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# INDUSTRY REPORT

## How the Consumer Electronics Dollars are Divided

Ever wonder just how the consumer electronics dollar is spent? You might be surprised to find that only about half of it (approximately 46%) is spent on color and black and white television.

The Electronics Industries Association publishes a yearly *Electronic Market Data Book* which presents statistics on the electronics industry, broken down into the areas of components, consumer, communications and industrial. The information to follow is taken from the 1980 edition.

Electronics at the factory level, equipment, systems and components was about an 80 billion dollar industry in 1979, up better than 14% over 1978. Consumer electronics, however, after being a constant percentage of the whole for a time, declined from about 13% in '77 and '78 to 11.5% in '79. The loss was to the steadily growing field of industrial electronics. The dollar value,

at the factory, came to approximately \$9.34 billion.

So how does this split up? First, we all probably think of color television. Color TV was valued at \$3.615 billion at the factory level for '79. This broke down in numbers to 10.235 million sets of which approximately 76% were table models and portables, 24% were consoles and 0.1 were combinations. Projection sets were apparently not statistically significant. Of these color receivers 1.369 million were imported at an average apparent value of \$221, while the other 8.673 million were manufactured or at least assembled in the U.S. at an average value of \$382.

Black and white sets totaled 6.575 million units at a value of \$565 million. Of these 0.3% were consoles; approximately 90% it appears, were imported; 10% were assembled in the U.S.

Home radios were valued at \$440 million for '79; apparently all of these were imported. Auto radios were valued at \$623 million. By value about three-fourths of these were produced in the U.S.

Phonographs, in which category EIA includes consoles and compacts with separate speakers, (they no longer even pay any attention to the "toy" one-piece

## Annual Factory Sales of Electronics by Industry Group (\$ Million); United States, 1927-1979

Year	Consumer Electronic Products	Communications Equipment	Industrial Electronic Equipment	Electronic Components	Government <sup>1</sup> Products	Grand Total
1927	\$ 95					\$ 200
1929	275					465
1931	124					220
1933	73					135
1935	135				\$ 20	240
1937	182				28	350
1939	186				37	1,750
1947	810				680	2,705
1950	1,500	\$ 1,005		\$ 1,158	655	3,663
1951	1,400	1,643		1,261	1,193	4,304
1952	1,300	3,600		1,730	3,100	6,630
1953	1,400	3,830		1,870	3,230	7,100
1954	1,400	3,750		2,008	3,100	7,158
1955	1,500	4,082		2,200	3,332	7,782
1956	1,600	4,545		2,280	3,595	8,425
1957	1,805	5,430		2,384*	4,130	9,619*
1958	1,660	6,130		2,368	4,725	10,158
1959	2,002	7,049		2,875*	5,373	11,926*
1960	1,774	8,104		3,093	6,124	12,971
1961	1,757	9,775		3,381	7,190	14,913
1962	2,127	11,105		3,631	8,080	16,863
1963	2,320	12,451		3,698	8,841	18,469
1964	2,643	13,043		3,853	8,775	19,539
1965	3,303	14,191		4,479	8,969	21,973
1966	4,130	\$ 7,397	\$ 6,670	5,502	10,330	23,699
1967	3,916	7,910	6,605	5,356	11,720	23,787
1968	4,157	8,534	6,850	5,282	12,563	24,823
1969	4,367	9,029	7,500	5,687	12,287	26,583
1970	3,683	10,080	8,498*	6,205*	11,295	28,466*
1971	5,331	9,800	7,854*	5,774*	10,700	28,759*
1972	6,493	10,739	10,560*	6,894*	10,600	34,686*
1973	6,934	11,702	12,577*	9,906*	10,800	41,119*
1974	6,274	12,797	15,118*	10,403*	11,150*	44,592*
1975	4,955	13,997	15,139*	9,286*	11,500*	43,377*
1976	6,921	15,243	17,889*	10,884*	12,750*	50,937*
1977	8,119	18,503*	21,676*	13,033*	15,300*	61,331*
1978	9,303	20,514*	25,162*	15,567*	17,650*	70,546*
1979	9,274	22,732	29,691	18,910	20,150	80,607

<sup>1</sup>Included in the grand total. The largest share of Government Products is Communications and Industrial Electronic Equipment. These data are estimated by EIA.

\*Revised



PTS ELECTRONICS, INC.

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# ET/D

ELECTRONIC TECHNICIAN/DEALER  
LEADING THE CONSUMER AND  
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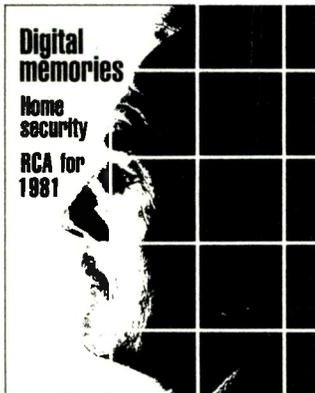
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**On the cover:** The speed and storage capacities of semiconductor memories are expanding rapidly. A discussion of their types and organization tops off ET/D's series on microprocessors.

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portable record player). Consoles accounted for just over one-half million units in '79, valued at about \$131 million, while compacts and component systems together totaled nearly four million units. Audio components had a value of about \$1.2 billion. Simpler phonographs were valued at about three-fourths of a billion. Audio tape equipment, both home and auto, totaled about 30 million units in '79 with a factory value of over \$1.3 billion; apparently nearly all of these were imported.

Factory production of VCR's totaled 507,686 units in '79, apparently all as-

sembled abroad (does anyone assemble VCR's in the U.S.?).

CB radio sales of about two million units, valued at something over \$64 million, including about one million mobile units valued at about \$10 million, were about one-third that of '78.

First half 1980 import statistics were released just as this was being written. They show a general continuation of the trends of the last few years (allowing for the recession). Black and white TV imports increased slightly compared to a year ago while color imports were down. Video tape recorder/player imports rose

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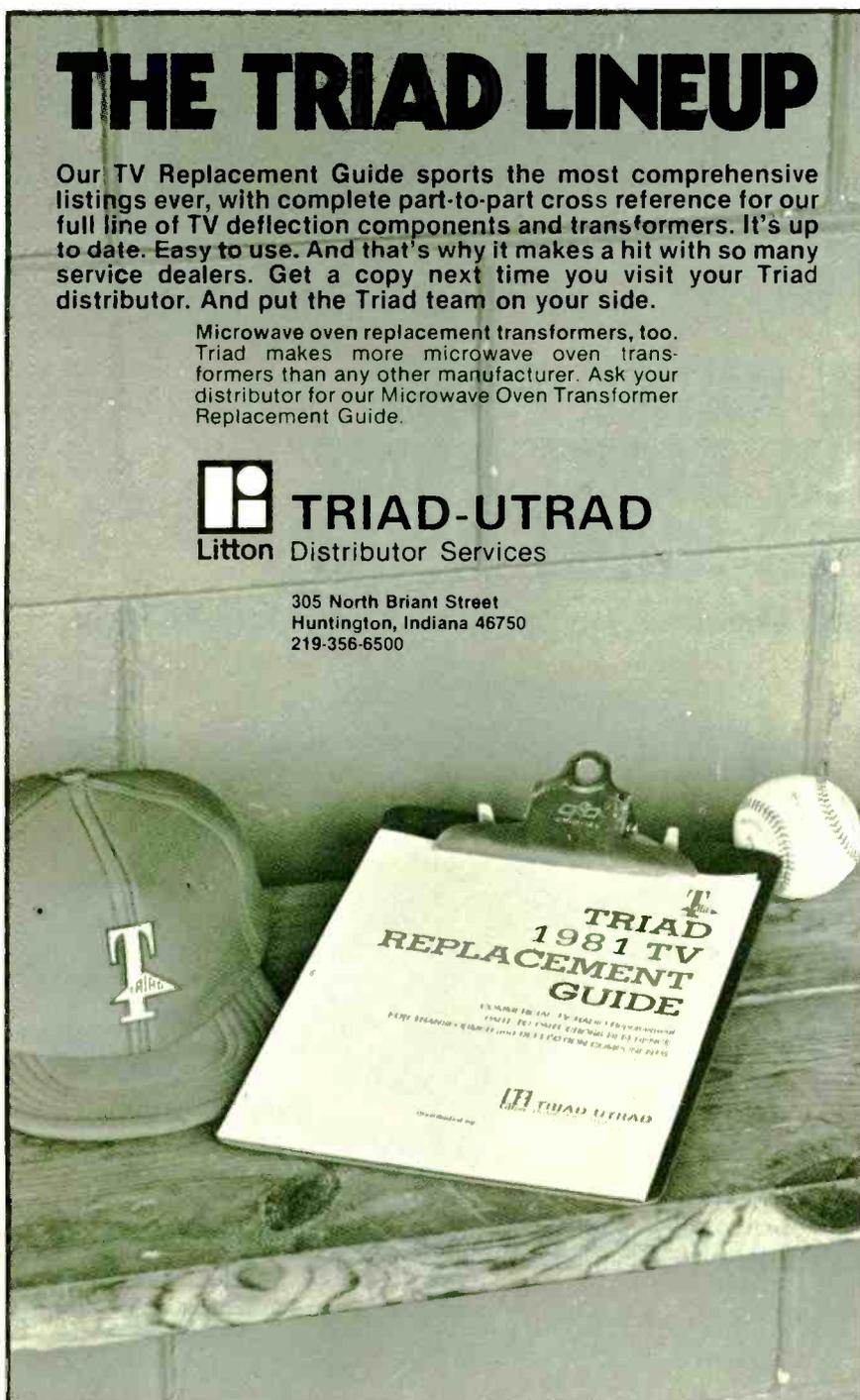
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by about 47%, while home audio tape player imports declined about 33%. Audio tape players/recorders were up slightly; turntables and record changers were down somewhat. Both home and auto radio imports were down (auto radios down almost 40%, reflecting the situation in the auto industry?).

The total value at customs of consumer electronics imports declined from about \$146 million to about \$122.5 million for the first half '80, as compared to the first half '79.

So—consider that less than half of the consumers' electronic's dollars are apparently spent on television, there must be some service opportunity involving all the rest of that radio and audio equipment. The secret of course has to be, to be able to do it efficiently and profitably. Look around—maybe we're all missing something.

### House Commerce Committee Rules Against AT&T

In what was considered a major initial victory for the alarm industry, the House Commerce Committee has approved a measure that would prohibit AT&T from selling alarm services.

With two groups opposing AT&T's movement into the alarm business—the National Burglar & Fire Alarm Association and the Consumers Union—the

measure cleared the committee, by an 8-6 vote, as an amendment to a Communications bill (H.R. 6121).

In the language of the amendment, alarm service was defined as "the provision to the public of any intrusion alarm service or any fire alarm service, or both, by any person."

The bill states that "no dominant carrier or any affiliated organization . . . may provide any alarm service . . . through any facility which is owned or controlled by such dominant carrier, affiliated organization, or fully separated subsidiary."

### Sony Consolidates Video Tape Effort

Sony Industries has announced that its magnetic tape division will become the only source for Betamax videotape in the U.S. consumer market. Previously, responsibility was split between Sony's consumer and tape divisions.

"This decision reflects the strong sales gains in the video recorder market," according to Sales Manager Don Unger.

He said video tape would be marketed and sold in a manner similar to the division's efforts with audio tape. This includes strong national advertising support coupled with trade and consumer promotions.

"The magnetic tape division has the resources to advertise, promote and merchandise videotape aggressively and this is demonstrated by our current video tape promotions and advertising," he said.

### Pay TV Battle Heats UP

The pay television industry has "declared war" on what it considers "pirate" equipment makers and says it will drive them out of business with civil and criminal legal actions in spite of "confusion over conflicting federal court decisions."

Subscription Television Association chairman Rinaldo Brutoco said the pay TV industry will bring suit against users and well as unauthorized manufacturers.

"We want all pirates and prospective pirates to know we will settle for nothing less than their eradication," Brutoco said. Brutoco's association represents some 12 companies which charge subscribers fees on a monthly basis to receive top sports events and recent movies without commercial interruption.

However, some manufacturers have been selling microwave antennas and decoders to the public which are capable of unscrambling these microwave signals. Dealers and manufacturers take the position that anyone is legally free to monitor any broadcast signal under the doctrine that the airwaves are public property. **ET/D**

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# FROM THE EDITOR'S DESK



The three-and-one-half years I have been editor of ET/D Magazine have been for me among the most rewarding from a personal standpoint of any of the 23 I have spent as a professional journalist.

The nature of the consumer electronics and consumer electronics service industries—their combined contributions, and the impact each has on the individual home, make these industries resources of unparalleled importance in American Society.

Now, with the emergence of satellite broadcasting, cable television, the spread of the microprocessor based technologies into virtually every walk of American life ranging from residential security to home appliances—the great potential for the independent electronics service center is just now beginning to become more clearly defined.

Without question, electronics service is an industry undergoing rapid change. In consumer electronics alone, we have just come through the sometimes traumatic experience of accepting the microprocessor into the American home. Right now, American homes are beginning a transformation from a communications standpoint that many believe will rival the sociological impact which television has had on our lives during the past 30 years. This latest “revolution” is known as the “video revolution” and its character is to transform the American home into an entertainment/education/communications center independent of any one or two giant networks for programming content.

These are indeed very exciting times in consumer electronics and consumer electronics service.

It is in this atmosphere of change that I have decided to leave as editor of ET/D to take a business position within the consumer electronics service industry itself.

In my place will be Walter Schwartz, who has served as Managing Editor of ET/D for the past two years, a man with exemplary credentials to take over and guide this important service industry publication as editor.

The many personal associations I have formed on both the manufacturing and service industry sides of consumer electronics during my tenure I consider to be the most satisfying aspect of the whole three-and-one-half years.

As to the future, I believe the potential of our industry from a service, as well as profitability standpoint, is enormous. I look forward to continued associations with all my friends as all of us move forward to meet the challenge of the 1980s.

Sincerely

*Richard M. Lay*

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AUGUST RECORD MONTH FOR COLOR. Color TV sales to dealers of 788,900 exceeded those of August '79 by 14.9% and exceeded the record set in August '78 by 1.4%, according to Television Digest. Sales to dealers ran at an annual rate of 9.8 million for the first 8 months of '79. Those for August were at a 10.7 million annual rate. Retail sales are felt to follow this healthy wholesale pattern.

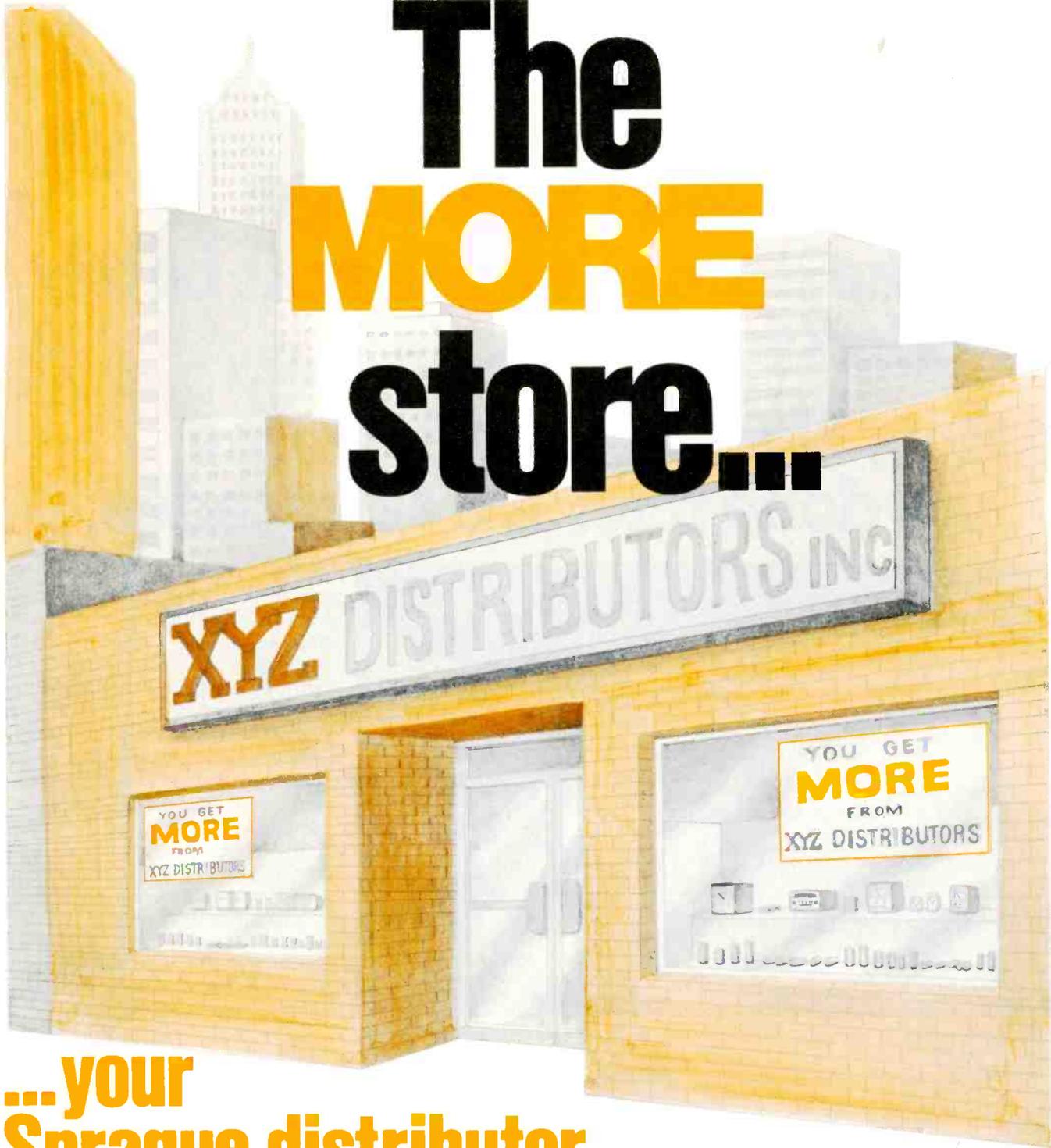
VIDEO DISCS ON THE MOVE. RCA finished demonstrations to potential Japanese licensees in late August and stated its stereo sound version would be available in 1982. Sylvania is reportedly insisting on a stereo system when it makes its choice. Magnavision is now on sale in 18 markets and should be available nationwide by the end of the year. Philips and 3M have announced a patent license exchange agreement on selected video disc technologies. According to Television Digest 3M plans to begin to press optical discs in consumer quantities in St. Paul in 1981.

NATESA HOLDS 30th ANNUAL CONVENTION. A total of 320 attended the NATESA (National Association of Television and Electronics Servicicers of America) convention at the Ramada O'Hare, Chicago, August 7-10. 1980-81 officers elected were: Leo Emond Cloutier, Los Angeles, president; Ellis Hall, Middletown, OH, vice president; Tom Leeney, Highland, IN, secretary and Richard Ebare, Essex Junction, VT, treasurer. Indian Lakes Resort, Bloomingdale, IL, was selected as the site of the next convention to be held August 19-23, 1981.

NESDA CONVENTION HELD AT LOUISVILLE. The National Electronic Service Dealers Association held its 1980 convention August 18-23 at the Galt House, Louisville, KY, with a total attendance of approximately 500. Jim Rolison of Portland, OR, was elected president. National vice president is George Bluze, CET, of Largo, FL. Elected secretary was Keith Knos, CET, of Liberal, KS, and re-elected treasurer was Bill Abernathy of Fort Worth, TX. Innisbrook Resort, Tarpon Springs, FL, was selected as the site of the 1981 convention.

PERSONAL COMPUTER MARKETING EXPANDS. Commodore Business Machines plans to set up a nationwide chain of company owned computer stores reportedly to the chagrin of its independent dealers. Xerox which opened its first store this spring intends to have 15 stores set up by the year's end. Xerox sells Apple II and III personal computers and the Xerox 510 small business computer as well as calculators and computer accessories at its stores. Xerox is also signing up independent distributors and dealers to market and service some of its low cost copiers. Control Data is reportedly opening two personal computer stores in Minneapolis.

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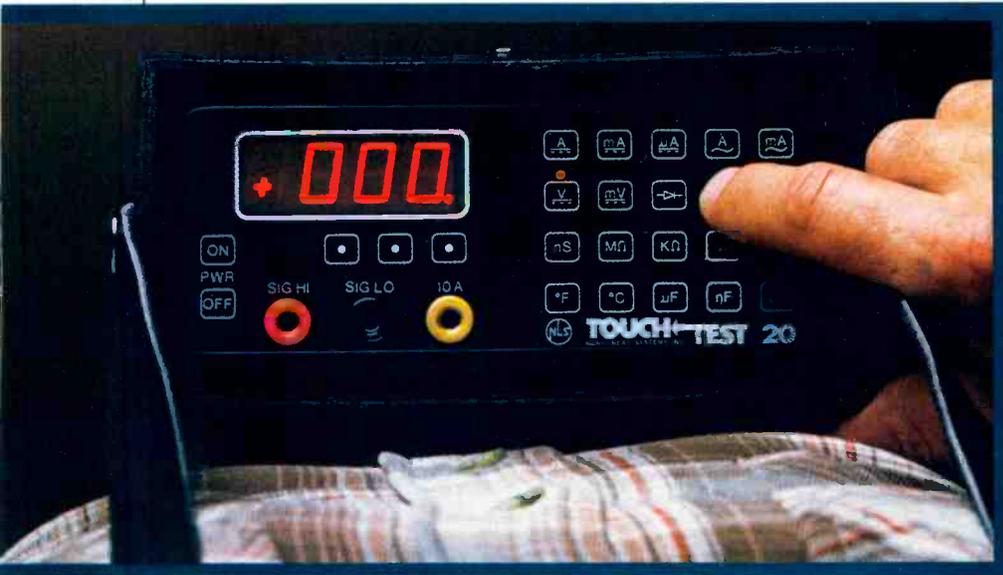


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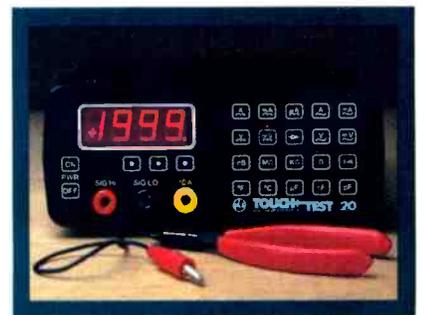
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# SERVICE SEMINAR

## **MAGNAVOX**

### **Color Chassis, General Information.**

The following information was excerpted from Magnavox's Color Television Service Tips Summary, 1970-1980 ST1038-480AT, available for \$1.50 from Magnavox Service Training Department, Fort Wayne, Ind. 46804. Many of these general tips may be applicable to other brands.

### **Solid-State TV Horizontal Output Stages— Horizontal Squeal**

Ferrite beads are miniature absorption-type trap circuits commonly used to attenuate harmonics over a specified range of frequencies. The beads are often located in the input and output leads of the horizontal output transistor to absorb harmonics that might interfere with channels 2 through 6. The components are tubular in shape and are mounted by threading the transistor connecting wires through the opening in the body. Since the beads are free to move along the wire, they may occasionally vibrate at the horizontal rate and produce a high-frequency, audible "squeal." This problem can usually be eliminated in one of the following ways:

1. Move the beads slightly so they cannot touch surrounding objects such as the chassis pan, other components, or another wire.
2. Kink the wire leads so the beads are locked in place.
3. Cement the beads in place with Devcon "5 Minute" brand quick drying epoxy or equivalent.

### **TV Horizontal Output Circuit Failure**

Failure of the horizontal output circuit in a solid state TV chassis is often caused by a short on the DC supply line to the horizontal output transistor or by a shorted load on one of the output windings of the flyback transformer. The problem usually causes the circuit breaker to trip, or, in some chassis like the T991, it may trip special overload protection circuits. When the flyback transformer is overloaded, the horizontal output transistor may draw too much collector current and short, thereby introducing a second fault in the output circuit.

The replacement transistor may also fail within a short time if the overload on the flyback winding has not been located and repaired. When the problem appears to be in the horizontal output section, make the following checks:

Start with ohmmeter measurements from the collector (case) of the horizontal output transistor to ground to determine if a DC short exists on the B+ line. If a short is present, remove the output transistor and check for the short again. If the short disappears, the transistor and/or the mica insulator is probably at fault. Replace the transistor with an exact Magnavox replacement part. This transistor has critical switching characteristics and a general replacement type will not hold up in this application. Check the mica insulator for cracks or holes and, if any imperfections are noticed, replace it with the correct type. Check the chassis for burrs which could puncture the insulator, and remove any rough edges that may be found. Apply an ample amount of Dow Corning 340 or Wakefield 120 heat sink compound to each side of the insulator before installation.

If the ohmmeter check indicates a short is still present on the B+ line with the transistor removed from its socket, look for shorted filter capacitors, feed-through capacitors, bypass

capacitors, and check for a shorted retrace capacitor or damper diode. Also check for a short between the primary windings of the flyback transformer and chassis ground.

After a shorted horizontal output transistor has been replaced, do not turn on power immediately. First make preliminary ohmmeter checks of the loads on the output windings of the flyback transformer. In a number of chassis, the flyback pulses are rectified to provide DC operating voltages for other circuits. For example, DC voltages derived from the flyback pulses power the vertical output transistors in the T985, T986 and T991 chassis. If a rectifier fails or if a vertical output transistor shorts, an excessive load is placed on the horizontal output transistor and it is likely to fail also. The rectifiers are located on the vertical module. A short in this circuit can be isolated by disconnecting the plugs from the vertical output transistors by removing the vertical module.

A shorted HV Tripler may also overload the horizontal output transistor. Due to the construction of the diodes within the Tripler, ohmmeter checks are inconclusive; however, a dynamic test can be made by unsoldering the lead from the tertiary winding at the Tripler and applying power to the chassis. If the overload is eliminated, the Tripler is probably shorted. There is some risk of damaging the replacement output transistor in this test since full power is applied to the chassis. A much safer check can be made by using a variac in the AC line. With this equipment, AC voltage to the chassis can be increased gradually from zero. The AC line current can be monitored as the voltage is raised to determine if the overload has been eliminated. The maximum normal AC current drain for a set operating at 120VAC is shown on the model identification label. If the normal current should be 2 amps, for example, and this amount of current flows when the line voltage is in the 50 to 70VAC range, the overload is still present, and other circuits operating from the flyback output windings should be checked for shorts.

The overload may be caused by shorted turns on one of the flyback windings. Shorts of this nature are difficult to locate with ohmmeter checks and often there are no visible signs of overheating. If no shorts can be found on any of the loads, replace the flyback transformer. Apply AC power cautiously with a variac and monitor line current to determine that the overload has been corrected.

In summary, problems in the horizontal output circuit usually involve shorts on the DC supply line to the output transistor, a shorted load on the flyback windings, a short in the flyback transformer itself, or a combination of these causes. When troubleshooting problems in this circuit, check for shorts on the B+ line and on the loads connected to the flyback. Try to isolate the problem by disconnecting loads such as the Tripler, the vertical module, or other circuits connected to the flyback. Operate the chassis with reduced line voltage by means of a variac to prevent damage to the output transistor, and monitor line current to determine when a short has been isolated.

### **Loose Yokes On In-Line CRTS**

While CRT replacement is still the recommended In-Warranty repair method for a "Loose Yoke Problem" on an RCA In-Line CRT, the servicer may elect in out-of-WARRANTY SITUATIONS, TO REGLOUE THE LOOSE YOKE. The following procedure is provided as a guide in this repair.

Materials Required: Goodyear Pliobond® General Purpose Adhesive, Scotch Brand® (3M) No. 27 Glass Cloth Electrical Tape (1/2" wide). (Glass Tape must be used to prevent a potential fire hazard). Pliobond adhesive may be purchased in most hardware stores and many electronic supply houses. The glass tape is available from most electrical supply houses.

**Instructions:**

1. Unplug the set and remove the cabinet back. The chassis may have to be removed to gain access for applying the adhesive under the Yoke Funnel Ring. Place the television on a protective pad with the picture tube face down.

2. Raise the Yoke Assembly and remove all loose particles of cement. Do not attempt to remove any cement that remains firmly fastened to the glass or plastic ring. While the Yoke is held up against the neck device, brush Pliobond® onto the Funnel of the picture tube where the Yoke Funnel Ring contacts the glass surface. The ring of Pliobond should be at least 1¼" wide in order to provide full coverage of the contact surface.

3. Allow the Pliobond® Adhesive to dry for one-to-two minutes and then lower the Yoke Assembly to contact the Funnel. Align the Rotational Position (Scanning Axis) of the Yoke using the following procedures:

a. Align the plastic tab that is below the center of the Yoke Terminal Board (nearest to the winding) with the anode contact.

b. On some assemblies, the Terminal Board and Yoke Ring are slightly different. The terminal board on these assemblies is rectangular and approximately 2" long. On these assemblies, align the center rib on the Yoke Ring (immediately in front of the Terminal Board) with the anode contact.

4. Seat the Yoke on the Funnel of the Picture Tube in its original factory position by observing the original "Factory Glue Pattern" and by rocking the Yoke gently back and forth to find the location where the Funnel Ring best fits the funnel. Re-check to see that the Yoke has not been rotated.

**Color Chassis—Install Correct Retrace Capacitor**

When installing a new retrace capacitor in the horizontal output section of a Color TV Chassis, it is very important to use an exact Magnavox Replacement Part. This practice should be followed on all current and older chassis as well. The value of this capacitor is critical because it forms part of a resonant circuit along with the deflection yoke and the Horizontal Output Transformer. An incorrect value of capacity can detune the horizontal output stage enough to cause incorrect CRT voltage.

This capacitor also has a safety function. Two separate leads are attached to each plate which provide a DC path for collector current through one plate and emitter current through the other plate. In the event the capacitor should open, the DC

paths to the Horizontal Output Transistor open and high voltage shuts down.

The following is the part number of the retrace capacitors that should be used for the current chassis. Note especially the differences in group numbers (last two digits).

**530165 Tripler Variations**

Magnavox color TV chassis have used HV Triplers since the T979 was introduced. Early production of the T979 used a 530153-1 tripler which was later replaced by the 530165. Service replacements for the 530153-1 are handled by the 171297-1 kit which includes a 530165-3 tripler and two resistors required for the modification. The basic Part No. for all variations of replacement triplers is 530165. However, the group number following the basic Part No. identifies the specific tripler. For example, even though externally a group-5 tripler might look like a group-3 tripler, internally they are not the same and are thus not interchangeable. Unless a substitute tripler is listed in the Service Manual Parts List or the Magnavox Parts Division sends a substitute for the tripler that was ordered, DO NOT attempt to substitute one group number for another. They will not function satisfactorily. The following is a list of approved tripler substitutes. Make No Other Substitutions!

For	Use	For	Use
530165-1	530165-3	530165-10	530165-10
530165-2	530165-3	530165-11	530165-17
530165-3	530165-3	530165-12	530165-12
530165-4	530165-3	530165-13	**
530165-5	530165-10	530165-14	530165-14
530165-6	530165-17	530165-17	530165-17
530165-7	530165-12	530165-19	530165-20
530165-8	530165-10	530165-20	530165-20
530165-9	530165-12	530165-21	530165-21

\*\* A small quantity of T995 chassis HV/Scan modules were built with a 530165-13 tripler/bleeder. In the event of failure of the -13 tripler/bleeder, the complete HV/Scan module, Part No. 703653-6 should be replaced.

As can be seen from this list, a servicer need only stock the 530165-3, 10, 12, 14, 17, 20, and 21 to replace any of the listed versions.

**Color TV Replacement Modules**

When replacement of a module is necessary, ensure that the correct Group Number is used. A higher Group Number than the original DOES NOT always mean that the module will replace earlier Group Numbers. As an example, the Low Level Video Module, 703921, in the T809/815 chassis is a Group 1 for auto-contrast versions and a Group 2 for non-auto-contrast versions. THEY ARE NOT INTERCHANGEABLE. The Service Manuals identify which modules are used in all the chassis versions.

Another example is the 703744 Power Supply modules used in the T991 and T809 chassis. Both the Group 1 and Group 2 are interchangeable and used in the T991 chassis ONLY. The group 3 is used in the T809 chassis ONLY.

As a general rule, use a replacement module having the same part number AND GROUP NUMBER as the original module. Exceptions to the rule are called out in an Installation Note packed with the new module. **ETD**

CHASSIS	USE CAPACITOR
T809	250663-19
T815	Use Retrace Module Part No. 703919-1 which has a 250663-18 capacitor
T981	250663-11
T982	250663-13*
T985	250663-14**
T986	250663-13*
T987	250663-13*
T991	250663-17
T995	Use Retrace/Screen Module Part No. 703647-7 which has a 250663-11 capacitor

\* Retrace capacitors 250663-9 and 250663-13 are interchangeable  
 \*\* Retrace capacitors 250663-10 and 250663-14 are interchangeable.

# LETTERS

## HELP NEEDED:

A few suggestions, then please print my "needed" request.

Since the big thing in electronics still is and will be TV servicing I agree with those asking for more articles on the subject, along the lines of how to repair and troubleshoot the countless new circuits.

Also we miss the parts numbers listing at the top of the TEKFAQ schema-

tics. It helped us know what part was needed without having to remove it from the TV.

And—for years I wondered why you won't print the TEKFAQ with black ink. It would be so much easier on some of our eyes, especially with some of the packed print now.

My request: Want to purchase pre 1972 GE, RCA, etc. service manuals, and troubleshooting charts like RCA's "Tech Reference Library".

P. Valer  
428 West Roosevelt Blvd.  
Philadelphia, PA 19120

Editor: We have been including recommended troubleshooting tips in current TV features and try to stress details of operation of the new circuitry in each chassis. We just don't have enough room for parts number lists in TEKFAQ. TEKFAQ has been printed in blue ink as long as anyone can remember, I guess it's a tradition. We try to give everything enough room so it is readable.

I need a flyback for a MGA color TV model #CH121, SAMS #1281-2, Fly #334P03402 (original).

MGA has told me that they no longer manufacture these sets.

Art's TV  
Route #2  
Waynesville, MO 65583

I am a new subscriber and I am very pleased with my first three issues, and I am anxiously awaiting my free TEKFAQ 115. I would like to backdate my TEKFAQ and would appreciate hearing from readers who have TEKFAQ available. I need TEKFAQ through 114 and foldouts to #1830. Does anyone have any for sale?

David H. Burroughs  
605 Kelly St.  
Warner Robins, GA 31098

I need a roll chart for a tube checker, Superior instruments Model TW11. Does anyone know where I can purchase a late tube roll chart?

Alex Nemeth  
310 Henry Avenue  
Steubenville, OH 43952

In your letters department please print the following. Needed: a schematic for "MASTERWORK" solid state hifi audio system model 2017, serial F617-646 and the selector switch. I will be willing to pay any reasonable price for both of them.

Thank you.  
Paul K. Tan  
3247 W. Diversey Avenue  
Chicago, IL 60647

Looking for schematic, service manual for a Toshiba Model 24A55DM table model stereo radio. Toshiba says it's no longer available.

Ben Miller  
The Electronic Doctor  
334R Cambridge Street  
Burlington, MA 01803 ET/D

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# Digital computer memories, part I

What they're all about

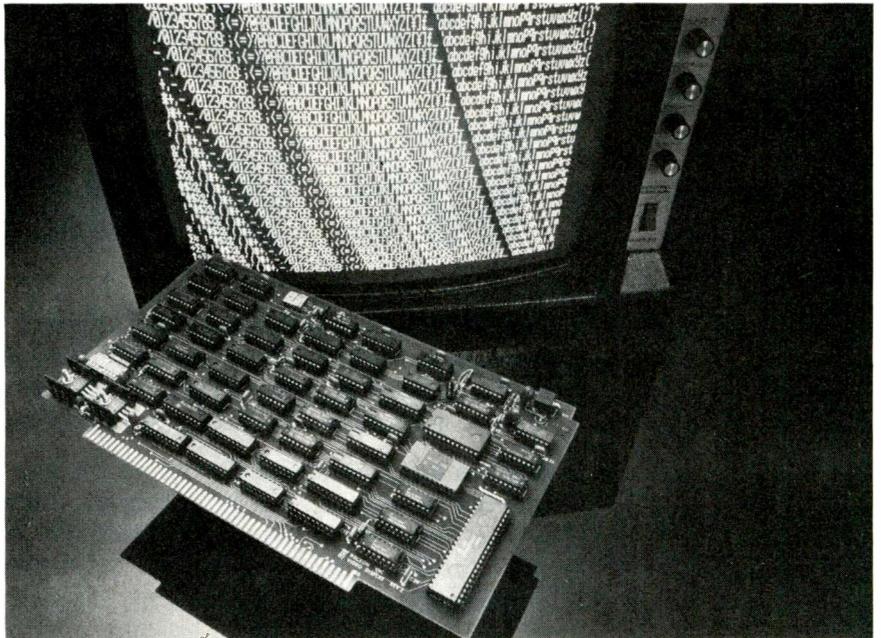
ROM, RAM, EPROM, EAROM!!! What's it all about? For years computer texts have bombarded us with such acronyms, yet functional definitions of such concepts are sadly lacking—or confusing. For a look at memory hardware, theory and its application, the author has taken the heretofore mystical subject and turned it into, of all things, plain English.

By Bernard B. Daien

Modern digital systems rely heavily upon digital memories as essential parts of the system. Despite this, the memory itself receives very little attention in *tets.awha* coverage occurs is uualally limited to memory addressing and interfacing. Consequently, most technicians (other than computer techs) find themselves lacking a clear concept of memories.

Compounding this problem is the fact that the business of manufacturing memories has been undergoing continuous and radical change, for several years. As a result, many books are technologically obsolete in the area of memory.

This chapter discusses memories, and memory organization, serving as a basic introductory text, and going on to such practical topics as the use of Read-Only memories for code conversion, character generation, etc.



*This video controller board contains 2,000 words of on board memory which is used for character generation. (Photo courtesy of Piiceon Inc., Sunnyvale, Ca.)*

There is a great deal of variety in memory devices, including magnetic cores, magnetic tape, magnetic disk, magnetic drum, punched paper tape, punched paper cards, bubble memory, bipolar semiconductor memory, MOS semiconductor memory . . . and still others!

Within the larger memory categories exist still other varieties. In order to make some sense out of this profusion, a short description of each of the commonest types follows, along with some pertinent comparisons.

Since modern digital computers are capable of very high speed, with operations times in the microseconds for small machines, and much faster than that for the larger machines, the system

speed will be limited by the memory, if the memory is slow. This fact must be kept in mind when we examine memories. System speed is very important to many computer users, since a fast machine is capable of more work per day . . . or, handling more customers on a time sharing basis. A fast small machine could be used to do the work of a larger, costlier machine, if the larger machine were slow. Therefore, manufacturers are continually striving to up the speed of their computers . . . and consequently, memories must follow this trend.

## The binary state

Before going further, it might be desirable to define a "memory" for our

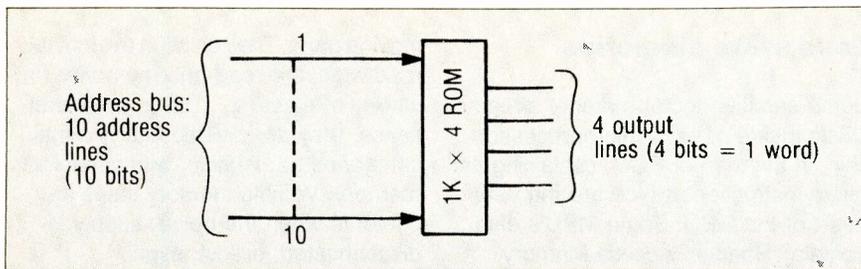


Fig. 1A. A 4,000 bit, single chip, semiconductor ROM with 1,000 four bit words. A  $1K \times 4$  ROM.

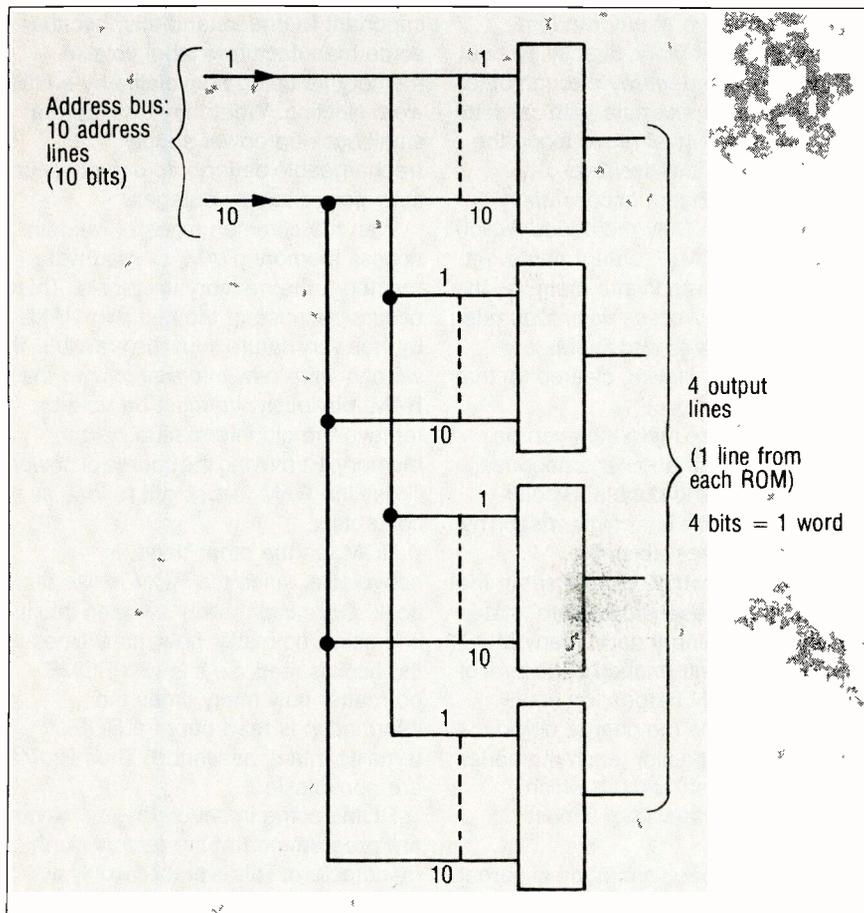


Fig. 1B. A 4,000 bit ROM organized with four chips. Each chip is a 1,000 bit ROM which outputs a 1 bit word. Combined outputs yield 1,000, four bit words. The four chips are all connected to the same address bus in parallel. This equals a  $1K \times 4$  ROM.

purposes: A "memory" is a device that stores binary information, that is information in one of two states ("ones" or "zeros"). The information so stored must be available for retrieval (readout) when needed. The binary information retrieved may consist of individual bits, or entire groups of bits, (words, or bytes). That basic definition will suffice for most ordinary uses.

Paper punched tape, and paper punched cards have the advantage of almost limitless memory capability. More cards, or more tape, expands memory storage capability . . . but, unfortunately requires more space, and more manual handling. Finally, these methods are very slow, with card sorters needed to recover the data stored on

punched cards as an example. Much of the information that was formerly kept on punched paper systems is now being stored on magnetic disks, or magnetic drums.

Magnetic drums are cylinders, supported on a shaft running through the center of the drum, and forming the rotating axis. Several read/write heads are located adjacent to the drum, in the manner of the fixed contacts strip on a turret type TV tuner. The drum surface is coated with a magnetic oxide, similar to audio recording tape. As the drum rotates each head can read out, or write, on the circumference of the drum beneath it . . . except for one head which is reserved for identification and location use. Beneath this head is a prerecorded

pattern of bits, which serve as "markers." The head reads out these bits, and uses them to positively locate positions on the circumference of the drum. The multiplicity of recording heads, and bulk of the drum, tends to limit its popularity.

Remember, only the surface of the drum is used, and the interior, which has most of the spacial volume, is not efficiently used. The drum, motor and frame are quite heavy. Drum memories also are fairly costly. Finally, drums, although faster than paper punch systems, are much slower than semiconductor memories.

One important point must be made now. Punched paper systems are basically "read only memory" (ROM). Once a card is punched, it cannot be unpunched. To change the data recorded, a new card is usually required. The magnetic drum is basically a "read/write" memory, and data can be changed at any time.

Disk memory has been rapidly increasing in popularity since it avoids the inherent disadvantages of drum memory, while retaining many of the advantages. (Disk has largely been replacing mass storage magnetic cores (toroids), and that trend is continuing, therefore we are omitting the discussion of core plane memories, devoting the space to semiconductor memories.)

### Rigid Vs. floppy disks

Disks fall into two main types, rigid disks, and "floppy" disks. Rigid disks are made of metal, with a metallic film of magnetizable material on the surface. They are quite large, ranging from one foot diameter to about a yard in diameter, and are spun at a fairly rapid speed. A single head reads or writes magnetic, binary coded information, via the metallic surface of the disk. The information is stored in *concentric rings*, which are so closely spaced that they resemble the old 78 RPM phonograph records. (Of course the pattern is not visible, and is not in the form of a spiral.)

It should be noted that some disk memories use multiple heads, as with drum memories, but the single moveable head seems to be the most popular. The disk is a mass storage device, with the capability of holding millions of bits, which can be stored on *BOTH* sides of the disk. Further, several disks can be run off the same motor drive, in the form of a "stack," containing hundreds of millions of bits!

Such disk systems are very effective and reliable, but are also quite

expensive, which brings us to the "floppy" disk now very popular with small systems users.

The floppy disk is made of plastic, and covered with a magnetic oxide similar to that used on audio tape recorders. They look very much like 45 RPM phonograph records, being less than 8 inches in diameter, yet holding close to a quarter of a million bits! Both the disk and the floppy disk use a rather complex system to identify locations, and the time to reach a given location by the moving head, may be in tenths of a second . . . quite slow, but much faster than paper card or tape systems.

### **Tape cassettes**

Another magnetic recording memory system is based on a tape cassette similar to audio cassettes, and is widely used in hobby, and very small personal computer systems. The binary coded data is usually recorded in the form of tone bursts, different frequencies being used for ones and zeros. This permits the use of FM detection systems, reducing noise and other problems in recording.

Cassettes are limited in the amount of storage that can be put onto a cassette, since the more tape inside the cassette, the longer it takes to get to a desired location, even in fast wind. But, although slow, the cassette is cheap, and handy, and has carved a place for itself in small portable systems. Finally, the cassette can be readily removed for mailing to remote locations, or hand carrying. Once again, the cassette is very slow compared with the capability of a computing system.

In order to achieve the speeds compatible with modern computers, we must go to solid state memories.

By now you must be thoroughly aware of the need for memory with speeds in the microsecond, or better, category. The previously mentioned memories all traded off this essential speed for such things as low cost, portability, or large (massive) storage capability. It is true that such trade-offs are often useful, but in most cases, this is not true. In the vast majority of cases, the speed limitation imposed on the entire computer system, by the memory, through which all programming must flow, is simply a severe handicap. Fortunately, today, we are developing memories with both speed and large storage capacity . . . the semiconductor memory. For this compelling reason, the rest of this article will be devoted to the various types of semiconductor memories.

### **Solid state memories**

Some semiconductor memory already exists inside of each microprocessor chip, in the form of ROM, containing the micro-instructions which are the very heart of the MPU. Some MPU's also contain "Random Access Memory" (RAM), which should really be titled, "Read/Write" memory. (The words "random access" signify that we can select information at any random location in the memory, directly, without having to go sequentially through other locations, as, for example, with cassette tape, where we must move along the tape to the location desired.)

The words random access apply equally to Read-Only memories, which are termed "ROMs," an apt name. (In the case of the read/write memory, the name "Random Access" is unfortunate, since BOTH RAMs and ROMs are random access. Having cleared up that point, let's move on.)

Semiconductor memories can be divided into three popular categories, Bipolar, MOS, and bubble. Bipolar memory stores the bits of information by means of flip-flops, (bistable multivibrators), which can be set in the "One" state, or reset in the "Zero" state, and thus hold binary data. Many MOS memories hold information in the form of stored electrical charges, on small capacitors. Since the charge quickly leaks off the capacitor, such memories require a "refresh" circuit, which recharges the capacitors almost continuously.

Bubble memories are made of garnet chips. The garnet contains little "islands" of magnetism, which are free to move about. A magnetic field is generated which forms the magnetic islands (bubbles) into an organized pattern in the garnet. The bubbles can be used as magnetic storage for binary data bits. They can be generated, erased, altered . . . in short, a RAM.

### **Bipolar memories**

Since this is a brief introduction with the emphasis on the practical rather than the theoretical, we are going to narrow our field of discussion still further, concentrating on bipolar memories. This avoids studying such details as refresh circuitry, needed in MOS memories, and special techniques required for the use of magnetic bubble memories. By doing this we can devote the space to the more general material, (memory organization, for example. More about this later.)

Semiconductor memories have no

moving parts. They come in the forms of read/write, and read-only memories (in a variety of types) . . . but in a general sense, they are divided into two main categories . . . *volatile*, and *nonvolatile* memory. Volatile memory loses its contents when the power supply is disconnected, or lost, even momentarily. Non-volatile memory retains its contents no matter how long the power source is interrupted. It is important to understand this, because some manufacturers label volatile memory as being nonvolatile by a little word twisting. What they do is add a small back-up power supply (rechargeable battery), to prevent *short term* power supply outages.

With the common types of random access memory (RAM, or read/write memory), the memory is volatile. This occurs because of the fact that RAMs, by their very nature, must be erasable. If we can write new information into the RAM, obviously we must be able to remove the old information held in memory. Removing the source of power "kills" the RAM, causing it to lose its contents.

ROM, on the other hand, is nonvolatile, since the ROM is like a book. Once information is written into it, it remains, no matter how many times the book is read. So it is with ROMs . . . no matter how many times the information is read out of a ROM, it remains intact, as written. Thus ROMs are nonvolatile.

ROMs come in several types. Some are programmed at the factory during manufacture. This is practical only when many identical ROMs are to be made. They are named for the manufacturing process used, "Mask Programmed ROMs" because a photographic system used in manufacturing utilizes photo masks to make the pattern on the chip.

Another type is the "Programmable ROM" (PROM), *which can be programmed after manufacture*, by blowing out fusible links in the chip pattern. This can be done at the factory, by the distributor, or by the customer. Once programmed, the programming cannot be altered, even to correct errors!

Good examples of mask programmed ROMs exist in the ROMs inside of MPU chips, which contain the microinstructions. These are not made user programmable because the MPU's basic "Instruction Set" is held in such ROM and must be protected against accidental loss, or change.

Now let's consider what happens when you make an error in programming

a PROM. You are just stuck with an unusable chip. But, there is a way out of this situation for people who do a great deal of user programming. There is another ROM called an "Erasable Programmable ROM," (EPROM). A small glass window on the EPROM chip is normally covered with a metal shield. If the metal shield is removed, and strong ultra violet light is played over the chip for about a half hour, the contents of the EPROM are erased. The EPROM can then be reprogrammed. The programming normally lasts for several years, or, until erased.

Another form of ROM is the "Electrically Alterable ROM," (EAROM). This one can be erased by means of applied electricity. (All of these ROMs are high speed semiconductor ROMs, and have largely replaced the magnetic core memories which were the original computer memories in the vacuum tube days. We have described them in order to provide necessary background.)

## ROM Vs. RAM

Since modern computing systems use rechargeable nickel cadmium batteries as a "back-up" power source for the memory section, you may wonder why ROMs are used so frequently. After all, a RAM can perform the function of a ROM, so why not use all RAM in the external memory (add-on memory) that is required with MPU based systems? Note; most large computers are supplied with fairly large amounts of memory included in the system. Most of the "microcomputers" based on microprocessors (MPUs) have very little memory . . . some have none at all. But, provision is made for adding extra, external memory, in the form of ROM or RAM, up to the limit of the addressing capability of the MPU.

The answer is that ROM offers several advantages for certain uses and situations. First, although a secondary power source reduces the chances of a power outage to the computer, it does not eliminate it. A short in the load system can shut down both power sources! Information that is used frequently is best stored in ROM, avoiding the need for reprogramming. And, as you will see later on, ROMs can be used as decoders, logic elements, character generators, etc. They are flexible ICs capable of many uses, which become visible only after a little discussion, and thought.

## Memory access time

We have mentioned memory "speed"

several times. Actually this is defined as "memory access time," which is the elapsed time interval between memory addressing, and the outputting of the data in the addressed location. Each bit of information has a specific location in the memory, where it is stored. That location is determined by the programmer. When we wish to retrieve (read out) the information at that location, we must provide the memory with the proper address. It's like the rack of mail compartments in the Post Office Box system. The little boxes are arranged in order. If you know the box number, you can quickly locate the desired box (addressing).

The most popular semiconductor memories have access times between 20 and 500 nanoseconds! The smaller memories are faster, larger memories take longer since there are more semiconductors in the system. The type of semiconductor memory (bipolar, MOS, bubble) also affects the speed, but, as you can see, semiconductor memories are roughly a million times faster than the other types of memory (and often faster than that!).

The cost, size, and weight, of semiconductor memories, gives them advantages in *moderate sized memory banks*. Magnetic memories offer the ability to store *very large amounts* of information, and are used in systems where a great deal of memory is required. In such systems, magnetic memories offer cost advantages, but trade off size, weight, and speed. As you can now see, there is no "all around best" memory. The type of memory is selected on the basis of system requirements; a financial bank, for example, would require a very large memory capability to cover all the many transactions occurring in the different bank branches. The fact that a customer might be required to wait for a few seconds is an acceptable trade off (speed).

On a missile shot, however, time is very important, and here, a semiconductor memory would be the choice. As you can see, other things being equal, cost might be the determining factor, and the cost of semiconductor memories has been dropping very rapidly as integrated circuit technology advances. At the same time the feasible maximum size of ICs has been increasing, to the point where memories with millions of bits are being planned. Thus, semiconductor ICs are moving into large scale memory systems, tending to displace the other

types, whereas, in the past, semiconductory memory was not attractive for such use.

## Memory organization

Memories can be "organized" in a variety of ways. In order to appreciate the need for "organization," you must understand that MPUs and computers send binary information through the system in "words" and "bytes." A "word" in binary is comparable to a word in English . . . where the word is made out of a group of letters (characters). We do not spell out words, a letter at a time, we use an entire word. So it is with computers, which send the binary bits in groups, not one at a time. The first MPUs used words consisting of four bits of binary information. Most of the current MPUs use eight bit words, and the larger computers use 16 or 32 bits, and some very large machines use 64 bits.

These binary words are sent on parallel cables, called "buses" . . . an eight bit word would require eight parallel wires in the cable, in order to send all eight bits simultaneously. This is called "parallel format" as opposed to serial transmission, in which each bit is sent in sequence over a single line. Parallel transmission is much faster . . . remember . . . speed to match the computer!

## Memory capabilities

Now, back to memory organization. Suppose we have to store a total of 4000 binary bits, for some specific task. If the MPU is a machine using four bit words, then we would need to store 1000 words of four bits each. Using this as a starting point, we can look through the catalogs and see what sort of memory chips are available that might meet this requirement. We note that we can buy RAMs with bit capacities of 256 bits, 512 bits, 1024 bits, 2048 bits, or 4096 bits.) (This is because in the binary system of numbers, each additional column of digits added, doubles the decimal value, after binary to decimal decoding.)

We note also that memory IC chips can be bought with different "word" lengths . . . i.e., we do not need to buy memory that can store only one bit at each address. Memories can be purchased that will output one, four, or eight bit words. It must be understood that if we select a memory with a four bit word, then upon addressing a given location, four bits will be outputted, no more, no less. There is no way to pick out less than the full word. Putting it another way, the individual bits of the

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word stored in the memory location are not accessible. Only the entire word of four bits is accessible.

### Selecting memories

Understanding these restraints, we can solve our little problem by selecting a memory of 4096 bits, organized into 1024 words of four bits each. Such a memory would be described as a "1K × 4 RAM," meaning "one thousand words of four bits each," and that is precisely what we needed. In this case we bought exactly what we needed... but such is not always the case. The matter of cost may arise, particularly if we are building a large number of systems, in which case the savings of a few dollars per unit adds up to a lot of money. It may be less expensive to buy four ICs, each with a capacity of 1000 bits, and a one bit word... a "1 K × 1 RAM."

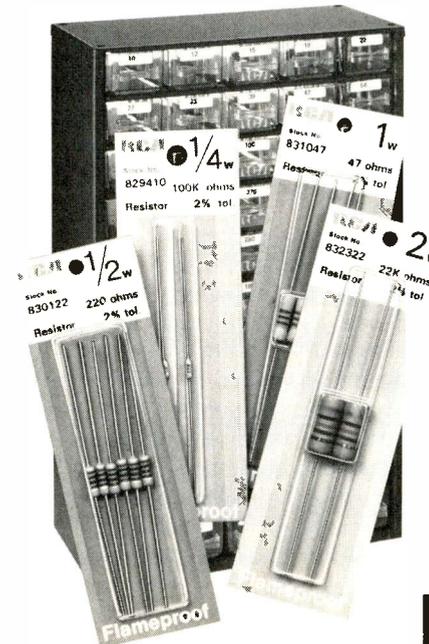
By using four such RAMs, we can out-put four bits, as required, with one bit being contributed by each of the four RAMs, and do it with less parts cost. Or, it might be less expensive to buy the 1K × 1 RAMs in the larger quantity, thus obtaining quantity discounts. Also, the chip availability from distributors, availability from second sources, and other considerations all have an effect.

Such chips may already be in-house.

As a matter of fact, we can also use two 1K × 2 RAMs, in which case two RAMs each contribute two bits, forming, in total, a four bit word. By now you should realize that what counts is the total number of bits... whether we get them from a single 1K × 4, or two 1K × 2, or four 1K × 1, etc. The total number of bits always comes out to 4000 bits, which can be rearranged readily to form the desired number of bits in the proper word length. This memory organization is left to the discretion of the system designer, and in many cases, with add-on memories, it is left to the user to determine. But, there are other factors which must be considered in memory organization. For example, in the case just described, 1000 words of four bits each, we must now have a suitable means of addressing all of the 1000 possible words. If you will examine the binary system of numbers, you will see that it takes ten bits of binary (10 digits in the binary numbering system) to yield 1000 different combinations, since nine bits can only count up to a total of 512 different combinations. Thus we are going to need a ten wire parallel address bus, in order to have the capability of

*continued on page 43*

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# Basic protection and alarm systems

An introduction to residential security

There are significant profits being made in the residential security market. Whether or not the electronic technician will be successful in capturing those profits will depend heavily on how well he understands the equipment he is installing. For a starting point, read on!

By Alan Carlton

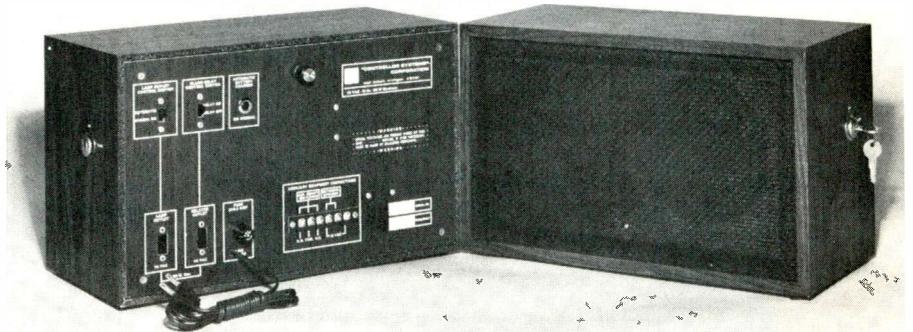


Fig. 1. A front and back view of a radio frequency residential alarm system. This Model 510 from Controller Systems Corporation lists at \$310 and contains inputs for automatic lamp control, alarm delay, and auxilliary equipment.

Among the most popular devices being used to protect doors and windows in residential security systems is the magnetic contact. An easy to install, relatively inexpensive item, presenting a low-profile appearance, it is well suited to the home application. The magnetic contact is an electro-mechanical device constituting a simple switch. When a door or window is opened, or in some cases closed, the switch short circuits, or there is a break in continuity of electrical flow, and an alarm is triggered. The magnet drawing away from the contact causes the alarm condition.

Other switches designed to protect openings include door jamb or plunger switches which are concealed switches operating like the switch found in a car which automatically turns on interior car lights when the car door is opened.

Vibration detectors are becoming

popular as an alternative to the magnetic contact in some applications. These devices are usually small units which are attached to windows, doors or walls, and are activated by the vibration caused by someone trying to break through the protected surface. The sensitivity of the device may be adjusted to accommodate specific environments. The devices are economical and are easy to install, as are the magnetic contacts.

Window foiling is another and older method for protecting windows and doors. The silver tape is often seen protecting store front windows or warehouse windows. Basically, it is a metallic tape with a small current flowing through it. When the tape is broken, as in the event of a break-in, an alarm is triggered.

The highly visible characteristic of the tape gives added benefit for the commercial application, warning off would-be thieves, but for the home

application, this characteristic seems to present problems. Many homeowners do not want to detract from the appearance of their homes with tape over their windows. In addition, labor time for cementing or etching the tape onto windows is often greater than needed for installing contacts or vibration detectors.

## Alarm screens

Another alternative for protecting windows which is particularly well tailored for the residential application is the alarm screen. This is a window screen, identical in appearance to the standard window screen except that it contains a built-in alarm wire which will alarm if the screen is cut or removed while the system is activated. More expensive than other devices mentioned, it is nonetheless an item the appearance-minded and security-conscious homeowner will usually respond well to.

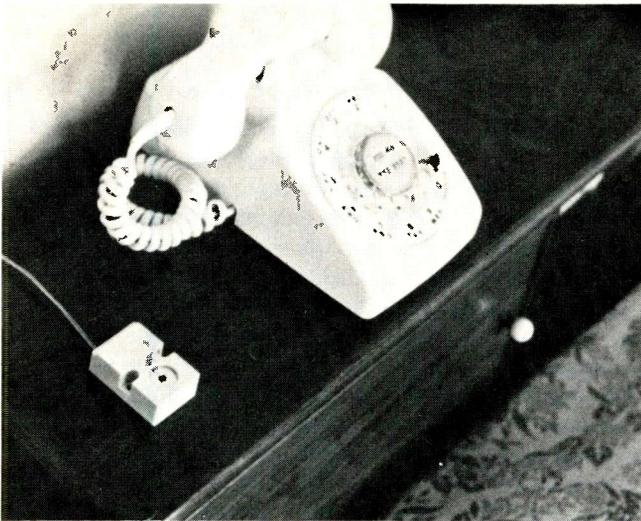


Fig. 2. A typical "panic" button installation is mounted in the bedroom. Touching the button activates the alarm even when the control unit is turned off. Photo courtesy of Master Lock Company.



Fig. 3. Visual surveillance systems are used for many applications, including entryways, monitoring individual interior rooms from a central location, or inside a weather proof box—for outside protection. Photo courtesy of Silent Watchman Corp.

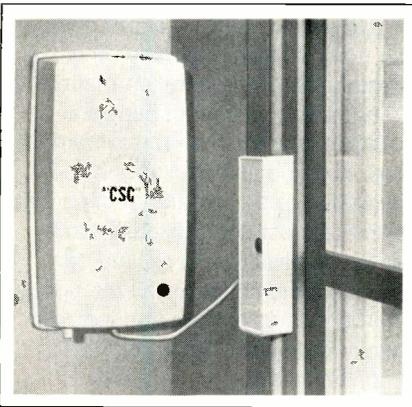


Fig. 4. This vibrator sensor attached to the window frame will activate on breakage of glass. It initiates an electronic alarm.

For extra security or as another alternative for protection of doors, alarm mats may be installed. These mats, installed concealed beneath carpeting, respond to pressure. When someone steps on them an alarm is activated. Although useful in many applications, it must be remembered that they would be ineffective if used in any areas where family pets would have freedom to roam.

For the homeowner with a very limited budget, these perimeter protection devices, linked with a control panel and a local alarm bell or siren, could function as a basic security system. For the homeowner who can afford a higher degree of security, interior room protection is in order. The installation of interior protection security equipment within the home will protect the homeowner from entry into his house through unprotected walls, ceilings or floors. In addition, it will provide him with a

secondary level of protection in the event that an intruder successfully compromises his perimeter protection security.

Installation of one of the major systems of room protection, microwave devices, ultrasonic devices, photoelectric devices, and passive infrared devices, has become a standard in most residential security systems. These devices, some of which may also be used in outdoor applications, are quite distinct from perimeter protection devices in cost, security technique, and installation ease. These devices are usually significantly more expensive, provide a different type of protection, and often require more care in installation. As they detect intruders only after they have penetrated the perimeter of the home, they do not replace perimeter protection but rather augment it. One without the other provides only half the security a homeowner should have. If he can, the homeowner will want to detect an intruder before he actually gets into the house itself. If the intruder successfully gets by the perimeter protection devices, the homeowner certainly wants detection devices more difficult to bypass within the house itself. In addition, the interior detection devices will alarm even if the intruder is in the house already before the system is activated.

#### Proper set up required

Wiring and physical installation of the devices in themselves can be as simple a task as installing perimeter devices, but accurately adjusting sensitivity levels, correctly aiming

photoelectric beams, microwave or ultrasonic energy, and similar subtleties in setting up the equipment can offer the inexperienced installer initial difficulties.

The ultrasonic systems are in many cases the least expensive of the major systems available. Inappropriately applied or installed, however, this favorable cost factor is soon lost in follow-up service calls to deal with false alarms.

Ultrasonic devices are generally about the size of stereo system speakers and indeed have been made to manifest that appearance in order to provide them with a low-profile appearance and not detract from a home's decor. They function by way of a transmitter sending out high frequency sound and a receiver monitoring that sound energy. The frequency of the sound is sufficiently high, usually between 20,000 and 40,000 Hz, to make it inaudible to the human ear.

When an intruder enters an area being protected by an ultrasonic device, his physical movement in the field reflects the sound waves back to the system receiver at a different frequency, much as movement through a sonar monitored field would do, the alarm triggers.

It must be taken into consideration that train whistles or honking car horns occurring outside the house may cause frequency shifts in the ultrasonic systems and cause false alarms. Likewise, doorbells or ringing phones may have the same effect. Some systems have been designed to overcome these problems, but careful investigation of both the environment

in which the devices will be installed, as well as the capabilities of the devices themselves, should be carefully considered before committing oneself to these devices.

### **Microwave protection**

Microwave units are similar to the ultrasonic devices in their method of operation. Like the ultrasonic devices, the microwave units include a transmitter and receiver pair. Signals transmitted are partially reflected by furniture and other objects in the field, providing the receiver with a reflected pattern of transmitted waves. Motion through this field causes a shift in frequency, called a Doppler shift, and this results in an alarm. Radio frequencies used are generally between 900-and-20,000 MHz. For residential applications, the higher frequencies are preferred as lower frequency levels will pass through building walls. Careful adjustment here is important.

The microwave units are for the most part unaffected by disturbances which might cause false alarms in the ultrasonic devices, but the microwave units can be affected by other environmental factors. Fluorescent lights can interfere with the microwave systems causing them to alarm, as can passing radio transmitters. Metal surfaces or steel-reinforced walls can be problem makers.

Like the ultrasonic device manufacturers, producers of microwave devices have been developing equipment less and less susceptible to nonintruder, environmental factors which might cause false alarms. Careful adjustment of the microwave unit, like the ultrasonic units, and responsible selection of high quality devices will avoid many problems. Photoelectric systems, like the preceding systems, operate on a transmitter/receiver pair type system, although here the receiver is receiving a transmitted light beam rather than sound or radio waves. The light being transmitted is generally generated from a light-emitting diode and is invisible to the human eye. If the beam is disrupted by the movement of a person through its path, an alarm is triggered. The transmitter and receiver are often designed to be hidden in a wall resembling an electrical outlet.

### **Proper selection required**

The effective range of these systems, unless a more costly laser light

system is used, will generally be more limited than those systems previously discussed. Ranges will vary with different devices of different manufacturers and again, as with all security equipment, careful selection of quality equipment is vital.

Installation of these devices may take some greater investment of time for the inexperienced installer as there can be some degree of difficulty in accurately aiming the transmitted light beam from transmitter to receiver.

Unlike the ultrasonic, microwave and photoelectric devices, the passive infrared detector does not detect motion. These devices detect body heat instead. This system does not require a transmitter/receiver pair. The system monitors the infrared radiant energy in the protected room and establishes this as a norm. When a person enters the protected room, his body heat alters the level of radiant energy by adding to it his own infrared energy. This alteration in the room's radiant energy triggers an alarm.

Like the other systems discussed here, the passive infrared detectors can result in many false alarms if placed in the wrong application or if poor quality equipment is used.

Some factors which might cause problems with some passive infrared devices include air conditioned rooms where temperature is not kept relatively constant, a room which has many windows and in which a passive infrared device can not be aimed away from a window so as to be unaffected by concentrated reflected sunlight off a car or snow, and electric heaters or boilers. As with other equipment mentioned, these problems are not insurmountable. Quality manufacturers have products or installation instructions to overcome them, but in choosing the right equipment for the right application, an installer should be aware of potential problems.

There is abundant literature available from manufacturers on each of the systems mentioned here. Obviously, space limitations do not allow for a truly thorough discussion of any individual system within the bounds of this article. The reader should take what is related here as a starting point for his consideration of security equipment suited for the residential market, and not as the final source for his decision on which format of equipment to go with. As has been expressed, each has its own distinct benefits and drawbacks and it is

likely, in any case, that an installer will use a number of different formats among different applications.

### **The control panel**

Perhaps the most important piece of equipment in any security system is the control panel. It is here that perimeter and interior protection devices will converge to report their alarm signals and, through the panel, activate local alarm bells and/or alert remote monitoring stations. It is also at the control panel that the system may be turned on or off, although many systems in addition have more convenient remote switches for the homeowner. The power source for the system will flow through the control panel and the control panel will usually also have a back-up battery connected to it to avoid vulnerability in the event of a power shortage. Other tasks performed at the control panel include system testing, alarm delay and reset adjustments, and other maintenance and operation matters.

The variety of control panels available is vast. They range from the most simple and least expensive, basically a relay box and nothing else, up to the most sophisticated which can automatically turn on and off systems, automatically call the police when an alarm occurs, and indicate exactly in which room an alarm condition exists.

One of the greatest weaknesses in an alarm system without remote reporting equipment is the problem of who is going to call the police when the alarm bell outside the house goes off. Today many neighbors do not want to get "involved." Others might think the bell just went off by accident or that the owner is testing the system. To avoid these problems, some control panels have automatic telephone dialers programmed to dial a specific number, such as the police, in the event of an alarm.

The control panel with remote reporting capability operates via communication over telephone lines. There are basically two types of reporting equipment, the tape dialer and the digital dialer. The tape dialer dials the prerecorded number via dual tone dial signals recorded on a tape cartridge. A voice recorded on the tape then notifies the answering party that a burglary is taking place at the location. Some dialers have the capability of more than one message, activating a fire alarm message in the

*continued on page 43*

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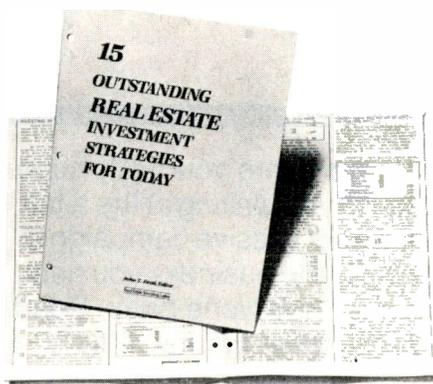
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# Generating more service business

Tips on grabbing a larger market share

The next time your telephone leaves you waiting at the altar, try an aggressive campaign to bring in the business you need to keep everyone busy. Read on for some workable tips.

By William Joseph

Everything looks rosy. The telephone is ringing with delightful regularity. The technicians' productivity is up. All of the bills are paid and there's even a little left over to buy baby a new pair of shoes.

Then it happens! The phone stops ringing.

That's the way it is in the service business. The telephone can be a noble friend, or it can be a very cruel master. When it decides to stop ringing, many service dealers know little more to do than sit on their hands waiting for business to pick up again.

If left unattended, those slow periods will be murder when it's time to put the P&L together. Healthy profits in a service organization depend on the efficient use of technicians' time, and a constantly fluctuating workload is a deadly enemy of efficiency.

One way to smooth out those peaks and valleys in your workload is to sharpen up your sales promotion skills so that you'll be ready to face those slow periods with a plan of action.

When it comes to planning, most service dealers might well take a lesson from their retailing brethren. A skilled retailer is busy making his Christmas plans in July—and orders for summer goods are placed when the snow is



Fig 1 Joe D'Agostino, and son Joe Jr., shown here, agree that antenna installations are an important part of the business. And don't forget the new kid on the block—subscription TV.

falling. In other words, a good retailer plans *in advance* for the predictable variations in his business.

Too often, we treat our seasonal slowdowns (or busy periods, for that matter) almost as if they were complete surprises. The worst possible time to plan a strategy for developing new business is after the slowdown has already begun.

If you've been keeping records of your service call volume each month, you already have all the information you need to draw a simple graph that will help you to pinpoint your next slow period with surprising accuracy.

As you can see in figure 2, for two consecutive years the slow period for the Hi-Voltage Service Company has been February through May. With this

knowledge, Mr. Hi-Voltage knows that his plans to develop additional business to fill in during those months will have to be completed and put into place by early winter.

The trouble is that Mr. Hi-Voltage shares the same lack of interest in advance planning that afflicts so many service dealers. And to make matters worse, the need for planning falls at a time when he and everyone else in the shop are very busy.

## Advance planning

Well, whoever said it was easy? Advance planning for your business will require equal doses of work and determination, but chances are that the contribution that such an effort will make toward the success of your business will

convince you to make it a permanent part of your business philosophy.

Perhaps the first—and certainly the most important—step in advance planning is to bring yourself to understand that the product you provide is a saleable commodity. There is absolutely no need to stand by helplessly when the phone stops ringing. To do so is to allow your business to run you, instead of vice versa.

**DIRECT MAIL.** Uncle Sam's postal service offers some unique opportunities for the service dealer to corral some new customers when they are most needed. For one thing, it permits focusing in on a specific group of prospects—residents of a given city or neighborhood, for example.

It also offers a highly predictable return once initial testing has been done. Direct mail advertisers have found that a mailing piece that produces a 2% return on its first run will probably produce the same rate of response on subsequent mailings. That situation makes it possible for the service dealer to "order" whatever number of additional calls are needed to round out next week's workload. If a given mail piece has been found to produce a 2% response rate and 40 calls are needed, a mailing of 2,000 pieces will bring in the desired work.

Of course, it's not quite that easy. Many service dealers I've talked to report that they have tried direct mail without success. When the facts are checked, though, in almost every case, the mailing was poorly done, badly printed, or it broke one or more of the basic laws that govern direct mail campaigns.

Generally speaking, the design of direct mail pieces calls for professional help. Very few people are blessed with a natural talent for writing effective advertising copy, yet most entrepreneurs seem to feel that they can do the job quite nicely. The fact is that most cannot. Copywriting and graphic design are very demanding skills. Most work done by amateurs looks as though it were done by amateurs.

Industry experiments over the years have shown that modifications of the most subtle kind in direct mail packages can produce startling changes in the rate of response. Changes in the color of the paper or envelopes used, slight changes in wording, the size or style of type used, number of colors, and even the day of the week that the package is received have all proven to affect the rate of response. In view of this, it isn't

surprising that many a potentially good idea for developing new service customers has been scuttled after disappointing response to a hastily put together sales letter.

### **Get professional help**

Your local Yellow Pages may be a good place to look for direct mail help. If you can locate a small advertising agency (or more likely a freelance copywriter) willing to help you draft a sales letter based on your ideas, then by all means try to negotiate a fee that you can handle. The chances are that the improvement in results will more than make up for the expense.

Considering the fact that getting professional help in composing your letter is a one-time investment, and that it can be used indefinitely with slight modifications, spending a few dollars to get it done properly is good business.

In the real world, though, the relatively small account of many service dealers will not be able to support the cost of professional assistance. If that's your situation, don't despair. If you're willing to work at it, you should be able to develop your ideas enough to bring in new service work when you need it most. One ace-in-the-hole may be your local printer. Chances are that he will be happy to offer you the benefit of his experience in working up a format and letterhead to suit your idea.

In any case, you'll boost your chances of success if you observe the tried and proven basics of direct mail selling.

In his book, *Mail Order Moonlighting* (Business Studies Inc., New York, 1975), mail order expert Cecil C. Hoge Sr. offers this advice: "Write in the style you usually write. Read your own letter carefully. Make sure it includes the points you want to get across. Be sure it has an introduction, body and conclusion. Keep sentences and paragraphs short and to the point. Start with a very short paragraph to key interest. End the same way to hold your point . . ."

Along those lines, you may want to keep in mind the words of the late William Strunk, Jr., a college professor of English. Many years ago, he wrote this classic advice: "Vigorous writing is concise. A sentence should contain no unnecessary words, a paragraph no unnecessary sentences, for the same reason that a drawing should have no unnecessary lines and a machine no unnecessary parts . . ."

### **Be precise**

It's no coincidence that most copywriting

experts voice similar philosophies. Despite the sophistication of today's society, people still respond favorably to selling efforts that are sincere and avoid the use of over-blown superlatives. Simple, easy to understand language is a must. Because of this, my personal preference is for letters written in the first-person. This "me-to-you" approach lends itself beautifully to the directness and simplicity characteristic of the most successful advertising in any medium.

Another point you will want to remember is the absolute need for high quality printing and paper. If your budget will restrict you to inexpensive mimeographed sheets or offset reproductions of amateurish copy, then I urge you to abandon the idea entirely and look to other means to generate new business.

Your direct mail piece is your personal salesman; it represents both you and your business. The use of cheap materials and unprofessional printing and design is one way to assure a disappointing direct mail effort, a waste of your money, and a harmful impression of your service.

When you put it all together, you may want to remember the observation of one advertising expert who says that advertising must create a favorable attitude toward the product; arouse the intent to buy; and provide the motivation to buy.

That's a tall order, isn't it?

If it all seems a bit baffling, you might be interested in some more advice from Mr. Hoge. He notes that a complete education in direct mail techniques is yours free if only you will study the pieces you receive in the mail almost every day. The techniques of some of the highest paid experts in the world are there for you to study and analyze at your leisure.

Before we leave the subject of direct mail, let's talk about post cards.

Forget them!

Direct mail professionals learned long ago that the simple post card has a very limited value as an advertising medium. It simply isn't adequate to tell a story well enough to create a strong desire to buy. If you attempt to develop additional service calls through the use of post cards, you are almost certainly in for a big disappointment.

Selling a potential customer on the merits of your service demands, at the very least, the dignity of a full-sized letter.

### **Other business builders**

If you prefer a more "hands on"

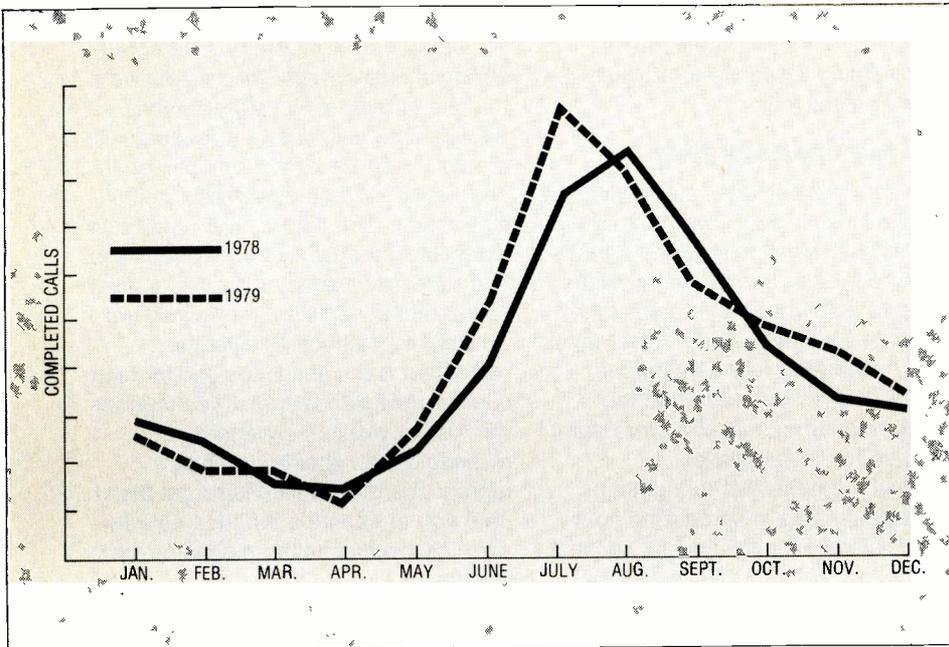


Fig 2 Charting your busy versus slack periods on a month-to-month basis is the first step toward smoothing those peaks and valleys in your service business.

approach than direct mail advertising, there are plenty of opportunities for you to exercise your ingenuity. Joe D'Agostino of Warminster TV, Warminster, Pa. says he feels a genuine concern for all those hard working techs who establish their own service businesses without a solid understanding of the business end of things.

"Too many capable technicians are barely eking out a living," he says, "because they sit back waiting for the business to come to them."

Joe keeps two of Warminster's three trucks equipped to do antenna installations, and relies heavily on the Yellow Pages to let his customers know that he's in the antenna business.

Another business builder for Warminster TV is the rebuilding of unclaimed TV sets for re-sale to its customers. Joe says that he finds a ready market for the sets he rebuilds when things slow down in the shop. The program, he feels, has the double advantage of keeping the bench technicians busy the year round, and is a convenience for customers who ask about bargain sets.

Most service dealers who rebuild unclaimed sets for resale agree that the effort makes economic sense only if it is used to fill in the slow periods for technicians who are already on the payroll. Because the work is of a non-priority nature, the activity can be stopped and started whenever necessary; thus, the true out-of-pocket cost for the labor involved is minimal.

One word of caution here. Since the sale of unclaimed merchandise is specifically regulated by law in some states and local communities, you will want to check out the rules. At the very least, where specific laws are not in effect, you should notify the owners by registered mail (or the less expensive certified mail) of your intent to dispose of the merchandise in question, allowing a period of at least an additional thirty days for the customer to change his mind and claim the article.

This is a good practice even in those cases where the customer has orally notified you of his intent to abandon the merchandise. The cost of mailing the letter (always specify "receipt requested") is nominal and may preclude an embarrassing or costly misunderstanding.

It's not very often that a brand new source of business for the electronic service dealer opens up; so when it does happen, you've got to be on your toes if you're going to get in on the action.

### How about STV?

In case you haven't noticed it, there's a new kid on the block in many towns. It's called subscription TV, and if your business is located in or near any of our fifty largest cities STV is or soon will be available in your area.

As you may know, STV differs from its fierce competitor cable TV in a very important way—there's no cable. Instead, a single channel antenna is used in conjunction with a decoder box to receive and unscramble an

over-the-air UHF signal. One an STV operator goes into business in a given city, he needs to find dealers to install those special set-ups. In one major eastern city, prospective STV subscribers are being quoted a four month delay. The reason—a backlog of thousands of antenna installations and an insufficient supply of dependable local contractors to handle the workload.

STV is now thriving in such cities as New York, Boston, Los Angeles, Sacramento, Phoenix, and Maimi; and stations are approved or under construction in Washington, D.C., Philadelphia, Vineland, N.J., Chicago, and more that two dozen other cities. Information concerning pending and approved applications for your area can be obtained from the Federal Communications Commission, Broadcast Licensing Division, Washington, D.C. 20554.

What do you do if you find that STV is in or is coming to your area?

The first thing is to take the initiative. You know that he's there, but he doesn't know about you. Contact the station operator and tell him you're interested in doing installations. You just might land a very profitable deal.

Finally, don't forget your technicians as an excellent source of fill-in business. A technician, provided he is well motivated, is in an excellent position to spot candidates for preventive maintenance check-ups.

Some dealers miss a good bet on this type of business by setting their prices too high for additional work. "The secret," says service dealer Anthony Arbutto, "is to make the customer an offer he can't refuse."

Once your technician has completed the work he was called to do, the bulk of the costs for additional time in the customer's home *has already been spent*. Those additional minutes spent on a PM check on a second set can be charged for at a much lower rate than your normal schedule and still return a better-than-average profit margin to you.

Your business building program can be as simple or as extensive as you choose, but it should always be ready to go well in advance of the time you'll be needing it.

The next time your telephone leaves you waiting at the altar, try an aggressive campaign to bring in the business you need to keep everyone busy. You'll find it's both exciting and profitable to run your business instead of allowing it to run you. **ET/D**

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# The latest from RCA

The CTC108 series

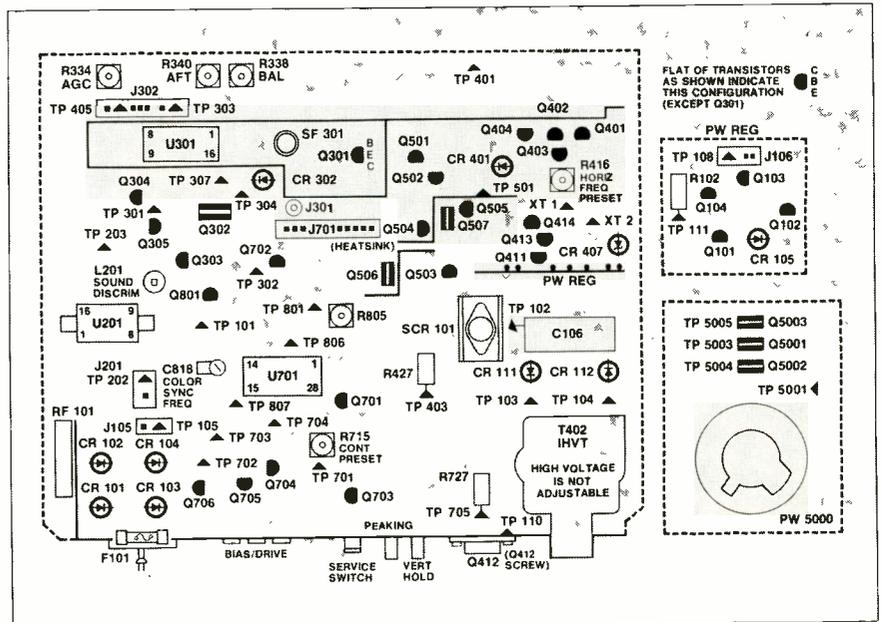
Current RCA color television receivers incorporate new circuits and devices for improved performance and serviceability. Here is some circuit description and some of RCA's troubleshooting tips

By Walter H. Schwartz

Ever heard of a sandcastle generator? Well, you have now. It's part of the burst keying and blanking circuitry of RCA's new CTC, 107, 108 and 109 and 111 Chassis. The CTC 108, the first of these to be introduced in early '80 is said to be the smallest color chassis in RCA's history. This latest of RCA's *unitized* chassis series (remember Setchell Carlson's *unitized* chassis of the early '50's which probably was the first modular TV design?) measures a mere 9½ x 11½ inches. While it resembles its predecessors in many ways, it also has some significant changes (and improvements), such as a considerable reduction in component density and a SAW Filter.

In line with its practice of the past decade or more, RCA's Technical Training Department has prepared a workshop (No. 21) which covers background of circuit operation and basic troubleshooting procedures. These RCA Workshops are probably the best and most widely offered continuing series of technician training sessions in the television service industry.

The CTC108 does resemble previous designs in the area of sound, power supply and regulator and horizontal oscillator and deflection circuits. There



rather high losses of the SAW Filter. A 47.25MHz adjacent sound trap is placed in the base circuit of Q301. The output of the SAW device is applied differentially to the first amplifier in U301. U301 amplifies the IF signal through three stages and applies it to a synchronous detector. After detection the video is passed through a noise inverter and amplified before leaving U301 at Pin 12. A 4.5MHz soundtrap at this point eliminates sound carrier from the chroma and video circuitry. Pin 12 is also the sound takeoff point. U301 also develops AGC which is used internally on the IF amplifiers, as well as being supplied to the tuner. RCA states that the noise limiting circuits in U301 make it possible to eliminate the need to key the AGC to horizontal retrace and, therefore, the horizontal oscillator pull-in is more effective.

U301 operates on 11.4V regulated by an external regulator, Q302. This results in lower dissipation within the IC.

The AFT is developed within U301 with the aid of one tuned circuit and a few other components. AFT output is at Pins 5 and 6.

### IF troubleshooting

Beyond the first and almost universal caution: *Use an Isolation Transformer*, one special note must be made; don't try to check the SAW Filter with an ohmmeter and use care when handling it, even though it reportedly has a dealer net price of only 59 cents.

The procedure for checking out the IF in cases of no sound or video is short and simple. Check first for video, about 2.2V P-P at TP301, under normal conditions. If no video is present, back up to V301 Pin 12. If no video appears at the output of the IC, check its supply voltage. If any voltage other than 11.4V appears at Pin 11 of U301, regulator trouble may be present. Bypass the SAW Filter and Q301 by pulling the IF link cable and connecting it to U301 Pin 16 through a 1000pfd capacitor. If this produces a picture (it may be distorted) the trouble probably lies in the bypassed components or circuitry. Otherwise, it's the tuner (use a subber) or U301.

AFT voltage at Pins 5 and 6 of U301 should be about 6.4V, no signal. Any other voltage probably indicates a defective IC.

In the case of a weak or snowy picture, check the AGC voltage at Pin 4 of U301. It should be about 7V with a strong signal and about 11V with a weak signal or with the IF link unplugged. If these voltages do not follow this pattern suspect U301. RF AGC should be 4V strong signal and

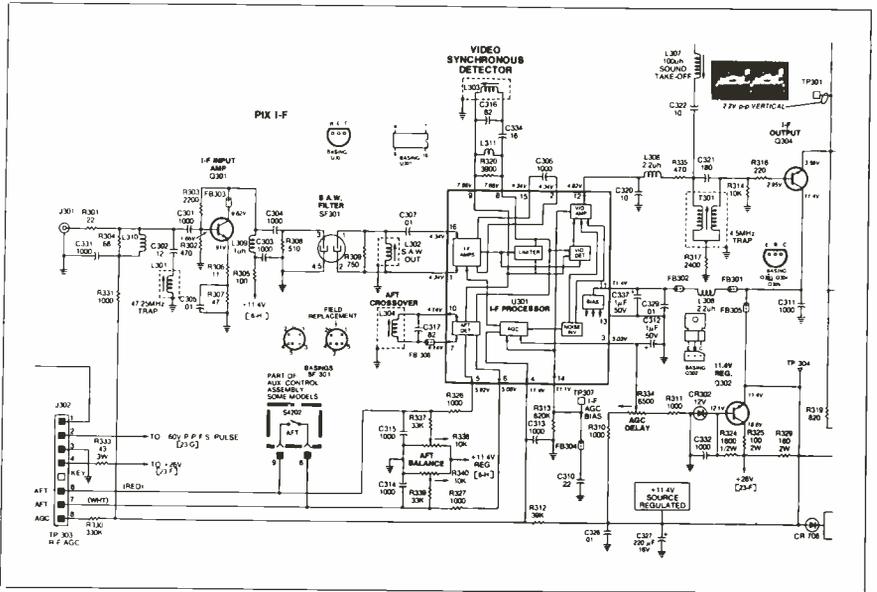


Fig. 1. SAQ Filter IF

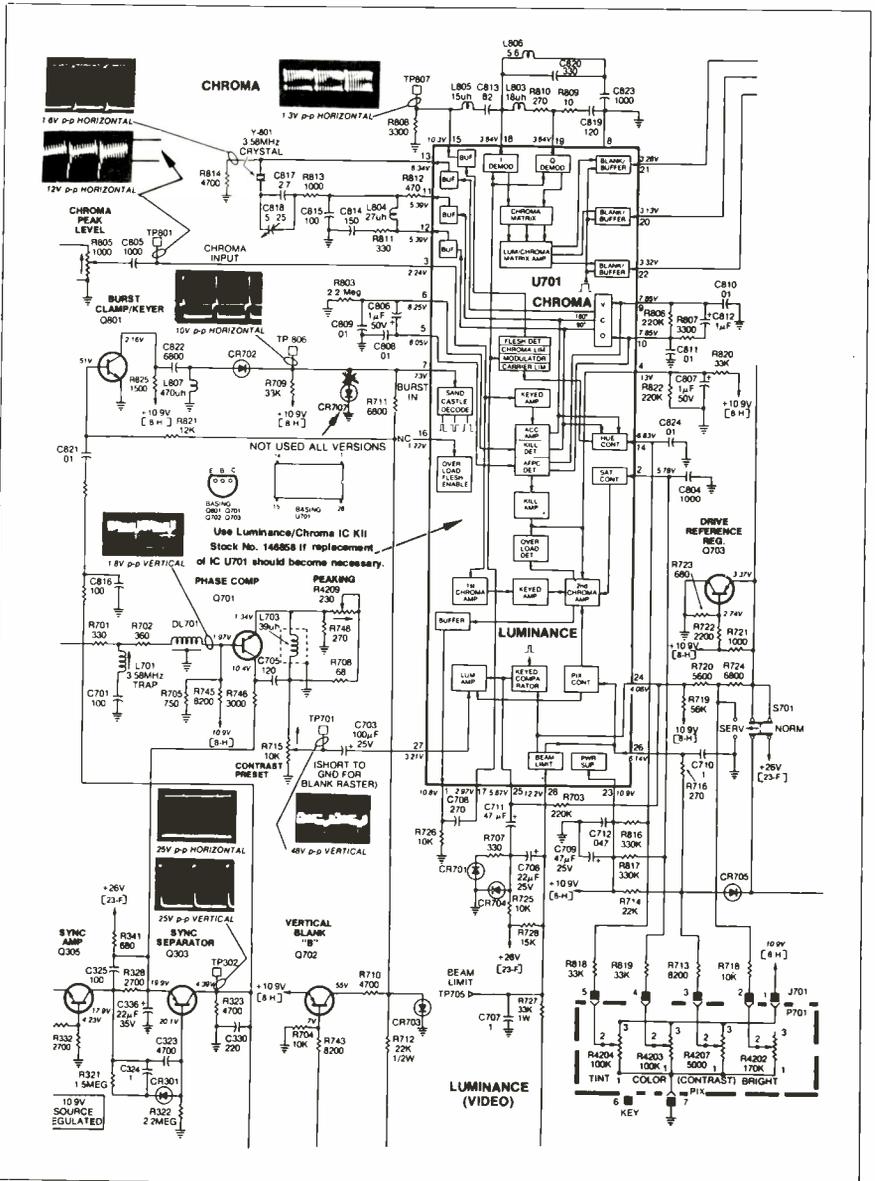


Fig. 2. Chroma/Luminance Circuitry.

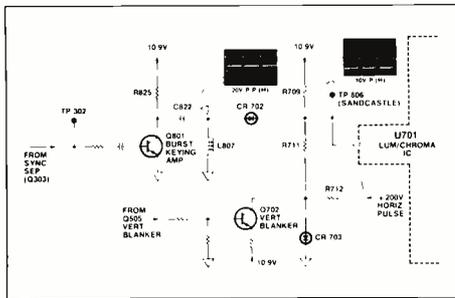


Fig. 3. The "Sandcastle" circuit.

11V weak signal. If these are OK suspect the tuner or Q301 or the SAW device.

### Luminance/chrominance

All luminance/chrominance signal processing takes place in U701 (Fig. 2). RCA states that this makes it possible to build color/contrast tracking into the IC.

Chroma enters U701 Pin 3 after passing through a coupling circuit consisting of L801, 802 and several capacitors. Chroma level is controlled by a dc level at Pin 2 (R805 is a chassis, chroma input level control).

Luminance enters at Pin 27 after passing through the delay line and a phase compensating stage. Contrast control is by means of a dc voltage at Pin 26 to the picture control amplifier. The output of the picture control amplifier controls both the luminance and chrominance channels to provide color/contrast tracking and the input of the picture control amplifier is modulated by the beam limiting circuit to provide beam limiting/contrast tracking. The beam limit circuit samples the flyback high voltage return and the customer brightness setting. Brightness level is controlled by comparing the brightness setting and the blue blanking signal during horizontal retrace to develop a voltage to control the luminance amplifier. With normal brightness voltage at Pin 28 of U701 is clamped at 12V. If beam current increases, this voltage drops, the beam limiter conducts and reduces the beam current by controlling the luminance amplifier.

Luminance and chrominance signals are matrixed in U701; the outputs at Pins 20, 21 and 22 are three color video signals. Blanking is also accomplished internally. The blanking signal is a single signal applied to Pin 7, called the "Sandcastle" signal because of its peculiar shape. Internal decoding separates the various blanking signals and applies them to their proper circuits.

The Sandcastle circuit (Fig. 3) combines the vertical blanking signal, a horizontal pulse and sync. The resultant pulse with its unique "Sandcastle"

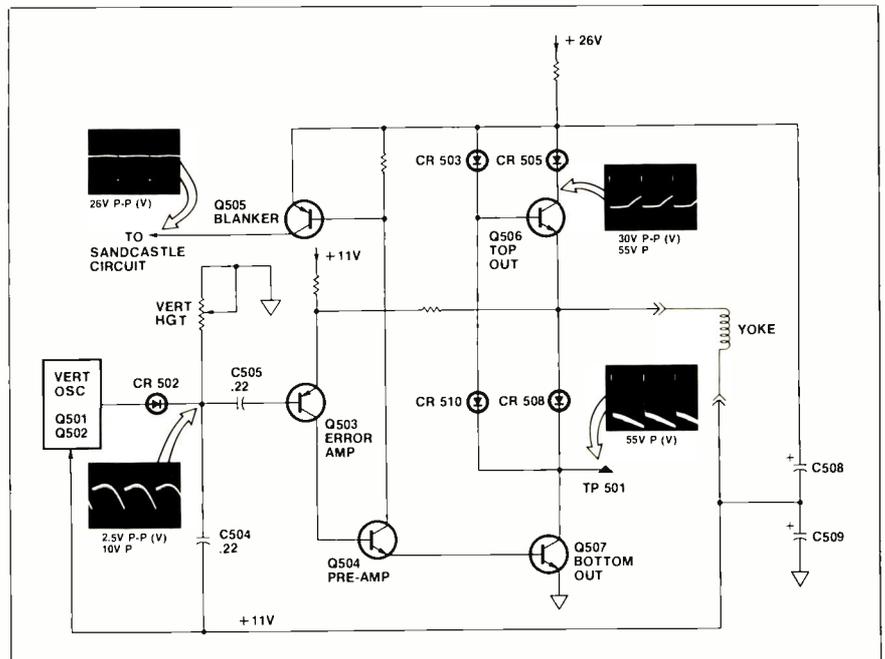


Fig. 4. Vertical deflection circuit, simplified.

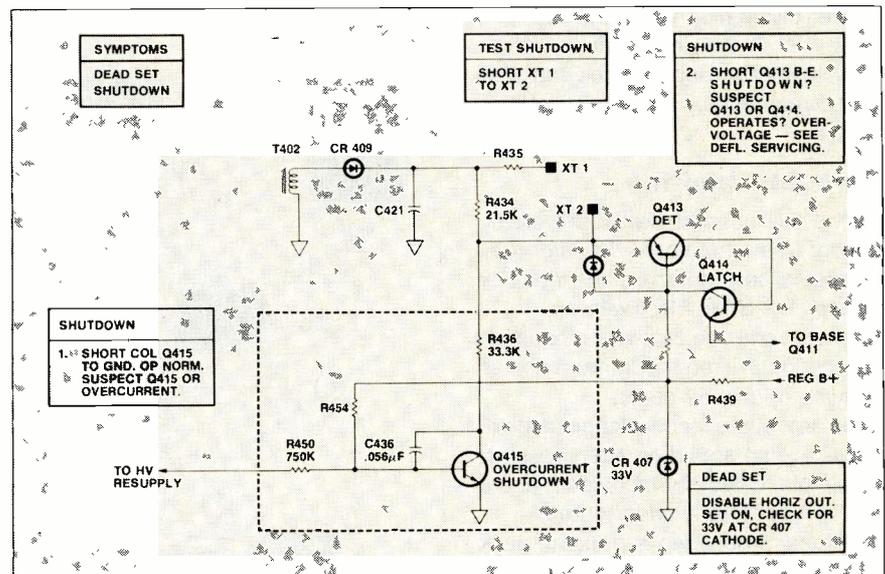


Fig. 5. X-ray and overcurrent circuit troubleshooting.

waveform is applied to U701, Pin 7.

### Luminance troubleshooting

In case of no video, no chroma, first check B+ 10.9V at Pin 23 (see Fig. 2) and check for red, blue and green output signals at Pins 21, 22, 23. Confirm video back at output of Q304 (TP301) and check for presence of Sandcastle waveform on Pin 7 (TP806). Beam limit voltage at Pin 28 will be less than 11.5V during limiting.

If no video is present but chroma is OK first check voltage at chroma (TP701). Check Sandcastle waveform and beam limiter.

In cases of loss of brightness or contrast control check for control voltage on Pins 24 and 26 respectively.

A washed out picture could be caused

by problems in the brightness limiter circuitry. Confirm 11.5V or more with low brightness picture at Pin 28.

### Chroma troubleshooting

With no chroma and perhaps no video, proceed as in luminance checkout but also confirm the presence of chroma at Pin 3 (TP801). Make sure the 3.58MHz oscillator is operating (check Pins 18 and 19 and TP807).

To adjust color sync, connect a color bar generator to the antenna input. Set control to midrange and input level control for normal viewing. Ground TP801 through a 0.01 mfd capacitor. Connect TP301 through a 270pfd capacitor to Pin 17 of U701. Adjust C818 for zero beat. That's it! Color sync should be checked anytime chroma is serviced.

SERVICE TEST POINTS	TP704 U701 BLUE OUTPUT	Q101 REGULATOR ERROR AMP— 142839	Q503 VERT ERROR AMP—142839
TP101 +185V DC	TP705 BEAM LIMITER		Q504 VERT PREAMP—142686
TP102 REGULATED B+	TP714 +10.9V DC	Q102 REGULATOR FREQ CONTROL—146847	Q505 VERT BLANK BUFFER— 143791
CTC107 114V DC	TP801 CHROMA INTO U701		Q506 VERT OUTPUT TOP— 146855
CTC108 118V DC	TP806 VERT. HORIZ BLANKING BURST. CLAMP KEYER COMPOSITE WAVEFORM	Q103 REGULATOR OSC NPN— 146847	Q507 VERT OUTPUT BOTTOM— 146856
CTC109 123V DC		Q104 REGULATOR OSC PNP— 143803	Q701 PHASE COMPENSATOR— 146847
TP103 -200V HORIZ PULSE	TP807 3.58MHz	Q301 I-F INPUT PREAMP—146848	Q702 VERT BLANK SWITCH— 146850
TP104 +200V HORIZ PULSE	TP5001 G2	Q302 11.4V REGULATOR—146849	Q703 DRIVE REFERENCE REGULATOR—143806
TP105 +26V DC	TP5003 RED CATHODE	Q303 SYNC SEPARATOR—146850	Q704 RED BIAS—146847
TP108 +150V DC	TP5004 GREEN CATHODE	Q304 I-F VIDEO OUTPUT—146847	Q705 GREEN BIAS—146847
TP110 HORIZ OUTPUT COLLECTOR	TP5005 BLUE CATHODE	Q305 SYNC AMP—146847	Q706 BLUE BIAS—146847
TP111 +33V DC REGULATOR SUPPLY	XT1	Q401 HORIZ AFT—146847	Q801 BURST. CLAMP KEYER— 146847
TP112 IHVT FOCUS TAP VOLTAGE	XT2 X-RAY PROTECTION CIRCUIT TEST POINTS	Q402 HORIZ SWITCH—146847	Q5001 RED DRIVER—141295
TP202 AUDIO OUTPUT		Q403 HORIZ INVERTER—143804	Q5002 GREEN DRIVER—141295
TP203 AUDIO 4.5MHz IN	DEVICE AND FUNCTION— STOCK NO.	Q404 HORIZ TRIGGER—146847	Q5003 BLUE DRIVER—141295
TP301 I-F VIDEO OUT	CR101 BRIDGE DIODE—147649	Q411 HORIZ DRIVER—146851	U201 AUDIO IC—146052
TP302 SYNC	CR102 BRIDGE DIODE—147649	Q412 HORIZ OUTPUT—145648	U301 I-F AFT IC—146857
TP303 RF AGC	CR103 BRIDGE DIODE—147649	Q413 X-RAY PROTECTION CIRCUIT LATCH PNP—147650	U701 LUM-CHROMA IC—146858
TP304 +11.4V DC	CR104 BRIDGE DIODE—147649	Q414 X-RAY PROTECTION CIRCUIT LATCH NPN—147651	SCR101 REGULATOR—142681
TP307 AGC BIAS	CR105 33V ZENER—146864	Q415 OVERCURRENT SHUTDOWN—143795	RF101 FUSED RESISTOR—143741
TP401 HORIZ SYNC DISABLE (SHORT TO GROUND)	CR111 +26V SUPPLY RECTIFIER—142569	Q501 VERT OSC NPN—146854	F101 FUSE—146533
TP402 HORIZ OUTPUT BASE	CR112 +185V SUPPLY RECTIFIER—142569	Q502 VERT OSC PNP—143791	
TP403 HORIZ DRIVER OUT	CR302 11.4V SUPPLY 12V ZENER—146846		
TP405 -60V HORIZ PULSE (FS TUNER SUPPLY)	CR407 XRP 33V ZENER—147654		
TP501 VERT OUT	CR409 XRP PULSE RECTIFIER— 147655		
TP701 VIDEO INTO U701			
TP702 U701 RED OUTPUT			
TP703 U701 GREEN OUTPUT			

Tint and color controls are dc voltages of between 1 and 11V for full range control.

If it is necessary to change U701, there are *only* 28 pins to unsolder and resolder.

### Vertical deflection

The CTC108 vertical deflection is a simplified redesign of that of earlier chassis (Fig. 4). The bottom output transistor serves, by means of diode switches, as driver for the top output stage. The output stage uses the 26V supply and obtains additional B+ for retrace from the regulated 118V source.

The vertical drive signal is generated by charging C504, .22 $\mu$ F, through the vertical height control to ground. As C504 charges it generates a sawtooth voltage which is coupled via C505 to the base of error amplifier transistor Q503 where it is amplified and applied to the preamplifier transistor. Vertical retrace is initiated by the oscillator turning "on" and discharging C504 through CR502 by applying B+ to the anode of CR502. After the oscillator shuts off, C504 begins charging again through the vertical height control completing a vertical cycle.

The vertical sawtooth is applied to the base of Error Amplifier Q503 which drives preamplifier Q504. Q504 further amplifies the current and drives the base of bottom output transistor Q507. During the first half of scan, Q507 amplifies this signal and drives the base of Q506 through diode CR 510. During the second half of vertical scan, Q507 acts as an output device by pulling vertical

yoke current through CR508. Q505 is a blanker transistor which provides a negative-going output pulse which is supplied to the Sandcastle circuit to provide vertical blanking of the video signal during vertical retrace.

### Vertical troubleshooting

In case of no vertical deflection, first check the dc voltage at the midpoint of vertical amplifier TP501 with the service switch in "set-up" position. If zero, suspect shorted bottom output transistor Q507, defective error amplifier Q503 or preamplifier Q504. To check shorted bottom output transistor, short the base of Q507 to ground. If its collector voltage increases, Q507 is OK, and defect is in Q503 or Q504. Short the base of Q504 to ground, if the collector voltage of Q507 increases, Q504 is okay—suspect Q503. If the voltage at TP 501 is approximately 17V, suspect a shorted Q506 top output transistor. If the voltage at TP 501 is approximately 11V, suspect a defective vertical oscillator or open Q503 or Q504.

The most likely cause of insufficient height would be an open R515.

Diodes CR503, CR506, CR508, and CR510 are responsible for providing proper switching levels to maintain linear output scan. A failure in any of these diodes will cause distorted vertical output to occur. Check bias voltages to confirm proper operation of biasing diodes.

### Overcurrent shutdown

The CTC108 chassis utilizes a shutdown circuit that will disable the set

if the high voltage or beam current increases above predetermined limits (Fig. 5).

A flyback sample pulse is rectified by CR409 and filtered by C421. The resultant dc voltage of approximately 55V is applied to the divider string of R434, R436, and Q415 (normally Q415 is in saturation, therefore having a very small voltage drop) resulting in a sample voltage at XT 2 (the emitter of Q413). The base of Q413 is connected to a 33V reference source (CR407). If the voltage at XT 2 exceeds the base reference of Q413, it will turn "on" supplying base current to Q414 which then turns "on," thus defeating the horizontal output stage and causing shutdown to occur. The shutdown circuit tracks with beam current and can also detect excessive beam current through the action of Q415 in the divider string. Q415 is normally biased into saturation by R454 from the reference supply voltage. The base of Q415 is connected to the high voltage resupply line through R450. As beam current increases, base bias is shunted away from Q415 causing it to begin dropping out of saturation. This increases the collector voltage and therefore the voltage at XT 2. If beam current is excessive, the voltage at XT 2 will rise high enough to trigger on shutdown Q413 causing.

The shutdown circuit operation should be checked by shorting XT 1 to XT 2. If the receiver does not "shutdown" when this is done, the circuit must be repaired *continued on page 45*

# BULLETIN BOARD

*Bussmann Division, McGraw-Edison Company*, has issued a new, full-color bulletin on its **small dimension fuses** and fuse accessories. Bulletin SFB, in its forty pages, presents the complete line of Buss fuses, fuseholders, clips, blocks and all merchandising aids—with all illustrations in full color, and dimensional data shown in metric and inch measurements. A cross-reference section in the SFB catalog allows a user to find a fuse by knowing (1) its electrical characteristics or (2) its physical characteristics, or (3) its catalog number. A section of the bulletin is devoted to explaining types of overcurrent, what to look for in circuit protection, and a guide on fuse selection based on current rating, voltage rating and time-current characteristics. It shows ferrule type, lead-in and pin type, automotive, and indicating fuses, plus limiters, semiconductor fuses, and dozens of fuseholders, fuse blocks and fuse clips. Time-current curves are supplied. A copy of Bulletin SFB is available from Bussmann Division, McGraw-Edison Company, P.O. Box 14460, St. Louis, MO 63178.

A new full-color **16-page oscilloscope selection guide**, describing the complete line of *B&K-PRECISION* laboratory and field service oscilloscopes, is now available from Dynascan Corporation. Included in the brochure are dual- and single-trace scopes ranging from 5MHz to 35MHz. A new 100MHz quadruple-trace lab scope is also introduced in the guide. Other new models featured include a 30MHz dual-trace delayed-sweep scope and an ultra-compact 15MHz dual-trace AC/DC battery mini-scope. The guide not only details individual features and applications for all of the scopes covered, it also discusses the design features common to the *B&K-PRECISION* family of scopes. These "family traits" reportedly include, expanded range power supplies, built-in probe calibrator/compensator, ultra-wide bandwidth triggering, compatible laboratory interfacing and efficient circuitry design for longer instrument life. A handy easy-to-read specification table is included in the brochure for quick reference and scope comparisons. Accessories, such as probes, carrying cases, a rack mounting kit and battery packs, are also described. For a free copy of the

new oscilloscope selection guide contact, *B&K-PRECISION*, Dynascan Corporation, 6460 W. Cortland St., Chicago, IL 60635.

*Multicore Solders*, has published a 4-page brochure which provides complete information on **soldering aluminum**. In addition to background that lead to the development of Alu-Sol 45D, the first multi-cored solder capable of soldering aluminum and its alloys, complete application, technical data, joint design recommendations and soldering techniques are also described. The brochure provides detailed performance information including a table on the solderability of various wrought and cast aluminum alloys, different aluminum finishes as well as other metals and alloys using Alu-Sol 45D. Alu-Sol 45D is a patented/combination of a specially formulated flux and silver-loaded tinlead solder. It contains no bismuth, zinc, cadmium or aluminum to reduce the corrosion resistance of the joint or interfere with its compatibility with standard tin-lead solders. Free copies of the brochure are available from *Multicore Solders*, Westbury, NY 11590.

*Quam-Nichols Company*, has introduced a completely redesigned 12-page **50th anniversary catalog**, featuring one of the most comprehensive lines of speakers available to distributors, including a significant number of units which are suitable for the fast-growing industrial market. Serving as a reference tool for loudspeaker selection, the catalog also includes updated listings of general purpose, automotive, musical instrument, communications, high fidelity, and commercial sound speakers. Among the catalog's many new listings are an 8" coaxial featuring a piezo ceramic element tweeter and factory assembled baffle/speaker/transformer combinations. As a special aid in ordering, the catalog maintains the well-established Quam system of "descriptive" part numbers for all speakers, indicating size, magnet type and weight, and special features. Copies of the catalog may be obtained by writing *Quam-Nichols Company*, 234 E. Marquette Road, Chicago, IL 60637.

ET/D recently received two excellent **new books** from *Prentice-Hall*. *Electronic Concepts, Principles and Circuits* by Wojslaw, \$18.95, is a basic text on analog electronics. It is a thorough presentation of the concepts of amplification, oscillation, regulation and filtering. The presentation involves a substantial

amount of mathematics but stops well short of calculus. Most of the circuitry is illustrated in both discrete component and integrated circuit form. A book like this belongs in every forward looking technician's library.

There would seem to be enough basic digital electronics texts available by now, but here's another and good one: *Digital Electronics: Fundamental Concepts and Applications* by Strangio. From switches to microprocessors, the various aspects of digital electronics and the underlying logic are covered in detail. The basic concepts of gates and Boolean algebra are particularly thoroughly covered. Over 500 pages, hardbound, \$24.95.

And from *Howard W. Sams* comes *Crash Course in Microcomputers* by Frenzel, wire bound, \$17.50. This is a programmed learning format introduction to small computers and begins with basic concepts and binary numbers and progresses to microprocessor instruction sets and the fundamentals of BASIC. The programmed learning format makes it quite obvious if you do not understand what you are reading. *Crash Course* is divided into fourteen units with self tests (and answers) at the end of each. A worthwhile book.

**A new catalog of hard-to-find tools** for electronic assembly and precision mechanics is offered free by *Jensen Tools, Inc.* The contents reportedly include over 3,000 tools of interest to field engineers, technicians, instrument mechanics, locksmiths, watchmakers, and electronic hobbyists. Major categories covered are: Micro-tools, test equipment, soldering equipment, tweezers, screwdrivers, cutters, drafting supplies, power tools, tool kits and tool cases. To obtain your free copy, write: *Jensen Tools Inc.*, 1230 South Priest Drive, Tempe, AZ 85281.

**Test instruments for rental and re-conditioned test instruments for sale** are the subject of two new catalogs from *Continental Resources, Inc.* *Continental Resources* rents or leases a wide variety of test instruments on a short or long term basis and also rents with the option to buy. Delivery is stated to be 24-48 hours. *Continental Resources* also sells reconditioned, calibrated and guaranteed test instruments periodically transferred from its inventory of rental instruments. *Continental* has approximately 35 sales offices nationwide. For a copy of either catalog call your local office or contact *Continental Resources, Inc.*, 175 Middlesex Tpk., Bedford, MA 01730. **ET/D**

# CUT YOUR AD BUDGET LATELY?

Honesty compels us to admit that you're not alone.

Whenever the cost/price squeeze gets really tough, it's a temptation to regard advertising as a cost... and to cut.

Not at every company, however.

In recent years, a significant change has taken place in the thinking of many management men about advertising budgets. No longer are appropriations cut automatically when the pressure is on.

Why?

For a number of reasons. Among them are:

1. *With the growth of the marketing concept*, advertising is no longer looked upon merely as an expense, but as an integral part of the company's marketing mix.

2. *Firms that maintain advertising during recession years do better in sales—and profits—in those and later years.* That was proved conclusively in studies of five separate recessions made by ABP and Meldrum and Fewsmith.

3. *The cost of a salesman's call today makes it imperative to make maximum use of advertising.* The average cost of an industrial sales call soared to a record \$96.79 according to the latest report by McGraw-Hill's Research Laboratory of Advertising Performance. Yet studies show that a *completed* advertising sales call—that is, one ad read thoroughly by one buying influence—literally costs only pennies. Why deny yourself such efficiency?

4. *In some cases, there is no way to reach customers except by advertising.* The "Paper Mill Study" shows (1) the number of buying influences in the average plant is far greater than marketers are aware of, (2) the vast majority of these influences are unknown to salesmen, (3) no salesman has the time to contact all influences even if he knows them.

5. *Selling costs are lower in companies that assign advertising a larger role in marketing products.* So advertising is an investment in profit, just like a machine that cuts production costs.

6. *Memories are short.* There is an estimated 30% turnover every year among buyers. It isn't surprising, then, that lack of advertising contact can quickly result in loss of share of market.

7. *Most down periods turn out to be shorter than expected.* The history of every postwar recession is that it didn't last as long as predicted. Why gamble your market position for short-term gain?

8. *Consider lead time.* Very few products sold to business and industry are bought on impulse. The advertising you are doing—or missing—right now will have its effect years from now.

9. *Advertising works cumulatively.* It would be nice to think that every reader reads all of your ad. We know it doesn't work that way. To be most effective, advertising must have continuity.

10. *Did your competitor cancel his budget, too?* If not, you may be taking a big risk.

11. *Will you lose salesmen?* They know that their chance of getting an order is better if they are backed up by advertising. Can you be sure of keeping them when they learn that that support has gone?

12. *You know better.* Survey after survey of executives shows that they expect a *drop* in sales if advertising stops.

## **But there is need for efficiency...**

whenever advertising budgets are being assembled—never more than in these inflationary times. Significantly, a recent survey shows that nearly 40% of the average budget for advertising to business and industry is invested in business publication space and preparation. That's *more than double* the next largest item.

Why? Because specialized business publications remain the most effective and efficient method of reaching target audiences in business, industry and the professions.

And we can prove it.

Write for your copy of "The ABP Library of Publishing, Advertising & Marketing" to American Business Press.



American Business Press, Inc:  
205 East 42nd Street  
New York, N.Y. 10017  
212 661-6360

# TEST INSTRUMENT REPORT

Keithley Instruments, Inc., a long established name in foreign and domestic electronic instrumentation markets, has entered the electronic service field with its first hand held, battery operated portable digital multimeter.

Placed on the market last November, Keithley's Model 130 has proven to be the company's biggest individual suc-

cess during the current year, according to a spokesman.

input impedance, the 310 has ranges of 2,000, 200, and 2 in mA; similar ranges for volts and ohms and an additional 200mV and 200ohm range setting. Also, there is a special 10amp setting. The 20Kohm setting is used for go, no-go diode tests. Over-range is indicated when the last three digits are blanked.

Five front panel jacks are designed into the unit. Two are special ground and input jacks for use in the 10amp range.

A two amp fuse protects the 2mA and 2,000mA current ranges and there is a built-in fuse check for this unit. Simply connect a jumper between the V-ohms and mA jacks with the unit set in the 2Kohm range and read .100.

The maximum allowable input in the ohms function is 300Vdc or ac, according to the manufacturer.

There are three ICs soldered into a single circuit board. One of these performs analog to digital conversions for the 3½ digit display.

Optional accessories for the 310 include a soft carrying case and stand, a spare parts kit, high voltage probe, a 50-amp shunt, and an RF probe that permits voltage measurements between 100KHz and 700MHz.

Practically speaking, the Model 130 is really built for field service use. It's ultra light weight, small size and rugged plastic case make it a natural for many field service environments, indoors or out.

The back of the carrying case is padded for extra protection and the meter is retained in the case by a single rear panel mounting screw.

The rotary switch design of the unit also adds to its usefulness. The switches are arranged so that they may be turned with the thumb, that is, two fingers are not required to change ranges or functions. The panel labeling is printed on the back of the transparent overlay for maximum protection.

It comes with a solid plastic stand that may be attached when desired. The back contains two compartments, one for the nine volt battery and the other for the two amp fuse. Either is easily accessible. Calibration may be achieved when needed simply by removing two back cover screws and following the directions which are supplied.

Keithley has long been known for laboratory and industrial instruments capable of measuring extremely small currents and voltages (picoammeter s/ electrometers). They recently introduced a rather complete line of bench/portable DMM's.

All in all, Keithley's first entry into the low cost compact DMM field service field is right on target. **ETD**



Keithley's 130 Digital Multimeter. For more information circle No. 150 on the readers service card.

## Keithley's Field Service DMM

A new competitor

By Richard W. Lay

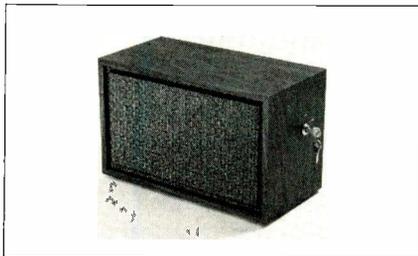
cess during the current year, according to a spokesman.

The 130, a 3½ digit liquid crystal DMM that lists for \$109, is a compact, half pound unit ideally suited for the purpose for which it was designed.

With a basic .5 percent accuracy in dc ranges, the 130 is designed around rotary switches for range and function selection. A nine volt battery, designated for 100 hours of use under normal operation, powers the unit. A low battery indicator (BAT) in the LCD appears when battery life is about 90 percent exhausted.

Input limitations in voltage ranges are 1000dc or peak ac non-switched and 750Vac switched. With a 10Megohm

# SECURITY PRODUCTS



## Microwave Motion Detector

Circle No. 138 on Reader Inquiry Card

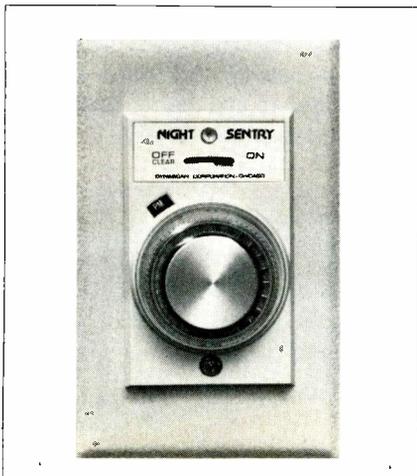
Controller Systems Corporation has recently introduced its Model 710, a single unit microwave motion detector. It is stated to be stable of operation with an open space coverage area of up to 100 ft in length and 50 ft in width. It will turn on two ac outlets, with 500w capacity, has adjustable exit and entry delays and a key switch off-on.

## Lighting Control/Timer

Circle No. 139 on Reader Inquiry Card

Dynascan Corp. has entered the home security field with the introduction of "Night Sentry," a microprocessor-based lighting control (timer) that replaces conventional wall light switches. The solid-state unit automatically controls indoor and outdoor lights such as ceiling or wall fixtures in foyer, stairway, kitchen, bath, den/family room; porch, patio, driveway, garage, yard and post lights.

Among Night Sentry's features are: microprocessor-based, solid-state construction with automatic programming and up to 48 On-Off times in a 24-hour period; wall switch location makes it readily accessible for programming and



for overriding the program at any time; it can be used as a conventional light switch by merely pressing the dial button to override the program (which remains in the memory).

Automatic "no hands" programming consists of using Night Sentry as a conventional On-Off switch for 24 hours, after which the "memory" repeats your pattern of use daily thereafter—automatically. "Rapid" programming is accomplished in minutes by setting the Night Sentry dial to the desired On-Off times and entering them in the memory by merely pushing the time dial pushbutton. A plus benefit claimed for Night Sentry is its "soft start" feature, which it is said triples incandescent bulb life. The Model WT-341 Night Sentry is Underwriters Laboratories listed and suggested selling price is \$24.95.

## Home Security System

Circle No. 140 on Reader Inquiry Card

Silent Knight's PAGE security system is reportedly a complete home security system offering protection against fire, burglary and other emergencies with its microprocessor control contained in a 11 x 5½ x 1½ inch control panel. This control panel has inputs for intrusion, fire



and emergency alarm signals and features entrance and exit delays. Accessories available include 12 Volt battery back-up power, audio pickup and listen-in modules, smoke detectors, a furnace failure detector and others. Silent Knight also offers several other models of home security systems and many accessories.

## Indoor Security Sensor

Circle No. 141 on Reader Inquiry Card

A new, reportedly low cost indoor microwave sensor system with coverage up to 75 feet is available from Racon, Inc. Model 20000-04 is designed for use by schools, businesses or homes for individual room protection, or trapping risk areas. The unit mounts in corners, on walls or on the ceiling, reportedly without degradation of the coverage pattern. A swivel mounting bracket is provided. To help establish the desired coverage



pattern, the unit has an LED umbilical wire "walk test" feature that tucks away inside the sensor during normal operation. The self-contained unit operates from 16.5 volt ac power and has a back-up battery if primary power fails. Electrical interference problems are said to have been eliminated by enclosing the sensor in a metal die cast case. The Model 20000-04 is offered with a one year limited factory warranty.

## Motion Detector Alarm

Circle No. 142 on Reader Inquiry Card

The TELTALE alarm system by MRC is a low frequency intrusion alarm system which unlike ultrasonic intrusion detectors uses an approximately 810Hz sound wave pattern, reportedly less likely to respond to false alarms caused by movement of small objects. The specially designed speakers that detect the motion also can be used for paging, intercom and alarm applications. The system operates from 117V ac and includes back-up battery power for up to 24 hours of operation in case of power failure.

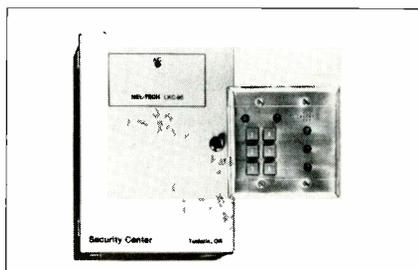
## Security Control Panel

Circle No. 143 on Reader Inquiry Card

Nel-Tech Development, Inc. has introduced the LKC-60, a surface mount, microprocessor based control panel. This panel is designed to provide flexibility in custom alarm planning for residential and commercial applications.

The LKC-60 is reportedly field programmable and offers three functions which can be operated and monitored from remote digital key stations. The three functions are: arm/disarm; interior shunt; and panic.

The LKC-60 also offers, as a fourth



optional function, a custom zone which operates as an additional shunt for door strike, second interior zone, outside lights or whatever the user desires. Each of these functions, including the custom zone, can be programmed independently with its own two to seven digit code. The codes can be the same or different and digits can be repeated for increased flexibility.

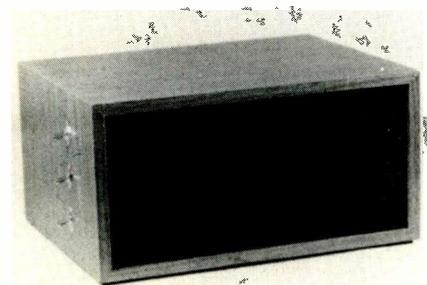
The LKC-60 control panel's features are said to include supervised/non-supervised mode of operation; separate entry/exit delays, from 10/20/40 or 80 seconds; bell timer with automatic reset; secondary loop protection; automatic lockout and alarm memory. The LKC-60 also provides three alarm outputs: burglar, fire and panic.

Recommended for use with the LKC-60 control panel are Nel-Tech's 6R-60 remote key stations. The 6R-60's feature five LED's and a pre-alarm buzzer. The LED's monitor the panel's functions while the built-in buzzer provides fail-safe arming and sounds for entry/exit delay or loss of line supervision. The 6R-60 remote key stations can be "custom" labeled and are available in brass, bronze, tan and stainless steel.

### Sound Discriminator

Circle No. 144 on Reader Inquiry Card

MRL, Inc., had added a new feature to its Sound Alert sound discriminator burglar deterrent system. Model #1100 has second act noise activation. When first break-in sound occurs, lights only are turned on. Unit begins to listen again after 3 to 4 seconds and for whatever time the cycle time is set; if second break-in sound occurs during this time, unit turns on noise and, if desired, activates a dialer to call neighbors, another number, police, etc. A second act pilot light comes on and stays on until turned off, if second act action occurs. If there is no second act, unit re-arms for regular protection. Sound-Alert is sensitive to hostile noises but reportedly does not alarm to ordinary noises outside or inside. Model #1100 comes in a speaker type cabinet and requires no installation. It has a sensitivity adjustment and alarm



duration control, provision for stand-by power and 900 watts of power for additional accessories. Sound-Alert comes with an unconditional one year service guarantee and has switches on side for activation of unit and horn.

### Electronic Siren

Circle No. 145 on Reader Inquiry Card

Model 49 Electronic Siren by EPC (Emergency Products Corp.), features a built-in driver module. No wiring to an external driver is required. The unit operates on 6vdc or 12 vdc systems with a current drain of 250ma (6 v) or 500ma



(12 v). Model 49 is suited for indoor use as an indoor fire warning device or as a backup sound to an outdoor alarm bell. It may also be used outdoors in protected areas. The unit is equipped with an adjustable bracket for mounting. Its size is 6 in. high x 5 in. wide x 5 in. deep.

### Telephone Alarm Systems

Circle No. 146 on Reader Inquiry Card

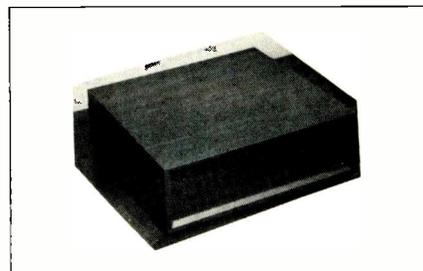


DIAL-ALERT Models D1 and D2 by Seaboard Electronics Co. send via the phone line to any selected location, alarms indicating fire, break-in or flood. Model D2 also allows listening in on any sounds in the alarm area. Sensors available include a microwave motion sensor, smoke alarm, toxic gas sensor, door and window switches, freeze sensor, refrigerator sensor, boiler pressure sensor, glass breakage sensor, flood sensor and a reverse pressure sensor.

### Motion Detector

Circle No. 147 on Reader Inquiry Card

Honeywell's Defender II is a single unit ultrasonic motion detector. It is specified to survey an area thirty feet forward and



twenty feet wide. Any movement in this area will resort in a shrill alarm sounding. It has approximate entry and exit delays, of twelve and twenty seconds, respectively. Defender II operates on 120 Vac and features two relay controlled ac outlets which can be used to turn on lamps or an exterior horn.

### CCTV System

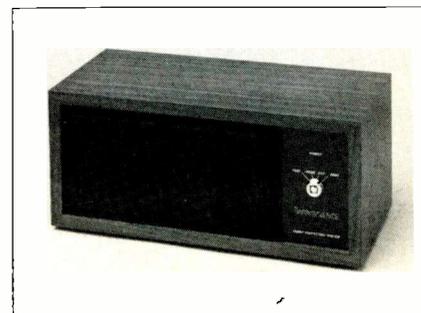
Circle No. 148 on Reader Inquiry Card

Zenith now offers a CCTV system which consists of a remote camera, a doorbell-intercom and a monitor which serves as a black and white TV receiver until the doorbell rings, at which time it shows who's at the door. You can then push the "talk" button to talk to the caller and when through push the "TV" button to return to the TV picture.

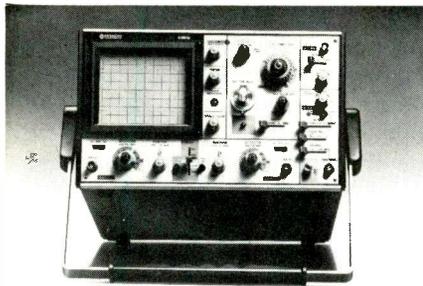
### Residential Security Systems

Circle No. 149 on Reader Inquiry Card

Transcience's RCS-100 R and RCS-200 R are versatile single and dual channel radio frequency security alarm system controls. These control units will respond to a variety of remote transmitters including door switches, window bugs, ultrasonic and microwave intrusion detectors, smoke detectors, heat sensors and portable personal alarm transmitters. The control unit can sound various alarms, turn on lights and dial the telephone for remote alert. Auxillary battery power makes it immune to power failure. The dual channel RCS-200R includes a second, 24 hour fire or panic priority channel. Transcience states that while about 60% of the cost of hardwired systems is installation labor, such costs may be as little as 10% with a wireless security system and that its basic package cost is less than \$1000.



# NEW PRODUCTS



## 50MHz Oscilloscope

Circle No. 152 on Reader Inquiry Card

Hitachi-Denshi America Ltd recently introduced a new 50MHz Oscilloscope. The new dual trace delayed sweep model V-550B is now available from authorized stocking industrial distributors. The V-550B offers a 6" square CRT with an internal graticule and the use of an improved metal backed phosphor reportedly makes the new Hitachi 10kV tube as bright as old type 15kV CRT. Among the scope's many features are trigger view, (external and internal triggering signals can be displayed as a third trace), variable trigger hold-off, full TV triggering and single sweep capability. An additional feature is automatic focus correction which restores proper focus whenever intensity or sweep range control settings are altered. Vertical sensitivity of the V-550B is 5mV/DIV over the full bandwidth and 1mV/DIV to 10MHz. Display modes are Ch1, Ch2 (normal or invert) alternate, chopped and added. The horizontal deflection system consists of the main time base "A" and the delayed time base "B". Time base "A" has 22 calibrated sweep positions from 50ns/DIV to 0.5s/DIV in 1-2-5 sequence. Time base "B" has 19 calibrated steps from 50ns/DIV to 50ms/DIV in 1-2-5 sequence. 10 X magnification extends fastest sweep rate of both time bases to 5ns/DIV. The V-550B weighs 20.5 lbs. and its dimensions are 12.2" (W) X 7.1" (H) X 16.1" (D). The price for the V-550B with two probes is \$1,745.00.

## DMM

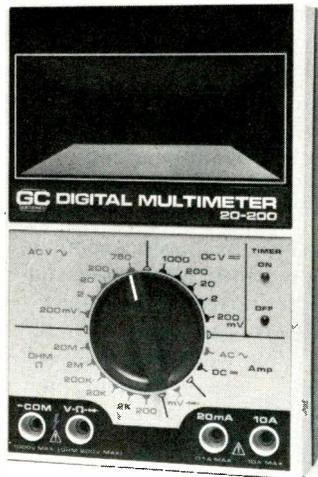
Circle No. 153 on Reader Inquiry Card

A 21 Range Digital Multi-tester (Cat. No. 20-200) is one of several pieces of electronic and electrical test equipment added to the GC Electronics line for 1980. The tester, housed in an impact-

resistant thermoplastic case, has a 19-position range selector switch. With 0.5% accuracy, GC's digital multi-tester features: auto zero, automatic over-range, overload protection and automatic polarity indication. Readout is a 7 segment, 4 digit (0.5") LED display.

GC also has introduced a new 43 Range Multi-tester (Cat. No. 20-210). This testmeter has a range doubler switch for increased current-voltage capability, single-knob range selector and a large (4 1/2") two-color mirrored scale to prevent parallax errors. It also features protection against accidental meter overload and has  $\pm 1\%$  temperature stabilized resistors.

Also new to GC's line of test equipment is the 6 Range Clamp Meter (Cat. No. 20-220). The instrument "clamps" around cables and wires to measure current at 50 and 60Hz without breaking

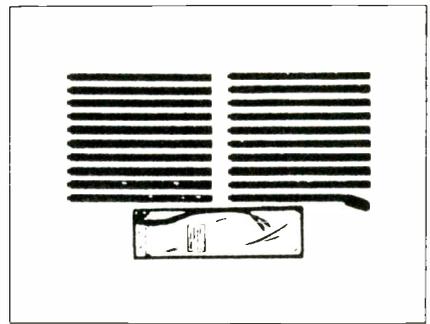


into the powerline and without connecting the meter directly to the circuit. The ohm probe is fused, preventing damage to the instrument. The pointer locks into place to give accurate meter readings - in the dark or hard-to-reach places. Included are test leads, ohms probe, batteries and a leather carrying case.

## Pull Rods

Circle No. 154 on Reader Inquiry Card

Pulling wires for MATV systems or perhaps for security systems? The right tools can make it easier. Pushing wire and cable into inaccessible areas can be expedited by Music Supply Co's push-pull rods each 27 inches long, a set of 20 of which can be screwed together for 45 feet. However, three sets reportedly have been pushed together for a distance of 135 feet. The lead rod is lightly



curved on one end with an insulating boot. Wire and cable can be taped to this first rod and then be pushed through the inaccessible area. The rods may also be used for making spans over warehouse areas blocked by equipment or shelving that cannot be readily moved. Made of aluminum alloy with 3/4-inch outside diameters, they come in either plain aluminum or with an insulation coating. A vinyl bag is supplied with each set, which consists of either 10 rods or 20 rods. They come with a 30 day money back guarantee and a 1 year warranty.

## DMM/Frequency Counter/Oscilloscope

Circle No. 155 on Reader Inquiry Card  
Vu-Data's new mini-scope, the 25MHz Model 2521 is now available with an optional multimeter and frequency counter.

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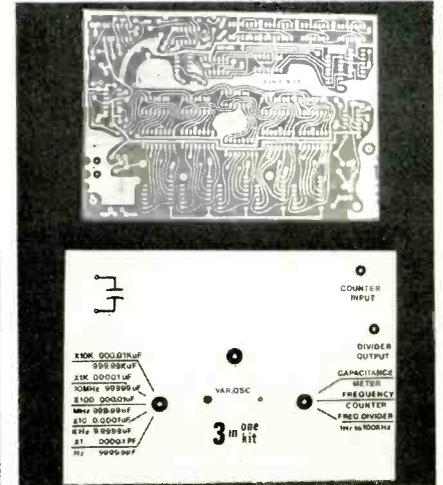
The DMM can automatically read voltage directly from the scope input and its 3½ digit meter measures dc and/or ac to 1000 volts full-scale, and resistance to 1.999 kohms. If CH1 input to the scope is ac coupled, the meter reads the rms value of the CH1 signal so the operator

need not make the mental calculation of p-p to rms. Range and polarity selection are automatic. The counter reads to 25MHz and digitally displays the input frequency of either CH1 or CH2. It is unique in that it operates from the scope trigger circuit, therefore requiring as little as 2.7 millivolts to trigger. Internal connections between scope inputs and DMM/Counter are selected by front panel pushbuttons. Both multimeter and counter can accept external inputs, thereby operating as separate, stand-alone instruments, each having its own LED display. Vu-Data offers this multi-mode feature on all scopes in their line,

from 25MHz to 50MHz. The price of the 2521 is \$1,785.00; without DMM/Counter it is \$1,395.00.

### Three-in-one instrument

Circle No. 156 on Reader Inquiry Card  
*Bagnall Electronics* offers a circuit board and panel decal to those of you who would like to build an instrument combining frequency counter, digital capacitance meter and squarewave



generator. This is not a kit; you get a good quality circuit board (undrilled) a panel decal, schematics, a circuit board layout drawing, a parts list, and a sheet of instructions. So if you want a modest cost challenge, here you are.

### LCD DMM

Circle No. 157 on Reader Inquiry Card

*Soltec* has introduced the new Model MD-200C to the DMM market. This DMM features compact size for convenient hand held operation, 0.5 inch 3 ½ digit LCD, 5 plug-in adaptors for measuring temperature, capacitance, hFe, ac current, and dc current. Standard features include a 24-Range switch with a "Push to Free" technique to allow rapid access to any range setting, autopolarity, and overload display. Hi-Lo switch for varying voltage output in semiconductor and diode conductance tests is incorporated along with a special crystal oscillator circuit which is said to eliminate external noise during mea-



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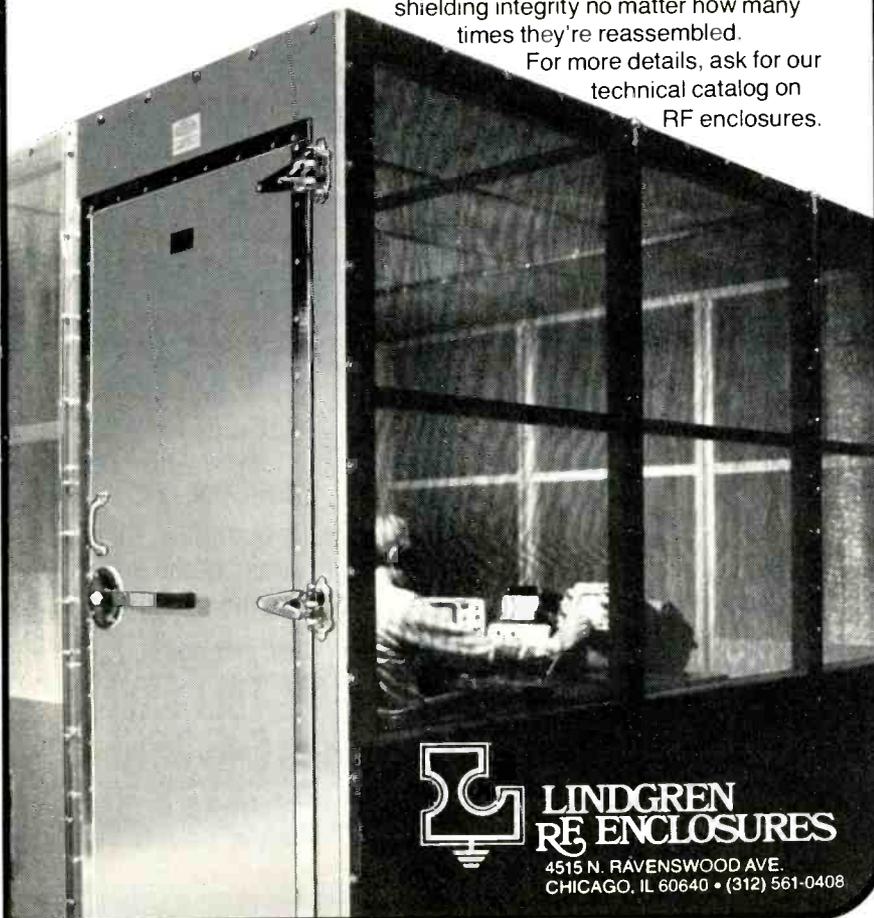
Lindgren's double-electrically-isolated (DEI) screen rooms offer 120 dB RF attenuation of electric and plane waves from 14 KHz to 1 GHz... up to 10 times more shielding than any other type of screen room.

This patented design keeps your design/test area interference-free despite rising ambient RFI levels. You get shielding equal to conventional solid-sheet-metal enclosures without sacrificing the see-through, hear-through and lighter-weight advantages of screen.

DEI design is superior because inner and outer screens of 0.011" dia. 22 x 22 bronze mesh are electrically separated, except for a single grounding point. Doors feature separate inside and outside RF seals on all four edges, with a single handle that assures an RF-tight closure by applying cam pressure at three points.

Built of panel modules, Lindgren RF enclosures can be moved, expanded or reshaped easily. Our patented overlapping pressure joints maintain full shielding integrity no matter how many times they're reassembled.

For more details, ask for our technical catalog on RF enclosures.



Circle No. 120 on Reader Inquiry Card

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### What makes Speed Learning so successful?

The new *Speed Learning Program* does not offer you a rehash of the usual eye-exercises, timing devices, costly gadgets you've probably heard about in connection with speed reading courses or even tried and found ineffective.

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thing you have ever seen or heard about. Research shows that reading is 95% *thinking* and only 5% eye movement. Yet most of today's speed reading programs spend their time teaching you rapid eye movement (5% of the problem) and ignore the most important part (95%) *thinking*. In brief, *Speed Learning* gives you what speed reading *can't*.

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This is a practical, easy-to-learn program that will work for you — no matter how slow a reader you think you are now. The *Speed Learning Program* is scientifically planned to get you started quickly . . . to help you in spare minutes a day. It brings you a "teacher-on-cassettes" who guides you, instructs, encourages you, explaining material as you

read. Interesting items taken from *Time Magazine*, *Business Week*, *Wall Street Journal*, *Family Circle*, *N.Y. Times* and many others, make the program stimulating, easy and fun . . . and so much more effective.

Executives, students, professional people, men and women in all walks of life from 15 to 70 have benefited from this program. *Speed Learning* is a fully accredited course . . . costing only 1/5 the price of less effective speed reading classroom courses. Now you can examine the same, easy, practical and proven methods at home . . . in spare time . . . without risking a penny.

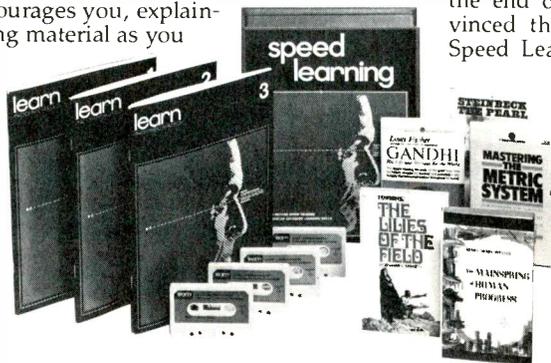
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You will be thrilled at how quickly this program will begin to develop new thinking and reading skills. After listening to just one cassette and reading the preface you will quickly see how you can achieve increases in both the speed at which you read and in the amount you understand and remember.

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- **American Management Association**  
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102	1.10	171A	0.90	260	4.70	338	16.00
102A	0.75	172A	0.40	261	1.40	339	23.00
103	1.10	173BP	6.00	262	1.40	340	1.90
103A	0.80	175	1.30	263	1.60	373	1.45
104	2.00	176	1.00	264	2.00	374	1.55
105	2.20	177	0.25	265	1.00	375	1.80
106	0.40	178MP	0.50	266	0.90	376	2.30
107	0.60	179	5.00	267	1.00	380	3.60
108	0.75	180	4.00	268	1.20	381	3.60
109	0.30	181	2.90	269	1.30	396	2.10
110MP	0.50	182	2.50	270	3.30	397	2.30
111	1.20	183	3.00	271	4.50	409	1.30
112	0.80	184	1.00	272	0.80	416	1.10
113A	0.80	185	1.20	273	1.20	428	0.80
114	0.80	186	0.90	274	2.60	519	0.40
115	0.80	186A	1.20	275	3.00	524	1.50
116	0.30	187	1.10	276	7.75	551	1.60
117	0.30	187A	1.30	277	9.80	601	0.25
118	1.30	188	1.50	278	2.50	703A	1.20
119	1.00	189	1.40	279	5.00	708	1.50
120	0.90	190	1.80	280	3.40	709	2.60
121	2.70	191	2.00	281	4.60	710	2.60
122	4.00	192	0.45	282	3.10	712	1.80
123	0.60	193	0.45	283	6.00	713	1.50
123A	0.55	194	0.45	284	4.20	714	2.80
123AP	0.70	195A	1.90	285	5.70	715	3.00
124	1.60	196	1.20	286	5.50	718	1.50
125	0.30	197	1.30	287	0.60	719	1.50
126	1.20	198	1.40	288	0.70	720	1.50
127	4.00	199	0.40	289	0.60	722	1.50
128	0.85	209	0.30	290	0.60	723	1.50
129	1.00	210	0.85	291	1.30	724	2.60
130	1.30	211	1.00	292	1.50	731	3.80
131	1.00	213	10.00	293	0.80	737	3.50
132	0.60	218	2.70	294	1.00	738	4.10
133	0.55	219	3.50	295	0.60	740A	2.20
134A	0.50	2.20	1.60	297	0.90	742	3.90
135A	0.50	221	1.50	298	1.00	743	3.30
136A	0.50	222	1.50	299	0.75	748	2.00
137A	0.50	223	3.00	300	0.70	780	2.50
138A	0.50	224	3.00	302	1.30	783	3.00
139A	0.50	225	4.50	306	1.30	788	2.80
140A	0.50	226	1.80	307	0.60	790	2.60
141A	0.50	226MP	4.90	308	6.80	791	2.80
142A	0.50	228A	1.00	309K	3.20	801	2.00
143A	0.50	229	0.60	310	6.50	807	3.20
144A	0.50	230	4.20	311	2.00	917	2.90
145A	0.50	231	3.80	312	0.60	955M	1.20
146A	0.50	232	0.60	313	1.90	977	1.20
147A	0.50	233	0.50	314	7.50	1002	1.30
148A	0.50	234	0.45	315	0.90	1003	1.20
149A	0.50	235	1.50	316	2.50	1006	2.00
150A	0.50	236	4.90	317	26.00	1009	2.15
151A	0.50	237	2.40	318	20.00	1010	2.15
152	0.90	238	3.30	319	1.10	1011	2.20
153	1.00	239	2.70	321	3.60	1014	2.20
154	1.40	241	2.00	322	1.90	1015	2.60
155	2.20	242	2.00	323	2.20	1016	2.20
156	0.45	243	2.10	324	2.50	1019	1.20
157	1.10	244	2.20	325	29.20	1020	2.90
158	0.90	245	3.00	326	0.90	1024	4.20
159	0.60	246	4.20	327	17.00		
160	1.80	247	4.00	328	9.00		
161	0.90	248	4.00	329	3.70	1025	
162	4.60	249	7.00	330	12.80	TO	
163A	5.60	250	7.00	330W	10.00	6400	
164	3.20	251	5.00	331	1.90	CALL	
165	3.30	252	7.00	332	2.00	FOR	
166	0.70	253	1.30	333	20.00	PRICE	
167	0.95	254	1.50	334	20.00		
168	1.00	257	1.80	335	25.00		

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surements. All standard ac voltage, dc voltage and resistance ranges are available to make the Soltec MD-200C DMM a versatile unit.

## Auto Ranging Capacitance Meter

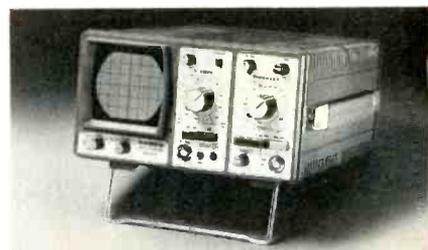
Circle No. 161 on Reader Inquiry Card

B&K-Precision's Model 830 is a ten range, auto ranging digital capacitance meter. It has a 3½ digit display with a resolution of 0.1 pfd on the lowest ranges and a basic accuracy of 0.2%. The autoranging capability is useful for quick sorting; if the capacitors to be measured are known to be within a range, the 830 can freeze in the desired range. The 830 covers from 199.9 pfd to 199.9 mfd full scale in ten ranges. A zero control can compensate for lead capacitance and the reading time is from 0.4 to 1.0 seconds up to 20 mfd and 6 seconds at 200 mfd. Optional accessories are a rechargeable battery pack and charger and a carrying case.

## Component Tester Oscilloscope

Circle No. 158 on Reader Inquiry Card

The HM 307 from Hameg is a compact light weight single trace oscilloscope de-



signed for field service and laboratory applications. It features a built-in component tester that tests common semiconductors and passive components in circuit. The built-in component tester can mean that for many service calls, no other instrument is needed. The HM307 changes from an oscilloscope to a component tester with the press of a button while the oscilloscope settings are left undisturbed. The component tester applies + or - 8.6 V rms maximum to the device with current limiting to 28 mA. The resulting V/I display reveals most bad semiconductors.

The HM307 employs integrated circuits for the deflection amplifier and triggering circuits. Consequently, it reportedly needs no drift compensation and will trigger on signals as small as 3 mm up to 30 MHz. The vertical sensitivity ranges from 5mV to 20V/cm in 12 calibrated steps. The time base is from 2 sec. to 1.2 usec/cm with auto and

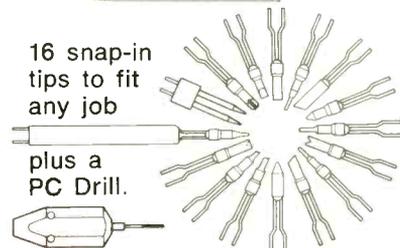
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external triggering from 2Hz to 30MHz. All critical dc voltages are regulated. The input line ac transformer can be connected to operate from 110 to 237 volts ac, 50 to 60 Hz. The built-in 1kHz, 0.2V (+ or - 1%) square wave generator is used for checking probe compensation. The HM307 comes housed in an all-metal case (4.5" x 8.3" W x 10.4" D) that is suited to field-service use.

Accessories for the HM307 include, X1 probes, X10 probes, X100 probes, demodulator probes, test cables, viewing hood, carrying case, and scope chart. Each instrument, including the chassis and tube is warranted for one year, and comes with comprehensive operating and service manuals. These service manuals feature troubleshooting procedures, circuit diagrams and complete pc board layouts. The price is \$405. **ET/D**

## Memories

continued from page 20

addressing 1000 different words. Figure 1 illustrates this, in block diagram form.

Fortunately, the manufacturers have provided for 16 bit memory address buses (16 wires), in modern MPUs, and we have the means of interconnecting the MPU and the memory adequately. (If this were not the case, we would require the use of two separate address words, totaling 10 bits, for addressing purposes, on machines with only an eight bit address bus. It would be less efficient, but can be done simply.)

Having considered the number of chips, and the number of address lines needed, we can go on to other memory organization factors. What means can we use to enable the MPU to use these various combinations of chips? Obviously we cannot use four ICs in place of one, without some means of accommodating the *electronic* changes required. Simply replacing one IC socket with four IC sockets is not enough. Such a mechanical change demands electrical changes in the system.

Furthermore, even though we now have enough address lines in the address bus, how do we use *ten lines* to address *1000 word locations*?

And, how can we make the RAM chips accept information, or deliver stored information, i.e., how does the RAM know when we want to read, or write, information?

Next month we will conclude our discussion of memories with tristate data lines and some applications of ROMs. **ET/D**

## Security

continued from page 24

appropriate case and a burglar message in the other.

The digital dialer, the latest innovation in the field, dials a phone number by means of switch settings and as they are all electronic and have no moving parts, some people in the industry believe the digital dialer is more reliable than the tape dialer. With the digital dialer, there are no taped messages. Rather a message coded in tone signals is conveyed. Naturally, the receiving party must be familiar with the key to the code to quickly decipher it and react. Where the remote reporting location is a private central station, of which there are many, all in the business of monitoring alarms for their customers, this will present no problem.

Many control panels are now being produced with modular components. The advantage of this construction is that it allows for convenient servicing and easy expansion of the system. When there is a problem in a control panel which is modular, a serviceman may take the faulty module from the control panel, replace it with a working module, and return to the shop with

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<input type="checkbox"/> TA7204P	Toshiba	\$1.00	<input type="checkbox"/> 2SC1358A	\$1.95
<input type="checkbox"/> TA7205P	Toshiba	\$1.00	<input type="checkbox"/> 165	\$1.95
<input type="checkbox"/> 1166 BA521		\$1.25	<input type="checkbox"/> 238	\$1.95

### REPLACEMENT FOR ECG

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<input type="checkbox"/> 152	\$ .49	<input type="checkbox"/> 197	\$ .59	<input type="checkbox"/> 792	\$1.50
<input type="checkbox"/> 153	\$ .49	<input type="checkbox"/> 230	\$2.84	<input type="checkbox"/> 793	\$2.00
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the malfunctioning one. This allows him to keep his customer protected while he works at his own convenience on the problem module. Expanding capability of a system with a modular panel is also simplified as no new control panel need be installed, just a new or additional module within the panel.

Microprocessors have also become popular within control panels, allowing for system programming, easy troubleshooting, and more efficient operation.

Once again, the most important thing to do is choose the right panel for the right application, and go with a reputable, high quality manufacturer.

### The next step

You should now have a basic understanding of what systems are available and how they function. Each of these devices may be incorporated into one single security system and it will be up to the reader to carefully choose and integrate each as called for in a security system custom-tailored for the needs of his customer. To do this well, he will have to go beyond the contents of this article and gather together information

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To succeed in this field, service calls for falsing systems must be kept to an absolute minimum. To avoid those service calls, the right system must be installed in the first place and the requires a very thorough education. The education is readily available for the ambitious businessman, and thereafter so are the considerable profits. **ETD**

### RCA

*continued from page 34*

before returning the set to the customer.

### Overcurrent troubleshooting

If the set is dead and does not tic-tic with the horizontal regulator transistor removed, the regulator is at fault.

If the set is shut down short the collector of Q415 to ground. Momentarily turn the set "on." If it operates, suspect overcurrent condition or defective Q415. Short Q413 base to emitter. If shutdown occurs, suspect defective Q413, Q414, or CR407. If set operates, suspect overvoltage condition. Check Regulator and

Horizontal Output Circuits.

Caution: Do not operate chassis for extended periods with shutdown disable (base-emitter of Q413 shorted) since a high voltage condition could cause additional failures to occur.

### Other circuitry

Most of the remainder of the CTC108 resembles earlier chassis. The audio is a single IC which is the most likely cause of failure. Most of the B+ supplies are developed from the integrated high voltage transformer, though there is no isolated ground in the CTC108. The B+ regulator is quite similar to earlier chassis and exhibits the characteristic tic-tic when operating but overloaded. Troubleshooting of the regulator and horizontal oscillator, driver and output follows the pattern of previous models. Overall the improved accessibility and multiplicity of test points has resulted in a much easier chassis to service. **ETD**

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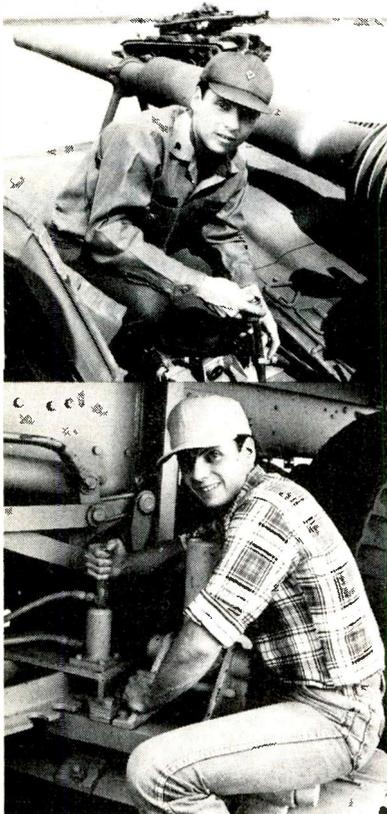
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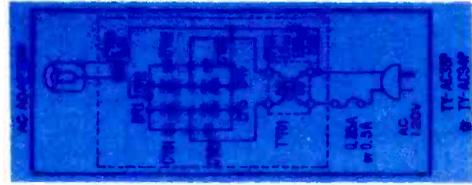
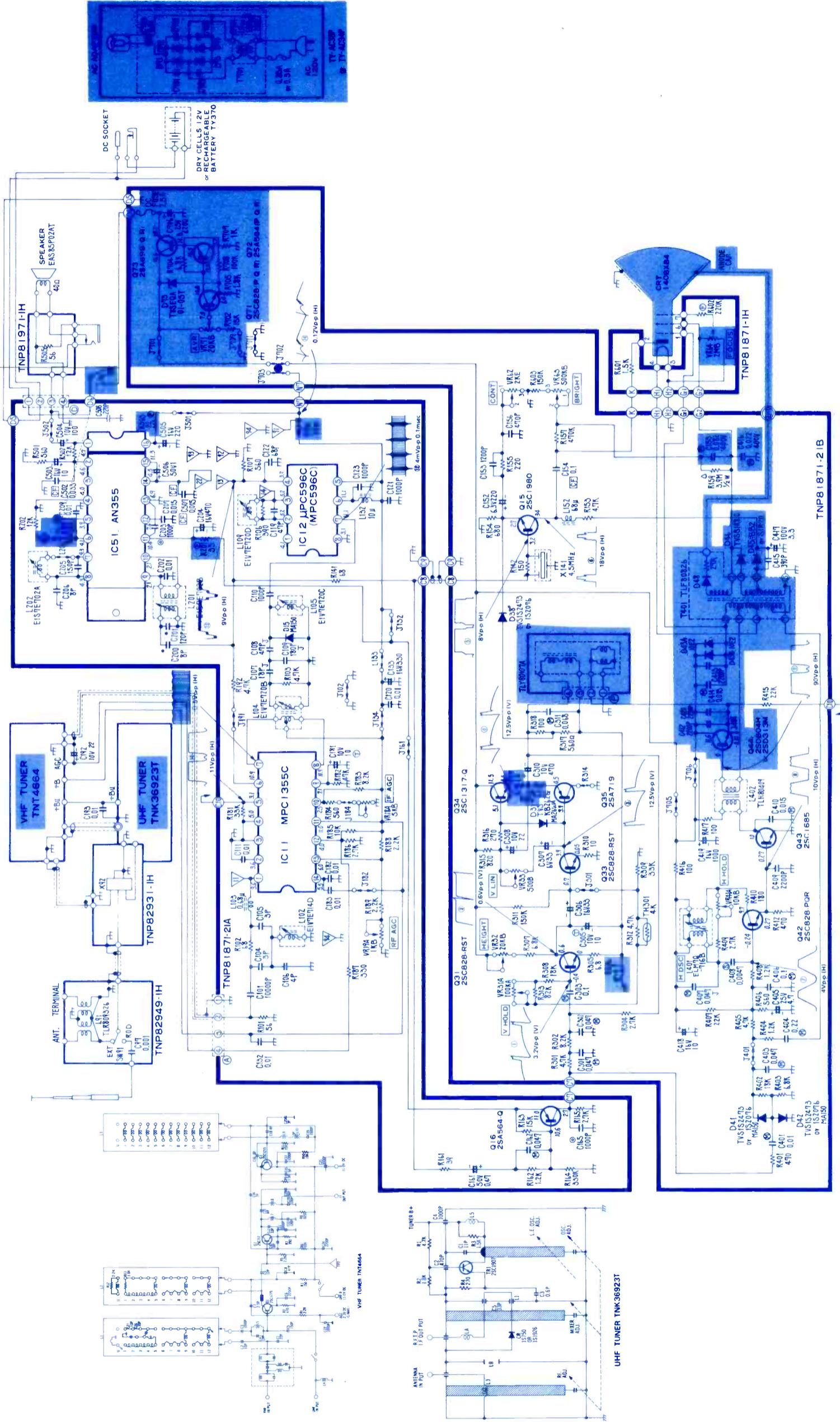


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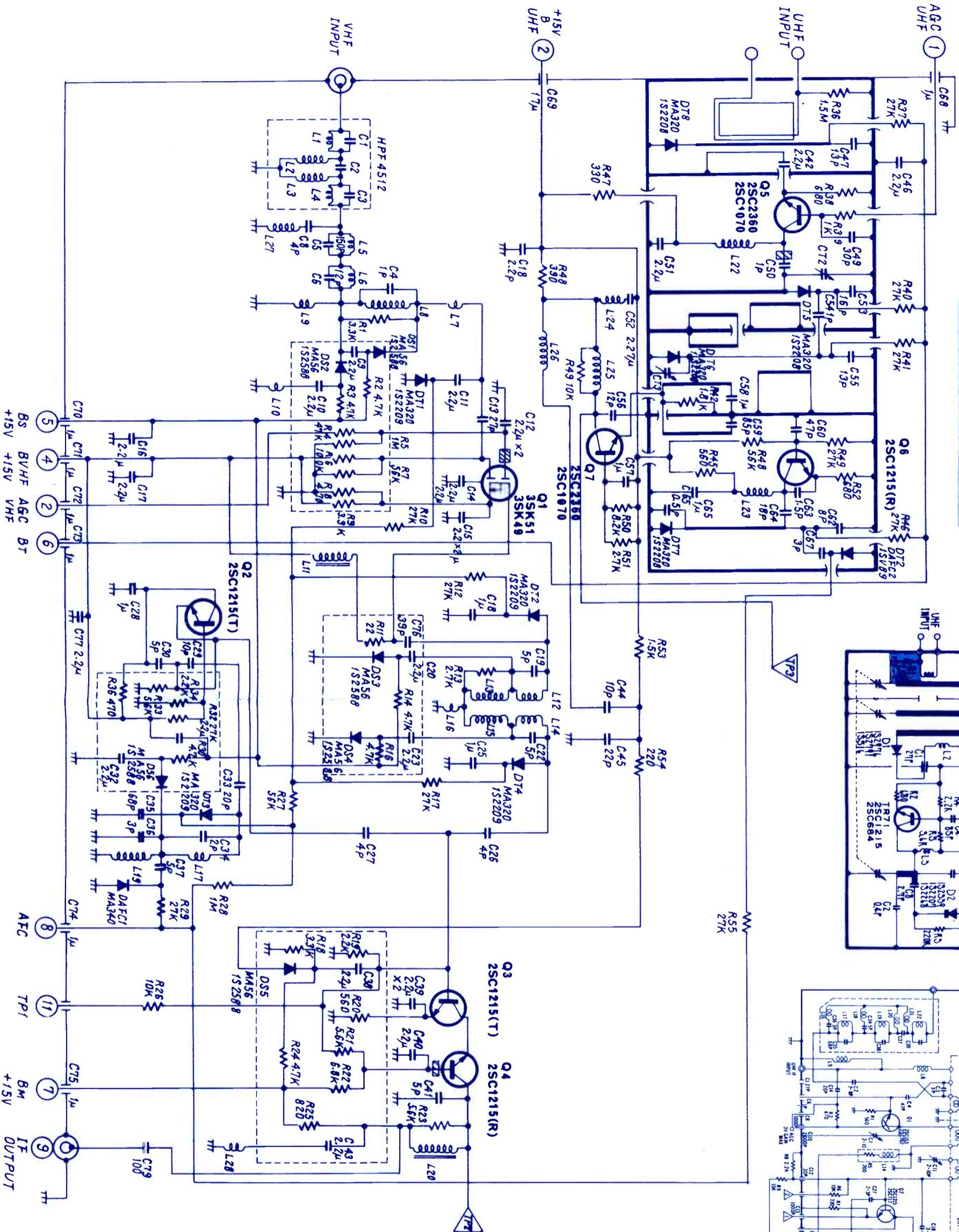




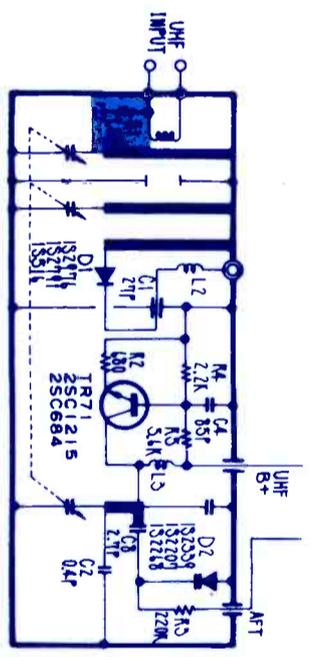


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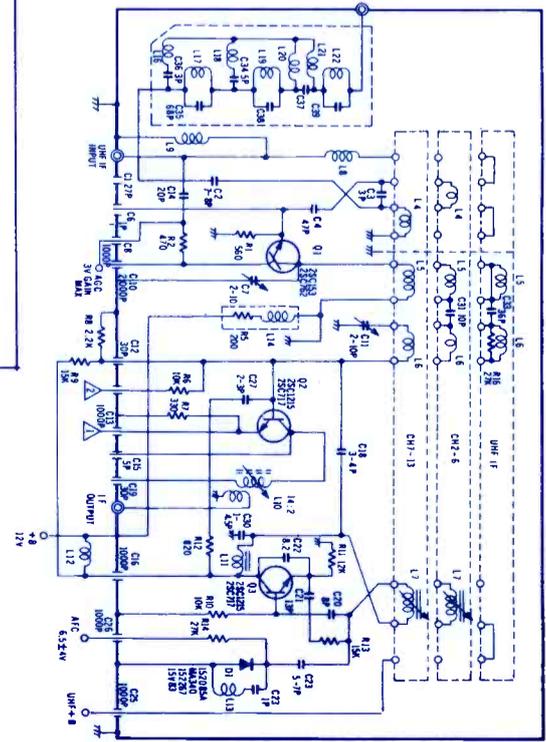
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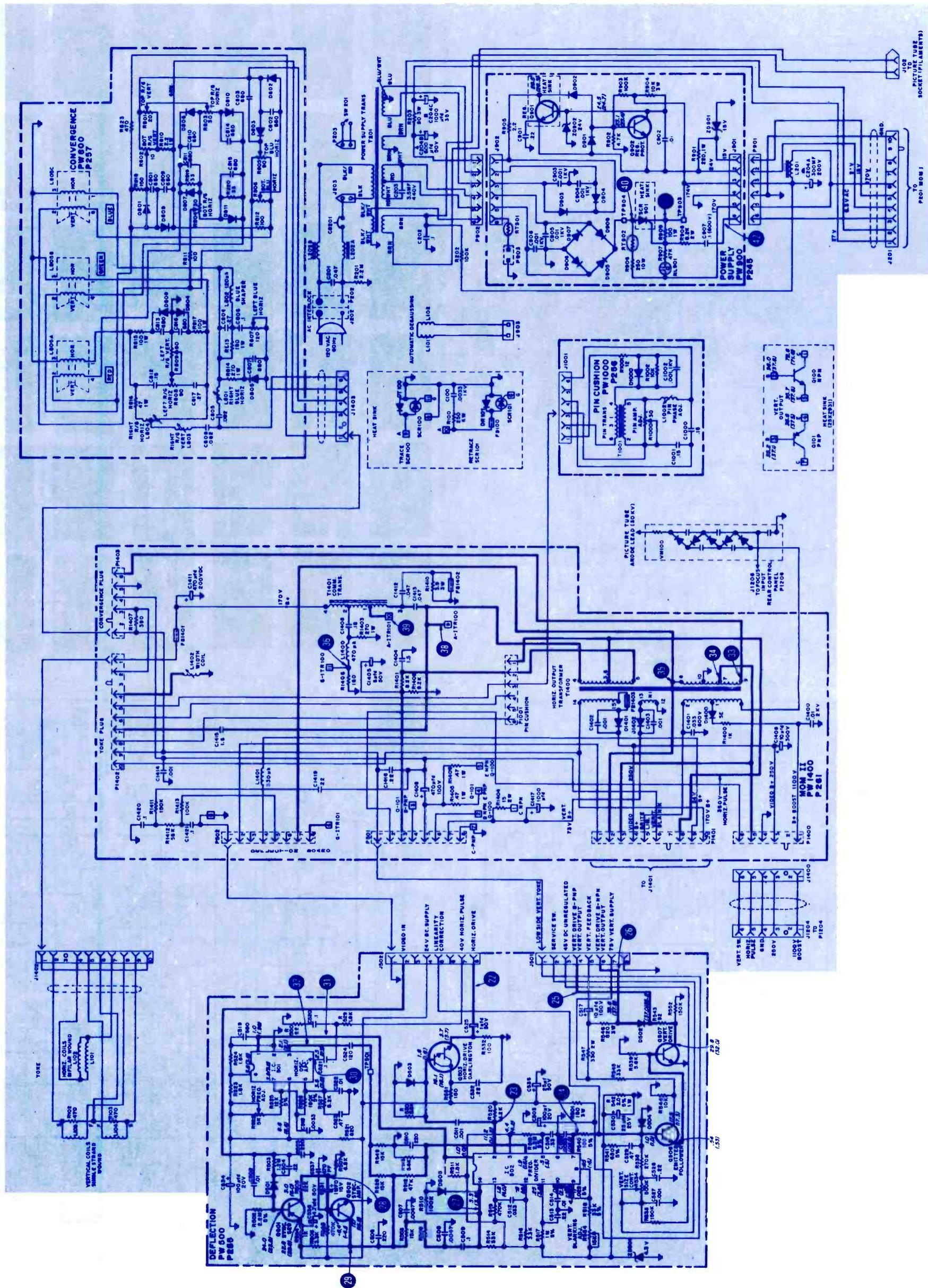


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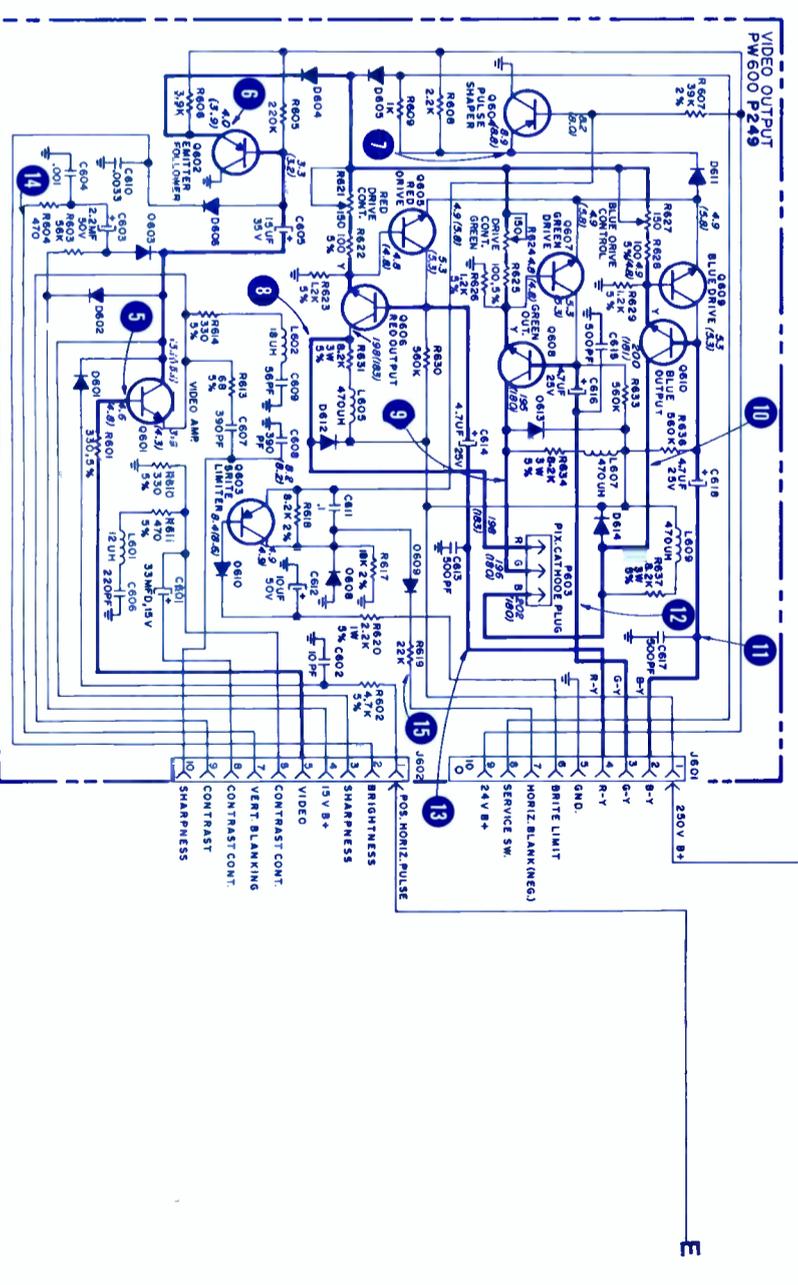
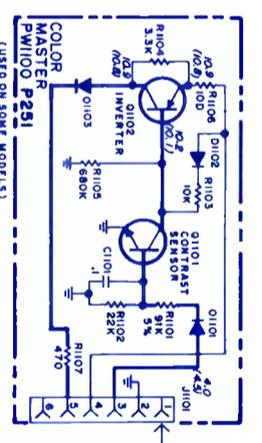
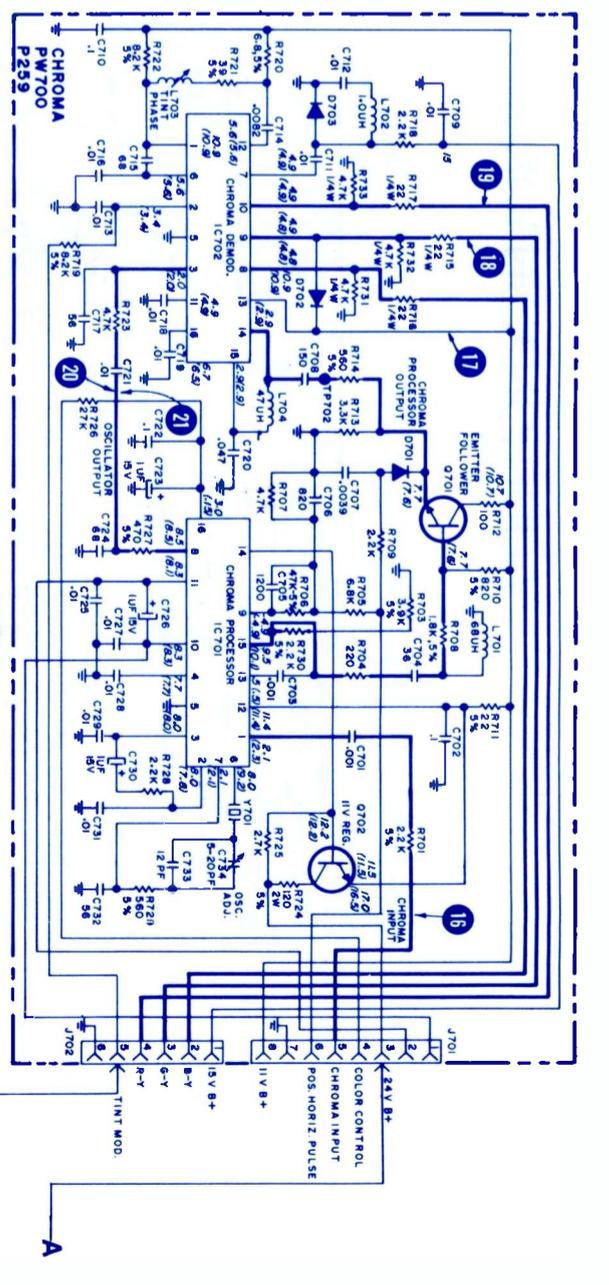
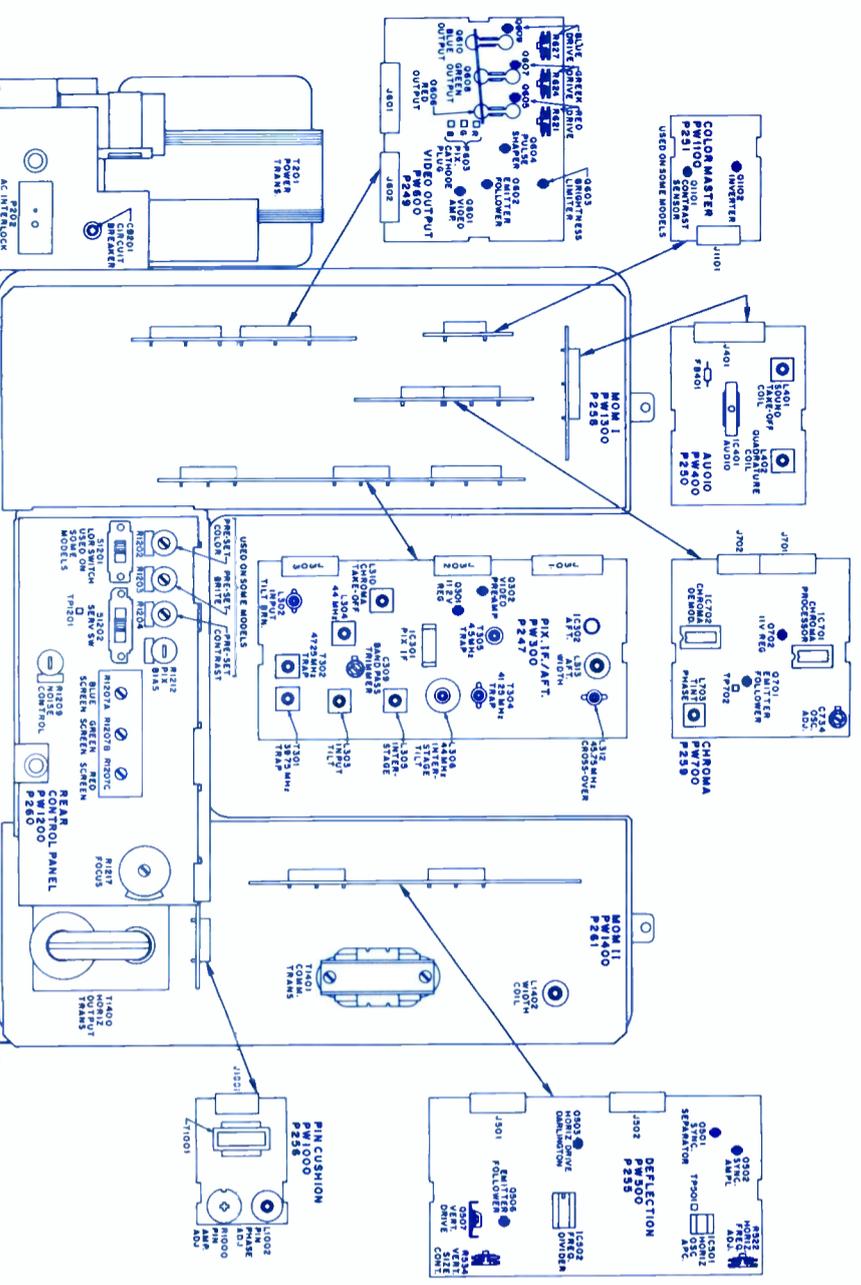
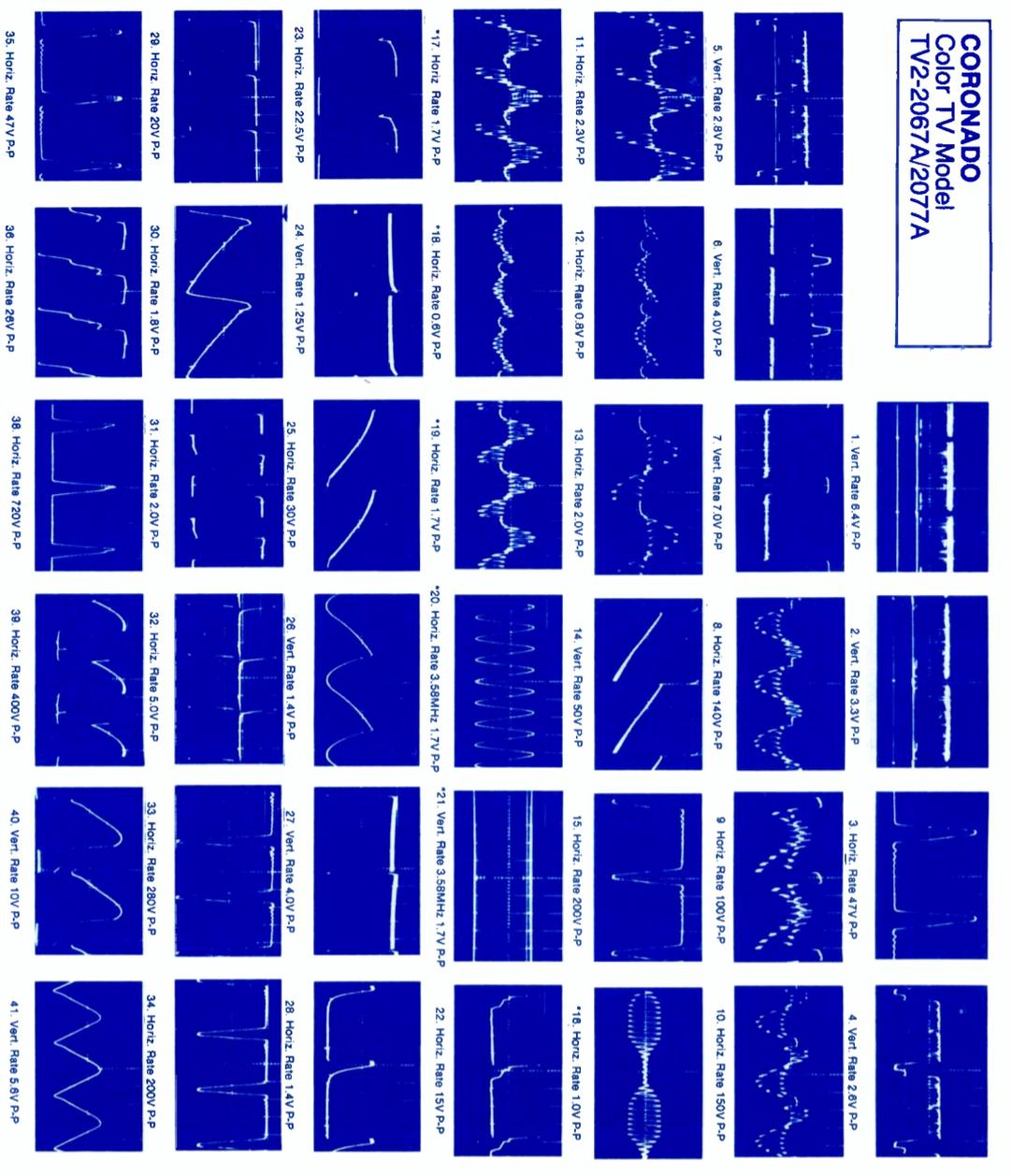


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	25C1819M	25C1819M
	25C1683	25C1683
	25D8137	25D8137
	25D8194	25D8194
	25D8292	25D8292
	25C1275	25C1275
	25C1510	25C1510
	25C1941	25C1941
	25B842	25B842

ADDITIONAL INFORMATION NEXT PAGE



**CORONADO**  
Color TV Model  
TV2-2067A/2077A



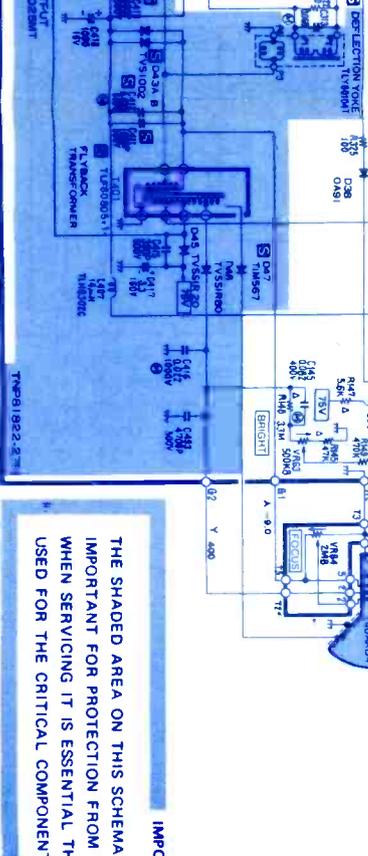
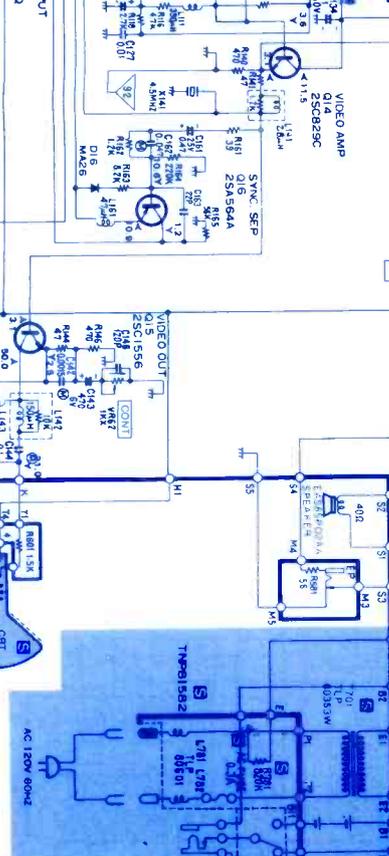
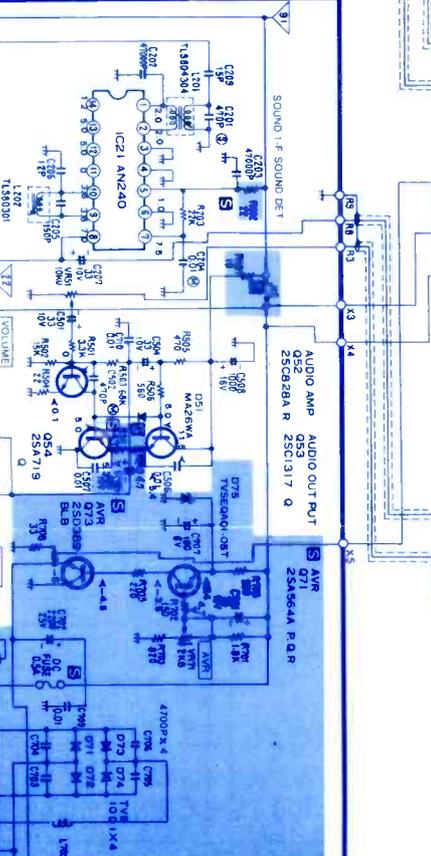
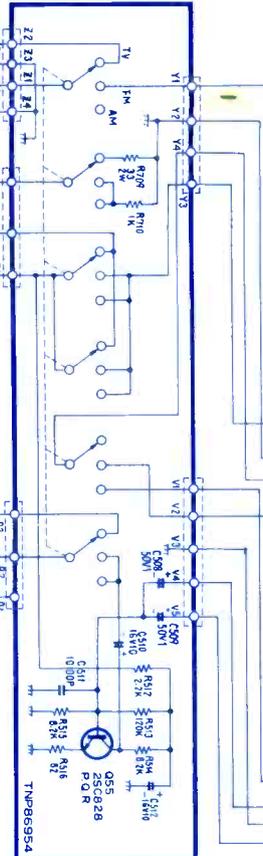
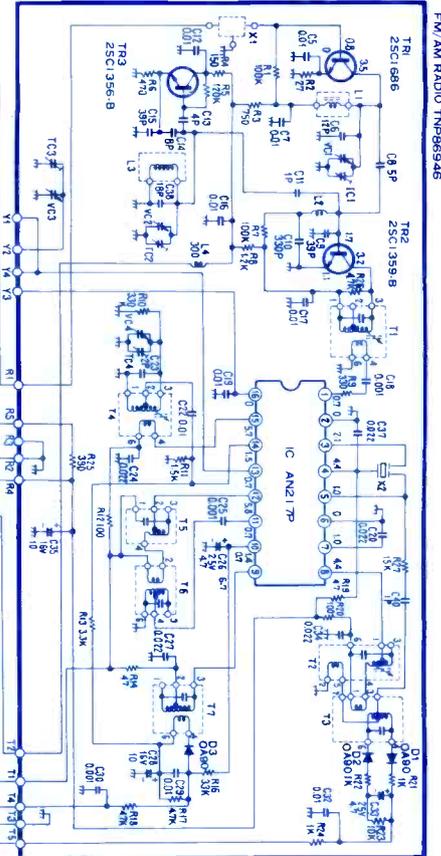
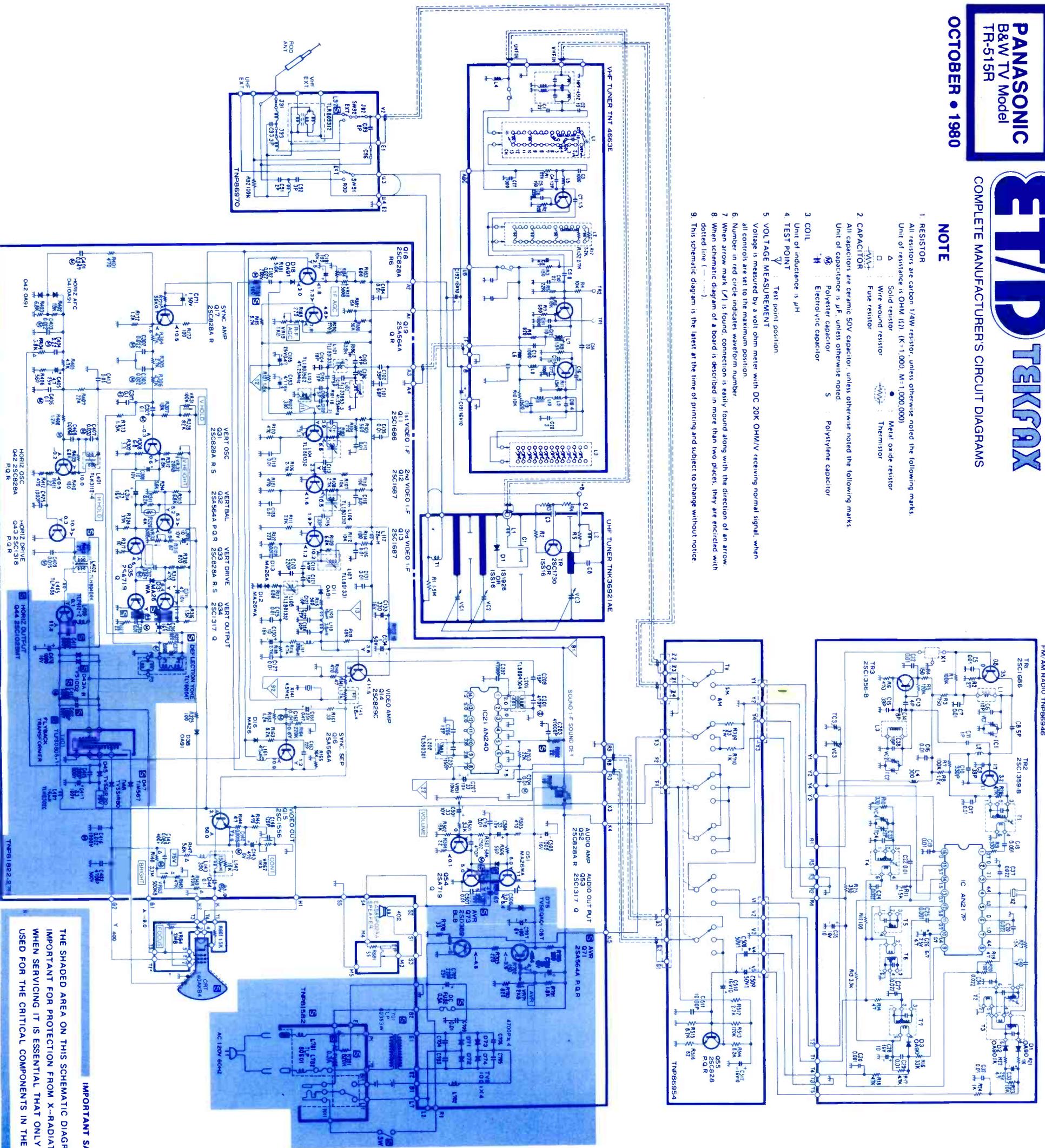




COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

NOTE

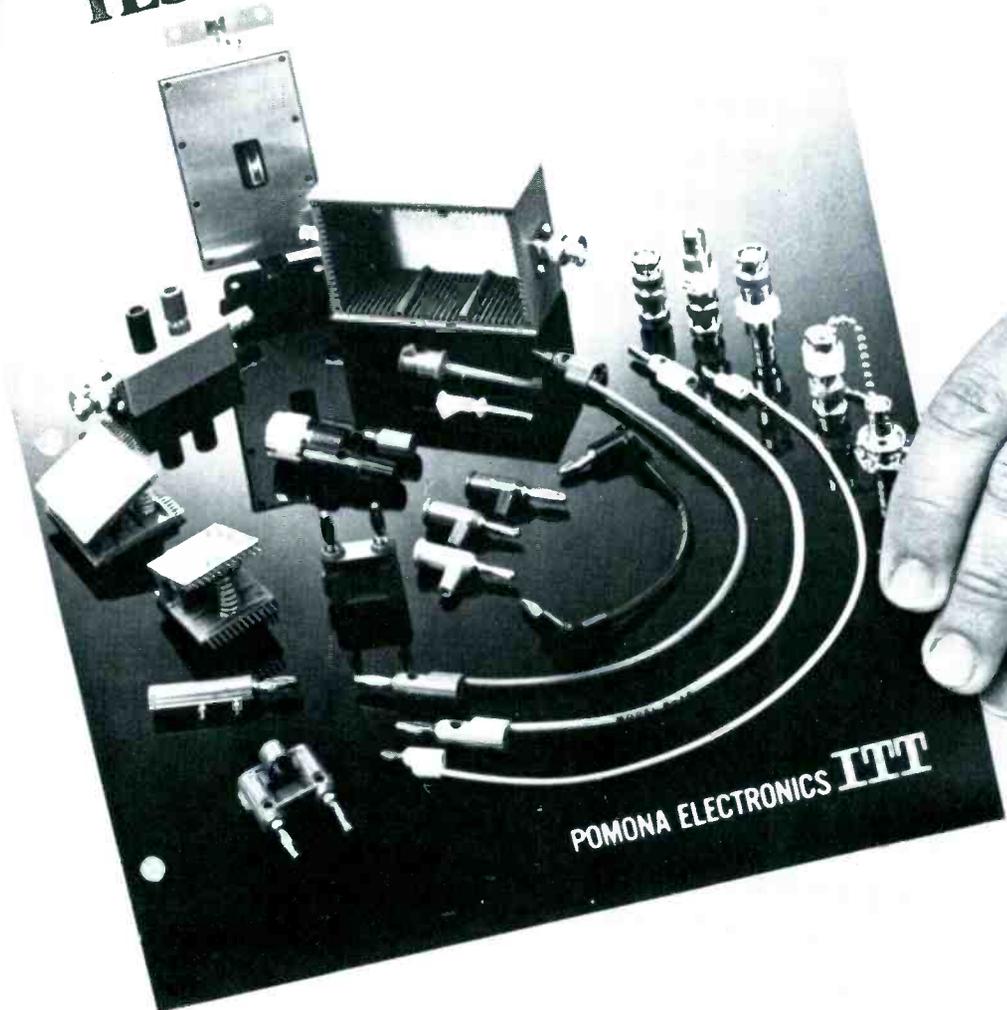
- RESISTOR**  
All resistors are carbon 1/4W resistor, unless otherwise noted the following marks:  
Unit of resistance is OHM (Ω) (K=1,000, M=1,000,000)  
Δ : Solid resistor  
□ : Wire wound resistor  
—W— : Fuse resistor  
—M— : Metal oxide resistor
- CAPACITOR**  
All capacitors are ceramic 50V capacitor, unless otherwise noted the following marks:  
Unit of capacitance is μF, unless otherwise noted  
—P— : Polyester capacitor  
—E— : Electrolytic capacitor  
—S— : Polyethylene capacitor
- COIL**  
Unit of inductance is μH
- TEST POINT**  
V : Test point position  
V : Voltage measurement point
- VOLTAGE MEASUREMENT**  
Voltage is measured by a volt ohm meter with DC 20K OHM/V receiving normal signal, when all controls are set to the maximum position.
- Number in red circle indicates waveform number.
- When arrow mark (↗) is found, connection is easily found along with the direction of an arrow.
- When schematic diagram of a board is described in more than two places, they are encircled with dotted line (-----).
- This schematic diagram is the latest at the time of printing and subject to change without notice.



IMPORTANT SAFETY NOTICE

THE SHADED AREA ON THIS SCHEMATIC DIAGRAM INCORPORATES SPECIAL FEATURES IMPORTANT FOR PROTECTION FROM X-RADIATION, FIRE AND ELECTRICAL SHOCK HAZARDS. WHEN SERVICING IT IS ESSENTIAL THAT ONLY MANUFACTURER'S SPECIFIED PARTS BE USED FOR THE CRITICAL COMPONENTS IN THE SHADED AREAS OF THE SCHEMATIC.

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