MicroPro International Corporation

WORDSTAR

INSTALLATION MANUAL
WORDSTAR
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Section 1
System Requirements

This section is intended for readers who wish to select a computer system on which to use WordStar, and those who wish to determine whether WordStar can be used on their present system.

WordStar's system requirements are an 8080/8085/Z80 Microcomputer with adequate RAM, floppy disk drives, a CRT terminal or video board, and the CP/M operating system. You will normally also want a printer, or access to another system with a printer and an operational WordStar.

DISK DRIVES

Two floppy disk drives are highly recommended, to allow you to back up files conveniently and set up new working disks, but a single-drive system can be used if you have a means of copying files from diskette to diskette and the disk capacity of one disk is sufficient to support the essential WordStar files (about 70K) and leave two times the size of the biggest file you will want to edit as unused space on the disk.

TERMINAL OR VIDEO BOARD

You may use any CRT terminal or video board providing a display area of at least 16 lines by 40 columns (and not larger than 120 lines by 250 columns)* capable of displaying ASCII codes 20 thru 7E hex and capable of directly positioning the cursor by sending line and column. The terminal must be accessible as the "console" device under CP/M; certain video boards (see Section 5) may also be accessed on a direct memory mapped basis for fastest display.

CRT's with line insert, line delete, and character-by-character inverse video or bright/dim highlighting may provide enhanced performance with WordStar; direct-memory-mapped video boards provide the best performance.

Selecting a Terminal

To be able to run WordStar, a terminal must have absolute cursor positioning. In addition, WordStar must "know" the control sequences used by the particular terminal or video board to position the cursor and perform other (optional) functions; these are set by the "installation" procedure, Section 2. WordStar may be installed for many common terminal types via a simple menu selection.

Serial Interface

As a serial interface for the terminal, you may select the MicroPro "I/O Master" S-100 interface board. This board's 32-character "FIFO" buffer permits the fastest text entry even during disk accesses and simultaneous printing and editing. Further, this board allows using the inexpensive "OEM" versions of the various manufacturers' daisy printers (next page). (Centronic's port and interrupt handler may also be used.)

   * Theoretical limit. The actual limit is determined by the RAM available on your system.

RANDOM ACCESS MEMORY

For a terminal with a 24 x 80 or smaller screen, including space for the opera-
ting system (CP/M) and text work areas, a minimum of 45K RAM is required. To
edit and print at the same time, 3K more RAM is required. Terminals with
unusually large screens require, in addition to one byte for each of the first
1920 characters, one additional byte for each character position on the screen
in excess of 1920 total characters. If the board requires more than 2096
bytes, WordStar will require 2 bytes for every byte over 2096. (If you have
one of the video boards that WordStar can access in direct memory mapped mode,
2K less RAM is adequate.)

While WordStar is perfectly usable in the minimum amount of RAM, additional RAM
is recommended for systems which will be used extensively for documents longer
than a few pages. Additional RAM increases the amount of text that can be held
in RAM simultaneously; thus, more RAM speeds editing and increases productivity
by reducing disk access. (Additional RAM does not affect maximum file size;
file size is limited by the capacity of the diskette, not of the RAM.)

PRINTERS

WordStar can be installed to drive virtually any printer. The features avail-
able are limited to those supported by the printer. Special installation is
required to access some features of some printers. Underlining, boldface
(multi-strike method), and double strike require a printer that can overprint
(most printers have this capability). Microspace justification, continuously
variable line height, continuously variable character pitch, subscripts, super-
scripts, and boldface (offset and restrike method) require a daisy wheel or
other printer capable of incremental motion.

High-Quality Printers

The following printers are fully supported by WordStar and the installation
program supplied with WordStar. All of WordStar's capabilities including bi-
directional printing are available with these printers; simple menu selections
(detailed in Section 3) will install WordStar for these printers:

> Serial Printers:
>
> > Diablo 1610/1620
> > Diablo 1640/1650
> > Qume Sprint 5
> > NEC Spinwriter 5510/5520
>
> OEM Printers*:
>
> > NEC 5500D
> > Diablo Hy-Type II 1345, 1355, 1355WP
> > Qume Sprint 3 (with Diablo-compatible cable adapter)
>
> > * MicroPro "I/O Master" Interface Board (or equivalent) required

The MicroPro "I/O Master" S-100 interface board allows use of the less-expen-
sive "OEM" daisy printers and provides simple installation, maximum printing
speed, and good response when editing while printing. The NEC 5500D printer
(or equivalent) with a PA-1 board may be used for either an Altos or a TRS-80
II terminal.

Other Printers

All other printers ("Teletype-like" or "non-daisy" printers) are treated in two classes, those that can backspace and those that cannot. The ability to return the carriage without feeding the paper is assumed; if this ability is lacking, overprint lines, boldface, and double strike will not work, but WordStar will be otherwise functional. WordStar can be installed for a basic "Teletype-like" printer of either class via selection from a menu. Through special installation, additional printer capabilities of the printer can be supported: choice of two character pitches, two ribbon colors, and up to four other special functions.

Suggested Setups

For a large installation, you will probably want a line printer for fast draft printout and daisy wheel printers for high quality final copy printout. When multiple work stations are used, it is practical to omit the printer (commonly the most expensive hardware item) on some, using these as editing stations only and moving documents on diskette to one of the printing systems.

WordStar can access the printer as the CP/M "list device" or by direct I/O to the printer interface ports. Provision is available for the "ETX/ACK" communications protocol required to run serial daisy wheel printers at maximum speed without buffer overrun.

Sections 2-5 provide details on installing WordStar to work with your terminal and printer. Sections 6-8 provide details on special installations. Special installations are required for setting up systems not handled by an ordinary installation and for modifying the operation of WordStar features (see "Features and Defaults" below). For a complete description of situations where a special installation is required, see Sections 6, 7, and 8.

FEATURES AND DEFAULTS

With an ordinary installation, WordStar comes up with all features set a certain way by default. When you run the INSTALL program, as described in Sections 2-5, you will automatically get the defaults. However, it is possible to alter the standard defaults, i.e., to reset the defaults for WordStar features to other values of your own choosing. Table 1-1 shows the standard defaults that you will get if you make no alterations.

If you would like further information on setting up a custom WordStar system, you may purchase **WordStar Customization Notes** from your dealer.

Table 1-1. Defaults for Parameters

Item	Document Mode	Non-Document Mode
Left Margin	Column 1	Column 1
Right Margin	Column 65 (80-column screen) Column 60 (64-column screen)	Column 65 (80-column screen) Column 60 (64-column screen)
Variable Tab Stops	Cols. 6, 11, 16,..., 56	Cols. 9, 17, 25,..., 73
Variable Tabbing	ON	OFF
Word Wrap	ON	OFF
Justification	ON	OFF
Ruler Display	ON	OFF
Page Break Display	ON	Inoperative
Print Control Display	ON	ON
Soft Hyphen Entry	OFF	OFF
Hyphen-Help	ON	OFF

Section 2
Installation Considerations

The "installation" procedure sets up WordStar to work with your particular terminal and printer. This procedure enables one distributed WordStar version to work with a wide variety of peripheral equipment. For most cases, installation is accomplished by entering choices from menus, as described in Sections 2-5. For exceptional terminals and printers, and for achieving refinements in installation, there are extensive provisions for "patching" by a programmer as described in Sections 6-8.

Special versions of WordStar are distributed for a few microcomputer systems with unusual requirements. These special versions are described in Appendix A; any special installation or operation considerations relating to a particular version are given there. Check Appendix B; if your system is shown, follow any instructions given there.

TERMINAL INSTALLATION CONSIDERATIONS

The INSTALL program supplied with WordStar can automatically supply the necessary control codes for many of the most common terminals, including these:

Compucolor 8001G	Beehive 150 / Cromemco 3100
Flashwriter I	Flashwriter II
Hazeltine 1500	Hewlett-Packard 2621 A/P
IMSAI VIO	Infoton I-100
Lear-Siegler ADM-3A	Lear-Siegler ADM-31
MicroTerm ACT-IV	MicroTerm ACT-V
Perkin-Elmer 550 (Bantam)	Processor Tech Sol
Soroc IQ-120	SWTPC CT-82
TEC Model 571	TeleVideo 912/920
Visual 200	

If your terminal is not shown, you will need to consult the manufacturer's manual to determine its control codes for cursor positioning (and possibly for other functions), then "patch" them in as described in Sections 6-8. For hints regarding some specific terminals, such as the settings required for option switches, check Appendix C. If your terminal is shown, follow any instructions given there.

PRINTER INSTALLATION CONSIDERATIONS

Daisy Printers and Teletype-like Printers

WordStar supports two classes of printers: daisy wheel and similar printers and "Teletype-like" printers (i.e., most other printers). We will discuss the general characteristics and capabilities of these classes of printers here, and also other considerations relating to printer installation. Appendix D gives additional specific information for each particular printer supported. Section 3 describes the actual printer installation procedure used once you know what choices you wish to make.

DAISY WHEEL AND SIMILAR PRINTERS

Daisy wheel printers are printers capable of incremental horizontal and verti-
cal motion, allowing use of variable line height, variable character spacing,
subscripts, and the rest of WordStar's print enhancements as described in the
Reference Manual. "Microspace Justification" is automatically implemented when
printing on a daisy wheel or similar printer. Since the control sequences are
different for each daisy wheel or similar printer, WordStar must be specifi-
cally installed for the printer that is to be used. WordStar can be installed
for one of the following daisy wheel printers via "menu" selection as will be
detailed in Section 3:

    NEC 5500D OEM printer with MicroPro "I/O Master" Interface Board
    Diablo 1300 series Hy-Type II OEM printer with MicroPro "I/O Master"
    Qume Sprint 3 OEM printer with adapter and MicroPro "I/O Master"
    Diablo 1610/1620*
    Diablo 1640/1650
    Qume Sprint 5
    NEC Spinwriter 5510/5520

       * Also used for the the NEC 5500D with a PA-1 board on Altos or TRS-80 II

Selecting one of the above printers from the menu installs WordStar to make use
of all capabilities of that printer. WordStar will print bi-directionally if
any of the above printers is selected.

"OEM" Daisy Printers

WordStar may be installed to drive the NEC 5500D, Diablo Hy-type II 1300
series, and Qume Sprint 3 (with cable adapter) OEM printers through the Micro-
Pro "I/O Master" interface board with a single menu selection (as will be
described in Section 3). For Altos and TRS-80 II terminals, WordStar may also
be installed to drive the NEC 5500D through the PA-1 interface board. Users of
OEM printers and the "I/O Master" interface board may disregard the rest of
this section and go on to Section 3.

"Serial" Daisy Printers

The printers not noted as "OEM" in the above list are usually supplied with a
"Serial" interface. When using a serial daisy printer with WordStar, you will
generally wish to set the printer and the computer interface to 1200 baud (120
characters per second), the highest transmission speed supported by these
printers. Such printers operate far below their speed capability with WordStar
when set to 300 baud or less. Use of 1200 baud generally requires use of a
"communications protocol" to prevent loss of characters; use of a communica-
tions protocol usually precludes access to the printer as the "CP/M List De-
vice". Read "Communications Protocols" and "Printer Drivers" later in this
section carefully and check Appendix D with regard to your printer, before
attempting to install WordStar to drive one of these printers at 1200 baud.

"TELETYPE-LIKE" PRINTERS

This class includes almost all printers other than daisy wheel printers—any
printer that prints the ASCII printing characters (codes 20 through 7E hex) and
responds to the carriage return and line feed codes, but not the more sophisti-
cated printing features. Using a Teletype-like printer, WordStar can under-
line, strike out, double strike, and overprint. Boldface is printed with three

strikes (or as specified by a customer through patching). Subscripts and super-
scripts are printed in the line below or above if that line is blank, otherwise
in the line in which they appear. Variable line height is not available. A
choice of two character pitches and two ribbon colors is available through
special installation, described in Section 7. Right-justification of printout
on a Teletype-like printer is accomplished by inserting whole spaces between
words, as on the screen during editing.

A daisy wheel or similar printer will operate with WordStar installed for a
Teletype-like printer, but only the Teletype-like printer capabilities will be
available, and bi-directional printing will not occur.

Two menu selections are provided for Teletype-like printers:

>   A. Any Teletype-like Printer
>   B. Teletype-like Printer that Can Backspace

Selecting A or B above installs WordStar to make use of the basic capabilities
common to all Teletype-like printers. Use of additional capabilities of speci-
fic printers, such as character pitch change or ribbon color change, can be
enabled via special installation as detailed in Section 7. The backspacing
selection produces faster printing of underline, boldface, double strike, and
backspace for moderate usage. (For a larger amount of underlining, etc. in a
given line, overprinting becomes faster.) Use selection B if you know your
printer can backspace; if you are in doubt as to whether your printer can
backspace, Selection A will work.

Other Printers

Generally, WordStar is installed for printers that are not Teletype-like (nor
among the specific daisy wheel and similar printers supported) by making one
of the two "Teletype-like" selections in the installation dialog. Additional
patches, if required, are covered in Section 7.

Both of the "Teletype-like" printer selections (A and B above) assume the
printer will return carriage without advancing to the next line when sent a
carriage return code that is not followed by a line feed code. If your printer
cannot return its carriage without advancing to the next line, but can back-
space (Selection B), overprint lines will not print correctly, but WordStar
will be otherwise operational. (Overprint lines are discussed in the Reference
Manual.) If your printer can neither return the carriage without feeding to
the next line nor backspace, use Selection A and avoid use of underline,
strikeout, boldface, double strike, backspace, and overprint lines.

If your printer can return the carriage independently of advancing the paper,
but does these functions under control of characters other than the standard
ASCII carriage return and line feed codes, WordStar can be made fully
operational with your printer by patching the appropriate control strings as
described in Section 7.

Another selection on the Printer Menu, "Half-Line Feed Printers", is intended
to facilitate installation for printers that can advance the paper one-half
line at a time; the half-line advance is utilized in printing subscripts and
superscripts. After making this selection, patches will probably be required.
See Section 7 ("Custom Printer Installation") along with Appendices D and E.

Communications Protocols

A "communications protocol" is a convention whereby a (serial) printer tells
WordStar when to stop transmitting characters (while those already received by
the printer are being printed) and when to resume transmitting.

Communications protocols as discussed here are not pertinent to "OEM" or
Centronic's interfaced printers; users with the NEC 5500D, NEC 5530, Diablo Hy-
type II, or Qume Sprint 3 OEM printers interfaced with either the MicroPro "I/O
Master" board or the PA-1 board may disregard this subsection.

A communications protocol is not necessary with a (serial) daisy wheel or
similar printers interfaced at 150 baud or less, and generally not at 300 baud.
However, if you have such a printer interfaced at that speed, you will want to
change it to 1200 baud when you discover how slowly it prints.

Unless hardware and cabling options are available and have been implemented, a
communications protocol is always necessary with a serial daisy wheel or simi-
lar printer interfaced at 1200 baud. If no communications protocol is instal-
led, the printer's buffer will overflow and characters will be lost.

We will describe the available communications protocols in general here; see
Appendix D for specific notes relating to your printer. The protocols sup-
ported by WordStar are "ETX/ACK protocol" and "XON/XOFF protocol". Both commu-
nications protocols require that the computer be able to receive characters
from the printer as well as transmit characters to the printer. This compli-
cates installation when a communications protocol is to be used, since the
normal method of accessing a printer under CP/M, the "list device", provides
only for transmission of characters from the computer to the printer.

ETX/ACK PROTOCOL

Under this protocol, WordStar sends a "message" consisting of a specified
maximum number of characters, followed by an "ETX" character (03). After
printing all characters up to the ETX, the printer transmits an "ACK" character
(06H) back to the computer, thus signalling WordStar that another message may
be transmitted. All daisy wheel and similar printers supported by WordStar can
use this protocol, though some printers require specific optioning to activate
it. See Appendix D and the printer manufacturer's documentation.

XON/XOFF PROTOCOL

Under this protocol, the printer transmits an "XOFF" character (DC3 ASCII code)
to the computer when WordStar should stop transmitting characters, then trans-
mits an "XON" character (DC1 ASCII code) when transmission may resume.
XON/XOFF protocol is supported as an alternate protocol by some daisy wheel and
similar printers; use XON/XOFF instead of ETX/ACK only if other considerations,
such as other software to be run on the same computer, necessitate its use, or
if you have an unusual printer that will perform XON/XOFF but not ETX/ACK.

Printer Drivers

Users with NEC 5500D, Diablo Hy-Type II, and Qume Sprint 3 OEM printers inter-
faced with the MicroPro "I/O Master" board may disregard this subsection
(selection of OEM printer / I/O Master interface combination during installa-
tion automatically selects the required driver). Users who wish to drive a
serial daisy printer at 1200 baud must read this section carefully. Users of
NEC 5500D OEM printers with PA-1 boards for Altos and TRS-80 II terminals
should use the list device (see below).

The normal method whereby a program accesses the printer under CP/M -- the
"list output device" -- does not support receiving characters from the printer,
as required by "communications protocols" (preceding subsection).

Also, the list output device does not allow the program to determine whether
the printer is busy or ready to receive another character via software. Deter-
mination of whether the printer is busy ("Printer busy test") is not essential
to WordStar operation, but is desirable as it improves keyboard response and
printer speed during concurrent editing and printing.

To handle communications protocols and printer busy tests, and accommodate
special cases, WordStar provides several methods for accessing the printer.
Each method of accessing the printer is termed a printer driver. When instal-
ling WordStar, one of the following printer drivers may be chosen. The para-
graphs that follow discuss each printer driver in detail. Selecting the desired
printer driver is accomplished during installation by selecting from a menu
(Section 3).

        CP/M "List Output" Device (LST:)
        CP/M "TTY:" Console Device
        CP/M "CRT:" Console Device
        Port Driver (direct input/output by WordStar)
        Custom Subroutines

CP/M LIST OUTPUT DEVICE (LST:)

This driver outputs characters to the printer via the printer driver in your
operating system. The list output device is the simplest way to access your
printer if your printer requires no communications protocol (preceding sub-
section) and no printer busy test is desired. (There is a patch that allows
Spinware to check busy for faster operation from WordStar.) If your printer
requires a communications protocol (as all daisy wheel and similar printers
interfaced at 1200 baud do), you may wish to choose another of WordStar's
printer driver options, or you may wish to make use of WordStar's provisions
for installation of a user-supplied list device character input routine. (See
Section 7.)

The "CP/M list output device" choice will work correctly from WordStar only if
your operating system can already output characters to the printer as the list
device. Suitable installation of the operating system is often necessary to
enable it to drive a specific printer. In some cases, the computer dealer or
manufacturer supplies a CP/M with a suitable printer driver already installed.
In other cases, the user must install a suitable subroutine in the "BIOS"
portion of the operating system if the system is to drive the printer. Of
course, such system installation is not necessary for WordStar use unless
WordStar is installed to do printer output via the CP/M list device.

In many systems, the "list output device" (LST:) is a "logical" device which can be assigned to one of several "physical" devices. If this is true of your system (check your system manual), you must either give the necessary command or provide the necessary system setup (SETUP.COM or CONFIG.COM) to assign LST: to the desired printer device before you can print with a WordStar installed to use the CP/M LIST DEVICE.

CONFIG.COM, CONFIGURE.COM and related files allow you to set up LIST DEVICE conditions via a kind of menu. Usually you have to run the "CONFIG" program and answer the questions (CONFIG is short for "configure" which is similar to MicroPro's INSTALL program). Look up the procedures for running one of these programs in your CP/M manual.

A more universal set-up is that procedure available via the STAT.COM program. Typing STAT LST:=LPT: will assign the LIST DEVICE to the physical device and its driver associated with the LPT:. This nearly always works, but is transient (ie. is lost when the system is re-booted); while the CONFIGURE set-up tends to be permanent (either optionally or by definition.)
To verify that your operating system drives your printer and that LST: is indeed assigned to the printer, type control-P at the system prompt (A>), then type additional characters. All characters typed on the console (and everything that appears on the display) should be printed on the printer until you type another control-P. This is an unqualified test of proper LIST DEVICE operation.

CP/M has no provision for inputting characters from the list output device, as required by the communications protocols, nor does it have a uniform provision for a printer busy test. However, WordStar provides for installation of user-supplied printer character input and printer busy test subroutines (such as those found in Spinware) for use in association with CP/M list output device printer output. (See Section 7.)

Caution

Do not attempt to install or use code **in the operating system** to implement ETX/ACK protocol when driving a Diablo or Qume daisy wheel printer. For WordStar to work with these printers under this protocol, the protocol **must** be executed by WordStar.

ALTERNATE CONSOLES

In many versions of CP/M the "console" is a logical device (CON:) which can be assigned to any one of four physical devices, usually called "TTY:", "CRT:", "BAT:", and "UL1". The terminal used by the operator is one of the "physical" consoles and must be the active one when WordStar is invoked; WordStar can access the printer as another of the consoles. WordStar can be installed to access the printer as the TTY: or CRT: console device by making an appropriate selection at the Printer Driver menu (Section 3). The other two physical consoles can be accessed via patching (Section 7).

Accessing the printer as an alternate console allows inputting characters from the printer, as required by communications protocols, without system software modifications or patching. The TTY: or CRT: printer driver is often the most convenient printer driver choice when a communications protocol is required, as by a daisy wheel printer set to 1200 baud. Accessing the printer as an alternate console does not provide a printer busy test unless the user installs his own subroutine (Section 7).

TTY: Alternate Console Device Printer Driver

This driver accesses the printer as the "TTY:" console device. This driver will support communications protocols and may be used if your CP/M operating system supports multiple consoles and the terminal from which WordStar is operated is not the "TTY:" device.

CRT: Alternate Console Device Printer Driver

Similar to the preceding, this driver accesses the printer as the "CRT:" console device. This driver will support communications protocols and may be used if your CP/M supports multiple consoles and the terminal from which WordStar is operated is not the "CRT:" device.

PORT DRIVER

WordStar's "port driver" bypasses the operating system and does input-output directly to the printer interface, thereby eliminating any complications introduced by the CP/M operating system. The port driver supports character input from the printer and includes a printer busy test; the port driver thus handles communications protocols (preceding subsection) and allows WordStar to provide the best keyboard response during concurrent editing and printing.

Installation of the port driver requires that you specify whether your printer interface uses "I/O ports" or is "memory mapped". If in doubt, assume "I/O ports" as this case is most common. Installation of the port driver requires determination of the output data port number (or memory address if memory mapped), output status port number, output status bits, and, if a communications protocol is to be used, the input data port, input status port number, and input status bits. If you don't know the port numbers for your interface, the WordStar installation program can be directed to search for the ports (as will be detailed later).

Note

Experience has shown that the DETERMINE function is extremely limited as a tool for determining available ports. For Dynabute, Altos, and Vector Graphics ports, refer to Sections 4 and 8 and Appendix F. If you don't find the information there, ask your dealer about supplementary Application Notes.

If your printer interface involves more than one output data port (or memory mapped location), one output status port, one input data port, and one input status port, WordStar's port driver is not applicable. Otherwise, if you know your printer's port numbers (or memory mapped addresses) and status bits, or can determine them in your system with the installation program's automatic search features, the port driver is the best printer driver choice where a communications protocol is required or a printer busy test is desired.

CUSTOM SUBROUTINES PRINTER DRIVER

Choosing this printer driver selection causes WordStar to call user-coded, user-installed subroutines to output to the printer, input from the printer (for communications protocols), and determine whether the printer is busy.

This choice may be used when the CP/M list device won't work (e.g., because a communications protocol, and thus printer character input, is required) and the port driver won't work (e.g., because an unusual printer uses several data or status ports).

After selecting "Custom Subroutines" on the INSTALL menu, it is up to you to code and install the necessary routines. See Appendix E for listings of the area in which to install your code, Section 7 for discussion.

Summary of Printer-Related Installation Selections

OEM PRINTER WITH I/O MASTER

OEM Printer with MicroPro I/O Master Interface Board: No complications discussed in this section are pertinent. Choose "I/O Master / OEM Printer" at the INSTALL program's printer menu (as will be described in Section 3). For any OEM printer with Spinware and either the I/O Master board or the PA-1 board, select "L" (CP/M list device) and "D" (Diablo 1610/20). INSTALL will present no further printer-related selections.

TELETYPE PRINTER

Teletype-like (Non-Daisy) Printer: If your CP/M operating system can already drive the printer, specify "Teletype-like" at the printer choice menu, specify "None" for communications protocol, and specify "CP/M list output device" for printer driver. Alternately, you may wish to use the port driver for better keyboard response during concurrent editing and printing.

DAISY WHEEL AT 300 BAUD

(Serial) Daisy Wheel or Similar Printer Interfaced at 300 Baud or Less: If your CP/M can already drive the printer, choose the specific printer type at the printer menu, specify "None" for communications protocol, and specify "CP/M list output device" for printer driver. Or use the port driver if desired, for better keyboard response during concurrent editing and printing. You will want to change your printer to 1200 baud as soon as possible so WordStar can print faster.

DAISY WHEEL AT 1200 BAUD

(Serial) Daisy Wheel or Similar Printer Interfaced at 1200 Baud: You will need to use a communications protocol and a driver that can input as well as output characters. See Appendix D for specific discussion of your printer. Specify the particular printer type at the printer choice menu. Specify ETX/ACK protocol, and set the printer to match, unless unusual considerations dictate using a different protocol.

PRINTER DRIVER

For printer driver, try using the port driver. However, if your operating system supports multiple consoles and your printer is already accessible as one of the console devices, you may wish to consider using the TTY: or CRT: alternate console driver. The CP/M list output device printer driver cannot be used with a communications protocol unless you patch in your own Printer Character Input routine (Section 7).

Exception: If your 1200 baud printer is a NEC Spinwriter 5510/5520, you may be able to make a special cable instead of using a communications protocol (see Appendix D). If you use the special cable, you may specify "None" for protocol and "List output device" or "Port driver" for printer driver.

Printer Configuration

Some printers have option switches which must be correctly set. These switches may be on an external control panel, on a control panel under the printer cover, or buried on circuit boards inside the printer. Common switches include the following:

AUTO LF or LOCAL LF (makes printer line feed upon receiving a carriage return code): must be OFF.

AUTO CR (makes printer start a new line if an overlong line is printed): OFF recommended.

SPEED: Must match the rate at which your computer transmits characters.

PARITY: Set to ignore parity ("M" position on some printers).

Communications Protocol: A "communications protocol" must be used with (serial) daisy wheel and similar printers interfaced at 1200 baud (120 characters per second), as discussed above. With many printers, use of a communications protocol requires setting switches or adding jumpers on circuit boards inside the printer. See Appendix C and your printer's documentation.

FORM LENGTH: Should be set to match paper in use if USE FORM FEEDS print option is to be used.

SET TOF: Press after positioning paper at top of form, if USE FORM FEEDS print option is to be used.

The Page Intentionally Left Blank

Section 3
Installation Procedure

THE DISTRIBUTION DISKETTE

The diskette (or diskettes) you receive upon purchasing WordStar contain the following files:

WSU.COM   Uninstalled WordStar; installation for your terminal and printer is achieved by running INSTALL as described in this section.

WSMSGS.OVR   WordStar message and overlay files; must be on diskette in
WSOVLY1.OVR   logged drive or drive A whenever WordStar is in use.

INSTALL.COM   WordStar installation program; used to install (customize) WordStar for your computer configuration.

EXAMPLE.TXT   File of sample text demonstrating some WordStar features.

MAILMRGE.OVR   Additional overlay file for the optional MailMerge feature (extra—possibly on a separate diskette).

Creating a System Diskette

Follow these steps to create a new system diskette to work from:

1. Format a new disk.

2. Copy a system onto this disk.

3. Copy PIP.COM onto this disk.

4. Insert this new disk into the boot drive (a:) and boot it.

5. Insert the original distribution disk into a second drive (b:).

6. Copy INSTALL.COM and WSU.COM from the distribution disk (drive b:) to the new working disk (drive a:) using PIP.

7. Run INSTALL as described in detail below. INSTALL will create a new file called WS.COM, with WordStar set up for your particular system.

8. Once you are certain that WordStar has been properly installed, erase INSTALL.COM and WSU.COM from your new working disk (drive a:), **but not from the distribution disk (drive b:).**

9. Now copy all overlay files (WSMSGS.OVR, WSOVLY1.OVR, and possibly the optional file MAILMRGE.OVR) from the distribution disk (drive b:) to your new working disk (drive a:) using PIP. (Type pip a:=b:*.ovr after a>.)

10. If you have room on your working disk, you may also want to copy STAT.COM and FORMAT.COM onto it.

11. Remove the distribution disk from drive b: and store it in a safe place.

Be sure to keep the original distribution diskette. If you wish an update in
the future, you may need to return it to your dealer.

Initiating Installation

To initiate WordStar installation, insert the diskette containing the files
copied from the distribution diskette, type control-C (if your system is al-
ready up), or else cold-start (boot) the system, and type the command:

        INSTALL

and press RETURN. INSTALL will take several seconds to load, after which it
will display a sign-on message and ask its first question. At this point, the
screen should appear as follows:

```
| A>INSTALL                                                          |
|                                                                    |
|                                                                    |
|                                                                    |
|                                                                    |
|  COPYRIGHT (C) 1981, MicroPro International Corporation            |
|                                                                    |
|  INSTALL release x.x for MicroPro WordStar release n.n             |
|                                                                    |
|                                                                    |
|  Do you want a normal first-time INSTALLation of WordStar?         |
|  (Y = yes;   N = display other options): ■                         |
```

In response to this question, type Y. (If you type N, additional options not
needed for initial installation as described here are displayed. These instal-
lation options will be described in Section 5.) In response to the Y, INSTALL
will tell you what it is going to do--create an installed WordStar on file
WS.COM, obtaining the uninstalled version from file WSU.COM—and ask for your
confirmation—as follows:

        This will INSTALL the WSU.COM on the current drive, save
        the result on file WS.COM on the current drive, and then
        run the INSTALLed WordStar.   OK (Y/N): ■

Type Y. (As with the previous question, an N here gets the installation
options, which are not needed for an initial installation.) An error message
will occur at this point if WSU.COM is not on the current (logged) drive. (If
you need futher explanation of any error message displayed while you are
installing your WordStar, refer to Appendix A.)

SELECTING THE TERMINAL TYPE

A terminal choice "menu" appears next, as follows:

```
| --------------------------------------------------------------- |
| |                                                             | |
| |   MicroPro WordStar release n.n serial 000000               | |
| |                                                             | |
| |     *****  WordStar TERMINAL MENU #1 *****                  | |
| |                                                             | |
| | A  Lear-Siegler ADM-3A        C  Lear-Siegler ADM-31        | |
| | D  Hazeltine 1500             E  Microterm ACT-IV           | |
| | F  Beehive 150/Cromenco 3100  G  IMSAI VIO                  | |
| | H  Hewlett-Packard 2621 A/P   I  Infoton I-100              | |
| | J  Processor Tech SOL / VDM   K  Soroc IQ-120               | |
| | L  Perkin-Elmer 550 (Bantam)  2  Terminal Menu #2           | |
| | 3  Terminal Menu #3           Z  None of the above          | |
| |                                                             | |
| | PLEASE ENTER SELECTION (1 LETTER): ▮                        | |
| --------------------------------------------------------------- |
```

If your terminal is shown on the menu, enter the corresponding letter. If your terminal is not shown, type "2" or "3" and another menu showing additional terminals will be displayed.

If your terminal type is not shown on any of the menus, you must make a custom terminal installation as described in Section 6. Enter Z for "None of the above" in order to bypass the terminal menus; patch the required control functions (as determined by study of Section 6, Appendix E, and your terminal's technical manual) into WordStar using INSTALL's patcher (end of this section) or your operating system's debugger.

After the terminal type letter is entered, INSTALL will display a brief message confirming the terminal type and ask

        OK (Y/N):

If you made an error or wish to change your selection, type N, and the TERMINAL TYPE question will be asked again. Upon repetition, a choice U for "NO CHANGE" will appear on the menu. When you answer Y to OK (Y/N):, INSTALL will proceed to printer choice. You can type "B" at this or any following question to return to the terminal choice menu.

PRINTER-RELATED SELECTIONS

Installing WordStar for a printer involves choosing the specific printer type, communications protocol, and printer driver, as discussed in Section 2.

Selecting a Printer

The next "menu" displayed by INSTALL allows you to choose the type of printer which the installed WordStar will drive:

```
+-----------------------------------------------------------------+
|                                                                 |
|              ***** PRINTER MENU *****                           |
|    (More specific info is displayed after choice is entered)    |
|                                                                 |
|   A   Any "Teletype-like" printer (ie almost any printer)       |
|   C   "Teletype-like" printer that can BACKSPACE                |
|   D   DIABLO 1610/1620 daisy wheel printer                      |
|   E   DIABLO 1640/1650 daisy wheel printer                      |
|   F   QUME Sprint 5 daisy wheel printer                         |
|   G   NEC Spinwriter 5520/5520 thimble printer                  |
|   I   "Half-Line-Feed" Printers                                 |
|   M   I/O MASTER / O.E.M Printer combination                    |
|   U   no change                                                 |
|   Z   none of the above                                         |
|                                                                 |
|   PLEASE ENTER SELECTION (1 LETTER): █                          |
|                                                                 |
+-----------------------------------------------------------------+
```

If your printer is listed, enter the appropriate letter. If you don't see your printer, type A, (or C if you know your printer can backspace). See Section 2 and Appendix D for futher discussion of the printer choices. INSTALL will then display a message explaining any special considerations relating the printer selection, then ask

            OK (Y/N):

If you wish to change your selection, type N, and the PRINTER menu question will be redisplayed. To proceed to the next menu, type Y. Also, you may type B to return to the beginning of the dialogue. The space bar may then be hit to keep the prior answer to questions whose answer you do not wish to change.

The M selection on the above menu applies to all brands of "OEM" daisy wheel and similar printers (NEC 5500D, Qume Sprint 5, Diablo Hy-Type II) when inter-faced with the MicroPro "I/O Master" board. For further discussion of these printers in combination with the "I/O Master" interface see Section 2, as well as the message displayed when M is entered. Since no communications protocol nor driver selection is necessary when installing WordStar to use an "OEM" printer with the "I/O Master" interface, the next two menus are skipped when M is selected.

If you chose M at the printer menu (above), proceed to the next subsection ("Bypassing the Patcher")

Selecting a Communications Protocol

The next menu displayed permits choosing a "communications protocol", as dis-cussed in Section 2.

```
|-----------------------------------------------------------------|
|                                                                 |
|          ***** COMMUNICATIONS PROTOCOL MENU *****               |
|                                                                 |
|  A "Communication Protocol" is necessary with some printers     |
|  to prevent printer buffer overflow and character loss.         |
|                                                                 |
|  E   EXT/ACK Protocol                                           |
|  X   "X-ON/X-OFF" Protocol                                      |
|  N   NONE required (or handled outside of WordStar)             |
|  U   no change                                                  |
|                                                                 |
|  PLEASE ENTER SELECTION (E, X, N, B, or U): ▮                   |
|                                                                 |
|-----------------------------------------------------------------|
```

As noted in Section 2, the appropriate answer is usually "None" except for
daisy wheel and similar printers interfaced at 1200 baud (120 characters per
second), for which the appropriate choice is usually "ETX/ACK". Enter the
desired letter. INSTALL will then display a message confirming the selection,
then ask OK (Y/N): as for the preceding menus.

Selecting a Printer Driver

The final printer-related menu permits choosing a printer driver:

```
|-----------------------------------------------------------------|
|                                                                 |
|              ***** DRIVER MENU *****                            |
|                                                                 |
|  Or, how should WordStar send characters to your printer?       |
|                                                                 |
|  L   CP/M "List" device                                         |
|  P   Direct I/O to 8-bit port                                   |
|  S   User-installed driver subroutines                          |
|  U   no change                                                  |
|                                                                 |
|  PLEASE ENTER SELECTION (L, P, S, B, OR U): ▮                   |
|                                                                 |
|-----------------------------------------------------------------|
```

If "none" was specified for "Communications protocol", then "CP/M list output
device" is commonly the appropriate choice here. See Section 2 for further
discussion. Enter the desired letter. INSTALL will display a confirming
message and ask OK (Y/N): as after previous selections.

Port Driver

If you selected a printer driver other than P at the above menu, or if you
entered M at the printer menu, proceed to the next subsection ("Bypassing the
Patcher").

If you selected WordStar's port driver (P on the above menu), INSTALL will ask
additional questions to determine how to access your printer (see Section 4).

BYPASSING THE PATCHER

After the printer selections have been completed, INSTALL will display the prompt:

        ARE THE MODIFICATIONS TO WORDSTAR NOW COMPLETE?
          IF THEY ARE ANSWER YES TO THE NEXT QUESTION.
          IF YOU WISH TO MAKE ADDITIONAL PATCHES TO THE
          USER AREAS IN WORDSTAR ANSWER NO TO THE NEXT QUESTION.

        OK (Y/N):

For a normal installation, type Y. If you type N, the "patcher" will be activated. The patcher permits additional custom modifications, not usually needed when WordStar is first installed. Description of the patcher will be deferred to the end of this section.

Note

In the subsections that follow, you will learn how to repeat the installation dialog and how to re-INSTALL a previously INSTALLed WordStar (using the installation options). In either case, you can retain the previous selection by pressing the space bar (or RETURN) at the Printer Driver Menu. If the previous selection was P and you press the space bar, the additional questions for the port driver will not be reasked; the old answers will be kept. If you wish the port driver questions to be reasked, so that you may change one or more answers, type P at the Printer Driver Menu.

CONFIRMING OR CORRECTING YOUR SELECTIONS

All of the installation choices have now been presented. INSTALL will next display the terminal type, printer type, communications protocol, and printer driver that you have selected, then ask OK (Y/N): yet once more. If you wish to make any changes, type N or B, and INSTALL will return to the Terminal Menu, allowing you to repeat all of the selections. For those choices you do not wish to change, enter a space. INSTALL will keep the previous selection.

When everything is as you wish it, type a Y at this final confirmation. INSTALL will then automatically save the installed WordStar on a file named WS.COM, for future use, then start (pass control to) the installed WordStar, allowing immediate use.

The next two subsections describe the installation options and the patcher (not normally needed for initial installation). The various error messages that can occur during INSTALL are given in Appendix A.

INSTALLATION OPTIONS

As described above, the INSTALLprogram normally takes an uninstalled WordStar from file WSU.COM on the current drive, creates an installed WordStar on file WS.COM on the current drive, then executes the installed WordStar.

Occasions may arise when you wish to vary the above procedure. You might wish
to use different file names, or files on drives other than the current drive
for the final installed copy of WordStar or you might wish to start with a
previously installed WordStar in order to change one of the selections without
reentering them all.

INSTALL has provisions for operator entry of the file names to be used, and for
return to the operating system instead of starting the installed WordStar. To
use these options, invoke INSTALL, then type N at first question "Do you want
a normal first-time installation?". INSTALL will then display the INSTALLATION
OPTIONS menu as follows:

```
|                                                                          |
|            *****  WordStar INSTALLATION OPTIONS MENU  *****              |
|                                                                          |
| A   INSTALLation of a distributed WordStar, INSTALLing WSU.COM,          |
|     producing WS.COM, and then running the INSTALLed WordStar.           |
|                                                                          |
| B   INSTALLation or re-INSTALLation of a WordStar COM file of            |
|     your choice, placing the newly INSTALLed WordStar in a file          |
|     of your choice, and then exiting to the operating system.            |
|                                                                          |
| C   Same as B except run the INSTALLed WordStar.                         |
|                                                                          |
| D   Modification of the INSTALLation of a WordStar COM file of           |
|     your choice.  The modified WordStar replaces the original            |
|     file.  The modified WordStar is then run.                            |
|                                                                          |
| PLEASE ENTER SELECTION (A, B, C, or D): ■                                |
|                                                                          |
```

Ordinary Install and Run
(Installation Option A)

Selection A on the Installation Options menu corresponds to the normal case.
The dialog then proceeds as described above, as though you had entered Y to
the question "do you want a normal first-time installation?".

Install to Another File and Exit
(Installation Option B)

Selection B asks for two file names as follows:

   Filename of WordStar to be INSTALLed? ■

      At this question, type in the name of the file from which INSTALL is to
      take the WordStar to be "customized" for your terminal and/or printer.
      Normally, this is file WSU.COM; you might want to enter "B:WSU" to get
      WSU.COM from drive B when the currently logged drive is A; or, you might
      want to enter the file name of a previously installed WordStar (e.g.,
      "WS") in order to change some of the installation selections without
      re-entering all of them.

Typing errors in the file name may be corrected by backspacing with control-H or rubout. Control-U may be used to erase the entire answer. Terminate your answer with the RETURN key. If you omit the period and file type, INSTALL will assume .COM. (If you press RETURN without entering anything, INSTALL will assume WSU.COM).

If the file you specified was not found, INSTALL will respond

THAT FILE DOES NOT EXIST

and repeat the question. Note that you must include the drive name (letter followed by colon) at the beginning of the file name unless the file is on the diskette in the current logged drive.

Filename for saving INSTALLed WordStar? ▮

At this question, type in the file name in which you wish INSTALL to save the installed WordStar. "WS" is the normal answer to this question; you might want to enter "B:WS" to save the WordStar on the diskette in the B: drive; or you may prefer a file name other than "WS". (If you omit the period and file type, INSTALL will assume .COM; if you press RETURN without typing anything, INSTALL will write a file called "WS.COM" to the current drive.)

After the two file names are accepted, the dialog under Option B proceeds as described earlier in this section. After the final confirmation, INSTALL saves the installed WordStar on a file of the specified name and then exits to the operating system. Option B does not run the installed WordStar.

Install to Another File and Run
(Installation Option C)

Selection C on the Installation Options menu is the same as selection B — file names are requested as above — except that after the installed WordStar is saved on the disk, it is run. Option C is thus a convenience when immediate use of the installed WordStar is desired.

Modify Another File and Run
(Installation Option D)

Selection D on the Installation Options menu combines the two questions of selection B or C into a single question: one file name only is requested. WordStar is read from this file, customized for your terminal or printer as you specify during the dialog, then re-saved on a file of the same name. This option is a convenience when you wish to modify the installation of a previously-installed WordStar — for example, to change the printer type while keeping the same terminal, or to change the communications protocol without changing anything else.

When modifying the installation of a previously installed WordStar under options B, C, or D, you may type U, or just press the space bar at any menu whose selection you do not wish to change. INSTALL will respond by displaying "Previous selection left unchanged:" and the previous terminal, printer, driver selection, communications protocol, etc, and allow you to confirm this unchanged selection by asking OK (Y/N): in the usual manner.

INSTALL'S PATCHER

INSTALL's patcher facilitates making special installations and modifications to WordStar. Installation of WordStar for terminals and printers not shown on INSTALL's menus, and other situations in which patching might be necessary or desirable, are discussed in Section 6 of this manual. If you wish to make such a special installation or modification, refer to Section 6, and to the listings in Appendices E and F, to determine exactly what patches to make. Once you have studied Section 6 and determined what bytes you wish to change in WordStar, INSTALL's patcher may be used to make the changes.

The patcher permits examining and/or changing any byte in WS.COM. The location of each byte to be changed may be specified by hexadecimal address or by label name taken from the USER1 or USER4 listing in Appendix E or F of this manual; the contents of each specified byte is displayed in hexadecimal and a new value may be entered in hexadecimal.

INSTALL's patcher is accessed by anwering N at the following prompt. As noted earlier in this section ("Bypassing the Patcher"), this prompt appears after the printer selections and before the final confirmation. (If you have already INSTALLed WordStar, and wish to make patches in the installed copy, you may use installation option B, C, or D and press the space bar to bypass the terminal and printer menus without re-entering those selections.)

        ARE THE MODIFICATIONS TO WORDSTAR NOW COMPLETE?
          IF THEY ARE ANSWER YES TO THE NEXT QUESTION.
          IF YOU WISH TO MAKE ADDITIONAL PATCHES TO THE
          USER AREAS IN WORDSTAR ANSWER NO TO THE NEXT QUESTION.

        OK (Y/N):

If you type N, a summary of the patching process will be displayed on your terminal, followed by the prompt:

        LOCATION TO BE CHANGED: ▮

Enter the desired address in hexadecimal, or enter the desired label (as shown in the USER1 or USER4 listing in Appendix E) followed by a colon. A label may be followed by a "+" and a hexadecimal number to access the location that many bytes after the label. Examples of valid answers:

        25B   (hexadecimal address)
        CTRAIL: (label)
        CTRAIL:+2   (label plus numeric offset)

INSTALL will then display the address in hexadecimal and the present contents of the indicated byte, and prompt you for the data you wish to replace it with. The screen line will appear as follows:

        ADDRESS: aaaaH   OLD VALUE: nnH   NEW VALUE: ▮

where aaa represents the hexadecimal address and nH represents the value that is presently occupying the byte at that memory address. Enter the hexadecimal value with which you wish to be replace the old value, or press RETURN only to make no change.

You will then be prompted to enter a new location. To access the next address, you may press RETURN only; to terminate patching, enter zero (type 0 and press RETURN).

By using symbolic labels, you can avoid absolute addresses, which change from release to release. Thus a patch made for one release of WordStar can easily be applied to a subsequent release without concern for changes in the location of the values which must be modified.

Section 4
Installation Procedure:
Port Driver

If you selected WordStar's port driver (P on the driver menu in Section 3), INSTALL will ask additional questions to determine how to access your printer.

Since the installation procedure for WordStar's built-in port driver is the most involved installation procedure, Section 4 is devoted exclusively to this subject.

I/O OR MEMORY-MAPPED

The first of the port driver questions requires you to specify whether your printer is connected to "I/O ports" or "Memory Mapped Ports". Determine this from the technical manuals for your computer; "I/O ports" are most common.

> Are the printer ports I/O Ports or Memory Mapped (I or M): ∎

Enter either I for "I/O" or M for "Memory Mapped". Entering RETURN only will default to "I/O" for an initial installation, or to the previous selection if re-installing a WordStar.

The remaining questions determine the input and output data and status ports, and the status bits. If possible, find the necessary information in the technical manuals for your computer, and have INSTALL accept the information from you. However, if you cannot determine the port numbers or addresses to which your printer is connected or you cannot determine the status bits, INSTALL may be directed to attempt to determine the necessary information at each of the following steps.

The determine function may not succeed in correctly identifying the information in all cases (INSTALL may report failure if the information is not successfully determined, but could report success yet produce a WordStar that could not print). Further, INSTALL may lock up your computer system (requiring you to reboot) during its attempt to determine one of the following items. Determining the information yourself and directing INSTALL to accept the information from you is always preferable to having INSTALL attempt to determine the information.

OUTPUT DATA PORT

> DO YOU WISH WORDSTAR TO DETERMINE THE VALUES OR SHOULD
> WORDSTAR ACCEPT THEM FROM YOU   (D OR A): D
>
> *************** CAUTION *****************
>
> THE FOLLOWING PROCEDURE WILL NOT WORK ON ALL HARDWARE AND
> MAY HAVE UNUSUAL RESULTS SOMETIMES. PLEASE REMOVE YOUR
> DISKS FROM THE DRIVES AND REPLACE THEM ONLY WHEN TOLD TO.

The next question allows you to specify whether you wish INSTALL to attempt to determine the output port to which your printer is connected, or you wish INSTALL to accept the port number or address from you:

> WHAT IS THE OUTPUT PORT FOR YOUR PRINTER?
>
> DO YOU WISH WORDSTAR TO DETERMINE THE VALUES OR SHOULD WORDSTAR ACCEPT THEM FROM YOU   (D OR A): ▮
>
> IN ORDER TO USE WORDSTAR'S AID TO DETERMINE THE OUTPUT PORT THE PRINTER MUST BE CONNECTED AND TURNED ON, WITH PAPER FILLED. A PRINT WHEEL AND A RIBBON MUST BE INSTALLED; THE COVER MUST BE CLOSED. THE SERIAL PORT THAT THE PRINTER IS ATTACHED TO MUST BE SET TO THE SAME BAUD RATE AS THE PRINTER.

On many **specialty printers** (NEC, DIABLO, etc.) not only do you have to have a ribbon in the printer, but you have to have enough to print (especially with the non-cycling carbon ribbons that can be used only once); otherwise, the printer will not be ready.

In addition you should note that if the baud rate is wrong, the printer will usually print jumbled information, as well as issue odd noises; this usually means that the port currently showing is the correct one, but that the **baud rate is incorrect** (meaning the **baud rate** set at the computer doesn't match the **baud rate** set at the printer).

Type A if you wish to enter the port number or D to have INSTALL help determine the port number. Pressing RETURN only will default to A. As noted above, A is preferable whenever you know or can find out the port number.

If you entered A, INSTALL will ask you for the port number:

> What is the OUTPUT port number in HEX: ▮

Enter the value as a hexadecimal number, or press RETURN to keep a previously entered value. If you are not sure of the value, consult the technical manuals for your computer, or try letting INSTALL determine the value for you by answering D at the preceding question.

If you entered D, INSTALL will display a message prompting you to remove the diskette(s) from the disk drives. This is due to the fact that while testing ports to determine the printer output port, INSTALL may access a port used by the disk system. Please follow this instruction carefully. **REMOVE THE DISKETTES.** INSTALL will tell you when it is safe to re-insert them. INSTALL will also remind you that your printer must now be connected to the computer, turned on, and ready to operate. This is because INSTALL is about to try to print on it.

Next, INSTALL will start outputting characters to a port and display the following prompt:

    Now OUTPUTting to PORT #: nn Hex OK (Y/N): ▮

where nn represents the port number to which INSTALL is outputting characters. If your printer is idle, type N, and INSTALL will try the next port. Wait a few seconds and press N again if your printer is still idle. Keep pressing N until characters begin to print. When your printer starts printing, press Y — the correct port number has been found. (During the process of finding the printer output port, characters may appear on your terminal. Disregard the characters and press N to try the next port.)

OUTPUT STATUS PORT

Next, the output status port and bits (whereby WordStar can tell when the printer is ready to accept another character) must be determined. INSTALL will again ask whether to attempt to determine the information or allow you to enter it:

    WHAT IS THE OUTPUT STATUS PORT FOR YOUR PRINTER?

    DO YOU WISH WORDSTAR TO DETERMINE THE VALUES OR SHOULD
    WORDSTAR ACCEPT THEM FROM YOU   (D OR A): ▮

Again, use A whenever you know or can determine the information. If you type D, INSTALL will attempt to determine the port number and bits, and will display the results. Any "active" status port between the bottom of port addressing (00H) and the actual printer port may cause erroneous port assignment. This is so often the case that this "DETERMINE" function is not as useful as it might seem.

If you type A, INSTALL will ask the following three questions. If in doubt about the correct answers, study the technical manuals for your computer or try typing D instead of A.

    What is the OUTPUT STATUS port number in HEX: ▮

        Enter the port number in hexadecimal.

    What are the bit(s) that change at the OUTPUT STATUS port
    when the OUTPUT port becomes ready to accept a character
    for OUTPUT (enter HEX value): ▮

    Which bit(s) change(s) from a 0 to a 1 (enter HEX value): ▮

        Enter a hexadecimal number with 1 bits in the positions corresponding
        to status bits that are 1 when the printer is ready, and 0 bits for
        bits that must be 0 or are insignificant. Usually, the answer to
        this question is the same as the answer to the preceding question.

After these prompts from INSTALL have been answered, either via the DETERMINE function, with data from your technical manual or with "educated guesses", INSTALL will ask you to confirm your selections by displaying the following prompt:

> IF YOU WISH TO RETRY THIS OPERATION ANSWER "Y" TO THE "OK Y/N" QUESTION BELOW. YOU MAY ABORT INSTALATION WITH A CONTROL C.
>
> OK (Y/N): Y

Answering 'N' rather than 'Y', as shown above, will cause INSTALL to return you to the beginning of the OUTPUT PORT installation sequence and you may correct or change any values which you feel are erroneous.

If you chose NO communications protocol, supplying a 'Y' response to this confirmation question will complete installation of the port driver—proceed to the next subsection ("Bypassing the Patching"). If you selected a protocol, INSTALL will ask a series of additional questions to permit inputting from as well as outputting to your printer.

INPUT DATA PORT

The DATA INPUT PORT is the port number (or mapped address) through which WordStar receives characters from the printer, as required when a protocol is in use. This port is frequently, but not always, the same as the output data port. We will not take a step-by-step approach to this set of prompts since they are nearly identical to those outlined above for the OUTPUT PORTS. INSTALL again asks whether to Determine or Accept the information, then asks for the port number (if you typed A) or displays the results of its determination (if you typed D).

Note that INSTALL will be able to determine the input port only if the connected printer is actually capable of and set up for the protocol selected for use by WordStar at the PROTOCOL MENU.

It is possible that INSTALL will report failure when attempting to DETERMINE the values and bits for this operation irrespective of the correct configuration of your printer and WordStar. In such cases it is possible to force the DETERMINE function to return correct values. If your printer has a keyboard, try typing characters on the printer keyboard while INSTALL is attempting to determine the input data port. If your printer does not have a keyboard and you have an extra terminal or keyboard available try substituting this in place of the printer temporarily. Now typing something at the keyboard while the DETERMINE function is operating may successfuly return the required port number and status bits. When this operation is complete you will, of course, want to replace the printer on the port.

INPUT STATUS PORT

Finally, the input status port and bits (whereby WordStar can tell whether a character has been received from the printer) must be determined. Again, INSTALL will ask whether to attempt to determine the information or to accept the information from you; the dialog and reservations are similar to those described above for the output status port.

Section 5
Testing WordStar

When WordStar is invoked--either as automatically occurs at termination of
INSTALLation, or when you type WS (or whatever file name your installed
WordStar is saved on)--WordStar should clear the screen and display a sign-on
showing the WordStar release and serial number and the terminal, printer,
protocol, and printer driver choices you made at installation.

After several seconds (or as soon as you press any key), the no-file menu plus
the names of the files on your diskette should display, like this:

```
          < < <   N O - F I L E   M E N U   > > >
 *  * * Preliminary Commands * * * |* File Commands *|* System Commands *
 L  Change logged disk drive       | P  Print a file  |R Run a program
 F  File directory    off (ON)     | E  Rename a file |X Exit to system
 H  Set help level                 | O  Copy a file   |
 *  * Commands to Open a File *  *| Y  Delete a file |* WordStar Options *
    D  Open a document file        |                  |M Run MailMerge
    N  Open a non-document file     |                 |S Run SpellStar ▮

DIRECTORY of disk A:
 CHAPTR1.DOC  CHAPTR1.BAK  CHAPTR2.DOC  CHAPTR2.BAK  CHAPTR3.DOC  CHAPTR3.BAK
 CONTENTS.DOC CONTENTS.BAK FILE1.DOC    FILE1.DOC    FILE2.DOC    FILE2.BAK
 LETTER.DOC . LETTER.BAK   TEXT1.DOC    TEXT1.BAK    TEXT2.DOC    TEXT2.BAK
 MAILMRGE.OVR WS.COM       WSMSGS.OVR   WSOVLY1.OVR
```

In the above diagram, the symbol ▮ represents the cursor position. If
highlighting is installed, the words displayed will be highlighted; if inverse
video highlighting is in use, inverse video boxes will be formed around the
menu and the phrase at the top of the screen.

TESTING CURSOR POSITIONING

If you get something like

```
 = " * * * Preliminary Commands * * *|* File Commands *|*System Com
mands* = # L Change logged disk drive (now  A ) | P Print a file |R Run a
program = $ F Turn file directory off (now ON ) | M Run MailMerge  | (STAT
to check = % H Set help level (3,2,1,0) (now  3 ) | S  Run SpellStar  |
space on disk) = & *  * Commands to Open a File  * *| E Rename a file
|X Exit to system = '       D Open a   document  file  | O Copy a file
|▮        =       N Open a non-document file      | Y Delete a file  |
 = + DIRECTORY of disk A:                  CHAPTR1.DOC  CHAPTR1.BAK  CHAP
TR2.DOC   CHAPTR2.BAK  CHAPTR3.DOC  CHAPTR3.BAK  CONTENTS.DOC  CONTENTS.BAK
FILE1.DOC   FILE1.DOC   FILE2.DOC   FILE2.BAK  LETTER.DOC  LETTER.BAK  TEX
T1.DOC   TEXT1.BAK    TEXT2.DOC    TEXT2.BAK    MAILMRGE.OVR    WS.COM
WSMSGS.OVR   WSOVLY1.OVR
```

with the lines run together and random punctuation between lines, then the
cursor positioning control codes are not working. Check your terminal documen-
tation and the setting of all option switches on the terminal, and reinstall
WordStar or correct your terminal as required.

CHECKING FOR THE MESSAGE FILE

If you get

```
|            editing no file                                    |
| @@@@ ▉                                                         |
|                                                               |
|  File WSMSGS.OVR not found.  Menus &                          |
|  messages will display as @@@@ only.                          |
|                                                               |
|                                                               |
|                                                               |
```

then the file WSMSGS.OVR, supplied on the distribution diskette, has not been
copied to the diskette in use (or the diskette is neither in drive A nor in the
logged drive). This file should always be on the diskette in drive A, or the
diskette in the logged drive (or both), when WordStar is in use. Type an X to
exit from WordStar and return to the operating system, copy WSMSGS.OVR to
diskette in drive A (or the logged drive) (the command PIP is used to copy
files in most CP/M operating systems), and invoke your installed WS again.

TESTING THE ERASE FUNCTION

Now (at the no-file menu, which should still be on the screen) type D. You
should get:

```
| D            editing no file                                  |
|                                                               |
|   Use this command to create a new document file,             |
|   or to initiate alteration of an existing document file.     |
|                                                               |
|   A file name is 1 to 8 letters/digits, a period,             |
|   and an optional 1-3 character type.                         |
|   File name may be preceded by disk drive letter A-D          |
|   and colon, otherwise current logged disk is used.           |
|                                                               |
|  ^S=delete character    ^Y=delete entry    ^F=File directory  |
|  ^D=restore character   ^R=Restore entry   ^U=cancel command  |
|                                                               |
|    NAME OF FILE TO EDIT? ▉                                     |
|                                                               |
| DIRECTORY of disk A:                                          |
|  EXAMPLE.TXT   INSTALL.COM   PIP.COM       STAT.COM           |
|  WS.COM        WSU.COM       WSOVLY1.OVR   WSMSGS.OVR         |
```

If parts of the no-file menu (what was last on the screen) appear where there
should be blank lines, then an erase to end line code is installed but not
working.

CHECKING FOR THE OVERLAY FILE

If you get

    *** FATAL ERROR F46: Overlay File WSOVLY1.OVR Not Found

then the file WSOVLY1.OVR, supplied on the distribution diskette, has not been copied to the diskette in use (or the diskette is neither in drive A nor in the logged drive). Get WSOVLY1.OVR onto drive A (or the logged drive), and invoke your installed WordStar again.

If the above screen displays correctly, press the RETURN key. The no-file menu and directory should again be displayed, with the rest of the screen clear.

Type D to again obtain the last screen shown.   Answer the question NAME OF FILE TO EDIT? by typing

       TEST.DOC

(or some other file name that is not in use on your diskette) and press RETURN. The phrase

       NEW FILE

will be added to the screen display. After several seconds, the screen display should change to the following:

```
  A:TEST.DOC  PAGE 1 LINE 1 COL 1            INSERT ON
             < < <      M A I N   M E N U      > > >
 *  *  Cursor  Movement * *|* Delete *|  * Miscellaneous * | * Other  Menus *
^S char left   ^D char right |^G  char   |^I Tab   ^B Reform  | (from Main only)
^A word left   ^F word  right|DEL chr lf|^V Insert On or Off |^J Help  ^K Block
^E line  up    ^X line down   |^T word rt|^L Find/Replce again|^Q Quick ^P Print
 *   *    Scrolling    *    *|^Y  line   |RETURN End paragraph|^O Onscreen
^Z line up    ^W line down  |          |^N  Insert a RETURN |
^C screen up  ^R screen down|          |^U  Stop a command  |
L----!----!----!----!----!----!----!----!----!----!----!--------R
■
                                                                    .
                                                                    .
                                                                    .
                                                                    .
                                                                    .
                                                                    .
                                                                    .
```

TESTING THE EDITING FUNCTIONS

Type a few words. They should appear on the screen line below the "ruler" (the line with the -'s and !'s); they should not be highlighted; the cursor should move right as you type. If the cursor does not move, the "column" portion of the cursor control codes is not functioning.

Type a ^J (^J on the screen menus and in this manual means to type control-J, that is, hold down the CTRL key on your keyboard and press J). After a second or two, a different menu should appear. The top line of the screen, the "ruler", and the words you typed, should remain. If portions of the previous menu remain to the right of the new, narrower one, then an erase to end line code is installed but not working. Press the space bar to return to the previous menu (the main menu).

Now type several lines of text. Gibberish is OK for our present purposes. WordStar will "wrap" the line for you if you type beyond the R end of the ruler without using the RETURN key; this is the normal operation of word wrap.

It should be possible to move the cursor around within the text you have entered, using ^E to move it up, ^D to move it right, ^S to move it left, and ^X to move it down. Try it. Recall that ^ means to hold down the CTRL key while typing the following letter.

Type a control-Y. The line of text containing the cursor should disappear, and the following lines move up. This tests the "delete line" control code, if one is installed. Type a control-N. A blank line should appear, with the lines below the cursor moving down. This tests the "insert line" control code, if one is installed.

ADDITIONAL TESTS FOR HIGHLIGHTING

Type a control-K. A different menu will appear. Type a B (or a b or ^B). The original menu will reappear, and "<B>" will appear at the cursor position. The <B> will be highlighted if you have installed highlighting. The characters on the line to the right of the cursor will move right three characters to make room for the <B>. Move the cursor forward a few characters (^D) or down a line or two (^X), and type ^K twice. The menu may not change, depending how soon you type the second ^K.

If no highlighting is installed, <K> will appear at the cursor position. If high-lighting is installed, the characters from the position of the <B> to the posi-tion where ^KK was typed should highlight - display in inverse video, or dimmer or brighter than the rest of the screen. The <B> should disappear. (What you have just done is "marked" a "block" of text, as in preparation for a block move or block copy command.) If the <B> disappears but the characters do not highlight, then inoperative highlighting control codes are installed.

Check the codes and reinstall if necessary; if they can't be made to work, remove them so the <B> and <K> will display. Another possibility (if you are using bright/dim highlighting) is that the contrast or brightness on your terminal are set such that bright and dim characters are indistinguishable.

Now type ^K. A new menu will appear. Type a D (or d or ^D). The message

                    SAVING FILE A:TEST.DOC

should appear. This saves the entered text on the disk, so that you can try printing it. Whenever text is entered or updated with WordStar, it is neces-sary to save it in order to keep it permanently, or to print it. After the save is complete (a few seconds), the no-file menu should reappear, as shown above.

TESTING THE PRINTER

To test the printer installation, type a P at the no-file menu. WordStar will ask you for the name of the file to print; enter TEST.DOC or whatever you called the file. Press the RETURN key. Several more questions will be asked; just press RETURN at each one for now. When Ready printer, press RETURN appears, make sure your printer is turned on and on-line (whatever your particular printer needs to be ready for use), then press any key. The text you entered should be printed, then the paper should feed to the bottom of the page and a "1" (page number 1) should be printed.

You may now delete (erase) the test file you entered, by typing a Y and answering the question NAME OF FILE TO DELETE? by entering TEST.DOC (or whatever you called your file) and pressing RETURN.

To return to the operating system, type an X at the no-file menu. The system prompt A> will appear at the bottom of the screen.

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Section 6
Custom Terminal Installation

MODIFICATION BY PATCHING

General Description

Modification by patching is used in installing WordStar for terminals not included in the installation menus (Section 3) and for printers that require special control strings or modifications to one of WordStar's printer drivers, and for achieving refinements in installation, such as supporting special features of specific non-daisy printers, circumventing the "DELETE-backspace feature" of certain operating systems, or enabling display in the last column of the last line of the screen.

Since basic installation is achieved with the INSTALL program as described in Sections 2-5, most users should not need to patch.

"Patching" means modifying WordStar by changing the contents of bytes in WS.COM. Patching may be accomplished with INSTALL's patcher (as described in Section 3) or with your debugger (DDT in most systems) or with your computer's front panel switches. Sections 6, 7, and 8 of this manual are primarily for those who already understand patching.

Listings in Appendix

Appendices E and F contain absolute assembly listings of two user-patchable portions of WordStar, USER1 and USER4:

  o   USER1 is the module containing all terminal-installation related patch areas;

  o   USER4 contains all printer-related patch items for non-daisy printers, plus many used for both daisy and non-daisy printers.

The listings are commented heavily; read them for a detailed description of each item. The following paragraphs give general description of the modules, and hit a few high points of the details, but do not attempt to duplicate the detailed information contained in the program comments. Note that the addresses provided in these listings are correct for the revision of WordStar specified on the listing and not necessarily for any other. Where LABELS: can be used, independence from revision-dependent locations is provided and is therefore desirable.

MODIFYING THE TERMINAL PATCH AREA

Modification of the terminal patch area is used for these purposes:

  o   to install WordStar for a terminal or video board not provided for in the INSTALL program

  o   to achieve a different installation for a terminal that is on the menu (e.g., to reverse the sense of bright/dim highlighting to suit individual preference)

o to achieve refinements in installation, such as permitting display in the last character position of the last line of the screen or disabling some operating systems' backspace-on-rubout "feature" that interferes with WordStar's screen updating

o to drive a terminal device which is not accessible via the operating system.

Installation for a Terminal
Not Shown on Terminal Menu

WordStar can be installed for most terminals by determining the terminal's control codes as discussed in this section, then making patches as discussed later in this section ("Terminal Patch Area"). Unusual installations, such as direct storage access to a video board, or use of a terminal which cannot be accessed via the operating system, are described in the next subsection ("Video Boards and Custom Terminal Drivers").

TERMINAL REQUIREMENTS AND OPTIONS

To be used with WordStar, the terminal must have a screen at least 16 (and not more than 120) lines high by at least 40 columns wide, and have the capability to place the cursor at any position on the screen upon receipt of a suitable control sequence from the computer.

Desirable, but not essential, additional terminal features include line insert, line delete, and/or erase to end line -- these may speed screen redisplay during editing — and inverse video, bright/dim, or some other form of character-by-character highlighting — highlighting allows WordStar to differentiate the menus and questions from the text of the document being edited, and to highlight the "marked block" of text that is to be moved or deleted.

DETERMINING CONTROL CODES

The first step in installing WordStar for a terminal not on the menu is to study the terminal manufacturer's manual to determine the screen size and the control codes which WordStar must transmit to the terminal to accomplish the various functions. Additional discussion of each required and optional function follows; patching the codes into WordStar is covered later in this section ("Terminal Patch Area").

CURSOR-POSITIONING CONTROL CODES

Positioning the cursor is the most complex terminal function used by WordStar, since it involves transmitting the row and column at which the cursor is to be placed. The form of the control string sent to the terminal to position the cursor varies widely from terminal to terminal; WordStar's cursor-positioning patch items are designed to accommodate almost all commonly used forms. For these reasons, it is necessary to analyze your terminal's cursor-positioning sequence to derive the information needed to patch WordStar.

Some terminals have a single control sequence to position the cursor at a line (row) and column (character) number; others have separate control sequences to position the cursor on a line and at a column; either will work with WordStar. In the former case, the terminal may require either the row or column transmitted first. For some terminals, the line and column numbers are sent with no

offset, that is, a zero is sent for the top line on the screen (or left column), a one for the next line down (next column over), etc. For others, an "offset" is added.

For example, several terminals require 20 (hexadecimal) for the top line or left column, 21 for the second line (or column), etc. For most terminals, the row and column are sent in binary, with a single byte (character) transmitted for each; for a few terminals, the row and column are each sent as a two- or three-digit ASCII number, with a character (ASCII "0" through "9") transmitted for each digit.

Analyze the cursor positioning codes for your terminal, as described in the terminal manufacturer's manual, and determine:

1.   Number of characters and character values that must be sent before either the line or column is transmitted.

2.   Whether the row or column is transmitted first.

3.   Number of characters and character values that must be sent after the row (or column, whichever is sent first), and before the other dimension is sent. For many terminals, this is no characters.

4.   Number and values of characters to send after both row and column, if any—usually none.

5.   Offset to add to row number—usually zero or 20 hex.

6.   Offset to add to column number—usually same as for row.

7.   Whether row and column are sent as single-byte binary value (the usual case), or multi-character ASCII number. If ASCII, determine the number of digits—ususally two or three.

Cursor Control Code Example A

Terminal requires, in order, 1B hex, 3D hex, line number plus 20 hex, column number plus 20 hex, to set cursor position. The answers to the above questions are as follows:

1.   2, 1B, 3D
2.   Row is first
3.   None
4.   None
5.   20 hex
6.   20 hex
7.   Binary

Cursor Control Code Example B

Terminal requires 1B hex, 01 hex, line number to set cursor to line, and 1B hex, 02 hex, column number to set cursor to column. The above questions may be answered as follows:

1. 2, 1B, 01
2. Row is first
3. 2, 1B, 02
4. None.
5. 0
6. 0
7. Binary

Cursor Control Code Example C

To position cursor, terminal requires, in order, 1B hex, 43 hex, column as 3-character ASCII number (with leading zeroes), row as 3-character ASCII number. The answers to the above questions are:

1. 2, 1B, 43
2. Column is first
3. None
4. None
5. 0
6. 0
7. 3-digit ASCII

The answers to the above questions provide the information necessary to patch WordStar for your terminal's cursor positioning control codes; application of this information is covered later in this section ("Terminal Patch Area").

If you have an extremly unusual terminal, you may find that it is not possible to analyze its required cursor positioning commands into answers to the above seven questions. For such cases, you must write (or have a programmer write) a subroutine to generate the necessary cursor positioning command sequence; installation of this subroutine is covered below ("Terminal Patch Area").

HIGHLIGHTING (OPTIONAL)

We also recommend determining the codes to invoke highlighting, if available, by inverse video display, bright/dim display, or some other method. If both bright/dim and character-by-character inverse video are available, we suggest inverse video, as it will highlight blanks as well as other characters, and stands out strongly. The highlighting method must operate on a character-by-character basis, take no screen positions, and not be tied to field protection.

Determine the code or code sequence to turn highlighting on, and the sequence to turn highlighting off. The "Highlighting on" sequence should cause subsequently transmitted characters to be highlighted until a "Highlighting off" sequence is transmitted. WordStar always turns highlighting off before transmitting a carriage return, line feed, or cursor positioning sequence; therefore, it does not matter whether or not these functions cancel highlighting on your terminal.

ERASE TO END OF LINE (OPTIONAL)

This function blanks all character positions from the cursor position to the end of the current screen line.

DELETE LINE (OPTIONAL)

This function should delete the entire screen line containing the cursor, moving the following screen lines up one line.

INSERT LINE (OPTIONAL)

This function should insert a blank line on the screen at the line containing the cursor, moving the cursor line and following lines down one line. If your terminal inserts below the cursor line, put a "cursor up" code at the beginning of the "insert line" string patched into WordStar.

After determining your terminal's control codes, proceed to "Terminal Patch Area" later in this section.

Video Boards and Custom Terminal Drivers

WordStar normally accesses the terminal by inputting and outputting characters via the operating system (direct jumps to the "BIOS" entry points are used). However, two variations are also supported: direct storage into a memory-mapped video board for output, and custom user-supplied subroutines for input, status, and/or output. These variations are of interest only to users with unusual installation requirements; most readers may skip directly to "Terminal Patch Area" later in this section.

DIRECT STORAGE TO A VIDEO BOARD

A memory mapped video board accessible (including cursor positioning) through the operating system character output calls may be installed as any other terminal is installed; you may proceed as described in this section ("Installation for a Terminal Not Shown on Terminal Menu" and "Terminal Patch Area").

However, WordStar can access memory-mapped video display boards meeting certain restrictions by storing directly into the video memory area. Such direct storage results in superior performance: extremely fast screen update, use of all character positions including last column of last line, and line insertion, line deletion, and erase to end line without the need of control codes for these functions. Further, direct-storage access to a video board makes about 2K more memory available for the file being edited.

The memory-mapped video board requirements for direct-storage access are as follows:

   o   Each character position must appear as a location in memory, contigu-
        ously from a starting address. The first line must begin at the
        starting address, the second line must immediately follow the first,
        etc. The lines must always be full length; WordStar will blank-fill
        them as required.

   o   Highlighting, if used, must be invoked by setting the high order bit
        of each character to be highlighted. WordStar cannot invoke high-
        lighting in any other manner while storing directly into a video
        board.

When accessing a memory-mapped video board on a direct storage basis, WordStar can position the cursor either with the control code sequence or user-installed

subroutine (as for a terminal), or by setting the high order bit in memory of
the character under the cursor.   Highlighting can be produced by setting the
high order bit; this produces inverse video on many boards. If the high order
bit is used both for highlighting and for cursor display, WordStar can blink
the cursor to make it stand out when it is on or adjacent to highlighted text.

**Even if cursor display is by high-order bit, a cursor position code sequence or
subroutine should be installed, as WordStar uses it to position the cursor at
the bottom of the screen at exit, and to initially get its cursor and the
externally known cursor in the same place.**

To Install WordStar to access a memory-mapped video board meeting the restric-
tions described above on a direct-storage basis, patch locations MEMAPV,
MEMADR, HIBIV, HIBCUR, and CRBLIV as explained in the associated comments.
Note that the cursor positioning items as used for a terminal should always be
patched even if HIBCUR is non-zero. Note also that there is a page of comments
near the end of the listing giving installation suggestions for video boards
which do not meet the requirements for direct-storage access and which cannot
conveniently be accessed via the operating system. Use items SWIN and SWOUT if
it is necessary to switch the board into the address space before access and
switch it out after access.

For video boards that are not always addressable, WordStar can switch the board
into the address space before storing into it and switch it out after each
access, provided the board occupies addresses above about 8000 hex when
"switched in".

Custom installation for direct-storage access to a memory-mapped video board is
accomplished by patching; proceed to "Terminal Patch Area."

CUSTOM CONSOLE DRIVER SUBROUTINES

Custom subroutines may be installed by the user for console input, console
status (character ready), and/or console output. Such routines may be used to
access a terminal device not accessible through the operating system and which
is not a memory-mapped video board meeting the requirements given above for
direct-storage access. For example, a memory-mapped video board with non-
contiguous lines or variable-length lines (disallowing direct-storage access)
and no cursor positioning control codes (disallowing access through the opera-
ting system) might be driven via a custom console output subroutine which could
interpret control codes as required. The patch locations and calling sequences
for these routines are given in the USER1 listing in Appendix E, as discussed
below ("Terminal Patch Area").

TERMINAL PATCH AREA

All patch items relating to terminal I/O and terminal control codes are in
program module USER1, as listed in Appendix E. Many are set by the INSTALL
program (thus, INSTALL should be run before, not after, patching, if you patch
with DDT). Additional items can be changed only by patching. Each item is
identified and explained in detail by comments in the listing; the following
discussion corresponds approximately to the order of items in the listing.

Note that all character strings to be sent to the terminal (erase to end line,
etc.) have the number of characters to be sent in the first byte, and the
characters to send in following bytes.

Terminal Installation

An earlier subsection ("Installation for a Terminal Not Shown on Terminal Menu") discussed requirements and information to be obtained from the terminal manufacturer's manual before making a custom terminal installation; read that section first if you have not already read it. The locations into which to patch terminal-related items are clearly identified by comments in the USER1 listing. The first two items in the listing are the locations into which to patch the screen height and width; following these are locations for cursor control string specification as analyzed per the seven questions given earlier in this section.

There is provision (item UCRPOS) for cursor positioning by an alternate method, calling a subroutine written and "patched in" by the user. The calling sequence for this subroutine is detailed in the comments; the information the subroutine receives includes the row, column, number of character positions from beginning of screen to cursor position, and number of character positions from beginning of screen to beginning of screen line containing cursor.

Space for the optional erase to end line, delete line, insert line, highlighting on, and highlighting off strings is given. Spaces for strings to be sent to the terminal at startup and at exit are provided, to allow special initialization or mode selection and deselection; there are also provisions for user-supplied subroutines which are called at startup and at exit.

Displaying in the Last Column
of the Last Line (USELST)

A flag, USELST, is provided in USER1 which may be patched non-zero to enable display in the rightmost column of the last line of the screen, making the "flag" character for this line display.

WordStar does not normally display in the rightmost column of the last line of the screen (except when using direct memory access to a video board), because many terminals automatically carriage return after display in the last column of a line, scrolling the screen up a line if it was the line at the bottom of the screen. For some terminals, scrolling after display in the last character position on the screen can be disabled via an option switch (possibly called "AUTO RETURN") inside the terminal; for others, such scrolling can be disabled via a mode selected with a control character string sent from the computer.

If you have a terminal which does not scroll after display in the last character position, or has been configured thus, patch USELST in USER1 (see listing in Appendix for address) non-zero to see the "flag" on the last file line displayed. If a mode which does not scroll after display in the last character position can be selected by a control sequence sent from the computer, the initialization string TRMINI may be used; the exit string TRMUNI may then be used to restore the normal mode for convenience when using other programs after exiting from WordStar. Note: it doesn't matter where the cursor goes—nowhere, or back to "home"—after displaying in the last character position, so long as the screen does not scroll up a line.

Patchable Function Delays (DELCUS and DELMIS)

Patchable function delays, DELCUS and DELMIS, are provided for use after the terminal functions indicated in the listing. These are present because many terminals lose characters if character output occurs too soon after cursor positioning or other functions. The default values are sufficient for most terminals; INSTALL increases and decreases them as necessary for certain terminals on the menu. For custom installations, you may need to patch longer or shorter delays as explained in the comments.

Usually it is best to get these delays to work before implementing any of the "unnecessary functions" (functions other than ABSOLUTE CURSOR POSITIONING and SCREEN HEIGHT and WIDTH). Get the terminal to work reliably (meaning character's don't disappear and meaningless characters don't appear) by increasing the DELAYS. Start by varying DELAY AFTER CURSOR SET (DELCUS:). Try increments of 10 hex bytes until the terminal stops being erratic. This will get all the spurious characters problems about 80 per cent of the time. Those problems left over can usually be "fine-tuned" away by varying DELMIS: using the same approach outlined for DELCUS:.

Once the "grossest" gross values for DELMIS: and DELCUS: have been determined, reduce DELCUS: until the problems just start to reappear. Next raise this delay 6 or 7 increments. Do the same thing for DELMIS:.

Next, install the highlighting functions (if available). This can often require that the DELAYS (either one or both) be increased several times the value required without highlighting them. Sometimes the terminal becomes so slow before highlighting will work properly that the user will have to decide whether or not highlighting is worthwhile.

Finally install ERASE-TO-END-OF-LINE, INSERT-LINE and DELETE-LINE FUNCTIONS. These are supposed to speed things up. Sometimes they do and sometimes they slow things down (i.e., DELCUS and/or DELMIS have to be increased to get the display acceptable when any one or combination of these functions are installed).

As a rule of thumb, use only those which speed up operation. If any one of the special functions slows things down, do not install it (them) and let the software do that function instead.

If any of these functions or combination of these functions resulted in a significant increase (10 or more decrements of DELMIS:, 20 or more decrements of DELCUS:), it may be time to try the HIGHLIGHTING FUNCTIONS again (assuming they slowed things down and they were left outg in the previous step). Sometimes, when these functions actually do speed things up they can have a profound effect on the operation of the HIGHLIGHTING functions.

Note that "sufficient" may mean acceptable to the general user, but tweaking for maximum performance is the **American way** and is more often than not possible and effective.

Circumventing the System's
DELETE-Backspace "Feature"

BACKGROUND

When a command is being entered to the operating system and the DELETE (RUBOUT) key is used to erase the last character entered, standard CP/M echoes the character erased. A number of manufacturer's and distributors variants of CP/M 1.4 have a modification added in the I/O patch section of the system ("BIOS") to cause the DELETE key to erase the character on the screen instead of echo another copy of the character erased. This modification works by outputting "backspace, space, backspace" in place of the next character output after a DELETE is input.

While a convenience in entering normal system commands, this feature interferes with WordStar operation: the next character output by WordStar after a DELETE is input is normally the beginning of a cursor positioning sequence, and if it is not transmitted without modification, the results on the screen are disastrous. Hence, there are provisions in USER1 for disabling the DELETE-backspace "feature".

SYMPTOMS

If your operating system erases characters on the screen, rather than echoing characters, when you use the DELETE key while inputting a system command, AND if the screen line containing the cursor is not correctly updated when you use the DELETE key while editing with WordStar, or the cursor is misplaced after use of the DELETE key, then your system has the DELETE-backspace "feature" and this "feature" must be disabled for correct screen updating in WordStar.

Examine the code of the BIOS (I/O patch) section of your system (listings of this portion of the system are normally supplied, or available on request, or you may poke around with your debugger without a listing) to determine how your DELETE backspace "feature" works, and apply one of the following methods to disable it.

Zeroed After Character Input (ZAFCIN)

Many DELETE-backspace implementations set a flag when a DELETE is input, or just store the last character input, in a fixed memory location, then substitute "backspace, space, backspace" for the next character output after a DELETE is input. Such implementations can be disabled when WordStar is running by patching the address of this location into USER1 at ZAFCIN: if ZAFCIN is non-zero, the location it points to is Zeroed AFter Character INput by WordStar. For example, S. D. Sales and Digital Microsystems' versions of CP/M, among others, store the last character input in location 4F hex. Patching ZAFCIN to 4F prevents the DELETE-backspace feature in these systems from interfering with WordStar's screen updating after the DELETE key is used.

Rubout Fix Locations
(RUBFXF and RFIXER)

These USER1 locations may effect a partial fix to the DELETE-backspace problem in cases where ZAFCIN cannot be effectively applied. If RUBFXF (RUBout FiX Flag) is patched non-zero, then the contents of RFIXER is output immediately after a DELETE is input. Put a relatively harmless character in RFIXER - try

null (00 hex), backspace (08 hex), or space (20 hex). When this character is output, your system will replace it with "backspace, space, backspace"; this will have less deleterious effect than changing the beginning of a subsequent cursor positioning string to "backspace, space, backspace". The results will probably be a single blanked screen position, instead of an entire messed up line and a misplaced cursor.

Custom Console Driver Routines

Items UCNSTA, UCONI, and UCONO allow installation of custom terminal I/O routines to be used in lieu of calls to the operating system's "BIOS" entry points.

To facilitate special video board installation, the custom terminal output routine (UCONO, as detailed in the listing comments) receives the following information: character to be displayed (with high order bit on for highlighting if HIBIV is patched non-zero), row, column, number of character positions from beginning of screen to cursor position, and number of character positions from beginning of screen to beginning of screen line containing cursor.

Note that the custom terminal character input routine (UCONI) may be called whether or not the status routine (UCNSTA) has already indicated that a character is available, despite a comment to the contrary in a prior release USER1 listing. Thus, your UCONI routine must include code to wait if necessary for a keystroke.

Delays

Items DEL1 through DEL4 allow control over the delay times used within WordStar to blink the cursor, hold the sign-on on the screen, etc. You may wish to vary these to accomodate your CPU speed or to suit your preference.

Note

Near the top of page 15 (Appendix E) are three special flags, TRSCRS, TRSCIF, and HETHBS. These do nothing in normal WordStar; they are active only in special versions, and are appropriately set by the INSTALL program supplied with those versions.

Patch Space for Added Subroutines

Items UCRPOS, INISUB, UNISUB, and others allow for a user-added subroutine; however, space is provided at these items for a JMP instruction only. There is space for a considerable amount of code at MORPAT, on the last page of the USER1 listing. If more space is needed, go to the free memory area, as pointed to by the actual contents (examine with DDT) of PBGMEM at the end of USER1. If you make additions there, be sure to patch PBGMEM to point beyond your additions, and be sure to determine and use the necessary SAVE command size — note that there are several thousand bytes between the normal end of the .COM file and address contained in PBGMEM.

Patches in this area must be made with your debugger (DDT); INSTALL's patcher will not correctly make patches in this area. Also, if you operate on your WordStar with the INSTALL program after adding code at the end, you will need to redo your additions — INSTALL will delete any code beyond the normal end of WordStar.

Testing Your Terminal Installation

Review Section 5 ("Testing WordStar"). That section shows various correct and incorrect screen displays, and gives likely causes of the incorrect displays. The tests given there will help you determine whether your installation is functioning correctly, and, if not, which patch item is most likely at fault.

The Page Intentionally Left Blank

Section 7
Custom Printer Installation

Modifications in the printer patch area are used to support optional printer
features, to install unusual printers which are similar to, but not exactly,
"Teletype-like", and to support communications protocols including specif-
ication of ETX/ACK message length. Modifications in the printer patch area are
also used to handle unusual installation requirements with regard to the
transmission of characters from (as required by communications protocols,
Section 2) and to the printer.

This manual does not cover patching to support the features of daisy-wheel
printers. The INSTALL program performs complete installation to support all
available features of the common daisy wheel and similar printers (including
NEC 5500-series, Diablo, and Qume printers). Patching for such printers is
extremely complex due to the interaction of many features and the requirements
of bidirectional printing, variable character width, and variable line height.
By purchasing **Customization Notes**, you can proceed with such patching.
However, all aspects of transmission of characters to and from serial daisy
wheel and similar printers are accessible and documented in this section.

The assembly listing of module USER4 in Appendix F shows all modifiable items
relating to Teletype-like and other non-daisy printers, and all modifiable
items relating to transmission of characters to and from Teletype-like printers
and serial daisy wheel and similar printers.

The rest of this section will follow the approximate order of items in the
USER4 listing, to facilitate relation of the text to the listing. Users making
an installation requiring a communications protocol (Section 2) will probably
be first interested in the printer driver patch items; these are described
later in this section ("Printer Drivers").

PRINTER TYPE AND RELATED ITEMS

Printer Overstrike Method (POSMTH)

POSMTH determines how overprinting, as required for boldface, double strike,
underline, backspace, etc. is acheived.

If POSMTH contains FF hex (as set by INSTALL when "Any Teletype-Like Printer"
is selected), WordStar will overprint by sending a carriage return code (see
item PSCR) followed by another complete line, containing spaces in columns not
to be overprinted. Several overprint lines for the same document line will be
sent if necessitated by the use of multiple enhancements or boldface.

If POSMTH contains zero (as set by INSTALL when "Teletype-like Printer That Can
Backspace" is selected), WordStar will overprint by backspacing (see item
PBACKS in the next subsection) then sending the character to be overstruck as
each character position requiring multiple strikes is encountered. POSMTH=0
produces faster printing than POSMTH=FF for printers that can backspace; also,
POSMTH=0 will allow printing underline, boldface, backspace, etc. on printers
that can backspace but cannot return the carriage without line feeding.

If any daisy wheel or similar printer is selected in INSTALL, POSMTH will be set to 1 and should not be altered.

Bold-Strike (BLDSTR)

BLDSTR contains the number of strikes of each character used for the "boldface" print enhancement. For Teletype-like printers, it may be increased or decreased to yield darker or lighter boldface; for daisy wheel and similar printers it should not be altered.

Double-Strike (DBLSTR)

DBLSTR contains the number of strikes (normally 2) used for the "double strike" print enhancement; it may be increased for darker "double strike" or reduced to 1 for no double strike, on any printer type.

PRINTER FUNCTION STRINGS

Patchable strings for a number of mandatory and optional printer functions are provided. Each string consists of the number of characters, followed by the character values. When altering a string, make sure you set the number of characters correctly. The optional string items should have a zero "number of characters" if the optional function is not installed.

Advance to the Next Line (PSCRLF—
Print String: Carriage Return, Line Feed)

This is the character string, normally "carriage return, line feed," sent to advance a non-daisy printer to the beginning of the next line. The characters in the string may be altered as required by unusual printers; the count may be increased to send nulls (zeroes) (up to a total of 10 characters) after the character string is sent if the printer requires a delay while the carriage returns and the paper advances.

Return to the Start of the Same Line
(PSCR—Print String: Carriage Return)

This is the character string, normally carriage return only, used to return the carriage of a non-daisy printer to the beginning of the same line. This string is used to permit overprinting for underline, boldface, etc. if POSMTH (above) is FF hex; it is also used whenever a carriage return without a line feed is encountered in the document, if POSMTH is FF or 0 (see "Overprint Lines" in the Reference Manual).

Non-Daisy Backspace (PBACKS)

This is the character string, normally an ASCII "backspace" character, used to backspace a non-daisy printer. This string is transmitted if POSMTH (above) is zero in order to permit printing a character in the same position as the preceding character for underline, boldface, backspace, etc. Note that if POSMTH is not zero this string is never transmitted and thus the printer need not be capable of backspacing.

Non-Daisy Half-Line Advance
(PSHALF—Optional)

This is a character string to return the carriage and advance the paper one-half line, for non-daisy printers with this capability but without the capability of advancing the paper backwards a fractional line (see also ROLUP and ROLDOW below). If installed, the half-line advance will be used to print subscripts and superscripts one-half line below or above, respectively, the rest of the line.

Example: If the printer advances one-half line for each line feed code sent, install the sequence "carriage return, line feed" at PSHALF and the sequence "carriage return, line feed, line feed" or "carriage return, line feed, carriage return, line feed" at PSCRLF.

Note

The INSTALL Printer Menu selection "Half-Line-Feed Printers" sets PSHALF and PSCRLF to the foregoing strings; this selection is otherwise identical to the selection "Teletype-Like Printer that can BACKSPACE".

Non-Daisy Roll UP (ROLUP—Optional)

This is a character string to roll the carriage UP (move the paper down) a fractional line, for non-daisy printers with this capability. If ROLUP and ROLDOW are installed, subscripts and superscripts will be printed by moving the carriage up and down in the course of printing a line.

Non-Daisy Roll Down (ROLDOW—Optional)

If ROLUP (preceding) is installed, then the string to roll the carriage down (paper up) a fractional line should be installed at ROLDOW.

Non-Daisy Alternate Pitch (PALT—Optional)

A string may be installed here to set the printer to an alternate character pitch (character width), for non-daisy printers with this capability. An alternate pitch print control (^A; **Reference Manual**) in the document will then invoke transmission of this string.

Note

WordStar contains the necessary logic to restore normal pitch while printing page offsets, headings, etc. that were specified when normal pitch was in effect.

Non-Daisy Standard Pitch (PSTD—Optional)

If PALT (preceding) is installed, then the string to restore the printer to its normal character pitch should be installed at PSTD.

Special Functions (USR1 through USR4—Optional)

These strings may be installed to invoke otherwise unsupported special functions of your printer (e.g. changing character fonts or activating a sheet

feeder) in response to the User Printer Function print control characters (^Q, ^W, ^E, and ^R, **Reference Manual**) imbedded in your document. For character pitch changes, PALT and PSTD should be used in preference to USR1 through USR4. If you have a daisy printer, USR1 through USR4 control strings should be installed with great caution, and tested thoroughly, as complex interactions with WordStar's operation of the printer are likely to occur despite the fact that WordStar always prints forward when printing a line containing a user printer function control. For some printers, INSTALL may define one or more of these controls; check Appendix D with regard to your printer.

Non-Daisy Ribbon Color
(RIBBON and RIBOFF—Optional)

These strings may be installed by the user to allow selection of alternate ribbon color with the ^Y print control (**Reference Manual**) on non-daisy printers with this capability; for daisy wheel and similar printers, RIBBON and RIBOFF are set appropriately by INSTALL.

Non-Daisy Initilization String
(PSINIT—Optional)

This is a string transmitted to the printer at the start of printing. For non-daisy printers, you may add any desired controls, (e.g., to turn the motor on or select a line spacing or character pitch). INSTALL puts a carriage return in this item; add your bytes and increase the count appropriately. For daisy printers, this item is appropriately set by INSTALL and should not be altered.

Non-Daisy Finish String
(PSFINI—Optional)

Similar to PSINIT, this string is sent at the conclusion of printing.

Initialization and Finish Subroutines
PRINIT and PRFINI—Optional)

These are <u>subroutines</u> called at the beginning and end of printing, respectively; they may be used to perform printer assignment or special initialization functions that cannot be performed by transmitting a character string. Space is provided for a JMP only; for finding space to put your subroutine, see "Terminal Patch Area," Section 6.

PRINTER DRIVERS

Printer Driver Flags

<u>PRINTER DRIVER FLAG (CSWTCH)</u>

Value determines which of the printer drivers (see next subsection) is used to transmit characters to (and possibly from) the printer:

    0: CP/M "List Output" Device
    1: WordStar's Port Driver
    2: User-installed Printer Driver Subroutines
    3: OEM Daisy Wheel and Similar Printer Driver
    4: Alternate Console Printer Driver

CSWTCH applies to all printers. CSWTCH is set by INSTALL in accordance with the choice made at the "Printer Driver" menu.

Printer Busy Test Flag (HAVBSY)

HAVBSY should be set to

o   non-zero if the printer driver in use has a "printer busy test" implemented

o   zero if no provision has been installed for determining when the printer is ready to accept a character.

When non-zero, WordStar will not output to the printer until the printer is ready, and WordStar will check more often whether the printer is ready to accept a character. Thus, a correctly installed printer busy test, plus a non-zero value in HAVBSY, cause the printer to run more steadily when editing is being performed at the same time as printing, while improving keyboard response in editing because the printer output routine will never "hang" while waiting for the printer to be ready to accept a character.

INSTALL sets HAVBSY non-zero if the port driver is selected, or zero if another driver is selected. The user should set HAVBSY non-zero after adding a busy test to the CP/M list device driver or the alternate console driver, or after installing custom driver subroutines that include a printer busy test.

Code for four distinct printer drivers is provided in USER4, and thus accessible to user modification. Location CSWTCH, described above, determines which driver is called.

Driver Entry Points

As discussed in Section 2, WordStar must be able to input from the printer as well as output to the printer when a "Communications protocol" (as required for daisy wheel and similar printers at 1200 baud) is in use. Also, WordStar's performance improves when a "printer busy test" is available to determine whether the printer is ready to accept an output character. Thus, each driver has three entry points, defined as follows:

Printer Busy Test: This entry should return the carry flag set (1) if the printer is NOT ready to accept a character; the carry flag should be returned clear (0) if the printer is ready to accept a character or if the busy test is not implemented. If this entry is implemented, HAVBSY (above) should be non-zero; if not implemented, HAVBSY should be 0.

Print Character: This entry should output the character in the A register to the printer. If HAVBSY is non-zero, this entry is not called until the printer busy test entry returns the carry flag clear.

Input Character From Printer: This entry need be implemented only if a communications protocol (Section 2) requiring input from the printer is to be used. This entry should return the carry flag set (1) if no character has been received from the printer since last called, or return the character in the A register and the carry flag clear (0) if a character has been received.

Specific descriptions of the printer drivers follow.

CP/M List Device Driver

The "print character" entry point to this driver is implemented to make the appropriate operating system call to print the character. The "printer busy" and "input character from printer" entries are not implemented, as standard CP/M provides no system calls for these purposes; space is provided at LIBSY and LISINP respectively for patching in JMP instructions to user-installed subroutines for these purposes. For finding space into which to patch added subroutines, see the end of the subsection on "Printer Driver Flags" earlier in this section.

If you add a "printer busy test" routine, patch HAVBSY to a non-zero value.

If you use a communications protocol with the List output driver, you must code and patch in an "Input character from printer" routine, and put a JMP to it at LISINP.

WordStar's Port Driver

The "Port driver" does direct hardware I/O to any printer interface using at most one output data port, one output status port, one input data port, and one input status port. The ports may be I/O ports or memory-mapped ports. The port driver includes implemented printer busy test and printer character input routines. When the port driver is selected during installation, the INSTALL program will accept the port numbers and status bits from the operator, or, on request, try to find them experimentally as detailed in "Port Driver" under "Printer-Related Selections."

The port driver code is in USER4, and thus accessible for further modification if desired. Note that the port driver as shown in the USER4 listing access I/O ports with "IN" and "OUT" instructions, but that a NOP is present after each to allow substitution of "LDA" and "STA" instructions for memory-mapped I/O. INSTALL makes this substitution if memory-mapped I/O is specified.

Alternate Console Printer Driver

The alternate console driver will drive a printer interfaced to be one of the four physical console devices (TTY:, CRT:, BAT:, and UC1:) other than the terminal, under operating systems which support multiple console devices and device assignment via IOBYTE (location 3; see your operating system documentation). The alternate console driver supports character input from the printer, making it convenient for use with communications protocols (as required for daisy wheel printers interfaced at 1200 baud); the alternate console driver does not include a printer busy test unless added by the user at location ACBSY (if you add a busy test, be sure to patch HAVBSY non-zero).

The alternate console driver entries work by changing IOBYTE, doing the console input or output, then restoring IOBYTE. The IOBYTE console field value used for printer access is taken from location CONFIE. CONFIE is set to 0 by the INSTALL program when the TTY: printer driver is selected, or to 1 when the CRT: console driver is selected. One of the other two console devices may be accessed by patching CONFIE to 2 or 3.

User-Supplied Printer Driver Subroutines

Space is provided at PUSEND, PUBSY, and PUINP for patching in JMPs to user-coded and user-installed printer character output, printer busy test, and printer character input routines. For finding space into which to patch your routines, see the end of "Terminal Patch Areas," Section 6; also, you may patch over the other drivers if you do not expect to use them at a later date. Note that the printer character input routine is mandatory if a communications protocol is installed; otherwise, this routine is not needed. Also patch HAVBSY non-zero if the busy test entry is implemented, or zero if it is not implemented.

CSWTCH must be set to 2 to cause WordStar to call the user-installed printer driver subroutines; this patch may be achieved by selecting "User Subroutines" in INSTALL before patching in your routines.

OEM Daisy Printer Driver

The OEM printer driver is pre-configured to drive certain "OEM" daisy printers through the MicroPro "I/O Master" interface addressed at ports F8-FA hex, as detailed in Appendix D and Section 2. Modification of this driver should not normally be necessary; the OEM driver is not included in the USER4 listing in Appendix F.

INSTALL sets CSWITCH to 3 to invoke the OEM daisy printer driver when "I/O Master Interface / O.E.M Printer Combination" is selected at the Printer Menu.

COMMUNICATIONS PROTOCOLS

A communications protocol (Section 2) is normally used with a (serial) daisy wheel or similar printer interfaced at 1200 baud; in these cases, the communications protocol items are correctly set by the INSTALL program. However, the communications protocol logic will function with any printer (except an OEM daisy printer, for which it is not pertinent). For an unusual Teletype-like printer that requires a protocol, you may wish to patch these items.

Protocol Type (PROTCL)

PROTCL determines type of communications protocol. The types of protocols are defined in the program comments and also in Section 2:

    0: None
    1: ETX/ACK   (and see EAKBSZ, next)
    2: XON/XOFF

PROTCL is set by INSTALL in accordance with the selection made at the "Communications Protocol" menu.

ETX/ACK Message Length
(EAKBSZ—ETX/ACK Buffer Size)

EAKBSZ contains the message length for ETX/ACK protocol; it must be equal to or less than ONE-HALF OF the printer's buffer size, as WordStar keeps two "messages" active at a time. The default value (127) assumes the printer can hold a buffer of at least 254 bytes; be sure to reduce it if you install ETX/ACK protocol for a non-daisy printer with a smaller buffer. When a daisy wheel or similar printer is installed with ETX/ACK protocol, INSTALL automatically sets EAKBSZ for the buffer capacity of the particular printer selected.

Section 8
Additional Modifications

OTHER PATCH ITEMS

In addition to the previously described patch items relating to terminal and printer installation, WordStar can be patched for a number of additional items, including the following:

o   Command keys, including prefix relationships and keystroke synonyms

o   All texts — menus, error messages, question prompts, etc.

o   Initial values for help level and insert toggle

o   Initial values for all on-screen formatting options

o   Default page format

o   Flag characters (rightmost screen column)

o   Serial diasy wheel and similar printer function strings

o   OEM daisy printer driver

Complete listings of the patch areas for these items, along with discussions, are contained in a separate publication, the WordStar Customization Notes. If you are interested in obtaining a copy of that publication, contact your dealer.

Descriptions of a few additional patch items of particular interest follow. The items are identified here by label only; the items may be patched (and/or their current hexadecimal addresses obtained) by using INSTALL's patcher as described in Section 3. Further discussion of these and many other items, plus pertinent listings, are included in the WordStar Customization Notes.

Initial Help Level (ITHELP)

Change this byte to 0, 1, 2, or 3 as desired to set the "Help Level" in effect when WordStar is invoked.

Help Level Message (NITHLF)

Setting this byte to 0 enables display of the message

> For maximum help (full menu display),
> select Help Level 3 by typing ^JH3.
> This message will clear when a key is pressed.

at the start of the first edit if help level is 1 or 2. Setting this byte to FF suppresses the above message. Use 0 if ITHELP (previous item) is changed to 2 and some users will be new WordStar users to whom level 3 would be helpful. Use FF if ITHELP is 3, so the above message will **not** appear if the user types H2 at the no file menu before initiating an edit.

Initial Insert Toggle (ITTTOG)

Change this byte to 0 to make WordStar come up with insertion OFF, FF hex to come up with insertion ON.

Initial No-File Menu Directory
Display Toggle (ITDSDR)

Set to FF hex to come up with directory display ON; to 0 to come up with directory display OFF.

Justification Toggle (INITWF±1)

Set this byte to 0 to come up with justification OFF (ragged right); set to FF hex to come up with justification ON.

Hyphen-Help Toggle (INITWF±4)

Set this byte to 0 to come up with "Hyphen-help" OFF; FF hex to come up with "Hyphen-help" ON.

Decimal Point Character (DECCHR)

This byte is normally 2E hex to designate a **period** as the decimal point in decimal tabs; European users might wish to change to 2C hex (**comma**).

Hyphenation Pauses (HZONE)

Decrease for more hyphenation pauses (i.e., to hyphenate shorter words) under ^B with Hyphen-help on; increase for fewer such pauses. Normal value is about 4.

Form Feeds (PODBLK±1)

Default for the Print and MailMerge USE FORM FEEDS question: make FF hex to use form feeds unless operator explicitly enters a "no" response.

Omit Page Numbers (ITPOPN)

Default omit-page-numbers flag: patch non-zero for implied ".OP" at beginning of each file, i.e., to omit page number at bottom of each printed or Merge-printed page unless and until .PN dot command is encountered in document.

Variable Name Delimiters
(VARCH1 and VARCH2)

Delimiter characters used before and after variable names where the variable value is to be inserted in a document being MailMerged. VARCH1 is the character used before the variable name; VARCH2 is the character after the variable name. Both are normally "&". They may be changed if desired; if changed, they may be the same or different.

Data File Field Delimiter (RVELIM)

Delimiter character used between fields in a <u>data</u> file being read by Mail-Merge. Normally 2C hex (comma).

Initial Default to N Mode (NONDOC)

Patch to OFFH to enable default entry to non-document mode (N) after response to the prompt, "FILENAME.TYP."

Automatic Backspace Characters
(AUTOBS through AUTOBS+9)

Up to 10 "autobackspace" characters may be defined by entering their ASCII codes at **AUTOBS** and following locations. Whenever one of these characters is typed during text entry, WordStar will automatically enter a backspace print control (^H) into the file after the character. This feature reduces the number of keystrokes required to enter text containing accent marks, in cases where the accent marks are separate characters on the printer. For example, if you patch 60 hex (the ASCII code for "`") at **AUTOBS**, then whenever "`" is pressed during text entry, "`" and a control-H are entered into the file, making it possible to enter "à" with the keystrokes `, a only.

PATCHING WORDSTAR'S PRINTER DRIVER
FOR CERTAIN TERMINALS

Altos

	FUNCTION	ADDRESS				VALUE
		2.10	2.25	.93A	1.01	HEX
1.	MASK ALL BUT BUSY BITS (ANI)	72C	72C	5E8	618	04
2.	MAKE BITS ONE IF READY (XOR)	72E	72E	5EA	61A	04
3.	OUTPUT PORT (DATA)	734	734	5F0	620	1E
4.	INPUT PORT (DATA)	741	741	NUSD	62D	1E
5.	MASK FOR CHAR FRM PTR READY	73B	73B	5F6	627	01
6.	MAKE BITS ONE FOR CHAR READY	73D	73D	5F8	629	01
7.	STATUS PORT	729	729	606	615	1F
		738	738		624	1F

INSTALLATION NOTES: Uses port designated as printer port in ALTOS documentation.

NUSD = NOT USED IN THIS VERSION

Dynabyte

	FUNCTION		ADDRESS				VALUE
			2.10	2.25	.93A	1.01	HEX
1.	MASK ALL BUT BUSY BITS (ANI)		72C	72C	5E8	618	10
2.	MAKE BITS ONE IF READY (XOR)		72E	72E	5EA	61A	10
3.	OUTPUT PORT (DATA)		734	734	5F0	620	86
4.	INPUT PORT (DATA)		741	741	NUSD	62D	80
5.	MASK FOR CHAR FRM PTR READY		73B	73B	5F6	627	08
6.	MAKE BITS ONE FOR CHAR READY		73D	73D	5F8	629	08
7.	STATUS PORT		729	729	606	615	83
			738	738		624	83
8.	ZERO THESE ID DATA INPUT & OUTPUT PORTS ARE NOT SAME (not relevant to RELEASE's 1.00 and later)		UNSD	UNSD	5FB	UNSD	00
			UNSD	UNSD	5FC	UNSD	00
			UNSD	UNSD	5FD	UNSD	00
			UNSD	UNSD	5FE	UNSD	00
			UNSD	UNSD	5FF	UNSD	00
			UNSD	UNSD	560	UNSD	00

NOTES: 04-28-80 –   It will be necessary to connect pins 4,6,8, and
                     20 at the printer side of the cable to each
                     other. The pins at the computer side can be
                     left unconnected. This will provide that all
                     handshaking is done via software (this means
                     you must use ETX/ACK protocol).

                     UNSD = NOT USED IN THIS VERSION

Vector Graphics

	FUNCTION		ADDRESS				VALUE	
			2.1	2.25	1.01		HEX	
1.	MASK ALL BUT BUSY BITS (ANI)		729	729	618		01	
2.	MAKE BITS ONE IF READY (XOR)		72C	72C	61A		01	
3.	OUTPUT PORT (DATA)		734	734	620		06	
4.	INPUT PORT (DATA)		741	741	62D		06	
5.	MASK FOR CHAR FRM PTR READY		73B	73B	627		02	
6.	MAKE BITS ONE FOR CHAR READY		73D	73D	627		02	
7.	STATUS PORT		729	729	615		07	
			738	738	624		07	

NOTES: 04-28-80 – You will very likely have some difficulty
                       bringing WORDSTAR up on a VECTOR GRAPHICS MZ
                       but this has nothing to do with the printer
                       patch. See the document "NOTES ON CONFIGURING
                       WORDSTAR FOR THE VECTOR GRAPHICS MZ", available
                       from your dealer.

           UNSD = NOT USED IN THIS VERSION
           NR   = NOT REQUIRED

WORDSTAR FOR MP/M

A WordStar which is targeted for use under MP/M should be installed to take
advantage of certain MP/M-specific functions and/or avoid certain CP/M-specific
conditions.

TCKFLG: The use of the MP/M system clock for determining certain timing
functions within WordStar will significantly improve performance when more than
one WordStar is running under the same MP/M system. Changing TCKFLG: from 00
to FFH will cause WordStar to utilize the MP/M clock rather than its own
isolated 16-millisecond timing loop.

RSTFLG: Due to the presence of a number of USERS on a single system and to the
nature of multi-operating systems in general, the normal disk "remounting" or
RESET function is often a nuisance. This reset function can be suppressed for
operation in MP/M environments by patching the flag RSTFLG: to FFH.

NMOFUS: NMOFUS+1: The number of users on the system is set to 1, but can be patched to handle up to 255. Resetting will increase throughput of WordStar under MP/M (or on a console-driven, interrupt-driven computer), and will cause WordStar not to poll CSTAT as often. Be sure to set NMOFUS+1:=NMOFUS: for initial response.

DEFDSK: Due to the possible configurations of the multiple user files, it is sometimes desirable to redefine the disk (read USER) to which WordStar will automatically go to find the overlay files. This can be done by placing the suitable drive number in DEFDSK: where A: is 01H, B: is 02H, etc.

Appendix A
INSTALL Error Messages

This appendix provides explanations of the messages that can be displayed while you are running INSTALL (Section 3).

NOT ENOUGH MEMORY TO RUN INSTALL,
OR YOUR OPERATING SYSTEM IS NOT
RELOCATED TO MAKE ALL RAM AVAILABLE.

> This message will occur when INSTALL is invoked if your computer system contains insufficient memory. Also, this message will occur even when sufficient memory is present in the computer but your operating system (CP/M or equivalent) has not been "relocated" to make the RAM available. Such relocation is accomplished with a system command sometimes called "CPM", "MOVCPM", or "RELOC" — see your system documentation for details.

NOT ENOUGH MEMORY TO RUN WordStar,
OR YOUR OPERATING SYSTEM IS NOT
RELOCATED TO MAKE ALL RAM AVAILABLE.

> This variation of the preceding message will occur when the memory available is sufficient to run INSTALL, but not enough to run WordStar. If you get this message, you can still produce an installed WordStar on a diskette file (for use after more memory has been made available on the system, or for use on a different system) by re-invoking INSTALL and specifying Installation Option B. This error message can occur only on normal installation and on those options which run the installed WordStar after installation has been completed. See Section 1 for WordStar's RAM memory requirement.

WSU.COM NOT FOUND ON CURRENT DISK

> This message occurs during "normal" installation, or under Installation Option A ("Installation Options," Section 3) if the uninstalled WordStar (file WSU.COM) is not found on the logged drive. For example, if WSU.COM is not on the diskette in any drive, or if the current drive is A: but file WSU.COM is on the diskette in drive B. Copy WSU.COM onto the diskette in use, or use installation option B or C to read it from the diskette in another drive.

THAT FILE DOES NOT EXIST

> This message does not occur during "normal" installation. Under Installation Option B, C, or D, this message indicates that no file was found with the name you entered for the WordStar to be installed. This message usually indicates that the name was mistyped, the drive was omitted, or the desired diskette was not in the drive. After displaying the message, INSTALL asks for the file name again, allowing you to enter the corrected name or allowing you to reenter the name after inserting the correct diskette.

INCORRECTLY FORMED FILENAME

Under Installation Options B, C, and D, this message indicates that a file name entered was not a correctly formed CP/M file name as described in the Reference Manual. After displaying this message, INSTALL will repeat the file name question. Enter the corrected filename.

UNEXPECTED END OF FILE DURING READ

The file from which the uninstalled WordStar was being read was shorter than expected. This message may indicate that you are using a bad copy of WSU.COM — try getting a fresh copy from your distribution diskette. If you entered the file name under Installation Option B, C, or D ("Installation Options," Section 3), this message may indicate that the file you named was not a WordStar.

DISK FULL

DISKETTE DIRECTORY FULL

The diskette, or its file directory, has filled up while attempting to record the installed WordStar. After this message, the WS.COM (or other file being written under Installation Option B, C, or D) will not be valid. Arrange more diskette space (e.g., by copying some files off onto another diskette), then repeat installation.

ERROR CLOSING FILE

This message should not occur; it indicates a system failure, or that you changed diskettes while INSTALL was recording the installed WordStar.

This version of INSTALL is incompatible with the version of WordStar you are trying to install

This message can occur on using one release of INSTALL with a different release of WSU.COM, or with a previously installed WordStar of a different release. Use INSTALL and WSU from the same distribution diskette together. This message may also occur if the file from which the uninstalled WordStar is being taken (WSU.COM, or name entered by operator under Installation Option B, C, or D) does not actually contain a WordStar.

The INSTALL sign-on message, showing the release number, and the WordStar sign-on message, showing its release number, are displayed on the screen below this error message.

Appendix B
WordStar Versions for
Specific Computer Systems

Most computer systems use the standard version of WordStar, as documented in the rest of this manual. Special versions of WordStar are distributed for a few specific systems which require a highly specialized adaptation of WordStar. This appendix describes the differences between these special versions and the standard version.

If your system is not shown in this appendix, then it uses the standard version. The standard version is adapted to your terminal and printer using the INSTALL program, as described in Sections 2-4.

"Special WordStar versions" does not refer to the format upon which the WordStar is delivered. In many cases where a "special WordStar version" is available, MicroPro will also make available in its product line a "standard" version on the same format.

Two such cases are the Apple and H-89 products which are supplied on the Apple and H-89 formats, respectively, in both "special" and "standard" versions. See H-89 and Apple discussion for more details.

HEATH 89 VERSION

The special "Heath 89 Version" is intended to run on Heath 89 and Zenith 89 computers which have ROM in the first 16K. This version is origined at 4300 Hex (rather than the usual 100 Hex) and has the terminal pre-installed.

Note

An "A" appended to the release number (e.g., "2.25A") indicates the 4300 hex origin.

A "standard" version of WordStar on the H-89 format is available for Heath and Zenith 89 computers which have been modified to accept programs origined at 100 Hex. Select "Heath or Zenith 89" as terminal when INSTALLing.

Since the terminal is pre-installed, a file called "WS.COM" is supplied on the distribution diskette in place of the usual "WSU.COM".

Upon receiving your Heath 89 WordStar, do the following:

1. Format a blank diskette with the FORMAT program and place a CP/M system image on the diskette using the SYSGEN program.

2. Use FILECOPY to copy WS.COM, WSMSGS.OVR, WSOVLY1.OVR and INSTALL.COM from the distribution diskette to the newly formatted diskette.

The edit function may now be used, as the Heath 89 WordStar is supplied with the terminal pre-installed. To select a specific printer (or a different terminal, if you have an external terminal connected to your Heath/Zenith 89), use the INSTALL program (Section 3). Because of the limited capacity of a

Heath/Zenith 89 diskette, it is necessary to write the newly installed WordStar back onto the same file. We suggest the following steps:

3.   Invoke INSTALL by typing INSTALL and pressing RETURN (Section 3).

4.   Press N to get to the installation options menu.

5.   Press D to select installation option D ("Installation Options," Section 3). Enter the filename WS.COM.

6.   The space bar may be used to bypass the terminal menu.

7.   Make the desired printer selections ("Printer-Related Selections," Section 3), and complete INSTALLation in the usual manner ("Bypassing the Patcher" and "Confirming or Correcting Your Selections," Section 3).

TRS-80 MODEL I VERSION

Installation

Upon receiving your TRS-80 Model I WordStar, do the following:

1.   Format a blank diskette with the FORMAT program and place a CP/M system image on the diskette using the SYSGEN program.

2.   Use PIP to copy WS.COM, WSMSGS.OVR, WSOVLY1.OVR and INSTALL.COM from the distribution diskette to the newly formatted diskette.

The edit function may now be used, as TRS-80 Model I WordStar is supplied with the terminal pre-installed. To select a specific printer (or a different terminal, if you have an external terminal connected to your TRS-80), use the INSTALL program (Section 3). Due to the limited capacity of a TRS-80 diskette, it is necessary (in a single drive system) to write the newly installed WordStar back onto the same file. We suggest the following steps:

3.   Invoke INSTALL by typing INSTALL and pressing RETURN (Section 3).

4.   Press N to get to the installation options menu.

5.   Press D to select installation option D ("Installation Options," Section 3). Enter the filename WS.COM.

6.   The space bar may be used to bypass the terminal menu.

7.   Make the desired printer selections ("Printer-Related Selections," Section 3), and complete INSTALLation in the usual manner ("Bypassing the Patcher" and "Confirming or Correcting Your Selections," Section 3).

TRS-80 Keyboard

The TRS-80 Model I lacks a number of keys present on normal terminals. The following keys on the TRS-80 keyboard are used to perform the indicated functions in WordStar:

Regular key	TRS-80 key	Comments
CTRL	DOWN ARROW	To enter a control character, hold DOWN ARROW and press desired letter.
RETURN	ENTER	
ESCAPE	Hold DOWN ARROW, press UP ARROW	
DELETE, RUBOUT	BREAK	Delete character left of cursor
^H or ^S	LEFT ARROW, ^H, or ^S	Backspace cursor
TAB or ^I	RIGHT ARROW or ^I	Advance to next tab stop
(alpha lock)	CLEAR	Set keyboard for upper case letters only. Press again for lower case.

APPLE II VERSION

System Requirements

Welcome to WordStar! To be able to run WordStar on an Apple II computer, you must have the following:

o   A 48K or 64K Apple II computer (64K is not necessary, but is highly recommended—use either the language card or a 16K RAM card)

o   A MicroSoft Z-80 soft card

o   An 80-column video board (either the Videx VideoTerm or the M&R Sup'R'Terminal)

o   One of the following systems:

   DOS 3.2 (for the 13-sectored version of WordStar)

   or

   DOS 3.3 or the language system (for the 16-sectored version of WordStar)

Note

With either the language card or a 16K RAM card, more pages of text (about ten) can be put in memory for fast access. Without the additional 16K, text access will be slowed down as fewer pages are held in memory and the computer must access the disk drive more often. (EXAMPLE.TXT will not be available on the 13-sectored version.) In addition, a user will find that they are unable to <u>block move</u> more than one or two lines without the additional 16K of RAM, nor will they have simultaneous edit and print under this condition.

Installation

Upon receiving your Apple II WordStar, first study the Microsoft CP/M Manual, then do the following:

1. Format a blank diskette with the Microsoft FORMAT program (pp. 1-9 in the Microsoft manual).

2. Use the Microsoft COPY program to make a backup of the distribution WordStar diskette (pp. 1-10 in the Microsoft manual).

3. Place an image of your Microsoft CP/M operating system on the backup diskette.

    a. Do this by running the COPY program again; but this time, use the /S option (see COPY in the Microsoft CP/M manual.

    b. The /S function copies only the operating system to the backup diskette, rather than the entire disk.

    c. If you forget to use the /S for this step, you will just copy the CP/M disk onto your WordStar disk again.

4. Run the INSTALL program by typing INSTALL and pressing RETURN (Section 3 of this manual).

Ordinarily, INSTALL takes the original distribution file (WSU.COM) and writes a new file for a particular system (WS.COM or some other name). But because of the the limited capacity of an Apple II diskette (especially the 13-sector formatted version), you will have to use the same file name (WSU.COM) to put the newly installed WordStar back onto the disk. Steps 5-7 may be used:

5. Press N (for NO) to get to the WordStar installation options menu.

6. Press D to select installation <u>option D</u> (writing back to the same file—Section 3).

7. The computer will ask you for the name of the file that you are installing. Type WSU.COM and press RETURN.

8. In the Apple II menu, select the appropriate combination of 80-column videocard, upper/lower (U/L) case conversion method and availability of shift key modification (optional but recommended for extensive use of the shift function).

Currently the special Apple version of WordStar supports three video boards via two menu options:

    o   Videx Videoterm (cursor on)

    o   M&R Sup'R'Term (cursor off)

The Smart Term board (vended by Apple) is installed by selecting the Videx Videoterm option.

The first class (Videoterm) leaves the cursor on at all times. This should be your first choice for a trial video board if you are not using either of the video cards named above. If you cannot see the cursor, try the other option (Sup'R'Term). These menu options may be considered as "classes" of video boards and the user may, thereby, use them in installing a variety of Video boards which do not explicitly appear on the menus.

If you have the hardware to generate lower-case, then select the "hardware U/L conversion" option; otherwise, select the "software U/L conversion" option to allow WordStar to perform the conversion. Finally, by using the very simple shift key modification (see your Apple dealer), you can enable the software U/L conversion to use the SHIFT key instead of the ESC key to perform the shift function. Just select the "shift key mod" option.

In addition, Apple user's should note that the "special" Apple version DOES NOT SUPPORT outboard terminals via a serial interface card. The user should acquire the "standard" WordStar on Apple format if they intend to use WordStar on an Apple with an outboard terminal.

    10. Make the desired printer selections (Section 3) and complete installation in the usual manner. Note that a printer must use a protocol to run at over 300 baud and that the Apple Asynchronous serial card will not properly support a protocol. For user's who wish to use WordStar's built in port driver (necessary if one wishes to operate the printer at over 300 baud since the CP/M LIST device does not support protocols) the following port and bit assignments are required when answering port driver questions:
        Answer M (Memory mapped) to the first question.
        Data Port is at E09F
        Status Port is at E09E
        Receive Ready bit is 01
        Transmit Ready bit is 02

Note

For those who wish to change the name of the resultant 'WSU.COM' file to a filename other than WSU, be advised that renaming under CP/M after INSTALLation will result in the disabling of the 'R' (Run program) command. Attempts to use the 'Run' program after a rename will result in the error message 'Cannot find FILENAME.FILETYPE', where FILENAME.FILETYPE is the original name of the file as established by the INSTALLation program.

The Apple II Keyboard

The Apple II lacks some keys found on most terminals. In particular, there is no provision for generating lower case or a number of special characters. If the "software U/L case conversion" option was selected during installation, then WordStar will provide for generation of lower case, as well as the full ASCII character set.

The ESC key is used by the Apple II for the shift lock/unlock function. In addition if the SHIFT key modification is not installed then ESC also doubles as the shift key. In this case, press ESC **twice** for shift lock and **once** for regular shift. Note that the ESC key is also used for WordStar functions. Whenever you press ESC for a WordStar function, an additional press or two will be needed to return to the proper upper/lower case mode. (A little experimentation here can be helpful.)

The LEFT ARROW key, which was previously a backspace (CTRL H), has been translated to give the RUBOUT code. This allows LEFT ARROW to be used to delete a character to the left of the cursor. If the SHIFT key modification has been made the FORWARD ARROW key can move the cursor to the right without altering the text under it.

The nine ASCII characters not usually available from the Apple II Keyboard are software generated in the lock mode.

WordStar has adapted the alpha lock function (using the ESC key as described above) to give you the complete set of possible characters, including some that don't appear on the Apple II keyboard. For example, normally you get an exclamation point when you hold the SHIFT key down and press 1. However, when you are in alpha lock mode, you will see a vertical line instead on the screen. The same principle applies in the following cases:

Key	SHIFT Key in Unlocked Mode	SHIFT Key in Alpha Lock Mode
"1"	Exclamation Point (!)	Vertical Line (|)
"7"	Closing single quote ( )	Opening single quote ( )*
"="	Equal Sign (=)	Underline (_)
"?"	Question Mark (?)	Backslash (\)
"8"	Left Parenthesis (()	Left Brace ({)
"9"	Right Parenthesis ())	Right Brace (})
","	Left Angle Bracket (<)	Left Square Bracket ([)
"."	Right Angle Bracket (>)	Right Square Bracket (])
"M"	Capital "M" (M)	Tilde (˜)

* Cannot be displayed by the Sup'R'Term; you will see a space instead.

To type "@" and "^," use alpha lock mode with the shift key depressed, just as the key tops indicate.

Appendix C
Specific Terminals

EXPLANATION

This appendix describes features available and gives configuration hints for many of the terminals on INSTALL's terminal menu.

Note

If your terminal had an auto line feed switch, make sure it is OFF.

THE TERMINALS

Beehive 150

No highlighting, erase to EOL, or line insert/delete implemented.

Cromemco 3100

Same as Beehive 150.

Hazeltine 1500

AUTO LINE FEED switch (under little cover above keyboard) must be OFF. Highlighted text displays dim. Erase end line and line insert/delete are used.

Hewlett-Packard 2621 A/P

No highlighting, erase EOL, or line insert/delete implemented.

IMSAI VIO

This includes the IMSAI VDP-40, VDP-80, PCS 80/30, and other integrated systems containing the VIO display board. Highlighting and cursor display is by inverse video; WordStar blinks the cursor when necessary to distinguish it from highlighted areas. The video RAM is accessed directly at F000 hex, producing fast screen update. The VIO must have the firmware ROM (as it always does in the above integrated systems), or equivalent routines must be present in your operating system.

Infoton I-100

Highlighted text displays dim; line insert/delete are implemented.

Lear-Siegler ADM-3A

The CURSOR CONTROL switch inside the terminal must be ON; the SPACE/ADVANCE switch should be set to SPACE. No highlighting.

Lear-Siegler ADM-31

Highlighted areas display dim. Erase end line and line insert/delete are used.

MicroTerm ACT IV

Highlighted text displays dim, assuming terminal was in dim state when WordStar invoked. Erase end line implemented; terminal does not have line insert/delete invocable from CPU.

Processor Technology VDM / SOL

The VDM is accessed through the operating system; ØB hex is sent to clear the screen, escape, 2, line number, escape, 1, column number is sent to position the cursor. No other functions are implemented. WordStar's working with the VDM depends on the particular adaptation of CP/M to the VDM not interfering; in particular, transmission of all line feeds and all non-redundant carriage returns must occur.

Soroc IQ-120

No highlighting, erase EOL, or line insert/delete implemented.

Appendix D
Specific Printers

DAISY WHEEL AND SIMILAR PRINTERS

Features

All printers described in this section support all of WordStar's print enhance-
ments and other features, as described in the Reference Manual, except as noted
in individual descriptions below. All printers described here will print
bidirectionally; "formed" text will printed with Microspace Justification.

Choice of Typewheels

The interchangeable typewheels for daisy printers come in many choices of
characters and character arrangements. The printed characters will match those
seen on the screen during editing only if the typewheel in use contains the
standard ASCII characters in the standard ASCII order. Some typewheels have
other character graphics; many have a different character arrangment so that,
for example, a period in the document will print as some other character. Some
compatible typewheels for each printer are listed below.

OEM DAISY WHEEL AND SIMILAR PRINTERS

WordStar can drive the following "OEM" (Orginal Equipment Manufacturer) daisy
wheel and similar printer models when interfaced with the MicroPro "I/O Master"
interface board:

    Diablo Hy-Type II 1300 Series
    Qume Sprint 3 (with cable adapter)
    Nec Spinwriter 5500D

The OEM printers provide simple installation and unexcelled performance with
WordStar and are generally the least expensive to buy; their chief disadvantage
is that they are more difficult to drive from other software than other types
of printers.

The above printers have a 24-bit parallel interface using a very different
command structure from that of all other printers supported by WordStar. One
installation selection specifies any of these printers, selects the OEM printer
driver in WordStar, and specifies the "I/O Master" (or IMSAI PIO-4) interface
board. When installed for an OEM printer, WordStar accesses the printer
interface directly. No operating system routines are used, and many
installation complications are thus avoided. A "printer busy test" is
provided, resulting in good response when editing and printing simultaneously.

Interfacing

For any of the OEM printers listed above, use the MicroPro "I/O Master" inter-
face board with the OEM printer ports addressed at F8 through FA hex. Connect
the interface board to the printer with the MicroPro printer cable (using an
adapter as noted below with the Qume Sprint 3).

An IMSAI PIO-4 board addressed at ports F8 through FB may also be used; the cable required is the same as the cable previously supplied by IMSAI, plus an additional conductor bringing the printer's "data 1/2" bit to bit 4 of port F9.

Installation

To install WordStar to drive any of the OEM printers listed above through either of the interfaces listed above, select "I/O Master / OEM Printer" at INSTALL's printer menu (see "Printer-Related Selections," Section 3). The same selection works with all the supported OEM printers and interfaces. The OEM daisy printer driver is pre-configured for the standard OEM printer port numbers and bit assignments used with the "I/O Master" interface. (Extensive modification would be required to drive another interface or to change the port numbers. A listing of the code that would require modification is available in the WordStar Customization Notes.)

Diablo Hy-Type II (1300 Series)

INTERFACING

The MicroPro printer cable can be used.

COMPATIBLE TYPEWHEELS

```
        Diablo 38100   Courier 10
        Diablo 38107   Courier 72
        Diablo 38101   Pica 10
        Diablo 38102   Elite 12
        Qume   82167   Prestige Elite 12
```

Qume Sprint 3

INTERFACING

The cable adapter (available from Qume) that provides a Diablo-compatible termination from this printer's connector is necessary in order to mate with the MicroPro printer cable.

COMPATIBLE TYPEWHEELS

Compatible Typewheels for the Qume Sprint 3 are as listed above for the Diablo Hy-Type II.

NEC Spinwriter 5500D

INTERFACING

The MicroPro printer cable can be used.

This is the Hy-Type-II-compatible version of NEC's OEM thimble printer.

The NEC 5500D will buzz and stop printing if the (carbon) ribbon is used up, the paper runs out, or the cover is opened. Install a new ribbon, new paper, or close the cover, and printing will continue with no character loss.

SERIAL DAISY WHEEL AND
SIMILAR PRINTERS

The descriptions in this section apply to the following printers, which have
"serial" interfaces:

    Diablo 1610/1620/1640/1650
    Qume Sprint 5
    Nec Spinwriter 5510/20

Some of the manufacturers also supply equivalent versions with an 8-bit
parallel interface; installation should be similar to the serial versions and
the descriptions here should be generally applicable.

Controls

Most serial daisy wheel and similar printers have a control panel including
some or all of the following switches:

AUTO LF: must be OFF.

AUTO CR: should be OFF.

Line Spacing 6/8 Lines per inch
Character Pitch 10/12 Characters per inch

    These switches have NO EFFECT on printing under WordStar. Character and
line spacing under WordStar always default to 6 lines per inch and 10
characters per inch respectively, and may be modified via print directives
imbedded in each document (Reference Manual). After printing with
WordStar, the printer is left set to the switch settings for use with
other software, except as noted below.

FORM LENGTH: set to match length of paper in use — commonly 11 inches or
66 lines; setting does not matter if USE FORM FEEDS print option (Section
11) will not be used and you don't wish the FF switch to work.

SET TOF: depress after positioning paper at top of form; necessary only
if USE FORM FEEDS print option is to be used or you wish the FF switch
to work.

FF or FORM FEED: depress to feed paper to top of form, e.g. after
aborting print.

Installation

All daisy wheel and similar printers interfaced at 1200 baud (120 characters
per second) must be installed with a "communications protocol" (as discussed in
Section 2) in order to avoid buffer overrun and consequent character loss (a
possible exception for the NEC is noted below). At speeds slower than 1200
baud, these printers print slowly; you will find the effort invested to install
one of these printers with a communications protocol rewarding because of the
markedly increased printing speed.

Caution

Do not attempt to use ETX/ACK protocol in your operating system when driving a Diablo or Qume printer from WordStar. It won't work. If your operating system already can drive a Diablo or Qume printer at 1200 baud through the use of ETX/ACK protocol, the portion of the operating system which implements the protocol must be disabled or bypassed when printing from WordStar.

The reason for this limitation is that if an "ETX" inserted in the character stream happens to fall within an "escape sequence" being transmitted to the printer, the printer will not recognize it as an ETX, and not respond with an ACK; nor will the printer interpret the escape sequence correctly. Keeping the ETX's out of the escape sequences is practical only in the program generating the character stream; WordStar contains the necessary special code.

Diablo 1610/1620

FEATURES

The "phantom space" and "phantom rubout" features of WordStar (**Reference Manual**) are not supported by these printers.

After printing, WordStar leaves these printers set for 6 lines per inch and 10 characters per inch. To set the character spacing according to the printer's "spacing 10/12" switch before use of other software, depress the "Clear" button. If other software has printed on the printer since it was powered up and before WordStar prints, you may, in unusual cases, find it necessary to press the printer's "clear" button, or to turn the printer off and on, before WordStar will print correctly (this is because the Diablo 1610/20 has no provision for a full reset initiated from the computer).

INSTALLATION

When installing WordStar to use a Diablo 1610/1620 printer interfaced at 1200 baud (120 characters per second), specify "ETX/ACK" protocol, and a driver capable of inputting characters, as discussed in Section 14. No settings are required on the printer for ETX/ACK operation. These printers do not support XON/XOFF protocol.

COMPATIBLE TYPEWHEELS

Compatible Typewheels for the Diablo 1610/1620 include:

        Diablo 38100   Courier 10
        Diablo 38107   Courier 72
        Diablo 38101   Pica 10
        Diablo 38102   Elite 12
        Qume   82167   Prestige Elite 12

Diablo 1640/1650

FEATURES

Form Feeds cannot be used with the Diablo 1640 and 1650; the USE FORM FEEDS question does not occur in the print initiation dialog (**Reference Manual**) when WordStar has been installed for a 1640 or 1650.

INSTALLATION

When installing WordStar to use a Diablo 1640/1650 printer interfaced at 1200 baud (120 characters per second), specify "ETX/ACK" protocol, and a driver capable of inputting characters, as discussed in Sections 2-5. A switch setting may be necessary inside the printer to enable ETX/ACK protocol (switch 2 on the HPRO4 circuit board, if operator control panel is fitted, or as described in your Diablo manual). These printers also support XON/XOFF protocol (Diablo calls it DC1/DC3 protocol); a switch setting is necessary inside the printer to enable this protocol (switch 3 on HPRO4 circuit board, or as described in your Diablo manual).

COMPATIBLE TYPEWHEELS

Compatible typewheels for the Diablo 1640 are as listed for the 1610/20 above.

Qume Sprint 5

INSTALLATION

When installing WordStar to use a Qume Sprint 5 interfaced at 1200 baud (120 characters per second), specify "ETX/ACK" protocol, and a driver capable of inputting characters, as discussed in Sections 2-5. No settings are required on the printer for ETX/ACK operation. The Qume Sprint 5 does not support XON/XOFF protocol.

COMPATIBLE TYPEWHEELS

Compatible Typewheels for the Qume are as listed above for the Diablo 1610/20.

NEC Spinwriter 5510/5520

FEATURES

The "phantom space and "phantom rubout" features (**Reference Manual**) are not supported on, nor relevant to, these printers.

When WordStar is installed for a NEC spinwriter 5510/5520, two of the User Printer Function print control characters (Section 10) are defined as follows to permit access to additional characters on NEC print thimbles (typing elements) with more than 94 graphics:

> ^Q sends "shift out" code to printer; changes to alternate character definitions, as described in your NEC documentation, until ^W is encountered in document.

^W sends "shift in" code to printer; restores normal character definitions after use of ^Q.

The NEC 5510/5520 will buzz and stop printing if the (carbon) ribbon is used up, the paper runs out, or the cover is opened. Install a new ribbon, new paper, or close the cover, then press the "Reset" switch, and printing will continue with no character loss.

INSTALLATION

When installing WordStar to use a NEC Spinwriter 5510/5520 at 1200 baud (120 characters per second), a communications protocol or a special cable must be used to prevent buffer overrun and character loss. The NEC printer is extremely versatile; we know of four possible solutions to the buffer overrun problem:

1. Check that the printer is set to use ETX/ACK protocol (switch 4 OFF on DIP switch SW1 on the circuit board behind the control panel, or as described in the NEC documentation). In the WordStar installation dialog, specify ETX/ACK protocol and a driver that can input characters from the printer (as discussed in Section 2-4). We suggest this as the normal solution.

2. Set the printer for XON/XOFF protocol (switch 4 ON on DIP switch SW1 on the circuit board behind the control panel, or as described in the NEC documentation). In the WordStar installation dialog, specify XON/XOFF protocol and a driver that can input characters from the printer (as discussed in Section 2-4).

3. ETX/ACK or XON/XOFF protocol implemented in a printer driver installed in your operating system may also be used with a NEC printer. In this case, specify "None" for protocol in the WordStar installation dialog.

4. This is a hardware solution, requiring fabrication of a cable adapter. It may not work in all cases; if it works in your case it has the advantages that it works with other software in addition to WordStar, and that no communications protocol, nor a printer driver that can input characters, need be specified in WordStar installation.

5. Make up a cable adapter which runs the printer's "Reverse Channel" signal (line 19 of EIA connector) into the "Request to Send" line (pin 4 of EIA connector) of the computer's serial interface. Check that the printer is set to produce a "low" signal on buffer full (switch 5 OFF on DIP switch SW1 on the circuit board behind the control panel, or as described in the NEC documentation). This signal will cause the USART in the computer's serial interface to stop sending characters when the printer cannot accept them, without any special software considerations.

TELETYPE-LIKE (NON-DAISY) PRINTERS

The term "Teletype-like" printer includes almost any printer designed to be connected to a microcomputer. The printer should return the carriage to the beginning of the line without advancing the paper upon receipt of a "carriage return code", advance the paper one line upon receipt of a "line feed" code, and print the appropriate character upon receipt of ASCII codes 20 through 7E hex. With such a printer, WordStar will not Microspace Justify nor print using variable line height nor variable character pitch. Subscripts and superscripts are printed in-line, or in the line below or above if it is a blank line; boldface is printed by overprinting the same characters three times; backspace is supported only if the printer can backspace.

If your printer has an AUTO LF switch, make sure it is OFF.

The following special features of specific Teletype-like printers may be supported via special installation (patching) done by the user as discussed in Sections 6-8:

    Choice of TWO character pitches via ^A and ^N print controls
    Choice of two ribbon colors via ^Y print control
    Ability to feed paper up and down a fractional line for superscripts and
        subscripts
    Up to 4 other special features via ^Q, ^W, ^E, ^R print controls

Any printer shown explicitly in WordStar's printer selection menu should be installed with the appropriate selection, rather than as "Teletype-like", to make its full capabilities available.

"Any Teletype-like Printer"

This menu selection will drive any printer meeting the above description, with the limitations noted above. Use it when no other selections match or when in doubt about the applicability of other selections.

"Teletype-like Printer
That Can Backspace"

This menu selection is preferred for printers that can back up the carriage to the preceding character position on the same line upon receipt of an ASCII "backspace" code (08 hex). Use of this selection will yield faster printing of underline, boldface, and double strike, and makes the "backspace" print control available.

OTHER PRINTERS

Non-Return Printers

WordStar provides limited support of printers that cannot return the carriage without advancing the paper, such as Selectrics. If the printer can backspace, install as "Teletype-like printer that can backspace" and avoid use of over-print lines (Reference Manual). Other print enhancements will work as described for "Teletype-like" printers. If printer cannot backspace, install as "Any Teletype-like printer" and avoid use of underline, strike out, double strike, bold face, backspace, and overprint lines in your documents.

"Half-Line-Feed Printer"

This menu selection is provided for use with printers that advance one-half line at a time, such as a Selectric with a half-line ratchet. Backspacing capability is also assumed by this menu selection, but no ability to feed paper backwards is required. The half-line advance is utilized to print superscripts and subscripts half a line above and below, respectively, the rest of the text. Two line feeds are transmitted between lines where no subscripts and super-scripts appear. Depending on the characters your interface is equipped to respond to, patching may be required after this selection is made; see Sections 6-8.

Appendix E
The Terminal Patch Area (USER1)

A listing of the WordStar user-modifiable module USER1 follows this page. This assembly listing is supplied for the convenience of the occasional user who may need to install WordStar for an unusual terminal or printer. Note that this listing is for the standard TBASE=100 Hex version. For the TRS-80 Model I version, and the Heath 89 version origined at 4300 Hex, add 4200 Hex to all addresses shown in listings. For a discussion of this listing, see Sections 6-8.

A separate publication, WordStar Customization Notes, is directed towards OEM's and system programmers. The Customization Notes contain additional source listings, including:

o   default areas

o   message files

o   keyboard dispatch tables

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TITLE USER1   04/23/81   TERMINAL PATCH AREA

; FOR WordStar RELEASE 3.0 May, 1981

ENTRY HITE,WID, CLEAD1,CLEAD2,CTRAIL,CB4LFG,LINOFF,COLOFF
ENTRY ASCUR,UCRPOS,ERAEOL,LINDEL,LININS,IVON,IVOFF
ENTRY TRMINI,TRMUNI,INISUB,UNISUB,DELCUS,DELMIS
ENTRY DEL1,DEL2,DEL3,DEL4,DEL5,NMOFUS,TCKFLG
ENTRY USELST,MEMAPV,MEMADR,HIBIV,HIBCUR,CRBLIV,ZAFCIN
ENTRY RUBFXF,RFIXER,UCONO,UCONI,UCNSTA,SWIN,SWOUT
ENTRY TRSCRS,TRSCIF,HETHBS,APLFLG,RSTFLG,DEFDSK,SCRLSZ
ENTRY MORPAT,PBGMEM

EXT OUTCHR, MEMORY

0100   TBASE   EQU 100H ;WHERE TO LOAD PROGRAM FOR NORMAL CP/M

0000'   ASEG   ;ABSOLUTE CODE, FOR LISTING

                        ORG TBASE+148H ;BEGINS AT 248 HEX OR 4448 HEX

                        PAGE 63   ;SETS PAGE LENGTH

```
;  ***********************************************************
;  *                                                         *
;  *    USER-MODIFIABLE CONSTANTS AND ROUTINES FOR           *
;  *    HARDWARE-DEPENDENT TERMINAL CHARACTERISTICS          *
;  *    AND FUNCTIONS USED BY EDITOR                         *
;  *                                                         *
;  ***********************************************************

;NOTE: THIS AREA IS NORMALLY PATCHED FOR YOUR TERMINAL
;TYPE VIA THE INTERACTIVE INSTALL PROGRAM.  ADDITIONAL
;PATCHING TO THIS AREA IS NEEDED ONLY FOR UNUSUAL TERMINALS
;OR UNUSUAL VIDEO BOARDS, OR TO MEET SPECIAL REQUIREMENTS
;OR ENHANCE OR PERSONALIZE PERFORMANCE.

;
; PATCHES ALWAYS NEEDED: SCREEN HITE & WIDTH, CURSOR.
;
; ALL OTHERS ARE OPTIONS FOR SPECIAL CASES OR ENHANCEMENT.
;


;
;    SCREEN SIZE
;
;    SCREEN HEIGHT AND WIDTH PATCHES ARE MANDATORY.
;
```

```
0248   18        HITE:   DB 24    ;MUST BE EXACT SCREEN HEIGHT IN LINES
0249   50        WID:    DB 8Ø    ;MUST BE <= EXACT SCREEN WIDTH
```

```
;
; IN ALL CHARACTER STRINGS TO BE SENT TO TERMINAL,
; FIRST BYTE IS NUMBER OF CHARACTERS, CHARACTERS FOLLOW.
;
```

```
;           PROVISIONS FOR PATCHING
;        CURSOR POSITIONING CONTROL SEQUENCES
;
;        CURSOR POSITIONING PATCH IS MANDATORY.
;
; CURSOR POSITIONING FOR MOST TERMINALS
; IS ACCOMPLISHED BY SENDING:
;
;   1.  A "LEAD-IN" STRING OF ONE OR MORE
;              TERMINAL-SPECIFIC CHARACTERS;
;   2.  THE LINE NUMBER, WITH AN OFFSET (OFTEN Ø)
;              ADDED; OR, FOR SOME TERMINALS,
;              THE COLUMN NUMBER IS SENT FIRST;
;   3.  ANOTHER LEAD-IN STRING, FOR SOME TERMINALS;
;   4.  THE COLUMN (OR LINE) NUMBER, WITH OFFSET;
;   5.  ANOTHER STRING (FOR SOME TERMINALS).
;
; FOR MOST TERMINALS, THE LINE AND COLUMN ARE SENT
; AS 1-BYTE BINARY NUMBERS; FOR A FEW TERMINALS,
; TWO- OR THREE-DIGIT ASCII NUMBERS ARE SENT.
;
; FOR TERMINALS THAT DON'T FIT THE ABOVE PATTERNS,
; YOU MUST CODE YOUR OWN SUBROUTINE.

            ;CURSOR PATCH AREAS ARE ON NEXT PAGE
```

```
                        ; CURSOR POSITIONING...
                        ;              SEE COMMENTS PRECEDING PAGE

                        ; FOR EXAMPLE, THE CURSOR IS POSITIONED ON THE
                        ; ADM-3A TERMINAL BY SENDING:
                        ;       ESCAPE, =,
                        ;       LINE # PLUS 20 HEX,
                        ;       COLUMN NUMBER PLUS 20 HEX.
                        ; THE FOLLOWING PATCH AREAS ARE SET UP FOR THIS
                        ; TERMINAL, AS AN EXAMPLE.

                        ; CURSOR POSITIONING INITIAL LEAD-IN STRING
024A    02              CLEAD1: DB 2     ;NUMBER OF CHARACTERS
024B    1B                      DB 1BH           ;FIRST CHARACTER
024C    3D                      DB '='           ;SECOND CHARACTER
024D    00 00 00                DB 0,0,0         ;SPACE FOR MORE
0250    00 00 00                DB 0,0,0         ;.. CHARACTERS

                        ; CURSOR POSITIONING STRING SENT BETWEEN
                        ;   LINE AND COLUMN
0253    00              CLEAD2: DB 0     ;NUMBER OF CHARACTERS -
                                         ; NONE IN OUR EXAMPLE
0254    00                      DB 0             ;FIRST CHARACTER
0255    00 00 00                DB 0,0,0         ;SECOND THRU 4TH

                        ; CURSOR POSITIONING STRING SENT AFTER
                        ;   BOTH LINE AND COLUMN HAVE BEEN SENT
0258    00              CTRAIL: DB 0     ;NUMBER OF CHARACTERS (NONE)
0259    00 00 00 00             DB 0,0,0,0

                        ; FLAG NON-ZERO TO SEND COLUMN BEFORE LINE
025D    00              CB4LFG: DB 0     ;LINE GOES BEFORE
                                         ;..COLUMN IN OUR EXAMPLE

                        ; OFFSET TO ADD TO LINE
025E    20              LINOFF: DB 20H   ;ADD THIS TO LINE #
                                         ;(WHERE 0 IS TOP LINE ON
                                         ; SCREEN BEFORE OFFSET)

                        ; OFFSET TO ADD TO COLUMN
025F    20              COLOFF: DB 20H   ;ADD THIS TO COLUMN #
                                         ;(WHERE 0 IS LEFT EDGE OF
                                         ; SCREEN BEFORE OFFSET)

                        ; BINARY / ASCII FLAG AND # ASCII DIGITS
0260    00              ASCUR:  DB 0     ;ZERO TO SEND BINARY LINE & COLUMN
                                         ;2 TO SEND 2-DIGIT ASCII NUMBERS
                                         ;3 TO SEND 3-DIGIT ASCII NUMBERS

                        ;SEE NEXT PAGE FOR POSITIONING
                        ;CURSOR VIA USER-CODED SUBROUTINE
```

```
                                     ;CURSOR POSITIONING...

0261    00 00 00                     DB 0,0,0         ;BYTES RESERVED FOR EXPANSION
                                 ;
                                 ; PROVISION FOR POSITIONING CURSOR BY USER-CODED
                                 ; SUBROUTINE INSTEAD OF UNDER CONTROL OF ABOVE ITEMS,
                                 ; FOR USE IN EXCEPTIONAL CASES ONLY:
                                 ;
                                 ; PUT A  JMP  INSTRUCTION TO YOUR SUBROUTINE IN
                                 ; FOLLOWING 3 BYTES.  WHENEVER FIRST BYTE IS
                                 ; NON-0, THIS LOCATION WILL BE CALLED TO POSITION
                                 ; CURSOR; ABOVE CURSOR PATCH ITEMS WILL BE DISREGARDED.
                                 ;
0264    00               UCRPOS: NOP       ;NORMALLY 0, OR JMP TO YOUR
0265    00                       NOP       ;SPECIAL CURSOR POSITIONING
0266    C9                       RET       ;ROUTINE.

                                 ; SEE "MORPAT" AT THE END OF THIS LISTING
                                 ; FOR SPACE TO PUT YOUR SUBROUTINE IN.

                                 ;     YOUR SUBROUTINE WILL RECEIVE LINE IN L REGISTER
                                 ; (0=TOP SCREEN), COLUMN IN H (0=LEFT EDGE).
                                 ;     YOUR SUBROUTINE MAY ALTER ALL REGISTERS.
                                 ;     TO OUTPUT A CHARACTER TO THE TERMINAL FROM WITHIN
                                 ; YOUR SUBROUTINE, CALL OUTCHR.  EXAMINE THE FOLLOWING
                                 ; 2 BYTES WITH YOUR DEBUGGER TO DETERMINE THE ADDRESS
                                 ; TO CALL IN CURRENT RELEASE OF WORDSTAR:

0267    0000*                    DW OUTCHR        ;ADDRESS OF BYTE OUTPUT
                                                  ;ROUTINE LOADED HERE

                                 ; YOUR CUSTOM CURSOR POSITIONING ROUTINE WILL ALSO
                                 ; RECEIVE THE FOLLOWING, WHICH MIGHT BE USEFUL
                                 ; IN SPECIAL VIDEO BOARD DRIVERS:
                                 ;    DE=NUMBER OF CHAR POSITIONS FROM BEGINNING OF SCREEN
                                 ;       TO NEW CURSOR POSITION (0=UPPER LEFT CORNER).
                                 ;    BC=NUMBER OF CHAR POSITIONS FROM BEGINNING SCREEN TO
                                 ;       BEGINNING OF LINE IN WHICH CURSOR IS BEING PLACED.

0269    00 00 00 00              DB 0,0,0,0       ;RESERVED BYTES
```

```
                              ;
                              ;EVERYTING THAT FOLLOWS IS OPTIONAL.
                              ;  EACH ITEMS RELATE EITHER TO ENHANCED PERFORM-
                              ;  ANCE (FOR EXAMPLE, USE OF INVERSE VIDEO
                              ;  OR BRIGHT/DIM TO SET OFF BLOCKS OF TEXT),
                              ;  OR TO ACCOMODATING UNUSUAL TERMINALS.
                              ;

                              ;ERASE TO END OF LINE. OPTIONAL - IF FUNCTION
                              ;NOT AVAILABLE, LEAVE FIRST BYTE ZERO AND EDITOR
                              ;WILL DO THE FUNCTION MORE SLOWLY VIA SOFTWARE.

026D    00            ERAEOL: DB 0     ;PUT NUMBER OF CHARCTERS HERE
026E    00                    DB 0     ;PUT FIRST CHARACTER HERE
026F    00                    DB 0     ;IF 2-CHAR SEQUENCE, PUT 2ND HERE
0270    00 00 00 00            DB 0,0,0,0 ;IF 3 TO 6 CHAR SEQUENCE,
                                       ;PUT ADDITIONAL CHARS HERE.

                              ;DELETE SCREEN LINE CONTAINING CRSOR, MOVE
                              ;LOWER LINES ON SCREEN UP ONE LINE. OPTIONAL.
                              ;SUPPLYING THIS SPEEDS SCREEN UPDATE.

0274    00            LINDEL: DB 0       ;PUT LENGTH HERE
0275    00 00 00              DB 0,0,0   ;SPACE FOR 1-6 CHARACTERS
0278    00 00 00              DB 0,0,0

                              ;INSERT A BLNK LINE ON SCREEN, MOVING CURSOR
                              ;LINE AND LINES BELOW IT DOWN ONE. OPTIONAL.
                              ;SUPPLYING THIS SPEEDS SCREEN UPDATE.
                              ;N. B.  IF YOUR TERMINAL INSERTS BELOW THE
                              ;CURSOR LINE, PUT A "CURSOR UP" BEFORE THE
                              ;"INSERT LINE" CHARACTER(S).

027B    00            LININS: DB 0       ;PUT LENGTH HERE
027C    00 00 00 00           DB 0,0,0,0 ;SPACE FOR 1-8 CHARACTERTS
0280    00 00 00 00           DB 0,0,0,0
```

```
                            ;TURN ON HIGHLIGHTING (INVERSE VIDEO, BRIGHT/DIM, OR
                            ;OTHER MEANS OF HIGHLIGHTING A SECTION OF TEXT).
                            ;APPLICABLE ONLY IF MEMAPV (NEXT PAGE) IS 0. OPTIONAL.

0284    00              IVON:   DB 0                ;LENGTH
0285    00 00 00                DB 0,0,0            ;UP TO 6 CHARACTERS
0288    00 00 00                DB 0,0,0

                            ;TURN OFF HIGHLIGHTING. OPTIONAL.
                            ;IF NO STRING PATCHED IN, IVON STRING WILL BE
                            ;USED TO TURN OFF AS WELL AS ON.

028B    00              IVOFF:  DB 0                ;LENGTH
028C    00 00 00                DB 0,0,0            ;UP TO 6 CHARACTERS
028F    00 00 00                DB 0,0,0

                            ;TERMINAL INITIALIZATION STRING: ANY BYTES YOU
                            ;WANT SENT TO YOUR TERMINAL AT BEGINNING OF
                            ;SESSION. OPTIONAL. SEE ALSO INISUB, NEXT PAGE.
0292    00              TRMINI: DB 0                ;LENGTH
0293    00 00 00 00             DB 0,0,0,0          ;THE BYTES,
0297    00 00 00 00             DB 0,0,0,0          ;MAX LENGTH 8.

                            ;ANY BYTES YOU WANT SENT TO TERMINAL AT END OF
                            ;SESSION.  OPTIONAL. SEE ALSO UNISUB
029B    00              TRMUNI: DB 0                ;LENGTH
029C    00 00 00 00             DB 0,0,0,0          ;THE BYTES,
02A0    00 00 00 00             DB 0,0,0,0          ;UP TO 8.

                            ;
                            ;USER-PATCHABLE INITIALIZATION SUBROUTINE. CALLED
                            ;JUST BEFORE TRMINI (PREVIOUS PAGE) IS SENT, THIS
                            ;SUBROUTINE MAY BE USED FOR SPECIAL CONSOLE INIT-
                            ;IALIZATION OR OTHER PURPOSES.
                            ;
02A4    00              INISUB: NOP         ;ENTRY POINT. PUT DESIRED CODE IN
02A5    00                      NOP         ;"MORPAT" AREA (3 PAGES AHEAD IN
02A6    C9                      RET         ;THIS LISTING) AND PATCH IN A "JMP"
                                            ;INSTRUCTION HERE.  FOR YET MORE
                                            ;SPACE, SEE "PBGMEM" ON SAME PAGE.
                            ;
                            ;USER-PATCHABLE DE-INITIALIZATION SUBROUTINE.
                            ;CALLED AT EXIT (JUST BEFORE TRMUNI IS SENT),
                            ;THIS SUBROUTINE MAY BE USED TO "UNDO" ANY SPECIAL
                            ;TERMINAL STATUS USED IN THE EDITOR.
                            ;
02A7    00              UNISUB: NOP         ;PUT DESIRED CODE IN
02A8    00                      NOP         ;"MORPAT" AREA, PATCH IN
02A9    C9                      RET         ;A "JMP" HERE.

                            ;
```

```
                              ;
                              ; MISCELLANEOUS TERMINAL-RELATED ITEMS
                              ;

                              ;FLAG TO PERMIT DISPLAY IN LAST COLUMN OF LAST LINE.
                              ;INITIALLY DISABLED, AS MANY TERMINALS SCROLL SCREEN
                              ; WHEN A CHARACTER IS DISPLAYED IN THIS POSITION.

02AA   00              USELST: DB 0   ;PATCH NON-0 TO PERMIT LAST CHAR ON LAST
                                      ;LINE TO DISPLAY IF THIS WILL NOT SCROLL
                                      ;SCREEN OF YOUR TERMINAL. NORMALLY LEAVE 0
                                      ;FOR USE WITH TERMINAL, PATCH NON-0
                                      ;FOR USE WITH MEMORY-MAPPED VIDEO BOARD.


02AB   00 00 00               DB 0,0,0        ;BYTES RESERVED FOR EXPANSION

                              ;
                              ;DELAYS EXECUTED AFTER VARIOUS TERMINAL FUNCTIONS,
                              ;BEFORE NEXT CHAR IS SENT TO TERMINAL, TO ALLOW RESPONSE
                              ;TIME REQUIRED BY CERTAIN TERMINALS WHEN USED AT HIGH
                              ;BAUD RATES.  PATCH LARGER IF YOU EXPERIENCE, FOR
                              ;EXAMPLE, LOSS OF CHARACTERS AFTER CURSOR POSITIONING.
                              ;EACH DELAY IS APPROX NUMBER OF MILLISECONDS ON
                              ;4 MHZ Z-80; DELAY IS ABOUT TWICE AS LONG ON 2 MHZ 8080.
                              ;
02AE   0A              DELCUS: DB 10    ;10+ MSEC DELAY AFTER CURSOR SET
02AF   05              DELMIS: DB 5     ;5+ MSEC DELAY AFTER OTHER FUNCTIONS
```

```
;
;
; PROVISIONS FOR MEMORY-MAPPED VIDEO BOARDS THAT MEET
; THE FOLLOWING RESTRICTIONS:
;
; 1. CHARACTERS POSITIONS APPEAR AS MEMORY LOCATIONS
;    AT SEQUENTIAL INCREASING ADDRESSES FROM A BASE.
; 2. HIGHLIGHTING, IF USED, IS INVOKED BY SETTING
;    HIGH ORDER BIT OF CHARACTER.
; 3. BOARD MUST ALWAYS BE "MAPPED IN" TO THE ADDRESS
;    SPACE, OR IT MUST BE SWITCHABLE IN AT AN ADDRESS
;    ABOVE APPROX 8000 HEX AND ROUTINES MUST BE PATCHED
;    IN AT "SWIN" AND "SWOUT" ON PAGE 12 OR SO BELOW.
;
; IF MEMAPV IS NON-ZERO, WORDSTAR WILL STORE DIRECTLY
; INTO YOUR VIDEO BOARD RATHER THAN DOING CONSOLE OUTPUT
; VIA CP/M.  THIS IS THE BEST INSTALLATION METHOD FOR
; VIDEO BOARDS MEETING THE RESTRICTIONS.
;
; FOR INSTALLATION SUGGESTIONS FOR OTHER VIDEO BOARDS,
; SEE DISCUSSION NEAR END OF THIS LISTING OR IN MANUAL.
;
```

```
02B0     00        MEMAPV: DB 0    ;NON-0 TO USE MEMORY-MAPPED VIDEO DISPLAY
                                   ;DISPLAY BY DIRECT STORAGE METHOD.
02B1     0000      MEMADR: DW 0    ;ADDRESS OF VIDEO SCREEN RAM, TOP LINE,
                                   ;LEFTMOST COLUMN.  THE REST OF THE SCREEN
                                   ;MUST BE AT CONTIGUOUS ASCENDING ADDRESSES.
                   ; WHEN USING MEMAPV, CHECK THE FOLLOWING ITEMS BELOW:
                   ; HIBIV:  NON-0 FOR HIGH-BIT HILITING (DETAILS BELOW)
                   ; HIBCUR: NON-0 FOR HIGH-BIT CURSOR
                   ; CRBLIV: NON-0 TO BLINK CURSOR IF ON HILIGHTED CHAR
                   ; SWIN, SWOUT: ROUTINES TO SWITCH VIDEO BOARD INTO
                   ;              AND OUT OF ADDRESS SPACE, IF NEEDED
                   ; SETTING USELST ABOVE IS ALSO RECOMMENDED.
```

```
                    ;
                    ;FLAG TO SAY INVERSE VIDEO, HIGH BRIGHTNESS, OR OTHER
                    ;MEANS OF HIGHLIGHTING CHARACTER WILL OCCUR IF HIGH
                    ;ORDER BIT OF CONSOLE OUTPUT CHARACTER IS ON.
                    ;    INTENDED PRIMARILY FOR USE WHEN MEMAPV IS NON-ZERO
                    ;    (SEE IVON/IVOFF ABOVE FOR HILITING ON TERMINALS);
                    ;    BUT MIGHT ALSO BE USEFUL WITH CUSTOM CONSOLE OUTPUT
                    ;    ROUTINE (UCONO, BELOW).
                    ;
02B3    00          HIBIV:  DB 0      ;PATCH NON-0 IF YOU HAVE INVERSE
                                      ;VIDEO ETC. INVOKED BY HI ORDER BIT.


                    ;
                    ;FLAG TO INVOKE DISPLAY OF CURSOR ON MEMORY MAPPED
                    ;VIDEO BOARD BY SETTING HIGH ORDER BIT OF CHARACTER
                    ;UNDER CURSOR, RATHER THAN BY SENDING A CURSOR POSI-
                    ;TIONING STRING UNDER CONTROL OF THE PATCH ITEMS ON
                    ;PAGES 3 AND 4.
                    ;    THIS SAVES TIME AND ELIMINATES INTERACTION PROBLEMS
                    ;    THAT CAN ARISE IF CHARACTER DISPLAY IS BY DIRECT
                    ;    STORAGE BUT CURSOR POSITIONING IS VIA THE EXTERNAL
                    ;    BOARD DRIVER.
                    ;NOTE: CURSOR POSITION PATCHES SHOULD STILL BE INSTALLED
                    ;    TO INTERFACE TO EXTERNAL CURSOR POSITION FUNCTION;
                    ;    IT IS USED AT STARTUP AND EXIT TO PLACE INTERNAL AND
                    ;    EXTERNAL CURSORS IN SAME PLACE.
                    ;
02B4    00          HIBCUR: DB 0      ;NON-0 TO DISPLAY CRSR BY SETTING
                                      ;HIGH ORDER BIT OF CHARACTER.
                                      ;APPLICABLE IF MEMAPV, ABOVE, IS NON-0.


                    ;
                    ;FLAG TO SAY CURSOR MUST BE BLINKED BY THE EDITOR
                    ;IN ORDER TO BE VISIBLE WHEN ON OR ADJACENT TO AN
                    ;INVERSE VIDEO (OR OTHERWISE HIGHLIGHTED)
                    ;CHARACTER.  THIS SHOULD BE 0FFH IF YOUR CURSOR
                    ;IS NOT VISUALLY DISTINCT FROM YOUR INVERSE VIDEO
                    ;AND INVERSE VIDEO IS USED (VIA IVON/IVOFF OR HIBIV).
                    ;NORMALLY NEEDED WITH MEMORY MAPPED VIDEO BOARDS
                    ;WITH HIBIV AND HIBCUR BOTH 0FFH.
                    ;APPLICABLE TO BOTH TERMINALS AND VIDEO BOARDS.
                    ;BLINK METHOD USED FOR A TERMINAL: ALTERNATELY
                    ;SEND IVON, IVOFF STRINGS, WITH DELAYS.
                    ;
02B5    00          CRBLIV: DB 0      ;FF HEX FOR EDITOR TO BLINK CURSOR
                                      ;WHEN ON INVERSE VIDEO CHARACTER.


                    ; SEE ALSO SWIN, SWOUT — 3 PAGES AHEAD
```

```
; TWO SCHEMES FOR CIRCUMVENTING OPERATING SYSTEMS
; THAT BACKSPACE WHEN "DELETE" IS INPUT.
;
;        A NUMBER OF PROPRIETARY VERSIONS OF CP/M
;OUTPUT BACKSPACE, SPACE, BACKSPACE IN PLACE OF THE
;THE NEXT CHARACTER OUTPUT AFTER A "DELETE" (RUBOUT)
;IS INPUT.  THE CODE TO DO THIS IS IN THE "BIOS"
;SECTION OF YOUR SYSTEM.
;        THE INTENT OF THIS "FEATURE" IS TO MAKE THE
;"DELETE" KEY ERASE A CHARACTER ON THE SCREEN,
;INSTEAD OF ECHOING THE DELETED CHARACTER, DURING
;SYSTEM COMMAND LINE INPUT.
; UNFORTUNATELY, THIS "FEATURE" CAUSES A MESS ON THE SCREEN AFTER
; THE DELETE KEY IS PRESSED IN WordStar, BECAUSE THE CHARACTER THAT
; YOUR SYSTEM REPLACES WITH BACKSPACE-SPACE-BACKSPACE IS USUALLY
; THE FIRST CHARACTER OF A CURSOR POSITIONING SEQUENCE BEING
; OUTPUT BY WordStar.
;
; THE "DELETE-BACKSPACE" FEATURE THUS MUST BE DISABLED
; DURING WordStar OPERATION; TWO METHODS ARE:
;
;    1.  BY REFERRING TO YOUR "BIOS" LISTING IN YOUR
;        SYSTEM DOCUMENTATION, INIDENTIFY THE LOCATION
;        IN WHICH YOUR OPERATING SYSTEM SAVES THE LAST
;        CHARACTER INPUT IN ORDER TO TEST FOR "DELETE"
;        ON OUTPUT.  IN SOME SYSTEMS, THIS IS LOCATION 4F.
;        PATCH THIS ADDRESS, LOW ORDER BYTE FIRST, INTO
;        "ZAFCIN" BELOW.
;
;    2.  PATCH "RUBFXF" BELOW TO NON-ZERO.  THE CONTENTS
;        OF "RFIXER" WILL THEN BE OUTPUT IMMEDIATELY
;        AFTER A "DELETE" IS INPUT; THIS CHARACTER, RATHER
;        THAN THE NEXT CURSOR POSITITIONING STRING, SHOULD
;        THUS BE REPLACED WITH BACKSPACE-SPACE-BACKSPACE,
;        REDUCING THE CONSEQUENCES OF YOUR SYSTEM'S
;        MACHINATIONS.  TRY NULL (ZERO) IN RFIXER FIRST;
;        IF THIS DOESN'T WORK, TRY BACKSPACE (08) OR SPACE.
;
```

```
02B6    0000    ZAFCIN: DW 0    ;ZERO OR POINTER TO LOCATION TO ZERO
                                ; AFTER EACH KEYBOARD CHARACTER IS INPUT

02B8    00      RUBFXF: DB 0    ;NON-ZERO TO OUTPUT CHARACTER IN RFIXER
                                ; AFTER EACH "DELETE" IS INPUT.

02B9    00      RFIXER: DB 0    ;CHARACTER TO OUTPUT AFTER EACH "DELETE"
                                ; IS INPUT IF "RUBFXF" IS NON-0.
```

```
                        ;
                        ; OPTIONAL USER-SUPPLIED CONSOLE I/O SUBROUTINES. USER MAY
                        ; PATCH JMP'S HERE TO HIS OWN CONSOLE INPUT, OUTPUT, AND
                        ; STATUS ROUTINES, IN WHICH CASE THESE ROUTINES INSTEAD OF
                        ; THE OPERATING SYSTEM "BIOS" ENTRY POINTS WILL BE USED FOR
                        ; ALL CONSOLE I/O (EXCEPT I/O TO PRINTER INSTALLED AS ALTER-
                        ; NATE CONSOLE).  THESE ROUTINES MAY ALTER ALL REGISTERS.
                        ;

                        ;  OPTIONAL USER CONSOLE CHARACTER READY ROUTINE
  Ø2BA    ØØ      UCNSTA: NOP        ;NORMALLY Ø, OR JUMP TO YOUR OWN STATUS
  Ø2BB    ØØ              NOP        ;SUBROUTINE.  MUST RETURN Ø IN A
  Ø2BC    C9              RET        ;IF NO CHAR READY, ØFFH IF CHAR IS READY.


                        ; OPTIONAL USER CONSOLE INPUT ROUTINE
  Ø2BD    ØØ      UCONI:  NOP        ;NORMALLY Ø, OR JMP TO YOU OWN INPUT
  Ø2BE    ØØ              NOP        ;SUBROUTINE. MUST RETURN CHARACTER IN A.
  Ø2BF    C9              RET        ;MAY BE CALLED BEFORE CHARACTER IS READY.
                                     ;IF NO CHARACTER IS READY, ROUTINE MUST
                                     ; WAIT UNTIL CHARACTER IS AVAILABLE.


                        ;  OPTIONAL USER CONSOLE OUTPUT ROUTINE
                            ;USE OF A CUSTOM ROUTINE ACCESSED HERE IS SUGGESTED,
                            ;FOR EXAMPLE, TO DRIVE A VIDEO BOARD THAT CANNOT BE
                            ;DRIVEN VIA OUTPUT TO OPERATING SYSTEM AND WHICH DOES
                            ;NOT MEET RESTRICTIONS FOR USE OF "MEMAPV" ABOVE.

  Ø2CØ    ØØ      UCONO:  NOP        ;NORMALLY Ø, ELSE JMP TO YOUR OWN CONSOLE
  Ø2C1    ØØ              NOP        ;OUTPUT SUBROUTINE.  SUBROUTINE RECIEVES
  Ø2C2    C9              RET        ;CHARACTER IN A; IF HI-BIT HILITING IS IN
                                     ;USE ("HIBIV" SET ABOVE), HI ORDER BIT
                                     ;WILL BE ON IF CHAR SHOULD BE HILITED.

                        ;UCONO ALSO RECEIVES: L=LINE # ON SCREEN, H=COLUMN #,
                        ; DE=# BYTES FROM BEGINNING OF SCREEN TO CHARACTER
                        ; POSITION (Ø=TOP LEFT), BC=# BYTES FROM BEGINNING
                        ; OF SCREEN TO BEGINNING OF CURRENT LINE

                        ;UCONO ROUTINE MUST HANDLE THE FOLLOWING CHARACTERS:
                        ; ASCII PRINTING CHARACTERS 2ØH THRU 7EH: DISPLAY CHAR,
                        ;      ADVANCE CURSOR TO NEXT POSITION. HI ORDER BIT WILL
                        ;      BE 1 FOR HILIGHTED CHARS IF HIBIV, ABOVE, IS NZ.
                        ; CR (ØDH):  POSITION CURSOR AT BEGINNING OF SAME LINE
                        ; LF (ØAH):  MOVE CURSOR DOWN ONE LINE; OR, IF ALREADY
                        ;            ON BOTTOM LINE OF SCREEN, SCROLL SCREEN
                        ;            UP ONE LINE.
                        ; PLUS ALL CONTROL SEQUENCES GENERATED BY CURSOR PATCH
                        ; ITEMS ABOVE (UNLESS A CURSOR SUBROUTINE (UCRPOS) IS
                        ; USED) AND OPTIONAL PATCH ITEMS ERAEOL, LINDEL, LININS,
                        ; IVON, IVOFF, TRMINI, AND TRMUNI ABOVE.
```

```
        ;
        ; PROVISIONS TO SWITCH A MEMORY MAPPED VIDEO BOARD INTO
        ; AND OUT OF THE ADDRESS SPACE.
        ;       MOST VIDEO BOARDS ALWAYS APPEAR IN MEMORY. HOWEVER,
        ; CERTAIN BOARDS MUST BE "SWITCHED IN" TO BE ACCESSED AND
        ; "SWITCHED OUT" WHEN NOT BEING STORED INTO, SO THAT
        ; SYSTEM ROM OR RAM AT THE SAME ADDRESSES MAY BE ACCESSED.
        ;       IF YOU HAVE A VIDEO BOARD THAT REQUIRES "SWITCHING
        ; IN" AND "SWITCHING OUT", THE BOARD MAY BE ACCESSED ON A
        ; DIRECT MEMORY MAPPED BASIS BY WORDSTAR WITHOUT LOSS OF
        ; USE OF MEMORY AT THE SAME ADDRESSES IF SUITABLE ROUTINES
        ; ARE INSTALLED FOR "SWIN" AND "SWOUT" BELOW.
        ;       WHEN SWITCHED IN, THE ADDRESSES OCCUPIED BY THE
        ; BOARD MUST NOT CONFLICT WITH WORDSTAR'S CODE, THAT IS,
        ; THE BOARD MUST APPEAR AT OR ABOVE ABOUT 8ØØØ HEX.
        ; THE BOARD MAY, HOWEVER, APPEAR AT THE SAME ADDRESSES
        ; AS THE OPERATING SYSTEM.
        ;       SEE "MEMAPV" AND OTHER ITEMS BEGINNING ON PAGE 8
        ; OR SO FOR OTHER ASPECTS OF INSTALLATION FOR DIRECT
        ; MEMORY ACCESS TO A VIDEO BOARD.
        ;       SIX BYTES OF SPACE IS PROVIDED FOR EACH ROUTINE
        ; BELOW. IF ROUTINE IS LONGER, PATCH IN A JMP TO A ROUTINE
        ; AT MORPAT OR ELSEWHERE.  YOUR ROUTINES MUST PRESERVE ALL
        ; REGISTERS EXCEPT THE PSW.  WHEN NO ROUTINE IS PRESENT,
        ; "NOP, NOP, RET" SHOULD BE LEFT IN THE PATCH ITEM.
        ; NO ROUTINES SHOULD BE INSTALLED EXCEPT WHEN A VIDEO
        ; BOARD IS BEING USED ON A DIRECT MEMORY MAPPED BASIS.
        ;
        ; OPTIONAL ROUTINE CALLED BY WORDSTAR BEFORE EACH
        ; DIRECT MEMORY MAPPED ACCESS TO A VIDEO BOARD.
        ; THIS ROUTINE MAY SWITCH THE VIDEO BOARD INTO THE
        ; ADDRESS SPACE, POSSIBLY DISPLACING PART OF THE
        ; SYSTEM'S RAM OR ROM ABOVE ABOUT 8ØØØ HEX.
        ; ROUTINE MUST PRESERVE CONTENTS OF B,C,D,E,H, AND L.
Ø2C3  ØØ          SWIN:   NOP        ;NORMALLY NOP, NOP, RET, OR
Ø2C4  ØØ                  NOP        ;SWITCH-IN ROUTINE OF 6 BYTES
Ø2C5  C9                  RET        ;OR LESS, OR JMP TO LONGER
Ø2C6  ØØ ØØ ØØ            DB Ø,Ø,Ø   ;ROUTINE.

        ; OPTIONAL ROUTINE CALLED BY WORDSTAR AFTER EACH
        ; DIRECT MEMORY MAPPED ACCESS TO A VIDEO BOARD.
        ; THIS ROUTINE MAY SWITCH THE VIDEO BOARD OUT OF
        ; THE ADDRESS SPACE, TO ALLOW SUBSEQUENT ACCESS
        ; TO ANY RAM OR ROM THE VIDEO BOARD DISPLACED.
        ; ROUTINE MUST PRESERVE THE B,C,D,E,H, AND L REGISTERS.
Ø2C9  ØØ          SWOUT:  NOP        ;NORMALLY NOP, NOP, RET, OR
Ø2CA  ØØ                  NOP        ;SWITCH-OUT ROUTINE OF 6 BYTES
Ø2CB  C9                  RET        ;OR LESS, OR JMP TO LONGER
Ø2CC  ØØ ØØ ØØ            DB Ø,Ø,Ø   ;ROUTINE.
        ;
```

```
                              ;
                              ; DELAYS FOR CURSOR BLINK, "NEW FILE" MESSAGE, ETC.
                              ;
                              ; THE FOLLOWING DELAYS MAY BE ALTERED TO ADJUST FOR
                              ; VARIATIONS IN CPU SPEED AND FOR INDIVIDUAL PREFERANCES.
                              ; EACH OF THE FOLLOWING FOUR ITEMS MAY BE SET TO VALUES
                              ; BETWEEN 1 (MINIMUM DELAY) AND 127 (MAXIMUM DELAY).
                              ; IT IS SUGGESTED THAT YOU RETAIN THE APPROXIMATE
                              ; RELATIVE PROPORTIONS OF THE DELAYS.

02CF    03           DEL1:    DB 3      ;CONTROLS SHORT DELAY. USES INCLUDE:
                              ; CURSOR BLINK (WHEN ON HILIGHTED CHAR AND CRBLIV
                              ;       ABOVE IS NON-ZERO): "ON" PORTION OF CYCLE.
                              ; CURSOR BLINK BETWEEN "REPLACE Y/N:" IN STATUS
                              ;       LINE AND FILE DISPLAY DURING REPLACE
                              ;       COMMAND (^QA): TIME IN FILE DISPLAY AREA.

02D0    09           DEL2:    DB 9      ;CONTROLS MEDIUM-SHORT DELAY. USES INCLUDE:
                              ; CURSOR BLINK (WHEN ON HILIGHTED CHAR AND CRBLIV
                              ;       ABOVE IS NON-ZERO): "OFF" PORTION OF CYCLE.
                              ; CURSOR BLINK BETWEEN "REPLACE Y/N:" IN STATUS
                              ;       LINE AND FILE DISPLAY DURING REPLACE
                              ;       COMMAND (^QA): TIME IN STATUS LINE.

02D1    19           DEL3:    DB 25     ;CONTROLS MEDIUM-LONG DELAY. USES INCLUDE:
                              ; TIME FROM HITTING A PREFIX KEY TIL
                              ;               PREFIX MENU IS DISPLAYED.
                              ; DELAY AT A "FILE NAME?", ETC. QUESTION BEFORE
                              ;       DISPLAY OF QUESTION SPECIAL CHARACTERS MENU.

02D2    40           DEL4:    DB 64     ;CONTROLS LONG DELAY: USES INCLUDE:
                              ; TIME SIGNON REMAINS ON SCREEN.
                              ; TIME "NEW FILE" MESSAGE REMAINS ON SCREEN.
                              ; TIME "ABANDON" MESSAGE REMAINS DISPLAYED.
                              ; TIME TO WAIT FOR FULL SCREEN REFRESH DURING
                              ; HORIZONTAL SCROLLING

02D3    09           DEL5:    DB 9      ;CONTROLS DELAY USED FOR A FULL SCREEN
                              ; REDISPLAY DURING HORIZONTAL SCROLLING. IT IS
                              ; THE AMOUNT OF TIME TO WAIT AFTER A KEYSTROKE
                              ; TO REFRESH THE SCREEN.
```

```
                              ;
                              ; ITEMS FOR NON-STANDARD VERSIONS OF WORDSTAR.
                              ; THESE ITEMS ADDED IN WORDSTAR 2.20.
                              ;
  02D4     00                 TRSCRS: DB 0     ;USED ONLY IN TRS-80 MODEL 1 WORDSTAR,
                                               ;INOPERATIVE IN NORMAL WORDSTAR.
                                               ;SET 0FFH TO USE SPECIAL CURSOR DRIVER.

  02D5     00                 TRSCIF: DB 0     ;USED ONLY FOR TRS-80 MODEL I WORDSTAR,
                                               ;INOPERATIVE IN NORMAL WORDSTAR.
                                               ;SET TO 0FFH FOR SPECIAL KEYBOARD DRIVERS

  02D6     00                 HETHBS: DB 0     ;USED ONLY FOR HEATH89 WITH LIFEBOAT
                                               ;CP/M 1.42 & 1.43. INOPERATIVE IN NORMAL
                                               ;WORDSTAR. SET TO 0FFH TO ALLOW WORDSTAR
                                               ;TO PATCH BIOS TO ELIVIATE BS, SPACE, BS
                                               ;PROBLEM WHEN RUBOUT IS ENTERED

  02D7     00                 APLFLG: DB 0     ;USED ONLY FOR THE APPLE VERSION OF WORDSTAR
                                               ;SET BY INSTALL, NO NEED FOR USERS TO CHANGE

  02D8     01 01              NMOFUS: DB 1,1   ;THE # OF USERS ON THE SYSTEM. NORMALLY 1
                                               ;SET TO A HIGHER VALUE IF WORDSTAR SPENDS
                                               ;TOO MUCH TIME POLLING CSTAT, CAUSING THE
                                               ;SYSTEM TO SLOW DOWN. SHOULD ONLY BE USED
                                               ;IF THE OPERATING SYSTEM CAN BUFFER KEY-
                                               ;BOARD CHARACTERS.

  02DA     00                 TCKFLG: DB 0     ;SET TO 0FFH IF UNDER MP/M & SYSTEM CALL 141
                                               ;CAN BE USED FOR A DELAY. THE VAUES OF DEL1,
                                               ;ETC. MAY HAVE TO BE CHANGED TO CORRESPOND
                                               ;TO THE AMOUNT OF TIME ALLOCATED PER TICK.
                                               ;THIS SAVES CPU TIME IN A MULTIPROCESSING
                                               ;ENVIRONMENT

  02DB     00                 RSTFLG: DB 0     ;SET TO NON-ZERO IF A DISK RESET SHOULD NEVER
                                               ;BE ISSUED MANY VERSIONS OF MP/M DO NOT ALLOW
                                               ;FOR DISK RESETS THIS WILL FIX THE MP/M ERROR
                                               ;MESSAGE THAT MAY OCCUR

  02DC     01                 DEFDSK: DB 1     ;THE DEFAULT DISK DRIVE TO TEST FOR WSMSGS,
                                               ;WSOVLY1.OVR, ETC. IF THE NECCESARY FILE IS
                                               ;NOT ON THE LOGGED ON DISK DRIVE PRESENTLY
                                               ;SET TO TEST THE A: DRIVE. SET 2=B:, 3=C:, ETC.

  02DD     14                 SCRLSZ: DB 20    ;# OF SCREEN POSITIONS TO HORIZONTAL SCROLL
                                               ;AT A TIME PRESENTLY SET TO 20, ADJUST IF YOU
                                               ;WANT SCREEN TO SCROLL MORE OR FEWER SCREEN
                                               ;POSITIONS
```

```
;
;   DISCUSSION OF MEMORY-MAPPED VIDEO BOARD INSTALLATION
;


;1. THE SIMPLEST INSTALLATION METHOD IS TO ACCESS THE BOARD
;    THROUGH THE OPERATING SYSTEM, AS THOUGH IT WERE A TER-
;    MINAL.  THIS REQUIRES, OF COURSE, THAT CURSOR CAN BE
;    POSITIONED BY OUTPUTTING A CHAR SEQUENCE.  ONLY THOSE
;    OPTIONAL FEATURES (LINE INSERT, ERASE END LINE, ETC.)
;    THAT CAN BE INVOKED VIA CHAR SEQUENCES MAY BE USED.
;
;2. MEMAPV/MEMADR (SEE PAGE 8 OR SO): FOR BOARDS THAT MEET
;    THE RESTRICTIONS (SEE PAGE 8), THIS METHOD IS BEST FOR
;    SPEED, MEMORY UTILIZATION, AND BECUASE ERASE TO END
;    LINE, LINE INSERT, AND LINE DELETE FUNCTIONS ARE
;    IMPLICITLY AVAILABLE WITH NO INSTALLATION CONSIDERATION.
;
;3. BOARDS THAT DO NOT MEET THE MEMAPV/MEMADR RESTRICTIONS:
;
;  A. ACCESS AS A TERMINAL IF PRACTICABLE - ITEM 1
;
;  B. BOARDS THAT CANNOT BE ACCESSED AS A TERMINAL (E.G.
;      BECUASE CURSOR POSITIONING OR SOME DESIRED OPTIONAL
;      FEATURE NOT ACCESSIBLE THROUGH OPERATING SYSTEM) AND
;      FOR WHICH MEMAPV/MEMADR CANNOT BE USED (E.G. BECAUSE
;      HIGHLIGHTING IS DESIRED AND IT IS NOT INVOKED BY
;      HIGH ORDER BIT OF CHARACTER, OR BECAUSE CHARACTER
;      POSITIONS DO NOT APPEAR AT CONTIGUOUS INCREASING
;      MEMORY ADDRESSES): YOU MUST CODE YOUR OWN DRIVER.
;
; SUGGESTIONS FOR CODING YOUR OWN VIDEO BOARD DRIVER:
;
;    BUILD THE DRIVER AROUND A CUSTOM CHARACTER OUTPUT
;SUBROUTINE ACCESSED VIA THE "UCONO" ITEM.  THIS ROUTINE
;WILL RECEIVE THE ASCII CHARACTER CODES 20H-7EH (WHICH IT
;MUST DISPLAY), THE CONTROL CHARACTERS CARRIAGE RETURN AND
;LINE FEED, WHICH IT MUST PROPERLY INTERPRET, AND OTHER
;CONTROL CHARACTERS PER YOUR PATCHES IN THE CURSOR POSI-
;TIONING ITEMS AND OTHER TERMINAL ITEMS, AS USED.  NOTE
;THAT UCONO RECEIVES ADDITIONAL USEFUL INFO IN BCDEHL.
;    CURSOR POSITIONING MAY BE BY CHARACTER SEQUENCE (USE
;CURSOR PATCH ITEMS AS FOR A TERMINAL, PAGE 3, AND INTER-
;PRET THE CHAR SEQUENCE IN YOUR UCONO ROUTINE, OR BY
;CUSTOM SUBROUTINE (UCRPOS, PAGE 4. READ COMMENTS WITH
;WITH UCRPOS RE USEFUL INFO IN REGISTERS CAREFULLY!).
;    HIGHLIGHTING MAY BE INVOKED BY HIGH ORDER BIT ON
;EACH HILITED CHARACTER (HIBIV) OR BY CHAR SEQUENCES
;(IVON AND IVOFF, AND INTERPRET THE CHARS IN UCONO).
;    ERASE END LINE, LINE DELETE, AND LINE INSERT, IF IMP-
;LEMENTED, MUST BE INVOKED BY CHAR SEQUENCES PATCHED INTO
;ERAEOL, LINDEL, AND LININS AND INTERPRETED IN UCONO.
;    INITIALIZATION MAY BE DONE VIA TRMINI OR INISUB.
```

```
02DE    00 00                              DB 0,0          ;SPACE RESERVED FOR EXPANSION
                                  ; SPACE FOR USER-ADDED SUBROUTINES
                                  ;
02E0                              MORPAT:
02E0    00 00 00 00                        DB 0,0,0,0
02E4    00 00 00 00                        DB 0,0,0,0      ;ADDITIONAL SPACE THAT MAY
02E8    00 00 00 00                        DB 0,0,0,0      ;BE USED FOR USER PATCHES,
02EC    00 00 00 00                        DB 0,0,0,0      ;FOR EXAMPLE FOR A CURSOR
02F0    00 00 00 00                        DB 0,0,0,0      ;POSITIONING SUBROUTINE, OR
02F4    00 00 00 00                        DB 0,0,0,0      ;FOR "INISUB" OR "UNISUB"
02F8    00 00 00 00                        DB 0,0,0,0      ;SUBROUTINES.
02FC    00 00 00 00                        DB 0,0,0,0      ;FOR YET MORE SPACE,
0300    00 00 00 00                        DB 0,0,0,0      ;SPACE, SEE "PBGMEM", NEXT.
0304    00 00 00 00                        DB 0,0,0,0
0308    00 00 00 00                        DB 0,0,0,0
030C    00 00 00 00                        DB 0,0,0,0
0310    00 00 00 00                        DB 0,0,0,0
0314    00 00 00 00                        DB 0,0,0,0
0318    00 00 00 00                        DB 0,0,0,0
031C    00 00 00 00                        DB 0,0,0,0
0320    00 00 00 00                        DB 0,0,0,0
0324    00 00 00 00                        DB 0,0,0,0
0328    00 00 00 00                        DB 0,0,0,0
032C    00 00 00 00                        DB 0,0,0,0
0330    00 00 00 00                        DB 0,0,0,0
0334    00 00 00 00                        DB 0,0,0,0
0338    00 00 00 00                        DB 0,0,0,0
033C    00 00 00 00                        DB 0,0,0,0
0340    00 00 00 00                        DB 0,0,0,0
0344    00 00 00 00                        DB 0,0,0,0
0348    00 00 00 00                        DB 0,0,0,0
034C    00 00 00 00                        DB 0,0,0,0
0350    00 00 00 00                        DB 0,0,0,0
0354    00 00 00 00                        DB 0,0,0,0
0358    00 00 00 00                        DB 0,0,0,0
```

```
                            ;
                            ; PROVISION FOR EXTENDED PATCHING
                            ;
                            ;PBGMEM POINTS TO BEGINNING OF MEMORY TO USE FOR WORK-
                            ;ING STORAGE. IF YET MORE SPACE IS NEEDED FOR PATCHES,
                            ;INSTALL FIRST, THEN PUT YOUR ADDED CODE WHERE PBGMEM
                            ;POINTS AND INCREASE PBGMEM TO POINT BEYOND YOUR PATCHES.
                            ;BE SURE TO USE A LARGE ENOUGH "SAVE" COMMAND!
                            ; — SAVE SIZE REQUIRED IS much LARGER THAN FOR WS.COM
                            ;WITHOUT ADDED PATCHES!

035C    0000*              PBGMEM: DW MEMORY     ; An indefinite amount of code may
                                                 ; be added here AFTER INSTALLation.
                                                 ; Do not add code before INSTALLing,
                                                 ; as INSTALL will delete it!
                            ;
                            ; ** END TERMINAL MODIFICATION AREA **

035E                        ALABEL  EQU    $     ;ASSEMBLER SHOULD PRINT 35E

                                    END          ;NEXT MODULE LOADS AT LOCATION 360 HEX
```

USER1   04/23/81   TERMINAL PATCH AREA MACRO-80 3.4   PAGE S

Macros:

Symbols:

ALABEL	035E	APLFLG	02D7I	ASCUR	0260I	CB4LFG	025DI
CLEAD1	024AI	CLEAD2	0253I	COLOFF	025FI	CRBLIV	02B5I
CTRAIL	0258I	DEFDSK	02DCI	DEL1	02CFI	DEL2	02D0I
DEL3	02D1I	DEL4	02D2I	DEL5	02D3I	DELCUS	02AEI
DELMIS	02AFI	ERAEOL	026DI	HETHBS	02D6I	HIBCUR	02B4I
HIBIV	02B3I	HITE	0248I	INISUB	02A4I	IVOFF	028BI
IVON	0284I	LINDEL	0274I	LININS	027BI	LINOFF	025EI
MEMADR	02B1I	MEMAPV	02B0I	MEMORY	035C*	MORPAT	02E0I
NMOFUS	02D8I	OUTCHR	0267*	PBGMEM	035CI	RFIXER	02B9I
RSTFLG	02DBI	RUBFXF	02B8I	SCRLSZ	02DDI	SWIN	02C3I
SWOUT	02C9I	TBASE	0100	TCKFLG	02DAI	TRMINI	0292I
TRMUNI	029BI	TRSCIF	02D5I	TRSCRS	02D4I	UCNSTA	02BAI
UCONI	02BDI	UCONO	02C0I	UCRPOS	0264I	UNISUB	02A7I
USELST	02AAI	WID	0249I	ZAFCIN	02B6I		

No Fatal error(s)

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Appendix F
The Printer Patch Area (USER4)

A listing of the WordStar user-modifiable module USER4 follows this page. This assembly listing is supplied for the convenience of the occasional user who may need to install WordStar for an unusual terminal or printer. Note that this listing is for the standard TBASE=100 Hex version. For the TRS-80 Model I version, and the Heath 89 version origined at 4300 Hex, add 4200 Hex to all addresses shown in listings. For a discussion of this listing, see Sections 6-8.

A separate publication, WordStar Customization Notes, is directed towards OEM's and system programmers. The Customization Notes contain additional source listings, including:

o   default areas

o   message files

o   OEM daisy wheel and similar printer drivers.

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```
                    TITLE USER4  04/10/81 PRINTER PATCH AREA
                ;
                ; FOR WordStar RELEASE 3.0 MAY, 1981
                ;
                ;ITEMS IN THIS FILE ARE NORMALLY SET AS REQUIRED BY THE
                ;INSTALL PROGRAM, OR USED WITHOUT CHANGE.
                ;
                ;THERE IS NORMALLY NO NEED TO REFER TO THIS LISTING IN
                ;ORDER TO MAKE WORDSTAR OPERATIONAL, AS THE INSTALL
                ;PROGRAM WILL SET ESSENTIAL ITEMS AS REQUIRED
                ;FOR ALL NORMAL INSTALLATIONS.
                ;
                ;MODIFICATIONS SOME USERS MAY WISH TO MAKE IN ITEMS
                ;LISTED HERE INCLUDE:
                ;
                ; 1.   ADDING CONTROL SEQUENCES FOR A TELETYPE-LIKE (NON-
                ;      DAISY) PRINTER TO SUPPORT ADDITIONAL FEATURES, E.G.:
                ;              CHARACTER PITCH CHANGE
                ;              RIBBON COLOR CHANGE
                ;              PARTIAL LINE MOTION (FOR SUBSCRIPTS).
                ;
                ; 2.   MODIFYING OR ADDING TO THE DRIVER CODE USED TO
                ;      SEND CHARACTERS TO AND FROM THE PRINTER, FOR THE
                ;      FOLLOWING OR OTHER REASONS, IN CASES WHERE
                ;      WORDSTAR'S PORT DRIVER (WHICH CAN BE FULLY SET UP
                ;      BY ANSWERING INSTALL'S QUESTIONS) CANNOT BE USED.
                ;          A) ALLOW RECEIVING CHARACTERS FROM PRINTER,
                ;             FOR PRINTERS WHICH REQUIRE ETX/ACK
                ;             PROTOCOL TO OPERATE AT MAXIMUM BAUD RATE;
                ;          B) ALLOW WORDSTAR TO DETERMINE IF PRINTER IS
                ;             READY TO RECEIVE A CHARACTER, FOR BETTER
                ;             PERFORMANCE IN CONCURRENT PRINTING;
                ;          C) INSTALLING A CUSTOM DRIVER FOR PRINTER NOT
                ;             SUPPORTED BY USER'S OPERATING SYSTEM NOR
                ;             SUPPORTABLE WITH WORDSTAR'S PORT DRIVER.
                ;
                    PAGE 63          ;SETS PAGE LENGTH
```

```
                         ; ENTRIES

                         ENTRY POSMTH,BLDSTR,DBLSTR,PSCRLF,PSCR,PSHALF,PBACKS
                         ENTRY PALT,PSTD,ROLUP,ROLDOW, RIBBON,RIBOFF
                         ENTRY USR1,USR2,USR3,USR4
                         ENTRY PSINIT,PSFINI, SOCHR,ULCHR
                         ENTRY PRINIT,PRFINI, CSWTCH,HAVBSY
                         ENTRY LIBSY,LISEND,LISINP, POBSY,POSEND,POINP
                         ENTRY POSTAT,POMASK,POOM,POOP,POINSK,POIM,PISTAT,POIP
                         ENTRY PUBSY,PUSEND,PUINP
                         ENTRY ACBSY,ACSEND,ACINP,ACFIN,ACSTA1,ACSTAR,CONFIE
                         ENTRY PROTCL,EAKBSZ

                         ; EQUATES

0100                     TBASE EQU 100H  ;WHERE PROGRAM IS LOADED FOR NORMAL CP/M

0000'                     ASEG  ;ABSOLUTE CODE, FOR USER LISTING

                          ORG TBASE+590H            ;BEGINS AFTER END OF USER3


0003                     IOBYTE EQU TBASE-100H+3 ;LOCATION OF SYTEM I/O
                                                 ;ASSIGNMENTS STATUS BYTE, USED BY
                                                 ;ALTERNATE CONSOLE PRINTER DRIVER.

0005                     BDOS EQU TBASE-100H+5    ;BDOS SYSTEM CALL ENTRY POINT,
                                                 ;USED IN CP/M LIST DEVICE PRINTER DRIVER.

0005                     LISTF EQU 5      ;CP/M LIST OUTPUT SYSTEM CALL FUNCTION #,
                                          ;USED BY CP/M LIST DEVICE PRINTER DRIVER.

0008                     BS      EQU     8        ;BACKSPACE CHARACTER
000A                     LF      EQU     10       ;LINE FEED
000C                     FF      EQU     12       ;FORM FEED
000D                     CR      EQU     13       ;CARRIAGE RETURN
007F                     DEL     EQU     7FH      ;DELETE OR RUBOUT
```

```
                                    ;ITEMS RELATING TO ALL PRINTERS
                           ;
                           ; PRINTER CHARACTERISTICS AND PRINTING METHOD
                           ;
                             ;PRINTER TYPE / OVERSTRIKE METHOD **** VERY
                             ; IMPORTANT: DETERMINES METHOD OF DOUBLE
                             ; STRIKE, UNDERLINE, ETC, AND WHETHER DAISY-
                             ; LIKE PRINTER CAPABLE OF MICROSPACE JUSTIFY.

                             ;POSMTH=FF HEX:
                             ;   PRINTER CAN OVERPRINT ONLY BY CARRIAGE
                             ;   RETURN WITHOUT LINE FEED.
                             ;POSMTH=0:
                             ;   PRINTER CAN OVERPRINT BY BACKSPACING AS
                             ;   WELL AS BY CARRIAGE RETURNING.
                             ;   NOTE: WITH POSMTH=0, CR-OVERPRINT IS USED
                             ;   ONLY FOR OVERPRINT LINES IN FILE.  FOR
                             ;   PRINTERS THAT CAN BACKSPACE BUT NOT RETURN
                             ;   CARRIAGE WITHOUT LINE FEED (EG SELECTRIC),
                             ;   USE POSMTH=0 AND DON'T USE OVERPRINT LINES.
                             ;POSMTH=1:
                             ;   PRINTER IS A DAISY WHEEL OR SIMILAR INCRE-
                             ;   MENTAL PRINTER.  CAN PRINT WITHOUT SPACING;
                             ;   CAN SPACE AND ROLL IN SMALL INCREMENTS.
                             ;   MICROJUSTIFICATION OCCURS ONLY IF POSMTH=1.
                             ;   ADDITIONAL PATCH ITEMS IN USER5.MAC ARE SET
                             ;   BY THE INSTALL PROGRAM FOR DAISIES.

0690    01                 POSMTH: DB 1H
                                   ;FF SEND CR THEN ANOTHER WHOLE LINE
                                   ;00 SEND BACKSPACE THEN CHAR TO
                                   ;      PRINT OVER LAST CHAR SENT
                                   ;01 DIASY WHEEL PRINTER WITH ALL NECESS
                                   ;   ITEMS IN USER4 AND USER5 INSTALLED.


0691    02                 BLDSTR: DB 2    ;NUMBER OF STRIKES FOR "BOLDFACE"
                                   ;SET 3, 4, 5, ETC FOR DARKER "BOLDFACE"
                                   ;ON NON-DAISY PRINTER. FOR DIASY
                                   ;PRINTERS, 2 IS USED - DON'T CHANGE.

0692    02                 DBLSTR: DB 2    ;NUMBER OF STRIKES FOR "DOUBLE
                                   ;STRIKE". INCREASE AS DESIRED.

0693    00 00 00                   DB 0,0,0        ;RESERVED
```

```
                        ; ******  USER-PATCHABLE FUNCTION
                        ;  STRINGS FOR NON-DAISY PRINTERS  ********

                        ;EACH STRING CONSISTS OF THE NUMBER OF BYTES,
                        ;FOLLOWED BY THE BYTES TO BE SENT.
                        ;IF FUNCTION IS NOT AVAILABLE,
                        ;NUMBER OF BYTES SHOULD BE ZERO.

                        ;  ITEMS ON NEXT N PAGES APPLY ONLY WHEN
                        ;  POSMTH (ABOVE) IS 0 OR FF, NOT 1.

                        ;
                        ;STRING TO ADVANCE TO NEXT LINE, USED WHEN
                        ;CR,LF ENCOUNTERED IN FILE.
                        ;
                        ;  IF YOUR PRINTER REQUIRES NULLS SENT
                        ;  AFTER CARRIAGE RETURN (FOR DELAY),
                        ;  INCREASE COUNT SO SOME OF
                        ;  FOLLOWING ZEROES ARE SENT.
                        ;
                        ;  IF YOUR PRINTER AUTO LINE-FEEDS AFTER
                        ;  CR CODE, REMOVE LF.  (IF POSSIBLE,
                        ;  TURN OFF AUTO-LF IN YOUR PRINTER
                        ;  INSTEAD, FOR GREATER FLEXIBILY OF
                        ;  WORDSTAR USE).
                        ;
0696    02              PSCRLF: DB 2      ;NUMBER OF CHARACTERS
0697    0D                      DB CR     ;1ST CHAR: CARR RET
0698    0A                      DB LF     ;2ND CHAR: LINE FEED
0699    00 00 00 00             DB 0,0,0,0       ;SPACE FOR 8
069D    00 00 00 00             DB 0,0,0,0       ;..MORE CHARS

                        ;
                        ;STRING TO RETURN CARRIAGE TO BEGINNING
                        ;OF SAME LINE, TO OVERPRINT.
                        ;
                        ;USED FOR UNDERLINE, DOUBLE STRIKE, ETC IF
                        ; POSMTH (ABOVE) IS FF.
                        ;AND WHEN CR WITHOUT LF IS ENCOUNTERED
                        ; IN FILE IF POSMTH IS FF OR 0.
                        ;ALSO USED WHEN POSMTH IS FF AND BACKSPACE
                        ; (^H) IS ENCOUNTERED IN FILE.
                        ;
06A1    02              PSCR:   DB 2       ;2 CHARS: CR AND A NULL,
                                           ;TO ALLOW A LITTLE TIME
                                           ;FOR CERTAIN PRINTERS.
06A2    0D                      DB CR      ;CARRIAGE RETURN
06A3    00                      DB 0       ;NULL, FOR DELAY
06A4    00 00 00 00             DB 0,0,0,0        ;SPACE FOR 4
                                           ;MORE CHARS.
```

```
                                    ;NON-DAISY STRINGS...
                                    ;
                                    ; STRING TO DO CARRIAGE RETURN AND HALF LINE
                                    ; FEED, FOR PRINTERS THAT CAN DO HALF LINE FEED
                                    ; DOWNWARD BUT NOT UPWARD.  USED TO PRINT
                                    ; SUBSCRIPTS AND SUPERSCRIPTS AT HALF-LINE
                                    ; INTERVALS IF ROLUP (BELOW) NOT INSTALLED
                                    ; AND POSMTH IS FF OR 0.
                                    ;
                                    ; FOR EXAMPLE, FOR A SELECTRIC THAT ALWAYS
                                    ; FEEDS HALF LINES, INSTALL ONE CRLF HERE,
                                    ; TWO IN "PSCRLF" ABOVE.
                                    ;
06A8      00                        PSHALF: DB 0
06A9      00 00 00 00                       DB 0,0,0,0,0,0
06AD      00 00

                                    ;
                                    ;STRING TO BACKSPACE, IE TO OVERPRINT LAST
                                    ;CHAR PRINTED.
                                    ;
                                    ;USED FOR UNDERLINE, DOUBLE STRIKE, ETC IF
                                    ;POSMTH (ABOVE) IS 0.  ALSO USED WHEN BACKSPACE
                                    ;(^H) ENCOUNTERED IN FILE IF POSMTH IS 0.
                                    ;
06AF      01                        PBACKS: DB 1
06B0      08                                DB BS              ;ASCII BACKSPACE
06B1      00 00 00 00                       DB 0,0,0,0
```

```
                                 ;NON-DAISY STRINGS...

                                 ;  **** THE FOLLOWING ARE OPTIONAL
                                 ;       STRINGS, PERMITTING USE OF ADDITIONAL
                                 ;       FEATURES IF SUPPORTED BY YOUR PRINTER.
                                 ;
                                 ;STRING TO SET ALTERNATE CHARACTER
                                 ;WIDTH, IF AVAILABLE.
                                 ;
06B5    00               PALT:   DB 0     ;0 CHARS: NOT AVAILABLE
06B6    00 00 00 00               DB 0,0,0,0
                                 ;
                                 ;STRING TO RESET TO STANDARD CHARACTER WIDTH
                                 ;
06BA    00 00 00 00      PSTD:   DB 0,0,0,0,0
06BE    00

                                 ;
                                 ;STRING TO ROLL CARRIAGE UP A PARTIAL LINE
                                 ; WITHOUT ALTERING CARRIAGE COLUMN,
                                 ; IF AVAILABLE, FOR USE BEFORE SUPERSCRIPT
                                 ; AND AFTER SUBSCRIPT.  ROLDOW SHOULD ALSO
                                 ; BE INSTALLED TO ROLL CARRIAGE SAME AMOUNT
                                 ; IN OTHER DIRECTION. APPLIES IF POSMTH=FF OR 0.
                                 ;
06BF    00 00 00 00      ROLUP:  DB 0,0,0,0,0
06C3    00

                                 ;
                                 ;STRING TO ROLL DOWN, AS AFTER SUPERSCRIPT,
                                 ; IF AVAILABLE.  USED ONLY IF ROLUP ALSO
                                 ; INSTALLED.
                                 ;
06C4    00 00 00 00      ROLDOW: DB 0,0,0,0,0
06C8    00


                                 ; ****** USER-PATCHABLE ITEMS FOR BOTH
                                 ;        BOTH DAISY AND NON-DAISY PRINTERS  ********
                                 ;
                                 ; STRINGS FOR USER-DEFINED FUNCTIONS 1-4, INVOKABLE
                                 ; WITH PRINT CONTROL CHARACTERS IMBEDDED IN FILE.
                                 ;    USE ONLY WITH EXTREME CAUTION AND VERY THOROUGH
                                 ; TESTING ON DAISY PRINTERS, AS WORDSTAR'S CONTROL
                                 ; SEQUENCES AND YOURS COULD EASILY INTERFERE.
                                 ;    LINES CONTAINING CONTROLS THAT INVOKE THESE
                                 ; ALWAYS PRINT FORWARD EVEN IF BIDIRECTION PRINT IS ON.
                                 ;
06C9    00               USR1:   DB 0
06CA    00 00 00 00               DB 0,0,0,0
06CE    00               USR2:   DB 0
06CF    00 00 00 00               DB 0,0,0,0
06D3    00               USR3:   DB 0
06D4    00 00 00 00               DB 0,0,0,0
06D8    00               USR4:   DB 0
06D9    00 00 00 00               DB 0,0,0,0
```

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```
                                    ;DAISY / NON-DAISY ITEMS...

                                    ;STRINGS USED BY BOTH DIASIES AND NON-DAISIES.
                                    ;AUTOMATICALLY PATCHED FOR DAISIES BY INSTALL PROGRAM;
                                    ;MEDDLE WITH CAUTION FOR DAISY PRINTERS.
                                    ;
                                    ; CHANGE RIBBON COLOR (OPTIONAL)
                                    ;
06DD   00                  RIBBON: DB 0      ;CHANGE TO ALTERNATE COLOR
06DE   00 00 00 00                 DB 0,0,0,0

06E2   00                  RIBOFF: DB 0      ;CHANGE BACK TO BLACK
06E3   00 00 00 00                 DB 0,0,0,0
                                    ;
                                    ; STRING TO INITIALIZE PRINTER.  SENT AT
                                    ; START OF PRINTING, MAY BE USED TO TURN MOTOR
                                    ; ON, SET STANDARD CHARACTER SIZE AND LINE
                                    ; HEIGHT, OR OTHER FUNCTIONS FOR YOUR SPECIFIC
                                    ; HARDWARE.  ALWAYS PATCHED BY INSTALL PROGRAM,
                                    ; ADD YOUR BYTES AFTER INSTALLATION.
                                    ;
06E7   01                  PSINIT: DB 1      ;NUMBER OF CHARACTERS
06E8   0D                          DB CR     ;CARRIAGE RETURN, TO MAKE SURE
                                              ;CARRIAGE STARTS AT LEFT EDGE
                                              ;OF PAPER.
06E9   00 00 00                    DB 0,0,0
06EC   00 00 00 00                 DB 0,0,0,0     ;UP TO 16 CHARACTERS ..
06F0   00 00 00 00                 DB 0,0,0,0     ;.. TOTAL TO SEND ..
06F4   00 00 00 00                 DB 0,0,0,0     ;.. TO PRINTER
                                    ;
                                    ; STRING SENT TO PRINTER AT CONCLUSION OF
                                    ; PRINTING, EG TO TURN MOTOR OFF.
                                    ;
06F8   00                  PSFINI: DB 0
06F9   00 00 00 00                 DB 0,0,0,0
06FD   00 00 00 00                 DB 0,0,0,0
0701   00 00 00 00                 DB 0,0,0,0
0705   00 00 00 00                 DB 0,0,0,0     ;UP TO 16 CHARS

0709   00 00                       DB 0,0         ;RESERVED


                                    ;
                                    ; CHARACTER USED FOR "STRIKEOUT" PRINT ENHANCEMENT
                                    ;       (INVOKED WITH CONTROL-X PRINT CONTROL)
070B   2D                  SOCHR:  DB '-'
                                    ;
                                    ; CHARACTER USED FOR "UNDERSCORE" PRINT ENHANCEMENT
                                    ;       (INVOKED WITH CONTROL-S PRINT CONTROL)
070C   5F                  ULCHR:  DB '_'
```

```
                                    ;
                                    ; CUSTOM PRINTER INITIALIZE SUBR, CALLED BEFORE
                                    ; STRING (PSINIT OR DINIT) IS SENT.  USE FOR
                                    ; ANYTHING THAT CAN'T BE ACCOMPLISHED WITH
                                    ; A STRING, SUCH AS ASSIGNMENT OR INITIALIZING
                                    ; A SPECIAL DRIVER INSTALLED IN YOUR BIOS.
                                    ;
070D    00             PRINIT: NOP        ;INITIALLY NULL. PATCH A JMP
070E    00                     NOP        ;TO YOUR ROUTINE HERE. SEE END
070F    C9                     RET        ;OF USER1.MAC RE FINDING PATCH
                                          ;SPACE.

                                    ;
                                    ; CUSTOM PRINTER FINISH (CLOSE) SUBR, CALLED
                                    ; AFTER STRING (PSFINI OR DFINI) IS SENT.
                                    ;
0710    00             PRFINI: NOP
0711    00                     NOP
0712    C9                     RET

0713    00 00 00 00            DB 0,0,0,0       ;RESERVED
```

```
                              ;  ***** FLAGS RELATING TO TRANSMISSION
                              ;         OF CHARACTERS TO PRINTER *****

                              ;ITEMS ON THIS PAGE RELATE TO ALL PRINTERS.


     0717    03               CSWTCH: DB 3    ;WHERE TO SEND EACH OUTPUT CHARACTER:
                                ; 00  TO CP/M LIST DEVICE.
                                ;   HAVBSY SHOULD BE 0 (UNLESS YOU
                                ;   INSTALL A "BUSY" ROUTINE AT LIBSY)
                                ; 01  TO INSTALL-PROGRAM-PATCHABLE PORT DRIVER
                                ; 02  TO USER SUBROUTINE, ENTRY POINTS
                                ;   PUBUSY, PUSEND, AND PUINP.
                                ; 03  TO OEM DAISY PRINTER DRIVER. FORCES POSMTH=1.
                                ; 04  TO ALTERNATE CONSOLE PRINTER DRIVER.


     0718    FF               HAVBSY: DB 0FFH ;NON-ZERO IF PRINTER DRIVER
                                        ; AS INSTALLED AND PATCHED
                                ; HAS A "BUSY" TEST SEPARATE FROM
                                ; "PRINT A CHARACTER".  IF NON-ZERO,
                                ; CONCURRENT EDITING AND PRINTING
                                ; WILL PERFORM BETTER; MUST BE ZERO
                                ; IF CAN'T FIND OUT WHETHER PRINTER
                                ; IS BUSY (AS WHEN CHARACTERS ARE
                                ; OUTPUT THROUGH CP/M "LIST" DEVICE).

     0719    00                        DB 0    ;RESERVED FOR EXPANSION
```

```
                                ;  *****  PRINTER DRIVERS PER SE *****

                                ; THERE ARE FIVE DRIVERS, CORRESPONDING TO
                                ; CSWTCH (PREVIOUS PAGE) = ØØ, Ø1, Ø2, Ø3, Ø4.
                                ;
                                ; EACH OF THE DRIVERS HAS THREE ENTRIES:
                                ; 1.  BUSY STATUS ENTRY.  RETURNS CY=1 IF
                                ;      PRINTER IS NOT READY.  IF UNIMPLEMENTED,
                                ;      RETURN CY=Ø.  HAVBSY SHOULD BE Ø IF
                                ;      UNIMPLEMENTED AND FF IF IMPLEMENTED.
                                ; 2.  SEND CHARACTER (A REGISTER) ENTRY.
                                ; 3.  INPUT A CHAR TO A, OR RETURN CY=1 IF NO
                                ;      INPUT CHARACTER READY.  THIS ENTRY IS
                                ;      USED ONLY FOR ETX/ACK AND XON/XOFF
                                ;      BUFFER FULL PROTOCOLS IMPLEMENTED
                                ;      WITHIN EDITOR (SEE "PROTCL" BELOW).
                                ;
                                ; THESE ROUTINES MAY CLOBBER ALL REGISTERS.


                                ;
                                ;PRINTER DRIVER TO OUTPUT TO CP/M LIST
                                ;DEVICE. ONLY CALLED IF CSWITCH=ØØ.
                                ;

Ø71A                            LIBSY:  ;BUSY TEST ENTRY - BUSY TEST MAY BE
                                        ;ADDED HERE IF YOUR OPERATING SYSTEM
                                        ;ALLOWS DETERMINING WHETHER PRINTER
                                        ;IS READY. PATCH HAVBSY TO FF IF USED.

Ø71A   ØØ                               NOP
Ø71B   B7                               ORA A          ;RETURN CY=Ø TO SAY
Ø71C   C9                               RET            ; .. NOT BUSY.

Ø71D                            LISEND: ;OUTPUT CHARACTER (A) TO LIST DEVICE

Ø71D   5F                               MOV E,A        ;CHARACTER IN E FOR CP/M
Ø71E   ØE Ø5                            MVI C,LISTF    ;FUNCTION # IN C
Ø72Ø   CD ØØØ5                          CALL BDOS      ;CALL SYSTEM
Ø723   B7                               ORA A          ;CLEAR CY FLAG
Ø724   C9                               RET            ;RETURN TO CALLER

Ø725                            LISINP: ;INPUT CHARACTER TO (A) OR RETURN CY=1
                                        ;IF NONE.  THIS FUNCTION IS NOT SUPPLIED
                                        ;BY OPERATING SYSTEM, USER MUST SUPPLY
                                        ;SUBROUTINE IF ETX/ACK OR XON/XOFF
                                        ;PROTOCOL IS TO BE USED.

Ø725   ØØ                               NOP
Ø726   37                               STC     ;IF NO ROUTINE INSTALLED, SAY
Ø727   C9                               RET     ; .. NO CHARACTER READY.
```

```
                                    ; PRINTER DRIVERS...
                                    ;
                                    ;PORT DRIVER.  CALLED ONLY IF CSWITCH=1.
                                    ;
                                    ;     DOES I/O DIRECT TO HARDWARE PORTS.  PORT NUMBERS AND
                                    ;STATUS BITS MAY BE SET AS DESIRED BY ANSWERING QUESTIONS
                                    ;ASKED BY THE INSTALL PROGRAM AFTER CHOOSING "PORT DRIVER".
                                    ;     INITIALLY SET UP TO USE PORT 4 FOR DATA, PORT 5 BIT 0
                                    ;ON TO INDICATE READY FOR OUTPUT, PORT 5 BIT 1 ON TO
                                    ;INDICATE INPUT CHARACTER READY.
                                    ;     SELECTING PORT DRIVER IN INSTALL SETS HAVBSY TO FF.
                                    ;
    0728                            POBSY:             ;PORT DRIVER STATUS ENTRY
                                        ;BUSY TEST CODE:
    0728    DB                          DB (IN)    ;"IN" INSTRUCTION
    0729    05                      POSTAT: DB 5        ;PATCH OUTPUT STATUS PORT # HERE
    072A    00                          NOP        ; - PORT 5 SHOWN AS EXAMPLE
    072B    E6                          DB (ANI)   ;MASK BIT(S) OF INTEREST -
    072C    01                      POMASK: DB 1        ; BIT 0 SHOWN AS EXAMPLE.
    072D    EE                          DB (XRI)   ;COMPLEMENT BITS WHICH MUST
    072E    01                      POOM:   DB 1        ; BE 1 FOR PRINTER READY.
                                        ;NOW HAVE NON-ZERO IF PRINTER NOT RDY
    072F    37                          STC        ;SAY NOT READY
    0730    C0                          RNZ        ;RETURN IF NOT READY
    0731    B7                          ORA A      ;CLEAR CARRY: SAY READY
    0732    C9                          RET        ;RETURN

    0733                            POSEND:            ;PORT DRIVER SEND CHAR ENTRY
    0733    D3                          DB (OUT)
    0734    04                      POOP:   DB 4       ;OUTPUT DATA PORT PATCHED HERE -
    0735    00                          NOP        ; PORT 4 SHOWN AS EXAMPLE.
    0736    C9                          RET

    0737                            POINP:             ;PORT DRIVER INPUT CHAR ENTRY,
                                                       ;USED IF PROTCL=1 OR 2 ONLY.
    0737    DB                          DB (IN)
    0738    05                      PISTAT: DB 5        ;PATCH INPUT STATUS PORT # HERE
    0739    00                          NOP
    073A    E6                          DB (ANI)
    073B    02                      POINSK: DB 2        ;MASK BITS OF INTEREST - B1 SHOWN
    073C    EE                          DB (XRI)   ;COMPLEMENT BITS THAT ARE ON WHEN
    073D    02                      POIM:   DB 2        ; INPUT CHARACTER IS READY
                                        ;NOW HAVE NZ IF INPUT CHARACTER NOT READY
    073E    37                          STC
    073F    C0                          RNZ        ;RETURN CY=1 IF NO CHAR READY
                                        ;CHARACTER IS READY, INPUT IT
    0740    DB                          DB (IN)
    0741    04                      POIP:   DB 4       ;PATCH INPUT DATA PORT # HERE
    0742    00                          NOP
    0743    B7                          ORA A      ;CLEAR CY
    0744    C9                          RET        ;RETURN WITH CHAR IN A
```

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                                          ;PRINTER DRIVERS...

0745   00 00 00 00   DB 0,0,0,0,0,0,0   ;RESERVED
0749   00 00 00
                          ;
                          ;USER-SUPPLYABLE PRINTER OUTPUT SUBROUTINES
                          ;CALLED ONLY IF CSWITCH=2.
                          ;
                          ; THIS MAY BE USED WHERE SPECIAL INTERFACE
                          ; REQUIREMENTS NECESSITATE A MORE COMPLEX
                          ; ROUTINE THAN THE PORT DRIVER ABOVE.
                          ;
                          ; SPACE IS PROVIDED HERE ONLY FOR THE JMPS TO
                          ; THE ROUTINES; PATCH OVER DRIVERS ABOVE, OR
                          ; IN "MORPAT" AREA AT END OF USER1 MODULE
                          ; (SEE PRECEDING LISTING). FOR MORE SPACE,
                          ; SEE "PBGMEN" AND ASSOCIATED COMMENTS AT
                          ; END OF USER1 LISTING.
                          ;
074C   00   PUBSY: NOP   ;ENTRY POINT TO USER-SUPPLIED
                                           ; ROUTINE TO RETURN CY=1 IF
                                           ; PRINTER IS NOT READY.
074D   B7   ORA A   ;IF UNIMPLEMENTED, RET CY=0.
074E   C9   RET

074F   00   PUSEND: NOP   ;ENTRY POINT TO USER-SUPPLIED
0750   00   NOP   ; ROUTINE TO PRINT CHARACTER
0751   C9   RET   ; IN A REGISTER.

0752   00   PUINP: NOP   ;ENTRY POINT TO USER-SUPPLIED
                                           ; ROUTINE TO INPUT CHARACTER,
                                           ; OR RETURN CY=1 IF NONE READY.
                                           ; USED ONLY IF PROTCL IS 1 OR 2.
0753   37   STC   ;IF UNIMPLEMENTED, SAY NO CHAR RDY.
0754   C9   RET

                          ; THE PRINTER DRIVER FOR CSWTCH=3 IS NOT IN USER4.

0755   00 00 00   DB 0,0,0   ;RESERVED

```
                              ;PRINTER DRIVERS...
                           ;
                           ; "ALTERNATE CONSOLE" PRINTER DRIVER
                           ;       CALLED ONLY IF CSWTCH=4.
                           ;
                           ; THIS DRIVER ALLOWS ACCESS TO PRINTERS REQUIRING
                           ; CHARACTER INPUT (FOR A COMMUNICATIONS PROTOCOL)
                           ; WITHOUT PATCHING IN A DRIVER, UNDER OPERATING
                           ; SYSTEMS WHICH SUPPORT MULTIPLE CONSOLES SELECTED
                           ; VIA THE "IOBYTE" I/O ASSIGNMENTS BYTE.
                           ;
                           ; THIS DRIVER IS SELECTED BY SETTING CSWTCH TO 4.
                           ;
                           ; THE SPECIFIC CONSOLE DEVICE TO BE USED IS SELECTED
                           ; BY SETTING ITEM "CONFIE" BELOW TO 00, 01, 02, OR 03.
                           ;
                           ; "HAVBSY" SHOULD BE 0 WHEN USING ALTERNATE CONSOLE
                           ; DRIVER, UNLESS YOU ADD A BUSY TEST ROUTINE.
                           ;
0758               ACBSY:  ;ENTRY POINT FOR OUPUT BUSY TEST.
                           ;NO ROUTINE SUPPLIED, AS NORMAL OPERATING SYSTEM
                           ; DOES NOT PROVIDE CONSOLE OUTPUT BUSY FUNCTION.
0758    00                 NOP
0759    B7                 ORA A   ;RETURN CY=0 TO SAY "NOT BUSY"
075A    C9                 RET


075B               ACSEND: ;ENTRY POINT TO SEND CHARACTER IN A TO PRINTER

075B    CD 0777            CALL ACSTAR     ;SET IOBYTE TO ALTERNATE CONSOLE,
                                           ;SAVING ORIGINAL IOBYTE IN B.
075E    CD 0000*           CALL COUCH##    ;OUTPUT CHARACTER (A) TO CONSOLE,
                                           ;PRESERVING REGISTERS.
0761    C3 076E            JMP ACFIN       ;GO RESTORE IOBYTE AND RETURN.


0764               ACINP:  ;ENTRY POINT TO RETURN CONSOLE INPUT CHARACTER
                           ;IN A REGISTER, OR RETURN CY=1 IF NO CHAR READY.

0764    CD 0777            CALL ACSTAR     ;SAVE AND SET IOBYTE
0767    CD 0000*           CALL CONSTA##   ;THIS SUBROUTINE RETURNS 0 IN
                                           ;A AND Z FLAG SET IF NO CHARACTER
                                           ;IS READY AT CONSOLE. SAVES BCDEHL.
076A    C4 0000*           CNZ INCHR##     ;IF CHARACTER READY, GET IT TO A.
                                           ;ELSE 0 IS LEFT IN A.
076D    57                 MOV D,A         ;PUT VALUE TO RETURN IN D FOR NOW
                           ;FALL THRU TO ACFIN ON NEXT PAGE TO RESTORE IOBYTE,
                           ;RETURN D IN A, CY=1 IF NO CHAR READY, ELSE CY=0.
```

```
                                         ;PRINTER DRIVERS...    ALTERNATE CONSOLE DRIVER...


     076E                          ACFIN:  ;ALTERNATE CONSOLE DRIVER COMMON EXIT ROUTINE

     076E    78                            MOV A,B        ;ORIGINAL IOBYTE, SAVED BY "ACSTAR"
     076F                          ACSTA1:        ;"ACSTAR" SUBROUTINE JOINS HERE
     076F    32 0003                       STA IOBYTE     ;SET NEW IOBYTE OR RESTORE ORIGINAL
     0772    7A                            MOV A,D        ;RESTORE A REGISTER
                                           ;RETURN CY=1 IF A=0: THIS IS NEEDED AT EXIT FROM
                                           ;"ACINP" ROUTINE, DOES NO HARM IN OTHER CASES.
     0773    B7                            ORA A          ;TEST FOR NON-ZERO, CLEAR CY FLAG
     0774    C0                            RNZ            ;IF NON-ZERO, RETURN CY FLAG CLEAR
     0775    37                            STC            ;ELSE SET CARRY FLAG
     0776    C9                            RET            ;FOR A=0 RETURN CY=1


     0777                          ACSTAR: ;COMMON ENTRY SUBR FOR ALTERNATE CONSOLE DRIVER

     0777    57                            MOV D,A        ;SAVE A IN D, FOR ACSEND.
     0778    3A 0003                       LDA IOBYTE     ;GET I/O ASSIGNMENTS STATUS BYTE
     077B    47                            MOV B,A        ;SAVE INITIAL IOBYTE IN B
     077C    E6 FC                         ANI 0FCH       ;ZERO THE "CONSOLE" PART OF IOBYTE
     077E    F6                            DB (ORI)       ;SET DESIRED CONSOLE BITS
     077F    01                    CONFIE: DB 01  ;USER OR INSTALLATION SETS DESIRED
                                                   ;CONSOLE BITS HERE:
                                                   ; 00 = TTY: PHYSICAL DEVICE
                                                   ; 01 = CRT: PHYSICAL DEVICE
                                                   ; 02 = BAT: PHYSICAL DEVICE
                                                   ; 03 = UC1: PHYSICAL DEVICE
                                           ; NEW IOBYTE VALUE IS NOW IN A
     0780    C3 076F                       JMP ACSTA1     ;GO SET IOBYTE FROM A, RESTORE A
                                                          ;FROM D, AND RETURN TO CALLER.
```

```
0783      00 00 00                    DB 0,0,0                ;RESERVED
                                   ;
                                   ; **** PRINTER COMMUNICATIONS PROTOCOL ****
                                   ;
                                   ; APPLICABLE IF CSWTCH=0, 1, OR 2.
                                   ; APPLICABLE FOR ALL POSMTH VALUES.
                                   ;
                                   ; THREE BUFFER FULL PROTOCOLS ARE SUPPORTED:
                                   ;
                                   ; NO PROTOCOL: (PROTCL=0): NO PROTOCAL EXECUTED IN WORD-
                                   ;     STAR: USE IF NONE REQUIRED OR IF HANDLED ELSEWHERE,
                                   ;     EG IN OPERATING SYSTEM OR IN USER DRIVER ROUTINES.
                                   ;
                                   ; ETX/ACK PROTOCOL (PROTCL=1): WS TRANSMITS "ETX" AT END
                                   ;     OF STRING OF CHARACTERS, PRINTER RESPONDS WITH
                                   ;     "ACK" WHEN ALL OF THESE CHARACTERS HAVE BEEN
                                   ;     PRINTED.  DRIVER MUST BE ABLE TO INPUT CHARACTERS.
                                   ;
                                   ; XON/XOFF PROTOCAL (PROTCL=2): PRINTER
                                   ;     SENDS "XOFF" WHEN WS SHOULD STOP SENDING,
                                   ;     "XON" WHEN TRANSMISSION SHOULD BE RESUMED.
                                   ;     DRIVER MUST BE ABLE TO INPUT CHARACTERS.
                                   ;
0786      00                   PROTCL: DB 0     ;0=NO PRINTER BUFFER FULL PROTOCOL
                                                ;1=ETX/ACK PROTOCOL. SET EAKBSZ BELOW!
                                                ;2=XON/XOFF PROTOCOL
                                   ; USE 0 FOR MOST TTY-LIKE PRINTERS AND FOR SERIAL
                                   ; DAISY PRINTERS INTERFACED AT 300 BAUD OR SLOWER.
                                   ; FOR DIABLO AND QUME AT 1200 BAUD, USE 1.
                                   ; FOR NEC AT 1200 BAUD, USE 1 OR 2 AND CONFIGURE THE
                                   ;  PRINTER APPROPRIATELY, OR USE 0 & CABLE ADAPTER.

0787      7F                   EAKBSZ: DB 127   ;ETX/ACK MESSAGE LENGTH (1/2 PRINTER'S
                                                ;BUFFER SIZE), APPLICABLE ONLY IF PROTCL=1,
                                                ;AUTOMATICALLY PATCHED FOR DAISY PRINTERS.

0788      00 00                       DB 0,0                  ;RESERVED FOR EXPANSION
078A      00 00 00 00                 DB 0,0,0,0              ;RESERVED FOR EXPANSION

078E                          ALABEL  EQU     $       ;ASSEMBLER SHOULD PRINT 78E

                                      END             ;NEXT MODULE LOADS AT 790H
```

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Macros:

Symbols:

ACBSY	0758I	ACFIN	076EI	ACINP	0764I	ACSEND	075BI
ACSTA1	076FI	ACSTAR	0777I	ALABEL	078E	BDOS	0005
BLDSTR	0691I	BS	0008	CONFIE	077FI	CONSTA	0768*
COUCH	075F*	CR	000D	CSWTCH	0717I	DBLSTR	0692I
DEL	007F	EAKBSZ	0787I	FF	000C	HAVBSY	0718I
INCHR	076B*	IOBYTE	0003	LF	000A	LIBSY	071AI
LISEND	071DI	LISINP	0725I	LISTF	0005	PALT	06B5I
PBACKS	06AFI	PISTAT	0738I	POBSY	0728I	POIM	073DI
POINP	0737I	POINSK	073BI	POIP	0741I	POMASK	072CI
POOM	072EI	POOP	0734I	POSEND	0733I	POSMTH	0690I
POSTAT	0729I	PRFINI	0710I	PRINIT	070DI	PROTCL	0786I
PSCR	06A1I	PSCRLF	0696I	PSFINI	06F8I	PSHALF	06A8I
PSINIT	06E7I	PSTD	06BAI	PUBSY	074CI	PUINP	0752I
PUSEND	074FI	RIBBON	06DDI	RIBOFF	06E2I	ROLDOW	06C4I
ROLUP	06BFI	SOCHR	070BI	TBASE	0100	ULCHR	070CI
USR1	06C9I	USR2	06CEI	USR3	06D3I	USR4	06D8I

No Fatal error(s)