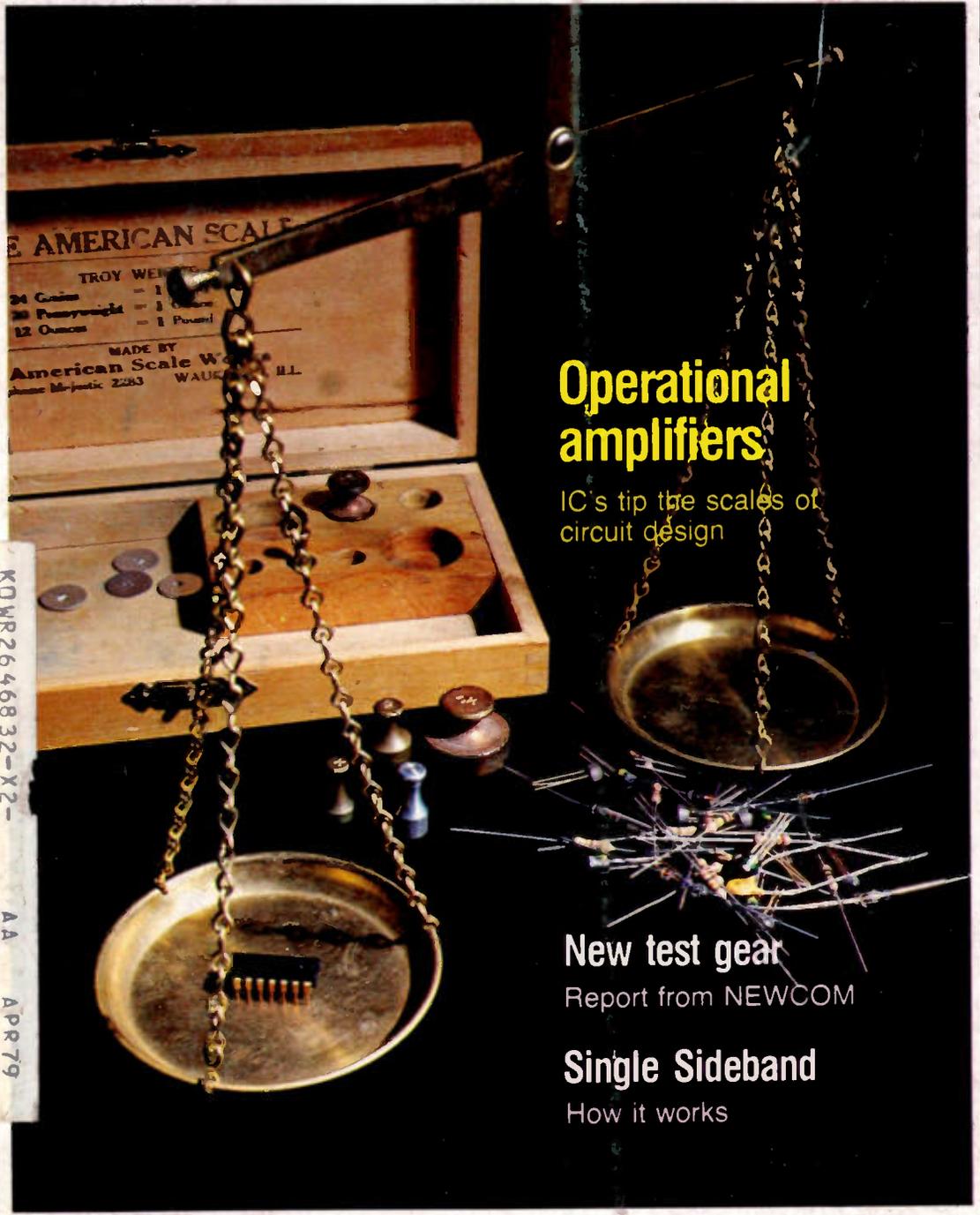


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JULY 1978, VOL. 100, NO. 7

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*Why you get more for your money with SSB transmission* \_\_\_\_\_ 27



**On the cover:** IC technology has expanded the uses and reduced the size of OP-AMPS dramatically—progress shown symbolically on this month's cover. (See OP Amps, page 23).

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# INDUSTRY REPORT

## Two National Service Organizations Set for Record August Convention Sessions .... ET/D Sponsors Golf Meets

Rapidly changing service industry patterns, particularly developments in video cassette recorders, projection television, and even microprocessors, are expected to generate record turnouts next month when the nation's two national electronic service associations meet in convention.

The National Electronic Service Dealers (NESDA) Association is scheduled to meet Aug. 7-13 at Portland, Ore., and this meeting will be followed by the four-day gathering of the National Association of Television and Electronic Servicers of America (NATESA) at Great Chateau Louise Resort, Dundee, Ill., beginning Aug. 24.

Electronic Technician/Dealer magazine will schedule golf tournaments in conjunction with both conventions. Both tournaments are scheduled for the first day of each convention.

According to NESDA convention chairman Nolan Boone, attendance at Portland is expected to top even that drawn last year to Orlando, Fla. because "the revolutionary new VCRs, projection TVs and microprocessors" are placing new pressures on electronic servicers to learn more about their future in electronics. "We have already received four times the number of advance registrations we had received by this time last year," Boone said.

As usual, both conventions are again being conducted on a work and pleasure basis. In addition to plenty of free time for recreational purposes, the real "meat" of the gatherings will be the seminars—business management, new technology, and troubleshooting sessions—which will keep participants active during their stays. In addition, special discussions dealing with such topics as falling rates of television service activity and with other industry problems will be held.

## Wescon Meeting Underscores Microprocessor's Impact

The accelerating impact which microprocessors are now exerting on electronics will be the underlying theme of this year's Wescon '78 show Sept. 12-14 at the Los Angeles Convention Center.

According to show manager Don Larson, eight special categories, including home, industry, automotive,

energy, games and toys, are among those which will be selected for special microprocessing awards as part of this year's show.

"The microprocessor revolution, in development for several years, is now beginning to show in finished products that save time, energy, money, and life," he said.

## Redesigned Sony Chassis Emphasize Energy Consumption-Price

Electronic tuning and low power chassis are emphasized in the completely redesigned color line introduced by Sony for 1979. In addition, a new two-hour Betamax (VCR) and a battery operated portable Betamax and color camera were previewed by Sony and are scheduled to be introduced before year's end.

Sony, which earlier this year announced a realignment of its marketing structure in the wake of disappointing financial results, has initiated price cuts ranging up to \$50 on 17 and 21 inch color models made in the United States.

In addition to the new chassis, Sony said the new sets will contain a newly designed picture tube, said to be 30 per cent brighter, and all models, except the 5 and 9 inch versions, will be equipped with touchbutton electronic tuning.



Figure 2—Sony's New Betamax with built-in timer and remote control.

## SHARP Introduces Projection Television System

Sharp Electronics Corporation has introduced a new, three projection tube, large screen projection system retailing in the \$3,000 area.

According to a company spokesman, the two-piece unit consists of a 72-inch screen, and projector, which are scheduled for introduction this October.

The system uses three projection tubes, a tri-potential electrostatic focus coil, and a comb filter circuit. A special "setting string" and "built in cross line pattern generator" permit user set up and adjustment, according to Sharp.

The unit also has a soft touch electronic channel selector which can instantly turn on any one of 12 pre-selected, channels. An ultrasonic remote control is also available.

Sharp reports the horizontal resolution is 400 lines and the projection dis-

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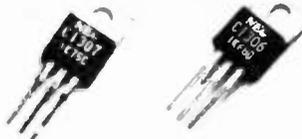
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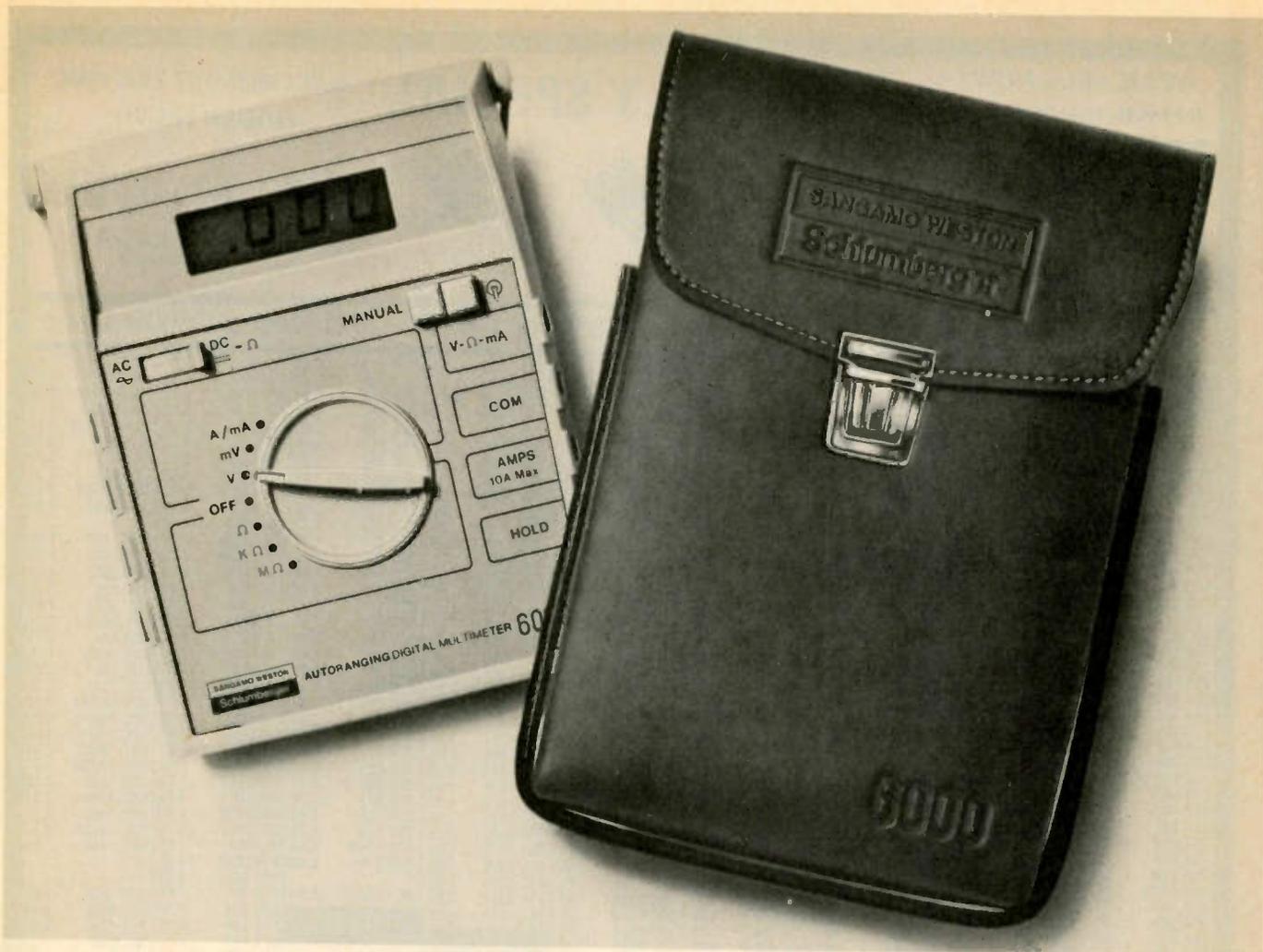
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tance is 83 inches. Controls include color, tint, picture balance, brightness, sharpness, crossline pattern, vertical hold and AFT switch.

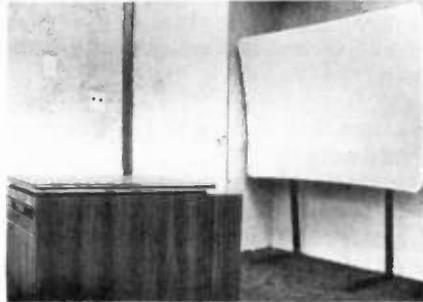


Figure 1—Sharp's \$3,000 large screen TV system

### RCA Introduces 1978 Consumer Line

RCA has taken another major step in its active video/VCR promotional campaign with the recent introductions of a low priced color camera, a programmable VCR timer, and a new single module 19-inch chassis that is expected to be out this December.

The new chassis, part of RCA's ColorTrak line which is using RCA's new frequency synthesizer "Chan- neLock" tuning, is said to reduce the number of connectors from previous chassis from 115 to 30 and the number of solder joints from 200 to 75.

Also part of the new RCA line for 1979 is a new 17-inch chassis, basically a continuation of a 13-inch chassis introduced in February, which replaced the phased out 15-inch models.

In the VCR end of the business, RCA gave further indications of its seemingly unflinching faith by coming up with a low-cost color home video camera which is expected to retail in the neighborhood of \$800, about half the price of the JVC model RCA also offers.

RCA also broadened its VCR line, introducing two models to go with the standard model it has been offering since it entered the market last August. One of these models is available with a revised version of Matsushita's 7-day, programmable television-VCR controller, first shown at the winter CES last January in Las Vegas (see ET/D March, p.26).

Prices are expected to remain basically the same for the video recorder, partly in response to heavy competition and partly in response to consumer sales softness.

One interesting sidelight to this current plunge into "second generation" VCR marketing, is that electronically the unit itself is slated for redesign.

While outward cosmetic appearances will change little to not-at-all, the guts of the machine are being modified to keep pace with the rapid

advance of LSI technology. Of course this is another reason for price stability.

### Philco Announces VCR Entry, New TV Models

Philco has revealed it would market the Matsushita-manufactured four-hour video-cassette recorder during its product introduction show recently. Also included are a new Philco line of 25, 21, 19, and 15-inch color television receivers—all equipped with Philco's first "Color-Rite" automatic color control system.

Color-Rite, according to the company, locks in color, tint, contrast, and brightness to levels set by the viewer.

In addition Philco has announced plans to market its own model of VCR, the V1000 Color Video Recorder. A built-in electronic digital clock and timer activates the system to record any program during a 24-hour period.

Philco officials said the unit has a suggested retail price of \$995 and it is available from outlets in conjunction with a black and white television camera with a suggested retail of \$319.95.

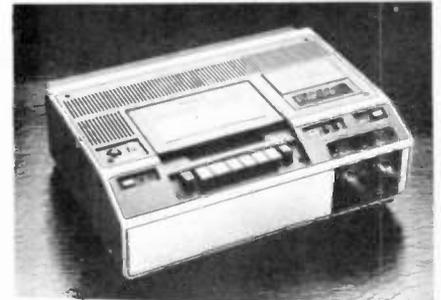


Figure 3—Philco's four-hour Matsushita-made VCR entry

### Sylvania adds VIR Circuitry and "Little Giant" Model

GTE Sylvania, the only American manufacturer to introduce its 1979 line outside the United States this year (Toronto), has introduced what it called the most fully automatic color sets now available.

According to GTE President Robert O'Neil, the 1979 chassis line includes the industry's first self-adjusting color system; a new color correcting computer controller which includes VIR circuitry, and automatic sharpness circuitry. According to O'Neil a special analog computer controls the "SUPERSET's" two built-in color correction circuits.

Viewers have the option to pre-set their own picture levels with regular manual controls or they may lock onto the incoming VIR broadcast signal. O'Neil said five 25-inch consoles are equipped with the computer controller system. They will retail about \$750.

Additionally, the company said a new 31,500 GT-400 chassis has been added to accommodate Sylvania's Dark Lite 50 color tube.

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Sylvania also introduced its "Little Giant" models, a unique combination of a 25-inch chassis, driving a 21-inch CRT,—all enclosed in a conventional sized 19-inch cabinet. All high end features can be obtained in the "Little Giant" series, according to the company.

### Panasonic Shows 1979 Products

Panasonic has unveiled two new 25-inch color models and nine color portables at its recently concluded home entertainment products show.

The 25-inch models include VIR chip circuitry as well as ColorPilot—Panasonic's system for color correction. Both new 25-inch models contain CATV/Master antenna connectors, according to the firm.

Additionally, the nine new portables range in screen size from 12 to 19 inches. The CT-978—a 19-inch model—is available with synthesizer electronic tuning, remote control, VIR chip circuitry, and the Quntrix II, in-line CRT.

Panasonic also revealed two new black and white portables for its "Outsider" line, the TR-3000 and the TR-555R, three and five inch models respectively.

Both models have been equipped with am/FM radios and electronic tuning.



Figure 4—Panasonic's AC-DC portable, 3-inch set.

### First Quarter TV Imports Down

Electronic Industries Association figures show that first quarter color television imports were down 8.8 per cent in comparison to the same period a year ago.

EIA said this year's first quarter results were 551,823 units, compared to 605,182 imported units during the first quarter of 1977. Black and white TV imports, however, jumped 15.2 per cent—from 1,032,421 last year to 1,188,901 for the first quarter of this year.

For video tape recorders (color and black and white), some 108,039 units

were brought into the United States during the first three months of the year, a gain of some 285 per cent over the 28,253 units imported during the comparable period in 1977.

### G.E. Adds New Chips

General Electric has announced three new transistor and 10 integrated circuits to its replacement parts inventory.

Among the integrated circuits being introduced are a complete TV (2 watt) sound system, a TV AFT circuit, a 4 and a 5 watt audio amplifier, and a dual channel AF power output (2 watts per channel).

Other new semiconductors are an AF high power amp, a low noise UHF amp, and a medium power AF power amp.

### New Antenna Firm Is Formed

Two ex-E.F. Johnson employees have formed a new CB antenna manufacturing firm to be called AVA, Inc. Located in Waseca, Minnesota, the new firm will produce a totally new line of 40 channel CB mobile antennas.

The two men are Gaillard Childs, former VP of engineering at E.F. Johnson, and Bill Oelke, former Johnson component applications engineer. Childs will be AVA president and chief engineer, and Oelke will be AVA VP of marketing.

"Consistent high performance and customer convenience, including easy installation and low maintenance backed by a full warranty program are our objectives," Oelke stated.

### Explosive Growth Predicted For VCR Market

A new research report from Frost & Sullivan, Inc., a New York-based market research firm, indicates that sales in the U.S. of video cassette recorders will show an increase of 97% by 1980.

The report says that "the consumer market responded so favorably from 1976 to 1977 that VCR production increased 96% and exports from Japan to the U.S. rose 245%.

The research firm points out in its report that many different industries will benefit from the video-cassette recorder, because its introduction has created a series of products which comprise a total system. Since the VCR is a completely modular system, each additional component generates incremental demand as it enhances the total capability of the system. The array of products that could be applied ranges from carrying cases to lighting equipment to the most sophisticated control devices for future video buffs.

In addition, the report indicates, as the price of VCRs drops below the current level of \$700, the uses for the system will multiply.

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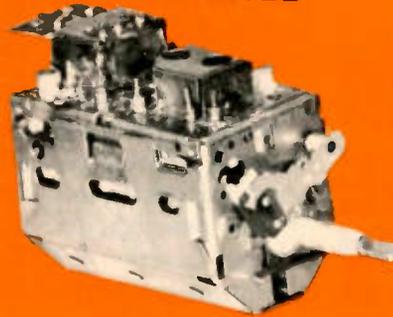
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# FROM THE EDITOR'S DESK



This July issue, comprised primarily of material which ET/D's editors obtained during the recent New Communications (NEWCOM) show in Las Vegas, plus our recent return from last month's successful Summer Consumer Electronics (CES) show in Chicago, provides ample evidence of the vast changes impacting consumer electronics.

Meetings such as these two comprise a very important role in helping us take the pulse of an industry that is exploding with manufacturing and electronic design technology.

Such meetings also allow us to take stock and assess the future editorial direction of ET/D, based on what we—the editors—feel will be the key developments in consumer electronics servicing in the *near* future.

And, so far, from what we've been shown at these shows, the future of consumer electronics servicing will rely heavily on the service industry's ability to come to grips with concepts involving medium and large scale (chip) integration design techniques, plus a hefty (and ever increasing) diet of digital concepts and applications.

Having taken an initial look at much of the new circuitry in many of the 1979 lines of television sets which have just recently been unveiled by manufacturers, I feel safe in saying that in most cases, the discrete transistor is quickly going the way of the electron tube insofar as consumer applications are concerned.

Having also taken a look at the hardware inside of today's modern and highly accurate test gear, this feeling was doubly reinforced.

In this day and age of chip voltage regulators, chip chroma sections, chip IF strips—FM audio as well as video—to say nothing of the digital chips you are now seeing in the maddening dash to electronic tuning—anyone not possessing a strong familiarity with the functional aspects of integrated circuit use, is virtually lost from the very beginning.

All of this, in my view, points to the inescapable conclusion that chip technology is already into consumer electronics in a big way and digital comprises a major portion of it—especially in the test gear which you are now beginning to use.

Speaking of test gear, our lead story this month features the newest of the new which we found at the NEWCOM meeting. It's equipment which is just now making its way into your distributor's showrooms, and equipment which we felt was important enough to give you a brief preview.

I might mention a first for ET/D in regard to this story. It is the first time—to our staff's recollection—we have ever used four color photographs inside ET/D as part of a news or feature article. If you agree with this format, why not let us hear from you? Maybe we could do it more often in the future.

Sincerely

*Richard M. Lay*

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NEW VCR PRODUCTS INTRODUCED BY MAGNAVOX. A new programmable video cassette recorder and a new lightweight, color TV camera for use with VCRs have been introduced by Magnavox. The new VCR can be programmed in advance to record up to four different channels over a seven day period, and features a touch-tune, fourteen channel push-button electronic tuner. Shipments to dealers of the new micro-processor-controlled VCR will begin this fall. The new VCR color camera, called Chromavue, will be priced upward from \$895, and has been designed as a companion to the company's VHS video cassette recorder. It will also work with any VCR with appropriate camera jacks. It also has a self-contained battery compartment which will permit portable operation when battery power VCR units are introduced. It is designed for 'hand-held' operation but can be used with a tripod.

RCA TO OPERATE JOB CORPS CENTERS IN NEW YORK AND ILLINOIS. Multi-million dollar contracts from the U.S. Department of Labor have been awarded to the RCA Service Company for the operation of Job Corps Centers in Joliet, Illinois and New York State. Both centers will provide basic education, vocational skills training, counseling, and a full range of support services for male and female disadvantaged youth from 16 through 21 years of age. Vocational courses to be offered at the Centers will include automotive, electrical/electronic, construction/mechanical, clerical, food services, and health occupations. Full enrollment will be reached at the centers by late December.

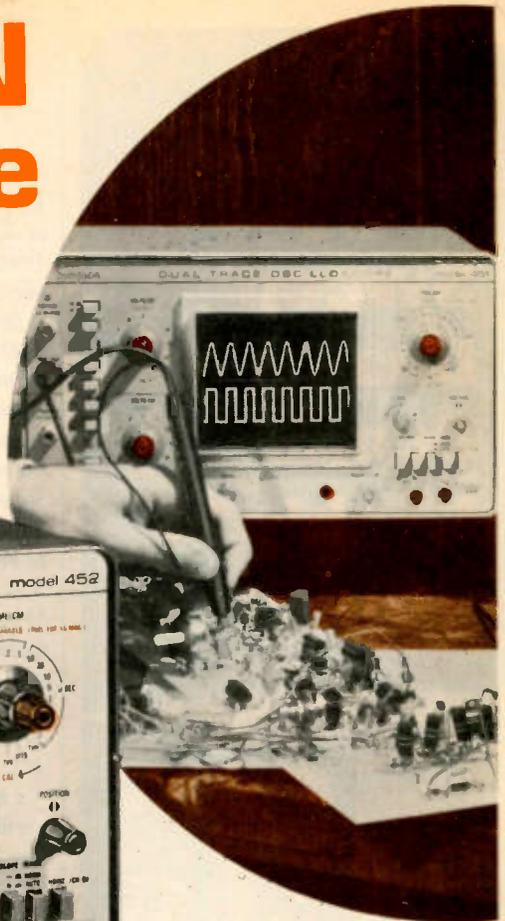
CB MARKET FORECAST FOR A 17 PER CENT GROWTH BY 1982. The CB radio market, stalled in 1978 with no growth projected over 1977, will move slightly ahead at a 2½ percent growth rate in 1979, then settle into a strong growth rate of 15 to 17 percent through 1982 to a level of \$629 million at wholesale, according to a 5-year forecast recently released by Stephen R. Davis, president, Acoustic Fiber Sound Systems. The sale of CB speakers, which AFS produces, offers a slightly better outlook, according to Davis. "After a stagnant 1978, sales will increase 16 percent in 1979 and 20-25 percent annually thereafter through 1982 to a wholesale level of \$20 million," Davis revealed.

METAL TAPE FOR AUDIO CASSETTES IS NEW FROM 3M. The first metal-particle tape in audio cassette version will be manufactured by the 3-M Company later this year. It is said to have performance characteristics sharply higher than oxide tapes used now and will eventually have applications in video tape. The new metal tape uses less tape but requires different heads and circuit changes. It will probably be used someday for portable VCRs.

NESDA AND NATESA CONVENTIONS TO FEATURE SAME SPEAKER. Both electronic service associations -- NESDA AND NATESA -- will feature RCA's Arthur J. Holst, popular humorist, as guest speaker at their national conventions in August in Portland, Oregon, and Chicago.

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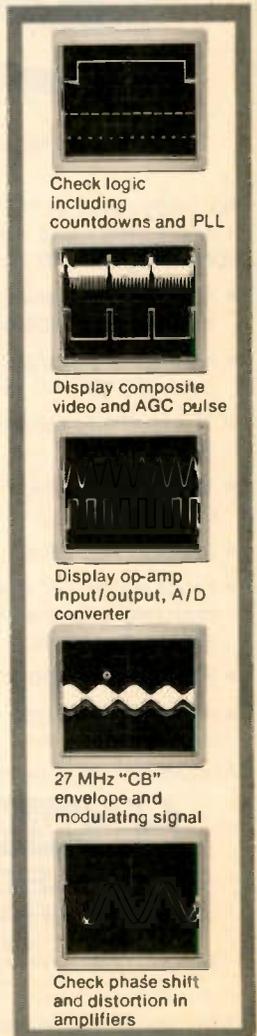
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## LETTERS

### ANTENNA ARTICLE A DISSERVICE

The article published in the March issue of ET/D: "TV Antenna Development—Thirty Years in Review" performs a disservice to your many readers.

Its title implies that the article is an overview of the state of the TV antenna art over the past thirty years. In actuality, it was not. Instead it was "puff" in the guise of impartial and perceptive editorial reporting that left the reader with the impression that all major antenna concepts of the last 30 years were the result of Winegard Co. engineering.

Many outstanding antenna designs have been successfully developed and marketed since the advent of commercial TV by Telrex, Channel Master, Jerrold, RCA, Kay Townes, Finney Co. and other antenna manufacturers as well as JFD.

I believe it is incumbent upon Electronic Technician/Dealer to inform their readers that this particular article is not representative of its implied purpose.

If ET/D was to publish an overview of TV antenna design events during the last 30 years, it should have been han-

dled by a staff reporter who personally interviewed all major antenna manufacturers and personally wrote the article accordingly.

James C. Sarayiotos  
National Marketing Manager  
JFD Electronics Corp.  
Oxford, North Carolina

EDITOR: Yours is not the first complaint we've received over the publication of this article in the March issue of ET/D. Your point is well taken.

Indeed the tradeoff between time saved and basic accuracy by employing an "industry expert" to provide such an article can—as ET/D has learned—be most disappointing.

Your suggestion for staff-originated articles in regard to similar articles in the future certainly seems the most appropriate way to proceed.

### WANTS MORE AUDIO INFO

I used to be a TV tech and have been receiving your magazine for two years now. I quit servicing TVs because I got bored by them, and I started doing strictly high power musical instrument amplifiers, special effects, etc.

The one thing that bothers me is that I have never seen a technical article on them or schematics (which aren't always easy to find) in ET/D.

Now surely I can't be the only guy (in fact, I know I'm not) who longs to see something written for his majority interest which seems to be (but isn't) a minority in the service world. Please!

Also, I would like to hear from other techs so we can exchange schematics and common problems with various makes. Thanks.

Rolf-Dieter Burckhardt  
26 Hillside Road  
Wanaque, N.J. 07465

EDITOR: Thanks for the idea. We'll take it under serious consideration.

### MORE HELP WITH WHOLESALE

In response to a letter from Richard W. Dambrun, Hazel Park, Mich., he did bring up some good points in his letter. We read it with interest.

My husband has been in the TV repair and retail sales business for five years and we've run into the same problems. He worked for a couple of TV repairmen before opening his own business in another town. He was able to come in contact with salesmen from various 'wholesale' companies on that job.

Our biggest help with problems that have come up in the business has come from the Wisconsin Electronic Service Dealers Association, as well as the Na-

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| 124   | 1.53  | 185   | 1.70  | 235   | 3.83  |
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| 154   | 2.34  | 196   | 2.06  | 281   | 6.35  |
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tional Electronic Service Dealers Association.

In attending the state convention, and getting together with other people in the business, we've helped our business greatly. We would encourage Mr. Dambrun to join his local association or the State association and go to the meetings. There are top speakers who present a specific talk on the many areas of the TV business. I'm sure his questions would get answered through these meetings. Even with talking to others in our business he may get the answers.

Local businessmen, especially in a small town like ours, are very reluctant to say anything about their operations for fear of someone taking business away from them. This doesn't happen at the Association meetings or State conventions. We're all there to improve our business techniques, productivity, and all important profit.

Mrs. Arlen Halvorson  
Spooner, Wisconsin 54801

#### HELP NEEDED IN CANADA

For several months now, I have been reading the "Letters to Ed" section and have noticed the "help needed" letters, so I'm going to make a try.

Two years ago I retired from the radio-TV business in Madison, N.J. (where I had been established for 25 years). I moved up to Canada, and in moving dozens of pieces of equipment, many manuals were lost, including that for my two Precise 300 triggered scopes. Fifteen years ago, these scopes were ahead of the whole field and even today, they're ahead of many in the \$500 and \$600 category.

I've been trying hard to get a service manual for these scopes, with no success. Even wrote to B&K who purchased Precision, but they had nothing.

If anyone knows where to find the manuals, or has a copy, I, of course, will be happy to pay any charges involved.

Also, that letter from Mr. Dambrun certainly hit the nail on the head. Everything he said was so true. There is no such thing as wholesale.

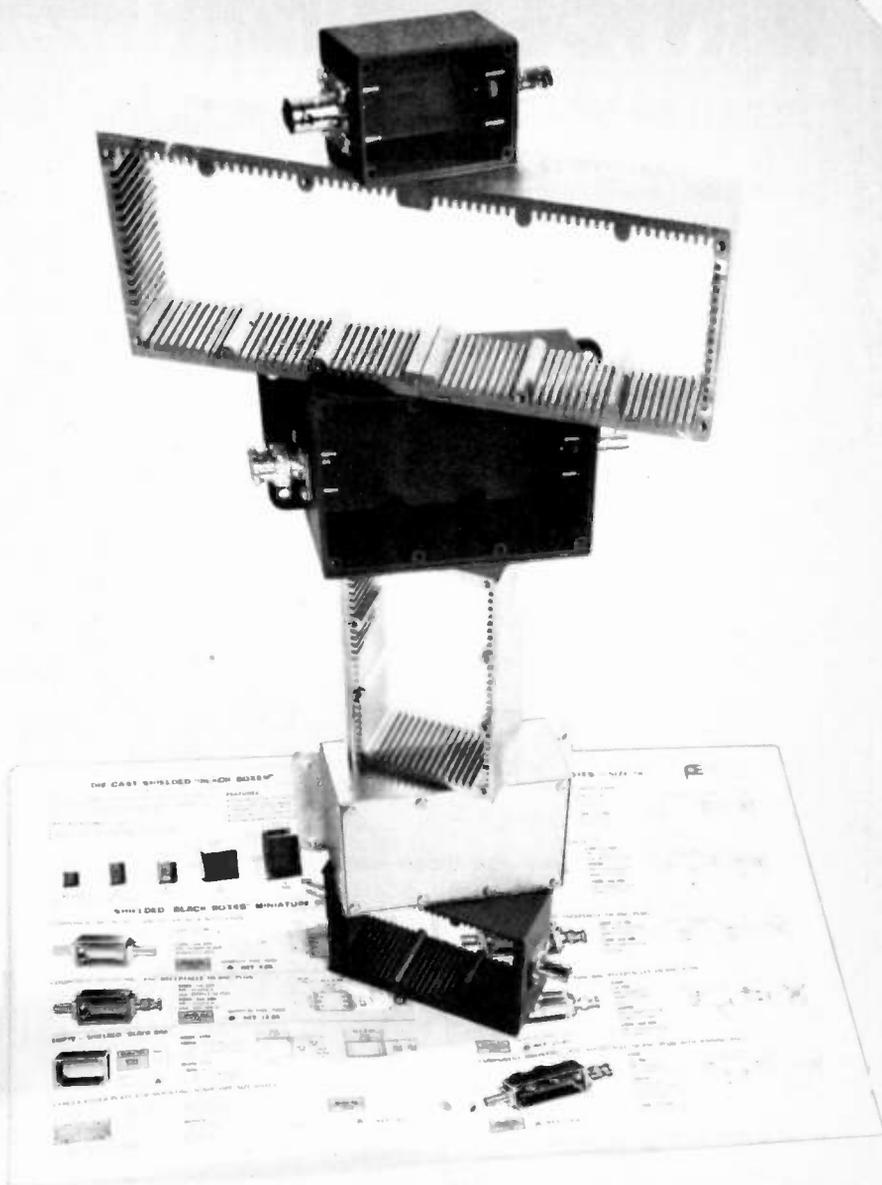
George Jeranek  
Economy R.R. #1, N.S.  
Canada.

#### THANKS TO ET/D

Have obtained meter repairs and parts for my Amphenol 870 FET meter through your "Letters" column. I now have the meter back in operation. Many thanks for your help.

Ed Scribner  
Schoharie, N.Y.

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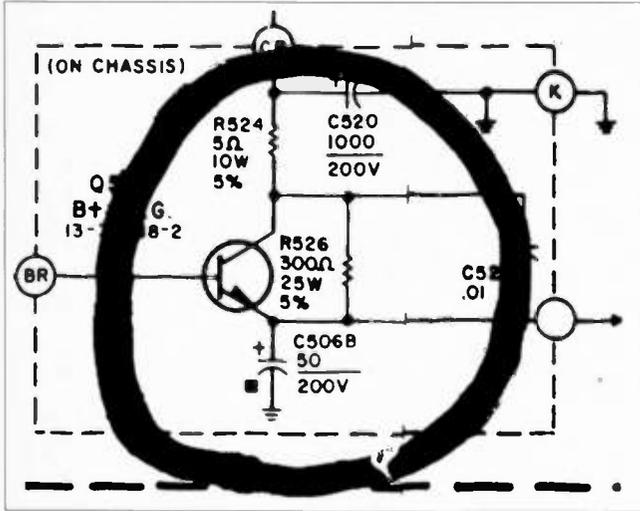


# SERVICE SEMINAR

## GTE SYLVANIA

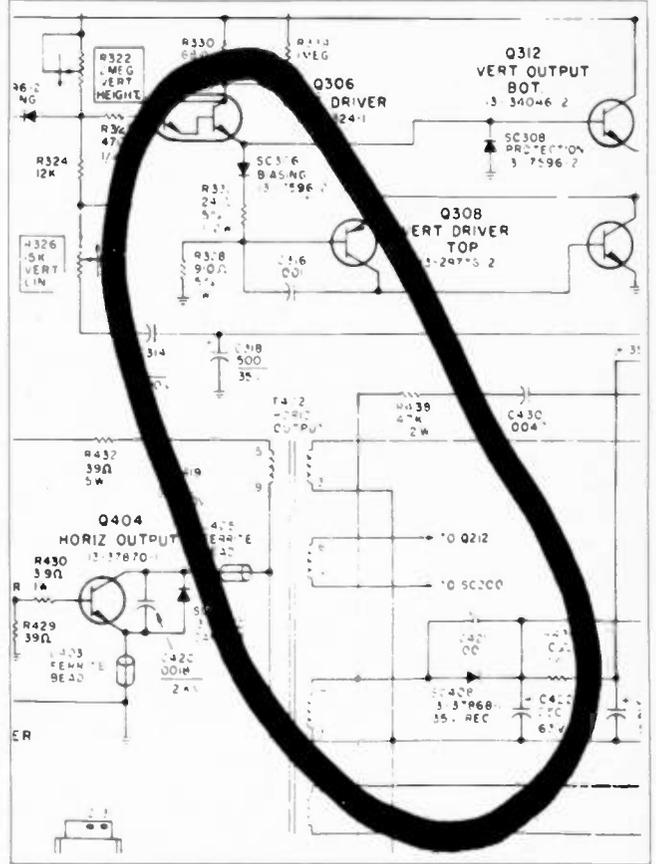
**E21-3 Chassis—**The regulated B+ supply stopped 70 volts, with a ticking sound from the flyback.

The cause is probably an open 50mfd, 200V section filter capacitor C506B. Replace capacitor.



**A12 Chassis—**No sound—no video—and SC408 shorts when replaced.

The cause is a partially short SC306, causing vertical stage to load down the 35V supply. To repair, replace both diodes—SC306 and SC408.



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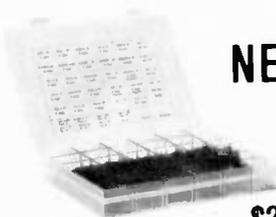
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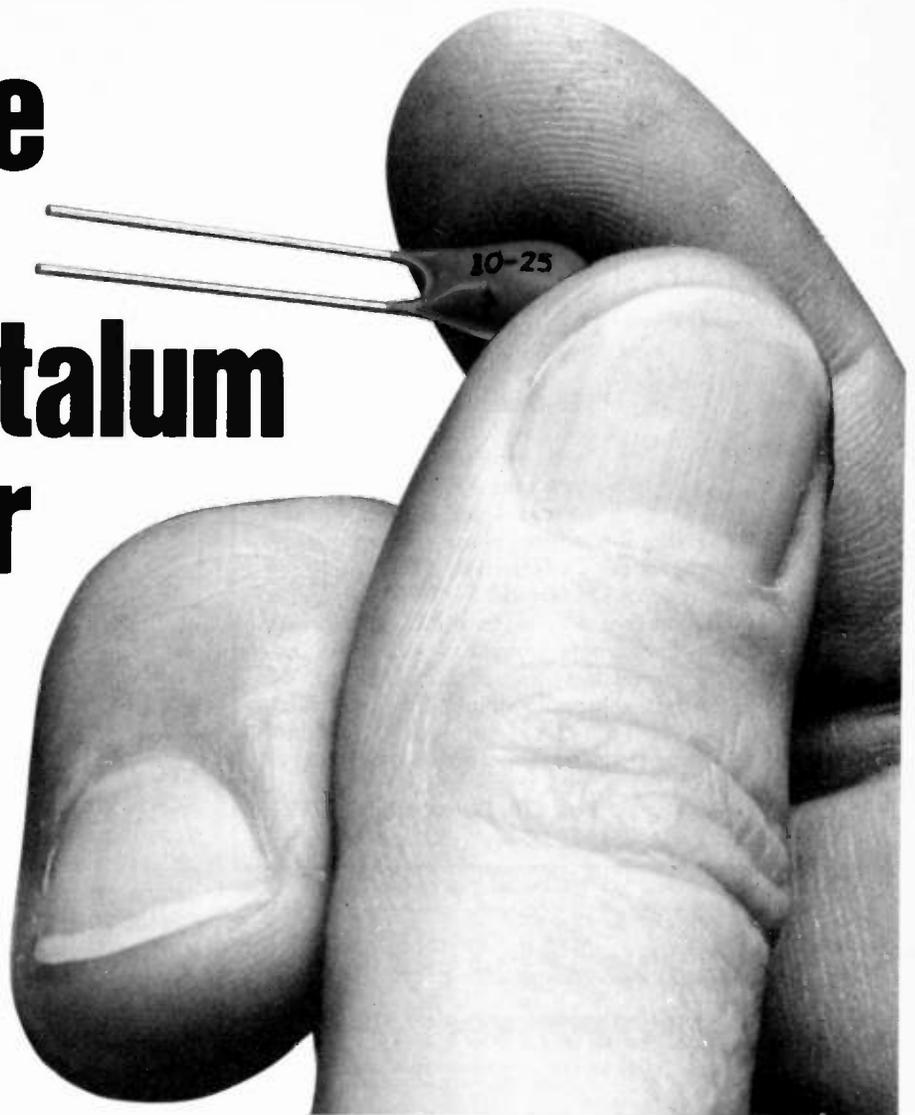


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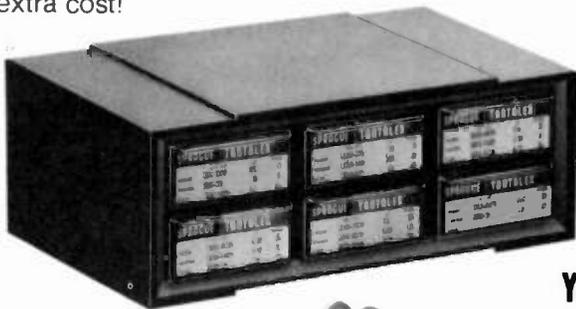


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2	SD35-R229	.22	8	SD35-4R79	4.7
2	SD35-R339	.33	8	SD35-6R89	6.8
5	SD35-R479	.47	10	SD35-109	10
2	SD35-R689	.68	2	SD35-159	15
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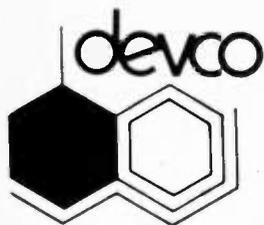


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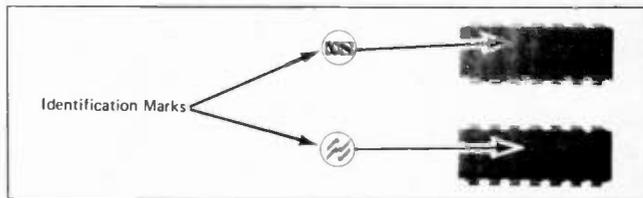
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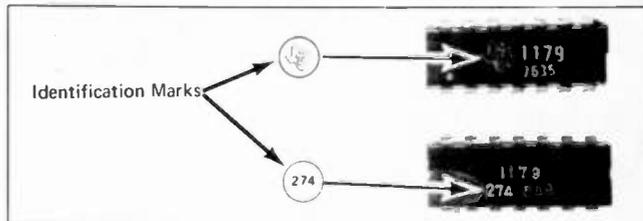
## GENERAL ELECTRIC

### YM Chassis—Audio Hum

Some YM chassis sets manufactured between June and October 1977 can have an audio hum because of a peculiarity of certain audio IC's (IC190). These are shown below:



To repair, replace IC's shown above with the replacement IC's shown below:

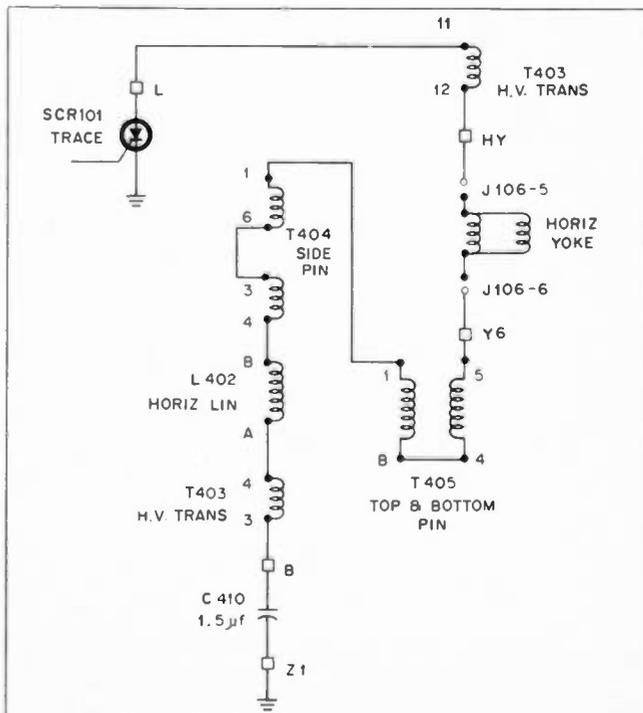


The new catalog number is EP84X38.

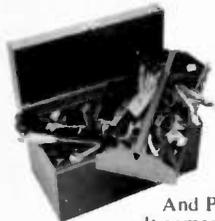
## RCA

### CTC 46 Chassis—Checking continuity of, and replacing SCR101 (trace).

If during servicing, it is determined that the Trace SCR (SCR101) is defective, the following checks should be made before replacement. (1) Measure continuity from PW400-L to PW400-B. Resistance should measure approximately 1 ohm. If an open is indicated, further resistance checks of the series path shown in the partial schematic below should be made to isolate the open. (2) If continuity is normal between PW400-L and PW400-B check for the possibility of an open in the SCR socket and/or the circuitry associated with the yoke return capacitor, C410. (3) Repair any open circuits located in Steps 1 and 2 then replace the SCR. **ETD**



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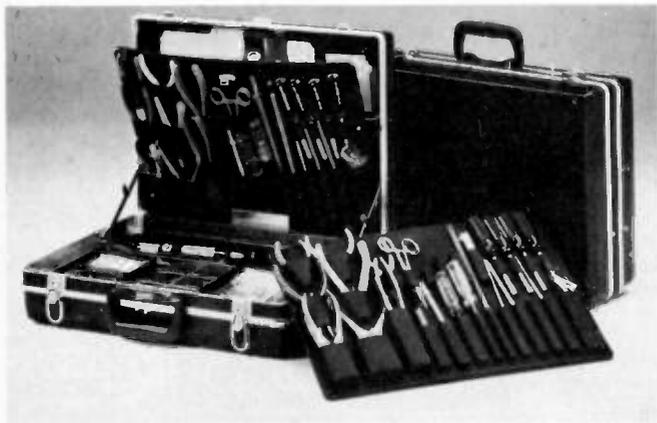
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GENERAL  ELECTRIC

# NEWCOM 1978

The shape of things to come

This year's show leaves no question that you're getting added sophistication, greater accuracy and more for your money on your test bench.

By Richard W. Lay

The growing functional utility, greater accuracy, and timesaving characteristics built into the new breed of test gear shown this year in Las Vegas during NEWCOM '78 leaves little doubt that the consumer and industrial service markets are reaping full benefits from space age electronics technology.

ET/D, in viewing the latest in test equipment, antennas and amplifiers, and during conversations with manufacturers from coast to coast, found these general trends sweeping the test gear market:

1—"Pocket Portability" is fast becoming a reality. With the impact of large scale integration in IC chips, even the concept of a shirt pocket oscilloscope seems within grasp at this point in time.

2—Multi-function test gear in the past six months has made heavy inroads into electronics service markets and its impact is increasing. Instead of just voltmeters and current meters we now see volt/current meters combined with regulated power supplies; instead of seeing oscilloscopes and counters separately, we now are beginning to see combinations of units planned for various service markets (see April issue of ET/D p. 21).

*(EDITOR'S NOTE: We are including special reader's service numbers on the new products shown in this NEWCOM feature report. Circle number on Reader Inquiry Card.)*

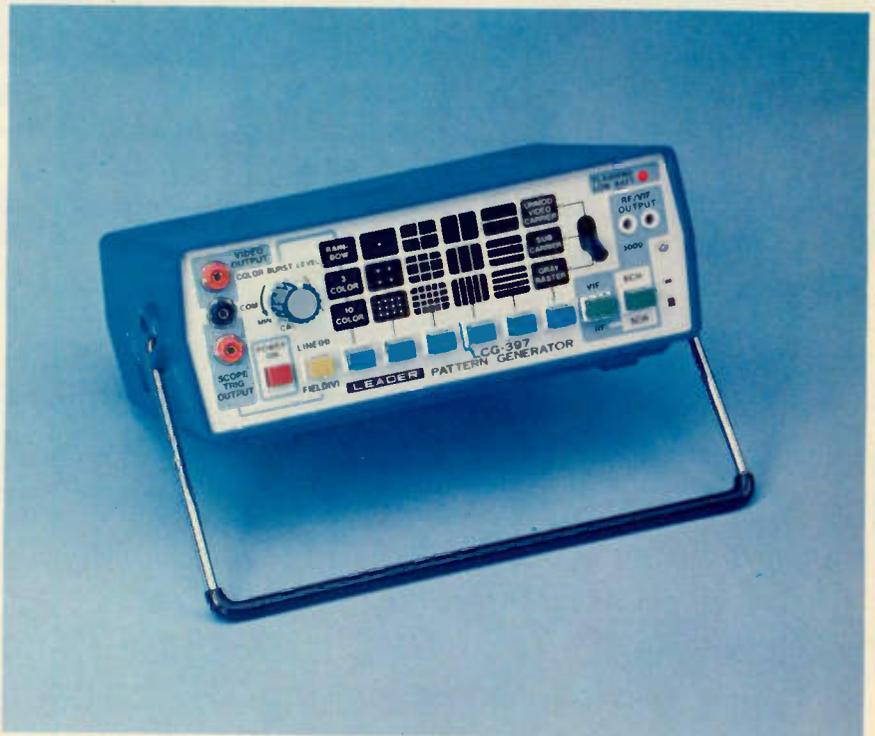


Fig. 1—Leader TV-Analyzer Generator —#200

3—And, price stability. In general we have noted a trend in these newer combination units toward greater price utility. While the multi-functional pieces of equipment carry a higher price tag than a single unit, the price is usually under the individual prices that you would pay for buying the same pieces of equipment singly.

From the standpoint of time saving devices for the service technician on the bench or in the field, from the standpoint of elimination of guesswork in troubleshooting and taking measurements, this year's NEWCOM Show was a platform for the most advanced pieces of equipment, yet aimed at the consumer electronics servicing market.

For your review, we will present the highlights of the show as a preview of

what you will soon be seeing in your distributor's showcases in the way of equipment, amplifiers and antennas.

Leader Instruments Corporation showed the production prototype of its compact, fully portable 18 pattern color bar generator which it calls the TV Analyzer-Generator. According to a company spokesman, the unit has scope trigger and composite video outputs. Built on LSI technology, the small, 1-1/2 pound unit operates on 4 "C" cells with optional AC adapter, and among the signal outputs are the RF, IF and composite video and an unmodulated RF carrier, color subcarrier and zero-level black raster. It will sell in the \$200 category, according to Leader.

Another unit from Leader, scheduled tentatively for fall introduction, will be a



Fig. 2—The Hickok Model 532, 30 MHz Dual Trace —#201



Fig. 3—Sencore Portable CB49 CB Analyzer —#202

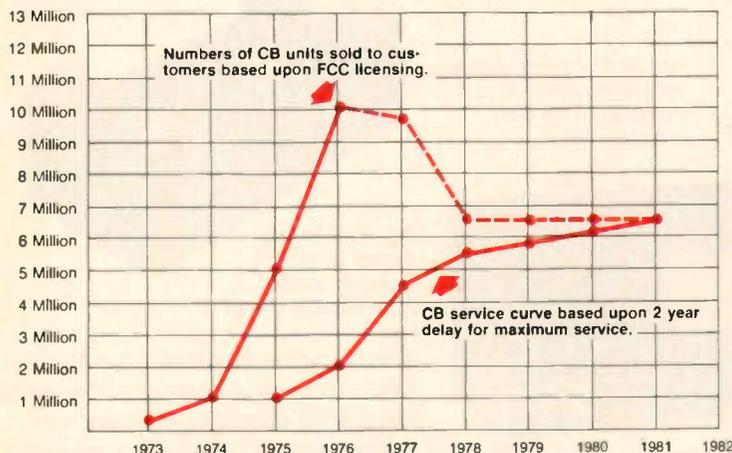


Fig. 4—CB Service Demand Chart (Courtesy Sencore)



Fig. 5—Leader's LDC 823, 8-digit counter —#203

250 MHz, 8-digit frequency counter with period function. The unit will be aimed at industrial, communications, VTR and video usage.

Hickok's newest scope, the Model 532 Dual Trace 30 MHz unit for industrial, service and video applications, was on display. This scope features built-in delay line for leading edge viewing of fast risetime pulses, a must for use in digital logic circuits. In addition, the 532 features color-coded front panel pushbuttons for quick association of functions.

Also, this unit features a 4-times expander. This special horizontal position control allows any pulse train up to four screen widths (40 full divisions) without the use of a multiplier switch.

Sencore is soon to be out with a portable version of a CB Analyzer (to complement its previously introduced CB42 CB Analyzer). According to Sencore forecasts, CB servicing is just beginning to cash in on the CB transceiver sales boom of 1975 and 1976 (see Figure 4). By Sencore's logic, CB service demand will lag behind

transceiver sales by some two years and this company's calculations indicate CB service demand will not peak before 1981.

The new Sencore unit, the CB49 Analyzer is a completely automatic and portable CB analyzer and performance tester. Included in the 10 pound battery operated (AC adapter available) unit are an RF wattmeter; a percent of modulation tester; a distortion checker; an RF generator; a unique "percent off channel tester" for which a patent has been applied; an automatic sensitivity checker; an audio wattmeter; an IF amp tester; and a signal sideband EIA tester.

Also aimed at communications service markets is Sencore's newest frequency counter, a 1 GHz unit (selling under \$1,000) for use in newly opened bands. Specific applicability is in the new 806-947 MHz two-way communications, business and police band; for the UHF TV band; for the 902-928 MHz medical electronic and industrial scientific band; plus future anticipated allocations from the FCC in the above 600 MHz band.

Among special features of the FC51,

which is AC or 12-volt DC operated, are a built in crystal checker, sensitivity adjustments for stabilizing complex waveforms, a 12-volt vehicle battery plug, a signal pick-up loop antenna for minimum loading effects in sensitive circuits, plus a 10 MHz frequency clock which can be used for calibrating less sensitive frequency counters and oscilloscope time bases, according to Sencore.

Another variety of the many combination units we saw at NEWCOM was displayed by VIZ with the introduction of its "DC Power Supply" series of regulated supplies and volt/current units. VIZ says the units provide power regulated at better than .075% and they will indicate two independent external DC voltages from 0-99.9 volts on twin 3-digit LED readouts. These same LEDs also indicate supply output voltage and current—at the flip of a switch.

According to the manufacturer, these latest units are being brought to the marketplace because "with the present trend towards electronics in everything



Fig. 6—The first 1 GHz counter aimed at the consumer market, Sencore's FC51 —#204



Fig. 7—Regulated triple DC supply and volt/current meter combo, VIZ's "Triple Supplst" —#205

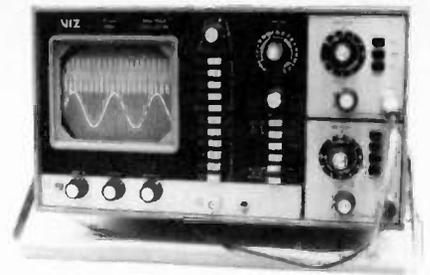


Fig. 8—The W0555 from VIZ, another channel has been added —#206



Fig. 12—Non-Linear has added another channel to its portable "Miniscope," this one called the Model MS 215 —#210

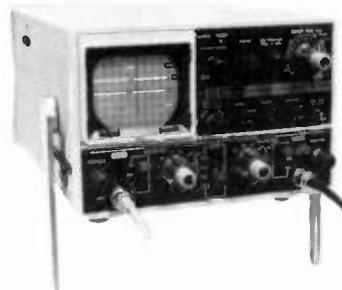


Fig. 14—B & K's 3010 Function Generator —#212

from kitchen ranges to washing machines, in-line electronic testing is becoming more and more necessary."

One of the Supplst's models is a "Triple Supplst" with three completely isolated DC supplies, two 0-20 volts at 0-2 amps, and the third is a fixed 5 volt supply at 4 amps.

Also from VIZ is an updated version of their 15 MHz single trace 527A oscilloscope (see ET/D, May, p. 36). This newest unit, the W0555, is also a 15 MHz scope with add and subtract features.

PTS Electronics offers three new servicing aids, two regulated power supplies and a unique universal component tester for \$54.95. This handy component tester, to be used in conjunction with your oscilloscope, is aimed at cutting servicing time when troubleshooting solid state circuitry in TVs, stereos, computers, CB and many other electronic devices.

The Model 8001 Component Analyzer works in or out of circuit. The technician, by familiarizing himself with the standard expected waveforms when testing a transistor, capacitor, or resistor, can determine at a glance whether the component under test is functional or not.

A high medium and low range switch on the 8001 matches the impedance of the component being tested. It also houses a comparator circuit and it can be used for in-circuit testing of electrolytics.

The new PTS DC-1 Digital Power Supply can be used as an external source for powering many types of



Fig. 19—The new Model LS 4040 four-way splitter from Winegard —#217

Fig. 13—The newest dual trace scope from B & K Precision, a 15 MHz portable —#211

consumer devices. The third unit, the PTS DG-4 Voltage Control Center produces, independently, four variable DC voltages for substituting critical control voltages for television electronic (varactor) tuners. One of the main problems in servicing varactors has been found to be inaccurate supply voltages to the tuner rather than a defective tuner itself and this unit is designed to quickly isolate the problem.

Another excellent servicing timesaver—applicable to most Zenith and RCA solid state chassis service work, is being offered by GTE Sylvania. Known as Chek-a-Board, the new troubleshooting aid is a module extension cable kit which permits in-circuit module testing by extending the module onto your test bench, thus making all test points readily available.

Additionally, each side of the cable is colored differently for quick identification. The overall length, some two feet, permits extension well away from the chassis.

According to Sylvania, Chek-a-Board

extensions are available in two kit sizes which are for RCA Accucolor Series sets using edge connector modules and Zenith series EC through JC, except for several non-modular models.

Non-Linear, another manufacturer concentrating on the portability aspects of test gear, is out with an upgraded version of its previously released "miniscope." The company has added a second channel to the 15 MHz unit, a battery operated, hand-held set weighing only three pounds. The MS-215 Miniscope, retailing at \$395, features external or internal triggering, .1 microseconds to .5 seconds per division in 21 steps, and battery or line operation. It also has chopped or alternate mode operation.

B & K Precision's newest oscilloscope entry continues the heavy emphasis now going toward the dual trace. According to the firm, the Model 1432 portable unit, featuring 2 millivolt sensitivity is "conservatively" rated at 15 MHz bandwidth with a usable response "well beyond 30 MHz." Designed for field or lab use, according to B & K Precision, the scope includes X-Y operation, addition and subtraction of channels A and B, and a times five multiplier for close-in viewing of displayed waveforms and signals. The 1432 also provides automatic selection



Fig. 9—PTS Electronic's 8001 Component Checker -#207



Fig. 10—This special "variable" four-way supply from PTS Electronics has special applications for electronic tuner servicing -#208

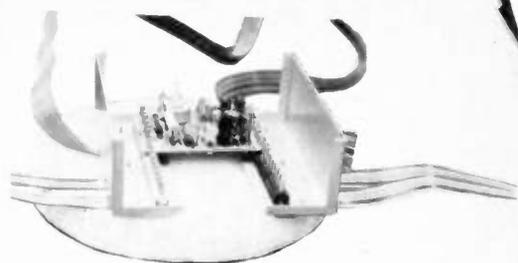


Fig. 11—GTE Sylvania's visionary Check-a-Board for solid state RCA and Zenith sets -#209



Fig. 15—The Model 2830 DMM from B & K Precision -#213



Fig. 16—One of the more unique units to watch for this Fall is B & K's low cost Model 820 Capacitance Meter -#214

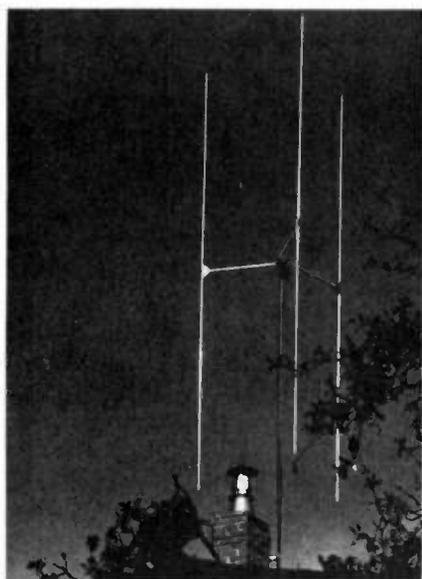


Fig. 20—Antenna Specialist's Model MS119 SuperScanner serves as both a beam and omnidirectional antenna -#218

of chopped or alternate mode as well as automatic selection of TV line and frame sync.

Another new B & K Precision unit displayed was the 3010 Function Generator, a \$175 unit, featuring sine, square and triangle waveforms from .1 Hz to 1 MHz in six steps. One of the unique features of the 3010, according to the manufacturer, is its voltage controlled oscillator and VCO external input. A ramp voltage applied to the VCO external input allows the 3010 to be used as a sweep generator in audio and I-F circuits and an audio signal applied in place of the ramp allows the 3010 to produce a direct FM output.

Several new digital multimeters that will soon be making their way to test benches across the nation were viewed during NEWCOM. Among them was Weston's 6000 autoranging liquid crystal display model. Capable of handling a full 10 amps of AC or DC current, the 6000 encompasses a

special "measurement hold," that is, once the reading is established the technician may remove the probe from the circuit under test and the reading will remain on the LCD display. This unit also features auto zeroing, a special light meter attachment permitting measurement of light intensity in foot candles and, the portable unit is powered by two nine volt transistor batteries capable of some 350 hours of operation, according to the manufacturer.

Simpson was at NEWCOM with its newest DMM, a super portable 3½ digit, pushbutton-operated Model 462. This is the autoranging version of its previously released Model 461. This handy unit, based on LSI technology, is less than 6 inches across and weighs only 1½ pounds, has automatic zero and polarity indication, .25 per cent DC voltage accuracy and will run eight hours on batteries. Twenty-six pushbuttons select all ranges.



Fig. 17—Sylvania's new variable gain SD-400 microphone -#215



Fig. 21—Eico's Model 272 DMM -#219



Fig. 22—Simpson's new Model 462 autoranging DMM. -#220

Eico's new 272 unit, available later this summer of Fall also was available for viewing during the show. This is a portable, battery operated automatic zeroing and polarity unit with three digit LED readout. It is capable of reading up to 1000 volts DC and 600 volts AC.

B & K Precision also unveiled a pushbutton 3½ digit multimeter that is just now hitting the market. Suited for lab or bench work, according to the manufacturer, the Model 2830 provides .5% DC accuracy, with a current measurement capability of up to 20 amps. The auto zeroing unit will read up to 1000 volts DC and 750 AC.

One of the rare breed of test instruments, but certainly one that can save anyone who's ever replaced a faulty capacitor with another faulty one a lot of trouble, was also shown by B & K Precision. That instrument—ostensibly to be on the market this Fall, was the 820 Capacitance meter. This welcome

*Continued on p. 44*

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# Operational amplifiers

A detailed look at Op-Amps

Originally in the domain of the analog computer, these easily manipulated devices are finding more and more acceptance in consumer applications.

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

The operational amplifier has been with us for over two decades in one form or the other, and in integrated circuit form since about the mid-sixties. As their generic name *operational* amplifiers seems to imply, the applications for these devices were once restricted to performing mathematic operations in analog computers and scientific instruments. Indeed, certain differential equations could only be solved easily on an op-amp based analog computer. Today, on the other hand, the operational amplifier finds many applications, even in consumer electronics. Certain properties of op-amps, coupled with their very low cost in IC form, has made them very popular with circuit designers.

## Fundamental Properties

There are several mathematical methods for describing the behavior of the operational amplifier, but they are a little too rigorous for our current discussion. We can describe the behavior of the operational amplifier in terms of Ohm's Law, and Kirchoff's Current Law, if we will only accept five basic properties of the op-amp as given:

1. It has infinite input impedance ( $Z_{in} = \infty$ )
2. It has infinite open-loop (no negative or positive feedback) voltage gain.
3. The output impedance is zero ( $Z_o = 0$ )
4. It has infinite bandwidth.
5. Both inputs *track* each other. That is to say they stay together—setting conditions at one input

allows us to treat the other input as if the same conditions are also applied to it (more on this shortly).

Of course, these properties apply in the literal sense only to ideal operational amplifiers. Real operational amplifiers only approximate these properties—even though some of them get very close to the ideal if one is willing to pay the price. Consideration of an "ideal case" allows us to derive the voltage gain formulas without resorting to any math greater than Ohm's Law (whew!).

Fig. 1A shows the basic circuit symbol for an operational amplifier. The two inputs are labelled "inverting" (-) and "noninverting" (+) because they have equal, but opposite phase, effect on the output voltage. This means that the two inputs form a *differential* input pair. If the same potential were applied to both inputs simultaneously the difference would be zero, so there is no output voltage created. Such an input voltage is called *common mode* potential because it is applied to both inputs at once.

Note that there is no ground terminal on the operational amplifier, and this fact causes some people a little consternation. The positive power supply terminal (Vcc) goes to a source that is positive with respect to ground, while the negative power supply terminal (Vee) goes to a source that is negative with respect to ground. An example of a bipolar op-amp power supply is shown in Fig. 1B.

It is very often the case that the Vcc and Vee power supply connections for the op-amp are deleted on circuit diagrams. This is not to say that no power is applied, however, and you must assume that the supplies are connected but not shown schematically. This is actually the practice in many IC circuit diagrams, not just in op-amp drawings. We sometimes see a little block to one side of the drawing giving the power supply pinouts.

## Negative feedback effects

Fig. 2 shows the *inverting follower* amplifier configuration. Recall property number five on our list? It tells us that both inputs "stay together." Since the noninverting input is grounded, we may, in fact must, treat the inverting input as if it were also grounded. Some op-amp textbooks like to call the situation at point "A," the inverting input, a "virtual ground." If you actually take a voltmeter and measure that it is the same as the noninverting input—0-volts.

An implication of property number one ( $Z_{in} = \infty$ ) is that the input terminal of the operational amplifier neither sinks nor sources current. That is to say it neither produces nor accepts a current. The only two currents in the circuit are I1 and I2, and by Kirchoff's current law:

$$-I_1 = I_2 \quad (1)$$

By Ohm's Law we know that the input current is produced by dropping the

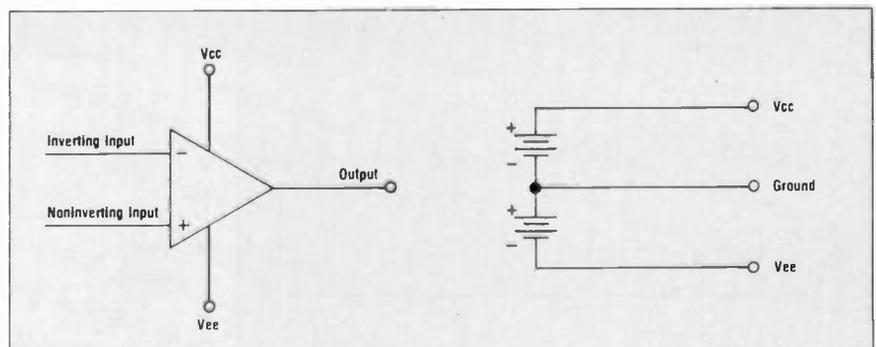


Fig. 1 a) Op-amp circuit symbol b) Dual polarity power supply used for Vcc and Vee

input signal voltage across the input resistor (remember point "A" is at ground potential), so

$$I_1 = E_{in}/R_1 \quad (2)$$

In order to understand where  $I_2$  comes from, we must consider the operational amplifier as a "black box" that somehow manages to produce an output voltage that will create a value of  $I_2$  that will allow point "A" to obey Kirchoff's law: it must equal  $I_1$ . We can say, then:

$$I_2 = E_{out}/R_2 \quad (3)$$

By the arithmetic trick of substituting (2) and (3) into (1) we obtain:

$$-E_{in}/R_1 = E_{out}/R_2 \quad (4)$$

and solving (4) to find  $E_{out}$ :

$$E_{out} = -E_{in}(R_2/R_1) \quad (5)$$

Equation (5) is called the transfer function of the inverting follower. For any amplifier the transfer function is  $E_{out} = E_{in}(A)$ , where  $A$  is the gain, or amplification. In this case the gain, then, is  $-R_2/R_1$ . The minus sign tells us that the amplifier inverts the input signal, so the output will be 180 degrees out of phase with the input.

The neatest implication of the transfer function for the inverting follower is that we can set overall circuit gain merely by setting the ratio of two resistors,  $R_1$  and  $R_2$ ! If, for example, we wanted a gain of

100, we need only find a pair of resistors with a ratio of 100. 1-megohm for  $R_2$  and 10 Kohms for  $R_1$  meets this qualification, so they would result in an amplifier that had a voltage gain of 100 from DC to the upper frequency limit of the particular device (real op-amps have a lot lower bandwidth than infinity!).

### Noninverting circuit

The noninverting configuration is shown in Fig. 3. Since the noninverting input is at a potential of  $E_{in}$  we must treat the inverting input as if it were also at a potential of  $E_{in}$ . If you actually measure the voltage at point "A" you would find that it is equal to  $E_{in}$ . By the same sort of reasoning as we used in the previous case:

$$I_1 = I_2 \quad (6)$$

Note the "-" sign at  $I_1$  is dropped

$$I_1 = E_{in}/R_1 \quad (7)$$

$$I_2 = (E_{out} - E_{in})/R_2 \quad (8)$$

$$E_{in}/R_1 = (E_{out} - E_{in})/R_2 \quad (9)$$

Solving (9) for  $E_{out}$  gives us the transfer function for this type of circuit:

$$(R_2 E_{in})/R_1 = E_{out} - E_{in} \quad (10)$$

Or in the form more often seen:

$$E_{out} = E_{in} \left( \frac{R_2}{R_1} + 1 \right) \quad (11)$$

The voltage gain of the noninverting follower is, therefore, equal to  $1 + R_2/R_1$ . Gain is once again given by a simple formula that depends upon the ratio of two resistors.

Note that a special case originates when  $R_2$  is equal to zero. In that case we could also delete  $R_1$  since it would have no effect. If  $R_2$  is 0-Ohms, that is to say the output terminal is shorted to the inverting input, the quantity  $R_2/R_1$  becomes zero, but note that the gain does not go to zero, it is +1. This version of the noninverting follower is usually called the *unity gain* noninverting follower, and it is used for applications such as buffering, with no gain or loss, and impedance transformation (high to low).

There is quite a difference between the input impedances of the inverting and noninverting followers. The input resistor limits the maximum impedance seen by circuits feeding signal to the inverting follower (point "A" is essentially grounded, after all). In the noninverting follower the input impedance is ideally infinite, because it is the op-amp input itself. In real op-amp devices the actual impedance will be greater than 50-Kohms in the cheapest rejects to over 1-terraohm ( $10^{12}$  ohms!) in those that have MOSFET input stages. For most common op-amps the input impedance is on the order of 500-Kohms to 5-megohms.

### A.C. amplifiers

The operational amplifier circuits shown thus far will operate from DC to the upper frequency limit of the device. The circuit in Fig. 4, however, is a noninverting AC signal amplifier. Note that it is essentially the same as the noninverting amplifier in Fig. 3.

The main difference between the AC and DC versions is the use of coupling capacitors  $C_1$  and  $C_2$  in Fig. 4. The output coupling capacitor ( $C_2$ ) serves to keep the DC level that will exist at the output terminal from getting into the next stage, while  $C_1$  serves to keep the "ground" end of  $R_1$  above actual ground

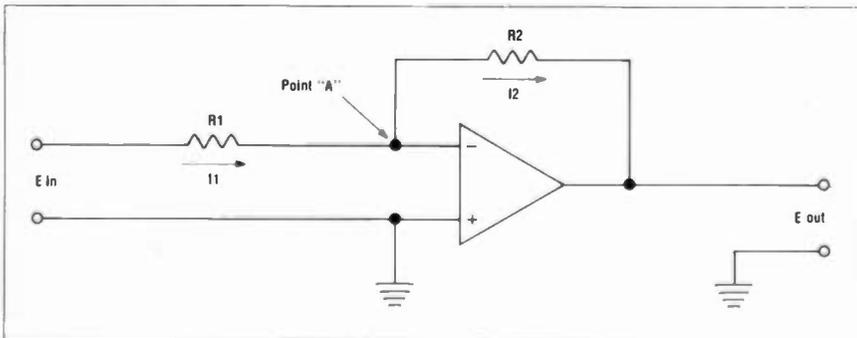


Fig. 2 Inverting follower

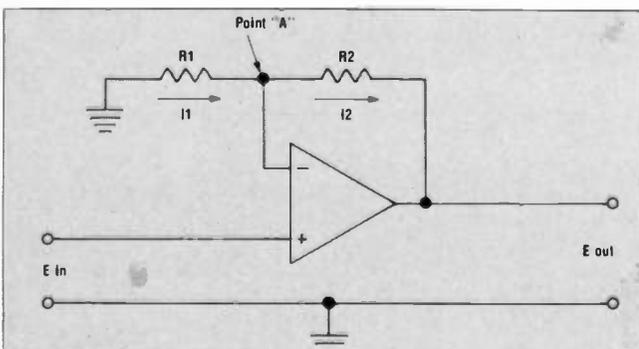


Fig. 3 Noninverting follower

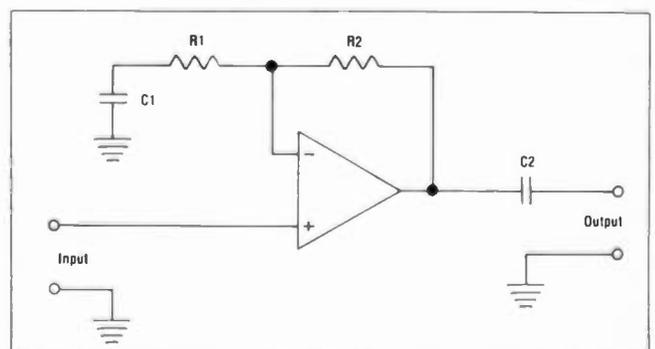


Fig. 4 A.C. coupled noninverting follower

for DC, but at ground for AC. The reactance of C1 should be one-tenth of the resistance of R1 at the low frequency 3 dB point.

Figure 5 shows a biasing technique for using a single power supply to power an op-amp circuit. In this example Vcc is connected to a positive-to-ground power supply, and Vee is grounded.

Ordinarily, this would cause the output terminal to saturate at a potential only slightly less than Vcc, but in this case we have two resistors (R1 and R2) that are used to raise the operating point to some positive potential. If the resistors are equal, then the quiescent output potential will be 1/2-Vcc.

### A phono preamplifier

Fig. 6A shows the phono preamplifier circuit as used in the Magnavox R247 stereo receiver chassis (Sams MHF-61 or the Magnavox service manual). This circuit uses a dual operational amplifier IC (two op-amps in one 14-in DIP package), p/n 612008-2. This device is approximately the same as the Motorola Semiconductor Products, Inc. type number MC1303P and the Fairchild uA739, both of which appear to be substitutes for the Magnavox part. Note that these numbers are industrial type numbers, not equipment manufacturer part numbers. Fig. 6A shows only the left channel, the right channel being identical except for pinouts.

The circuit in this example is essentially the noninverting AC amplifier discussed earlier, with some added refinements that suit it to phono preamplifier service. The low frequency gain (near DC) is set by the ratio  $(R1 + R2)/R3$ , which calculates out to about 900. But phono amplifiers do not have a flat frequency response because they must equalize the signal using the RIAA de-emphasis curve. Recall that there are two breaks in the downward slope of the standard RIAA curve, indicating that we need a different gain characteristic in the respective regions of the frequency spectrum.

It is to account for the two breaks in the RIAA curve that they use two feedback resistors, each shunted by a capacitor. The reactance of a capacitor drops as frequency is increased. A capacitor across the negative feedback resistor of an operational amplifier will feedback higher frequencies more than lower frequencies, so the gain at those frequencies will be lower. Since two breaks are in the RIAA curve we need two such networks.

The custom tailoring of the response curve in the phono preamplifier circuit

points out one of the most appealing properties of designing with op-amps. The overall circuit response is set by manipulating only the negative feedback loop!

The op-amp used in this circuit has a wideband open loop frequency response. The unity gain crossover point may be on the order of 1-MHz or more! Without some sort of frequency compensation, however, the phase shifts in the circuit may add up to 360 degrees at a frequency where the op-amp has more than unity gain, so oscillation will occur at that frequency.

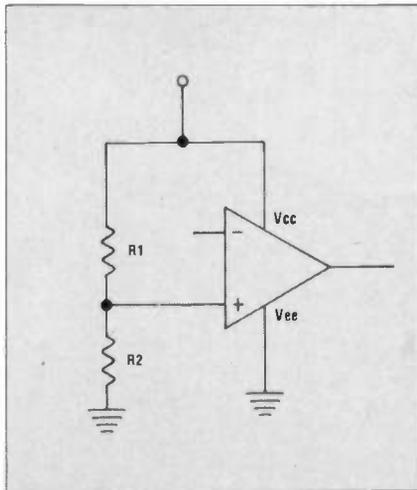


Fig. 5 Resistors R1 and R2 biases the noninverting input up so that a single power supply may be used.

Pins 3 and 4 form a pair of frequency compensation terminals for op-amp Ala, while 10 and 11 do the same in op-amp Alb. Fig. 6B shows the output of an uncompensated op-amp. The 1000-Hz output signal is combined with a 350-kHz "carrier," because the op-amp is oscillating. In Fig. 6C we see the effects of connecting as little as 33-pf across the frequency compensation terminals (i.e. 3 & 4 or 10 & 11). Note that the oscillation has stopped.

Some op-amps, notably those of the 741 family, are designed to be "frequency compensated" internally. The price for being unconditionally stable, however, is to drop the frequency response so low that no 360 degree phase shifts can occur at a point where the gain is greater than unity. Some of these devices have a -3 dB point as low as 8-KHz, and the rolloff above the -3 dB point is rapid. Such op-amps cannot be used in high fidelity service, although they are occasionally found in P.A. or communications audio circuits.

The Magnavox R247 chassis uses a single polarity power supply for the phono preamplifier. The Vcc terminal of the MC1303P/uA739 (pin #4) is tied to the +18-volt DC source, and Vee is grounded. To compensate for the DC unbalance this creates it is necessary to form a bias network consisting of

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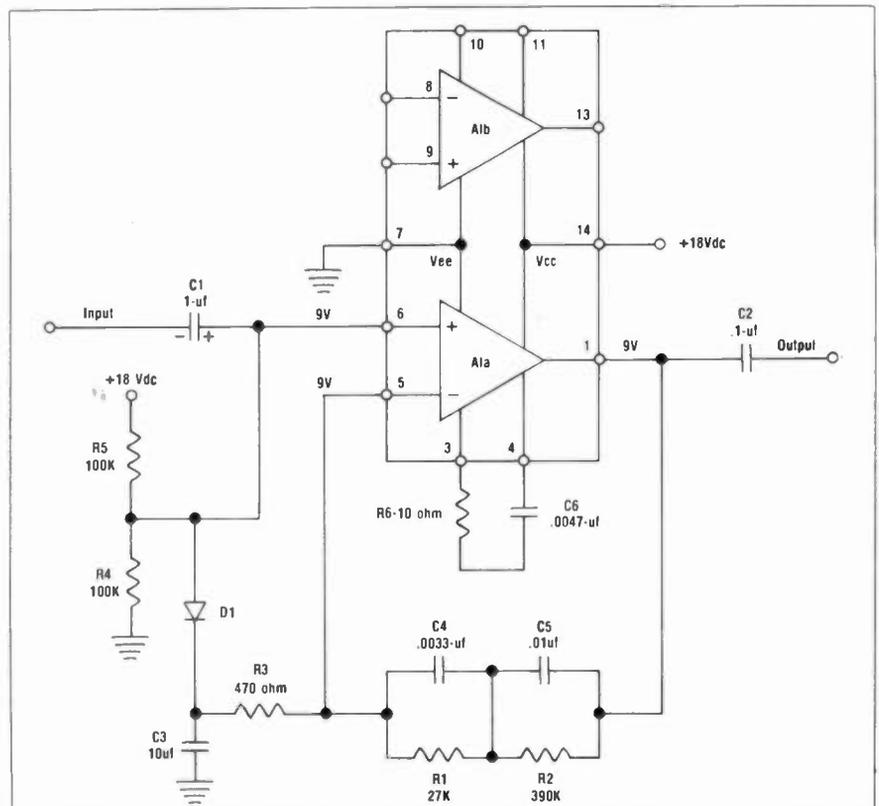
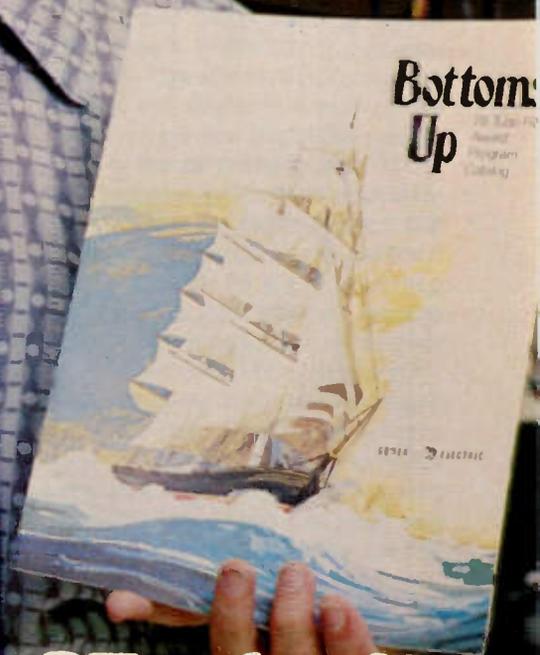


Fig. 6 (a) Phono preamplifier from the Magnavox R247 stereo chassis (b) Oscillations occur unless frequency compensation is used (c) Effect of only 33-pf across pins 3 and 4 of the op-amp.

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# CB signal characteristics

## Why some CBs work better than others

We look at AM and SSB transmission and discuss performance differences

By Ed Piller

Have you ever wondered why some CB sets perform beautifully and others fall completely apart when the going gets rough? The basic answer normally lies in the type of receiver used and the features incorporated in it. In many cases, it can spell the difference between good communication under communication at all.

Many of these differences may not be noticed when operating in remote areas where you and your contact may be the only signals on the band. The acid test comes when communicating on a busy highway in an urban area during the peak travel hours.

Front end overload will cause the inadequate receiver to lose sensitivity and even blank out completely from an out of channel transmission of another nearby transmitter. This type of overloading can appear when the vehicles are within several blocks of one another and increase as the separation lessens. Poor immunity to ignition noise from your own or an adjacent auto's electrical system can knock out communication. Noise limiters and noise blankers will help this situation. Noise limiters (clippers) normally clip the interference at a level near the peak of the detected audio signal. (See Figures 1A and 1B). Clipping lower than this point will introduce distortion in the audio output. As clipping is done after detection, the noise pulse can be stretched by a sharp I.F. filter.

Noise blankers, if properly functioning, are superior to noise



B&K's CB Service Analyzer

limiters. The blanker samples the incoming noise pulse and generates a blanking pulse of the same duration which effectively cuts off a front end stage and makes the receiver inoperative during the time of the ignition pulse. (See Figures 1C and 1D). A good blanker normally operates near the front end of the system ahead of the I.F. filter. Pulse stretching is thereby eliminated.

Adjacent channel splatter can become annoying if there is insufficient selectivity in the receiver. Even with selective receivers, strong adjacent channel signals, either overmodulated or with an improperly adjusted power mike, will cause splatter products on nearby channels.

### Crystal vs. phase locked loop

Transceivers using crystal banks to control the receive and transmit frequencies may suffer from the effects of aging crystals. This aging process causes crystals to slowly change or

even jump frequency. This can be detected by a distorted or weaker received signal in one or more channels and an out-of-tolerance receiver or transmit crystal frequency. The newer CB transceivers, using frequency synthesis, employ electronic circuitry which locks all frequencies to one crystal. If this frequency is correct, then all other frequencies will also fall right in.

Lack of sensitivity in a CB set may be caused by a faulty antenna or transmission line, by a poorly designed set or one which is malfunctioning. A quick test can be made by setting up the receiver on a quiet channel in a location which is free of ignition and other signals. With the squelch circuit turned off, a rushing noise caused by front end thermal effects should be heard. If the output is silent, chances are that the receiver is lacking sensitivity and should be checked with a signal generator.

One of the more serious causes of communications problems on CB is the use of an improperly adjusted power microphone. By utilizing an audio clipper which is included in the power microphone the average talk power can be increased. However, if the power mike does not employ a filter after clipping, then sideband energy due to harmonics of the clipped signal can be generated. These harmonics, which increase with larger amounts of clipping, cause distortion of the inband signal and strong adjacent channel splatter. If a noise cancelling microphone is not used in this process, then the background road noise will increase and make the signal more difficult to copy. Many strong but unintelligible signals have been heard on the citizens' band which suffer from this problem.

### AM vs SSB

The use of single sideband (SSB) has proven advantageous, for many years



Hickok's CommLine integrated C.B. system.



Sencore's CB42 Analyzer

on amateur and commercial frequencies, over amplitude modulation (AM). The advantages of SSB can be shown by referring to Figures 2A and 2B.

A spectrum analyzer display is shown of a 100% tone modulated AM signal. Let's assume that the total unmodulated carrier output is four watts. As the total power in the carrier (at 100% modulation) is twice that of the power in the sidebands, each sideband will contain one watt of power. If we examine



Leader LSG-227 Signal Generator

the double sideband AM signal, it can be seen that the same information is contained in the upper and lower sideband. Therefore, only one sideband need be transmitted. Demodulation of the SSB signal can be accomplished at the receiver by inserting the carrier at the correct frequency at the tail end of the I.F. system in the detector.

It is thus shown that we can eliminate a sideband and carrier and put all the transmitter power into the one sideband.

This gives us a power advantage of four times (or 6 db). Furthermore, the transmitted signal takes up only half the spectrum space and can be copied on a receiver whose bandwidth is one half of that for an AM signal. Therefore, another 3 dB of power advantage is realized when using SSB. Consequently, it is shown that the use of SSB gives a power advantage of 6 to 9 dB (4 to 8 times) over that of AM.

An added advantage of SSB will be noticed on a busy channel. When the correct frequency is inserted at the receiver by tuning to demodulate the SSB, only the signals that are within 50Hz of the SSB signal will be demodulated. All other signals which could be as much as 1 to 2KHz off frequency will sound like monkey chatter.

#### Performance testing a transceiver

The AM or SSB receiving characteristics of a CB can be conveniently checked

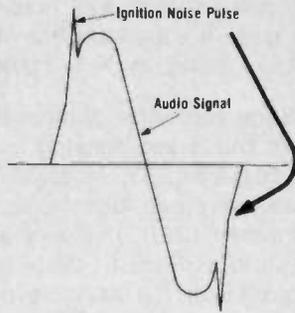


Fig. 1A Unclipped Noise on Audio Signal

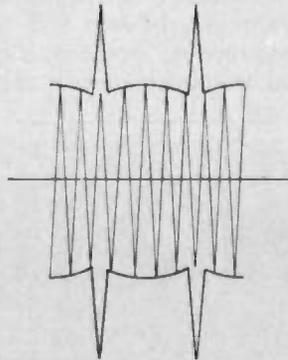


Fig. 1C Noise on RF Signal

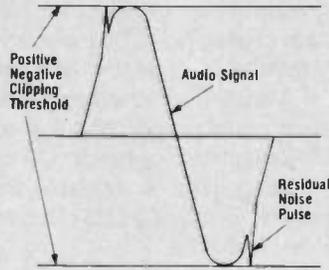


Fig. 1B Clipped Noise

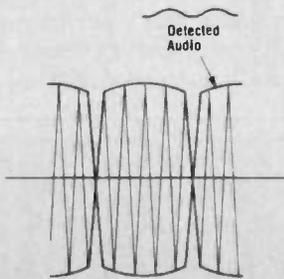


Fig. 1D Effect of blanked noise on RF signal and detected audio

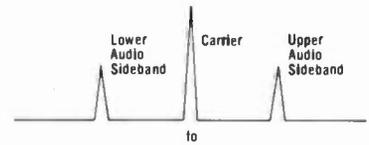


Fig. 2A Spectrum Display of 100% tone modulated A.M. Signal

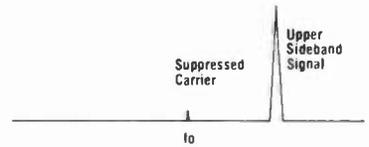


Fig. 2B Spectrum Display of fully modulated upper sideband SSB Signal

using the proper combination of test instruments. Many integrated CB test units are conveniently available today from a number of manufacturers. Included in this list would be the Leader LSG-227 unit; B & K Precision's CB Servicemaster; Hickok's CommLine units; and Sencore's CB 42 Automatic CB Analyzer. A set-up for testing these parameters is shown in figure 3.

As an example, the Leader LSG-227 provides the following features:

1. Forty channel synthesizer controlled signal source
2. Metered signal output level from .05 to 100,000 microvolts
3. Metered modulation level from 0 to 100% for 0.4, 1, and 2.5KHz tones plus C.W. and external modulation
4. Calibrated variable channel frequency of  $\pm 5$ KHz
5. SSB test features such as plus and minus 1KHz offset at channel for USB and LSB tests
6. Internal noise generator for noise limiter and blanker tests

The receiver tests which can easily be performed include the following:

- AM receiver sensitivity test
- AM receiver AGC test
- Squelch characteristic test
- Noise blanker and ANL tests
- Audio output and distortion tests

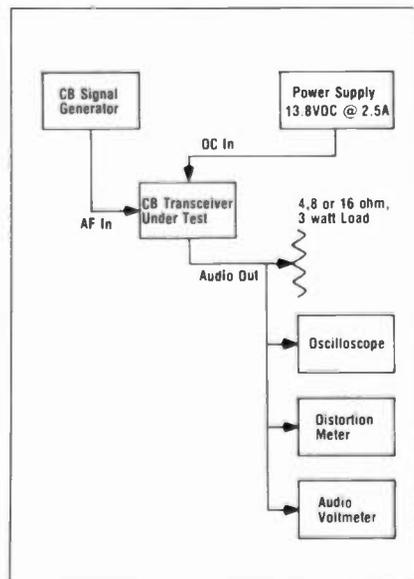


Fig. 3 Equipment hookup for CB receiver characteristic measurements

SSB receiver sensitivity test  
A typical CB receiver test set-up is shown in Figure 3.

### CB transmitter testing

A setup for testing the transmitter section of a CB set is shown in Figure 4. With this, the following parameters can be observed: R.F. power output, channel frequency, and an oscilloscope

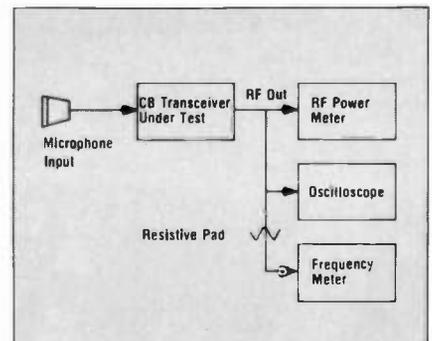


Fig. 4 Equipment hookup for CB transmitter measurements

display of the R.F. modulated waveform. The last characteristic is important as under or overmodulation effects can be readily observed.

The major consideration in getting clear intelligible communication is in microphone technique. The microphone should be held at the side of the mouth and talking should be done across the microphone so that speech distortion is not caused by the breath impinging on the diaphragm of the microphone. The internal microphone gain setting should be adjusted by a qualified technician to prevent overmodulation with its attendant distortion effects. Many sets are not properly adjusted for transmit audio gain by the manufacturer.

# BULLETIN BOARD

**Microminiature Lamps** are featured in the latest data sheet from Chicago Miniature Lamp Works. The new publication covers the firm's recently expanded line of T $\frac{1}{4}$ , T- $\frac{3}{8}$  and T $\frac{1}{2}$  lamps and includes detailed drawings of each. These extremely small lamps are designed primarily for LCD watches and other applications which require the smallest lamp available. They are available in four configurations with eight ratings. The data sheet is free from *Chicago Miniature Lamp Works*, 4433 N. Ravenswood Avenue, Chicago, IL 60640.

**Test Instruments**, including analog and digital panel meters, meter relays, and controllers are listed in the latest 60-page four-color Stock Instrument catalog from Simpson Electric. New products in catalog No. 4700 include the firm's Model 461 digital multimeter priced at \$142.50 and the new series 2860 digital panel meters. Both the 461 and 2860 utilize state-of-the-art LSI circuitry. Catalog 4700 is available free from *Simpson Electric Co.*, 853 Dundee Ave., Elgin, IL 60120.

**Different Soldering Applications** requiring a combination of the right alloy and flux are covered in a new "Solder User's Guide" available now from Multicore. The guide lists in an easy, quick reference chart most applications, the alloy to use, a description of the product

and the part numbers in a variety of different convenience packaging. Also included are accessories such as a desoldering wick for removing solder from a joint quickly and cleanly. Free copies of the guide are available from *Multicore Solders*, Westbury, N.Y. 11590.

**A Semiconductor Master Replacement Guide and Catalog** for 1978 is available from GTE Sylvania. The guide cross references, alphanumeric order, more than 137,000 industry part numbers to the Sylvania ECG line. It contains approximately 18,000 more part numbers than previous editions. It includes outline drawings, circuit diagrams, and technical descriptions of the listed transistors, diodes, rectifiers, SCRs, TRIACs, Zener diodes, modules, digital and linear integrated circuits and special

## WINEGARD WORKS..



purpose devices. Available for \$2.95 from Sylvania distributors, or *GTE Marketing Services Center*, 70 Empire Dr., West Seneca, N.Y. 14224.

**Test Instruments** are detailed in two new catalogs available from VIZ Test Instruments. One catalog is an 8-page short-form publication that provides highlights of 36 popular VIZ instruments. The other is a 4-page full-line catalog that gives specifications and technical information on more than 55 products, including oscilloscopes, digital VOMs, VoltOhmysts, frequency counters, rf, audio, pulse, function, and color bar generators. Many of the products featured are new and appear in print for the first time. Available free from Robert Liska, *VIZ Test Instruments Co.*, 335 E. Price St., Philadelphia, PA 19144.

**A Crimp Tool Guide** that describes crimp insertion and extraction tools has been published by ITT Cannon Electric. Catalog CCTG contains 52 charts, six photographs and six drawings. The charts include such information as contact size, wire size, pin and socket part numbers. Additional chart information covers crimp tool part number locator, extraction tool number, insertion/extraction tool number and tool colors. Available free from *ITT Cannon Electric*, 666 E. Dyer Rd., Santa Ana, Calif. 92702.

**Universal Replacement Antennas** for television sets, portable radios, and CB walkie-talkies are cross referenced in a new guide published by RMS Electronics. The brochure features full size illustrations of all replacement dipoles

and back of the set antennas with complete listings of all set manufacturers brands and set model numbers where applicable. The actual size diagrams facilitate correct matching of replacements required since the technician can see the complete bracket and connecting terminal details. Available free from *RMS Electronics, Inc.*, 50 Antin Place, Bronx, N.Y. 10462.

**The Newest In Electronic Kits** is covered in Heath Company's 104-page Spring 1978 catalog. New products include games software for the H8 computer system, a professional-quality low-cost engine analyzer, a metal detector with adjustable discrimination, a variable-speed ceiling fan that is both attractive and efficient, a bi-directional wattmeter for use in amateur radio, CB,

# in Cardiac Care.

It's a life or death matter.

Winegard equipment helps doctors, nurses, and biomedical technicians keep a constant watch on the heartbeats of cardiac patients.

Telemetric equipment, such as that developed, manufactured and installed by Spacelabs, Inc., Chatsworth, CA, uses Winegard TV reception products as components in the continuous monitoring of ambulatory patients' heart rhythms.



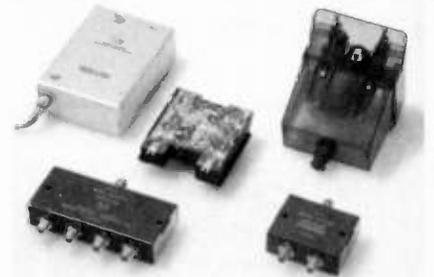
In St. Mary's Medical Center, Racine, WI, heart signals are displayed on Micro-computer Arrhythmia Detection Units, products of Spacelabs, Inc. Mobile patients are equipped with low output transmitters, which feed impulses from 18" electrode leads to an antenna. Biomedical Telemetry systems operate in the VHF television band, (174 through 216 MHz) providing vital signs information to the hospital staff on up to 70 Cardiac Care Patients in a single

unused television channel. From the antenna to the monitors, Winegard equipment is totally involved, using various combinations and models of low-noise, high-gain preamplifiers, power supplies, splitters and couplers, depending on size and type of installation. Ambulatory patients stay within a 300 foot radius of the antenna.

Heart telemetry is especially valuable in getting patients up and moving around as part of recovery, and in opening up beds for other cardiac cases. This aids in reducing costs to patients by getting them out of bed at the earliest time.

An important feature of Spacelabs systems is the capability of monitoring units to be programmed to alert the Critical Care Nurse, if heartbeats exceed upper and lower limits determined by the physician, and to print out ECG tapes that carry each patient's code number, time and date. This telemetry system provides diagnostic quality monitoring for the physician, equal to that obtained from hard-wired systems, while permitting patient mobility. Spacelabs, Inc., specifies Winegard off-the-shelf TV reception products as telemetry components

for dependability and performance. Winegard preamps are vital in attaining adequate gain at receiving units. Limited power of transmitters



through electrode leads, and the necessarily small size of omnidirectional antennas result in a low signal. Low-noise preamps are important in boosting signals to monitors, and extending workable range of the system. Efficient splitters and couplers are required to combine antenna lines, and to split combined signals to feed various monitors tuned to the different frequencies. Winegard power supplies provide the capacity to power from 3 to 24 preamps. Winegard...at the heart of quality reception, where performance is paramount.

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Circle No. 136 on Reader Inquiry Card

ET/D - July 1978 / 31

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aircraft and marine radio, and the HW-2036A 2-meter radio for the amateur radio enthusiast. The catalog is free from the *Heath Company*, Benton Harbor, Michigan 49022.

**Portable Electrical Testing Equipment** is detailed in the latest full line, short form catalog and price sheet from a.w. Sperry Instruments. The new catalog, MES-100, contains detailed specifications for the firm's line of Snap-Around ammeters, multi-testers, insulation testers, voltage indicators, and accessories. An accompanying price sheet lists the suggested trade prices along with instructions for purchase. The literature is free from *a.w. Sperry Instruments, Inc.*, 245 Marcus Boulevard, Hauppauge, N.Y. 11787.

**Module Extension Cable Kits**, a new servicing aid, are described and illustrated in a new fact sheet from Sylvania. The literature, ET1372, details the new Chek-A-Board products, designed for troubleshooting plug-in modules for RCA and Zenith color TV receivers. The cable kits permit in-circuit module testing without pulling the chassis. The fact sheets are free from Sylvania distributors, or from *GTE Marketing Services Center*, 70 Empire Dr., West Seneca, N.Y. 14224.

**The Proper Use & Care of Hand Tools** is the subject of a new booklet from Klein Tools. The 88 page, 2-color booklet contains hundreds of illustrations which show how to select the proper tool for various jobs, the care and maintenance of tools and many of the hazards which can result from misuse of tools. Cartoon characters are frequently used to emphasize the text. Available free from *Klein Tools, Inc.*, 7200 McCormick Road, Chicago, IL 60645.

**Variable Transformers** are described and illustrated in the latest 60-page catalog from Superior Electric. Designated Catalog P178, the new literature consolidates descriptive and technical data on their complete product line. Included are ratings, dimensions, performance curves and schematic connection diagrams in an easy-to-read format. It includes metric equivalents and covers new 1.5 amp type 9 and 575 volt series as well as information on manual, motorized, enclosed laboratory, metered knob, 40-volt, square frame, multiwound, line corrector models and adjustable speed motor drives. Free from *The Superior Electric Co.*, 383 Middle St., Bristol, CT 06010. **ETD**



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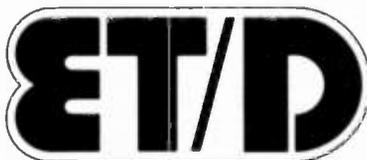
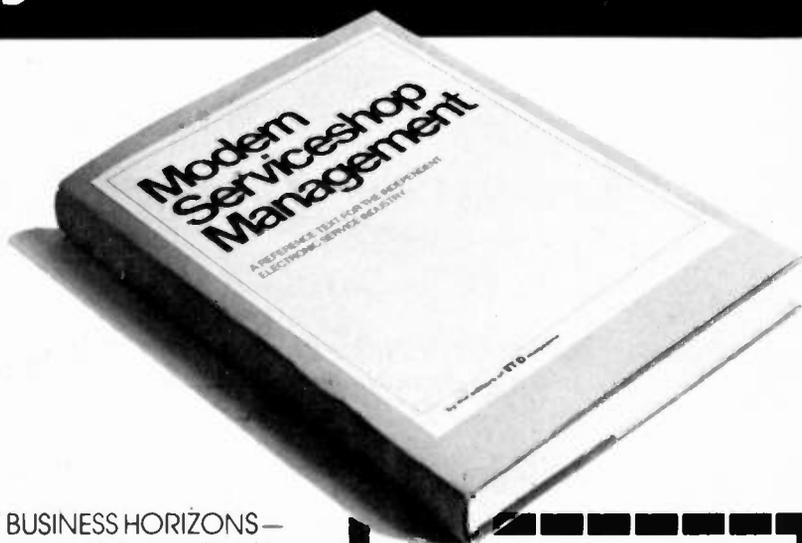
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# TEST INSTRUMENT REPORT

The practical applications for a function generator are so numerous that it is hard to imagine a modern electronics serviceshop without at least one of these efficient units on the bench.

While the cost may have been a factor in the past in deciding whether or not to invest in such an "ancillary" unit, the advance of modern manufacturing

need more accuracy than that we suggest you hook it to your own frequency counter to verify the output.

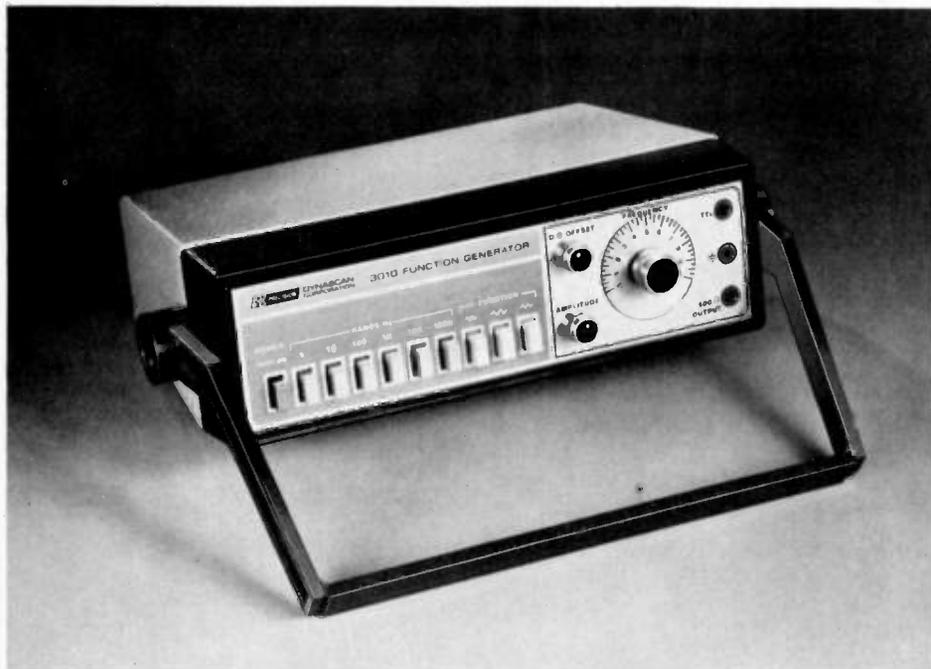
The Model 3010 has so many basic applications it is hard to know just exactly where to begin, so let's start by mentioning a few. It can be used as a basic signal source for checking amplifier response, for basic calibration work in oscillator circuits, as a regulated low-current DC power supply, variable from plus or minus 10 volts (600 ohms internal impedance), or when used in conjunction with its VCO (voltage controlled oscillator) back panel jack, it may be used as a sweep generator for AM and communications receiver alignment work—or it will provide a direct FM output.

In addition to the on-off, frequency selection, and function pushbuttons and the variable frequency dial, the other front panel controls are an amplitude control which varies the 600 ohm output from minimum to 20 volts peak to peak (open circuit) or 10 volts peak to peak (into 600 ohms), plus a DC offset knob. When using the 3010 on higher frequency ranges, especially with square wave output, it must be terminated into 600 ohms to minimize ringing and overshoot.

The DC offset control can be used to add a positive or negative component (plus or minus 5 volts into 600 ohms) to the AC output found at the regular 600 ohm output. (The TTL square wave output is independent of both the amplitude and offset controls). The DC offset feature allows the 3010 to be used as a bias or regulated supply (when all of the function and frequency select pushbuttons are disengaged) and, this feature also has applications for testing AC circuit bias conditions or in design work. The offset, when used in conjunction with the sine, triangle or square wave outputs, permits clipping of these waveforms at various amplitudes—as you can readily see by connecting the 3010 up to your scope.

Another unique feature of the 3010 is the VCO backpanel input. The unit is designed so that a 0-to-5.5volt ramp wave applied here will provide an output frequency change of 100 to 1. That is, if a 0-to-+5.5 volt (maximum) ramp is applied to the VCO jack, when the range selector is set on 10 kHz and the dial is set for 0.1, the output frequency when the ramp reaches +5.5 volts will be 100 kHz, for a total sweep of 1 kHz to 100 kHz.

*Continued on p. 45*



*For more information about this test instrument circle 140 on the Reader Service card in this issue.*

## B&K-Precision's 3010 Function Generator

Applications abound

By Richard Lay

technology has effectively negated this decision for us.

One of the very latest low cost (suggested retail \$175) function generators to come onto the market in recent months is B & K-Precision's Model 3010, which I first saw at this year's NEWCOM show. It is the subject of this month's test instrument report.

The 3010 has three basic waveform outputs, triangle, sine and square wave in six basic frequency ranges from 0.1 Hz to 1 MHz. However, a fourth front panel output, for work in digital TTL circuits, is a 0-to-+5 volt pulse waveform. But, don't go away, because a variable frequency control is used in combination with the basic frequency selector pushbuttons to change the basic 0.1-to-10 dial to a multiple determined by its pushbutton value—or any frequency from 0.1 Hz to 1 MHz.

And, according to tests run on ET/D's bench, we found the accuracy of the range expander dial throughout its range to approximate 97 per cent of the designated multiplier (2% better than manufacturer's specifications). If you



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And then there's our specialized manuals: The "CB Replacement Guide" that cross-references more than 5,500 parts for 73 different brands of CB equipment; our "Industrial MRO Replacement Guide" that lists ICs and

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# DEALER'S SHOWCASE



## Total CB System

Circle No. 141 on Reader Inquiry Card

A 'total CB system' concept, patterned after amateur radio products, has been introduced by *Stoner*. The concept includes the PRO-40 CB transceiver, a matching speaker, AM adaptor, operator console, ham radio adaptor, monitor oscilloscope, meter console and a computer interface modem. The speaker is a bass reflex type with internal damping, the adaptor permits incorporation of AM into the system, and the operator's console can energize the entire system at any present time with a

digital clock controller. The console also incorporates a full fidelity phone patch for connecting mobile and distant stations into the local telephone network, and it has the provision to record and playback incoming stations on a customer supplied tape recorder.

## Microwave Radiation Detector

Circle No. 142 on Reader Inquiry Card

A new easy-to-use electronic instrument that checks microwave ovens for potential radiation leakage has been introduced by *Tanray Associates*. Designed for use by the consumer, the hand-held, lightweight device requires no batteries or AC power. Tests are conducted by



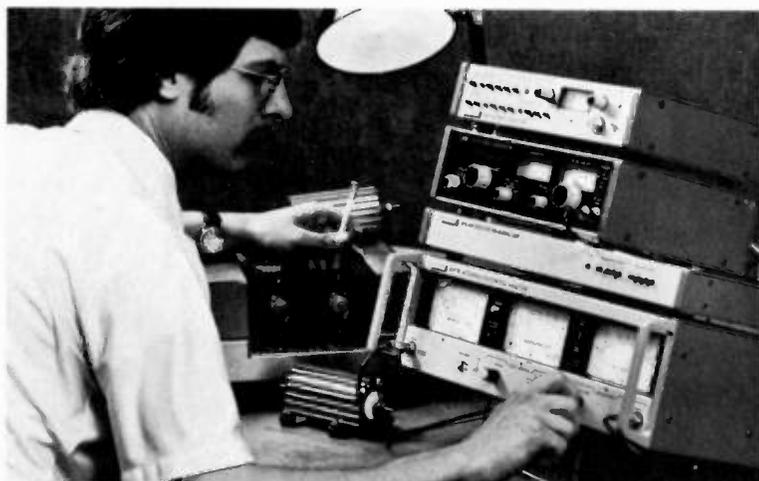
turning on the oven and moving the instrument, called a Guard-Rod, along the space between the oven door and the oven itself. If the pointer on the meter swings to the red portion of the scale, leakage may exist. The instrument retails for \$19.95.

## Loudspeaker System

Circle No. 143 on Reader Inquiry Card

A new loudspeaker system designed to provide maximum audible performance in the \$100 price range has been announced by the *Advent Corporation*. Called the Advent/1, it is a two-way system incorporating a 1-3/8 inch cone tweeter with ferro-fluid damping, and a nominal 10 inch acoustic suspension woofer. The result is a frequency range including a deep bass response that is said to be similar to that of the widest range speakers available. A minimum of 15 watts per channel is recommended for

# SIGNAL GENERATION PURE AND SIMPLE.



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The RE101 has frequency ranges of 87-130 MHz and 0.15-30 MHz. In addition to providing digital display of the carrier frequency, this low leakage signal generator can simultaneously modulate FM and AM...with very little distortion.

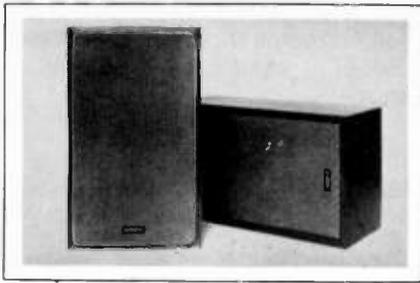
For testing of high-quality stereo decoders and Hi-Fi stereo receivers, the SMG40 offers more than just a time multiplexed composite signal. It also features L-R separation greater than 65 dB, distortion less than 0.03% and easy pushbutton operation.

For a demonstration or more information on signal generation pure and simple, call or write The London Company, U.S. representative for Radiometer Electronics, 10000 Sharon Drive, Cleveland, OH 44145. Telephone (216) 431-7000.

 **Radiometer Electronics** <sup>INC.</sup>

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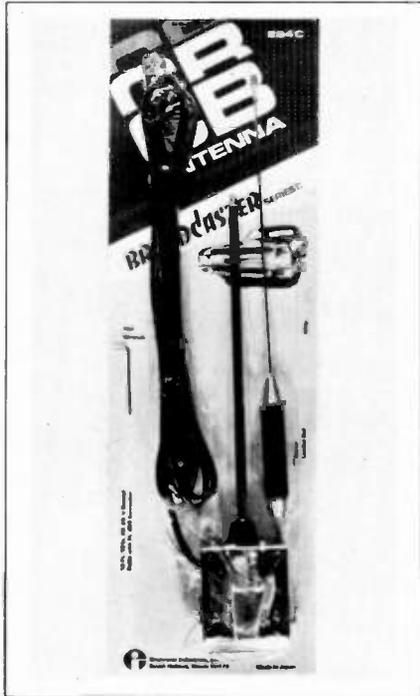


the 8-ohm system, which measures 22 inches by 13¼ inches by 9¼ inches deep. Two cabinet finishes are available; walnut grained vinyl at \$99.95 and genuine walnut veneer at \$120.

### CB Whip Antenna

Circle No. 144 on Reader Inquiry Card

A new gutter mount CB whip antenna has been introduced by *Electronic Industries, Inc.* Designated Model 224C, the new antenna features a quick mount spring clamp and a center loaded coil. Stainless steel construction offers dura-



bility to the whip, and the unit is easily adjustable for lowest possible SWR. The new antenna comes with a hex key wrench and a 10 foot 10 inch 58U coaxial cable with PL-259 connector. Finished in heavy chrome, the antenna has a black coil jacket and is packaged on an attractive display card. Suggested retail price is \$14.95.

### Attache Public Address

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A new public address system contained in an attache case weighing only 22 pounds is being introduced by *Perma*

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Circle No. 123 on Reader Inquiry Card

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**Power Electronics.** Identified as Model S-210A, the system includes a 35 watt amplifier, a cardioid microphone, and a full-fidelity speaker built right into the at-



tache case, with 40 feet of cable. The mike can be worn in the lavalier holder, or in the desk or floor stand holder. The new system is battery operated, can be used indoors or out, and will operate up to 200 hours on one set of alkaline flashlight batteries. It can also be accessorized with an AC adapter for plug-in use.

### Power Base Microphone

Circle No. 146 on Reader Inquiry Card

Two new power microphones for CB base station use with both AM and SSB have been announced by *GC Electronics*. They are: Range Booster II, an amplified microphone with amplifier gain of up to 26 dB, and Range Booster III which incorporates variable compres-



sion and amplifier gain up to 56 dB. The speech compressor in Booster III is said to increase total average modulation by reducing instantaneous peak voice sounds and eliminating possible overload distortion in the transmitter. Amount of compression is variable with a control

on the mike. A 6-wire configuration is used, and mikes are solid-state. Booster II retails at \$53.10 and Booster III at \$63.72.

### Hand Held Transceiver

Circle No. 147 on Reader Inquiry Card

A new hand held transceiver, designed for personal or business communication in the 460-470 MHz General Mobile Radio Service FM-CB band has been introduced by *Standard Communications Corp.* Designated Model GMR-2, the new unit has 2 watts power output, with two crystal controlled channels for



point-to-point, or direct communication with another hand held, mobile unit or base station. The second channel is to key up a repeater station. The GMR-2 uses rechargeable Ni-Cad battery packs, and measures 3 inches by 1-3/4 inches by 8 inches. Accessories available include carrying case, small flexible antennas, battery chargers and tone encoders. **ET/D**

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785-294 p.—Microprocessor/Microprogramming Handbook (\$9.95)

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913-476 p.—The Complete Handbook of Electrical & House Wiring (\$10.95)

780/790-350 p.—TWO BOOKS—111 Digital & Linear IC Projects & 21 Simple Transistor Radios You Can Build (\$15.90)

909-140 p.—How to Build Metal/Treasure Locators (\$7.95)

919-434 p.—Color TV Trouble Factbook—Problems & Solutions (\$9.95)

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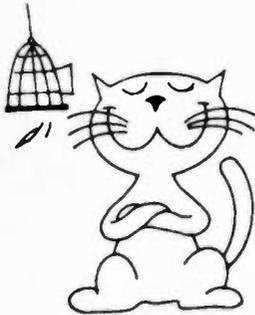
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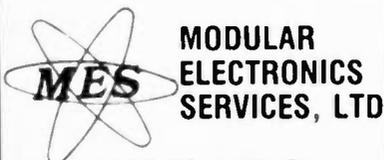
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## NEW PRODUCTS



### Modulation Meters

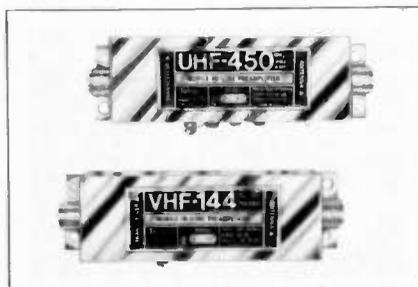
Circle No. 148 on Reader Inquiry Card

Two new modulation meters that offer frequency range coverage to 2 GHz and automatic tuning and amplitude leveling have been introduced by *Racal-Dana*. They are Models 9008 and 9009. Both instruments are reported to provide fully automatic measurement of AM and FM signals in approximately one second. They permit measurements on equipment operating at frequencies in the MF, VHF and UHF bands. Model 9008 is remotely programmable and has frequency coverage from 1.5MHz to 2GHz, while Model 9009 provides frequency coverage from 10MHz to 1.5GHz. Both units are portable and operate from either AC or an optional rechargeable battery pack. Model 9009 is priced at \$1495, and Model 9008 at \$1295.

### Mobile Preamplifiers

Circle No. 149 on Reader Inquiry Card

Two new mobile inline receiver preamplifiers designed for amateur, police, emergency, business band, and Class A CB transceivers have been announced by *Telco Products*. The new preamps are models VHF 144 and UHF 450. Each features an RF 'sniffer' circuit that allows the preamplifier to sense when the transceiver is keyed, effectively switching the preamplifier off during the transmit mode. Thus, the preamp can be



connected directly into the coax line without modification to the system. VHF 144, priced at \$49.95, has a frequency range of 140-180 MHz, with a 5 MHz bandwidth. UHF 450, priced at \$59.95, has a frequency range of 400-512 MHz, with a 1 MHz bandwidth.

### CATV Drop Cable

Circle No. 150 on Reader Inquiry Card

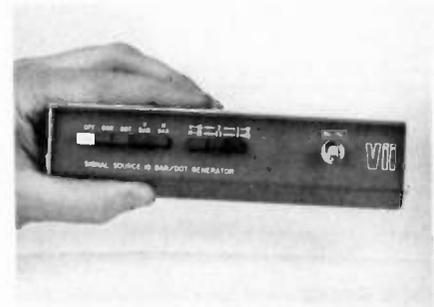
CATV operators can now get a free vinyl carrying case for each 25,000 ft. of coaxial drop cable ordered in *Belden's* dispenser cartons. The dispenser cartons, called the Unreel method, is said to offer savings in installation time compared with conventional reel-type cable dispensing. Further handling convenience



is provided by a tough blue vinyl case, with two sling-type carrying straps. Cable pays out drag- and tangle-free directly from the dispenser port of the carton.

### Industrial TV Tester

Circle No. 151 on Reader Inquiry Card



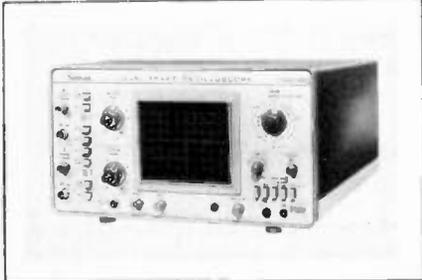
A new test instrument that develops a set of display setup signals for use in portable industrial television testing has been announced by *Visual Information Institute*. The composite video signal generated by the unit is also valuable for "go-no-go" video signal transmission testing in industrial distribution systems. Called Signal Source 10, the new pocket-sized generator develops bars, dots, H bars or V bars in one of three modes—21 x 15, 11 x 7 or 1 x 1 ele-

ments. The output signal is industrial interlace for the 525/60scan rate, at a level of 1.0V overall at a 75 ohm source impedance. Powered by two 9 volt batteries. Priced at \$149.95.

### Dual Trace Scope

Circle No. 152 on Reader Inquiry Card

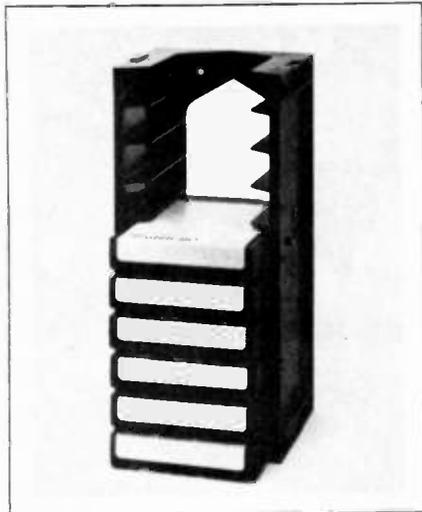
Simpson's newest oscilloscope is a 15MHz (usable to 27MHz, according to the manufacturer) dual trace triggered sweep unit, retailing for \$675. Called the Model 452, the scope features a 5-inch CRT with P31 blue phosphor, internal or



external triggering with TVV, TVH and VITS positions, and X-Y capability with matched vertical amplifiers. It also includes a times-5 magnifier for close inspection of waveforms, channel A or B display, channel A and B display, channels A plus B, and channels A minus B. With a 24 nanosecond rise time, it is capable of digital work. It features a built-in .5 volt peak-to-peak square wave (1KHz) calibrator, and is compatible with 120 or 230 volts AC.

### Cassette Storage System

Circle No. 153 on Reader Inquiry Card



A new 'rack-n-stack' cassette storage and filing system with a cartridge rack for 8-track tapes is new from J.L. Alger, Inc. The new system files and protects ten 8-track cartridges in each unit. It also

# You have your own calculator. Why not a DMM?



Finally, a digital multimeter that's yours, just like your pocket calculator, and more useful. Only \$169.\*

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The 8020A is a true field instrument, designed with a highly readable LCD display, and inexpensive 9V transistor battery power for continuous use up to 200 hours. Reliability, quality and value: *that's* Fluke tradition.

To get your hands on one, call (800) 426-0361, toll free. Give us your charge-card number and we'll ship an 8020A the same day. Or, we'll tell you the location of the closest Fluke office or distributor (where you can save by buying a ten-pack of 8020As for only \$1521\*).

\*U.S. price only.

## Fluke 8020A DMM for Field Service: \$169.

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Circle No. 115 on Reader Inquiry Card

ETID - July 1978 / 41

interlocks to additional units for a wall-mounted system. Cartridge titles are clearly shown and rapid removal and insertion of cartridges is easy. The cartridge rack is molded of polystyrene in five colors.

### Power Mike for CB

Circle No. 154 on Reader Inquiry Card

A new counter card merchandising program for selling power microphones and adapters for CB is available now to authorized distributors and dealers from



the GTE Consumer Electronics Group. Designed to help sell Sylvania SDX-100 power mikes and adapters, the counter card consists of a two-color, point-of-purchase display and is designed as a supplement to other CB advertising. The SDX-100 power microphone features variable gain control and is reported to offer maximum voice amplification without clipping, a 4dB increase in average modulated power, and negligible audible distortion. The adapter system, called the Match-All system, is said to eliminate wiring and soldering.



cerns. Operating range is in excess of 12 inches to nearly any object. A visible LED indicator lamp is provided for alignment purposes. Single unit price is \$49.95.

### Proximity Sensor

Circle No. 155 on Reader Inquiry Card

A new miniaturized, self-contained 120VAC powered infra-red proximity sensor utilizing integrated circuits and without the need of a separate power supply or amplifier has been announced by Scientific Technology, Inc. Designated Series 6030, the new sensor provides either an opto-isolated open collector output or a solid state AC Triac output or a reed relay output. An epoxy-encapsulated package permits operation in harsh industrial environments. Detection without physical contact alleviates contamination or abrasion con-

### Desoldering Tool

Circle No. 156 on Reader Inquiry Card

A new self-contained, lightweight desoldering vacuum tool is new from Edsyn, Inc. Called the Soldapull III, the new tool features a precision molded plastic barrel and a low mass plunger assembly that is said to create an instant high vacuum impulse upon release of the trigger mechanism. Other features include a fully enclosed plunger shaft for safety

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103	.92	131MP	2.84	181	3.75	236	5.20
103A	.90	132	.73	182	2.20	237	4.05
104	.80	133	.90	183	2.50	241	1.15
104MP	1.60	152	1.10	184	1.00	242	1.26
105	1.82	153	1.25	185	1.15	243	1.35
106	.48	154	1.65	186	1.15	244	1.82
107	.68	155	1.71	187	1.25	245	2.20
108	.77	156	.65	188	1.10	246	2.90
109	.17	157	1.08	189	1.25	247	2.39
110MP	.27	158	.93	190	1.55	248	3.21
112	.44	159	.77	191	1.90	249	4.19
113	.40	160	1.08	192	.90	250	4.25
114	.40	161	.80	193	.93	251	4.19
116	.33	162	4.20	194	.53	252	4.25
117	.30	163	5.38	195A	1.98	253	1.03
118	1.48	164	4.20	196	1.35	254	1.21
120	.45	165	6.75	197	1.26	261	.96
121	1.59	166	.81	198	1.33	262	1.08
121MP	3.18	167	1.03	199	.41	263	.98
122	1.65	168	1.13	210	1.00	264	.147
123	.53	169	1.53	211	1.15	274	1.40
123A	.66	170	2.48	218	2.63	280	3.15
124	1.15	171	1.08	219	3.25	281	4.10
125	.40	172	.45	220	1.25	284	5.05
126	.93	173BP	3.05	221	1.34	285	5.48
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Circle No. 112 on Reader Inquiry Card

and a high/low vacuum adjustment ring for miniature or standard desoldering requirements. A disconnect feature al-



lows fast separation of the barrel from the trigger housing for routine cleaning of solder accumulation.

### Portable Frequency Counter

Circle No. 157 on Reader Inquiry Card

A new 8-digit portable frequency counter has been introduced by *Communications Modifications, Inc.* Designated the FC101-K, the new 45 MHz counter reads 8 digits in KHz or 7 digits in MHz with memory mode. It is accurate within .0025 per cent, has a time base of .001 PPM, sensitivity of 10-30 mv, resolution of 1 Hz in KHz position, an RF shielded metal case and uses less than 250 ma, supplied by 7.5 to 15 VDC. Includes: a remote inductively coupled tap

off box, an RF line cord, DC power cord, AC adapter, Portable antenna and mounting bracket. Suggest retail price is \$149.95.

### Intrusion Alarm

Circle No. 158 on Reader Inquiry Card

A new type of portable, battery-powered intrusion alarm for use at home or travel has been introduced by the *Mallory Company*. Called the "Door Sentry", the new device hangs on a doorknob by a metal chain and is triggered by anyone who touches the knob. It is powered by a



9-volt alkaline battery. When activated, the alarm gives off a high-pitched noise that cuts through background sounds and can be heard through the door by a potential intruder. The noise is made by an electronic tone generator developed by Mallory. It does not require special wiring or installation, and is about the size of a small transistor radio. Suggested retail price is \$29.95.

### Clear Vinyl Splices

Circle No. 159 on Reader Inquiry Card

A new line of splices and disconnects with clear vinyl insulation that lets the installer see the wire during installation



has been introduced by the *Panduit Corporation*. The clear vinyl allows for proper tool positioning and proper wire insertion length. Insulation is color tinted for wire size identification. The splices

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Color T.V. Pattern Generator

MODEL **WR-515A**

- All patterns output RF, IF, Video, 75 $\Omega$  or 300 $\Omega$ .
- Color bars with bar, market, dots, cross-hatch, blank raster.
- Professional "super-pulse" white window signal for over-all receiver analysis, with sync control.
- Ideal for MATV, CATV, CCTV systems.



Scope Dual-Tracer

MODEL **WM-541A**

- Convert single trace scope to dual trace.
- Freq. response DC to 4 MHz - 3dB, input imp. 1M $\Omega$  shunted by 45 pF.
- Choice of variable "alternate" or "chopped" switch rate.
- 1, 2, 4 ratio attenuators. CMOS circuitry, BNC connectors.

### COLOR PATTERN GENERATOR

MODEL **WR-508B**



- Latest IC circuits, reliable glass circuit board.
- Compact, small for portability.
- Extremely stable.
- Low cost, high performance.
- Provides basic test patterns.
- Switches from AC-line to battery operation.
- Output on Ch. 3...Adj. to Ch. 2 or 4.

### Audio Sine/Sq. — Wave Generator

MODEL **WA-504B/44D**



- Output 20 Hz to 200 kHz in 4 ranges, stability 0.5% and 5% dial cal.
- Voltage output 4 ranges 0.01 to 10V at 600 $\Omega$ .
- All solid-state, through out 3 wire AC cord.
- Sine wave harmonic distortion 0.15% sq. wave rise and fall 150 ng, tit 2%.
- All solid-state, through out 3 wire AC cord.



### RF Signal Generator

MODEL **WR-50C**

- Tunable on fundamental 5 ranges 45 kHz to 40 MHz 2% with sweep output at 455 kHz and 16.7 MHz plus External stat.

- RF output 0.05V rms, 2 step 10 to 1 plus fine adj. attenuator.
- Internal Modulating freq. 600 Hz adj. to 80%.
- Audio output 6V rms across 15  $\Omega$  load.
- FE $\gamma$  amplifier for rugged stability, 3 wire AC cord.



### Color/B&W Picture Tube Tester/Restorer

MODEL **WT-333B**

- Complete with 5 socket adapters including in-line type.
- Easy to use, compact, rugged ABS plastic case.

- 3 meter design permits all three guns of color picture tube to be tested simultaneously.
- Effective cathode-emission restorer adds life to weak picture tubes.

### Ruggedized Color Bar Generator

MODEL **WR-538A**

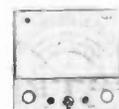


- Die-cast aluminum case, tough-glass PC boxed shock mounted pattern switch, oper. temp. 5 F to 145 F.
- 100% digital I.C. crystal control.
- Color bars with markers, dots, crosshatch, super-pulse and sync control, 3 line AC cord.

### Senior VoltOhmyst

MODEL **WV-98C**

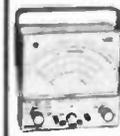
- 3 color meter face and panel for positive function identification peak to peak and rms scales.
- Meter electronically protected against overload.
- Response to 3 MHz, 11M $\Omega$  input resistance.
- Die-cast aluminum case.
- Easy-to-read 6 $\frac{1}{2}$ " (16.4 cm) mirror-scale meter.



- Measures from 0.2 $\Omega$ , 0.01 VDC, 0.95 VAC to 1000M $\Omega$ , 1500 volts DC and AC,  $\pm$  3% accuracy all functions.

### Master VoltOhmyst

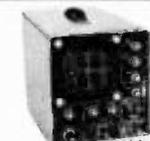
MODEL **WV-510A**



- Excellent stability.
- Battery or AC operation.
- Measures from 0.01 milliamperes to 1.8 amperes in 7 ranges.
- Measures from 0.2 ohms to 1000 megohms in 7 ranges.
- Measures from 0.01 volt to 1500 volts DC in 8 ranges.
- 21-megohm resistance on all DC ranges,  $\pm$  3% F.S. accuracy all function.
- Supplied with DC/AC Ohms probe with flexible shielded input cable (BNC connector), and current test leads.
- Mirror scale meter—movement electrically protected against burnout.

### 5-inch Oscilloscope

MODEL **WO-535 A**



- All solid-state.
- DC/AC input.
- Preset TV "V" and "H" frequencies for instant lock-in.
- Flat-face 5-inch CRT.
- Illuminated graph screen calibrated directly in volts.
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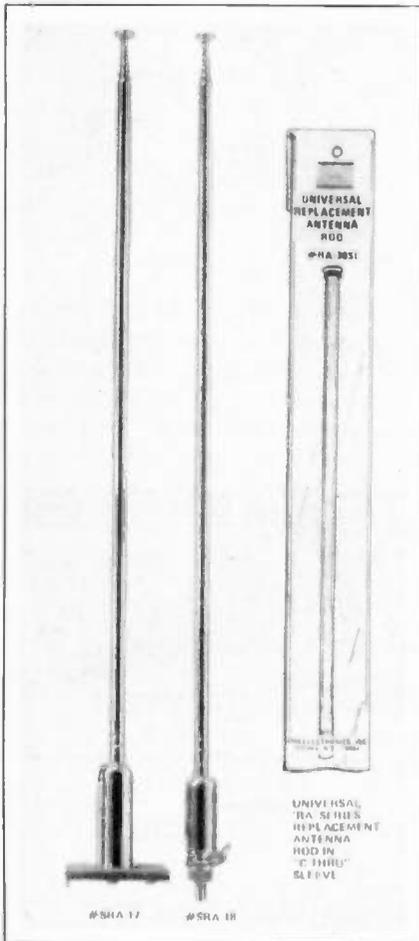
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and disconnects, which cover a wire range from No. 22 through No. 10 AWG, include internal wire barrel serrations that assure maximum tensile strength and wire contact when crimped.

## Antenna Rod Replacements

Circle No. 160 on Reader Inquiry Card

Two new TV antenna rod replacements for Sharp and other private label sets are now available from *RMS Electronics, Inc.* The new items are the No. SRA-17 and 18. The SRA-17 is for Sharp models 19A73, 19A75, 19A77, 19A79, 19A83 and 19A87, and Monitor sets XR214B, C-2050, and C-19876. The SRA-18 is



for Sharp sets 63-12327, 63-12547, 63-12541, C9000, C15141, C1541X, and others. Both replacement antenna rods have 5 telescoping sections which extend to 42 inches. The length of the rod when fully collapsed is 10-3/4 inches. Both replacements are individually skin-packed on a peg-hand card with a list price of \$5.15.

## Automatic Frequency Counter

Circle No. 161 on Reader Inquiry Card

A new 520 MHz automatic frequency counter is new from *Philips*. Designated the PM6664-01, the new counter has an



LED display of 8 digits, with resolution of 1 Hz up to 80 MHz and 10 Hz above 80 MHz. It can handle various power requirements automatically, and features a wide range of automatic input sensitivity from 20 mV rms (100 Hz—520 MHz) to 1 Vrms. Input attenuation is automatic and continuously variable, ensuring accurate measurements. Is is priced at \$545. **ET/D**

## NEWCOM

*continued from page 21*

addition to any test bench will, according to the manufacturer, measure anything from .1 pica to 1 farad. The battery operated, portable meter is rated at .5 percent accuracy, is fuse protected and carries a four digit LED display.

According to B & K the unit is especially applicable for measuring cable capacitance, matching capacitors, setting trimmers, or measuring the capacitance in series parallel networks.

GTE Sylvania's special markets division also announced the addition of three multi-purpose CB meters to their line of CB accessories. They are the SWM 20 portable SWR/field strength meter; the SWM 40 SWR/Power/Modulation meter equipped with illuminated scales; and the SWM 60, an SWR/Power/Modulation and antenna tuner. This latter unit is capable of modulation readings from zero to 100 percent, SWR readings of 1:1-3:1, and power readings of zero to 100 watts.

Sylvania also unveiled its SDX 400 base station power mike at the NEWCOM. This new variable gain microphone will broadcast up to 20 dB gain with output impedance ranging from zero to 25-hundred ohms and a maximum sensitivity of minus 45 dBs.

Another communications equipment manufacturer, Telco Products Corporation of Glen Cove, N.Y., is out with a "Swattmeter," a combination SWR-wattmeter. The Model 10-10 is described by the manufacturer as carrying three laboratory calibrated watts scales switchable from 10, 100 and 1000 watts and calibrated for 3

percent accuracy. It will retail at \$59.95.

JFD showed its new line of JFD SuperNova TV/FM antennas. The SuperNova line consists of six new "modest cost" designs and six advanced design antennas for use in areas where higher gain is required on UHF channels.

The new designs, JFD said, combine interleaved colinear element design to eliminate parasitic elements and they also contain a corner reflector/bowtie section to increase the vertical capture of UHF channels (on SuperNova-C models only).

Blonder-Tongue Laboratories was on hand to display its brand new Galaxy line of preamplifiers. According to the manufacturer the Galaxy features the lowest noise figure of any boosters on the market today.

Unique to the Galaxy is that these preamps employ separate amplifiers for VHF low band (channels 2-6), VHF high (Channels 7-13), and UHF (all the way to 83), according to the manufacturer. This arrangement, Blonder-Tongue says, prevents harmonics of low band channels from "wiping out" high band VHF signals. In addition, the Galaxy line is four-way lightning and surge protected.

Taco/Jerrold showed its new line of TV-FM antenna amplifiers plus a new TV remote control.

The amplifiers, seven new models known as the Maximizer line, offer very low noise figures and high gain. They feature a new all-weather housing which seals the input and output terminals and each Maximizer system comprises an outdoor preamp and an indoor power supply with either one or two TV outlets.

The TV remote, Model TRC-82, is adjustable for either channel 3 or 4 output and provides instant random access tuning of all VHF and UHF stations.

Winegard Company presented the introduction of two new splitters, one a two-way, the other four-way. Both encapsulated in polypropylene to permit outdoor installation. Winegard also showed a new back-of-the-TV set separator, its Model CS 3010 which adapts either twin-lead or coaxial cable to 75 ohm VHF and 300 ohm UHF to the set's antenna terminals.

In CB antennas, Antenna Specialists showed their MS119 Superscanner. According to the firm the SuperScanner is both omnidirectional and a beam antenna. An electronic control unit allows CB users to select "scan" with a 5.75 dB omnidirectional gain, or "beam" with a gain of 8.75 dB. **ET/D**

## OPERATIONAL AMPS

continued from page 25

resistors R4 and R5. Since both are 100-Kohm resistors the noninverting input is set to +9 volts DC. For reasons discussed earlier this places the inverting input and the output terminals also at +9-volts.

### Troubleshooting

Most of the problems associated with operational amplifier circuits, except possibly for oscillations, will affect the DC levels at the inputs and output terminal. The problem is to tell whether these DC changes are due to defects in the op-amp, or in the external circuit.

Examine again the circuit in Fig. 6A. I recently saw a case in which the voltage at the noninverting input was approximately 2-volts DC, and that at the inverting input was only 0.7-volts. I should have immediately recognized that the I.C. was probably bad because property number five had been violated! The situation became clearer though after Jerry Hennings (of Sheffield Electronics in Annandale, VA.) unsoldered the two input pins and left them floating. The DC voltages at the printed circuit pads for those pins were measured again, and were correct—about +9-volts. The I.C. was indeed bad.

Another troubleshooting technique, although not one to be taken lightly, is to short together the two inputs. This can only be guaranteed for circuits using dual polarity power supplies, and does not apply all the time if there is direct coupled circuitry following the op-amp.

If the two input terminals are shorted together in a classic two-polarity circuit, the differential voltage becomes zero, so the output voltage should also drop to zero. If it does not, then the chip is defective.

Three cautionary notes are in order regarding this troubleshooting technique. First, make sure the darn thing is actually an op-amp. Not all I.C.s are so forgiving of shorts across inputs! Second, make sure the pins being shorted are the input pins. Use of other pins will destroy the I.C., and thirdly, do not use the method if there is direct coupled circuitry following the op-amp. The op-amp will not be harmed if the inputs are shorted together, but some other component downstream might be, especially if it depends upon having a certain d.c. level from the op-amp at all times.

Recommended reading list:

1. *Op-amp Circuit Design & Applications*. by Joseph J. Carr; TAB Books, Blue Ridge Summit, PA, 17214; Cat. #787.
2. *Operational Amplifiers: Theory and Servicing* by Edward Bannon; Reston Publishing Company, 11480 Sunset Hills Rd., Reston, VA, 22090.
3. *Handbook of Operational Amplifier Circuit Design* by Stout and Kaufman, McGraw-Hill Book Co., P.O. Box 400, Hightstown, NJ 08520. **ETD**

### TEST INSTR.

continued from page 34

Operation of the 3010 in this mode, of course, allows the unit to be used as a sweep generator.

To obtain a direct frequency modulated signal from the unit, apply an AC signal (no DC component) and the output will vary above and below the frequency set by the range switch according to the ratio 100 per cent for each 5.5 volt peak to peak signal applied.

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STABILITY: .05% (after 15 minutes)  
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Square wave variable, TTL square wave fixed.  
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DISTORTION: Less than 1% to 100 kHz. Less than 0.5% typical.  
RISETIME: 100 ns at maximum output; greater than 25ns with TTL output  
TRIANGLE WAVE LINEARITY: 99% at 100 KHz  
OUTPUT: 20v p-p open circuit; 10v p-p into 600 ohms  
CONTROL: Continuously variable with greater than 30 dB range.  
D.C. OFFSET: Continuously variable from minus 10 to plus 10 volts open circuit, or from minus 5 to plus 5 volts into 600 ohms.  
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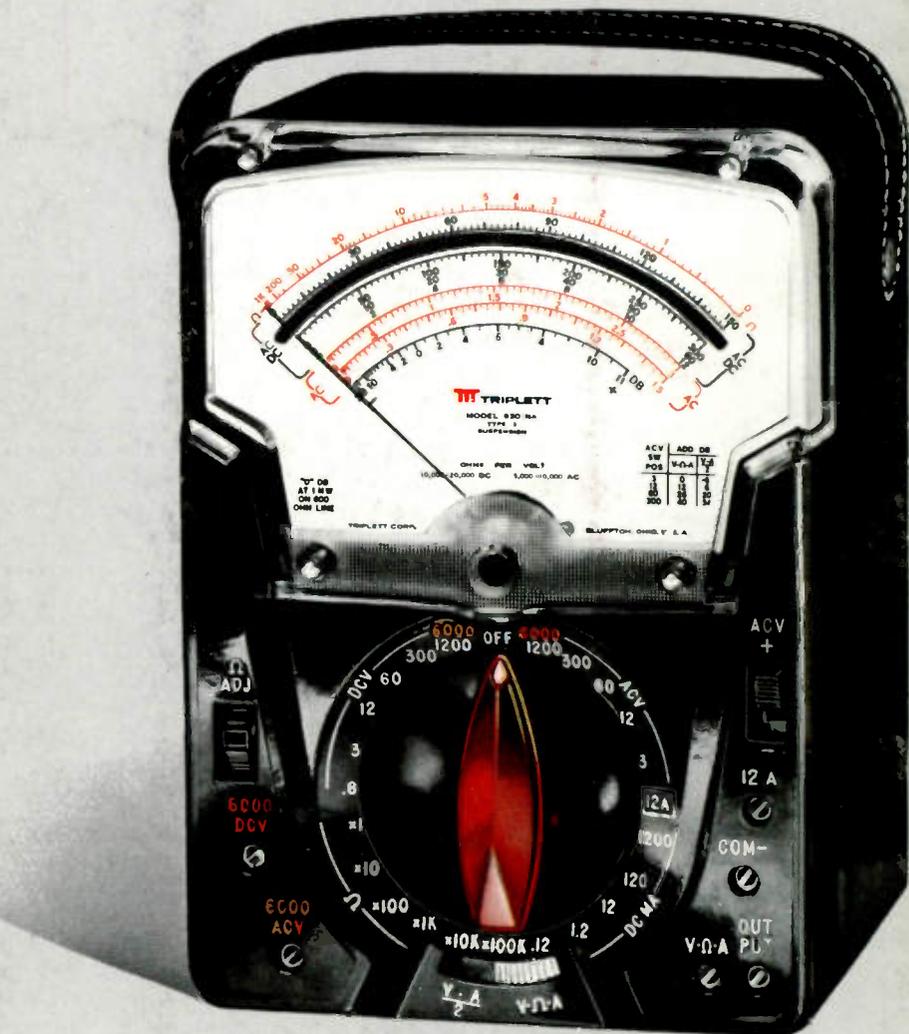
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