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NOVEMBER 1978 • $1.00

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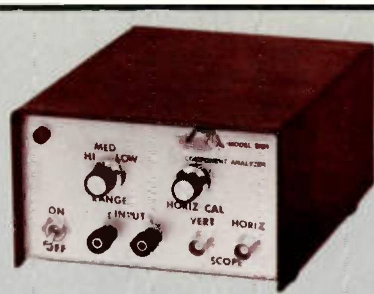

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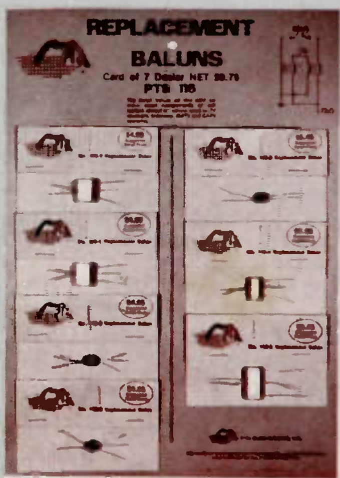

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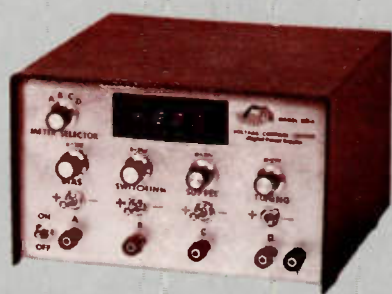

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INDUSTRY REPORT

Admiral Television Ceases U.S. Operations

Admiral Television, which had accumulated losses of $74 million since its acquisition by Rockwell International four years ago, will discontinue producing and selling television sets in the United States in the near future.

With an estimated 2 percent of the total U.S. television market under the Admiral name, the firm also acquired additional business as a supplier of some Montgomery Ward, K-Mart, and Western Auto (Truetone) television receivers.

The move, which a spokesman said would amount to a gradual phase out of its U.S. business activities upon completion of present commitments, will eventually involve the loss of some 2,000 United States jobs. However, an Admiral spokesman said some positions would be retained to continue warranty and parts service activities.

Admiral said that although production facilities in Taiwan and Harvard, IL, will be closed due to the management decision, they will continue to market and make television sets in Mexico and Canada.

"Intense price competition, particularly from Japanese sources, had contributed to significant operating losses in Admiral's domestic television business since the acquisition of Admiral in 1974," a Rockwell International spokesman commented. Thus, Admiral becomes the second U.S. television manufacturer in less than a year to end U.S. production activities. While, at the same time, naming Japanese competition as a major factor in that decision.

Last year Zenith Radio Corporation announced some 5,000 U.S. television manufacturing jobs would be phased out as it moved its production facilities to foreign shores.

According to Robert Anderson, Admiral's president and chief executive officer, the discontinuance of Admiral's domestic television business will result in an estimated after tax write-off of some $25 million. Estimated earnings for the 1978 fiscal year, after considering the tax write-off aspects of the Admiral TV group, would be about 15 to 20 percent higher than 1977 earnings of $4.18 per share.

In commenting on the demise of Admiral in the United States, one securities analyst said Admiral has consistently operated at a cost disadvantage because of its relatively small production level considered on a world-wide basis.

Admiral was founded in 1934 as a manufacturer of low-cost radio receivers.

Hope for AM Stereo System in 6 Months

The Federal Communications Commission moved ahead with plans for selection of a single method of broadcasting commercial AM stereo in the United States when it decided to seek public comments on the five current competing systems.

An FCC spokesman reports that comments and replies to those comments will be received no later than December 29 and January 31, respectively.

The current systems for broadcasting commercial AM stereo, which are under consideration, have been developed by Magnavox, Motorola, Kahn, Harris, and Belar. Three of these systems, Motorola, Magnavox, and Belar have undergone FCC field tests, the results of which have been reported without comment or recommendation.

According to supporters of AM stereo, the adoption of AM stereo standards in this country would provide broadcast stereo free of the distance/reception problems of FM stereo. And, it would permit AM stations to compete more effectively with FM stereo outlets, which have grown enormously in the past six years. The eventual impact of AM stereo on the FM stereo industry is, of course, unknown at this time. However, some quarters are reportedly anxious over the possibility of another down trend reminiscent of the slump which hit the CB industry during the 40-channel controversy.

Is the Personal Computer "Boom" a Bust?

Yes and no is the answer to the above question if you listen to the latest signals eminating from various camps. The consensus so far is that the "boom" is a "bust." Not so much from the standpoint of a potentially lucrative market, but just how quickly that market will mature.

Manufacturers of the personal computers, last year at WESCON (Western Electronics Show and Convention) came out with a glowingly optimistic report that personal computers are the next big "boom" market. Now they're saying it's going to take a massive educational program aimed at the public first.

For one thing, the publc just doesn't know what to do with those strange little things. That's the party line eminating from this year's WESCON gathering at Los Angeles. Manufacturers in their haste, according to one spokesman, apparently forgot a basic premise of marketing strategy for most products. That is, unless a product has a defined use or application, there just isn't much

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NOVEMBER 1978, VOL. 100 NO. 11

On the cover: Our lead feature this month deals with servicing opportunities on microwave ovens. Thus our cover is devoted to key elements of the microwave system; the magnetron (radar) electron tube, and the huge power transformer.

FEATURES

DEPARTMENTS

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going for it.

"It's not enough that we as engineers think they (personal computers) are neat," said one manufacturer's spokesman, "but we've also got to show the consuming public that they have a use."

Actually, what the whole situation boils down to is that the manufacturers are relearning what IBM learned long ago in the "big" computer business: unless you can provide the programs to use in the computer, they are about as valuable as a used pile of ICs and circuit boards.

The situation has modern day personal computer manufacturers likening their market to the market for pianos and sewing machines, of all things. Listen to this excerpt from a WESCON seminar on personal computers:

"The successful piano product marketing manager knows that you don't sell more pianos by increasing the number of retail outlets. Nor, do you do it by slashing the price. The way you sell more pianos is to make them easy to play. And that's why piano lessons are an important ingredient in every successful retail store sales plan."

This particular seminar participant, Frank J. Burge of Regis McKenna, Inc., a marketing firm, even went so far as to say that home computers eventually will be a bigger status symbol than the piano . . . "a symbol of cultural elevation to the nth power," no less.

Zenith Adds 3-Hour VCR Unit, Two New Cameras

Zenith has announced it is adding the Betamax format three-hour VCR to its line, plus two new color cameras.

The new VCR is the KR9000W. Differences between this unit and last year's model are not so marked on the electronic or mechanical side, but the major change is in the tape cassette design and thinner tape.

A new remote pause control allows the viewer to stop the tape momentarily in either the record or playback mode. The suggested retail price on the unit, Zenith reports, is $995.

The color cameras, both optional, will retail for suggested prices of $995 and $1,395. The lower priced camera, the KC1000, is equipped with color temperature and brightness controls, an automatic light level control, and has a low light indicator. The 25mm lens, Zenith said, has been especially designed for use with the new tri-electrode vidicon tube which utilizes red, blue and green stripes to produce the correct color signal.

Also coming onto the market is the higher end KC1250 camera equipped with a 6:1 Canon zoom lens for wide angle and telephoto shots. The camera features an electronic viewfinder which incorporates a 1½ inch black and white picture tube used as a viewing monitor. Additionally, the KC1250 carries all of the other features found on the KC1000, according to Zenith

Sony to Market U.S. Made Products in Japan

Sony Video Products Company, a subsidiary of Sony Corporation of America, has announced that two video accessories designed and made by its Video Technology Center at Palo Alto, CA, will be sold in Japan, Europe and the United States.

Both accessories were designed for use with the Sony BVH-1000, a one-inch compact helical scan video tape recorder used in broadcasting and industrial television applications. The accessories, Sony reports, are the APK-1000, a simplified, two-machine editor kit, and the XC-1000, a crystal calibrator for test and alignment of recorder operating conditions.

Sony said the accessories are scheduled to be ready for shipment from Palo Alto this fall. Ken Tsunoda, president of the video products group, said other video products are being developed at the center for future marketing in both the U.S. and foreign countries, including Japan.

Predict Biggest CES Ever This January

The 1979 International Winter Consumer Electronics' Show has been scheduled for Las Vegas' Convention Center beginning Saturday, January 6 through Tuesday, January 9.

According to a spokesman for the Consumer Electronics Group of the Electronic Industries Association, this year's winter event—the second to be staged in Las Vegas since its move from Chicago—is expected to be just as large as the mammoth summer show held in Chicago which drew some 53,000 registrants.

Jack Waymen, senior vice president of CES, said exhibitors will be grouped together by product category to facilitate interaction between attendees and exhibitors.

Many allied events and special exhibits are scheduled to be presented during the five day convention. Daily CES conferences will be held each morning on the subjects of personal communications, telephone devices, audio systems, auto sound, television and projection TV, video systems and personal computers and television games. In addition, CES retail workshops are scheduled for Saturday through Monday and will feature tips and strategies on retail advertising, sales promotion, retail sales training and retail inventory controls and sales analysis.

This year, according to a CES spokesman, a special retail resource center will offer attendees an opportu-

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nity to consult with 15 exhibitors providing nationwide retail store services such as financing, store design and lighting, freight bill auditing services, retail management services, merchandising aids, retail sales training programs, group insurance and audio demonstration rooms.

The headquarters hotels are Caesar's Palace, MGM Grand, Sahara, and the Las Vegas Hilton.

News In Brief

Stuart Rauch, currently product manager of professional television test equipment for Philips Test and Measuring Instruments, will assume additional responsibilities as general marketing services manager for that firm in the U.S. and Canada . . . Additionally, Hans Toorens becomes product manager for oscilloscopes for Philips.

Leader Instruments Corporation has announced that more than 40 test instruments have been affected by a price increase initiated September 1. The reason, according to corporate vice president Bill Brydia, is "the unstable relationship between the U.S. dollar and the Japanese yen" . . . Also, Leader announced that Michael Benjamin, an eight year veteran in test instruments sales and engineering, has been appointed western regional manager.

Sylvania and Quasar Post Losses

Neither Sylvania or Quasar are likely to show a profit this year, according to an article in *Television Digest,* quoting company spokesmen. The rising value of the yen caused Quasar's losses for fiscal 1978, though the company may break even for the calendar year. While Quasar expected two years of deficit during production and management reorganization, it did break even last year and so is essentially on schedule as planned with sales of $316 million this year, compared to Motorola's TV sales peak of about $261 million, according to the article.

Sylvania will show a profit this year only if color picture tube operations are included. ETD

CORRECTION

The frequency burst patterns shown on page 24 of the September 1978 ET/D article, "High Resolution Television," Fig. 10, were displayed incorrectly. In other words, the sixth and seventh bars mentioned in the illustration's cutline, actually turn out to be the first and second bars, as printed. ET/D regrets the error.

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NEWSLINE

ZENITH NUMBER 1 AMONG TECHNICIANS. In a story published recently in Television Digest, the publication reported that Zenith claims to be the "preferred" television brand among both technicians and consumers. According to the story, technicians were asked to name the brand with the highest quality, the fewest repair problems, and the set they'd most likely buy if in the market for a TV. In all cases, TV Digest said, Zenith claimed to be number one over RCA.

PAY TELEVISION EXPERIENCING RAPID GROWTH. It's a "mini boom," according to General Instruments Corporation Chairman Frank G. Hickey. GIC's Cable TV group, Hickey said, showed substantial growth which surpassed all forecasts last year. Number of pay subscribers is now 2.5 million. That'll increase to 7.5 million in five years.

BEST COLOR TELEVISION SALES WEEK AND MONTH IN HISTORY. Dealer sales of color TV sets was 326,530 for a month's total of 1,208,200 for the biggest week and month ever, beating the same week of last year by 1.5% and the best previous month (Sept. 1973), by 6.8%, according to Television Digest.

RCA IS LARGEST SATELLITE TV CARRIER. RCA American Communications, now entering its third year, is the largest distributor of satellite television. As of September, RCA reports, its two orbiting satellites will distribute more than 4,000 hours of television programming each month. There are 11 different program packagers offering some 12 channels to millions of cable TV viewers. Also, the Satcom I satellite is the world's largest network of earth receiving stations. There will be over 800 such stations serving 8 million viewers by early next year, RCA contends.

SHARP COLOR TELEVISION PLANT TO BE BUILT NEAR MEMPHIS. Sharp is acquiring a site near Memphis for a color TV and microwave oven assembly plant, according to Television Digest. Sony, Toshiba, Matsushita (Quasar) and Mitsubishi (MGA), all have U.S. plants in operation while Hitachi is awaiting Justice Department O.K. for its joint venture with GE, General TV of America.

PRIVATE PHONE MARKET; NEWEST ELECTRONIC BOOM. The United States Supreme Court's ruling permitting consumers to purchase their own telephones is the driving force behind what may be a $179 million market...at least according to one manufacturer, Allied Telecommunication Equipment. According to this firm there is a "bright, new gold lode" out there for developing and marketing all electronic phones with ICs. That market consists of 70 million homes, or 160 million telephones, according to this source.

BELL & HOWELL, MEMOREX FORM NEW COMPANY. Bell and Howell, a Chicago based firm, and Memorex of Santa Clara, Cal., have announced a joint venture to manufacture half-inch VHS and Beta format cassette tapes. According to a joint statement, the tapes will be produced by a newly formed subsidiary--M/B&H Home Video. The first of the tapes, in the VHS format, are expected to reach the market by the first quarter of 1979, according to company spokesman.

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Compact Model 462
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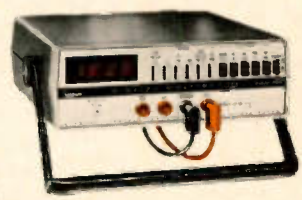

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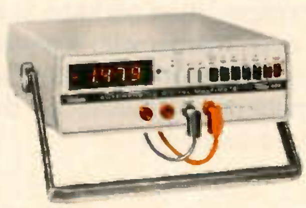

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For $288
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FROM THE EDITOR'S DESK

Big Business or Small Business ... Which is Best?

I received a letter recently from a reader obviously disturbed over an article that appeared in the August 1978 issue entitled "Independent Electronic Service" (P. 14). The article centered on personal interviews with the executive directors of the two national electronic service organizations, the National Association of Television and Electronic Servicers of America and the National Electronic Service Dealers Association.

The sender of the leter interpreted certain quotes in the article as placing ET/D firmly behind "big business" when it was stated that the trend in the home entertainment electronic service industry most likely will be toward *fewer*but *larger* service establishments.

Quite frankly, I firmly believe this will be the trend of the immediate future. However, because this trend does exist does not in any way mean that ET/D has taken a stance behind so-called "big business" as opposed to "little business."

ET/D is not against any kind of legitimate business, large or small. The point of the article was in fact to point out that what ET/D is for, in every instance, is *efficiently run business.*

It was stated in the article, and I would like to state it again here, that in today's highly competitive electronics service market, efficiency of operation—from a business management standpoint—is now essential to the continued existence of that business.

If indeed the smaller less efficiently run serviceshops are "dropping out," then the conclusion can only be that they are indeed the less efficiently run of the service establishments we are talking about.

We all know the endless demands placed on our technological competence in view of the yearly changes and modifications to circuitry by each and every manufacturer. The evidence seems to indicate that while most of the "small" serviceshops are able to compete technologically, they are not keeping up from a professional management standpoint.

So what can be done?

The whole point of the article in question was, I believe, that if the smaller service establishments so choose, there are still options open that will insure continued existence in this highly competitive marketplace. However, this same shop must accept the fact that it must grow and adapt in order to survive. It *must* seek new opportunities and, in instances where smallness is a hinderance to the application of sound management practices, then perhaps alternative arrangements should be considered, even merger with a similarly small shop.

I don't believe such a merger arrangement can be considered a philosophical endorsement of "big business." But it is a philosophical endorsement of continued existence.

Sincerely,

Richard W. Lay

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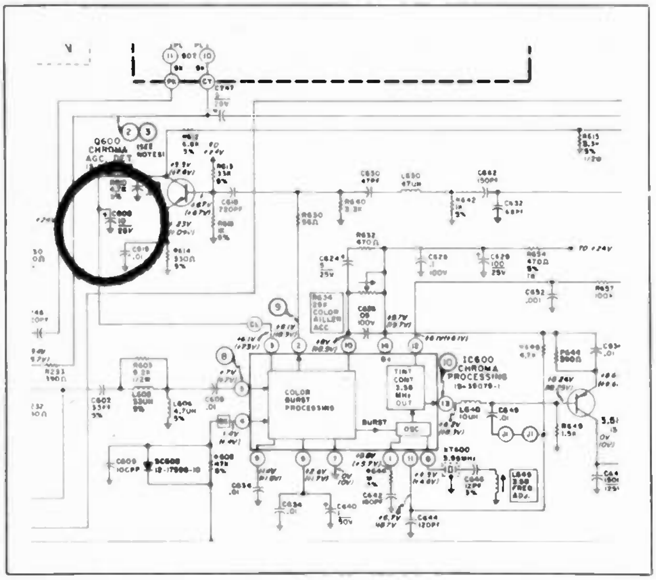
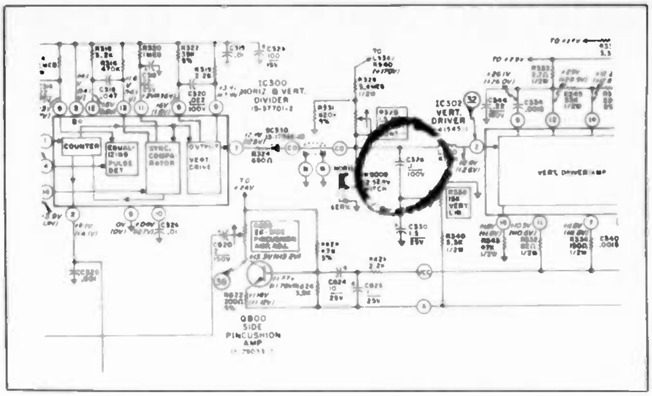
GTE SYLVANIA

Color Chassis E20/21—Intermittent Color change. C608 found to be intermittent.



Color Chassis E21—No Vertical Sweep. Sweep drives normally with sweep analyzer. The cause was found to be a leaky C328 in the vertical linearity control circuit.



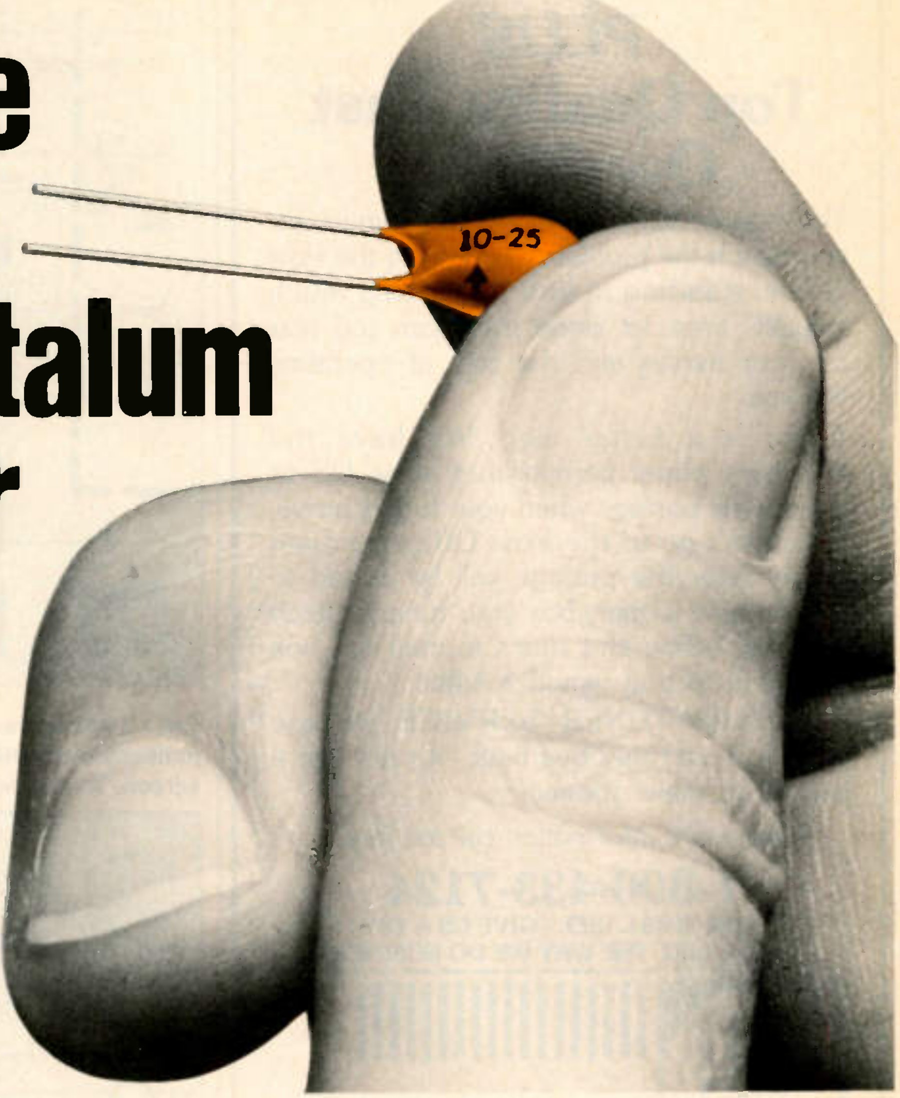
MOTOROLA

Color Chassis TS-934—Unable to converge blue horizontal on left and right sides. Red and green tilt coil and blue center horizontal phase control have little effect. When horizontal blue amplitude is turned maximum cw, blue line looks 180° out of phase. Wave form W37 and W38 have increased from 28vP-P to about 150vP-P. The cause is a bad ground connection at pin 9 on the HA (convergence) panel.

RCA

TV Chassis KCS203—Horizontal sweep does not "startup"—no picture or sound—other times normal except picture is shifted to the right one inch. The probable cause is one or both of the horizontal AFC diodes, CR217 and CR218.

Best way to replace a dipped solid-tantalum capacitor



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2	SD35-R229	.22	8	SD35-4R79	4.7
2	SD35-R339	.33	8	SD35-6R89	6.8
5	SD35-R479	.47	10	SD35-109	10
2	SD35-R689	.68	2	SD35-159	15
8	SD35-19	1.0	8	SD35-229	22
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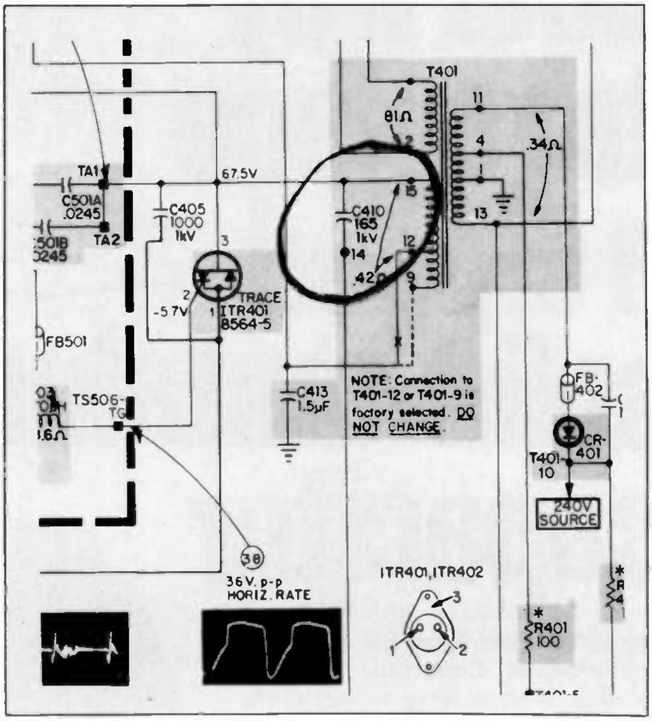
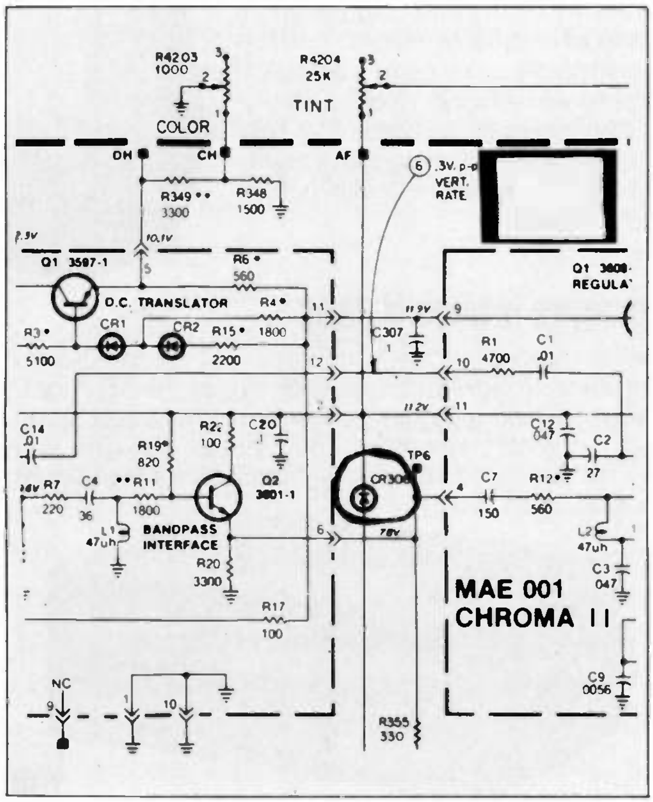
Color TV Chassis CTC81—Defective MCK IF module but replacement does not restore operation. Check C410—if it is shorted, R36 in the replacement module will probably open.



Color TV Chassis CTC72—No color except for a one inch multicolored vertical bar at the extreme left edge of the screen. The probable cause is a shorted CR306 diode.



SONY

Color TV Model KV-1711—No picture, no sound, all fuses okay. Check and replace open resistor R617, 100 ohms and shorted Q604, (2SC 1124). These are part of the horizontal oscillator start circuit. ET/D

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Model 2010 Specifications

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AC Volts: 100 μV to 1 kV RMS in 5 ranges (Basic accuracy 0.5% ± 1 digit)
DC Current: 0.1μA to 10 A in 6 ranges (Basic accuracy 0.5% ± 1 digit)
AC Current: 0.1 μA to 10 A in 6 ranges (Basic accuracy 0.5% ± 1 digit)
Resistance: 0.1Ω to 20 MΩ in 6 ranges (Basic accuracy 0.1% ± 1 digit)
Diode Test Current: 0.1 μA, 10 μA, 1mA, in 3 ranges
ACV Frequency Response: 40 Hz to 40 kHz (40 Hz to 1 kHz on 1 kV range)
Imput Impedance: 10 MΩ
Input Overload Protection: 1200 VDC or RMS on all voltage ranges: 250 V (DC or RMS) and fuse-protected on Ω and current ranges
Power Requirement: 4.5 to 6.5 VDC (4 "C" cells) Optional nickel-cadmium batteries or AC adaptor/charger.
Display: 0.36" (9,2 mm) 7-segment LED
Size: 8" W x 6.5" D x 3" H (203 x 165 x 76 mm)

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Servicing microwave ovens

Another source of income

It's quick, easy and the only additional tool you'll need is a microwave leakage test meter.

By Homer L. Davidson

Are you looking for additional service income? If so, repairing microwave ovens is right down the service technicians' alley—or back door, so to speak. Right now microwave ovens are selling all over the country and every major appliance manufacturer is building them. Factory and out of warranty maintenance has picked up tremendously the past five years and eventually every unit may require electronic servicing. Here's where you, the electronic technician, come into the picture.

The microwave oven is an electrical and electronic appliance designed to warm or cook food within minutes. After a sequence of buttons and switches are engaged, power is applied to a magentron tube. Primarily, these are the same type of tube used during World War II with radar warning equipment. The magnetron tube gives off RF (radio-frequency) energy. The RF energy is tunneled to the oven and cooks the food placed in the oven cavity.

Microwaves are short electromagnetic waves of RF energy which pass through glass, paper and most plastic materials. Metal and aluminum foil tend to reflect microwaves and may be used only as recommended by the manufacturer. Food with high moisture content, however, tends to absorb microwave energy. As the microwave energy enters the food, the molecules align themselves with that energy and at high speeds of oscillation. This causes friction between the molecules and converts the microwave energy to heat. Most microwave ovens operate around a frequency of 2,450 MHZ.

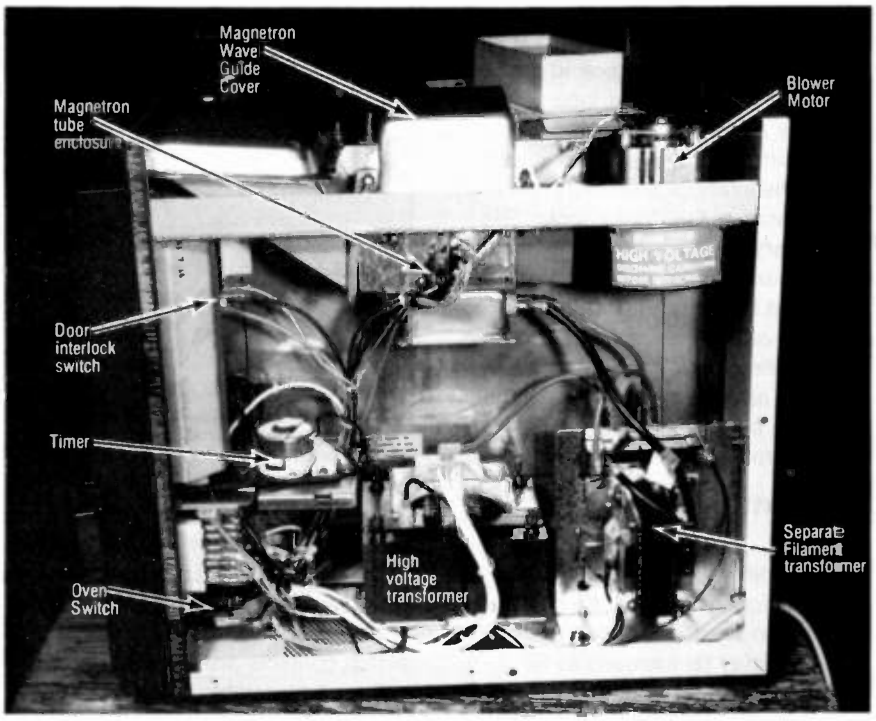

Fig. 1 The back metal cover is removed from the microwave oven showing the cooking mechanism.

Tools

Very few additional tools are required other than those found in any TV shop. A VTVM or VOM is needed to check voltages and continuity of the various components. After each oven has been repaired or tested, a microwave leakage test should be made with a survey instrument. These instruments recommended by the industry are NARDA 8100, NARDA 8200, Holaday 1500 and Simpson model 380M (Fig. 2). They may be obtained through various electronic and electrical distributors. A homemade discharge tool (such as the one you discharge those picture tubes with) may be constructed with two large screw drivers and attached cable. Besides the normal Phillips screw drivers and long-nose pliers, only a glass or plastic cup is needed to hold tap water for cooking tests. After repair you will want to know if the oven is working correctly. For this you run the water and thermometer test.

Basic oven operation

It's very important to know the operating sequence when the oven is in the cooking mode. From the sequence of operation and following the schematic

Fig. 2 Simpson's 380M microwave leakage tester.

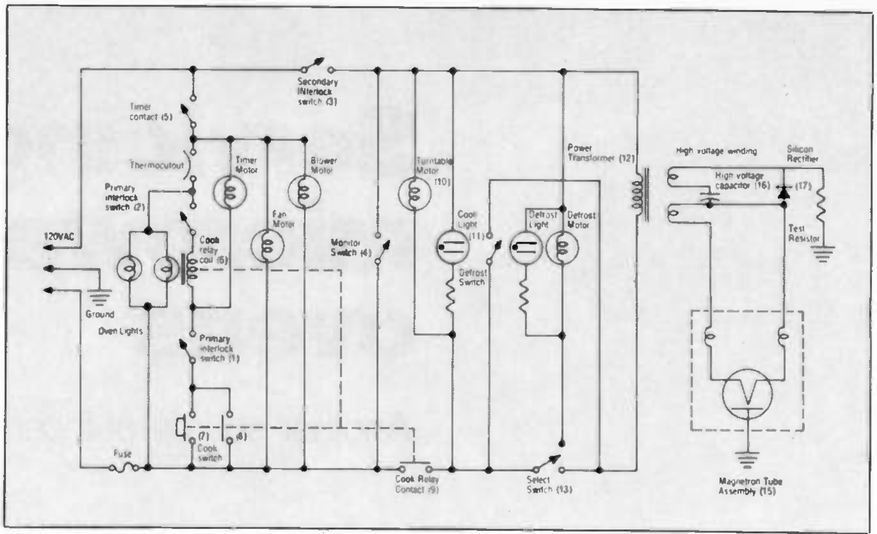

Fig. 3 A typical microwave oven schematic diagram. (Courtesy-Sharp Mfg. Co.)

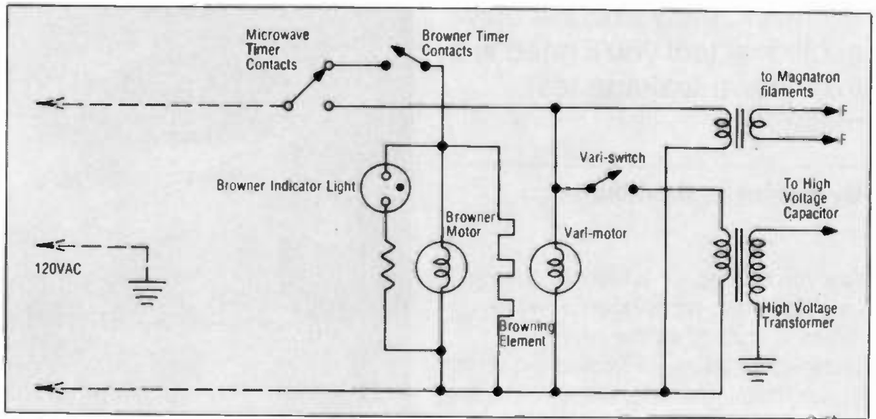

Fig. 4 A partial schematic of the browner unit.

diagram, one can easily spot the possible defective components (Fig. 3). Although most ovens cook in the following manner, some incorporate different switch and relay functions.

With the front door closed in most ovens the interlock switches (1) and (2), are located at the door handle. The secondary interlock switch (3) may be located around the door area or activated by an extending lever, at the left side of the oven area. If for some reason the oven door does not fully close or any one of the three interlock switches becomes defective, the cooking relay (6) will not energize.

"Defeat" switch

For instance, if the interlock switches become defective and locked in the "on" position, for any reason, the oven would begin to cook with the door open and the operator may be exposed to RF radiation. To prevent this condition, a monitor switch (4) was installed and is normally open when the door is closed. But, when the door is opened, the monitor switch contacts are closed. Now if the other interlock switches are locked in the "on" position, the monitor switch appears directly across the fuse and the 120 volt ac power line. Naturally, the fuse is blown open to prevent the oven from cooking with the door open.

In some microwave ovens the oven lights are on when the door is opened and in others the timer must be on before the oven lights come on. When the timer (5) is turned on and set for the correct time, the fan and blower motor are turned on to circulate air over the magnetron tube and into the oven. You may find only one fan motor in some models. The timer motor, itself, is not activated until the cook switch is pushed on. After the timer is set for correct cooking time, the cooking switch (7) may be touched and power is applied to the cooking relay coil (6). Contacts 8 and 9 of the cooking relay energize and contact 9 applies voltage to the power transformer (12). Also, when the cook switch contacts are closed, the timer motor and turntable motor will stay on until the cooking timer shuts off.

In some models you may find a turntable motor rotating a glass turntable in the center of the oven. By rotating the food, proper cooking uniformity is obtained. This motor will start to rotate after the cook relay contacts are made. The turntable feature is found in only a relatively few models at present. Another added feature in some models is a browning element (Fig. 4). The browning element is located at the top of the oven and resembles an ordinary electric cooking element. You will find a separate browner timer motor and indicator light is added to these circuits.

At this point in the circuit, the operator may want to either cook or defrost food before the cooking cycle. To defrost, push the select switch and defrost light and motor (14) will begin to operate. The defrost motor rotates one cycle per minute by means of a cam provided on the defrost motor shaft. In other words, power is supplied to the power transformer intermittently in 30 second intervals on some models.

In the cook position, 120 volts ac is applied to the primary winding of the power transformer (12). A filament winding lights up the magnetron tube and another secondary winding provides high voltage to the magnetron tube (15), resulting in RF cooking energy. In this particular model the filament voltage is 3.2 volts ac with 2400 volts ac applied to the voltage doubler circuit. A high voltage capacitor (16) and silicon rectifier (17) form the voltage doubler circuit of approximately 4000 negative dc volts applied to the cathode of the magnetron tube.

The oven will continue to cook the food until the timer shuts off the applied voltage. When the timer shuts off the cooking relay, contacts are broken and power is no longer applied to the power transformer. Also, the oven lights and fan motors are turned off.

HV capacitor

Before checking any component or

wiring of the microwave oven, discharge the high voltage capacitor—just like you discharge the CRT before working around the anode high voltage. Remember, the high voltage is around 4KV and carries some heavy amperage (Fig. 5).

You may find one or more oven lights to illuminate the interior so the food being heated may be examined visually through the door window. This light may come on when the cooking door is opened or after the timer is set—check the schematic to be sure. The cook switch light may be out in the open or behind the cook switch. It indicates the oven is in the cook cycle. These small appliance bulbs are obtainable through the manufacturer or appliance distributors.

After the timer contacts are made, the blower and fan motors draw cool air through the oven base. The cool air is directed at the magnetron assembly to keep the tube from overheating. In some units a separate fan is used to cool the tube and another to channel air through the oven to remove steam and food vapors. If the fan is not running, check for ac line voltage across the motor terminals. Remove one motor lead when checking motor continuity with the ohmmeter. If the voltage and motor continuity appear normal, check for dry or gummed up motor bearings.

Turntable motor

The turntable motor is located in the center of the oven and rotates the food to cook it evenly. It's best when testing the oven to have the glass turntable in position. If not, the plastic rotator may become overheated and begin to drag or bind.

In case the oven goes into the cook cycle and the turntable will not move, check the turntable motor and wiring. Check for ac line voltage across the motor terminals. Remove the power plug and measure the motor field continuity with an ohmmeter. Remove the motor assembly and check the plastic bearing assembly. The bearing should rotate freely. If not, check for proper lubrication. In some models the plastic bearing assembly may be chewed up and should be replaced. If the turntable motor is operating intermittently, monitor the motor terminal voltage and if there is no fluctuation, suspect a defective plastic bearing assembly.

The timer assembly is another area that can go bad. When the timer is set for the correct cooking time, the switch contacts are made and turn on the oven lights. In some models, the fan and blower motor may be activated, while in other models the blower motor may not come on until the cook switch is pressed. But the timer motor does not start until the cook switch is pressed. If none of the above functions occur, suspect defective timer contact points.

Remove the power plug and check the timer switch contacts with the ohmmeter. Turn the timer on and the contacts should be made. Check the wiring from the contacts to the motors and cook switch. If the fan motors are running with the timer turned off, the timer contact points are frozen together. When the timer is suspected of not functioning properly, check the required time setting with a watch. You may find the timer assembly will function intermittently, sometimes run slow and then stop. Double check the timer before replacing it. These units must be ordered directly from the oven manufacturer.

Power transformer

A very large power transformer is used to supply filament voltage to the magnetron and high voltage to the voltage doubler circuit (Fig. 6). If the oven light is on, but very little or no cooking heat is noticed in the oven with the water test, suspect a defective power transformer, rectifier, high voltage capacitor or magnetron. When the oven is cooking normally, you can hear the loading down of these various components. Be very careful when checking voltages around the power transformer. High voltages are present during the cook cycle.

Sometimes you can look down upon the magnetron through the fan cage and see the tube light up, indicating filament voltage is applied to the magnetron. Check for 120 volts ac at the primary terminals of the power transformer. If normal, proceed with filament voltage tests. You may find a separate filament transformer in some models. If the tube filament can't be seen, pull the power cord and clip the ac meter leads to the filament connections. Do not hold the leads in your hands. The filament voltage should be around 3.2 volts ac. But, from filament winding or meter

Fig. 5 Always discharge the high voltage capacitor before servicing a microwave oven. Many manufacturers place a very convenient sign to remind of this operation.

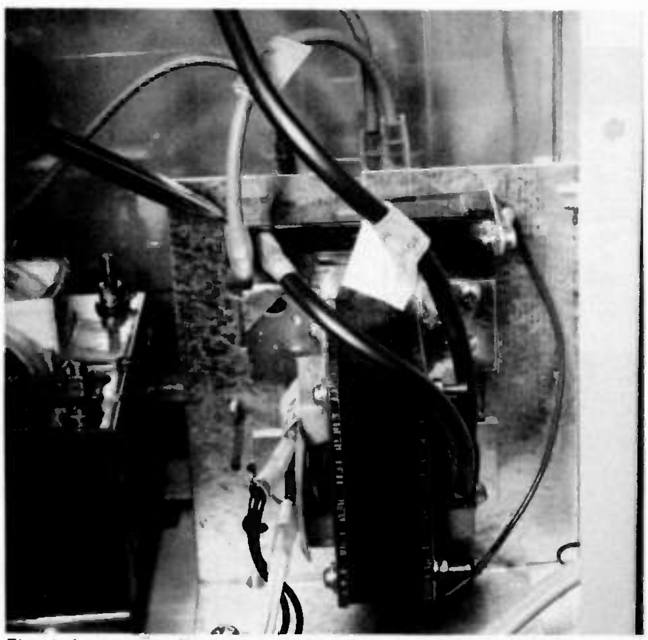

Fig. 6 A separate filament transformer is found in models to supply filament voltage to the magnetron tube. Notice the large high voltage transformer to the left.

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leads to the oven chassis is over 4 KV. If no voltage, suspect an open primary transformer winding or wiring. Pull the power cord and discharge the high voltage capacitor. Check for about 1 ohm resistance across the primary winding. Since the filament winding is of very large wire you will have a lower reading with the filaments of the magnetron in the circuit. The secondary high voltage winding should have a resistance of approximately 20 ohms. Sometimes the high voltage winding may internally arc over to the transformer laminations, grounding out the high voltage. The point to remember, however is that these readings vary with different manufacturers of microwave ovens.

The voltage doubler

The high voltage capacitor and silicon rectifier increase the ac voltage supplied by the high voltage transformer. Generally, the high voltage capacitor causes very little trouble but remember to discharge it before working around it. If the capacitor is open, no high voltage will be available to the magnetron. A shorted or leaky capacitor may short out the high voltage transformer. Remove the capacitor leads and check for an open or short between its terminals with the ohmmeter. With the capacitor normal and using the high range of the ohmmeter, the needly will indicate continuity and slowly drop down to open condition. Reverse the ohmmeter leads and the capacitor will charge again and slowly discharge. If the capacitor is leaky an ohmmeter reading will be noticed and the capacitor should be replaced.

The silicon rectifier changes alternating current into pulsating direct current. You may find the high voltage rectifier inside the magnetron tube assembly in some ovens. Check the rectifier with the high ohmmeter range. A normal rectifier should have a high resistance in one direction and infinite resistance with reversed test leads; (Some multiple junction units will show infinite resistance in both directions with low ohmmeter test voltages). An ohmmeter reading in both directions indicates a leaky high voltage rectifier which should be replaced. Sometimes, if leaky, the high voltage rectifier will feel warm, but the high voltage capacitor should be discharged before touching it. A defective high voltage capacitor or rectifier may cause low or no high voltage.

The magnetron

Before attempting to remove the magnetron tube, make sure the tube is defective (Fig. 7). When filament voltage is located upon the tube pins and the tube does not light up, suspect an open internal filament connection. Be sure the high voltage circuit is discharged before attempting ohmmeter tests. A continuity check across the magnetron filament leads should be less than 1 ohm. Now check from filament leads to chassis ground. You should have an infinite reading. If there is any type of resistance reading, the tube is grounded. Remember some magnetrons have the high voltage rectifier inside the metal assembly and a rectifier could be defective instead of the tube.

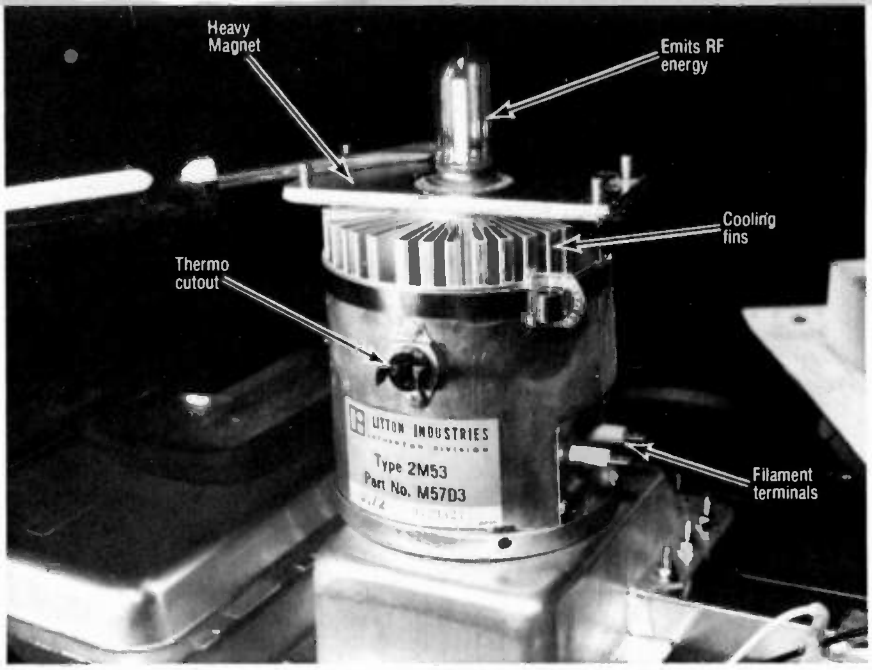


Fig. 7 Be very careful when working around the tube. The heavy tube magnet can pull tools from your hands.

You may find the magnetron wave guide assembly has to be removed before the magnetron can be pulled out. Many bolts or screws hold the wave guide assembly into position and are fastened with non-loosening glue. When replacing this assembly make sure all bolts and nuts are snug to prevent arcing along the wave guide. Four nuts bolt the magnetron into position. Be very careful when working around the expensive magnetron. The heavy magnet may pull metal tools from your hands and possibly crack the top of the glass envelope. These tubes typically cost from $175 to $225.

After the magnetron is removed, check the filament leads for continuity. Check for leakage between filament and the magnetron metal body. The magnetron is the most expensive component in a microwave oven and should be replaced with the exact part number. A defective magnetron may also cause slow or poor cooking. The power output of the magnetron may be measured by performing a water temperature rise test according to the manufacturer's service data.

Interlock switches

Primary and secondary interlock switches may cause more problems than any other oven components. They are in use constantly when the oven door is opened or closed. First, determine from the schematic which set of switches are not functioning. Then locate the possible defective set of switches in the oven. The primary interlock switch may be located at the oven door handle. A secondary interlock switch may be located at the door or along side of the oven. When located along side of the oven, a long lever arm activated by the door triggers the secondary switch assembly.

All switches may be checked with an ohmmeter. Isolate the switch and connect the meter leads to the switch terminals. Take a closer look and you may spot a defective switch with the slip-over wire connection burned. A poor wire connection to the switch may produce the same symptoms. The meter should indicate a closed circuit with the door closed and an open condition when open. If the switch is open or is erratic in operation, replace it.

The secondary interlock switch assembly may have two switches—one normally closed and the other open when the door is closed. Generally, one side of the switch is directly in one side of the power line. A defective secondary switch may produce a dead cooking condition. If a long extending arm is found, you may find only switch adjustments to be needed. After the oven door has been opened and closed

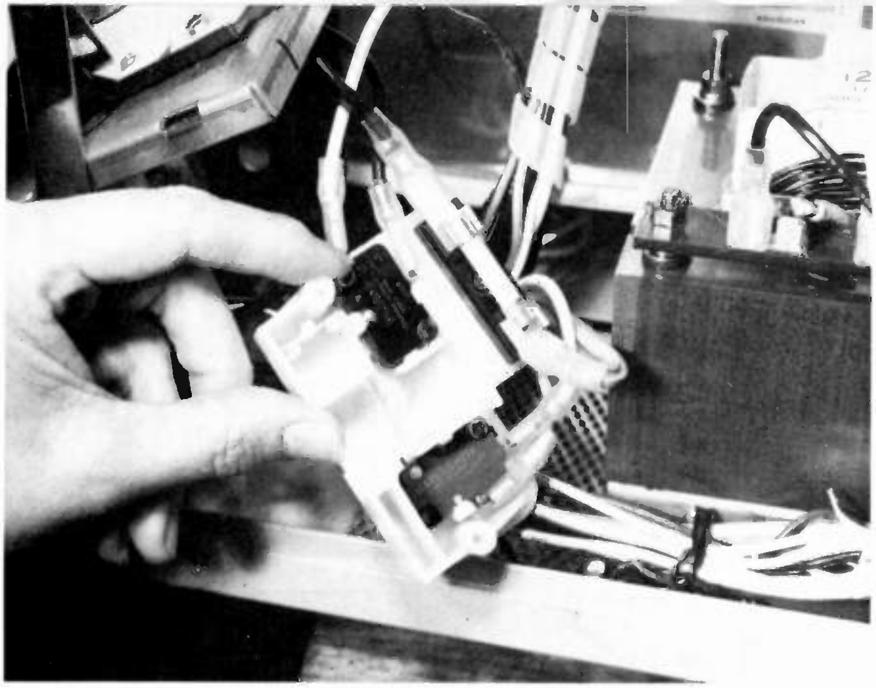


Fig. 8 Many microwave oven repair problems are caused by interlock switches. Either the switch goes bad or may need adjustment.

for several years, the secondary interlock switch adjustment should be made. Follow the manufacturers adjustment procedures. In some ovens it's a matter of loosening two nuts and sliding the switch assembly.

When the oven comes in in a dead condition, suspect a blown fuse in the monitor switch assembly (Fig. 8). The monitor switch protects the operator in case the oven door opens up and the cooking operation does not shut down. Check the monitor switch with the ohmmeter. It's best to replace the entire monitor switch assembly when you find a blown fuse in a particular oven. A defective monitor switch or poor switch adjustment may cause the fuse to open up. When the door is closed the monitor switch contacts open. All monitor or primary interlock switches should be replaced with original manufacturer's components.

When the customer complains the oven will only function by pushing against the oven door, suspect poor switch or door adjustment. Sometimes the door becomes sprung and will not close properly. Improper switch assembly adjustment may be caused by a loose screw or nuts, which permits the switch to slip downward. In some units the microswitch levers become bent and out of line, letting the door plunger slip past the switch levers. If the microswitches cannot be adjusted properly, replace them.

Cooking water test

After each oven repair is made, a power output temperature test should be made with a measuring cup and 16 oz. of tap water. Measure the temperature with a thermometer. Insert the cup and turn the oven on full power for one minute. Remove the cup and stir the thermometer around to record the maximum temperature. Subtract the cold water temperature from the hot. A normal rise of temperature should vary between 15 and 30° F.

Microwave leakage tests

When making a leakage test place a cup of water in the oven and turn the oven on full power. Set the timer for fifteen minutes and if the water begins to boil before the leakage tests are made, replace it again with cool water. Hold the probe of the survey instrument perpendicular to the gap between the door and the body of the oven. Move the probe slowly and notice for maximum readings of the meter. Also, check for leakage at the door screen, sheet metal seams and exhaust fan areas.

The highest leakage indication should not exceed 5mw/cm^2 at any point 5 cm or more from the external surface of an older oven.

New microwave ovens may not display a leakage of 1mw/cm^2 at any point 5 cm or more from the external surfaces. The cone of the meter probe is so designed to maintain 5 cm (2 inches) distance from the oven to the sensing probe. Always follow the manufacturers leakage emission tests or directions supplied by the microwave leakage tester when servicing a particular microwave oven.

Servicing the electronic microwave oven is easy and is added income for the electronic technician. A microwave leakage instrument is the only additional tool required to do the job. ETD

Sylvania for '79

Digital remote control and VIR

A look at the evolutionary development of the Sylvania television chassis.

By Walter H. Schwartz

Since last examined in ET/D (January 1976), the Sylvania color television line has undergone many further evolutionary refinements, rather than a wholesale redesign.

These Sylvania color television receivers have been designed with considerable recognition of the problems of the servicer. The chassis pull back for easier access with the removal of two screws, labeling of the components and test points is good on both sides of the circuit boards, and most notably all transistors and ICs plug into sockets.

The Sylvania modular series

The modular series, which began earlier with the E03-4-5 chassis, incorporated GT-Matic, Sylvania's automatic self-adjusting color system, a vertical countdown IC and an exceptionally wide locking-range horizontal AFC. These last two circuits, locking the vertical sweep to the horizontal, through a counting circuit eliminated the customer hold controls. Sylvania considers these to have been the industry's first automatic color TV chassis.

For 1976, Sylvania offered the E11/E12 modular chassis in their top of the line sets. These chassis had 30kv high voltage for use with the "Dark-Lite 50" light absorbing glass faceplate picture tubes. The E20/E21 chassis, a non-modular unit, was used in the 17 and 19 inch (diagonal) sets and the E40 modular chassis with somewhat lower high voltage, was used in certain 21 and 25 inch (diagonal) sets.

The E20/E21 chassis were continued in the 1976-77 line, as was the E40. Sylvania at that time stated that the most important change was an improvement in both short term and long term reliability achieved through much more rigid control of component quality and of workmanship. The E41 and E42 were new numbers given to updated and upgraded versions of the E11 and E12 chassis. These used 21 position single knob control of UHF and VHF varactor tuners, with individual tuning potentiometers in each position. A new four lead safety retrace capacitor was also added to this chassis.

The 1977-78 line consisted of the E23-E24 non-modular chassis and the E44-E45-E46 modular sets. Sylvania stated advances in integrated circuits continued to upgrade picture quality and automatic correction to user controls.

Video enhancement

A new video processing IC and redesigned associated circuitry in these chassis provided automatic sharpness control as follows, referring to Fig. 1: Q902, the second video amplifier's output signal is developed across R914, a 1k ohm collector resistor. The signal is applied to Block B. Simultaneously, the video signal at pin No. 12 is fed through an unterminated lagging network R919, L919, C919, to pin No. 11. The unterminated lagging network reflects the signal at pin No. 11, back to pin No. 12. The twice delayed signal and the undelayed signal are differentially combined in Block C, resulting in the preshoot signal. Further differential processing develops the overshoot signal. These signals are combined with the video signal in Block C. The

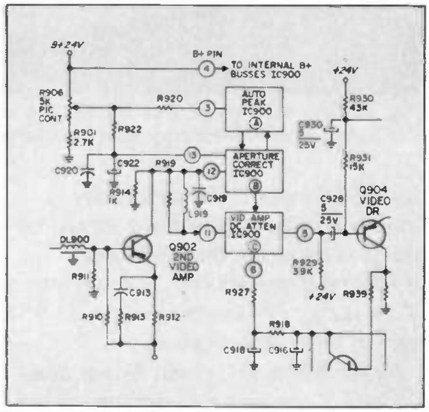


Fig. 1–Automatic peaking circuitry.

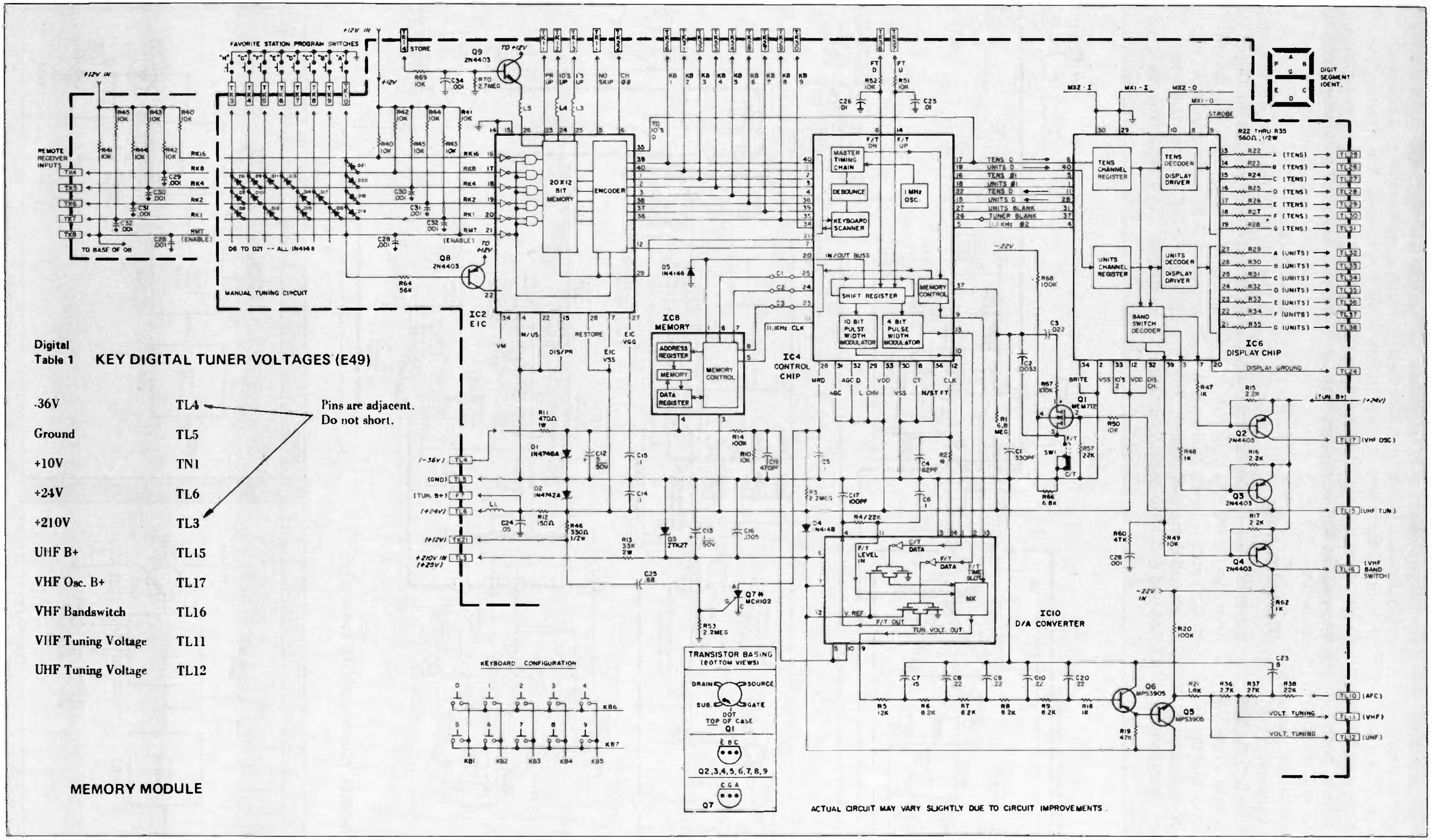
net result at pin No. 5 is the aperture corrected video signal containing the preshoot and overshoot enhancements.

Block A is a detection system that looks at the amount of peaking the viewer wants, and compares the peak amplitude of the overshoot and preshoot signal to R900, the peaking control setting. If the peaking signal level and the peak control setting are the same, no action takes place. However, should the peaking fall below the preference setting, the detector sees the difference and corrects the condition. It does this over a wide range of signal variations. All chassis also incorporated improvements in blanking (in the new video processor IC) automatic color level, color-contrast tracking and a new improved horizontal/sync/AGC IC.

The E46 introduced Sylvania's Random Access Digital Tuning (which will be examined later as carried over into the E49 chassis of the '79 line).

Advances for '79

The 1979 line uses the E45, E48 and E49 chassis and updated versions of the E24 and E25. The E48 and E49 are new modular chassis with 32kv high voltage for greater brightness



Digital Table 1 **KEY DIGITAL TUNER VOLTAGES (E49)**

-36V	TL4
Ground	TL5
+10V	TN1
+24V	TL6
+210V	TL3
UHF B+	TL15
VHF Osc. B+	TL17
VHF Bandswitch	TL16
VHF Tuning Voltage	TL11
UHF Tuning Voltage	TL12

Pins are adjacent. Do not short.

Fig. 2—The E49 digital tuner control. (Courtesy of GTE Sylvania)

with the "Dark-Lite" picture tubes. The high voltage section has been designed for X-ray protection and better regulation at this high HV, and, as has the rest of the set, been designed for lower power dissipation.

The "Computer Controller" provides automatic circuitry to maintain the picture as viewer adjusted; the E48 and E49 chassis include a new VIR module to correct color and tint to those of the point of origination in spite of transmission distortion. Control switches back to GT-Matic automatically if VIR is not transmitted or manually by means of a VIR defeat switch, if the VIR signal is distorted or incorrect, as with most video tape recorders.

Digital tuning

Sylvania's new remote control digital tuner used in the E49 uses the random access tuning system first introduced in the E46 chassis. The E46 and E49 tuner assemblies are designed around MOS digital circuitry and are replaceable as a complete unit if necessary. The "memory" module (Fig. 2), receives commands from the keyboard or remote receiver and supplies control voltages to the tuner proper.

The Control Chip (IC4) interfaces to all other parts of the system. Direct access is accomplished with the ten keyboard switches connected to KB1 through KB7. IC4 converts the two keystrokes into a serial address for

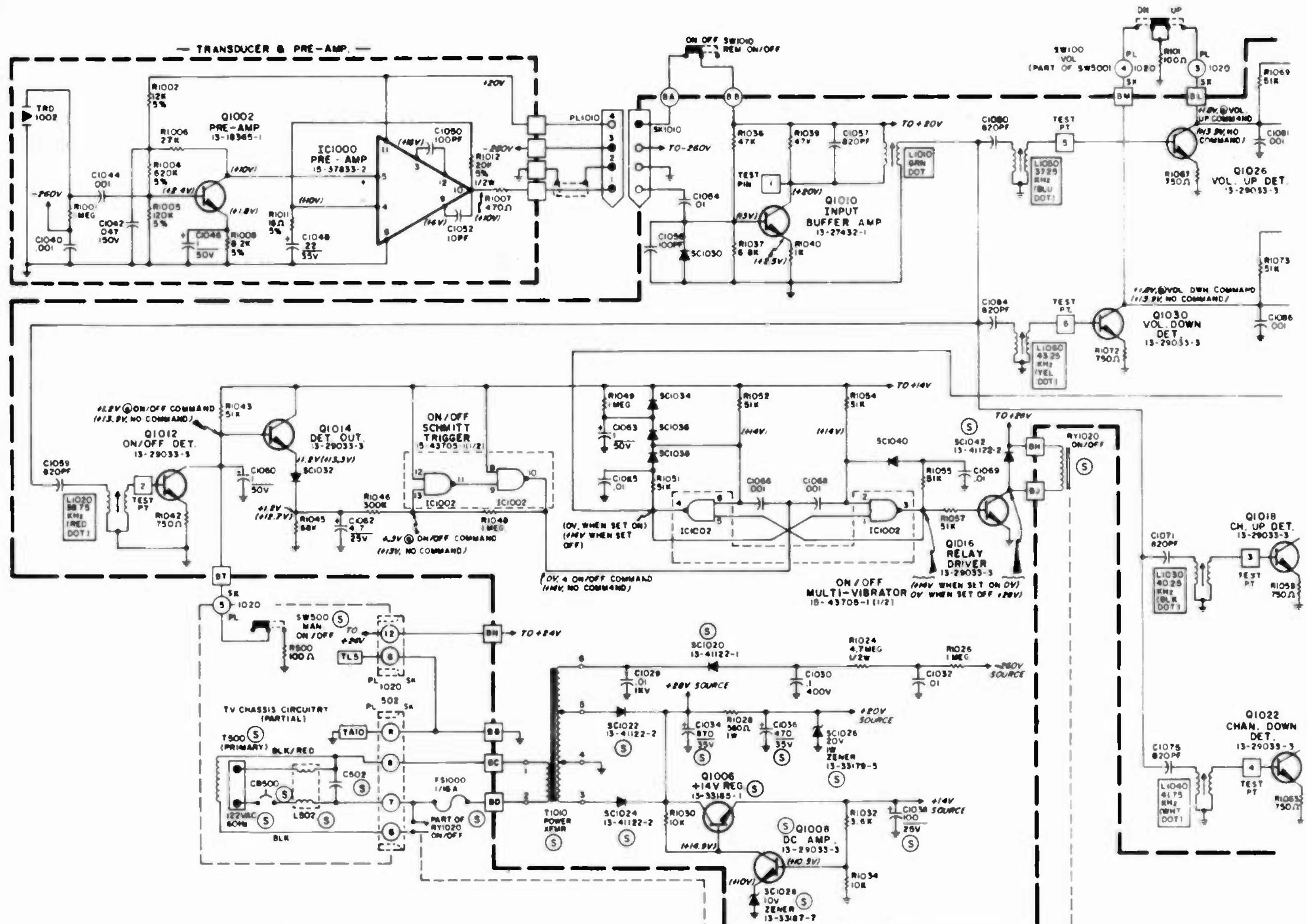


Fig. 3-E49 remote receiver. (Courtesy of GTE Sylvania.)

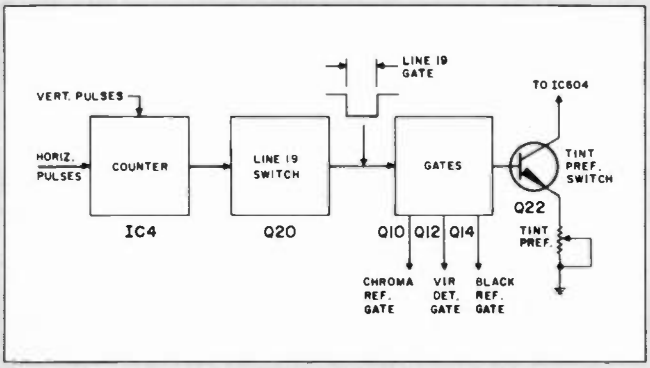


Fig. 4–Simplified schematic line 19 identifier.

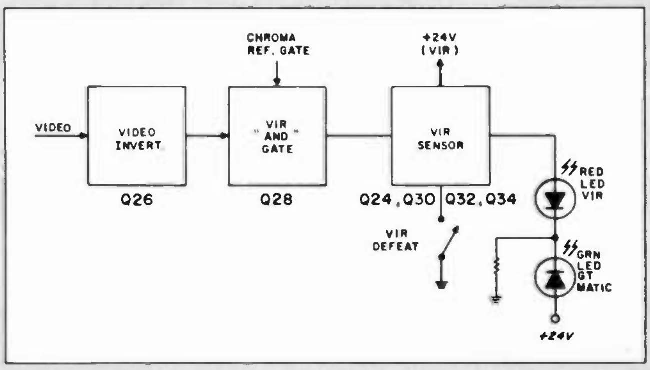


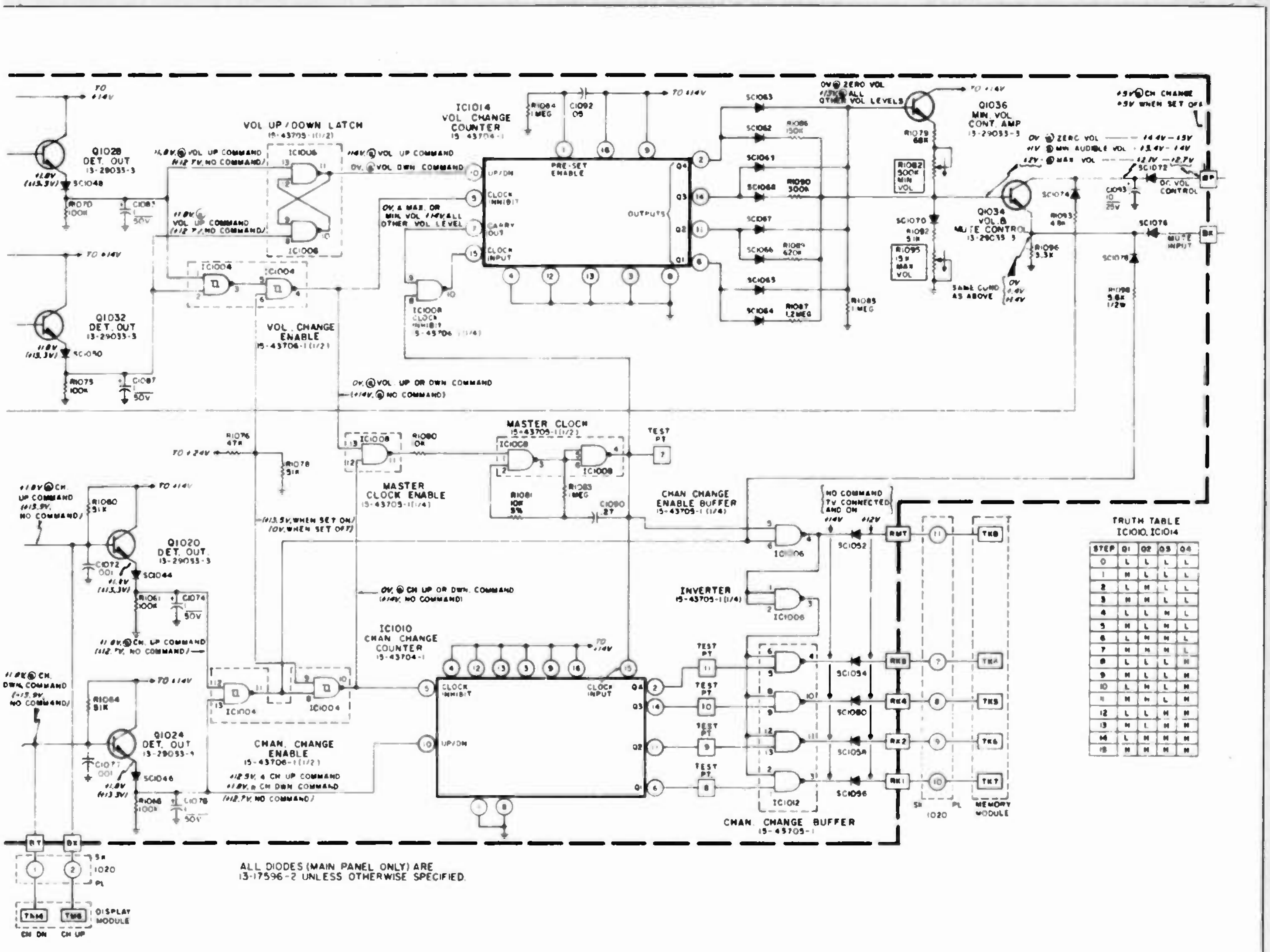
Fig. 5–Simplified schematic VIR sensor.

the Electronically Alterable Read Only Memory (IC8). The EAROM is a nonvolatile, serial input/output, re-programmable memory device. It will retain its memory for ten years or more. The Control Chip also controls the Display Chip (IC6) which drives the display and also selects the bandswitch transistors for VHF and UHF operation.

Pins 10 and 13 of IC4 carry a Pulse Width Modulated code to the Digital/Analog Converter (IC10). IC10 and the integrator network produce a dc tuning voltage buffered by Q5 and Q6 for the varactor tuners.

IC2, the European Interface Chip, converts a single input from the favorite station buttons or the remote receiver into two keystrokes as required by the Control Chip. IC2 stores favorite station data in its own non-volatile memory.

For troubleshooting, it should be determined if a channel selection problem is in the tuner section or the chassis. The four voltages supplied by the chassis should be checked and any missing or incorrect voltage must be restored before the tuning system is condemned. TL4 is the −36v input to the memory module and TL3 is the +210v supply. These are adjacent pins; great care should be taken not to short these together. TL5 is ground TL6 is +24v and TN1 is +10v for the display LEDs. TL15 is UHF B+, TL16 is VHF bandswitch, TL17 is VHF oscillator B+, and TL11 and TL12



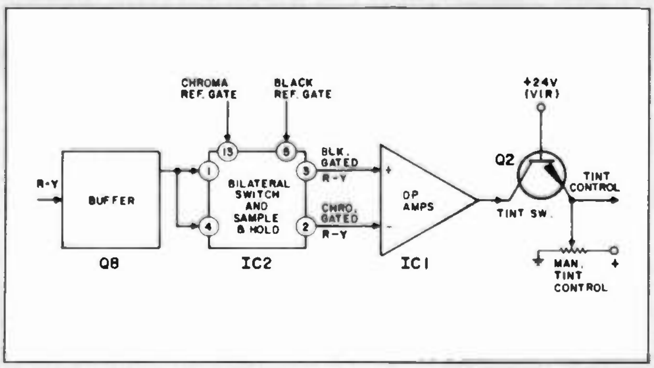


Fig. 6–Simplified schematic tint control.

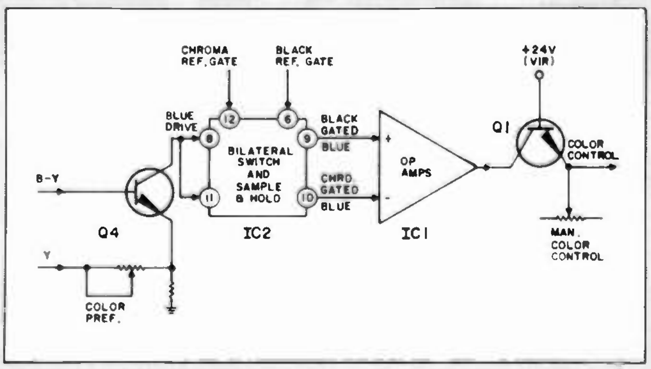


Fig. 7–Simplified schematic color control.

respectively are VHF and UHF tuning voltages.

The E49 remote

The E49 remote (Fig. 3) uses 20 NAND gates for its various functions. When the set is powered and no on/off command signal is present, Q1014 is on, placing +13v at pin 13 of the on/off Schmitt Trigger. With pins 12 and 13 both Hi, pin 11 is Low. With pin 8 Hi and pin 9 Low, pin 10 goes Hi (+14v). When the set is powered, SC1034 and SC1036 bias the on/off multi-vibrator so that pin 4 is Hi and pin 3 is Low. This holds Q1016 and RY1020 off.

The on command (or SW500) turns off Q1014 which causes pin 13 of the Schmitt Trigger to go Low. This puts pin 11 Hi and pin 10 Low. The Low signal coupled to pin 6 of the multi-vibrator has no effect as pin 5 is already Low. However, the Low signal at pin 2 causes the multi-vibrator to flip and pin 3 to go Hi. This turns on Q1016 which picks up RY1020. The multi-vibrator is stable in this condition until the next on/off command signal.

The off command again turns off Q1014, making pin 10 go Low. This flops the multi-vibrator to the off state (pin 4 Hi, pin 3 Low) and turns off Q1016 and RY1020.

With no volume command signal, Q1028 and Q1032 are both biased on placing a Hi signal at pins 8 and 13 of the Volume Up/Dn Latch. This Hi is also placed on pins 1 and 2 of Volume Change Enable. This puts a Low at pin 3 and hence, a Hi at pin 4. This Hi from pin 4 is applied to pin 5 of IC1014 (Volume Change Counter) to inhibit the clock so that no volume change can take place. A Hi at both pins 12 and 13 of the Master Clock Enable holds the master clock off.

A Volume Up or Down Command will cause Q1028 or Q1032 to turn off, depending on whether volume up or down is pressed. This will put a Low at either pin 1 or 2 of Volume Change Enable which allows pin 4 to go Low and enable the Master Clock (pin 13 of IC1008) and also removes the Hi clock inhibit from pin 5 of IC1014. If Volume Up was pressed, pin 11 of Volume Up/Dn latch will go Hi and likewise pin 10 of IC1014. IC1014 now counts up the volume steps as long as the volume up signal is present. If Volume Dn was pressed, pin 11 of Volume Up/Dn latch and pin 10 of IC1014 will go Low and IC1014 will count down. When the command button is released, pins 1 and 2 of Volume Change Enable both go Hi, which makes pin 5 of IC1014 go Hi and inhibit the clock. This stops the volume change. Also, with pins 12 and 13 of the Master Clock Enable both Hi, the clock stops. Whenever a channel change command is present, a Hi mute signal through SC1076 turns off Q1034 and mutes the sound.

With no channel change command, Q1020 and Q1024 are both On which makes pin 12 and pin 13 at Channel Change Enable both Hi. This makes pin 11 Low and pin 10 Hi. With pins 12 and 13 at Master Clock Enable both Hi, the clock does not run. A channel Up or Down command triggers the Master Clock and 1C1010 to count in the proper direction just as was done with the Volume Counter. No Minimum or Maximum Disable is needed as the channel counter will count up from 00 to 15 and continue on through 00 or from 15 down to 00 and continue through 15. The binary output is inverted and fed to E1C chip

continued on page 53

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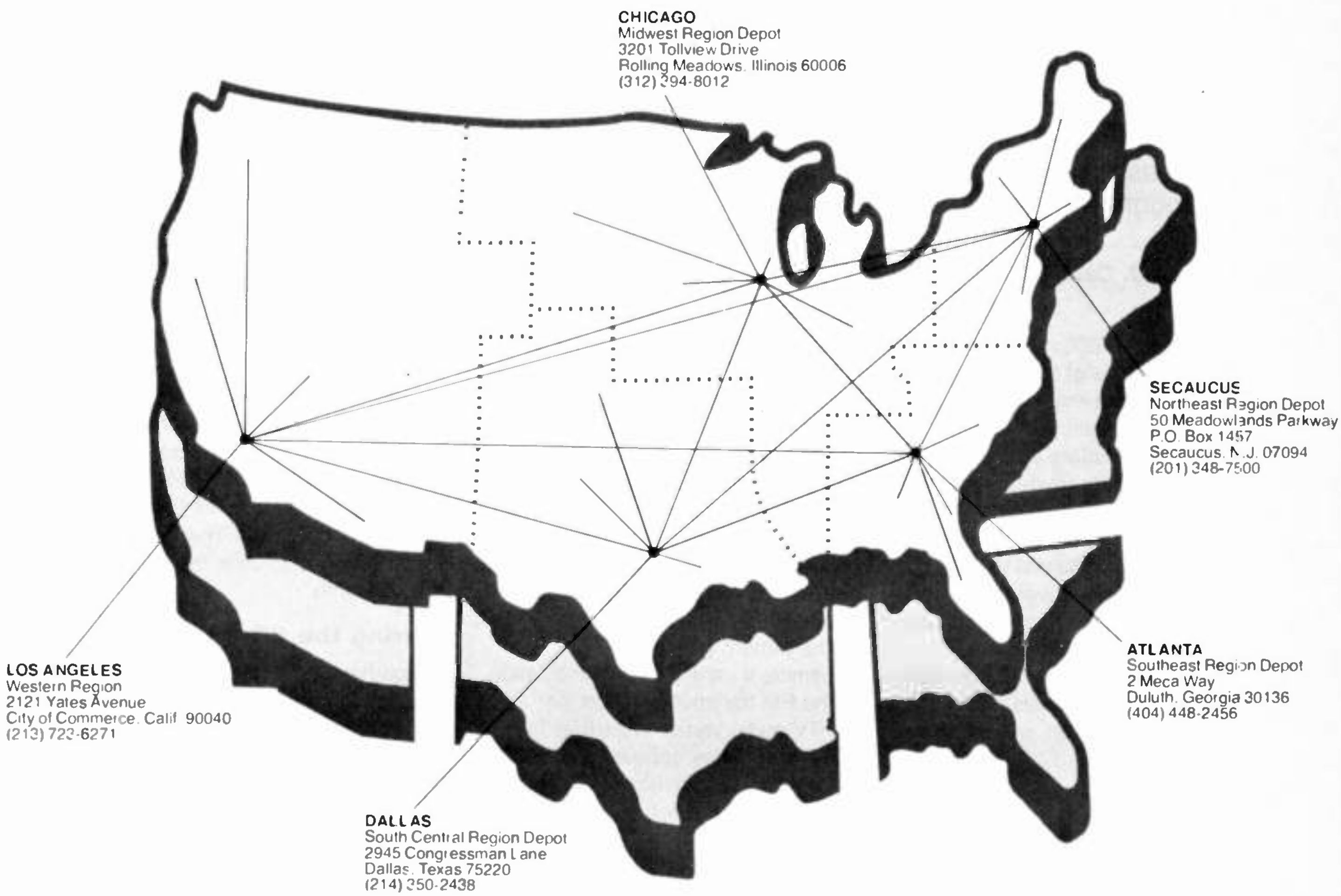

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Tracking down TV interference

A look at some case histories

Perhaps no other area of troubleshooting gives so many false leads. Here are some ideas for winding your way through the maze.

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

An FCC study of 500 homes in six metropolitan areas of the U.S. revealed that a significant television interference (TVI) problem exists. With over 20 million CB transmitters on the air, plus several million more amateur radio, VHF marine, and land mobile transmitters in service, things can only get worse.

The FCC study showed that 55 per cent of the TVI cases were the fault of the CB transmitter, but the remainder were the fault of the TV receiver! Although interference can be caused on any TV channel, channels 2 and 5 are the most often affected, with channel 9 in third place.

Identifying TVI

Interference to TV receivers is not always as easy to identify as Hi-Fi interference, or interferences to the audio amplifiers of the TV set; there may be no radio station call letters coming through the loudspeaker! The only indication might be some unusual patterns on the screen, some of which look enough like other problems to lead the servicer astray. Figures 1 through 4 show four different TVI problems.

Figure 1 shows *electrical* interference to a TV picture; a type of interference *not* caused by a radio transmitter. This type of problem can be caused by electrical sparking from lightning, motor vehicle ignition systems, or small appliances using motors (i.e. hair dryers, drills, etc.).

Figure 2 shows an example of co-channel interference. This problem is caused by either atmospheric conditions that allow an out of town signal to interfere with local reception or it exists in areas that are approximately equidistant between two cities that have stations on the same channel.

Figures 3 and 4 show two forms of genuine transmitter interference to television reception. The problem shown in Fig. 3 results from interference by an FM broadcast transmitter. Although FM broadcast transmitters can affect any TV channel, especially in the VHF "lower-12," it is usually Channels 5 and 6 that are affected. These channels are adjacent to the FM band on the low side. Two-way radio transmitters can also cause this effect.

The pattern caused by FM transmitters varies as the modulation of the FM transmitter varies, *not* as the TV audio varies. Note that TV audio beat notes appearing in the picture can be eliminated by proper fine tuning of the set.

Figure 4 shows the type of interference normally caused by CB, amateur (ham), and other amplitude modulated transmitters. The bars will tend to move as the transmitter operator talks.

Causes of TVI

In most cases, TVI is the result of response to a harmonic of the transmitter signal. The harmonic can be generated by the transmitter, or be created by the TV itself in response to a nominally "clean" transmitter fundamental signal. Figure 5 shows that the TV channels most affected by CB transmitters are those that have a second or third harmonic relationship to the 27 Mhz CB band. These TV channels are harmonically related to the CB output frequency!

Regardless of whether the actual fault is an excessive harmonic radiation from the transmitter, or the generation of harmonics, that otherwise did not exist before, by the TV set, the result is a customer who cannot watch TV.

Note well, before you tackle any TVI service, it can be an explosive issue in some neighborhoods. Often both the CB operator and the TV owner feel that theirs is the side of righteousness, and the other side be damned. You could very well become a traget for both sides, especially if you sold either the CB or the TV (or both!). Blessed be the peacemakers, for they catcheth hell from both sides. The best thing to do is to find a solution that all sides can live with.

Curing the CB Set

If you have access to the offending transmitter, then it may be possible to try several fixes. Keep in mind, however, that troubleshooting TVI problems is sometimes a lot like trying to skin an amoeba! Sometimes, no one fix works; sometimes no fix works.

First, try and find out if the CB operator is using a linear amplifier. If a linear is being used, then the station is automatically illegal, and you had better leave it alone! In that case, perhaps, an enforcement action by the local FCC field office is the best fix. Linears, incidentally, were found implicated in 46 per cent of the cases where the TVI was the fault of the CB set. In more than half of these cases, the problem disappeared when the linear was disconnected.

Check to see that the radio transmitter is properly grounded. Note that a single piece of wire to a ground rod, or the use of the third wire in the ac power mains connector, may not be a good rf ground even though it is a good ground at 60 Hz or shows

Fig. 1–Electrical arcing interference

Fig. 2–Co-channel interference

Fig. 3–FM interference

Fig. 4–AM (i.e. CB) interference

"zero ohms" on a dc ohmmeter! Multiple, short-length, large-diameter conductors to a metal cold water pipe, or multiple ground rods, are best.

The next step is to install a good grade of commercial low pass filter (designed for CB) in the CB transmitter output line. Place the filter as close as possible to the transmitter, and ground its case properly. Follow any special instructions offered by the filter manufacturer.

If installation of the filters caused the interference to disappear, or to change in any significant manner, then it is likely that either harmonics or parasitic oscillations are present in the transmitter signal.

The sources of these problems include misadjustment of transmitter tuned circuits, faults in the internal TVI trap, missing or corroded shields, bad transistors, bias problems, and even the power supply.

If installation of the low pass filter did not materially affect the interference, then it is less likely to be caused by the transmitter. But before hustling over to the TV set-owner's home, check the CB antenna and transmission line. Broken antenna elements, or corroded solder joints or connectors, rusted element joints, etc., all act like natural "diodes," and can introduce just enough nonlinearity to create harmonics, even though the output of the transmitter was essentially clean. In this case, the harmonics are *caused by the CB antenna system*.

Checking the TV set

Ordinarily, an unmodified CB set, in good repair, will not interfere with a TV receiver that is also of good design and in good repair. This is especially true of CB sets of recent manufacture, which must meet stricter harmonic and parasitic radiation limits.

If you note that other TV sets in the same vicinity are unaffected by the CB transmissions, then it is likely that the fault is in the TV set. Some ardent CB and amateur hobbyists make it a point to keep a TV set near the CB transmitter to show any complaining neighbors that it is *possible* for TV and CB to coexist.

There are several mechanisms by which a TV receiver will generate harmonics of strong input signals, even when the original signal was clean of excessive harmonics. Anytime nonlinearity creeps into the system, then the possibility of harmonic generation exists! In one case several years ago, I found a shorted rf amplifier tube was doing this trick. But since we are in a metro area that has very strong local TV signals, the set owner had never noticed the loss of the tube.

In still other cases, the majority perhaps, the input circuit of the rf amplifier in the TV tuner is driven into nonlinearity by the strong signal affecting its bias. This problem is due to a lack of shielding and poor front-end selectivity in the tuner.

Front-end overload can often be eliminated by improving the selectivity of the front-end with a high pass filter. This filter will reduce the level of the interfering signal reaching the tuner, at only a small cost in the TV signal's level. The high pass filter should be installed in the antenna line of the TV receiver (Fig. 6). I have used Drake TV-75HP and TV-300HP filters to good effect. The filter is most effective when it is mounted directly to the antenna input terminals *on the tuner*. But you may want to try connecting it first to the back of the set to see if the interference is eliminated. If it is, leave it there, and save yourself some time.

A very good indication that the high pass filter will be effective is to note whether or not the interference disappears, or is reduced in severity, when the antenna terminals are disconnected at the back of the set. If the problem disappears, then the filter will probably work connected to the antenna terminals at the back of the set. If, on the other hand, it merely reduces the severity, then try disconnecting the antenna at the tuner itself. If it then disappears, attach the high pass filter to the tuner. (Note: if the tuner shield is missing, replace it before continuing.)

Another problem spot in TV reception systems using either antenna preamplifiers or distribution amplifiers, is the creation of harmonics due to overloaded amplifiers. These devices can suffer from the same problems as any other rf amplifier when overloaded and should not be overlooked. It is, incidentally, quite easy to overlook them because they tend to be mounted in out-of-the-way locations. If you disconnect the amplifier, and the problem clears up, then suspect the amplifier. Figure 7 shows the proper placement of high pass filters in a master antenna system. If a high pass filter placed in the system at the TV antenna terminals reduces the interference, then suspect the amplifier, or install the filters per Fig. 7. In any electronic system, incidentally, it is good engineering practice to install any frequency selective filters *ahead* of any amplification; especially the wide-band type of amplifiers used in TV antenna systems!

Special problems

It is quite possible for a strong neighborhood CB transmitter to cause interference to Ch. 2 TV reception, even though the transmitter is legal and in good repair. One possible solution is to place a series resonant tank circuit (Fig. 8) across the TV receiver's antenna terminals. Adjust the capacitor for minimum interference.

Another approach, which has a certain elegance, is to use a quarter wavelength open-circuited stub (Fig. 9) across the antenna terminals of the TV receiver. The length of the stub is given by $L = \frac{2952\ V}{F}$

Where:

L is the length in inches

F is the frequency in mHz

V is the velocity factor of the transmission line

L works out to be about 40 inches for foam coax, and 50 inches for twinlead. Cut off ¼ inch at a time until the interference is eliminated.

FM broadcast interference to TV reception can also prove troublesome. The first step is to install a commercial FM rejection filter. Your antenna supplies wholesaler should have these traps in stock. If the trap is ineffective, then try the quarter wavelength open stub used above (25 in. for foam coax, 30 in. for twinlead, cut off ¼-in. at a time until the interference is eliminated). In both cases, incidentally, two stubs may be required; one at the antenna terminals on the back of the set, and another at the antenna terminals of the tuner.

One last method is to use a

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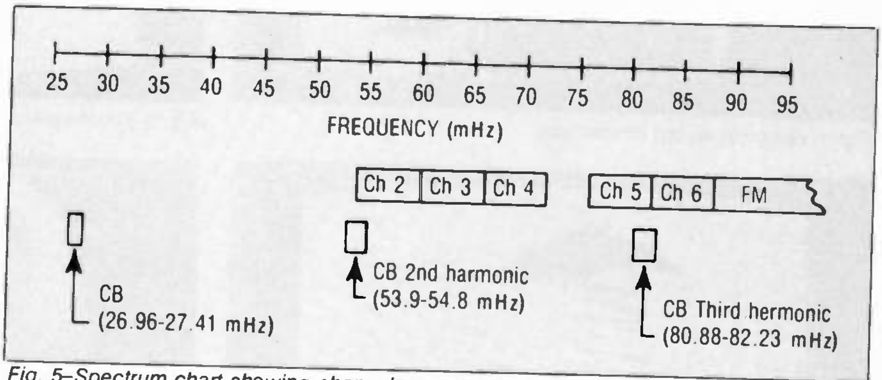

Fig. 5–Spectrum chart showing channels susceptible to interference

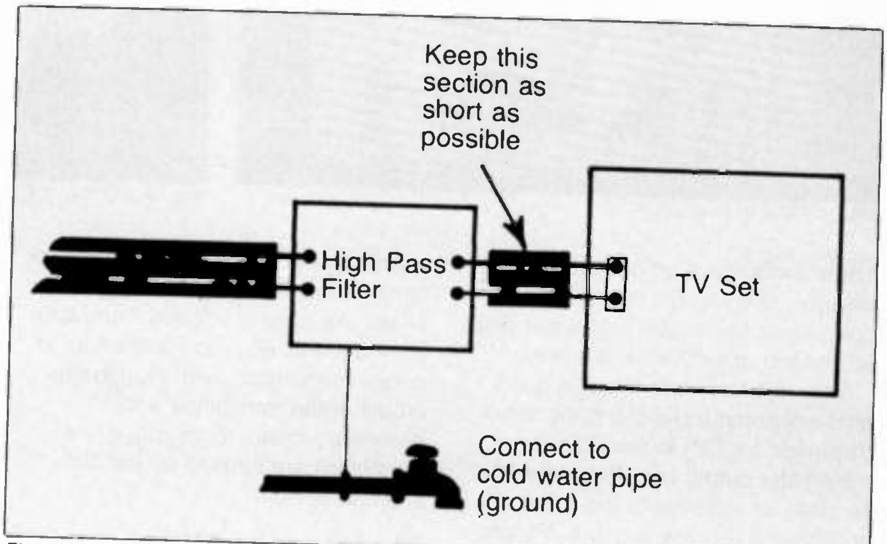

Fig. 6–Proper installation of a high pass filter

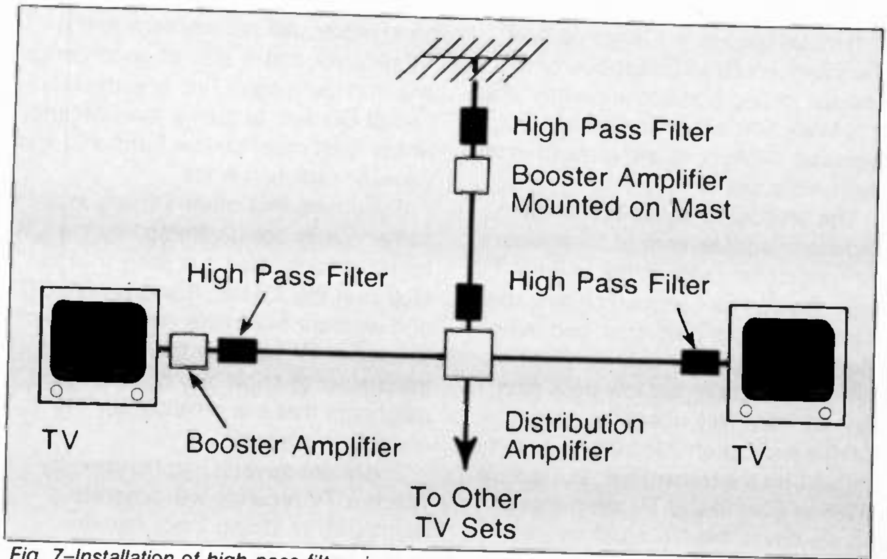

Fig. 7–Installation of high pass filters in a master antenna system

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Circle No. 111 on Reader Inquiry Card

Getting more Business

Managerial skills are the key

A look at the operating philosophy of Aid Electronics of Indianapolis and how it expanded three-fold in just seven years.

by Dick Glass*

How does an ordinary TV service business grow from the average size of three to five technicians to one of the largest service-only shops in the state of Indiana? Many servicers would like to know. There are always questions which, if answered could help growing shops avoid mistakes which hold them back. There are no standard methods of increasing the amount of business. The ways Aid Electronics went about it may not be orthodox, but they worked and should serve as guidance to readers who are searching for answers to the many unknowns involved in running an electronic service business.

Veral Shields was an employee-technician with Aid Electronics in the 1950s and '60s when the company was located about four miles north of the center of Indianapolis. That area was then a fairly prosperous residential section of the city.

Veral took out an SBA loan to buy the business in 1970 and moved the firm to its present location on the northeast side in the suburb of Lawrence.

Few service shops sport a front entrance 85 feet wide (see Fig. 1)! Since Aid moved to the Lawrence location it has had to enlarge its quarters frequently and now occupies about half of a mini-shopping-center location. The only space at Aid not used in the service

Fig 1–Aid's 85-feet of frontage is readily identifiable from the street.

operation is one office occupied by George Shields, an attorney. It might appear that having your own "resident" lawyer right in the business could have some definite good or bad effects but there seems to be no clear indication of that, one way or the other.

Veral Shields has his own private office; excellent accounting; access to all statistics and ratios; and concentrates on management duties as his prime role in the organization. He also is a technician and by acting in a "problem solving" capacity, assisting the other techs with "tough-dog" repairs, is able to keep his nose in the repair activity. Day-to-day bookkeeping, checkwriting, payroll, etc., is performed by Mrs. George (Bonny) Shields.

The customer entrance and counter is given ample space, as the majority of repair jobs are "carry-in" from retail customers or from the several department or discount stores which use Aid as their service agent. Technician and dealer licenses (required in Indiana) and other certificates are displayed for customers in the entrance area. Customer records are also maintained here, the small items such as batteries, line cords, and adapter cables are displayed.

The service benches are not unlike the "U" shaped servicing modules found in many shops around the country. Those at Aid are larger than most, with stereo-radio department modules having about 16 feet of bench space each, and color TV with five such modules, each having over 24 feet of bench space (Figs 4 and 5).

Repaired items are located directly behind the customer entrance area, each shelf slot having its own identifying number.

Incoming sets are located in either the TV department on a 3-tiered-by-30-foot-long shelf that occupies the exact center of the room, or in the audio-radio department on a similar storage island, or on a floor to ceiling wall rack. For such a large

**Mr. Glass, a consultant and freelance writer, is a former Executive Director of the National Electronic Service Dealers Association.*

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NORTHEAST

ABDELMALEK SPACEAGE TV & RADIO SERVICE
FREE ESTIMATES AT OUR SHOP
3753 N Post Rd--------------898-5824

ACCURATE TV
Service On
RCA • Zenith • GE • Admiral • Quasar
Magnavox • Sears • Philco • Motorola
Foreign Imports • Other Major Brands
Expert Repair On Solid State Equipment
Stereo • Radio • Repairs By Licensed
Tech - Free Engraving For Theft Protection
On Serv. Units - Save On Carry-In Serv.
4220 N Post Rd--------------899-3434

AID ELECTRONICS SERVICE INC
WE SERVICE ALL MAKES TV'S
Radios • Stereos • Tape Recorders • CBs
8-6 Daily 9-4 Sat.
4721 N Franklin Rd-----------547-1384

ALERT TELEVISION & RADIO SERV
2534BrooksideAv - -------------636-6005
BEKAS TV SALES & SERVICE
4401NFranklinRd - -------------547-2943

ZENITH TV AND RADIO-SERVICE
Distributor Approved Service Centers are equipped to provide Zenith warranty service. Personnel are trained on Zenith products. The quality goes in before the name goes on.®
ZENITH
"FOR INFORMATION CALL"
DISTRIBUTOR APPROVED SERVICE CENTERS
ACR APPLIANCE CENTER
5215NCollegeAv - -----------283-1371
AID ELECTRONICS SERVICE INC
4721NFranklinRd - ----------547-1384
ARLINGTON TV SERVICE CENTRE
2002NArlingtonAvUnit3 - ----359-3851
ASSOCIATED TELEVISION CO
6413EWashington - ---------357-7760
BEKAS TV SALES & SERVICE
4401NFranklinRd - ---------547-2943
BRUNO TV SALES & SERV
5055E16 - ---------------357-3884

Radios—Citizens Band

A & B COMMUNICATIONS
Business Band • C B • Telephone
Sales - Service - Installation
724 N Capitol Av-------------632-7097

A E S Inc 1811WWashington--------632-7309

AID ELECTRONICS SERVICE INC
Citizen's Band Radios Repaired
4721 N Franklin Rd-----------547-1384

Stereophonic & High Fidelity Equipment—Dealers & Service

A-1 LABORATORY
STEREO & PHONOGRAPH SERVICE
SERVICE ON ALL MAKES
FOREIGN & DOMESTIC
RAUB RADIO
5905 N College Av------------255-2466

ABCO Electronics 4842NCollegeAv ----924-9792
ACR APPLIANCE CENTER
5215NCollegeAv - -------------283-1371
ABDELMALEK SPACEAGE TV & RADIO SERVICE
STEREO & HI-FI REPAIR
ALL MAKES - 38th & POST
3753 N Post Rd--------------898-5824
Accurate TV 4220NPostRd---------899-3434
AID ELECTRONICS SERVICE INC
Many Years Of Experience
STEREO - HI FI REPAIRING
4721 N Franklin Rd-----------547-1384
ALL AMERICAN RENTAL CENTER
See Our Ad under Television Rental
3307MadisonAv - -------------788-4777
APPLIANCE CENTER THE
Factory Auth. Service For
Pioneer • Nikko • Dual • P.E. • Sanyo
Parts & Service On Many Other Brands
3202 N Bolton Av------------547-6075
AUDEX CORP Hwy67 McCordsville---335-2531
Audio Electronics-Wholesale 4831W38-297-1704
Avenue Radio & Television Serv
3324E10 - ------------------636-2827
Ayr-Way Stores
8811Hardegan Greenwood --------882-9311
CMC STEREO CENTERS 6020E82--849-6167
(See Advertisement Following Page)
C-Y Electronics Inc 4937W38-------299-6454
(See Advertisement Page 990)
CAPITAL APPLIANCE DISTRIBUTORS
ADMIRAL APPLIANCES
Solid State FM/AM-FM Stereo
• Wholesale Only •
3333 N Franklin Rd-----------898-2320
Charlie's TV Sales & Service
6004 SoutheasternAv -----------357-2201

Fig 2—Aid Electronics multiple "Yellow Pages" listings.

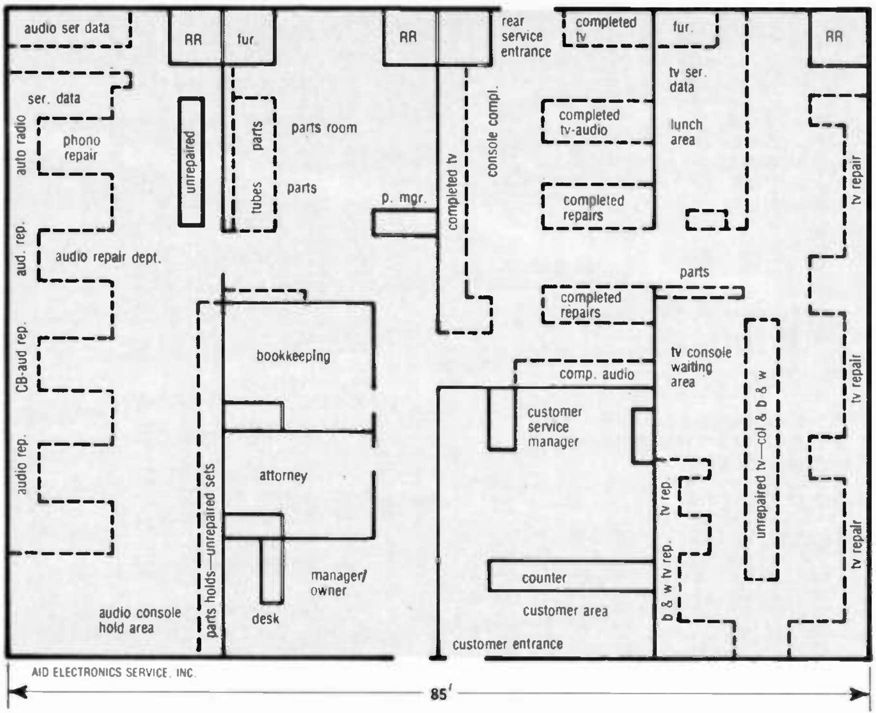


Fig . 3–Floor plan of Aid Electronics

operation the layout is such that technicians waste very little time running back and forth.

Parts department

The parts department is located in a controlled area near the center of technician activity (see Fig. 3). Several ideas used here are worth emphasizing: 1. Belts, drives, coils, controls, and other one-of-a-kind type parts are arranged on 6'-high pegboards for ease in visually locating them. Some pegboards are built in a "U" shape to conserve space and allow maximum wall area. 2. Particularly handy is the transistor, IC, solid-state devices system. The 13-two-inch deep shelves hold plastic "coffee-creamer" cups in which all the small items are individually contained. Each cup is labeled with a typed stick-on paper tag and located in alpha-numeric sequence. When the last part in a cup is used, the "coffee-creamer"-cup is turned right-side-up to alert the parts manager for reordering (if that part has not already been ordered). 3. All parts are inventoried on 4 × 6" file cards which are located in several file boxes on the parts manager's desk. Technicians and parts department personnel are required to write down each part as it is taken from the parts department, on a legal pad, maintained on the parts manager's desk. By using the simple parts-used pad, warranty parts paperwork, the inventory file cards, and location tags on the parts themselves, the near impossible job of maintaining parts control is well handled.

Back to the subject of "getting the business", Mr. Shields feels that growing is a tough problem for any service business. There is very little room on either side of the "optimum" point where you have just enough repair work (not too little and not too much) for the technician work force you employ. Ordinarily there is either too little or too much work. If there is too much for a period of time a new technician must be employed. As luck would have it, immediately thereafter business drops off and some of the techs are low, or out of work. It is then that thoughts of "how to get more business" come to mind and the vicious circle starts all over again!

Aid advertising philosophy

1. Large Yellow-Pages display ads have three drawbacks: They cost a lot of money; they tend to cause some potential customers to think of your firm as extravagant, probably resulting in higher prices; and the ads are not necessarily read by a majority of the people "walking" through the Yellow-Pages, looking for services.
2. A service firm should try to be "listed" in each Yellow-Pages product category it intends to service.
3. Servicers should be "listed" in each "area" category of their phone Yellow-Pages section.
4. Advertising in major newspapers which cover large areas outside your servicing location is uneconomical. The same goes for radio-TV.
5. Advertisement/donation assistance to local community groups, such as churches, schools, the Boy Scouts etc., is worthwhile so long as a policy is established to limit it to your area and to bonafide local people.
6. Advertising in the small weekly newspapers is worthwhile so long as you realize the results will not be immediate, but should pay off in the long run.

To illustrate the Aid Yellow-Pages philosophy, here is the way the company is listed. There are eleven separate listings in the Indianapolis Yellow-Pages Directory (see Figure 2).

Obviously, Aid has a sizable phone bill each month. Eleven listings are expensive, especially considering that one of them is a 2¼ × 2" column ad and two others are ½" deep ads. Interestingly, the total cost for all the Aid listings is about 75% of what one quarter-page display ad in the Yellow-Pages would cost!

Most service shops and all television retail sales stores would enjoy having Aid's 85 foot frontage, the ample paved parking area, the well traveled main street location, and all the window space which is used mainly for displaying the Aid name. However, these are not considered to be prime factors in gaining business. Instead, a large mounted roadside sign and well-painted window identification are thought by Aid to be primarily useful only as an aid for customers intending to do business with Aid.

Most service businesses consider their panel truck signs as important advertising tools. It lets potential customers see the store name as the truck goes about its business in shopping areas and residential neighborhoods. Aid has only a small magnetic sign on its vehicles. It used to be that large signs on a TV service truck were an open invitation for a thief to partake of tube caddies and portables. This is no longer the problem it once was, but it sill exists to some degree. In Aid's case a second reason keeps them from displaying "billboard" type truck signs: Aid does business for about two dozen retail stores (37% of its business is warranty work). These stores are not interested in advertising the fact that they do not do their own service, or that an outside service firm is frequently making calls at their sales floor. Therefore, downplaying the truck signs is better for the department-store/service-agency relationship.

Retail contracts

Much of Aid's business comes from the retail stores it services. In addition to

Fig . 4–The phono and auto radio repair section of Aid Electronics .

Fig. 5–Several TV repair stations. Note the scope cart and amole bench area.

warranty work which comes directly from the stores (such as Lazarus, K-Mart Woolco, etc.) these stores also refer after warranty work to Aid. In performing a large amount of warranty work, the after warranty business must be maintained if the total program is to be profitable. The reason is simple, as illustrated at Aid where 37% of the units serviced are warranty repairs, while only 22% of the dollar volume is produced by them.

Aid has no written contract with the over two dozen stores it services, which may seem surprising. Aid's only contracts are with the manufacturers it does warranty work for (58 brands). To attempt to keep a larger number of after warranty customers, they have plans to enter the *retail service contract* business shortly.

Aid's policy is not to turn down "off-brand" products for service. In fact, Aid's willingness to service nearly any electronic product, its large number of technicians, and large facilities, causes many retailers of audio and other products to frequently bring in their "overflow" repair work for Aid to repair. Dealers receive a substantial labor and parts discount at Aid. Auto radio is also a part of the Aid service. The firm acts as the "exchange" repair center for all Ford dealers in the area.

Adequate service data is available for

continued on page 54

BULLETIN BOARD

The Sylvania ECG Semiconductor Master Replacement Guide second supplement was recently announced by *General Telephone and Electronics*. This 20-page supplement supersedes one published earlier this year and includes information on 31 new devices, and about 3500 industry part numbers which have been added to the cross-reference section. The ECG master guide and supplement are available from any authorized Sylvania distributor.

A new CMOS product guide is available from RCA. This revised, 28-page brochure covers RCA's line of COS/MOS ICs for digital designs in industrial, commercial, and military applications. The new designer's aid provides maximum ratings, recommended operating conditions, static electrical characteristics, classification and selection charts, and functional diagrams for the complete line of "A" series (15v absolute maximum rating) and "B" series (20v absolute maximum rating) RCA COS/MOS digital integrated circuits. Product classifications include gates, flip-flops, latches, multivibrators, registers, counters, multiplexers/demultiplexers, phase-locked loops, quad bilateral switches, interface circuits, arithmetic circuits, display drivers, crosspoint switches, and memory circuits (RAM). A function selection chart provides a brief description of each device. Copies of this brochure, COS-278G, may be obtained from *RCA Solid State Div.*, Box 3200, Somerville, NJ 08876.

Motorola . . . The Total Communications Systems Supplier is the title of a new brochure describing the products and services available from *Motorola Communications and Electronics, Inc*. Motorola offers a line of radio systems and products for commercial, government or industrial applications which can be leased or purchased. In addition to different types of two-way radios, Motorola offers car telephone paging communications systems, base station communications systems, visual (CCTV) systems, remote radio control systems, point-to-point microwave systems, modular communications control systems, marine communications equipment, portable communication systems and mobile radios. For a free copy of the brochure, contact Barbara Bennett, Literature Distribution Center, 2122 N. Palmer Dr., Schaumburg, IL 60195.

High Performance, Dual and Single Trace Oscilloscopes are featured in a new catalog from *Leader Instruments Corp*. This 16-page catalog presents eight 3 and 5 inch oscilloscopes from the LBO-520, a 5 inch 30MHz dual trace instrument with delay line, which sells for $1100 with probes, to the LBO-310A, a 4MHz single trace unit for less than $250. Several intermediate models offer 10 and 20 MHz bandwidth, X-Y operation and rack mounting options. All carry the manufacturer's two year limited warranty. For further information contact: Leader Instruments Corp., 151 Dupont St., Plainview, NY 11803.

ITT Cannon Electric has announced the publication of a new 206-page Standard Line Connector Catalog. This 1978-79 catalog features 18 major connector lines including subminiature circular, standard and miniature circular, environmental, rack/panel, coaxial, and others. It includes drawings, photographs, charts and graphs and a special connector guide. Also, it contains information of materials and finishes, electrical data, contact arrangements and tools. The catalog is available from distributors or from *ITT Cannon Electric*, 666 E. Dyer Rd., P.O. Box 924, Santa Ana, CA 92702.

Allied Electronics 1979 **Engineering Manual and Purchasing Guide** is now available. This 260-page, 9 by 11 in. catalog contains data and specifications and pricing on a wide selection of industrial-type electronic parts, supplies and equipment. It has cross references and product and manufacturers indexes. Allied's 1979 Guide is available for $1 from: *Allied Electronics*, Dept. C-79 401 E. 8th St., Ft. Worth, Tx 76102.

More than 1300 electronic wire and cable types are listed in Belden's 1978 catalog. The manufacturer states that the 180-page publication contains 30 percent more products than its 100-page predecessor. The catalog, Publication 878, lists seven individually indexed categories: multi-conductor cables, computer cables; bonded and laminated flexible flat cables; hookup wire; coaxial and cable products and assemblies, and shielded/unshielded cords and portable cordage. Construction details and physical and electrical characteristics are given. OL and CSA compliance is indicated. Uniform product code numbers are given for simplified ordering. For a copy of Publication 878, write: Manager, Marketing Communications, *Belden Corp.*, 2000 S. Batavia Ave., Geneva, IL 60134.

Atlas Sound has just released a short form catalog covering two series of indoor/outdoor music speakers and a wide range of microphone booms and accessories. The catalog features eight models of the AP series of high-efficiency environment-resistant loudspeakers, and several models of the WR/WT weather-resistant loudspeaker series. A separate section covers microphone stands and boom attachments. Request Form 1840R from: *ATLAS SOUND*, A Division of American Trading and Production Corp., 10 Pomeroy Rd., Parsippany, NY 07054.

An update to their 1977 Audio-video Belt Catalog and cross reference chart has been announced by Projector Recorder, Belt Corp. This catalog describes 500 new reference listing and makes corrections to the 1977 catalog. It reportedly is the most comprehensive belt repair catalog in the electronics and audio-visual equipment field. The catalog is available upon request from *Projector Recorder Belt Corp.*, 200 Clay St., Box 176, Whitewater, WI 53190.

Thordarson Meissner has recently released a new **Tech-Mate® Semiconductor Cross Reference Guide**, which reportedly contains over 161,000 listings of universal and exact replacement ICs, IC modules, voltage multipliers, semiconductors and accessories. It is available from Thordarson Meissner distributors.

Security System Equipment is the subject of the latest catalog of *Mountain West Alarm Supply Company*. The 72-page catalog reportedly describes over 900 alarm system products to provide a one stop source of supply for repairers, installers, business and industry, including items from simple door switches and bell systems to the latest radar, ultrasonic and infrared detection. Catalog A-29 is free from Mountain West Alarm Supply Co., 4215 N. 16th St., Box 10780, Phoenix, AZ 85064. ET/D

TEST INSTRUMENT REPORT

The Telequipment type D67A and D66A oscilloscopes

Convenient and versatile

By Walter H. Schwartz

Fig. 1–Tektronix D67A oscilloscope. For more information about this instrument, circle 150 on the Reader Service Card in this issue.

With the exception of a good multimeter, the oscilloscope is the most basic and important troubleshooting and analysis instrument in the service shop. It is an extremely powerful troubleshooting tool in itself, and a part of test setups for alignment and color circuit analysis.

The Telequipment D67A and D66A—we tested the D67A—are versatile 25Mhz oscilloscopes intended for engineering, production, or service. The two instruments are similar except for the delayed sweep capability of the D67A and the X-Y feature of the D66A. Additionally, the time base and vertical calibration of the D67A are more accurate—reportedly due to a regulated power supply.

Both instruments are dual trace, chopped or alternate, and have vertical deflection factors of from 10mv/div to 50v/div and also have a X10 gain switch which increases the amplifier sensitivity to 1mv/div at a 15Mhz bandwidth. The sweep speed can be varied from 2s/div to 100ns/div for the D66A and to 200ns/div for the D67A. The sweep also has available a X5 magnifier providing a maximum sweep speed of 20ns/div for the D66A and 40ns/div for the D67A. In the TV mode, the triggering switches automatically from line to field between 50 and 100µsec/div. The D67A's delayed sweep offers a versatility of sweep and triggering and an ease of viewing certain waveforms not otherwise easily obtainable. Four different horizontal display modes can be selected. When A Only is selected, only sweep A is operative. When A Int is selected, the part of the A sweep covered by the B sweep is intensified. This section can be adjusted with the B sweep controls. When B Delayed is selected, the B sweep, which should be set faster than the A sweep, is displayed. When Mix is selected, a mixed sweep is displayed, the first portion of which is A sweep, swept and triggered at what ever rate is selected. The rest of the trace is displayed at the B sweep rate. The Delay control can be used to vary the point at which the transition occurs. Ungated, the B sweep will start at any point on the A sweep as selected by the Delay control. Gated, it will start only when a B triggering signal occurs.

In use, the D67A met specifications easily. The bandwidth was better than 25Mhz, the calibration of the input attenuators and sweep proved accurate and the scope triggered solidly and readily. The delayed sweep is fascinating to use. To demonstrate, connect a test probe to the output of the video detector of a television receiver. Set sweep A at .2sec/div, trigger with vertical sync pulse (external), and set the display selector to A only. The 17th, 18th and 19th lines of the vertical interval should be visible to the left of center of the screen, quite compressed. Set the delay control to about 9. Switching the display to mix and setting the B sweep to 10µsec/div, should allow the delay control to expand and move, line after line, off the right side of the screen until first line 19, VIR, and then 18, with the composite radiated signal, and finally, line 17 with alternate multiburst test signal (Field 1) and color bar test signal (Field 2) appear expanded in size enough for very easy examination. Connecting the probes from both channels 1 and 2 to the same test point and using both traces on alternate sweeps allows both fields 1 and 2 to be viewed, and both the multiburst and color bar test signals to be seen simultaneously. (See Fig. 2.)

The D66A can be used as an X-Y scope for vector color analysis in conjunction with a color bar generator. Unfortunately, the D67A cannot conveniently be used in this way since it has a restricted bandwidth, fixed gain, horizontal amplifier.

The D67A is an excellent scope for

service and troubleshooting. It has two limitations, however. First is the lack of X-Y—vector scope—capability and the second is its maximum input voltage which is defined as 400v peak, DC, AC, or sum of. The Tektronix probes used with it have a maximum rating of 600v, decreasing with increasing frequency above several Mhz. This voltage rating

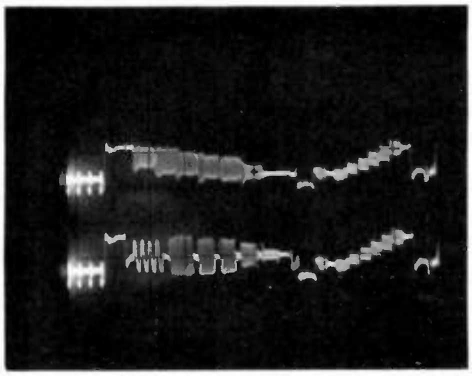


Fig. 2–Color bar and multiburst test signals displayed via delayed sweep at 10 μsec/div with main sweep (showing lines 14, 15 and 16) at .2msec/div.

would be a disadvantage possibly in some of the older vacuum tube sets and would require care to stay away from the output circuits of vertical output tubes and horizontal output transistors.

The control layout is convenient and the knobs, though small, are of adequate size. The pushbutton switches have black caps on red shafts showing at a glance whether the switch is in or out.

The D66A sells for $1220 and the D67A for $1470, each with manual. Probes of X1 or X10 attenuation of various lengths, are extra. ET/D

Circle No. 125 on Reader Inquiry Card

DEALER'S SHOWCASE

Clock Radio

Circle No. 151 on Reader Inquiry Card

Magnavox has just introduced a new clock-radio, the Model 3200 in a walnut grained cabinet. It features an electronic clock with LED readout, AM/FM reception, pushbutton tuning, a 3 by 5 in. oval speaker, and a slide rule dial. It measures 12-¾ in. long, 8¼ in. high, 5-¼ in. in depth, and has a suggested retail price of $69.95.

Cassette Deck

Circle No. 152 on Reader Inquiry Card

Kenwood is presently introducing a new stereo cassette deck. The Model KX-630 uses the Kenwood dual-belt drive system, a large heavy flywheel driven by a high-torque electronically controlled motor. Kenwood reports that the increased accuracy of the drive system reduces wow and flutter to less than 0.07% wrms. The manufacturer states that superior amplifier circuitry and a Dolby™ noise reduction system achieve a noise level of -64dB with chrome tape and Dolby™ on, and that an extra-hard permalloy head obtains a frequency response of 30 to 16,000Hz (40 to 15,000 ± 3dB) with chrome tape. The KX-630 also features three-position equalizer control, two-position bias control and a FM Dolby™ MPX filter for FM stereo broadcast recording. The advertised value is $250. Kenwood's KX-530 offers slightly less control and fewer features for an advertised $200.

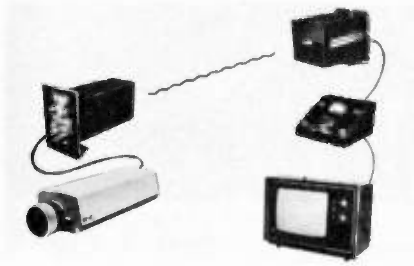
Cable Cutter

Circle No. 153 on Reader Inquiry Card

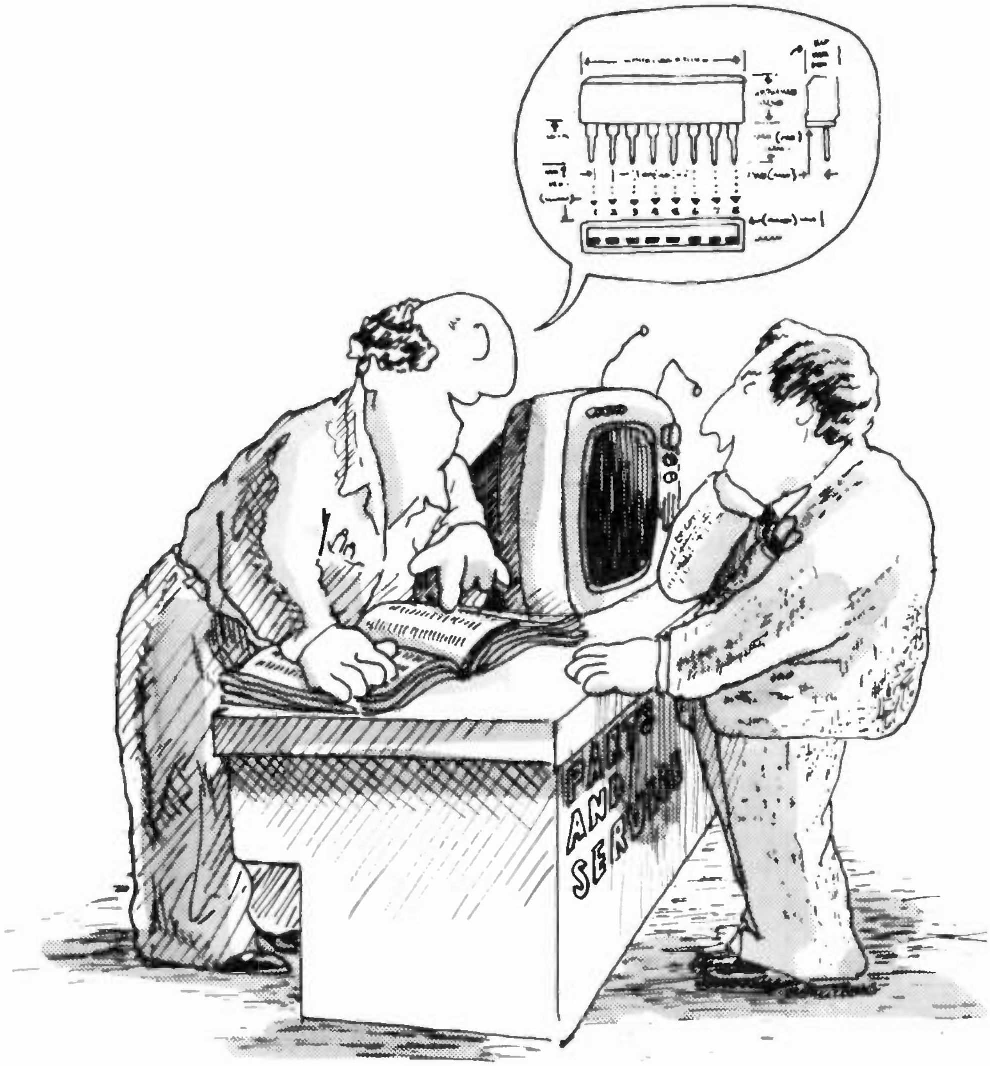
Klein Tools, Inc., announces, reportedly, the first really handy cable cutter. The #63050 is only 9½ in. long, yet has the capability of cutting 4/0 aluminum, 2/0 soft copper, battery cable, etc.

Intrusion Sensor

Circle No. 154 on Reader Inquiry Card



The Video Beam intrusion system transmits a microwave intrusion signal and a high quality television picture simultaneously for a distance of up to one kilometer according to the manufacturer, *Visual Methods Inc*. The system operates at 10.525 GHz and consists of



The world's biggest parts catalog has the one your customer needs.

The new 1978 Sylvania Master Replacement Guide, complete with supplements, is a gold mine of semiconductors for the entertainment, industrial and commercial markets. No other catalog even comes close to our total of 2,000 devices cross referenced to replace more than 142,000 parts for 139 brand names.

And that's just for openers.

The technical data section has been enlarged and completely updated. You'll find over 500 new devices have been added including bridge rectifiers, varistors, SCR's and zener diodes.

There's a brand new digital IC section complete with logic diagrams, pinouts, package drawings and descriptions for 340 IC devices.

You can even turn to new sections on linear IC applications and solid state component testing.

Get your copy from your local Sylvania distributor. You may not have to order 142,000 parts. But it's nice to know you could satisfy that many customers.

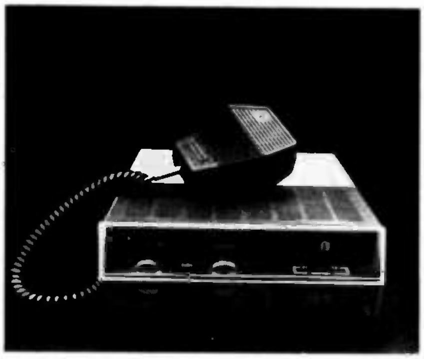
SYLVANIA Electronic Components GTE

small weatherproof transmitter and receiver modules and a control console. It is said to be compatable with all standard television equipment. The intrusion detection operates on a fifteen milliwatt beam which can be reflected around corners and passed through wood, plaster and concrete walls, it is stated, simultaneously transmitting video. Intrusion is indicated by an indicator lamp or an audible alarm. The cost is indicated to be less than 90 ¢ per protected foot: i.e., less than $3000.00 for the system.

FM Mobile Radio

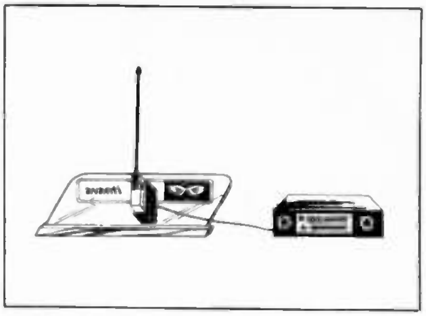
Circle No. 155 on Reader Inquiry Card

E. F. Johnson Company, has just introduced an economically priced two-way FM radio of, according to the manufacturer, high performance specifications. The PPL 6060 (Price/Performance Line) is a compact 15w unit with a die-cast aluminum frame and steel cabinet and single circuit board construction with no interconnecting wires, according to Johnson. Circuitry includes an RF amplifier for fringe area reception, 10.7MHz crystal IF filters and temperature compensated crystal oscillators. Service is easy with all tuning and calibration points accessible from one side. The PPL 6060 carries a full one-year parts and labor warranty which Johnson states is an exclusive. It is available with one or two channel capability.



Marine CB Antenna

Circle No. 156 on Reader Inquiry Card



The *Avanti Astro-Fantom* mobile-marine-base CB antenna, the manufacturer states, is ideal for trucks, vans, RVs (including fiberglass bodies), motorcycles, boats and base station use. A free display is available for use with any working CB radio on the display counter.

Four-way compact Stereo

Circle No. 157 on Reader Inquiry Card

The *Imperial Division of Superscope, Inc.*, has added a new four-way stereo compact music system to its line. The Model C-520 features an AM-FM stereo receiver, an eight-track player-recorder, a top load cassette recorder and an automatic record changer. According to the Imperial Division, the C-520 incorporates phase-locked loop circuitry, automatic frequency control, tape output jacks, record automatic level control,

Put "LIFE" into your Picture Tube Sales!

Channel Master OPTI-CHROME "LT" can liven up your profit picture by offering your customers something no other picture tube has... a lifetime warranty!*

Statistics show you'll get only one chance to sell a replacement CRT in the lifetime of a set.... so make that sale count by selling the Opti-Chrome "LT." to you for the life of their set...a hedge against the service giants...something new and exciting to talk about...the best CRT and the best warranty available at any price!

Free Tube Replacement for as long as your customers own their sets!

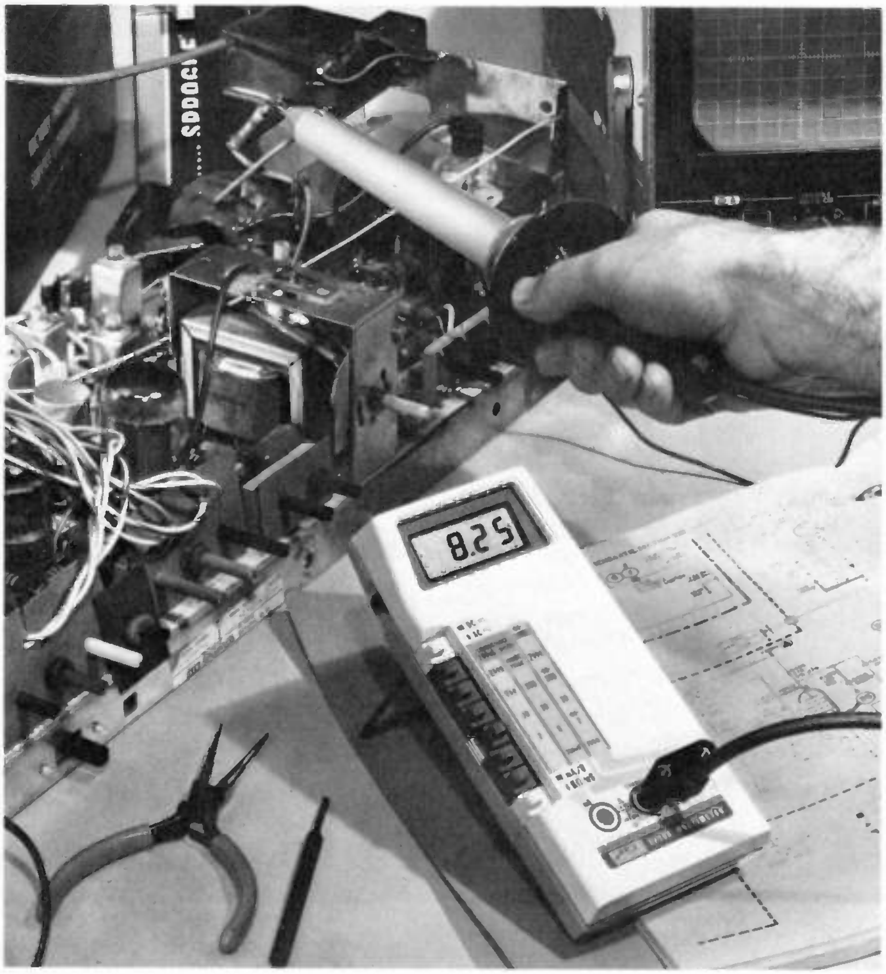
With Opti-Chrome "LT" you get: more profits... the best warranty feature on the market...a door-opening sales tool...a tube that ties the customers

Opti-Chrome "LT"....it's going to revolutionize the picture tube industry!

Channel Master Division of Avnet, Inc. ETD1178, Ellenville, N.Y. 12428

*Limited Warranty—Labor not included.

Circle No. 110 on Reader Inquiry Card



eight-track auto stop and cassette auto shutoff. The speakers offer acoustic suspension design in an 8-inch, two-way system, with mechanical crossover. Included are two dynamic microphones. The suggested list price is $269.95.

4 In. B&W TV, AM-FM Digital Clock Radio

Circle No. 158 on Reader Inquiry Card

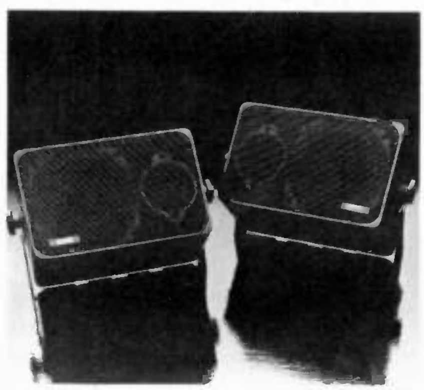
Sharp Electronics Corporation has recently introduced the third small black and white television set in its line, the Model 3T57, with a 4 in. (diagonal) screen, AM-FM radio, and digital clock.

This set has a varactor tuner, slide rule radio dial, sleep switch, and snooze alarm and comes in a walnut grained cabinet. It is solid state and includes a dynamic earphone, weights but six pounds and has a suggested retail price of $209.95.

Miniature HI-FI Speakers

Circle No. 159 on Reader Inquiry Card

Big Brute™ HF4200, a miniature high fidelity auto speaker system has been introduced by *COMM Industries*. The units each contain a 4-inch woofer and a 2-inch tweeter and are capable of 30 watts RMS input power with a frequency response that reaches from 55 to 22,000 Hz according to COMM. The two unit package is to retail for about $150.00 complete with mounting brackets, lead wire and a rugged all metal exterior. The weight is stated to be ten pounds.



Let's face it. The longer a set sits in your shop, the less profit you make. And call backs hurt even more. If you have to work on a set again because a replacement part failed, your profit is gone. Maybe even your customer.

We've been working with technicians for years to help solve these problems. So when you order WEP semiconductors, we make you two simple promises:

1. No back orders. Your distributor won't do that to you, because we won't do it to him. And you'll get sets out faster.

2. Fewer call backs. When you install WEP semiconductors, you're installing the best quality parts available. We know they're good, so we promise you fewer part-failure related call backs with WEP.

In addition you get great margins, and complete technical information on every package.

Next time you need semiconductors, or any replacement parts, ask for WEP/Workman. You'll most likely end up with a few less sets "waiting on parts," and a few more happy customers.

Your business card or letterhead will bring immediate response from one of our representatives.

P.O. Box 3828
Sarasota, Fla. 33578
813-371-4242
TWX 810-864-0401

WEP
WORKMAN
ELECTRONIC PRODUCTS INC
Semiconductors From
The Parts Specialists

WEP REPLACEMENT SEMICONDUCTORS: THEY HELP YOU TURN JOBS AROUND FASTER. AND KEEP THEM TURNED AROUND.

Circle No. 144 on
Reader Inquiry Card

NEW PRODUCTS

Ham Transceiver

Circle No. 160 on Reader Inquiry Card

Swan Electronics recently introduced the 100 MX, a 100 watt completely solid state mobile transceiver, which incorporates state-of-the-art design and styling. It features a PTO with 1kHz readout resolution, noise blanker and VOX, CW with sidetone, receiver incremental tuning, 25kHz calibrator and preselector for transmit and receive—all in a 13 lb. package measuring 3.75 by 11.75 by 9.75 in. It covers 80, 40, 20, 15 and 10 meters with upper sideband, lower sideband, and CW. Ten meter operation is on 28.5-29 MHz as supplied. Other segments can be covered by simply replacing the standard crystal with the optional crystal for the desired band segment.

Microwave Leakage Tester

Circle No. 161 on Reader Inquiry Card

Simpson Electric's Model 380m Microwave Leakage Tester is designed for testing for 2450MHz leakage of micro-

wave ovens, heaters, and dryers. It reportedly meets HEW performance standards and is suitable for service and repair use, as well as production testing. It is a hand held wide-range tester with four ranges of to 100mW/cm^2 with accuracy of $\pm$1dB and a 1.2 second response time, according to specifications. The probe is priced at \$246.75, complete with batteries and manual.

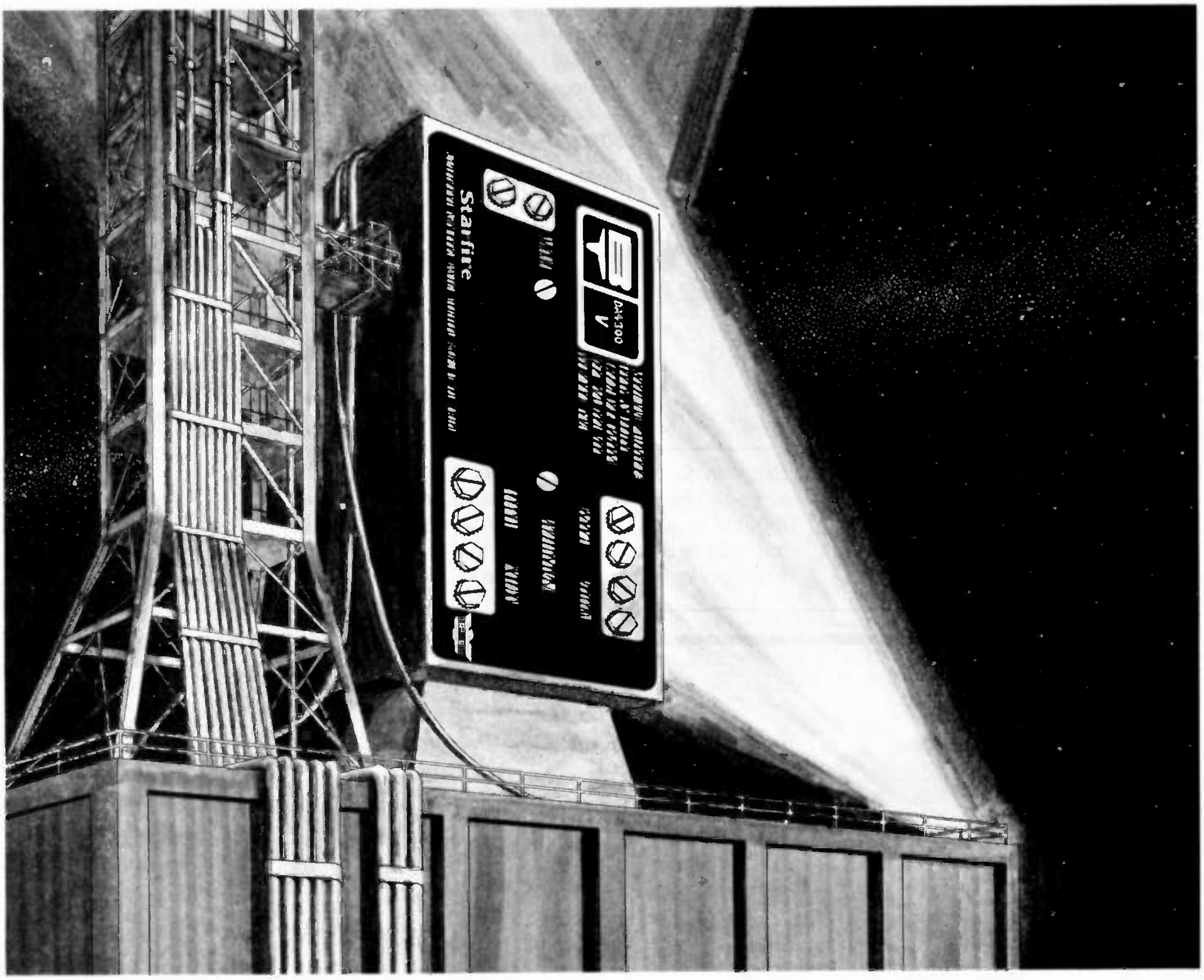
Audio Analyzer

Circle No. 162 on Reader Inquiry Card

American Scientific Corporation has introduced a new Audio Analyzer with the capability, the manufacturer states, of quickly analyzing equipment and listening room performance. For room equalization, the Audio Analyzer drives the speaker system with a "pink noise" signal and displays ten octave responses so that room peaks and dips can be equalized. The same technique can be used for the acoustic set-up of halls or auditoriums. American Scientific states that antennas can be oriented, speakers tuners, amplifier and other components can be tested and compared, and tape recorder equalization, separation and distortion can be checked. The Model

Circle No. 121 on Reader Inquiry Card

Blonder-Tongue announces the launching of another profit booster.



The Starfire Series.

With the introduction of the Starfire series, Blonder-Tongue Laboratories has taken the second step in becoming the last word in TV/FM signal amplification systems.

Starfire distribution amplifiers contain the same habitual devotion to engineering excellence that has made the Galaxy series an industry leader.

- Four outputs. All solid state.
- Built-in power transformer for safety and line surge protection.
- Patented ICEF* circuit for wide dynamic range.
- Tunable FM trap to attenuate strong interfering FM signals.
- Full band FM amplification (same as VHF TV signals) when FM trap is not used.

Add to this, exceptional noise and gain figures coupled with the most expansive co-op program in Blonder-Tongue's history, and you'll realize that Blonder-Tongue's Starfire series and your profit picture are in the same orbit.

*U.S. Patent No. 3413563

BLONDER TONGUE
LABORATORIES, INC.

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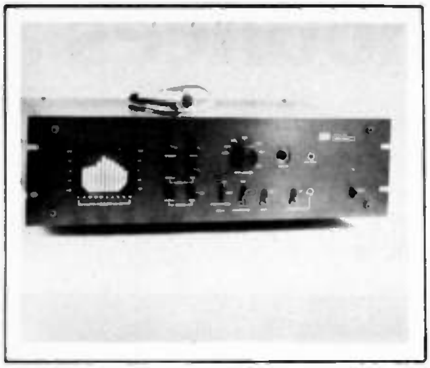


910 Audio Analyzer, complete with a calibrated flat response condenser microphone, has a price of $895.

Digital Panel Meter

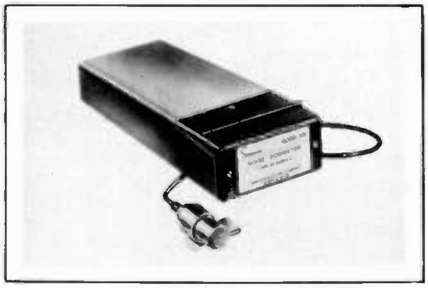
Circle No. 163 on Reader Inquiry Card

Data Tech has introduced a new digital panel meter designated the Model 78 to

replace the popular Fairchild models 53, 75, and 78 3 ½ digit units. The Model 78 case fits the same panel cutouts as the Fairchild, plus it has the additional feature of front mounting capability and panel locking retainers. It is available in 200mV, 2V, 20V and 200V ranges at 0.05% accuracy. Parallel BCD units are available as are 5v DC powered units. The Model 78 will be marketed at prices from 20% to 30% lower than Fairchild models in any quantity, offering improved design at low cost.

Noise Dosimeters

Circle No. 164 on Reader Inquiry Card

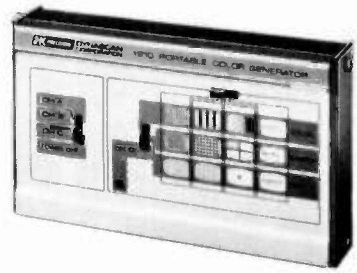


Simpson Electric Company manufactures two noise dosimeters for use in industrial areas where noise levels might be hazardous to a worker's hearing. Both instruments measure and display the accumlated noise exposure of a worker. The 891 to levels above 90dBA to meet ANSI specifications, the 892 to levels above 80dB to meet ISO standards. Each can be worn on the belt or in a pocket with a microphone near the ear. A warning light indicates when 100 percent dosage has been reached. The instruments are priced at $495.

Color Pattern Generator

Circle No. 165 on Reader Inquiry Card

B&K Precision, Dynascan Corporation offers a new color pattern generator, Model 1210. According to B&K its features include 10 stable patterns, color level adjustment, output from 10,000 to 35,000 µv on preset channels 2, 3 and 7, sturdy case and detachable output cable.



BUSINESS

continued from page 37

Fig. 6-Owner Veral Shields

the techs, as is the latest in test equipment and tools. Professional service invoices, well dressed and well groomed technicians and unusually clean and comfortable work areas are immediately evident at this shop. Like any other service business, recalls are constantly a problem to be lived with. Recalls were running at a 7.83% rate in 1977, or slightly below the 10% "rule of thumb" the industry seems to consider par.

The biggest problem for Veral Shields is obtaining good technicians. With a large number of employees, ordinarily employing several apprentice techs (often promising college or trade school students), and constant growth, the need for good techs is nearly constant at Aid. The firm makes use of the employment section of the metropolitan newspaper to solicit for new technicians.

What is the future for service businesses like Aid Electronics? Probably to keep on growing, servicing more products, and improving the profit picture. It seems Aid just ignores those people who complain about how bad the service business is. ET/D

Fig. 7-A typical newspaper ad placed in Aid Electronics' local area paper.

SYLVANIA

continued from page 28

by 1C1012, the Channel Change Buffer. The E1C then converts this to an equivalent code which simulates the two-button keyboard signal.

Troubleshooting the remote

First make sure the receiver is turned on and all voltages are present. The supply voltages are +24 volts (supplied from the main chassis), +14v, +20v, +28v and −260v (a meter will load this supply to approximately −160v). The logic circuits can be checked with a high impedance meter, a scope or a logic probe. Check first for the proper "no command" states and then for the correct changes from Low to Hi or Hi to Low. Commands may be simulated by shorting following points to ground through a 100 ohm resistor:

On/Off	BT
Vol. up	BL
Vol. down	BM
Chan. up	BX
Chan. down	BY

VIR

The E48 and E49 chassis VIR is contained on a new, separate, additional module. It can be defeated either automatically, if VIR is not present, or by means of a manual defeat switch. In either case, the color-tint functions revert to GT-Matic. Sylvania states the module, in fact, can be removed and the set will continue to function on GT-Matic.

The VIR signal is placed on line 19 of the vertical retrace interval. Four steps are necessary to use the VIR signal for color and tint correction.
(1) Line 19 must be identified.
(2) The presence of VIR must be verified.
(3) Adjust tint for equal VIR color and black levels in R-Y signal.
(4) Adjust color for equal VIR color and black levels in the blue drive signal.

Line 19 identifier (Fig. 4)

Q16 and Q18 form a reset gate for IC4, the line counter. IC4 counts to line 19 and produces a positive gate to Q20, which inverts to produce negative going gates at its output. Q22 thereby is turned off so the tint preference voltage does not affect VIR tint comparison.

A differentiated negative gate is fed to Q10, inverted to a positive chroma reference gate and fed to the "Quad

Bilateral Switch". This gate also is fed to Q12, inverted, differentiated, and used to gate Q14 to produce at TP EA a positive black reference gate which also is fed to the "Quad Bilateral Switch".

VIR Sensor (Fig. 5)

Video is fed to Q26 where it is inverted and clipped and sent on to the base of Q28, the VIR AND gate Video, if present at the output of Q28, is then inverted and integrated producing a signal to turn on the VIR driver and the tint and color switches.

Tint control (Fig. 6)

The R-Y signal is coupled through Q8 to IC2. Here the chroma reference and black reference should be equal in amplitude if the tint is correct. The 20 μsec chroma reference gate pulse allows video to pass through IC2 during the chroma reference period only, to the sample and hold. This occurs only once per field; the sample and hold, holds this value until the next pulse occurs. The Black Reference Gate Pulse is an 8 μsec wide pulse delayed 40 μsec from the beginning of line 19. This gates on IC2 during black reference only. IC1 develops a correction voltage to override the tint control when the tint switch transistor is turned on.

Color control (Fig. 7)

B-Y is fed d to the base and video to the emitter of Q4 and matrix action produces blue drive at its collector. The color preference control adjusts the Y input to allow control of color saturation in the VIR mode.

The blue signal is delivered to IC2 where the chroma and black reference and the blue drive should be of equal amplitude. The chroma reference gate pulse allows blue drive through during chroma reference period only. It is then fed to the sample and hold. The black reference gate pulse gates on IC2, which then develops a correction voltage to override the manual color control when the color switch transistor is turn on. ET/D

INTERFERENCE

continued from page 32

tuned-stub as in Fig. 10. Tape it loosely to the antenna twinlead, close to the terminals at the back of the set. Next, adjust the capacitor for minimum interference, and then slide the assembly along the twinlead until a point of minimum interference is obtained. Now, securely tape the trap in place.

Now for a *real* bear! Consider this problem: interference to Ch. 5 by a CB transmitter, and it appears to be harmonic radiation. BUT, examination of the CB set with a quality (i.e. $8300!) spectrum analyzer failed to reveal any harmonics. Examination of the TV set, and several attempted fixes were likewise negative. The problem turned out to be an antenna preamplifier *in another house*. The preamplifier had a defective front-end, and was generating harmonics of the CB signal, and then reradiating them out the receive antenna! Since both the harmonics and the receive antenna were on the same frequency, i.e. a TV channel, then the signal radiated in a very efficient manner. A friend of mine, serving on a voluntary TVI committee, found this one only because the complainant's antenna was equipped with a rotator, and it was noted that the interference had some directivity! In this type of "other party" situation, it may well be that the other party will be somewhat bewildered, and refuse to cooperate. Refer the problem to the FCC;

re-radiating signals, even if by accident, is a no-no.

Bear Number 2: Another difficult to solve problem involves intermodulation between two unrelated signals to produce a hetrodyne product on a third frequency. This is known as a $3F_1 + F_2 = F_3$ situation. For example, if a third harmonic, however generated, from a CB set (i.e. 81 mHz), hetrodynes against an FM broadcast signal between 106 and 108 mHz, then Ch 9 TVI can result. Example, 107 MHz + (3 × 27 Mhz) = 188 Mhz, right in the Ch. 9 spectrum! The cure is to install a wavetrap for either or both of the signals being beat together.

Television interference problems are a fact of life in an era when there are so many sources of rf energy. A receiver must not only select the desired signals, but must also reject undesired signals. The FCC has published a booklet on this subject titled "How To Identify and Resolve Radio-TV Interference Problems," which can be purchased for $1.50 from Consumer Information Center, Dept. 051F, Pueblo, Colo., 81009. ET/D

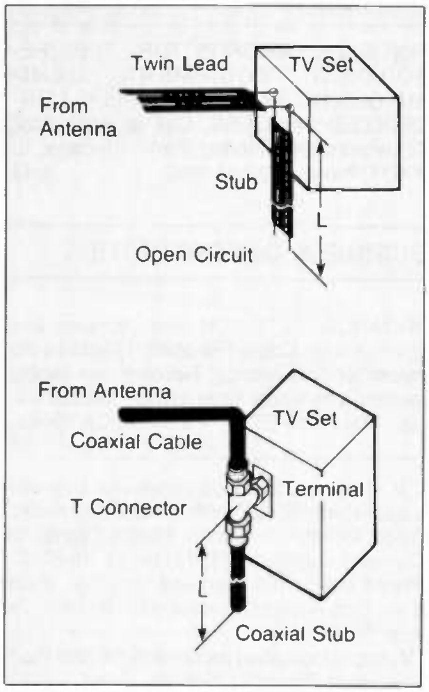


Fig. 9–Quarter wavelength open stubs

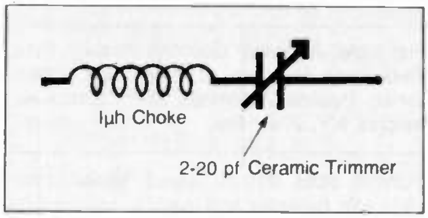


Fig. 8–Series tuned trap

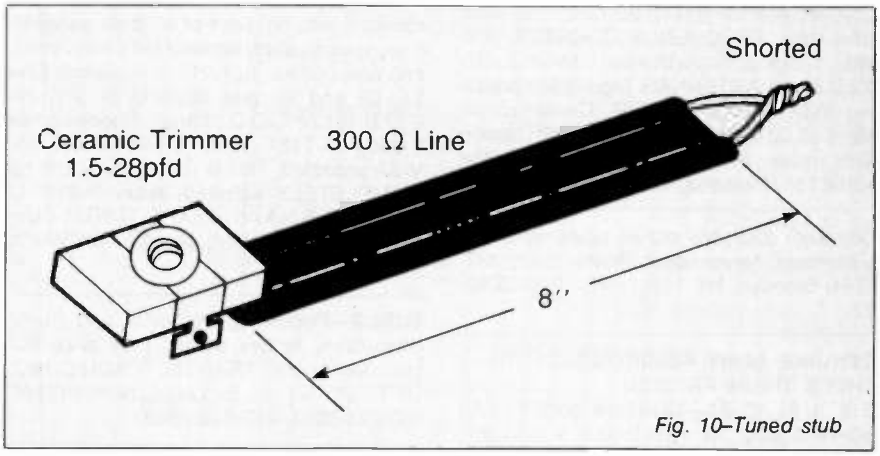


Fig. 10–Tuned stub

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104	.97	1.60	167	1.10	2.05	232	.59	.98
104MP	1.94	3.20	168	1.26	2.25	233	.62	1.02
105	2.45	4.22	169	1.84	3.05	234	.57	1.00
106	.52	.95	170	2.75	4.95	235	3.50	6.30
107	.68	1.35	171	1.25	2.15	236	6.25	10.40
108	.85	1.53	172A	.50	.90	237	4.60	8.10
109	.24	.33	173BP	4.30	6.54	238	12.25	15.75
110MP	.32	.54	175	1.25	2.25	239	2.75	3.63
112	.55	.87	176	2.21	3.94	241	1.35	2.29
113	.35	.60	177	.50	.90	242	1.55	2.52
114	.35	.60	178MP	.54	.95	243	1.85	2.69
116	.38	.66	179	5.01	8.88	244	2.60	3.63
117	.35	.60	180	4.98	8.84	245	3.10	4.40
118	1.35	2.95	181	4.15	7.50	246	3.95	4.77
120	.55	.90	182	2.90	4.40	247	3.25	4.77
121	1.70	3.18	183	3.25	5.00	248	4.50	6.42
121MP	3.40	6.36	184	1.10	1.99	249	5.65	8.38
122	1.80	3.30	185	1.30	2.29	250	5.95	8.50
123	.59	1.05	186A	1.30	2.29	251	5.90	8.38
123A	.70	1.32	187A	1.45	2.50	252	5.95	8.50
124	1.20	2.30	188	1.20	2.20	253	1.45	2.06
125	.45	.79	189	1.30	2.50	254	1.60	2.41
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128	.99	1.75	192	1.00	1.80	263	1.50	1.95
129	1.10	1.85	193	1.05	1.86	264	2.25	2.93
130	1.95	3.80	194	.55	1.05	274	2.40	2.80
130MP	3.80	7.60	195A	2.40	3.95	280	4.20	6.30
131	1.75	2.84	196	1.65	2.70	281	5.40	8.20
131MP	3.50	5.68	197	1.60	2.52	282	4.50	6.45
132	.88	1.60	198	1.58	2.65	283	6.75	9.40
133	1.00	1.80	199	.46	.81	284	6.70	10.10
152	1.20	2.20	210	1.15	1.99	285	7.30	10.95
153	1.30	2.50	211	1.35	2.29	286	6.70	8.20
154	1.85	3.30	218	3.10	5.25	287	.60	.86
155	1.95	3.42	219	3.25	6.49	288	.65	.93
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157	1.10	2.15	221	1.50	2.68	290	.99	1.26
158	.99	1.86	222	1.80	2.90	291	1.70	2.49
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ADVERTISER'S INDEX

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