

# Omron 8035/8038 Programmable Display Terminals



## MANAGEMENT SUMMARY

The Omron 8035 and 8038 display terminals are designed to save substantial hardware costs for multiple-terminal users. Omron's market strategy uses a programmable terminal for development of user application programs and a cost-reduced terminal that executes the user-created programs. Omron's cost-effective approach allows the user to have customized terminals at a fraction of the cost of operating with fully-programmable terminals at each location.

The Omron 8035/8038 terminal combination includes a programmable terminal, the 8035, and a non-programmable terminal, the 8038. The 8035 is equipped with dual diskette storage and an extensive diskette-resident software development system, which includes an assembler, editor, debugger, disk operating system, communications monitor, and utility programs. User programs are stored on diskette and returned to Omron, where the program is loaded into PROM memory, creating permanent copies of the original program. The user-programmed PROM's are then installed in 8038 terminals to perform the user-specified functions.

The Omron 8035 and 8038 terminals are actually the Omron 8030B terminal, which was introduced in May 1976. The ETOS operating system provided with the 8030 is available for the 8035 as a disk-resident program. The ETOS program provides basic operating functions such as cursor control, format protection, and editing. The microprocessor-based 8030B contains an Intel 8080A with a basic 20K RAM memory. Memory is currently expandable to 32K bytes and will probably be expandable to 64K bytes eventually. The terminal features a 15-inch screen and an integral keyboard that includes a numeric pad. Printed copy can be produced by attaching a user-supplied printer to the terminal's serial interface. The user can establish a different set of transmission parameters for the terminal's receive and

Stand-alone programmable display terminal (Model 8035), which produces user programs for its economy-priced PROM-programmed companion (Model 8038).

Data entry and editing functions are also provided via software for Model 8035. Standard 8035 features include an Intel 8080A microprocessor with 20K bytes of RAM, dual diskette drives, a serial printer interface, and a program development package. Additional RAM memory up to 32K bytes is optional.

The basic 8035 sells for \$7,500 (in unit quantities) including 20K bytes of RAM, dual diskette storage, and all software. Quantity discounts are provided for OEM buyers and end users. Model 8038 is priced substantially below the 8035.

## CHARACTERISTICS

**VENDOR:** Omron Electronics, Inc., Information Products Division, 432 Toyama Drive, Sunnyvale, California 94086. Telephone (408) 734-8400.

**DATE OF ANNOUNCEMENT:** August 1977.

**DATE OF FIRST DELIVERY:** Initial 8035 deliveries—April 1977; production 8035 and 8038 deliveries—December 1977/January 1978.

**NUMBER DELIVERED TO DATE:** Over 60.

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

## MODELS

Models 8035 and 8038 are identical terminals except that the 8035 configuration includes a dual diskette drive, while the 8038 does not. The 8035 is intended for creating user programs on diskette which are converted to PROM-resident programs for the 8038. The 8035 and 8038 both use the Omron 8030B as the basic hardware element of each terminal. The 8030B is a microprocessor-based terminal with integral keyboard. The basic 8035 is equipped with an Intel 8080A microprocessor with 2K bytes of display memory and 18K bytes of RAM main memory, expandable to 32K bytes in 4K-byte increments. A serial (RS-232C) printer interface is standard.

## TRANSMISSION SPECIFICATIONS

Transmission parameters can be manually established via switches and jumpers for a default condition, but are programmable. Asynchronous or synchronous transmission in the half- or full-duplex mode can be selected at 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, or 9600 bits/second. Character, block, or page transmission can be programmed. The 8-, 10-, or 11-unit, 8-level ASCII code is used. Odd or even parity, marking, or spacing is also selectable. The terminal is equipped with an RS-232C

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➤ send logic. During operation, the transmission parameters are under program control with default to those selected when the terminal is initialized.

The concept of a programmable terminal to create programs that are then loaded into less expensive models without resources to generate programs is a practical solution for large-volume users who do not require programmable terminals at every location. The terminals are customized according to user applications, thereby eliminating the extra cost for programmability. As a typical example to illustrate this philosophy, consider the cost of 20 Model 8035 terminals (priced at \$7,500 each) at a total cost of \$150,000, compared with the cost of 1 Model 8035 and 19 8038's (priced at about \$2,700 each) for a total cost of less than \$60,000—a saving of \$90,000. The 8035/8038 combination is a very effective approach to multiple, custom-tailored terminals for local businesses, professional offices, schools, retailers, and others who are not budgeted for custom terminals. Omron itself benefits by being able to offer a more competitively-priced custom-programmed terminal and by having the 8035 as a program development tool for creating other special programs to sell to new and existing customers. (The program developed for one customer is frequently attractive to others in the same business.)

The Information Products Division, formed in 1973, is one of three manufacturing/marketing divisions of Omron Electronics, Inc., the U.S. Western Hemisphere subsidiary of the Omron Tateisi Electronics Company of Japan. □

➤ interface. A 20 or 60 ma dc current loop interface is optional.

### SOFTWARE

The Omron 8035 software library consists of the Intel 8080 macro assembler, an editor, a debugger, a disk operating system, file maintenance utilities, a Peripheral Interchange Program (PIP), a communications monitor (Talker), and a packaged operating system called ETOS 30. The latter is a diskette-based version of the ETOS PROM-resident operating system used by the Omron 8030 and provides all the data entry and editing features of ETOS. See Report C25-673-101.

User programs are created at the 8035 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.

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.

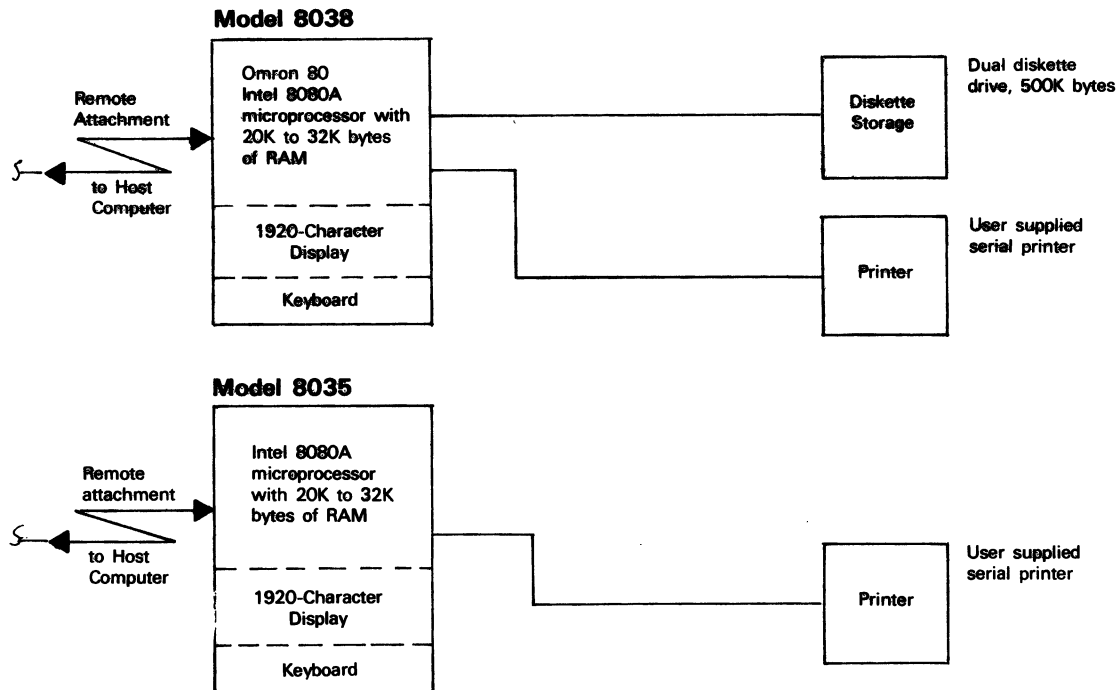
Keyed parameters appended to a PIP command specify special operations including: block transfer, deletion (truncation) of a line of data, display all transferred data, treat source as HEX file, translate upper case alphabetic to lower case or the converse, write line numbers at the beginning of each 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 page and previous page, tab, line feed, carriage return, and bell keyboard functions. ➤

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### Configuration



► 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 32-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 search for next occurrence is used immediately following a file search command to locate another match 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 com-

mands 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 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 communications with a host computer. Either diskette drive can be assigned as the source or destination file for the data to be sent or received. 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, changing the "prompt" control code, 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. ►

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► 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, New Line, Tab, Back Tab, Shift, Lock, and Control. The numeric/function keypad includes 12 numeric keys (lower portion) including decimal point and comma and independent cursor controls (upper half) 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, Line, Character, Upper Case (only), 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, and Receive/Reset. Eleven of those function keys are switch-indicators and contain an LED indicator embedded in the keytop.

Power On/Off and Brightness (thumbwheel) 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 diskette data storage capacity is 266,256 bytes. Two tracks plus 16 sectors are reserved for the operating system.

### PRICING

The Omron 8035 and 8038 are available to large end users, OEM systems houses, service bureaus, etc. on a purchase basis only. Quantity discounts are provided. 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 \$75.

	End User Purchase Prices	
	<u>1-2 Units</u>	<u>3-5 Units</u>
Model 8035 with 20K bytes of RAM and dual diskette drive	\$7,500	\$7,200
Model 8038	2,700	N/A
RAM Memory Module, 4K bytes	350	350

N/A—not available, contact vendor for price.■