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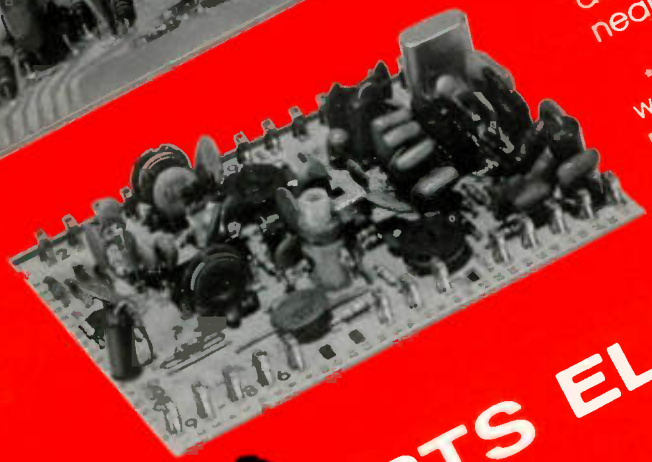

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...for more details circle 102 on Reader Service Card

NEWS OF THE INDUSTRY

Sylvania-Panasonic Join Home Video Tape Parade

Panasonic and GTE Sylvania are the latest to join the growing list of U.S. television manufacturers who will market home video cassette recorder/players in time for Christmas this year. Both have opted for Matsushita's two and four hour recording format, the same unit being marketed by RCA which caused industry waves by pricing their unit at a suggested retail of $1,000 earlier this year.

Matsushita, of course, is Panasonic's parent company.

Panasonic's entry into the field began about two weeks ago with their unit, called Omnivision IV, going for a suggested retail of $1,095. Sylvania, on the other hand, delayed putting their units on the market until an initial round of distributor service seminars could be conducted around the country. At press time, no decision had been reached by Sylvania on price or what they will call their version of Matsushita's machine.

Following the industry trend, both will offer optional black and white television cameras for a price in the neighborhood of $300.

Still taking a wait and see attitude regarding VCR units are General Electric and Admiral among the major U.S. manufacturers.

Sony, the first to market VCR in this country with its Betamax two-hour maximum recording time, is also offering its $1,300 unit through other manufacturers. Zenith Radio Corp., is thus far the only U.S. manufacturer having opted for this format, although it is also being offered through Toshiba and Hiatachi.

Among the manufacturers selecting Matsushita's VHS (Video Home System) format are JVC, RCA, Magnavox, Panasonic, and Sylvania. JVC is actually manufacturing the Matsushita designed unit.

Quasar Electronics is the only manufacturer offering a third variation of the VCR, a single head recording "Alpha Wrap" format with one or two hour record/play options. This unit, as of press time, was priced at $995.

Radio-TV Dealer Sales Boom

Booming color television sales, judging by third quarter statistics, continue to point to 1977 as a banner year, according to EIA figures.

Color TV sales to dealers for September were 1,104,941, up 28.3 per cent from a year earlier and for the nine-months totaled 6,208,922, up 20.5 percent over a year earlier. Total television also showed strong gains with the nine-months figure totaling 9,960,807 which amounts to an increase of 15.1 per cent over the nine months figures a year earlier.

Both RCA and Zenith report color TV sales to dealers at record or near record levels while other manufacturers report performances substantially ahead of last year.

EIA also reported soaring dealer sales in radio. For September 7,765, 263 units were sold, up 60.5 per cent over September of 1976. For the nine months, EIA said, total radio sales were 39,446, 360 and this amounted to a hefty 35.6 per cent increase over figures for the comparable period a year earlier.

Tube Warranty Practices Criticized

The Chicago chapter of NATESA (National Association of Television and Electronic Servicers of America) says members are becoming increasingly concerned over the "growing practice" of circuit tube sales without warranty and it is considering notifying the Consumer Advocates office in Washington, D.C.

According to NATESA president George Weiss, "Ultimately it will be the consumer who will get burned if this trend continues."

Although manufacturers about two years ago discontinued warranties on circuit tubes, distributors were giving a 5 per cent discount to cover faulty tubes. Now, Weiss said, some distributors in the Chicago area have discontinued the practice of passing on the 5 per cent discount to service dealers and others are contemplating following suit.

"Right now I find in my own shop a 10 per cent tube failure rate, and it is not the $3 tubes that are giving out. It's the bigger $12 tubes.

"If one of these breaks down in the home there's the additional consideration of a $25 service call we have to sacrifice, so it's a problem of labor costs as well," he said.

A statement released by NATESA said that an August 12 letter to tube manufacturers and marketers calling attention to the situation has gone unanswered. The non-warranty policy "is conducive to a serious drop in quality," NATESA charged, and added "it appears that such is already the case" since field reports indicate the 5 per cent allowance "definitely is not compensating for the cost of needed replacement and certainly not for the cost of calls."

In addition to the proposal that the Consumer Advocate be notified, NATESA said it was also suggested that servicers "find new sources re-

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ELECTRONIC TECHNICIAN/DEALER

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THE COVER: Raymond Lipinski, Acting Director of Biomedical Engineering at Northwestern Memorial Hospital, Chicago, adjusts a non-fade display monitor in the hospital's Intermediate Coronary Care Unit. Telemetry signals transmitted from mobile heart patients allow the staff to monitor heart functions in real and delayed time.

DEPARTMENTS

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gardless of point of origin" or simply tell the customer there is no warranty even though "this obviously will...nullify guarantee on the set as well."

In a letter sent to tube manufacturers, NATESA said the present situation "is not conducive to good industry or consumer relations (and) servicers being on the 'firing line' are catching most of the flak."

Zenith Seeks Supreme Court Decision; Announces Third Quarter Loss

Zenith Radio Corp., which announced in October a 25 per cent reduction in its U.S. workforce over the next year and transfer of its module and chassis assembly operations to foreign shores, has officially asked the U.S. Supreme Court to review a lower court's ban on counter duties on Japanese consumer electronics products.

Zenith has long been seeking U.S. government intervention in what it has termed unfair competition. Specifically, Zenith cites the Japanese government's practice of rebating to Japanese manufacturers excise taxes on consumer electronics products for import to the United States.

Although Zenith won an initial U.S. Customs Court ruling defining the rebate as a Japanese government subsidy to manufacturers, a federal appeals court reversed that ruling.

Opposing the Zenith position is the U.S. Treasury Department which fears a world trade debacle since many Japanese and European manufacturers are the beneficiaries of similar tax considerations by their governments on items for export in world trade. Apparently the U.S. is in a bind over the situation since the sanctioned General Agreement on Tariffs and Trade has said such counter duties would violate world trade agreements.

Joining Zenith in its bid to have the Supreme Court settle the issue are several U.S. television manufacturers and labor groups as well as the U.S. Steel Corp.

Zenith contends the effect of the Japanese government's rebate policy allows consumer electronics products sold in Japan to be sold in the United States for up to 40 per cent less in price.

If the Supreme Court decides to hear the issue, it will most likely hand down a decision sometime around the first of the year.

In another announcement Zenith said it had suffered a $12.9 million third quarter loss, primarily through the write-off of an inactive color picture tube plant in Lansdale, Pa. The loss amounted to 69 cents per share with the plant write off accounting for 65 cents.

For the first nine months Zenith sales totaled $724 million, compared to $699 million in 1976 and net income totaled $600,000, compared to $24.8 million for the comparable period a year earlier.

CB Or Not CB

CB radios are often the whipping boy for all kinds of reported television interference, reports the Citizens Radio Section of the Electronics Industries Association, when in fact the problem may be common household appliances.

That statement came from the Citizens Radio Section as it proposed new technical standards to eliminate what it called the "occasional interference" which unwanted signals from CBs cause in TV sets. The section said in a proposal to the FCC that CB harmonic emissions be limited to 75 decibels below the station's 4 watt power limit.

"Harmonics have no communication value to the CB user, but may have the potential for interfering with certain TV channels," especially in high density residential areas. However, the CB section said, a study of American households reveals that the typical private home might contain 60 to 100 devices capable of TV and radio interference, devices such as auto ignitions, household appliances, fluorescent lights, electrical toys "and

many other sources."

In addition, "no significant decrease in reported cases of CB interference to TV reception can be expected until firm action is taken to end the use of illegal power amplifiers."

GTE Reports Earnings Increase

General Telephone and Electronics Corporation reports third quarter earnings of $143.4 million, an increase of 26 per cent over third quarter results a year earlier.

According to a company spokesman the improvement was attributable to "substantial increases" in manufacturing earnings from the communications products and consumer electronics products groups.

Theodore F. Brophy, chairman, said the consumer electronics products group sustained a $4.3 million third quarter loss in 1976 but this year showed a $444,000 gain.

Briefs

EIA's 10-year forecast for the government electronics market indicates a modest real growth rate of 1.4 per cent, or 7.4 per cent when the expected 6 per cent rate of inflation is counted in—EIA's Board of Directors has voted to support Sony's position in the latter's legal battle with Universal Studios and Walt Disney Studios. Universal and Disney allege copyright infringement through the marketing of Sony's videotape recorder equipment—and, Donald R. Kronenwetter has been named vice president of GTE Sylvania's newly reorganized Distributor and Special Markets Division. It was formerly known as the Replacement Markets Operation. ■

NEWSLINE

EXTENSION OF 23-CHANNEL CB SALES IS DENIED. The FCC has turned down requests from 23 CB manufacturers, importers, distributors and retailers for an extension to Aug. 1, 1978 of the deadline for sales of 23-channel transceivers. Thus, the deadline stands at Jan. 1 at which time all 23-channel radios must be off the retailers shelves. The FCC felt that an extension would be unfair to those who have already lost money unloading their 23-channel inventories.

MEANWHILE -- CB MANUFACTURERS ARE HAVING MONEY PROBLEMS. The E. F. Johnson Co., Electronic News reports, is negotiating with its banks for a restructure of its credit agreement in accordance with the company's changed financial situation. Because of an announced third quarter loss of $4.4 million, the firm expects to grant the banks security interest in the balance of its assets. Johnson spokesmen say year-to-date sales were hurt by cost of liquidation of 23-channel radios and oversupply of foreign imports.

DYNASCAN REPORTS LOSS FROM CB SQUEEZE. Dynascan, producer of Cobra CB products, has reported a loss of $682,000 or 24 cents a share on sales of $12,432,000 in three months ended Sept. 30. Dynascan's president, Carl Korn, "Excess supplies of 23-channel and 40-channel models have led to a continuation of price-cutting, and to reduced sales of 40-channel models." Korn said, however, the firm's Industrial Products group continued to show strength with sales exceeding last year's record in test equipment and radio remote controls.

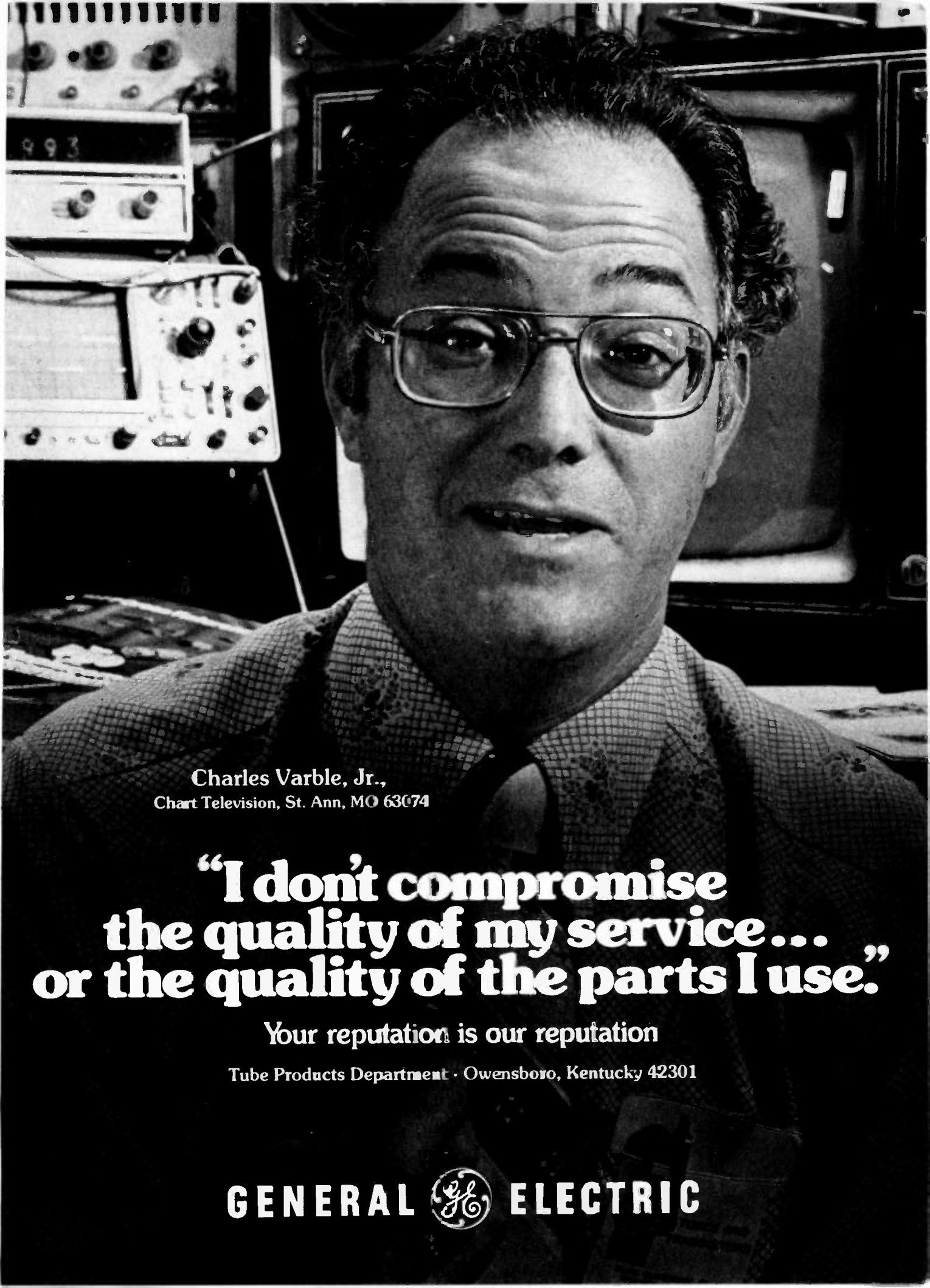
SHARP SURVEY REVEALS LIKELY SALES POINTS FOR HOME VTR. A survey by Sharp Electronics reveals that the TV departments of mass merchandisers and department stores, along with appliance stores and hi fi specialty shops are the most likely places through which home VTR will be sold. Most department stores and mass merchandisers (92%) said the addition of home VTR offered a new opportunity to form "a more advanced consumer entertainment department."

COMPETITION UP -- PRICES DOWN IN VTR. Following the lead of others, Sony has dropped the list price for their Betamax from $1,300 to $1,095. This is still $100 above the new price announced by Zenith for the same unit. Zenith's new price is $995, which makes it competitive with the RCA offering.

FOUNDER OF THE TRIPLETT CORPORATION DIES. One of the few remaining pioneers of the electronic industry, Ray L. Triplett, 93, founder of the Triplett Corporation, died in Florida on October 25. His one room factory, founded in Bluffton, Ohio in 1904, has grown into one of the major test instrument manufacturers.

EICO MOVES TO NEW LONG ISLAND LOCATION. The EICO Electronic Instruments Company, producer of electronic kits and wired equipment, has moved from Brooklyn to new quarters at 108 New South Road, Hicksville, NY. The new location will permit intergration of the company's engineering, production and shipping departments into one modern building.

WINTER CES SHOW IS A SELL-OUT. The 1978 Winter Consumer Electronics Show, to be staged for the first time in Las Vegas, Jan. 5-8, is a complete sell-out with over 75 applicants on the waiting list.



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VTR repair: yes or no?

A recent phone check with many of the television manufacturers who are bringing out one of the two basic VTR units in time for Christmas (see Industry News Page) reveals that training sessions are in full swing. If your service shop is contemplating getting into this service area as it develops, now would appear to be the time to make that decision.

However, there are several things you should keep in mind. Primarily, the considerable investment in equipment you will have to make to service these very complicated machines will have to be weighed against the limited amount of service that will be available initially. VTR service at present is not self-supporting. Whether it becomes self-supporting in the future is a judgmental decision that can be argued either way. However, for the present, it seems likely that to make your investment as economical as possible you'll have to know both the Sony Betamax and the Matsushita VHS formats.

In addition to freeing up a technician for the four or five days of schooling on VTR units, you'll need the following in the way of basic test equipment (in addition to the special jigs which each manufacturer is selling for servicing the servo-mechanical parts of these units).

—An NTSC color generator

—A dual trace, delayed sweep scope with channel 2 polarity inversion and TV sync separator capabilities.

—A quality frequency counter with at least 7 digit readout and 4 place period display.

—And, a quality digital VOM.

Most of the manufacturers have just finished first level training sessions for their distributors. Now it is up to the distributors to continue with the training cycles, sometimes with support from the manufacturer, in other cases without. To be blunt about it, the distributor level training will be geared toward locating authorized retail dealers with service centers and "serious" independent shops willing to purchase the specialized test equipment that goes with the specific VTR unit. To assess your chances of getting into this area, it would be best to contact your local distributor. Meanwhile, here's a rundown on who's doing what in the service training area on VTRs.

SONY: Began Sept. 25th in its four U.S. regions 5-day training seminars aimed at Sony Service Centers, servicing dealers, and selected independents.

GTE SYLVANIA: Began Oct. 17th special 4-day distributor training seminars at various U.S. locations. Second round of training to continue at distributor level with manufacturer support.

ZENITH: Began 5-day session in mid-August for distributors, service centers and independent dealers. Currently accepting class loads of about 30 technicians in Chicago.

RCA: Started 5-day sessions for 70 distributors in late August. Some distributors began a special 1-day introductory course open to all service dealers and centers, plus a second level 5-day program for authorized service centers.

MAGNAVOX: Began Nov. 14th, 5-day sessions for selected franchised independent service dealers.

Suffice it to say VTRs are complicated and precise electronic and mechanical products. For instance, Matsushita's VHS unit contains 9 circuit boards which serve as 13 when operated in the 2 and 4 hour modes. Video information recorded on tape is an FM square wave, the chroma signal recorded on tape is beat down to 629 KHz, drive motors are clocked by video signals. In short, it's a whole new world.

With this issue ET/D is beginning the first of a series of articles on VTRs, or VCRs, if your prefer. I hope they will give you a better insight on what to expect when you come face-to-face with them in the field.

Richard W. Day

TECHNICAL LITERATURE

Indicator Lights and Lampholders are catalogued colorfully and completely in new literature available from Chicago Miniature Lamp Works. The new catalog, No. 7800, describes the company's full line of standard lenses, incandescent and neon indicators, cartridge hardware and lampholders. Each page covers a separate series, showing features, dimensional drawings, electrical and mechanical specifications. Also included are lamp types suggested for use in the various indicators. Available free from George Neeno, **Chicago Miniature Lamp Works,** 4433 N. Ravenswood Ave., Chicago, Illinois 60640.

Chemicals For Electronic Servicing are described and illustrated in the latest catalog from the Rawn Company. The new 12-page catalog covers such chemical servicing aids as tuner cleaners, tuner lubricants, circuit and component coolers, cements for all types of repair work, protective and insulating coatings, solvents and polishes. Prices are included. This new catalog is available free from **Rawn Company, Inc.,** Box 9, Spooner, Wisconsin 54801.

Getting To Know OSCAR-From the Ground Up is the title of new guide book to amateur communications satellites from the American Radio Relay League. In 14 sections, the new book provides an introduction to space communications, the equipment needed, a description of the brand-new OSCAR satellite and future ones now under construction. Each copy of the book contains a four-color tracking device that makes finding the satellites an easy task. Available for $3 from **The American Radio Relay League,** 225 Main Street, Newington, CT 06111.

CB Microphone Adapters for 1080 models and 153 CB transceiver brands are cross referenced and described in a new 4-page guide available from GTE Sylvania. The new guide identifies the right Sylvania Match-All adapter to use with the different CB brands and models. The guide, which is in alphabetical order, also contains a listing of those CB radios which require other Sylvania microphones. Available free from CB marketing Dept., **GTE Sylvania Inc.,** 100 First Ave., Waltham, Mass. 02154.

Pre-packaged Electronic Components are shown in the latest catalog from Sprague Products. Catalog C-651 contains 28 pages of information on carded components ranging from all types of capacitors, including trinners, to carbon-film and vitreous-enamel resistors, silicon and germanium transistors, rectifiers, diodes, integrated circuits, quartz crystals, optoelectronic devices, switches, wiring components, pulse transformers, and CB noise filters. Available free from distributors or from Technical Information Service, **Sprague Products** Co., Marshall Street, North Adams, Mass 01247.

Mobile Communications Antennas for all frequencies used for mobile-to-mobile and mobile-to-base operations are described in the latest catalog from Larsen Electronics. Both quarter wave and gain types are featured with a variety of permanent and temporary mounts included. Over 200 antenna types, frequency ranges, and mounting styles are detailed. The catalog is indexed by both number designations and description for easy finding of specific styles or models. Available free from **Larsen Electronics,** P.O. Box 1686, Vancouver, WA., 98663.

Sub and Microminiature Switches for many applications are covered in the most recent catalog from C & K Components. The 48-page catalog describes and illustrates brand-new offerings of the company in the first five pages ranging from actuators, bushings, terminations and interchangeable nylon lever handle caps for toggle switches. Also in the catalog are specifications for: toggle, rocker and lever handle, printed circuit mounting, snap-acting pushbutton, alternate and action and momentary pushbutton, subminiature and microminiature pushbutton, illuminated rocker, power, slide, and thumbwheel switches. Available free from **C&K Components, Inc.,** 103 Morse St., Watertown, MA 02172.

The Proper Use & Care of Hand Tools is the subject of handy 88-page booklet available now from Klein Tools, Inc. Tools covered are pliers, screwdrivers, wrenches, striking and struck tools, vises, clamps, snips, tool boxes, chests and cabinets. The booklet contains hundreds of illustrations which show how to select the proper tool for various jobs, the care and maintenance of tools and many of the hazards which can result from misuse of tools. Cartoon characters are used to emphasize the test. This new literature is available free from **Klein Tools, Inc.,** 7200 McCormick Road, Chicago, Illinois 60645.

Quartz Crystals Technology is covered in a new 150-page manual avail-

able from the Sentry Manufacturing Co. The new book is said to take the mystery out of understanding and using quartz crystals. It helps you specify what you need for your commercial two-way, marine, aircraft, public service, ham and monitor radios. Also, frequency charts for 23 channel sets and what crystals are need for conversion to 40-channels. Available for $2.95 from **Sentry Manufacturing Co.**, Chickasha, Oklahoma 73018.

AC/DC Power Supplies and Converters are described in a new 8-page booklet from Analog Devices. Full product summaries are included of the firm's 900 series AC/DC modular power supplies, available with 5 to 24 volt output and current ratings from 25 mA to 2A and modular DC/DC converters that satisfy a wide variety of floating single 5V and dual 15V power requirements. The booklet also describes the newest additions to the company's line of chassis mount supplies. Available free from **Analog** Devices, Inc., P.O. Box 280, Norwood, MA 02062.

Test Instruments, Assembled and in Kit Form are covered fully in the 1978 catalog from Eico. The new 38-page book features their complete line of electronic kits and factory assembled instruments, burglar/fire alarm systems, and CB accessories. Completely new test instruments for 1978 are: portable digital multimeters, function generator, portable IC color generator, digital frequency counters, a solid state triggered sweep 10 MHz oscilloscope, a self-service tube tester and a digital power supply. New CB accessories include a 100 watt in-line wattmeter, an SWR/Power meter, a mobile field strength meter and power supplies. Available free from **Eico Electronic Instrument Co., Inc.**, 108 New South Road, Hicksville, N.Y. 11801.

New Test Instruments in 9 separate product categories and designed for use in industry, quality control, service, education and communications are featured in a newly published 12-page short form catalog from Leader Instruments. The new brochure features dual trace and single trace oscilloscopes ranging from 30 MHz bandwidth down to 4MHz; digital multimeters with single pushbutton semi-automatic operation; audio analyzer systems; color bar generators; counters, bridges and testers; signal generators for CB, audio and RF testing; wow and flutter meters; and 9 communications testers. Available free from Patrick Redko, **Leader Instruments Corp.**, 151 Dupont St., Plainview, N.Y. 11803. ■

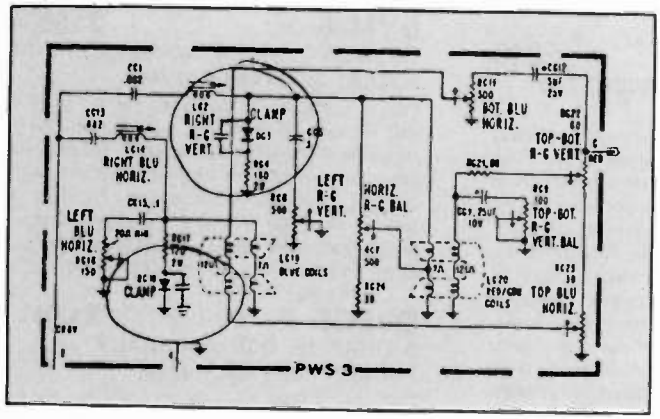
SERVICE SEMINAR

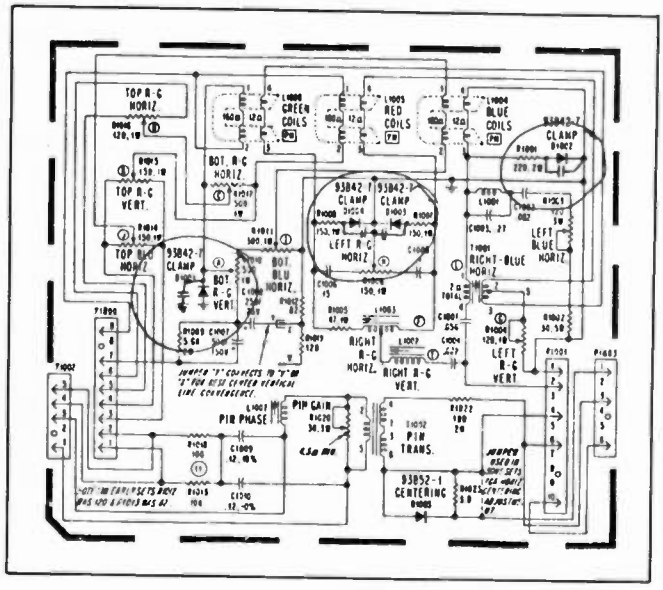
The material used in this section is selected from information supplied through the cooperation of the respective manufacturers or their agencies.

ADMIRAL

Color TV Chassis K10 & K19—One or two thin, dark, vertical interference bars from left to center of picture

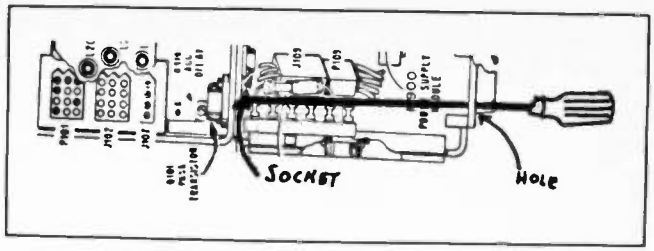
These bars, which are more prevalent on the low VHF channels, may only be noticeable on weak signals or when using a built-in antenna. The position of the bars changes when the horizontal dynamic controls on the convergence board are adjusted. This is not the same as 'snivets' which are caused by the horizontal output tube during UHF operation. The problem can be corrected by adding a 680pf 500V capacitor across each of the clamp diodes on the convergence assembly, as shown in drawings below. The top diagram is for the K10 chassis, and the bottom diagram for the K19 chassis. Keep the leads short.





Color TV Chassis M10—Service Hint for Replacing Transistor Q101

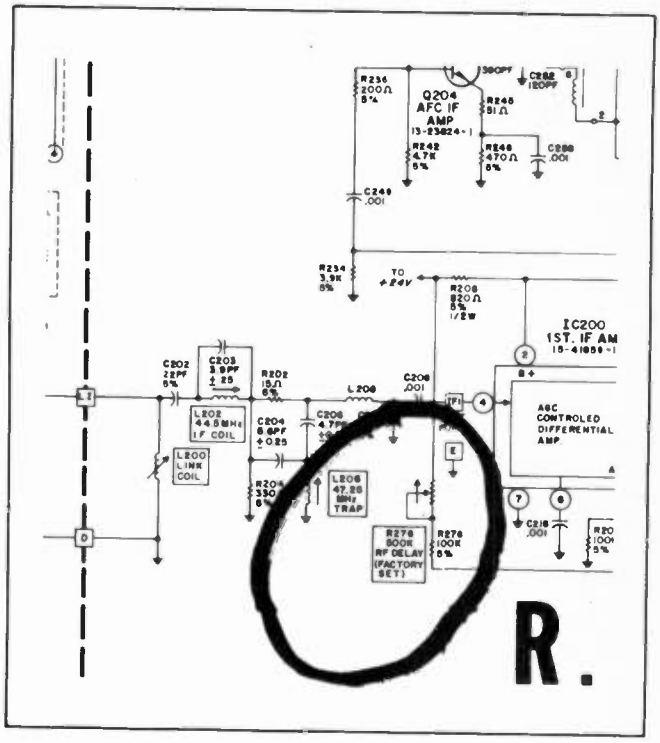
When replacing the forward pass transistor Q101 the transistor socket may slip out of its retainer while inserting the new transistor. Improper installation could be the result with failure, then, of Q101, blown fuses, etc. To avoid this problem, insert a blunt rod or tool through the lower of the two holes in the bottom left rear of the chassis shown below, and to the left of the power supply panel. Pressure can then be applied to hold the socket in its retainer while removing and inserting the new transistor.



GTE SYLVANIA

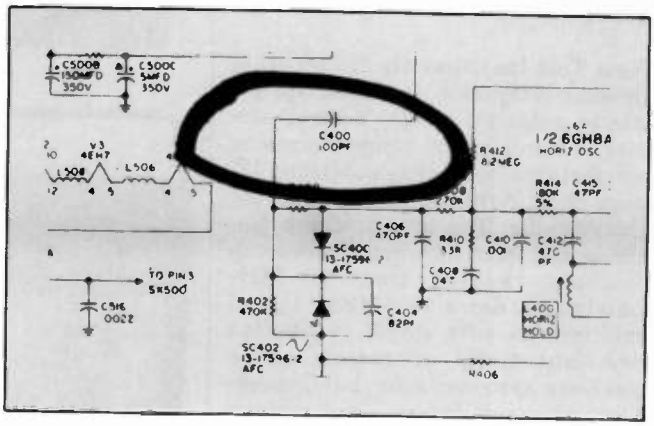
Color TV Chassis E06/08/20/21—Snowy UHF picture

The cause is probably the RF AGC Delay (R276) set too high. Do not replace the UHF tuner. Instead, check the delay control.



B/W Chassis B-10-7—Horizontal oscillator will not start except when set has been in 'instant on' mode. Then it is off frequency.

The fault is capacitor C400 which is shorted. Replace.



B/W Television (console)—Correction of VHF dial slippage

Properly calibrate VHF dial, and then remove complete dial and hub assembly from tuner shaft. Install soft wire staple through the plastic dial and hub as shown in dia-

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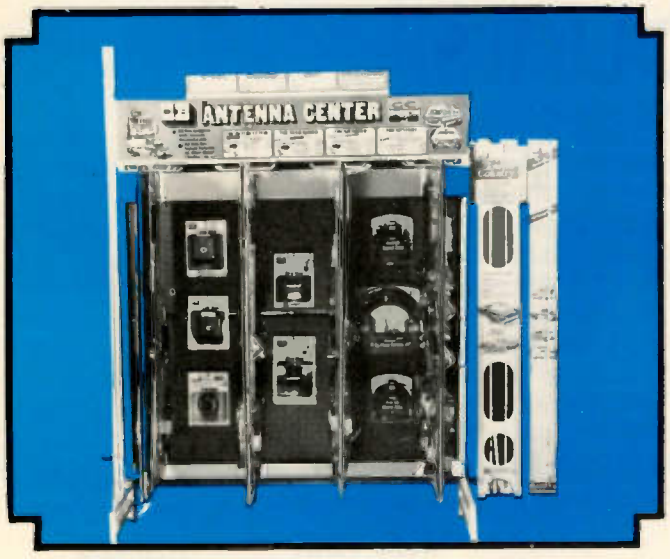

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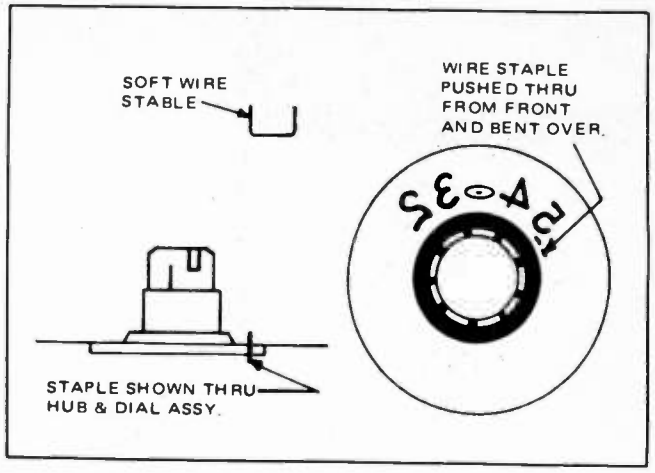
gram. Use a low wattage soldering iron to heat staple as you push it through hub and dial. Then bend staple over on the backside.



GENERAL ELECTRIC

Color TV Chassis CD—Poor horizontal sync or no horizontal sync This refers to sets serial coded 5T3T and later sets with stick HV rectifier. The cause is a decrease in value or an open with the 39K, ½ watt resistor, R251. The solution is to replace R251 with a 39K, 1 watt 10% carbon resistor.

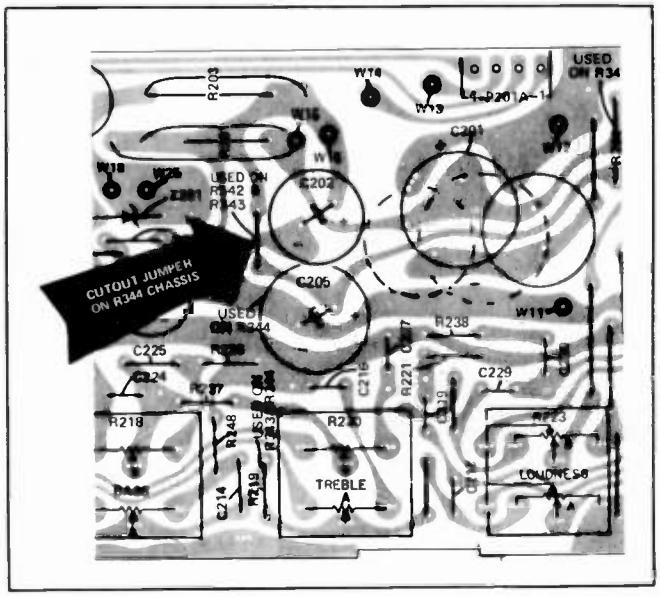
Color TV Chassis MC & MB-75—When the grass is not green. To solve this 'blue grass' problem, first, set up the fleshtone properly in both the auto and manual positions with the tint control. Then turn the core of L642 on the chroma

module clockwise one full turn. This reduces the demodulation angle by about 25 degrees. Next, check the tint control in the manual position to make sure that the fleshtone range is still wide enough. Then widen fleshtone range, if necessary, by turning L642 counterclockwise until the desired results are attained. This adjustment is only possible on EP93X41 modules. It is fixed on EP93X89 modules.

MAGNAVOX

Radio Chassis R344—C202 capacitor failure

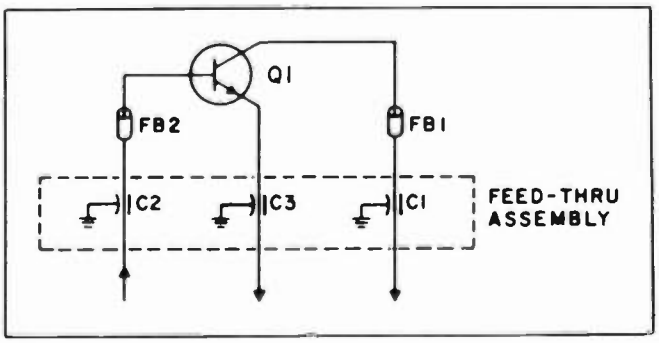
A few R344 stereo console chassis were produced with a jumper at C202 installed. This jumper is intended for use only on the R342 and R343 chassis. When it has been installed wrongly in the R344, it can create distortion at high volume levels, and can eventually damage C202. If the jumper is found in an R344 chassis being serviced, remove the jumper.

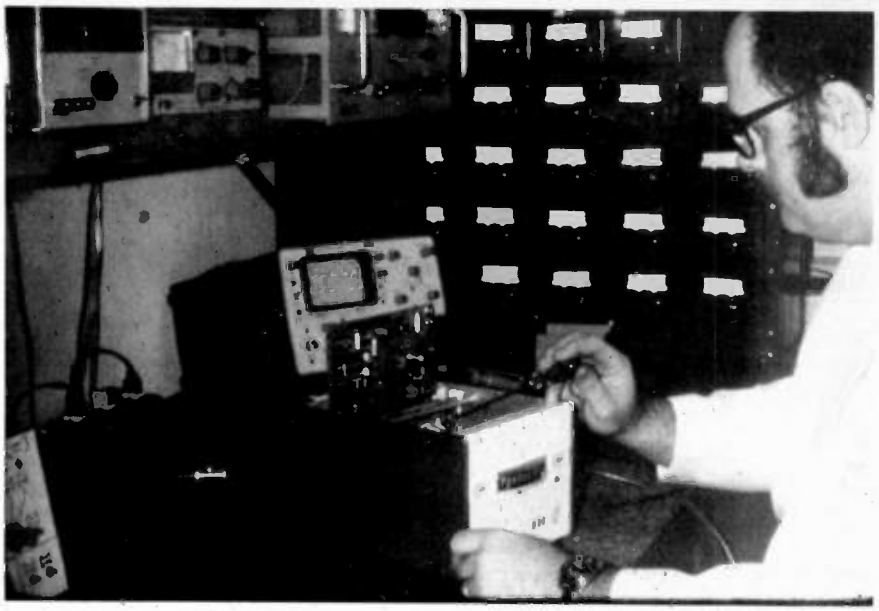


Color TV Chassis T995—Replacing the feed-thru capacitance assembly

In late production of the T995 chassis, three feed-thru capacitors and two ferrite beads have been added to the horizontal output stage. The capacitors are soldered to a mounting bracket which is attached to the heat sink alongside the horizontal output transistor, Q1, as shown in the diagram. The connecting leads to the base and collector pass through the opening in the ferrite beads.

If replacement of one of the feed-thru capacitors is necessary, you can save time by replacing the entire feed-thru assembly, which consists of the bracket and capacitors soldered in place. The ferrite beads are not provided because the originals can be re-used. Part number is 171441-1.





The author servicing an ECG amplifier module.

Tapping the medical electronics market

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

■ *(Editor's Note: The sale of medical industrial electronic equipment to medical institutions within the United States now constitutes a market that surpasses $660 million annually. It is expected that medical instrumentation sales will increase at a rate of 15 to 20 per cent through 1980. All of this equipment needs regular service and calibration. As part of ET/D's goal of keeping the consumer electronics service industry aware of expanding opportunities, we present this general overview of the medical electronics service business and how to break into it).*

Biomedical equipment servicing is one of the service industry's growth areas and potentially quite profitable for both service companies and individual technicians. Considering that some 1,300 manufacturers offer about 10,000 different models, the medical equipment industry obviously is healthy enough to structure a career around, or a business from.

I know from experience that the person who is really qualified to service a solid-state color television receiver is knowledgeable enough in basic electronics to *learn* medical equipment servicing. There's little that is exotic, but some specialized knowledge is required.

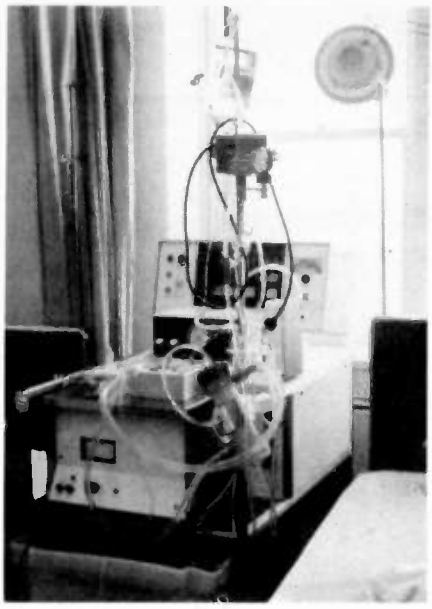
So how do you get this knowledge? The best is from a formal program at a college, university, or technical institute. A good background in electronics courses, plus a few courses in biomedical instrumentation or something similar would be in order. A number of community colleges now offer such programs and their popularity is growing everyday.

And don't forget to check your local library or scientific bookstore for such books as the one I have written, "Servicing Medical and Bioelectronic Equipment" (TAB Books No. 930). Medical equipment manufacturers themselves provide well written and complete service and training manuals on their own products.

*(*Mr. Carr is Senior Bioelectronics technician at the George Washington University Medical Center, Washington, D.C.)*

WORKING IN THE HOSPITAL ENVIRONMENT

The hospital is a sensitive area,



A renal dialysis machine.

so things that might be marginally acceptable in other jobs or shops will be unacceptable in the hospital. When you enter a patient's room to repair a cardiac monitor, for example, you are expected to get in and out as quickly as possible. There's no room for the chit-chat that might be tolerated on a television service call.

Extremely high standards of craftsmanship are enforced in the hospital environment. Hospitals will give job preference to technicians who are certified by one of the existing certification groups (see accompanying list elsewhere in this article). Sloppiness in this business can be fatal. I recall the case where a defibrillator failed to operate when the doctors tried to resuscitate a heart attack victim. Subsequent examination revealed a classic case of bad craftsmanship. A technician had soldered a tubular electrolytic across the open section of a multiple-section electrolytic capacitor in the power circuit. The bad section of the electrolytic eventually shorted to ground (as they often do) and this rendered the machine inoperable. We will never know if this killed the patient, but the technician who takes such shortcuts has no business in medical electronics.

A point to remember if you contemplate getting into medical electronics is that you won't be servicing electronics alone. Many very important devices are actually electro-mechanical in nature.

Included in this list would be the renal dialysis "kidney machine." It contains electrical as well as mechanical components and no small amount of plumbing. Other electro-mechanical devices you'll run up against are the intra-aortic balloon pump, heart lung machines, autotransfusion pumps, respirators, suction pumps and a host of other devices.

KNOW YOUR MARKET

If you are a shop owner contemplating a medical service business, an investigation of your potential market will give you a good idea of your chances. In the larger cities there will probably be others doing the same type of work. However, smaller towns often offer the best opportunities.

A reader in a small western town wrote to me about a proposal he received from the local hospital administrator. The hospital wanted local service for their coronary care unit patient monitoring system. The nearest factory service was out of San Francisco, some 600 miles away. Each service call, one every three weeks, cost not less than 8 to 10 hours in time (at $35 an hour). Add air fare for the technician and air freight for his equipment and parts, and the hospital ended up typically paying $500 per call—or about $9,000 a year.

To check out your service shop's potential in this area, first determine who does the buying. Hospital departments are economic activities not unlike businesses, and you may be able to sell your services to specific departments if not the whole institution.

Service purchase decisions may be made by any of the following people, either singly or in concert with each other: administrator, assistant administrator, purchasing director, director of materials management, medical doctors, department heads, director of nursing, head nurses in intensive care units, operating rooms, emergency rooms or dialysis units, and lastly the director of plant operations. More recently, you may have to "sell" the clinical engineer, senior biomedical equipment technician (BMET), or a technical administrator.

WHAT SERVICES SHOULD YOU OFFER?

The two areas where many hospitals seem to be potential customers are in repair and a regular preventive maintenance program. The repair function must be clearly defined so you will have to decide on what you can do. You should remember, too, it is virtually mandatory you offer 24-hour service seven days a week. In fact this may help you get an account if the competition in your area does not provide such service, or fails to deliver as promised. In some cases, hospitals use outside vendors only after hours so that they do not have to pay a salary differential to the in-house technician. This then could be your foot in the door.

If there are only a few hospitals in your locale, and you want their general electronic repair business, it will be wise to assemble a list, by manufacturer and model number, of their intensive care, coronary care, operating room and emergency room monitoring equipment, all of the electrosurgery equipment in the OR, and all of their ECG (electro cardiogram) machines. Contact each manufacturer to inquire about doing their service formally. If new installations are contemplated inquire about becoming a warranty station. In any event, try obtaining all service manuals and other pertinent literature, plus a list of recommended spare parts. Generally the service technician at the plant is the best source of information.

Preventive maintenance has become a major consideration in hospitals because of the requirements of the JCAH (Joint Commission on Accreditation of Hospitals) and insurance carriers. Also, it's necessary as a legal safeguard in medical malpractice suits.

This job may be performed in-house or by an outside contractor on a fee-for-service basis. The job may range from checking a piece of equipment to a complete mechanical rebuilding. But, beware of contracts that leave you open to liability for the cost of some repair parts, as they can be quite costly.

BASIC TEST EQUIPMENT

Although some specialized equipment is necessary in medical electronic service, most of the test instruments required will be of the same sort as needed in any electronic servicer operation.

Oscilloscope: It should have a

bandwidth of not less than 5-MHz (15-MHz is necessary if a lot of digital circuits are serviced). It should be dual trace and have a triggered sweep circuit.

DMM: Capable of setting a potential to 0-volts + 10-*millivolts*. This means at least 3½-digits of resolution, which is no longer either uncommon or expensive.

Electrosurgery apparatus are high powered R.F. generators capable of delivering upwards of one ampere of R.F. current to a 500-Ohm (non-inductive) dummy load. Therefore you will need a tester that provides a means for observing the waveform (safely!) on an oscilloscope. This capability is necessary for servicing some solid-state electrosurgery equipment.

Another required instrument is the electrical safety analyzer. Safety considerations in medical environments are far more critical than in other places, so a constant surveillance program must be followed. An addition to this is an electronic a.c. leakage current tester for more portable operation.

The ECG waveform simulator, affectionately dubbed a "chicken heart", is used to provide a reasonable waveform to ECG preamplifiers when troubleshooting or testing.

Also required will be a defibrillator analyzer, and be sure to specify a model that has an oscilloscope output jack. These devices are little more than a 50-Ohm dummy load, driving an integrating voltmeter calibrated in watt-seconds.

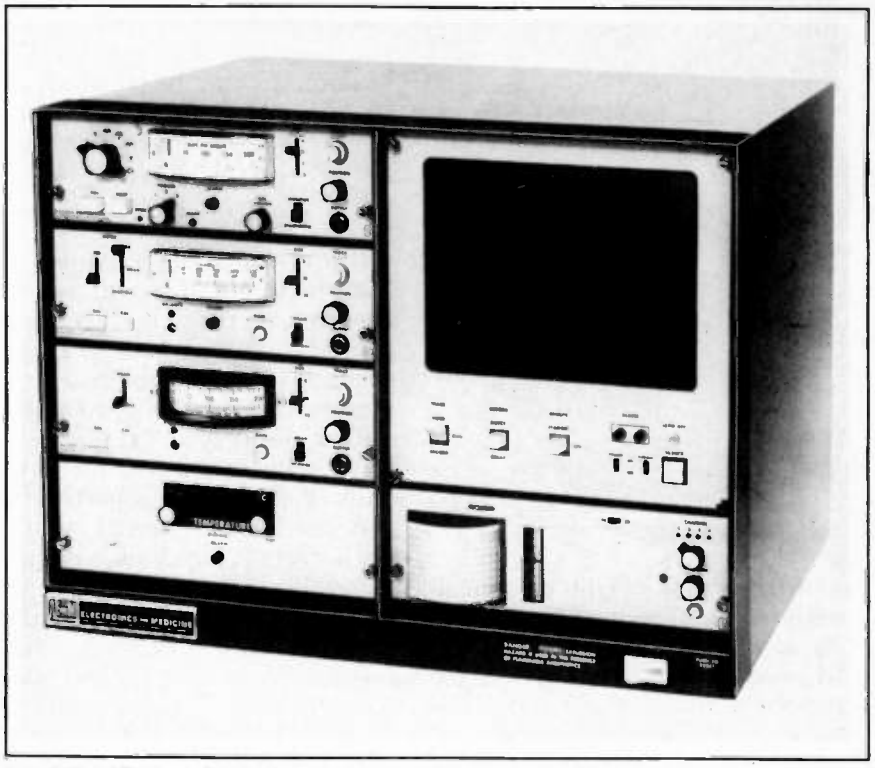
A leading supplier of specialized test equipment for the BMET is Med-Search Systems, Inc.; 5480 Wisconsin Avenue; Chevy Chase, MD 20015. They are in a position to make up a starting package of instruments from several manufacturers.

CERTIFYING ORGANIZATIONS

There are two non-governmental organizations offering certification for medical electronics technicians—in addition to the Veteran's Administration which has its own certification procedure.

Certified Electronic Technician (CET) program of ISCET (1715 Expo Lane; Indianapolis, IN. 46224). This organization offers a medical electronics option.

Association for the Advancement of Medical Instrumentation (AAMI—1901 Fort Myer Drive; Suite 602; Arlington, VA 22209). The AAMI also certifies clinical engineers, who are often responsible for directing the efforts of BMET's in addition to performing the functions of consultant on medical equipment purchases, design of new devices and facilties planning.



A bedside patient monitor system *(courtesy of Electronics for Medicine).*

JOB ROLES IN MEDICAL ELECTRONICS

The Biomedical Equipment Technician (BMET) fills the most common job roles in medical electronics regardless of whether he works for a vendor, manufacturer, or is employed in-house by a hospital. His duties will be to troubleshoot, repair, calibrate, inspect and manage the maintenance of medical equipment as well as to instruct other hospital personnel on the proper operation of the equipment.

Below are listed the most common functions of the BMET.

The Factory BMET: Usually works out of a local field office with company car and modest expense account. Will service his company's line of equipment and make new installations. Generally they report incomes of $10,000 to $22,000.

In-House BMET: Salary generally ranges from $10,000 to $16,000 a year. Works regular hours at the same location every day. He may be employed by the maintenance or "plant operations" section, one of the hospital's clinical departments, or a separate department of biomedical or clinical engineering.

Independent Vendors: They come in two varieties, national corporations and local service companies. The locals tend to be operated in much the same manner as consumer electronics and two-way radio shops. Pay is usually competitive but advancement may be limited due to smallness.

National Corporations, such as Honeywell, Inc., and The Stanwick Corporation, provide maintenance services. Pay and incentives are about the same as for manufacturer's technicians, but these technicians will service a much broader range of equipment than the factory servicer. ■

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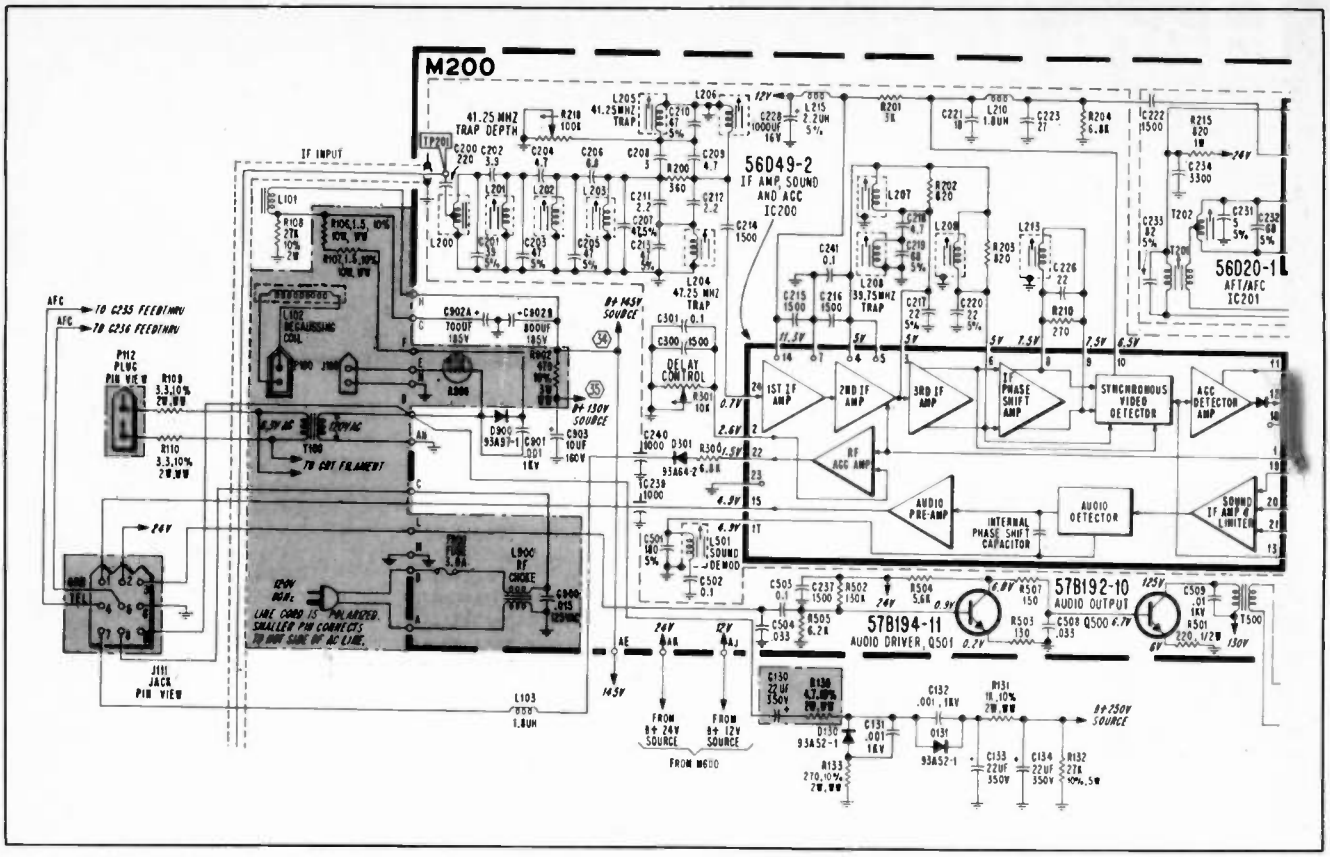

Fig. 1—A section of the schematic for Admiral chassis 25M55M showing the source of +145 and +250 B+ voltage supplies.

Admiral color television for 1978

Eight models in Admiral's 1978 color TV line feature the new 25M55M chassis which is basically an M45 chassis with modifications. We take a look at the changes.

■ A total of thirteen new models make up the 1978 color TV line for Admiral. Five of the thirteen use last year's 9M50 chassis with electronic tuning, and the remaining eight models feature the new 25M55M chassis. All models use the negative matrix 90 degree delta CRT. The new 25M55M chassis is basically an M45 chassis which has been modified for full N-S and E-W pincushioning as well as to drive the larger 23-inch and 25-inch delta CRTs. Now let's take a look at circuitry which is new with the 25M55M chassis.

POWER SUPPLIES

The 25M55M is a line-connected chassis (Fig. 1) that gets its B+ from two basic rectifier supplies. One is a +145 volt source primarily used for horizontal and vertical sweep output. This supply is then decoupled to produce +130 volts for the audio output. The other rectifier supply is a +250 volt source for the RGB output amplifiers. The +250 volt source is required in the case of delta CRTs because a 140-150 volt bias is needed between cathodes and grids for gun cut-off. Actually, 170 to 180 volts of instantaneous signal/DC is used for gun cut-off because the control grids are already operating at about 30 volts above ground.

An isolation transformer must be used during servicing as one side of the AC line is 'hot'. It's this hot side that provides the AC source for the half wave diode, D900, used in the +145 supply, and diodes D130 and D131, as a half wave doubler to produce the +250 volt supply. The hot side of the AC line is also applied across PTC R900 and the degaussing coil, L102.

The low voltage supply (+24 and +12 volts) that operates the front end, the tuners, the low level signal and low level sweep circuits comes through Module M600 but is derived from the positive flyback pulse (Fig. 2) that appears across the horizontal output transformer, T101, secondary winding between pins 7 and 10. This is a pulse-derived supply even though it is often called 'scan-derived'. It is actually produced by the 40KHz flyback *pulse* oscillation.

The +250 volt supply which, as has been noted, is required by the delta CRT for gun cut-off, is produced by the doubler circuit (Fig. 1) that includes diodes D130 and D131. This doubler circuit works in the following manner: Diode D130 starts to conduct to ground through capacitor C130 and resistors R130 and R133 during that half of the AC cycle when the 'hot'

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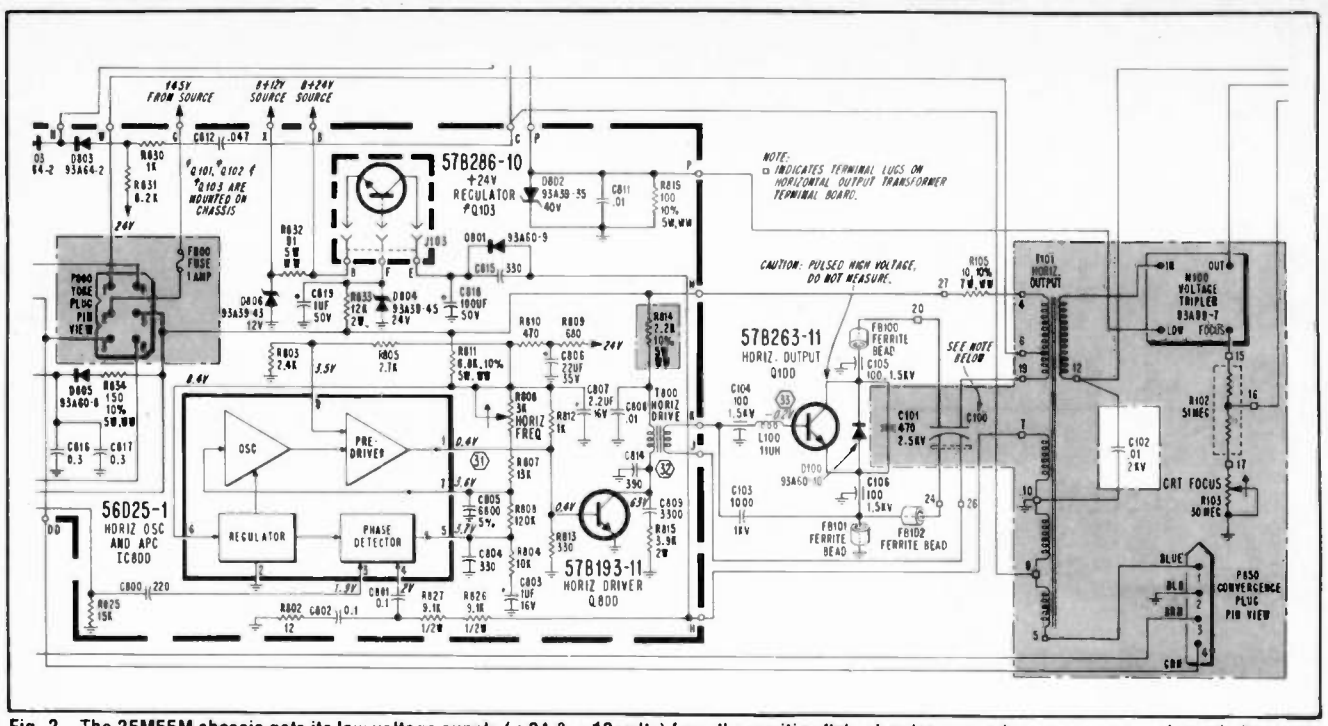


Fig. 2—The 25M55M chassis gets its low voltage supply (+24 & +12 volts) from the positive flyback pulse appearing across a secondary winding of the horizontal output transformer.

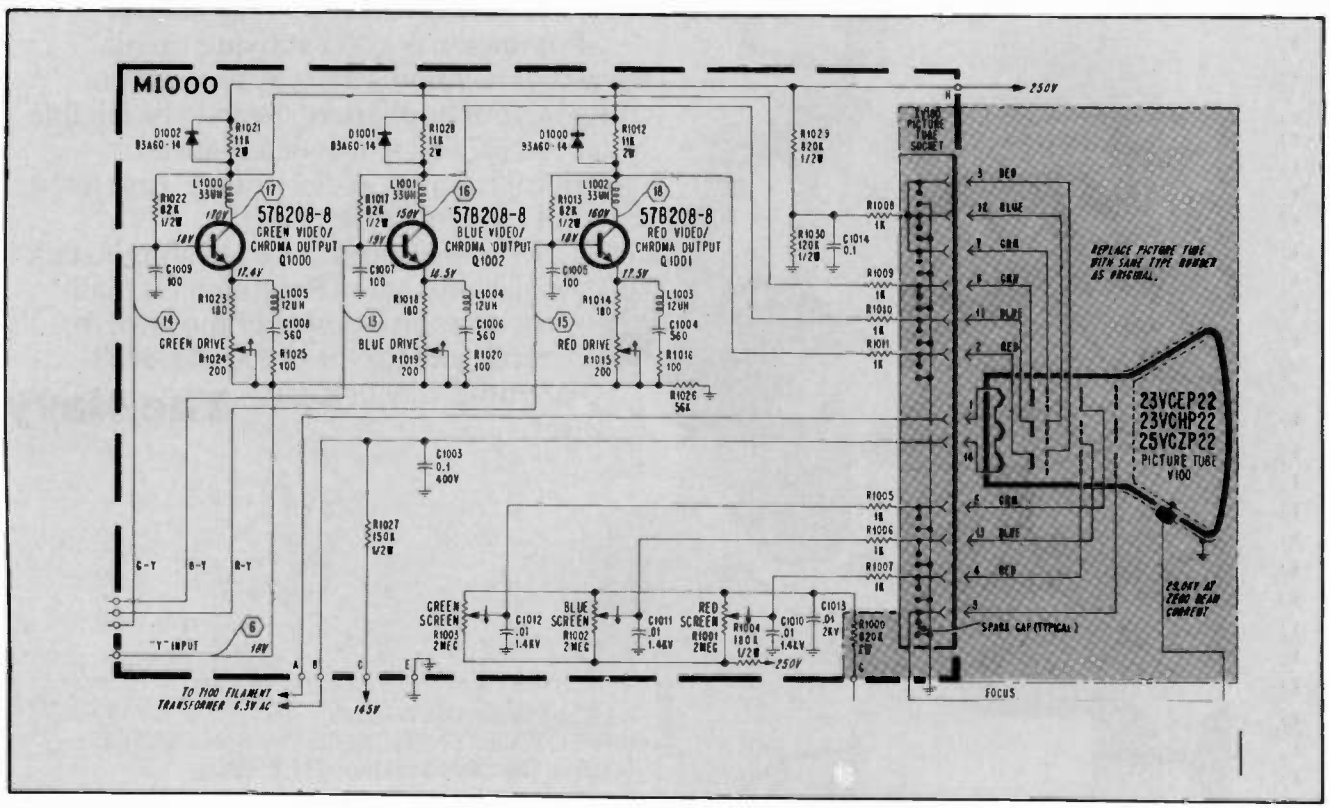


Fig. 3—Separate drive and screen controls are included for each gun in the 25M55M chassis to accommodate the new delta CRT.

side is negative with respect to chassis ground. This action charges capacitor C130 to near line voltage peak. Then, when the hot side of AC becomes positive with respect to ground during the other half cycle of AC, diode D131 starts to conduct with a path from ground through filter capacitors C133 and C134, and then through D131, R130 and C130 to the positive AC source. The two voltages produced combine to produce almost twice as high a charge across filter capacitors C133 and C134 as could be obtained from a simple half wave rectifier.

THE SIGNAL SYSTEM

The signal circuits—front end AGC loop, Y video and chroma—are almost the same as in the previous M45 chassis except for some minor modifications. The changes, mainly, have been made to accommodate the new delta CRT. For example, separate drive controls are used in the emitters of the green, blue and red amplifiers, as shown in Fig. 3. And separate G2 screen controls are included for each gun. The G2 supply voltage is produced by a separate diode in

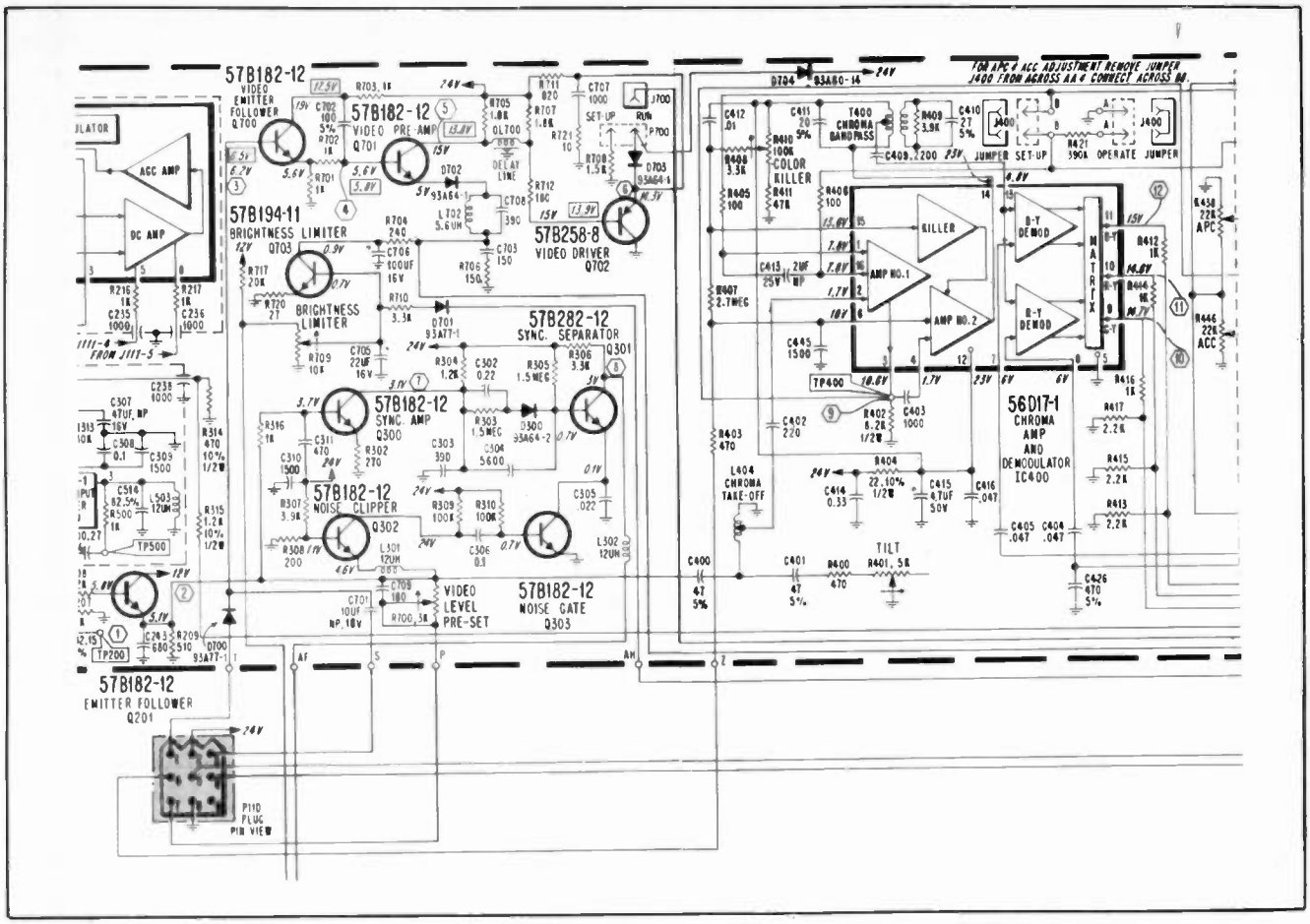


Fig. 4—A portion of the 25M55M schematic that contains pre-set controls for tint, color and brightness.

the H.V tripler, M100, (Fig. 2) and is obtained from the flyback pulse input return winding at pin 12 of the horizontal output transformer.

The +250 voltage supply described earlier is used as the R,G, and B collector source for cut-off of the CRT guns. A +145 volt supply was used for this purpose in the earlier M45 chassis.

PRE-SET CONTROLS

When the Admiral color control (ColorMaster) system is in operation, pre-set adjustments for tint, color and brightness are substituted for manual customer controls. The connections from the control assembly to the chassis are made through jack J110 and plug P110.

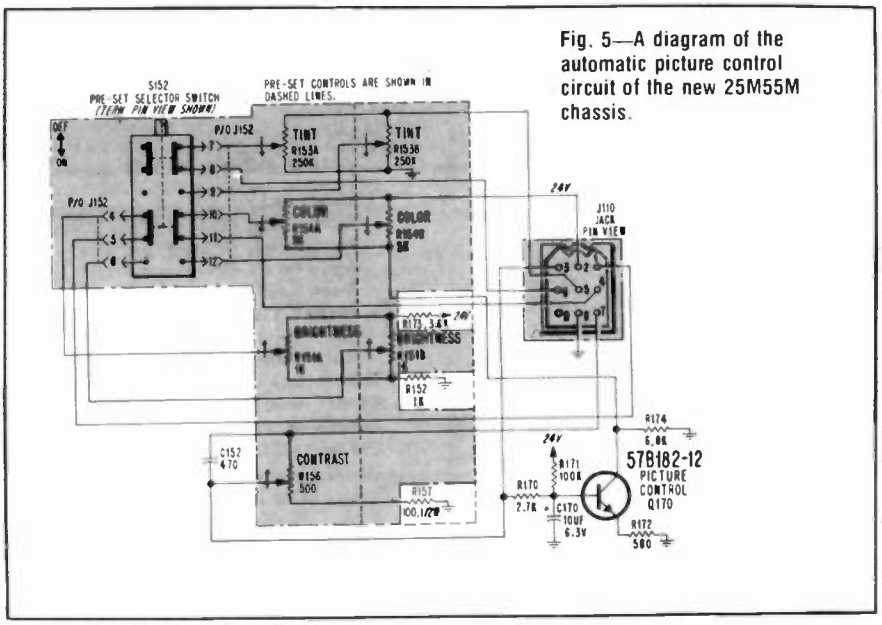


Fig. 5—A diagram of the automatic picture control circuit of the new 25M55M chassis.

Brightness

Whether pre-set or manual, the brightness control varies the positive DC voltage at pin 1 of P110 (Fig. 4). This voltage is applied to the anode of the Video-Emitter/Follower, Q700. Because of DC coupling through the remainder of the "Y" channel, the DC bias voltage is altered at the CRT cathodes which in turn changes the average CRT gun conduction and, therefore, brightness.

Color

The color gain control (Fig. 4) varies the DC voltage on pin 4 of P110. The voltage is then applied to pin 6 of the Chroma Amp and Demodulator IC400 which, in turn, varies the gain of the 2nd chroma amplifier in the IC. The color gain increases as the voltage is decreased toward zero volts.

Tint

Depending on the ColorMaster setting by the customer, either the manual or pre-set tint control arm (Fig. 4) is connected to pin 6 of P110. This connection shifts the 3.58MHz oscillator output phase, which in turn, changes the de-

modulation angle of the demodulators in IC400. The source DV voltage for the tint control potentiometers appears on pin 5 of P110. The altered tint voltage from the arm of either manual or pre-set tint control is applied to pin 1 of Subcarrier Regenerator IC401.

CONTRAST CONTROL

In Admiral's 25M55M chassis, the contrast control is not pre-set. It is a manual control in series with a video level pre-set, which is a service adjustment. The video level control selects the proper peak-to-peak composite video for the "Y" channel input. Admiral's service literature for the 25M55M chassis points out that this video level control is necessary because there is no signal loop gain level adjustment for the front-end AGC gain loop, and thus the composite video can vary widely from set to set.

The contrast control center arm (Fig. 4) is connected to pin 3 of P110 and then through a 10 mfd coupling capacitor (C701) to the base of the video emitter follower, Q700. DC coupling is used in all "Y" circuits from C701 to the CRT cathodes.

AUTOMATIC PICTURE CONTROL

A device, Q170, in the 25M55M chassis known as "picture control" automatically changes the color level of the set in accordance with the amplitude of the "Y" video content. By observing the circuit of Q170 (Fig. 5), you'll notice that the base has a 10 mfd capacitor to ground to bypass any signals that might be present. This means that Q170 is only a DC device. Its collector voltage is the source voltage for the color gain control potentiometers.

Three resistors, R171, R170 and R157, and the contrast control, R156, make up a voltage divider from the +24 volt supply to ground. However, as Admiral's technical literature points out, "a calculation of the maximum change in voltage from this divider that would result at the arm of the contrast control over the full range of the control would show it to be less than .1 volt. Thus, a larger voltage source must be involved for the picture control device."

This larger voltage comes from the emitter of the 1st video stage, Q201, which varies slightly with black content, but is inversely proportional to the energy level of the IF signal. This source voltage, with a DC value of about +3.5V with normal signals, appears across the divider made up of the video level pre-set, R700, the contrast control, R156, and resistor R157 to ground.

When the contrast control is turned down, a less positive (or more negative) DC voltage appears at the arm of R156 as well as at the base of Q170. As a result, less collector current flows through Q170, and a higher (or more positive) voltage appears at the collector, and along any point on the divider in the collector circuit. This divider connects from the +24 volt supply and through the color gain control and finally through R174 to ground. The more positive voltage from the arm of the color control is applied through pin 4 of J110-P110 to pin 6

continued on page 45

Modular chroma circuits, part two: Adding luminance

After last month's discussion of the different methods of sub-carrier regeneration, we go a step further to show circuit variations after demodulation.

By Bernard B. Daien

■ In the TV receiver, the red and blue demodulators drive the red and blue amplifiers which in turn drive the grids of the CRT, as shown in figure 4A. To derive the green signal voltage (only red and blue voltages are transmitted) we combine voltages from the red and blue amplifiers in the proper proportion at the green amplifier. (This proportion is minus 51% of the red signal voltage plus minus 19% of the blue amplifier output). Notice that the *input* to the red amp is labeled −R−Y, and the blue amp −B−Y. Thus a phase reversal occurs as the signal passes through the amplifier stages. This, of course, is easily obtained due to the addition of the extra stage of gain employing a common cathode (or common emitter) configuration.

This is important, because by noting the signs on the signal labels going into a module or IC it is possible to analyze the circuit and its defects, with the aid of the schematic diagram.

In the circuit of 4A it is usual to apply the color signals to the CRT grids, and the luminance signals to the CRT cathodes. But now look at figure 4B. It is similar to 4A, except that the color amp outputs are now R+Y, G+Y, and B+Y, indicating that *both color and luminance signals are present* in the outputs of the color amps. Look again, and notice that there is also a Y input to the color amps. Since the Y is not inverted in the color amps, the input is probably to the *emitters* of the color amps, hence is not inverted. Trinitron tubes, which had one grid and 3 cathodes, had all the inputs applied to the cathodes via the color amps, in similar manner, except, since the *cathodes* were driven the signals were inverted to −R+Y, −G+Y, and −B+Y. So you see that there are many variations of the basic color circuits.

ADDITIONAL CONSIDERATIONS

The previous examples should enable the reader to follow the signal paths and phases, and understand them. So let's proceed to apply what we have read to some actual color sets. First, however, we must make a few general comments about some other things you will find on modules, which might cause problems, if you fail to keep them in mind.

Many modules have jumpers on spare terminals, which are wired to form interlocks on the power sources in the set. Removing a module often turns off all, or part of the set, to prevent damage, or for safety reasons. A dead, or partly dead set is often due to a dirty module contact...so a good point to start on a modular set is by cleaning contacts. Lift the module partly off the contact, spray the contacts with tuner spray, and reseat the module. Do it a few times if necessary. It's surprising how often the set is "repaired". Remember, the average set uses about 8 modules, with a dozen or more contacts active, so we have one hundred or more *metal contacts* which can sit there for years, tarnishing. A 99% "good" rate is not enough with 100 contacts!

In addition, many modules have built in "on board" voltage reg-

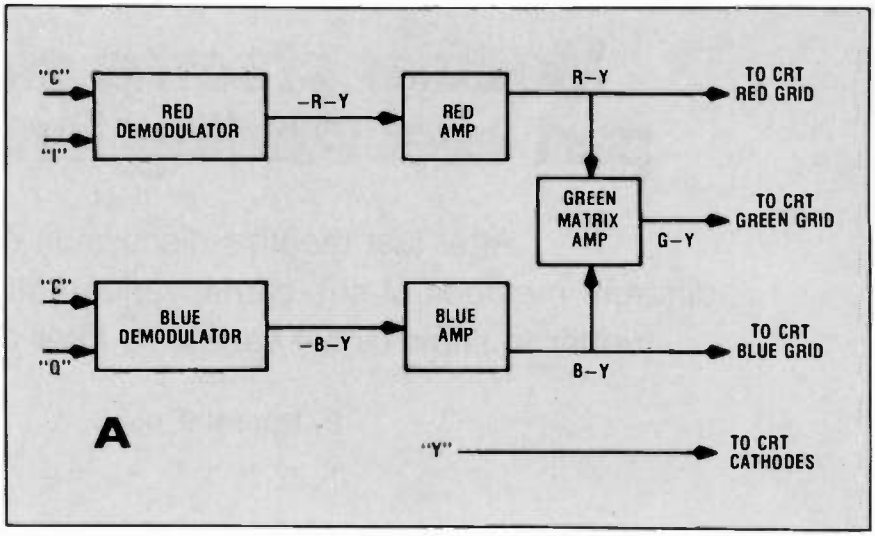
ulators. Older TV sets used main regulators, or voltage dividers to supply all circuits. Today, many integrated circuits have regulators on the chip, for three reasons. *It* spreads the heat, eliminating the need for heavy, heat sinked power regulators and high power resistors. Second, each module can run at a different voltage as required. Third, it reduces the need for big decoupling filters in the supply leads, since the regulators wipe out ripple, signals, and noise on the power leads. But we now have many little regulators, and sooner or later we have failures due to sheer numbers involved. Since the regulators control the *internal* voltages on an IC, you may have to probe the pins to see if the dc voltages are ok, *even if the supply line to the module is good.*

TEST EQUIPMENT

I have evolved a little technique that helps in this regard. It consists of wiring up one of those little retractable probe type miniclips to a two foot insulated test lead terminating in an alligator clip. The module can be removed, the miniclip clipped on the desired point, the module replaced, and you have a lead brought out for test purposes with power on the module. These insulated miniclips can actually clip onto one IC lead without touching the adjacent one! Probing such closely spaced terminals with your meter test leads often results in shorting two pins together and blowing out the circuit.

To get back to the chroma modules, remember the chroma is 3.58 mHz, so if you wish to see the signals on a scope you must have a scope flat to 4 mHz. You will also have to take your sync from either the sync separator, or the horizontal keying or blanking pulses (say, the keyed agc pulses), using the external sync on your scope, and adjusting the frequency to the horizontal rate of 15,750 to see one line. You should hook up your color bar generator, set for color bars, so that you have a steady signal with a consistent information pattern.

The RCA CTC 76 is a recent chassis, which illustrates many of the things we have discussed. (See



April 1977 TEKFAX #1689). Since the chroma in this set is spread over five modules, I suggest you obtain the schematic, in order to obtain the most from this section. Chroma I module is an MAC002 and contains the chroma bandpass amplifier, ACC, color killer, burst amp, 3.58 mHz oscillator, *and the zener diode used as a reference for the voltage regulator used on another chroma module* (the MAE001B). In addition there is a tint centering control, and a 3.58 mHz oscillator frequency trimmer, on the module.

WHICH BOARD IS BAD?

The output of the Chroma I amplifier module drives the Chroma II module, (the MAE001B), which contains the 90 degree phase shifter, the red and blue demodulators, and the R–Y, G–Y, and B–Y low level color amplifiers. This board has a voltage regulator on it, which uses the reference from the Chroma I module. *Thus a defect in the Chroma I module, or its removal, will drastically affect the dc voltages on the Chroma II module.*

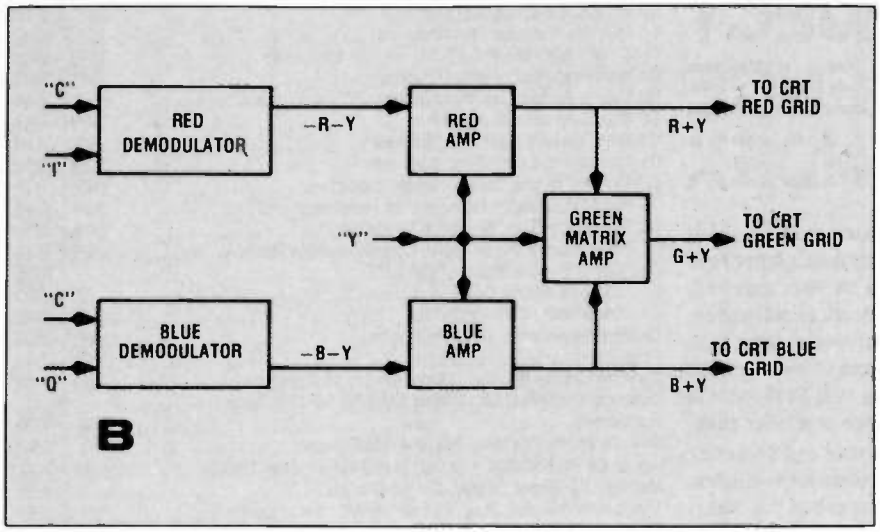
Each of the three color amplifiers drive an output color amp, on a separate module. Thus there are three identical MAD001 modules. The relatively high voltage of 150 volts dc is applied to these amplifiers, as well as horizontal blanking pulses, for horizontal retrace blanking. Each MAD001 module drives one of the *cathodes* of the color CRT. The video (luminance, "Y") signal is also applied to the cathodes of the CRT. The three CRT grids are tied together, and bias applied.

Thus we have a total of five modules involved in the chroma, plus the CRT tube's elements, which also affect the color. It should be noted that when a color defect occurs, the CRT should be tested as a matter of routine, and if good, the CRT socket should be removed and the operating voltages at the socket measured. Quite often chroma modules are replaced when the actual problem is a bad connection to the CRT, a bad potentiometer in the screen circuits, a shorted spark gap capacitor, or defects in the PC board.

At this point it is advisable to stress the common sense fact the modules should not be removed or replaced with the power on the set. Further, modules with large capacitors should have the capacitors discharged with a 5000 ohm 5 watt resistor before reinserting in the set, as the heavy discharge current from a large capacitor can destroy other components.

LOSS OF COLOR

Since we know that the ACC and color killer circuits are in the Chroma I module, along with tint centering, defects in these functions would indicate this module likely to be at fault. Loss of color could be due to loss of input, failure of the 3.58 oscillator, loss of voltage applied, or failure of the Chroma II module. It is unlikely that all three MAD001 modules would fail, but loss of one color may indicate a defect in one of them.



The most important lesson to be learned from this popular set, which has a chroma system similar to many other RCA modules receivers, is that servicing modular chroma is not very different from servicing a set with one large PC board. You still have to use a schematic, and you still have to understand chroma theory. The big advantage of the module is that *you can trade in a piece of the set*. This is a lot better than pulling a chassis into the shop, or hauling a console down the stairs! It still requires a skilled tech, a schematic, and some reasonable amount of test equipment.

In this regard, you should be aware that some set manufacturers have over-simplified the problems of modular set repair, as a selling point for the customer, as well as the service-dealer. This leaves the service tech, who must face the customer, stuck with the customer relation problem of telling the customer that his modular, instantly repairable set, will cost close to $50 to repair. Consider an intermittent, for instance. It could be on either of two modules. Replace two modules at $16 each, plus tax, plus service call. Time in house 20 minutes! (No module tester available). Alternative;...replace each module in turn, wait for intermittent to act up, charge for time in house. The bill will be the same. It is a fact that a large percentage of modules turned in as defective are actually good!

"EDUCATED GUESS" PAYS OFF

Since neither the set manufacturers nor the semiconductor manufacturers have felt any obligation to market testers for modules, or linear IC's, (to replace the tube testers), the service tech will have to make some "educated guesses", and consequently some mistakes, without these needed diagnostic instruments. More about this after looking at another set.

The General Electric MC chassis (see TEKFAX #1614 in Nov. 1975), uses modules which have a high percentage of discrete parts, and some ICs. Like the Zenith, RCA, and Magnavox sets of the same year, the CRT cathodes are driven elements, with both color and video applied, (R+Y, G+Y, and B+Y).

The large number of accessible discrete parts in this set makes it attractive to attempt module repairs. The Chroma module has a voltage regulator on it, a color killer threshold control, ACC control, and a chroma gain equalization control. There are two ICs on the board, one a chroma processor with the burst regeneration function in it, the other is a color demodulator and matrix which delivers R-Y, B-Y, and G-Y outputs to the "R G B Amplifier" module. There is also an input from the video section, which is combined with the color inputs. As a result, the output of the RGB Amp is R+Y, G+Y, and B+Y, driving the crt cathodes. Three drive controls are on the board. This set has both positive and negative supply voltages, with minus 21 volts, and positive 23 volts applied to this module. Following a recent trend, some of the sources are derived from the horizontal output transformer.

MAKE VISUAL CHECKS

Before trading in a module, especially one with mostly discrete components, it is advisable to closely *examine* the board under a good light, with a magnifier. Modern resistors must meet certain safety standards, and unlike the older composition resistors, they crack before showing much discoloration. You must look for these cracked components, as well as defective semiconductors. All voltage regulator transistors seem to have a high failure rate, so it is advisable to test them first if the voltages are incorrect on the board.

Now for diagnostics. With a color bar generator hooked up to the antenna terminals of the set, tune for the best presentation of the bars, and then look for the waveforms from each of the color amplifiers, using horizontal sync from the sync separator, or some other convenient point in the set. If one or more is missing, go to the inputs of the color amps, which are almost always accessible. This will determine if the problem is in the color amps, or further front in the receiver. If the color demodulators have chroma in, and if the burst regenerator is running, there should be output from the color demods, otherwise, the problem is in the demods. Lack of burst regenerator output, "I" is readily noted on the scope, as is loss of "C", (chroma).

ADDITIONAL CHECKS

Be sure to check for color killer action. Often "C" is lost because the killer threshold is set wrong, or has drifted over a period of time. The waveforms involved are very easy to recognize after you have seen them. Unfortunately troubles in the picture I.F., or automatic fine tuning can lead to loss of chroma by putting the color carrier too far down the slope of the IF response curve. If the fine tuning on the tuner does not have enough range, the same thing happens. I have restored color on many sets

continued on page 45

ET/D 1977 SUBJECT REFERENCE INDEX

To make the articles easier to find in the back issues, we have coded the listings in the following manner: first the subject, then a letter code in parenthesis indicating the department in which the item appeared, and finally a number code indicating, first, the month of publication, and secondly, the page in the magazine. The departmental letter code used is as follows: (NP) New Products; (NI) News of Industry; (SS) Service Seminar; (TR) Test Instrument Report; and (DS) Dealer Showcase. Feature articles are indicated by the absence of a letter code.

Information on subjects covered in the November and December issues of ET/D was not available until after presstime for this index. Thus, they are listed under the months at the end of this index.

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IN THE DECEMBER ISSUE

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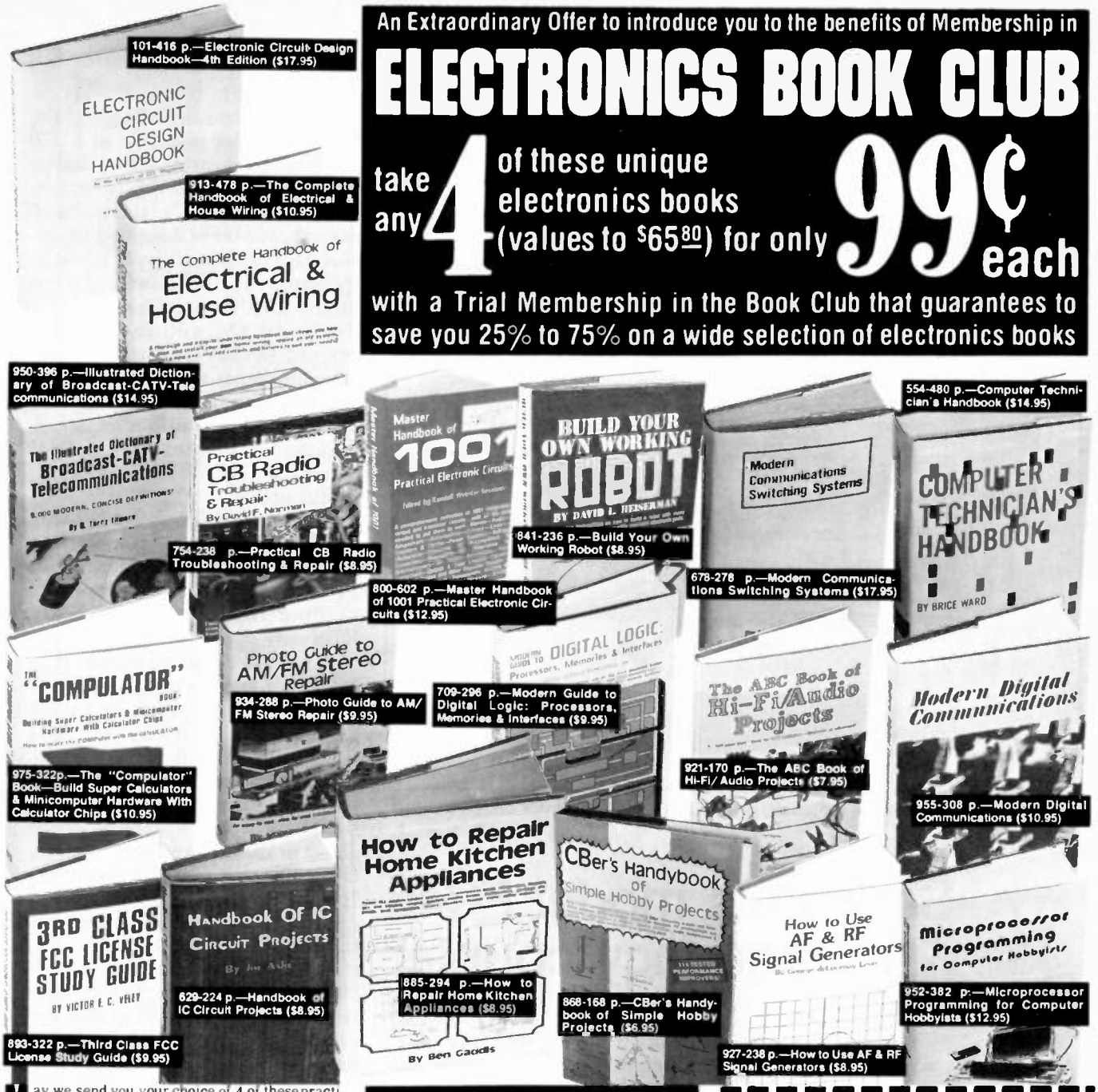

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TEST INSTRUMENT REPORT

For more information about this instrument, circle 133 on the Reader Service Card in this issue.

Sencore's model FC45 frequency counter

■ Sencore's FC45 frequency counter would be a versatile welcome addition to any test bench whether you're into digital clock circuits, CB, land mobile and marine, ham or FM-TV servicing. An optional prescaler extends the range into UHF.

While you'll feel perfectly at home using it as a permanent bench top accessory, it is light enough (6.5 pounds) to be picked up and carried out to the car where you can plug it into the 12-volt cigarette lighter for on-the-spot testing.

It's completely push button operated for quick adjustment of operating modes and the eight large ½-inch LEDs make the display easily readable whether used in the shop or on the car seat in the light of day.

In addition to its 30 Hz to 230 MHz standard range, the PR47 prescaler (optional at $125) can extend the range of the counter to 600 MHz for UHF coverage. Loaded with 15 ICs, the state-of-the-art counter is designed to provide average 25 millivolt sensitivity across the VHF band and when used with the prescaler, 225 millivolts in the 450-to-600 MHz range. Sencore reports that all measurements exceed FCC specifications for communications work with 1 part per million accuracy.

Some of the features of the FC45 which you should find especially useful are:

—A built in high power (12-watt fuse protected) 50-ohm dummy load for direct connection of the FC45 to the transmitter (for use in reading frequencies above 100 KHz only).

—A front panel universal crystal socket for checking any crystal with a fundamental frequency of 1-to-20 MHz. Tests on 500 KHz, 3.58 MHz, and 4 MHz crystals came out right on the button.

—Mini clip counter probe with a switch right on the probe for either direct or isolated connection to the test point. With the probe in the "isolated" mode, a 33pf isolation capacitor is placed in series with the test lead to prevent detuning that may occur in many sensitive circuits when a direct connection is made. (The 12 VDC power lead and the direct/isolation probe are supplied with the FC45).

One accessory I found most useful with the FC45 was the PL207 RF pick-up loop for $9.95. It's especially handy for probing in low-level circuits where direct connections will upset the oscillator frequency even with the direct/isolation probe. Just lay the pick-up loop next to a coil preferably, but sometimes a transistor or capacitor will do the trick, and you can verify, for instance, the presence of your 3.58 MHz CW in chroma troubleshooting. The same goes for frequency checks in the horizontal or vertical oscillator sections of the TV, although direct connections also worked in the latter two circuits.

But the PL207 isn't for low level circuits exclusively. It'll also see

you through frequency checks in higher power transmitters where voltages exceed the FC45's 1 Meg input rating or the 12 watt rating of the 50 ohm dummy load.

The FC45 is operating from seven front panel push buttons. Frequency range buttons of 30 Hz to 30 MHz and from 30-to-230 MHz; input buttons of 50 ohm, 1 meg. and the "crystal" check button. Two other "read rate" push buttons will give you updated reading either once every second or 10 times a second.

The special crystal check connector is located in the front as well as the on-off and a special 9-volt output to power the optional prescaler. A back panel connection is for the 12-volt DC supply input.

The manufacturer's specified maximum input in the 30 Hz to 10 KHz range is 250 volts pp; from 10 KHz to 30 MHz, 50 volts pp; and 8 volt pp (3 volts rms) in the 30-to-230 MHz range. However, these input limitations may be exceeded by a factor of 10 when the FC45 is used in conjunction with a 10-to-1 low capacity scope probe, which incidentally increases the 1 meg input impedence to 10 Megs. ■

SPECIFICATIONS

INPUT FREQUENCY
1 Meg Input: 30 Hz-230 MHz
50 Ohm Input: 100 KHz-230 MHz
Crystal Check: 1-20 MHz Fundamental Frequency—overtone crystals read at approximate fundamental frequency.

ACCURACY
±timebase accuracy, ±1 count

RESOLUTION
30 Hz-30 MHz: 1 Hz (1 S timebase) 10 Hz (.1 S timebase). 30 MHz-230 MHz: 10 Hz (1 S timebase) 100 Hz (.1 S timebase).

SENSITIVITY
50 Ohm Load: 10 milliWatts average (see graph 1)
1 Meg Input: 30 Hz-30 MHz: 20 m V.30 MHz to100 MHz: 25 mV. 100 MHz-230 MHz: 25 to 400 mV (see graph 2).

INPUT PROTECTION
50 Ohm: Diode protected to 12 Watts. Fuse protected over 12 Watts.
1 Meg Input: 250 VP-P to 10 KHz. 50 VP-P to 30 MHz. 8 VP-P to 230 MHz.
DC Blocking: 250 Volts.

TIMEBASE
Crystal Frequency: 10 MHz—oven controlled.
Setability: ±0.1 ppm (.00001%).
Temperature stability: 1 ppm (.0001%), 0-40° C ambient after 10-minute warmup.
Time Stability: 2 ppm/year after 30 days

GENERAL
DISPLAY: 8 digit, 0.5" LED, Auto decimal, "Hz" and "MHz" indicators.
SIZE: 5.5" x 7.83" x 9" HWD (14 cm x 19.9 cm x 22.9 cm).
WEIGHT: 6.5 lbs. (3 Kg).
POWER: 105-130 VAC, 50/60 Hz, 30 W max. (220 VAC conversion available) 12 VDC, 2.2 Amps maximum.
FUSE REQUIREMENTS: .5 A, 3 AG Fastblow for 50 Ohm input, 2 A 3 AG Fastblow for 12 VDC leads. Two spare fuses supplied. AC line: transformer internally fused.
ACCESSORY OUTPUT VOLTAGE: 9-12 VDC through front panel jack to power PR47 Prescaler.

ACCESSORIES
Supplied: 39G112 Direct/Isolated Counter Probe
39G111 Fused DC Supply Lead
Optional: PR47 UHF Prescaler
NE206 Noise Eliminator
PL207 RF Pick-Up Loop
39G80 10:1 Lo Cap Probe

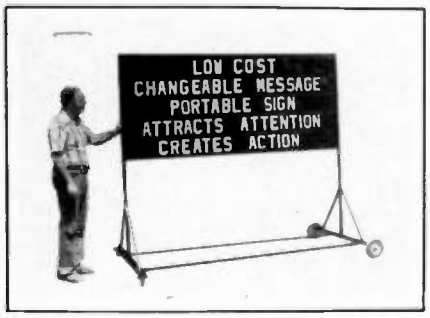
Specifications subject to change without notice.

DEALER SHOWCASE

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

PORTABLE CHANGEABLE SIGN 134

A new double-faced, portable and changeable sign unit is now available from *Berloc Sign Co.* Each side of the sign offers five complete lines of copy and comes with a font of 200 heavy-gauge aluminum letters. Lightweight and unbreakable, the complete set of 6½ inch letters, file box and index can be held in one hand. Letters slip quickly and securely in place, permitting messages to be changed in minutes. The panels are 8 feet wide by 3½ feet high. The steel frame is 7 feet high. Front wheels are included for portability. Priced at $595.



PHONO CARTRIDGE MAINTENANCE KIT 135

A new kit that allows the consumer to inspect, maintain, install and replace delicate phono needles and cartridges is available now from *Robins Industries*. Called the 'Stylee' kit,

components included are: precision stylus handheld microscope, screwdriver, tweezers, and stylus cleaning fluid and brush, all packaged in a permanent plastic storage case. The nucleus of the kit is the hand-held microscope with precision optically designed lens of sufficiently high powered magnification to reveal imperfections and wear points. The kit has a suggested list price of $10.

MICROPROCESSOR CRYSTALS 136

A new line of "time-base" microprocessor crystals for use in TV games, toys, home computers and advanced commercial and industrial computer applications is announced by *United States Crystal Corp.* Marketed under the name of "Synclock", the new crystals are precision made, high quality crystals engineered to close tolerance specifications for stability and lower resistance levels. They are aged, individually tested and factory sealed in protective packages for in-store merchandising. A display unit is also available, on a 'no-risk' deal for dealers. A full credit return plan allows dealers to trade-in any frequencies which prove to be slow-movers.

CB ANTENNA FOR CYCLES 137

A new CB antenna, called the "Super-Broad", that delivers broad band coverage over the entire 40 channel CB range with low SWR readings is available now from *Antler Antennas*. The antenna, Model 1C40, has an adjustable clamping bracket that

locks onto tubing or bars up to one inch in diameter. It is made of heavy-duty, chrome-plated steel and is finished to eliminate sharp edges or corners. The antenna is a 'center-load' style that is precision tuned at the factory. The whip is made of 17-7 stainless spring steel and is adjustable for fine tuning.

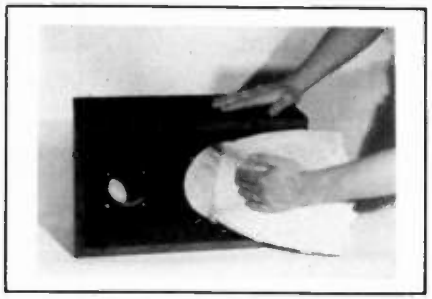
RECORD CLEANER ROLLER 138

A new roller-type record cleaner which lifts dirt, fingerprints, dust and smudges from within the ridges of phonograph records and renews itself by simple washing in warm water and detergent is being introduced by *Rotel*. The new roller/cleaner uses a rubber-elastomer material which is said to

never lose it original surface tackiness, and will not affect the record surface or label in any way. Comes with a protective plastic collar that slips over the roller to prevent nicks, mars and cuts that would affect the surface. It is offered in a see-through, polymer container with a pre-formed, plush velvet platform/liner. Retails for $20.

ACOUSTIC PADDING FOR SPEAKERS 139

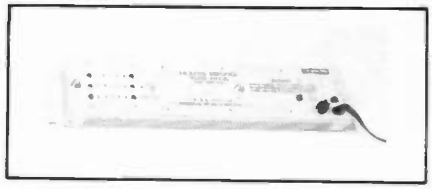
An easy-to-handle, non-irritating material for the acoustic padding of speaker cabinets is being introduced by *Audiotex*. Designed for sale to do-



it-yourselfers, the new product, called Tufflex, is made of natural wood fibers, and is said not to irritate skin like fiberglass. Tufflex provides total damping of standing sound waves and prevents cavity resonance in the speaker enclosure. It will also help to eliminate undesirable echos, feedback and reverberations. It is available in 55 inch by 24 inch by 1 inch sheets.

AM RADIO AMPLIFIER 140

A new AM radio amplifier, Model AMA-51, which will boost radio sales by providing clear, static-free reception in showrooms is now available from *Extronix, Inc.* The new unit amplifies signals received by a rooftop antenna and retransmits them to overcome the poor receptions in steel-frame buildings, and the electrical interference generated by fluorescent lights, elevators and appliances. The amplifier boosts the whole AM radio band (540-1600 KHz) to a satisfactory reception level without tuning. Composite output is rated at 3.0 volts in 75 ohms with all distortion at least 40 dB down. Installation is made with ordinary TV cable.



If you are an executive and have not heard of Drake-Beam & Associates...

You should have.

Drake-Beam & Associates, Inc. is a consulting organization specializing in the application of behavioral sciences to the solution of "people-problems" in business.

Drake-Beam is particularly skilled in the design and implementation of innovative approaches aimed at increasing the utilization of its clients' most valuable resource — people.

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Executive Search . . .
Through a unique, dynamic and demonstrably successful approach, finding the right person for a key position in your organization.

Mid-Career Guidance . . .
Revitalizing a valued employee whose performance is failing within your organization: improving the performance of a key management member who has high potential.

Personnel Research & Assessment . . .
Providing sound recommendations about organization and individual problems by means of attitude surveys and individual psychological assessments. Drake-Beam also validates hiring and test selection procedures.

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Making individuals and groups more productive through team building and job design.

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...for more details circle 132 on Reader Service Card

NEW PRODUCTS

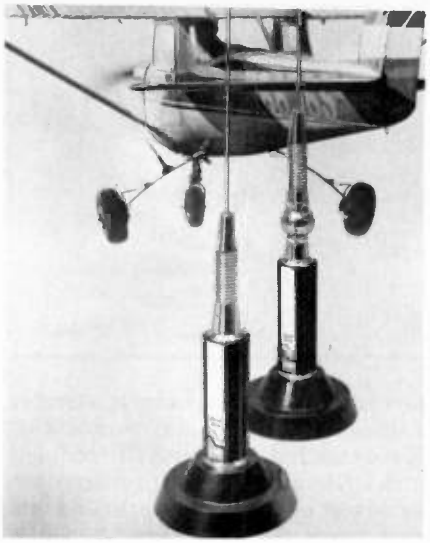
Descriptions and specifications of the products included in this department are provided by the manufacturers. For additional information, circle the corresponding numbers on the Reader Service Card in this issue.

VOM WITH FIVE-OHM MID-SCALE RANGE 141

A new 30,000 ohm/volt compact VOM has been introduced by *B&K-Precision*. The new instrument, Model 115, features a five-ohm mid-scale range for checking the low-resistance of coil, transformer and motor windings. All four resistance scales (0-500Ω, 50k, 500k, 5MΩ) are fuse protected. For checks of the thermocouples and oil burner controls, four DC current ranges are included (0.03, 0.06, 60, 60mA). DC and AC voltage measurement extends to 1200 volts, or 12kVDC with the optional HV-12 high-voltage probe adapter. The color-coded meter scales are uncluttered and simplified. A full-arc mirrored scale eliminates parallax errors. The 115 is small enough to fit into most tool kits. Test leads and instruction are included. Priced at $37.50.

MAGNETIC MOUNT CB ANTENNA 142

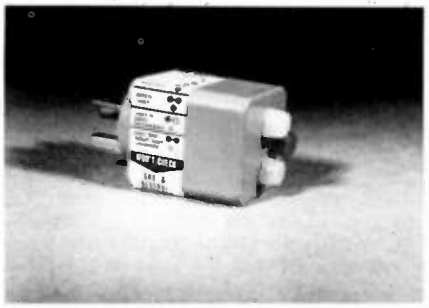
Two new magnetic mount CB antennas—Models 5029A and 5030—are announced by *Channel Master*. Called the 'Mag-Ne-Tenna', the new models were tested on a plane going 140 mph and a vinyl top car at 100 mph. They are said to be the only magnetic mount CB antennas that use an in-line ferrite choke, mounted in the base housing, to stabilize SWR, boost efficiency, and enable the antennas to perform on vinyl top cars. Both antennas have epoxy-dipped,



base-loaded coils protected by weatherproof housing, plus a stainless steel shock spring and high-capacitance stainless steel whip. Model 5030, which is adjustable, comes with a triple chrome-plated universal ball-joint. Model 5029A sells for $29.95 and Model 5030, $33.95.

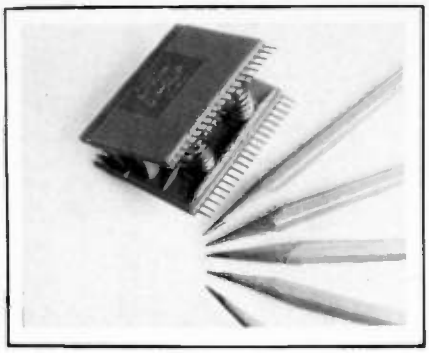
RECEPTACLE TESTER 143

A new, pocket-sized tester for correct wiring of 15 or 20 amp, 115V single-phase 3-wire receptacles is now available from *Etcon Corp.* To test, simply plug the unit into the receptacle. A combination of colored lights indicates whether the receptacle is properly wired. It is a lightweight and compact enough to be carried in a shirt pocket. Called the CT 102 Circuit Tester, it incorporates the same blades as a standard 15 amp U-ground plug, and fits either 15 or 20 amp U-grounded receptacles.



IC TEST CLIPS 144

A new 40-pin, dual-in-line test clip for attachment of test probes to IC packages has been announced by *ITT Pomona Electronics*. Designated Model 4140, the new clip is designed to permit handfree testing while maintaining a good electrical connection. Special features include solid, non-



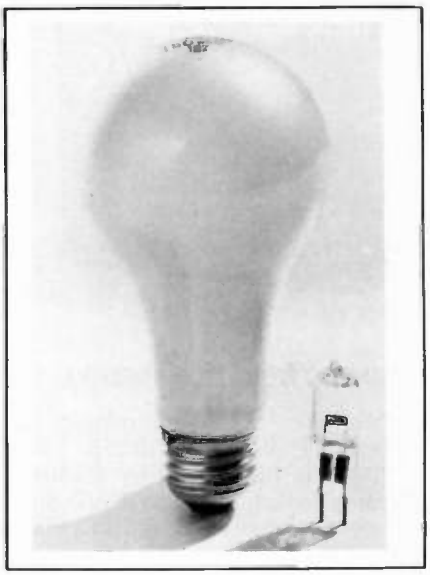
tarnish nickel silver contacts; serrated 1.02mm (.04 inch) side contacts on lower end that mate with DIP contacts and 0.63mm (.025 inch) squared serrated test points on the upper end that will accept mini test clips. A molded barrier between each contact allows connection to be made on live boards without accidental shorting of adjacent contacts. It can also be used as a DIP removal tool. Priced at $19.95 each.

CB BASE STATION ANTENNAS 145

A new line of high performance, ground plane base station antennas for CB has been announced by *Winegard Industries*. Bearing the "Wavemaster" tradename, the new antennas are small in size, yet are said to provide the performance expected of larger models. Gain of the six models in the line ranges from 3.5dB to 5.0dB. They are engineered for 40 channel operation. Installation is easy with the four basic parts of each antenna assembled without tools. They feature twist-lock sockets which hold the radiator and radial elements firmly in place, assuring solid electrical contact between the elements and the transmission cable.

TUNGSTEN HALOGEN LIGHT BULB 146

A tiny tungsten halogen light bulb designed for use as a light source for microfilm readers, optical comparators, medical and dental lighting fixtures, scientific instruments, and other low voltage lighting equipment has been introduced by *Westinghouse*.



The 24 volt quartz bulb, containing a pressurized halogen atmosphere, provides a high brightness level (4500 lumens) and excellent color rendering ability (3400° Kelvin). It offers 100% lumen maintenance throughout its

life. As a result of a tightly wound oval filament, the new lamp provides illumination clarity with a minimum of imaging in optical projection systems. It features a bi-pin base. The suggested list price is $11.25.

REMOTE CONTROL TRANSMITTER TESTER 147

A new tester for checking television remote control signals from handheld remote transmitters is available now from *Zenith Radio*. Designated Model 852-240, the new instrument is designed for use both by sales and service

people. It is capable of testing all Zenith Space Command remote transmitters, both mechanical and electronic units. It will also check output on other brand transmitters emitting a continuous sinewave to 50,000 Hz. Operation is simple. When remote transmitter is held about six inches from the tester, a red LED indicates whether or not there is sufficient output to operate the TV receiver.

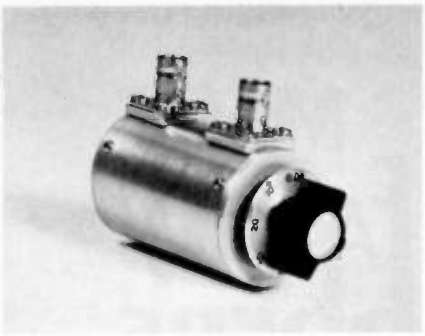
COIL-SPRING FUSE HOLDER 148

A new type of coil-spring fuse holder that eliminates the need to pull a chassis or tuner for fuse replacement is being introduced by *Oneida Electronic*. The new holder, which is per-

manent, is constructed of tempered spring steel with dip soldered leads. It is said to eliminate the need for O.E.M'S for using more costly pig-tail fuses, and does away with cutting and resoldering pig tail leads. Available at distributors.

MINIATURE ROTARY ATTENUATOR 149

A new line of miniature rotary attenuators for low cost applications has been announced by *Kay Elemetrics*.



Designated the 200 series, the new attenuators are designed specifically for operation from DC-750 MHz (75Ω impedance) and DC-1GHz (50Ω impedance). They have gold plated double contacts, glass epoxy rotor wafers with gold circuitry, silver plated rotor, woven RF gaskets and precision metal film resistors. There are four models in the series with an overall attenuation range of 0 to 70 db. Priced at $85.

HIGH VOLTAGE PROBE 150

A full-size dual range high voltage probe that breaks down to fit into a convenient caddy case is new from *Polaris New York*. Designated the '851' Caddy-Probe, the new tool is a dual range instrument with a voltage capability of 400 Ma DC with ± 2% accuracy. The meter movement has a sensitivity of 50 Ua. It is manufac-

tured from high impact styrene with high dielectric strength. When assembled, overall length is 15 inches. The entire package, with case, weighs 16 ounces.

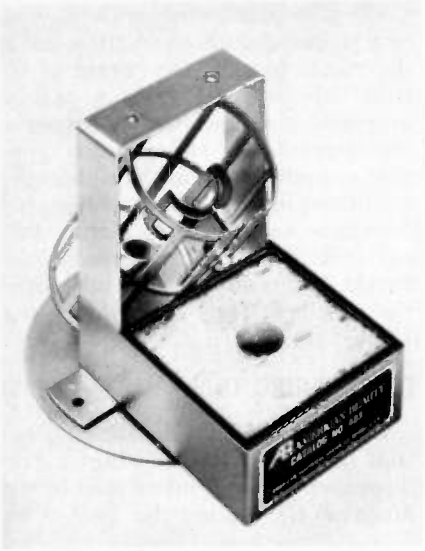
UHF/VHF FIELD STRENGTH METER 151

A new UHF/VHF field strength meter with a digital display window is new from *Blonder-Tongue Labs*. The window contains a half-inch 3-digit LED readout that is photo transistorized to adjust brightness for optimum visibility under changing ambient lighting. There is also an analog

meter and scale to facilitate tuning for maximum levels and a status display comprised of four LED's to indicate over or under range, picture carrier tuning and battery charge warning. The new meter provides 90 db total range with 0.1 db resolution. An autoranging attenuator automatically programs the display to the proper range. Selectable detector mode of operation includes accurate pulse peak detection, quasi-peak detection or noise detection for S/N ratio measurement.

SOLDERING IRON STAND/TIP CLEANER 152

A new safety stand and tip cleaner for pencil-type soldering irons is being introduced by *American Beauty*. Des-



ignated Model 483, the new device protects irons from overheating damage while at rest by surrounding the iron's tip with a pool of molten solder. The solder acts as a heat sink and keeps tip tinned ready for use. An integral part of Model 483 is the tip cleaner which has its own water reservoir and wick-fed sponge. A hole in the sponge and the stainless steel supporting shelf provides an ample wiping edge. Excess solder, dross and burnt flux drop thru the hole, leaving wiping edge free of contaminants.

INSIDE CB ANTENNA 153

A new CB antenna that, installed inside the vehicle, utilizes a vehicle's metal frame as a slot-fed metal ground plane antenna has been introduced by *Microwave Filter Co.* Called the "In-

tenna," the new device thwarts CB equipment rip-off, eliminates exterior damage encountered with conventional outside antennas, and is said to have from 3 to 6 dB less noise pickup than typical outside antennas. It may be used on cars, vans, station wagons, pick-up trucks—in fact, any vehicle with a metal skin. All components in-

cluding a tunable matching section and 8 feet of RG-58-U coax cable are furnished. Price is $24.90.

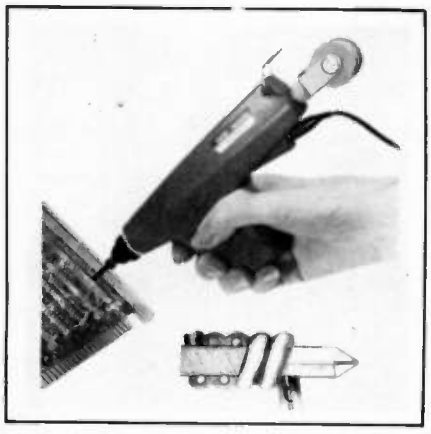
TUNER CLEANER & LUBRICANT 154

A new tuner cleaner and heavy lubricant for use in coastal areas and other locations with high humidity has been introduced by the *Rawn Company*. Named Blue Magic, the new product

has undergone extensive field tests and is intended for use by professional technicians for tuner servicing. It is said to be not harmful for plastics or other tuner components and is non-inflammable. It has been formulated to provide resistance to oxidation and gumming.

WRAPPED-WIRE TOOL 155

A newly developed wrapped-wire tool that makes gas-tight interconnections with standard Tefzel insulated wire without time-consuming measuring, cutting and stripping is available from *Vector Electronic Co.* Polyure-



thane-Nylon wire only could previously be slit and wrapped. With the new tool, 'daisy-chain' terminations require about 5 seconds per post. A special bit uses 28-gauge silver-plated copper wire with Tefzel insulation fed from a spool on the tool's shaft. A cutting edge, adjacent to the wrapping bit, slits the insulation longitudinally along the wire at the point a wrap is to be made. Life of the cutter edge is said to exceed 10,000 wraps. Three models are priced at $29.50, $80.00 and $89.00.

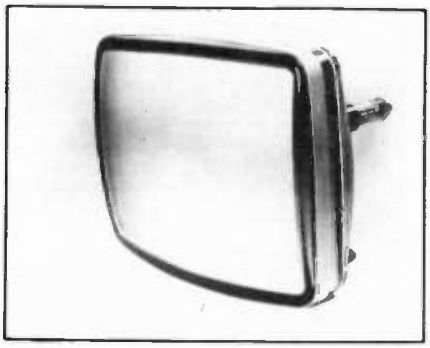
DIGITAL TROUBLESHOOTING COURSE 156

A new color videotape program for those wanting to learn 'Digital Troubleshooting' is now available from *Hewlett-Packard*. Equivalent in coverage to a two-day live seminar, this 14 section videotape program has a total running time of 5 hours and 31 minutes, and includes a 180-page textbook, lab workbook and study guide. The curriculum is designed to provide instruction for individuals learning digital troubleshooting for the first time and for technicians needing a refresher course on digital techniques. Topics include: introduction to

digital electronics and the binary system; the basics of transistors and IC's; logic gates and symbols; digital IC families; troubleshooting digital IC's; flip flops; counters; shift registers; combinational logic circuits; display technologies; IC manufacturing and memories. Individual videocassettes are priced individually from $250 to $375, and the entire course, textbooks and all, is available for $3,600.

UNIVERSAL REPLACEMENT CRT 157

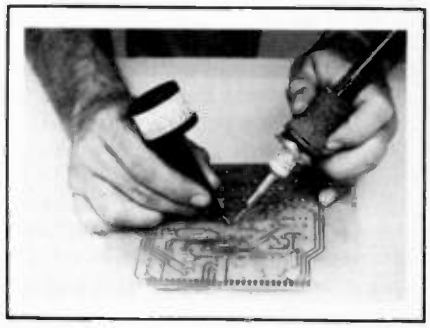
GTE Sylvania is introducing a new line of eight universal picture tubes that can be used as replacements for 385 industry types. The tubes are metal bonded types which can be used as direct replacements for bonded



safety plate picture tubes. They have a new copper ground strap attached to the metal band in the corner of the tube which facilitates a safely-grounded installation. When used as replacements for safety plate types, they are said to provide a brighter picture since no safety plate is required. New labels on Sylvania picture tube cartons identify Universal Color Bright 85 types and list the tube which they replace. They carry a five-year limited warranty.

DESOLDERING TOOL 158

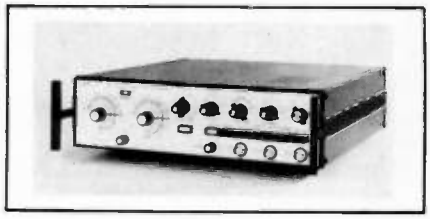
A new hand-held desoldering tool that utilizes a heat resistant plastic dispenser is being introduced by the *Mohawk Co.* Called the Tech-Wick,



the new device is said to allow for steady, pin-point positioning of the pure copper wick on the connection to be desoldered. The wick, constructed of fine strands of pure copper treated with non-conductive, non-corrosive rosin flux, is designed to eliminate the hazard of burned fingers or electrical shock. Tech-Wick is available in two styles—Model S-16, with 10 feet of No. 16, gauge wick—and Model R-20, with 20 feet of No. 20 gauge wick. S-16 is priced at $2.75 each, and R-20 is $3.75 each.

LOG SWEEP FUNCTION GENERATOR 159

A new 5MHz, 100,000:1 log sweep function generator, designated Model 508, is available now from *Exact Electronics*. The new instrument is actu-



ally two generators in one package—a VCF generator covering 0.0001Hz to 5.5MHz and producing sine, square, triangle, pulse, haversine, and haver-triangle waveforms, and a Ramp generator, producing ramps with periods from 10μsec to 100 sec. The Ramp generator is used for direct out-

put and for sweeping, triggering, and gating the main generator. A V:f output is provided for driving analog devices such as horizontal drive to oscilloscopes or X-Y recorders. Priced at $745. ■

ADMIRAL

continued from page 26

of color IC400. It also reduces the color gain when the picture contrast is reduced.

With this control circuit, color and contrast track one another as the controls are varied. If the contrast control is turned up to produce more contrast, the opposite polarities will result, Q170 will conduct more, collect voltage will fall, and color gain will increase.

SWEEP CIRCUITS

The vertical sweep circuit in the 25M55M chassis is almost identical to that used in the previous 7M45 chassis. The horizontal sweep circuit is also basically the same as the M45 chassis. There is some difference, however, in the use of pincushion correction and a convergence panel. The convergence voltage for horizontal is derived across an added winding on the horizontal output transformer between pins 9 and 5.

For pincushion correction, the winding between pins 3 and 6 of the pin reactor, T600, is placed in series with the horizontal yoke in order to produce maximum horizontal sweep width when the vertical scan is in the CRT center and minimum width on the top and bottom of the picture.

Pincushion correction is maximum but opposite on the top and bottom of the CRT and gradually decreases toward the center. It is zero in the CRT center.

The convergency panel is similar to that used in the M50 chassis but is not directly interchangeable. It should be noted that a 4 pin socket for connections in the 25M55M is used, as compared to a 3 pin socket in the M50. ■

MODULAR CHROMA

continued from page 29

by spacing the oscillator coil in the tuner to put the fine tuning range where it belonged! This problem usually shows up on one or two channels only, and is due to tuner drift.

Finally, weak chroma, and poor contrast can result by poor "set up" of the picture tube. Excessive negative bias on the CRT results in washed out pictures. Turning up the IF gain by tweaking the AGC only results in overload symptoms such as poor sync.

I think it is important to remember that troubleshooting chroma is less difficult than handling IF problems, (chroma can be viewed directly on a scope). The signal levels are fairly high and using a color bar generator gives an easily recognizable display. As for modular sets, they are nothing but a PC board broken up into smaller pieces. Take out the connector problems, and there's no difference. ■

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...for more details circle 117 on Reader Service Card

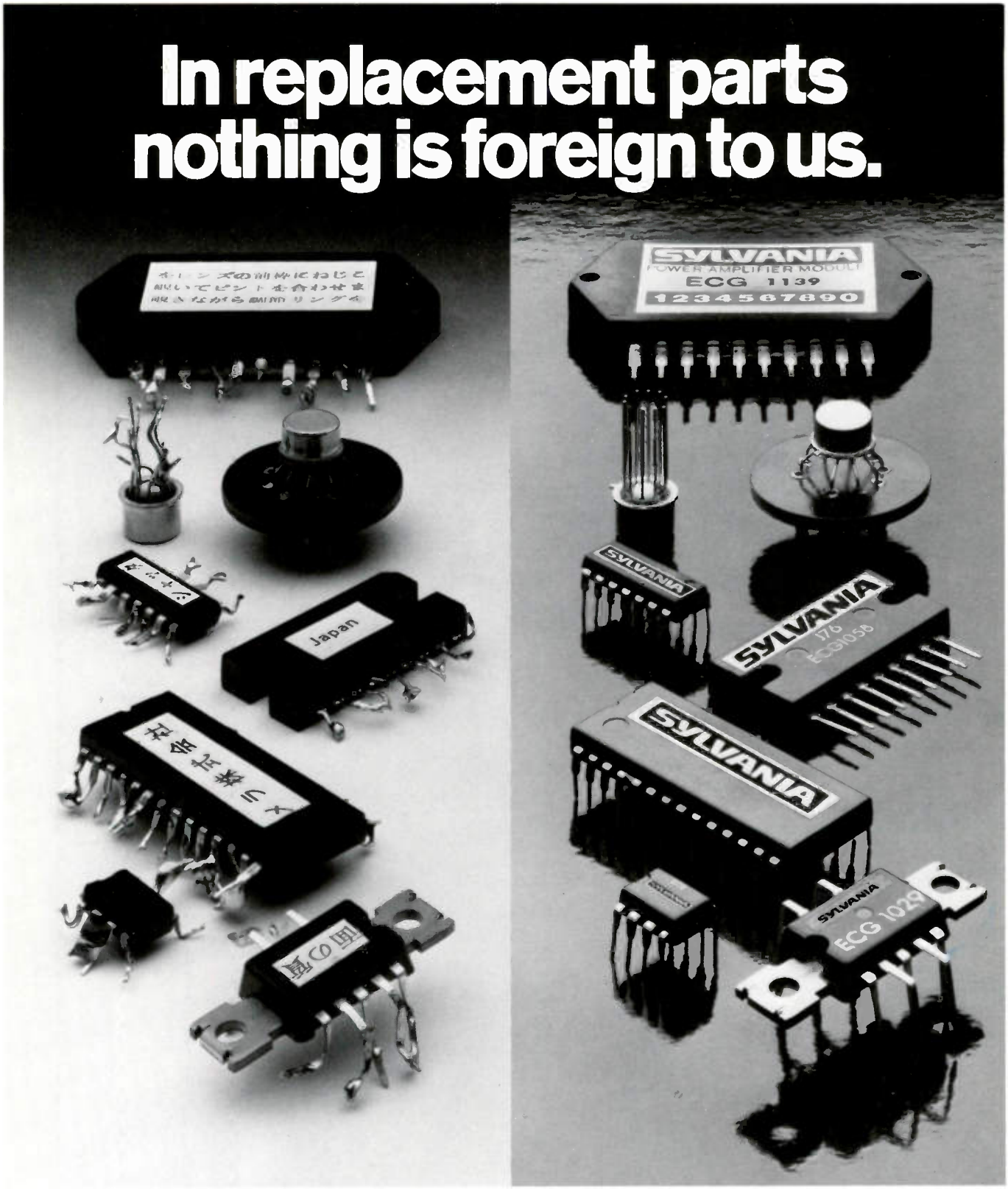
READER SERVICE INDEX

ADVERTISER'S INDEX

This Index is furnished for the readers' convenience. However, the publisher can not guarantee its accuracy due to circumstances beyond our control.

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

In replacement parts nothing is foreign to us.



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a New Family of VOMs
The Model 60 Series

MODEL 60

RANGES
8 DC VOLTS
4 DC CURRENT
6 AC VOLTS
5 OHMS
5dB

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MODEL 60-NA

16 DC VOLTS, 10 DC CURRENT,
10 AC VOLTS, 6 OHMS,
AND 8 dB RANGES

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The new 60 Series has been designed for the value conscious users in industrial production and maintenance, communications, vocational training and hobbyists, airconditioning, appliance and automotive service, R & D and application engineering . . . anyone who wants to be more productive with the latest in V-O-M technology. The large, "simplified" 4½" scale is an "easy reader". This combined with a single range selector switch minimizes the possibilities of error. Detented handle position, only 2 recessed input jacks and 48" safety engineered test leads are just a few of the many other user benefits of the 60 Series. Compare them with other V-O-Ms and you'll know why the new Triplett family of V-O-M's eliminate over 90% of the costly repairs from V-O-M misuses. Cultivate a profitable habit for selecting Triplett designed products. For more technical data and a demonstration of the Model 60 Series, see your local Triplett distributor or a Triplett sales representative. Triplett Corp., Bluffton, Ohio 45817, (419) 358-5015.

MODEL 64

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8 DC VOLTS
8 AC VOLTS
7 OHMS
6 Low Power
JUNCTION
TEST

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