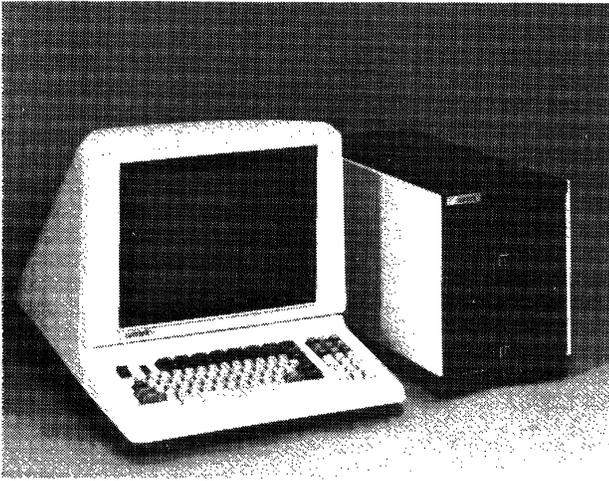


# Ramtek 8400 Series Programmable Display Terminals



## MANAGEMENT SUMMARY

Ramtek's 8400 Series is a family of terminals that provides a unique interrelationship planned to save substantial hardware costs for multiple-terminal users. The high end of the family, Model 8410, provides full support for development of user applications programs via 8080 machine language. The 8410 is equipped with dual diskette drives; extensive diskette-resident software, including an assembler, editor, debugger, disk operating system, and utilities; and 32K to 64K bytes of user-accessible main memory.

Once user programs are developed on the 8410, they can be sent to the central host computer and downline loaded to, or burned into PROM chips and installed in, another less expensive 8400 Series terminal for day-to-day execution. Model 8450 is equipped with a data communications monitor program called Talker, which provides the terminal with the ability to communicate with the host, receive downline loaded programs, and send/receive data. Model 8470 supports implementation of user-written programs in PROM. Model 8460 is a "hybrid" model that combines both capabilities: downline loading via Talker and PROM-installed program storage.

The primary hardware component of the 8400 Series is Ramtek's Model 8120 CRT terminal. Display and keyboard specifications are identical to the 8120, and transmission specifications are only slightly enhanced. The differences in communications specification between the 8120 and the 8400 Series lie in three areas: synchronous as well as asynchronous transmission is supported on all 8400 Series models; transmission parameters can be selected separately for send and receive operations; and the procedures by which transmission parameters are selected vary depending on the particular model's software support. All of the editing/formatting and other capabilities provided by the 8120's ETOS operating system are ➤

A family of four terminals that provide up to 64K bytes of RAM for program execution.

The high end of the series, Model 8410, supports program development in 8080 machine language and is equipped with one or two dual floppy disk drives. For the other three models, programs are downline loaded from the host computer or stored on PROM logic boards.

The Models 8410 and 8470 were formerly Omron's Models 8035 and 8038 respectively.

Single-quantity end-user pricing for Model 8410 with one dual floppy drive ranges from \$8,200 for the 32K-byte version to \$9,200 for the 64K-byte version. Quantity and OEM discounts are available.

## CHARACTERISTICS

**VENDOR:** Ramtek Corporation, 2211 Lawson Lane, Santa Clara, California 95050. Telephone (408) 988-2211.

**DATE OF ANNOUNCEMENT:** August 1977.

**DATE OF FIRST DELIVERY:** Initial 8410 deliveries—April 1977; production deliveries—December 1977/January 1978.

**NUMBER DELIVERED TO DATE:** Over 300 (Model 8410).

**SERVICED BY:** Ramtek and third parties.

## MODELS

Model 8410 is a microprocessor-based terminal with a CRT display, an integral keyboard, and one or two dual diskette drives. The display/keyboard component is based on Ramtek's Model 8120. The basic 8410 is equipped with an Intel 8080A microprocessor and 32K bytes of RAM memory, which can be expanded in one or two 16K-byte increments for a maximum memory capacity of 64K bytes. Two RS-232C interfaces are standard, one for communications and one for attachment of the diskette drives; a serial printer interface for a customer-supplied printer, or a 3-port serial I/O interface that can support other customer-supplied auxiliary I/O devices, is optional. A 20 or 60 mA dc current loop interface is also optional.

Models 8450, 8460, and 8470 lack the floppy disk drives and the program development software provided for the 8410, but do provide RAM memory for local program execution. Model 8450 is equipped with a communications monitor program called Talker that permits communications with the host computer for downline loading of programs stored at the host computer. Model 8470 permits local storage of user-written programs on PROM logic boards. Model 8470 accommodates both methods of implementing programs: downline loading via Talker and PROM program storage. ➤

## Ramtek 8400 Series Programmable Display Terminals

➤ available on the 8400 Series terminals. Please refer to Report C25-709-101 for further details on Model 8120.

The 8400 Series can accommodate a number of prominent serial printers, including the GE TermiNet Series, DEC-writer II, Diablo HyType I or II, NCR 260, Texas Instruments Silent 700 Series, Centronics, Tally, and Teletype RO. Ramtek is also evaluating printers and plans to make two printers (low and medium speed) available.

The 8400 Series is among several CRT products now being manufactured by Ramtek as a result of its acquisition of certain assets of the Information Products Division of Omron Electronics, Inc. in February, 1979. The Ramtek Model 8410 is Omron's former Model 8035; Ramtek's Model 8470 was previously Omron's Model 8038.

### USER REACTION

In October 1979, Datapro interviewed 5 users, whose names were supplied by Ramtek, and who reported their experience with a total of 548 terminals. Models included in their ratings include Omron's 8035, 8038, and 8025, and Ramtek's 8410, which had been in use for one to four years. The ratings assigned by these users are listed below.

	Excellent	Good	Fair	Poor	WA*
Overall performance	1	4	0	0	3.2
Ease of operation	1	4	0	0	3.2
Display clarity	3	1	1	0	3.4
Keyboard feel and usability	0	4	0	0	3.0
Hardware reliability	2	2	1	0	3.2
Maintenance service	1	1	2	1	2.4
Technical support	0	3	1	0	2.8

\*Weighted Average on a scale of 4.0 for Excellent.

These users were generally satisfied with their terminals. Advantages cited by more than one user included low cost, display clarity, adaptability to a wide variety of applications, and usage of standard 8080 machine language. Also mentioned were ease of operation, ease of program loading, configuration flexibility in selection of memory size and software modules, and willingness of the vendor to customize the terminals to suit the user's needs.

Disadvantages mentioned include inadequate field service, difficulties in terminal maintenance, and limitations in software support. All five users had experienced problems with field service (some with Omron and some with Ramtek personnel), including lack of local support, slow response to calls for service, limited availability of service personnel, and lack of documentation for field representatives on customized units; however most of them felt that service had improved somewhat in recent months. Two users who were doing their own maintenance service felt that maintenance was unusually difficult, and that, although hardware reliability was satisfactory, when breakdowns did occur, repairs were not simple to make. Two users felt that software field support provided by Omron/Ramtek was not as good as that available from other terminal vendors with whom they had had experience. □

### ➤ TRANSMISSION SPECIFICATIONS

Transmission is asynchronous or synchronous in half- or full-duplex mode at transmission rates of 110, 300, 600, 1200, 1800, 2400, 4800, or 9600 bits/second. The ASCII transmission code is used. Parameters including technique (asynchronous or synchronous); data rate; character length; odd, even, or no parity generation and checking; and number of stop bits are specified independently for transmit and receive operations, either by strap selection, or by keyed command via the Communications Initialization utility program (Model 8410), Talker (Models 8450 and 8460), or escape sequences. Character length can be specified as 5, 6, 7, or 8 bits; stop bits can be set for 1, 1.5, or 2 stop bits. Transmission parameters selected by keyed commands revert to strap selections when power is removed from the terminals or when the terminal is reset. The 8400 Series provides compatibility with the Bell Systems 202C modem. The 202C feature, when specified by command, sustains the Request-to-Send signal for 4 milliseconds after the block termination character is transmitted; in character mode, the RTS is sustained when the transmit buffer becomes empty. An RS-232C interface is provided for communications; a 20 or 60 mA dc current loop interface is optional.

### SOFTWARE

The Ramtek 8410 software library consists of the Intel 8080A macro assembler, an editor, a debugger, a disk operating system, file maintenance utilities, and a Peripheral Interchange Program (PIP). A communications monitor (Talker) is provided for Models 8450 and 8460. All units include a packaged operating system called ETOS. The latter is a diskette-based version of the ETOS PROM-resident operating system used by the Ramtek 8120 and provides all the data entry and editing features of ETOS. See Report C25-709-101.

User programs are created at the 8410 keyboard using the 8080 assembly language to create a source file on diskette. The 8080 assembler produces two diskette files—a listing and an object file. The listing contains error flags and the machine code for each statement. The object file (in hexadecimal) is ready for loading and execution.

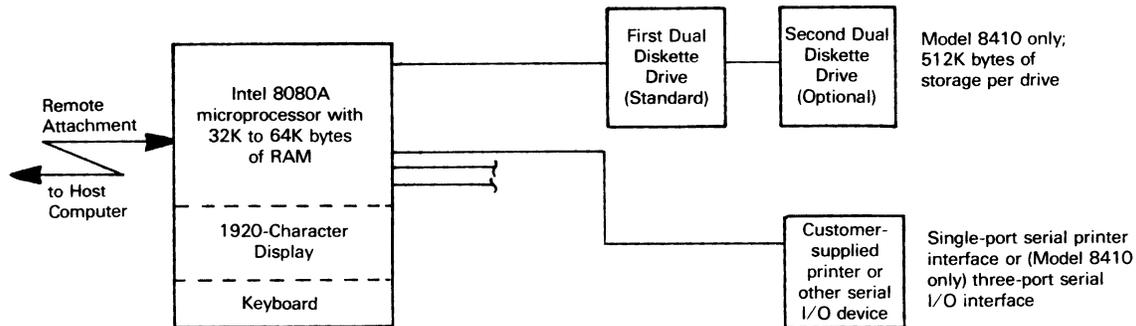
The *interactive debugger (DDT)* lets users execute specific sections of a program and examine and alter processor registers and memory locations via the CRT screen and keyboard.

The *editor (ED)* permits the user to create or alter ASCII source files via the keyboard, and features operator prompting via displayed messages. Both the editor and the source file are loaded from diskette into main memory. Through a set of commands, the editor handles the source file as a series of lines, each consisting of a sequence of characters terminated by a carriage return and line feed. Edit commands include text transfer, text display, character pointer movement, text search and alteration, and macros consisting of a user-specified group of edit commands. The editor also prints error messages along with the last characters read from the command string prior to the error. Commands can be entered sequentially and all executed following a keyed carriage return or when the command line reaches 128 characters in length.

Text transfer commands transfer text between the main memory, keyboard, and diskette files. Text display commands display lines or pages of memory-resident text. Character printer movement commands are used to delete or skip characters or lines of text, move to the beginning or end of text, or move to the next line and display it. Text search and alteration commands locate strings of text in main memory and alter the strings when directed.

## Ramtek 8400 Series Programmable Display Terminals

### Configuration



- The edited file is returned to diskette storage; however, the original file is never destroyed. It can be reclaimed and renamed.

The *Peripheral Interchange Program (PIP)* permits the user to combine source files and transfer them to a destination file or peripheral device. Source files can be transferred from diskette storage or a peripheral device, including the keyboard. PIP reads from each source until an end-of-file condition is encountered and copies the source to a destination. Multiple sources are concatenated from left to right into the destination until all sources are processed. Keyed commands can interrupt the current source and transfer the next source, halt and restart PIP, and abort the processing of the current command. PIP features operator prompts to alert the operator to current operating conditions.

Keyed parameters appended to a PIP command specify special operations including: block transfer, deletion (truncation) of a line of data, display all transferred data, treat source as HEX file, translate upper case alphabetic to lower case or the converse, write line numbers at the beginning of each line transferred, ignore end-of-file and read to end of data, terminate or initiate data transfer on positive comparison of an encountered string of data with an established string, expand tabs to every defined column when transferring to destination, and verify that a destination file was written correctly by a read-after-write operation. PIP also displays one of a set of 18 error messages when a definable error is encountered.

The *disk operating system (CP/M for control program/monitor)* is composed of three components: a console command processor (CCP), a transient program area (TPA), and a floppy disk operating system (FDOS). Console interaction with CP/M is performed via CCP, which reads and interprets commands entered from the keyboard. Keyed commands fall into two classes: built-in and transient. Built-in commands (a total of five) are predefined and include commands for erasing a file from diskette, listing names of files on a diskette, renaming a file, storing a file, and displaying the contents of a file. Transient commands are programs loaded from diskette into the TPA for execution. Utility and other programs such as Editor, PIP, etc. are pre-defined transient programs. An executing transient program can overlay any or all of the CP/M by using the CCP and FDOS as data area. Transient programs that use FDOS I/O facilities cannot overlay any of FDOS. When executed, the transient must return control to CCP.

The CP/M operating system responds to a set of keyed commands. Among these are the scroll up and scroll down, next line and previous line, tab, line feed, carriage return, and bell keyboard functions.

FDOS consists of a set of procedures used to access diskette storage and peripheral devices. Transient programs and the CCP issue I/O commands to FDOS by sending I/O parameters through the FDOS entry point.

File organization defines a diskette file as any number of 128-byte records from zero to 241K bytes. The disk file directory resides in 2K bytes of diskette storage. The directory consists of 64 file control blocks (FCB), each 32 bytes long. Each FCB contains name and allocation information for all file operations on a particular file. Up to 16K bytes of a file can be described by one FCB; therefore, files greater than 16K bytes require more than one FCB. When a file is opened, FDOS reads an FCB from diskette to memory, updates the FCB as file operations are executed, then rewrites the FCB on diskette when the file is closed. Transient programs that access disk files must define an FCB for each file referenced. The CCP also constructs an FCB for each file it accesses.

Executable file operations include the establishment of an FCB, file search, search for next occurrence, file creation, file deletion, file renaming, file opening and closing, file reading and writing, file utility functions, and peripheral I/O functions. An FCB is established within a 33-byte segment of a transient program's data area for each file to be accessed. The FCB specifies disk selection, file name and file type, and record to be accessed (for read/write operations). The file search and search for next occurrence (used immediately following a file search command) locate matches in the file directory. File creation and deletion commands add an FCB to or delete an FCB from the file directory. File renaming requires an FCB supplied by the transient program to establish a new file name and file type. File opening commands must precede a read command, an open or create command must precede a write command. When writing is finished, a file must be closed. Read and write commands can specify sequential or random access. A 128-byte record is read from or written to the file. Three unsuccessful attempts to execute a read or write command result in a displayed error message. Peripheral I/O commands are used to perform console I/O functions, printing, and communications operations.

*Utility programs* are provided for loading or dumping files, displaying diskette status, batch processing of commands, diskette duplication, communications initialization, and sysgen. All utility programs display operator messages.

The communications initialization utility establishes program-defined (via control words) communications parameters that include the data rate; character length (number of bits/character); parity, marking, or spacing; and synchronous or asynchronous mode) for the two Synchronous/Asynchronous Communications Adapters (SACA). The

## Ramtek 8400 Series Programmable Display Terminals

► parameters for receiving and sending can differ; each SACA operates independently. The default parameters are those established by the baud rate switch and jumpers on the terminal.

Sysgen transfers a copy of the operating system (CP/M) between either diskette and the transient program area (TPA). It transfers only CP/M and not the system utilities, which can be transferred by PIP or the copy utility.

*Talker* is a data communications monitor that supports Model 8450 and 8460 communications with a host computer. Talker commands can be keyed or received and include commands for sending and receiving, suspending communications, ending received data and updating the file, half- or full-duplex selection, and cancelling an operation. All communicated data is displayed, and keyed data is transmitted. Keyboard control functions, except for Break and Talker commands, are ignored by the Talker program.

### COMPONENTS

**CRT DISPLAY UNIT:** A 15-inch (diagonal measurement) CRT with a viewing area of 8 inches high by 10 inches wide. The display arrangement is 24 lines of 80 characters each for a total of 1920 character positions. The standard character set includes 128 displayable ASCII symbols including upper and lower case alphabets, numerics, specials, and graphic symbols that represent each of the ASCII control codes. The standard character set is expandable to 96 additional symbols for a total of 224 displayable symbols. Several foreign character sets are available including French, Swedish, Katakana, etc. Symbols are formed within a 7-by-7 (upper case) or 7-by-9 (lower case) dot matrix; the increased matrix size for lower case characters accommodate the line descenders of characters such as g, j, p, q, and y. The standard half-dot shift feature effectively increases the matrix density from 7-by-9 to 14-by-9 dot positions, providing increased character resolution. Data is displayed in white. Standard display attribute functions include half and full intensity, zero intensity (blank), reverse video, and underscore. The display attributes can be combined to provide special effects. The cursor is displayed as a blinking underscore or as a blinking block when protected fields are displayed.

**KEYBOARD:** A 57-key, typewriter-style integral keyboard that also includes two additional rows of 8 function keys

each, located over the main keygroup, and a numeric/function keypad to the right. Key functions within the main keygroup include Escape, Carriage Return, Line Feed, Tab/Back Tab, Shift, Lock, and Control. The numeric/function keypad includes 12 numeric keys including decimal point and common; independent cursor controls for Up, Down, Left, Right, and Home cursor functions; Scroll Up and Down functions; and Previous and Next Page functions. The two additional rows of eight function keys include (top row) Transmit, Full Page/Partial Page Mode, Line Mode, Character Mode, Upper Case Lock, Character Delete, Character Insert, Carrier Detect/Break; (bottom row) Print, Half-/Full-Duplex, Function Mode, Clear Memory/Clear Line, Clear Partial Page/Clear Full Page, Line Delete, Line Insert, and Receive/Reset. Eleven of those function keys are also switch-indicators and contain an LED indicator embedded in the keytop. Power On/Off and Brightness (thumb-wheel) controls are also located on the keyboard at the left.

**DISKETTE SUBSYSTEM:** A dual-drive, IBM 3740-compatible unit. The diskette unit (a Shugart SA 100) features an average access time of 260 milliseconds, and an average rotational delay of 85 milliseconds. The recording density and data transfer rate are 3200 bpi and 31.25K bytes/second, respectively.

The diskette is formatted into 77 tracks (73 data tracks) plus 3 spare tracks and 1 index track). Each track is divided into 26 sectors, and each sector (except for the index sector) stores 128 bytes. Index sectors each store 80 bytes. The total storage capacity per diskette is 256,256 bytes. Two tracks plus 16 sectors are reserved for the operating system.

### PRICING

The Ramtek 8410 available to large end users, OEM systems houses, service bureaus, etc. on a purchase basis only. OEM discounts on purchases of 100 or more terminals are generally provided at a rate of 20 to 25 percent off the list price; contact Ramtek for details. Installation is priced at \$120 per terminal on a single-terminal basis, and the investment tax credit is passed on to the customer. On-site or factory training is available for large customers. Documentation includes an operator's manual (provided with each terminal) and a maintenance manual, available for \$50.

	End-user Purchase Prices					
	1-2 Units	3-5 Units	6-9 Units	10-24 Units	25-99 Units	100+ Units
Model 8410	\$8,200	\$7,875	\$7,500	\$6,975	\$6,575	Contact Vendor
Model 8450	5,100	4,900	4,750	4,675	4,600	4,300
Model 8460	Contact Vendor	Contact Vendor	Contact Vendor	Contact Vendor	Contact Vendor	Contact Vendor
Model 8470	Contact Vendor	Contact Vendor	Contact Vendor	Contact Vendor	Contact Vendor	Contact Vendor
<b>Options</b>						
First 16K-byte memory increment; Model 8410; factory-installed	500	550	475	500	450	Contact Vendor
Second 16K-byte memory increment; Model 8410; factory-installed	500	475	450	425	400	Contact Vendor
First or second 16K-byte memory increment; Model 8410; field-installed	750	750	750	750	750	750
RS-232C Printer Interface	275	275	275	275	275	275
RS-232C Printer Cable	50	50	50	50	50	50
3-port Serial I/O Interface; Model 8410	350	350	350	350	350	350
Second Dual Diskette Drive; Model 8410	2,950	2,950	2,950	2,950	2,950	2,950