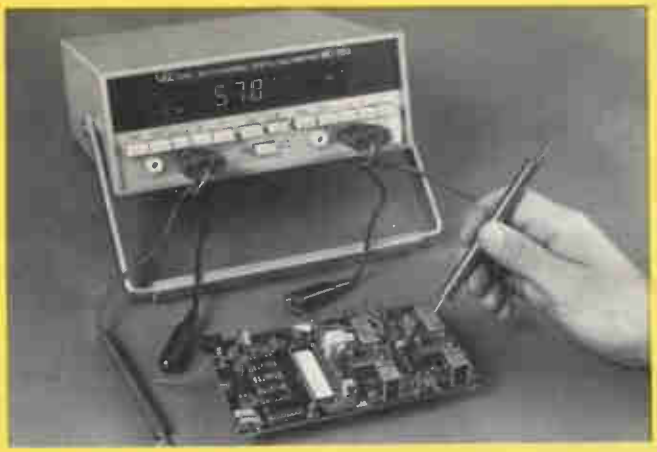
ELECTRONIC
Servicing & Technology

DECEMBER, 1981

29 50

Servicing digital tuners

TV systems around the world



LOOK! 8 NEW DIGITALS FROM VIZ

They can make your job a lot easier.

NEW ...DUAL INPUT, AUTORANGING 3½ DMM

It does the job of two autoranging DMMs but costs about 30% LESS. Talk about convenience. You can measure or monitor voltage, current or resistance from two points in a circuit. Extra bright digital LED display. Accurate to 0.1% DCV, ±1 digit. Auto-zero, auto-polarity, autoranging. Just push panel buttons to preprogram the instrument to perform the function you want. Measure any value from 1 millivolt to 1000V DC (750V AC). Measure audio frequencies to 20kHz (up to 10V). From 1 microamp to 2A DC or AC. High or low power ohms from 1 ohm to 20 MΩ. You'll soon find it to be the most used instrument you own! **WD-753** **$384.95.**

NEW ...

MULTI-COUNTER

A dual input counter with frequency range from 5 Hz to 125 MHz. For audio, video, CB and other high-frequency applications. Four gate times from .01 to 10 sec. Sensitivity 15 mV. Accuracy 3 ppm ± 1 count. **WD-755**

$279.95

NEW ...

DIGITAL POWER LINE MONITOR

Easy-to-read 3 digit LED display has large bright 0.8-in. digits. Indicates brown-out condition. Instantly shows line voltage fluctuations. Range from 0 to 500 VAC. Freq. 50 Hz to 60 Hz. Current limit 8A. Compact—approximately 4 x 5 x 3 in. **WD-121**

$89.95

NEW ... DOUBLE SLOT SUPPLYST POWER SUPPLY

Outputs at 5V or 13VDC, precision adjustable ±1½V, 0 to 7.5A, current limiting. Lab quality test logic or mobile equipment. Read digitally volts and amps or use as 0 to 99V DC external voltmeters on two large 3-digit LED displays. **WP-709**

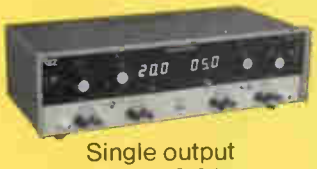
$299.75

NEW SUPPLYST™ 40W POWER SUPPLIES

Laboratory quality power sources, each with two built-in 3 digit meters to measure or monitor voltage or current. Adjustable current limiting. Choice of four supplies:

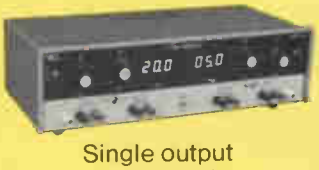
VIZ RELIABILITY

VIZ is a 50 year-old company. Our instruments are fully warranted, parts and labor, for a year. All items tested to NBS standards. We offer service and parts availability for a minimum of ten years. Over 15 repair depots in U.S.A.



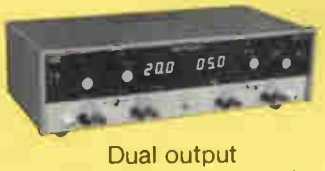
Single output 0-20V, 0-2A

WP-711 **$244.95**



Single output 0-40V, 0-1A

WP-712 **$256.95**



Dual output 0-20V, 0-1A. 0-20V, 0-1A.

WP-713 **$324.95**

Triple output 0-20V, 750mA. 0-20V, 750mA. 5V, 4A.

WP-714 **$368.95**

Want full technical details and a demonstration? Call toll-free, **1-800-523-3696**, for the VIZ distributor nearest you.

VIZ

Look to VIZ for value, quality, availability. Over 70 instruments in the line—PLUS full accessories.

VIZ Mfg. Co., 335 E. Price St., Philadelphia, PA 19144

Circle (1) on Reply Card

ELECTRONIC
Servicing & Technology

Editorial, advertising and circulation correspondence should be addressed to: P.O. Box 12901, Overland Park, KS 66212-9981 (a suburb of Kansas City, MO); (913) 888-4664.

EDITORIAL
Bill Rhodes, *Editorial Director*
Carl Babcoke, *Consumer Servicing Consultant*
Rhonda Wickham, *Managing Editor*
Tina Thorpe, *Associate Editor*

ART
Dudley Rose, *Art Director*

CIRCULATION
John C. Arnst, *Director*
Evelyn Rogers, *Manager*
Dee Manies, *Reader Correspondent*

ADMINISTRATION
R. J. Hancock, *President*
Cameron Bishop, *Publisher*

ADVERTISING
Greg Garrison, *National Sales Manager*
Jeanette Staley, *Production Manager*
Mark Raduziner, *Marketing Coordinator*

Regional advertising sales offices listed near Advertisers' Index.

Member, Audit Bureau of Circulation

ABP Member, American Business Press

ELECTRONIC SERVICING & TECHNOLOGY (USPS 462-050) (with which is combined PF Reporter) is published monthly by Intertec Publishing Corp., P.O. Box 12901, 9221 Quivira Road, Overland Park, KS 66212-9981. Second Class Postage paid at Shawnee Mission, KS 66201. Send Form 3579 to P.O. Box 12901, Overland Park, KS 66212-9981.

ELECTRONIC SERVICING & TECHNOLOGY is the "how-to" magazine of electronics. it is edited for electronic enthusiasts who are interested in buying, building, installing and repairing home-entertainment electronic equipment (audio, video, microcomputers, electronic games, etc.).

Subscription prices to qualified subscribers: one $12, two years $19, three years $24 in the USA and its possessions. Foreign countries: one year $17, two years $27, three years $35. Subscription prices to all others: one year $25, two years $50 in the USA and its possessions. Foreign countries: one year $36, two years $72. Single copy price $2.25; back copies $3.00. Adjustment necessitated by subscription termination to single copy rate. Allow 6 to 8 weeks delivery for change of address. Allow 6 to 8 weeks for new subscriptions.

ISSN 0013-497X/81 $2

INTERTEC PUBLISHING CORP.

The how-to magazine of electronics...

ELECTRONIC
Servicing & Technology

December 1981
Volume 1, No. 2

Further development of high definition television now permits as high of picture resolution as 35mm film. See story on page 41. *(Photo courtesy of Sony)*

12 **The satellite earth earth market...**
...an in-depth study
With the prospect of strong competition and deep price cuts, where are the opportunity areas for the next few years?

14 **How to increase service shop productivity**
By Carl Babcoke, CET
Shop managers should give top priority to increasing productivity because of today's rising business costs.

20 **Some troublesome issues in a deregulated environment**
By Charles D. Ferris
The former FCC chairman provides an insight into new technologies and government regulation.

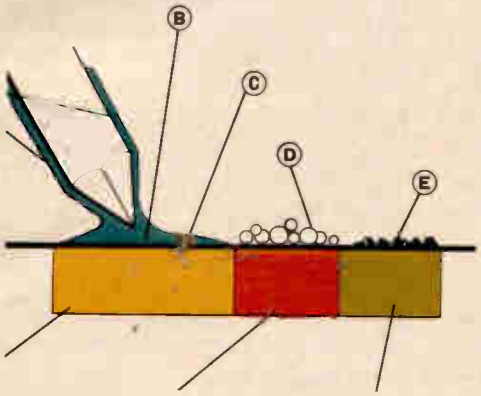
24 **TV systems around the world**
By James E. Kluge, Winegard Company
When TV programs are exchanged around the world, sophisticated equipment and technology are required.

36 **Choosing and using the proper soldering iron**
By Ungar, division of Eldon Industries, Inc.
Hand soldering is often one of the most misunderstood and neglected operations in electronics.

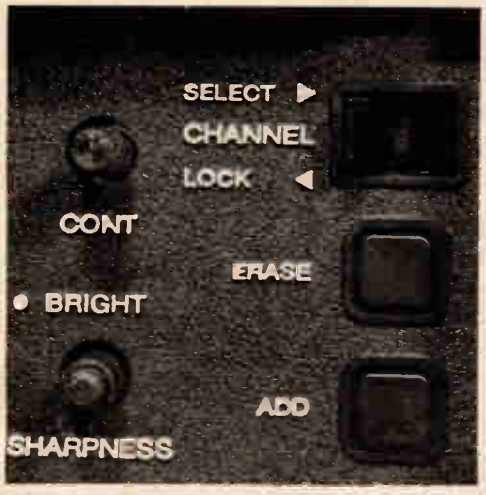
41 **HDTV: A breakthrough in resolution**
Sony Corporation has developed a high definition video system with video recording, time base correction and other capabilities.

46 **SMPTE panel examines HDTV**
By Blair Benson
The SMPTE New York Section met Sept. 9 for a discussion of HDTV by a panel of experts.

48 **Servicing digital tuners**
By Carl Babcoke, CET
Electronic tuners without moving parts have been in use for several years, and understanding their basic operation is the first step in troubleshooting.



Page 36



Page 48

Page 14

DEPARTMENTS

4 Electronic Scanner
7 Association News
8 Photofacts
11 Calendar of Events
40 Symcure
56 New Products
58 Reader's Exchange
61 Book Reviews
66 New Literature

ELECTRONIC SCANNER

1986 U.S. semiconductor shipments to triple 1980 levels

Despite a tumultuous market history, even greater change is in store for the U.S. semiconductor industry during the 1980s, according to a Frost & Sullivan study on semiconductors.

The report projects U.S. company shipments to worldwide markets will total $20 billion in 1986, nearly triple the 1980 level. For this year, U.S. semiconductor shipments will be $9.8 billion, up more than $1.2 billion from 1980.

By semiconductor type, integrated circuits shipped worldwide by U.S. companies will total $17.4 billion in 1986, up from $6.4 billion last year. Shipments of discretes will increase 50% over the study timeframe – from $2 billion in 1980 to $3 billion in 1986.

The 217-page report, referring to the unsettled market environment says that "many uncertainties could seriously affect the projected growth and vendor market share, especially during the second half of the (1980s) decade."

For further information, contact Customer Service, Frost & Sullivan, Inc., 106 Fulton Street, New York, NY 10038; (212) 233-1080.

Entertainment on the house

More and more Americans are foregoing nights on the town in preference to entertaining themselves and friends in well-equipped media rooms, or entertainment centers, according to *Time Magazine.*

"Begotten by the electronics revolution, the thoroughly modern media room comprises an eye- and ear-boggling assemblage of spectacle and sound," *Time* says. "For upwards of $14,000, the home entertainer can furnish his room with, say, a big-screen Kloss Novabeam projection TV, a Sony Betamax video recorder, a Panasonic videotape color camera, an RCA videodisc player, a Yamaha audionics stereo with electrostatic-charged speakers, a film library, videotapes and discs, stereo records and Atari electronic games." Annual stereo and video sales across the country are running about $2 billion, *Time* said.

Hollywood writer-director Melville Shavelson says: "A media room becomes a focal point for the family. You make your own popcorn, make sodas at the fountain, drinks, barbeque...It's total entertainment."

A Midwestern home owner invites guests to the media room to watch an instant videocast of the other guests out in the garden. Some parents project Atari games such as Space Invaders and Missile Command for their children on a 7-ft. screen.

Time says, "Media roomies... rattle on endlessly about the advantages of not getting around much any more: no need to fight for a cab, no danger of getting mugged, no standing in line for tickets. And, they invariably point out, once one has paid all those big bucks for the home Odeon, entertainment is forever after...on the house."

Genave announces new manufacturer's representative

Genave Inc. has appointed JM Associates as manufacturer's representative, according to Claude L. Henderson, president. JM Associates will represent the company's land mobile communications equipment in northern Nevada and northern California.

JM Associates, headed by Joan Moeller, is located at 560 Oxford Ave., Palo Alto, CA.

Engineering short courses offered in February

The Continuing Engineering Education Department of George Washington University is offering a series of courses for February 1982 in Washington, DC; Orlando, FL; Chicago, IL; London, England; Berlin, Germany; and Mexico City, Mexico.

The courses include electro-optics, fiber-optics and lasers for non-electrical engineers; design and prediction of sonar systems; integrated circuit engineering with emphasis on VLSI and VHSIC; sonar signal processing; public and private packet switched networks; fiber and integrated optics; electromagnetic pulse; the integration of microcomputer and robotic technology; and synchronization in spread spectrum systems.

For further information, please contact the Director of Continuing Engineering Education, George Washington University, Washington, DC 20052 or call toll-free (800) 424-9733.

SRI launches study of new technologies

The world semiconductor market will reach $74 billion by 1990, a 23% per year growth rate during each of the next nine years, according to Dr. Julius Muray, a staff scientist at *SRI International's* Engineering Sciences Laboratory.

"On the other hand, it has become exceedingly clear," Muray said, "that the future directions and growth of this industry will be driven by technological innovations. Research and development activities are operating at an unprecedented level where an increasingly higher degree of sophistication will be required to predict which innovations will have a major impact on the industry, and what effect these innovations will have on manufacturers, users, and suppliers."

With this background, Muray's group is launching an in-depth program to study the entire microelectronics industry – the technology, devices and trends. The program will focus on the critical issues created by changing technology and predict how these changes will affect semiconductor manufacturers and their customers.

"Intense competition will mean even greater choice for users," Muray said. Creative approaches by competing manufacturers will force product planners and designers to monitor emerging product developments – simply to maintain pace with the market."

Muray's program is intended to guide the microelectronics executive through "the maze of technological changes that will soon affect every aspect of the growth and evolution of the industry."

Further information concerning client participation in the program (Microelectronics Technology, Devices and Trends) can be obtained by contacting Dr. Julius Muray, SRI International, 333 Ravenswood Ave., Menlo Park, CA, (415) 859-2465.

Strategic updates satellite report

Strategic Inc. has released updated forecasts and information in its report, "Small Satellite Earth Stations: U.S. Market Opportunities, 1981-1989" (No. 309). The study contains current data and projections regarding direct broadcast to homes by satellite.

Marsha F. Adams, director of audio-video services, reported that the projections by Strategic "are conservative, compared to manufacturers' claims." Restricted to the U.S. non-military market segment, Strategic predicts that the total small satellite communications earth station market will grow at an average annual rate of more than 48% (in units) through the decade of the '80s. Declining prices, especially in the DBS segment, will limit the annual revenue growth (in constant 1980 dollars) to about 18%. Total equipment sales (receivers, antennas, transmitters and amplifiers) will be in excess of $1 billion over the 1981-1989 period.

The April 1981 FCC ruling that tentatively permits direct-to-home broadcasting represents a significant milestone in the development of the small earth station market.

"However, there are still hurdles to overcome," according to Mrs. Adams. "Protests by cable television companies, government red tape, lack of programming, competition by other video media for the viewers' time, and delays of K-band satellite transmission until the mid-1980s," are all obstacles to be overcome. Strategic predicts sales of 160,000 antennas in 1989, assuming that DBS does not become a viable service until 1985-1986. Sales are then expected to increase tenfold each year in the early 1990s, as the DBS services increase.

The report includes a company/product matrix of more than 85 firms involved in the manufacture of small earth station equipment for the U.S. market.

The 120-page report is now available for $1500 from Strategic

Inc., 4320 Stevens Creek Blvd., Suite 215, San Jose, CA 95129, (408) 243-8121. For additional information, contact Mrs. Marsha F. Adams, Director, Audio/Video Services.

NEC America forms new subsidiary

NEC Home Electronics (U.S.A.) *Inc.* has been formed as a wholly-owned subsidiary of NEC America Inc., effective October 1, 1981. The new subsidiary is structured on the basis of the former Consumer Products Divisions of NEC America.

At the board of directors meeting on Oct. 1, 1981, Masahiro Tsukimoto (formerly general manager, Consumer Products Division) was elected president and Akira Sugiyama (formerly assistant general manager) was elected secretary/treasurer of the corporation.

NEC's entry into and commitment to the growing personal computer market in the United States was a factor in the decision to restructure the organization. The new corporation will continue to sell a broad line of equipment, including video products and display monitors, as well as personal computers.

NEC America Inc. is a wholly-owned subsidiary of Nippon Electric Company Ltd.

NEPCON West '82 seeks expanded exhibit space

For the third consecutive year, NEPCON West, scheduled Feb. 23-25, 1982 at the Anaheim Convention Center, has sold all available booth space during its initial reservation period.

A waiting list of manufacturers wishing to exhibit has been established, according to the organizer, the Cahners Exposition Group (CEG).

"If the response for booth space remains at its current level," said Aaron Kozlov, general manager of CEG's Chicago division, "we will arrange for additional display space in the Convention Center.

"Booth reservation requests should be sent to our Chicago office," Kozlov indicated. "All exhibitors who have been unable to obtain booth space during the initial reservation period will be contacted with updated information."

Nearly 40,000 engineers, prototype designers, testing personnel, support specialists and QC/QA managers attended in 1981 and exhibitors report they are expecting a larger audience in 1982.,

"With its unique focus on packaging, production and testing disciplines, NEPCON is the electronic industry's only exposition that presents a total overview of the necessary interrelationships between circuit packaging/design, production and testing required to bring electronic products to the end-user in a cost-efficient manner," said Kozlov.

NEPCON West '82 is co-sponsored by *Electronic Packaging and Production* magazine, *Semiconductor International* magazine, the International Electronics Packaging Society, the California Circuits Association, the Arizona Printed Circuits Association and the Photo Chemical Machining Institute.

Additional details on participating in NEPCON West '82 may be obtained from Cahners Exposition Group, 222 West Adams St., Chicago, IL 60606, (312) 263-4866 or telex 256148.

MCE to supply semi-custom CMOS devices

Micro-Circuit Electronics (MCE), the western affiliate of Micro-Circuit Engineering, has announced that it has signed a license agreement to market a family of semi-custom CMOS devices developed by Master Logic Corporation.

The CMOS devices will be available through all MCE affiliates, at Nuremberg and Munich, West Germany, in addition to Sunnyvale, CA, and West Palm Beach, FL.

Under the agreement, MCE will manufacture and market seven metal-gate CMOS arrays as part of its semi-custom UNIRAY (universal array) product line. These devices handle a wide range of complex digital functions and some simple linear functions.

"This license underscores our commitment to offer the broadest line of semi-custom arrays in the industry," said Andy Procassini, president of MCE's western U.S. affiliate. With the addition of the CMOS family, MCE now numbers 42 semi-custom devices in its UNIRAY line. Included are analog, digital and combined analog/digital functions – as well as bipolar and CMOS technologies.

Lafayette parts available from Terryville Electronics

The parts department of Lafayette Radio Electronics of Syosset, NY, has been purchased by Terryville Electronics Inc. The new address for obtaining Lafayette parts is 693 Old Town Road, Terryville, NY 11776, (516) 473-0192.

Heath provides self-study programs

"Self-study used to be the stepchild of the technical training industry – but not any longer," said Douglas Bonham, director, Educational Products, *Heathkit/Zenith Educational Systems Division of the Heath Company.* More companies are turning away from the classroom approach to use self-paced individual learning programs for reasons of cost, time and employee motivation.

The cost of air travel, meeting facility rental and related expenses is so great that many workshops and seminars are no longer cost-effective, says Bonham. Seminars can cost up to $2000 per employee. Heathkit/Zenith's self-study programs can train 10, 20 or more employees for that price. Companies can use one of more than 30 technical training courses offered by Heathkit/Zenith for less than $100 each. The courses include textbooks, flip charts, audio-cassettes and other materials.

"In addition, many employees who continue their education are highly motivated and prefer to learn by doing rather than sit in a traditional classroom environment," Bonham said.

ES&T

ASSOCIATION NEWS

EIA comments on VCR court decision

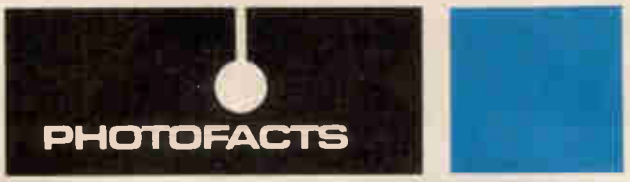
Speaking on behalf of the *Electronic Industries Association's* Consumer Electronics Group, Jack Wayman, senior vice president, stated, "The decision of the ninth circuit court of appeals regarding prohibition of the use of the videocassette recorder to tape programming off the air for home use is unfortunate and disturbing for a number of reasons.

"It is our belief that the decision violates the public interest by prohibiting the American consumer from utilizing and enjoying a product which significantly improves the quality of their lives.

"We also believe that the intent of Congress was clearly stated in 1971 when it permitted private persons to record sound-only off the air for home use.

"The videocassette recorder is one of the most popular and the fastest growing products sold in the consumer market. There are currently more than 3 million in use. It has numerous uses, such as time shifting of broadcast programs that the viewer otherwise might have missed. This type of time shift recording thus increases the audience available to broadcasters who pay royalties to the owners of the copyrighted material. The popularity of the VCR also results from its use for the production of home movies and for the showing of prerecorded video tape on which royalties have already been paid.

"The issue in question has been in the courts for a number of years and we expect that this decision will not conclude the matter. We fully support any requests for rehearing in the ninth circuit court, en banc, and finally at the Supreme Court level if necessary, in order to see this decision reversed." ES&T



BOHSEI
Chassis M3C2-1B,2 2035-1

EMERSON
RED-5600A 2033-3

GOLD STAR
RV-100, VR-031 2039-1
TCV-3800 2035-2

KMC
KMB-0920G 2033-1

JCPenney
685-2000F,-00 (855-2713),
685-2015F,-30 (855-0725),
685-2050F,-10 (855-1848) 2037-1

PHILCO
B225PSL 2036-1

QUASAR
Chassis ADTS-976,
ASLEDTS-976, EDTS-976 2036-2
Chassis C/D7TS-626 2039-2
Chassis TS-991 2035-3
TT5968SW 2033-4

RCA
Chassis CTC110A,B 2033-2
Chassis CTC111A,B,C,D,E,H 2038-1

SHARP
3K-82B 2036-3

SONY
Chassis SCC-267A-A,B-A 2037-2

SYLVANIA
Chassis E32-4 2034-1

WARDS
GGV-12350C/2781B 2038-2
GGV-12910C/912A,B/940D,E 2039-3
GGV-12970D/991A,B 2034-2

GET MORE FACTS

Want more information? Circle the numbers of those items of interest to you

PLACE FIRST CLASS POSTAGE HERE

ELECTRONIC
Servicing & Technology

P.O. Box 12901
Overland Park, KS 66212-9981

READER SERVICE INFORMATION CARD 12/81

This card is usable until March 1, 1982. Please apply appropriate postage before mailing.

For more information on products or services mentioned in this issue, simply circle the appropriate numbers below, check one box in each column, type or print your name and address and mail.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180

IMPORTANT! Please check your business classification:

Type of Business
Check One:

A.☐ Independent Electronic Service Organization
B.☐ Retailer with Electronic Service Department
C.☐ Independent or Self-Employed Service Technician
D.☐ Electronics, Radio, TV Manufacturer
E.☐ Industrial Electronic Service
F.☐ Wholesaler, Jobber, Distributor
G.☐ Other (Specify .....

Position
Check One:

H.☐ Owner, Manager
I.☐ Ser. Manager
J.☐ Technician
K.☐ Other

Be sure you have checked ONE box in each column above!

Please print plainly:

Name _____
Title _____
Organization _____
Co. Address _____
City _____ State _____ Zip _____
Telephone: Area Code ( ) Tel. Number _____

SAVE TIME Use peel-off address label for faster service.

READER SERVICE INFORMATION CARD 12/81

This card is usable until March 1, 1982. Please apply appropriate postage before mailing.

For more information on products or services mentioned in this issue, simply circle the appropriate numbers below, check one box in each column, type or print your name and address and mail.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150
151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170
171	172	173	174	175	176	177	178	179	180

IMPORTANT! Please check your business classification:

Type of Business
Check One:

A.☐ Independent Electronic Service Organization
B.☐ Retailer with Electronic Service Department
C.☐ Independent or Self-Employed Service Technician
D.☐ Electronics, Radio, TV Manufacturer
E.☐ Industrial Electronic Service
F.☐ Wholesaler, Jobber, Distributor
G.☐ Other (Specify .....

Position
Check One:

H.☐ Owner, Manager
I.☐ Ser. Manager
J.☐ Technician
K.☐ Other

Be sure you have checked ONE box in each column above!

Please print plainly:

Name _____

Title _____

Organization _____

Co. Address _____

City _____ State _____ Zip _____

Telephone: Area Code ( ) Tel. Number _____

SAVE TIME Use peel-off address label for faster service.

PLACE FIRST CLASS POSTAGE HERE

ELECTRONIC
Servicing & Technology

P.O. Box 12901

Overland Park, KS 66212-9981

Want more information? Circle the numbers of those items of interest to you

GET MORE FACTS

CALENDAR OF EVENTS

January

7-10
Winter CES, Las Vegas Convention Center, Las Vegas, NV. Contact Consumer Electronics Shows, Two Illinois Center, Suite 1607, 233 North Michigan Avenue, Chicago, IL 60601 (312) 861-1040.

26-28
Spacecraft Electronic Conference, Hyatt Hotel, Los Angeles, CA. Contact Frank Mitchell, director, Requirements Committee, EIA Government Division, 2001 Eye St., N.W., Washington, DC 20006, (202) 457-4944.

February

2-4
Southcon '82, Orlando, FL, at the Sheraton/Hyatt. For more information call (800) 421-6816.

23-25
NEPCON WEST, Anaheim Convention Center, Anaheim, CA. For more information, contact Cahners Exposition Group, 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

March

19-21
Computer Fair, Civic Auditorium, Brooks Hall, San Francisco, CA. For more information call (415) 851-7075.

23-25
Southcon/82 Show and Convention, Sheraton Twin Towers Hotel, Orlando Hyatt Hotel and Holiday Inn International Drive, Orlando, FL. Call (800) 421-6816 for more information.

29-May 1
1982 Electronic Distribution Show and Conference, New Orleans Hilton, New Orleans, LA. Contact David L. Fisher, Electronic Industry Show Corp., 222 S. Riverside Plaza, Suite 1606, Chicago, IL 60606, (312) 648-1140.

April

23-25
Hamvention '82, Dayton Hara Arena, Dayton, OH. For more information call (513) 277-5314.

29-May 1
Electronic Distribution Show, New Orleans Hilton, New Orleans, LA. For more information call (312) 648-1140.

May

10-12
The 32nd Electronic Components Conference, Sheraton Harbor Island Hotel, San Diego, CA. Contact program chairperson D. J. Bendz, IBM Corp., Dept 649/014-4, 1701 North St., Endicott, NY 13760.

18-20
Northcon/82 Show and Convention, Seattle Center Coliseum, Seattle, WA. Call (800) 421-6816 for more information.

25-27
Electro '82, Hynes Auditorium, Boston, MA. For more information, call (800) 421-6816.

June

6-9
Summer CES '82, McCormick Place, Chicago, IL. Contact Consumer Electronics Shows, Two Illinois Center, Suite 1607, 233 North Michigan Avenue, Chicago, IL 60601, (312) 861-1040.

7-10
National Computer Conference '82, Astro Arena, Houston, TX. For more information call (703) 558-3600.

August

2-7
Joint convention of NESDA, ISCET, The Texas Electronics Association, the Louisiana Electronic Service Dealers Association, and Television Service Association of Arkansas. At the Hilton in New Orleans, LA. Contact The National Electronic Service Dealers Association, 2708 West Berry St., Ft. Worth, TX 76109, (817) 921-9061.

September

14-16
Wescon '82, Anaheim Convention Center, Anaheim, CA. For more information call (800) 421-6816.

October

11-13
EIA Fall Conference, Century Plaza Hotel, Los Angeles, CA. For more information contact the Electronic Industries Association, 2001 Eye Street N.E., Washington, D.C. 20006.

November

30-December 1-2
Midcon, Dallas Convention Center, Dallas, TX. For more information, call (800) 421-6816.

Photo courtesy of Microdyne.

...an in-depth

In the mid-1970s, there were fears in some quarters that a profitable market for satellite transmission would never develop domestically, and that the prospect of unused transponder capacity would overhang the entire telecommunications transmission market. The opposite has happened. When RCA's third satellite was lost in space in lage 1979, there was near panic on the part of some potential satellite users – demand for satellite channels had already outstripped supply. And the growth in satellite usage was coming not only from the telecommunications industry, but also – in fact, most strongly – from the pay TV, cable TV and newswire companies.

Now that the first Satellite Business Systems bird has paying customers, while Comsat pushes rapidly ahead with its Direct Broadcast Satellite (DBS) plans, the satellite earth station market is booming. But with the prospect of strong competition and deep price cuts in some sectors of the market, where are the opportunity areas for the next few years? International Resource Development Inc. has completed an in-depth research report analyzing each sector of the satellite earth station market and forecasting the probable growth of the market over the next 10 years. The report (#174) costs $985.00, and an abbreviated table of contents follows:

THE SATELLITE EARTH STATION MARKET...

study and analysis

1.) Executive Summary;
2.) The Future Market for Earth Stations;
3.) Projected Earth Station Markets Through 1991;
4.) An Overview of Satellite Systems;
5.) Earth Station User Requirements;
6.) The Technology of Earth Stations;
7.) How Real Is DBS?;
8.) Satellite Teleconferencing Services;
9.) Supplier Industry Structure; and
10.) Leading Equipment Suppliers.

Section 2 reviews the technological and political framework in which satellite transmission has developed and analyzes the way in which satellites compete with other forms of medium-distance and long-haul telecommunications. A detailed analysis, segment by segment, of a dozen different segments of the satellite earth station market is presented in *Section 3,* which includes a discussion of the requirements of the cable TV market, the newswire, government, marine, hotel/motel, timesharing and other segments. Current shipment levels and the value of shipments are identified in each case, and projections are provided through 1991 for each of the segments.

In *Section 4* the current and planned future commercial satellites in the United States are identified and discussed, and a brief overview is provided of overseas countries and their use of Intelsat and domestic satellites for domestic traffic.

Section 5 discusses the different needs of different categories of satellite earth station users and reviews the probable trend toward higher frequency satellite transmission and what this will mean to earth station users.

The technology of satellite earth stations is covered briefly in *Section 6,* which describes the configurations of different types of earth stations and explains the operation of the receiving and transmitting circuitry.

Direct Broadcast Satellites, which carry TV signals direct to a home earth station antenna, are reviewed in *Section 7.* Viewed until recently as unlikely because of political (overseas and United States) and technological constraints, DBS is rapidly emerging as a probable entrant to the U.S. video scene in 1985 or 1986. Fueled by Comsat's ample cash and credit, the most ambitious of the DBS plans seems to be on the way toward implementation, and others are close behind. The implications of this are considered, and projections are provided of the probable earth station market potential for DBS.

Section 8 reviews current activities in the market for teleconferencing services and the role played by transportable earth stations in that business.

Section 9 analyzes the present supplier industry structure in the earth station market and includes estimates of the market shares of each of the leading suppliers of earth stations.

A discussion of the presently possible future market positioning and strategies of the principal earth station vendors is provided in *Section 10,* which includes an exhaustive list of suppliers of earth stations and components, identifying the nature of the earth station involvement of each.

The team which produced this study has been involved in several earlier analyses of the satellite communications market, both for custom studies for suppliers in this marketplace and for previous IRD multiclient research reports.

International Resource Development Inc. (IRD) is an independent consulting firm specializing in the measurement and analysis of technological and financial-services markets. IRD reports have been purchased by several thousand government and commercial organizations for every major country in the world.

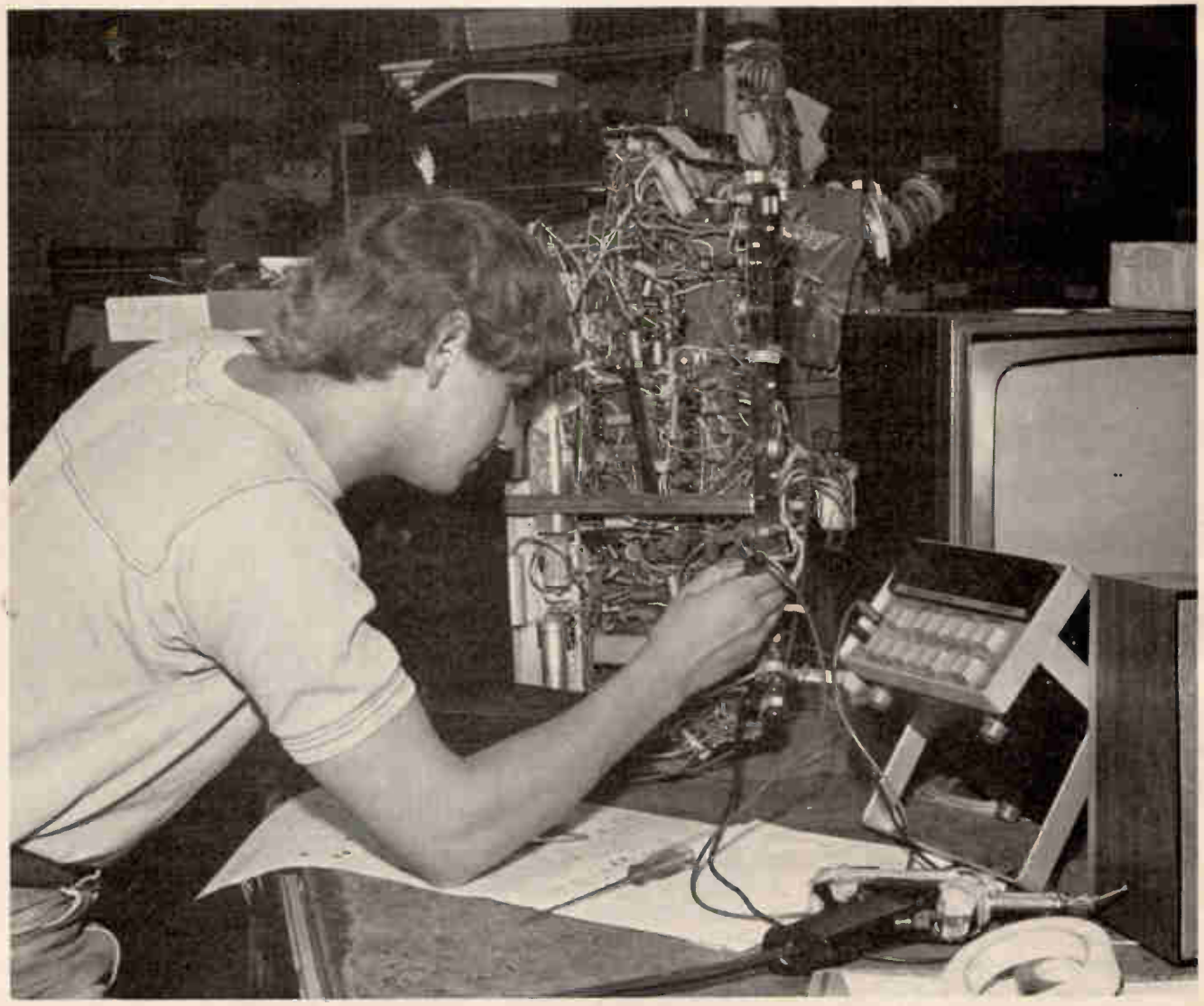
For more information, contact International Resource Development Inc., 30 High St., Norwalk, CT 06851; (203) 866-6914.

ES&T

How to increase service shop productivity

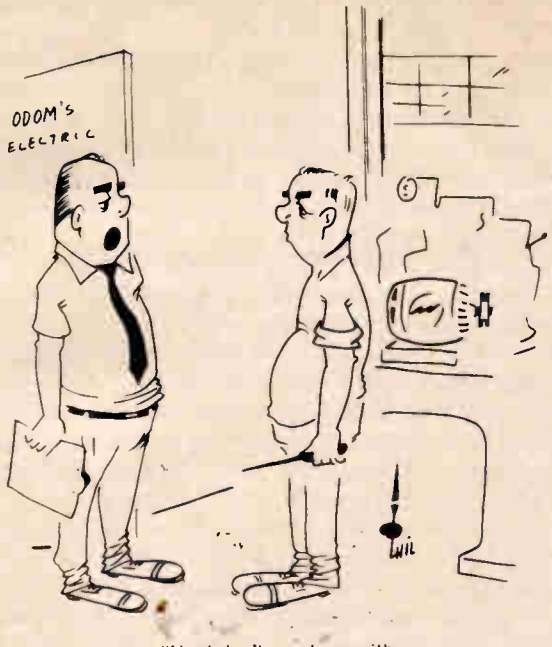
By Carl Babcoke, CET

No standards exist for productivity in shops that service electronic products. The number of completed repairs varies widely according to the type of device, the age and condition, the shop's equipment and the ability of the technicians. Helpful suggestions are given here for measuring and improving this productivity.



This picture of an equipment rack constructed long ago is one example of an efficient permanent grouping of specialized equipment (alignment gear, in this case) in a table or rack that is mounted on wheels so it can be moved to the repair area when needed. Other ideas include movable tables for the customer products, which are moved near the repair area when needed.

Repairing television or other electronic products in a haphazard clutter of other machines, basic test equipment, and a few hand tools is typical of operation in smaller shops that repair many different makes, models and types. Time-saving changes for higher production should include permanent work positions with adequate tools (not shared or moved to other positions) and test equipment that is mounted separately from the machines being repaired.



"No, I don't go along with
the idea that no work means zero defects!"

Owners and managers of electronic servicing shops should give top priority to increasing the productivity of the business if it is to exist and prosper in today's difficult financial climate. Business expenses are rising rapidly, but inflation pressures are hurting customers also. Therefore, customers have reasons for opposing increases of service-shop prices. Shop managers are caught between these pressures, so any significant decrease of business costs will help the financial standing without triggering customer resentments or bringing inflationary price increases.

However, increasing the productivity of skilled technicians only is not the total answer. The project must involve each person in the business.

The complete solution should include these steps:

- Calculate both the total shop productivity and each technician's productivity;
- Ask all employees for suggestions about improving productivity;
- Make all possible changes that offer the most improvement;
- Calculate the new productivities; and
- If the productivity has improved, compliment and reward employees in proportion to the improvement.

Calculating productivity

Many methods have been used to calculate the productivity of technicians. The least accurate is where any excess-of-labor charges to customers, above wages paid to the technician, represent gross profit. Another virtually useless plan is to make certain the technician is busy during every working hour.

A more accurate method is based on the theory (proved to be approximately correct in actual cases) that each technician should bring in 2½ times his wages. If a technician is paid $200 per week but brings in about $300 per week, his productivity could be rated at 60% (2½ times $200 equals $500, and $300 is 60% of $500). However, this 2½ ratio is not an absolute law.

Perhaps the best method is to compare the labor income with the hours worked vs. the shop's hourly rate. For example, a technician worked 43 hours one week, bringing in $548.25 in labor charges. But the shop rate was $25 per hour, which *should* have brought in $1075. Dividing $548.25 by $1075 yields a productivity of only 51%. These figures can help set each technician's wages.

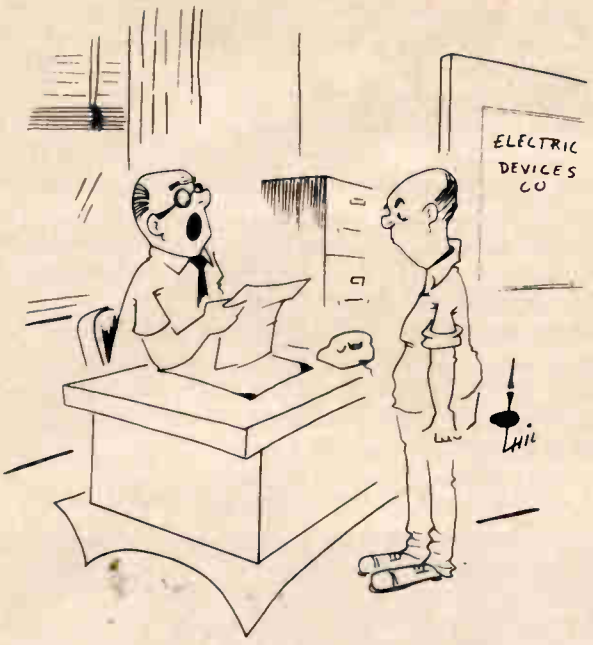
Of course, if a technician is required to talk on the phone or at the counter to customers, order parts, repair trade-in merchandise, sweep the floor, or other necessary but unproductive work, some allowances should be made to account for the apparent shortage of labor income.

After a method of measuring productivity is established, the same method should be used later to determine any gain or loss.

Ask for suggestions

Employees can produce an amazing number of useful ideas for eliminating wasted time and improving efficiency. No manager can afford to ignore this valuable source, so all suggestions should be considered carefully. Some will have apparent value and require little labor money to implement. For example, moving the service-data files nearer the technician's work area does not need much discussion. On the other hand, the purchase of a 2-wheeler (that can move large televisions up and down stairs and requires only one man to operate) needs a numerical assessment of how many times per month it would be needed and the cost vs. the time saved.

"Temper, temper!"



"Haskins, I was thinking about giving you a raise, but then I started thinking about your production!"

If technicians have been taking many service-call orders over the phone and a suggestion is made to have a person without technical knowledge take the calls, the manager or one of the trained technicians must make up a list of questions to ask. This is very important, particularly with warranty calls that might be disallowed by the factory if they do not meet the factory terms.

Make all changes

Physical changes should be made first before any incentives. The value of some suggestions depends on the volume of machines in the shop. For example, if only three or four receivers or chassis are stored before or after repair, no special method is needed. However, if the number of stored machines exceeds 12, an identification system for the shelves is mandatory. Perhaps each space can be assigned a number, and the same number written on the service order. When a customer calls about the machine, the space number can be obtained easily from the in-shop service-order file.

Arrangements of benches and test equipment also depend on the volume of repairs and the diversity of machines repaired. A large shop with more than four full-time shop technicians should be specialized. For example, two work areas might include space and test equipment appropriate for color TV servicing, one area for radios and stereo units and a separate bench or area for repairs of machines that have important mechanical functions (tape recorders, videodisc players and record changers).

In fact, the use of conventional benches is declining rapidly. A single long bench with drawers in front and shelves above and behind the bench top is almost obsolete, except for small shops whose diversity of repairs prevents any specialization.

Many variations of the lazy-susan revolving bench have been proposed. A revolving setup for servicing color TVs might have a built-in CRT test jig plus another area for table models. The test equipment could revolve to be accessible to either test area. Minor niceties include signals from an MATV antenna system, many ac outlets, a variable-voltage line-power transformer for high or low power operation, and bright lighting that is shaded from the test-jig CRT screen.

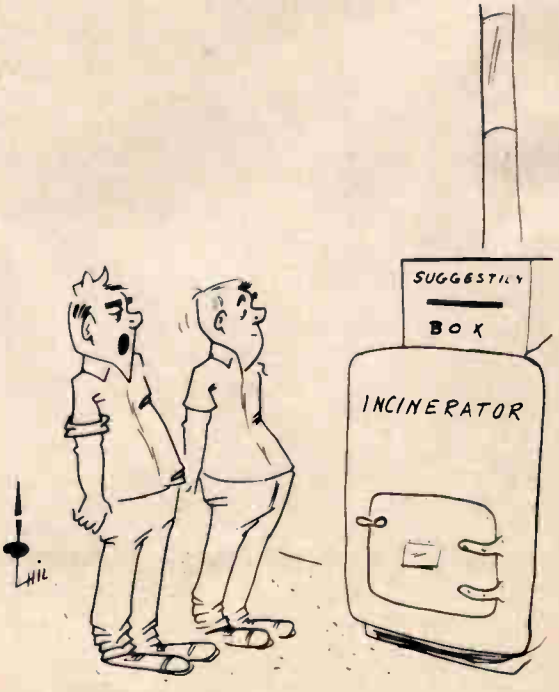
Other minor conveniences include a trim around the bench top that prevents tools and loose screws from falling to the floor and a narrow shelf under the bench top where tools and small components can be placed temporarily out of the way.

Each bench or work area should have a complete set of tools so it is not necessary to move them from one bench to another, and a small area on the bench top should be reserved for service data.

Another time and back-muscle saver is a selection of small tables on wheels. Some shops place merchandise on such a table immediately at the front counter or the back door where the trucks unload. The machine remains on the same table until it leaves the shop.

Many successful shop managers recommend a separate parts storeroom, one with walls or fencing around it and a door with a lock. Although pilferage by employees might not be a problem, the secure parts room is a silent witness to all employees that parts are valuable and must be accounted for. If parts are kept at the work stations there is a tendency for technicians to forget small components, such as resistors and capacitors, when the service order is completed.

Seldom can one shop's layout be used without modification by another. But these suggestions can



"We have a great system of communicating around here!"

Which incentive is more likely to motivate your employee or co-worker to give you the extra effort needed to make your business successful?

inspire ways of improving your own shop area.

Improving employee attitudes

During and after physical improvements to the shop, remodeling should be performed on any employee attitudes that are not compatible with the winning combination of cooperation, helpfulness, and the desire to furnish efficient, rapid and dependable repairs for the customer's equipment.

Brute force or intimidation is no more effective with employees than it is with customers. Wise managers learn rapidly that consideration for the feelings of technicians usually results in increased production. Many technicians have no special love for their jobs, but a high percentage are fascinated by working with electronics. They like money, but the mystery of troubleshooting and the satisfaction of a repair made quickly and completely is the extra payment. Those technicians will respond when the manager asks for help in improving the shop and in repairing more items of merchandise per day.

Attempting to force a technician to work faster under constant pressures of specific and inflexible rules, however, can be self defeating if it bring nervousness or excessive strain. It is better to remove hindrances and offer inspiration instead.

Specialize

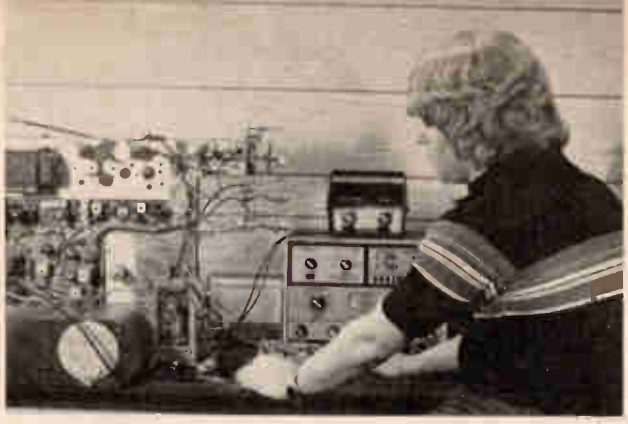
Specialization can have many different forms. If a service shop has two or more bench technicians, the men can specialize according to products (color receivers or audio and stereo) or according to brands (RCA and GE vs. Magnavox and Zenith). It is difficult for any technician to have complete competence for all repairs on all makes and models, so in larger shops, specialization is imperative.

Also, specialization should divide some steps of repairs between beginners or apprentices and experienced technicians. Skilled techs should not be required to routinely test tubes, clean and dust chassis or cabinets, carry in portable televisions, move products to the finished bench and other similar tasks.

Recalculate productivity

After all these changes and improvements, the productivity of individual technicians and the overall shop productivity must be recalculated and compared with the previous percentages. There should be a definite improvement. Part of the increased production probably came from the changes made. But another substantial increase came from paying attention to your employees.

A true story illustrates this last point. During



Is this TV technician working hard or hardly working? Lack of production can be caused by poor attitudes, lack of proper electronic knowledge, or working under inefficient conditions. A wise shop manager will discover and remedy anything causing poor production.

Productivity

World War II, several production engineers studied the operation and daily output of one moving production line in a war plant. They decided the noise level was excessive and distracting, so partitions were erected and traffic diverted around the area. Production increased significantly. The production engineers were jubilant, and decided to improve the output more by installing brighter, shadow-free lighting. Again production increased. Several other changes also brought larger production. Finally, all the improvements were finished, but the engineers continued to check the number of units finished by the line and the quality of the products relative to the defects and rework. Important company and Signal Corps people came to examine the results of the improved working conditions. The production rate continued to rise. Over the next few weeks, attention to the production line and its workers declined to zero, significantly matched by a declining production rate.

The moral of this example is that benevolent attention must be continued if the improved benefits are to continue. Therefore, the service-shop manager should have staff meetings at regular intervals to inform all employees of the problems or victories. Also, private conversations should be held with individual employees. Follow this general rule: *compliment in public, and reprimand in private.* These activities will promote better understanding and cooperative teamwork.

Technical ability

There is no satisfactory substitute for technical competence. A diagnostic assignment that cannot be finished is far less profitable than not accepting the item for repair. Of course, if you are in a densely populated area, perhaps the product can be taken to a factory-service shop or to a friendly competitor who will repair it for a price. In comparison, manual labor (such as laying a brick wall or plowing a field) might be performed fast or slow, but there is little doubt that it *will* be finished. A diagnosis might *never* be finished if the technician is inadequate.

Electronic science and discoveries never stop; new circuits and products are added constantly. Technicians cannot reach perfection, for the standards of competence continue to rise rapidly. Therefore, all technicians should add to their store of knowledge by attending seminars and reading books and magazines. This should not be a burden for technicians who are vitally interested in electronics—the best techs want more than money and security.

A skilled service-shop manager must learn to judge competency in technicians. If the manager knows electronics, it is not difficult to probe the technician's limits. A non-technical manager must rely on apparent competency plus records of callbacks and complaints.

Finally, *establish wages according to productivity.* Of course, there can be other important considerations. A bench technician who ends up with most of the tough jobs would not be expected to compete with another who does routine work.

Check productivity regularly

Technician productivity should be calculated monthly, with a review each year. Productivity ratings of all technicians should be displayed openly at all staff meetings. The manager should inspire the techs to greater productivity, but he should never say anything derogatory about a low-rated tech or compare his record against another tech with a higher percentage. Let the figures speak for themselves in open meetings.

This low-key competition can produce these benefits:

- Most technicians will try to improve their record;
- If wages are based (at least partially) on productivity, each tech will know when his wage rate is fair;
- After they realize that higher wages can come only from higher profits, most employees will not be sheepish about explaining price rises to customers. Customer confidence is destroyed when a technician gives customers the impression that higher repair prices are being charged merely *because the boss is greedy;*
- All employees will be more inclined to improve efficiency by making sure parts are reordered and keeping test equipment in good working condition; and
- Clutter in service vans and shop benches will be minimized to improve efficiency by preventing wasted time.

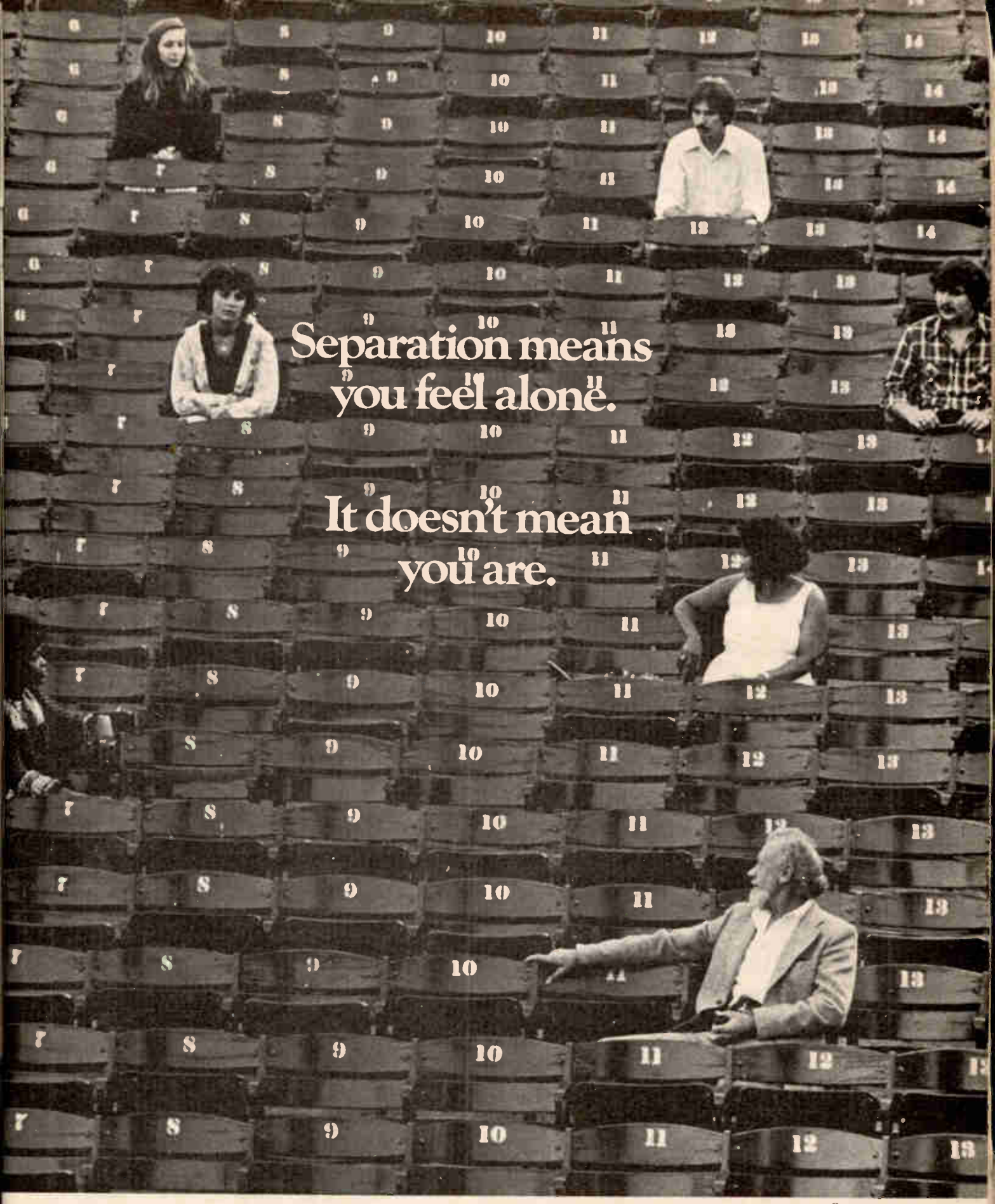
Comments

High productivity alone will not make a business successful. If a loss is taken on each repair, increased productivity will not help. Pricing that is fair to customer and service shop alike must be instituted, and a sufficient volume of repairs must be maintained.

Remember that *a technician's time is a perishable commodity.* If it is wasted, the time is gone forever. Each technician must be kept busy with profitable work.

Finally, *no condition or situation can be managed properly unless it can be measured.* This applies to productivity as well as to electronic problems. *Learn to measure productivity in order to control it.*

ES&T



Everybody faces separation.
It may take different forms: divorce, moving, going away to school, aging, the death of someone close. Separation is a lonely feeling, but you're not alone in feeling that way. It's one of the things we all have in common. And that common feeling can provide a basis for getting together. Talking. Listening. Dealing with separation as a part of life, not as the end of it.

Concern Counts.

"some troublesome issues in a deregulated environment"

By Charles D. Ferris

At a recent meeting of the Society of Motion Picture and Television Engineers, noted filmmaker Francis Ford Coppola appeared on a panel along with a number of technically oriented broadcast industry executives. He spoke of films "to be mixed like music instead of edited" and studios that would "pump pictures and sound around like hot and cold running water." Why would Coppola take time from a busy schedule to appear at technical group meetings?

He appeared to encourage the design and development of distribution systems that allow the viewer to receive the full power of the electronic cinematographer's art. Coppola's appearance was significant, I think, because it is one of the more overt signs that technology is creating new pressures on familiar relationships.

Coppola's concern that technology might not advance sufficiently to allow him to fully exploit his theories in video is one example of these pressures. Another comes from the advent of satellite-delivered programming because it is putting increasing pressure on network-affiliate relations. Networks, after all, are bi-directional brokers that capture economies for the other party on either side. They allow programmers to develop products for sale to hundreds of outlets; however, they deliver programming to those same outlets in a highly cost-effective manner. With the proliferation of high quality programming and its relatively inexpensive availability by satellite, there will be an increasing incentive for affiliates to be more selective in the programming they elect to broadcast in the future. I believe competition for viewers will require a more focused set of programming judgments on the part of local broadcasters.

However, the re-definition of these relationships is only one effect of the steady development of new technological options. Perhaps the single most important effect of the widespread implementation of new technology, particularly computer-based equipment, is the new possibilities it creates. The benefits of these possibilities are well known and are being readily accepted by industry, customers and government. From my own communications policy making perspective, I can say that the many deregulatory initiatives of the past few years were premised on the successful exploitation of these possibilities.

Regulation/deregulation

In theory, federal regulation is designed to protect consumers when the market itself cannot. On its face, this is a simple concept. Commentators, particularly those trained in economic analysis, have argued that the simplicity is deceptive. What these experts have shown rather clearly is that regulation itself imposes some costs upon consumers and that these costs must be measured against the costs consumers will pay in a deficient market which is unregulated.

What a deregulatory policy emphasizes is that the entrepreneurs – large or small – striving to achieve the benefits of these possibilities are changing the structure of the markets in which they operate. Not only are they breaking down market classifications that only a short time ago seemed immutable, but the *internal* character of each of the markets is changing as well.

A few examples will illustrate this point. The current interest in viewdata and teletext services raises many issues that can be analyzed within one general model. Shall new services, combining some elements of TV entertainment, some of newspaper publishing and some of data base services, be treated as one or the other service, or as something entirely new? This is a question not yet answered by the legal system in communications. My own view is that new services can only meet the public need they were designed for if policymakers rethink the ap-

plicability of, or need for, the regulatory premise each time a new service is introduced. Only in this way can a service and its market be assessed on its own terms rather than as an amalgam of ill-fitting regulatory garments from another era.

Even within particular markets, the nature of the business is changing. High capacity cable systems, videocassette and videodisc players, MDS, STV and DBS hopefuls are all attempting to deliver video programming to consumers. In this case, is television the right market anymore? I believe that it still is, because the viewing public does not have the same access to these technologies as it does to over-the-air television. Nevertheless, it is quite clear that the day is coming when an individual viewer's program consumption will depend on his or her choices made from hundreds of available channels. The only question is when will time arrive?

Because the nature of markets in which these new services will be offered is still so uncertain, it is difficult to support the need for regulation in them. With an increasingly plentiful supply of both programs and distribution media to deliver those programs, the chances for a competitive market look good. As with the common carrier industry, it is also appropriate that the new entrants, without significant market power to protect themselves from suffering the consequences of poor performance, should be deregulated first.

To impose a system of rules and restrictions before one can tell whether competition will take root is to guarantee that its progress will be deflected.

The present deregulatory policies recognize the competitive potential of the new technologies. To impose a system of rules and restrictions before one can tell whether competition will take root is to guarantee that its progress will be deflected. As a result, I think the hands-off, pro-market approach to these new technologies is the most appropriate policy now.

Questions on standards

Given this notion, however, there are several issues that are ambiguous enough to warrant special consideration. These problems involve the question of whether technical standards should be adopted by the government and two related issues of integrity: Should government take an active role in assuring that delivery systems are not abused to invade subscribers' privacy interests or programmers' property interests?

The area of technical innovation involves an exceedingly delicate balance of efficient use of scarce resources, particularly when spectrum is employed, technological dynamism, commercial/competitive consequences and design and development expertise. The establishment of design or operating standards provides certainty to manufacturers, operators and subscribers. This certainty is often necessary before manufacturers can bring unit costs low enough to develop substantial markets for their products. Consumers obtain benefits in a number of ways. The adoption of an industry-accepted standard may allow for an earlier introduction of the product than would otherwise be possible. It may also allow manufacturers to charge lower prices while protecting some customers from suffering a sudden obsolescence if the design of a competing model is defeated in the market.

But the establishment of a technical standard by regulation freezes the technology too. Technical advances that might have been only a short time away but which demand more flexibility would be foreclosed. Other promising avenues of research would be pointless pursuits. And the benefits to be derived will be achieved, for the most part, regardless of whether a standard is arrived at by operation of market forces selecting a design or the government doing so. Given the breathtaking successes that have occurred over the past several decades, freezing technological progress is a radical step.

Government policymakers, it seems to me, should be modest when confronted with a number of the nation's most prestigious research houses, each risking real (and big) money in the belief that its design is superior to all others. This need for such modesty is confirmed by the fact that policymakers are generally not technical experts but are nevertheless forced to make judgements about differences that in some cases are extraordinarily subtle and refined and in others dramatic and fundamental. Unfortunately, neither alternative provides much solace. This is particularly the case when these differences may represent deliberate marketing choices and are designed to be optimal for selected applications, and would be foreclosed by government adoption of a single technical standard.

There may be circumstances in which the costs of picking a standard can be minimized. For example, if there are a limited number of alternative proposals, each is generally recognized as performing at comparable quality levels and there are consumer benefits, either in direct costs or advantages of com-

patibility, the selection of one plan may be warranted. When this rare combination of fortuitous circumstance is not present, however, the public is best served if the market, or at least broadly based industry groups, resolve the question of any design or operational standards that may be deemed necessary.

Privacy: In danger

The issue of privacy poses even greater difficulties in assessing the market's ability to secure the important customer and supplier interests at stake. Advances in the miniaturization of computing power bring with them the source of, and perhaps a solution to, these problems. Interactive technology, combining customer expressions of preferences with memory capacity, makes it possible for third parties to compile detailed profiles of customers without their knowledge.

In the home of the future, family members will bank, shop, read, do their taxes and calculate their checkbooks and investment returns at their terminal. Each night they will choose between programming presenting cultural, informational, political, news or other entertainment formats. This same home may be wired into the communications system with exterior and interior monitoring for alarm purposes.

Given the breathtaking successes that have occurred, freezing technological progress is a radical step.

The amount of personal information suddenly being turned over to a system operator under these circumstances is enormous. The interests at stake are at the very heart of our society. A citizenry whose predilections, strengths and foibles are so exposed can never be secure in its freedom without an effective system of safeguards.

I believe it is the responsibilitiy of the system providers, and in turn, that of the design and development engineers, to determine how this technology can provide its cornucopia of services without robbing us of our ability to enjoy them in our solitude. This issue is a serious one, and the consequences of a failure to address it before it becomes a real problem will be severe. Already certain governmental computer system architectures have been rejected because of their privacy implications.

Because of the fundamental value our society places on the right to privacy, I believe the market's ability to assure its protection will be closely scrutinized. A free market requires that consumers have information adequate to allow them to make rational comparative decisions. In this case, however, the computers receiving and retaining the information on each of us will be at distant and often times unknown locations. Moreover, the compilation of individual profiles will almost, by definition, be an after-the-fact operation, and may even involve third parties joining data from otherwise separate facilities. Thus, consumers may never know the status of the information they unwittingly generate in the course of their daily lives.

Of course, this problem exists even today. It's effects will be exacerbated, however, in an era when even the most superficial of our daily functions is recorded by memory-equipped machinery. The functions performed by this equipment do not require unbridled discretion regarding the treatment of this data. Program selections, for example, can be stored in local memory that is polled only in the aggregate and at limited times. Storage can be compartmentalized to make access impossible for unauthorized purposes. Erasures should be made regularly. I urge the technical community to address this issue before those with less substantive expertise are forced to do so by the pressure of an outraged public.

Program protective

Finally, the relationship of industry's electronic capabilities and its property rights in programming transmitted over the air is highly uncertain. MDS, STV, satellite delivered channels of all kinds and, to a lesser extent, cable systems, all are vulnerable to the uncompensated, unauthorized reception of a signal meant for sale. Within certain technical constraints, advances in technology may allow more or less sophisticated scrambling techniques to be employed. But with the sale of the first decoder to an authorized customer, history shows that the first unauthorized decoder cannot be far behind. Perhaps programmers will be able to develop randomly changed scrambling patterns or interactive decoders designed to indicate their legitimacy. But unless a product or technique can be invented that cannot be duplicated without the consent of the originator, some form of governmental enforcement of the producer's property right may warrant consideration.

The current Section 605 of the Communications Act prohibits the unauthorized interception of radio signals. The number of court cases around the country against "pirate" vendors indicates that at the very least, this provision is not specific enough about the rights and duties of various parties in the modern era. Representatives Waxman and Wirth, the latter Chairman of the House Subcommittee on Communications, have introduced a bill that contains both criminal and civil penalties for

I believe it is the responsibility of the system providers and the design and development engineers to determine how this technology can provide its cornucopia of services without robbing us of our ability to enjoy them in solitude.

unauthorized receptions of pay programming. While stiffening the penalties for commercial entities engaged in these businesses, this bill also contains a provision for limiting fines of "innocent" individuals to $100.

I believe this bill warrants careful consideration. It does not solve all the problems associated with the issue, of course, because it is not self-policing. Only a (reasonably) unbreakable technological solution can achieve that. And that technology may only be developed when the market losses of programmers are high enough to justify the technology to prevent it. If that technology is not likely to be developed soon, however, Waxman and Wirth's proposal may provide adequate protections to programmers and distributors, without impinging excessively on the free flow of information.

The issues of standards, privacy rights and unauthorized reception all represent the coming together of conflicting interests. A deregulatory, hands-off approach, such as regulations themselves, needs to be rethought so that it is not blindly followed either. These issues, at least in some circumstances, may warrant a more affirmative government approach. If they do, it will be a result of a conclusion that for technical, economic or political reasons, enterpreneurs could not produce a better solution. As such, I hope the market has made a concerted effort on which to be judged.

ES&T

TV systems around the world

By James E. Kluge,
technical editor,
Winegard Company.

We often tend to take television for granted these days. Crisis and events around the world are relayed almost instantly via satellite to the comfortable surroundings of our homes.

With a twist of the wrist, we can switch from the U.S. hostage crisis in Iran to the Soviet invasion of Afghanistan to the Winter Olympic games in Lake Placid, NY, to local events in our own community. The fact that these pictures are coming to us "over-the-air" escapes our imagination even more than the fact that at times they are originating on the other side of the world.

Unknown to most people, color TV standards are different in most foreign countries. When programs are exchanged on film and tape or relayed back and forth via satellite, expensive and sophisticated equipment and technology are required to decode or convert from one color TV standard to another in order to make the signals compatible with TV receivers on which these programs are to be viewed.

Basically there are three different color TV standards in use throughout the world. Most of North and South America plus Japan use the NTSC system; Europe (except for France) uses PAL; and France, the USSR and Communist Bloc countries use the SECAM system. A TV receiver that works in France may not work in Germany or in Great Britain and a TV receiver made in the United States will not work in any of these countries. Not only is there a difference in the channel bandwidth, carrier frequencies and in the way the picture is formed, but also in the way the color information signals are encoded and decoded. Considering these differences, plus the fact that power-line voltages and frequency are also different from those used here in North America, don't take your TV set abroad with you. Instead buy, rent or borrow one locally in each country where you are staying.

History of Color TV

All color TV systems in use throughout the world owe their origin to the NTSC (National Television System Committee) system which was invented and developed by RCA in the United States.

After establishing monochrome TV standards in the late 1930s, NTSC was reconstituted in 1950 to recommend a color TV system compatible with the existing black-and-white standards established in 1941. Both recommendations were based largely on systems developed by RCA and were ultimately

adopted by the FCC for television in the United States. RCA's development of the 3-color, shadow-mark, cathode-ray tube was the principal factor in making a high quality, all-electronic color TV system available at reasonable prices for consumers.

In January 1954, NTSC color TV broadcasts were authorized in the United States. By 1960, Japan adopted the NTSC system and began mass producing NTSC color TV receivers for consumption at home and in the United States. Japan's adoption of the NTSC system was later followed by Canada and Puerto Rico in 1966 and by Mexico in 1967 and eventually by most countries in the northern portion of the Western Hemisphere, Pacific regions, Korea, Taiwan and the Phillipines.

During the 1960s, several Western European countries began a concerted cooperative effort to develop a color TV standard that would overcome

TABLE I
INTERNATIONAL TELEVISION CHANNEL ASSIGNMENTS OF MAJOR COUNTRIES AND AREAS

VHF Television – Bands I, II & III

1) United Kingdom & Ireland: System A (channel width = 8MHz)

Ch		MHz
B-1		45.00/41.50
B-2		51.75/48.25
B-3	Band I	56.75/53.25
B-4		61.75/58.25
B-5		66.75/63.25
B-6		179.75/176.25
B-7		184.75/181.25
B-8		189.75/186.25
B-9		194.75/191.25
B-10	Band III	199.75/196.25
B-11		204.75/201.25
B-12		209.75/206.25
B-13		214.75/211.25
B-14		219.75/216.25

2) Ireland: System I (channel width = 8MHz)

A		45.75/51.75
B	Band I	53.75/59.75
C		61.75/67.75
D		175.25/181.25
E		183.25/189.25
F	Band III	191.25/197.25
G		199.25/205.25
H		207.25/213.25
J		215.25/221.25

3) Continental Europe: (except France, Monaco, Italy & ORIT members): System B (channel width = 7MHz)

E-2		48.25/53.75
E-2A	Band I	49.75/55.25
E-3		55.25/60.75
E-4		62.25/67.75
E-5		175.25/180.75
E-6		182.25/187.75
E-7		189.25/194.75
E-8		196.25/201.75
E-9	Band III	203.25/208.75
E-10		210.25/215.75
E-11		217.25/222.75
E-12		224.25/229.75

4) Italy: System B (channel width = 7MHz)

Ch		Pix/Snd MHz
A	Band I	53.75/59.25
B		62.25/67.75
C	Band II	82.25/87.75
D		175.25/180.75
E		183.75/189.25
F	Band III	192.25/197.75
G		201.25/206.75
H		210.25/215.75
H-1		217.25/222.75

5) Australia: System B (channel width = 7MHz)

0	46.25/51.75
1	57.25/62.75
2	64.25/69.75
3	86.25/91.75
4	95.25/100.75
5	102.25/107.75
5A	138.25/143.75
6	175.25/180.75
7	182.25/187.75
8	189.25/194.75
9	196.25/201.75
10	209.25/214.75
11	216.25/221.75

6) New Zealand: System B (channel width = 7MHz)

1	45.25/50.75
2	55.25/60.75
3	62.25/67.75
4	175.25/180.75
5	182.25/187.75
6	189.25/194.75
7	196.25/201.75
8	203.25/208.75
9	210.25/215.75

7) USSR and IORT members (except German Democratic Republic): System D (channel width = 8MHz)

Ch		Pix/Snd MHz
R-1	Band I	49.75/56.25
R-2		59.25/65.75
R-3		77.25/83.75
R-4	Band II	85.25/91.75
R-5		93.25/99.75

TV systems

R-6		175.25/181.75
R-7		183.25/189.75
R-8		191.25/197.75
R-9	Band III	199.25/205.75
R-10		207.25/213.75
R-11		215.25/221.75
R-12		223.25/229.75

8) France, Monaco: System E (channel width = 14MHz)

F-2	Band I	52.40/41.25
F-4		65.55/54.40
F-5		164.00/175.15
F-6		173.40/162.25
F-7		177.15/188.30
F-8A		185.25/174.10
F-8	Band III	186.55/175.40
F-9		190.30/201.45
F-10		199.70/188.55
F-11		203.45/214.60
F-12		212.85/201.70

9) French Overseas Territories: System K1 (channel width = 8MHz)

K-4	175.25/181.75
K-5	183.25/189.75
K-6	191.25/197.75
K-7	199.25/205.75
K-8	207.25/213.75
K-9	215.25/221.75

UHF Television – Bands IV & V

10) Europe and Africa: Systems G, H, I, K, L (channel width = 8MHz)

Ch	Pix Carrier MHz
E-21	471.25
E-22	479.25
E-23	487.25
E-24	495.25
E-25	503.25
E-26	511.25
E-27	519.25
E-28	527.25
E-29	535.25
E-30	543.25
E-31	551.25
E-32	559.25
E-33	567.25
E-34	575.25
E-35	583.25
E-36	591.25
E-37	599.25
E-38	607.25
E-39	615.25
E-40	623.25
E-41	631.25
E-42	639.25
E-43	647.25
E-44	655.25
E-45	663.25
E-46	671.25
E-47	679.25
E-48	687.25
E-49	695.25
E-50	703.25
E-51	711.25
E-52	719.25
E-53	727.25
E-54	735.25
E-55	743.25
E-56	751.25
E-57	759.25
E-58	767.25
E-59	775.25
E-60	783.25
E-61	791.25
E-62	799.25
E-63	807.25
E-64	815.25
E-65	823.25
E-66	831.25
E-67	839.25
E-68	847.25
E-69	855.25

For sound carrier frequency for each channel add (5.5MHz for systems G, H; 6MHz for system I and 6.5MHz for systems K, L) to picture carrier frequency. (In West Germany, channel 38 is reserved for aeronavigation.)

United States of America: System M (channel width = 6MHz)
VHF Channels

Ch	Band	Pix/Snd MHz
A-2		55.25/59.75
A-3	Lo-VHF	61.25/65.75
A-4		67.25/71.75
A-5		77.25/81.75
A-6		83.25/87.75
A-7		175.25/179.75
A-8		181.25/185.75
A-9		187.25/191.75
A-10	Hi-VHF	193.25/197.75
A-11		199.25/203.75
A-12		205.25/209.75
A-13		211.25/215.75

UHF Channels

A-14		471.25/475.75
A-15		477.25/481.75
A-16		483.25/487.75
A-17		489.25/493.75
A-18		495.25/499.25
A-19		501.25/505.75
A-20		507.25/511.75
A-21		513.25/517.75
A-22		519.25/523.75
A-23		525.25/529.75
A-24		531.25/535.75
A-25		537.25/541.75
A-26		543.25/547.75
A-27		549.25/553.75
A-28	UHF	555.25/559.75
A-29		561.25/565.75
A-30		567.25/571.75
A-31		573.25/577.75
A-32		579.25/583.75
A-33		585.25/589.75
A-34		591.25/595.75

A-35	597.25/601.75
A-36	603.25/607.75
A-37	609.25/613.75
A-38	615.25/619.75
A-39	621.25/625.75
A-40	627.25/631.75
A-41	633.25/637.75
A-42	639.25/643.75
A-43	645.25/649.75
A-44	651.25/655.75
A-45	657.25/661.75
A-46	663.25/667.75
A-47	669.25/673.75
A-48	675.25/679.75

Ch	MHz
A-49	681.25/685.75
A-50	687.25/691.75
A-51	693.25/697.75
A-52	699.25/703.75
A-53	705.25/709.75
A-54	711.25/715.75
A-55	717.25/721.75
A-56	723.25/727.75
A-57	729.25/733.75
A-58	735.25/739.75
A-59	741.25/745.75
A-60	747.25/751.75
A-61	753.25/757.75
A-62	759.25/763.75
A-63	765.25/769.75
A-64	771.25/775.75
A-65	777.25/781.75
A-66	783.25/787.75
A-67	789.25/793.75
A-68	795.25/799.75
A-69	801.25/805.75
A-70	807.25/811.75
A-71	813.25/817.75
A-72	819.25/823.75
A-73	825.25/829.75
A-74	831.25/835.75
A-75	837.25/841.75
A-76	843.25/847.75
A-77	849.25/853.75
A-78	855.25/859.75
A-79	861.25/865.75
A-80	867.25/871.75
A-81	873.25/877.75
A-82	879.25/883.75
A-83	885.25/889.75

Japan: System M (channel width = 6MHz)
VHF Channels

Ch	Band	Pix/Snd MHz
J-1		91.25/95.75
J-2	Lo-VHF	97.25/101.75
J-3		103.25/107.75
J-4		171.25/175.75
J-5		177.25/181.75
J-6		183.25/187.75
J-7		189.25/193.75
J-8	Hi-VHF	193.25/197.75
J-9		199.25/203.75
J-10		205.25/209.75
J-11		211.25/215.75
J-12		217.25/221.75

UHF Channels

J-33		591.25/595.75
J-34		597.25/601.75
J-35		603.25/607.75
J-36		609.25/613.75
J-37		615.25/619.75
J-38		621.25/625.75
J-39		627.25/631.75
J-40		633.25/637.75
J-41		639.25/643.75
J-42		645.25/649.75
J-43		651.25/655.75
J-44		657.25/661.75
J-45		663.25/667.75
J-46	UHF	669.25/673.75
J-47		675.25/679.75
J-48		681.25/685.75
J-49		687.25/691.75
J-50		693.25/697.75
J-51		699.25/703.75
J-52		705.25/709.75
J-53		711.25/715.75
J-54		717.25/721.75
J-55		723.25/727.75
J-56		729.25/733.75
J-57		735.25/739.75
J-58		741.25/745.75
J-59		747.25/751.75
J-60		753.25/757.75
J-61		759.25/763.75
J-62		765.25/769.75

Hong Kong: System I (channel width = 8MHz)

Ch		Pix/Snd MHz
E-21	TVB-1	471.25/477.25
E-25	TVB-2	503.25/509.25
E-23	RTV-1 (Chinese)	487.25/493.25
E-27	RTV-2 (English)	519.25/525.25
E-29		535.25/541.25
E-42		639.25/645.25
E-43		647.25/653.25
E-44		655.25/661.25
E-45		663.25/669.25
E-53		727.25/733.25
E-55		743.25/749.25

People's Republic of China: System D (Channel width = 8MHz)

VHF Channels	Band	Pix/Snd MHz
C1		49.75/56.25
C2		57.75/64.25
C3	Lo-VHF	65.75/72.25
C4		77.25/83.75
C5		85.25/91.75
C6		168.25/174.75
C7		176.25/182.75
C8		184.25/190.75
C9	Hi-VHF	192.25/198.75
C10		200.25/206.75
C11		208.25/214.75
C12		216.25/222.75

UHF Channels	Frequency (Approx)
C13-24	470-570
C25-36	600-700
C37-48	700-796

the principal deficiency of the NTSC system: hue instability. Such a system, called PAL, was developed at Telefunken Laboratories of Hanover in the Federal Republic of Germany (West Germany).

A basic variant of NTSC, PAL was adopted in 1967 by West Germany and the United Kingdom and was followed by a majority of countries which have initiated color TV services within their national boundaries. Some of those nations adopting the PAL system are Australia, Austria, Belgium, Brazil, Denmark, Ireland, the Netherlands, New Zealand, Norway, Portugal, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey and Yugoslavia. The People's Republic of China is the most recent addition to the PAL System.

The third color TV system is SECAM. It was developed in France and was adopted by that country in 1967; the only major non-PAL country in Western Europe. SECAM was also adopted by Bulgaria, Czechoslovakia, East Germany, Egypt, Hungary, Tunisia, Poland and the USSR. More recently, several Middle East countries have joined the SECAM community. All three systems have much in common but all three systems are also incompatible. Of the three, NTSC and PAL share the most similarity.

ORIT

The International Radio and Television Organization (O.R.I.T.) is an organization consisting principally of Communist-Bloc countries including the USSR, Red China, Mongolia, North Korea, Vietnam, Poland, Romania, Czechoslovakia, Hungary, Bulgaria, East Germany, Albania, Finland, Estonia, Latvia, Lithuania, Moldavia, Ukraine, Byelorussia and Cuba. African and Middle Eastern members include Egypt, Sudan, Iraq, Mali and Algeria.

With few exceptions, O.R.I.T. members have adopted the D,K TV standards (see table), and for the most part, are members of the SECAM community along with France and Monaco. The exceptions to SECAM users among O.R.I.T. members are Cuba, using NTSC, and Red China, Finland and Algeria, using PAL. Exceptions to the D,K system standards are Vietnam on the M (NTSC) standard; Finland, East Germany, Algeria, Sudan, Egypt, Iraq are on the B,G (European) standard. Yugoslavia, an independent communist country, uses the European B,G standards and the PAL color system.

EBU

Many of the free nations in Europe, North Africa and the Middle East are active members of the European Broadcasting Union (EBU) and use those channel-frequency assignments made in accordance with the determinations of its members (see table I). Among the associate members to the EPU are many countries from around the world including several broadcasters and TV networks in Japan and the United States.

Bands I, II, III, IV and V as listed in the text and

TABLE II

*Planned

–SOUTH AMERICA–

MONOCHROME	NTSC	PAL
Argentina(N)	Bolivia(N)	Brazil (M)
Fr. Guiana (K)	Chile (M)	
Paraguay (N)	Columbia(M)	
Trinidad & Tobago (M)	Ecuador (M)	
Uruguay (N)	Netherlands Antilles (M)	
	Peru (M)	
	Surinam (M)	
	*Trinidad & Tobago (M)	
	Venezuela (M)	

–NORTH & CENTRAL AMERICA–
(incl. WEST INDIES)

MONOCHROME	NTSC	SECAM
Guadeloupe (KI)	Antiqua (M)	Haiti (M)
Honduras (M)	Bahamas (M)	*Martinique (KI)
Jamaica (N)	Barbados (N)	
Martinique (KI)	Bermuda (M)	
Miquelon (K)	Br. Virgin Is. (M)	
St. Pierre (K)	Canada (M)	
	Costa Rica (M)	
	Cuba (M)	
	Dominican Rep. (M)	
	El Salvador (M)	
	Guatemala (M)	
	Mexico (M)	
	Nicaragua (M)	
	Panama (M)	
	St. Kitts (M)	
	United States (M)	

–EUROPE–

MONOCHROME	PAL	SECAM
Albania (D)	Austria (B,G)	*Albania (D)
Azores (B)	Belgium (B,H)	Bulgaria (D,K)
Canary Is.(B)	Denmark (B)	Czechoslavakia (D,K)
France (E)	Finland (B,G)	France (L)
Ireland (A)	Germany, W. (B,G)	Germany, E. (B,G)
Luxembourg (C)	Gibraltar (B)	Greece (B)
Malta (B)	Iceland (B)	Hungary (D,K)
Madeira Is. (B)	Ireland (I)	Luxembourg (L)
Monoco (E)	Italy (B,G)	Monoco (G,L)
United Kingdom (A)	Luxembourg (C)	Poland (D,K)
	*Malta (B,G)	Romania (D,K)
	Netherlands (B,G)	U.S.S.R. (D)
	Norway (B)	
	*Norway (G)	
	Portugal (B,G)	
	Spain (B,G)	
	Sweden (B,G)	
	Switzerland (B,G)	
	United Kingdom (I)	
	Yugoslavia (B,G)	

–ASIA–

MONOCHROME	NTSC	PAL
Afghanistan (D)	Japan (M)	*Bangladash (B)
*Burma	So. Korea (M)	China P.R. of (D)
Cambodia (M)	Taiwan (M)	Hong Kong (B,I)
India (B)		Indonesia (B)
Korea, P.D.R. of (D)		*Malaysia (B)
Mongolia (D)		Pakistan (B)
Thailand (M)		Singapore (B)
Vietnam (M)		Thailand (B)

–PACIFIC REGION–

MONOCHROME	NTSC	PAL
Fr. Polynesia (KI) (Tahiti)	Hawaii (M)	Australia (B)
	Okinawa (M)	Brunei (B) (Borneo)
New Caledonia (KI)	Phillipines (M)	
	Samoa (M)	New Zealand (B)
	U.S. Trust Terr. (M)	

–AFRICA–

MONOCHROME	PAL	SECAM
Afars & Issas (KI) (Djibouti)	Algeria (B)	*Afars & Issas (KI)
	*Ethiopia (B)	*Angola (I)
Angola (I)	Ghana (B)	Eqypt (B)
Central African (B) Rep.	*Liberia (B,H)	Gabon (KI)
	*Rhodesia (B,G)	Ivory Coast (KI)
Chad (KI)	*Sierra Leone (B)	Libyan Arab Rep. (B)
Equatorial Guinea (B)	So. Africa, (I) Union of	Niger (KI)
Ethiopia (B)		*Republic of Congo (D)
Ghana (B)	Tanzania (B)	
Guinea (B)	Zambia, Rep. of (B)	*Reunion (KI)
Kenya (B)		Tunisia (B)
Liberia (B)		Zaire, Rep. of (KI)
Malagasy Rep. (KI)		
Rep. of Congo (D)		
Reunion (KI)		
Rhodesia (B)		
Senegal (KI)		
Sierra Leone (B)		
Sudan (B)		
Uganda (B) *(G)		
Upper Volta (D)		

–MIDDLE EAST–

MONOCHROME	PAL	SECAM
Cyprus (B)	Bahrain (B)	Iran (B,G)
Saudia Arabia (M)	Israel (B,G)	Iraq (B)
Syria (B)	Jordan (B)	Lebanon (B)
Yemen, P.R. of (B)	Kuwait (G)	Mauritius (B)
Yeman, A.R. of (B)	Oman (B,G)	Saudia Arabia (B)
	Quatar (B)	
	Saudia Arabia (G)	
	*Syria (B)	
	Turkey (B,G)	
	U.A. Emirates (B)	

in the channel-assignment chart refer to broadcast frequency bands allocated for FM and TV broadcasting in the "European Broadcasting Area" according to the Stockholm Plan. Bands I and II contain both FM and TV broadcast stations between 41 to 68MHz and 87.5 to 100MHz. Bands III, IV and V are reserved exclusively for television (no FM). Band III is similar to the high VHF band (ch. 7-13) in the United States and includes 162 to 230MHz. Bands IV and V are UHF frequencies from 470 to 582MHz and 582 to 960MHz respectively.

It should be remembered that these bands I through V are allocated just for Europe and parts of Africa located in Region I. Regions II (North and South America) and III (Asia and Western Pacific areas) are not bound by these frequency allocations or channel assignments.

SECAM III & IV

SECAM standards have been adopted by France, those countries under the French sphere of influence, the USSR and most countries under Soviet domination plus a growing number of Middle Eastern countries. When we speak of the SECAM system, the one commonly referred to is SECAM III-B. Occasionally, a reference will show the USSR as N.I.R. or SECAM-IV system. As far as is known, it has never been implemented.

SECAM-IV is a somewhat modified SECAM-III system jointly developed and tested by France and the USSR. It was proposed by France in 1966 as a single European color standard instead of PAL and SECAM III. The proposal was withdrawn for pragmatic and political reasons in preference to SECAM-III. SECAM-IV is fully compatible with all standard monochrome 625-line TV systems except system N (which is the M-NTSC standard modified for 625-lines, 50Hz and used only in South America and the West Indies).

Technical standards

COLOR TV SYSTEMS Basically, there are two line-scanning standards and three color-signal-processing standards being used in the world for color TV. NTSC is used in the United States and Canada and employs a horizontal-line-scanning rate of 525 lines/sec and a vertical field rate of about 60Hz. At last count (1977), there were 25 countries using the NTSC system including Canada, Mexico, Japan and a number of smaller countries in both the Western hemisphere and the Far East that fall under the American sphere of influence.

The other two color TV systems are the German-developed PAL system, used by 37 countries and the French-developed SECAM system used by 22 countries including France and the Soviet Union plus many countries that fall under the sphere of influence of those two nations.

Both the PAL and SECAM systems use a horizontal-line scanning rate of 625 lines/sec and vertical-field rate of 50Hz. The field rates coincidentally happen to correspond to the power-line frequency used in those countries.

In the United States, we have used 525 lines/sec and a 60Hz field rate from the beginning of commercial black and white television. The NTSC established this standard in 1936 for monochrome TV and later adopted it with slight changes in the horizontal and vertical rates as part of a color TV compatibility standard issued in December 1953.

TV systems

MONOCHROME TV Among monochrome (black-and-white) TV systems, four different scanning rates have been used. In addition to NTSC with 525, Ireland and the United Kingdom use 405 and 625, France and Monaco use 625 and 819 lines/sec.

When the PAL and SECAM color standards were established, the 405- and 819-line systems were abandoned for color in favor of a common European 625-line color-TV system. However, these standards may still be used for monochrome TV where they have not yet been phased out.

The NTSC-system countries stayed with 525-lines and a 60Hz field rate. Because color TV viewers make up the bulk of the world's viewer population, then for all practical purposes, there are only two line-scanning systems in use in the world today: 525 lines/60Hz and 625 line/50Hz. In those few countries in which the 405-line and 819-line black-and-white systems were established for monochrome TV, they have been replaced with a 625-line color system.

Color TV standards

NTSC SYSTEM As mentioned earlier, NTSC came into existence in 1936. In 1941, the FCC authorized commercial black-and-white broadcasting in the United States, but that was shortly interrupted by World War II. NTSC was reinstituted in 1950 to establish color TV standards in the United States.

Shortly after the FCC had adopted the CBS-developed rotating color-wheel system in 1950, the Korean War began. The need for strategic materials resulted in shutting down the production of color TV receivers at CBS before it ever "got off the ground." For the TV industry, this was a blessing in disguise.

CBS COLOR WHEEL The CBS-proposed system had several major flaws. First, it was incompatible with existing black-and-white TV receivers because it used a 405-line scanning system and 12MHz bandwidth – twice the existing 6MHz channel band width established for monochrome TV. In other words, color programs could not be viewed on black-and-white receivers. This would mean the loss of nearly all the existing B&W-viewer market. Simply put, commercial color programs could not compete with B&W productions for prime-time hours. Second, the CBS color-receiver was a mechanical monstrosity. It required a rotating wheel containing red, green and blue filters passing sequentially in front of the picture tube in synchronism with another rotating wheel attached to each studio color camera. A 20-inch TV receiver would require a 4-ft. diameter motor-driven wheel rotating at 1440 rpm, all weighing about 700 lbs. Nevertheless, in 1950 the FCC adopted the CBS "spinning-wheel" color system. The many varied TV-industry interests challenged the FCC decision all the way to the U.S. Supreme Court but were defeated on every count.

By the time the Korean conflict came to an end, enough evidence had been gathered against the CBS non-compatible system by an RCA-supported all-industry group and the NTSC to convince the FCC to reverse its decision. This they did in December 1953 and subsequently adopted the RCA-developed compatible, all-electronic, NTSC color TV system that we have today.

So, the Korean War, despite the grave consequences it inflicted on the world and its toll of Allied casualties, did save the United States from having to endure the frustration of a non-compatible color TV standard during the many years that followed.

COLOR TV IN EUROPE Despite the several shortcomings of the NTSC all-electronic system, it was essentially adopted first by Western Europe and later by other countries of the world with certain modifications. One of those modifications, as we know, was the 625-line scanning rate and a 50Hz field rate. Generally, those countries with a 50Hz power-line frequency have adopted the 50Hz field rate and likewise with the 60Hz rate respectively. The other modification concerns the method of encoding and decoding the color information with the monochrome signal. Most similar to NTSC (but not compatible) is the PAL color TV system which stands for *Phase Alternation Line.* SECAM, the other system developed in France and adopted by the USSR and the Communist-Bloc countries, stands for *Sequential And Memory.*

NTSC color system

In order to understand how each of the color TV systems differ from each other we will describe the NTSC system first because the other two systems bear much similarity to it.

The NTSC color system was developed by RCA in the late 1940s and was eventually adopted by the FCC in late 1953. The NTSC standard employs a color subcarrier located 3.579545MHz above the picture carrier within the 4.2MHz video bandwidth.

The phase of this subcarrier frequency referenced to the picture-carrier frequency determines the correct hue (tint) of the color TV scene. In fact, a tolerance of ± 5 degrees maximum phase shift must be maintained to obtain the correct hue in the picture. This is accomplished by building a 3.579545MHz crystal-controlled oscillator into every color TV receiver, which is then phase-locked to a short 8- to 10-cycle burst transmitted on each horizontal line of the video signal. This 3.579545MHz burst is located on what we call the "back porch" during the horizontal-line blanking period. The color-burst signal locks the chroma-oscillator frequency to it.

NTSC Defects This approach highlights one of the two defects of NTSC. Correct hue requires reproducing, in the receiver, the phase of the transmitted color-burst signal to within ± 5 degrees or, less than an 8nsec time-base error. This is a difficult tolerance to maintain, especially after the signal propagates over the RF and microwave transmission paths, through various RF amplifiers, videotape recorders, switchers and video distribution networks and amplifiers. A reasonable and

practical solution to the problem resulted in the TV manufacturers providing the viewer with a variable phase-shift control on the front of the set which will shift the chroma-oscillator frequency ± 70 degrees. Commonly called the TINT control, it will allow the viewer to obtain the correct skin-tone colors and to permit green grass and blue sky to appear natural. The only remaining problem is that it requires frequent adjustment as the program material changes from live action to movies to commercials as well as when switching channels. Later, the set manufacturers enhanced the red/yellow colors (skin-tones) to make the phase shifts less noticeable.

Recently, a reference signal transmitted during the vertical interval of each frame of the picture has been added to automatically correct for phase shift experienced by the signal. Automatic phase-correcting circuits in the TV receiver accomplish this task. However, this development has taken nearly 20 years to evolve, and it adds extra cost to each receiver produced. The other shortcoming associated with the NTSC system is the variation in color saturation. Any amplitude variation of the amplitude-modulated color-subcarrier experienced during transmission and processing of the signal results in a change of color saturation in the picture. When switching between channels and between various program sources the color saturation may change. The obvious solution by the set manufacturers was to provide a "color" control on each set so that the viewer could adjust or readjust the color saturation level (or vividness of the hue) according to their tastes.

This resulted in a total of four picture controls on each NTSC receiver: brightness, contrast, color and hue (tint), all somewhat interactive.

Although similar to NTSC, the PAL system has successfully eliminated the hue control on the receiver while the SECAM system has eliminated both the color and hue controls.

PAL color system

Phase-Alternation-Line (PAL) system, developed by Telefunken in Germany and widely used throughout Western Europe, was designed to eliminate the need for a tint control on the TV receiver. PAL gets its name from the fact that on each scanning line of the raster, the color information signals are reversed 180 degrees in phase from that of the previous line. By doing this, any phase error appearing on one line has its phase error reversed on the following line causing visual cancellation of the phase shift and thus elimination of any perceptible change of hue.

The PAL receiver requires an electronic circuit to reverse the demodulator action and thus the phase on every alternate line of the field. It also requires delay line to delay the chrominance signal by one line length (64μ sec). Other than that it is similar to an NTSC receiver. The PAL signal is fully compatible with monochrome receivers, which employ the same line-scanning and field rate.

SECAM color system

The Sequential-And-Memory or Sequence a Memoire (SECAM) color TV system was developed in France and designed to eliminate the color and hue controls on the front of the receiver. It, similar to PAL, employs sequential-line-switching techniques, but what makes it totally incompatible with NTSC and PAL is its use of 2-color subcarriers, which are frequency modulated by the color-difference signals. SECAM receivers, similar to PAL receivers, employ a line-switching signal to sequentially switch the color demodulators on each alternate scanning line and also require a 64-μsec delay line. Because it uses normal sync and blanking, the SECAM signal is fully compatible with black-and-white TV receivers that employ the same line-scanning and field rates; i.e. 625 lines/sec. and 50 fields/sec.

European color TV standards

In the early 1960s, there were three color TV standards proposed for use in Western Europe. One, the NTSC system, which had been successfully employed in the United States, was modified for 625 lines/sec. and a 50Hz field rate. Second, the PAL system developed by Dr. Walter Bruch of Telefunken AG in West Germany in early 1963, successfully eliminated hue instability – a major shortcoming of NTSC. A third, the SECAM system developed in France by Henri de France in 1960, proposed to eliminate the problems of crosstalk between the two color signals by frequency modulating two color subcarriers instead of quadrature amplitude modulation of a single subcarrier.

All three systems are similar in that each takes the three color-separation signals (red, green and blue) and form three other signals corresponding to a brightness or luminance signal (Y) and two color-difference signals, (R-Y) and luminance signal (Y) and (B-Y) (also referred to as I and Q in NTSC, U and V in PAL, or in the case of SECAM as D_B, the blue-difference signal and D_R, the red-difference signal).

The luminance signal (Y) then modulates the video carrier frequency and, the chrominance information contained in the two color-difference signals modulate a color subcarrier (or two carriers in the case of SECAM) located in the upper portion of the video passband. The color difference signals are of relatively narrow bandwidth.

The three systems differ in how the chrominance information is processed and by the method of modulation employed.

In the NTSC system, the color-difference signals, I and Q, amplitude-modulate a subcarrier alternately displaced by 90 degrees. This is called Q.A.M. or quadrature amplitude modulation.

The PAL system transmits the U and V color-difference signals in phase quadrature on each line but the phase of the subcarrier is reversed from + 90 degrees to – 90 degrees on each alternate scanning line. In addition to a color-burst signal, the PAL system also requires a line-switching signal to be transmitted that will switch the phase appropriately in the receiver for each line.

SECAM also employs a line-sequential technique

but only one color-difference signal is transmitted on alternate lines. By employing a 64μs delay (1 line-scan period in the TV receiver, the two color-difference signals appear simultaneously. A slight reduction in vertical color resolution results from this approach. The main difference between SECAM and the other two systems is that SECAM employs **two** color subcarriers, each frequency modulated by the two individual color difference signals, D_B and D_R. Because the color information is contained in the frequency deviation, SECAM is relatively immune to the effects of differential gain, differential phase and time-base displacement errors. Likewise, the amplitude of the color subcarriers is not critical, thus eliminating both the color and tint controls on the front of the receiver.

TABLE III

PRINCIPAL USERS	SYSTEM	EBU BANDS	LINES/ FRAME	LINE FREQUENCY	FIELD FREQUENCY
Ireland, United Kingdom	A	I/III (B&W)	405	10,125	50
France, Monaco	E	I/III (B&W)	819	20,475	50
Belgium	F (obsolete)	I/III (B&W)	819	20,475	50
Continental Europe, Africa, Asia, Mideast, S. Pacific	B	I/II/III	625	15,625	50
Luxembourg	C	III	625	15,625	50
I.O.R.T. (except E. Germany)	D	I/II/III	625	15,625	50
Continental Europe, Africa, & Mideast	G	IV/V	625	15,625	50
Belgium & Liberia	H	IV/V	625	15,625	50
Ireland, U.K. Angola, S. Africa	I	IV/V	625	15,625	50
European O.I.R.T. (except E. Germany)	K	IV/V	625	15,625	50
French Overseas Territories	KI	III	625	15,625	50
France, Monaco, Luxembourg	L	IV/V	625	15,625	50
Argentina, Bolivia, Paraguay, Uraguay, Barbados, Jamaica	N	N.A.	625	15,625	50
North & South America (except N) Japan, North Pacific	M	N.A.	525	15734.264	59.94

The blue difference signal, designated D_B, has a rest frequency of 4.25000MHz while the red difference signal, D_R, has a rest frequency of 4.40625MHz. These frequencies are equal to the 272nd and 282nd harmonic, respectively, of the line-scanning frequency of 15,625kHz.

Various sources of information were used in compiling much of the data contained in the tables of this article. In order to acknowledge those sources, they are listed below.

1) TV Factbook, Vol. I & II 1980 ed.
2) C.C.I.R. Publications ("The Green Book")
3) Richard Burke, Tektronix Inc.
4) Charles W. Rhodes, Tektronix Inc.
5) L.E. Weaver, B.B.C., England
6) Astec International Ltd.
7) NBS-NOAA-NTIA Library, Boulder Labs, Boulder Colorado.

(MHz)

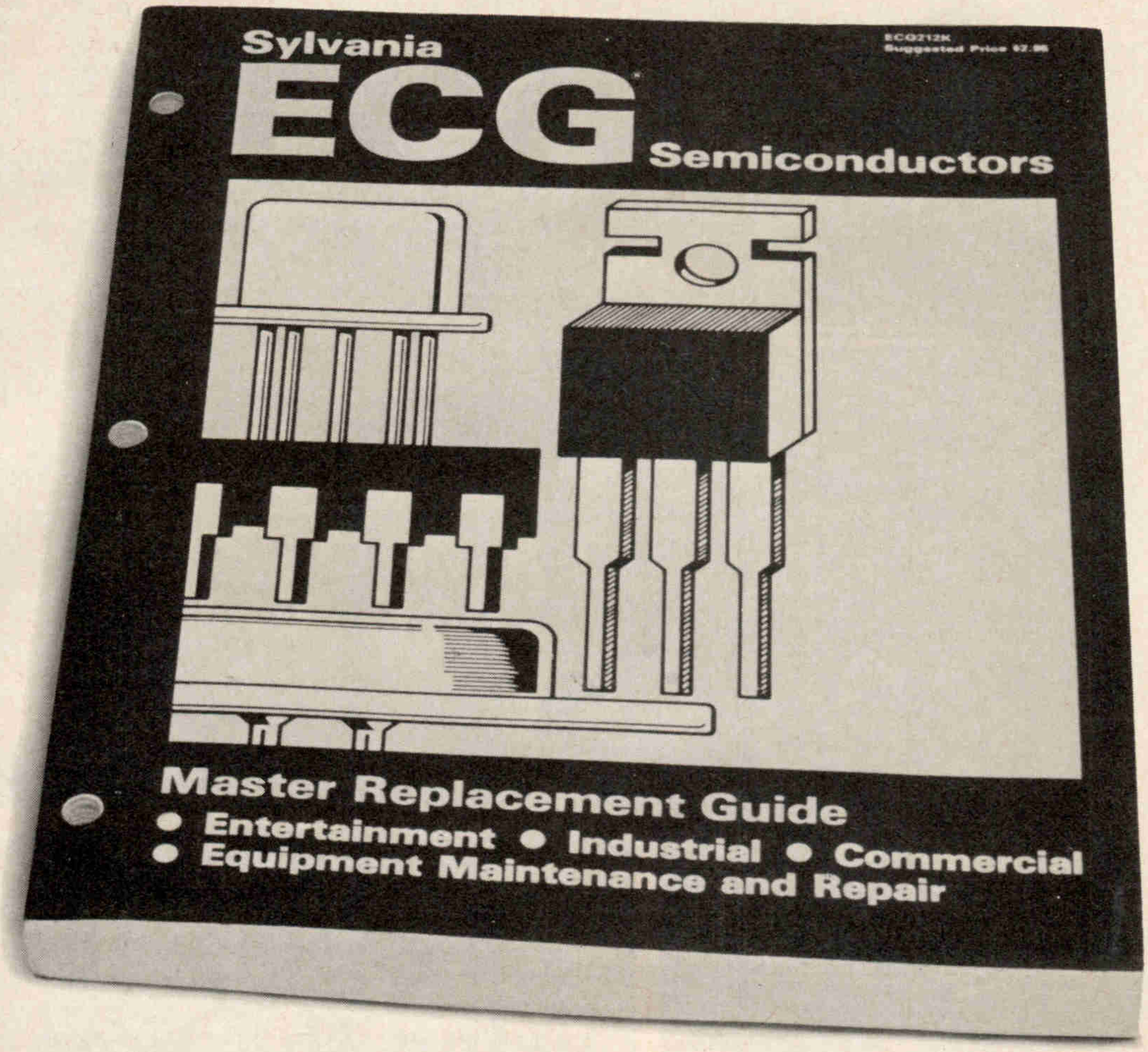
CHANNEL WIOTH	VIDEO BANOWIOTH	SOUNO-PICTURE SEPARATION	VESTIGIAL SIDEBAND	PICTURE MODULATION	SOUNO MODULATION
5	3	-3.5	0.75	Pos	AM
14	10	+11.15	2.0	Pos	AM
7	5	+5.5	0.75	Pos	AM
7	5	+5.5	0.75	Neg	FM
7	5	+5.5	0.75	Pos	AM
8	6	+6.5	0.75	Neg	FM
8	5	+5.5	0.75	Neg	FM
8	5	+5.5	1.25	Neg	FM
8	5.5	+6	1.25	Neg	FM
8	6	+6.5	0.75	Neg	FM
8	6	+6.5	1.25	Neg	FM
8	6	+6.5	1.25	Pos	AM
6	4.2	+4.5	0.75	Neg	FM
6	4.2	+4.5	0.75	Neg	FM

Two ways to find replace

When you think about the number of new electronic gizmos that come off the boat every year, it's staggering.

If you happen to be a repairman, it's enough to drive you crazy. It seems there's absolutely no way for you to keep on top of all those new electronic components required.

But don't worry. There's a very easy way to keep up. Get a Sylvania ECG®



ments for foreign parts.

Master Replacement Guide from your Philips ECG distributor.

It cross references more than 170,000 industry part numbers to over 2,500 ECG devices including most of the hard-to-find foreign parts.

You get concise descriptions on each with clear illustrations of packaging and circuit diagrams. And, you have the full technical resources of Philips at your disposal for any tricky replacements you might have questions about.

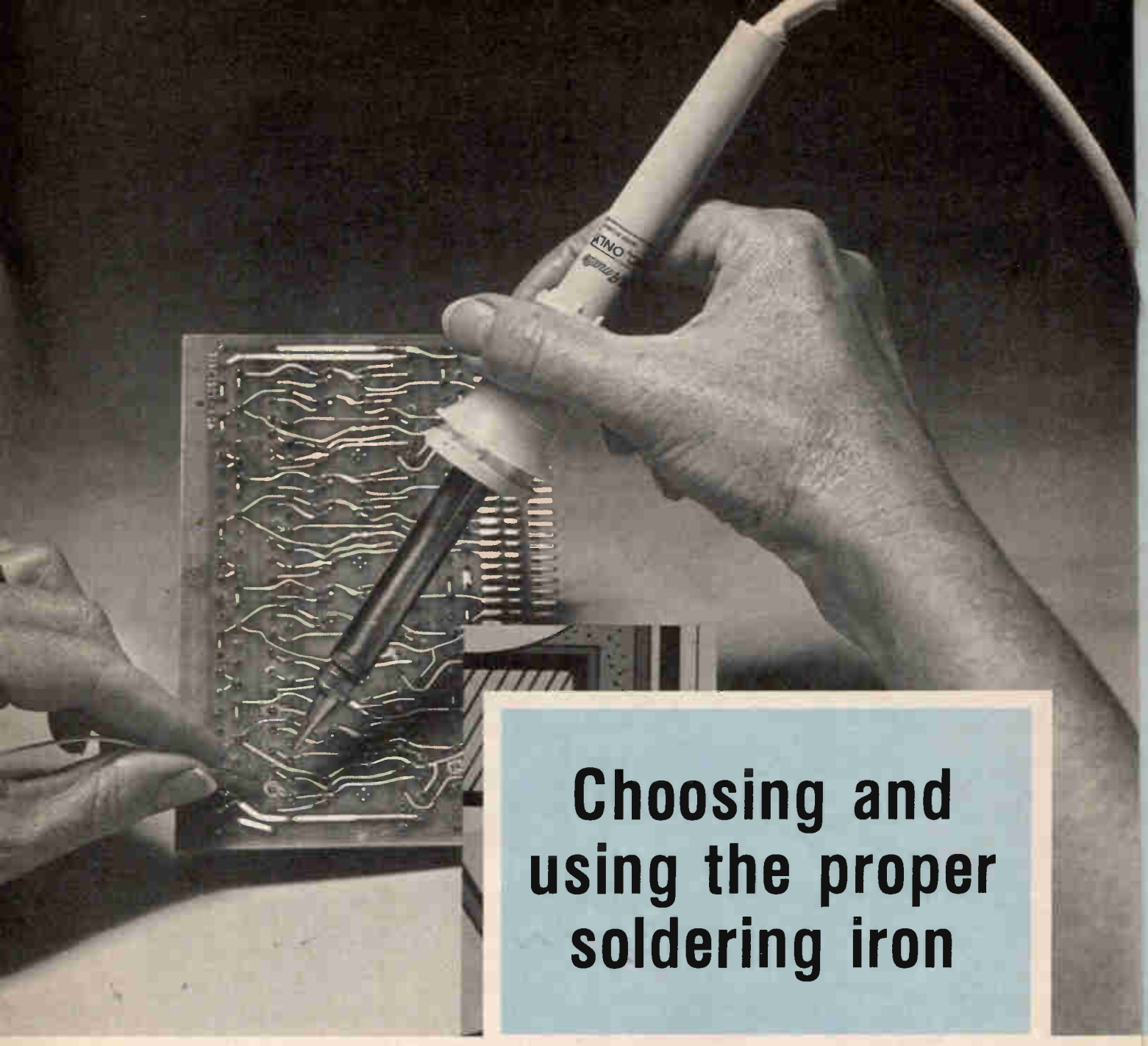
What's more, the ECG parts you receive are of the highest quality. Specifications on these devices are equal to, and usually exceed, those of the original part. To maintain quality and performance levels, all of the ECG's are checked in accord with military standard testing procedures.

But the best part is that you don't have to go every which way to get them. You just go to your nearest ECG distributor.

PhilipsECG

A North American Philips Company

Circle (4) on Reply Card



Choosing and using the proper soldering iron

By Ungar, division of Eldon Industries Inc.

Hand soldering is often one of the most misunderstood operations in electronic assembly, and the soldering iron is often one of the most neglected tools in the operation, until assemblies are rejected or a new soldering operation is required. Therefore, it is suggested that you review these few critical points in the selection and maintenance of soldering irons and tips so that you may use the full value of your soldering equipment.

Solder Connection

Solder is not merely a shiny hot-melt adhesive, but rather an alloy that metallurgically combines with another metal to form a third alloy or intermetallic layer, as shown in Figure 1. This intermetallic layer forms the electrical and mechanical connection, and its formation depends upon a critical combination of time and temperature, which in turn is dependent upon proper soldering tool selection, operation and maintenance.

Contamination and flux

Copper and tin are the two metals that are most commonly soldered, and both of these metals have the unfortunate characteristic of rapid oxidation (Figure 2). Solder will not wet oxidized or contaminated connections, and it is therefore extremely important that boards, components, stripped wire ends and other connections be protected from:

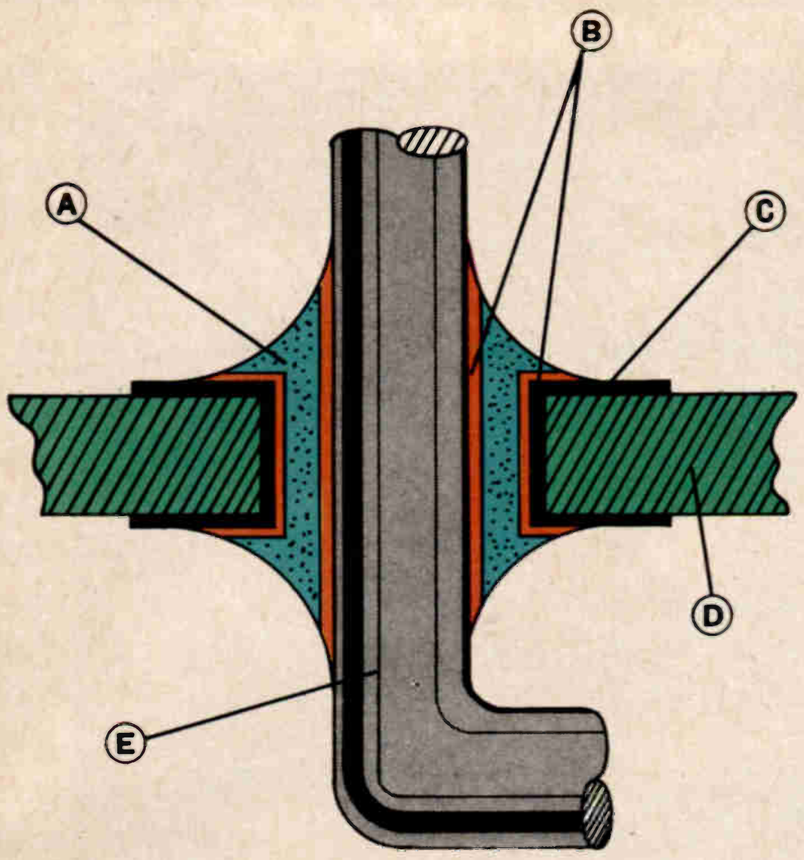
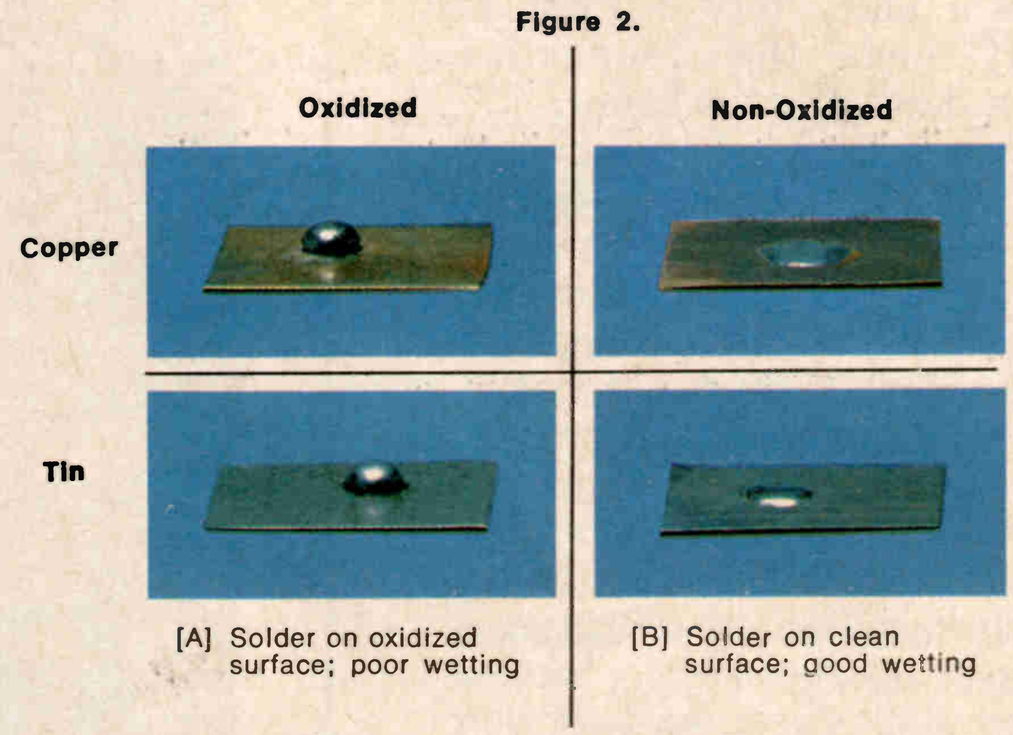


Figure 1.
Typical Cross Section of Printed Circuit Board, with plated through holes
[A] Solder
[B] Intermetallic Layer
[C] Plated Hole
[D] P. C. Board
[E] Lead

Figure 2.



[A] Solder on oxidized surface; poor wetting

[B] Solder on clean surface; good wetting

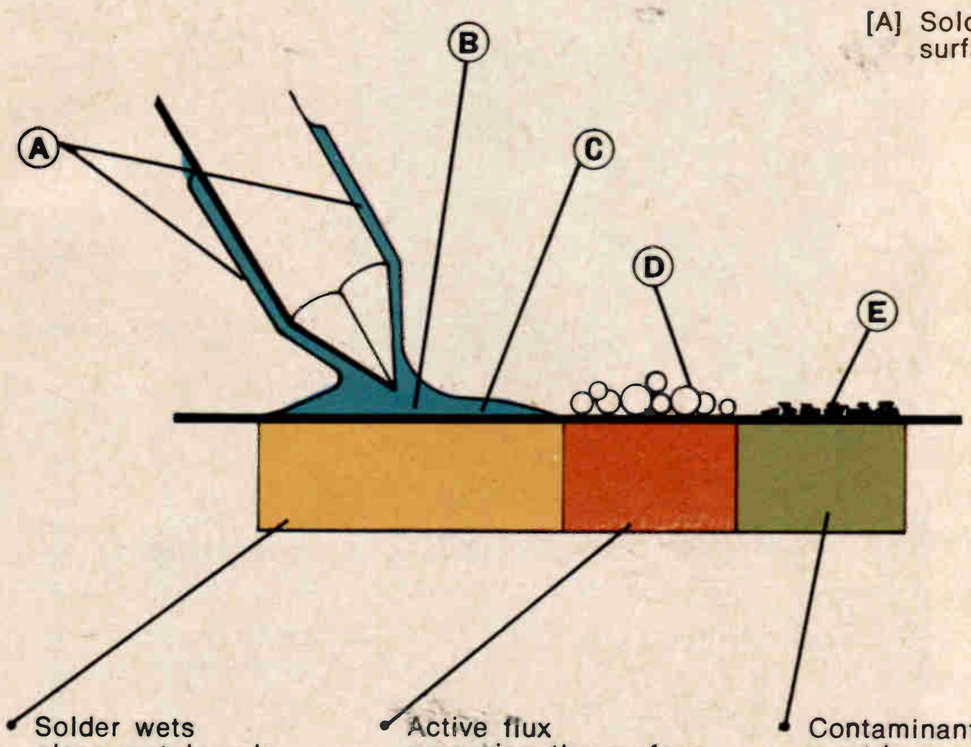


Figure 3.
Soldering with flux.
[A] Well tinned tip
[B] Surface contact
[C] Good Wetting
[D] Flux
[E] Oxidation and Contamination

- Oxidation
- Soot
- Machine Oil
- Hand Lotion
- Smog
- Skin Oil
- Food
- Silicones

These contaminants all decrease the quality of hand-soldered connections, and steps should be taken to prevent their presence. However, they do crop up despite the finest controls, and it is therefore recommended that their effects be minimized by using solder with *the most active flux* that you can effectively clean (Figure 3).

Time/temperature relationship

The illustrations in Figure 4 show the importance and the relationship between time and temperature in the formation of the intermetallic layer.

For an example: 63/37 tin/lead solder melts at 361°F. Alloying with most base metals occurs at 500°F to 600°F.

The proper thickness of intermetallic layer will form at these temperatures between ¼ and ¾ seconds. There is a typical time lag of from ¼ to ¾ seconds to bring the connection to those temperatures, so the total time for a hand-soldered connection should be ½ and 1½ seconds, *if the iron and tip are properly selected and maintained.*

Tip selection and maintenance

The soldering iron tip is the critical heat pipe from the soldering iron to the connection, and the pipe should be as large as practical to transfer the maximum amount

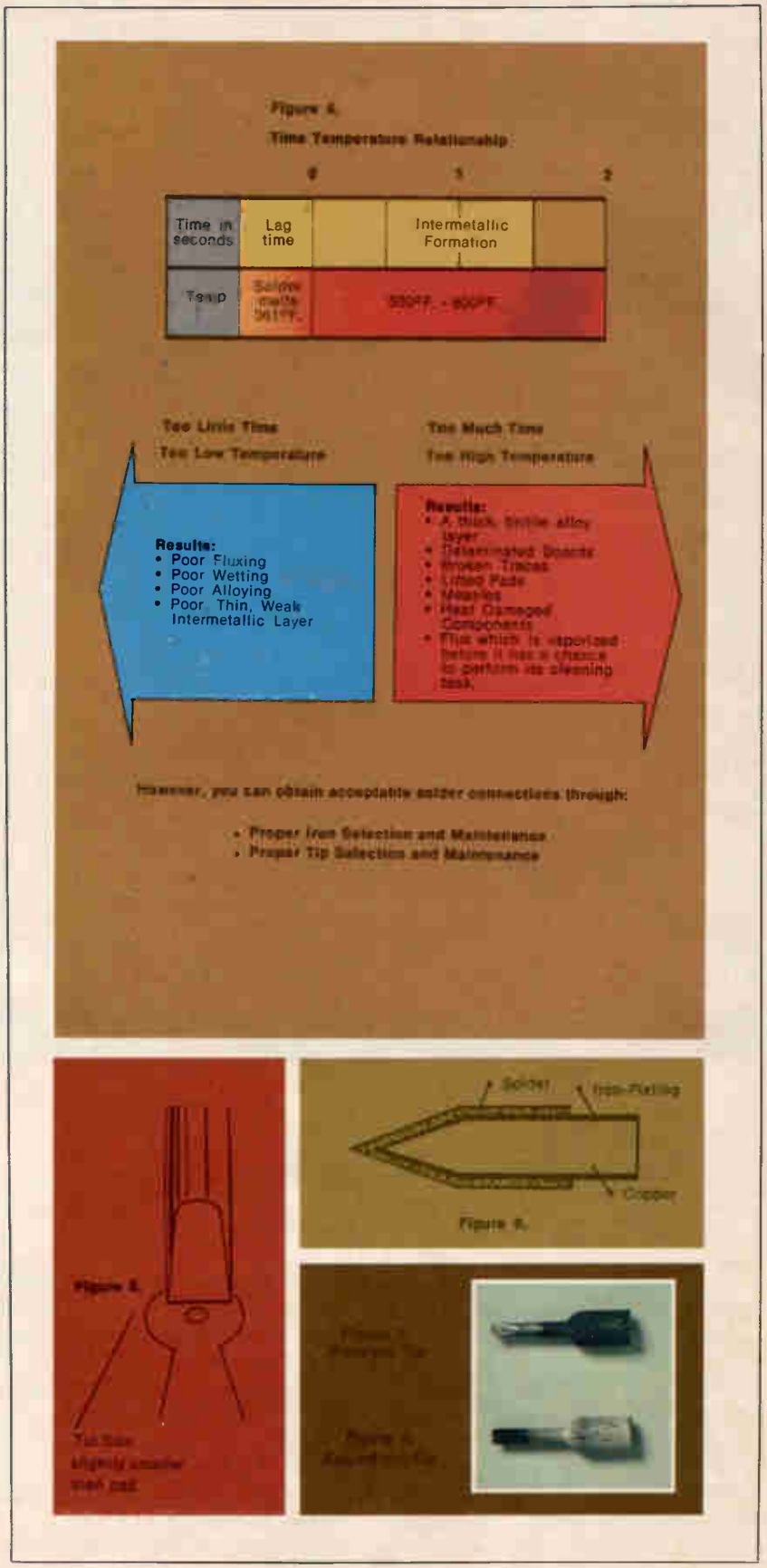
of heat in the minimum amount of time. Therefore, the soldering iron tip should ideally be as large as possible, but still a bit smaller than the pad to be soldered (Figure 5). This will allow the operator to rapidly heat the connection without damaging the board.

It does little good to purchase the finest iron available and to select the perfect tip for the application if you cannot transfer heat from the tip to the connection because of poor tip maintenance. "Good tip maintenance" is synonymous with "keeping the tip thinned" for two reasons:

First, it is difficult to conduct any great amount of heat between two parts through a point or line contact, and that is the best that can be expected of a dry soldering iron tip. However, if that tip is tinned, or coated with a thin layer of molten solder, that fluid layer will squash or flatten out where the tip touches the connection and form a surface contact with it. Obviously, this surface contact forms a much more efficient heat path than does either a line or point contact of a dry tip.

The second reason for "keeping the tip tinned" is to use the life that was built into it. Practically all tips are machined from copper so as to use the high thermal conductivity of the metal. However, copper is highly soluble in tin, and solder will quickly erode an unplated copper tip. Therefore, a thin layer of iron is usually plated on the copper as shown in Figure 6. The iron surface will still wet with solder, but it is soluble in tin at a much slower rate than copper, thereby extending the tip life.

Iron has two bad characteristics, however. One is that it is a relatively poor conductor of heat, and the plating thickness must be kept relatively thin. The other characteristic is that it oxidizes rapidly, especially at elevated temperatures. When this occurs, the tip becomes covered with black or brownish scale that will not wet with solder and will not transfer heat well. These "burned out" tips



are usually discarded, even though they may often be cleaned with a fine abrasive and retinned. However, they should never be filed or harshly abraded because this could damage the thin iron plating.

The way to prevent tips from "burning out" (Figure 8) is simply to keep the tip tinned with a thin coat of molten solder to protect the iron plating from the atmosphere. This is particularly important while the iron is idling in a holder. Never wipe the tip on a sponge before returning the iron to the holder. Rather, add a bit of fresh solder to the tip before resting in the holder. Also, it is important that any new tips be tinned as soon as they are heated to the melting point of solder to prevent oxidation of the surface.

However, even with proper care, repetitive use will wear out a tip as shown in Figure 7. This condition results frm gradual erosion of the iron plating by the solder until a pinhole is formed. The solder is then able to dissolve the underlying copper and cause pitting of the tip.

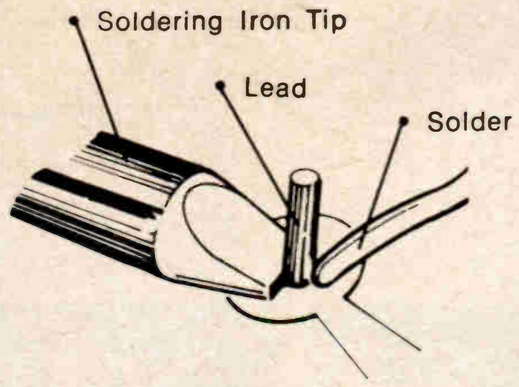


Figure 10.
Melt Solder on part not on Tip

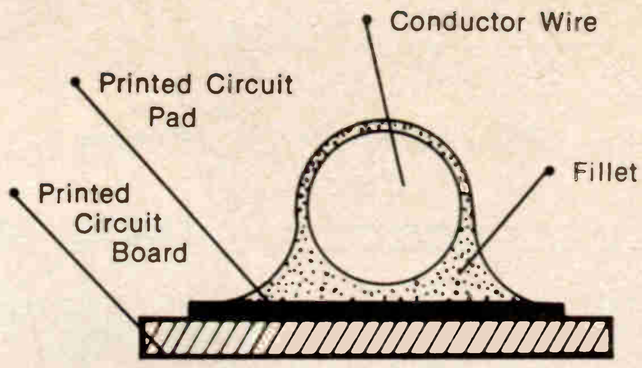


Figure 11.
Proper Solder Coverage

Selecting the proper hand soldering iron

Soldering irons are all too often selected on the basis of input wattage or tip idling temperature, neither one of which is valid criterion for matching the right iron to the job. What is important is the tip operating temperature while it is actually heating the connection to be soldered.

Figure 9 shows simulated tip working temperature curves for a variety of soldering iron capacities and heat sink loads. The chart aso shows the 361°F melt point of 63/37 Eutectic Tin/Lead Solder and it shows the 500°F to 600°F temperature band within which the intermetallic layer will properly form. Assuming that there is a temperature gradient between the tip and the connection that averages approximately 100°F, we are able to define the ideal tip working temperature, or the "tip thermal working zone," as a temperature band between approximately 600°F and 700°F for most electronic assembly. As the operator begins to solder and makes successive soldred connections, the tip will reach an equilibrium temperature within the thermal working zone if the soldering iron and tip are properly matched to the job, as shown in Figure 9. If, however, the iron is too low a capacity, each successive connection will drive the tip temperature lower and lower until the tip "sticks to the pad." At this point, the temperature has fallen so far below the thermal working zone that the tip actually freezes to the connection. Every connection soldered between that point and the bottom of the thermal working zone has a high probability of being faulty.

On the other hand, an iron with too high a capacity will usually produce too high a tip temperature and possibly result in the failures listed in Figure 4.

Temperature-controlled soldering irons

The way to insure that the tip temperature always remains within the thermal working zone is to use a temperature-controlled iron, one that actually senses the tip operating temperature and automatically controls the power to the iron to maintain the preset tip temperature. Such irons will handle a wide variety of soldering tasks while providing consistent results, connection after connection.

Besides taking one of the critical variables out of the soldering task, temperature-controlled irons offer several other benefits, such as long tip life. Iron is soluble in tin only above 820°F, so if the tip is controlled below that temperature the iron-plating will not be dissolved by the solder. Oxidation of the tin on the tip is also reduced due to the lower, controlled idling temperatures which means that the tip will remain tinned longer. Another advantage offered by the temperature-controlled iron is its capability of quickly heating up to the proper temperature. This makes it possible to shut the iron off for lunch and breaks, thus offering a savings in power costs.

Power soldering techniques and joints

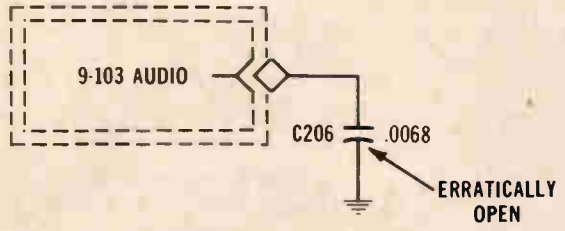
After correctly selecting the proper soldering iron and tip, place the heated tip on the pad of the connection as shown in Figure 9. Be sure that the tip is in contact with both the pad and the lead that are to be soldered. When the connection is hot enough apply solder from the side of the connection opposite the tip. It is not necessary to move the solder around the connection, for if the connection is properly heated and in a non-contaminated condition, the solder will simply flow evenly over the lead and the pad as shown in Figures 1 and 10. Notice that the contour of the component lead or conductor wire is visible.

ES&T

SYMCURE

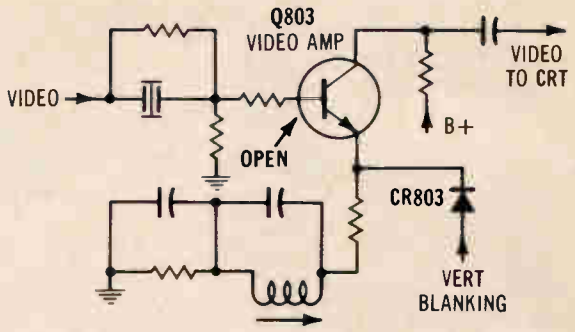
Symptoms and cures compiled from field reports of recurring troubles

Chassis – Zenith 19FC45 1
PHOTOFACT – 1466-3



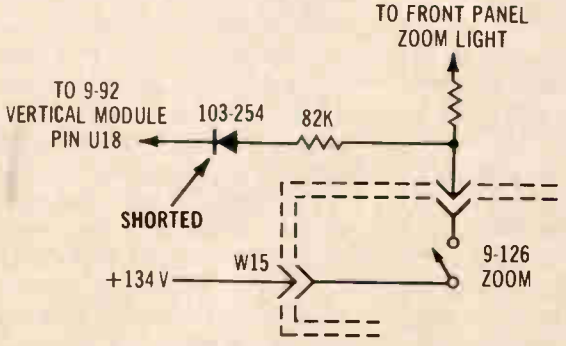
Symptom – Intermittent noise in sound, heard at all volume levels
Cure – Check capacitor C206, and replace it if open

Chassis – Zenith 20CC50z 2
PHOTOFACT – 1238-3



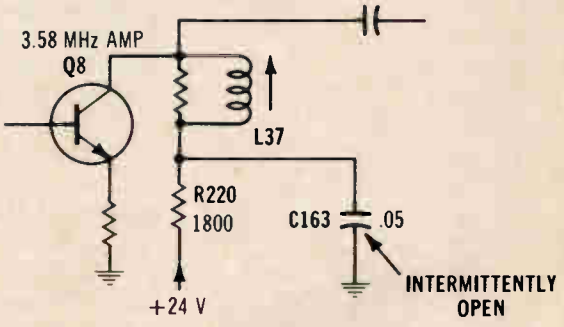
Symptom – Vertical color stripes appear erratically
Cure – Check capacitor C163, and replace it if intermittently open

Chassis – Zenith 19BG1z (monochrome) 3
PHOTOFACT – 1692-2



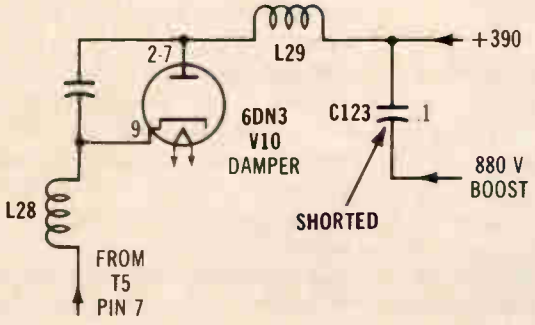
Symptom – Retrace lines in a low-contrast picture
Cure – Check video-output transistor Q803, and replace it if open

Chassis – Zenith 20CC50z 4
PHOTOFACT – 1238-3



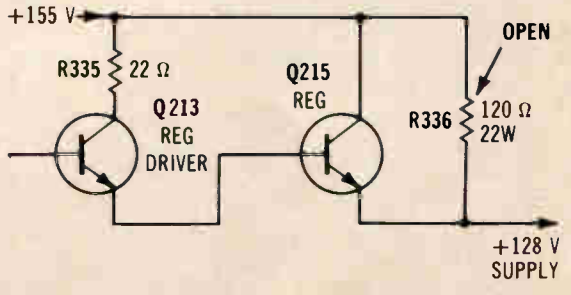
Symptom – Loss of HV; horizontal-output plate glows red
Cure – Check capacitor C123, and replace it if shorted

Chassis – Zenith Space Command with Zoom 5
PHOTOFACT – many



Symptom – Insufficient vertical height in non-Zoom operation
Cure – Check diode shown here, and replace it if shorted

Chassis – Zenith 25DC57 6
PHOTOFACT – 1315-3



Symptom – Loss of raster; regulator transistor overheats
Cure – Check 22W dropping resistor R336, and replace it if open

HDTV: A breakthrough in resolution

Photo print of a picture produced by Sony's HDVS (1125 lines, 60 fields/sec.) *(Courtesy of Sony Corp.)*

Photo print of a picture produced by the standard TV system (525 lines, 60 fields/sec.) *(Courtesy of Sony Corp.)*

In an industry surprise move following the National Association of Broadcasters Convention last April, The Sony Corporation announced in Japan that it had developed a new, high standard video recording and playback system called *Sony High Definition Video System* (HDVS) designed to expand the uses of video and television toward the new image requirements of the 21st century. Sony claims to have become the first company in the world to demonstrate a high definition TV system that incorporates video recording capabilities. This high definition video system is a result of Sony's research and development work in future-oriented visual information technology.

The prototype HDVS by Sony features 1125 scanning lines and 60 fields per second with a frequency band width of about 30MHz, which can contain five to six times more information than the present NTSC standard color TV system. The NTSC system used in Japan, the United States

and some other countries uses 525 scanning lines and 60 fields per second with a maximum bandwidth of 4.2MHz.

Based on the recording and processing of wideband video signals, this is a total video system to meet the requirements of high definition images, including a new video camera, VTR, display unit and other video-related equipment.

With the standard TV system, which uses 525 scanning lines, it is impossible to obtain pictures of high resolution approaching the quality of 35mm film. However, supported by the rapid advances in video technology in recent years, there has been a growing interest in high definition pictures among the TV broadcasting, cinema and other image-handling industries in the world. This global interest in high definition images has already stimulated the reassessment of the present broadcasting systems.

Japan Broadcasting Corporation (NHK) conducted research and development in this field for the first time in 1968. The NHK system, which also uses 1125 lines, was demonstrated at the SMPTE conference in San Francisco in February 1981. NHK showed its high definition TV system at an FCC gathering in Washington also. With remarkable features, the NHK system is attracting the interest of the world's broadcasting industry as an initial step toward the coming era of high definition visual information.

Based on NHK's HDTV technology, Sony has developed this high definition video system by adding video recording, time base correction and other capabilities. Sony expects to play a significant role in promoting and enhancing the high definition technology as proposed by NHK and providing a direction for the new image industry of the coming era.

Sony has demonstrated this HDVS prototype so as to substantiate its feasibility as a highly potential video system in the coming age of high definition pictures. The new system is expected to improve the economical efficiency and expand the production techniques of motion-picture production drastically with its electronic shooting and editing capabilities. The system ensures that the picture resolution is the same as the present 35mm film.

The 1125-line Sony High Definition Video System mainly consists of the following equipment:

- *High definition 3-tube TV camera* that incorporates a newly developed 1-inch Saticon* high-resolution pickup tube.

Provided here are the original prototype plans for High Definition Television from NHK, the Japan Broadcasting Corporation

High–Definition Television

The realization of a new television system, more attractive for viewers, and with an improved impression of "realism" is the aim of our research and development of wide-screen high-definition television.

The Japan Broadcasting Corporation (N H K) has adopted provisional television standards using a 1,125 scan-line system specifically for expediting the development of necessary hardware for new systems.

The picture sharpness obtained with the 1,125 scan-line system is evaluated as being the same as that of a 35-mm motion picture.

Provisional Specifications for a High–Definition Television System compared with Conventional Standards

	HD TV	Conv. TV
Number of scanning lines	1125	525
Interlace ratio	2 : 1	2 : 1
Number of frames per second	30	30
Aspect ratio	5 : 3	4 : 3
Bandwidth of the video signal	30 MHz	4.2 MHz
Preferable viewing distance	3 H	6 H
Visual angle *	28.3 degree	10.7 degree

* Visual angle in the horizontal direction viewed from the preferable viewing distance of each system.

Main specifications of the Sony High Definition Video System

Signal system	RGB component 3-channel system
Horizontal scanning lines	1125 lines
Number of fields	60 fields per second
Interlace	1:2
Aspect ratio	1:1.33 (Standard) 1:1.85 (Vista) or 1:2.35 (CinemaScope)
Bandwidth:	About 30MHz per channel

- *1-inch wide-band RGB VTR* that employs a new high density recording format.
- *Wideband digital time base corrector* that features a new wideband A/D converter.
- *20-inch and 32-inch high definition Trinitron monitors* with a fine-pitch Trinitron picture tube.
- *100-inch high definition TV projector* with a wideband picture tube for projection use.

The HDVS incorporates a 3-channel component signal system that processes three different color signals (red, green and blue) separately from the input to the output of video signals. This new signal system accommodates a wide bandwidth of about 30MHz for each of the three color channels.

**Saticon is a trademark registered by NHK.*

Numerous possibilities of HDVS

Sony's ¾-inch video system has been used in Electronic News Gathering (ENG) by TV stations in the last nine years, steadily replacing 16mm film because of its economy, efficiency in program production and convenience in editing. Video is used not only for news events, but also in production and editing of programs.

High–Definition Cathode–Ray Tube Display

It has been made possible to display a very sharp and attractive television picture unobtainable with conventional television display, by the development of a wide-screen high-definition colour cathode-ray tube.

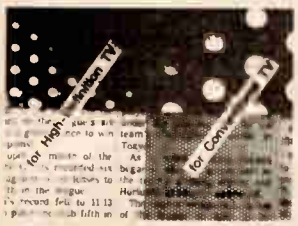
The new cathode-ray tube display has the following features :

(1) Achievement of high-definition performance with an increased number of phosphor-dots (four times as many as in a conventional tube) along with an impregnated cathode ;

(2) Minimization of misconvergence and deterioration in resolution due to application of a newly-developed high-resolution deflection-yoke composed of deflection coils in a two-segment structure and dynamic focus and corner convergence circuit applications.

Specifications of High–Definition Cathode–Ray Tube Display

		28V-type	24V-type	Remarks
Pitch of shadow-mask holes		340 μm	360 μm	less than a half conventional
Deflection angle		90 degree	90 degree	
Aspect ratio		5 : 3	5 : 3	
Resolution	horizontal	more than 1000 TV-lines	900 TV-lines	500TV-lines for conventional tube
	vertical	750 TV-lines	750 TV-lines	
Video bandwidth		30 MHz	30 MHz	
High voltage		30 kV	27 kV	
Input signals		R, G, B, HD, VD		



← Fineness of shadow-mask

High–Definition Color Camera

This camera with high resolution and negligible lag, has an inherently wide-bandwidth video signal.

Camera features may be summarized as follows :

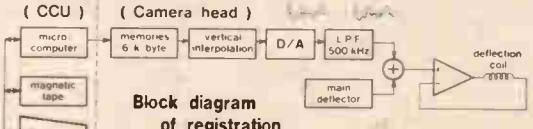
(1) A practical camera with a 1,125 scan-line system ;

(2) D I S tube, especially developed for high-definition television ;

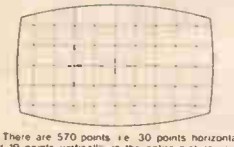
(3) Fine registration digital system, equipped to maintain registration with high precision.

Specifications of High–Definition Colour Camera

Camera system		R, G, B three-tube system
Pickup tube		1-inch DIS tube
Optical lens		Zoom lens, 14x, 16.5 - 230 mm, F 2.1
Limiting resolution	more than	1600 TV-lines at the center 1200 TV-lines at the edges
Sensitivity		4000 lx of illumination, F 2.8
Lag	less than	1 % after 3 fields
Video bandwidth		60 MHz
Signal-to-noise ratio		39 dB, for Y channel, 30 MHz of B.W.
Geometrical distortion and Registration	less than	0.025 % across full picture area
Power consumption		750 W, including picture monitor etc.

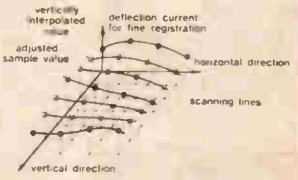


Block diagram of registration control system



There are 570 points i.e. 30 points horizontally and 19 points vertically in the entire picture area at which red, green and blue traces can be adjusted independently.

Illustration of the method to achieve precise registration



Depiction of interpolation for smoothing registration date

Now, the Type C 1-inch VTR developed by Sony is widely used for producing, editing and broadcasting of TV programs.

However, the present standard TV system, which uses 525 lines and 60 fields per second, cannot provide a picture resolution as high as that of 35mm film because of its technical limitations. At present, therefore, 35mm films (occasionally 16mm films) are used for shooting and producing TV movies and motion pictures for theater projection. About one million picture elements are provided by 35mm film.

Sony's High Definition Video System, however, equals the 35mm film capabilities in definition and color fidelity, as it uses 1125 lines (with 60 fields per second) and the RGB 3-channel signal system. The HDVS, therefore, is expected to change the production and distribution methods of motion pictures dramatically in the future, challenging the dominance of 35mm film.

Some of the advantages of using video in movie-making are:

Economy and production efficiency. The use of video in motion picture production will lead to drastic reductions in raw film consumption, film developing, editing and other related costs.

A story can be perfected progressively and efficiently, because video enables repetitive recording and playback of any segment of the story for on-the-spot preview and trial editing at the time of collative reading (of a dialogue script) or rehearsing. Thus, the HDVS will reduce production time greatly by simplifying the work involved, including automation.

Moreover, the new system can expand the range and scope of special effects by producing special effects through electronic processing with accompanying cost reduction.

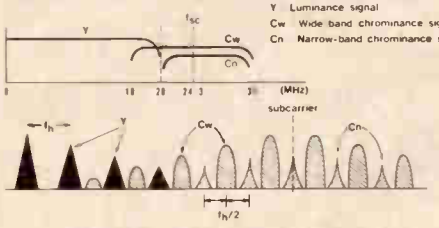
As such, the use of video technology will reduce the total cost of motion picture production. Called *Electronic Cinematography* and enthusiastically promoted by Joseph Flaherty, CBS vice president, Hollywood film directors, Francis Coppola, George Lucas and other leaders, this kind of movie production is expected to change the conventional filmmaking techniques dramatically.

Signal Forms for High-Definition Television

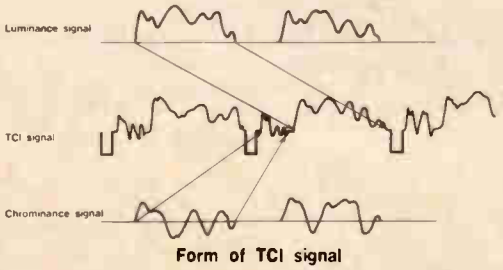
A composite colour television signal for high-definition television called the HLO-PAL (Half-Line Offset Phase Alternation by Line) signal was proposed as it was advantageous in being able to prevent the signal from deterioration caused by fluctuation of transmission-path characteristics, and showed less mutual interference among the luminance signal and the two chrominance signals.

It has been used for general transmission, including optical fiber transmission.

Another signal form called the TCI (Time Compressed Integration) signal was also proposed and has been used for appropriate experiments. In this signal, two chrominance signals or a line-sequential chrominance signal are compressed along the time axis and time-division multiplexed with the luminance signal.



Spectrum of the HLO-PAL signal



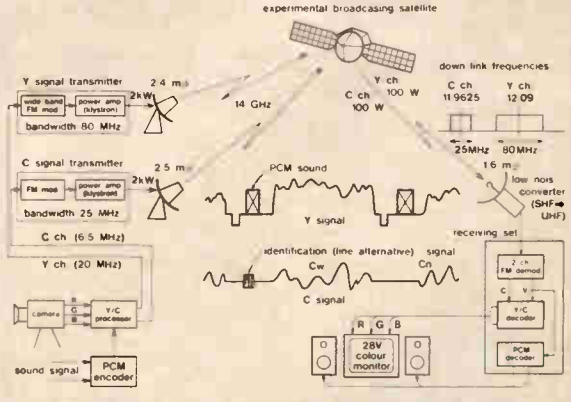
Form of TCI signal

Satellite Transmission of High-Definition Television

An experiment for the transmission of the 1,125 scan-line high-definition television signal was carried out with "Yuri", the Japanese Medium-scale Broadcating Satellite for Experimental Purpose, in November 1978.

For the purpose of maintaining satisfactory picture-quality with a relatively limited satellite transmitting power, a unique transmission system of Y/C Separate FM Transmission was applied, in which the luminance signal Y and the line-sequential signal C were transmitted by individual carriers.

The received picture-quality, with an antenna of 1.6 meter in diameter, was satisfactory.



Experimental Y/C Separate FM Transmission System of High-Definition Television

Picture quality. The Sony HDVS ensures as high picture resolution as 35mm film even on a VistaVision-size screen (aspect ratio 1:1.85), as it provides a wide bandwidth of about 30MHz for each of the three color (red, green and blue) channels. Also, because of its high definition, the new system ensures a wide range of color reproduction and fidelity characteristics unique to video.

Distribution. Electronic cinematography is expected to change the conventional method of film distribution as well.

What is produced in video can be transferred onto 35mm film by an electron beam recorder, or by means of laser recording, and then distributed to movie theaters. Also, after converting it to an interim signal system (using, for example, 800 lines) between the HDVS and the NTSC standard system, the video production can be distributed in ¾-inch cassettes to so-called mini-theaters, which are becoming popular in the United States and Europe.

Uses of the HDVS can be further expanded through satellite broadcasting, cable TV, or fiber-optic transmission in the future.

In addition to the expansion of motion picture production techniques through video, the HDVS is expected to enhance the techniques of TV program production and broadcasting by the present NTSC system.

- Such special effects as electronic zooming and trimming can be easily provided in the post-production process, without degrading the picture quality.
- Image enhancing, noise reduction, conversion to PAL or SECAM, besides NTSC, and other operations can be easily done through digital image processing before broadcasting of programs that are produced by the HDVS.

The demonstration of its prototype High Definition Video System puts Sony definitely on a firm technological base for this advancing technology and Sony plans to continue its research and development in the field for the coming era of high standard visual information.

ES&T

Pickup Tube with High Resolution and Low Lag Characteristics ~ D I S Tube ~

This tube developed at the N H K Technical Research Laboratories is the only one of its kind in the world. Using it, it is possible to pick up high-definition pictures live.

The abbreviation D I S derives from

Diode-operation electron gun (which differs from the conventional crossover electron gun in beam-shaping),

Impregnated cathode, and

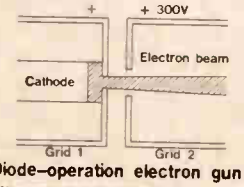
Saticon, a photoconductive layer which has high-resolution performance.

The diode-operation electron gun has the following characteristics :

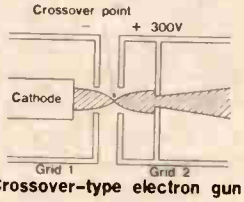
(1) An impregnated cathode employed so as to combine a high current with a sharp electron beam profile ;

(2) Capacitive lag has been reduced by eliminating the crossover where local congestion of electron flow spreads the velocity distribution of electrons ;

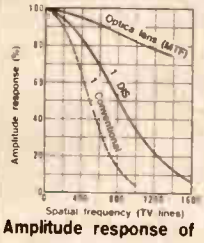
(3) Deterioration in resolution at the edge of the picture has been improved by diode-operation in which the electron beam divergence angle is relatively small.



Diode-operation electron gun



Crossover-type electron gun



Measured with a slant-line test pattern, Type P200 (in the direction of right-side down), including an optical lens with an aspect ratio of 4 : 3.

Amplitude response of the DIS tube


Lag characteristics of the DIS tube

The 55-inch High-Definition Projection Display

This projector is capable of displaying television pictures with greater sharpness and attractiveness and with a subjective feeling of "realism" on a large, wide screen. Its features are as follows :

(1) Application of a magnetic focusing system to a 7-inch high-brightness projection tube, improving picture sharpness ;

(2) Improvement in resolution at the edge of the picture with the adoption of dynamic focusing and of an aspherical plastic lens ;

(3) Minimization of picture deterioration caused by misconvergence by means of a convergence control system using digital memory applied to the projector ;

(4) Reduction of projected picture deterioration caused by the ambient light, by utilizing a surface-reflection, high-gain and directive spherical screen.

Specifications of the 55-inch High-Definition Projection Display

Method of projection	refraction lens system
Applicable viewing direction to the normal of the screen	horizontal 30 degree vertical 10 degree
Size of screen	55 inches in diagonal (with an aspect ratio of 5 : 3)
Resolution	horizontal 800 TV-lines vertical 750 TV-lines
Cathode-ray tube	7 inches, 55 degree deflection, three-tube system(R,G and B)
Optical lens	focul length of 136 mm, F 1.4

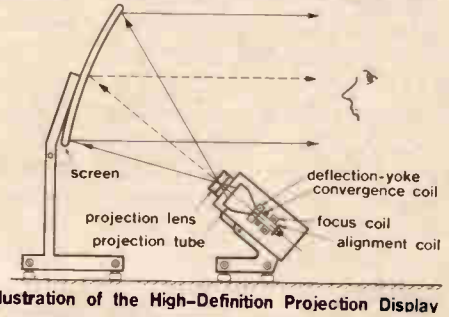


Illustration of the High-Definition Projection Display

SMPTE panel examines HDTV

By Blair Benson, engineering consultant, Norwalk, CT

Flaherty: HDTV will be expensive—for broadcasters, a reinvestment; for filmmakers, a new investment.

Coppola: HDTV provides significant improvement in resolution and contrast over present broadcast standards.

Sugimoto: Once the public has seen HDTV, they will want it because of the greater detail and sense of reality.

The SMPTE New York Section hosted an audience of more than 350 on Sept. 9 at CBS' Broadcast Center for a discussion of high definition television (HDTV) by a noteworthy panel of experts in engineering, research and program production. The meeting, although locally sponsored, took on national significance because of the great interest in the subject and the distinguished panelists present.

Moderated by Joseph Flaherty, Engineering and Development vice president of the CBS Television Network, the panel consisted of Francis Ford Coppola, well-known for his innovative use of electronic techniques in film production; Dr. Richard Green, CBS Technology Center scientist; Executive Producer Glen Larson; Dr. Stephen Lukasik, FCC chief scientist; Renville McMann, president of Thomson-CSF Labs US; Dr. Kern Powers, RCA's vice president of Research and Engineering; and Dr. Masao Sugimoto, manager, systems research at NHK. During the discussion, at the request of the moderator, the panel was joined by Donald Fink, renowned for his work in the development of NTSC Standards (among his many other engineering achievements), and presently the chairman of the SMPTE high definition study group.

Joe Flaherty opened the discussion with an outline of the technologies that must be studied in the course of the development of HDTV standards. He classified these broadly into the areas of: production and signal generation; distribution by broadcast transmission, cable, satellite, cassettes and disc; and reception and display.

Problems facing standardization

Standing in for Joseph Polonsky of Thomson-CSF in Paris, who was unable to attend, Renville McMann discussed some of the problems to be faced in standardization, and in transmission and display. He said that any standard would be a compromise, arrived at by careful consideration of all requirements and estimates of future technology, and should be relevant for at least two generations.

A major consideration and possible limitation in transmission will be the requirements of wider bandwidth. Current allocations are inadequate for over-air transmission. In fact, to permit multichannel satellite transmission, some form of digital signal bit-rate compression will be required. This poses the question regarding distribution: Will cable systems be

using fiber-optics or will direct broadcast satellites (DBS) be used to beam signals to the viewer's homes?

In order to use the full capabilities of HDTV, developments are needed in picture/display equipment, particularly if the 3:4 aspect ratio is to be abandoned for wider screen displays. This may well result in the first use of HDTV being in the motion picture industry, rather than in TV broadcasting.

HDTV needed for electronic cinematography

On the production front, Francis Ford Coppola opened his remarks with a review of the TV system techniques used in the production, by his Zoetrope Studios, of the film *Apocalypse Now*. The editing decisions are made using ½-inch Beta videotape cassettes to produce an edited cassette, the equivalent of a film "workprint." This tape then serves as the film editor's guide in assembling and editing the film takes. He pointed out that videotape editing is slowed by the lack of random access, which would permit immediate playback of the edits in real time.

Also, he emphasized the need for a high definition TV system to eliminate the need for release on 35mm film. For this purpose he considers that Sony and NHK systems provide the necessary five times improvement in resolution and contrast over the present broadcast standards.

In support of Coppola's views, Glen Larson, executive producer of Glen Larson Productions in Hollywood, stressed the need for TV engineering development in HDTV, and particularly to achieve the higher contrast "film look." Larson criticized American manufacturers for not pioneering in HDTV development, as had been done in the past by RCA in color TV and by Ampex in videotape. He added that only CBS is giving full backing to engineering advances, and these are coming from Japan–for example, Sony's reported expenditure of $200 million on HDTV.

On the question of cost for the adoption, Flaherty commented that, although broadcasters and film producers will be faced with sizable expenses, the broadcasters will be experiencing a *reinvestment*. On the other hand, for the film industry it will be an initial investment in new hardware, an important financial consideration.

FCC spectrum allocation/ problems and regulatory position

Lukasik emphasized the seriousness of the problem of spectrum availability. Broadcast channels are not available, nor are satellite channels, unless bandwidth-reduction techniques can be employed. The development of 18GHz technology will be necessary to accommodate the 100MHz or greater bandwidth required.

In regard to regulation, the FCC will permit, not mandate, HDTV, and will rely upon industry volunteers to develop the necessary standards. He added that the HDTV standards and implementation must be studied under the context of the broad subject of information transmission.

Transmission, distribution and reception

Green pointed out that, in addition to storage-type distribution on videotape and disc, a transmission technique must be available that permits terrestrial delivery of programs by both broadcast and cable. To date the transmission techniques have been extremely wasteful of spectrum because they are intended to permit the use of the lowest cost receivers and display devices. The high degree of redundancy in the TV picture signal opens the way for bandwidth reduction, particularly by the use of low-cost frame stores in home receivers.

In regard to the home receiver, Powers predicted a marked improvement in receiver performance through the use of frame-store comb filters costing no more than $5, and using 30Hz read-in and 60Hz read-out to improve picture quality.

HDTV development and implementation, however, will require a large investment over the next 5-10 years by industry in production/post-production and transmission facilities, and receiver tooling and components. The major expense for the receiver industry will be in the wide-screen display. He suggested that first HDTV may be used as a production tool for the cinematographer.

Although not scheduled to appear on the program, Donald Fink joined the panel at the request of Joe Flaherty. In concurrence with Powers, Fink commented that the motion picture industry can provide a marvelous test bed for HDTV. From the information and experience gained, the best techniques and system parameters can be selected, and within the framework of the SMPTE organization, a standard can be developed that will be as long-lasting as NTSC.

He further suggested, in view of the direction in digital TV development, that we may want to consider only a component system, rather than composite. Powers questioned the need to eliminate composite transmission, considering the excellent results possible with frame-store comb filters, combined with the continuing reduction in cost of frame stores.

NHK: How, why and when

Sugimoto described the NHK high definition wide-screen system and reviewed the research that was conducted in arriving at the standards finally selected for their wider audience-reaction tests. NHK has found present-day technology satisfactory for HDTV with stereo sound. Delivery to homes in the future by satellite, cable, film and tape seems promising. Once the public has been exposed to HDTV, they will want the service because of the greater detail, the larger wide-screen picture, and greater sensation of reality. The public expects HDTV in five years, a time schedule that is technically feasible.

The future for high definition television

The ambitious program sponsored by the New York SMPTE section left the audience with the distinct impression that there has been a dramatic increase in interest by industry and the public alike in high definition television, and that the technology is available. As a result, we may see an acceleration in the development of universal standards for HDTV and a new, improved TV service to be adopted in the not too distant future.

ES&T

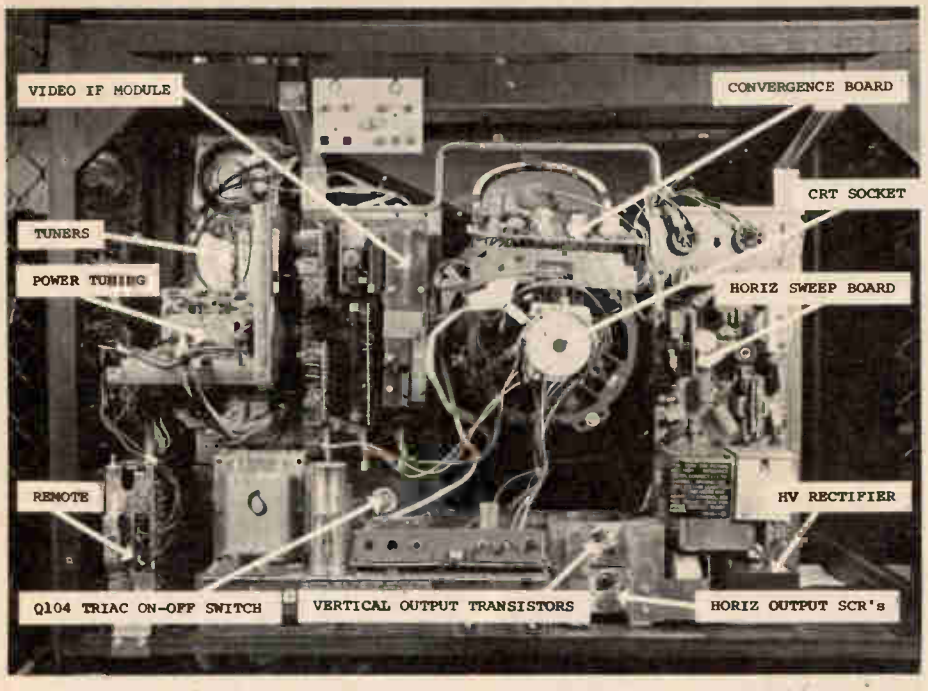


Figure 1 In the RCA CTC54 color receiver, a motor-driven rotary switch selected dc tuning voltages and band-switching voltages for 20 channels. The 20 tuning voltages were developed by 20 multi-turn potentiometers that could be adjusted to tune in any TV channel.

Servicing digital tuners

By Carl Babcoke, CET

Several types of electronic tuners for TV receivers have been used over the year. The first step in troubleshooting these advanced tuners is to recognize the basic operation. A brief description and troubleshooting tips are given for the various tuner systems.

Electronic tuners without moving parts have been used for several years. However, there is no common system; only one important detail is found in all. Therefore, a technician must know which system is incorporated in the TV needing repair. It is also imperative to have a schematic for that model.

Older tuners (that produced different TV channels by physical rotation of a front-panel knob) had identical basic features; only the details were different. An experienced technician could clean corroded contacts on almost any tuner without having seen one previously and without a schematic. Only module or board replacements can be done on digital tuners when the technician has no specific knowledge of the system.

Electronic tuners in the past

Electronic Servicing & Technology (previously **Electronic Servicing**) has covered most of the basic types of electronic tuners. The first mention of varactor-diode and diode-switched tuners occurred in the December 1969 roundup of new color TV circuits. Diode-switching in tuners uses the on-or-off states of diodes. A forward-biased diode is the equivalent of a low resistance, while a reverse-biased diode is virtually an open circuit (having mostly a small stray capacitance). Evidently, this was the basic mode of switching VHF channels in the limited production "Two Thousand" RCA model. Although the diode-switching *concept* is simple, the pioneering RCA tuner and motorless remote-control system required 78 transistors, 122 diodes, four FETs, nine zener diodes and six integrated circuits.

At that time, varactor-tuned auto radios and TV tuners came on the market, and the November 1971 issue described circuit operation of the RCA KRK-155 VHF and KRK-160 UHF tuners.

Another basic method of controlling varactor tuners was described in **Electronic Servicing** in January 1972. The RCA CTC54 combined remote-control and

panel selection of stations and other essential functions. A motor-driven rotary scanner switch selected an appropriate tuning voltage and bandswitching voltage at each of 20 channel positions (Figure 1). Twenty multi-turn potentiometers were provided for selection of the desired channels, while an analog meter indicated the approximate channel position. After setup, the AFT maintained optimum tuning. Bandswitching was accomplished by switching diodes, and the tuning voltage varied the varicap capacitances to provide channel tuning. UHF and VHF tuners were varactor types. Up and down scanning push-buttons on the front panel or the remote control selected the 20 channels sequentially.

In the same year, several popular Zenith models included tuner systems that *appeared* to use conventional VHF knob-rotated tuners (Figure 2). However, the rotating turret did not tune anything directly. Each position of the turret (and the dial drum with channel numbers) connected a separate multi-turn potentiometer that had been adjusted to tune-in the desired channel by acting as a variable voltage divider from a regulated supply. A panel meter aided channel adjustments. Both VHF and UHF tuners were varactor types.

Since that time, many other brands and models have followed this basic tuner format. Figure 3 shows several photographs of a Sylvania tuner assembly having a turret containing multi-turn potentiometers to supply tuning voltages for two varactor tuners. Such systems were simple but had several important advantages.

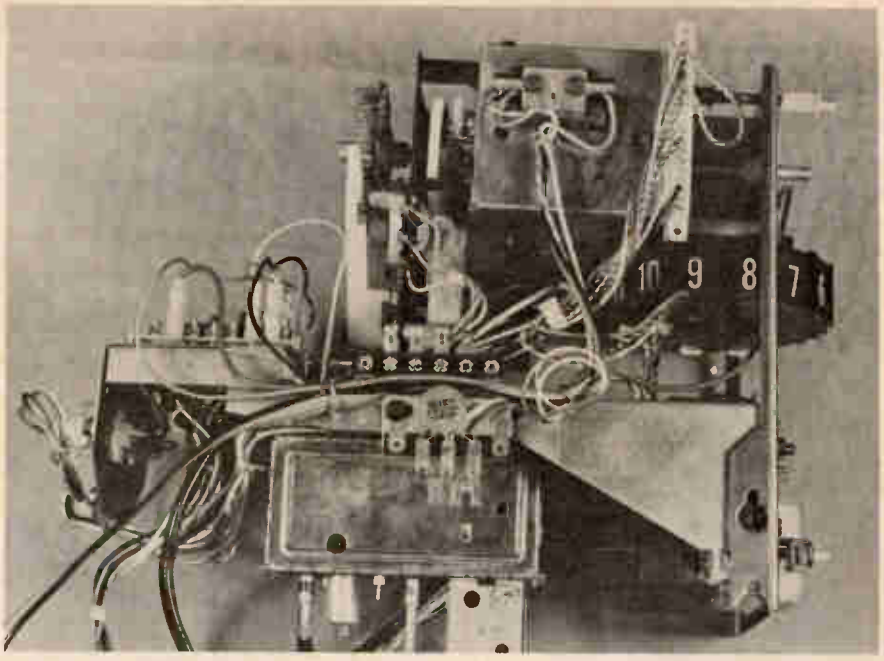


Figure 2 This Zenith varactor-tuning system is one example of electronic tuners that strongly resemble the earlier rotary-switch or turret TV tuners.

These pioneering tuners were much more dependable and required far fewer routine cleanings of the switch contacts than did the rotating-switch types that handled RF signals directly.

Dc voltages applied to band-switching diodes can vary by several volts without adversely affecting the switching, provided each diode is forward biased when it is called for or reverse biased when desired. Contact resistances of multi-turn controls supplying tuning voltages are more critical, but far less critical than if the same contacts carried RF signals.

Therefore, servicing these types of tuners requires less attention to the switch contacts and more to the band-switching diodes or sources of tuning voltage. For example, when a band-switching diode is shorted, tuner operation will be normal for all functions where that diode is supposed to be forward biased, but other func-

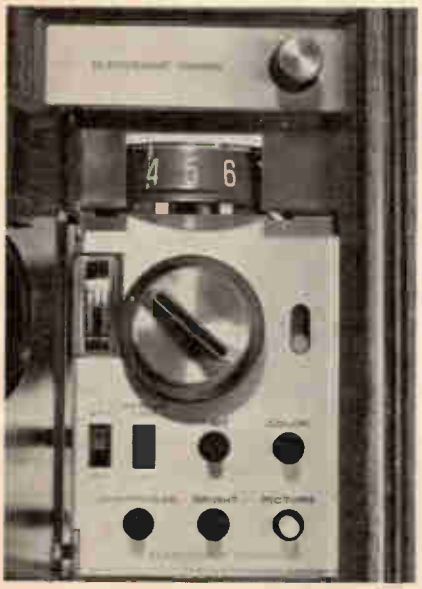
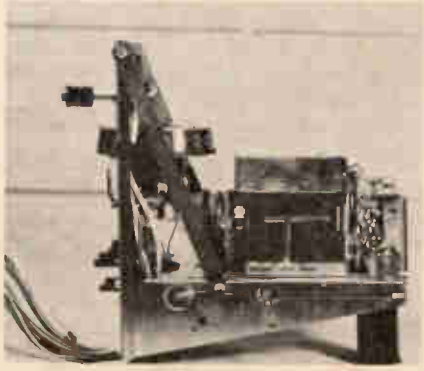
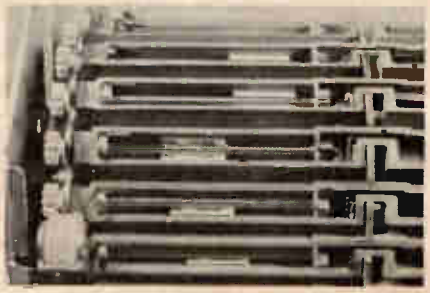


Figure 3 A later version of the multi-turn potentiometer turret (that resembles older turrets with tuning coils) is found in this Sylvania receiver.





tions will be incorrect. One essential is an accurate in-circuit diode tester.

Seeking tuners

Another basic type of TV tuner started from a parked position (perhaps belwo channel two) and scanned up through the channels until it found a carrier having several selected characteristics. The Magnavox STAR system is one example. In the scan mode, it stops for every carrier identified as having video modulation.

A variation of this principle has been found in some Sony receivers during the past few years (**Electronic Servicing**, December 1980). The tuners were mounted to the main framework (Figure 4), while the tuner-controler assembly was located behind the front panel (where the rotary-switch tuners were located in other models).

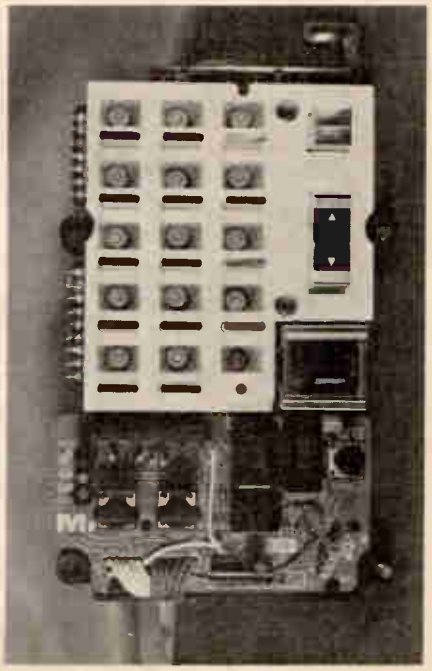
Sony scanning was used to locate TV channels that had not yet been programmed, such as UHF channels, video games or videocassette recorders. These receivers were programmed for all 12 VHF channels at the factory. Reprogramming can be a bit complex, depending on the starting and ending channels. A clear method was given on pages 26 and 27 in the article mentioned earlier (factory information can be confusing), and this method is recommended. Remember that *reprogramming cannot be done unless the desired signal source can be received at the time.* Scanning continues to the next carrier that has video modulation during reprogramming. After the scanning stops at the desired signal, the *channel-set* switch is moved from *on* to *off*. This stores the proper digital signal in the microprocessor, so pressing the corresponding front-panel button (or remote button) *after reprogramming* tunes-in the signal accurately. Up and down scanning buttons are also provided to allow a sequential selection of programmed channels.

Memory tuners

The Magnavox T995 with Videomatic Touch-Tune system is one example of television tuners that store the digital code obtained by manually programming the system to tune-in each channel. This digital code is then stored and recalled when the corresponding two channel buttons are pressed on the selector panel. The channel program appears almost instantly, along with the number shown by

Figure 5 The front-panel selector assembly and the control/tuner chassis of the Magnavox T995 color chassis are shown removed for examination or testing. A microprocessor is incremented or decremented to vary the varactor tuners' tuning voltage until the desired channel is received. This digital code is then memorized for recall when the corresponding buttons are pushed. No variable controls (only push-buttons) are used by the viewer. However, the door above allows technicians access to the programming switches and rotary controls when reprogramming is needed.

Figure 4 One example of the *station-seeking* tuner system is provided by this Sony receiver. Signal seeking is used to program new channels, but the digital code is then stored so that channel can be recalled by pressing one panel or remote pushbutton. A microprocessor acts as controller.



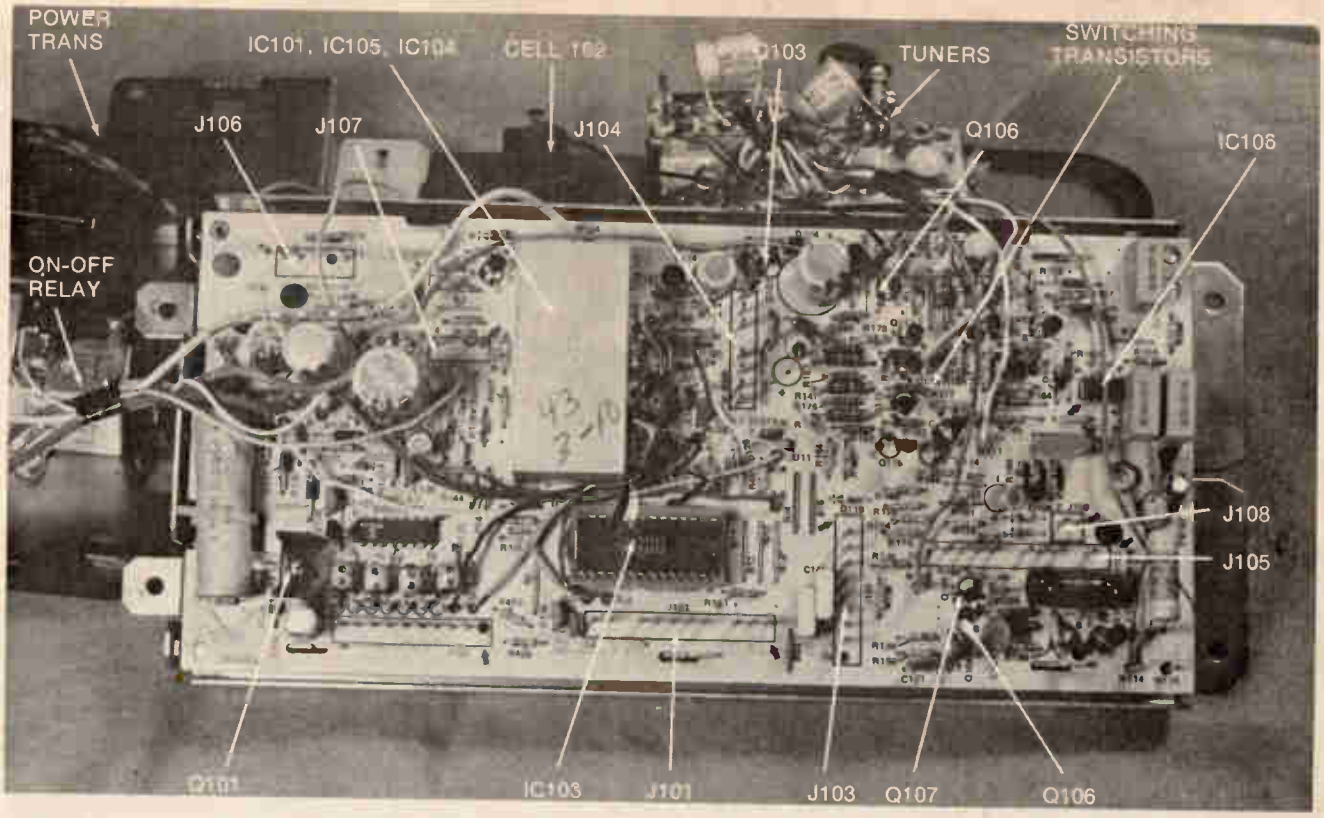


Figure 6 Arrows point to many components on the Magnavox T995 tuning-control chassis. IC103 is the microprocessor. Battery cells are used to maintain memory when the receiver power is turned off.

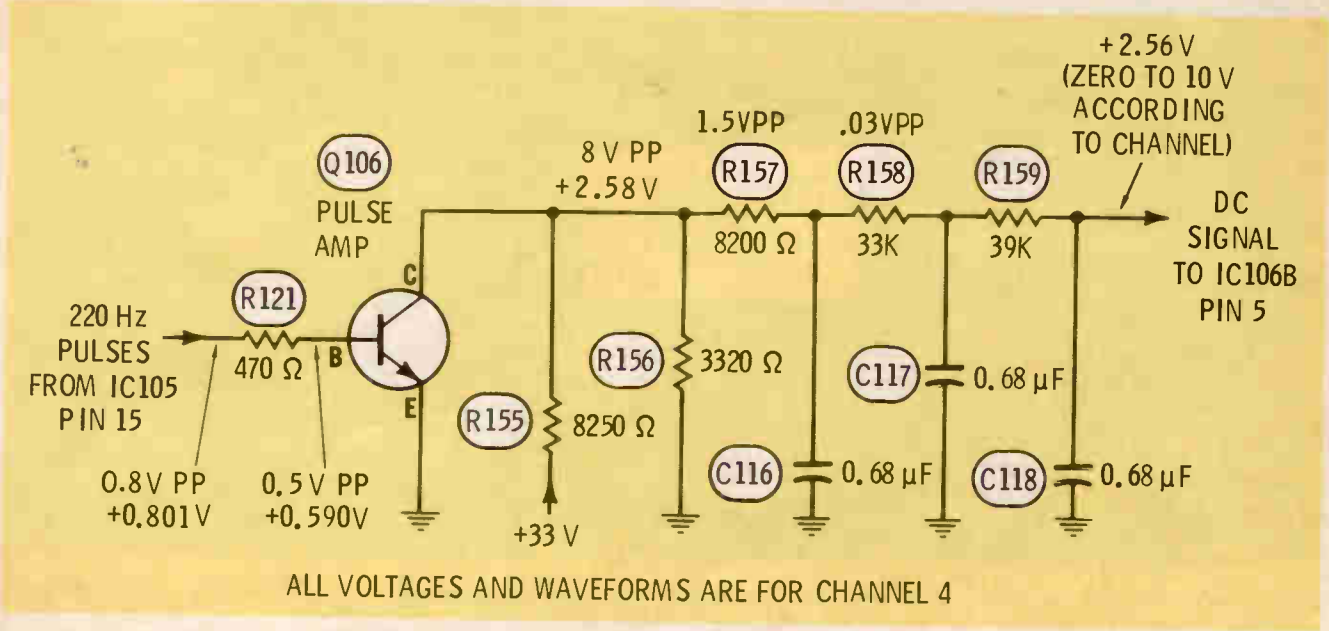


Figure 7 In the Magnavox T995, tuning voltage originates as dc-voltage pulses that can be varied in duty cycle. After amplification and filtering (as shown), the dc pulses become pure dc voltage. Narrow pulses become a low dc voltage, while wide pulses become a much higher dc voltage that tunes the varactor tuners.

two LED displays on the selector panel. All 12 VHF channels are pre-programmed by the factory; UHF channels are programmed in the customer's home in accordance with those channels active in the area. This is a random-access system that allows channel selection in any sequence.

The tuning system has two major sections: the front-panel selector assembly and the moderately large chassis (mounted on the cabinet's bottom) with the microprocessor-controlled circuitry and both varactor tuners (Figure 5). Details of the control chassis are shown in Figure 6.

During programming, a switch is activated to allow incrementing (counting upward) or decrementing (counting downward) of the microprocessor, which produces dc pulses having a duty cycle that varies with the up or down counting. After filtering, the narrower pulses produce a low dc voltage,

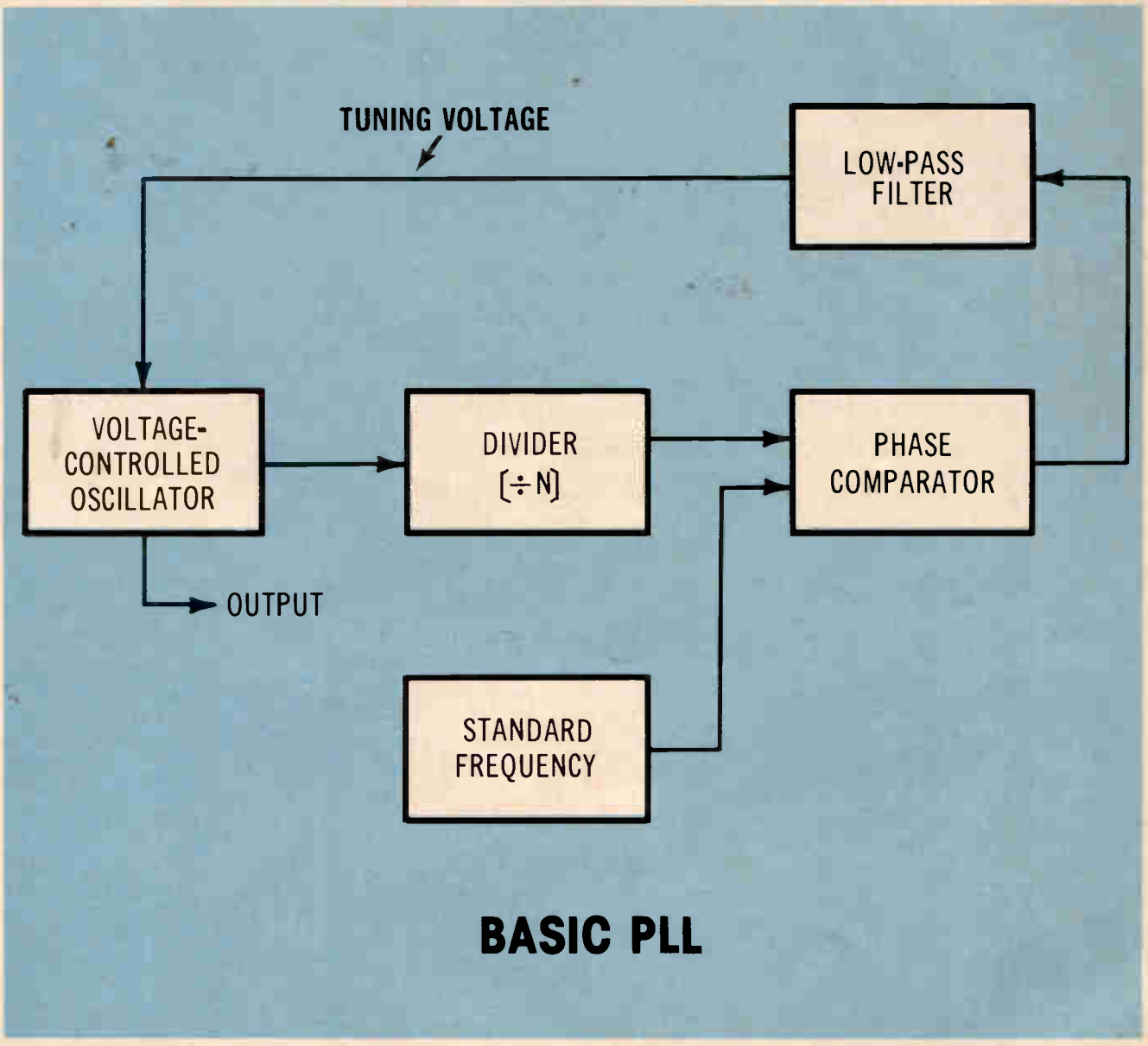


Figure 8 A basic phase-locked loop (PLL) circuit has these elements. The two inputs (standard frequency and divider output) *must* have precisely the same repetition rate after the system has stabilized. When the divider ratio is changed (or when the power is first applied), the two repetition rates are different, causing the phase comparator to have a certain dc voltage output in the direction needed to swing the voltage-controlled oscillator (VCO) frequency to whatever frequency produces phase lock. When phase lock has occurred (both comparator inputs have identical repetition rates), the error correction voltage (output of the low-pass filter) remains at whatever voltage was required to shift the oscillator frequency far enough to produce phase lock. In FM demodulators, the error-correction voltage is the audio signal. For TV frequency-synthesis tuner control systems, however, *the error-correction voltage is the tuning voltage applied to both VHF and UHF tuners.*

Figure 9 One of the first Quasar color receivers to have frequency-synthesis PLL-varactor tuning operated from this random access push-button keyboard.

while wider pulses produce a higher dc voltage (Figure 7). The dc voltage is amplified and becomes the tuning voltage for both tuners. A panel meter has approximate channel positions marked for three bands, with LEDs identifying the band in use. This allows easy programming of new channels.

Digital frequency-synthesis tuners

The frequency-synthesis type of television tuner has gradually become the standard for high quality tuners. At the heart of each frequency-synthesis system is a phase-locked loop (PLL). A simplified circuit is shown in Figure 8.

Phase-locked loops are currently in use for many circuits, such as FM demodulators. PLLs were not practical until LSI integrated circuits produced reliable programmable dividers that could be directed to divide by many different ratios. Other important facts are given in Figure 8.

One of the first Quasar random-access tuners operated from front-panel buttons (Figure 9). The circuit included a microprocessor-controlled PLL with prescaler dividers to handle the oscillator count-down.

During 1980, the RCA CTC99 and CTC101 color receivers were analyzed in detail in **Electronic Servicing.** All major sections of the scanning tuners in the CTC99 are shown in the block diagram of Figure 10. The sample CTC99 had up and down channel scanning *without* keyboard random-access selection or remote control. However, provision was made for skipping inactive channels, so scanning six or seven channels could be finished rapidly.

None of the channels in a frequency-synthesis tuner requires programming. All are available when needed.

The pictures in Figure 11 show features of the front-panel controls and locations of the control module and the two tuners. Of course, both tuners are varactor types.

Servicing advanced tuners

It is obvious from this review of basic television tuners that no single troubleshooting method can be effective for all systems. Some servicing suggestions were made for models previously covered in **Electronic Servicing.**

However, the results of a limited telephone survey of several distributors, manufacturers and tuner/module rebuilder organizations indicated that most technicians have no strong desire to make discrete component repairs by replacement of entire boards or

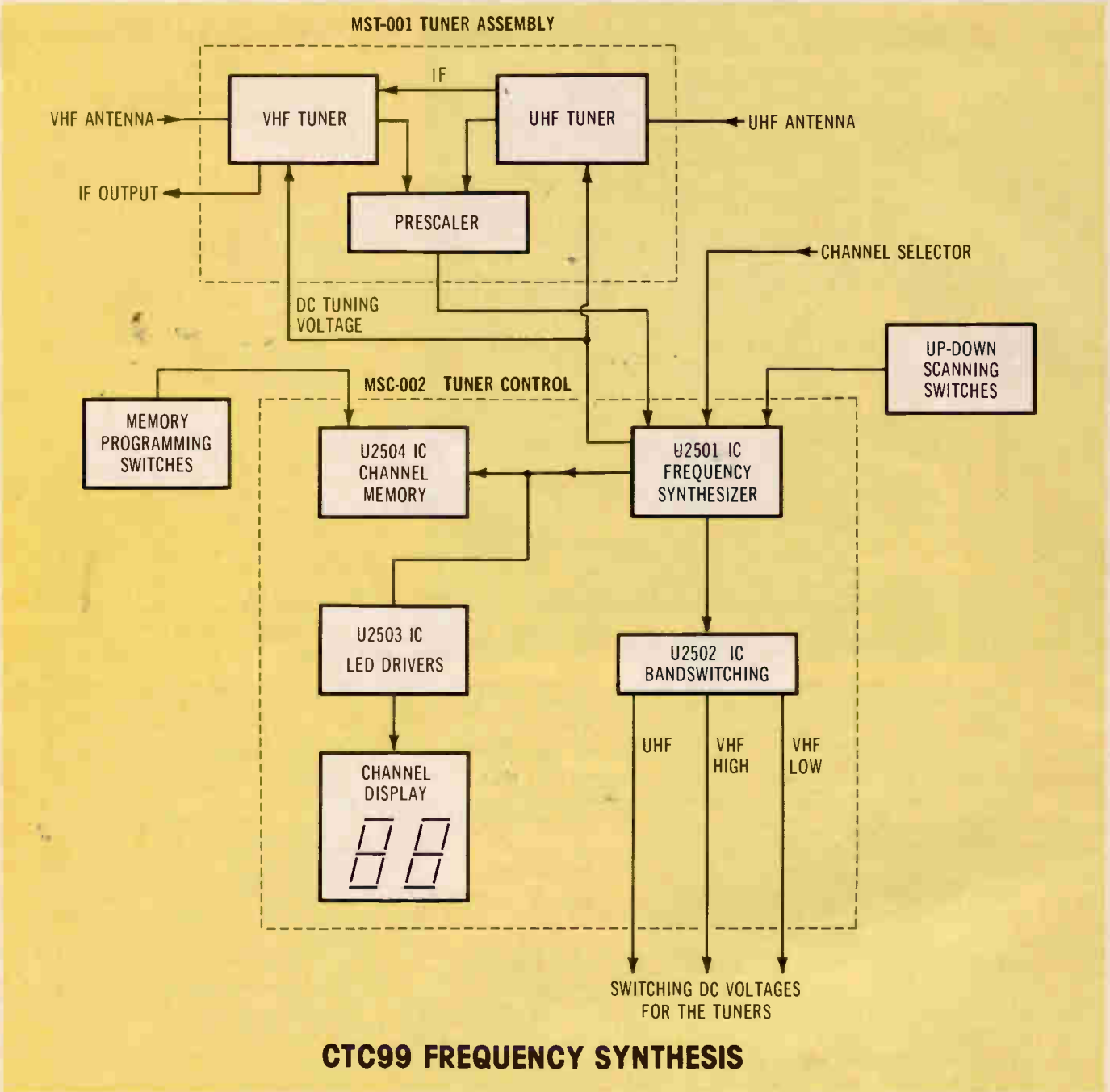
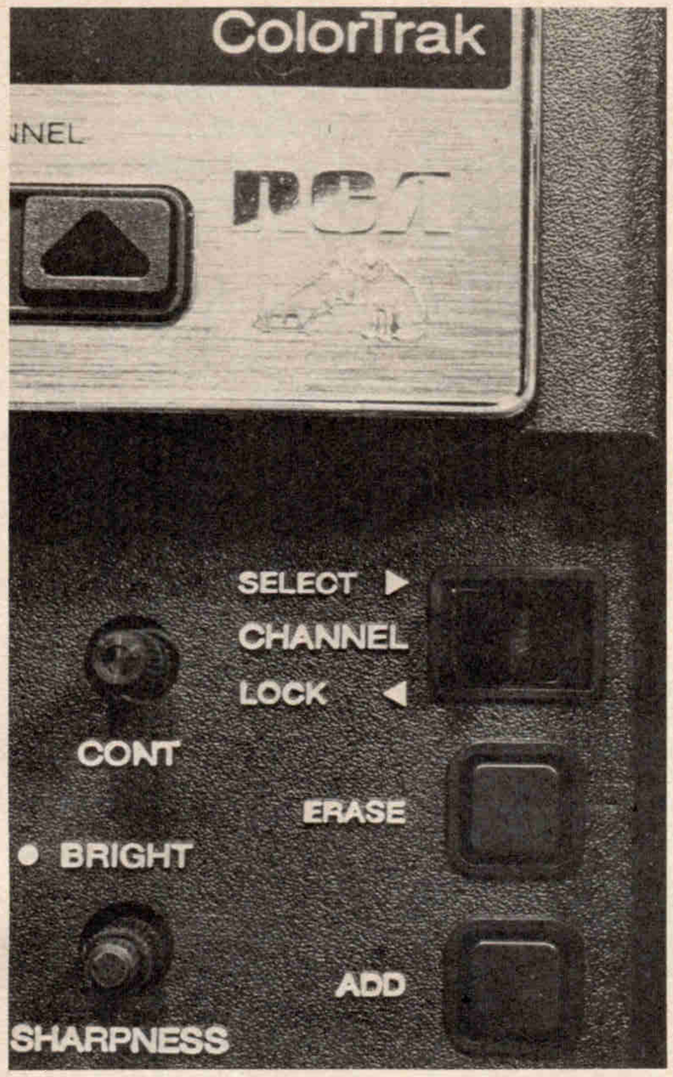


Figure 10 In the RCA CTC99 scanning-type frequency-synthesis system, the PLL is inside integrated circuit U2501, and the various elements cannot be identified.



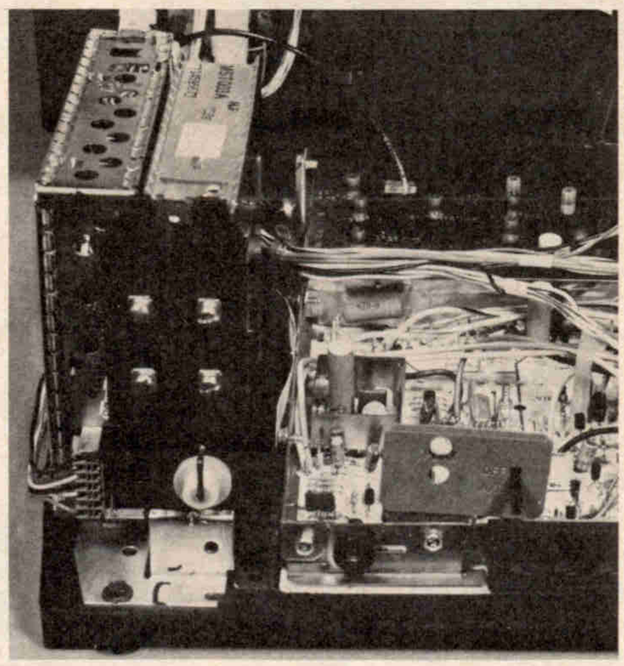


Figure 11 Pictured are the RCA CTC99 panel (left) and the main chassis (right) with separate but adjacent shielded boxes containing the tuner control and both tuners (at left).

modules (with many of these exchanged for new or rebuilt replacements). The editors of **Electronic Servicing & Technology** welcome comments from readers about possible future coverage of TV tuner repairs.

The following are practical suggestions for troubleshooting complex tuners:

- Determine from the schematic the basic type of circuit, as explained in this article.
- Perform the usual visual and mechanical tests, looking for burned resistors, overheated components or erratic operation during vibration.
- *Locate the varactor tuning-voltage at the VHF tuner.* Measure this dc voltage while attempting to select various channels. Compare the results with the nominal voltages that are expected. Experienced tuner technicians explain that many complaints involve a varying or drifting tuning voltage that can be caused by internal tuner defects or problems in the tuning-voltage supply. Check these possibilities before becoming involved in the remainder of the PLL.
- If the tuning voltage is incorrect and is suspected of being the origin of poor tuning, use a tightly regulated voltage supply to substitute for the tuning voltage that comes from the control section. Varying this test tuning voltage should allow reception (often normal operation) of all channels. If so, the tuners are normal, and the search must change to the control section.
- Have an accurate digital frequency counter handy for checking key frequencies in the PLL section. Measure the important dc voltages with an accurate digital multimeter, and use a scope to determine if any pulses or clock signals are found where they belong and that the B+ does not have abnormal ripple or hash.
- Use a good in-circuit diode tester on all suspected diodes and transistors. A digital multimeter with a diode voltage-drop test has been found best in these circuits. A constant current is forced through the diode junction while the diode voltage drop is measured by the 2V range. The readout is the actual voltage drop, which is a more reliable test than are the usual ohmmeter checks.
- Usually, the previous measurements will point to the general location of the defect, and subsequent tests should locate the defect. If not, the entire board or module can be replaced.

No single troubleshooting method can be effective for all systems.

ES&T

NEW PRODUCTS

Digital multimeter

Digalog display, *Simpson Electric Co.'s* combination of a 3½-digit digital readout for accurate measurements, and a bargraph analog display for observing trends, peaking and nulling, highlights their model 467 digital multimeter.

The 467 also has differential ± peak holding capability, fast pulse detection and indication for logic work, and visual/audible continuity indication.

The 26 ranges measure dc and true RMS ac voltage and current, plus resistance. Basic accuracy is 0.1%.

The model is UL listed and is available in a blue or black high-impact molded case. Optional accessories include temperature, RF, high voltage probes, Amp-Clamp adapter and carrying case.

Circle (20) on Reply Card

Solder Extractor

A new, portable solder extractor, by *Automated Production Equipment Corp.*, features a unique high-torque piston pump and a 2-year guarantee.

The EX-525 provides a high-flow, controlled vacuum of up to 1.2 cfm. This strong suction permits the desoldering of components from multilayer PC boards without re-sweating.

Similar to other A.P.E. solder extractors, the new EX-525 works to literally remove the solder joint, not just the solder.

Other features include foot-switch-controlled air flow; a comfort-designed desoldering handpiece that delivers 15 to 65W of desoldering heat, plus vacuum, at the tip; front-mounted panel knobs; and a self-standing dual tool holder with tip cleaner brush.

Circle (21) on Reply Card

Portable digital lab

Dynascan, B&K Precision, has just unveiled a new all-in-one portable digital lab. The new instrument, designated the LA-1000

System Analyzer, is designed for use primarily by field engineers in the maintenance of microcomputers and microcomputer-based products. This high technology instrument combines the functions of signature analyzer, logic analyzer, autoranging frequency counter, autoranging ac and dc digital voltmeters and autoranging digital ohmmeter.

An important feature of the instrument is its ability to operate as a 20MHz, single-channel logic analyzer. In this mode, it can present data in both state and time domains. State data are formatted in hexadecimal code on the integral 4-digit LED display. Timing diagrams of one channel by 16 bits can be displayed externally on most conventional oscilloscopes. For convenience, clock pulses and a cursor are also displayed on the scope display. The memory permits storage of 16 "words," with 16 bits per word, giving the LA-1000 a memory that is 256 bits deep. The word number is indicated by an LED readout.

With its signature analysis capability, the LA-1000 allows even semi-skilled technicians to rapidly troubleshoot microprocessor-based products down to the component level, by making simple comparisons of digital "signatures."

Circle (23) on Reply Card

Color TV line

N.A.P. Consumer Electronics Corp. has recently introduced an extensively redesigned Philco color TV line that includes new chassis and a totally restyled 19-inch portable line.

The 1982 color TV line highlights include a new cable-ready mid-band and super-band and a microcomputer tuning system. The Philco line consists of three 13-inch, six 19-inch and fifteen 25-inch color TV sets.

All 15 new 25-inch color TVs feature the Philco Color-Rite II automatic color control system, and 11 of these models have the new push-button Computer Command tuning system which incorporates a frequency synthesizer and a microcomputer. This tuning system enables the viewer to tune directly to 70 UHF, 12 VHF and 23 cable (CATV) channels. The built-in memory of the microcomputer precisely fine tunes each channel.

Circle (24) on Reply Card

Oscilloscope

The latest addition to the growing family of Gould series 4000

digital storage oscilloscopes (DSOs), the DSO4040, is announced by *Gould Inc.*, Instruments Division.

This versatile new instrument combines the best of digital and analog scope capabilities. It provides a digital/analog sampling rate of 10 MHz, the best of available digital-storage features

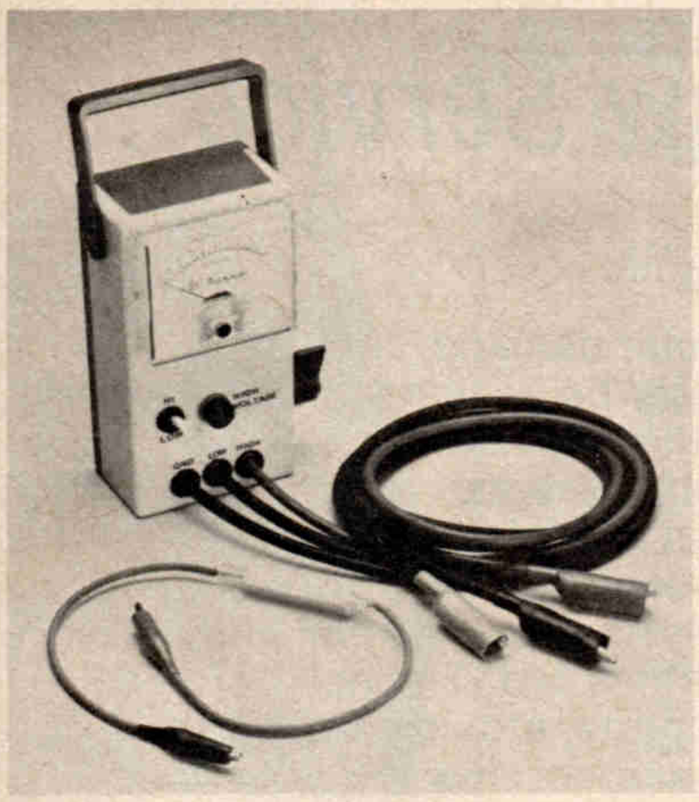
for high-speed transient capture, conventional operation (normal mode) for 25MHz real-time TY and XY phase measurements, detailed multi-trace comparison, and digital or analog output to data systems or recorders.

The model has dual-channel, 4-trace display capabilities. In the single-channel multisweep mode, four sequentially triggered events (each with 1250 data points) can be displayed and compared, or up to three stored events can be compared with a fourth in real time. In the dual-channel mode, two stored waveforms can be compared with two real-time traces. Comparison is enhanced by the capability of shifting stored traces on both the X and Y axes.

Circle (26) on Reply Card

Oven voltage tester and radiation detector

Help for microwave oven service technicians is now available from *GC Electronics* in the form of an



oven voltage tester and a pocket-sized microwave radiation detector.

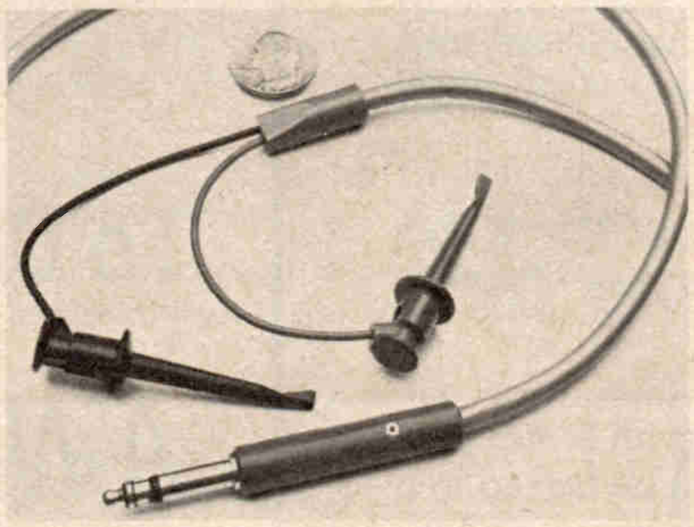
The Magnameter (20-226) makes anlayzing operation of the magnetron in both home and commercial ovens safe and easy. Because it has built-in safety features, the GC Magnameter protects against dangerous levels of high voltage. Permanently mounted high-voltage test leads (for high voltage, low voltage and ground) reduce the risk of using inadequate leads. A red neon light warns when high voltage is present, and there's an exclusive discharge switch to "dump" the dangerous voltage from the capacitor before touching oven current components.

Testing time is cut in half because a simple flip of a switch tests both plate voltage (high voltage) and plate current (low voltage) measures as the drop in voltage across the plate resistor. A 10Ω test resistor accessory is included for ovens with no plate resistor. A handy chart converts values for ovens with resistors other than 10Ω.

Circle (27) on Reply Card

Patch cord for phone plug

ITT Pomona Electronics has announced a Minigrabber patch cord



with PJ-051 (WE310) phone plugs.

Model 4812 uses 22 AWG, 2-conductor shielded microphone cable and standard PJ-051 R phone plug. The gold-plated, beryllium copper Minigrabber provides maximum sensitivity.

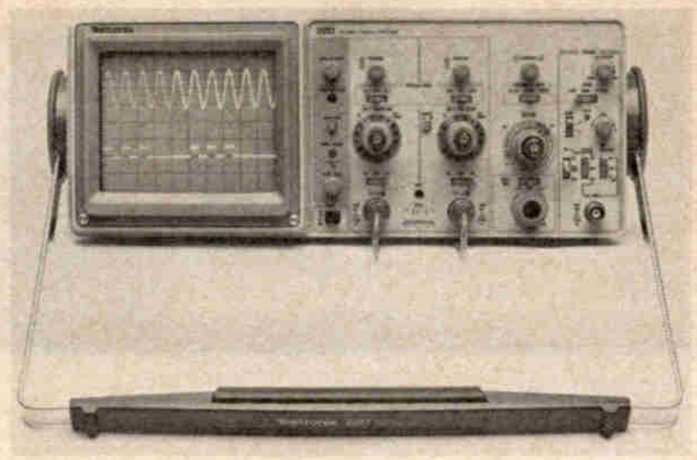
ITT Pomona Electronics manufactures electronic test accessories including banana plugs, jacks, patch cords, test clips and molded accessories.

Circle (28) on Reply Card

Oscilloscopes

Tektronix Inc. has the new performance/price standard in oscilloscopes, the 2200 series. The first two oscilloscopes in the 2200 series are designed to meet the growing needs in the low- to mid-performance general purpose portable oscilloscope market.

The 2213 and 2215 are dual-trace, delayed-sweep instruments achieving 60MHz at 20mV to 10V and 50MHz at 2, 5 and 10mV set-



tings. The maximum sweep speed is 5ns/div.

The 2213 and 2215 incorporate advanced systems for easy triggering. The vertical mode system triggers synchronous signals in dual-channel alternate operation and enhanced auto triggering, minimizing time-consuming adjustments. Television line and field triggering give the user a wide range of video measurements, and variable hold off gives stable triggering on long or complex analog and digital signals. Finally, position insensitive triggering gives the user easy waveform positioning without affecting the triggers.

With the 2200 series, fewer operator CRT adjustments are required because the 2213 and 2215 have auto intensity and auto focus. The A and B sweeps are maintained at nearly the same intensity, regardless of changes in sweep speeds.

To increase measurement performance and user convenience, two 10x probes have been designed for the 2200 series. The new probes provide full bandwidth measurements at the probe tip and are lightweight with flexible cable for greater convenience. The probes also have an IC grabber: a new accessory tip for precise, accurate, easy, in-circuit IC connections.

Circle (29) on Reply Card

Graphic equalizers

The newest additions to *Altec Lansing's* family of graphic equalizers offer custom frequency tailoring in three versatile, cost-effective equalizer packages.

The Altec Lansing 1651A active graphic equalizer is a single-channel equalizer with 10 minimum phase shift, active band

(continued on page 62)

READERS' EXCHANGE

Needed: Oscilloscope manuals for Tektronix model 316 and RCA model WO-56A. Will buy or copy. *Frank Dickinson, Stony Point TV, 33 N. Liberty Drive, Stony Point, NY 10980.*

Needed: Diagram for a radio, Airline model 62-194 (circa 1936). *Art Cook, 170 Viewpoint, Ventura, CA 93003.*

Needed: Picture tube for Toshiba model C095 #270LB22; new, used or rebuilt. *Long's TV Service, 720 Goshen St., Salt Lake City, UT 84104.*

Needed: A circuit to build an R. F. attenuator of about -12 to -20dB at 60 MHz (channel 3), without degrading the picture quality. *George Campbell, 44445 13th St. E., Lancaster, CA 93534.*

Needed: Used, good b&w CRT, 440BGB4. *Mike's Repair Service, P.O. Box 217 Aberdeen Proving Ground, MD 21005.*

Needed: Tube test information giving all tester settings for all the types of tubes that can be tested in a Hickok model 539B tube tester. *Paul Capito, 637 W. 21st St., Erie, PA 16502.*

Needed: 16CWP4A b&w picture tube, 17CFP4A b&w picture tube, 24DP4A b&w picture tube, thermistor 20Ω cold for GE color TV (model H-D 520 3WD, serial #5A5-P 17102). *Joseph J. Mehalko, 324 4th St., Blakely, PA 18447.*

Needed: A manual or schematic for an Eversonic AM/FM radio and record player, tape model 100R. Also 2-output ICTDA 2611A. Write or call collect. *Sammie L. Crawford, Rte 1, Box A-112, Appling, GA 30802, (404) 541-0230.*

Needed: Late tube set up chart for Eico model #628 tube tester. *Ed Smith Radio and TV, 5425 S. 52nd St., Omaha, NE 68117.*

Needed: A used but good yoke for an RCA CTC22AA TV. Part Number 906214-501 or 120890. *William Hennen, 324 Forest Ave., Aurora, IL 60505.*

Needed: Manual for Tektronix 545 scope. Will buy or copy and return. *D. Greenwood, 1985 Southgate Way, Grants Pass, OR 97526.*

For Sale: Eico 315 signal generator, B & K 1246 digital IC color generator, B & K 415 sweep, marker generator (never used), B & K 1076 analyst. All have the manuals and leads and are in good working order. Also Sencore YF33 and variable autotransformer. *Peter Daley, Daley's TV & Communications, 305 North St., Rt. 2, Box 34, Preston, MN 55965, (507) 765-2572.*

For Sale: B & K CB test bench, lambda power supply, Healthkit test equipment, FM signal generators, Sencore test equipment. All equipment in good working order and below normal prices. Send S.A.S.E. for complete listing and prices. *Ronald Bauer, 3836 E. Sheena Drive, Phoenix, AZ 85032, (602) 867-9076.*

For Sale: Sencore VA 48, like new, best offer over $600.00. Also a TF 46 Super Cricket, best offer over $100.00. *Mike Shepherd, 394 E. Hwy. 20, Republic, WA 99166, (509) 775-3219.* ES&T

To Our Readers:

A New Service...

Due to popular demand, "For Sale" items will now be accepted at no charge for the *Readers Exchange* column. Both "Needed" and "For Sale" listings must contain no more than *three* items each and **ES&T** reserves the right to select and edit all copy. "For Sale" items MUST consist of used equipment, parts, etc., owned by individuals and not new items for sale by companies or manufacturers. To *ensure* publication of your "For Sale" item, it is suggested your ad also be placed in the regular *Classified* column at a small fee.

When submitting a "For Sale" item, please indicate whether you desire it to appear in *Readers Exchange* or *Classified.*

If you can help with a request, please write directly to the reader, not to **ES&T.**

Formerly Electronic Servicing, a new, exciting, bigger and better-than-ever magazine for the electronics of today and the future!

The "how-to" magazine of electronics

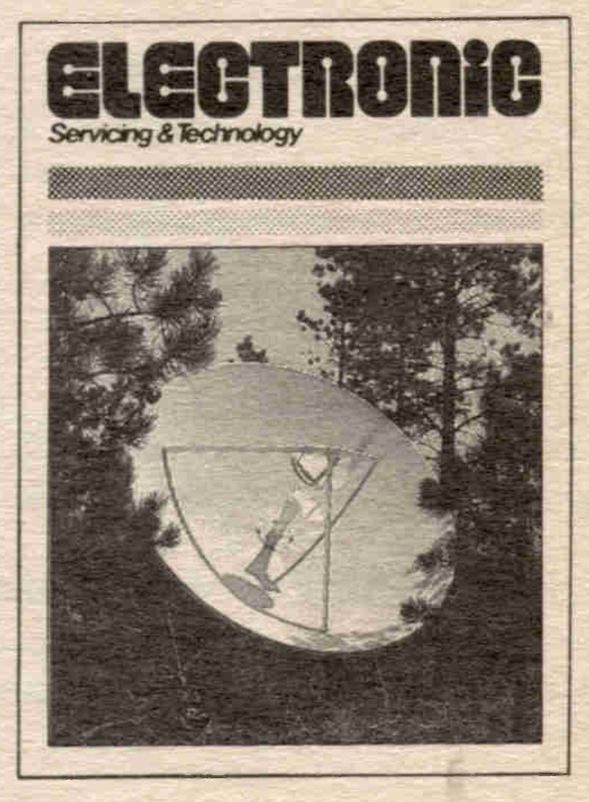
You will find Electronic Servicing & Technology **must** reading if you are to keep abreast of the rapidly changing technology in electronics whether you are a professional technician or an avid hobbyist.

Every month you will receive your personal copy jam-packed with the information you need and want...information that will save you time and money...the most complete and up-to-date service data on audio and video equipment...information that will help you make intelligent buying decisions...information that will take you into the future of electronics...information you just can't afford to be without.

At a very low cost you'll explore the exciting new developments in Satellite TVRO; Microcomputers; Television; Video Tape and Cassette Recorders/Players; Video Disc; Audio Products; Test Equipment; Ham, CB & Mobile Radio; Robotics; Security Products; Electronic Games, etc.

Nowhere else will you find such accurate and complete material. Charts, graphs, schematics and pictures generously supplement the easy-to-read and understand text.

You would probably expect to pay much more for a magazine of this caliber, but right now you can take advantage of a special, limited-time subscription offer. Don't hesitate...subscribe now!



Return this order card with your check to:

ELECTRONIC
Servicing & Technology

P.O. Box 12901
Overland Park,
KS 66212

IMPORTANT!
Please check your business classification.

Type of Business

Check One

- ☐ Independent Electronic Service Organization
- ☐ Retailer with Electronic Service Department
- ☐ Independent or Self-Employed Service Technician
- ☐ Electronics, Radio, TV Manufacturer
- ☐ Industrial Electronic Service
- ☐ Wholesale, Jobber, Distributor

Other (Specify) _____

Position

- ☐ Owner, manager
- ☐ Service Manager
- ☐ Technician

Other _____

Be sure you have checked one box under each arrow!

YES! Enter my subscription to ELECTRONIC
Servicing & Technology

I PREFER:

- ☐ 3 years at $24.00 (You save $12 off regular price)
- ☐ 2 years at $19.00 (You save $5 off regular price)
- ☐ 1 year at $12.00

(please allow 6-8 weeks for shipment)

Above rates apply only in U.S.A. and its possessions.
Elsewhere, one year $17, two years $27.

I enclose payment of $ _____ **Check** ☐ **Money Order** ☐
or please bill me ☐

Please Print
Name _____
Company _____
Address _____
City _____ State _____ Zip _____
Your signature, please _____

Writing to Electronic Servicing & Technology?

PREVENT DELAY BY USING THESE ADDRESSES:

ABOUT YOUR SUBSCRIPTION

Changes of address or any questions about your subscription should be sent to the address at right. Please advise us of a change of address at least 6-8 weeks in advance of your move, if possible. Also allow 6-8 weeks for new subscriptions.

Dee Manies, Customer Service
ELECTRONIC SERVICING & TECHNOLOGY
P.O. Box 12901
Overland Park, Ks 66212-0930

TO THE EDITOR

If you have a comment or question about an article, an opinion about industry conditions, a Troubleshooting Tip, an item for Reader's Exchange, or a suggestion for a future article, write to:

Bill Rhodes, Editor
ELECTRONIC SERVICING & TECHNOLOGY
P.O. Box 12901
Overland Park, Ks 66212-0930

PHOTOFACTS, BOOKS, OR SCHEMATICS

Electronic Servicing & Technology does not have parts, books, or schematics for sale. Questions or orders for Photofact schematics of Sams technical books should be sent to:

Howard W. Sams & Co., Inc.
4300 West 62nd Street
Indianapolis, Ind. 46268

No Postage Necessary if Mailed in the United States

BUSINESS REPLY CARD
First Class Permit No. 1810 Overland Park, KS

Postage Will Be Paid By Addressee

ELECTRONIC
Servicing & Technology

P.O. Box 12901
Overland Park, KS 66212-9981

BOOK REVIEWS

Editor's note: *Periodically* ***Electronic Servicing & Technology*** *presents reviews of books dealing with subjects of interest to our readers. Please direct inquiries and orders to the publisher at the address given in each review rather than to us.*

Increasing Profitability with Minicomputers, by Robert Allen Bonelli; Petrocelli Books Inc.; 202 pages; $17.50.

One of today's most popular tools for building a stronger corporate income is the computer. With its ever-increasing capabilities and appealing economics, the minicomputer has become a prominent feature of business planning. This book is a guide for the businessman on how to apply a minicomputer system to achieve increased profits.

A step-by-step approach is used to analyze a business situation and increase the bottom line through the use of minicomputers. All aspects of system planning, including cost vs. benefit evaluations, operations analysis, equipment procurement, software development, system conversion, and operations management, are covered. The book also includes a glossary of technical terms.

Published by Petrocelli Books Inc. and distributed by Van Nostrand-Reinhold, 135 West 50th Street, New York, NY

101 Easy Test Instrument Projects, by Robert N. Brown and Tom Kneitel; Tab Books Inc.; 210 pages; $13.95 hardbound, $7.95 paperback.

This guide gives plans for 101 testing devices that can be built in a home workshop at minimum cost, usually for less than $5. Step-by-step instructions and detailed diagrams and illustrations are included. Most of the projects are designed to be completed in one evening.

Included in the book is a dry cell rejuvenator, an antenna current indicator, electronic timer, picture tube rejuvenator, RF meter and more.

Most items can be assembled from parts already on hand or that can be purchased from a local electronics distributor. Many of the projects use interchangeable parts, so one instrument can be converted into another by changing a few components. A substitution guide is included.

Published by Tab Books Inc., Blue Ridge Summit, PA 17214.

The Giant Handbook of Electronic Circuits, edited by Raymond A. Collins; Tab Books Inc.; 882 pages; $24.95 hardbound, $16.95 paperback.

More than 800 pages and 1100 illustrations, charts, diagrams and schematics are contained in this reference source. Information designed for ham operators, computer buffs, service technicians and electronics hobbyists is included. Also included is information on advanced communications and control system circuits.

Other chapters deal with alarms, sensors and triggering circuits, biomedical circuits, chopper circuits and AM/FM broadcast receivers.

Published by Tab Books Inc., Blue Ridge Summit, PA 17214.

Giant Handbook of 222 Weekend Electronics Projects; Tab Books Inc.; 496 pages; $18.95 hardbound, $11.95 paperback.

All kinds of make-it-yourself electronic items are included in this project book, from AM/FM radios to home computers. More than 200 projects designed to be built in a weekend are included. Step-by-step instructions plus more than 450 diagrams, schematics, photographs and parts lists give all the information needed to complete and use each project. In addition, there are 50 test devices, from the simple test lead rack to a hi-fi analyzer.

A chapter on club teaching demonstrators and group electronics activities gives more than 50 group projects.

Published by Tab Books Inc., Blue Ridge Summit, PA 17214.

ES&T

rejection filter sections. Easy-to-read, center-detented slide controls provide ±12dB boost/cut at ISO preferred 1-octave frequencies (31.5Hz–16kHz).

The 1652A is a stereo graphic equalizer with the same features as the 1651A for each of two channels. Both the 1651A and the

ALTEC 1653A 1/3-Octave Equalizer

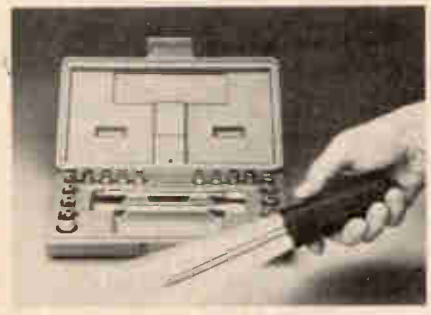
1652A incorporate a continuously variable high-pass filter with 18dB/octave roll-off, and a user-selectable low-pass filter with 6dB roll-off at 12.5kHz.

Circle (30) on Reply Card

Tool kit

Dim light repairs light up with the *Day-Nite* tool kit, a portable 23-piece screwdriver and socket set featuring the twin-lighted power torque handle.

The Day-Nite power torque handle is made of rugged ABS plastic and has twin lights built in the handle to shine light on your work area. A screw-lock on-off switch in handle is recessed for efficient use.



The unit uses two leak-proof AAA batteries, included with set.

Day-Nite tool kit includes 18 sockets to fit almost any nut or bolt–9 standard (3/16-inch to 1/2-inch) and 9 metric sizes (4mm to 12mm)–plus a socket adapter with 1/4-inch drive, a 3/16-inch standard screwdriver blade and a No. 2 Phillips blade. Blades are chrome vanadium steel, torque tested to 80 lbs. psi.

Circle (31) on Reply Card

Personal computer

IBM Corp. has announced its smallest, lowest-priced computer system–the IBM personal computer.

Designed for business, school and home, the system offers many advanced features and optional software.

The IB personal computer will be sold through participating ComputerLand dealers, Sears, Roebuck and Co.'s new business machine stores, IBM product centers and a special sales unit in the company's data processing division.

An enhanced version of the popular Microsoft BASIC programming language and easily

understood operation manuals are included with every system. They make it possible to begin using the computer within hours and to develop personalized programs easily.

Available with the system are an 83-key adjustable keyboard, up to 262,144 characters of user memory (16,384 standard), a printer that can print in two directions at 80 characters per second, self-testing capabilities that automatically check the system components and a high speed, 16-bit microprocessor.

Operating at speeds measured in millionths of a second the IBM Personal Computer can generate and display charts, graphs, text and numerical information. Business applications–including accounts receivable and word processing–can be run on the same system with applications covering personal finance and home entertainment.

The color/graphics capabilities provide users with a text system capable of displaying 256 characters in any of 16 foreground and 8 background colors. It is also capable of displaying graphics in four colors.

A starter system consisting of a keyboard and system unit can be connected to a home TV set with a frequency modulator. It can then be expanded to a system with its own display, printer and auxiliary storage cassettes or small discs.

Circle (32) on Reply Card

Screwdriver set

Vaco Products Company has introduced the Vaco-Total screwdriver set no. 70476 which contains six of the most popular and frequently used screwdrivers including the #1 and #2 Phillips and ¼" x 4", 5/16" x 6", 3/16" x6", and 1/4" x 6" slotted sizes.

Each screwdriver features the Vaco Comfordome handle which gives maximum comfort. There are no unfinished seams or sharp edges, and the handles features scientifically designed flutes for an enhanced grip. The blades are

machined from chrome vanadium steel and nickel plated for corrosion resistance. Blade tips are ground to precise tolerances, assuring a perfect fit into the screw slot.

Circle (33) on Reply Cart

Mobile monitor antenna

The new M-80 series tri-band mobile monitor antenna, introduced by *Armstrong Industries*, provides up to 3.5dB gain and covers HF (25-50MHz), VHF (130-174MHz) and UHF (450-512MHz) bands.

Available in magnetic or trunk lip mounting styles, the antenna has a 36-½-inch stainless steel radiator and solid 18-gauge copper wire load. The antenna whip has a

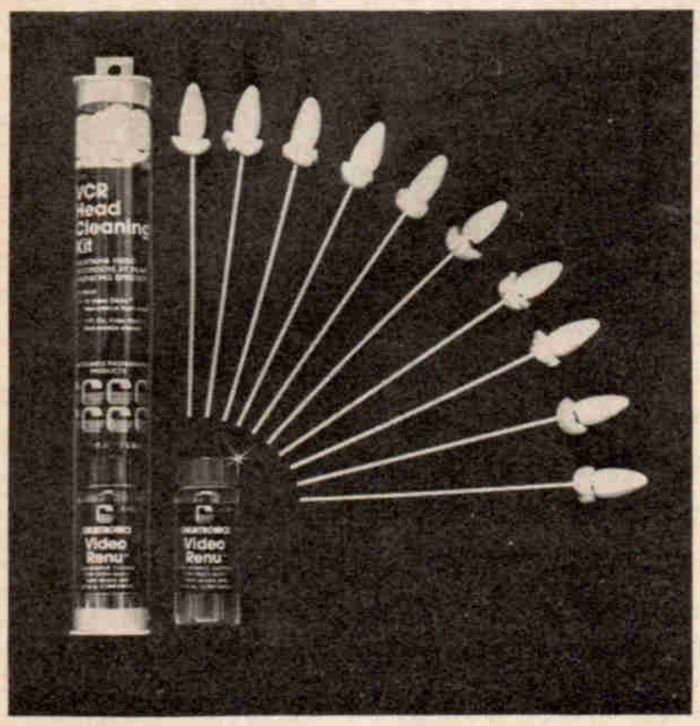
3/8" x 24" thread and may be purchased separately for use with other Armstrong mounts. All fittings are solid brass, chrome plated. The 18 feet of RG-58AU coax with a standard Motorola connector allows hook-up to any 3-band scanner.

VSWR is 1.5:1 at 40MHz, 1.12:1 at 160MHz and 1.02:1 at 480MHz. Impedance is 50Ω.

Circle (34) on Reply Card

Head cleaning kit

"Now owners of home video machines can perform regular



head cleaning maintenance themselves, at a considerable savings over service shop fees," said Louis Friedman, *Chemtronics'* vice president. He made the remarks during the announcement of the company's new VCR Head Cleaning Kit, a product designed to allow the do-it-yourselfer to obtain professional results.

VCR Head Cleaning Kit contains a 1 oz. bottle of Video Renu head cleaning fluid and 10 Video Sticks urethane foam swabs, specially constructed for safe non-residual cleaning of delicate video heads, as recommended by manufacturers.

Video Renu is formulated to completely dissolve the damaging, abrasive deposits which build up on these heads, causing snowy pictures and distortion and ultimately requiring costly head replacement. The formula is harmless to all plastics, rubber and tape used in video equipment.

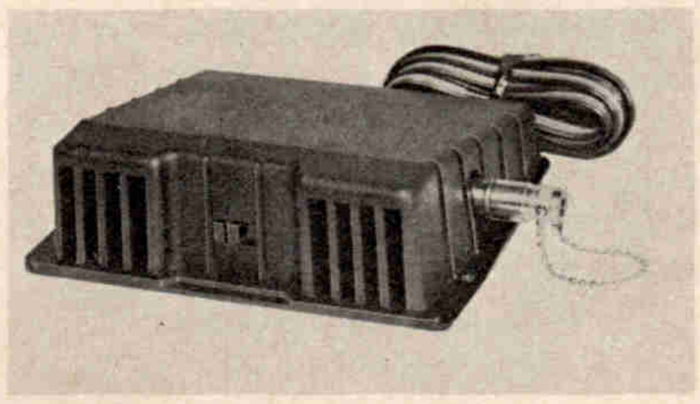
Video Renu is also available in 6 oz. and 24 oz. spray cans and Video Sticks are available in packs of 16 and 50.

VCR Head Cleaning Kit will be available through video recorder and videotape outlets.

Circle (35) on Reply Card

Alarm system

The Sonic Sentry from *Mountain West* gives burglar protection



for vans, motor homes, cars and trucks without exterior indication of an alarm system. Once it is armed, the vehicle interior is blanketed with harmless invisible beams. The Sonic Sentry is triggered only by an actual intrusion, and sounds a 60-second horn blast. At the end of the 1-minute cycle, the Sonic Sentry immediately resets itself, ready for the next intrusion. If the intrusion continues, so does the horn blast.

Commercial applications include delivery trucks, sales fleets, demonstration vehicles and semi-trucks.

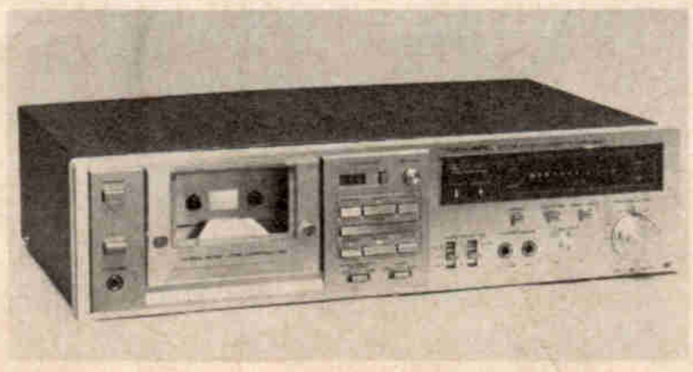
Armed by a simple on-off switch, the 5-second entrance and 12-second exit delays allow the owner to de-activate and activate the alarm without setting it off.

Circle (40) on Reply Card

Cassette deck

Radio Shack, a division of Tandy Corporation, has announced a 3-head, solenoid-operated cassette deck with double Dolby noise reduction.

Designated the SCT-32, the unit allows full electronic control of tape motion accomplished by twin



solenoids and logic circuitry. Two direct-acting solenoids replace complex linkages for quieter and more reliable operation. The full-logic circuitry prevents tape jams, even when switching between fast forward and rewind, or between fast wind and play; this also permits light-touch push-button controls with recessed color-coded LED status indicators.

Silent electronic editing is made possible with an automatic record-mute feature that works along with the pause control. The pause LED blinks once per second as an additional editing and timing aid.

A switch-controlled auto-rewind/memory feature automatically returns the tape to the position where the PLAY button was last pressed, and either begins playback again or shuts off, as selected. Also, a timer input and switch permit unattended operation under the control of an external timer (not included).

Circle (41) on Reply Card

Hand-held gaussmeter

A new, self-contained, hand-held Hall effect gaussmeter for measuring dc and ac (RMS) magnetic fields is being introduced by *Walker Scientific Inc.* of Worcester, MA.

The Walker MG-4D portable hand-held Hall effect gaussmeter provides dc and ac field readings from ± 1 gauss to ± 19.99 Kgauss with true RMS readings from 5Hz to 20kHz. Featuring two full-scale bipolar ranges of ± 1000 gauss and ± 10.00 Kgauss with 100% over-range and 0.05% resolution, it displays measured values on a 3½-digit ± 0.05% bipolar LCD meter.

Measuring 1.31" x 3.63" x 6.13" (less probe), the 14-ounce, battery-powered Walker MG-4D can be furnished with a wide selection of precalibrated, interchangeable transverse and axial Hall probes (some capable of extending field readings to 150.0 Kgauss). An auto-shutoff circuit extends battery life, and a battery charger/eliminator is optional.

Circle (43) on Reply Card

Wire wrapper

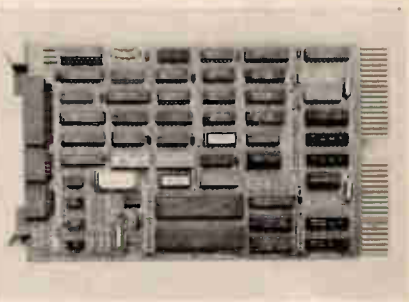
The new OK-729 pneumatic wire-wrapping tool from *OK Machine and Tool Corp.* is balanced and features precision steel drive components enclosed in a reinforced Lexan housing for maximum performance and reliability. An effective muffler, a positive indexing mechanism with adjustable stop location, and a 6-foot (2m) flexible air hose round out the features of the tool.

The tool is available in two versions: "Standard" at 5000 rpm and "CSW" with higher torque and a lower 3000 rpm speed for cut/strip/wrap applications. Designed to operate at 80-100 PSI (6-7ATU) OK-729 is fully rated for heavy-duty applications on wire as large as AWG 18 yet its unique light weight and balance make it ideal even for the most delicate 30-32 AWG (0,25-0,20mm) work.

Circle (44) on Reply Card

Multifunction interface board

Introduction of a half-wide multifunction interface board for use as a basic building block module has been announced by *Technical Magic Inc.* Completely compatible with the LSI-11, this high density board saves backplane space while providing an abundance of options. The board contains two DEC DLV11-J compatible serial ports and a bi-directional parallel port. It is available in three basic configurations: the 2SP, with no additional options; the 2SPB, with a multidevice bootstrap option added, but no termination; and the 2SPBT, with bootstrap and Q-bus termination options.



The interface board allows selection of only those functions actually required and omits unwanted features, such as a half complement of memory.

The two serial ports can be used as general purpose interfaces to serial peripheral devices using standard RS-232C, RS-422, and RS-423 communication protocol. One serial port can be configured as the console port for communication with a local or remote terminal. The bi-directional parallel port can be configured as a general purpose interface, or as a printer port to drive a Centronics or Data Products compatible line printer. The bootstrap and/or termination options provide the multifunction board with even greater flexibility.

Circle (46) on Reply Card

Threading set

A 12-piece tap and die threading set with instructions for the home craftsman is being introduced by *Henry L. Hanson Inc.*

The Ace Hanson Home Threading Kit features carbon steel plug taps and ⅝" hex dies in five sizes

commonly used around the home. For a start to finish job, the kit includes 5/8" hex die stock, tap wrench, and an instruction booklet.

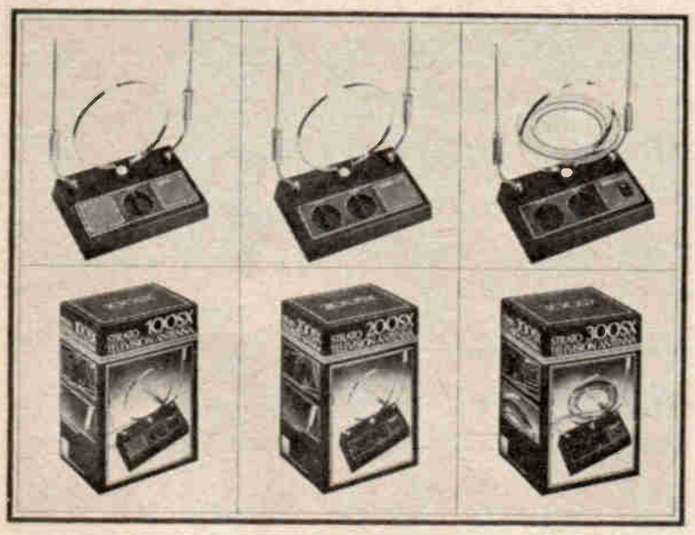
Containing 6-32, 8-32, 10-24, 20-32 and 1/4-20 sizes, the kit is packed in a high impact styrene tray with a permanent clear cover that aides visibility and selection. It is suitable for use with vacuum cleaners, radios/TVs, faucets, storm doors, garden equipment, and other home appliances.

Circle (47) on Reply Card

Indoor TV antennas

Gemini Industries has recently introduced a line of indoor TV antennas. The Strato TV antennas consist of three models: the 100 SX, 200 SX and 300 SX. Each model produces sharp pictures in both color and black and white for VHF and UHF stations transmitting on channels 2 through 83. The antennas also receive FM and stereo signals, and video signals.

Each model in the line features a



12-position rotary switch, chrome-plated brass VHF swivel dipoles, a phased UHF loop and axial indicators. The 200 SX model also includes a rotable UHF loop for fine tuning.

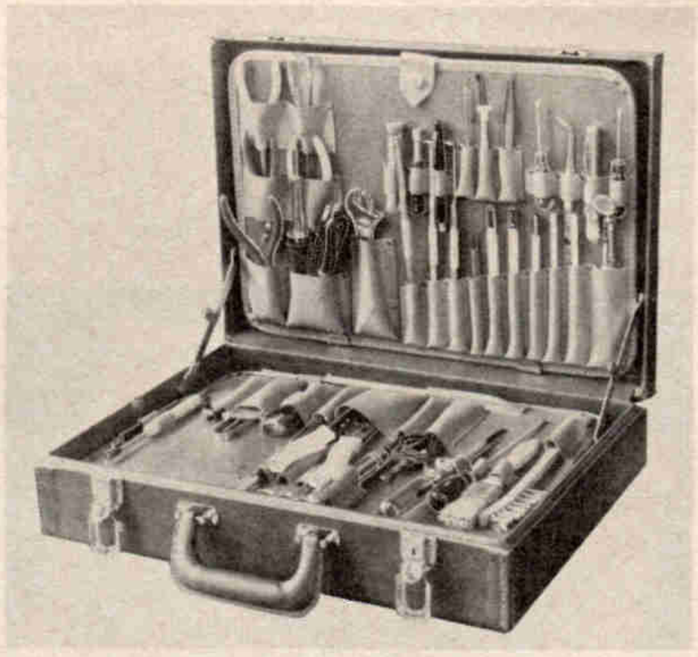
Circle (48) on Reply Card

Tool kit

Jonard introduces a 50-piece tool kit designed for adjusting, maintaining and servicing all types of computers, electrical instruments, radar and other electro-mechanical devices.

The kit features tools that are finely machined and finished to give dependable, durable service; removable boards for easy selection; extra pockets for tools; and separate compartments for notes and papers.

The tools are mounted in individual pockets in a durable,



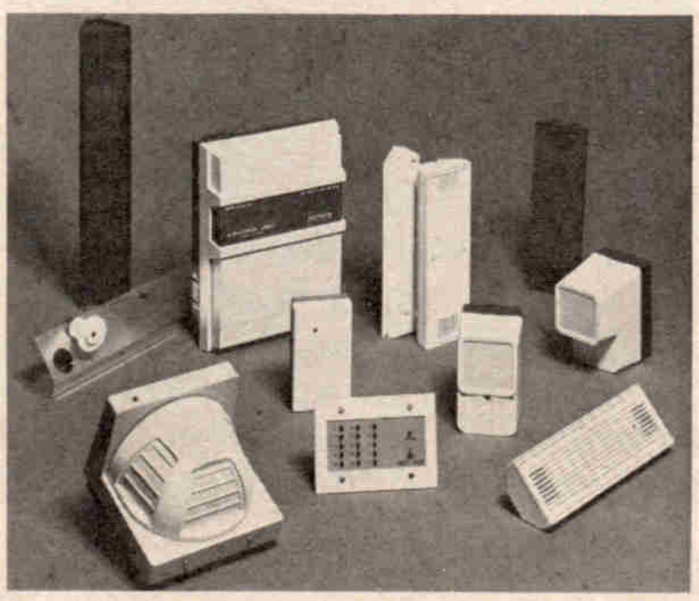
scratch-resistant Barco case. The kit weighs 13 pounds and measures 14"x18"x4¾". The kit is supplied with the case, or tools can be purchased individually without the case.

Circle (49) on Reply Card

Alarm system

The *Aritech* 230 alarm system can be installed with up to 15 of a wide variety of intrusion detection sensors: ultrasonic or passive infrared, wall ceiling corner or shelf mount, transceivers or range expanders, surface or flush mount, white or brown, long range or wide angle.

Each sensor has independent signal processing. Background disturbances in one room do not affect detection in another room. This permits high sensitivity, minimizes false alarms, and allows daytime walktesting.



Circle (50) on Reply Card

ES&T

NEW LITERATURE

Weston Instruments announces the publication of a 4-page, 2-color, illustrated bulletin on the 2430 series of 3½-digit, line-powered digital panel meters.

According to the bulletin, the two basic models provide for input power of 115 or 230Vac; both of which also provide BCD output (as an option). Either one provides any one of four basic Vdc ranges; 200mV, 2V, 20V, and 200Vdc, all at the same high (0.05% rdg ± 1 LSB) basic accuracy.

Circle (51) on Reply Card

A 48-page catalog covering **Triad-Utrad's** complete line of transformers, inductors and power supplies has been published by the Litton Industries division.

The publication features the company's compact new Flat Pack power transformer, along with transformers for power supply, control and filament circuits, and for rectifier circuits. Low voltage, low current, plug-in printed circuit units and plate and filament transformers also are shown. In addition, isolation transformers, step-up/step-down units, transistor

power supplies and filter reactors are offered.

Triad-Utrad's broad variety of military grade power transformers and commercial and military grade audio transformers are described, along with its toroidal inductors.

Circle (52) on Reply Card

A 10-page, tab-indexed catalog of capacitors, published by **KD Components Inc.,** contains everything the prospective user

needs to know about KD's 125° to 300°C high- and low-voltage ceramic, chip and mica capacitors.

The 8½" x 11" 2-color booklet is illustrated by photos, diagrams and a variety of size/capacitance/voltage tables. One section is devoted to a series of easy-to-read performance curves.

Four tabbed sections are devoted to specific information about the following capacitors: 125°C high voltage multilayer ceramics; 125°C200°C low corona ceramics and 300°C micas; 200°C high and low voltage ceramics; and 200°C high and low voltage "chips." Each section discusses design criteria, specific performance features and all technically critical specifications.

Circle (53) on Reply Card

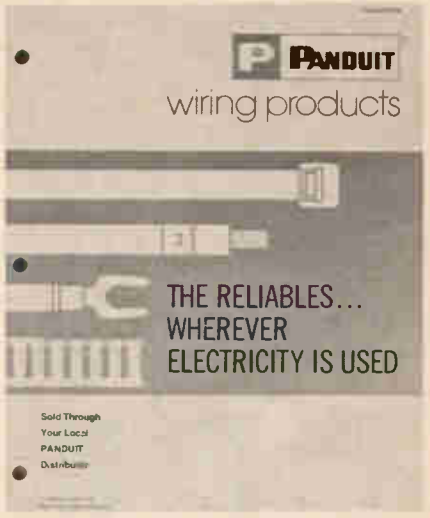
Bondhus Corporation has published an 8-page brochure describing the timesaving Bondhus line of BALLDRIVER hex tools in its different versions, such as L-wrenches, screwdrivers, power and insert bits, and the new line of chamfered hexkeys.

This catalog is illustrated to show changes on some tool specifications, and the description of new sets. The design and advantages of the new milled chamfered L-wrenches are clearly and graphically described.

Circle (54) on Reply Card

A newly revised and updated 24-page condensed catalog covering the full line of **Panduit** wiring products is now available free from Panduit Corporation Electrical Products Group.

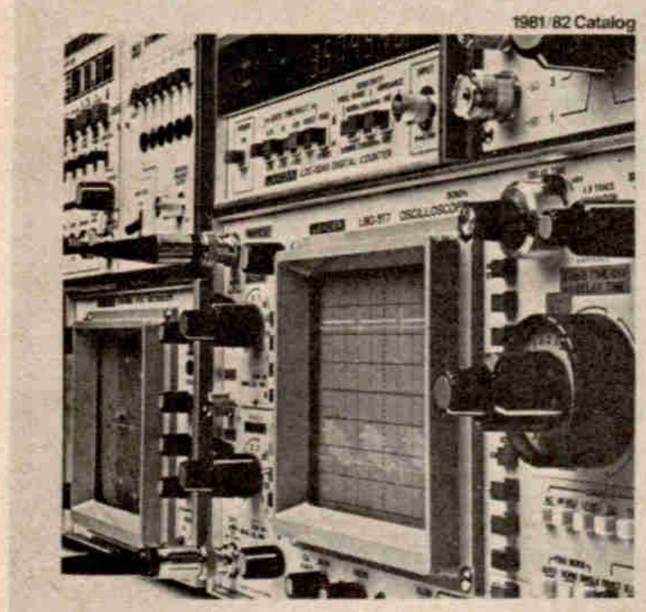
Included is illustrated information on PAN-TY and STA-STRAP cable ties, specialty ties, clamps and marker ties; cable tie mounting and marking accessories; wire mounting devices; harness board accessories; tension-controlled cable tie installation tools; stainless steel ties; plastic wiring duct; spiral wrapping; the full line of PAN-TERM terminals, splices,



disconnects, wire joints and installation tools; INSTA-CODE wire and identification markers, safety signs and hazard tape; and PAN-TERM compression connectors, accessories and installation tools.

Circle (55) on Reply Card

Leader Instruments Corp. has announced the availability of their 1981-82 catalog. The 48-page, comprehensive catalog includes detailed descriptions, specifications, photographs and pertinent charts and illustrations of more than 70 products, including oscilloscopes, frequency counters, digital multimeters, function generators and video and audio test instruments.



Ten new products are announced in the new catalog, including the only vectorscope in the industry with CRT-generated vector targets, an X-Y display module that can be precisely customized to user needs and requirements, and the first CRT display designed for use in microwave swept frequency measurements.

Circle (56) on Reply Card

Mountain West Alarm has released its latest 68-page illustrated catalog offering over 1600 alarm and security products. A one-stop supermarket for burglar and fire alarm installers, this catalog is also of interest to homeowners, businesses and institutions. Buyers may select from systems for the first time do-it-yourselfer to the most sophisticated electronic systems available. Basic instructions and diagrams are included in the catalog.

Burglar detectors range from simple magnetic door switches to ultrasonic, microwave and passive infrared units to detect moving intruders. Other products include control units, power sources, undercarpet mats, bells, sirens, lights, window protectors, phone dialers, locks, timers, tools, wire, body armor, fire alarms, safety equipment, vehicle alarms and books.

Circle (57) on Reply Card

An idea-filled, four-page folder from **Hickok Electrical Instrument Co.** offers time and effort saving techniques for electronic troubleshooters. "A sound solution to the five most common troubleshooting problems" includes new methods of tracing voltages around a circuit, troubleshooting circuits in hard-to-reach locations, tracing continuity, making tuning type adjustments and troubleshooting digital logic circuits. This free folder should be of interest to troubleshooters and those in charge of electronic field maintenance or bench testing operations.

Circle (58) on Reply Card

The Distributor & Special Markets Division of **Philips ECG Inc.,** has made available a 352-page manual devoted exclusively to technical data for nearly 300 TTL devices in the Sylvania brand ECG semiconductor replacement line.

Organized for the technician, the information in this manual is presented in a concise format. Each individual device has its own self-contained data sheet with pertinent dc and ac information.

Product categories covered in this TTL manual includes gates, flip-flops, buffers/inverters, Schmitt triggers, registers, latches, arithmetic functions, memo-

ries, counters, multiplexers, decoders/demultiplexers, drivers, display decoder/drivers, monostable multivibrators, transceivers/receivers and voltage-controlled oscillators.

Circle (59) on Reply Card

ES&T

THE MARKETPLACE

Advertising rates in the Classified Section are 35 cents per word, each insertion, and must be accompanied by cash to insure publication.

Each initial or abbreviation counts a full word.

Minimum classified charge $3.00

For ads on which replies are sent to us for forwarding (blind ads), there is an additional charge of $3.00 per insertion to cover department number, processing of replies, and mailing costs.

Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or distributor.

For Sale

AUTOMOBILE RADIO and tape replacement parts. Delco, Chrysler, Philco-Ford, Motorola, Panasonic and many others. Large inventory. Laran Electronics, Inc., 3768 Boston Road, Bronx, NY 10469, (212) 881-9600, out of New York State, (800) 223-8314. 5-79-tf

TV & RADIO TUBES, 36 cents EA!! Free color catalog. Cornell, 4221 University, San Diego, California 92104. 8-76-tf

ELECTRONIC SURPLUS: CLOSEOUTS, LIQUIDATIONS! Parts, equipment, stereo, industrial, educational. Amazing values! Fascinating items unavailable in stores or catalogs anywhere. Unusual FREE catalog. ETCO-011, Box 762, Plattsburgh, N.Y. 12901. 6-78-tf

SCRAMBLED TELEVISION, encoding/decoding. New book. Theory/circuits. $9.95 plus $1 shipping. Workshop, Box 393ES, Dept. E, Bethpage, N.Y. 11714. 7-80-tf

PRINTED CIRCUIT boards from your sketch or artwork. Affordable prices. Also fun kit projects. Free details. DANOCINTHS INC. Dept. ES, Box 261, Westland, MI 48185. 5-81-tfn

TUBES FOR TV AND RADIO – 35¢ ea. Washington TV Service, 1330 E. Florence Ave., Los Angeles, CA 90001. 10-81-5t

PICTURE TUBE REBUILDING EQUIPMENT capable of producing four high quality tubes per day (WILL TRAIN TO OPERATE). Call or Write Atoll Television, 6425 Irving Park, Chicago, Illinois 60634, ph. 312-545-6667. 10-81-6t

INDIVIDUAL PHOTOFACT FOLDERS under 1100. Postpaid $3.00. Loeb, 414 Chestnut Lane, East Meadow, NY, 11554. 11-81-3t

FOR SALE (Cont.)

SATELLITE TV SYSTEMS – New and used satellite receive systems and components. Antennas, LNAs, Receivers, Modulators, Cables and Connectors. Signals can meet all your TVRO, CATV and MATV needs. Complete 28 page catalog $3.00. SIGNALS SATELLITE SYSTEMS, Box 8836, Detroit, MI 48224, 313-361-5146.

"OLD SAMS PHOTOFACTS 121TO 300 in Sams "B" fast action binders. Good shape. Also 300 to 955 in file cabinets. Make offer. B&K 1471B oscilloscopes. Good shape $225.00." 12-81-1t

USED TEST EQUIPMENT – Scopes, Hi-pots, Variacs, Sola's, VTVMS, Freq. Meters, Flutter Meters and more. Call or write for specifics. Bob Sutton, 608-274-6960, Fabrication Industries, 6701 Seybold Rd., Madison, Wisc. 53719. 2-81-1t

Help Wanted

TV and 2-way Technicians wanted. $15K to $22K per year. Benefits include employee stock purchase plan, in the largest Retail Service Center in Northwest Kansas. Friendly community, good schools, short drive to the Rockies. Equal Opportunity Employer. Miller's Electronics Inc., Goodland, KS 67735. 913-899-2386. 10-81-tfn

Business Opportunity

TV TECHNICIAN! Increase your income up to $60,000 yearly. Rent-lease-sell TVs new-used, even from comfort of your home. Basic Preliminaries $4.00. Perrys TV Systems, 1467 Hwy. 90 West, Milton, FL 32570, 904-994-0068. 12-81-tf

ESTABLISHED STEREO SERVICE CENTER and small electronic parts distributorship located in sunny San Diego area. Steady business in service, and over-the-counter parts, plus merchandise sales. Business self-runs, except for bookkeeping and banking. Priced right, terms available (714) 578-9534. 10-81-3t

COMPUTERIZE YOUR ENTIRE TV OPERATION. GL-AP-AR-INV. Tubes – Parts – Customer – Vendor & TV rental files-programs. Start small & add to later. For Apple TRS80-NEC-Heath-Zenith. Free details. Perrys Computer Systems, 1467 Hwy 90 West, Milton, FL 32570. 904-994-0068. 11-81-tf

COMPLETE TV & STEREO SHOP EQUIPMENT FOR SALE. Everything needed to go into business. Includes latest test equipment; complete Sams; Sony, RCA, Zenith modules & parts. Bargain price! For details call 303-641-4678. 12-81-1t

TV SALES AND SERVICE IN SUNNY CALIFORNIA – Small established shop with high potential in Ventura County, Southern California. Authorized Zenith, Sylvania, and Tatung Dealer. Call Frank (805) 646-5818 or 649-1566. 2-81-1t

GET COMPLETE DETAILS

about the products advertised or described in this issue.

Use Free Inquiry Card.

ADVERTISERS' INDEX

Creative Electronics 63
ETCO 68
Gamit Enterprises 61
Jensen Tools Inc. 61
Keithley Instruments Div. 7
Mountain West Alarm Supply Co. 65
NATESA 65
NESDA 67
Oelrich Publications 63
Philips ECG 34-35
RNJ Electronics 67
Sencore, Inc. 1
Viz Manufacturing Co. . . . . IFC
Zenith Radio Corp. . . . . BC

ELECTRONIC *Servicing & Technology*

Advertising Sales offices

NATIONAL SALES MANAGER
Greg Garrison
P.O. Box 12901,
Overland Park, KS 66212
Phone: (913) 888-4664

LONDON, ENGLAND
John Ashcraft & Co.,
John Ashcraft
12 Bear St., Leicester Square
London, WC2H 7AS, England
Phone: 930-0525 Telex: 895-2387

AMSTERDAM, Holland
John Ashcraft & Co.
John J. Lucassen
Akerdijk 150A
1171 PV-Badhoevedorp, Holland
Phone: 0-2968-6226 Telex: 18406 HARKE NL

TOKYO, JAPAN
International Media Representatives, Ltd.
2-29 Toranomon 1-chome,
Minato-ku, Tokyo 105, Japan
Phone: 502-0656

NORWOOD, AUSTRALIA
Williamson & Associates Pty. Ltd.,
John Williamson,
P.O. Box 419,
Norwood 5067, Australia
Phone: 42-7074

For the man that would rather fix it himself –

Technical Publications has service manuals designed for you!

SES-13 Small (Air Cooled) Engines Service Manual. $9.95 (336 pages). You can service your own engines on lawnmowers, tractor sprayers and other power equipment. Special section on fundamentals, troubleshooting, preventive maintenance. Step-by-step instructions.

WLMS-1 Walking Lawnmower Service Manual $7.95 (128 pages). The **complete** guide to the care and repair of your walk-behind, push-type lawnmower. Exploded views and diagrams.

CSS-6 Chain Saw Service Manual. $8.95 (over 300 pages). Here's everything you need to know to tear down, repair, reassemble and adjust most popular chain saws. A truly **complete** chain saw manual.

GSM-1 Small AC Generator Service Manual $7.95. A brand new manual that contains maintenance, service and troubleshooting procedures, as well as wiring schematics for most generator models. Covers electrical powerplants under 8kW that generate alternating current and are driven by air cooled engines.

OS1-8 Outboard Motor Service Manual Volume 1 $8.95 (236 pages). Covers motors below 30 hp.

OS2-8 Outboard Motor Service Manual Volume 2 $8.95 (232 pages). Covers motors with 30 hp and above. Both Volumes 1 and 2 provide detailed fundamentals on periodic servicing.

Put these books to work on your own equipment...(Or service outside equipment for profit!)

- ☐ *Small (Air Cooled) Engines Service Manual*
- ☐ *Walking Lawnmower Service Manual*
- ☐ *Chain Saw Service Manual*
- ☐ *Small AC Generator Service Manual*
- ☐ *Outboard Motor Service Manual (Vol. 1)*
- ☐ *Outboard Motor Service Manual (Vol. 2)*

Remittance must accompany orders of less than $25.00. ***Postage paid when payment accompanies order.*** *Allow four weeks for delivery.*

How to send money: The best way to send money is your own personal check, post office money order, express money order or by bank draft or check. DO NOT SEND CURRENCY OR STAMPS.

- ☐ Check Money Order Enclosed
- ☐ Ship C.O.D. (No C.O.D.s outside of U.S.)

Missouri and Kansas Residents add 4% sales tax.
Tennessee Residents add 6% sales tax.

Write for a free catalog covering our entire line of service manuals and wheel-type tractor service manuals.

☐ VISA ☐ MASTERCHARGE
Credit Card Number _____
Expiration Date _____

Please Print:

Name _____

Street _____

City _____

State _____ Zip _____

Signature _____

Technical Publications

Division
Intertec Publishing Corp.
P.O. Box 12901, Dept. ES
Overland Park, KS 66212
(913) 888-4664

Strike it rich

in the fastest growing segment of the TV business

with a line of VCR and Video Disc Player accessories as strong as its name.

Now, Zenith brings you an assortment of the fastest-moving VCR and Video Disc Player accessories, each individually packaged and labeled to sell on sight from the 54" x 36" floor display as shown. Prominently displayed are such accessories as dust covers, video tape ID kits, cassette storage modules, signal splitters, attenuators, terminators, A-B switches, "F", mini, and other types of plugs and jacks in virtually any combination, plus cables in a variety of lengths each with gold-electroplated connectors. All with the built-in acceptance of TV's leading name for quality home entertainment products. Call your Zenith distributor now for his strike-it-rich VCR and Video Disc Player Accessory Program!

ZENITH®

The quality goes in before the name goes on

Zenith Radio Corporation/Service, Parts & Accessories Division/11000 Seymour Avenue/Franklin Park, Illinois 60131

Circle (2) on Reply Card