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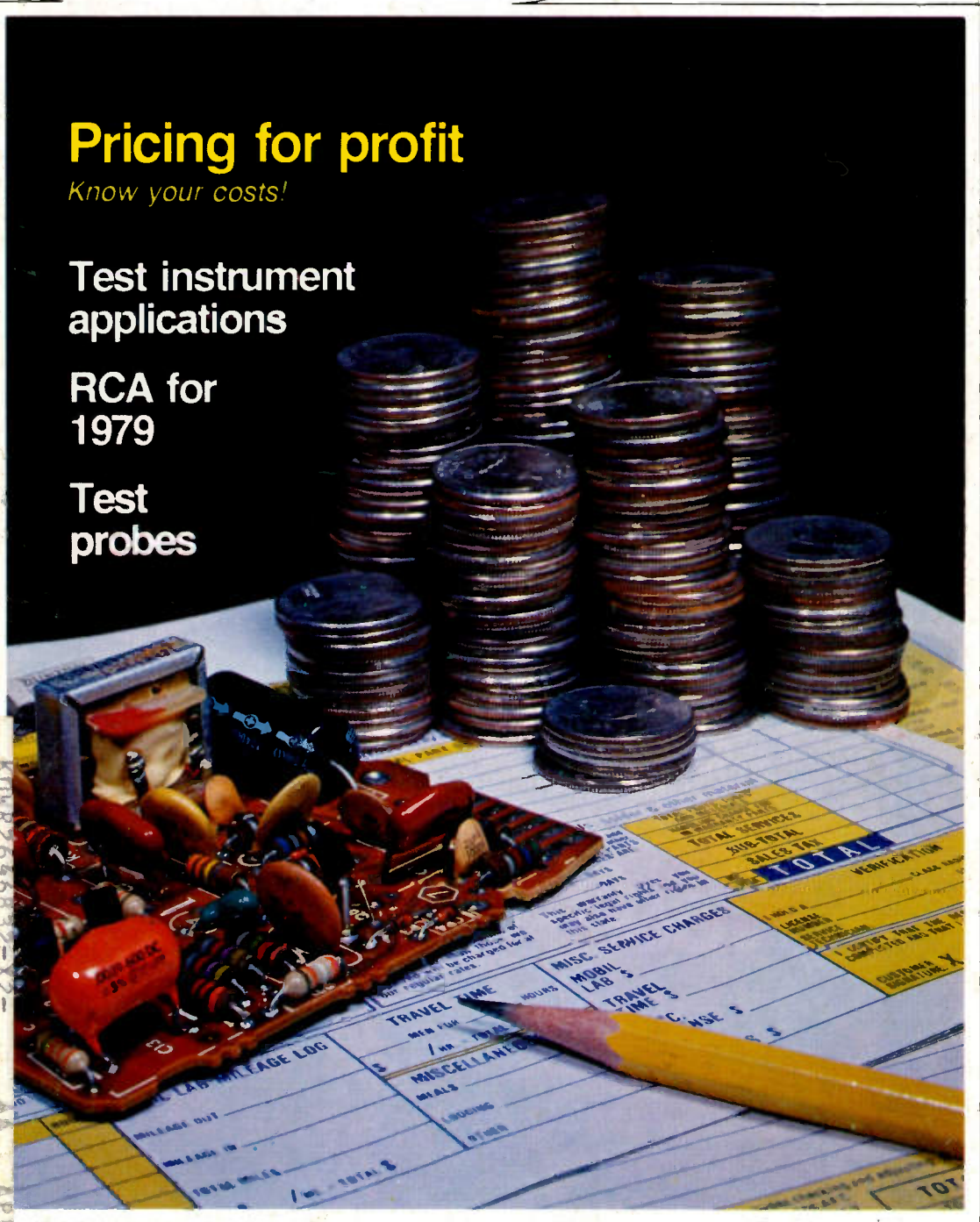
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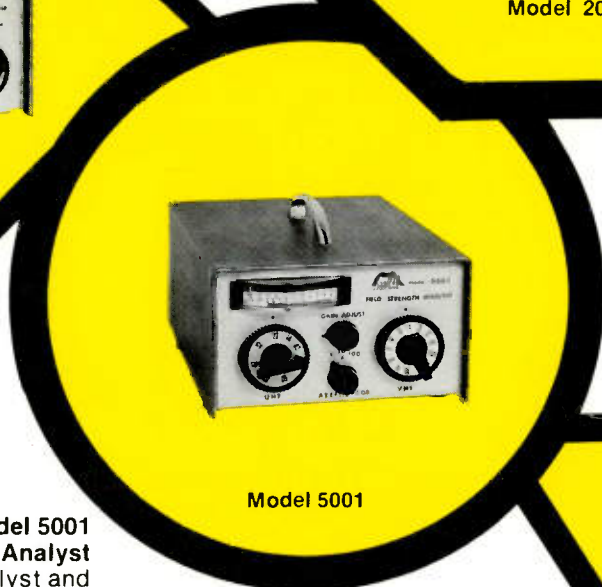


Model 1010



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Model 3001

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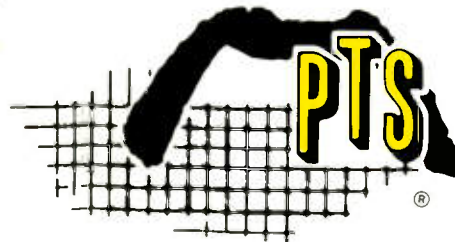
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OCTOBER 1978, VOL. 100, NO. 10

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On the cover:

This month's cover symbolizes the service industry's foundation upon business management—as explained in "Pricing for profit" (page 26).

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INDUSTRY REPORT

Warranty Suit Appeal Fund Started

In what amounted to an amazing show of solidarity between two often opposing organizations — NATESA and NESDA — the members of both groups coughed up (within minutes of being asked) well over \$11,000 for a special appeals fund in the California warranty suit case.

In a case already decided in favor of manufacturers by a California court, members of both organizations pulled out their ballpoints in force to fill in empty Visa and Master Charge slips passed out during business sessions at the organizations' recent national meetings.

Instigator of the special appeals fund is manufacturers nemesis — or service industry champion — depending on whose side of the fence you stand, Miles Sterling, a Garden Grove, CA, service dealer.

Sterling, who was spotted some years back when he began teaching business and financial management seminars to servicers, has been the main thrust in a suit filed under California law charging some consumer industry manufacturers with unfair practices and restraint of trade in allegedly soliciting consumer electronics service organizations to perform warranty work at below cost rates.

A California judge has already ruled summarily in the initial case in favor of the manufacturers and the fund solicitation is to provide front money for appeals attorneys. Sterling, who asked the representatives of manufacturers to leave the room before making his fund raising plea, said he needed \$16,500 for attorneys fees and other costs associated with an appeal.

Fortified with official support from both the NESDA and NATESA ruling bodies, members who contributed after hearing Sterling's appeal assessed themselves an average of \$200 apiece, according to association spokesmen.

NATESA Meets; Kelley Named President

Paul F. Kelley, Warwick, RI, has been named President of the National Association of Television and Electronic Servicers of America. He succeeds George J. Weiss who stepped down after serving two terms in that post.

Other officers elected during NATESA's recent national convention at Chateau Louise, Dundee, IL, were Leo E. Cloutier, Los Angeles, who moved from Secretary to Vice President; Lelia Aunspaw, Dayton, OH, the first woman to hold national office with NATESA,

was named Secretary, and Richard Ebare, Essex Junction, VT, accepted another term as Treasurer.

During his executive director's report, Frank Moch told delegates that many of NATESA's efforts during the past year centered on problems arising out of warranty abuse, the demise of service business establishments, the declining service rate on new television chassis, and product liability insurance.

On the later subject, Moch said NATESA planned to offer soon to members a whole range of insurance coverages pertaining to business operations.

Yeranko Retires from Magnavox

Ray Yeranko, Director of Service and Consumer Affairs for the Magnavox Consumer Electronics Company, retired August 31 after 44 years with the firm.

He will be succeeded by Ray Guichard, currently Technical Service Manager.

Yeranko joined Magnavox in 1934 as an assembler in the electro acoustic di-



vision. He has been active in national service and consumer affairs organizations for many years and is a past president of the National Association of Service Managers. In addition, Yeranko has served as chairman of the Consumer Electronics Group Service Committee of the EIA.

He assumed his most recent duties in July of 1975.

ISCET Returns to Indianapolis

The question of autonomy or status quo for the International Society of Certified Electronics Technicians (ISCET) came a step closer to solution when ISCET members voted to return ISCET headquarters from Ames, Iowa to the NESDA facilities in Indianapolis.

In actions taken during the recent ISCET annual meeting in Portland, OR, newly elected ISCET Chairman Jesse Leach and NESDA President Bob Vil-

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lont, appointed a six-member fact-finding committee to explore "all sides" of the IS CET-NESDA autonomy question.

A joint statement said the committee "will consider and examine all viewpoints on the subject of proposed independence and self-government — including both positive and negative comments — and will prepare a detailed written report that fairly expresses all facets of the issues."

According to a NESDA statement, the results of the committee's work are to be announced "no later than the mid-year meetings of the NESDA House of Representatives and the IS CET Board of Governors in San Diego" early next year.

NESDA Elects New Officers

Robert A. (Bob) Villont, 55, Tacoma, WA, a member of the electronics service industry for more than 25 years, is the new President of the National Electronic Service Dealers Association.

Villont, who replaces outgoing president LeRoy Ragsdale, was unopposed for the post which was balloted on during NESDA's recently completed national convention in Portland, OR.

Warren Baker was named Vice President of the organization during balloting and West Correll, Tustin, CA, was the run-off election winner for the post of

Secretary. He is a former Regional Vice President of NESDA.

Another officer, George Simpson, was unopposed in his bid for a second term as Treasurer.

Zenith Increases Color TV Prices

Zenith has upped its suggested retail price for most of its color TV lines from \$10 to \$30.

According to a Zenith statement, most 19-inch models have been increased \$10 while 25-inch models are up \$30. Increased costs were the reasons given by Zenith VP Walter C. Fisher.

Sylvania Adds 6 TVs, 9 Stereos to Line

Sylvania has announced the addition of six new color TV sets and nine stereos to its consumer products line for 1979.

The new television receivers include four 25-inch SuperSet PLUS Models with remote control, another 25-inch SuperSet console model and a 21-inch table model with separate cabinet base.

According to Sylvania, the SuperSet Plus units, with remote and VIR circuitry included, sell for a suggested retail of \$975 for the deluxe model.

Stereo consoles added to the line include five AM/FM stereo receivers with sealed air suspension speaker systems. These stereo units also include built-in Sylvania Phase Q4 matrix four-channel

circuitry and jacks for two optional speakers and two dynamic microphones.

In addition, an increase of \$10 to \$20 in the suggested retail list prices of selected 19-, 21-, and 25-inch (diagonal) Sylvania color television sets—almost half the Sylvania line—will become effective October 1, 1978.

Kenneth C. Thomson, vice president sales, Sylvania, GTE Electronics Company, said the price increase affects 22 out of 47 current line sets, including two 19-inch models, two 21-inch models, and 18, 25-inch models. "We increased prices of these selected sets due to rising material, labor, and transportation costs," he said.

U.S. Mobile Radio Market to Double Over Next Decade

The mobile radio equipment market in the U.S. was \$1.9 billion last year, which was down \$500 million from the 1976 level. But it will expand to \$2.5 billion by 1980 and \$3.7 billion by 1985, according to a new study by market specialists Frost & Sullivan, Inc., New York City. Declines in CB and marine VHF radios will result in slow growth through 1980, but the market will rebound to attain an 8 percent annual compounded growth rate thereafter, says the 274-page study, *The Mobile Radio Market*.

Technical innovations, including digital

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print messages in police radios, voice scrambler devices, application of the "cellular" concept to the 800-900MHz band and application of microprocessors will affect many aspects of the market, according to the report. The report also predicts a total land mobile radio growth of 15% per year, 1976-1980; and 10% per year, 1980-1985.

The report continues explaining: "Not that everything is hunky-dory...the mobile radio industry has its share of problems, too." However, it is felt that CB radio will come back strongly, and it is pointed out that microprocessors and other LSI circuitry are making inroads into CB radios and that the 800-900MHz band, opening to mobile radio, presents opportunities. The "cellular" concept employing low-power FM transceivers at many locations and digital radio signal transmission is "likely to be incorporated in leading U.S. cities".

The New York City RF Proposal

A recent issue of *Television Digest* explained the NYC proposal for radiation standards; the power density for RF emissions above 10MHz would be 50 micro-watts per square centimeter for fixed transmitters in areas "accessible to the public." This is 200 times less than the OSHA standard, and covers any "facility." It is not clear whether each antenna is a "facility" or this means total

power of all antennas on a common mast. If so, this would produce an "uninhabitable" zone for a radius of 0.5 miles from the Empire State Building and such a zone would extend for 1.2 miles from the proposed World Trade Center mast.

NAB Asks New York City to Hold Off on Radiation Standards

In a filing with New York City's Health Department Radiation Control Bureau, NAB said there is no valid evidence of any harm from broadcast transmitters and that several federal agencies are engaged in research to establish standards.

13 Inch Color Television Shipments Doubled in First Half of '78

13 inch color shipments are up in 1978's first half by 110.6%, while the total TV supply (production and imports) increased 15.1% to 5,214,500 units, according to *Television Digest*. The increase in 13 inch sets was at the expense of the other smaller portables, while 19 inch sets increased their percentage to 60.9%. Color consoles lost ground, down from 27.1% to 25.3%, to the portable-table models' 74.4%, and combinations' 0.3%. Remote control sets increased to 15.2% of the total and varactor tuned sets are up to 34.2%. Interestingly, as *Television Digest* points

out, U.S. assembled 13 inch sets increased relative to imports to 72.5%, up from 24.4% one year earlier; imports declined as a percentage of the total portable-table mix to 30.6% from 39.9%.

Industry Update

Radio Shack says it will open 50 computer sales and service centers during the coming year, bringing its grand total to around 100...Leader Instruments reports that despite tornado damage to its corporate headquarters and warehouse facility in Plainview, N.Y., business continued "without missing a beat"...And state-of-the-art electronics technology applications and Soviet superiority in some weapons systems will dictate an electronics warfare market of some \$10.4 billion during the next five years, according to one management consultant's report. **ETD**

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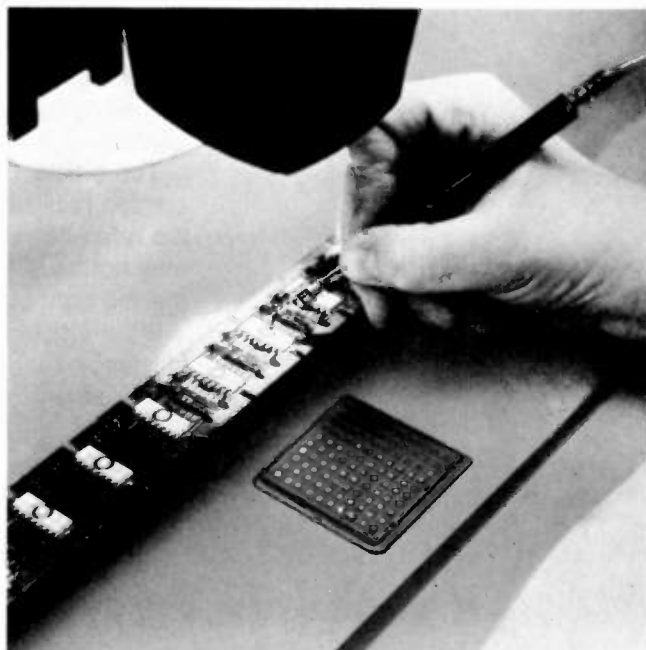
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RCA

SK Solid State Replacement

FROM THE EDITOR'S DESK



A primary cause of failure among small businesses in the United States today—along with under financing—is the lack of business management know-how. The Small Business Administration tells us this is not a phenomenon unique to our day. The lack of practical management ability—from the financial, marketing and inventory control standpoints, is well documented by the many failures associated with small business operations.

Added to this problem, insofar as the electronics serveshop is concerned, is the additional burden of a rapidly changing technical environment. The demands on the manager who must keep up with technology as well as new management techniques as they evolve in order to keep his shop out of the red, can be staggering indeed.

It is no wonder we are seeing a dropout of less efficiently run shops across the country. The one indelible fact emerging from all of the statistics we see is, simply put: if you are going to stay in business you must have an efficiently run operation *in addition to a high level of technical competence.*

That is the reason for ET/Ds lead article this month ("Pricing for Profit"), which focuses on one "business management" aspect of running a profitable service operation—pricing. The article is aimed particularly at those establishments which in the past, for various reasons, always seem to be in a position of stretching to make ends meet. I hope that such an article, in an otherwise technically oriented publication, will provide at least some insight for the otherwise "too busy" one or two man operation, into the importance of applying modern management methods to practical work-a-day situations.

Such information can serve as a platform to assist the manager in making quick and accurate management decisions with more confidence.

The article, in fact, is one of the chapters from ET/Ds up and coming publication "Modern Serveshop Management," a desk top reference manual for the busy shop manager who up to now may not have had at his fingertips the necessary information for making right business decisions quickly.

If the article contributes in some way to your shop's improved efficiency, then you should know that "Modern Serveshop Management" will be available in its entirety very shortly.

Sincerely

Richard M. Lay

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LETTERS

HELP NEEDED

I need a schematic for a B&K Model 1000 Video Generator. B&K no longer has any service literature available. Any help from your readers will be most appreciated.

Greg Small
Swedish American Hospital
1400 Charles St.
Rockford, IL 61101

*I have a RF-AF and TV Marker and Bar Generator which I assembled from a kit put out by **Precise**. I need a schematic and service information.*

John B. Hultgren
201 West St.
Geneva, IL 60134

I need an address for a parts source for Bradford (W. T. Grant) electronic products.

Norman L. Fitkin
Television Sales and Service
627 S. Commerce Ave.
Sebring, FL 33870

I need any information on Sylvania TV Lab Scopes type 400 and 404, and TV Generator type 500 and Tektronix TV Adapter type 124. Sylvania and Tektronix no longer have manuals on this gear.

Clyde N. Smith
11 Brown St.
Reynoldsville, PA 15851

We have a Model 860 Amphenol which needs repair. Aztec Electronics, Commander Communications is out of business. We wrote them a letter and got it back. Does anyone repair these units? Kinetic T.V. Co.

27 E. 30th St.
New York, NY 10016

I need a service manual and schematic for a Video Instrument Corp. Field Strength Meter model 1747. My letter to them was returned. Maybe some of the ET/D readers could help me.

Lee V. McKinnis, Jr.
P.O. Box 1225
Bloomington, IN 47401

We need the following out-of-print Magnavox service manuals: 1392, 1394, 7279, 7281 and 7289.

Frank's TV Service
2909A Industrial Rd.
Las Vegas, NV 89109

HELP RECEIVED

In the June 1978 Edition of ET/D, you published a letter from me asking for help in the matter of a "Knight" KG-625 meter movement. Due to that letter, which you printed, and the courtesy shown by some of your readers, the response was tremendous. I have been able to acquire three of the meters—all new for a slight cost. One reader in Milwaukie, Or. even sent another brand of meter to replace the "Knight" meter, at no cost. How about that!! Please try to print a portion of this letter so that the readers will know that "mission has been accomplished," and people will stop sending me their equipment.

James S. McIntyre
Mac's Radio & TV Repairs
Star Route Box 607
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NEWSLINE

CATV INDUSTRY LOOKING UP. The CATV industry, according to a Frost & Sullivan industry survey, is looking up, with the profit outlook bright and plenty of venture capital. However, the management consultants warn the alternative to CATV--over-the-air subscription television--is a real threat to the CATV industry's growth. According to Frost and Sullivan pay-TV and satellite program transmission will increase CATV penetration into U.S. households from the current 15 per cent level to 29 per cent by 1986. "Over the 10-year period CATV subscribers will generate a total of almost \$19 billion in gross revenues."

NATESA CONTINUES WARRANTY PROBLEMS CRUSADE. Contending the 1978 NATESA convention was "sadly disappointed" with the television manufacturing industry's response to its survey of warranty practices, Executive Director Frank Moch says the next step will be to confront manufacturers individually. Moch says NATESA membership responded well to a 17 question survey seeking information on specific alleged problems but an industry response through an EIA representative was "very disappointing" and dealt only with parts procurement practices.

ZENITH INTRODUCES THREE HOUR VCR. Zenith has unveiled its new Beta format three hour video cassette recorder...the model KR9000W. The new unit, which Zenith says will retail in the \$995 area (same as earlier units) incorporates a new remote pause control and a built-in electronic clock/timer. According to Zenith the pause control allows the viewer to stop the tape in either the play or record mode for editing purposes. Two new optional color cameras are also being offered in conjunction with the new video unit. The lower cost camera retails at \$995 and the higher end camera, with zoom lens and a 1 1/2 inch black and white CRT monitor, is priced in the \$1,400 range.

TI GAINS JAPANESE PATENT. Texas Instruments says it has received a patent from the Japanese government covering virtually all miniature electronic calculators. What this means to the huge Dallas-based electronics firm is that it will have the right to negotiate, retroactive to 1974, royalties on Japanese manufactured calculators using the basic Texas Instruments concept. The patent, TI reports, is based on the battery-operated calculator which has its main electronic circuitry in a single IC chip. Japan is now the 19th country to award TI a patent on this concept. Other countries in which TI maintains patents include Britain, Italy, France and four Latin American countries.

SALARY SURVEY RELEASED. A recent publication, Salaries and Related Matters in the Service Department, reports the "average" annual salary for a national service manager is now \$25,658. That is according to the firm of Abbott, Langer & Associates which says it surveyed some 25,000 positions in over 200 organizations in both manufacturing and non-manufacturing service areas. Other results of the report, which is available at \$60 per copy by writing P. O. Box 275, Park Forest, IL 60466 is that the average salary for a bench service repairman is \$12,420 and for a field service representative, \$13,291.



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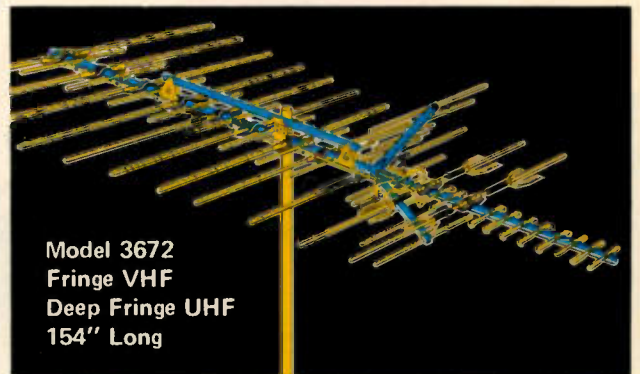
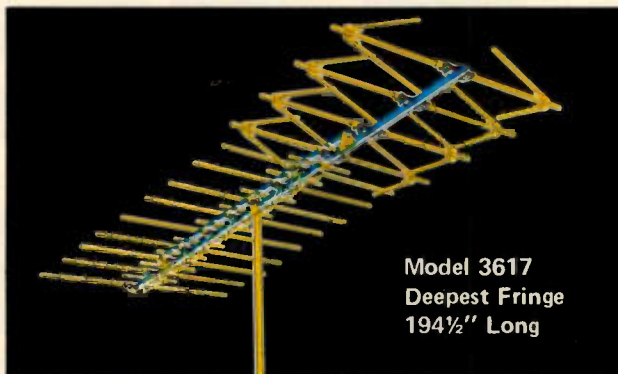
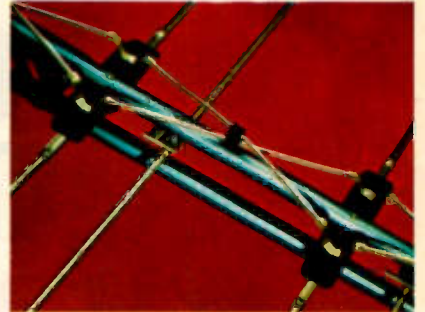
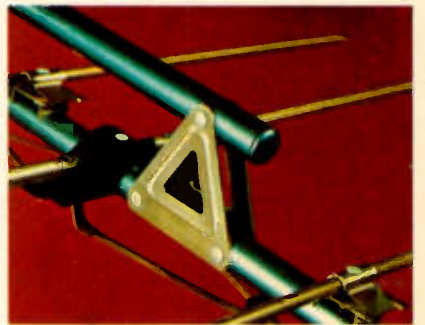
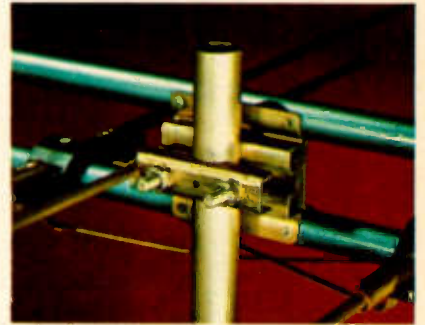
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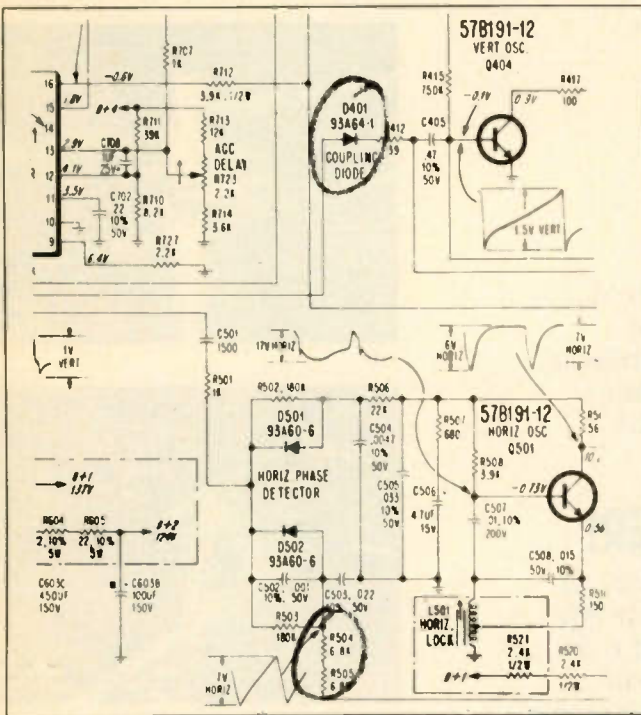
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SERVICE SEMINAR

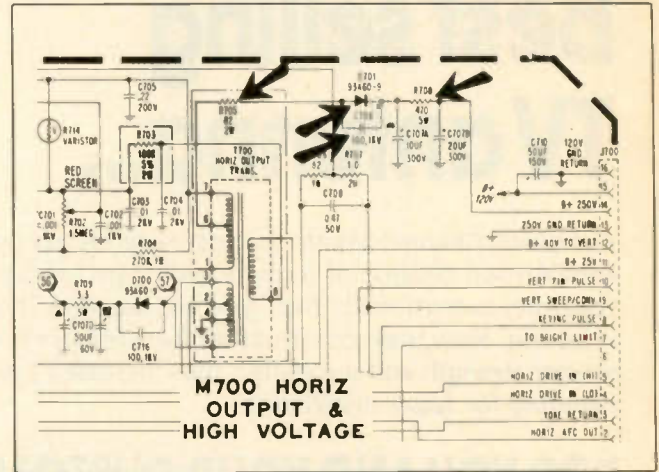
Replacement of IC701 does not correct problem. Voltages on IC701 are substantially different than schematic indicates. A probable cause is a defective D401, (sync coupling diode), and open R504 or R505, (horizontal pulse coupling resistors).

ADMIRAL

Chassis N3—Loss of horizontal and vertical sync.



Color Chassis 9M50—Loss of picture, no control of brightness, retrace lines, and loss of 250v Scan B+. Probable causes are: (a) open R705 (820Ω, 2 watt), (b) open R708 (740 Ω, 5 watt), (c) Shorted or leaky C706, 100 pfd 1kv, (d) shorted D701.

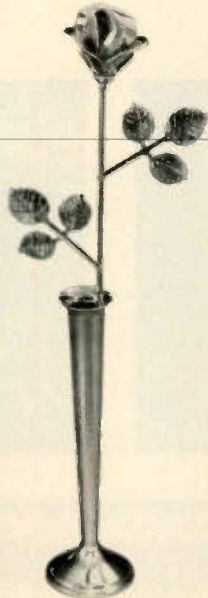


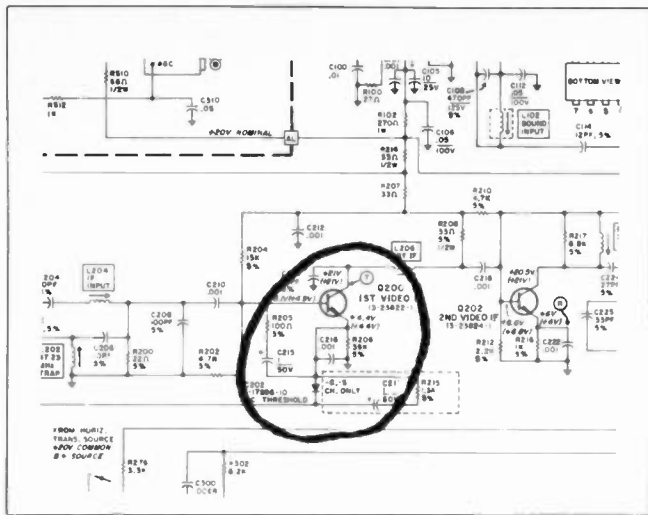
GTE SYLVANIA

A12 Chassis—AGC overload when horizontal hold is adjusted. Sync is critical. Possible cause is a shorted AGC threshold diode (SC202).

RCA
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TOP DEAL





A12 Chassis—Sound O.K. but horizontal line across middle, R330 (68 ohm) resistor burning or open.
 The SC308 protection diode on the base of Q312 is probably shorted.

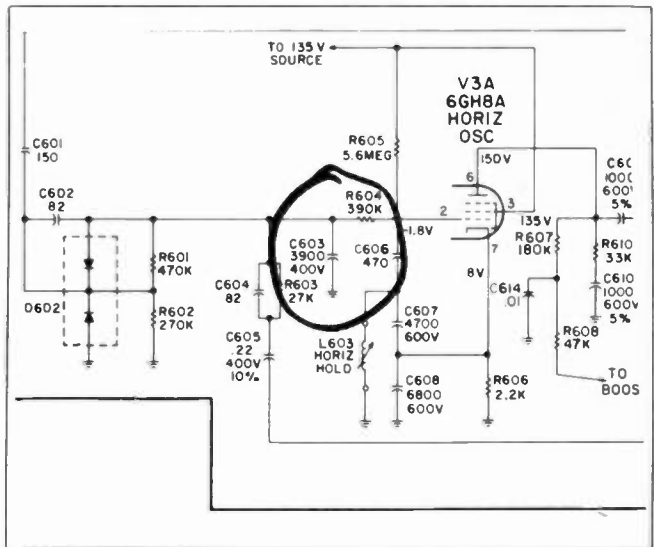
MAGNAVOX

Color TV Chassis T997—No horizontal sync

If a problem of no horizontal sync is encountered with the T997 chassis, check the wire connection from Pin 5 of the flyback terminal board to the flyback 17V pulse winding. This wire may have been broken during shipment. To correct this problem, solder a short piece of wire from Pin 5 to the broken lead of the flyback winding.

TV Chassis T960—Erratic horizontal sync

A condition of erratic horizontal sync with the T960 chassis may be caused by an incorrect value capacitor installed at location C603. C603 should be a .0039 mfd, 10%, 600VDC capacitor. A wrong value capacitor causes interference to the horizontal AFC correction voltage. If it is determined this is the situation, replace C603 with the correct capacitor, Part No. 250590-3929.



BG7520 Odyssey—No ball reset

If the BG750 (Odyssey 500) is stored in a cold environment, the ball may not reset until the unit has been allowed to stabilize at room temperature. This problem has been traced to the Odyssey Blanking Pulse Width adjustment. The blank-

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ing pulse varies enough with temperature change to prevent the ball from resetting after it goes off the right side of the screen. It has also been determined that a black bar to the left and/or right side of the screen may result from excessive heat.

If either of these symptoms are encountered, first insure the unit has been allowed to stabilize at room temperature. If the problem still persists, perform the Blanking Pulse Width and Centering adjustments as follows: 1. Adjust R43 until a black bar just appears at either or both edges of the screen.

2. Adjust R44 to center the picture (bar should be showing on both sides of the screen—if not, repeat step 1 and 2).

3. Readjust R43 until the bars at the edge of the screen just disappear. (Make sure the picture remains centered while readjusting R43).

ZENITH

Modules inoperative because of ineffective contacts.

In many instances, a module suspected of being inoperative may only have ineffective or marginal contacts. You can quickly check for this possibility. Simply remove the module in question from its receptacle, and plug it back in. If contacts were weak, the receiver will in all probability operate properly. (If the operation of the set is still not proper, a known good module should be tried.) In the event that the contacts were weak, the module should again be removed and the spring tension of the contact tabs on the module should be increased. To increase tension, use a narrow instrument such as a jewelers-type screwdriver and carefully push the tabs slightly inward. *CAUTION: Do not push excessively on tabs, or breakage may occur.*

EDITOR'S NOTE: *This technique applies to other makes. It has been a common problem with Motorola Quasar "CA" panels causing unusual and sometimes intermittent video and color symptoms. ETD*

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23HC45 Color TV Chassis	Raster and sound both intermittent (2 or 3 times in 8-hour period).	Faulty 24-volt regulator transistor QX201.
25EC58 Color TV Chassis	"White Streaks" horizontal through picture. AGC delay action critical.	Leaky capacitor C231 (near video processor module 9-48).
23HC45Z4 Color TV Chassis	No Color	Shorted winding in flyback transformer TX206.
25HC45 Color TV Chassis	Pix almost normal with low brightness. Color smears when G2 control. brightness is advanced.	Capacitor C208 shorted (on red).
23HC50 Color TV Chassis	Left 1/3 of picture darker than right side.	Open filter capacitor CX214.
25HC45 Color TV Chassis	With red G2 at maximum, green and blue will not vary. No green and blue with G2 off. Cannot get gray scale.	Capacitor C211 shorted (on right side of schematic near CRT).

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RCA 1979

New receivers and new VCRs

Automatic electronic fine tuning and a new single board chassis set the trend at RCA.

By Richard W. Lay

RCA's emphasis on exotic tuning systems, lower power IC chassis and its determination to be the prime marketing force for VCT/TV color camera development in this country mark the highlights of the 1979 home entertainment offerings of this industry giant.

But, while RCA is taking full advantage of the application of digital and other state-of-the-art electronics to consumer markets, the major effect of its 1979 thrust insofar as the service industry is concerned will be the introduction of its single board CTC93 (25-inch) series chassis. It's a concept that will further drive the wedge between the champions of modular construction and the "motherboarders" and — as RCA's G. Jay Franklin contends — "it will once again force technicians to be technicians instead of tube changers or board switchers."

Complementing RCA's major color chassis for the coming year are the modularly designed CTC91 (19-inch) and the CTC92 (25-inch) chassis. These are virtually similar chassis and each contains 10 interchangeable modules which house virtually all circuits except horizontal output and some power supply components.

Other relative newcomers to the 1979 RCA line are the CTC87, a single board, 13-inch model which draws a reported 69 watts at average beam current. A new solid state voltage regulator allows the set to operate between 105-and-135 vac. (This chassis, incidentally, received an 86 per cent serviceability rating from an IS CET inspection team.)

In the black and white line, RCA has upgraded its "Sportable" line with low cost 9-inch AC901B model weighing 13 1/2 pounds.



Fig. 1-RCA's newest VHS format VCR, the programmable VCT400 with electronic indexing feature. It retails around \$1,275.

Another significant part of RCA's 1979 consumer products effort is the expansion of the "SelectaVision" VCR line with a new high-end programmable model, plus the introduction of two new color TV cameras for "instant home movies."

The TV cameras will retail for \$850 and \$1,275 for the "Zoom lens" model.

The newest VHS format SelectaVision is the model 400 with a suggested retail of \$1,275. However, RCA will continue with its previously introduced model 200, retailing around \$1,000, plus a slightly higher version at \$1,075.

According to RCA, the VCR400 is capable of being preprogrammed to record up to four television programs on different channels during a seven-day period. An electronic programming index also allows a viewer to find the

starting point of a program.

"Synthesized" tuning

Heading the list of major changes for RCA's latest television receivers is "ChanneLock" tuning—a phase locked loop system of IF frequency generation which eliminates fine tuning. Under development for three years, ChanneLock will be applied in the CTC91, 92 and 93 chassis. (For a review of a similar application of synthesized frequency generation see ET/D, September, 1977, page 25.)

RCA is offering three variations of its ChanneLock tuning. They are keyboard control for random access tuning; a manual scan system for channel up or down operation, and a remote scan system.

The system contains two tuning modules, the frequency synthesis

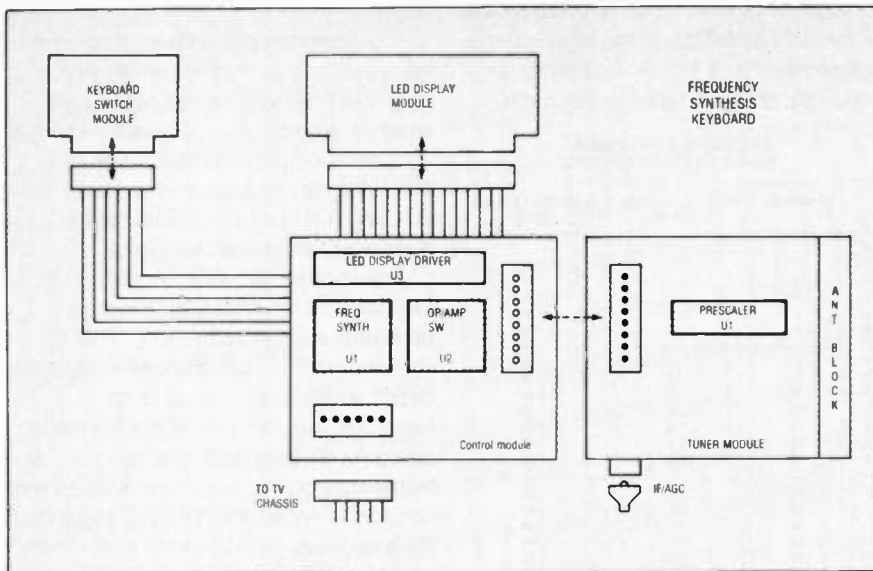


Fig. 2-Block diagram of RCA's frequency synthesized "keyboard" tuning system.

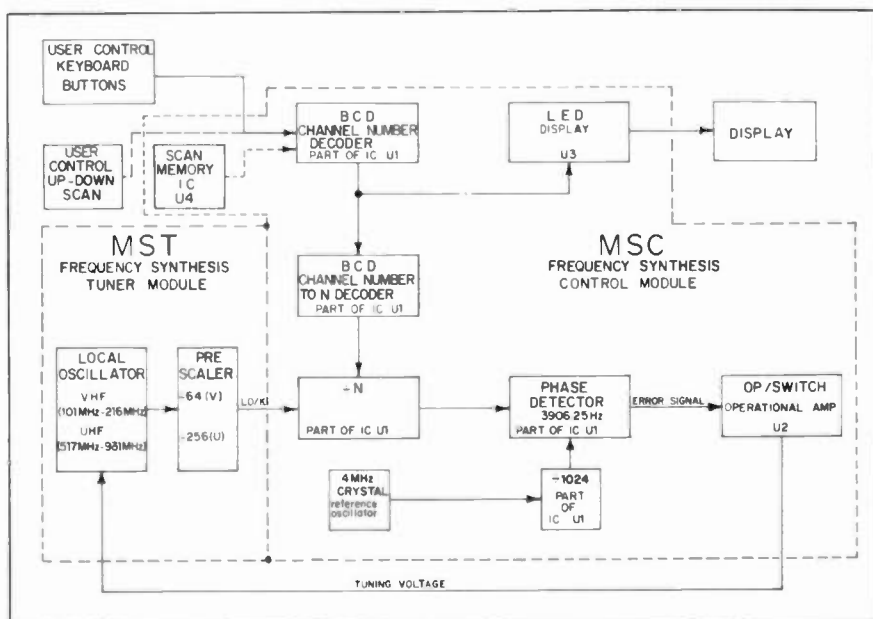


Fig. 3-Signal flow chart of the phase locked loop "ChanLock" tuning system.

control module (MSC001A for keyboard operation or the MSC002A for scan operation) and the MST001A synthesis tuner module.

Among the ChanLock advantages, according to RCA, are the elimination of the fine tuning control, guaranteed "lock in" due to VCO controlled PLL circuitry, crystal controlled frequency generation using only one crystal, a "scan" feature allowing the system to tune to only stations which are broadcasting, and an electronically alterable read only memory (EAROM) for preserving pre-programmed channels for up to seven years.

The keyboard system

The most basic of the three tuning variations is the keyboard, RCA reports (see figure 2) with a 10 button keyboard entry panel and LED channel display.

When the unit is turned on it automatically selects channel "02." To select a new channel two numbers are pressed, such as "0" and "5," for channel five.

The scanning system (manual) uses a channel up/down selector button and selects channels in numerical order at one-half second intervals if the selector button is held in. A special volatile memory device allows customer programming of only those channels in a particular area which carry broadcast signals.

In this programmed mode the channel jumps directly from one active channel to the next without passing through intervening unused channel positions. Frequency synthesis uses seven custom ICs—four basic units and three optional. These are the prescaler, synthesizer, operational amplifier band

switch and the LED decoder driver. The options are channel memory, on-screen display clock, and remote receiver decoder. (See figure 3 for basic block diagram.) *The Prescaler:* This IC divides the local oscillator frequency by 256 for UHF and by 64 for VHF operation.

The Synthesizer: This IC uses NMOS technology arranged to provide the crystal reference oscillator, timing counter, programmable divider, phase counter, mode control and user input control. In essence, RCA states, this IC receives signals from the prescaler and processes them through a programmable divider that is controlled by the user's channel selection. The divider's output goes through a phase comparator and error signals are developed.

In addition to other functions, this chip also contains automatic tuning of offset signals on VHF channels such as may be encountered in CATV and MATV systems. In this mode the tuner either drifts toward a signal outside of the AFT pull-in range or locks onto one within the range.

The OP Amp bandwidth: This LSI circuit accepts error signals from either the synthesizer or AFT circuits and produces the tuning control voltages (see figure 4).

The LED Decoder Driver: This IC decodes the binary coded decimal channel number from the synthesizer and drives the cathodes of the two seven segment display LEDs.

Channel Memory: The output of this IC is a skip or non-skip command to the synthesizer, according to a user programmed list of desired active channels.

On Screen Display Clock: This optional chip displays time of day and channel number information on the CRT screen. It's readout is white characters surrounded by a black edge and it accepts horizontal and vertical sync signals for positioning.

Remote Receiver Decoder: Receives the remote input signal and contains a digital to analog converter for volume control, channel change, and on/off operation.

The phase locked loop

The heart of the frequency generation system is the phase locked loop. It operates (see figure 2) by sending a portion of the VCO generated signal to the divide by N counter. BCD signals are decoded by the counter to produce frequency "N," which is the desired frequency of the VCO. This signal and the reference oscillator signal are then

fed to a phase detector circuit which makes any necessary correction before passing on any existing error signal to the operational amplifier IC. This IC accepts it and produces a tuning control voltage which is fed back to the local oscillator for correction purposes.

Once the channel is locked in, this condition will remain until a new "N" factor is received by the divide by N counter from the "channel number to N decoder."

The CTC93

RCA's CTC93 chassis (see figure 4) is a return to the once popular single board concept. It contains - except for ChannelLock tuning, which is optional — only one module — PW5000. Most of the circuitry is located on the motherboard. Exceptions are the horizontal power devices and the color video output stages located on the module.

While I have not yet seen this chassis, RCA reports the serviceability of the chassis is enhanced by its accessibility and segmentation by circuit area. These circuit areas are marked by boundary lines right on the board, according to RCA.

While much of the circuitry is similar to previous RCA chassis, the CTC93 does contain a new video input circuit which uses a differential amplifier to control the contrast level of the video information. In addition, most of the circuits in the CTC93 are powered from derived B+ voltages, including the horizontal oscillator stages. However, this horizontal stage is dependent on a "start-up" circuit. In this particular chassis, RCA reports, the sound circuit is a good indicator of faulty voltage source, if sound is heard this is a good indication of proper operation of the start circuit, the +150vdc, the horizontal B+ regulator and the horizontal output system.

CTC92 and CTC91

The CTC92 and 91 chassis are virtually identical, the 91 housing the 19-inch CRT and the 92 a 25-inch tube. Both draw an average beam current of 102 watts (134 watts maximum) and both are capable of maintaining operation over input line voltages fluctuations from 105-to-135 vac.

A block diagram of the CTC92/91 chassis is shown in figure 6. These chassis have two ground systems, the main chassis ground and a secondary ground on the heatsink panel which forms a non-isolated ground. The main chassis is an isolated ground. DC

voltages and pulses are derived from the secondary windings of the high voltage transformer and these secondary windings are grounded to the main

FREQUENCY SYNTHESIS
TUNER VOLTAGE CHARTS

	CHANNEL	TUNING VOLTAGE (TYPICAL)	PRESCALER FREQ (MHZ)
V H F	2	1.8	1.58
	3	3.3	1.67
	4	5.4	1.76
	5	11.4	1.92
	6	19.0	2.01
	V H F	7	8.5
8		9.6	3.54
9		11.0	3.65
10		12.6	3.73
11		14.6	3.84
12		17.5	3.92
13		22.0	4.01
U H F	14	1.8	2.02
	24	3.8	2.25
	34	6.3	2.48
	43	8.4	2.69
	53	10.5	2.93
	63	13.4	3.16
	73	17.0	3.40
	83	24.0	3.63

Fig. 4-Frequency synthesis tuner voltage charts.

chassis.

The power supply of these chassis is a full wave bridge (non-isolated) which develops 150 vdc for the regulators, which in turn provide regulated 114 for horizontal output operation. The rest of the voltages are scan derived as in the CTC93. Again, horizontal output is dependent on a start up circuit.

The chroma (MDC001A and luminance/sync MDL002A) contain on-board voltage regulators. The chroma module contains one integrated circuit which performs all chroma functions, including fleshtone correction and auto chroma overload control. Two transistors on this board perform as the horizontal ringer and 11.VDC regulator. Its output are demodulated red, green and blue difference signals which are fed to red, blue and green output transistors on the Kine module.

continued on page 52

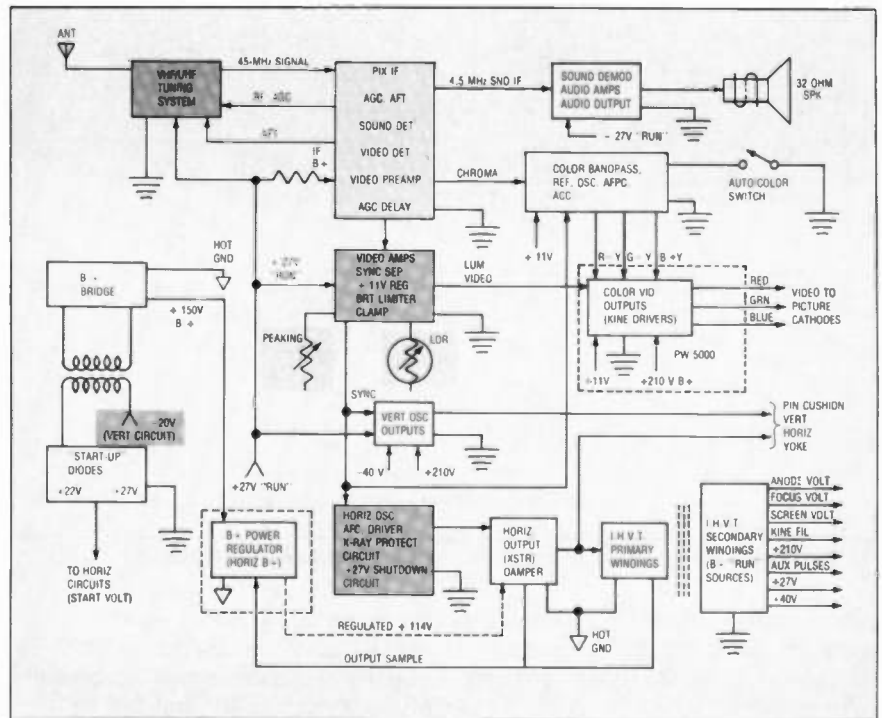


Fig. 5-The CTC93 chassis signal flow block diagram.

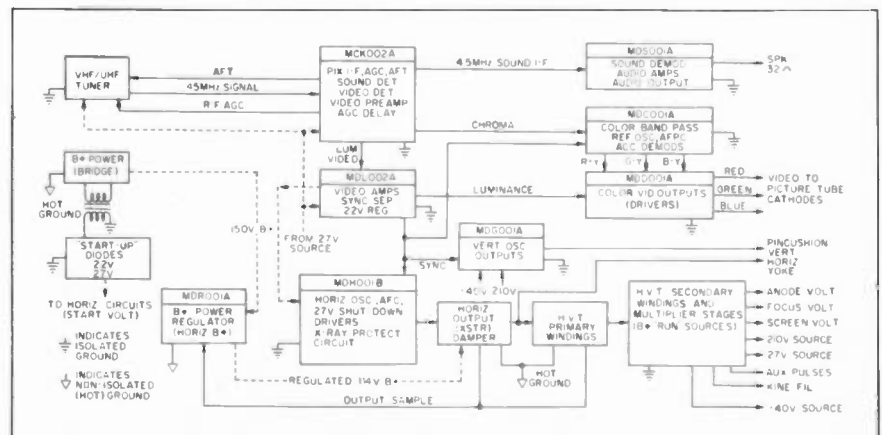


Fig. 6-Block diagram of CTC92/91 modular chassis.

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Circle No. 107 on Reader Inquiry Card

Extending your meter's range

Accessory probes make the difference

In this article we take you on a tour of what's available to make your multimeter more versatile.

By J. A. Ter Haar

Multimeters are one of the most common items on workshop and laboratory benches and in field service tool bags. But although modern instruments offer many facilities not even dreamed of several years ago, the addition of some simple—and some not so simple—accessories can extend the range of measurements possible and also make many everyday measurements simpler. Accessories can be used in three ways:

- To extend the meter ranges;
- To make work easier and safer; and
- To cope with specific measuring problems.

A whole host of accessories is available to extend the range of the multimeter—from high-voltage and high-frequency probes increasing the range of readings possible, to rechargeable battery packs allowing the easy use of high-accuracy laboratory meters in the field. Special probes are available for specific problems such as temperature measurement.

The use of current transformers, special connecting leads, extended probe tips and similar accessories helps make everyday measuring jobs simpler and safer. Carrying cases, protection and so on, to safeguard the instrument, also help to make life easier—arriving at

a service job to find the instrument damaged is no joke.

High basic specifications

Although details will vary from model to model, most modern multimeters have high basic specifications. Typically a standard multimeter—analogue or digital—will cover a voltage range from 100 mV to 1 kV, a current range from 1 mA to 1 A and resistance measurements from 100 ohms to 10 megohms. Such a meter is shown in Fig. 1.

An important requirement often is to extend these basic ranges, and to meet this requirement there is a wide range of high-current and high-voltage accessories. Typical is the universal current shunt shown in Fig. 2. This particular model allows readings up to 10 A or 31.6 A—typical range scales found on analogue meters. The design of the shunt is reasonably straightforward, being composed of a thick chunk of resistive material. The current is fed through the circuit as shown and the resulting voltage drop—in millivolts—is fed out through the meter terminals. The output is direct for digital meters—100 mV range for 10 A, and 31.6 mV for the 31.6 A range—but only the 100 mV range is needed for the analogue meter.

Current ranges can be extended even further using the current transformer shown in Fig. 3. This is designed for measuring ac currents up to around 100 A. It is very simple and easy to use with a standard 1000:1 transfer factor giving 100 mA for 100 A. This unit is a simple clip-on affair and with its small compact form losses are very low.

High voltage safety

Extending the voltage range of voltmeters is another desirable



Fig. 1 A typical modern multimeter will cover a voltage range from 100 mV to 1 kV, a current range from 1 mA to 1 A, and resistance measurements from 1/200 ohm to 10 megohms.

step, particularly if checking such items as TV sets. High voltages bring inherent dangers, so not only must the probe be capable of handling the voltage, it must also be capable of handling it safely. Such a probe is shown in Fig. 4. This is designed to measure voltages up to 30 kV and provides a 1000-times attenuation; a 1 kV input provides a meter input of 1 V. A choice of three internal terminations makes it suitable for meters with 1.2, 10 or 100 megohm input impedances.

The length of the probe helps keep the operator's hand away from the dangerous high-voltage point—with the provision of a hand grip to stop the hand from slipping. An additional safeguard is grounding on the hand shield. A further aid is the sharp, not rounded, point of the probe to insure that it does not slip off the measuring point. This last is important—any time high voltages have to be measured it is worth insuring that the probe has a hard point for solid contact with the test point. This also guards against the operator coming in

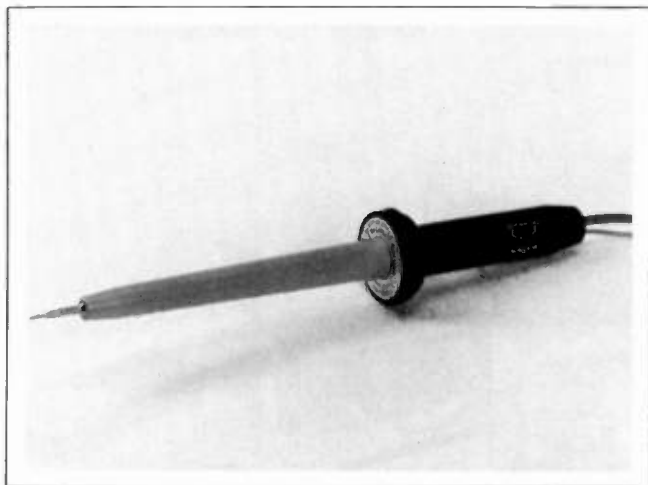
*Mr. Ter Haar is a member of the Philips Test and Measuring Instruments Department, Almelo, The Netherlands.



Fig. 2 Design of this current shunt is simple. The input current is fed through a chunk of resistive material and the resulting voltage drops measured. This model can 10 A or 31.6 A. measure



Fig. 3 Modern current transformers are simple clip-on affairs, the small compact design minimizing losses. Maximum reading from this model is around 100 A.



This high voltage probe allows the range of a typical multimeter to be extended up to 30 kV safely.

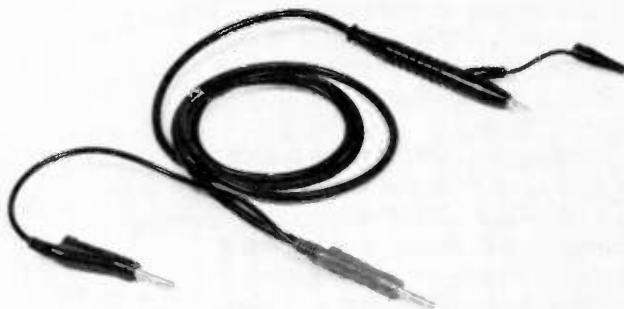


Fig. 5 This relatively inexpensive probe is ideal for extending frequency ranges on low cost multimeters. It works well up to 30 kHz and signal tracing is possible up to 300 MHz.

contact with the high-voltage source.

High frequency probes

Extending the range of readings is not the only problem. Trying to obtain straightforward voltage and current readings on high-frequency signals can often be difficult. So the addition of high-frequency probes to multimeter accessories is often essential.

The simplest type of high-frequency probe is shown in Fig. 5. This is a relatively inexpensive design, aimed at low-cost multimeters. It works well up to 30 MHz and can be used up to 300 MHz for signal tracing—a conversion card is supplied with the probe to allow compensation for errors due to non-linear diode characteristics. Construction is simple with a metal housing in a silicone rubber cover. The whole unit is designed to be thrown away rather than repaired.

A more sophisticated type of high-frequency probe is shown in Fig. 6. This has ac coupling and a linearization circuit giving an accurate reading

directly from 150 mV to 15 V—a conversion card is provided to allow measurements below 150 mV. The probe works up to 1 GHz with a very good flat response between 100 kHz and 10 MHz. A T-adaptor is provided to allow measurement in co-axial circuits—mainly to compensate for the capacitive loading of the meter. In fact, a whole set of different co-axial connectors is available. High-voltage measurements—from 2 to 200V—are dealt with using a capacitive attenuator with an adjustable transfer ratio.

Other measuring functions

One of the advantages of the integration of much of the multimeter circuitry is the possibility of incorporating extra facilities within the multimeter. One typical example is temperature measurement—and several multimeters are now available with just such a facility.

Uses of a temperature probe are many—from simple temperature adjustment in consumer servicing to

circuit trouble-shooting. Servicing freezers or air-conditioning systems cries out for temperature measurements, and carrying a separate instrument just for that purpose is not always feasible. Identifying circuit faults by identifying hotspots is greatly speeded up if it is only a question of switching leads instead of instruments when working around a suspected overheating component.

A typical temperature probe is shown in Fig. 7. The whole of the circuitry required is built into the probe tip. This particular probe measures from -60 to +200°C with a 0.1°C resolution. The only limitation is that the voltage at the probe tip must not exceed 60 V. Another useful feature often built into instruments and/or probes is a data hold, allowing measurements in difficult places without having to look continuously at the instrument display.

Measuring leads

An important accessory often overlooked is the measuring

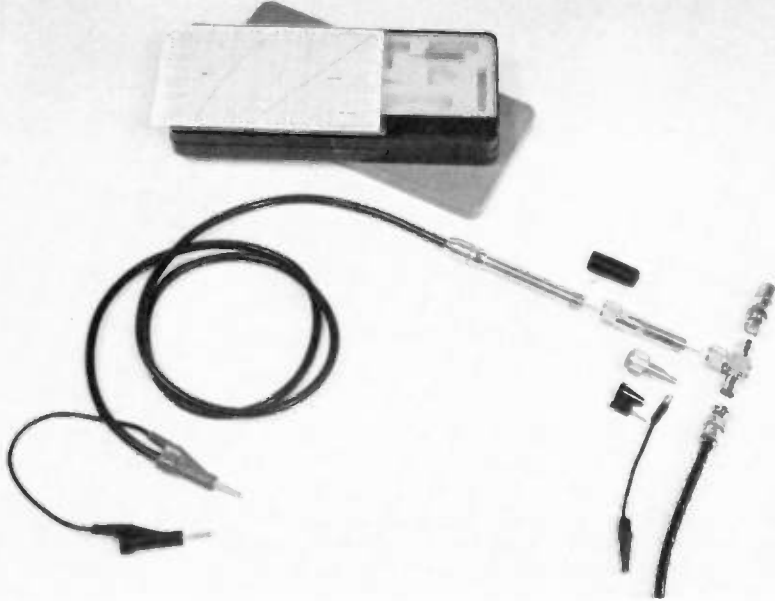


Fig. 6 This sophisticated high frequency probe works up to 1 GHz with a particularly flat response between 100 kHz and 10 MHz. A whole range of adapters is provided to meet a variety of measuring requirements.

leads—normally supplied with the meter. Bad quality leads reflect on the quality of the instrument so most manufacturers take some care in providing leads.

To protect the user the probe tips are designed to the German VDE standard 425/1.53. Such a probe is tested for example to 4 kV. As mentioned before, a sharp point is essential to stop the probe tip from slipping off the test point—and this also allows breaking through insulation, such as varnish. To increase testing versatility, probe tips should be loosely connected to the measuring leads. This allows direct connection of the leads to 4 mm sockets and other circuit connections—such as crocodile clips.

The leads are made of stranded wire to give sufficient flexibility. A special silicone rubber coating is used which can cope with temperatures from -100 to +300°C—so the lead will not burn if it touches a soldering iron tip. The use of stranded wire also means that the lead will not break on sharp points—the wire here has a 1 mm² cross section made up of 512 strands. Experience shows that 1 meter is the ideal length. A further point is that the probe is the same length as the width of the meter to fit easily in the meter carrying case.

Power supply flexibility

Most multimeters are battery operated. For laboratory use or on any workbench, the use of batteries can be eliminated using a line voltage supply unit. A typical example usually provides 6, 7.5 or 9 V and can be used to power several instruments. However, many requirements need fairly continuous battery operation—and especially with



Many range extension and shock absorption accessories are available to make your meter a more versatile instrument.

digital units power demands can be high. Power savings by switching off the display after a fixed short time help, but the answer often lies in rechargeable batteries.

Any rechargeable battery unit should have the recharging unit built in—and the multimeter should be usable even during recharging. Recharging should be possible overnight. Rechargeable batteries are almost essential for field work, but also important is some form of protection for an instrument which is going to be carried around—often at the bottom of a tool bag. The simplest protection is a type of rubber ring that fits around the meter case and absorbs shocks.

Even better protection can be provided by a shock resistant carrying



Fig. 7 A temperature measuring capability is useful addition to a multimeter, enabling many measurements to be speeded up—from regular servicing as shown here to electronic circuit troubleshooting.

case. This type usually has padding on the inside for shock absorption. A simpler case is designed to be resistant to weather and chemicals. Both have the facility to switch off the instrument when the case is closed.

System development

More and more emphasis is coming on the use of multimeters in automatic test and measurement systems. So many accessories are now appearing which provide interface boards, data bus connections, remote controls and so on. But that really is a different subject.

But whatever the job and multimeter used, thoughtful selection of accessories can do much to improve the versatility and range of the instrument—make it simpler and safer to use. **ETD**

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

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

1. No back orders. Your

distributor won't do that to you, because we won't do it to him. And you'll get sets out faster.

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

In addition you get great margins, and complete

technical information on every package.

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

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

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

WEP
WORKMAN
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Semiconductors From
The Parts Specialists

Circle No. 133 on
Reader Inquiry Card

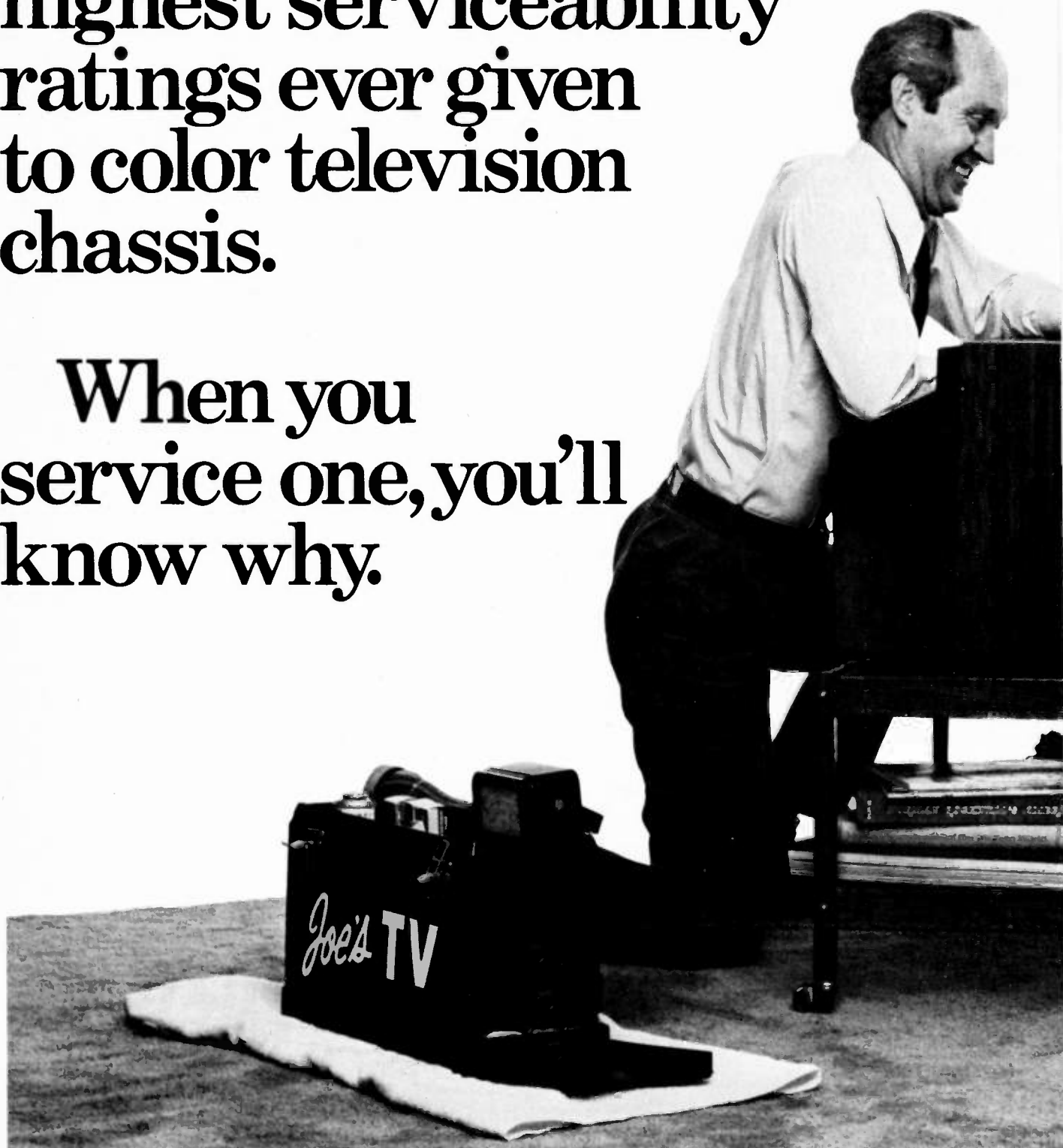
**WEP REPLACEMENT
SEMICONDUCTORS:
THEY HELP YOU TURN
JOBS AROUND FASTER.
AND KEEP THEM TURNED AROUND.**



WAITING ON PARTS

**Two of RCA's new
XtendedLife Chassis
have been awarded the
highest serviceability
ratings ever given
to color television
chassis.**

**When you
service one, you'll
know why.**



Sooner or later, every television set requires service by a professional. So RCA designed two new XtendedLife Chassis to make servicing easier for any professional service technician. These new chassis are easily accessible and clearly marked.

To prove it, we invited NESDA/ISCET (the International Society of Certified Electronics Technicians) to send a team to inspect and evaluate our new CTC88AC and CTC93D chassis. And they gave them the highest serviceability ratings of any color television chassis they have ever tested.

RCA CTC88AC chassis	93.90%
RCA CTC93D chassis	91.92%

Two new RCA color chassis receive "excellent" ratings—highest in NESDA/ISCET history.

Here are a few of the reasons:

- The wire pattern* is printed on both sides of the circuit board, making it easy to trace out individual circuits.
- Schematic symbols* identify each component on the board.
- All power supply source voltages and key pulse voltages* are identified.
- All key test points* are marked on the chassis, with their functions on the Cabinet Layout Chart.
- An Active Device Location Guide* in the cabinet reduces the need for service books or diagrams.
- The chassis slides back* for better accessibility in normal field servicing.

These new chassis earned their high ratings from some of the toughest judges around—professional, independent service technicians. And when the testing was done, and scores were in, here's what the leader of the ISCET team had to say:

"The scores are important, and they are very good; but of greater importance is the result of RCA's efforts in making sets easier to service, which will earn the recommendation of thousands of technicians who will be working with these chassis for years to come." —Dean R. Mock, Chairman, NESDA/ISCET Serviceability Committee.



Pricing for profit

From ET/D's upcoming management manual

The ability to present your costs accurately can spell the difference between success and failure.

By Dick Pavek*

(EDITOR'S NOTE: This Fall *ELECTRONIC TECHNICIAN/DEALER MAGAZINE* is publishing a hard bound desk-top reference for the professional electronic serveshop. Entitled *MODERN SERVICESHOP MANAGEMENT*, the volume will provide the user with a basic reference and source of business, financial, management, technical, and business expansion ideas. "Pricing for Profit" is one of these chapters. To give you, our readers, a better idea of what you will find within the pages of *MODERN SERVICESHOP MANAGEMENT*, we present here Mr. Pavek's article).

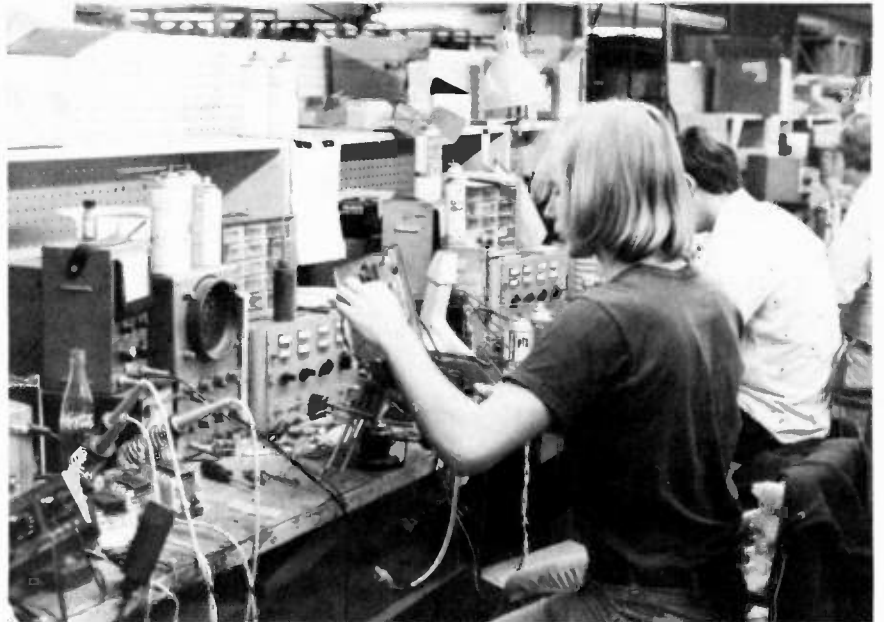
Pricing of service work is the single most important job for a service manager to know how to do. I say critical because this one thing will make or break his business faster than any other.

In order to price properly, he must be able to do two things well. The first is to know what his costs are and the second is to be able to present those costs, plus a reasonable profit to his customer and collect them. The selling of a price is more difficult than the selling of the repair. Knowing how to put the price down on a piece of paper is not enough, the bill has to be presented and collected too.

Knowing what your costs are

Costs are not just the monthly bills, payroll and those things directly involved with the repair of a set. Costs include a share of the ad in the Yellow Pages,

*President, Tech Spray, Inc.



A modern electronics serveshop workbench were each tech is equipped with his own work area, plus all necessary parts at his fingertips (Photo courtesy PTS Electronics).

depreciation on equipment, and the wasted time when you pay technicians to do nothing because "the truck isn't back" or whatever. Naturally, it is to your best interests and to those of your customers to keep these things to a minimum, but there is a certain amount that can't be helped and must be accounted for.

I might say a word here about tough dogs. There are generally two schools of thought. One school says that they are the customer's responsibility and should either be billed to the customer or averaged out across all the sets worked on. The other school says either tough dogs are your fault and the cost should be absorbed by you or they aren't your fault; but, you have to absorb them anyway. Actually both schools have a point and are both partly right. Here's one way to look at it.

Occasionally a set will come along where you or one of your men will make

an error in diagnosis or simply overlook something. These cannot be blamed as 'tough dogs'. A mistake is a mistake, and an honest business man will neither charge his customer for them or average them out over all his jobs. Neither does your customer have an obligation to pay you while you are learning something you pretend to know when you accept the set for service.

On the other hand, some sets are simply elusive enough to defy the best technician and run him a race for a long time. The cost to repair these sets must be averaged into your overall shop cost or you will end up on the short end of the profit stick.

In order to determine what your costs are and how to apply them to your hourly rate, you must be able to accurately compute your costs and project them to include you future growth over the coming years. After all, you are not figuring how to charge for the sets

Figure 1.

	Total Expense	Service Category			
		TV	Auto Radio	Stereo	Other
Advertising					
Vehicle Expenses 1.					
2.					
3.					
Vehicle Depreciation 1.					
2.					
3.					
Rent					
Depreciation on equipment					
Office Wages					
Accounting					
Telephone/Utilities					
Supplies, Misc.					
Taxes					
Insurance					
Shop Wages					
Tech. # 1.					
2.					
3.					
4.					
5.					
Service Mgr.					
Total Sales Less Salaries for Sales =					
Owner:					
Total Less Sales					
Interest on Investment					
Investment ___ x ___ % =					
Profit					
Sales ___ x ___ % =					
TOTAL					

and service charge. This instance is a good example of the difference between planning to be small and planning to be large. If you scrimp when figuring costs, planning to cut corners and get by for awhile, you will find yourself just getting by years from now.

Note that this chart in Fig. 1 is set up to include several types of service. Breaking it down this way looks complicated. It is not. It is quite simple to use and has the distinct advantage of being accurate for all types of service. Many shops that do mostly TV service lump all their expenses under TV and do not allocate enough to other types of repair.

This causes a double error. First, the other types of service do not return enough to be actually profitable. Second, the service manager sees the small dollar figure being brought in and tends to discourage that type of service. This false reasoning has caused many shops to completely miss out on a potentially good addition to the profit of the shop.

Line by line examples of how to use the chart are shown in Fig. 2 for a shop that sells TVs and services TVs, auto radios and stereos. Please refer step-by-step through this service operation.

Advertising

Here you simply divide the portion of advertising (don't forget the Yellow Pages) that was devoted to each type. This is important because you will probably find that the proportions do not actually correspond with the service revenue produced. For example: 75 percent of your ads may stress TV, 15 percent stereo and 10 percent auto radio, while your actual service revenue may run 60 percent TV, 25 percent stereo and 15 percent auto radio. You will not know your actual costs unless you divide by the percentage of ad space. (This will also show you where you get the best dollar return on your ad investment and where your ad dollars should go. See Fig. 2.)

Vehicle expenses

To properly calculate your vehicle expenses, you need to consider what percentage of your work is brought in for repair. Most shops insist on auto radio being brought in for repair. For example, very little vehicle expense should go toward auto radio expenses in this case.

A shop might find that all stereo and auto radio work is brought in while all TV

you've already serviced, but for those you service in the future.

The best way to do this is to figure your past costs for each item and then project them individually to cover expected future increases. This is not as tricky as it sounds. The way to approach this is to use a basic form such as the one shown in Fig. 1.

Estimating last year's data

You estimate. But you must be careful to be realistic. First, you divide the percentages of service arbitrarily by what you intend to solicit, if you plan to devote 80 percent to TV and 20 percent to stereo, you simply use those figures for the first year. However, you must change them to the actual percentages after you have

had a year's experience.

You can also tell what percentages of your advertising budget will go to the different categories for telephone, supplies, estimated taxes, most other categories. There is, however, one area of danger for the one man shop. It is the wife that 'is going to help out with the phone and the books'. There is nothing wrong with having a wife willing to put her energy into your project to help it get started. And there is nothing wrong with her intention not to be paid for a period of time.

What is wrong is the failure to make some allowance for wages for her time. Why? Because if you don't make that provision now, how do you add it later on? Make the allowance now and you won't have to change your costs

service is brought in on the truck. The truck is needed either to service it in the home or to bring it in. In this case, virtually all vehicle expense is to be charged to TV service. Perhaps 5 to 10 percent should be charged to stereo and auto radio, which would cover parts pick up.

Depreciation on vehicle

A simple way to determine vehicle depreciation is to ask your truck dealer how much that model truck (or trucks) depreciates in a year. This is certainly accurate enough for this purpose. Remember, you need to recover this much each year. The percentages assigned to the individual service work will be the same as truck expenses. Except, of course, that the dollars involved will be different.

Rent

The percentages of rent should be divided between the various categories by calculating the floor space used for each one in the shop. Do not consider the front display area when calculating these percentages. It will automatically be figured in when the percentages are divided into the total rent. There is an exception to this. When you sell sets, you must exclude all the rent for the floor space used for set sales in these calculations. This is done before you calculate the rent portion.

Office wages

This includes telephone answering service charges if you use one. If your wife or other member of the family works to help the business, and you do not pay them a separate wage, you should include a reasonable amount here for them. It is really better to pay them separately. But if you do not, at least this will provide something at the end of the year in the 'profit' to have made it worthwhile.

Office wages should be divided between the types of service by considering the number of jobs you do in each category. This is easy if you keep separate batches of invoice numbers. Until you do, you can get a fair estimate by counting the invoices for a month by category. Incidentally, this is a good way to begin to find out where the shop's work is coming from. It's easy for shop managers to overlook the importance to them of some of their servicing income just because TV sets take up so much more space than the smaller electronic equipment.

NOTE: Do not include in office wages any time charged to the selling of TV

	Total	TV	Auto Radio	Stereo	Other
Advertising	\$1200.00	\$900.00	\$120.00	\$180.00	—
Vehicle Expenses	\$1000.00	\$900.00	\$ 50.00	\$ 50.00	—
Vehicle Depreciation	\$ 800.00	\$720.00	\$ 40.00	\$ 40.00	—
Rent Total 12000.00 less sales 7000.00 Serv. Dept. 5000.00	\$5000.00	\$4500.00	\$200.00	\$300.00	—
Depreciation equipment	\$ 650.00	\$250.00	\$200.00	\$200.00	—
Office Wages	\$6000.00	\$4000.00	\$1000.00	\$1000.00	—
Accounting	\$ 600.00	\$400.00	\$100.00	\$100.00	—
Technicians Wages					
#1	\$16000.00	\$16000.00	—	—	—
#2	\$15000.00	\$12000.00	—	\$3000.00	—
#3	\$12000.00	\$ 3000.00	\$6000.00	\$3000.00	—
Service Mgrs. Wages Total Less Sales Net: \$20,000 - \$4,000	\$16000.00	\$14000.00	\$1000.00	\$1000.00	—
Owners Wages Total Less Sales Net: \$20,000 - \$10,000	\$10000.00	\$ 9000.00	\$ 500.00	\$ 500.00	—

A typical cost allocation workchart

sets or radios. Expenses for counter sales have to be charged elsewhere.

This includes not only the paychecks you have written, but also includes the social security you withheld and the social security you contribute and the withholding taxes you withheld from your employees checks. It also includes workman's compensation and employee insurance payments (both withheld and contributed by you). The easiest and most accurate way to work up your payroll costs is to take the year end totals for all of your office workers instead of starting from the wages per hour. This way automatically adjusts for

the overtime you paid.

Take the (1) total wages from the W2 forms, your contribution to, (2) FICA (SS) taxes, (3) employee insurance, (4) profit sharing, (5) retirement fund payments. Be careful not to use the withholding of FICA figures from the front of the W2 form, because tax is included at the total wage section.

Depreciation on equipment

This should definitely be allocated strictly according to the category the equipment is used to service. For example, depreciation of equipment with TV benches (and TV trucks) is

charged to TV service, while the equipment on the auto radio bench is entirely charged to auto radio service.

Accounting costs

Unless you have formal training, you will probably need a professional accountant in order to take advantage of all your proper deductions for expenses. First deduct a reasonable portion for your sales department. The remainder should be split according to the number of jobs done. Use the percentages you came up with when you divided the office wages.

Telephone, utilities, supplies, taxes and insurance. Again, separate out a reasonable portion for the sales department and divide the rest according to the number of jobs done. Do not include payroll taxes or hospital insurance here.

Service department wages

First, you will need to separate your technicians by service category. In a few cases you will need to apportion a technician's wages between two or more categories. You can do this accurately by checking his time cards, or you can estimate the proportion to go to each category. When figuring total wages, you will need to include all the extras as described under office wages. Enter the total of each technician's wages in the appropriate category. Some special care must be taken with your shop manager's salary and with yours.

First, the manager, if part of his time is involved in sales (of sets, not of service), the salary representing the portion of his time taken up by the sale of sets must not be included in your costs per hour for service work. Only the time spent on the service department can be counted.

The same holds true for you and your time. With this one additional thought—only count your productive time. If you spend half of your day drinking coffee with your buddies, playing golf, or tending to your garden at home, you cannot properly pay yourself a full salary and also the "reasonable profit" which shows up later on in the chart. A half salary would be more appropriate.

On the other hand, many owners, especially in small shops, work a full forty-hour week in a truck, on the bench, or acting as a service manager. These men deserve both a full salary and a profit on their business as well.

Now we come to Return On Investment And Profit On Service Sales. Return on investment or interest on

loans. You have invested a certain amount of money in your business. Either you went to the bank to borrow the money for your equipment and parts, or you paid for it out of your own pocket.

In either event, a return on investment must be included. If you owe the bank, this covers your interest payments. If you don't owe the bank, you get to keep it, which is proper. If you had invested it elsewhere, you would have expected a return, so why loan your money to your business free. Eight-to-10% is reasonable here, or you can check and see what your bank is charging for commercial loans. Figure up your total investment in parts and equipment. (Be sure to take the depreciated cost of your vehicle, not the purchase price, as you have already allowed for depreciation.

Multiply your investment by the interest percentage. This usually will be pro-rated between the categories in the same ratio as your cost of equipment.

Profit

Profit needs to be planned for or it will not exist when you expect it to be there. A profit of at least 10% is reasonable and is figured by multiplying the service sales total for each category by 10%. Place these profits under their correct categories. In the above case we assumed total service sales of \$100,000.

Calculating your cost/hour

This completes the data necessary to figure the cost per hour part of our calculations. Total the columns for each category and divide the answers by the salaries paid in each category. For some shops this will be easy. Those are the shops that are departmentalized. For those of you who have a shop where your men work in more than one category of service, you will have to calculate what portion of their time went to each category. The simplest way to do this is by estimating. It is also very inaccurate. A more accurate way is to do a ratio study of the charged-out time for each man.

One caution: do not include all your time or your service manager's at this point. This system spreads the managerial cost over all of the technicians. Only include that portion of your time and your manager's actually spent in the repair of sets. Let's restate this: to find your total technician hours, add from the quarterly payroll records the total paid-for hours of all the technicians (separated by categories). Add the straight time and overtime hours together equally. Add only that portion of

your hours and your manager's hours that were actually spent repairing or servicing.

Efficiency ratio

Now that you have your costs per man hour you must consider your shop's efficiency. Just because you paid for 40 hours work doesn't mean that you get to charge for 40 hours does it? Of course not. You paid for coffee breaks, trips to the doctor, time out to get a flat fixed and all the other odds and ends of delays that crop up.

There is a simple way of determining your shop's efficiency, if your time cards show an accountable time (time actually spent on the job). If they don't, it will pay you to run an efficiency study for two weeks and find out.

Just have your men keep a record of when they start a job and when they finish with notations for breaks, time off, and for non-productive work. At the end of the two weeks, add up all of the productive time. Then add up all the paid-for time and divide the productive time by the paid-for time. The result is your efficiency ratio. You may find that your ratio is as high as .75 or as low as .35. If it is .35, you are in trouble and you had better tighten up because some of your competitors are going to be working at .60 or .70 efficiency, and their prices will run rings around yours. However, if your ratio is .65 to .75, you are in pretty good shape and need not fear being undercut by a successful shop. It is best to be cautious here, most shops are not as efficient as they think they are.

Figuring your hourly rate

Now that you have your cost per hour and your efficiency ratio, it is easy to calculate what your hourly rate must be. Simply divide your cost per hour by the ratio number, and you will have the hourly rate that you must charge in order to be successful and survive. (See Fig. 3. Note that we assumed a cost per hour of \$15.) Do this for each category.

I would like to emphasize here that it is absolutely vital that you repeat this process each year. If you don't, sooner or later you are going to run into trouble.

Pricing the job

Now that you know your hourly rates, the rates that you wish to charge, you need to translate this to the actual job. There are many methods by which you can do this. Some are much better than others.

Flat rate service

This is the simplest to do and the worst, *continued on page 52*

Make your test equipment do more

Standard equipment, non-standard uses

Do some tubes read "GOOD" on your tube checker only to fail in the set? Have you ever tried to check out the UHF tuner during a service call only to find the UHF stations were off the air? You can quickly handle these problems, and many others with your present test equipment after reading this article.

By Bernard Daien

Tube testers are useful devices, but they have their limitations. Unfortunately, these limitations are seldom discussed in the literature available to servicemen. In order to use a tube tester intelligently, these limitations must be understood.

A good general rule is: If the tube reads "BAD" on any test, discard it. If it reads "GOOD," it may either be good, or bad. Which brings us to the question, "How do I know if a tube that reads good on my tester is really good?"

Whenever you test emission, drop the filament voltage to the next lower voltage on the dial. Thus, a six volt tube would be tested at five volts. If the emission falls into the bad range, replace the tube since it is at end of life and has no reserve emission. It would also perform poorly when the line voltage is low. *This test will weed out vertical and horizontal deflection output tubes, a common cause of trouble.*

To better understand the reason for this, consider that tube testers apply either pure dc, or rectified but unfiltered dc. Thus, the conduction angle may be 180° (Class B), or more. The resulting plate current is read on a typical average

reading milliammeter . . . note "average reading."

Consider, however, the conduction angle of deflection amplifiers, which run Class C. The conduction angle is much less than 180° in many cases. Thus, to achieve the same *average reading*, the peak current must be much higher. For simplicity, let us look at a tube handling a square wave, with a 180° duty cycle. If the tube handled one ampere while it was in conduction for a half cycle, and was cut off for the other half cycle, the average current read on the meter would be half an ampere. If the same tube were to conduct for 90° (a quarter cycle), and be cut off for three quarters of a cycle, it would have to draw two amperes while conducting, in order to have the same half ampere average current! Thus, you can see that deflection amplifiers which operate Class C, must handle very high peak currents. In plain words, they must have very high emission capability.

Since most tube testers cannot closely duplicate the conditions of TV deflection service, they may fail to weed out bad deflection amplifiers. This is why the vertical output tube that cannot make good linearity at the bottom of the screen (peak current point), still reads good on the tester.

Now let's look at another area where the tube tester falls short of true service conditions. High voltage rectifiers run at 30kv. Most tube testers run at only a few hundred volts. Your common sense tells you that problems that occur at 30kv often will not appear at 300v.

Minute amounts of gas will ionize at high voltage, like a neon tube, and leakage and arc over may only appear at high voltages. Thus, the only way to check a HV rectifier is in the set! I have personally seen many weird symptoms which cleared up when the HV rectifier

was changed, despite a good reading on the tester.

Another check that must be performed with intelligence, is the "leakage," or "gas" test. Some tubes suffer from grid emission *when fully heated*. Some tubes release gas from the surfaces and insides of the tube materials *when fully heated*. A tube is *not* fully heated when the filament reaches operating temperature! Consider a power amplifier tube operating at 400v and 200ma, or 80w input. Assuming the tube is running at 50% efficiency, the plate dissipation is 40w. The filament may be operating at 6v and 1.5a, for a total filament heating power of only 9w. You can see that this tube will run very much hotter if the plate is operating.

Now consider your tube tester. It has a gas and leakage test, but that test should be performed *only after the tube sits in the emission test position* (plate is powered) *for about five minutes* to assure warm up. Many tubes which read good on a quickie leakage check will show up definitely bad when tested in this manner. I am sure you have had a horizontal amplifier test good, but show up with a red hot plate, and tripping the circuit breaker after a few minutes of operation in the set.

Now you know why, and what to do about it. I have recently observed a significant percentage of new, imported, horizontal amplifiers, which do not pass this test. And invariably, such tubes had to be replaced within the warranty period.

Grid emission occurs when it is heated to the point where it becomes a cathode. Precautions are taken in manufacture to use grid materials which do not ordinarily emit readily, but impurities can contaminate

the grid . . . for example, minute amounts of the cathode emitter material may migrate to the grid, which is quite close to the cathode. Once the grid emits, grid current flows, and thus the grid is no longer a nonconductor. Bias is lost, plate current soars, and fireworks!

Finally, a tube may develop internal shorts only when heated thoroughly. Heating warps the internal structure causing elements to touch. Heat may also affect the heater to cathode insulation, causing HK shorts. (This is why an occasional pix tube develops HK shorts with a booster.) Again, testing for shorts AFTER sitting in emission test is helpful to weed these intermittent type shorts out.

You may argue, "This method of testing takes time." True. But time is an essential ingredient in many things. And you pass time charges on to the customer. But can you pass recall charges on to the customer? If you can't fix a set right, you have no business in our very complex profession. I know that many of the shops insist on 12 service calls a day per man. I also know the quality of their work, and so do the customers. Hit and run, slap in a tube, if it plays, go. Never mind that the convergence is poor, etc. Of course, the recalls will probably put the shop out of business in a few years, so the matter is self adjusting in the end. Unfortunately, we all get hurt by the image earned by a few. Yes, it takes a little more time to use your tube checker properly, but it will be doing what it is supposed to do . . . weeding out the bad tubes, after you supply the brains. But, after all, isn't that what you're there for?

Color bar generator kinks

Suppose you are on a service call! Your color bar generator is tuned to channel 3 (or 4). The TV set does not work well on the high VHF band, channels 7-13. Is it antenna trouble, or tuner trouble? Surprise . . . if you will tune the high VHF channels, you will find harmonics of the generator.

The same thing applies to UHF. Several harmonics generally are quite strong, and suffice to test if the UHF tuner is operating, even though there are no UHF stations on the air at the time. Just don't forget to transfer the signal generator to the UHF antenna terminals. (Never connect your generator to the antenna terminals with the antenna connected. Results are quite poor, and you will radiate an interfering signal into nearby sets.)

A quick, rough check of receiver sensitivity can be made with your

generator by holding the generator output leads close to, but not touching, the set antenna terminals. I clip the generator onto the *insulation* on the wires leading from the antenna terminals on the set back to the tuner. The resulting attenuated signal provides some indication of the set performance. A better method is make up an attenuator out of 1/2w composition resistors, using attenuation factors suitable for the area in which you service. Fringe areas would require more attenuation than primary service areas. A few tests in your shop should result in a pad tailored to your needs. Your generator can quickly show up poor sync, both vertical and horizontal, as well as weak color sync.

An invaluable use for your generator is in pacifying crank customers (and some con men), who insist that the set is not working properly after repairs, when the problem is in the customer's antenna system. The color bar pattern settles the question definitively. It also helps in demonstrating the need for a new antenna.

The color generator is also useful as a quick check on faults in the video and video IF. If no vertical bars can be tuned in on cross hatch, the high frequency response is down. If the vertical bars are much weaker than the horizontal bars, the same fault exists in lesser degree. If the situation can be radically improved with small movements of the fine tuning knob (with the AFT off), the problem is in the IF. The same goes for ringing problems. If, on the other hand, small changes in fine tuning have little or no effect on the ringing, or loss of high frequencies, the problem is in the video section. Vertical bars have very narrow width (fine detail), corresponding to frequencies above 2.5MHz. Horizontal bars run the full width of the screen, approximately 50msec duration, corresponding to a half wave at a frequency of 10kHz.

Try bypassing a high impedance point in the signal path of the video amplifier to ground with a .01mfd capacitor, and then look for the vertical cross hatch stripes. It's an interesting experiment.

Another use for the generator is checking out an antenna system that feeds several sets. Connect your generator into one of the lines normally feeding a TV set. You are now pumping a signal into all other sets on the line. You can quickly spot bad connections, miswiring, open lines, etc.

Some sets require the use of a milliammeter to set the efficiency (linearity) coil. This is inconvenient, and

sometimes requires the use of a soldering iron to open and reclose a jumper. The color bar generator does a good job here. Just set the coil slug for the best horizontal linearity, using the vertical lines as a guide. (You have probably used the horizontal lines for checking the vertical linearity control. It's the same principle.) And it's quick. Good linearity is at the same point as minimum current, or very close to it.

Chroma problems also can be checked with the generator set for color bars. If the color is faint, regardless of the fine tuning control setting, the problem is in the chroma section. If the color changes radically, with small variations of the fine tuning control, the problem is probably in the IF.

Procedure effectiveness

Using the tube checker as described, deflection tube failures, which had been an appreciable percentage of "in warranty" work, were reduced to the same level as other random failures. Sets pulled needlessly were reduced by over 75%. (Use of the color bar generator eliminated sets pulled for antenna defects.) Misalignment was quickly diagnosed. Lack of UHF stations for UHF tuner check was no longer a problem . . . as a result, service call time schedules were no longer a problem. It pays off to know how to get more out of your test equipment. **ETD**

WOOSY OWL HOOTS:

Shhhhhhh...
Noise pollutes, too.



GIVE A HOOT. DON'T POLLUTE



BULLETIN BOARD

A **Business Forms Catalog** published by New England Business Service, Inc. illustrates and describes a wide range of forms available for television and appliance sales and service businesses. Service orders of several types, many of which contain promissory note forms and guarantee and policy statements

are available. Also included are service orders with claim checks, service orders with both identification tags and claim checks and repair tags with claim checks. Tags, memo forms, envelopes, and business cards are other supplies also described. The catalog is free from *New England Business Service, Inc.*, Townsend, MA 01470.

"**Big Ugly**" a new heavy duty 2-conductor plug is described in a bulletin from Switchcraft. The manufacturer states, "Big Ugly," Part no. 173P1, is a larger than normal plug designed to hold

up under rough treatment, and features rugged construction, a cable strain relief clamp that withstands up to 20 pounds pull and a threaded frame for additional strain relief. It is designed for use by musicians and sound technicians in connecting amplified instruments, and amplifiers, mixers, speakers and microphones. New Product Bulletin 333 is available free from Sales Dept. *Switchcraft Inc.*, 5555 N. Elston Ave., Chicago, IL 60630.

Digital Low Resistance Ohmmeters are described in a new bulletin from James G. Biddle Co. Described is a product line that includes a basic measuring module and a choice of three power supplies; rechargeable batteries, dry cell pack, or AC power pack. Also shown is a special model for use where a test current of 100 amperes is required. A variety of test leads and connections is illustrated and described. Bulletin 24-1b is free from *James G. Biddle Co.*, Township Line and Jolly Roads, Plymouth Meeting, PA 19462.

A new **Surplus Electronics Catalog** of interest to technicians, dealers, educators and hobbyists has just been issued by ETCO Electronics. A wide variety of items is described from parts, components, and subassemblies to consumer, industrial, and educational equipment. ETCO claims low prices since their stock comes from surplus inventories, overstocks and bankruptcies. A free copy of the catalog can be obtained from: *ETCO Electronics*, Dept. 029, North Country Shopping Center, Rte 9N, Plattsburgh, NY 12901.

A **wiring components catalog**, revised and completely updated is now available from Panduit Corp. This catalog includes illustrated information on cable ties, clamps and marker ties, cable tie marking and mounting accessories, tools, wiring duct, spiral wrapping, terminals, splices and disconnects, identification markers and connectors, and accessories. New condensed catalog, Bulletin CC-4, is free from *Panduit Corp.*, 17301 Ridgeland Ave., Tinley Park, IL 60477.

"**The Electro-Mechanical House,**" a 112 page catalog has just been issued by Waldom Electronics, Inc. It presents a wide assortment of Hollingsworth solderless terminals and connectors, Molex nylon connectors, Bivar P.C. board hardware, Waldom Speedy-Tys®, spacers and electronic hardware. It includes some of the most popular hardware in kit assortments. Complete

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specifications and dimensional details are given for the thousands of items listed. The new catalog is free from *Waldom Electronics, Inc.*, 4301 West 69th St., Chicago, IL 60629.

A completely new, according to Cherry, **Keyboard Catalog** is now available. Included in it are Custom Designed Keyboards, a Keyboard Designer's Worksheet, Solid State or Gold Crosspoint Contact Keyboards, a complete line of Standard Keyboards, Gold Crosspoint Keyboard Switches and molded keycaps. The catalog features diagrams, photos and specifications. It is available free from *Cherry Electrical Products Corp.*, P. O. Box 718, Waukegan, IL 60085.

"**Technician's Guide To Microelectronics**," by John Douglas-Young, recently published by Parker Publishing Company is an introduction to the basic concepts of integrated circuits, both digital and linear and the troubleshooting of equipment using them. It gives a thorough basic explanation of the fabrication of MOS devices, of basic logic, and logic families, and troubleshooting techniques and also, the basics of analysis of linear ICs and microwave micro-

electronics. The "Technician's Guide" is written at a very useful level for the technician who needs to quickly put troubleshooting techniques to work. "Technician's Guide To Microelectronics" is available from; Mark Bently, Dept. GC-501, Mail Order Sales, *Parker Publishing Co.*, West Nyack, NY 10994.

"**From Sundials to Atomic Clocks**" is The National Bureau of Standards new publication on the evolution of clocks and timekeeping concepts. The basic mechanisms and principles employed down through the ages are explained and theory covering resonances, accuracy and stability is covered in a non-technical style without getting involved in higher mathematics. The book explains the essential relationships between clocks and frequency standards and between the complementary concepts of time and frequency. Other sections of the book deal with the relations between human time and the sun, moon, and stars; how time is coordinated all over the earth; how time signals are disseminated from government laboratories to users; and how time information is used as an essential component of diverse modern systems and

processes, ranging from television and other communication systems to electric power networks and navigation systems. The last section provides an overview of how the concept of time is intimately bound to many aspects of modern science and technology, with chapters on the topics of physics (gravity, relativity, symmetry), astronomy and cosmology, and feedback systems. The book closes with a chapter exploring some of the possibilities for future improvements in clocks and timekeeping. "From Sundials to Atomic Clocks" is a large format (20 x 26 cm), 175-page paperback. It is available from the *Superintendent of Documents*, U. S. Government Printing Office, Washington, D. C. 20402 (NBS Monograph 155, Stock No. 003-003-01650-1); price \$4.

An updated audio products catalog has recently been released by Mura. The new eight page, color brochure covers Mura's wide range of audio equipment with applicational and detailed specifications. A wide variety of microphones, stereo headphones, accessories and the Muradapter is featured. Catalog MAPC-178-10 is free from *Mura Corporation*, 177 Cantiague Rock Road, Westbury, NY 11590.

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VIZ Test Instruments Group 335 E. Price St. Philadelphia

Circle No. 132 on Reader Inquiry Card

ET/D - October 19.

TEST INSTRUMENT REPORT

The properly equipped service shop needs several instruments which can be relied upon to give rather exact answers to measurement questions. Modern digital voltmeters and frequency counters now give excellent accuracy at modest cost. A good LCR bridge can make component testing also more certain.

LCR bridges have been available as

for all R, L or C measurements.

Without really precise inductance and capacitance standards it was difficult to check the L and C ranges for absolute accuracy. Measuring several 5% and 1% capacitors and an assortment of inductors from a 10mh air core R.F. choke to large iron core filter choke, indicated good accuracy. Low Q chokes require alternately nulling the main RCL indicator and the D-Q dial for a good null, as do electrolytic and other lossy capacitors.

The LCR-740 is convenient to use with push button range selection, slide switch selection of L, C or R, and five-way binding posts for the unknown. It has a ten-turn dial for null balance, which is a little slow when running through the entire range. The only control which presents any problem though, is the sensitivity control. It needs a vernier or a different taper, for on most ranges, when using an ac source, it changes from no reading to full scale on the meter in about 15 degrees of rotation making on scale settings difficult. Hopefully this was simply a quirk of the particular instrument tested.

The LCR bridge as indicated earlier can provide a accuracy of component measurement not otherwise obtainable at reasonable cost. Being able to really know component characteristics with accuracy can sometimes answer service questions that can otherwise be time consuming to work around by substitution or other methods. **ETD**

Specifications

Resistance Measurement

Range	0.001Ω to 11MΩ in eight ranges with +10% extension at each range.
Minimum Resolution Accuracy (at 20° ± 5°C)	1mΩ (0.001Ω) Range: 1Ω - 100kΩ ±(0.5%+0.1% f.s.) 1MΩ ±(1%+0.1% f.s.) 0.1Ω ±(2%+0.1% f.s.)
Residual Terminal Resistance	Approx. 3mΩ

CAPACITANCE MEASUREMENT

Range	1pF to 11,000mF in eight ranges with +10% extension at each range.
Minimum Resolution Accuracy (at 20° ± 5°C)	1pF. Range: 1000pF - 100μF ±(0.5%+0.1% f.s.) 100pF ±(1%+0.1% f.s.) 1000μF ±(3%+0.1% f.s.)



For more information about this instrument, circle 140 on The Reader Service Card in this issue.

Leader Electronics' LCR Bridge Model LCR-740

For greater accuracy

By Walter H. Schwartz

laboratory instruments for many years. RC bridges of lesser accuracy are available at low cost, but few shops are able to measure resistance and capacitance to an accuracy of 1% or better, and fewer still can measure inductance at all.

The Leader LCR-740 can measure each of these at a claimed accuracy of 0.5% throughout most of its range. It uses a conventional Wheatstone bridge for resistance measurements and standard derivations of it for capacitance and inductance. The dc source is a 9v battery which also supplies power to the 1Khz ac source and the ac null detector.

Measuring an assortment of 0.05% resistors confirmed 0.5% or better accuracy. Many of the resistor measurements were much closer than the claimed accuracy would require. The higher resistance ranges show a poor dc null because of the low voltage source used, but this can be remedied in two different ways. Provision is made to use an external high voltage source with a current limiting resistor, or the source can be switched to ac if the resistor is non-inductive. The gain of the meter amplifier is sufficient for a very good null

DEALER'S SHOWCASE



Marine Radio

Circle No. 141 on Reader Inquiry Card

SBE has just announced a new 78 channel VHF marine transceiver with a microprocessor scanning receiver. Designated The Sea Command SVC-9708, the transceiver has dual keyboards which allow direct entry of any domestic/international channel, scan for active weather, Coast Guard, navigational, telephone, commercial fishing, or receive only police channels, priority

override, scan for marine channels, scan of ten selected channels and lock to an active channel. Other functions keyboard selectable include local or remote operation, use as a hailer or as a foghorn, high or low power and channel 16 automatic revert. Full remote control is available. The SCV 9708 is priced at \$799.00.

Pre-recorded Videocassettes

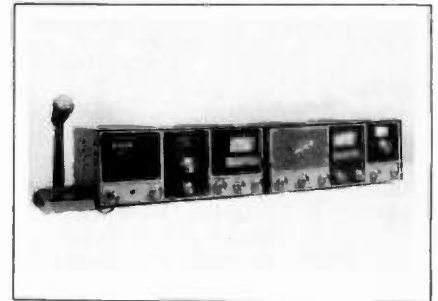
Circle No. 142 on Reader Inquiry Card

Blackhawk, Inc. has announced a new retail sales program called Hollywood Gold. Hollywood Gold is a package of 110 contemporary, classic, sports and documentary films recorded on both VHS and Beta format videocassettes.



CB Base Station

Circle No. 143 on Reader Inquiry Card



Browning Laboratories, Inc. has just announced the latest in their series of Golden Eagle AM/SSB CB Base Stations—the Mark IV A. Similar in appearance to its predecessor it is claimed that it is extensively redesigned internally with "state of the art" devices and circuits, notably a totally new frequency

Looking for Original Japanese Replacement Parts for CB, TV and Stereo ?

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2SA 473	.45	55	.60	2SC 373	.20	27	30	2SC 1013	.50	.64	.70	2SK 68	.40	.45	.50	UPC 20C	2.10	2.50	2.80
2SA 484	1.90	2.10	2.40	2SC 380	.20	27	30	2SC 1014	.50	.64	.70	2SK 22Y	1.40	1.60	1.80	UPC 563	1.90	2.10	2.40
2SA 485	1.90	2.10	2.40	2SC 381	.30	.40	.45	2SC 1016	.70	.80	.90	3SK 35	1.30	1.45	1.60	UPC 575C	1.30	1.45	1.60
2SA 488	1.10	1.25	1.40	2SC 382	.30	.40	.45	2SC 1039C	1.80	2.10	2.40	3SK 37	1.80	2.10	2.40	UPC 576	1.90	2.10	2.40
2SA 495	.25	.35	.40	2SC 387A	.30	.40	.45	2SC 1060	.70	.80	.90	3SK 39	1.30	1.45	1.60	UPC 592H2	1.80	2.10	2.40
2SA 497	1.00	1.20	1.30	2SC 394	.30	.40	.45	2SC 1061	.70	.80	.90	3SK 40	1.30	1.45	1.60	UPC 1008H	1.90	2.10	2.40
2SA 509	.30	.35	.40	2SC 458	.20	27	30	2SC 1079	3.40	3.55	3.90	3SK 41	1.30	1.45	1.60	UPC 1008C	5.00	5.30	5.90
2SA 537A	1.50	1.70	1.90	2SC 481	1.30	1.40	1.50	2SC 1080	3.40	3.55	3.90	3SK 45	1.30	1.45	1.60	UPC 1020H	1.90	2.10	2.40
2SA 561	.30	.35	.40	2SC 1166	.30	.40	.45	2SC 1098	.45	.55	.60	3SK 48	3.40	3.55	3.90	UPC 1025	1.90	2.10	2.40
2SA 562	.30	.35	.40	2SC 482	1.10	1.25	1.40	2SC 1098	.50	.64	.70	3SK 49	1.30	1.45	1.60	UPC 1156	1.90	2.10	2.40
2SA 634	.40	.45	.50	2SC 485	1.30	1.40	1.50	2SC 1111	2.10	2.50	2.80	AN 214D	1.30	1.70	1.90	UPD 857C	8.00	8.40	9.50
2SA 643	.30	.40	.45	2SC 496	.45	.55	.60	2SC 1114	4.20	4.40	4.90	AN 239	4.20	4.40	4.90	UPD 858C	8.00	8.40	9.50
2SA 673	.30	.40	.45	2SC 497	1.10	1.25	1.40	2SC 1115	2.50	2.70	3.00	AN 247	2.50	2.70	3.00	PLL 01A	3.00	4.70	4.60
2SA 683	.40	.53	.59	2SC 509	.30	.40	.45	2SC 1116	3.20	3.40	3.70	AN 274	1.50	1.75	1.95	PLL 02A	5.00	5.30	5.90
2SA 684	.40	.53	.59	2SC 517	3.00	3.20	3.40	2SC 1116A	3.40	3.55	3.90	AN 315	1.80	2.00	2.25	PLL 03A	7.60	8.00	8.80
2SA 695	.40	.53	.59	2SC 535	.30	.40	.45	2SC 1124	.80	.90	1.00	BA 511A	1.80	2.00	2.25	IS 184	.45	.55	.60
2SA 699A	50	64	70	2SC 627	1.30	1.45	1.60	2SC 1127	.80	.90	1.00	BA 521	1.90	2.10	2.40	IS 188	.16	.18	.20
2SA 706	85	100	1.10	2SC 696	1.00	1.20	1.30	2SC 1162	.70	.80	.90	HA 1139	2.50	2.70	3.00	IS 332	.35	.40	.45
2SA 719	.25	.35	.40	2SC 710	.20	27	30	2SC 1172B	3.20	3.60	3.95	HA 1156	1.60	1.80	2.00	IS 953	.16	.18	.20
2SA 720	.25	.35	.40	2SC 711	.20	27	30	2SC 1173	.50	.64	.70	HA 1308W	2.00	2.20	2.50	IS 1007	.35	.40	.45
2SA 733	.20	.27	.30	2SC 712	.20	27	30	2SC 1177	11.00	12.90	14.00	HA 1322	2.50	2.70	3.00	IS 1209	.35	.40	.45
2SA 744	4.20	4.40	4.90	2SC 717	.35	.40	.45	2SC 1209	.25	.35	.40	HA 1339	2.50	2.70	3.00	IS 1211	.35	.40	.45
2SA 745R	3.60	4.00	4.40	2SC 730	3.00	3.20	3.40	2SC 1226	.50	.64	.70	HA 1392A	2.50	2.70	3.00	IS 1555	.20	.22	.25
2SA 747	4.20	4.40	4.90	2SC 732	.20	27	30	2SC 1226A	.50	.64	.70	HA 1392B	2.50	2.70	3.00	IS 1588	.20	.22	.25
2SA 847	1.40	1.50	1.59	2SC 733	.20	27	30	2SC 1237	1.80	2.00	2.25	LA 4031P	1.80	2.00	2.25	IS 1885	.16	.18	.20
2SB 54	.30	.40	.45	2SC 734	.20	27	30	2SC 1239	2.20	2.70	2.90	LA 4032P	1.80	2.00	2.25	IS 2076	.20	.22	.25
2SB 55	.40	.53	.59	2SC 735	.20	27	30	2SC 1306	1.30	1.70	1.90	LA 4400	1.90	2.10	2.40	IS 2093	.35	.40	.45
2SB 75	.30	.40	.45	2SC 756	1.50	1.80	2.00	2SC 1307	2.20	2.70	2.90	M 51513L	2.00	2.20	2.50	IS 2473	.16	.18	.20
2SB 77	.30	.40	.45	2SC 756A	1.50	1.80	2.00	2SC 1318	.30	.40	.45	STK 011	3.60	4.00	4.40	IN 34	.12	.13	.15
2SB 186	.20	.27	.30	2SC 775	1.40	1.60	1.80	2SC 1364	.30	.40	.45	STK 015	4.20	4.40	4.90	IN 60	.12	.13	.15
2SB 187	.20	.27	.30	2SC 776	2.00	2.20	2.50	2SC 1383	.30	.40	.45	TA 7055	4.50	5.00	5.60	1001	.25	.35	.40
2SB 324	.25	.35	.40	2SC 777	3.00	3.25	3.50	2SC 1384	.30	.40	.45	TA 7055P	2.00	2.20	2.50	10010	.45	.55	.60
2SB 367	1.10	1.25	1.40	2SC 778	2.90	3.20	3.40	2SC 1400	.30	.40	.45	TA 7060P	90	1.10	1.20	VD 68	.25	.35	.40
2SB 495	.25	.35	.40	2SC 781	2.00	2.20	2.50	2SC 1403	3.20	3.40	3.70	TA 7061P	90	1.10	1.20	W2 050	.20	.22	.25
2SB 497	.70	.80	1.00	2SC 784	.35	.40	.45	2SC 1419	.60	.70	.80	TA 7062P	1.10	1.25	1.40	W2 051	.20	.22	.25
2SB 434	.80	.90	1.00	2SC 789	.80	.90	1.00	2SC 1475	.70	.80	1.00	TA 7089P	2.00	2.20	2.50	W2 052	.20	.22	.25
2SB 473	.70	.80	1.00	2SC 793	2.00	2.20	2.50	2SC 1567A	.60	.70	.80	TA 7129P	1.30	1.50	1.90	W2 071	.20	.22	.25
2SB 474	.70	.80	.90	2SC 799	2.00	2.20	2.50	2SC 1657	.25	.35	.40	TA 7203P	2.50	2.70	2.90	W2 075	.20	.22	.25
2SB 507	.70	.80	1.00	2SC 828	.20	.27	.30	2SC 1678	1.30	1.45	1.60	TA 7204P	2.00	2.20	2.50	W2 081	.20	.22	.25
2SB 511	.70	.80	.90	2SC 829	.20	.27	.30	2SC 1687	.40	.45	.50	TA 7205P	1.60	1.80	2.00	W2 090	.20	.22	.25
2SB 536	1.00	1.20	1.30	2SC 838	.30	.40	.45	2SC 1728	1.00	1.20	1.30	TA 7310P	1.30	1.45	1.60	W2 120	.20	.22	.25
2SB 557	2.10	2.50	2.80	2SC 839	.30	.40	.45	2SC 1778	1.50	1.75	1.95	TBA 8105H	1.90	2.10	2.40	W2 182	.20	.22	.25
2SB 595	1.10	1.40	1.50	2SC 867	3.20	3.40	3.70	2SC 1730	.45	.53	.59	TC 5080P	5.00	5.20	5.80	W2 260	.20	.22	.25
2SB 596	1.10	1.40	1.50	2SC 897	2.00	2.20	2.50	2SC 1760	.90	1.10	1.20	TC 5081P	3.00	3.20	3.40	W2 280	.20	.22	.25
2SB 600	5.00	6.00	6.60	2SC 900	.20	27	30	2SC 1775	.30	.40	.45	TC 5082P	3.40	3.55	3.90	WG 613	5.20	5.40	5.95
2SC 183	.40	.53	.59	2SC 930	.20	27	30	2SC 1816	1.50	1.75	1.95	UHC002	3.00	3.20	3.40	MPS U31	1.30	1.70	1.90
2SC 184	.40	.53	.59	2SC 945	.20	27	30	2SC 1908	.25	.40	.45	UHC004	5.00	5.20	5.80	78L05	.90	1.00	1.10
2SC 281	.25	.35	.40	2SC 959	1.00	1.20	1.30	2SC 1909	2.20	2.70	2.90								

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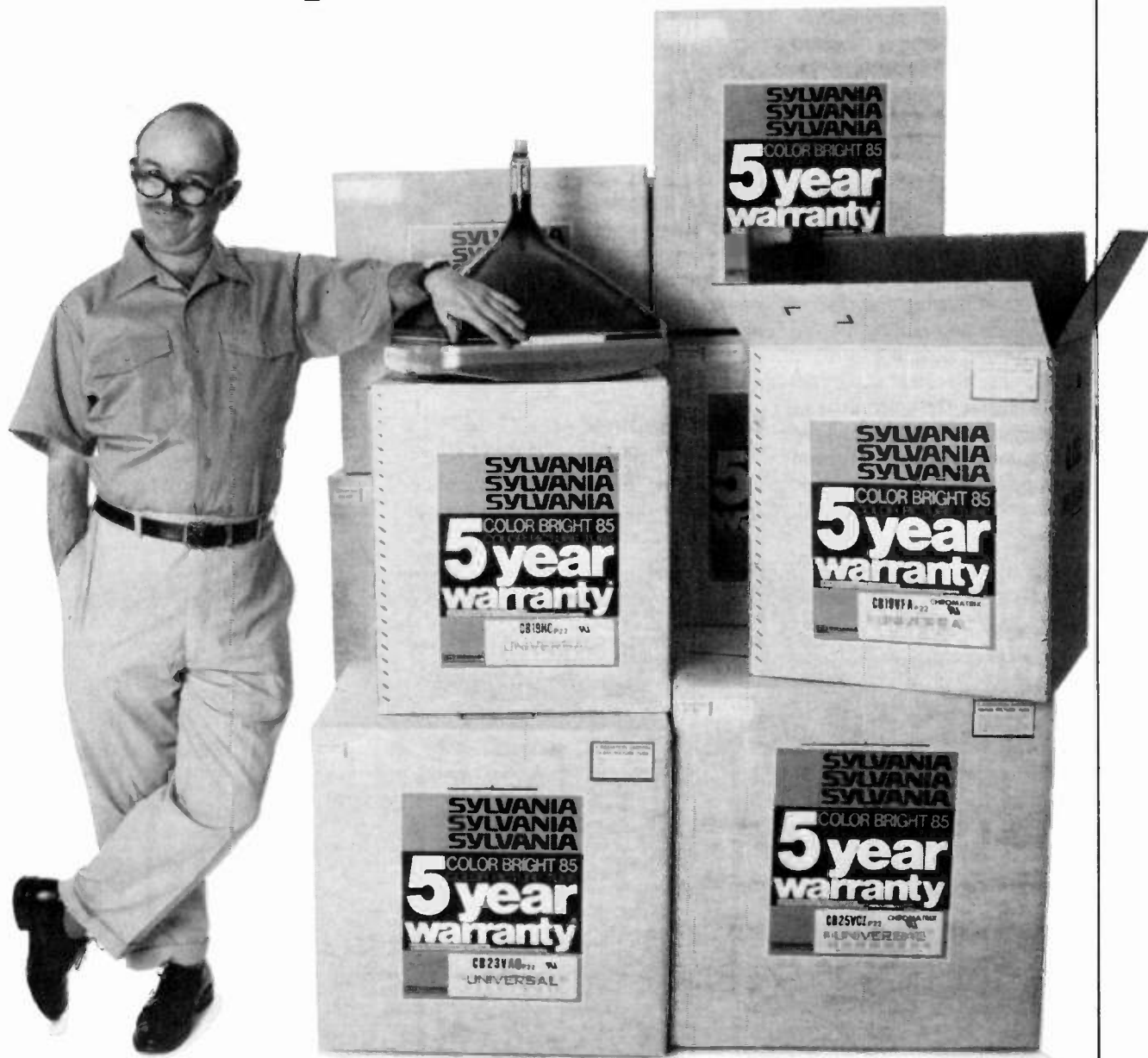
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**Electronic
Components**

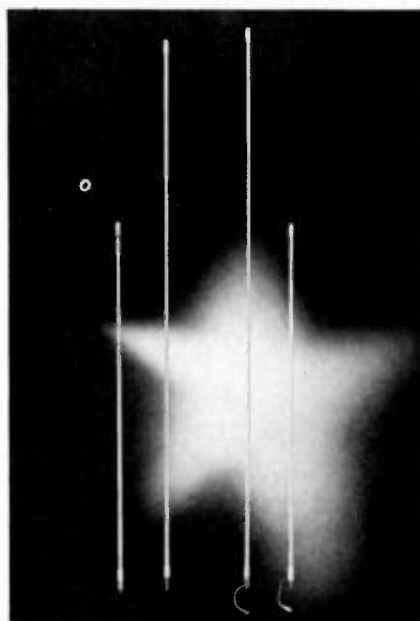
GTE

synthesizer for the transmitter. The separate receiver-transmitter design of former Golden Eagle base stations has been retained with a spot switch to allow tuning the receiver to the exact transmitter frequency. Transmitter controls include channel, mode, SWR calibrate, and meter, which allows for metering of modulation, bias, relative power and SWR. Receiver controls include, power/volume, tone, RF gain, AGC, ANL, squelch and bandsread with continuous tuning of all channels provided by the tuning control. The receiver includes a quality 6 inch oval speaker. The suggested retail price is \$950.

Mobile Fiberglass Antennas

Circle No. 144 on Reader Inquiry Card

Lightning Antennas introduces new concept in helical antennas by shunt feeding them, the manufacturer claims, for a better match and putting the antenna at DC ground potential to reject unwanted signals, electrical static and non-resonate noises. The antenna has a sealed adjustable tip under the vinyl cap for SWR adjustments. All antennas have the 3/8 x 24 base utilizing a pigtail and clip for grounding. This antenna is avail-



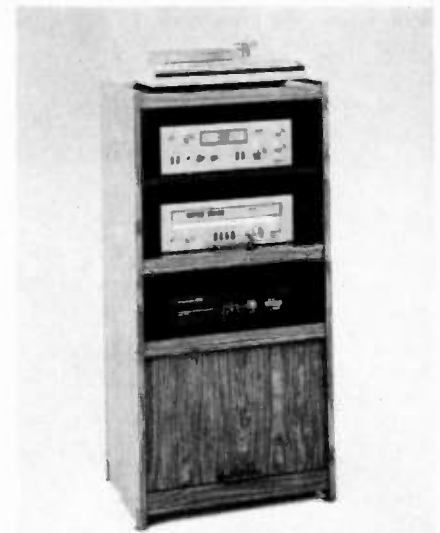
able with or without shunt feed. Antennas come in 40 inch and 60 inch lengths and are available in five different colors.

Stereo Cabinet

Circle No. 145 on Reader Inquiry Card

Gusdorf has introduced a new component stereo cabinet with simulated wal-

nut finish and smoked acrylic sliding doors. The Model 1470 features four shelves, with the central shelf adjustable in 1 3/8 in. increments. The top shelf, for turntables, features adjustable feet for precise leveling, and a disappearing slide-up door covers a large storage space with removable record dividers. Access holes, with plugs, in the full back



are provided for organizing and concealing connecting wires. The Model 1470 measures 47 1/2 in. high by 19 1/2 in. wide

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AN272	3 90	M53273P	1 60	UPC1028	1 80	Z5C1474	96	AN239	6 50	UM1C006	6 40	25B337	1 35	Z5C1079	3 95
AN313	4 85	M58473P	7 90	UPC1031H	2 98	Z5C1548	79	AN241	2 10	UPC20C	3 65	25B370	62	Z5C1096	75
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AN326	3 30	M88719	7 70	Z5C1630	3 60	Z5C1681	39	AN315	2 80	UPC563H2	3 65	25B407	1 20	Z5C1172	4 80
AN362	2 70	MN3006	5 90	Z5C1682	39	Z5C1775	54	BA511A	2 65	UPC566H	1 15	25B435	1 25	Z5C1173	70
AN366	2 49	MN3007	19 95	Z5C1761	1 58	Z5C1778	45	BA521	2 75	UPC575C2	2 35	25B463	1 40	Z5C1226A	70
AN606	4 50	NPC5107	14 95	Z5C1787	62	Z5C1811	1 29	CX101G	6 20	UPC592H2	1 05	25B474	85	Z5C1237	2 15
AN612	2 70	PL103A	14 95	Z5C1788	4 85	HA1339A	3 75	HA1306W	3 50	UPC1001H2	3 40	25B492	85	Z5C1239	3 15
BA401	1 50	SG264A	7 80	Z5C1796	4 85	LA1356	3 60	HA1339A	3 75	UPC1008C	5 75	25C372	35	Z5C1306	2 45
BA402	1 50	SG609	4 50	Z5C1798	45	LA4051P	2 70	LA4051P	2 70	UPC1025H	2 85	25C373	35	Z5C1307	3 85
BA405	6 30	SG629-3	3 40	Z5C1811	1 29	LA4400	3 10	LA4400	3 10	UPC1029H	3 25	25C380	35	Z5C1383	45
BA612	2 40	SG6523	17 50	Z5C1844	54	L03141	1 80	L03141	1 80	UPC1156H	2 80	25C387A	45	Z5C1384	55
BA1310	2 34	SI1010	6 90	Z5C1885	79	M5115P	4 90	M5115P	4 90	UPD857C	9 99	25C394	39	Z5C1675	40
HA1125	2 10	SI1020	13 95	Z5C1906	48	M51513L	3 90	M51513L	3 90	UPD857C	9 99	25C458	45	Z5C1678	1 90
HA1329	2 45	SI1030	19 00	Z5C1923	39	MN3001	19 50	MN3001	19 50	UPD858C	7 20	25C460	45	Z5C1728	1 00
HA1366W	3 30	SI1050	27 80	Z5C1940	64	MN3002	11 70	MN3002	11 70			25C481	1 45	Z5C1760	1 05
HA1366WR	3 30	SM5104	8 90	Z5C1945	6 75	MN3003	11 70	MN3003	11 70			25C482	1 35	Z5C1909	2 75
HA1388	3 35	SM5107C	11 95	Z5C1951	1 59	PLL01A	8 60	PLL01A	8 60			25C495	6 79	Z5C1957	95
HA1406	1 20	STK013	11 25	Z5C1959	39	PLL02A	8 40	PLL02A	8 40			25C509	45	Z5C1973	55
LA1222	1 59	STK014	11 85	Z5C2021	65	PLL02A-G	8 40	PLL02A-G	8 40			25C517	3 25	Z5C2028	74
LA1365	2 20	STK041	17 40	Z5C2027	3 95	STK011	5 80	STK011	5 80			25C535	45	Z5C2029	3 35
LA1368	3 42	STK075	8 22	Z5C2120	45	STK015	6 15	STK015	6 15	25A102	39	25C627	1 35	Z5C2091	2 40
LA3101	3 55	STK413	6 75	Z5C2214	1 45	STK032	13 80	STK032	13 80	25A473	65	25C634A	45	Z5C2092	3 10
LA4220	2 55	TA7092P	6 30	Z5C2214	1 45	STK050	23 75	STK050	23 75	25A474	65	25C710	37	Z5C2098	3 40
LA4430	2 70	TA7112P	6 50	Z5C2214	1 45	STK055	10 90	STK055	10 90	25A496	89	25C730	3 95	Z5D72	78
L03000	2 25	TA7205P	3 06	Z5C2214	1 45	STK056	8 10	STK056	8 10	25A497	1 39	25C732	35	Z5D92	1 75
L03080	2 70	TA7214P	5 15	Z5C2214	1 45	STK439	10 10	STK439	10 10	25A564A	39	25C735	35	Z5D180	2 35
L03110A	3 75	TA7217AP	3 30	Z5C2214	1 45	TA7045M	2 80	TA7045M	2 80	25A634	65	25C756A	2 40	Z5D218	3 45
L03150	1 95	TA7222P	3 50	Z5C2214	1 45	TA7060P	1 05	TA7060P	1 05	25A636	1 25	25C778	3 35	Z5D234	80
M5109P	3 30	TA7521M	3 55	Z5C2214	1 45	TA7063P	1 10	TA7063P	1 10	25A643	55	25C781	2 50	Z5D265	40
M5112V	6 70	TA7607P	9 90	Z5C2214	1 45	TA7074P	2 90	TA7074P	2 90	25A678	55	25C784	45	Z5D266	89
M5118L	2 50	TA7609P	4 80	Z5C2214	1 45	TA7089P	2 75	TA7089P	2 75	25A682	1 35	25C789	85	Z5D313	90
M5130P	3 12	TA7610AS	3 30	Z5C2214	1 45	TA7092P	1 05	TA7092P	1 05	25A683	45	25C793	2 45	Z5D315	1 05
M5135P	3 40	TA7611AS	3 30	Z5C2214	1 45	TA7120P	5 45	TA7120P	5 45	25A684	45	25C799	2 65	Z5D325	85
M5142P	5 70	TA7612AS	3 30	Z5C2214	1 45	TA7153P	6 75	TA7153P	6 75	25A699A	80	25C828	35	Z5D330	89
M5340P	1 55	TA7613AS	3 30	Z5C2214	1 45	TA7201P	3 15	TA7201P	3 15	25A706	1 25	25C839	43	Z5K19	68
M5930P	85	TA7614AS	2 10	Z5C2214	1 45	TA7203P	3 60	TA7203P	3 60	25A733	35	25C867A	3 95	Z5K33	85
M5935P	1 20	TA7615AS	6 50	Z5C2214	1 45	TA7204P	3 20	TA7204P	3 20	25B22	45	25C930	35	Z5K55	89
M5946P	85	TA7616AS	4 60	Z5C2214	1 45	TA7205P	2 60	TA7205P	2 60	25B24	35	25C945	35	Z5K22	1 80
M5953P	2 55	TA7617AS	2 50	Z5C2214	1 45	TA7310P	2 95	TA7310P	2 95	25B54	35	25C1014	83	Z5K40	1 90
M5962P	85	UPC572C	4 10	Z5C2214	1 45							25C1018	85	Z5K45	2 10

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Circle No. 121 on Reader Inquiry Card

Is Bachman's the fastest growing florist in Minnesota?

A 1979 DODGE MAXIVAN COULD HELP YOUR BUSINESS BLOOM.

We asked Alan Bachman, from one of America's most successful florists, to preview the new, 1979 Dodge Maxivan . . . roomiest van on the market (based on cubic capacity calculated by SAE procedure HS J1100a).

"The extra cargo room is a definite plus to anyone in the business of delivering or moving merchandise," he said. "A bigger load means fewer trips back to reload." That can add up to real savings. And better service for your customers.

Extra room isn't the only good idea you'll find in the '79 Dodge vans. From new styling and a big list of factory-installed options, to a standard 22-gallon fuel tank and the biggest selection of cargo door options on the market, they're filled with ideas your business can use. No matter what kind of business you're in.

Dodge has a tighter turning circle, model for model, than Ford or Chevy, to get your van into tight places. And we've got eight models to choose from.

Is Bachman's really the fastest growing florist in Minnesota? "I'll just say that we are considered to be one of the largest in the industry."

AMERICA'S FASTEST GROWING TRUCK COMPANY:

Bachman's has grown by recognizing good ideas when they come along. And Dodge has become America's fastest growing truck company by providing new ideas to people like you. Does that give you any ideas?

*357% increase from 1967 to 1977.

DODGE IS INTO 'TRUCKIN' LIKE AMERICA'S INTO JEANS.



by 16 $\frac{7}{8}$ in. deep. The unit comes ready to assemble with assembly tool furnished. Suggested retail price is \$137.

Hand-held VHF-UHF Scanner

Circle No. 146 on Reader Inquiry Card

Electra Company has introduced a new Bearcat "Four-Six" scanner, so named because of its four band, six channel capability. Electra Company claims it is

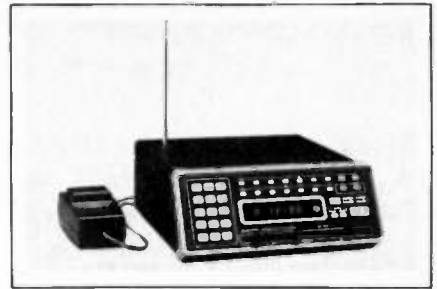


the first time VHF and UHF reception have been combined in a hand held unit. The Four-Six features patented track-tuning for full performance across the wide-spectrum UHF bands. Sensitivity is rated at 1 microvolt or better VHF and 1.5 microvolt on the UHF and an audio power output of 300 milliwatts. The scanner has a flexible "Rubber Ducky" antenna and an external antenna jack for mobile or fixed antennas for extended range. Crystals can be plugged-in in any sequence of frequency or band with no switches or jumper wires to adjust. Channels are indicated by bright red LED indicators and individual lock-out switches permit channel bypassing. Optional accessories include earphone, battery charger and an external AC power supply. The suggested retail price is \$169.95.

Programmable Scanning Monitor

Circle No. 147 on Reader Inquiry Card

A new keyboard-programmable scanning monitor has been announced by J.I.L. This new unit, designated the SX-100, has the capability of scanning more than 6000 VHF low, VHF high, and UHF public service channels and offers either



mobile or base operation. Most used frequencies can be keyboard-entered into the unit's 16-channel memory system. Each channel can be push button retrieved or the unit can scan the frequencies programmed, stop wherever it finds a signal and display the frequency in bright fluorescent numerals. The controls include volume, squelch, and a variable rate scan control. The unit includes a digital clock which indicates time and date on the display panel when the Hour/Day buttons are depressed. The monitor has a built-in speaker and provision is made for 12VDC or 120VAC operation.

8-Track to Cassette Adapter

Circle No. 148 on Reader Inquiry Card

The Muradapter an eight-track cartridge to stereo cassette adapter has been in-

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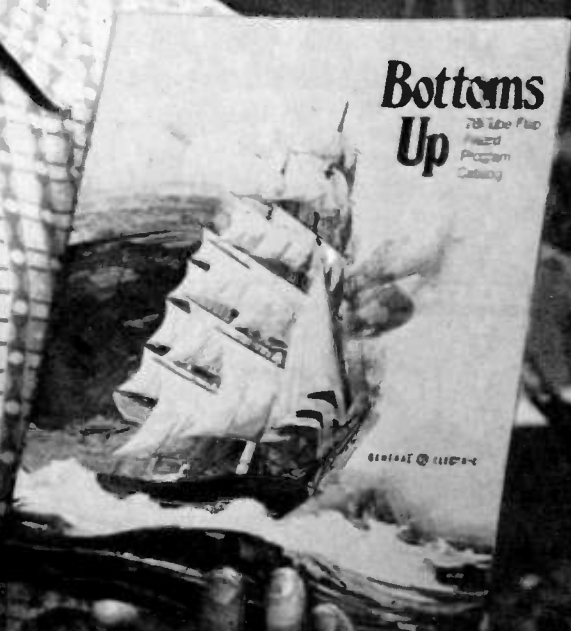
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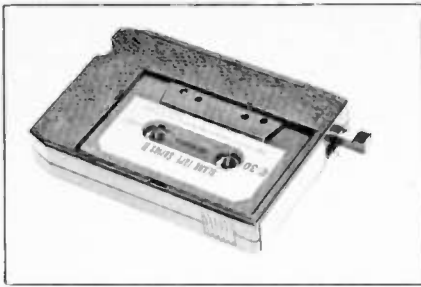
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GENERAL  ELECTRIC



roduced by *Mura Corporation*. This adapter allows the playback of stereo cassettes in an eight-track cartridge player (it cannot be used to record). It inserts like a cartridge and has fast forward and eject features.

Car Stereo Speakers

Circle No. 149 on Reader Inquiry Card

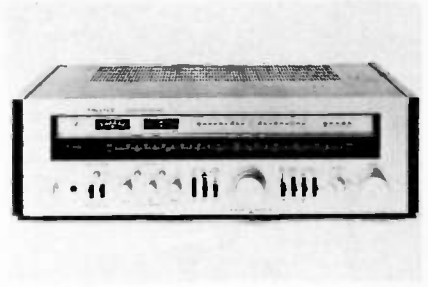


Acoustic Fiber Sound Systems, Inc. has introduced its Audio Separates system of mix and match tweeters, mid-woofers and bi-amplified sub-woofers to be tied together by a tuner or an equalizer. The system utilizes two polycarbonate one-inch dome tweeters, two mid-woofers and a choice of sub-woofers, a 6 inch x 9 inch molded cone, foam edge, extended range speaker or the bi-amplified DOMAXIAL[™] speaker. The system is used with AFS' environmental equalizer, which features separate mid-woofer and treble controls. FM noise filter and bi-amplification connection. The speakers can be used in pairs with or without the equalizer. The tweeters retail for \$54.95 pr, the equalizer for \$24.95, the mid-woofers for \$49.95, pr., the sub-woofers for \$64.95 pr., and the bi-amplified woofers for \$124.95 pr.

120 Watt Receiver

Circle No. 150 on Reader Inquiry Card

H.H. Scott's top-of-the-line model 390R stereo receiver features 120 watts RMS output at 0.03% thd. The receiver features 18 LED digital logarithmic power display indicators calibrated in watts and dBW, two tape monitors, DC configura-

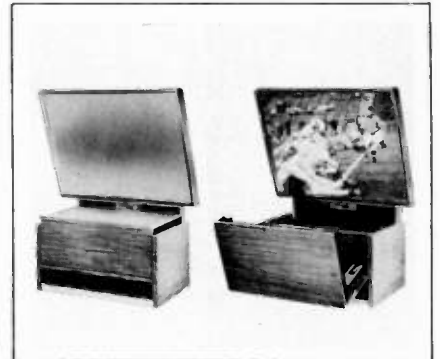


tion OCL power amplifier, provision for three pairs of speakers, 110/220 VAC switchable voltage, active filters with multiple turnover points, bass, midrange and treble tone controls that may be bypassed for completely flat response, and a front panel LED indicator for an electronic protection system which will prevent a short circuit from damaging amplifier circuitry or the speaker system. Suggested resale price of the 390R stereo receiver is \$699.95.

Projection Color Television

Circle No. 151 on Reader Inquiry Card

Quasar Electronics has just introduced their Great Show Machine a 5 foot diagonal screen projection color television receiver. The one-piece construction, using Schmidt Optics and an in-line tube, eliminates the need to position and align two separate units and provides greater light output for viewing under



normal room lighting conditions, Quasar states. The Quasar projection system incorporates all of Quasar's most advanced features, a 16-function remote control, Dynalock one-button color and a four speaker sound system.

New Base Station Antenna

Circle No. 152 on Reader Inquiry Card

The Omega, a 40-channel omnidirectional base station Citizens Band radio antenna featuring pre-assembled construction and four-way mounting, has been introduced by *Channel Master*. Said to assemble in 60 seconds, the Omega can be mounted either above or below an existing TV antenna, on its own



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- Orders over \$25.00 shipped free, under \$25 add \$1 UPS. C.O.D. orders are welcome. To approximate the cost of a replacement part order, deduct 40% from dealer cost of ECG or other types. All orders shipped within 24 hours.

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NEW TESTING SYSTEMS ASSURE SUPERLATIVE AUDIO PERFORMANCE

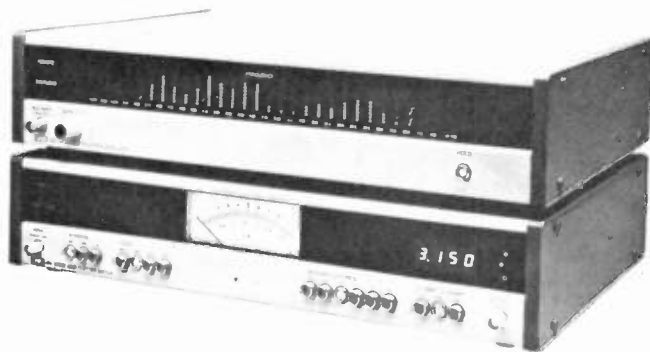


The perfect combination for FM Stereo tests and measurements

Generating a high quality stereo signal is one thing, delivering it faithfully is something else. Radiometer Electronics' new Stereo Signal System combines a unique FM Carrier Unit featuring $>60\text{dB}$ separation and $<0.08\%$ distortion with an exceptionally versatile Stereo Generator/Modulator.

The **RE110 FM Carrier Unit** eliminates the need to twist dials. Simply push the button to select from three presettable frequencies between 88 and 108 MHz, individually or with sweep or in a dual carrier frequency mode.

The companion **SMG40 Stereo Generator** also lets you push a button to select the stereo signal you want; L, R, L&R, L=R, L=-R; with or without pre-emphasis of 25, 50 or 75μ sec. You can also choose from five audio frequencies with $<0.02\%$ distortion and separation $>70\text{ dB}$.



New system takes the hassle out of Wow and Flutter measurements

This new instrument team measures magnitude, determines drift and displays the frequency spectrum of Wow and Flutter tests. Significant information is maximized and new dimensions are available to evaluate mechanical performance.

The **RE 402 Meter** provides analog measurements of Wow and Flutter conforming to accepted standards, plus digital display of Drift.

Spectrum component analysis is provided by the microprocessor controlled **RE 403 Analyzer**. Its 30 column LED display forms a unique method for relating frequency distribution to mechanical properties.

For further information, contact:
The London Company, U.S. Representative for
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Circle No. 134 on Reader Inquiry Card

New Filters

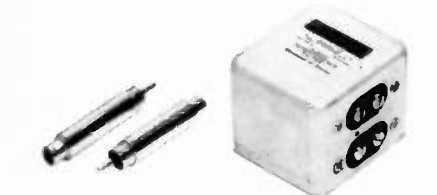
Eliminate Interference To TV & Audio Equipment



Low-Pass Filters eliminate or greatly reduce interference to TV channels 2 and 5 by CB or radio amateur station when installed in antenna lines of those transmitters. Input and output impedance 50 ohms. Insertion loss .3 db max.; VWSR 1.2:1. Attenuation greater than 75 db above 41 MHz. C-511-T: 25 W AM 50 W PEP SSB. C-514-T: 1000 W AM 2000 W PEP SSB.



High-Pass Filters, when installed in the antenna, eliminate or greatly reduce front end overload interference to TV or FM receivers caused by CB or amateur radio transmitters and other high frequency radio services. Filter attenuates signals below 40 MHz by a power factor greater than 1,000,000 to 1. Impedance C513-T1: 75/300 ohm; C-513-T2: 75/75 ohm; C-513-T3: 300/300 ohm.



Audio Interference Filters eliminate interference caused in your audio equipment by CB, radio amateur transmitters and other radio services. C-505-R installs in the input lines of audio equipment. Consists of 1 pair. C-506-R installs in speaker lines. Unit will take care of stereo speaker system.



AC PWR Line Filters eliminate or reduce interference to CB receivers, TV's and radios, and prevent CB radio signals from entering power line. C-508-L: 3-section LC filter, 3 A max. C-509-L: 5-section LC filter (for more severe interference), 5 A max.

For name of your nearest distributor, write to:

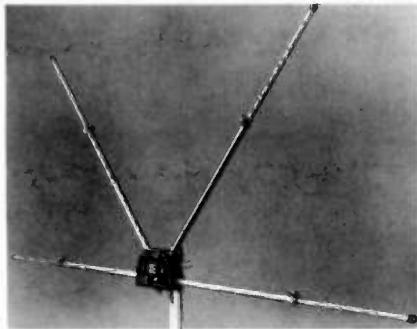


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Circle No. 108 on Reader Inquiry Card

44 | ET/D - October 1978



mast or in an attic with at least 6 ft 2 in. of clearance from floor to ceiling. Channel Master says the Omega utilizes a co-phased design similar to that used for co-phased mobile CB antennas, and uses two angled radiators instead of a single vertical radiator. Overall height of the antenna is 8 feet, and the unit is completely weatherproofed with all antenna elements protected by gold EPC coating and the housing unit constructed of ABS plastic. The company rates the antenna's average SWR at 1.3:1 across 40 channels with 4 dB gain. Suggested resale price is \$34.95.

2-Meter Handheld Radio

Circle No. 153 on Reader Inquiry Card

A compact 1 watt, 2-meter amateur handheld FM transceiver is now available from *Standard Communications*. The C-118 radio is about the size of a dollar bill and permits the user to transmit +600 kHz, -600 kHz or receive and transmit on the simplex frequency with just one crystal, providing a total of 18 transmit channels with only six crystals. The C-118 also incorporates a built-in condenser microphone and LED status lights for channel-busy and transmit. Also included are BNC connector with rubber flex antenna, provisions for external DC power supply and earphone. The unit has a frequency range of 144-



148 MHz and is equipped with one crystal for operation on 146.94 simplex and 146/.34/94 MHz for repeater operation.

Hi-Fi, AM/FM, Receiver

Circle No. 154 on Reader Inquiry Card

Scientific Audio Electronics, Inc. has introduced an AM/FM receiver, the R3C as a member of its new SAE TWO line. This receiver's full complementary circuitry assures maximum power output with lowest distortion, the manufacturer claims. The R3C receiver delivers 30 watts per channel minimum RMS, into 8



ohms, from 20 hz to 20,000 hz with no more than 0.09% total harmonic distortion. It has a linear phase IF filter for FM stereo distortion of less than .25% and 50dB quieting in stereo for a 40 μ v input signal. Additional features include speaker switching capabilities to allow the use of two pairs of speakers together or separately, loudness switch and rumble filter. The suggested retail price is \$335.

CB Radio

Circle No. 155 on Reader Inquiry Card

The Key Com 1000 is a 40 channel microprocessor marine CB transceiver recently announced by *SBE*. Features, according to the manufacturer, are a red channel 9 key which allows quick access to the Coast Guard in case of emergency and a receiver section which allows the scanning of any ten user-selected channels for the reception of



fishing reports, weather information, and other marine CB radio traffic. A priority override key allows the mariner to listen to one channel as well as guard another channel on an override basis. The Key Com 1000 operates on positive or negative ground. **ETD**

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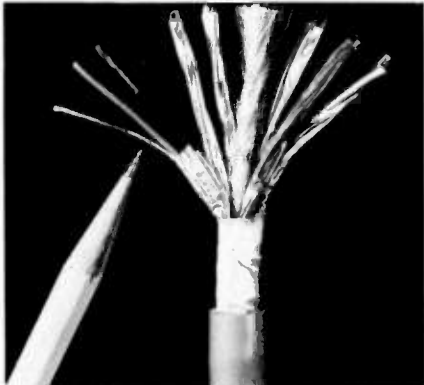
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NEW PRODUCTS



Computer Cables

Circle No. 156 on Reader Inquiry Card

A new line of shielded-pair electronic cable utilizing an expanded copolymer polyolefin insulation called Datalene is now available from *Belden Corporation*. According to the company, the cable is designed for precision computer and data communication applications, and features a low dielectric constant and dissipation factor for high speed, low-

distortion data handling, good crush resistance and a temperature range of -40°C to 80°C . Two styles of cable are available with 150 ohm impedance: a UL listed 22-ga. stranded pair with nominal capacitance of 8.8 pf/ft and nominal DC resistance of 14 ohms/1000 ft; and a two-pair 22-ga solid conductor design with a nominal capacitance of 8.8 pf/ft and a nominal DC resistance of 16.1 ohms/1000 ft. For 100 ohm impedance applications there are nine UL-listed 24-ga stranded cables with a nominal capacitance of 12.5 pf/ft and nominal DC resistance of 24 ohms/1000 ft. The 22-ga cables are available in 500- and 1000-foot lengths; 24 ga cables are available in 100-, 500- and 1000-foot lengths.

AC/DC Scope

Circle No. 157 on Reader Inquiry Card



The *DeForest Electronics* Model 6010 oscilloscope is a 10 MHz, single channel unit featuring all-pushbutton design and battery or AC line operation. Sensitivity of the unit is rated at 10 mV/div., with maximum input of 200 VDC and 500 VAC. Sweep rate is 0.1 microseconds to 5 milliseconds with accuracy of $\pm 3\%$. Dimensions of the unit are $10.2 \times 8.5 \times 3.5$ in., weighing 8.5 lbs.

Flameproof Resistors

Circle No. 158 on Reader Inquiry Card



A line of flameproof resistors for replacement use in entertainment products, industrial MRO equipment, communications gear and fuse resistor applications has been introduced by *General Telephone & Electronics*. Packaged

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MODEL 520B

Industrial Transistor Tester

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- Measure fit of bipolar transistors up to 1500 MHz
- Nondestructive testing of transistor and diode breakdown voltages
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MODEL 820

New Portable Digital Capacitance Meter

- Measures capacitance from 0.1pF to 1 Farad
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- 10 ranges for accuracy and resolution
- 4 digit easy-to-read LED display
- 0.5% accuracy
- Special lead insertion jacks or banana jacks
- Fuse protected
- Uses either rechargeable or disposable batteries
- Overrange indication



MODEL 3010

New Low Distortion Function Generator

- Generates sine, square and triangle waveforms
- Variable amplitude and fixed TTL square wave outputs
- 0.1 Hz to 1MHz in six ranges
- Push button range and function selection
- Typical sine wave distortion under 0.5% from 0.1 Hz to 100 kHz
- Variable DC offset for engineering applications
- VCO external input for sweep-frequency tests



MODEL 3020

New Sweep/Function Generator

- Four instruments in one package—sweep generator, function generator, pulse generator, tone burst generator
- Covers 0.02Hz-2MHz
- 1000:1 tuning range
- Low distortion high-accuracy outputs
- Three-step attenuator plus vernier control
- Internal linear and log sweeps
- Tone-burst output is front-panel or externally programmable



Model 1650

New Multiple-Output Lab Power Supply

- Functions as three separate power supplies
- 5VDC, 5A fixed output
- Two separate 0 to 25VDC outputs at 0.5A
- Fully automatic, current-limited, overload protection
- Unique tracking circuit allows automatic tracking of variable DC outputs
- - and - terminals of each output are fully isolated, even when in automatic tracking mode
- All three outputs may be connected in series or parallel for higher voltage or current requirements

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New 50MHz Digital Probe

- Multi-family, compatible with TTL, DTL, RTL, HTL, CMOS, MOS and NMOS
- Displays DC to 50MHz
- Displays pulse presence and logic states
- Memory mode to "freeze" pulse display

MODEL DP-50

- Pulse mode—stretches short pulses
- 2 megohm input impedance
- Input overload protected
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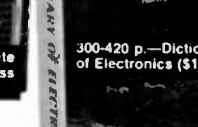
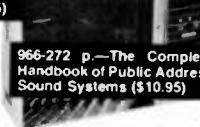
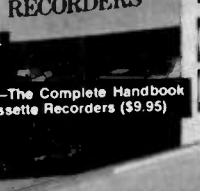
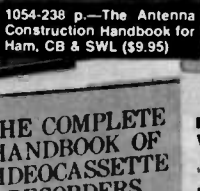
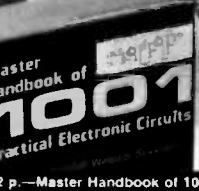
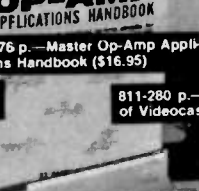
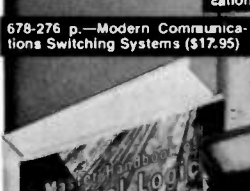
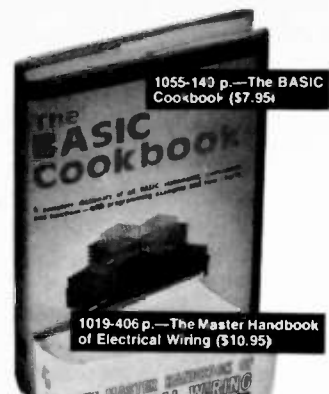
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Circle No. 115 on Reader Inquiry Card

in color-coded blister packs, the line consists of 1/4-, 1/2-, 1- and 2-watt devices. The 1- and 2-watt series are offered in small body sizes. In addition to flameproof resistors, the new line can replace carbon composition, carbon film, metal film, wirewound and fuse resistors with tolerances of 2, 5, 10 or 20%. In operation, the resistors open the circuit like a fuse and are capable of overloads from 10 to 100 times rated power without shorting or showing any trace of flame.

IC Jumper Cables

Circle No. 159 on Reader Inquiry Card

A new IC jumper cable designed for use with 14/16 pin dual in-line test clips has been introduced by *ITT Pomona Electronics*. The Model 4185 is 24" long and has two eight-pin IC sockets at one end



with beryllium copper contacts and gold plated finish. The cable is PVC insulated, 26 AWG, 16 conductor flat ribbon cable. There is no connection on the second end, the wires being individually stripped and tinned. Cost of the jumper cable is \$11.85.

Logic Probes

Circle No. 160 on Reader Inquiry Card

The *Heath Company* has just released the IT-7410/ST-7410 logic probes which are designed for in circuit testing of TTL and CMOS integrated circuits. Features include switch selection of TTL or CMOS threshold levels and a memory to turn on an LED when threshold level is crossed. The manufacturer states that the probes provide true logic level detection at high frequencies (not AC-coupled) and that they will detect pulses as short as 10 ns. Upper frequency limits are 100 MHz (TTL or CMOS @ 5 vdc squarewave)



and 80 MHz (CMOS @ 15 vdc squarewave). Power for the probe is drawn from the circuit under test via two spring loaded, insulated clips. A ground lead is provided for high frequency operation. Overload protection is 50 VDC continuous and 175 VDC for 5 seconds. The IT-7410 is a kit at \$39.95 and the ST-7410 is assembled at \$64.95.

Industrial Soldering Irons

Circle No. 161 on Reader Inquiry Card

Both the *Weller W* and *WP* industrial soldering iron series feature multi-purpose operational use with a selection of interchangeable tips. The W60 and W100 controlled output irons offer an assortment of screwdriver-style tips with automatic temperatures of 600-degrees, 700-degrees and 800-degrees. Five sizes of screwdriver styles, plus narrow screwdriver, conical and single flat tips are available for the WP25 and WP40 irons. Both series are available in two- and three-wire cord models.



Breadboard/Power Supply Combo

Circle No. 162 on Reader Inquiry Card

The *Continental Specialties Corporation* Model DM-1 Design Mate provides a power supply, breadboarding area and meter in one convenient package priced at \$69.95. The meter measures 0-15 VDC with 5% accuracy and is independent of the power supply, with leads brought out to a pair of five-way binding posts. The power supply is adjustable from 5-15 VDC output at up to 600 milliamps, with better than 1% load and line regulation and less than 20 mV ripple

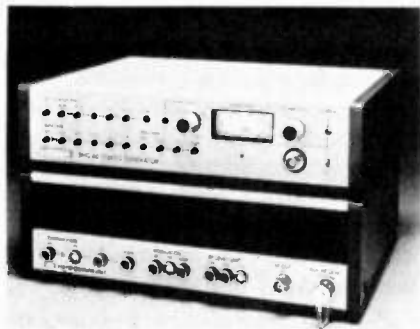


and noise at full load. The solderless breadboarding area provides enough space to breadboard a circuit with six DIP ICs and associated components. The three-pound DM-1 package requires 12 watts or less at 117 VAC 60 Hz. A 220 VAC 50/60 Hz version is available at \$77.

FM Stereo Signal Generator

Circle No. 163 on Reader Inquiry Card

Radiometer Electronics has introduced a new Stereo FM Carrier Unit. Designated the RE 110, it is a compact RF signal source specifically designed to handle high quality stereo modulation from Radiometer Electronics' SMG 40 Stereo Generator. Outstanding features of the new carrier unit include the ability to maintain more than 60 db L - R channel separation and less than 0.08% distortion. Operational features include push button choice of three presettable frequencies in the 88 to 108 MHz band, together with a unique dual carrier frequency mode, a sweep frequency mode with center frequency marking, and very low RF leakage. Provision is made for remote control of front panel functions. These include choice of output fre-

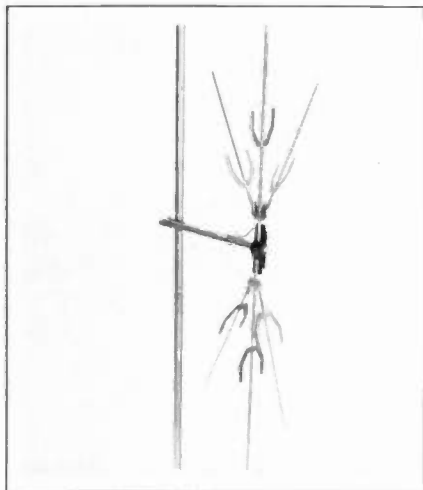


quency, selection of dual carrier operation and CW, sweep or stereo modulation. Primary application areas include development, testing, quality control and servicing of high quality stereo equipment.

Preassembled Antenna

Circle No. 164 on Reader Inquiry Card

The Monitenna from *Channel Master* is a fully preassembled quad-band scanner antenna with separate receiving elements for 30-50 MHz low band, 150-170 MHz high band (including marine),



450-470 MHz UHF and 450-512 MHz UHF-T band. Monitenna is made of aircraft-type aluminum, is weather protected with gold EPC coating and comes with 50-feet of RG-59/U coaxial cable and a preassembled Motorola plug that fits most scanners. The antenna also is available in a kit which includes a trimast mount, two standouts and all necessary mounting hardware. Price for the antenna alone is \$23.95; for the Monitenna kit, \$29.95.

High Accuracy Counter/Timer

Circle No. 165 on Reader Inquiry Card

A specially designed high stability oscillator for the PM6620 series of Philips timer/counters has increased the stability to better than 5×10^{-10} per 24 hours and 5×10^{-9} for a temperature range of

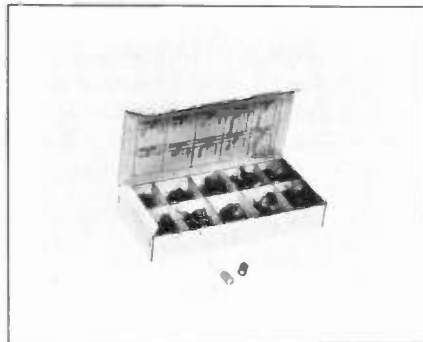
0 to 50 degrees C. The PM6620 series offers 5 time base oscillator options and permits upgrading should requirements change. Features are trigger hold-off and independent trigger selection for channels A and B of AC/DC coupling, slope, and attenuation. A bright, high contrast planar plasma display allows optimum readability even at extreme



angles according to Philips. The PM6620 series offers frequency ranges of 80, 520 and 1000 MHz and options including battery operation, BCD output, IEEE interface, rack mount, carrying case and IF display offset.

Capacitor Kit

Circle No. 166 on Reader Inquiry Card



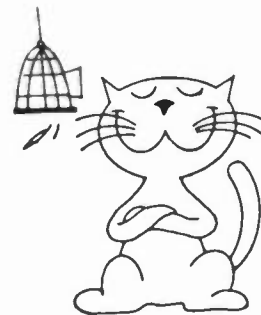
Elcapak, an electrolytic capacitor kit containing more than 150 radial (PCB) mount capacitors, has been introduced by *ORA Electronics*. The capacitors are packed in a compartmentalized box for both bench and field work. Price of the Elcapak is \$24.95.

Moisture Repellent

Circle No. 167 on Reader Inquiry Card

Chemtronics has introduced a newly-formulated industrial moisture displacing spray labeled DPL. Wet sockets, plugs, components and wiring need only be sprayed to eliminate moisture induced short circuits. Treated equipment will retain a coating which protect it against rust and corrosion for six months to a year outdoors, and over a year indoors. New equipment for use in wet areas can be given a light coating of DPL

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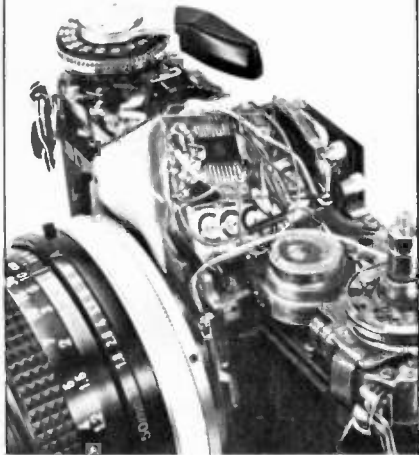
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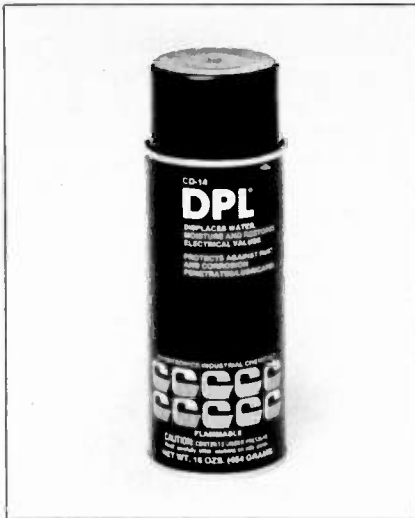
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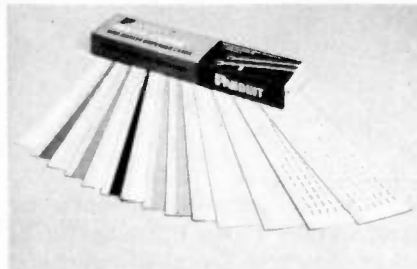


as a preventive measure. Chemtronics states that DPL has been thoroughly tested for salt, fog and humidity resistance and is excellent for use in water craft, both in electronic equipment and around the engines.

Wire Markers

Circle No. 168 on Reader Inquiry Card

The line of PANDUIT INSTA-CODE wire markers has been expanded to include additional solid number dispenser cards, new NEMA color markers, and new half-length, write-on self-laminating markers. Solid number dispenser cards are now available with legends from 0 through 250. Dispenser cards are also



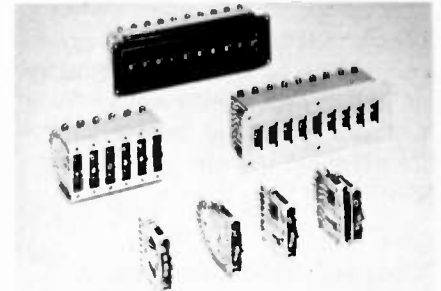
now available in 16 solid NEMA colors without legends. Another recent addition to the wire marker line is a selection of half-length (3/4" long) write-on, self-laminating wire markers. These markers provide for writing or stamping legends on white area with a clear laminate portion protecting the legends. The new markers are part of a complete line of wire markers in cards and books plus voltage markers and safety signs.

Thumbwheel Switches

Circle No. 169 on Reader Inquiry Card

Metal-Mite 2, a new series of thumbwheel switches offering flexible output code selection, up to 20 switching stations and 2-pole switching modules,

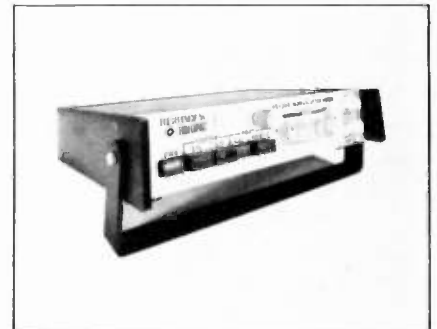
has been introduced by *Switchcraft*. The company recommends the switches for retrofitting machine controls, data processing, and manufacturing process controls, and other equipment which require programmable and changeable digital inputs. More than 40 decimal and binary codes are available, including BCD, BCO and hexadecimal. Switch modules are available with 8-,



10-, 12- and 16-positions, and complete switch assemblies may be ordered with factory-installed bezels or escutcheons, which can be supplied in a variety of colors.

Wow and Flutter Meter

Circle No. 170 on Reader Inquiry Card



The Model 65-390 wow and flutter meter from *Electronics by Fidelipac* checks periodic or cyclical variations in speed rates of cartridge, reel-to-reel or cassette tape recorders, video tape recorders, turntables and film projectors. A single meter readout indicates deviation from true speed within 5%, and the unit also features an internal 3,150 Hz reference oscillator, self-contained switchable weighting filter and a standard phono output jack for oscilloscope connection.

Digital Capacitance Meter

Circle No. 171 on Reader Inquiry Card

A digital capacitance meter featuring one-step push button autoranging and wide dynamic measurement range has been introduced by *IET Labs* at a suggested resale price of \$299. The CM-500 provides the user with a digital electronic output of the capacitance

value and range through a 26-pin connector. This output can be interfaced with a microprocessor, printer, recorder or any other device. The unit measures from 1 pF to 200,000 uF with basic accuracy of $0.1\% \pm 1$ LSD. The CM-500 uses



a $\frac{1}{2}$ " , $3\frac{1}{2}$ digit LED display and operators on standard D-cells to provide approximately 30,000 measurements, enough for a year of use. It is supplied with batteries, component clip, test leads and instruction manual.

Dual-trace Miniscope

Circle No. 172 on Reader Inquiry Card

A 15 MHz, dual trace oscilloscope operable on battery or line power and weighing just 3 lbs, is now available from *Non-Linear Systems*. The unit includes separate, chopped or alternate dual trace sweep modes, as well as internal and external sync modes. Time base

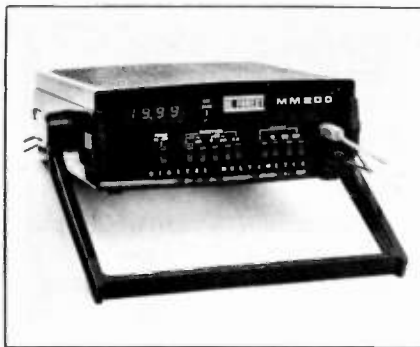


controls provide 21 settings with a range from 0.1 microseconds per division to 0.5 seconds per division. Twelve vertical gain settings for each channel provide a range from 0.01 to 50 volts per division for each channel. The compact scope measures 2.9" x 6.4" x 8" and includes two input cables, battery charger and rechargeable batteries. Options include a leather carrying case with neck strap and belt hook and a 10-1, 10 megohm probe. Cost of the unit is \$395.

Digital Multimeter

Circle No. 173 on Reader Inquiry Card

The MM200, a $3\frac{1}{2}$ digit multimeter with five functions and 1 mv resolution, is



now available from *DeForest Electronics*. The unit measures AC and DC voltage, AC and DC current, and resistance with four range multipliers (1, 10, 100 and 1000) and automatic decimal placement. The unit is powered by either batteries or with the combination AC-DC converter/battery recharger. It measures 3.4 inches by 10.6 inches by 12 inches.

Ultra-High Capacity Ni-Cads

Circle No. 174 on Reader Inquiry Card

A family of ultra-high capacity nickel cadmium cells has been announced by *Panasonic*. Available in Sub-C, C, and D sizes, these cells offer 20 to 30% more ampere hour capacity than conventional

cells of the same size according to *Panasonic*. For example, the D size offers 5-plus ampere hours versus 4 for the conventional cell. This has been made possible by applying the latest advances in electrode technology, according to the manufacturer. The new cells are available as individual cells and also as batteries of required voltages.

Digital Panel Meter

Circle No. 175 on Reader Inquiry Card

The Model PM-351 digital panel meter, featuring liquid crystal readouts for clear viewing in bright sunlight and 2 ma power consumption, has been introduced by *Non-Linear Systems*. The unit includes full scale ranges of .1999, 1.999, 19.99, 199.9 and 1000 vDC. Au-



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omatic polarity is standard, and unit operates on 5 vDC. The unit measures 15/16 inches high x 2 7/16 inches wide x 3 7/16 inches deep. Single quantity cost is \$66.

Rechargeable Battery Display

Circle No. 176 on Reader Inquiry Card

Dynamic Instrument is making available at no cost a point of sale display for its rechargeable batteries as part of a dealer package deal. The rack can be used as a counter display or as a peg-board hung wall rack, either pilfer-proof or self-service. The red, black and white display measures only 26 inches high by 16 inches wide by 11 inches deep and can hold merchandise worth over \$600 at retail. It is available with either of two starting inventories, Deal 2 B having twice the inventory of Deal 1 B. The batteries carry a 5 year warranty. **ETD**

RCA

continued from page 18

The luminance module contains one IC that performs all luminance signal processing. One of six transistors on this module serves as the 22 volt regulated

source. This source, in turn, feeds the tuner and two other modules, the horizontal and IF/AFT modules. So trouble here is going to show up in these other areas.

CTC87

The small screen (13-inch) CTC87 color model features the "U" type construction with four printed circuit boards and one module. The module contains, IF, AFT, AGC and sound detector circuits.

According to RCA, most of the circuitry found inside this chassis is similar to that used in CTC85/89 and 90 series chassis. However, one innovation is contained in this new model, the introduction of a new integrated high voltage transformer. This transformer, RCA reports, has high voltage rectification incorporated as an integral part of the high voltage transformer.

Additionally, the high voltage (25.35Kv, $\pm 1.35Kv$) is not adjustable on this chassis and should be measured at minimum beam current. **ETD**

PRICING

continued from page 29

both for you and your customer. Any attempt to flat rate or average out all service calls or all shop jobs is at best highly inaccurate. You risk either not getting enough return or antagonizing your customer because of over pricing. There is no way you can be fair with this system.

Time and charges

This method is fair, provided you don't run into a "tough dog." In that case, either you or your customer is going to take a beating. A further disadvantage is that you can't give very good estimates. Estimates that are accurate to within 10% or 20% are required in several states, and are certainly good policy in all the others.

Average rate per job type

This is the best way. It is the most accurate, produces the highest revenue for you and assures your customers that they are being reasonably treated.

You can establish your service times for type of job in your shop by keeping accurate records for a year or two, or you can save yourself a lot of time and avail yourself of one of the two pricing systems available.

The first of these, the Sperry-Tech System, is highly accurate and covers virtually every job you will ever undertake. The pricing guide with instructions is about \$15, and is

available from Sperry-Tech. To use the system, you keep track (count) of every solder joint, every nut removed, and every part replaced. The instruction book gives you average times, or "minutes" for every one of these operations and times for troubleshooting every portion of the set. When the job is finished, you add up all the minutes shown in the tables, and you have an "average" time from a long history of similar jobs. Simply translate this to dollars by using the handy tables provided. For those who have trouble understanding the system, Sperry-Tech occasionally has 4-hour seminars around the country to explain the method.

The other and newer system is the Tech Spray Pricing Guide. This system has the advantage of being simple to understand and use and costs about \$5. The cost is small enough that you can supply all your men for just a few dollars.

With this system, you merely look up the listed job and it gives you the total average minutes for that job. You then look up the number of minutes on the hourly rate chart, and you have the charges. While this system covers only about 95% of the service jobs (some MATV and specialized jobs are not listed), it does cover virtually all the jobs the average service shop will encounter. The Tech-Spray Pricing Guide is available from most distributors.

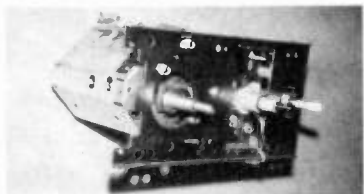
Whichever system you use, you will find that you have saved time and worry. Not only can you satisfy your customer that their set is being charged against national averages for that particular job; but, just as important, you can now control the prices your servicemen charge and be certain that there is no variation from job to job within your own shop. Sometimes servicemen being paid an hourly wage and having no direct knowledge of the cost of operation, will shave a bit off the charges because "they seemed too high." This may make the customer feel good, but it won't pay your note at the bank. Strict adherence to a pricing guide will prevent this.

Invoicing

The first step in pricing is in the presentation of the prices. This has to be done twice; first when the estimate is given, and second, when the final bill is delivered.

In both cases, the only sensible way to do this is with the invoice. Estimates, just like the final bill, must be written and not just verbally presented to the customer. Not only are verbal estimates illegal in

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some states, but it is the worst of business practices to fail to keep written records of your transactions.

Fortunately, there are several good invoices available that can help you tremendously in your presentation of estimates and final bills. Worthwhile invoices will cost you between seven and ten cents each. This is for four-part snap-out invoices imprinted with your name, address, phone and license numbers. Yes, you can go to the local stationery store and spend two or three cents on a book of cash tickets; but any man who would do that in an age where even the poorest of auto repair shops uses professional forms, is making a mistake. Your invoice is a strong part of your image.

Good forms are available from your distributor. There are several brands available. O. W. Donnell, M. M. Forms, Ohelrich, Sperry Tech, and Tech Spray, all have forms available that are designed to be a help in your service shop. Each has unique features that you will want to evaluate as you decide what form is best for you.

The O. W. Donnell form has an excellent credit agreement, and was the first to use this desirable feature. The Ohelrich forms are perhaps the most simple of all the forms in makeup. Some shops will find this to be an advantage; others will not. The Sperry-Tech forms are designed to be used with the Sperry-Tech pricing system, and are useful in states where a check off system is legal. The Tech-Spray invoice features a simplified data entry system that ties in with the Call Control System, also from Tech-Spray, that organizes and keeps track of all your service jobs. This form also has a credit agreement, and is designed to help you collect the maximum possible revenue.

You want to examine all the invoices you consider purchasing for these points: (1) Are there spaces for all the data that you will use? (2) Is it organized in a logical sequence, or do you have to skip around from corner to corner to fill out the data you need? If it is not well organized, you will find that your men often forget sections. (3) Is it crowded with hard-to-understand language, or is it simple to understand both by your men and by your customer? (4) Are all pages the same, or does different data appear on different pages? Certain data is not needed on all copies. Eliminating it from pages where it is not needed allows other data to be added. This can double the usefulness of an invoice. (5) Check the reverse side of the invoice. On some invoices the reverse of the form has a

complete bookkeeping set-up to record time payments and charges. (6) Is it neat and attractive, and does it present a professional appearance? If the invoice you present to your customer is too cluttered for him to understand, it will not be a help to you in explaining the service charges you wish to collect. If it does its job correctly, it will be easy to show what the charges are and why they are the amount shown. A good invoice is second only to a good customer when it comes to public relations.

As you can see, the subject of pricing is not as simple as some owners and managers would seem to think. Many who thought it was simple are now working for someone else wondering why their shops failed. Don't let this happen to you and your shop.

Lumped vs. itemized charges

When charging the customer, you need to consider his reaction. Is he going to accept a single, large, unitemized price, or is he going to react better if the charges are broken down and itemized? I strongly believe that a service shop can make more money and have much better customer satisfaction by itemizing.

Consider how you feel when you have your truck repaired. If you were handed a lump charge of \$100 for service, most likely your first question would be to ask what was done to warrant this amount. If the bill had been broken down to "so much to remove and replace the transmission, so much for brake repair, and so much for tune-up," you would have accepted the bill without question.

A truck is less of a mystery than a TV set, at least to most people. The person who gets your bill may pay it without asking for a breakdown, but you can bet that there will be some questions asked by other members of the family.

With the pricing guides available, it is easy to itemize, at least to the major repairs. If you list separately these items:

1. Analysis
2. Bench Diagnosis
3. Major Repairs
4. Tune-up and Adjustments
5. Convergence
6. Service Call

you will have gone a long way toward a good, clear explanation of the charges.

Remember, whatever invoices or pricing guides you choose, you must also know your costs and efficiencies ratio. Finding the data you need to calculate these will take a little time, but will be well worth it. You simply cannot go on hunches in today's market. **ETD**

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<input type="checkbox"/> UPC1025P	\$2.00	<input type="checkbox"/> 121-821 Zen.	\$1.50
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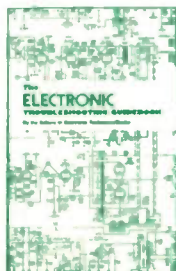
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