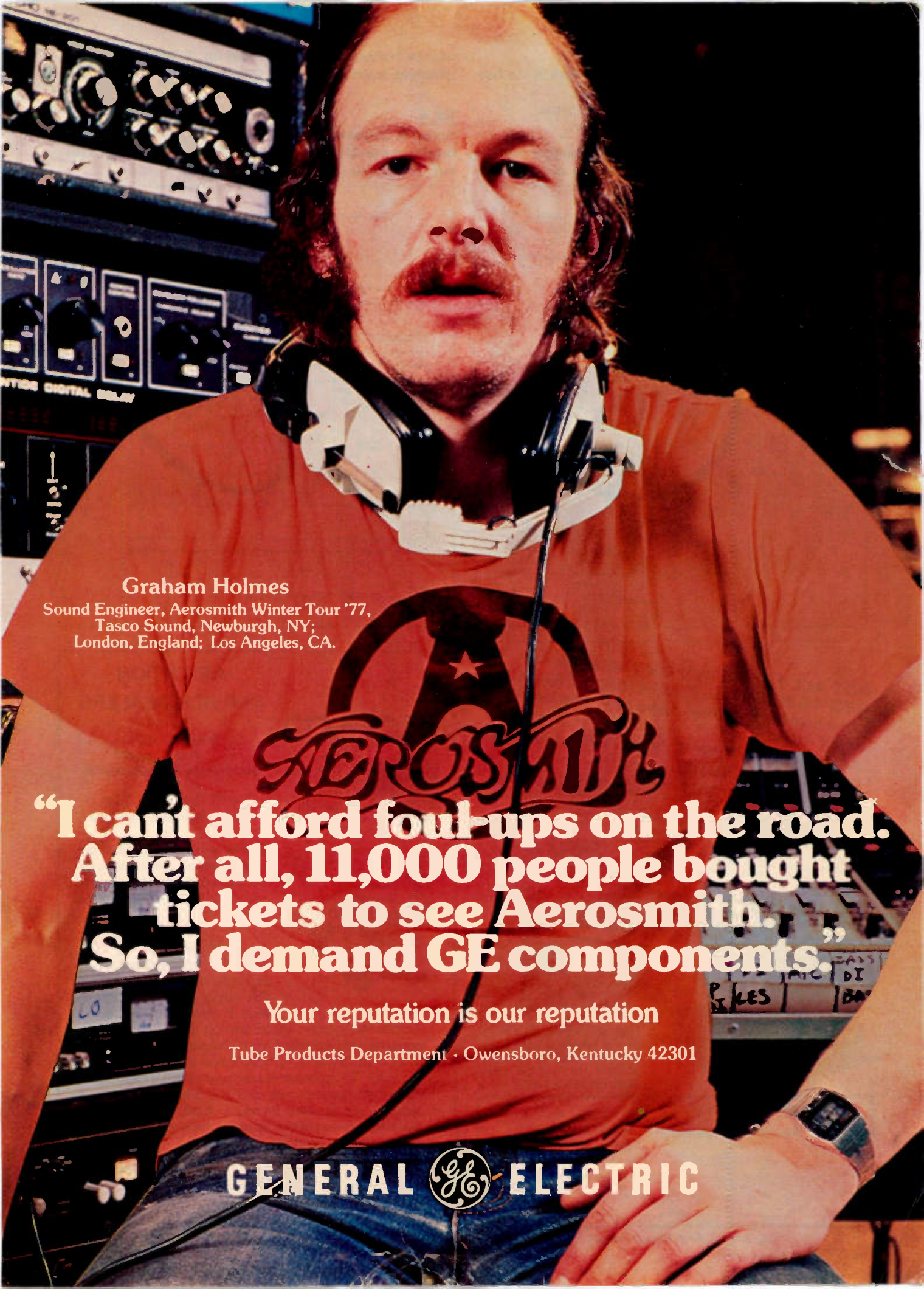


GENERAL ELECTRIC

Color TV Chassis YA—Hum in the Audio

You should be able to get rid of the hum by relocating the ground wire for the Volume control as shown in the photo below.




Graham Holmes
Sound Engineer, Aerosmith Winter Tour '77,
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London, England; Los Angeles, CA.
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GENERAL ELECTRIC

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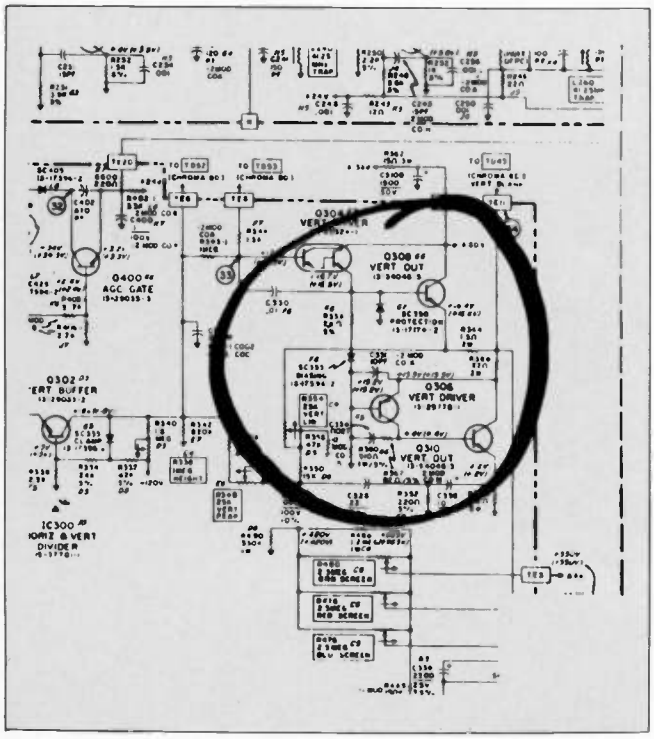
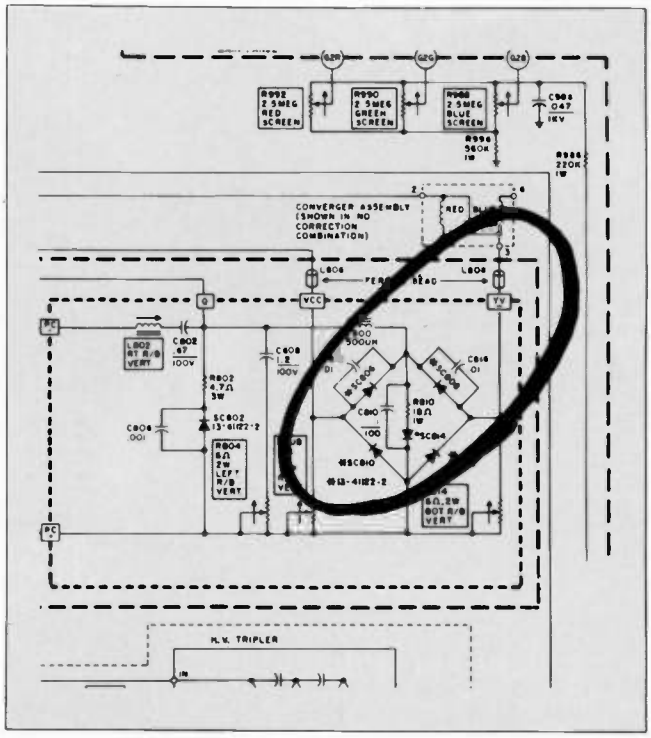
Color TV Chassis E03/04/05—The raster lines at the bottom third of the screen squeeze together.
Replace the Vertical Driver, Q306 (diagram below).

Color TV Chassis E21—The red & blue bottom vertical lines would not converge. Turning the control only causes bottom of picture to fold up. SC808 is probably breaking down under load. Checks O.K. out of circuit.



RCA

Color TV Chassis CTC 48—Circuit breaker trips at high brightness levels. Previous replacement of C403 was incorrect. Replace now with RCA specified part.



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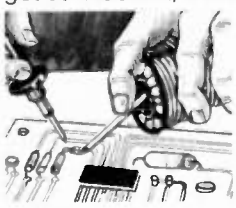
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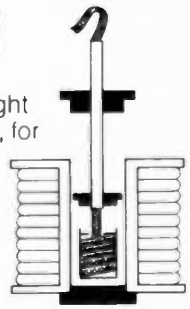
Snapped right into the center of a pound spool of our high quality 16, 18 or 21 gauge MIL-spec solder is D5 —our easy-to-use desoldering tool. D5 contains 5 feet of pure copper braid wick that lets you see the absorption of solder . . . so you never overheat boards and components by working with a used portion of wick. And its non-activated, pure, water-white rosin flux coating helps assure that every drop of solder is quickly removed, without leaving corrosive residue.

Nothing beats the D5 dispenser tool for easy desoldering without burnt fingers. Its 2½-inch Teflon probe reaches right in . . . even to tight areas, for precision solder removal. And by applying tension to the D5 probe, you can shape, form or "web" the wick to provide a greater absorption surface. You also use less wick, dispensing only the right amount as you need it.

FREE! A $2.45 VALUE!


Modular construction—D5 tool is removable; 2½" probe snaps into wick refill

SD5 is the total system for maximum soldering/desoldering efficiency at your bench or assembly station. Alone, the D5 tool is perfect for times when you want to pocket the wick and leave the solder behind. And D5 is also refillable. Just snap out the Teflon probe and plug in a D5 refill, available in two gauges—.10 inch and .06 inch for all desoldering applications.


Snap out, pocket D5

The Chemtronics modular solder/desolder system can be purchased separately as half- or one-pound spools of solder, D5 desoldering tool and D5 wick refill. Or buy it as a complete SD5 unit with free D5 desoldering tool. Take advantage of this limited-time introductory offer at your Chemtronics distributor now.

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Home video recorders

A new avenue for service volume

In this article the author describes the azimuth recording system basic to the modern cassette units currently penetrating American homes.

By Bernard B. Daien

Just as in audio recording, the cassette loading format is the most desirable for general use, since it eliminates the need for tape handling, threading, and thus enhances customer acceptance. Unfortunately the lack of standardization as to tape width, number of heads, tape speed, and handling mechanisms between competing companies has delayed wide spread use.

This appears to be the year for VTRs to take off, however. In the past, Sony, Concord, Panasonic, JVC and 3M used a ¾ inch tape width. Now Panasonic, Matushita, Sanyo, Toshiba, Zenith, Magnavox, and others have gone to the ½ inch cassette. The tape handling mechanism which is now the most popular, and seems destined to become the standard for some time, is based on Phillip's VCR (Video Cassette Recorder). We will examine this type of machine as being representative of the latest, and most successful effort so far in cassette machines.

The electronic recording process that is now most popular goes under several names ... "VHS", for Video Home System ... "Betamax", etc. All use the same basic system incorporating *azimuth recording,* which will be covered in this article. Azimuth recording is the secret of the LP, (long playing), 4 hour tapes.

The electronic system

In article two of this series we showed the slant track machine, and it's recorded tracks. If we consider a two head machine, the heads, and their gaps, can be represented as in Figure 1. The resulting magnetic fields would appear on the tape as in the illustration, Head "X" records the tracks marked "X", while head "Z" records the "Z" tracks. As the head drum rotates, each head alternates with the other in recording. Thus each head records "every-other" track. Since the head gaps are oriented identically, the recorded fields are likewise identically oriented.

Notice that between each track there is a "guard band" in which no recording occurs, thus the tracks do not interfere with each other, (crosstalk). This means that there is much tape on which nothing is recorded. If we could eliminate the guard bands, we could devote the entire tape length to recording, yielding LP (long playing) tapes.

This is accomplished by the method illustrated in Figure 2, wherein the two heads have their gaps tilted in opposite directions. The resulting recorded fields on the tape are likewise angles. At *high frequencies,* if the direction of the magnetic fields recorded on the tape is different from the head gap orientation, there is little or no pickup. Thus, despite the lack of a guardband, each head does not playback the material recorded by the other head, and there is no crosstalk.

Recording color

The recorded fields on the tape are shown in the figure which indicates the results of the head angling. This is called, "Azimuth Recording". Remember, this effect is useful only at the higher frequencies. But, you will recall from the previous article, only the luminance (black and white) information is recorded at the higher frequencies. The chroma information is heterodyned down to below 1 megaHertz before recording. The chroma information therefore *would suffer from crosstalk* between tracks, despite the azimuth recording technique .... but we use another method to prevent this, as described below. (The method of heterodyning down the color information is termed the, "Color Under" method.)

Since the chroma information is processed separately, we can phase invert *every line fed into one of the heads*. Upon playback we again invert the signal from the same head. Thus it appears as if the signal were never processed, since two inversions bring the output of both heads back in phase.

But crosstalk picked up during playback undergoes only one phase inversion and, therefore, is out of phase when the two playback heads are compared. One of the signals is then passed through a delay line, with a time delay of one horizontal line. The delayed, and the non delayed signals, are then fed into an adder, or summing amplifier, the output of which is the sum of the inputs. Thus, the desired signals add up, while the crosstalk is cancelled out. In this manner we get rid of crosstalk at the lower chroma frequencies on the tape, *without the need for guardbands*.

Due to the elimination of the guardband, and some refinements, the tape speed is reduced to less than 1 inch per second! The head to tape speed is over 23 feet per second however, due to the high head rotational speed made possible by the closely spaced tracks.

Tape handling mechanism

The cassette has a supply reel, and a takeup reel within it. Since the machine is a slant track, the tape within the cassette must be wrapped half way around the two head drum. This is accomplished by means of the "Loading Arm", which draws the tape out of the

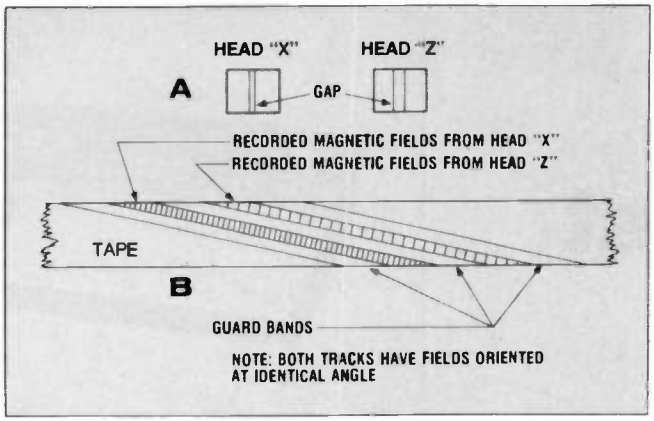


Fig. 1 – Vertical orientation of head gaps (1A) necessitates guard bands (1B) between recorded tracks to eliminate crosstalk.

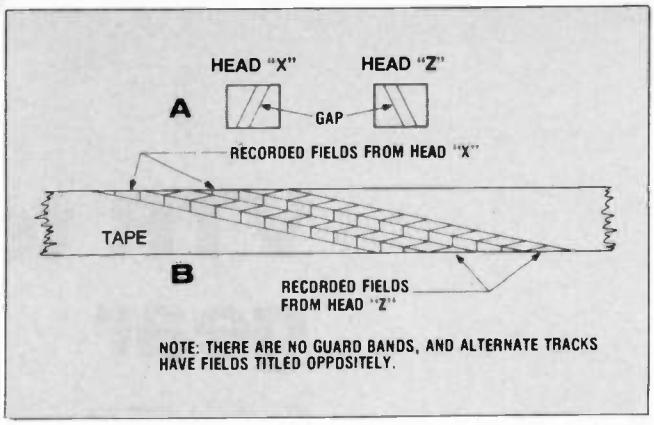


Fig. 2 – Oppositely slanted head gaps (2A) permit recording with oppositely polarized tracks (2B) which in turn reduce crosstalk action without the use of guard bands.

cassette, around the various heads, idlers, head drum, and drive capstan. The operation of the loading arm is shown in Figures 3A, B and C.

The recording and playback proceed as in other slant track machines, with one exception. Since the tape must be drawn out of the cassette in a complicated maneuver, and returned the same way, no other operations can be made during the time of drawing out and return. Thus interlocks, and a warning light are usually provided, preventing recording, playback, rewind, etc., during the several seconds required to complete this action, in order to prevent tape jamming. This is a peculiarity of this type of cassette format, inherent in the design, and can cause problems to users who are not familiar with the machine, or who fail to read the instructions before using.

VCR characteristics

Cassette recorders have a built in UHF-VHF tuner, and an antenna coupling/switching system. The TV antenna is connected to the terminals on the back of the VTR, and signals are supplied both to the tuner in the VTR and the tuner in the TV set.

The output of the VTR is on either Channel 3, or 4, whichever is not used in the area. With the VTR off, the TV antenna is connected to the TV set. With the VTR on, whichever channel the VTR tuner is tuned to is recorded, and the TV set can be used as a monitor by tuning it to either 3 or 4. On playback, the VTR feeds a signal to the TV set via a built in transmitter (similar to the way a color bar generator works), and the picture and sound are seen and heard via the TV set, like any off-the-air signal.

Since the VTR has its own tuner, the TV set can view one channel normally, while the VTR records another, for future viewing. Provision is also made for recording tape from a TV camera with microphone, which is available as an accessory. The camera for this use has its own vertical and horizontal sync and sweeps, and generates a composite TV signal similar to the signal from the video detector in a TV set.

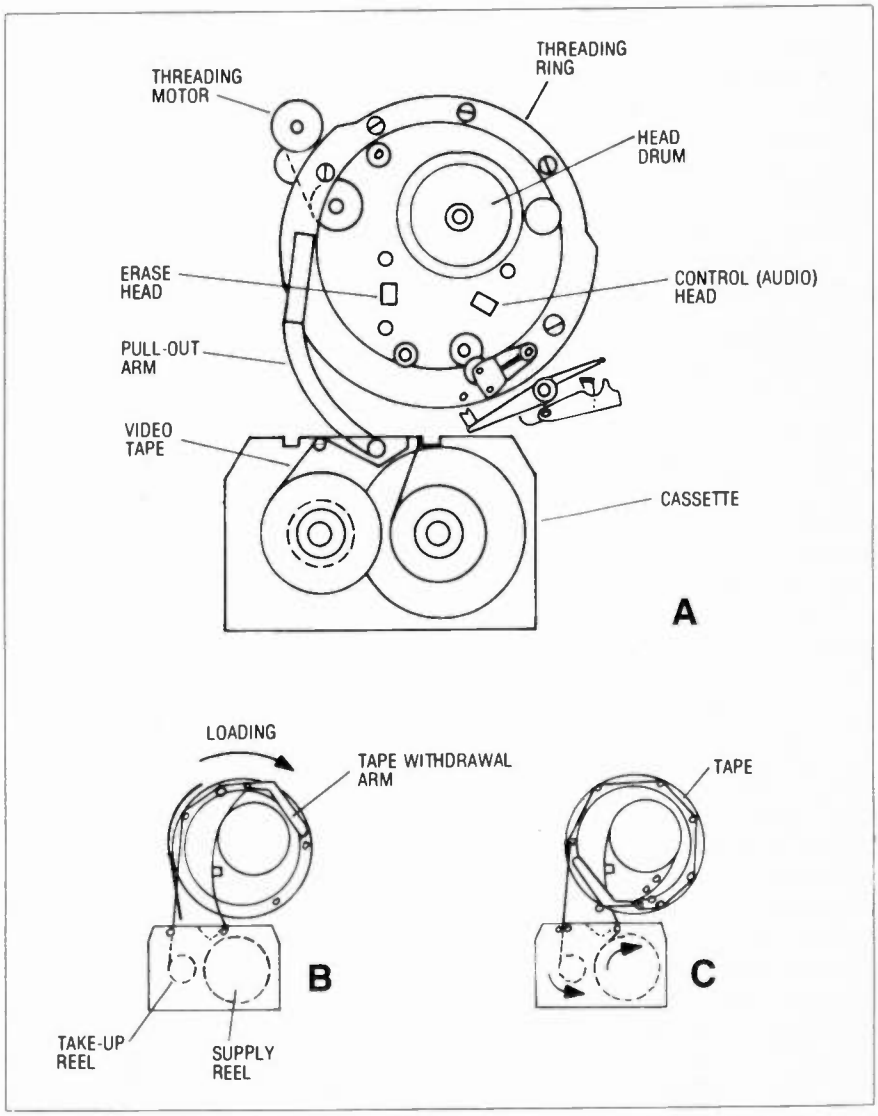


Fig. 3 – Progressive views of the tape threading operation. Figure 3A shows tape position at the start; 3B is a view of the half completed threading operation; and 3C shows the completed threading.

It should be noted that some TV cameras do not have internal sync generators, but derive their sweeps, from the system to which they are connected. Thus one must be careful in attempting to adapt other cameras to the videocassette machine. ET/D

VTR test gear

Special ET/D report

Video tape recorder servicing is a new and developing service area for the modern television and home entertainment service shop. As a service to our readers and in conjunction with ET/D's articles dealing with video tape recorder theory, we have asked the manufacturers of electronic test equipment to tell you, through us, what types and kinds of equipment are available and on the market today for this specialized service area.

As you can see in the following pages, most of the equipment is not new or strange to you. You'll need a high quality scope—for obvious reasons. In this regard, manufacturers say high bandwidth is not so important as signal delay action so as to permit viewing of the leading edge of high frequency pulse activity.

A sensitive counter capable of handling the usual television frequencies is necessary because of the critical timing characteristics of the VTR oscillators. Also, for obvious reasons a high quality digital multimeter is something you'll absolutely have to have—digital readouts being so much easier to interpret. However, you'll find some very high quality meters with both digital readout plus a small analog meter incorporated on the front panel for null and peaking tests.

Finally, something you cannot get along without is the color generator. A word about the different basic types, the NTSC Standard generator and the Gated Rainbow—or "offset" generator.

At least one manufacturer of the VTR unit requires the use of an NTSC color generator as a condition for becoming an authorized VTR service shop. Others, however, do not set this requirement and in this case a quality rainbow generator is considered sufficient.

The NTSC Standard color generator produces six colors bars which are 75 to 100 per cent saturated, a reference black level, a reference white level, and the pure I and Q signal color bars. These signals are used in many instances for calibration purposes in the broadcast studio setting.

The standard rainbow generator produces a display of 10 color bars each separated by 30 degrees from one another. While it does not produce the "pure" I and Q signal bars, this really has little significance in a machine operating of the color difference system (R-Y), (BY), (G-Y). Insofar as the generator is capable of producing the other reference patterns, or patterns that may be substituted for them, then it may be substituted for the NTSC generator for many testing and servicing purposes. Thus it is that we have listed both NTSC and Gated Rainbow types of generators.

Following then is ET/D's report on those manufacturers who responded to our survey. We asked them to supply us with the information on the test gear which they make and which *they* recommend for use in servicing video tape (cassette) recorder/players. Because of space limitations. ET/D has limited each manufacturer to one specific type of unit per category, when in fact several alternatives may have been recommended by the manufacturer. In any case, if a piece of test gear in this report interests you, we suggest you contact the manufacturer of that equipment direct for any equipment updates or alternatives, before making your purchase.

continued on page 18

Fig. 1


Fig. 4B

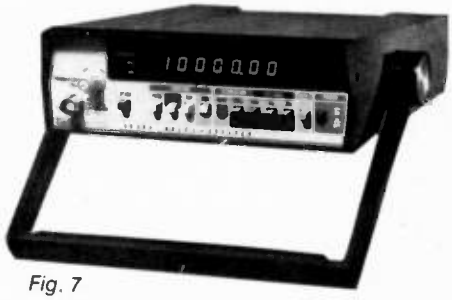


Fig. 7

Fig. 9B

Fig. 1–Ballantine's newest DMM is a portable rms responding meter with a low end full scale range of 20mV plus the High-Low ohms feature. Fig. 2–Viz's Model 750A features both digital and analog readouts for peak and null tests. Fig. 3–Racal-Dana offers this high .01½ accuracy DMM for VTR service work. Basic input impedence measure 10,000 Megohms. Fig. 4–Leader's LBO 515, B &

Fig. 2

Fig. 3

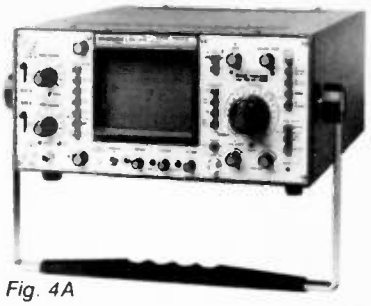


Fig. 4A

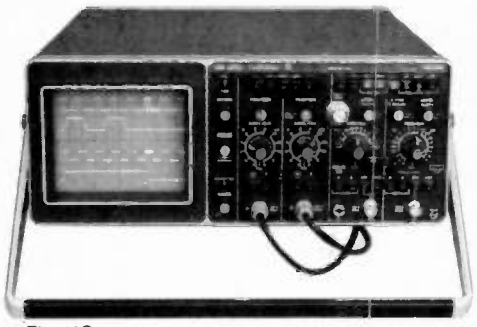


Fig. 4C

Fig. 5

Fig. 6

Fig. 8

Fig. 9A

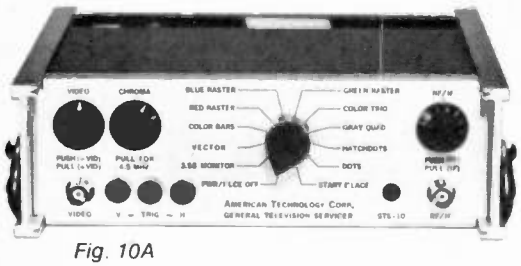


Fig. 10A

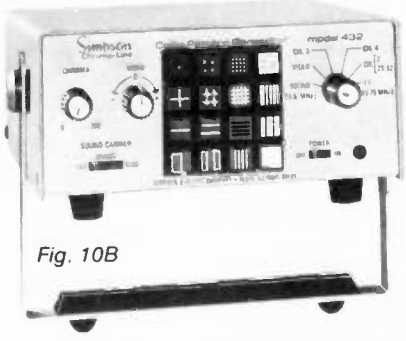


Fig. 10B

Fig. 11

K's MOdel 1474 and Phillips Model 3214 comprise three excellent scopes for VTR work. Each features wide band response, plus signal delay and channel inversion capabilities. Fig. 5–Hickok's 30Mhz dual trace Model 532 is a rugged, compact unit suited for bench or field service. Fig. 6–Phillips offers a pair of fully automated, compact and light weight counters based on LSI circuitry in 80 or 520 Mhz versions. Fig. 7–John Fluke Co. is out with a 7 digit multi-counter with excellent 20mV sensitivity and a basic maximum frequency rating of k25 Mhz. Fig. 8–Non Linear Systems offers its FM-7 seven digit, 60 Mhz counter for under $200. Fig. 9–At least one VTR manufacturer recommends NTSC color generators for VTR service. Two units to choose from are Tektronic's model 1470 and Leader's LCG-396. Fig. 10–Simpson and American Technology Corp. offer two less expensive color generators. Rainbow patterns are developed by the "offset" method. Fig. 11–Sencore's newly developed VA (Video Analyzer) 48. Manufacturer's specifications indicate this comprehensive test signal unit includes all necessary signals for TV-VTR-and-MATV applications.

VTR test gear...

continued from page 17

Color Generators

Manufacturer	Model & Cost	Color Bars Gated Rainbow—NTSC	Rasters	Video Freq. Response Check
American Technology Corp. Canyon City, Co.	GTS-10 $349	Yes	R-B-G-Grey	Yes
Hickok Cleveland, Ohio	246 $225	Yes	R-B-G-Grey	Yes
Leader Plainview, N.Y.	LCG-396 $899	Yes	R-G-B-White	Yes
Sencore Sioux Falls, S.D.	VA48 $975	(Uses the new & patented "Bar Sweep" methods for chroma and video response calibrations.)		
Simpson Elgin, Ill.	432 $215	Yes	R-B-G-White	Yes
Tektronix Beaverton, Ore.	1470 $26,000	Yes	R-B-G-White	Yes
Viz Philadelphia	WR 515A $199	Yes	R-B-G-White	Yes

Digital Multimeters

Manufacturer	Model & Cost	Display	DC Volts Ranges High	Low	Freq. Limit	High/Low Ohms	DC Accuracy
Ballantine Boonton, N.J.	3028B $295	D(3½)	1200	.02	110Khz	Yes	
B&K Precision Chicago, Ill.	283 $185	D(3½)	1000	1	400Hz	Yes	1%
Data Precision Wakefield, MA.	175 $189	D(3½)	1000	.1	50Khz	Yes	1%
Fluke Mountlake Terrace, Washington	8000A-o6 $325	D(3½)	1200	.2	10Khz	Yes	.1%
Leader Plainview, N.Y.	LDM 851 $199	D(3½)	1000	.1			
Non Linear Systems Del Mar, CA.	LM 4A $227	D(4)	1000	1	400hz	No	1%
Simpson Elgin, Ill.	460-3 $299	D(3½) & Analog	1000	.2	20Khz	Yes	.1*
Systron Donner Concord, CA	7141A $395	D(4)	2000	.2	20Khz	No	.05%
Racal-Dana Irvine, Ca.	4600 $549	D(4½)	1000	.2	100Khz	No	.01%
Triplett Bluffton, Ohio	3300 $175	D(3½)	600	.2	—	No	.5%
Viz Philadelphia, Pa.	750A $267	D(3½)	1200	.2	500hz	Yes	1%
Sencore Sioux Falls, S.D.	DVM38 $348	D(3½)	2000	.2	5Khz	Yes	1%
Hickok Cleveland, Ohio	334 $234	D(3½)	1200	.2	1Khz	No	.3%
Hewlett Packard Palo Alto, CA	3476 $225	D(3½)	1000	.1	5Khz	No	.3%

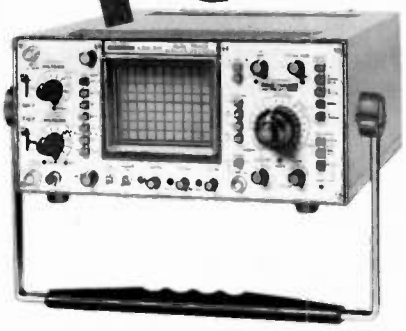
Dual Trace Scopes

Manufacturer	Model Cost	Bandwidth	Calibrated Sweep	Signal Delay	Channel Inversion
Ballantine Boonton, N.J.	1010A $595	15 MHz	Yes	No	No
B&K Precision Chicago	1475 $960	30 MHz	Yes	Yes	Yes
Hewlett Packard Colorado Springs, Co.	1222A $895	15 MHz	Yes	Yes	Yes
Leader Plainview, N.Y.	LB0515 $1,395	25 MHz	Yes	Yes	Yes
Phillips Mahwah, N.J.	PM3214 $1,425	25 MHz	Yes	Yes	Yes
Simpsom Elgin, Ill.	452 $675	15MHz	Yes	No	Yes
Tektronix Beaverton, Ore.	T922 $850	15Mhz	Yes	No	Yes
Viz Philadelphia	WO555	15Mhz	Yes	Yes	Yes
Heath/Schlumberger Benton Harbor Mich.	SO4510 $750	30Mhz	Yes	Yes	No
Hickok Cleveland, Ohio	532 $995	30Mhz	Yes	Yes	No

Frequency Counters

Manufacturer	Model & Cost	Digits	Sensitivity	Maximum Frequency (Mhz)
Ballantine Boonton, N.J.	5720A $195	8	50mV	80
B&K Precision Chicago, Ill.	5740 $260	6	30mV	80
Data Precision Wakefield, Ma.	5740 $295	7	30mV	100
Fluke Mountlake Terrace, Wash.	1910A $395	7	20mV	125
Heath/Schlumberger Benton Harbor, Mich.	Im4110 $190	8	25mV	110
Hickok Cleveland, Ohio	380 $269	7	80mV	80
Leader Plainview, N.Y.	LDC 22 $299	7	20mV	80
Non Linear Systems, Del Mar, Ca.	FM 7 $195	7	30mV	60
Phillips Mahwah, N.J.	PM6661 $275	8	20mV	80
Sencore Sioux Falls, S.D.	FC45 $395	8	25mV	230
Simpson Elgin, Ill.	710 $150	6	50mV	60
Systron Donner Concord, Ca.	6241A $595	8	10mV	100
Viz Philadelphia	WD752A $255	6	100mV	60
Racal-Dana Irvine, Ca.	9911	8	10mV	

APPROVED FOR VTR SERVICE



The Leader Scope

LBO-515
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- Built-in variable delay circuitry — 1μSec to 5Sec.
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LCG-396
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- NTSC color bars and staircase.
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- Provides full-field for IQW insertion, plus on-off control of chroma and luminance.
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Quasar's latest color receivers

What's new for '78

A completely redesigned color system, "Audio Spectrum" sound, and tri-potential in-lines highlight Quasar's 1978 models.

By Richard W. Lay

Quasar's new 1978 table and console model television chassis (TS-961/962) incorporate a number of circuit changes over previous models which are designed to result in sharper resolution and better color registration while maintaining the advantages of the "Super Module" chassis (TS-958/959) introduced last year.

In the 13- and 15-inch color portable field, the new TS-963 incorporates the most reliable circuitry of the past while adding newly revised circuitry in the video, audio and vertical sweep circuits, plus simplified customer color controls and AFT switch.

Essentially, the TS-961 and 962 contain the same basic circuitry as found in last year's modules, including the easily removed super module board (secured by six screws) which contains about 70 per cent of the components; scan derived +20 volts and regulated +12 volt sources; the "slide back" chassis for easier servicing in the 19-inch (TS-961) models, and the "Works in the Drawer" 25-inch (TS-962) model.

However, important changes have been made, primarily in the color circuitry, the high voltage assembly, a special three-speaker "Audio Spectrum" sound system on some models, and the addition of tri-potential, 100 degree in-line gun black matrix CRTs.

Both the 962 and 961 contain an added color processing IC (602) which serves as the color demodulator and automatic "flesh tone" corrector which Quasar calls "Dynacolor." The high voltage assembly and associated diodes contain a new 12K volt tap used to feed the new tri-potential, 100 degree deflection CRT and this combination permits the higher resolution necessary to allow use of a 25-inch in-line CRT for the first time.

Circuitry in the video path has been revised to accommodate Quasar's new Dynacolor system. In previous models the emitter of first video amp Q301 fed both the 2nd video amp Q302 and was the takeoff for the input to the color processor. However, in the TS-961 and 962, the collector of 301 now feeds the input to the first color processor, IC601, and this arrangement, with the Dynacolor button activated, reduces the range of the picture and color controls to prevent severe customer misadjustment (Figure 2).

The tri-potential CRT

The new tri-potential, 100 degree deflection CRT features reduced spot size, negative guard band black matrix construction for improved contrast, and simplified convergence — a characteristic of all in-line guns.

Significant differences in the focus system are a 12K volt potential placed on grids 3 and 5 which are placed before and after the 6-7K volt potential on G4 for improved picture resolution (See Figure 3).

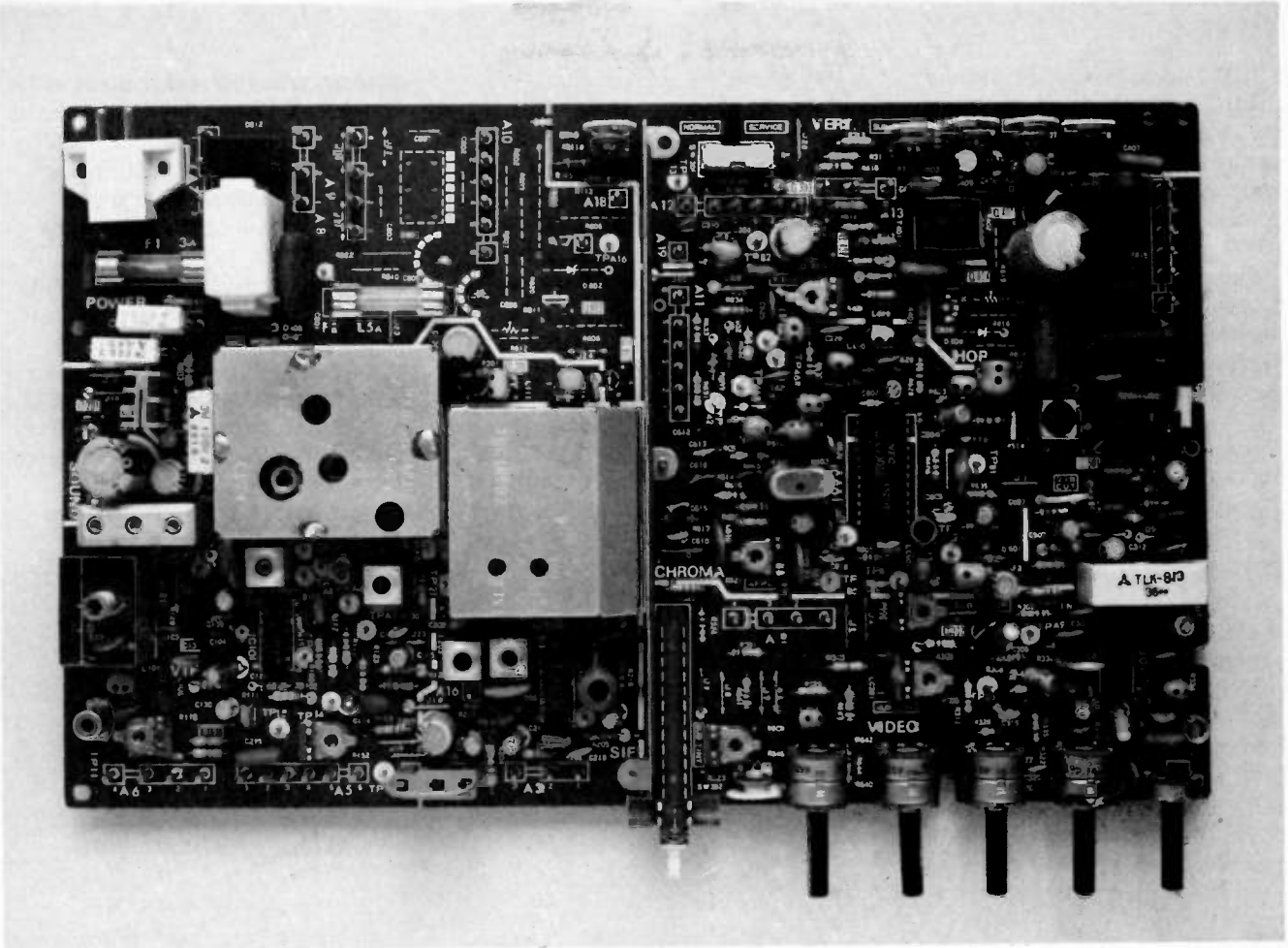
The audio section in the new chassis is basically the same as that found in last year's models, until it gets to the output section in the new high end models. The output of the third video IF Q101 is fed to audio detector D201. The detected 4.5 MHz FM sound signal is fed through tuned circuits and T201 to pins 1 and 2 of sound processor IC201 which contains the IF amplifier/limiter, the FM detector and the audio amp. Pin 12 of the IC feeds audio output transistor Q201 which is turn is fed to the speaker through T202.

However, in "Audio Spectrum Sound" models two additional speakers have been added (Figure 4). One speaker is physically located on the right side of the cabinet below the control cluster and two others are on the left side, which has necessitated increased cabinet width. Crossover frequency capacitors have been added. An 8 ohm speaker connects across the audio output transformer and responds to lower frequencies. Additionally, audio signals connect to the 16 and 32 ohm speakers through 30mfd non-polarized electrolytics, whose natural impedance (capacitive reactance) decreases as signal frequencies increase. Thus these speakers pick off the high and mid range signals. Resistor 250 and a 25 ohm POT which varies signal amplitude to the 8 and 32 ohm speakers and, when fully counter-clockwise, it disconnects the left side speakers from the system.

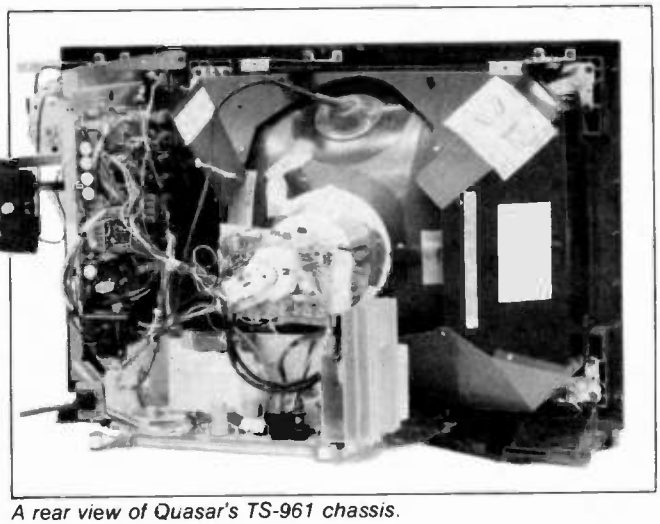
Low voltage supplies

As in the TS 958 and 959s, scan-derived +20 and +12 volts power most of the signal processing circuits. Positive voltage from the flyback during scan is rectified by D505 (Figure 4) and charges C520 to develop the +20 volts used in the audio, vertical sweep and third video IF circuits.

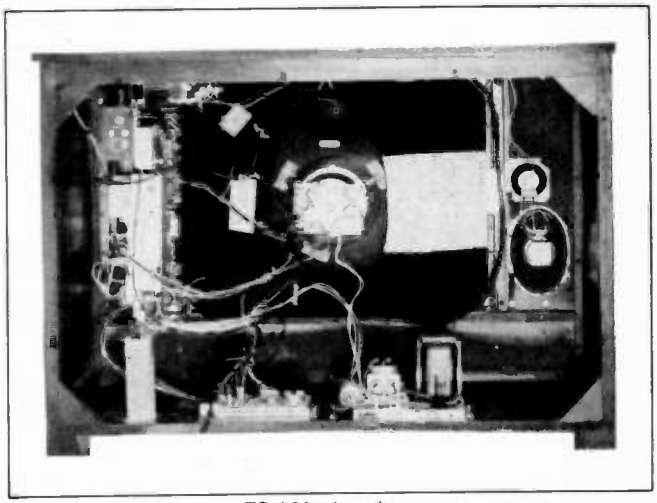
This +20 volts is also applied to the collector of pass transistor Q805. Zener diode 806 clamps the base of this transistor at +12.5 volts forcing it



A top view of the Super Module used in Quasar's new TS-962 chassis. It is similar except for a few extra components to the module used in the TS-961 chassis.



A rear view of Quasar's TS-961 chassis.



A rear view of Quasar's TS-962 chassis.

to function as a dynamic variable resistor to provide regulated +12 volts to most of the signal processing circuits, the customer controls and tuners.

The 25-inch TS-962 chassis features a self-regulating ferro resonant power supply for the 130 volt source. Two power diodes are used for full wave rectification which is filtered by an L-C network.

In the TS-961 chassis the 129 volt source is from a line operated full wave bridge rectifier assembly and a series regulation circuit. This circuit is basically the same as the TS-959 although it appears different schematically. The driver transistor has been removed from the "super module" but is included in the circuitry. A new regulator transistor is actually a Darlington, thus both the driver and regulator are enclosed in a common case.

A new color system

Quasar's new color processing system (Figure 6) has been substantially changed from previous models to include the automatic color intensity and flesh tone correction system—"Dynacolor." ICs 601 and 602, which are CA3126EM1s and CA3137EM1, replace the previous color processing IC601, a UPC1380C/AN380, found in the TS958/959 chassis. Included in IC601 are the 1st and 2nd chroma amps, the burst gate and phase detector, the 3.58 MHz oscillator and amplifier, a phase shifter and overload detector.

IC602 contains the 3rd chroma, the DC level and color difference amps, the hue and flesh controls, a carrier limiter, an I & Q demodulator and matrix section to develop the color difference signals (R-Y), (B-Y), (G-Y).

The output of IC602, pins 6, 7 and 8, provide low impedance outputs at the proper DC levels which are fed to the red, blue and green drivers on the CRT/Video assembly board. With Dynacolor activated a flesh corrector corrects for flesh tone phase errors but has minimum effect on the three primary colors.

IC601

Color signals are fed from the collector of the first video amp to Pin 1 of IC601, the first chroma amp, which in turn feeds the ACC detector, burst gate and 2nd chroma amp. Horizontal keying pulses from the keyer, trigger the detector and gate into conduction while similarly turning the 3rd chroma amp off, and vice versa. Therefore the outputs of these stages are pure burst signal from the detector and burst gate, and pure chroma minus the burst from the 2nd chroma amp. This chroma signal, from Pin 15, feeds the auto intensity amplifier, Q601, and Pin 3 of IC602. This transistor functions as an automatic intensity control (AIC) which is independent of the burst signal amplitude and it acts to control the gain of the 3rd chroma amp in IC602.

Here's how it works: Sub intensity control establishes the conduction level of Q601 which amplifies the chroma signal. This signal is rectified by diode D603. When R622 is grounded through the automatic intensity control, C609 differentiates the rectified signal applied to the overload detector. With the AIC in

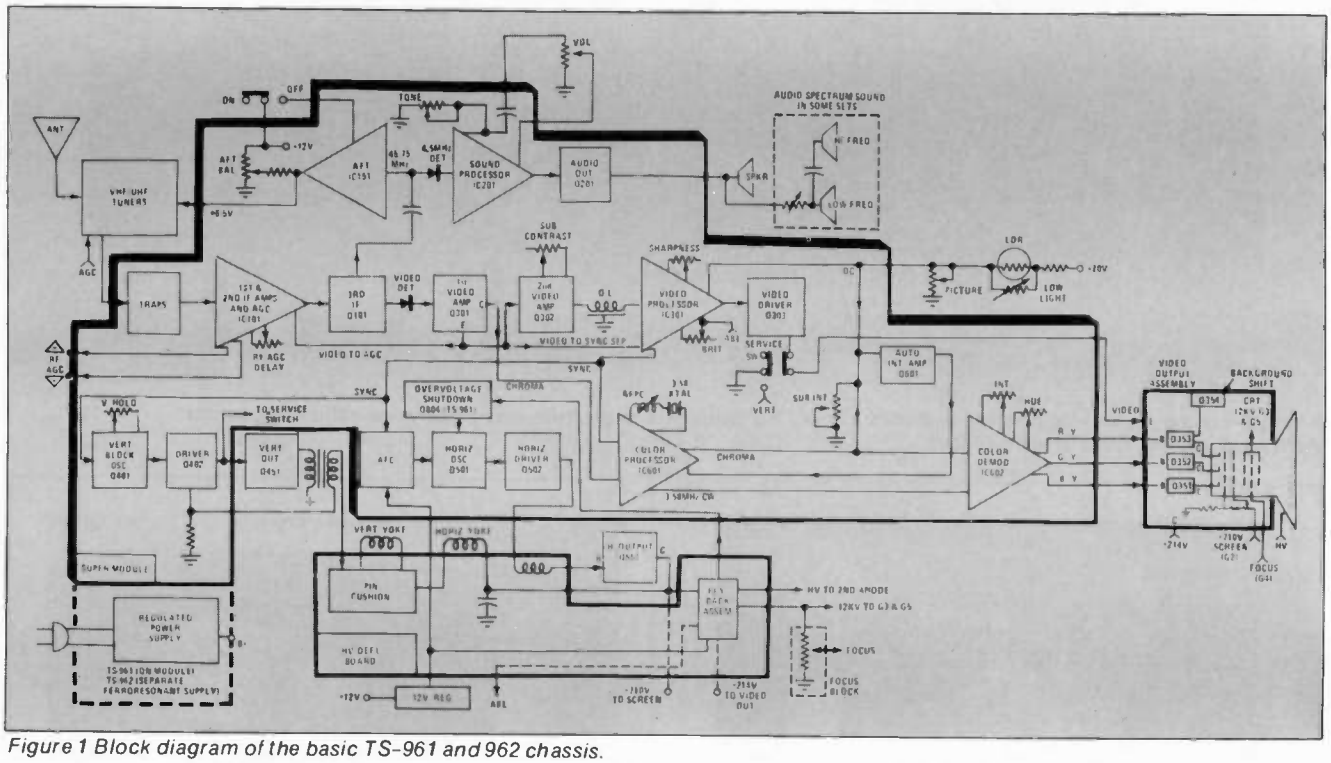


Figure 1 Block diagram of the basic TS-961 and 962 chassis.

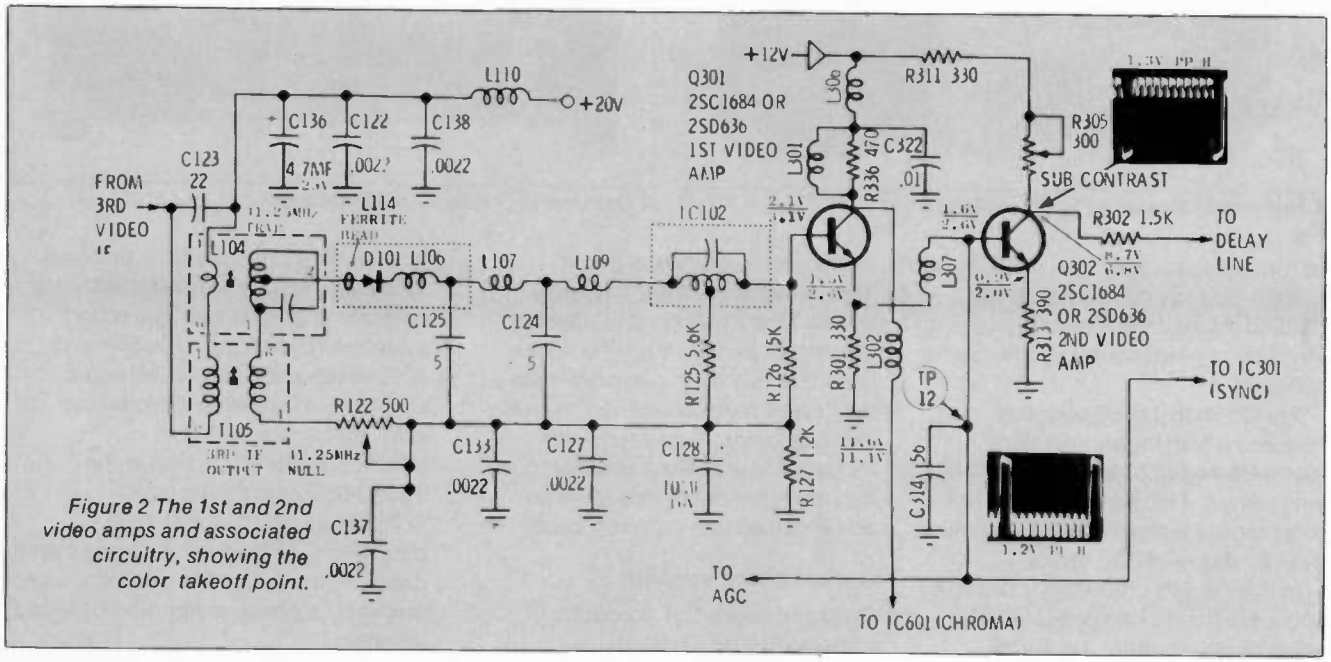


Figure 2 The 1st and 2nd video amps and associated circuitry, showing the color takeoff point.

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the "off" position, the ground return resistence of C609 is greatly increased and the charge accumulated prevents coupling to the overload detector.

The overload detector reacts to large areas of color or noise which may cause saturation and it applies a bias to the 2nd chroma amp through D603 to reduce gain with the AIC "on."

The gain of the 3rd chroma amp, as stated previously, is controlled by a bias developed through the automatic intensity amp which adjusts for large areas of color. The color intensity control is active with Dynacolor on but its range is greatly reduced through shunting resistor R644.

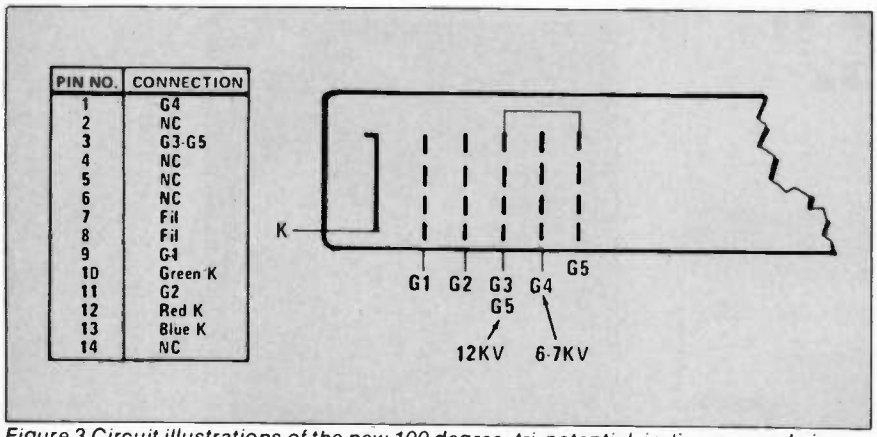


Figure 3 Circuit illustrations of the new 100 degree, tri-potential, in-line gun and pin connections.

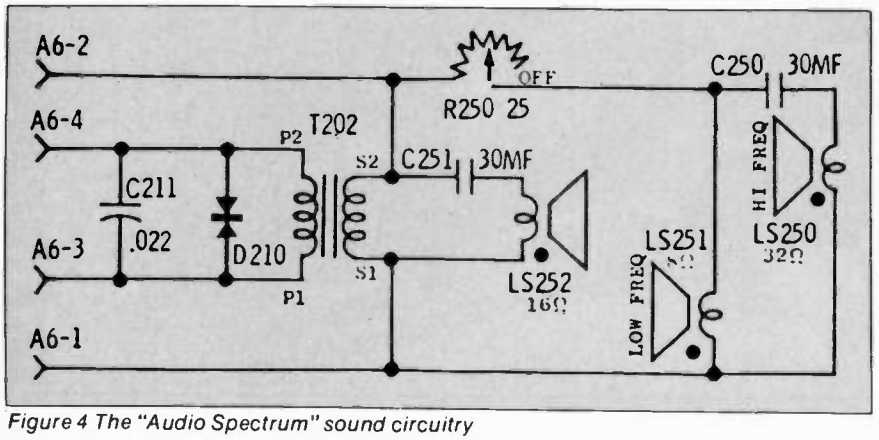


Figure 4 The "Audio Spectrum" sound circuitry

Over voltage shutdown

The TS-961 includes a special over voltage beam current shutdown circuit to guard against excessive radiation if runaway conditions develop (Figure 8).

During horizontal retrace a positive pulse from the horizontal output transformer biases D813 into conduction and charges C814. Any increased pulse amplitude correspondingly increases the charge on this capacitor. A special shutdown control, R818, is adjusted to cause conduction of zener diode D809 when the horizontal pulse reaches a predetermined level. When this occurs, the zener gates SCR Q804 into conduction and this reduces B+ to the horizontal oscillator, causing circuit shutdown. This control is factory sealed to prevent accidental misadjustment.

Small screen changes

The most significant differences in Quasar's portable chassis design (TS-963) for 13-and-15 inch CRTs, are found in the video, vertical and sound output sections.

The newly redesigned video section uses five transistors to provide video amplification, DC restoration, vertical and horizontal blanking, brightness, picture and sharpness control.

The vertical sweep section is comprised of four transistors and associated circuitry which generate

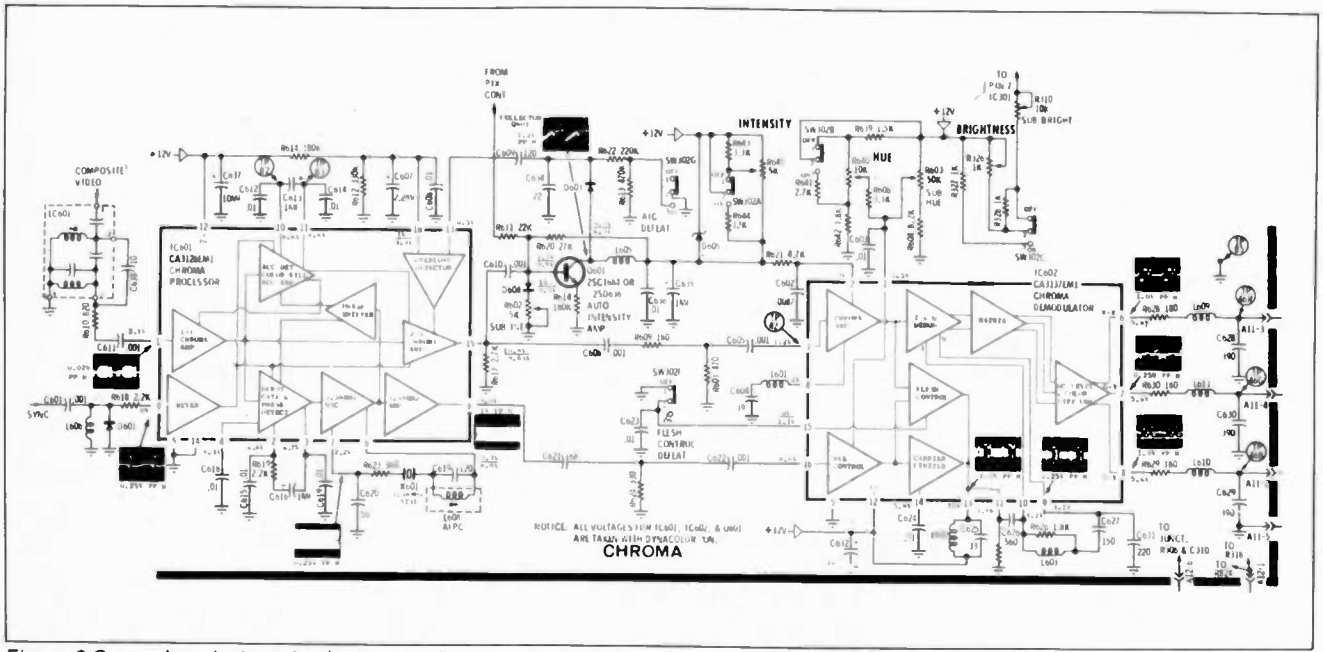


Figure 6 Quasar's redesigned color processing circuitry

the vertical sweep currents. A base-gated multivibrator develops the sawtooth waveform applied to the output, two stacked NPNs which share the B-plus supply voltage.

A complimentary symmetry output section is the biggest difference in the audio section of the TS-963 (Figure 9).

Audio signals from Pin 12 of IC201, the sound processor, are applied to audio amplifier Q251, the collector of which feeds Q251, an NPN device, and Q253, a PNP transistor.

Therefore a positive audio signal to the base of 251 increases collector conduction and lowers its voltage. This, in turn, decreases bias to 251 but increases bias to 253. A negative going signal produces the opposite effect, thus causing current through the output transformer to reverse.

Automatic hue control

The 3.58 MHz oscillator signal is applied to the flesh control and carrier limiter stages through a hue control stage. The external hue control varies a DC voltage which shifts the phase of the oscillator signal to adjust picture hues. The sub hue control centers on the range of the customer hue control, which is always active but with reduced range with Dynacolor on.

A separate carrier limiter stage limits the amplitude of the 3.58 MHz oscillator signal. It couples through C626 to the "I" demodulator and through a 90 degree phase shifter network to the "Q" demodulator.

Following "I" and "Q" axis demodulation, the R-Y, B-Y and G-Y signals are developed in the matrix stage and applied to the color outputs on the CRT/Video output board.

Flesh tone correction circuitry corrects for yellow/green and purplish flesh tones by phase modulating the 3.58 MHz carrier. A phase detector compares the chroma and continuous wave carrier signals and controls a modulator which phase shifts the generated carrier proportional to the phase error and *toward the flesh region*. The greatest shift is in the yellow/green or magenta regions and minimum correction occurs for errors in the flesh colors. Maximum correction range is limited to a plus or minus 20 per cent phase shift.

In addition, with Dynacolor "on," a light dependent resistor controls the DC voltage applied to the picture control circuits which helps maintain the proper ratio of brightness, contrast and intensity. The viewer may adjust the picture to personal preference and the light sensor maintains the selected ratios.

Video output assembly

The CRT socket boards in the TS-961 and 962, while basically the same, are not interchangeable (Figure 7). Luminance from the service switch is DC coupled through series drive controls to the emitters of the red and blue output transistors and through a fixed resistor to the emitter of the green

continued on page 45

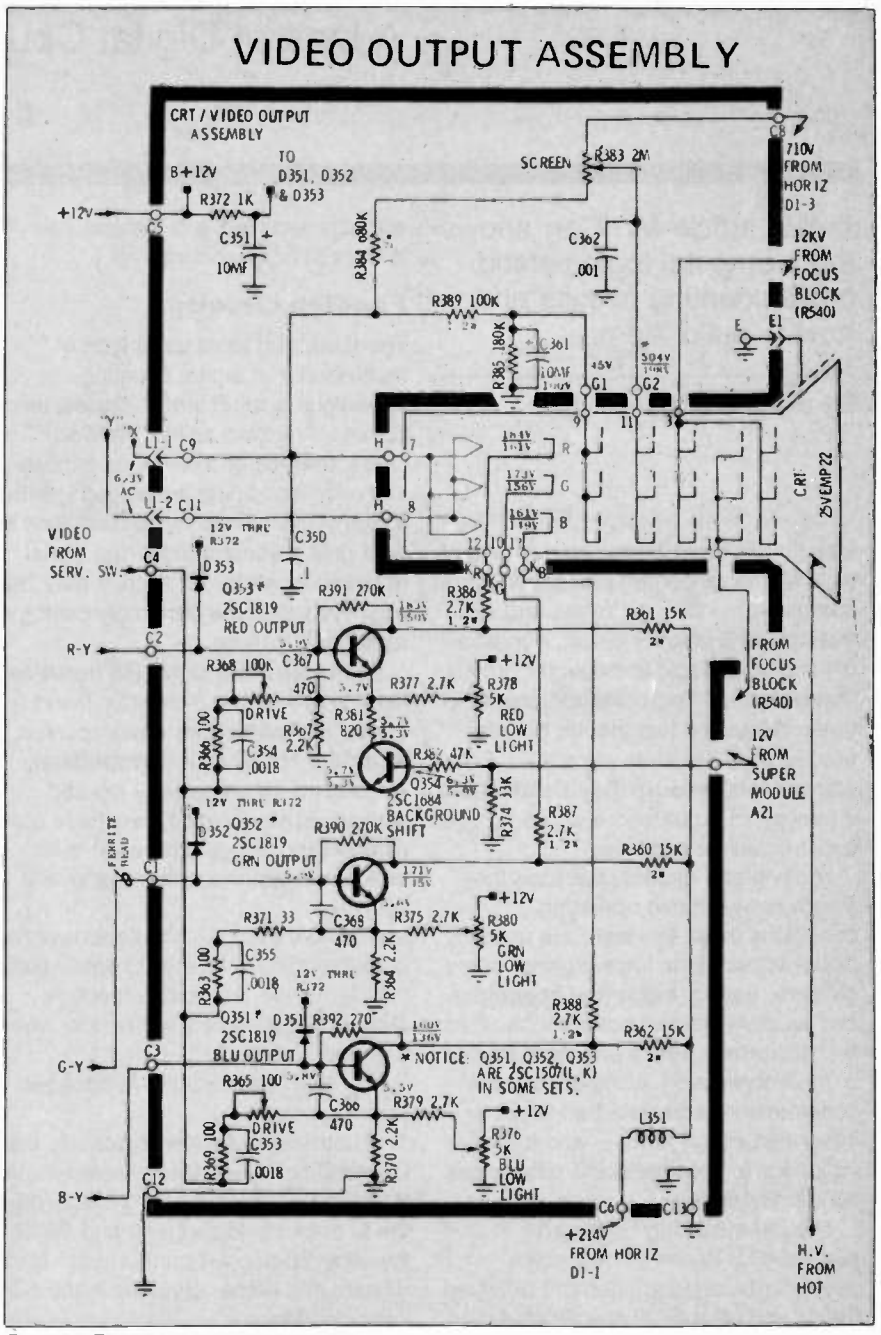


Figure 7 The video output assembly

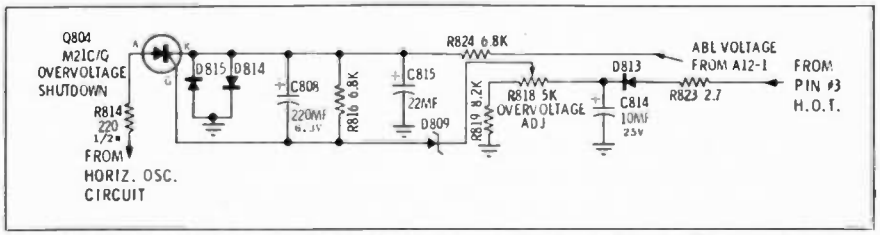


Figure 8 The over voltage beam current shutdown circuit used in the TS-961 chassis.

Digital electronics, part three

A look at Digital Counters

In this article Mr. Carr shows the elemental logic behind basic counting circuits and how to build them.

By Joseph J. Carr, C.E.T.

Now that we have discussed elementary logic elements we can proceed to more complex clocked logic forms and an example of a counter circuit. Almost all of the clocked logic and counter circuits may be formed from combinations of the gates discussed last month, but are usually considered as separate components because they are available in integrated circuit form and need not be constructed for each use.

Multivibrator circuits, because they switch between two operating conditions (high and low), are used in digital applications for switching, pulse shapers, gating (triggering) operations and as counters and scalers in modern test equipment. There are several types of multivibrators — whether they are constructed via discrete transistors or in integrated circuit form — and it is important to note the basic differences concerning them.

The "free running" or *Astable* multivibrator is one whose active devices (transistors) alternate between the on and off state at specifically timed intervals. This type of multivibrator is generally employed as a waveform generator oscillator since it does not require continuous triggering.

Another type is the Monostable "one shot" multivibrator, which alternates between its two operating conditions *only* when a triggering signal is received. In other words, one of the switching actions occurs when the triggering signal is received and the second follows at a specific interval.

Flip-flop circuits

The third, and most used type of multivibrator in digital counting operations is the *Bistable* device, more commonly known as the "flip-flop." The characteristics of this device indicate that once its outputs are placed in either a high or low condition, that condition is *held* until a second triggering signal reverses its state. As such, it may be employed as a type of *memory* device in digital applications.

Examples of a bistable RS (reset-set) flip-flop are shown in figures 1 and 2. These are made from cross coupled NOR and NAND gates, respectively. Although both are usually labeled similarly in schematics, they have quite different properties (study the truth tables accompanying the respective figures).

Also note that these flip flops have two output terminals, labeled Q and $\overline{Q}$ (read not Q). These are complementary outputs because one will be low when the other is high.

The NOR gate RS flip-flop follows these rules:

1. If both inputs are low (logical-O), then Q and $\overline{Q}$ remain in their present state.
2. If the SET input is brought high, then the Q output is forced high and the $\overline{Q}$ is low. The flip-flop will remain in this state despite any further changes in the SET input condition.
3. If the RESET is brought high, then the Q will go low and the $\overline{Q}$ is made high. The flip-flop will not respond to any further changes in the RESET input.
4. If both inputs, SET and RESET, are brought high the poor thing doesn't know what to do. This is a disallowed state.

NAND gate rules

The Nand gate flip-flop of figure 2 will obey *these* rules:

1. If both inputs are low, no change occurs (same as rule #1 above).
2. If the SET is made high, then the Q output is low and the $\overline{Q}$ is high.
3. If the RESET is made high then the Q output goes high and the $\overline{Q}$ is low.
4. If both inputs are high, again a disallowed state.

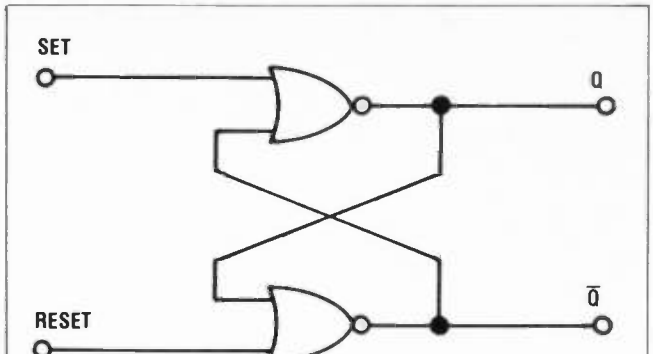
Note that both types of RS flip-flop respond the same to the conditions of rules #1 and #4, but in the rules #2 and #3 they behave in *opposite* manners. This is not actually too surprising since they are constructed of opposite types of gates; NOR and NAND. Some older texts (and a few new ones) called the latter flip-flop a $\overline{R}$-$\overline{S}$ (Not-R-Not-S) flip-flop but that is awfully clumsy, so most people simply call them both by the name RS flip-flop.

Gates and the RS flip-flop operate in response to changes at their respective input terminals, and will react at the time when the changes occur. This is known as *asynchronous* operation. Another class of flip-flops operate in a *synchronous* manner in that they will respond to input changes *only* at certain times that are dictated by a system clock (a pulse train). This is known as a TYPE-D, or gated flip-flop.

Type-D flip-flops

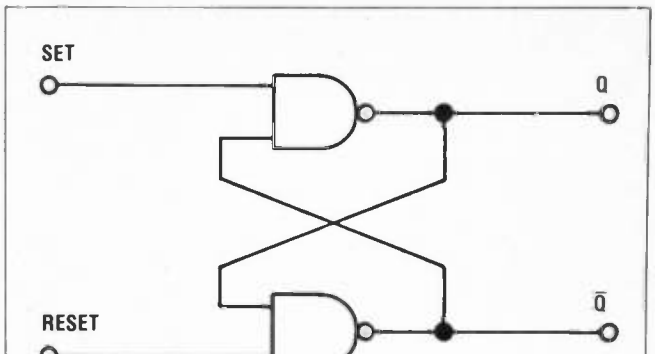
An example of a simple clocked logic flip-flop is the Type-D circuit of figure 3. The signal level (1 or 0) applied to the *date* (D) input is transfered to the output only when the clock terminal is in a high state. Data transfer occurs on the positive *transition* of the clock pulse. It is necessary that the clock pulse be a sharp, square, well-defined and noiseless pulse from 0-volts to +5-volts. Otherwise, erroneous operation will occur.

The Q and $\overline{Q}$ outputs will remain in the condition dictated by the data signal until



R	S	Q	$\overline{Q}$
0	0	(no change)	
0	1	1	0
1	0	0	1
1	1	(disallowed)	

Fig 1-Two input NOR gate RS flip-flop with its associated truth table.



$\overline{R}$	$\overline{S}$	Q	$\overline{Q}$
0	0	(no change)	
0	1	0	1
1	0	1	0
1	1	(disallowed)	

Fig 2-Two input NAND gate flip-flop with its associated truth table.

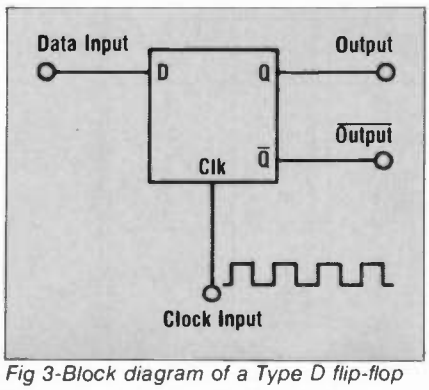


Fig 3-Block diagram of a Type D flip-flop

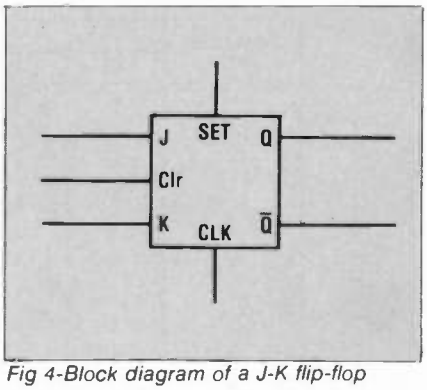


Fig 4-Block diagram of a J-K flip-flop

the next clock pulse is received. Between clocked pulses the data *input* signal can change all it wants, but no change will be reflected at the *outputs* until a clock pulse is received.

Direct Vs. clocked input

The J-K flip-flop is a little more complicated, and is shown in figure 4 and its accompanying truth table 1. This type of clocked logic circuit has two types of input, direct and clocked. The *direct* inputs force the outputs to a predetermined condition, while the clocked inputs follow rules that determine what will happen by the conditions present at the J and K inputs.

If the SET input is made high, and the CLEAR input is low, then the output will be low. If the SET is low and the CLEAR is high, then the output is high. *Clocked operation occurs if both the SET and CLEAR inputs are high*. Under this condition, the flip-flop responds to changes at the J and K inputs, only when allowed to do so by the clock, in this case on the negative going transitions (i.e., from +5 vdc to 0 vdc). By triggering *only* on the falling edge of the clock pulse you will note there are only half as many output pulses as there are only half as many output pulses as there are input pulses (see Table 2 and the accompanying waveforms). The J-K flip-flop then, can be used as a counter since it divides by two. The output frequency is one half input frequency.

Counter circuits

Counter circuits perform not only the binary counting function that their name implies, but are also used as frequency dividers. The simplest counter is the divide-by-two, consisting of a single J-K flip-flop with its K and J terminals connected *permanently* to +5 volts (logical-1). We can get other counters by the mere expedient of cascading the divide-by-two stages.

The timing diagram of a three stage circuit is show in Figure 5. These diagrams are extremely useful for figuring out the circuit action in digital electronics, and should be drawn whenever you are studying a new circuit. Recall that a J-K flip-flop will only respond to the falling edge of the input pulse. We get one output transition for every falling edge applied to the input clock. The output frequencies of such a circuit are f, f/2,f/4,f/8...f/(2^n).

Of course, information coded in binary form is useful inside of an electronic instrument (computer, counter, calculator), but virtually meaningless if displayed in binary form for the human operator. Since we are most accustomed to counting in decimal numbers, it is quite common in digital circuits to devise systems that count in the same number also.

Scale of 10 counters

Actually, by using common binary flip-flop circuits and various types of feedback we can "trick" the counter into thinking it is counting in decimal form. The secret is to make the counter reset to zero on the tenth pulse.

Let's describe one, of many, methods for doing this.

Refer to figure 6, a block diagram of four cascaded flip-flops with an inverted

feedback capability into the SET inputs of FF2 and FF3. In this case the flip-flops are SET by negative going pulses. Also refer to the input pulse table for this circuit.

As the input table shows, the count proceeds normally during the first seven input pulses. For example, on the third input pulse, FF1 has just been activated into the "high" state, FF2, which does not respond to positive going pulses, remains in the "high" state, and this gives us a binary count at the four flip-flops of 0011, which you should recognize as decimal number "3."

However, as the eighth input pulse reaches FF1, its output reverts to the zero state. This negative going output from FF1 should have triggered FF2 into the zero state, and FF2's falling polarity should have triggered FF3 "low," and similarly, FF3's falling polarity should have triggered FF4 into the "high" state. But — because of our inverted feedback arrangement — it doesn't work that way.

Here's what happened. As FF4, representing binary "8" went high, the signal inverter in the feedback circuit to the SETs of FF2 and FF3, kept those two flip-flops in the high state. Thus the eighth input pulse advanced the binary count to an apparent 14—1110. The application of the ninth pulse to FF1 simply advanced the binary count by one, to binary 15— or 1111.

However, look what happens on the 10*th* pulse, everything falls to zero — or reset — which brings us full circle for our scale of ten counter. In other words, all four flip-flops responded to the negative pulse at their inputs and their outputs fell to the zero state. The zero state at the output of FF4 was inverted and fed to the SET inputs of FF2 and FF3, but since they do not respond to positive going pulses, there was no effect on their output.

In the past few months we have featured a little about digital electronics and introduced you to simple counting principles. Now that you have the basics, you may expect to see an increased number of articles on digital circuits and more sophisticated counting methods. **ETD**

TABLE 1

Set	Clear	Output
0	0	(Dissallowed)
1	0	0
0	1	1
1	1	(see clocked operation)

Table 1-Direct input rules for the J-K flip-flop

TABLE 2

Rules for Clocked Operation

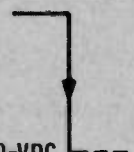
Clock	J	K	Q Output
	0	0	(no change)
	1	0	1
	0	1	0
0-VDC	1	1	(Goes to opposite of present condition)

Fig 5-Timing diagram for three plus stage flip-flop circuit showing input and output wave forms.

Input Pulse Number	Counter State				Apparent Count
	FF_4	FF_3	FF_2	FF_1	
—	0	0	0	0	0
1	0	0	0	1	1
2	0	0	1	0	2
3	0	0	1	1	3
4	0	1	0	0	4
5	0	1	0	1	5
6	0	1	1	0	6
7	0	1	1	1	7
8	1	1	1	0	14
9	1	1	1	1	15
10	0	0	0	0	0

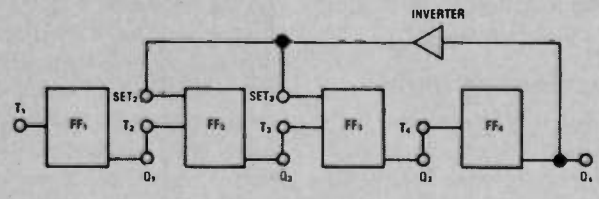


Fig 6-Block diagram of a scale of 10 counter and the table showing its summary of states.

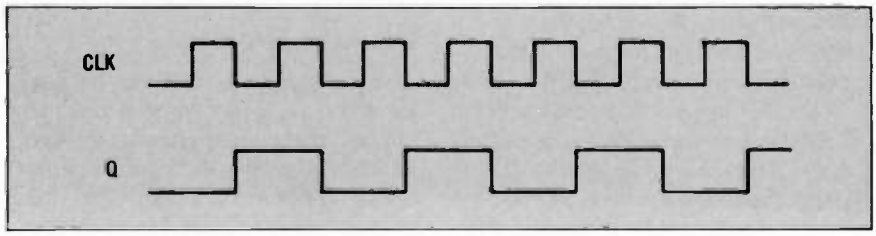


Table 2-Truth table for clocked operation of the J-K flip-flop plus the associated wave forms

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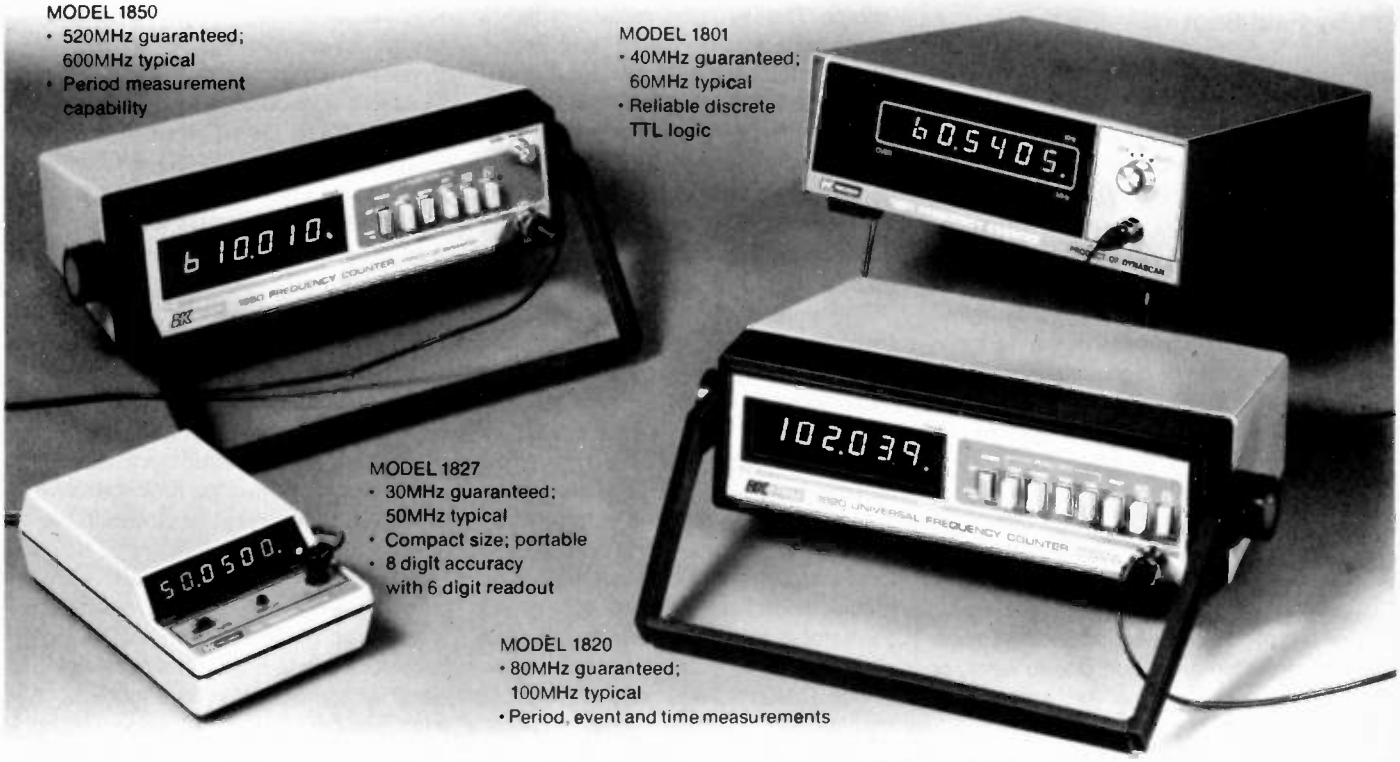

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Electronic tuning systems

The conversion has begun

In this article Mr. Shih analyzes the operation of "first generation" sequential electronic tuners.

By Paul Shih

Electronic tuning of television receivers, first introduced in Europe, has been slow gaining acceptance in the United States primarily due to the cost. Now, however, the advantages in the performance of electronic tuning over that of a mechanical tuning system have begun to outweigh that concern. Additionally, technological advances in the design and production of digital circuitry have cut down the cost of electronic tuning systems. Some U.S. TV manufacturers have now begun to switch to all-electronic tuning systems not only for their top-of-the-line console chassis, but also for 19 '' and smaller portable chassis.

Inherent disadvantages associated with a mechanical tuning system, such as unreliable operation due to wear, or poor contacts and inconvenience in switching from one channel to the others, have long been recognized. More advanced random access tuning systems make it possible to go directly from one channel to any other in a fraction of a second without encountering other channels along the way. This makes UHF tuning as easy as VHF tuning.

In this article I will limit myself to the "first generation" of sequential electronic tuning systems. Their analysis can be a problem when you find that LSI technology encapsulates the whole tuning system in one or two large integrated circuits.

Basic principles

Electronic tuning is made possible by use of a varactor tuner in conjunction with analog or digital control devices that provide necessary tuning voltages. A varactor is a semiconductor diode whose junction capacitance is inversely proportional to the applied reverse bias voltage. The varactors replace ordinary tuning capacitors in the RF amplifier, mixer, and local oscillator. (see D_2, D_4, D_6 and D_8 in Fig. 1) When variable DC voltages are applied to these varactors in the tuner through various schemes to be discussed later, the capacitance of the four tuning circuits is changed accordingly, thus accomplishing tuning operation.

There are at least three systems now being used to produce and switch the required tuning voltages. The simplest system uses an array of 16 or 20 potentiometers that are connected between a constant DC voltage source and the ground. After preadjusting each potentiometer to obtain a voltage that would tune the receiver to one of the local channels, it becomes a matter of routing these analog pre-set voltages to the tuner in order to tune in the desired stations.

The analog voltage routing process may be accomplished by selectively pressing a set of push-buttons on the front of the receiver to close the potentiometer circuit for the desired channel. (see Fig. 2) A tab for identifying the channel number is usually inserted in each push button.

Digital switching circuits

A more elaborate method to produce and switch a pre-set analog tuning voltage employs an AFC voltage source in conjunction with a digital switching circuit. To illustrate such a system, the first generation of General Electric electronic tuning, found in MB chassis, will be used as an example (see Fig. 3). The system produces and switches tuning voltages and also performs such functions as channel indication, VHF Hi/Lo channel switching, UHF/VHF B+ switching, AFC defect and deprogramming of unused channels.

The voltage source for the tuning potentiometers is obtained from a combination of a regulated power supply and the collector voltage of a differential amplifier which consists of Q_{148} and Q_{149}. The dual-polarity AFC voltages from IC 202 on the MB chassis are coupled to the bases of the differential amplifier. Variations of the AFC voltage at the base of Q_{148} cause its collector voltage to become more or less positive. This changing DC voltage is applied to the upper ends of the VHF tuning potentiometers.

By properly adjusting each of these tuning potentiometers, the initial tuning voltage for the desired channel is obtained at the wiper arm, and after amplification by Q_{160}, the tuning voltage is coupled to the varactor diodes in the tuner.

How is AFC operation on VHF channels achieved? The AFC operation is achieved when the changing DC collector voltage from the differential amplifier compensates for slight mistuning caused by an improper setting of the wiper or frequency drift in the local oscillator. The maximum DC voltage change at the top of the VHF potentiometers is approximately ± 2 volts.

UHF operation

The AFC setup for the UHF channels is slightly different than that for the VHF channels. This is due to the fact that each UHF potentiometer must tune through a wide frequency range for 70 channels in a similar tuning voltage range as in the VHF operation. It is obvious that the ± 2 volt variation in the DC voltage source would be too much for one single UHF channel. Therefore, instead of connecting the top of the UHF

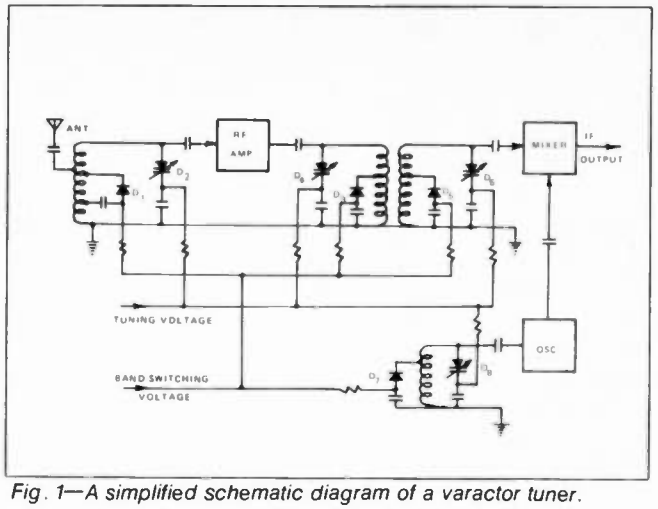


Fig. 1—A simplified schematic diagram of a varactor tuner.

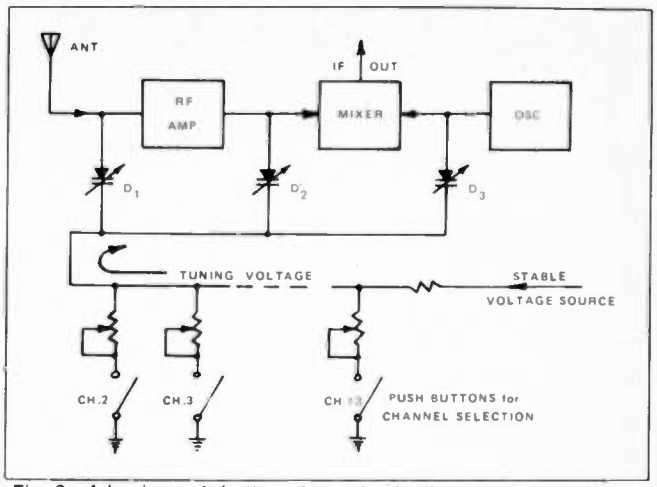


Fig. 2—A basic push-button channel selection system.

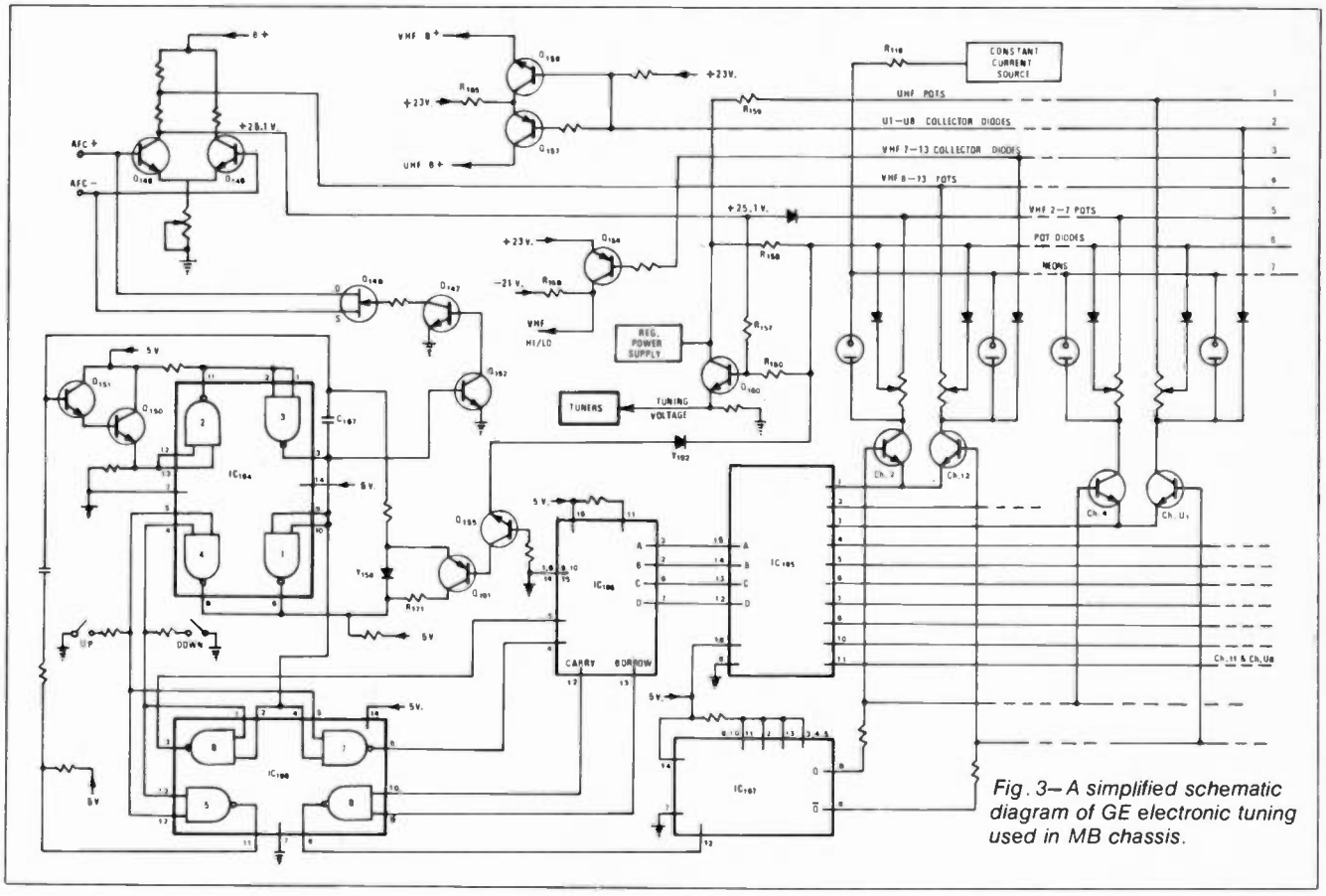


Fig. 3—A simplified schematic diagram of GE electronic tuning used in MB chassis.

potentiometers to the 25.1±2 volt collector potential, the UHF potentiometers are connected to the fixed DC power supply through R_{159}. The AFC ±2 volt variation at the collector of Q_{148} is scaled down to a very small AFC voltage by R_{157} and R_{160}. This small AFC voltage added to the voltage coming from the wiper of the UHF potentiometer at the base of Q_{160} for the UHF operation does not have an appreciable effect on the VHF operation because the VHF AFC voltage swing has a much wider range.

When turning on the set and also during switching between channels, the normal AFC function is defeated to prevent channel lockout. This is done by sending a pulse from the oscillator, to be discussed shortly, through Q_{152} and Q_{147} which saturates Q_{146}. The saturated Q_{146} shorts out the dual AFC inputs to the differential amplifier.

The digital gates

There are five digital ICs used for switching the tuning voltage. The IC_{194} and IC_{198} each have four two-input NAND gates. The four gates in IC_{194} and gate 5 in IC_{198} are wired externally with Q_{151} and Q_{150} to form a switching oscillator. When either the "up" or "down" switch is closed, the charge and discharge of C_{187} in the oscillator circuit begin to produce a sequence of timed pulses. The pulses are coupled to two interfact NAND gates 6 and 7 in the IC_{198} and are shaped into square waves for application to the up/down counter IC_{196}.

By counting the square wave input pulses, the counter produces four-bit binary coded decimal (BCD) outputs which are then converted into ten digital encoded outputs by the decoder IC_{195}. The ten digital encoder outputs (only two possible states, high DC voltage or low DC voltage) are applied to the emitters of ten pairs of

channel driver transistors, one driver transistor for each channel. These twenty transistors are divided into two groups in terms of their base connections. The bases of one group of transistors for channel 2 through 11 are connected to the Q output at pin 8 of the flip-flop IC_{197}. The Q (not Q) output at pin 6 is tied to the bases of the remaining group of transistors for channels 12, 13, and eight UHF channels.

A channel is selected by saturating the driver transistor because under this condition the conducting transistor completes the potentiometer tuning circuit and allows the tuning voltage to be supplied to the tuner. The transistor is switched to saturation by a low DC voltage from IC_{195} on the emitter and a high DC voltage from IC_{197} on the base. All of the other 19 transistors will be cut off. The "carry" and "borrow" pulses from IC_{196} trigger gate 8 in IC_{198}, and the output from the NAND gate is used as the clock input to IC_{197}. The output of flip-flop IC_{197} at pin 8 and pin 6, which as we said, controls the base voltage of the driver transistors, is switched into either state by the clock input at pin 12.

Channel switching

To see how a series of channels are tuned in, let's assume that the "up" switch is held down, and the system is cycled to channel 2. At this point, the channel 2 driver transistor is saturated, and the tuning voltage is being applied to the tuner. If the switch is still closed, the oscillator will continue to produce pulses which are counted "upward" by the counter. The result is that pins 2, 3, 4, continuously to 11 of IC_{195}, will have a low DC voltage one after the other, and thus channels 3 through 11 will be sequentially tuned in the same way as channel 2.

After channel 11 is selected, a carry pulse from the IC_{196} will trigger the flip-flop IC_{197}, causing the Q voltage at pin 8 to become low on the low channel driver bases and Q output at pin 6 to become high on the high channel (channels 12, 13, U_1 through U_8) driver bases. The high channels from 12 through U_8 will be tuned sequentially in the same manner. After channel U_8 is tuned in, a carry pulse again will switch the state of Q and Q, and the next channel to be tuned in is channel 2.

Tapping either the "up" or "down" switch will switch one channel at a time. The momentary closing of the channel selection switch causes the counter to advance one "counting" number. The result, of course, will be for the system to switch one channel.

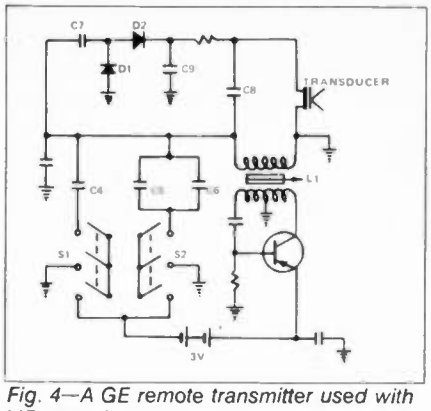


Fig. 4—A GE remote transmitter used with MB chassis.

Volatile memory system

The General Electric electronic tuning has a volatile memory system that allows the receiver, when turned on again, to return to the same channel that was being viewed when the set was tuned off. This is accomplished by continuously supplying the power to the tuning, switching and AFC circuits whether the set is on or off, as long as the receiver line cord is plugged into a electric outlet.

Sequentially switching the channels from one to the next has a pre-determined rate. However, if some unwanted or empty channels are in the way and need to be by-passed, simply turn their respective potentiometers fully counterclockwise. This places the arm of the pot at the driver's collector end. When any one of these channels is selected, the saturated transistor causes its collector voltage, and also the arm of the pot, to drop below 1.2 volts. Since the cathode of the pot diode is now near the ground potential, both the pot diode and the diode Y_{192} condu conduct, causing Q_{155} and Q_{191} to saturate. The saturating Q_{191} shunts R_{177} across Y_{156} to decrease its back resistance. This causes the oscillator to increase its frequency sharply so that the unwanted channels will be passed over very quickly.

Channel indication is shown by the flow of an indicator lamp directly behind the associated channel number. A neon bulb is connected between the collector of each driver transistor and a constant current source through R_{118}. When a channel is selected, the collector of the selected channel driver transistor and one side of associated neon bulb will be at a low potential. Since the other side of the neon bulb is still at a high potential, the bulb glows.

VHF Hi/Lo channel switching

The frequency range for the VHF channels 2 to 13 has a ratio of 1:4, which is too much of a variation for capacitive tuning by a varactor diode. In order to obtain a sufficient tuning range by using the same varactor diode, part of the inductance is shorted out to reduce inductance for the high VHF channels 7 through 13. This is accomplished by applying a voltage to forward bias a switching diode that is connected across part of the inductance. (see D_1, D_3, D_5 and D_7 in Fig. 1). To tune in low frequency channels 2 through 6, the switching diode is cut off by a reverse bias voltage so that the full inductance is restored.

The forward and reverse bias voltages are switched back and forth by a PNP transistor Q_{159} (see Figure 3). When any of the VHF high channels is selected, the corresponding saturating channel driver transistor causes its collector diode to conduct. This pulls the base voltage at Q_{159} down, and the result is that Q_{159} saturates, and its collector voltage jumps from −21 volts to +22 volts. The +22 volts from the collector is routed to the tuner to forward bias the switching diodes.

During the low channel operation, none of the high channel driver transistors or their collector diodes are conducting. This allows the base voltage of Q_{159} to return to about +23 volts, and thus cuts off Q_{159}. With Q_{159} cut off, R_{168} presents a lower source impedance than that of the collector to emitter of Q_{159}. Thus, −21 volts is now supplied to the tuner to reverse bias the switching diodes.

Remote control system

A wireless remote control system, used in MB chassis, employs ultra-sonic waves at 38.5 khz to activate the on-off and volume stepping function and 41.5 khz to start the "up" channel selection operation. The system consists of a hand held transmitter unit and a receiver unit that is located inside the TV cabinet.

In the transmitter unit, a free-running oscillator produces either 38.5 khz or 41.5 khz ultra-sonic waves, depending on the value of capacitance of the LC tuning circuit (Fig. 4). Two switches S_1 and S_2 are used to select two different capacitances, as well as to turn on the battery power for the transmitter unit. Pressing the ON-OFF VOLUME switch S_2 closes the battery power supply circuit and at the same time places $C_{5\text{-}6}$ in parallel with L_1 for generating 38.5 khz waves. When the CHANNEL SELECT switch S_1 is pressed, once again the battery supply circuit is completed, and C_4 is connected in parallel with L_1 to produce 41.5 kHz waves.

BULLETIN BOARD

Antennas and Accessories and many other electronic items are covered in the new expanded catalog from RMS Electronics. Items detailed include: TV and FM antennas, antenna kits, hardware, and accessories, MATV systems equipment, replacement antenna rods, CB and two-way communications equipment, and PA and audio speaker horns. New items covered include: a 75-300 ohm balun for indoor and outdoor use, new MATV cables featuring a 75 ohm CB interference filter, a 75 to 75 ohm CB interference filter with a new solid-state network, and others. The new literature also includes a guide to exact replacement for the SRA and RA series of replacement antenna dipoles and back-of-the-set antennas. Catalog is free from *RMS Electronics, Inc.*, 50 Antin Place, Bronx, N.Y. 10462.

How to Obtain An Electronics Degree Through Independent Study is described in a new catalog available from the Center For Degree Studies. The literature describes a guided independent-study program designed especially for those who can't fit personal or working hours to classroom schedules. This program, when completed, will result in an AST degree (Associate in Specialized Technology) in Electronics Technology. Study schedule and pace of study are up to the individual with no need to attend classes. The brochure includes information about the complete curriculum and how to enroll. Free from *Center For Degree Studies,* Electronics, AST, INTEXT, Scranton, PA 18515.

The Full Line of Wiring Components is described and illustrated in the latest literature from the Panduit Corporation. The newly updated 12-page catalog includes illustrated information on the firm's line of cable ties, clamps and marker ties; cable tie mounting and marking accessories; tension-controlled cable tie installation tools; plastic wiring duct; spiral wrapping; terminals, splices, disconnects, wire joints, installation tools and wire and identification markers. Bulletin CC-3 is free from *Panduit Corporation,* 17301 Ridgeland Ave., Tinley Park, Illinois 60477.

Electronic Component Assortments available from Sprague Products are featured in a new 12-page tabloid flyer. The new brochure features 8 aluminum electrolytic capacitor assortments; 11 film tubular capacitor assortments; 1 dipped tantalum capacitor assortment; 2 carbon film capacitor assortments; 1 Zener diode assortment; 1 small signal and power transistor assortment; and 1 switch assortment. Also included in the brochure are 3 metal-encased component assortments intended for larger service shops, labs, schools and industrial plants. The brochure, M-946A, is free from Technical Literature Service, *Sprague Products Co.*, Marshall St., North Adams, Mass. 01247.

Replacement Parts for TV Games are listed in a new brochure from Workman. The literature describes crystals, chips, switches, controls, antenna junction boxes and AC adaptors needed for servicing of the new TV, or video games. The brochure, No. MS2422, is available free from *Workman Electronic Products, Inc.*, P.O. Box 3828, Sarasota, Florida 33578.

Aluminum Electrolytic Capacitors are described in a new technical information

bulletin now available from the Mallory Capacitor Co. The bulletin (Form 4-303A) is a comprehensive information source containing standard design ratings, an application guide, typical performance curves and complete performance characteristics for the capacitor. The CGS capacitor is a computer grade capacitor available in a wide variety of mounting and technical configurations. The literature is free from George Smith, Product Mgr., *Mallory Capacitor Co.*, P.O. Box 1284, Indianapolis, Indiana.

Japanese Replacement Parts, for CB Radio, Tv, and hi-fi equipment are covered in a new 8-page illustrated catalog from Ora Electronics. Featured parts include: integrated circuits, transistors, ceramic filters, and tape and cassette heads. Also included is "Understanding Japanese Semiconductors," a purchasing guide for Japanese parts. Free from *Ora Electronics*, P.O. Box 7548, Van Nuys, CA 91409.

Cable, Wire, Assemblies & Harnesses are described in new literature from Precision Cable. The catalog details the firm's cable assemblies, wire harnesses, cable and all types of wire, such as automotive, electrical, military primary, milspec and UL wire, from 8 to 28 gauge size. Catalog is free from *Precision Cable*, 2722 National, Garland, Texas 75040.

Exact Replacement TV Antennas are covered in a new 16-page guide offered by JFD Electronics Corporation. The new booklet catalogs the firm's antenna replacements for table and portable TV sets including the latest models. Included are exact replacement antenna listings for Admiral, Emerson, GE, Magnavox, Motorola, Packard Bell, Panasonic, Philco, RCA, Sears, Sylvania, Sony, Westinghouse and Zenith. Each replacement antenna is cross-referenced to each brand by TV chassis number and antenna part number. Free from Linda Swindell, *JFD Electronics Corp.*, Industry Drive, Oxford, N.C.

A New Microphone Shorting Plug designed to eliminate hum and noise pickup is covered in new literature available from Switchcraft, Inc. New Product Bulletin No. 323 describes the firm's new "Q-G" shorting plugs that connect directly to female receptacles, shorting circuits together, and reportedly eliminating hum and noise pickup by unterminated circuitry. A six-inch chain on the plug is included for anchoring, preventing loss or misplacement. The Bulletin is free from Sales Dept., *Switchcraft, Inc.*, 5555 No. Elston Ave., Chicago, Il.

A New Portable Frequency Counter is described and illustrated in new literature available from Continental Specialties. The new brochure describes the firm's 8-digit 100MHz frequency counter, Max-100. The full-color four-page brochure is free from *Continental Specialties Corporation*, 70 Fulton Terrace, New Haven, Connecticut 06509.

A Brief Guide to Microphones is the title of a new instructional booklet available from Audio-Technica U.S., Inc. The 15-page booklet explains microphones through eight basic terms — dynamic, condenser, omnidirectional, unidirectional (or cardioid), proximity effect, feedback, impedance and sensitivity. It uses a step-by-step approach with simplified technical terms and should be useful to amateur and pro recordists and audio retailers. The firms says it is not a product catalog and that the information applies to all brands of microphones. Available free from *Audio-Technica U.S., Inc.*, 33 Shiawassee Ave., Fairlawn, Ohio 44313. ETD

TEST INSTRUMENT REPORT

For more information about this instrument, circle 200 on the Reader Service Card in this issue.

Sencore's new video analyzer

By Richard W. Lay

Sencore has come up with a truly versatile and unique piece of video test equipment in its new VA48 Video Analyzer which features a brand new (patented) method for fast video IF and chroma section alignment work. What they've come up with in this unit is a complete and practical system for analyzing and troubleshooting in TV, VTR, and MATV systems.

Retailing at $975, the VA48 is a complete 23 pound package which contains all of the signal generating circuits required for checking via the signal substitution method in any section of a TV receiver from the low level front end and color sections to the high level horizontal and vertical drive signals. While similar signal substitution units are on the market, Sencore's approach goes a step further to provide signal levels which emulate those found in today's modern, modularly constructed receivers— in addition to providing the signal levels necessary for electron tube work.

However, the major innovation is the VA48's newly patented "Bar Sweep" method for IF and chroma section alignment. Together with an oscilloscope, you and your VA48 should be able to completely align any receiver in record time without the need for separate color or post marker-sweep generators. More about the "Bar Sweep" method later.

Other highlights of the VA48 are the seven video patterns (see illustration). RF signals at the 5mV level are available for UHF, VHF and tuner substitution purposes. There are 50mV level signals for injection into the 2nd IF stage, and 500mV signals for the 3rd IF input or for checking the adjacent video, sound, adjacent sound and sound IF traps.

Later stage injection signals are available from a separate Drive Signals selector at two maximum levels, 30 and 300 volts. These include vertical and horizontal output pulses, vertical and horizontal sync pulses, a horizontal keying pulse for testing AGC or burst gates, a keying pulse designed for SCR horizontal stages, and a 30 volt maximum 1,000 Hz audio tone and 3.58 Mhz crystal oscillator for substituting the color subcarrier. Additionally, any of the seven video patterns may be selected. A separate "Drive Level" controls signal attenuation between −30 and +30 volts for solid state circuits and between −300 and +300 volts for work in tube circuits.

Other features of the VA48 include a separate bias and B+ supply (adjustable from zero to +35 volts), a special circuit for ringing and impedance matching tests on flybacks or yokes, and a meter for use with the impedance tests as well as for display of signal levels for all drive signal functions.

But, what really sets the VA48 above any of its competitors is the Bar Sweep method of IF and color section alignment.

The VA48 provides an IF frequency suitable for direct injection into the IF stages. This IF is modulated by five frequency bars, any of which may be individually injected into a circuit simply by depressing that frequency bar's front panel button. The available frequencies are 188Khz, 750Khz, 1.51Mhz, 3.02Mhz, and 3.56Mhz and they have been selected to provide a good reading of overall frequency response throughout the video bandpass area. Simply by viewing the bars on the CRT screen you can see which bars do not provide sufficient detail or ringing.

Theoretically, all of the bars should have about the same response throughout the video bandpass. Therefore, by simply turning down the brightness control of the receiver, and observing which of the frequency bars drops from view

first, you can tell at which end of the spectrum your IF strip or tuner is having problems.

Once, having determined a problem does exist, you can determine whether you have IF or tuner problems using the VA48 as a tuner subber or via direct injection of the signals into the various IF stages.

Similarly, alignment of the color bandpass amplifiers is facilitated with the VA48s patented "Chroma Bar Sweep" system.

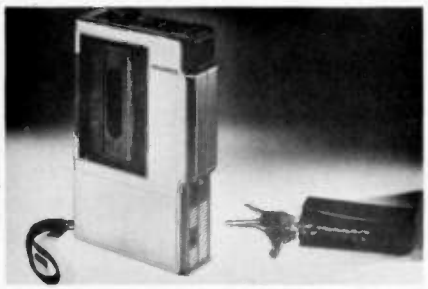
The chroma bar sweep provides three color bars at 3.08, 3.56, and 4.08Mhz. It may be used as a direct replacement for the NTSC color generator in video tape applications in that it contains a color burst signal for properly setting color killer circuits.

Again, simply by reducing the brightness level of the receiver and observing the chroma bar pattern on the CRT screen, you can determine at which end of the frequency spectrum your bandpass problem exists. To complete the color bandpass amplifier alignment *directly from the CRT*, just adjust the coils for equal brightness levels on the first and third, (upper and lower) sideband color bars. If you're still using your scope, adjust the three color bars for equal amplitude on the scope screen.

All in all, this has been a rather quick rundown of a very unique piece of new equipment from Sencore. The theory behind the use of this instrument extends far beyond what I can describe in this short article.

Suffice it to say, the VA48 has applications for troubleshooting, analyzing and correcting within every stage (video, chroma, sound, sync, etc.) to be found inside of a television receiver. It's an exciting new piece of test equipment well worth checking into. **ETD**

DEALER'S SHOWCASE



Portable Tape Recorder

Circle No. 135 on Reader Inquiry Card

A new AC/DC minicassette tape recorder, Model 2002, has been introduced by *Magnavox*. Offering 'no hands' operation with its built-in condensor microphone, and fingertip controls for stop/reject/rewind, the new recorder operates on DC with five 1½ volt batteries, or on AC with a plug-in AC supply unit included with the cassette. Other features include a safety record interlock to prevent accidental erasure, pause control, quick repeat button for fast rewind/replay and a tape travel indicator.

Front-loading Cassette Decks

Circle No. 136 on Reader Inquiry Card

Three new front loading cassette decks have been introduced by *Marantz Company, Inc*. They are Models 5030, 5025 and 5010. Model 5030 features a DC servo transport and three-head, full process Dolby noise reduction system.

Heads are of super-hard permalloy. Model 5025 has two heads and single process Dolby. This model also features mic/line mixing, master level/fader control, tape counter with memory and a defeatable peak limiter. Model 5010 features the Dolby noise reduction system, permalloy head, extended range VU meters, peak limiter and Bias and EQ settings for three types of tape.

CB Antennas & Accessory Display

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A new colorful, island display promoting CB antennas, accessories and replacement parts is now available for dealers from *Antler Antennas*. The unit displays up to six antenna models plus an assortment of accessories and parts. A container is included on the display

unit for distribution to customers of a free antenna selector brochure. The red, gold, white and brown unit provides a focal point for floor or window displays. The tower design is 6-feet high, yet, is only 20 inches at the base. The display unit is available free with quantity antenna orders.

TV, CB and Telephone Accessories

Circle No. 138 on Reader Inquiry Card

New packaged lines of television, modular telephone and CB accessories are now available for dealers from *Columbia Electronic Cables*. The new packaging is designed to make both buying and selling easier through the comprehensive sales information provided on each package. The firm's full line of TV accessories includes antenna coaxial cable assemblies in 50 ft., 75 ft., and 100 ft. lengths with "F" fittings and transformers. CB accessories include coaxial assemblies, cable, antennas, mikes, plugs, lightning arrestors, adaptors and mike holders. Modular telephone accessories include modular converters, line and extension cords, jack covers and assemblies, jack and wall plate assemblies and adaptor plugs.

Telephone Privacy Control

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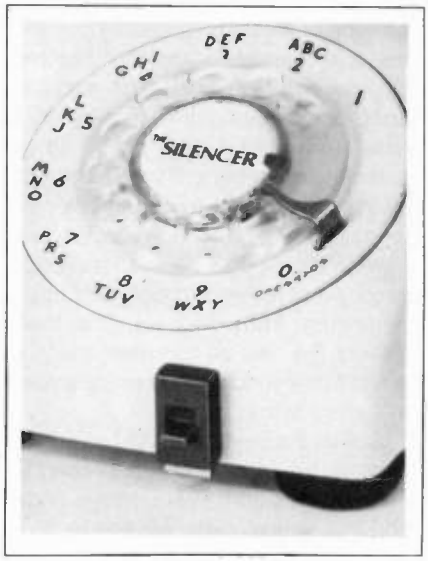
A new product, called the "Silencer", that provides protection from the invasion of unwanted telephone calls, has been introduced by *Zoom Telephonics*.



The device, which fits all normal phone styles, and installs easily with a screwdriver, clips on a phone, and keeps the phone from ringing. A flip of the switch turns the device on or off. It will retail for $9.95.

Anti-static Turntable Mat

Circle No. 140 on Reader Inquiry Card

A new rubber phono turntable mat that reduces static charge from records has been introduced by *Audiotex Laboratories*. Carbon fibers impregnated into the "Anti-Stati" mat attracts static away from an album the moment it is placed on the mat. This action is said to free the reproduction of the album from static induced noises. This 12-inch rubber mat may be used either as a turntable replacement mat or on top of the original mat. ETD

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NEW PRODUCTS

Clamp-on Dmm

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A new clamp-on digital multimeter that continuously measures volts, ohms and amps, with a readout on a 3-digit LED display has been introduced by the *James G. Biddle Co.* Accuracy on all ranges and setting is 1% with low range capability extending from 0.1 to 99.9. A special 'surge-lock' mode allows mea-

surement of voltage and current surges while a unique 'invert' feature permits the display to be read if the instrument is turned upside down. Clamp jaws open to a full two inches. The case is of high-impact ABS plastic, with a break-resistant clear plastic display window. An optional recharger kit is available using rechargeable Ni-Cad batteries.

Modular Service Benches

Circle No. 140 on Reader Inquiry Card

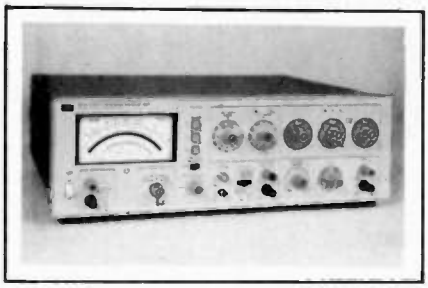
A new series of benches designed to permit the selection of optional features to meet any electronic service requirement or budget is now available from *Advance Engineering Systems*. Called the "Valuemaster Series," the new benches offer different ways to create the most efficient work stations, without the expense of custom benches. Starting with a basic bench, it is possible to add an instrument shelf, a service duct for electrical and other efficiency options at relatively low cost. Electrical circuits

can be placed at any of 9 optional locations for convenience. Bench tops are covered with non-glare, thermosetting plastic to provide a durable surface and minimize eye strain. Available in 4, 5, 6 and 8 foot lengths. Prices for basic benches start at $89.

Distortion Analyzer/Oscillator

Circle No. 141 on Reader Inquiry Card

A new true-rms distortion/ac voltmeter and low distortion oscillator has been introduced by *Hewlett-Packard*. The new instrument, Model 339A, is a small lightweight bench measurement set that allows THD measurements as low as 0.0018% over a 10 Hz to 110 kHz frequency band including harmonics to 330 kHz. As a distortion analyzer, the instrument measures total harmonic distortion from 0.01% to 100% full scale in



nine ranges. The fundamental frequency range for distortion measurements is from 10 Hz to 110 kHz; harmonics are indicated up to 330 kHz. As a true-rms calibrated voltmeter, Model 339A measures input levels from 1.0 mV RMS to 300 V RMS full scale over a frequency range from 10 Hz to 110 kHz. As an ultra-low distortion oscillator, it delivers sinusoidal frequencies from 10 Hz to 110 kHz with output level adjustable from 1mV to 3V rms into a 600 ohm load. Priced at $1900.

Coronary Observation Radio

Circle No. 142 on Reader Inquiry Card

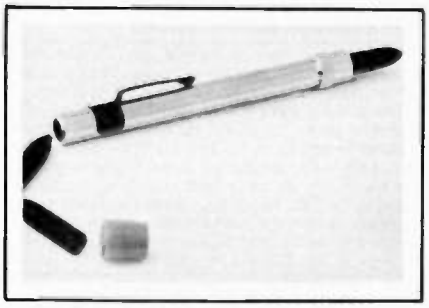
A new Duplex/Multiplex Coronary Observation Radio with 12 watts of power contained in a rugged case weighing only 19 pounds is being introduced by *Motorola Communications*. The radio's duplex/multiplex operation allows medical personnel at the hospital to receive an uninterrupted transmission of the patient's electrocardiogram while discussing the patient's condition with the paramedic. Operation of the radio is similar to the procedure for lower powered portables that use repeater radios in nearby vehicles. Duplex operation for one hour having 12 watts RF output is possible with the new radio. In applica-

tions where additional RF power is needed, the unit can be tuned to 15 watts with a reduction in operating time.

Oxidation Eraser

Circle No. 143 on Reader Inquiry Card

A new 3-in-1 oxidation eraser for use by electronic technicians, jewelers, machinists, and other servicemen has been introduced by *Fancort Industries*. The new eraser is furnished with three interchangeable erasers, each impregnated with a special abrasive to allow the spot erasing of solder particles, rust, corrosion, oxidation or heat marks.

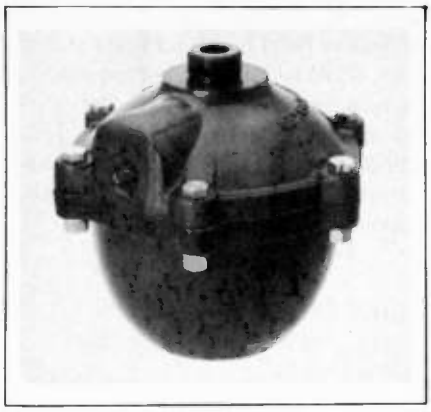


Eraser grades are fine, medium and coarse. Featuring a metal spring clasp, the device can be carried as a pen or pencil with two spare erasers stored inside. It is made of brass and chrome plated and adapts to a drill press for high speed cleaning.

Sound System Driver

Circle No. 144 on Reader Inquiry Card

A new sound system driver designed for use in the presence of flammable liquids, dusts and gasses has been introduced by *University Sound*. The new unit, designated Model 711OX, is U.L. listed for Class I, Groups B, C and D, and Class II, Groups E, F and G environments. It is manufactured from heavy die-cast aluminum explosion barrier housing, and finished in baked-on, corrosion-resistant acrylic paint. The driver features an 8-ohm voice coil and

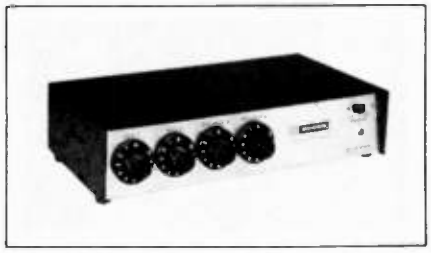


has a power handling capacity of 65 watts. The driver's throat is protected by a U.L. listed, sintered bronze filter.

Four-channel Mixer-preamp

Circle No. 145 on Reader Inquiry Card

A new four-input, all-silicon transistor mixer-preamplifier, Model CXM, is now available from *Lear Siegler/Bogen*. It has been designed especially for the expansion of inputs in public address systems. The new unit features active

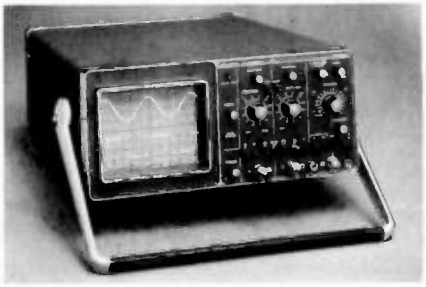


mixing, normally found only in expensive consoles, for nearly zero interaction among its four input controls. Active mixing is said to minimize the residual mixing bus noise and provides constant preamplifier gain as more input channels are added. The CSM has four microphone inputs, two of which are convertible to auxiliary inputs. Each input can accept either high- or low-impedance microphones. Suggested list price is $137.25.

Portable Oscilloscope

Circle No. 146 on Reader Inquiry Card

A new, portable 15 MHz/2mV oscilloscope designed for a wide range of applications has been introduced by *Philips*



Test & Measuring Instruments. Designated Model PM3211, the new scope features a double insulated power supply, so no grounding is needed and measurements can be made without ground loops, thus eliminating hum and spurious signals which often influence results. Triggering on the PM3211 can be in "auto" or level-set modes and multi-sourced, thus eliminating the need to change probes. Channel B can be used as an X input to facilitate X-Y displays with calibrated attenuation of both X and Y inputs. Channel B can be inverted and with the ADD function can display A + B. The scope's 18-speed timebase has a vernier control for simplified phase and timing measurements. Priced at $875.

Single-Chip Power Transistor

Circle No. 147 on Reader Inquiry Card

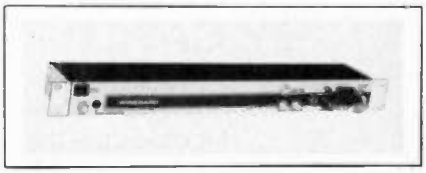
Billed as the "world's first," a new single-chip power transistor with Ic up to 100 Amps has been announced by *Germanium Power Devices*. The design is based on what is believed to be the largest discrete Germanium junction ever used — a 0.475 inch diameter chip. The devices are styled GPD 100SC series, and will be available with various

operating voltages. Typical applications are in inverters, switching regulators, power amplifiers and similar high current circuits. Being based on Germanium technology, the GPD 100SC series also is said to give high gain (H_{FE} = 120 typical at −60A Ic, −1V V_{CE}),high efficiency, low input voltage and, above all, very low saturation voltage.

Broadband MATV Amplifier

Circle No. 149 on Reader Inquiry Card

A new broadband VHF-FM amplifier that covers channels 2 through 13 and FM, is new from the *Winegard Company*. The new model, DX-0323, is part of the DX-series strip amplifiers from the firm and replaces the DA-1000. Typical gain of the new amplifier is +35db to + 54dB with 54dBmV output per channel. Input for one channel runs from OdB to 19dBmV with 17dBmV to 36dBmV total.

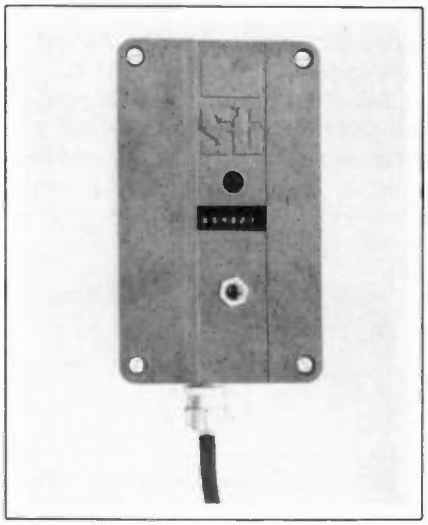


The noise figure is extremely low: 3.2 dB on the low band and 3.5dB on the high band. VSWR is 1.5:1. Power required for the new amplifier is 8 watts. Two F-59 connectors, F-59TB terminator, coax jumper, and mounting hardware are furnished. It can be rack or surface-mounted. List price is $284.75.

Digital Display Counter

Circle No. 148 on Reader Inquiry Card

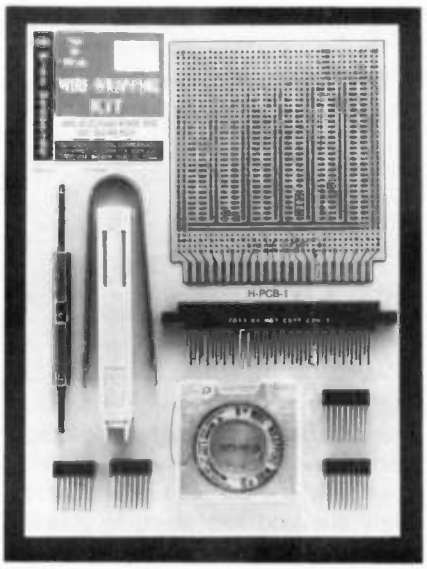
A new six digit industrial display counter has been announced by *Scientific Technology, Inc*. Available both as an accessory to its standard line of process control infra-red sensors and as a stand alone general purpose event counter, it will accept either contact closure or logic inputs. The unit was developed for severe industrial counting applications in hostile environments with the LED display, counter circuitry and power supply mounted in an aluminum die case NEMA 4 & 12 rated enclosure. Counting rate is up to 1 mHz and input power sources from 12 VDC to 240 VAC can be accommodated. Standby battery power is also available. Priced at $85 in single unit quantities.



Wire-wrapping Kit

Circle No. 150 on Reader Inquiry Card

A new wire-wrapping kit that contains a universal PC board, an edge connector with wire-wrapping terminals, two 14-pin DIP sockets, two 16-pin sockets, a DIP inserter, a DIP extractor, a wire dispenser and a new wire wrapping and unwrapping tool, is now available from *OK Machine and Tool*. The tool, model

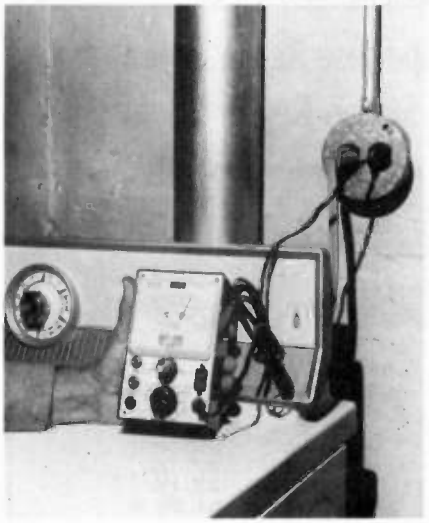


WSU-30, wraps and unwraps 30 AWG wire on .025 square pins and strips the wire. The board features glass coated epoxy laminate construction with solder coated 1 oz. copper pads. Sockets have gold plated terminals and thermoplastic bodies. The wire dispenser includes 50 feet of kynar insulated, silver plated copper wire. The kit is priced at $25.99.

Appliance and Auto Multitester

Circle No. 151 on Reader Inquiry Card

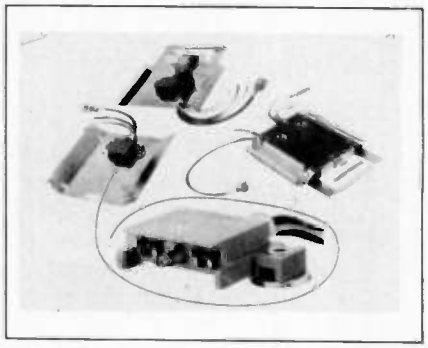
A new versatile multitester designed especially for home-appliance and auto maintenance and repairs is now available from *EICO, Inc*. Called the Model 540, the new instrument can be used to locate faults in electrical appliances, such as irons, toasters, heaters, electric blankets, etc., and for troubleshooting auto electrical systems. It has four ac and dc voltage ranges: 7.5, 15, 150 and 300 volts, and two resistance ranges. Two of the ac and dc voltage ranges connect the meter to the tester's built-in line cord, so that by simply plugging into any wall outlet, line voltage can be measured directly without test leads. Then by plugging an appliance into the built-in receptacle, the condition of the wiring can be checked by noting how much the voltage drops. In kit form, priced at $21.95, or factory-wired, at $29.95.



Two-way Radio Slide Mount

Circle No. 152 on Reader Inquiry Card

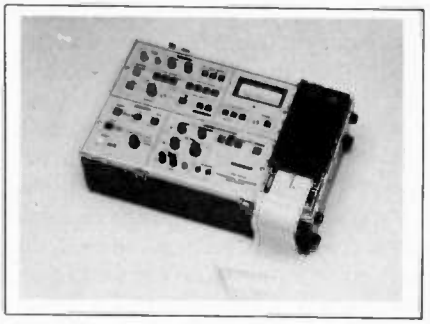
A new slide mount that provides easy removal of two-way radios for antitheft and/or convenience of transferring and interchanging radios from one vehicle to the other has been introduced by *Scientific Dimensions*. Designated Model SDI-700, the new mounting device features a tin-nickel plated contact that will handle up to 500 megaHertz. It is constructed of 16 gauge steel finished in chrome. It has a three-way spring lock to guarantee positive connector contact. All wire leads in the slide mount are securely clamped into place to prevent breakage. The leads are 18-gauge stranded with 10 amp capacity. Coaxial cable is RG58 C/U with UHF connectors attached. The new mount is priced at $19.95.



Frequency Response Recorder

Circle No. 153 on Reader Inquiry Card

A new Frequency Response Recorder that measures and graphically charts frequency response, wow and flutter, drift, voltage and temperature parameters of audio equipment has been introduced by *Leader Instruments*. Designated Model LFR-5600, the new instrument consists of two basic sections: an audio sweep oscillator and a pen recorder. The sweep oscillator may be used separately for direct frequency response readout on an oscilloscope. In addition, the chart section can also serve as a direct current reader to 10mV/cm. The design format includes: automatic start

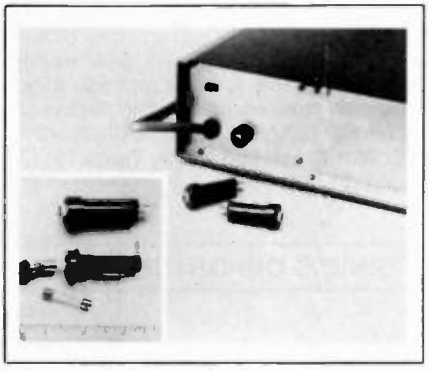


circuitry which is said to simplify tape recorder response measurements; standard signal frequencies of 1KHz and 333Hz for reel-to-reel or cassette recorder checkouts. Priced under $3000.

Circuit Protector

Circle No. 154 on Reader Inquiry Card

A new circuit protecting device called "Re-Cirk-It" is being introduced by *Heinemann Electric Co.* The new device protects like a fuse but is resettable. It is

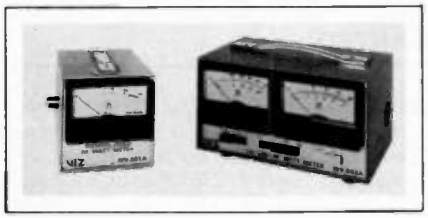


said to be cost-competitive with fuses and fuseholders, installs in the same panel space as a conventional fuseholder, and is attractive enough to be placed on front panels. The unit trips instantaneously on short circuits and with delay on sustained overloads. It can only be electrically tripped, and it can't be turned off or held against a fault. Available in current ratings from 0.25 through 10A. Sample is available for $1.00 and a blown fuse.

RF Wattmeters

Circle No. 155 on Reader Inquiry Card

Two new easy-to-use RF wattmeters have been introduced by *VIZ Test Instruments*. Designed for testing ham, vhf, fm, cb and uhf transmitters, the new instruments are the Model WV-551A dummy-load rf wattmeter and the WV-552A in-line rf wattmeter. The WV-551A has a broad frequency range — from 1.0 to 512MHz, with a power range from 0.5 to 15W with full-scale accuracy better than 5%. Input impedance is 50 + 2%, and VSWR is less than 1.15 at 500 MHthe WV-552 in-line rf wattmeter is a dual taut-band meter unit used to measure forward and reflected power — especially useful in matching and adjusting transmitters to antennas for optimum power output. The Model WV-551A wattmeter is priced at $60, and Model WV-552A is priced at $150.



Projection TV Kit

Circle No. 156 on Reader Inquiry Card

A new projection television kit that includes a color TV set is now available from *Miami Flock Equipment*. The kit is furnished with a two element Fresnel fl.5 lens and an easy-to-mount lens hood assembly. A 12 inch color TV set and a stand with wheels are included in the kit. The new kit sells for $375. **ETD**

QUASAR

continued from page 25

driver. A low light control in the emitter circuit of each device and a single screen control establish conduction levels for proper low level tracking. Highlight tracking is established by the drive control settings in a conventional manner.

The color difference signals are fed to the base of the output transistors, the collectors of which feed the CRT cathodes. **ETD**

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READER SERVICE INDEX

ADVERTISER'S INDEX

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ET/D TEKFAX

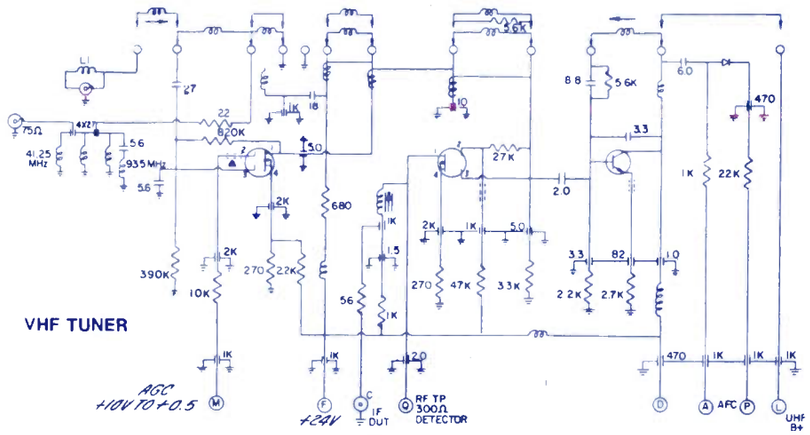
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

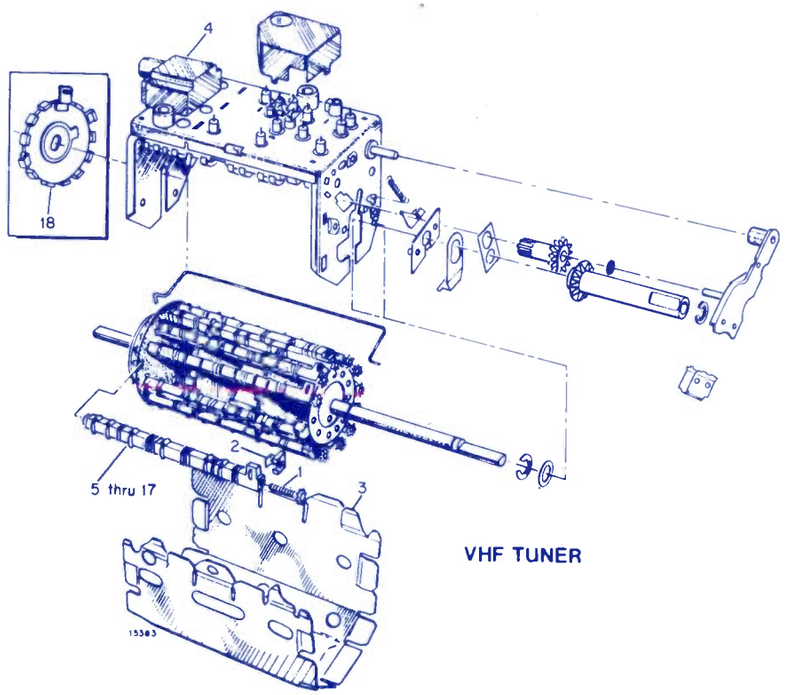
1730

AIRLINE
Color TV Model
GAI-17437B

FEBRUARY • 1978

	SCHEMATIC NO.		SCHEMATIC NO.
AIRLINE Color TV Model GAI-17437B	1730	GTE SYLVANIA Color TV Chassis E46-1, 2	1732
GTE SYLVANIA Color TV Chassis E24-2, 3	1731	ZENITH Color TV Chassis 17JC55	1733





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Ref. No.	Part No.	Description
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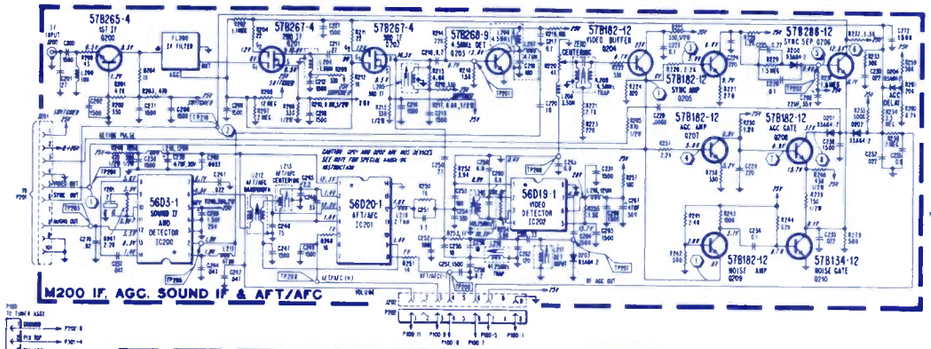
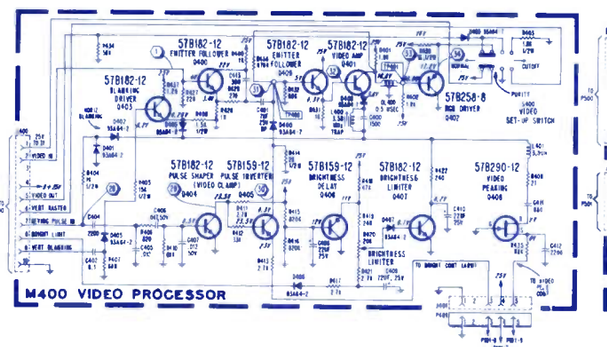
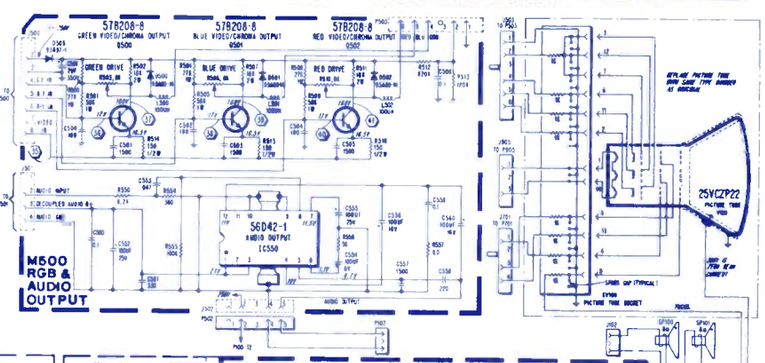
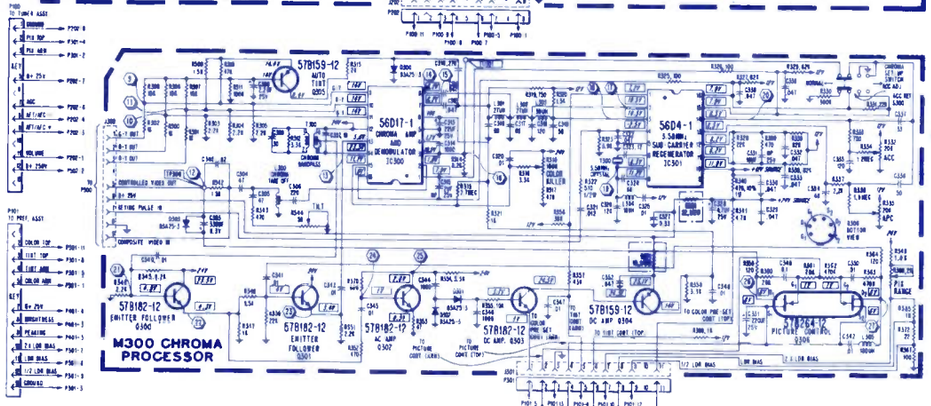
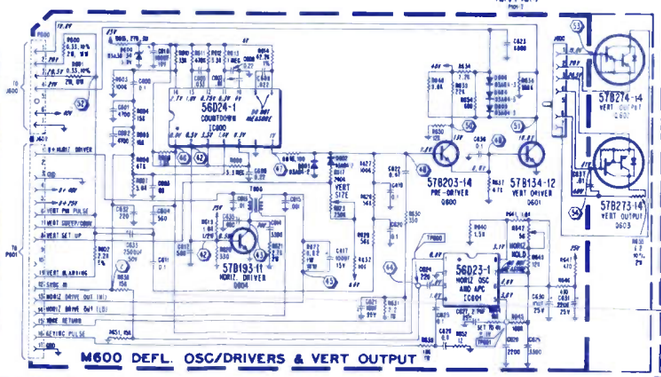
2	6096-9	Shaft, Fine Tuning
3	3316-8	Caver (Shield)
4	6180-507	Antenna Trap Assembly
5	2869-604	Channel 1 Strip
6	4862-599	Channel 2 Strip
7	4863-599	Channel 3 Strip
8	4864-599	Channel 4 Strip
9	4865-599	Channel 5 Strip
10	4866-599	Channel 6 Strip
11	4867-599	Channel 7 Strip
12	4868-599	Channel 8 Strip
13	4869-599	Channel 9 Strip
14	4870-599	Channel 10 Strip
15	4871-599	Channel 11 Strip
16	4872-599	Channel 12 Strip
17	4873-599	Channel 13 Strip
18	77A237-8	Switch, AFC Defeat

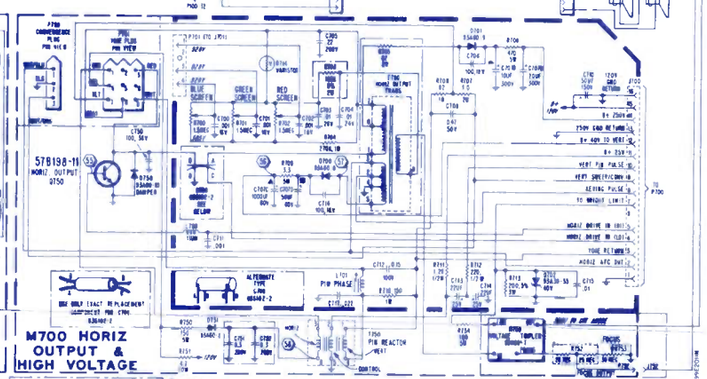


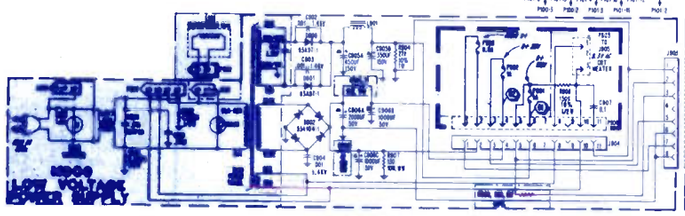


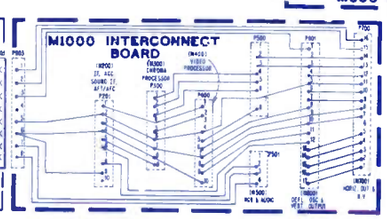


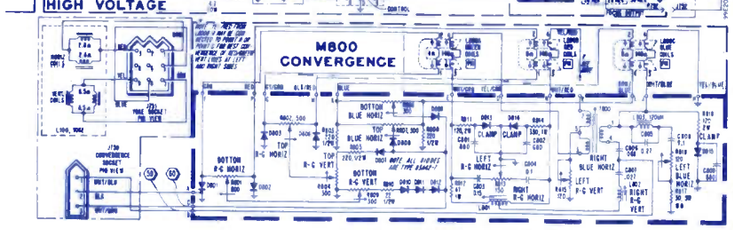












SAFETY CRITICAL COMPONENTS

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 AND COMPONENTS SHOWN IN SHADED AREAS ON THE SCHEMATIC SHOULD BE REPLACED WITH EXACT FACTORY REPLACEMENT PARTS. THE USE OF UNAUTHORIZED SUBSTITUTE PARTS MAY CREATE A SHOCK, FIRE, X-RADIATION, OR OTHER HAZARD. SERVICE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY.

RELIABILITY AND PERFORMANCE

FOR CONTINUED RELIABILITY AND PERFORMANCE, EXACT FACTORY REPLACEMENTS ARE RECOMMENDED FOR ALL OTHER PARTS REPLACED. IF A SUBSTITUTE MUST BE USED, BE SURE ITS QUALITY AND SPECIFICATIONS ARE IDENTICAL TO THE ORIGINAL PART.

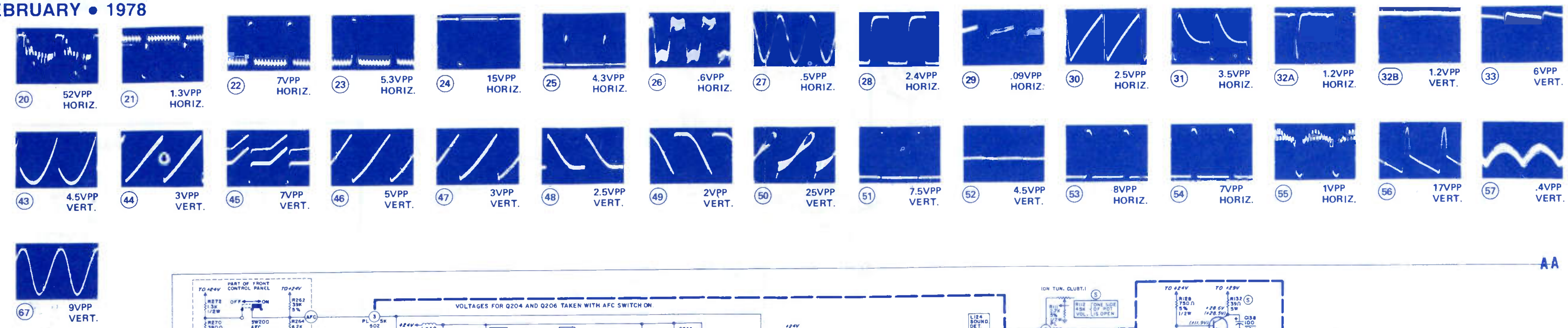
1731

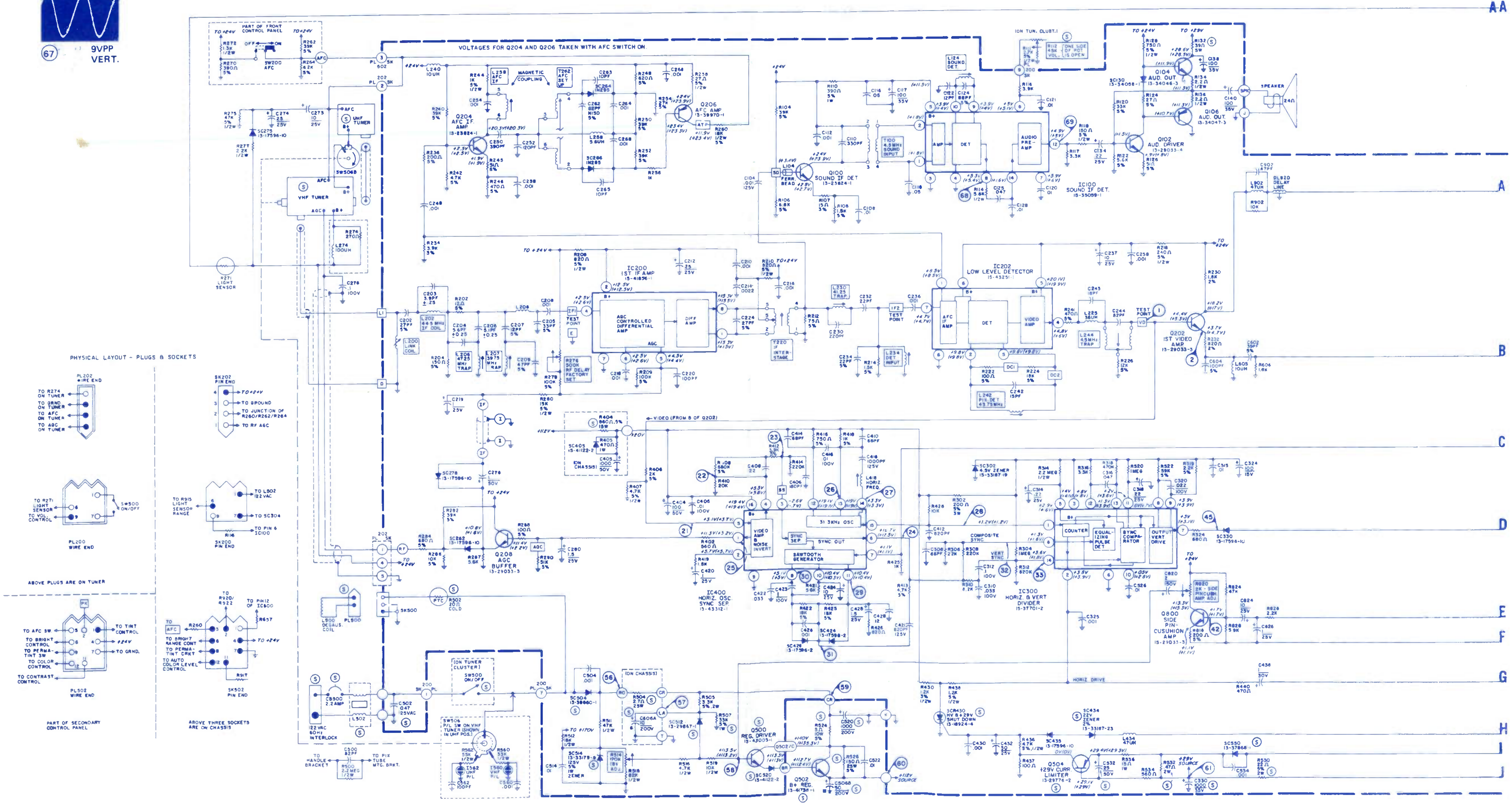
SYLVANIA
Color TV Chassis
E24-2, 3

ET/D TEKFAX

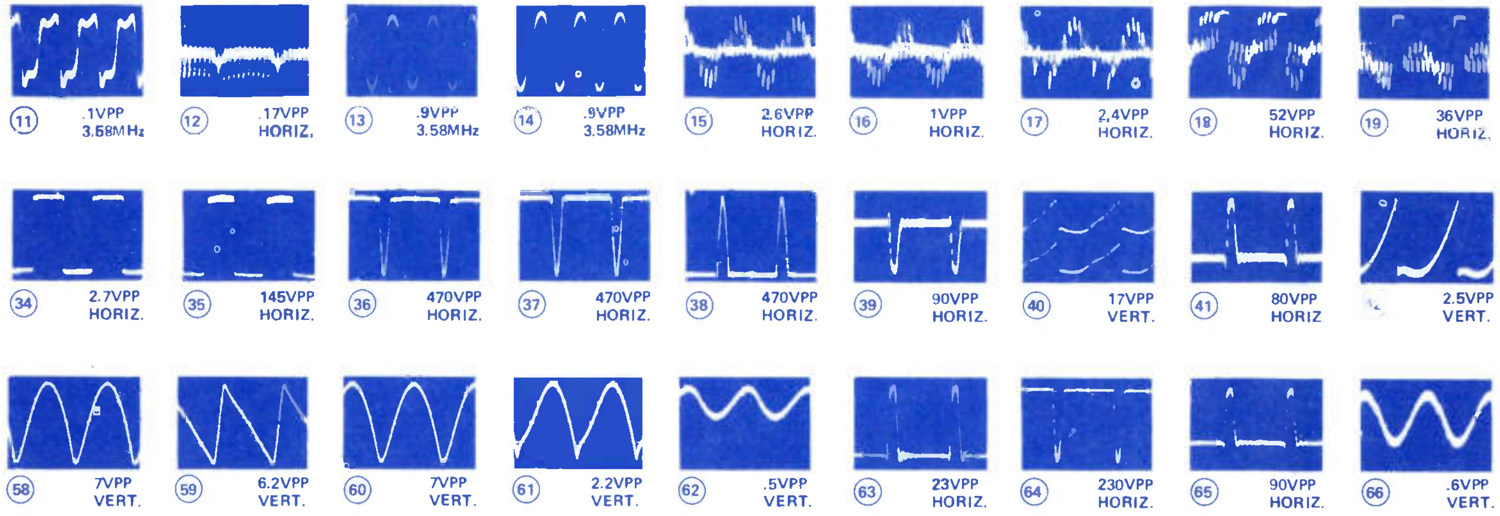
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

FEBRUARY • 1978



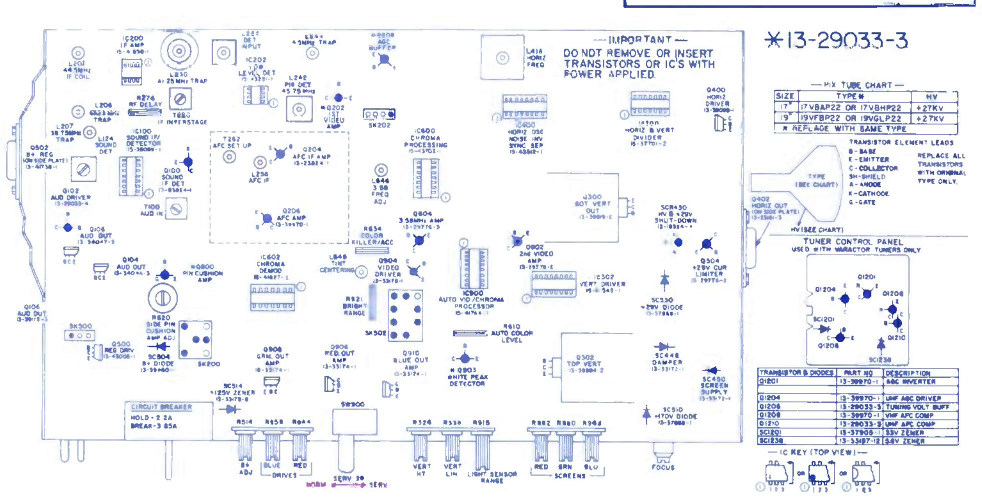


GTE SYLVANIA
Color TV Chassis
E24-2, 3

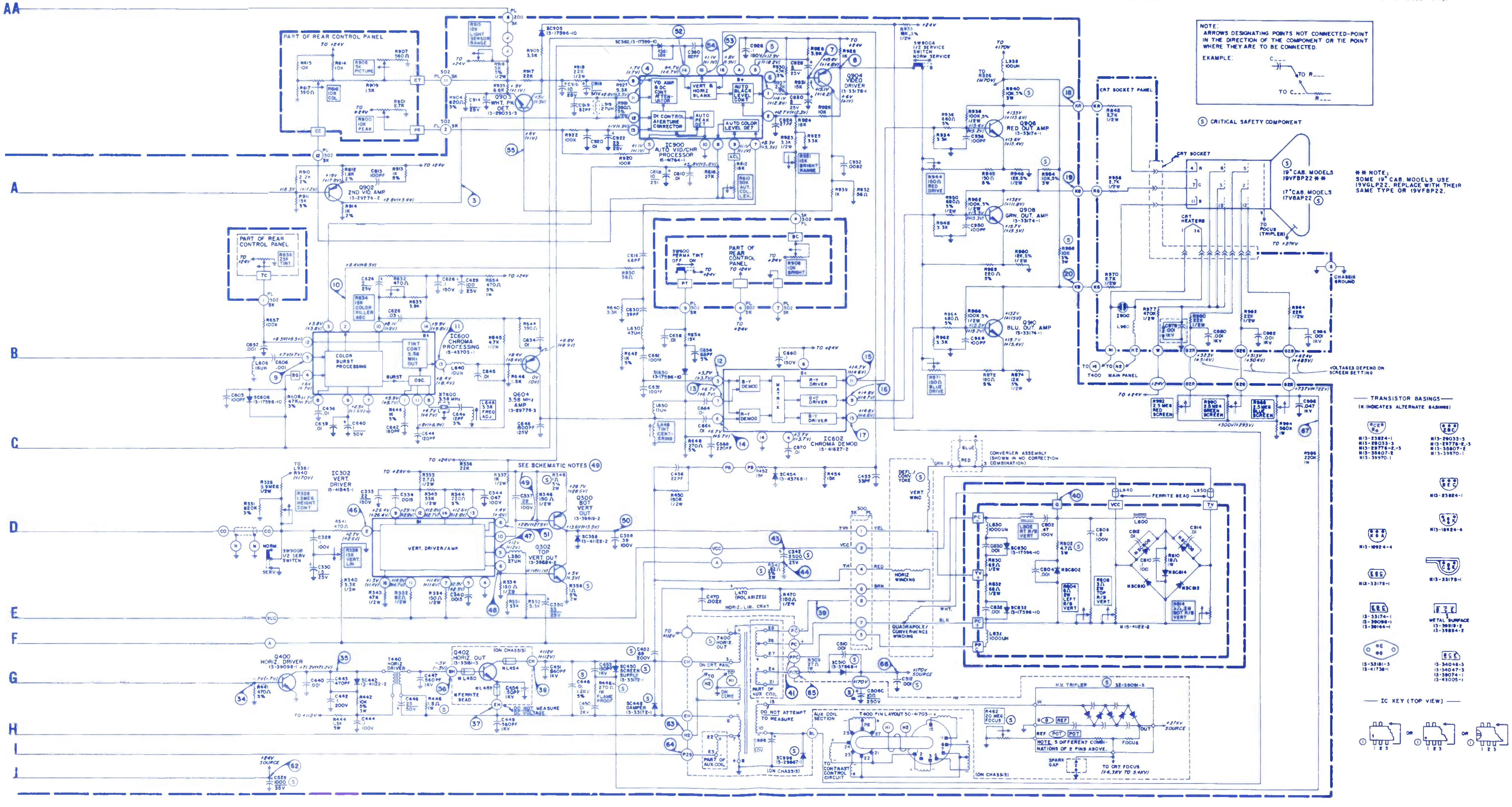


(68) & (69) NO WAVEFORM SHOWN. AMPLITUDE AT 69 APPROX. 6 TIMES THAT OF 68.

TRANSISTOR LAYOUT



✱13-29033-3

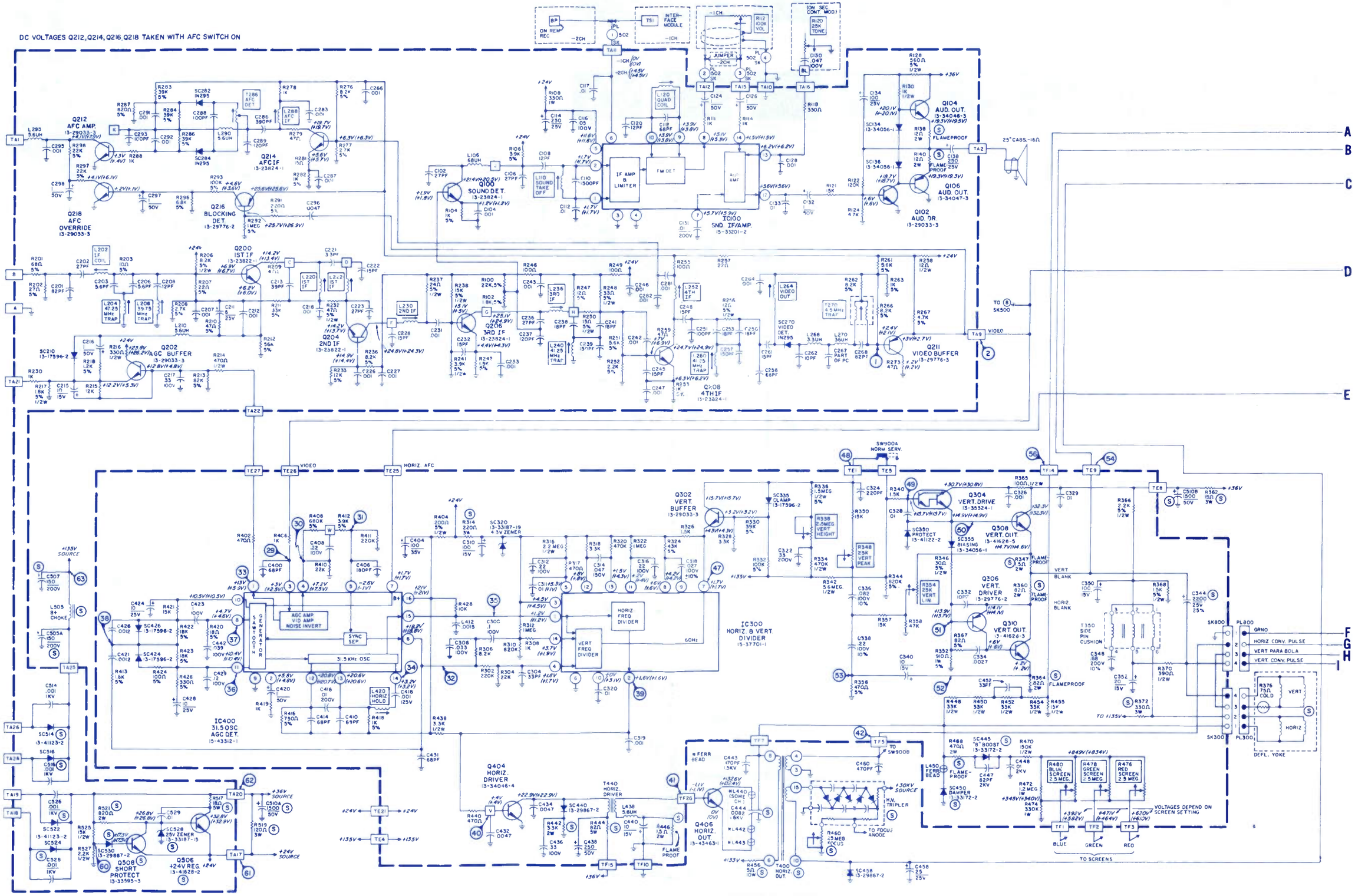


1732

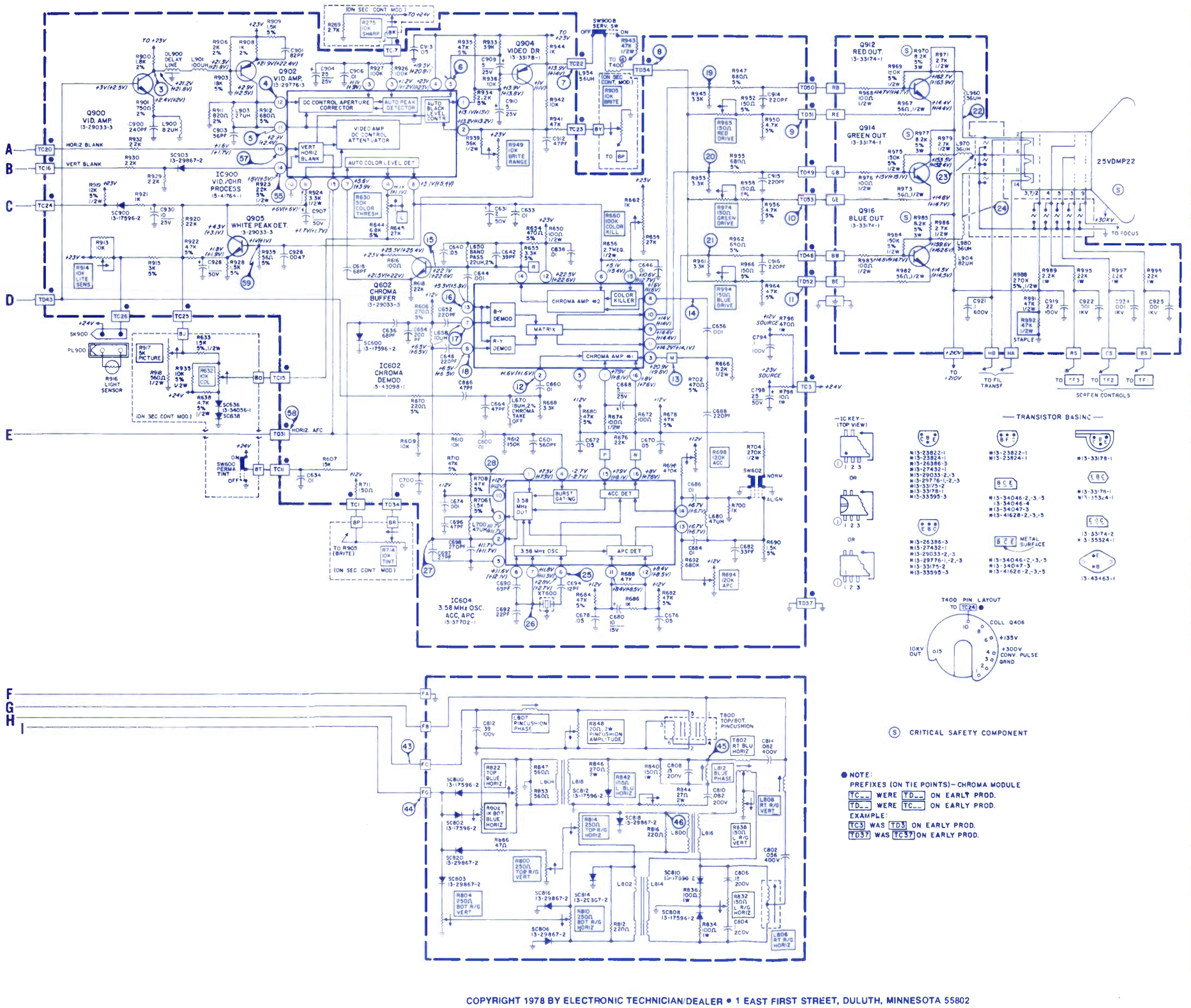
SYLVANIA
Color TV Chassis
E46-1, 2

ET/D TEKFAX
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

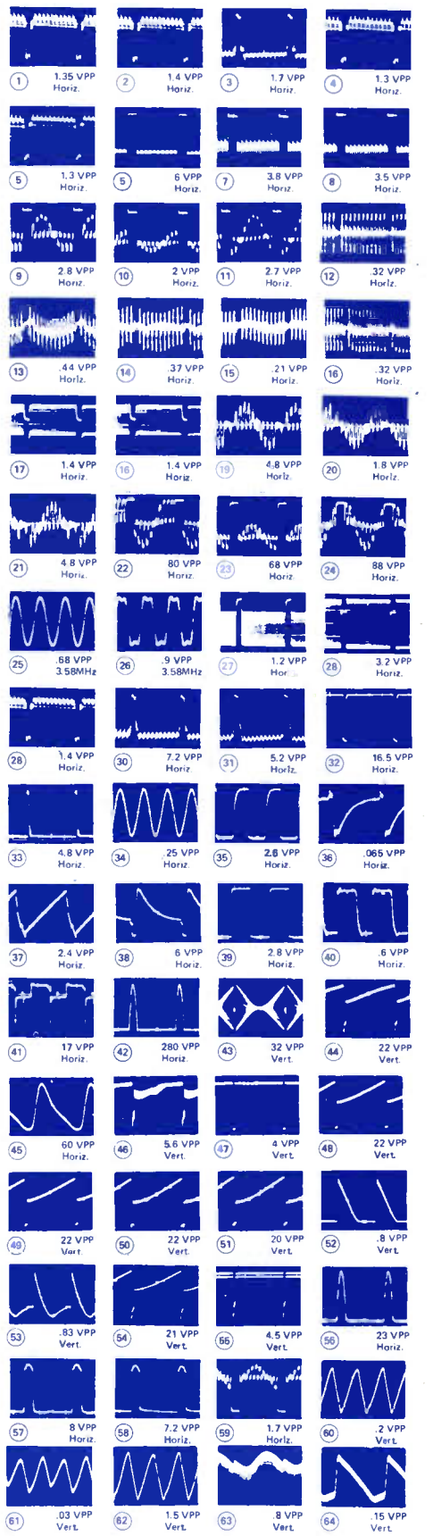
FEBRUARY • 1978



GTE SYLVANIA
Color TV Chassis
E46-1, 2



● NOTE:
PREFIXES (ON TIE POINTS)– CHROMA MODULE
TC__ WERE TD__ ON EARLY PROD.
TD__ WERE TC__ ON EARLY PROD.
EXAMPLE:
TC3 WAS TD3 ON EARLY PROD.
TD37 WAS TC37 ON EARLY PROD.

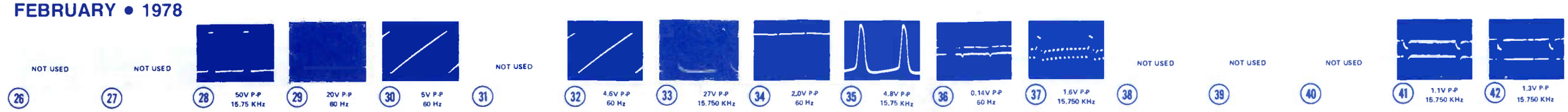


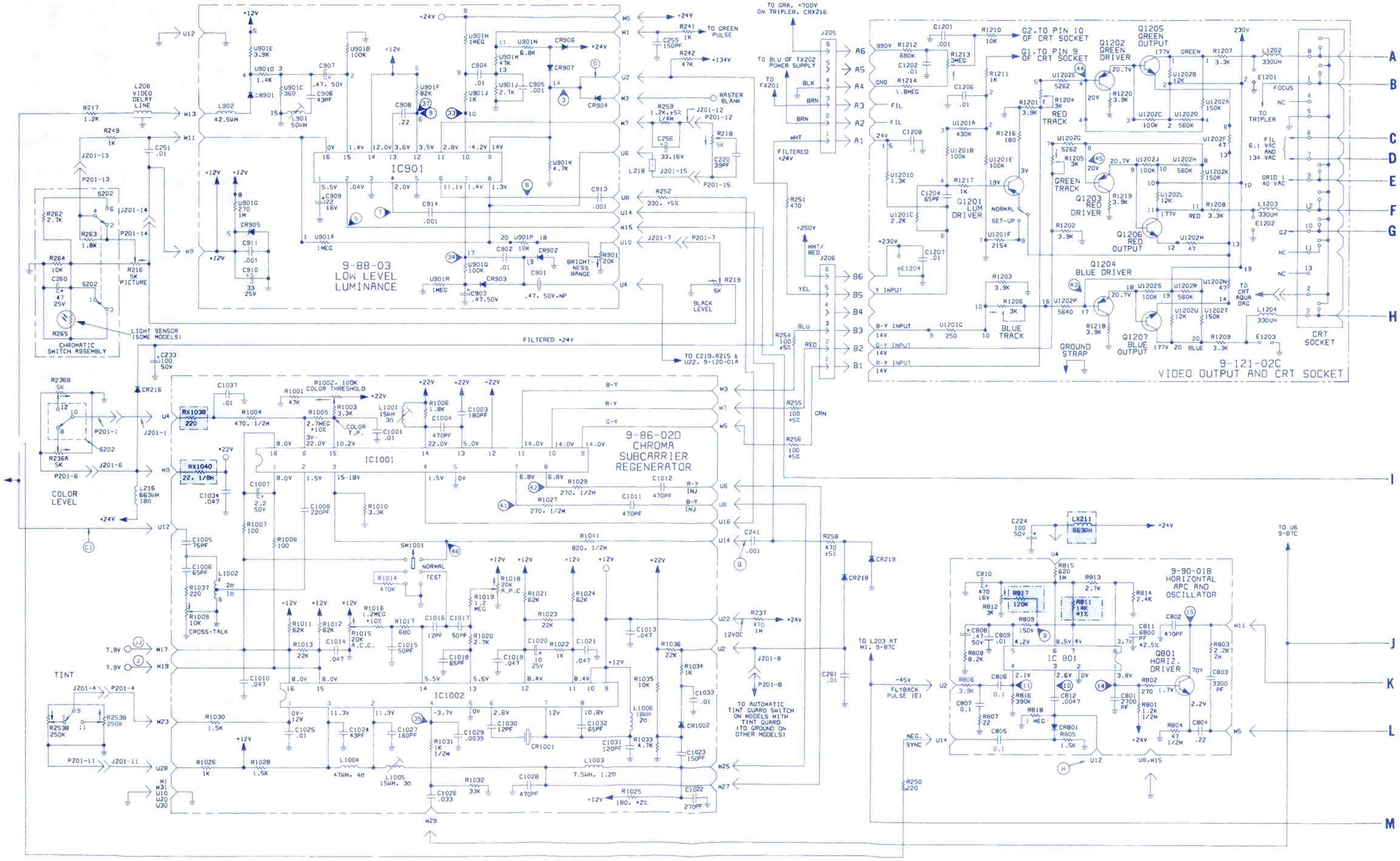
1733

ZENITH
Color TV Chassis
17JC55

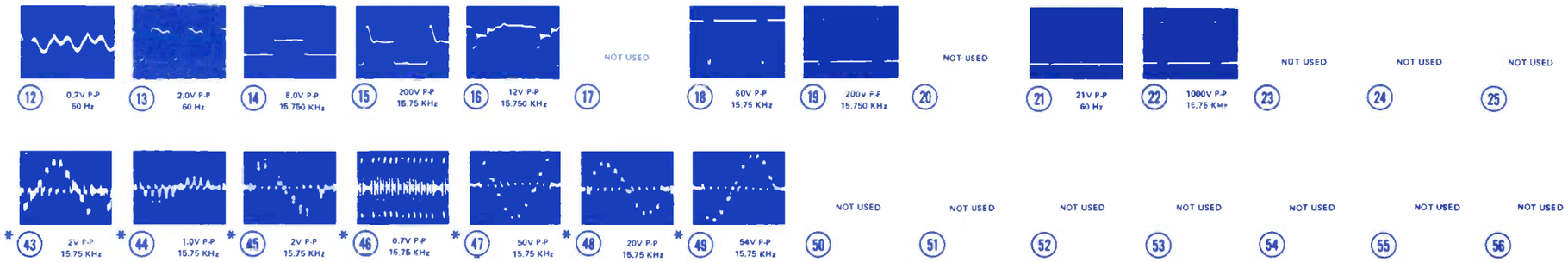
FEBRUARY • 1978

ET/D TEKFAX
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

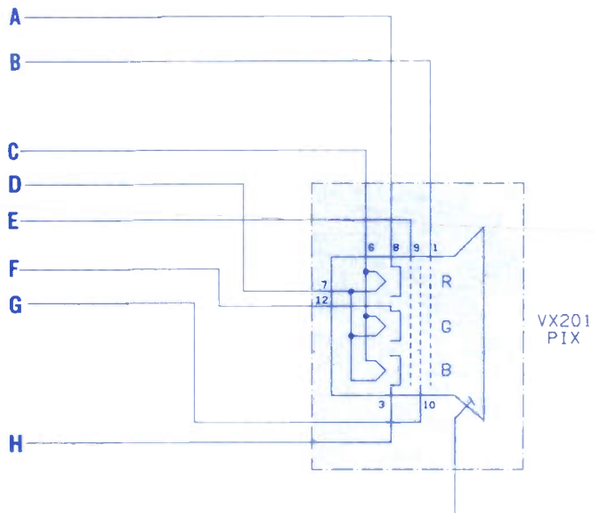


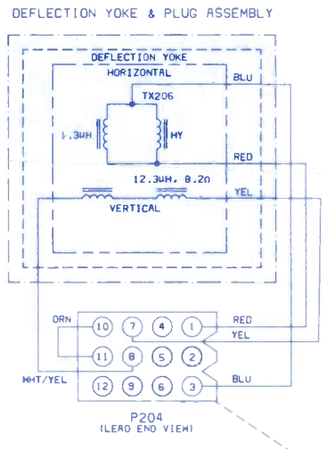


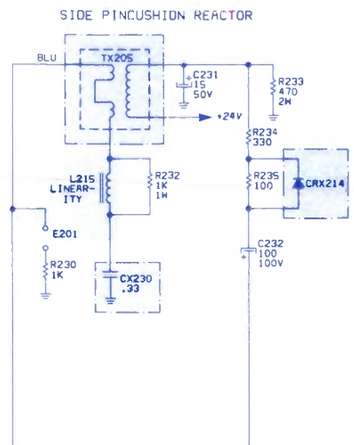
ZENITH
Color TV Chassis
17JC55



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

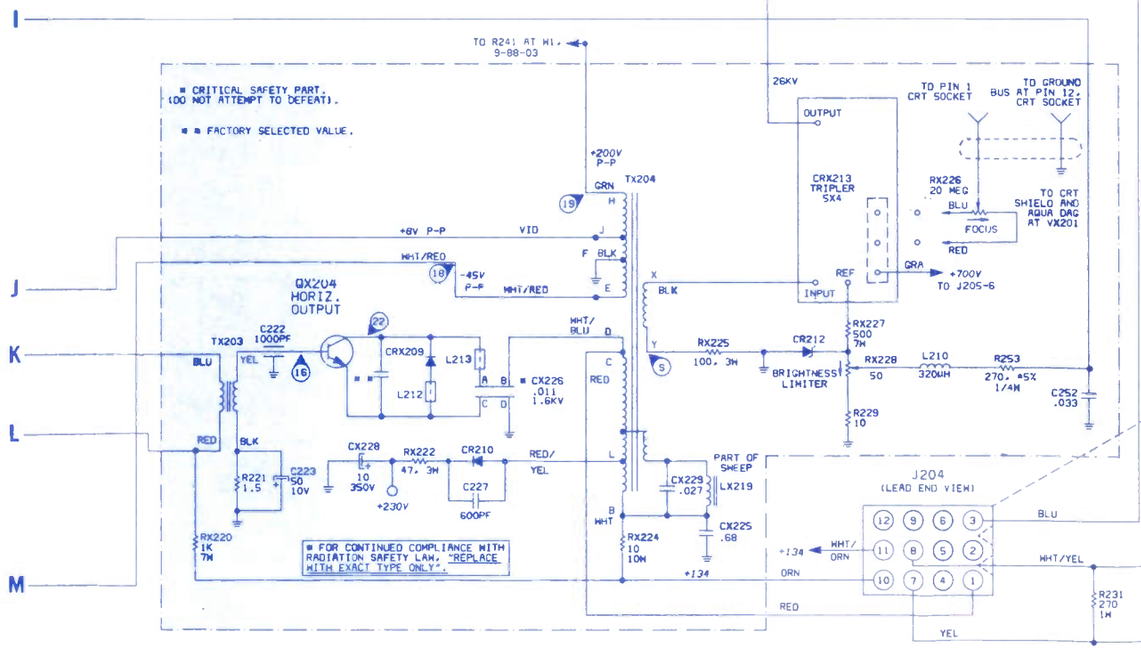


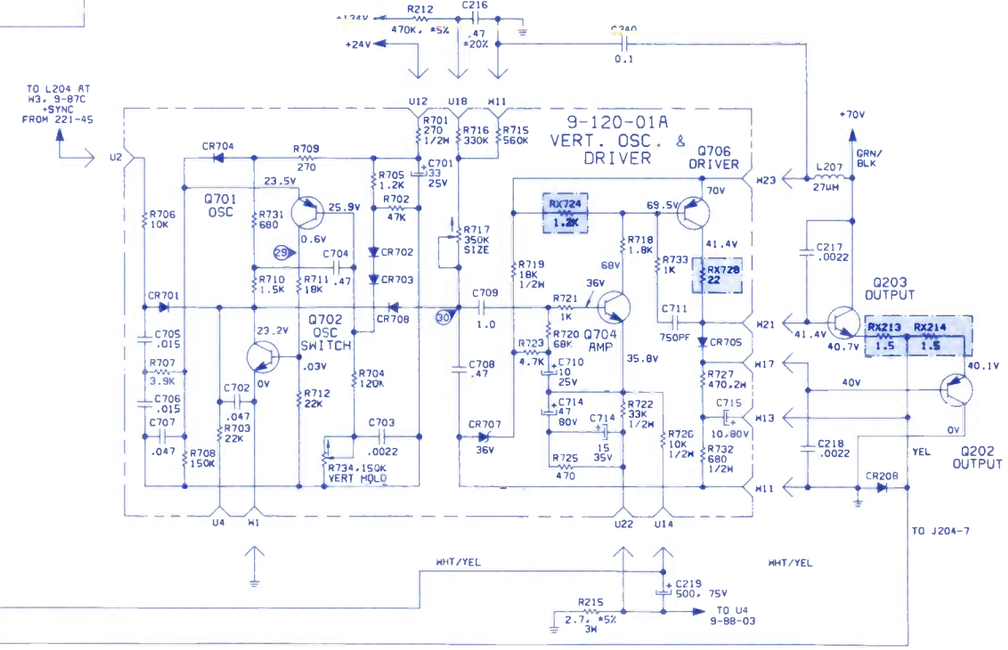




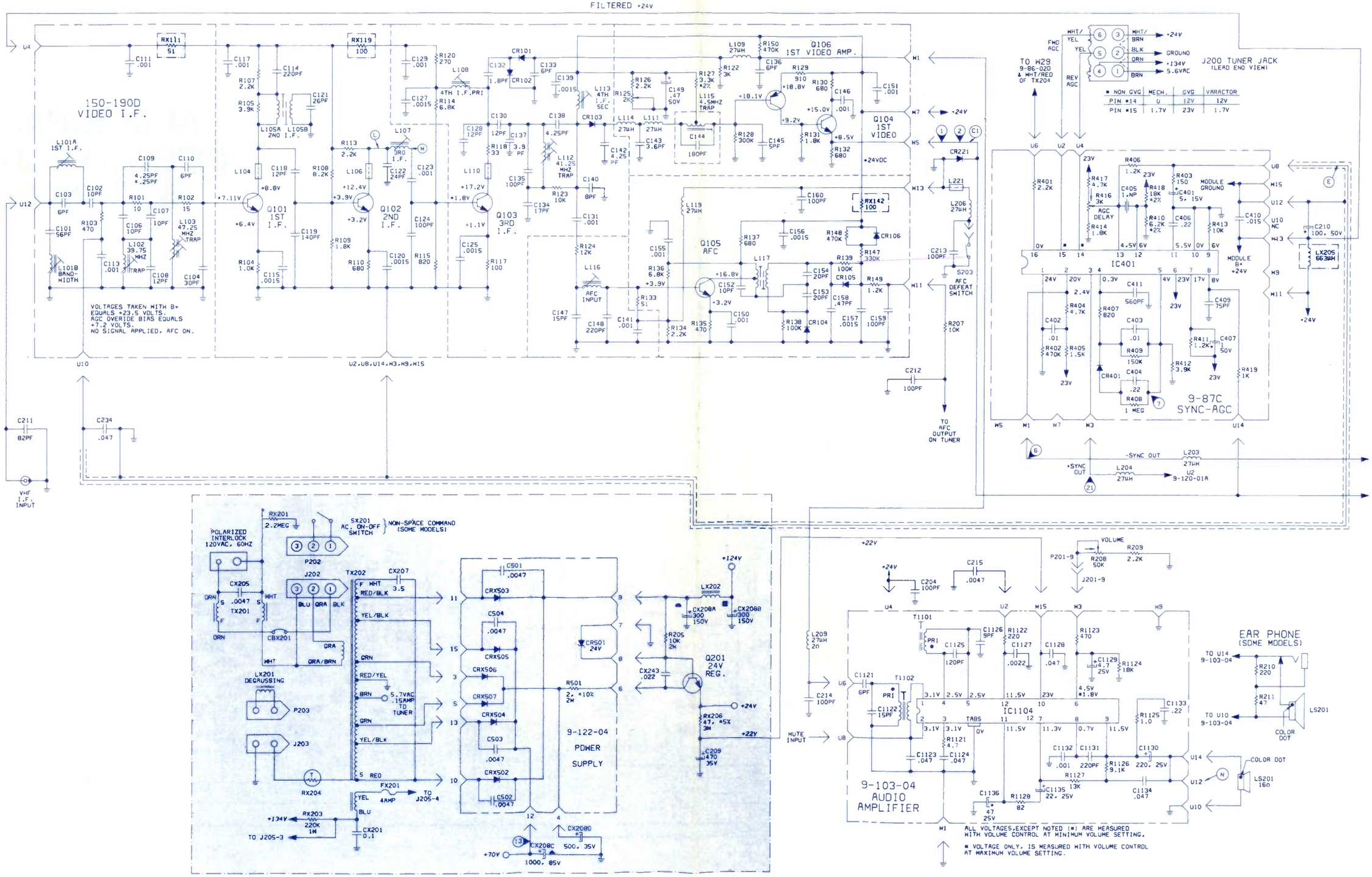
TEST POINTS	
TEST POINT	FUNCTION
C1	PICTURE DETECTOR OUTPUT
C2	SOUND DETECTOR OUTPUT
D	BY-PASS WITH 25WH, 25V ELECTRO. DURING COLOR ALIGNMENT.
E	I.F. A.G.C.
H	ZERO BEAT OF HORIZONTAL HOLD
J	FOR COLOR ALIGNMENT
JJ	FOR COLOR ALIGNMENT
N	AUDIO OUTPUT TO SPEAKER
Q	A.C.C. VOLTAGE
R	RED COLOR AMP. COLLECTOR
G	GREEN COLOR AMP. COLLECTOR
B	BLU COLOR AMP. COLLECTOR
S	BEAM CURRENT ADJUSTMENT

ADDITIONAL INFORMATION NEXT PAGE





ZENITH
Color TV Chassis
17JC55



Chances are you can improve color viewing no matter what make TV your customers now have.

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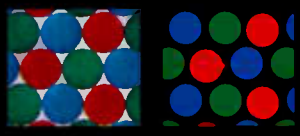
Before Chromacolor, every large screen color TV picture was made up of thousands of tiny red, green and blue dots on a gray background.

But Zenith found a way to make the dots smaller, surround them with jet black and, for the first time, fully illuminate every dot not only for greater brilliance, but also for dramatic contrast.



The result was the famous Chromacolor picture tube – widely recognized at its introduction as one of the most important breakthroughs in color picture tube technology since the coming of color television.

Today, Chromacolor still represents a significant forward step in the state of picture tube technology...in brightness, contrast, and true-to-life color.

And for reliability, there's no comparison between a Chromacolor picture tube from your Zenith distributor and that you may attempt to re-build yourself. When you get down to it, you simply can't invest man hours in a re-built that will seldom, if ever, measure up to the reliability, the consistency, the integrity of a factory-supplied Chromacolor.

As a result of this reliability, Chromacolor can do a lot for older color TV's...and many not-so-old sets as well. Even those of other makes.

That's why you should check with your Zenith distributor now and stock up with Zenith's 17", 19", 23", and 25" diagonal sizes.

Besides brightening your customers' picture viewing, Chromacolor will brighten your profit picture too! Reliably!

Call your Zenith distributor now.

For your own reputation and in your customers' best interest, always specify Zenith exact replacement parts and accessories.

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