Color Perception

By Dr. Mauro N. Zambuto
There's more to Air Traffic Control than meets the eye.

Everyone will recognize this controller's scope.

But unless you're a Hazeltine engineer or an FAA employee you may not know that our Alpha-Numeric Generator is in the back room converting computer data into the symbols, characters, lines and vectors on the scope.

Our ANG is an important improvement in air traffic control—the positive association of aircraft identity and altitude information with the aircraft targets shown on radar displays. It is the latest of a long-line of Hazeltine contributions.

**RADAR SYSTEMS RESEARCH**

Study of systems using advanced pulse compression, research in multi-dimensional radar resolution, space object identification, ultra-high resolution systems. Experience in radar systems analysis and hardware implications desirable.

**ADVANCED COMMUNICATIONS RESEARCH**

Synthesis and advanced development of ECCM communications, navigation and IFF, including AJ, secure and concealed systems. Strong theoretical background with substantial experience in analysis and/or synthesis required. Additional background in circuit design and hardware development desirable.

**SIGNAL PROCESSING RESEARCH**

Investigation of problems in advanced pulse compression waveforms and signal processing, optimum filtering, multi-static radar data association. Both experimental and analytical backgrounds desirable.

**CIRCUIT DESIGN**

BS in EE (MS preferred) with 2 or more years experience in the design and development of solid state circuitry for military electronics systems. Assignments in diversified programs working from specification to prototype.

**SYSTEMS ENGINEERING**

Graduate EE required with several years experience in design of military systems involving RF, data processing and display components. Background in logic or equipment design and familiarity with MIL specs desirable.

**RADAR ENGINEERING**

Senior openings in Radar and ECM Systems design. Intermediate and junior openings in RF and IF solid state circuit design. Junior openings in general solid state circuit design.

**FIELD ENGINEERING**

Engineering representative at field sites where Hazeltine equipment is installed. BS in EE or Physics required, with one or more years practical experience in installation, maintenance or servicing electronic systems and equipment. Military experience in electronics preferred.

Openings in DISPLAY, RFI, and TEST ENGINEERING also available.

Write in confidence to Mr. W. A. Speer

HAZELTINE CORPORATION

Little Neck, Long Island, N. Y.

An Equal Opportunity Employer, M/F
Stevens Institute of Technology
IEEE Basic Sciences — Electronic Computers
SYMPOSIUM — COMPUTER AIDED BASIC RESEARCH

Date: Friday, April 22, 1966
Time: 9:30 A.M. - 5:00 P.M.
Place: Stevens Institute
Hoboken, New Jersey
Cost: Regular $10; students $5
(includes lunch, preprints)

Papers presented by prominent researchers in socialized oriented disciplines will be discussed by an authoritative panel and the audience. The attendees will be furnished preprints of the papers to be given before the conference. The speakers will review and summarize their paper in a short exposition. A panel of half a dozen or so specialists in author's field, associated fields or computers will interrogate the speaker and make additional comments. The audience will address comments and questions to the panel or the speaker.

Speakers include: Computers — Ivan Flores, Stevens; Biology — Warren McCulloch, MIT; Psychology — Ward Edwards, U. of Michigan; Sociology — Philip Stone, Harvard; Philosophy — Fred Fitch, Yale; Music — John Pierce, Bell Labs.

For information, registration and preprints apply to: Dr. Ivan Flores, EE Dept., Stevens Institute, Hoboken, N. J. 07030.

CALENDAR

Tuesday, April 19

N. Y. COMTEC GROUP
6:30 P.M. — "Communications Transmission, Part III Design Application of Wideband Data Systems"
T. L. Leming, Director of Telecommunications Engineering
Collins Radio Corp.
At Western Union auditorium, 160 West Broadway, N. Y. C.

N. Y. COMPUTER GROUP
7:30 P.M. — "Panel To Debate Deficiencies In Area’s Computer Education"
Prof. Ted Bashkow, Columbia University
Edward Shanken, Engineers’ Joint Council
George Kaye, IBM
At Burroughs Corp. auditorium, 605 Third Ave. at 40th St., N. Y. C.

NORTH JERSEY COMTEC GROUP
8:00 P.M. — "Expanding Cable Communications"
F. T. Andrews, Jr., Bell Telephone Labs.
At Communication Systems, Inc., Paramus, N. J.

Wednesday, April 20

NORTH JERSEY GMTT
8:30 P.M. — "Fundamentals of Holography"
Dr. Herwig Kogelnik
At Bell Telephone Labs., Arnold Auditorium, Murray Hill, N. J.

Thursday, April 21

N. Y. POWER & INDUSTRIAL
2:00 P.M. — "Inspection Trip To Bell Telephone Labs"
For tickets contact R. A. Martinson, L. I. Lighting Co., Hicksville, N. Y.
At Bell Telephone Labs., Murray Hill, N. J.

NORTH JERSEY POWER GROUP
6:30 P.M. — "Lightning Protection"
Round table discussion and election of officers
At Public Service Terminal Bldg., Room 3171A, 80 Park Place, Newark, N. J.

Friday, April 22

NORTH JERSEY SYMPOSIUM
9:30 A.M. to 5:00 P.M. — "Electron Computers IEEE Basic Sciences — Computer Aided Basic Research"
Apply to Dr. Ivan Flores, EE Dept., Stevens Institute
At Stevens Institute, Hoboken, N. J.

Thursday, April 28

N. Y. COMTEC GROUP
9:30 A.M. — "Inspection Trip To N. J. Bell Telephone Co.
Electronic Switching Exchange"
Contact F. E. Sellinger, ADT Co., Inc., 155 Sixth Ave., N. Y. C.
At N. J. Bell Telephone Co. Electronic Switching Exchange, Succasunna, N. J.

NORTH JERSEY SECTION MEETING
AUTOMATIC CONTROL GROUP SPONSORED
8:00 P.M. — "Subjective Color Perception By The Adapted Eye"
Dr. Mauro H. Zambuto
At Arnold Auditorium, Bell Telephone Lab., Murray Hill, N. J.

Wednesday, May 18

N. Y. POWER & INDUSTRIAL
6:00 P.M. — "1966 Spring Get-to-Gether — Flatfoot’s Frolics"
Contact Andy Massarella, Con Ed. of N. Y., 4 Irving Pl., N. Y. C.
At 165th Regiment Armory, Lexington Ave. between 25th & 26th St., N. Y. C.

The Newsletter, April 1966
Measures Wide Range of Waveforms and Frequencies to 1/4% Accuracy...In Seconds!

You can measure non-sinusoidal voltages in seconds with Ballantine’s Model 350 True RMS Voltmeter... and with an accuracy to 1/4%. All you need do is set four knobs for minimum indication, and read the unknown voltage directly from a NIXIE in-line read-out. Such simplicity in use and the little training needed to operate the rugged Model 350 recommend it for the production line, in the laboratory, and even in the field.

The precision of the instrument is 5 to 10 times higher than its stated accuracy. This feature of the Model 350, plus its excellent stability, also gives you these benefits: (1) for observing small changes beyond its accuracy limits; (2) in comparing two voltages; and (3) in using it as a precision transfer device.

**SPECIFICATIONS**

- **Voltage Range**: 0.1 V to 1199.9 V
- **Frequency Range**: 50 Hz to 20 kHz
  (Harmonics to 50 kHz are attenuated negligibly)
- **Max Crest Factor**: 2
- **Input Impedance**: 2 MΩ shunted by 15 pF to 45 pF
- **Accuracy**: 
  - 1/4%, 100 Hz to 10 kHz
  - 0.1 V to 300 V, 1/2%, 50-100 Hz and 10 kHz to 20 kHz, 0.1 V to 1199.9 V
  - A specified correction for voltages above 300 V is applied to keep within 1/2%.
  - Available in portable or relay rack versions

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**NORTH JERSEY POWER GROUP**

**LIGHTNING PROTECTION**

- **Date**: April 21, 1966
- **Time**: 6:30 P.M.
- **Place**: Room 3171A
  - Public Service Terminal Building
  - Newark, New Jersey

A round table discussion will cover the latest techniques in lightning protection of distribution lines, equipment and underground cables. Arrangements have been made to have knowledgeable manufacturers, utility and consultants technical representatives participate in the discussion.

Since this will be the last meeting of the Power Chapter until Fall, election of officers will be held. All chapter members are urged to attend and bring their associates.

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**N. Y. COMMTEC GROUP**

**INSPECTION TRIP TO NEW JERSEY BELL TELEPHONE COMPANY ELECTRONIC SWITCHING EXCHANGE**

This morning’s trip will be to the New Jersey Bell Telephone Company’s Electronic Switching Exchange, at Succasunna, New Jersey, to inspect the No. 1 Electronic Switching System (ESS).

Attendance is limited to 40 persons and is by advance registration only. Transportation will be made available by Chartered Bus, leaving 43rd St. & Vanderbilt Avenue, New York, at 9:30 A.M., Thursday, April 28, 1966. Cost of transportation to be determined by number of people using bus. Return before April 22, 1966.

Mr. F. E. Sellinger, ADT Co., Inc.
155 Sixth Ave., N. Y., N. Y. 10013

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**N. Y. POWER & INDUSTRIAL**

**INSPECTION TRIP TO BELL LABS**

- **Time**: 2:00 P.M.
- **Date**: Thursday, April 21, 1966
- **Place**: Bell Laboratories
  - Mountain Avenue
  - Murray Hill, New Jersey

The tour will cover research work in the fields of lager, electronic switching, and cable insulation. The tour will take about two hours and will be limited to 50 persons, with advance registration required.

A chartered bus will leave New York from in front of Hotel Holland, 321 West 42nd Street (between 8th & 9th Avenues) at 12:30 P.M. and should return by 6:00 P.M. Round trip fare is $2.00.

Request for tickets should be made to:
R. A. Martinson, L. I. Lighting Company
175 E. Old Country Rd., Hicksville, N. Y.

Make checks payable to Power & Industrial Division, New York Section IEEE. No request will be considered after April 18, 1966.
Subjective Color Perception
By The Adapted Eye

Speaker:  Dr. Mauro H. Zambuto
Date:  Thursday April 28, 1966
Time:  8:00 P.M.
Place:  Arnold Auditorium
        Bell Telephone Labs
        Murray Hill, N. J.
Pre-meeting Dinner:  Wally's Tavern
                    Watchung, N. J.
                    6:00 P.M.

The chromatic sensation generated by a light stimulus of given spectral composition depends on the conditions of adaptation of the eye. A mathematical representation of the "subjective (or adaptive) stimuli" is presented as a logical consequence of classical color theory, known psychophysical laws, and recent measurements of eye properties. Support of the validity of the law is presented in the form of several experiments verifying mathematical predictions. Some engineering applications are suggested and described.

About the Speaker:

Dr. Mauro Zambuto attended the Universities of Rome and Padua, Italy where he received his doctorate degree. He is currently engaged in laser, quantum electronics, and color perception research. He is Professor of Electrical Engineering at Newark College of Engineering. Dr. Zambuto was formerly, over a period of many years, technical director and manager of motion picture studios in Italy and the U.S.A.

NORTH JERSEY GMTT

FUNDAMENTALS OF HOLOGRAPHY

Date:  Wednesday, April 20, 1966 at 8:30 P.M.
Speaker:  Dr. Herwig Kogelnik
Place:  Arnold Auditorium
        Bell Telephone Labs
        Murray Hill, N. J.
Pre-meeting Dinner:  6:30 P.M., Wally's Tavern
                    Watchung, N. J.

This talk will survey briefly the areas of application of holographic techniques, and discuss the fundamental principles of holography and wavefront reconstruction. Topics to be discussed are: the three-dimensional aspects of wavefront reconstruction; the use of a spatial carrier or reference beam; the effect of thick emulsions; and others. The talk is followed by a demonstration of holograms.

Herwig Kogelnik was born in Graz, Austria. He received the degree of Dipl. Ing. in electronic engineering in 1955 and the Dr. Techn. in 1958, both from the Technische Hochschule, Wien, Austria, and the Dr. phil. in 1960 from Oxford University, England.

From 1955 to 1958 he was Assistant Professor at the Institut für Hochfrequenztechnik in Vienna, engaged in microwave research and teaching. He won a British Council Scholarship to Oxford, 1958 to 1960, where he did research on electromagnetic radiation in magnetoplasmas and anisotropic media. He joined the Electronics Research Department of Bell Telephone Laboratories in 1961 where he has worked on optical masers.

Dr. Kogelnik is a member of the American Physical Society and the Elektrotechnischer Verein Österreichs, Austria.

N. Y. COMPUTER GROUP

PANEL TO DEBATE DEFICIENCIES IN AREA'S COMPUTER EDUCATION

Officials will discuss the problem at the April 19 meeting of the New York Metropolitan chapter of the Computer Group.

The meeting is scheduled for 7:30 P.M. at the Auditorium of the Burroughs Corp., 605 Third Ave., at 40th St. (Entrance through showroom). The meeting will be preceded by a Dutch-treat dinner at Gatti's Restaurant, 246 E. 40th St., at 5:45.

The panel will include Prof. Ted Bashkow of Columbia, Edward Shanken from the Engineers' Joint Council and George Kaye of IBM.

N. Y. ENGINEERING MANAGEMENT GROUP

PAPERS ON ENGINEERING MANAGEMENT TOPICS

Four papers of current engineering management concern will be delivered at the April 21 meeting of the Engineering Management Group. The meeting, open to all, will be held at 7:30 P.M. in Room 125, United Engineering Center, N. Y. The presentations will highlight the decision-making and long-range planning phases of EM.

N. Y. POWER & INDUSTRIAL 1966 SPRING GET-TOGETHER

Title:  "Flatfoot's Frolics"
Date:  May 18, 1966
Time:  6:00 P.M.
Place:  165th Regiment Armory
        Lexington Avenue between 25th & 26th Streets
        New York City
Tickets:  $5.75

Andy Mazzarella, Room 1341-S
c/o Consolidated Edison Company of New York, Inc.
4 Irving Place
New York, N. Y. 10003

Please enclose stamped, self-addressed envelope.
Executive Committee
Nominations — 1966 - 67

The Nominations Committee of the North Jersey Section of the IEEE presents the following slate of officers for 1966-67.

For Chairman — Stephen A. Mallard
For Vice-Chairman — Bernard Meyer
For Treasurer — Joseph G. O'Grady
For Secretary — M. M. Irvine
For Member-at-Large
R. L. Whittle and
Herbert Blaicher

Additional nominations may be made by presenting a petition signed by not less than twenty-five (25) voting members of the North Jersey Section to the Executive Committee not later than 1st of May. The petition must certify that the persons nominated have agreed to serve if elected.

Election of Officers will take place at the General Meeting in May unless the Executive Committee decides that a special ballot is required.

Mr. Mallard received his ME from Stevens Institute of Technology in 1948 and his MS form Stevens in 1951. He taught in the Electric Engineering Department at Stevens from 1948 to 1951. Since 1951 he has been employed in various engineering capacities by the Public Service Electric and Gas Company. He is presently the Transmission Planning Engineer of that company.

In addition to being a Senior Member of IEEE, Mr. Mallard is a member of CIGRE (International Conference on Large Electric Systems), Tau Beta Pi, the National Society of Professional Engineers, the Montclair Society of Engineers, the Essex County Grand Jury Association and the Serra Club of Bloomfield.

Mr. Mallard will be attending the CIGRE Conference in Paris in June of this year. He lives in Nutley with his wife and three children: Kevin, a freshman at Iona College; Catherine, a freshman at Marylawn of the Oranges; and Eileen, who is in grade school.

Bernard Meyer received his BA and BEE from New York University in 1942 and 1950 respectively. He has been active in the North Jersey Section of the IRE and IEEE as Student Affairs Editor, Managing Editor, and Editor of "The Newsletter." He has also served as Chairman of the Publicity Committee and Chairman of the Publications Committee, and is now member-at-large on the Executive Committee.

At present he is employed as an Electronics Engineer at Picatinny Arsenal in the Electrical Inspection Equipment Branch of the Quality Assurance Directorate.

Mr. Blaicher, Jr. was graduated from the Pennsylvania State University in 1949 with a degree of B.S. in Electrical Engineering. Following graduation he entered the cadet engineer training course of Jersey Central Power & Light Company. Since then he has worked in various assignments in system planning and distribution engineering. He is presently in the System Planning Group where he is in charge of engineering computer applications.

Mr. Blaicher served on active duty with the U. S. Armed Forces from 1943 to 1946.

Mr. Blaicher is a senior member in IEEE and has served as chairman of the Education Committee during the 1961-62 season, and as an IEEE representative on the New Jersey Engineer's Committee for student guidance. He is presently chairman of the Power Group Chapter in North Jersey Section, IEEE.

Mr. O'Grady is the Assistant Laboratory Engineer at the Maplewood Testing Laboratory of the Public Service Electric and Gas Company. He joined the Company in various positions in the Electrical Division of the Laboratory and was appointed to his present position in 1964.

He is a graduate of the College of Engineering of New York University where he received a BEE degree in 1954, and is a former member of the Instructing Staff of the Special Courses Division of Newark College of Engineering.

He has been a member of the Section Executive Committee for several years, having been chairman of both the Section Program Committee and the Publicity Committee. In 1965 he was elected Section Secretary.

Mr. O'Grady is a senior member of both IEEE and ISA, and is also a member of Rotary International.

M. M. Irvine, R.D.

Mr. Irvine received his B.A. in Physics, Lehigh University, in 1955 — Ph.D. Physics, Lehigh University, in 1955. He is a member of the American Physical Society, the IEEE Society of the Sigma Xi, the American Association for the Advancement of Science, the Board of Directors of the Sigma Pi, the National Society of Professional Engineers, the Montclair Society of Engineers, the Essex County Grand Jury Association, and the Serra Club of Bloomfield.

Mr. Irvine is a member of the IEEE Wire Communication Committee's task force for standardizing testing methods for telephone instruments, and is a member of the IEEE National Committee on Communications, formerly known as the Central Committee.

Mr. Irvine is presently chairman of the Power Group Chapter of the IEEE North Jersey Section.

NORTH JERSEY COMTEC
EXPANDING CABLE COMMUNICATIONS

Date: April 19, 1966
Time: 8:00 P.M.
Speaker: F. T. Andrews, Jr.
Bell Telephone Laboratories
Place: Communication Systems, Inc.
Paramus, New Jersey

Mr. Andrews will discuss the very important and continuing role of wire and cable communication systems which, unlike the radio spectrum, are unlimited in their ability to grow and meet expanding needs. He will describe the wire and cable systems in major use today, which range from single channel voice frequency transmission over wide open wire lines, to carrier transmission of as many as 1860 channels on coaxial cables. Future systems providing even larger channel cross-sections and some using pulse transmission techniques will also be described.

Mr. Andrews is Director of the Transmission Systems Engineering Center at the Bell Telephone Laboratories, a position he has held since 1962. His responsibilities include establishing transmission performance and maintenance objectives, engineering voice-frequency transmission equipment, and research in human factors. He joined the Bell Laboratories in 1948 upon graduation from the Pennsylvania State University with the BS degree in Electrical Engineering. He completed the Communications Development Training Program at the Bell Laboratories and his early work was in the field of switching circuits, memory systems, and nonlinear magnetic logic elements. He participated in the development of T1 carrier, the Bell System's first PCM system, prior to assuming his present responsibilities. He is chairman of the IEEE Wire Communication Committee's task force for standardizing testing methods for telephone instruments, and is vice-chairman of CCITT Study Group XII.

N. Y. COMTEC GROUP
COMMUNICATIONS TRANSMISSION

Starting on April 19, the Education Committee will begin Part III "Design Applications of Wideband Data Systems" of its lecture series on Communications Transmission. The dates and subjects are as follows:

Date Subject
Apr. 19 — Microwave Systems
Apr. 26 — Radio propagation and frequency allocation
May 3 — Radio systems design
May 10 — Pulse Code Modulation
May 17 — Pulse Code Modulation
May 24 — Wideband Data

Speakers for Part III are as follows:
April 19, 26 and May 3 — T. L. Leming, Director of Telecommunications Engineering, Dallas Division, Collin Telephone Corp.

Note: Biography of R. L. Whittle not available at press time.
New Tektronix Type 556

DUAL-BEAM DC-to-50 MHz
Oscilloscope

with 10 ns/cm sweep rate on both beams and many new operating and convenience features

CHARACTERISTICS

New Dual-Beam CRT (with illuminated internal graticule) — provides "zero-parallax" viewing of small spot size and uniform focus over the 8 cm by 10 cm display area.

Calibrated Sweep Delay — extends continuously from 0.1 microsecond to 50 seconds, to permit expansion of a selected portion of the sweep.

Independent Sweep Systems — provide 24 calibrated steps from 0.1 μs/cm to 5 μs/cm; the X10 Magnifier extends the fastest sweep rates to 10 ns/cm.

Single-Sweep Operation — enables one-shot displays for photography of either normal or delayed sweeps.

2 Independent Triggering Systems — provide stable displays over the full bandwidth, and to beyond 50 MHz. Both vertical amplifiers supply trigger signals to both of the time-base triggering systems.

Meets Interference specifications of MIL-I-6181D over the following frequency ranges — Radiated (with CRT mesh filter installed): 150 kHz to 1 GHz; Conducted (power line): 150 kHz to 25 MHz.

Other Specifications — size is 15" by 17" by 24"; weight is ≈ 80 pounds without plug-in units; power requirement is 100-130 V or 200-260 V, 50-60 Hz, ≈ 850 watts.

Type 556 Dual-Beam Oscilloscope .... $3150

Rack Mount Type R556 Oscilloscope .... $3250

Call your nearby Tektronix field engineer for complete information or write Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

Plug-ins illustrated
Type 1A1 Dual-Trace Unit .... $600
(Dual-Trace; 50 mV/cm at DC-to-50 MHz, 5 mV/cm at DC-to-28 MHz. Single-Trace: 500 μV/cm at 2 Hz-to-15 MHz. 5 Display Modes: Channel 1, Channel 2, Alternate, Chopped, Added Algebraically. Front-panel signal output.)

Type 1S1 Sampling Unit .... $1100
(DC-to-1 GHz, internal triggering, built-in delay line. Sweep Rates: 100 ps/cm to 50 μs/cm, with ±3% accuracy, normal or magnified (up to X100). DC Offset Range: greater than ±1 V. 4 Display Modes: repetitive, single sweep, manual scan, or external scan.)

U.S. Sales Prices, f.o.b. Beaverton, Oregon

Tektronix, Inc.
VOLTAGE MEASUREMENTS TO 1 GHz WITHOUT TUNING

Using a principle new to voltmeters, Hewlett-Packard's Model 3406A reads ac voltages from 10 KHz to 1 Ghz, resolves differences as small as 20 µv, and shunts the measured circuit with low input capacitance. In use it requires no tuning. The meter has full-scale ranges from 1 millivolt to 3 volts.

To improve its usefulness in measuring voltages at hard-to-reach points in rf circuits, Model 3406A has a pushbutton conveniently located in its probe. So long as the button is pressed, the meter will retain its reading. When the user finds that a test point is out of sight of the instrument, this memory feature makes measurement still easily possible.

In its lower frequency range (10 KHz to 100 MHz) the new meter's accuracy is ± 3%. At higher frequencies (100 to 700 MHz) it is ± 5%. At the upper extreme (700 MHz to 1 GHz) it is ± 8%. Useful sensitivity is provided from 1 KHz to 2 GHz.

The 3406A utilizes an incoherent sampling technique in an economical analog voltmeter combining wide bandwidth and high sensitivity. It indicates the absolute average value of the input signal regardless of the shape of the waveform, and provides greater accuracy than peak detecting voltmeters.

The new Hewlett-Packard instrument weighs only eight pounds, is 6 1/4" high, 8 7/8" wide and 11 1/2" deep. The HP Model 3406A is priced at $650.00.

-HP ASSOCIATES OFFERS VERSATILE SWITCH MODEL 3530

Here is a new Microwave Single-Pole-Single-Throw PIN Diode Switch designed for integration into strip-line circuits. The hermetically sealed, ultra-miniature -hpa-3530 features broad frequency coverage, high switching ratio, and a package which matches stripline geometry.

Design of the switch package is such that simple, inexpensive stripline "N"-pole, "N"-throw switches may be constructed with combinations of -hpa-3530's as modules.

Dimensions of -hpa-3530 are 0.562" diameter by 0.172" thickness. Lead dimensions are .015" maximum diameter by .250" length. Operating and storage temperature limits are -65° to +150°C maximum. At 25°C the -hpa-3530 can dissipate 1.25 watts resulting in switching ratings of 8 watts average, and more than 75 watts peak. Maximum rating as an attenuator is 1.25 watts. -hpa-3530 will withstand 1500 g shock and 20 g, 10-2000 cps vibration environments.

The price of -hpa-3530 in quantities of 1-99 is $175.00 each. And for complete information on all Hewlett-Packard products call your local HP FIELD ENGINEER.