Test & Measurement World

Fall 1981

PREMIER ISSUE

Video and CCTV: Enhancing Inspection Technology

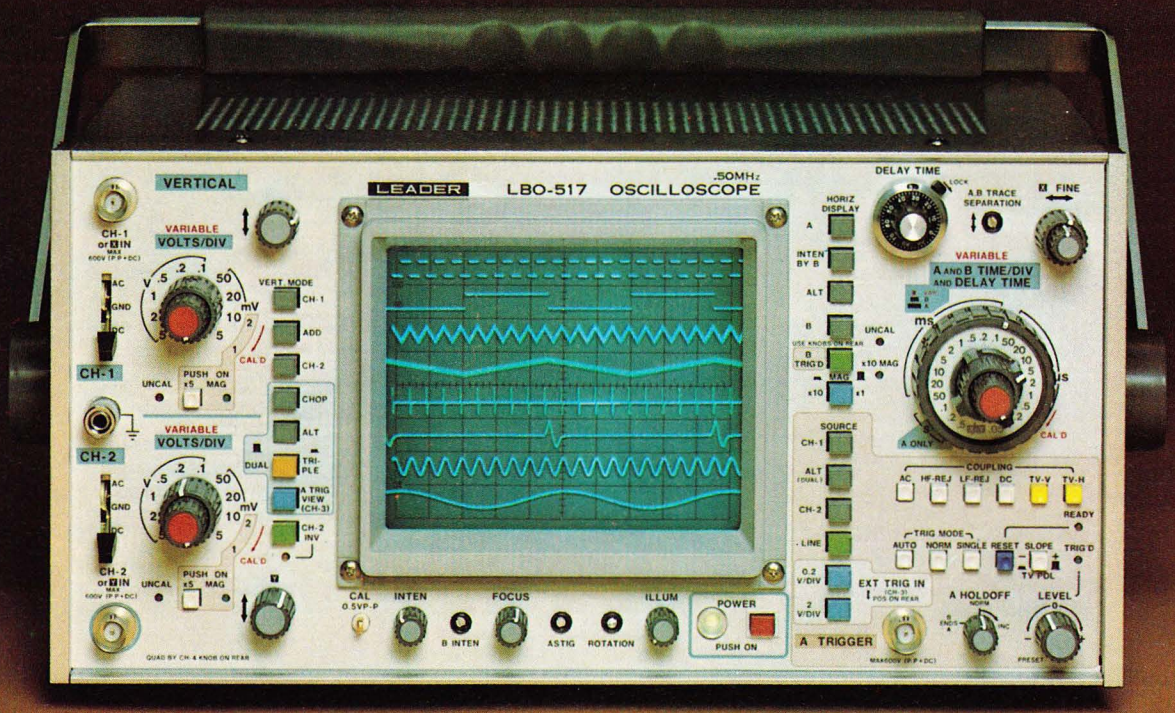
ATE: Still the Promised Land?

Industry Profiles: Strategies for Growth

Test Equipment and High Tech Espionage

To Qualify For Your Own Subscription, Fill Out Form On P. 23 NOW

It takes a lot more than 60-MHz to beat the 50-MHz Leader.



In side-by-side comparisons with the Tektronix 60-MHz oscilloscope, the reasons for selecting the 50-MHz LBO-517 become apparent.

Our 20 kV accelerating potential provides the sharp, bright trace that has always been the hallmark of a high-performance oscilloscope.

All the Important Bells and Whistles.

To be really useful today, an oscilloscope needs more than bandwidth. The LBO-517 gives you: ***Four Channels (8 traces).*** Essential for displaying clock or trigger pulses, or for simultaneously looking at three or four terminals of a logic gate. ***B-Ends-A Mode.*** For an even brighter delayed sweep display. Lacking this feature, some signals would just disappear. ***B-Time Base Triggering.*** For displaying some complex signals. Also eliminates jitter on delayed time base. ***Automatic Video Triggering.*** Separates either vertical *or* horizontal sync pulses for stable video waveform monitoring. ***Vertical Amplifier Output.*** Lets you drive less sensitive instruments with just 1 mV input to the LBO-517. ***Illuminated Graticule.*** Needed when photographing waveforms. All of these capabilities, plus ***"UNCAL" Warning Lamps,*** ***Pushbutton Switches,*** and more, put the LBO-517 in a class by itself.

Here's Proof!

MANUFACTURER MODEL NO.	LEADER LBO-517	TEKTRONIX 2215
ACCELERATING POTENTIAL	20 kV	10 kV
BANDWIDTH/ SENSITIVITY	50 MHz/5 mV 10 MHz/1 mV	60 MHz/20 mV 50 MHz/2 mV
NO. OF CHANNELS	4 CH	2 CH
MAX. NO. OF TRACES	8	4
TRIGGER VIEW	YES	NO
B-ENDS-A MODE	YES	NO
EXT. TRIGGER OF B SWEEP	YES	NO
VIDEO TRIGGER SEPARATOR	V and H	V ONLY
L.F. TRIGGER REJECT	YES	NO
CH-1 AMPLIFIER OUTPUT	50Ω, 100 mV	NO
GRATICULE ILLUMINATION	YES	NO
"UNCAL" WARNING LAMPS	YES	NO

Beware of False Economy.

You get what you pay for. Don't be lured by low price alone. You might keep on paying in the long run, by not having the features you need.

Two-year warranty. Evaluation units.

Our two-year warranty (even on the CRT) is backed by factory service depots on both Coasts. Evaluation units are available to qualified customers. **Call toll-free (800) 645-5104 to request:** an evaluation unit, catalog, the name of your nearest "Select" distributor and more information.

For engineers who know the difference.

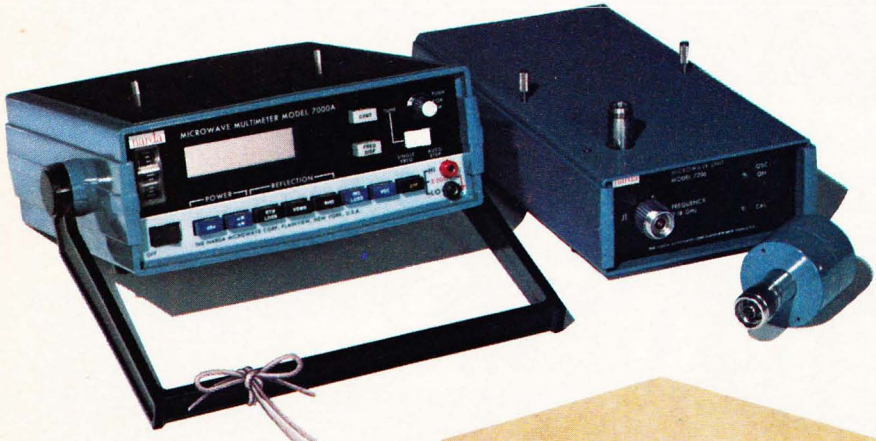
LEADER Instruments Corporation

380 Oser Avenue
Hauppauge, N.Y. 11788 (516) 231-6900
Regional Offices:
Chicago, Los Angeles, Dallas.

FOR MORE INFORMATION, CIRCLE 2

MICROWAVE MULTIMETER

measure
POWER • REFLECTION • TRANSMISSION • DC VOLTAGE



Self-contained microwave test station that leads the operator step-by-step through the procedure, automatically calibrates itself, selects the proper frequency range, sets zero references, and performs measurements — and it's portable.

$5975*

Finally . . . an instrument that makes microwave measurements quickly and accurately. It's like having an expensive test bench — that's portable. Use it for Continuous Incoming Inspection, Field Service Tests, Production Line Tests, Flight-Line Testing and Lab Testing.

Save time — call or write for complete technical literature.

MICROWAVE UNIT

Model	Frequency Range	Model	Frequency Range
7103	3.7-4.2 GHz	7202	0.01-2 GHz
7105	8-10 GHz	7206	2-18 GHz

*Select any one of these four Microwave Units with your Microwave Multimeter Model 7000A.

AT ADDITIONAL COST Microwave Unit Frequency		OPTIONS INCLUDE	
Model	Range	Model	Range
7104	7.2-8.4 GHz	7500	Printer
7115	10.5-12.7 GHz	7501	Printer
		7000A-01	Battery Option
		7000A-02	IEEE-488 BUS

narda

FOR MORE INFORMATION, CIRCLE 43

*Domestic

259

THE NARDA MICROWAVE CORPORATION · PLAINVIEW, L.I., NEW YORK 11803

516-349-9600 • TWX: 510-221-1867 • CABLE: NARDACORP PLAINVIEW NEWYORK

Being first is the difference between lightning & thunder.

WILSON IS NUMBER 1 IN TEST-EXERCISERS

First with new ideas, first with new products, first with new services to QA, QC and Field Engineers...Wilson strikes like lightning to bring you the best in the Test-Exerciser industry.

Pick up a Wilson Testercizer test-exerciser. Open it up and you know right away that there are a lot more reasons why we are first. Every Testercizer is light in weight but very rugged. The well organized panel is packed with everything you need to isolate problems.

WHAT IS A TESTERCIZER?

A Testercizer *both* tests and exercises equipment to pinpoint existing faults and uncover intermittent ones. Used to test a wide range of computer peripheral devices, Testercizers contain all the capabilities to determine the condition of the interface, servo and data functions.

A FULL LINE - There's a Testercizer™ for you...

SX-530
Storage Module
Testercizer

HAT-500
Head Alignment
Testercizer

TFX-500
Tape Formatter
Testercizer

DX-1000
Disk Drive
Testercizer

DX-2314
Disk Drive
Testercizer

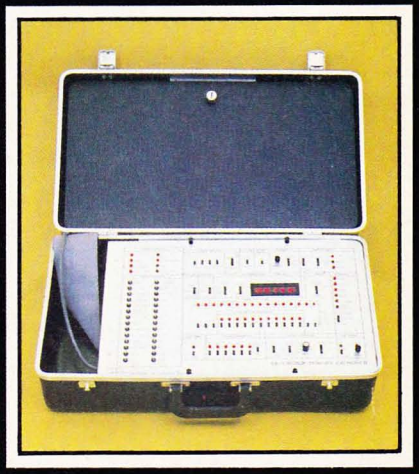
TX-1200
Tape Drive
Testercizer

FX-500
Floppy Disk
Testercizer

DX-500
Disk Drive
Testercizer

TX-500
Tape Drive
Testercizer

CX-500
Communications
Testercizer



Send For Complete Information

WILSON Laboratories, Inc. 2237 N. Batavia St., Orange, Calif. 92665 / Tel. (714) 998-1980 · Telex 181 598

FOR MORE INFORMATION, CIRCLE 59

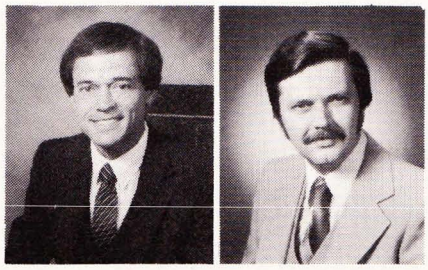
CONTENTS

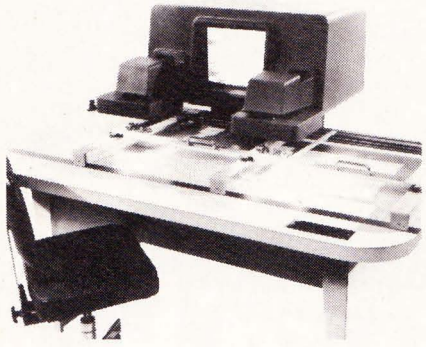
Test & Measurement World

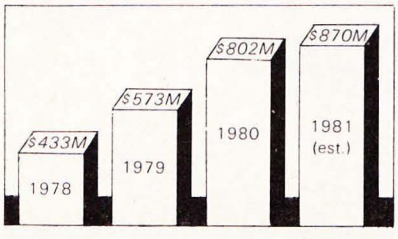
The international electronics publication of test and measurement news, products, business and technology

Fall 1981 Volume 1 Number 1

FEATURES







DEPARTMENTS

Product Features

Product News

STAFF

Publisher/Editor-in-Chief
Susan Chouinard

Staff Editors
John Case
Charles Malkiel
Mitchell Rose
Carmen D. Wiseman

Editorial Assistants
Patricia E. Berry
Sara Greenwald

Marketing and Sales
Mathilde Najjar

Manufacturing
Kathleen M. Gagne

Administration
Darlene Fisher

Conference Administration
Meg Bowen

Conference Booth Sales
Elise Hunt—(617)254-1445

ADVERTISING/SALES

Northwest
Theodora L. Franson
(408)996-0194

Southwest
Thomas M. Barosko, Jr.
(714)894-6605

Subscription Policy

Test & Measurement World is circulated, without charge, to managers, engineers, supervisors and company executives responsible for the selection, specification, recommendation, authorization or cost justification for purchases of equipment, services and software used for test, measurement, characterization, evaluation, quality assurance, reliability, quality control and related support functions in OEM and end-user industries around the world. Non-qualified individual domestic subscriptions: $12/year. Domestic libraries: $48/year. Outside US and Canada: qualified subscriptions—$20/year by surface; $48/year by air; library subscriptions—$65/year by surface; $95/year by air. Send requests for qualification forms and change of address (include old label) to: Circulation Director, *Test & Measurement World*, 215 Brighton Ave., Boston, MA 02134. Editorial, Sales and Subscription Offices: 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.

Test & Measurement World is published monthly by Interfield Publishing Company, Inc., 215 Brighton Ave., Boston, MA 02134. Application to mail at second-class postage rates is pending at Boston, MA and additional mailing offices. **Postmaster:** Send address changes to *Test & Measurement World*, 215 Brighton Ave., Boston, Ma 02134.

PUT THE BEAVER TO WORK ON YOUR ANALOG, DIGITAL, AND HYBRID CIRCUIT TESTING TASKS."

Beaver proves your tester doesn't have to be big – or expensive – to do analog, digital, and hybrid circuit testing automatically. What Beaver has is an appetite for hard work and a talent for excellence.

A.T.E. Systems has designed a fully-integrated, easily-programmed, microprocessor-based system into a compact, benchtop unit. This is the Beaver. It tests electronic assemblies with speed and precision, and at less than $50,000 — roughly one-third the cost of most automatic test systems — it is the most economical functional and in-circuit tester around.

Beaver Gets Right To Work

On the same day it enters your facility, Beaver can be working for you. Questions flashed on Beaver's display direct the test engineer to enter test parameters in simple English commands. No need to learn languages or to debug programs. Beaver does the work.

Beaver Works Fast

Beaver chews into tasks at the rate of 50 tests per second. It isolates faults — prints them right out — so board repair time is cut. And so are costs. Reliable Beaver never needs calibrating and rarely has down time, even in uncontrolled industrial environments.

Beaver Is Versatile

Beaver provides for power-down testing, static testing, and fully functional testing of analog, digital, and hybrid systems, assemblies, and circuits. Built-in aids and Beaver's calculating ability make interfacing simple. And Beaver's complete test capability means that even marginal boards are repaired before systems test.

Unlimited Applications Engineering Support Backs Every Beaver

Once you've bought a Beaver, you can turn to A.T.E. Systems at anytime for applications assistance. So confident are we of Beaver's ability to solve your testing problems — so certain that Beaver can save you time and money — that we make an offer unique in the testing field. But then, A.T.E. Systems has worldwide support offices and draws on experience from hard working Beavers in over 700 operations around the world.

Bring one of your products and its test plan to our applications engineering center. We'll demonstrate Beaver. Not a simulation, but a full working demonstration on your product. Call A.T.E. Systems today.

FOR MORE INFORMATION, CIRCLE 6

A.T.E. SYSTEMS INC.
10 Dale Street, Waltham, MA 02154
Telephone (617) 899-9614

"Meet A Dependable Company"

Cleveland (216) 729-2222, Chicago (312) 889-8033, San Jose (408) 725-0212, Boston (617) 899-5600

Test & Measurement — From Soup to Semiconductors

With this premier issue, *Test & Measurement World* dedicates itself to you — the engineer or manager responsible for selecting and implementing test and measurement equipment for the electronics OEM and its end-user industries.

Each month, *Test & Measurement World* will guide you through the latest advances in test and measurement technology. Every issue will provide: incisive analyses of the news that impacts test and measurement developments; comprehensive overviews of test and measurement products; and clearly rendered comparisons of test and measurement equipment and technologies, so that your purchase decisions can be the right ones guided by the information you need.

Test & Measurement World maintains that the techniques for making measurements on deposited nitride layers in the semiconductor lab are (and should be) intimately related to the techniques for troubleshooting the microprocessor systems built from the IC devices that began with the nitride layer. (After all, the system is merely the sum of the devices within it.)

Therefore, whether you are charged with responsibility for:

- measuring Angstrom tolerances of a lapped and polished silicon wafer;
- measuring the harmonics of a complex intermittent signal;
- evaluating the spectral signature of impurities in a dopant gas;
- monitoring gain, delay or phase response of an audio receiver;
- tracking RFI from a terrestrial microwave station;
- analyzing data logged from a burn-in chamber;
- simulating failure modes and response patterns for a complex logic board;
- inspecting surface quality of a plated through hole;
- mapping bit patterns for a complex memory component;
- tracing continuity via current, optical or infrared emissions;
- troubleshooting computers, airplanes, tanks or turkey-soup process-control systems;

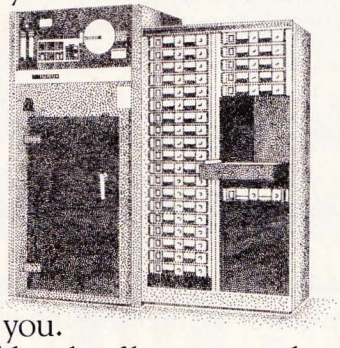
Test & Measurement World — every month — will help you measure, explore, evaluate and calibrate, by weaving together the disparate threads of test and measurement technology into a comprehensive overview. Wherever you make measurements on the electromagnetic spectrum — from DC to light — in wavelengths, in Angstroms, in mils, in Hz, *Test & Measurement World* will search for and deliver the facts you need to make informed decisions based on knowledge.

Susan Chouinard

Susan Chouinard
Publisher/Editor

We want to help you fail. Successfully.

There's a time and place for everything. Even failure. Especially when it happens before it happens to your customers. Who happen to be getting very, very picky about being used as a burn-in test facility.



Which is why we want your semiconductor parts to fail. Before they fail you.

And we have all kinds of burn-in and screening tests for all kinds of parts for all kinds of customers. Your customers or ours, such as AMI, AMD, Harris, Intel, Motorola, National, and T.I., who are also pretty picky about results.

We can help you wring out bipolar or MOS, RAMs and PROMs. Spot bad microprocessor chips. And do it with both custom as well as standard designs over all the technologies from ECL to TTL.

From 16K memories up to memory sizes that are still a glimmer on the drawing board.

Also we make it convenient for your budget. You can choose from one of our standard systems, tailor your own from our modular line. Or get started without capital outlay whatsoever through Advanced Microtechnology's comprehensive, commercial test laboratory.

How, now, can you fail to fail with a choice like that?

Call or write John Lalley for immediate information on Advanced Microtechnology's SafeFail™ systems, providing complete test service and burn-in systems to the semiconductor industry: 480 Mercury Drive, Sunnyvale, CA 94086, (408) 736-3860.

ADVANCED MICROTECHNOLOGY

SafeFail™ for success.

Staff Memo

As the professionals who buy and use test and measurement equipment, you face the challenge of keeping up with the rapid pace of technological change while coping with day-to-day test problems. Our job, as the editorial staff of *Test & Measurement World*, is to help you face this challenge with the best defense possible—knowledge.

Through our numerous contacts in the industry, we will gather information and present it to you in features, columns and reviews covering the latest developments in test and measurement equipment. But we believe that your work is also affected by such forces as upheavals in the international electronics marketplace and advances in electronics technology. So we will add to our technology coverage news about the business, people and events that shape the world of test and measurement.

We are firmly committed to producing editorial material that meets your needs. To do our best, however, we must know more about you. Although our qualification form requests data about your professional duties, it cannot tell us what you think about the equipment and technology that are so vital to your work. To address this problem, we invite you to participate in an ongoing Test & Measurement User's Forum. If you are interested in talking to us periodically about test and measurement, make yourself known by filling out the form on page 59.

Joining this forum may cost you a little time, but the rewards will be immediate. Via surveys, telephone conversations and other inputs, your desires, comments, complaints and questions will guide the editorial thrust of *Test & Measurement World*. We want to establish an interactive dialog in our pages, and with your participation, we can do it.

Charles Malkiel

Carmen Wiseman

Susan Chouinard

Mitchell Rose

John Case

SOPHISTICATED SIMPLICITY!

For Coating Thickness Measurements
THE AUTOBETA TC-3000*

You do not have to understand computers to understand Twin City's new AUTOBETA TC-3000. With the push of a button, it speaks your language.

How? Step by step, the TC-3000 guides you through calibration, measurement and complete evaluation of your measurement data. Simple instructions on the CRT screen make even the most complex statistical evaluations a snap. The end result is the most accurate measurement of precious metal and other coatings on electronic components, printed circuit boards, semiconductor wafers and packages, jewelry, and much more. It's that simple!

FOR UNMATCHED VERSATILITY:
☐ Detailed display and storage of up to 32 measuring applications.
☐ Continuous display of thickness and related statistics, including histogram, for many thousands of measurements. ☐ Optional graphic displays, such as used for trend analysis, are available.

FOR MAXIMUM ACCURACY: ☐ Automatic check of each reading during calibration eliminates errors due to improperly placed or imperfect standards. ☐ Audible and visual signals for measurements falling outside of pre-set limits. ☐ Calibration with up to ten standards. ☐ Automatic calculation of the shortest measuring time.

FOR MEASUREMENTS YOU CAN DEPEND ON... **the AUTOBETA TC-3000** from the quality control experts at Twin City International... Sophistication made simple at a price you can afford.

TEI Twin City International, Inc.

Measure with us - We measure up!

*Another BETASCOPE® instrument from Twin City International. Formerly Twin City Testing Corp.

P.O. Box 248, Amherst, NY 14150, 716/691-8855. Telex No. 9-1362/West Coast Phones: L.A. area, 714/633-BETA; Bay area, 415/573-5785.

FOR MORE INFORMATION, CIRCLE 55

MEETINGS

6th Meeting on Integrated and Guided Wave Optics

Asilomar Conference Center, Pacific Grove, CA, Jan. 6-8, 1982. Contact: Optical Society of America, 1816 Jefferson Place, N.W., Washington, DC, 20036.

ATE Seminar/Exhibit

Pasadena Center, Pasadena, CA, Jan. 18-21, 1982. Contact: Registrar, ATE Seminar/Exhibit, 1050 Commonwealth Ave., Boston, MA 02215. (617)232-5470.

Second Working Conference on Current Measurement

Sea Pines, Hilton Head, SC, Jan. 19-21, 1982. Contact: W.E. Woodward, Dept. of Commerce, National Oceanic and Atmospheric Administration, Rockville, MD 20852

Advanced Semiconductor Equipment Exposition

San Jose Convention Center, San Jose, CA, Jan. 26-28, 1982. Contact: Cartlidge and Associates, 491 Macara Ave., Sunnyvale, CA 94086. (408)254-6870.

Annual Reliability and Maintainability Symposium

Biltmore Hotel, Los Angeles, CA, Jan. 26-28, 1982. Contact: H.C. Jones, Westinghouse, MS 3608, P.O. Box 1521, Baltimore, MD 21203.

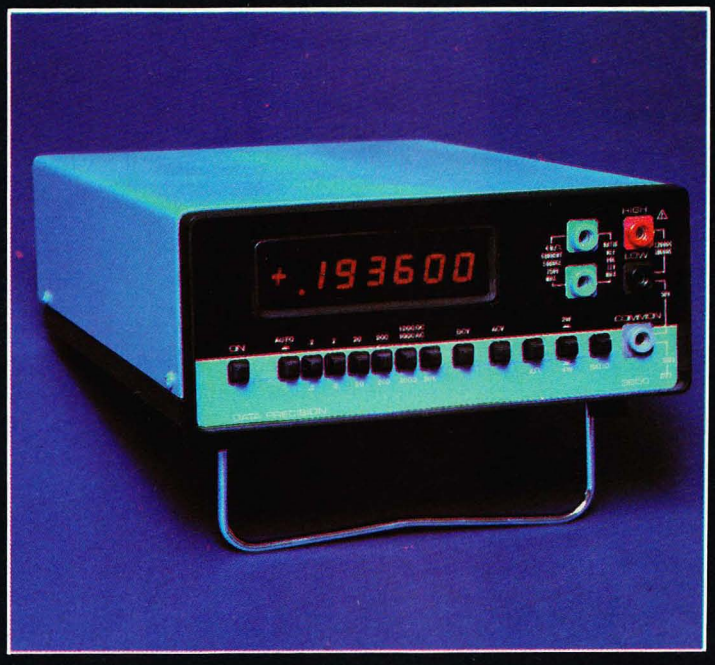
Reliability of Local Networks

South Padre Hilton Resort, Brownsville, TX, Feb. 3-5, 1982. Contact: Robert Schwarz, Prime Computer, Inc., 500 Old Connecticut Path, Framingham, MA 01701

Test and Measurement World Expo

San Jose Convention Center, San Jose, CA, Apr. 19-22, 1982. Contact: Meg Bowen, Interfield Publishing , 215 Brighton Ave., Boston MA 02134. (617)254-1445.

BUS COMPATIBILITY



In an expandable modular instrument.

Model 3600
Microcomputer-based 5½-digit Lab/Systems DMM.

Now you don't have to buy more instrument than you need just to get the measurement function you're looking for. The Model 3600, from Data Precision, offers the highest accuracy, widest ranges and finest resolution in its class. And its capabilities grow when you need them.

It is ATE-configured, and provides automatic test and validation routines, automatic lockout of false readings, automatic overload indication, and automatic compatibility with the IEEE 488 bus. And the unique Opti-Ranging™ feature senses your first reading, then causes the sensitivity to jump to the most appropriate range for your measurement.

The basic instrument offers a choice of 2, 3 or 4-wire measurement and will measure DC voltage from ±1μV to ±1200V in five ranges and DC ratio from ±000001:1 to ±199.999:1 in five ranges (3-wire). Basic accuracy is ±0.004% 24 hours and ±0.007% 1 year with a one year recommended calibration cycle.

Add capabilities whenever you need them with optional field-installable modules such as: ☐ AC Volts average response: five ranges, 1μV to 800V (to 100kHz) ☐ AC Volts RMS, AC Coupled: five ranges, 1μV to 800V (to 100kHz) ☐ AC Volts RMS, DC Coupled: five ranges, 1μV to 800V (to 20kHz) ☐ Resistance: six ranges, 1mΩ to 20MΩ ☐ DC/DC and AC/DC Ratio (4-wire): same ranges as 3-wire ☐ IEEE 488 Interface ☐ Remote Program/Data. Logic-compatible, dedicated control inputs, parallel BCD outputs (data and status).

Call for a demonstration of the DMM that lets you choose the features you need, when you need them.

Base price...$765.00 Price USA
GSOOS - 27470

For immediate delivery, demonstration, or instrumentation catalog, just contact your local Data Precision distributor or call:

(800) 343-8150
(800) 892-0528 in Massachusetts.

Maintaining the Integrity of Measurement.

DATA PRECISION®
DIVISION OF ANALOGIC CORPORATION

Data Precision Division of Analogic Corporation, Electronics Avenue, Danvers, MA 01923, (617) 246-1600, TELEX (0650) 921819.

FOR DEMONSTRATION, CIRCLE 28; FOR MORE INFORMATION, CIRCLE 29

Microelectronics Test Pattern Standards Released

Two new developmental microelectronics test patterns for evaluating process and material test structures have been released by the National Bureau of Standards, Electron Devices Div. Note NBS-12 addresses geometric design considerations for cross bridge sheet resistor test structures, and NBS-24 offers a variety of preliminary designs for the integrated gated-diode electrometer and a series of variations on the design of the MOSFET DC profiler. The report, *Microelectronics Test Patterns—NBS-12 and NBS-24,* is available for $6.50, prepaid, from the National Technical Information Service, Springfield, VA 22161 (order #PB81-214892).

Microwave FET Heats Itself to Measure Transients

Microwave engineers are keenly aware of the role that junction temperature plays in the proper operation of their designs. Maintaining the proper thermal characteristics of semiconductors such as GaAs FETs is absolutely necessary to extend the operating lifetime of the system especially in air and space applications.

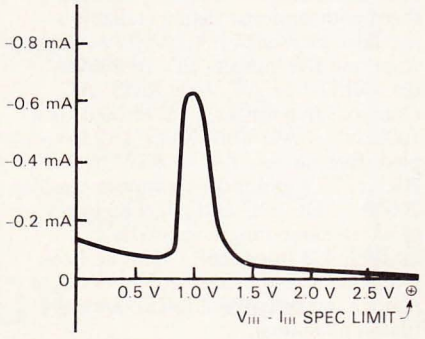
To test junction temperature, engineers rely primarily on optical inspection techniques to measure the infrared emission from the surface of uncapped chips. However, this routine entails careful microscope setup, skillful operators and a lot of time—all in all, not a suitable operation for a smooth manufacturing process.

In an application note from Sage Enterprises, Mountain View, CA, Bernard Siegal describes an alternative to IR emission measurements. Using a device to heat itself and sense its own junction temperature, Siegal documents how the relationship between the forward biased voltage drop across a diode, Vf, and junction temperature, T_J, determines the thermal characteristics of a GaAs FET. The relationship, claims Siegal, is well defined, very linear over normal temperature ranges and easily determined.

This test technique can be performed on all devices, capped or uncapped, at any stage in the manufacturing process, without large investments in test equipment or training time. The obvious advantage is reduced field failures and service costs. To obtain a copy of the paper, write Sage Enterprises, Inc., 1080 Linda Vista Ave., Mountain View, CA 94043, and ask for note TA 8102.

Test Note Urges Close Watch on IC Input Current

When device manufacturer's specifications don't tell the whole story, testing can go haywire. According to a technical note from Pragmatic Designs of Sunnyvale, CA, this is the case with a series of octal bus drivers manufactured by Texas Instruments, the 74LS240, 241 and 244.



Input current vs. output current for TI 74LS240

Apparently, the problem centers around the current for each of the inputs to the octal buffer/line drivers. Device specifications list the input current at two voltages: IIL = -0.2 mA max at 0.4 V and IIH = 20 μA max at 2.7 V. These values suggest that the current increases in some well defined fashion as the voltage increases.

However, according to the people at Pragmatic Designs, the current actually *decreases* from -0.5 to -0.8 mA when the voltage increases from 0.7 to 1.1 V. This decrease may affect a couple of areas. If incoming inspection tests are performed at these voltages, the device may fail. And if the circuit design incorporating this device does not provide a sufficient margin, the circuit will not work.

This condition also seems to vary with temperature and may cause intermittent failures. Proper test strategy, according to Pragmatic Designs, is to force a worst case current (-0.2 mA here) and measure the voltage, in addition to forcing the voltage and measuring the current.

Hipot Testers Need High Power for AC Tests

Underwriters Laboratories now require 100 percent production line hipot testing. However, according to Roy Clay of Rod-L Electronics, Menlo Park, CA, many data processing equipment manufacturers still perform DC tests rather than the more rigorous AC tests. AC testing is preferred because it drives the product in a manner similar to its end use—yet the high level of capacitors in products incorporating RF line filters often causes the tester itself to fail. The solution, says Clay, is to use a hipot tester with sufficient power. Look for an exploration of this problem in a forthcoming issue of *Test & Measurement World.*

WE'RE LETTING THE CAT OUT OF THE BAG IN JANUARY.

The code name is "Panther."

It stands for a secret project ComputerAutomation is going to spring on the circuit board testing industry, come January.

You might even get the story sooner, judging by the way industry reporters have been prowling around Panther.

This much we can share in advance:

TESTSHARING IS THE CONCEPT BEHIND PANTHER.

Since there wasn't a word describing this revolutionary A.T.E. concept, we coined one.

Testsharing.

The Testsharing idea offers important advantages that simply weren't available before.

UNSNARLS THE TEST PROBLEM.

We're not talking little advantages here. We're talking significant throughput, flexibility, programming efficiency and, especially, long-term cost advantages.

So, be patient.

If you buy somebody else's system before we let ours out of the bag, you could end up holding the bag.

ComputerAutomation Industrial Products Division

For productivity...today and tomorrow.

2181 Dupont Drive, Irvine, California 92713, (714) 833-8830.

FOR MORE INFORMATION, CIRCLE 26

Wafer Inspection System Shows Up Processing Defects

After processing, a silicon wafer contains dozens of identical chips marching in neat rows to slicing and dicing machines. But as any fabrication manager knows, wafer probing reveals chips ruined by defective photomasks or less than perfect processing. Inspection systems for photomasks can readily identify most mask defects, since these systems compare transmitted light images of adjacent chip patterns to make errors stand out like a sore thumb. But a similar inspection system for chips undergoing processing is unavailable for a good reason: you can't shine a light through a wafer like you can shine a light through a photomask.

In a paper delivered at the Kodak Microelectronics Seminar, Interface '80, engineers from two Japanese companies (NJS Corp. and Mitsubishi Electric Corp.) describe an ingenious solution to this problem that uses an old workhorse—the laser. Comparing the patterns on two adjacent chips is the preferred method to reveal defects, but normal light directed to the wafer surface is scattered and cannot easily differentiate between the chip's lines, valleys and hills. By using the directed beam of a 10 mW He-Ne or Ar laser and processing circuitry to wrestle with the data, the researchers were able to detect faults as small as 3.0 μm.

The fully automatic inspection system deflects the beam in two directions: in the X direction by a vibration mirror driven with 75 Hz waveforms, and in the Y direction by an acoustic optic light deflector driven by 31.5 kHz signals. A central control unit drives the scanning laser and an X-Y stage for the chip, and a built-in autofocus mechanism keeps the image sharp at all times.

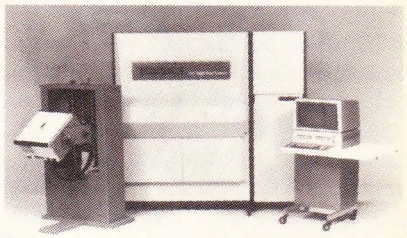
Product Introductions Abound at Cherry Hill Test Conference

With many exhibitors showing new products at the 1981 International Test Conference (Cherry Hill), it is apparent that ATE manufacturers are fighting the current slowdown head to head with systems more advanced and flexible than ever. Although logic and memory ATE sales are particularly hard hit, the majority of product introductions were for digital device testing.

Accutest's 7900

The ranks of suppliers offering VLSI testers swelled with the introduction of Teradyne's J941 and Accutest's 7900. The first logic tester from each firm has a minimum test speed of 20 MHz, with varying amounts of pattern memory for testing at 40 to 50 MHz. Just a notch below in capabilities are the newest LSI test systems from Megatest, Tektronix and Fairchild. The Megatest Q2/62 and Tektronix S-3220 are updated versions of their previous LSI testers, while the Fairchild Series 10 replaces their Sentinal tester. While the Q2 series also includes memory device test systems and the Series 10 will have memory test capability, the conference was also the showplace for three new dedicated memory device testers, the Eaton MD-001E and Fairchild's Xincom 5583 and 5587.

Not to be forgotten by ATE manufacturers are board test systems, well represented by the first showing of GenRad's 227X series of in-circuit testers,



Teradyne's J941

Fairchild's Series 30/333 in-circuit tester and Three Phoenix's 3PX series of functional board test systems. The Cherry Hill conference also marked the U.S. introduction for Marconi's System 80 in-circuit tester with its automatic repair station. In addition, the show's booths displayed new wafer probers from Teledyne and Electroglas, as well as IC handlers from Micro Component Technology and Delta Design.

Nobel Awarded for Laser Spectroscopy Studies

A Swedish researcher and two American scientists were jointly awarded the 1981 Nobel Prize in physics for their work in laser spectroscopy. Cited for his studies in the development of high-resolution electron spectroscopic techniques, Dr. Kai Siegbahn of Uppsala University in Sweden shared the $180,000 award with Dr. Arthur Schawlow of Stanford University and Dr. Nicolaas Bloembergen of Harvard University. Schawlow is generally acknowledged as the codiscoverer, with Charles H. Townes, of the laser, while Bloembergen did pioneering research in the field of nonlinear optics.

Another of Dr. Bloembergen's particular areas of interest is the effect of picosecond pulses on materials—a phenomenon that may eventually prove useful for laser annealing of semiconductors.

Do you hear footsteps? If you don't, you will.

It's a jungle out there. The American steel industry didn't hear footsteps. Neither did the auto industry. And you know what happened. Right now, most of the American electronics industry is still using yesterday's edge connector technology to test and troubleshoot today's μP and VLSI-based circuit boards. That's not only inefficient, it's expensive. Expensive in original equipment cost. In board float. And too expensive to distribute to the depot and field. Sure, it works. So does a crowbar. But you're going to hear footsteps. Clear across the jungle.

Enter Millennium's test systems. Our family of test and support instruments and ATE provides a single, functional test and troubleshooting network that stretches from the lab to production test, repair, depot and field. The series 4000 and 4500 MicroSystem Analyzers are specifically designed to be cost-effective test solutions for today's, and tomorrow's LSI/VLSI-based technology. Featuring in-circuit emulation, signature analysis, and time-domain analysis. In every instrument and system.

In-circuit emulation. Millennium's ICE* feature lets you replace the system μP with a known-good nucleus, a window into the system. Boards are functionally tested using the backplane as the test fixture. And even if the board doesn't have a μP, it can be stimulated through the backplane from the CPU board. That means you can test a single board, or, an entire system. With a single instrument. In real time. At system speed.

FASTPROBE™ ATE network. FASTPROBE ATE transforms your μSA's into a total test network that stretches from factory to field. It automatically generates and updates fault trees so your μSA's can be used to test and troubleshoot your products wherever they're located. Using the same software. That means no more expensive engineering time wasted analyzing and designing fault trees for your products, and their revisions.

Testing with confidence. Confidence in GO/NO-GO testing. In guided probe fault isolation. And, in a test network that provides efficient answers to board test problems. With FASTPROBE ATE, a complete failure history file of each board is maintained. Down to the node level. Check files give you a true, not simulated, confidence factor that each, and every node on your board has been tested.

Better test systems. Using today's technology. The 4000 and 4500 MicroSystem Analyzers and FASTPROBE ATE offer a life insurance policy throughout your product's life cycle, providing a systems solution to test development, functional testing, and fault isolation. That means better functional board test. Better board yield. Reduced board float. And best of all, lower system cost. Plus, a modular approach to board testing that allows you to build your test system your way. When you're ready. For the life of your VSLI, μP-based products.

One hour. That's what it takes to learn about Millennium's test instruments and ATE. It's as easy as a phone call to the toll free numbers below. Call us. We'll come running with more information about the coming ICE age in functional board testing. Before you start hearing footsteps.

MILLENNIUM

A subsidiary of AMI, Inc.
19050 Pruneridge Avenue · Cupertino, CA 95014

(800) 538-9320 Toll Free
(800) 662-9231 in California

FOR MORE INFORMATION, CIRCLE 40
FOR DEMONSTRATION, CIRCLE 41

*ICE is a trademark of Intel Corporation
FASTPROBE is a trademark of Millennium Systems

NEW MARKETS MAY PUSH SEMICONDUCTOR ATE RECOVERY

Mostly cloudy for the rest of 1981 and only a chance of clearing by March '82 is the forecast made for the semiconductor ATE industry by Jerry Hutcheson and Michael Sherry of Technical Ventures, a market research firm based in Cupertino, CA. Writing in *Outlook* magazine, published by the Semiconductor Equipment and Materials Institute, the two ATE meteorologists do see some possible sunshine for certain sections of the T&M world.

Memory Test at Burn-in

As memories grow larger, the time required to thoroughly test them becomes disproportionately greater. One way to cut down on test time is to perform some simplified tests at the burn-in stage. Several companies now make equipment for this task, but the better-known manufacturers appear to be ignoring this market, claim Hutcheson and Sherry. By running only a few simple tests along with the burn-in procedure, manufacturers can eliminate the time required to handle, insert and bin already defective devices. The forecasters believe that a manufacturer can save 17,000 hours at final test if gross functional failures are weeded out of an initial supply of 2,000,000 devices.

Capacitance Wafer Probing

Using a capacitance measuring system rather than edge sensors to evaluate wafer thickness, a new Japanese prober described in the Technical Ventures report may be a milestone in yield improvement. The Tokyo Electron Labs (TEL) system automatically adjusts the height of the chuck for each die to maintain the correct contact pressure and reduce gouging. Combined with a capacitance measuring system (manufactured by ADE Corp.), the dual-chuck setup allows one wafer to undergo probing while the second wafer is mapped along the Z axis and coordinated die by die. The manufacturer claims that the system provides significantly higher yields and quality. Users must agree: in one year, TEL's sales jumped from $4 million to $22.5 million. Reportedly, U.S. firms are working on similar systems.

Process Monitoring

Hutcheson and Sherry note that software suppliers for wafer fab lines are starting to write functional routines for gathering and reducing test data, as well as for process control/optimization and recipe management. For instance, Bruce Systems now offers a controller that stores lot history files and throughput information, and also monitors diffusion furnace tube functions. Teknekron, a software firm, supplies a package that performs process monitoring, process control and data acquisition, with an emphasis on diffusion control. The forecasters see process monitoring and data acquisition as important elements in semiconductor fabrication throughput.

PWB Equipment Market to Grow Denser

Capital equipment required to design, manufacture, assemble and test printed wiring represents a giant chunk of the total market for electronic production. According to a study made by Saltzer Technology Enterprises of Cupertino, CA, continuing advances in circuit design and complexity will parallel the growth of suppliers of PWB equipment. Test and measurement equipment alone for this market will pass $600 million in sales during 1985—up from $260 million last year—while design, fabrication and assembly equipment manufacturers will sell more than twice the amount in 1985 that they did in 1980. ($1.2 billion vs. $560 million). Copies of the report (*Electronic Capital Equipment Markets and Technologies*) are available from Electronic Trend Publications, 10080 N. Wolfe Rd., Suite 372, Cupertino, CA 95014.

Europeans Bullish on ATE

Faced with the same productivity and quality assurance problems as their counterparts in the United States, Western European end-users are gobbling up ATE and microprocessor development systems as fast as they're produced, according to a 258-page report published by Frost & Sullivan. Sales of component, bare board, in-circuit, and functional testers skyrocketed from $350 million in 1979 to $430 million in 1980; this booming marketplace, projected by F&S to grow at an average of 16 percent annually, should reach $1.9 billion by 1990. The European μP development system market picture looks equally rosy, with a current

value of $50 million and an astonishing 27 percent annual growth rate. U.S. ATE manufacturers seeking to promote universal μP development systems overseas should be cheered by these statistics. For additional information about the report (*Electronic Component-Circuit Board Automatic Test Equipment and Microprocessor Development Systems Markets in West Europe,* #E453,) contact Frost & Sullivan, Inc., Department R-1, 106 Fulton St., New York, NY 10038.

Japanese Scope Production Up, Domestic Buys Down

The Japanese oscilloscope industry and market is a puzzlement; production and exports are up, but domestic use is down. According to a report by Mamoru Kobayakawa of the Nomura Research Institute, 40 percent more scopes were produced in 1980 than in 1977. But an increase in exports, from 67 percent to 83 percent of the entire production output, signals a downward trend in units purchased for the local market. A whopping 26 percent fewer scopes, including imports, were purchased by the Japanese in 1980. A bit of bright news is that imports grabbed a slightly larger share of the market, up from 6 percent in 1977 to 12 percent in 1980.

Bruel and Kjaer Creates New Image, Headquarters

One of the largest foreign instrument makers is spending $10 million to create a new name, logo and headquarters for the U.S. market. Bruel and Kjaer Instruments, fomerly B & K Instruments, recently announced the shift of its corporate headquarters from Cleveland, OH to a newly constructed facility in Marlboro, MA. Serving as the North American service and sales headquarters, the new operation will have Ron Cobley as service chief and Greg Michel as sales director.

We Can Take a Hint

Test & Measurement World *wants to learn about unusual uses of unlikely equipment. A future column will be devoted to the inventive solutions that readers have found for their T&M problems—whether the equipment is custom-engineered, simply used in a new way or adopted from another industry. Send us a brief note describing your hint. All contributors whose tips are printed will be given full credit. Clever prizes awarded.*

T&M Hints
Interfield Publishing Company, Inc.
215 Brighton Ave.
Boston, MA 02134

WE'RE ABOUT TO

We'd like to introduce you to the ultimate weapon in the battle to improve the quality of your printed circuit boards.

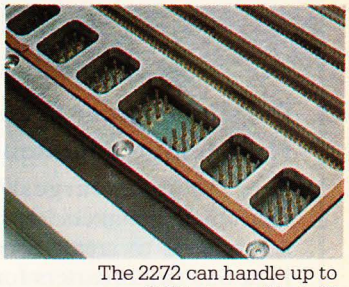
The GenRad 2272 Circuit Board Test System.

A test system so powerful, so fast, and so deadly accurate at finding and eliminating board problems, we call it The Destroyer.

The 2272 can take on bigger missions than any other system (up to 3584 pins, to be exact). But unless you've been locked below deck for a decade or so, you're bound to recognize that the easy way to give you that kind of fire power is to make some tradeoffs in the quality of your tests.

We refused to knuckle under.

Instead, we came up with a nifty multiplexing technique that lets us do more rigorous testing than any other in-circuit system—with exceptional speed and no sacrifice in performance. (We should also note that our idea holds down the cost per pin and keeps our 2272 from getting as big as an aircraft carrier.)



The 2272 can handle up to 3584 pins—all hybrid.

What kind of performance are we talking about?

Well, for starters, you get full hybrid capability, with total access to digital or analog instrumentation from every pin. Imagine what that could do for you. You get parallel drive and sense and local pin memory for all drivers to give you absolutely meticulous testing accuracy.

You're armed with the most extensive library of ECL, TTL, and LSI/VLSI devices in the industry. You have an arsenal of

LAUNCH THE 2272.

features no one else has, such as automatic bus disable to "zero in" on the device under test; automatic feedback squelch, to defend against glitches and other intruders; and automatic component wiring compensation to protect you from devious wiring constraints. And you have our exclusive Scratchprobing™ method and Bus Busting™ beyond-the-node diagnostics at your command, as well.

In fact, we can safely say our new 2272 Circuit Board Test System gives you the fastest program development, the easiest debug and the most comprehensive, thorough testing of any in-circuit system you can buy.

The 2272. It'll destroy a lot of the illusions you have about what an in-circuit test system can do.

For a test cruise, just call your nearest GenRad office. Or write GenRad, 300 Baker Ave., Concord, MA 01742. Tel: (617) 369-4400.

GenRad
THE BEST IN TEST.

FOR MORE INFORMATION, CIRCLE 35

The Destroyer. Our 2272 Circuit Board Test System.

I'd like to see The Destroyer in action.
☐ Set up a demo.
☐ Have a salesperson call.
☐ Just send literature.

☐ I test small and medium-size boards. Send me information on your 2270 and 2271 Circuit Board Test Systems.

Name _____
Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Telephone _____
My need is: ☐ Now! ☐ Soon ☐ 6 Months

STRATEGIES FOR GROWTH

Profiles of test and measurement companies vividly demonstrate that almost all segments of the test industry share both a commitment to technological advancement and optimism in the face of today's economic doldrums.

by John Case, Staff Editor

What unites test and measurement practitioners isn't a single product or set of products like automobiles or specialty steel. The real link seems a commitment to a profession—test engineering—and to developing whatever technology is necessary to get the job done.

But however you view it, the industry is growing. New companies are incorporating at a rapid pace to provide the sophisticated hardware and software required by the ever-expanding electronics industry. Even the sluggish economy seems to have put only a small dent in the industry's healthy growth. "We probably picked the worst time in history to start a company," says Keith Rosburg, who founded Practical Technology three years ago. "But things look pretty good. And think how well we'll all be doing when the worst is over."

The growth in test and measurement over the past few years seems to be showing up in a new attitude as well. "Testing used to be a stepchild of the engineering profession," remarks Bob Therrien, president of the Accutest Corp. in Chelmsford, MA. "But now it's seen as a real challenge and a career opportunity, embodying everything from sophisticated architecture problems (including high-performance analog and digital circuit design) to a tremendous software investment."

To get a sense of these changes, *Test & Measurement World* asked a sampling of professionals from around the industry to tell us what they see as the industry's chief obstacles and opportunities for the '80s. The report that follows can't claim to be scientific or exhaustive, but it does provide a good indication of how some parts of the industry have changed and what some of the testing world's top people are thinking. And happily enough, it's an upbeat story.

ATE Consulting Services

"What good is a jet airplane without a pilot?" The man posing this question is Arnold Greenspan, and his company—AMG Associates, based near Washington, DC—sees a good part of its job as piloting bewildered users through the complex world of automatic test equipment (ATE). Along the way, AMG offers everything from systems analysis and selection to test program set development and applications software. The objective, says Greenspan, is a "total, integrated solution" to ATE problems.

Greenspan's experience in the field goes back 20 years, when he began working in a large-scale monitoring and testing program for RCA. Five years ago he started AMG. Today the company employs 25 people and does roughly $1 million worth of business a year, nearly all of it in the United States. About 60 percent of that is military work; one of the services, for example, asked Greenspan to develop an automatic testing management plan, beginnning with initial R&D and continuing through hardware and software development all the way up to deployment, support and maintenance. The firm also has developed a retargetable ATLAS compiler and an ATLAS syntax analyzer, and has written documentation such as an engineering guide used by the Navy for test program development.

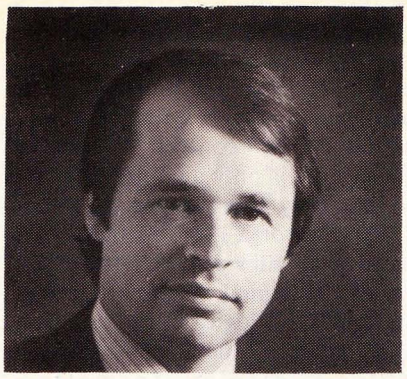
The future, Greenspan thinks, will bring more of the same: mainly facilitating software services, though he's also getting involved in the problem of enhanced productivity in test program set development. He hasn't had any trouble getting work, but like many industry professionals, he's worried about the shortage of skilled personnel in the field. His strategy: hire good people and give them their head. So far it seems to be working out.

Finding work isn't a problem for **Giordano Associates** either. "We're probably a little bigger than we'd like to be right now," laughs co-owner Phil Jackson. "There's a ton of work now in ATE, and we've grown almost in spite of ourselves."

Giordano Associates goes back to 1976, when Paul Giordano left Instrumentation Engineering to set up his own company. Six months later Jackson joined him. Giordano Associates now has multiple facilities: the home office in Sparta, NJ, the others in Midland Park, NJ, Dayton, OH, Washington, DC and two in California. The company offers a range of ATE services,

Phil Jackson—Giordano Assoc.

Anton Vierling—HHB



Lutz Henckels—HHB

including logistics support, systems engineering and software. But it sticks for the most part to what Jackson terms "the high-tech stuff"—compilers, pin electronics, probes, sophisticated software, hardware design for new products.

Giordano's business came to about $2 million last year, about half with the military, and it employs some 50 people. The company has not yet gotten involved in the export market. What's on Jackson's mind as he faces the future? "No particular big problems," he grins. "Just 50 little ones."

Henckels, Haas & Brown, the Electronics Software Company, is also in New Jersey—although its hometown, Upper Saddle River, sounds as if it ought to be in Montana. HHB, as most people call it, may be one of the most rapidly growing companies in the software business. Founded only three years ago, its sales will hit $4 million this year and may go as high as $8 million next year. Most of this growth has been in the domestic commercial arena. Though the company has a few European customers (the most important being Siemens in Germany), the export market has not constituted a large part of its business to date. And though the firm does perhaps 30 percent of its business with military prime contractors, it performs only a small amount of R&D work directly for the Pentagon.

The company's focus, says vice president Dr. Anton Vierling, lies in three areas: applications of ATE programming (e.g., designing and programming tests for IC chips and printed circuits); generating systems software (an automatic test-generating package for GenRad, for instance); and ATE training. The training component also has one positive side effect, namely that it offers HHB a way around the common industry problem of a shortage of skilled personnel. "We don't just hire people; we grow professionals through intensive technical training," says Dr. Vierling. "Frequently engineers right out of school or bench techs working with test instruments start at HHB and are trained to be effective programmers/engineers in a two- to four-month period of time."

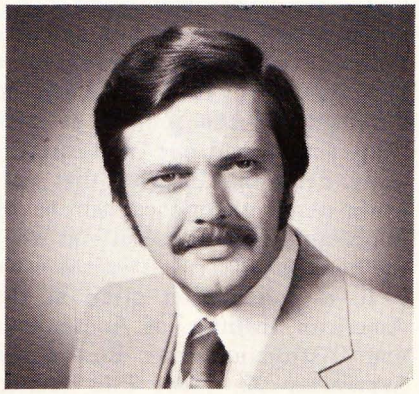
The future? "For the next five years computer-based products are basically software limited," says company founder Dr. Lutz Henckels. "HHB wants to continue to be innovative in generating software, particularly in ATE. We envision new methods that will allow nontechnical people to perform testing and programming tasks that now require sophisticated and expensive engineering skills. We must make the computer do more of the work."

Thickness Measurement

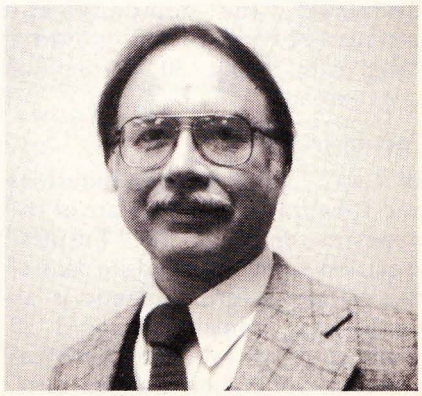
Not all of the T&M industry, of course, is made up of young companies working with software; a number of firms have been around for some time and offer equipment for many types of testing. Business has been good for these firms as well. Moreover, technological development turns out to be just as important for the older parts of the industry as for the newer ones.

UPA Technology, for example, goes back to 1946, when it was incorporated as Unit Process Assemblies. Today the Long Island-based firm manufactures plating and coating thickness measuring instruments for nearly every conceivable application, from through-hole plating on circuit boards to metal-on-metal combinations in industrial applications. All of the firm's instruments do their work nondestructively; most incorporate advanced features such as digital readouts, thus eliminating the need for calibration curves. A recent innovation—the company calls it Nickelderm™—enables the measurement of nickel plating thickness through application of the Hall effect. The company's workforce numbers in the neighborhood of 150, and it maintains a full domestic sales force. International sales, moreover, are "substantial," according to sales manager Jack Ritter; "we even provide literature in 15 different languages."

Like UPA, **Twin City International**, located in western New York State, makes automatic nondestructive thickness measuring equipment—"built with the nontechnical operator in mind," as sales vice president John Tiebor puts it. The company holds the original patent on the popular beta backscattter technique. "Our BETASCOPE is the leading instrument worldwide for measuring coatings on semiconductor wafers, device packages, PCBs and



Jack Ritter—UPA Technology



John Tiebor—Twin City Int'l.

components," notes Tiebor. Along with its basic backscatter products, the company has a line of eddy current and magnetic thickness measuring instruments; one of these AUTOTEST units permits the measurement of aluminum on silicon. A house specialty at Twin City International is the development of thin film measurement techniques and probe systems that extend down to the low angstrom range and can handle measurements on complex surfaces, such as the "coined" tips of a lead frame.

The last few years, says Tiebor, have been a period of "phenomenal, record growth," as evidenced by the company's recent move to a new $1.5 million facility in Amherst, NY. With sales offices around the world, Twin City International does about a quarter of its business in the export market. Tiebor sums up the outlook for the firm: "Prospects for further growth have been very encouraging, and we look forward to even greater expansion in the future."

Things must look good at **Rudolph Research** too: the 40-year-old, $2.7 million firm has also opened a new manufacturing, sales and engineering facility in Roxbury, NJ. Rudolph does most of its business on ellipsometry, a technique in which it pioneered, but the company recently introduced a film thickness monitor used primarily for measuring photoresist on chrome and silicon. The FTM, as it's called, employs a modified interferometer approach, and is capable of measuring thickness from 1,500 A to 4000 nm, with an extended range version available as well. Despite the sluggish economy, says sales manager Richard Budzinski, the company has averaged 10 to 15 percent growth a year, with about 30 percent of sales abroad.

Test Instruments

In a way, **North Atlantic Industries** and **Practical Technology** are at the opposite ends of the business spectrum as well as opposite ends of the country. North Atlantic is an established company, founded 25 years ago, with over 300 employees and some $17 million in annual sales. The firm's instrument division on Long Island manufactures synchro/resolver test equipment, a line that includes a phase-angle voltmeter, angle position indicators and a programmable synchro/resolver simulator. In contrast, Practical Technology is only a couple of years old, has only 4 employees, and does $125,000 worth of business. Its products are all low-cost instruments aimed at digital troubleshooting; they include a logic trigger detector, logic pattern generator, and logic analysis display formatter, nicknamed LADY. ("Has your oscilloscope met our LADY?" asks one of PT's ads.)

Despite their differences, however, both companies are sharing and enjoying the industry's growth. "Business is good in spite of the economy," comments marketing director Ken Salz of North Atlantic, "and I think the industry is likely to continue growing for some time." Keith Rosburg of Practical Technology concurs: he'd like to see his company double in size over the next year.

Positive Outlook

Will the test and measurement industry's growth continue? So far the record is encouraging: despite high interest rates, stiff competition and an occasional shortage of skilled personnel, the curve has continued to climb. And there's a feeling in the industry that this pattern will continue. "The technology we're supporting has exploded in the last five years," says Practical Technology's Rosburg, citing as an example the fact that the personal computer market scarcely existed a few years ago. "We're pulled along by that growth—and I think our business will be exploding, too."

SCREWDRIVERS AND CINDERELLA

Mike Ellis, the British-born executive vice president of ATE Associates is fond of a good story. One evening in Cambridge, MA he recalled his first lesson in the limitations of sophisticated equipment.

"I was working in a small electric repair shop one summer when I was in high school," he said, "and they gave me a broken hi-fi amplifier to fiddle with—probably just so I wouldn't get into trouble. I tested and examined it until I located a capacitor that I thought was faulty. Then I asked my boss for a capacitance bridge to test it.

"The old fellow chuckled and said, 'Don't be a fool. You don't need that.' He then took the capacitor, hooked it up to a simple ohmmeter, and gave it a hard whack with the butt end of a screwdriver—an unorthodox procedure to say the least. When the ohmmeter's needle jumped he said, 'Yup, she's a bad one.' and threw it away. From that I learned that seat-of-the-pants experience can be as important—and as useful—as what the book says."

In a presentation given at the American Institute of Aeronautics and Astronautics in Boston on September 22, 1981, Ellis related another of his favorite stories. This one is about Cinderella—or, more accurately, a sequel to Cinderella. Once she was seen to be living happily ever after, a company heard the news and began manufacturing glass slippers, confident in its belief that young girls would want to emulate Cinderella and therefore snap them up. Before long production was proceeding full speed, and factory tests assured management that the slippers were of impeccable quality. It wasn't long, however, before reports of breakage began to come in, and eventually the company was faced with a huge class-action lawsuit from injured glass-slipper wearers.

The trouble, Ellis explains, started right at the beginning. The story was of French origin. The French word for glass is "verre." But the French word for ermine is "vaire." Cinderella never did wear glass slippers; she wore *ermine* slippers, and the idea that glass could ever be used as footwear was due merely to a foolish mistranslation from the French. The moral? Research your market thoroughly—find out how your product will be used and then test it *in the field.* Otherwise, the tightest quality control procedures become useless. "And that goes for ATE, too," concludes Ellis.

TEST & MEASUREMENT WORLD

SUBSCRIPTION QUALIFICATION FORM

FALL 1981

For New Subscription, Change of Address or to Renew Old Subscription, Use This Form

Fill in all sections of this form. Please read all sections carefully before filling out. YOUR FREE SUBSCRIPTION CANNOT BE PROCESSED UNLESS ALL SECTIONS ARE COMPLETED. Be sure to sign and date the form before mailing. The publisher reserves the right to accept or reject any subscription.

NEW SUBSCRIBERS: To qualify for your free subscription, fill out this form completely. **CHANGE OF ADDRESS:** If you need to change the address that appears on the mailing label, simply print your new address in Part 1 of this form and fill out entire form. Be sure the original mailing label is attached to the form when you mail it to us. **SUBSCRIPTION RENEWAL:** Fill out the form completely, include original mailing label and return to us. **FOREIGN SUBSCRIBERS:** (outside of the U.S., its territories, and Canada): include cost of postage with your qualification form. Send this form with your check (payable in U.S. funds, drawn on a U.S. bank) in a self-stamped envelope. Postage for Seamail: $20.00; Postage for Airmail: $45.00.

PART 1

Affix mailing label here.
Fill out entire form.

Please send me/continue sending me a free subscription for TEST & MEASUREMENT WORLD yes ☐ no ☐

Circle one
new subscription change of address renewal

Signature Date

First Initial Middle Initial Last Name

Job Title

Company Name

Dept/Div/Mail Stop

Company Street or P.O. Box Number

Company City State Zip

( )
Phone

If company requires home delivery, please fill in home address below. However, company name and address are still required above.

Home Street

Home City State Zip

PART 2

My principal responsibility is (circle only one):

1. Management 2. Engineering

PART 3

Approximate number of employees in my company (circle only one):

1. ◄50 2. 51-500 3. ►500

PART 4

My principal job function is (circle only one):

1. Corporate and General Management
2. Manufacturing/Production Management
3. Design Engineering Management
4. Manufacturing/Production Engineering
5. Design Engineering – Systems/Equipment
6. Design Engineering – Circuits
7. QC/QA/Reliability/Evaluation
8. Basic Research Manager/Engineer/Scientist
9. Applied R&D
10. Engineering Support
11. Field Service Manager/Engineer
12. Calibration Lab Manager/Engineer
13. Process Control Manager/Engineer
14. Operations/Maintenance Engineering/Management
15. Marketing/Purchasing

PART 5

The primary end product (or service performed) of my plant and the product (or service) that is my own work (write one number in each box even if number is the same for both):

my plant ☐ **my own work** ☐

1. Computers, including Peripherals & Accessories
2. Data Processing Systems
3. Office & Business Machines
4. Test, Measurement & Instrumentation Equipment
5. Communications Equipment
6. Navigation & Guidance Systems & Equipment
7. Consumer Electronics
8. Industrial Controls & Equipment
9. Components, Subassemblies, Semiconductors, IC's
10. Materials & Hardware
11. Aircraft, Missile, Space & Ground Support Equipment
12. Oceanography & Support Equipment
13. Medical Electronics
14. Processing Industries, Paper/Pulp, Chemicals, Food, Refining
15. Industrial Co. within the OEM incorporating Electronic Equipment in their End Product, not elsewhere classified
16. Independent Research, Test & Design Laboratories & Consultants (only if not connected with a manufacturing co.)
17. Government Agencies & Military
18. School, University or Library
19. Nuclear
20. Processing & Production Equipment Manufacturing
21. Device (Active & Passive) Manufacturer
22. Original Equipment Manufacturer with in-house IC-manufacturing Facilities
23. Utilities
24. Industrial companies using any electronic products in their Manufacturing, Research or Development activities
25. Commercial user of electronic equipment
26. **Independent Field Service Org.**

PART 6

Products I plan to specify, recommend, or buy in the next 12 months. (Circle all that apply.)

Test Instruments

1. Analyzers, Bus
2. Analyzers, Frequency Response
3. Analyzers, Logic
4. Analyzers, Network
5. Analyzers, Signature
6. Analyzers, Spectrum
7. Analyzers, Waveform
8. Automotive Diagnostics Equipment
9. Bridges, RLC
10. Calibrators
11. Calibration Standards
12. Comparators
13. Controllers
14. Counters/Timers
15. Current Meters
16. Decade Loads
17. Distortion Meters
18. Electronic Filters
19. Emulators
20. Fiber Optics Testers
21. Frequency Synthesizers
22. Gaussmeters
23. Generators, Function
24. Generators, Noise
25. Generators, Pulse
26. Generators, Signal
27. Generators, Sweep
28. Generators, Waveform
29. Generators, Word & Data
30. Logic Probes
31. Mircroprocessor/Microcomputer Development Aids
32. Microprocessor Troubleshooting Tools
33. Multimeters, Digital
34. Noise Meters
35. Ohmmeters
36. Oscilloscopes
37. Phase Angle Voltmeters
38. Phase Meters
39. Power Meters
40. Power Supplies
41. PROM Programmers
42. Recorders
43. Temperature Probes
44. Voltmeters, Analog
45. Voltmeters, Digital

Production/QA/ATE

46. ATE, Analog/Linear IC
47. ATE, Digital IC
48. ATE, Memory Component
49. ATE, Memory Board
50. Burn-in/Screening Equipment
51. Coil Testers
52. Continuity Testers – Cable/Harness/Board
53. Current Leak Detectors
54. Dedicated Microprocessor Testers
55. Discrete Component Testers (Diodes/Resistors/etc.)
56. Environmental Chambers
57. Fault Isolation Tools
61. Functional ATE, PCB
62. Functional ATE, Systems
63. Handlers/Sorters
64. HiPot/Insulation Breakdown Testers
65. Hybrid Device Testers
66. In-Circuit Testers
68. Parametric Testers, Digital
69. Power Supply Testers
70. Relay/Transformer Testers
71. Temperature Cycling Equipment
72. **Wafer Probers**

Test/Analysis Services/Consultants

78. Burn-in/Screening
79. Calibration/Maintenance
80. Component Failure Analysis/Test
81. Electron Microscopy
82. Mass Spectroscopy
83. PCB Test
84. Repair Services
85. SEM Services
86. Surface Analysis
87. Test Equipment Leasing/Rental
88. Test Programming
89. X-Ray Analysis

Test Hardware

94. Adaptors
95. Clips
96. Connectors
97. Fixturing
98. Performance Boards
99. Probe Cards
100. Probes/Contacts
101. Sockets
102. Switching Matrices

Software/Data Monitoring/Control

107. Compilers
108. Data Acquisition/Reduction Systems
109. Data Reduction Software
110. Distributed Control Systems
111. Simulation Systems
112. Test Software Development Aids
113. Translators
114. Data Loggers

Interfaces

116. Computer I/O
117. Connection
118. GPIB/IEEE 488
119. Patch
120. RS-232

Microelectronics Measuring/Monitoring Equipment

124. Acoustic Emission Testers
125. Adhesion Testers
126. Angle-lapping/Polishing Equipment
127. C-V Plotters
128. Centrifuges
129. Chemical Element Concentration Analyzer
130. Coating Thickness Testers
131. Conductivity Probes/Testers
132. Cryogenic Testers
133. Densitometers
134. Die Attach Testers
135. Diffusion Depth Testers
136. Doping Profilers
137. Electrostatic Measuring Equipment
138. Ellipsometers
139. Film Thickness Measuring Machines
140. Gas Analyzers
141. Gas Chromatographs
142. Hardness Testers
143. Inkers & Ancillary Equipment
144. Interferometers, Laser
145. Ion Beam Analyzers
146. Ionic Contamination Testers
147. Junction Depth Testers
148. Lead Fatigue Testers
149. Leak Detectors
150. Mass Analyzers
151. Micro Balances
152. Micrometers
153. Particle Counting Systems
154. PIND Testers
155. PH Monitoring Systems/Probes
156. Photoresist, UV Monitoring
157. Photomask Flatness Testers
158. Resistivity Test Systems
159. Reticle Alignment Instruments
160. Solderability Test Systems
162. Spreading Resistance Testers
163. Surface Analysis/Profiling Equipment
164. Tensile Strength Equipment
165. Wafer Flatness Testers
166. Wafer Thickness Gages
167. Water Purity Testers
168. Wire Bond Strength Testers

Inspection Equipment

177. Auger Spectrometers
178. Automated Wafer/Die Inspection Equipment
179. Coordinate Measuring Machines
180. Comparators, Optical
181. Dimensional Measuring/Inspection Equipment
182. Electron Microprobes
183. Image Analyzers
184. Infrared Cameras
185. Linewidth Measuring Equipment
186. Mask Defect Inspection System
187. Micro Sectioning Equipment
188. Microscopes, Comparison
189. Microscopes, Incident Light
190. Microscopes, Infrared
191. Microscopes, Interference
192. Microscopes, Measuring
193. Microscopes, Optical
194. Microscopes, Projection
195. Microscopes, Scanning Electron
196. Microscopes, Stereoscopic
197. Microscopes, Video
198. Scanning Auger Microprobes
199. Spectrometers
200. Spectrophotometers
201. Thermal Imaging Equipment
202. TV Inspection Systems
203. X-Ray Machines

Communications/Microwave Test Equipment

208. Communications Test Equipment
209. EMI Testers
210. Microwave Impedance-measuring Equipment
211. Microwave Multimeters
212. Microwave Power-measuring Equipment
213. Microwave Spectrum Analyzers
214. Radio/Audio Testers
215. RF Meters
216. TV Test Equipment

Process Monitoring & Control Instrumentation

220. Accelerometers
221. Detectors/Sensing Instruments
222. Displacement Testers & Load Cells
223. Flowmeters
224. Gages: Dimensional, Level Pressure, Force, Vacuum
225. Humidity Instruments
226. Panel Meters, Analog
227. Panel Meters, Digital
228. Shock Testers
229. Temperature-measuring Instruments
230. Transducers
231. Vibration Testers

PART 7

Specifying/Purchasing/Responsibility/Authority (Circle one number in A, one in B, and all that apply in C.)

A. I *recommend* purchase of equipment/instruments/services that cost (circle one only):

1. ◄$5K
2. $6-10K
3. $11-50K
4. ►$50K

B. I *authorize* purchase of equipment/instruments/services that cost (circle one only)

5. ◄$5K
6. $6-10K
7. $11-50K
8. ►$50K

C. I recommend or authorize purchase of (circle all that apply):

8. Test Instruments
9. Production/QA/ATE
10. Microelectronics Measuring/Monitoring Equipment
11. Inspection Equipment
12. Communications /Microwave Test Equipment
13. Process Monitoring & Control Instrumentation

PART 8

Types of Testing/Measuring I perform/manage

(Circle all that apply):

1. Incoming Inspection
2. Production Testing
3. QA/QC/Reliability
4. Prototype Evaluation
5. Microprocessor Development
6. Design Test
7. Field Service
8. STDS/Calibration
9. Process Measurements/Control
10. Failure Analysis
11. Basic Research Measurements
12. Plant/Operations Maintenance

PART 9

Frequency Ranges in which I perform/manage tests/measurements

(Circle all that apply):

1. Powerline
2. Mechanical/Vibration
3. Audio
4. Hz
5. KHz
6. MHz
7. GHz

☐ Check here if you do not wish to receive promotional mail from TEST & MEASUREMENT WORLD.

Use this form to qualify for your free subscription to

TEST & MEASUREMENT WORLD

Be sure to answer all the questions on this form.

please pass this form to a colleague.

TEST & MEASUREMENT WORLD

If you have already sent in a qualification form to

Be sure to affix sufficent postage.

PLACE STAMP HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

please tape
don't staple

GenRad User Alert!

- *Minimum 2808 Kit only $16,000*
- *Assemble your own System and Save*
- *Complete Integration Manual Included*
- *Put your ATE spares to work*
- *Complete 2808 System available*

A proprietary DEC/TEC interface emulates the GenRad 1797 hardware coupling of computer to special peripherals. Build your own Test Programming Station!

HHB

The Electronics Software Company

116 Route 17 North
Upper Saddle River, NJ 07458
(201) 327-8014

Easy-to-use Manual for System Assembly and Software Integration.

FOR MORE INFORMATION, CIRCLE 37

VIDEO AND CCTV INSPECTION: THE NEXT ERA OF TEST AND MEASUREMENT?

Still in its infancy, video inspection technology can provide simple magnification of submicron objects or full analysis of surface details. More applications await. It may simply be a problem of thinking of them in video terms.

by Mitchell Rose, Staff Editor

Some advances in electronics are bona fide breakthroughs that signal the debut of a new technology; others spring from refinements of established methods and instruments. The growing application of video equipment to inspection and measurement required something else: independent developments in cameras, computers, software and interfaces. The technology remains in its infancy, but observers believe the marriage of video equipment and inspection tools will be as successful as the match between uPs and test gear. Even at this early stage, video systems are used to enhance the inspection of everything from wafers to magnetic-head gaps.

The sophistication of available video systems ranges from simple CCTV equipment mounted on microscopes to image analyzers that map dust particles on wafers. Manufacturers employ video systems at all stages of production to inspect raw materials, wafers, devices, boards and even finished products, though few, if any companies use the technology throughout a single plant at this time. Still, this noncontact technology has added accuracy and speed to both complex and simple inspection routines. But new instruments must arrive before the trend grows into an era.

This primer on video technology and its disparate applications provides an overview of an important visual inspection technique. Future articles will cover photometer systems and electron microscopes.

Accept/Reject Decisions

Several microscope makers, including American Optical, Bausch & Lomb, Olympus, Nikon and Vickers, offer photomicrographic video equipment as options for their product lines (see the special product feature on p. 52 of this issue). In the simplest arrangement, a TV camera is located on the trinocular, and a monitor displays the image to reduce eyestrain or allow more than one person to observe the unit under test (UUT). Multiple monitor hookups can carry an image of, say, a defective chip to different areas of a plant. For illustrative purposes, a movable pointer attached to the body of the instrument draws attention to details. Such instruments can facilitate inspection in cases where low volumes don't demand automated inspection techniques, or where the object doesn't lend itself to inspection by any other method.

TV magnification is a function of the camera's picture tube diameter and the diagonal dimension of the monitor. American Optical, which has both color and black-and-white video inspection equipment, provides two simple equations to determine this variable:

For a 2/3 in. camera tube, magnification factor =

$$\frac{\text{Diagonal monitor measurement (in inches)}}{0.4187}$$

For a 1 in. camera tube, magnification factor =

$$\frac{\text{Diagonal monitor measurement (in inches)}}{0.625}$$

These factors are multiplied by the microscope magnification to obtain the total magnification. Together, a 1 in. tube, 13 in. monitor and 40X microscope objective yield a total screen magnification of 832X—*19.8 times greater* than that provided by the unaided 40X objective.

A setup that provides such powerful magnification can aid an operator in making basic accept/reject decisions. At a factory for phonograph cartridges, for instance, the shapes of incoming styli are checked by comparing the video image of the sample with a mylar

AO's microscopes can be outfitted with video cameras and monitors.

transparency affixed to the monitor. Deviations from the proper contour drawn on the mylar are readily apparent, so the operator can make a go/no go judgement. No measurements are taken in this case. When measurements are necessary however, microscope manufacturers offer a variety of stage micrometers and reticles.

Just as video technology has enhanced and changed microscope inspection techniques, optical comparators, which use mirrors and a projection viewing system to check a master board against a production sample, have been transformed into *video* comparators by the addition of two cameras and a monitor. Most optical comparison units require special room illumination and/or an overhead canopy for clear viewing of the projected image. Video-based systems, on the other hand, don't impose these requirements.

Alternate images of the UUT and the master—a loaded, bare or solder-side-up board—flash on the monitor. Errors show up as differences in color and motion between the views; based on these differences, the operator can assess the UUT as good or bad. For closer inspection, both boards can be frozen on a split screen. Such instruments as Ham Industries' CVC 3000 are particularly suitable for inspecting the high-density PCBs used in computer and aerospace gear.

Automated Measurement

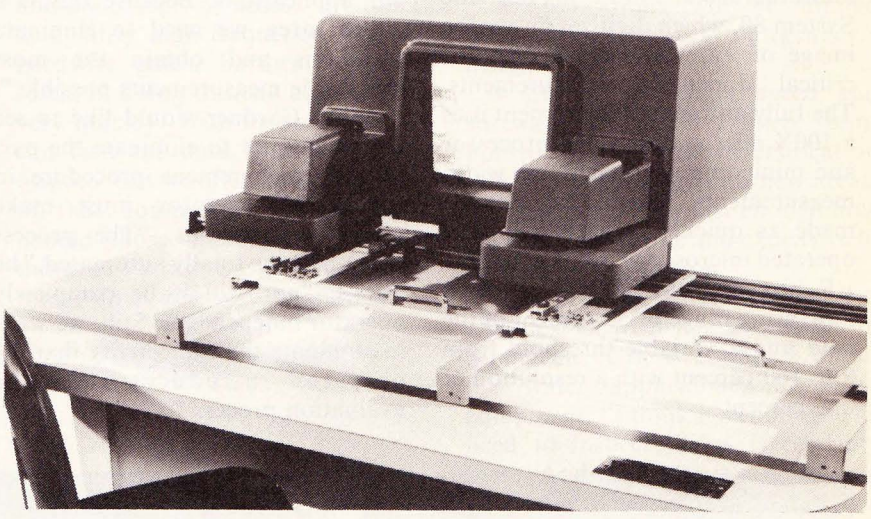
If the camera and monitor are connected to a computer, information can be digitized and analyzed—and the inspection process becomes totally or at least partially automated. To measure and inspect PCBs, stamped metal parts, injection-molded plastics and other objects, View Engineering's automatic optical micrometer employs a μP and video processor that work with an X-Y stage. A part placed on the stage moves automatically into the field of view. The camera travels along the Z-axis to bring the UUT into focus; the instrument then registers the image, which is digitized by the video processor. Finally, the data are processed by software, and the measurement displayed on the CRT. This method provides higher accuracy than optical comparators and works more quickly than coordinate measuring machines.

Manufactured by the Boice Division of Mechanical Technology, Inc., the Vista system uses the same optics and video electronics as View Engineering's instrument. The Boice unit, however, has a larger coordinate measuring surface for performing dimensional checks on glass and mylar artwork for PCBs (both systems can check finished boards for proper hole dimaeters and locations). To assist in observing objects that aren't perfectly flat, the Vista remains accurate up to a 6 in. depth ±0.0005 in.

Future refinements in this kind of instrument will probably focus on three aspects of video technology. Top lighting of parts can cause too much reflectivity when viewing glossy surfaces; if an image is to digitize well, good contrast between the various features is mandatory. Fiber optic lighting, in the form of rings clamped around the lens for even illumination or gooseneck lamps angled at the part to create sharp shadow edges, may enable the instrument' use for viewing to view solid UUTs (at present, backlighted pieces must contain holes or be semitransparent). Likewise, camera improvements should bring better image definition, while new software will permit entry of the relevant data on a terminal without having to walk through the measurement routine.

By experimenting with different illumination techniques, AMP of Harrisburg, PA, hopes to use an automated system once it can structure a lighting system that will pinpoint small surface blemishes on flat circuitry, such as the membranes for its line of switches. The firm aims to eliminate the ordinary visual inspection process—"the boring job of sitting for eight hours a day looking at parts"—explains Jim Eagan, manager of advanced quality technology. "We haven't gotten far enough to tell whether video would enhance this kind of work and make it more reliable. But that's our intention—to try to improve this capability."

For AMP, improved visual inspection, not measurement, is the goal. "I'm more interested now in good/bad decisions," states Eagan, "than in *how* good or *how* bad." Currently available measurement equipment has been too slow for AMP's production requirements, so this application will be put aside until higher-speed instruments appear on the market.



Alternate images of the test piece and master—a loaded, bare or solder-side-up board—flash on the monitor of the Ham CVC-3000.

At the other end of the production line, go/no go inspection methods have been significantly upgraded by video techniques, too. Delta Design Inc.'s image analyzers check the print quality of up to 10,000 IC packages per hour. In addition to ruling whether the parts pass or fail, the company's Model 210 can send output signals to halt marking machinery for readjustments.

View Engineering's Vision 85 is a general pattern recognition system that retrofits wire bonders, saws and wafer probers. After the reference

patterns have been entered for a bonding operation, for instance, misalignment shows up as a difference between the stored image and that of the UUT. The instrument then signals the bonder's drive motors to reposition the part before proceeding. The seven-step operation usually takes less than 500 msec. And though they're as secretive about their plans as the CIA, several companies are known to be working on very advanced software that will provide near-instantaneous pattern recognition for other applications.

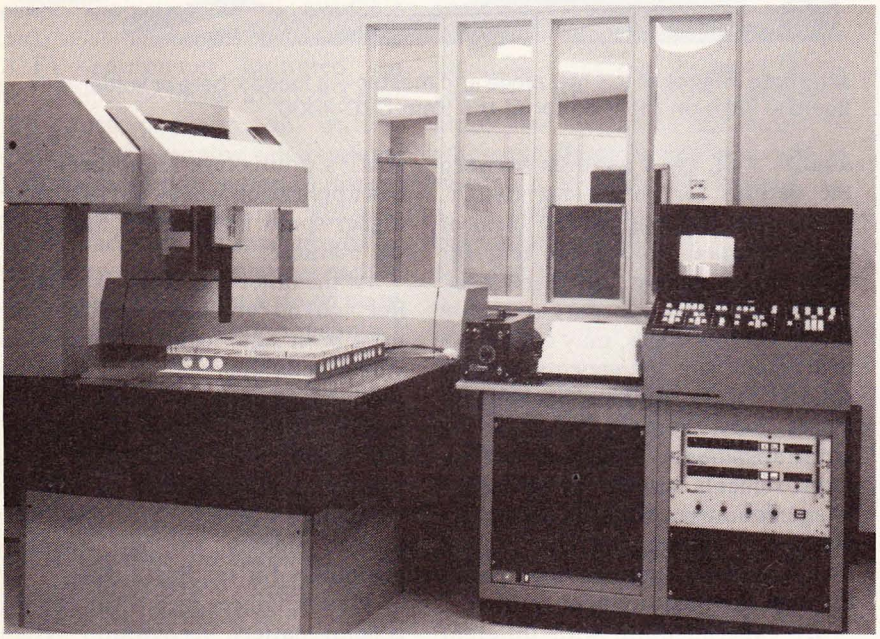
The wafer that is inspected with a microscope and CCTV equipment can be measured automatically with equipment from ITP, Leitz and other manufacturers. ITP makes the System 80, which digitizes an analog image of wafer and mask lines for critical dimension measurements. The fully automated instrument uses a 100X microscope, video processor and minicomputer to perform width measurements that could not be made as quickly using a manually operated microscope. Leitz offers the μP-based AMS-100, with a measuring range of 30 percent of the field and a variable threshold from 0 to 100 percent with a resolution of one percent.

The pluses of this instrument are greater repeatability, accuracy and ease of operation (little training is required). Applications include inspection of magnetic-head gaps and bubble memories.

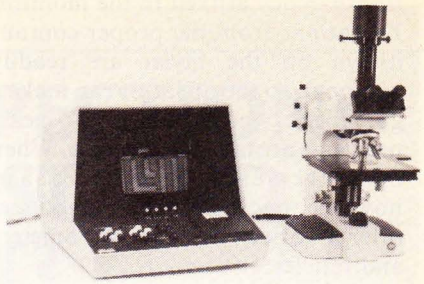
At the Motorola Bipolar IC Group, Mesa, AZ, video-enhanced systems are used to make line-width measurements and locate surface defects on masks. Five years ago, the lab first investigated video equipment, including particle analyzers. In the future, they plan to add more video equipment for line-width inspection.

"We'll be constantly upgrading our equipment," explains Pat Gardner, photomask engineering manager. "As instruments become available that are operator independent and totally automated, we will try to adopt this equipment to our applications. Because this is a critical area we need to eliminate variations and obtain the most repeatable measurements possible."

What Gardner would like to see are techniques to eliminate the part of the measurement procedure in which the operator must make subjective decisions. "The process won't become totally automated," he thinks, "nor will it be completely operator independent. Still, we want to eliminate the subjectivity that the operator introduces into the evaluation process."



Vista Automatic Video Inspection System can check PCBs with an accuracy of ±0.0005 in.



In addition to masks, the Leitz AMS-100 can check magnetic-head gaps and bubble memories.

The Whole Picture

Instruments like the View Engineering and Boice units don't process an entire video frame but a maximum of 100 points per program. This seeming drawback turns out to be a virtue; since the μP doesn't compile unnecessary data, measurement time is reduced for large objects (up to 48 in. x 48 in. for the standard Boice series). When a whole frame needs to be digitized for more detailed analysis, however, the complexity of the data processing requirements jumps by several orders of magnitude. Depending on the instruments used, 200K to 600K picture elements or *pixels* must be scanned for a full-frame analysis. Most of the dormant applications and need for equipment improvement lie in this area of video inspection.

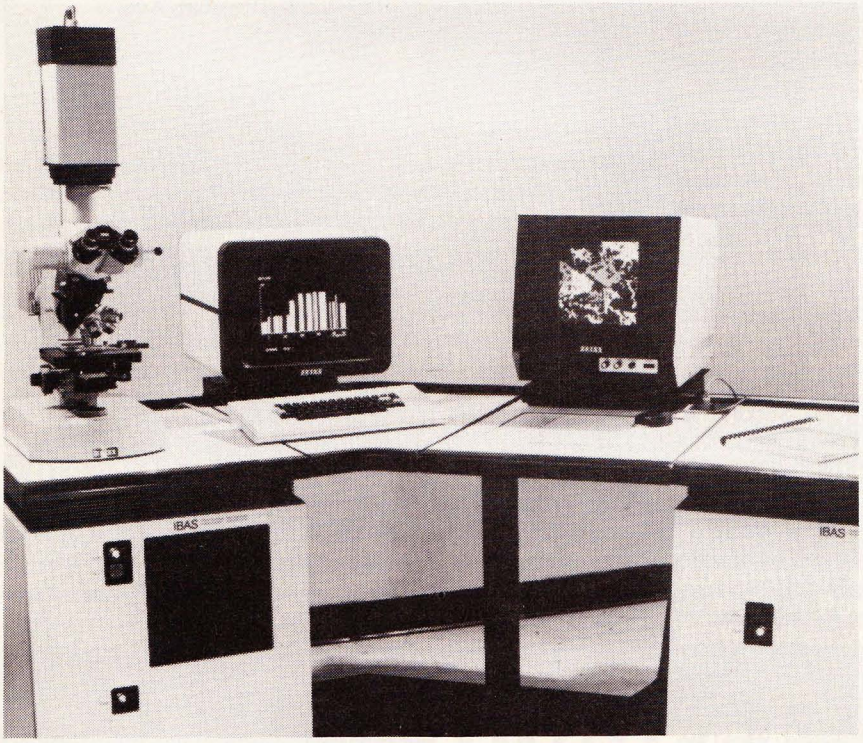
Image analyzers, probably the most sophisticated inspection tools, do examine an entire frame. Instruments such as the Leitz T.A.S. (texture analysis system), Zeiss IBAS and Cambridge Instruments Quantimet 900, register the dimensions within the field of view for area, height, width, particle count, perimeter and densitometric (gray level) information to derive several other parameters, including average area of particles, volume fraction and average reflectivity. These instruments have generally been employed in fields outside the electronics industry: in material sciences for counting asbestos fibers and examining petrochemicals, and in biomedical applications for ascertaining ratios of live to dead cells. Nonetheless, semiconductor manufacturers have also used image analyzers for checking direct photolithography and wafer particle contamination.

By scanning wafers for impurities (dust, surface defects), the analyzer can map imperfections and make immediate calculations of their regional distribution. Editing features enable highlighting particular aspects of the test surface. Some models are extremely versatile, with hookups for videotape recorders or for use with scanning electron microscopes.

The strengths of these instruments derive from their software. Leitz designed the T.A.S., for example, to use flexible software so that processing and output can be tailored to a specific application. The system can display the results of an observation on a hard-copy printout or on the monitor in histogram or text format. Leitz and other firms offer program libraries for investigating particle sizing, fiber length, optical density and so on. To facilitate rapid integration with existing inspection routines, the multilingual Cambridge Quantimet 900 has the ability to accept an option for accessing data files in FORTRAN, BASIC and PASCAL programming languages.

John Crowe is a test engineer at Hamamatsu, Waltham, MA, a firm that offers a broad array of building blocks for custom-designed inspection systems. He agrees with others in the industry that available software is too slow for many complex applications, but he also sees hardware as an obstacle to the assimilation of data, particularly if a total frame is involved. "There's one speed problem that you run into when you're dealing with TV rates and digitizing," he notes. "TV rate is at a fairly high frequency. We can hardwire gates, hardware and so forth; in doing this, we acquire data very quickly. With the interface, we can feed the data to whatever we want to. But we often have a problem in that computers typically can't handle those speeds, can't handle things at TV rate. So, we have to slow things down one way or another."

"The applications are there," says Hamamatsu's John Crowe. "It's a matter of thinking of them in video terms."



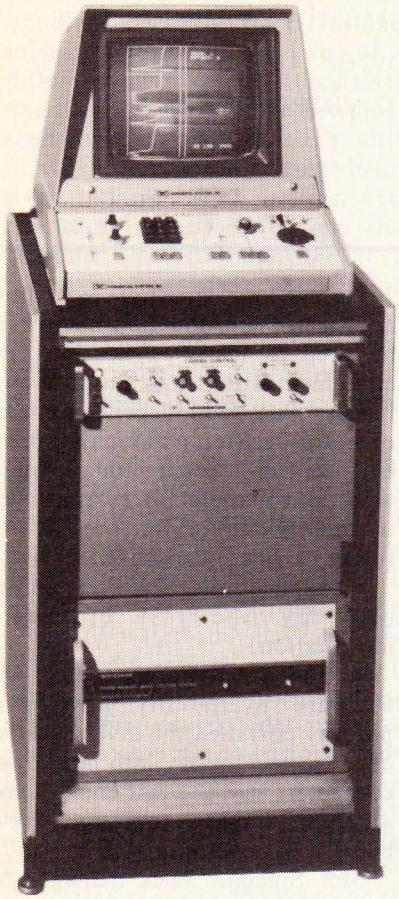
The monitor above the keyboard on the IBAS Image Analysis System from Zeiss shows a histogram of the image that is displayed on the color monitor on the right.

As video inspection techniques approach the production-line speeds required by many applications, the equipment will furnish the precision, repeatability and independence from operator decision making that many engineers are seeking today. Many users and manufacturers are united in their views of the present and future of video inspection:

- Applications will be limited only by the test engineer's imagination.
- Current computer speed and software availability have temporarily corralled the diversification of video technology into new areas; computers that are fast enough now are simply too large and expensive to be used for inspection.

Jim Sinclair, sales manager for Quantex video image processors in Sunnyvale, CA, is confident about the wider applicability of video equipment: "I think it's coming. The need to inspect things is certainly there. And the faster it can be done, the better. The problem to date has revolved around the computer interface and software, rather than the hardware. You can store an image of a known good part or assembly and then subtract the test part from it. But initially, that requires very accurate fixturing; otherwise, you get a difference just because the same part is rotated slightly or off the left/right or up/down axis. That's a production-line problem: to quickly fix something that accurately—and for the tooling to hold up for any length of time."

John Crowe also sees unlimited applications for video technology. "The field is in its infant stages," he comments. "But once you can work with a computer to acquire digital information in real time, applications will increase. I think video—just the



Hamamatsu's C1440 Video Frame Memory stores a video image and recalls it or shows the difference between the input and memory.

field of video and image analysis—is rapidly changing the manufacture of semiconductors. The applications are there. It's a matter of thinking of them in video terms."

Video Inspection Equipment

Microscopes with CCTV equipment: See the special product feature including a list of manufacturers on p. 52.

Boice Division
Mechanical Technology, Inc.
968 Albany-Shaker Rd.
Latham, NY 12110
(518)456-4131
- Vista automatic video system

Cambridge Instruments Inc.
40 Robert Pitt Drive
Monsey, NY 10952
(914)356-3331

Cambridge Instruments Ltd.
Rustat Rd.
Cambridge CB1 3QH
England
(0223)42021
- Quantimet 720, 800 and 900 image analyzing systems

Colorado Video Inc.
Box 928
Boulder, CO 80306
(303)444-3972
- Model 321 video analyzer
- 305 Video Micrometer
- 274C Video Frame Store

Daigger Scientific
10 Harbour Way
Richmond, CA 94801
(415)233-6464
- Micro-measuring system

Delta Design, Inc.
P.O. Box 421
San Diego, CA 92112
(714)292-5000
- Model 210 image analyzer

Optoelectronics Systems Operation
General Electric Co.
Bldg. 3, Electronics Park
Syracuse, NY 13221
(315)456-2832
- Optomation systems for manufacturing automation applications

---

Ham Industries, Inc.
835 East Highland Rd.
Macedonia, OH 44056
(212)467-4256
- CVC 3000 color video comparator
- HamScan image recognition systems

Hamamatsu Systems, Inc.
332 Second Ave.
Waltham, MA 02254
(617)890-3440
- C-1000 computer compatible video camera and control
- C-1440 video frame memory
- C-1285 Image Analysis System
- C-1143-00/01 Area Analyzer

E. Leitz, Inc.
Rockleigh, NJ 07647
(201)767-1100
- T.A.S. (texture analysis system)
- AMS-100 automatic measuring system
- Latimet measuring microscope (CD dimensions)
- MVG mask comparator

McBain Instruments, Inc.
9175 Eton Ave.
Chatsworth, CA 91311
(213)998-2702
- Micro-measuring system

Quantex Corp.
252 N. Wolfe Rd.
Sunnyvale, CA 94086
(408)733-6730
- DS series of video image processors

Ryokosha Co., Ltd.
Shinyaesuguchi Bldg.
2-2-1
Yaesu
Chou-ku, Tokyo 104
Japan
(03)(273)0711
U.S. Distributor:
Coberly & Associates
3350 Scott Blvd.
Building 47
Santa Clara, CA 95051
(408)727-1530
- ZA-51 telecomparator system

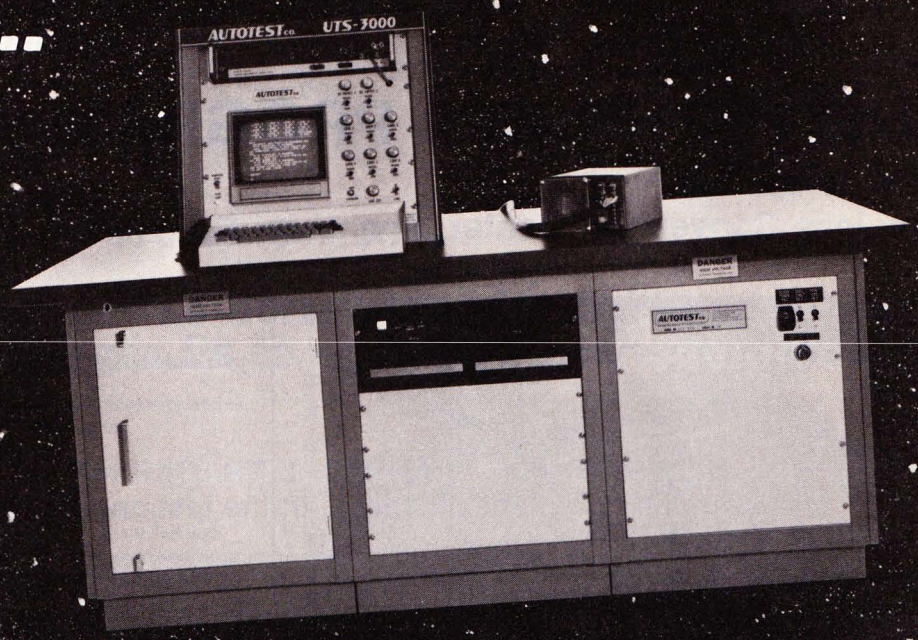
Stocker & Yale, Inc.
RT 128 & Brimbal Ave.
Beverly, MA 01915
(617)927-3940
- Stocker & Yale videogauge

Technical Instrument Co.
348 Sixth St.
San Francisco, CA 94103
(415)431-8231
- Compumetric AMS-100 critical dimension measuring system
- VMS video measuring system

View Engineering, Inc.
9731 Variel Ave.
Chatsworth, CA 91311
(213)998-4230
- Automatic optical micrometer
- Vision 85 automatic pattern recognition systems

Carl Zeiss, Inc.
444 5th Ave.
New York, NY 10018
(212)730-4400
- IBAS interactive image analysis system

Power Supply Testing? Let The Leader Show You How It's Done...



Autotest Co.: #1 in a growing field. The world loves a winner . . . and in Power Supply Testing, Autotest Company, by virtue of cold hard experience, is the undisputed leader. We've delivered *more* power supply test systems than anyone . . . anywhere.

Why?

The indusfry needed a Power Supply Test Unit that had been thoroughly *researched, tested* and *proven* in the field, with more *capability* than any other.

Result?

The UTS-3000™: The State of the Art in Power Supply Testing!

We knew that for *system integrity* and *reliability* any Power Supply Test Unit had to be manufactured by a single source. Therefore, over 90% of the modules in the UTS-3000™ are designed and handcrafted by us.

Next, to minimize labor costs, we made sure that anyone with *minimal training* could operate the system easily.

And, we added multi-station test head capability, so that UTS-3000™ has *versatility* to fit the complexities of your operation. In addition to its primary duties, you'll find numerous secondary roles, whereby it can help you achieve maximum *efficiency* and *savings . . . and, all at a price* you can afford.

Our AUTOSOFT™ software is the industry's most advanced and integrates totally with our hardware. Our automatic program generation allows anyone to quickly generate test programs. To back your system up, we've included a *spare parts kit* and *comprehensive support plan.* To optimize uptime . . . we have knowledgeable *Field Representatives,* who will show you how to get the most from your UTS-3000™ . . . and consult with you on a continuing basis. No brag, just fact: the UTS-3000™ will *save time, cut labor costs* and give you *consistent results* for maximum *product quality control.*

Autotest Co: around the clock — around the world — Future Power Supply Testing technology — NOW! When you're ready, talk to the leader.

AUTOTEST co.

The Innovators of Modern Automatic Power Supply Testing • P.O. Box 20264 • 5355 Dietrich Road • San Antonio, Texas 78220
Phone (512) 661-8661 • TWX 910-871-1229 ACECO SNT

FOR MORE INFORMATION, CIRCLE 16

TEST & MEASUREMENT WORLD *magazine proudly announces the first annual*

TEST & MEASUREMENT WORLD EXPO

THE TECHNICAL PROGRAM

April 19-22, 1982
San Jose Convention Center, San Jose, CA

The only specialized conference/exhibition to offer in-depth yet comprehensive coverage of all aspects of test technology.

SIX SPECIALIZED TECHNICAL TRACKS will provide in-depth examination of specific areas in the test and measurement industry:

- **Test Instrument Technology**
  Track leader: Soren Vestergaard
  Tektronix, Inc.
- **Production/QA/ATE**
  Track leader: Craig T. Pynn
  Plantronics/Zehntel
- **Microelectronics Measurement**
  Track leader: TBA
- **Optical Inspection**
  Track leader: Dr. John Buono, Vice President
  Analytical Services, Photometrics, Inc.
- **Communications/Microwave Test**
  Track leader: Asad Madni, Engineering Manager
  Instrument Group, Systron-Donner, Inc.
- **Process Monitoring and Control Measurements**
  Track leader: David Neal, Manager,
  New Business Development, Acurex Corp.

Each track will consist of an overview session plus 6-8 technical workshops. The tracks are designed to give attendees a thorough technical exercise on the technology covered by the track.

Keynote Speakers

Marshall McComas, President
Lomac Corporation

Norbert Laengrich
Racal-Dana Instruments

Lutz Henckels, President
HHB, Inc.

Technical Program Moderator:

Arnold M. Greenspan, President *AMG Associates*

The only conference/exhibition covering the entire range of equipment and services for optical inspection, QA/QC, incoming parametric/functional inspection, production test, microprocessor/prototype development, circuit and system design test, laboratory/precision measurement, control instrumentation design/application, microwave test, microelectronics surface/physical/mechanical measurement, EMI monitoring, fiber optics testing, communications test, calibration, field test, plant operations/maintenance measurements.

THE EXHIBIT

April 20-22, 1982
San Jose Convention Center, San Jose, California

Measuring Instruments
Oscilloscopes
Microprocessor Development Aids
Calibration Tools & Standards
Generators - Signal, Function, Waveform, Noise, Sweep
Prom-Programmers
Analyzers - Logic, Spectrum, Bus, Signature, Waveform, Network
Bridges - RLC
Meters - Handheld & Benchtop
Comparators
Probes - Logic & Electrical
Counters/Timers
Recording Instruments
Phase Measuring Equipment
Controllers & GPIB Equipment
Emulators
Power Supplies
Fiber Optics Testers

Automated Test Equipment
Burn-in/Temperature Cycling Equipment
Environmental Chambers
IC Functional/Parametric Testers
Memory & Microprocessor Testers
Subassembly Testers
System Testers
Discrete Component Testers
Microelectronics & Semiconductor Parametric Probers
Continuity Testers
Insulation Breakdown Testers
Handlers
Power Supply Testers
Microprocessor Dedicated Testers
Hi-Pot Testers
Relay/Transformer Testers

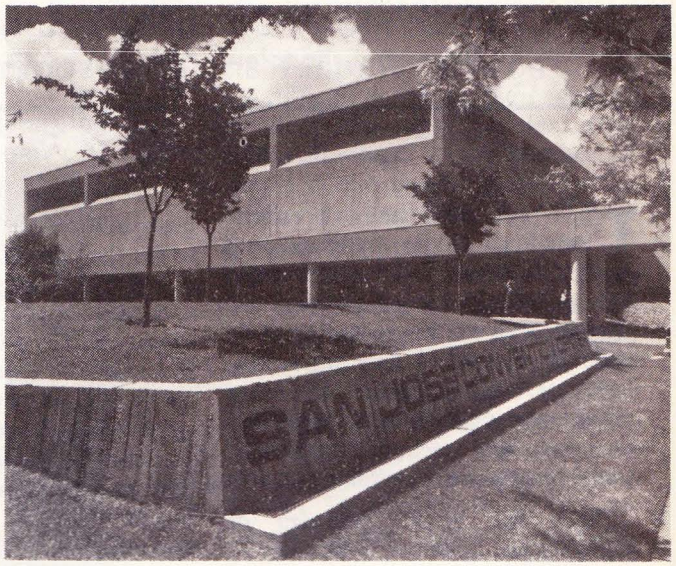
Inspection Equipment
Auger Spectrometers
Video Microscopes
Projection Microscopes
Interference Microscopes
Optical Microscopes
Scanning Electron Microscopes
TV Inspection Systems
Stereoscopic Microscopes
Optical Comparators
Automated Wafer Inspection Equipment
Microsectioning Equipment
Mask Inspection Systems
Failure Analysis Equipment
Wafer Flatness Inspection Systems

Microelectronics Monitoring/ Measuring Equipment
Process Monitoring & Control Instrumentation
Ellipsometers
Spreading Resistance Measurement Systems
Gas Composition Analysis Systems
Film Thickness Gages
Doping Profilers
Die Attach Testers
Wire Bond Testers
C-V Plotters & Profilers
Sheet & Slice Resistivity Testers
Ion Probe Analyzers
Gas Monitoring & Process Control Equipment
Adhesion Testers
Acoustic Emission Testers
Leak Detection Systems
Electrostatic Measurement Instruments
Diffusion Depth Testers

Miscellaneous
Software/Equipment for Test
Test Hardware
-interfaces/adaptors
Test Services
-consultants
-electronics test
-mechanical test
-software design
-SEM/spectroscopy analysis
-calibration/maintenance

Communications & Microwave Test & Measuring Equipment
RF Meters
Radio/Audio Testers
Microwave-Impedance-Measuring Equipment
Microwave-Power-Measuring Equipment
Microwave Multimeters
Communication Test Equipment
Microwave Spectrum Analyzers
TV Test Equipment

Process Monitoring & Control Instrumentation
Temperature-Measuring Instruments/ Calibrators
Panel Meters - Analog
Panel Meters - Digital
Vibration Testers
Acceleration, Pressure & Force Gages
Displacement Testers & Load Cells
Transducers
Process Flow/Viscosity/Density Monitoring
Process Control Systems
Chemical Analysis Systems



For more information call

To exhibit: Elise Hunt, 617/254-1445
To attend: Meg Bowen, 617/254-1445

Interfield Publishing Company
215 Brighton Avenue Boston, MA 02134

☐ **I am interested in attending. Please send me full details on the Test & Measurement World Expo technical program.**

☐ **I am interested in exhibiting at Test & Measurement World Expo. Please send me full details.**

Name_____ Title_____
Company_____
Address_____ Dept./Mail Stop_____
City_____ State_____ Zip_____

Produced by TEST & MEASUREMENT WORLD magazine

TEST EQUIPMENT BEHIND THE IRON CURTAIN: EXPORTS AND ESPIONAGE

A recent case of high-tech espionage involving test equipment led *Test & Measurement World* to investigate the rules and regulations governing the export of this gear to the Eastern bloc. Our inquiry revealed that all test equipment has been designated "security-sensitive" under the Reagan administration's new get-tough policies. It's up to individual manufacturers and buyers, though, to guard against illegal transfer of sophisticated electronics technology.

by Carmen D. Wiseman, Staff Editor

The test and measurement industry is normally not a political animal. Like most other high-technology business sectors, it's caught up in the never-ending cycle of developing, marketing and selling products. In general, the test community is guided and shaped by economic and technical concerns, rather than political affiliations.

Since the Soviet takeover of Afghanistan, however, a number of American business segments have collided with the amorphous but powerful interests of "national security." Growing concern over Soviet military intentions has induced the U.S. government to impose stricter controls on trade with the Eastern bloc, particularly on exports of high-technology goods. (Just after the U.S.S.R. invaded Afghanistan, for instance, President Carter stepped in to bar the shipment of several American-made mainframe computers that the Soviets had ordered and paid for.)

These restrictions seem to have turned international espionage into a high-tech affair. Instead of using some kind of James Bondian "secret formula" to barter with iron curtain countries, spies are now dealing in advanced U.S. electronics gear: mini- and microcomputers, LSI devices and, naturally, the equipment required to design and test them.

Even if the technology incorporated in an item is not a hush-hush matter, the item may still fall under the aegis of "security-sensitive" (compromising U.S. national security), because other nations *might* use it to build up their military expertise. Under the current umbrella definition, then, all electronics test equipment would be classified as security-sensitive. And this means that test equipment buyers may be subject to more rigorous background checks than was formerly the case.

A Test Equipment Spy Ring

In Los Angeles, the U.S. District Court recently convicted two people of high-tech espionage involving substantial amounts of test equipment. The Justice Department has labeled this case "the largest in scope and most sophisticated in execution of any illegal strategic export operation known."

After being indicted this August on some 60 counts of exporting high-technology goods without obtaining the proper licenses, Anatoli T. M. Maluta, a 61-year-old Russian-born U.S. citizen, and Sabina Dorn Tittel, 31, originally of West Germany, were found guilty of the charges on October 27, 1981. Between January 1977 and January 1980, the pair conspired with several European businessmen—Werner J. Bruchhausen and Hans J. Koenig of West Germany and Dietrich Ulrichshofer of Vienna—to set up over 30 dummy corporations for the purpose of funnelling sensitive U.S.-made electronics gear into the Soviet Union via Western Europe. The so-called Bruchhausen network sent at least 20 Fairchild Xincom 10 MHz test systems (enough to meet the needs of a medium-scale memory manufacturing facility), a Tektronix 485 oscilloscope, an Intel μP development system, semiconductor from various firms, and other security-sensitive equipment to the Eastern bloc over the three-year period. The dollar value of these illegal activities is estimated to run as high as $8 million. (Apparently Maluta and Dorn Tittel implemented the scheme by misrepresenting the nature and value of the shipments—claiming a cargo of expensive testers as "meters," for instance.)

Maluta had originally told Fairchild that he was using all those testers at an Arizona plant for manufacturing sophisticated security equipment. But when suspicious Fairchild officials asked to have a look at the Arizona operation, he refused. This piqued the interest of the Fairchild people, and they ordered an informal security check on Maluta, who claimed he had previously been associated with U.S. Air Force Intelligence. He passed the security check but threatened to cancel an order for six testers if Fairchild took further action, such as bringing in the Department of

Commerce (DOC).

Eventually, however the DOC did enter the picture, and on April 3, 1981, it issued a bulletin denying export privileges to Maluta and his associates for an indefinite period of time. Meanwhile, the Santa Clara Sheriff's Department had been conducting its own investigation of Maluta. After 18 months of digging, the department accumulated enough evidence against the "Bruchhausen network" to indict Maluta and Dorn Tittel (others could not be extradicted from Europe) for violating federal export regulations. And by October, the test equipment spy ring had been laid bare.

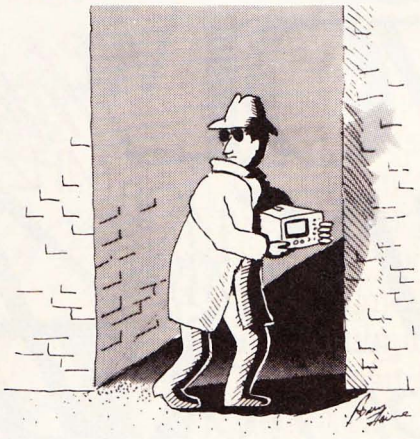
Tougher Regs

Which regulations did Maluta, Bruchhausen and their cover companies run afoul of—and how was the DOC able to clamp down on their activities?

Trade with foreign countries is governed by the Export Administration Act of 1979, which is amended regularly every year. These massive regulations (they run about 500 pages) restrict imports "for reasons of national security, foreign policy and domestic short supply." Under their complex provisions, a U.S. firm must obtain a license to sell, exhibit or manufacture goods in any foreign country. Right now, though, exports to the U.S.S.R, Eastern Europe and, to a lesser degree, the People's Republic of China are considered the most sensitive.

Reflecting the post-Afghanistan U.S. position on Soviet policy, export regulations have become much stiffer over the past few years. The restrictions cover all kinds of trade with the Warsaw Pact countries, not just exports of high-tech goods. But the Reagan administration is particularly concerned about the transfer of advanced U.S. technology to the Eastern bloc, and the tougher regs aim to stymie what the administration perceives as a serious and growing threat to national security.

In testimony given before the Senate Subcommittee on International Economic Policy on September 16, 1981, Lawrence J. Brady, assistant secretary of commerce for trade administration, summed up the Reagan stance on U.S./Soviet trade and technology transfer: "Our feeling is, based on [interagency] policy review, that we may have to tighten strategic controls on goods and technology which upgrade Soviet production in areas relevant to their military strength. In my view, we must place greater focus on controlling the technology and process know-how which the Soviet Union is anxious to acquire for expanding their military/industrial capabilities. Consistent with this tightening at the top of the export control lists, we will strive for decontrol of products at the lower end of the technology spectrum. Our purpose is not to stop trade with the Soviet Union, but rather, to manage the flow of trade to protect our national security interests. In this, I believe we share the aspirations of the American business community to trade while safeguarding U.S. national interests."



A Department of Commerce spokesperson told *Test & Measurement World* that any equipment controlled by the NATO International Coordinating Committee (COCOM), a 25-year-old deliberative body that monitors the export of strategic items, would probably require a DOC license. Basically, this means that if an item is high-tech and might be used to enhance a country's millitary capabilities, it's tagged as security-sensitive or "dual-use" equipment. As mentioned, electronics test gear falls into this category.

But all equipment that goes outside the United States must be licensed. Of course, it's easier to get a license to sell equipment in France, for instance, than in the Soviet Union. Even a license to sell an oscilloscope to a French firm, however, carries an unspoken fiat that the scope will go to France and stay there—and that the DOC will have a record of the transaction. In this way, the DOC can keep an eye on exporters who use third-party dummy companies as a shield for illegal activities, as Maluta and his associates did.

Western European subsidiaries of American test equipment companies are also subject to these restrictions; specifically, they need either COCOM or DOC approval to sell security-sensitive goods to the Eastern bloc. Even if a subsidiary manages to obtain authorization from the trade administration in its home country, the DOC can still bar the sale if the goods were manufactured in the United States.

Violations Increasing

It's difficult to gauge the extent of illegal technology transfer. One index, however, is the number of export denial orders issued by the DOC. A Commerce Department spokesperson cited at least 10 violations of the Export Administration Act, including the Maluta case, from January through September of this year. In all these cases, the violators were either fined heavily or denied export privileges because they exported high-tech gear without getting the appropriate licenses. The total breaks down to an average of one high-tech offense a month. And it doesn't include the violators who didn't get caught.

The DOC feels that individual manufacturers are responsible for taking precautions against possible high-tech espionage—for example, by running thorough financial checks, which often yield information that could be a tip-off on shady activities, or by examining the department's regularly supplemented list of export denial orders if something seems out of the ordinary. National security is not in such dire straits that companies have to run security checks on every prospective buyer. However, the more stringent export controls may lead some test equipment suppliers to tread more cautiously than they did in the past, and buyers should be aware that they might come under closer scrutiny.

If you have any questions about exports or licensing, call the Department of Commerce at (202)337-4811.

"If you can't measure it, you can't improve it."

Alex d'Arbeloff, President
Teradyne

Quality begins with knowledge. Once you know where you are and where you want to be, the rest is just a matter of commitment.

In electronics, knowing where you are means testing. Not just good-bad testing, but testing that gets inside a device and probes the subtle differences between pretty good and very good.

The subtleties vary from device to device. For high-performance memories, where the issue is usually speed, you need a test system that can set timing edges to within a quarter nanosecond. For precision D to A converters, you need a system that can integrate noise measurements over programmed time intervals. For codecs, you need a system that can measure idle channel noise in the submillivolt region.

Measurements like these are not easy, but they're not impossible. Teradyne test systems have been making tough, critical measurements for years – on digital and linear ICs, discrete semiconductors, hybrid circuits, film resistors, automotive electronic modules, analog LSI devices, and printed circuit boards.

What all this experience gives us is a sense of what really matters in the testing of electronics.

What it gives you is the kind of in-depth measurement you need to improve product quality.

TERADYNE

We measure quality.

FOR MORE INFORMATION, CIRCLE 60

account analyst for Teradyne, "was that the large computer and peripheral manufacturing companies stopped buying semiconductors and started to use up their reserves for fear of holding a stockroom full of parts during a recession. Users were still making products and testing devices, but the manufacturers stopped pushing parts out the door."

The situation was like an accident on a crowded highway, where passing drivers slow down and create a traffic jam two miles behind. People kept talking about the coming recession, more companies began to hedge on capital equipment purchases, and finally the recession hit. Now, claims Rob Tucker, marketing manager for Fairchild's Series 70 systems, customers are more careful about how they spend their money. "Three, maybe four years ago, buying a piece of ATE was no sweat. Whether it paid for itself in six months or two years wasn't really relevant. Now, it's not the fact that people don't have the money—it's that justification for the expenditure is examined more carefully. "That's why," states Tucker, "you see a relative flatness this year. But I don't believe the market has really gone flat. I believe it has increased in terms of both dollar value and yearly volume."

Smaller ATE Firms Still Profitable

This is indeed the case for many smaller ATE manufacturers. Bill Halper, product marketing manager for Accutest's 7000 series of testers, reveals that Accutest expects a 30-35 percent increase in sales for 1981 $14 million compared to $8 million in 1980). "Basically," he says, "this figure is what we expected for this year. There has been a steady increase in sales throughout the year, but it has taken rapid new product introductions to offset the effect of the sluggish economy."

Even Accutest has noticed the slowdown, however, and Halper notes "a movement from some of our traditional customers to new customers in the semiconductor industry." But new business gained from in-house IC manufacturing facilities is making up for part of the loss of Accutest's sales to the semiconductor giants.

Other smaller ATE firms, such as LTX and Instrumentation Engineering, also report sales increases. Brad Fisher, a spokesperson for LTX, expects that the company should meet its goals for 1981 with an increase to at least $30 million in sales—up from $24 million in 1980. And Ron Harmon of Instrumentation Engineering says that his firm views the future confidently, with 1981 well on the way to becoming a pretty good year.

At Plantronics/Zehntel, sales vice president Neal Vinson also sees an increase in sales for 1981, though at a slightly slower rate: "There is such a positive impact in terms of return on investment for our equipment that OEMs are beginning to give up hope that interest rates will go down in the near future. I see an upsurge in ordering in the next few months."

Can Big ATE Companies Ride It Out?

What of the larger firms—the ones most adversely affected by sales softening? Can they withstand the current slump and look optimistically toward the future? In Boston, Fred Van Veen, vice president of Teradyne, distinguishes a very strong board test market from a weak semiconductor test market, but concludes that overall sales will be flat for 1981 and may not pick up until the latter part of 1982. And Steven Stadler, GenRad's vice president for strategic planning in Concord, MA, is not willing to predict any more than a mild upswing for the rest of this year and the first half of 1982.

Injecting some brightness into this gloom, however, are reports that buyers may be getting ready to increase their purchases of ATE. Michael Silverstein from Teradyne's Semiconductor Test Division in Woodland Hills, CA, sees growing user activity, which implies that people are starting to gear up for new products. He predicts that the upturn will arrive quickly but may not be immediately apparent: "Device manufacturers are starting to buy equipment in anticipation of the rush on the market for ATE." Ignited by predictions of record-breaking sales for 64K RAMs, the semiconductor houses realize that "if they anticipate the demand, they can have test equipment in place in time to gain a share of the market." However, delivery times could be a problem, cautions Silverstein. Due to the slowdown, current delivery schedules are quite favorable for ATE buyers. But with the expected quickening of the ATE business, he suggests that "delivery times will be ungodly"—stretching out to as many as 40 weeks. For ATE buyers, it may be first come, first served.

ATE Market Still Has Long-Term Strength

Nearly everyone agrees with the market research firms' predictions for the long-term durability of the

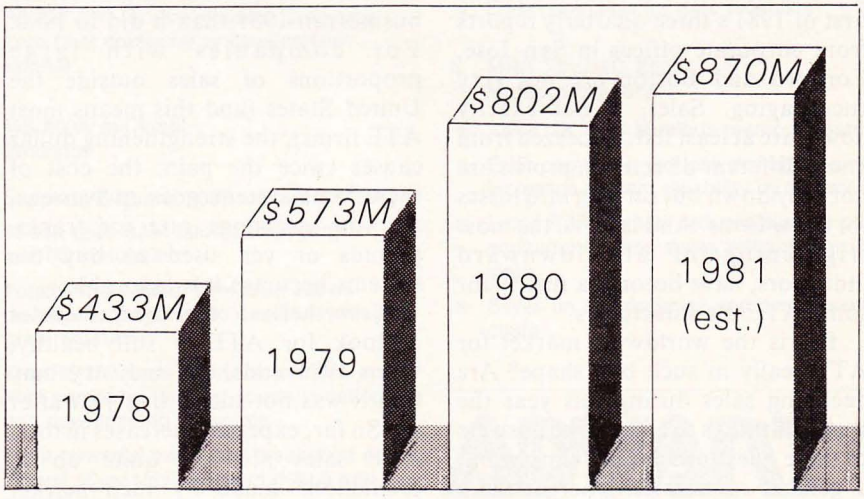


Fig 1. Worldwide ATE sales this year will not approach the gains reached in the last three years.

TEST & MEASUREMENT WORLD

SUBSCRIPTION QUALIFICATION FORM

FALL 1981

For New Subscription, Change of Address or to Renew Old Subscription, Use This Form

Fill in all sections of this form. Please read all sections carefully before filling out. YOUR FREE SUBSCRIPTION CANNOT BE PROCESSED UNLESS ALL SECTIONS ARE COMPLETED. Be sure to sign and date the form before mailing. The publisher reserves the right to accept or reject any subscription.

NEW SUBSCRIBERS: To qualify for your free subscription, fill out this form completely. **CHANGE OF ADDRESS:** If you need to change the address that appears on the mailing label, simply print your new address in Part 1 of this form and fill out entire form. Be sure the original mailing label is attached to the form when you mail it to us. **SUBSCRIPTION RENEWAL:** Fill out the form completely, include original mailing label and return to us. **FOREIGN SUBSCRIBERS:** (outside of the U.S., its territories, and Canada): include cost of postage with your qualification form. Send this form with your check (payable in U.S. funds, drawn on a U.S. bank) in a self-stamped envelope. Postage for Seamail: $20.00; Postage for Airmail: $45.00.

PART 1

Affix mailing label here.
Fill out entire form.

Please send me/continue sending me a free subscription for TEST & MEASUREMENT WORLD yes ☐ no ☐

Circle one
new subscription change of address renewal

Signature Date

First Initial Middle Initial Last Name

Job Title

Company Name

Dept/Div/Mail Stop

Company Street or P.O. Box Number

Company City State Zip

( )
Phone

If company requires home delivery, please fill in home address below. However, company name and address are still required above.

Home Street

Home City State Zip

PART 2

My principal responsibility is (circle only one):

1. Management 2. Engineering

PART 3

Approximate number of employees in my company (circle only one):

1. ◄50 2. 51-500 3. ►500

PART 4

My principal job function is (circle only one):

1. Corporate and General Management
2. Manufacturing/Production Management
3. Design Engineering Management
4. Manufacturing/Production Engineering
5. Design Engineering – Systems/Equipment
6. Design Engineering – Circuits
7. QC/QA/Reliability/Evaluation
8. Basic Research Manager/Engineer/Scientist
9. Applied R&D
10. Engineering Support
11. Field Service Manager/Engineer
12. Calibration Lab Manager/Engineer
13. Process Control Manager/Engineer
14. Operations/Maintenance Engineering/Management
15. Marketing/Purchasing

PART 5

The primary end product (or service performed) of my plant and the product (or service) that is my own work (write one number in each box even if number is the same for both):

my plant ☐ **my own work** ☐

1. Computers, including Peripherals & Accessories
2. Data Processing Systems
3. Office & Business Machines
4. Test, Measurement & Instrumentation Equipment
5. Communications Equipment
6. Navigation & Guidance Systems & Equipment
7. Consumer Electronics
8. Industrial Controls & Equipment
9. Components, Subassemblies, Semiconductors, IC's
10. Materials & Hardware
11. Aircraft, Missile, Space & Ground Support Equipment
12. Oceanography & Support Equipment
13. Medical Electronics
14. Processing Industries, Paper/Pulp, Chemicals, Food, Refining
15. Industrial Co. within the OEM incorporating Electronic Equipment in their End Product, not elsewhere classified
16. Independent Research, Test & Design Laboratories & Consultants (only if not connected with a manufacturing co.)
17. Government Agencies & Military
18. School, University or Library
19. Nuclear
20. Processing & Production Equipment Manufacturing
21. Device (Active & Passive) Manufacturer
22. Original Equipment Manufacturer with in-house IC-manufacturing Facilities
23. Utilities
24. Industrial companies using any electronic products in their Manufacturing, Research or Development activities
25. Commercial user of electronic equipment
26. **Independent Field Service Org.**

PART 6

Products I plan to specify, recommend, or buy in the next 12 months. (Circle all that apply.)

Test Instruments

1. Analyzers, Bus
2. Analyzers, Frequency Response
3. Analyzers, Logic
4. Analyzers, Network
5. Analyzers, Signature
6. Analyzers, Spectrum
7. Analyzers, Waveform
8. Automotive Diagnostics Equipment
9. Bridges, RLC
10. Calibrators
11. Calibration Standards
12. Comparators
13. Controllers
14. Counters/Timers
15. Current Meters
16. Decade Loads
17. Distortion Meters
18. Electronic Filters
19. Emulators
20. Fiber Optics Testers
21. Frequency Synthesizers
22. Gaussmeters
23. Generators, Function
24. Generators, Noise
25. Generators, Pulse
26. Generators, Signal
27. Generators, Sweep
28. Generators, Waveform
29. Generators, Word & Data
30. Logic Probes
31. Mircroprocessor/Microcomputer Development Aids
32. Microprocessor Troubleshooting Tools
33. Multimeters, Digital
34. Noise Meters
35. Ohmmeters
36. Oscilloscopes
37. Phase Angle Voltmeters
38. Phase Meters
39. Power Meters
40. Power Supplies
41. PROM Programmers
42. Recorders
43. Temperature Probes
44. Voltmeters, Analog
45. Voltmeters, Digital

Production/QA/ATE

46. ATE, Analog/Linear IC
47. ATE, Digital IC
48. ATE, Memory Component
49. ATE, Memory Board
50. Burn-in/Screening Equipment
51. Coil Testers
52. Continuity Testers – Cable/Harness/Board
53. Current Leak Detectors
54. Dedicated Microprocessor Testers
55. Discrete Component Testers (Diodes/Resistors/etc.)
56. Environmental Chambers
57. Fault Isolation Tools
61. Functional ATE, PCB
62. Functional ATE, Systems
63. Handlers/Sorters
64. HiPot/Insulation Breakdown Testers
65. Hybrid Device Testers
66. In-Circuit Testers
68. Parametric Testers, Digital
69. Power Supply Testers
70. Relay/Transformer Testers
71. Temperature Cycling Equipment
72. **Wafer Probers**

Test/Analysis Services/Consultants

78. Burn-in/Screening
79. Calibration/Maintenance
80. Component Failure Analysis/Test
81. Electron Microscopy
82. Mass Spectroscopy
83. PCB Test
84. Repair Services
85. SEM Services
86. Surface Analysis
87. Test Equipment Leasing/Rental
88. Test Programming
89. X-Ray Analysis

Test Hardware

94. Adaptors
95. Clips
96. Connectors
97. Fixturing
98. Performance Boards
99. Probe Cards
100. Probes/Contacts
101. Sockets
102. Switching Matrices

Software/Data Monitoring/Control

107. Compilers
108. Data Acquisition/Reduction Systems
109. Data Reduction Software
110. Distributed Control Systems
111. Simulation Systems
112. Test Software Development Aids
113. Translators
114. Data Loggers

Interfaces

116. Computer I/O
117. Connection
118. GPIB/IEEE 488
119. Patch
120. RS-232

Microelectronics Measuring/Monitoring Equipment

124. Acoustic Emission Testers
125. Adhesion Testers
126. Angle-lapping/Polishing Equipment
127. C-V Plotters
128. Centrifuges
129. Chemical Element Concentration Analyzer
130. Coating Thickness Testers
131. Conductivity Probes/Testers
132. Cryogenic Testers
133. Densitometers
134. Die Attach Testers
135. Diffusion Depth Testers
136. Doping Profilers
137. Electrostatic Measuring Equipment
138. Ellipsometers
139. Film Thickness Measuring Machines
140. Gas Analyzers
141. Gas Chromatographs
142. Hardness Testers
143. Inkers & Ancillary Equipment
144. Interferometers, Laser
145. Ion Beam Analyzers
146. Ionic Contamination Testers
147. Junction Depth Testers
148. Lead Fatigue Testers
149. Leak Detectors
150. Mass Analyzers
151. Micro Balances
152. Micrometers
153. Particle Counting Systems
154. PIND Testers
155. PH Monitoring Systems/Probes
156. Photoresist, UV Monitoring
157. Photomask Flatness Testers
158. Resistivity Test Systems
159. Reticle Alignment Instruments
160. Solderability Test Systems
162. Spreading Resistance Testers
163. Surface Analysis/Profiling Equipment
164. Tensile Strength Equipment
165. Wafer Flatness Testers
166. Wafer Thickness Gages
167. Water Purity Testers
168. Wire Bond Strength Testers

Inspection Equipment

177. Auger Spectrometers
178. Automated Wafer/Die Inspection Equipment
179. Coordinate Measuring Machines
180. Comparators, Optical
181. Dimensional Measuring/Inspection Equipment
182. Electron Microprobes
183. Image Analyzers
184. Infrared Cameras
185. Linewidth Measuring Equipment
186. Mask Defect Inspection System
187. Micro Sectioning Equipment
188. Microscopes, Comparison
189. Microscopes, Incident Light
190. Microscopes, Infrared
191. Microscopes, Interference
192. Microscopes, Measuring
193. Microscopes, Optical
194. Microscopes, Projection
195. Microscopes, Scanning Electron
196. Microscopes, Stereoscopic
197. Microscopes, Video
198. Scanning Auger Microprobes
199. Spectrometers
200. Spectrophotometers
201. Thermal Imaging Equipment
202. TV Inspection Systems
203. X-Ray Machines

Communications/Microwave Test Equipment

208. Communications Test Equipment
209. EMI Testers
210. Microwave Impedance-measuring Equipment
211. Microwave Multimeters
212. Microwave Power-measuring Equipment
213. Microwave Spectrum Analyzers
214. Radio/Audio Testers
215. RF Meters
216. TV Test Equipment

Process Monitoring & Control Instrumentation

220. Accelerometers
221. Detectors/Sensing Instruments
222. Displacement Testers & Load Cells
223. Flowmeters
224. Gages: Dimensional, Level Pressure, Force, Vacuum
225. Humidity Instruments
226. Panel Meters, Analog
227. Panel Meters, Digital
228. Shock Testers
229. Temperature-measuring Instruments
230. Transducers
231. Vibration Testers

PART 7

Specifying/Purchasing/Responsibility/Authority (Circle one number in A, one in B, and all that apply in C.)

A. I *recommend* purchase of equipment/instruments/services that cost (circle one only):

1. ◄$5K
2. $6-10K
3. $11-50K
4. ►$50K

B. I *authorize* purchase of equipment/instruments/services that cost (circle one only)

5. ◄$5K
6. $6-10K
7. $11-50K
8. ►$50K

C. I recommend or authorize purchase of (circle all that apply):

8. Test Instruments
9. Production/QA/ATE
10. Microelectronics Measuring/Monitoring Equipment
11. Inspection Equipment
12. Communications /Microwave Test Equipment
13. Process Monitoring & Control Instrumentation

PART 8

Types of Testing/Measuring I perform/manage

(Circle all that apply):

1. Incoming Inspection
2. Production Testing
3. QA/QC/Reliability
4. Prototype Evaluation
5. Microprocessor Development
6. Design Test
7. Field Service
8. STDS/Calibration
9. Process Measurements/Control
10. Failure Analysis
11. Basic Research Measurements
12. Plant/Operations Maintenance

PART 9

Frequency Ranges in which I perform/manage tests/measurements

(Circle all that apply):

1. Powerline
2. Mechanical/Vibration
3. Audio
4. Hz
5. KHz
6. MHz
7. GHz

☐ Check here if you do not wish to receive promotional mail from TEST & MEASUREMENT WORLD.

Use this form to qualify for your free subscription to

TEST & MEASUREMENT WORLD

Be sure to answer all the questions on this form.

please pass this form to a colleague.

TEST & MEASUREMENT WORLD

If you have already sent in a qualification form to

Be sure to affix sufficent postage.

PLACE STAMP HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

please tape
don't staple

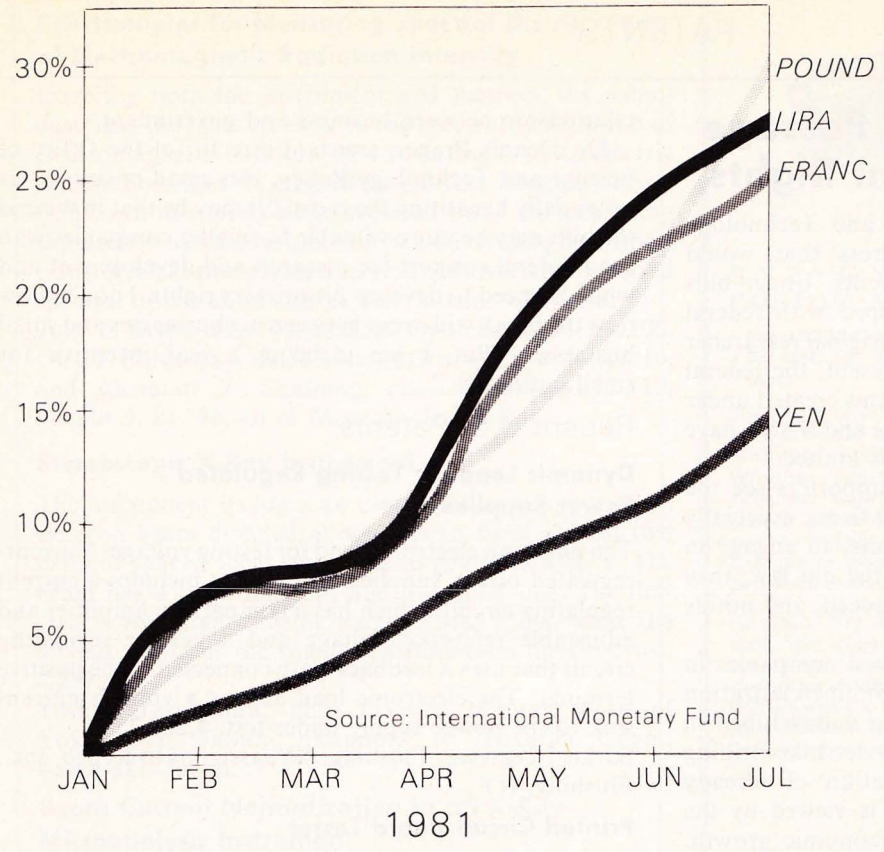


Fig 2. During the first six months of 1981, the dollar rose in value as much as 30 percent against foreign currencies.

ATE industry:

- Fred Van Veen of Teradyne—"Sales projections still show 20-25 percent growth over the next few years."
- Bill Halper of Accutest—"We see substantial growth in our sales over the next few years."
- Rob Tucker of Fairchild—"I see continued growth."
- Neal Vinson of Plantronics/Zehntel—"There are a lot of customers out there with needs that haven't been filled yet."
- Steven Stadler of GenRad—"I think we're in a great business, no question about it."

Obviously, the rest of the world must agree with these optimistic views, as evidenced by the entry of foreign competitors into the U.S. market. From Japan come Takeda Riken, Ando Electric, and Minato, and from Europe Marconi and Membrain with Olivetti waiting in the wings. But even in the face of slow European sales, foreign ATE firms feel positive. Europe has been in a recession for three years, claims Rob Tucker, and sales there are flat for many ATE suppliers. Still, people now think they can see some light at the end of the tunnel, and can thus start installing more capital equipment to meet demands when Europe pulls out of its economic quagmire.

Both Takeda Riken and Marconi believe in the underlying strength of the ATE market in the United States. Yasuoki Toi, vice president of Advantest, the U.S. distributor of Takeda Riken products, feels that his firm will garner a good share of the market. Although Takeda Riken's first product, the 100 MHz Series 3300 test system, has met with some resistance, its 40 MHz memory memory tester has been well received. Keith Elkins, executive vice president of Marconi, also sees a major market in the U.S. that he feels must not be ignored: "Our management recognizes that ATE is going to be a significant element in any test and measurement company's business in the next decade." So, despite the current slowdown for some companies, the future cannot come soon enough for most members of the ATE industry.

Administration Urges Passage of Bills to Open Patent Rights

The White House Office of Science and Technology Policy supports two bills in Congress that would drastically alter the regulation of patents. Under bills S 1657 and HR 4564, patents developed with federal R&D money would be licensed to the original researcher or another interested company. At present, the federal departments decide about rights to patents created under their grants. The Department of Defense and NASA have issued some licenses, but the practice is limited.

Congressional and White House supporters see the legislation as encouraging many R&D firms, especially large ones that ignored federal projects, to engage in needed national research. Because of the old law, they maintain that fewer patents were produced, and not as much important research took place.

Besides getting previously uninterested companies in new projects, the bills would open to commercialization old patents that have been languishing undeveloped in back issues of the Patent Office *Gazette*. Like drilling rights on federal land, the exploitation of already researched methods and instruments is viewed by the administration as boosting national economic growth. The bills would permit the government to revoke rights if a company tried to use a license to block commercial development to protect its interests.

In a research-dependent industry like test and measurement, responding quickly to technological advances imposes a burden on companies of all sizes. While the major electronic firms have the resources to finance necessary research and smaller ones scrimp to keep pace, the reservoir of important knowledge available in government-held patents could serve both. From prototype to field tryout, the development of new test equipment often presses a company, especially a small one, to build up expertise in unfamiliar areas. The ability to tap the federal government for relevant patents would help small high-tech manufacturers expand product lines and upgrade existing items.

Although there is wide support for these bills, they are not identical. The Senate version provides for no recoupment (the paying of royalties to the government), while the House bill does. Administration sources express interest in the possibility of the government receiving a fee for any commercial applications, but do not believe that the paperwork involved would make it worthwhile to start calculating percentages of profits. A bunch of new regulations would not fit into the Reagan view of the world, either.

Opponents in and out of government are reluctant to simply give away the fruit of federally funded projects. They point to licensing arrangements that are negotiated daily between companies to their mutual benefit as a possible model for the government to follow. In the bill passed last year, universities and nonprofit institutions received many of the same privileges pending for the private sector in the current legislation. Simply giving out such licensing to industry strikes some as too intimate a relationship between business and government.

Dr. Dennis Prager, assistant director of the Office of Science and Technology Policy, sees small businesses as potentially benefiting the most: "It may be that in the end the bills may be more valuable to smaller companies who need federal support for research and development and who also need to develop proprietary rights. I don't know how the break will occur between big businesses and small businesses. But I see it being a real incentive for small businesses."

Recent U.S. Patents

Dynamic Load for Testing Regulated Power Supplies

The unit is an electronic load for testing voltage-/current-regulated power supplies. The design includes a current regulating circuit, which has a comparison amplifier and adjustable reference voltage and a voltage regulating circuit that uses a feedback path connected to the positive terminal. The electronic load acts as a voltage/current sink to the power supply under test. 4,288,739.
Sarkis Necessian, Flushing, NY, assignor to Kepco, Inc., Flushing, NY.

Printed Circuit Board Tester

The tester is a truncated, box-like structure with a sloping top surface and platen, which receives a test head assembly. When the assembly is directed to a predetermined location on the platen, electrical connection is made. 4,288,745.
James E. Plante, Attleboro, MA, and Warren E. Pfeifer, North Kingstown, RI, assignors to Ostby & Barton, Providence, RI.

Measuring Speed Sensor

The speed sensor produces an output signal corresponding to the angular rotation between two movable components. The rotor includes a ring-shaped member having many magnetizable projecting sectors of equal dimensions that change the magnetic field while passing the pole shoe of the stationary stator. To minimze spurious noise signals, the maximum cross section of each sector is equal to the maximum distance between two adjacent sectors. 4,288,746.
Gunther Singbartl, Hanover, Fed. Rep. of Germany, assignor to Wabco Westinghouse GmbH, Hanover, Fed. Rep. of Germany.

Improved Self-Scanning Apparatus for Measuring the Contour of a Metallic Body

Detection sensors are arranged along a reference line, so their distance to the test surface is measured. A distance-detecting circuit notes changes in the impedance of each coil caused by mutual inductive action. Improvements include a memory feature for processing measurements sequentially, storing them and then updating the memory with new data. 4,288,747.
Shigeo Kawabata, Tokyo, and Norihisa Inazaki, Yokohama, both of Japan, assignors to Nippon Kokan Kabushiki Kaisha, Tokyo, Japan.

Spectrometer for Measuring Spectral Distribution of Electromagnetic Radiation Intensity

Covering both the instrument and method, the patent describes the measurement of the spectral distribution of electromagnetic radiaton by converting it to an electric signal. The signal is created by a direct integral Hilbert transform in superconducting weak links. By measuring the electric signal as a function of a direct integral Hilbert transform parameter and applying the inverse, the desired spectral distribution can be determined. 4,287,418.
Jury Y. Divin, ulitsa Narodnogo Opolchenia, 54, kv. 100, Oleg J. Polyansky, ulitsa Malaya Gruzinskaya, 46, kv. 10, and Alexandr Y. Shulman, ulitsa Dubninskaya, 12, korpus 3, kv. 96, all of Moscow, U.S.S.R.

Stereoscopic X-Ray Instrument

The instrument includes an evacuated envelope with an electron beam directed at a target to form at least two pairs of spaced focal spots and to generate X-rays. The beam has a large filament and a smaller one. The first creates the larger outside pair of focal spots, while the second positions the smaller pair between the first two. 4,287,420.
Toshio Yamamura, and Takeshi Muraki, both of Yokohama, Japan, assignors to Toshiba Corp., Kawasaki, Japan.

Beam Current Normalization in an X-Ray Microanalysis Instrument

The patent describes an improvement of an electron column instrument for quantitative energy dispersive X-ray microanalysis, which uses an optical beam of a preset current level directed into the specimen. Specifically, the improvement includes a beam current sensor for monitoring stability and a means of introducing delay in the time of actual data accumulation so the X-ray spectral data is acquired over a defined beam current integral. 4,288,692.
Frederick H. Schamber and Jon J. McCarthy, both of Middleton, WI, assignors to Tracor Northern, Inc., Middleton, WI.

Process and Circuit for Measuring the Coefficients of Message-Transmission Equipment

The patent covers a process for measuring the transmission characteristic of a test object by generating a measuring signal and applying it to the test object. The distorted output is then received. By differentially combining and processing this output with a compensation signal to produce a residual signal, the circuit derives at least one coefficient representation of a transmission characteristic. 4,287,469.
Peter Harzar, Eningen u. A., Fed. Rep. of Germany, assignor to Wandel & Goltermann, Eningen, u. A., Fed. Rep. of Germany.

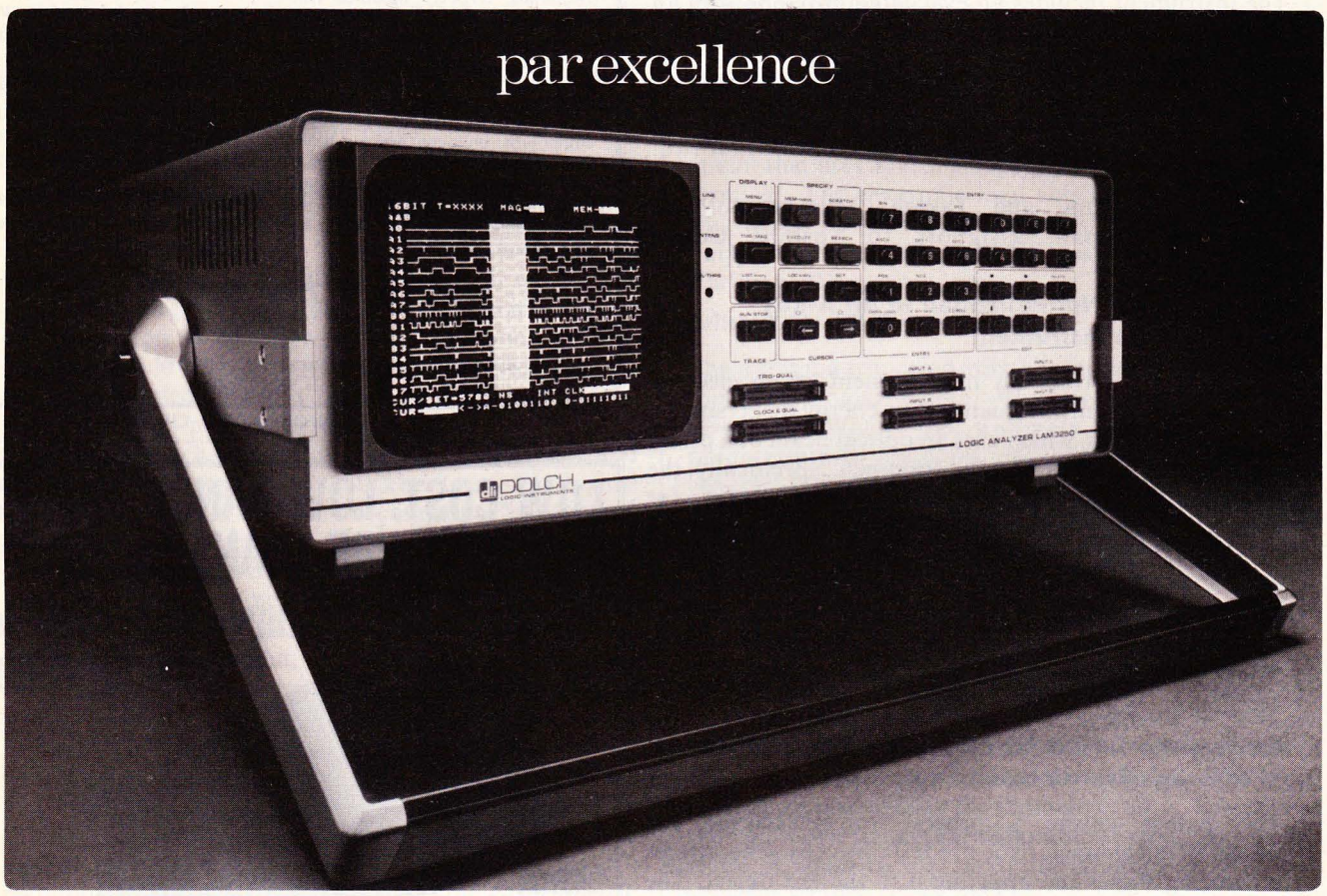
Nondestructive Method for Detecting Flaws in Photodetector and Solar Cell Devices

The method specifies that an illuminator forward biases the semiconductor, which is scanned by a light spot. The device topography is then mapped from the detected output voltage. 4,287,473.
David E. Sawyer, Rockville, MD, assignor to the U.S. Department of Energy, Washington, DC.

Dolch.

advanced logic analysis

par excellence



32 to 64 Channels plus Mnemonics.

Trace it all—fast—and disassemble your code into Mnemonics. When you have a sophisticated job to do, don't get bogged down in machine code. The Dolch LAM 3250 logic analyzer gives you the channels you need to trace data, address, port and control lines. And Dolch makes sure you'll be able to handle future needs with channel expansion to 48 or even 64 channels.

Hook up fast, too. Dolch personality probes clip right over your CPU chips so you don't waste valuable time connecting dozens of individual hooks on IC pins. And the probe takes care of clock, timing and signal interfacing so you don't have to worry about signal conditions.

Store your setups. The Dolch LAM 3250 lets you hold setups in a nonvolatile memory. Six files of menu and display configurations can be stored for up to three months without power. You don't have to reprogram every time you power up.

Don't settle for less than Dolch. The LAM 3250 is truly a universal logic analyzer with recording speeds of up to 50 MHz, sophisticated sequential triggering, multilevel clocking, and 1 K-deep source and reference memories.

See a demonstration. You'll appreciate the difference in Dolch. For details on the LAM 3250, or any of our other trouble-shooting tools, write: Dolch Logic Instruments, Inc., 230 Devcon Drive, San Jose, CA 95112. Or call toll free: (800) 538-7506; in California call (408) 998-5730.

DOLCH
LOGIC INSTRUMENTS

FOR MORE INFORMATION, CIRCLE 27

Separate Audio Testers Merged into Multifunction Instruments for Faster, More Efficient Measurements

The growing sophistication of audio equipment demands test and measurement instruments with better accuracy, resolution and sensitivity than their predecessors. Performance has improved to the point where yesterday's exceptional specs are now commonplace, and the number of channels in professional audio systems has risen accordingly.

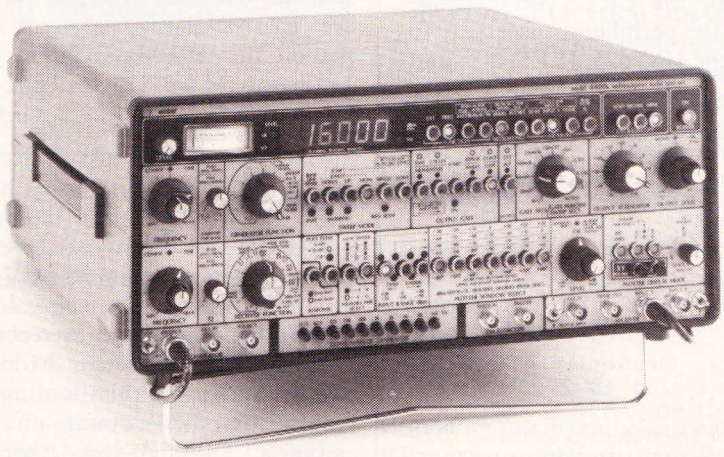
Driven by this complex technology, audio measurement requirements—from the design/prototype stage to the establishment of specs for proof-of-performance documentation—have become more stringent as well. To meet these rigorous new demands, manufacturers of audio test equipment are offering instruments that promote efficiency and increased accuracy by packing several components and functions into a single enclosure.

Amber

To help simplify tape recorder evaluation and acoustic measurements, Amber's 4400A multipurpose audio test set includes every commonly used audio generator: function, log sweep, noise, tone burst and comb. The function generator produces very low distortion sine waves as well as asymmetrical waveforms for system polarity checks. A high-power output (+33 dBm) facilitates headroom tests, while floating outputs reduce ground loop problems. With a resolution of 0.01 dB, the digital meter measures frequencies from 10 Hz to over 150 kHz and levels from -120 dBm (narrow band) or -90 dBM (wide band).

For display on any nonstorage oscilloscope, an internal memory holds up to four plots of amplitude or phase vs. time or frequency. A selection of scale factors, sweep speeds, display formats, frequency markers, reference lines and plotting modes allows quick generation of plots. This feature is especially useful for the evaluation of equalizers, filters, tone controls, amplifiers, and so forth.

To aid in tape recorder measurement and alignment, the 4400A contains special circuits that synchronize the record/reproduce cycle for creating sweep plots. Used to measure tape erasure or channel crosstalk, the instrument's tunable filter can monitor the third-order harmonic for bias adjustment. The sweep frequency spectrum analyzer, with its virtually infinite resolution, reportedly provides a more accurate means of measurement than one-third octave real-time analyzers. The improved resolution is required for proper transducer evaluation, monitor system equalization and room analysis, according to Amber.



Amber Multipurpose Audio Test Set

Potomac

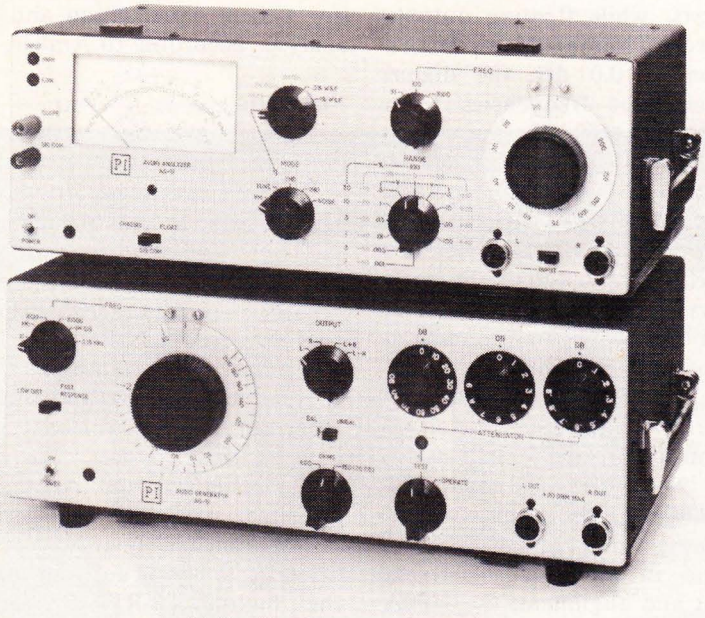
Another audio test system, the AT-51 by Potomac Instruments, simplifies the measurement of critical parameters in mono and stereo audio equipment. Designed primarily for commercial broadcast proof-of-purchase measurements and equipment maintenance, the AT-51's capabilities are also well suited for laboratory measurements, quality control and service. The AG-51 audio generator and AA-51 audio analyzer, packaged separately for remote measurements, use RFI shielding to permit accurate testing in the high-level RF environments characteristic of broadcast transmitter facilities. Signal input and output connectors are also RFI shielded.

The AA-51 analyzer automatically measures THD, IM, wow and flutter, frequency response, S/N ratio, RMS voltage level, stereo phasing and differential gain (ratio). The instrument automatically levels input signals between 0.1 V RMS and 80 V RMS to the proper reference for distortion measurements, so "set level" or "balance" controls are eliminated. Out-of-range lights denote input levels that don't fall within the usable 58 dB range.

The phase and ratio features assist in making line equalization measurements, aligning the azimuth of stereo tape heads, and troubleshooting audio consoles, amplifiers and networks.

The AG-51 generator contains a low distortion 20 Hz-200 kHz sine wave generator, a SMPTE standard intermodulation signal generator, and a fixed frequency sine wave generator at 3.15 kHz for wow and flutter tests. Available at levels up to

+20 dBm, outputs can be switched for left only, right only, left and right in phase (L + R), and left and right in phase opposition (L - R). Automatic leveling circuitry with a self-test feature provides a constant output level to reduce the need for output metering.



Potomac AT-51

RE Instruments

When combined with the company's RE 501 stereo generator and RE 104 RF signal generator, RE Instruments' RE 256 dual-channel analyzer replaces six traditional test instruments: voltmeter, spectrum analyzer, distortion meters, frequency counter, and various filters. The controller keyboard programs the stereo generator and RF signal generator to provide the inputs to the DUT. The outputs go to the analyzer, and the results of the measurement appear on the CRT display.

The analyzer automatically initiates a self-test routine upon power-up. If desired during a test procedure, the self-test routine can be ordered via the system controller.

The heart of the instrument is the computer, based on a 16-bit CPU with 16K of program memory. The CPU card also generates the alphanumerics, meter pointers and video signals for the CRT. The interface contains the peripherals necessary to support the IEC 625/IEEE 488 and RS-232C ports.

RE Instruments 256

Amber Electro Design, Ltd., 4810 Jean Talon West, Montreal H4P 2N5, Canada. (514)735-4105. **Circle 361**

Potomac Instruments, Inc., 932 Philadelphia Ave., Silver Spring, MD 20910. (301)589-2662. **Circle 362**

Radiometer Electronics A/5, Frederikssundsuej 254, DK-2700 Bronshoj, Denmark. 01-80 12 11.
Radiometer Electronics U.S., Inc., 31029 Center Ridge Rd., Westlake, OH 44145. (216) 871-7617. **Circle 364**

Automatic Loopback Tester Eliminates On-Site Evaluation

Com/Tech Systems' Model 202SC allows you to test continuous carrier data links from a central office site. Extending the capability of the firm's Link/Chek bit-error rate and interface test system to full-duplex as well as half-duplex and multidrop links, the 202SC, a slave unit, automatically distinguishes between loopback commands from the master Link/Chek and normal traffic.
Other applications include on- or off-line evaluation of TDM channels, crypto systems, buffers, error control systems, and interface converters. Com/Tech Systems, Inc., 505 Eighth Ave., New York, NY 10018. (212)594-5377. **Circle 307**

Variable Test Load Aids RF Power-Amplifier Evaluation

Design Automation has introduced an adjustable passive load for testing radio transmitters and RF power amplifiers. Using a 10.5 MHz operating frequency, the Model L10-5 helps to determine if these instruments can withstand arbitrary mismatched output loads without damage or spurious oscillation.

With a 50 Ω nominal transmission-line impedance, the Model L10-5 provides 10 values of SWR. Depending on the SWR value, the test load can dissipate 5 to 20 W. Other standard test loads from 1 to 100 MHz are also available. Design Automation, Inc., 809 Massachusetts Ave., Lexington, MA 02173. (617)862-8998. **Circle 310**

High-Speed Recorder Captures Data Communications Problems

A portable magnetic tape recording instrument, the Spectron Model T-511 assists in troubleshooting and monitoring data communications channels. The high-speed tape unit records all traffic on both sides of a

data link at rates from 50 to 56,000 bps.

The T-511 is compatible with most forms of data transmission, whether synchronous or asynchronous. Recording on a magnetic tape cartridge at 25 or 100 ips, the unit provides a perpetual history of all events on the line until all four tracks are full. New data replaces the old as the recording continues; the cartridge can also be changed at any time to create a permanent record. The T-511 can be operated alone for replay or with the Model D-601 DATASCOPE, which provides a real-time or slow-speed display of all traffic. Northern Telecom, Spectron Division, 344 New Albany Rd., P.O. Box 620, Moorestown, NJ 08057. (609)234-5700. **Circle 316**

Versatile Error Measurement System Weighs In at Only 32 lbs

The Tau-Tron BERTS-25 provides bit-error measurements of communications digital data links, such as cable systems, radio and fiber optics. It works from 100 Hz to 25 MHz, providing programmable 16-bit words in addition to seven pseudorandom sequences from 2^7 to 2^{23} bits. For long-term unattended testing, the system includes a real-

time clock and built-in printer.

The BERTS-25 has both a synthesizer-controlled transmitter and an automatic receiver. Total bit errors and the bit error rate are computed simultaneously. Other features include automatic or manual pattern selection, synchronization, measurement start time, duration, input-clock frequency measurements and time-of-day indication. Tau-Tron, 27 Industrial Ave., Chelmsford, MA 01824. (617)256-9013. **Circle 312**

Converter Transforms Standard Test Equipment for Fiber Optic Evaluation

The Fotec C converts standard multimeters and voltmeters into fiber optic power meters. It figures the total power transmitted through the fiber and converts optical power into a corresponding linear DC voltage. This voltage is then measured by the multimeter and displayed directly in microwatts or milliwatts of optical power with an accuracy of ±5% over a range from less than 20 nW to over 2 mW.

The Fotec S, used with the Fotec C, gauges cable attenuation, splice or connector loss, and receiver sensitivity. Since it produces a pulse train output rather than DC, the Fotec S can test data links when repeaters are used. Both units operate on batteries or AC power. Fotec Incorporated, Box 246, Boston, MA 02129. (617)242-0863. **Circle 317**

Microwave Counters Feature Synthesizer Capability

Two microwave frequency counters from EIP Microwave — Models 575 and 578 — offer a broadband source-locking capability. Operating in the "lock-box" mode, each μP-based counter coarse/fine tunes and phase-locks swept signal sources to the input fequency. The Model 575 spans the frequency range from 10 Hz to 18 GHz, while the 578 covers the 10 Hz to 26.5 GHz range and, via available modular options, can go up to 110 GHz.

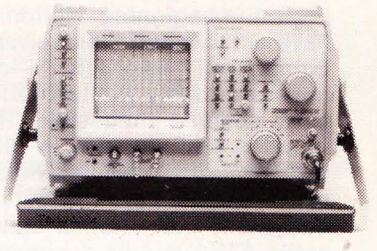
For repetitive testing, the counters can store up to nine preprogrammed frequencies in memory, which you call up from either the front panel keyboard or over the GPIB. EIP Microwave, Inc., 2731 N. First St., San Jose, CA 95134. (408)946-5700. **Circle 308**

E-Fields Regulated Intelligently without Minicomputers

Providing intelligent gain control of RF power amplifiers, the LPA-2 by Instruments for Industry helps to create closed-loop control systems for precise regulation of electric field strength in screen rooms and test chambers. With four inputs as the basic configuration and options available, the design eliminates variations in field levels that occur as the source frequency changes, according to the manufacturer. Instruments for Industry, Inc., 151 Toledo St., Farmingdale, NY 11735. (516)694-1414. **Circle 311**

Microwave Spectrum Analyzers Measure 1 kHz to 1.8 GHz

Aimed at the baseband, HF, VHF and UHF high peformance industries, the Tektronix 496 and 496P spctrum analyzers provide stability and a resolution bandwidth that adjusts from 1 MHz to 30 Hz



over the entire frequency range. The instruments' accuracy and 80 dB dynamic range match the demands of proof-of-performance measurements, and they are portable enough to fit under airplane seats. Digital storage simplifies the comparison, subtraction and retention of maximum values or noise averages for spectral displays. The constant tuning rate aids the quick and accurate positioning of the signal at any frequency span.

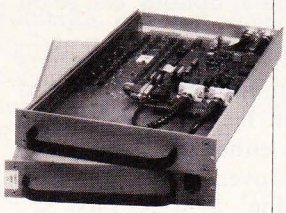
The fully progammable 496P listens to and executes commands from a GPIB controller in normal mode. All important front panel settings can be operated remotely, and displayed waveforms can be sent from digital storage to a calculator computer or data storage unit such as a tape or disc file. Tektronix, Inc., P.O. Box 500, Beaverton, or 97075. (800)547-6711. (In Oregon call 1-644-9051.) **Circle 318**

HOW POW CHALLEN AS SEEN BY

From the beginning, Halfon and Moise Hamaoui have established themselves as ATE (Automatic Test Equipment) "visionaries"—creating testers where none previously existed. Often for a price the experts deemed impossible. The Hamaoui brothers founded 3H Industries in 1975 and introduced the world's first simple-to-program benchtop linear IC tester using a card reader*. The Hamaouis followed up quickly with another concept: a family of versatile ATE systems designed to cope with today's advanced power supplies. Testing power supplies demands innovative techniques to meet the challenge. The brothers Hamaoui have some definite ideas about meeting this particular challenge. And they'd like to share a few of them with you.

*Patented by 3H Industries.

Q. What makes testing today's power supplies so tough?



Halfon: Because power supply designs are running far ahead of the development of ATE to test them. Power supplies that two or three years ago only needed a simple check of output under load now have multiple outputs and complex sequencing. Such increasing complexities place greater demands on the ATE to make sure that all power supply parameters are what they should be.

Q. What should a buyer of power supply ATE look for?

Moise: Not too long ago, power supplies were considered among the less critical components of an electronics system. That's no longer true. And ATE can make a big difference in the production of "industry standard" and very advanced power supplies. For instance, our system typically tests power supplies in less than 5% of the time taken in the manual method. Any ATE worth considering should be able to perform sophisticated testing routines with maximum accuracy, and to provide statistical analyses of the obtained results. There are five important things to examine carefully before purchasing power supply test equipment: the controlling computer, the measurement hardware, the software programming routines, ease of use, and serviceability.

Q. What type of computer control is best?

Halfon: "In-house" designed computer setups often are limited, and they offer virtually no more than "GO/NO GO" testing capabilities. Using a commercially available computer seems the best way to go for ATE. It's a vital link between the user and the power supply under test. And it must offer *proven* reliability, an efficient operating rate, worldwide servicing, and full compatibility with all other data processing equipment and peripherals. By using a popularly accepted computer, a system designer is freed to concentrate on the task at hand. He can use thoroughly tested software developed for his computer. And he can communicate with other current data systems when he has to, around the test lab or around the world.

Q. What is important when considering hardware?

Moise: In the case of power supply testing, programmable stimuli hardware involves primarily source and loads. An AC source for power supplies should cover a wide range of requirements. Single- and three-phase operation. Programmable amplitude and frequency. Power output to 6000VA to cover most applications. Fast response. And a lot more. Our PT 900 PRODIGY features an electronic AC source to assure the user will not have any spurious effects and keep a high degree of integrity during any test conditions.

ER SUPPLY TESTING GES THE ATE WORLD. THE BROTHERS HAMAOUI.

Q. What about internal measurement?

Halfon: Many high-speed digital systems operate at low voltages, and their power supplies must be tested at voltages as low as 1.7 volts, at currents up to 500 Amps. Our PT 900 system has this capability. Ideally, any ATE for advanced power supplies must be able to accurately measure input voltage, current and power over the operating range of the unit under test. Our PT 900 incorporates a precision measuring unit that covers the full range of voltages required. It also offers "sample-and-difference", so you can measure small changes in large-value output voltages. This gives you highly accurate regulation measurements.

Q. Is there a growing need for precise timing measurements?

Moise: Yes. Precise timing is vitally important to today's more complex power supplies. Our PT 900 system's time measurement setup lets the user check rise and fall times, overshoot, power fail holdup time, and all other transients. This means you can test power supplies where the sequence of an output's settling time is critical.

Q. We hear much about ATE software today. What should the buyer consider?

Moise: Software's the real "glue" that binds any subsystem and the ATE computer together. Here's where the game is won or lost. You need a usable, flexible, and—above all—an understandable software system. Our PT 900 series uses a Pascal-based test operating system. Many thousands of man-hours went into its design and development. The result is a highly structured software for easier use. And yet one that still offers much more flexibility.

Q. Can a customer start on a low budget—with a small power supply tester—and upgrade later?

Halfon: Of course. One of the basic design parameters of our PT 900 Power Supply Tester Series is its modularity. It lets a customer meet his budget requirements in the beginning, and then, as new and different power supplies need to be tested, he can upgrade the system to meet his requirements when he has the budget to do so. A system can begin at $55,000 and be modularly expanded as the customer's requirements demand.

This has been a brief glimpse of some of the challenges of the ATE world, as seen by the brothers Hamaoui. For more information on this subject, contact us directly by phone or letter, or use the accompanying coupon to receive our latest booklet.

Dear brothers Hamaoui:
I'm interested in more information about your ATE techniques for testing power supplies. Please send me your new booklet. *How Power Supply Testing Challenges the New ATE World. As Seen by the Brothers Hamaoui.*

Name_____ Position_____

Company_____

Address_____

City_____ State_____ Zip_____

Phone( )_____

UNITED STATES H.Q.:
1289 Hammerwood Avenue
Sunnyvale, CA 94086
Bob Davi, (408) 734-5970
U.K., EUROPE H.Q.:
5 London Road
Loughton, Milton Keynes
Bucks, MK8 OAB, England
Ray Canning, (44)-0908-53322

3H INDUSTRIES

FOR MORE INFORMATION, CIRCLE 38

IC Inspection Microscopes: The Options Make the Difference

When 5 in. wafers and 6 in.-square masks made their debut new inspection demands tagged along. Microscopes required larger stages and holders to accommodate these UUTs and instrument makers developed a panorama of options to supplement and enhance the equipment. The basic stand became the superstructure of an Erector set that could be built up as needed.

Manufacturers still offer traditional add-ons, such as recticles, filters, micrometers, dual-viewing teaching accessories and objectives with a variety of magnifications. But the more esoteric additions—CCTV and special illuminators—can give birth to an inspection tool suited to a particular inspection job.

Along with color and black-and-white CCTV, available photomicrographic equipment ranges from the 35 mm format to 4 in. X 5 in. and Polaroid. Illumination systems cover brightfield only, brightfield and darkfield, EPI and the Nomarski differential contrast attachment, which highlights slight variations in surface quality by using differences in gray color density or in interference colors to show scratch depths and peak-to-peak heights. With the options now available for the inspection of wafers, hybrids and packaged chips, a basic microscope can be transformed into a sophisticated photomicrographic research and measuring instrument.

Bausch & Lomb has upgraded its MicroZoom microscope with the addition of a new 50X long working distance (LWD) objective. When the 50X is used with the 2.25X, 8X and 2X LWD objectives, the MicroZoom offers magnifications up to 1000X (1500X with accessories), a useful feature for photomask and photoresist inspection. The LWD objectives permit in-focus zooming to twice the stated magnification, a maximum working distance of 29.5 mm at low power and a minimum of 12.5 mm at high power.

A standard 20 W tungsten-halogen light source with aperture diaphragm provides precisely controlled vertical illumination; rheostat-controlled illuminators for oblique illumination are also available. The microscope stand can accommodate a wide range of other photomicrographic, CCTV, and wafer and mask stage accessories.

Intended for inspection and quality control of large masks and wafers, the *Olympus* Model BHMJL features a stage with 6 in. X 6 in. of travel to accept 5 in.-diameter wafer and 6 in.-square masks. The stage rolls manually if you don't use the movement controls, and the Y-axis locks to enable accurate X-axis scanning. Along with its receiving carousel and other inspection fixtures, the stage can come with an optional left-handed movement control.

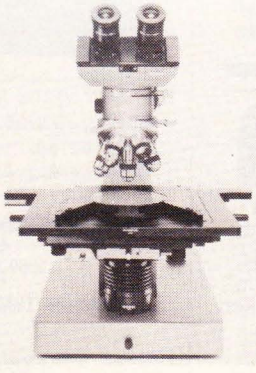
This microscope offers several types of illumination: brightfield, brightfield/darkfield and Nomarski differential interference contrast, as well as photomicrographic and microprojection accessories. The illumination transformer contains two secondary outlets, one for 6 V (15 W tungsten) and another for 12 V (50 W halogen) lamps. Attached to the monocular tube, an optional micrometer eyepiece with a digital counter measures minute details on IC mask patterns with minimum increments of 0.1μ (10X, 20X and 40X) and 0.01μ (100X).

To enhance the image quality of its IC inspection microscope, *Nikon* has combined an extra low-dispersion glass with CF optics, a technique that eliminates chromatic abberations. These optics are employed in the instrument's fully compensated objectives and eyepieces.

A 20 W halogen Koehler lamp supplies even illumination, and the stand provides 6 in. x 6 in. of travel. For smooth movement from positon to position, a coaxial course/fine focusing mechanism operates on roller bearings. The five available body tubes include an erect image binocular, which you can use when manipulation is desired, and an ultrawide trinocular with a 26.5 mm field. The microscope also offers three illumination techniques.

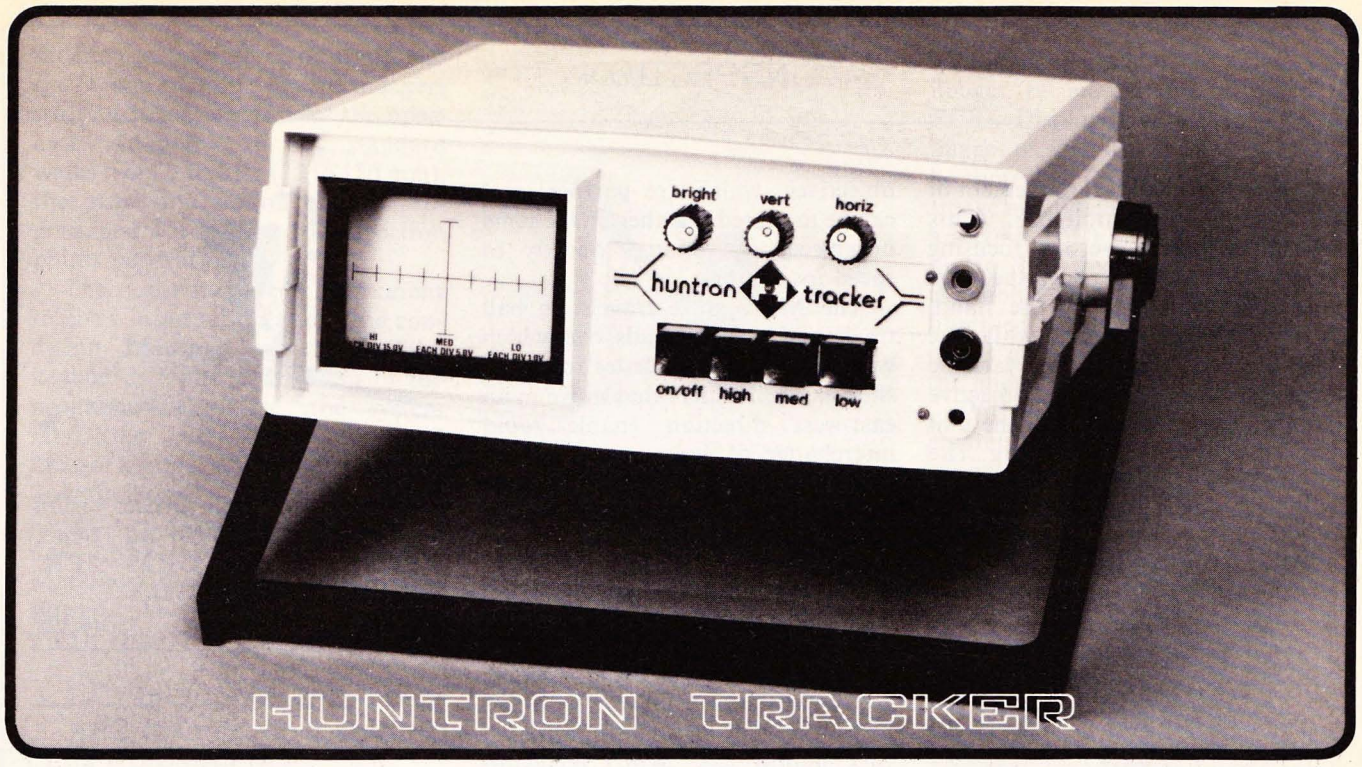
Unlike most other microscopes, the AO 1860 from *American Optical*

Bausch & Lomb



Olympus

Nikon



HUNTRON TRACKER, Model HTR 1005B-1S, an advanced instrument for trouble shooting solid state components and circuits.

NOW! A SOLID STATE TEST INSTRUMENT THAT TESTS COMPONENTS IN THE CIRCUIT...WITH NO CIRCUIT POWER REQUIRED! This unique, patented test unit can help you get escalating service and repair costs back on target through time savings of 30...40...even 50%. Score a bullseye for COST-EFFECTIVE trouble shooting. Ask for a demonstration of the HUNTRON TRACKER and be ready for a surprise. This could be the most important purchase you've made since solid state arrived.

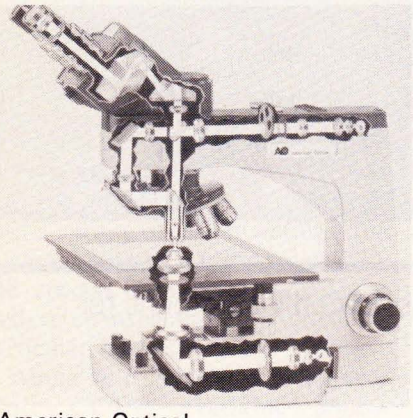
HUNTRON INSTRUMENTS

15123 Highway 99 North, Lynnwood, Washington 98036

(800) 426-9265

FOR MORE INFORMATION, CIRCLE 36

doesn't rely on vertical movement of the stage for focusing. This instrument makes use of a focusing nosepiece principle to keep the stage base solidly attached to the stand. Height remains constant while the nosepiece is focused; a variable autofocus stop prevents the objective from making contract with the unit you're viewing, reducing the possiblity of damage. The fixed stage height permits the application of

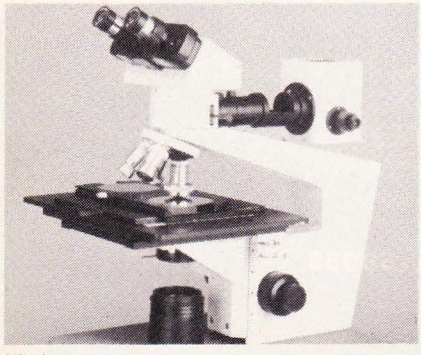


American Optical

microprobes, micromanipulators and other hardware.

Using two 20 W halogen lamps, the AO 1860 provides either incident only or incident and trasmitted illumination standard 10X widefield eyepieces percent an 18.5 mm field of view. And differential interference capability reveals opaque-surface details to facilitate detecting surface irregularities and faults.

Available with all the photographic and most of the television equipment offered for other models, Vickers' M45 comes with such standard gear as 10X compensating eyepieces and a diverse assortment of objectives. The brightfield and brightfield/darkfield



Vickers

objectives, which are parfocal and can be mounted together on the same nosepiece, can change quickly to speed inspection.

The M45's stage travels on ball tracks and has guide rails, over which wafer holders and palettes for mask slide easily. Holders that move in an east-west direction enable rapid interchange of wafer pairs, and an optional rotational movement feature orients the wafer with a minimum of handling.

Bausch & Lomb, Scientific Optical Products Division, Rochester, New York 14692. (716)338-6000. **Circle 366**

U.S. office: Olympus Corp. of Americia, Precision Instrument Div., 4 Nevada Dr., New Hyde Park, NY 11042. (212)895-0843. Home office: Olympus Optical Co. (Europa) GmbH, 2 Hamburg 1, Steindammm 105, West Germany. **Circle 367**

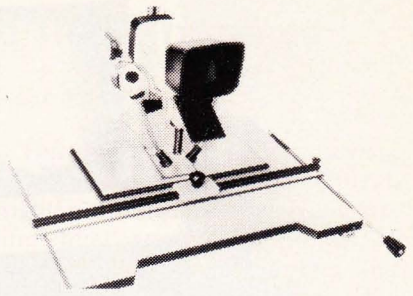
Nikon Inc., Instrument Div., 623 Steward Ave., Garden City, NY 11530. (516)222-0200. **Circle 368**

American Optical, Instrument Div., Box 123, Buffalo, NY 14240. (716)895-4000. **Circle 369**

Vickers Instruments, Inc., Riverview Business Park No. 27, 300 Commercial St., P.O. Box 99, Malden MA 02148. (617)324-0350. **Circle 370**

Scanners Speed PCB Inspection

Available in mono (Model VS4) and zoom stereo (Model VS5) versions, Vision Engineering's scanners provide fast critical inspection during PCB manufacturing and assembly. On the mono scanner, a range of fixed magnification flat field parfocal objectives goes from 5X to 50X, and a zoom unit covers 7.5X to 50X. The VS5 employs a zoom stereo projection microscope with a range of 7.5X to 50X that can be supplemented with other lenses. Rotating graticules attach to the lead for track-width measurements; flex and stay focusable fiber optic guides provide surface illumination. U.S. Office: Vision Engineering, Inc., Kenosia Ave., Danury, CT 06810.

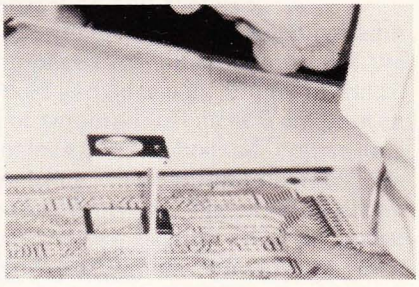


(203)744-7181. Home Office: Vision Engineering, Ltd., Send Rd., Send, Woking, Surrey GU23 7ER, ENGLAND. (0483) 223417.

Circle 298

Measuring Magnifier Unfolds from Pocket Size

The PMZT Series of measuring magnifiers from Zi-Tech comes with reticules marked in either inch or metric dimensions. This feature expedites precise measurements on drawings, circuit boards and other flat surfaces. Available in 5X, 8X and



10X power magnifications, the units are compact when collapsed—the largest model is only 2 in. x 1½ in. x ½ in. The magnifiers have cast metal frames, and a velvet pouch protects each unit when not in use. Zi-Tech Division, Aikenwood Corp., 2151 Park Blvd., P.O. Box 11456A, Palo Alto, CA 94306. (415)326-2151.

Circle 303

Station Provides Nondestructive Wafer Inspection

The CI-750 by Applied Materials eliminates wafer damage during inspection by automatically moving components on belts from the input

indexer, to the inspection stage, and on to one of three output indexers without being touched by the operator. Adaptable to any standard wafer from 3 to 6 in. (75 to 150 mm), the inspection station can be programmed for up to 16 inspection points per wafer.

The μp-controlled instrument receives information about the condition of each wafer via the keyboard. Upon completion of the programmed routine, the system sends the wafer to the "accept," "rework" or "reject" indexer. Simultaneously, as the first wafer leaves the examination stage, the next one moves in. Applied Materials, Inc., Cobilt Division, 3050 Bowers Ave., Santa Clara, CA 95051. (408)727-5555. **Circle 299**

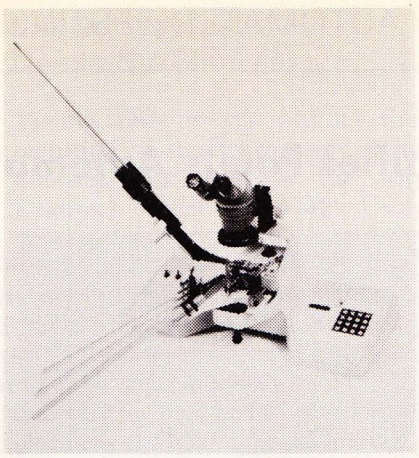
Lens Adjustment Automated On Scanning Electron Microscope

To create the effect of a continuously variable final aperture, the Stereoscan 250 by Cambridge Instrument Company adjusts automatically or manually for the best resolution or depth of field possible under any specific set of operating parameters. The SEM has a guaranteed secondary resolution of better than 60 A, and furnishes split imaging, selected area diffraction and continuously variable EHT of 1 to 40 kV.

The pumping system supplies an ultraclean vacuum virtually free of residual hydrocarbons, significantly reducing the background contamination level. Other features include dual video channel control, an autobrightness system and 5 in. sample capability. U.S. office: Cambridge Instruments, Inc., 40 Robert Pitt Drive, Monsey, NY 10952. (914)356-3331. Home office: Cambridge Instruments, Ltd., Rustat Rd., Cambridge CB1 3QH, ENGLAND. (0223) 42021. **Circle 300**

Inspection Station Speeds Device Sorting

Used in semiconductor DIP manufacturing applications, the Series



3000 I optical inspection station facilitates the sorting of components into accept, rework and reject categories.The tube-fed devices enter the station from a two position input adaptor and advance individually into a viewing fixture controlled by a precision joy stick.
Adcotech Corp., 575 Maude Ct., Sunnyvale, CA 94086.
(408)733-2820. **Circle 305**

Visual Inspection System Preserves Productivity

The OPTEK 101 visual inspection system from Operations Technology uses special light gathering optics. To heighten operator efficiency and provide consistent results over a wide range of magnification, the instrument presents a right-reading, right-side-up image of the piece under inspection on an 18 in. x 24 in. screen, which has an aspect ratio close to that of TV. Six interchangeable lenses are available: 8X, 15X, 20X, 25X, 50X, and a 15X to 25X manual zoom.

Additional features offered by a similar instrument, the OPTEK 102, include digital measuring capability of $\pm$0.0015 across the entire work surface. A motorized table permits hands-off scanning. Operations Technology, Inc., P.O. Box 276, Blairstown, NJ 07825.
(201)362-6200. **Circle 302**

Hybrid Comparator Employs 3-D Images

Incorporating digital readout capabilities for locating errors on a schematic grid, the Metron hybrid comparator provides full color, 3-D images of master and production PCBs. Displayed as moving mirror images of each other, the boards can be controlled for speed and direction. Image magnification is 30X, allowing a section 0.560 in. wide to be blown up to 16.7 in. Wires, circuits or assemblies that don't match can be observed directly. The display requires no lens eyepieces for viewing the midair, split-mirror image.

With very high resolution and 70% greater field of view, the comparator supplies 3-D images with more than double the depth of focus of a stereo microscope. This arrangement eliminates the "competition between the eyes" sometimes experienced with two-eye stereo instruments, according to the manufacturer. Metron Optics, Inc., P.O. Box 690, Solana Beach, CA 92075. (714) 755-4477. **Circle 304**

Scanning Electron Microscope Aimed at Production Applications

While scanning electron microscopes have been used in IC inspection for several years, International Scientific Instruments' multibeam wafer SEM (Model IC-150) is reportedly the first production-oriented unit built specifically for the semiconductor industry. The instrument provides high resolution at low accelerating voltage to minimize electron beam damage, along with an ultraclean vacuum to prevent wafer contamination. An accelerating voltage of 20 kV provides image resolution of 80 angstrom; 1.5 kV yields 150 angstrom.

The design incorporates a dual electron-optical column system equipped with LaB_6 electron guns, which can be operated with W filaments. Independent scan generator controls and two viewing screens allow simultaneous imaging of the same area of the wafer at 0° and 60° at the same or different magnifications. A photo CRT can record either image. International Scientific Instruments, Inc., 3255-6C Scott Boulevard, Santa Clara, CA 95051. (408)727-9840. **Circle 301**

In-Circuit Tester Identifies Faults Automatically

As many manufacturers have discovered, in-circuit testing significantly lowers costs by detecting manufacturing flaws early in the production cycle. Users who opt for this beneficial and important technique have a wealth of sophisticated ATE to choose from: the latest in-circuit testers provide improved fault coverage, simplified programming and functional test capabilities. But even the most sophisticated machines still report test data in the same way—that is, results are printed on a short strip of paper which identifies faults by component or circuit trace number, and this report is attached to the tested board. To find out exactly where the failures are, repair personnel have to check schematics and fault lists. In a nutshell, failure reporting has lagged behind other areas of technical development for in-circuit ATE.

But ATE suppliers are becoming more aware of the entire PCB manufacturing process, especially the need to upgrade production as well as test throughput. Hopefully, this recognition is the start of a trend toward better integration of manufacturing and testing resources.

One part of the manufacturing process, board repair, is addressed by Marconi's Model 1924 repair station.

Introduced at the "Cherry Hill" International Test Conference in late October, this automatic system is designed to expedite fault location so that repair personnel can work more efficiently. When used with the firm's System 80 in-circuit tester—unveiled for the first time in the United States at Cherry Hill—the repair station points out faulty components and traces by displaying an actual graphic representation of the board on a color CRT.

Faults detected at in-circuit test are transmitted to the repair station's DEC 11/23 computer. After the faulty board is brought to the station, it's identified by part number or with a bar code, and the test results are called up. The CRT display shows the outline of the board with all components and circuit traces in proper position and perspective, and with each fault highlighted in a contrasting color.

Normally, a repair person must consult a fault list, refer back to a blueprint of the board layout, and then tag or repair the fault. The Model 1924 repair station eliminates the need to consult defect lists and refer to schematics. At the same time, the system's programmable CRT displays additional information, including component type, value, stock code and an overall fault summary for each card.

Programming the information required for the PCB display is relatively simple. System software comes with graphic display data for thousands of components of different values, shapes and sizes. Using a digitizing cursor, the programmer traces the outline of the board and fills in the position and orientation of each component and circuit trace, numbering them to correspond with test program information. The board information is stored on a floppy disk and easily modified to accommodate engineering changes.

The repair station can be retrofitted to Marconi's System 80

in-circuit tester, which can evaluate analog, digital and hybrid PCBs at one or two test stations. The optional second station includes full operator controls and does not reduce the tester's total pin count. Marconi offers both vacuum and pneumatic test fixtures. An IEEE 488 bus enables adding more instrumentation, if desired.

Able to make guarded measurements of resistance, capacitance and inductance, the System 80 can also test discrete components, such as diodes, transistors, FETs and op amps. Each of the system's 640 test pins can perform analog or digital measurements as well as opens/shorts testing at 100 locations/sec.

Digital testing is controlled by a 1 MHz clock, and can occur at every node on the bed of nails. A hand-held guided probe diagnoses stuck-at-one or stuck-at-zero states by identifying the faulty component. The system software contains a library of tests for many popular SSI, MSI, LSI and VLSI components. A high-level programming language, INCITE, serves as the operating system, and two additional programs aid in development of the test routine and in control of test parameters.

Marconi Instruments, Automatic Test Systems Div., 292 Gibraltar Dr., Dept. A-4, Sunnyvale, CA 94086. (408)745-7516. **Circle 382**

Translator Generates English-Language Failure Information

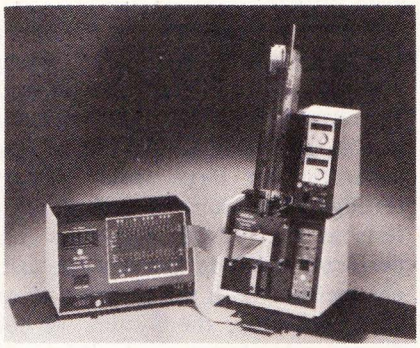
An option for Everett/Charles' Series 55 loaded board tester generates failure information in English by automatically translating the output connector pin field list to actual device connector nomenclature. The translator can speed repair by eliminating the need for hard copy assembly prints, nodal point data lists, or test head wiring conversion charts. An 8-in. floppy disk unit, part of the translator option, stores up to four test programs, including translator tables, with software for hard copy and display of user-defined product nomenclature. In addition, Everett/Charles can provide datalogging software for manufacturing process or inspection reporting. Everett/Charles Test Equipment, Inc., 2887 North Towne Ave., Pomona, CA 91767. (714)621-9511. **Circle 333**

Discrete Semiconductor Test System Offers Data Analysis

Teradyne's T357 is a discrete semiconductor test system used in quality assurance and incoming inspection of bipolar transistors, diodes and FETs. The system comes with 64K of memory, which permits job development without slowing test throughput. On-line software includes device library lists that permit job preparation direct from memory, along with lists for name and function of all keyboard commands, types of tests used with each module, and types of modules available. For leakage and breakdown tests, the T357 provides 16 A and 400 V, extendable to 160 A and 2,000 V for power device testing. An optional low-current source performs FET leakage measurements down to 100 fA with 10 fA resolution. To aid in manufacturing process control, on-line data reduction can produce several types of graphic displays and correlation analyses between datalogged parameters. Teradyne, Inc., 183 Essex St., Boston, MA 02111. (617)482-2700. **Circle 338**

LSI Device Tester Needs No Program

Testing LSI devices without first requiring a test program seems unusual, but that is the way Exatron's Model 2800 works. Using



the signature analysis technique on a known good device, the Model 2800 then compares each UUT to that unique signature. Dedicated switches on the front panel of the tester set each pin position to input, output, ground or V_{cc}. Tests run at 20 MHz, and the system can measure the worst-case propagation delay at the device's rated operating speed. Exatron, Inc., 181 Commercial St., Sunnyvale, CA 94086. (800)538-8559. **Circle 383**

Functional PCB Test System Speeds Programming Time

Test engineers do not need a degree in software languages to develop programs for the Elecon 9100 functional board test system. Interactive manipulation of digital timing diagrams, such as those found on an oscilloscope, sets dual threshold levels for digital boards with mixed logic, as well as analog and hybrid boards. Programmed with the proper stimuli, the test system drives up to 768 active nodes on a known good board. The board's responses, compressed and stored in software, form the basis for comparison and diagnosis on boards under test.

The test system drives the UUT with pseudorandom parametrics stored in RAM behind each drive pin for digital testing at 2 MHz. Three additional RAMs receive digital data from each pin for test comparisons. Two D/A converters provide reference levels for decisions affecting analog components. During diagnosis, waveform and timing displays appear on the system's CRT, automatically guiding the operator to the earliest, most significant failing node. The 8100 uses a bed-of-nails test fixture designed with short signal paths, twisted-pair signal lines, and terminated bus lines to limit ringing and crosstalk. Elecon, Inc., 2106 Ringwood, San Jose, CA 95131. (408)946-6000. **Circle 329**

Benchtop Unit Functionally Tests 6800 MPU Family

Dedicated to the 6800 family of microprocessors and peripherals, the Data I/O 1500A is a benchtop tester for low volume incoming inspection. The tester detects functional failures by operating each part at real time speeds with resistive loading, under high, low and nominal supply voltage levels. Data I/O, P.O. Box 308, Issaquah, WA 98027. (206)455-3990. **Circle 339**

30 MHz Memory Tester Accepts Auto Handler

The Minato 9300M test system can combine with an automatic IC handler or hook up directly to a wafer prober for high-throughput memory testing. Running at 30 MHz, the system conducts four tests simultaneously for parallel measurement, including function and dc tests. The three-address type pattern generator reduces testing time by separating processing from testing. With a memory 86 bits wide, the algorithmic pattern generator has a variety of control instructions for the address, data and index fields.

The system's timing generator has a resolution as fine as 2 nsec with pulse delays and widths as small as 100 psec. For failure analysis, the 9300M provides bit mapping, a counter for real-time failures, and a divided memory for storing and masking failed addresses. Minato Electronics Inc., 4105, Minami Yamada-cho, Kohoku-ku, Yokohoma, 223, JAPAN. 045-591-5611. **Circle 342**

In-Circuit Testers Grow to Handle Large Hybrid Boards

In an update to their line of in-circuit test systems, the GenRad 227X series can now test hybrid boards with as many as 3500 nodes. Each pin of the 2271 and 2272 test system has electronics which permit it to drive or receive signals, and is backed by local memory for constant and controllable timing. Dual programmable logic levels permit the 227X series to test different device technologies and mixed logic, with tight control of voltage and current to protect the UUT.

Through a 4-line switching matrix, the 2271 and 2272 direct instrumentation for analog measurements, including combined phase and magnitude readings to differentiate between parallel wired components. The 2271 handles boards with 960 nodes and the 2272 accepts boards with as many as 3,584 nodes. Each system comes with up to four programmable power supplies.

Test program generation software to support the 227X series includes a library of device models, a subset to display driver and sensor pin activity in a timing diagram format for debugging, and diagnostic routines that identify the failed device on a bus without the need for hand-held probing. In addition, board programming and testing can take place simultaneously with an optional program feature. GenRad, Inc., 300 Baker Ave., Concord, MA 01742. (617)890-4900. **Circle 394**

LSI Test System Runs at 10 MHz

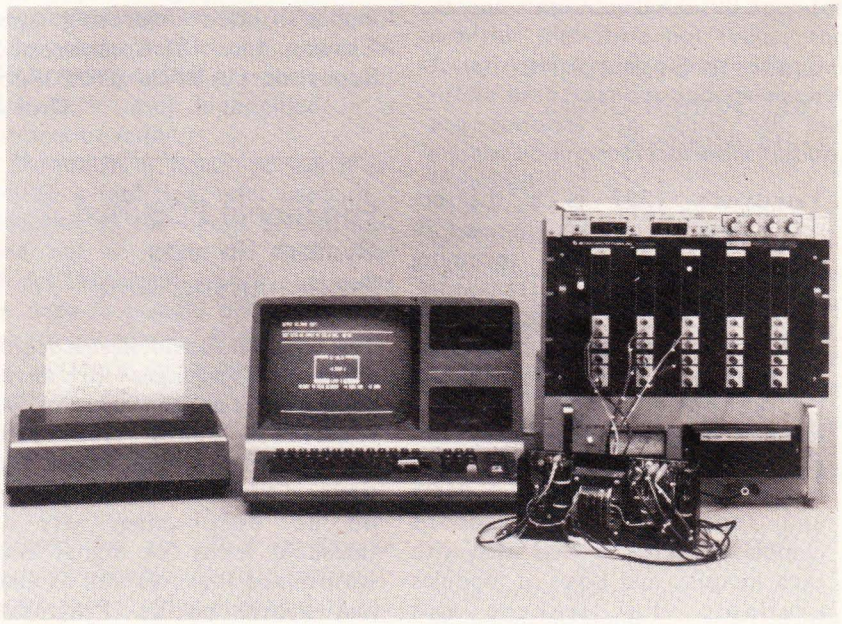
Able to test a wide variety of IC families, the Fairchild Series 10 is a production test system for memories, microprocessors, peripheral devices and other digital devices that require test speeds of up to 10 MHz. The system comes in a 30, 44 or 60 pin configuration and can accept one or two test heads. Built by Fairchild, the system's CPU uses an English-like test programming language, known as FACTOR, and contains a 128K word memory which is expandable to 256K words, and can be expanded even further.

The available options include a timing module with 16 timing generators that run in normal, synchronous or asynchronous modes, and an algorithmic pattern generator for large scale memory testing. The system runs functional tests at the 10 MHz test rates and performs 1,000 dc parametric tests per second. With the addition of an expansion bay, the System 10 can provide test electronics for 90 or 120 pins. Fairchild Test Systems Group, 1601 Technology Dr., San Jose, CA 95110. (408)998-0123. **Circle 385**

Benchtop Board Tester Needs No Software

Eliminating the need for any externally generated software, ATE Systems' Beaver 3 benchtop board tester uses a menu programming technique to create test plans with as many as 480 steps. Interactive commands prompt the test engineer to determine static or dynamic functional parameters for analog, digital and hybrid boards. The Beaver 3 can measure ac voltage, dc current and voltage, time, and count. An IEEE 488 interface allows the tester to accept up to 15 additional instruments. ATE Systems, Inc., 10 Dale St., Waltham, MA 02154. (617)899-9614. **Circle 330**

Automatic Power Supply Tester Programmed in BASIC



Software programmable ATE for boards and devices are commonplace, but usually not for power supply testing. However, the MPI-7505 from Microcomputer Power is a complete turnkey system programmed in BASIC for automatic power supply testing. All of the software is menu driven with prompts for data entry, and can easily accept updates or changes. A CRT display shows the test being performed and prompts the operator with an audible signal if adjustments are necessary. The system comes with a 500 W programmable AC power source, five 25 A loads and a Z80 based CPU with dual floppy disks. The MPI-7505 comes with all the software needed to immediately create programs. Microcomputer Power, Inc., 2272 Calle de Luna, Santa Clara, CA 95050. (408)988-0265.

Circle 363

An Invitation to the Readers of Test & Measurement World

Do you have Questions, Comments or Complaints that you would like the makers of test and measurement equipment to hear? That you would like to share with your colleagues in test and measurement? Then let this magazine be your forum—

Join the Test & Measurement User's Forum

The only dues is your willingness to communicate. Through direct contact with the staff of *Test & Measurement World*, you will be sure that your voice will be heard. Please fill out the form and return it to us immediately.

Yes, I want to join the Test & Measurement User's Forum.____

My area of expertise is _____

The topics I would like to see covered in the pages of *Test & Measurement World* are _____

_____

Please have the editors contact me directly: Yes____No ____

Name_____Title _____

Company _____

Address _____

Telephone (___) _____

Yes, I want to join the Test & Measurement User's Forum.____

My area of expertise is _____

The topics I would like to see covered in the pages of *Test & Measurement World* are _____

_____

Please have the editors contact me directly: Yes____No ____

Name_____Title _____

Company _____

Address _____

Telephone (___) _____

Yes, I want to join the Test & Measurement User's Forum.____

My area of expertise is _____

The topics I would like to see covered in the pages of *Test & Measurement World* are _____

_____

Please have the editors contact me directly: Yes____No ____

Name_____Title _____

Company _____

Address _____

Telephone (___) _____

Be sure to affix
sufficent postage.

PLACE
STAMP
HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

Be sure to affix
sufficent postage.

PLACE
STAMP
HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

Be sure to affix
sufficent postage.

PLACE
STAMP
HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

Fast Simulator Creates Board Test Programs

The trend toward larger and more complex PCBs also increases the worth of computer-aided test program generation tools. With a library of IC models and the ability to program as many as 32,000 nodes, the CADET digital logic simulator from HHB eases the task of test programming. With its menu-type programing technique, the CADET simulator allows you to select primitive device elements and create macro structures, automatically take care of bidirectional pins and buses, and include ROMs with a specialized modeling language. LSI device modeling is simplified by a flexible high level language and individual statements for subroutines, variables and arrays.

The simulator provides for four states and is accurate to picoseconds for time-domain determination. Warning messages automatically indicate bus contentions, and worst case timing analysis detects races and other hazards. For fault analysis, the CADET simulator identifies IC level inputs and outputs, and stuck at one and stuck at zero fault modes. Without reducing fault accuracy, the program can decrease simulation times by a factor of 50 with its concurrent fault simulation technique. HHB, Inc., 116 Route 17 North, Upper Saddle River, NJ 07458. (201)327-8014. **Circle 386**

Semiconductor RAM Tester Also Accepts Core Memories

In addition to testing random access semiconductor memories, the Concept Development T-119 can test core memories. This stand-alone unit automatically sequences four semiconductor test patterns at speeds up to 10 MHz. For core testing, the T-119 provides five industry standard patterns. User-selectable initial and ending addresses enable testing memory configurations as large as 16 million words by 24 bits. To test other types of memories, the T-119 can accept plug-in boards that contain the necessary timing and control signals. Concept Development, Inc., 3198G Airport Loop Dr., Costa Mesa, CA 92626. **Circle 334**

Memory Board Tester Maps Defective Devices

To identify the failed memory devices on a board, Eaton's MD-300 can draw a picture representing chip locations with defective devices labeled. Running at 10 MHz, the test system has up to 16 user selectable programmable power supplies and 16 clock phases which are programmable independently of the normal timing and control functions. With the MD-300's real time control, the test system operator can modify any timing relationship during the test sequence, and interactive Shmoo plots permit the manipulation of UUT behavior data under various parameter settings. The MD-300 comes with a DEC LSI-11 minicomputer and has a timing resolution of one nsec. Eaton Corp., Semiconductor Equipment Operations, 21135 Erwin St., Woodland Hills, CA 91365. (213)887-5550. **Circle 392**

Benchtop IC Tester Performs AC/DC Parametric and Functional Tests

Small enough to fit under a bench and able to mate with automatic handlers, Datatron's Spectrum Series I is a go/no go IC test system for incoming device inspection. Functional and parametric testing at speeds to 5 MHz provides dynamic test capabilities for memories, μPs and other digital devices. In addition to forcing and measuring currents and voltages, the Spectrum performs ac testing with phase clocks programmable in 1 nsec increments.

Each one of the 96 pins available can switch from the drive mode to the sense mode in under 35 nsec, providing the ability to test bidirectional device pins as well as monitoring tri-state devices. Behind each pin, the Spectrum has 16K words of storage for patterns to test the most complex LSI devices. To test dynamic memories, an optional generator is available for algorithmic patterns. The system uses an English-language format for program generation and editing. Datatron, Inc., 2942 Dow Ave., Tustin, CA 92680. (714)544-9970. **Circle 331**

Test Program Software Runs on CA, GenRad ATE

Making it possible to run test programs on other companys' ATE, Teradyne offers LASAR test program generation post processors for Computer Automation and GenRad test systems. In addition, post processors are available for Teradyne's L200 board test system and the J283 and J325 logic test systems. In addition to the new translators, LASAR software now includes enhancements to ease microprocessor and RAM modeling.

Using a high level language, the microprocessor assembler generates patterns based on the assembler code of a particular microprocessor. LASAR software's module RAMGEN is a subset which enables the programmer to model RAMs within minutes. Also included in the new release of LASAR software (version 5.3) is the function PERSUE, which runs off of simulator data and functions as a logic analyzer for hundreds of points on the board. Teradyne, Inc., 183 Essex St., Boston, MA 02111. (617)482-2700. **Circle 387**

Linear and Digital LSI Tester Adds High Speed Patterns

The addition of a high speed pattern generator permits the LTX DX89 to run at 12.5 MHz for testing analog/digital devices, such as high speed converters, codecs and μPs with analog I/O. The system can also serve as two or more parallel testers, delivering synchronized vector sequences for devices with two or more classes of digital functions. Each channel has local storage for 16K bits and a 4K bit data recorder register for comparison of pin responses.

For telecommunications testing, the system offers 32K bit channels for data send and receive. A programmable master clock provides resolution to one part per million. The DX89 uses test patterns generated algorithmically, arbitrarily stored, learned from good devices, assembled from other data files, or synthesized. LTX Corp., 145 University Ave., Westwood, MA 02090. (617)329-7550. **Circle 335**

Digital In-Circuit Tester Probes Mixed Logic Families

Plantronics/Zehntel's Troubleshooter 900 is an in-circuit test system for large digital, analog and mixed boards. The system has a capacity of 3,024 test points, grouped into 63 driver/detector boards with 48 points each. The ability to individually program each driver/detector board for logic levels and supply voltages enables testing boards with as many as 63 different types of logic.

Each test point can adapt to either analog or digital testing, allowing the system to find shorts and continuity failures. Program capabilities include dynamic truth table testing of SSI/MSI devices and functional testing with signature analysis of LSI/VLSI devices. The Troubleshooter can test microprocessors at speed, stimulating pattern rates at 1 MHz and receiving signals at 4 MHz. Under program control, the system can select any one of three external clocks on the board and synchronize with the first phase of the device's machine cycle clock.

The Troubleshooter 900 includes an automatic program generator with a test library, error coding, CRT prompting and program validation, and can accept an optional remote programming station to free the system for production testing. Plantronics/Zehntel, Inc., 2625 Shadelands Dr., Walnut Creek, CA 94598. (415)932-6900. **Circle 344**

Automatic Handler Delivers Leadless Chip Carriers

Delivering leadless chip carriers at the rate of one per second, Standish Development's SD series of handlers is fully automatic, requiring operators only for loading and unloading part reservoirs. Depending on the model type, the handler shunts the chip carriers to any one of eight output tracks. Spring loaded pick-up arms compensate for size variations from part to part, and optional conversion kits adapt the handler to accept leadless chip carriers ¼ in. to 1 in. square. The handler interfaces with all chip test systems. Standish Development, Inc., 38 George Leven Dr., N. Attleboro, MA 02760. (617)699-4529. **Circle 343**

Test Fixtures Easily Accept Different Probe Tips

The ability to change styles of probe tips without replacing probe plates or individual tips gives the TESTmate Series of fixtures the advantage of testing the same board when bare or loaded. Available in vacuum and mechanical styles, Test System's fixtures come with interfaces that are compatible with most in-circuit test systems on the market. Predrilled for all PCB hole locations and then sealed to maintain vacuum integrity, the fixtures can readily accommodate additional probes. With the Series II and III fixtures, an indexing option allows users to change the position of the probe plate to selectively access any of the test points. In either position, the fixture maintains complete mechanical isolation from the other position, permitting the same fixture to be used with separate test systems.

If there is a need to change to a different style of probe tips, a panel drilled to the same geometry fits on top of the probe plate. The new probes make electrical contact with the old probes for testing loaded boards or for functional testing after in-circuit evaluation. The TESTmate Series II vacuum fixtures come as large as 19½ in. x 19½ in. with a capacity of 4,096 test points. The Series III mechanical fixtures have a capacity of 9,792 test points on a 22 in. x 25 in. grid, and can handle products up to 5 in. high. The Series V universal fixture is a drawer-type fixture that provides 32,768 test points on 0.100 in. centers in an area 20 in. x 20 in. large. Test Systems. Inc., 1045 W. Geneva Drive, Tempe, AZ 85282. (602)894-9735. **Circle 345**

Benchtop In-Circuit Tester Runs Devices at Speed

Using the principle of comparison to a known good device, the Thalamus I tests devices in-circuit at synchronous clock rates up to 5 MHz. Adaptable to most device technologies and densities from SSI to LSI through a change of internal reference boards, the tester can locate hard-to-find problems such as intermittent and heat-related faults. This benchtop unit includes a keyboard for generating and editing test sequences and is portable for use in field service applications. An auxiliary interface, employed as a high input impedance buffer, translates signals from the device under test into levels compatible with the tester. Test clips connect the interface to the DUT. Thalamus Electronics, Inc., 1885 Sismet Rd., Mississauga, Ontario L4W 1W8, CANADA. (416)624-0390.

Circle 341

Memory Burn-In System Monitors Soft Errors

When used for quality assurance and incoming inspection of memory devices, this μC-controlled burn-in system locates failed addresses and calculates a soft error index for each failed cell. Programmed in MTS BASIC, the MG3000 controls test temperature, supply voltage, type of test pattern, test duration and device position masking criteria. The system can run in a continous mode, with test patterns run at speed through all device locations and errors logged in real time, or in a failed address mode with failure reporting specified to device location, failure address within the device, and number of failures for each device and cell. Printed error maps locate the failed devices on each carrier board. The MG 3000 can incorporate up to three pattern generators for simultaneous testing of multiple device types. Reliability Inc., P.O. Box 218370, Houston, TX 77218. (713)492-0550. **Circle 336**

4 good points from Everett/Charles

1. LARGE SELECTION.

- Over 100 combinations of probe sizes, tip configurations and spring pressures in stock.
- Available in 9 sizes.
- Mounting centers as close as .039 inches (1mm).
- 20 standard tip configurations.
- 2 standard spring forces available on most stock items.
- "Snap-out" design for easy replacement.
- Mating receptacles available with wire wrap, solder, crimp, or push-on terminations.

2. PRODUCT INTEGRITY.

At Everett/Charles we believe the probe must be the strongest component in the test system. We've developed proprietary designs, materials, and processes, along with test procedures and parameters to assure compliance with industry requirements. That's why we can guarantee product integrity for over a million cycles; you may expect zero mechanical failures and minimal contact resistance change. (Test data available on request.)

3. CUSTOM DESIGNS.

Our twenty years of expertise is also available. We know the tough problems and their solutions, from microamp test levels to corrosive environments. Put Everett/Charles experience to work on your special application.

Let us design a probe to your requirements.

4. SUPER SERVICE.

Get them fast—from a major producer. Off-the-shelf delivery of standard products in three working days or less. And, superb after-sale service too.

Just call Everett/Charles Contact Products, Inc. at (714) 596-5933 in Pomona, California, USA; (0462) 31341 in Hitchin, Herts, England; (06021) 21067 in Aschaffenburg, West Germany; (045) 242-2556 in Yokohama, Japan.

EC™

Everett/Charles
Contact Products, Inc.

FOR MORE INFORMATION, CIRCLE 32

We've taken the bugs out of debugging.

You know how debugging an LSI test program can go.

You start by checking and rechecking a hard-copy printout. You code changes, recompile, and rerun the program. Tying up your entire test system, background and foreground. All accompanied by a prayer that you found all the errors so you don't have to go through the whole process again.

Thanks to Fairchild's new program debug tool, SAGE, there's no reason to go through this process at all.

Simply speaking, SAGE is an intelligent color graphics terminal and software package. It displays all programmed stimulus and response to and from the device under test. Compatible with our Sentry and Series 20 systems, it provides a "menu" of options to any debug problem, in a friendly rather than a computer language.

In other words, SAGE offers the ability to modify the program stimulus interactively and see the changes on a real-time basis. Not only that, you can debug in the background as you test in the foreground.

What all this means to you is fewer man-hours spent debugging, more machine time for actual testing, and programmers who don't flinch when they hear the word "debug."

Before you find yourself frustrated by another debugging problem, call or write us.

We can help you debug your debugging. As well as your programs.

For more information contact Fairchild Test Systems Group, 1601 Technology Dr., San Jose, California 95110, (408) 998-0123.

FAIRCHILD

A Schlumberger Company

The First Family of ATE.

FOR MORE INFORMATION, CIRCLE 33

Modular Substrate Characterization System Tests up to 2,000 Wafers/Hour

Commercially available instruments for measuring wafer resistivity, type and thickness are usually just that: dedicated *instruments* which may perform only one of these functions and are not designed for use in large-scale production testing. But there's no reason why the automated, high-throughput test techniques that have revolutionized device and PCB evaluation can't be applied with equal success to measure the physical properties of semiconductor wafers.

ADE Corp., a 12-year-old firm based in Newton, MA, feels that wafer testing belongs in production, and the company's recently announced WaferCheck 7000 tester should make it much easier to merge physical test with semi fab operations. The system is a bona fide piece of production ATE: it characterizes and sorts LSI/VLSI substrates at throughputs up to 2,000 wafers an hour. And, like other types of ATE, it can be operated by nontechnical personnel.

A modular system, the WaferCheck 7000 can be configured to measure flatness, thickness and resistivity, and to sort the tested wafers into up to 48 categories. The system accommodates all popular substrate diameters, materials and cassette pitches. A test engineer can set up the parameters and limits for each test either on-line, using the integral mag card reader/writer, or off-line, use ADE's intelligent MicroTerm read/write terminal. After the cards have been preprogrammed, the operator simply inserts them into the WaferCheck card reader. The tester's μP-controlled subsystems do the rest.

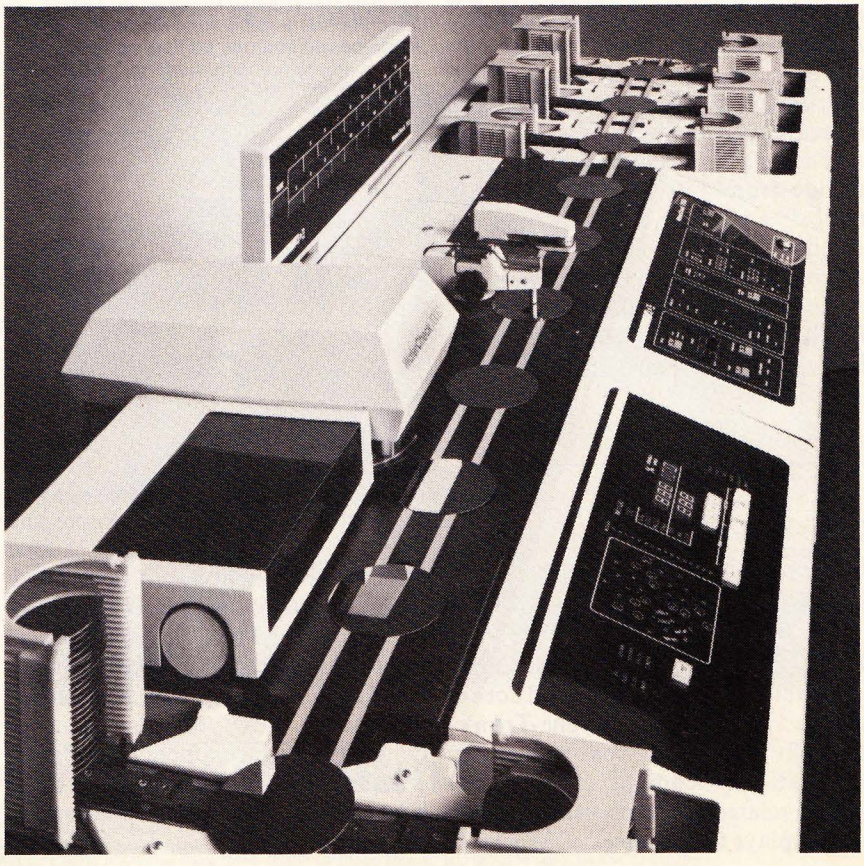
But before any wafer undergoes physical testing, it's checked at a visual inspection station, where the operator can pinpoint such surface defects as fingerprints, pitting, scratches, particulates and stains. Wafers that flunk visual inspection are rejected and passed directly to a receiver cassette without undergoing further testing.

Nondestructive, noncontact evaluation is a key feature of the WaferCheck 7000. Wafers to be tested ride from cassette to cassette on special conveyor belts that eliminate backside scratching—a byproduct of friction between the wafers and cleat-type transport setups. In the WaferCheck 7000 system, UUTs don't come in contact with anything during the entire test procedure.

The system uses noncontact capacitance test techniques to evaluate thickness and flatness with 0.5 μm accuracy. Flatness tests include total indicator reading, focal plane deviation and local slope, while the thickness subsystem measures total thickness variation as well as wafer thickness. Also noncontacting, the resistivity subsystem spans a measurement range of 0.001 to 199.9 Ω/cm. Finally, the WaferCheck 7000 can sort substrates into N-type, P-type and null decision (indeterminate dopant) categories. (Null-decision substrates must be checked with a manual wafer prober.)

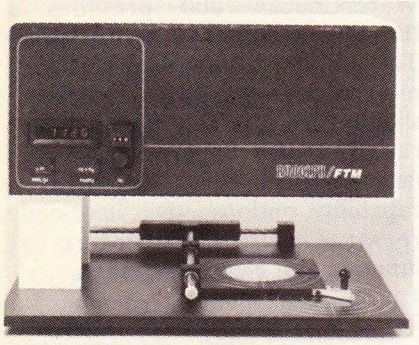
Configured to measure centerpoint thickness, type and resistivity, the WaferCheck 7000 provides a throughput of 2,000 wafers/hour. The addition of multipoint thickness measurement capability tends to slightly decrease this figure. Prices range from $90K to $250K, depending on size, measurement capability, options (VDT, hard-copy terminals) and number of input/output elevators desired.

ADE Corp., 77 Rowe St., Newton, MA 02166. (617)969-0600. **Circle 374**



Instrument Uses Reflected Light to Gauge Film Thickness

The measurement principle behind the FTM™ film thickness monitor from Rudolph Research involves reflection of light from film-covered substrates. Polychromatic light is reflected first from a reference film and then from the film-covered surface under test. The reference film thickness, which varies linearly, is "scanned" by the light beam. The photodetected intensity of the doubly reflected light reaches a maximum as a function of scan position when the optical thickness of the reference film



matches that of the unknown sample. Actual thickness measurement requires setting four controls, and the instrument can make a single-point measurement in 4 sec.

The FTM evaluates SiO_2 and nitride from 150 to 2,700 nm with typical accuracy of ±0.5 pecent. Available options extend the measurement ranges to 6,000 nm for SiO_2 and photoresist, 4,000 nm for nitride. Rudolph Research, 40 Pier Lane, P.O. Box 1446, Fairfield, NJ 07006. (201)227-6810. **Circle 226**

Automatic Test Station Types Semiconductors, Measures Resistivity

To evaluate volume resistivity and conductivity for semiconductor sample production, Magne-Tron's M-800 integral test station automatically computes geometric factors related to its four-point probe and displays the results on a 3½-digit panel meter. If the resistivity of a sample is too low for normal rectification, the typing circuit senses the difference and flashes a set of N-P symbols to indicate that the thermoelectric mode should be energized for proper N- or P-typing.

Along with the DPM, the M-800 contains a probe stand and a current source with 12 selectable ranges from 1 to 100 mA and 0.453 to 45.3 mA. A built-in test calibration mode enables checking current and voltage ranges for calibration accuracy. Magne-Tron Instruments, P.O. Box 653, Palo Alto, CA 94302. (415) 328-7069. **Circle 224**

Instrument Tests Thickness, Flatness, Roughness of Surfaces

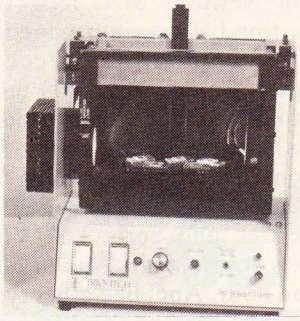
To analyze the surface profile of thin and thick film circuits, including the fundamental roughness of ceramic substrates, Planer Products' Surfometer has a diamond stylus that travels at controlled speed over the surface under test. Via a special transducer, this British-made instrument can readily measure surfaces with submicron roughnesses and plot the resulting profile on a recording. The basic resolution is 100 A, with full-scale ranges varying from 1.5 μ to 100 μ.

In combination with the integral optical flat reference, the Surfometer's lightweight test head nondestructively measures fired and unfired thick film circuit layers, photoresists and other relatively soft subtances. The unit can also check distortion, bow or the general contour of surfaces under test. Planer Products Ltd., Windmill Rd., Sunbury-on-Thames, Middlesex, England. **Circle 219**

Leak Bubble Testers Meet MIL-Specs

The theory behind the microelectronics gross leak test outlined in Test Condition C-1, Method 1014.1 of MIL-STD-883A is that dry N_2 inside the cavity of the DUT will increase in pressure, causing a flow through a gross leak of 1×10^{-3} or greater. By observing the resulting bubbles, you can readily identify the leak path.

Trio-Tech's A-481 line of self-contained bubble test chambers and accessories satisfy C-1 requirements by performing gross leak detection to $\geqslant 10^{-3}$ atm cc/sec. When used with the firm's Model A-486 pressure system, the testers can also run gross leak checks according to Test Condition C-2.



Available accessories include a chill ring assembly that minimizes Fluorinert™ boil-off, a filtration unit that cleans the Fluorinert™ to 1 μ absolute in less than 4 min., and an illuminated, adjustable magnifier to raise the tester and provide a close-up view of the chamber. Trio-Tech International, 2435 N. Naomi St., Burbank, CA 91504. (213) 846-9200. **Circle 229**

System Employs Trigonometry to Measure Junction Depth of Wafers

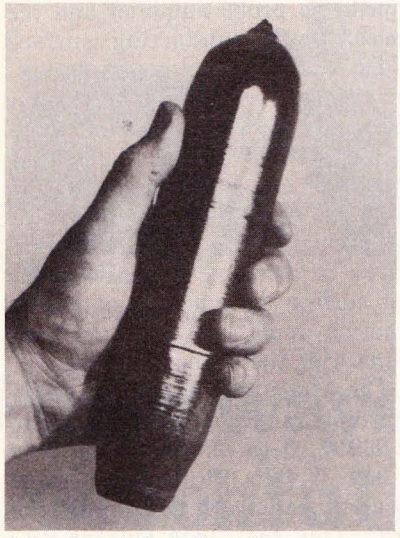
Using an arcuic trigonometric equation, Philtec's portable junction depth measurement system automatically translates microscope measurements of stained layers of bipolar, MOS, VMOS, GaAs and SoS materials from 1 to 200 μ. The unit can also aid in interface resistivity checking.

The firm's 2015 sectioner produces

FROM CRYSTALS TO CHIPS

Whether you require crystals for semiconductor applications; the equipment to grow, process and inspect crystals; or instruments for electron beam lithography, Cambridge can fulfill your needs.

Single Crystals, Ingots and Wafers



Gallium Arsenide Single Crystal Ingot

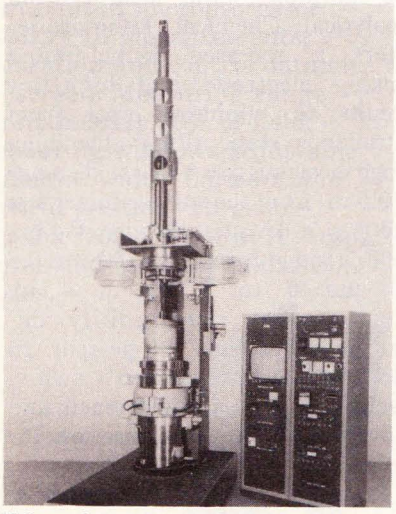
Cambridge supplies large diameter, Czochralski grown, perfectly round, semi-insulating, undoped boules and wafers of Gallium Arsenide (GaAs). Other crystals available are Gallium Phosphide (GaP) and Indium Phosphide (InP) — all grown and processed in equipment of our design and manufacture.

Circle No. 20

Equipment for Crystal Growth

Choose from our own range of high and low pressure crystal pullers — the Melbourn and Malvern systems for GaAs, GaP, and InP production, or the Autox System for the growth of GGG, Yag and other oxide crystals.

Additionally, our MR 100-AS alkyl epitaxial reactor is at the forefront of M.O. CVD technology.



Melbourn Gallium Arsenide Crystal Growth System

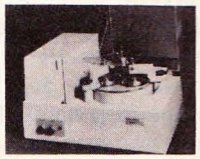
Circle No. 21

Slicing and Polishing of Crystals

Cambridge's Microslice 4 cuts the most delicate and brittle materials into ultra-thin parallel slices, leaving a good surface with minimum kerf loss.

In polishing machines, the Multipol 2 is ideal for laboratory applications, while the Multipol 4 is designed for production etch polishing of semiconductor wafers.

Microslice 4



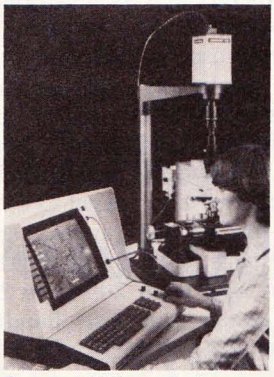
Multipol 4

Circle No. 22

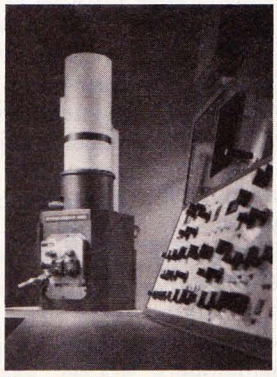
Image Analyzers and SEM's for Critical Inspection

To inspect crystals, chips, reticles and masks, use our Quantimet 800, a compact microprocessor-driven image analyzer, or the new Quantimet 900 which provides hard-wire performance and software-based operation for a vast range of industrial or research requirements.

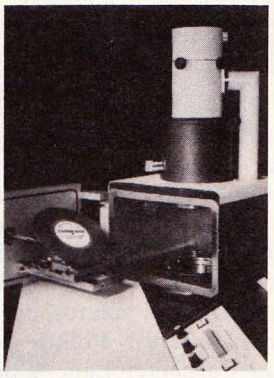
To take the inspection still further, use the Stereoscan 250 SEM which features Optibeam automatic column control; or use our new Stereoscan 100 with a specimen chamber able to take samples of 6" and more, magnification to 200,000 X, and 70 Å resolution guaranteed.



Quantimet 900 Image Analyzer



Stereoscan 250
Scanning Electron Microscope



Stereoscan 100 SEM
Specimen Chamber

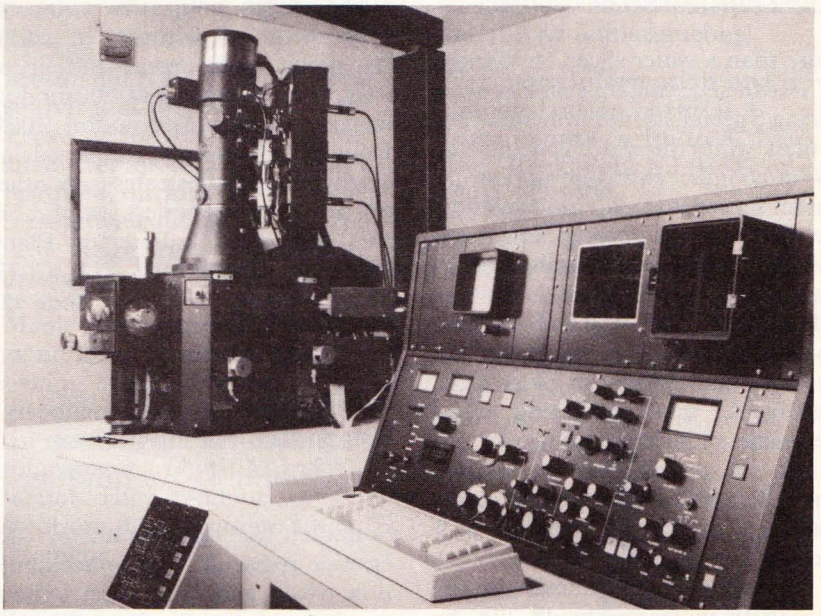
Circle No. 23

Circle No. 24

High Resolution E-Beam Systems

Further processing of wafers is accomplished in our vector-scanning EBMF-6 electron beam microfabricator which can generate complex reticles and masks or write directly on wafers.

With the capability of making line widths as narrow as 0.1 um, it produces the highest density packaging yet available of any E-Beam system.



EBMF-6 Electron Beam Microfabrication System

Circle No. 25

CAMBRIDGE INSTRUMENTS

U.S.A. • CAMBRIDGE INSTRUMENTS INC, 40 Robert Pitt Drive, Monsey, New York 10952, tel. (914) 356 3331 telex 137 305 MONSEY CIC
U.K. • CAMBRIDGE INSTRUMENTS LTD, Rustat Road, Cambridge CB1 3QH, tel. (0223) 42021 telex 81162 CI MR G
W. GERMANY • CAMBRIDGE INSTRUMENTS GmbH, Harnackstrasse 35-43, D4600 Dortmund 1, tel, (0231) 12 60 86 telex 8227346 CIC D
FRANCE • CAMBRIDGE INSTRUMENTS S.A.R.L., Centre d'Affaires Paris Nord, 93153 Le Blanc Mesnil, tel. 8670134 telex IMANCO 230185 F
S. EASTERN EUROPE • CAMBRIDGE INSTRUMENTS (AUSTRIA) GmbH, Lainzer Strasse 90, A-1130 Vienna, Austria, tel. 82 25 55 telex 133426 CAMIN A

a precise radial groove in a wafer. After grooving, the operator stains and measures the groove width at the surface and at the junction. A computer-generated index provided with the sectioner converts section width into depth. Loading, grooving, staining and measuring a wafer of semiconductor material to 1 percent accuracy over the entire depth range generally takes less than two minutes.

The digital filar eyepiece is electronically interfaced to an HP 97 card programmable printing calculator, which prints out measurement data on tape for permanent record keeping.

Two types of wafer-holding chucks are available: a line chuck that produces a straight groove across wafer material, and a spot chuck for use with a spot spindle that produces a short rectangular wafer section. Both chucks serve as wafer handling and microscope prealignment fixtures. Philtec Instrument Co., Carpenter Lane, Philadelphia, PA 19119. (215)438-2800. **Circle 220**

Slicer Checks and Charts Wafer Bow/Flatness As It Cuts

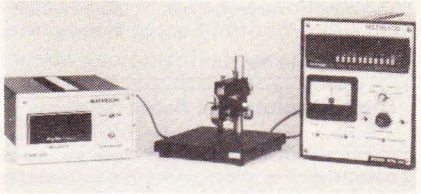
More than a wafer slicer, the Model STS-1010 slice tracking system from Slicing Specialists monitors bow and flatness while the wafer is being cut. The noncontact electronic measuring system senses the axial movement of the blade as it is cutting, and notes this movement on a built-in strip chart recorder, which can be calibrated to either μ/div. or 0.0001 in./div. The trace tells the operator the direction and amount of blade axial movement, thus indicating when the blade requires dressing. In addition, the system has an integral controller with adjustable setpoints that stop the slicing machine if it exceeds the limit.

According to its manufacturer, the STS-1010 increases blade life by alerting operators to excessive blade wander, and can improve yields by reducing core rubbing and kerf loss. The unit works on all inside diameter and outside diameter slicing machines. Slicing Specialists, 2662 Estella Dr., Santa Clara, CA 95051. (408)241-0821. **Circle 228**

Resistivity/Type Meter Goes Up to 20 MΩ, 10 mA

An instrument for measuring resistivity and determining the conductivity of silicon materials, Matheson's portable RTM-100 meter is suitable for evaluating epitaxial and diffused layers as well as substrates.

To measure conductivity, an operator can use the instrument's four-point probe as the sensing element; an analog meter on the front panel indicates conductivity type over a -5 to +5 μA range. Resistivity is displayed on the front panel DVM, which has five voltage ranges from 200 mV to 1,200 V and five resistance ranges from 200 Ω to 20 MΩ. The meter can also handle currents from 0.1 μA to 10 mA.



The meter comes in two versions—with or without an Alessi four-point probe stand and probe head. The optional LTM-200 module increases voltage resolution 100X (from 100 μV to 1 μV) for measuring heavily doped substrates and other low-resistivity samples. Matheson, P.O. Box 85, 932 Paterson Plank Rd., East Rutherford, NJ 07073. (201)933-2400. **Circle 227**

Multichannel Electrostatic Voltmeter System Uses Ion-Coupling Technique

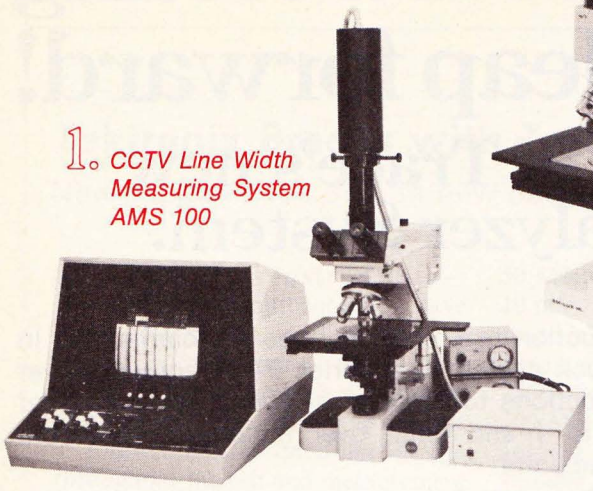
Suitable for semiconductor and electret research, charge accumulation work, and other electrophotographic and xerographic production applications, the Trek Model 460 noncontacting ion-coupled electrostatic voltmeter system measures electrostatic potential EMF with ±0.1 percent accuracy. The modular instrument (it's configured as a mainframe with plug-ins) takes a minute quantity of Nickel 63, a weak beta emitter, to create an effective ionized air bridge between the high-impedance probe amplifier and the dielectric or conducting surface under test. The voltmeter detects, magnifies, and integrates any differences between probe and UUT to generate a research potential, which is fed back to the probe housing. Via this technique, the feedback reference voltage is servo driven to the same potential as the test surface, so you can obtain an accurate replica of the UUT by monitoring the probe potential.

The Model 460 has three switch-selectable input voltage ranges: 0 to +2,000 V, 0 to -2,000 V, and 0 to +1,000 V. Its probe can make accurate readings at temperatures to 55°C. Trek Inc., 1674 Quaker Rd., Barker, NY 14012. (716)795-3211. **Circle 218**

Portable Static Detector Operates at High/Low Voltages

Designed for on-site static measurement and control, the ACL-300 portable static locator from Analytical Chemical Laboratories offers a recessed nickel-plated sensing electrode and high/low circuits to minimize error from extraneous static fields. The high range measures 0 to 5 kV at a distance of 0.5 in. from the surface under test and 0 to 30 kV at a distance of 4 in.; the low range covers 0 to 500 V at 0.5 in. and 0 to 3 kV at 4 in. Measurement repeatability deviation is less than ±1 percent. In addition, a "quick-zero" switch instantly rezeroes the instrument and provides ground compensation for the user.

Powered by a 9 V transistor battery, the ACL-300 can run for 40 continuous hours at full meter deflection. Analytical Chemical Laboratories, 1960 E. Devon, Elk Grove Village. IL 60007. (312) 981-9212. **Circle 223**



1. CCTV Line Width Measuring System AMS 100

2. SM LUX-HL 6x6

3. Metalloplan HL 6x6

5 new ways to keep a watchful eye on quality of masks, wafers & other small objects

... and do it faster, easier and with greater precision. These Leitz instruments were designed to keep pace with the demanding requirements of the semiconductor industry:

1. CCTV Line Width Measuring System AMS 100: Compact unit with built-in microprocessor displays all measurements, calibration and control data on TV screen. Measuring range approximately 30% of field. Measuring windows adjustable in height, width, horizontal or vertical position. Threshold variable from 0-100% in 1% steps. Stores and recalls 6 calibration modes.

2. SM LUX-HL 6x6: An optically superior wafer inspection microscope for brightfield and darkfield IC observations. Magnification range 32 to 1600X. Equipped with quick-acting stage.

3. Metalloplan HL 6x6: An ideal research and inspection microscope for investigation in transmitted or reflected light, in brightfield, darkfield or interference contrast. Features 6" x 6" stage travel and digital filar eyepiece.

4. Mask Comparator MVG 7x7: A new and larger comparator for checking mask or wafer registration. Accepts masks up to 7" in size. Highly accurate stage displacement in both X and Y direction. High readout resolution: 0.1 micron or 10 microinches.

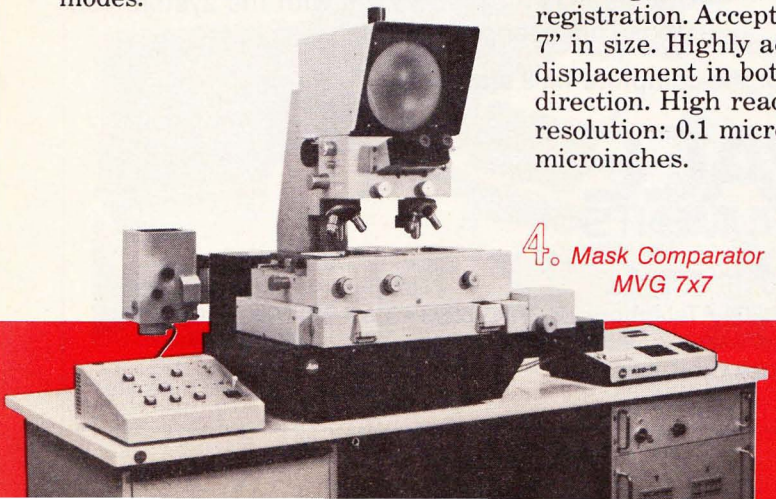
5. Comparator 200/3: A highly precise instrument for semi-automatic linear measurement of photomasks and wafers. Digital readout of high resolution measurements (0.1 micron or 5 microinches).

For more information and a demonstration of these instruments, write to E. Leitz, Inc., Rockleigh, NJ 07647 or call (201) 767-1100.

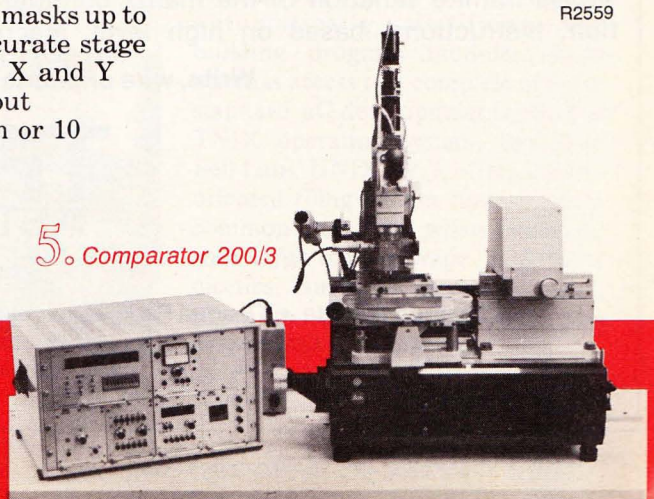
FOR MORE INFORMATION, CIRCLE 39

Leitz **Leitz Means Precision. World Wide.**

R2559



4. Mask Comparator MVG 7x7



5. Comparator 200/3

Bare and loaded board testing takes a quantum leap forward!

with the introduction of Trace's new Series TA-9 Test Analyzer System.

From this moment on, you will have an entirely new concept of high speed board testing. You are about to discover an analytical system so advanced that its capabilities will dwarf and obsolete any you have used or known.

☐ The Trace Series TA-9.

Conceived and developed by the same people who revolutionized board testing procedures with their TA-4 and TA-5 Systems, the Series TA-9 virtually eliminates the division between tester and computer.

Through a dramatic, new design principle, the tester, itself, has been transformed into a true computer, containing both program and data memory. This significant change opens the door to a vastly broadened range in the selection and control of test algorithms. A range never possible before. And, for the first time, both bare and loaded boards may be tested at high speeds, with a system that pinpoints even the minutest areas of error.

The network program may be put into the data memory either from a known good board, uploaded from a floppy disk, or transferred in from a data processing computer. A new system of Crosspoint™ switching, originated by Trace, allows infinite variation of the matrix configuration. Instructions, based on high level, macro-instruction machine language are carried out in 2 clock cycles. The Series TA-9 requires fewer instructions to function at speed advantages of 100 to 1 and more over microprocessor controlled units.

The Series TA-9 is always at the command of the operator. Programs may be created, edited and revised quickly and easily and existing programs may be saved or incorporated into the new mode.

☐ A new era of testing evolution.

The Series TA-9 is designed to stand alone. But the use of a data processing computer, in conjunction with it, can increase its versatility even more. It will never become obsolete. Because it has been designed to become the basic system for a series of modular units, now under Trace development and testing, that will continue Trace's leadership in technological advances in the testing industry. The Series TA-9 will grow in its capabilities to meet your expanding needs.

☐ Before you invest - investigate Trace

If you are considering a new testing system, it will pay you to look into Trace and the new Series TA-9. Because Trace is the acknowledged leader and innovator in the field.

After all, you'll have to work with the system you choose, for a long, long time!

Write, wire or phone for the complete TA-9 story!

TRACE INSTRUMENTS

A Methode Company

9030 Eton Avenue • Canoga Park, California 91304 • Telephone (213) 341-5593 • TWX 910-494-5989

FOR MORE INFORMATION, CIRCLE 56

Tektronix Breaks with Tradition

New capabilities come in new packages

Modular test instruments—particularly oscilloscopes—have been the bread and butter of Tektronix for many years. The billion-dollar company's phenomenally successful plug-ins have become a touchstone for modular design throughout the test and measurement industry; as a result, Tek has been somewhat reluctant to modify its distinctive and easily recognized equipment packages. But even a firm with a market-proven concept need not be bound by tradition. Recent Tektronix product innovations (most of which were on display at the 1981 WESCON exhibition) show how this established supplier has shifted its outlook to encompass user demands for portability, microcomputing power, multifunction flexibility and GPIB systems capability.

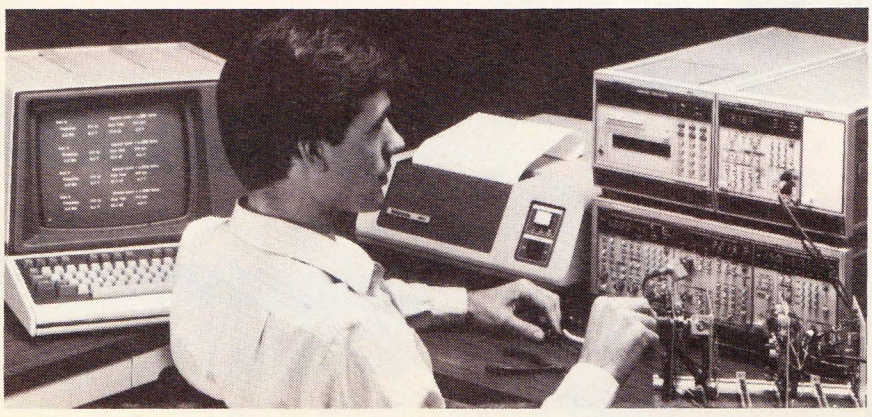
The 2200 and 2300 Series of low-end portable scopes represent perhaps the most radical departures from Tek's long-standing instrument design philosophy. Aimed specifically at the field service market, these stand-alone units replace all but two scopes in the T-900 line, as well as the discontinued 442, 445 and Telequipment models. One member of the 2200 family, the dual-trace, delayed-sweep 2215, is a compact instrument with a 60 MHz bandwidth from 20 mV to 10 V and a 50 MHz bandwidth at 2, 5 and 10 mV settings; maximum sweep speed is 5 nsec/div. Another delayed-sweep, dual-trace instrument in the 2200 Series (Model 2236) has a 100 MHz bandwidth and 5 mV/div vertical sensitivity. This unit is suitable for making more complex measurements in digital systems.

The instruments in the TM 5000 Series look like the traditional Tektronix TM 500 plug-ins and mainframes, but the resemblance ends there. All of the TM 5000 units are automatically programmable via the IEEE 488 bus and have been designed to simplify systems integration and software development, since they're compatible not only with each other but with over 40 manual TM 500 instruments. The firm believes that this series is a harbinger of a new approach to GPIB implementation and should have a significant impact on test and measurement in the 1980s. Some of the first products in the TM 5000 line were unveiled at WESCON '81: a 20 MHz function generator, a 350 MHz universal counter and a DMM, as well as associated power supplies, scanners and a controller.

Multifunction instruments seem to be the wave of the present (see related story in this section), and Tek is making inroads in this area, too. The DAS 9100 digital analysis system merges logic analysis functions, pattern generation, mass storage and communications interfaces into a single, modular unit. Users plug card modules into the system's μP-controlled mainframe to obtain up to 104 channels of data acquisition, synchronous and asynchronous sample rates to 330 MHz, 1.5 nsec resolution (660 MHz) and up to 80 channels of pattern generation at 25 MHz. Optional mag tape storage, RS-232C or GPIB interfaces, and composite video are also available. The system allows designers to simulate and emulate the response of a UUT before all hardware or firmware is completed.

Tektronix has been active in the relatively new field of μP/μC development systems for the past couple of years; one of the firm's principal offerings in this area is the 8500 Series of microcomputer development labs. With the recently introduced 8540 host integration unit and the 8560 microcomputer design team system, Tek rounds out the series, which can now handle single-user, multiuser and host microcomputer design tasks for variety of 8- and 16-bit processors.

The 8560 is designed to facilitate the team-oriented design approach dictated by the trend toward larger processors and programs. According to Tektronix, this system is the first to provide text processing and documentation tools, a team-oriented file system, and utilities for automatically modifying and building program modules. Each user has access to a complete array of standard μC development tools. The TNIX operating system, based on Bell Labs' UNIX™ V.7, offers a team-oriented filing system that creates a common data base when combined with large mass storage. And other niceties, such as electronic mail, promote better communication between team members.



Tektronix TM 5000 Series

For information on any of the products described in this article, **Circle 371**

TO THE CUSTOMER IT'S A SERVICE CALL.

TO YOUR COMPANY IT'S MONEY OUT THE WINDOW.

Fischer Technology brings your attention to the skyrocketing cost of service calls. And what to do about it.

Service after the sale.

It's an accepted *way* of doing business, and for good reason. Customers expect it and deserve it.

But service is also a *cost* of doing business. Some sources say that, on the average, each time one of your service representatives walks out the door it's costing your company between $300 and $700. And that's just getting him out the door!

This doesn't even include the cost of replacement parts, customer "downtime", or the most costly item of all—the loss of customer goodwill and faith in your products.

The point is, that while many service calls are necessary, many more are not. A lot of them are simply money out the window.

Eliminate Unnecessary Service Calls And Save Money

The best way is to prevent them in the first place. One good way to begin is to review your procedures and consider a quality control audit that covers each step of your finishing process.

Another way is to have the right quality control equipment *on-line.* The best procedures in the world won't do you any good if you don't have the right equipment.

But this brings up another problem. *Money.* With most companies facing tight budgets, many are reluctant to purchase the equipment they need for quality control. So what's the solution?

Fischer Quality For $5000 Or Less

When it comes to coating and thickness measurement, the world's leader once again sets the pace.

We're making quality control affordable with a series of highly accurate, easy-to-use and inexpensive equipment for under $5000 each. For about what it would cost your company in eight service calls, you could begin saving money *now* with Fischer Equipment.

It's a question of economics. You can spend money on unnecessary service calls. Or on equipment that can help prevent them. We think the choice is pretty obvious.

Get The Facts. Fast. Free.

For more information about Fischer's Dualscope™, Isoscope®, Deltascope™, Permascope®, Nickelscope™, Magna 250™, Eddy 350™, Magna 460™, Eddy 560™, or Couloscope™, ***call us toll-free at (800) 243-8418.*** In Connecticut call (203) 683-0781.

fischer® technology

750 Marshall Phelps Road
Windsor, CT 06095

FOR MORE INFORMATION, CIRCLE 34

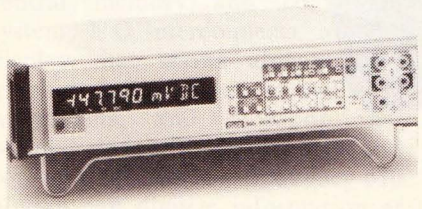
WESCON Sees More "Smart" Gear

Fluke premiers μP-based DMMs, controller and oscilloscope calibration system

A major power in the brave new world of μP-based electronics test equipment, John Fluke Mfg. Co. continues to bring out trend-setting instruments that, in some cases, are almost ATE in miniature. The parade of "smart" test equipment debuted by Fluke at the 1981 WESCON show included a 5½-digit multimeter, a programmable switch controller and an automated oscilloscope calibration system. In addition, the company announced sweeping changes in its line of 8020A hand-held DMMs, slated to be replaced by the upgraded "B" Series.

The 8522A DMM—a close relation to last year's 8520A—comes with standard switch-selectable parallel and BCD interfaces. Like the 8520A, this "smart" meter can store up to 50 readings in memory (expandable to 400 locations with available options), and supplies seven math programs, including Deviation, Limits Testing and External Reference. The 8522A also measures DC voltages to a resolution of 1 μV, true RMS AC voltages to 1 MHz, two- or four-wire resistances from 100 μΩ to 100,000 MΩ, and conductance—all at a rate of 240 readings/sec with the full 5½ digits of resolution.

Intended for bench and system applications, the μP-based 2205A switch controller handles up to 10 different switching/scanning modules in its mainframe, and can control up to 100 modules with the aid of an extender chassis. The instrument, which scans up to 125 channels/sec, is programmable either locally via front panel pushbuttons or remotely over the RS-232C or GPIB interface.



Fluke 8522A Digital Multimeter

Fluke's 7410 oscilloscope calibration system

Scope calibration is traditionally an onerous chore, but Fluke's 7410 system may offer some relief. As soon as it's installed, the system automatically calibrates scopes, probes, plug-ins, amplifiers and other calibrators. It comes with applications software designed to simplify calibration program generation, and operators can reportedly learn how to use the 7410 in a day, since the 1720A instrument controller incorporated in the system uses an interactive touch-sensitive display. A complete IEEE 488-linked scope cal unit includes the 1720A, a programmable calibration generator and the company's 8520A DMM.

While not "intelligent" like the μP-controlled 8520A and 8522A, Fluke's 8020A Series of hand-held DMMs offer a number of enhancements that should make life easier for service personnel. Three of the four units in this line feature high-speed (50 μsec response) continuity beepers; all of the low-cost meters provide heavy-duty 600 V double fusing on current inputs, nonskid rubber feet and a locking tilt bail to keep each instrument rooted in place, and easy-to-read front panel nomenclature. Furthermore, specs are guaranteed for two full years—and so are the warranties on parts and labor.

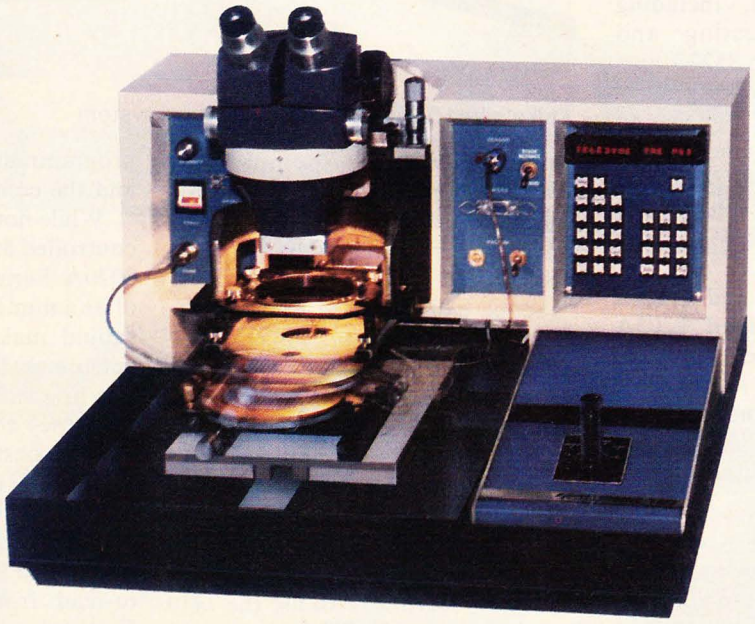
For information about any of the products described in this article, **Circle 217.**

Q:

What is bigger than a breadbox, microprocessor controlled, probes 2", 3", 4", and 5" wafers, program selectable english/metric indexing, has random access IEEE-488 interface bus, menu programming, compatible with Teledyne TAC'S full service line of prober accessories and . . . .

A:

Teledyne TAC'S new low cost PR-53 Automatic Wafer Prober.



Call, write or use the number below to get the whole story in our new brochure.

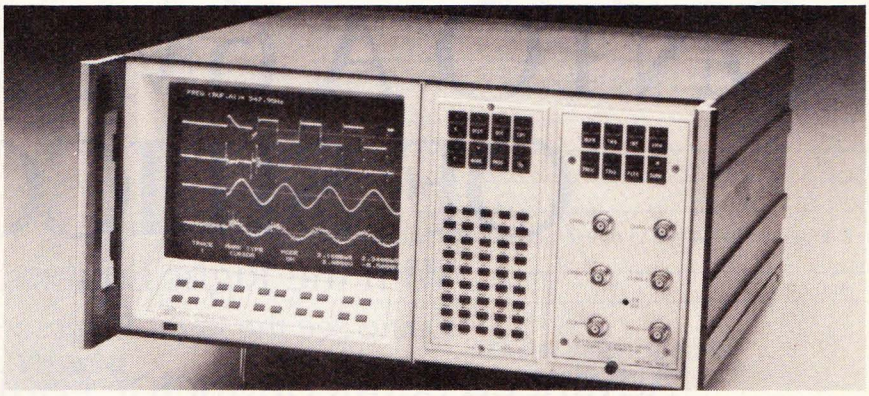
TELEDYNE TAC

10 Forbes Road, Woburn, Massachusetts 01801 • Tel: 617-935-5400 Telex: 94-9440

FOR MORE INFORMATION, CIRCLE 54

Multifunction Instruments: Versatility at Affordable Prices

An entire test bench in one package? This notion might have seemed like an impossible dream 5 or 10 years ago, when many test engineers were still struggling with racks of instruments connected by spaghetti-like lengths of cable. Thanks to LSI and μP technology, however, it's become possible to sandwich several related test functions into a single, easy-to-use enclosure. The resulting time- and space-saving benefits have greatly simplified test operations both in the field and on the production floor. The best news, though, is that decreasing LSI prices have also brought down the cost of this do-it-all test gear. Multifunction equipment is a real bargain, considering how much capability it provides; in some cases, a multifunction test set may cost less than just one of the instruments it's designed to replace.



Waveform Analysis and More

For some time now, μP-controlled digital processing oscilloscopes have been mutating into waveform analyzers. Data Precision has made a quantum leap in this direction with its recently introduced Data 6000, an extremely powerful signal analysis machine. This multifunction instrument merges the capabilities of a digital storage scope, a waveform analyzer, a spectrum analyzer, a transient signal analyzer and a data acquisition system into one compact (7 3/4 in. X 15 in. X 19 in.) enclosure. And it sells for less than $10,000.

The Data 6000 consists of a set of interchangeable plug-in preamplifier digitizers and a μP-controlled mainframe, which incorporates a central memory and computing system, I/O interconnects, a 9 in. display that shows alphanumeric graphic information as well as waveforms, and such optional peripherals as a floppy disk drive and control unit. The low-frequency 610 plug-in can digitize information at rates up to 100K samples/sec with 14-bit resolution and a basic accuracy of ±(0.5 percent/reading + 0.5 percent/range); this plug-in can also acquire up to four channels of isolated, floating analog signals. The 620 high-frequency digitizer module can multiplex two channels at 50 MHz with 8-bit resolution, or one channel at 100 MHz with 7-bit resolution. Both front ends are the first members of a family of interchangeable plug-ins.

Between the digitizers and the display is an automatic signal processing/analysis system based on the 16-bit Motorola 68000 μP. Up to four traces may be displayed at the same time and positioned or expanded independently. In addition, users have independent control of two timebases, which can serve to acquire any of the four channels of digitized data.

To aid in analyzing repetitive waveforms, the Data 6000 has the ability to generate sweep-to-sweep weighted averages of from 1 to 10,000 sweeps of the input signal. A min/max envelope function permits simultaneous display, via three overlaid traces, of present value as well as continuous minimum and maximum values of the envelope over any time period.

Users have several signal comparison options at their disposal: comparison of a live signal with one from memory or disk, comparison of time or level, integration, differentiation, and auto- and cross-correlation. All these functions are executed by a single keystroke. Moreover, there's a keystroke-actuated FFT function that produces magnitude and phase data using one real input or two real and imaginary input signals.

Pushbutton-selectable waveform characteristics are displayed in numeric format on the CRT. These characteristics include period, frequency, rise/fall time, average or RMS value, pulse width and delay, and time of threshold crossing in either direction.

Whether you're examining one-shots or repetitive waveforms, the Data 6000 can handle the job. Data Precision feels that there's very little in the growing field of signal analysis that the instrument won't do; to obtain all the capabilities offered by the Data 6000, you'd have to invest in a substantially more expensive rack-mounted setup crammed with test gear. Once again, multifunction versatility has come to the rescue of engineers seeking low-cost, space-saving alternatives to unwieldy test bench configurations.

A Portable Digital Test Lab

No field engineer likes to lug a benchful of test equipment to a customer's site. However, servicing complex μP-based products usually demands several different kinds of test instrumentation, even if the engineer is only performing a board or chip swap. And μP trouble-shooting is nightmarish enough

HOW DO YOU GET 64,000 CIRCUITS ONTO A 6MM PIECE OF SILICON?

With the Right Equipment.

Come See the Right Equipment at

Advanced Semiconductor Equipment Expo

Cartlidge & Associates, Inc., 491 Macara Avenue, Sunnyvale, CA 94086 (408) 245-6870

January 26, 27, 28, 1982
San Jose, California, Convention Center

ASEE'82 Trade Show Exhibits.

The latest in semiconductor device manufacturing equipment and materials from over 400 leading suppliers of:

*Production Machinery & Equipment; *Testing, Measuring, Monitoring; *Tools, Fixtures, and Other Production & Processing Products
*Encapsulation Materials; *Photomasking
*Bonding; *Chemicals, Gases, & Materials
*Clean Room/Clean Air Stations & Equipment
*Wafer Purification & Filtration; *Deposition
*Diffusion; *Wafer Fabrication Equipment
*Heat Treating Furnaces & Ovens

ASEE Presents Lampoon'82

"Tokyo Sally Hits Silicon Valley"

A hilarious musical-comedy stage production. Ticket includes industry dinner.

ASEE'82 Comparative Technologies Conference for Engineering Professionals

Authorities from leading equipment suppliers & major U.S. semiconductor manufacturers focus on design, application, & reliability of new, forecasted, and present equipment in the areas of:

*Plasma Processes; *Automated Wafer Processing; *Assembly Technology
*Photolithography Systems; *Diffusion, Implantation Systems

Register Now.

Send to:
ASEE'82
Cartlidge & Associates, Inc.
491 Macara Ave., Suite 1014
Sunnyvale, CA 94086

Complete & mail to receive your free trade show admission badge ($8.00 value/does not include conference admission). Do not mail after January 7, 1982. Bring to Expo for complimentary admission.

Please send:
- ☐ Free Trade Show Admission Badge
- ☐ Comparative Technologies Conference for Engineering Professionals Schedule & Registration Form
- ☐ Lampoon'82 Information & Registration Form
- ☐ Hotel Reservation Form

Your Principal Job Function:
- ☐ Engineer/Scientist
- ☐ Corporate/Engineering Management
- ☐ Manufacturing/Engineering Technician
- ☐ Sales/Marketing
- ☐ Purchasing/Procurement
- ☐ Consultant
- ☐ Other (specify) _____

Principal Area of Interest:
- ☐ Processing
- ☐ Assembly
- ☐ Test
- ☐ Other (specify) _____

NAME _____

COMPANY _____ MS/DIV _____

ADDRESS _____

CITY/STATE _____ ZIP _____

PHONE/EXT. _____

Test & Measurement World

1	41	81	121	161	201	241	281	321	361
2	42	82	122	162	202	242	282	322	362
3	43	83	123	163	203	243	283	323	363
4	44	84	124	164	204	244	284	324	364
5	45	85	125	165	205	245	285	325	365
6	46	86	126	166	206	246	286	326	366
7	47	87	127	167	207	247	287	327	367
8	48	88	128	168	208	248	288	328	368
9	49	89	129	169	209	249	289	329	369
10	50	90	130	170	210	250	290	330	370
11	51	91	131	171	211	251	291	331	371
12	52	92	132	172	212	252	292	332	372
13	53	93	133	173	213	253	293	333	373
14	54	94	134	174	214	254	294	334	374
15	55	95	135	175	215	255	295	335	375
16	56	96	136	176	216	256	296	336	376
17	57	97	137	177	217	257	297	337	377
18	58	98	138	178	218	258	298	338	378
19	59	99	139	179	219	259	299	339	379
20	60	100	140	180	220	260	300	340	380
21	61	101	141	181	221	261	301	341	381
22	62	102	142	182	222	262	302	342	382
23	63	103	143	183	223	263	303	343	383
24	64	104	144	184	224	264	304	344	384
25	65	105	145	185	225	265	305	345	385
26	66	106	146	186	226	266	306	346	386
27	67	107	147	187	227	267	307	347	387
28	68	108	148	188	228	268	308	348	388
29	69	109	149	189	229	269	309	349	389
30	70	110	150	190	230	270	310	350	390
31	71	111	151	191	231	271	311	351	391
32	72	112	152	192	232	272	312	352	392
33	73	113	153	193	233	273	313	353	393
34	74	114	154	194	234	274	314	354	394
35	75	115	155	195	235	275	315	355	395
36	76	116	156	196	236	276	316	356	396
37	77	117	157	197	237	277	317	357	397
38	78	118	158	198	238	278	318	358	398
39	79	119	159	199	239	279	319	359	399
40	80	120	160	200	240	280	320	360	400

FALL 1981

READER SERVICE CARD
Expires April 30, 1982

Name _____ Title _____

Company _____

Dept./MS. _____ Phone _____

Company Address _____

City _____ State _____ Zip _____

If this issue was not addressed to you, circle 400

Which articles were most interesting/useful? Why? _____

Which articles were not useful? Why? _____

Which subjects would you like to see covered in future issues?

Test & Measurement World

1	41	81	121	161	201	241	281	321	361
2	42	82	122	162	202	242	282	322	362
3	43	83	123	163	203	243	283	323	363
4	44	84	124	164	204	244	284	324	364
5	45	85	125	165	205	245	285	325	365
6	46	86	126	166	206	246	286	326	366
7	47	87	127	167	207	247	287	327	367
8	48	88	128	168	208	248	288	328	368
9	49	89	129	169	209	249	289	329	369
10	50	90	130	170	210	250	290	330	370
11	51	91	131	171	211	251	291	331	371
12	52	92	132	172	212	252	292	332	372
13	53	93	133	173	213	253	293	333	373
14	54	94	134	174	214	254	294	334	374
15	55	95	135	175	215	255	295	335	375
16	56	96	136	176	216	256	296	336	376
17	57	97	137	177	217	257	297	337	377
18	58	98	138	178	218	258	298	338	378
19	59	99	139	179	219	259	299	339	379
20	60	100	140	180	220	260	300	340	380
21	61	101	141	181	221	261	301	341	381
22	62	102	142	182	222	262	302	342	382
23	63	103	143	183	223	263	303	343	383
24	64	104	144	184	224	264	304	344	384
25	65	105	145	185	225	265	305	345	385
26	66	106	146	186	226	266	306	346	386
27	67	107	147	187	227	267	307	347	387
28	68	108	148	188	228	268	308	348	388
29	69	109	149	189	229	269	309	349	389
30	70	110	150	190	230	270	310	350	390
31	71	111	151	191	231	271	311	351	391
32	72	112	152	192	232	272	312	352	392
33	73	113	153	193	233	273	313	353	393
34	74	114	154	194	234	274	314	354	394
35	75	115	155	195	235	275	315	355	395
36	76	116	156	196	236	276	316	356	396
37	77	117	157	197	237	277	317	357	397
38	78	118	158	198	238	278	318	358	398
39	79	119	159	199	239	279	319	359	399
40	80	120	160	200	240	280	320	360	400

FALL 1981

READER SERVICE CARD
Expires April 30, 1982

Name _____ Title _____

Company _____

Dept./MS. _____ Phone _____

Company Address _____

City _____ State _____ Zip _____

If this issue was not addressed to you, circle 400

Which articles were most interesting/useful? Why? _____

Which articles were not useful? Why? _____

Which subjects would you like to see covered in future issues?

Test & Measurement World

1	41	81	121	161	201	241	281	321	361
2	42	82	122	162	202	242	282	322	362
3	43	83	123	163	203	243	283	323	363
4	44	84	124	164	204	244	284	324	364
5	45	85	125	165	205	245	285	325	365
6	46	86	126	166	206	246	286	326	366
7	47	87	127	167	207	247	287	327	367
8	48	88	128	168	208	248	288	328	368
9	49	89	129	169	209	249	289	329	369
10	50	90	130	170	210	250	290	330	370
11	51	91	131	171	211	251	291	331	371
12	52	92	132	172	212	252	292	332	372
13	53	93	133	173	213	253	293	333	373
14	54	94	134	174	214	254	294	334	374
15	55	95	135	175	215	255	295	335	375
16	56	96	136	176	216	256	296	336	376
17	57	97	137	177	217	257	297	337	377
18	58	98	138	178	218	258	298	338	378
19	59	99	139	179	219	259	299	339	379
20	60	100	140	180	220	260	300	340	380
21	61	101	141	181	221	261	301	341	381
22	62	102	142	182	222	262	302	342	382
23	63	103	143	183	223	263	303	343	383
24	64	104	144	184	224	264	304	344	384
25	65	105	145	185	225	265	305	345	385
26	66	106	146	186	226	266	306	346	386
27	67	107	147	187	227	267	307	347	387
28	68	108	148	188	228	268	308	348	388
29	69	109	149	189	229	269	309	349	389
30	70	110	150	190	230	270	310	350	390
31	71	111	151	191	231	271	311	351	391
32	72	112	152	192	232	272	312	352	392
33	73	113	153	193	233	273	313	353	393
34	74	114	154	194	234	274	314	354	394
35	75	115	155	195	235	275	315	355	395
36	76	116	156	196	236	276	316	356	396
37	77	117	157	197	237	277	317	357	397
38	78	118	158	198	238	278	318	358	398
39	79	119	159	199	239	279	319	359	399
40	80	120	160	200	240	280	320	360	400

FALL 1981

READER SERVICE CARD
Expires April 30, 1982

Name _____ Title _____

Company _____

Dept./MS. _____ Phone _____

Company Address _____

City _____ State _____ Zip _____

If this issue was not addressed to you, circle 400

Which articles were most interesting/useful? Why? _____

Which articles were not useful? Why? _____

Which subjects would you like to see covered in future issues?

Be sure to affix
sufficent postage.

PLACE
STAMP
HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

Be sure to affix
sufficent postage.

PLACE
STAMP
HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

Be sure to affix
sufficent postage.

PLACE
STAMP
HERE

TEST & MEASUREMENT WORLD

INTERFIELD PUBLISHING COMPANY, INC.
215 Brighton Avenue
Boston, MA 02134

without the extra hassle of taking a rack of test gear into the field.

That's why B&K-Precision/Dynascan's μP-controlled LA-1000 system analyzer should be a welcome addition to the tool kits of μP/μC service personnel. Weighing in at under 14 lbs., this multifunction instrument does the work of a signature analyzer, a logic analyzer, an autoranging frequency counter, autoranging AC and DC DVMs, and an autoranging digital ohmmeter—all for just $1,745.

Operating as a DC-20 MHz, single-channel logic analyzer, the LA-1000 can present both time and state domain data. State data appear in hexadecimal code on a 4-digit LED display, while timing diagrams of one channel by 16 bits can be displayed externally by hooking the instrument up to a standard oscilloscope, which also displays clock pulses and a cursor. The 256-bit-deep memory stores up to 16 words of 16 bits apiece. Along with

probe settings, three pushbuttons provide full control of the instrument's logic analysis function.

The advantages of signature analysis (SA), the component-level μP troubleshooting technique developed by Hewlett-Packard, have been thoroughly documented, as have its disadvantages (namely, that products must be designed or retrofitted with SA circuitry to permit application of the technique). The fact that the LA-1000 incorporates a signature analysis function, however, makes life that much easier for field service personnel who encounter μP-based products with SA provisions. This portion of the instrument has continuous signature and signature-hold modes, unstable signature indication and unstable signature-hold capability. It can accommodate TTL, MOS and CMOS logic.

The LA-1000 also offers a built-in μP-controlled autoranging DVOM, which operates independently of the instrument's other functions. AC/DC voltage and resistance measurements appear on a 3½-digit LED display. After the user selects the desired function and connects the LA-1000 to the circuit under test, the DVOM's processor automatically moves to the proper range, thus ensuring maximum resolution. DC accuracy is 0.1 percent, best AC accuracy is 0.5 percent, and resistances can be measured to ±0.3 percent. All the DVOM functions have overload protection.

Because of the need to perform clock and RF frequency measurements on μP-based systems, the LA-1000 supplies an autoranging frequency counter. Frequencies to 25 MHz are displayed on a 6-digit LED readout, and may be autoranged or measured with fixed resolution in the 1 sec mode. For convenience, the frequency counter input comes through the accompanying SP-1 probe's data input channel.

According to the manufacturer, the LA-1000 provides so many features that when combined with a portable scope, it rivals the capabilities of the average engineering bench. And its multifunction versatility should make it useful for many in-plant applications, too.

Data Precision Div., Analogic Corp., Electronics Ave., Danvers, MA 01923. (617) 246-1600. **Circle 372**

B&K-Precision/Dynascan, 6460 Cortland Ave., Chicago, IL 60635. (800)621-4627. In Illinois, call (312)889-9087. **Circle 373**

4½-Digit Multimeters Feature Built-in Counter, HV Measurement

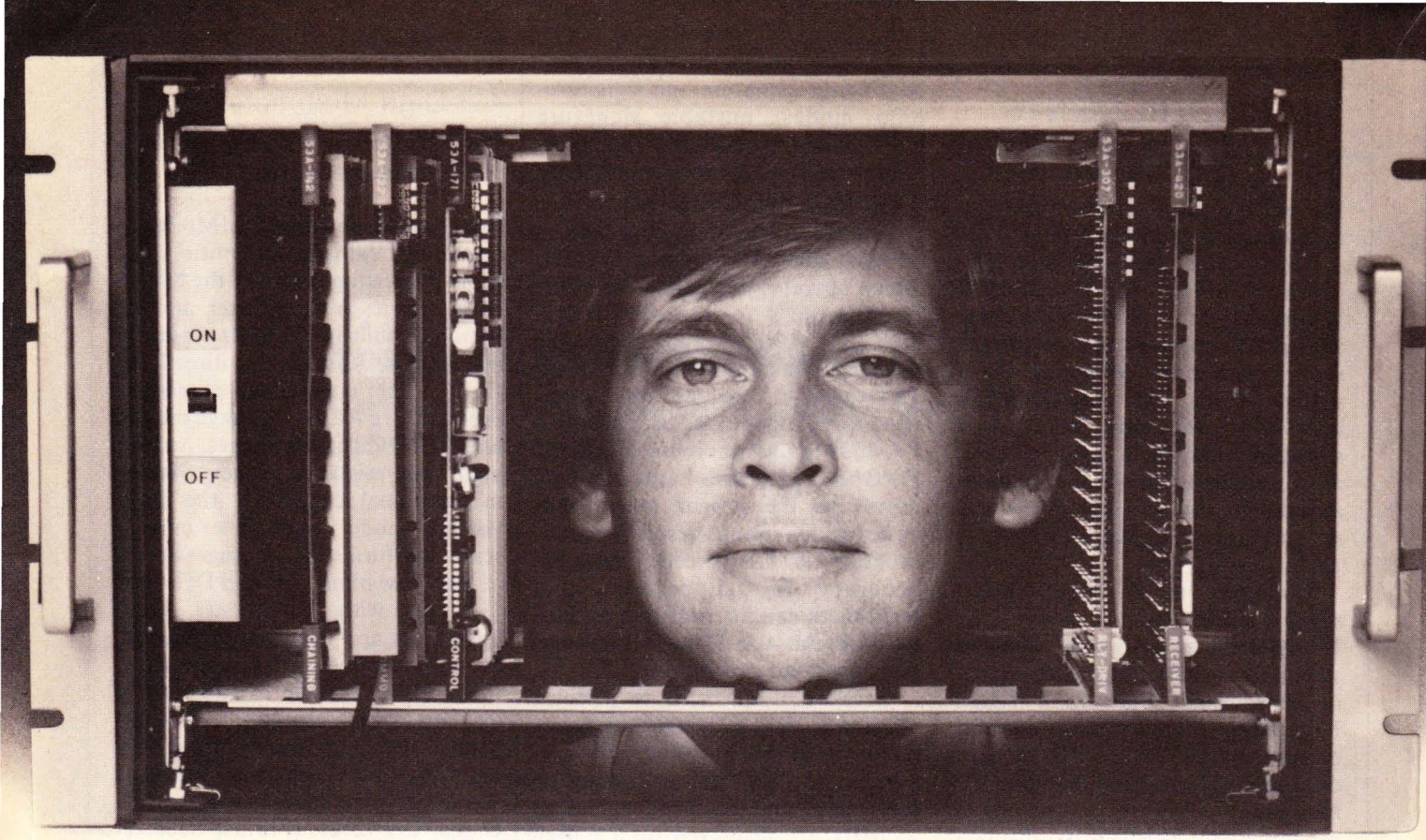
Two battery-powered DMMs introduced by Valhalla Scientific offer some interesting "extras": the Model 4440 marries a multimeter and an optional built-in 20 MHz counter, while the 4450 measures directly to 15 kV. The meter/counter combo provides five AC/DC voltage ranges, five AC/DC current ranges, and six high/low resistance ranges. Similar in functional capability, the high-voltage model omits the current scales but furnishes six ranges apiece of high/low ohms, AC and DC volts.

Along with 1,000 mΩ input impedance and wideband, low noise, average responding AC converters, the DMMs provide 4½-digit LED displays with resolution of 0.005 percent. Basic DC accuracy for both units is ±0.5 percent. Valhalla Scientific, Inc., 7576 Trade St., San Diego, CA 92121. (714)578-8280. **Circle 272**

Phasemeter Handles Square or Sine Waves to 1 MHz

Covering a frequency range between 10 Hz and 1 MHz with 0.5° accuracy and 0.1° resolution, Krohn-Hite's Model 6200A digital phasemeter accepts sine or square wave inputs. The meter's 0.1 V-120 V RMS input voltage range enables making measurements with greater than 60 dB dynamic range between the two input levels. Measured phase angle results appear on a 3½-digit planar gas discharge display, over a continuous range of -180.0° to +180.0°. To make a phase measurement, the operator simply connects the reference and unknown signals to their respective inputs and observes the readout.

The Model 6200A also provides an analog output equal to 10 mV per degree phase for use with an external meter or strip-chart recorder. A BCD output is available as an option. Krohn-Hite Corp., Avon Industrial Park, Bodwell St., Avon, MA 02322. (617)580-1660. **Circle 200**



TWO SMART SYSTEMS.

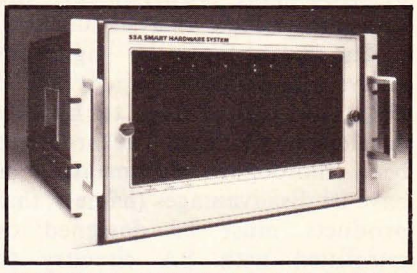
You and the Smart Hardware™ System from CDS. A time and cost saving combination for ATE systems development.

The CDS Smart Hardware System™ can help you reduce both the time and the costs associated with user-developed hardware interfaces and software drivers in an extensive range of ATE applications. The rack-mountable, completely interfaced 53A card cage houses a family of function-intensive, programmable plug-in cards that provide a full complement of digital data coupling, analog measurement/stimulus, and switching and scanning functions. Controlled with either our built-in BASIC language controller or your external computer or calculator, the 53A unit lets you move from an ATE concept to a completed working system with greater speed, increased economy, and lower space requirements than the bench top instruments required for comparable operations.

But even the smartest hardware system needs an intelligent human touch. That's where you and your design capabilities come in. Because of its building block flexibility, you can configure the 53A system to meet specific testing requirements, then change or expand it according to product needs. The plug-in cards can be assembled in any desired combination without costly custom interfacing, while additional card cages can be added on when you need them. That means you never pay for more system than you want at any given time.

When you come up against ATE, process control or data acquisition problems, consider the cost and performance advantages of the 53A modular plug-together system. Two smart systems working together can go a long way.

For more information, including a detailed application guide, please contact CDS at the address below.



BUILDING SMART SINCE 1973

CDS®

3301 W. Hampden Ave., Unit C
Englewood, Colorado 80110
(303)762-1640
TWX 910-933-0193

FOR MORE INFORMATION, CIRCLE 19

TEST INSTRUMENTS

All-in-one Fiber Optics Measurement System

To evaluate core diameter, cladding, thickness and other fiber optics parameters for QC and production testing, the Vickers Mark Two linear micromeasurement system uses a patented image shearing technique. Two images of the fiber you're examining are sheared across each other and set at the point where their edges begin to fuse together; after this setting is established, the system's direct dimensional readout processes an electrical signal representing the amount of attained shear and displays the measurement value digitally in inches or metric units. You can also rotate the image of the fiber to analyze discrepancies in concentricity and ellipticity.

The complete system, which can perform repeatable measurements down to 0.01 μ on step index fibers and 0.1 μ on graded index fibers, consists of a research microscope with optics and accessories, the image shearing and readout units, and either a binocular or trinocular viewing head with CCTV monitor. Vickers Instruments, Box 99, Malden, MA 02148. (617)324-0350.

Circle 211

Modular Power Supply Gives 12 Output Combinations

General Electric's SwitchMod kit contains everything required to configure a multiple output open frame switching power supply into 12 different combinations of output voltages and currents. The heart of the kit is a 300 W "chassis" (heatsink and board) with a 5 VDC main channel (30 A maximum). To obtain the switcher output you need, you insert auxiliary output cells into prewired board sockets. SwitchMod cells are available in these outputs: ±12 VDC @ 4 A each, ±15 VDC @ 3 A each, -5 VDC @ 2 A, and ±24 VDC @ 2 A each. General Electric Co., Power Supply Operation, P.O. Box 1701, Fort Wayne, IN 46801. (800)348-1770.

Circle 265

MPU-Based Analyzer Measures Solar Cell Characteristics

Built around a μP-controlled electronic load, the Model 100 analyzer from Metronix automatically measures, displays, and records current and voltage characteristics of solar cells. After you attach the solar cells to the Model 100 in a four-probe configuration, the instrument obtains a true short circuit current reading by back-biasing its load to compensate for voltage drops resulting from lead and contact resistances. The load is then ramped in programmed steps, and measured currents and voltages are stored until the zero-current point is reached. Along with the short circuit current value, the analyzer stores and displays open circuit voltage, maximum power, fill factor, current and voltage at the maximum power point, voltage at any preselected current, and current at any preselected voltage. Using the optional X-Y recorder outputs, you can graphically record complete illuminated current/voltage curves for the cells you're testing.

The standard Model 100 has two current ranges and can measure solar cells with short circuit currents up to 2 A. Other available versions offer four current ranges and current capacities to 6 A. Metronix, P.O. Box 4886, Thousand Oaks, CA 91359. (805)496-0544. **Circle 209**

Instrument Lets Voltmeters Check Low Resistances

When Alpha Components' Model RX-2 LOHMETER is plugged into a digital or analog voltmeter, it enables measuring resistances from 100 Ω to 0.001 Ω within the accuracy of the meter used. The solid-state instrument, which employs the four-wire principle, operates from 120 VAC line power; units for 240 VAC service are also available. Two LEDs hooked up to the selector switch indicate the appropriate range. Applications include production and tolerance testing of windings and contact resistances. Alpha Components Corp., 115 Eucalyptus Dr., P.O. Box 306, El Segundo, CA 90245. (213)322-7780. **Circle 266**

DMM Has Analog/Digital Display

A combination analog/digital LCD readout, differential (plus or minus) peak-holding capability, and fast pulse detection and indication all give the Model 467 hand-portable DMM from Simpson the ability to handle pulsating as well as steady signals. In its differential peak mode, the 3½-digit instrument can make percent modulation and signal tracing measurements. The pulse detection mode provides visual and/or audible indication of pulse presence and logic states.

Other standard features include 26 AC/DC voltage, current and resistance ranges; 0.1 percent basic accuracy; visual/audible continuity checking capability; and double fusing and high-voltage transient protection. The "cordless" DMM reportedly operates for a year on one 9 V alkaline battery, and its design meets the UL 1244 standard for safety of electronic test equipment. Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120. (312)697-2260. **Circle 275**

IEEE 488

What price safety –

With an IEEE 488 compatible hipot tester?

Hi-pot (dielectric withstand) testing and ground continuity testing are now required as standard production-line procedures by Underwriters Laboratories and several international regulatory agencies. ROD-L hi-pot testers provide **Safe, Fast, Efficient,** and **Reliable** ways to perform these important safety tests in production or R&D environments.

Designed for Safety

Front-panel plug receptacle design and various safety interlocks remove the user from direct exposure to high voltage while performing hi-pot tests. Our hi-pot testers themselves are UL Listed — **the only UL Listed hi-pot testers now available.** They are designed to protect both the operator and the device under test.

Designed for Speed

Completely programmable, ROD-L hi-pot testers provide features customized for your production test environment. Each hi-pot tester (we have several models to choose from) performs the required test with the push of a button. Everything else is automatic. Or, if you choose, you may remotely control our testers with a TTL signal, you can even put them on the **IEEE 488 Bus.**

Designed for Efficiency

ROD-L makes testing simple by designing equipment which does the complex work. **Devices which fail can be re-worked** rather than junked **because catastrophic failure is avoided.** And because they simultaneously perform hi-pot and ground continuity tests, your finished goods testing is faster and more thorough.

Reliability?

Ask the users at any of our client companies, including:

- **General Electric**
- **Hewlett-Packard**
- **Honeywell**
- **TRW**
- **IBM**
- **ROLM**
- **Digital Equipment Corporation**
- **Tektronix**
- **John Fluke**
- **NCR Corporation**
- **Xerox**

Safety has no price. It has great value. You'll want our product literature if you are making UL Listed products, or are subject to local or international safety standards. Write or phone today. 1185 O'Brien Drive, Menlo Park, CA 94025. (415) 327-5380.

ROD-L ELECTRONICS, INC.

"If you want (UL), you need ROD-L."

CPS CONSUMER PRODUCT SAFETY AWARD WINNER 1980 PRESENTED BY PROFESSIONAL INSURANCE AGENTS

FOR MORE INFORMATION, CIRCLE 50

Nonintrusive GPIB Analyzer Stores 40 Bus States

Designed for debugging and trouble-shooting applications software in GPIB-based systems, Racal-Dana's Model 488 bus analyzer operates nonintrusively to keep errors to a minimum. In addition, the hand-held instrument runs off four 1.5 V batteries, so ground loops and power line noise do not disturb system operation.

Three operating modes are available. In Passive mode, the Model 488 monitors bus activity and displays the status of each active line on an LCD readout. The Trace mode allows normal bus activity and activates the analyzer's 40-word memory; after capturing 40 transactions, you can examine previous bus activity on a handshake-by-handshake basis. Single-Step operation allows the analyzer to control the bus handshake, stepping each activity byte by byte.

Like a logic analyzer, the Model 488 has trigger condition controls that allow you to establish "trigger words" using the DIO, ATN, SRQ and EOI lines. When the instrument is in its Single-Step mode, the GPIB system can run at full speed until a trigger condition is detected, and then be single-stepped from that point in the program. With the "trigger word" placed at any point in memory during Trace mode operation, you can capture and recall data that occurred before, after or around the trigger conditions. Racal-Dana Instruments, Inc., 18912 Von Karman Ave., P.O. Box C-19541, Irvine, CA 92713. (714)833-1234.

Circle 273

Hand-held DMM Takes Hard Knocks

Waterproof and dustproof, the HD-100 3½-digit multimeter holds its own under rigorous field conditions. The DMM's double-thick ABS plastic case is fire retardant and can withstand the impact of accidental drops; its internal electronics, including the LCD readout and 9 V battery, are shock mounted to prevent impact damage. Input protection extends to 1,500 VDC or 1,000 V RMS on the 10 voltage ranges, to 2 A/250 V on the 9 current ranges, and to 500 VDC on the 7 resistance scales.

Along with traditional DMM measurement functions, the HD-100 provides a quick visual continuity test capability called Insta-Ohms™. In any resistance range, an ohms symbol (Ω) appears on the readout when continuity is detected. A diode test function is also available. Beckman Instruments, Inc., Electro-Products/Helipot Group, 2500 Harbor Blvd., Fullerton, CA 92634. (714)993-8803. **Circle 271**

LCR Meter Displays Component Values in Full

To reduce operator error, Wayne Kerr's B424/CA4 LCR meter provides a direct readout of component values, in addition to signal lights for passed or failed components. A liquid crystal display on the front panel of the meter shows each value in full, with the decimal point in proper position and units indicated. If the meter decides that range changing would produce better resolution, it flashes small pointers on the display, prompting the operator to switch to a higher or lower range. The B424/CA4 automatically chooses the correct frequency and amplitude for each application and employs both parallel and series measurements. A polarizing potential is available for electrolytic capacitors, and built-in protection guards against charged capacitors. Wayne Kerr Rendar, Durban Rd., Bognor Regis, West Sussex, PO22 9RL, England. **Circle 201**

Rugged Field Service Scope Goes to 25 MHz

Weighing in at 4 lb., 10 oz. and housed in a compact DMM-style case, Ballantine's Model 1024A dual-trace oscilloscope is geared specifically toward field service work. The portable "miniscope" runs with less than a 9°C rise in ambients from 0° to 50°C, and reportedly operates reliably in hostile environments and at altitudes to 10,000 ft.

With a 25 MHz bandwidth in each of its two vertical input channels, the 1024A readily handles fast signals. The passive delay line permits display of the leading edge of fast rise time signals and pulses when operating in the internal trigger mode.

To simplify field use, the 1024A can operate from any 10-22 VDC source, and may also be powered by battery packs, plugged into automobile cigarette lighters, or run from boat or aircraft supplies. Ballantine Laboratories, Inc., P.O. Box 97, Boonton, NJ 07005. (201)335-0900. **Circle 261**

Timer/Counter Measures Frequency, Period to 80 MHz

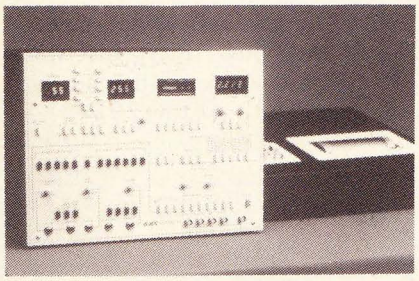
Realizing that counters "take" to MPU-based automation like a duck to water, manufacturers are bringing out more and more of these talented instruments. Triplett's entry is the Model 7000, a universal counter/timer that evaluates both input signal frequency and period to 80 MHz, performs event counting to 1 billion, and measures elapsed time from 100 μsec to 100 hours—all for a base price of $300.

Users manipulate the instrument's single front-panel control to select any of the six functions provided. A selectable X1 and X10 attenuator operates over the dynamic range of the input to minimize the signal noise level and maximize the signal amplitude for counting. Measurements appear on a 6-digit LED readout with annunciators that automatically indicate proper levels of Hz/msec, K/μ or M/n. The Model 7000 also has a built-in self-test function.

For tenfold improvement in temperature stability over a 0 to 40 range, a temperature compensated crystal oscillator is available as an option. Triplett Corp., Bluffton, OH 45817. (419)358-5015. **Circle 264**

Audio Spectrograph Marries Spectrum Analyzer and Oscillograph

Spanning the audio range from DC to 16 kHz, Kay Elemetrics' Digital Sonograph™ merges spectrum analyzer features with a 3-D display, a grey scale printer, and an oscillograph. By manipulating the



instrument's various display modes and filter bandwidths, you can evaluate up to 2.56 sec of signal—recorded in a 64K word X 10 bit memory—at 8 kHz, or up to 41 secs at 500 Hz. Memory address readouts, which correspond to reference points on a 3-D print of frequency vs. time vs. amplitude, help eliminate triggering problems during power spectrum analysis; you can set these readouts to view important transitions on a scope, if desired. The Sonograph can display and print as little as 6 msec of any portion of the time domain signal. A complete package includes the analyzer (model 7800), five filters, an audio monitor, and the firm's model 7900 printer. Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058. (201)227-2000. **Circle 208**

DMM Measures Capacitance, True RMS, dB

Accurate to 0.5 percent, the MA 5D 4½-digit multimeter from BBC-Metrawatt/Goerz provides capacitance, dB and true RMS measurement capability; it can also handle conventional DMM jobs, including current measurement to 20 A. Standard features include overload protection, universal input terminals, and AC or battery operation. BBC-Metrawatt/Goerz, 165 Fieldcrest Ave. Raritan Center, Edison, NJ 08837. (201)225-4414. **Circle 210**

Digital V/A/W Meter Maintains Same Accuracy for AC and DC

Accurate to 0.25 percent, the Model 259 digital V/A/W meter from Clarke-Hess yields true RMS, waveshape-independent readings of current, voltage and power from DC through 100 kHz. The DC-coupled instrument provides equivalent DC and AC accuracies, so you can use it to transfer a DC voltage or current standard into the AC region.

Current scales include 5, 50, 500, and 5,000 MA ranges; voltage scales are 20, 200, and 1,000 V. With external transformers or broadcast shunts, you can extend the current ranges to 800 A, AC or DC. In addition, a calibrated POWER X10 range combines with the unit's 12 normal power scales to provide 24 combinations from 10.00 mW to 5,000 W.

Optional IEEE 488 and BCD/remote control interfaces are available. Clarke-Hess Communication Research Corp., 156 Fifth Ave., NY 10010. (212)255-2940. **Circle 269**

Controller Is a Fast Talker

Ziatech has introduced the ZT 85/38 GPIB controller for the MULTIBUS family of microcomputers to transfer data to other computers, peripherals or instruments at rates up to 250 kbytes/sec. According to the manufacturer, the GPIB, though traditionally an instrument bus, has replaced RS-232C as a local computer-to-computer connection.

The ZT 85/38 has complete talker, listener and controller capabilities for the GPIB. With high data rates achieved through on-board DMA transfer to the controller's dual-port RAM, the memory can be accessed from the MULTIBUS as either words or bytes, allowing the board to work the 8086-, 8085- or Z8000-based SBCs. Driver software in Intel 8085 assembly code on diskettes facilitates system programming. CP/M and ISIS formats are also available. Ziatech Corp., 2410 Broad St., San Luis Obispo, CA 93401. (805)544-9011. **Circle 322**

Interface Furnishes 488 Bus Control of Analog Instruments

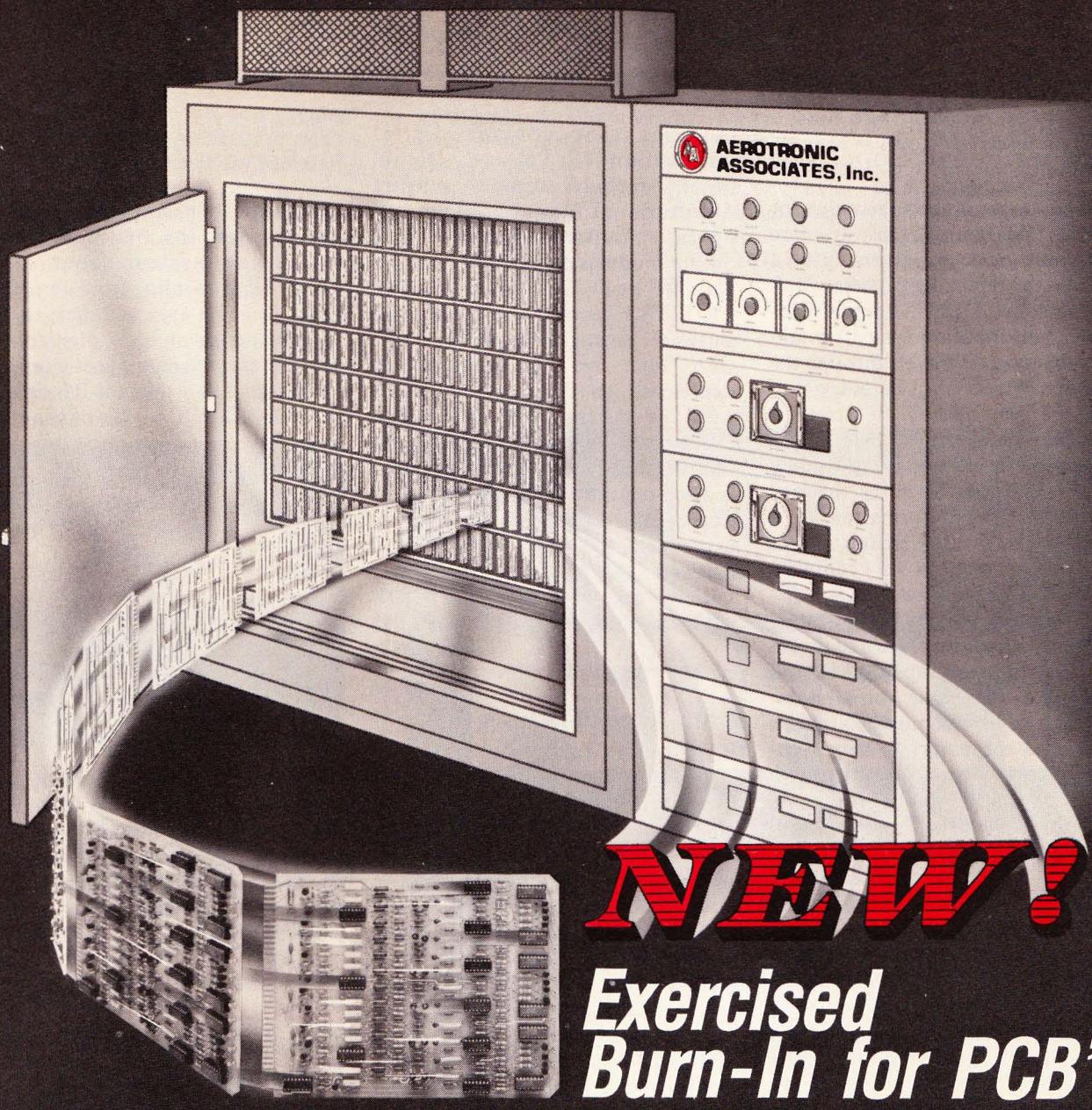
The Model 4871 from ICS Electronics uses IEEE 488 bus-controlled DC analog outputs to interface power supplies, X-Y plotters, strip-chart recorders or any analog-input device. The 4871 operates as a listener or talker, with most functions programmable. Four analog-output channels provide three separate selectable output-signal ranges per channel: 0 to +10 V, -10 to +10 V, or -4 to -20 mA. To create a low-noise environment for system applications, the analog output channels are isolated from the IEEE 488 bus itself as well as from the 4871's internal logic.

Along with a self-test upon turn-on, the 4871 features three modes of automatic calibration. Four auxiliary relays supply on/off control for plotter pen positioning and chart recorder motors, as well as

control for auxiliary devices powered from the bus. ICS Electronics Corp., 1620 Zanker Rd., San Jose, CA 95112. (408)298-4844. **Circle 324**

Catalog Covers Switches and Interfaces

Giltronix, has a new short form catalog that lists over 20 product types. The catalog also details several applications for the company's manual, remote control and automatic interconnect units, which are used with RS-232 instrumentation. Giltronix, Inc., 450 San Antonio Ave., Palo Alto, CA 94306. (415) 493-1300. **Circle 326**



NEW!

Exercised Burn-In for PCB's

From Aerotronic Associates, where innovative systems engineering is helping to solve today's electronic reliability problems, comes the *SERIES 240* — industry's first "turnkey" line of Burn-In and Temperature Cycling Systems for Printed Circuit Boards!

The *SERIES 240* offers the ultimate in user flexibility. So complete is our design that you can configure your own turnkey system. Why? Because the *SERIES 240* is made up from pre-engineered "building blocks". Simply begin by selecting one of our steady-state high temperature burn-in chambers or one of several temperature cycling models. Next, choose from a comprehensive shopping list of building blocks to outfit the chamber until you have tailored a *SERIES 240* to your specific needs.

What about this shopping list of building blocks? See for yourself:

- Fixturing for nearly all PCB sizes — even 18X18 inch!
- Through-the-wall interconnect densities from 16 to over 100 lines per PCB.
- Custom designed "carriers" for PCB's with complex interconnect designs.
- Analog and digital exercising during burn-in or temperature cycling.
- High current AC/DC power busses.
- Scanning systems for "at temperature" functional and parametric testing.
- Electronic monitoring and load circuitry.
- Electronic interfaces to major PCB testers.

Impressed? We'd be disappointed if you weren't because we've done all of the systems design for you. That's money in the bank! Improving your product reliability through PCB burn-in will save you much, much more!

For more details about the *SERIES 240* family of PCB Burn-In and Temperature Cycling Systems, simply circle the reader service card or call John Brooks at (603) 746-4631.

AEROTRONIC ASSOCIATES, Inc.
Contoocook, New Hampshire 03229
(603) 746-4631

FOR MORE INFORMATION, CIRCLE 9

Reporting System Manages Repair Depot

Keeping track of subassemblies or systems undergoing repair is often inefficient and paper-heavy. To improve the reporting process, Digital Datacom's DEMIS (depot management information system) monitors each job as it travels through the work and inspection cycle. A series of card readers, placed in strategic locations around the repair depot, follow a single card attached to each job. As the work progresses, the card readers transmit information to a central data base that creates master files and maintains a complete history of all repair activity.

The system keeps a file on work performed, labor involved and inventory used for each repair cycle, and develops a data base for all jobs. DEMIS can also communicate with mainframe computers to help coordinate repair depot activities with overall business data processing. System software helps the user to define the data base requirements, format the job card and create reports. Tailored to individual user's requirements, the system normally includes a CPU with 512K bytes of memory, a disk drive, video terminals, card readers and line printers. Digital Datacom, Inc., 27721 La Paz Rd., Laguna Niguel, CA 92677. (714)831-8470. **Circle 291**

Data System Controls and Manipulates

Like an octopus in the factory, the PROSYS I from the ADAC Corp. manipulates many tasks simultaneously; gathering, storing and processing data, controlling systems and producing reports. Based on a DEC LSI-11 computer, the data acquisition system can accept more than 20 digital and analog output modules that connect with any transducer or industrial control element.

Analog input modules include low and high level digitizers and thermocouple digitizers. For driving current loops, the system offers modules that convert digital information to voltage. Digital inputs include contact closure detectors, TTL receivers and optically isolated inputs. Digital output modules provide latched high current and TTL level signals. PROSYS I has an English-language software package that allows users with little or no programming experience to easily communicate with the system. Written for data acquisition, process control and industrial automation, the software is a self-contained package that does not require auxilliary storage, assemblers, loaders or supplemental software. ADAC Corp., 70 Tower Office Park, Woburn, MA 01801. (617)935-6668. **Circle 295**

Data Analyzer Runs Parallel to Testing

Combined with a wafer process test system, the LOMAC Data Center processes information in parallel with testing. Operating in the foreground/background mode, the Data Center offers program development, data acquisition and storage on user-defined media. At the same time that an operator runs wafer evaluations at the test head, the Data Center reduces, analyzes and displays data. In addition to parallel testing and data analysis, the system can serve as a test program generator.

The Data Center comes with either a DEC PDP-11/03 or PDP-11/23 processor and a variety of field installed peripherals. LOMAC Corp., 3052 Orchard Dr., San Jose, CA 95134. (408)946-6770. **Circle 297**

Sampler Acquires Data for Remote Processing

Designed for data gathering at remote sites, the Series 300 data acquisition system from Data Control can monitor from 16 to 224 channels. The system takes 16,000 samples per second and digitizes the data for storage on magnetic tape or for transmission over an RF link or land-line cable. Constructed

modularly, the Series 300 has digital encoders and decoders for low frequency data and FM analog encoders for frequencies up to 20 kHz. Data Control Systems, P.O. Box 860, Danbury, CT 06810. (203)743-9241. **Circle 296**

Correlator Cites Differences in Color

Color graphics highlight the analysis of data gathered by the Malvern M2000 correlator during particle sizing, polymer characterization and flow measurements. Programmable in BASIC, FORTRAN or ASSEMBLER languages, the M2000 measures the similarity between two fluctuating analog or digital signals over as many as 1,096 channels. Data gathering can occur in real time over 72 channels and information processed in parallel to make sample times as short as 100 nsec. The correlator also provides autocorrelation, cross-correlation, pulse counting, multichannel scaling and probability analyses. Malvern Scientific Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779. (516)558-4100. **Circle 290**

ATLAS Development System also Manages

At the same time that test program development is underway, CCI's EMAP (Environment for Managing ATLAS Programs) collects data, supervises scheduling and makes plans for future resource utilization. A multiuser system, EMAP provides eight test engineers with ATLAS subsets and development tools, including program and diagnostic editors, compilers and program verifiers. Management information software collects statistics on all phases of the development process and automatically updates schedules upon completion of tasks.

Before moving the test program to the ATE, test engineers can use EMAP to verify ATLAS program syntax and schematics, check available ATE resources and confirm the proper execution of the program. Since the system provides a template function for the proper use of syntax and schematics, minimal programming skills are required. EMAP has, in addition, an electronic mail system for internal communication among the test program development team. Computer Consoles, Inc., 1212 Pittsford-Victor Rd., Pittsford, NY 14534. (716)248-8200. **Circle 289**

Batteries Power 100 Channel Logger

Powered by rechargeable batteries and contained in a weather-resistant case, the Crodata M1600L datalogger serves field applications by recording and playing back data with a single tape transport system. The datalogger accepts up to 100 channels of mixed digital or analog inputs, and scans as quickly as every 20 msec. or as slowly as every 99 min. A liquid crystal display, useful for calibration or for monitoring inputs during long scanning sequences, displays any single input channel. A dual 256 byte memory serves as a data buffer between the control electronics and the tape transport. Optional interface cards allow the M1600L to communicate with computers, printers, calculators or other data processing equipment. Crodata Corp., 255 Bear Hill Rd., Waltham, MA 02154. (617)890-0145. **Circle 292**

We Can Take A Hint

Test & Measurement World *wants to learn about unusual uses of unlikely equipment. A future column will be devoted to the inventive solutions that readers have found for their T&M problems—whether the equipment is custom-engineered, simply used in a new way or adopted from another industry. Send us a brief note describing your hint. All contributors whose tips are printed will be given full credit. Clever prizes awarded.*

T&M Hints
Interfield Publishing Company, Inc.
215 Brighton Ave.
Boston, MA 02134

Endpoint Monitors Detect Plasma Process Optical Emissions

Plasma etching is well accepted on the semiconductor fabrication line due to its ability to etch fine lines and adapt easily to automation. But knowing when to stop the plasma process is a problem without a single solution. One method of detecting the endpoint of the process is emission spectroscopy—using the spectrum emitted from the plasma discharge to reveal changes in the etch rate. Operating on this principle are two monitors—one from UTI, the other from Front End Processes—used to detect the endpoints of such operations as plasma etching, ion milling, reactive ion etching and sputter etching.

UTI Model 1101 Endpoint Monitor

Both process monitors detect the plasma spectrum and quantitatively determine the relative proportions of the atoms, ions and molecules in the gas. To select a particular wavelength for observation, the units have monochrometers, which are adjustable for a single wavelength over a wide range; a user-selected optical filter is also available for the UTI monitor as an option. In both monitors, photomultiplier tubes transform optical information into electrical signals for data manipulation.

The Endpointer Model EP200M from Front End Processes (FEP) can observe any wavelength from 200 to 1,000 nm, selected with a resolution of 0.5 nm or better. This monitor uses a monochronometer with a 200 mm focal length concave holographic grating, which has a minimum bandpass of 0.2 nm. Users select the desired wavelength by rotating the grating, and the precise setting is displayed on an LED readout or printed on an optional strip-chart recorder.

Normally, the Endpointer is used to detect a single gas at partial pressure by monitoring the emission lines. But optional plasma sources offered by FEP make it possible to monitor high-vacuum or low-pressure lines leading to the plasma chamber as well. The signal produced by the monochrometer and photomultiplier tube can serve as a means of monitoring a reactant molecule or etch byproduct in real time. The selected endpoint, determined by a variation in intensity or rate of change, causes a relay to close, terminating the process.

UTI's Model 1101 operates on the same spectroscopic principle, but can also monitor two channels simultaneously to evaluate emissions from both the reactant and the product. Automatic calculations for difference and ratio between the two channels allow the instrument to accurately monitor endpoints.

The design of the unit's sensor permits the 1101 to collect and transmit optical information even when the window to the plasma process is coated with scattered material. A fiber optic link transmits the optical signals to an adjustable monochrometer or optical filter, and a photomultiplier converts the signal. The optical cable link can transmit wavelengths as small as 240 nm.

Along with menu programming to assist in setting up the proper system parameters, the μP-controlled instrument has a CRT and keyboard for displaying long- or short-term signal variations as they occur. A key lock prevents accidental changes, and a battery-powered memory backup stores programs almost indefinitely during system maintenance or power outages. The 1101 also provides two built-in programmable timers, remote control input and a flexible I/O interface system for direct control of accessories on the plasma system.

Front End Processes Endpointer

Front End Processes, Inc., 2912 Blystone, Dallas, TX 75220. (214)350-2482.

Circle 388

UTI, Inc., 325 N. Matilda Ave., Sunnyvale, CA 94086. (408)738-3301.

Circle 389

WAKEFIELD'S

Titan™

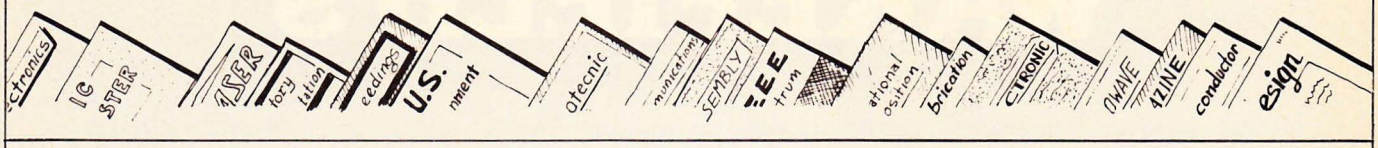
BURN-IN SYSTEMS

A NEW CONCEPT IN BURN-IN TECHNOLOGY

- Quality
- Versatility
- Advanced Electronics

EG&G WAKEFIELD SYSTEMS

34 AUDUBON ROAD, WAKEFIELD, MASS. 01880
TEL: (617) 245-5900 TWX: 710-348-0091
FOR MORE INFORMATION, CIRCLE 31



"Radio and TV Testing in the Digital Age" *BM/E—Broadcast Management and Engineering,* July 1981, p. 29, p. 37, p. 43

Today's sophisticated broadcast gear has spawned a host of test problems (and solutions) that differ markedly from those of even 10 years ago—and now is the time to beef up your skills and equipment to meet these challenges. That's the prevailing message of *BM/E*'s three-article series on test and measurement for the new broadcast technology.

In "Radio Testing: Some Ground Rules for the New Game," *BM/E* editors list the factors that are exerting the greatest influence on radio evaluation in the 1980s:

- Operating equipment is 10 times more refined than it was a decade ago, and thus dictates correspondingly refined test methods.
- Fierce competition in the radio market and the public's hunger for top-grade sound are forcing stations to exceed FCC minimum requirements.
- Expert engineering help is scarce, so testing must be highly efficient to make the best use of available personnel.
- Protecting a station owner's high capital investment (over $1 million in many cases) implies efficient operation and a first-class maintenance effort.

All audio testing requirements have been impacted by the new technology, but currently available equipment—scopes, spectrum analyzers, function generators, counters and specialized audio test instruments—can handle the most exacting jobs. Distortion testers, for instance, can measure levels so low that they were unknown 10 years ago.

The future of radio testing lies in checking digital equipment. Since the technology has not reached the point of standards for error correction or coding, this type of evaluation remains complex; users of digital broadcast equipment must rely on the manufacturer for maintenance and repair, usually via board replacement. However, troubleshooting—say, with a digital logic probe or fast scope—can prove beneficial once you know your way around the equipment.

Television is also in a state of flux, as evidenced by the article entitled "Test and Measurement in the Transition Plant." The modern television facility is a mixture of analog and digital equipment with different requirements for checking each type of performance. But problems go way beyond the issue of selecting the right hardware for a plant that's neither fish nor fowl. TV personnel cite such hassles as inability to get down to the component level to repair a digital product and lack of documentation, which manufacturers often withhold on proprietary grounds. In the long run, it turns out that there's plenty of equipment to analyze digital data, but figuring out what the data are supposed to be is often difficult.

Two approaches offer some hope. First digital TV equipment manufacturers can assist harried engineers by designing self-diagnostics into their products. Also, establishing design standards may solve many—though not all—of the test and measurement problems in TV plants.

To cap off the series, Tom Long echoes most of the preceding sentiments in "Test and Measurement: A Look at What Lies Ahead." Long, vice president and general manager of Tektronix's Communications Div., reviews some of the most crucial test and measurement requirements spurred by digital broadcast technology: measurement of IM distortion, digital modulation, incidental carrier phase modulation (for analysis of video sound), and delay/gain flatness frequency response in the 1-3 MHz range (for teletext applications).

The digital revolution is a two-way street. In addition to driving the technology that has irrevocably changed the broadcast industry's test and measurement practices, digital design is having a significant impact on communications test equipment. Instruments are getting smaller, programmable, more intelligent (not to mention more complex and expensive). But scopes and other familiar service instruments won't disappear entirely, either, since there's still a need for the kind of information they provide.

BM/E, 295 Madison Ave., New York, NY 10017.

"Air Force contract to Sperry division will set guidelines for ATE in the 1990s"

Electronics, Aug. 11, 1981, p. 42

After a three-year battle, Sperry Corp. has captured a $54.8 million four-year contract to develop the Air Force's Modular Automatic Test Equipment (MATE) program. The Air Force (still smarting from the GAO's denouncement of its F-15 ATE system early this year) views MATE as a hardware standard, rather than standard hardware: "It's a systematic approach to satisfying our ATE needs." As part of this new stance, MATE will give commercial suppliers a bigger slice of the procurement pie.

The MATE guidelines include: Air Force/contractor management procedures for ATE procurement, ATE hardware/software development criteria; a test program set describing how avionics test

software should be written, a crew guide on using ATE in the field, and descriptions of how avionics systems contractors can design their equipment for ATE testability. By the mid-1980s, MATE should be impacting almost all Air Force and avionics procurements. More important, the program will significantly affect avionics design and test in the coming decade.

Electronics, 1221 Avenue of the Americas, New York, NY 10020.

"Vacuum Operated Hg Probe for CV Plotting and Profiling"

Solid State Technology, Aug. 1981, p. 123

Since mercury is noninvasive and does not mar semiconductor surfaces, it looks like a promising replacement for aluminum contacts in four-point probe measurements. A mercury probe enables fabricating measured wafers into devices without having to remove aluminum dots, and leaves the wafers clean enough for further processing. Moreover, mercury probing techniques may prove highly suitable for resistivity and lifetime measurements. Albert Lederman's article describes the contact-producing mechanism in the vacuum operated mercury probe and then reviews its application in measurements of MOS, homogeneous and nonhomogeneous wafers, and the semiconducting layers of insulating substrates.

Solid State Technology, 14 Vanderventer Ave., Port Washington, NY 11050.

"DC Characteristics Aid Dual-Gate FET Analysis"

MicroWaves, July 1981, p. 71

Authors Christos Tsironis and Roman Meirerer outline a technique in which a versatile new design parameter, the bidimensional DC transfer characteristic, helps define the exact internal bias conditions—and thus the degree of saturation—of each half of a dual-gate FET. Using the simple DC measurements described in the article, you can construct a nomogram that sheds light on dual-gate GaAs FET behavior.

MicroWaves, 50 Essex St., Rochelle Park, NJ 07662.

In upcoming issues of
Test & Measurement World

How mergers and acquisitions change the face of the test and measurement industry.

Can test equipment keep up with the latest developments in fiber optics?

The move toward total factory automation—from process production to production test.

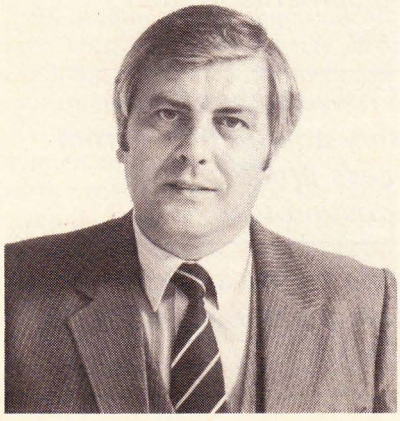
Should OEMs still consider bubble memories in a total test plan?

RINGING IN THE SERVICE DECADE

by Ron Mewett, Marketing Manager,
General Test & Service Div., John Fluke Mfg. Co., Inc., Everett, WA

The effects of the microprocessor revolution have been extensively documented, lauded and bemoaned, but no one can deny that large-scale integration has irrevocably changed the world of electronics. So much so, in fact, that electronics personnel probably think of the 1970s as the Microprocessor Decade rather than the "Me" Decade.

Microprocessors are turning up in every imaginable item: washing machines, pinball machines, cash registers, photocopiers. In the past, these machines were mechanical monsters that broke down frequently but proved easy to service. While microelectronic design has enhanced the reliablility of such equipment, it's also created a service nightmare, especially since many of the people engaged in fixing μP-based products were responsible for troubleshooting the older mechanical gear as well. Asynchronous signals and bidirectional buses that control a number of different components have made fault isolation a hellish process for these mechanically oriented engineers; along with screwdrivers and hammers, their basic tool kits now contain logic analyzers and emulators that require a high level of technical expertise to operate. And new service personnel who are already familiar with μP technology are hard to come by.



To overcome these problems, a whole new service philosophy has evolved: board swapping. Today's service engineers make their calls armed with a host of replacement modules, and exchange good boards for bad until the system is up and running again. In some cases, a service rep will exchange the entire unit to get the customer's equipment back on the air as quickly as possible. This approach is certainly the fastest, and it leaves the customer very satisfied. But consider the expense of maintaining an inventory of replacement modules or equipment: It's estimated that $9 *billion* worth of inventory is lying fallow in engineers' cars, UPS trucks or depots throughout the world. The irony is that 70 percent of this inventory is perfectly operational! However, it spends its life shunting back and forth between service site and factory, where it ties up valuable production time in the test department.

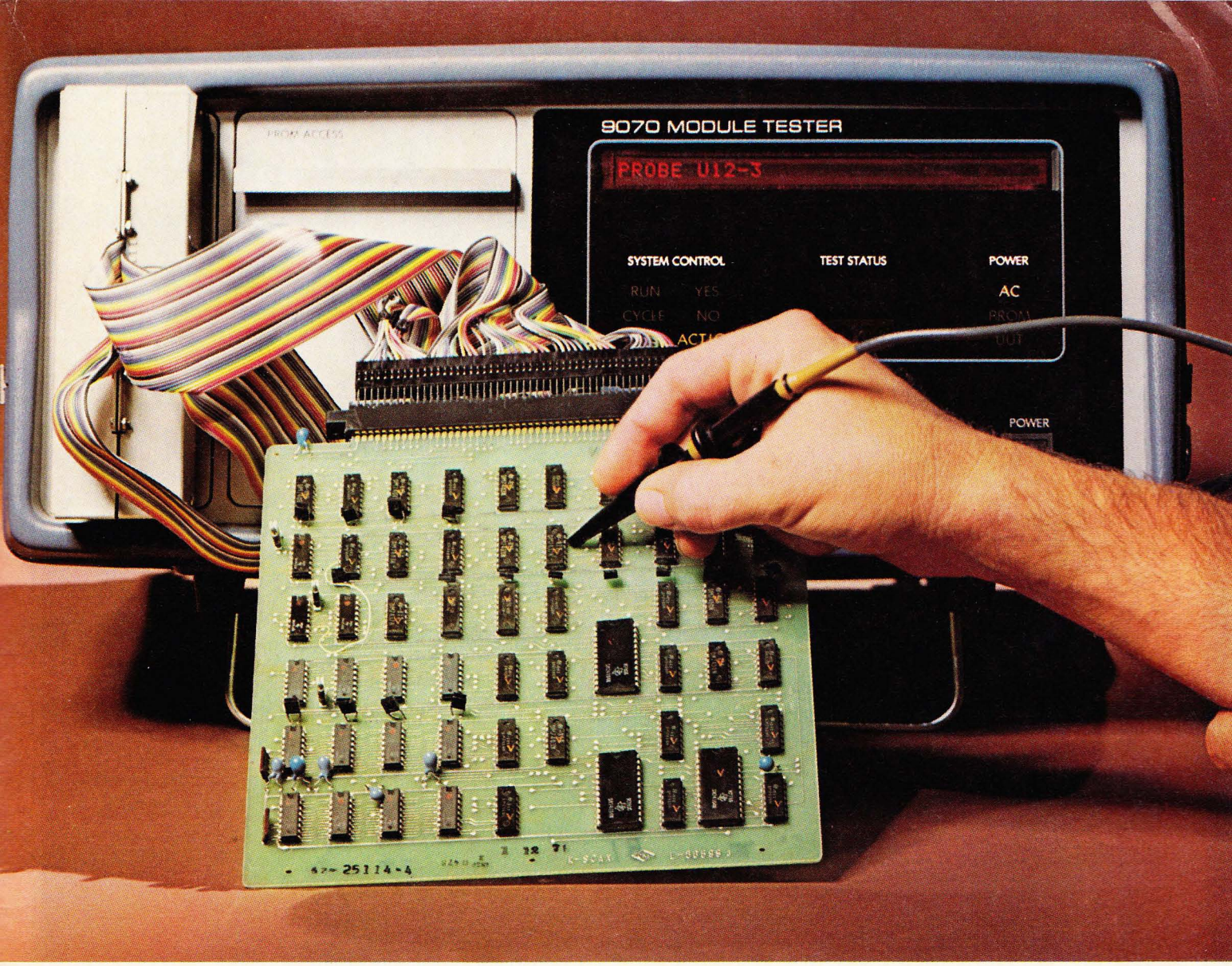
Furthermore, board swapping is only a temporary panacea for the common problem of bad or intermittent connections. Plugging in a new board may clean a dirty connection, but a few days later the system might fail again. Result: an unhappy customer and another expensive service call.

It's obvious that board swap is not enough. Finding alternatives has become a compelling issue over the last few years. In response to the service crunch, a new breed of portable test instrumentation has been developed—equipment aimed expressly at troubleshooting μP-based systems in the field. Moreover, system manufacturers are incorporating diagnostic capability into their products and opening depots to bring service closer to the customer, thus eliminating the expense of returning equipment to the production line.

Education may really be the long-range solution, though. Educational institutions now include μP/μC troubleshooting courses in their curricula to familiarize present and future field service personnel with μP systems and available test equipment. And electronics publications like *Test & Measurement World* are beginning to zero in on the serious and far-reaching problems of servicing today's complex electronic products.

We're off to a good start, but so much remains to be done. If we really get a grip on these issues, the 1980s may someday be known as the Service Decade.

Test & Measurement World *agrees with Ron Mewett that field service is one of the greatest challenges facing the electronics industry today. In this column, we hope to provide a forum that will address the needs and concerns of the service industry. If there's a topic you'd like us to cover in future issues, write to Carmen Wiseman, View from the Field,* Test & Measurement World, *215 Brighton Ave., Boston, MA 02134.*



If there is a PCB fault to be found, the Bendix 9070 will tell you where.

See the instruction..."PROBE U12-3" ...on the easy to read, 32 character display panel. That's *really* guiding the probe.

If U12-3 checks out okay, the operator will be told what node to check next, and next, and next until the fault is isolated.

Of course, it's what's on the other end of the guided probe that makes the system work. It's the Bendix 9070 module tester. The guided probe is just one of many features of this highly sophisticated, microprocessor controlled tester. In its basic configuration, the 9070 is a self-contained GO/NOGO functional tester. With the additions of options like the guided probe, it can expand to handle whatever functions you require. And, the options and peripherals are all plug-in.

What about test programs?
No problem. If you have existing programs, they can be translated for the 9070. If you have to write new programs, you can do it on line. Either way, it's a simple, straightforward procedure.

The Bendix 9070. The go anywhere, do anything ATE. Find out what the 9070 can do for you...call or write:

Joe Beninger,
The Bendix Corporation
Test Systems Division
Teterboro, New Jersey 07608
201-288-2000, Extension 1266

Patent No. 4,108,358

We speak total testing

Bendix

FOR MORE INFORMATION, CIRCLE 18

Senate to Rule on Ban

Hidden Payback of Defense Contractors' Lobbying Costs Questioned

Members of a Senate subcommittee will soon introduce legislation to prevent defense contractors from rolling their lobbying costs into existing contracts. The proposal would immediately affect large contractors like Rockwell International and General Dynamics and indirectly touch subcontractors and smaller companies not maintaining offices in Washington, DC. The major companies' liaisons, seen as vital and legitimate by both sides, gather information to keep the home offices enlightened about Congressional doings that influence their industry. But when the passive role of reporter turns into the active one of aggressive lobbyist to further a company's causes, the expense of such an activity becomes a public issue — especially when tax dollars are paying for it.

For electronics companies bidding on test equipment orders or R&D proposals, the passage of this legislation would not completely equalize the clout wielded by big and small companies in the fight over defense contracts. But while it is unlikely that any large contractors would decamp from Washington, they would be forced to pay for these offices under the same principles that a 30-person company on the West Coast must follow. Whether tiny or multinational, a company must include sales expense as another aspect of overhead, which is recouped by figuring it into a bid. Along with clout, price quotes may be equalized a bit also.

Since the mid-'70s, when the Defense Contract Audit Agency (DCAA) examined the activities of several contractors' Washington offices, the Department of Defense (DOD) has been wrestling with an embarrassing problem that it tried to keep an internal matter. The DCAA ruled on the inappropriateness of charging such expenses against existing contracts, but could cite no specific regulation that had been violated. In 1980, the DOD shrugged. It reasoned that if the Defense Acquisition Regulation Counsel (DARC) could not satisfactorily define lobbying, DOD could not make a rule prohibiting contractors from lumping lobbying costs into current contracts.

Until 1980, the audits had not been aired before the public. Common Cause, the Washington consumer group, won a court ruling to force the DOD to release the findings, which were eventually published in the organization's magazine.

Coasting on the attention created by the article and ruling, Senator David Pryor (D, AK) and his subcommittee staff have been drafting legislation to respond to these findings. A critic of the symbiotic relationship between contractors and the DOD, Pryor has repeated many earlier criticisms of the suppliers' power over military policy. Notably, President Eisenhower during his farewell address 20 years ago warned of the entrenchment of the military/industrial complex in government and economic affairs.

Doug McDaniel, minority counsel to the Subcommittee on Civil Service, Post Office and General

Ostby & Barton's New FF8100 Test Heads

Restate the Art of Fixturing!

Debugging operations are more efficient with O&B's new FF8100 Test Heads for Fairchild In-Circuit ATE. The FF8100 *hinges* open from the base plate to allow easy access to the receptacles, even during vacuum actuation. Wire wrap pins on the contact panel are also accessible.

The FF8100 is the sturdiest test head on the market. Precision engineered for low vacuum pressure requirements, the test heads use full ¼" stripper plates to protect probes. Heavy duty guide pins insure accurate alignment, time after time. And, the FF8100 features probes with long stroke and uniform spring pressure required for positive contact with uneven PCB surfaces.

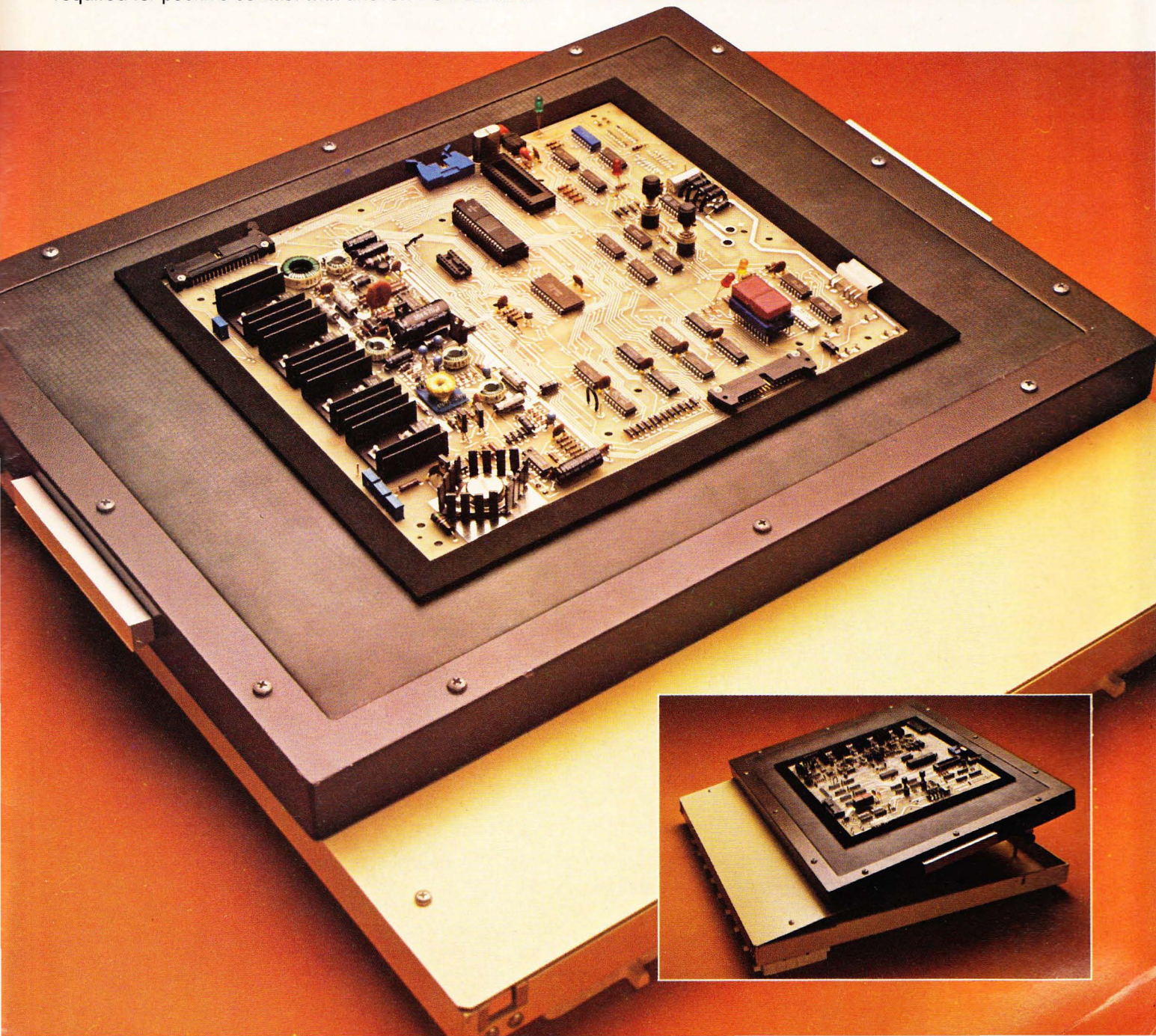
FF8100 Test Heads are made in three sizes, each with maximum point capacity. They're offered in a choice of drilled, filled and wired test heads or complete kits.

Practice the refined art of fixturing, with O&B's FF8100 Test Heads! For more information on the complete line of O&B precision test fixtures and probes, contact Ostby and Barton Company, 487 Jefferson Blvd., Warwick, RI 02886, (401) 739-7310.

The line of excellence.

FOR MORE INFORMATION, CIRCLE 45

ostby and barton company



In upcoming issues of
Test & Measurement World

How mergers and acquisitions change the face of the test and measurement industry.

Can test equipment keep up with the latest developments in fiber optics?

The move toward total factory automation—from process production to production test.

Should OEMs still consider bubble memories in a total test plan?

CONTRACTS

Services, thinks the proposal's aim is simple enough. "Basically what we would like to do is just write a piece of legislation to say that those expenses associated with the direct lobbying efforts of contractors are not allowable expenses under a contract. Now that has nothing to do whether they are *deductible* by the defense contractor. That's an entirely different set of criteria under the Internal Revenue Code."

Washington observers think the subcommittee's statements plus public attention pushed the DOD to deliver its own regulation on October 9, 1981. While it defines lobbying and proclaims associated costs as unallowable charges, the regulation is viewed as considerably more liberal than the expected wording of the subcommittee's proposal.

McDaniel acknowledges the subcommittee's own difficulty in defining lobbying, but defends the worthiness of such legislation: "We felt it only appropriate to put these corporations on the same footing as other individuals and corporations that are not being subsidized by the government with tax dollars."

Deriving from cynicism or a disinclination to have any dealings with the DOD, several major companies have avoided defense work. Whether the passage of this legislation would change any company's policy remains the unknown in this federal equation.

Industry Contracts

GenRad of Concord, MA, received a $740,000 order from Harris Corp. Government Systems for a GR 16, a 96-pin VLSI tester. Harris will use the equipment, which will be delivered in the first half of 1982, to check custom and standard devices. GenRad also reports another GR 16 sale to American Microsystems, Inc. Both systems are expandable for testing larger devices.

Plantronics/Zehntel of Walnut Creek, CA, has announced two orders for its test systems. Tandem Computers, Inc., Cupertino, CA, placed a $1.8 million order for a 10-system contract covering two years. In another TroubleShooter 800 sale, Craig Pynn, vice president of marketing, disclosed a $700,000 order from Convergent Technology, Santa Clara, CA, for 3 of the in-circuit PCB test systems.

Government Contracts

Lincoln Labs, a government research arm of MIT, was given a $505.2 million three-year extension on its present contract with the Air Force Electronic System of Hanscom AFB, MA. The broad contract, which includes extensive use of test and measurement instruments, covers such diverse projects as missile reentry, satellite communications and laser technology. In a continuing microelectronics experiment, the restructurable VLSI program examines the barriers to putting more and more elements on a chip.

VLSI System Design Philosophy. Design philosophies are solicited to expedite the exploitation of VLSI microelectronic technology to permit reliable, low-cost and high-performance designs. Directorate of R&D Contracting, Wright-Patterson AFB, OH.

ADVERTISER INDEX

TEST CONSULTANTS AND SERVICES

Test & Measurement World *will print business card advertisements from test consultant and/or service organizations. Advertisers should submit 3 clean copies of their business cards. Black and white positive prints should be supplied for business cards printed on dark stock.*

Advertising Rates:

1x	*3x*	*6x*	*9x*	*12x*
$300	*$275*	*$250*	*$225*	*$200*

For more information on advertising in the Test Consultants and Services section, call Kathleen Gagne, (617)254-1445.

CLASSIFIED ADVERTISING

Test & Measurement World *is a unique new vehicle for advertising your employment needs. If you're looking for test and measurement professionals, you'll find them through the classified section of* Test & Measurement World.

For more information on employment or equipment/services classified advertising, call Kathleen Gagne, (617)254-1445.

SALES OFFICES

Test & Measurement World Sales Headquarters: *Susan Chouinard, Publisher.* **East and Midwest Sales:** *Mathilde Najjar, 215 Brighton Ave., Boston, MA 02134, (617) 254-1445.* **Southwest Sales:** *Tom Barosko, 6252 Cheyenne Dr., Westminster, CA 92683, (714)894-6605.* **Northwest Sales:** *Theodora Franson, 115 Fancher Court, Los Gatos, CA 95030, (408)354-3260.*

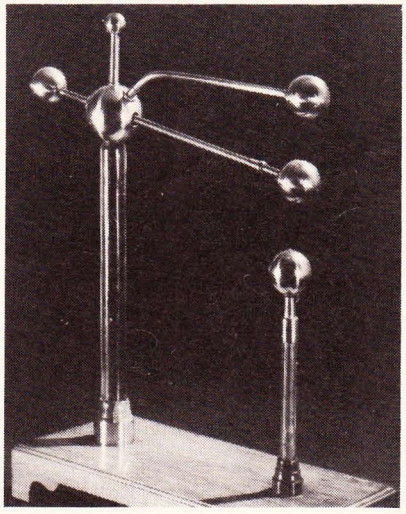
A CHRONICLE OF ANCIENT TEST INSTRUMENTS

Test and measurement is not just a brainchild of the high-tech era. Rooted in the dawn of scientific inquiry, the field may be as old as curiosity itself. People observing and attempting to make sense of the physical world have always had to count, to measure, to evaluate—in short, to back up assumptions with verifiable proof. And throughout the millenia they've used instruments to aid them in the investigation and pursuit of that most elusive of Holy Grails, a logical universe.

Nigel Hawkes's *Early Scientific Instruments* (New York: Abbeville Press, 1981) is a testament to this kind of human ingenuity. Lavishly illustrated with 70 full-color photographs, the volume offers a panorama of the marvelous gadgets people have devised to augment observations made with the unaided senses, from the middle ages to the early 20th century. While all the instruments depicted are handsomely crafted and have fascinating stories behind them, a number are of particular interest to our own world of electronics test and measurement.

The science of electricity began to dominate the development of instrumentation some 150 years ago. For many years, electricity remained a novelty item, but by 1784 George Adams, instrument maker to King George III, was sufficiently impressed by the phenomenon to aver that "the science of electricity is now generally acknowledged to be useful and important... at a future period, it will be looked up to as the source from whence the principles of natural philosophy must be derived."

Test and measurement sprang up as a natural adjunct to the discovery of electricity, and one of the earliest instruments used to measure a quantity of electricity was the balance discharge electrometer. The instrument shown in the photograph was built to a design attributed to British instrument maker John Cuthbertson and dates from about 1799. In use, the electrometer's two vertical conductors were attached to each side of a Leyden Jar to create a difference of charge between the two stationary balls on the right, which were affixed to oppositely charged conductors. The pivoted ball was repelled from the ball above it, which had a like charge, and attracted to the oppositely



charged ball. Whether the pivoted ball descended far enough to make contact with the lower ball, thereby discharging the jar, depended on the sliding weight; as it neared the pivot, the attraction between the balls had to be great enough to overcome gravity and permit the tube carrying the ball to drop. Thus, by moving the slider along the pivoted tube, the quantity of electrical charge in the jar could be estimated and safely discharged.

Along with this primitive electrometer, the book describes other forerunners of the instruments and measurement principles we take for granted today: Faraday's electromagnetic coils; Ohm's resistance apparatus (it comprised a thermocouple, a galvanometer and two egg-cups); Joule's electromagnet; Lord Kelvin's rotating coil, designed to measure electrical resistance in terms of absolute time and length; and Tesla's transformer coils, which the Hungarian scientist used to research alternating current at the same time Thomas Edison was propounding the merits of direct current.

There are also several gorgeous (if not overwhelmingly practical) microscopes, mostly from the 17th and 18th centuries. One ridiculously ornate instrument, constructed for the British Prince Regent in the 1780s, is completely covered with beaten silver and festooned with allegorical figures, classical urns and mermaids. It didn't work very well, but it must have looked splendid in the prince's drawing room.

We may be amused by the idea of a rococo silver microscope; we may wonder at the primitive austerity of a simple electrometer or Pascal's seminal, unwieldy calculating machine. But we must also remember that without these early instruments, we wouldn't have the sophisticated μP-based test equipment, ATE and SEMs of today. The instruments of the past are part of a rich heritage of scientific exploration. To learn about them is to gain an understanding of the evolution of measurement technology.

That's what "Then and Now" is all about. In future issues, *Test & Measurement World* will feature other pieces of antique equipment. We hope you will enjoy this glimpse into the intriguing technology of days gone by.

Clyde's on to something.

It's the First General-Purpose Memory-Board Tester with a Low-Skill Level of Operation and a 100 MHz Burst Feature.

You've heard of Clyde. He's big in the movies and ready to take it easy just about any which way he can. We gave him a chance to back up our claim that the new Series 6000 general-purpose memory-board tester is the easiest system to operate on the market today. That turned out to be Clyde's favorite feature. He didn't go for the others, but we're not sure he understood how important they really were.

Take I/O burst for instance. That's an industry first which lets us turn a 10MHz tester into a 100MHz powerhouse. Then, to make our powerhouse even more impressive, we rounded it out with burst timing, real-time control of timing, signature analysis, bus structure for growth, an IEEE 488 bus/controller and a PASCAL MT+/ CPM operating system.

Find out why we consider the Series 6000 to be one of the best buys around. Call or write for details. We'll tell you all about new products on the horizon and custom systems along with more on the Series 6000 and its companion product, the Series 5000. If you ask, we'll even include a list of satisfied customers. We think you'll be impressed, but don't take our word for it. Ask Clyde. After all, he's on to something BIG. TestMaster, Inc., 3191-D Airport Loop Drive, Costa Mesa, California 92626. (714) 754-0225. TWX 910-595-2468.

TestMaster™

FOR MORE INFORMATION, CIRCLE 3

Why do A.T.E. engineers insist?

THE P.C. BOARD TESTER THAT CAN HANDLE HIGH DENSITY BOARDS IS THE TESTER OF THE FUTURE!

The reason is obvious . . . Your multilayer boards are becoming more and more dense and quality less . . . with today's labor costs you can hardly overlook this problem.

That is why we developed the CA-2000, the ultimate machine that will do the job for you now, and in the future, with style . . . and accuracy.

The CA-2000 is a TURN KEY system developed with emphasis on mechanical as well as electronic performance. Operating on 60 PSI pressure it eliminates vacuum pumps, hoses and hookups. As the Bed of Nails Fixture does not rely on the limited pull force of vacuum, testing high density boards does not make it necessary to compromise by using low force type spring probes at the expense of reliability. You can quickly interchange test heads in the CA-2000's simple, Bed of Nails "Drawer" System that handles test products up to 24″ × 26″ and up to 10,240 test points. Contact densities up to 100 test points per square inch with our standard 4 oz. probes.

The CA-2000 self-learns the test program from a "known good" sample; and thereafter, testing consists of comparing the unit under test with its electronic memory. A Floppy Disk Option provides for permanently storing the memory data on a disk for future programming. A 48 column Alpha Numeric Printer prints all continuity errors.

CA-2000 CIRCUIT ANALYZER SYSTEM

Designed to test P.C. Boards with low and high density

The CA-2000 can also test cables, flexible circuits, loaded boards, and backplanes. RS-232 interface, Friendly Language Translator, computer interface options available.

Ask for our brochure.

P D I

PROGRAM DATA INCORPORATED

16632 Hale Avenue, Irvine, California 92714

(714) 549-0335 • TWX 910-595-2640

FOR MORE INFORMATION, CIRCLE 4