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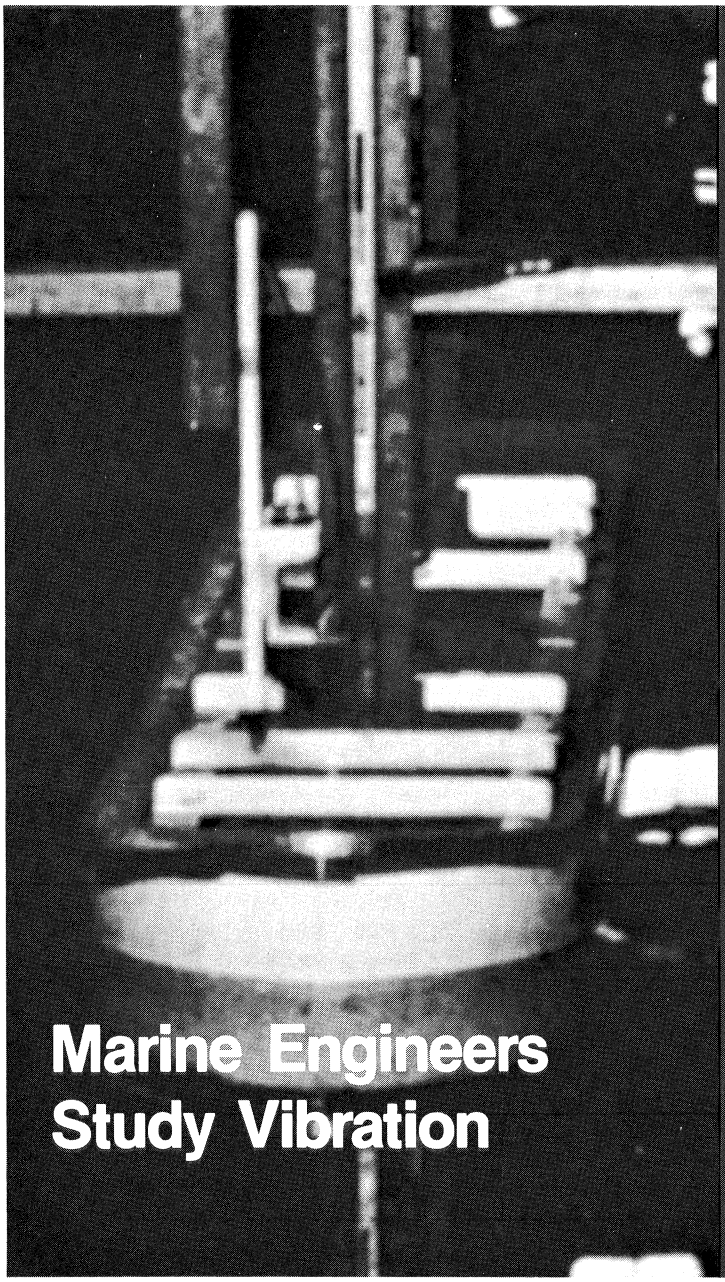
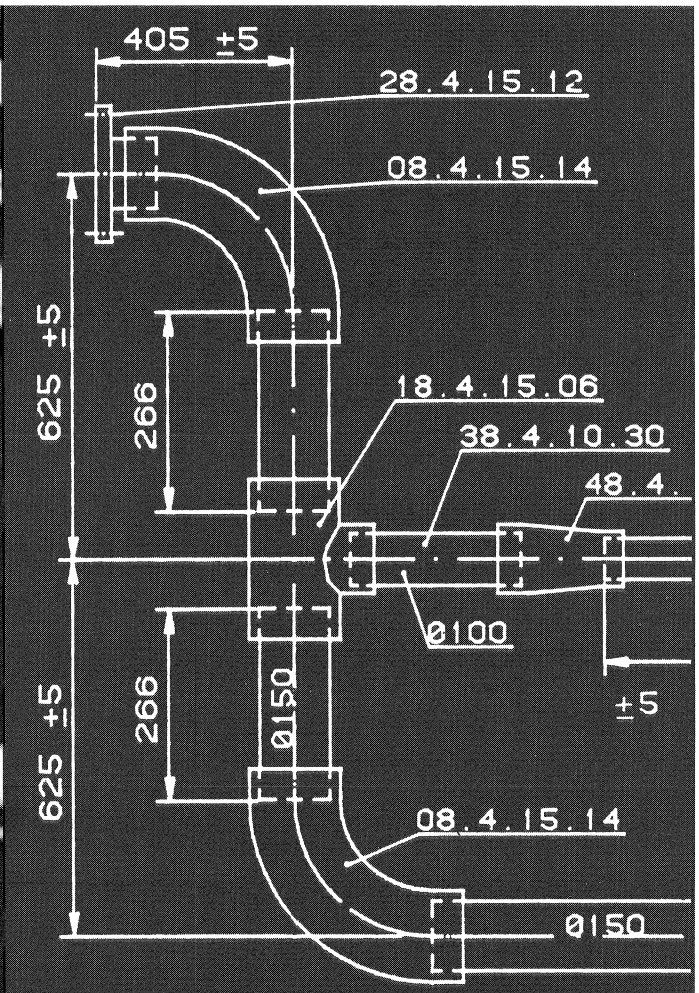


Marine Engineers Study Vibration



Graphics Improves Efficiency of Plastic Pipes Design

Tektronix®
COMMITTED TO EXCELLENCE

Tekniques

In This Issue

TEKniques, the 4050 Series Applications Library Newsletter, is published by the Information Display Division of Tektronix, Inc., Group 451, P.O. Box 500, Beaverton, Oregon 97077. It is distributed to TEKTRONIX 4050 Series users and members of the 4050 Series Applications Library.

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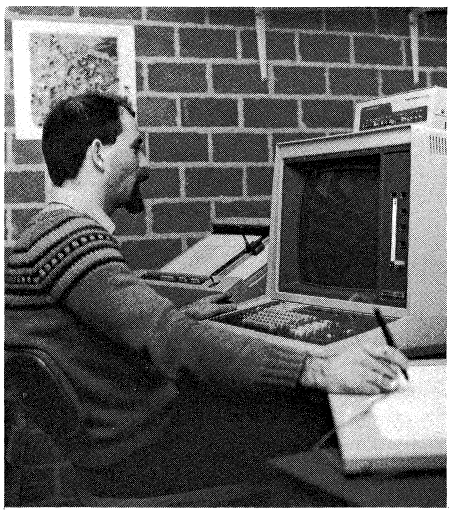
Graphics Improves Efficiency of Plastic Pipes Design

by William Third



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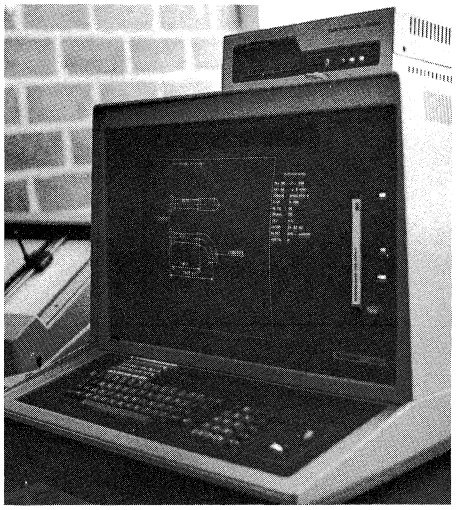


1b.

Figure 1a. The Tektronix 4054 Desktop Graphic Computer.

Figure 1b. The Tektronix 4054 Desktop Graphic Computer connected to the 4956 Graphics Tablet and 4662 Interactive Digital Plotter speeds design drafting at the Wavin drawing office in Hardenberg, The Netherlands.

The little town of Hardenberg in rural Overijssel, The Netherlands, seems an unlikely spot for industry. In fact, it is the site of a large, modern factory making products of plastic.

The factory, part of the Wavin Group, was brought into existence in the 1950's as a result of the provincial water authority's search for new pipe material. Since then the factory, and company, have expanded considerably. Although the production of pipes and pipe networks remains an important part of the activities, the product range is now much wider, and includes plastic crates and film products like the familiar plastic "vuilniszakken" or garbage bags.

Part of the reason for the company's growth, perhaps, has been its openness to new developments. It has a large research facility and a well established 30-strong computer center serving the whole Dutch organization. One of the computer center's recent tasks was implementing a Tektronix computer-aided design (CAD) system for producing drawings for pipes and pipe systems. It has helped achieve considerable savings in time taken to make a drawing and has helped reduce the risk of drawing errors leading to errors in assembly.

After evaluating a number of commercially available systems, including Wang, Hewlett-Packard and IBM, the company chose Tektronix equipment. Performance was a key factor, but so was the fact that Tektronix could offer a complete system, thus eliminating compatibility problems and giving a better service support position.

The system consists of a Tektronix 4054 Desktop Computer graphics terminal, a 4956 Graphics Tablet, and a 4662 Interactive Digital Plotter.

"Eighty percent of the glass fiber reinforced epoxy pipe production (Wavistrong) is exported to overseas markets, often in remote locations. Thus, there is a high degree of preassembly of pipes and fittings to minimize work in harsh environments," said Jan Carel Jansen Klomp, who headed the automation project. He continued, "We deal with two kinds of drawings: an isometric drawing from the client, and the usual two-dimensional drawings for the factory from which they make the pipe assemblies. Although each pipe network is custom made, we work with standard modules. So automation through computer-aided design equipment offered important advantages at the drawing stage."

The equipment was installed in January 1981 and was fully operational in four months. Mr. Jansen Klomp, who worked on the software, reflected, "Although we

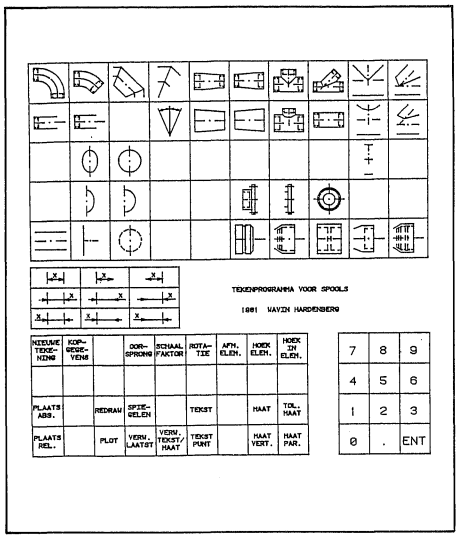


Figure 2. The two menus for element selection and drawing program used by the draughtsmen at Wavin.

had had no experience with this kind of equipment or with BASIC, the most difficult part of the operation was finding out from the users exactly what they needed. Some of the requirements the application demanded were fast response and flexibility, plus an interactive program to make operation easy. BASIC was chosen for practical reasons; new symbols to represent new components could easily be added by the people in the drawing office. When the software was ready, two draftsmen followed the Teleac TV course on BASIC at their own initiative. Since then the system has been fully operational and both hardware and software are performing very satisfactorily."

The Tektronix 4054 Desktop Computer offered two working methods. One entailed direct input of existing drawings from the 4956 Graphics Tablet using the digital pen. Although convenient for certain applications, it did not offer the accuracy of a second method.

In the latter approach, a program contains a subroutine for each element. The coordinates, such as begin-point, end-point, angles, and so on, are defined mathematically, and symbols are assigned to represent the different components.

"The mathematical method is more accurate and because we have a fixed amount of elements, it is easier," said Mr. Jansen Klomp. "The draftsman merely has to select from two menus. One displays the symbols for the elements, such as elbow, t-junction, bend, etc.; another displays the drawing instructions, such as vertical defining line, rotation, remove last element, element size (this in conjunction with a number submenu), redraw, and so on.

"When creating a drawing, the draftsman selects the element from the menu and positions it on the screen using the crosshairs controlled by the 4054's joystick. The position of the crosshair cursor on the screen is fixed by pressing RETURN. The beginning and end points of a pipe are also defined through this method. Once the 'locate' command is given, the element will appear in place on the screen.

"But, in fact, there are two location functions: a relative and an absolute. The absolute command draws the element at the fixed position of the crosshair cursor. The relative command directs the system to look for the closest connection point and 'go to' it. Also known as the 'snap-to' function, it automatically joins up the drawing. This makes drawing a lot easier," said Mr. Jansen Klomp.

Wipe out and rotation functions permit the drawing to be changed or perfected. Also, the draftsman does not have to worry about the scale of the elements, since that is determined by the elements chosen, in other words automatic scaling.

The decision not to draw to scale was made at the software stage. The advantage of not drawing to scale is a clearer drawing. If you have a pipe 10 meters long and an end piece of a few centimeters, you will hardly be able to distinguish the small, important end piece on a scale drawing. But, although the pipes are not *drawn* to scale, the correct sizes are in the computer!

The draftsmen develop and design the pipe assemblies on the Tek 4054 and assign the scale from the customer's isometric drawing. The drawings produced also carry information such as a drawing number for archive retrieval, article number, description of the subassembly, diameter of pipe and pressure rating (6 to 25 bar), plus the draftsman's name, client's name, date and number of pieces. All that is fixed and displayed for operating purposes. The drawing is plotted on preprinted forms, so all the relevant information for element type number, description, size and amount number are in the correct location.

The drawing with the article/element type number, etc., is used in the factory. They take the standard pieces from the store and put the assembly together. Since everything is numbered, errors are practically eliminated.

"The main advantage of the system, of course," concluded Mr. Jansen Klomp, "is that it greatly reduces drawing time. What used to take an hour can be done in seven minutes! This is very important because we now have tenders ready faster. We can react more quickly to the client's needs. Also, the styles of three draftsmen have been replaced by a uniform style. This ironing out of individual differences also made things easier in the factory."

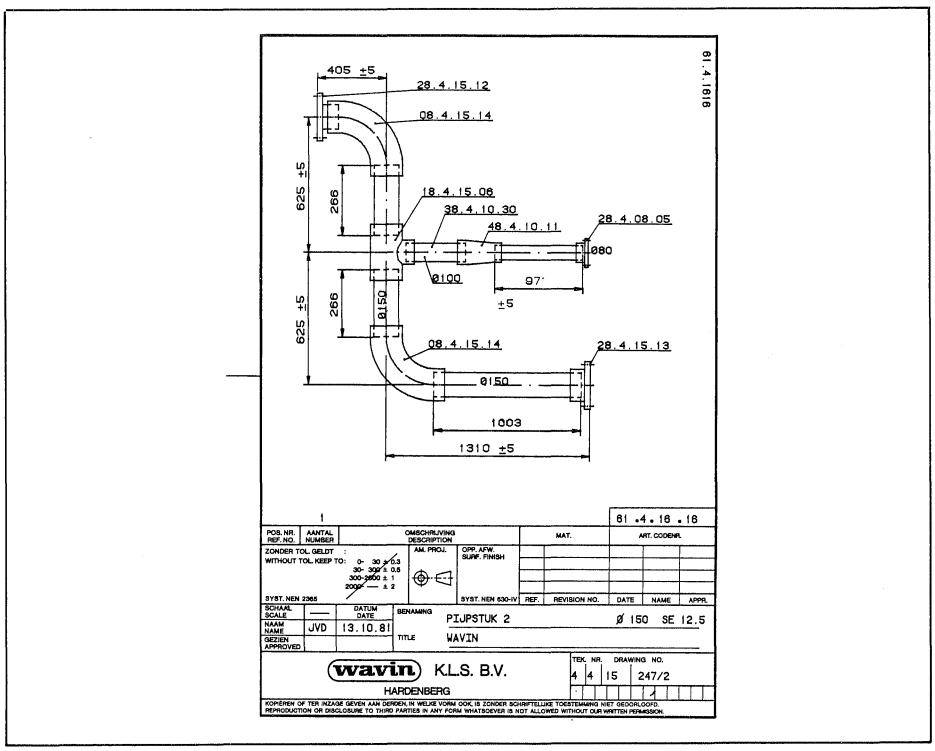


Figure 3. A typical drawing made at Wavin on the Tektronix 4662 Interactive Digital Plotter.

Marine Engineers Study Vibration in Great Lakes Ore Carriers with 4052 and FFT ROM

by Patricia Kelley
TEKniques Staff

Take a paper clip and bend it. Bend it once and it won't break; bend it back and it still won't break; but bend it several times and it breaks. Fatigue stress is the culprit.

Fatigue stress and the forces that cause fatigue stress are coming under scrutiny at the University of Michigan, located in Ann Arbor. The objects of the studies are the ore carriers plying their trade on the nearby Great Lakes. In contrast to ocean vessels which rust out and are retired within a few decades, these ships have unusually long lives. Some Great Lakes ships in use today were built in the 1890s; a fairly new ship is one built in 1950.

However, the Great Lakes ore carriers now being constructed are much longer (1000 feet from bow to stern) than earlier models. But they're no wider (only 100 feet across the beam), and must have a shallow draft to fit through the navigational locks on the lakes. You might think of them as long floating shoe boxes.

Their design makes the ships conducive to vibratory motion triggered by wave action, which, consequently, subjects them to stress, fatigue stress. Just as the paper clip breaks after repeated oscillation, what will long-term vibration do to the 1000 footers? Can they be expected to repeatedly plow through Great Lakes storms and still last 60 years or so? Just how important is this wave-spawned vibration?

Coming to grips with these issues, the Maritime Administration and the American Bureau of Shipping have funded a study which is being carried out by Dr. Armin Troesch, Director of the Ship Hydrodynamics Laboratory at the University. Helping him find the answers are a TEKTRONIX 4052 Desktop Computer equipped with the 4052R08 FFT ROM and a TransEra Auxiliary Memory module.*

The quest for answers takes place in a 360- by 22-foot towing tank (figure 1). A towing carriage rides smoothly on rails along the tank's walls; clamped at its bottom, a model of a Great Lakes ore carrier glides through the water (figures 2a and 2b). The 4052 and other testing equipment are strapped to a

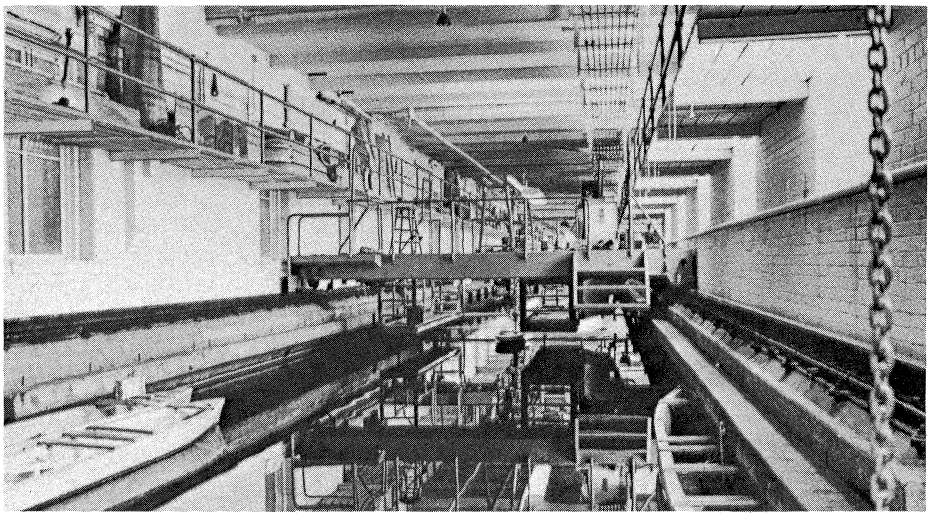


Figure 1. Testing of scale models of Great Lakes ore carriers is being conducted at the Ship Hydrodynamics Laboratory towing tank, University of Michigan (courtesy of the University of Michigan).

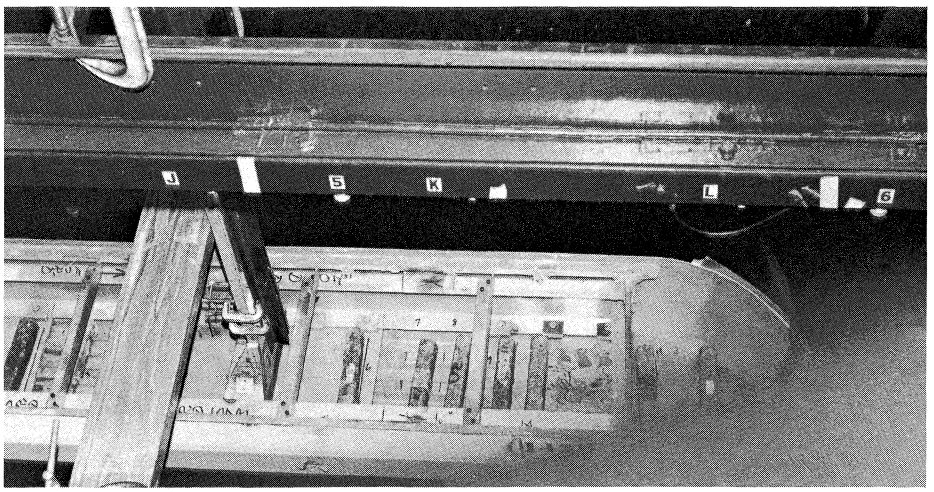


Figure 2a. Clamped to the towing carriage, the bow of an ore carrier model illustrates the length and width ratio of the full scale vessels.

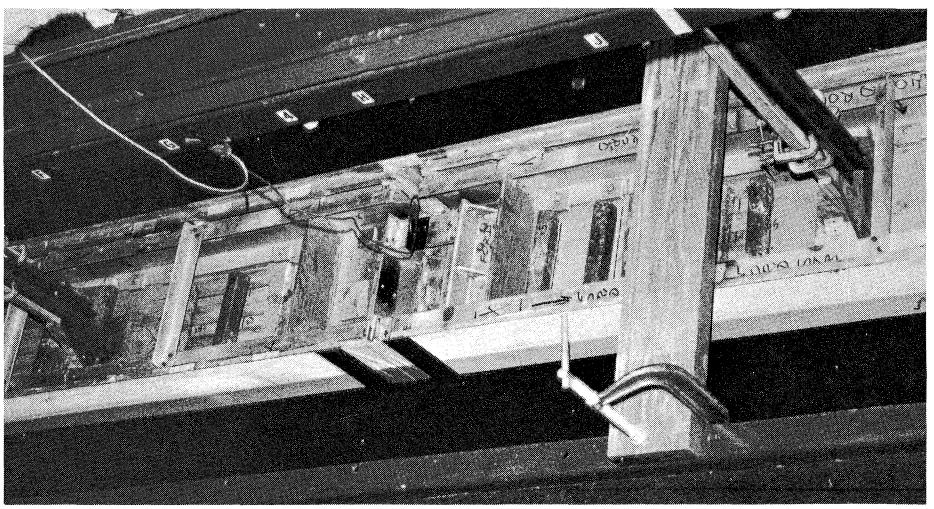


Figure 2b. Sensors on the midsection of the model pick up its bending moment. Dr. Armin Troesch is making some adjustments to the instrumentation.

* Features of the TransEra Auxiliary Memory were discussed in TEKniques Vol. 6, No. 1.

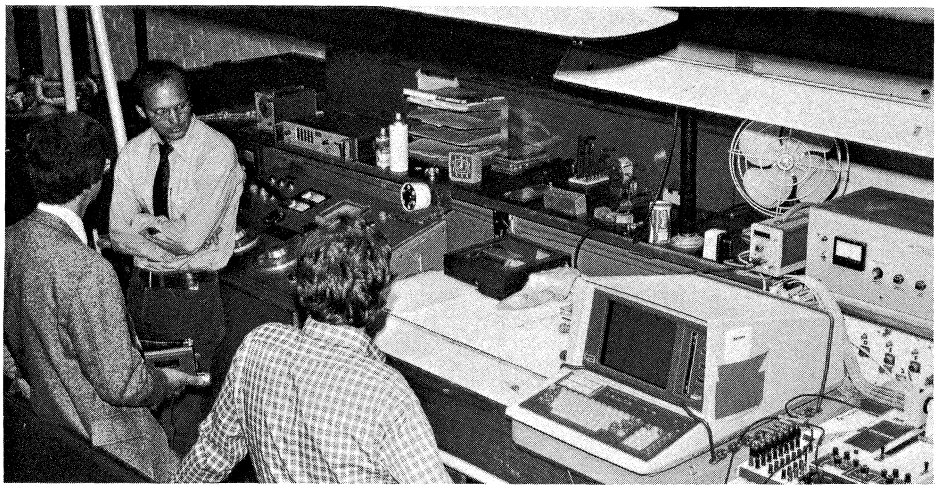


Figure 3. The Tektronix 4052 equipped with 4052R08 FFT ROM, TransEra Auxiliary Memory and other instruments ride on the towing carriage and capture and analyze the data. Dr. Armin Troesch (facing) and Scott Slocum describe the measurements to Greg Worth (left), Tektronix Systems Analyst.

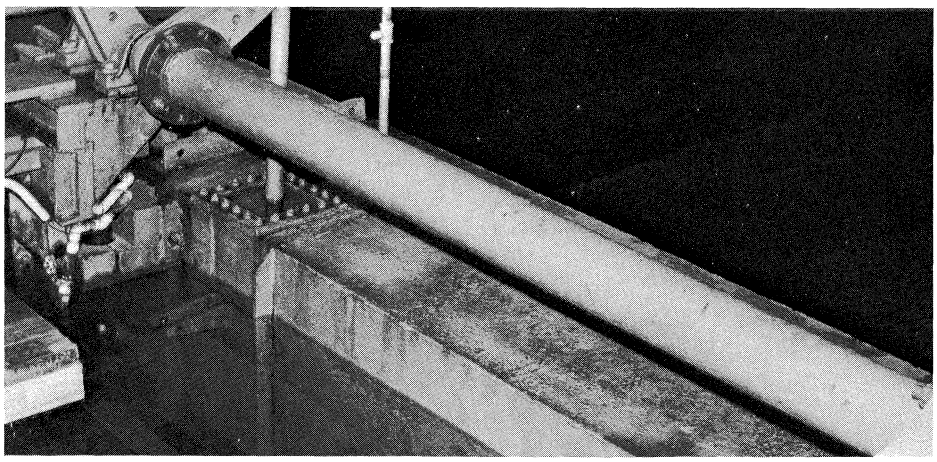


Figure 4. A wavemaker driven by an FM tape recorder generates the desired waves in the towing tank. The signal on the recorder was first produced by a Tektronix 4052 and then converted to an analog signal by a TransEra D/A converter.

bench on the deck of the towing carriage (figure 3). Built into the upper end of the tank is a wavemaker (figure 4).

How Wave Shapes Incite Vibration

Bending down to the model attached to the towing carriage, Dr. Troesch demonstrated the nature of their concern. "To show you how soft Great Lakes ships are, if you press here (middle) and release, you can actually see it shaking. That's what the full scale ships do — sit and shake, vibrate; the model has the same relative stiffness as a full scale vessel.

"If you run a ship into a wave of the right frequency, one that very nearly matches the ship's natural frequency, it can generate resonance and very high stresses in the vessel."

Or, if the ship encounters a "packet" of waves, the resulting flex can also be quite large. Dr. Troesch related the following statement made by a crew member of one of the vessels: "Imagine yourself standing at the stern of an ore carrier and your friend on the bow. As the middle of the hull flexes upward, the person on the bow will drop out of your sight. It's rather impressive to see your friend keep bobbing out of sight at the end of 1000 feet."

Determining the behavior and structure of Great Lakes waves and assessing their impact on the long ships is of utmost importance to the industry.

Explaining how waves trigger vibration in a ship, Dr. Troesch outlined the current focus of their study. When a wave travelling at a particular frequency excites a ship at the same frequency, it is a linear transfer, that is, energy from the wave is transferred directly to the ship at the same frequency; this they understand fairly well. But when a wave excites a ship not only at the same frequency, but at greater frequencies as well, that is a nonlinear transfer. To understand the nonlinear transfer of energy, how it occurs, and what forces it inflicts on the ship, they must determine the correspondence between the wave's frequency components and the frequency at which the ship responds.

An example of the nonlinear resonance is when the model encounters a wave comprised of more than one frequency. A certain sequence of waves will produce such a "combination" wave. Lower frequency long waves travel faster than higher frequency short waves (waves are measured from crest to crest), thus, the wavemaker generates short waves first, then follows with longer waves. This produces a beat phenomena. As the waveforms move down the tank together, the longer ones catch up with the shorter. When they arrive at the middle of the tank, the waves overlap. The model arrives at the same time and runs through this packet of waves.

The time histories of such waves are constructed digitally on the 4052. Using a TransEra D to A converter, they are sent to a frequency-modulated recorder which drives the wavemaker.

Capturing the Data

During the test the towing carriage with the model attached moves to the lower end of the tank. As the wavemaker, driven from the FM tape, produces the desired waves, the towing carriage glides up the tank toward the wavemaker (figure 5).

A small sonar wave recorder attached to the towing carriage records the oncoming waves. Sensors on the model pick up its movement and register its bending moment. The 4052 on the towing carriage captures both signals from the model and passes the data through a TransEra A to D converter, to the TransEra 764 Auxiliary Memory unit. Once the data is in auxiliary memory, the program running in the 4052 analyzes it with the aid of the 4052R08 FFT ROM.

Correlating Waveshape to Vibration

The wave record picked up by the sonar probe is displayed on the 4052 screen along with the graph of the model's bending moment (figure 6).

"According to linear analysis," explained Dr. Troesch, "the bending moment of the ship should show a response of at least two frequencies, since the waves were of two frequencies. But according to nonlinear analysis, we should be able to pick up, for a two-frequency waveform, an additional four frequencies: the sum, the differences, and the multiples. Since we aren't really interested in the differences, we haven't spent much time on a program that identifies them. We are interested in the sum frequencies and the multiple frequencies, so that's what we've been looking for."

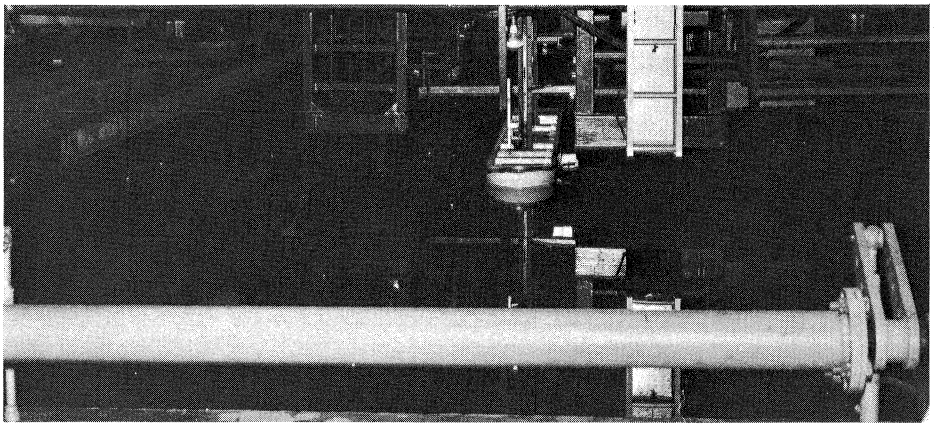


Figure 5. The towing carriage with model attached moves from the lower end of the towing tank to meet the waves emanating from the wavemaker.

Once the FFT (Fast Fourier Transfer) ROM converts the signals into their spectral components, the results are displayed on the 4052 screen. In figure 7 the top graph is the FFT of the incident wave, the bottom, the FFT of the model's response. In the bottom graph the first spike indicates a very large bending moment which correlates to the first spike in the incident wave (top graph). A smaller bending moment follows correlating to the second spike in the incident wave. The transfer is strictly linear and predictable.

"After the second spike in the graph of the incident wave, there isn't much action, so where did the third spike in the response come from," asked Dr. Troesch. He reasoned that it resulted from the sum of the first two acting together in a nonlinear sense. "In other words, energy is being drawn from the first and the second and is being transmitted to the model at a higher frequency."

They can now take the convolution of these signals and calculate the second order transfer function. Pointing to figure 8, Dr. Troesch explained, "When you are looking for the second order transfer function, the convolution tells you the amount of energy you have at the sum frequencies. Compare the spikes in the upper and lower graphs (figure 8). In the convolution of the wave spectrum (upper graph), three pronounced spikes appear. They are due to the combined effects of the two wave frequencies in the incident wave system. The first spike of the convolution occurs at twice the lowest wave frequency. The second spike is a result of the interaction between the two waves and occurs at the sum of their frequencies. The third and last spike occurs at twice the highest wave frequency. The rest is wave noise. This indicates that there is a very large amount of second order energy right at the frequency where we got all the motion. By performing a detailed analysis over a range of frequencies, we can calculate the transfer function."

Currently, the researchers are able to predict the vibration and resulting stress in a ship from waves of a single frequency, but they are not able to tell what will happen when waves of two frequencies act together. Knowing the second order transfer function will enable them to determine the nonlinear response.

In addition to predicting vibration and stress, the study results might be used to modify the operations of a vessel. For instance, if an operator is encountering certain types of waves, he might slow down to lessen the vibratory responses of his ship.

Testing Speeded by 4052

Dr. Troesch is in the second year of this project and says he has a ways to go. But referring to earlier research, he reflected that the 4052 system was shaving three days off each hydrodynamics test. At a cost of $1,000 per day, that represents a significant saving to their budget.

Before the 4052 was acquired, they would record the analog data, take it to another part of the campus and run it through an A to D converter to tape. Next they would hand carry the tape to the computing center, mount it and review the data on a terminal. One of the graduate students working on the project, Scott Slocum (and the one who wrote many of the 4052 programs) spent all last summer reducing 250 runs.

"What's so nice," remarked Dr. Troesch, "is that it's almost real time analysis. We are ready to begin another run and we already know how we did on our last. In the past we'd have to guess, and it would literally be months before we found out the same information (as they're getting from the 4052 now). The 4052 is saving us months in real time."

Ship builders, owners, crew and insurers are all concerned that the ships not fall victim, as did the paper clip, to fatigue stress. Dr. Troesch and the Tektronix 4052 are helping them unscramble the myriad elements which affect the 1000 footers.

Editor's Note: A large amount of appreciation goes to Dr. Troesch who took time from frantic preparations for the celebration of 100 years of naval architecture and marine engineering at the University. The day following the interview, a large number of alumni were on hand to view the model testing and the performance of the 4052.

Thanks is also due Greg Worth, Tektronix Systems Analyst in Detroit, for bringing Dr. Troesch's application to TEKniques' attention, and for participating in the interview.

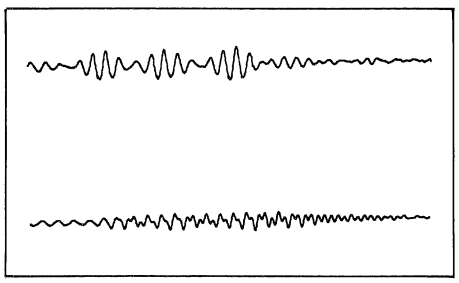


Figure 6. The beat phenomenon of the waves is clearly depicted in the upper graph of the waveform captured by the sonar recorder on the towing carriage.

Illustrated in the lower graph is the bending moment of the ship as it encounters the waves.

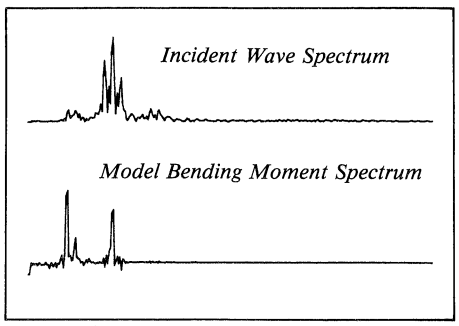


Figure 7. The waveforms of the incident wave and the bending moment of the ship have been converted into their spectral components and are displayed on the 4052 screen.

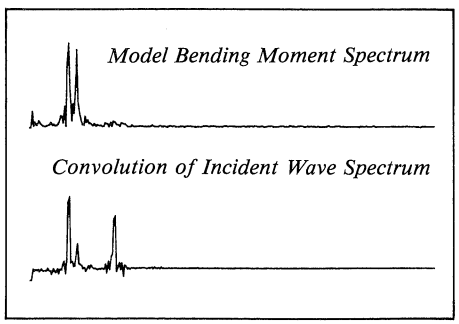
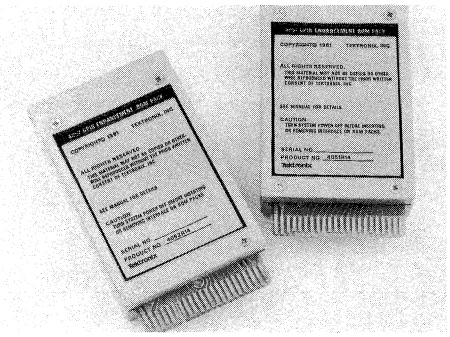


Figure 8. Convolving the FFT of the incident wave and the bending moment reveals the energy (upper graph) transferred to the model which resulted in the third spike (lower graph).

GPIB Enhancement ROM Pack Provides Greater Control of the Bus

by Mark Mehall
Tektronix, Inc.
Wilsonville, OR



TEKTRONIX 4051R14 and 4052R14 GPIB Enhancement ROM Packs Expand Bus Control.

Is your 4050 Desktop Computer acquiring data or controlling instruments over the IEEE-488 General Purpose Interface Bus (GPIB)? If so, a new ROM pack is sure to save you time and expand your capability. The ROM Pack comes in two versions: the 4051R14 with 41 new commands for the 4051, and the 4052R14 with 39 new commands ("MTPack" and "WAIT" are already built in) for the 4052 or 4054.

A group of twelve commands improves GPIB polling by adding parallel polling, enhancing serial polling, assisting blind polling, decoding Tektronix Codes and Formats* standard instrument error messages and adding direct control over SRQ interrupts.

Another twelve commands provide friendly interface with the GPIB by implementing the standard bus commands through "CALL" statements using the corresponding IEEE-488 mnemonics instead of WBYTE statements.

The rest of the commands add routines particularly valuable in GPIB environments.

A brief look at a few of its functions will suggest the ROM pack's utility.

A time-out parameter to the serial poll routine prevents unexpected bus conflicts when a device does not respond to a poll request.

A new routine automatically determines what devices are on the GPIB and returns their primary, and optionally their secondary addresses. This allows programs to check the availability of all necessary equipment before data collection or transmission.

The CALLs for GPIB functions use common names such as "IFC" for Interface Clear and "SDC" for Selected Device Clear. Instruments may be selected as talkers or listeners through the CALL "TALK" or "LISTEN" commands.

Binary data may be transferred in either packed or unpacked form. Hexidecimal conversions are easy and fast. Utility routines provide better control of tape operations such as named tape files or LAST file search. Array sizes may be determined with the CALL "ARSIZE" command.

The bit manipulation routines which set, clear, and test individual bits in a variable promote easier data transmission to and from devices on the GPIB.

For a complete profile of the 4051R14 or 4052R14 GPIB Enhancement ROM Pack, contact your local Tektronix Sales Engineer.

* *Tektronix Codes and Formats is discussed in a separate article found within this issue of TEKniques.*

Expanded Character Set and Increased Printing Speed Features of TEKTRONIX 4643 Printer

by Art Yerkes
Tektronix, Inc.
Wilsonville, OR

Report-quality printing and high reliability are built into the TEKTRONIX 4643 Printer.

Ninety-six ASCII characters plus 32 commonly used International Characters comprise the new TEKTRONIX 4643 Printer's vocabulary. The characters may be printed in three sizes: condensed, standard or expanded. By selecting condensed characters, you can print out a 132-character line on an 8½ by 11 sheet of paper.

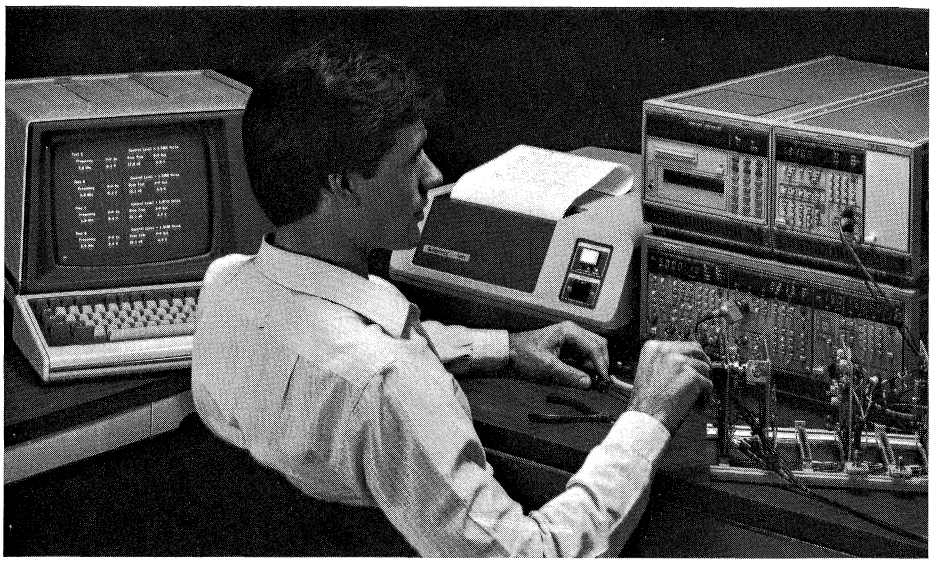
The 340-character-per-second printing speed and the high print quality of the dot matrix characters mean quick production of reports for internal or external distribution.

No maintenance for more than 300 million characters can be expected from the unique 14-wire matrix head. In fact, a diagnostic display and self-testing routine virtually eliminate the need for any preventive maintenance calls.

For more information on this highly reliable, low-cost printer, contact your local Tektronix Sales Engineer.

TEKTRONIX 4041 Optimized for Instrument Control

by Jim Jadin
Tektronix, Inc.
Wilsonville, OR



Configuring the 4041 with the TEKTRONIX TM 5000 Series instruments, an alphanumeric terminal and a printer results in a system capable of performing the most demanding jobs.

Its packaging, software flexibility and hardware options make the TEKTRONIX 4041 the optimal controller for most instrumentation tasks. The program development ROM and keyboard shown with the 4041 are two of its key options.

Speaking an instrument-oriented language which is familiar and friendly, the TEKTRONIX 4041 Computer/Controller is optimized for I/O. It fully supports IEEE-488 and Tek Codes and Formats,[1] and can operate with two IEEE-488 and two RS-232 interfaces.

Smart and compact, the 4041 fits neatly into the instrumentation environment, whether in the lab, on the designer's bench, on the manufacturing floor, or traveling around in the field. Integrating it with the TEKTRONIX TM 5000 Series,[2] provides a complete-system solution to test and measurement problems.

A quick look at some key features of the 4041 will suggest its versatility.

Self-Contained

- 20-character alphanumeric LED display
- 20-character alphanumeric thermal printer
- System keys and numeric/function key pad
- Magnetic tape drive, 160K byte capacity
- One IEEE-488 and one RS-232 interface, each expandable to two; optional IEEE-488 interface with Direct Memory Access
- 32K byte memory, expandable to 160K bytes
- Optional keyboard
- Optional program development ROM

Extended BASIC Language

- Full IEEE-488 support
- FORTRAN-like subprogramming
- 8-character variable names and line labels
- Full interrupt capability
- Complete error trapping functions
- Overlapped I/O and execution

The 4041 is based on the Motorola 68000 microprocessor, one of the most powerful 16-bit processors available. Add the program development ROM and the 4041 becomes a programmable computer. Without the program development ROM, the 4041 operates as an execute only controller. Any RS-232-C terminal, such as the TEKTRONIX 4027, 4006, 4112 or 4114, may be configured for interactive programming and analysis.

Your local Tektronix sales office can provide you with more information about the powerful 4041 Computer/Controller.

[1] Tektronix Codes and Formats is discussed in a separate article found within this issue of TEKniques.

[2] The Tektronix TM 5000 Series programmable instruments were reviewed in TEKniques Vol. 6, No. 1.

A Step Toward Greater Compatibility on the GPIB: Tektronix Codes and Formats

Using the General Purpose Interface Bus (GPIB) is somewhat like using the telephone system. In both cases a physical connection can be established between two locations and data can be transmitted. However, on the telephone system unless both people speak and understand the same language very little communication can take place. Beyond having a common language, they must also share the same vocabulary for real communication to take place. Similar problems can arise between different instruments not specifically designed to work with others.

This paragraph from a recently published booklet reflects the concern which prompted Tektronix to adopt its Codes and Formats standard. While the IEEE-488 1975 standard defines three aspects of an instrument's interface — mechanical, electrical and functional — it did not address a standard for data transfer. Tektronix has adopted such a standard, and has incorporated it in the design of all Tektronix GPIB instruments.

Explaining the reasons for and details of the Tektronix Codes and Formats standard, a 12-page booklet from Tektronix would be enlightening for anyone using the GPIB. The document also discusses the concept of instruments designed for people.

Your local Tektronix Sales Engineer can provide you with the "Tektronix Codes and Formats for GPIB Instruments," part #99AX-4607.

GPIB Facts and Functions

The General Purpose Interface Bus (GPIB) was defined in 1975 to enable a convenient, easy-to-implement, and powerful communications link between instruments and instruments and controllers. The 4050 Series Desktop Computers conform to the GPIB standard and are used intensively in GPIB environments. As a result, many manuals, brochures, and other documents have been prepared to help our customers achieve full benefit from the GPIB. The following collection is available from Tektronix.

Title	Part Number
4051 GPIB Hardware Support manual	070-2270-00
GPIB Applications Support manual	070-2307-00
GPIB Programming Guide	070-3985-00
4052 GPIB Programming Guide	062-6400-00
A Vital Link in Instrument Systems: The General Purpose Interface Bus (GPIB)	AX-4524-1
Tektronix Codes and Formats for GPIB Instruments	99AX-4607

Your Tektronix Sales Engineer will be happy to order any of these for you.

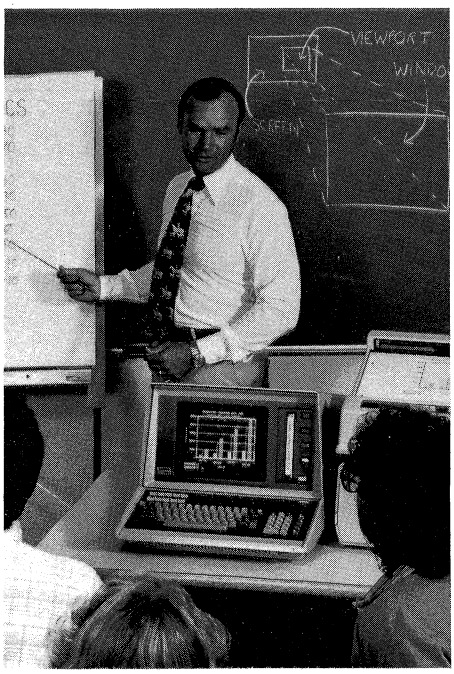
Input/ Output

PLOT 50 Standard Files

Paul J. Ossenbruggen, Associate Professor, University of New Hampshire, and Roland de Wit, U.S. Department of Commerce in Washington D.C., have both inquired about using PLOT 50 Standard files in connection with tape-based systems.

A Tektronix programmer explains the premise for Standard Files. It is the 4907 File Manager that makes PLOT 50 Standard Files feasible. Its directory structure and random access capability are the keys which allow PLOT 50 Standard Files to smoothly and rapidly communicate data between PLOT 50 Standard File compatible packages. Therefore, PLOT 50 Standard File compatible packages are disk based. The tape cartridge is intended to serve only as a backup for Standard Files on the disk or to serve as intermediate communication between package disks.

However, two programs on the disk announced in this issue of TEKniques may help. Program 3, "PLOT 50 Standard Data File Reformat," takes other types of data files and reformats them to PLOT 50 Standard Data Files. Program 4 moves PLOT 50 Standard Data Files and other PLOT 50 Data Exchange Files between tape and disk. With some recoding, these programs might aid individuals with tape-based systems.



4050 Series Graphic Systems Workshops Scheduled

The 4050 Series Graphic Computing Systems workshops are designed to help you get the most out of your graphic system. The week-long workships combine classroom lecture with extensive laboratory sessions.

The 1982-1983 schedule is:

Rockville, MD	Santa Clara, CA
June 7–11	June 21–25
June 28–July 2	July 19–23
August 2–6	August 16–20
September 13–17	September 20–24
October 11–15	October 18–22
November 1–5	November 15–19
December 6–10	December 6–10
January 3–7	January 10–14
January 31–February 4	February 7–11
February 28–March 4	March 7–11
March 21–25	April 4–8
April 18–22	May 2–6
May 2–6	May 23–27
May 23–27	

For additional information, contact Customer Training at (503) 642-8660.

* Editor's Note:

Major Issue Coming in Mid-Summer

To allow time and resources for a forthcoming major issue of TEKniques, this issue has been trimmed from its usual 32 pages. But, we think you'll agree, its variety has not been sacrificed.

The two application articles demonstrate once again the versatility of the 4050 series. Anyone with a floppy disk will find the disk care tips enlightening. The GPIB is in the news in four of the articles — find out what Tek's Codes and Formats are all about. The 4050 workshops have been scheduled throughout the year on the East and West Coasts. And, watch for the next issue of TEKniques; it'll be a big one!

Back Issues and Reprints from TEKniques

TEKniques is in its sixth year of publication. Issues from the first three years (Volumes 1–3) have all been distributed. However, most of the articles from those issues have been assembled by application area and are available in the following reprints:

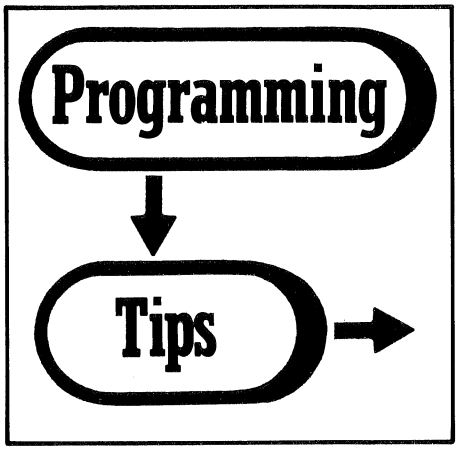
Engineering and Design AX-4449
Mapping AX-4460
Data Acquisition and Analysis ... AX-4450
Business Graphing and
Reporting AX-4451
Peripherals and ROM Packs AX-4452

If you need an article from one of these previous volumes, and don't have your copy, one of the reprint sets will likely fill your needs. To obtain a copy of one of the reprint volumes, just contact your local Tektronix office or the Applications Library office serving you.

And, of course, back issues of TEKniques Vol. 4 (1980), Vol. 5 (1981) and Vol. 6 (1982) will continue to be available from the 4050 Series Applications Library office that serves your area.

Programming Tips Handbook

The programming tips from the first three years have been collected into a handy booklet which is included in the Programming Aids T2 tape documentation (part #062-5972-00).



Ensuring Maximum Diskette Life and Reliability

by Jack Kryder
Tektronix, Inc.
Wilsonville, OR

The best way of ensuring data reliability on your 4907 File Manager diskettes is:

a) Use proper diskette

b) Protect diskettes when not in use

c) Backup diskettes

d) Keep the 4907 File Manager in proper working order including proper calibration

Use Proper Diskettes

The first maxim is to use the proper diskettes in your 4907 File Manager. Single-sided, double-density, hard-sector diskettes are the storage medium for the 4907.

A single-sided diskette has one index hole in the jacket near the large hole in the center; it is recorded on one side only.

A double-density diskette has twice the storage capacity of a single-density diskette. How this is done is beyond the scope of this article. Suffice it to say that double-density diskettes are manufactured to closer tolerances. Although you might use a single-density diskette in your 4907, the encoding method doesn't change; consequently, a diskette intended for single density will be written at double density. This could result in higher rates of data loss and a higher rate of read/write errors. The quality of individual single-density diskettes varies and their reliability depends on how close they are to double-density standards.

A hard-sector diskette has 32 holes near to and surrounding the large center hole (which may be verified by gently turning the diskette within its permanent jacket). A soft-sector diskette has just one index hole near the central hole. A Memorex-type diskette has the index holes located near the outside of the diskette. These diskettes are not interchangeable.

Therefore, use single-sided, double-density, hard-sector diskettes in your 4907 File Manager. If you are ordering them through Tektronix, the part number is:

Box of 10 Diskettes . . . 119-1011-01

Protect Diskettes

Do not lay objects on top of the diskette or bend it.

Avoid writing on the diskette or on its protective envelope with the diskette enclosed. If you must write on a diskette label, use only a felt tip (or other soft tip) pen.

Don't touch the exposed surface of the diskette (the oxide part showing through the permanent hard paper jacket).

Attempts to clean a diskette may destroy data or damage its surface.

Store diskettes in their protective covers in an upright (vertical) position, at a temperature between 10 °C and 45 °C (50 °F and 113 °F).

Keep the diskette away from direct sunlight, heat sources, or magnetic fields.

Don't leave diskettes in a disk drive when not in use. This includes not leaving them hanging half in and half out of a drive.

Avoid static electricity around diskettes; it can destroy data stored on a diskette. Carpeting and items of clothing can generate static electricity. If you walk across the floor with a diskette in hand, be sure you discharge any static electricity — using your free hand — before you touch the diskette to any metal surface (such as the disk drive). Be careful before picking up a diskette from a metal surface where a static electricity arc might occur.

Backup Diskettes

Data stored on a 4907 File Manager diskette can be lost due to diskette wear-out, data overwrite, or accidental deletion of files by programs or operators. Here, we are not concerned with data capture or data generation, but loss of data that has been previously stored on a diskette. The only practical method of protection from data loss is to make backup copies of the data.

Using a 4050 Series Graphic Computing System and 4907 File Management System allows data backup on diskette or magnetic tape.

Tape Backup

The easiest way to back up data from diskette onto tape is to use the internal 4050 Series tape drive and a cartridge tape (as the archive device and media). A specific set of utilities is available from Tektronix: Disk-to-Tape Backup/Restore Utilities. These utilities were designed specifically for owners of a single-drive 4907 File Management System who need to back up information from their diskettes onto tape; see Applications Library Program Documentation: Utility T1 (part #062-5974-01 or 062-5975-01). Using these utilities, all file types supported by the 4907 File Management System can be archived or restored using the internal 4050 Series tape drive.

Diskette Backup

If two diskette drives are available, the 4907 File Manager system COPY statement can be used; see Section 5, COPY . . . TO in the 4907 File Manager Operator's manual. The COPY statement will perform diskette-to-diskette copies.

If only a single drive is available and you want to use a diskette as backup, the tape backup and restore procedures can be used in a two step operation:

a) With the main diskette in place, perform diskette-to-tape backup.

b) Remove the main diskette, replace it with the backup diskette, then do a tape-to-diskette restore.

This does take awhile.

When Should Backup be Performed

There is no hard and fast rule to this question. It is a function of several factors, the most important of which is: How important is the data in question to your operations? A related question is: How hard would it be to replace the data? The more important the data or the harder it is to replace, the sooner it should be backed up. Remember that a diskette, program, or operator failure can occur at any time.

Assessing Diskette Condition

The main method the 4907 File Manager has of assessing a diskette's physical condition, is a long format; see CALL "FORMAT" in the Operator's manual. A long format writes a special data pattern, parity bit, etc., on each block (sector) of the diskette, and then attempts to read each block back. It is a format of the diskette as well as a surface analysis. Any block it cannot successfully read back means that that block is bad.

Remember: A long format destroys all data on a diskette.

Using the message received after a CALL "MOUNT" statement (a Device Status Message), you can get the values for SIZE and FREE.

SIZE is the number of bytes available on a perfect diskette; it is a constant equal to 630784 (bytes) for each diskette.

FREE is the number of free (unused) blocks still available for use.

Each diskette block contains 256 bytes. Block zero (0) is always used for system requirements. After a long format, the only block not free on a diskette with all good blocks is block zero. Therefore, if the calculation SIZE-FREE yields a result other than 256, you know there was one or more bad blocks. In other words, after a long format with no bad blocks detected, SIZE will equal 630784 and FREE will be 630528 (630784-256); any other result means bad blocks were found. The number of bad blocks can be calculated by:

Bad blocks = (SIZE-FREE-256)/256

Remember, this is true only after a long format and before any files are created on the diskette.

NOTE: Be wary of a diskette that formats with bad blocks and do not use it for critical applications.

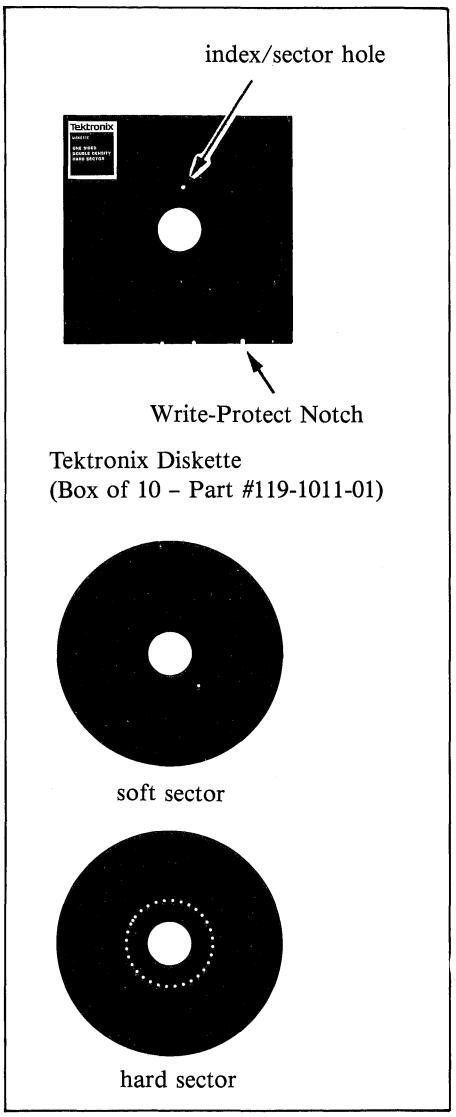
Clean and Calibrate the Diskette Drive

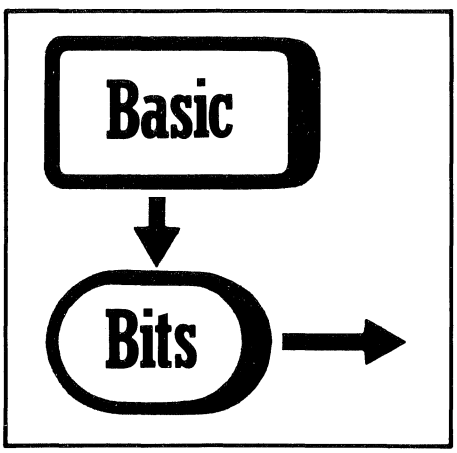
A clean diskette drive will minimize any data reliability problems; see Section 6 in your 4907 File Manager Operator's manual. Diskette drives should be kept in calibration; consult the 4907 File Manager Service manual or your local Field Service Office.

Observe Prewarning Conditions

When the 4907 File Management System is reading data, it does not give up if the first attempt to read a block is unsuccessful. In fact, it will try 10 times before it stops and indicates the error to the user. Anytime the 4907 File Management System cannot read a block correctly the first time, it goes into a reread mode. Part of the reread process is to accumulate, as a running total, the number of rereads since power was applied to the system. Reread totals are independent of which diskettes or drives the rereads occurred on, i.e., totals are system totals. You can find out the total number of rereads by using the CALL "HERRS" statement; see CALL "HERRS" (Hard Error Status) in this manual.

If a large number of rereads are taking place in a 4907 File Management System, there are problems somewhere in the system. It could be due to one or more diskettes going bad, a write problem, calibration problem, etc. In any event, a large number of rereads indicates the system is in a degraded (far from optimal) condition and needs attention; the offending problems need to be found and corrected or data will start being lost or the system will fail completely, etc.





4907 CREATE Command and 4052/4054

by Bob Wheeler
Intermountain
Software Company
North Ogden, UT

The 4052/4054 File Manager ROM Pack won't take variables for the numeric parameters of the CREATE command.

Won't work: `CREATE "TEST";A,B`

However, it does dynamically allocate more space if you have more records than what you specified, but the records themselves cannot be increased in length.

If you wish to have variable parameters, you can make a math operation out of the parameters and it will accept them.

Will work: `CREATE "TEST";A+0,B+0`

4050 Series Applications Library Programs

Ordering

Programs included in the Applications Library prior to September 1981 are packaged and nomenclated by function. Those programs accepted into the Library after September 1981 are packaged and nomenclated with the Volume and Number of the corresponding issue of TEKniques in which the package was announced.

Each package includes the source code on tape or disk (T = tape; D = disk) together with the supporting documentation; listings are not included in the documentation. Documentation may be purchased separately.

The 4050 Series Applications Library Programs catalog contains the abstracts describing the programs in each package along with representative output in most cases. The catalog part number is ***062-6343-00.***

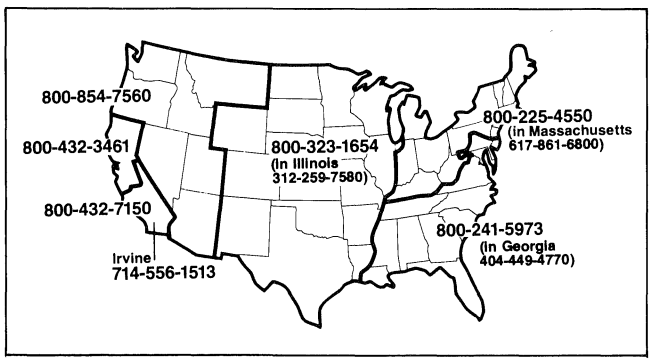
Package Title	Documentation Part #	Package Part #
Business Aids T1	*062-5987-00*	*062-5987-01*
Business Aids T2	*062-5988-00*	*062-5988-01*
CAD T1	*062-5976-00*	*062-5976-01*
CAD D1	*062-5977-00*	*062-5977-01*
Character Generator T1	*062-5951-00*	*062-5951-01*
Education/Research T1	*062-5982-00*	*062-5982-01*
Education/Research T2	*062-5983-00*	*062-5983-01*
Electrical Engineering T1	*062-5978-00*	*062-5978-01*
Graphing T1	*062-5964-00*	*062-5964-01*
Graphing T2	*062-5965-00*	*062-5965-01*
Graphing T3	*062-5966-00*	*062-5966-01*
Graphing D1	*062-5967-00*	*062-5967-01*
Graphing D2	*062-5968-00*	*062-5968-01*
Interfacing T1	*062-5984-00*	*062-5984-01*
Mapping T1	*062-5980-00*	*062-5980-01*
Mechanical Engineering T1	*062-5979-00*	*062-5979-01*
Programming Aids T1	*062-5971-00*	*062-5971-01*
Programming Aids T2	*062-5972-00*	*062-5972-01*
Project Aids T1	*062-5985-00*	*062-5985-01*
Project Aids D1	*062-5986-00*	*062-5986-01*
Recreational Plots T1	*062-5989-00*	*062-5989-01*
Slidemaker T1	*062-5962-00*	*062-5962-01*
Slidemaker D1	*062-5963-00*	*062-5963-01*
Text Processing T1	*062-5969-00*	*062-5969-01*
Text Processing D1	*062-5970-00*	*062-5970-01*
Utilities T1	*062-5974-00*	*062-5974-01*
Utilities D1	*062-5975-00*	*062-5975-01*
Tekniques Vol. 5 No. 4 T1	*062-5981-00*	*062-5981-01*
Tekniques Vol. 6 No. 1 T1	*062-6443-00*	*062-6443-01*
Tekniques Vol. 6 No. 1 D1	*062-6442-00*	*062-6442-01*
Tekniques Vol. 6 No. 2 D1	*062-6515-00*	*062-6515-01*

U.S. Orders

To receive a copy of the catalog, contact your local Tektronix field office. The field office has the current prices.

Order 4050 Series Applications Library programs through the toll-free number of Tektronix Central Parts Ordering. The following map delineates the geographical regions and the toll-free number serving each region.

Call the number serving your area and give the customer service representative the nine-digit part number and name of the Applications Library program you wish. If you have any questions, call your local Tektronix Field Office.



Orders Outside U.S.

To receive a copy of the catalog, or to order a package, contact the local Tektronix sales office or one of the Libraries serving your area. See Library Addresses section of TEKniques.

Program Contributions

Contribute one program to the Applications Library and receive the package of your choice in exchange. Send in the membership card from your 4050 Series Graphic System Reference Manual to get the details. In the U.S., you may call us at (503) 685-3618. Outside the U.S., call your local Tektronix sales office or your Applications Library. See Library Addresses section of TEKniques.

Software Support Category C

The program material contained herein is supplied without warranty of any kind, and without any representation regarding quality, performance or suitability. TEKTRONIX specifically disclaims any implied warranties of merchantability or fitness for a particular purpose. Software suport is TEKTRONIX Category C: Software is provided on an "as is" basis.

TEKniques Vol. 6 No. 2 D1 - Part #062-6515-01

TEKniques Vol. 6 No. 2 D1 disk consists of 10 programs:

two Programming Aids, two Utilities, one Text Processing, one Graphing and four Computer Aided Design.

The individual abstracts describe the programs.

Program 1

Title: Superlist
Authors: John Harms
Dan Taylor
Tektronix, Inc.
Wilsonville, OR
Memory Requirement: 32K
Peripherals: 4907 File Manager
Optional-4641/3 Printer
Files: 5 Program
Statements: 2767

This program produces a formatted listing and variable cross-reference table of 4050 BASIC programs. Features include:

- Named subroutines (with references cited by name)
- Branchpoint indications (along with "branch-from where")
- Special "Remcodes" to reformat a REM (e.g., put a box of stars around it)
- Files from disk or tape
- Multiple file name entry, each with wildcards allowed
- Output to a printer, mag tape, or screen

Some users may recognize that this is a greatly enhanced version of Applications Library program Cross-Reference & List Program Variables (Program 6 in Programming Aids T1, #062-5971-01).

Program 2

Title: Super Disk Directory
Author: Thomas A. Price
Lorillard div. of Loews
Greensboro, NC
Memory Requirement: 16K
Peripherals: 4907 File Manager
Optional-4641 Printer
Files: 1 Program
Statements: 255

This program produces a sorted disk directory for the 4907 File Manager.

The directory appears on numbered, titled pages. The disk ID and owner are printed at the top of each page.

Each library appears on a separate page. The total number of files and space required for each library appear at the top of the page.

Each file entry appears on a single line which includes:

File Name	Space Used
File Type	Date Created
Space Allocated	Date Last Modified

The directory can be sorted in ascending order on any combination of the items above. An alphabetic name listing is default.

Output is directed to the screen or a 4641 printer.

Program 3

Title: PLOT 50 Standard Data File Reformat
Author: Carol M. Peterson
Purdue University
W. Lafayette, IN
Memory Requirement: 8K
Peripherals: 4907 File Manager
Files: 1 Program
Statements: 134

This program takes ASCII data files from a tape on the internal tape drive and, after asking the necessary questions, creates PLOT 50 standard disk files (both the header file and the data file).

We use this program to reformat data (which has been transferred from other computer systems to a 4050 tape) to a TEKTRONIX PLOT 50 Statistics disk. Because we have only one disk drive, we must store data we wish to study with our Stat packages on the Stat package disk.

Users with two disk drives could use this program to reformat data on other disks.

Program 4

Title: Disk Utilities
Author: Robert Parent
Tektronix, Inc.
Wilsonville, OR
Memory Requirement : 32K
Peripherals: 4907 File Manager
Files: 13 Program
2 Data
Statements: 2165

PLOT 50 Data Exchange files are specially formatted files used to transport data between PLOT 50 applications packages. Three types of Data Exchange files have been defined: Standard Files, GMX Picture Files, and GMX Font Files.

Disk Utilities performs various extended input/output operations on these PLOT 50 Data Exchange files. These include:

GET - moves a Data Exchange file from tape or disk to disk

PUT - moves a Data Exchange file from disk to tape or disk

DIRECTORY - produces a directory listing of groups of files; these may be any files or Data Exchange files

DUPLICATE - duplicates the contents of one disk to another to back up information

DELETE - deletes specified files, any file or Data Exchange files, on disk. The user may optionally confirm the deletion before execution.

FORMAT - formats disks so information may be stored on it.

RENAME - changes the file names of any file, or Data Exchange files.

Program 5

Title: Text Editor
Authors: CW2 Hal Schmerer
CW3 H. James Rogan
Dept. of the Army
Fort Bragg, NC
Memory Requirement: 32K
Peripherals: 4907 File Manager
4641/42/43 Printer
Files: 1 Program
1 ASCII Data
Statements: 848

This program creates a text file, edits it, prints it, deletes it, backs it up on tape, or restores it from tape to disk.

The edit functions include:

Insert text any place you select

Delete a line or range of lines

Replace a line

Browse forward or backward or beginning at a specific line number

Search and print lines with keyword

Search and replace keyword with another

Save edited text to disk

Each text line may have 60 characters (including spaces). The number of lines is limited only by disk space. A tutorial file is included.

Program 6

Title: Connect the Dots
Author: Jim Bushner
Ingersoll-Rand Company
Allentown, PA
Memory Requirement: 32K
Peripherals: 4907 File Manager
Files: 1 Program
Statements: 675

This program combines easy plotting with smooth curve drawing. It scales and plots data points, then joins them with a smooth curve.

Eight different data point symbols identify multiple curves on a single display. The display may be titled, the axes may be labeled, and the data point symbols may be labeled.

You may enter the data from the keyboard or from a data file. All curves must have the same number of data points. Data points may be changed, added, or deleted.

Files may be stored or combined on the 4907 File Manager.

You may change the shape of the curve by selecting different curve factors and segment sizes.

Program 7

Title: Arrowhead Macro
Author: Terry L. McCain
Purdue University
W. Lafayette, IN
Memory Requirement: 8K
Peripherals: 4663 Plotter w/Opt. 31
Files: 1 Program
1 Data (example)
Statements: 55

The Arrowhead Macro is a short program which loads a macro into the 4663 Plotter (the plotter must have Option 31 — Circular Arcs and Programmable Macros).

When expanded directly or from the user's program, the macro will draw an arrowhead at the current pen location. The orientation of the arrowhead will be the orientation of the last line drawn by the plotter. The program will prompt for the plotter address, macro number, and length and width of the arrowhead desired.

The window in use at the time the program is executed determines the actual physical size of the arrowhead — subsequent window commands will not alter the size of the arrowhead. The user may store several different sizes of arrowheads by changing the macro number each time the program is executed.

Program 8

Title: Operator Digitizing on the 4663 Continued
Author: Carol Peterson
Purdue University
W. Lafayette, IN
Memory Requirement: 32K
Peripherals: 4663 Plotter
4907 File Manager
Files: 1 Program
Statements: 39

The program activates the digitizing mode of the 4663 Plotter.

As points are digitized from the plotter, each point is stored as three elements in an array:

1. X-coordinate
2. Y-coordinate
3. Variable indicating Move, Draw or Last Point

After the last point has been entered or the array has 1000 points, the array is written to a disk file.

This program is similar to the programming tip in TEKniques Vol. 5, No. 3 "Operator Digitizing on the 4663," however this program saves all the points on a disk file, and is more flexible. It may be used in conjunction with "Plot Digitized File" included in this package.

Program 9

Title: Plot Digitized File
Author: Carol Peterson
Purdue University
W. Lafayette, IN
Memory Requirement: 32K
Peripherals: 4663 Plotter
4907 File Manager
Files: 1 Program
1 Data (example)
Statements: 112

This program draws a set of digitized points on a 4663 Plotter or on the 4050 screen. It will treat the points as the whole plot or as half a plot. In this last case, it draws the other half assuming symmetry about a vertical line.

The operator may change the plot's scale, location, and rotation.

This program may be used in conjunction with the program "Operator Digitizing on the 4663 Continued" also contained in this package.

Program 10

Title: Space Manipulator
Author: David Badeau
Tektronix, Inc.
Seattle, WA
Memory Requirement: 4054 Option 30
64K
Peripherals: 4907 File Manager
Optional—4956 Tablet
Optional—4662/3 Plotter
Files: 1 Program
Requires Data Files on Disk
Statements: 1019

Space Manipulator permits you to digitize the boundaries of an office, magazine page, picture or anything. Within these boundaries you may move, rotate, scale and fix objects. Once you are satisfied with the placement, you may save them to a file or plot them.

The objects are chosen from a menu of symbols. Five symbols provided by the program are: wall, file cabinet, desk, table and box. You may also define symbols and save them to a symbol file. During object manipulation you may include five of your symbols along with those provided by the program. This could easily be changed through some simple code changes.

Boundaries are digitized from the tablet and may contain up to 500 move/draw segments.

Symbols may be created using the crosshairs, keying in coordinates or digitizing from the tablet. They may consist of 50 to 100 move/draw segments.

Objects are "picked" from a menu on the screen and scaled, moved, rotated and fixed using the Dynamic Graphics Option of the 4054. Up to 300 objects may be manipulated and stored in the object file.

During object manipulation mode, you may define a rectangular area of your space to be cross-hatched.

4050 Series Applications Libraries

Africa, Europe, Middle East

Contact local sales office

Australia

4050 Series Applications Library
Tektronix Australia Pty. Limited
Sydney
80 Waterloo Road
North Ryde, N.S.W. 2113

Canada

4050 Series Applications Library
Tektronix Canada Ltd.
P.O. Box 6500
Barrie, Ontario
Canada L4M 4V3

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