

# Ge(Li) beans

SOMETHING TO CHEW ON.

## Five steps to improve energy resolution

Some things to check in order to get optimum performance from a Ge(Li) detector:

1. Minimize leakage current; remove moisture from all connectors.
2. Use an FET preamp with selected FET's; you may have to check out five to find one.\*
3. For large volume detectors, use three or four FET's in parallel at the input.\*
4. Select the main amplifier time constants to obtain best resolution.
5. Adjust (where possible) the ADC of the pulse height analyzer to accept the output pulse shape from the main amplifier.

Of course, there's a sixth step. You must start out with a high-resolution detector.

Even our largest detectors give an energy resolution of better than 5 keV (FWHM) at Co<sup>60</sup>, including electronic noise. Our test spectra at Co<sup>60</sup>, delivered with each detector, verify this performance.

Our smaller detectors (under 20 cm<sup>3</sup> active volume) are even better. One customer reports 2.8 keV (FWHM) at 800 keV for a 20 cm<sup>3</sup> detector. And that's with the preamp at room temperature.

If you have a Ge(Li) detector that is not giving you excellent resolution, call us. We'll be glad to give you our best advice. Even if it isn't one of our detectors. And visit us at the New York APS meeting (booth 17) to pick up a copy of our GUIDE TO THE USE OF Ge(Li) DETECTORS.

\*If you prefer, we can supply a complete detector-cryostat-preamplifier system with guaranteed performance.

## PRINCETON GAMMA-TECH

Box 641, Princeton, New Jersey, U.S.A.  
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has been appointed senior scientific representative in Australia by NASA.

Harvey Mudd College has honored two former physics faculty members, the late **Duane E. Roller** and **Ray Lee Edwards**, who retired last year, by the establishment of two new scholarships.

**Waldo H. Kliever**, Kliever Development Laboratories, has been made a fellow of the Instrument Society of America for his work in aircraft instrumentation and automation.

**Richard A. Blue**, formerly at Ohio State University, **Donald E. Ellis**, from the Massachusetts Institute of Technology, **Ralph C. Isler**, from Columbia Radiation Laboratory, and **Joseph S. Rosenshein**, of MIT and the University of Rome, have been named assistant professors of physics at the University of Florida; **James K. Gleim** of the US Naval Observatory and National Aeronautics and Space Administration and **Frederick R. West** of NASA Ames research center have joined the Florida faculty as assistant professors of astronomy.

**Richard J. Anderson**, a recent PhD at the University of Oklahoma, and **Charles B. Richardson, Jr** formerly at the University of Washington, have joined the physics staff at the University of Arkansas. **O. R. Plummer** has been appointed assistant professor of theoretical physics there.

**David F. Bleil**, associate technical director and head for research at the Naval Ordnance Laboratory, has been cited with the Navy's highest honor for civilians, the Navy distinguished civilian service award, in recognition of his many contributions to the field of naval ordnance.

**Robert Jastrow**, director of the Goddard institute for space studies, and **Dean E. Wooldridge**, co-founder of the firm that became Thompson-Ramo-Wooldridge, have been named fellows of the American Institute of Aeronautics and Astronautics.

**Charles H. Holbrow**, formerly of the University of Pennsylvania, has joined the staff of *PHYSICS TODAY* as associate editor.

**Arthur Y. Sakakura**, formerly of the University of Colorado, and **Jerrold J. Burnett**, formerly of the University of

Oklahoma, have joined the physics department of the Colorado School of Mines as assistant professors. **John V. Kline** has been promoted to professor and **Robert W. McAllister** has been promoted to associate professor.

**Eugene Rabinowitch**, editor of the *Bulletin of the Atomic Scientists*, has been selected as the 1966 winner of the international Kalinga Prize for the popularization of science. The prize of \$2800 is awarded annually by an international jury.

**Stuart J. Golin**, formerly assistant professor of physics and metallurgy at the University of Illinois, has become assistant professor of physics at the University of Pittsburgh. Visitors at Pittsburgh this year include **Johan J. DeSwart**, professor in theoretical physics at Katholieke University, Nijmegen, Holland, and **Wolfgang Kundt**, Universitaetdozent at the University of Hamburg, Germany.

**Frank W. Patten** has been granted leave of absence from the Naval Research Laboratory to be a visiting lecturer at Dartmouth College.

## Spectroscopy Society Award Given to Ralph A. Sawyer

The chairman of the board of the American Institute of Physics, **Ralph A. Sawyer**, has received the 1966 annual medal award of the New York section of the Society of Applied



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Spectroscopy. The gold medal, awarded for outstanding achievements in spectroscopy, was presented to Sawyer for his accomplishments in the advancement of applied spectroscopy.



# ANALOG MONOLOGUE

On Means for Modelling, Measuring, Manipulating, & Much Else

Volume 1, No. 4

## A SHORTER PATH TO PRACTICAL ELECTRONIC MEASUREMENTS

One requirement is common to all scientific research . . . threads through all development engineering . . . marks every empirical exercise — *the need to measure*. Our interest in this arises from the fact that electronic circuits (often with transducers) are generally the most practical means for measuring and recording parameters. Moreover, an increasing number of practical and economical electronic measuring circuits employ Operational Amplifiers — our specialty in analog computing devices since before 1946, and as a circuit component since their introduction as such in 1952.

During the past twenty years, we have been privileged to work closely with specialists in many disciplines, helping them to design and build literally thousands of different kinds of circuits — instruments, signal "conditioners", and data "processors" and others ad infinitum. We have learned that our "opposite numbers" in Chemistry, Metallurgy, Aerodynamics, Hydraulics, Mathematics, Stress Analysis, Physics, Thermodynamics, etc., are generally enthusiastic about what Analog Operational circuits *can do*, but almost totally disinterested in *how* they can be made to do it . . . and that is pretty much as it should be. To each his own.

We have observed that a major deterrent to more widespread use of the powerful Analog Way (of sensitive, accurate measurement and data processing) has been the time, effort, and considerable skill required to convert the circuit diagram into a complete, functioning instrument. Now we have found a way to speed and simplify that process. We call it the *Universal Operational Module* (U.O.M.): One such module, the Q3-A1P, is shown here.



Model Q3 — A1P

The Q3-A1P consists of a unique mechanical structure, in which are mounted a high-performance, chopper-stabilized Operational Amplifier, a compatible power supply, and an "Operating Deck", on which is located a cluster of conveniently-disposed, clearly-labeled jacks, for interconnecting input and feedback components with the amplifier and its supply. The structure also provides connectors and space for auxiliary networks, for input and output cables, and a front panel with duplicate input/output terminations. With a Q3-A1P and a few simple pluggable components (i.e., resistors, capacitors, etc.) any one of literally thousands of useful circuits — complete and ready to use — may be realized . . . *minutes after it is conceived*, without punching a hole, or soldering a wire.

Best of all, the physical organization of the Q3-A1P has been carefully planned to anticipate and prevent or circumvent most of the tiresome and unproductive "debugging" and "tweaking" that plagues almost any original design. Shielding, guarding, wire-routing; "strays", "sneaks", "parasitics" — you may forget them all, in almost every instance.

The Q3-modular packaging system which includes a variety of universal operational modules, some of which are listed in Table 1, permits concentration on the *important things* — What and Why, instead of How.

TABLE 1

Q3-A1P	Compact, self-powered, chopper-stabilized amplifier complete with patch panel and accessory socket.
Q3-A2P	As above, but using a low noise, low current-offset, differential amplifier.
Q3-J1P	A switch-programmable, self-powered integrator-differentiator.
Q3-M1P	A switch-programmable, self-powered unit capable of performing non-linear functions such as multiplying, dividing, squaring and rooting.
Q3-M2P	As above, less switches, programmable via a patch panel.

These universal operational modules (U.O.M.'s) consist of a standard Q3 series package, equipped with a carefully optimized interface facility to permit the combination of amplifiers, networks, components, and power supplies into highly-flexible, universal analog devices.

If you have been thinking of adding staff, perhaps to accelerate important programs, consider this alternate possibility: reducing the instrumentation burden on your present staff, with Philbrick Q3 U.O.M.'s and Philbrick Applications Engineering assistance — both distinguished by their versatility, integrity and reliability.

Write today for MBA Package #4 which contains a short form catalog. Philbrick Researches, Inc., 27-R Allied Drive at Route 128, Dedham, Massachusetts 02026. Phone (617) 329-1600.



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Sawyer, who retired in 1964 from his posts as dean of the graduate school and vice president for research at Michigan, now divides his time between his activities at the American Institute of Physics and the National Bureau of Standards where he is chairman of the National Academy of Sciences advisory committees to the Bureau.

#### **Optical Society Awards Wald 1966 Ives Medal**

**George Wald**, professor of biology at Harvard University, was awarded the 1966 Frederic Ives medal of the Optical Society of America. Wald is an authority on the biochemistry of vision and was the first to identify vitamin A in the retina of the eye. The award was made in recognition of the extent to which these and other studies have, in the words of the Ives Medal citation, "contributed uniquely to our knowledge of vision."

#### **Gordon Receives Gold Medal for Ionospheric Studies**

The Balzh van der Pol gold medal has been awarded to William E. Gordon, dean of engineering and science at Rice University, at the general assembly of the International Scientific Radio Union in Munich. The award was in recognition of Gordon's studies of the ionosphere and development of related electronic equipment. He also played a principal role in the conception and design of the Arecibo Ionospheric Observatory.

#### **William F. Meggers Dies; Was World-Famous Spectroscopist**

The dean of American spectroscopists and the world's leading contributor to the elucidation of atomic energy levels, William F. Meggers, died on 19 Nov. at his home in Washington, D.C., after a period of hospitalization for a heart attack. He was 78.

Meggers joined the National Bureau of Standards in 1914 as a laboratory assistant to the late Keivin Burns, and had been chief of the spectroscopy section of the Bureau from 1920 until his retirement in 1958. This last event had little effect on his scientific activity, however, and at the time of his death he was working to complete his

analyses of the very complex spectra of the elements thulium, ytterbium and hafnium.

Meggers puzzled out the external electronic structures of many more atoms and ions than any other scientist, and was in great degree responsible for the establishment of spectroscopy as a satisfactory tool for chemical analysis. He devoted more than 50 years to



MEGGERS

correcting deficiencies in spectroscopic data, and described and interpreted the spectra of more than half the known elements in many stages of ionization. He was the first to unravel spectral structures as complex as those of the rare-earth elements.

Meggers' outstanding characteristic, apart from the meticulous care with which he attacked scientific problems, was his persistence in measuring and searching for clues in the complex maze of atomic data that so absorbed him. For more than half a century he spent a majority of his days patiently sitting at a comparator, measuring the wavelengths of atomic spectrum lines, estimating and recording their intensities in his neat legible script, and later at home, far into the night working out relationships among their frequencies from which he could deduce the quantum numbers of the energy states from which they originated. Slowly and systematically he dissected the great mounds of information he accumulated, knowing that in them must be buried the choice jewels of information he sought. His pace in everything was deliberate, and his work almost never needed revision.

Meggers was born in Wisconsin in 1888. His family's circumstances pre-

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## **Ge(Li) beans**

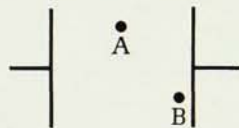
SOMETHING TO CHEW ON.

### **Time resolution**

Whether your Ge(Li) detector is planar or coaxial, of whatever cross-section, there is a fundamental spread in the pulse risetime. This is basic to the nature of a p-i-n device.

Gamma-rays produce ionizing events throughout the active volume of the detector. The collection time of the carriers produced will depend upon the position of each ionizing event. As a result, there must be a spread in the pulse risetimes.

To illustrate. Say that a gamma-ray is absorbed (via photoelectric effect, etc.) at point A, generating electron-hole pairs in the vicinity of A. The risetime of the signal is the time for the carriers to be swept from point A to either collecting electrode.



However, a gamma-ray may instead be absorbed at point B, close to one of the collecting electrodes. Then the risetime will be the time for the carrier which must reach the more distant electrode to be swept all the way across the depletion layer.

Clearly, in an ideal planar diode, this effect will account for a variation in risetime of about a factor two. This fundamental effect is the largest source of risetime variation in Ge(Li) detectors. Risetime variation is the major limiting factor in time resolution.

Crossover timing (such as is done with scintillation counters) is not the answer. To get good resolution with a Ge(Li) detector, use careful leading edge timing.

For details on this and other topics, please write or call. Or visit us at the New York APS meeting (booth 17) and pick up a copy of our GUIDE TO THE USE OF Ge(Li) DETECTORS.

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