COMPANY CONFIDENTIAL

# Engineering News

VOLUME 3/ NUMBER 4 APRIL 1976 JOYCE LEKAS, EDITOR X6601 RHYS SCHROCK, ASSOCIATE EDITOR X6071 DS 50/462


# TEK CHANGES T&M INSTRUMENTS TO FIT UL1244

"The problem here is that you shouldn't be able to touch a live part when the scope is operating. . ."

## TEK TEST AND MEASUREMENT CHANGES TO MEET UL1244

UL1244, Underwriter's Laboratories, Inc. standard for electrical and electronic test and measurement equipment is still in draft form. An increase in industry response will bring further revisions before it will be issued in final form. To find out exactly what UL1244 will mean to future Tektronix designs, Engineering News interviewed Richard Nute, Product Safety Engineering Manager.

*When is UL1244 expected to become final? When will it begin to affect Tek?*

Right now it looks like it will be in final form near the end of summer. The original goal was June, but the date was moved because of recent developments. Industry is now responding as an organized group through WEMA.[1] Higher levels of management in some companies have provided a more professional, broader based, and unified response to the most recent (December, 1975) edition of UL1244. UL will hold a meeting with representatives of the electronics industry on April 13 to discuss the impact of UL1244 on industry, and negotiate plans for implementation of the standard.

UL1244 will take effect one or two years after it reaches final form. The decision is made by UL, based on how long manufacturers say it will take them to comply, UL has always cooperated with industry.

*As the instruments affected by UL are used mostly by scientific people, does UL consider the competency of the user in their standard?*

No. you can see the reason for that right around our own plant. Test and Measurement equipment is used in production and manufacturing areas by people who are not scientists or highly trained.

*Will we be required to modify existing instruments which have already been sold? How about non-listed instruments still in inventory?*

UL does not require us to modify instruments which are already sold. Some customers may ask us to modify equipment, and we would probably do that, for a price. But frankly, I don't expect that we will be asked.

Instruments on the shelves which have not been sold yet could be handled a couple of ways. We could sell them without listing since we still have a lot of customers who don't require listing. Or, we could modify the instruments although that alternative would be expensive.

*What expenses will be involved in changing existing product lines?*

Changing an existing product line can be expensive, but learning the new discipline for new products is relatively easy. Take, for example, the selection of a plastic material. UL requires that you consider the flammability. Flammability characteristics of a material can be considered early in the design of a new instrument. Flame retardant material may cost a little more, and require harder, more expensive tooling, but included from the beginning of a project, the changes would not add to the time or difficulty involved.

Sometimes UL requirements can cut costs, as with some of our probes. It is more expensive to design a probe to meet UL requirements, but one result of this additional design expense is interchangeable parts which result in long term savings.

*Will the plug-in system used in our 7000 series, TM500, etc. have to be modified at all?*

UL and industry are still looking at the plug-in question. The problem here is that you shouldn't be able to touch a live part when the scope is operating, with or without plug-ins installed. Newer products are being designed with protective covers over the internal circuitry. In a new version of the TM504, for example, only the plug-in connectors are accessible. →

[1] Richard Nute is chairman of the WEMA UL1244 committee. -ED.

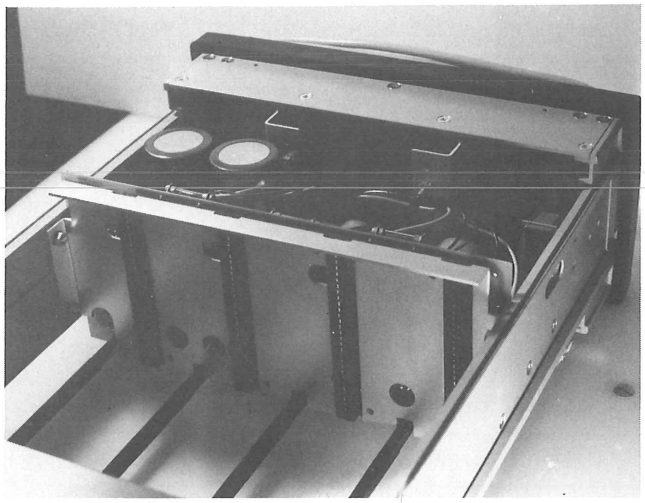


Figure 1. A metal cover protects the user from dangerous currents in a new version of the TM504.

*Is there anything that would make us scrap the plug-in concept?*

No. If you can show UL that you would have to scrap a product line, they will probably change their requirements to accommodate the line.

*Are most of our instruments basically within UL1244 requirements? Where are they out of spec?*

Most of our instruments are close to the UL1244 requirements. In general, the problems include the internal construction, choice of plastic materials, and in some instances, sloppy wiring. We will have to concern ourselves with wire insulation systems and can have no wires passing over sharp edges.

*What must we change in our internal wiring systems?*

We will have to watch the temperature and voltage ratings. Each wire and insulation system has maximum voltage and temperature ratings which we cannot exceed. Wires of different voltage ratings must not touch one another. This will mean separating some of our wiring harnesses. (See March 19, 1976 COMPONENT NEWS, page 20.)

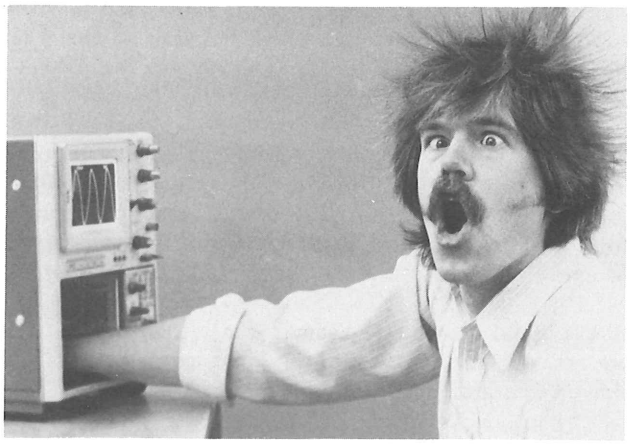


Figure 2. Live parts are accessible in the plug-in compartments of our instruments.

We also run wires over sharp edges in some places. UL does not allow this. There must be grommets in sharp holes and the sharp edges may be bent over.

*Do all our power cords meet UL1244?*

The cords we buy are UL recognized. It is hard to buy a non-UL-recognized power cord. But the cords are not safe in the unwired condition because they have a plug on one end and three wires sticking out the other end. They must be wired into an instrument safely before the UL label can be put on the instrument.

*What will have to be done with our transformers?*

The problem with our transformers is that they are low impedance devices. UL wants to limit the currents from secondaries. With the currents limited, you can't get enough energy to cause a hazard. What concerns UL is that in failure mode, the internal temperatures of the transformers could increase to the point where the internal insulation will cook or burn, causing other hazards. Some type of protection must be built into a transformer. In order to meet UL requirements Tek will put a thermal protector inside the transformer. The placement of the thermal protector is critical. We will have to test until we find the position where the protector reacts when the transformer gets hot enough to do damage. Transformers costs will increase if we are to meet UL requirements.

*In general, what is considered abnormal operation and what types of problems appear?*

Abnormal operation is when a failure occurs in a secondary circuit. The failure can create sufficient loading to cause excessive heating. This, in turn, may damage insulation, creating a shock hazard or internal fire.

*Are there any implosion hazards with CRTs?*

Implosion is not considered a hazard if the viewing surface is less than six inches in diameter. This includes most of the CRTs in our Test and Measurement equipment.

*Can we presently get UL listing for Test and Measurement equipment?*

Despite the fact that the UL1244 standard is not yet adopted, nor are there any official requirements, we can still list products under UL1244. If there are any future changes in the standard, UL will review the listing, and will let us continue to use the listing marking on the product for a year or so. That would give us plenty of time to conform to the new standard.

# CSA (Canadian Standards Association)

CSA Test and Measurement safety requirements are presently in draft form. They concern themselves mainly with primary circuitry. They also make one assumption that UL does not: that such measurement equipment is used only by professionally trained people. Therefore, they are not concerned with anything on the secondary side of the transformer. The general requirements are very basic; you must have a solid panel under the power transformer, CSA certified components on the primary circuit, and must pass dielectric withstand testing and power cord polarization testing.

During the second week in March, a CSA engineer qualified Tektronix' Product Safety Engineering Group to certify IDG products for compliance with the CSA data processing equipment requirements. Adequate documentation and records must be maintained to show that we do meet the requirements. Product Safety Engineering expects soon to be qualified to certify Test and Measurement products also.

# SAFETY REPORT!

The Corporate Safety Department has asked managers in Building 50 to ensure that flammable liquids used in their areas be contained in approved safety cans. The Technical Center is not at present protected by a fire sprinkler system, and though one is planned, it will take a long time to install it. In the meantime, there are many gallons of flammable liquids in the building. Most of these liquids are not in safety containers. Under the circumstances a fire, unless controlled immediately, poses a severe risk. Stainless Steel Safety cans are currently under evaluation. The main problem with stainless steel is that it may contaminate the liquids. IC Engineering processes require a high degree of purity. These liquids are now purchased in glass bottles with a poly-vinyl chloride coating. In case of breakage this type of bottle is good for preventing strong acids and bases from splashing on someone, but flammable liquids may still leak out the neck. In case of fire these bottles provide no protection whatsoever.

The major flammable liquids that are used in the IC Engineering Lab are Acetone, Xylene, and Isopropyl Alcohol (IPA). Acetone is by far the most common. A typical use for acetone is to dissolve the organic molecules (resins) of photoresist from the surface of the silicon wafers used in IC production. The photoresist is a gooey substance, and is applied to the wafer with a syringe. Acetone is used to clean the photoresist from the syringe also.

If a defect is found in the photoresist after it is baked on, acetone will not dissolve the material. In this case Trichloro ethylene (TCE) is used. TCE is non-flammable but is stronger than acetone in some applications. It can also be a pollution problem. The fumes are unhealthy, and contact with the skin makes it difficult to tell the difference between the hands of a teenager and those of her 40 year old mother.

**Figure 1.** Photoresist is applied to the wafers with a syringe. The wafers rest on rotating pads. The speed of the rotation determines the thickness of the photoresist.

Xylene is another flammable solvent, but is used primarily as a thinner for photoresist. It is also used occasionally as a cleaner when acetone and TCE will not do the job. It is considered a health hazard.

Sometimes it is important to completely remove all traces of water from the wafer surface. Isopropyl alcohol (IPA) is used to dissolve the water, then the IPA evaporates quickly from the surface by means of an air gun. Acetone can also be used to do this.

IPA is useful for general cleanup jobs in the lab. The fumes are not particularly harmful, and skin contact is not considered a hazard.

There are no acceptable inorganic solvents suitable for these applications, so special precautions are taken to ensure safe →

storage and handling. The bottles containing these flammable liquids are stored in a ventilated cabinet at room temperature. Solvents are used only in exhausted hoods. Users wear gloves at all times to protect their hands and maintain lab cleanliness. Only a couple days supply of solvents are kept in the lab at any time. There are no problems with violent chemical reactions, although some liquids, particularly Xylene can do physical damage when absorbed into the skin.

**Figure 2.** Flammable liquids, solvents, chemicals, and acids used in Building 50 are stored in the Chem shed.

The fire marshall has for some time been asking Tektronix to replace the glass bottles with stainless steel cans. We have hesitated to do this because of possible contamination. Gene Hansen's group is experimenting with 12 approved stainless steel safety cans.

First, a can is rinsed with the liquid to be tested to remove any loose particles from the inside of the can. Next, the can is filled with the high purity liquid. A control sample is set aside and compared against test samples which are removed from the cans at 2 days, 10 days, and 42 days. There has been some contamination, but no more than 100 parts per billion. In some cases there has been little change after 10 days. Although there are too many variables to draw definite conclusions, the indication is that contamination will decrease with usage.

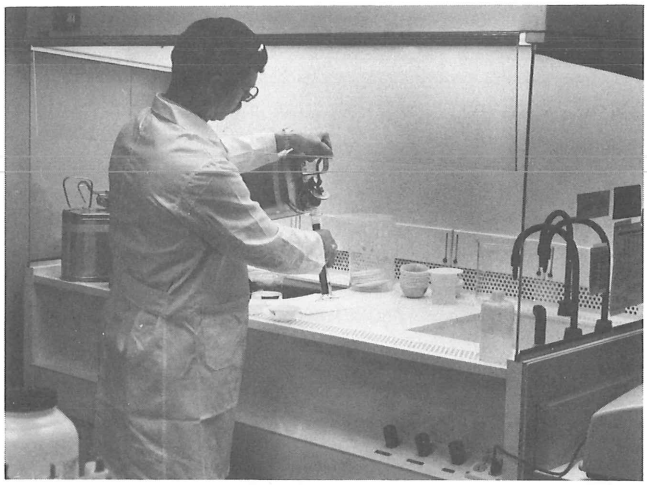


**Figure 3.** Liquids are poured from one container to another in a laminar flow hood. The air within the hood is filtered through Micropore filters and collimated across the hood entrance to keep the working area free of contaminants.

If Tek decides to use stainless steel safety cans, there is the additional problem of adding contamination while filling them. There are two ways to handle this: 1) we may be able to purchase the liquids already in such containers. But a guarantee would only cover the purity of the liquid, not the cost of four or five weeks work if a run of wafers was ruined through contamination. 2) We could load the safety cans at Tek. To do this and maintain purity of the contents will require sophisticated dispensing equipment and stringent quality control, which we do not presently have.

Rick Bushell, Corporate Safety Director says that management is putting together a plan and timetable for the use of safety cans. In the meantime, he suggests that we store all flammable liquids in safety cabinets; store only as much as is absolutely necessary; and especially to use care.

## BICYCLES

Have you noticed the bicycles chained to benches, in the aisleways, and on the handrails between buildings? A few

**Figure 4.** There are no known laws, regulations or codes that forbid the parking of bicycles in this walkway. →

weeks ago a number of bicycles were gaily decorated with safety committee tags, recommending their removal. This action provoked heated controversy reaching high into morning coffee breaks and Area Rep activity. The concern raised by some was that the parking of bicycles in a walkway consititutes a safety hazard in case of building evacuation. Bicycle owners contend that the bicycles needed protection from the rain, and that they weren't in the way.

The problem was submitted to the Corporate Safety Department for a decision. They looked into the situation with respect to laws, regulations, and codes governing walkways. It was found that in this specific case no infraction existed.

If the safety committee feels that a situation is unsafe, despite the lack of supporting legislation, they can submit the problem to the Corporate Safety Department. If they reach an agreement that the situation is unsafe, they will document the conclusions and lend whatever support is necessary to enforce the decision. On the other hand, if the situation is not found unsafe, and the safety committee still wishes to change the situation, they must take it up with the persons and managers in the area involved.

# Calculator/Plotter Combine For Fast Analysis

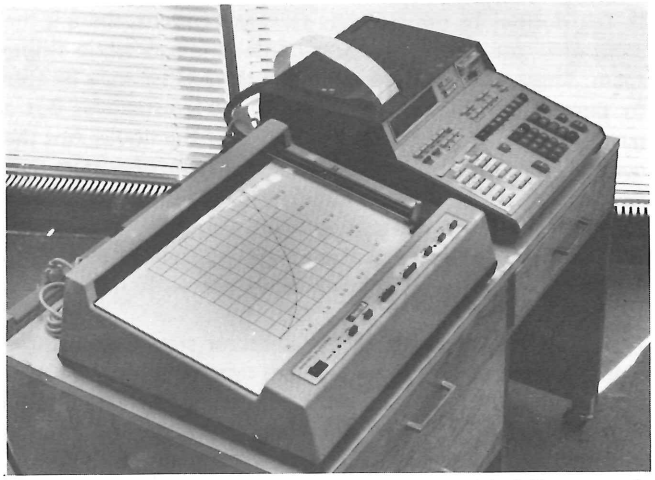


**Figure 1.** The Tek 31 Calculator and the 4661 Digital Plotter work together to process data in the Analytical Support Lab. Programs on magnetic tape instruct the calculator to perform mathematical calculations and the Digital Plotter to draw graphs.

## ANALYTICAL SUPPORT LAB'S PROGRAMS for the TEK31 and 4661

Bob Bechtold, Analytical Support Lab, is developing programs which combine the Tek 31 Calculator and the 4661 Digital Plotter to process data in the lab. The Analytic Support Lab analyzes samples of unknown materials to determine crystal structure, molecular composition and percentages of the substances found. Data collected from x-ray equipment, the spectrograph, the gas chromatograph, and other analysis equipment must be processed mathematically for comparison with compound comparison charts. These calculations would take hours or even days to perform using a slide rule or calculator. The programs that Bob is writing or adapting perform the same calculations in as little as ten minutes. Only the entry of data is required. The calculator-plotter team averages, analyzes, plots, and generally processes the data into usable forms.

### X-ray Analysis

Unknown materials found in an oven or on a surface are sometimes difficult to eliminate unless their composition is known. X-ray analysis is a time consuming, but reliable way to get this information. A sample is sent to Bob Bechtold,-50-289. He grinds the sample and places a portion in a capillary tube with an inside diameter of .2mm. The end of the tube, containing the sample is mounted as the target in the center of a 6 inch diameter X-ray powder camera. An x-ray beam is aimed at the target, which rotates at one RPM for three or four hours. A series of concentric circles given off by the crystal is recorded on the film. The circle pattern is a unique characteristic of each crystal.

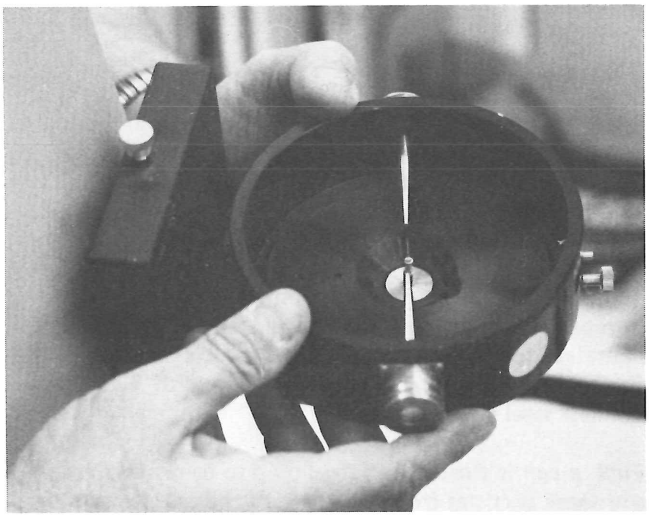


**Figure 2.** An x-ray Powder Camera. The sample is mounted in the center, a strip of film is placed around the inside circumference of the camera, and the sample is bombarded with x-rays as it rotates at one RPM.

The lines on the film are measured with a highly accurate film measuring device and the distance recorded. Now the calculations begin. The distances are averaged to find center →

lines; film shrinkage is calculated; distances are equated to a 180 degree scale; and the various dimensional parameters of the crystal are calculated.

Using the calculator's programmable feature with a magnetic tape cartridge, the entire sequence is executed in less than ten minutes. The results are visually compared to a card file which tells the crystal structure, composition, etc.

Bob averages about 3 x-ray analyses a week. He estimates that he can identify approximately 50% to 70% of those substances submitted. Accuracy is very high, and analysis can be done on very small samples.

Bob is working on a number of similar programs for the other equipment in the Analytical Support Lab.

1. Programs are available for use with the gas chromatograph. The gas chromatograph analyzes hydrocarbons in liquids and gases.

2. The x-ray diffractometer is similar to the x-ray powder camera, except larger samples are required, and the results are recorded electronically, rather than on film. A program is being developed to collect and process the data.

3. One program will plot what LAUE x-ray photographs will look like for any crystal orientation. The crystal is then aligned in the LAUE to match the plot. In this way, alignment errors can be determined in cut and polished crystals to a high degree of accuracy.

4. Programs will be developed to process data from most of the Analytical Lab equipment. Most of these programs will reduce the lengthy mathematical calculations which are necessary in some laboratory analyses.

For more information, contact Bob Bechtold, ext. 7520.

# *papers. . .Call for papers. . .Call for papers*

**The 1976 Submillimeter Wave Conference and Winter School** will be held in San Juan, Puerto Rico on December 6-10, 1976.

SPONSOR: Optical Society of America and the IEEE Society on Microwave Theory and Techniques, and International Commission for Optics.

TOPICS: Any work concerned with submillimeter wave (25 micrometers to one millimeter) and far infrared theory, techniques, devices, system spectroscopy, and applications will be considered. Areas of interest include:

Apparatus
- Coherent sources, tunable and fixed frequency
- Detectors, all types
- Modulators
- Instruments and Devices

Measurements
- Spectroscopy
- Astronomy and Astrophysics
- Nonlinear Optics; Radiometry; Plasma Diagnostics

Applications
- Communications
- Radar
- Pollution Detection
- Analysis
- Isotope Separation

ABSTRACTS: Submit a 35-word abstract by August 2, 1976 to the Program chairman:

Kenneth J. Button
Massachusetts Institute of Technology
National Magnet Laboratory
Cambridge, Massachusetts 02139

OTHER: Submit a summary of 500 to 1000 words with up to four illustrations by October 1, 1976 to the Publications Chairman. The summary and illustrations must be submitted on special paper which may be obtained from the Publications Chairman:

Prof. Sidney Perkowitz
Physics Department
Emory University
Atlanta, Georgia 30322

CALL FOR PAPERS

**The 47th Shock and Vibration Symposium** will be held at the Albuquerque Inn, Albuquerque, New Mexico on October 19-21, 1976.

SPONSOR: The Defense Nuclear Agency.

TOPICS: Contribution papers relating to the many aspects of the mechanical shock and vibration technology are solicited. No specific topics have been chosen; however, →

plans are being formed and suggestions for topics are welcomed.

OTHER: Further information may be obtained from:
The Shock and Vibration Information Center
Code 8404, Naval Research Laboratory
Washington, D.C. 20375

## CALL FOR PAPERS

The complete notices for all Call for Papers are on file in the Technical Information Office. Editorial assistance with these papers is available from the Technical Information Services, ext. 6601, del. sta. 50-462. Ask for Joyce.

### IN PRINT

Neil A. Robin, Industrial Display OEM, authored an article which appeared in the March, 1976 issue of COMPUTER DESIGN magazine entitled "The Logic Analyzer: A Computer Troubleshooting Tool." The main characteristics common to logic analyzers are discussed, logic timing analyzers are compared to logic state analyzers, and some of the outstanding features of some logic analyzers are described including pre-trigger viewing, multi-beam display, digital output, state mapping displays, and state and time distorted displays. A chart compares features of logic analyzers produced by Tektronix, H-P, Biomation and other companies. Two typical applications are also included.

### IN PRINT

The 4051 Graphic Computing System is featured in the microprocessor application section of the March 5, 1976 EDN magazine. The graphic capabilities are described, as well as the bus system, interface capabilities, and the reasons for choosing the Motorola 6800 $\mu$P rather than the Intel 8080.

### IN PRINT

Jim Tallman, 7000 Series Engineering, authored a two part article which appeared in the January 20 and February 20 issues of EDN magazine entitled "Bringing up the PACE microprocessor—a detailed application story." Jim was with Datatron when he did the work described in the article. Part one describes how he and co-workers built a breadboard for the PACE microprocessor. They used the bare minimum number of parts required to operate the PACE. A sample program to exercise the breadboard is explained, as well as a software teletype interface, schematics, and timing diagrams.

Part two, in the February 20 issue, describes a minimum debug program which was run on the PACE. After a description of what a delay program is, in general, a detailed flowchart and program listing is given with schematics of additional hardware. This program can be used as the basis for understanding debug concepts and developing more advanced programs.

## WRITING FOR PUBLICATION ---EDN

The editors of the trade journals stop by Tektronix from time to time looking for technical articles and information. Because the Technical Information office is set up to help serve both their needs and the needs of the engineers who want to write articles, we will run a series of articles describing the specific needs of some of the magazines. We'll start with EDN.

**Technical Articles:** EDN wants articles that are **useful.** What that means is: 1) It must be proven idea; 2) It must tell the reader something he doesn't already know; 3) It must describe to the reader he can use this information. As with all the trade journals (we'll discuss the exceptions later) a technical article is not a sales pitch. For example, you'll generally have better luck, discussing a technique that can be used with **any** oscilloscope, and use a Tek scope to demonstrate the technique, than you will with a technique that can be carried out **only** on a Tek scope. Of course there are exceptions, so we'd like you to bring articles around and talk about them rather than to reject ideas out of hand.

**How long should articles be?** Long enough to cover the subject. Magazines generally do not publish book length stories. Most articles are three to four printed pages which is nine to twelve typed pages double spaced. Illustrations will take part of that space. Remember! It is better to write too much than too little. We can edit down but have trouble adding material.

**How much do they pay?** $30 per printed page. This is pretty standard among the 'trade magazines.'

**News Stories:** These are one or two pages of information interesting to other engineers but not necessarily ready to be finalized. Breadboard designs, breakthroughs in technology, quick techniques, things you have found that might be useful to another engineer.

**Design Ideas:** Again, a page or two. (typed) These are usually circuit designs. EDN pays $25 for each printed design, a $25 bond for each issue winner, and $1000 bond for the annual grand prize winner.

Look through EDN to see if you would like to write for →

them. If you find it a useful magazine, chances are that they will like what you write. EDN articles which have not been described here are generally staff written. You may be called upon to provide information for them, but there is no pay for that preformance.

So bring your rough drafts or article ideas to the Technical Information office, 50-462. We'll help with the rewrite, contact the editors, and you'll be on your way.

### IDG TECHNICAL REPORT

Steve Baunach, IDS Calculator Engineering, presented a paper at Compcon/76 entitled, "Graphics in a Language Directed Machine." In this paper, he explains how a set of two dimensional graphic commands may be added to an interactive problem-solving language. BASIC was chosen because it has acceptance as an interpretive interactive language and it lends itself well to a dedicated language machine. He includes extending existing I/O commands to handle external devices, commands which allow the operator to specify his own data space, and a description of graphic primitives (commands to draw relative and absolute vectors on the graphic device.) The paper also discusses details of the concepts which are implemented on the Tek 4051 graphic computing system.

# Stolen Equipment

Following is a list of instruments and calculators that have been reported missing from Tek in the past month. If you know the whereabouts of any of these items, contact **Myron Warren**, ext. 5337. If you feel uncomfortable because of circumstances, anonymous letters will be accepted. His delivery station is 50-250. Include particulars (serial number, etc., if possible); the equipment may just be on loan.

| ITEM | SERIAL NUMBER | BLDG. | VALUE |
|---|---|---|---|
| 324 | 303134 | 46 | $1,325.00 |
| "Kennedy" Tool Box & Tools | --- | 46 | 200.00 |
| 213 Test Scope | --- | 47 | 1,200.00 |
| Takumar 28mm wide angle lens | 7220539 | 58 | 136.15 |
| IBM Selectric Typewriter | 9772701 (Tek Item 71612) | 58 | 500.00 |
| Waterloo Machinist's Tool Box | --- | 50 | 250.00 |
| 1 Gram Scale | --- | 19 | 100.00 |
| PG 506 | B031198 | 50 | 1,195.00 |
| J16 Photometer | A08 | 58 | 660.00 |
| J6511 Illuminance Probe | A039 | 58 | 300.00 |
| Welding Torch, tips, hoses, fittings and regulators | --- | 58 | 224.55 |
| Schefflera plant and pot | unknown | 73 | 70.00 |
| Sears radio, battery, & headset | --- | 47 | 38.00 |

### TECHNICAL ECONOMICS FOR ENGINEERS

The national AICHE (American Institute of Chemical Engineers) Today Series Course, "Technical Economics for Engineers" will be given at the Portland Hilton, May 13 and 14, 1976 (including lunch). The instructor will be Dr. A. W. Hawkins, formerly with the Planning and Evaluation Section, Research and Development Division, Explosives Department of DuPont in Gibbstown, New York.

It is a two-day short course intended to provide engineers with a working knowledge of the fundamentals and current practices in process economics. Over half of the time will be devoted to problem working and discussions, the rest to lectures. Applicants will need to spend about six hours in preparation. Upon arrival they will need to have a grasp of financial statements and interest. The participants are encouraged to bring straight edge and calculators or slide rules to the course since it is a working type course. The class size is limited to 40.

To assure a common base for all participants, pre-course assignments in financial statements and discrete interest problems should be completed before the course lecture sessions. The necessary material will be mailed to the registrants directly. Please allow at least two weeks for this material to be covered.

The course fee is $100 and registration should be made through Dr. Mark Hannah, Crown Zellerbach, Centra Research, Camas, Washington 98607 - phone 834-4444. The AICHE Program notice, course schedule, and a copy of the registration form are in the Technical Information office, 50-462.

# *Education Loans For Women*

An article in the April 2 OREGONIAN announced the establishment of a revolving loan fund to assist women in obtaining graduate engineering degrees. Established by the Business and Professional Women's Foundation, the fund has received a $100,000 grant from Exxon Education Foundation to assist in starting the program. $70,000 in loans will be granted annually to women accepted for masters-level study as universities accredited by the Engineers Council for Professional Development.

Application forms are available from the foundation at 2012 Massachusetts Ave. NW, Washington, D.C., 20036. Deadline for applications for the 1976-77 academic year is April 20.

# M 156: Vertical Amplifier

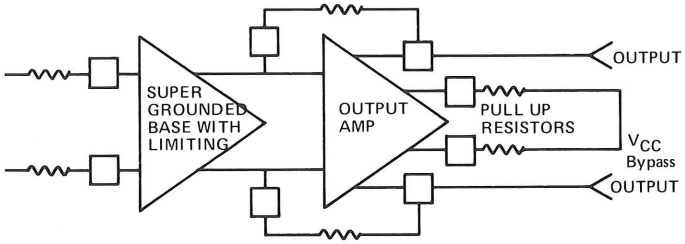
**NEW INTEGRATED CIRCUIT**

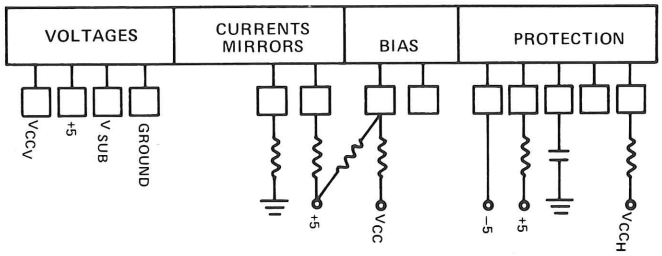
The M156 is a low power class A-B differential deflection amplifier capable of up to ±45 volts differential output swing. Transresistance, pull up speed, bias current, average output level, protection circuits, and internal levels are programmed by external resistors. Input impedance is low and relatively constant over a large portion of the dynamic range to facilitate accurate delay line series termination. Distortion is low for both the sine wave and the step response over a large portion of the available dynamic range.

This circuit has passed initial testing. A companion circuit, the M157 is in process. This circuit pair was intended to be mounted on a substrate with thick film resistors to form a complete deflection amplifier system with a bandwidth in the neighborhood of 25 MHz, and 20 nsec sweep speed without heatsink.

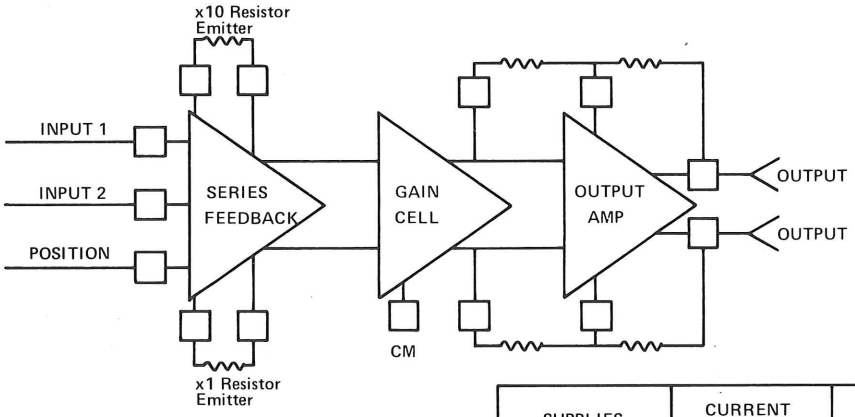
Below are block diagrams of the two circuits. For further information about possible applications, contact Jim Knowlton, ext. 6118, or Carl Battjes, ext. 5811.

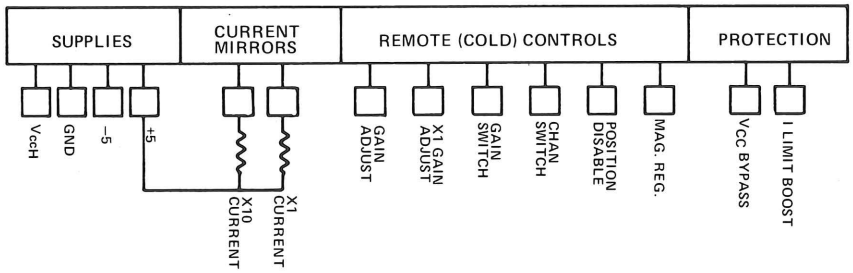
## M 156 (Vertical)




## M 157 (Horizontal)



# SPECIAL DESIGN FILE

Here are some more drawing packages which are available for the asking. These are designs which have been built by various groups for their own use, and which they think might be adaptable for other areas. If you would like a copy of any of these drawing packages, call Rhys, ext. 6071. Also, send in drawing packages and brief descriptions of any special designs that you would like to share to Special Design File, 50-462.

**File No. 0005**

**POWER CONVERTER, POWER LINE TO SINGLE OUTPUT**

Line range: 90-250 $V_{rms}$, D.C. or 44 to 440 Hz.
Load range: 0 to ≈ 15 watts, fully overload and short circuit protected.
Output Voltage: 9.80 V ±1% (alterable)
Efficiency: ≈ 70%
Meets UL114 and UL1244
Manufacturing cost: ≈ $19.00 (February, 1976)
Artwork for 3" x 5.5" EC board available, schematics available, 2 minor circuit problems remain unpolished. - Bruce Campbell

**File No. 0006**

**THEMOELECTRIC HEATER-COOLER, +85°C to +5°C**

This system can be adapted for any application. -Gary Spence

**File No. 0007**

**DIFFERENTIAL INSTRUMENTATION ANALYSIS AMPLIFIER**

1. Stability: .0005% @ 30 minutes
2. Input: ±15 V
3. Zero crossing detector included
4. Output offset servo input
5. Precision gain window
6. Input nulling balance indicator -Gary Spence

**File No. 0008**

**START-RUN-RESET TIMER** - Gary Spence

**File No. 0009**

**VACUUM STATION CONTROLLER AND MONITOR SYSTEM**

1. Automatic liquid nitrogen level control
2. Automatic cryopanel control
3. Multiple ion gauge switch -Gary Spence

**File No. 0010**

**ELEVATED GRID UNBLANKING CIRCUIT -Gary Spence**

**File No. 0011**

**LOGARITHMIC AMPLIFIER FOR UTI 1200 QUADRUPOLE GAS ANALYZER**

1. > 50 KHz response
2. Baseline integrator
3. < 3 mV peak-to-peak noise
4. Four decade dynamic range
5. Single sweep reset - Gary Spence

**File No. 0012**

**DUAL FILAMENT AUTOMATIC CATHODE BREAKDOWN UNIT**

1. 5 watts per filament
2. High pressure gas interlock
3. Programmable
4. The unit is available for loan. - Gary Spence

**File No. 0013**

**HIGH SPEED PHOTODETECTOR**

1. System sensitivity: 15 $nW/cm^2/mV$
2. Frequency response: DC-200 kHz
3. Rise and fall time: < 1 $\mu s$
4. Minimum detectable signal: 5 $nW/cm^2$
5. Noise: < 1 mV peak-to-peak — Gary Spence

**File No. 0014**

**PROCESS GAS ANALYSIS PROGRAM FOR TEK 31 CALCULATOR**

Calculates 42 gases. Program tape and operation booklet available for loan. -Gary Spence

**File No. 0015**

**REMOTE GAIN AMPLIFIER**

External voltage sets the gain. - Ron Robinder

# Scientific Computer Center

## STAR

The STAR program (Simple Test Approach to Readability) is now available on Tek's KRONOS timeshare system. STAR estimates the complexity of text.

To use STAR (after you obtain a user number and log on) type:

→ STAR

After a delay, while the system prepares itself, STAR will ask:

→ ENTER READ FILE NAME

?

→ The user responds with the name of a **permanent** file. (The text which is being analyzed by STAR must be in a file.)

Next the user is asked:

→ DO YOU WANT TEXT PRINTED? (YES OR NO)

?

Finally:

→ DO YOU WANT HI-CAL WORDS PRINTED? (YES OR NO)

?

If the program has any trouble getting the file, an error message will be printed and the program will begin with the first question again. If the error message is too cryptic, consult the SCC personnel.

The program will either list the text with hi-cal (three syllables or more) words interspersed, list the text, list the hi-cal words, or procede with the summary. The information contained in the summary includes the so-called Flesch Index, Dale Index, and a guesstimated grade level.

For further information on STAR and what it does, contact Joe Mondell, ext. 6527.

## WHAT IS A CCD AND HOW IS IT USED?

The CCD (Charged-Coupled Device) is an IC first invented and built in 1969. There are two different configurations in which the CCD can be built: an area CCD which is composed of a grid of tens of thousands of gate electrodes on a silicon substrate; and a linear CCD, which is made up of a series of gate electrodes side by side. Application of a charge to an electrode causes a depletion region or potential well in the silicon region beneath. Charge-coupling is the transfer to charges placed in those wells to adjacent wells by external voltage control. (Similar to a fireman bucket brigade where water is poured from one bucket to the next.) As in the case of the water, something is lost each time the transfer is made. Therefore, to obtain maximum transfer efficiency, structures and processes must be carefully considered in CCD design.

CCDs are used in both digital and analog systems. TRW has been the primary source of CCDs for digital applications. Recently they announced plans to construct a CCD digital version of a Fast Fourier Transform (FFT) Block. The CCD will implement the basic and/or gating functions. Because CCD have higher packing density and lower power requirements than MOS, TRW will try to build the complete function on a single chip.

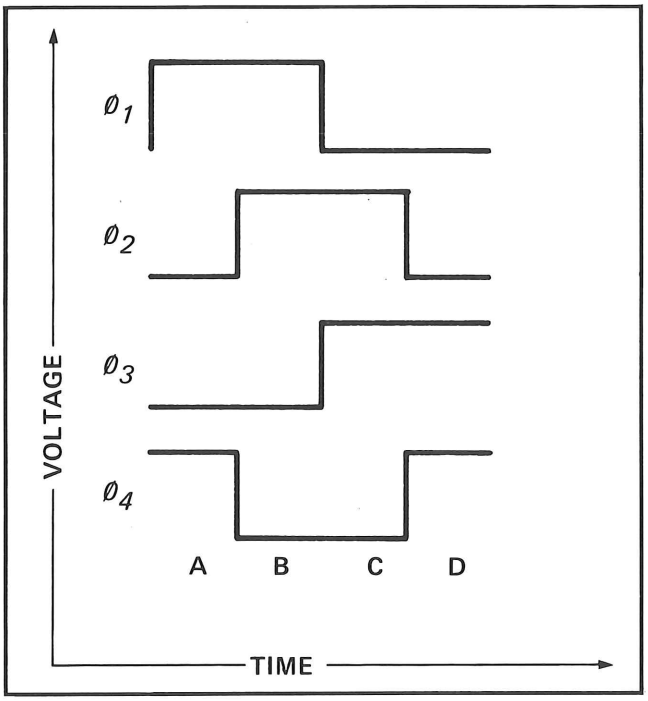



**Figure 1.** Clock signals are applied to the phases to create charge movement.

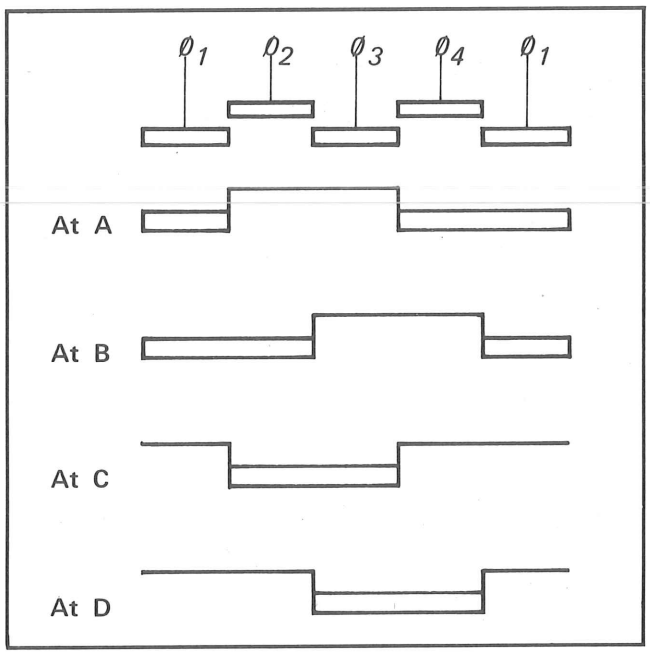



Figure 2. The charges in potential wells are transferred sequentially.

Analog applications of CCD are much more common. They include signal averaging, filter functions, transform function, A/D conversion, video pickup, and delay lines. The television vidicon tube was the first CCD use to find support and exploitation. During the past three years, other analog applications of CCD have been under investigation, but none of these devices is presently commercially available.

Most CCDs are surface channel which means that the charge is moved at the silicon-silicon dioxide interface. They operate at a low clock rate of 10 MHz or less. Rockwell International is developing buried channel CCD and has obtained clock frequencies of 230 MHz. The upper speed of CCD operation has not yet been reached. So far, operating speed has been limited by external driver electronics which are necessary for operation.

For more information about CCDs and how they work, run over to the library and dig out the February, 1974 SCIENTIFIC AMERICAN, and the April 12, 1975 issue of ELECTRONIC DESIGN.

## SEMINAR ON REED SWITCHES

Representatives from Hamlin, Inc. will be here at 9:00 a.m. on Tuesday, April 20, for a one day Engineering Seminar on "Reed Switches, Today and Tomorrow." The Technical Center Auditorium has been reserved for the seminar. For further information, contact Jim Deer, ext. 6365, or Elmar Wefers, ext. 5814.

## 7000 SERIES INTERFACE MAINFRAME SPEC BOOK

Vaughn Weidel, 7000 Series Engineering, has recently completed a 7000 Series Interface Mainframe specification book. It will be distributed soon. To obtain a copy, call Judee Johnson, ext. 6527.

## TEKS ON BOTH SIDES

Two Tektronix Engineers will be involved in the 26th Annual Electronic Components Conference in San Francisco, April 26-28, 1976. **James Keski,** Ceramic Engineering, was on the paper selection committee for Manufacturing Technology. **William Berg,** Hybrid Circuits Engineering will present a paper on the Hypcon Connector System.

**Dr. Leslie W. Ball, Physicist**

*A Professor with the University of Pennsylvania*

will be at

Tektronix

★ ★ ★ 3 DAYS ONLY ★ ★ ★

**April 13, 14 and 15**

Dr. Ball, a Nationally Noted Reliability consultant, has had **MAJOR** Reliability Management Responsibilities with *Boeing* and *NASA*. He is a

*SPECIALIST*

in

*Reliability Management*

*&*

*Program Implementation Methods*

It will be a **6** hour Seminar in **2** (count 'em) parts.

**1** THURSDAY, APRIL 15, 9:00AM to 12:00PM

**2** FRIDAY, APRIL 16, 8:30AM to 11:30AM

in

TECHNICAL CENTER AUDITORIUM

He will discuss techniques of management for assuring success in achieving **RELIABILITY** goals. This seminar is directed primarily toward **ENGINEERS** and **PROJECT MANAGERS** who have reliability responsibilities. This seminar is **OPEN** to anyone who can benefit from this type of knowledge.

*A SPLENDID TIME IS GUARANTEED FOR ALL !*

For more details on this extravaganza, contact Jim Averil, Ext. 5186.

# Committee/Membership

Following is a list of people and work related committees to which they belong. It is hoped that this information will make it easier for Tek employees to address problems or comments to a specific group.

If you would like to make your membership on a committee more effective, fill in the following blanks and send the information to ENGINEERING NEWS at 50-462.

Ron Bohlman, Scientific Computer Center
IEEE Computer-Aided Network Design Committee (CANDE)

Robert Chew, Instrument Research, Tek Labs
Interface Standards Committee (IEC Instrumentation Interface Bus)

Morris Engelson, FDI
Spectrum Analysis Committees of IEEE and IEC

Bruce Hamilton, S.P.S. Engineering
U.S. Advisory Committee to U.S. Representatives and IEC TC66/WG3

Gray Hoselton, STS Engineering
IEC Interface Committee

Jon A. Meads, IDG/IDS Systems Engineering
ACM (Association for Computing Machinery) SIG/SIC Board
ACM Membership Committee
ACM/SIGGRAPH Standards Committee
Associate Editor, Computers and Graphics
NCC Referee

Bill Pooley, Industrial Support
ASME Member

Barry Ratihn, Industrial Support
ASME Member

John Reichen, Industrial Support
Society of American Value Engineers, Certified Value Specialist

Jack Sachitano, Integrated Circuits Engineering
ASTM Committee F-1 on Electronics

Chuck Sullivan, Technical Standards
American National Standards Institue Y14.5, Dimensioning and Tolerancing of Engineering Drawings

Elmar Wefers, Industrial Support
VDWI (Verband Deutscher Wirtschafts Ingenieur)

---

Please fill out & return to "Engineering News" 50/462

Maureen Key 60-553

NAME: _____

DEPT: _____

YOUR COMMITTEES: _____

_____

_____

_____

_____

RETURN TO: 50-462