

EDITOR'S PROFILE of this issue

from a historical perspective ...

with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)

October, 1961:

Cover: A high-speed camera system (left) takes microsecond photos of a ruby-laser beam (upper right).

p. 8: J. Presper Eckert, who designed the first general-purpose electronic digital computer (ENIAC) with John Mauchly, speaks at the Electronic Computers monthly Group meeting.

p. 12: The GRID's finances dip into the red for the first time. This became an issue again in the late '90's; as a result, the GRID switched to an electronic version delivered over the Internet to save on printing/mailling costs. Then in 2004, when WESCON was cancelled and editor Doug Davolt retired for a second time, I stepped in to become the IEEE SF Bay Area Council's Communications Director and GRID editor. I created the e-GRID that went to members' mailboxes every two weeks, and a new website with RSS feed, and the GRID Magazine as a monthly PDF, with extensive coverage of chapter meetings and paid advertisements. I expanded circulation from 18,000 up to 32,000 (in 2014) even as IEEE membership declined. The e-GRID Mobile Apps (for iOS and Android) made finding and selecting meetings much easier – see figure. Revenue was typically \$60,000 each year, with half of it being split between the three Sections.

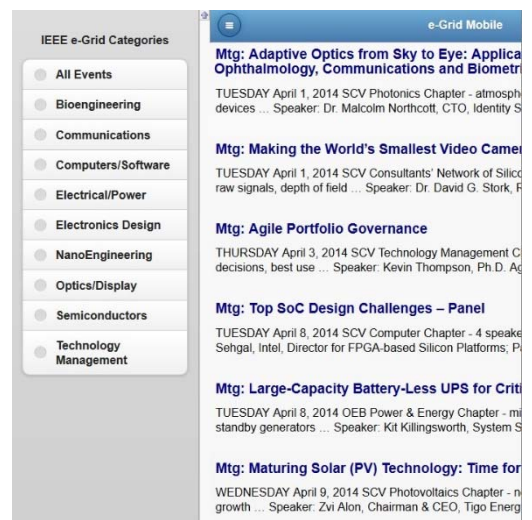
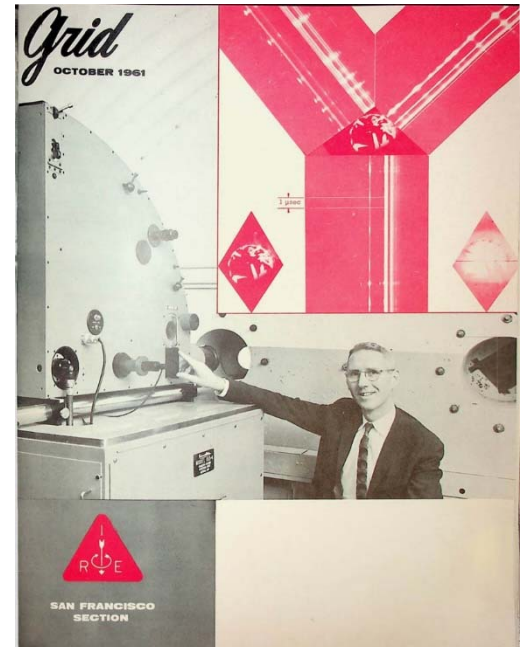
p. 14: The IRE Group on Broadcasting hears about the proposed standards for FM stereo; Jim Gabbert, a Stanford engineer who did the first Bay Area testing of stereo transmission using his station KPEN, is now Secretary-Treasurer for the chapter.

p. 16: WEMA reports that one-fourth of total US electronic sales and employment is contained in the 11 western US states. We now have 215,000 employed, a growth year-over-year of 25,000. 128,000 are in the L.A. area, while 45,500 are in the SF Bay Area.

p. 18: Memorex is formed in Santa Clara by expats from IBM's disk drive facility in San Jose, with its first product shipping in 1968. In 1967, Information Storage Systems (ISS) is started by the "dirty dozen" from IBM, to make a new plug-compatible 2311-type disk drive with a non-hydraulic head positioner, replacing it with a voice-coil motor. It also replaced detent-based positioning with servo track-following positioning. When I joined ISS in 1970, it was just starting to ship product, and it was fabulously profitable; Jimmy Woo, the vice-president, said that everyone who flew more than 2 hours got to go first class! Two of us went back (first class) to Bell Labs in New Jersey, to negotiate a license to the new Bubble Memory technology developed by Andy Bobeck; it was being positioned to replace disk drives, and ISS needed a plan. I worked on rare-earth liquid-phase epitaxial film growth on gadolinium-gallium-garnet wafers and bubble device evaluation. Some years later, our offices, on Tantau Avenue in Cupertino, later were refurbished to become home to Tandem Computers, with my office in about the same location. Some engineers would have preferred to call the Santa Clara Valley "Storage Valley" rather than Silicon Valley, but it never stuck.

p.20: William (Bill) Perry, a Stanford grad, becomes director of Sylvania's electronic defense labs in Mountain View; in 1964 he founds ESL (Electromagnetic Systems Laboratory) to digitize electronic surveillance, for signals intelligence (Sigint) gathering from the Soviet Union. President Reagan appoints him to a Commission on Strategic Forces, and he later becomes President Clinton's Secretary of Defense.

p. 22: The Santa Clara Subsection of the AIEE (which becomes the IEEE SCV Section) features Prof. Ed Ginzton of Stanford, who talks about the \$114 million 2-mile linear accelerator being designed for behind the campus. I used to ride my bicycle out along Sand Hill Road, study there on nice spring days, and to watch the SLAC construction. He was known for his early contributions to the klystron, and was a co-founder of Varian Associates in 1948 and headed it for many years.



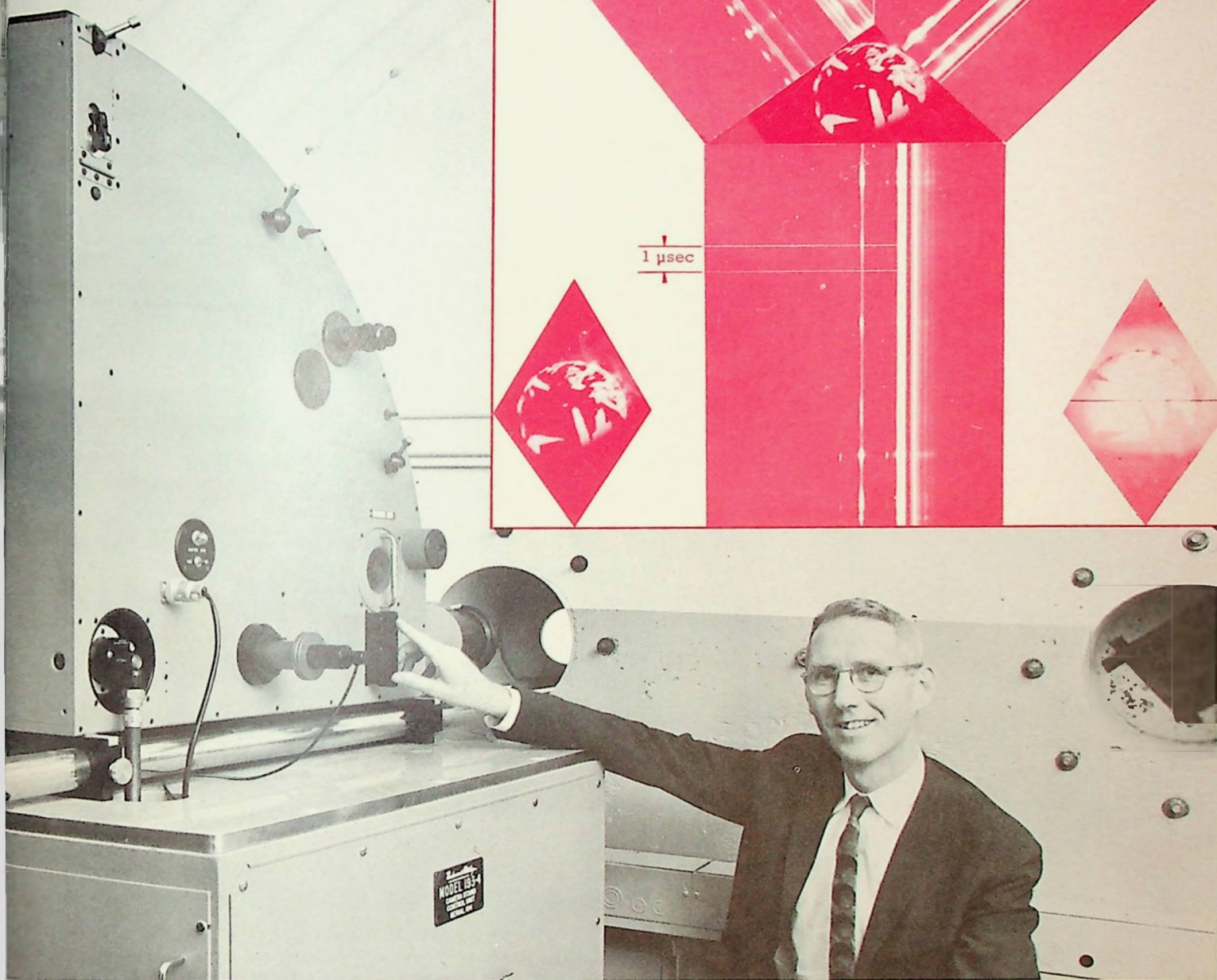
Archive of available SF Bay Area GRID Magazines is at this location:

https://ethw.org/IEEE_San_Francisco_Bay_Area_Council_History

At time of scanning, the bound volumes are held by Paul Wesling. January, 2021 Contact p.wesling@ieee.org

Grid

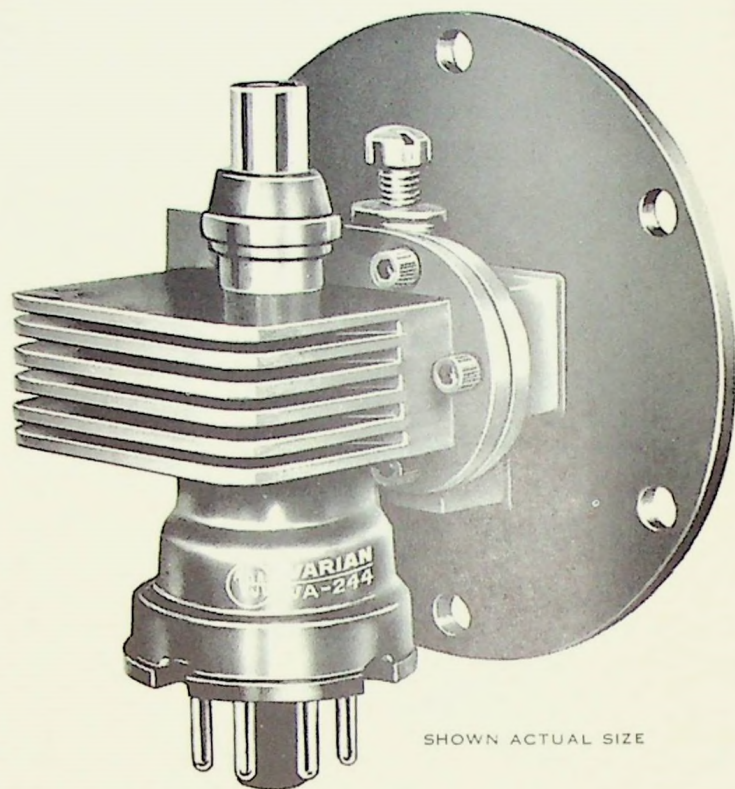
OCTOBER 1961



**SAN FRANCISCO
SECTION**

FOR MICROWAVE
RELAY SERVICE:

NOW 3 TUBES DO THE JOB OF 23!



SHOWN ACTUAL SIZE

FREQUENCY RANGE

TUBE #1:	VA-244A	5.8-6.6 kMc
TUBE #2:	VA-244B	6.5-7.3 kMc
TUBE #3:	VA-244C	7.1-7.9 kMc

Varian Associates' VA-244 series of reflex klystrons is designed for versatility in microwave relay applications. Three high-performance tubes can do jobs which formerly required 23 different types. They're engineered for flexibility, ideal for equipment in the common carrier bands. Series covers the microwave spectrum from 5.8 to 7.9 kMc. Use VA-244 series klystrons as transmitter tubes with average power output of 1 watt. As local oscillators, they operate at reduced voltages, with average power output of 60 milliwatts. Reliable, exceptionally stable, fully conduction-cooled. Low FM distortion, improved single-screw tuning.

The versatility of the VA-244 series minimizes manufacturers' and customers' stocking problems. Order in quantity to take advantage of price reductions. For technical data, write Tube Division.



VARIAN associates

PALO ALTO 16, CALIFORNIA

BOMAC LABORATORIES, INC.
VARIAN ASSOCIATES OF CANADA, LTD.
S-F-D LABORATORIES, INC.
SEMICON ASSOCIATES, INC.
SEMICON OF CALIFORNIA, INC.
VARIAN A.G. (SWITZERLAND)

SPECIFY ARNOLD IRON POWDER CORES...

COMPLETE RANGE OF SIZES AND SHAPES FOR YOUR DESIGNS

Arnold offers you the widest range of shapes and sizes of iron powder cores on the market.

In addition to toroids, bobbin cores and cup cores—typical groups of which are illustrated below—Arnold also produces plain, sleeve and hollow cores, threaded cores and insert cores, etc., to suit your designs. Many standard sizes are carried in warehouse stock for prompt shipment, from prototype lots to production quantities. Facilities for

special cores are available to order.

The net result is extra advantage and assurance for you. No matter what shapes or sizes of iron powder cores your designs require, you can get them from a single source of supply—with undivided responsibility and a single standard of known quality. And Arnold's superior facilities for manufacture and test assure you of dependably uniform cores, not only in magnetic properties but also in high mechanical

strength and dimensional accuracy.

• For more information on Arnold iron powder cores, write for a copy of our new 36-page Bulletin PC-109A. *The Arnold Engineering Company, Main Office and Plant, Marengo, Illinois.*

ADDRESS DEPT. TG-10



ARNOLD
SPECIALISTS in MAGNETIC MATERIALS

SAN FRANCISCO, Office: 701 Welch Road, Palo Alto, Calif.
Telephone: Davenport 6-9302



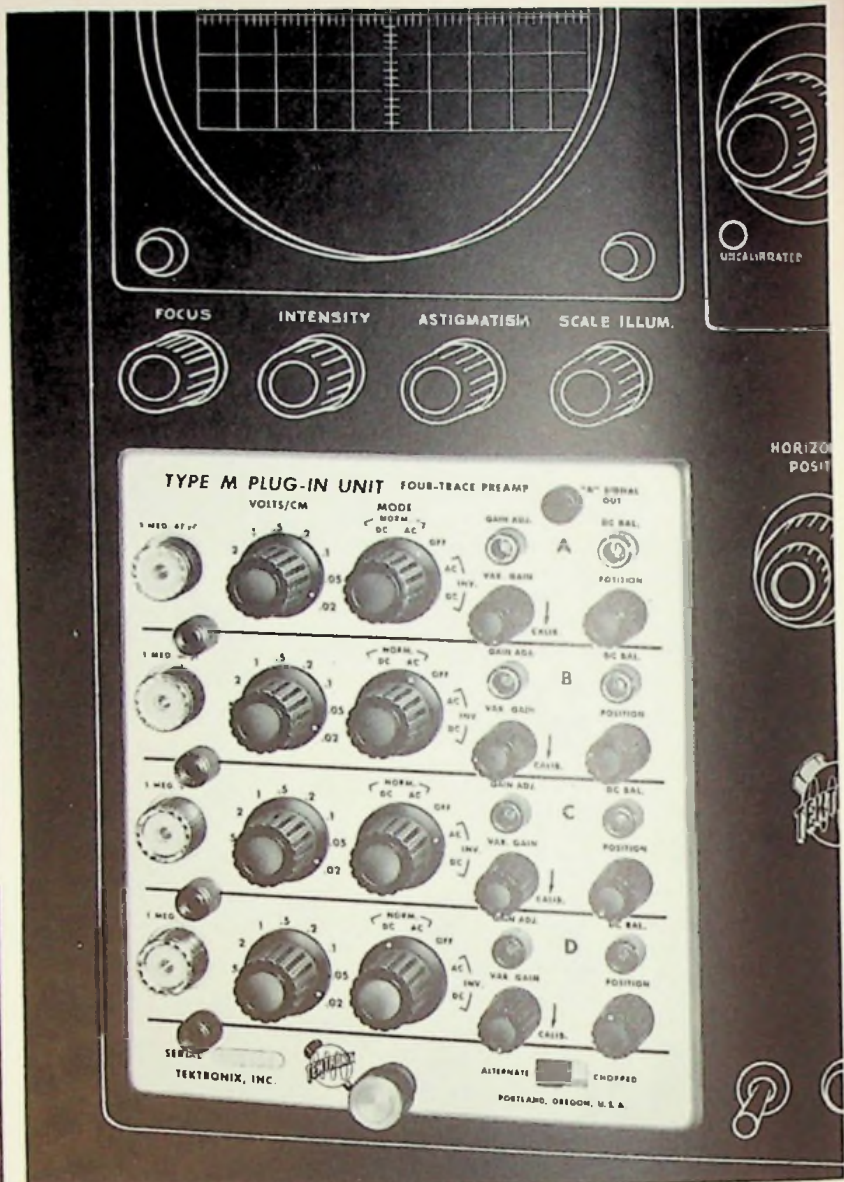
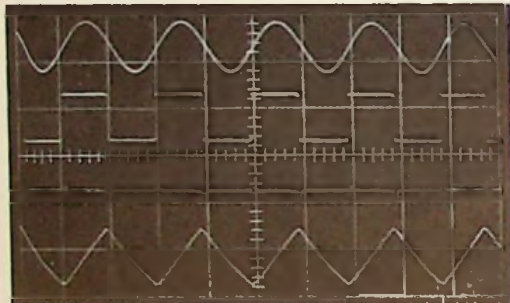
**TOROIDS
BOBBINS
CUPS
ETC.,
ETC.,
ETC.!**

NEW

4-TRACE

PREAMPLIFIER

*for Tektronix
Oscilloscopes that
accept
letter-series
plug-in units*



TYPE M UNIT Seventeenth in the letter-series of plug-in units, the new Type M Unit adds multiple-trace displays to the wide range of applications possible with your Tektronix oscilloscope.

With a Type M Unit, you can observe up to four signals—either separately, or in any combination.

Independent controls for each amplifier channel permit you to position, attenuate, invert input signals as desired.

Other convenient preamplifier features—such as triggered or free-running electronic switching . . . ac-coupling or dc-coupling . . . and, after initial hookup, little or no cable switching—ideally suit the new Type M Unit for multiple-trace presentations in the laboratory or in the field.

For more information about this new 4-Trace Preamplifier, please call your Tektronix Field Engineer.

CHARACTERISTICS

Operating Modes—Any combination of one to four channels electronically switched—at the end of each sweep or at a free-running rate of about 1 mc (1 μ sec width samples). Or each channel separately. **Channel Sensitivity**—20 mv/cm to 10 v/cm in 9 calibrated steps. Continuously variable uncalibrated between steps, and to 25 v/cm. **Channel A Signal**—available on front panel for optimum triggering in some applications. **Frequency Response and Rise Time**—With Type 540-Series and Type 550-Series Oscilloscopes dc to 20 mc, 17 nsec. With Type 531A, 533A, 535A Oscilloscopes dc to 14 mc, 25 nsec. **Constant Input Impedance**—at all attenuator settings.

Type M Plug-In Unit \$455.00
f.o.b. factory

Tektronix, Inc. SAN FRANCISCO FIELD OFFICES

3530 GOLDEN GATE WAY • LAFAYETTE, CALIF. • Yellowstone 5-6101
3944 FABIAN WAY • PALO ALTO, CALIF. • Davenport 6-8500
From Oakland, Berkeley, Richmond, Albany and San Leandro: CLifford 4-5353

Grid

October 1961

Published monthly except July and August by the San Francisco Section, Institute of Radio Engineers

PUBLISHER & EDITOR:
FRANK HAYLOCK

GENERAL OFFICES:
109 HICKORY LANE,
SAN MATEO, CALIF.
FIRESIDE 5-1617

POSTMASTER: PLEASE
SEND FORM 3579 TO:
P. O. BOX 1193, SAN
MATEO, CALIFORNIA

OFFICE OF PUBLI-
CATION: 394 PACIFIC
AVE., FIFTH FLOOR,
SAN FRANCISCO

SUBSCRIPTION: \$2.00
(SECTION MEMBERS);
\$4.00 (NON-MEMBERS)
\$5.00 (FOREIGN) PER
ANNUM

SECTION MEMBERS:
SEND ADDRESS
CHANGES TO IRE NA-
TIONAL HEADQUAR-
TERS, 1 EAST 79
STREET, NEW YORK 21,
N. Y. OTHERS TO P. O.
BOX 1193, SAN MA-
TEO, CALIFORNIA

SECOND-CLASS POST-
AGE PAID AT SAN
FRANCISCO, CALIF.

contents

Remarks from the Chair	6
Meeting Calendar	8, 9
Meetings Ahead (PGRQC, PGED, EBSS, PGPEP, PGMIL, PGCT)	9-12
Meeting Reviews	
PGB (Gabbert)	14
PGIT (Elspas)	14
Grid Swings	18-20
Events of Interest	22-24
Section Membership	26-28
Index to Advertisers	28
Manufacturers Index	29

cover

In the upper right-hand corner of this month's cover are some unusual photographs showing how a ruby-laser output looks to a high-speed camera. The camera itself is shown at left—a Beckman & Whitley Model 189 high-speed photo recorder; and below, Section member John Corcoran, senior scientist at Beckman & Whitley, San Carlos, who designed the experiment that produced the recordings.

At the center of the recording is a single framing-camera record made at the rate of 240,000 exposures per second (or 4.16 μ sec between frames)

made during a burst of laser emission. Radiating outward in the arms of a letter Y are three sweeping-image records (to one of which a time reference has been added), showing the origin of the output as it relates to the irregular character of the laser face.

At lower left is a framing-camera record of the laser fluorescing in the absence of a burst; and at lower right a conventional still picture of the laser surface, taken by reflected light, and therefore showing a negative or reverse image of the framing-camera records.

section officers

Chairman—Stanley F. Kaisel
Microwave Electronics, 4061 Transport, Palo Alto

Vice Chairman—Peter D. Lacy
Wiltron Co., 717 Loma Verde, Palo Alto

Secretary (absent on leave)—Charles Süsskind
Cory Hall, University of California, Berkeley 4

Acting Secretary & Treasurer—Alan T. Waterman
Stanford University

publications advisory

Chairman—Peter N. Sherrill
Hewlett-Packard Co., Palo Alto

Treasurer—Berkley Baker
Litton Industries, San Carlos

section office

Manager—Grace Pacak
Suite 2210, Whelan Bldg., 701 Welch Road,
Palo Alto, DA 1-1332

advertising offices

109 Hickory Lane, San Mateo, Calif.
P.O. Box 1193, FI 5-1617

EAST COAST

H & H Associates, 489 Fifth Ave.,
New York 17, N.Y. YU 6-5887

SOUTHERN CALIFORNIA

Pugh & Rider Associates, 1709 W.
8th St., Los Angeles 17, California,
HU 3-0537



Stanley F. Kaisel



from the chair

The San Francisco Section, as a result of its rapid growth in membership, has been in a period of transition for the last several years—particularly in matters relating to the management of Section affairs. As a result of the ever-increasing scale and scope of professional meeting activities, it has become impossible to coordinate activities on an informal volunteer basis. To meet this need, the IRE office was established and an office manager appointed. As the number of Professional Groups active in the Section grew, the Executive Committee became too large to conduct the detailed management of the Section effectively. The Operating Committee was established. It meets monthly to deal with current problems not requiring full Executive Committee action. In the last year, further study has been given to the problem of Section management and further steps will be taken this year to improve the service of the Section Office to the membership.

The **Grid** has grown correspondingly with the Section membership, in part because of its increased audience, but more directly because of its high quality as a publication. As a result of this growth, the **Grid** and **Grid-Bulletin** now represent a significant portion of the

Section's financial budget. In order to maintain closer control of Section publication activities, the **Grid** will now report directly to the Operating Committee. To this end two actions have been taken.

First, a Publications Board has not been appointed this year. Instead, publications activities will report directly to the Operating Committee through the Section Chairman. A Publications Advisory Committee headed by Peter Sherrill of H-P has been appointed to advise the Operating Committee on publication policy.

Second, action has been initiated to bring into the IRE Office all those Grid activities having to do directly with the mechanics of **Grid** publication, including advertising management. The services of Frank Haylock, to whose efforts the high caliber of the **Grid** must be attributed, will be retained to provide editorial assistance and control. In making these changes, the primary consideration will be to preserve the present high standards of the **Grid**.

Other Section activities are to be bolstered this year and a new activity added. It has become apparent both in the Section and at the national level that there are many technical people who derive benefit from IRE activities, qualify for IRE membership, but who are not members of the IRE.

Fred MacKenzie of SRI has been appointed Membership Chairman of the Section, and with the help and advice from last year's committee, plans to organize a membership drive within the Section.

To follow up on my comments at the Annual Meeting with regard to IRE service to the community, I have activated a new committee, the Committee on Secondary Education, headed by Joe Rubenson of Watkins-Johnson. This committee is exploring with the local school administration officials ways in which the IRE can provide help in interesting junior high school students in careers in science. This work will be the subject of a later report in these columns.

The Section faces an active year technically and organizationally. In a growing organization, change is the order of the day. The Section management makes no particular claims to special wisdom and would welcome any suggestions from the membership on better ways to serve their needs.

Stanley F. Kaisel

—STANLEY F. KAISEL
CHAIRMAN, SAN FRANCISCO SECTION



TODAY'S BEST SELLERS

Neely Volumes I through X are the electronic industry's most trusted references for source material. Small wonder they're best sellers, too.

There's a world of electronics know-how at your fingertips when you turn to Neely. And you'll be money and engineering time ahead!

For 28 years Neely has been researching the problems of this growing field... and finding the best solutions.

Eight Neely "electronic centers" in key California, Arizona, Nevada and New Mexico locations are fully staffed with factory-trained field engineers. Give them a call — they'll be at your door with the answer in record time.

Six factory-authorized Service Departments make quick work of the most complicated repairs... also!

For up-to-date data on the latest electronic developments, turn to Neely, Volumes I through X.



NEELY

enterprises

ELECTRONIC MANUFACTURERS' REPRESENTATIVES

NORTH HOLLYWOOD, 3939 Lankershim Blvd. • Phone: TR 7-1282 • TWX: N-HOL 7133
 SAN CARLOS, 501 Laurel St. • Phone: LY 1-2626 • TWX: San Carlos-Belmont CAL 94
 SACRAMENTO, 1317 Fifteenth St. • Phone: GI 2-8901 • TWX: SC 124
 SAN DIEGO, 1055 Shafter St. • Phone: AC 3-8103 • TWX: SD 6315
 ALBUQUERQUE, 6501 Lomas Blvd., N.E. • Phone: 255-5586 • TWX: AQ 172
 LAS CRUCES, 114 S. Water St. • Phone: 526-2486 • TWX: Las Cruces NM 5851
 PHOENIX, 641 E. Missouri Ave. • Phone: CR 4-5431 • TWX: PX 483
 TUCSON, 232 S. Tucson Blvd. • Phone: MA 3-2564 • TWX: TS 5981

MEETING CALENDAR

SAN FRANCISCO SECTION

● Wednesday, Nov. 29

(Joint meeting with PGEM) (Tentative)

Speaker: Sir Robert Watson-Watt, governing director, Sir Robert Watson-Watt & Partners, Ltd.; chairman, advisory board, Axe Science & Electronics Corp., London, England

EAST BAY SUBSECTION

8:00 P.M. ● Monday, Oct. 30

"Electrical Aspects of a New Spiral-Ridge Variable-Energy Cyclotron"

Speaker: Dr. Bob Smith, LRL, Berkeley

Place: LRL Berkeley Auditorium (Bldg. 50) Use Hearst Avenue entrance

Dinner: 6:30 P.M., Spengers, foot of University Avenue, Berkeley

Reservations: Winophee Veeder, THornwall 3-2740, Ext. 5451; or

Chris Widger, Hlghgate 7-5100, Ext. 2470, by October 25

PROFESSIONAL GROUPS

Antennas & Propagation

8:00 P.M. ● Wednesday, Nov. 8

"Some Aspects of Sandwich Wire Antenna Design"

Speaker: George J. Koloboff, Dalmo Victor Co.

Place: Main Conference Room, Bldg. 1, SRI

Dinner: 6:30 P.M. (Social Hour 6:00 P.M.), The Red Shack, Palo Alto

Reservations: Sandy Torrey, DA 1,3300, Ext. 392

Audio

8:00 P.M. ● Tuesday, Oct. 17

(Joint meeting with Society of Motion Picture and Television Engineers)

"A Very Directional Condenser Microphone" and "Acoustical Considerations in the Design of a Sound Studio"

Speaker: Michael Rettinger, RCA

Place: Studio "A," KGO-TV

Dinner: 6:30 P.M., Rathskeller Restaurant, 602 Turk Street, San Francisco

Reservations: Stan Oleson, DA 6-6200

Audio

8:00 P.M. ● Wednesday, Nov. 1

(Joint meeting with the Audio Engineering Society)

"A New Transistorized Audio Oscillator and Wave Analyzer"

Speaker: David S. Cochran, project leader, Hewlett-Packard Co.

Place: Conference Room B, Stanford Research Institute

Dinner: 6:30 P.M. (Cocktails at 6:00), Ramor Oaks, 3435 ECR, Atherton

Reservations: Stanley Oleson, SRI, DA 6-6200

Circuit Theory

8:00 P.M. ● Wednesday, Nov. 1

"Microsystem Circuit Analysis"

Speaker: Dr. P. S. Castro, Lockheed Research Laboratory

Place: Room 277, Cory Hall, University of California, Berkeley

Electron Devices

8:00 P.M. ● Wednesday, Oct. 18

"Electron Beam-Plasma Interaction for Microwave Amplification"

Speaker: Matthew A. Allen, Microwave Laboratory, Stanford University

Place: Room 101 Physics Lecture Hall, Stanford University

Electronic Computers

8:00 P.M. ● Tuesday, Oct. 24

"Executives 100 Feet Tall"

Speaker: J. Presper Eckert, Jr., Remington Rand Div., Sperry Rand Corp.

Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto

Dinner: 6:00 P.M., The Red Shack, 4085 El Camino Way, Palo Alto

Reservations: None required

Engineering Management

● Wednesday, Nov. 29

(Joint meeting with San Francisco Section, see above)

Engineering Writing & Speech

8:00 P.M. ● Tuesday, Oct. 24

"Description of the IBM Language-Translation Machine, AN/GSQ-16"

Speaker: Dr. Harwood G. Kolsky, manager, systems science department, IBM research lab, San Jose

Place: Auditorium, Hewlett-Packard Co., 1501 Page Mill Road, Palo Alto

Grid reporters

EBSS: JAMES B. WRIGHT, SANDIA CORPORATION

PGA: STANLEY OLESON, STANFORD RESEARCH INSTITUTE

PGAP: RAYMOND D. EGAN, RADIO-SCIENCE LABORATORY, STANFORD UNIVERSITY

PGB: JAMES GABBERT, KPEN-FM, SAN FRANCISCO

PGBME: JAMES BLISS, STANFORD RESEARCH INSTITUTE

PGCS: OWEN E. THOMPSON, SECODE CORPORATION

PGCT: R. C. KIESSLING, ITT LABORATORIES

PGEC: DONALD L. EPLEY, ELECTRICAL ENGINEERING DEPT., STANFORD

PGED: AB SERANG, SYLVANIA MDD

PGEM: LEONARD M. JEFFERS, SYLVANIA EDL

PGEWS: DOUGLAS DUPEN, ASSOCIATED TECHDATA, INC., PALO ALTO

PGI: MALCOLM McWHORTER, STANFORD ELECTRONICS LABORATORIES

PGIT: BERNARD ELSPAS, STANFORD RESEARCH INSTITUTE

PGMIL: J. WETTSTEIN, LOCKHEED MSD

PGMTT: P. H. VARTANIAN, JR., MELABS

PGPEP: HARMON R. TRAVER, HEWLETT-PACKARD CO.

PGRFI: R. G. DAVIS, LOCKHEED MSD

PGRQC: R. OWEN HOLBROOK, ARINC RESEARCH CORP.

PGSET: DONALD E. WILLOUGHBY, PHILCO WDL

UNIVERSITY OF CALIFORNIA: D. J. ANGELAKOS, CORY HALL

HISTORIAN: WILLIAM R. PATTON, VARIAN ASSOCIATES, PALO ALTO

production staff

ASSOCIATE EDITOR: MARY HAYLOCK

EDITORIAL ASSISTANTS:

EMMA SCARLOTT, MARJORIE SILVA

MEETING CALENDAR

Information Theory 8:00 P.M. • Wednesday, Oct. 18

"Networks of Noisy Channels"
 Speaker: Prof. Peter Elias, MIT
 Place: Auditorium, Sylvania EDL, 155 Whisman Road, Mountain View
 Dinner: To be announced

Information Theory 8:00 P.M. • Thursday, Nov. 9

"Some Recent Results in the Study of Feedback Communication Systems"
 Speaker: Leonard S. Schwartz, New York University
 Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
 Dinner: To be announced

Information Theory 8:00 P.M. • Thursday, Nov. 30

"A Generalization of Woodward's Theorem on FM Spectra"
 Speaker: Dr. Nelson M. Blachman, Sylvania EDL
 Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
 Dinner: To be announced

Instrumentation 8:00 P.M. • Tuesday, Oct. 31

"Measurement of Fallout"
 Speaker: Dr. R. R. Newell, professor emeritus of radiology, Stanford, and resident consultant in radiophysics, Naval Radiological Defense Lab
 Place: Hewlett-Packard Co., 1501 Page Mill Road, Palo Alto (main lobby)
 Dinner: 6:00 P.M., Stardust Motel, 4320 El Camino Real, Los Altos
 Reservations: Mrs. Blackler, DA 1-7751, by October 27

Military Electronics 7:30 P.M. • Tuesday, Nov. 7

"Organization & Function of United States Air Force Systems Command"
 Speaker: Major Herman H. Teifeld, USAF R&D Command
 Place: Building 202, Lockheed Auditorium, 3251 Hanover Street, Palo Alto
 Dinner: 6:00 P.M., The Red Shack, 3085 El Camino Way, Palo Alto
 Reservations: General Victor Conrad, DA 6-4000, Ext. 2212

Product Engineering & Production 8:00 P.M. • Tuesday, Oct. 24

"Value Analysis and Cost Reduction"
 Panel discussion and plant tour
 Panelists: Arthur W. Brown, IBM; Walter Day, Berkeley/Beckman; N. J. McMahon, United Air Lines; David Steinberg, Lenkurt
 Place: Beckman/Spinco Division, 1117 California Avenue, Palo Alto

Reliability & Quality Control 7:30 P.M. • Wednesday, Oct. 18

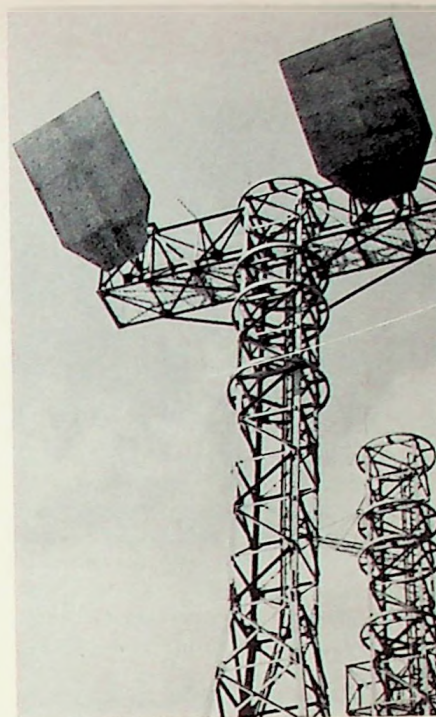
Tour of Federal Aviation Agency facilities at Fremont
 Leader: Lee Hilscher, Supervisor of navigational aids, FAA
 Place: 5125 Central Avenue, Fremont, Calif.
 Dinner: 6:00 P.M., George's Restaurant, 102 Center Square, Fremont
 Reservations: None required

Space Electronics & Telemetry 8:00 P.M. • Tuesday, Oct. 17

"Recent Developments in Optical Pumping"
 Speaker: A. Bloom, Spectra-Physics Corp.
 Place: Lockheed Auditorium, Building 202, 3251 Hanover St., Palo Alto
 Dinner: 6:30 P.M., El Camino Bowl, Palo Alto
 Reservations: Cynthia Chaney, DA 1-8010, Ext. 64

CHRONOLOGICAL RECAP

October 17—Audio/SMPTE, Space Electronics & Telemetry
 October 18—Electron Devices, Information Theory, Reliability & Quality Control
 October 24—Electronic Computers, Engineering Writing & Speech, Product Engineering & Production
 October 30—East Bay Subsection
 October 31—Instrumentation
 November 1—Audio/AES, Circuit Theory
 November 7—Military Electronics
 November 8—Antennas & Propagation
 November 9—Information Theory
 November 29—San Francisco Section/Engineering Management
 November 30—Information Theory



Microwave reflector towers—a part of the facilities to be seen on the PGRQC tour to Fremont

—John Hall Photo

meeting ahead

RELIABLE FLIGHT

On Wednesday, October 18, PGRQC will be touring the facilities of the Federal Aviation Agency at Fremont. Check the Calendar for details.

All instrument flights (ifr) between airports are under the direction of the Federal Aviation Agency, which assigns routes and altitudes and monitors all congested areas by radar.

Search radars located at Paso Robles, Half Moon Bay, and Sacramento transmit video information by microwave link to the Oakland air-route traffic-control center (located at Fremont) where traffic-control personnel plot the progress of all flights.

The usual ppi scope presentation, which requires semidarkness for viewing, is being replaced by a high-brilliance "television" presentation which may be viewed in normal room light. This new presentation uses a high-resolution horizontal raster but maintains the ppi picture.

The airplane map about each radar site can be superimposed on the actual radar scanned picture to show the true geographical position of any plane with relation to prescribed airlines.

Specially constructed recorders record all FAA voice traffic control conversation for filing.

Lee Hilscher, supervisor of navigational aids, has arranged the tour. The Fremont facility is reached by traveling

(Continued on page 10)



*John W. Hall,
chairman, PGRQC*



*Rudy Cazanjian,
vice chairman, PGRQC*



*R. Owen Holbrook,
sec'y-treasurer, PGRQC*

MORE FREMONT TOUR

east on Thornton Road from either the Dumbarton Bridge or the Nimitz Freeway to Blacow Road, turning right (south) on Blacow to Central Avenue, and right again to 5125 Central Ave.

Julian Hilman has resigned from chairmanship of the PGRQC Chapter and the roster of officers now stands as follows:

Chairman: John W. Hall, IBM.

Vice Chairman: Rudy Cazanjian, Sylvania.

Secretary-Treasurer: R. Owen Holbrook, Arinc Research Corp.

Program Chairman: Roger H. McDonald, Sylvania.

meeting ahead

MICROWAVE POWER SOURCE

As set forth in detail in the Calendar, the October meeting of PGED will be devoted to the subject "Electron-Beam/Plasma Interaction for Microwave Amplification." The speaker will be Matthew A. Allen of Stanford.

The electron beam-plasma interaction mechanism will be discussed. Recent work carried out both in this country and abroad will be described; in particular, the experiments which are being performed at Stanford using a thermally generated cesium plasma will be covered in detail. It will be shown that, because of the unique properties of the plasma, the use of this interaction for the amplification and generation of

microwave power may provide significant advantages over existing devices.

Matthew A. Allen was born in Edinburgh, Scotland, in 1930. He received his undergraduate education at the University of Edinburgh and his graduate education at Stanford University, ob-



M. A. Allen

taining the PhD degree in physics in 1959. Since 1955, he has been at the microwave laboratory at Stanford University, where he is presently a research associate, engaged in research in plasma physics and high-power microwave tubes.

PGED's new officers are:

Chairman: H. John Shaw, Stanford Microwave Laboratory.

Vice Chairman: Jules S. Needle, Sylvania.

now available

NEW SECTION DIRECTORY

Traditionally, the September issue of the **Grid** includes a Directory of Officers, but tradition was broken last month.

Members who would find such a listing useful may obtain one from the Section Office, 701 Welch Road, Palo Alto; DA 1-1332.

Secretary: Murray I. Disman, Eitel-McCullough, San Carlos.

Treasurer: Richard P. Borghi, Project M, Stanford University.

meeting ahead

NEW CYCLOTRON

Electrical details of the new spiral-ridge variable-energy cyclotron will be covered by Dr. Bob Smith of the Lawrence Laboratory at an October East



Bob Smith

Bay Subsection meeting. Details in the Calendar.

There will be, in addition to the talk, a short tour of the 88-in cyclotron.

Smith received his BS, MS, and PhD degrees in electrical engineering from the University of California. He has been employed at the University of California Lawrence Radiation Laboratory, Berkeley, since 1951 and is presently project engineer on the 88-inch cyclotron.

(Continued on page 12)



*H. John Shaw
chairman, PGED*



*Jules S. Needle,
vice chairman, PGED*



*Murray I. Disman,
secretary, PGED*



*Richard P. Borghi,
treasurer, PGED*



TOGGLE SWITCH MODEL 20

PRECISION HIGH FREQUENCY ATTENUATORS

DC TO 500 MEGACYCLES

- 50, 70, or 90 ohm impedance
- High-Frequency, Precision Teflon & Silver Switches
- 1% Carbon Film Resistors ■ Fully Shielded Units
- Up to 101 db ■ Fixed 0 or 10 db insertion loss
- SWR: 1.2 : 1 max up to 250 mc
1.4 : 1 max 250 to 500 mc
- Min. Insertion*: 0.1 db at 250 mc; 0.2 db at 500 mc
- Accuracy: At Full Attenuation: 0.5 db at 250 mc, 1.2 db from 250 to 500 mc
- Price: (Model 20) \$79.00 f.o.b. factory (\$87.00 F.A.S. N. Y.)

*Zero insertion loss (Model 20-0) \$75.00 f.o.b. factory

KAY ELECTRIC COMPANY
DEPT. G-10 • MAPLE AVENUE • PINE BROOK, N. J. • CAPITAL 6-4000

Write for
Catalog Information

KAY ELECTRONIC INSTRUMENTS

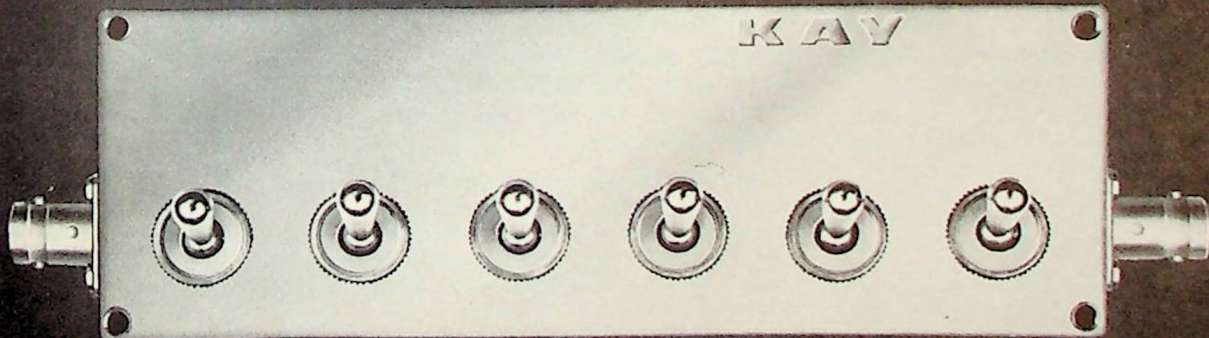
Sweeping Oscillators
Frequency Markers

Audio Spectrum Analyzers
Pulse — Pulsed RF Generators

Precision Attenuators
Random Noise Generators

Kilo-Sweeps®
Kada-Sweeps®
Ligna-Sweeps®
Sona-Sweeps®
Marka-Sweeps®
Vari-Sweeps®
Mega-Sweeps®

MODEL KA492 FOR PANEL MOUNT





George F. Reyling,
chairman, PGPEP



Olof Landeck
vice chairman, PGPEP



W. Dale Fuller
secretary-treasurer, PGPEP



Thomas E. Scatchard,
program chairman, PGPEP

MORE CYCLOTRON

Smith previously worked on the conversion of the 184-inch cyclotron at Berkeley and was responsible for the r-f design of the 94-inch cyclotron at Livermore.

meeting ahead

P & L

For its October meeting, PGPEP will convene to consider the subject of value analysis and cost reduction. This will be a brief insight into the methods used by four major Bay Area companies in the successful pursuit and acquisition of the elusive dollar through competitive buying and better-than-average liaison.

The all-star cast will tell this and possibly more.

Officers who will serve the Professional Group on Product Engineering & Production for the ensuing year are as follows:

Chairman: George F. Reyling, Varian Associates.

Vice Chairman: Olof Landeck, Electro Engineering Works.

Secretary-Treasurer: W. Dale Fuller, Lockheed Missiles and Space Co.

Program Chairman: Thomas E. Scatchard, Beckman Instruments, Inc., Berkeley Division.

meeting ahead

BEHIND THE WINGS

Major Herman H. Teifeld, who in 1942 flew the first radar airborne system developed at MIT, will speak on the subject of the organization and function of the U.S. Air Force Systems Command at the PGMIL meeting for November. See the Calendar for particulars.

In addition to describing the organization and functions of the U.S. Air Force Systems Command, including recent administrative changes; Major Teifeld will give an outline of research and development trends in USAF electronic activity. This presentation will be of great interest to those engaged or

not engaged in work sponsored by the USAF, both from a technical and administrative standpoint.

Besides being with the Eighth Air Force in Europe, Major Teifeld has been a wing electronic officer with SAC, Alaska, in charge of cold-weather operations. He is a graduate of the Air Force Institute as an industrial engineer and has served in numerous special assignments.

The meeting is unclassified, so no clearance is required, and refreshments and discussion are promised for the period following the presentation.

meeting ahead

THIN-FILM THEORY

November will start for PGCT with a meeting on the Berkeley campus presenting P. S. Castro of the Lockheed research laboratory. As he will point out, an important microminiaturization technique is that of realizing complex network components by means of resistive and dielectric films. A general method for analyzing these film-type networks, built around the theory of indefinite matrices, will be presented and he will develop simple rules for generating subnetworks from a given 4-terminal network.

EXCOM

MICROMINUTES

Business transacted at the September 25 meeting of the Executive Committee of the Section included:

Financial reports indicated the probability of an operating year in which expenditures will outstrip revenues by about \$5000—to be accomplished by dipping into Section reserves.

Publications reports indicated that both the **Grid-Bulletin** and the **Grid** have been going through heavy weather. The former, instead of returning an anticipated \$3,000 revenue, essentially broke even. The latter, instead of breaking even, has an operating deficit.

The discussion covered **Grid** advertising rate increases and accelerated sales activities, as well as proposed organizational improvements — all of which should combine to alleviate the difficulties.

A resolution was adopted supporting the Wescon "gentleman's agreement," and another stating its relationship to **Grid-Bulletin** operations. Assuming the concurrence of the Los Angeles Section, who are partners in this particular publication activity, the result will be refusal by the **Grid-Bulletin** of "overt" recruitment advertising.

Chapter Operations will be the subject of a new operating guide being compiled under the direction of Vice Chairman Peter Lacy.

Committee Chairmen were confirmed as follows: Henry W. Schroeder, arrangements; Stanley E. Webber, awards; Joseph G. Rubenson, secondary education; Robert A. Craig, education and student relations; Earl G. Goddard, historical; Fred J. MacKenzie, membership; Peter D. Lacy, program; Peter N. Sherrill, publications advisory; and Harry H. Smith, San Francisco Engineering Council.



Charlie, your research work has saved the firm more than three million dollars! Please accept our heartfelt thanks!



Said Johann Kepler: "The planets move in elliptical orbits about the sun, and the square of their periods of revolution are proportional to the cube of their mean distances from the sun."

With interplanetary voyages fast becoming a reality, complete information regarding the velocity requirements for travel between planets is of vital importance. With these data available, it is possible to analyze propulsion requirements, plan ultimate system configurations, and conduct feasibility studies for any particular mission.

Lockheed Missiles & Space Company scientists have actually evolved a rapid-calculation method, utilizing a high-speed computer. This has produced literally thousands of orbits, velocity requirements, and elapsed time, for design studies of trips to and from both Mars and Venus—every tenth day from now until January, 1970.

More simple to analyze are many factors which make Lockheed Missiles & Space Company a wonderful place to live and work. Located in Sunnyvale and Palo Alto, California, on the beautiful San Francisco Peninsula, Lockheed is Systems Manager for such programs as the DISCOVERER and MIDAS satellites and the POLARIS FBM. These, together with research and development projects in all disciplines, make possible a wide diversity of positions for creative engineers and scientists in their chosen fields.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-14F, 962 West El Camino Real, Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required. An Equal Opportunity Employer.

LOCKHEED MISSILES & SPACE COMPANY

A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION

Systems Manager for the Navy POLARIS FBM and the Air Force AGENA Satellite in the DISCOVERER and MIDAS programs. Other current programs include SAINT, ADVENT and such NASA projects as OGO, OAO, ECHO, and NIMBUS. SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA • CAPE CANAVERAL, FLORIDA • HAWAII



Hugh W. Granberry
chairman, PGB



Paul Gregg,
vice chairman, PGB

meeting review

BROADCASTERS—ALL EARS

Late in August, the Professional Group on Broadcasting held a dinner meeting at the Canterbury Hotel in San Francisco to discuss the new proposed f-m rules, stereophonic f-m broadcasting, and other facets of broadcasting as viewed by the FCC. The meeting was attended by over 65 people, including members of the PGB and the local broadcast-engineering profession.

The three main speakers were Harold L. Kassens, chief of the aural existing facilities of the broadcast bureau of the FCC, Washington, D. C.; James Barr, assistant chief of the broadcast bureau of the FCC, Washington, D. C.; and Daniel von Recklinghausen, chief research engineer of H. H. Scott, Incorporated, Maynard, Massachusetts.

The meeting lasted three hours. It was very enlightening for broadcasters, as the FCC's thinking toward f-m broadcast stations and f-m station allocation was expressed.

New officers for the Professional Group Chapter on Broadcasting have been announced as follows:

Chairman, Hugh W. Granberry, General Electric Co.

Vice Chairman: Paul Gregg, Bauer Electronics.

Secretary-Treasurer: James Gabbert, KPEN. —JAMES GABBERT

meeting review

TO ERR IS TELEPHONIC

Associate Professor W. Wesley Peterson of the University of Florida addressed a special meeting of PGIT in mid-September on the practical implications of recent work in coding theory. This second meeting of the newly formed San Francisco chapter of PGIT was held at the Stanford University Physics Lecture Hall with an audience of 50 in attendance.

The speaker is well known for his work in coding theory, including numerous papers and a recent book on the subject. His approach was sufficiently tutorial to be of value to the non-specialists in the audience, while still retaining enough detailed technical content, especially on recent results, to

command the interest of the coding theorists present.

Professor Peterson began by reviewing the fundamental theorem of Shannon (1948) for the noisy channel. A brief description of the properties of two idealized channels, the binary symmetric channel and the continuous gaussian channel, then followed. The performance bounds of Elias-Shannon (1955-56) were then discussed by means of well-chosen examples for the binary symmetric channel. These examples indicated what block lengths, n , one would need for given values of data rate, R bits per second, and channel bit error probability p , to guarantee a probability of error, $P_e = 10^{-5}$, 10^{-10} , 10^{-20} , for a decoded word. For transmission at rates close to the channel capacity C , the block length n must be prohibitively large if the channel is poor ($p > 0.01$) or the desired error probability is small ($P_e < 10^{-5}$) or both.

A moderate relaxation of any of these requirements results in block lengths of the order of only several hundred binary digits, for which relatively easily instrumented, efficient codes are now known, although only recently. An extract from Peterson's tables is shown below. N is the number of binary digits traversing the channel per second.

p	R/N =		P _e	n (approx.)
	C/N	k/n		
0.01	0.929	0.9	10 ⁻⁵	11,300
0.01	0.929	0.67	10 ⁻¹⁰	340
0.0001	0.9985	0.9	10 ⁻¹⁰	325

Next, the performance of the best multiple-error-correcting codes known (those of Bose, Ray-Chaudhuri and Hocquenghem) were compared with the Elias-Shannon bounds by way of two examples.

Code A: $n = 511$ binary digits, $k = 340$ data digits, correcting any 20 erroneous digits per block, yields $P_e = 2.5 \times 10^{-5}$ for $p = 0.01$, and has $R = 0.67N$.

Code B: $n = 511$ binary digits, $k = 466$ data digits, correcting any 5 erroneous digits per block, yields $P_e = 1.7 \times 10^{-6}$ for $p = 0.0001$, and has $R = 0.9N$.

These examples indicate that the Bose-Chaudhuri codes get us reasonably

close to the theoretical performance of the Elias-Shannon bounds, but still leave a gap to be bridged. On the other hand, the instrumentation for these codes is fairly simple, especially when the number of errors is not too great.

A different approach to achieving reliable digital data transmission, usable when a two-way channel exists, was briefly considered by Professor Peterson. This approach consists of using a redundant code solely for error detection, with the receiver requesting a repeat of each code block in which errors are detected. The instrumentation for such decision-feedback schemes is much simpler, and less costly, than for actual error-correction schemes. Moreover, the improvements theoretically obtainable in this way on a binary symmetric channel are quite impressive, if the channel is not too poor to begin with. For example, if $p = 10^{-1}$, a Bose-Chaudhuri code with $n = 255$, $k = 238$, yields $P_e =$ probability of an undetected error $= 10^{-10}$, with a data rate of over 90 per cent of channel capacity. However, if the channel is too noisy to begin with, say $p = 0.01$, then feedback schemes appear to be ineffective, since there are conflicting requirements on the block length, n . On one hand n must be chosen fairly large to keep the fraction of redundant digits low. On the other hand, if n is large, practically every received block will contain some detected errors and thus initiate a repeat, bringing the data rate R down to a very small fraction of C .

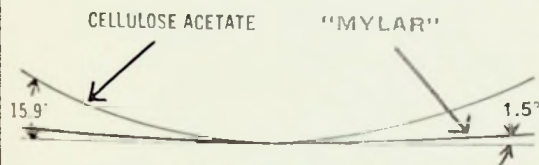
Up to this point the discussion was largely concerned with idealized channels. Telephone lines have been of great interest for use as digital channels in recent years. Theoretically they would appear to possess channel capacities of the order of 20 to 30 kilobits per second. However, no practical schemes have realized more than 20 per cent of this capacity, and that only very recently. Many tests of error statistics have been carried out indicating that errors on telephone lines are highly non-random—they tend to occur in bursts, often quite long bursts (also bursts of bursts). Thus the binary symmetric channel with independent errors is quite unsuitable as a model for telephone lines. Burst-error-correcting codes offer some improvement as compared to multiple-error-correcting codes, but even then not much improvement can be obtained on telephone lines by error correction. The reason is that errors are so catastrophic. When transmission is good there is no need for the excess baggage of redundant digits; when transmission goes bad, it goes so bad that no reasonably efficient code will correct all the errors that occur.

(Continued on page 16)

GUARD AGAINST READ/WRITE ERRORS WITH RELIABLE TAPES OF MYLAR®

CUPPING

Test per MIL-T-21029 (Ships) Section 4.4.6.
Average degree of cupping:
1.5 mil Cellulose Acetate—15.9° (Range: 12.0°
to 33.5°) 1.5 mil "Mylar"—1.5°

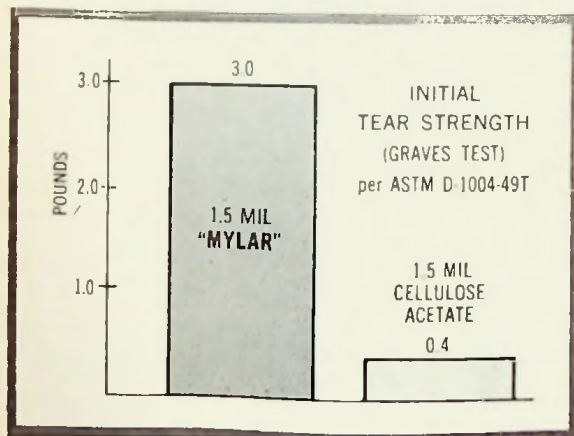


Unstable tape can cup or ruffle—cause read/write errors because the tape loses contact with the recording and playback heads. Dimensionally stable "Mylar"* polyester film base prevents tape cupping or ruffling. It does not shrink from dryness or swell from excess humidity, but maintains the original width and flatness of the tape.

"Mylar" is strong . . . has an ultimate break strength over 20,000 psi! Tapes of "Mylar" can resist edge nicks, stretching or breaking from sudden stops and starts. And since it contains no plasticizer to dry out, tapes of "Mylar" can be stored indefinitely without becoming brittle.

A stable tape assures accurate data acquisition—helps prevent costly read/write errors and loss of valuable test data. Tapes of "Mylar" have this stability. To be sure you'll get the best performance, insist on a base of "Mylar" on your next order for magnetic tape. Write for the free booklet on comparative test data. Du Pont Company, Film Dept., Wilmington 98, Delaware.

*"Mylar" is Du Pont's registered trademark for its brand of polyester film. Only Du Pont makes "Mylar".

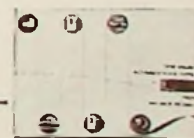


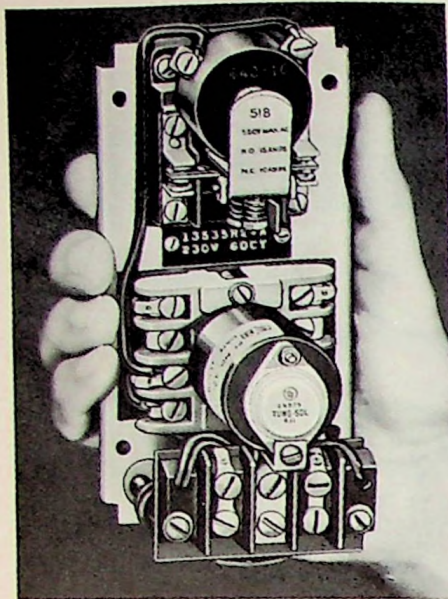
Better Things for Better Living . . . through Chemistry

DU PONT
MYLAR®
POLYESTER FILM

E. I. du Pont de Nemours & Co. (Inc.)
Film Department, Room #12, Wilmington 98, Delaware
Please send free, 12-page booklet of comparative test data
to help me evaluate magnetic-tape reliability.

Name _____ Position _____
Company _____
Address _____
City _____ Zone _____ State _____





Cutler-Hammer relies on Tung-Sol 'cold-weld' seal semiconductor for transistorized relay

Tung-Sol semiconductors furnish the combination of sensitivity and ruggedness needed for Cutler-Hammer's transistorized relays. The Tung-Sol units react quickly and display unflinching electrical stability. They resist shock and vibration.

Why don't you get the benefit of Tung-Sol component knowledge and experience too? Tung-Sol components—whether transistors, tubes or silicon rectifiers—fill virtually every military, commercial and entertainment requirement with unexcelled dependability. For quick and efficient technical assistance in the application of all Tung-Sol components, contact:

Your Tung-Sol Representative:

NEILL B. SCOTT

6542 Kensington Ave.
Richmond, BE 2-8292

Your stocking distributors:

OAKLAND
ELMAR ELECTRONICS
140 11th St.
TE 4-3311

SAN FRANCISCO
PACIFIC WHOLESALE
1850 Mission St.
UN 1-3743

SAN JOSE
SCHAD ELECTRONICS
499 South Market St.
CY 7-5858

 **TUNG-SOL**[®]
ELECTRON TUBES • SEMICONDUCTORS

16—grid



Forrest F. Fulton, Jr.,
chairman, PGIT



Charles H. Dawson,
vice chairman, PGIT



Bernard Elspas,
secretary, PGIT

MORE CODING

Decision-feedback with error detection at the receiver, on the other hand, provides a reasonable solution to this problem. Very little redundancy is required for a sizable amount of error detection, and the repeat requests are rare enough not to affect the data rate appreciably. For example, an encoding-decoding system being built at Lincoln Laboratory will employ a Bose-Chaudhuri, $n = 255$, $k = 231$ code for error detection of any 6 errors per block, any burst less than 25 bits wide, and the overwhelming majority of other error patterns. It is predicted that this system will have a mean free time between undetected errors of 300 years! The circuits are extremely simple.

Brief mention was also made of other code instrumentation work going on at Lincoln Laboratory, notably a Bose-Chaudhuri encoder-decoder for a $n = 127$, $k = 92$ code correcting any combination of up to five errors per block. The whole encoder-decoder combination costs less than 10K and it will fit into one file drawer.

Professor Peterson pointed out that his discussion was limited to algebraic coding and had ignored the possibilities afforded by so-called sequential decoding, really a scheme for non-algebraic encoding and decoding of digital data, which in effect makes use of random codes, and employs a special statistical decision technique for decoding. These ideas appear in a recent book by Wozencraft and Reiffen.

In the question period which followed Professor Peterson's fascinating talk, questions were raised about the effects of noise on the feedback channel in a two-way system, about the behavior of the Elias-Shannon bounds for fairly large values of p , and on the decoding delays required for the error-correction schemes discussed. The speaker dealt effectively with these questions to the evident satisfaction of the interlocutors.

In the San Francisco Chapter of PGIT, the following new officers have been elected:

Chairman: Forrest F. Fulton, Jr., Lockheed Missiles and Space Co.

Vice Chairman: Charles H. Dawson, Philco WDL.

Secretary: Bernard Elspas, Stanford Research Institute.

—BERNARD ELSPAS

grid return

PRaise AND RESERVATIONS

Menlo Park, Calif.

To the Editor

Dear Sir:

The 1961 Wescon show was the best so far. However, the banquet committee should go back to school and take a course in humility.

The tickets stated that there was to be a reception at 7:00 p.m. and the banquet at 8:00 p.m. So we all arrived on time for the reception looking forward to an hour of meeting friends and fellowship. But lo and behold, the reception was only for a select few who held special tickets. The rest of the guests were shunted off to a cocktail bar lounge as if they were poor relations. The committee members shrugged it off as just one of those things.

To compound the first error, the tables in front of the long speakers' table were all reserved. Reserved for whom? Perhaps the entire function should have been reserved, and the rest of us could have made other arrangements.

Anyway, the dinner was delicious, the speeches were short, and the dance music was excellent. Only next time please remember that a committee functions to serve all members.

Very truly yours,
Louis L. Fisher

electronic pulse

STATE OF THE BUSINESS

Electronic-industry growth in the 11 western states is continuing to outstrip the national average and the West now accounts for one-fourth of total electronic sales and employment in the United States, according to the Western Electronic Manufacturers Association

(Continued on page 18)

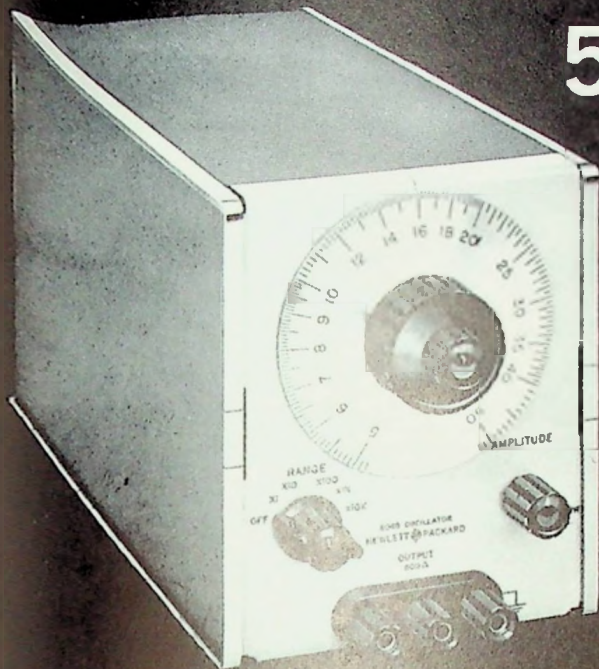
october 1961

Use it on the bench—carry it anywhere!

New High Stability Oscillator

5 cps to 500 KC

Unique frequency,
amplitude stability
in this compact,
light weight, solid
state oscillator!



hp 204B Portable Oscillator

The unusual stability of the new hp 204B combines with solid state design and battery operation to give you one of the most useful, reliable, versatile oscillators available today. Because the 204B is fully transistorized, internal heat is small and warmup drift is negligible. In addition to battery operation, the 204B is operable on ac, with an ac power pack available at extra cost.



Frequency stability over the entire 5 cps to 500 KC range is better than $\pm 0.03\%/^{\circ}\text{C}$ from 0° to 55°C . Amplitude stability over rated frequency range and output levels is better than $\pm 0.1\%$ over 8 hours of operation at constant line voltage and temperature*; better than $\pm 0.2\%$ for line voltage changes of $\pm 10\%$; better than $\pm 0.1\%/^{\circ}\text{C}$, $0-55^{\circ}\text{C}$.

Output of the 204B is fully floating, isolated from both power line ground and chassis. Balanced and unbalanced loads, and loads referenced either above or below ground, can be driven by this versatile oscillator.

Low impedance circuits drive the 600 ohm output, effectively isolating the oscillator stage.

SPECIFICATIONS

Frequency Range:	5 cps to 500 KC, 5 ranges, 5% overlap, vernier control
Dial Accuracy:	$\pm 3\%$
Frequency Response:	$\pm 3\%$ with rated load
Output Impedance:	600 ohms
Output:	10 mw (2.5 v rms) into 600 ohms; 5 v rms open circuit
Output Control:	Continuously variable bridged "T" attenuator with at least 40 db range
Distortion:	Less than 1%
Noise:	Less than 0.05%
Power Source:	4 battery cells at 6.75 v each, 7 ma drain, life at least 300 hours
Power Accessory Available:	AC power supply can be installed in place of batteries. Optional at extra cost.
Dimensions:	6 - 3/32" x 5 - 1/8" x 8". 6 lbs.
Price:	Ⓟ 204B, \$275.00

Designed in the new  instrument module packaging, the 204B is only 6-3/32" high, 5 1/8" wide and 8" deep; weighs just 6 pounds! A new rack mount adapter holds three 204B oscillators or other  instruments of the new modular design.

*On battery operation, stability -1% during battery depolarization, less than 30 minutes.

HEWLETT-PACKARD COMPANY

CONTACT OUR ENGINEERING REPRESENTATIVES, NEELY ENTERPRISES, FOR INFORMATION — Los Angeles, 3939 Lankershim Blvd., North H'wd., TR 7-1282 and PO 6-3811; San Carlos, 501 Laurel St., LY 1-2626; Sacramento, 1317 Fifteenth St., GI 2-8901; San Diego, 1055 Shafter St., AC 3-8106; Phoenix, 641 E. Missouri Ave., CR 4-5431; Tucson, 232 So. Tucson Blvd., MA 3-2564; Albuquerque, 6501 Lomas Blvd. N.E., 255-5586; Las Cruces, 114 S. Water St., 526-2486.



Alfred Electronics' recently completed plant in Palo Alto contains 32,000 square feet, a 300-per-cent increase in size over the firm's previous facility

grid swings

IT IS REPORTED:

About Companies

Emerson & Cuming, Inc. announces the opening of its San Francisco Sales Office; **Arthur D. Little, Inc.**, has announced expansion of its regional electronics-research operations to serve the Western electronic industry; **Hewlett-Packard Co.** announced a major expansion of its European operations, including the leasing of a manufacturing facility in England and the construction of a new plant in West Germany; **General Electric Co.** has announced establishment of a new office facility at 701 Welch Road and the relocation of the regional distributors office in San Francisco; a new electronic firm, **Memorex Corporation**, has been founded in Santa Clara, to specialize in the field of electronic memory and to develop advanced materials and technology related to this field; **Jensen Engineering, Inc.**, has been organized in Palo Alto to provide services and equipment in the field of satellite communications and control engineering; **Indamer Electronics, Inc.**, has been formed to produce semiconductors and other component testers and circuit modules in Sunnyvale; **Dalmotor Division** of Yuba Consolidated Industries, Inc., has been purchased by its original

founder, **Walter Cabral** and is being merged with **Cabral Motors, Inc.**, Los Gatos; **Sylvania Electric Products, Inc.** has announced the formation of a new operating division, the microwave device division, with laboratories in Mountain View; **Watkins-Johnson Co.** has announced the award of a contract to Haas & Haynie for a \$430,700 addition to its plant in Stanford Industrial Park; **Fairchild Semiconductor Products** will be manufactured and marketed in Italy by **Societa Generale Semiconduttori** of Milan; **The Sanborn Company** of Waltham, Mass., has become a wholly-owned subsidiary, **Hewlett-Packard Co.**

Bernard Wambsganss has been appointed assistant to **Fred W. Kruse**, president of **Alfred Electronics Corp.** Before joining Alfred, Wambsganss was chief scientist of the Office of Naval Research branch office in San Francisco. His previous experience includes five years at the Sylvania electronics defense laboratories in Mountain View.

Western Gold and Platinum Co. has announced the election of **Harry A. Mason** to the newly created post of vice president, marketing. Mason, formerly sales manager, will have complete responsibility for the company's marketing and sales activities.

Hewlett-Packard Co. has recently announced the formation of a newly affiliated company to engage in solid-state research and development. The new firm, known as **HP Associates**, is headquartered in Palo Alto. Its president is **Jack L. Melchor**, former president and treasurer of Melabs.

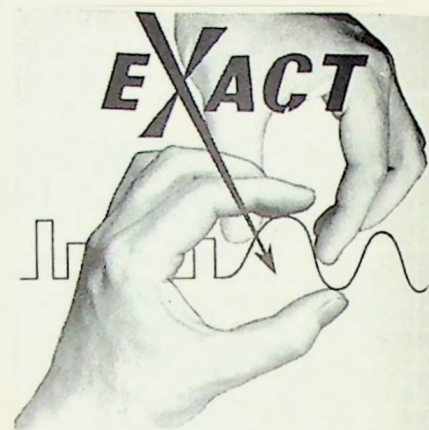
(Continued on page 20)



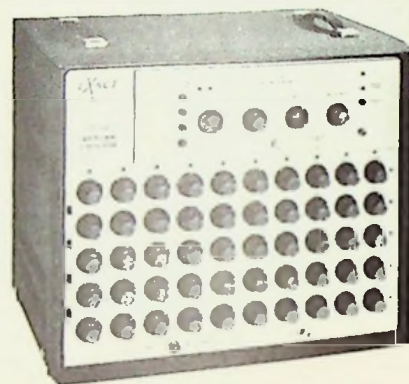
Mason

Melchor

YOUR TSI MAN represents



WAVEFORM GENERATION — ANALYSIS — CONTROL



Type 200 Waveform Synthesizer shown with Type E 100-Increment Generator Plug-In unit. Type C Variable Width and Type F Variable Slope Plug-Ins also available.

The Exact Waveform Synthesizer is a flexible tool for generation, simulation, control, study, and design of complex waveforms.

APPLICATIONS INCLUDE:

Missile and Space Telemetry Simulation • Digital Pattern and Word Generation • Stairstep Generation • Shock, Vibration, Environmental Testing • Correctional and Cancelling Signal Generation • Guidance System Generator • Systems Tolerance Check-Out, etc.

EXACT electronics, inc.

P. O. Box 234 • Hillsboro, Oregon

For information call:



TECH-SER, INC
Electronics Engineering Representatives

3540 Wilshire Blvd., Los Angeles DU 5-6051
640 Donohoe St., Palo Alto DA 5-3251
Box 6544, San Diego AC 2-1121
SEE US AT THE AEROSPACE ELECTRICAL SOCIETY
SHOW, PAN-PACIFIC AUDITORIUM, LOS ANGELES
NOV. 15-17 — BOOTH 500-501

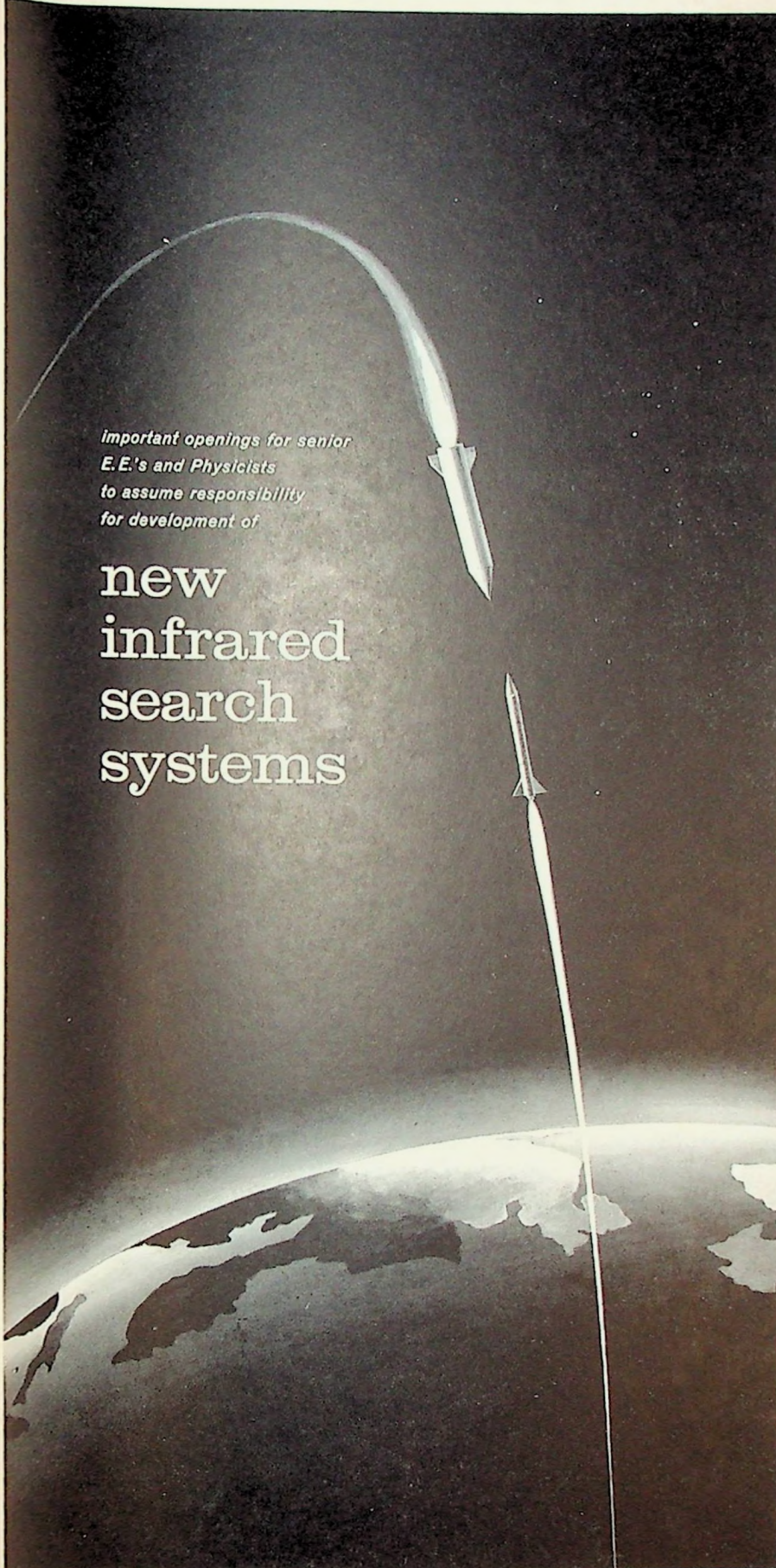
MORE BUSINESS

(WEMA) annual survey of the western electronic industry.

Employment in western companies has reached 215,000—24.6 per cent of the total U.S. electronic manufacturing employment. Electronic sales in the West this year should climb to \$2.8 billion—24.9 per cent of the national total.

The 215,000 employed by western firms represent a numerical gain of 25,000 over the total a year ago.

Of this number, 128,000 or approximately 60 per cent are now employed in the Greater Los Angeles area, while 45,500 or 21 per cent are in the San Francisco Bay area.



*important openings for senior
E.E.'s and Physicists
to assume responsibility
for development of*

new infrared search systems

Progress of the Hughes Infrared Systems and Guidance Heads Department reflects Hughes' overall growth. In the past ten years, employment has risen from under 2,000 to over 30,000 in semi-autonomous divisions concerned with Engineering, Research, Commercial Products, Ground Systems, Communications and Manufacturing. The infrared activity includes these typical projects:

1. Air-To-Air Missiles
2. AICBM
3. Air-To-Air Detection Search Sets
4. Satellite Detection & Identification
5. Infrared Range Measurement
6. Detection Cryogenics
7. Detector Application Physics
8. Optical Systems Design

These activities have created a number of new openings for graduate engineers and physicists with analytical and inventive abilities.

You are invited to investigate these openings if you have several years of applicable experience in infrared, optics or electronics, and can assume responsibility for systems analysis and preliminary design.

The importance of infrared development at Hughes is shown in substantial development contracts and in the fact that Hughes is investing its own funds in further exploration.

We invite your earliest inquiry. Wire collect, or airmail resume directly to:

Mr. William Craven, Manager,
Infrared Systems and
Guidance Heads Department,
Hughes Aerospace Engineering Division,
Florence and Teale Streets,
Culver City 11, California.

An equal opportunity employer.

**We promise that you will hear from us
within one week!**

Creating a new world with Electronics

HUGHES

HUGHES AIRCRAFT COMPANY
AEROSPACE DIVISIONS



Ryser

Smyrnos



Butterfield

Klein



Perry

Black


MORE SWINGS

ABOUT PEOPLE

Lawrence W. Ryser has been named manager of western-area communications engineering in the government marketing organization at Lenkurt Electric Co.; Gus J. Smyrnos has joined the engineering staff of Lynch Communication Systems Inc.; Eric D. Daniel has been appointed associate technical director of the recently formed Memorex Corporation; Alexander J. Dessler, Lockheed Missiles & Space Co. scientist, will spend four years in India assisting that nation in establishing a rocket and space program; Jack P. Davey has been assigned to the position of manager of western area sales for Link Division, General Precision, Inc.; Roy A. Anderson has been appointed assistant director of financial operations of the

Lockheed Missiles & Space Co.; Frank E. Butterfield is chief engineer of the electronic defense laboratories of Sylvania Electric Products Inc.; Richard J. Grant has joined the engineering staff of Lenkurt Electric Co.; John Gerling has been named director of marketing for Radiation at Stanford; Fluvio F. Garzoli has moved up to head the new product and modification engineering section of Lynch Communication Systems Inc.; Armand L. Klein has been appointed vice-president for marketing at Electro Magnetics Co.; Oliver W. Whitby has been appointed staff scientist for Stanford Research Institute; and Roy C. Amara will succeed Whitby as manager of the general systems department of the engineering sciences division; at Stewart Engineering Co., Bruno Kaiser has been assigned to the newly created post of manager of marketing, and Albert T. Isaacs has been promoted to

advanced development engineer; R. W. Thompson Associates has appointed George Grinnel instrument sales manager; William J. Perry became director of Sylvania's electronic defense laboratories in Mountain View; and Guy Black was named staff engineering specialist—development planning for Sylvania electronic systems; Max P. Farrer has joined Kane Engineering Laboratories as senior engineer; at Dalmo Victor, William F. Gates has been appointed vice-president of products and Robert Murie has joined the staff as chief engineer; Robert H. Hamilton has been named manager of the commercial division of the Dalcon Corp.; Robert C. Walton was named as head of the West Coast office of Radio Engineering Laboratories, San Jose; Sterling Call has been elected vice-president of Allegritech, Inc.



**AUDIO
DELAY LINES**

Type L894C with 5000 usec features phase linearity of $\pm 0.1\%$ in center frequency band, 100 usec rise time, 3 db point at 3.5 kc, cut-off at 7 kc. m-derived network design plus matching of individual sections and phase equalization insure precision performance. Many models in standard rack-type cabinets available. Write for data.

**COLUMBIA
TECHNICAL
CORPORATION**
Woodside 77, N.Y. - YE 2-0800
represented by
M. W. RIEDEL & CO.
136 E. Valley Blvd.
Alhambra, Calif.

ENGINEERS, SCIENTISTS, MANAGERS

Top Level Openings, B.S., M.S., PhD.

In Communications Systems, Servo Systems, Nucleonics, Microwave Antennas & Propagation, Telemetry, Klystrons, TWT, Instrumentation.

For Confidential Referrals on a No-Fee Basis Drop in or Send Resume


NORTHERN CALIFORNIA PERSONNEL AGENCY

(A Technical Agency)

407 California Ave., Palo Alto
DAvenport 6-7390


INFRARED

from the leader in the field



SERVOTHERM


thermistor bolometers
infrared detectors
industrial pyrometers



SERVOFRAX

infrared optics
(superior infrared optical materials and lenses)

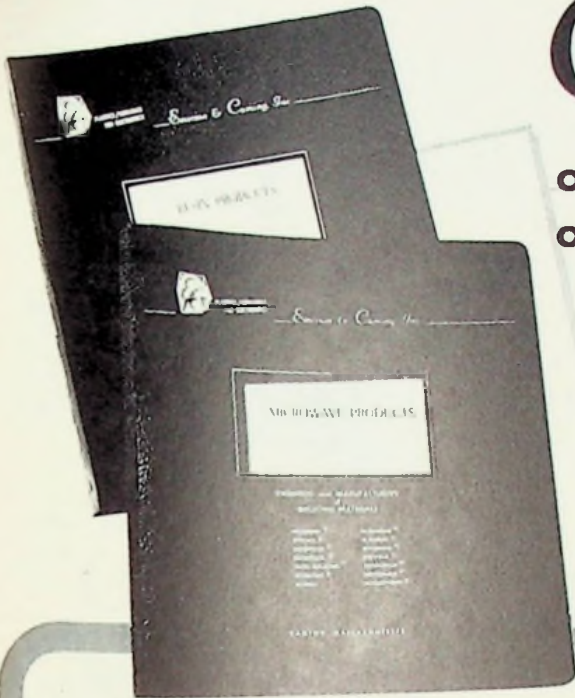
SERVO CORPORATION OF AMERICA
SAN FRANCISCO DISTRICT OFFICE
430 CAMBRIDGE - PALO ALTO, CALIF. - DAvenport 1-6856

 Tear off this page . . . it's your

EC REFERENCE LIST

of CATALOGS and BROCHURES on DIELECTRIC MATERIALS

Now . . . at your fingertips . . . technical information to help solve complex Electronic problems. Comprehensive catalogs to simple booklets, each was designed to fit your permanent files. If your problem is not covered in these brochures, let us know. An application or a new product can be developed. Consultation invited.



CONCISE GENERAL CATALOG: Briefly outlines all Emerson & Cuming Plastics/Ceramics including Casting Resins, Foams, Absorbers, Adhesives, Impregnants, Coatings, Ceramics and Reflectors. Eight pages, 4-color. File-folder style.

RESIN Products

COMPREHENSIVE CATALOG — complete specifications, instructions, price lists for: STYCAST®, ECCOBOND®, ECCOCERAM®, ECCOCOAT®, ECCOFOAM®, ECCOMOLD®, ECCOSEAL®, ECCOSIL®, ECCOSPHERES® and ECCOSTOCK®. Additional — Epoxy/Silicone Properties Chart (4-color) lists Physical Properties, Electrical Properties, Interesting Features, Major Uses. Reverse side charts Dielectric Materials.

STANDARD RESINS — technical data and price list on: STYCAST®, ECCOCOAT®, ECCOSIL®, ECCOBOND®, ECCOCERAM®, ECCOSEAL®.

ECCOSPHERES® — in addition to technical data, brochure covers Where They Are, How Are They Made, Properties, Uses. Potential Uses, Development, Price List.

MICROWAVE Products

COMPREHENSIVE CATALOG — technical bulletins on Standard Microwave Products: ECCOSORB®, ECCOFOAM®, ECCOSTOCK®, ECCOSHIELD® (Nuclear Radiation Shielding), ECCOSHIELD® (Radio Frequency Interference and Microwave Shielding), ECCO REFLECTOR® and ECCO LUNEBERG LENS, ECCOSPHERES® — Hollow Glass, Ceramic and Metal Microspheres. Also — 4-color chart on ECCOSORB® — Microwave Absorbers.

ECCOSHIELD® — describes design, performance, testing of R.F. Shielded Chambers, plus E/C service.

ECCOSHIELD® — describes microwave chambers. Better than 100 db performance at X band.

ECCOSORB® Anechoic Chambers — complete coverage and technical data; evolution of design, etc. Striking photos, diagrams, typical installations.

STANDARD MICROWAVE CHAMBERS CATALOG — covers ECCOSORB®, Anechoic Chambers, ECCOSORB®, R. F. Shielded Anechoic Chambers, ECCOSHIELD®, R. F. Shielded Chambers. supplement, price list

Please send us information on your particular applications. We'll send you the literature best suited to your needs. No cost. No obligation.



Plastics/Ceramics for Electronics

Emerson & Cuming, Inc.

Canton, Massachusetts • 604 W. 182nd St. (Gardena), L.A., California

23275 Montclair Court. Los Altos, California

NON-IRE LOCAL EVENTS

Oct. 21—Broadcast over KPFA (94.1 mc) and KPFB (89.3 mc) Berkeley, 4.00 to 4:30 p.m. Equipment report: "The new Norelco Continental line of tape recorders" by R. S. MacCollister.

Oct. 25-27—Joint West Coast and Electronics Division meeting of the **American Ceramic Society**. Subjects to be covered include: Electroluminescence, thermoelectric materials, ceramics in transistor packaging, injection moulding of ceramics, laminate structure, ferroelectrics, thermistors, and dielectric properties. Jack Tar Hotel, San Francisco. Registration: J. T. Putnam, Rm. 1034, Kaiser Center, Oakland 12, Calif.

Nov. 15—Santa Clara Subsection, **American Institute of Electrical Engineers**. "The Stanford University Two-Mile Linear Electron Accelerator" by Prof. E. L. Ginzton, Stanford University. 8.00 p.m., Physics Lecture Hall, Room 100, Stanford University.

Congress recently voted final authorization for the construction of Stanford University's \$114 million linear electron accelerator.

The project, sponsored by the Atomic



E. L. Ginzton

Energy Commission, is to be completed in a five year period and an additional year is to be utilized in preparing the accelerator for the research schedule to follow. Details can be found in **Grid** issues of January and March, 1961.

Dr. Ginzton has, together with Professor W. K. H. Panofsky, taken the responsibility for guiding the project's fortunes since its inception.

IRE MEETINGS SUMMARY

Oct. 16-17—**National Symposium on Engineering Writing and Speech**. Michigan State University, E. Lansing, Mich. J. D. Chapline, Philco Corp., 3900 Welsh Road, Willow Grove, Penna.

Oct. 19-20—**Symposium on Electronics Engineering & Education**. Greensboro Coliseum, Greensboro, North Carolina. Exhibits: H. G. Eidson, Jr., Dept. 8760, Charham Road Plant, Westinghouse Co., Winston-Salem, N.C. Program: Henry A. Voorhees, 1015 Wendover Circle, Winston-Salem, N.C.

Oct. 20—**Second N.Y. Conference on Electronic Reliability**. NYU College of Engineering, University Heights, New York, N.Y. Registration: M. A. Benanti, Molecular Electronics Co., New Rochelle, New York.

Oct. 23-25—**East Coast Conference on Aerospace & Navigational Electronics (ECCANE)**. Lord Baltimore Hotel, Baltimore, Md. W. C. Vergara, Adv. Res. Dept., Bendix Radio Div., Baltimore, Maryland.

Oct. 23-25—**URSI-IRE Fall Meeting**. University of Texas, Austin, Texas. Mrs. Helen E. Hart, USA Natl. Comm. URSI, 2101 Constitution Ave., NW, Washington, D.C.

Oct. 24-26—**8th Annual Meeting of PGNS Symposium on Aerospace Nuclear**

Propulsion. Hotel Riviera, Las Vegas, Nev. P. M. Uthe, Lawrence Radiation Lab., University of California, Box 808, Livermore, California.

Oct. 25-26—**Conference on Reliability Assurance Techniques for Semiconductor Specifications**. Dept. of Interior Auditorium, Washington, D.C. William H. von Alven, ARINC Research Corporation, 1700 K St., NW, Washington, D.C.

Oct. 26-27—**Instrumentation Facilities for Biomedical Research Symposium**. Sheraton Fontenelle Hotel, Omaha, Nebr. Harold G. Beenken, University of Nebraska, College of Medicine, 42 & Dewey Ave., Omaha, Nebraska.

Oct. 26-28—**1961 Electron Devices Meeting**. Sheraton Park Hotel, Washington, D.C. Dr. I. M. Ross, Bell Telephone Labs., Murray Hill, New Jersey.

Oct. 30-31—**Radio Fall Meeting**. Hotel Syracuse, Syracuse, N.Y. Virgil Graham, EIA Engineering Dept., 11 West 42 Street, New York 36, N.Y.

Nov. 6-8—**Special Technical Conference on Non-Linear Magnetics**. Statler-Hilton, Los Angeles, Calif. Exhibits: Philip Diamond, Perkin Engineering Co., 345 Kansas Street, El Segundo, Calif. Programs: Dr. Ted Bernstein, Space Technology Labs., P.O. Box 95001, Los Angeles 45, California.

(Continued on page 24)



DC NULL DETECTOR

MODEL 91-CA PRICE \$395

- HIGH VOLTAGE SENSITIVITY** 10 μ v full scale; 0.5 μ v smallest division
- HIGH INPUT IMPEDANCE** 10 megohms constant on all ranges
- HIGH POWER SENSITIVITY** 10⁻¹¹ watt full scale; .05 micro-micro-watt smallest division 15 x 10⁻¹¹ watt
- FAST METER RESPONSE** Approximately 1 second for full scale on most sensitive range

300 μ VOLTS 300 μ VOLTS 300 μ VOLTS
 μ VOLTS 300 μ VOLTS 300 μ VOLTS 300
 300 μ VOLTS 300 μ VOLTS 300 μ VOLTS
 μ VOLTS TS 300
 300 μ V TS 300
 μ VOLTS TS 300
 300 μ V TS 300
 μ VOLTS TS 300
 300 μ V TS 300
 μ VOLTS TS 300



THE LEADER

in R.F. Voltage Measurements at Low Level

from 10 KC to 600 MC

MODEL 91-CA MODEL 91-C
 300 microvolts to 3 volts Price: \$495
 1000 microvolts to 3 volts Price: \$395

ALSO MANUFACTURERS OF THE FOLLOWING INSTRUMENTS:



Boonton ELECTRONICS Corp.
 Morris Plains, N. J. • Jefferson 9-4210

Represented By:

O'HALLORAN ASSOCIATES
 ELECTRONICS ENGINEERS
 SALES REPRESENTATIVES

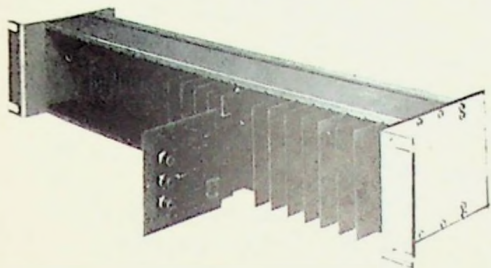
11636 Ventura Blvd., No. Hollywood, Calif.
NO. HOLLYWOOD • Triangle 7-0173
PALO ALTO • Davendport 6-1493

SAN DIEGO • Broadway 3-5500
PHOENIX & TUCSON • Enterprise 3200

DIGITAL MODULES

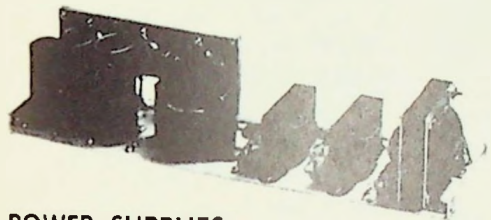
SERIES 500

and components for systems design



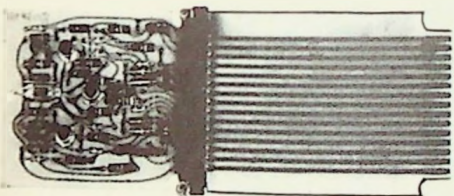
LOGIC BLOCK CHASSIS

Rugged, lightweight — for mounting modules in standard relay racks.



POWER SUPPLIES

Provide all required voltages — several current ratings — mount in logic block chassis.

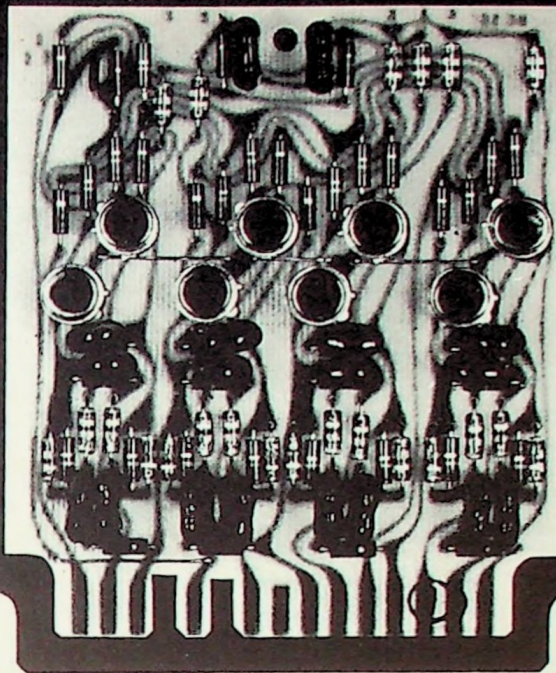
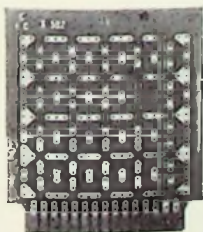


EXTENDER CARDS

For convenient checking and troubleshooting.

BLANK MODULES

With etched fingers and drilled pads — for breadboarding, special circuit fabrication.



MODULES

A complete family of plug-in building blocks — computer-grade components for reliability — wide operating temperature range.

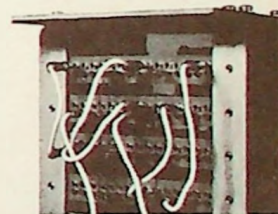


INSTRUMENT CHASSIS

Five sizes for mounting in standard cabinets — space for front panel and rear apron components, built-in power supplies.

PATCH CORD WIRING

Taper pin patch cords, connectors — for fast logic breadboarding, system production.



EXTRACTORS

Remove modules from chassis conveniently.

INDICATOR LAMPS

State indication on flip-flops and shift registers — provision for remote lamps.

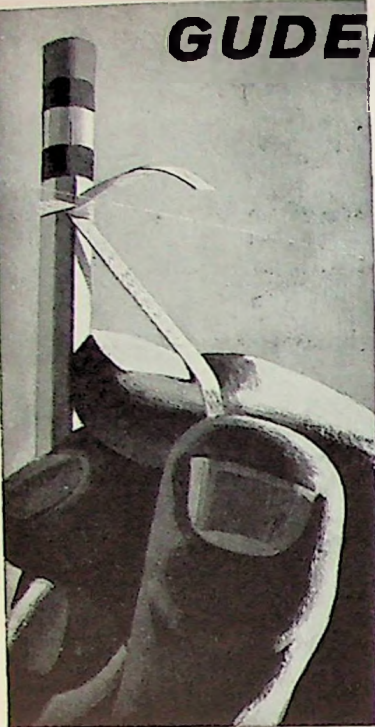


CONTROL EQUIPMENT CORPORATION

19 KEARNEY ROAD, NEEDHAM HEIGHTS 94, MASSACHUSETTS

Represented by **BEALL ELECTRONIC SALES** Palo Alto, Davenport 1-8501

GUDELACE®...



the lacing tape with a NON-SKID tread

You can't see it, but it's there! Gudelace is built to grip—Gudebrod fills flat braided nylon with just the right amount of wax to produce a non-skid surface. Gudelace construction means no slips—so no tight pulls to cause strangulation and cold flow.

But Gudelace is soft and flat—stress is distributed evenly over the full width of the tape. No worry about cut thru or harshness to injure insulation . . . or fingers.

Specify Gudelace for *real* economy—faster lacing with fewer rejects.

Write for free Data Book. It shows how Gudelace and other Gudebrod lacing materials fit your requirements.



GUDEBROD BROS. SILK CO., INC.

ELECTRONICS DIVISION
225 West 34th Street
New York 1, New York

WEST COAST OFFICE
2833 S. Olive Street
Los Angeles 7, Calif.

EXECUTIVE OFFICES
12 South 12th Street
Philadelphia 7, Pa.



**MOLDED
R.F.
CHOKES**

**LOW DISTRIBUTED CAPACITY
COLOR CODING
HERMETICALLY SEALED
TOLERANCES AS SPECIFIED
in accordance with
MIL-C-15305A, GRADE AND CLASS 7**

STOCKING DISTRIBUTORS

<p>Elmar Electronics Inc. 140 - 11th St. Oakland, Calif.</p> <p>Federated Purchaser Inc. 11275 W. Olympic Blvd. Los Angeles, Calif.</p>	<p>Radio Products Sales Inc. 1501 South Hill Los Angeles, Calif.</p> <p>Wesco Electronics 1715 E. Colorado Blvd. Pasadena, Calif.</p>
---	---

J. W. MILLER COMPANY • 5917 So. Main St., Los Angeles 3, Calif.

MORE EVENTS

Nov. 7-9—**7th Conference on Radio Interference Reduction and Electronic Compatibility.** Illinois Institute of Technology, Chicago, Ill. H. M. Sachs, Armour Research Foundation, 10 West 35 Street, Chicago, Illinois.

Nov. 8-11—**Professional Group on Ultrasonics Engineering** at the Fall Meeting of the Acoustical Society of America. Netherland Hilton Hotel, Cincinnati, Ohio. D. W. Martin, Baldwin Piano Co., 1801 Gilbert Ave., Cincinnati 2, Ohio.

Nov. 13-16—**7th Annual Conference on Magnetism and Magnetic Materials.** Hotel Westward Ho, Phoenix, Ariz. Exhibits: John W. Whitlock, 253 Waples Mill Road, Oakton, Va. Program: F. E. Luborsky, G. E. Research Lab., P.O. Box 1088, Schenectady, New York.

Nov. 14—**Symposium on Electronic Systems Reliability.** Linda Hall Library Auditorium, 5109 Cherry, Kansas City, Mo. Arthur Goldsmith, Wilcox Electric, Kansas City, Missouri.

Nov. 14-16—**Northeast Research and Engineering Meeting (NEREM).** Somerset Hotel and Commonwealth Armory, Boston, Mass. Exhibits: Stewart K. Gibson, Instr. of New England, 108 Greenwood Lane, Waltham 54, Mass. Program: F. K. Willenbrock, Pierce Hall, Harvard University, Cambridge 38, Mass.

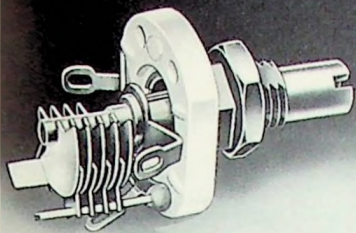
IRE PAPERS CALLS

Oct. 20—100-word abstract and 500-word summary with title of paper and author's name and address, all in triplicate for the 1962 IRE International Convention (New York, N.Y.; March 26-29). Send to: Dr. Donald B. Sinclair, chairman, 1962 Technical Program Committee, The Institute of Radio Engineers, Inc., 1 East 79th Street, New York 21, New York.

Nov. 1—300 to 500-word abstracts for the 1962 International Solid-State Circuits Conference (Philadelphia; February 14-16). Send to: Richard H. Baker, Room C-237, MIT Lincoln Laboratory, Lexington, Massachusetts.

Nov. 10—Three copies of complete preliminary draft for the Spring Joint Computer Conference (San Francisco; May 1-3, 1962). Send to: Richard I. Tanaka, Lockheed Missiles and Space Co. research branch, 3251 Hanover St., Palo Alto.

Nov. 15—100-word abstracts, 500-word summaries, and short biographies of the authors for the 1962 Winter Convention on Military Electronics (Los Angeles; February 7-9). Send to: Matthew E. Brady, Space Technology Laboratories, P.O. Box 95001, Los Angeles, Calif.

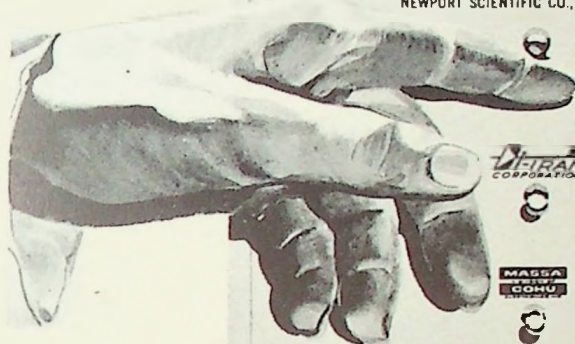


TURN TO QUALITY

Hammarlund variable air capacitors have earned an international reputation for quality and outstanding reliability. Now you can buy the best . . . for no more than you would pay for run-of-the-mill units.

For variable capacitors, from massive to miniature in standard or special design, specify Hammarlund. For Complete Details, Call or Write

R. W. THOMPSON ASSOC., INC.
1375 E. CARLINE WAY, PALO ALTO, CALIFORNIA
DAVENPORT 1 6887



Flick any switch for data from McCarthy

Applications data . . . price and delivery data . . . follow through on instrumentation problems—these helps are yours from a McCarthy sales engineer. He represents reliable, well-know manufacturers . . . knows their equipment, and carries many demonstrators. McCarthy provides service and calibration on all lines handled.

We issue technical bulletins throughout the year on recent developments in instrumentation. Write to receive "The Instrument Reporter."

Instruments to Control . . . Measure . . . Record



MCCARTHY ASSOCIATES, INC.
ENGINEERING SALES & SERVICE

Fluke (Calif. only); Hughes (No. Calif. only)

PASADENA:
1055 E. Walnut • MU 1-7411

MENLO PARK:
635 Oak Grove • DA 6-7937

SACRAMENTO-FOLSOM:
ENTERprise 1-0879 (no toll charge)

SAN DIEGO:
3460 Ingraham St. • BR 4-1100

TUCSON:
Fort Huachuca • ENTERprise 7250

PHOENIX:
Phone ENTERprise 7717



hp PROJECT ENGINEERS

New openings in a fast-growing division of Hewlett-Packard Company for two individuals to take full responsibility for developing circuits, selecting components, guiding layout and packaging design and directing electronic and mechanical engineers.

One position involves work in IF amplifiers, pulse generator circuitry, and phase locking systems for controlled RF signal sources. Requires 5-10 years experience in RF, IF and pulse circuit design. Transistor experience and knowledge of microwave components is desirable.

Other position involves work in VLF transistor amplifiers, oscillators and detectors. Requires 5-10 years experience. Knowledge of pulse circuitry desirable.

Excellent opportunity for personal advancement, top salaries, plus outstanding extra benefits program.

Send resume to:

HEWLETT-PACKARD COMPANY

1501 Page Mill Road
Palo Alto, California

An Equal Opportunity Employer



MEASUREMENTS ANSWERS FAST!

AT YOUR SERVICE, the world's largest direct telephone network! Local directory listings in all principal marketing areas — no long distance charges! Check the yellow pages — call us direct for fast, accurate product, purchasing, service information. Any questions? Use your phone. Talk to an ESI Applications Engineer at the factory as easily as calling across town or to the next office. If we are not listed in your exchange, call us collect —

CHERRY 6-3331, PORTLAND, OREGON.



Impedance Bridges and Accessories
Decade Voltage Dividers
Decade Resistors and Capacitors
ESIA Computers

Electro Scientific Industries
7524 S.W. MACADAM • PORTLAND 19, OREGON

formerly | **ELECTRO-MEASUREMENTS, INC.**

the section

MEMBERSHIP

Following are the names of IRE members who have recently entered our area, thereby becoming members of the San Francisco Section:

- | | |
|-----------------------|-------------------------|
| Dale M. Andersen | William K. Linvill |
| Thomas J. Anderson | Walter Loewenstern, Jr. |
| Joseph J. Apuzzi | Robert S. Lone |
| Richard F. Bader | Melvin E. Lowe |
| George R. Baker | Charles R. Mallory |
| W. Gerald Bانشاک | Robert H. Mann |
| Wayne K. Barlow | Robert C. Morrow |
| William A. Bares | Louis Martin |
| John H. Barton | Kenneth D. Marx |
| Clinton H. Bazzill | Addams S. McAllister |
| David S. Bennet | Louis B. McCaslin, Jr. |
| Chris C. Billat | Milton S. McDowell |
| Charles J. Bleakly | David A. McGibbon |
| James C. Bliss | Berhl J. McLendon |
| Ronald A. Blyth | Clor W. Merle |
| Forrest I. Boley | Wayne R. Merryman |
| Michael S. Bonny | John W. Metzler |
| Charles H. Bowen | Thomas P. Miles |
| Walter M. Broen | Gerald N. Minden |
| Harold A. Brinkman | Lee R. Moffitt |
| Arthur J. Brodersen | Imre Molnar |
| Henry K. Burbidge | Michael Montalbano |
| James J. Burns | Charles R. Moore |
| Kenneth L. Butler | Bernard G. Morais |
| Barney J. Byle | Robert Nagel |
| Hugh E. Chase | Calbert K. Nakata |
| Kenneth W. Y. Chin | Charles W. Near |
| John Chow | Glenn A. Nelson |
| Lawrence Colin | Nils J. Nilsson |
| Palmer M. Craig | Carl B. Olson |
| William Culshaw | Alden C. Packard |
| John E. Dannenberg | Arnold Paige |
| George C. Datum | Albert Y. K. Pang |
| Irvin F. Davis | Gerald P. Parsons |
| Thomas D. Davis | Abdul M. Patwari |
| Robert L. Deming | G. Mikhel Purnaiya |
| Ulric E. Dennis | Peter F. Paul |
| Clifford R. Ditzen | Robert M. Paul |
| Bruce A. Dolan | W. M. Peterschmidt |
| William P. Doolittle | Edward A. Polgar |
| Daniel G. Dow | Sava Price |
| Charles F. Edgemon | David L. Redo |
| David J. Edson | Albert J. Reichner |
| Charles E. Enderby | Richard E. Rice |
| Charles R. Erickson | Jerry L. Richman |
| Murray Falkowitz | Peter C. Ricupero |
| Joe E. Faver | Ralph E. Riegel |
| Keith M. Ferguson | Guy H. Rackey |
| Edwin A. Fink | Jerdan C. Rodgers |
| Robert N. Flanders | Robert G. Rogers |
| Andrew D. Fliss | Hugo Romander |
| Armin H. Frei | Peter L. Rose |
| Erwin P. Frech, Jr. | Albert B. Ruff |
| Dean K. Frederick | Dominic J. Ruggieri |
| H. Kent Frewing | Robert C. Saint |
| William F. Garmon | Walter J. Sawick |
| Sammie W. Gee | Robert R. Schell |
| Norman G. Glaeser | John P. Schwalbenberg |
| William D. Greenfield | Saul Schwartz |
| Henry C. Goodwin | William E. Seaman |
| Jay W. Griffin | Robert A. Sears |
| David W. Grimes | Charles V. Shaffer |
| Wayne M. Grove | Paul D. Shaft |
| Barrett E. Guisinger | John C. Shanahan |
| Ronald J. Guyote | William M. Shaver |
| Joseph Habra | Lawrence N. Shaw |
| James Arnold Hall | Robert C. Shelton |
| William O. Hamlin | John M. Skaug |
| Jack Hammond | Philip Smaller |
| George H. Hare | Ewart B. Smith |
| Anthony G. Hartman | Wellington E. Smith |
| Bruce M. Hassell | Gus J. Smyrnos |
| Donald G. Heberlein | Theodore W. Sneddon |
| Edward K. Heffner | Gwynne W. Spencer II |
| Kwai Wah Ho | Phillip S. Steinberg |
| James L. Hodel | Edward D. Staekert |
| R. Thomas Hood | Dale W. Swafford |
| Edward A. Huber | Wai Mun Syn |
| Kjell Huslid | Albert J. Talerico |

(Continued on page 28)



ANTISUBMARINE WARFARE SYSTEMS

Hydrophiles knowledgeable in the operational and systems aspects of ship-based and air-borne ASW systems will find opportunities to match their depth of experience and ability at Litton. The need is for engineers who know the field thoroughly and can assume primary responsibility in such areas as advanced systems design and integration, operations analysis, proposal preparation, and technical presentations. Write to Mr. S. L. Hirsch.

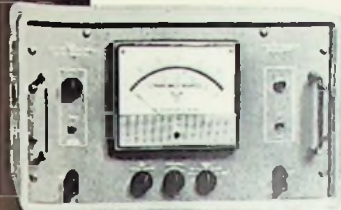
An Equal Opportunity Employer



LITTON SYSTEMS, INC. Data Systems Division
Canoga Park, California

NEW

- Direct Reading In Degrees.
- Accuracy 0.05° or 1%.



**PHASE
SHIFTERS**

Type 405 Series:

1 cps to 500 kc. Accuracy 0.25° relative, 1° absolute. No amplitude adjustment from 0.1v to 70v. Suitable for plotting phase curve.

Type 202: 20 cps to 500 kc. Accuracy 0.02° or 2%. 1° full scale sensitivity. Phase range 0-1, 0-2, 0-4, 0-12, 0-120 and 0-180 degrees.

Type 205A1-A2: 100 kc to 15 mc. Accuracy 0.05° or 1%. Sensitivity 0.04v.

Type 205B1-B2-B3: 15 mc to 1500 mc. Accuracy 0.05° or 1%. Sensitivity down to 20 microvolts with receiver.

AD-YU

ELECTRONICS LAB, INC.
249 TERHUNE AVENUE
PASSAIC, NEW JERSEY

**Watkins-Johnson
Company**

*Invites Expressions of
Interest from Creative*

SYSTEMS ENGINEERS

Immediate opening for a creative Systems Engineer with proven ability to generate new and sophisticated military systems. Must be able to present ideas effectively in well-written technical proposals and in oral briefings.

Mature experience in system development is sought:

Reconnaissance

Microwave Communications

Space Tracking

Telemetry

A record of patents and publications—classified or unclassified—is desirable.

To discuss this opening in confidence, contact

JOSEPH G. RUBENSON
Manager, Systems Division

**Watkins-Johnson
Company**

3333 Hillview Avenue
Palo Alto, California
DAvenport 6-8830

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

**BALLANTINE True RMS VTVM
model 350**



**Measures
wide
range of
waveforms
with**

1/4% ACCURACY

For highly accurate voltage measurements, the uncertainty introduced by waveform distortion limits the use of average and peak-responding instruments. The Model 350 is a 0.25% accurate, true rms-responding instrument designed to overcome this limitation. It provides the engineer with a rugged, reliable and easy-to-use laboratory or production line instrument. It will measure a periodic waveform in which the ratio of peak voltage to rms is not over 2.

The method of measurement with the Model 350 is similar to balancing a bridge: four knobs are set for minimum indication and the unknown voltage is read directly from a 4 to 5 digit NIXIE® in-line readout. The precision exceeds the stated accuracy by 5 to 10 times. Price: \$720.

SPECIFICATIONS

Voltage Range 0.1 V to 1199.9 V	Frequency Range 50 cps to 20 kc
Accuracy ¼%, 100 cps to 10 kc, 0.1 V to 300 V; ½% outside these limits	Max Crest Factor 2
	Input Impedance 2 MΩ shunted by 15 pF to 45 pF

Write for brochure giving many more details

— Since 1932 —



BALLANTINE LABORATORIES INC.

Boonton, New Jersey

CHECK WITH BALLANTINE FIRST FOR LABORATORY AC VACUUM TUBE VOLTMETERS, REGARDLESS OF YOUR REQUIREMENTS FOR AMPLITUDE, FREQUENCY, OR WAVEFORM WE HAVE A LARGE LINE, WITH ADDITIONS EACH YEAR. ALSO AC DC AND DC AC INVERTERS, CALIBRATORS, CALIBRATED WIDE BAND AF AMPLIFIER, DIRECT-READING CAPACITANCE METER, OTHER ACCESSORIES. ASK ABOUT OUR LABORATORY VOLTAGE STANDARDS TO 1,000 MC.

Represented by Carl A. Stone Associates, 825 North San Antonio Road—Palo Alto, California

ELECTRONIC ENGINEERS

&

SCIENTISTS

Drop in for a free

ABACUS

and learn about the opportunities for career advancement with our many client firms on both the West and East Coast.

(Companies pay the fee, of course.)

Professional & Technical Recruiting Associates

(A Division of the Permanent Employment Agency)

825 San Antonio Rd. Palo Alto
DA 6-0744

MORE MEMBERSHIP

Robert S. Jacobson
H. Raymond Jacobus
Klaus H. Jaensch
Paul G. Jeffries
Alfred C. Johnson
C. R. Joller
Clifford F. Jungling
Fred W. Kaaz
Richard R. Kelley
Thomas I. Kirkpatrick
Allen Klingler
Conrad R. Knopf
Arthur J. Koelling, Jr.
Kazu Konakawa
Frank A. Kottmeir
Ronald C. Kunzelman
Lloyd M. Lambert, Jr.
Donald M. Lange
John R. Lauritzen, Jr.
Peter O. Lauritzen
Chung T. Lee
Henry L. Leonard
Dr. Daniel Levine
Ronald B. Lias
Michael I. Lichtenstein
Milton S. Lindner

Richard D. Thornton
Donald Tom
Robert P. Townley
Frank F. C. Tung
David P. Turner
William L. Tyler
Berdett P. Underwood
Hosein M. Vakili
David G. Vandermolen
Barry J. Weiner
Royal Weller
James R. Wheeler
Tore Wesel-Berg
Walter L. Whipple
Milton G. Whitten
Charles M. Williams
Stanley R. Williamson
Dennis L. Wilson
Richard H. Winkler
Gilbert L. Wolf
Edward K. Wong
John H. Wood
Edmund T. Wright, Jr.
Gary W. Yee
Neal F. Young II
Gregory L. Yung

Following are the names of individuals who have been elected to current membership:

Allen I. Agena
Gerald L. Ainsworth
Everett E. Alexander
Otto H. Altenmueller
Richard B. Asher
Ronald C. Barber
Edward D. Barry
Henry J. Beech
Astrid Bergel
Karl Arnold Belser

Jack C. Heffington
Robert Lee Hogg
Howard Hong
Kurt Hubner
Joseph D. Hurley
Marshall R. Johnson
Lester G. Jones, Jr.
Elmer A. Joseph, Jr.
Donald K. Kowamoto
Arthur R. Kraemer

Norman W. Berger
Arthur A. Bergman
Oliver G. Bjerke
Robert D. Blaine
Kenneth B. Bley
Ross L. Blunt
Walter M. Bolinger
Richard L. Brady
David R. Broker
William L. Breed
Alvo L. Carbonette
Kenneth A. Case
Sylvia S. Cass
Conner F. Chaney
Arthur N. Clark
Robert R. Cotant
Robert J. Cowart
John F. Craven, Jr.
Alon J. Dawes
George D. Dill
Milton R. Dunning
Alan J. Dworsky
James E. Eichenberg
Charles Elkind
Brian J. Elliott
Norman S. Elliott, Jr.
Norman N. Epstein
William C. Estler
Edward M. Evans
James B. Farison
Michael Foisel
Allen S. Foster
Kenneth R. Fransehn
Barry I. Gamble
Chester L. Gazin
Dennis C. Glover
Royal E. Grover
Donald C. Gudis
Sherred L. Guille
Someshwar C. Gupta
Charles F. Hahn
Hubert R. Halkin
Richard D. Harris
Ross R. Hatch
Albert B. Hawkins
J. Christopher Hayes
Thomas W. Hefferon

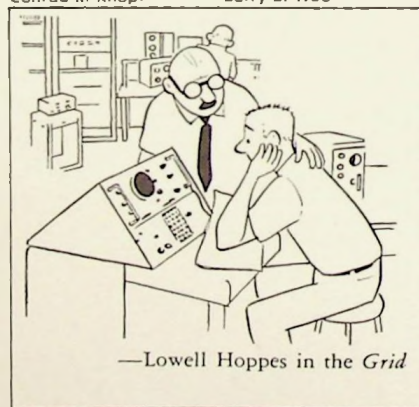
Richard E. Kutz
Robert V. LaRocca
Gustavo E. Laska
Namon K. Little, Jr.
William I. Loitz
Ronald E. Martz
Paul W. Meyer
Brian G. Middleditch
Patrick E. Moore
Charles E. Morgan
William R. Murray
Rudolph H. Nevarez
Alfred J. Paolucci
John F. Paul
William M. Penney
W. M. Peterschmidt
Clayton F. Rasmussen
Robert H. Rositzke
Walter E. Rudd
Leo K. Russell
Phil M. Sachs
Joseph S. Sanders
Said Sapir
Thomas E. Scatchard
Richard J. Serviss
Elden K. Shaw
Marvin A. Skeath
Philip B. Spohn
Edwin H. Stewart, Jr.
Gary P. Strong
Frank A. Thatcher
Per Thaulow
James D. Thompson
Richard M. Toda
Julio L. Torres
Wei Kong Tsang
Andrew V. Tynne
Robert W. Ulrickson
Fred S. Underwood
Jay A. Vander Tuin
Duane Walker
Robert M. Ward
Robert F. Werner
James B. Wheeler
Charles K. Whittaker
Robert A. Young, Jr.
John A. Watson

Following are the names of members who have recently been transferred to a higher grade of membership as noted:

MEMBER

Paul J. Ahern
Bruce Bartholomew
John R. Duffy
W. Randall Fowkes
Harry T. Hearn
Darrell J. Iverson
John E. Kallander
Leo Kanner
Yates A. Keir
Donald F. Kidder
Conrad R. Knopf

Frederick R. Nelson
Bradford L. Peery
Dallas W. Pruett
George A. Sarnack
Armenak A. Shahbazian
George R. Sinfield
Dan C. Smith
Avram C. Soudack
Robert P. Townley
Robert F. Tusting
Barry B. Woo



—Lowell Hoppes in the Grid

"This isn't really too tough a problem, son! Just get a little more book on your ball and you'll make the bowling team easily!"

INDEX TO ADVERTISERS

Ad-Yu Electronics Lab., Inc.	27
Arnold Engineering Co.	3
Auto Data	30
Ballantine Laboratories	27
Beattie-Coleman	30
Belsco	29
Box 907, Palo Alto, DA 1-8501	
Burroughs Corp.	30
Columbia Technical Corp.	20
Components Sales California, Inc.	29
Palo Alto; DA 6-5317	
Costello & Co.	29
535 Middlefield, Palo Alto;	
DA 1-3745	
Control Equipment Corporation	23
du Pont Co. (Mylar Industrial)	15
Electro Scientific Industries	26
Emerson & Cuming, Inc.	21
General Radio Co.	32
Gertsch Products	31
Gudebrod Bros. Silk Co., Inc.	24
Hammarlund Mfg. Co.	25
Hewlett-Packard Co.	17, 25
Hill Co., J. T.	29
1682 Laurel, San Carlos;	
LY 3-7693	
Hughes Aircraft Company	19
Kay Electric Company	11
Liton Industries	26
Lockheed Missiles & Space Co.	13
Miller Company, J. W.	24
McCarthy Associates	25, 29
635 Oak Grove, Menlo Park;	
DA 6-7937	
Neely Enterprises	7, 29
501 Laurel, San Carlos;	
LY 1-2626; 1317 15th St.,	
Sacramento; GL 2-8901	
Northern California Personnel	20
O'Halloran & Associates	22, 29
825 San Antonio Road, Palo	
Alto; DA 6-1493	
Premmco, Inc.	29
2406 Lincoln, Alameda;	
LA 3-9495	
Professional & Technical	
Recruiting Associates	28
Rupp Co., V. T.	29
1182 Los Altos Ave.,	
Los Altos; WH 8-1483	
Servo Corp. of America	20
Snitzer Co., T. Louis	29
510 So. Mathilda Ave.,	
Sunnyvale; RE 6-6733	
Stone Associates, Jay	29
349 First Ave., Los Altos;	
WH 8-4563	
Straube Associates	29
1943 University Ave.,	
Palo Alto; DA 3-2476	
Tech-Ser, Inc.	18
Tektronix Inc.	4
Thompson & Associates, R. W.	29
4135 El Camino Way,	
Palo Alto; DA 1-6383	
Tung-Sol Electric Inc.	16
Varian Associates	2
Watkins-Johnson, Inc.	27
Western Gold & Platinum Co.	30

MANUFACTURERS/REP REFERENCE:
see opposite page

MANUFACTURERS INDEX

Manufacturer	Representative	Manufacturer	Representative
Accurate Instrument Co.....	Jay Stone & Assoc.	Hewlett-Packard Company.....	Neely Enterprises
Ace Engineering & Mch. Co.....	R. W. Thompson Assoc.	Huggins Labs., Inc.....	O'Halloran Assoc.
Aircom, Inc.....	Components Sales California, Inc.	Hughes Aircraft Co., Indus. Systems.....	McCarthy Assoc.
Airflow Company.....	Premmco, Inc.	Hughes Vacuum Tube Products Division.....	Belsco
Allen Electronic Corp.....	Straube Associates	Keithley Instruments.....	T. Louis Snitzer Co.
American Optical Co., Instrument Div.....	J. T. Hill Co.	Kepco, Inc.....	V. T. Rupp Co.
American Standard, Norwood Unit.....	J. T. Hill Co.	L.B.S. Network Laboratories.....	R. W. Thompson Assoc.
Analab Instrument Corp.....	V. T. Rupp Co.	L.E.E. Incorporated.....	J. T. Hill Co.
Antenna Systems.....	T. Louis Snitzer Co.	Laboratory for Electronics.....	O'Halloran Assoc.
Antlab, Inc.....	Jay Stone & Assoc.	Lavoie Laboratories, Inc.....	McCarthy Associates
Arnoux Corporation.....	Straube Associates	Lindsay Structures.....	Premmco, Inc.
Astra Technical Instrument Corp.....	Straube Associates	Magnetic Amplifiers (Sieglar).....	O'Halloran Assoc.
Baldwin-Lima-Hamilton Corp.....	Neely Enterprises	Massa Div., Cohu Electronics.....	McCarthy Assoc.
Barnes Engineering Company.....	Costello & Co.	McMillan Laboratory, Inc.....	R. W. Thompson Assoc.
Beckman/Berkeley Division.....	V. T. Rupp Co.	Melcor Electronics Corp.....	Components Sales Calif.
Behlman Engineering Co.....	T. Louis Snitzer Co.	Menlo Park Engineering.....	O'Halloran Assoc.
Bogart Microwave.....	Jay Stone & Assoc.	Metron Instrument Co.....	Components Sales California
Bomac Laboratories, Inc.....	Neely Enterprises	Microwave Associates.....	T. Louis Snitzer Co.
Boonton Electronics Corp.....	O'Halloran Assoc.	Microwave Dynamics Corp.....	Jay Stone & Assoc.
Boonton Radio Corp.....	Neely Enterprises	Microwave Electronics Corp.....	Jay Stone & Assoc.
Bradley Semiconductor Corporation.....	Costello & Co.	Millitest Corp.....	Components Sales California, Inc.
Carad Corporation.....	McCarthy Associates	Millivac Instruments, Inc.....	McCarthy Associates
Caswell Electronics Corp.....	R. W. Thompson Assoc.	Monitor Products Company Inc.....	Straube Associates
Communications Control Corp.....	T. Louis Snitzer Co.	F. L. Moseley Co.....	Neely Enterprises
Components Corp.....	Straube Associates	Narda Microwave Corp.....	O'Halloran Assoc.
Components Engineering & Mfg. Co.....	Premmco	Natl. Instr. Laboratories, Inc.....	R. W. Thompson Assoc.
Computer Instruments Corp.....	Components Sales Calif.	Nucor, Central Electronics Div.....	R. W. Thompson
Control Equipment Corporation.....	Belsco	Optimized Devices.....	O'Halloran Associates
Control Switch Div., Controls Co. of America.....	Belsco	Pacific Electro Magnetics Co.....	T. Louis Snitzer Co.
Dage Div., Thompson Ramo Wooldridge.....	Neely Ent.	Polarad Electronics.....	T. Louis Snitzer Co.
Datafilter Corp.....	Jay Stone & Assoc.	Power Sources, Inc.....	J. T. Hill Co.
Digitronics Corp.....	Components Sales California, Inc.	Precision Mechanisms Corp.....	Components Sales Calif.
Diodes Inc.....	Straube Associates	Quantech Labs.....	Jay Stone & Associates
DuMont Labs, Tubes & Instruments.....	J. T. Hill Co.	Radar Design Corporation.....	Belsco
Dymec, Div. Hewlett-Packard Co.....	Neely Ent.	Radiation at Stanford.....	O'Halloran Assoc.
Dynamics Instrumentation Co.....	J. T. Hill Co.	Radiation Instr. Devel. Labs., Inc.....	R. W. Thompson
E-H Research Laboratories, Inc.....	V. T. Rupp Co.	Rixon Electronics, Inc.....	Costello & Co.
Edgerton, Germeshausen & Grier, Inc.....	J. T. Hill Co.	Sanborn Company.....	Neely Enterprises
Electromagnetics, Inc.....	O'Halloran Associates	Scientific-Atlanta, Inc.....	J. T. Hill Co.
Electronic Measurements Co.....	O'Halloran Assoc.	Sensitive Research Instrument.....	McCarthy Assoc.
Emcor, Ingersoll Products Div.....	Neely Enterprises	Sierra Electronic Corp.....	T. Louis Snitzer Co.
Erie-Pacific.....	O'Halloran Assoc.	Sorensen & Co., Inc.....	McCarthy Assoc.
John Fluke Mfg. Co., Inc.....	McCarthy Assoc.	Sperry Microwave Electronics Co.....	J. T. Hill Co.
Fabri-Tek, Inc.....	Costello & Co.	Spruce Pine Mica Co.....	Straube Associates
Franklin Electronics, Inc.....	T. Louis Snitzer Co.	Stoddart Aircraft Radio Co.....	R. W. Thompson Assoc.
Frequency Standards, Inc.....	McCarthy Associates	Technibilt Corp.....	J. T. Hill Co.
General Communication.....	T. Louis Snitzer Co.	Telemetrics Inc.....	Straube Associates
Genesys.....	O'Halloran Assoc.	Tel-Instrument Electronics.....	O'Halloran Associates
Glass-Tite Industries.....	Jay Stone & Assoc.	Telonic Industries.....	T. Louis Snitzer Co.
Good All Capacitors.....	Straube Associates	Trygon Electronics, Inc.....	T. Louis Snitzer Co.
Hamner Electronics.....	McCarthy Associates	Valor Instruments, Inc.....	Belsco
Hammarlund Mfg. Co.....	R. W. Thompson Assoc., Inc.	Varian Associates.....	Neely Enterprises
Hathaway Denver.....	J. T. Hill Co.	Wiltron Co.....	O'Halloran Assoc.
Heli-Coil Corp.....	Premmco, Inc.	Wincharger Corp. (Zenith Radio Corp.).....	Premmco, Inc.

← For addresses and telephone numbers of reps listed, see opposite page

WESGO

WESGO—a local manufacturer offering these premium quality products to the electronics industry:

High alumina ceramics—three vacuum-tight aluminas with Al_2O_3 contents from 95% to 99.5% and one virtually pure porous body (99.85% minimum Al_2O_3). These strong, hard, abrasion resistant ceramics offer exceptional chemical inertness, high thermal conductivity, superior electrical properties, even at extremely high temperatures. Available in sizes and shapes to meet your individual specifications.

Ultra pure low vapor pressure brazing alloys—a complete range of melting points and wetting characteristics, available in wire, ribbon, sheet, powder, preforms and the new Wesgo Flexibraise, for versatility and economy.

"VX" Super Refractory—Wesgo ceramics with uniquely high resistance to thermal shock, ideal for use in furnace brazing, available in boats, slabs, special brazing fixtures.

Silver metallizing paint & flake—electrically conductive coating for ceramics, glass, plastics, mica, titanites, paper and other materials.

Precious metals—high purity platinum, gold, silver and alloys of these metals in many forms to meet your need.

Wesgo—long the standard of the vacuum tube industry.

a growing supplier of semiconductor components.

WESTERN GOLD & PLATINUM COMPANY

Located to serve you • Dept. G-10 525 Harbor Blvd. • Belmont, Calif. • LYtel 3-3121



6752

new product capsule advertisements



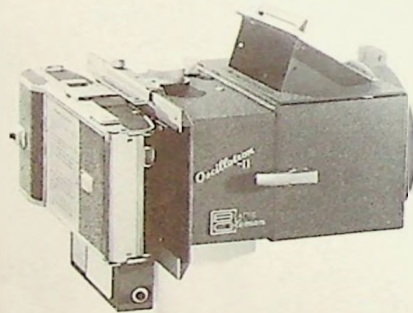
COMBINATION DIGITAL VOLTMETER

The new Model 2000 digital voltmeter, combines all the important features of a quality digital voltmeter, programmable comparator, and a null indicator in a single package. The Model 2000, in addition to serving as a general-purpose digital voltmeter, offers facilities for programmable medium-speed precision testing.

Outstanding features of the Model 2000 include 1/100 per cent accuracy, 5-digit resolution (with front-panel meter), wide-view readout, and transistorized circuitry with no stepping switches or conventional relays. The instrument is compatible with several other products in the Auto Data line for testing-system combinations, especially in the GO/NO-GO area.

Auto Data, San Diego, California

Represented by Edsco, 485 Ramona Street, Palo Alto, California.



OSCILLOSCOPE CAMERA

A completely new camera system for oscilloscope photography permits the operator to select any object-to-image ratio from 1:1 through 1:0.5 infinitely without extra lenses or other parts. Designed to fit any 5-in. scope, the Mark II Oscillatron provides external rack-and-pinion focusing, direct-viewing port, electric shutter, shutter-open indicator light, rotating back for vertical or horizontal pictures, Polaroid dark slide, and either Polaroid roll-film back or 4x5 cut-film back, with ground glass for focusing. A fixed-focus data recorder is optional.

Beattie-Coleman, Inc., 1000 N. Olive St., Anaheim, California.

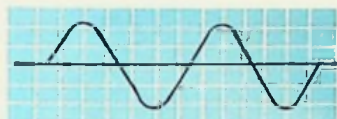


TRANSISTORIZED COUNTER MODULE

A new 1-megacycle transistorized Beam-X counter module, the DC-116, features a minimum of active components since it utilizes only 3 silicon transistors, 1 shielded Beam-X switch, and a long-life Nixie indicator tube. The latter provides a direct in-line readout. The unit also features 10 electrical outputs for such circuit functions as presetting and operating printers.

The new 1-mc unit is physically and electrically compatible with the 100-kc type DC-114 counter previously announced. Therefore, a complete 1-mc transistorized counting system can be designed with modular flexibility and optimum spacing. The DC-116 is priced at \$125.00 in small quantities.

Burroughs Corporation, Box 1226, Plainfield, New Jersey.



GERTSCH NULL INDICATOR

—A Phase-Sensitive, Fully Transistorized Unit.
 Combined With Any Gertsch RatioTran,[®] It Forms
 An AC Ratio Bridge. These Features Are Standard:

10 μ v sensitivity—excellent resolution for bridge circuit operation. Sensitivity ranges: 10 μ v, 100 μ v, 1000 μ v.

Quadrature rejection—provided by phase-sensitive detector.

Zero-center meter gives a "sense" as to above or below null. Frequency range: 50-10,000 cps. Unit can be used as an amplifier.

Available in two models: NI-2, battery operated, portable carrying case—NI-3, a 3 $\frac{1}{2}$ " high rack mounted version, with built in AC power supply. Request Bulletin NI.

companion instrument:

GERTSCH RATIOBRIDGE

—offers high accuracy and high input impedance at 10 kc and up

Combined in the one instrument is a precision ratio transformer and an electrostatically shielded bridge transformer. Either can be used independently. This instrument when teamed with the NI-2 or NI-3, forms a complete AC ratio bridge.

Accuracy of the RatioBridge is as good as .0025%. Input impedance is 300K ohms at 10 kc. Ratios up to 1.1111. Unit provides switching transient suppression, plus in-line switching and readout. *Bulletin RB-105.*

Gertsch

GERTSCH PRODUCTS, Inc.

3211 S. La Cienega Blvd., Los Angeles 16, Calif. • Upton 0-2761 • Vermont 9-2201
 Northern California Office: 794 West Olive, Sunnyvale, California, REgent 6-7031

Variac AUTOTRANSFORMERS

To Control... VOLTAGE • SPEED • LIGHT
HEAT and POWER

The first commercial continuously-adjustable autotransformer, providing smoothly-variable ac output voltages from zero to 15% above line voltage.



Over 100
Different Models

POWER RATINGS
from 300 va to 54 kva

- Single units or ganged assemblies, either cased or uncased
- Portable types with or without meters
- All units with or without ball bearings
- Manually operated or motor driven
- Line frequencies from 25 to 1200 cycles; line voltages from 120 to 480
- Exclusive DURATRAK (U. S. Pat. 2,949,592) brush-track coating for extra-long life, less maintenance and ability to withstand temporary overloads to 1,000%

WRITE FOR THE VARIAC CATALOG FOR COMPLETE DATA

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

MILWAUKEE WASHINGTON D. C. SAN FRANCISCO LOS ANGELES IN CANADA