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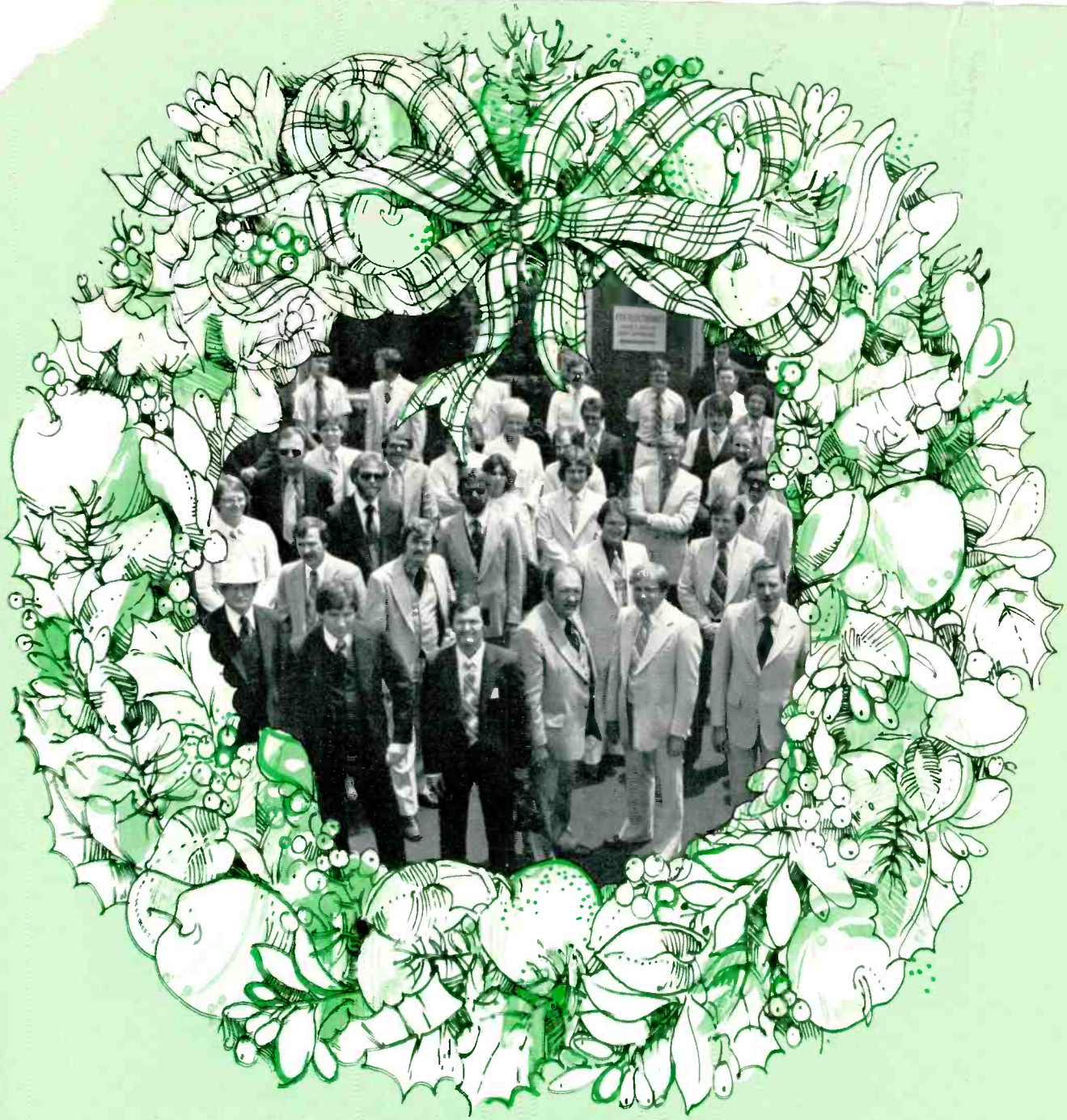

We're PTS. . .and beyond all our equipment and warranties and technology, we're a company of people. Individuals. Dedicated to doing the best job of what we do best. . .serving the needs of the people in the TV service dealer industry. At this time of year, it gives all of us great pleasure to wish all of you the happiest of holidays and best wishes for great success in the new year.

PTS ELECTRONICS, INC.

The Only Name You Need To Know

For the location nearest you, see Servicenter Guide on next page.

INDUSTRY REPORT

France Plans Videotext Expansion

The French now have a system which could make the printed telephone directory a thing of the past. An electronic directory—a system which combines telephone, television screen and alphanumeric keyboard.

Rather than search through the pages of a bulky telephone book, the user "instructs" the directory by typing the required name onto the keyboard. Within seconds, the information appears on a nine-inch, black-and-white television screen.

The electronic directory, which hooks into the existing telephone line, is reportedly easy to use, faster, and, with mass production, cheaper than its printed counterpart. It eliminates the expense of publishing and revising printed directories. It can always be up to date.

In addition to providing telephone listings, the directory can call up emergency numbers for hospitals, ambulances, police and fire departments, and other services.

A Saint Malo trial, begun in mid-July, is the first of several throughout France. By next year, some 250,00 terminals will be installed, free of charge, in other parts of the country. So confident are they of the success of the electronic directory, that the French expect to see the complete abolition of printed telephone books by 1995.

A further video text development is teletel, an interactive videotex service which delivers the latest computer technology directly to the consumer, at home or at work.

The user simply turns on the television, contacts the appropriate data base by telephone, and taps out the request for information onto the keyboard and the information shortly appears on the screen.

This autumn in Velizy, 2,500 families will participate in an early trial of the videotex system.

Several companies in France have developed a low-cost consumer facsmile—called "mass-fax"—which can transmit a page of paper through the existing telephone network—in anywhere from 40 seconds to two minutes. Mass-fax can also act as a photocopier or hard copy printer for the teletel videotex terminal.

Gerard Thery, Director General of Telecommunications predicts that one million telephone lines in France will be equipped with facsimile units by 1990—and as a mass market for these units develops, the price will drop within reach of consumer pocketbook

Franchiser Sells Initial Territories

Tronics 2000, the new franchise organization for consumer electronics serviceshops, has announced the sale of three territories in Illinois, Ohio, and Florida during its initial three weeks of operation.

The territories, each with a minimum 600,000 population-are located in suburban Chicago, Cincinnati, and central Florida. When developed, each is expected to have a minimum of 20 franchised radio, TV, audio-video, and appliance service centers.

Among the territories sold thus far and their purchasers are:

Robert P. Neal, owner of Able Electronics, Waukegan, Illinois. This territory is comprised of Lake, McHenry and Boone counties with a population base of some 615,000.

William B. Terrell, a Cincinnati businessman who purchased Hamilton County with a population base of about 877,000.

And, Jim Cardnell, a Homosassa Springs, Florida, businessman who purchased Lake, Sumter, Hernando, Pasco and Citrus. These counties, spreading across central Florida just north of Tampa in the west and including Daytona Beach on the east coast, comprise a population base of about 685,000.

NAB Protests FCC Station Proliferation Plans

The National Association of Broadcasters has recently issued a series of statements opposing tbe FCC's intent to significantly increase the number of AM broadcast stations and VHF television stations, without they feel, adequate consideration of the technical problems involved.

Robert K. King, chairman of the NAB Television Board of Directors, according to a NAB news release said the FCC's "blind embrace of 'more is better' leads not only to more radio stations and more cable television distant signals," but also leads to more and different forms of broadcast television service. He said broadcasters are concerned about the potential of low power television stations to cause interference and the proposal to increase the number of radio stations without adequate study of the technical impact.

King also said that while the Commission is deregulating the cable industry, broadcasting remains wrapped in red tape and is working under a copyright law that "unjustly allows cable to payone percent of its revenues for all the programs it can beg, borrow or steal, while broadcasters pay 35 to forty percent for theirs." In addition, he stated, the FCC is considering allowing more television stations by tampering with the present

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December 1980, Vol 102 No 12

On the cover: What can a small computer do for a small business? It can, as implied on the cover, take care of much of your bookkeeping chores as well as many other types of paperwork and record keeping.

FEATURES

DEPARTMENTS

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minimum-mileage separations.

"The Commission," he said, "has paused on the brink of this instantaneous dismantling of the basic framework of television channel allocations" and before it acts next week it may realize that "more in this case is not better, but, indeed, may be less. Indeed, it may very well be that the Commission will be pulling the rug out from under the best opportunity for more service, more competition, more diversity and more opportunity for minority ownership, and that's UHF television."

A few days later the NAB's executive vice president and general manager stated:

"At a time when UHF is finally beginning to solidify itself in the television marketplace, it is unfortunate that the Commission is proposing to shoehorn in some 140 possible new VHF television stations. Such a move is sure to undercut the growth and health of the UHF service.

"Additionally these proposals present technical questions requiring substantial study. The Commission has limited the ability of the industry to provide such technical input by choosing to proceed by Notice of Proposed Rulemaking which involved ex parte restrictions that tend to inhibit full industry and public involvement. A Notice of Inquiry would have permitted a much greater opportunity for examination of the technical issues involved."

Thordarson invites Technician's Comments

Thordarson Meissner, Inc. has established a review board to act on advice received from service technicians. Effective immediately, a postage free reply card will be packed with each Thordarson flyback and yoke. The card asks several questions about installation, replacements, and comments about the product. Each month the board will meet to review the cards received and take appropriate action.

Homah Collie, VP-Operations said: "Service technicians are the ultimate users of our products. We need their comments to help us serve them better." Since there is a time lag for some of these products to follow through distribution, technicians who purchased Thordarson products before this announcement may obtain cards by writing to John Evans, Marketing Program Manager, Thordarson Meissner, Electronic Center, Mt. Carmel, Illinois 62863.

Thordarson Meissner, Inc. manufactures a wide selection of flame retardant flybacks and yokes for replacement service as well as a broad line of transformers for industrial and OEM applications. Other products include exact replacement voltage multipliers and Tech-Mate® universal replacement semiconductors. ET/D

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Right now, in selected electronics supply stores across the country, Fluke is introducing a new line of low-cost DMM's: the Fluke Series D. With their distinctive dark cases and full range of accessories, these five DMM's are designed to meet the test and measurement needs of the uncompromising service technician, home hobbyist, student or working engineer.

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If your dealer doesn't carry Series D Multimeters yet, call this number. We'll be happy to tell you who does. 1-800-426-9182

D 804: A powerful, versatile handheld DMM with nine functions, 26 ranges, 0.1% basic dc accuracy and more. Direct temperature readings in °C with K-type thermocouples; peak hold on voltage and current functions; even an audible indicator for instant continuity and logic level detection. Available January 1981. $229.*

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For technical data circle no. 105

FLUKE®

SERVICE SEMINAR

This month we have a selection of TV troubleshooting tips on popular sets old and not so old, courtesy of NESDA and a group of alert, hard working technicians.

ADMIRAL

Chassis 25M55, intermittent or *no* sound—voltage measures low on Collector of Q500. To correct: Replace defective Q500 Transistor (leaky). Frederick C. Hutt, Sr., Ballston Spa, NY.

Chassis 2M10CA/3M/4M, raster and sound intermittent—complete loss of low & high voltage supply. To correct: Replace D108 clamp diode in horizontal oscillator circuit. C.E. Chandler, San Diego, CA.

CURTIS MATHES

Chassis CMC-33, tuner drive: motor runs continuously—only way to stop tuner drive motor is to unplug set. To correct: Replace Q604 transistor on remote receiver panel (transistor leaky). Chester Maus, West Columbia, TX.

Chassis C-40/CMC-40, color oscillator drifts (after warm-up)—low negative voltage measured at Pin 2 of V-10B. To correct: Replace defective CR-702 bias rectifier. J. Tim Stenger, CET, Youngstown, OH.

GENERAL ELECTRIC

Chassis 19QB, drive lines in raster (then horiz. output transistor shorts)—replacing horiz. output transistor does not correct problem, then it shorts out again. To correct: Replace C-234, .0047 MFD at 1200v capacitor (open). R.A. Horn, Des Moines, IA.

Chassis 25YM, no picture—no H.V., collector of horizontal output measures zero volts, (resistance measures 300 ohms to ground). To correct: Replace defective deflection yoke T-820, GE P.N EP7(6X20 (vertical windings shorted to horizontal windings). Roger Varn, Massillion, OH.

Chassis KD, loss of higher channels after several minutes—tapping first I.F. tube (6JD6) causes upper channels to return. Tube (6JD6) tests okay by substitution. To correct: Repair and clean tube socket pins. Repair socket by tightening connectors so tube fits tighter. Clean with an electronic degreaser. W.M. Suhy, Stratford, CT.

MAGNAVOX

Chassis T-987, no video—raster ok, retrace lines, no control of brightness. To correct: Replace R-231, 10 ohm resistor and video delay module, P/N-M03551-1. Jim Heater, Denver, CO.

Chassis T-989, excessive brightness—brightness can not be decreased. To correct: Replace power transformer (270v line output is defective). Larry Erickson, Denver, CO.

Chassis T-956-01, insufficient vertical sweep and horiz. hold critical—130v B+ is low (80-100v) R-131 running hot. To correct: Replace defective diode D-102 (shorted). Tino Burrida, Jr., Corpus Christi, TX.

Chassis T958, fine tuning out of range on upper VHF channels—AFC voltage (+20v) will measure low at tuner. To correct: Repair or replace UHF tuner (UHF tuner shorted). Walter W. Ward, CET, Glen Falls, NY.

Chassis T920, 933 & similar, picture tube snaps—arcing visible in neck of CRT. To correct: Replace 6MD8 and 12HG7 electron tubes—check and reset high voltage if necessary. Gailen "Smiley" McMullen, Beatrice, NE.

Chassis T-991-T995, no picture, no sound (circuit bkr opens)—arcing appears in CRT when ckt. bkr is reset, then ckt. bkr re-opens. To correct: Removed foreign material which was causing casing of horizontal output transistor to short through the insulator to chassis ground. Keith Crankshaw, Muskegon, MI.

Chassis T931, vertical foldover on bottom—may have vertical roll. Checking B+ to vertical output circuit revealed 1K, 3 watt resistor increased in value. To correct: Replace defective 1K ohm, 3 watt resistor. Terry Satrang, Aberdeen, SD.

PANASONIC

Model CT-97P, AGC overload—all voltages measure normal, sound ok. To correct: Replace defective resistor R323, 27 ohm 1 watt located between AGC tube and second video transistor. Arsen Janikian, CET, Queens, NY.

QUASAR

Chassis (all using CA panel or equiv.), circuit breaker trips (approximately 2 seconds after set is turned on)—B+ rectifiers & power supply tests normal. To correct: Replace CA panel. NOTE: Red screen transistor shorts. Mike Carwile, Petersburg, VA.

Chassis TS-962, 6-inch stationary horizontal black bar across top half of screen—C-522 on high voltage pin cushion board missing. To correct: install new 3.3 mfd, 160v capacitor to replace factory omission. Donald F. Swanson, CES/CET; Sequim, WA.

Chassis TS929, picture distorted—picture visually appears with a weave (filter). To correct: Replace defective filter capacitor C-809 (located off -37v power supply). Scott Liebrand, CET, Des Moines, IA.

RCA

Chassis CTC-86, two white hum bars and horizontal hold critical—1.4 volt AC ripple in 22vdc power supply. To correct: Replace shorted CR-302 diode connected to center tap of secondary of start-up transformer (22v start-up diode). Joe Janssen, Milan, IL.

Chassis CTC-59, picture fuzzy—occasionally external vibration will cause fuzziness to vary. To correct: Check I.F. panel, replace if defective, but if okay, check mating of plug between I.F. panel and socket. Then secure I.F. panel so it does not move. Tom Napierlski, Medford, NJ.

Chassis CTC-72C, no raster, sound ok—no high voltage, (TR-101 shorted, replaced TR-101 and shorted again). To correct: Repair open connections by re-soldering connections between coil L403 and the printed circuit board. Replace TR-101 with new kit RCA P/N 141255. George Sieja, Beaver Dam, WI.

Chassis CTC-87, no picture; no sound—2v and 27v source missing. To correct: Re-installed CR-3114 properly. Found it has been installed backwards previously. Manual De La Rosa, CET, Morro Bay, CA.

Chassis CTC-81B, no vertical deflection—26vP-P vertical pulse is missing. And upon replacing defective (open) R-407 in horizontal stage, it opens up again instantly. To correct: Replace C-408, 1 KV capacitor (shorted) and replace R-407, 220 ohm, 5 watt resistor. Jack Sellards, CET, Barbourville, KY.

Chassis CTC-16X, ghosts at right side of objects in picture—adjusting fine tuning does not vary ghosts. To correct: Replace C-118D, 40 mfd capacitor, located at the AGC control. LeRoy Robins, Shelton, WA.

Chassis CTC-49, picture pulled in from all sides—appears like a pincushion correction defect. To correct: Replace defective Q401, high voltage regulator transistor. Eric Kehew, Jacksonville, FL.

Chassis CTC-51/52, vertical and horizontal sync poor—test set on reduced line voltage and sync locks in. To correct: Replace defective R-541, 120K ohm ½ watt resistor (changed value). Charles and Muriel Crofoot, Rodeo, CA.

SONY

Model KV1201/KV1212, vertical fluctuates with slight foldover on bottom—problem is intermittent. To correct: Replace R 554, 15K ohm @ ½w, resistor (increased in value). Romo Electronics, Pomona, CA.

Model KV 1920D, no picture—has H.V. and audio. No G-2 drive voltages. To correct: replace defective D807 diode. Also resistor R814 (NOTE: Located in "E" circuit board). Ed Watson, CET, Lynbrook, NY.

SYLVANIA

Chassis E-21, color streaking—dim picture. To correct: Replace R-448, 270 ohm, ½ watt resistor NOTE: Should be replaced with a 1 watt resistor. K. Baker, CET, Longview, TX.

Chassis D12-01, AGC overload and picture flashes—continuity test reveals RF transistor amp Q201 open. However, Q201 itself is good. To correct: Repair defective Solder connection at base of Q201. C.J. Rucker, Ft. Worth, TX.

Chassis E06-2, intermittent convergence—R-804 (R-B control) operates intermittently. To correct: Replace C-808, 2.2MFd capacitor at 150v. NOTE: Current critical part (non-electrolytic). Cyrus Dinshah, CET, Malaga, NJ.

Chassis E-11-13, no raster, sound ok (smokes)—R-372 smokes, opens instantly (135v line). To correct: Replace C-507A filter capacitor (shorted) P/N 41-39282-1. Charles Gallagher, Corpus Christi, TX.

Chassis E-21, no picture, no sound—set is not in shut down. To correct: Replaced defective flyback transformer (open at pin no. 6). Scott Liebrand, CET, Des Moines, IA.

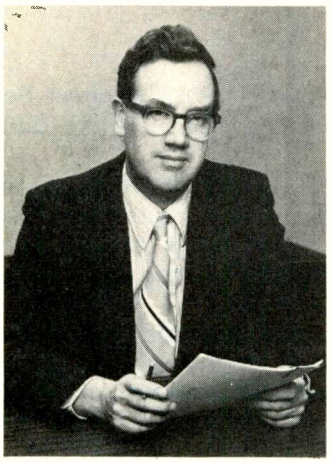
ZENITH

Chassis 23GC45, no control of brightness. To correct: Replace defective 24 volt regulator transistor. ZENITH Radio Corporation.

Chassis 25EC58, picture shrunk—10 inch picture appears on a 24 inch screen-hum in raster, video and audio, horizontal foldover. Not in power supply, although 128 volt line is ½ of normal. To correct: Replace defective deflection yoke. George W. Crouch, CET, Concord, CA.

Chassis 25GC45/45Z, insufficient vertical deflection—bottom half of picture okay, but top half is missing. To correct: Replace defective Q707, vertical output transistor. (NOTE: if a general replacement transistor is used, filtering may have to be utilized in order to suppress unwanted oscillations. The author used a 50 pfd, 1Kv capacitor connected to one side of fuse FX203 and the other side to ground which corrected this problem. Clem Moore, Ft. Worth, TX. ET/D

FROM THE EDITOR'S DESK



This month I am going to quote a news item from *The Scanner,* the official publication of the Arizona State Electronics Association. It suggests a rather ominous outlook, in some instances, for relations between the cable television companies and independent TV sales and/or service businesses. The news item headlined "Independent Service Dealers Threatened With Extinction" follows:

"The greater Phoenix City Council allows cable companies to sell, service, or lease television receiving equipment. The Council in 1976 and again in 1980 refused to put a clause in the CATV Ordinance or Franchise agreements prohibiting cable companies from selling, servicing, or leasing television receiving equipment. With the CATV company being able to, according to national average, count on 45 percent subscribers in any area they supply cable to, it would seem they would be able to take an unfair advantage in the sale, service, or leasing of television receiving equipment by being able to supply a service that no other servicing/dealer could offer. If this happened over a period of time, you would probably find about 45 percent of the television service dealers going out of business due to the lack of customers.

In Phoenix already American Cable Television is selling new television receivers with the inducement of one year of HBO free including installation if you purchase one of the models listed. This value of HBO to the retail customer is approximately $280.00. The ads state that if you are unable to receive HBO they will give you a cash discount on the article purchased. The question to ask is How Much?

In closing, the consumer is the one who will be hurt in the long run. If there are 45 percent fewer dealers to choose from, what prices are they going to have to pay, and what kind of service are they going to receive?"

Frank Moch, Executive Director of NATESA testified before the committee on cable TV for the City of Chicago September 5, 1980 and expressed a concern that the cable TV companies might well attempt to establish virtual monopolies of all aspects of television.

"It is very conceivable that cable TV entrepreneurs will quickly move to consolidate their hold on all phases of TV, including production and distribution of programs, connection to the system, TV sets, service and maintenance thereof.

This would become a dangerious monopoly of mammoth size which would require the same very expensive deterrent as quite recently has been brought to bear on the telephone company monopoly. It would seriously deprive many small businesses, which have contributed greatly to the development of home electronic TV as a most important service to the public.

We strongly urge that any franchise that may be granted, carry permanent provisions restricting operators of cable TV systems from providing TV sets in any manner, and from installing, servicing or maintaining the sets.

Such franchises would guarantee the best deal for all concerned, and particularly for the public."

I understand many cable franchises do prohibit the sales and service of television receivers by the cable company. How prevalent is the incursion of cable companies into sales and service? I feel that cable has a tremendous part to play in the future of television, but not as a sales and service agency. In fact I feel the cable company cable should end upon entering the house and what is done thereafter, as long as it does not affect the cable system is only the homeowners business, opening up the in house distribution system to any competent installer. This is, after all, essentially the case with the telephone, now, finally.

We invite your comments.

Walter W. Schmitz

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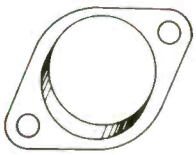
Horizontal Output Transistor Equivalent to ECG 238

(ECG is a registered trade mark of the Sylvania Corp.)



2.4
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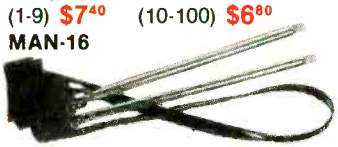
MAN-16



UHF/VHF/FM Splitters
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(1-9) $1.39 (10-100) $1.19
SPL-701

75 Ohm
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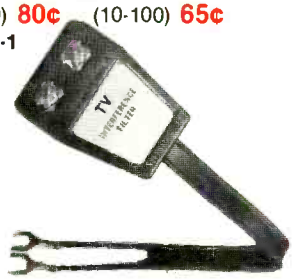
(1-9) 80¢ (10-100) 65¢
TVI-1



75 Ohm to 300 Ohm Converter
(1-9) 65¢ (10-20) 55¢
TVT-1

F-59 Connectors with Ferule
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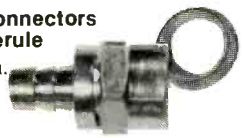

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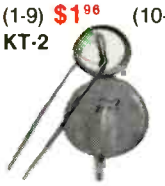

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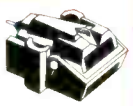

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V SOUND SYSTEM TESTING BEGINS. Test conducted by Matsushita
ay of Franklin Park, Il and broadcast over WTTW, Channel 11,
npare three systems, (EIAJ, Telesonics and Zenith), each capable of
MULTI Cereo and a second language program at the same time. Japan has been
Indu stereo TV sound for sometime. According to the EIA, separate tests will
ed out using three companding, (selective compression/expansion)
CBS, Dolby and dbx systems will be tested with a view to improving television
compressed, audio (with receivers capable of proper expansion).

EST INSTRUMENT BUSINESS SOLD. The test instrument business of 3M's Mincom
ision was sold in August to Data Check of San Diego Ca. The instruments involved
ere the former 3M models: 610A Sweep Generator; 6100B Test Set; 6110 Signal
Analyzer; 6275A FM Test Set; 6500 Recorder Test Set; 8155A, 8160 and 8100 A-W
Flutter Meters and the 8300 A-2 IRIG Flutter Meter.

INCREASED SATELLITE CAPABILITIES IN '81. Domestic satellite capacity will be increased greatly next year according to Television Digest. RCA Americom is to launch 48 transponders on 2 Satcoms in 1981. Both are to be dedicated to cable, opening more of the current transponders to broadcast.

COLOR TV SHORTAGES OCCUR. With the record setting color TV sales of the last few months spot shortages have been occurring says Television Digest. RCA is reportedly experiencing shortages of remote control models and 13 inch portables; Quasar which held down production because of the recession is suffering across the board shortages.

GE/JVC/MATSUSHITA/THORN EMI VIDEO DISC ANNOUNCEMENT. General Electric (US), Matsushita Electric Industrial (Japan), Victor Company of Japan and THORN EMI (Great Britian) announced definitive plans late in October to form three jointly owned companies to launch the VHD, video high density, video disc in the US in late '81. The VHD system, developed by JVC uses a 10.2 inch groveless disc capable of one hour playing time on each side and offers stereo sound. It features fast and slow motion, fast forward and reverse, stop mode and random access.

RADIO SHACK TO ADOPT RCA's VIDEO DISC. Radio Shack in early November decided to market RCA's CED video disc players, probably to be manufactured by Hitachi. According to *Television Digest* this lines up the large retail chains which market consumer electronics under their own brand names; J.C. Penney, Wards, Sears, and Radio Shack. Reportedly Hitachi, Sanyo and Toshiba are soliciting OEM CED business.

LETTERS

HELP NEEDED:

Perhaps one of your readers can help me. I am desperately searching for a 6v AM/FM/SW auto radio, preferably stereo, preferably Blaupunkt.

I still enjoy your magazine after many years as a subscriber and look forward to it each month.

Thank you for your consideration.
Marshall H. Reddin
2900 A Eads
El Paso, TX 79935

I need a schematic and manual for Supreme Model 666 RF Signal Generator. Will pay up to $10.00 plus cost of shipping or, cost of making a copy and shipping.

Been subscribing to your fine magazine for years. Keep up the good work.
Augustine's TV & Radio Service
530 N. 9th St.
Reading, PA 19604

I am in need of service data on schematics on the following:

Precise Electronics–Model 905 VTVM; Browning Laboratories, Inc., Model ST-300, SCA FM Radio Receiver. Will pay for copies and postage.
Gary Mead
334 Eastley
San Antonio, TX 78217

I need assistance in locating a part for a Hewlett-Packard Model 132A Oscilloscope.

The part I am in need of is the high voltage transformer, Hewlett-Packard #00132-61101. I would also gladly accept the entire high voltage assembly, the part # of which is 00132-66504.

The model 132A scope has been obsoleted by Hewlett-Packard, and they have indicated that these parts are no longer stocked. Any help your readers can supply in obtaining the above listed part(s) will be greatly appreciated. Thank you.
Dave Hann Sr.
908 Barber Lane
Joliet, IL 60435

Thank you for your fine service magazine. I wish I had known about it 3 years ago. Thank you also for the gift of TEK-FAX 115 for my 2-year subscription. It arrived one day last week. I am very pleased with it.

I need a source of older TV and radio schematics–tube types of the 60's.

I need the schematic and service info, as well as source of replacement parts including transformer for a Philco Model No. 42-100B Code 122, Chassis No. 60518; and Philco Model No. 42-380, Code 121, Chassis No. U19213.

Any help with these would be greatly appreciated.
L.K. Sampson
Sampson's Electronics Service
84 W. Main St.
Friendship, NY 14739

I need a schematic for a Bendix (Ford) F85BF auto radio (Photofact AR54).
Jesse Chaves
9768 Michaels Way
Ellicott City, MD 21043

Editor:
Photofact AR54 is out of print; I'm sure someone can help.

ET/D welcomes letters of comment on the industry, and letters of request for help in obtaining obsolete information or parts. Write: ET/D, Editor, 1 E. First St., Duluth, MN 55802. ET/D

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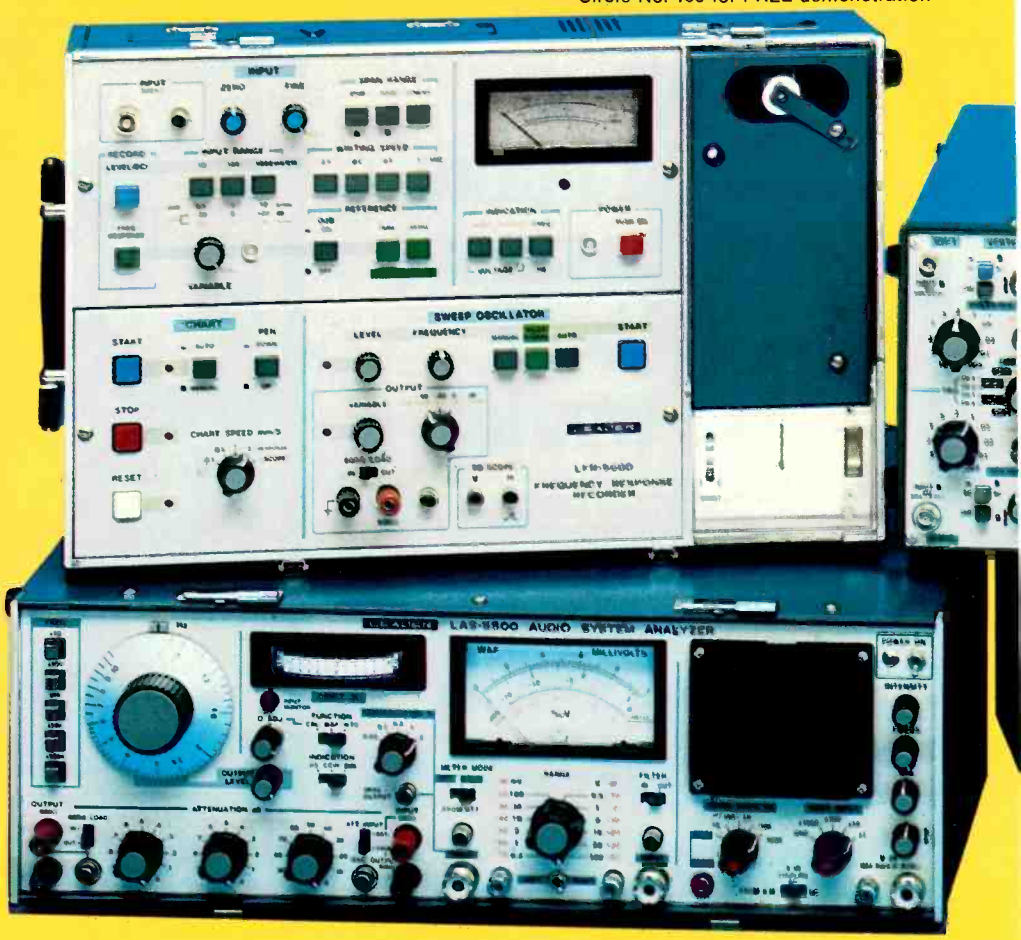
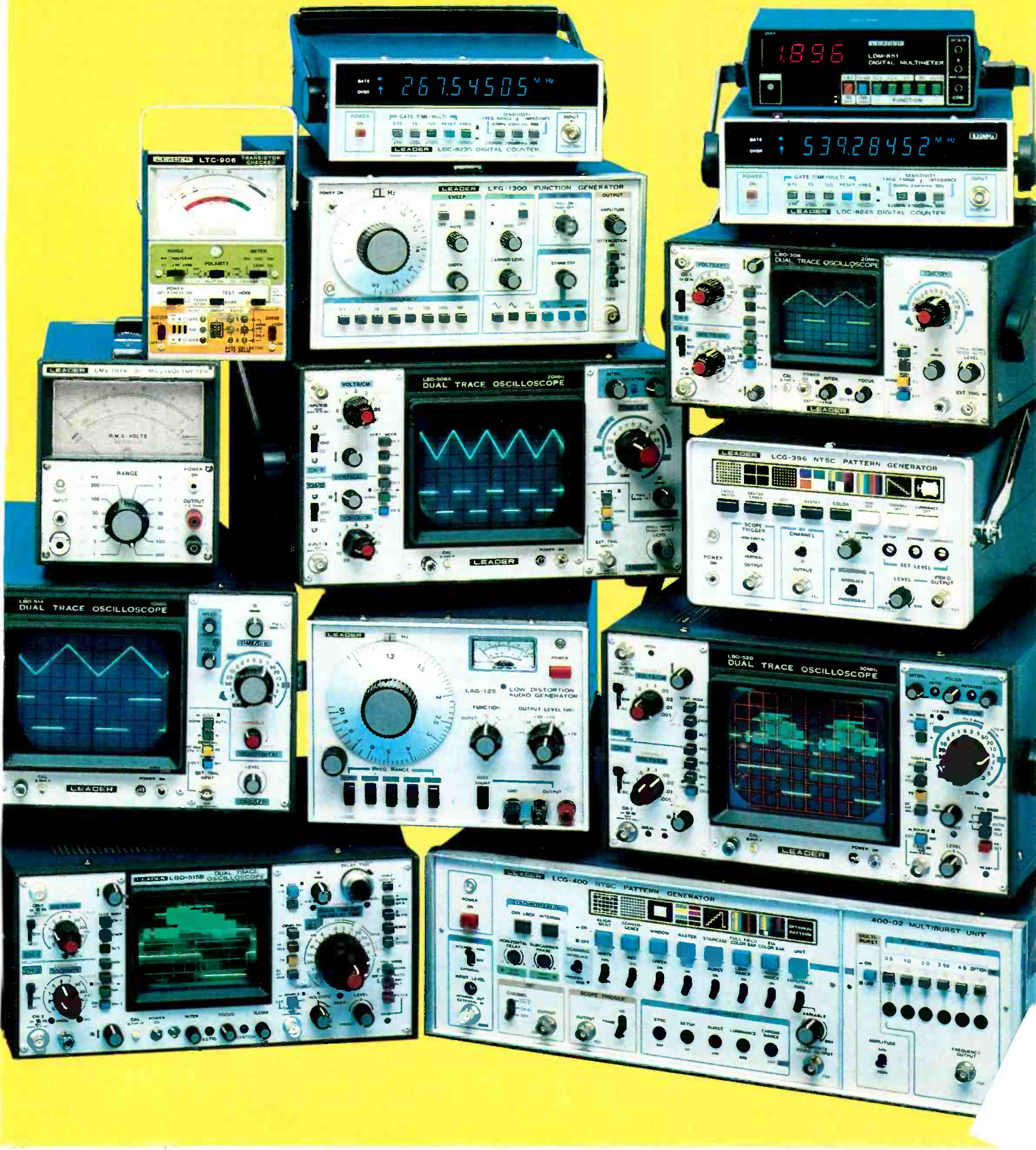
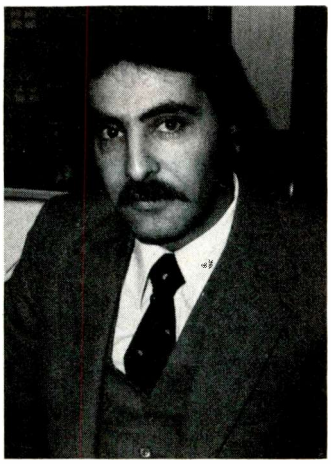


use most are immediately surprising leader.



SECURITY VIEWPOINT



One problem that exists in every small business is the problem of collecting monies from overdue accounts. The obvious answer would be not to let you or your business be put in a disadvantageous situation such as this. Realistically, the problem does occur, so let's try and come up with some practical advice to help you deal with this type of situation.

Billing on credit is what business is all about. But you become your own worst enemy if you don't sit down with pencil and paper and calculate just *how much* credit you can feasibly extend to each customer. Once you make this determination, keep a close watch on the client's ability and attitude towards meeting his financial obligations to you.

Most dealers will extend credit for either 30 or 60 days. To extend credit for a longer period of time, say 90 days, is really not to your advantage but is permissible if the account is habitually slow paying. The key in this type of situation is to have the client send you some partial payment each month. The principle here is to prod the client, as opposed to demanding monies due you. You want to collect your money as well as keep the account.

The next order of business involves sitting down and giving close scrutiny to the bills you send out each month. Are they fairly self-explanatory? The easier your bill is to understand, the less chance of your customer saying, "I would have paid sooner, but I didn't understand fully what I was being billed for." To expedite matters, make sure that your bill shows the following:

- What the customer is specifically being charged for
- Any and all materials you had to purchase (and the cost of each)
- Any partial payments the customer has made to date
- Balance due
- Any portion of the balance that is currently overdue

If the need arises for you to send out warning notices of late payments, use discretion! You should never send a threatening notice or letter unless you sincerely plan to follow up on it. Clients who start to receive this type of letters each month with no follow-up, soon learn that your bark is probably worse than your bite.

While on the topic of your customer, have you taken time to check his credentials *before* doing business with him? You should explain to all potential customers that you run credit checks as standard operating procedure since you will be most likely installing expensive, sophisticated equipment in their home or business.

Be wary of the potential client who informs you he was not happy with the services your competition was providing him. While that may have been the case, he may have been refused further service because he had fallen behind in his payments.

You should make it a practice to send your bills out the same time each month. Clients will come to expect them at a certain time, and usually will make plans to have the money on hand when the bill comes in.

After you send out your billing, if an account is more than two weeks late, try sending a friendly reminder letter. In most instances this will remedy things, but if it doesn't you should send a sterner request for payment. After a period of 90 days, if you haven't heard or received payment from the client, a final notice should be sent stating that if payment is not made within seven days, service will be interrupted, and any equipment will be removed.

Turning the matter over either to a collection agency, or an attorney should really be your last alternative. While both work well, they cost you money.

Collection agencies will retrieve any monies owed you, but keep in mind that their fees are often 25% and higher of whatever they manage to collect for you.

Also, before you decide to take an overdue account to court, consider the time and money *you* will be investing. Unless you just want to prove your point, the money you may retrieve may well be offset by legal fees, and lost business while you pursue this matter.

All told, your best bet is to stay on top of billing and keep an eye on your operations. While $60 due from one client may not seem to worry you, 60 accounts each owing you $60 is another matter. It's your business. You hold the reigns. Know when to pull them in a little.

Ray Allegrezza

BULLETIN BOARD

Five new sound systems are described in brochure AS-80, recently published by *Argos Sound*. Intended for small or medium sized requirements, each system includes an amplifier, microphone and sound columns. Argos defines each system's capabilities in terms of audience size, sound projection distance, room configuration and type of sound required.
Circle No. 125 on Reader Inquiry Card

More than 250 **land mobile antennas** in every professional frequency range from low band to 800 MHz, including more than two dozen models introduced since previous publication, are described in a new trade catalog just released by *The Antenna Specialists Co.* Complete technical specifications, including radiation patterns are provided in a compact new format, indexed by frequency and antenna type for quick reference.
Circle No. 126 on Reader Inquiry Card

A free, full-color, 40-page catalog describing **educational programs and test instruments for schools,** industry, government and self-instruction, has just been published by *Heath Company,* Benton Harbor, Michigan. This edition details course information on 17 complete self-instruction and group instruction college-level programs in electronics, microprocessors, automotive, and computer programming. Information on experimental trainers for laboratory sessions is also supplied. The catalog also features product descriptions and specifications on more than 40 available test instruments, including: oscilloscopes, power supplies, chart recorders, signal generators, and TV service instruments. Programs listed in this catalog are offered by Heath/Zenith Educational Systems, which is a licensed school in the State of Michigan, and is accredited by the National Home Study Council. Selected programs presented in the catalog are accredited for Continuing Education Units (CEU), a nationally-recognized way of certifying non-credit adult education.
Circle No. 127 on Reader Inquiry Card

"Solid State Design", published by the *American Radio Relay League,* is a soft cover book written for the radio amateur, electronics technician, or engineer interested in extending his/her theoretical understanding and practical application of solid state devices for communications equipment. Detailed in its 256 pages are such topics as advanced receiver design concepts, test equipment, accessories and portable radio gear. Mathematics has been kept to a basic engineering level. Charts, graphs, tables, schematic diagrams and photographs support the text. Authors Wes Hayward and Doug DeMaw have a combined 50 years of experience in the fields of Amateur Radio experimentation and technical communication. The price is $7.00 in the United States, $8.00 elsewhere. For the person who is just beginning to explore the functions of solid state devices there is *Solid State Basics,* a beginner's course in electronic theory that takes a learn-by-doing approach. With the information contained in these 159 pages excerpted from QST, a person with limited electronics experience can learn to build a digital volt meter, audio amplifier and frequency counter. The price is $5.00 in the United States, $5.50 elsewhere. Both books are recommended by the editors of ET/D for anyone needing such information. *Solid State Design* has been available for a while and we have found it to be a most exciting, practical, book for one interested in the design and construction of solid state radio equipment—a fascinating book.
Circle No. 128 on Reader Inquiry Card

The latest catalog of **test jigs and adapters,** tuner subbers, CRT brightners, and sound system equipment is available from *TeleMatic/Magna Sound/Polaris.* This catalog describes three TeleMatic test jigs, solid state adapters, yoke and convergence adapters and other accessories, indexes the yoke and convergence adapters and also includes information on brightners, tuner subbers, HV repair parts and Magna Sound amplifiers, speakers and tuner. See your distributor or check the reader service number.
Circle No. 129 on Reader Inquiry Card

A 16-page brochure, **"BiMOS/BiFET Comparison,"** comparing performance characteristics for operational amplifiers involving bipolar-MOS (BiMOS) and bipolar-field-effect-transistor (BiFET) technologies is now available from *RCA Solid State Division.* The booklet uses the industry-standard 741 op amp as a base reference for comparisons and stresses such parameter improvements as input offset current, input bias current, input offset voltage, slew rate, bandwidth, input impedance, output swing capability, zero standby current consumption, and supply voltage range. The comparison chart for each parameter identifies specific test conditions for the nine RCA BiMOS op amps, two TI BiFET op amps, and four National BiFET op amps involved in the tests.
Circle No. 130 on Reader Inquiry Card

Visual Information Institute (VII) has recently published a guide for the application of **television test instruments** to various TV systems. Topics covered include Standards and Common Practice, selection of scan rates, specification of resolution, and other technical notes. The application of various test patterns is discussed, and a brief summary of the features of various test instruments is included.
Circle No. 131 on Reader Inquiry Card

A new **"Power Measurement Handbook"** is now available from *RFL Industries, Inc.* The twenty-seven page publication covers electrical power measurement instruments and their applications. The use of digital, analog, electrodynamic, electrothermic and other types of single and polyphase instruments is described in six chapters. Ac, dc and reactive power measurements are discussed with more than two-dozen diagrams and photographs used to illustrate the text. Nineteen formulas covering almost all aspects of power measurement calculations are provided. A description of RF's broad line of power and electrical instrumentation is also included.
Circle No. 132 on Reader Inquiry Card

A directory of the consumer video industry containing information on about 125 companies offering video products and services to the users of home video products has been recently published by Video Magazine. Intended to be the first annual *Video Industry Directory* this volume gives basic information on television and video recorder manufacturers, video tape producers and distributors, MATV equipment manufacturers, anyone involved in consumer vido. It also lists their executives and their advertising agencies. It lists trade and consumer video publications, and includes a glossary of video terms and a short history of home video. Video Industry Director should be a useful reference for those seeking sources of products or seeking to market to the industry. **ET/D**
Circle No. 133 on Reader Inquiry Card

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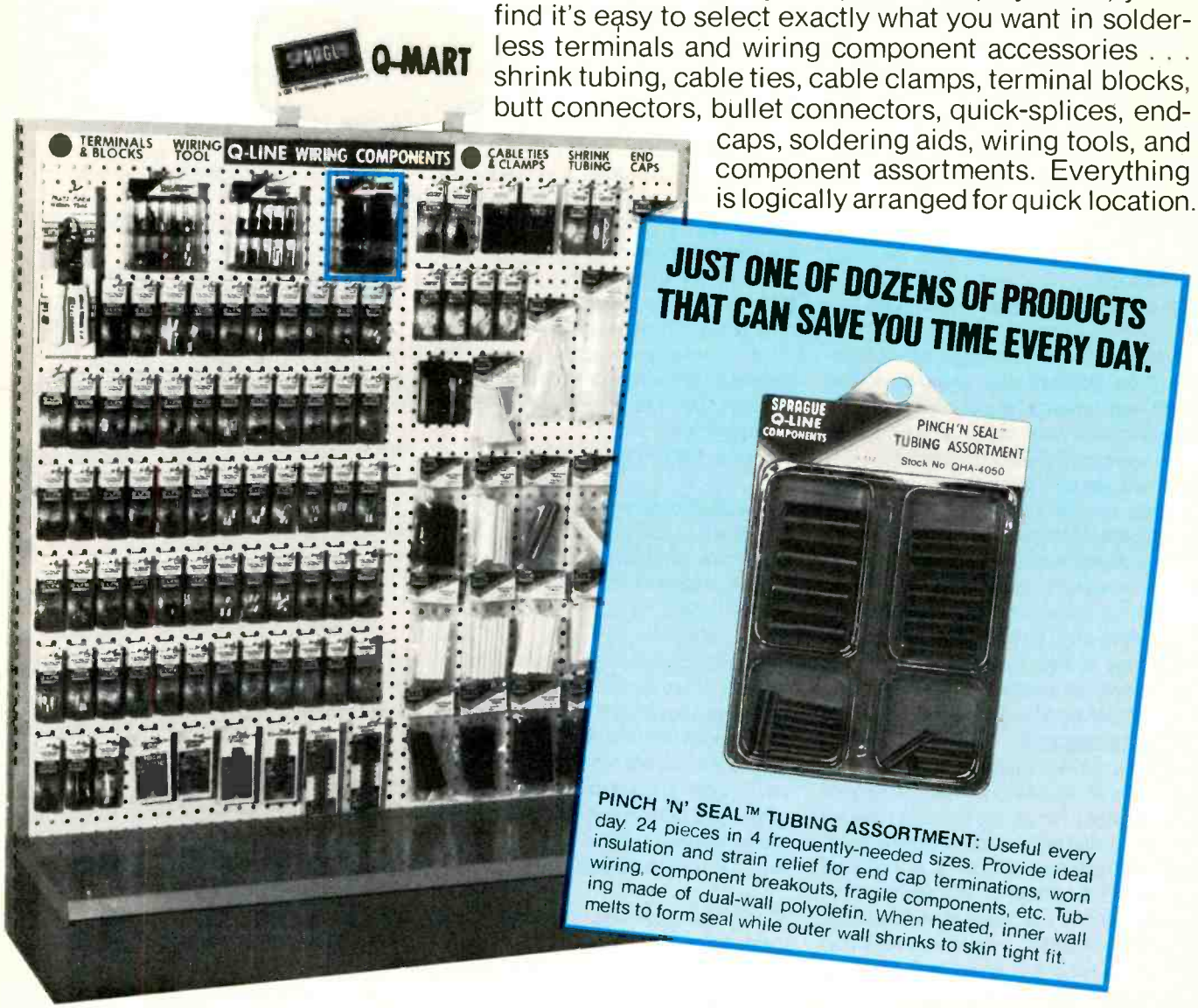

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Solid state transient suppressors

Protecting semiconductors

Transients can be disastrous in MOS and computer circuits. Here are some of the devices that can minimize their effects.

By Bernard B. Daien

Transients were just annoyances in the vacuum tube days, primarily causing disturbances in the performance of electronic equipment. With the advent of bipolar semiconductors, reliability was seriously affected. Now that MOS technology is proliferating, the threat to reliability is reaching very serious proportions.

With the new automobiles crammed full of MOS integrated circuits . . . voltage regulators, solid state ignition systems, engine control computers, and more . . . all in a terrible transient environment . . . the problem of transients takes on new dimensions.

The government has compounded the transient crisis by adding new regulations to reduce radio frequency interference . . . and transients cause RFI.

These factors, taken together, have forced new equipment designers to incorporate transient suppressors in the designs . . . and the older equipment is often fitted with transient suppressors too. As a result, manufacturers are responding to the need with more transient suppressors, which work on both natural, and man-made transients. The telephone companies have been effectively using transient suppressors for years. This article covers solid state transient suppressors, and their applications, in a practical way.

Now you see it, now you don't!

One of the most difficult things about troubleshooting transient caused problems is that you seldom see the cause. Transients can be so fast (in the nano-second region), that most oscilloscopes either cannot display them because of lack of bandwidth, or else cannot be synced to the transient. Transients often are not regularly repetitive, and may not be present when you are looking for them . . . and, again, the transient may be hidden under other signals which tend to act as "camouflage." The end result is the same, however, . . . you never see the transient . . . you only see the result!

In order to give you some "feeling" for the transient problem, data has been accumulated proving that transients in a typical home, wired for 120 volt outlets, run to over 5000 volts! Automobiles of popular manufacture, with 12 volt battery systems, also have transients of hundreds of volts on the 12 volt line! (If you happen to live near a heavy industrial area, the problem can be even worse, insofar as your home transients are concerned.)

Why solid state?

Transient suppressors come as a variety of devices, among them gas discharge tubes which are similar to neon tubes. Nothing happens until a certain voltage level is reached, then the gas ionizes, the internal resistance drops to a very low value, and heavy current flows. These devices do not operate until a fairly high voltage (around 65 volts) is reached, which

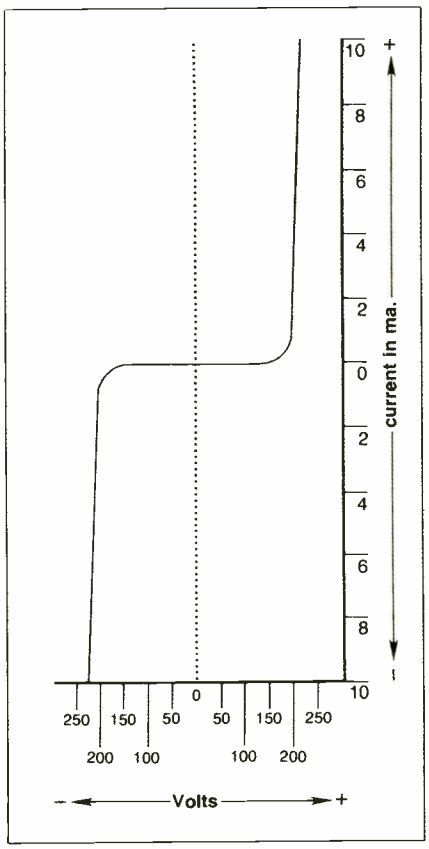

Fig. 1 Voltage versus current characteristic curve of a metal oxide varistor transient suppressor, showing symmetry which permits operation on both dc and ac.

makes them less useful for the protection of low voltage semiconductors, like high frequency transistors . . . or for the protection of transistor base/emitter junctions (inputs). It also takes the gas discharge tube milliseconds to deionize, once it has ionized, and this may be a problem when quick recovery is essential.

Gas discharge tubes do have their

place, and can be used effectively in many situations, however we are not discussing them at further length, since this limited article is primarily devoted to the solid state suppressor.

The solid state suppressors are very fast, operating and recovering in less than a microsecond. Like the gas devices, the solid state suppressor is light, compact, easily applied, and inexpensive. It does not tend to generate "ringing" (damped oscillations) like the inductance/resistance/capacitance networds often used to reduce transients. Also, it does not tend to extend the duration of a transient, the way "damping diodes" do. Thus the solid state transient suppressor is ideal for modern semiconductor circuit applications. It is, in fact, quite often designed for such use, being made available in a wide range of voltage, current, and power handling capabilities.

Fact and fancy

There are some myths about transients that should be laid to rest before we proceed. It has often been assumed that the use of a "good" transformer, with a well regulated design, and an electrostatic shield (Faraday Shield) between windings will provide protection against transients. This is not so. There are some special transformers with internal magnetic shunting action, which do reduce some transients very effectively, but these transformers are "Voltage Regulating" transformers. The usual power, or isolation, transformer does not have this characteristic. A "well regulated" transformer simply means, with the usual transformer, that there is very little voltage drop in it at full load current. As a matter of fact, since such a well regulated transformer has a larger iron core, it is capable of storing MORE energy, and will generate a bigger transient if the circuit is opened, or the load is suddenly reduced! The electrostatic shield is effective only against static fields, and not magnetic coupling. Thus, a good, well designed transformer often generates bigger transients!

The reason for this is fundamental. Inductors store energy in the magnetic field, which exists only as long as current is flowing through the inductor. If the current is interrupted, or suddenly reduced, the field collapses, fully or partially, returning stored energy to the circuit. This energy has to be dissipated somewhere. If the circuit is opened, the voltage will continue to rise across the open circuit, until an arc develops, or something breaks down. (The current flowing in the arc so produced is equal to the current that was flowing through the inductor at the moment of circuit interruption, providing of course that the magnetic core was not saturated). This is the principle of spark coils.

It should be carefully noted that such discharges often produce a damped oscillation, which results in both POSITIVE AND NEGATIVE polarity excursions! That means, in simple language, you had better have transient protection for both "up" and "down" transients! The solid state suppressors can provide such protection.

Repeated transients, which may at first only arc "across" the surface of insulation, eventually erode, char, or decompose the insulation to the point where it loses much of its insulating properties, and eventually breaks down completely. We say that this breakdown is "time dependent," because it takes a while for the transients to do their dirty work. Moral: "Don't assume that fifteen minutes on the bench is an adequate test for a piece of equipment that has suffered from transient induced failures.

Another myth is that fuses can provide protection against transients. The fact is that they often make the problem worse. Here's why . . . let's assume that a transient has just occurred, causing higher than normal voltage, which in turn is causing the fuse protected circuitry to draw higher than normal current. The fuse opens, INTERRUPTING A HIGH CURRENT SUDDENLY! If there is any inductance in series, such as a filter choke, power transformer, isolation transformer, audio transformer, noise filter, etc., the voltage will rise, as previously described, until something arcs, or fails, or degrades. (Magnetic relays are offenders in this respect, as are deflection transformers, and other iron cored components we tend to "overlook.") In this case, and others like it, the fuse opening actually helped to "finish off" the destruction.

A great deal of electronic equipment today is never turned off . . . from "instant on" TV sets, to huge computers. Such equipment is a sitting duck for line transients . . . 24 hours a day, 365 days a year, the equipment gets socked with every transient coming down the line, via ac power input, antenna input, telephone line input, and even the ground bus! Mother nature can deliver a real wallop, by direct lightning hits, induced charges from passing clouds, or hits on the lines many miles away. (People in metal hulled boats have been shocked by the effects of lightning hitting the water some distance from the boat . . . and you couldn't ask for a better ground than water, according to most texts!

By now, the reader should be realizing that in many cases we simply cannot control the source of the transient or the route of the transient . . . and that some protective devices may sometimes actually make the situation worse. Which is why we now have the transient suppressor! To fully realize the impact of transients in present day equipment, permit me to refresh the memories of those among you who were in the automotive electronics repair business in the past. Do you remember a little device called a "spark plate," built into auto radios years ago? That was designed to arc over on the really big transients . . . a sort of "spark gap" transient suppressor. Now, think. We just stated that things have gotten worse since then, both in transients generated in autos, and in the susceptibility of the solid state devices!

Fortunately the automobile industry, and its suppliers, are now starting to incorporate transient suppressors in equipment, in order to avoid in warranty repair costs. General Electric has been making transient suppressors for years, Motorola is now in the business in a bigger way, and General Semiconductor has been manufacturing their TransZorb devices for several years now.

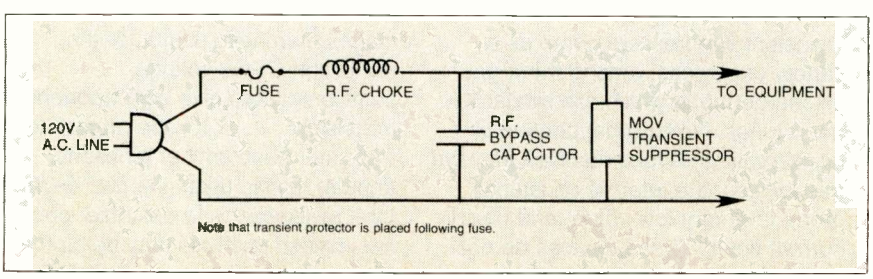

Fig. 2 Typical use of solid state transient suppressor, for protection against ac line transients.

Different types

There are different types of transient suppressors. One type is basically a zener diode . . . with some

modifications to optimize performance for transient suppressor applications. Normally, the zener conducts a steady, or varying, direct current. The ratio of average power dissipated, to peak power dissipated is quite low. Thus a ten volt, ten watt zener, would ordinarily handle a maximum of one ampere, steady state dc current. The chip inside the zener package would be quite small for this current level, and the connecting wires between the terminals and chip would be of very small diameter.

When a zener is used as a transient suppressor, it handles very high peak voltages, which cause very high peak currents, and correspondingly high peak power. A transient suppressor the size of a power zener would be rated for peak powers running in the kilowatts! The internal interconnects have to be beefed up to handle surge currents in the hundreds of amperes!

A good example of this is Motorola's 1N5908, a six volt zener intended to protect digital logic power supplies. About the size of a half watt resistor, this little device can handle a peak power of eighty kilowatts at 100 nanoseconds derated to forty five kilowatts at one microsecond duration, ten kilowatts at ten microseconds, and 2 kilowatts at one millisecond! According to the published specifications for this device, it can handle repetitive pulses of 200 amperes, half square wave shaped, with a pulse width of 8.3 milliseconds (the period of a half wave at a 60Hz frequency), at the rate of 4 pulses per minute! Now that is a lot of transients, with a lot of power. (240 transients per hour.) The zener avalanche is very fast, in the nanoseconds.

These devices are polarized. If it is necessary to clip transients with negative and positive polarities, back-to-back matched zeners can be ordered, or you can put two similary rated zeners back-to-back yourself. (Usually matching is unnecessary for transient protection.)

The chip inside these zener diode packages is a silicon crystal, with uniform structure. The chip is mounted on the supporting package, and all the heat is generated in the chip itself, and then transferred to the package, and finally into the air (or heat sink, if one is used). This is doing things the hard way, but zeners have been around a long time, and the manufacturing techniques are already well established.

Another type of solid state transient protector is made by General Electric, under the name of "GE-MOV" Varistors. They are metal-oxide varistors. A "varistor" is a voltage dependent, non-linear resistor. You have seen similar devices used in some of the degaussing networks in color TV sets, and in the voltage regulator networks for high voltage regulation in color TV sets that do not use high voltage regulator tubes, using instead horizontal output tube bias variation.

Figure 1 shows the voltage versus current characteristic curve of a transient protector MOV. You will notice that it resembles two zener diodes, back to back, and therefore is effective against both positive and negative going transients. What the curve does not show is that, unlike the zener, the MOV has a small but definite current through it, even at low voltages. The zener has a knee, and below that knee, conduction is negligible for most purposes. Not so with the MOV. There is a small, but definitely not negligible current, well below the knee, and this current increases at an exponential rate as the voltage is increased. The rate of increase can be equal to the fiftieth power of the voltage, or even higher! The MOV is very fast, going into conduction about as fast as the zeners.

A one inch diameter MOV, closely resembling a disc capacitor, can handle a RMS applied voltage of one thousand volts, and conduct almost 3000 amperes for 10 microseconds or less . . . that's real power! (Half square wave, single transient.) At one millisecond duration this device, the V1000LB160, can still handle peak currents of about 90 amperes at 1000 volts . . . still nothing to sneeze at! Despite this, the MOV has an average life in the millions of hours . . . so it can be considered as reliable as any other semiconductor for all practical applications.

The method of construction of the MOV is quite different from that of the zener. Those old timers who recall the copper oxide instrument rectifiers of bygone years . . . or the selenium power rectifiers of post World War II era, or, more recently, the selenium high voltage "stick" rectifiers used in color TVs, have seen some forerunners of the MOV devices. (By the way, you might remove the end cap of one of those selenium stick rectifiers. A bunch of little individual "plates" will tumble out. The stick is nothing but a lot of selenium plates stacked in series to achieye the desired inverse voltage rating. You can use them for a lot of interesting experiments. They make excellent clippers for audio use.)

These devices are NOT single crystals. The selenium rectifier is made of a coating on an aluminum plate. This construction spreads the heat over a wide area, and enables quite a bit of power dissipation. The copper oxide rectifier is also made of plates, of copper, with an oxide of copper formed on one side of each plate . . . again, not a single crystal device.

The MOV greatly resembles a ceramic disc capacitor in construction. A ceramic disc has a conductive coating applied to each side of the disc, to which the leads are attached. An insulating coating is then applied over the entire device. The ceramic disc contains metallic oxides pressed into shape under high heat and pressure.

The thickness of the disc determines the voltage rating. The diameter (area) of the disc determines the current that can be handled. The electrical characteristics can also be modified by varying the composition of the mix of which the ceramic disc is made.

Which to use?

The zener type of transient protector can be had in voltages down to six volts or so, and thus can provide protection for very low voltage semiconductor junctions. The MOV devices usually run above twenty volts, and are useful for many semiconductor power supply voltages. The MOVs can handle more power and current in most devices. Both zeners and MOVs are fast enough for semiconductor protection, both are long lived, and both are small, light, and inexpensive. One important advantage of the MOV is that it can be used on either dc or ac, since it is a symmetrical device. Zeners must be used back to back in order to work on ac, but they can be ordered that way. Zeners are generally limited to about 200 volts maximum, while MOVs are made up to 1000 volts rating.

Using transient protectors

The two types of transient protection devices we have just described . . . avalanch "zeners," and MOVs are essentially constant voltage devices. Above a certain level the transient conducts, but at lower voltages no conduction occurs. It is important to note this because there are other devices used for transient protection which have a certain "striking voltage," causing them to conduct, and once conducting, the voltage drops towards zero. Some examples of this would be gas discharge tubes, SCRs used as "crowbars," and, surprisingly . . . spark gaps! As you can understand, such devices have to be

applied differently.

Another factor to be considered when using transient protectors, is cost. In many cases, adding a transient protector can actually reduce the cost of parts in designing a circuit, or repairing a circuit. Think about rectifier costs, as one example. High voltage rectifiers cost more than low voltage rectifiers. It is common practice to use 1000 volt rectifiers routinely, since experience has demonstrated they "stand up better" than 600 volt rectifiers. On a 120 volt line, the line may go as high as 130 volts, the peak will be about 185 volts, and the peak-to-peak or maximum inverse voltage would then be 370 volts. So why not use a 600 volt rectifier, with over 50% extra safety factor? Well, the fact is that transients usually wipe out the 600 volt unit. With full wave single phase we are talking about using two rectifiers, in a bridge four rectifiers, and in three phase systems six rectifiers! The transient protector also enables us to use lower voltage capacitors, transistors, etc. The money so recovered often exceeds the cost of the suppressor, and the increased reliability avoids in-warranty repair costs.

The transient suppressor also reduces, or eliminates, radio frequency interference (RFI), since it reduces transients, and the oscillations resulting from transients, and because it is fast enough to control impulses of extremely short duration (RF). This reduces the amount of LC filtering required to bring RFI down to acceptable levels.

Zeners and MOV devices cannot be used in parallel to increase power handling ability, but they can be used in series, providing that the power dissipated in each device does not exceed the rated value. This can be done most easily by using devices of the same type and the same voltage rating, thus avoiding the need for calculations.

It should be pointed out that the transient problem has occurred before . . . and it was really a bad one. When silicon rectifiers and germanium rectifiers replaced the selenium rectifiers in use after World War II, transients were a frequent cause of rectifier breakdown. At that time some rather elaborate schemes were devised for reducing transients, with varying degrees of success. It seems the older selenium units had very good transient immunity, acting much the way transient suppressors do. Unfortunately the selenium devices had a fairly short life under load at moderately high temperatures. They were also affected by various chemical fumes . . . otherwise they would have remained popular as transient suppressors.

It is often essential to know what kind of semiconductor you are trying to protect. For example, in low voltage, high current applications, the forward drop of a rectifier diode may be an appreciable percentage of the supply voltage, as in automotive use, on a twelve volt battery system, the forward drop of one to two volts in a conventional silicon diode may not be acceptable efficiency. It is common to use Schottky diodes, which look exactly like a silicon diode, but have a lower forward drop. Unfortunately, Schottky diodes do not have much reverse voltage rating (usually less than 600 volts) and are particularly susceptible to transient induced breakdown. Certainly you would want to know this if you are trying to set up transient protection.

A nice feature of transient suppressors is the tremendous peak current capability . . . which makes them useful right across the ac power line . . . but that raises another problem . . . the suppressor can cause the house fuse to blow, which is inconvenient. The way to get around this is to put the suppressor in the circuit following the fuse, as in Figure 2. Notice that the fuse, and the conventional LC line interference filter, provide a small but useable impedance to help limit the peak current, and that the equipment fuse will open before the house line fuse blows.

I find it good insurance to add transient protection to home electronics equipment that has had a history of semiconductor failure, particularly in the case of line operated TVs, etc., which do not use a power transformer. In such cases, if the equipment does not have a line RF choke, I add one, as in Figure 2. The customer is charged for the added parts, of course. Automotive, marine, etc., installations should always include transient suppressors as part of the job.

One word of caution . . . you cannot add transient protectors where the capacitance will detune circuits, etc. They are not suitable across tuned circuits of high Q, or across high frequency networks such as video amplifiers, or IF amplifiers. They can be placed across such stages on the supply leads, or in other ways to provide effective transient protection without disturbing the circuit operation. You may have to think a bit about just where you want to connect the suppressor, but in the vast majority of jobs you will have little trouble finding a suitable hookup.

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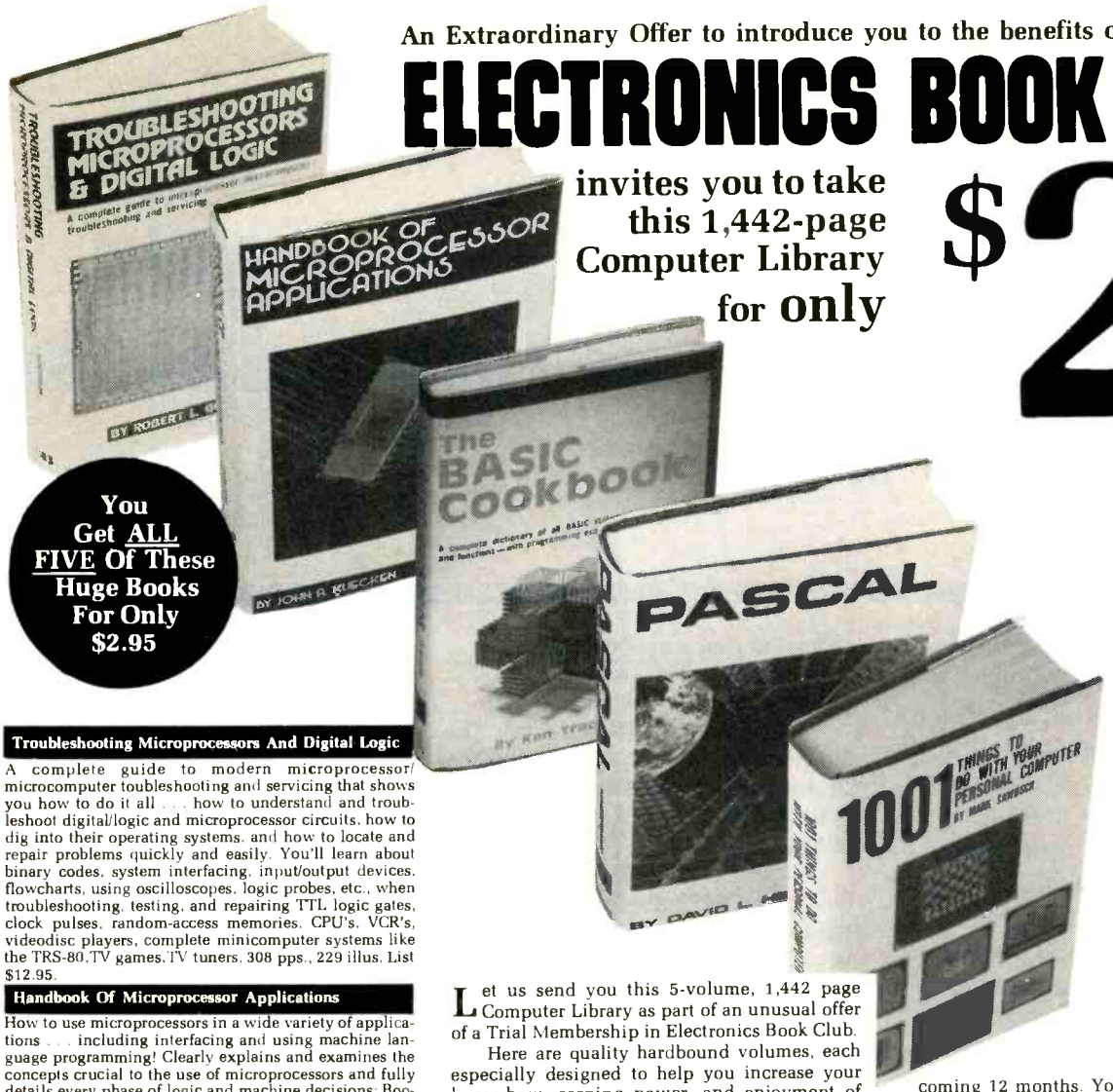

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A computer for the service dealer

What can it do?

The manager who manages the activities of several technicians, is responsible for an extensive parts inventory, who has a payroll to make out, bills to pay, bills to collect, all the paper work problems of a business, may need a better way to do things. A computer might be the answer. If you are interested, here are some of the things one can do for you.

by William Joseph

With the exception of oxygen, it's the most common element on earth. When you were a youngster, there's a good chance that it fooled you into thinking you had discovered silver or gold as it glistened playfully at you from inside a newly-found rock. You or your technicians come into contact with it every day.

What is it?

If you said silicon, go to the head of the class. That same material used in all those rectifiers and diodes has teamed up with modern micro-technology to produce those tiny chips that play such a big part in the life of anyone involved in electronics today—and which are the heart and soul of that family of new microcomputers that are now helping to run thousands of small businesses.

A chip small enough to rest on the tip of your finger contains as much computer power as one of those early "electronic brains" that filled an entire room and cost a million or more of yesteryear's dollars—at one-thousandth of the original cost.

But enough of this technical talk. The important question is whether a service dealer—even a very small one—can make profitable use of this latter-day miracle.

Here's what service dealer Ed DeAngelis of Huntingdon Valley, Pa. has to say on the subject. "How else can you get all the information you need to run a service business today? You can hire someone at $10,000 per year or more, or you can get yourself a computer to do the work at less than half that cost."

Ed is referring to cost-effectiveness, a fancy term for a simple idea with which you are already very familiar.

You know, for example, that once a given piece of test equipment can be shown to improve efficiency and productivity, it's smart to buy it. According to one trade association estimate, if a test instrument can save one minute of a technician's time per job, it's worth $1,000. More and more service dealers are coming to feel that the new family of small business computers are now in that class.

In order for you to determine whether it would be cost-effective for you to own your own computer, you've got to know two things: How much will it cost, and what will it do for you? First things first.

How much will it cost?

The cost barrier was broken in September of 1977 when Radio Shack made what was, if not the first, the most widely publicized introduction of the so-called personal computer, the Model TRS-80. The price was $599. (In keeping with the continuing improvements in manufacturing technology in this field, the price has since been reduced to $499.) More than 150,000 TRS-80's have been sold.

It became quickly evident, though, that computers of that capacity were sorely limited in applications for even the smallest of businesses. American ingenuity being what it is, a host of manufacturers, including Radio Shack, have set to work to fill the gap. As a result, service dealers considering the purchase of a computer can shop in a price range that extends from $499 to about $30,000 with stops at almost every point in between.

With today's high cost of money, most small businessmen are opting for a lease arrangement rather than an outright purchase. According to Dick Ott, President of S.B.S. Computers of Mt. Laurel, N.J., the smallest system, complete in every detail and capable of performing all the functions required by a typical service dealer, would run in the neighborhood of $16,000 to $17,000. On a lease basis, such a system would probably cost the dealer about $400 per month.

One arrangement gaining in popularity is the lease/purchase plan. At the end of the lease period, an additional payment—usually about 10% of the original cost—transfers ownership of the equipment to the user.

In addition to Radio Shack, such well known manufacturers as Texas Instrument, Apple, Data General, Digital Equipment, and even the venerable giant IBM are scrambling for a share of the relatively untapped small business market. Currently, IBM is aggressively advertising its Model 5120 at under $13,000.

Companies like these want your

business, and you can expect to see the competition get white hot in the months ahead.

Why such a wide range of prices? According to Dick Ott, it's no mystery. "You get what you pay for," he says.

In its most elementary form, a complete computer package for your business would consist of three parts.

1. Hardware
2. Software
3. Training and support services.

Hardware is easy to explain, and easy to buy. That's the actual computer machinery. The central processing unit, high speed printer, input keyboard, cathode ray terminal, and other equipment needed to make the system operate.

Software is the name given to the various programs designed to get the computer to do what you want it to do. Expressed another way, software is the pre-packaged instructions that tell your computer how to provide the specific types of information that you have said you need to run your business.

The best computer hardware made will be of no value to you without software that will guide it according to your needs. Says Ed DeAngelis, "A lot of companies sell perfectly good hardware. The real problem is getting good software appropriate to your business.

One computer programmer puts it a bit more bluntly. "Without proper programming," he says, "a computer is just a dumb hunk of iron."

Training and support are part of the services that are provided by computer systems companies such as S.B.S. Computers. According to Dick Ott, the average small businessman, even an electronically trained one, is confused about computers. He doesn't know where to turn to get reliable information on a practical system precisely correct for his business. "That's where we come in," he says. "We offer the small businessman a complete turnkey system. After the system is complete and installed, professional training and continued support is what makes it all go."

Obviously, a lot of people feel that there is a genuine need for a service such as this. Ott says that most of the business for companies like his come from referrals by the computer manufacturers.

Ed DeAngelis places a very high priority on the assistance of a systems company. According to Ed, a complete package, custom designed for your own service operation is the only way to go.

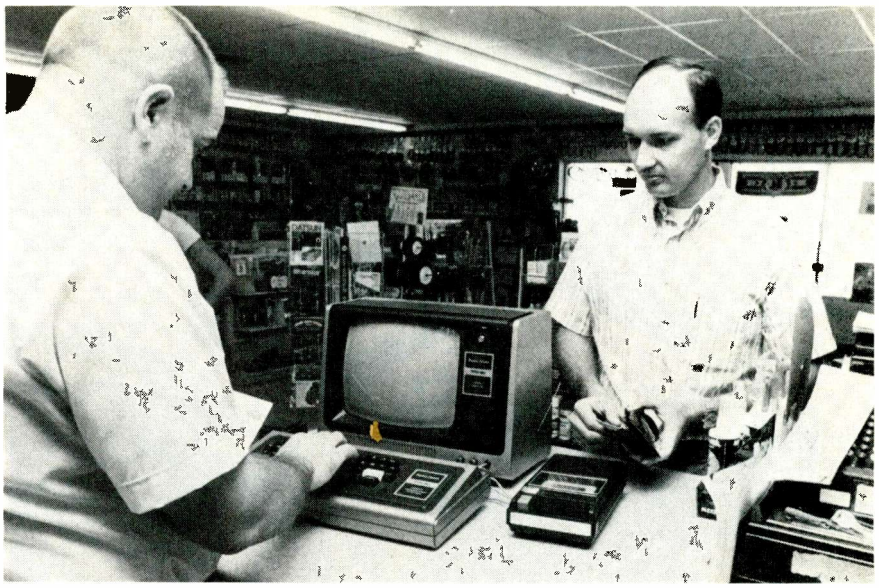


Fig. 1 Radio Shack's TRS-80 microcomputer system in use. Courtesy Tandy Corp.

"Also," he says, "don't let yourself be a guinea pig. Make sure that the programs offered to you have been tested and proven before you try to put them to work in your system."

Ed isn't alone in his concern for proper software. New Rochelle, N.Y. businessman Robert L. Hallock paid $18,000 for a computer more than two years ago. It still isn't operational because of programming snags. Needless to say, Mr. Hallock is becoming a bit disenchanted.

In at least one case, IBM is reported to have made a complete refund to the purchaser of one of its $12,000 computers when he was unable to get it programmed properly for his business after a full year of trying. While he was happy with IBM's fair treatment, he was still out about $10,000 in programming fees.

Many systems companies are beginning to specialize in order to minimize problems of that sort. Computer Data Access, Inc. of Clifton, N.J., specializing in parts inventory systems, recently adapted its "Parts Handler" program for Valley Parts Distributors in Wayne, N.J. According to Richard Henches, Valley's owner, his old manual system of inventory control and billing was eating into his profits. Henches feels that the system designed for him by Computer Data Access is doing a fine job of invoicing and other clerical activities while keeping track of the 13,000 different part numbers in the computer.

Of course, not everyone agrees with the need for involving a third party when buying a computer, especially for a very small business. For anyone on a tight budget, there is a tempting assortment of hardware and slickly packaged programs that are capable of doing some jobs quite nicely. And for those with the inclination and the time to learn, a certain amount of programming can be accomplished on a do-it-yourself basis. Needless to say, though, not everyone would be suited to such a project.

Radio Shack, in its bid to provide a complete computer package for use by the small businessman has recently introduced its TRS-80 Model II. The new version boasts twice the speed of the original and an expandable memory capable of two million bytes. (Byte is a term used to describe the capacity of a computer memory. One byte is roughly equivalent to one typewritten character.)

Of course, such dramatic improvements over the $499 original don't come cheaply. Says Lewis Kornfeld, Radio Shack's president, "We're well aware that TRS-80 Model II purchases will average up to ten times the cost of Model I systems, and for the small businessman we're aiming at that's a lot of money."

As one of their recent ads observes, a fully equipped Model II system with all the trimmings costs less than a company car or truck; in other words, less than $10,000.

However you say it, though, that's still a lot of money. In seeming deference to that fact, Radio Shack recently announced its own leasing program in order to make it easier to buy their product. The number of manufacturers offering similar enticements is growing rapidly.

What will it do for you?

Despite the pervasive influence of computers in our lives, many of us do not

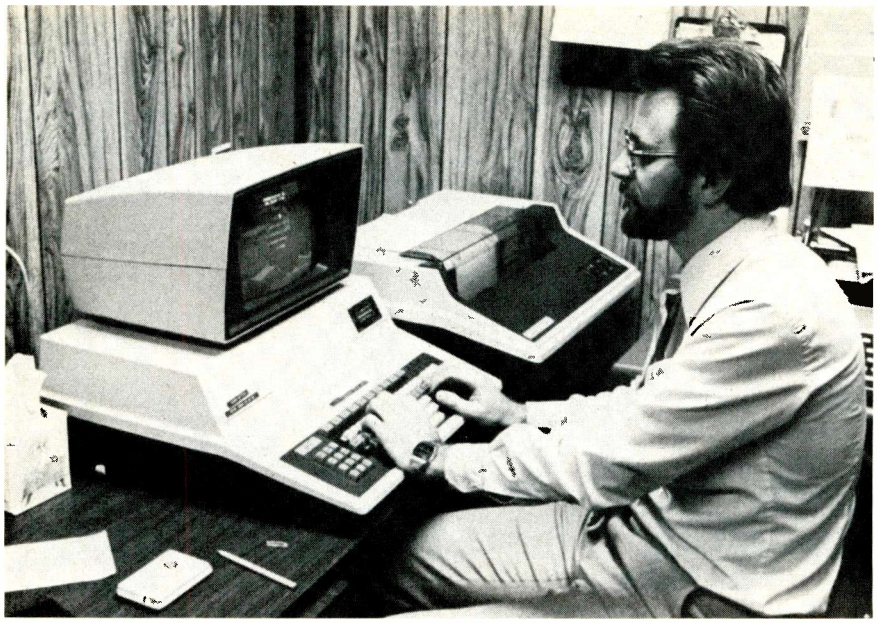


Fig. 2 Ed DeAngelis "talking" to his Texas Instruments computer system. Photo by the author.

yet seem to have a clear idea of where a computer might fit into our operations, and just what it can do. Of course, it's no disgrace to be confused by data processing; while computers do involve electronic concepts, the field is highly specialized.

While an article such as this can do little more than offer a primer style explanation, it might help to do a quick run down.

In order to visualize its basic function, you can think of a computer as a giant filing cabinet; the larger the computer's memory, the more "storage space" in the cabinet. Any data that is now written, printed, or typed on paper can be stored in a business computer, much in the same way that it can be stored in an ordinary filing cabinet.

The difference, of course, is that all this is done without the paper. A computer system that can snuggle into a corner in a small office can store enough information to fill several rooms if it were printed on paper. Information and records are added to or subtracted from the computer memory by way of a typewriter-style keyboard which allows you to "talk" to the system.

When you want to retrieve information stored in the computer, you pass along your instructions through the keyboard. In this way, you can command the system to display the desired information on the cathode-ray screen, to print out a "hard copy" on paper, or both.

Couple this ability for the storage and retrieval of information with the computer's ability to perform complex mathematical computations and you will begin to appreciate the almost unlimited clerical functions that can be done for you by a computer of sufficient capacity. For example:

Payroll. Virtually all of the manual computations and payroll records now being done by you or your bookkeeper can be done by a small computer. Just "tell" the computer how many hours Technician Jones worked last week and the computer will do the rest.

Inventory. How many of each part is on hand? Is it time to re-order? How many should be ordered? How many of a given part were used last week? Last month? Last year? In short, all of the statistical information you need to properly manage a repair parts inventory can be supplied by a computer working in conjunction with a proper program.

Plus such things as:
General Ledger
Accounts Receivable and Payable
Profit and Loss Statements
Balance Sheets

And a special bonus. With a custom-tailored program, your computer can supply you with meticulously detailed data on your service operations:

Technician Productivity
Not Home Percentages
Lack Parts Percentages
Cost-per-call
Mileage-per-call
Truck Operating costs

All of which can be analyzed on a technician-by-technician basis as well as by group averages for larger service operations. How many individual functions your computer will be able to do for you, and how well and how quickly it can do them, all gets back to the price range from which it has been selected.

Does all of this require that you hire your own computer expert, or spend countless hours in painful study in order to learn how to operate your computer system? Not according to Ed DeAngelis.

While sitting proudly at his computer keyboard, Ed says, "It's so simple to operate, you wouldn't believe it. If I can learn to do it, anyone can." Then, even as I watched, Ed punched a few keys and almost immediately a report showing a number of parts that had reached the time-to-order quantity was printed and handed to me.

According to DeAngelis, his computer system computes gross profit on each technician, has helped to improve productivity in the entire organization, and is making a direct contribution to the bottom line. The hardware in his system was provided by Texas Instruments.

Of course, all of the things described in this article can be accomplished through the use of someone else's computer. That's called time-sharing, and would probably cost the average dealer somewhat less than buying or leasing his own system. Trade associations such as the National Association of Retail Dealers of America (NARDA) provide this service to many service dealers.

The opinion of many independent service dealers, though, is probably reflected by Jerry Rolnick, a Kearny, N.J. parts distributor who explains his decision to buy: "I wanted to have control of the situation. I don't want anyone telling me I can do nothing on the computer because it's Saturday or Labor Day."

If the idea of having your own computer sounds good to you, Ed DeAngelis sums up his experience with this advice:

1. Buy your hardware from a reputable manufacturer; computers need service, and when they're down, you'll need help quickly.

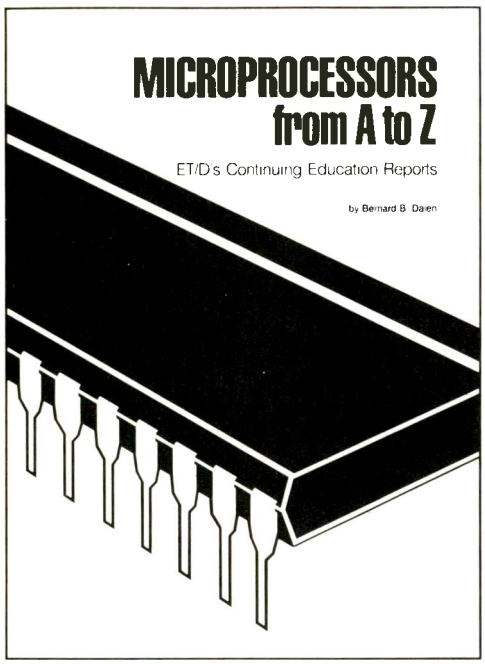
2. Try to get tried and proven programs. If at all possible, avoid being the first one to test newly-developed software.

3. Adequate training and support after the system is in place is vital. Make sure it's available before you buy.

A computer is not going to turn a poorly managed service business into a successful one. It can, though, help a good businessman to become a better one. ET/D

MICROPROCESSORS from A to Z

by Bernard B. Daien



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Hi-Fi auto audio

Some 1980 developments

Changes are occurring in car radios as they are in other facets of consumer electronics. Here Joe Carr discusses some of the things Delco has done to improve the sound of its 1980 offerings

By Joseph J. Carr, CET

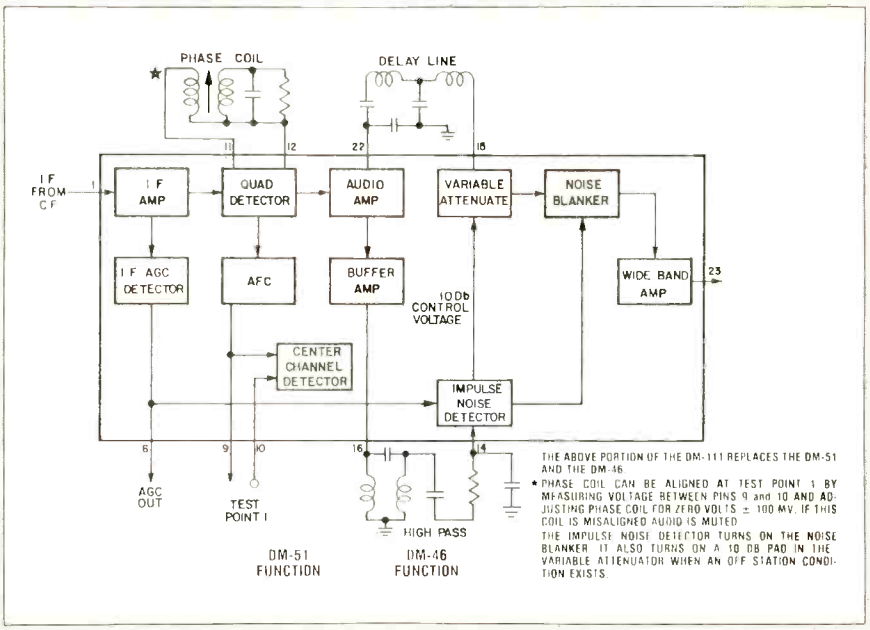


Fig. 1 Delco's DM-111 FM IF and noise suppression IC.

One day in the late 50's, my large frame crawled across the front seat of a '55 Buick to check out the car radio; being the apprentice technician in the shop, R'N'R fell my way despite my size (sigh). Turning on the radio waiting for the tubes to heat up, and then tuning the radio; there was nothing wrong with the radio, but I did notice how good the sound was. I had been working on other models thus far, and had not yet seen these Delco Buick Sonomatics. The tone was almost as good as some of the Hi-Fi amplifiers that we worked on in that shop! Those radios used a pair of 12V6 power vacuum tubes in ultra-linear push-pull to drive a built-in 7, or 8 inch speaker.

But most car radios of that era, up through today, were dogs, tone-wise. They used Class-A amplifiers with high distortion and consumed immense amounts of dc power. Even when transistors came along, initially in the late 50's but for real in 1962, the circuit designers used class-A amplifiers with limited negative feedback. Some lower cost models had total harmonic distortion figures in the 5 percent range. The efficiency was terrible! A class-A single-ended amplifier is theoretically no more than 25 percent efficient. This means that a 10w output audio amplifier requires 40w of dc power!

By the late 60's, some Japanese and a very few American car radios were using push-pull amplifiers of one type or another. A class-B audio power amplifier can produce up to 78.5 percent efficiency. The total power dissipation for a class-B push-pull amplifier under zero input signal conditions is near-zero watts. Compared with the class-A amplifier, we find that 100 percent of the power is dissipated by the class-A under no signal conditions. This means that the transistors used in class-A single-ended amplifiers must be much larger than the transistors used in class-B push-pull amplifiers. The introduction of the class-B amplifiers reduced the physical size of the transistors, and increased the power output for any given level of A-lead current. It is interesting to note that Blaupunkt, Telefunken, and Becker Autoradio, the principle European manufacturers of auto radios, were using push-pull back in the vacuum tube days and never changed. This is one reason why "fine car" enthusiasts routinely ordered one of these manufacturer's products with their new cars. Some U.S. makers used the same single-ended, class-A power amplifiers into the70's as were used in the later 50's and early 60's! True, they made the preamplifiers in IC form, but the power amplifier remained the same.

But today, some new winds are blowing through the auto electronics field. Advances in audio circuitry have made it possible to offer power levels exceeding 100w (where 10w used to be a "big" auto audio amplifier), Hi-Fi levels of THD, and extra features such as graphic equalizers! Part of this advance is due to IC technology, which makes some of them possible in the first place, while the rest of the pressure comes from customers who demand Hi-Fi-like sound in their cars.

Never underestimate the power of that demand. I saw it initially in the early 60's when customers were first ordering FM car radios. They were simply not happy with the sound because it did not approach the sound produced by their new stereo units at home. Today, most

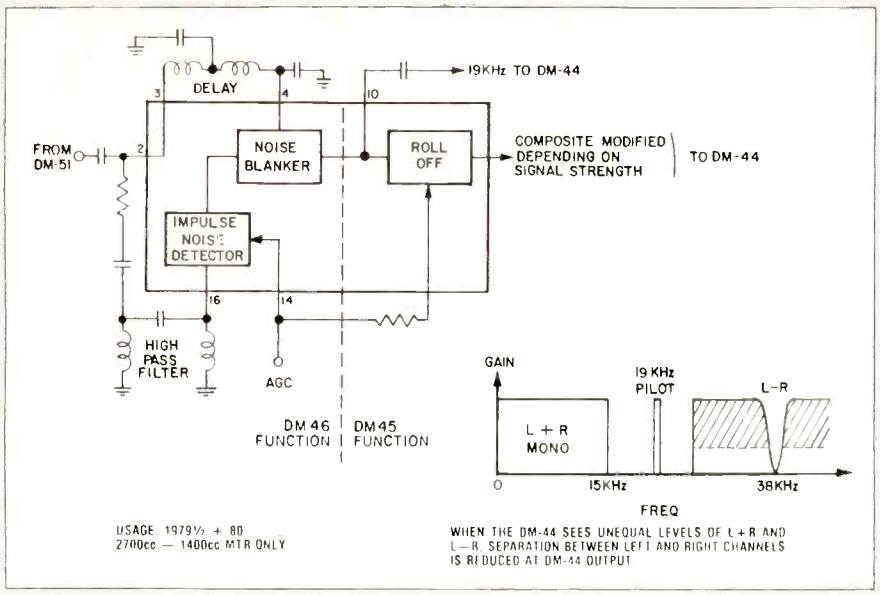


Fig. 2 The Delco DM-105 tick-filter/blend IC.

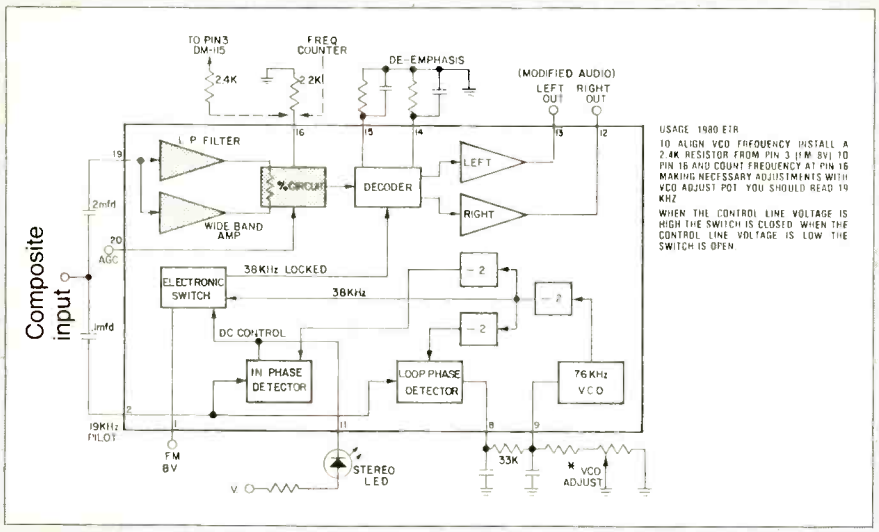


Fig. 3 Delco's DM-115 stereo decoder and blend IC.

car radios are stereo, and have THD figures more in line with what was demanded by customers for a long time.

Improved FM

Several problems have always aggravated FM auto audio customers. In the old days, all we could do was shrug, and curse the salesman that promised them the moon. But today, circuitry is available to reduce some of these problems.

One of the problems was impulse noise from spark plugs and other electrical sources. The common complaint was that " . . . told us that FM is noise free." This was strengthened by experience with home stereo equipment that was, indeed, noise free. But noise-free operation is guaranteed in FM receivers only when the signal level was sufficient to drive the limiter circuit into full limiting. The noise amplitude modulates the incoming carrier, so the limiter can slice the noise impulses off the carrier without affecting the frequency modulation of the carrier. But, in auto radio situations, the vehicle would move about from one location to another, and this meant that it would see varying signal strengths. In many, perhaps most, locations the signal strength would be too low to insure noise free operation.

Another problem was that the stereo decoding would become noisy as the signal strength dropped. As you drive away from the station, the stereo will become noisier and noisier until it is almost unlistenable. But, note, the mono FM mode is still capable of producing listenable signals, even though the input signal is too low to provide proper stereo decoding.

Figure 1 shows the block diagram of a new detector IC used in the 1980 Delco (General Motors) FM stereo car radios. This IC contains a noise suppression circuit. The input stage is an FM IF, which receives the bandwidth limited signal from the IF output of the FM mixer IC and crystal filter (CF). This signal is then passed internally to the quadrature detector (ICQD). The detector outputs two signals. One is the composite audio and the other is the AFC voltage. The composite signal is applied to an audio amplifier, from whence it is split into two paths. One path takes it through a delay line (external to the IC) to the signal input of an electronically variable attenuator stage. The other path is through a buffer amplifier, a high-pass filter, and an impulse noise detector.

The impulses of noise riding on the FM IF signal are predominantly high frequency in nature. The high-pass filter at the input of the noise detector, then, reduces the composite, and passes the noise impulses. These trigger the noise detector into two different operations. One is to turn on a 10 dB pad (i.e. the variable attenuator) that reduces the signal amplitude markedly during off-station operation. The second is to fire a pulse into the noise blanker. This stage will briefly turn off the audio path for the duration of the noise pulse, thereby eliminating the impulse in the audio signal passed to the outside world via the wideband amplifier.

Alignment of the phase coil is made easier by this circuit. The voltage between pins 9 and 10 of the DM-111 is 0 ± 100mv when the radio is correctly tuned. The phase coil in the ICQD can be aligned to produce this voltage when the radio is tuned to a constant FM IF/RF input signal. Interestingly enough, a misaligned phase coil will mute the audio output.

The DM-111 is used in the electronically tuned FM-stereo receivers produced by Delco for 1980. But they make a version for the 1979½-80 manually tuned AM/FM radios in the form of the DM-105 tick-filter/blend IC (Fig. 2). This IC contains two sections. One is the noise blanker section, which operates in the same manner as the noise blanker section of the DM-111 above. The second section is used to reduce the problem caused by low signal strength into the stereo decoder. The AGC signal applied to the rolloff section of the DM-105 is used to modify the composite signal according to the signal strength. when the signal is strong enough to produce good decoding of the stereo signal, then the L+R and L-R signals are passed full-strength. But, as the FM signal drops lower, the rolloff section will begin to reduce the amplitude of the L-R portion of the composite,

without reducing the L+R. This will reduce the stereo separation as the signal strength is reduced!

A similar function is provided by the new stereo decoder IC used by Delco, the DM-115. In this case, the blending of the stereo/mono functions as the signal level decreases is provided in the percentage circuit (shaded portion of Fig. 3). The composite from the FM detector is applied to two amplifiers. One is the wideband amplifier which amplified the L-R and L+R signals equally. The low pass filter amplifier, on the other hand, amplifies the L+R, and attenuates the L-R. The outputs of these amplifiers are blended together in the percent circuit. Under high signal conditions, the composite is passed entirely from the wideband amplifier. But, as the AGC signal drops in response to lower signal levels at the antenna, the percent circuit will begin to crank in more and more L+R from the low pass filter. This will begin to "monauralize" the signal as input strength drops lower. The rest of this chip is a VCO "coilless" stereo decoder.

Bridge audio

Some new car radios, notably the Delco models, have a little tag on the chassis that says "DO NOT GROUND LOUDSPEAKERS." Why not? After all, aren't car radio loudspeakers normally grounded? In the past, single-ended and push-pull audio amplifiers used a speaker system in which one side was grounded. This makes sense in a car radio because we can then use the car chassis as the return for the speaker system. But, in making sense economically, it also limited the bandwidth in many models. The output transformer sapped frequency response. When transformerless outputs came along, they too had a single-ended output configuration. But now we are seeing something called bridge audio. What is bridge audio? See Fig. 4.

Figure 4 shows the block diagram for a bridge audio power amplifier stage. Transistors Q1 through Q4 are power amplifiers, and are connected into a bridge circuit with the loudspeaker at the bridge output terminals. You will recognize Q1/Q2 and Q3/Q4 as the ordinary single-ended totem-pole output amplifier used for a number of years in auto radio. Ordinarily, the voltage at points X and Y is ½-Vcc, which is this case would be ½ (14), or 7v dc. When a signal is applied, the phase inverter section will turn one transistor of each pair on and the other off, depending upon the polarity of the input signal. The voltage at points X and Y will, then rise and fall with the input signal. To make the circuit an audio bridge, we must connect two totem-pole power amplifiers such that a loudspeaker is connected between X-Y. When there is no input signal, the dc voltages at points X and Y will be 7v dc, so the net voltage across the loudspeaker is zero.

To make this circuit work properly, we must conspire to drive the Q1/Q2 amplifier out of phase with the Q3/Q4 amplifier. This will drive the signal at point X up, when point Y is going down. Similarly, when point X is dropping in response to the input signal, the point Y voltage increases. This creates a large net signal across the loudspeaker than would be possible with either transistor pair alone.

Amplifiers A1 and A2 are used to drive the power amplifier sections. Preamplifier A1 is an audio operational amplifier connected in the noninverting follower configuration. This means that the voltage at point B will be in-phase with the voltage applied to the noninverting (+) input of A1. The signal at *B* will drive the Q1/Q2 transistor pair.

We need to drive Q3/Q4 with an inverted version of the input signal. The signal at point C must be 180 degrees out of phase with the input signal. But note where the input of the inverting follower (A2) is connected. If we connected it directly to the signal input of A1, as might be expected, it would load the circuit too much. In actual practice, the input resistor to A2 must be quite low in value. But, by the normal operating rules for operational amplifiers, the voltage at point A is *identical* to the voltage applied to the noninverting input.

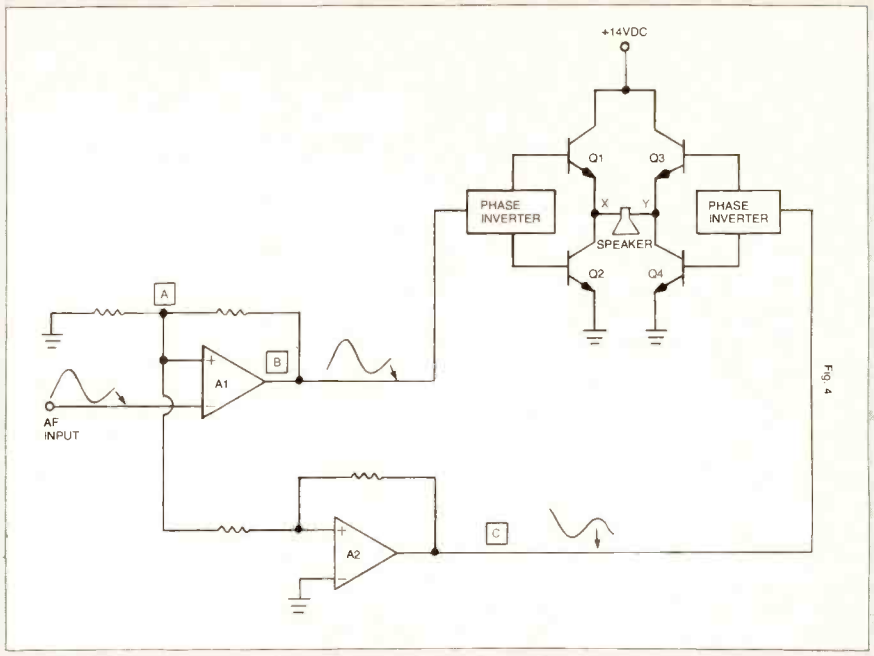


Fig. 4 A typical bridge configuration amplifier.

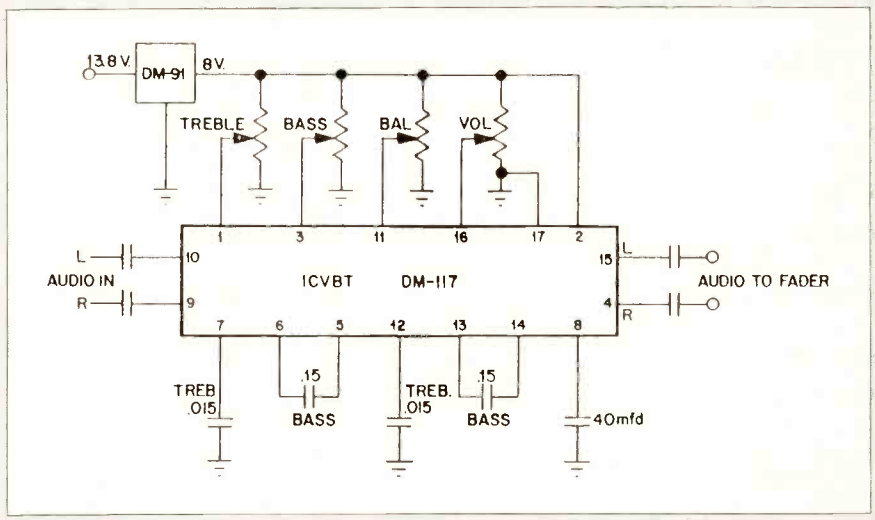


Fig. 5 DC control of volume/tone/balance with the Delco DM-117 IC.

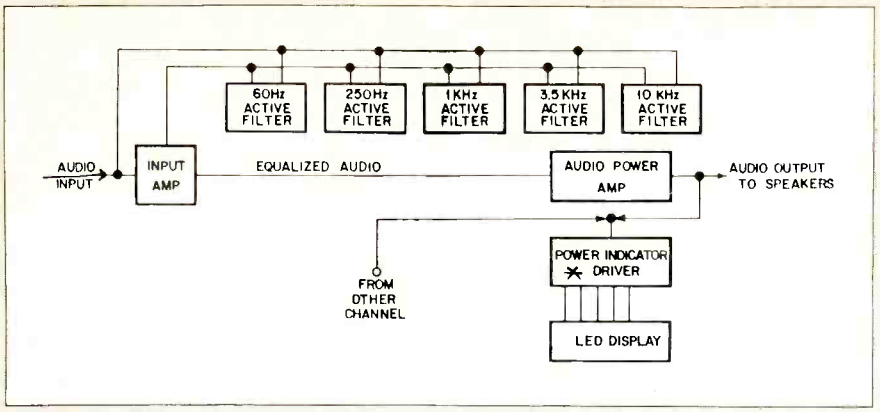


Fig. 6A block diagram of an active filter graphic equalizer.

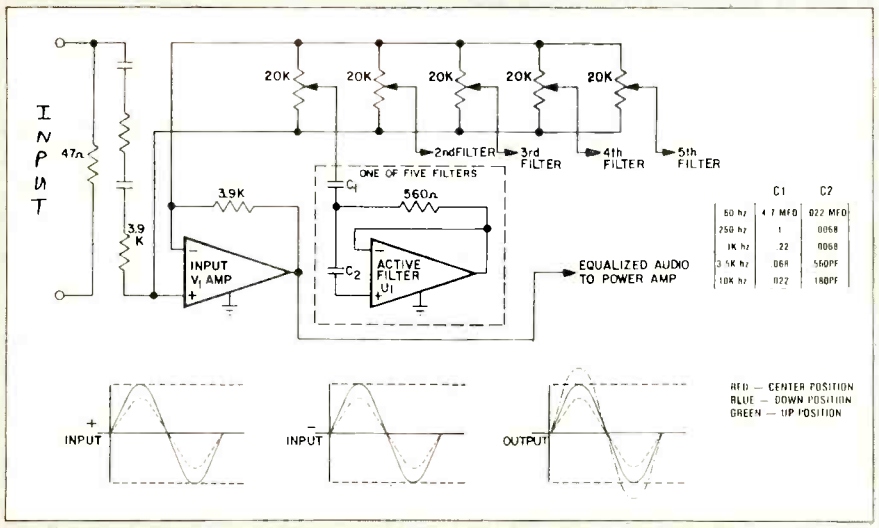


Fig. 6B Schematic of one of the active filters.

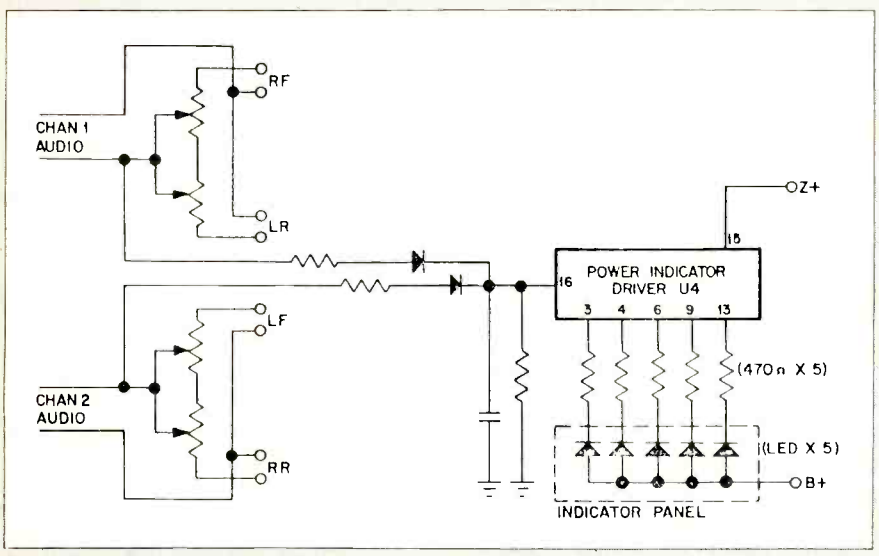


Fig. 7 Delco's power level indicator.

It is a basic property of any operational amplifier that the inverting and inverting inputs always stick together. This means that a voltage applied to the noninverting input will also appear on the inverting input. Since this is a lower impedance point, we can connect the input to the inverting amplifier (A2) to the inverting input of the noninverting amplifier (A1). Confusing? Read it several times until you are either starry eyed or understand it (sigh).

Delco started using bridge audio in IC form several years ago when they introduced their DM-84 ICBA device. Current Delco models use the DM-84 plus several "later generation" versions of the device. (DM-98, DM-125, etc). Delco offers the DM-84 through their regular auto radio parts distributors. But another division of Delco also offers the device under the number DA101 through *industrial* electronics parts wholesalers. These don't ordinarily deal with servicers, but will on a COD basis if a minimum order (usually $15-30) is met. The price of the DA-101 is considerably less than the DM-84, but servicers report that the two are pin-for-pin compatible (in fact, identical).

Some modern Delco receivers use four ICBA chips to feed the four speakers. It is common in stereo car radios to have front and rear speakers for each channel, so four speakers are needed. But, in most radios, there are only two power amplifiers for the four speakers. In the Delco design, there are four power amplifier ICBA chips, one for each speaker, in the external power amplifier module models. The fader control is low level, meaning that it takes the preamplifier signal and routes it to the inputs of the two power amplifiers serving that channel.

One principle cause of noise pick-up in car radios since the first Motorola was put on the market is low level signal pick-up in the audio stages. Motor noise impulses would come into the chassis via the radio power wiring, and would then be radiated to nearby volume/tone control wiring. The fact that the raw, unfiltered, dc power from outside of the radio is fed to a switch *mounted on the* multi-potentiometer volume/tone control didn't help much. In fact, it is relatively common over the years to see service bulletins from car radio manufacturers asking the servicer to re-dress audio and/or power wiring in the vicinity of the volume control in order to reduce noise pick-up.

This problem is lessened by allowing dc control of the volume and tone control circuits. This is done in the Delco DM-117 IC-Volume-Bass-Treble (ICVBT) device shown in Fig. 5. The left and right channel low level audio signals from the stereo decoder is input via pins 9 and 10. The bass, treble, balance and volume controls signals are dc levels derived from an 8v dc regulator circuit. The signals from the audio never have to come near the noise-ridden dc power wiring in the vicinity of the switch. Hence, the listener hears less of the impulse spark noise and alternator whine than would be present in ordinary volume tone circuits.

Graphic equalizers

A graphic equalizer is a device that will boost, or attenuate, the audio signal according to the frequency band. This

continued on page 43

Security Electronics

From basics to details

ET/D will be presenting the essentials of electronics as applied in security equipment in a series of features by Mr. Ross, beginning with the most elementary concepts and progressing to detailed descriptions of equipment such as microwave motion detectors and other sophisticated security devices.

By James A. Ross

ELECTRONIC TECHNICIAN/DEALER has recognized that electronic security is a field which is growing very rapidly with many business opportunities for its readers. Accordingly, the editors have made plans to feature security regularly in the future, and, as a part of those plans, have asked me to do a series of articles on the subject. For my part, I am in total agreement with their reasoning and their objectives. I teach electronics at a college which specializes in electronic engineering technology and I have been heavily involved in security for many years. I *know* that it is a rapidly growing field and I *know* that there are great opportunities for you if you understand electronics and how the security equipment/systems work.

Most of the people working in security have experience in police work, guard services, investigative and protective companies; but few really understand the first thing about voltage, current, Ohm's Law, dc, ac, AF, IF, RF, etc. The security business is full of horror stories of problems caused by errors made which were the result of a total lack of knowledge of some very basic theory.

In these articles I will present technical information relating to equipment and systems which you may become involved with. I will be pleased to answer questions and give advice. I am not an installer so I will not be presenting "hints and kinks" on how to install systems. I will pass along comments from readers, but keep in mind that I must respect the request that certain information not be revealed because it is proprietary and divulging it could damage someone's competitive position in the marketplace. Other than proprietary information and tips which could help the bad guys, the articles will be factual, technical and in whatever detail is necessary to put the point across.

To set the scene for this series I have prepared a chart to show my concept of electronic security, its subdivisions and how they interrelate. Referring to the chart, I see the three main areas under protection of persons and property as the ones into which the experienced electronic technician can move quickly and easily. Those areas are intrusion detection and alarm systems, access control systems, and loss-prevention systems. I plan to start with intrusion detection and alarm systems, covering sensors, processing and communication, and response systems in that order. Later in the series, after we have covered these topics, we'll cover how to design a system incorporating the appropriate elements to accomplish the objective within the budget. So for this first article let's take a first look at the sensors used for intrusion detection and examine the most common one in detail.

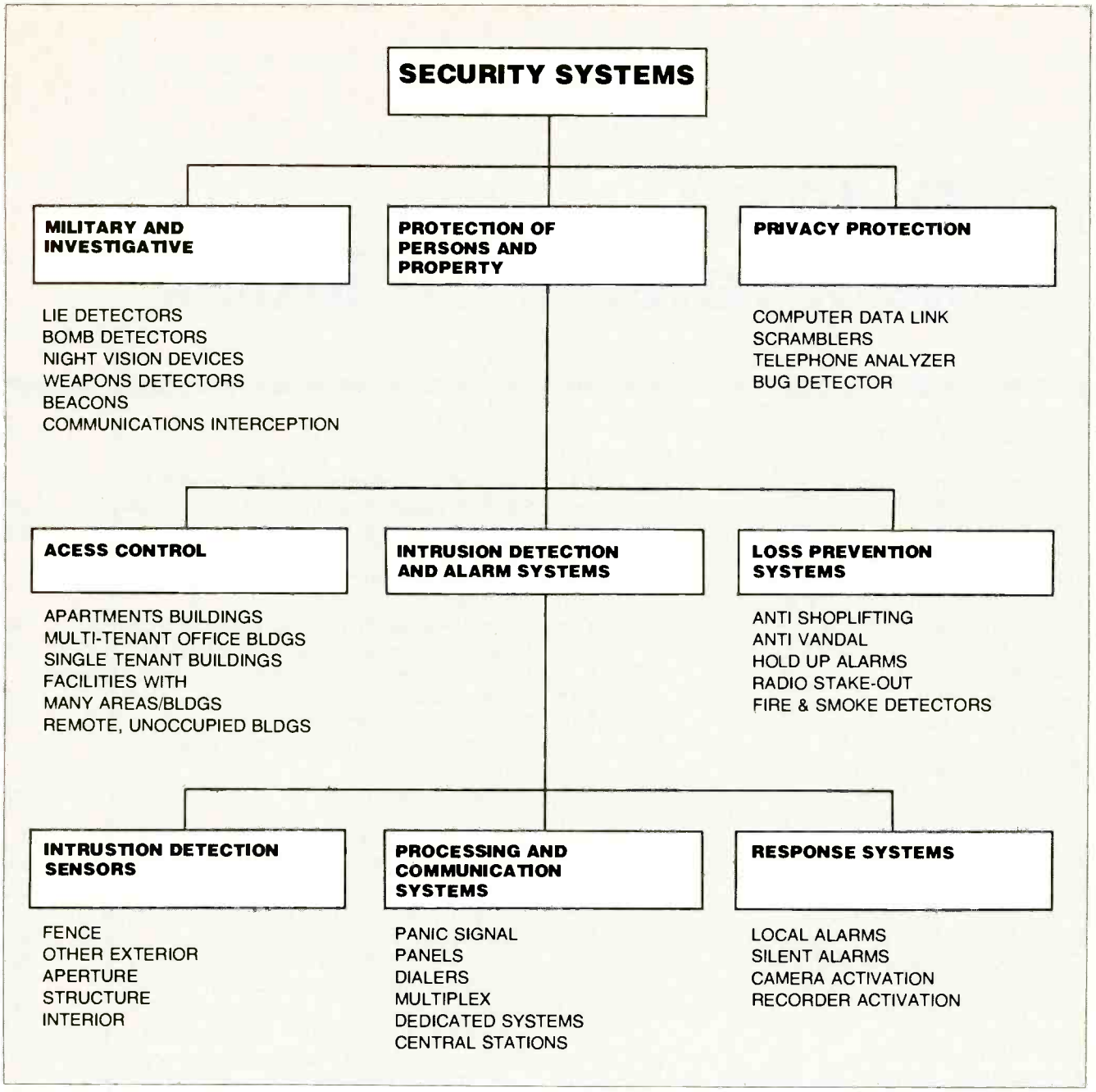
As shown on the chart, sensors can be classified by where they are used: fence, other exterior, aperture (window, door, skylight, etc.), structure, or interior. Another method of classifying sensors is by the type of coverage each provides, such as area, line or point. In my comments on sensors for this series however, I plan to classify them according to how they work electronically with the most common being:

Break Wire (including magnetic switches, plunger switches, and window tape)
Ultrasonic Doppler
Microwave Doppler
Audio Discriminator
Passive Infrared
Vibration/Tilt/Motion Switches
Pressure and Tape Switches
Light Beam (visible or invisible)

Less common that those listed above, but with good potential for some applications are:

Seismic
TV with motion detection
Air Pressure
Proximity (capacity switch, etc.)
Stress and Strain
Manned Optical/Audio

And last but not least is the most common sensor of all-the one which is, at one and the same time, the simplest and most complicated: the human being with his five senses (or six!) equipped with a panic button which is either hard wired, or connected by radio, ultrasonic, or sound to the processor and response system. The human cannot be ignored in this discussion because protection of the person is the most important aspect of this technology and the human can play a very important role



The security field subdivided by function. All of these apply electronics—indeed require electronics.

as a sensor.

As you can appreciate, a detailed technical discussion of all sensor types would fill many books, but we'll be covering at least one sensor or sensor system each month in this series of articles.

Let's consider the simplest of all electronic intrusion detection systems. It consists of one closed loop which conducts current continuously as long as the perimeter remains intact. The current is run through the winding of an electro-mechanical relay, holding the relay contacts open. If the current is interrupted, the relay closes creating the alarm signal by connecting the alarm power supply to the alarm-bell, siren, lights or whatever. This single closed loop consists of a simple series circuit with normally closed switches at all doors, windows, or other possible entry points. The switches most commonly used are magnetic switches consisting of two parts: the magnetic reed switch attached to the door frame and the activating magnet fastened to the door opposite the switch. When the door is closed the switch is closed and forms a part of the closed loop. When the door is opened, the magnet moves away and the reed switch opens, cutting off the current and creating the alarm.

These are by far the most common switches in use. They are good, they're reliable, they're easy to install, the wiring is very, very simple to install because it's all on the surface. However, the other side of the coin is that all of the characteristics which make them valuable and useable are characteristics which may be negative characteristics. For instance, they are surface mounted. This means that every person coming and going sees them, knows they are there, and is tempted to play games and vandalize. If you look at security systems in model homes you find that in almost every case the surface mounted magnetic switches have in some way been damaged during the viewing hours for the model homes. It is not that this person is intending to break in later; it's just simply there and it's a challenge to see if it can't be somehow destroyed or beaten. For this reason, a

continued on page 45

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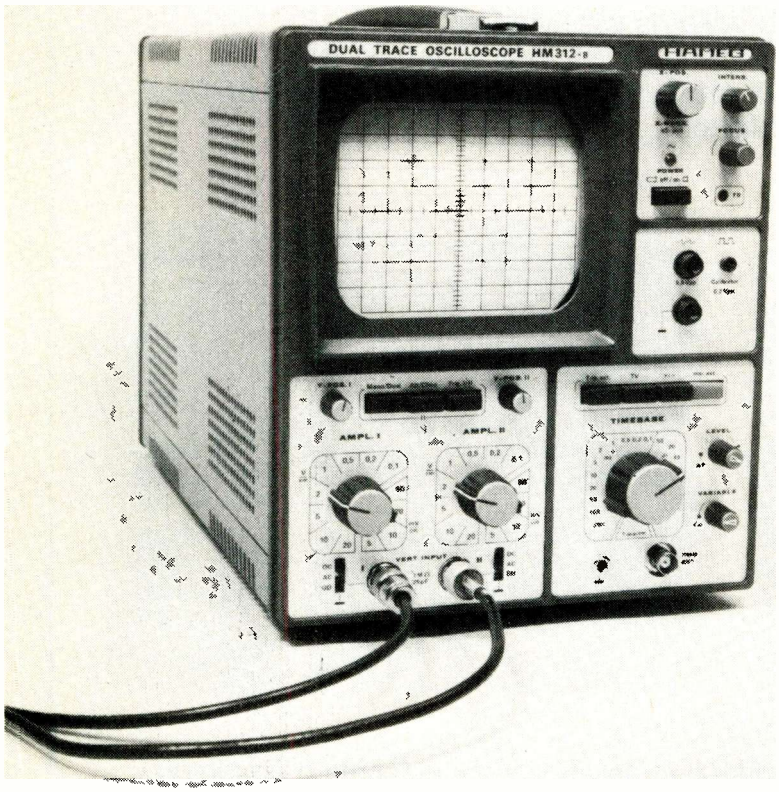

The Hameg HM 312 oscilloscope.
For more information Circle No. 150 on the Reader Service Card.

The Hameg HM312

A new scope from Europe

by Walter H. Schwartz

Hameg is a rather recent entry into U.S. oscilloscope markets. The West German manufacturer has been setting up marketing and now assembly operations in the United States and ultimately hopes that a full line of scopes will be assembled at its Long Island facility.

At present five models are marketed in the U.S.: The HM 307, a 10MHz single trace three inch scope which includes a component tester function and costs $405; the HM 312, a 20MHz dual trace unit, priced at $580; the HM 412, similar to the HM 312, but including delayed sweep; the HM 512, a 50MHz dual trace delayed sweep instrument and the HM 812 a 50MHz storage scope. The prices of these last three are $915, $1,485, and $4,035 respectively. These prices appear quite competitive.

We selected for evaluation the HM 312 because of its apparent feature/price position in the marketplace. The HM 312 is a basic 20MHz, dual trace, five inch (thirteen cm) instrument. It has all the basic, necessary features though several of these are not immediately apparent (read the manual!). The HM 312's bandwidth is specified at 20MHz (3dB down) and measures just a little better than specified. It has an input attenuator calibrated from 5 mv to 20 volts in a 1-2-5 sequence. There is no variable gain between these steps, which bothered me until I stopped to try to think just when I last used the variable gain. I cannot remember, though I do remember the last time I made measurements in error because someone else left the variable control off its calibrated position.

The HM 312 offers input modes of Channel I, Channel II, Channel I and II alternate or chopped as well as X-Y operation (X input via Channel II). Switching from Channel I to Channel II is by depressing the Alt/Chop switch. Depressing the Mono/Dual switch also, then selects dual trace operation. For X-Y operation the Hor. Ext. switch is depressed. Although the specified bandwidth of the X channel is 2.3MHz it appears, from our tests, to operate satisfactorily as a color television vector-scope. The input rating is 500V dc + peak ac.

Sweep speed of the HM 312 is from 0.5 usec/cm to 0.2s/cm also in a 1-2-5 sequence and the X5 magnifier increases this to 100 ms/cm. It offers automatic or variable manual trigger level from either Channel I or II or an external source. TV trigger coupling strips high frequencies from the trigger signal for better television frame (vertical) trigger.

After a bit of learning the HM 312 seemed to behave as it should. I had to get used to the triggering—why I'm not sure, but it did behave well once I did. The control layout follows what has become a sort of standard, so everything is about where one would expect it. A viewing hood is valuable; the trace is bright enough, but somehow, at least under our lighting conditions, the CRT face reflected a considerable amount of glare. The hood took care of this problem. Beyond this, what should I say? The calibration is accurate, the bandwidth is as specified and it could do what I asked of it with one exception. I had to use external trigger from the vertical sweep to view VITs and VIR signals. But then most scopes seem to require this.

The mechanical construction of the German built HM 312 is modestly impressive. The circuit boards are glass epoxy mounted to a sturdy aluminum chassis frame and subpanel. Switches and controls are small but quite sturdy in appearance; the ICs are in sockets; calibration trim pots are not subminiature and delicate but full size units. The case is steel with a dark grey finish. The front panel is molded plastic but it is backed up by the aluminum subpanel to which are mounted the switches and input connectors.

A number of accessories are available for use with the HM 312. The HZ 30, X10 probe is $25.00 as is the HZ 35, X1 probe. The HZ 36, X1/X10 probe is priced at $30.00 and the HZ 37, X100 probe costs $60,00. The HZ 37 is useful for input voltages to 1500 volts. A demodulator probe, the HZ 39 costs $28.00. Carrying cases, and a scope cart are available as is a very useful viewing hood/light shield at $12.75.

Hameg also makes a component tester accessory costing $58.00 a four channel adapter and a calibrator. ET/D

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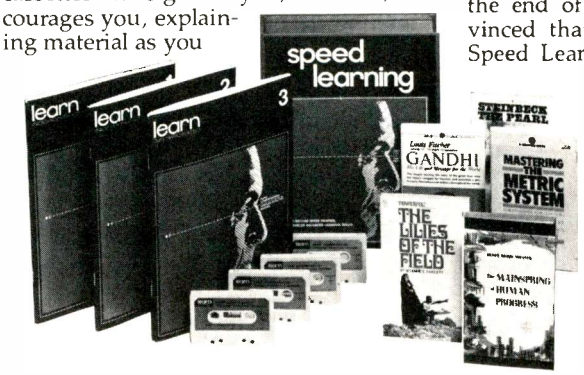
In just a few spare minutes a day of easy reading and exciting listening, you discover an entirely new way to read and think — a radical departure from anything you have ever seen or heard about. Research shows that reading is 95% *thinking* and only 5% eye movement. Yet most of today's speed reading 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*.

Imagine the new freedom you'll have when you learn how to dash through all types of reading material *at least* twice as fast as you do now, and with greater comprehension. Think of being able to get on top of the avalanche of newspapers, magazines and correspondence you have to read . . . finishing a stimulating book and retaining facts and details more clearly and with greater accuracy than ever before.

Listen-and-learn at your own pace

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.

Examine Speed Learning FREE for 10 days

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.

You must be delighted with what you see or you pay nothing. Examine this remarkable program for 10 days. If, at the end of that time you are not convinced that you would like to master Speed Learning, simply return the program and owe nothing. See the coupon for low price and convenient credit terms.

Note: Many companies and government agencies have tuition assistance plans for employees providing full or partial payment for college credit programs.

In most cases, the entire cost of your Speed Learning Program is Tax Deductible.

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Speed Learning is approved for credit by the following professional and educational institutions:

- **Foundation for Accounting Education** 20 CPE Credit Hours
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- **College Credit** 3 credits from the National College of Business

Details and registration forms included with each program.

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HBJ-5-ET/D-1280

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Please send me the Speed Learning Program at $89.95 plus $3.00 for handling and insured delivery.

Please check the method of payment below:

☐ Check or money order enclosed for items ordered. New Jersey Residents add 5% sales tax.

☐ Please charge my credit card under the regular payment terms: ☐ Bank Americard ☐ Master Charge Interbank No. _____ ☐ American Express ☐ Diners Club

Card No. _____ Exp. Date _____

I understand that if after 10 days I am not delighted in every way, I may return the materials and obtain a full refund with no questions asked.

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Address _____

City _____ State _____ Zip _____

x Signature _____

If you don't already own a cassette player, you may order this Deluxe Cassette Recorder for only $49.95. (Includes handling and delivery.)

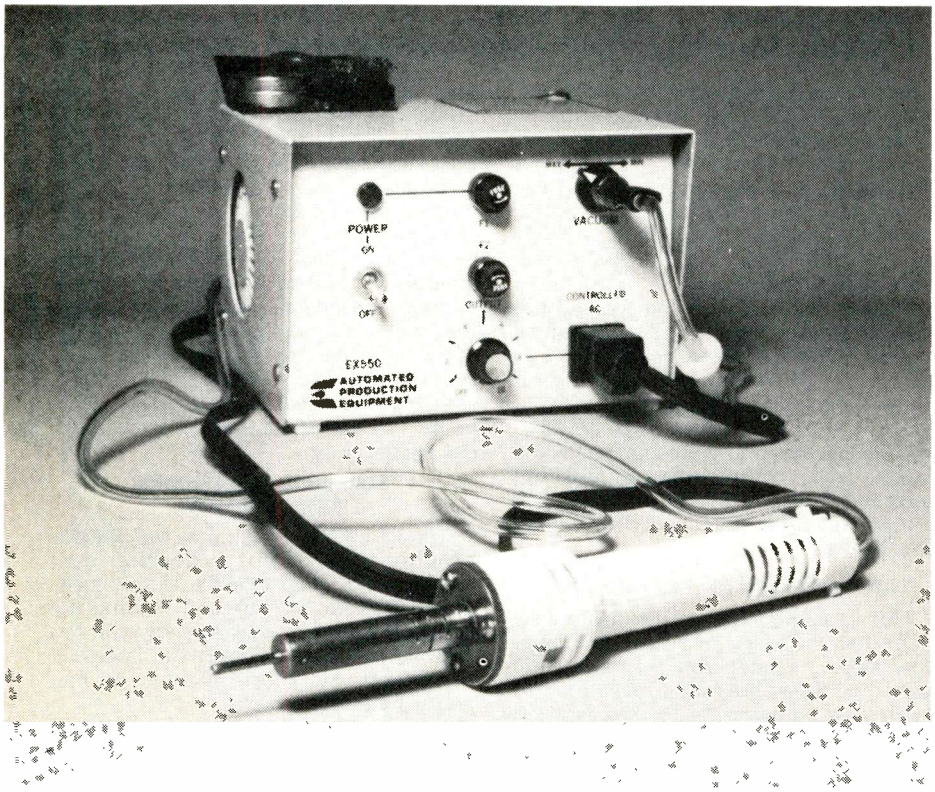
Check here to order ☐

Outside U.S.A. $99.95 + $3 surface mail — airmail extra

TEST INSTRUMENT REPORT

This time Test Instrument Report is going a bit afield and is reviewing a tool which because of its cost is a little out of the class of casual purchases and therefore warrants such consideration.

Automatic Production Equipment manufactures several desoldering and rework systems of which the EX 550 at $269.00 is the least expensive. The EX 550 is a self contained system consisting of a power unit and a handpiece; the system is powered from 120V. The power unit contains a small vacuum pump, controlled by a foot switch and a heat control for the desoldering handpiece. The control/regulator circuitry is electrically quiet; we could not hear it in a radio plugged into the same circuit a few feet away; the radio had to be right next to the power unit to pick up its switching transients. The temperature control is calibrated roughly in tip temperature, 6 corresponds to a tip temperature of about 600°F; 9 corresponds to 900°F, and so on. The handpiece looks a bit clumsy but handles well. Tips are available in various sizes from .091 in I.D. (.123 O.D.) to .018 in I.D. (0.04 O.D.).



The Automated Production Equipment Model EX 500.
For more information circle No. 151 on the Reader Service Card.

Automated Production Equipment's EX-550

Desoldering made easy

by Walter H. Schwartz

We used the EX 550 to desolder about two hundred connections in salvage circuit boards and a Sony TV receiver. At about connection number one-ninety-eight it stopped working—clogged. The filters weren't clogged nor was the hose. Upon close examination, we found the silicon rubber seal between the handpiece body and tip assembly had somehow filled solidly with solder. Melting this solder with another soldering iron cleared it immediately. This seal is the one place where the brushes, etc., supplied with the EX 550 will not clear clogs. I found the vacuum control valve was not set at maximum—perhaps if it had been this solder would have been pulled out completely through the seal into the removable glass tube where it could have been cleared out easily.

Attached to the top of the power unit case is an assembly consisting of a good handpiece holder and a flux container and a wire brush. I note that a dual free-standing holder—for a desoldering handpiece and an iron—is available with the more expensive systems. These also have hot air pressure and two heat controls, one for the soldering iron and one for the desoldering handpiece.

Automated Production Equipment has available a variety of tools for reworking circuit boards. They offer drills, burrs and abrasive wheels, thermal tools such as strippers, plating and other circuit board repair supplies, and circuit board cleaning supplies.

The EX 550 is low enough in cost so that the service shop doing a reasonable amount of component replacement should consider it (or a similar unit). We found it to clean circuit board holes and leads quickly and efficiently enough to avoid board or pad damage. It works quickly enough to avoid separation of copper from the board.

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.

ABP

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

NEW PRODUCTS

Low Noise Amplifier

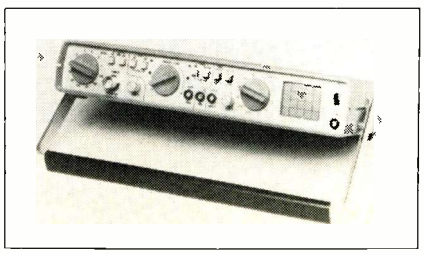
Circle No. 135 on Reader Inquiry Card

Avantek, Inc., is now offering a GaAs FET earth station preamplifier (LNA) with full 3.7-4.2GHz frequency coverage, 120°K guaranteed maximum noise temperature (1.5dB noise figure), and 50dB typical gain (with guaranteed ±0.5dB full-band gain flatness) at a $795 *single-quantity price.* This is reportedly presently the *lowest* price for a comparable LNA in the industry. This amplifier, designated the AEC-4215, is suitable for use in virtually any small earth station application—particularly the private and cable television receive-only terminals. Combined with a 4.5 to 6 meter diameter parabolic dish antenna (or the equivalent) and any one of a number of commercially-available receiver/demodulators, the AWC-4215 should provide distribution-quality television signals from the SATCOM or WESTAR transponders anywhere in the continental United States, and from the 3.7-4.2GHz ANIK transponders in Canada. Other performance characteristics of this low-cost GAAs FET LNA are +5dBm minimum output power (1dB gain compression), +15dBm intercept point for third-order intermodulation products and excellent gain slope group delay and AM-PM conversion characteristics to assure the undistorted amplification of wideband FM television signals. The maximum input and output VSWR in a 50-ohm system is 1.3:1 and 1.5:1 respectively. Powered from +15 to +18vdc (150 mA Typ.), the AWC-4215 accepts input power through the RF output connector. It may be powered directly by a receiver providing dc voltage to the feedline, or through an optional Avantek *DCB-42,* 3.7-4GHz dc block assembly. Built to the same standards as other Avantek 3.7-4.2GHz LNAs, the AWC-4215 is packaged in a one-piece cast-aluminum case with integral CPR-2295 waveguide flange (RF input) and type N female RF output connector. The case is coated with a textured urethane finish and the lid is sealed with elastomeric O-rings to assure complete weather resistance when used in an unprotected environment such as the antenna feedpoint. It also incorporates a ferrite isolator at the input to assure low VSWR—since input reflections can cause serious degradation of video signal quality. It contains an integral IC voltage regulator, RFI filter and reverse and over-voltage protection. The price of FET LNA is made possible by efficient, large-scale production techniques as well as the advantage of in-house production of all RF transistors—both GaAs FET and silicon bipolar—that are used in the AWC-4215. The AWC-4215 is available with deliveries 30 days ARO, and may be ordered directly from Avantek or through the world-wide network of factory-authorized representatives. A specification sheet on this product, as well as information on the complete family of 3.7-4.2GHz earth station amplifiers and accessory components is available.

Portable Oscilloscope

Circle No. 136 on Reader Inquiry Card

The new *Sinclair-Thandar* Model SC 110 portable oscilloscope reportedly offers full size oscilloscope performance in a light weight slim package with ultra low power consumption. The SC 110 is based on a 2 inch diagonal CRT which consumes extremely low power in the heater and deflection circuits. Vertical deflection bandwidth is DC to 10 MHz ± 3dB with a sensitivity of 10 mV to 50 V/division in 12 ranges and an input impedance of 1 megohm in parallel with 47 pF. Horizontal bandwidth is DC to 2 MHz ± 3dB with a sensitivity of 0.5 V/div. and an input impedance of 1 megohm in parallel with 10 pF. The switch selectable timebase spans the range from 0.1 microseconds/division to 0.5 secs./division in 21 steps with a calibration accuracy of ±3% for all but the fastest rate. Triggering is internal or external, selectable with AC, DC, TV frame and line coupling capability. Level is continuously variable over the waveform. The screen graticule is divided into 5 × 4 divisions, and economy mode blanks the screen to conserve power until the sweep is initiated by the trigger circuit. Unutilized circuitry is automatically shut down to contribute to battery life. The power requirements are 4 V to 10VDC from disposable cells, rechargeable cells, or AC adapter. The dimensions are 10 in. × 5.8 in. and the weight is less than 2 lbs. The price is $369.



Computer Technician Kit

Circle No. 137 on Reader Inquiry Card

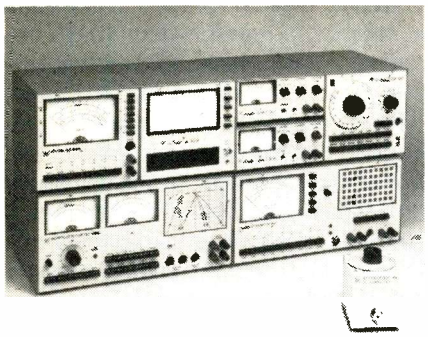
Jensen Tools Inc. has developed and introduced the new JTK-66, stated to be a complete kit for service and repair of computer equipment. The kit contains a wide array of tools. Included are a logic monitor and probe, circuit board puller, DIP insertion tool and extractor pliers,

wire strippers, soldering equipment, screwdrivers, nutdrivers and much more. The tools are mounted on two removable pallets in a durable injection molded attache case. The case features a combination lock and extra room for additional tools.

Audio Service Instrumentation

Circle No. 138 on Reader Inquiry Card

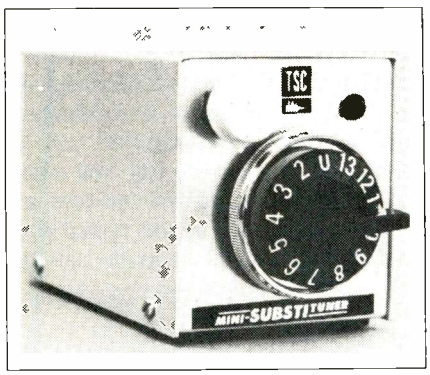
Bang & Olufsen have designed and developed professional measuring instruments for more than two decades. It is stated that robust construction and effective overload protection circuits in most instruments make them rugged and hard-wearing. They are compact, space-saving and versatile thanks to their simple modular construction. Their dimensions are based upon a basic module whose least common multiple is 8 cms. This permits easy stacking and facilitates easy handling. These electronic instruments offer a wide range of application-from work in the lab, to production, workmanship and training centres. Some of them are remote con-



trollable. The program comprises distortion meters, wow/flutter meters, audio monitors, power supplies, oscillators, and milliohmmeters. As something new January '81 Bang & Olufsen will launch a signal/noise meter, Type NM1. The instrument has built in filters and measures acc. to DIN 45405, DIN 45633, CCIR 468½, IEC 179, IEC 315-6, IHF-A-202, ANSI S 1.4, JIS C 1502 and others. In addition, the NM1 can be used as stereo watt-meter 0.4nW-140W, AF voltmeter 20 uV-370V, and measuring amplifier -50dB to +70dB, and there are built in detectors for true RMS, quasi peak, and average.

Mini Substitute Tuner

Circle No. 139 on Reader Inquiry Card

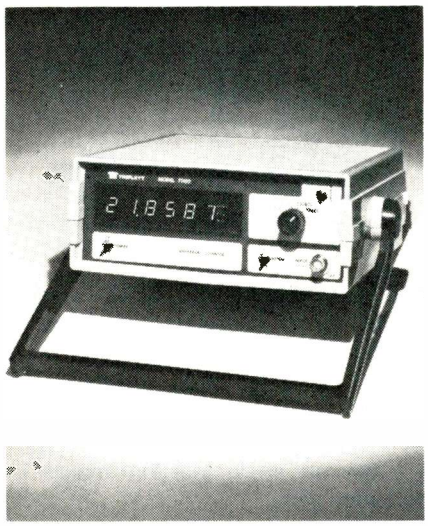


Tuner Service Corporation has developed what is said to be the smallest television tuner substitute now available on the television repair market. This 300 ohm, VHF testing replacement tuner, with the trade name of the "Mini-Substi-Tuner," comes with the IF connector cable and plug and is powered with two 9 volt batteries. It has 12 VHF channels, an on/off switch, AGC control and LED indicator.

80MHz Universal Counter

Circle No. 140 on Reader Inquiry Card

New Model 7000, 5Hz-80MHz Universal Counter just introduced by *Triplett Corporation,* utilizes an microprocessor controlled reciprocal counting scheme to offer sophisticated frequency, period and event measurements reportedly usually found only on instruments costing twice its $300 price. High resolution 5Hz-80MHz frequency measurement, plus totalize (event) counting to 1 billion and elapsed time measurement from 100μS to 100 hours is offered. Unlike other six-digit meters that usually are limited to 1 million counts, the Model 7000's microprocessor/ROM automatically rounds-off the display while continuing to count each event up to 1 billion. Another feature from the programmed circuitry is the Model 7000's elapsed time readout in hours, minutes and seconds, eliminating cumbersome calculations. The Model 7000 offers high resolution with the reciprocal counting scheme that permits six digit resolution even at 5Hz in just one second of measurement time. The 43'' LED readout with a floating decimal point is augmented with three annunciators that indicate proper reading levels of Hz/ms, K/μ or M/n. A selectable XI and X10 attenuator operates over the dynamic range of input signals to achieve an optimum signal/noise ratio. Operation is simple with the auto-ranging feature that permits a single color-coded selection knob for six operating modes. Operator confidence is further enhanced by the self-testing feature. In the TEST mode, the Model 7000 microprocessor systematically verifies proper circuitry and display performance. Extended time between calibrations and a specified ten-fold improvement in temperature stability over 0-40° C range is offered on the optional TCXO crystal controlled Model 7000.



Ten inches wide by 3-¾'' high by 9-¼'' deep, the Model 7000 is housed in a tan, high-impact thermoplastic LaFrance case with carrying handle. The unit operates on standard 115 VAC, 60Hz (230vac with internal Transformer jumpers) furnished complete with detachable 3-wire power cord and coax cable input lead. A rear panel accessory lead for input to an external (TTL or contact closure compatible) count gate is also provided.

Computer Terminal CRT Tester

Circle No. 141 on Reader Inquiry Card

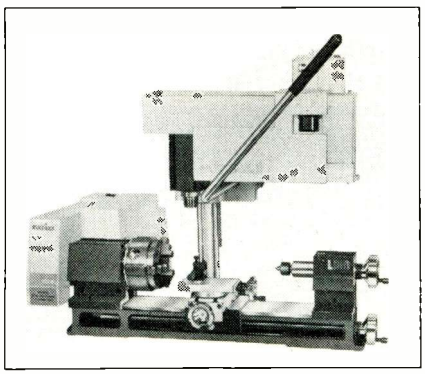
Complete information now supplied with *B&K-Precision* CRT restorer/analyzers permits the field testing of computer terminal cathode ray tubes—both monochrome and color. The B&K-Precision model 467 provides "yes or no" answers to tube conditions. A built-in restoring capability also permits the field engineer to often restore extended life to faulty tubes. B&K-Precision's 467 is designed for fast operation and can remove shorts and leakage from faulty tubes. Automatic restoration timing governs restoration duration. Perpetual set-up chart updates and new adapter developments help prevent obsolescence. The model 467 offers a multiplex testing technique, called TriDynamic™ testing. The system reportedly tests all three guns of a color CRT simultaneously, under actual operating conditions. Another 467 feature is its capability to test focus elec-

trode lead continuity. The B&K-Precision model 467 CRT restorer/analyzer is housed in a convenient carrying case with internal storage compartments for CRT adapters and set-up charts. The unit is priced at $360.

4-in 1 Machine Tool

Circle No. 142 on Reader Inquiry Card

Machinex 5 from *American Edelstall* is a multi-purpose metalworking machine designed to provide electronic and communication labs with a large variety of small parts machining operations. The basic tool, together with its accessories, reportedly performs turning, facing, boring, threading, drilling, reaming, tapping, milling, grinding, sawing and polishing. It can machine steel, cast-iron, soft metals as well as plastics and wood. The basic machine is a 5 in.-swing precision lathe with a 10 in. center distance. It features a headstock/drive/motor assembly that can be easily removed from the machine bed and remounted on an acessory steel column for all essential vertical drilling, milling and grining operations. The heastock's precision spindle is mounted in ball bearings, preloaded and lubricated for life. Six spindle speeds—250 to 4000 rpm are provided by a 4-pulley, V-belt drive system that is powered by a ¼-hp permanent magnet 110V motor that is included as basic equipment. The spindle nose is threaded 1 in. × 16 to mount accessory lathe chucks and tooling. It's bore takes special double-tapered collets up to ½ in. capacity. The machine bed is made from fine-grain cast iron and is heavily ribbed for maximum rigidity. Its dovetail bedways are precision ground to assure high accuracy. The lathe cross slide is T-slotted and with the tool post removed, is used as a milling/fixture table when the machine is set up for vertical operations. Both cross slide and carriage are gibbed for feed



and wear adjustments. All feed handwheels are chrome plated and feature resettable feed dials graduated in .001 in. Machinex 5 is priced at $399.95 and is manufactured in the U.S.A. Its machine system includes a large selection of accessory equipment that makes it quite versatile.

Multi-Function Counter/Timer

Circle No. 143 on Reader Inquiry Card

A new 150MHz multi-function counter/timer, the Model 5845, has been announced by *Data Precision Corporation*. This instrument, the successor to the Model 5740 counter/timer, measures frequency, period, period average, elapsed time, and event counting/totalizing. A feature of this counter is that is addition to measuring sinewave frequency it also measures and resolves pulses occurring as close as 15nS apart. With the digital input/output option, it reportedly can be completely remote controlled and will output full measurement and status data. The instrument has a specified sensitivity as low as 10mV rms for sinewaves or 30mV peak-to-peak for pulses and will accept signals as large as 250V. It has selectable (1/20) intput range attenuator and front panel adjustment of the trigger level and also features a switchable 100kHz low-pass filter to maximize noise rejection when measuring low frequency square wave or pulse signals. All readouts are direct reading in KiloHertz on the 8-digit, .43 in. high LED display panel. In frequency mode, gate time selection from .01 seconds to 10 seconds in decade increments allows resolution from 100Hz to 0.1Hz. When operating in the overflow mode the displayed least significant digits are true readings to get measurement resolution beyond the inherent limit of the display itself. In period mode, decade steps afford direct reading of the signal's period to a resolution of 1uS or by averaging 10,000, or 1000 periods, the resolution is increased to 10nS. All readings are directly in Microseconds or, in case of frequency, Kilohertz. Individual events, pulses, or frequency bursts are counted up to 2 Megapulses per second. The count is continuous with a display capability up to 99,999,999, the display will "roll over" and further counting will indicate an overflow occurred. When measuring time interval 99,999 seconds can be

displayed to the nearest millisecond (27.78 hours), elapsed time will continue beyond the display limit with the overflow light coming on. Once again, the reading will be correct in the least significant digits displayed. The instrument's standard time base is a 10MHz crystal with a specified basic accuracy of ±4 ppm per year. Provision is made to accept a TCXO as a option. Input impedance is 1Mohm shunting by approximately 25pf, as an accessory a 50ohm

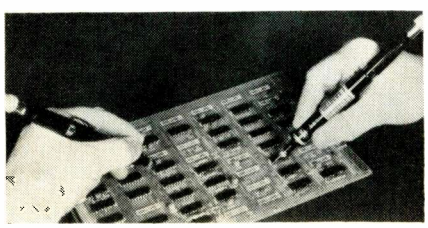
BNC termination is available. The Model 5845, housed in a standard Data Precision instrument case, 8¼ in. × 2-⅞ in. × 8-⅞ in. complete with carrying handle, features pushbutton control. It is designed for either 115V or 230 V standard power and dissipates less than 10W. The Model 5845 is priced at $325; a field-installable input/output option is available. This option provides full BCD output of data and status with printer controls. It also includes remote control of all functions/ranges, start/stop and reset control for automatic handling. Provision for an external 10MHz clock input is also included as part of this option. The price of this option is $125 and a TCXO is also available for 214.50.

Logic Probe and Logic Pulser

Circle No. 144 on Reader Inquiry Card

OK Machine and Tool's new PRB-1 Digital Logic Probe costs $36.95, yet, it is stated, offers features of much more expensive probes. It detects pulses as short as 10 nsec, and has frequency response to better than 50MHz and automatic pulse stretching to 50 nsec (+ and -). It is fully compatable with all RTL, DTL, HTL, TTL, MOS, CMOS and microprocessor logic families. It also features 120K ohm impedance, power lead reversal protection and overvoltage protection to 200v (+V-V). It features constant brightness LED's over full supply voltage range of 4-15v. The optional PA-1 adapter allows its use with supply voltages of 15-25v. It is supplied with a 6 foot coiled power cord and tip protector.

The PLS-1 logic pulser will superimpose a dynamic pulse train (20 pps) or a single pulse onto the circuit node under test. There reportedly is no need to unsolder pins or cut printed-circuit traces even when these nodes are being clamped by digital outputs. PLS-1 is a multi-mode, high current pulse generator packaged in a hand-held shirt pocket portable instrument. It can source or sink sufficient current to force saturated output transistors in digital circuits into the opposite logic state. Signal injection is by means of a pushbutton switch near the probe tip. When the button is depressed, a single high-going or low-going pulse of 2 μ sec wide is delivered to the circuit node under test.



Pulse polarity is automatic: high nodes are pulsed low and low nodes are pulsed high. Holding the button down delivers a series of pulses at 20 pps to the circuit under test. PLS-1 is suited for use in conjunction with the PRB-1 probe and costs $48.95. ET/D

Solid State

continued from page 19

recessed mounted plunger switch in the doorjamb on the hinge side below the lowest hinge is recommended. Mounted here it is out of the way and inconspicuous and these switches are very reliable. It is harder to install because it requires that a hole be driven into the doorjamb and another one down into the space for running the wiring but keep in mind that having wiring which is not exposed makes for a much more secure system.

The window switches can be recessed plunger switches or they can be the magnetic type. You should locate a standard sliding switch or toggle switch near the window in shunt with the other switch so that the homeowner can flip the bypass switch if he wishes to open the window for ventilation. If you have covered all of the doors and all of the windows with switches, you have covered the perimeter of the enclosed space. However, there are burglars who do not insist on opening the window. There are some who simply knock out all of the glass. If you want an additional degree of protection, something should be done to indicate the breaking of the glass. There are many methods which we will cover, but the oldest and most common method is to put a conducting tape around the window so that if the glass is broken the tape is broken. Again, this tape is a part of the series circuit entirely around the perimeter of the premises to be protected.

The system which has been described is the most common electronic intrusion detection system because it is simple, cheap and reliable. Because it is normally closed, it is called a self-supervising system (N/C means a normally closed loop with current flowing all of the time). That means that if someone tried to deactivate the system by cutting the wire, the very act of cutting the wire would cut off the current and therefore generate an alarm.

Next month I'll cover other sensors for use in detecting intrusion and introduce you to the "panel" which is the logic and processing heart of any electronic intrusion detection system. If you have any questions or any subject you specifically want covered, write to me c/o ET/D. ET/D

NEXT MONTH IN ET/D

- **A VCR Review**
- **More on MPU's**
- **Inventory Control**

Hi-Fi auto audio

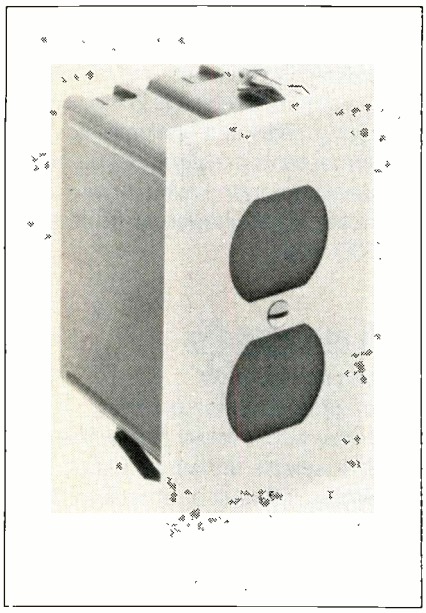
continued from page 29

device differs from the ordinary bass/treble boost circuit in that the equalizer selects narrow bands of frequencies to boost or attenuate. The front panel will contain five (or more) slide controls that allow the user to tailor the frequency response to personal taste. Each control will select an active filter (Fig. 6A).

The actual circuit is shown in Fig. 6B, although only one of the five active filter circuits is shown. While we don't have the space in this article to go into the operation of this circuit in detail, the filter is of a class called a *gyrator,* and it behaves like a series resonant LC tank. Let me forestall the objections "how can an RC circuit think it's an LC circuit?" The capacitor C1 is the tank circuit capacitance, while amplifier U1 and C2 are designed to pretend it is an inductor by dumping energy back into the circuit in the phase relationship resembling an inductance *(Op-amp Circuit Design & Application* by Joseph J. Carr, TAB Books 787).

The power indicator device in the circuit of Fig. 7 7 is a gimmick offered by Delco and certain others. Several semiconductor manufacturers offer a special bar graph display IC. There will be five (or more) outputs that are driven by a stack of five comparators. Each comparator is biased a little higher than the one below it, so will be turned on only when the voltage applied to all of them is of an appropriate level. Zero power will not allow any of the LEDs connected to the outputs to turn on. But as the power increases, first one and then the others are turned on. When all of the LEDs are on, the amplifier is producing a maximum output. I presume that this feature gives the driver something to watch while waiting for a traffic light. ET/D

SECURITY PRODUCTS



Passive I R Detector

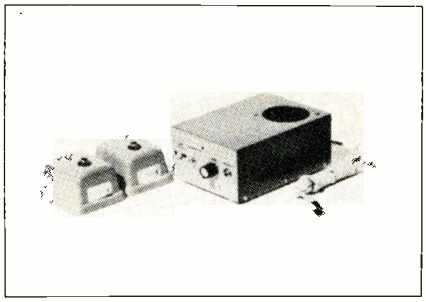
Circle No. 153 on Reader Inquiry Card

Intended for residential and mini-commercial applications, the DS903 passive infrared was designed by *Detection Systems, Inc.*, to be flush mounted so to resemble an ac outlet for greater security and room decor. Balanced detectors cancel the effects of vibrations, pressure changes and hot and cold drafts directly on the unit. Illumination changes including a 100W tungsten light bulb switched on and off in a sensitive zone at 20 ft. also have no effect. Field of view is internally adjustable of ±10° on the horizontal plane. When aimed straight ahead the unit offers a maximum range of 40 ft. composed of 2 sensitive zones, each 2 ft. wide by 4 ft. high, spaced 4 ft. apart. A dual power supply allows for 6-18vdc or 12vac operation providing battery standby with the ac operating unit.

Audio/Video Security System

Circle No. 154 on Reader Inquiry Card

A new line of security products has been recently introduced by *Louroe Electronics*. The key product is a sensitive microphone. This electret microphone reportedly is designed especially for security work and is stated to be capable of picking up sounds within a 30 foot diameter. As support for the security microphone, Louroe has designed a line of peripheral equipment. The model AP-1 is a power supply-monitor amplifier,

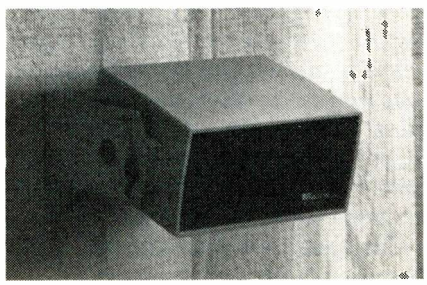


capable of monitoring two microphones, one at a time, in two different locations. The AVS Series incorporates the properties of the AP-1 with the addition of Audio-Video Switching giving total security support. In this series, both cameras and microphones are switched automatically and sequentially. All support equipment has both audio and video line outputs for conveniently attaching to video monitors and VTR equipment.

New Motion Sensor

Circle No. 155 on Reader Inquiry Card

A compact and low cost motion sensing controller for varied applications such as automatic lighting control, access control, prowler protection or energy control is available from *Racon, Inc.* Called the MicroTrol, the easy to install, self-contained microwave unit has an adjustable sensing range up to 30 feet. The sensor, upon detection of motion, provides a 24 Vac output signal to actuate an external control relay for accomplishing control functions such as turning lights on or off, running conveyor lines, opening warehouse doors or sounding an alarm. The MicroTrol, for both indoor and outdoor

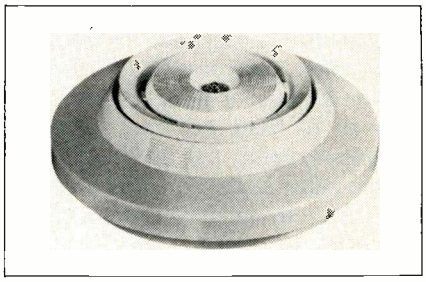


use, it housed in a metal die cast case which reportedly eliminates RFI or environmental contaminant problems. Temperature changes, air motion, sounds and humidity changes do not affect operation. The Micro Trol unit is provided with a multi-position mounting bracket. An LED indicator that lights when motion is detected allows the installer to adjust the detection range to the desired distance. Detection range is adjustable from 5 to 30 feet. On time is adjustable from 30 seconds to 3 minutes. The unit requires 24Vac input to operate. Unit cost for the Micro Trol is $132.00.

Fire/Smoke Detector

Circle No. 156 on Reader Inquiry Card

Ademco's No. 648 is a two wire dual chamber system ionization detector, which may be used with a 24vdc fire control system (such as the Ademco No. 880) that has Class B, 2-wire initiating device loops. Powering and monitoring of the detector is accomplished over two wires from the fire control panel. The dual chamber is highly sensitive to products of combustion and can respond quickly to fast burning (clean fires) and slow smoldering fires. Its dual chamber permits exceptional stability in almost all installation environments. Detector will latch in alarm and turn on an LED. The 649 Base must be used in conjunction with the 648 Detector which easily twist-locks into place. Ademco offers a wide variety of alarm system components, control panels and sensors.



Home TV/Security System

Circle No. 157 on Reader Inquiry Card

GBC's LOOK-OUT 2000 allows a television to present regular TV programming while doubling as a video security system. The moment the doorbell rings while the TV is being watched, the LOOK-OUT receiver switches automatically into a closed circuit TV that lets you see and talk with the person at the door. The LOOK-OUT system is designed to handle as many as three camera locations with one receiver. Parents inside can keep an electronic eye on children playing outside, a mother in one room of the house can watch her children playing in another.

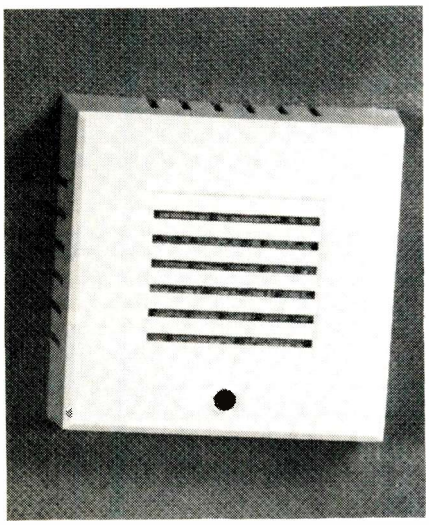
The entire system consists of a CCTV

camera weighing less than 2 lbs., a UHF/VHF CCTV 82 channel 12" black and white TV receiver, indoor-outdoor camera mount, sound module and plug-in cable. It is prewired and requires little installation. The camera mounts with only a screwdriver. The dealer price of the basic system is $3.50; additional cameras are $136.50.

Sound Discrimination Switch

Circle No. 158 on Reader Inquiry Card

MRL, Inc. has a new product for security dealers and installers. The Audio Switch operates on 6 or 12 volts ac or dc, externally supplied. Hard wired, it is a sound discriminator unit, to be used in conjunction with most alarm control panels. Two models are available, either flush mount



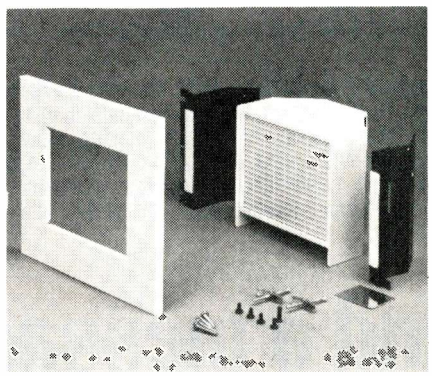
or surface mount. The unit has a sensitivity adjustment, NO and NC dry contacts, automatic reset, and low power consumption. The Audio Switch is reportedly a true sound discriminator, detecting sounds of forcible entry while ignoring sounds of normal operations.

Passive I R Detector

Circle No. 159 on Reader Inquiry Card

Arrowhead Enterprises has recently introduced a new passive infrared detector to the Alarm Industry. The heart of this new device is its, reportedly unique, optical lens. It is stated that unlike the current passive infrareds available, it does not rely on a fixed lens or a reflective mirror, but incorporates a segmented, *"interchangeable lens."* This front mounted lens can be easily removed allowing the installer to simply change the protective pattern, by changing the lens assembly. The two lens assemblies being introduced now, include a 40' × 40' *area protection* pattern and a 150' *long range* pattern. The area protection pattern has 12 zones, 6 long and 6 short. The long range pattern has 3 zones, a 150 foot zone, an intermediate zone and a short range zone. The S8000 can be ordered with either an area or long range lens installed. A benefit of this optical arrangement is that it gives the installer the capability of altering the protective pattern of any lens. By covering or "masking" any of the lens segments, you can eliminate one or more of the zones to avoid a potential trouble area.

Arrowhead, with the Series S8000, states they have overcome one of the major shortcomings of passive infrared detectors. Through the use of the pattern locator the installer can actually "see" what the detector is "looking" at. When the cover is removed the pattern locator automatically turns on. The installer when standing in one of the protective zones will "see" the pattern locator's red glow being illuminated from the lens array. He can follow the Pattern Locator and tell exactly where the unit is "looking." When he is *not* in a protective



zone the pattern locator will *not* be visible. During set-up he now knows if the detector is viewing a problem area, and if so, re-alignment of the internal optics or "masking" of a lens segment can change the field of view. Other features of the S8000 include an environmental interference test switch which can reduce false alarm potential by checking marginal environmental conditions. The sheet metal enclosure is formed to provide mounting of 45° or 90° and by using the internal optic adjustments, the unit can be installed to provide optimum protection. The S8000 will operate from either 12 Volt ac or dc and an optional standby battery is available when using ac input. This new passive infrared contains a cover-activated tamper switch with a dual set of contacts, one set is permanently connected to the alarm relay, and the second to the terminal block for 24 hour monitoring. The alarm/walk-test LED and the tamper switch are independent of each other, so set-up and walk testing can be done with the cover removed. ET/D

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AD INDEX

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NEW PRODUCTS

SECURITY PROD.

ET/D TEKFAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

	SCHEMATIC NO.
WARDS B&W TV Model GEN-11179A/B	1877
SHARP Color TV Model 19060	1878
QUASAR Color TV Chassis TS-968	1879

TEKFAX TEN-YEAR INDEX

Listed in this index are those TV receivers which have been covered in TEKFAX schematics during the period January 1971-December 1980. Brand names are listed in alphabetical order and associated model or chassis numbers are listed in alphanumeric order under each brand name. To the right of each model or chassis number is the number of the TEKFAX schematic in which it is covered. The month and year of the ET/D issue in which a particular TEKFAX schematic was published can be found by referring to the numerical TEKFAX-ISSUE cross reference on this page.

TEKFAX-ISSUE CROSS REFERENCE

1335-1339 ..... Jan. 1971	1524-1528 ..... May 1974	1711-1715 ..... Sept. 1977
1340-1344 ..... Feb. 1971	1529-1533 ..... June 1974	1716-1719 ..... Oct. 1977
1345-1349 ..... March 1971	1534-1538 ..... July 1974	1720-1722 ..... Nov. 1977
1350-1354 ..... April 1971	1539-1543 ..... Aug. 1974	1723-1725 ..... Dec. 1977
1355-1359 ..... May 1971	1544-1548 ..... Sept. 1974	1726-1729 ..... Jan. 1978
1360-1364 ..... June 1971	1549-1553 ..... Oct. 1974	1730-1733 ..... Feb. 1978
1365-1369 ..... July 1971	1554-1558 ..... Nov. 1974	1734-1736 ..... March 1978
1370-1374 ..... Aug. 1971	1559-1563 ..... Dec. 1974	1737-1740 ..... April 1978
1375-1379 ..... Sept. 1971	1564-1567 ..... Jan. 1975	1741-1744 ..... May 1978
1380-1384 ..... Oct. 1971	1568-1572 ..... Feb. 1975	1745-1748 ..... June 1978
1385-1389 ..... Nov. 1971	1573-1577 ..... March 1975	1749-1751 ..... July 1978
1390-1393 ..... Dec. 1971	1578-1582 ..... April 1975	1752-1755 ..... Aug. 1978
1394-1398 ..... Jan. 1972	1583-1587 ..... May 1975	1756-1759 ..... Sept. 1978
1399-1404 ..... Feb. 1972	1588-1592 ..... June 1975	1760-1763 ..... Oct. 1978
1405-1409 ..... March 1972	1593-1597 ..... July 1975	1764-1767 ..... Nov. 1978
1410-1414 ..... April 1972	1598-1602 ..... Aug. 1975	1768-1770 ..... Dec. 1978
1415-1419 ..... May 1972	1603-1607 ..... Sept. 1975	1771-1775 ..... Jan. 1979
1420-1424 ..... June 1972	1608-1612 ..... Oct. 1975	1776-1779 ..... Feb. 1979
1425-1429 ..... July 1972	1613-1617 ..... Nov. 1975	1780-1783 ..... March 1979
1430-1434 ..... Aug. 1972	1618-1621 ..... Dec. 1975	1784-1787 ..... April 1979
1435-1438 ..... Sept. 1972	1622-1626 ..... Jan. 1976	1788-1791 ..... May 1979
1439-1442 ..... Oct. 1972	1627-1630 ..... Feb. 1976	1792-1797 ..... June 1979
1443-1446 ..... Nov. 1972	1631-1635 ..... March 1976	1798-1801 ..... July 1979
1447-1450 ..... Dec. 1972	1636-1640 ..... April 1976	1802-1805 ..... Aug. 1979
1451-1454 ..... Jan. 1973	1641-1644 ..... May 1976	1806-1810 ..... Sept. 1979
1455-1459 ..... Feb. 1973	1645-1648 ..... June 1976	1811-1814 ..... Oct. 1979
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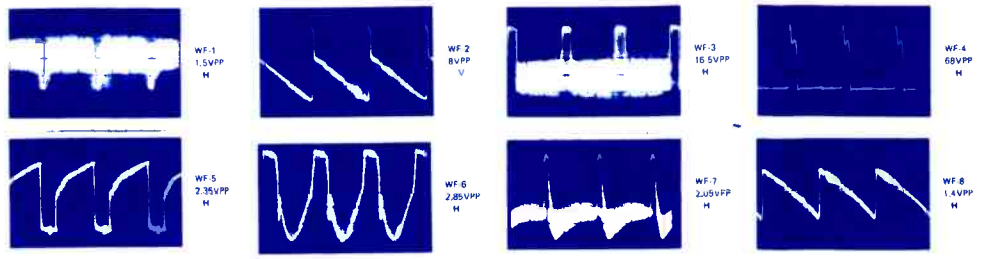
1478-1481 ..... July 1973	1666-1669 ..... Nov. 1976	1832-1836 ..... March 1980
1482-1485 ..... Aug. 1973	1670-1674 ..... Dec. 1976	1837-1640 ..... April 1980
1486-1489 ..... Sept. 1973	1675-1678 ..... Jan. 1977	1841-1645 ..... May 1980
1490-1494 ..... Oct. 1973	1879-1682 ..... Feb. 1977	1846-1850 ..... June 1980
1495-1499 ..... Nov. 1973	1683-1686 ..... March 1977	1851-1855 ..... July 1980
1500-1503 ..... Dec. 1973	1687-1690 ..... April 1977	1856-1860 ..... Aug. 1980
1504-1508 ..... Jan. 1974	1691-1695 ..... May 1977	1861-1864 ..... Sept. 1980
1509-1513 ..... Feb. 1974	1696-1700 ..... June 1977	1865-1868 ..... Oct. 1980
1514-1518 ..... March 1974	1701-1705 ..... July 1977	1869-1876 ..... Nov. 1980
1519-1523 ..... April 1974	1706-1710 ..... Aug. 1977	1877-1879 ..... Dec. 1980

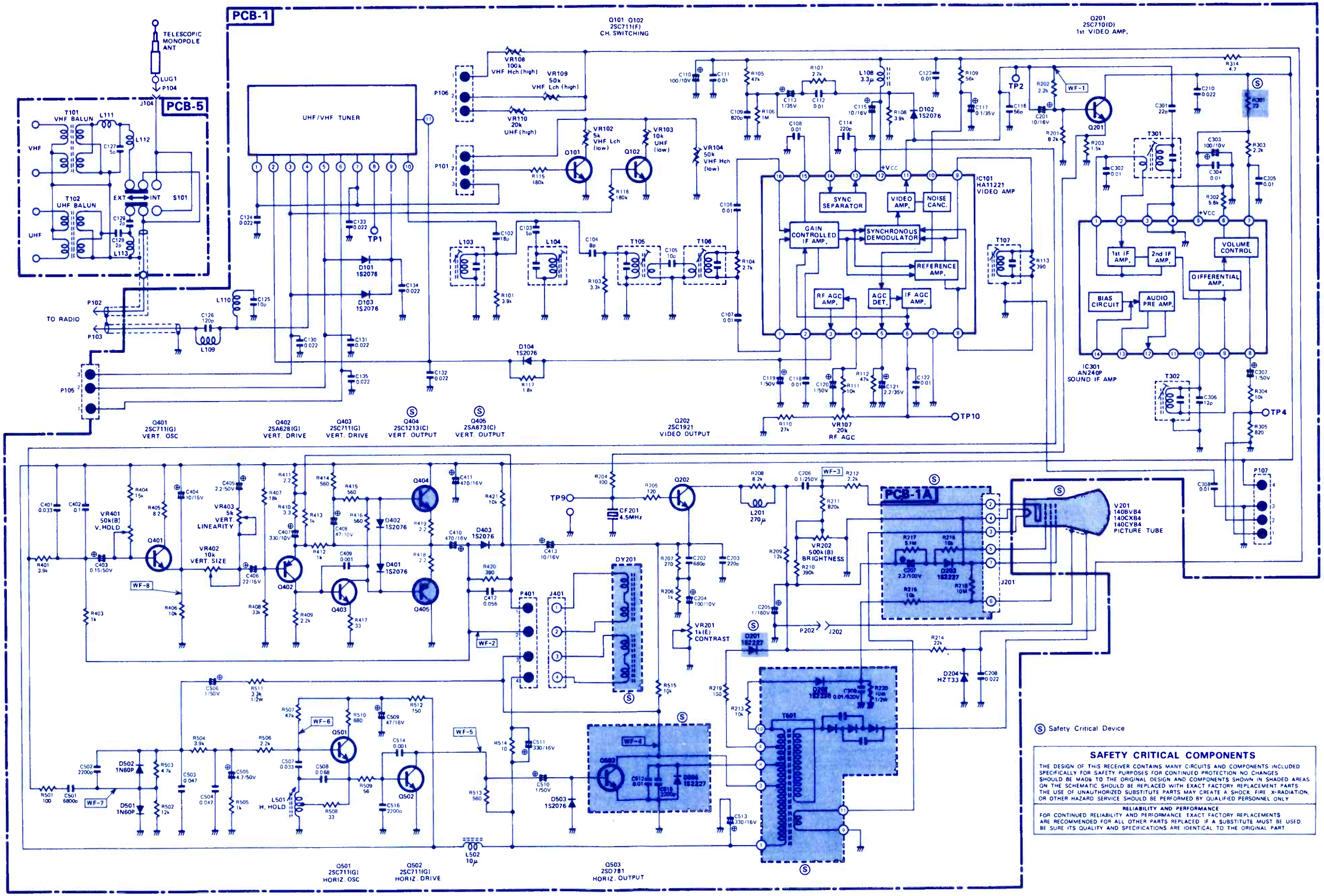
Continued on next page

ET/D TEKFAX
COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS

1877
WARDS
B&W TV Model
GEN-11179A/B

DECEMBER • 1980





Ⓢ Safety Critical Device

SAFETY CRITICAL COMPONENTS

THE DESIGN OF THIS RECEIVER CONTAINS MANY CIRCUITS AND COMPONENTS INCLUDED SPECIFICALLY FOR SAFETY PURPOSES FOR CONTINUED PROTECTION NO CHANGES SHOULD BE MADE TO THE ORIGINAL DESIGN AND COMPONENTS SHOWN IN SHADED AREAS ON THE SCHEMATIC SHOULD BE REPLACED WITH EXACT FACTORY REPLACEMENT PARTS. THE USE OF UNAUTHORIZED SUBSTITUTE PARTS MAY CREATE A SHOCK, FIRE, X-RADIATION, OR OTHER HAZARD SERVICE SHOULD BE PERFORMED BY QUALIFIED PERSONNEL ONLY

RELIABILITY AND PERFORMANCE

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

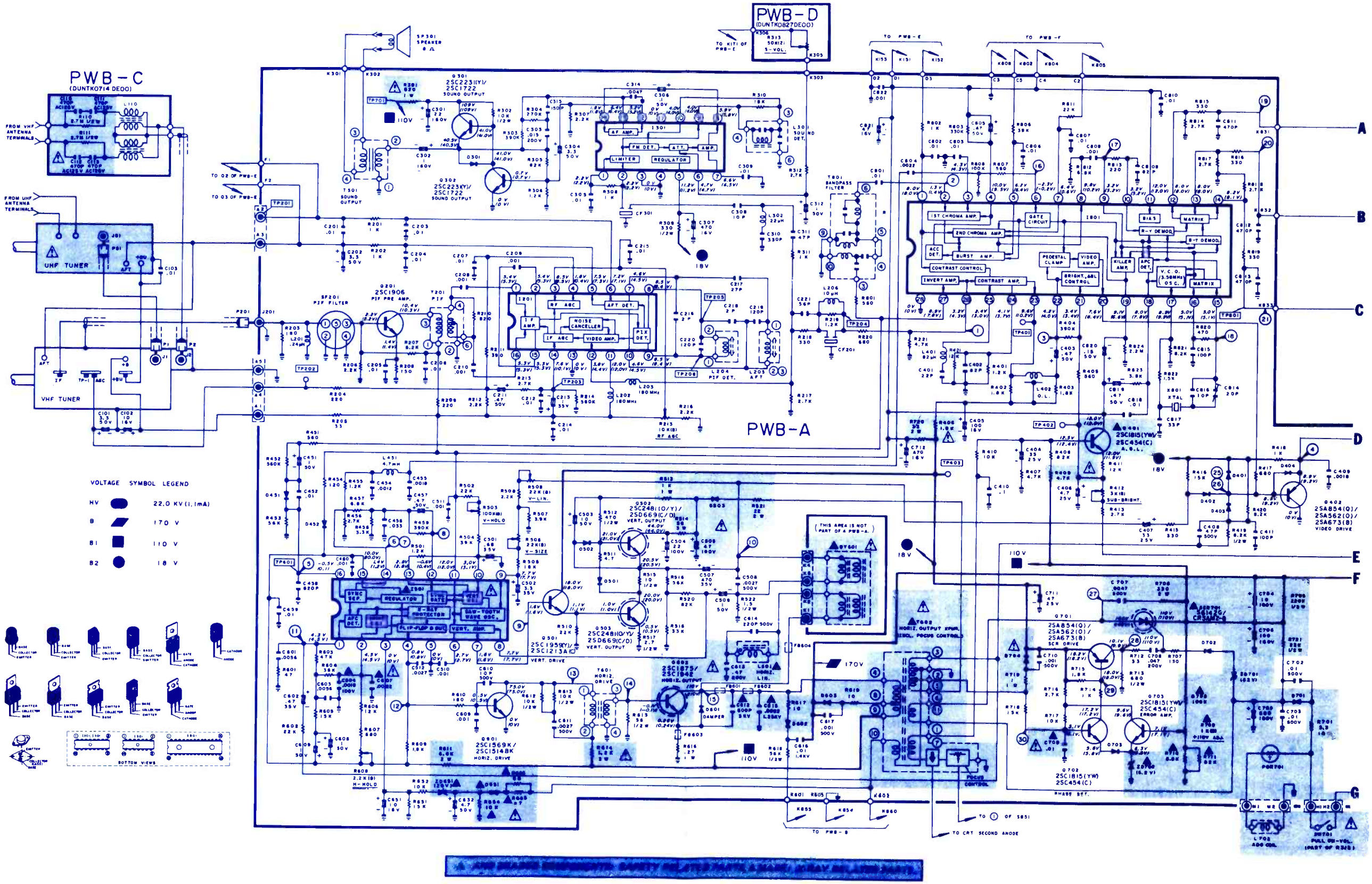
1878

SHARP
Color TV Model
19060

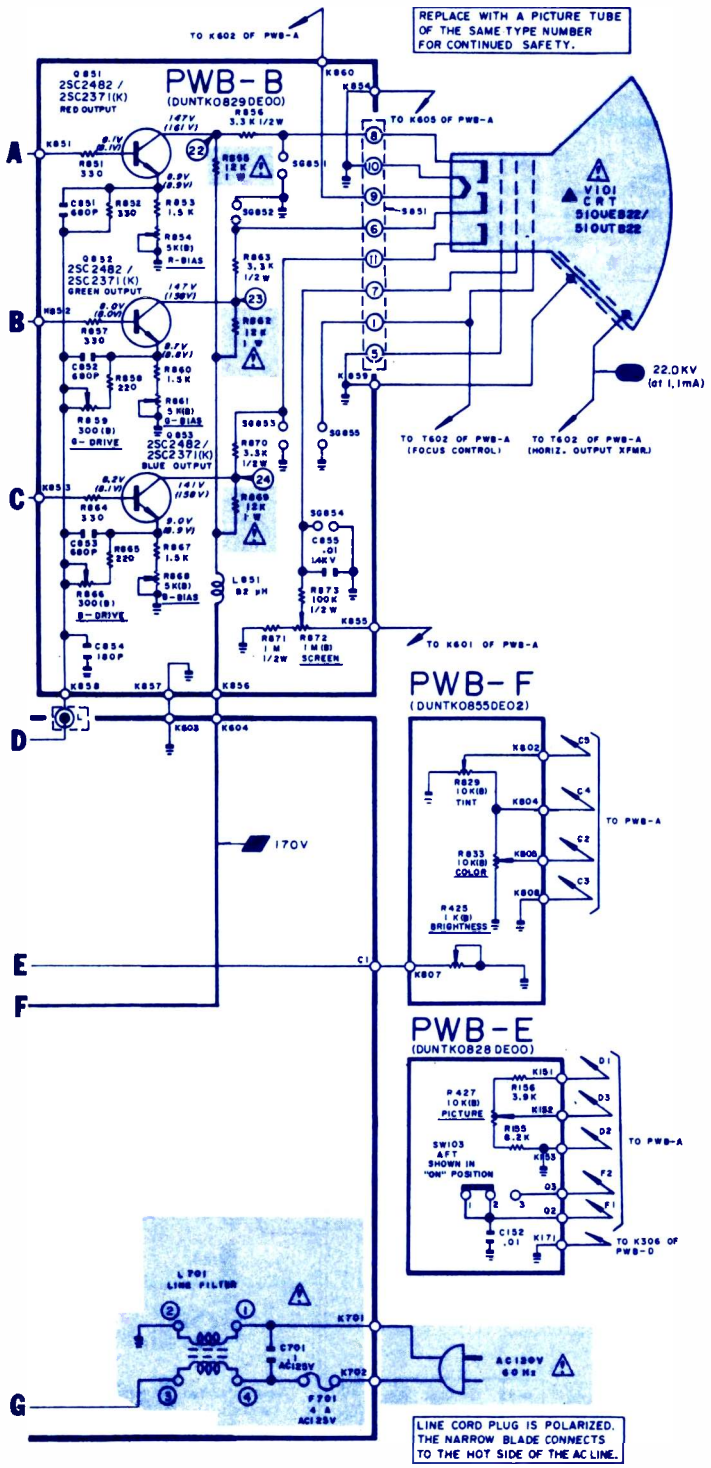
DECEMBER . 1980

ET/D TEKFAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS



SHARP
Color TV Model
19060



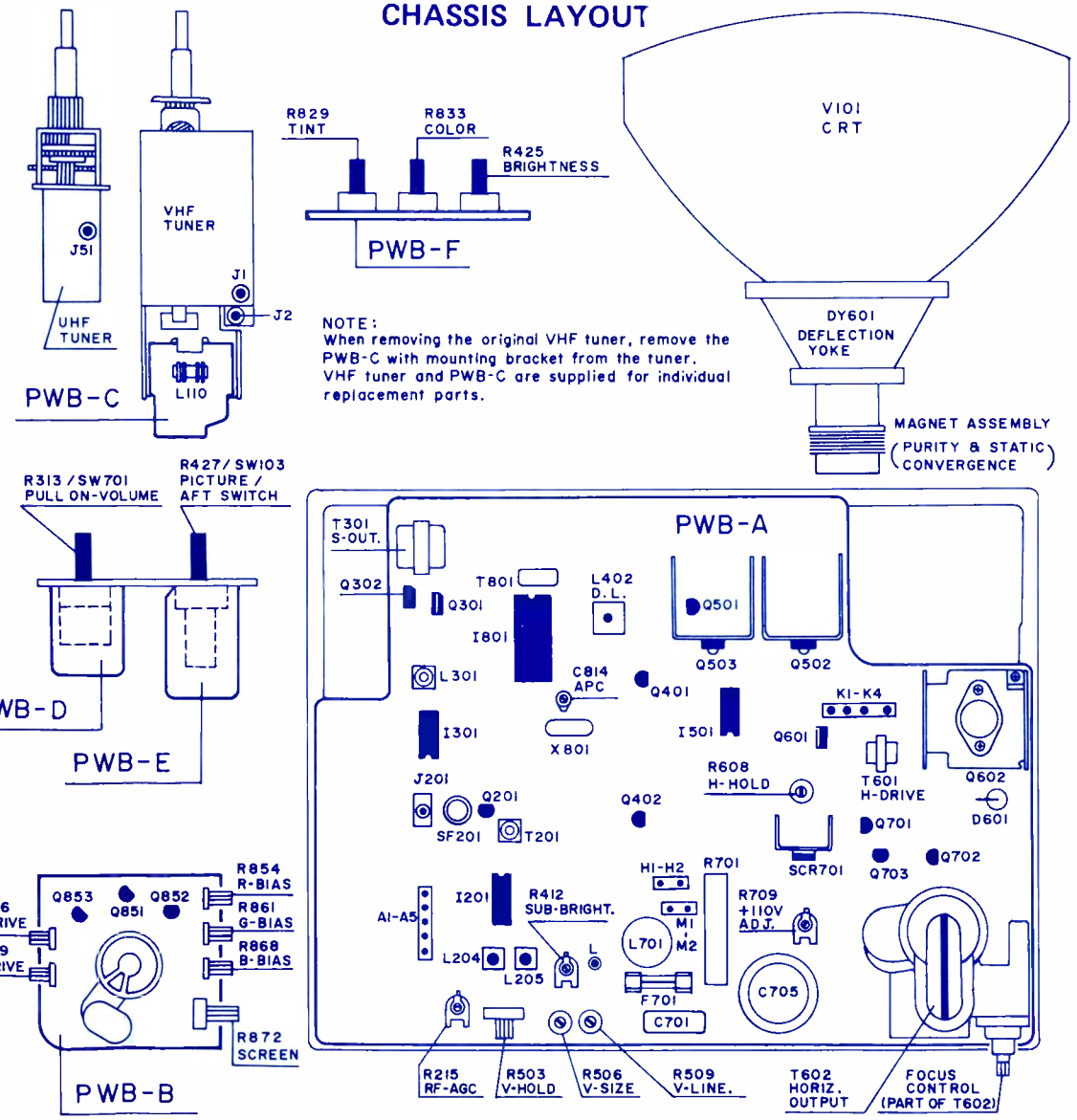
SAFETY PRECAUTION:

A. Service personnel should be thoroughly familiar with safety procedures before attempting repairs.
B. ⚠ and shaded components have special characteristics important to safety. For continued protection, replacement parts must be identical to those used in the original circuit.
C. The use of a substitute replacement part which does not have the same safety characteristics as the factory recommended replacement parts shown in this service manual may create shock, fire, x-radiation or other hazards.
D. Before returning the receiver to the customer, to make leakage current measurements:
1. Between all exposed metal parts and any exposed metal parts having a return to chassis, and
2. Between exposed metal parts and earth ground.
(Refer to the IMPORTANT SERVICE NOTES appearing on page 2.)

WAVEFORMS

① 1.9Vp-p	② 0.47Vp-p	③ 0.9Vp-p	④ 10.2Vp-p	⑤ 2.1Vp-p	⑥ 8.1Vp-p	⑦ 8.1Vp-p	⑧ 1.6Vp-p	⑨ 2.6Vp-p	⑩ 46Vp-p
Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Vert. Rate	Horiz. Rate	Vert. Rate	Vert. Rate	Vert. Rate
⑪ 6.4Vp-p	⑫ 1.65Vp-p	⑬ 230Vp-p	⑭ 1.9Vp-p	⑮ 900Vp-p	⑯ 6.5Vp-p	⑰ 0.7Vp-p	⑱ 0.52Vp-p	⑲ 4.5Vp-p	⑳ 1.6Vp-p
Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate
㉑ 4.1Vp-p	㉒ 140Vp-p	㉓ 115Vp-p	㉔ 130Vp-p	㉕ 15.5Vp-p	㉖ 12Vp-p	㉗ 250Vp-p	㉘ 14Vp-p	㉙ 1.7Vp-p	㉚ 7.3Vp-p
Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Vert. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate	Horiz. Rate

CHASSIS LAYOUT



NOTE:
When removing the original VHF tuner, remove the PWB-C with mounting bracket from the tuner. VHF tuner and PWB-C are supplied for individual replacement parts.

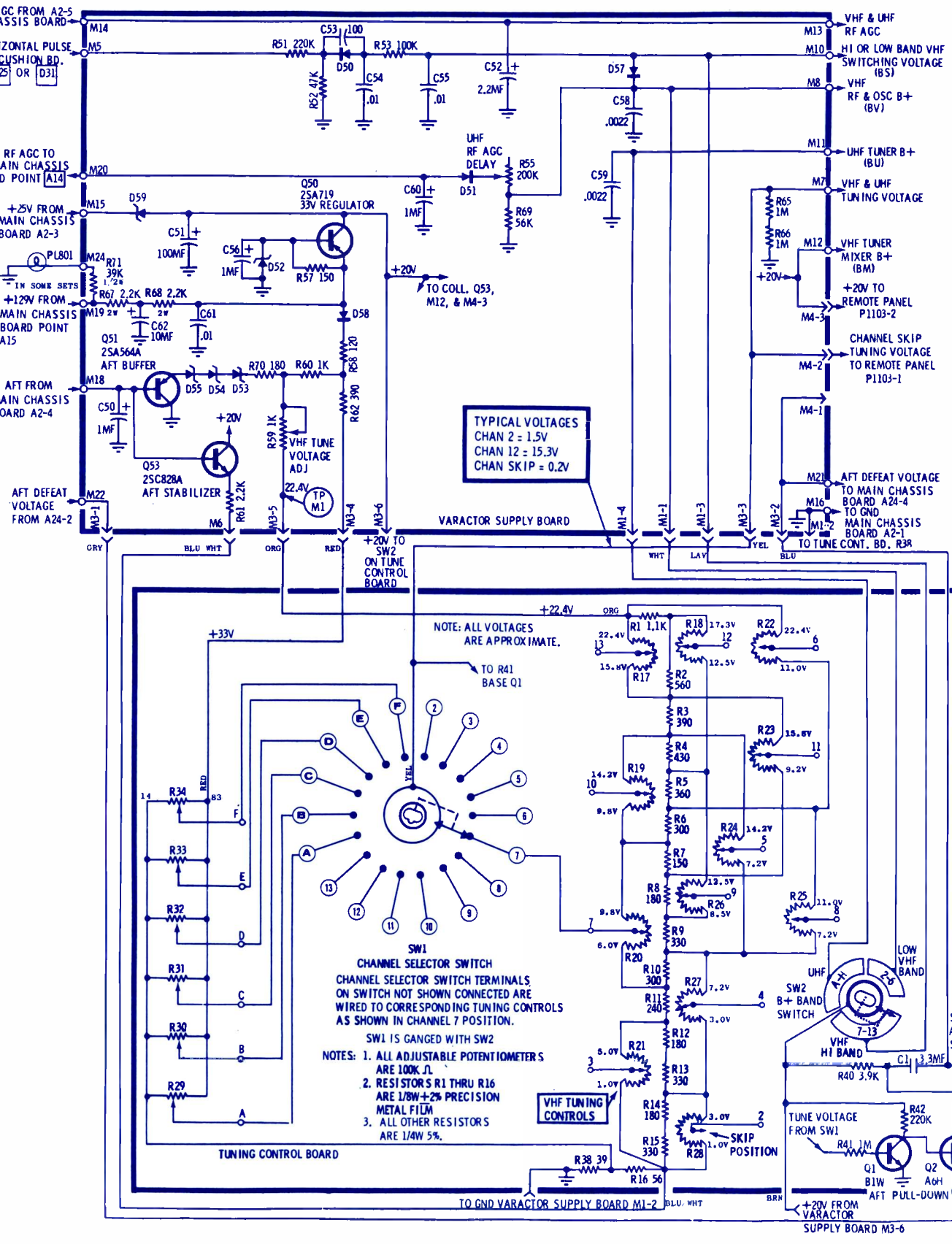
1879

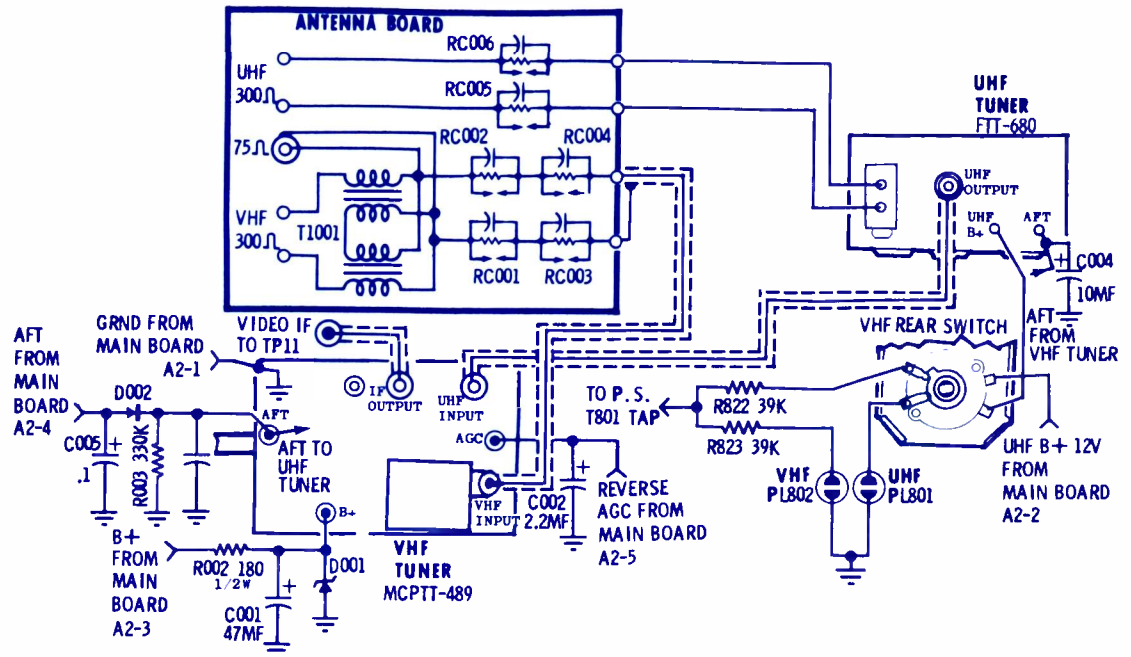
QUASAR
Color TV Chassis
TS-968

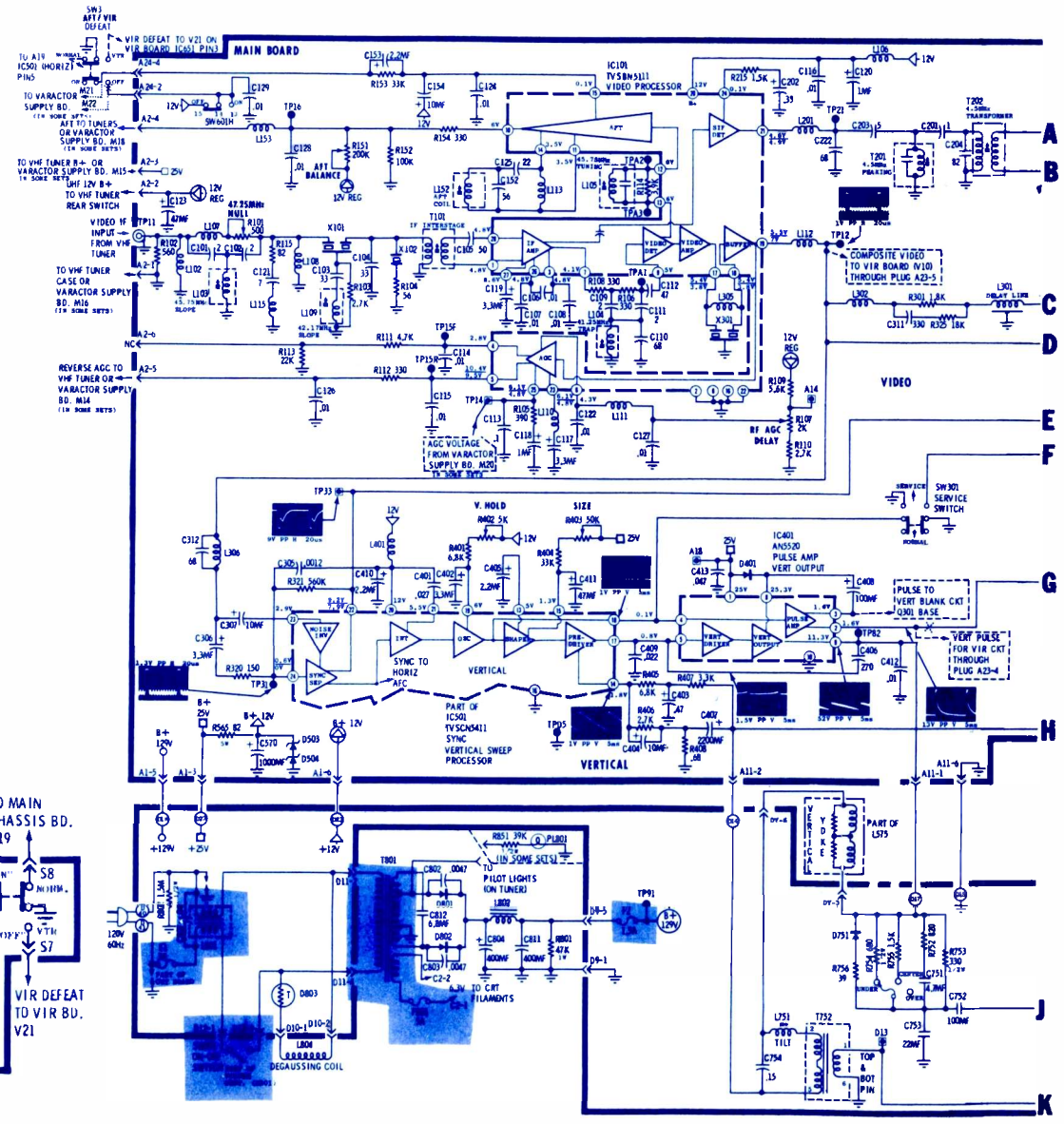
DECEMBER • 1980

ET/D TEKFAX

COMPLETE MANUFACTURER'S CIRCUIT DIAGRAMS







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IMPORTANT NOTES:

Each component is identified with a reference number and a prefix letter (i.e. R201) which is related to legend on the panels. Numbers vary with circuit association as indicated below.

ASSOCIATED CIRCUIT	REFERENCE DESIGNATION
IF/AFT	100-199
Audio	200-299
Video	300-399
Vertical	400-499
Horizontal – HV	500-599
Chroma – VIR	600-699
Pincushion	700-799
Power Supply	800-899
Tuner	000-99

1. UNLESS OTHERWISE SPECIFIED: RESISTORS ARE 1/4W 5%. CAPACITOR VALUES LESS THAN ONE IN MF, ALL OTHERS IN PF. CAPACITANCE VALUES ONLY ARE SHOWN ON SCHEMATIC DIAGRAM. FOR COMPLETE DESCRIPTION OF CAPACITORS, REFER TO PARTS LIST.

2. WAVEFORM MEASUREMENTS – TAKEN WITH A STANDARD GATED RAINBOW TYPE COLOR BAR PATTERN. RECEIVER ADJUSTED FOR NORMAL VIEWING AS IN TRANSMITTED AIR SIGNAL.

3. ALL VIDEO AND COLOR WAVEFORMS TAKEN WITH A WIDE BAND SCOPE AND A PROBE WITH LOW INPUT CAPACITY (10 TO 1). SHAPE AND PEAK-TO-PEAK AMPLITUDES MAY VARY DEPENDING ON CALIBRATION, TYPE OF TEST EQUIPMENT USED, AND CONTROL SETTINGS.

4. VOLTAGE MEASUREMENTS: EXCEPT WHERE NOTED, TAKEN FROM POINT INDICATED TO CHASSIS WITH AN ACCURATELY CALIBRATED VTVM.

AC INPUT TO RECEIVER 120V. CONTROLS AT NORMAL SETTING. DYNACOLOR "ON". SOME VOLTAGE READINGS WILL VARY WITH ASSOCIATED CONTROL SETTINGS AND SIGNAL STRENGTH.

WHERE TWO (2) VOLTAGES ARE SHOWN, THEY REPRESENT VOLTAGE WITH AND WITHOUT SIGNAL AS FOLLOWS:
20V – ZERO SIGNAL (TUNER BETWEEN CHANNELS).
16V – AIR SIGNAL
VOLTAGES WITH * INDICATE AIR SIGNAL WITH VIR.

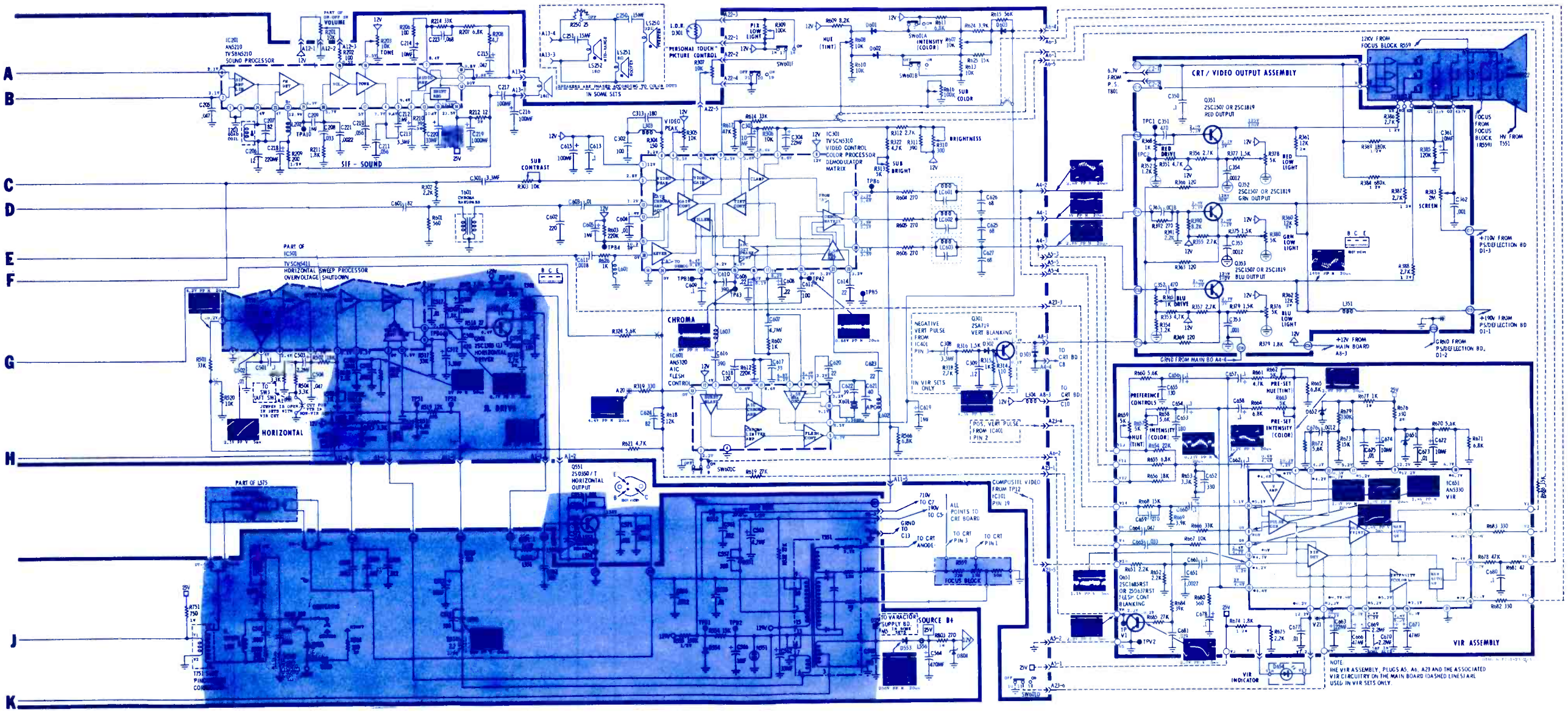
SERVICE TECHNICIAN: IMPORTANT NOTE

THIS RECEIVER HAS BEEN DESIGNED TO MEET OR EXCEED APPLICABLE SAFETY AS SPECIFIED BY GOVERNMENT AGENCIES AND INDEPENDENT TESTING LABORATORIES.

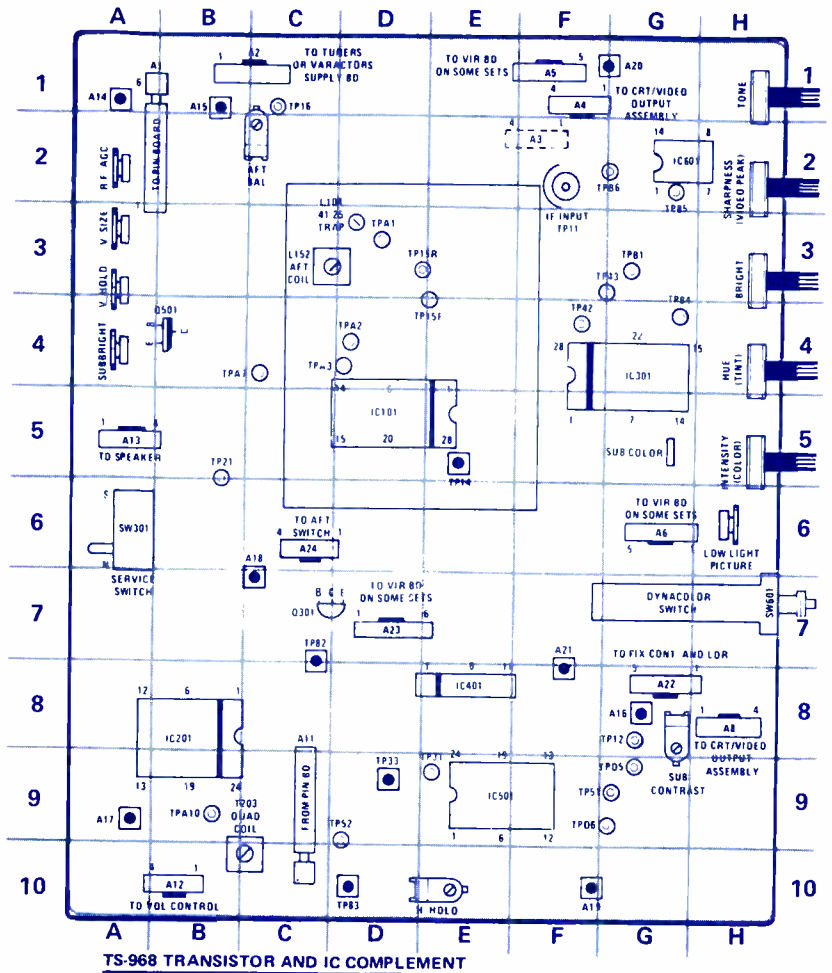
TO MAINTAIN ORIGINAL PRODUCT SAFETY DESIGN STANDARDS, RELATIVE TO SHOCK AND FIRE HAZARD, THE PARTS SHOWN IN THE SHADED AREAS OF THIS SCHEMATIC MUST BE REPLACED WITH IDENTICAL REPLACEMENT PARTS. ORDER PARTS FROM YOUR QUASAR DISTRIBUTOR USING PART NUMBERS SHOWN IN THE SERVICE MANUAL OR GIVE COMPLETE CHASSIS NUMBER AND PART REFERENCE NUMBER.

FOR OPTIMUM PERFORMANCE AND RELIABILITY, ALL OTHER PARTS SHOULD BE REPLACED WITH COMPONENTS HAVING IDENTICAL SPECIFICATIONS.

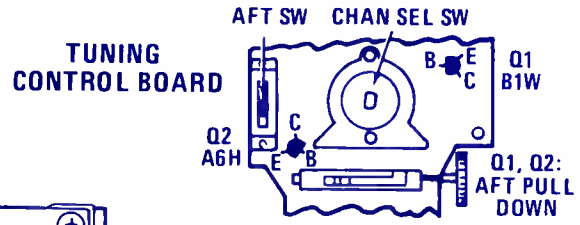
ADDITIONAL INFORMATION NEXT PAGE

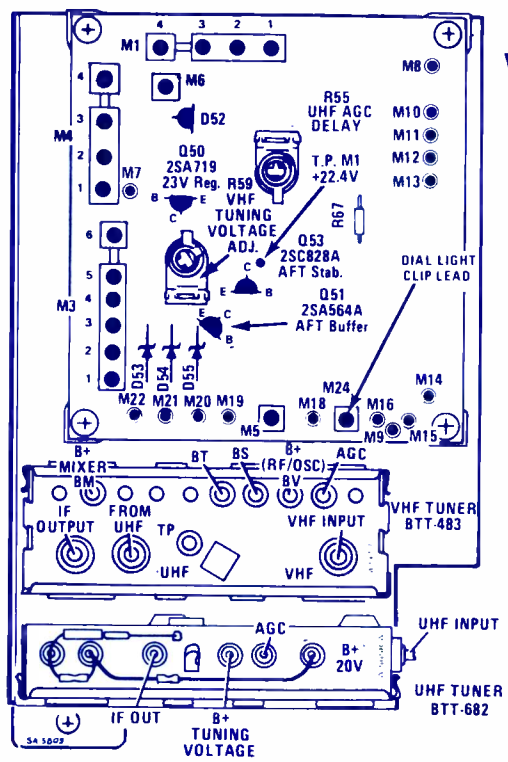


QUASAR
Color TV Chassis
TS-968



MAIN CHASSIS	
TEST POINT	LOCATION
TPA1	D-3
TPA2	D-4
TPA3	D-4
TPA7	C-4
TPA10	B-9
TPB1	G-3
TPB4	G-4
TPB5	G-2
TPB6	G-2
TPD5	G-9
TPD6	G-9
TP12	G-8
TP14	E-5
TP15F	E-4
TP15R	D-3
TP16	C-1
TP21	B-6
TP31	E-9
TP33	D-9
TP42	F-4
TP43	F-3
TP51	G-9
TP52	D-9
TP82	C-8
A15	B-1
A17	A-9
A18	C-6
A19	F-10
A20	F-1





PLUG OR POINT	CONNECTS TO	
M1	Tuning control bd. (on Front Panel)	
M3	Tuning control bd.	
M4	Remote panel "YH" (P1103) (on Remote sets)	
M5	From P/S board D25 (H pulse)	
M6	Tuning control bd. (AFT)	
M7	UHF/VHF Tuning voltage (BT)	
M8	VHF B+ (BV)	
M9	Tuner grnd.	
M10	VHF Band-Switching Voltage (B_s)	
M11	UHF B+ (B_U)	
M12	VHF Mixer B+ (B_m)	
M13	UHF/VHF AGC to tuners	
M14	UHF/VHF AGC from A2-5	
M15	+25V (A2-3)	On Main Chassis
M16	GND (A2-1)	On Main Chassis
M18	AFT (A2-4)	On Main Chassis
M19	B+ (A15)	On Main Chassis
M20	UHF RF AGC (A14)	On Main Chassis
M21	AFT SW (A24-4)	On Main Chassis
M22	AFT SW (A24-2)	On Main Chassis
M24	To Dial Light	On Main Chassis

VHF TUNER BTT-483 VOLTAGE CHART

	NO SIGNAL LOW BAND VHF		NO SIGNAL HIGH BAND VHF		NO SIGNAL UHF	
VOLTAGE	CH 2	CH 6	CH 7	CH 13	CH 14	CH 83
BM	19.5V	19.5V	19.2V	19.2V	19.4V	19.5V
BT	2.0V	18.3V	8.1V	18.8V	1.3V	30.4V
BS	–20.9V	–20.9V	19.2V	19.2V	–20.6V	–20.8V
BV	19.5V	19.5V	18.4V	18.4V	0V	0V

TS-968 TRANSISTOR AND IC COMPLEMENT

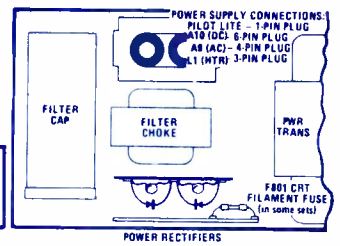
REF. NO.	FUNCTION	TYPE
IC101	Video Processor	TVSBN5111
IC201	SIF Amp, FM Det, Audio Amp, Shunt Reg.	AN5210 or TVSBN5210
IC301	Color Proc. Matrix	AN5310 or TVSCN5310
IC401	Pulse Amp, Vert Driver, Vert Out	AN5520
IC501	Sync, Vert & Horiz Gen, X-Ray Prot.	TVSCN5411
IC601	AIC, Burst Amp, 3.58 Osc, Flesh Corrector	AN5320
IC651	VIR Processor (On VIR sets)	AN5330
Q301	Vertical Blanking (On VIR sets)	2SA719
Q351	Blue Video Output	2SC1507 or 2SC1819
Q352	Grn Video Output	2SC1507 or 2SC1819
Q353	Red Video Output	2SC1507 or 2SC1819
Q501	Horiz. Driver	2SC1505
Q551	Horiz. Output	2SD350/T
Q651	AIC Flesh Correction Blanking	2SC1685 R.S.T. or 2SD637 R.S.T.

PINCUSHION/HV BOARD

POINT NO.	CONNECTS TO
D1	CRT BD
D2	N/C
D3	N/C
D4	N/C
D5	A1-1
D6	Q551-Base
D7	Q551-Emitter (gnd) & A1-2
D8	Q551-Collector
DC-5	Power supply (+129V)
DC-1	Power supply (gnd)
Degauss	Degaussing coil
AC	AC to power supply (T801 PRI)
D12	AC switch
D13	–
D14	A11-2
D15	A11-6 (Gnd)
D16	A11-4
D17	A11-1
D18	A1-5
D19	A11-5
D20	A1-4
D21	A11-3
D22	A1-3
D23	A1-6
D24	–
D25	M5 (Var. supply bd.)
D40	AC line (gnd)
D41	AC line (hot)
DY	Defl. Yoke

TRANSISTOR, IC, TEST POINTS & CONTROL LOCATIONS

POWER SUPPLY

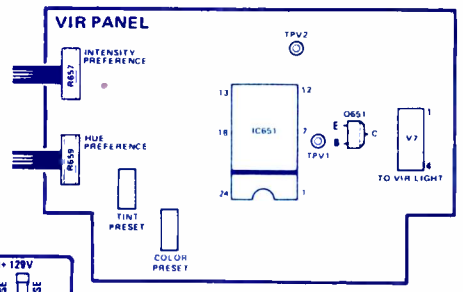


PIN CONNECTOR LEGEND
A = MAIN PANEL
C = CRT/VIDEO OUTPUT ASSEM
D = PINCUSHION/HV BOARD

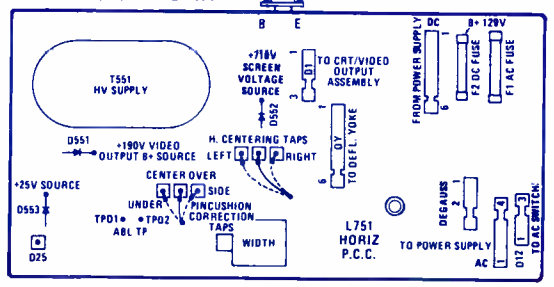
VIR BOARD (Not in All Sets)

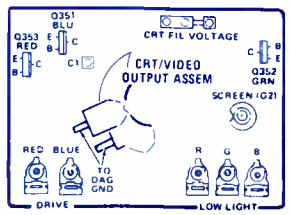
POINT NO	CONNECTS TO	POINT NO	CONNECTS TO
V1	A6-5 (thru R686)	V10	A23-5
V2	A6-1	V11	A5-5
V3	A5-1	V12	A5-4
V4	A23-4	V13	A5-3
V5	A5-2	V14	A23-3
V6	A23-1	V15	A6-3
V7-1	V18 } LED VIR Light	V16	A6-4
V7-2	V17 }	V17	V7-2
V8	A6-2	V18	V7-1
V9	A23-6	V21	AFT Sw

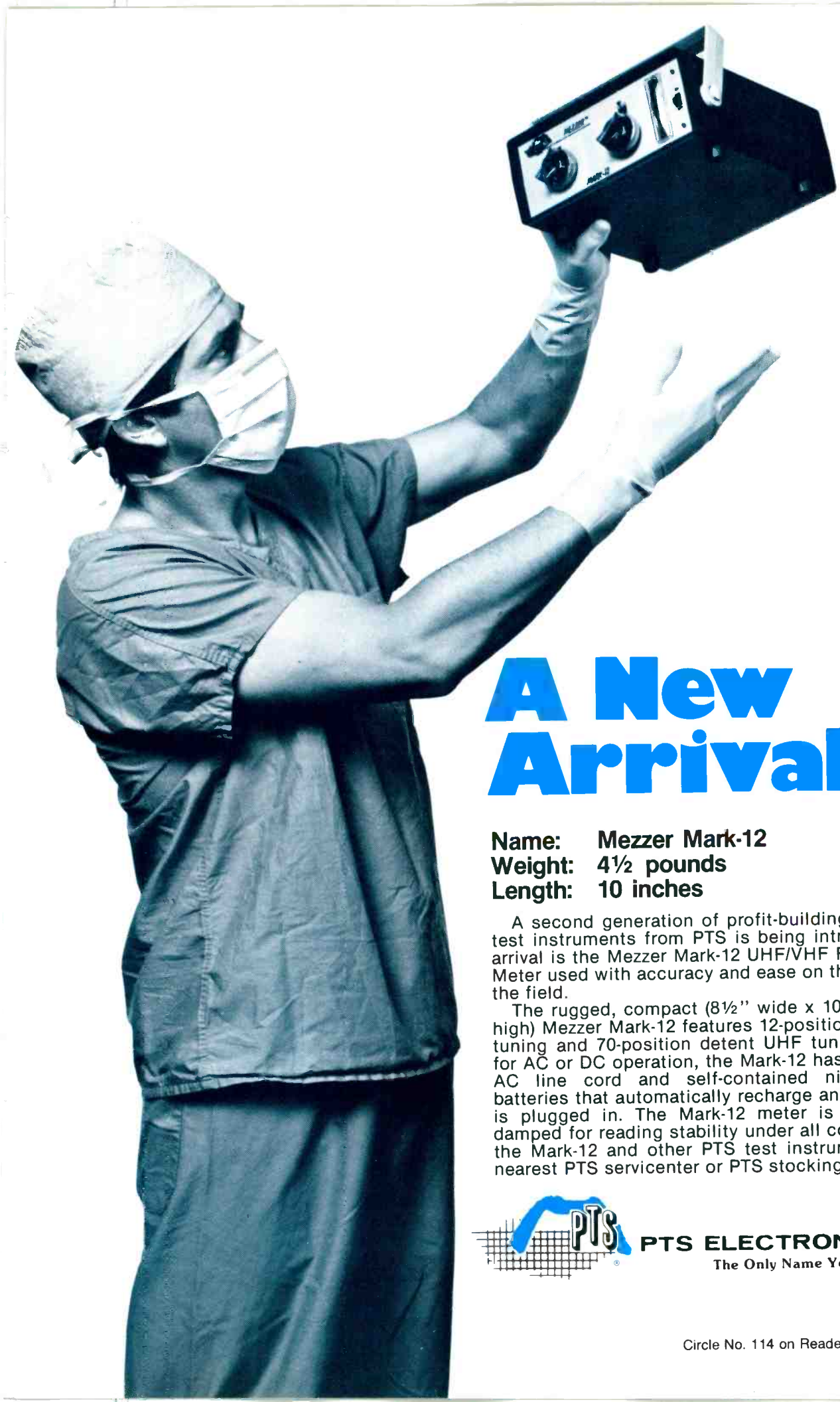
VIR PANEL



PINCUSHION/HV BOARD







A New Arrival

Name: Mezzer Mark-12
Weight: 4½ pounds
Length: 10 inches

A second generation of profit-building, time-saving test instruments from PTS is being introduced. First arrival is the Mezzer Mark-12 UHF/VHF Field Strength Meter used with accuracy and ease on the bench or in the field.

The rugged, compact (8½" wide x 10" long x 3¾" high) Mezzer Mark-12 features 12-position detent VHF tuning and 70-position detent UHF tuning. Designed for AC or DC operation, the Mark-12 has a detachable AC line cord and self-contained nickel-cadmium batteries that automatically recharge anytime the unit is plugged in. The Mark-12 meter is electronically damped for reading stability under all conditions. See the Mark-12 and other PTS test instruments at your nearest PTS servicenter or PTS stocking distributor.

PTS ELECTRONICS, INC.
The Only Name You Need To Know

Circle No. 114 on Reader Inquiry Card

THE NEW performer.

. . . UNBEATABLE PRICE / PERFORMANCE RATIO

The Model 7000 Universal Counter / Timer

ONLY $300

MADE IN USA

Built for your budget, the Model 7000 is a micro-processor controlled reciprocal universal counter. It is capable of measuring both input signal frequency and period over the full 5Hz to 80 MHz range in one second with six digit resolution. The autoranging unit has both frequency and multiple period averaging measurement capability. Its microprocessor executes the optimum measurement and displays the desired format, frequency or period.

1. High resolution, μP controlled reciprocal counting design provides both input signal frequency and period measurements.
2. 80 MHz frequency measurement plus event counting to 1 billion and elasped time measurement from 100 μS to 100 hours.
3. Single function knob for easier operation and built in self testing confidence test circuit.

Its ease of operation, versatility and accuracy make the Model 7000 an ideal instrument for the hobbyist, technician or engineer. The Model 7000 can also be ordered with a temperature-compensated oscillator for applications where higher accuracy is needed.

See your Triplett distributor, Mod Center or representative for a free no-obligation demonstration. Triplett Corp., Bluffton, Ohio 45817. (419) 358-5015, TWX (810) 490-2400.

Circle No. 117 for information
Circle No. 118 for FREE demonstration

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