

WORKSTATION EMULATOR/250

USER'S MANUAL

Version 3.0

(For IBM-PC, Compatibles, and HP150)

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I. OVERVIEW

The Hewlett-Packard HP250 has been a very innovative small business computer. Its operating system make it one of the easiest to use minicomputers, especially suiting it for use in turnkey applications. One of its few drawbacks, however, is its use of non-ASCII workstations which have firmware that suits them only for use with an HP250. They cannot be used to connect to other computers, to control auto-dial modems, or as terminals on an upgrade machine such as the HP3000. Further, the options for connecting printers to the HP250 workstations have been inadequate: an expensive and now obsolete HP2631 HP-IB printer can be connected to the discontinued HP2649D, and the newer HP2622D supports only an internal thermal printer. No serial or letter quality printers are supported on the HP250 workstations.

The OPUS Corporation has worked with the HP250 since its release in 1978 and is one of the leading Hewlett-Packard OEMs who have made a major commitment to the HP250. OPUS has recognized what users and OEMs need in a workstation for the HP250 and has developed several "emulators" of Hewlett-Packard workstations.

The workstation emulator consists of software that runs on a standalone microcomputer. It sends properly translated characters to the HP250 and interprets and carries out commands from the HP250. The software mainly performs communications and terminal control tasks and must be designed to operate at up to 9600 baud without missing characters.

The first terminal emulator developed by OPUS ran on the TeleVideo 802 microcomputer and was written in Z80 assembly language. Many of these devices with the original OPUS emulator are in daily use on HP250s. Because of limitations of this microcomputer's display, however, most HP250 screen enhancements could not be duplicated, making the emulator inadequate for certain applications. Also, the hardware was unique and software written for it did not lend itself to transportability to other devices.

The advent of the IBM-PC, MS-DOS, and IBM-compatible 16-bit microcomputers has revolutionized the industry. OPUS recognized the potential of these machines and is using them with emulator software on both the HP250 and HP3000.

The HP250 workstation emulator has been fully rewritten to take advantage of the increased power of MS-DOS and of what was learned developing the first HP250 workstation emulator. WORKSTATION EMULATOR/250, or WS250, is the result and represents OPUS's second generation emulator product. It provides essentially a full emulation of the HP2622D workstation. Beyond this, it provides features that have been needed in a good workstation for the HP250. Local printers can be accessed, files can be transferred to and from PC diskettes, and auto-dial modems can be controlled.

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Also, a variety of display enhancements can be used, depending on the monitor being used. The resulting workstation is suitable for running applications as well as for software development.

OPUS's emulator requires no modification to existing HP250 hardware or software; and, the HP250 cannot detect that it is not connected to an HP2622D. A microcomputer running the emulator can do everything an HP2622D can do. It is perhaps worth emphasizing that WS250 is only a workstation emulator, not an HP250 environment emulator. That is, HP250 software cannot be run on a standalone PC not connected to an HP250. HP250 software still runs on an HP250 and the PC running the emulator interacts with the software as a normal HP250 workstation would.

WS250 is written in "C" with the interrupt handlers written in 8088 assembly language. The software runs on a wide variety of MS-DOS microcomputers, including the HP150 and most IBM-compatible machines. MS-DOS computers on which WS250 is currently operating are the following:

- IBM-PC/XT
- CORONA
- COLUMBIA
- ZENITH
- COMPAQ
- EAGLE
- HP150

Several of these units are portable. OPUS is continually testing WS250 on other machines.

Version 3.0 is compiled in Optimizing C86 and offers some throughput improvement over earlier versions. Several enhancements have also been made to this version.

This manual provides details on the operation of the WS250 software. It assumes that the user is already quite familiar with the HP250, its commands, and operation of the HP2622D. Familiarity with MS-DOS and the particular microcomputer being used is also assumed.

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II. INSTALLATION

Installation of WS250 on the MS-DOS computer (hereinafter usually referred to as "PC") involves the following tasks:

- assuring that the PC is properly configured in terms of port adapters, memory, and operating system;
- connecting the PC to an HP250, either directly or through a modem;
- possibly connecting printers to the PC;
- making the software available for the PC to load.

These are discussed below. Most of the information applies generally to all MS-DOS machines. Where special considerations apply for particular machines, these are pointed out.

Required PC Configuration

WS250 does not require much memory relative to the memory that is typically used in an MS-DOS PC. A minimum of 128KB is recommended although the emulator itself requires only approximately 40KB. (For the usual mix of word processing and spreadsheet applications, OPUS normally recommends a minimum of 256KB of memory.)

The connection to the HP250 must be made through an asynchronous port configured as "COM1:". It may be on a standard asynchronous adapter in the PC or on one of the popular multi-function cards.

If a printer is to be used, it may be connected to either a serial or parallel port. If a serial printer is used, it must be connected to an asynchronous port configured as "COM2:". If a parallel printer is used, it may be connected to a parallel port configured as "LPT1:" or "LPT2:". It is also possible to have both serial and parallel printers on a system. The desired printer can be selected through configuration screens as described in Section III.

If the hardware supports both, either a monochromatic or color display may be used. WS250 determines which is connected to the system.

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At least one diskette drive is required from which to load WS250.

MS-DOS 2.0 or later must be used. On all but the HP150, the ANSI screen extension in DOS 2.0 is necessary for proper operation of the direct ASCII mode. In order to load this, create a file named "CONFIG.SYS" which contains the line "DEVICE=ANSI.SYS". Alternatively, copy the "CONFIG.SYS" file provided on the distribution diskette, as explained below.

Connection to the HP250

For a direct connection, the COM1: port of the PC should be connected to one of the HP250 asynchronous ports with a "straight through" data cable. This applies if the PC port is configured as DTE (Data Terminal Equipment), which is the usual case. Some machines, however, such as the Corona and several multifunction cards, additionally permit configuration as DCE (Data Communication Equipment), in which case a null-modem cable is required. See Appendix A for details of serial data cable connections. The cable should not be over about 100 feet without proper line drivers or short-haul modems.

The HP250 port used must be configured as

"WORKSTATION", "2622", "32KB" or "64KB" of memory.

If the older desktop HP250 is being used, the ten straps for the selected port on the back of the 5-port async panel should normally be all in the "A" position (left and center jumpered). If the newer HP250 is used, the dip switches for the selected port on the back of the 5-port async panel should normally be set with the left four up and the remainder down. The corresponding thumbwheel on the HP250 ASI board must be set at the rate to be used. The relationship of the numbers on the wheel to rate is as follows:

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Thumbwheel Number	Rate, Baud
0	110
1	150
2	300
3	600
4	1200
5	1800
6	2400
7	4800
8	9600
9	not used

For dial-up operation, the PC should be connected to a suitable asynchronous, full-duplex modem. Rates of 300 baud and under are not very satisfactory. Best results will be obtained with a 1200 baud unit (Vadic 3400 or Bell 212 compatible) or one of the newer 2400 or 4800 baud asynchronous modems.

The modem on the HP250 end must be compatible with that on the PC end. The connection from the modem to the HP250 asynchronous port must be made with a cable equivalent to HP's 45111A cable. See Appendix A. All other configuration and strap settings are the same as with the direct connection.

Connection to Printers

Printers connected to the PC should use the appropriate serial or parallel data cable for the printer in use. The parallel connection is the simplest in terms of printer strapping. This includes the HP-IB connection in the case of the HP150. A professionally fabricated cable should normally be used.

The serial connection presents a variety of options, depending to some degree on the printer being used. The cable to the PC will have to be fabricated or bought. See Appendix A for pin connections. The most significant aspect to using a serial printer is that hardware handshaking should normally be used since WS250 provides no special device driver to handle DC1/DC3, ETX/ACK, ENQ/ACK, or any other character protocol. On the HP150, system drivers are provided for a variety of protocols and any may be used. On IBM-compatible units, hardware handshaking is implemented using pin 5 of the asynchronous adapter. Most printers use pin 20 and must be strapped internally for an "active low" busy line. Note, however, that some printers use other pins, such as 11 (Texas Instruments) and 19 (NEC). The printer cable shown in Appendix A should satisfy

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the interface requirements of most printers.

Loading The WS250 Software

The distribution diskette contains the following files:

File Name	Contents
-----	-----
WS250.EXE	The emulator program
SAVEIT.DAT	An HP250 program for storing transmitted files
CONFIG.SYS	The DOS 2.0 configuration file which loads ANSI.SYS (this file not provided with the HP150 version)

WS250 will create a file WS250.DAT on the logged device in which is stored the current configuration. This is used to simulate the HP2622D's configuration held in battery backed-up memory. If the file is not found, WS250 will revert to its default configuration given in Section III. below.

On IBM-compatible computers, CONFIG.SYS should be copied to your system disk. ANSI.SYS should also be on the disk. Obtain this from the DOS 2.0 distribution diskette.

Place the distribution diskette in an available diskette drive and log to that drive. Enter "WS250" to start the emulator. After the Licensee Name and License Number will appear, press RETURN to begin. A RESUME is issued and the emulator should be operational. The configuration selections described in the next section can then be made.

If it is desired to transfer WS250 to another disk(ette) (usually a hard disk), enter

WS250 TRANSFER d:

where "d:" is the desired drive designator. Then copy the files on the distribution diskette to the new drive using the COPY command. For example, to go from A: to C:, enter

COPY A:*. * C:

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Once the transfer has been made, WS250 will only run from the new disk(ette).

On the HP150, WS250 may be run from the distribution diskette directly, or it may be installed from the distribution diskette onto another diskette using the INSTALL program. If installed, the transfer procedure described above must be carried out to make the copy on the new disk functional.

Backup can be performed by simply copying all data files on the distribution diskette to another diskette. The same COPY command as above can be used. Of course, it will not be possible to run WS250 from the backup copy.

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III. CONFIGURATION

The WS250 Configuration program may be run even if the workstation is not connected to an HP250. Once the emulator has been started, press SHIFT F1 and the Configuration screen will appear. Although similar to that on the HP2622D, the WS250 screen will be seen to have some additional selections relating to the printer, the LOG and SEND files, and enhancements.

Inverse video highlights the variable fields. The cursor begins in the first variable field and can be moved to the next by pressing the TAB or RETURN key. The cursor may be moved backward by pressing SHIFT TAB or SHIFT RETURN. In all but the file name and Delay fields, the function keys are used to select the NEXT (F2) or PREVIOUS (F3) allowable choices. The DEFAULT VALUES key (F4) will fill the screen with the default settings shown below. The SAVE CONFIG key (F1) saves the configuration shown on the screen. WS250 will continue with this configuration and will also be impressed with this configuration on subsequent starts. The EXIT (NO SAVE) key will leave the configuration mode without changing the configuration. Any changes made on the screen will be ignored. On the HP150, touch is not implemented on the configuration keys.

The meanings of the variable fields are as follows, with the default values shown highlighted:

PORT TO HP250 = COM1: **9600** Baud **DIRECT** Connection

The default rate of 9600 baud is normally used when directly connected. Lower rates such as 1200 baud are used when communicating through a modem. The word structure and parity are automatically set to those expected by the HP250. The connection type is either DIRECT or MODEM. This is similar to the modem active/ignore setting of the HP2622D. If MODEM is selected, an ALTERNATE F9 (not implemented on the HP150) will cause the RTS and DTR lines to be lowered temporarily. This in turn will cause a properly strapped modem to disconnect without requiring the telephone to be hung up manually. If DIRECT is chosen, RTS and DTR will remain high, even if ALT F9 is pressed. In either case, WS250 may be terminated and RTS and DTR will be kept high (unless lowered by some other software). This means that you can return to WS250 and pick up exactly where you left off. A RESUME is automatically issued by WS250 when it starts. Note below, however, that all LOG and SEND FILES are closed upon exit from WS250. This means that these two functions will not continue automatically if the emulator is re-entered. Also, the CAPS LOCK and CURSOR/NUMBER pad toggles are reset to their startup values and the status line is replaced by the copyright message. These may be easily toggled back.

PORT TO PRINTER = **LPT1**: Baud . Data Bits Parity . Stop Bit

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The default printer port is LPT1:. LPT2: may also be selected. The remainder of the items on the line are not used for these parallel printer selections. If the serial port, COM2: is selected, the remaining fields on the line become active:

PORT TO PRINTER = **COM2:** 1200 Baud 8 Data Bits **NONE** Parity 1 Stop Bit

In addition to the rate, 7 or 8 Data Bits, NONE, EVEN, or ODD Parity, and 1 or 2 Stop Bits may be selected. It is best to run the printer at the highest rate it can accept. When logging to the printer, the rate of the printer will pace the emulator's response to the HP250.

On IBM-compatible computers, for printers to work properly, the MODE command should not have been used to redirect the printers before entering WS250.

For the HP150, use the standard configuration screens to establish communication parameters before entering WS250. COM1: should be associated with PORT 1. This port should be set at the desired rate, **Odd** Check Parity, 7 DataBits, Clock **INT**, 1 Stop Bit, EnqAck **No**, TR(CD) **Hi**, SR(CH) **Lo**, and everything else **No** or **None**. Establish the printer parameters for your particular printer and set that printer as the "to" device before entering WS250. The lines for the HP250 and Printer Ports in the WS250 Configuration screen do not affect the HP150 configuration.

LOG FILE = _____

This field must be filled in to have a LOG FILE opened. A new file is created unless the named file exists, in which case it will be purged and recreated. A file is specified as "d:name.ext", where "d" is the drive letter, "name" is up to 8 characters, and "ext" is up to 3 characters. The drive designator may be omitted if the logged drive is to be used.

SEND FILE = _____ **ENTER** Terminator 100 Delay

The SEND FILE is similarly specified. If it does not exist, an error message will be displayed. The file must contain lines of ASCII characters. The Terminator field determines whether each transmitted line is ended with an ENTER or a NEW LINE. The significance of this will be explained in Section VII. The Delay parameter specifies an amount of time between sending successive characters from the SEND FILE. This is also explained in more detail below in Section VII.

Note that only one of the files, LOG or SEND, can be open at any one time. Also, when the Configuration routine is entered, any open files are closed. Therefore, finish any file logging and sending before entering the Configuration routine.

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On the bottom portion of the Configuration screen is a presentation of the video enhancements as they will appear on the display in use. Each of the sixteen enhancements consists of a 2-character hexadecimal code and the display using that code. The default codes will produce the named normal HP250 video enhancements on a monochrome IBM monitor except for certain combinations with inverse video.

Some of the default enhancements will not be distinguishable on some displays. For example, displays used with a color graphics adapter will not be able to display an underline. The display enhancement codes may be modified to accommodate this situation by selecting a displayable enhancement.

When a full color display is being used, it may be desirable to convert some of the enhancements to specific colors. For example, inverse could be made green, blinking could be made red, etc.

For IBM-compatible units, the enhancement code corresponds to the IBM attribute byte. The bits in the attribute byte are as follows, where "bg" stands for background and "fg" stands for foreground:

/blink/bg red/bg grn/bg blu/intensity/fg red/fg grn/fg blu/.

For example, an enhancement of blinking green on red with high intensity would result from a code of binary 11001010, or hexadecimal CA.

For the HP150, the first hexadecimal digit of the enhancement code determines the character set, as follows:

0	Normal Roman
1	Line Drawing
2	Bold Face Roman
3	Italic Roman

The second hexadecimal digit is the enhancement, as follows:

0	normal
1	blinking
2	inverse
3	blinking, inverse
4	underline
5	blinking, underline
6	inverse, underline
7	blinking, inverse, underline
8	half
9	blinking, half

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A	inverse, half
B	blinking, inverse, half
C	underline, half
D	blinking, underline, half
E	inverse, underline, half
F	blinking, inverse, underline, half

Experimentation with the enhancements will produce some interesting results. Note that when entering the codes, they must be hexadecimal digits 0 through 9, A, B, C, D, E, or F. Upper and lower case are acceptable. Blanks are treated as zeroes.

On the IBM-compatible version of WS250, the bottom of the Configuration screen shows

EMULATOR CURSOR Top: 11 Bottom: 11 EXIT CURSOR Top: 11 Bottom: 11

The numbers are the top and bottom scan lines for the cursor while in the emulator and for setting the cursor on exit to MS-DOS. Some computers, such as the COMPAQ which have displays that appear to the operating system as color/graphic displays but have high resolution text might display a cursor in the middle of a line rather than on the bottom. Adjusting the top and bottom scan lines permits positioning the cursor as desired. It is also possible to define a split cursor by making the bottom line less than the top line.

IV. GENERAL OPERATION, KEYBOARDS, AND DISPLAYS

With knowledge of the HP250 and its normal workstations, a user should have very little difficulty learning to operate WS250 from a PC. The different key placement on the keyboard will probably present some initial problems, but these will soon be overcome with use.

Screen displays are pretty much identical to the corresponding HP2622D displays. On IBM-compatible units, a 25th line shows status of several variables including the softkey CYCLE, whether logging to a printer and/or PC file is in progress, the name of the LOG FILE, whether information is being sent from a PC file, the name of the SEND FILE, whether the pad will transmit NUMBER or CURSOR information, whether CAPS lock is on or off, and whether the INSERT mode is on or off. SHIFT F5 toggles the status line on and off. The status line is forced on when certain features such as file use are activated. When the status line is not displayed, a copyright notice and license number are displayed. Some error messages also temporarily appear in this status line area.

On the HP150, applications softkeys normally appear on lines 25 and 26. Since the HP250 softkey labels use lines 22 through 24, lines 25 and 26 are free for presentation of status information. The HP150 has separate number pad and cursor keys and thus needs no toggle from one to the other. The area in the IBM-compatible status line for this status is replaced on the HP150 with a TOUCH status which shows whether the touch screen is active or not. Line 27 on the HP150 is not used explicitly by the emulator, although it will show the time. Its presentation of other status parameters will remain at the values in effect when WS250 was started. Note that touch must be on when WS250 is entered for touch to be available within WS250. On line 25, the cursor line and column locations will change as the cursor is moved around the screen.

The Keyboard

The keyboard layout goal was to use normal PC keyboard labels where reasonable. There is, thus, a one-to-one mapping of most keys and key combinations. The following shows the correspondence between the HP2622D and the PC keyboards and functions.

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HP2622D KEY	IBM-COMPATIBLE KEY	HP150 KEY
-----	-----	-----
Alphanumeric characters	one-to-one correspondence	one-to-one correspondence
SFK1 - SFK8	F1 - F8	F1 - F8
RESUME	F9	Unlabeled key above numberpad *
CYCLE	F10	Unlabeled key above numberpad /
EXECUTE	ESC	ESC
BACKSPACE	BACKSPACE	BACKSPACE
TAB (forward)	TAB	TAB
SHIFT TAB (backward)	SHIFT TAB	SHIFT TAB
TAB + (set)	ALT TAB	EXTEND-CHAR TAB
TAB - (reset)	ALT SHIFT TAB	EXTEND-CHAR SHIFT TAB
CAPS LOCK	CAPS LOCK	CAPS
CLEAR	PRTSC *	CLEAR LINE
NEW LINE	END (CURSOR mode)	SELECT
HOME	HOME (CURSOR mode)	DIAGONAL UP ARROW
UP ARROW	UP ARROW (CURSOR mode)	UP ARROW
DOWN ARROW	DOWN ARROW (CURSOR mode)	DOWN ARROW
LEFT ARROW	LEFT ARROW (CURSOR mode)	LEFT ARROW
RIGHT ARROW	RIGHT ARROW (CURSOR mode)	RIGHT ARROW
DELETE	DEL (CURSOR mode)	DELETE CHAR
INSERT	INS (CURSOR mode)	INSERT CHAR
ENTER	RETURN	RETURN
ENTER (pad)	+ (to the right of the pad; not affected by CURSOR status)	ENTER in pad
HALT	SCROLL LOCK/BREAK	Unlabeled key above pad -
CTRL	CTRL	CTRL
SHIFT	SHIFT	SHIFT
Touch Toggle	N/A	Unlabeled key above pad +

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All shifted function keys on the HP2622D operate identically under WS250. There are additional functions, however, as denoted by asterisks below:

FUNCTION KEY COMBINATION -----	EFFECT -----
SHIFT F1	Configuration screen
SHIFT F2	* Exit WS250
SHIFT F3	* Close SEND or LOG file
SHIFT F4	Print screen
SHIFT F5	Toggle status line
SHIFT F6	* Cycle log type
SHIFT F7	* Toggle sending from SEND file
SHIFT F8	Label definition screen
ALT F1	* Direct ASCII mode
ALT F9	* Drop RTS and DTR temporarily to disconnect modem; operates only when MODEM Connection is selected; not implemented on the HP150

CTRL and SHIFT CTRL function keys for changing video enhancements operate as on the HP2622D.

All SHIFT, CTRL, CAP LOCK combinations on the HP2622D are the same on the PC keyboard. On IBM-compatible computers, the PGUP and PGDN keys on the keypad are equivalent to SHIFT UP ARROW and SHIFT DOWN ARROW. Either may be used. Likewise is the effect of the PREV and NEXT keys on the HP150 keyboard. On IBM-compatible units, the NUMLOCK key on the PC keyboard toggles between a NUMBER and CURSOR control pad. Note that the INS and DEL are only functional in the CURSOR mode. The current mode is shown on the status line (SHIFT F5). The "+" key on the PC keypad is identified with the HP2622D keypad ENTER key. On the HP150, the number pad has a true ENTER key and the "+" key there has not been reprogrammed. (The number pad ENTER key with CTRL may be used to single step through HP250 programs in the mode where subprograms and functions are executed entirely before returning to the next main program line.)

As shown above, the PC ALT (ALTERNATE) key is only used for three functions. One is setting and clearing tabs. Another is ALT F1 which invokes the Direct ASCII mode. The last is ALT F9 which drops RTS and DTR if COM1: is set up as a MODEM connection.

There are some keys on the PC keyboard that have no equivalents on the HP2622D

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keyboard. When these keys are pressed, a null is transmitted to the HP250, causing a BEEP response. These keys are for the characters logical or, backslash, open brace, close brace, and tilde. Several of the function keys on the HP150 are treated similarly.

The PC key for open brace/open bracket will always transmit [, regardless of the shift status. Likewise, close brace/close bracket will always transmit].

On the HP150, the CLEAR LINE key is equivalent to the HP250 CLEAR key. The CLEAR DISPLAY key is equivalent to SHIFT CLEAR; the DELETE LINE is equivalent to SHIFT DELETE; and the INSERT LINE is equivalent to the SHIFT INSERT combination on the HP250.

The Key Label screen, obtained by pressing SHIFT F8, shows all SHIFT and CTRL function key functions as well as the currently defined softkey labels. Note that in this screen on the IBM-compatible units, the enhancements for softkey labels are all overridden, and the labels appear with the enhancement defined as "unenhanced". The status line is forced on for this display. Exit the display by pressing the space bar.

After the Emulator has been entered and exited once, the IBM function key F10 is programmed to enter "WS250" and a carriage return when pressed. This permits easy re-entry to the Emulator. This is not implemented on the HP150.

Most IBM-compatible units have keyboards with keys in the same positions as those on the IBM keyboard. There are some, however, such as the EAGLE desktop unit where liberties have been taken. Experimentation will usually show the key correspondences. The following table shows how the special keys on the EAGLE correspond with the HP250 function:

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EAGLE KEY	HP250 FUNCTION
-----	-----
F9	RESUME
F10	CYCLE
F11 - F14	Not used
F15	RESUME
F16 - F18	Not used
F19	ENTER
HELP	Not used
*	CLEAR
F20 - F24	Not used
ENHANCE	Not used
INS	Not used
DEL	Not used
SCRLOCK BREAK	HALT
ESC	EXECUTE
SHIFT LOCK	Toggles between NUMBER and CURSOR (press twice)
ALPHA LOCK	Toggles CAPS LOCK (press twice)
DOWN ARROW	RESUME
LEFT ARROW	N/A
UP ARROW	N/A

F11 through F24 need not be used since those that do perform functions duplicate functions of other primary keys. When the CURSOR pad is active, cursor movement is achieved through using the numbers of the pad: UP ARROW is 8, RIGHT ARROW is 6, DOWN ARROW is 2, LEFT ARROW is 4, HOME is 7, PAGE DOWN is 3, PAGE UP is 9, and NEW LINE is 1. Also, in the CURSOR mode, the pad 0 is INSERT and the pad . is DELETE.

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V. DIFFERENCES FROM THE HP2622D

There are inevitably differences in an emulator and the object being emulated. Although the fidelity of WS250 is very high, there are some differences that should be pointed out.

First, the screen enhancements available on the HP250 and those possible on the IBM-PC compatible screens are shown in the following table. The abbreviations are IV=InVerse, BL=BLinking, UL=UnderLine, HB=Half Bright.

HP250 ENHANCEMENT	PC MONOCHROME	PC COLOR
IV	IV	IV
BL	BL	BL
BL/IV	BL/IV	BL/IV
UL	UL	Blue
UL/IV	UL	Blue/IV
UL/BL	UL/BL	Blue/BL
UL/BL/IV	UL/BL	Blue/BL/IV
HB	HB	HB
HB/IV	HB/IV	HB/IV
HB/BL	HB/BL	HB/BL
HB/BL/IV	HB/BL/IV	HB/BL/IV
HB/UL	HB/UL	HB/Blue
HB/UL/IV	HB/UL	HB/Blue/IV
HB/UL/BL	HB/UL/BL	HB/Blue/BL
HB/UL/BL/IV	HB/UL/BL	HB/Blue/BL/IV

The difference between some of the half and full bright display combinations is less perceptible than on the HP250. The relative brightness control on the monitor can be used to accentuate the difference.

The IBM-PC display has two intensities, normal and bright. The HP2622D has a normal intensity and half bright. That is, the enhancement on the PC goes up from normal, while on the HP2622D it goes down from normal. When WS250 is running, the high intensity is used, and half bright uses the lower or normal intensity. Consequently, it may be necessary to adjust the brightness and relative brightness controls on the PC display to comfortable values upon entering and leaving WS250.

The standard IBM-compatible graphics characters are used to represent the HP250

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line drawing characters. The IBM-compatible PC's graphics characters are less extensive. Reasonable identifications have been made with the HP250 set. The resulting forms will be recognizable, but not identical to their HP2622D appearance. Appendix B shows the character correspondence.

Control characters that are produced when Display Characters (CTRL F4) is on and certain control keys are pressed are different from those of the HP250 character set. The correspondence for these is shown in Appendix C.

The CAPS LOCK key on the HP2622D is a mechanical lock that always "remembers" whether it is locked. The CAPS LOCK key on the PC is a software toggle only and, as such, has no memory over program loads and resets. Consequently, it will be noticed that the CAPS LOCK status will change when exiting and re-entering WS250, after resets (CTRL HALT, SCRATCH A, etc.), and when going between background and foreground tasks. The default in WS250 is CAPS LOCK "on".

The NUM LOCK key, used to toggle between CURSOR and NUMBER pad modes is a software toggle like the CAPS LOCK key and is likewise reset.

Most of the above differences will not be noted on the HP150. All video enhancements are supported, and the line drawing set is closer to that of the HP250. The main negative difference noted with the HP150 is its speed: it is significantly slower than both the IBM-compatible units and the HP2622D workstation. OPUS has increased the speed of WS250 running on the HP150 significantly and will concentrate on more speed in future releases of the software.

VI. LOGGING TO PRINTER AND DISK FILES

All logging functions are accessed via the HP250 PRINTER IS 10 commands. These include

```
PRINTER IS 10
SYSTEM PRINTER IS 10
PRINT ALL IS 10.
```

Data from the HP250 may be printed out on the printer, sent to a PC disk file, or sent to both simultaneously. Printer logging may be toggled on by pressing SHIFT F6. A "P" will appear on the status line after "LOG:". Logging may be stopped by pressing SHIFT F6 again. Be sure and set the PRINTER 10 back to 8 (or some other device) after logging is complete. Use of PRINT ALL IS 10 is convenient for monitoring data that is being logged or printed, although it will slow transmission.

In order to log to a file, it is first necessary to define a LOG FILE in the Configuration mode. This file's name will appear in the status line after "LOG:", and pressing SHIFT F6 will then cycle between " / " (no logging), "P/ " (logging to printer only), " /F" (logging to file only), and "P/F" (logging to both printer and file). Pressing SHIFT F3 will close the LOG FILE. The file will also be closed if the Configuration routine is invoked (SHIFT F1) or if the emulator is exited (SHIFT F2).

Remember, the PRINTER IS 10 commands must be used to direct output to the local printer or the LOG FILE. It is not sufficient to toggle the printer on or set up a LOG FILE. Also note that if logging to the printer or disk is not selected, the HP250 will return an ERROR 133 if asked to print to unit "10". If a printer is not connected, a message will appear in the status line area. Logging will be adjusted so that the printer will not be accessed. Press any key to continue.

Never remove a diskette to which a file has been logged until the file has been closed. A file is closed by pressing SHIFT F3, entering the Configuration mode (SHIFT F1), or exiting the emulator (SHIFT F2). Closing a file flushes the final buffer and causes the directory to be updated.

Finally, when SHIFT F4 is pressed, whatever information is on the screen will be sent to the configured serial or parallel printer. Log to printer (LOG:P/) will be set temporarily and an error message will be displayed if the printer is not on. The original log state is restored after the screen copy is sent to the printer. Note that the line drawing and special characters are replaced by a period in information sent to a local printer.

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VII. SENDING DISK FILES

The current version of WS250 has a primitive capability to transfer data files from the PC to the HP250. The limitation is that the HP250 has no method of receiving files rapidly in a block mode while checking for and correcting errors. A request has been made to the Hewlett-Packard HP250 team to include the popular X-MODEM file transfer protocol in one of the future operating systems for transferring information to and from workstations. Until some such protocol is available, the present method must suffice.

In order to send a file from the PC, an existing file must be defined in the Configuration mode (SHIFT F1). The name of the SEND FILE will appear in the status line after "SEND:". By pressing SHIFT F7, sending from the file can be toggled ON and OFF. When the end-of-file is encountered, the file will be closed automatically and the name will disappear from the status line.

How each line sent from the PC is terminated is important. If terminated with a NEW LINE, the information will simply be placed in the workstation partition's display memory (in the HP250) and not syntax checked. (Note that if the capacity of the display memory is exceeded, data will be scrolled off the top.) The displayed lines can then be read and stored; or, if they are program lines, they may be entered individually. Generally, this method is good for shorter files. (The SAVEIT file on the distribution diskette may be transferred to the HP250 using this option.)

If each line is terminated with an ENTER, the HP250 will take an action on each line. If no program is running to read the lines, each line will be assumed to be a program line and will be syntax checked. This can be time consuming and the HP250 may not be able to keep up with the transmission rate, especially if other tasks are running in the HP250. The better method is to use a short program such as the one in the SAVEIT.DAT file on the distribution diskette. This program, when running in the HP250, will read in each line and store it to an HP250 disk file. The data may then later be edited or used directly.

The Delay parameter defaults to a value that appears to transmit data without loss to an HP250 that is running only the SAVEIT program. Lower values of the parameter cause characters to be sent from the PC file faster. It may be necessary to adjust the parameter to obtain optimum transmission. Be sure when entering new data in the Delay field to put in all four digits to erase any previous digits. Use leading zeroes as necessary.

As mentioned, the HP250 operating system currently has no means of pacing information from its workstations or of correcting transmission errors. The only indication from the HP250 that something is amiss is a BEEP. Therefore, whenever the emulator receives a BEEP signal from the HP250 during transmission to the HP250, it

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immediately toggles off sending from the SEND FILE. It may be toggled back on (SHIFT F7). Of course, the cause for the BEEP should first be corrected (different terminator, longer delay, etc.).

VIII. DIRECT ASCII MODE

One of the frustrations of the standard HP250 workstations is that they do not send out normally coded ASCII characters. For example, when the sequence "CAT" is entered on the keyboard, the result sent out is "PH5". Further, even before this can be sent, certain modes must be set in the workstation by the HP250 and the workstation must respond properly to commands by the HP250. Thus, it is not possible to communicate with a non-HP250 host computer or an auto-dial modem connected to an HP2622D or HP2649D.

Consequently, a Direct ASCII mode has been included in WS250. This mode is entered by pressing ALT F1 (EXTEND-CHAR F1 on the HP150). When in the Direct ASCII mode, the special keyboard routine and key interpretations are bypassed. The normal PC BIOS keyboard routine is used, and the characters are sent out as they are entered on the keyboard. (Note that on IBM-compatible units the CTRL ALT DEL combination is trapped in this mode and will terminate the emulator. CTRL BREAK and CTRL C are not trapped.)

Function key F9 (F7 on the HP150) will put the communications program in a half-duplex, or local echo mode for use with modems or host computers which do not echo back the characters sent to them. Function key F10 (F8 on the HP150) changes to full-duplex mode. Function key F8 (F6 on the HP150) will clear the screen, and F1 will terminate the direct ASCII mode, automatically issuing a RESUME to restore the pre-existing display.

When in the Direct ASCII mode on an IBM-compatible unit, the screen will respond to ANSI control sequences (see the DOS 2.0 manual) if the DEVICE=ANSI.SYS specification has been included in the CONFIG.SYS file. If not, parts of various escape sequences will appear on the screen and screen behavior will be erratic.

In the Direct ASCII mode, the display acts as a "glass teletype": when lines are scrolled off the top, they are lost; cursor keys not normally affect the display; etc.

It is not recommended that the Direct ASCII mode be used to send characters to an HP250. Returning to the emulator mode (F1) will usually clear any problems that might occur from sending inappropriate characters in the Direct ASCII mode. If not, try RESUME.

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APPENDICES

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APPENDIX A — SERIAL INTER-CONNECTION DATA CABLES

PC TO HP250 OR MODEM

PIN NUMBER OF
CONNECTOR TO PC
(female, DB25S, for IBM;
male, DB25P for HP150)

PIN NUMBER OF
CONNECTOR TO HP250 OR MODEM
(male, DB25P)

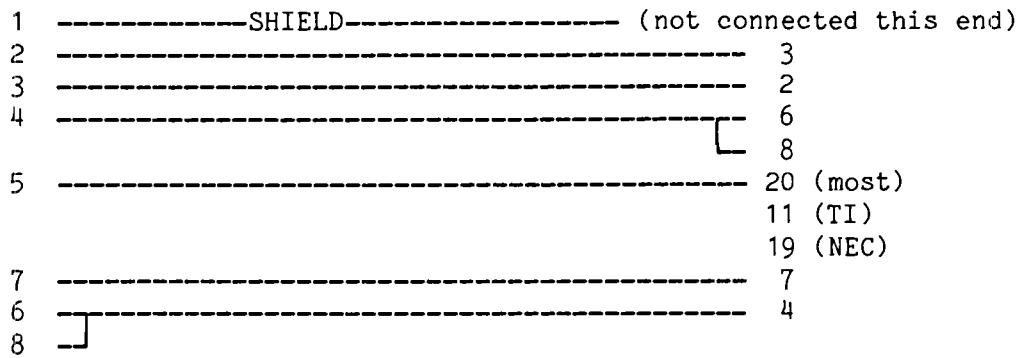
-----	-----
1	-----SHIELD----- (not connected this end)
2	----- 2
3	----- 3
4	----- 4
5	----- 5
6	----- 6
7	----- 7
8	----- 8
20	----- 20

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PC TO PRINTER

PIN NUMBER OF
 CONNECTOR TO PC
 (female, DB25S, for IBM;
 male, DB25P, for HP150)

PIN NUMBER OF
 CONNECTOR TO PRINTER
 (male or female)



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HP250 TO MODEM









































































































































































PIN NUMBER OF
CONNECTOR TO HP250
(male, DB25P)

PIN NUMBER OF
CONNECTOR TO MODEM
(male, DB25P)

-----	-----
1	-----SHIELD----- (not connected this end)
2	----- 3
3	----- 2
4	----- 4
5	----- 5
7	----- 7
8	----- 8
6	----- 20
20	----- 6

Note: This cable is equivalent to HP's 45111A (except for straight through wiring of pins 22 and 23 which are not supported on the HP250).

APPENDIX B — LINE DRAWING CHARACTERS

HP	IBM	HP	IBM	HP	IBM	HP	IBM	HP	IBM	HP	IBM
											
											
											
											
											
											
											
											
											
											
											
											
											
											

UNSHIFTED

SHIFTED

APPENDIX C — CONTROL CHARACTERS

	HP	IBM		HP	IBM
NULL		BLANK (NULL)		DLE	▶
SOH		☺		DC ₁	▲
STX		☹		DC ₂	↕
ETX		♥		DC ₃	!!
EOT		♦		DC ₄	⌘
ENO		♣		NAK	§
ACK		♠		SYNC	■
BELL		●		ETB	↕
BS		☾		CAN	↑
HT		◯		EM	↓
LF		☉		ESC	→
VTAB		♂		SUB	←
FF		♀		FS	└
CR		♪		GS	↔
SO		♫		RS	▲
SI		☀		US	▼



THE OPUS CORPORATION

MEASUREMENTS OF HP250 WORKSTATION SPEEDS

WORKSTATION TYPE	NO SCROLLING		WITH SCROLLING		
	Effective Rate (Baud)	Relative to unscrolled HP2622D	Effective Rate (Baud)	Relative to unscrolled HP2622D	Relative to scrolled HP2622D
Model 35 Console	8800	200%	7600	173%	200%
HP2622D	4400	100%	3800	86%	100%
IBM-PC with WS250	4400	100%	2400	55%	63%
HP150 with WS250	2500	57%	1200	27%	32%

Notes:

All tests were run with communications at 9600 baud. The handshaking protocol and workstation control characters reduce the effective throughput according to the speed and load of the processor in the workstation, giving the effective values shown.

Tests involved writing a full 80-character line.

Scrolling normally only becomes a factor when doing CATs, LISTs, and running applications which scroll through text, such as word processors. Typical HP250 applications work only within the first 24 lines and do not scroll.

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