
tek talk
employee's publication
of Tektronix, Inc.
volume 10 number 4 November 1963
TRANSISTOR
MANUAL
CIRCUITS
APPLICATIONS
SPECIFICATIONS

tek talk

Published six times a year by Tektronix, Inc., 13955 SW Millikan Way, Beaverton, Oregon, by and for its employees and with the cooperation of the Printing and Photography departments. Address mail to Tek Talk, Communications department.

Editor, Joe Floren; production coordinator, Willie Henning; graphic artist, Nancy Sageser.
Other contributors, this issue: Jane Martin, Becky Weber, Josef Oswald, Ken Ireland, Dick Koe.

TEK NEWSREEL

(A summary of some of the major recent happenings on the Tek scene)

The long-awaited public offering of Tektronix, Inc. shares took place September 11. The price to the public was $19.75 per share, and to employees $19.25 per share (less the selling commission).

Previous to the offering, employees received copies of a preliminary prospectus, a card on which to indicate desire to purchase some of the 50,000 shares reserved for them and later, a notification of the number of shares made available to them.

Nearly 2100 employees, excluding those in Europe, indicated an interest in buying more than 185,000 Tek shares. Don Ellis, treasurer, reported that allocation was made in the quantity indicated for those interested in purchasing up to 25 shares; 25 shares to those desiring 26 to 50 shares and 30 to those wishing 51 or more. No employee was allocated more than 30.

On the day of the public offering, the price and the final prospectus were sent to employees. After that, it was a matter of paying for fractional shares purchased (or getting reimbursed for fractional shares sold), paying for additional shares purchased and receiving share certificates for shares purchased or for shares exchanged for TEKEM certificates.

Once on the public market, Tek shares were purchased at prices varying from $20 to $26. At present, Tektronix shares are over-the-counter stocks, or unlisted securities. Tek has applied for listing of the common shares on the New York Stock Exchange.

Share quotations are sent daily to Tek field personnel and also to employees in Guernsey and Heerenveen.

Frank Barton, Oregonian financial editor, commented in his column on September 15 that Tek shares going on the market was the biggest event that has happened in the local investment community for a long time. Numerous brokers advertised Tek shares—bought, sold or traded—in the local dailies as well as in nationwide papers such as Electronic News.

●

Staff reorganization and personnel changes continued to make news. Biggest changes took place among Tek's engineering design and development efforts. On October 7, Bob Fitzgerald (vice-president, Operations) announced that Bill Polits will head overall Engineering activities.

Five departments exist under the consolidation, with the following managers: (1) Advanced Circuitry, John Kobbe; (2) Instrument Engineering, Jack Rogers; (3) Display Device Development, Norm Winningstad; (4) Electron Physics Research, Jean Delord; and (5) Pre-Production Engineering, Lang Hedrick.

Engineering will have a prime responsibility for product and project planning. With these changes will be a reassessment of the Product Planning Strategy group by Fitz, Bill Polits and Howard Vollum.

In other operations, these personnel changes or clarifications were noted:

Manufacturing—Jim Woo was named manager of MSE's New Product Evaluation group, which will evaluate electrical characteristics in new instruments and new accessories before production areas begin to build them in larger quantities; Ken King, formerly of MQA, became F & M Quality Assurance manager; Homer Speer became Manufacturing accountant and Dick Ditter replaced him as F & M accountant; Scott Reekie was appointed F & M Production Engineering manager; Bill Tescher was appointed F & M Production Tooling manager; and Newt Espe became IM Production Services manager with Jack Hughes replacing Newt as IM Engineering Contact manager.

Marketing—Tony Bryan, formerly Walnut Creek, Cal. field engineer, became Portland field office manager in August, replacing Sandy Sanford, who transferred to Field Information.

Finance—Terry Clifford, formerly of Systems & Planning's Product Administration, became assistant credit manager in Accounting Services, replacing Sid Moody.

Systems & Planning—Hawkin Au, Long-Range Planning manager, transferred to Marketing to head a new Marketing Information and Evaluation group. Replacing Hawk in LRP is Jack Hornor.

Personnel—Tom Sloan now heads a consolidated Employment and Employee Relations department, formed after Irv Smith terminated to work toward an advanced degree at University of Washington.

●

Earl Wantland, International Manufacturing manager, returned with his family to Beaverton in August to direct Tek's overseas manufacturing operation. He assumed his new role in September, to help assure that overseas needs are given constant attention here. Earl has been Heerenveen Operations manager the past two years. He will make the first of his periodic trips to Heerenveen and Guernsey in November.

Also locating in Beaverton is Don Alvey, International Marketing manager. Don is in charge of development and administration of all Tek marketing activities outside the United States. He has served as European Marketing manager the past year.

●

Tektronix board of directors increased from four to five members on September 6, adding Dr. Walter P. Dyke, president of Field Emission corporation, McMinnville, and former director of the Linfield Research institute. He is known for his development of the portable X-ray unit, which has contributed significantly to radiology. Dr. Dyke is presently on a lecture tour in Europe.

Other members are Jack Murdock, chairman; Jim Castles, secretary; Howard Vollum and Bob Fitzgerald. One more board position remains to be filled.

●

Dick Ropiequet, Future Products manager , terminated in September. Dick had been at Tektronix since 1949, during which time he held the positions of vice-president in charge of engineering and engineer in charge of new product design.

He became known for his design of a new type of time-base (sweep) circuit which embodies features providing a high order of accuracy and linearity as well as very wide range and simplicity of operation. The Type 315 scope was the first to use Dick's sweep.

●

Lang Hedrick, Pre-Production Engineering manager, was named to the Retirement Trust Administrative committee in October, replacing Bob Davis.

●

Biggest news in the Tek building and construction program was Tek Guernsey's move to its new manufacturing plant at LaVilliaze near the Guernsey airport. The move took place on the weekend of August 24-25 and by Monday, August 26, scope production was underway. The new plant, comprising 35,000 square feet and located on 8½ acres of land, houses assembly and administrative operations. Tek Guernsey's original building, near the athletic field, will continue to accommodate other manufacturing functions.

In Beaverton, the 32,000-square-foot Electrochemical building was occupied in November. The new building houses all Tek's engineering, development and production needs in electrochemistry. The concrete chemical storage building, located behind the Electrochem structure, was completed in October.

Groundbreaking has started this fall for the new Engineering building, to be known as the Technical Center. It will be located west of the Electron Devices building.

●

New names for two Tek buildings were proposed by Bob Swanson of Property Accounting during August. "Millikan West" was suggested for Building 76 since it is the westernmost building on Millikan Way. The building was purchased from the Retirement Trust in May, thus making the RT label obsolete. Building 86 was given the title "Sunset North", since it is the northernmost building in the Sunset area. These new names now appear on the company's statement of values.

●

In case of power failure, Tek will now have general communication to each building by the new emergency public-address system. Thirty-three amplifiers, built by Facilities, will be powered by emergency lights in each Tektronix building. They will be connected to separate speakers located strategically about the buildings.

●

Over 100 Tektronix employees attended or participated in the 1963 WESCON (Western Electronic Show and Convention) at San Francisco's Cow Palace in August. Tek products were displayed in the exhibition arena. Tom Hutchins (Semiconductor Devices) presented a technical paper on "Solid-State Electrometer Using M-O-S Diodes".

●

Bill Banaka, Company Training coordinator, announced a new tuition refund program. Instead of an "approved list of courses" for which tuition refund is automatically granted, managers now will approve individual courses which relate to Tektronix' needs and the employee's self-development and which do not interfere with his work.

Four objectives of the plan are (1) to encourage self-development for the benefit of both the individual and Tek; (2) to build a company reserve of useful skills and knowledge; (3) to serve as a source of new ideas and (4) to increase employee versatility.

In other educational news, 360 employees registered for eight Tektronix voluntary classes: Blue Print Reading, Sampling-Digital-Storage Circuits, Fundamental Physics, Oscilloscope Orientation, Better Writing and Effective Writing. A series of special technical classes also were given to MSE and Engineering Services personnel.

●

Tek US employees received their Retirement Trust statements during August, announcing an earnings rate of 23.95 per cent—highest rate in the history of the Trust, resulting primarily from the increased market value of Tektronix, Inc. shares, which represents 46.71 per cent of the Trust's investments. Four major investments by the Trust are Blake & Neal Finance company, Premium Advance company, Riverside Plaza and University Village, Inc.

All Tektronix products are directly related to oscilloscopes . . . plug-ins, signal generators and auxiliary instruments, probes and scope carts are items which extend the usefulness of the oscilloscopes. The oscilloscopes themselves all seem to look alike; each comes in a blue cabinet; has a front panel complete with knobs and a CRT screen. There are more similarities among scopes than differences.

Technically oriented people speak easily about the instruments but most of us have a hard time distinguishing one from another and understanding the reasons for manufacturing so many types. Let's see if we can bring into sharper focus some products we make, their differences and the reasons for those differences.

Oscilloscopes can usually be classified in this way: GENERAL-PURPOSE, an all-around useful measuring instrument; SPECIAL-PURPOSE, an example of which is the Transistor Tester Type 575; RACKMOUNT, a scope designed to fit in a standard electronics rack instead of a blue Tektronix cabinet; DAYLIGHT, which, using trace-and-filter combination, lets you observe waveforms in relatively bright light; SAMPLING, a method of seeing very high-frequency waveforms; STORAGE, a scope capable of **storing** a signal and displaying it when "asked".

Oscilloscopes in the 300 series—Type 310, Type 321, etc.—have 3-inch diameter screens. Those in the 500 series have 5 inch diameter screens.

A PLUG-IN slips into the front of the scope and changes the way the instrument acts, or responds to incoming signals. Plug-ins make a scope more useful, as do the attachments on a vacuum cleaner, or the snap-on gadgets on an electric mixer. One plug-in may increase the amplification of a scope, another may split the cathode ray into two traces (a dual beam) or four traces. Still another plug-in may extend the scope's range into the very low frequencies.

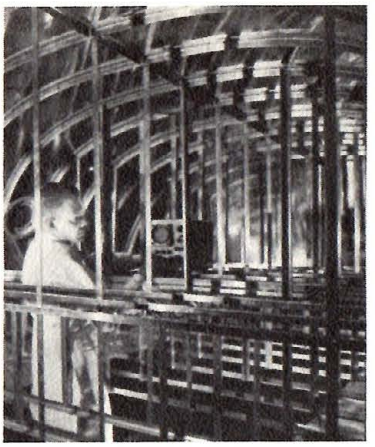
A PROBE is a small device attached to a length of cable built to transfer the electrical signals from the source to the oscilloscope; that is, from the subject being measured to the measuring instrument.

TYPE 502A DUAL-BEAM OSCILLOSCOPE: This scope is widely used by people doing medical research, because of its high sensitivity at relatively low cost. It is so sensitive that very small electrical signals in the human body can be picked up directly from electrodes in contact with the skin and viewed without the use of any extra equipment.

Medical electronics is a growing field; many of our scopes find their way into hospitals and research centers throughout the world.

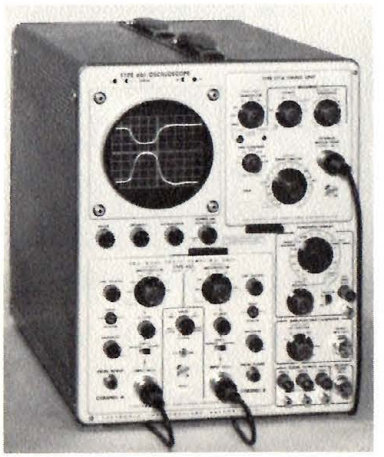
A dual-beam scope has two independent beams in the same CRT, driven by separate inputs (separate signal sources). This makes it possible to compare two events occurring at the same time, or two parts of the same event (i.e., respiration and pulse, or heartbeat and arterial pulse, or stimulus and reaction, or two different points in an electronic circuit . . .).

The 502A costs $1050.



TYPE 310A OSCILLOSCOPE: The small (23-pound) 310A features big performance in a portable package. It has proven popular in the computer industry, which likes its smallness and performance. IBM, Burroughs, National Cash Register and most other large computer manufacturers have bought thousands of these instruments for on-site computer repair. Our northern radar protection system, the DEW line, makes extensive use of the 310A, which sells for $675.

TYPE 321 TRANSISTORIZED PORTABLE: This is our most compact scope transistorized except for the three-inch CRT and the input tube. It operates from almost any power source—AC lines, its own batteries or auto, aircraft or marine electric systems. Weighing only 17 pounds, the 321 was the first high-performance transistorized scope on the market. Price, $820.



TYPE 661 PULSE-SAMPLING OSCILLOSCOPE: As the use of very high frequencies and microwaves has become commonplace for satellite communications

WHAT'S OUR LINE?

and television network links, it has become important to industry to have instruments capable of use as working tools in this very specialized field. The 661 with its plug-ins can fill this need better than any previous scopes.

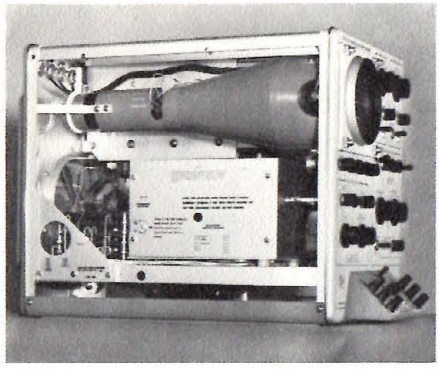
Using this instrument, sine waves occurring 3,500,000,000 times per second can be viewed.

Pulse-sampling is not related to any medical procedures; it is a technique for reproducing very high-frequency signals on a relatively low-frequency oscilloscope.

How does it work? It's much the same as if you were riding in a very fast car and passed a series of identical signs placed at intervals along the road. You wouldn't have time to read all the words on one sign, so by reading the first word from the first sign, the second word from the second sign, the third word from the third sign, and so on, eventually you would get the whole message.

A pulse-sampling oscilloscope takes a "look" at a piece of an electrical signal the first time it occurs and places this sample on the CRT in the form of a dot. Then it takes another look a little later in the signal next time it occurs and places **this** sample on the CRT as a dot. After several hundred of these samples have been taken, all the dots are laid out across the CRT like a string of beads, in the shape of the signal the oscilloscope has been sampling. All of this may occur hundreds or thousands of times per second, resulting in a continuous picture.

The 661 without plug-ins costs $1150.



TYPE 575 TRANSISTOR CURVE TRACER: This special-purpose oscilloscope is set up to draw graphs (called characteristic curves) that help engineers predict how transistors, diodes and other semiconductor devices will perform in electrical circuits. The instrument is a "must" in many laboratories.

Until these curve tracers became available, a semiconductor's performance had to be slowly and laboriously plotted by applying voltages at the terminals of the transistor, carefully measuring the changes at other terminals and plotting the results on graph paper. This had to be done for many transistors of the same type to get average curves. The 575 and other instruments do this automatically, many times per second, and display the results. An engineer desiring a special transistor for a "tailored" circuit can sort through dozens of transistors in a few minutes.

The 575 is often used to test production transistors, at the rate of several per minute. Defects show up immediately. Transistors that meet the manufacturer's specifications but are not suitable for our special needs can be sorted. Price, $1075.

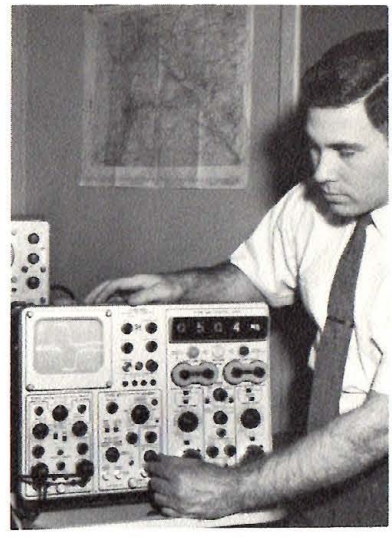
To extend the power range of the 575, the Type 175 adapter may be purchased for $1475.

TYPE 561A OSCILLOSCOPE: A low-cost basic package accepts plug-in units designed to make this an instrument to suit many uses and many budgets. The 11 specially designed plug-in units control both the horizontal and vertical movement of the beam. The basic package can be accessorized to become many different types of scopes; hence we save manufacturing costs, and the customer saves hundreds of dollars by not having to buy many complete instruments.

The 561A uses an exclusive Tektronix development: A rectangular cathode-ray tube of ceramic instead of glass, with the graticule printed **inside** the faceplate instead of on its outer surface. Because the cathode-ray beam touches the graticule instead of ending a quarter of an inch away from it, there is no likelihood of looking at the graticule from an angle and misreading the display.

The 561A costs $470; plug-ins for it cost $100 to $1100.

TYPE 567 DIGITAL READOUT SCOPE: This oscilloscope is a significant step forward in the oscillographic art. In the 567—at the upper right in the photo—are illuminated numerals (digits) which relate to the waveform on the CRT. By means of preset controls, the operator is able to read the displayed electrical characteristics in numbers. This allows a relatively untrained person to use the scope,



and this makes it an invaluable production-line tool.

Special circuits make it possible to program the 567 with punched tape, so it will automatically run a series of tests on systems and components, and distinguish between good and bad units.

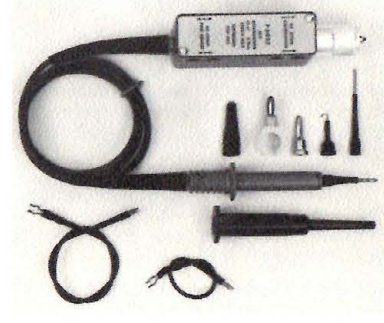
The basic unit cost is $700. Plug-ins cost $2500, $1100 and $650. One package, including basic unit and all plug-ins, would cost just under $5000.

TYPE 530 AND 540-SERIES OSCILLOSCOPES (Typical are the 531A/535A and the 541A/545A): This is commonly called our "bread and butter" line because it has provided most of our sales.

This series of high-performance, precision scopes is designed to accept a large line of plug-ins, from Type A to Type Z. The scopes cost $995 to $1550, with plug-ins from $90 to $625.

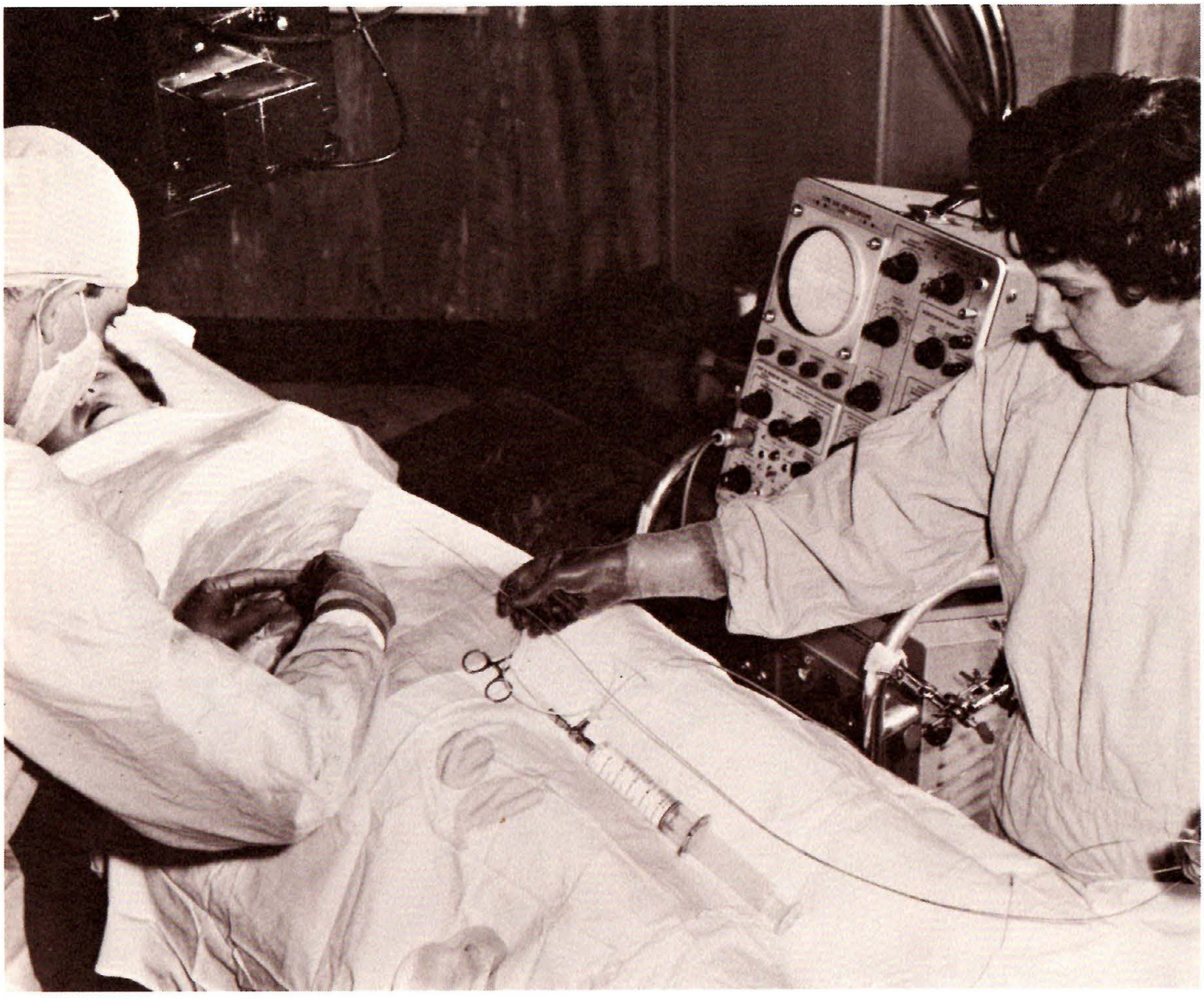
Some of our plug-ins for this series are: The CA, which makes possible dual-trace operation of a single-beam scope; the M for four-trace operation of a single-beam scope; the E for observing electrical signals of less than 50 millionths of a volt; the N, which makes a pulse-sampling oscilloscope out of any 530/540 series instrument; and the Q, for measuring the amount of stretch or compression of metal under pressure.

New plug-ins are constantly being developed to extend the versatility of Tek scopes already in use.



PROBES: Getting the signal from the subject to be measured to the scope without distortion is an art in itself. This we usually do with a probe.

Tek makes about 16 types in three main categories: General-purpose, special-purpose and pulse-sampling. So that the



signal to the scope is not distorted, or too great or too small, the user must select a probe that matches the sensitivity and fidelity of the scope, steals as little power as possible from the object measured and transfers the signal without altering it.

Most probes come with a variety of points—hooked, spring clip, alligator clip, etc.—and several cable lengths. Typical prices: $12.50, $21.50, $35, $50, $63, $86, $235 (with amplifier), $140, $190.

CAMERAS: C12, C13, C19: A scope camera is an essential accessory when a permanent record of the scope trace is needed. Our cameras help sell scopes, because an oscillogram (picture) often tells a story more completely and concisely than many words. Oscillograms taken from Tek scopes often appear in technical magazines and advertisements for other products.

The cameras have interchangeable backs that accept standard film packs, and Polaroid and 35 mm film. Prices range from $375 to $515.

TYPE 190B SINE-WAVE GENERATOR: Not an oscilloscope, the 190B **generates** constant-amplitude (10 volts, 20 volts, etc.) sine waves. Their frequency can be varied from 50 thousand to 50 million cycles per second. (By contrast, a hi-fi is considered hi-fi if it responds accurately up to 20 thousand cycles.)

This instrument is used for checking the frequency response of amplifiers, attenuators ("reducers" or "decreasers"), filters, delay networks (systems that delay a signal for a few fractions of a second) and indicating devices used in electronics engineering.

For example, frequencies generated by the 190B might be fed into a piece of electronic equipment, and the equipment's output looked at on a scope. By comparing the change between input and output waveforms, the accuracy and response of the equipment can be determined.

Our new catalog lists 51 oscilloscopes, 48 plug-in units, 29 auxiliary instruments and 64 accessories.

120 lbs. beef
6 teaspoons pepper
15 oz. salt
36 oz. flour
12 lbs. onions
6 lbs. celery
30 lbs. potatoes
18 lbs. carrots
Simmer gently from 3 a.m. till 7 a. m.

The above recipe could well be the makings of beef stew for a large army installation . . . but it isn't. These are the ingredients necessary to prepare a single dish for the 800-1000 employees who **may** eat hot food in Tektronix cafeterias each day.

The quantities would stagger the minds of the many mothers who boast cooking for six or seven each day. How much planning, preparation and more planning does it take to give hot, tasty, nourishing, inexpensive, easily accessible, appetizing-to-look-at meals to this small army—each person with a different like or dislike—every single working day? And what happens when, for some unknown reason, several hundred decide **not** to eat in the cafeteria (perhaps feasting on home-made food at a department smorgasbord, or taking a departing employee out to lunch on his last day)? Who whips up these gargantuan meals and distributes enough for each cafeteria to feed whoever may show up to eat?

In 1943, in a vacant Safeway store and an empty auto repair shop, Bob Fryer began a small pie-making venture. A short time later he opened a coffee shop. Located on N.W. 23rd avenue, across the street from Good Samaritan hospital, the Quality Pie Shop soon became a popular meeting place, and its fleet of light-green pie trucks was familiar all over Portland.

During the early 1950s, besides pastry and coffee, Tek employees nibbled on hard-boiled eggs from the snack bar. Following the eggs came canned soups, Tiffany sandwiches, individual Bradley pies, individual Reser salads and Stewart Infra-Red hot sandwiches.

In 1957 employees asked if hot foods like spaghetti and meatballs, macaroni and cheese, etc., could be brought to the Sunset plant (our only location then). Elsie Heem, who was the only Food Service employee at the time and who operated the snack bar, arranged with the Quality Pie Shop to have hot casserole-style dishes brought to the plant. Later requests from employees for a wider variety of salads and sandwiches, prompted Elsie to ask the Quality Pie what they could do, and Bob Fryer agreed to try. Salad cases, food warmers and several dispensing machines were installed by the pie shop at their expense.

Now Quality Pie Shop is sending great trays of steaming food to Tektronix.

Everything from the main course, through salads and dessert, right down to the cream in our coffee. Trucks equipped with special cabinets—to keep the hot food hot and the cold food cold—begin arriving at 6:30 a.m. at the first of nine snack-bar locations. Several early-morning trips are made with pastries, salads and soups; later the trucks return to pick up the dirty pans and bring fresh food to the swing-shift crews.

According to Elsie, before Tektronix could ever buy, prepare and serve the amount of food consumed here, the company would have to invest about $150,000 in equipment alone. Added costs would be people to prepare the food, on a regular payroll system.

Instead of having food from an established catering service, and taking pretty much what they have to offer, Tek has been fortunate in associating with a company that is ready and willing to meet our special needs. Quality Pie has grown right along with Tektronix. Rather than saying, "This is what we have to offer", their attitude seems to be, "What do your people want and need? We'll have it for them."

Pie Shop Serves Many

Is Tek their only customer? Not by a long way. They provide hot food to the new Pacific Northwest Bell telephone office, Portland General Electric, the Lincoln building and the new Post Office, and their list of pastry customers reads more like the Portland section of a Dun & Bradstreet directory: White Stag, Meier & Frank, Northwest Natural Gas, Standard Insurance Bldg., Pendleton Woolen Mills, Rose City Transit, Multnomah college and on and on and on.

The food served in several of these locations is exactly the same as served at Tektronix, but it costs more. For example, a doughnut or maple bar sold at Tek for 8 cents sells for 15 at several other companies. Pie, which is cut into six pieces and sold for 15 cents at Tek, is cut into seven slices everywhere else and sold for 25 cents. Pork chops and dressing cost $1 at Quality Pie Shop; at Tek you can have the pork chop dinner for 71 cents. Most people in the food business fail to understand how we can serve food at the low cost we do—probably because several Tek people are trying very hard to keep it that way, Bob Fryer commented.

Sixty-three employees work at Quality Pie, keeping the stoves hot and the food cooking 24 hours a day.

About midnight, the pastries and pies are pulled from the ovens. "Tiny" Woods, head baker (who still likes to eat what he cooks), is extremely proud of the quality of Quality's food. So proud, in fact, he no longer trust his own judgment as to whether a piece of baked goods is good. He often recruits nurses and dieticians from the hospital to be his taste-testers—sending them home with a sackful of items to try out, and he claims they're tough critics. Several nights a week the nurses are ushered into the kitchen to give their profession opinions as to whether there's enough salt in the spaghetti, enough crunch on the crunchies, enough taste on the tasties or enough twist to the cinnamon twists. Gazing fondly at a tray of maple bars, "Tiny" (who has worked at the pie shop for 15 years) says: "Those are the best darn maple bars in the city—even if I work here and make 'em myself." He points out proudly that each maple bar has the same amount of maple frosting.

Over in another area, huge steam kettles are brewing everything from glaze for the blackberry tarts to bean soup and banana cream pie filling. All the recipes are formulated; each ingredient is measured and weighed carefully. (The cooks can tell you exactly how much salt is in every single dish sent to Tek.)

With the quick efficiency that comes with 18 years of making cream fillings, Hilda Langston is blending a pie filling. The utensils she uses are so big it hardly seems like cooking to someone whose biggest effort is a turkey at Thanksgiving. The "spoons" used to stir the fillings look more like boat oars, the wire whips look like cages big enough for a live squirrel and the electric blenders are man-size, with "bowls" that hold 180 pounds of whatever you happen to be blending.

Real butter goes into almost everything they make. It comes in 60-lb. chunks (unsalted to keep track of how much salt is in the recipe). Monosodium glutamate, which supposedly makes everything taste better, is purchased in 100-pound drums; flour usage is estimated at 40,000 pounds per month, and meat 800 pounds a day, or 16,000 pounds a month.

At about 2 a.m. (if you can keep your eyes open and keep from falling into the stew) you can see the main-course dishes being prepared. The big kettle there by the stove has so much potato salad in it, you look away quickly because you don't want to believe that much potato salad exists anywhere.

How much does Tek eat? Employees down 58,800 pieces of pastry every four weeks. About 8658 pieces of pie are devoured; 24,093 main entrees, 12,609 salads, 8217 cold sandwiches, 4092 cups of hot soup and—hold on to your mugs—271,390 cups of coffee. (The reason the pastry figure is so big is that 40 per cent of employes often smuggle the doughnuts back to their desks (probably in empty file folders or yellow inter-plant envelopes) or munch them beneath their workbenches. You never **see** as many people eating doughnuts and gooeys as there really are!)

Job Growth Rapid

Elsie Heem (Food Service manager) came to Tek eight years ago, and if Tektronix' growth has been rapid, so has the growth of her job. The more employees —the more food—and the more problems.

Following are a few of the areas of concern when someone is faced with feeding 4000 employees:

- Prepare and serve food in nine locations; prepare coffee and pastry for breaks; distribute coffee carts, if necessary.
- Try to satisfy the desires of employees for nourishing, tasty food of highest quality, in sufficient variety, under clean, sanitary conditions at reasonable prices.
- Prepare and distribute menus.
- Meet special requirements for those working unusual hours.
- Make monthly reports of food operation in each location.
- Try to have the food service break even costwise (excluding coffee), at least recovering direct and indirect payroll costs.
- Inspect operations for cleanliness and sanitation, equipment needs, storage needs, and so on.
- Arrange for proper maintenance of equipment; recommend improvements.
- Handle approximately $20,000 each month.
- Train all Food Service personnel continuously in sanitation and proper handling of goods.
- Determine quantities of each type of food, and order daily.
- Arrange for special luncheons and dinners.
- Keep cost records of all food sold.
- Supervise collection of IOUs from employees.

How many people share these responsibilities? They're all on Elsie's job description. "Without the help of Ellen Plesha (working assistant), my manager, Don Kepler (Personnel Services manager), the thirty food service operators and attendants, and Juanita Lee and Elna Wachline, who work in the office, we couldn't do it—they deserve a great deal of credit —I certainly couldn't do it without them," Elsie commented.

Each year Tektronix **gives** its employees $58,229 worth of coffee, cream, sugar, tea and condiments. About $4500 is needed each year to provide thermocups, plastic cups, plates, napkins and plastic knives, forks and spoons.

(The coffee cost balloons to $108,000 annually when labor, space, utilities, electricity to operate urns and percolators and distribution by carts is included!)

When smorg-fanciers don't show up to eat in the cafeteria, extra food is sent by truck to Blanchet House mission in Portland. Some months, donated food reaches $350 (yes, it's deducted from our profit share). Elsie doesn't feel the least bit bad when someone calls to tell her they're having a smorg or an outside lunch party. In fact, she's delighted, because then she can adjust the food order to compensate.

Keeping Teks from growling about the food, or their stomachs from growling from not enough of it, is a big job. And behind the scenes, Elsie and the cheerful crew at the Pie Shop are always thinking up new and better ways to do the job. And to help them with this chore—they need constructive foodback — er, uh, feedback, from those of us who eat the feed — er, uh — food.

(Note: Last July, Canteen Company of Oregon, who services many of our vending machines throughout the company, set up new cafeteria facilities in building 81 on a trial basis. They feature hamburgers and french fries and other short-order items, as well as hot food similar to that served in Tek's other locations. This was done at considerable savings to the company, as the snack bar there was due for extensive remodeling.)

Tektronix overseas: a history

(Tektronix international marketing and manufacturing have been expanded and restructured in recent months. This article is a brief history of the development of our international operations.)

To sell an oscilloscope in Baltimore, a field engineer is only required to match an instrument capability with a customer need. But to sell the same oscilloscope in Belgium, the field engineer, or distributor, must hurdle a language barrier, an exchange barrier, a customs barrier, a market barrier—and at times a predisposition by the purchaser to buy goods from a Belgian supplier rather than a foreign firm.

To overcome these barriers, to supply our overseas customers with instruments unexcelled in the electronics industry and limited only by the current state of the art, and to give them the same service offered our US customers, Tektronix devoted much thought and planning during its early years.

Tek Talk, January 1952, summarized the establishment of our European market:

> "During February 1948, one of our original Type 511 scopes was purchased by the Ericsson Telephone Sales company, New York City, for shipment to their parent operating company, Aktiebolaget Ericsson Telephone company of Stockholm, Sweden. Several reorders were immediately forthcoming and 'twas thus that the fame and utility of Tektronix instruments began to spread through the ranks of research scientists and engineers abroad.
>
> "We received correspondence from several Swedish electronic concerns with applications to serve as Tektronix sales outlets for the Scandinavian countries . . . After an exchange of many letters, mutual banking and trade references, etc., an agreement was reached, and on December 3, 1948, Aktiebolaget Norrlandia in Stockholm, Sweden, was established as the first authorized distributor of Tektronix products outside continental United States.
>
> "Mr. Erik Ferner, one of two partners owning Norrlandia, carried the news of the superiority of our instruments throughout the length and breadth of Sweden and an almost immediate response occurred in the form of orders from the Royal Institute of Technology, the Swedish Air Force, A.B. Svenska Phillips, Chalmers Institute of Technology . . . University of Lund, University of Upsala (established in 1746), Royal Swedish Defense Laboratory, Royal Swedish Telegraphs, etc. Mr. Ferner personally visited our Hawthorne boulevard plant July 3 and 4, 1949, and left more firmly convinced than ever of the high value of our products and policies."

Mr. Ferner now owns several companies, one of which is the distributor for Tek equipment in Sweden: Erik Ferner AB.

Korean Crisis Halts Shipments

The Korean Crisis brought US defense production priority regulations, which virtually halted overseas activity by diverting oscilloscopes to defense-rated orders. But by 1952 we were able to resume export shipments.

By January 1952, distributorships were established in Norway and South Africa. According to Scotty Pyle, International Marketing staff, we establish a distributorship when the prospective distributor's knowledge of the language, local conditions and technical capabilities will enhance the value of Tektronix instruments to the customer. Two of the major factors considered in establishing Tektronix distributorships are (1) adequate experience and knowledge in commercial transactions and (2) technical know-how for customer assistance.

We now boast 30 distributors (distributors who sell and receive commissions on all Tektronix instruments sold within their territories) and three commercial agents (representatives who have no technical responsibility but who negotiate orders and receive commission on those orders for which they are the procuring cause).

In the late fifties we realized that import duties and overseas competition were threatening our export market. Especially was this the case in Great Britain, where purchasers had to pay 33 per cent duty on Tek instruments that had an English-made equivalent. Customers do not have to pay duty on instruments that have no English equivalent.

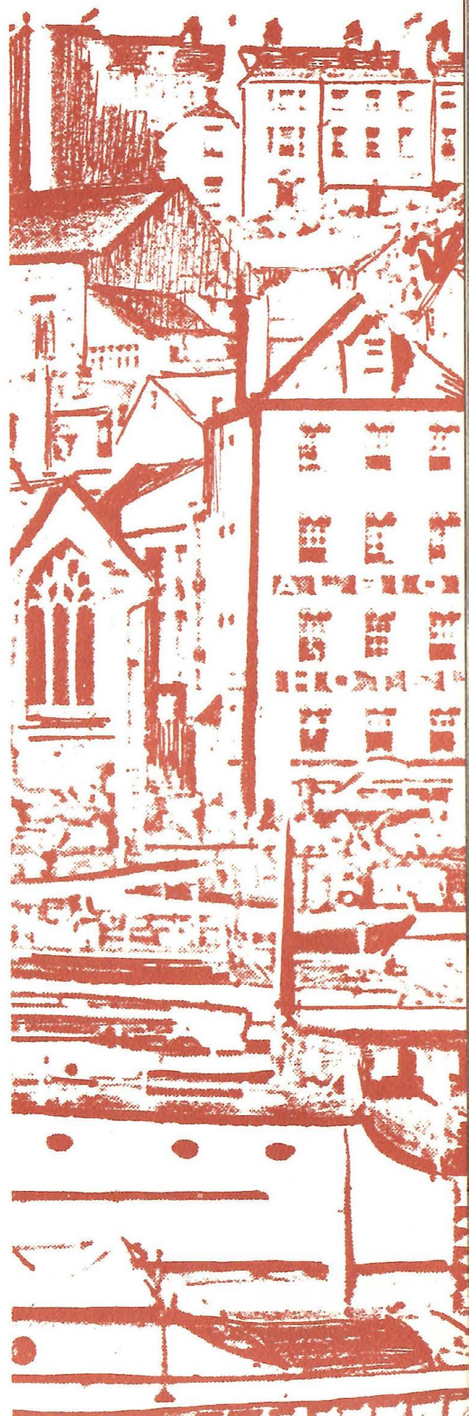
Development of plans for the European Economic Community (EEC, often called the Common Market, composed of Belgium, The Netherlands, Luxembourg, France, West Germany and Italy) and the European Free Trade Association (including Great Britain, Portugal, Austria, Denmark, Norway, Sweden and Switzerland) also forced action, since duty on US-made instruments could increase as duty on EEC or EFTA instruments decreased.

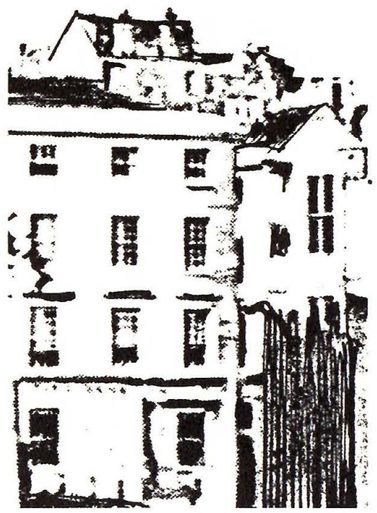
In 1957 Al Hannmann left the Export department to serve Tek as a roving field engineer in Europe, based in Zurich, Switzerland. Al's responsibilities were to provide closer liaison between Tektronix and the European distributors and customers; at the same time he studied the feasibility of establishing a manufacturing operation in Europe. He reported that Guernsey seemed to be a good location for our overseas expansion, with a physical plant available and an adequate manpower supply.

On December 6, 1958, Dave Spinks and Earl Wantland arrived in Guernsey from Beaverton to initiate the manufacturing operation. Al moved from Zurich to Guernsey to assume duties as Guernsey manufacturing manager, and Don Alvey transferred from US Marketing to replace Al as field engineer in February 1959.

(Dave Spinks, who returned to Beaverton in May 1963, now works in Central Staff Services. Earl Wantland is now International Manufacturing manager. Al Hannmann is manager of Tektronix Australia Pty. Limited.)

By January 1, 1959, the Guernsey group had eight employees; by the end of that





year they were assembling four scopes (545, 524AD, 535, 515) and seven plugins (B, CA, D, E, G, K, L) and supplying customer service parts. It was incorporated in 1961 as Tektronix Guernsey Ltd. (prior to that time it was a branch of Tektronix, Inc.). It is now a full-scale manufacturing facility, employing 285 and occupying 80,000 square feet in two buildings. Bob Gwynn is manager.

To expand and improve the marketing activities in Europe, Tektronix International A.G. was established in March 1961. Based in Zug, Switzerland, this sales office coordinated efforts of distributors throughout Europe, Africa and the Middle East, and was responsible for marketing Tektronix products within these countries.

Also in March 1961 Tektronix Holland N.V., a manufacturing plant near Heerenveen, The Netherlands, began operations. The Heerenveen plant, patterned after the Beaverton assembly buildings and managed by Tom MacLean (formerly of Beaverton Instrument Manufacturing), employs approximately 190 Dutch nationals.

International Field Offices Started

Tektronix' domestic marketing approach for many years contained aspects not found in the electronic instrument industry. As soon as it was feasible, Tektronix, Inc. set up field offices throughout the US, where factory-trained field engineers and field maintenance engineers maintain direct contact with customers and provide on-the-spot repair and recalibration service.

This marketing approach was highly successful in the US. And our limited experience in directly contacting overseas customers tended to confirm that this approach was desirable in some marketing areas also. So, early this year, the international marketing and manufacturing operations were restructured to move toward this direct marketing goal in some countries, as well as to effect closer marketing and manufacturing liaison with Beaverton.

A new company, Tektronix Ltd., headed by Frank Doyle (formerly with Tektronix International A.G.), was incorporated on Guernsey to assume the marketing responsibilities formerly performed by Tektronix International A.G.

Tektronix International A.G. continues to consolidate financial and personnel functions for Tek's European operations, as well as to serve as a field office for Switzerland. Nine employees man this office.

Tek Ltd. Markets Scopes in Europe

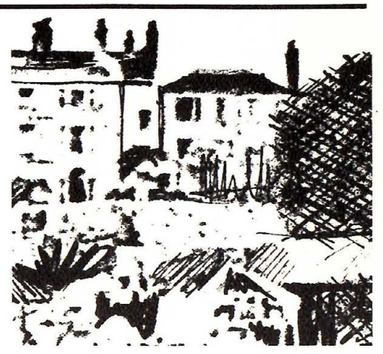
Major marketing and technical support responsibilities for Europe, South Africa and the Middle East are performed by Tektronix Ltd. Their 53-employee staff coordinates activities of distributors in these areas, has responsibility for processing quotations and orders for them, and will work in close cooperation with Tektronix marketing companies in Switzerland and the United Kingdom. Tektronix Holland N.V. and Tektronix Guernsey Ltd. market instruments manufactured at those sites, with marketing assistance from Tektronix Ltd.

The UK marketing company, Tektronix U.K. Ltd., was organized in mid-1963. Harry Sellers, formerly with our British distributor (Livingston Laboratories Limited), is manager.

But our overseas vision did not stop at Europe. Customers in other parts of the world merited the same consideration and marketing approach. Tektronix Canada Ltd. became part of the international structure in 1963. And this July an Australian field office, Tektronix Australia Pty. Limited, opened its doors in Sydney. Al Hannmann transferred from Guernsey to direct the activities of this new enterprise.

One last move seemed reasonable. Because of communications difficulties caused by having operating managers several thousand miles apart, the decision was made to base the European manufacturing and marketing managers in Beaverton. Earl Wantland, International Manufacturing manager, returned to Beaverton in August. Don Alvey, International Marketing manager, returned in October.

Marketing will closely evaluate the field offices in England, Switzerland and Australia to determine whether they meet the needs of our overseas customers. If they do, consideration will be given to the feasibility of establishing field office operations in other countries where such a move would be in the best long-term interest of customers and Tektronix. Manufacturing, too, is appraising its operations and will consider expansion to countries where our marketing potential cannot be achieved or maintained by continued shipment from current manufacturing locations.



sure there are problems . . . but respect for the Dutch character is helping us work out answers, says manager back from Heerenveen.

Earl Wantland believes it would be good for every American not only to live in a foreign country sometime, but also to **adapt** to it. He has done both.

Some US visitors abroad may be so wealthy that their environment adapts to **them.** Others may not care. But to Earl — who had the responsibility of setting up, staffing and managing Tektronix' manufacturing plant in Heerenveen, The Netherlands — it was important both to understand and to fit in.

To a man with that kind of task, it's more than an idle concern how the Dutch people are governed, how they're educated and where. It matters. What they believe, matters. How they think, matters.

And so Earl — for a time the only American in a city of 12,000— found his job of planning and managing our Dutch plant was closely tied in with the traditions and attitudes of the people.

His problem, in brief: How — in a country whose government, geography, economy, education and social structure differ so greatly from our own — how to build a company that was still Tektronix?

How, for example, to mesh Tek's use of first names with the Dutch custom of addressing even one's own parents in formal language? (The change **has** been made — and Dutch Teks seem to like it. But outside the plant, formality still is the rule.)

Earl, now back in Beaverton on Mike Park's Manufacturing staff, sums up his two-plus years in Heerenveen: "It's a different world."

Some Wantland comments, at random, about the country:

Geography — Low, green, flat — two-thirds of it below sea level. Other than the "Dutch Alps", a 600-foot range of hills in the southwest, there is no high ground. Weather: Gray, cloudy, coastal.

Earl's first impression was of the country's gueling — and victorious — battle against the sea, draining, diking and farming the polder (reclaimed) land. This land goes to the top graduates of the Agricultural University, who farm it expertly and scientifically.

People — Industrious, stable, trustworthy, family-oriented. Eager for education, fond of discussion. Friesland, where Heerenveen is situated takes pride in the very large number of Frisians in Dutch government and higher education.

Government — Socialistic (although it owns only two major industries, the excellent Dutch railroad and the coal mines.) Restricting inflationary trends and keeping wage costs as low as possible have enabled The Netherlands, though a tiny country, to price its products competitively in the world market. The program has bootstrapped a recovery not only from World War II but also from the crushing economic loss of the Dutch East Indies in 1949.

The necessity to curb domestic purchasing ability means that, in negotiations between labor and management, the government does more than stand by. It sets the ground rules (for instance, how much of a pay raise will the economy stand?), and unions and companies play the game accordingly.

The result: Almost no strikes, and a solid economy that strongly resists economic crisis.

Labor-management—Each industry has its own employers group (Tektronix belongs to the Metaalband, the metals industry organization) and its own labor union (actually a composite of **three** unions: Catholic, Protestant and Socialistic). Bargaining, generally for three-year contracts, is done with an objectivity and a consideration of all points of view that would be unusual in the United States, Earl remarks.

Education—Dutch schools, like those of many nations, are not "democratic" in the US sense. From the start they strive to separate and to group students according to aptitude. How far they may advance—and in what direction—depends first of all on their competence, (second on their interests). This educational winnowing process is much different from our public education, in which a student takes, pretty much, the schooling he **wants.** It provides not only "levels" of academic achievement but also a social stratification that will last the students all their lives. The Dutch honor academic success as much as Americans may honor, say, business success.

Because of the stature that educational achievement gives, many citizens are engaged in voluntary night-school education at all levels, largely under government auspices, with centrally prepared examinations.

The role of the schools in shaping Dutch society is very strong, Earl points out, and has many consequences for industry.

The Dutch system is organized, roughly, in this way:

At the bottom is the Lower School, similar to our grade school but with a more advanced curriculum. After six years, students are separated into two groups: Those who may go on to further academic or vocational training, and those who may not. These latter remain two more years in lower school, then become part of the labor market—often at age 14.

Of those who continue:

A girl may attend Home Economics School for three years, thus completing her education in her midteens. (Interestingly, the average age of our assembly girls there is 18½.)

A boy may go to Lower Technical School for four years. Then he either seeks a job or, if he's a top student, he may choose to go on to Middle Technical School, for advanced practical training in a technical vocation. This completes **his** education.

A boy or girl academically inclined and competent may go from Lower School to Middle High School (similar to our high school) for four years. But the **top** Lower School students enter to what Dutch call "High School", but what would be equivalent to a US high school limited to superior students.

After five years in High School a student automatically has entrance to the University or the Technical University (which turns out masters-degree engineers). But he may choose instead to undergo shorter, more specialized training in the Higher Technical School, which graduates bachelors-degree engineers.

Although it's uncommon, a top student in Middle High School may take one more year of schooling there to qualify for admission to the university. Or, if his aptitudes justify it, he may go on to **specialized** technical schools. (There are two excellent electronics schools, which are prime sources of Tektronix Holland's technical staff.)

The selectiveness of the school system—channeling apt students into intensive technical training—benefits us; Tektronix is technically a strong organization.

But obtaining Manual workers (a government job classification including tool and die makers, assembly workers and shop employees) is more difficult. The supply of qualified people is smaller, for one thing, and once we find them there are problems in motivating and keeping them. (We **do** have a dedicated and competent crew, but largely because we have the opportunity, so far, to be very selective, Earl points out.)

To put these problems into perspective, he explains the Dutch system of labor-management relationships:

The government, in the interests of guarding the small nation's economy, plays a strong role. Each year the national system makes its economic report. Among other things, it spells out what the economy can stand in the way of pay raises.

Within this framework, the union and the employers group negotiate the **form** of the increase. Sometimes it's more retirement benefits, sometimes sick pay, sometimes actual raises. Each year **some** sort of increase has been allowed; so labor costs in Holland, as throughout Europe, are on the rise.

These ground rules are only part of the story and, from an employer's standpoint, not the toughest part. More difficult is the tight control over job classifications and pay ranges. The classifications are rigid, the ranges very narrow.

Particularly this is a problem in the Manual labor classification. For example, the pay range for a tool-and-die maker has a spread of about two US cents. This, plus a strict control over pay raises, makes it difficult to provide incentive, Earl notes.

In the Manual category, raises are mandatory each year of employment for several years. (In the Clerical category, mandatory annual raises continue **until age 45.)** These are **seniority** increments but strongly affect our ability to grant **merit** increases, because:

Not only is there a specified minimum **individual** wage, but also a minimum and maximum allowable **average** wage for each job classification. The nearer a company's average wage is to the maximum, the less leeway the company has to grant individual merit increases in that job classification. (And remember, the range is very narrow anyway.)

Add to this the fact that pay for clerical jobs is higher than that for manual work (a secretary may earn more than a tool-and-die maker), and you can see part of the problem of providing incentive for our assembly, shop and other manual people—about half the 190-person

EVEN BACK in Beaverton, there is no respite from the problems of Tektronix overseas marketing and manufacturing, Earl Wantland and Don Alvey find. Earl is on Mike Park's staff as International Manufacturing manager and Don on Byron Broms's staff as International Marketing manager. Don is also a member of the Management Group.

Heerenveen work force.

Nor is it easy to use overtime as a bonus incentive. Not only is the **amount** of overtime a person may work restricted to six hours a week, but to work any overtime at all—even one hour for one person—you need the permission of the local labor inspector.

Another factor: Even though money is an incentive to the Dutch worker, he is so strongly oriented to home and family that in many, if not most, cases he doesn't **want** to work overtime.

How, in the face of all these barriers, do you provide incentive for this group?

Our answer has been to try to develop a premium system—extra pay for quality and quantity production beyond an accepted 100 per cent standard. Earl points out that this requires good standards, objectively derived.

Other industries in Holland have had their premium systems approved. The most liberal treatment has been granted for the piecework approach, since it's quantitative and easy to measure.

The incentive problem is less in other top categories: Clerical, supervisory and (the highest paid) technical.

But we ran into other problems in selecting clerical people: For one, top girl students—generally—receive few commercial courses, their education being largely academic.

Because most women quit work when they marry, because of the lack of commercial training for top girls, and because clerical jobs are paid higher than manual work, many clerical positions are held by men. (This is not as true of Tektronix as it is of many Dutch businesses; banks, for example, are staffed almost 100 per cent by males.) As you might guess, there is a lot of evening study to get into clerical jobs.

Wage rate increases are agreed on, or employee benefits determined, by the employers groups and the unions, together working out what are called collective labor agreements (CAO) for the industry. (Profit share, too, requires approval in a CAO.)

Dutch employee benefits are not the most extreme in Europe, but they **are** typically European in their variety and liberality: Up to two years sick pay; medical benefits for the whole family, including pharmaceuticals. As in the US, part of the cost is paid by the employee, part by the company.

The first government after the war, a coalition, laid the structure for the country's system of social benefits. They include a children allowance, so much per month per child, an insurance paid by the employer to head of the household.

The Dutch economy is solid; they've done a "tremendous" job of recovery, and they have an intensive industrialization program. The tiny nation is the home of three of the world's giant corporations: Unilever, Shell Oil and Phillips.

Most industries there stress mass-production techniques, as contrasted with Tektronix' unit system of assembly. Whereas the work cycle in most of these plants is under three minutes, ours runs one to two hours, depending on the instrument—with the implications, in The Netherlands as here, for conscientious work and pride in craftsmanship. Our workers there **are** conscientious, and proud—and morale is good.

In an economy as rigidly directed as Holland's, intangibles become very important, Earl stresses. The fact we're an American firm is one; the good reputation of our company name is another. And a very important one is Tektronix' traditional recognition of and respect for individuals as people—and for the individual character of the Dutch nation.

As Earl pointed out: It's important to adapt.

TEKROSTIC NO. 3

A 90 52 104 53 34 80 — Dropping a fly, adding wrong, playfully punching Sonny Liston, etc.

B 97 36 93 76 108 43 — Shout to gain attention (two words)

C 22 105 10 117 31 88 51 135 — They're increasing in number, in Russia

D 62 17 55 7 129 29 67 — Best place to keep your pet hippopotamus

E 49 3 95 57 38 — When to turn your back on him

F B U R N E R (147 11 71 65 132 46) — Incinerator

G 103 25 69 59 83 99 74 — Indian maid, in familiar song (two words)

H 115 146 27 125 — Identical geometric forms

I 150 40 13 102 91 — Pulpy

J 151 18 123 114 126 106 — Consecutive wins (or losses)

K 26 110 119 81 100 19 — It's best not to hold one of these

L 143 111 131 75 127 113 1 48 86 — Sound of repeated short, sharp concussions (3 words)

M 118 20 63 134 4 47 — Bids

N 109 8 35 70 33 14 — Not perceived, sensed or believed

O 121 84 21 136 — Plan; conspire

P 58 141 12 77 148 124 — Revolting people

Q 149 50 92 24 142 68 — Inside portion of Red China

R 144 137 101 — Set in opposition, as one against another

S 44 98 32 85 72 9 116 42 2 — Thousand-thousandth

T 15 89 112 107 — Part of a foot

U 94 5 30 87 60 23 — Therapeutic purchase for women (two words)

V 37 133 78 54 138 16 128 61 — Insistently

W 56 120 45 122 — Large plant in Tek Industrial Park

X 64 139 39 140 96 145 — One who cuts or corrodes with acid, as in F & M

Y 41 82 28 79 130 6 73 66 — Fainting

INSTRUCTIONS

1. Fill in the word blanks A through Y. (We've done word F as an example.) Do as many words as you can, then . . .

2. Transfer the letters from the words into the indicated spaces on the acrostic square. (The letters in word F have been transferred, to start you off.)

3. The acrostic square—when completed—will spell out a complete quotation about Tektronix. The message reads left to right **across** the puzzle. It does **not** run up and down like a crossword puzzle.
Words in the quotation are separated by dark square **only**—not by the end of a line.

4. Puzzlers often find it easiest to work not only from the word list to the acrostic square, but also back **from** the square **to** the list. That is, when you can guess a word in the quotation, fill it in and transfer the letters to the proper blanks in the word list.

5. When the puzzle is completed, the first letters of words A through Y, read from the top down, will spell out the **source** of the quotation (the person who said it, or the publication it came from, or both.)

ANSWER TO LAST TEKROSTIC:

". . . The most valuable people are those who don't have to rely on status symbols . . . Your real status is the status you've earned, and when you've really earned it you don't need the symbols."

—President Howard Vollum

1-L	2-S	3-E	4-M	5-U	■	6-Y	7-D	■	8-N	9-S	■	10-C	11-F U	12-P
13-I	14-N	15-T	16-V	17-D	18-J	19-K	■	20-M	21-O	22-C	■	23-U	24-Q	25-G
■	26-K	27-H	28-Y	29-D	30-U	31-C	32-S	33-N	■	34-A	35-N	■	36-B	37-V
38-E	■	39-X	40-I	41-Y	42-S	43-B	44-S	45-W	46-F R	47-M	■	48-L	49-E	50-Q
■	51-C	52-A	■	53-A	54-V	55-D	56-W	57-E	58-P	■	59-G	60-U	61-V	■
62-D	63-M	■	64-X	65-F N	66-Y	67-D	68-Q	69-G	70-N	71-F R	72-S	73-Y	74-G	■
75-L	76-B	77-P	■	78-V	79-Y	80-A	81-K	82-Y	83-G	84-O	85-S	■	86-L	87-U
88-C	89-T	■	90-A	91-I	■	92-Q	93-B	94-U	95-E	96-X	97-B	98-S	99-G	100-K
■	101-R	102-I	103-G	104-A	105-C	106-J	107-T	■	108-B	109-N	110-K	■	111-L	112-T
113-L	114-J	115-H	116-S	117-C	■	118-M	119-K	120-W	■	121-O	122-W	123-J	124-P	125-H
126-J	127-L	128-V	■	129-D	130-Y	131-L	132-F E	133-V	134-M	135-C	136-O	■	137-R	138-V
■	139-X	140-X	141-P	142-Q	143-L	■	144-R	145-X	146-H	147-F B	148-P	149-Q	150-I	151-J

Robt. A. Millikan

(Roads in Tektronix Industrial Park have been named after three outstanding scientists who have contributed much to physics and electronics: Robert A. Millikan, A. A. Knowlton and Karl Braun. This article will discuss some of Millikan's contributions.)

Robert A. Millikan was awarded the Nobel Prize in physics in 1923 for his study of the electronic charge and the photoelectric effect.

Millikan was born in 1868 in Morrison, Ill. He graduated from Oberlin college in 1891 and received his doctorate from Columbia in 1895. He also attended the universities of Berlin and Gottingen, Germany.

In 1896 he became assistant professor of physics at the University of Chicago. In 1910 he became a full professor.

In 1921 he resigned his chair at Chicago to accept the directorship of the Norman Bridge Laboratory of Physics at California Institute of Technology. He later became chairman of the executive council of the institute, which position he held until his retirement in 1945.

Millikan represented the United States for 10 years (1922-1932) on the League of Nations committee for intellectual cooperation, one of the social and economic committees whose advice was often sought in connection with political disputes but whose main function was to organize and extend international cooperation in social and economic affairs.

The work for which he was most famous was his precise measurement of the charge carried by the electron. This work began in 1906 and lasted more than 10 years. Previous attempts to identify the electron and measure its charge had been made by J. J. Thompson and H. A. Wilson in England. Their method was to observe the speed of minute water droplets falling in an electrical field. As the electrical field was changed, the droplets fell at different rates, depending on their size and on the electrical charge. The method was not accurate because the droplets tended to evaporate and give inconsistent measurements.

In 1906, Millikan took up the problem. Using Wilson's technique, he tried various methods to obtain greater consistency. He did succeed in obtaining much better values simply by shortening the time of observation, which reduced the error due to evaporation, but he still was not satisfied. By experimentation he finally hit upon the method of adjusting the strength of the electric field to hold the droplets stationary, assuming that he could then observe the rate of evaporation and allow for it. The method was not wholly successful, but he did find it was possible to hold the droplets stationary for nearly a minute.

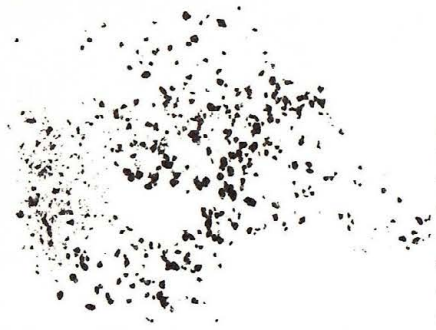
In 1909 he discarded Wilson's method and substituted oil droplets about 1/1000 millimeter in diameter, which could be observed by a telescopic microscope in a chamber of his own design. Because the droplets were electrified by the friction of spraying, they did respond to an electrical charge placed on plates at the top and bottom of the chamber. Oil had the advantage of practically no evaporation, so the droplets could be treated as a constant.

Millikan was able to observe that under the force of gravity, all droplets fell at identical rates but, subjected to a constant electric field, the rates of the droplets varied from one to another. Because the times of passage through the electrical field occurred in exact rather than fractional steps, Millikan assumed this was due to the effects of 1, 2, 3, 4 or more electrons giving an electrical charge to the droplets. By taking into account the droplet's size and weight, the force of gravity, the friction of the air and the electrical charge on the plates, he was able to calculate the charge of an individual electron.

Over eight years, he was able to calculate and confirm that the charge on the electron was equal to 4.807×10^{-10} e.s.u. (ElectroStatic Units, which had been calculated over 100 years earlier.)

Hardly less important than his work on the electronic charge was the work he did on the photoelectric effect and cosmic rays. In 1923 he was awarded the Nobel Prize in physics for the first two.

Millikan's greatest contribution to science was to establish beyond a reasonable doubt that which had been only theory. By showing that electrical charge always consists of exact multiples of a fundamental charge, he was able to identify and give a value to the charge on the electron. Likewise, he established the validity of Einstein's equation for the photoelectric effect by subjecting it to the severest possible tests.



A STORY IN this column, two issues back, told about Russ Fillinger's little boy astounding a "Dr. Blank" at the U of O Medical school by firing up a 565 scope for him. It has brought a very nice letter from Dr. Duane Denney, who admits to being the doctor involved.

He passes on some kind words about Tek people:

"Later I met one of the designers of the instrument. He proved to be not only a diplomatic man but spotted some deficiencies in the instrument which were not explained by my inexperience. A week later I found him—unobtrusively and without having to be asked—poking around among the internal organs of that beautiful machine. Like a good electronic surgeon he soon had all its viscera working properly, and I've had no further problems.

"I would like to . . . commend the representatives of your organization, and Russ Fillinger and Sandy Sanford in particular, for their lack of haughty pretentiousness amongst we electronic first graders, willingness to listen to our little problems . . . eagerness to be of service when the switches don't work, and for being just plain nice guys.

"You will be happy to know I have learned to operate at least some of the knobs and dials on the 565."

"You may quote me if you wish." We do. And we *are* happy.

THIS ALWAYS has been one of the more interesting space fillers:

Suppose now, a rope were stretched tight around the world at the equator. You cut it and splice in another six feet. Now, suppose you could raise the rope from the surface of the globe an equal distance all around the earth.

Question: How far would the rope be off the ground (or water)?

A sampling of coffee-breaking Teks brought these guesses:

"About .0001 inch."

"Not very far."

"Who wants to know?"

"Has this something to do with fractional shares?"

The correct answer: About one foot.

This is strange but true, whatever size sphere you use—a pingpong ball, or the world. (If you want to work this out for yourself, you'll find it handier to use the pingpong ball than the world—and you'll bother fewer people.)

FREAK WIND department:

Oregonians, wind-shy ever since the big Columbus Day whoosh of '62, got their adrenalin going again last month, when a 50-mile gale roared up the Tualatin valley to scare mamas, kids and others.

The wind came up fast from the middle of a hot sultry afternoon, and sent homeowners into quick reaction. Some headed for their housetops, where they could be seen prancing spastically across the roofs, stomping on one flapping shingle after another.

Others rushed to their backyards to prop up trees. Still others gathered up the lawn furniture, by catching it on the fly as it blew past.

Milt Smith (Instrument Engineering) was putting in lawn. He'd laid down the seed neatly, and covered it neatly with peat moss. Up came the wind and blew the whole mess — neatly — to the neighbor's and beyond.

"Oh, pshaw," Milt may have said.

Teks

OTHER NEWS from the home front:

Otto Zach (Manufacturing staff) tells of his dad's chipmunk problem. What the 'munks were up to, was snitching filberts from under the tree.

Mr. Zach rigged a leash and tethered the family cat to the tree, with enough rope to browse about on any chipmunks who got in the way. (Enough also, as it nearly turned out, to hang himself.)

The cat climbed the tree, snagged its leash, then tried a standing broad jump from a branch to the roof. Would have made it, too, had he not run out of leash. As it was, Cat's horizontal flight terminated (as we at Tek say) abruptly. Down he shot, stopping measurably short of terra firma, and was recovered some time later just hanging there, doing nothing—except, probably, counting filberts and grinning.

FOR THOSE of you who don't get to read Tektopics, the excellent publication of Tek Guernsey, here are a couple recent items of interest:

- That group marked down its first five-year employee in October. She's Val Davison, now a member of the Tektronix Ltd. staff.
- November 5 will see the crew celebrate Guy Fawkes Night. This may be a strange name to us, but the ensuing "Sausage Sizzle" isn't.
- And, all credit goes to Guernseyites for finally coining a name for lady Teks: Tektrinians.

FOR JUST plain old human interest, we like this picture sent by Walt Morrison on Guernsey. It shows one lively event at this year's Tek Guernsey picnic: The kids' twist contest.

Thanks to Walt, and apologies for the tardy publication. The picture, though, is timeless:

High Street, St. Peter Port, Guernsey

TEKTRONIX, INC.
13955 S.W. Millikan Way
Beaverton, Oregon
Return Requested

BULK RATE
U.S. POSTAGE
PAID
BEAVERTON,
OREGON
PERMIT NO. 1