EDITOR’S PROFILE of this issue
from a historical perspective ...
with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)

October, 1963:
Cover: The drawing depicts a factory application of electronics, with closed circuit television, automatic production, and computer-controlled equipment. This is the topic of a meeting of the fledgling Industrial chapter (becomes IES). More on page 5.
IEEE Grid
OCTOBER 1, 1963
SAN FRANCISCO SECTION
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

October 8 (Tuesday) TDI, PTGCS
October 9 (Wednesday) PTGBME, PTGEM
October 10 (Thursday) PTGIT
October 23 (Wednesday) SCVSS,
PTGMTT/PTGCT/PTGCS
Microcircuitry... PLUS Isolation of Components

GI MULTICHIPS: The Advantages of Packaged Circuitry—with “Three-Dimensional Freedom” in the Location of Circuit Elements

WHEN A HEAT-sensitive circuit component must be placed closely adjacent to another component that generates heat—and on the same substrate—it is rather obvious that circuit performance and reliability may be compromised...

IT IS EQUALLY obvious, of course, that this problem frequently cannot be evaded in the familiar, fully-integrated “monolithic” microcircuit in which various types of components must be mounted and interconnected on a single surface. By its very nature, a monolithic Integral Circuit Package, if it is to retain its highly desirable advantage of extreme miniaturization, cannot always permit ideal isolation of components—either physically, electrically or thermally.

The Advantages of GI Multichips

THERMAL TRANSFER—like intercoupling of components, especially between input and output circuits, and various other limitations of the monolithic, common-substrate ICP—can readily be avoided by utilizing General Instrument's highly advanced technology of multichip microcircuits.

THIS FREEDOM of layout gives you the opportunity not only to separate temperature-sensitive elements from heat-producing elements but also to isolate input and output components of a circuit and any other elements whose parasitic intercoupling, electrically, electromagnetically or electrostatically might be undesirable. Component isolation, in fact, can closely approach that of conventional, discrete elements on a conventional circuit board—with only a fraction of the bulk and weight. And there are other advantages, as well...

The Ideal Substrate for EACH Component

MONOLITHIC ICP's, naturally enough, must be produced on a single substrate material which is a reasonable compromise between the ideal characteristics for each resistor, capacitor, diode, transistor or other component comprising the finished circuitry. No such compromise is necessary in GI multichip technology. Since we batch-manufacture a number of identical components on each silicon wafer (which are later diced apart and assembled to produce your finished circuit) the base material for each type of component can be selected to have the optimum parameters for that particular component and no other.

...YOUR Design, at Low Cost!

EVEN WHERE the foregoing considerations do not apply, many design engineers have welcomed the opportunities inherent in the GI multichip technology because it permits them to make minor (or, for that matter, major) modifications in design without entailing excessive tooling-up costs. The multichip technique allows you to specify virtually any arrangement of virtually any practical micro-components at a total tooling-up cost of no more, usually, than a few hundred dollars. A fully integrated monolith created to your own specs—even if the modifications represented only relatively slight changes from a standard, “off-the-shelf” circuit—would run to many thousands...

Get BOTH Sides of the WHOLE Story

PLEASE DON'T get us wrong. This advertisement happens to touch on a few of the advantages of GI multichip ICP's. But we also manufacture fully integrated monolithic microcircuits for the many standardized applications where a standardized monolith is eminently suited. We have no special axe to grind in favoring either type—and will be happy to give you experienced and completely unbiased advice, without obligation, whenever you may be in doubt about which type to choose.

MEANWHILE, if you'd like to know more about the specific advantage of GI multichips—and there is a great deal more to the story—a word from you will bring interesting, useful, complete data and literature. For promptness, please write to Jerry Fishel at the address below.

GENERAL INSTRUMENT CORPORATION
SEMICONDUCTOR PRODUCTS GROUP
65 Gouverneur Street, Newark 4, New Jersey
CLAMP AROUND THE LEAD:

and measure dc current 0.1 ma to 10 amps, without breaking circuit leads, without loading the circuit.

Pull back the probe flange, the probe opens. Aim it at a lead and let loose. The probe closes. Now you can measure dc current, on a bare or insulated wire . . . and you can read it directly, even in the presence of equally strong ac on the same wire, without breaking a lead and without loading the circuit.

The hp 428B Clip-on DC Ammeter reads dc current directly in 9 ranges by sensing the magnetic flux induced by the dc current. To measure the sum or difference of currents flowing through two separate wires, you simply clamp the probe around them both . . . and read. The standard 428B has a range of 0.1 ma to 10 amps and lets you read dc currents on wires up to \( \frac{3}{4}\)" in diameter. A recorder, oscilloscope output is provided on the 428B.

The hp 3528A Current Probe ($450 with degaussser) lets you measure dc current in conductors up to \( \frac{3}{4}\)" in their maximum dimensions . . . even pipes, multiconductor cables, lead-sheathed cables, microwave waveguide.

The hp 3529A Magnetometer Probe ($75) is useful in applications ranging from acoustical transducer design to study of the Zeeman effect; it measures the direction or magnitude of any magnetic field with 1 milligauss sensitivity.

Look at the 428B specs, then call your hp field engineer or write direct for a single data sheet which describes all its capabilities.

### 428B SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Range:</td>
<td>1 ma to 10 a full scale in 9 ranges</td>
</tr>
<tr>
<td>Accuracy:</td>
<td>( \pm 3% ), ( \pm 0.1 ) ma</td>
</tr>
<tr>
<td>Probe Inductance:</td>
<td>( &lt;0.5 ) ( \mu )H introduced into measured circuit</td>
</tr>
<tr>
<td>Probe Induced Voltage:</td>
<td>( &lt;15 ) mv peak into measured circuit</td>
</tr>
<tr>
<td>AC Rejection:</td>
<td>ac with peak value less than full scale affects meter accuracy less than 2% at frequencies above 5 cps and different from carrier (40 kc) and its harmonics; (on 10 range, ac is limited to 4 a peak)</td>
</tr>
<tr>
<td>Recorder/Oscilloscope Output:</td>
<td>app. 1.4 v across 1400 ohms full scale; frequency response dc to 400 cps</td>
</tr>
<tr>
<td>Probe Insulation:</td>
<td>300 v maximum</td>
</tr>
<tr>
<td>Price:</td>
<td>hp 428B, 1600 (cabinet); hp 428BR, 5605 (rack mount)</td>
</tr>
<tr>
<td>(428A also available; same as 428B except range: 3 ma to 1 ampere full scale; no recorder output, $500)</td>
<td></td>
</tr>
</tbody>
</table>

Data subject to change without notice. Prices f.o.b. factory.

HEWLETT-PACKARD COMPANY

CONTACT OUR FIELD SALES OFFICES, NEARLY ENTERPRISES—Los Angeles, 5029 Linkersham Blvd., North Hollywood, 18 7-1282 and PO Box 3811; San Francisco, 501 Lowell St., San Jose, 351-7661; Sacramento, 2591 Carmel Ave., 492-1463; San Diego, 1055 Shafter St., 3-8103; Portland, 200 N. Scotts vandal Rd., 945-7601; Tucson, 232 So. Tucson Blvd., MA 3-2344; Albuquerque, 6501 Lomas Blvd., N.E., 235-5586; Las Cruces, 114 S. Water St., 526-2486; Earl Lippincott Co.—Denver, 1350 S. Broadway, FE 3-3791; Salt Lake, 1482 Major St., HU 8-8166; ARVA, Inc.—Seattle, 1320 Prospect St., MA 2-0177; Portland, 2035 S.W. 5th Ave., CA 2-7327; Earl Lippincott Associates—Dolce, 3605 Inwood Rd., FL 17-8081 and ED 2-6667; Houston, 3825 Richmond Ave., MO 7-2407.
High-Speed Oscilloscopes with General-Purpose Utility
Type 580A Series with a Type 82 Dual-Trace Unit

- **DUAL-TRACE OPERATION** with 4 operating modes and independent controls for each channel—for individual attenuation, positioning, inversion, and ac or dc coupling as desired.
- **PASSBAND** typically DC-TO-85 MC (3-db down) at 100 mv/cm (12-db down at 150 Mc), and typically DC-TO-80 MC (3-db down) at 10 mv/cm.
- **CALIBRATED SENSITIVITY** in 9 steps from 100 mv/cm to 50 v/cm, and in 10X Amplifier Mode, from 10 mv/cm to 5 v/cm, variable between steps.
- **INTERNAL AND EXTERNAL TRIGGERING** to 150 Mc.
- **SWEEP RANGE** from 10 nsec/cm to 2 sec/cm.
- **SUPPLIED SMALL SIZE PASSIVE PROBES** increase input R to 10 meghoms and decrease input C to approximately 7 pf., with risetime (of probe, plug-in unit, oscilloscope) at over-all sensitivity of 100 mv/cm at approximately 4 1/2 nsec.

**PLUS**
- **COMPATIBILITY WITH 17 LETTER-SERIES PLUG-INS** to permit differential, multi-trace, sampling, other laboratory applications—when used with Type 81 adapter.

Type RM585A Oscilloscope, illus. $1825
Type 585A Oscilloscope $1725
Types RM585A and 585A have 2 modes of calibrated sweep delay ranging from 1 μsec to 10 seconds.

**Type 581A Oscilloscope.** $1425
No sweep-delay capabilities... but other features similar to Type 585A Oscilloscope.

Type 82 Dual-Trace Unit $650
Type 86 Single-Trace Unit $350

Type 81 Plug-in Adapter $135
Adapter allows insertion of Tektronix letter-series plug-ins. Band-width (to 30 Mc) and Sensitivity depend upon plug-in used.

Oscilloscope Prices without plug-in units.
U.S. Sales Prices f.o.b. Beaverton, Oregon

FOR A DEMONSTRATION, CALL YOUR TEKTRONIX FIELD ENGINEER

Tektronix, Inc. SAN FRANCISCO FIELD OFFICES
3944 FABIAN WAY • PALO ALTO, CALIF. • Phone: 326-8500
1709 MT. DIABLO BLVD. • WALNUT CREEK, CALIF. • Phone: 935-6101
From Oakland, Berkeley, Richmond, Albany and San Leandro: 254-5353
JAMES D. WARNOCK, Executive Editor

Address all mail to:
IEEE OFFICE, SUITE 2210, 701 WELCH ROAD, PALO ALTO, CALIF.

Mailing office of publication: 394 Pacific Ave., Fifth Floor. Second class postage paid at San Francisco, Calif.

Subscription: $4.00 (members); $6.00 (others); overseas, $7.00 per annum.

SECTION MEMBERS! To stay on mailing list when you move, send address change promptly to IEEE National Headquarters, Box A, Lenox Hill Station, New York 21, N.Y.

contents

Meeting Calendar ........................................ 4
Meetings Ahead (TDI, PTGEM, PTGCS, PTGIT, PTGBME) .... 5, 6, 7
Papers Call—IEEE International Convention .......... 7
Grid Swings—News of the Industry ...................... 8
Events of Interest—IEEE National Meetings .......... 9
Manufacturer/Representative Index, Representative Directory... 10, 11
New Literature, Currently Available .................. 12
Advertisers and Agencies ................................ 12

cover

Two plant tours (Industrial Division/Energy Systems, Inc., and PTGEM/Microwave Electronics Corp.) being scheduled for early October, the cover portrays an industrial application of electronics to factory production utilizing closed circuit television and electronic data processing of automatic production and control equipment. Cover drawing courtesy of Western Electronic Manufacturers Association.

san francisco section officers

Chairman: William A. Edson
Vice Chairman: John C. Beckett
Secretary: Jack L. Melchor
Treasurer: Gerard K. Lewis
Membership Co-chairmen: Fred MacKenzie, Stanford Research Institute, DA 6-6200
William Warren, Shell Development Co., OL 3-2100
Publications Advisor: Howard Zeidler, Stanford Research Institute
Executive Secretary: James D. Warnock, Section Office: Suite 2210, 701 Welch Rd.
Palo Alto, Calif., DA 1-1332

advertising

East Coast: Cal Hart, H & H Associates, 501 Fifth Ave., New York 17, N.Y., YU 6-5886
Southern California: Jack M. Rider & Associates, 1709 W. 8th St., Los Angeles 17, Calif., HU 3-0537

october 1, 1963

grid — 3
MEETING CALENDAR

SANTA CLARA VALLEY SUBSECTION
8:00 P.M. • Wednesday, October 23
Space Power Systems (a panel discussion)
Speakers: Dr. Y. C. Lee, technical director, power systems, research & development div., Lockheed MSC, moderator
Dr. Nathan Snyder, chief scientist, Kaiser Aircraft & Electronics
Frank J. Thomas, ass’t mgr., engineering div., Aerogen General Nuclear
Robert H. Watson, staff scientist, auxiliary power, Lockheed MSC
Dr. A. E. Levy-Pascal, staff scientist, electrochemical, Lockheed MSC
Place: Lockheed Auditorium, Bldg. 202, 3251 Hanover St., Stanford Industrial Park, Palo Alto

TECHNICAL DIVISIONS

Industrial 7:30 P.M. • Tuesday, October 8
Recent Examples of High-Power Electronic Systems (presentation and plant tour)
Speaker: Vernon L. Smith, chief engineer, RF systems div., Energy Systems, Inc.
Place: Energy Systems, Inc., 3180 Hanover St., Palo Alto (formerly Radiation at Stanford)

PROFESSIONAL TECHNICAL GROUPS

Bio-Medical Electronics 8:00 P.M. • Wednesday, October 9
Brain Waves and Signal Identification
Speaker: Walter J. Freeman, associate professor of Physiology, University of California, Berkeley
Place: Life Sciences Bldg., Room 2507, University of California
Dinner: 6:40 P.M., Spenger’s Restaurant, University Ave. at the Freeway, Berkeley
Reservations: Con Rader, 326-1970, Ext. 328

Communications Systems 8:00 P.M. • Tuesday, October 8
Automatic Waveform Equalization for Data Transmission Purposes
Speaker: Dr. Emil Hopner, manager, advanced information retrieval technology, advanced systems development div., IBM, San Jose
Place: Room 1164, 760 Market St., San Francisco
Dinner: 6:00 P.M., Bardelli’s Restaurant, 243 O’Farrell St. (near Powell), San Francisco
Reservations: Mrs. Manzi, LY 1-8461, Ext. 430

Engineering Management 8:00 P.M. • Wednesday, October 9
The Founding and Development of Microwave Electronics Corporation (presentation and plant tour)
Speaker: Dr. Stanley F. Kaisel, president, MEC
Place: Microwave Electronics Corp., 3165 Porter Drive, Stanford Industrial Park, Palo Alto

Information Theory 8:00 P.M. • Thursday, October 10
Maximum-Distance Q-Nary Codes
Speaker: Dr. Richard C. Singleton, senior research mathematical statistician, Stanford Research Institute
Place: Stanford Research Institute, No. 1 Conference Room, 333 Ravenswood, Menlo Park
Reservations: Mrs. B. Kelly, 326-6200, Ext. 2944

Microwave Theory & Techniques 8:00 P.M. • Wednesday, October 23
(Joint with PTGCT and PTCCS)
Some Microwave Filter Design Concepts and Their Application to the Design of Microwave Devices
Speaker: Dr. George L. Matthaei, Stanford Research Institute
Place: P.H. 100, Stanford University
For further information contact: Leo Young, Stanford Research Institute, DA 6-6200
Meeting Ahead

High-Power Systems

The first scheduled meeting of the Industrial Division will be held on October 8, at Energy Systems, Incorporated, 3180 Hanover Street, Palo Alto (formerly Radiation at Stanford).

The meeting will consist of a presentation with slides by Vern Smith, chief engineer-RF systems division, showing recent examples of high-power electronic systems, such as high-voltage d-c power supplies, high-power RF transmitters, high-voltage switching systems, high-voltage triggered arc gaps, and high-power LASERS. A plant tour will follow where several examples of each of the equipments can be seen in various stages of assembly. The meeting will start at 7:30 p.m.

Section Notes

Regular Tuesday Luncheon

A special luncheon table is reserved every Tuesday at the San Francisco Engineers Club for members of IEEE. Club membership is not required and a cash ticket may be purchased from the cashier for $2.00, including tax. No reservations are required.

IEEE members are invited to drop in for lunch whenever they are in the San Francisco area on Tuesdays. The club occupies the 15th floor at 206 Sansome St., San Francisco.

Management in Action

Dr. Stanley F. Kaisel, president of Microwave Electronics Corp., will host PTGEM on October 9 at the MEC facility in Stanford Industrial Park. Dr. Kaisel will discuss the founding and development of MEC and then showcase the facility for PTGEM members and their guests.

Dr. Kaisel started his electronics career at Washington University in St. Louis where he received his B.S. degree in electrical engineering in 1943. He worked for RRL at Harvard prior to return to Stanford University where he worked as a research associate concerned with linear accelerators and traveling wave tubes. During this period, he completed his studies for advanced degrees and was awarded the M.A. and Ph.D. in electrical engineering. He then joined RCA Princeton Laboratory to continue his work in the field of TWT. In 1951 he returned to Stanford to spend the next four years with the electronics research laboratory. In 1955 he joined Litton to learn more of the industrial phase of tube research and development.

In 1959, Dr. Kaisel, Arthur L. Webb, and Hugh W. Jamieson officially launched Microwave Electronics into the microwave tube and solid-state device business.

Administration building and plant of Microwave Electronics Corporation, Stanford Industrial Park, scene of a presentation by Dr. Stanley F. Kaisel and a plant tour for the October meeting of PTGEM.
WAVEFORM EQUALIZATION

Automatic waveform equalization for data transmission purposes will be the subject of Dr. Emil Hopner before the October meeting of PTGCIS.

Delay and amplitude distortion prevent effective utilization of transmission facilities for data transmission purposes. The speaker will describe automatic means of signal distortion correction and report on experiments performed by the advanced systems development division laboratories of IBM. The related theoretical considerations will also be discussed.

Dr. Hopner is manager of advanced information retrieval technology, advanced systems development division, IBM, San Jose. He joined IBM in 1955 in Poughkeepsie in the speech recognition program. In 1956 he transferred to San Jose research and was appointed to the data transmission and communications project. He was directly responsible for the development of IBM's data transmission subset.

During the latter part of 1958 Dr. Hopner was appointed manager of the data transmission project. During 1959 he initiated studies and advanced development activities on the problem of high-speed data transmission over high-frequency radio lengths. His group did significant work in the development of self-correcting codes for adjacent errors in data transmission. During 1960 Dr. Hopner continued his work with the CCITT, a committee of the International Telecommunications Union, assisting them with their data transmission problems and tests.

In June, 1961, Dr. Hopner was transferred to the IBM Lab at Peekskill, New York, as manager of computer communications. In January, 1963, he returned to San Jose.

NEW CLASSIFIED SECTION

In response to many requests, and primarily as a service to the membership, the Grid will offer a classified advertising section beginning with the November issues. Every appropriate category of advertisement will be carried, including business and professional cards, consulting services, positions available, positions wanted, and products. Rates for members will be $15 for the first column-inch, $10 for the second inch, and $5 for each additional inch, not to exceed a total of 4 inches. Special type or logos will not be carried. Nonmembers will be charged $20 for the first inch, $15 for the second inch, and $10 for each additional inch.
Meeting Ahead

Brain Waves

Professor Walter J. Freeman’s talk before the October 9 meeting of PTGBME will concern brain waves and signal identification and will deal with the isolation of the sources of localized signals from particular cell populations within the brain which is considered as a volume conductor. He will describe measurements made utilizing computer techniques correlated with the behavior of laboratory animals which have chronically implanted electrodes.

Professor Freeman received his M.D. from Yale University in 1954 after graduate studies at Johns Hopkins University and post-doctoral work at UCLA.

Those interested in sharing rides from Palo Alto should meet in front of Room M-112 of the Stanford Medical School at either 5:20 p.m., if attending the dinner, or at 6:30 p.m. if going directly to the meeting.

For those willing to pay 50 cents, parking on the campus is available after identification of medical electronics or IEEE is given to the gate attendant.

The meeting is open to all those interested. The PTGBME chapter plans to hold 7 meetings this year on the 2nd Wednesday of every month through May, with the exception of January. One or two of the future sessions will be held in San Francisco or Berkeley; the locations of the other meetings will be normally at the Stanford School of Medicine at 8 p.m. in Room M-112. Call the secretary, Con Rader, at 326-1970; ext. 328, if you do not receive notice prior to meeting time.

Events of Interest

Papers Call

October 18—Statement, in quadruplicate, indicating the contributions made by the paper which warrant its inclusion in the IEEE International Convention program; 100-word abstract in quadruplicate, title of paper, name and address; 500-word summary in quadruplicate, title of paper, name and address. Indication must be made regarding technical area of paper from the following: basic sciences and techniques, power, industry and industrial applications, communication, electronic systems, computers and data processing, instrumentation, materials, components and production processes, biomedical electronics, and professional activities. Address all material to Ferdinand Hamburger, Jr., chairman, 1964 technical program committee, IEEE, Box A, Lenox Hill Station, New York 21.
STATE-OF-THE-ART LOG IF AMPLIFIERS ON THE SHELF AT RHG

Choose from RHG’s shelves the logarithmic IF amplifiers you need. A complete line is now available to reduce your hardware costs, save valuable design time, and provide versatile system compatibility. All standard models feature:

Wide Dynamic Ranges, To 90 db
True Logarithmic Compression
Excellent Pulse Fidelity

grid swings

IT IS REPORTED:

Burgess Dempster, newly elected chairman of the board of Siliconix, has announced the election of Richard E. Lee as president, Thomas S. Edwards as vice president, and Arthur D. Evans as vice president.

Guy W. Wilson has been named manager of marketing services of Esterline Angus Instrument Co., Indianapolis.

Gould Hunter has been appointed personnel manager for Watkins-Johnson Co., Palo Alto.

Harry Hohn has been appointed president of Shelly Associates, Inc., consulting and manufacturing engineers, El Segundo.

Charles Elkind has been promoted to the new position of communications manager of the components division of International Business Machines Corp., Poughkeepsie, N.Y.

Terry E. Bibbens has joined Applied Technology, Inc., Palo Alto, as applications engineer, marketing dept.

RHC ELECTRONICS LABORATORY, INC.
54 Milbar Blvd., Farmingdale, L.I., N.Y.
Engineers Sales Representative:
WALTER ASSOCIATES
P.O. Box 790, Menlo Park, Calif. (415) DA 3-4606

Solitron DEVICES, INC.
500 Livingston St. - Norwood, N.J.

A year or so ago we obtained from a local distributor several of your diffused silicon rectifiers. To the best of my knowledge there has not been a single failure of these units, many of them operating eighteen hours each day.”

“Recently, we wished to install more of these in place of tube rectifiers and the local supplier substituted a well-known brand. One of these substitutes lasted about one week.”

The above letter was recently sent to us by Mr. Lambert B. Howard, Chief Engineer of WFIE-TV, Evansville, Indiana. It is but one more in a continuous series of unsolicited testimonials from users of highly reliable, performance-proved Solitron products.

Solitron produces Silicon Rectifiers, Solid-State Hi-Voltage Assemblies (Solidpak®) and Noise Diodes (Soundvisers®). Product specifications/applications data and price lists are available on request.


Beating the bushes — making cold calls — eats up salesmen's time, when time means money.

Why make your men fish without bait? Far better to condition prospects before face-to-face selling takes place!

Printed sales material such as folders, brochures, catalogs can turn up live leads, dramatize product features, pre-sell.

The right kind of printed literature can upgrade your sales-to-calls ratio and wipe anxiety from your salesmen's faces!

We welcome the opportunity to supply the bait!

Just phone us at 327-0880

THE NATIONAL PRESS
Designers • Printers • Lithographers • Publishers
Every type of business communication — business cards, stationery, forms, brochures, folders, data sheets, catalogs.
850 HANSEN WAY • In Stanford Industrial Park • PALO ALTO
### Accutronics, Inc. .......... G. S. Marshall Co.
Ace Engineering & Machine Co. ........ R. W. Thompson Assoc.
Adcom Corporation ................. W. K. Geist Co.
Adirondack Wire & Cable Co., Schwarzschild Assoc.........
AD-YO Electronics Labs, Inc., Carl A. Stone Assoc.
Aerotech ................. Jay Stone & Assoc.
Airborne Instruments Lab. ...... Wright Engineering
Alford Electronics ............... Moxon Electronics
Ameray Corporation .............. White & Co.
American Nuclear Corp. .......... McCarthy Assoc.
Ammon Instruments, Inc. ........... Tech-Ser, Inc.
Antlab, Inc. ....................... Jay Stone & Assoc.
Applied Magnetics Corp. ....... The Thrason Co.
Applied Microwave Lab., Inc. ... Moxon Electronics
Applied Technology, Inc. ...... Moxon Electronics
Arizona Instruments ............ West Eleven
Arnold Magnetics Corp. ......... Walter Assoc.
Arra ................................... West Eleven
Astreda, Inc. .................... Moxon Electronics
Astron (Skellett Electronics) Corp. .... Long Autronics Corp.
Ballantine Labs, Inc. ........ Carl A. Stone Assoc.
Bausch & Lomb, Inc. .......... Perlmuth Electronics
Bay State Electronics Corp. .... Perlmuth Electronics
Beckman/Berkeley Division ........ V. T. Rupp Co.
Beckman/Stevens-Evans, Inc. ...... V. T. Rupp Co.
Behman/Invar Electronics Corp. ... Snitzer Biocom, Inc. .......... Schwartzchild Assoc.
Blaw Knox ...................... The Thrason Co.
Boonshaft & Fuchs, Inc. ......... W. K. Geist Co.
Boonton Electronics Corp. ........ O'Halloran Assoc.
Boonton Radio Co., Div. of H-P .... Neely Enterprises
Borg Equipment .................. Recht Assoc.
Bryant Computer Products ...... Costello & Co.
Burroughs-Brown Research Corp. ...... W. K. Geist Co.
Burroughs Corp., ECD .......... Tech-Ser, Inc.
California Instruments Corp. ...... V. T. Rupp Co.
California Technical Indus. .... Perlmuth Electronics
Century Electronics & Instruments .... V. T. Rupp Co.
Chlone-Log Corp. .............. West Eleven
Cimron Corporation ............ Ault Assoc.
CircuitDyne Corp. ............... T. Louis Snitzer Co.
Clairex Corp. .................... Moxon Electronics
Camar, Inc. ...................... Moxon Electronics
Communication Electronics .......... Costello & Co.
Components Engineering & Mfg. Co. ... Premmo Components for Research
Computer Instruments Corp. ... Components Sales
Computer Measurements Co. ... Moxon Electronics
Continuous Sensing, Inc. .......... Birnbaum Sales Co.
CTS Corp. ......................... J. Logan & Assoc.

### Dana Laboratories, Inc. .......... McCarthy Assoc.
Datamec Corporation ........ Moxon Electronics
Datapulse, Inc. .................. O'Halloran Assoc.
Decker Corporation .............. Costello & Co.
DeMerron-Bonardi Corporation .... J. T. Hill Co.
Diamond Antenna & Microwave Corp. ... Wright
Di/An Controls, Inc. .......... Wright Engineering
Digital Electronics Corp. .......... Peninsula Assoc.
Digilircs Corp. .................. Components Sales Calif.
Duncan Electronics, Inc. .......... Birnbaum Sales Co.
Dymec, Division of H-P .......... Neely Enterprises
Dynatran Electronics Corp. ...... G. H. Vaughan

### Eckel Corporation .......... White & Co.
E-H Research Laboratories, Inc. .... V. T. Rupp Co.
Elcor, Inc. ....................... T. Whychell Co.
Electra Manufacturing Co. ...... Birnbaum Sales Co.
Electro Assemblies, Inc. .......... Birnbaum Sales Co.
Electronic Modules Corp. .......... Walter Assoc.
Electronic Products Corp. .......... West Eleven
Electronic Products, Inc. ........ Jay Stone & Assoc.
Electronic Research Assoc., Inc. ....... Tech-Ser, Inc.
Emcor, Ingersoll Products Div. ... T. Louis Snitzer Co.
E M I .................................. O'Halloran Assoc.
Empire Devices, Inc. .......... Carl A. Stone Assoc.
Eppler Laboratory, Inc. .......... W. K. Geist Co.
Eubanks Engineering Company ...... Tech-Ser, Inc.

### Fabri-Tek, Inc. .................. Costello & Co.
Fabricant, Inc. .................. Costello & Co.
Fil-Shield Div. of Filtron, Inc., Carl A. Stone Assoc.
Fillers, Inc. .................... Compar San Francisco
Flow Corporation ................ G. H. Vaughan Co.
Franklin Systems, Inc. .......... Carl A. Stone Assoc.
Frenchtown Porcelain Co., ........ Compar San Francisco
Frequencit Engineering Lab. ...... West Eleven

### General Instrument, Capacitor Div. ...... J. Logan
General Instrument, Semiconductor Div. ...... J. Logan
General Thermodynamics, Inc. ...... Long & Assoc.
General Ultrasonics Div. (Acoustical) ... Tech-Ser, Inc.
Globe Industries ............... Long & Assoc.
Greenberg Electric Co. .......... Peninsula Assoc.

Hammer-Elektronik, Inc. .......... McCarthy Assoc.
Harrison Labs., Div., H-P .......... Neely Enterprises
Heli-Coil Corp. .................. Premmo, Inc.
Heller Industries, Inc. .......... Tech-Ser, Inc.
Hewlett-Packard Co. .......... Neely Enterprises
Holt Instruments Laboratories .......... W. K. Geist Co.
Hughes Aircraft Co., Instruments .... Walter Assoc.

### Impact-O-Graph Corp. ........ White & Co.
Industrial Instruments, Inc. ... G. H. Vaughan
Inland Motor Corp. .......... Costello & Co.
International Resistance Co. ...... J. Logan & Assoc.
ISO/Serve, Inc. .................. McCarthy Assoc.

### James Knight Co. .......... G. S. Marshall Co.
Jetronics Labs. .......... Goodrich & Assoc.
J-Omega Company .......... Moxon Electronics

### Keithley Instruments .......... T. Louis Snitzer Co.
Kemet Co. ................. G. S. Marshall Co.
Kepco, Inc. .................... V. T. Rupp Co.
Kinetics Corporation .......... The Thrason Co.
KRS Electronics .......... V. T. Rupp Co.

### Marshall Company, G. S. .......... 708 Warrington Road,
Redwood City, 364-9223
McCarty Associates .............. 1011-E Industrial Way,
Burlingame, 342-8901

### Neely Enterprises .......... 501 Laurel St.,
San Carlos; 591-7661
1317 Fifteenth St.,
Sacramento; GI 2-8901

### O'Halloran Associates .......... 3921 E. Bayshore,
Palo Alto; DA 6-1493

### Peninsula Associates .......... 1345 Hancock Street,
Redwood City; EM 5-1226

---

**REPRESENTATIVE DIRECTORY**

**Artwel Electric, Inc.** 1485 Bayshore Blvd., San Francisco; 586-4074

**Ault Associates** 120 Santa Margarita, Menlo Park; DA 6-1760

**Birnbaum Sales Company, Inc.** 626 Jefferson Ave., Redwood City; EM 8-7757

**Compar San Francisco** 1817 Bayshore Highway, Burlingame, 697-6244

**Components Sales California, Inc.** Palo Alto; DA 6-5317

**Costello & Company** 535 Middlefield Road, Palo Alto; DA 1-3745

**Dynamic Associates** 1011-D Industrial Way, Burlingame; 344-1246

**Geist Co., W. K.** Box 746, Cupertino; Y0 8-1608, AL 3-5433

**Goodrich & Assoc., James L.** 68 Alston Way, San Francisco; OV 1-3874

**Hill Company, J. T.** 4117 El Camino Way, Palo Alto; 327-0311

**Logan & Associates, Jack** 801 Mahler Road, Burlingame; OX 7-6100

**Long & Associates, Inc.** 505 Middlefield, Redwood City, EM 9-3324

**Marshall Company, G. S.** 708 Warrington Road, Redwood City, 364-9223

**McCarthy Associates** 1011-E Industrial Way, Burlingame, 342-8901

**McDonald Associates** 716 Wilshire Blvd., Santa Monica; 394-6610

**Moxon Electronics** 15 - 41st Avenue, San Mateo; 345-7961

---

October 1, 1963
GERTSCH

VARIABLE PHASE STANDARD

--permits shifting of phase between
2 self-generated voltages to any desired
angle, with accuracy better than ±0.05°

Precise generation of voltage vectors. The Gertsch VPS-1 generates 2 signals differing in phase by any angle from 0° to 360°, as determined by front-panel controls. The reference signal has a fixed amplitude of 50V rms. The vector output, which may be displaced in phase, has a maximum amplitude of 50V rms, and can be attenuated in steps of 50 mv within a range of 0-50V rms.

Operation at any 3 frequencies within a range of 150-3000 cps is provided by a front panel selector switch. Fine adjust control permits varying the frequencies ±5% max.

Completely self-contained-unit requires no accessories for operation. Case or rack mounted. Send for literature VPS-1.
CONTINUOUS COVERAGE

From dc through microwave, your Neely Field Engineer is the man to call for your instrumentation and system requirements. He represents the quality equipment manufactured by the Hewlett-Packard family of companies. He has the right answer for your instrumentation needs, and further, he is a seasoned engineer who is a true specialist in the application of test instruments and related equipment. Your Neely Field Engineer is backed up by a complete office staff, including extensive order processing and follow-up facilities. An added value is Neely's local service centers assuring you of continuing satisfaction with your instrument purchases.

NEELY ENTERPRISES
THIRTY YEARS OF SERVICE

an affiliate of Hewlett-Packard, representing Boonton Radio, Dymec, Harrison Laboratories, Hewlett-Packard, F.L. Moseley and Sanborn Company. Offices: North Hollywood: 3939 Lankershim Boulevard, TR 7-1282; San Diego: 1055 Shafter Street, AC 3-8103; San Carlos: 501 Laurel Street, 591-7661; Sacramento: 2591 Carlsbad Avenue, 482-1463; Scottsdale: 3009 North Scottsdale Road, 945-7601; Tucson: 232 South Tucson Boulevard, MA 3-2564; Albuquerque: P.O. Box 8366, Station C, 6501 Lomas Blvd., N.E., 255-5586; Las Cruces: 114 South Water St., 526-2486