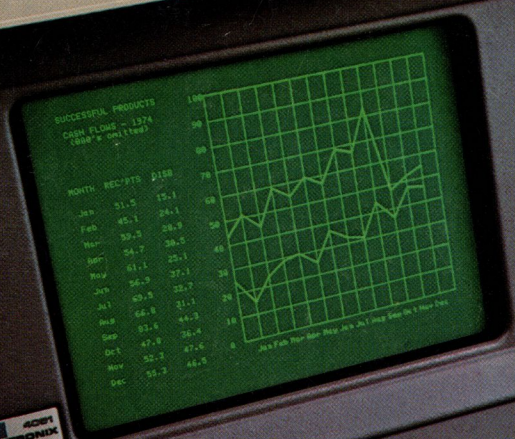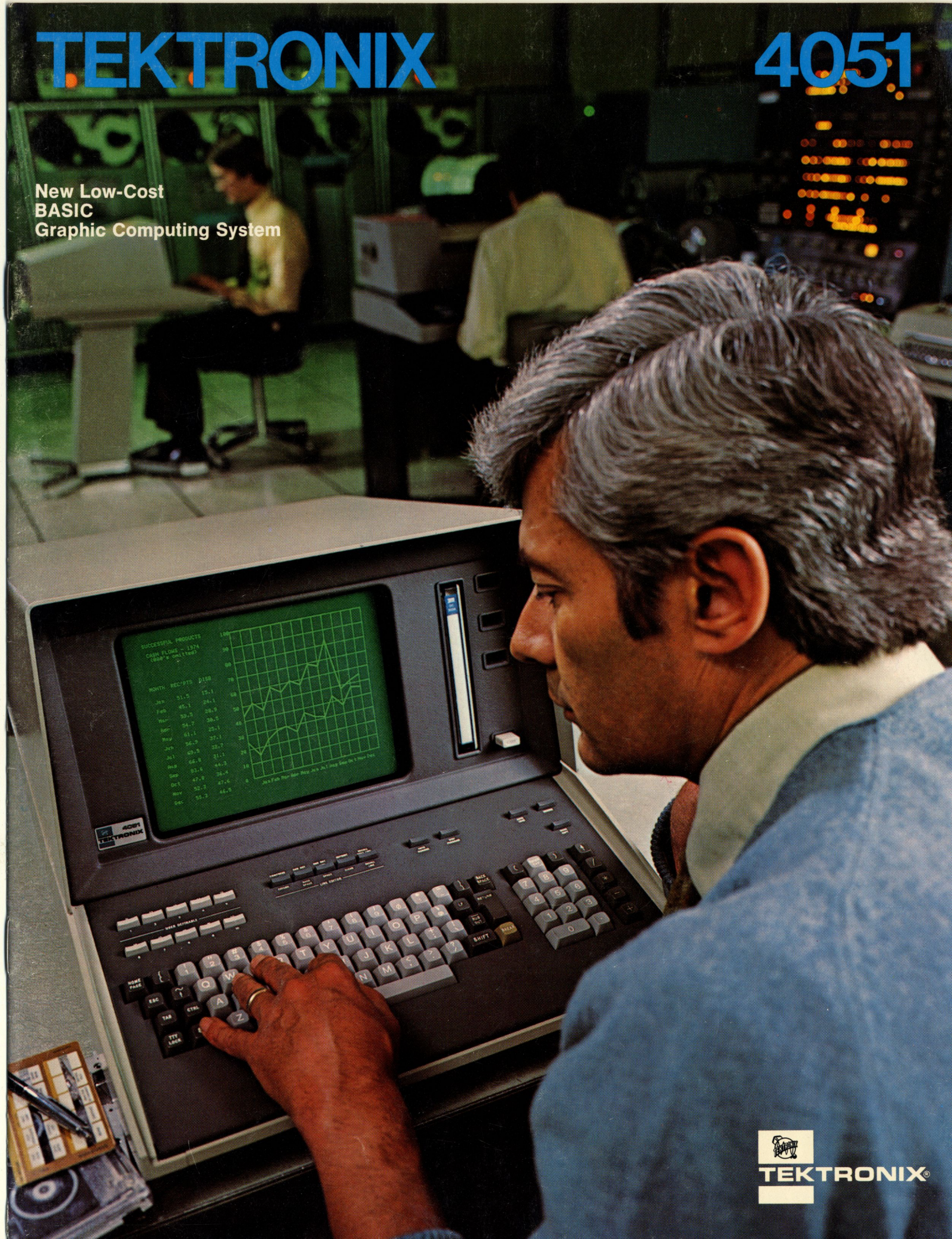# TEKTRONIX

4051

New Low-Cost
BASIC
Graphic Computing System

TEKTRONIX®

Advantages you can see...

and use...

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 3M® cartridges. 300K byte capacity.

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

ROM backpack: capable of accepting two 8K byte extended function ROM packs; for storing heavily used subprograms without using up valuable memory space.

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: fast four-function computations.

Tape and Hard Copy controls: AUTO LOAD (tape to memory); 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 an 8K switchable bank that enables firmware expansion and flexible data communications modes via the data communications option. For even more memory, a user can address 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).
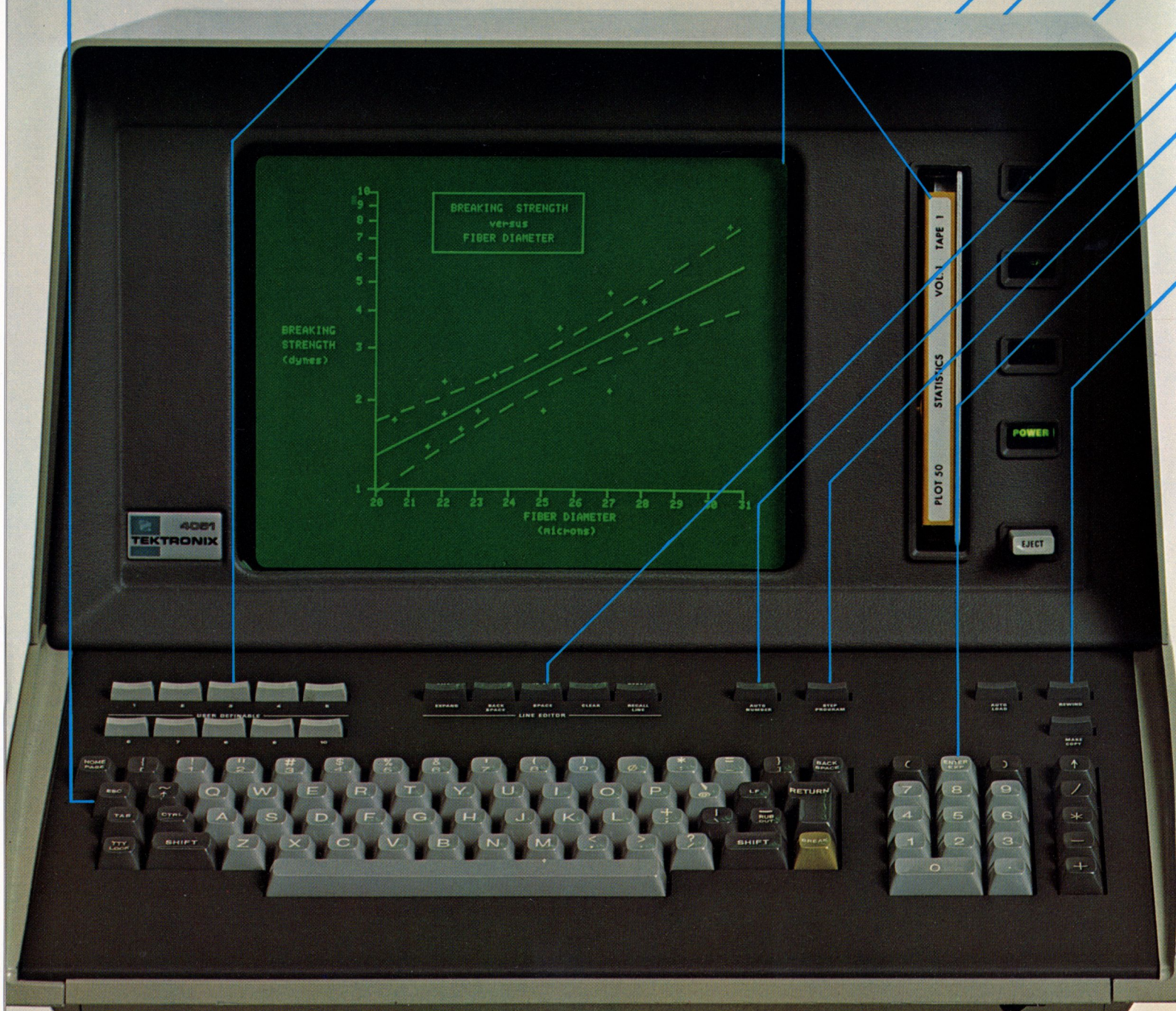
- A full range of built-in math functions.
- Powerful MATRIX COMMANDS, featuring, at no extra cost:

DIM; MAT INPUT; MAT PRINT; MAT READ; and MATRIX arithmetic 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); MAT DRAW/ MAT RDRAW/ MAT MOVE/MAT 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 exactly like a Tektronix 4012 Computer Display terminal. Keyboard inputs go direct to your mainframe, returning data and graphics go up on the screen. Use all 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.

DISC FILE PLOTTER MAG TAPE HOST COMPUTER PRINTER JOYSTICK HARD COPY UNIT 4051

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 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.

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: MAT DRAW executes the graphing command instantly.

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.

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 Magnetic Tape Unit 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 4662 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.

Accessories.

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

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

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.

The backpack includes two plug-in spaces to hold firmware ROMs for specialized applications. ROM options will be coming steadily from Tektronix. User-designed ROMs will also fit its versatile design.

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	File Storage Keywords
CALL	FIND
COPY	MARK
DATA	OLD
DEF FN	SAVE
DELETE	APPEND
DIMENSION	TLIST
END	
FOR . . . TO . . . STEP	**Operators**
FUZZ	+
GOSUB	−
GOTO	*
HOME	/
IF . . . THEN . . .	↑
IMAGE	
INIT	MIN
INPUT	MAX
LET	AND
LIST	OR
NEXT	NOT
OFF	=
ON . . . THEN . . .	< , >
PAGE	
POLL	**Functions**
PRINT	ABS
RBYTE	ACS
READ	ASC
REMARK	ASN
RENUMBER	ATN
RESTORE	CHR
RETURN	COS
RUN	EXP
SET	INT
STOP	LEN
TYPE	LGT
WAIT	LOG
WBYTE	MEM
WRITE	PI
	POS
Graphic Keywords	REP
MOVE, RMOVE	RND
DRAW, RDRAW	SEG
SCALE	SGN
AXIS	SIN
WINDOW	SPA
VIEWPORT	SQR
ROTATE	STR
GIN	TAN
POINT	VAL

Numeric Accuracy: 14 decimal digits

Numeric Range: $1 \times 10^{\pm 308}$

Internal Peripherals

Keyboard

- Complete upper and lower case alphanumerics with auto-repeating keys. Full ASCII. 128 characters.
- 10 Function 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 File 1 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

Type: 3M® DC300A cartridge.

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®

A-3229