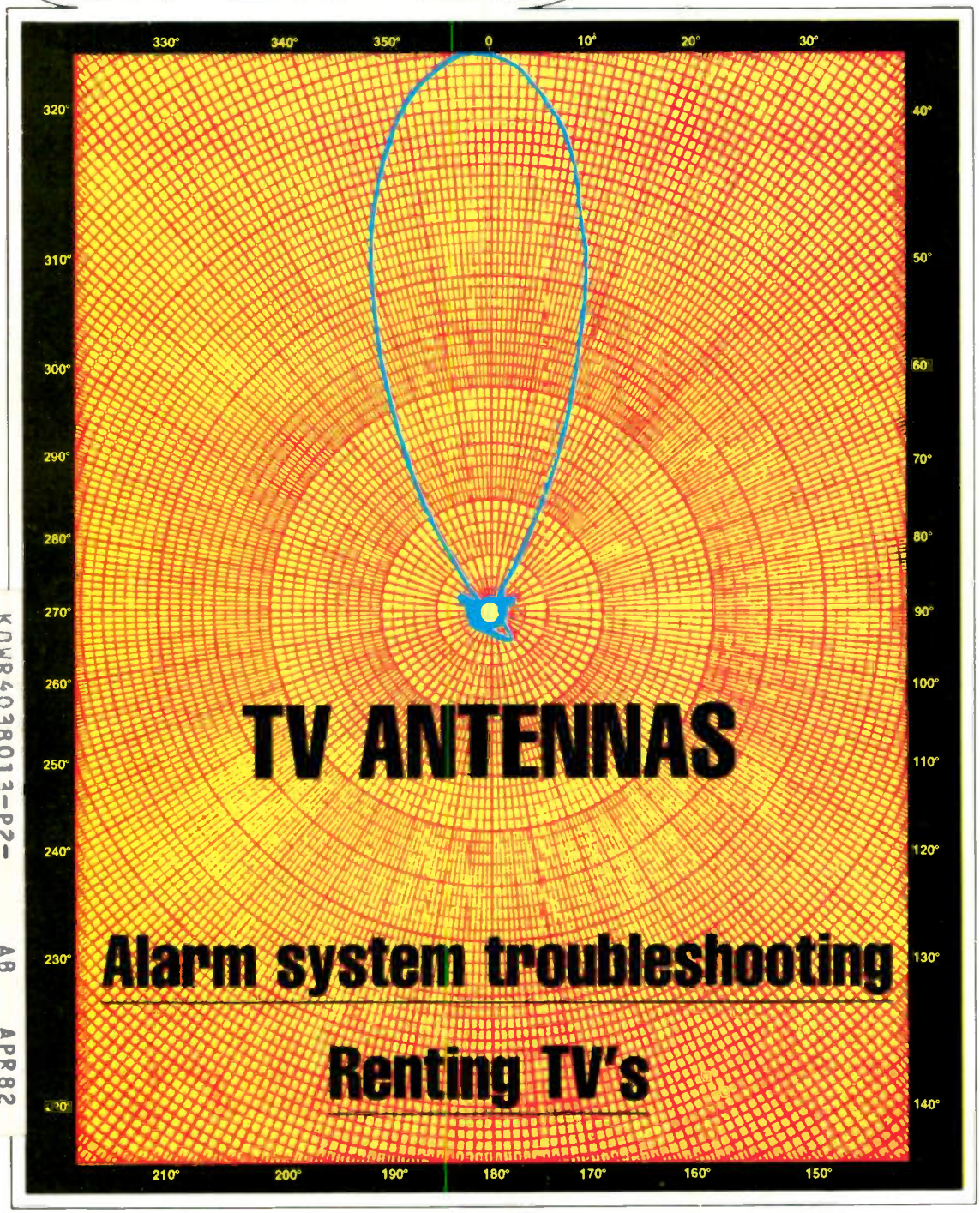
ET/D

OCTOBER 1981 • $1.50

ELECTRONIC TECHNICIAN/DEALER
LEADING THE ELECTRONIC
SERVICE MARKETS



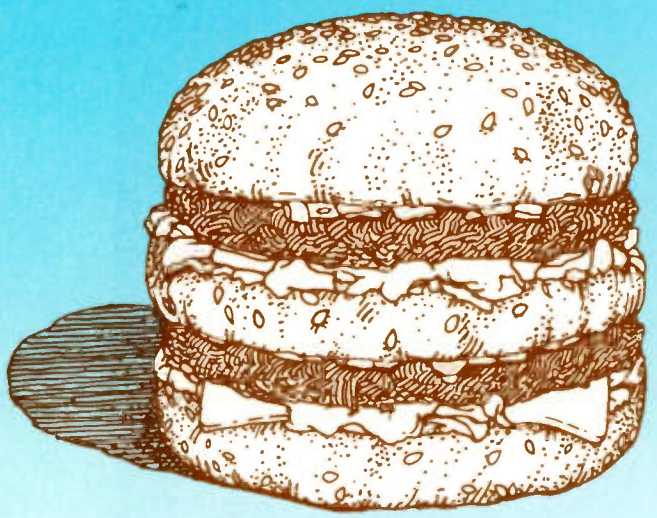
TV ANTENNAS

Alarm system troubleshooting

Renting TV's

HBJ A HARCOURT BRACE JOVANOVICH PUBLICATION

THORDARSON gives you a FREE BIG MAC® SANDWICH



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Purchase top-selling Thordarson exact replacements for the RCA and Zenith flybacks and yokes listed below. Inside each distinctly marked box are McDonald's® gift certificates worth $1.50. That's possibly enough for a BIG MAC® SANDWICH AND MORE.

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RCA				ZENITH			
FLYBACKS		YOKES		FLYBACKS		YOKES	
RCA Part Number	Thordarson Part Number	RCA Part Number	Thordarson Part Number	Zenith Part Number	Thordarson Part Number	Zenith Part Number	Thordarson Part Number
113382	FLY 277	109532A	Y 103	800-678	FLY 323	95-2501	Y 108
115843	FLY 278	124245	Y 150	800-690	FLY 363	800-747	Y 130
116554	FLY 307	135755	Y 204	800-692	FLY 626	95-2667	Y 132
115876	FLY 308	137542	Y 224	895-732	FLY 408	95-2780	Y 137
119834	FLY 312	114741	Y 245	800-689	FLY 489	S-89633	Y 167

Hurry! Offer expires November 30, 1981.

THORDARSON

Thordarson Meissner Inc.
Electronic Center
Mt. Carmel, Illinois 62863

Circle No. 115 on Reader Inquiry Card

READER SURVEY

Here is the second part of ET/D's reader surveys. This time we would like to know more about your business so we can know more about the consumer service industry as a whole. Again note that no signature or other identification is required. We encourage you to answer on the postage paid return card. We feel that you can help us help the industry with your answers.
Thank you.

Walter H. Schwartz, Editor

1. Approximate annual gross income of the electronics servicing and/or retailing business which you own or in which you are engaged
1) less than $25,000 2) $25,000 but less than $50,000 3) $50,000 but less than $100,000 4) $100,000 or more 5) not in electronic servicing and/or retailing business
2. Number of technicians employed by your business or your place of employment
1) none 2) 1-2 3) 3-5 4) 6-9 5) 10 or more

Items 3-18 are types of electronic products. Indicate the approximate percentage of total annual gross income your shop or the one in which you work receives from the servicing and/or installation of each.

	NONE	UP TO 20%	21% TO 50%	51 TO 75%	OVER 75%
3. VCR/Video Disc	1	2	3	4	5
4. Color TV	1	2	3	4	5
5. B-W TV	1	2	3	4	5
6. Home or commercial security systems	1	2	3	4	5
7. Home audio	1	2	3	4	5
8. Home radio	1	2	3	4	5
9. Auto radio and/or tape players	1	2	3	4	5
10. Home antennas (including MATV)	1	2	3	4	5
11. Citizens Band Radio	1	2	3	4	5
12. Two-Way Radio	1	2	3	4	5
13. Commercial sound systems	1	2	3	4	5
14. Industrial Electronic control equipment	1	2	3	4	5
15. Medical electronics	1	2	3	4	5
16. Appliances	1	2	3	4	5
17. Mini/Micro Computers	1	2	3	4	5
18. Video Games	1	2	3	4	5

(Items 19-29) Indicate the approximate percentage of total annual gros s income your business or the business in which you work receives from retil sales of the following electronic products:

	NONE	UP TO 20%	21 TO 50%	51 TO 75%	OVER 75%
19. VCR/Video discs	1	2	3	4	5
20. TV (B-W & Color)	1	2	3	4	5
21. Home radio & audio	1	2	3	4	5
22. Home antennas and/or antenna systems	1	2	3	4	5
23. Commercial audio systems	1	2	3	4	5
24. Auto radio and/or tape players	1	2	3	4	5
25. Communications equipment (including CB)	1	2	3	4	5
26. Home and/or commercial electronic security systems	1	2	3	4	5
27. Home appliances	1	2	3	4	5
28. Mini/Micro Computers	1	2	3	4	5
29. Video Games	1	2	3	4	5

30. Approximate percentage of total annual gross income your business or the business in which you are employed receives from sales of replacement parts
1)None
2)Up to 20%
3)21% to 50%
4)51% to 75%
5)Over 75%
32. Approximate percentage of total annual gross income your business or the business in which you are employed receives from warranty servicing of electronic products
1)None
2)Up to 20%
3)21% to 50%
4)51% to 75%
5)Over 75%
33. *Do you advertise in
1)Yellow Pages
2)Newspapers/shoppers
3)local radio
4)direct mail
5)business sign
34. How many read your copy of ET/D?
1)1
2)2
3)3
4)4 or more
35. *To which of the following magazines do you presently subscribe:
1)Electronic Servicing
2)Radio Electronics
3)Popular Electronics
36. What security magazines do you read?
1)Alarm Signal
2)SDM
3)AID
4)Security World.
37. TEKFAX should cover:
1)information on popular chassis
2)hard to find information on less common sets.
38. In the last several years my level of business has:
1)increased
2)remained the same
3)decreased.

As this is being written the first results of our September survey are beginning to arrive. We are pleased and grateful at the response. Unfortunately, we made a serious error on the reply card. The keyliner left out response numbers for questions eight and twenty-nine. Therefore, we are asking you to bear with us; we will repeat the affected section of the survey in November, since we cannot be sure of the results of questions eight through forty. So please reply once again to the survey in November. We apologize for the trouble.

To try to compensate to you for your trouble, we will comment editorially on the survey results in January and February, after enough results are in for us to see patterns form. We will try to give you an idea of the range of size of the consumer service business, its service income, its degree of diversification and a number of other facts with which you can compare your business and interests. This information can be interesting and important to all of us. Thank you again.

ET/D

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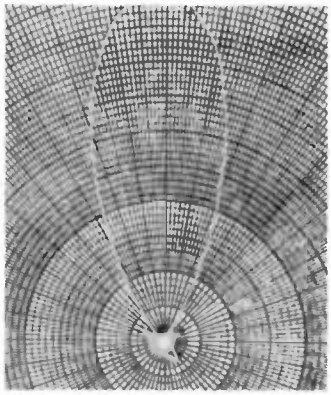
FEATURES



On The Cover: A good TV antenna is required for optimum reception. This month's cover emphasizes this with a representation of the polar pattern of an excellent antenna. Note the absence of side lobes and the front-to-back ratio.

DEPARTMENTS

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INDUSTRY REPORT

1981 NESDA Convention

The 1981 National Electronics Service Convention, was held August 3-8, at Innisbrook Resort, Tarpon Springs, FL. The convention was sponsored by the National Electronics Service Dealers Association, the International Society of Certified Electronics Technicians, and the Florida Electronics Service Association.

One of the highlights of the convention was the technology and business opportunities offered by new products such as satellite systems and computers. Sessions featured business management seminars, technical seminars, and training seminars for educators in the field of consumer electronics.

A trade show featured new products for dealers, the latest innovations in consumer electronics, and high technology service aids and test equipment.

Bill Abernathy, Fort Worth, TX, is the new president of NESDA. Abernathy had previously served as NESDA Treasurer.

Elected to serve with Abernathy on the national Executive Committee of NESDA are George Bluze CET/CSM, Largo, FL, as National Vice President, Roger Wood, Altoona, WI, as Secretary and Keith Knos CET, Liberal, KS, as Treasurer. Serving as ex-officio members of the Executive Committee are outgoing president, Jim Rolison, Portland, OR, ISCET Chairman Frank Grabiec, Phoenix, AZ, and Executive Director J.W. Williams.

Regional Vice Presidents elected to complete the NESDA Executive Council are: (Region 1) Ted Stackhouse CET, Portland, ME; (2) John Salama, Flushing, NY; (3) Jim Teeters CET, Norfolk, VA; (4) Bob Harrell, Johnson City, TN; (5) Art Nelson, Milwaukee, WI; (6) Fran Cawfield CET, Corpus Christi, TX; (7) John Krier CET, Wichita, KS; (8) Jack Kelly CET, Goodyear, AZ; (9) Bill Lawler, Los Angeles, CA; (10) Al Lamer CET, Salem, OR.

During the convention, elections were also held for officers of the International Society of Certified Electronics Technicians (ISCET), the Technical Division of NESDA. Elected to 1-year terms were: Chairman, Frank Grabiec, CET, Phoenix, AZ; Vice Chairman, Ralph Pollmiller, CET, Jacksonville, NC; Secretary Jim Parks, CET, Orlando, FL; and Treasurer John Krier CET, Wichita, KS.

The 1982 NESDA/ISCET National Electronics Service Convention has been set for August in New Orleans, LA, and will be a joint convention of NESDA, ISCET, the Texas Electronics Association, the Louisiana Electronic Service Dealers Association, and Television Service Association of Arkansas.

National Sound and Communications Association Names New Officers, Directors

A new slate of officers and directors for the National Sound & Communications Association has been announced by Robert F. Ancha, Elk Grove Village, IL, the group's President.

Re-elected as NSCA officers are Ancha and Edward Knight, Oak Park, MI, Vice President. Treasurer for the 1981-82 year is Melvin J. Wierenga, Wyoming, MI. Francis C. "Bud" Rebedeau continues as Executive Secretary.

Three new members elected to the Board of Directors are Ed Burquez, Birmingham, AL; Lloyd F. McKinney, Hayward, CA; and William E. Yeager, Alexandria, VA.

Incumbent board members continuing to serve are Harold B. Lander, Seattle, WA; and Arthur C. Smith, Phoenix, AZ.

The National Sound and Communications Association provides a vehicle for idea exchange, industry communication, and shared services to sound and electronics systems contractors.

The group will sponsor and conduct the third annual National Sound and Electronic Systems Conference in New Orleans, April 29-May 1, 1982, concurrent with the Electronic Distribution Show and Conference.

Information about NSCA membership and activities can be obtained from the National Sound & Communications Association, 5105 Tollview Drive, Suite 201, Rolling Meadows, IL 60008. Phone 312/577-8390.

ETA Annual Meeting

The Electronics Technician's Association held its 1981 Annual Meeting in the Student Union building on the Iowa State campus, Ames Iowa, July 9, 10, 11.

A short preliminary business meeting was held the evening of the 9th. The following two days were filled by seminars on test equipment, Certified Electronic Technician test review sessions, a seminar on technical writing, seminars on business, satellite earth stations and other subjects.

The official annual business meeting was held on Saturday. George Savage, CET, Doniphan NE is the new chairman; Don Anker, CET, Marshaltown, IA, vice chairman; newly elected secretary is Ron Lettieri, CET, of Dunmore, PA; treasurer is John PcPherson, CET, Yorktown, VA; CTD division chairman is John Guinan, CET, Philadelphia; EEA division chairman is Ed Carroll, CET, Indianapolis; communications chairman is Mike Chapman, CET, Scranton, PA and ETA Canada chairman is Bill Patullo, CET, Kitchener, Ontario.

Donald Thorne, Chicago, was selected to receive the Norris R. Browne Technician of the Year Award.

Business Mobile Radio Market To Increase Greatly in 1980's

The mobile radio market in the U.S. is "in the midst of fundamental changes," states a new market report. Frequency congestion that has suppressed latent market growth will be overcome during the 1980 decade, as trunked radio and cellular systems come into play.

These developments, along with availability of the 800-900 MHz frequency band, plus higher performance equipment made possible by increased LSI chip usage will render mobile radio "one of the best performing markets in the 1980s," says the 293-page study, entitled, "Mobile Radio Markets and Technology," by Frost & Sullivan, Inc., New York City.

Business will be the biggest beneficiary of the new environment. Mobile radio equipment shipments to this sector will increase sevenfold during the 1980 decade, compared to less than a five-fold increase in sales overall.

Specifically, the mobile radio equipment market in the U.S. at $1.4 billion last year will increase to nearly $3 billion in 1980 and to more than $6 billion in 1990. Shipments into business applications per se at $580 million in 1980 will increase to more than $4 billion by decade end. (All figures are based on manufacturer selling price.)

This is not to say other application sectors will remain stagnant. On the contrary, shipments into public safety radio, fire, police, local government, and other such services at $126 million in 1980 will increase to $305 million by 1990. Industrial radio services to manufacturers, the petroleum industry, utilities, forest products, and similar end use categories will increase from $181 million in 1980 to $564 million in 1990.

The F&S report also examines paging equipment to forecast that this market at $86 million in 1980 will increase to $400 million in 1990. Yet other equipment markets analyzed include:

Radio scanners, a $130 million market last year that will virtually triple by 1990 with sales of synthesized scanners accounting for 80 percent of the market by 1985;

Scramblers, a market to increase four-fold through 1990; CB radios, to remain essentially flat through 1982 and then proceed to double by 1990, reaching $215 million annually that year.

ET/D

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FROM THE EDITOR'S DESK

I hope you have noticed that this is the second month that the first thing you see when you open ET/D is a reader survey. This month we would like to know a little about your business activities. Again note, you need not identify yourself.

There are several areas of consumer electronics which will, from all indications, boom in the next few years and which therefore are of particular interest to us. All the market studies we see lead us to believe that microcomputers will rival television in dollars in three or four years. We would like to know your feelings and would particularly like to hear from anyone that has made an entry into microcomputer sales and *service*. I would like to have offered to ET/D a variety of microcomputer troubleshooting articles this next year; I know the average technician is not yet at all familiar with them. (And ET/D's editors are not either. We will be learning right along with you. I will be working my way through the planned series on programming for the technician as it arrives from the authors.) We are open to suggestions.

Another area that is of great interest is TV receive only earth stations. It will be a little while before direct broadcast satellites are in orbit (4 or 5 years) but meanwhile there would seem to be the opportunity to sell a half-million or more systems to receive the present satellite television transmissions. From what we can see looking at the present methods of merchandising, most of the manufacturers need dealers. Several companies would appear to have excellent equipment and even complete systems available, but lack distribution. They need you, the experienced, competent video technicians and sales people to sell, install and service their product. Here again how do you view the situation? Have any of you been selling and installing earth stations?

A last thought for the month—the editors of ET/D believe that service associations can be very valuable and we would like to promote their effectiveness. We have run little news other than that of their annual conventions recently. We wish to inaugurate a *Calendar* column in which we would give meeting and convention schedules for educational seminars, conventions, regional and state as well as national. To this end please keep us informed.

Sincerely

Walter H. Schwartz

SERVICE SEMINAR

GENERAL ELECTRIC

Chassis DE—No raster, sound garbled. Capacitor on deflection yoke blown apart. To Correct: Replace yoke capacitor (.039 MFD @ 400v). W. M. Sulry, Stratford, CT.

MAGNAVOX

High voltage arcing—Chassis T991. If a symptom of arcing is encountered in the T991 chassis, check the high voltage lead that connects the tripler to the CRT anode. If the insulation on this lead wire has been damaged, its 40kv breakdown rating may be reduced to the point where the high voltage can arc through to the chassis. One way this lead wire may be damaged is by a sharp edge on the cable clamp that is used to give mechanical support to the lead wire during shipping. If this is the case, dress the lead of the replacement tripler away from the yoke and discard the cable clamp. Make no attempt to repair the damaged high voltage lead.

Working with IC's. Now that the industry is making extensive use of integrated circuitry in its products, it may be beneficial to review a few servicing techniques concerning the removal and replacement of an IC. Neatness should be the main consideration when removing an IC that is soldered to a Printed Circuit Board. Several methods of accomplishing this are available, which include the use of a solder sucker or a soldering iron tip designed for IC removal. However, the most widely accepted method is the Solder Braid. Using the Braid has the advantage of performing two tasks at the same time. Not only does it remove all the solder from the joint, but it acts as a heat sink during the process. After removal of the IC is accomplished, proper installation of the new IC is undertaken. Many different basing patterns are used to help determine the correct orientation of the IC. The screening on the printed circuit board will identify the correct position of the number 1 pin and also the other three corner pins if space on the board permits.

PANASONIC

T125A-T126A—Shaded from left to right, part of video blacked out and look negative. Boost voltage low, diodes ok. To correct: Replace C420 1 μf 160v boost voltage filter cap. Part No.: ECEA160V1. Other similar chassis in other makes has same problems. Kaz Glista, Newington, CT.

TR-542—Sound level low and distorted, may cut out completely intermittently. Chilling C208 temporarily corrects fault. To Correct: Replace 208, 207pF capacitor in sound detector circuit. Sound IF may need alignment after replacing capacitor. James Travis, Cuba, NY.

L2 Chassis, buzzing sound when white lettering is super-imposed to normal video background. This problem is most noticable by CATV subscribers on some areas and can also be present in MATV hook-ups. The problem is generally caused by one or both of the following conditions: a) Excessive video modulation of white letters. b) A high picture carrier to sound carrier ratio. (Sound carrier level is too low with respect to

picture carrier level). Perform the following Adjustment Procedures: 1) Rotate T101 ("F" Coil) one full turn clockwise (360°C.W. as viewed from top). 2) Adjust T202 to obtain maximum sound level. 3) Adjust T201 to obtain minimum buzz.

RCA

Replacement IHVT lead dress information—CTC 107, 108, 109. In the event the Integrated High Voltage Transformer (IHVT) is replaced in a CTC 107/108/109 chassis, to assure correct filament voltage supply to the picture tube, dress the leads as shown below. The brown lead connecting IHVT terminal 14 to the PW 5000 board must be dressed between the ferrite core and the IHVT frame as shown. Do not dress the brown lead through the space between the auxiliary windings and the main epoxy-covered windings.

Chassis	Stock No.	Drawing No.
CTC 107	146485	1455851-501
CTC 108	146486	1455852-501
CTC 109	146487	1455853-501

RCA

CTC—71—Insufficient height and width when changing channels. Tuner has been serviced recently. To correct: Remove short from Pin 4 (case) of MOSFET RF amp on tuner (shorted to ground). Gene Coahly, CET, Beatrice, NB

CTC—17XE—No picture, no sound. High voltage OK, 135 volts at pin 6 of 6AQ5 audio output tube measures zero. To correct: Replace defective R221, 1200 ohm, 7 watt resistor (open) also replace 6JC6 tube (3rd pix IF). Check focus rectifier tube which may also be bad. Mike Carwille, Petersburg, VA.

SONY

Open heater in CRT-KV-5000, 5100. When a set is encountered with open CRT heater(s), necessitating CRT replacement, install 3 additional spark gaps, 1-519-063-XX, on the T board.

ZENITH

Chassis 19DC22, no vertical sync, video processor and horizontal sync panels test normal. To correct: Replace coupling capacitor C209. Part Number 22-3661. Located in emitter circuit of vertical oscillator transistor. Kay Glista, CET, Newington, CT.

Chassis 23DC14—Horizontal streaks in picture. Varying position of IF lead at point where it connects to IF chassis connector appears to clear up picture but, when properly installed, picture still has streaks. To Correct: Replace defective C-208 capacitor, SMFD at 15VDC. Manual De La Rosa, CET, Monro Bay, CA.

Chassis 19HC50—No color sync & horizontal phase shift. Upon observing wave form from Flyback to Horiz. Module, spikes of voltage will appear after set has been on awhile. To correct: Replace defective flyback transformer P/N 95-3264-01. Clayton Reid, Jacksonville, FL.

NEWSLINE

REVISED EIA COLOR TELEVISION STATISTICS. A change in the method of reporting U.S. color TV statistics necessitated by increased production in the U.S. by foreign manufacturers, has increased the estimated 1980 figure for sales of color TV sets to retailers from 10,162,276 to 10,897,080--up 6.7%. Sales for 1981 reported under the same system are:

	July			Year-To-Date (30 weeks)		
Television	1981	1980	Percent Change	1981	1980	Percent Change
Color	775,181	690,434*	+12.3	5,198,796	5,538,010*	+ 6.9
Monochrome	377,051	338,791	+11.3	3,139,554	2,775,523	+13.1
TOTAL TELEVISION	1,152,232	1,029,225	+12.0	9,058,350	8,313,533	+ 9.0
HOME VCR	87,636	50,313	+74.2	631,109	336,914	+87.3

This information reflects total market statistics for products produced and/or sold in the United States regardless of the brand name or country or origin.
*Using revised 1980 data

RCA PREDICTIONS FOR THE '80's. RCA predictions of the expansion of video for the 1980's (published in the July/August 1981, RCA Engineer) indicated this will be a continuing process for all modes. By 1990 the TV networks will have lost some of their audience to the many other forms of viewing, cable, recorders, disc, etc. "The average home will have between one and two new systems, thus creating an increasing demand for software."

	Household penetration 1979	1990
Network stations	100	100
Independents	71.0	80.0
PBS	90.0	92.0
Cable	20.0	50.0
Pay Cable	7.5	35.0
Subscription TV	0.9	7.7
Direct Broadcast Satellite	--	5.0
VCR's	1.6	17.0
Video Disc	--	28.0
Home Computers	0.6	13.0
Games	14.0	20.0
Teletext/Viewdata	--	33.0

Hitachi V-202 and V-352 Dual Trace Oscilloscopes

When you get exceptional capability per dollar, that's superior cost-performance. And that's the 35 MHz Hitachi V-352 and the 20 MHz Hitachi V-202 dual trace oscilloscopes.

Proof? Just skim these features, then note the price. For starters, both scopes have a 2-year limited warranty. And then there are features like square CRT's with internal graticules, vertical sensitivity of 1 mV/division, and a wide dynamic range for vertical amplifier of 8 divisions or more. Each scope features front panel X-Y operation, 10X sweep magnification, 3% vertical deflection and sweep accuracy, and low vertical drift. For ease of operation, functionally related controls are grouped into 3 color-coded front panel blocks.

How do we build in all that capability at such low cost? Chalk it up to two decades of oscilloscope design experience and some of the most modern production methods around.

Hitachi V-352 and V-202 are stocked by your authorized industrial distributor and ready for fast delivery.

Ask for a demonstration and see more performance than you expected for less than you thought possible.

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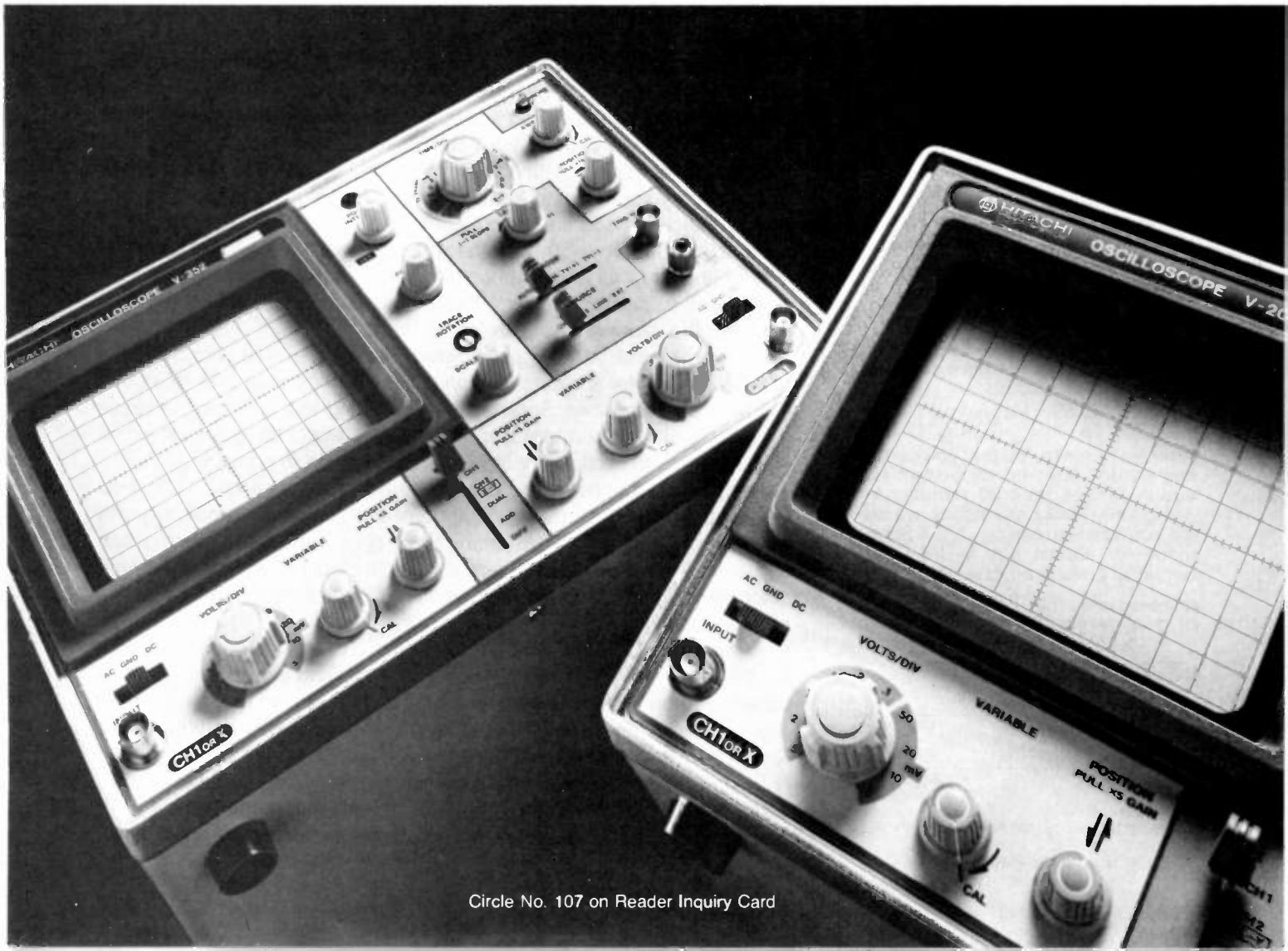


Circle No. 107 on Reader Inquiry Card

SECURITY VIEWPOINT

By Ray Allegrezza

Sooner or later most alarm dealers/installers start thinking about using the services of a central station. Many dealers I've met in fact started out using the services of a central station and eventually ended up owning the operation.

Basically, there are a number of things a central station can do for you and your business:

- Limit your liabilities (ensure that alarm messages are not lost).
- Eliminate the need for you to use an answering service.
- Increase the amount of protection you can offer your customers.

Now is as good a time as any to consider the feasibility of using a central station because a growing number of police stations are requesting some type of go-between link from the alarm dealer to the police precinct.

Simply stated, the job of the central station is to affirm or verify any alarm call before requesting police assistance. And by confirming that an alarm condition does in fact exist, you and your clients can be assured that the particular law enforcement agency notified will give the call the highest priority.

The next logical question then must be "how do I find the best central station for my needs?"

The best advice for that question is shop around. Most central stations will be more than happy to arrange a visit and explain their particular range of services and fees.

Be sure to ask about the station's capabilities. In many cases you may not have to go out and buy new communicators. Many times you can use the tape dialers you are currently working with. Here's where the increased protection to your customers comes into play. By using a digital dialer in conjunction with the central station you have access to some very sophisticated features such as lightning protection, low battery indication and line seizures.

Establish that the central station you are considering allows for semi-annual testing of all alarm connections. This is a *minimum* figure.

If possible, find a company that provides monthly testing (directly between the client and the central station).

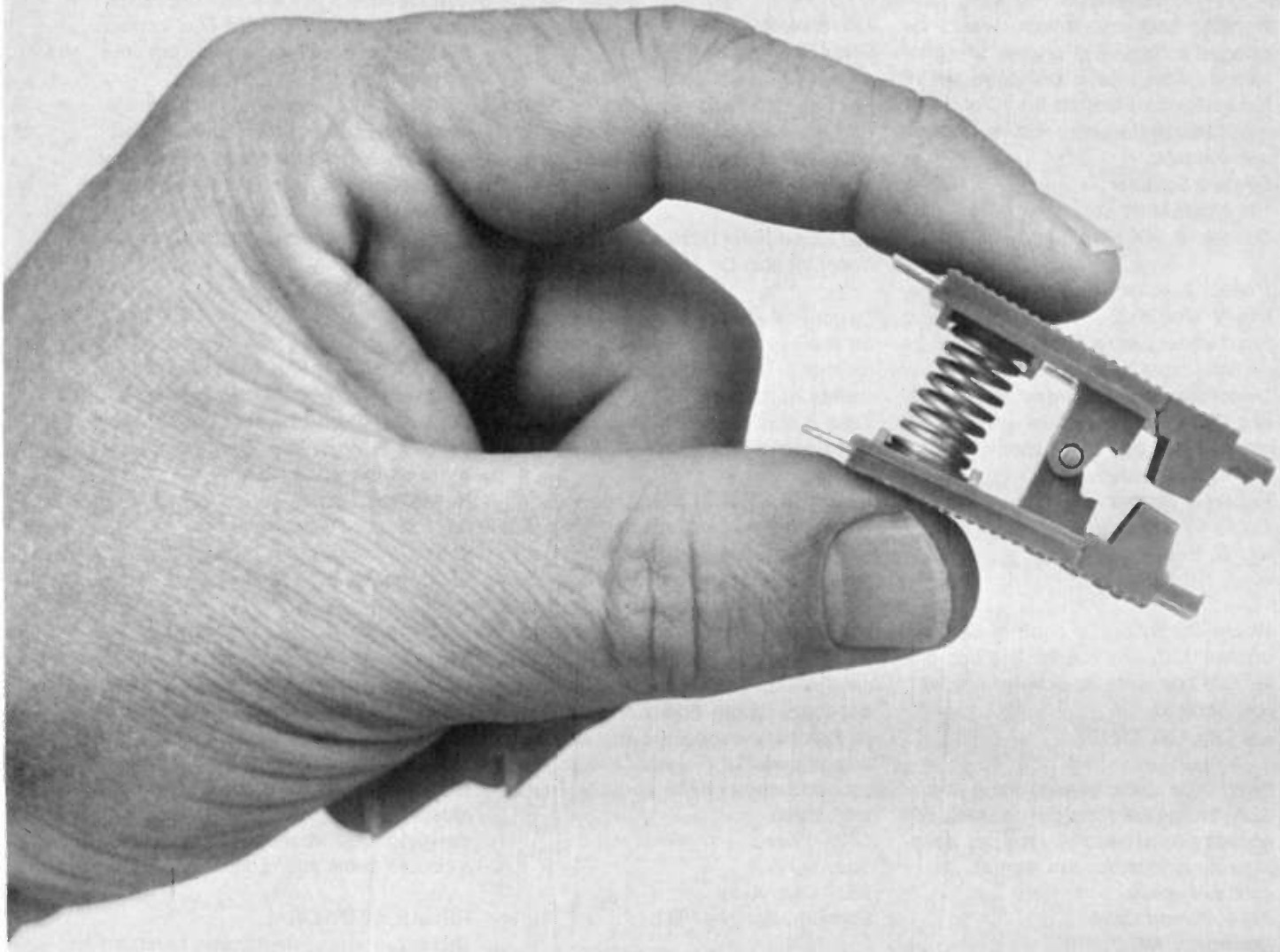
In the event that you have customers outside the state your business resides in, look for a central station that either offers an 800, or WATS (Wide Area Telephone Service) line. By doing this, you can increase the scope of your territory and your clients won't be charged with a long-distance toll call every time they need to be in contact with you.

Many times, (but not always) the central station can and will offer you technical advice in terms of equipment problems and problems with false alarms. Since they are "in the field" right along with you, they can sometimes be even more helpful than the equipment manufacturer since they have probably come across problems similar to the ones you may be having.

Perhaps the last, but most important piece of advice when searching for the proper central station is make sure you find a company that has clearly demonstrated its business ethics. Remember they in a sense are a go-between, acting as your agent, between you and your client. The last thing you need is to discover (too late) that your central station is trying to take your accounts from you.

Be carefully choosing a central station, the final result can be a relationship that benefits both you, the central station and the client.

Find Quality Dip Clips™ At Your Fingertips.



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Such as Dip Clip™ test clips that aid you through thick and thin.

There's our regular-thickness 14/16 pin dual in-line test clip, along with a 24-pin size and a 40-pin size.

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They all feature solid, tarnish resistant, nickel-silver contacts, serrated for good electrical connection.

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Consistent quality for a complex world.

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Circle No. 112 on Reader Inquiry Card

LETTERS

HELP NEEDED:
I am in need of a service manual including the schematic diagram for a model A-1 PENTRON repeating tape amplifier and mechanism. Would be pleased to receive an original or a photocopy. Also I have complete set of Riders Radio Manuals from Volume 1 right through the entire Riders TV manuals for sale.
Edward Scribner
181 North Main St.
Schoharie, NY 12157

I need a schematic for a Fisher Receiver Model 250. I understand it is listed under Sam's Photofacts MHF-24 (which I have been unable to get) and I would appreciate either the manual or a Xerox copy of the Fisher 250 schematic. I will pay a substantial fee for any help provided.
Robert J. Barger
Bob's TV Service
411 S. Redwood Ave.
Brea, CA 92621

Would like to buy a copy of TEKFAX booklet 113. Any reader that has one for sale can write to: Edward Napier,
860 Scott St.,
Del City, OK 73115.

Need tape deck head(s) for a Model 1288 Wollensak recorder (stereo). Will accept a used head(s). I will pay a reasonable amount for this item(s).
John L. Lackey
2414 Atwood Drive
Burlington, NC 27215

Schematics or service information for HH Scott Model 296, Dynaural Tube Type, Stereo Amplifier.
William Meyst
2010 14th St.
Menominee, MI 49858

I need information—a manual—on a WWII AN/FRC-1, built by the Marine Radio Service.
Peter R. Turchi, K2IPK
1420 Maple Ave.
Huddon Heights, NJ 08035

I have a (f) Farfisa Portable compact Duo organ, Model F/AR (c) on the preamp. The model number is on a small box that the compact duo plugs into. I was playing it one evening when the sound blasted out and then died dead. Since I repair TVs, I am wondering whether you have the address of a place of business that may have the schematics on it or the service book on it. Of course, I would purchase the information.
George Olsen
Olsen TV
13519 Westwind Dr.
Silver Spring, MD 20904

Flyback for a Zenith B/Q TV. The Zenith Part # is 95-3298. New (or used if good). The above part is no longer available from Zenith.
Ray's TV
4841 East View Drive
New Orleans, LA 70126

I wonder if you could publish a request for me? I need SAM's tape recorder manual TR19. Would appreciate this.
James Humphrey
1006 E. 28 St. RM 212
Los Angeles, CA 90011

SERVICE PROBLEMS:
I have had a lot of problems servicing single board chassis solid-state type sets, both B&W and color. I can't see why the manufacturers couldn't design a chassis main board that is replaceable if they don't want a modular chassis. I realize costs must be kept down but these single board chassis are a real problem especially with soldered-in components. I would like to have your comments on this problem. Thanks very much.
G. H. Seever
Seever TV
2337 Ohio Ave.
Connersville, IN 47331

Replacing the whole circuit board would be expensive though Quasar did offer a set with such a feature a few years ago. The major problem I feel is soldered-in semiconductors, but sockets cost money, and might cause reliability problems. Though this should not be a big factor. Editor.

The Security Business:
I just received the Aug. 81 issue of ET/D and found a problem with the explanations in Alarm Installation by John Sanger. In figs. 1 through 4 he uses Normally Closed switches in the closed circuit loop. That is wrong. You would use Normally Open switches so that when you put an external force on the switch it will close. Such as placing a magnet near it for magnet switches or pushing in the plunger on a mirro switch. In this way when the force is removed, such as opening the door or window, the switch will open.

The same goes for the open circuit alarm. You would use Normally Closed switches. In this way when the force is applied the switch opens.

In the letters to the editor the observations by David Odette was correct but he did not tell you how to get your full mark-up.

Take the percentage mark-up desired and subtract that from 100 percent. Take that figure and divide that into the Dealer Cost and the answer will cover your cost and give you a full mark-up of desired percentage, in this cast 30 percent.

Dealer Cost	*$697.45*
Retail Price	*$697.45 - .70 = $996.35*
Profit	*$996.35 - 697.45 = $298.90*
Profit Margin	*$996.35 × .30 = $298.90*

This way you receive 30 percent on price not 30 percent on cost. 30 percent of a larger pie is more money. Keep up the good work.
Kenneth A. Griffin
Alert Security Management
46315 Worlington
Mt. Clemens, MI 48044

Thank you for your comments. You are correct; door, etc. switches are closed when the door or whatever is closed. When the door is open and nothing is acting upon the switch is would be open. ET/D's readers being competent electronic technicians hopefully would recognize this. But they might not understand their accounting as well, so a double thank you! Editor.

RE: JULY EDITORAL:
This is to request permission to reprint an editorial entitled "From The Editors Desk" appearing in the July, 1981 issue of ET/D. If permission is granted, this reprint will appear in the next issue of "Scanner," which is the official publication of Florida Electronic Service Association of Broward Country, Florida.

It is our feeling that the points you made in this editorial must be brought to the attention of all service shops and PUT INTO PRACTICE BY THEM or we will all watch a great many good shops fall by the wayside.
Joyce A. Ziegler, ED. Scanner
1049 N. State Rd. 7
Margate, FL 33063

We are very pleased this editorial was noticed and would be honored to have it reprinted. Editor.

"You fix TV's... what brand should I get?"

You're on the spot. Any set you tell your customer about has a chance of failing sometime.

But though we're not saying we're perfect, we'd like you to recommend RCA. Because we're sure your customer will love its picture performance.

You can find the problem and repair it quickly if anything does go wrong. Because with RCA's unitized chassis, failures are easy to handle.

RCA gives frequent hands-on workshops, as well as lectures. So when failures do occur, you'll be ready.

RCA has more than 500 parts distributors nationwide. We have this large network because we don't want you to have to wait too long for parts.

We also keep your inventory expenses lower by using components instead of modules, in most circuits.

We know your customers think you're responsible for everything about their sets.

Good and bad.

And that's why we here at RCA are doing everything possible to make sure that when you finish a service call, everybody's smiling. Your customer's happy with your recommendation. And you're still the expert.

RCA

RCA IS MAKING TELEVISION BETTER AND BETTER.

For your free subscription to RCA COMMUNICATOR, our magazine of news and advice for service technicians, write RCA, Dept. 1-455, 600 North Sherman Drive, Indianapolis, IN 46201.

Rental TV

New profits

Renting television receivers is the usual thing in some parts of the world, such as Britain. There is indication that it can become more common here and that it can be quite profitable. Here's a quick rundown on how several dealers approach the TV rental business.

By William Joseph

	TV selling price	service contract	interest	total	weekly payment*
52 week portable	$569.00	$ 30.00	$ 96.44	$ 695.44	$13.37
console	$849.00	$ 30.00	$144.20	$1023.20	$19.68
104 week portable	$569.00	$100.00	$194.55	$ 863.55	$ 8.30
console	$849.00	$100.00	$290.28	$1239.28	$11.92

*plus sales tax

Times are tough in the TV service business. Calls are off. Solid state was the worst thing that ever happened. There's no future in the business. Right?

Wrong.

While some service dealers continue to convince themselves that we're all going to hell in a handbasket, others are too busy searching out profitable methods of diversifying to think about it.

You have read often in these pages about the need to diversify. As a result, such things as security alarms, sound equipment, and subscription TV installations are helping to provide a solid foundation of economic growth for service dealers in all parts of the country.

In some cases, the need to diversify has led to unexpectedly profitable ventures. Such was the experience of Dick Jones who, along with his sons Dick, Jr. and Allen, owns and manages Jones TV in Kingston, N.Y.

Jones TV is a sales and service organization founded in 1932 by Jones' father. Dick points out proudly that there are now four generations of the family active in the business.

Both sales and service are located in the same two-story building in Kingston, with sales on the first floor and the service department on the second. In total, the business occupies about 4400 square feet.

This year, gross income for Jones TV should be about $420,000; with about $100,000 in service and the balance in sales and rentals.

Says Jones flatly, "I'm not sure that Jones TV would still be in business if we hadn't branched out into rentals. It is, by far, the most profitable segment of our business."

According to Jones, the market for rentals in the Kingston area seems almost limitless. "We can rent as many TV sets as we're able to buy," he says.

Without any formal advertising, except for store signing, the company has managed to build the business to the point where hundreds of sets have been rented over a two year period. According to Jones, about 250 to 300 sets will be out for rental at any given time.

After several experiments to establish a method for pricing, the company has settled on a rather involved formula that takes into account the selling price of the set, the cost of a service contract for the rental period, an interest charge to cover the capital investment, and the number of weeks that the customer expects to keep the rental. Here is how the formula works for new solid-state sets rented for either 52 or 104 weeks:

The same formula is used to arrive at weekly rental rates for a variety of new and used sets—tube types, hybrids, and solid-states—ranging from $6.46 to $19.68 per week, plus sales tax. The company also rents black-and-white sets for from $4.00 to $5.50 per week for a twelve month period.

Another successful rental business has been built by Finklea's Service in Florence, S.C.

L.W. Lee, service manager for the company says that a separate subsidiary was formed exclusively to handle its rental TV business. In the two years that the company has been in the rental business, Lee estimates that about 500 sets have been rented. He agrees completely with Jones on the profitable nature of the business.

Finklea's prefers a simpler formula for determining its rental rates:

Cost of the set, multiplied by three, divided by the number of weeks (either 52, 88, or 104) to be rented.

Lee explains, "The 88 week contract is our most popular. We use it for all 25 inch consoles. The 52 week period is used for component stereos and small portables while the 104 week contract is used for our color combinations."

Although less involved, Finklea's formula produces rental rates quite similar to those at Jones TV. Example at $200 cost:

$200 × 3 = $600 divided by 53 = $11.54 per week (Finklea's charges a minimum rental of $10.99 per week)

Another difference between the Finklea and Jones programs is in the customer's equity. Under the Jones program, the customer has the option of renting the set for one additional week at the end of the rental period for a payment of $5.00. At that point, ownership

Reorder from Green Enterprises – (616) 342-4488 after hours (616) 345-2476

RENTAL AGREEMENT

MERCHANDISE LISTED BELOW, IF NOT PAID ON DUE DATE MUST BE RETURNED TO:

FINKLEA'S RENTALS 2011

223 S. McQueen St.
Florence, S. C. 29501
662-1136

239 N. Main St.
Marion, S. C. 29571
423-3770

DATE _____

RENTER _____

RES. ADDRESS _____ APT. _____ PHONE _____

CITY _____ COUNTY _____ STATE _____

ITEMS _____

BRAND _____

MODEL _____

SERIAL _____

MAINTENANCE LIMIT _____

WEEKLY RENTAL RATE IF PAID ON OR BEFORE DUE DATE	OPTIONAL DAILY RATE	COLLECTION CHARGES PER DAY
$ _____	$ _____	$ _____

1ST DUE DATE / DAY OF WEEK _____ DATE _____

THIS IS A RENTAL AGREEMENT ONLY

The undersigned, herein called "Renter", hereby rents from **THE ABOVE NAMED DEALER** herein called "Owner", the above described property, herein called "Property", and agrees to pay therefor the rental rates set forth above, payable weekly in advance, beginning on the commencement date stated above. Except as may be otherwise stated herein, this is a week-to-week rental.

1. **TITLE AND TERM**: Title to the Property shall remain at all times in the Owner. Renter shall receive possession and the right to use the Property for successive one week terms so long as weekly rental payments are made on or before the date due and Renter complies fully with all covenants and promises herein. In the event Renter fails to renew for a week-to-week term by payment of the weekly rental rate in advance on or before the date due, Renter agrees to rent the Property on a day-to-day term at the optional daily rental rate set forth above, payable in advance. Renter may thereafter elect to renew on a week-to-week basis on any weekly anniversary of the first due date above by making all required payments to the anniversary date and by making the payment for the succeeding one week term.

2. **TERMINATION BY RENTER**: Renter at his option may terminate this Agreement at any time by return of the Property to Owner in the condition when taken, reasonable wear and tear excepted, and by payment of all rental payments due through the date of return.

3. **TERMINATION BY OWNER**: This Agreement may be terminated at the option of the Owner, without notice to Renter, upon the failure of Renter to make a rental payment on or before the date due, or by breach by the Renter of any promise, covenant or representation contained herein. Renter shall immediately return the Property to Owner. Renter shall be liable for all payments due hereunder to the date possession is returned to Owner and also responsible for the performance of all promises and covenants herein.

4. **LOCATION OF PROPERTY**: Renter shall keep the Property in his possession at the location above and shall not remove the Property from that location without the prior written consent of Owner. If Renter moves the Property without securing such prior consent, it shall constitute a breach by Renter of this Agreement.

5. **INSURANCE**: Renter understands that Owner carries no insurance on the Property. It shall be Renter's responsibility to carry fire, casualty and theft insurance on the Property at Renter's expense.

6. **DAMAGES**: Renter shall be responsible for the loss, theft or destruction of the Property from all causes whatsoever and shall reimburse Owner for the fair market value of the Property in the event of such loss. In the event of damage and/or partial destruction of the Property from any cause whatsoever, Renter shall pay to Owner the reasonable cost of repair to the Property.

7. **ASSIGNMENT**: This Agreement is personal to Renter and Renter shall not assign, sub-rent or transfer his rights herein without the prior written consent of Owner.

8. **MAINTENANCE AND TAXES**: Any and all maintenance or repairs to the Property shall be performed by the Owner. Owner shall not be responsible for costs of any repairs done by Renter or done by others at the request of the Renter. Maintenance by Owner shall not be required beyond the date specified above as "Maintenance Limit".

9. **REPOSSESSION**: Upon a failure to pay rent by due date or any other breach of this Agreement by Renter, Owner may terminate this Agreement and take possession of and remove the Property from wherever it might be located. Owner and its agents shall not be liable to Renter for any claims for damage or trespass arising out of the removal of the Property. Renter shall indemnify Owner and its agents from all costs, expenses and damages occurring directly or indirectly from, or related to, the taking of possession and the removal of the Property. Renter shall also be responsible for and reimburse Owner for all costs incurred in retaking possession of the Property, including court costs and reasonable attorneys' fees.

10. **LARCENY**: Renter has no right to sell, mortgage, pawn, pledge, encumber, or dispose of the Property or to move the Property from the residence address listed above. To do so is a breach of this Agreement and Renter shall be liable under applicable state law. Failure, refusal or neglect to return the Property to Owner within 24 hours after the agreed rental period has expired, or after any breach of this Agreement by Renter, shall be prima facie evidence of Renter's intention to commit larceny.

11. **SEVERABILITY**: The provisions of this Agreement shall be severable so that the invalidity, unenforceability or waiver of any one or more of its provisions shall not affect the remaining provisions.

12. **TRANSFER OF OWNERSHIP**: In the event Renter at his sole election renews this Rental Agreement for _____ successive one-week terms, Owner will transfer the Property to Renter. Time is of the essence of this Agreement.

13. **ENTIRE AGREEMENT**: No oral statements or agreements shall be valid or binding on the parties hereto. This Rental Agreement may be modified or extended, or the promises or covenants hereof waived, only by a written instrument executed by the parties. Renter acknowledges receipt of the Property in satisfactory operating condition. The Property is not represented to be new property.

14. **JOINT OBLIGATION**: If more than one person executes this Agreement as "Renter", the obligations of the same shall be joint and several.

I HAVE READ AND UNDERSTAND THE ABOVE RENTAL AGREEMENT

RENTER _____ D.Lic. _____

RENTER _____ D.Lic. _____

WITNESS _____ TIME _____

ORIGINAL

Fig. 1. A typical rental agreement has carefully considered terms and conditions.

is transferred to the customer. The Finklea program, which is called the rent-to-own program, provides that ownership of the set is transferred to the customer automatically at the expiration of a paid-up rental contract.

Lee cautions that the wording of the rental agreement must be drawn up with care and precision in order to avoid running afoul of such things as usury laws (see figure 1). In particular, he says, the document should be clearly labeled as a rental agreement. To be avoided are such terms as "time contract" or "leasing agreement." The use of an attorney familiar with credit legislation is essential.

What about losses? Are some rental customers going to disappear with your television sets?

Both Jones and Lee agree that losses of this type have been minimal. According to Lee, the industry reports losses of around 3%; however, both Jones and Lee say that their losses have been under that figure. Mr. Lee says, "We operate in a small community and so we try to take a relaxed approach to the program. We know most of our customers and try to work with them if they run into financial trouble. However, we do assess a late penalty of $2.00 per day for overdue payments. The late charges add to the profitability of the program."

Dick Jones feels that early qualification of rental customers is one of the keys to keeping theft losses to a minimum. He asks each rental customer to fill out an application containing a considerable amount of personal information, friends, local references, etc. This used to qualify the customer as to which sets can be rented to him.

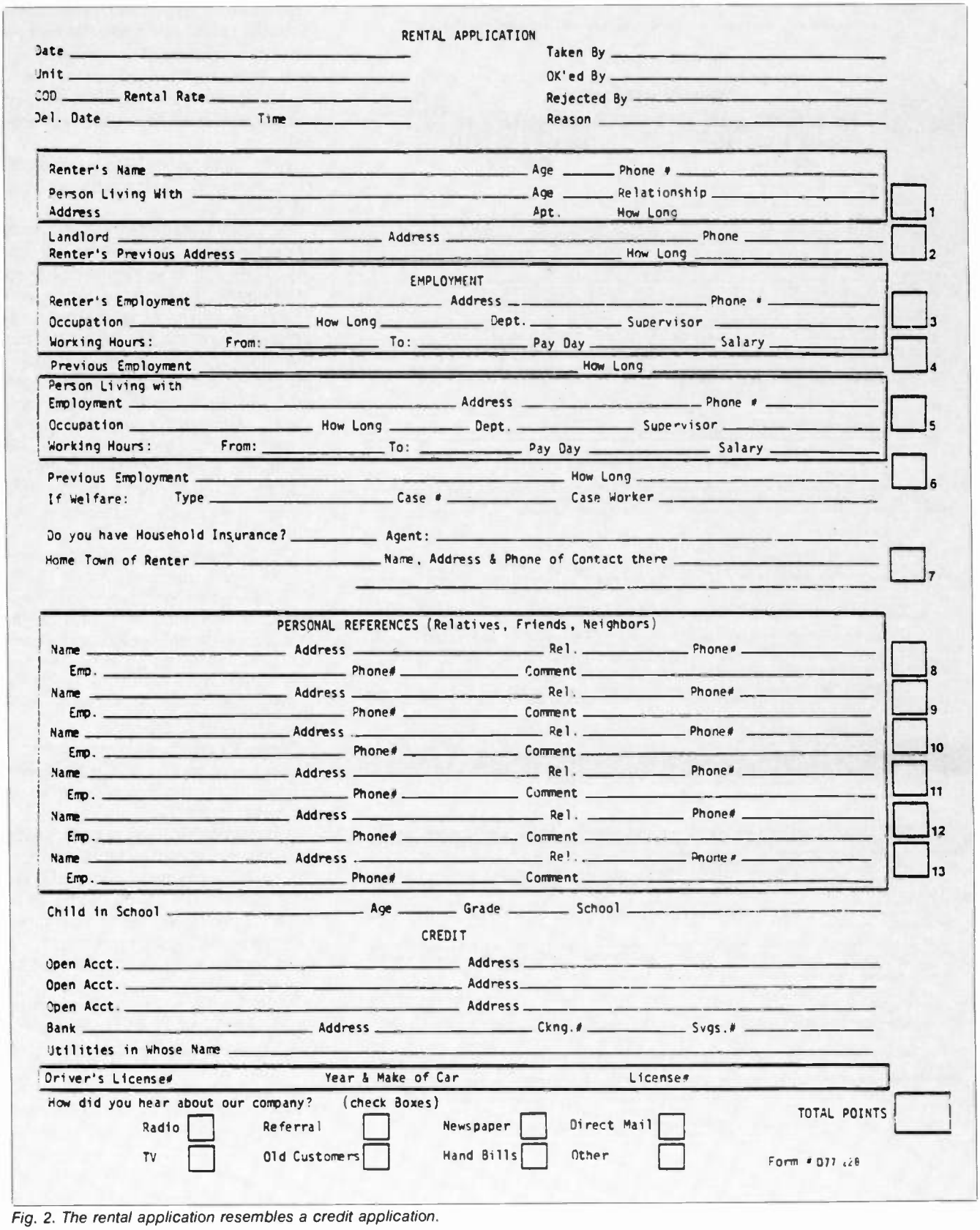
Jones TV provides rental customers with payment books that specify weekly payment, due every Friday. Why weekly instead of monthly?

Jones speaks vigorously on that subject. "It's a matter of control," he says. "With weekly payments due, you don't let a problem get ahead of you. Personally, I don't wait long. If a customer falls two weeks behind in payments, we send someone out to collect in full or pick up the set.

"With monthly payments, a customer could be into you for a lot more money before you were alerted that something was wrong. Of course," he adds, "there's also the obvious point: Weekly payments are a terrific boost to cash flow, and with all of the sets that we have rented, that's no small consideration."

Jones also feels that issuing a weekly payment book somehow has something to do with their very low rate of collection problems. "It's apparently a matter of psychology," he says. "There's something about a payment book that seems to make the whole thing official. The average person with a payment book will make every attempt to keep it up-to-date."

Over at Finklea's, the procedure is pretty much the same. Payments due



RENTAL APPLICATION

Date _____ Taken By _____
Unit _____ OK'ed By _____
COD _____ Rental Rate _____ Rejected By _____
Del. Date _____ Time _____ Reason _____

Renter's Name _____ Age _____ Phone # _____
Person Living With _____ Age _____ Relationship _____
Address _____ Apt. _____ How Long _____ 1

Landlord _____ Address _____ Phone _____
Renter's Previous Address _____ How Long _____ 2

EMPLOYMENT

Renter's Employment _____ Address _____ Phone # _____
Occupation _____ How Long _____ Dept. _____ Supervisor _____ 3
Working Hours: From: _____ To: _____ Pay Day _____ Salary _____

Previous Employment _____ How Long _____ 4

Person Living with
Employment _____ Address _____ Phone # _____
Occupation _____ How Long _____ Dept. _____ Supervisor _____ 5
Working Hours: From: _____ To: _____ Pay Day _____ Salary _____

Previous Employment _____ How Long _____ 6
If Welfare: Type _____ Case # _____ Case Worker _____

Do you have Household Insurance? _____ Agent: _____
Home Town of Renter _____ Name, Address & Phone of Contact there _____ 7

PERSONAL REFERENCES (Relatives, Friends, Neighbors)

Name _____ Address _____ Rel. _____ Phone# _____
Emp. _____ Phone# _____ Comment _____ 8
Name _____ Address _____ Rel. _____ Phone# _____
Emp. _____ Phone# _____ Comment _____ 9
Name _____ Address _____ Rel. _____ Phone# _____
Emp. _____ Phone# _____ Comment _____ 10
Name _____ Address _____ Rel. _____ Phone# _____
Emp. _____ Phone# _____ Comment _____ 11
Name _____ Address _____ Rel. _____ Phone# _____
Emp. _____ Phone# _____ Comment _____ 12
Name _____ Address _____ Rel. _____ Phone# _____
Emp. _____ Phone# _____ Comment _____ 13

Child in School _____ Age _____ Grade _____ School _____

CREDIT

Open Acct. _____ Address _____
Open Acct. _____ Address _____
Open Acct. _____ Address _____
Bank _____ Address _____ Ckng.# _____ Svgs.# _____
Utilities in Whose Name _____

Driver's License# Year & Make of Car License#

How did you hear about our company? (check Boxes)
Radio ☐ Referral ☐ Newspaper ☐ Direct Mail ☐
TV ☐ Old Customers ☐ Hand Bills ☐ Other ☐

TOTAL POINTS ☐

Form # D77 428

Fig. 2. The rental application resembles a credit application.

on a weekly basis serve to keep the program moving. Says Lee, "We buy our rental sets at cost from our sales division. While the sales department obviously doesn't make any profit on those sales, the program does help them to move units. And with such things as rebates and co-op advertising, everyone benefits."

Of course, the "service only" dealer who wanted to get into the rental business would have to develop a source from which to purchase his sets, but even that chore can produce some interesting developments.

One New Jersey service dealer who prefers to remain anonymous reports that some customers who originally come in to inquire about rentals eventually decide to buy instead. "Frankly," he says, "I'd just as soon they rent since I eventually make a lot more money on rentals."

In any case, that's one service dealer

NON-NEGOTIABLE NON-TRANSFERABLE

The sum of $10 and 00 cts DOLLARS $ 10.00

CREDIT TO THE ORDER OF

Finklea's
TV & Stereo Rentals
Marion, S. C.
Florence, S. C.

AUTHORIZED SIGNATURE

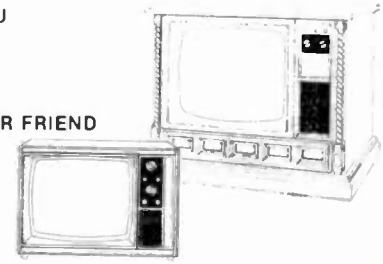
THE $10.00 CHECK ABOVE IS FOR YOU

We will give you ten dollars
when you bring a friend to rent a color
television or stereo from Finklea's TV & Stereo Rentals*

THE $5.00 CHECK BELOW IS FOR YOUR FRIEND

When you bring a friend to rent a color
television or stereo from Finklea's TV & Stereo Rentals,
we will give him $5.00 off his first weeks rent.

This offer cannot be combined with any other
offer made available by Finklea's TV & Stereo Rentals.



*AFTER YOUR FRIEND HAS MAD SET FOR 30 DAYS

NON-NEGOTIABLE NON-TRANSFERABLE

The sum of $5 and 00 cts DOLLARS $ 5.00

CREDIT TO THE ORDER OF

Finklea's
TV & Stereo Rentals
Marion, S. C.
Florence, S. C.

AUTHORIZED SIGNATURE

Fig. 3. Finklea's finds these "checks" are effective advertising.

who has painlessly made the transition from service only to sales and service.

For the most advantageous deals and for simplicity in service, both Jones and Lee recommend that a dealer branching out into rentals buy only one or two brands of TV sets. That simplifies parts inventories and will help to develop a little muscle with distributors.

Finklea's rents only Magnavox—the brand sold in its sales division.

For those dealers who feel that rentals aren't worth the effort, or are just a temporary quirk in the marketplace, think again. All indications are that this new marketing phenomenon may be around for a very long time.

Eleven stores in Chicago, Boston, and Washington, D.C. in the big Zayre chain are now offering rentals of television sets as well as videotape equipment. The service is offered as a concession by Rentacolor, a Connecticut-based firm. Quasar and Panasonic 19 inch color sets are available for rental as are 13 inch portables and 25 inch consoles.

According to an official of Rentacolor, renting is definitely on the upswing and now accounts for 5% of all television sales.

There is, in fact, a marked increase around the country in the number of rentals of all sorts of household equipment and appliances, a phenomenon that has not gone unnoticed at Finklea's. Although the company is basically a television sales and service dealer, service manager Lee reports that they have recently started renting washers, dryers, and refrigerators. Says Lee, "Once a customer has paid out on one contract, we want to have something else to offer him."

That, as well as anything, illustrates what diversification is all about. Today, the road to profitability and growth is much smoother for those who are willing to maintain a wide-open approach—a constant search for a new twist that makes use of present skills and experience. ETID

TV Antennas and Transmission lines, I

What's important

Look around any area not dominated by cable and you will see infinite possibilities for improved television reception through new, adequate, properly installed television antennas.

By Stan Prentiss

IT'S TOUGH to see a picture when no picture exists. Weathered and broken transmission lines with large standing wave ratios, poor quality, cracked plastic, and improper matching impedances, all immersed in the dampness of a wet, shingled roof or flooded gutter characterized much of America's consumer receiving apparatus.

Coupled with inadequate, outmoded, soot or salt spray-encrusted antennas of either ancient vintage or with defective/broken elements, you then have a slightly exaggeraged but basically realistic picture of what's atop 20-odd million U.S. rooftops today.

That it's time for a change, will be disputed by few, but by whom, what, and where are all mostly intangible questions with which the average homeowner is unprepared to deal, since the many fulltime installation crews often can't answer them either. Unfortunately, cheap antennas and lower grades of transmission lines are where many installers make their money, and usually mediocre or poor TV pictures result. However, with the advent of new, broadband receivers, many newer transmitting facilities, the spread of CATV, and even new TV stations on the air, decent sets require maximum signal quality for worthwhile pictures.

Transmission Lines.

The least understood of our two prime topics is lead-in (cable) or, in more elegant terms, transmission lines. In television there are two main types: twin (or bright) lead, with 300 ohms impedance and two stranded conductors; or coaxial (a cable within a cable) cable, having 75 ohms impedance and a single center conductor.

Unshielded twin lead, before the relatively recent advent of first quality coax, was almost universally used in most home-type TV installations. Shielded twin lead is very lossy and isn't used in routine installations.

In the early days of television when there were only one or two TV stations serving each community and pictures over the air were a great novelty, almost any sort of image on the tube was relatively acceptable. Today, 15 TV stations in a 40-mile radius aren't novelties any more, and the FCC is already indicating it intends to add more soon in some of the larger markets barring overwhelming opposition. Meanwhile, in the intervening 30-odd years, telephone and electric lines, 2-way radio, citizens band radio, and am/fm radio stations of all descriptions have all increased enormously in numbers, and this means more interference to all types of signals. In addition, stray signal pickup from spark-emitting lawnmowers, trucks, and even some automobiles is still prevalent in many communities. The time's come, therefore to go almost 100-percent with coaxial cable.

But simple basket weave, open-spaced loose shielding is insufficient for the job, and an aluminum wrap around the polethylene center insulator plus closely braided outer shielding and vinyl wrapping against the elements are strongly recommended. This will ensure minimum outside signal pickup and best signal transmission between antenna and receiver, especially for ultra high TV frequencies at 470-890 MHz. Then with good signal propogation characteristics, not too much capacity, and modest signal attenuation per 100 ft., the use of coax turns into a real bonanza that will outlast ordinary twin lead by many years and still retain most or all of its signal passage and shielding properties. In the long run, the combination of cost and prolongued utility is actually cheaper than ordinary or even extraordinary twin lead.

As an illustration (Fig. 1), we'll use a 6/U cable type that's 100 percent sweep tested and fully characterized by Belden Corp. This particular coax., numbered 9114/9116 (40 or 60 percent braid cover), is available to distributors (who can cut shorter pieces) in 500 and 1,000 ft. lengths. From right to left you see a steel, copper-clad center conductor then the core, aluminum wrap (Duobond®), tight braid wrap, then the covering vinyl jacket. All characteristics, of course, are interesting, but especially note the 78-percent velocity of propogation, the 18 AWG center conductor specification, shield coverage, and the very small dB attenuation per 100 ft. between 50 and 900 MHz—the entire fm and tv band. Note also that the cable has been electronically swept between 5 and 300 MHz to check for any electrical discontinuities. This way your are assured of obtaining first class cable that can be used in MATV, CATV, or the better home installations.

Now compare statistics with Belden's best all-weather twin lead and you'll notice only a two percent increase in propogation velocity, very little difference

6/U TYPE DUOBOND® +BRAID

Description	Trade & UL Type Number	Standard Lengths ft.	Standard Lengths m	U.P.C. No.	AWG (Strand-ing) [Dia. in mm] Nom. D.C.R.	Insula-tion & Nominal Core O.D. Inch	Insula-tion & Nominal Core O.D. mm	Nominal O.D. Inch	Nominal O.D. mm	No. of Shields and Material Nom. D.C.R.	Nom. Imp. (ohms)	Nom. Vel. of Prop.	Nominal Capacitance pF/ft.	Nominal Capacitance pF/m	Nominal Attenuation MHz	Nominal Attenuation db/ 100 ft.	Nominal Attenuation db/ 100 m
18 GAGE SOLID CONDUCTOR																	
100% SWEEP TESTED 5 to 300 mhz	★9114	U-500 U-1000	U-152.4 U-304.8	86016 86015	18 (Solid) .0375 [.95] bare copper covered steel 45.5Ω/M' 149.3Ω/km	Cellular Poly-ethylene	.180	4.57	.275	6.99	DUOBOND II + 40% aluminum braid 17.5Ω/M' 57.4Ω/km 100% shield coverage	75	78%	17.3	56.7	50 100 200 500 900	1.5 2.1 3.1 5.0 6.9	4.9 6.9 10.2 16.4 22.6

BELDEN

Black vinyl jacket.

metro and maxi lead-in wire for color tv

Description	Trade No.	Standard Lengths ft.	Standard Lengths m	U.P.C. No.	AWG (Strand-ing) [Dia. in mm]	Nominal O.D. Inch	Nominal O.D. mm	Nominal Velocity of Propaga-tion	Nominal Capacitance pF/ ft.	Nominal Capacitance pF/ m	Nominal Attenuation MHz	Nominal Attenuation db/ 100	Nominal Attenuation db/ 100 m
ALL-WEATHER POLYETHYLENE JACKET	9085	Carry-pak, coils			22 (7x30)	.165x	4.19x	80%	5.0	16	100	1.4	4.6
		25			[.76]	.400	10.16				200	2.2	7.2
		50									300	2.8	9.2
		75									500	3.8	12.5
		100									900	5.6	18.4

Recommended for use in VHF, UHF, Color and B/W TV and FM installations in uncongested or fringe areas where interference is not a problem. Designed to deliver more signal to the receiver under adverse environmental conditions. The brown cellular polyethylene insulation protects the major portion of the signal energy fields around the conductors and resists ultraviolet degredation.

COPPER COVERED STEEL CONDUCTOR FOR MAXIMUM STRENGTH

MAXI-COLOR® TV LEAD-IN WIRE

300 ohm UHF/VHF/FM

DB LOSS PER 100 FEET	MHz	57	85	177	213	500	650	800	900
	DRY	1.0	1.4	1.7	2.2	3.7	4.1	5.2	6.3
	WET	1.5	1.9	2.5	3.4	7.7	9.9	11.8	14.4

DB LOSS PER 100 FEET	MHz	57	85	177	213	500	650	800	900
	DRY	.9	1.2	1.5	2.0	3.2	3.8	4.5	5.4
	WET	1.8	2.8	3.7	5.2	14.0	20.0	32.0	46.0

Fig. 1. Manufacturers characteristics tables show that the best cable is not perfect under all frequency and weather conditions.

in attenuation—acutally less in coax. through 200 MHz—and a third less capacitance which makes little difference in relatively short hauls of coax. And toward the end of the maxi-color table see what the manufacturer's recommendations are in this excellent twin lead's usage.

Is it really worthwhile continuing the use of run-of-the-mill twin lead that, when old, dirty, and wet, actually retains only a few percent of its original signal handling ability? Most people would obviously say "no!" First because a lower impedance cable (300 vs 75 ohms) means a better antenna/receiver match, therefore little or no standing waves, exclusion of outside interference, the entire incoming signal contained within the cable itself, and a small diameter lead in that can be taped to the antenna mast, installed with a staple gun, draped over air conditioning ducts or any other metal, and easily brought into housing without awkward and expensive insulators. And if you're some distance away from the tv transmitter or want several receivers connected to the same antenna, highly satisfactory uhf/vhf amplifiers are available for a reasonable price (about $50 to $75) that will distribute excellent signals throughout the house or apartment, permitting shielded splitters or couplers to serve the entire dwelling or working area.

If you're still not convinced, look at the characteristics of some ordinary twin lead just below the de luxe twin cable that is Belden's best. You pay less, but the price is proportionately costly. Especially note the difference between dry and wet. Some of these figures, as you can see are rough! We could continue and carry these analogies to extremes, but the results wouldn't change; good coaxial cable, in almost every conceivable way, is vastly superior.

You may also be interested to know that caution is suggested when using "F" connectors with poor quality coax. Loose shielding often does not make good contact, especially with loose braid, which then results in a 30 dB loss through leakage. And one piece "F" fittings make better cable contact than the two piece versions since they're safer, stronger, and have less leakage.

Antennas

Evaluation of these highly specialized transducers designed to pick up broadcast electroamagnetic radiation and deliver it in the form of microvolts or millivolts to some receiver's antenna terminals isn't really much more difficult than transmission lines. Just like cable, however, you must look at the specifications and understand what's needed,

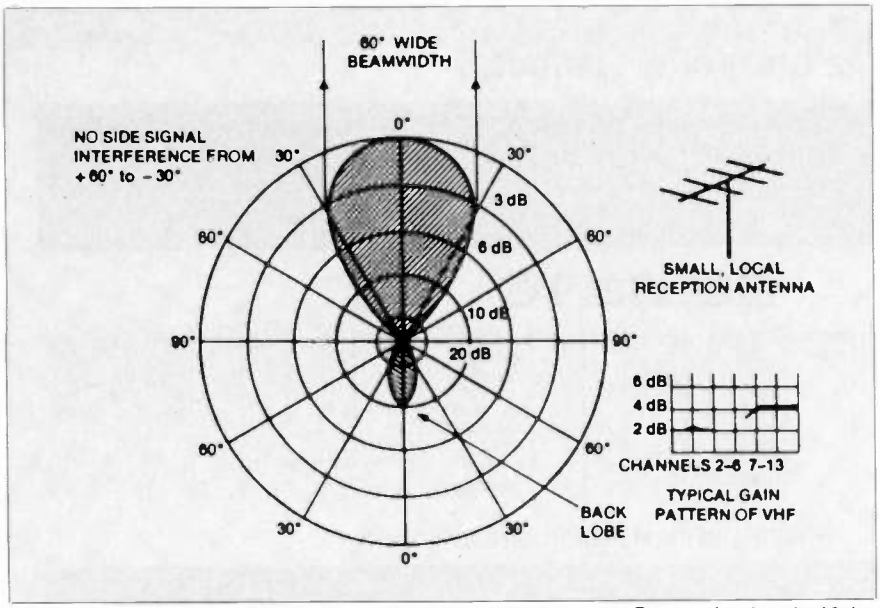


Fig. 2. A typical local antenna polar pattern and gain diagrams. Front-to-back ratio 10:1 (poor).

where, and why. Unfortunately, just any old antenna stuck on some roof outcropping won't do. Smart installers select a certain antenna for a specific application, use good cable downlead and make sure few, if any, standing waves interfere.

Every antenna has both ISWR or VSWR (current or voltage standing wave ratio), and front-to-back ratio characteristics built in. And if the manufacturer is on the beam, you'll also be able to see the various channel beamwidths, plus uhf/vhf gains (with reference to some isotropic or mythical dipole), and the antenna's overall signal handling ability called polar patterns. In some instances, channels 7 through 13 (high vhf) may require medium or high gain; in other situations, uhf is the critical factor. So, for best reception, you'll have to design your particular installation to accomodate one or more special advantages or problems. Here's how:

Standing wave ratios usually amount to E(max)/E(min) or I(max)/I(min) and can be thought of as incident (outgoing) or reflected (incoming) waves which combine to form peaks or valleys of stationary energy, either adding to or subtracting from the received signal. This usually means signal loss and even undesirable fine line picture interference. Half and quarter wave traps are often used to remote this difficulty, but a good impedance match between antenna, transmission line, and receiver generally solves the problem. Here is where nominally low impedance 75-ohm cable has less chance of producing standing waves than 300-ohm twin lead. And if you're using 75-to-300-ohm balanced-to-unbalanced transformers (baluns) both at the antenna and receiver, it's very difficult, especially with coax. to generate SWR unless there's either faulty antenna or cable. Some antenna companies, such as Winegard, are even providing 75 to 300-ohms switch terminations at antenna-cable couplings for automatic impedance matches to down leads. And when the TV makers finally discover there's only 1.3 to 1.5 dB loss difference at 900 MHz between the best twin lead and coax., perhaps we'll even have all-coax. u/v splitters going into at least the better receivers instead of the usual awkward combination of the two. Usable signals from uhf stations are equivalent to vhf anyway, and since there's a minimum insertion loss of from 0.5 to 1 dB among even the best baluns, why not use good quality coax. for both? Furthermore, u/v tuners are annually becoming more

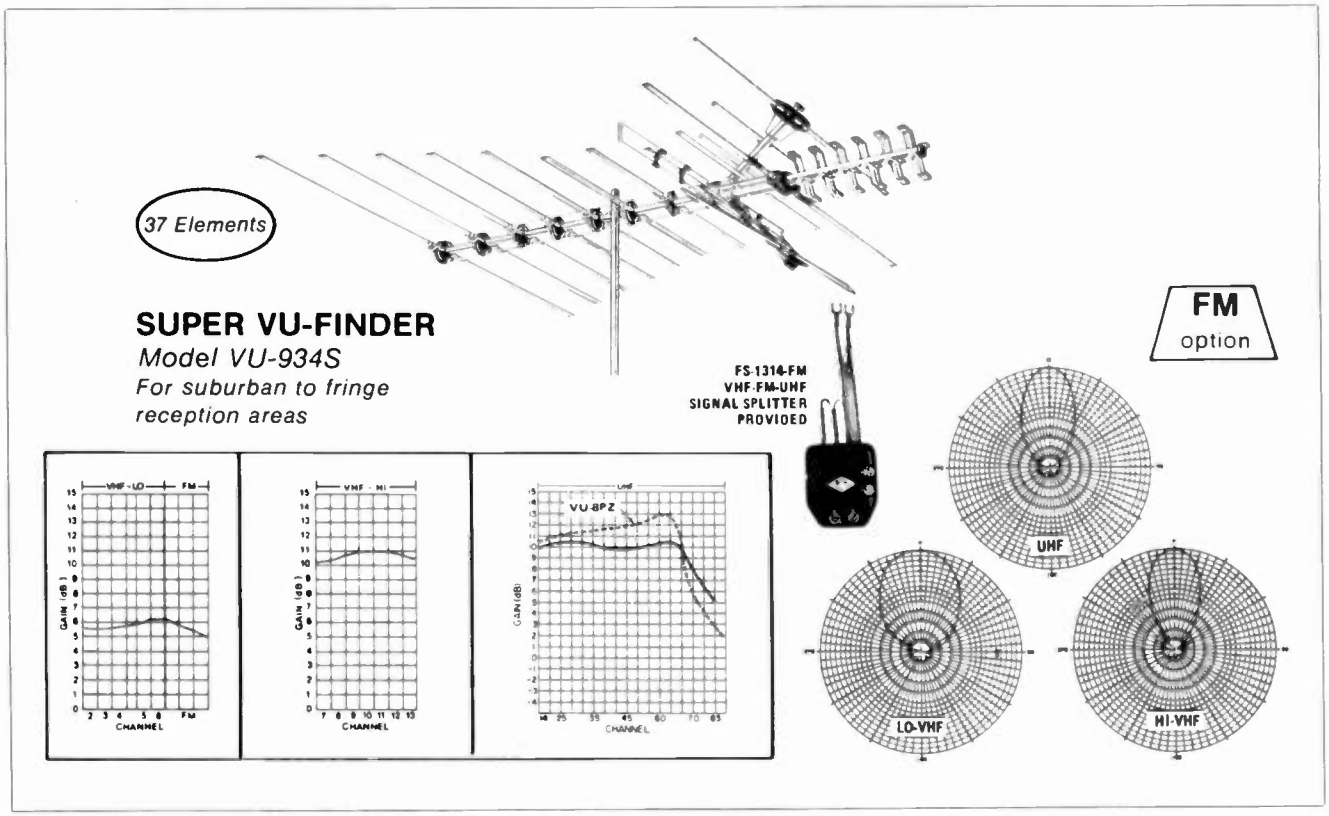


Fig. 3. Jerrold's 10 to 90-mile super VU-Finder log periodic. Most elements are driven, not parasitic.

comparable in signal pickup.

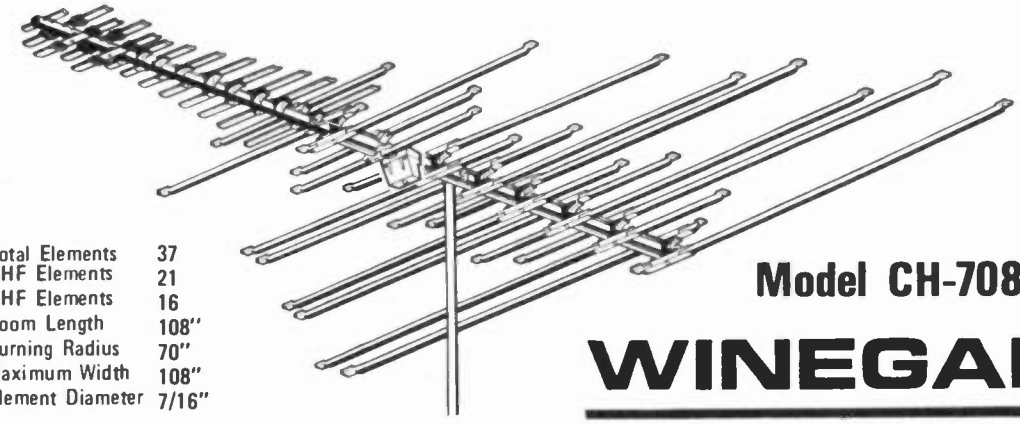
The next points worth making involve front-to-back antenna ratios, along with side and back lobes, plus beamwidth. These are all important considerations since they directly involve antenna selections for metropolitan and distance areas and the actual station spread you want the antenna to "see."

Let's draw a pattern of some hypothetical metro antenna (Fig. 2) with a good, wide front lobe, no side lobes, and a fairly prominent back lobe. This would be almost ideal for any short-to-medium distance antenna if was not for the 10 dB back lobe. Usual interferences between +70 and −30 degrees aren't going to penetrate normal reception frequencies since they're tuned out. Because of the 10 dB back lobe, however, this antenna's front-to-back ratio is 10:1, and you'd much prefer a 20:1 situation to prevent co-channel and other interference from entering.

Unfortunately, low gain antennas with broad beamwidths are going to exhibit some back or side lobes, and this makes very little difference in high signal areas that are *not* surrounded by large buildings or highly uneven terrain. But when such phenomena do occur, you'll need a high gain antenna with considerable directivity (narrow beamwidth), then reduce its signal pull with resistive padders called attenuators. Unfortunately, all input signals are equally attenuated by this method and if a single broadcaster is your only problem, you may require an especially cut transducer for that one particular station—a situation which can be arranged if you're willing to pay custom costs. On the other hand, judicious selection of a combined u/v antenna with suitable gains can probably solve most difficulties without either undesirable attenuators or peculiar transducer rigs. We suggest the latter approach, but you'll probably need to investigate more than one manufacturer's offerings to find the particular product.

What about stations in more or less opposite directions? Well, we're situated in something of a modest Vee between two large cities, and a single u/v rig does moderately well for both. A rotor, of course, would help, but those things sometimes freeze, lock up, or have connection problems that either require the services of a mechanic or early replacement . . . Use at your own discretion.

Now let's proceed to the very real



Total Elements	37
UHF Elements	21
VHF Elements	16
Boom Length	108"
Turning Radius	70"
Maximum Width	108"
Element Diameter	7/16"

Model CH-7082

WINEGARD

GAIN	CH.2	CH.4	CH.6	CH.7	CH.9	CH.11	CH.13	CH.14	CH.32	CH.50	CH.69
% over reference dipole	86	97	90	202	195	188	346	254	246	188	188
db over reference dipole	5.4	5.9	5.6	9.6	9.4	9.2	9.2	10.8	11.0	10.8	9.2
beamwidth at half power points	72°	72°	75°	43°	55°	50°	50°	40°	48°	42°	33°
front-to-back ratio	20	19	20	17	20	20	20	20	20	18	20

POLAR PATTERNS

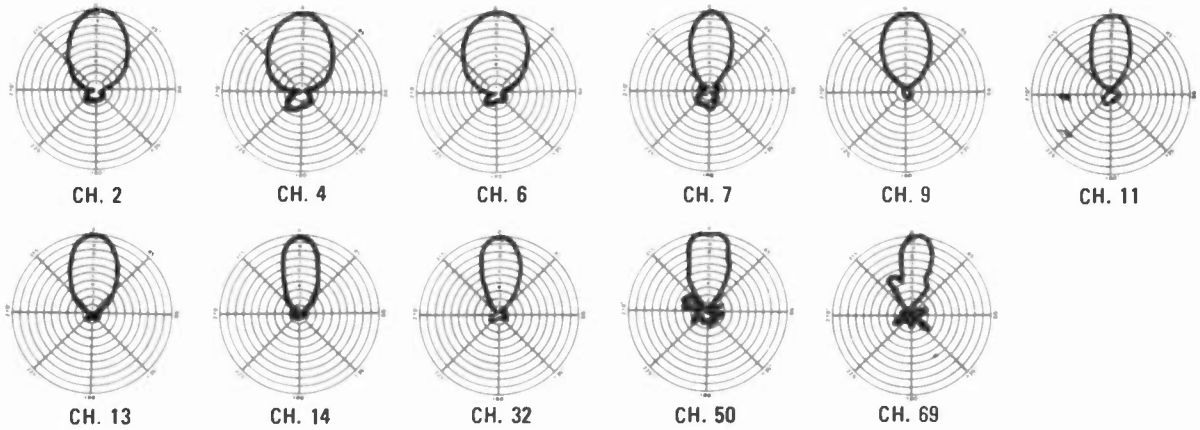
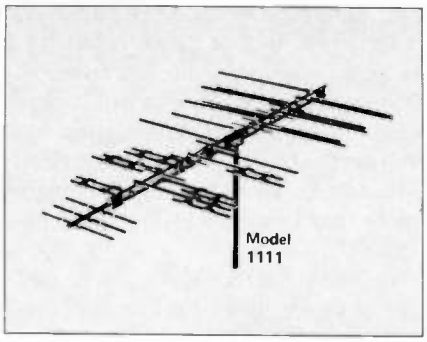


Fig. 4. Winegard's 10 to 40-mile antenna with a full set of polar patterns and other data for each channel.



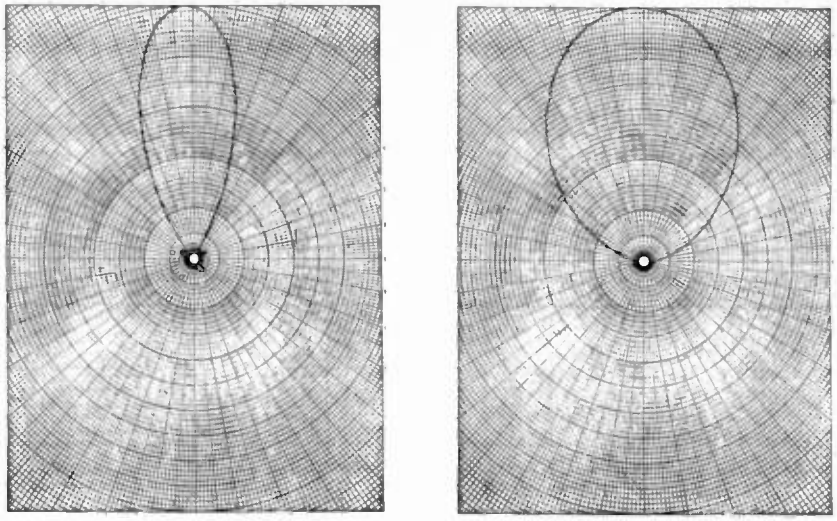


Fig. 5. Typical Channel Master Quantum antenna high and low channel polar pattern.

world of antennas, polar patterns and gains for first-hand observation of what's new and worthwhile in the market. As you may or may not know, plain antennas don't even have unity (1) gain, therefore all their statistics come from comparisons with a mythical dipole, whatever that is. Nontheless, comparing antenna gains is not necessarily odious, nor do we flinch from comparing some of the better arrays now on the market. At the moment, some of the best designed and best selling antennas are made by three manufacturers: Taco-Jerrold, Winegard, and Channel Master. True, these are three of the more expensive signal receptors, but their overall performance is well worth the difference.

Taco-Jerrold (Fig. 3), a true log periodic, has mostly driven elements, a few directors in front and no reflectors for the usual rear isolation since a coupling harness changes phase between front and back so that the two extremes are 180 degrees out-of-phase. This, of course, serves as an electronic rear reflector and generally prevents back reception of unwanted signals.

Careful phasing and sufficient elements offer good broadband, high gain, and a highly effective antenna array that easily includes uhf at considerable signal gain in the front end u/v coupling. The price is somewhat steep, but if you want the best of all worlds with maximum efficiency, a good log periodic will do the job nicely. Our test antenna is a model VU-934S, having an element count of 37 (including a half dozen directors), a bow-tie uhf arrangement with corner reflector, followed by all the tuned vhf elements. On low vhf, note the very broadband beamwidth for channels 2 through 6, somewhat less for 7 through 13, and a very similar composite pattern for uhf stations 14 through 69—channels 70 and above are now FCC-assigned to land mobile, although a few remain in the use as tv repeaters. Gain for low band channels averages better than 5.5 dB, highband channels over 10 dB, and uhf (solid line) about the same. Larger models have double booms for maximum strength, and VSWR, according to Jerrold does not exceed 1.8:1 for vhf or 1.5:1 for uhf. Breakaway elements extend these ranges to a full 890 MHz for all-channel uhf, and maximum fm reception, as well. Front-to-back ratios are between 18 and 20 dB, and the VU-934S is quite useful between 10 and 40 miles from stations in reasonable reception areas, and all elements have an alodine finish against weather and corrosion.

Winegard (Fig. 4) is offering a special line of Chromstar antennas with a recent tri-linear uhf system that performs as three half wave directors at the high end and becomes a simple half wave director on the low end, resulting in relatively linear gain for all uhf channels. Elements are cross-phased and end fire driven in an overall high performance, ruggedized Yagi. And since this antenna has no corner reflector and a relatively flat plane, there is little wind resistance.

Truss-type phasing bars top and bottom offer maximum signal transfer and 7/16-inch diameter aluminum elements give greater strength and somewhat better performance than smaller tubing. But the feature we like best in this line is a weather-protected cartridge housing with built-in balun for either 75- or 300-ohm downlead connections. This antenna, as you will observe, is quite comparable to the 37-element Jerrold except a little difference in the upper vhf channels, according to the gain patterns, but my own tests showed this not to be true. U/v pickups were almost equal. Even most front-to-back ratios are equivalent. Some back and side lobes do show on channels 4, 7, 50, and 69, but are well controlled and shouldn't be a problem since the minimum front-to-back ratio for all these channels is 17, with the remainder around 20.

Beamwidth is very broad among the low vhf channels, and respectable among the high vhf stations. Uhf is about what you'd expect, considering the frequencies. Since this is another 37-element receptor, its useful range lies between 10 and 40 miles as the crow flies.

Channel Master's perhaps most effective antennas in problem locations (they make several other types) is its Quantum Series. These were designed for sharp beam patterns and exceptional front to back ratios (up to 35dB) as well as excellent mechanical strength. Available in UFH/VHF and VHF only versions, various Quantum antenna models are suitable for from suburban to deep fringe use, the longest, the Model 1110 being almost sixteen feet in length. The Quantum series has been used to solve severe reflection problems in city and suburban locations as well as receive stations up to 150 miles away with stations about 45 miles away off the back.

Other features of the Quantum series are a full line of baluns and preamplifiers, housed in a compartment in the antenna structure, double boom construction, and ⅜ in. bolts for mounting. Typical beam patterns and front to back ratios are shown in Figure 5.

Suggested retail prices on all antennas illustrated for the three manufacturers range from $35 and to over $100, depending on the number of elements and your sources or installer. Installation, of course, is extra, and overall prices vary with lead-in, technical skills, and geographical location.

Part 2 of this series will discuss indoor antennas and how they're being aided by broadcasters transmitting circulat polarized patterns, and an up-to-date rundown on CP itself. ET/D

MORE ON

THE METS SYSTEM

(Minimum Effort Trouble Shooting)

Have you ever met a technician who uses a volt meter like a magic wand? He doesn't figure anything out, he just walks through a circuit and seems to always know exactly what he is looking for. He seems to earn as much money fixing dogs as he does replacing circuit breakers. Wanna know something else? **He doesn't really know any more than you do** about **how** any particular circuit works. (We'll call him Technician "A")

It's a Proven Fact

One technician/shop owner works his tail off six days a week for $15-20,000 per year. Another shop owner works half as hard only five days a week and earns $20-30,000 per year.

I decided to find out just how much a TV technician **could** earn and at the same time prove my system.

I put an ad in the newspaper, asking for color TV repair jobs that:
(1) Other shops have turned down
(2) Other shops couldn't fix
(3) Other shops didn't want
(4) Someone said **couldn't** be fixed

I further stated that I had a new concept of TV repair and that I would fix any of the above **in the customer's home** in approx. **one hour.** Furthermore that my rates would be comparable or less than any other shop in town. In addition, if I couldn't fix the set in one hour, **in the customer's home** for **less** than my estimate, there would be **no** charge whatever.

I spent $63.00 per week for the ad which brought me enough business to work only 3½ days a week. I opened my business June 1 (during the slow season). By August 31 I had grossed over $26,800. I paid out $891.00 for parts, $522.00 gas and oil and $1,071.00 for advertising. Since I had no rent or utilities, I put the remaining $23,316.00 in my pocket. (Over $370.00 per **day** net profit for each day I worked. *

*Additional stats: service call $25.00 plus $49.00 flat-rate chassis labor plus approx. retail for parts. 282 different jobs completed in 63 working days at an average of $95.00 per job, including 6 CRTs, approx. 4.5 jobs per day. 1/3 of all time was spent driving (usually for parts!) The whole thing happened in a Pontiac 4-door sedan, no truck, no shop, no overhead. My longest work day was 7 hours.

Don't laugh—you could probably do it, too . . . once you understand the troubleshooting concepts. (It goes something like this).

Every technician starts out as a "C^1". They're the ones who have to figure out every job as they go. Their career begins with the concept that all troubleshooting is based on knowing **how** a circuit works.

Subconsciously, about 5% of the C^1's will begin to realize that knowing **how** a circuit works is only a small part of it. They will subconsciously begin to think in terms of which components fail more frequently than others. At this point, they become "C^2"s.

Through the years the vast majority of the C^1 and C^2 technicians will become extremely knowledgeable as to **HOW** almost every circuit works. A proportionately high percentage of them will become part-time Vo-Tech instructors. For the most part, they will all become the "good old boys" of our industry. They will always be our "stable" stock.

C^2s Become C^3s

A very small percentage of the C^2 technicians will subconsciously carry the epidemic parts failure concept a step further. In addition to noticing that certain parts fail over and over again, they begin to relate these parts to specific circuit functions. For example, the .0082 or .01 @ 1600v capacitor that goes from the plate of the vertical output stage "towards" the Multi-Vibrator stage (the feedback loop) **will** eventually become thermally unstable and cause vertical sync problems. Thus far we have described only the symptom to epidemic parts failure concept used by C^2 technicians. The C^3 technician carries this concept a step further; he begins to ask WHY!! He ultimately relates the failure to RF bombardment coming from the vertical output stage. Eventually his entire thought process begins to drift away from the "How Does the Circuit Work" concept. Instead he begins to relate to how and why certain components FAIL. (There are many such concepts. We mentioned only one so that you could relate to the idea). This same concept makes the C^3 technician suspicious of all focus and centering pots or coils. For that matter, he suspects any component that must operate in an RF environment. He has determined that RF bombardment destroys parts. Because of **another** concept, he will begin to understand **which** parts. The C^3 technician doesn't know any more about theory or how a TV works than a C^2 or most C's for that matter; he simply relates to the problem from a different vantage point. Eventually the C^3 will become an "A" technician.

As I said, you could probably do it. It really isn't that difficult. In fact, I've written a two-part course on troubleshooting concepts and short-cuts that are based not on how a set works but how, why and what happens . . . when they fail. One section is called the Dog-Catcher. The D-C series consists of 41 different troubleshooting procedures that explain short-cuts and troubleshooting concepts for AGC, vertical, color, video, IF, LV pwr supplies, six different horiz circuits including SCR output and the CTC 101 RCA start-up and shut-down horiz out and pwr supply. Plus many more. There is also a 96-page in-depth manual on vertical circuits that covers practically every vertical circuit used. The DC series sells for $151.95 pre-paid.

The second part of the course is called "Digital Thinking." The DT manual is designed to provide you with the concepts on why components fail, what each one does, the in-circuit relationship of one component to another during operation and, to teach you to analyze **any** circuit when it is in its static condition (**not** working). After all, that's what you have to work with if and when you're going to fix it. Digital Thinking is an absolute must for any electronics technician in any field, not just TV repair. D-T sells for $89.00 pre-paid. It comes complete with a test section after each portion.

METS, BOX 8228, AMARILLO, TX 79109

Dear METS,

- ☐ Enclosed is my check for $151.95. Please send the DC Series pre-paid. ☐ Send it C.O.D. I'll pay the additional estimated $7.00 postage and handling.
- ☐ Enclosed is my check for $89.00. Please send the D-T manual pre-paid. ☐ Send it C.O.D. I'll pay the additional estimated $5.00 postage and handling.
- ☐ **Enclosed is my check for $200.00. Send both the DC and D-T Series (a savings of $40.95).**
- ☐ Send both C.O.D. I'll pay the additional estimated $9.00 postage and handling or an estimated $209.00. (C.O.D. postage varies in different mail zones; it's expensive).

Company Name

Street Address

City, State, Zip

WHILE THEY LAST

We have a limited supply of color-coded (8 different colors) schematics for Zenith horiz/hi-voltage circuits 25CC55 thru 25KC45 (66 chassis in all) complete with color-coded parts location pictorials and color-coded troubleshooting procedures. We will include a copy of this entire color-coded series with each order received until we run out (retail value $39.00)

Here are just a few endorsements:

"I am convinced that METS could double or triple the production of any technician that uses it."

Smokey Wells
President, Houston Local
Texas Electronics Association

"My METS literature paid for itself the second day I had it. I would highly recommend it to any technician. Call me and I'll tell you so."

Bill Poole
Knight's TV
Newark, NJ

"METS has done something I do not believe anyone has done before . . . I think that studying **METS** procedures thoroughly and understanding the circuitry involved as well as the (METS) troubleshooting procedures and their implications could result in some very effective technicians."

Walter Schwartz
ET/D
July 1981 Issue

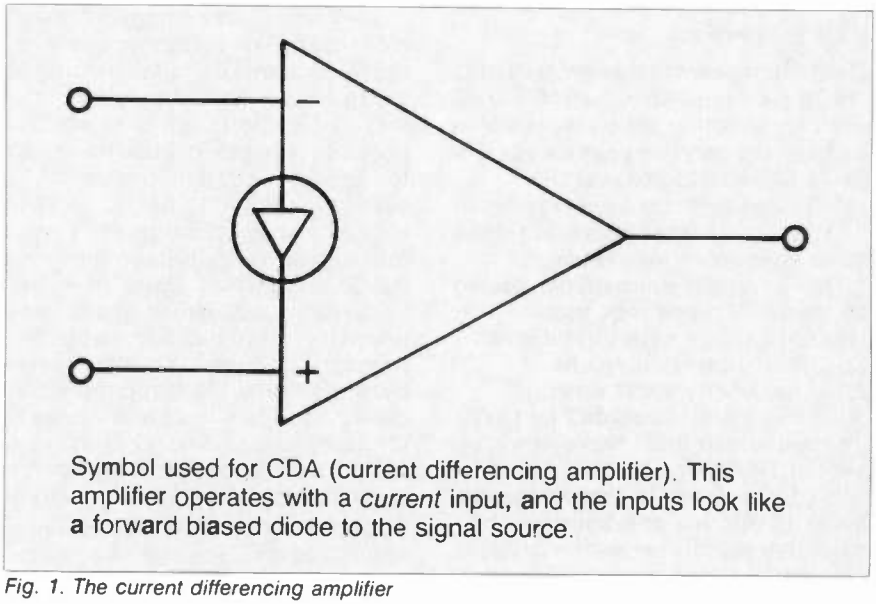
OP Amps IV

Norton amplifiers and active filters

In this installment of *Op Amps* we will give you some very practical background in active filters and try to take the mystery out of their basic design and operation

By Bernard B. Daien

In the last few years, op amps have been developed for use with a single power supply. In the main, they are intended for ac inputs (audio). Many of these devices are "Current Differencing Amplifiers" (CDAs), sometimes referred to a "Norton Amplifiers," or "current mirror amplifiers." These op amps are quite different in use, and deserve a little discussion . . .



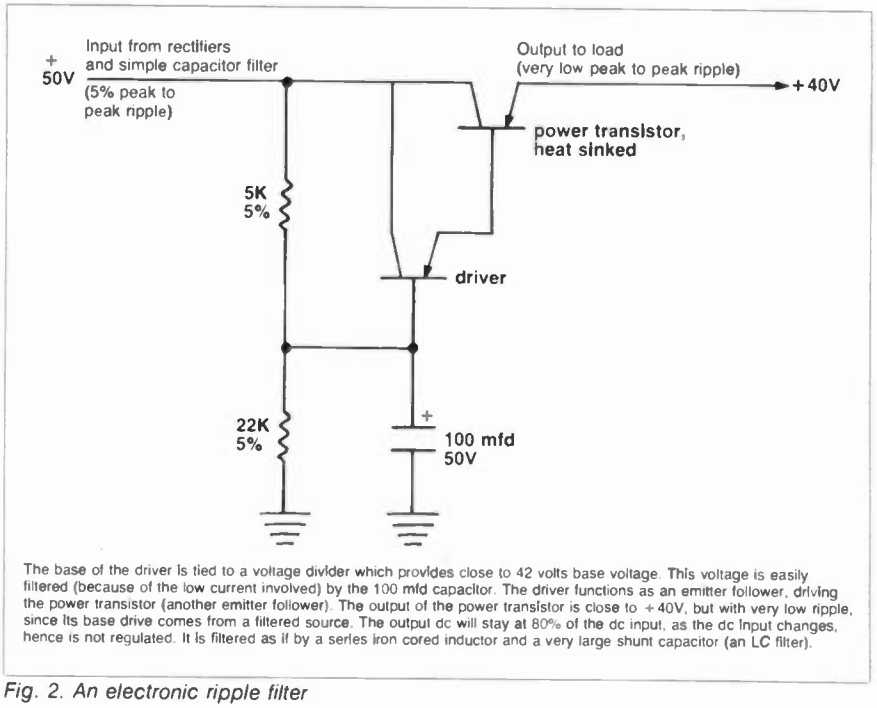
Symbol used for CDA (current differencing amplifier). This amplifier operates with a *current* input, and the inputs look like a forward biased diode to the signal source.

Fig. 1. The current differencing amplifier

Current differencing amplifiers

CDAs are designed to operate with an input voltage swing that can go down to zero, or up to full power supply voltage. The output swing goes to within a quarter volt of ground, and up to within one volt of the supply voltage. A good example of this op amp is the LM3900, a quad op amp (four in a package), which works well in audio circuits, is very inexpensive, and commonly available.

The manufacturers of CDAs have been trying to establish a new op amp symbol, to differentiate between conventional op amps and CDAs. The symbol is shown in Figure 1. There is a very good reason for emphasizing on a schematic that a CDA is being used . . . the input of a CDA is a current, while in most op amps the input is a voltage. In fact, the input of a CDA looks much like a forward biased diode, or an emitter-base junction of a bipolar transistor (which it is). Now you already know that if you attempt to drive the emitter base junction of a transistor with an input greater than 0.6 volts, the diode (junction) simply conducts, and clamps the voltage to 0.6 volts. Any attempt to increase the input voltage simply results in a larger input current. Stated another way, a forward biased silicon junction is a good 0.6 volt voltage regulator, functioning much like a zener (except of course, that it is forward biased).



The base of the driver is tied to a voltage divider which provides close to 42 volts base voltage. This voltage is easily filtered (because of the low current involved) by the 100 mfd capacitor. The driver functions as an emitter follower, driving the power transistor (another emitter follower). The output of the power transistor is close to +40V, but with very low ripple, since its base drive comes from a filtered source. The output dc will stay at 80% of the dc input, as the dc input changes, hence is not regulated. It is filtered as if by a series iron cored inductor and a very large shunt capacitor (an LC filter).

Fig. 2. An electronic ripple filter

The CDA input therefore behaves in a similar manner. As a result, if you wish to drive a CDA from a voltage source,

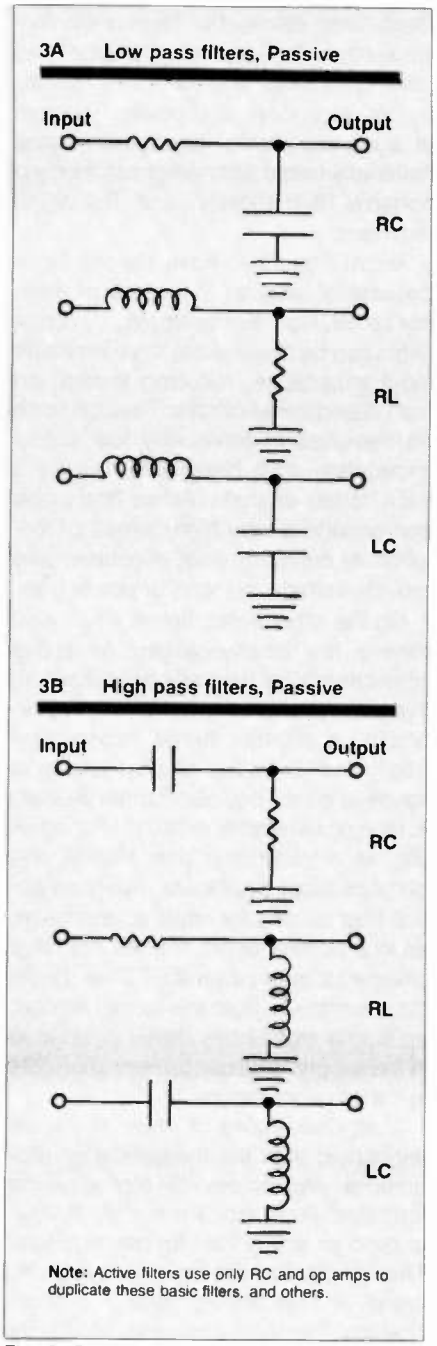


Fig. 3. Passive filters

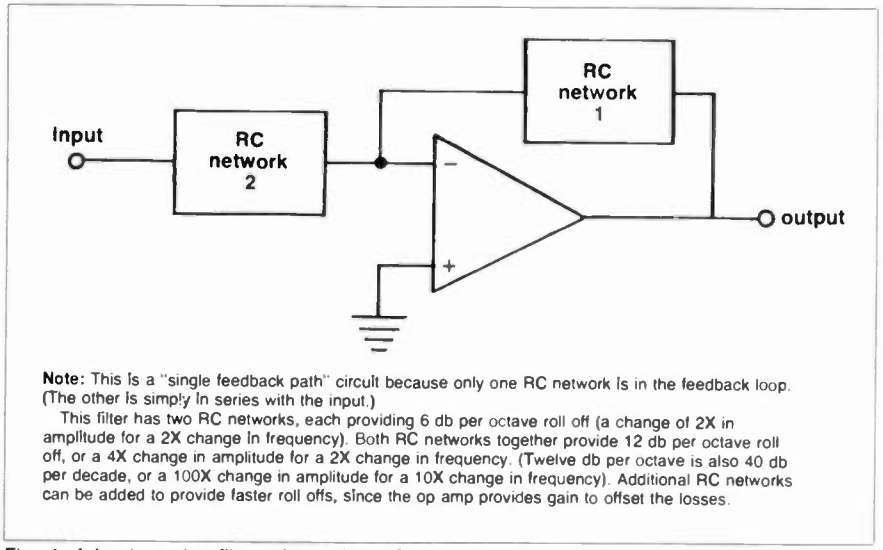


Fig. 4. A basic active filter with a single feedback path

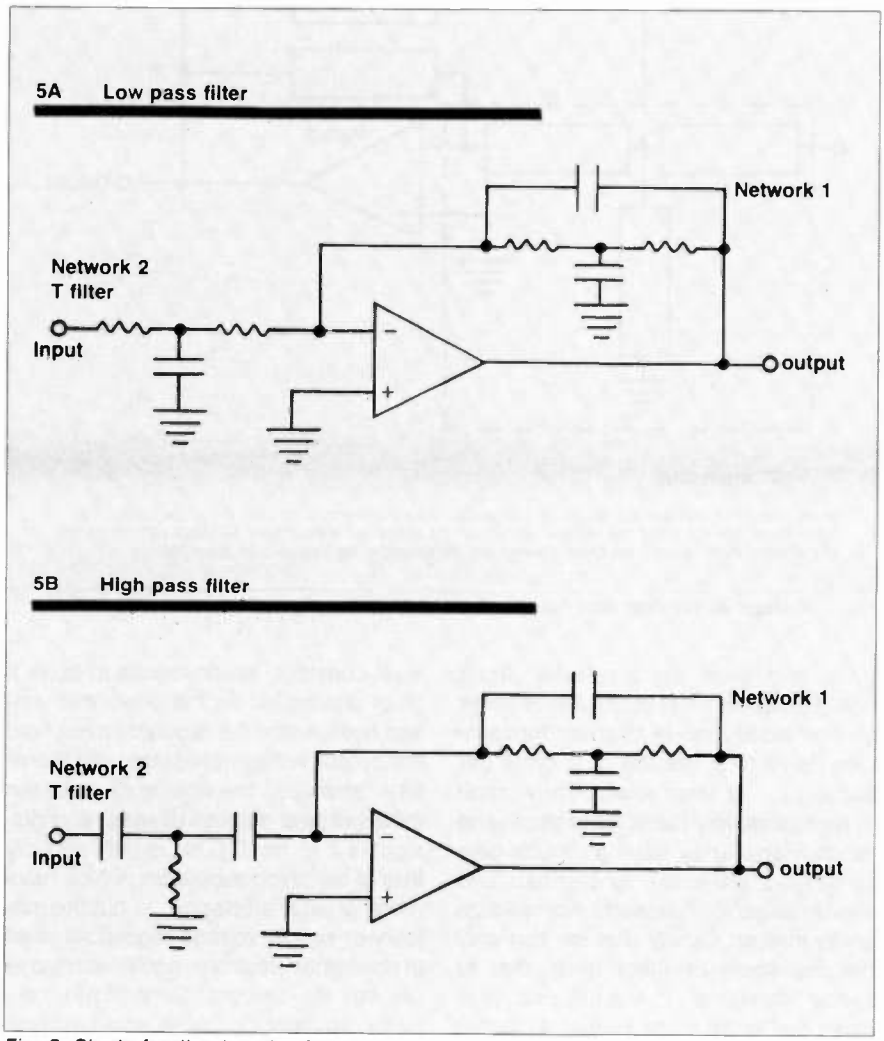


Fig. 5. Single feedback active filters

you MUST use a series resistor between the source and the CDA input. Normally, with a conventional op amp, using the inverting input, we do the same thing BECAUSE THE INVERTING INPUT IS A VERY LOW IMPEDANCE due to the feedback being applied to it. However, the NON INVERTING INPUT IS NORMALLY A VERY HIGH IMPEDANCE, which is NOT the case withthe CDA. Thus the CDA requires a series input resistor for both the inverting, and the non-inverting inputs.

Of course, if you are driving the CDA with a current source, a high impedance generator . . . as discussed earlier in this series, then the resistor may be omitted. (A high impedance source limits the current due to the internal impedance of the generator itself).

Since much of our electronic equipment operates with a single power supply, CDAs are attractive for such uses as active filters. Generally these applications use more than one op amp, and the dual and quad op amps are very small and inexpensive, and thus particularly attractive for such circuitry. CDAs are made in multi op amp packages, as previously mentioned; thus the use of CDAs is growing for these applications.

Active filters

The active filter generally eliminates the need for inductors . . . and audio inductors are large, heavy, and expensive.

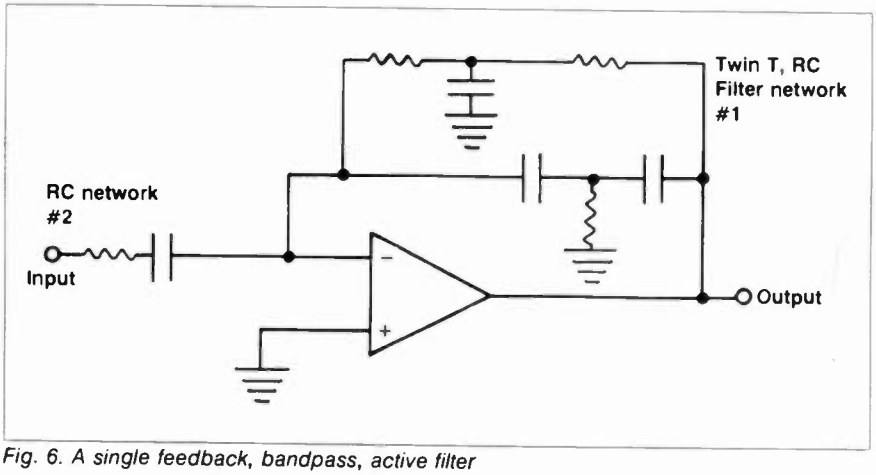
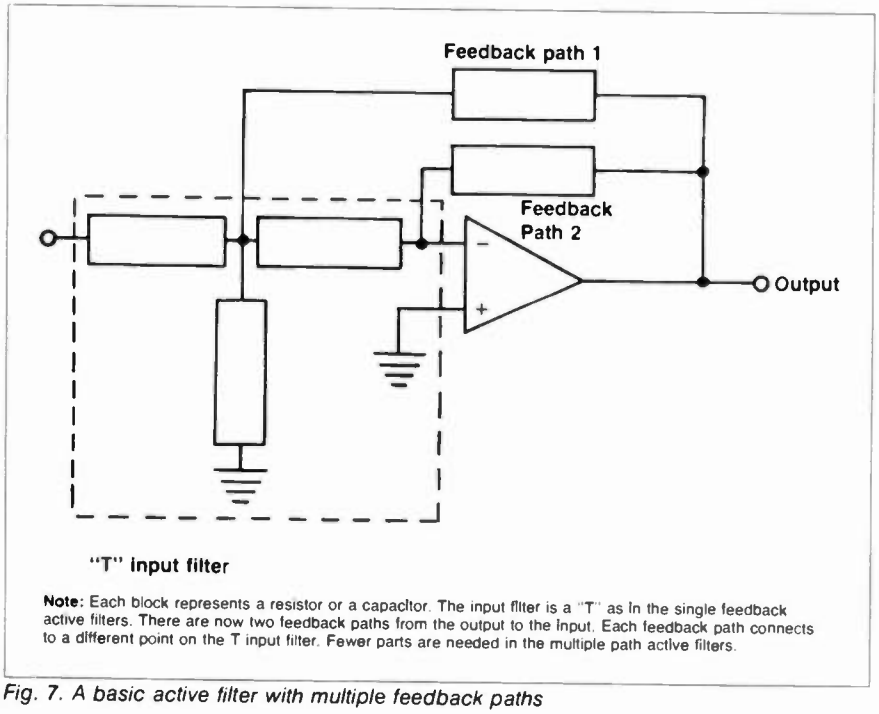


Fig. 6. A single feedback, bandpass, active filter



Note: Each block represents a resistor or a capacitor. The input filter is a "T" as in the single feedback active filters. There are now two feedback paths from the output to the input. Each feedback path connects to a different point on the T input filter. Fewer parts are needed in the multiple path active filters.

Fig. 7. A basic active filter with multiple feedback paths

(Mounting them on a printed circuit board is a problem in itself). Active filters can be readily made to cover frequencies down to a fraction of a cycle per second . . . or even lower. They come in high pass, low pass, band pass, and notch filters. They have as much gain as desired, are small, light, cheap, and easily "tuned" or "aligned." Active filters come in such variety that we can only discuss some of them here, due to space limitations . . . but the examples given will enable the reader to better understand the basic active filters, and hopefully, pursue the subject further, with enough understanding of the topic to facilitate self study.

Active filters are used increasingly in power supplies, to reduce ripple. You must be careful to differentiate between an electronic "filter" and a "voltage regulator" however. It is true that a voltage regulator also reduces ripple ("filters"), but it does this by holding the output dc level constant, which results in quite a bit of dissipation as the powerline voltage rises, since the regulator must hold the output voltage constant, and therefore "absorbs" the difference between the input and output voltages, and dissipates it as heat. (This is only partially true of switching regulators, which have much greater efficiency . . . but the majority of simple voltage regulators used in consumer electronic equipment today are still the straight "Series type transistor regulator," or, even worse, a brute force "shunt type" zener regulator).

An electronic filter is shown in Figure 2, along with the explanation of its operation. Notice that if the input dc voltage rises, the output voltage will also rise. In the case shown, the output voltage will always be close to 80% of the input voltage, but with a much lower voltage. Due to the gain of the transistors, which are active devices, the circuit behaves like a passive filter with very large filter elements. Thus relatively small capacitors are made to appear as large capacitors and inductors, saving weight, size, cost, and power. The use of such electronic filters contributes materially to the light weight of modern portable High Fidelity, and Television receivers.

Active filters also have several other desireable features . . . some of them not so obvious. For example . . . active filters can be designed to have very high input impedance, reducing loading on high impedance sources. They can also be designed to have very low output impedance, thus being able to drive a wide variety of loads. Active filters also can provide a very high degree of isolation, or buffering. And, of course, they provide voltage, current, or power gain.

On the other hand, active filters also have a few disadvantages. An active filter cannot be free of connections to the supply, and to ground, as, for example, a parallel tuned "absorption trap" which is free of all connections to anything else. They also cannot be used at high power levels, or high voltage levels, as in transmitter use. Finally, and perhaps most significant, when an active filter is used for ripple suppression, as in a power supply, *it does not have energy storage capability*. Thus the filter is unable to hold the output voltage up during momentary drops of outages in the supply. This can be very important in certain applications.

Most discussions of active filters are concerned with the theoretical considerations, and replete with mathematical formulae. As a result it is very difficult to build an active filter for practical use. This discussion will be in two general areas . . . the theory, and . . . some practical filters you can easily modify for the particular frequencies you want to use. It turns out that the active filters with the most THEORETICAL advantages are not easily adapted to use with simple computations and adjustments . . . while the filters which seem to offer fewer advantages, are easier to calculate, adjust, and use, and therefore are most practical. After our discussion concerning HOW active filters work, there will be a collection of practical circuits you can easily build, adjust and use.

How they work

A variety of R/C, and R/L passive filters are shown in Figure 3, and they are certainly familiar to the average technician. Active filters simply do the same job, but use R/C networks to replace the coils. And when we replace L/C networks, again we use only R and C components

to the job.

This is possible because the active filter has the ability to PHASE INVERT signals. If you think about it, an inductor causes a phase lag in current of 90°, while the capacitor causes a current lead of 90°. Thus the capacitor is 180° out of phase with the inductor. If we use a capacitor to cause a 90° leading current, then phase invert the current, the result will be a lagging 90° current . . . or *an inductive current!* Thus a simple bipolar transistor in a common emitter circuit, along with a capacitor and a few resistors, can behave like an inductor . . . since the transistor is a phase inverter. More about this later . . .

Using the gain of an amplifier, with inverting and non inverting inputs, we can also create simple feedback loops from output back to input. We can use negative feedback to reduce gain . . . and if the negative feedback loop contains a capacitor in it, we can reduce the gain on a frequency selective basis. Using positive feedback, on the other hand, we increase gain . . . and if we use a capacitor in the positive feedback loop we can increase gain on a frequency selective basis. Thus we can use feedback loops to create frequency selective networks, and the result will appear at the output of an op amp.

Further, we can put a simple R/C network in series with the input to the op amp, thus we have three frequency determining networks. Finally, it is possible to put another R/C network in the output of the active filter, thus obtaining a total of four frequency selective networks, which can work so as to add together in cumulative effect forming high pass or low pass filters . . . or combine in such a way as to form band pass and band stop filters.

It is possible that we could use passive R/C networks to do some of the same things . . . but passive networks all have losses, and combining several of them results in a very small signal . . . "in the noise." This happens because passive networks obtain their roll-offs by reducing gain only, whereas an active filter can start at some gain level, and, after roll off, still yield a useable signal level. Further, passive filters need some sort of isolation, or buffering, to prevent undesireable reactions between them . . . and the op amp in the active filter provides this action.

The basic, most commonly discussed active filter is shown in block diagram in Figure 4. One RC network is used in the feedback loop between the output and the INVERTING input (negative feedback, frequency selective), and the other RC network is inserted between the signal source and the input to the amplifier. Figure 5 shows how this circuit can be implemented for high pass, and low pass functions, by merely reversing the positions of some of the R's and C's. This circuit is known as the "single feedback active filter" *because it has one RC filter in the feedback to THE INVERTING INPUT,* (and one RC filter in the input, but not in the feedback loop). This provides a roll-off of 12 db per octave (the gain is changed 4X for each 2X change in frequency). Or, stated another way, the roll off is 40 db per decade (100X change in amplitude for a 10X change in frequency).

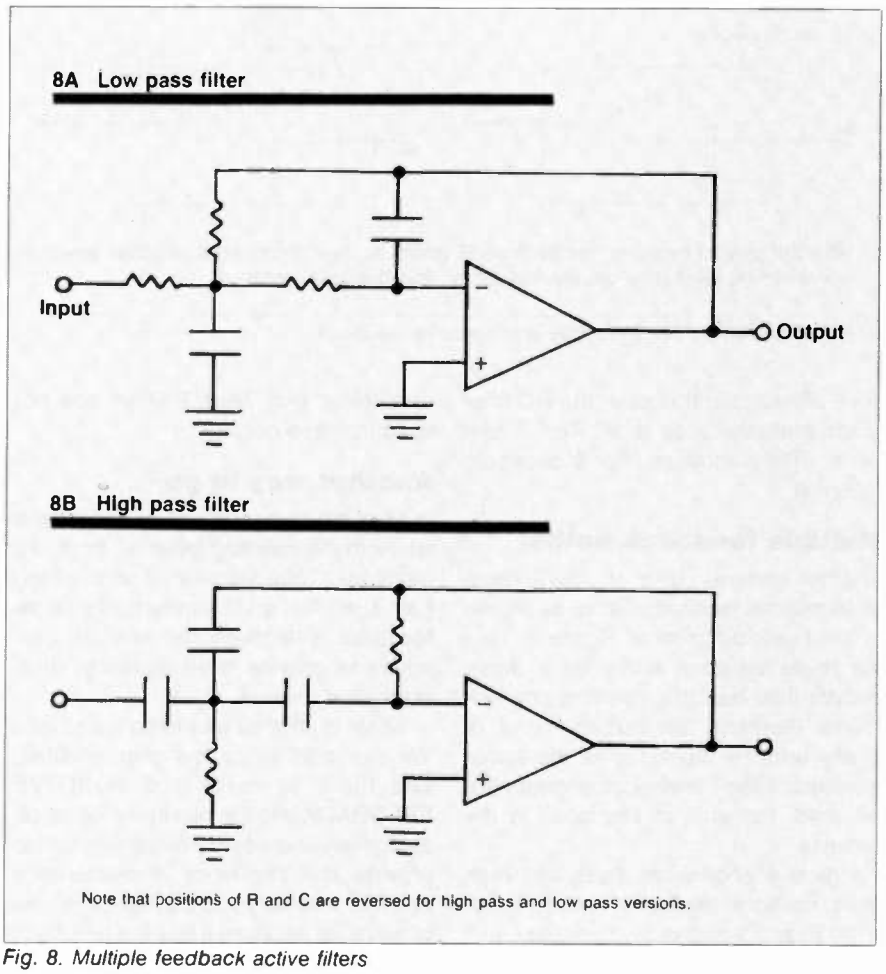


Fig. 8. Multiple feedback active filters

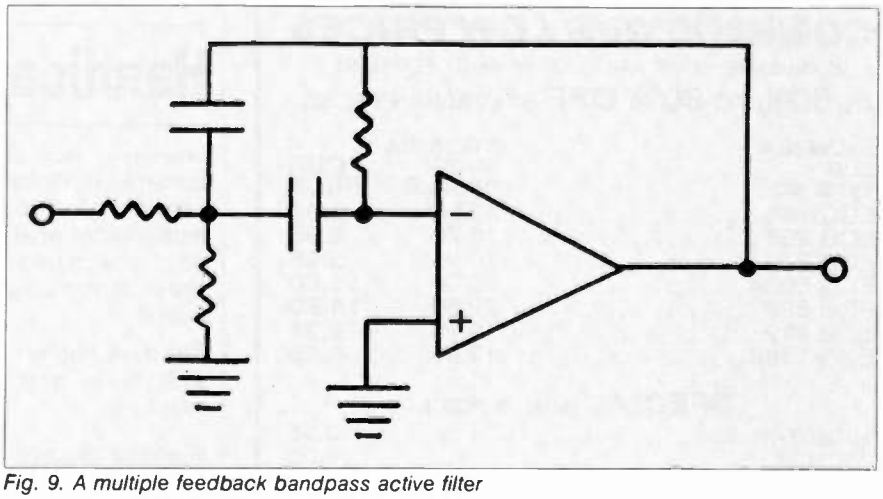
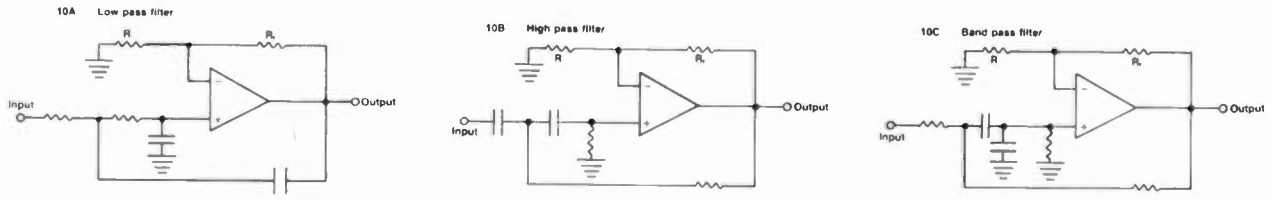


Fig. 9. A multiple feedback bandpass active filter

Both the high pass and low pass single feedback active filters used a complex RC filter in the feedback loop, and the reader is urged to review both "bridged T" and "Twin T" RC filters, since they have common application in active filters, and their review here would take more space than would be practical in this series.

It is also useful to use the single feedback active filter to form a bandpass



Note the use, of negative feedback via R_f and R to inverting input to establish low closed loop gain. Positive feedback to non-inverting input then causes frequency selective gain increase.

Fig. 10. Active filters using positive and negative feedback

filter, although in this case the RC filter in the feedback loop is a *"Twin T network."* The bandpass filter is shown in Figure 6.

Multiple feedback paths

Another general class of active filters uses multiple feedback paths, as shown in the block diagram of Figure 7. Like the single feedback active filters, these circuits also use the inverting configuration, therefore the output is out of phase with the input. Unlike the single feedback filters, fewer components are required, but gain is sacrificed in the process.

Figure 8 shows low pass and high pass multiple feedback active filters, while Figure 9 shows the bandpass version. Note that Twin T filters are not used in these circuits.

Another way to go

In all of the above circuits, the feedback was into the inverting input . . . negative feedback. Thus we started with a high gain amplifier, and by means of inverse feedback, selectively reduced the gain so as to provide the frequency characteristics desired.

There is another way to go about this. We can start with a low gain amplifier, and then, by means of POSITIVE FEEDBACK into the non inverting input, selectively increase the gain so as to provide the frequency characteristics desired. Naturally you can spot this type of amplifier because it has the feedback loop with the RC networks, connected back to the non-inverting input terminal. Figure 10 shows the high pass, low pass and band pass filters using this type of circuit. Notice that the inverting input is fed from a simple voltage divider, which has a flat frequency response, thus fixing the gain of the amplifier at some relatively low level (compared to the amplifier's open loop gain). The feedback into the non inverting input (positive feedback), has RC frequency shaping networks included, and thus establishes the active filter response curve, *by increasing the op amp circuit gain over the level set by the negative feedback.* Since it is necessary to first set the op amp gain

continued on page 45

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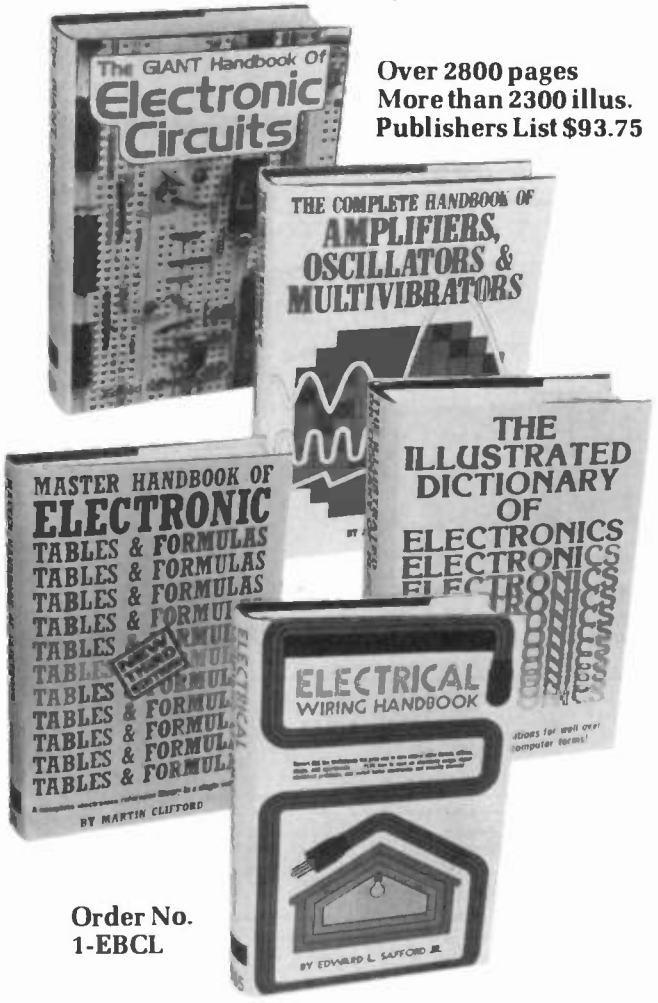

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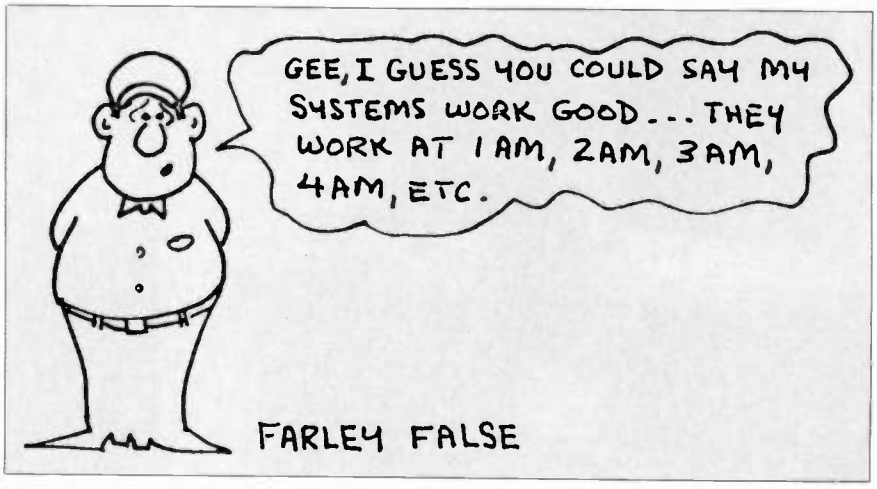
Alarm systems service

Troubleshooting basics

ET/D has, during the last year, attempted to give you a cross section of basic alarm system designs. In spite of their often simple appearance, troubleshooting can be confusing. Here are some common problems, diagnoses and solutions.

By Joe Lanier*



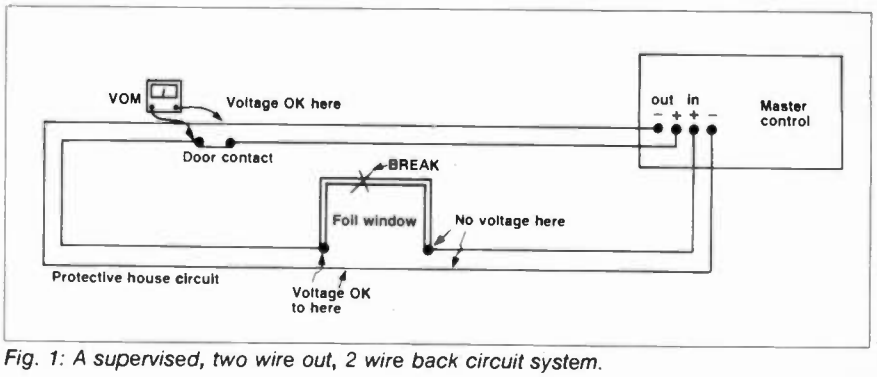


Fig. 1: A supervised, two wire out, 2 wire back circuit system.

The first step in avoiding service calls is a proper installation. Remember to always:

Use good equipment (it costs less in the long run).
Install it properly.
Read the installation and/or service instructions supplied.
Make all connections before applying power.
Double check connections before applying power.

If system will not "set up" (master control cannot be turned on without going into the alarm condition mode), you are in luck, as this is normally the simplest, and the most common service call. Generally, something out on the house protective closed circiut is open, such as a broken foil window tape, protected door left ajar, etc.

Supervised circuits

If system is of the truly supervised circuit type (both negative and positive protection circuit wiring) open the Master Control cabinet. If control has built-in or accessory power pak (or batteries) located inside its cabinet, you are starting the protective circuit at the control, and returning it to same (2 wires out, 2 wires back), after the building has in effect been "looped," catching sensors used. Check circuit out terminals first for voltage. Placing your Volt-Ohm-Meter on low voltage dc scale across these terminals and reading proper circuit voltage output (3-6-12vdc depending on control) will indicate this section of control is OK. Next, check the protective *input* terminals for voltage back in. Or, check these first if the system uses a circuit "tail-end power" design. No voltage in would indicate an open on the house circuit. Now go approximately to the center of the protective circuit and take another voltage reading across the house circuit. This will immediately show you if the problem is between you and the control output or input. In other words, you trace the good voltage until you lose it. The point of loss will be where the problem is, provided your problem to start with was an open condition, which is the most common.

Hot loop circuit

Should your circuit be of the so-called hot loop type (a simple series circuit) which isn't generally recommended, you will have to disconnect the protective circuit from the Master Control terminals and check for continunity only across the 2 wires. You cannot check voltage (except voltage will appear across an open). Your VOM on contin-

*President, Defensive Security, Jasper, TX, and the creator of Farley False.

unity scale (normally Rx1) will register a short (needle swings all the way over), or close to it, depending on length/connections/resistance of the circuit, if circuit is good. However, we are still assuming your problem is out on the circuit, so the meter would indicate an open (no continunity). Now you will have to check the house circuit down the line for continunity. This can be a much longer process than voltage checking, especially on a large system.

Figure 2 shows a continunity only or hot loop circuit. If using 2 conductor wiring note that if a short (one side of the circuit touching the other side) occurred across these 2 wires, the circuit would only be good (protected) to that point. (Figure 3) Any switches beyond that point would be shorted out. Although a single wire, out and back, well separated, would solve this potential problem, a broken wire itself could prove quite difficult to locate. Better overall security is provided by the supervised circuit.

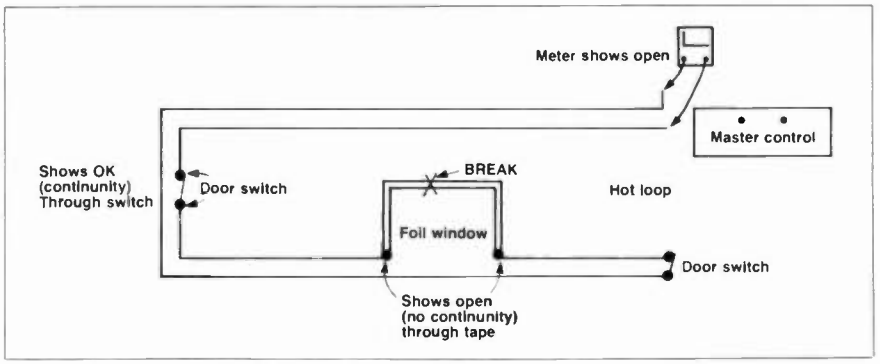


Fig. 2: A hot loop (a simple series circuit system).

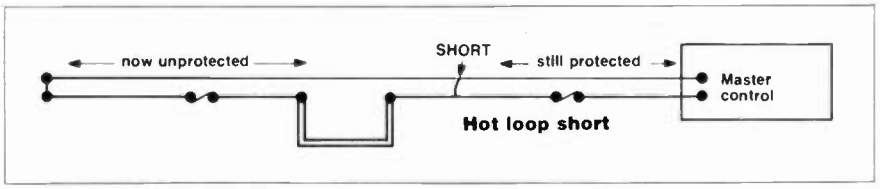


Fig. 3: A short in a hot loop system disables the sensor beyond it.

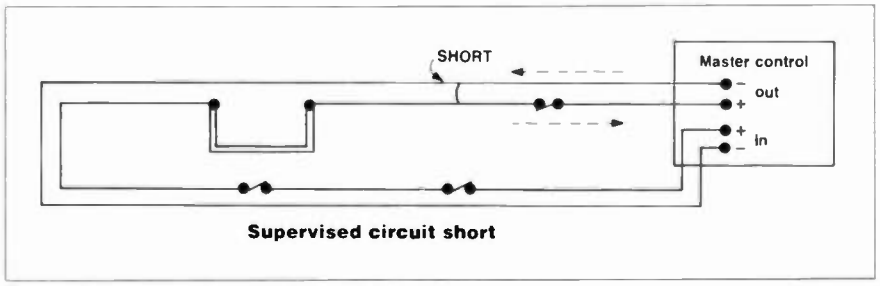


Fig. 4: A short in a supervised circuit is evident.

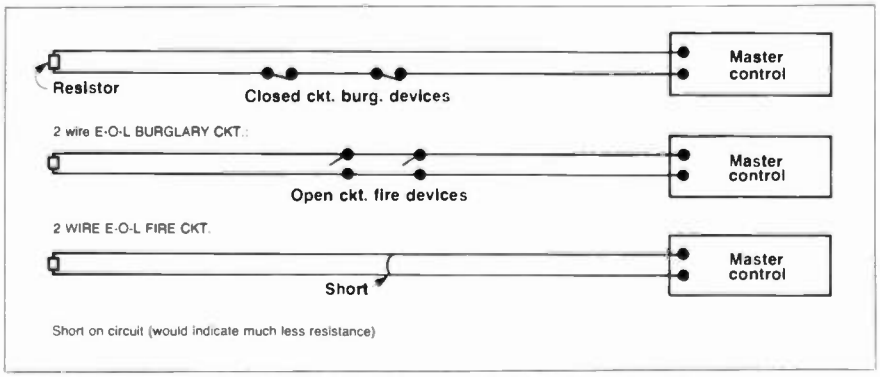


Fig. 5: End-of-line resistor supervisor. A short causes an alarm condition.

Supervised preferred

If the system utilizes 2 wires, one negative and one positive, a short would serve to rob your control input of required current flow to set up (Figure 4). Therefore, on a truly supervised circuit (both negative and positive used) a short would be evident.

2-Wire circuit with "E-O-L"

Relatively new in the burglar alarm field is the 2-wire "E-O-L" panel design. These controls start with 2 wires at the panel, but dead-end on a resistor (usually around 50 ohms). Therefore, the control would see the normal protective circuit resistance (generally 10-40 ohms) plus the end-of-line resistance. A short on the circuit (between the control and the end-of-line resistor) would cause the panel to fail to set up (or go into the alarm mode if armed), as the panel would see much less than normal resistance. This design is also sometimes used on a Normally Open Fire Circuit to provide supervision. Fire devices (such as pull stations, heat stats, smoke detectors) would be connected in parallel across the 2 circuit wires to short in event of an alarm. On burglary circuit applications, the devices (such as switches, motion detectors, etc.) would be inserted in series in the circuit. An opening by one of these devices would activate panel (Figure 5).

Shorts

With a short present on the supervised circuit, the voltage reading will fall considerably below normal, between control power output and the short. Also, there will be little or no voltage reading between the short and the control input terminals (Figure 6). Therefore, if the voltage is much lower than it should be (example, 2v on a 6v control), disconnect the alarm circuit from the output terminals. Take another reading across the terminals, and if 6v are now present, you probably have a short out on the house circuit. Connect terminals back to power source and go approximately half-way down the protective circuit and disconnect it from the balance. Now take another reading across the 2 ends coming from the output. If good (normal voltage), a short exists between you and input terminals. If still low (or no voltage), the short is between you and output terminals. Continue in this manner until the exact location of the short is found. Shorts should be a relatively rare problem, if the system was carefully installed. A major source would be a staple, driven in, cutting insulation on the 2 conductors and shorting them.

Shorts may also be found by disconnecting the circuit from power terminals and the input terminals also. Make sure these leads are not touching each other on either end, and check continunity only with meter on Rx1 scale, on either end. Again, break circuit in approximately its center, and check both ways, running the short down in this manner

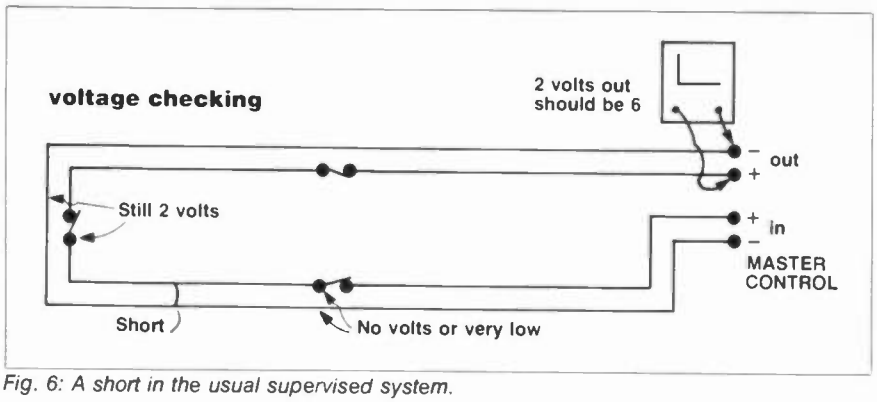


Fig. 6: A short in the usual supervised system.

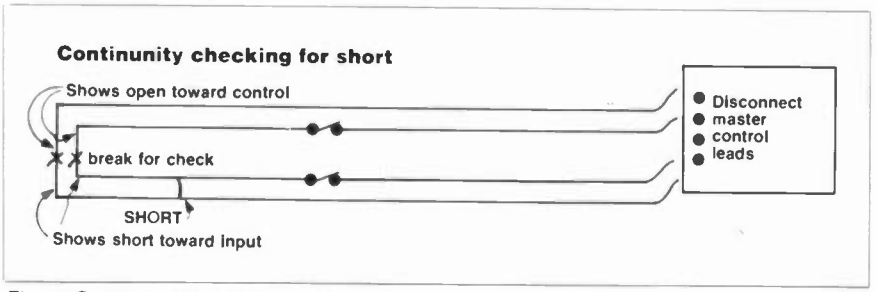


Fig. 7: Short checking in a supervised system.

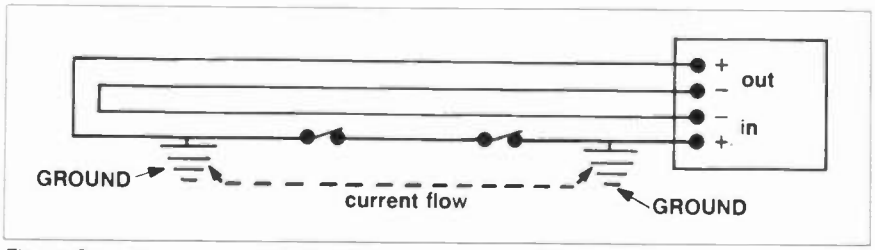


Fig. 8: Grounds in a supervised system. Since the circuit is floating one causes no problems, two will short out some part of the system.

(the same as you would have to on a hot loop type circuit). Remember to first remove power, and disconnect both ends, so you don't read back around and through the end connections (Figure 7).

Continunity checking can also serve to indicate the overall condition of a house circuit. Twist one end of the circuit pair together (negative to positive) with NO POWER on the circuit. Check continunity across other loose ends on Rx1 scale. Resistance should probably not exceed approximately 30-40 ohms on average size protective circuit. A higher reading would be a good indication of poor connections. Also, watch needle on meter a few minutes to make certain it is remaining stable. If it is moving back and forth even slightly, it would serve as further proof of poor connection(s), as well as a possible swinger. Swingers will be covered later.

Grounds

Another relatively rare problem on good installations would be grounds on the protective circuit. One ground would generally not affect system operation, but two grounds (Figure 8) would allow current flow to bypass some protected devices, rendering that portion of the circuit unprotected.

A ground occurring on both the negative and positive sides would have the same effect as a short. Make sure all connections and wiring are well insulated, with no bare wire or foil window tape touching any metal walls or frames. Grounds may be located by meter on voltage (or continunity) checking from one side of circuit to a ground.

Swingers

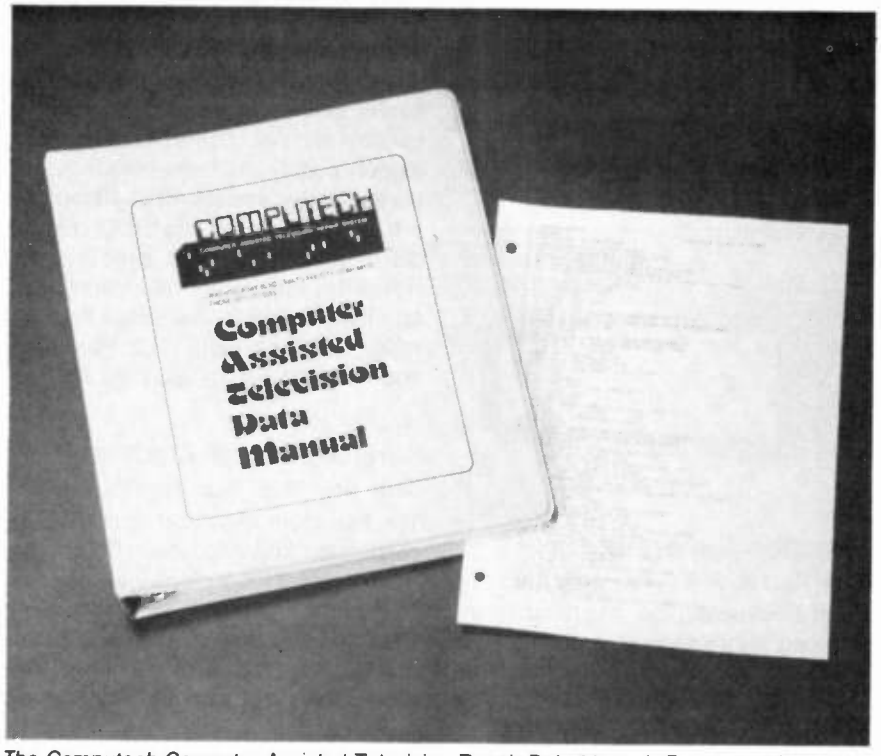
A swinger is an intermittent, a momentary opening of the closed circuit, that recloses and does not remain in the open mode. The system has false activated, yet will reset. Needless to say, the circuit is "technically OK," at least for the present, otherwise the system would not reset. Let us say the circuit involved is a relatively simple tape/wire/switch circuit (perimeter circuit) with no motion detectors, beams, etc., involved. First, make sure the master control is changing over to standby power upon failure of primary 110vac power. Turn the system on with the protective circuit closed, and unplug the transformer, etc., for a few moments, then plug it back in. Should the system go into the alarm mode, this is probably the problem. The standby battery is either dead or too low to the power system, or not switching over properly. This would produce a non-power state during power failures, allowing protective circuit transistor or relay to fall out (become de-energized), and be in the down or alarm state when power is returned to the unit. If using tail-end power (such as dry cell batteries) make certain they are fresh. Weak batteries may supply enough current to initially set up a control input, but not to maintain it. Remember, batteries cannot be properly checked with VOM meter or a voltage scale. Use a loading type battery tester.

Check overall resistance on the house circuit as earlier mentioned. Look for high resistance and/or an unstable meter needle. Visually check the system, tightening connections along the way. Especially check window foil tape for any tears or cracks. Remember, foil is metal, and will expand with heat and contract with cold. A fine, hair-line crack or razor cut may barely touch due to expansion when window is warm, yet contract enough to produce a false alarm when window area cools down during the night.

A VOM's meter is dampened, and may not spot an instantaneous open. Special "swinger checkers" are available that are made especially for the alarm industry. They usually operate in this fashion; take power off the circuit, disconnect it from the control, and twist one end together. Connect the other end to the swinger checker, and go along circuit gently tapping on switches and glass areas protected by foil tape, pulling slightly on door cords, etc. A momentary opening of the circuit caused by this action will register on the checker by light and/or buzzer, with lock-in output. Stop when this occurs and check close the area causing activation. If you do not locate fault visually, bring checker down to the suspected location and connect it directly across the window, etc., again setting up a vibration by tapping area. If the checker activates, your problem is at or near this location. Possibly you have a broken wire inside a door cord, defective switch, poor foil connection under a take off block, etc. Don't forget to check the tamper switches inside the bell or siren cabinet too. These devices would be subject to outside environmental conditions.

continued on page 45

TEST INSTRUMENT REPORT



The Computech Computer Assisted Television Repair Data Manual. *For more information circle number 150 on the Reader Service Card.*

Computech

Computer aided troubleshooting

By Walter H. Schwartz

Your microcomputer can soon be as valuable a troubleshooting tool as your test instruments or service data. State Electronics of Salt Lake City has developed a computer diagnostic system called Computech. As used by State Electronics, and soon to be offered as a franchise program to others, this system is used to not only troubleshoot but to estimate and sell the repair job to the customer.

When the set is initially brought in for repair, the technician uses the computer in the presence of the customer to determine the likely fault. The technician answers yes or no to a series of questions asked by the computer. The computer determines the area of the chassis likely to be at fault and asks the technician to select a typical circuit for the set in question. It then displays this circuit and indicates the most likely faulty components, and displays an estimate of the labor and parts cost for the repair. All of this information is displayed on a 19 inch television screen for the customer as well as the technician. This diagnostic procedure reportedly takes less than ten minutes; the estimate charge is $9.95.

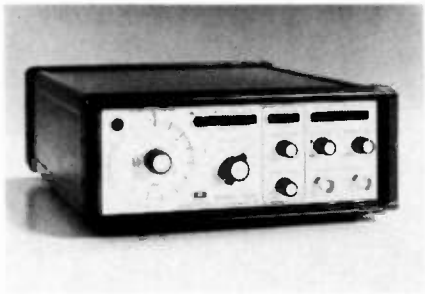
Computech also will be providing accounting, inventory, mailing list programs tailored specifically for service operations.

The most immediately useful aspect of the Computech System is, however, the computer print out of troubleshooting problems and solutions. Sold as a subscription service, updated monthly, the Computech, *Computer Assisted Television Repair Data Manual*, at present lists about 6500 symptoms and solutions for most major brands of television sets. These symptoms and solutions are indexed by Sam's Photofact number and go back to number 688 (approximately 1964). Incorporated into this data is al of State Electronics and several other shops' experience as well as manufacturers information (all contributions are welcome). Also included in Computech Manual is a selection of service procedures, prepared by computer. These procedures give step-by-step diagnostics for most problems in most television receivers, HV through video, sync, AGC through sound, or vertical.

The editors of ET/D have carefully reviewed the Computech Manual. It probably includes the most extensive short form listing of symptoms/solutions ever presented for television troubleshooting and the service procedures will probably lead you to a fix for most problems and give a methodical approach to assist greatly even if they do not lead to an immediate repair. And the information is added to monthly!

As stated earlier Computech expects to offer, at the price of a service van, a franchise for the whole Computech system. This would include the entire hardware/software package, troubleshooting system, accounting, inventory, all records, etc., business management and the right to use the Computech name.

NEW PRODUCTS



Function Generator

Circle No. 128 on Reader Inquiry Card

Exact Electronics, Inc. has recently announced the release of a new 20MHz 100,000:1 Log Sweep Function Generator with 30 volts p-p output. The Model 528 has a frequency range of 0.001 Hz to 20 MHz and produces sine, square, triangle, positive square and negative square waveforms from the main generator. The auxiliary ramp is also available through the main output amplifier. In the sweep mode the ramp generator is used to internally sweep the main generator either up or down linearly (up to 1000:1) or logarithmically (up to 100,000:1). The start and stop frequencies are independently settable and both may be set and measured using the RUN/HOLD and TRIGGER/HOLD positions of the ramp mode switch. The main generator frequency can be manually swept linearly up to 3 decades or logarithmically up to 5 decades using the start frequency outer dial. A VCF input allows external control of frequency over a 5 decade range in the log mode and a 3 decade range in the linear mode. The start and stop frequency controls are dual function contols providing 10-turn resolution within a one decade range of frequencies or single-turn resolution with with band frequency range. As a pulse generator the Model 528 uses the ramp generator to trigger the main generator. Square pulses of either polarity, or single pulses of sinewave, triangle, haversine, or havertriangle waveforms can be selected. Two voltage outputs are provided which are controlled by the main generator frequency. V:f (voltage proportional to frequency) is a linear of log output which can be used for X axis drive when sweeping manually, externally, or with the internal ramp. A VCF (voltage controlled by frequency) output is always linear even when the generator is in the log mode. This allows a linear X axis drive when logarithmically plotting frequencies on a semi-log graph. Other Model 528 features include: ±15v of variable and switchable DC offset, gate, trigger, pulse, and burst modes; variable symmetry; variable start phase; 30v p-p output (15v p-p into 50 Ohms); 80 dB of attenuation; and sync outputs. Housed in a lightweight aluminum package the Model 528 measures 31.8 cm wide × 12.7 cm high × 27.9 cm deep, and weighs approximately 4.5 Kg.

Semiconductor Analyzer

Circle No. 129 on Reader Inquiry Card

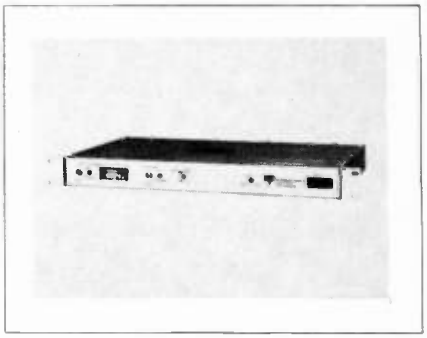
The Parametric Analyzer from *UWC Incorporated* is an accessory to any oscilloscope with X-Y display capabilities. Due to the manner in which the Analyzer controls the cathode ray tube's (CRT) beam positioning, the oscilloscope does not impose any specific bandpass or triggering limitations on the Analyzer. The Analyzer allows you to test junction-type devices (such as

diodes, transistors, resistors, capacitors and integrated circuits), as well as other discrete devices on a non-powered board without removing the components from the circuit. The Analyzer is self-contained and includes all necessary test probes and cables to connect the unit to your oscilloscope. On model PMA-2 the power cord is permanently attached to the unit. Model PMA-3 uses a molded transformer and cord assembly.

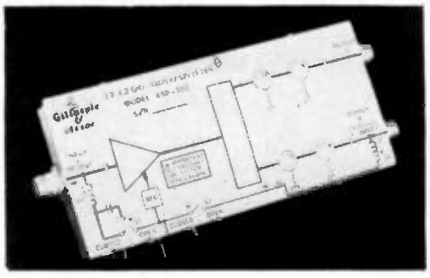
Earth Station Modulator

Circle No. 130 on Reader Inquiry Card

Blonder-Tongue Laboratories, Inc. has recently announced the availability of an Earth Station Modulator specifically designed for operation with Television Receive Only (TVRO) satellite terminals where the audio and video are provided as separate base band signals. The ESM-4928 is available for VHF channels 2-13 and Mid Band channels A-1. The ESM-4928 is a vestigial sideband audio/video modulator with crystal controlled visual and aural carriers to minimize color beats and audio distortion. The unit has a calibrated video modulation meter and a true peak-reading LED audio overmodulation indicator to assure precise modulation control. The audio indicator permits adjustment for optimum sound quality. A video low



pass filter in the ESM-4928 rejects unwanted subcarrier frequencies of secondary satellite services, preventing adjacent channel interference, and a low loss RF loop-thru diplexer allows higher output levels with lower distortion when combining channels. The ESM-4928 is compact, lightweight (8 lbs) and can be mounted in a standard EIA 19 in. rack. All indicators and controls are located on the front panel for monitoring and adjusting.



Satellite Splitter

Circle No. 131 on Reader Inquiry Card

The Ampli-Splitter® TVRO multiplexing system from *Gillaspie and Associates* provides for separate access of two or more satellite receivers to the same antenna and low noise amplifier, including single conversion type receivers utilizing image reject mixer technology. The weatherized and shielded Ampli-Splitter® contains a 3.7 to 4.2 GHz line amplifier, a two-way microwave signal splitter with 50dB port-to-port isolation, and is designed for either up the cable dc powering of the Ampli-Splitter® and the LNA, or for separate dc power insertion. Other independently operating receivers can be added to the system with minimum signal loss by cascading Ampli-Splitters® along the extended system.

Voltage Standard

Circle No. 132 on Reader Inquiry Card

Standard Reference Labs, Inc. has recently introduced a single cell, ovenized, solid state voltage reference standard with guaranteed voltage output stability of 2ppm/year. Typically, its output changes less than a few tenths of a ppm/year. Model VTS-101SC/2-10, which is housed in a all aluminum case with collapsible prop-up carrying handle, is a rechargeable Gel-Cell battery powered transport standard. It features the prime output Vz value of 6.3 volts nominal and a convenience output of 10 volts. Output is guaranteed to change less than 0.1ppm for every degree Centigrade change in ambient room temperature. This solid state voltage standard reportedly offers several distinct advantages. It produces an output an order of magnitude higher than previously possible freeing the user from traditional worries about thermal voltage errors and providing a level closer to that required for practical application. It can be loaded or even shorted out without damage or long term effects, and is said to be insensitive to position, vibration, and shock associated with normal transportation and handling.

Fiber Optic Converter

Circle No. 133 on Reader Inquiry Card

A new fiber optic instrument that converts standard multimeters into fiber optic power meters has been introduced by *FOTEC, Inc.* Called the FOTEC C Fiber Optic Converter, it can be used with any multimeter or voltmeter to measure basic fiber optic system parameters such as fiber attenuation, connector or splice loss, source power coupled into fibers, or signal level at the receiver. While designed with the requirements of laboratory fiber optic measurements as a guide, FOTEC C is also for field service of fiber optic installations. FOTEC C can measure signals in the range of less than 20 nanowatts to over 2 milliwatts of optical power with an accuracy of ±5%, and with any signal frequency from dc to hundreds of megahertz. It can be used

with sources in the 400 to 1100 nanometer range, and is easily recalibrated for various source wavelengths. The output is a linear dc signal calibrated as 1v/uW or 1v/mW on two switchable ranges. When used with a 3½ digit DMM, for example, it gives 1 microwatt resolution on the milliwatt range and 1 nanowatt resolution on the microwatt range. Auto-zero circuitry include in the FOTEC C design allows its high accuracy to be maintained over a broad range of operating conditions. FOTEC C is portable and is powered by a single 9V 1.5 × 3 × 5.25 in. (28 × 85 × 133 mm.) and weighs 7½ oz (210 grams).

Alarm systems

continued from page 42

If you do not have such a checker, and cannot locate trouble with a standard VOM, turn the system on, having first disconnected the bell output and placed a small horn or buzzer across these terminals. Now go down circuit tapping and pulling as above. The area having the swinger should activate the control, activating the buzzer. This is also a good method to double check yourself after having initially found and corrected what you felt was the problem. It is possible to have more than one swinger on the same circuit. Wire splices (if not soldered) can definitely be a problem area over a period of time. *All* connections must be good and tight.

It is also possible, but only remotely, that outside RF is false tripping your master control. The protective circuit may be acting like an antenna, allowing RF to get into the master control panel board. This would be most likely caused by a strong, close by, transmitter, or a passing police vehicle. Again, this would be a rare situation. However, should it be the case, grounding of the master control chassis should solve it.

Should you suspect the problem is a defective master control itself, due to circuit checking good, etc., disconnect protective circuit and replace it with jumpers on the control terminal board, simulating a miniature house circuit. If the panel fails to set up with power applied, the control is apparently defective. Also, if the panel fails to activate when armed, when the jumper is removed, the alarm output mode is probably defective. If you are unable to make a field repair, such as cleaning and adjusting a relay, the panel will have to be replaced. Should the external bell or siren fail to sound upon alarm activation, don't automatically assume the panel is defective. Be sure and check bell or siren and disconnect its incoming wires and recheck. If no voltage is present, you have a broken (or possibly shorted) wire run. Of course if ± voltage is present here, the bell or siren speaker is apparently defective.

Now let's assume we have a more elaborate system. In addition to a perimeter circuit some form of motion detection is used. The protective circuit has passed all the swinger checks, and the master control is apparently functioning properly. *ALWAYS* check the perimeter circuit; just because the motion detector is more complex, don't assume it's the problem.

Troubleshooting time here could be saved by the use of a zoned control instrument with lock in alarm indication. The perimeter circuit would be up one zone, with the motion detector on the other. Although more expensive zoned controls save time service wise by pinpointing the source of alarm.

Next month we will discuss the problems that some of the motion detectors can lead to and examine digital dialers and fire circuits. ETD

OP Amps IV

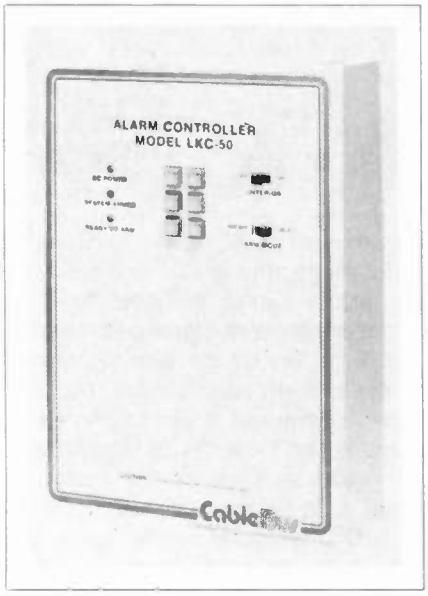
continued from page 38

by means of the negative feedback, in this type of active filter, it is called a "controlled source" active filter.

Still more . . .

There are other types of active filters, and we will discuss them in the last part of this series . . . in order to cover a basic introduction to the scope and variety of active filters. Some practical active filters will be shown, along with information useful for modifying them for the reader's specific needs. We will be covering low pass, high pass, band pass, and notch filters. Also to come are trouble-shooting tips for op amps and suggestions as to where to obtain further information. ETD

SECURITY PRODUCTS



Alarm Controller

Circle No. 120 on Reader Inquiry Card

The LKC-50 from *Cable Business Systems* is a self-contained alarm controller that monitors burglar, fire, and emergency pushbutton loops and provides output signals to local annunciating devices and to the CableBus SE-5 Alarm Reporting Module. Six pushbuttons on the LKC-50 front panel allow the homeowner to arm and disarm the system using a unique three-digit code. If an unauthorized person tries to break the code by pressing random combinations, the keyboard locks out and will not resume operation until a unique combination of keys is pressed simultaneously. The code may also be entered by means of remote six-key panels. The LKC-50 has slide switches for selecting arming mode and for arming an interior loop. Arming mode may be either immediate or delayed. In immediate mode, the perimeter burglar alarm loop is armed as soon as the code is keyed in. In delayed mode, there is a time delay, settable by the homeowner, before the loop is armed. This permits the homeowner to key in the code and leave the house before the LKC-50 starts watching for intrusions. In addition, in delayed mode, when entry is made through designated doors, the LKC-50 does not immediately signal an alarm. Instead an output signals a soft "prealarm." If the disarm code is not entered during this prealarm delay period, the LKC-50 signals a burglar alarm. The "interior" switch works in conjunction with the LKC-50's perimeter loop alarm. When the perimeter is armed, activating the "Interior" switch will arm a second loop in instant mode.

Timer

Circle No. 121 on Reader Inquiry Card

Dynascan Corp. has recently introduced a new microcomputer-based timer for controlling lamps, the Model TC-485. This new model requires no installation and reportedly for the first time in the history of light timers, incorporates a built-in dimmer, eliminating the need for two devices if you wish to time and dim a lamp at the same time. Like its predecessor, the wall-mount timer, the new table top model offers (1) all solid-state construction, with automatic programming and up to 48 ON-OFF times in a 24-hour period; (2) manual programming in minutes for pre-setting the ON-OFF times to a pre-arranged pattern; (3) use as a conventional light switch by merely pressing the pushbutton to override the program (which remains in the computer memory); (4) ready accessibility for programming, overriding, or re-programming. In addition, as indicated above, the Model TC-485 Night Sentry has a built-in dimmer which permits the user to set the brightness level desired by merely turning the dimmer ring on the top of the compact unit. Automatic programming consists of using Night Sentry as a conventional ON-OFF switch for 24 hours, after which the computer memory repeats the pattern of use daily thereafter—automatically. Manual programming is accomplished by setting the Night Sentry dial on the bottom of the unit to the desired ON-OFF times and entering them into the memory by pressing the pushbutton on the top of the unit.

CCTV Cameras

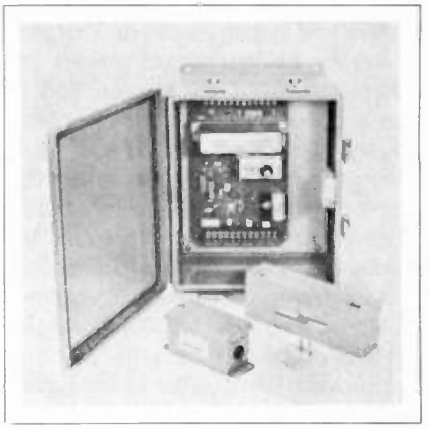
Circle No. 122 on Reader Inquiry Card

Crest Electronics recently introduced its GLC 333 Series CCTV Cameras. Key features are power line lock, vertical phase, high resolution, low lag, automatic light compensation, top or bottom mounting. All enclosed in a die-cast case. All controls are externally adjustable including the "tri-focus" system. The units are designed primarily for security and surveillance purposes and are available in 110v, 24v, ac, 12v, dc, single cable camera system and Newvicon versions.

Security System

Circle No. 123 on Reader Inquiry Card

The Model E-4 E-Flex Protection System from *Stellar Systems* utilizes a new sensor technology (patented) to offer protection to any perimeter fence or structure (interior or exterior) which can utilize the minute flexing of a cable and/or discreet vibration signatures to produce an alarm. This would include such areas as perimeter fences, walls of all types, and ceilings where movement or climbing and cut-through protection is required. Because of the shielded cable sensor used, it can be installed on a chainlink fence, interior or exterior walls. No special care or treatment of the cable is required at the terminator end. Simply dress back ground shield, expose center conductor, and attach to appropriate terminal strip points in the terminator ET-4. The E-4 system consists of an electronic control unit and a small diameter shielded E-flex sensor



cable. A special and very small electric signal is generated when the cable dielectric is stressed by movement or disturbed by vibrations in certain characteristic frequency bands. These signals are processed by the control unit to provide CUT-THROUGH and CLIMB-OVER alarm outputs. A sensor cable up to 1000 feet can be connected to each control unit. The cable is then attached to fences, zigzagged on walls and ceilings or other structures to detect the abnormal pressure and/or vibrations when an attempted intrusion occurs. Unique signal processing achieves a high order of detection probability while reportedly eliminating false alarms from extraneous cable vibration (wind, etc.) or direct mechanical pick up from non-intruder sources. Since the alarm signal is generated by changes internal to the cable, the system has an inherent high resistance to external electrical interference. Separate alarm count and gain sensitivity settings allow control over the amount of flexing (signal) necessary to cause an alarm. The cable is fully supervised against cutting and shorting when ET-4 Terminator is used and the control unit is tamper proofed.

Tape Dialer

Circle No. 124 on Reader Inquiry Card

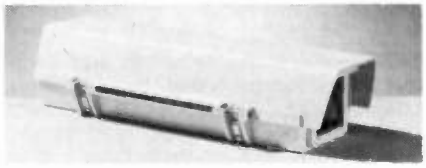
A compact "slave" tape dialer has recently been introduced by *Adcor Electronics*. The Adcor Model NW422 features a tape drive mechanism with a high-torque constant speed motor and a unique anti-tape-foul device that reportedly prevents the tape from sticking

or wrapping around the pinch roller. The dialer can monitor two separate alarm systems with normally open or applied voltage tripping. Momentary (self-latching) or sustained (automatic self-abort) tripping options are field selectable by channel. In-band dialing techniques results in a clear, highly intelligible voice message. Dialing can be touch tone or rotary. Up to 5 calls may be recorded on the six-minute tape. The dialer also has a memory circuit so that all calls on both channels will be made in the event both channels are tripped. A terminal has been provided for a cancel-call feature permitting manual abort by momentary contact. Heavy-duty line-seisure and dialing relays have an 1800v standoff rating to guard against damage from voltage surges on the telephone line. The Adcor Compact Tape Dialer Model NW422 operates on 12v direct current but may operate on 6v using the model CV6 voltage converter. The cabinet size is 7.5 in. wide by 10.5 in. high by 3 in. deep.

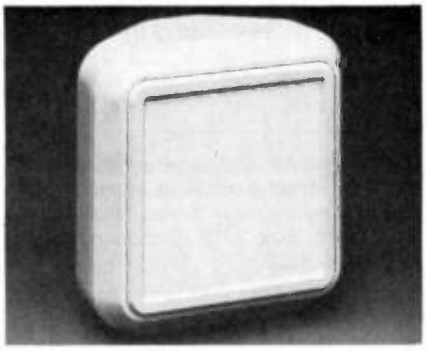
Enclosure

Circle No. 125 on Reader Inquiry Card

A housing which utilizes structural foam molding technology, the V8000H, from *Vicon Industries*, is reportedly impervious to the effects of weather. Designed for high impact strength and durability, the V8000H Enclosure reportedly provides maximum CCTV camera pro-



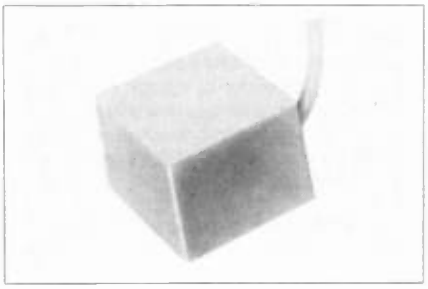
tection. Accessories for the V8000H include: A thermostatically controlled heater and blower, a remote controlled window wiper and washer, and tamper-proof locks and security latches.



Intrusion Detector

Circle No. 126 on Reader Inquiry Card

Raytek, Inc., recently announced the introduction of the BiSpy 4080 passive infrared intrusion detector for residence or office. Measuring 4½ in. square, this new detector is the smallest yet to utilize Beta Logic circuitry and infrared technology. This reportedly makes the BiSpy 4080 extremely effective in rejecting false alarm stimuli, including radio frequency interference, hot or cold moving air, rapidly heating surfaces, stray light or vibration, while providing excellent intruder detection. Designed to mount on walls or in corners, the BiSpy 4080 is easy to install and unobtrusive in home or office. The unit includes an optional battery for four hours of standby operation during power failure and features 40 ft. × 40 ft. coverage.



Glass Break Sensor

Circle No. 127 on Reader Inquiry Card

Ademco has recently introduced the new No. 9701 Glass Break Sensor, an electronic device which solely detects intermolecular noises which occur in glass as it is breaking. The No. 9701 contains electronic discriminating circuits which reportedly "hear" noises only in the 100Hz to 1MHz range. This precludes the sensor from causing false alarms due to common shock, vibration, temperature variance, etc. The sensor protects up to 120 sq. ft. of one continuous piece of glass and automatically resets after each alarm.

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SCHEMATICS - LIBRARY SERVICE. One month rental fee $2.25. Membership card $10.00. **ALL RIDERS** manuals and **SAMS** available for your use. **THE TV SHOP,** 530 Minnesota Ave., Fallbrook, California 92028. (Telephone 1-714-723-1302). 1/82

BUSINESS OPPORTUNITIES

For Sale: Zenith Sales and Service shop near major highway, complete with truck. 5 minutes to beach in Los Angeles area. $25,000 plus inventory. Call Jim, 213-375-2233. 10/81

MECHANICALLY INCLINED INDIVIDUALS Assemble electronic devices in your home. Knowledge or experience not necessary. Get started in spare time. Turn your spare or full time into cash. No investment-Write for free details. ELECTRONIC DEVELOPMENT LAB, Box 1560B, Pinellas Park, FL 33565. TF

Long established T.V. service business in excellent central Oregon Coast location. Complete tools and equipment for 2 techs. Long lease available. $50,000 inventory and equipment at wholesale. Owner retiring. Ideal husband and wife operation. Price set to sell at $35,000. OREGON REALTY ASSOCIATES, Box 28, Depoe Bay, OR. 97341 (503)765-2131. 11/81

TV Business in Central City, NE. COMPLETE! Small town, agricultural community. Great Potential. Inventory, building, truck and records $45,000. Central Farm Development Co., 308-946-3263, Box 275, Central City, NE 68826. 11/81

PACIFIC BEACH, SAN DIEGO 17 years established TV rental and repair business. Main street shopping center, $16,500. For details call 1-714-274-4161 or write shop owner **TELSTAR TV,** 1476 Garnet Ave., San Diego, CA 92109. 11/81

FOR SALE

OSCILLOSCOPES SPECIAL SALE-HP & TEK, 50MHZ DUAL TRACE, $595. reg. $695. Limited Quantities. Reconditioned, Calibrated, Guaranteed. Free Catalog. A-OK ELECTRONICS, 1445 NW. 9th St., Homestead, FL. 33030. (305)247-6349 11/81

OCTOBER SPECIALS, RG-59/U Coax Cable-7¢/Ft., F Type Connectors-F-59 with separate ring-15¢ Ea., F-59A ring attached-20¢ Ea., F-81 Barrel-30¢ Ea., F-61A Chassis Mount-28¢ Ea., F-71B Double Male Coupler $1.60 Ea., BNCF BNC Male to F Female Adapter $3.30 Ea., 75-300 OHM Matching Transformers-55¢ Ea., Coax Splitters-2 Way $1.50 Ea., 3 Way $2.20 Ea., 4 Way $2.80 Ea., 300 OHM Couplers-2 Set-$1.95 Ea., 4 Set-$2.20 Ea.-C.O.D. ADD $1.50. CZ Labs 55 Railroad Ave., Garnerville, N.Y. 10923. (914) 947-1554. 11/81

SCRAMBLED-TV WHAT IT IS-HOW IT WORKS. New publication explains how the two encoding/decoding systems used today work. Theory, circuits, etc. Send $9.95 to: Workshop, Box 393ETO Bethpage NY 11714. TF

UHF Varactor Tuners with Internal AGC $17.95 Dealer Net plus Shipping and C.O.D. Charges. Brand new units, Schematic drawing with each order, Channels 14 through 83, Output channels 2 and 3. Dimensions: 2.28" × 3.78" × 1.05" and 75 ohm. United Tuner Service, 1201 West Second Street, Bloomington, IN 47401 812-339-2179. 10/81

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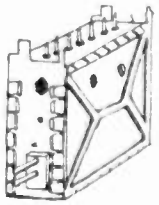

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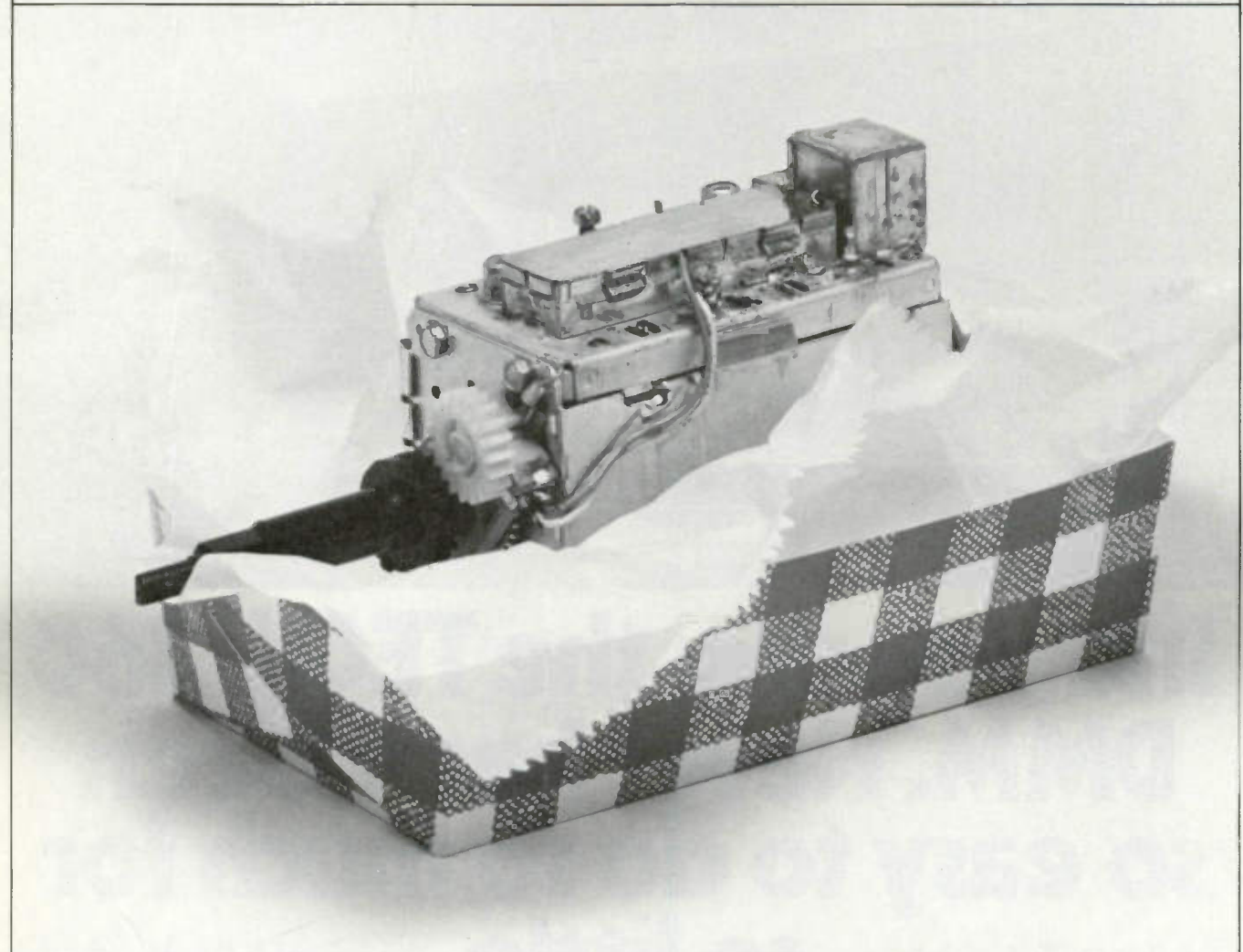

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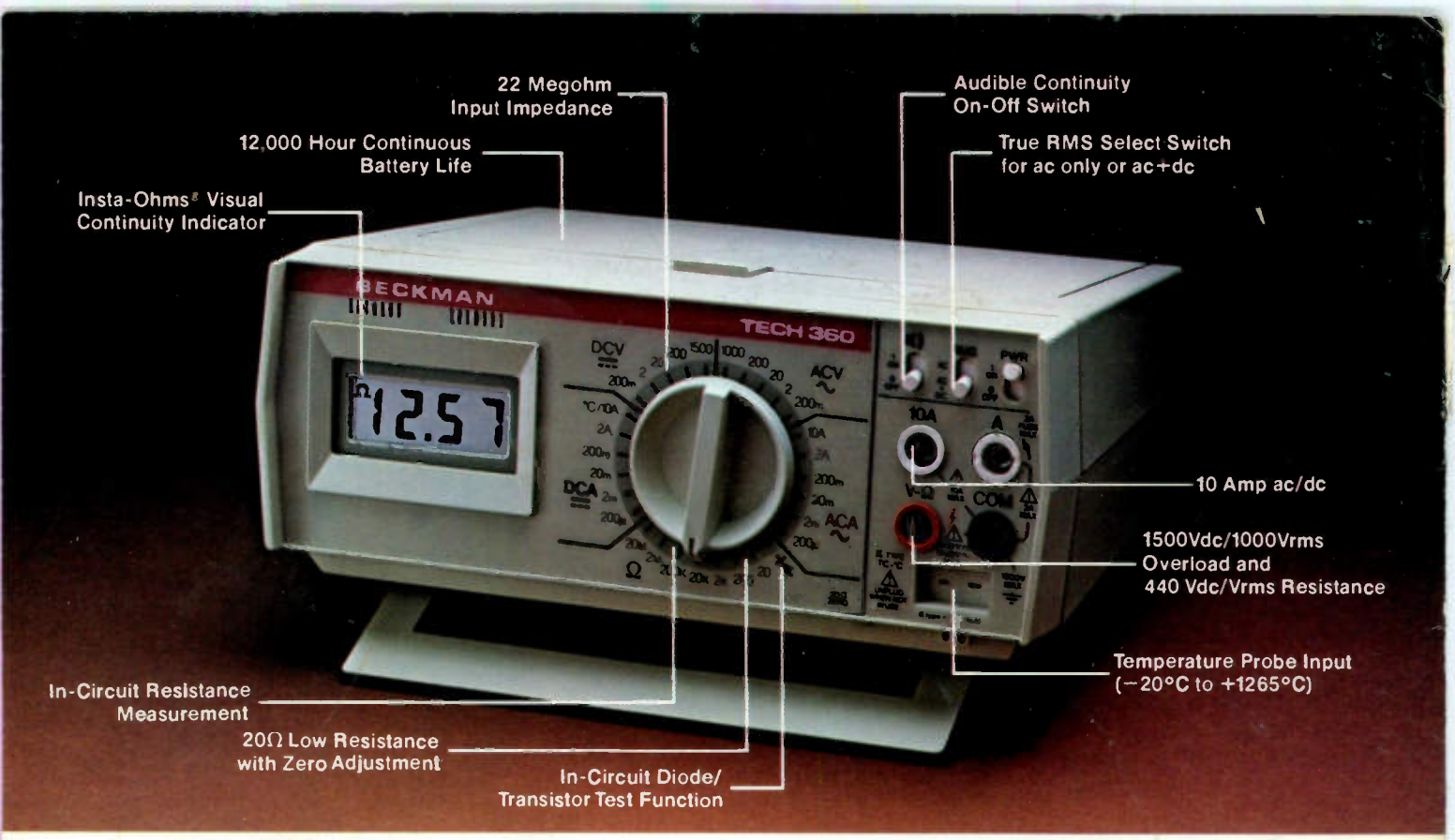

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