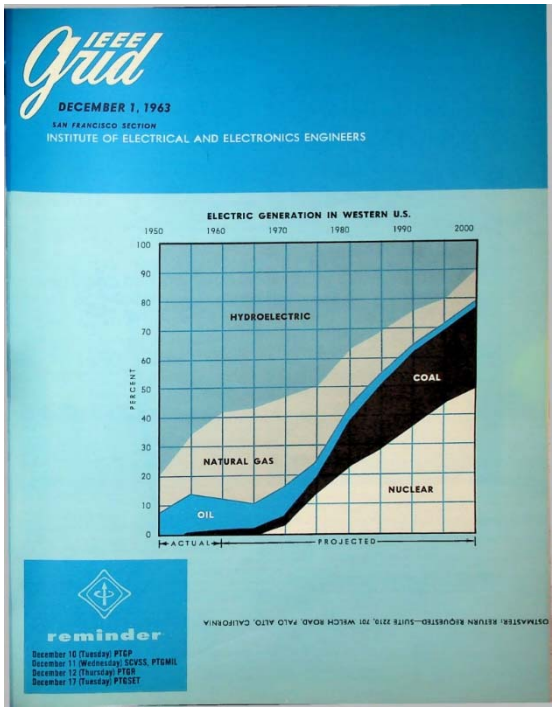
# EDITOR'S PROFILE of this issue

*from a historical perspective …*

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

December, 1963:

Cover: The graph shows the distribution of fuels for generation of electricity expected for the USA West. More about these predictions on page 5.

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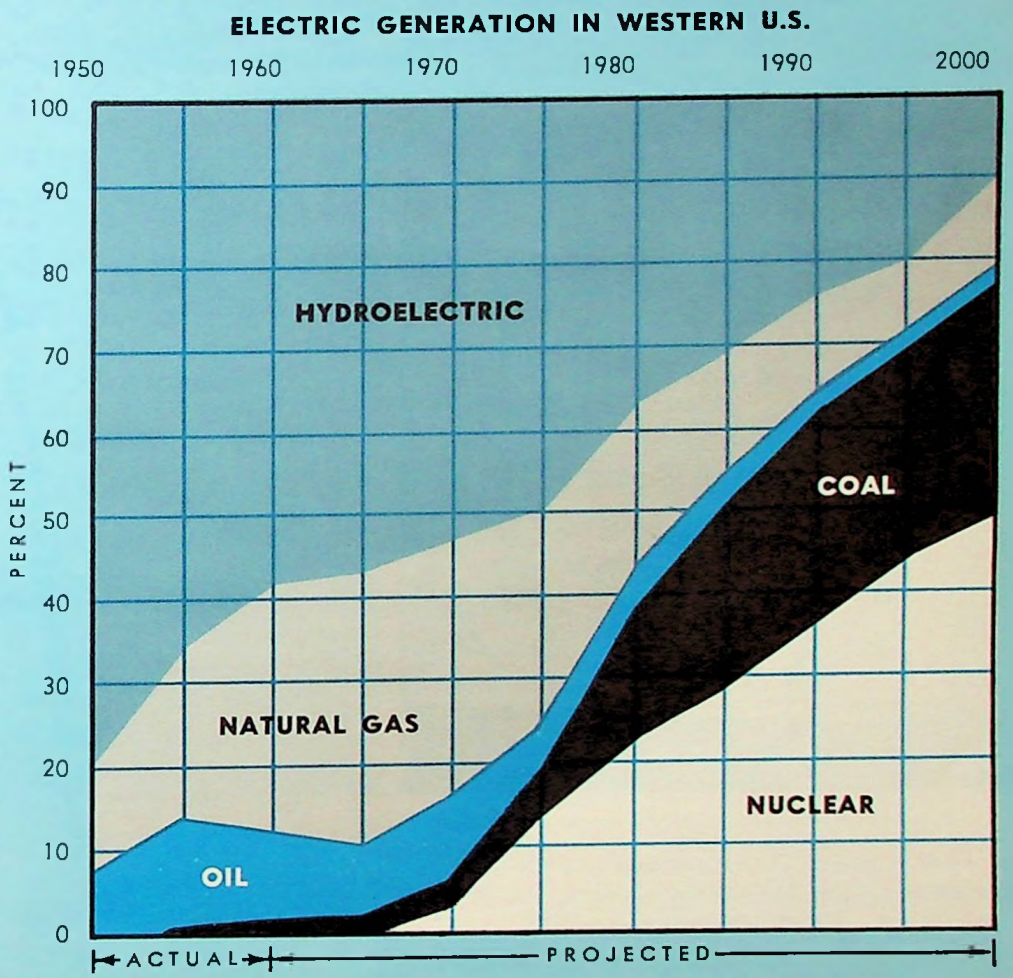
At time of scanning, the bound volumes are held by Paul Wesling. July, 2021 Contact p.wesling@ieee.org

IEEE Grid

DECEMBER 1, 1963

SAN FRANCISCO SECTION

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

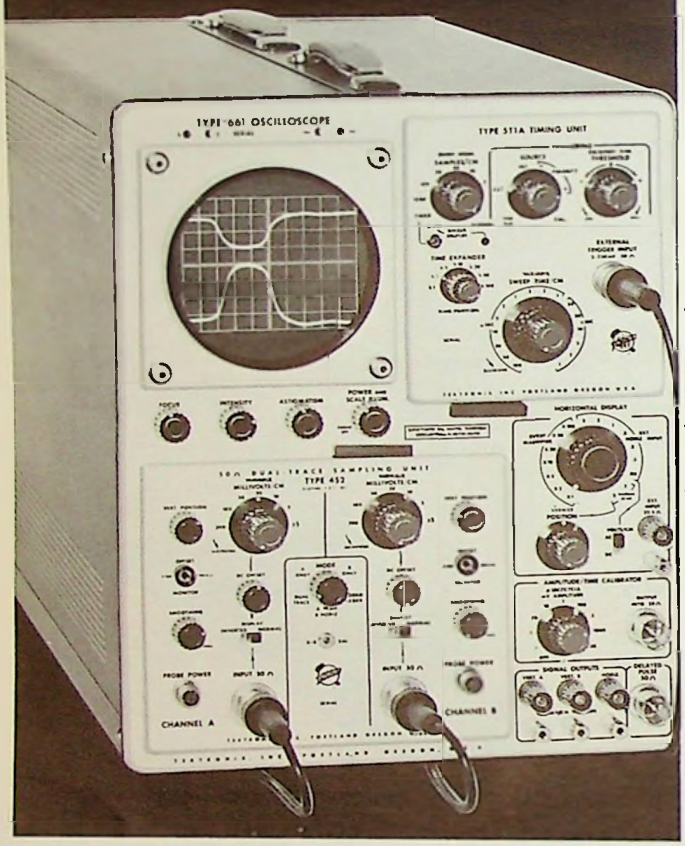



## reminder

December 10 (Tuesday) PTGP
December 11 (Wednesday) SCVSS, PTGMIL
December 12 (Thursday) PTGR
December 17 (Tuesday) PTGSET

POSTMASTER: RETURN REQUESTED—SUITE 2210, 701 WELCH ROAD, PALO ALTO, CALIFORNIA

# HIGH-RESOLUTION SAMPLING SYSTEM

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**RESOLVES** most tunnel diode switching times. (Only diodes with better than 3 ma/pf are faster.)

**RESOLVES** stored charge in switching diodes to the 0.01 picocoulomb/milliampere region (generally limited by diode capacity and turn-on capability).

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. . . reduce time jitter and amplitude noise, if needed, on the more sensitive vertical ranges and faster sweep rates by means of a smoothing control.

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. . . show lissajous patterns in addition to single and dual-trace displays and signals added algebraically.

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Type 4S3—0.35-nsec risetime . . . . . $1600
(includes two direct-sampling probes)

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|---|---|
| Range: | ± 15 mv to ± 1500 v full scale |
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| | |
|---|---|
| Ranges: | ± 1.5 μa to ± 150 ma full scale |
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**OHMMETER**

| | |
|---|---|
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| Accuracy: | ± 5% of reading at mid-scale |

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| Voltage gain: | 100 maximum |
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| AC rejection: | 3 db at ½ cps; approx. 66 db at 50 cps and higher frequencies for signals less than 1600 v peak or 30 times full scale, whichever is smaller |
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| | |
|---|---|
| Ranges: | 0.5 v to 300 v full scale, 7 ranges |
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| Meter: | calibrated in rms volts for sine wave input |

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| | |
|---|---|
| Maximum input: | dc-100 v on 15, 50 and 150 mv ranges; 500 v on 0.5 to 15 v ranges; 1600 v on higher ranges; ac-100 times full scale or 450 v peak, whichever is less |
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*contents*



*cover*

The changing relationship of fuels for electric generation in the West shows the future dominance of coal and nuclear sources, as demonstrated on our cover and in the talk by James Moulton, vice president and executive engineer, Pacific Gas & Electric Co., at the November 12 organizational meeting of the San Francisco Chapter of the PTG on Power. For more on Moulton's talk, see page 5.

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UNRETOUCHED PHOTO OF OUTPUT PULSE, MODEL L2005
(Horizontal scale: 5 μsec/cm)

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| L0502 | 5 mc | 2 mc | 80 db | 0.5 μsec |
| L1003 | 10 mc | 3 mc | 80 db | 0.3 μsec |
| L1505 | 15 mc | 5 mc | 80 db | 0.2 μsec |
| L2005 | 20 mc | 5 mc | 80 db | 0.2 μsec |
| L3002 | 30 mc | 2 mc | 90 db | 0.5 μsec |
| L3010 | 30 mc | 10 mc | 80 db | 0.1 μsec |
| L6002 | 60 mc | 2 mc | 90 db | 0.5 μsec |
| L6010 | 60 mc | 10 mc | 80 db | 0.1 μsec |
| L6020 | 60 mc | 20 mc | 80 db | 0.05 μsec |
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*meeting ahead*

## LADIES NIGHT

The PTG on Reliability will be host to the ladies at their annual banquet and lecture to be held at Dinah's Shack at 6:30 p.m. on Wednesday, December 12.

The group and ladies will be honored by the presence of the guest speaker, Captain Larry Ives, veteran pilot with TWA. The captain's talk, which will be supplemented with slides, film, and tapes, should be as equally interesting and informative to the ladies as to the technically minded. The talk will cover, among other things, the captain's responsibilities, problems of flying an airplane, instrumentation and navigational aids used during take-off, flying, and landing. Where else is reliability and the man-machine concept so important?

*meeting ahead*

## SUN SEEKER

John W. Cecil, senior research engineer, Lockheed Missiles and Space Company, will talk to the Santa Clara Valley Subsection about a new sun-seeker servo system now under development. The December 11 meeting will be held at the Lockheed Auditorium, Building 202, Stanford Industrial Park, Palo Alto.

The particular electro-mechanical system under discussion controls the attitude orientation of the solar cell arrays so that they face the sun. The operation is similar to other sun-seekers with the exception that the device controls orientation in two axes. The servo amplifier is unusual in that it is, in effect, a hybrid analog/digital device. This configuration was chosen in order to achieve high efficiency with respect to power consumption. The operation during the acquisition and tracking phases will be described with emphasis on fields of view and performance of the unique solar detection assemblies utilized. Some of the initial system concepts and design mechanizations which were considered early in the program will be discussed with trade-off considerations to be explored.

The actual electronics assembly, a combination of welded module and printed circuit board techniques, will be described in some detail. Slides will be used to show exploded views of the package. An operating prototype model of the complete servo system, including sensors, will be demonstrated.

# MEETING CALENDAR

## SANTA CLARA VALLEY SUBSECTION

8:00 P.M. • Wednesday, December 11

*Sun Seeker (Two Axis Solar Servo System)*
**John W. Cecil, flight control electronics, Lockheed MSC**
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto

## PROFESSIONAL TECHNICAL GROUP CHAPTERS

### Military Electronics

6:30 P.M. • Wednesday, December 11

*Annual social affair. Bring your wife and friends*
Dinner: Rick's Swiss Chalet, 4085 El Camino Way, Palo Alto
Reservations: Vic Conrad: 326-4000, Ext. 2212

### Power

7:30 P.M. • Tuesday, December 10

(Election of interim officers and adoption of chapter bylaws)
*Progress report on computer control of power plant automation*
**A. A. Ward, assistant mechanical engineer, Southern California Edison Co.**
**A. G. Syriotas, senior engineer, computer applications, Bechtel Corp.**
**R. G. Livingston, project engineer, process computer section, General Electric Co.**
Place: Engineers Club of S.F., 206 Sansome St., San Francisco
Dinner: 6:30 P.M. (cocktails at 5:30)
Reservations: Engineers Club, GA 1-3184

### Reliability

6:30 P.M. • Thursday, December 12

(Ladies night and banquet)
*This is your captain speaking*
**Captain Larry Ives, veteran pilot with Trans World Airlines**
Place: Dinah's Shack, 4269 El Camino Real, Palo Alto
Dinner: 6:30 P.M., Dinah's Shack
Reservations: 739-4321, Ext. 24211, by December 10

### Space Electronics and Telemetry

8:15 P.M. • Tuesday, December 17

*Communication applications of lasers*
**Dr. B. J. McMurtry, Sylvania Electronics Systems, MDD, Mountain View**
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Palo Alto
Dinner: 6:15 P.M., El Camino Bowl, 2025 El Camino Real, Mountain View
Reservations: Robert H. Light, 968-6211, Ext. 2024, by noon, December 17
Coffee and doughnuts after the meeting

*meeting ahead*

## POWER ELECTION SCHEDULED DECEMBER 10

Election of interim officers for the San Francisco Chapter of the PTG on Power and adoption of bylaws for the chapter will take place at the December 10 meeting of the group at the Engineers Club.

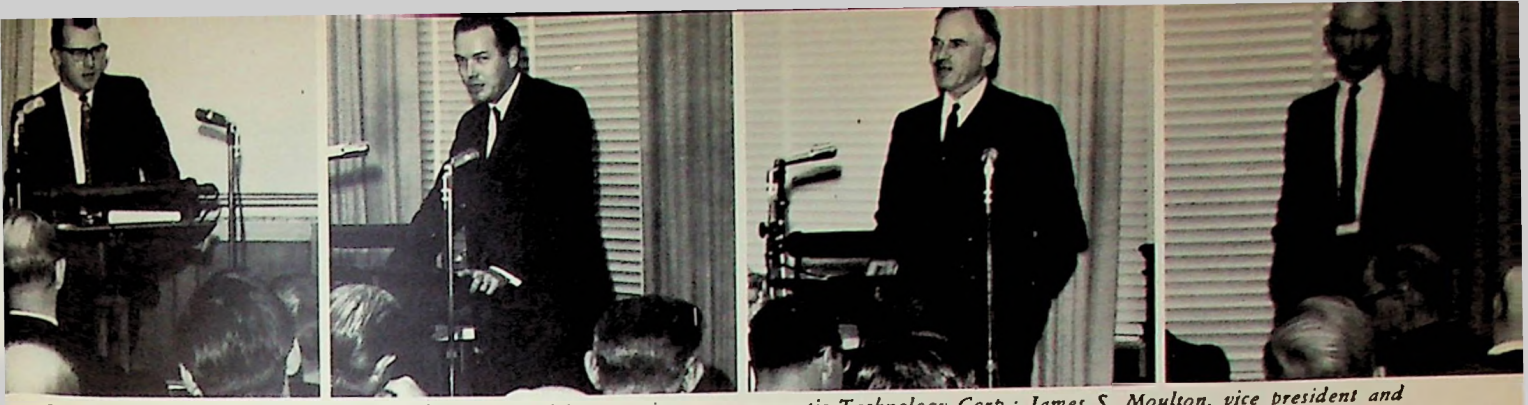
A progress report on computer control for power plant automation will follow the business meeting. The report will be presented by A. A. Ward of Southern California Edison Co., A. G. Syriotas of Bechtel Corp., and R. G. Livingston of General Electric. Advance reservations are urged.

*Cecil*

*Ward*

*Syriotas*

*Livingston*



*Speakers at the November 12 PTGP chapter organizing meeting included (left to right) J. E. Barkle, Bechtel Corp., chapter organizer; Dr. William A. Edson, section chairman and president, Electromagnetic Technology Corp.; James S. Moulton, vice president and executive engineer, Pacific Gas & Electric Co., principal speaker; and John C. Beckett, Hewlett-Packard Co., section vice chairman*

*meeting review*

## POWER FUTURE TOLD; PTG CHAPTER FORMED

More than 120 potential members of the Power PTG chapter gathered at the San Francisco Engineers' Club November 12 to consider details of organization and to hear PG & E's James Moulton discuss the changing fuels picture for electric power generation in the West.

Presiding was John Barkle, Bechtel Corp., who will also act as organizer and chairman of an ad hoc committee which is expected to recommend a slate of officers for election at the December 10 meeting. These officers would act until a permanent organization is set up, locally and nationally, to take effect July 1, 1964. Nominated to serve on the committee were John Beckett, Hewlett-Packard Co.; Charles Hochgesang and M. G. Lewis, Bechtel Corp.; Werner Stirnus, Kaiser Engineers; Victor Kaste and James Tice, General Electric; William Johnson, Robert Miller, Charles Sedam, and James McCann, Pacific Gas & Electric Co.; Edward Morris, Westinghouse; Prof. Charles Dalziel, University of California; Thomas Maley, I-T-E; Walter Michalke, Alcoa; and Edwin Fleischmann, consultant.

Electrical generation is expected to increase west of the continental divide from 133 billion kwhr in 1960 by four times to 538 billion in 1980 and ten times to 1,378 billion kwhr in the year 2000, said Moulton. In relation to total energy used, electricity will move up from 22 percent to 37 percent to 48 percent in those same years. These figures were quoted from a recent report (No. 18) of an advisory committee headed by Moulton for the Federal Power Commission's national power survey.

Moulton said the predictions are based upon anticipated increases in population from 23,672,000 in 1960 to 39,800,000 in 1980 and to 58,600,000 in 2000, and increased usage of electricity per capita. Limited development possibilities for presently used energy sources, such as hydro, gas, and oil, will require further development of coal reserves and accelerated use of nuclear fuel after 1970. Generation from coal mined on both sides of the continental divide will account for about 28 percent of the total by the year 2000. Nuclear will account for nearly 50 percent, with the heaviest concentration of such power plants on the Pacific Coast. Delivered prices, smog control, and declining nuclear costs will virtually keep coal out of California except for metallurgical use. Oil will continue in use in California, with air pollution control tending to limit growth. Gas will be used increasingly until the early 1970's, after which nuclear generation will account for most of the increase.

Regarding transportation of energy, Moulton said the report shows that transportation in the form of electricity over high-voltage lines is generally the most expensive method. Next to moving nuclear fuel by rail, shipment of oil by tanker is cheapest. Oil by pipeline and by rail or tank truck is more expensive. Gas by pipeline is more expensive than oil by pipeline because gas, even under compression, contains less energy per volume. Recent estimates for moving coal as slurry in pipelines or by means of integral train show these methods are becoming competitive with gas pipelines.

Power-oriented section members are reminded that a completed subscription order form for **Power Apparatus and Systems** automatically makes them members of the San Francisco Chapter of PTGP being formed. If they have not yet completed the order form recently mailed, they are urged to do so and mail it with a check for $6.00 to the section office. Additional forms and explanatory news letters are available from the office or from Jack Barkle or Chuck Hochgesang at Bechtel.

PAUL LEECH

*meeting review*

## BRAIN WAVES

The first PTGBME meeting was held October 9 on the Berkeley campus of the University of California, in keeping with a philosophy of rotating this year's meetings among the Palo Alto, San Francisco, and Berkeley areas. This practice should increase both attendance and interest in the bio-medical sessions.

The subject of Professor Freeman's talk was "Brain Waves and Signal Identification" and it was accompanied by a demonstration of how signals are received from electrodes implanted in the brain of a live and otherwise normal cat.

Professor Freeman told an audience of about 50 that signal identification involves receiving, measuring, and interpretation. For better understanding of the nature of the brain waves, the measurement of the signal from an individual brain cell was treated. The signal from this isolated cell takes on a variety of forms depending on position of recording electrodes and type of polarization the cell is undergoing. Professor Freeman's work involves recording from groups of brain cells—all interacting.

The stimulus to the animal is a bipolar, 5V, 100m sec wave which is sync'd to an oscilloscope. Visible on the scope face is a repetitive waveform mixed with some random signal.

Professor Freeman explained how the mathematical transfer function for this signal is derived. The resulting equation becomes quite complicated when the non-linear behavior of the brain cells to stimulus is taken into account. When the random signal is averaged out, a damped sinusoid signal results but this is complicated by a varying frequency, decay rate, and phase shift with time. At this time no mathematical model perfectly fits the experimental data.

The formal meeting was followed

*(Continued on page 7)*

*meeting review*

## CAPACITOR TESTING

A new automatic capacitor measurement system was the subject discussed at the first PTGIM meeting in October. Ralph Lydecker, group leader, data acquisition systems, Dymec division of Hewlett-Packard Co., was speaker.

Requirements for the system were basically established by needs of capacitance manufacturers and users who do a large amount of testing, such as the aerospace industry. Features considered essential include automatic operation with recording output capability, high accuracy, high reliability, and speed. Capability of testing a wide range of capacitance values also was believed mandatory, including high-valued capacitors used in transistor circuitry since these now constitute a substantial part of capacitor usage. Such capacitors present unique measurement problems because they typically have relatively high dissipation which affects the capacitance measurements.

In equivalent circuits for an actual capacitor the loss is represented by resistance in series, or in parallel, with a capacitance, and these equivalent capacitance values differ by a factor depending on dissipation. The difference is small for low dissipation (high Q) components, but is significant for moderate to high loss capacitors. The dissipation is directly expressed by the series circuit, so high-valued capacitors are now generally specified in terms of equivalent series capacitance and dissipation factor.

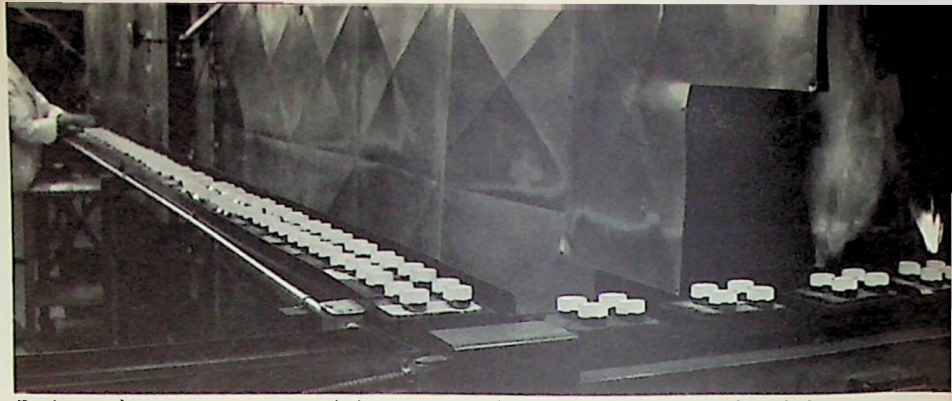
Lydecker reviewed a new all-electronic system designed to meet these requirements. The completely solid state circuitry provides direct digital readout of both series capacitance and dissipation factor with capacitance accuracy of approximately 0.1 percent of reading over much of the measuring range which extends to 4,000 mf. Capacitance readings are in percent of nominal (normalized) form. Measurement speed is one or more components per second depending on setup. Features are included for measuring leakage currents and for application of polarizing voltage.

The basic circuit is a constant current bridge utilizing a pair of operational amplifiers with a precision reference capacitor and the test capacitor, respectively, in their feedback circuits. Both amplifiers are driven from a single source through precision resistors which are the standards establishing the ratio of the currents in the capacitors. Advantages of the resistance standards are precision, size, stability, and the ability to measure an exceptionally wide range of capacitors. Reactive and resistive components of the test capacitor impedance are detected in phase sensitive detectors and the proportional DC voltages measured by integrating digital voltmeter (ratiometer) circuitry which is insensitive to noise in the signals.

Several other types of circuits widely used in manual testing of capacitors were considered. These included the capacitance comparison bridge, ratio transformer, impedance comparator, and operational amplifiers with constant test voltage. Principal difficulties in adapting these to an automatic system included the fact that some measure the equivalent parallel capacitance while others require electromechanical servo switching for nulling each reading.

Component scanning is complicated by a requirement that a predetermined exposure to polarizing voltage is necessary for correct measurement of leakage current. This problem may be solved best by stick scanners now becoming available. Components are mounted on an intermittently moving assembly which transports them past a series of polarizing terminals to the test position. Only one component at a time is connected to the test terminals. This avoids switching problems such as stray capacitance effects, which might be encountered if elaborate switching systems were used.

CAL WORLEY



*Fusing moly-manganese to ceramic in conveyerized furnace of ceramic-metal prod. dept.*

*meeting review*

## CERAMIC-TO-METAL SEALING AT EIMAC

In October, members of PTGPEP chapter visited the Eitel-McCullough Corporation in San Carlos. Robert Culbertson, manager of the process and materials lab, described their ceramic to metal sealing process.

Ceramic to metal seals had their beginning in Germany about 20 years ago during World War II. They are used in vacuum tubes, diodes, rocket igniter bodies, microwave windows, and similar applications. Although there are several hundred ceramic metalizing mixes and processes, Eimac specializes in the molybdenum manganese process. They begin with a high ratio of aluminum oxide crystals to glass in the ceramic. This results in less warpage at high temperatures.

The ceramic blanks are first immersed in red dye which makes any cracks readily visible as the dye seeps into them. The blanks are then cleaned and coated with a molybdenum manganese preparation. This consists of about 80 percent molybdenum and 20 percent manganese suspended in a nitrocellulose lacquer base. The preparation can be applied with automatic rollers, hypodermic syringe, or silkscreen. The compound dries in about 15 minutes in air, or faster if an infrared drying oven is used.

Next, the metalizing compound is fused to the ceramic in a six-stage hydrogen atmosphere furnace. Parts are carried through the furnace along a 50-foot conveyor to be heated in six stages to 1,450°C. Here, the glass migrates to the surface of the ceramic and bonds with the manganese while the molybdenum forms a .001-inch film on the surface of the ceramic.

The metalized areas of the ceramic can be plated with silver, copper, nickel, and gold. Or they can be brazed to other metal parts using copper, copper alloys, or silver. This process will give seals capable of holding $10^{-8}$mm Hg vacuum at over 700°C. The bond is stronger than the ceramic.

After the talk Stan Jepson, manager ceramic-metal production, and several Eimac employees led a comprehensive tour through the production facility. This included the ceramic painting room where the moly-manganese is applied, the Harper furnace for sintering the moly to the ceramic, and the various brazing operations.

RONALD K. CHURCH

## ERROR-CORRECTING CODES

The PTGIT chapter held its first and second meetings of the 1963-64 year in October. Both meetings took place at Stanford Research Institute, Menlo Park, and both speakers addressed themselves to the general subject of error-correcting codes.

At the October 10 meeting, Dr. Richard C. Singleton, a senior research mathematical statistician in the Mathematical Sciences Department at SRI, spoke about his work on "Maximum Distance Q-nary Codes." These are codes based on a symbol alphabet containing q different symbols (instead of the usual $q = 2$). If such a code contains $q^k$ words, each n symbols long, then the (minimum) Hamming distance cannot exceed $n - k + 1$. The speaker concerned himself with codes attaining this maximum distance, d. It was shown that such codes are necessarily separate codes. In fact, every set of k places may be regarded as information positions, with the remaining $r = n - k$ places as redundant (checking) positions.

Dr. Singleton proved that codes with $k = 2$ information places and $d = r + 1 = n - 1$ are equivalent to sets of r pair-wise orthogonal latin squares of order q. These are known to exist for $r = q - 1$, when q is a prime or prime power. Codes for $k = 1$ (also for $r = 1$) can be shown (almost trivially) to exist for any n and q. Codes dual to the latin square codes yield maximum distance codes for the case $r = 2$, $d = 3$ for any $k \leq q - 1$ (q-nary Hamming single-error-correcting codes). Hence the interesting and difficult part of the problem of constructing maximum distance q-nary codes occurs for $k > 2$, $r > 2$.

It was shown that when both k and r are at least 2, then neither k nor r can exceed $q - 1$ in a maximal distance code. However, the existence problem for such codes is not completely solved. A number of special results were given without proof. For $k = 3$, the desired codes exist with

*(Continued on page 8)*

## MORE BME REVIEW

by a lively discussion period and interested persons were allowed to observe how the electrodes are positioned in a cat's brain. Also observed was the use of the CAT-400A (Computer of Average Transients) to remove the random noise from the stimulus-evoked signal. This device is essentially a small digital computer which enables a researcher to extract a repetitive signal from random signals or noise.

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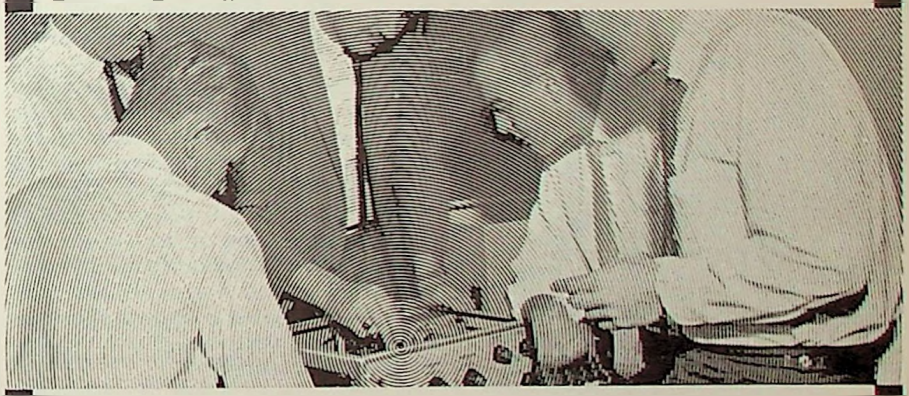

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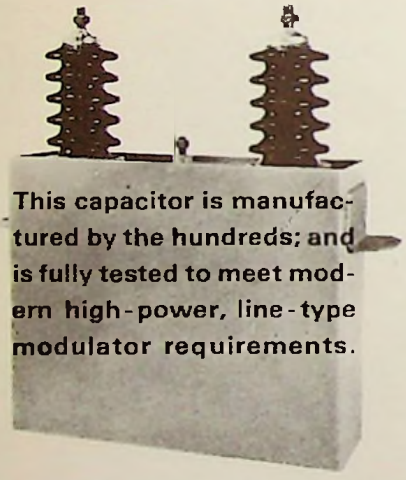

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## IEEE NATIONAL MEETINGS

February 24-25—**Seminar on Writing Improvement Programs for Engineers**, Delmonico Hotel, New York. PTGEWS/PTGED. Program: Chas. A. Meyer, RCA, Harrison, N.J.

April 1—**Mining Industry Technical Conference**, Wilson Lodge, Gelbay Park, Wheeling, W.Va. IEEE, et al. Program: R. V. Bovenizer, Hanna Coal Co., Cadiz, Ohio.

April 1-2—**Fifth Symposium on Engineering Aspects of Magnetohydrodynamics**, MIT, Cambridge, Mass. IEEE/AIAA/MIT. Program: Dr. G. S. Janes, Avco Everett Research Labs., Everett 49, Mass. Proceedings.

April 6-7—**Rubber & Plastics Industry Conference**, Sheraton-Mayflower Hotel, Akron, Ohio. IEEE.

April 6-8—**International Conference on Nonlinear Magnetics (INTERMAG)**, Shoreham Hotel, Washington, D.C. IEEE. Program: R. C. Barker, 2158 Yale Station, New Haven, Conn. Proceedings at conference.

April 8-9 — **Railroad Conference**, Cleveland Engineering & Scientific Bldg., Cleveland, Ohio. IEEE/ASME. Program: K. O. Anderson, General Electric Co., Erie, Pa.

April 13-14 — **Cement Industry Technical Conference**, Huntington-Sheraton, Pasadena, Calif. IEEE. Program: D. B. Carson, General Electric Co., P.O. Box 2830, Los Angeles 54. Bound proceedings.

April 13-15 — **Farm Electrification (Rural) Conference**, Brown-Palace Hotel, Denver, Colo. IEEE. Program: C. C. Ambrosius, Illinois Power Co., 500 S. 27th St., Decatur, Ill. No proceedings.

## MORE INFORMATION THEORY REVIEW

$r = q - 1$ (hence $n = q + 2$) and $d = q$ if and only if q is a power of two. More generally, for $q = p^m$, a (linear) code exists with $d = r + 1$, $n = q + 1$ whenever k satisfies $2 \leq k \leq q - 1$.

A small but intensely interested audience followed Dr. Singleton's arguments in close detail, as judged by the large number of intelligent questions that were put to the speaker.

At the second meeting, held on October 24, the speaker was Professor David A. Huffman, visiting this year at Stanford University's Department of Electrical Engineering. Dr. Huffman is a full professor in Electrical Engineering at Massachusetts Institute of Technology. His talk was entitled, "Geometric Approach to Low-Density Parity-Check Codes." After reviewing some basic concepts of error-correcting codes, using the well-known Hamming codes by way of example, Dr. Huffman explained his new graph-theoretic approach—something he has come upon only during the past few weeks.

Briefly, a linear graph of n branches and k independent loops can be used to define a binary group code with $2^k$ n-bit words, each word having k information digits. The following correspondences exist: (1) each branch corresponds to a digit position of the code, (2) each fundamental loop (mesh in a planar graph) defines a code generator (having 1's in positions corresponding to the branches which make up that loop), (3) the branches making up $n - k$ independent cut-sets (which can be taken around $n - k$ nodes) define the parity checks that the code satisfies, (4) the minimum distance between any two distinct code words is equal to the number of branches in the "shortest" loop of the graph. The set of all $2^k$ code words corresponding to a given graph is obtained by taking the "mod two" sums of the k fundamental loops in all possible ways, branches common to an even number of loops being "canceled out," so to speak.

This geometric approach has some attractive features: both the minimum Hamming distance (hence also the correction capabilities of the code) and the complexity of the parity checks required are directly obtainable from the graph. The speaker exploited these properties to construct a family of codes based on the "complete" graphs (these graphs have one branch for each pair of nodes). The resulting codes have the parameters:

$n = p(p + 1)/2$, $k = p(p - 1)/2$, p parity checks

and a Hamming distance of three. They have somewhat higher redundancy than the Hamming codes, but they involve considerably fewer parity check operations for a given block length, n. This could be an attractive advantage in applications where ease of implementation is more important than code efficiency.

Strangely enough, the standard Hamming codes do not have a graph-theoretic interpretation in Huffman's terms. Professor Huffman closed his provocative exposition with some comments on the relation between the four-color map coloring problem (still unsolved) and some coding problems related to planar graphs.

BERNARD ELSPAS

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For the convenience of Bay Area engineers, two collection points have been set up: Dr. E. G. Chilton, Manager, Mechanics Dept., Stanford Research Institute, 333 Ravenswood Ave., Menlo Park; and Engineers and Scientists Committee, People-to-People, PG&E, 540 Bush St., San Francisco. Send prepaid or deliver packages comprising one year's issue or more of technical publications (no trade magazines). More information on the program may be obtained from the Committee, c/o Chinatown Branch Library, 1135 Powell St., San Francisco 8, Attn: Melville N. Clark.

## PAPERS CALLS

December 15—Third Symposium on Micro-Electronics, Chase-Park Plaza Hotel, St. Louis, Mo., April 13-15. T. F. Murtha, P.O. Box 4104, St. Louis, Mo.

December 31 — Symposium on Quasi-Optics, Statler-Hilton Hotel, New York, June 8-10, Prof. L. Felsen, PIB, 55 Johnson St., Brooklyn 1, N.Y.


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San Mateo; 345-3157

*the section*

## MEMBERSHIP COMMITTEE

Under the co-chairmanship of Fred MacKenzie, Stanford Research Institute, and William Warren, Shell Development Co., the San Francisco Section has a large and active membership committee with 83 current members from 73 firms and institutions throughout northern California. In order to acquaint section members with this committee so that they can refer membership and upgrading inquiries to the committee member in the company, the Grid begins in this issue a photo feature on them.

*GENERAL ELECTRIC, S. F. Apparatus Service Shop, K. B. Rymer (left); SYLVANIA, Electronic Systems—West, Sadao Baishiki.*

*BECKMAN INSTRUMENTS, Spinco Division, Robert J. Ebret (left); VARIAN ASSOCIATES, Quality Assurance and Reliability, Eric B. Edberg.*

*UNITED AIR LINES, Maintenance Base, Keith M. Cummings (left); ADMIRAL CORPORATION, Palo Alto Division, William Milwitt.*

*GRANGER ASSOCIATES, RF Equipment, David S. Pratt (left); LENKURT ELECTRIC CO., INC., Chief Engineer, Lyle R. Groberg.*

*Sikorsky* *Ward*

*the section*

## MEMBERSHIP

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

### Senior Member

Emil Sikorsky — S. A. Ward

### Member

N. E. Boyle — K. J. Mellor

D. F. Norlander — A. N. St. John

R. C. Service

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

P. E. Bureher — R. Muller, Jr.
D. L. Brown — B. Nowe
O. E. Christophersen — R. M. Nutting
H. A. Cole — P. L. Prince
C. S. DeLong, Jr. — J. H. Quinn
R. W. Fitzsimons — J. Richards
C. T. Gutleben — G. D. Scannell
N. A. Harris — D. L. Scott
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F. R. Holmstrom — P. D. Stogis
P. G. Hussey — H. Ueda
T. A. Jolly — A. E. Victor
D. T. S. Leong — P. N. Williamson

M. I. Alvarez — J. C. Metzger
P. Arcuni — J. J. Miotke, Jr.
T. Bellucci — D. E. Morgan
L. A. Cangianelli — E. D. Nielsen
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J. P. Crumpacker — R. E. Runyon
T. E. Darby, Jr. — C. W. Seuert
F. Frankos, Jr. — A. Sigari
H. K. Gondo — J. Singleton
G. S. Hamilton — J. J. Smith
H. J. Hoechstetter — M. E. Smith
D. W. Kellerman — R. K. Tobin
T. C. Lutton — D. E. Williamson

D. J. Williamson

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

R. B. Arps — V. C. Harding
D. M. Boardman — E. T. Hatley
C. W. Bundy — R. Hayes
A. J. Critchlow — C. Horvath
D. F. Crosby — L. A. Howard
A. G. Daulton — B. L. Irwin
G. W. Deakin — R. E. James
P. N. Duggan — S. F. Kaufman
A. C. English — D. L. Leichtweis
T. E. Everhart — G. A. Madson
T. R. Fredriksen — G. R. Penn
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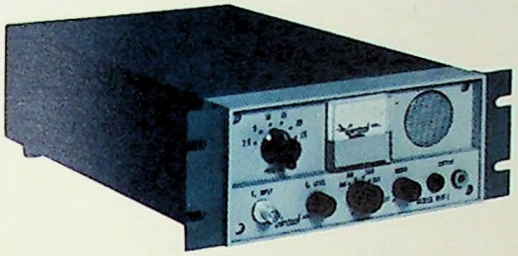

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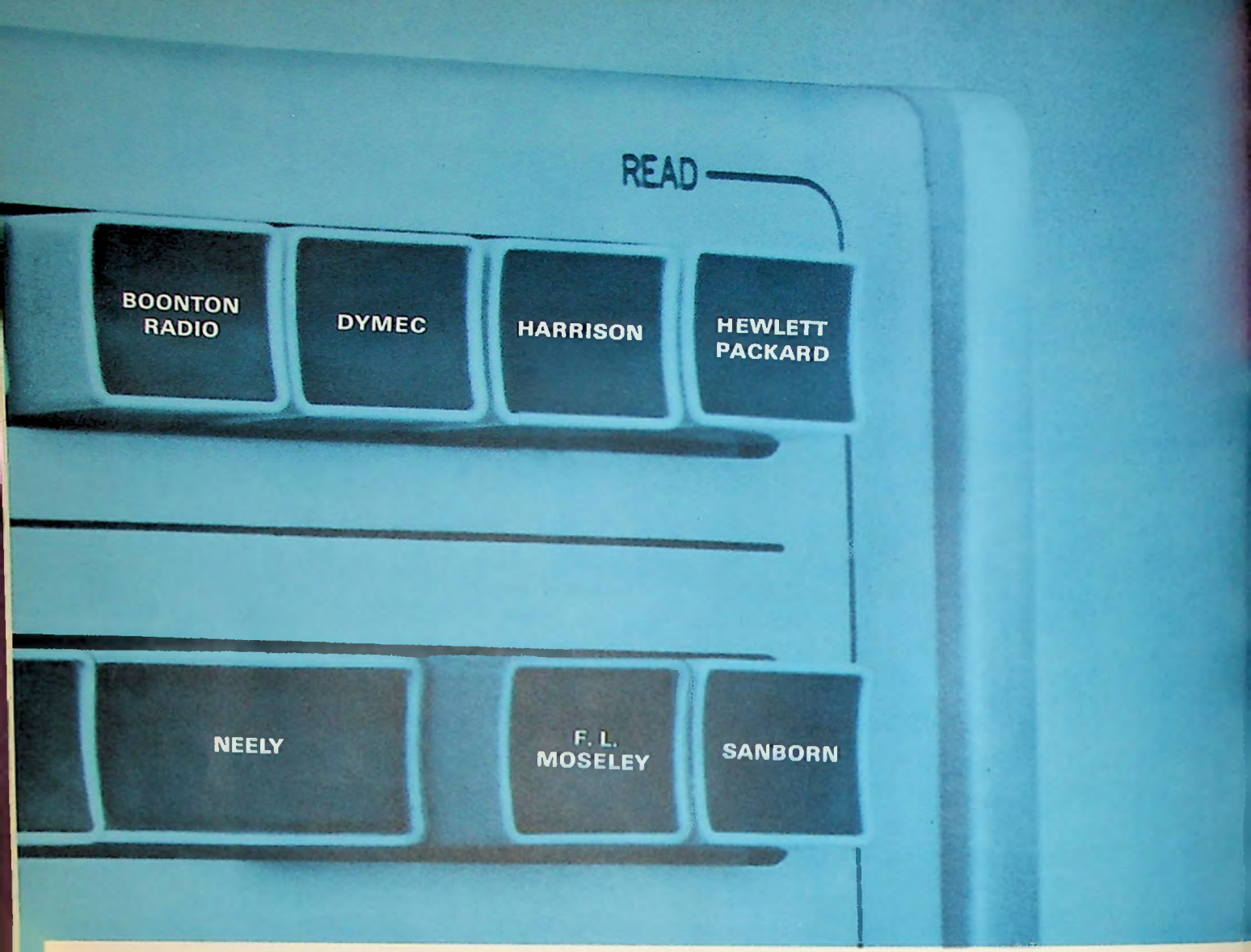


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