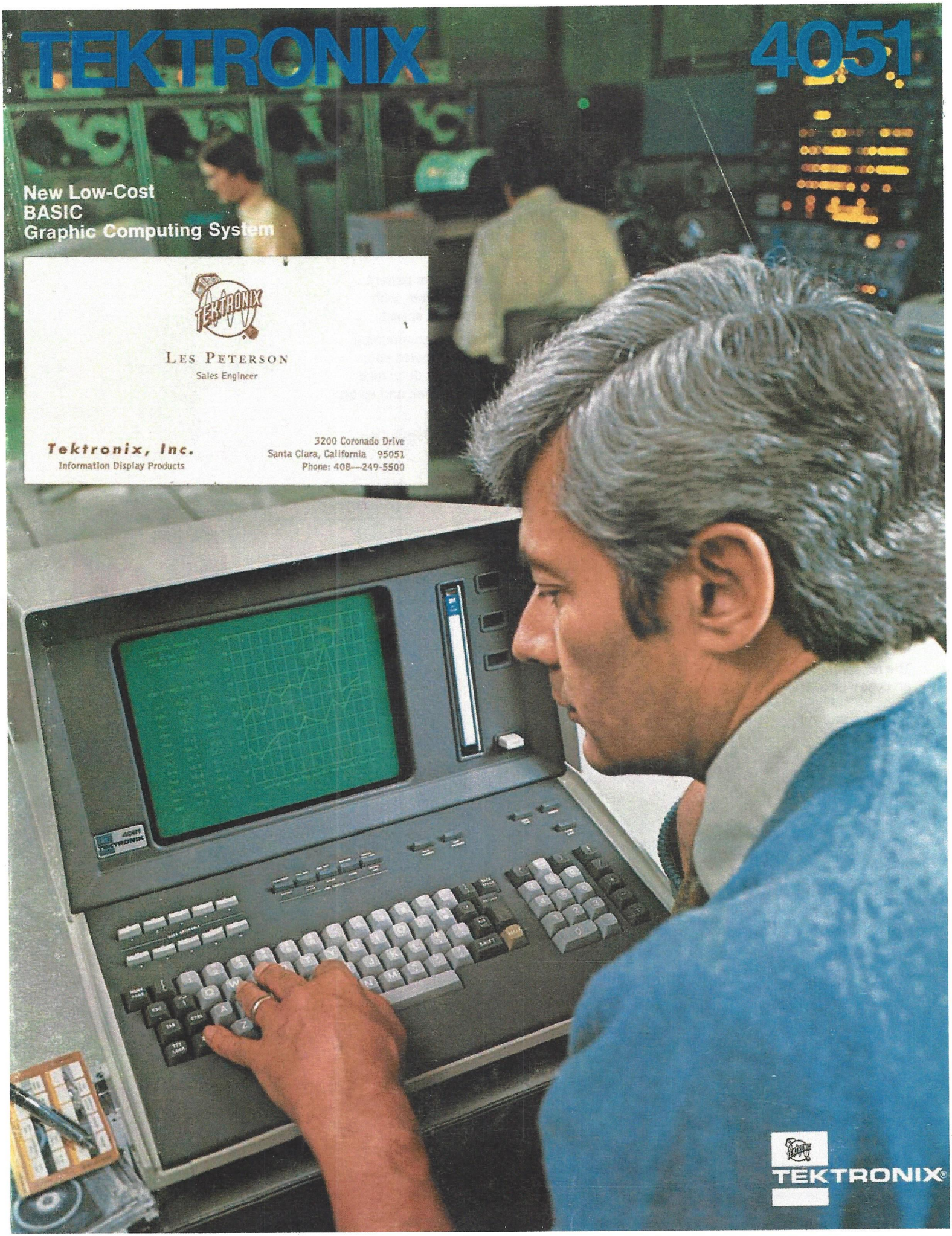
TEKTRONIX 4051

New Low-Cost
BASIC
Graphic Computing System



LES PETERSON
Sales Engineer

Tektronix, Inc.
Information Display Products

3200 Coronado Drive
Santa Clara, California 95051
Phone: 408—249-5500

TEKTRONIX®

This desk-top has a view

The new TEKTRONIX 4051 BASIC Graphic Computing System is the only compact data system you can buy that combines high-level BASIC-language interaction, built-in computing, and local tape memory—plus the unique graphic capabilities of the Tektronix display.

Many users are now looking for a compact computing system with local control, a convenient storage medium and enough computing and calculating power to handle their workload. The 4051 answers all these needs, at a price competitive with systems offering only a much smaller, alphanumeric CRT display.

But then the 4051 takes off where other systems quit: with Graphics.

If you have ever been intrigued by the possibilities of graphic output for your own application, you should seriously investigate the economics and ease of the 4051.

The manager... can interpret data, not just shuffle it. Forecasting comes alive, and costly errors are easy to spot.

The researcher... can spot check and analyze weeks of logged data, in seconds.

The engineer... can design, debug, and analyze without leaving desk-side.

The analyst... gains complete data security, with prompt access to unlimited taped programs.

The physician... can analyze patient data, obtain charts, input notes, with greater comprehension and speed.

Furthermore, with the data communications option, the 4051 distributes your computing by doing double-duty: as a graphic input/output terminal: and as an on-line tape storage facility.

The 4051 BASIC Graphic Computing System bears looking into.

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It's your intelligent alternative...

. . . to time-sharing
How would you like to reduce your time-sharing outlay, or even eliminate it?

The 4051 offers you one fixed system charge, instead of the "fixed unknown" of time-share charges. Compare its price and your current costs. In most cases, the 4051 can actually pay for itself in *less than one year.*

The 4051 gives you control of data and program libraries with increased reliability. You get complete data security, low-cost local storage and fast, no-wait local input and output. Plus you get graphics software and capability that most commercial time-sharing services can't match.

For users with in-house time-sharing, the 4051 promises reduced communications traffic, fewer system loading problems and greater accounting control.

The individual user can keep personal projects local and uncomplicated. There are no sign-on protocols to interrupt the train of thought and no connect charges to worry about.

For increased control, cost-effectiveness and creativity—look into the 4051.

. . . to super-calculators
Interested in getting a graph as easily as you now get a number?

The 4051 uses an enhanced version of BASIC, a widely approved language for high-level language calculators. And it can operate like a desktop calculator.

What you probably won't expect is the kind of graphics you'll be able to generate at your very first session with the 4051: everything from bar charts, time plots and function plots to complex structures, and much more.

If you're plotting manually now, the time-saving will be immense. If you're not plotting at all, BASIC graphics will soon have you wondering how you ever did without it.

The 4051's BASIC handles most application problems. For your most complex problems, the 4051's data communications option can put you on line to powerful graphic applications that no stand-alone calculator can tackle.

The 4051 offers you greater interactivity; our famous Graphics; flexible interface options; expert software support; and compatibility with a whole line of TEKTRONIX 4051 peripherals.

For an enhanced personal calculator, with a graphic bonus—look into the 4051.

. . . to mini-systems.
You know a mini-system is low cost. But, have you ever added up all the costs, including setting up the interfacing, peripherals and physical layout? And you're still faced with software development.

Machine time is cheap. Human time is costly. A mini may be faster than a speeding bullet. But if its idiosyncracies put you, your programmer, and your schedule off-target, then you haven't saved anything.

The BASIC language built into the 4051 lets you interact with it quickly, easily and a lot more powerfully. You can start and go. There's no daily tangle of paper tape loading.

The 4051 is a well-designed, compact package. It's a desk-top system, not a whole-desk system. It's lower-cost and smaller than any ready-made mini-based system of equal ability. Plus, it includes a Tektronix terminal, which you'd have to buy anyway to add high-capability, low-cost Graphics.

And we won't just show you a schematic and get a deposit. A Tektronix field office near you has a working model of the 4051, and a working knowledge of what it can do for you—today, not "when the bugs are out."

For design efficiency, Graphics support, and off-the-shelf pricing—look into the 4051.

Advantages you can see...

Full 128 character set ASCII keyboard: upper/lower case; 96 printing characters; 32 control characters; upper case TTY mode. Color-keyed.

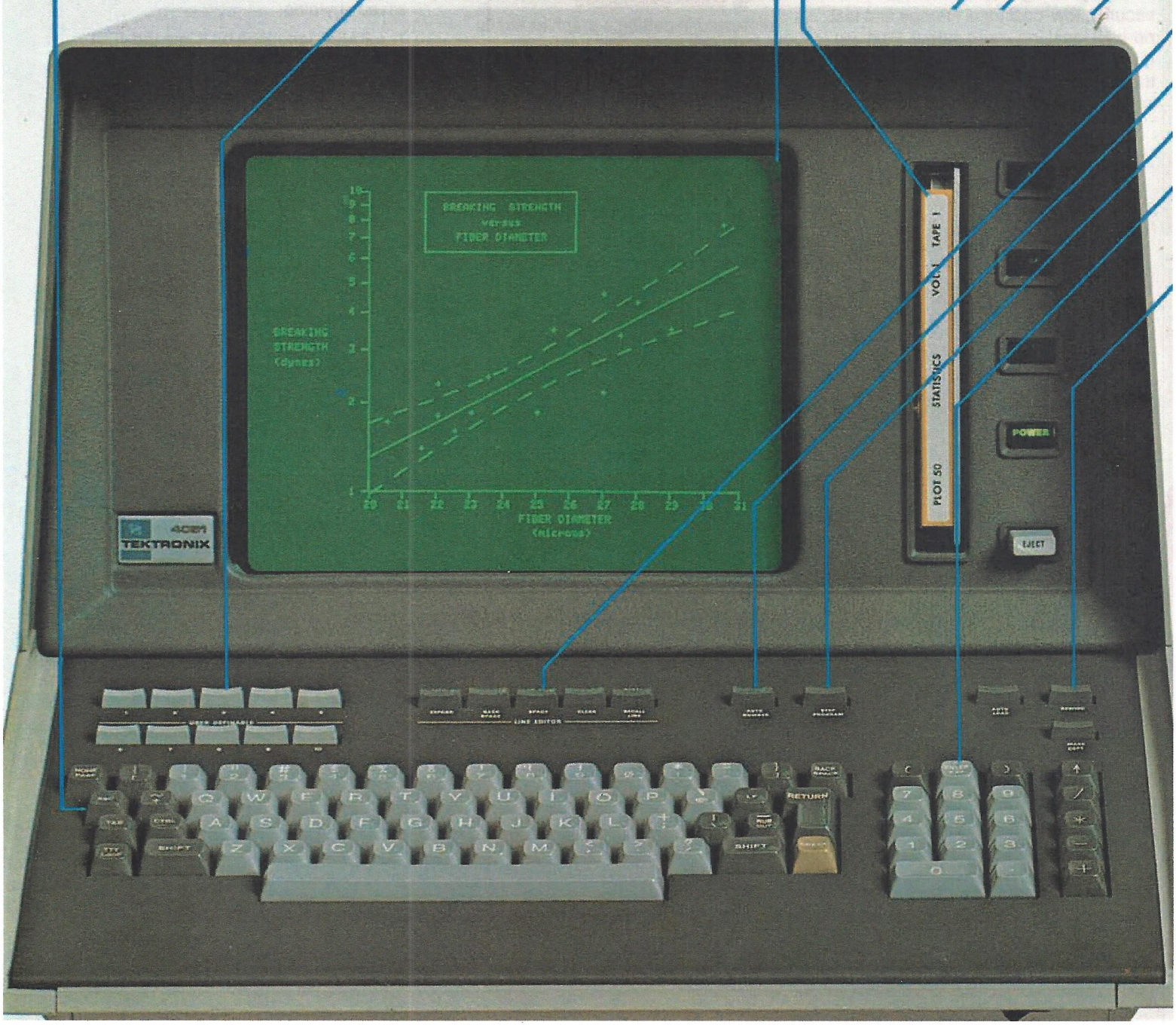
Multiple fonts: six built-in character sets: U.S.; Scandinavian; German; General European (Fr., Brit., It.); Spanish; plus special symbols.

10 user-definable keys: call up to 20 routines with shift control; no typing, no screen clutter.

11"-diagonal direct view storage CRT: upper case/lower case; 72 characters/line; 35 alphanumeric lines/page; 1024 x 780 addressable graphic points; keyboard or program control; no memory needed for display refreshing; no eye-fatiguing flicker.

Magnetic tape unit: program or key access, by file segment; reliable cartridges. 300K byte capacity.

IEEE standard 488-1975-compatible interface: for plotters, instrumentation, etc; the new instrumentation industry standard.



and use...

ROM backpack: capable of accepting two 8K-byte extended function ROM packs. Addition of these packs extends the capabilities and performance of the 4051.

Printer output option: to plug in RS-232-C compatible peripherals including standard terminals and printers; 110-2400 Baud.

5 keys/10 functions for program editing: featuring insert space for additions; CLEAR LINE from memory; RECALL last statement.

AUTO NUMBER key: automatically generates line numbers.

STEP key: executes a program one step at a time.

Numeric keypad: for fast five-function calculator computations.

Tape and Hard Copy controls: AUTO LOAD (replaces commands FIND, OLD, and RUN for first program on tape), REWIND (tape to beginning); and MAKE COPY (activates the optional 4631 hard copy unit).

Extended BASIC language in the 4051 gives you easy, English-like access to the computer. Other BASIC software converts easily to it. In graphics, it lets you work in your own data units, not raster or machine units.

But the 4051 has important BASIC extensions, including: special graphic primitives; file system data access; matrices for powerful graphic manipulation; exceptional string functions for text handling; and high level interrupts to access the processor whenever you need it.

Standard 8K BYTE work space gives you plenty of graphics and computation room. Memory is expandable in 8K options, up to 32K total, with a size for any application.

In addition, a 32K ROM (Read Only Memory) in the 4051 holds the operating system, including 8K switchable banks that enable ROM pack expansion and flexible data communications modes via the data communications option. For even more memory, a user can access the 300K byte tape cartridge for data or programs.

It all adds up to an incredibly responsive computing power; at your command, at your desk.

4051 BASIC includes:

All the standard BASIC COMMANDS

System operating commands, featuring:

APPEND (retrieves and attaches a stored BASIC program to one already in the workspace, to effectively overlay larger programs; CALL (passes control to an optional ROM pack firmware routine; SET (sets to RAD/DEG/GRAD units); TRACE (line-at-a-time) or NORMAL execution, KEY or NOKEY (to enable user function keys).

- A full range of built-in math functions.
- Totally unique GRAPHICS COMMANDS, the stars of 4051 BASIC:

AXIS; DRAW/RDRAW/MOVE/RMOVE (draws or invisibly moves to new absolute or relative position); GIN (returns x and y locations of graphic cursor); DRAW/RDRAW/MOVE/RMOVE (instant lines from any data matrix); ROTATE; and more.

- Output formatting commands, rare in BASIC.
- Unique interrupt control for the peripherals.

Doubled by data communications capability.

You can literally multiply the capabilities of your 4051 with our low-cost data communications. We can only sketch its capability here, but a demonstration will really show you the beauty of it.

The communications option:

A special RS-232-C Interface; with built-in firmware for interactive data communications mode selection.

What can you do with the communications option?

Enter a single command. Instantly you are given control of the RS-232-C capability. Then you interactively choose baud rate, parity and other applicable communication parameters.

In TERMINAL mode, the 4051 acts like a TEKTRONIX 4012 Computer Display terminal. Keyboard inputs go direct to your mainframe, returning data and graphics go up on the screen. Use the TEKTRONIX PLOT-10 graphics software, or tailor your own.

In COMMUNICATIONS mode, the 4051 internal tape unit looks like a paper tape reader/punch to your computer—but it's a lot more to you. You can send or receive data via the tape, at asynchronous speeds up to 2400 Baud —much faster than keyboard or paper tape input or output. Minimize computer connect time and line use. Maximize common data base use.

The potential is enormous.

The communications-equipped 4051 as a graphic data communications satellite is at once a subtle and powerful concept, with broad potential.

Worldwide, companies are using the intelligent satellite to combine local data convenience with central computer power, while holding line traffic and computing expense to a minimum.

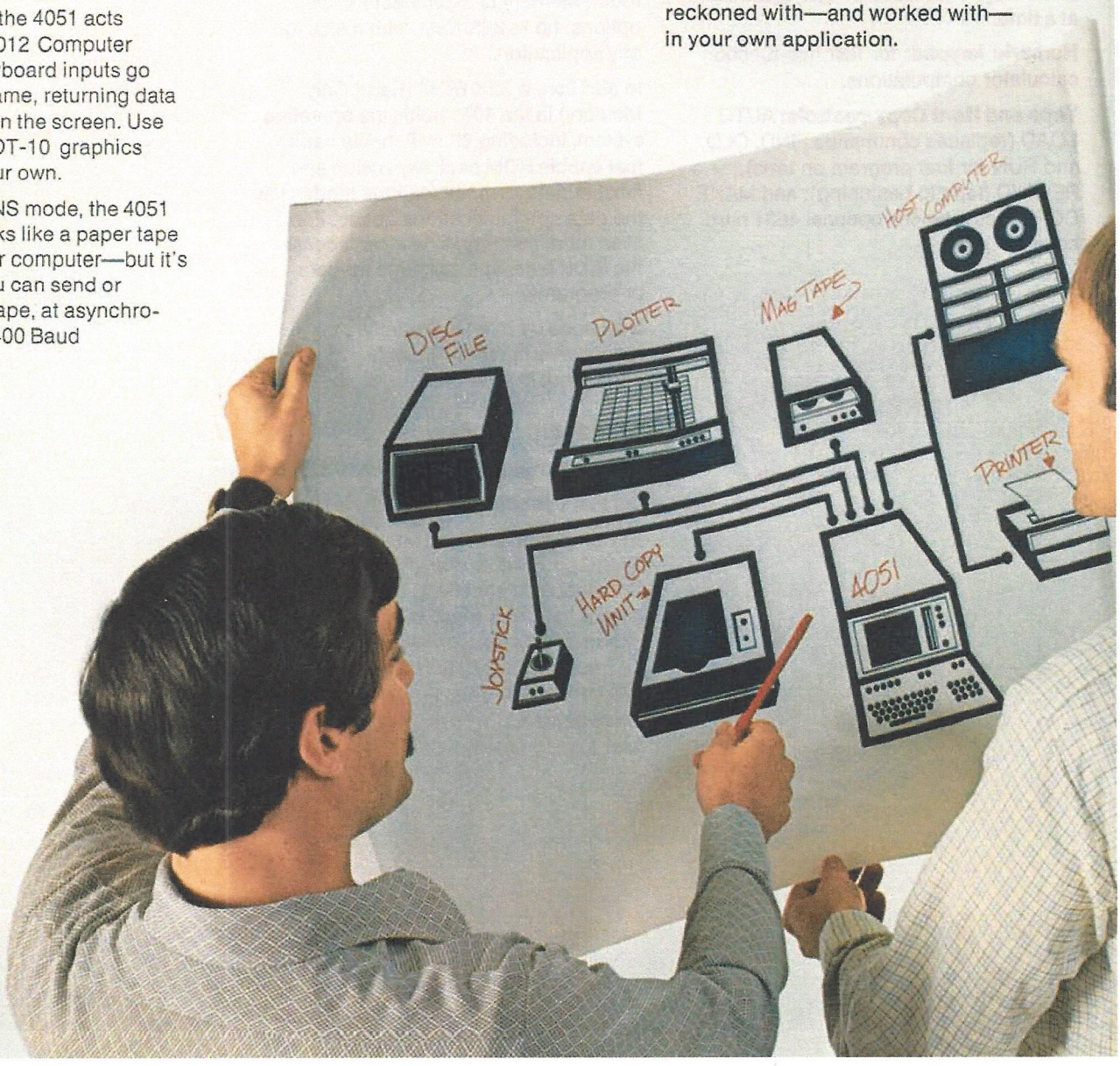
A scientist with a lot of programs in the host computer can do big or shared-data programs in the host, and small BASIC programs locally, switching programs and data in and out of the 4051 as needed.

Production controllers and instrumentation users can do complex manipulations in the host, get output back to the 4051, then use local programs to generate a graphic report.

Small colleges can access big university computers, but retain a local processor for computer-aided instruction.

A graph communicates measurably better than printed output. TEKTRONIX 4051 Graphics wins the instant endorsement of those who see it at work in data communications systems.

It's an emerging concept to be reckoned with—and worked with—in your own application.



Graphics comes free, BASIC comes easy.

With the orientation manuals and tapes that come free with the 4051, you can sit down and knock out your first graph in minutes.

Free.

TUTORIAL Program. It's a quick, hands-on introduction to the 4051 and extended BASIC commands. Covering operation of the keyboard, use of cartridge tapes, and the Graphics commands, the Tutor package enhances the User's Manual.

The PLOT-50 Programming Manual. Designed to turn a novice into a programmer, the manual is "human-oriented" and loaded with illustrations and examples.

The 4051 Operator's Manual. It assumes you know a little about programming, and goes on to let you in on the features and fine tuning of the machine.

The 4051 Reference Manual. It's a complete explanation of enhanced BASIC language, with a guide on command use.

The PLOT-50 Graphics Manual. It's a beginner's guide to histograms, x-y plots, time plots and function plots. And that says a lot.

PLOT-50 Graphics Software. Programs on the system tape tell the 4051 how to do what you learned in the Graphics Manual.

System Verification Software. This package checks out all operations of the 4051, and indicates their status.

And easy.

BASIC communicates at a high level, so the machine takes care of most of the details.

BASIC goes great with graphing. It's especially good at turning a collection of co-ordinates into a graph: DRAW executes the graphing command instantly on a pair of values or two vectors.

And more.

For users who want generalized software with graphing facilities, Tektronix has applications-oriented software packages.

They're full of BASIC routines you can easily add to your own programs, and their cost is nominal, compared to the development costs you could expect.

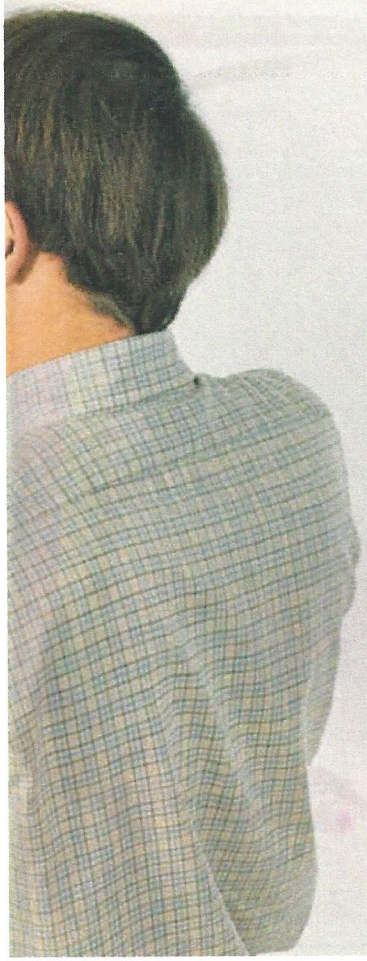
Statistics. Three volumes* cover distributions (F; T; Chi-square; Gamma; Normal; Beta; Point, Single and Accumulative Binomial; Point, Single Term, and Accumulative Hypergeometric; High Accuracy Normal); tabled values (F, T, Chi-square, Gamma, Normal, Beta); M x N and 2 x 2 (Fisher's test) contingency tables; one sample, two sample and paired t-tests; linear regressions; and analysis of variance. Most important, 4051 Statistics also includes automatic curve plotting, table formats, and histograms.

Mathematics. Two volumes* include conversions (metric, number base, co-ordinate system), special functions, function analysis, matrices, interpolation, complex numbers, calculus, and more, including Graphics.

Electrical engineering. One volume* provides a microwave circuit analysis and plotting package, including elements and circuit building, featuring a convenient and flexible vocabulary to specify frequencies and re-test portions of an analysis. EE includes automatic plotting on Smith's, polar or rectangular grids.

If that doesn't keep you busy, you can expect more offerings of Tektronix software support to help it all add up.

*Purchased separately.



There's capability to build on.

The 4051 is designed to work with an effective range of peripherals—now and in the future.

The unique 4631 Hard Copy Unit produces a fast, high resolution copy of any 4051 display, using a clean, quiet, dry-process technique, for economical selective copying.

The 4924 Digital Cartridge Tape Drive is designed for fast data I/O and tape copying applications and is an extension of the internal 4051 tape file system. Read/write speed is 30 ips, search speed is 90 ips. Total capacity is 300K bytes.

The 4641 Printer is ready for reliable performance at speeds up to 180 cps. It adjusts for forms up to 6 parts, and for 11 different forms lengths. Its rugged reliability includes a self-test function for all characters. (not shown)

The 4662 Interactive Digital Plotter offers speed, precision, and exacting resolution. It features hardware page scaling and alphanumeric capability for off-line plotting applications, plus built-in digitizing capability.

The 4952 Option 2 Joystick is used for positioning the graphic cursor. BASIC language keywords GIN and POINTER add interactive Graphics capability to the 4051/Joystick combination. Just plug it in and it's ready to work.

General Purpose Interface.

The I/O connector at the back of the 4051 is a guarantee of compatibility with an increasing number of state-of-the-art peripherals, from Tektronix and other instrumentation manufacturers. It meets the new IEEE standard (488-1975) for Programmable Instruments. It can handle multiple devices at once in a "daisy chain."

RS-232-C Printer Interface.

The RS-232-C connector outputs the right format to drive your choice of printer, printing terminal or other compatible peripherals.

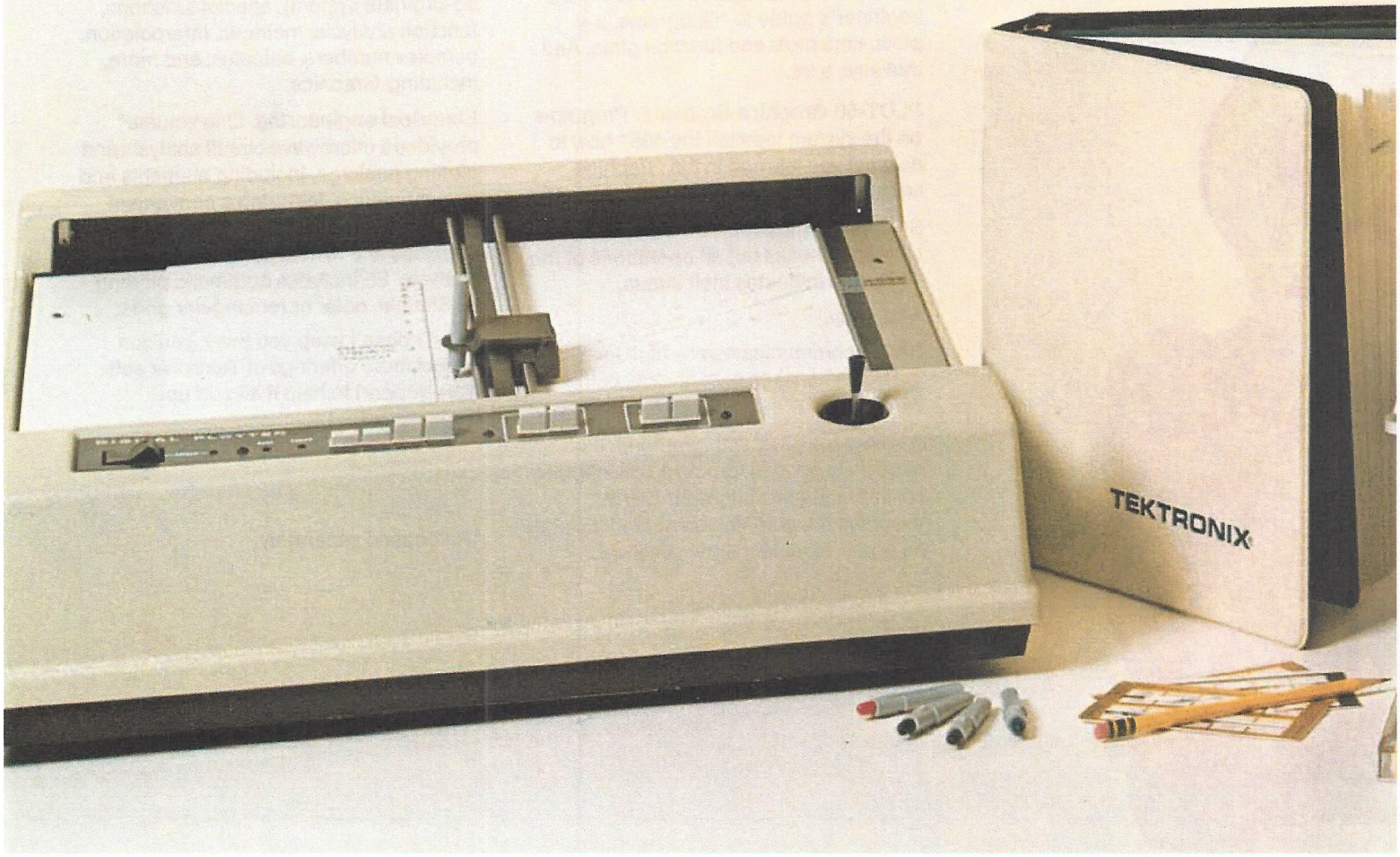
Data Communications Interface and firmware module.

The Data Communications Interface Option increases the 4051's scope from desktop graphic computing system to intelligent graphic terminal, by enabling several data communications modes.

Optional Accessories.

A specially designed pedestal provides a stand-alone configuration for the 4051.

Special cables, dust cover, viewing hood and other accessories are available.



TEKTRONIX
TEKTRONIX
4631
HARD COPY UNIT
STATISTICS

Plus working agreements.

The best of all systems . . .

. . . is the one that solves your application problems. There is capability here to guarantee a cost-effective, graphically clear answer to your needs today.

Equally important, there is the built-in promise of design compatibility with the answers of tomorrow.

When you buy from Tektronix, you're working with a field office that stays within earshot, and a company that goes around the world.

All equipment carries the Tektronix warranty: 90 days for any problem; and on all parts for one year.

Field service extends from ready phone advice to a wide range of available service contracts. Your Sales Engineer has details on emergency repairs, scheduled and contract maintenance and on-site service.

Financial arrangements go from our standard to extended terms (with additional service charges); installment plans; and flexible rental agreements. OEM agreements are also available.

Your local Sales Engineer will help you prepare your purchase, including peripherals, options, and accessories. In fact, your Sales Engineer may be the most important accessory Tektronix provides: equipped with technical expertise, applications awareness and service.

Systems analysts are also located at Tektronix field offices to help you analyze systems, software and configurations of Tektronix products.

Wherever you are, we'll work something out for you.

From Tektronix.

Where else? For a high capability graphic computing system, you need a high capability graphic cathode ray tube. No one else has quite gotten the knack of making the storage tube that Tektronix customers have learned to love.

A lot of other engineering and manufacturing wizardry has gone into the 4051, though most of it is less visible than the famous tube.

You can count on it—and graph on it—for a long time to come. It's from Tektronix.

Product data.

Central Processing Unit

Type: LSI Microprocessing Unit

Workspace Size: 8K Bytes Standard Expandable to 32K Bytes

Programming Language: BASIC with integrated operating system, built-in graphics and numerous other extensions

4051 BASIC Language Elements

Keywords
CALL
COPY
DATA
DEF FN
DEG
DELETE
DIMENSION
END
FOR . . . TO . . . STEP
FUZZ
GOSUB
GOTO
GRAD
HOME
IF . . . THEN . . .
IMAGE
INIT
INPUT
LET
LIST
NEXT
OFF
ON . . . THEN . . .
PAGE
POLL
PRINT
RAD
RBYTE
READ
REM
RENUMBER
RESTORE
RETURN
RUN
SET
STOP
WAIT
WBYTE
WRITE

Graphic Keywords
MOVE, RMOVE
DRAW, RDRAW
SCALE
AXIS
WINDOW
VIEWPORT
ROTATE
GIN
POINT

File Storage Keywords
FIND
KILL
MARK
OLD
SAVE
APPEND
TLIST

Operators
+
–
*
/
^
MIN
MAX
AND
OR
NOT
=
< . >

Functions
ABS
ACS
ASC
ASN
ATN
CHR
COS
EXP
INT
LEN
LGT
LOG
MEM
PI
POS
REP
RND
SEG
SGN
SIN
SPA
SQR
STR
TAN
VAL

Numeric Accuracy: 14 decimal digits (12 displayed)
Numeric Range: $1 \times 10^{\pm 307}$

Internal Peripherals

Keyboard

- Complete upper and lower case alphanumerics with auto-repeating keys. Full ASCII. 128 characters.
- 10 user definable Keys with SHIFT for up to 20 separate function calls.
- Five editing keys with SHIFT control 10 different editing functions used to modify BASIC source programs.
- Calculator key pad including 10 key numeric pad, 5 math operator keys, decimal point and parenthesis.
- Control keys:
  AUTO NUMBER—generates program line numbers automatically
  STEP—executes program steps one at a time
  AUTO LOAD—automatically loads and runs first program on tape
  REWIND—Rewinds tape
  MAKE COPY—activates optional 4631 Hard Copy Unit.

Display Characteristics

Type: Direct view storage CRT.
Dimensions: 8 inches wide by 6 inches high (20.3 cm x 15.2 cm).
Alphanumeric Format: 72 characters per line, 35 lines; 2520 total.
Character Set: Full ASCII character set, including upper/lower case. Also includes Scandinavian, German, General European, and Spanish fonts.
Graphic Resolution: 1024 x 780 points
Hard Copy: Compatible with our 4631 Hard Copy Unit.

Tape Drive

Capacity: 300K bytes max (dependent on number of files).
System Characteristics: File structures for storage of programs or data. Access is via 4051 BASIC operating system.

General Purpose Interface Bus (GPIB)

Specifications: Conforms to IEEE standard 488-1975. Byte serial, bit parallel transfer mode.
Control Mode: External devices can be serviced via interrupt procedures available in the BASIC operating system. Enable/disable, polling and data transfer commands are available under program control.

Physical Characteristics

Height: 13.6 inches (34.5 cm)
Width: 18.3 inches (46.5 cm)
Depth: 32.5 inches (82.6 cm)
Weight: 65 pounds (29.5 kg)

Power Requirements:

Line Voltage Range: ± 10%.

Low	Med	Hi	
100	110	120	operates between 90V to 132V RMS.
200	220	240	operates between 180V to 264V RMS.

Line Frequency: 48-66 Hz
Power Consumption: 200W maximum
Operating Temperature: + 10 degrees C to + 40 degrees C

Tektronix, Inc.
Information Display Group
P.O. Box 500
Beaverton, Ore. 97077
Telephone: (503) 638-3411
TWX: 910-467-8708
Cable: TEKTRONIX

Tektronix Datatek N.V.
P.O. Box 159
Badhoevedorp, The Netherlands
Telephone: 02968-6051
Telex: 16565
Cable: DATATEK Holland

Sony/Tektronix Corporation
9-31 Kitashinagawa-5
Shinagawa-Ku
Tokyo 141 Japan
Telephone: 445-0221
(Area 03/Tokyo)
Telex: 02422850
Cable: SONYTEK Tokyo

Tektronix Australia Pty. Limited
Sydney
80 Waterloo Road
North Ryde, N.S.W. 2113
Telephone: 888-7066
Telex. AA 24269
Cable: TEKTRONIX Australia

Tektronix Canada Ltd.
Montreal
900 Selkirk Street
Pointe Claire, Quebec H9R3S3
Telephone: (514) 697-5340
Telex: 05-821570
Cable: TEKANADA

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