HEWLETT PACKARD

RuggedWriter Printer

Owner's Manual

RuggedWriter 480
High Performance Printer
Owner's Manual

HEWLETT
PACKARD

Manual Part No.
02235-90002

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Regulatory Notices

Potential for Radio/ Television Interference (USA only)

The RuggedWriter 480 printer generates and uses radio frequency energy and may cause interference to radio and television reception. Your printer complies with the specifications in Subpart J of Part 15 or the Federal Communications Commission rules for a Class B computing device. These specifications provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If the printer does cause interference to radio or television reception, which can be determined by turning the printer off and on, you can try to eliminate the interference problem by doing one or more of the following.

- Reorient the receiving antenna.
- Reorient the position of the printer with respect to the receiver.
- Move the printer away from the receiver.
- Plug the printer into a different outlet so that the printer and the receiver are on different branch circuits.

If necessary, consult an authorized HP dealer or an experienced radio/television technician for additional suggestions. You may find the following booklet, prepared by the Federal Communications Commission, helpful: How to Identify and Resolve Radio/TV Interference Problems. This booklet is available from the US Government Printing Office, Washington D.C. 20402, Stock No. 004-000-00345-4.

To comply with FCC rules Part 15J Class B computing device use only shielded interface cables.

Funkentstörung Deutschland

Dieses Gerät wurde in einer typischen Systemkonfiguration geprüft und entspricht den Bestimmungen der Allgemeinen Genehmigung FTZ 1046/84. Als Nachweis ist das Gerät mit dem VDE-Funkschutzzeichen mit Index 0871-B/P für Peripheriegeräte gekennzeichnet.

Wird das Gerät innerhalb einer Anlage betrieben,

- So muß bei Inanspruchnahme der Allgemeinen Genehmigung FTZ 1046/84 die gesamte Anlage der oben genannten Genehmigung entsprechen.
- Die mit einer FTZ-Serienprüfnummer gekennzeichnet ist, und für die eine Betriebsgenehmigung vorliegt oder beantragt wird, so sind in der Regel keine weiteren Schritte notwendig.

Power Module Statement—Australia

The power module cannot be repaired; if it is defective it should be discarded or returned to the supplier.

Sweden

Får endast anslutas till jordat nätuttag.

Observera!

Skadas sladden till detta strömförsörjningsdon skall donet kasseras. Sladden går ej att byta ut.

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Acknowledgments

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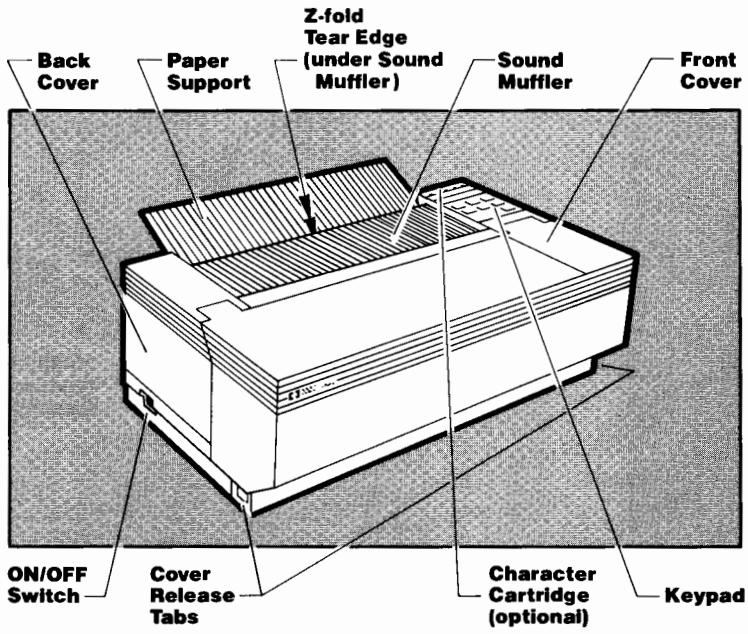
Meet Your Printer

Take a minute to become acquainted with your printer.

You'll be glad you did.



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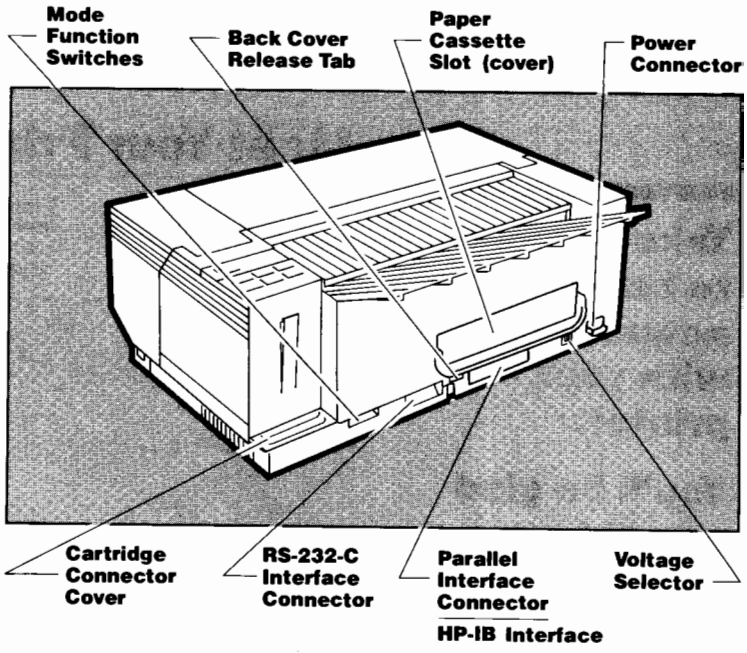
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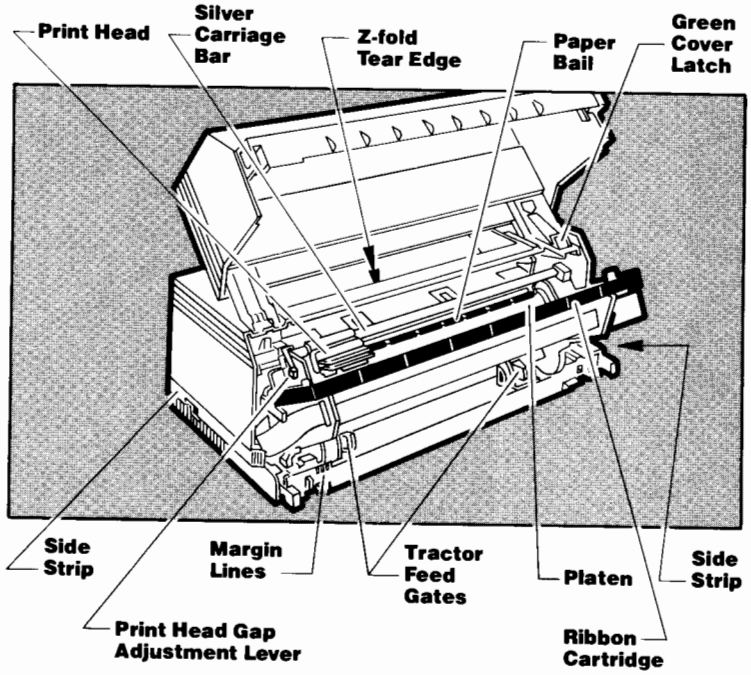
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Silver Carriage Bar
Z-fold Tear Edge
Paper Bail
Green Cover Latch
Side Strip
Margin Lines
Tractor Feed Gates
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Getting Started 1

WELCOME!

This section of your Owner's Manual contains the information you'll need to get started using your new printer. We encourage you to read it from start to finish.

Unpacking and Setting Up Your Printer

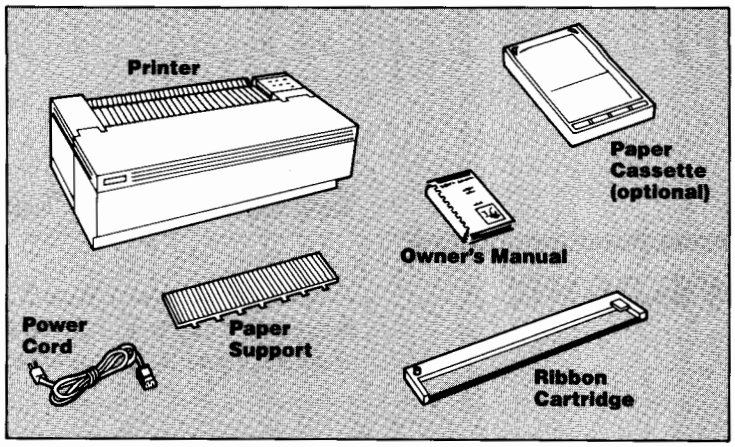
Unpack your printer and set it on a flat, stable surface.

Check that the following items were shipped along with your printer:

- Owner's Manual (which you are reading)
- Ribbon
- Power Cord
- Paper Support
- Paper Cassette (if optional sheet feeder was ordered)

Attention

In this section, discussions of Paper Paths and Print Modes assume that mode function switches A6, A7, and A8, located on the printer's back panel, are in the position they were when the printer was shipped from the factory: all DOWN. Because of the variety of selections available through these three switches it is not possible to discuss them all in detail in this section of the manual. For further information on switch settings see pages 7-1 to 7-4 of the Appendix.



If any of these items are missing, immediately contact your local HP Sales and Support Office, or the dealer from whom you purchased your unit.

Note

The interface cable, used to connect your printer to your computer or terminal, is not provided with your printer, it must be ordered separately. See Setting Up Your PC or Terminal in Chapter 2 for information on interface cables used with many popular PC's. If your system is not represented there, contact your nearest HP dealer. Be sure to use only shielded interface cables.

Before Proceeding

- Make sure your printer is turned OFF (end of switch marked with 0 depressed).
- Become familiar with the parts of the printer called out on pages xv-xvi. Doing so may help you when installing the ribbon and loading paper.

Then, see the instructions on the following pages to accomplish the steps outlined below.

- Open the printer's cover and remove the black restraints.
- Install the ribbon.
- Connect the power cord between the printer and the wall outlet.
- Load paper.
- Run the printer's self test. The self test will provide you with a printed sample, demonstrating that the printer is working properly.
- Connect the interface cable between the printer and your PC or terminal and configure them.
- Set the Mode Function Switches on the printer's back panel, if necessary.
- Set up your software package to work on your printer.
- Enjoy!

Abbreviations to Know

We'd like to define a few abbreviations you will see often in this manual.

CPI—Characters per inch. Also called pitch. Used in describing the number of characters that will print within one horizontal inch. For example, 10 pitch printing will yield 10 characters per inch.

CPS—Characters per second. Refers to printing speed. Used in describing the number of characters that will print per second. For example, your printer will print in Letter Quality (LQ) mode at 200 characters per second.

LPI—Lines per inch. Used in describing the number of lines that will print within one vertical inch. Most printing is done in 6 or 8 lpi.

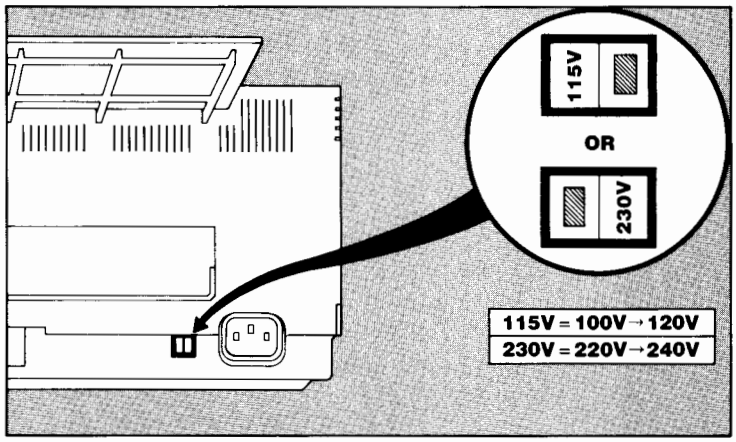
Getting Ready to Print

Setting the Voltage

The voltage selector switch is located on the printer's back panel, next to the power connector. The two voltage settings offered are 115V and 230V. These two settings cover a range of voltages as shown below. To change the voltage, insert a pen or other sturdy object into the depression on the switch and push to the left to change from 115V to 230V, or to the right to change from 230V to 115V.

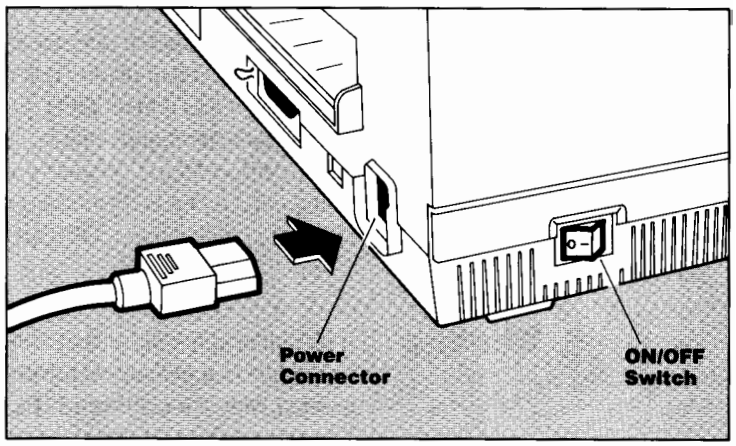
Warning

It is extremely important that you set the voltage selector to match the power requirements for your area. Your printer may be damaged if the wrong selection is made. We urge you to contact your dealer if you are not sure which setting you should select.



Connecting the Power Cord

1. Begin with the printer turned OFF.
2. Plug the power cord into the connector on the printer's back panel (right side as viewed from the back), then into a grounded 3-prong outlet.



ON/OFF Switch

The ON/OFF switch is located near the bottom of the printer's left side (as viewed from the front), near the back. (See illustration above.) To turn ON the printer depress the end of the switch marked with 1. When the printer is turned ON the print head will "home," and the ON LINE light and selected print mode and paper path LED's will be on.

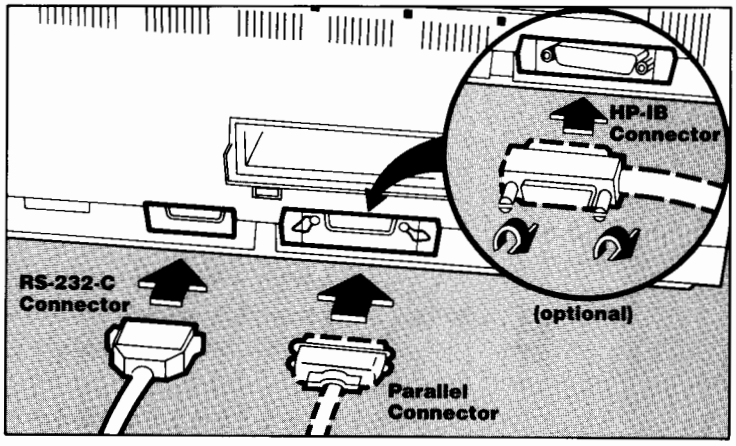
Connecting the Interface Cable

RS-232-C and Parallel interface connectors are standard equipment on RuggedWriter 480 printers; however, printers with the RS-232-C and HP-IB interface connector combination are also available.

If you are using the RS-232-C (serial) interface, connect one end of the interface cable to the left connector (also called a port) on the printer's back panel (as viewed from the rear). If you are using the Parallel or HP-IB interface, connect one end of the interface cable to the right connector on the printer's back panel (as viewed from the rear). Connect the other end of the connector to your PC or terminal. Take extra care to be sure you are connecting the interface cable to the correct connector.

Note

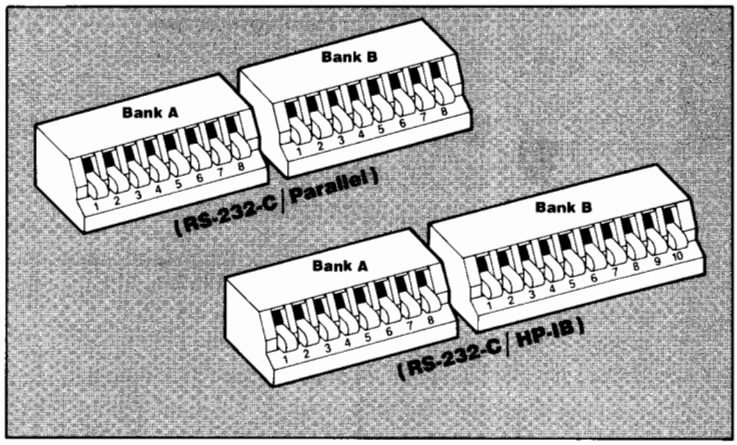
Do not connect more than one interface cable to the printer. Use only HP approved shielded interface cables.



Setting the Mode Function Switches

The two groups of mode function switches located on your printer's back panel are set to select specific features or interface attributes which are resident in the printer. Features/attributes selected through these switches range, for example, from selecting 12 cpi rather than 10 cpi, and for selecting draft quality rather than letter quality printing.

Your printer was shipped from the factory with all switches set DOWN. While these settings will satisfy the needs of many users, you may wish to consult the function switch summary on pages 7-1 to 7-4 of the Appendix to see what other options are available.

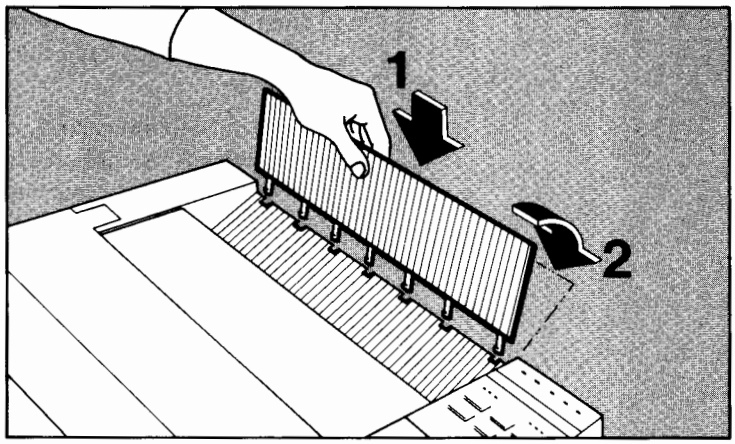


Note

If you will be using a software program that doesn't format your data, we recommend setting mode function switch B3 UP.

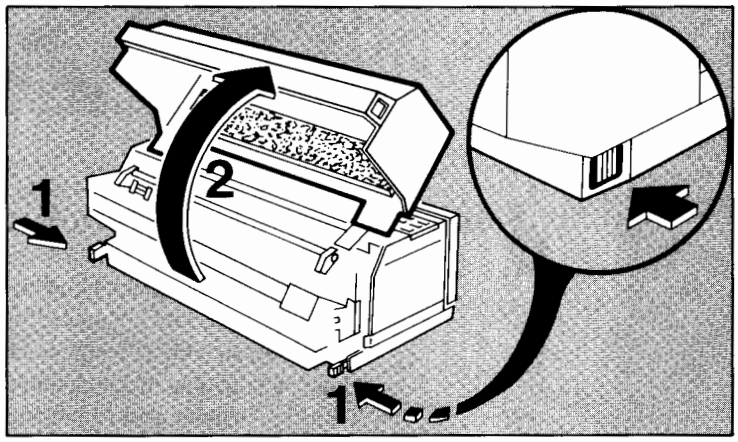
Installing the Paper Support

To install the paper support follow the illustration below.



Installing the Ribbon

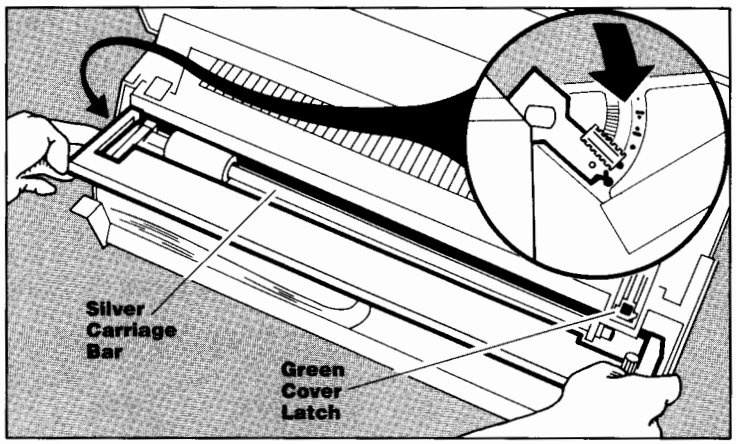
1. Open the printer's cover by pressing in on the cover release tabs and lifting up on the cover. See below.



2. Remove the black restraints (initial installation only).
3. Remove the ribbon cartridge from its packaging.
4. Take up any slack in the ribbon by turning the knob on top of the ribbon cartridge in the direction indicated by the arrow.

5. Make note of where on the white print head gap adjustment scale the green gap adjustment lever is set, then adjust the lever (located on the left side by the silver carriage bar) to the bottom dot. See illustration below.

6. Hold the ribbon cartridge with both hands.
   a. Position the ribbon cartridge over the print head carriage, and lower the right side of the cartridge to slip the ribbon between the cover latch (with green tab) and the silver carriage bar. See below.

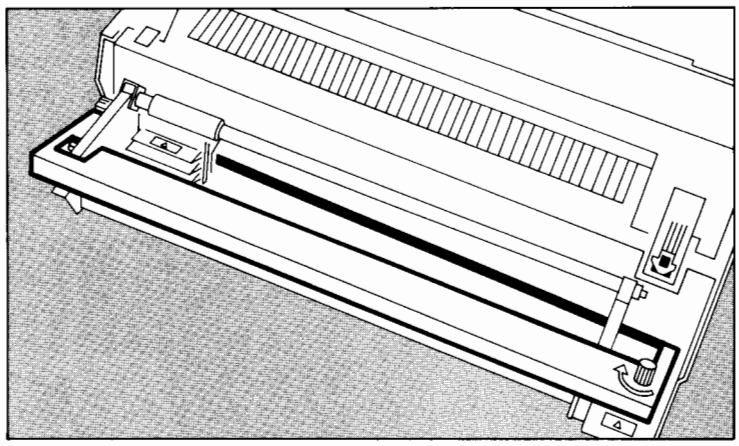


Note

The printer is shipped from the factory with the print head sitting in the middle of the carriage. At the completion of a printing job the print head may come to a stop at any point along the carriage. This will not hinder ribbon installation. However, do not attempt to install the ribbon when the print head is sitting at the extreme left of the carriage. If it is, turn OFF the printer and move the print head to the right before installing the ribbon.

b. Lower the left side of the cartridge slightly, then gently pull the cartridge toward you.

c. Seat the cartridge. See below.



7. Take up any slack in the ribbon by turning the knob on top of the ribbon cartridge in the direction of the arrow.
8. Adjust the print head gap adjustment lever to the position noted in step 5. Print head gap adjustment is discussed on pg. 1-13.

Changing the Ribbon

1. Grasp the ribbon cartridge with both hands and pull the cartridge up and out.
2. Discard the old ribbon cartridge.
3. Follow steps 3–8 above for installing a new ribbon cartridge.

Note

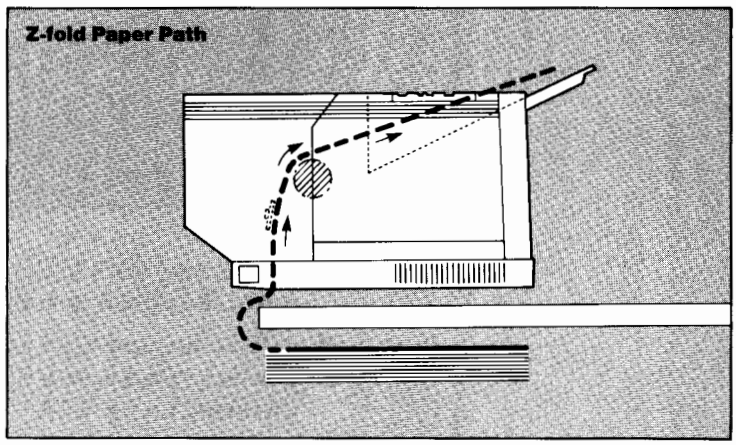
Be sure to change a worn or damaged ribbon prior to the beginning, or at the completion, of a printing job. Turning OFF the printer during printing results in the loss of all data yet to be printed.

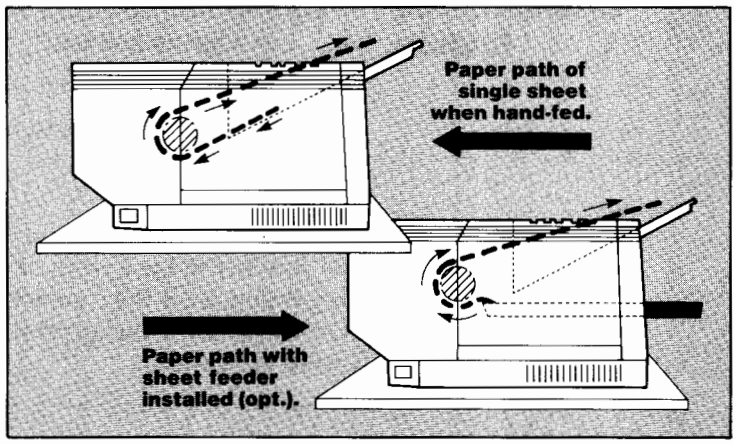
Loading Paper

First a Word on Paper Paths

Multiple Paper Paths

Your printer offers three paper paths: one for Z-fold paper, one for hand fed paper, and one for the optional sheet feeder. This variety of paper paths allows you to use single sheets or sheet feeder paper without having to remove any Z-fold paper that may already be loaded in the printer.





Selecting Paper Paths

All three paper paths can be selected through the printer's keypad; only the Z-fold path and the sheet feeder path are selectable through the mode function switches located on the printer's back panel. When the printer is turned ON it will be ready to load paper from the paper path selected through mode function switches. The printer is shipped from the factory with the Z-fold paper path selected (switches A6 and A7 Down). If switches A6 and A7 on your printer's back panel have been set to select the sheet feeder paper path, when the printer is turned ON your printer will be ready to load paper via that path.

Once the printer is turned ON, any of the three paper paths offered through the keypad can be selected. Remember, when the printer is turned OFF, selections made through the keypad will be lost and the printer will return to the path chosen through the function switches. (A summary of function switch settings is located in the Appendix.)

Print Head Gap Adjustment Lever and Scale

The print head gap adjustment lever is used to adjust the print head closer to (top dots) or farther from (bottom dots) the platen. The lever was set at the factory to provide you with optimum print quality for single sheets. However, due to the many grades of paper available, we suggest that you adjust the lever to your satisfaction for print quality and paper thickness.

The dots on the print head gap adjustment scale indicate at which point the print head is closest to or farthest from the platen. The thicker the paper or forms, the farther down on the scale the gap adjustment lever should be set.

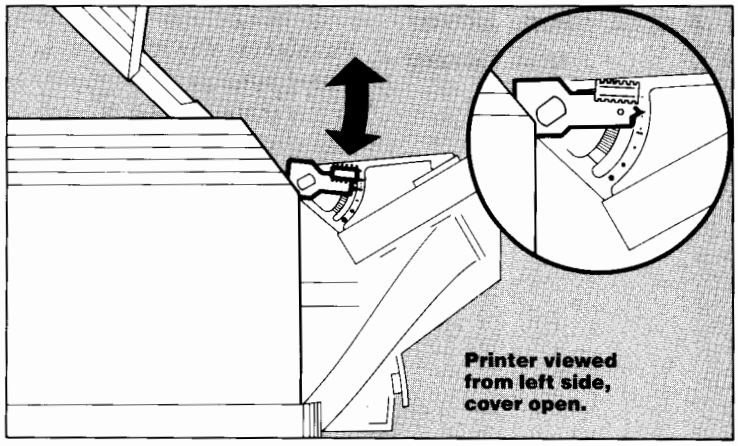
Helpful Hints

1. Always remove single sheets of paper from the hand fed path before switching to another paper path. If this isn't done, the printer will try to load from both paths, and a paper jam will result.
2. Do not turn off the printer with single sheets loaded in the printer. Doing so may cause a paper jam.
3. When using Z-fold paper be sure to cleanly tear off used paper at the perforation *before* switching paper paths. Failing to do so may cause a paper jam.

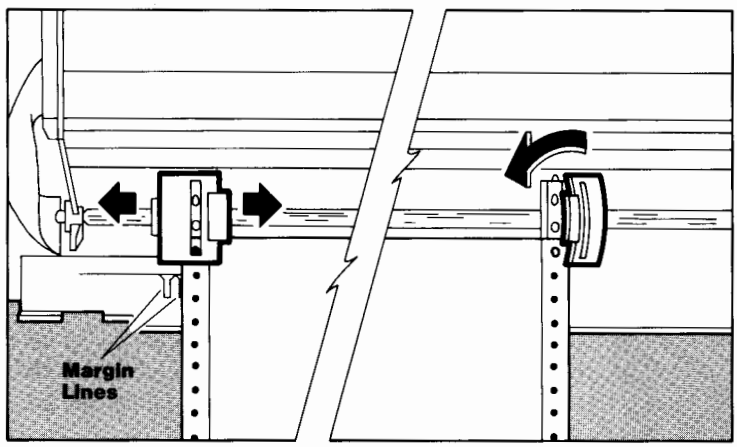
Loading Paper— Z-fold Multi-part Forms

(See the discussion of paper paths on previous page.)

1. Open the printer's cover by pressing in on the cover release tabs and lifting up on the cover. See illustration on page 1-9.
2. Adjust the green print head gap adjustment lever (located on the left side by the silver carriage bar) as necessary to reflect the thickness of paper you are using. The thicker your paper or forms, the farther down on the scale the gap adjustment lever should be set.

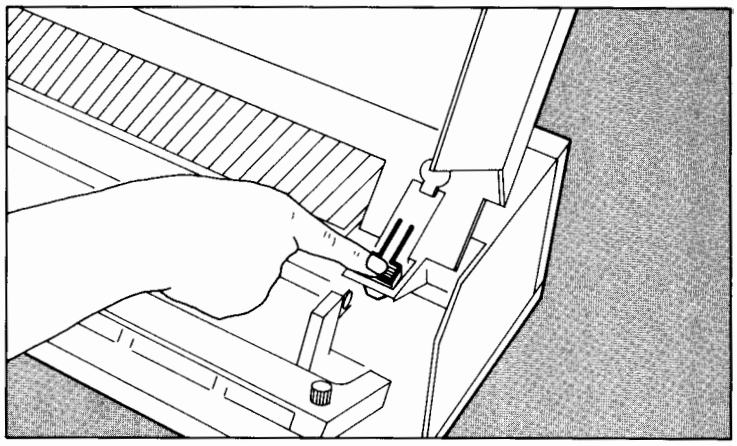


3. Open the green left tractor gate and place the paper over the pins on the left tractor. Do not load paper past the top pin. Close the left tractor gate over the paper. Move the tractor to the right or left as necessary to align the left edge of the paper with one of the two margin lines located directly below the left tractor. (Note that the movement of the left tractor is limited.) See below. (Margin lines are discussed on page 1-25.)

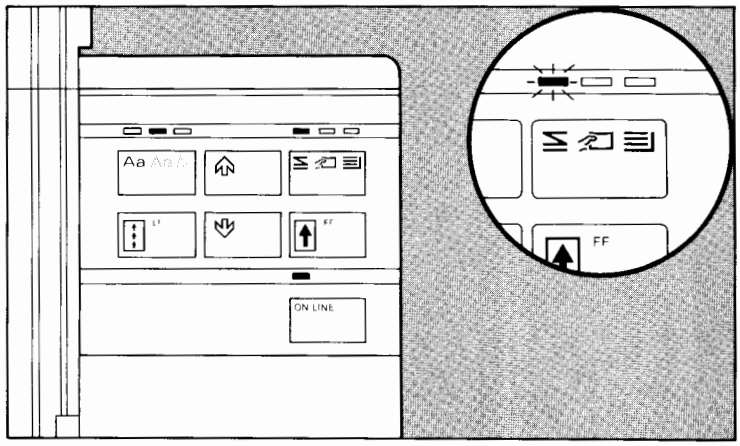


4. Open the right tractor feed gate and move the right tractor as necessary for the width of paper you are using. Place the paper over the pins on the right tractor and close the right tractor feed gate over the paper. See above.
5. Adjust the right tractor as necessary, making sure that the paper is taut enough that it won't wrinkle as the print head moves across it, but not so taut that the paper tears around the tractor feed pins.

6. Press the green cover latch and close the cover securely. See below.



7. Turn ON the printer. The print head will "home" and the ON LINE and draft mode lights will be ON. Press the paper selection key until the light above the Z-fold paper symbol comes on. See below.



8. Press the FF key. Paper will advance to the printer's tear edge (visible with sound muffler forward). The tear edge allows you to cleanly tear off Z-fold paper at the perforation without wasting a sheet of paper. When the paper is positioned at the tear edge, printing will begin on the first line on the page. To increase the top margin, do so through your software package.

You are ready to do the self test, page 1-21.

Note

(Z-fold Paper Only) To advance paper so that the last line printed can be viewed at the tear edge, press the ON LINE key and the Up arrow key simultaneously. The paper will be automatically retracted when the printer receives data. To manually retract the paper to its printing position after viewing the last line printed, press the ON LINE key and the Down arrow key simultaneously. Auto view mode is selectable through an escape sequence described in Chapter 4, Programming (HP Mode only).

Hand Fed Paper*

(See the discussion of paper paths on pages 1-12, 1-13)

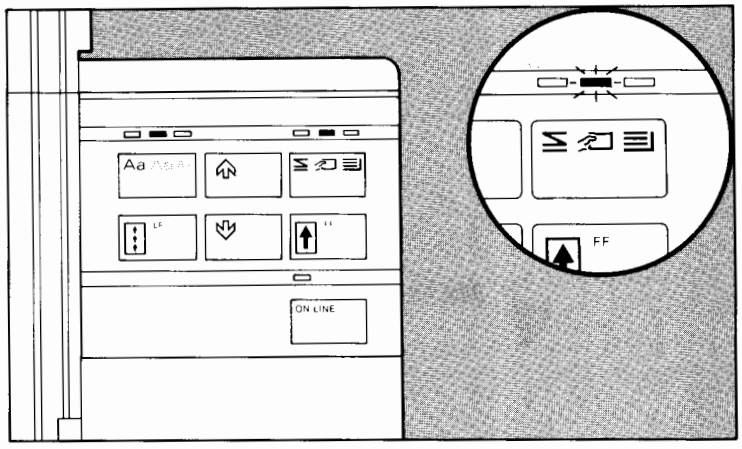
1. Flip the sound muffler toward you.
2. Remove any single sheet paper that may be resting against the paper support.
3. Turn ON the printer if it isn't already ON. The print head will "home," and the ON LINE and draft mode lights will be ON.

*Do not load labels through this path.

Note

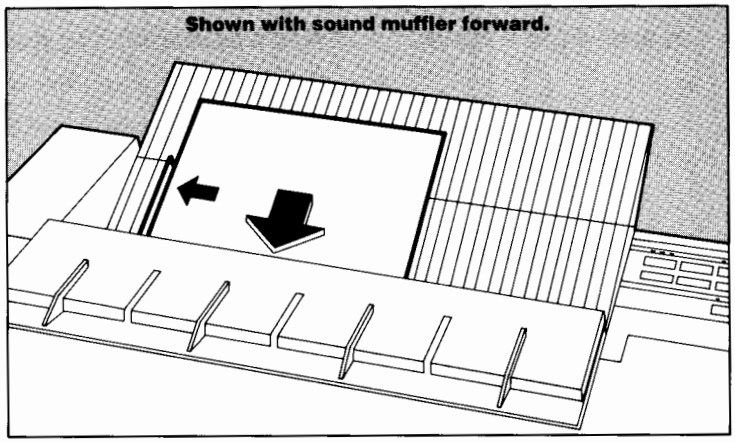
Single sheet paper provides an automatic ¼" left margin.

4. Press the paper selection key until the light above the hand fed symbol comes on. See below.



*Do not load labels through this path.

5. Insert a sheet of paper squarely into the printer, left edge against the paper edge guide (providing a ¼" left margin). Insert letterhead paper head-first into the printer, letter head facing away from you. See below.



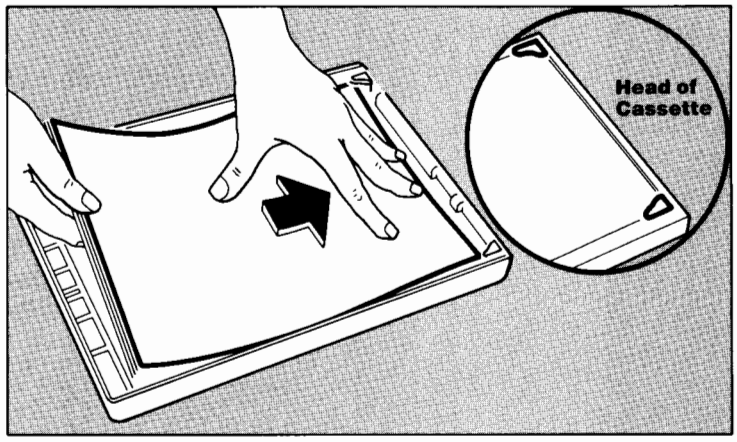
6. Press the FF key to advance the paper into the printer, and make sure that the printer is ON LINE.

You are ready to begin printing.

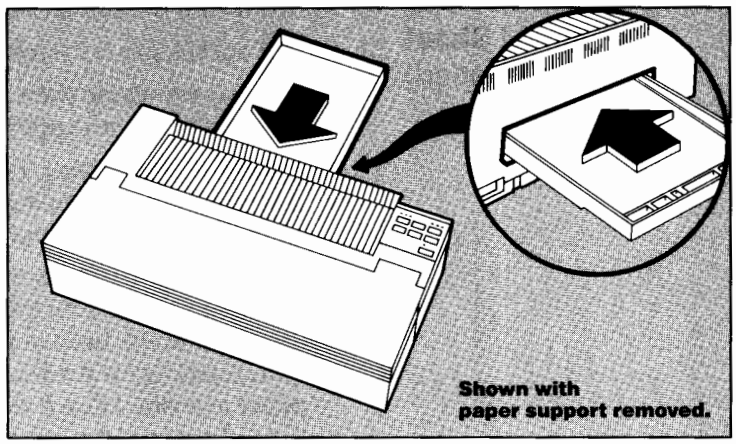
Loading Paper from the Sheet Feeder (Optional Sheet Feeder Installed)

(See the discussion of paper paths on pages 1-12, 1-13)

1. Begin with the printer's cover closed.
2. Pull out the paper cassette slot cover and set aside.
3. Remove any single sheet paper that may be resting against the paper support.
4. If you have been using Z-fold paper, press the FF key to advance a sheet to the tear edge and tear off the paper cleanly along the perforation.
5. Fan a stack of paper about ½" thick (less than 100 sheets) and place it in the paper cassette: Press down on the paper at the head of the cassette so that the corners of the stack go under the metal retaining clips and the paper is pushed down along the Velcro strip located on the right side of the cassette. See below. (Place letter head paper face down in the cassette with the letterhead at the head of the cassette.)

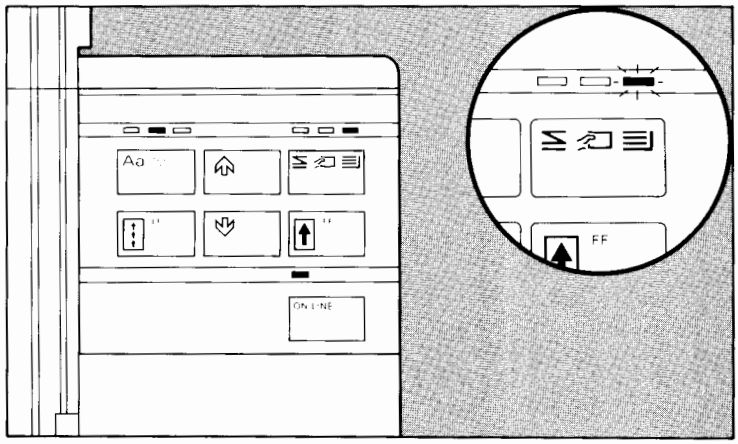


6. Slide the cassette into the printer as shown below.



7. Turn ON the printer if it isn't already. The print head will "home" and the ON LINE and draft mode lights will be ON.

8. Press the paper path selection key until the light over the sheet feeder symbol comes on. See below.



You are ready to do the self test, page 1-21.

Self Test

1. If using sheet fed paper, press the FF key to eject any paper already loaded.
2. Turn OFF the printer.
3. Press the LF key while turning ON the printer. If you are using wide Z-fold paper, press the FF key while turning ON the printer.
4. Paper will load from the paper path selected through mode function switches A6 and A7, and the self test will print. (The printer is shipped from the factory with the Z-fold paper path selected, A6 and A7 DOWN).

If your printed self test doesn't resemble the example shown below, or nothing prints at all; or if all keypad lights blink, your printer has failed the self test, and you should call a qualified Hewlett-Packard service representative.

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Firmware Version 12/23/87
00000000 00000000
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
qrstuvwxyz{|}~
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnop
qrstuvwxyz{|}~
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'abcdefghijklmnop
qrstuvwxyz{|}~

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwx
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxy
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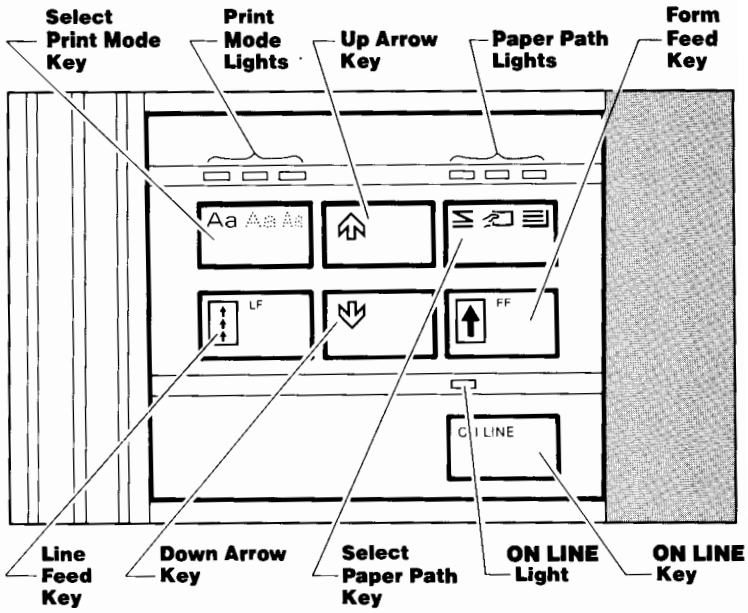
,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{
-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}
/0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~!
123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~!"
23456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~!"#
```

Keypad



The following descriptions will help you become acquainted with your printer.

Note

Selections made through the keypad will be lost when the printer is turned OFF.

ON LINE

The ON LINE key has several uses.

A. To stop printing. Press and hold the ON LINE key until the ON LINE light goes off. The printer will finish printing the line it is on, then stop. Press the key once more to resume printing. The printer will start where it left off.

B. To restart printing after loading paper. When the printer runs out of paper the printer detects an "error condition". This is reflected by the blinking paper path lights on the printer's keypad. When paper is reloaded and the ON LINE key is pressed, the error condition is cleared, and the printer is again ready to print.

C. To view the last line printed (Z-fold Paper Only). Press the ON LINE key and the Up arrow key simultaneously. The printer will advance the last line printed to the printer's tear edge. The paper will be automatically retracted when the printer receives data. To manually retract the paper to its printing position press the ON LINE key and the Down arrow key simultaneously.

Aa Aa Aa (Select Print Mode) Key

This key is used to select between the three print modes offered through the keypad: Letter Quality (LQ) mode, draft mode, or compressed mode. When the printer is turned ON (paper is loaded) the printer will be in draft mode as indicated by the light on above Aa . (The printer is automatically in draft mode when it is turned ON). When this key is pressed once the printer will be in compressed mode as indicated by the light on over Aa . When this key is pressed again, the printer will be in LQ mode (Courier 10 pitch), as indicated by the light on over Aa. Press the key once more to put the printer back into draft mode.

Print modes can be changed while the printer is printing, but the change may not take effect for up to several pages. Accurate changing of print modes is handled by software commands.

LQ=200 cps at 10 cpi, Courier.
Draft mode= 400 cps at 10 cpi, Line Printer.
Compressed=333 cps at 16.7 cpi, PCL mode; 346 cps at 17.3 cpi, Epson mode.

Up Arrow Key

The Up arrow key is used to advance Z-fold paper in fine increments. It is most often used to advance the paper to the tear edge, and to fine adjust the printing position on preprinted forms. This key is only active when the Z-fold paper path is selected.

(Z-fold Paper only) Press the ON LINE key and the Up arrow key simultaneously to advance the paper so that the last line printed can be viewed at the printer's tear edge (with sound muffler flipped forward).

Down Arrow Key

The Down arrow key is used to retract Z-fold paper in fine increments. It is most often used to retract paper to the tear edge, and to fine adjust the printing position on preprinted forms. This key is only active when the Z-fold paper path is selected.

(Z-fold Paper Only) After paper has been advanced for viewing (using the ON LINE and Up arrow keys) press the ON LINE key and the Down arrow key simultaneously to manually retract the paper to the last line printed.

Select Paper Path Key

This key is used to select one of the three paper paths offered. When the printer is turned ON and paper is loaded, press this key until the light over the desired paper path is ON. For example, to use hand fed paper, press this key until the light over the hand fed symbol comes On. See the Loading Paper section of this chapter for more information on paper paths.

Paper paths can also be selected by mode function switches, or through escape sequences discussed in the Programming chapter. When the printer is turned ON the active paper path will be the one chosen through the corresponding mode function switches.

The light over the corresponding paper path symbol will flash when the printer is out of paper. If a paper jam has been detected all three paper path lights will blink.

LF Key (Line Feed)

The LF key is used to advance the paper one line. When held down this key will do multiple line feeds.

FF Key (Form Feed)

The FF key is used to load paper from any of the three paper paths, and is also used to advance paper one sheet at a time. Pressing the FF key will advance the paper to the beginning print position set through your software package.

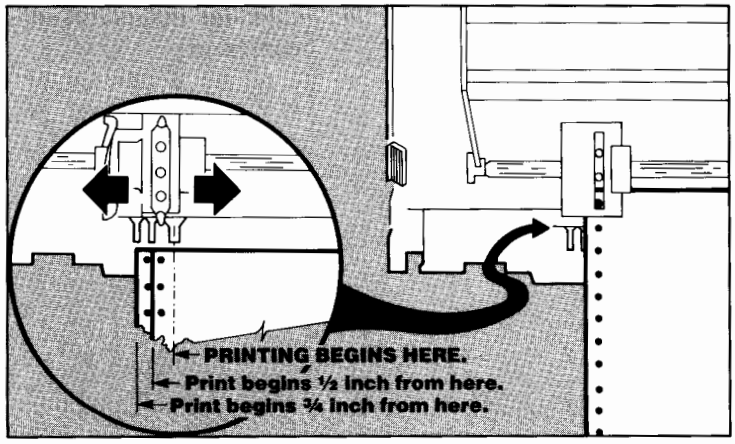
Margin Lines

Because Z-fold paper has a perforated strip that runs the length of the paper, it can be difficult to tell where your left margin will fall once that perforated strip is removed. The margin lines located on the base of your printer beneath the left tractor feed gate provide a means of gauging where printing will begin on your paper in relation to the perforated strip.

As shown below, when the extreme left edge of Z-fold paper is lined up with the leftmost margin line, you will get a ¼" left margin after the perforated strip has been removed. If the left edge of the paper is lined up with the second margin line you will get a 0" margin after the perforated strip has been removed. The third margin line, the rightmost line, is actually an indicator of where printing will begin regardless of the margin you've chosen. Do not line up the left edge of your paper with this line or printing will begin on the extreme left edge of your paper.

Note

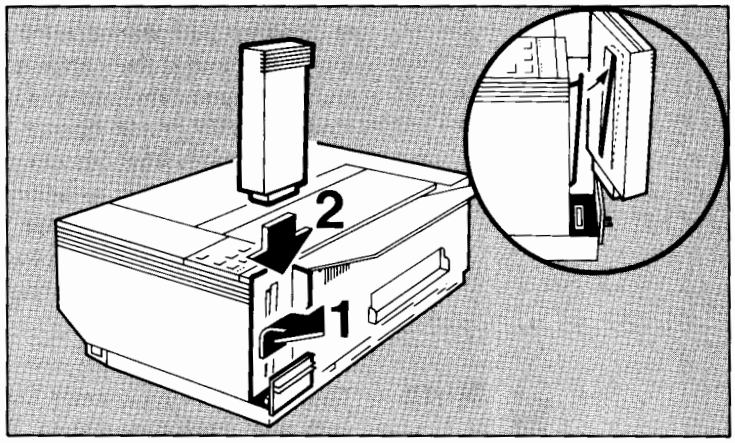
This explanation assumes that you are using Z-fold paper with a ½" perforation strip. Perforation strip widths vary with the paper manufacturer.



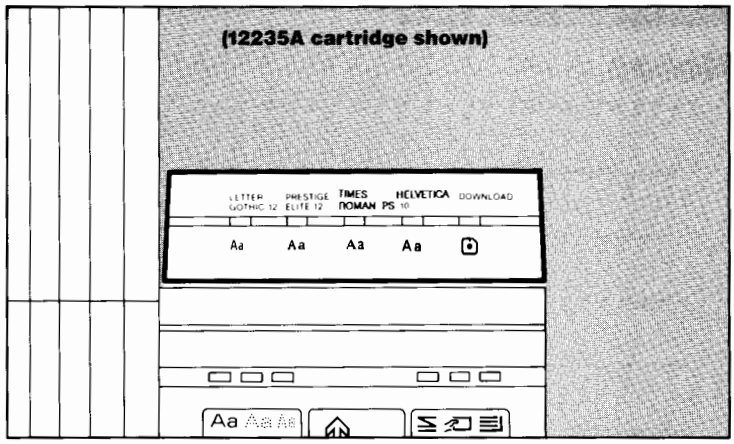
Installing the Character Cartridge (Optional Accessory)

In addition to the Courier 10 pitch (10 cpi) font that is resident in your printer, a wide variety of typefaces and typestyles is also available in optional character cartridges that install easily onto the back of the printer.

1. Make sure that the printer is OFF.
2. Install the character cartridge as shown in the illustrations below.



3. Turn ON the printer.
4. Press the Aa Aa Aa key until the light on the cartridge that corresponds to the font you wish to use comes on.



The character cartridge is active and ready for use.

A summary of the type styles and fonts available in character cartridges is located in the Appendix.

Warning **DO NOT TOUCH THE CONNECTOR ON THE PRINTER OR ON THE BOTTOM OF THE CARTRIDGE. DOING SO MAY DAMAGE BOTH UNITS.**

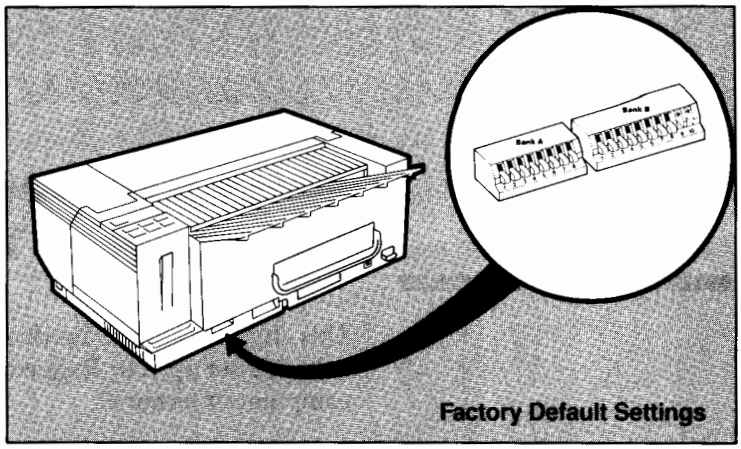
Notes

Notes

Notes

Setting Up Your Computer or Terminal 2

This chapter contains hardware application notes that will help you set up your RuggedWriter 480 printer with your computer or terminal.



* Switches B9 and B10 are present only on RuggedWriter 480 printers with the optional HP-IB interface.

Setting Up Your Computer or Terminal

The following application notes describe how to set up your personal computer or terminal with a RuggedWriter 480 printer.

If you are using a system that is not covered by these notes, follow the setup instructions provided in your system documentation for your computer or terminal, then refer to Chapter 5, Datacomm, in this manual for information on data communications.

Computers and Terminals

Set up information is provided for the following computers and terminals.

- HP3000, 3X, 4X, 5X, 6X, 7X, Micro 3000, Micro 3000/XE
- HP9000 Series 300 HPUX
- HP9000 Series 200, 300 Using PASCAL
- HP9000 Series 200, 300 and 500 Using BASIC
- HP9000 Series 200, 300 and 500 Using SRM
- HP1000 Series A
- HP1000 Series E, F
- HP250/260
- HP2392A and HP2394A
- HP2393A and HP2397A
- HP Touchscreen/150 A, B, C
- HP Vectra
- IBM PC Family and Compatibles

HP 3000 3X, 4X, 5X, 6X, 7X, Micro 3000, Micro 3000/XE To The RuggedWriter 480 Printer

HOST CONFIGURATION:

Serial Interface:

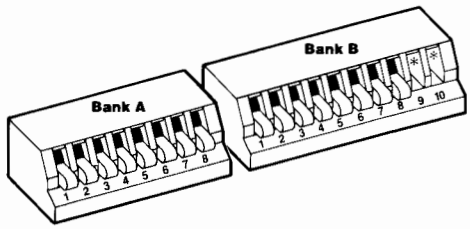
Cables: HP 13242Y, HP 92219G, or HP 13242N for the ADCC and 25-pin ATP Ports,
HP 13242X for 3-pin ATP Ports

MPE Configuration:

Logical Device #?	(Provided by System Manager)	
Device Name?	**HPPCLATP**	(for ATP/ATP37)
	HPPCLADCC	(for ADCC)
DRT #?	(Provided by System Manager)	
UNIT #?	(Provided by System Manager)	
Software Channel #?	**0**	
Type?	**32**	
Sub Type?	**14**	
Term Type?	**TTPCL26**	
Speed?	**960**	(Chars/sec)
Record Width?	**66**	
Output Device?	**0**	
Accept Jobs/Sessions?	**N**	
Accept Data?	**N**	
Interactive?	**N**	
Duplicative?	**N**	
Initially Spooled?	**Y* or N**	
Auto Reply?	**N**	
Driver Name?	**HIOASLP0**	(for ATP/ATP37)
	HIOASLP2	(for ADCC)
Device Class?	(optional)	

*Within usage limits of service contract. Service contracts specify the maximum usage. Contact your sales representative for current limits.

PRINTER SETTINGS:



*Switches B9 and B10 are present only on RuggedWriter 480 printers with the optional HP-IB interface.

HP9000 Series 300 HP-UX To The RuggedWriter 480 Printer

HOST SET UP:

An HP-IB interface is standard on all HP Series 300 Technical Computers. The following describes the system set up for the RuggedWriter 480 printer as the default system printer using that interface.

HP-IB Cable(s): HP 10833 D, A, B or C (0.5, 1, 2 and 4 meters long).

HP-UX Reconfiguration

1. Execute the **RECONFIG** command.
2. Hi-light **Configure the line printer** using the **TAB** key.
3. Press the **SELECT** softkey to display the Printer Configuration Menu.
4. Fill in the menu as shown below:

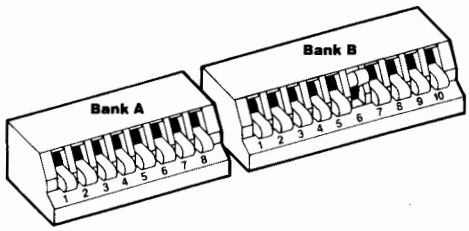
PRINTER NAME:	2235	MODEL:	dumb
PRINTER INTERFACE:	HPIB (NON-CIPER)	SUB-ADDRESS:	1
SELECT CODE:	7		
DO YOU WANT THIS TO BE THE DEFAULT SYSTEM PRINTER?:			yes

5. Press the **DONE** softkey to exit.

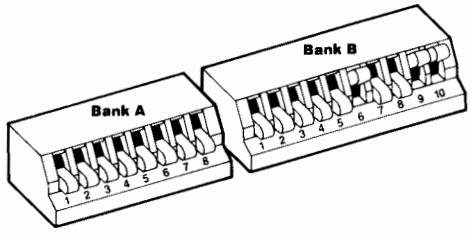
PRINTER SETTINGS:

There are two modes of HP-IB operation supported by the RuggedWriter 480 printer. These are referred to as Standard and Secondary Command modes and are selected as shown below. The Secondary Command mode should be used if the same HP-IB bus is driving your printer **and** a disc drive. Otherwise, the Standard mode is the better set up.

STANDARD MODE:



SECONDARY COMMANDS MODE:



TO VERIFY:

To verify the correct set up:

1. Execute the **LPSTAT -T** command. RuggedWriter 480 should be displayed as the default system line printer.
2. Execute "**ls ¦ lp -dprintername**". This will result in the current directory being printed.

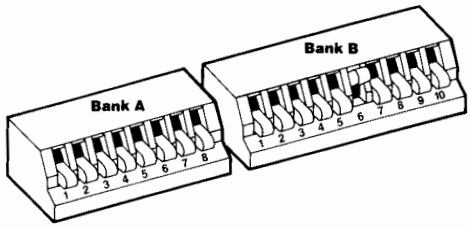
HP9000 Series 200, 300
Using PASCAL To The RuggedWriter 480 Printer

HOST SET UP:

An HP-IB interface is included standard with all HP Series 200 and 300 Technical Computers.

HP-IB Cable(s): HP 10833 D, A, B or C (0.5, 1, 2 and 4 meters long).

PRINTER SETTINGS:



TO VERIFY:

From the Main System Menu:

1. Type **F** (runs the Filer).
2. Then enter **L** (Directory Listing).
3. Now enter "***.PRINTER:**" and press **Return**.

A listing of the default directory will be printed.

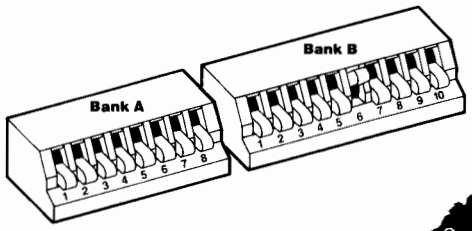
HP9000 Series 200, 300 and 500
Using BASIC To The RuggedWriter 480 Printer

HOST SET UP:

An HP-IB interface is standard with all HP Series 200, 300 and 500 Technical Computers.

HP-IB Cable(s): HP 10833 D, A, B or C (0.5, 1, 2 and 4 meters long).

PRINTER SETTINGS:



TO VERIFY:

The BASIC program below can be used to verify the correct set up of both the computer and printer. Load BASIC and enter this program.

```
10 PRINTER IS 701
20 FOR I=1 TO 2
30 FOR J=33+I TO 111+I
40 PRINT CHR$(J);
50 NEXT J
60 PRINT
70 NEXT I
80 PRINT
90 END
```

Press the **RUN** key and this pattern will print:

```
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopq
```

HP9000 Series 200, 300 and 500
Using SRM To The RuggedWriter 480 Printer

HOST SET UP:

The following describes the system set up for the RuggedWriter 480 printer (HP-IB Interface) as a spooled printer over the SRM LAN.

HP-IB Cable(s): HP 10833 D, A, B or C (0.5, 1, 2, and 4 meters long).

SRM SET UP

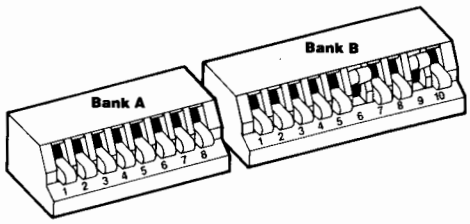
Execute the following commands from the SRM console. These will add the RuggedWriter 480 printer (2235) as a spooled printer.

ADD PRINTER 7,1

SP ADD 7,1 "PR"

SP UP 7,1

PRINTER SETTINGS:



TO VERIFY:

To verify the correct set up, execute the **UNIT** command. All of the devices controlled by the SRM will be displayed. Check to verify that 2235 appears on this list confirming the proper set up.

HP 1000 Series A
To The RuggedWriter 480 Printer

HOST SETUP:

For specific information on configuring your system with the appropriate device and interface drivers refer to the HP 1000 Driver Reference Manual and the HP 1000 Generation and Installation Manual.

Serial Interface:

Interface: 12792C/D Multiplexer
Cable: HP 92219G
Device Driver: DDC.00
Interface Driver: ID800, ID400, or ID100
Device Specification: Printer

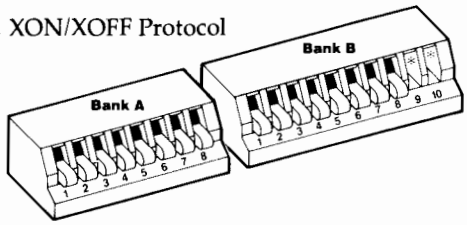
HP-IB Interface:

Interface: 12009A HP-IB Interface
Cable: HP 10833 D, A, B, or C (0.5, 1, 2 and 4 meters long).
Printer Address–6
Device Driver: %DD*.12
Interface Driver: ID*37
Device Specification: Printer

PRINTER SETTINGS:

Serial Interface:

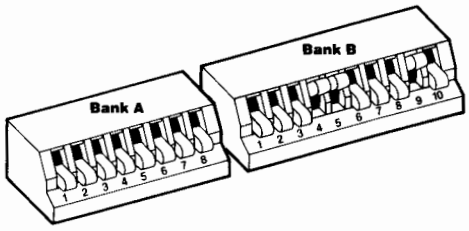
9600 Baud, 8 Data Bits, No Parity, XON/XOFF Protocol



*Switches B9 and B10 are present only on RuggedWriter 480 printers with the optional HP-IB interface.

HP-IB Interface:

Address 6, Secondary Commands ON



Switches B9 and B10 are present only on RuggedWriter 480 printers with the optional HP-IB interface.

HP 1000 Series E, F
To The RuggedWriter 480 Printer

HOST SETUP:

For specific information on configuring your system with the appropriate device and interface drivers refer to the HP 1000 Driver Reference Manual and the HP 1000 Generation and Installation Manual.

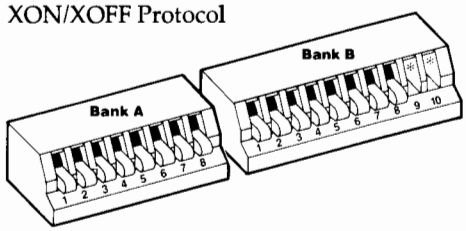
Serial Interface:

Interface: 12792C Multiplexer
Cable: HP 92219G
Device Driver: DDV12
Interface Driver: DVM00

PRINTER SETTINGS:

Serial Interface:

9600 Baud, 8 Data Bits, No Parity, XON/XOFF Protocol



*Switches B9 and B10 are present only on RuggedWriter 480 printers with the optional HP-IB interface.

HP 250/260 To The RuggedWriter 480 Printer

HOST CONFIGURATION:

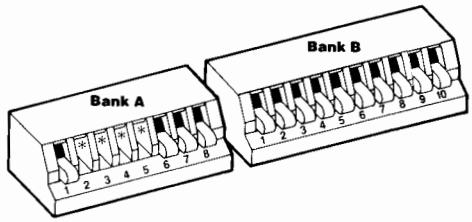
Serial Interface:

- OS Revision: B.08.00 or greater
- DROMS Required: TIO
- ASI Port: Any port. If multiple printers are to be used, each printer must be on a separate port.
- ASI Panel Strapping: Application dependent. Refer to the HP 250/260 manuals for more information, or contact your HP Customer Engineer.
- RFIG Values:
  Class: Printer
  Type: 2225 or 268X
  Format: 8N1

  This example assumes 9600 baud.

PRINTER SETTINGS:

Serial Interface:



Switches B9 and B10 are only present on RuggedWriter 480 printers equipped with the HP-IB interface and do not affect this setup.

*Dependent on Primary Language on the system.

HP 2392A and HP 2394A To The RuggedWriter 480 Printer

HOST SET UP:

Serial Cable : HP 13242G or HP 40242G

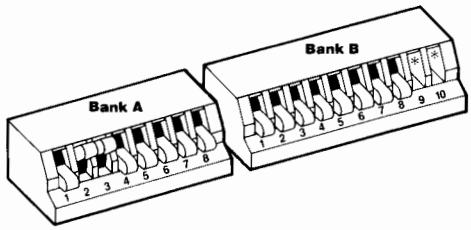
Parallel Cable: HP 13242D or HP 40242D

To configure the terminal's port to work with your RuggedWriter 480 Printer, press the **User System** key. Next, press the **config keys** (f8) and the **ext dev config** key (f4). The External Device Configuration Menu will be displayed. Ensure that the display of settings reflect those shown below. The same settings can be used for both serial and parallel interfaces. Be sure to exit this display by pressing **Save Config** (f1).

EXTERNAL DEVICE CONFIGURATION

BaudRate	9600	Parity/DataBits	None/8	PrinterNulls	000
PrinterType	ROMAN8				
		SRRXmit	NO		
XmitPace	Xon/Xoff	SRRInvert	NO	CS(CB)Xmit	NO

PRINTER SETTINGS:



** = Switches B9 and B10 are only present on RuggedWriter 480 Printers equipped with an HP-IB interface and have no effect on this Set Up.

TO VERIFY:

To verify that your printer is connected properly, type something on the screen and copy it to your printer by doing the following:

1. Press the **User System** key.
2. Press the **modes** key (f4).
3. Press **REMOTE MODE** key (f4) until the asterisk (*) disappears from the **REMOTE MODE** label on the screen. This selects Local Mode.
4. Press **AUTO LF** (f8) until the asterisk (*) appears in the **AUTO LF** label on the screen. This selects automatic line feeding.
5. Type **This is a Test!** and press the **Return** key.
6. Hold down the **Shift** key and press the **Print Enter** key. **This is a test!** will print.
7. Press **REMOTE MODE** (f4) until the asterisk (*) appears in the **REMOTE MODE** label, then press the **User System** key to return the terminal to normal operation.

HP Line Draw—

The HP Line Draw Character Set for the RuggedWriter 480 printer is contained in a Character Cartridge, HP P/N 12235A. With this cartridge installed, the configuration described in this application note will allow these "special" characters to be printed. To ensure proper line spacing refer to the discussion of HP Terminal Mode located in the Appendix.

HP 2393A and HP 2397A To The RuggedWriter 480 Printer

HOST SET UP:

Serial Interface: Cable–HP 13242G or HP 40242G

Parallel Interface: Cable–HP 13242D or HP 40242D

To configure your terminal to work with the RuggedWriter 480 printer, press the **System** key twice. Next, press the key labeled **config keys**, then the **ext dev config** key. When you press the **ext dev config** key, one of the following menus will be displayed: If your terminal has a serial interface, the External Serial Device Configuration Menu will be displayed; if your terminal has a parallel interface, the External Parallel Device Configuration Menu will be displayed. Ensure that the value displayed reflects those shown below for the interface your terminal has. When the changes have been made, save the new configuration by pressing the **SAVE CONFIG** key.

EXTERNAL SERIAL DEVICE CONFIGURATION

BaudRate	9600	Parity/DataBits	None/8			PrinterNulls	0
XmitPace	Xon/Xoff	SRRXmit	No	CS(CB)Xmit	No	DM(CC)Xmit	No
		SRRInvert	No	Protocol	HP		

GRAPHICS PRINTOUT

Contents	B&W	Invert B&W	Yes	Image Size	X1	Layout	Vert

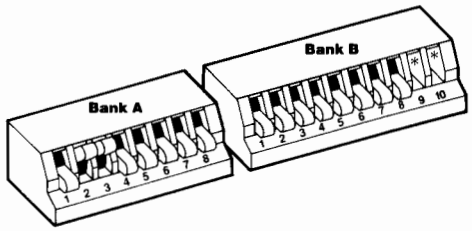
EXTERNAL PARALLEL DEVICE CONFIGURATION Port 2

				Protocol	HP		

GRAPHICS PRINTOUT

Contents	B&W	Invert B&W	Yes	Image Size	X1	Layout	Vert

PRINTER SETTINGS:



** = Switches B9 and B10 are only present on RuggedWriter 480 printers equipped with an HP-IB interface and have no effect on this Set Up.

TO VERIFY:

To verify that your printer is connected properly, type something on the screen and copy it to your RuggedWriter 480 printer by doing the following:

1. Press the **User System** key.
2. Press the **modes** key (f4).
3. Press the **REMOTE MODE** key (f4) until the asterisk (*) disappears from the **REMOTE MODE** label on the screen. This selects Local Mode.
4. Press **AUTO LF** (f8) until the asterisk (*) disappears from the **AUTO LF** label on the screen. This deselects automatic line feeding.
5. Type **This is a Test!** and press the **Return** key.
6. Hold down the **Shift** key and press the **Print/Enter** key. **This is a Test!** will print out on your printer.
7. Press **REMOTE MODE** (f4) until an asterisk (*) appears in the **REMOTE MODE** label. Press the **User System** key to return the terminal to normal operation.

HP Line Draw—

The HP Line Draw Character Set for the RuggedWriter 480 printer is contained in a Character Cartridge, HP P/N 12235A. With this cartridge installed, the configuration described in this application note will allow these "special" characters to be printed. To ensure proper line spacing refer to the discussion of HP Terminal Mode located in the Appendix.

Touchscreen/Touchscreen Max/ HP 150 To The RuggedWriter 480 Printer

HOST SET UP:

Serial Cable: HP 13242G

HP-IB Cable(s): HP 10833D, A, B, or C (0.5, 1, 2 and 4 meters long)

Three or four major steps (depending on the interface) are required to set up the Touchscreen for use with the RuggedWriter 480 printer. These steps are the MS-DOS Device Configuration, the device control configuration, and the Terminal Configuration. Carefully follow the steps outlined below as they apply to either the Serial or HP-IB interface.

MS-DOS Configuration

From P.A.M.

1. Select **DEVICE CONFIG** then **Start Applic** (f1). The menu below will be displayed.
2. Ensure that the values displayed reflect those highlighted below.

Serial Interface*–

MS-DOS Device Configuration		Main		Active Values
System Devices				
	Interface	Model	Print Wheel	
PRN:	Port2	2934A		
LST:				
AUX:				

	Interface	Address
PLT:		
COM1:		
COM2:		

*This assumes your printer is connected to Port 2 on the HP 150.

MS-DOS Device Configuration | Main | Active Values

System Devices

	Interface	Address	Model	Print Wheel		Interface	Address
PRN:	HP-IB	1	2934A		PLT:		
LST:					COM1:		
AUX:					COM2:		

Only those fields associated with the operation of the RuggedWriter 480 printer have values displayed in them. Refer to your PC's manual for information on changing the values in these fields.

3. Once the changes, if any, have been made, save the information by pressing **Save Config** (f4), then **Exit Config** (f8) to return to P.A.M.

DEVICE CONTROL CONFIGURATION

From P.A.M.

1. Press the **Terminal** key (f6), then the **User System** key followed by **device control** (f1) and **"to" devices** (f3).
2. Select the appropriate "to" device by pressing **Serial Device** (f2) or **HP-IB Device** (f5). Ensure that an asterisk (*) appears only in the field corresponding to the interface you are using.
3. Press the **User System** key.

Port 2 Configuration—Serial Interface Only

From P.A.M.:

1. Press the **Terminal** key (f6). Press the **User System** key on your keyboard, then press **config keys** (f8), then **port2 config** (f4). The following menu will be displayed.
2. Set the values on your PC to match those shown.

Terminal Config. Screen

FULL DUPLEX HARDWIRED Port 2

BaudRate	19.2K	Parity	None	DataBits	8			Clock	INT
Asterisk	Off			Stop Bits	1	EnqAck	No		
TR(CD)	Hi	Check Parity	No	SR(CH)	Lo				
RecvPace	None			SRRXmit	No	RR(CF)Recv	No		
XmitPace	Xon/Xoff			SRRInvert	No	CS(CB)Xmit	No	DM(CC)Xmit	No

3. Once the changes have been made, save the Port 2 configuration by pressing **Save Config** (f1).

GLOBAL CONFIGURATION—Serial Interface Only

From P.A.M.:

1. Press the **Terminal** key (f6). Press the **User System** key on your keyboard, then press **config keys** (f8), then **global config** (f1). Make sure that the Remote/Serial Dev field displays PORT1/PORT2.
2. Once the changes have been made, save the global configuration by pressing **SAVE CONFIG** (f1).

HP LINE DRAW—TERMINAL CONFIGURATION

The HP Line Draw Character Set for the RuggedWriter 480 printer is contained in a Character Cartridge, HP P/N 12235A. With this cartridge installed, the following terminal configuration will allow these "special" characters to be printed. To ensure proper line spacing refer to the discussion of HP Terminal Mode located in the Appendix.

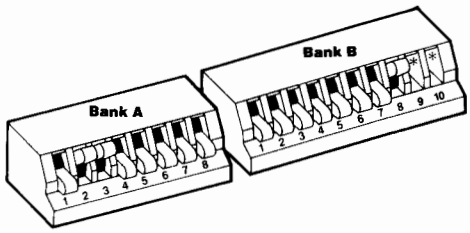
From P.A.M.:

1. Press the **Terminal** key (f6).
2. Press config keys (f8), then **terminal config** (f5).
3. Set the values on your screen to match those shown below. (The other values on your screen govern other functions and do not apply specifically to Line Draw.)

   ASCII 8 Bits **YES**
   Alternate Set **Line(B)**
4. Once these changes have been made, save the terminal configuration by pressing **Save Config** (f1).
5. Return to P.A.M. by holding down the **Shift** key and pressing the **Stop** key.

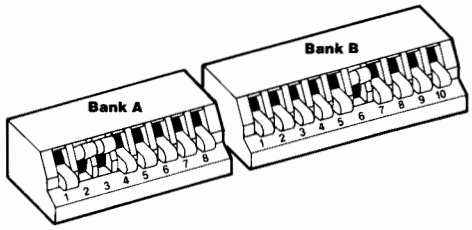
PRINTER SETTINGS:

For Serial Interface



*Switches B9 and B10 are present only on RuggedWriter 480 printers with the optional HP-IB interface.

For HP-IB Interface



Switches B9 and B10 are present only on RuggedWriter 480 printers with the optional HP-IB interface.

TO VERIFY:

From P.A.M.

1. Select **MSDOS COMMANDS**, then press **Start Applic** (f1).
2. Once the **A>** prompt appears, type **dir>prn**, then press the **Return** key. A directory of the disc in drive A will print.
3. Type **Exit**, then press **Return**. This will exit MS-DOS and return you to P.A.M.

HP Vectra PC To The RuggedWriter 480 Printer

HOST SET UP:

Follow the instructions below for the type of interface you will be using with your RuggedWriter 480 printer.

Parallel Interface:

When using HP 24540A Serial/Parallel interface card–
Cable: HP 24542D.

No other configuration is required.

Serial Interface:

If using the HP 24540A–Serial/parallel interface card, use–
Cable: HP 24542G

If using the HP 24541A–Dual serial interface card, use–
Cable: For port 1 (9 pin connector) use HP 24542G cable.
For port 2 (25 pin connector) use HP 13242G cable.

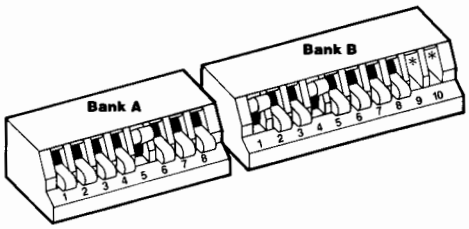
From the DOS prompt (A> or C>) enter the following commands:

1. **MODE COM1:96,N,8,1,P** then press the **Enter** key.
   - This command sets the serial communications at 9600 baud, no parity, 8 data bits, and 1 stop bit.
2. **MODE LPT1:=COM1** then press the **Enter** key.
   - This command directs the primary communication to the first serial port (COM1).

If your printer is connected to the second serial port, change COM1 to COM2 in the two DOS commands above.

To eliminate the need to type the two MODE commands every time your PC is turned on, create an AUTOEXEC.BAT batch file to AUTOmatically EXECute them. Refer to your DOS manual for more information on the MODE command and how to create BATch files.

PRINTER SETTINGS:



The above printer settings match the Host set up described on the previous page, and selects the Epson Control Mode and PC-8 character set. Using Epson Mode and the PC-8 character set will provide the best match with your IBM PC/compatible software.

** = Switches B9 and B10 are only present on RuggedWriter 480 printers equipped with the HP-IB interface, and do not effect this set up. Both the parallel and HP-IB versions of the printer can be used with an IBM PC/compatible over the serial interface with the switches set as shown above.

TO VERIFY:

To verify that your printer is connected properly, type something on your screen and copy it to your printer by doing the following:

1. Make sure both the printer and PC are ON.
2. If you are using the serial interface, make sure the above MODE commands have been executed.
3. Hold down the **Shift** key and press the **PrtSc** key.

All text on the screen will print.

IBM PC Family and Compatibles To The RuggedWriter 480 Printer

HOST SET UP:

Follow the instruction below for the type of interface you will be using with your RuggedWriter 480 printer.

Parallel Interface:

Use Cable: HP 24542D

No other configuration is necessary.

Serial Interface:

If using IBM Asynchronous Communications Adaptor on the PC–
Cable: HP 13242H, or HP 17255D.

If using Serial/Parallel Dual Interface Card on the PC AT–
Cable: HP 24542G.

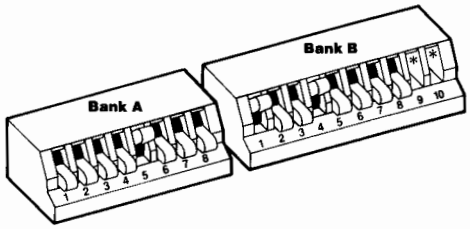
From the DOS prompt (A> or C>) enter the following commands:

1. **MODE COM1:96,N,8,1,P** then press the **ENTER** key.
   - This command sets the serial communications to 9600 baud, no parity, 8 data bits, and 1 stop bit.
2. **MODE LPT1:=COM1** then press the **ENTER** key.
   - This command directs the primary printer communication to the first serial port (COM1).

If your printer is connected to the second serial port, change COM1 to COM2 in the two DOS commands above.

To eliminate the need to type the two MODE commands every time your PC is turned ON, create an AUTOEXEC.BAT batch file to AUTOmatically EXECute them. Refer to your DOS manual for more information on the MODE command and how to create BATch files.

PRINTER SETTINGS:



The above printer settings match the Host set up described on the previous page, and selects the Epson Control Mode and PC-8 character set. Using Epson Mode and the PC-8 character set will provide the best match with your IBM PC compatible software.

** = Switches B9 and B10 are only present on RuggedWriter 480 printers equipped with the HP-IB interface, and do not effect this set up. Both the parallel and HP-IB versions of the printer can be used with an IBM PC/compatible over the serial interface with the switches set as shown above.

TO VERIFY:

To verify that your printer is connected properly, type something on your screen and copy it to your printer by doing the following:

1. Make sure that both the printer and PC are ON.
2. If you are using the serial interface, make sure the above MODE commands have been executed.
3. Hold down the **SHIFT** key and press the **PrtSc** key.

All text on the screen will print.

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Setting Up Your Software and Printer 3

Your Software and the RuggedWriter 480 Printer

This chapter contains a series of notes that describe how best to use your RuggedWriter 480 printer with a wide variety of software. These software notes assume that your printer and system are already set up, so be sure that your RuggedWriter 480 printer and system have been set up as described in the previous chapter.

The following paragraphs cover general topics useful in most situations where commercial software is being used. These topics include: Selecting a Printer Driver, Recommended Page Format, and Notes on Using fonts. The software notes follow these discussions.

Selecting a Printer Driver

Any software package that contains the command to "print" requires what is called a printer driver. These drivers are supplied along with the software and provide the proper communication between the software package and the printer.

The complexity of the printer driver itself will increase as the printing features of the package increase. Therefore, software that performs relatively simple "print & space" printing normally has a single built-in driver. With these software packages it is unnecessary to install a printer driver in order to use your RuggedWriter 480 printer. Typically this includes spreadsheet and database software like dBase, Multiplan, R:Base, and many others.

The software packages that perform more sophisticated printing normally require the installation or setup of a driver specifically designed for your printer. These packages are usually word processing or graphics software such as Word Perfect, 1-2-3 PrintGraph, MS Word, Framework, WordStar, etc. When installing this type of software you will need to make a decision as to which printer driver in the list presented is the one to use. The **best choice** in this case is always the **HP RuggedWriter 480** should it appear in your list.

Because the RuggedWriter 480 printer is such a versatile printer it can be used very effectively along with many printer drivers. Below is a list, in priority order, of drivers designed for other printers that can be used with the RuggedWriter 480 printer. When choosing one of these alternative printer drivers it is important to keep two things in mind: 1) Your selection should be based on the computer that will be running the software; and 2) the number of features supported will decrease as you move down the list.

For HP Vectra & IBM PC's EPSON Mode (Switch B1-UP)	For all other HP Computers HP Mode (Switch B1-DOWN)
Epson LQ-800 or 1000	HP 2930 Series
Epson LQ-1500	HP LaserJet
Epson FX Series	HP QuietJet
Epson MX Series	HP ThinkJet
Standard Printer, TTY, etc.	Standard Printer, TTY, etc.

Recommended Page Format

The RuggedWriter 480 printer is very flexible in its paper handling capability, providing paper paths for single sheets as well as Z-fold (continuous tractor fed) paper. To assure that your printing is trouble-free it is best to format your output with at least a one inch top and bottom margin. With these margins the potential for the RuggedWriter 480 printhead catching on the corners or perforations of the paper will be avoided.

A majority of software packages on the market today automatically apply "default" margins that are consistent with those recommended above. Therefore, no action on your part is necessary.

One special note of caution when printing on single sheet paper. Many software packages allow the printing of "headers" and "footers" which are usually placed within the top and bottom margins of a page. Headers and footers, particularly when printed on single sheets must be at least one line (1/6th of an inch) away from the top or bottom edge of the paper and one inch away from the left and right edges of the paper. This will avoid catching the corners of the page.

When printing on single sheet paper, using the automatic sheet feeder or the hand feed path, the RuggedWriter 480 printer will print ¼ inch to the right of the established margin. In other words, all of the printing will be moved to the right ¼ of an inch on the page. In most cases this offset is not noticeable. For example, if your software package has set 1" left and right margins, your left margin will actually be 1¼" and the right margin will be ¾", approximate.

Notes on Using Fonts

To print using the RuggedWriter 480 printer fonts through your software first refer to the following software notes. If your software is not discussed in this manual consult the software documentation to determine how best to imbed "user-definable" strings or escape sequences. The Programming chapter of this Manual, Chapter 4, is the best source of information on which escape sequences to use for printing in the available RuggedWriter 480 fonts. Be sure to refer to the section of the Programming chapter that pertains to the mode (HP Mode–switch B1 DOWN, or Epson Mode–switch B1 UP) in which the RuggedWriter 480 printer is being used.

Notice

The information contained in the following application notes is intended for informational purposes only and is subject to change without notice. Please refer all questions regarding the operation of any application to your software vendor. While every precaution has been taken in the preparation of this material, **Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose**. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Software Packages

Setup information is provided for the following software packages:

AdvanceWrite I, II, III	HP Vectra
DisplayWrite 3	HP Vectra, IBM PC Family and Compatibles
Framework II	HP Vectra, IBM PC Family and Compatibles
HPWORD	HP 3000 and HP 150
Lotus 1-2-3 Release 1A	HP Vectra, HP Series 100*, IBM PC Family and Compatibles
Lotus 1-2-3 Release 2	HP Vectra, HP Series 100*, IBM PC Family and Compatibles
MS Word	HP Vectra, HP Series 100*, IBM PC Family and Compatibles

cont.

Microsoft Windows	HP Vectra, IBM PC Family and Compatibles
MultiMate	HP Vectra, HP Series 100*, IBM PC Family and Compatibles
Print Central	HP 3000 with the HP Vectra, Series 100*, IBM PC Family and Compatibles
Symphony	HP Vectra, HP Series 100*, IBM PC Family and Compatibles
WordPerfect 4.1	HP Vectra, IBM PC Family and Compatibles
WordStar	HP Vectra, HP Series 100*, IBM PC Family and Compatibles
WordStar 2000	HP Vectra, IBM PC Family and Compatibles

* HP Series 100 PC's include the Touchscreen/150 A, B, C, and The Portable.

Using AdvanceWrite I,II,III

On the HP Vectra

Introduction

The procedures outlined below will help you use AdvanceWrite with your RuggedWriter 480 printer. Before beginning the setup procedures for the printer, please review the Printers chapter in your Using AdvanceWrite manual.

The Install program for AdvanceWrite allows you to select the printer(s) you will be using. If you have already installed AdvanceWrite, use the CHANGE program provided on the Printing Disk to set up AdvanceWrite to work with your RuggedWriter 480 printer. Because the CHANGE program is similar to the Install program's printer section, the instructions provided below will apply to both. For more detailed information on running the CHANGE program, refer to the Using Printers with AdvanceWrite manual. For more information on running the Install program refer to the AdvanceWrite Getting Started Manual.

Setting Up AdvanceWrite

When installing AdvanceWrite, proceed with the Install program until the list of printers is displayed. If AdvanceWrite has already been installed, run the CHANGE program and proceed with it until the list of printers is displayed.

From the list of printers, select the **Epson LQ-1500**. Next, indicate the type of interface you will be using with your printer by entering a **P** for parallel, or an **S** for serial interface. You will then be asked if you are using more than one printer with AdvanceWrite. Answer **NO** to the question by pressing the **Enter** key. The CHANGE or INSTALL program will then copy the appropriate printer information onto your disk.

If you are using the serial interface on your RuggedWriter 480 printer, AdvanceWrite must be configured to send your documents through the serial interface on your HP Vectra. This configuration is done in AdvanceWrite's Default Page. To insert this into the Default Page, run AdvanceWrite and press the function key labelled **Do**, then press **D**. You will be asked if you wish to work with the default settings. Press **Enter** and the Default Page Settings will be displayed. Use the **TAB** key to move to the field entitled **Path for Output:**. Indicate that you will be using the serial interface by typing **COM1** in the field.

Using Printer Features

The Printers chapter in the Using AdvanceWrite manual gives an overview of each of the supported printers. For an explanation of how AdvanceWrite works with your printer, refer to the Epson LQ-1500 section.

Using DisplayWrite 3

On the HP Vectra and IBM PC Family and Compatibles

Introduction

The procedures outlined below will help you use DisplayWrite 3 with your RuggedWriter 480 printer. Before beginning the setup procedures for the printer, please review the Printing chapter and the Profiles chapter of your DisplayWrite 3 User's Guide.

Setting Up DisplayWrite 3

In order to print a document from DisplayWrite 3, the document must be converted into a form that your printer understands. The type of conversion that is done depends on the printer class assigned by DisplayWrite 3. In order to correctly print documents on your RuggedWriter 480 printer, it must be assigned the appropriate printer class.

Information such as printer class, the port to which your printer is connected, and other important configuration settings, is kept by DisplayWrite 3 in a profile. To use your RuggedWriter 480 printer with DisplayWrite 3, the profile must be revised.

Run the DisplayWrite 3 program and select **Profile Tasks** from the TEXT TASK SELECTION menu. From this menu, select **Revise Profile**. Press **Enter** to revise the current profile. Next, select **Change Work Station Defaults**. From this menu select the option to change the Printer Description that corresponds to the RuggedWriter 480 port (LPT1, LPT2, or LPT3)*.

To assign the printer class, select **Printer Type**. You will then be prompted to select your choice for the printer type. Enter the number corresponding to Class A. You may then select other default values, namely the print quality and the paper path you will be using. These default values indicate to DisplayWrite important facts about your printer. These are used as initial values for documents that you create using this revised profile.

Using Printer Features

For more information on using RuggedWriter 480 features, refer to the Formatting and the Printing chapters of your DisplayWrite 3 User's Guide. After you have assigned RuggedWriter 480 to the appropriate printer class, we suggest that you try printing the PDTSETUP.TXT file that is provided with your DisplayWrite 3 program (Diskette Vol. 3). This file will exhibit features of your RuggedWriter 480 printer that DisplayWrite 3 supports. When you are using RuggedWriter 480 as a Class A printer, note that 12 pitch, 15 pitch, and proportional spacing are not available.

Special Note

Remember that function switch B1 on your printer must be UP.

Using FrameWork™ II

On the HP Vectra and IBM PC and Compatibles

Introduction

The procedures outlined in this application note will assist you in using FrameWork II with your RuggedWriter 480 printer. Before proceeding, please review the Setting Up FrameWork section of the FrameWork II Getting Started Manual.

Setting Up FrameWork II

FrameWork II provides an easy-to-use program entitled SETUP which asks you about your computer system and modifies FrameWork II accordingly. SETUP is used when FrameWork II is initially installed, and is also the program used when setting up your new RuggedWriter 480 printer to run with FrameWork II.

The SETUP program is contained on your program disk, or it can be found on the original SETUP disk. Begin the SETUP program by typing **SETUP**. The program will ask if you are setting up FrameWork for the first time or if you are making changes to an already installed copy of FrameWork II. Select the answer that reflects your situation.

If you are installing FrameWork II, follow the instructions below under First Time Install. If you are changing an already installed copy of FrameWork II, follow the instructions below under Reconfiguring FrameWork II.

First-Time Install

Proceed with the SETUP program until the Setting Up Your Printer, Step One menu appears. A list of all supported printers will be displayed. Select **LQ-1500** from the list of Epson printers.

In step two, you will be asked to select the type of interface (parallel or serial) that you will be using. All of the selections that you have made up to this point will then be displayed, including the printer port that FrameWork II assigned to your printer. If the selections are correct, select the option to set up FrameWork II as specified. If they are not correct, select the option to start over again. Follow the instructions on the screen to complete the installation.

Reconfiguring FrameWork II

Proceed with the SETUP program until the Main Menu is displayed. From the Main Menu, select **CONFIGURATION**. The Configuration Menu will then be displayed; from there, select the **PRIMARY HARDWARE** option. When the Primary Hardware Menu is displayed, select **Printer 1 Driver**. A list of all supported printers will then be displayed. Select **LQ-1500** from the list of Epson printers.

After selecting the Printer 1 Driver, you will return to the Primary Hardware Menu. Next, select **Printer 1 Port Assignment**. The list of possible ports (parallel and serial) will then be displayed. Select the desired port. It will usually be Parallel Port 1 (LPT1:) for parallel interfaces or Serial Port 1 (COM1:) for serial interfaces. Return to the Main Menu by entering an **M**. Now select the option **SAVE ALL NEW SETTINGS**. Follow the instructions provided to have the new printer driver copied from the SETUP Disk.

Using Printer Features

FrameWork II has a variety of printing features and print formatting commands available. The Print Menu in FrameWork II contains selections that start and control printing. Select **BEGIN** from the Print Menu and press the **ENTER** key to print the currently selected frame. For more information on printing from FrameWork II, refer to the Formatting and Printing Section of your Using FrameWork II Manual. For additional information about FrameWork II Print Formatting Functions, refer to the FrameWork II Advanced Topics Manual.

Using HPWORD

On the HP3000 and the HP150

Introduction

HPWORD and the RuggedWriter 480 printer are both powerful products; therefore, you must use a RuggedWriter 480 printer driver in order for them to work together. This driver will provide complete feature support for your printer, including Word Text Enhancements, Pitch Environments and Paper Paths.

HPWORD/3000

The RuggedWriter 480 printer driver is available as part of version A.05.06 of HPWORD/3000. If your version of HPWORD/3000 is earlier than this, contact your local HP support representative.

HPWORD/150

Check to see if your version of HPWORD/150 contains a RuggedWriter 480 printer driver. If it does, follow the instructions provided in Configuring Your Printer in the Introducing HPWORD/150 chapter of your HPWORD/150 manual, and specify RuggedWriter 480 as your Printer Type. If there is no RuggedWriter 480 driver as part of your version of HPWORD/150 continue with the Set Up description that follows.

Setting Up HPWORD

The following setup description provides limited RuggedWriter 480 functionality through use of either the LaserJet (HP2686) or the ThinkJet (HP2225) driver. This is the recommended set up for versions of HPWORD that do not have a RuggedWriter 480 printer driver. Note that the ThinkJet printer driver is available only on HPWORD/150.

The selection between the LaserJet and ThinkJet drivers is based strictly upon which of your printer's paper paths you will be using. The LaserJet driver forces the use of the Automatic Sheet Feeder, while selecting the ThinkJet driver forces the use of the Tractor (Z-fold) path. The best choice is the LaserJet driver (sheet feeder required) because it supports all HPWORD Text Enhancements.

The WORDUTIL program is used to set up HPWORD to work with the RuggedWriter 480 printer. Run WORDUTIL and respond to the following prompts (those relating to printer set up) as shown.

WORDUTIL Prompt	Sheet Feeder Response	Tractor Response
Type of Printer:	LaserJet	ThinkJet
Type of Paper Feed:	Single	Tractor
Standard Form:	plain bond or letterhead	
Special Form:	plain bond or letterhead	
10-Pitch Environment:	COUR086.*	PICA25.ENV
12-Pitch Environment:	GOTH286.*	ELITE25.ENV
Proportional Environment:	TMSRP86.*	ELITE25.ENV
Default Pitch:	10 or 12	
Default Paper Size: (Only in some versions)	Letter, Legal, A4 or B5	
Orientation: (Only in some versions)	Portrait	

* = For HPWORD/3000 users – type **WP.HPOFFICE** following the environment file name (for example, COUR086.WP.HPOFFICE)
For HPWORD/150 users – type **ENV** following the environment file name (for example, TMSRP86.ENV).

Using Printer Features

- HPWORD provides a variety of Text Enhancements. These enhancements are fully supported when using the LaserJet driver, while the ThinkJet driver supports only a limited number of enhancements. Refer to the table below to determine which enhancements are supported.

Text Enhancement	LaserJet	ThinkJet
Underline	Yes	Yes
Double Underline	Yes	Single Underline
Bold	Yes	DO NOT USE
Italics	Yes	Single Underline
Bold/Italiic	Yes	DO NOT USE
Superscript	Yes	Single Underline
Subscript	Yes	Single Underline

Print Pitches

- If you are using the LaserJet driver, both 10 and 12 pitch will work well with your printer. The proportional spaced printing environment for LaserJet does not match that for the RuggedWriter 480 printer and should not be used.

When using the ThinkJet driver use only 12 pitch.

Using Lotus 1-2-3® Release 1A

On the HP Vectra, HP Series 100*; and the IBM PC Family and Compatibles

Introduction

The following will assist you in setting up and using your RuggedWriter 480 printer with Lotus 1-2-3. Lotus 1-2-3 has two distinct printing environments, 1-2-3 and PrintGraph. Spreadsheets are printed from within 1-2-3 and graphs are printed from PrintGraph. These two environments are discussed separately in the following.

This note will help you set up 1-2-3 and PrintGraph such that RuggedWriter 480 is your default system printer. If you would like further information on printing with Lotus refer to the 1-2-3 manual, where the PRINT command section and the PrintGraph program discussion are both helpful.

Setting Up 1-2-3

1. Run Lotus 1-2-3.
2. After the empty spreadsheet appears, enter the commands below that correspond to your PC set up. This will designate your 1-2-3 Primary System Printer.
   a. HP Vectra and IBM PC's: Using the First Parallel Port (LPT1), enter **/WGDPI1** (Worksheet, Global, Default, Printer, Interface, Parallel). Using the First Serial Port (COM1), enter **/WGDPI28** (Worksheet, Global, Default, Printer, Interface, Serial, 9600 Baud)

*Includes the HP Touchscreen/150 A, B, C and The Portable.

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b. HP Series 100 PC's: Using RuggedWriter 480 as the PRN Device, enter **/WGDPI1** (Worksheet, Global, Default, Printer, Interface, PRN Device).
Using RuggedWriter 480 as the LST Device, enter **/WGDPI28** (Worksheet, Global, Default, Printer, Interface, LST Device)

3. Enter **AN** (Auto-LF, NO – This assures proper linefeeding)
4. Enter **QU** (Quit, Update – This saves the setup on the disc)
5. Enter **Q/QY** (Quit, Command Mode, Quit, Yes, Exit 1-2-3)

Page Formatting with 1-2-3

When printing spreadsheets on RuggedWriter 480 the best way to specify the page format is to use 1-2-3 itself. The desired format can be easily established as either the general/default format or specifically for a particular spreadsheet.

To define the Default Format:

1. Enter **/WGDP** (Worksheet, Global, Default, Printer). From here set your left, right, top and bottom margins, and page length.
2. After the selections have been made, enter **QUQ** (Quit, Update, Quit). This will save your new format on the disc and will automatically be used each time you print with 1-2-3 unless a specific format is defined.

To define a Spreadsheet Format:

1. Enter **/PPO** (Print, Printer, Options). From here you can change or set headers, footers, margins, borders, and page length for this spreadsheet.
2. Enter **QQ** (Quit, Quit – This exits Command Mode).
3. This format will be saved along with this file when it is saved. Enter **/FS** (File, Save).

Reminder: Before you begin printing, be sure that you have positioned the paper at the desired top-of-form, then enter **/PPA** (Print, Printer, Align). This will tell Lotus 1-2-3 that the paper is aligned at the beginning of the page.

Using Setup Strings

For more advanced users, 1-2-3 provides the ability to send control codes and escape sequences directly to the printer using "Setup Strings". Setup strings can be defined as part of either the default or spreadsheet page format described earlier.

For Default Setup Strings:
Enter **/WGDPS** (Worksheet, Global, Default, Printer, Setup)

For Spreadsheet Format:
Enter **/PPOS** (Print, Printer, Option, Setup).

The following is a list of the more commonly used Setup Strings. Remember to choose the correct "string" for the mode your RuggedWriter 480 is operating in: Epson Mode (Switch B1–UP) for Vectra and IBM PC's, and PCL Mode (Switch B1–DOWN) for HP Series 100 PC's.

	Setup String	
Setting Print Pitch	**Epson Mode**	**PCL Mode**
20 Characters/Inch	\027M\015	\027(s20H
17.13 Characters/Inch	\027P\015	
16.7 Characters/Inch		\027(s16H
15 Characters/Inch	\027g	
12 Characters/Inch	\027M	\027(s12H
10 Characters/Inch (Default)	\027P	\027(s10H
Setting Print Quality		
Draft Quality–Line Printer	\027x0	\027(s0t0Q
Letter Quality–Courier	\027x1	\027(s3t2Q
Setting Line Spacing		
8 Lines/Inch	\0270	\027&ℓ8D
6 Lines/Inch (Default)	\0272	\027&ℓ6D
Initializing RuggedWriter 480		
Printer Reset	\027@	\027E

Setting Up PrintGraph

PrintGraph requires that a printer driver file that will properly communicate with RuggedWriter 480 printer be selected from its library. The proper driver will depend on which PC you are using. For the HP Vectra and IBM PC's select the Epson FX80 driver; for the HP Series 100 PC's select the HP 2930 Series driver. The instructions below describe the correct set up process for PrintGraph including the appropriate driver selection.

1. Run PrintGraph.
2. Enter **CD** (Configure, Device–The driver library will be displayed)
3. Use the arrow keys to highlight:

   For HP Vectra and IBM PC's:
   EPSON FX80 Single, Double, Triple or Quad
   (Switch B1–UP)

   For HP Series 100 PC's:
   HP 2930 Series Printer
   (Switch B1–DOWN)
4. Press **Space** to select the desired driver (an * will appear next to it), then press the **Enter** or **Return** key.
5. Enter the commands below that correspond to your PC set up.
   a. For HP Vectra and IBM PC's: Using the First Parallel Port (LPT1), enter **I1** (Interface, Parallel). Using the First Serial Port (COM1), enter **I28** (Interface, Serial, 9600 Baud)
   b. For HP Series 100 PC's: Using RuggedWriter 480 as the PRN device, enter **I1** (Interface, PRN device). Using RuggedWriter 480 as the LST device, enter **I28** (Interface, LST Device)
6. Enter **SR** (Save, Replace–This saves the setup on the disc)
7. Enter **QQY** (Quit, Quit, Yes–Exit PrintGraph)

Using Lotus 1-2-3® Release 2

On the HP Vectra, HP Series 100*; and the IBM PC Family and Compatibles

Introduction

The following will assist you in setting up and using your RuggedWriter 480 printer with Lotus 1-2-3. Lotus 1-2-3 has two distinct printing environments, 1-2-3 and PrintGraph. Spreadsheets are printed from within 1-2-3 and graphs are printed from PrintGraph. These two environments are discussed separately in the following.

This note will help you set up Lotus so that RuggedWriter 480 is your default system printer. If you would like further information on printing with Lotus refer to the Printing Your Work, or the Print Command sections of the 1-2-3 reference manual, and the PrintGraph Program discussion.

Install-Selecting Text & Graphics Printer Drivers

Before you set up the 1-2-3 and PrintGraph printing environments, you must create a driver set. The 1-2-3 Getting Started manual discusses the Install Program which is used to create a driver set. A driver set tells 1-2-3 about the peripherals (printers, monitors, etc.) that are connected to your PC. Follow the instructions for running the Install Program, and proceed until the main menu appears.

- If you are creating a new (first time) driver set, select **First-Time Installation** and follow the instructions displayed.
- If you are changing an existing driver set, select **Change Selected Equipment** and follow the instructions displayed.

*Includes the Touchscreen/150 A, B, C and The Portable.

Then add both the appropriate text and graphics printer drivers depending on your PC:

For HP Vectra or IBM PC's–
For the Text Printer: Select **Epson**, then select **Epson FX, RX and JX series; LQ-1500**
For the Graphics Printer: Select **Epson**, then select **LQ 1500**

For HP Series 100 PC's–
For both the Text and Graphics Printer: Select **HP**, then select **HP ThinkJet or 2930 series**.

After making your printer driver selections, continue with the remainder of the installation process and save your selections in the driver.SET file. Then exit the Install Program.

Setting Up 1-2-3

1. Start Lotus 1-2-3.
2. After the empty spreadsheet appears, enter the commands below that correspond to your PC set up. This will designate your 1-2-3 Primary System Printer.
   a. For HP Vectra and IBM PC's: Using the First Parallel Port (LPT1), enter **/WGDPI1** (Worksheet, Global, Default, Printer, Interface, Parallel)
   Using the First Serial Port (COM1), enter **/WGDPI28** (Worksheet, Global, Default, Printer, Interface, Serial, 9600 Baud)
   b. For HP Series 100 PC's: Using RuggedWriter 480 as the PRN Device, enter **/WGDPI1** (Worksheet, Global, Default, Printer, Interface, PRN Device)
   c. Using RuggedWriter 480 as the LST Device, enter **/WGDPI28** (Worksheet, Global, Default, Printer, Interface, LST Device*)

3. Enter **AN** (Auto-LF, NO–This assures proper Linefeeding)
4. Enter **QUQ** (Quit, Update–This saves the setup on the disc, Quit)

Setting Up PrintGraph

PrintGraph requires that a driver be selected from its library that will properly communicate with RuggedWriter 480. The proper driver will depend on which PC you are using. For the HP Vectra and IBM PCs select the Epson LQ-1500 driver, and for the HP Series 100 PCs select the HP 2930 Series driver. The instructions below describe the correct set up process for PrintGraph, including the appropriate driver selection.

1. Start the PrintGraph Program.
2. Enter the commands below that correspond to your PC set up.
   a. For HP Vectra and IBM PC's: Using the First Parallel Port (LPT1), enter **SHI1** (Setup, Hardware, Interface, Parallel). Using the First Serial Port (COM1), enter **SHI28** (Setup, Hardware, Interface, Serial, 9600 Baud)
   b. For HP Series 100 PC's: Using RuggedWriter 480 as the PRN Device, enter **SHI1** (Setup, Hardware, Interface, PRN Device). Using RuggedWriter 480 as the LST Device: Enter **SHI28** (Setup, Hardware, Interface, LST Device)
3. Enter **P** (Printer–The installed driver.set will be displayed)
4. Use the Up & Down arrow keys to highlight:

   For HP Vectra and IBM PC's:
   EPSON LQ-1500 Low or High density
   (Switch B1–UP)

For HP Series 100 PC's:
HP 2930 Series
(Switch B1–DOWN)

5. Press the **Space** key to select the desired driver, (the # symbol will appear next to the selected driver), then press the **Enter** or **Return** key.
6. Enter **QS** (Quit, Save–This saves the setup on the disc)

Page Formatting with 1-2-3

When printing spreadsheets on RuggedWriter 480 the best way to specify the page format is to use 1-2-3 itself. The desired format can be easily established as either the general/default format or specifically for a particular spreadsheet.

To define the Default Format:

1. Enter **/WGDP** (Worksheet, Global, Default, Printer). From here set your left, right, top and bottom margins, and page length.
2. After the selections have been made, enter **QUQ** (Quit, Update, Quit). This will save your new format on the disc, it will automatically be used each time you print with 1-2-3 unless a specific format is defined.

To define a Spreadsheet Format:

1. Enter **/PPO** (Print, Printer, Options). From here you can change or set headers, footers, margins, borders, and page length for this spreadsheet.
2. Enter **QQ** (Quit, Quit–This exits Command Mode).
3. This format will be saved along with this file when it is saved. Enter **/FS** (File, Save).

Reminder: Before you begin printing, be sure that you have positioned the paper at the desired top-of-form, then enter **/PPA** (Print, Printer, Align). This will tell Lotus 1-2-3 that the paper is aligned at the beginning of the page.

Using Setup Strings

For more advanced users, 1-2-3 provides two different ways to send control codes and escape sequences directly to the RuggedWriter 480 using (1) "Setup Strings", and (2) imbedding "strings", in the spreadsheet. Setup strings can be defined as part of either the default or spreadsheet page format described earlier, while imbedded strings are stored as part of the spreadsheet itself.

For Default Setup Strings:
Enter **/WGDPS** (Worksheet, Global, Default, Printer, Setup)

For Spreadsheet Format:
Enter **/PPOS** (Print, Printer, Option, Setup).

For Imbedded Strings:
Locate the cell to contain the string.
Enter ‼ (Hold down the **Shift** key and press ¦ twice).
Enter the desired string as shown below.

The following is a list of the more commonly used "strings." Remember to choose the correct "string" for the mode your RuggedWriter 480 is operating in; Epson Mode (Switch B1–UP) for Vectra and IBM PC's and PCL Mode (Switch B1–DOWN) for HP Series 100 PC's.

	Setup String	
Setting Print Pitch	Epson Mode	PCL Mode
20 Characters/Inch	\027M\015	\027(s20H
17.13 Characters/Inch	\027P\015	
16.7 Characters/Inch		\027(s16H
15 Characters/Inch	\027g	
12 Characters/Inch	\027M	\027(s12H
10 Characters/Inch (Default)	\027P	\027(s10H
Setting Print Quality		
Draft Quality–Line Printer	\027x0	\027(s0t0Q
Letter Quality–Courier	\027x1	\027(s3t2Q
Setting Line Spacing		
8 Lines/Inch	\0270	\027&ℓ8D
6 Lines/Inch (Default)	\0272	\027&ℓ6D
Initializing RuggedWriter 480		
Printer Reset	\027@	\027E

Using MS Word®

On the HP Vectra, HP Series 100*; and the IBM PC Family and Compatibles

Introduction

The procedures outlined here will help you use your RuggedWriter 480 printer with MS Word. For more information on printing and the print command, check the index of your MS Word manual.

Setting Up MS Word

When using MS Word to print documents, you must have a copy of the correct ".PRD" file on your Program Disk. A ".PRD" file is a printer description file which MS Word uses to correctly activate the desired printer features.

For HP Vectra and IBM PCs:
LQ800.PRD (Best Choice) (Switch B1–UP)
or **EPSONFX.PRD** (Switch B1–UP)

For HP Series 100* PCs:**HP2934A.PRD** (Switch B1–DOWN)

Copy the correct ".PRD" for your PC to your MS Word Program Disk. These files will give you the best RuggedWriter 480 printer performance with MS Word.

Before printing using MS Word you must first establish the proper Print Options for your system. From the MS Word program press **Esc**, then **PO**. Use the **Tab** key to move around this Print Options menu and select the following settings (Use the "down-arrow" or your "right-hand" mouse button to view the available selections:

printer: **LQ800** or **EPSONFX** (Vectra & IBM PCs)
HP2934A (HP Series 100 PCs)

*Includes the HP Touchscreen/150A, B, C and The Portable.

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feed:
Manual (hand fed paper)
Continuous (Z-fold paper or Sheet Feeder/ LQ800)
Bin1 (Sheet Feeder/HP2934A)

setup:
LPT1: (Vectra and IBM parallel port)
COM1: (Vectra and IBM serial port)
PRN: (HP Series 100 primary port)
LST: (HP Series 100 secondary port)

Press the **Enter** or **Return** key, followed by **Esc** and then press **Enter** or **Return** again. The Print Options information will be automatically saved when you Quit MS Word. Therefore it needs to be entered only once.

Using Printer Features

The printing features available when running MS Word depend on the ".PRD" in use.

For HP Vectra and IBM PC's:

When using the LQ800.PRD, all of the features in the MS Word Character Format will work properly with the RuggedWriter 480 printer which makes it clearly the best choice. If you do not have the LQ800.PRD, the EPSONFX.PRD is the next best alternative. Your MS Word documentation fully discusses the active printing features available when using EPSONFX.

For HP Series 100 PC's:

When using HP2934A, the resulting MS Word Character Formats are supported as shown on the next page. Any others, although they may be active, are not recommended.

Character Format	HP2934A.PRD Support	
bold:*	Yes	
italic:*	Yes	
underline:	Yes	
strikethrough:	Yes	
uppercase:	No	
small caps:	No	
double underline:	No	
position:	Yes–Normal, Super & Supscripts	
font name & size:		
Standard–	Draft*	10, 12, 16
	Courier-40	10, 12
Optional Font Cartridge–	Prestige-40	10, 12
	Letter Gothic-40	10,12
	Helv-40	10,12

*When using the Draft font avoid printing bold-italics because they will misprint. Bold-italics will print properly in any of the other fonts listed above.

Using Microsoft Windows®

On the HP Vectra, and IBM PC Family and Compatibles

Introduction

The procedures outlined below will help you use your RuggedWriter 480 printer with the Microsoft Windows Operating Environment. Before you can use your printer with Windows, you must install a printer driver. The Epson LQ-1500 driver provides the best performance on your printer, but the Epson FX-80 driver can also be used. The printer drivers mentioned are arranged in a prioritized order. A printer driver is a program/file that Windows applications use to communicate correctly with your printer. Printer drivers are installed with the Control application program that is distributed on your Windows application disk.

For more information, refer to the Adding and Removing Printers, and the Configuring Your System sections of the Using the Control Panel chapter in your Microsoft Windows User's Guide. The following information describes how to use the CONTROL.EXE program to install the best printer driver for the RuggedWriter 480 printer.

Note

"Select," as used in the following instructions means to use a mouse or keyboard keys to choose (or enable) designated menus and/or menu items.

Setting Up Microsoft Windows

1. Select the Control Program (CONTROL.EXE) from the MS-DOS Executive.

To Install the Printer Driver:

2. Select the **Installation Menu**.

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3. Select **Add New Printer**.
4. Enter the path name for one of the Epson printer drivers mentioned in the introduction (Epson LQ-1500 or FX-80). For example, if the printer driver is on the disk inserted in drive A, enter **A:**. If your printer driver file is in the WINDOWS directory on drive C, enter **C:\WINDOWS**.
5. Press the **Enter** key.
6. Select the Epson printer driver (Epson LQ-1500 or FX-80) and press the **Enter** key.

To select the Printer Output Port:

7. Select the **Setup** menu.
8. Select **Connections**.
9. Select the Epson printer driver (Epson LQ-1500 or FX-80).
10. Select the port to which your printer is connected (usually LPT1 for parallel and COM1 for serial).
11. Select **OK**.

If you are using the Serial Printer Port:

12. Select the **Setup** Menu.
13. Select **Communications**.
14. Select the serial port your printer is connected to (**COM1:** or **COM2:**), then select the following settings:

Communications Settings					
Port	◉ COM1:			○ COM2:	
Baud Rate:	9600				
Word Length	○ 4	○ 5	○ 6	○ 7	◉ 8
Parity	○ Even		○ Odd		◉ None
Handshake		◉ Hardware			○ None

To select the Default System Printer and Change Printer Features:

If you have more than one printer installed, Microsoft Windows allows you to choose any one of the printers to be the current, or default, printer. The current printer is the printer that applications designed to run with Windows will use. Once you have selected the Epson LQ-1500 or FX-80 as the default system printer you may specify whether you want printouts to be printed in Portrait mode (normal), or Landscape mode (lengthwise). To select the current printer and the modes:

15. Select the **Setup Menu**.

16. Select **Printer**.

17. Select Epson LQ-1500 or FX-80.

18. Select **OK**.

19. Use the mouse or keyboard keys to select the printer options or modes you want to use with your printer, and select **OK** when you are done.

Special Note

Remember that function switch B1 on your printer must be UP.

Using MultiMate®

On the HP Vectra, HP 100 Series*; and IBM PC Family and Compatibles

Introduction

The procedures outlined here will help you use your RuggedWriter 480 printer with MultiMate. For more information we suggest you read the sections on printing in the Screens and Menus chapter in your MultiMate manual; HP Series 100 users will find this chapter in the MultiMate Reference manual; HP Vectra/IBM users will find this chapter in the MultiMate Beginner's Guide.

Setting Up MultiMate

To use your RuggedWriter 480 printer with MultiMate, the utility that controls printing must be set up with the appropriate information. Included in this information is the name of a .PAT file. A .PAT file is the file that MultiMate uses to communicate with your printer. The .PAT files are stored on the Printer Tables Diskette or the MultiMate Utilities Diskette. If you are using an HP Vectra, IBM PC, or compatible, you will use EPLQ1500.PAT or EPSONFX.PAT. If you are using an HP Series 100 PC use HP2934A.PAT. The .PAT file that you use must be copied onto your system disk.

To set up the print utility, select **Printer Control Utilities** from MultiMate's main menu. Next, select **Edit Printer Defaults**. The MODIFY PRINTER DEFAULTS screen will then be displayed.

*Includes HP Touchscreen/150 A, B, C and The Portable.

The following information needs to be supplied in the menu fields listed below (use the **TAB** key to move between fields):

1. Printer Action Table–Enter the name of the .PAT file you will be using.
2. Sheet Feeder Action Table–
   If you will be using the sheet feeder, enter the name of the sheet feeder action table that corresponds to the .PAT file that you are using.

   HP 100 Series Users:
   HP2934A.PAT– HP29340.SAT

   HP Vectra/IBM Users:
   EPLQ1500.PAT– DIABLF33.SAT
   EPSONFX.PAT– DIABLF33.SAT

If you are using the sheet feeder enter **1** in the following fields:

First Page **1** Middle **1** Last Page **1**

3. HP Series 100 Users:
   P (PRN) / L (LST) / C (COM) / A (AUX) / F (FILE)–**P**
   Refer to the hardware application note in this same chapter for instructions on configuring your PC's PRN device.

   HP Vectra/IBM Users:
   P(arallel) / S(erial) / L(ist) / A(uxiliary) / F(ile)–**P or S**
   If your printer is connected to a parallel port (LPT1) enter **P**.
   If your printer is connected to a serial port (COM1) enter **S**.
4. Device Number–**001**
   For HP Vectra/IBM users enter a **1** if you are using LPT1 or COM1, or enter a **2** if you are using LPT2 or COM2.
   HP Series 100 users enter a **1**.

The settings displayed in this menu are the default values used in formatting documents to print on your RuggedWriter 480 printer. Look over the remaining fields of the menu and set the values to reflect the way you commonly use MultiMate. Refer to the Screens and Menus chapter of your MultiMate manual for an explanation of each field.

Using Printer Features

Printer enhancements are selected by using special key sequences before and after the sections of a document that you want enhanced. For information on using specific enhancements refer to your MultiMate Reference Manual.

What To Expect

The level of RuggedWriter 480 feature support will depend on the .PAT file that you are using. Listed below are the alternative .PAT files with an explanation of what to expect when using a specific .PAT file.

If you selected the EPLQ1500.PAT (HP Vectra/IBM Users):

- Proportional Space will not print correctly.
- Seven print pitches are supported. Below is a list containing the MultiMate Print Pitch Indicator and the corresponding RuggedWriter 480 printer pitch.

Print Pitch Indicator	Print Pitch Selected
1	Expanded (5 cpi)
2	Expanded (6 cpi)
3	Expanded (8.53 cpi)
4	Normal (10 cpi)
5	Normal (12 cpi)
7	Compressed (17.13 cpi)
8	Compressed (20 cpi)

If you selected the EPSONFX.PAT (HP Vectra/IBM Users):

- Draft/NLQ print must be selected through your printer's keypad.
- Proportional Space will not print correctly.
- Five print pitches are supported. Below is the list containing the MultiMate Print Pitch Indicator and the corresponding RuggedWriter 480 printer pitch.

Print Pitch Indicator	Print Pitch Selected
1	Expanded (5 cpi)
3	Expanded (8.53 cpi)
4	Normal (10 cpi)
5	Normal (12 cpi)
7	Compressed (17.13 cpi)

If you selected the HP2934A.PAT (HP Series 100 Users):

- Draft/NLQ print must be selected through your printer's keypad.
- Proportional Space is not supported.
- Four print pitches are supported. Below is a list containing the MultiMate Print Pitch Indicator and the corresponding RuggedWriter 480 printer pitch.

Print Pitch Indicator	Print Pitch Selected
1	Expanded (5 cpi)
4	Normal (10 cpi)
5	Normal (12 cpi)
7	Compressed (17.13 cpi)

When changing the print pitch remember to alter your document margins so that the number of characters in a line does not exceed the maximum number allowable.

Using Print Central

On the HP3000 with the HP Vectra, HP Series 100*; and IBM PC Family and Compatibles

Introduction

Print Central lets you print documents and spreadsheets you have created on your PC to printers connected to a host HP3000 computer system. The procedures outlined below will assist you in using Print Central with your RuggedWriter 480 printer.

Setting Up Print Central

To use Print Central, the host (HP3000) and the PC must be configured correctly. Two sets of instructions are outlined below. The first set is to be used by the System Manager to configure the host. The second set of instructions is to be used by the PC user to configure the PC.

Setting Up the Host HP3000 (System Manager)

The RuggedWriter 480 printer has two modes of operation, HP mode and Epson mode. Before setting up Print Central to work with your printer, the System Manager needs to determine which mode, HP or Epson, will best meet the needs of RuggedWriter 480 printer users. The following paragraphs will explain the best environment for each mode. The mode is determined by mode function switch B1 located on the back panel of your printer. The DOWN position is HP mode, and the UP position is Epson mode. For more information on these two modes of operation, refer to the Programming chapter of this manual.

*Includes the HP Touchscreen/150 A, B, C and The Portable

HP Mode

If most RuggedWriter 480 printer users are using an HP150 PC, the printer should be used in **HP Mode** (switch B1 DOWN). In HP mode, HP150 PC users and HP3000 application users can easily control the printer (with Print Central). The useability of any HP mode printer drivers on HP Vectra and IBM PC applications (with Print Central) must be evaluated on a driver-by-driver basis by the System Manager.

Epson Mode

If the majority of RuggedWriter 480 printer users are using HP Vectras and/or IBM PCs, the printer should be used in **Epson Mode** (switch B1 UP). In Epson mode, HP 150 PC users use the available Epson LQ printer drivers, but the printer would not be available for use with HP3000 applications.

Regardless of the mode used, printer users should be informed of how the printer is to be accessed—as a dedicated Print Central device (Epson mode), or as a device that can be accessed by HP3000 users and PC users using Print Central (HP mode).

Print Central Operating Modes

Print Central has two modes of operation for printers, DIRECT and PROCESSED. The RuggedWriter 480 printer must be used in DIRECT mode in Print Central.

To use Print Central, three tasks must be accomplished. These are: installing the Print Central Software; configuring the printer in MPE; and configuring the printer into the Print Spooler (the spooler used by Print Central). For instructions on installing the Print Central software onto an HP3000, please refer to the Print Central System Manager Manual. For information on configuring the printer in MPE, refer to the hardware application note for HP3000s in Chapter 2. Print Central only supports the RuggedWriter 480 printer as a SPOOLED printer. Therefore, when configuring the printer into MPE be certain to specify that it is a spooled printer.

The Print Spooler Utility (PSUTIL) allows you to configure a printer into Print Central on an HP3000. The Print Spooler Utility Manual provides full details on running PSUTIL. The Print Spooler groups devices into classes. For each supported printer a default class is provided. To see a list of the supported printers type **LISTCONFIG** at the PSUTIL prompt. The currently configured classes, and the devices within those classes, will be listed. Look to see if the RuggedWriter 480 printer (HP2235A) is listed as a supported class. If it does not appear in the list, it must be configured as an HP2934A printer.

Within PSUTIL, the ADD command is used to add a device to the spooler configuration. From the PSUTIL prompt type **ADD**. You will be prompted for the following information. The answers you should give are in bold.

Select CLASS or DEVICE: **D** (device)
Device Name: **User Defined**–1-16 characters
Model Number: **HP2235A** (HP2934A if HP2235A did not appear in the configuration)
Class: **HP2235A** (HP2934A if HP2235A did not appear in the configuration)
Address: **MPE LDEV Number** or an MPE Class Name
Connecton: **M**–For MPE Spooled
Options: (not needed for SHARED printers; options are controlled by the PC application.)
Ownership: (press the **Enter** key)
Language: (press the **Enter** key)

Remember to unlock the configuration after you have added the device. This is done by typing **UNLOCK** at the PSUTIL prompt.

Setting Up the PC

For specific instructions on installing Print Central on your PC, refer to the Installation chapter in your Print Central PC Users Manual. The Make Sure Your Printer is Configured Correctly section of the Installation chapter will help you ensure that your PC is configured correctly.

The REDIRECT program allows you to direct your printer output to a local printer connected to your PC or to a printer connected to an HP3000. When Print Central is installed, the default printer setup directs any printer output to your local printer. To access the RuggedWriter 480 printer connected to the HP3000, the appropriate printer setup must be activated. Your printer is supported as a DIRECT printer. For DIRECT printers, setup files are provided on the Print Central disk.

To redirect printer output from your PC to the RuggedWriter 480 printer connected to the HP3000, begin the REDIRECT program. From the main menu enter **HP2235D.PPC** in the Setup File: field and press the function key labelled **Read File**. If HP2235D.PPC was not found on your Print Central disk, enter **HP2934A.PPC** and press the **Read File** key. The information contained in the file will then be displayed. Enter your HP3000 Logon information in the Logon: field. (See your System Administrator for information about your Logon.) Next press the function key labelled **Activate Setup**. Print Central will then verify that your PC is connected to your host correctly. Exit the program by pressing the function key labelled the **Exit Utility**.

Print Central is now installed. To print documents from your PC applications make sure that the application is printing to the PRN or LPT1 device. If the output is not as you expected, check with your System Manager to verify that you are using the correct printer driver in your application.

Using Symphony®

On the HP Vectra, HP Series 100*; and the IBM PC Family and Compatibles

Introduction

The procedures outlined here will help you use Symphony with your RuggedWriter 480 printer. Symphony has two printing "environments." The text printing environment is used when you are in Symphony; the graphics printing environment is used when you are in PrintGraph. The set up and use of Symphony and PrintGraph are different and independent, and are treated that way here.

For a good, general understanding of printing in Symphony, review the sections of your software Reference Manual that discuss printing your work from the spreadsheet (SHEET), the word processor (DOC), and the database (DATA). Also, review the section on printing graphics.

Install—Selecting Text & Graphics Printer Drivers

Before you set up the text and graphics printing environments, you must first create a driver set. The driver set you define tells Symphony about the peripherals (printers, plotters, etc.) connected to your PC. To create a driver set you must run the Install program. Refer to the Install section of your Symphony Getting Started or Introduction manual. Follow these instructions, and proceed until the main menu appears.

- If you are creating a new (first time) driver set, select **Installation:Create a Driver Set** and follow the instructions displayed.

*Includes the Touchscreen/150A, B, C and The Portable.

- If you are changing an existing driver set, select **Change Selected Equipment** and follow the instructions displayed.

Then, add both the appropriate text and graphics printer drivers depending on your PC:

For HP Vectra or IBM PCs–
Select **Epson**,
Then select **Epson LQ-1500 (switch B1 UP).**

For HP Series 100 PCs–
Text Driver:
Select **HP**,
Then **HP 2686 LaserJet** (switch B1 DOWN).
Graphics Driver:
Select **HP**,
Then **HP 2930 series** (switch B1 DOWN).

After making your printer driver selections, continue with the remainder of the installation process and save your selections in the driver.SET file. Then exit Install.

Setting Up Symphony

1. Run Symphony
2. Press the **Services** key.
3. Enter **CP** (Configuration, Printer).
4. a. For Vectra/IBM users:
   If your printer is connected to the first Parallel printer port, enter **T1** (Type, first parallel port). If your printer is connected to the first Serial port, enter **T28** (Type, first serial port, 9600 baud).
   b. For HP Series 100 users:
   If your printer is set up as the PRN device, enter **T1** (Type, primary printer). If your printer is set up as your LST device, enter **T2** (Type, secondary printer).

   For further information on configuring your PRN and LST device refer to the HP Touchscreen/150 Hardware Application Note located in Chapter 2.
5. Type **AN** (Auto-line feed off).

6. a. When using the Automatic sheet feeder or Z-fold paper, type **WN** (do not wait between pages).
   b. When manually feeding paper, type **WY** (wait between pages).
7. Enter **N***, then enter the number that corresponds to Epson LQ-1500 (for Vectra/IBM PCs) or HP2686 LaserJet (for HP Series 100 PCs).
8. Enter **QU** (Quit then Update).
9. Press the **ESC** key, then type **EY** (go back to Services, then Exit).

*Older versions of Symphony (i.e., 1.0) may not allow the name selection.

Setting Up PrintGraph

1. Run PrintGraph.
2. a. For Vectra/IBM PCs:
   If your printer is connected to the first parallel printer port, type **SHI1** (Setup, Hardware, Interface, First Parallel Port). If your printer is connected to the first serial printer port, type **SHI28** (Setup, Hardware, Interface, First Serial Port, 9600 baud).
   b. For HP Series 100 PCs:
   If your printer is configured as the PRN device, type **SHI1** (Setup, Hardware, Interface, Primary printer). If your printer is configured as the LST device, type **SHI2** (Setup, Hardware, Interface, Secondary printer).
3. Type **P** (Select Graphics printer).
4. Use the Up & Down arrow keys to highlight one of the following printers:

   For HP Vectra and IBM PC's:
   EPSON LQ-1500 (Switch B1–UP)

   For HP Series 100 PC's:
   HP 2930 Series (Switch B1–DOWN)
5. Press **Space** to select the desired printer driver (# will appear next to it), then press the **Enter** or **Return** key.
6. Enter **QS** (Quit, Save–This saves the setup on the disc).

Using Printer Features

Every print attribute available through the Symphony Word Processor is supported by your printer when using the Epson LQ-1500 or HP2686 LaserJet driver. These attributes are discussed in detail in the Symphony Reference Manual.

Reports and documents can be easily formatted from any of the Symphony environments by pressing the **Services** key, then typing **P**, which will display the Print settings. Next, type **S**. From here you can define the page format by typing **P** to change the page settings or typing **M** to change the margins.

For more advanced users this is the menu from which you define Init-Strings. This method of sending control and escape sequence codes is used to set various printer functions. The Init-String that you define will be sent to the printer when you initiate printing. To input an Init-String from the Print Settings Menu type **SI** (Settings, Init-String), then enter the desired string.

Below are the more commonly used init-strings. Remember to choose the correct "string" for the mode your printer is operating in; Epson Mode (Switch B1–UP) for Vectra and IBM PC's, and PCL Mode (Switch B1–DOWN) for HP Series 100 PC's.

	Init-String	
Setting Print Pitch	**Epson Mode**	**PCL Mode**
20 Characters/Inch	\027M\015	\027(s20H
17.13 Characters/Inch	\027P\015	
16.7 Characters/Inch		\027(s16H
15 Characters/Inch	\027g	
12 Characters/Inch	\027M	\027(s12H
10 Characters/Inch (Default)	\027P	\027(s10H
Setting Print Quality		
Draft Quality–Line Printer	\027x0	\027(s0t0Q
Letter Quality–Courier	\027x1	\027(s3t2Q
Setting Line Spacing		
8 Lines/Inch	\0270	\027&ℓ8D
6 Lines/Inch (Default)	\0272	\027&ℓ6D
Initializing RuggedWriter 480		
Printer Reset	\027@	\027E

Using WordPerfect 4.1

On the HP Vectra, and IBM PC Family and Compatibles

Introduction

The procedures outlined here will help you use WordPerfect with your RuggedWriter 480 printer. In order to correctly print documents from WordPerfect, you must specify the printer you are using. This is done through the Select Printers option available from the WordPerfect Printer Control Menu. Refer to the Printers, Select section of your WordPerfect manual for more information on selecting printers.

Setting Up WordPerfect

The Select Printers menu allows you to identify, in order of priority, the printers you will use. You may select up to 6 different printer definitions. Begin with the Printer Control Menu by holding down the **Shift** key and pressing **F7**, then select option 4, Printer Control. From this menu select option **3, Select Printers**. A list of printers will then be displayed. Notice the current Printer Number at the bottom left of the menu. This number indicates the printer (1-6) that you are about to select.

From this menu use the **PgDn** (Page Down) key to find RuggedWriter 480 in the list of printers, and enter the corresponding number. If RuggedWriter 480 does not appear, enter the number corresponding to Epson LQ-800/ LQ-1500 (2. ROM). It may be necessary to press the **PgDn** (Page Down) key to display the entire list of printers. Next, you will be asked to indicate the printer port you will be using. This will usually be LPT1 if you are using the parallel interface, or COM1 for the serial interface. For a serial interface (COM port) you will be asked to provide the following settings for your printer (the answers you should provide are in bold):

Baud Select	**9600**
Parity	**None**
Stop Bits	**1**
Character Length	**8**

Following the port selection, you will be asked to indicate the Type of Forms (paper path) you will be using on your printer. With your RuggedWriter 480 printer and WordPerfect, paper may be fed by tractor (continuous), by the hand-fed path (manual), or by the single bin sheet feeder.

If you select the sheet feeder option, WordPerfect needs to know specific information about your sheet feeder. You will be asked the following questions: (Note: The answers you should give are in **BOLD**.)

Number of Extra Lines Between Pages (12 LPI): **0**
Column Position of Left Edge of Paper (10 Pitch): **0**
Number of Sheet Feeder Bins (1-3): **1**

After answering the above questions, a list of sheet feeders will be displayed. From this list select RuggedWriter 480. If the RuggedWriter 480 does not appear in the list, select Epson LQ-1500 Single/Dual.

After indicating the Type of Forms you will be using, the list of printers will reappear. Press **F7** to return to the Printer Control Menu. From the Printer Control Menu select option **1**, Select Printer Options. Ensure that the Printer Number displayed corresponds to the Printer Number (1-6) that you identified from the Select Printers menu.

Using Printer Features

WordPerfect provides files to test the functions of your printer. These files are on the WordPerfect Learning disk. The files are PRINTER.TST and PRINTER2.TST. To print either of these files, ensure that your printer is connected to your computer and is ON LINE. Load the file into the WordPerfect program by holding down the **Shift** key and pressing **F10**. You will then be prompted for the name of the document to be retrieved. Type **A:\PRINTER.TST** or **A:\PRINTER2.TST** (assuming that the Learning disk is in the A: drive). Next, hold down the **Shift** key and press **F7**. Select option **1**, Full Text, and the document will be printed. For more information on the print functions, please see the Reference section of the WordPerfect manual.

If you wish to use proportional spacing, remember that fonts 2–7 use the appropriate character width tables. Select one of those fonts (2–7) when you turn on proportional spacing. Refer to your printed copy of the PRINTER.TST file for examples of those fonts.

Special Note

Remember that the function switch B1 on your printer must be UP.

Using WordStar®

On the HP Vectra, HP Series 100*; and IBM PC Family and Compatibles

Introduction

The procedures outlined here will help you use your RuggedWriter 480 printer with WordStar.

Setting Up WordStar

WINSTALL is the program used to customize WordStar. With it you can prepare WordStar to work properly with your printer. It will also allow you to tailor a variety of WordStar features to your needs.

For information on how to begin WINSTALL if you are using an HP Vectra, or an IBM PC, XT/AT, refer to the Basic Installation chapter of the WordStar Installation Manual and the IBM PC Addendum; if you are using an HP Series 100 Computer, refer to the Basic Installation chapter of the Series 100/WordStar Training and Installation Manual.

Follow the instructions in your WordStar manual and proceed with the WINSTALL program until the INSTALLATION MENU appears. This menu displays the options that can be used to tailor your copy of WordStar. Select the option entitled **Menu of Printers**. The first page of supported printers will appear.

If you are using an HP Vectra, or an IBM PC, XT/AT, select **Epson LQ 800/1000 or Epson MX 80/100** from the list of printers (it may be several pages long).

*HP Series 100 includes the Touchscreen/150 A, B, C.

Proceed with the questions by selecting NO PROTOCOL and then a Parallel or Serial Driver depending on the RuggedWriter 480 interface you will be using. If you are using an HP Series 100 Computer, select **HP 2934A**. You will automatically return to the Installation Menu after selecting the printer.

Exit the INSTALLATION MENU by entering an **X**. The printer settings will then be displayed. Ensure the settings reflect the correct answers and then save the new settings.

Using Printer Features

WordStar provides two good ways to format your printed output. One way is through WINSTALL, and the other is by using the Print Control and the Dot Commands. Using WINSTALL you can change the "default" or initial settings for many WordStar features including print format. The settings you input while in WINSTALL will be used every time you begin using WordStar: these become your new defaults. All formatting and enhancements will be saved right along with the text of the document.

Refer to the Designing the Printed Page or Formatting Your Document chapter in the WordStar Manual for information about using Print Controls and Dot Commands.

What To Expect

After running WINSTALL, we suggest you verify your configuration. An excellent way to do this is to use WordStar to print a file called PRINT.TST which is provided along with your copy of WordStar. With PRINT.TST output to your printer, you can easily determine which printing features are available. For example, if you installed the Epson MX80/100 printer in the WINSTALL program, superscripts and subscripts are printed a full line above or below the current line. To have them work correctly you must double space your text.

If you installed the Epson MX80/100 printer in the WINSTALL program, you may want to consider using the WINSTALL program again to customize the printer installation to better support the RuggedWriter 480's features. First, print the PRINT.TST file and examine the output to see if the features used will satisfy your needs. If not, the features listed below can be added by customizing the WINSTALL program.

Refer to the Custom Printer Installation chapter in the Installation Manual for instructions on customizing your printer installation. To add the listed features, run the WINSTALL program and proceed to the INSTALLATION MENU, then select **Custom Installation of Printers**. The PRINTER INSTALLATION MENU will then be displayed. Each feature listed corresponds to the option you will choose from the menu.

Feature	Command Name	Sequence	Function
Character pitch	Alternate Pitch (^PA)	1Bh 4Dh	Selects 12 pitch
	Standard Pitch (^PN)	1Bh 50h	Selects 10 pitch
User-defined Functions	User Patch Q(1) (^PQ)	1Bh 19h 30h	Ejects Current Page
	User Patch W(2) (^PW)	1Bh 19h 31h	Select page from sheetfeeder
	User Patch E(3) (^PE)	1Bh 19h 32h	Select page from manual paper path
	User Patch R(4) (^PR)	1Bh 19h 34h	Select page from tractor fed path
Ribbon Selection	Alternate ribbon (^PY)	1Bh 78h 31h	Select NLQ print
	Standard ribbon	1Bh 78h 30h	Select Draft print

When entering the sequences each of the numbers must end with an **h**, followed by a **RETURN**. On-screen instructions will be given to aid you in inserting the sequences.

For HP Vectra and IBM users who want superscripts and subscripts to print correctly, another printer can be installed in the WINSTALL program. This will, however, require custom installation BEFORE you can try to print. If you wish to proceed with the custom installation, follow the instructions given below.

Custom Installation

To perform the custom installation, run the WINSTALL program and proceed until the INSTALLATION MENU appears. Select **Menu of Printers**. When the list of printers appears, select **Half line feed printer**. Proceed with the questions by selecting **NO PROTOCOL**, then a Parallel or Serial Driver depending on the interface you will be using on your printer. You will then automatically return to the Installation Menu.

From the Installation Menu, select **Custom Installation of Printers**. The PRINTER INSTALLATION MENU will then be displayed. Refer to the Custom Printer Installation chapter in the WordStar Installation Manual for more detailed instructions on customizing your printer installation.

From the PRINTER INSTALLATION MENU select **Initialization**. This will allow you to change the sequence sent to the printer before and after each document that you print. The sequences that need to be entered are given below. Each number is the hexadecimal equivalent of each character in the sequence. When entering the sequences, each number must be followed by an "h," then press **RETURN**. On-screen instructions will also be given to aid you in inserting the sequences.

Function	Sequence
Initialization Sequence	1Bh 33h 0Fh 0Dh
De-initialization Sequence	14h 12h 1Bh 33h 1Eh

In order to support more of the RuggedWriter 480 printer's features you may want to insert the sequences explained on the previous page.

Using WordStar 2000®

On the HP Vectra, and IBM PC Family and Compatibles

Introduction

The procedures outlined here will help you use your RuggedWriter 480 printer with WordStar 2000. Review the Installing a Printer chapter in the WordStar 2000 Installation Guide before proceeding.

Setting Up WordStar 2000

The program used to customize WordStar 2000 is **WS2INS**. It allows you to tailor a variety of features to your needs, and prepares WordStar 2000 to print with your RuggedWriter 480 printer. The program is found on the Installation Disk, or if you have a hard disk with WordStar 2000 installed, it will be in the directory with the WordStar 2000 program.

To set up WordStar 2000 to work with your printer run the **WS2INS** program and proceed until a list of printers appears. From the list of printers select one of the following printers. Depending on your version of WordStar 2000 not all of the choices listed below will be available. These are listed in order of preference.

Epson LQ-800/1000
Epson LQ-1500

For each of the printers listed above more than one driver is available. For example, the Epson LQ-800/1000 has a driver for draft mode, one for NLQ mode, and another driver for proportional space. Select the driver that will best suit your needs. For information on the differences in the drivers refer to the What To Expect section of this application note.

When you finish the WS2INS program, be sure to save the changes that you made during the program.

Using Printer Features

After installing your printer in the WS2INS program, we suggest that you print the file PRINT.TST (PRINT.SPL in version 1.01) that is provided with WordStar 2000. This file will show the RuggedWriter 480 features that are available through WordStar 2000 using the printer driver you have installed. For information on the print features of WordStar 2000, refer to the Using Print Enhancements and Interrupting Printing chapter of the WordStar 2000 Training Guide, and to the sections on formatting and printing in the WordStar 2000 Reference Guide.

What To Expect

Depending on the printer driver that was installed, the following limitations should be noted:

- If an Epson LQ-1000 or LQ-1500 printer driver was selected, WordStar 2000 does not support a line spacing of 8 lines per inch.
- If your copy of WordStar 2000 is prior to Release 2.00, the fonts available in the HP12235A Font Cartridge cannot be selected through WordStar.
- If you are using a version of WordStar 2000 prior to Release 2.00 and are using one of the Epson LQ-1500 drivers, NLQ print is selected through the Print Color command.
- To correctly print proportionally spaced text the RuggedWriter 480 printer or the Epson LQ-800/1000 proportional space printer driver must be used.

If your version of WordStar 2000 is Release 2.00 or later, the Print Extra command can be reprogrammed to access the fonts in the HP12235A font cartridge. This can be done in the WS2INS program. Refer to the Installation Supplement in the WordStar 2000 Getting Started Manual for instructions on reprogramming Print Extra command features. The values you must use to reprogram the Print Extra command features are listed on the next page. The sequences should be entered exactly as shown.

HP12235A Font Cartridge	
Font	**Sequence**
Helvetica 10	^[x^A^[k^A
Courier	^[x^A^[k^B
Prestige Elite 12	^[x^A^[k^C
Times Roman PS	^[x^A^[k}
Letter Gothic 12	^[x^A^[k~

After the Print Extra command has been reprogrammed, the cartridge fonts can be selected from within the WordStar 2000 program. When using the Print Extra command be sure to first use the Print Font command to select the print pitch that corresponds to the cartridge font selected by the Print Extra command.

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Programming 4

Introduction to Control Codes and Escape Sequences

Note

Spaces have been imbedded in the control codes and escape sequences found in this chapter for ease of reading only. Do not imbed spaces when sending these commands.

This chapter explains how to use the many features of the RuggedWriter 480 printer. It is written for people who have programming experience and want to write their own programs, and users whose software requires them to input escape sequences.

The features of your printer are controlled by control codes and escape sequences. Control codes are data that, when sent to your printer, do not cause anything to be printed, they cause an action (such as line feeds and carriage returns). CTRL is used in this manual to specify a control code.

One control code is ESCAPE. ESCAPE is always followed by one or more characters which together form escape sequences used to control specific printer features, such as print pitch and underlining. The ESCAPE control code is represented in this manual by E_C.

Some print features are controlled by function switches located on the rear panel of the printer, and by escape sequences. In these cases, the switch sets the default condition of the feature, but the escape sequence overrides the switch. When the printer is turned OFF and ON, the Printer Reset escape sequence is sent, or the position of switch B1 is changed, the feature returns to the setting selected by the switch. Note, paper path, and print mode selections made through the keypad, are not affected by the Printer Reset escape sequence.

To generate printouts using these print features you must become familiar with the method used by your computer or software to send escape sequences and control codes to your printer. Several of the methods used are:

- Typing escape sequences and control codes directly from the keyboard.

Control codes always begin with the letters CTRL*. CTRL is generated by pressing the CONTROL key on your terminal's or PC's keyboard. This key may be labeled on your keyboard as CTRL, CNTL, or CTL. An example of a control code is CTRL N. To generate a control code, hold down the CTRL key while typing the next character.

E_C is generated by pressing the ESC* key on your keyboard, or by pressing the CONTROL key and typing "[" (left bracket) simultaneously. An example of an escape sequences is E_C & k 1 S. A list of the escape sequences recognized by your printer is located in the Appendix.

- Specify each control code, including E_C, by its decimal value.

* In BASIC, control codes are represented by CHR(). For example, CTRL N is represented by CHR$(14). The E_C control code is represented by CHR$(27).

Some software packages require that you specify each control code by its decimal value, usually preceded by a special character such as "\". For example, E_C & k 1 S would be specified in Lotus 1-2-3 as \027&k1S.

- Specifying each character of the escape sequence by its decimal value.

Some software packages require that you specify E_C and the characters following it by their decimal value. For example, E_C & k 1 S would be specified as 27 38 107 49 83.

If you are using a software package such as a word processor or spreadsheet, refer to your software documentation to see how control codes and escape sequences must be sent.

Control Modes

As mentioned earlier, your printer has two control modes: HP mode and Epson mode. Switch B1 on the rear panel of the printer sets the mode the printer is used in. The position of Switch B1 (UP or DOWN) depends on the printer driver specified in the software program's print menu. Choosing the appropriate control mode for your computer system is discussed in Chapter 2 of this manual. Once you have determined in which position Switch B1 should be set it should not have to be changed.

HP Mode:

Switch B1 DOWN. HP Mode implements HP PCL Level III, plus some extensions. HP PCL is the abbreviation for Hewlett-Packard Printer Command Language, a standard developed by Hewlett-Packard to ensure compatibility between current and future PCL printers. If your software restricts itself to PCL Level III commands, be assured that it will also work with future HP PCL Level III printers.

All control codes and escape sequences in this manual that are extensions to PCL Level III are designated as such.

Epson Mode:

Switch B1 UP. Epson Mode implements the Epson printer control sequences used in the Epson LQ-1000.

(Switch B1 DOWN)

The control codes and escape sequences described in this section, except where noted, conform to the Hewlett-Packard Printer Command Language.

Control Codes

The control codes recognized by the RuggedWriter 480 printer are described in the table on the next page. The "symbol" column lists the standard abbreviation for each control code. The "Value" column lists the decimal and hexadecimal values which correspond to each control code. The "Keystroke" column lists the letter to be used in combination with your PC's CTRL key to generate the control code.

The "current print position" mentioned in some of the code descriptions is the position at which the printer will print the next character.

RuggedWriter 480 Control Codes					
Code Name	Symbol	Description	Value (dec)	Value (hex)	Key-stroke
Backspace	$^{B}_{S}$	Causes the printer to move the current print position one character position to the left.	08	08	CTRL H
Line Feed	$^{L}_{F}$	Causes the printer to advance the paper one line at the current line spacing.	10	0A	CTRL J
Form Feed	$^{F}_{F}$	Causes the printer to advance the paper to the next top-of-form. Top-of-form is the first line of printing on the next page.	12	0C	CTRL L
Carriage Return	$^{C}_{R}$	Causes the printer to move the current print position to the left margin. Does not cause a paper advance.	13	0D	CTRL M
Shift Out	$^{S}_{O}$	Causes the printer to select the currently-designated secondary character set for use. (Refer to the "Font Selection" discussion later in this section for information on primary and secondary character sets.)	14	0E	CTRL N
Shift In	$^{S}_{I}$	Causes the printer to select the currently-designated primary character set for use. (Refer to the "Font Selection" discussion later in this section for information on primary and secondary character sets.)	15	0F	CTRL O
Device Control 1	$^{D}_{1}$	Used for RS-232-C protocols only. Used as Xon character for the RS-232-C Xon/Xoff handshake. Also used as the trigger for the Status Request. (The Status Request is discussed in this section. See the Data Communications chapter for more information on handshakes.)	17	11	CTRL Q
Device Control 3	$^{D}_{3}$	Used for RS-232-C protocols only. Used as Xoff character for the RS-232-C Xon/Xoff handshake. (See the Data Communications chapter for more information on handshakes.)	19	13	CTRL S
Escape	$^{E}_{C}$	Indicates to the printer that the characters immediately following are part of an escape sequence command.	27	1B	CTRL [
Space		Causes the printer to move the current print position one character position to the right.	32	20	CTRL \
Delete		Causes the printer to print the ASCII DELete character.	127	7F	

Using Printer Features

Note

Spaces have been imbedded in the control codes and escape sequences found in this chapter for ease of reading only. Do not imbed spaces in the control codes and escape sequences that you send. (For example, you will see E_C & k 0 S, but would send E_C&k0S.)

Before You Begin...

Before you begin programming, there are a few things you should be aware of.

- The printer uses a priority system to sort through its print features to select the appropriate font from the fonts available. This means that you may change something that appears high on the printer's priority list, and as a consequence, find that some of the other print features have changed in a way you'd not expected. The printer's priorities, are discussed under Print Feature Priorities, page 4-9.
- With a few exceptions, the print features discussed in this section will remain in effect until they are specifically turned off. For example, if you turn on (enable) super-scripting the printer will continue to print superscripted characters until you send the command to stop (disable) superscripting.
- Finally, many of the escape sequences in the first part of this section are structured in such a way that they apply specifically to the primary character set (designated by the left parenthesis in an escape sequence, such as E_C (s # H). The primary character set is the set of characters normally in use by the printer. The secondary character set (designated by a right parenthesis in an escape sequence) can use all the print features discussed for the primary character set. Refer to the discussion entitled, "Font Selection" for details.

Font Selection

First, some definitions:

Character Sets are collections of the symbols and characters that constitute all the elements of a language, including punctuation and numbers.

There are two kinds of character sets, 128-character sets and 256-character sets. Character sets containing 128 characters are often referred to as "7-bit" character sets because only seven bits of the character byte are used to designate the character. Character sets containing 256 characters are referred to as "8-bit" character sets because the 8th bit of the character byte must be used in order to access all 256 character codes.

The definitions of the first 128 characters in the 8-bit character sets have been standardized by the American Standard Code for Information Interchange (ASCII). The first 33 codes (decimal 0 through 32) are defined as control codes. The next 95 codes (decimal 33 through 128) are the letters, numbers, symbols, and punctuation marks used to print the English language.

The remaining 128 characters of the 8-bit characer sets contain the special characters and punctuation marks that are used to print languages other than English.

The RuggedWriter 480 printer supports four 8-bit character sets: Roman-8, PC-8, PC-8 Danish/Norwegian, and ECMA-94 Latin 1.

Seven-bit character sets conform to standard definitions set forth by the International Standards Organization (ISO). The first 33 codes (decimal 0 through 32) in each of these sets contain the control codes. The control code definitions in these ISO sets are identical to those in the 8-bit sets. The remainder of each 7-bit character set (decimal codes 33 through 128) contains the letters, numbers, punctuation marks, and special symbols required for a specific language.

The RuggedWriter 480 printer supports ten 7-bit character sets: ISO UK, ISO Germany, ISO France, ISO Italy, ISO Norway, ISO Sweden, ISO Spain, JIS ASCII, ISO Portugal, and ISO Sweden: Names.

The primary character set is the character set normally in use. The secondary character set may be turned on by sending the printer a Shift Out (SO) control code. Characters generated following the Shift Out will be from the secondary set. Sending a Shift In (SI) control code will return you to the primary character set.

For every escape sequence that begins with E_C ((designating a primary character set), there is a corresponding escape sequence that begins with E_C) (designating secondary character set) offering a full set of complementary functions that apply to the secondary character set.

Character set charts are located on pages 7-5 to 7-8 in the Appendix.

Typefaces are the shapes that characters come in. The typefaces supported by the standard RuggedWriter 480 printer are Line Printer and Courier.

Type Styles are the angles of italicization that characters can have. The standard printer supports two type styles: Standard print and Italicized print.

Fonts are collections of characters that are all the same character set, typeface, quality, character width, height, stroke weight, and vertical placement. The following table illustrates all the elements that make up a font.

RuggedWriter 480 Font Attributes

(PCL Mode only)

	Typeface	Quality	Character Width cpi	Character Height points	Style	Stroke Weight	Vertical Placement
Standard RuggedWriter 480 Fonts	Courier	LQ	5, 10, 12, PS	12	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript
	Line Printer	Draft	5, 10, 12, 16.7, 20, PS	12	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript
	Line Printer "Micro"	LQ	5, 10, 12, 16.7, 20, PS	8	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript
Optional Character Cartridge HP Part #12235A	Prestige Elite	LQ	5, 10, 12, PS	12	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript
	Times Roman	LQ	5, 10, 12, PS	12	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript
	Helvetica	LQ	5, 10, 12, PS	12	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript
	Letter Gothic	LQ	5, 10, 12, PS	12	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript
	HP Line Draw	LQ	5, 10, 12, PS	9	Normal Italics	Normal Bold Emphasized	Normal Super & Subscript

Print Feature Priorities

Your printer follows a specific decision-making procedure to sort through the various print feature settings, and uses a priority system to make selection decisions. If you will be using escape sequences to control print features, being aware of the printer's feature priorities will enable you to consistently predict your print results.

The printer prioritizes features in the following order:

1. Character Set
2. Sub- and Superscripts*
3. Proportional Spacing* or Print Pitch
4. Character Height

* = Supported on all fonts

5. Type Style (Italics)*
6. Stroke Weight (Normal, Bold, Emphasized)*
7. Typeface (Letter Gothic or Courier)
8. Print Density (Draft or Letter Quality)
9. Select RAM** font over ROM font

The printer uses this prioritization scheme to select the appropriate font from the fonts available (for example, Courier 12, letter quality is an available font). When the definition of one of the items in this list is changed, the printer "sorts" through its available fonts performing a process of elimination that begins with the first item on the priority list and continues until it narrows its choices down to just one font. If the printer makes it all the way to the last item on the list, all other settings being equal, and still has more than one font to select from, it will select the font resident in RAM over a font available in ROM.

The following examples illustrate how this font selection scheme can give you unexpected results. Example 1: If you are printing in Letter Quality print, and have selected compressed printing (16.7 cpi), you will get draft quality compressed print, rather than the letter quality print you might have expected. This is because the printer does not print the smaller characters in letter quality density, and draft quality compressed print provides the closest available match to what you requested. Example 2: If you have typeface set to 3 (Courier) and you select a quality of 0 (draft) you will not get draft because typeface is a higher priority.

* = Supported on all fonts.
** = RAM font is available on the optional character cartridge only.

Designating Character Sets

The default primary character set is selected through switch settings. The default secondary character set is usually the same as the default primary character set. To change the defaults, or to specifically designate the character set you want as the active primary set and which you want as the active secondary set, send the following escape sequences:

E_C (# ID—Designate Primary Character Set

E_C) # ID—Designate Secondary Character Set

In this example, the "#" and "ID" designate the language.

The following table contains the character sets offered by your printer and the escape sequences that select them.

Character Set	Escape Sequence *
Roman-8	E_C (8 U
PC-8	E_C (10 U
PC-8 Danish/Norwegian	E_C (11 U
ECMA 94-Latin 1	E_C (0 N
ISO UK (04)	E_C (1 E
ISO Germany (21)	E_C (1 G
ISO France (69)	E_C (1 F
ISO Italy (15)	E_C (0 I
ISO Norway (60)	E_C (0 D
ISO Sweden: Names (11)	E_C (0 S
ISO Spain (17)	E_C (2 S
JIS ASCII (14)	E_C (0 K
ISO Portugal (16)	E_C (4 S
ISO Sweden (10)	E_C (3 S
Default Font	E_C (3 @
Download character set	E_C (0 X
Line Draw	E_C (0 L

* Designates primary character set.

Charts showing the characters available in these sets are located in the Appendix.

Sub- and Superscripts (Not a PCL Level III Feature)

Sub- and superscripts are text printed higher (superscript) or lower (subscript) than normal printing. To print sub- or superscripts, first send the escape sequence to enable sub/superscripting, then send the text to be sub/superscripted, then instruct the printer to return to normal printing.

E_C (s -1 U – Begin subscripts

E_C (s 0 U – Resume normal printing

E_C (s 1 U – Begin superscripts

Example: Sending the printer this:

Chocolate is full of CE_C(s-1U6E_C(s0UHE_C(s-1U12E_C(s0UOE_C(s-1U6E_C(s0U .

Results in this: Chocolate is full of $C_6H_{12}O_6$

These examples are printed in the standard height (12-point font). To print sub/superscripts in the Micro height (8-point font), you must select the Micro font first by changing the height to 8 by sending E_C (s 8 V. After sending the sub/superscript characters return to normal height printing. (The standard and micro character heights are discussed on page 4-14, this chapter.)

Sending the printer this:

Hot chocolate is full of HE_C(s-1UE_C(s8V2E_C(s0UE_C(s12VO .

Results in this: Hot chocolate is full of H_2O.

Proportional Spacing

(All fonts support Proportional Spacing)

Proportional Spacing is a feature that makes your printed text resemble set type. In print pitches where the printer prints a certain number of characters per inch, each character is allotted the same space, whether the character is a narrow letter like "i" or a wide letter like "w". In Proportional Spacing, the characters are allotted a space proportional to their width requirements. The following example shows the difference between proportional-space and fixed-pitch printing:

```
This line is proportionally spaced.
This line is printed at 12 cpi.
```

E_C (s 1 P–Select Proportional Spacing

E_C (s 0 P–Return to Fixed Pitch Printing

See the Proportional Spaces tables located in the Appendix.

Print Pitches (Characters Per Horizontal Inch)

Your printer supports print pitches from 5 characters per inch (cpi) to 20 cpi in draft mode, and 5 cpi to 12 cpi in letter quality mode. Any positive number can be specified as the print pitch. If you select a print pitch that the printer does not support it will substitute the next larger pitch, i.e., next larger number of characters per inch, resulting in narrower or smaller individual characters.

```
This is 10 cpi Draft mode.
This is 20 cpi in Draft mode.
This is 5 cpi Lette
Quality mode.
This is 12 cpi Letter Quality mode.
```

E_C (s # H–Select print pitch.

= The pitch you wish to print in. For example, to print in 12 pitch you would send E_C (s 12 H

Character Height

Character height refers to the height of a printed uppercase character. The character height is defined in points, one point is 1/72nd of an inch.

Your printer supports two character heights without the optional font cartridge installed: Standard height, which yields 12-point characters, and micro height, which yields 8-point characters. Any positive number can be specified as the character height. If you ask for a height that the printer does not support, it will substitute the next closest height.

E_C (s # V – Define character height

= The height you wish your printed characters to be. For example, for 12 point characters, you would send E_C (s 12 V Remember, the character height is defined in units of 1/72nd of an inch.

Examples: To select a height of 12 points, send: E_C(s12V
The resulting print:

```
This line is 12 points high.
```

To select a height of 8 points, send: E_C(s8V
The resulting print:

```
This line is 8 points high.
```

Type Style

(All fonts support Italics)

Italics

Italics printing provides another way to make certain words or portions of text stand out from the surrounding text.

Print Sample:

You can print a full sentence in this style.
Or you can italicize a *single* word or phrase.

E_C (s 1 S – Enable Italic Print Style

E_C (s 0 S – Disable Italic Print Style

Stroke Weight

(All fonts support Bold and Emphasized Printing)

Bold Printing

Bold printing darkens text. Bold text is printed twice, in two passes of the print head. The result is text that appears darker than normal printing, but is the same size and density.

E_C (s 3 B – Enable Bold Print

E_C (s 0 B – Disable Bold Print

Emphasized Print

Emphasized print adds strong emphasis to printed text. The printer prints emphasized text in two passes of the print head, just as it does when printing Bold, but it slightly offsets the print between the first printing pass and the second. The result is text that is a bit thicker than normal or bold text. The print sample on the following page compares normal print, bold print, and emphasized print.

```
This is regular 10-pitch Draft print.
This is 10-pitch Draft print in Bold.
This is 10-pitch Draft in Emphasized.
This is Letter Quality print.
This is Letter Quality print in Bold.
This is Letter Quality in Emphasized.
```

E_C (s 7 B – Enable Emphasized Print

E_C (s 0 B – Disable Bold or Emphasized Print

Note

The bold escape sequence disables emphasized print, and the emphasized escape sequence disables bold print.

Note that because the bold and emphasized print features require the printer to print all enhanced text twice, text containing bold or emphasized print will print more slowly than normal text.

Typeface

Two typefaces are available in the standard RuggedWriter 480 printer: Courier and Line Printer. Note that line printer is available only in draft quality, and Courier is available only in LQ. (Other typefaces are available in optional font cartridges.)

E_C (s 0 T – Select line printer typeface
E_C (s 3 T – Select Courier typeface

More fonts are available in optional font cartridges. Examples of the typefaces available in font cartridges, and ordering information, is located in the Appendix.

Print Density

Your printer offers two print densities, draft quality at 400 characters per second, and letter quality at 200 characters per second. Draft quality is the power-up default, and is selected through function switch A8. Draft quality offers you the advantage of fast output; letter quality offers you clean, professional-looking print. The print sample below demonstrates the difference between the two print densities.

```
This is Letter Quality Courier Typeface, printing at 200 cps.
This is 10-pitch Draft Quality, printing at 400 cps.
This is 12-pitch Draft Quality, printing at 480 cps.
```

E_C (s 0 Q – Select draft quality printing

E_C (s 2 Q – Select letter quality printing

Print Enhancements

Underlining draws a continuous underline below a portion of text. The print sample below shows how underlining looks.

Underlining can be used for a single word.
Entire lines can be underlined, too.

E_C & d D – Enable Underline

E_C & d @ – Disable Underline

Note that when the printer is in its default mode, once underlining has been enabled it will stay on until it is disabled. However, underlining can automatically be disabled at the end of a line. This feature is discussed under Print Enhancement Control, page 4-38 this section.

Combining Escape Sequences

You can save time by combining escape sequences that have the same two characters following the Escape character. To combine escape sequences, begin the sequence with E_C and the two shared characters, then append the remaining characters from each command.

These escape sequences

E_C (s 1 Q E_C (s 3 B E_C (s 3 T

can be combined into

E_C (s 1 q 3 b 3 T

Notice that "E_C (s" is the portion of the escape sequence that all three sequences share. Also note that in the combined sequence, "q" and "b" are now lowercase, while "T", because it is the last character in the sequence (the terminator), remains in uppercase.

Remember, only escape sequences which share the same two characters immediately following "E_C" can be combined.

Positioning Print on a Page

The features in this group are arranged in the order in which they must be defined for your printer. Each definition in this group of features depends on the definition of the features that came before it. Thus, line spacing must be defined before you specify page length; and the top margin must be set before the text length is specified.

Line Spacing

Line spacing is the vertical distance between printed lines on the page, measured in number of printed vertical lines per inch (lpi).

E_C & ℓ # D—Define Line Spacing

#=The number of lines per inch. The default line spacing is 6 lpi. To set line spacing to 8 lpi, send E_C & ℓ 8 D.

Note

The "ℓ" in these escape sequences is a lowercase ell (L) and not the number 1.

If you specify a number of lines per inch that the printer cannot print, the escape sequence will be ignored.

Page Length

Page Length is the actual length of the paper being used in the printer. Page Length is expressed in lines of print, defined according to the current line spacing. Therefore, if you will be changing the line spacing from 6 lines per inch, you should do so before defining the Page Length. The default page length is set through function switches A6 and A7. The following table illustrates the page length/ paper path selected through these two switches.

Function Switch		Power On		Paper Path Selection via Keypad	
A6	A7	Default Paper Path	Default Page Length	Tractor Page Length	Single Sheet Page Length
Dn	Dn	Tractor	11″	11″	11″
Dn	Up	Single	11″	11″	11″
Up	Dn	Tractor	12″	12″	A4
Up	Up	Tractor	11″	11″	A4

E_C & ℓ # P–Define Page Length

#=The page length in number of lines. For example, if you are using 11 inch paper and are printing at 6 lpi, your page will consist of 66 lines. The escape sequence you would send is E_C & ℓ 66 P.

When using single sheets make sure that the page length you specify correctly reflects the length of paper you are using.

Note that at power-on, the default page length selected by switches A6 and A7 is dependant on the default paper path. If the paper path is changed by escape sequence the page length will remain unchanged. However, if the paper path is changed through the keypad, the page length will be reset to the A6, A7 specification. In general, any change of the paper path by escape sequence should be accompanied by a page length escape sequence for that new paper path.

Note

E_C E: E_C E (Printer Reset) does not alter paper path. Therefore, selecting a new path via the keypad may change the page length, but sending an E_C E will not restore the old page length. Path selection via datacomm does not alter the current page length.

Perforation Skip Mode

Perforation skip mode controls the top and bottom margin. If perforation skip mode is OFF, no bottom margin is established. If perforation skip mode is ON, the next printable position skips to the top margin on the next page when the bottom margin is entered. Whenever perforation skip mode is changed, it defaults the top margin and text length.

E_C & ℓ 1 L – Enable Perf Skip Mode

E_C & ℓ 0 L – Disable Perf Skip Mode

The perforation region is defined as the area outside the text area but within the page. If perforation skip mode is ON (default) and a line feed or half line feed causes the current print position to enter the perforation region, the current page will be ejected from the printer. The default perforation skip mode is set through function switch B3.

Margins

Left and right margins are counted beginning with column 0.

E_C & a # L—Set left margin

E_C & a # M—Set right margin

= The number of the print column where you want printing to begin. Columns are specified in terms of the current print pitch (characters per inch). So, if you are printing in 12 cpi and want a one-inch left margin, printing will begin at column 12: E_C & a 12 L

Note that when the printer is using single sheet paper, the leftmost printable position (column 0) is 1/4" in from (to the right of) the left edge of the paper.

E_C 9—Clear left and right margins

When the printer receives this escape sequence, it clears both margin settings. The escape sequence has no effect on the top margin setting or the text length definition.

The default left and right margins are 0 and 135 respectively (positioned at columns equivalent to 10 characters per inch).

Top Margin: (Not a PCL Level III Feature) Top margin is the area between the top of the paper and the beginning of the printed text. The first printable line below the top margin is defined as top-of-form. The default top margin is 0 when perforation skip is OFF. Perforation skip ON will default the top margin to 1/2". If you want to change that definition, you must do so before you set the text length because redefining the top margin resets the text length to its default definition.

E_C & ℓ # E – Set top margin

= The number of lines in the top margin. The number of lines is interpreted according to the current line spacing definition. You can specify any number of lines for the top margin, from zero lines to one less than the number of lines in the Page Length.

For example, if you are printing at 6 lines per inch, and want a one-inch top margin, send E_C & ℓ 6 E

Bottom Margin is set via the Text Length definition, discussed below.

Text Length

The Text Length is defined as the page length minus the top and bottom margins. Because it is only possible to specify page length, top margin, and text length, setting the text length specifies the size of the bottom margin. If you will be changing the default definitions of the page length and top margin, you must do so before you can define the Text Length. Text Length is meaningful only when perforation skip mode is enabled.

E_C & ℓ # F – Define Text Length

= The page length in number of lines at currently defined line spacing.

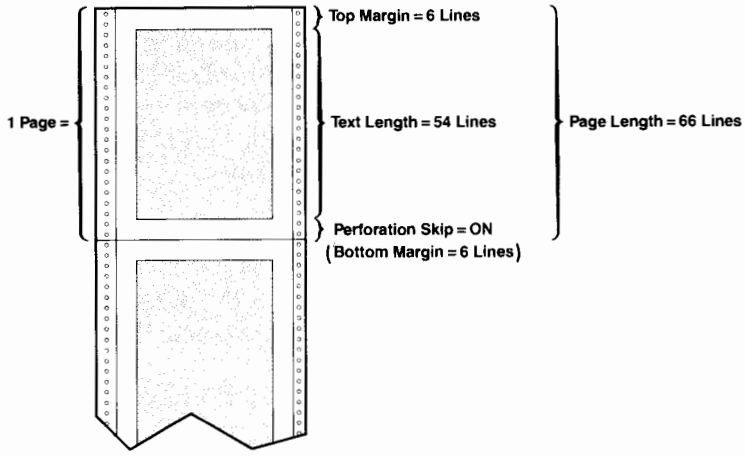
Suppose that you want to set a 1 inch bottom margin and have the following settings:

Line spacing: 6 lpi.
Page length: 66 lines (11 inches).
Top margin: 6 lines (1 inch).
Perforation skip: On.

In order to set a 1 inch (6 line) bottom margin, set the text length to:

Text length = 66 lines – 6 lines – 6 lines = 54 lines.

The following figure illustrates the above example.



Any number from 1 through 127 can be specified, but any number of lines that exceeds the available area (page length minus top margin) will be ignored. (A text length of 0 will default to the default page length set by the the mode function switches.)

Paper Control and Print Position

The RuggedWriter 480 printer can feed paper along several paper paths.

Paper Feed Control (Not a PCL Level III Feature)

When the printer receives the command to eject the current sheet, it will eject the sheet (or advance Z-fold paper to the top of the next form). If no paper is currently in the mechanism the command to eject a sheet will be ignored. Once a new paper path is selected the printer will continue to use that path until it is changed.

The default paper path is set through function switches A6 and A7.

If the printer receives a Form Feed control code when a cut sheet is in position to print, the printer will eject the current sheet, but will not feed the sheet into the printing position until the printer receives data to print. This keeps the paper from being curled by a long wait in the paper advancing mechanism.

Changing the paper path via escape sequence will not modify the page length. If you have paper of different lengths in the different paths, you should first select the appropriate path, then set the length.

E_C & ℓ 0 H – Eject Current Page

E_C & ℓ 1 H – Feed from Paper Cassette

E_C & ℓ 2 H – Handfed Sheets

E_C & ℓ -1 H – Feed Z-fold Paper

A Printer Reset escape sequence (described later in this section) will not change the paper path selection. After receiving a Reset escape sequence, the paper will continue to feed from the most-recently selected path.

A note about selecting paper path by escape sequences: If you are switching from Z-fold paper to another path, you must tear off the last page of Z-fold paper and put the printer ON LINE before the printer will resume printing. The printer will not resume printing until this is done. (Note that you need only tear off the paper from the top; you do not need to remove the paper supply from the tractors.)

Motion Index Definitions

Motion Index definitions determine the increments of movement by which character spacing and line spacing are defined. The Vertical Motion Index defines line spacing, and the Horizontal Motion Index defines character spacing.

The VMI is expressed in increments of 1/48". The default VMI (the VMI defined at power on) is 8, which yields Line Feeds of 8/48", or 6 lines per inch. To change the VMI, you must know how to express the size of the Line Feeds you want as n/48", and use that value for "#" in the escape sequence. You may use any positive number in the range from 0 to 126, inclusive.

E_C & ℓ # C—Set Vertical Motion Index

= The number representing the value of the VMI you want.

The Horizontal Motion Index (HMI) defines how far the current print position moves for each character. The HMI is expressed in increments of 1/120". To change the HMI, you must figure out how to express the width of the character spacing you want as n/120", and use that value for "#" in the escape sequence. You may use any positive number in the range from 0 to 126, inclusive.

E_C & k # H—Define Horizontal Motion Index

= the number representing the value of the HMI you want.

Print Position

The features discussed in the following paragraphs control print position. Escape sequences in this group move the print position either vertically or horizontally, by row or column, by decipoint, and by dot.

Vertical Positioning

The Vertical positioning commands move the paper up or down, as needed, to position the print as you have specified. Vertical position can be specified by row number, by decipoint, or by dot position.

Positioning By Row. When positioning the print on the page by moving the paper up (therefore moving the print position down), you are limited to one physical page of movement. When moving the paper down (moving the print position up), you are limited to 1/3 inch of movement.

In addition, when moving the position to a specified row, you can specify any row in the range from 0 to the end of the page.

The "default" print position is determined as follows: When a new page is loaded or a new paper path is selected, the print position is initially set to the left margin (horizontal) and the top margin (vertical). See the description of those features for a list of defaults.

E_C & a # R—Move Print Position to Specified Row

E_C & a+# R—Move Down # Rows from Current Position

E_C & a −# R—Move Up # Rows from Current Position

= The number of the row to which the print head is to be moved. Rows are counted from the first line below the top margin which is row 0, to the bottom of the physical sheet of paper. Rows are counted according to the current line spacing definition.

For example: To position the print head two and a half inches down from the top margin when printing at 6 lines per inch, position the print head at line 15 by sending E_C & a 15 R (6×2.5=15.)

Positioning by Decipoint. Positioning by decipoint puts the baseline of the next character in line with the decipoint position you specified. A Decipoint is 1/720". Decipoints are counted vertically from 0 (the Top Margin) downward. Any positive number from 0 (the top margin) to the decipoint that corresponds to the Bottom Margin (bottom margin is defined with the text length escape sequence) can be specified.

E_C & a # V—Move Print Position to Decipoint

E_C & a+# V—Move Down # Decipoints from Current Position

E_C & a −# V—Move Up # Decipoints from Current Position

#=The number of the decipoint at which you want the print head positioned.

To position the print head two and a half inches down from the top margin, convert that distance into decipoints. You will get 1800 decipoints: E_C & a 1800 V

Positioning by Dot. (Not a PCL Level III Feature)
A dot-position is equal to 1/180", regardless of the graphics resolution you have defined for the printer. (See the Graphics discussion for more information on graphics resolution.) Any dot position between the top and bottom margins can be specified. Dot positions are numbered beginning with 0, which is the dot position at the lower edge of the top margin.

For example: To position the print head at the dot position two and a half inches down from the top margin, convert inches into dot-positions. You will find that two and a half inches is equivalent to 450 dots: E_C * p 450 Y

E_C * p # Y—Move Print Position to Specified Dot

E_C * p +# Y—Move Down # Dots from Current Print Position

E_C * p −# Y—Move Up # Dots from Current Print Position

#=The number of the dot at which you want the print head positioned. The print head is positioned with its baseline dot at the dot-position you have specified (unless you are printing graphics, in which case the print head is in position to print the next raster row).

Half Line Feed. The following escape sequence will instruct the printer to perform a Half Line Feed.

E_C = – Perform Half Line Feed

Horizontal Positioning

Horizontal positioning commands move the print position to the right or left, as needed, to position it as you have specified. You can specify horizontal position by column number, by decipoint, or by dot position.

Positioning By Column. Horizontal positioning is accomplished relative to the leftmost printable position. Columns are numbered left to right, starting with column 0 at the leftmost printable position. Columns are counted in terms of the currently-active print pitch. On Z-fold paper, column 0 is adjustable by moving the tractor feeds. On single sheets column 0 is located 1/4" to the right of the left edge of the paper. Horizontal positioning is not limited by margin definitions.

E_C & a # C – Move Print Position to Specified Column

E_C & a + # C – Move # Columns to the Right of Current Print Position

E_C & a – # C – Move # Columns to the Left of Current Print Position

= The number of the column to which you want the print position to move. For example, if the current-active print pitch is 10 cpi, and you wish your first column to begin 5 inches from the left margin, you would send E_C & a 50 C

Positioning By Decipoint. A Decipoint is 1/720". Decipoints are counted horizontally from the leftmost printable position toward the right. You can specify any number from 0 (the leftmost print position) to the decipoint that corresponds to the right edge of the paper.

E_C & a # H—Move Print Position to Decipoint

E_C & a +# H—Move # Decipoints to the Right of Current Print Position

E_C & a −# H—Move # Decipoints to the Left of Current Print Position

#=The number of the decipoint at which you want the print head positioned.

For example: To change the print position to five inches in from the left edge of the paper, convert the distance into decipoints. You will find that five inches is equivalent to 3600 decipoints. The escape sequence you will send is E_C & a 3600 H

Positioning By Dot. (Not a PCL Level III Feature)
A dot-position is equal to 1/180", regardless of the graphics resolution you have defined for the printer. (See the Graphics discussion for more information on graphics resolution.) The dot positions are numbered beginning with 0, which is the dot position at the left edge of the sheet of paper (or 1/4" from the left edge of the paper, if you are using cut sheets).

E_C * p # X—Move Print Position to Specified Dot

E_C * p +# X—Move print # Dots to the Right of Current Print Position

E_C * p −# X—Move Print # Dots to the Left of Current Print Position

#=The dot at which you want the print head positioned.

For example: To position the print head at a dot position five inches to the right of the left edge of the paper, convert inches into dot-positions. You will find that five inches is equivalent to 900 dots. The escape sequence you will send is E_C * p 900 X

Printing Graphics

Your printer uses a form of graphics called "dot-image" graphics in which pictures are made up of patterns of tiny dots called Pixels (for Picture Elements). In this system, the paper can be thought of as consisting of a grid of dot positions. Graphics data specifies which of the dot positions should be printed and which should be left blank.

Graphics data is sent to the printer one byte (8 bits) at a time. Each bit specifies whether a dot position is blank or printed. If a bit is zero, the corresponding dot position is left blank. If a bit is one, a dot is printed at the corresponding position. In HP printers, graphics data bytes are sent to the printer in groups, each group containing the graphics data for one raster (horizontal) dot row. The first (most significant) bit of a graphics data byte specifies the leftmost dot; the last (least significant) bit specifies the rightmost dot.

Raster Graphics Dump

The transfer of data known as a Raster Graphics Dump takes place in three major parts: the beginning, the middle, and the end. The beginning is a command to tell the printer to prepare to receive graphics data. The middle is the actual data transfer. The end is a command telling the printer that the transfer is complete.

To begin the raster graphics dump, send the printer one of the escape sequences shown below. Note that the Prepare for Raster Data at Current Print Position escape sequences is not a PCL Level III feature.

E_C * r 0 A—Prepare for Raster Data at Leftmost Print Column

E_C * r 1 A—Prepare for Raster Data at Current Print Position

In addition to telling the printer it will be receiving graphics data, the "Prepare for Raster Data" escape sequence defines the left graphics margin. Note that the graphics margin is independent of any text margins you may have already defined.

The next step is the binary data transfer. The escape sequence shown below transfers one row of graphics data to the printer. You must issue this escape sequence for each raster row in the image.

E_C * b # W ⟨Data⟩ – Transfer One Raster Row

= The number of bytes that you are sending in this block. This number tells the printer how much data to expect, and corresponds directly to the Data being transferred. The number should be in the range from 0 to 306 (2448 ÷ 8) in 180 ppi, or 0 to 153 (1224 ÷ 8) in 90 ppi. This range allows for printing an image up to 13.6 inches wide. If you specify a value greater than 306 (or 153), the printer will truncate the image.

The "⟨Data⟩" in the sequence is the actual raster data being transferred. This data is sent in the form of 8-bit binary characters, which represent the On/Off state of individual dots. (Note that the brackets "⟨ ⟩" are included here for clarity only. Do not include them with your data.)

Paper advance occurs automatically between graphics dot rows; it is not necessary to send any paper advance control codes.

The following escape sequence informs the printer that all raster graphics data has been transferred to the printer.

E_C * r B – End Raster Graphics

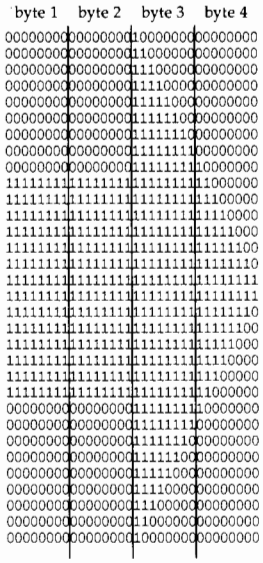
Sample Graphics Program

The program on the next page prints raster graphics in the shape of an arrow. The illustration of 1's and 0's shows how each dot is placed to form the arrow. A 1 causes the printer to print a dot, and a 0 causes a space.

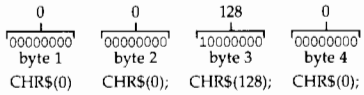
In BASIC, data must be sent to the printer in decimal numbers (in the form CHR$(decimal number). Therefore, each group of eight 1's or 0's (each byte) must be converted to a decimal number. The following illustration shows binary (1's and 0's) representation of an arrow and illustrates how the first line of binary data is converted to decimal so that BASIC can interpret the data. NOTE that this example was tested using MicroSoft BASIC, version A2.0 on the IBM PC. Other versions or releases may not support some of the BASIC commands (such as WIDTH "LPT1:,255).

Binary Representation

BINARY REPRESENTATION



(LINE 1) DECIMAL CONVERSION



To print this arrow: 

```
10 REM *** BASIC program to print an arrow in PCL graphics ***
20 REM
30 REM
40 WIDTH "lpt1:",255       :REM   Disable auto CR-LF
50 OPEN"lpt1:" AS #1       :REM   Open printer as a file
60 REM
70 PRINT #1,CHR$(27);"*t90R";      :REM  Set resolution to 90 ppi
80 REM
90 PRINT #1,CHR$(27);"*rA";        :REM  Start raster graphics
100 REM
110 REM Begin loop to read data and print graphics
120 FOR J = 1 TO 32
130 READ A,B,C,D           :REM each raster row has four bytes
140    PRINT #1,CHR$(27);"*b4W";CHR$(A);CHR$(B);CHR$(C);CHR$(D);
150 NEXT J
160 REM
170 REM
180 PRINT #1,CHR$(27);"*rB";       :REM end raster graphics
190 REM
200 CLOSE
210 REM
220 REM  This is the data for the arrow
230 DATA 0,0,128,0
240 DATA 0,0,192,0
250 DATA 0,0,224,0
260 DATA 0,0,240,0
270 DATA 0,0,248,0
280 DATA 0,0,252,0
290 DATA 0,0,254,0
300 DATA 0,0,255,0
310 DATA 0,0,255,128
320 DATA 255,255,255,192
330 DATA 255,255,255,224
340 DATA 255,255,255,240
350 DATA 255,255,255,248
360 DATA 255,255,255,252
370 DATA 255,255,255,254
380 DATA 255,255,255,255
390 DATA 255,255,255,255
400 DATA 255,255,255,254
410 DATA 255,255,255,252
420 DATA 255,255,255,248
430 DATA 255,255,255,240
440 DATA 255,255,255,224
450 DATA 255,255,255,192
460 DATA 0,0,255,128
470 DATA 0,0,255,0
480 DATA 0,0,254,0
490 DATA 0,0,252,0
500 DATA 0,0,248,0
510 DATA 0,0,240,0
520 DATA 0,0,224,0
530 DATA 0,0,192,0
540 DATA 0,0,128,0
```

To print this arrow: ➡

To print this arrow, replace line 70 in the above program with this line of code:

```
70 PRINT #1,CHR$(27);"*t180R";     :REM  Set resolution to 180 ppi
```

Temporary Graphics Offsets (Not a PCL Level III Feature)

Graphics offsets are used to reduce the number of bytes needed to specify white space in a graphics image. You may instruct the printer to offset its graphics printing for one raster row with the temporary graphics offsets. These offsets move the next raster row horizontally or vertically the number of dot-positions you specify. Horizontal (X) offsets are defined in terms of pixels, and vertical (Y) offsets are defined in terms of raster rows.

The offsets are referred to as "temporary" because they are in effect for the printing of only one raster row. Thus, you must send the Temporary Offset escape sequence before the transfer of each raster row that you want offset.

The Horizontal Offset moves the graphic image to the right of the left graphic margin (which is determined by the "Prepare for Raster Data" escape sequence). To define the horizontal offset send the following escape sequence:

E_C * b # X—Temporary Graphics X-offset

= The number of pixels you want to offset the next row. This number must be divisible by eight, because the printer's firmware converts pixels to bytes. Any number from 0 to 32,760 can be specified as long as it is divisible by eight. The offset will be defined in terms of the currently-active graphics resolution. (This means that the size of the offset is related to the size of the dot spacing; see the Graphics Resolution discussion for more detail.)

The Vertical Offset moves the graphics image vertically from the current print head position. To specify the vertical offset send the following escape sequence:

E_C * b # Y—Temporary Graphics Y-offset

= The number of raster rows you want the offset to contain. You can specify any number from 0 to 32,767. The offset will be defined in terms of the currently-active graphics resolution. (This means that the size of the offset is related to the size of the dot spacing; see the Graphics Resolution discussion for more detail.)

Raster Width (Not a PCL Level III Feature)

Specifies the width in pixels of the raster graphics sent by the next graphics dump. The raster width escape sequence is used for speeding up graphics throughput by limiting the width.

E_C* r # S—Specify Raster Width

= The number of pixels rounded up to the nearest eighth pixel.

Raster width is reset to the maximum line length whenever an End Raster Graphics command is sent.

Graphics Resolution (Not a PCL Level III Feature)

The graphics resolution determines how fine a grain the printed graphics image will have. The resolution is defined in pixels per inch (ppi). The more pixels per inch, the higher the resolution of the printed image. This definition must be made before you send the printer the "Prepare for Data" command which starts the raster dump. If you define the graphics resolution after you've sent the "Prepare for Data" command, the graphics resolution command will be ignored. The command is only executed after graphics mode is exited, "ended".

E_C * t 90 R—Set Graphics Resolution to 90 pixels per inch (Default)

E_C * t 180 R—Set Graphics Resolution to 180 pixels per inch

If you specify a graphics resolution in the range from 0 to 90 ppi, the printer will print at the 90 ppi resolution. If you request a graphics resolution of 91 ppi or more, the printer will print at the 180 ppi resolution.

Graphics resolution cannot be changed until the End Raster Graphics escape sequence is sent.

Miscellaneous Printer Controls

The control sequences included in this group are: End-of-Line Wraparound, Line Terminator Selection, Print Enhancement Control, Shift-In/Shift-Out Control, Transparent Print Mode, Display Functions Mode, Select View Mode, Reset, Self-test, and Printer Status.

End-of-Line Wraparound (Not a PCL Level III Feature)

If the printer is sent a line of text longer than its physical line length, the way the printer responds is dependent on whether or not the line wraparound feature is enabled. If line wraparound is disabled, the printer will truncate the text when it reaches the end of the print line. If line wraparound is enabled, any text that extends beyond the defined margins or the physical line length will wrap around to the next line. The text "wrapping" takes place within the current margin settings.

E_C & s 0 C—Enable End-of-Line Wraparound

E_C & s 1 C—Disable End-of-Line Wraparound

The default setting is End-of-Line Wraparound disabled.

Line Terminator Selection (Not a PCL Level III feature.)

Each line of text has a precise ending which the printer understands to be the end of line. Many software packages (or operating systems) embed a carriage return at the end of each line of text, while others terminate lines with a line feed. Still others terminate lines with both characters. When text is sent to the printer it needs to be told what to do with the line feeds or carriage returns that it receives.

E_C & k # G—Select Line Terminator

= The definition of the line terminator. Replace the "#" with one of the values defined on the next page.

0 – CR causes CR; LF causes LF; FF causes FF.

1 – CR causes CR LF. LF causes LF; FF causes FF.

2 – CR causes CR. LF causes CR LF; FF causes CR FF.

3 – CR causes CR LF; LF causes CR LF; FF causes CR FF.

The default line terminator definition is CR=CR; LF=LF; FF=FF.

Print Enhancement Control (Underlining Only) (Not a PCL Level III feature.)

The Print Enhancement Control determines whether underlining is to work on a mode basis, or a line-by-line basis. Mode basis means that once enabled it will remain in effect until it is specifically turned off. Line-by-line basis means that it automatically turns off when the end of a print line is reached.

E_C & k 0 E – Line-by-Line Enhancement Control

E_C & k 1 E – Mode Enhancement Control (default)

Shift-In/Shift-Out Control (Not a PCL Level III feature.)

The Shift-In/Shift-Out Control determines whether the shift-in and shift-out control codes (decimal values 15 and 14, respectively) will work on a mode basis or a line-by-line basis. On a mode basis, the most-recently-received control code will remain in effect until its complementary control code is received. On a line-by-line basis, the effect of the shift-out control code will be automatically cancelled at the end of a print line.

E_C & k 0 F – Line-by-Line Basis, SI/SO

E_C & k 1 F – Mode Basis (Default), SI/SO

Display Functions Mode

In display functions mode, the printer prints control codes instead of acting on them. When display functions mode is enabled the printer will respond only to carriage return (CR), and disable display functions (E_C Z). When in display functions mode, the printer will print a carriage return code and execute it as a carriage return and line feed, and will print and execute the command to disable Display Functions mode. All other control codes and printer commands are printed, but not executed.

E_C Y – Enable Display Functions

E_C Z – Disable Display Functions

Transparent Print Mode

The transparent print mode serves a function very similar to that of display functions mode: control codes and escape sequences are printed instead of executed. The difference between transparent print mode and display functions is that in transparent print mode, NONE of the control codes or escape sequences are executed.

E_C & p # X ⟨Data⟩ – Print Data in Transparent Mode

= The number of ⟨Data⟩ bytes you want to print in Transparent Mode. Any number from 0 to 32,767 inclusive may be specified.

The "⟨Data⟩" is the actual text that you want printed transparently. Note that the brackets "⟨⟩" have been included for purposes of clarity only. You should not include the brackets with your data.

Auto View Mode

Auto view mode allows the user to see the last printed line. After approximately 2 seconds of sitting idle (no printing) the paper will advance to put the last line printed at the tear edge. When another line is ready to print, paper will be automatically retracted to the correct position. Auto View Mode is available in HP mode only and active when using Z-fold paper.

E_C & k 0 V–Auto View Mode

E_C & k 1 V–Manual View Mode (Default)

Printer Reset

Printer reset sets all features to their default settings and moves the paper to the next top-of-form if using Z-fold paper, or ejects the current cut sheet. The reset does not clear the print buffer. The reset also has no effect on paper path selection. After a reset, printer features will return to the definitions specified by switch settings, and/or the most recent definitions made through the keypad. Printer reset will not delete downloaded characters.

E_C E–Printer Reset

Self-Test

The printer's self-test verifies the proper operation of its processor and ROM. After printing the self-test, the printer will execute a form feed.

E_C z–Perform Self-test

After a self-test, the printer features will return to the definitions specified by switch settings, and/or the most recent definitions made through the keypad.

Printer Status (Not a PCL Level III feature)

The printer will respond to two different requests for status information: Model Number and I/O Status.

The Model Number request is a means for the host system to accurately identify the printer by model number. The model number request is not recognized by printers using the Parallel interface.

E_C * r K–Request for Model Number

When the printer receives the I/O status escape sequence it will respond by sending the following to the host:

2235 xxxx C_R L_F

xxxx=Will vary depending on printer's date code.

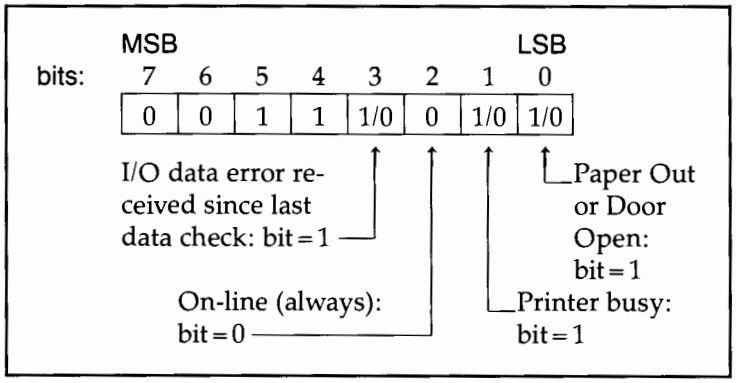
("C_R" and "L_F" represent a Carriage Return and Line Feed.)

Note that because the request is placed in the printer's input buffer, the host will not get a response from the printer until the printer has emptied its buffer of everything preceding the request. Therefore, an indeterminate length of time may pass between the receipt of the escape sequence and the return of the printer's response.

The I/O Status request is effective over RS-232-C only and must include the D_C1 (Device Control 1) control code as a trigger. The I/O Status request causes the printer to return a status byte followed by a carriage return and line feed. The escape sequence requesting I/O Status is:

E_C ? D_C1–Request for I/O Status (RS-232-C only)

The status byte which the printer returns in response to this request is detailed in the diagram below.



Downloadable Character Sets

With the printer's ability to accept downloaded characters and character sets, you can define and print characters of your own design.

In order to use the printer features described in this section you must have an optional character cartridge with RAM installed, and function switch B2 must be UP to allocate the RAM to download characters. (Character cartridges are sold as accessories and must be ordered separately. Check the Ordering Information in Section 6, the Appendix, or call your local HP Sales outlet for more detailed information on character cartridges.)

Download Process Overview

Downloading characters to the printer involves the steps listed below.

Step 1: Design the character or characters you want to download.
Step 2: Clear any residual RAM font with E_C * c 0 F.
Step 3: Create a blank Letter Quality character font with E_C) s 0 W.
Step 4: For each character, set the character code definition with E_C * c # E.
Step 5: For each character, download the character data with E_C (s # W ⟨data⟩.
Step 6: Select the downloaded character set as the primary set with E_C (0 X, or as the secondary set with E_C) 0 X.

Before You Begin... Things To Consider Before Designing Characters

Characters printed by the RuggedWriter 480 printer can be draft quality or letter quality. The print density that you wish to use for your downloaded characters will determine the type of character grid you must use in designing them. Letter quality characters can contain more than three times the number of dot-columns that draft characters can. Both print densities, though, have the same grid height, and carry several constraints. Character grids for the two print densities are located on pages 4-44 and 4-45.

Draft quality characters use every other bit of the character data bytes, as illustrated by the grid. For each byte, the most-significant bit (MSB) is used, the next bit is not, and so on, alternating through the byte. The draft character grid reflects this method of alternating bits. If your character design uses all twenty-four dots in a column, the printer will only "see" half of them, because it will ignore the ones it doesn't use. This means that if you use all twenty-four possible dot rows in designing your characters, you could end up with a draft character that looked quite different from what you had expected because the printer will print only those dots contained in odd-numbered rows.

Draft characters have an additional dot space requirement: no two dots can print in adjacent horizontal positions. In other words, there must be a blank dot on each side of every printed dot. If this isn't done, the printer will do it for you following an algorithm to "throw out" enough dots to ensure that each dot is surrounded by blanks. If that happens, your printed character may differ significantly from the character you expected to see.

There is no limit to the number of dots that a draft character can contain. If your characters are very dense and dark, they will be printed slowly.

Letter Quality characters use all eight bits of each character data byte the printer receives, but they also have a horizontal dot space requirement: all printed dots must be separated by two blank dots. Vertically, the character can use all dots available.

If you do not design your characters with all printed dots separated by two blank dots, the printer will adjust your character design, following an algorithm to "throw out" dots as needed to achieve the proper dot spacing.

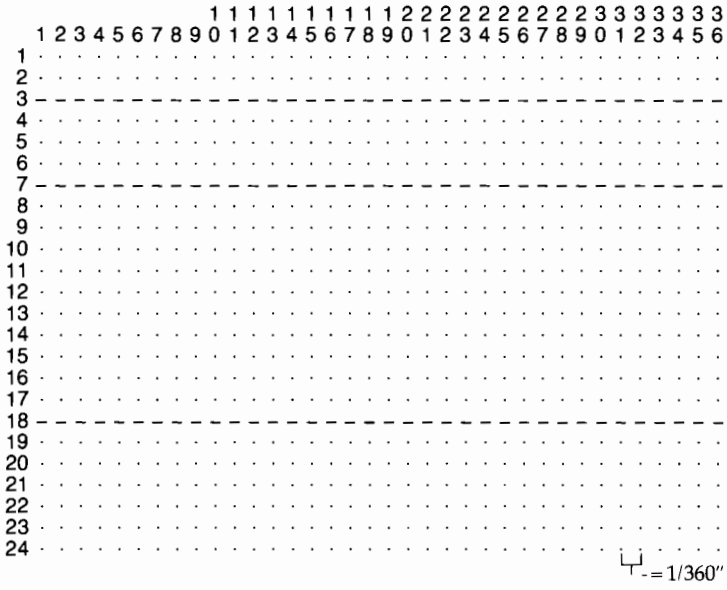
In addition, letter quality characters cannot exceed a maximum number of dots per cell, even though it is possible to define a character cell containing more dots. This maximum varies, depending on the print pitch currently in use. The maximum number of dots a character can use in each of the print pitches is decided by dividing 1440 by the print pitch you are using.

Max number of dots: 1440 divided by 10 = 144
1440 divided by 12 = 120
1440 divided by proportional space
= dependent on character width.

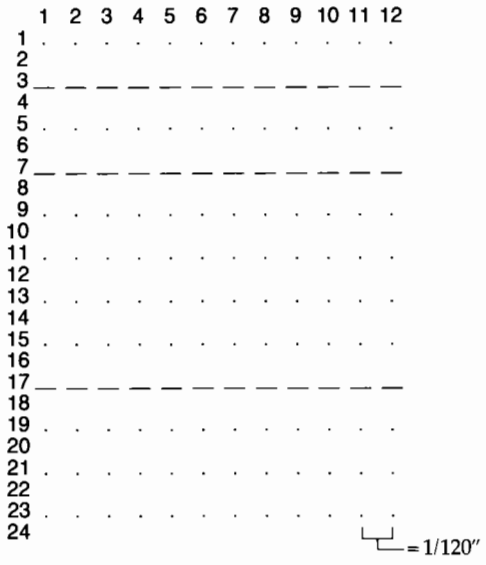
If a character contains more than the maximum number of dots, it cannot be printed, and the printer will "throw it out" at the time of printing. Dense, dark characters which contain a legal number of dots will be printed, but due to the dot density will be printed slower.

The character grids for draft and letter quality are shown below and on the next page.

Letter Quality Character Matrix—(10 Pitch)



Draft Quality Character Matrix—(10 Pitch)



Note

- Capital Letters extend up to Row 3 for both Draft & LQ.
- Lowercase letters extend up to Row 7 for both Draft & LQ.
- The baseline is Row 17 for Draft.
- The baseline is Row 18 for LQ.
- Descenders extend down into the range of Rows 22 to 24.

Introduction to Font and Character Control

The printer's standard fonts and the fonts contained in the optional character cartridge reside in ROM (Read Only Memory). Any characters that you download to the printer will reside in RAM (Random Access Memory). This entails a number of implications.

First, ROM provides permanent storage, while RAM storage is volatile and is cleared whenever you turn the printer off. (The Printer Reset escape sequence does not clear the RAM.) Therefore, if a character set is downloaded then the printer is turned off, the character set must be downloaded again before it can be used.

Secondly, because the downloaded character set is stored in RAM, it can be deleted. This is discussed below under Clear RAM Font.

The following paragraphs describe the download process.

Clear RAM Font

The Clear RAM Font command clears any character data from the RAM in preparation for the downloading of new characters. It is important to clear the RAM font at the beginning of the download process so that the RAM will contain only data that you have specifically put there. The escape sequence used to clear the RAM is:

E_C * c 0 F—Clear RAM Font

When the Clear RAM Font escape sequence is sent, any font in RAM is deleted. If you had cleared a font using this escape sequence and later tried to select it for use, the printer would search through its available fonts for the closest match. The "closest match" may not be very close at all, however, especially if the downloaded characters were of a typestyle radically different from those offered by the printer.

Any "empty" or undefined character will print as a Space.

Creating a Font

There are two ways to create a font: Copy the Current ROM Font into RAM, and Define a New Font. Both are valid methods, and each has advantages over the other. The best one for you will depend on how you intend to use the downloaded characters.

Copy Current ROM Font into RAM. This command copies the contents of the currently-selected character set ROM into RAM. This method of creating a font is particularly useful if you want to use a character set that is very similar to a character set already available in the printer. When ROM is copied into RAM, a complete duplicate font is created, and the few characters that you wish to change can be easily redefined.

If you do not copy the ROM font into RAM, the RAM will contain only those characters that you specifically define. All other characters will be undefined and will print as spaces.

If you choose to define the font by copying ROM into RAM, you should send its escape sequence after clearing the RAM, as described above.

E_C * c 6 F – Copy Current ROM Font into RAM

Defining a New Font. This command defines a font descriptor, a comprehensive definition that describes the font you are creating: its character set, its character height, its typeface, and its print density (letter quality or draft). Once the font descriptor has been defined, the RAM will contain a blank (empty) 7-bit character set with all its print definitions set, and the printer will be prepared to accept downloaded characters.

This method of font definition is useful when you need to define a full set of characters.

E_C) s # W ⟨descriptor data⟩ – Define a New Font

= The number of bytes that will be included in the Descriptor Data. The Descriptor Data is a series of bytes that specify the various settings to be used by the font. The data is structured as shown in the following table.

Font Descriptor

Byte	Contents	
0	0	0
2	0	0
4	0	0
6	0	0
8	0	0
10	0	0
12	0	0
14	Character Set	
16	0	0
18	Character Height	
20	0	0
22	0	0
24	0	Typeface
26	0	0
28	Print Density	0

Font Descriptor Structure
As you can see, only four parts of the Font Descriptor are used in font definition for the RuggedWriter 480 printer. The remaining bytes are reserved and must have values of zero (ASCII NU, CTRL-@).

The four features specified in the Font Descriptor are defined in the table below. Explanations and an example font definition follow the table.

Byte #	Feature	Dec	Hex	ASCII	Keystroke
14, 15	Character Set	(See following explanation)			
18, 19	Character Height	(See following explanation)			
25	Typeface	Line Printer	0	N_U	CTRL-@
		Courier	3	E_X	CTRL-C
		Letter Gothic	6	A_K	CTRL-F
28	Print Density	Draft Quality	0	N_U	CTRL-@
		Letter Quality	1	S_H	CTRL-A

Character Set

Bytes fourteen and fifteen specify the "#" and ID in the escape sequences which define the character set. To calculate the value which will take the place of bytes 14 and 15, multiply the numeric portion of the identifier ("#") by 32, then add the ASCII value of the alphabetic portion of the identifier (ID), then subtract 64. (Refer to the character set designation table on page 4-11.) For example, to select the Roman-8 character set which has a value (#) of 8 & an ID of U, send:

$$(8 \times 32) + (85\ [\text{the ASCII value of U}] - 64) = 277$$

The result, 277, is the number which specifies Roman-8. The allowable range for the result is 0 through 2047, inclusive. The way this number is used in the font descriptor depends on the method used to send the escape sequence to the printer. For example, in BASIC to send the character set value of 277, you will send chr$(277/256);chr$(277 mod 256) because it takes two characters to specify a two byte quantity.

If you fail to specify a Character Set, the printer will only be able to use the default definition of 0X (the download character set designation).

Character Height

The character height specified with bytes 18 and 19 is the height of printed uppercase characters, expressed in decipoints. A decipoint is 1/720". Specify the number you need, in the range from 0 to 2550 decipoints. For example, a 10 point font is 100 decipoints high. In BASIC, to send the a height of 100 decipoints send chr$(100/256);chr$(100 mod 256) because it takes two characters to specify a two byte quantity.

To define a 12-point Roman-8, Letter Quality Courier font, you would sent the following escape sequence:

ASCII:	$^{E}_{C}$	)	s	2	9	W	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{S}_{H}$	$^{N}_{K}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	x	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{N}_{U}$	$^{E}_{X}$	$^{N}_{U}$	$^{N}_{U}$	$^{S}_{H}$
Decimal:	27	41	115	50	57	87	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	21	0	0	0	120	0	0	0	0	0	3	0	0	1
Hex:	1B	29	73	32	39	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15	0	0	0	78	0	0	0	0	0	3	0	0	1

Symbol Set 8U (Roman-8)
Character Height in decipoints
Courier typeface
Letter Quality print density

Setting the Character Code

Each downloaded character must be associated with a character code so that the printer will know where to find that character data when the time comes to print it. To perform this association, "set" the character code before downloading each character. Thus, a downloaded character code is assigned to the character value that was most recently "set".

E_C * c # E – Set Character Code

= The decimal value that you wish to assign to the character. If you send the escape sequence without specifying a decimal value, the printer will use the default value of zero.

Example: To assign a code to a character that would take on the value of the ASCII character "A", replace the "#" with "65", the decimal value of "A", and the resulting escape sequence would be E_C * c 65 E.

Note that the code set by this escape sequence will remain "set" until it is changed. Note also that the actual downloading is not the only function that uses the "set" code to determine what to take action on. Delete a Character, described later in this section, also uses the setting.

Downloading Characters

In order to download each character, you must set the character code, as described above, then send an escape sequence that carries the graphics data required for printing the character. Up to 128 characters can be downloaded, with character values ranging from 0 through 255, decimal. You may define any character code as a download character except for the Space character code (decimal 32, hex 20).

E_C (s # W ⟨data⟩ – Download One Character

= The number of bytes of data that are to be sent as ⟨data⟩. This number includes the character descriptors which are the first three bytes in the data stream. The character descriptors are defined in the following paragraph. The method for generating character data from a dot-pattern on a character grid appears after that.

As we've explained, the first three bytes are character descriptors. These three bytes define Format, Continuation, and Descriptor Size, and must always have the values shown below:

	Value	ASCII	Keystroke
First Byte:	8	B_S	CTRL-H
Second Byte:	0	N_U	CTRL-@
Third Byte:	1	S_H	CTRL-A

Character data is transferred in bytes that correspond directly to the graphic representation of the character on the character grid. As you will see demonstrated in the example at the end of this discussion, the first dot column of the character image is made of the first three bytes, the second dot column is made of the fourth, fifth, and sixth bytes, and so on. Each dot that will print corresponds to a bit value of 1, and each dot that is blank corresponds to a bit value of 0.

The corresponding of dot patterns to data bytes is illustrated on the next page. This translation of dots-into-data is required for every column of dots in the character image. A more detailed demonstration follows this discussion.

Translation of Character Dots Into Data Bytes

Byte 1:
00100101 =37 decimal=25 hex=ASCII "%"

Byte 2:
01000110 =70 decimal=46 hex=ASCII "F"

Byte 3:
01001011 =75 decimal=4B hex=ASCII "K"

Deleting a Character

Downloaded characters may be deleted. The escape sequence that performs the deletion acts on the character code that is currently set. (Setting the character code is described earlier in this section.)

E_C * c 3 F—Delete a Character

If you try to print a character that has been deleted, the printer will print it as a Space.

Using the Downloaded Character Set

To use the downloaded characters, simply select the download character set as the primary or secondary character set. The escape sequences that perform those selections are:

E_C (0 X – Select Download Font as Primary

E_C) 0 X – Select Download Font as Secondary

When the download font is selected as the primary character set, all normal printing will draw its character images from the download font.

In addition to selecting the character images for use in the primary or secondary character sets, these escape sequences activate all the print feature definitions of the download set. For example, if the downloaded font has been defined as a letter quality font, and you select the downloaded font as primary, the printer's output will be printed as letter quality, even if the printer had just been printing draft quality text.

Downloading and 7-bit Character Sets

Any modification made to the Roman-8, or any ISO, character set will affect the Roman-8 set and all ISO character sets. This is important information if you have copied the Roman-8 character set from ROM to RAM and plan to download characters into it, or if you have copied any one of the ISO 7-bit character sets from ROM to RAM and plan to download into it.

The 7-bit ISO character sets do not exist on their own in ROM; they are subsets of the Roman-8 character set and exist solely as definitions of how they relate to the Roman-8 set. An ISO character set, in other words, is actually a set of definitions of how each 7-bit character it contains is mapped into the Roman-8 set.

For this reason, if you copy an ISO character set into RAM, you are really copying the Roman-8 character set into RAM, along with the character-mapping definitions that make the ISO set unique. Therefore, any characters you download into that RAM set will be reflected as changes in the Roman-8 character set. And because the ISO character sets are all subsets of Roman-8, any modifications you make to the RAM set will be reflected in all the ISO character sets as well. Any change you make to the definition of a symbol will effect every 7-bit character set that contains that symbol.

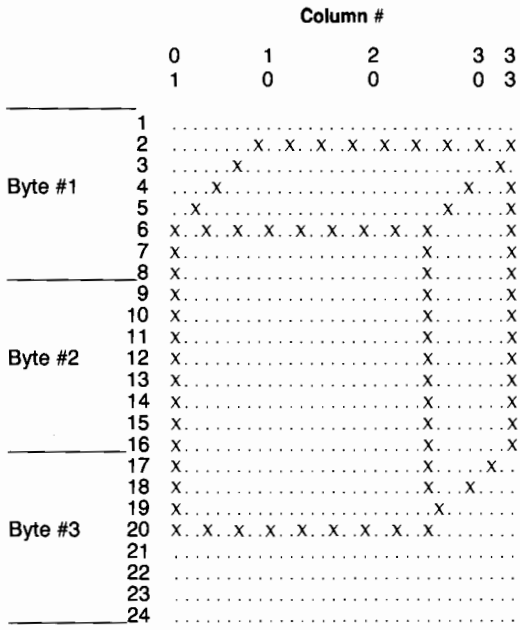
It is important to note that it is the graphic symbol for the character which is affected in this manner, and not the character code.

For example: If you copy the ISO-UK character set from ROM to RAM, then modify the pound symbol (£), (decimal value n), that symbol will also be modified where it appears in the Roman-8 character set (decimal 187), and in all the other ISO character sets that contain the pound symbol.

Sample Download Program

The following example demonstrates the design of a down-load character, illustrates the process of converting the image into data bytes, then presents a sample BASIC program which performs the character download and runs a short demonstration to prove that it succeeded.

Binary Representation



Note: for visual clarity: X=1 (black dot); · =0 (white dot)

Decimal Conversion of the Pixel Information

Column #1			Column #2			...	Column #33		
byte 1	byte 2	byte 3	byte 1	byte 2	byte 3	...	byte 1	byte 2	byte3
00000111	11111111	11110000	00000000	00000000	00000000	...	01011111	11111111	00000000
↓	↓	↓	↓	↓	↓		↓	↓	↓
7	255	240	0	0	0		95	255	0

To download this character: ❐

```
10 REM *** BASIC program to download a box-shaped character in PCL mode ***
20 REM
30 REM
40 WIDTH "lpt1:",255                    :REM   Disable auto CR-LF
50 OPEN "lpt1:" AS #1                   :REM   Open printer as a file
60 REM
70 PRINT #1,CHR$(27);")s0W";            :REM   Create a blank NLQ font
80 REM
90 PRINT #1,CHR$(27);"*c64E";           :REM   Set character code to 64
100 REM
110 REM   Download the character
120 REM
130 PRINT #1,CHR$(27);"(s102W";CHR$(8);CHR$(0);CHR$(1);
140 REM
150 REM   Begin loop to download the character data
160 REM
170 FOR I = 1 TO 99
180    READ A
190    PRINT #1,CHR$(A);
200 NEXT I
210 REM
220 PRINT #1,"Here is the downloaded character: ";
230 REM
240 REM   Now select the downloaded font as the current primary font.
250 REM
260 PRINT #1,CHR$(27);"(0X";
270 REM
280 LPRINT CHR$(64)              :REM  Print the downloaded character
290 REM
300 PRINT #1,CHR$(27);"(3@";     :REM  Change back to the default font
310 LPRINT "Done."
320 CLOSE
330 REM
340 REM   This is the data for the box-shaped character
350 REM
360 DATA 7,255,240
370 DATA 0,0,0
380 DATA 8,0,0
390 DATA 4,0,16
400 DATA 16,0,0
410 DATA 0,0,0
420 DATA 36,0,16
430 DATA 0,0,0
440 DATA 64,0,0
450 DATA 4,0,16
460 DATA 0,0,0
470 DATA 64,0,0
480 DATA 4,0,16
490 DATA 0,0,0
500 DATA 64,0,0
510 DATA 4,0,16
520 DATA 0,0,0
530 DATA 64,0,0
540 DATA 4,0,16
550 DATA 0,0,0
560 DATA 64,0,0
570 DATA 4,0,16
580 DATA 0,0,0
590 DATA 64,0,0
600 DATA 7,255,208
610 DATA 0,0,32
620 DATA 72,0,0
630 DATA 0,0,0
640 DATA 16,0,64
650 DATA 64,0,0
660 DATA 0,0,128
670 DATA 32,0,0
680 DATA 95,255,0
```

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Epson Mode

(Switch B1 UP)

The control codes and escape sequences described in this section are those used by Epson printers, specifically the LQ-1000.

Control Codes

Control codes recognized by the RuggedWriter 480 printer in Epson mode are described in the following table. The "Symbol" column shows the standard abbreviation for each control code. The "Value (dec)" column lists the decimal value that corresponds to each control code, and the "Value (hex)" column lists the hex value. The "Keystroke" column shows the letter to use in combination with your PC's CTRL key to generate the control code.

Note

The syntax used in the discussion of Epson escape sequences, uses the control code symbols for values and codes. The hex and decimal values of the control codes can be found in the control code table below.

RuggedWriter 480 Control Codes					
Symbol	Full Name	Description	Value (dec)	Value (hex)	Key-stroke
B_S	Backspace	Causes the printer to move its print head one character position to the left.	08	08	CTRL H
H_T	Horizontal Tab	Moves the print head horizontally to the next preset tab stop.	09	09	CTRL I
L_F	Line Feed	Causes the printer to advance the paper one line and moves the print head to the left margin.	10	0A	CTRL J
N_U	Null	Causes no action	0	0	CTRL @
S_H	Start of Heading	Causes no action	1	1	CTRL A
S_X	Start of Text	Causes no action	2	2	CTRL B
E_X	End of Text	Causes no action	3	3	CTRL C
E_Q	Enquiry	Causes no action	5	5	CTRL E
E_M	End of Medium	Causes no action	25	19	CTRL Y
A_K	Acknowledge	Causes no action	6	6	CTRL F
B_L	Bell	Causes no action	7	7	CTRL G
E_T	End of Transmission	Causes no action	4	4	CTRL D
V_T	Vertical Tab	Advances the paper to position the print head at the next defined vertical tab stop.	11	0B	CTRL K
F_F	Form Feed	Causes the printer to advance the paper to the next top-of-form and moves the print head to the left margin. Top-of-form is the first line of printing on the next page.	12	0C	CTRL L
C_R	Carriage Return	Causes the printer to start printing. Moves the print head to the left margin, but does not cause a paper advance.	13	0D	CTRL M
S_O	Shift Out	Causes the printer to select the double-wide print mode. (Refer to the "Print Pitches" discussion for more information.)	14	0E	CTRL N
S_I	Shift In	Causes the printer to select the condensed print mode. (Refer to the "Print Pitches" discussion for more information.)	15	0F	CTRL O

RuggedWriter 480 Control Codes (cont.)					
Symbol	Full Name	Description	Value (dec)	Value (hex)	Key-stroke
D_1	Device Control 1	Used for RS-232-C protocols only. Used as Xon character for the RS-232-C Xon/Xoff handshake. (Refer to the Data Communications section for more information on handshakes.)	17	11	CTRL Q
D_2	Device Control 2	Turns off condensed print mode.	18	12	CTRL R
D_3	Device Control 3	Used for RS-232-C protocols only. Used as Xoff character for the RS-232-C Xon/Xoff handshake. (See the Data Communications section for more information on handshakes.)	19	13	CTRL S
D_4	Device Control 4	Turns off double-wide print mode.	20	14	CTRL T
CAN	Cancel	Cancels all data in the printer's print buffer, but does not affect control codes.	24	18	CTRL X
E_C	Escape	Indicates to the printer that the characters immediately following are part of a command sequence.	27	1B	CTRL [
DEL	Delete	Removes the last text character from the print buffer, but does not affect control codes.	127	7F	

Using Printer Features

Before You Begin...

Before you begin programming, there are a few things that you should be aware of.

- Many of the print features described in this section can be defined by function switch settings, keypad selections, or by escape sequences. Features that can be controlled like this will have as their active setting the one most recently made.
- Many of the print features discussed in this section will remain in effect until they are specifically turned off. For example, if underlining is enabled, all text the printer receives will be underlined until the printer receives the command to disable the feature.

Print Pitches

The print pitch is the number of characters per inch (cpi). Characters Per Inch is a horizontal measure. The printer can print in several pitches:

```
This line is Pica pitch (10 cpi).
This line is Elite pitch (12 cpi).
This line is 15-pitch (15 cpi).
```

Larger printed characters are often used for titles, while smaller pitches are commonly used for spreadsheets.

E_C P – Print at Pica Pitch (10 cpi)

E_C M – Print at Elite Pitch (12 cpi)

E_C g – Print at 15 cpi

Print Widths are the widths of the individual printed characters. The width definitions work in partnership with the pitch definitions to expand the printer's print pitch offerings. The widths available are Condensed, Normal, and Double-Wide. The printer prints at the "Normal" width if no width definition is made. An example of each print width is shown below:

```
This is normal Pica.
This is condensed Pica.
T h i s   i s   d o u b l e - w i d e   P i c a .
This is normal Elite.
This is condensed Elite.
T h i s   i s   d o u b l e - w i d e   E l i t e .
This is normal 15-pitch.
T h i s   i s   d o u b l e - w i d e   1 5 - p i t c h .
```

The escape sequences and control codes below control the print width definitions.

E_C S_I -or- S_I – Select Condensed print mode

D_2 – Cancel Condensed print mode

E_C S_O -or- S_O – Select Double-Wide print for one line

D_4 -or- C_R -or- F_F – Cancel Double-Wide print (one line) -or- L_F -or- V_T

E_C W S_H – Select Double-Wide print mode

E_C W N_U – Cancel Double-Wide print mode

Proportional Space printing makes your printed text resemble set type. In print pitches where the printer prints a fixed number of characters per inch, each character is allotted the same character width whether the character is a narrow letter like "i" or a wide letter like "w". In proportional spacing, the characters are allotted a character width proportional to their width requirements. The following print sample demonstrates the differences between proportional-spaced and fixed-pitch printing:

```
This line is proportionally spaced.
This line is printed in Elite (12 cpi).
```

See the Proportional Space table located in the Appendix.

To choose between Proportional Space and Fixed Pitch printing, send the following escape sequences:

E_C p S_H – Select Proportional Space mode

E_C p N_U – Cancel Proportional Space mode

Print Density

Print Density is the feature which determines whether your printing is draft quality or letter quality. Draft quality offers the advantage of fast output; letter quality offers clean, professional-looking print. The print sample below illustrates the difference between these two print densities.

```
This is regular 10-pitch Draft print.
This is 10-pitch Draft print in Bold.
This is 10-pitch Draft print, Emphasized.
This is Letter Quality print.
This is Letter Quality print in Bold.
This is Letter Quality print, Emphasized.
```

To select the desired print density, send one of the following escape sequences:

E_C x N_U – Select Draft Quality Print

E_C x S_H – Select Letter Quality Print

Print Enhancements

Your printer offers several special printing effects which can be used to add emphasis to your printed text. These are: double strike print, emphasized print, underlining, italics, and subscripts and superscripts. These enhancements may be used with any pitch or density.

Double Strike printing darkens text. Double strike print is printed twice, in two pases of the print head. The result is text that appears darker than normal printing, but is the same size and density. The print sample below contrasts normal printing to double strike print.

```
This is regular 10-pitch Draft print.
This is 10-pitch Draft print in double-strike.
This is Letter Quality print.
This is Letter Quality print in double-strike.
```

To turn Double Strike print on and off send:

E_C G – Select Double Strike Printing

E_C H – Cancel Double Strike Printing

Emphasized print adds strong emphasis to your printed text. The printer prints emphasized text in two passes of the print head just as it does when printing double strike, but it slightly offsets the print between the first printing pass and the second. The result is text that is a bit thicker than normal or double strike text. The following print sample compares Normal Print, Double Strike Print, and Emphasized Print.

```
This is normal print, unenhanced.
This is double-strike print.
This is emphasized print.
```

To turn Emphasized printing on and off, send the following escape sequences:

E_C E – Select Emphasized Print

E_C F – Cancel Emphasized Print

Underlining draws a continuous underline below a portion of text. The print sample below shows how underlining looks.

Underlining can be used for a single word.
Entire lines can be underlined, too.

To control underlining mode, send the following escape sequences:

E_C - S_H – Select Underlining

E_C - N_U – Cancel Underlining

Italics printing provides another way to make certain words or portions of text stand out.

You can print a full sentence in this style.

Or you can italicize a *single* word or phrase.

To instruct the printer to print in Italics, use the following escape sequences:

E_C 4 – Select Italic Print

E_C 5 – Cancel Italic Print

Master Select is a special escape sequence that can be used to select any valid combination of nine print modes. These are: Pica, Elite, Proportional Space, Condensed, Emphasized, Double-strike, Double-Wide, Italic, and Underline.

The Master Select command is provided for your convenience. Use it only if you think it may be more convenient than other methods. Note that, however, because it controls nine modes, the Master Select code will cancel any of the nine not selected.

The Master Select escape sequence is:

E_C ! # – Master Print Mode Select

= The combination of modes that you want to select. This is a number represented by the ASCII character which has a decimal value equal to the number. To get this number, add together the values of the modes you want. The values are listed in the following table:

Underline	128
Italic	64
Double-Width	32
Double-Strike	16
Emphasized	8
Condensed	4
Proportional	2
Elite	1
Pica	0

To select the combination of modes you want, add the values of each of the modes and use that number in place of the "#" in the escape sequence.

For Example: To print Italic Emphasized Elite text, add their values together like this:

Italic: 64 + Emphasized: 8 + Elite: 1 = 73

The number "73" represents the combination of enhancements you want, but it is not used literally in the escape sequence. Instead, the number is represented by the ASCII character whose value corresponds to that number. The character with a decimal value of 73 is "I". (A complete list of ASCII characters is located in the Appendix.)

Thus, the Master Select escape sequence for these features is: E_C ! I

Superscript and Subscript commands cause the printer to print the specified text higher (superscript) or lower (subscript) than normal printing. In addition to being in a different position, the sub- and superscripted text is automatically printed in the Micro (8 point) font. The commands to control sub- and superscripting are:

E_C S N_U – Select Superscript Mode

E_C S S_H – Select Subscript Mode

E_C T – Cancel Super/Subscript Mode

To print subscripts or superscripts you must embed the "Select Mode" command in your text just before the text to be sub/superscripted, and embed the "Cancel Mode" command immediately following the sub/superscripted text.

For Example:

Sending the following line to the printer:

Chocolate is full of $CE_CSS_H6E_CTHE_CSS_H12E_CTOE_CSS_H6E_CT$

Results in this printed output:

Chocolate is full of $C_6H_{12}O_6$.

Features for Positioning Print on a Page

The features described in this section determine how the text will be arranged on the page.

Margins

Your printer supports four kinds of margins: left and right margins, and top and bottom margins.

Left and right margins are defined with the following escape sequences:

E_C Q # – Set Right Margin

E_C ℓ # – Set Left Margin

= The decimal value that equals the number of the print column where you want the margin set. Columns are counted from the left edge of the paper, and are specified in terms of the current print pitch. For example, if the printer is printing at 12 cpi and you want to define a one-inch left margin, you would set the left margin at column 12 by sending E_C ℓ F_F, because F_F is the character with the decimal value of 12.

When using cut sheet paper from the paper cassette, column zero is located 1/4-inch to the right of the left edge of the paper.

The maximum width of the print line is 13.6 inches. If the right margin is set to exceed this print width the escape sequence will be ignored. If the right margin is set less than or equal to the left margin, or if the left margin is set greater than or equal to the right margin, the escape sequence will be ignored. The default for the left margin is column 1. The default for the right margin is column 136.

Top and bottom margins are defined with the perforation skip mode definition. See the discussion of perforation skip mode for more information.

Page Length

Page length is the length of the physical sheet of paper that the printer is using. Page length can be expressed in lines of print, or in inches. The maximum page length setting allowed is 22 inches. If you attempt to set a page length greater than 22 inches the escape sequence will be ignored. When using single sheets make sure that the page length you specify correctly reflects the length of paper you are using. To set the page length in lines, send:

E_C C # – Set Page Length in Lines

= The number that specifies the page length in number of lines. Any number from 0 to 127, inclusive, can be specified with the character whose decimal value matches the number you want. Lines are counted according to the currently-defined line spacing. If a number greater than 127 is selected, 128 will be subtracted from it and the result will be used. The default page length is set through function switches A6 and A7. The table on page 4-19 illustrates the page length/paper path selected through these two switches.

Example: If you are using paper that is 11 inches long, and the printer is printing at 6 lines per inch, you would specify a page length of 66 lines. The escape sequence you would send is E_C C B because B is the character with the decimal value of 66. To set the page length in inches, send:

E_C C N_U # – Set Page Length in Inches

= The number of inches from the top to the bottom of each sheet of paper.

Example: If you are using paper that is 11 inches long, you would send E_C C N_U V_T, because V_T is the character with the decimal value of 11.

Perforation Skip Mode

Perforation skip mode allows you to define top and bottom margins, as well as prevent the printer from printing on the perforation of Z-fold paper. When Perforation Skip Mode is enabled, the printer advances the paper to the first print line on the next page whenever it enters the Perf Skip region.

To control Perforation Skip Mode, use the following escape sequences:

E_C N # – Define and Enable Perforation Skip

E_C O – Cancel Perforation Skip mode

In the first escape sequence, the "#" represents the number of lines you want the printer to skip between the last printed line on one page and the first printed line on the next page. The lines are defined in terms of the current line spacing. You may specify any number of lines from 1 through 127, expressed with the character whose decimal value matches the number you want. If a number greater than 127 is selected, 128 will be subtracted from it and the result will be used. If you set a perforation skip area greater than or equal to the page length, the escape sequence will be ignored.

The "O" in the second escape sequence is the letter "Oh", not a zero.

This feature may also be set through function switch B3. Refer to the Switch Settings Summary in the Appendix for more information.

Line Spacing

Line spacing is the vertical distance between printed lines on the page. It is measured in number of printed lines per inch (lpi). The RuggedWriter 480 printer supports several line spacings. The escape sequences to control them are shown below.

E_C 2 – Set Line Spacing to 6 lpi

E_C 0 – Set Line Spacing to 8 lpi

E_C A # – Set Line Spacing at #/60-inch

E_C 3 # – Set Line Spacing at #/180-inch

The third escape sequence specifies a line spacing in increments of 1/60th inch. The "#" represents a character specifying the number of 1/60-inch increments to advance after each line. You may specify any number from 1 through 127. If a number greater than 127 is selected, 128 will be subtracted from it and the result will be used. The power-up default is 6 lpi.

Example: To use this escape sequence to set a line spacing appropriate for printing 8-wire graphics, set the line spacing to 8/60th-inch. The "#", then, is 8, and the character whose decimal value is 8 is the Backspace character. Thus, the escape sequence is: E_C A B_S.

The fourth escape sequence specifies a line spacing in increments of 1/180th inch. The "#" in the sequence represents a character specifying the number of 1/180-inch increments to advance after each line. You may specify any number from 1 through 255.

Justification

When the printer justifies text, characters at the beginning or end of a line (or both) line up flush against the left margin (left justified), right margin (right justified) or both (fully justified). The escape sequence controlling justification is:

E_C a # – Select Justification

= The type of justification that you want the printer to perform. Replace "#" with the character whose decimal value matches the value listed below for the type of justification you want. In its default state, the printer performs left-justification, in which all lines of text are printed flush against the left margin. Centering is when the text is centered between the left and right margins.

Character	Value
N_U	0 = Select Left Justification
S_H	1 = Select Centering
S_X	2 = Select Right Justification
E_X	3 = Select Full Justification

When the printer performs full justification, it adds spaces between words to make the print lines all the same length. When printing in this mode the printer may pause between lines while it buffers up enough text to fill the next line.

Tabs and Tab Stops

Horizontal and vertical tabs provide a means of quickly positioning the print head at a desired position. The commands in this group include those for setting horizontal and vertical tab stops, defining vertical tab channels, and selecting vertical tab channels. Two relative positioning commands are also included.

Horizontal tab stops may be set at specific columns with the following escape sequence:

E_C D # #. . . N_U – Set Horizontal Tab Stops

= The numbers of the columns at which you want the tab stops to be set. The tab position is specified by entering the character whose decimal value matches the number of each column. Columns are numbered from the leftmost printable position, beginning with column 1. Column positions are calculated in terms of the current print pitch. You may specify up to 32 horizontal tab stops. The column numbers for this escape sequence must be entered in ascending order. If a column number is entered that is lower than the previous number, the escape sequence will be terminated and tab stops will be set at all the previously specified column numbers. If a tab stop is set beyond the right margin, a C_R and L_F will be generated if you attempt to tab to this position.

Power-On default horizontal tabs are set at every eighth stop, ie, column 9, 17, 25, etc. to 136.

To clear all tabs, send the escape sequence with no column numbers specified: E_C D N_U.

Vertical tab stops may be specified for specific row numbers on the page with the following escape sequence:

E_C B # #. . . N_U – Set Vertical Tab Stops

= The row numbers at which you want the vertical tab stops set. These numbers are specified by entering the character whose decimal value equals the number of each row. The first printable line on the page is line 0. Position is defined in terms of the current line spacing. Any changes in line spacing will not change the location of the vertical tab stops. You may define up to 16 vertical tab stops. The column numbers for this escape sequence must be entered in ascending order. If a column number is entered that is lower than the previous number, the escape sequence will be terminated and tab stops will be set at all the previously specified column numbers. If a tab stop is set beyond the page boundary, or inside the perforation skip area, a F_F will be generated if you attempt to tab to this position.

There are no power-on default vertical tab stops. (If no vertical tab is set, $V_T = C_R/L_F$.)

To clear all vertical stops, send the escape sequence with no row numbers specified: E_C B N_U.

Vertical tab channels are an alternate method of defining vertical tab stops. To use vertical tab channels, first define the tab stop positions contained in each tab channel, then specify the number of the channel whose tabs you want to use. The default tab channel is Channel 0.

The following escape sequence assigns the vertical tab stops to channels:

E_C b # #. . . # N_U – Set Vertical Tabs in Channels

The first "#" in the escape sequence specifies the number of the channel to which you want the tab stop(s) assigned. The channel number may be any number from 0 to 7, inclusive. Specify this number by sending the character whose decimal value matches the channel number you want. If you select a number greater than 7 this escape sequence will be ignored.

The series of "#"s which follows the channel number are the numbers of the rows at which the desired tab stops occur. These, also, are expressed as characters with the appropriate decimal character values.

Up to 16 tab stops may be specified for any given channel.

To select a vertical tab channel, send the escape sequence shown below:

E_C / # – Select Vertical Tab Channel

= The channel you wish to select. This is a number from 0 to 7, inclusive, and is expressed by specifying the character that has that number as its decimal value. If you select a number greater than 7 this escape sequence will be ignored.

To use the vertical tab stop definitions, send the printer a vertical tab control code (V_T, decimal 11).

Setting Tabs

To set a tab stop at regular intervals across the page or vertically on the sheet, use one of the escape sequences shown below:

E_C e N_U # – Set Horizontal Tab Stops at Intervals

E_C e S_H # – Set Vertical Tab Stops at Intervals

= The interval at which you want the tab stops spaced. You can specify any number from 0 to 127, inclusive. This number should be expressed with the character whose decimal value matches the number you want.

To set horizontal tabs at regular intervals, specify the number of character spaces between tab stops. Character spaces are interpreted in terms of the current print pitch.

To set vertical tabs at regular intervals, specify the number of lines to skip between tab stops. Lines are interpreted in terms of the current line spacing.

Example: To set horizontal tab stops at every fifth character position, send the following escape sequence: E_C e N_U E_Q. This will set tab stops at character positions 5, 10, 15, 20, 25, 30, and so on, across the page.

Print Position and Paper Control

Print Position

The escape sequence commands in this group control the current active print position: the physical position at which the next character will be printed. Escape sequences in this group move the print position either vertically or horizontally. Movement can be specified in relative or absolute terms.

(Note that you may also control print position with horizontal and vertical tabs. Refer to the discussion of tabs and tab stops, which appeared earlier in this section.)

To move the print position relative to the current position, send:

E_C f N_U #—Horizontal Relative Move

E_C f S_H #—Vertical Relative Move

The first of these escape sequences will cause the print position to move the specified number of spaces to the right of the current print position. The width of a character is based on the current print pitch. You may specify any number from 0 to 127, inclusive, expressed as the character with a decimal value that matches the number you want. If a number greater than 127 is selected, 128 will be subtracted from it and the result will be used. If the horizontal move is beyond the right margin, the escape sequence will be ignored.

The second escape sequence will cause the printer to advance the paper the number of lines you specify. The number of lines ("#") may be any number in the range from 0 to 127, inclusive, and is also expressed as a character with the appropriate value. If a number greater than 127 is selected, 128 will be subtraced from it and the result will be used. The length of a line is based on the current line spacing. The maximum allowed vertical move is 22 inches. If the selected vertical move is greater than 22 inches, the escape sequence will be ignored. If a perforation skip region is defined and the selected vertical move is in or beyond this region, the print position will be moved to the next top of form.

To move horizontally to a position relative to the current position, use the escape sequence shown below:

E_C \ # #—Relative Horizontal Positioning

The two "#" symbols in the escape sequence represent two values used by the printer in calculating how far to move the print position to the left or right. The printer calculates the distance of movement according to the formula shown below, and interprets the distance in inches from the last character printed.

To calculate the distance of print head movement in inches, use the following formula:

Draft: (n1 + (n2 × 256))/120
LQ: (n1 + (n2 × 256))/180
Proportional: (n1 + (n2 × 256))/180

In the formula, "n1" corresponds to the first "#" in the escape sequence, and "n2" corresponds to the second "#".

To use this feature, you must calculate how many inches of movement is required, then work through the following steps to find the values of n1 and n2 to use in the escape sequence.

1. If the printer is in draft mode, multiply the number of inches to move by 120. If the printer is in LQ or proportional mode, multiply the number of inches to move by 180.
2. If the desired movement is to the left, subtract the result of step 1 from 65536.
3. Divide the result from above by 256. The quotient will be n2, and the remainder will be n1.

Example 1: Desired movement of 3 inches to the right, in draft mode:

Step 1: 3 × 120 = 360
Step 2: Skip for movements to the right.
Step 3: 360/256 = 1 with remainder 104
n2 = 1, n1 = 104
Escape Sequence: E_C\h S_H

(Note that "h" has decimal value 104 and S_H has decimal value 1.)

Example 2: Desired movement of 3 inches to the left, in LQ mode.

Step 1: $3 \times 180 = 540$
Step 2: $65536 - 540 = 64996$
Step 3: $64996/256 = 253$ with remainder 228
n2 = 253, n1 = 228

E_C $ # # – Absolute Horizontal Positioning

This command moves the print position to the location you have specified with the two numbers. The printer calculates the distance by inserting the two numbers you have specified into the following formula:

Print position movement, in inches: $(n1 + n2 \times 256)/60$

The "n1" in the formula corresponds with the first "#" in the escape sequence, and the "n2" corresponds with the second "#".

If you attempt to move the print position to the right of the right margin, the printer will ignore the command.

To move the print position vertically relative to the current position, command the printer to feed the paper a distance specified in increments of $^1/_{180}$-inch. The escape sequence to send is:

E_C J # – Relative Vertical Positioning

= The number of $^1/_{180}$-inch increments that you want the paper to be moved. You can specify any number in the range from 0 to 255. The number must be expressed through the character with that decimal value.

For Example: To move the paper one-half inch, send the following escape sequence: E_C J Z, because Z is the character whose decimal value is 90.

Paper Feed Control

The RuggedWriter 480 printer can feed paper along several paths. The commands that control paper feed and paper path are:

E_C E_M R–Eject Current Page

E_C E_M 0–Feed Z-fold Paper

E_C E_M 1–Feed from Paper Cassette

E_C E_M 2–Handfed Sheets

E_C E_M 4–Feed from Paper Cassette

When the printer receives the command to eject the current sheet, it will eject the sheet currently in position to print. If the printer is using z-fold paper, and is instructed to eject the current sheet, it will move the paper to position the print head at the first line on the next page. Once a paper path is selected, the printer will continue to use that path until it is changed.

The default selection of paper path (the definition that is in effect when you turn the printer on) is determined through function switches A6 and A7.

A Printer Reset (described later in this section) will not change the selection of the paper path.

Remember, when switching from Z-fold paper to another path, you must tear off the last page of tractor paper and press the On-line key before the printer will resume printing.

Character Sets

The basic elements of information in this section are very simple. However, a solid understanding of some underlying concepts is essential in order for you to put the information to good use.

Character Sets

Character sets are collections of the symbols and characters that constitute all the elements of a language, including punctuation and numbers.

There are two kinds of character sets, 128-character sets and 256-character sets. Character sets containing 128 characters are sometimes referred to as "7-bit" character sets, because only seven bits of the character byte are used to designate the character. Character sets containing 256 characters are referred to as "8-bit" character sets, because the 8th bit of the character byte must be used in order to access all 256 character codes.

In Epson Mode, the RuggedWriter 480 printer supports two 8-bit character sets: PC-8 and PC-8 Denmark/Norway. Character set charts are located on pages 7-16, 7-17 in the Appendix.

In Epson Mode, the RuggedWriter 480 printer supports thirteen 7-bit character sets: Epson USA, Epson France, Epson Germany, Epson UK, Epson Denmark, Epson Sweden, Epson Italy, Epson Spain, Epson Japan, Epson Norway, Epson Denmark II, Epson Spain II, and Epson Latin America. Character set charts are located on pages 7-16, 7-17 in the Appendix.

Selecting Character Sets

To designate the active character set send:

E_C R #—Select Character Set

= The numeric code which designates the character set you want to select. In the escape sequence sent to the printer, replace the "#" with the ASCII character whose decimal value matches the code you want. The list below shows the codes that correspond to each character set.

Character	Value	Set
N_U	0	Epson USA
S_H	1	Epson France
S_X	2	Epson Germany
E_X	3	Epson United Kingdom
E_T	4	Epson Denmark I
E_Q	5	Epson Sweden
A_K	6	Epson Italy
B_L	7	Epson Spain
B_S	8	Epson Japan
H_T	9	Epson Norway
L_F	10	Epson Denmark II
V_T	11	Epson Spain II
F_F	12	Epson Latin America

If you select a code that is not listed above, the escape sequence will be ignored.

Character sets are also selectable through function switches located on the back of the printer. Refer to the Switch Settings Summary in the Appendix for more information on switch settings.

Selecting Typeface

This command affects only the letter quality typeface.

To designate the active typeface send:

E_C k # – Select Typeface

#=The numeric code designates the typeface you want to select. In the escape sequence sent to the printer, replace the # with the ASCII character whose decimal value matches the code you want. The list below shows the codes that correspond to each typeface.

Character	Value	Typeface
N_U	0	Cour
S_H	1	Helvetica*
S_X	2	Cour
E_X	3	Pres Elite*
}	125	Times Roman PS*
~	126	Letter Gothic*

*Available only on optional character cartridge.

Printing Graphics

Epson Mode Graphics uses a form of graphics called "dot image" graphics. The graphic image is made up of dots which are called Pixels (for PIcture ELement dots). These dots can be printed in a variety of densities, with as many as 360 dots per inch (dpi) horizontally and 180 dpi vertically.

The printer can print graphics in several densities and in two modes: 8-wire mode, which uses only 8 wires of the print head, and 24-wire mode, which uses all 24 wires for high-resolution graphics output.

Graphics Image Modes

Graphics Image Modes control the resolution, darkness, and print speed of the graphics printed by the printer. Some of the modes are for 8-wire graphics printing, and others are for 24-wire. The Graphics Image Mode that you select is specified in the escape sequence that transfers the graphics image to the printer. The following table details these modes.

Graphics Image Modes

8-wire Graphics			
Mode	**Mode Num.**	**ASCII Value**	**Horiz. Density, Dots per Inch**
Single density	0	N_U	60
Double density	1	S_H	120
Double-density	2	S_X	120
Quadruple density (See Note below)	3	E_X	240
CRT I	4	E_T	80
CRT II	6	A_K	90

24-wire Graphics			
Mode	**Mode Num.**	**ASCII Value**	**Horiz. Density, Dots per Inch**
Single density	32	SP	60
Double density	33	!	120
CRT III	38	&	90
Triple density	39	'	180
Hex density (See Note below)	40	(	360

Note

When printing high-density graphics such as Quadruple or Hex density, the printer cannot print two horizontally-adjacent black dots.

Alternate Mode Commands for 8-Wire Graphics

Four commands provide an alternate method for specifying the Graphics Image Mode when you are printing 8-wire graphics. These commands specify some of the same modes listed above, but they do it in a different format. These commands are:

E_C K n_1 n_2 ⟨Data⟩ – Single Density Graphics Mode

E_C L n_1 n_2 ⟨Data⟩ – Double Density Graphics Mode

E_C Y n_1 n_2 ⟨Data⟩ – Double Density Graphics Mode

E_C Z n_1 n_2 ⟨Data⟩ – Quadruple Density Graphics Mode

In these escape sequences, n_1 and n_2 represent the number of columns of graphics data that follow the escape sequences. The number of columns is calculated according to the following formula:

$n_1 + (n_2 \times 256) = \text{Number of Columns}$

n_1 and n_2 can be calculated in the following manner:

$$n_2 = \frac{noc^*}{256}$$

$$n_1 = noc^* \bmod 256$$

$^* = \text{number of columns}$

To change the graphics mode that you have assigned with one of the four escape sequences above, send one of the escape sequences shown below:

E_C ? K # – Reassign Graphics Mode
E_C ? L # – Reassign Graphics Mode
E_C ? Y # – Reassign Graphics Mode
E_C ? Z # – Reassign Graphics Mode

This escape sequence is linked directly to the alternate escape sequences described above: the letter appearing in the "Reassign" escape sequence (K, L, Y, or Z) determines which 8-wire mode will be reassigned, and the "#" in the command represents the mode to which you want to change. The "#" value is the Mode Number listed in the Graphics Image Modes table. As before, this number should be specified with the character whose decimal value matches the number of the mode.

For example, to change the "L" command and instruct the printer to change to Quadruple-density graphics send
E_C ? L E_X

Note Be careful when using the "Reassign" command. If you specify a reassignment to a 24-wire graphics mode, the graphics data may print as garbage (or not print at all).

Graphics Transfer

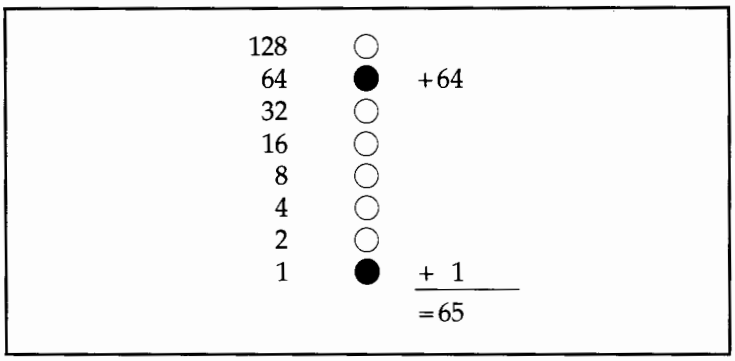
The graphics image is transferred to the printer one dot column at a time. The way that this is accomplished depends on which graphics mode the printer is using, 8-wire graphics or 24-wire graphics.

When it is printing 8-wire graphics, the printer expects to receive one byte of graphics data for every dot column it is to print. Thus, the printer expects one bit of data for each wire that is active: 8 wires, 8 bits, 1 byte.

When it is printing 24-wire graphics, the printer expects to receive three bytes of graphics data for each dot column. This is because the print head contains 24 wires, and the printer requires 24 bits of information to control all 24 wires. Since graphics data is transferred in 8-bit bytes, this means that each printed column of the graphic image requires three bytes of data.

The host transfers the graphics image by sending a command that tells the print head which wires to fire. The wires have been assigned values in groups of eight, as shown in the illustration below. To fire a specific wire you must send its number to the printer. Using this system, if you want to fire the wire that is next-to-the-top of the group of eight, you would send a value of 64. If you want to fire the wire at the bottom of the group, send a value of 1. If you want to fire both of these wires, add their numbers together and send that value: 65.

You can fire any combination of wires by adding their values together. The illustration below demonstrates how the wire values correspond to dot patterns, and how the added values are calculated.



By using this numbering system to specify which wires to fire, any combination of the eight wires in the group can be designated by a unique decimal number from 0 to 255, and can, therefore, be specified with an 8-bit data byte.

The escape sequence command which turns graphics printing on also defines the mode in which that image will be printed. The graphics printing command is:

E_C * # # # ⟨Data⟩ – Print Graphic Image

The first "#" in the escape sequence represents the number of the mode that you want the printed image to use. Graphics image modes were described in detail in the previous section. Specify the mode number with the character whose decimal value matches the number of the mode you want.

The remaining two "#"s in the escape sequence specify the number of columns to reserve for graphics printing. In other words, they tell the printer the quantity of graphics you will be printing.

The two numbers reserving columns are calculated according to the following formula:

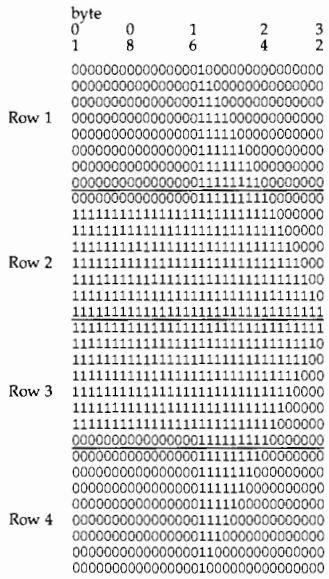
$$n1 + (n2 \times 256) = \text{Number of Columns}$$

For example: To print 1632 columns of graphics data, n1 would be 96 and n2 would be 6 (because $1632 = 96 + (6 \times 256)$). The escape sequence, with the 24-wire double density graphics mode, would be: E_C * ! ' A_K

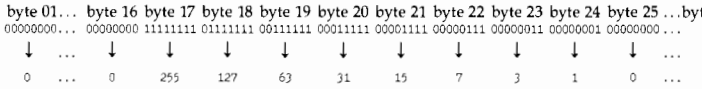
Sample Graphics Program:
The graphics print examples that follow demonstrate the transfer of a simple graphic image. The first example prints a small arrow in the 8-wire graphics mode. The second example prints an arrow in the 24-wire graphics mode.

For each example, we have included a binary representation of the image, showing the Ones and Zeros that make up the graphics data, followed by a BASIC program which defines the graphics settings, transfers the image, then prints it.

Binary Representation, 8-Wire Graphics



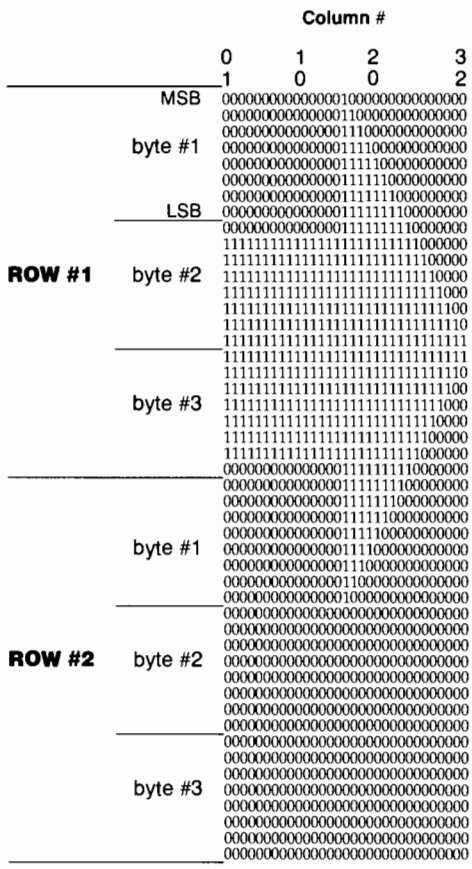
Row 1 decimal conversion



To print this arrow: 

```
10 REM *** BASIC program to print an arrow in 8-wire column graphics ***
20 REM
30 WIDTH "lpt1:",255                  :REM Disable quto CR-LF
40 OPEN "lpt1:" AS #1                 :REM Open printer as a file
50 REM
60 REM
70 PRINT #1,CHR$(27);"A";CHR$(8);     :REM Set line spacing to 8/60 inch (8 dot ro
ws)
80 REM
90 REM Loop to read data and print graphics
100 FOR I = 1 TO 4                    :REM Loop for each row
110   REM  Single density 8-wire column graphics with 32 columns of data
120   PRINT #1,CHR$(27);"*";CHR$(0);CHR$(32);CHR$(0);
130   FOR J = 1 TO 32
140     READ BYTE1                    :REM Read one byte
150     PRINT #1,CHR$(BYTE1);         :REM Print one column
160   NEXT J
170   PRINT #1,CHR$(10);              :REM Advance and return to left margin
180 NEXT I
190 PRINT #1,CHR$(27);"2";            :REM Reset line spacing to 6 lpi
200 REM
210 CLOSE
220 REM
230 REM Data for the arrow
240 REM
250 REM Row 1
260 REM
270 DATA 0,0,0,0,0,0,0,0
280 DATA 0,0,0,0,0,0,0,0
290 DATA 255,127,63,31,15,7,3,1
300 DATA 0,0,0,0,0,0,0,0
310 REM
320 REM Row 2
330 REM
340 DATA 127,127,127,127,127,127,127,127
350 DATA 127,127,127,127,127,127,127,127
360 DATA 255,255,255,255,255,255,255,255
370 DATA 255,127,63,31,15,7,3,1
380 REM
390 REM Row 3
400 REM
410 DATA 254,254,254,254,254,254,254,254
420 DATA 254,254,254,254,254,254,254,254
430 DATA 255,255,255,255,255,255,255,255
440 DATA 255,254,252,248,240,224,192,128
450 REM
460 REM Row 4
470 REM
480 DATA 0,0,0,0,0,0,0,0
490 DATA 0,0,0,0,0,0,0,0
500 DATA 255,254,252,248,240,224,192,128
510 DATA 0,0,0,0,0,0,0,0
```

Binary Representation, 24-Wire Graphics



Decimal Conversion of the Pixel Information

ROW 1:

Column #1			Column #2			Column #32		
byte 1	byte 2	byte 3	byte 1	byte 2	byte 3	byte 1	byte 2	byte3
00000000	01111111	11111110	00000000	01111111	11111110	00000000	00000001	10000000
↓	↓	↓	↓	↓	↓	↓	↓	↓
0	127	254	0	127	254	0	1	128

To print this arrow:

```
10 REM *** BASIC program to print an arrow in 24-wire column graphics ***
20 REM
30 WIDTH "lpt1:",255                    :REM Disable quto CR-LF
40 OPEN "lpt1:" AS #1                   :REM Open printer as a file
50 REM
60 REM
70 PRINT #1,CHR$(27);"A";CHR$(8);       :REM Set line spacing to 8/60 inch (8 dot r
ows)
80 REM
90 REM Loop to read data and print graphics
100 FOR I = 1 TO 2                      :REM Loop for each row
110   REM  Single density 24 wire column graphics with 32 columns of data
120   PRINT #1,CHR$(27);"*";CHR$(32);CHR$(32);CHR$(0);
130   FOR J = 1 TO 32
140     READ BYTE1,BYTE2,BYTE3          :REM Read three bytes (for 24 wires)
150     PRINT #1,CHR$(BYTE1);CHR$(BYTE2);CHR$(BYTE3); :REM Print one column
160   NEXT J
170   PRINT #1,CHR$(10);                :REM Advance and return to left margin
180 NEXT I
190 PRINT #1,CHR$(27);"2";              :REM Reset line spacing to 6 lpi
200 REM
210 CLOSE
220 REM
230 REM Row 1
240 REM Data for arrow
250 REM
260 DATA 0,127,254,0,127,254,0,127,254,0,127,254
270 DATA 0,127,254,0,127,254,0,127,254,0,127,254
280 DATA 0,127,254,0,127,254,0,127,254,0,127,254
290 DATA 0,127,254,0,127,254,0,127,254,0,127,254
300 DATA 255,255,255,127,255,255,63,255,255,31,255,255
310 DATA 15,255,255,7,255,255,3,255,255,1,255,255
320 DATA 0,255,255,0,127,254,0,63,252,0,31,248
330 DATA 0,15,240,0,7,224,0,3,192,0,1,128
340 REM
350 REM Row 2
360 REM
370 DATA 0,0,0,0,0,0,0,0,0,0,0,0
380 DATA 0,0,0,0,0,0,0,0,0,0,0,0
390 DATA 0,0,0,0,0,0,0,0,0,0,0,0
400 DATA 0,0,0,0,0,0,0,0,0,0,0,0
410 DATA 255,0,0,254,0,0,252,0,0,248,0,0
420 DATA 240,0,0,224,0,0,192,0,0,128,0,0
430 DATA 0,0,0,0,0,0,0,0,0,0,0,0
440 DATA 0,0,0,0,0,0,0,0,0,0,0,0
```

Miscellaneous Printer Control

Printer Reset

The escape sequence shown below clears all definitions you have made by sending escape sequences to the printer. When it receives this escape sequence, the printer returns to the definitions specified by the settings of the function switches, or in the case of paper path and page length, to the most recent keypad selections, Top-of-Form is set at the current vertical position, and horizontal position is set at the default left margin.

E_C @ – Initialize Printer

Controlling the Eighth Data Bit

The escape sequences in this group control the value of the most significant bit (MSB) of incoming data bytes. If a 7-bit character set is enabled and a character is received with the MSB set, that character will be printed in italics. These escape sequences should not be used when an 8-bit character set is enabled. Graphics are not affected by these escape sequences.

E_C = – Set MSB to 0

E_C > – Set MSB to 1

E_C # – Cancel MSB Control

Note that in the "Cancel" escape sequence, "#" is the actual pound-sign, not a numeric parameter.

Intercharacter Spacing

Intercharacter Spacing refers to the distance between printed characters in fixed pitch printing. The spacing is specified in the number of dot-spaces which appear to the right of the printed character. The escape sequence controlling intercharacter spacing is:

E_C S_P # – Define Intercharacter Spacing

The "S_P" in the escape sequence is the ASCII Space character (decimal 32).

= The number of dot-positions that should be added as space to the right of each printed character. You may specify any number of dot positions from 0 to 127, inclusive, expressing the number with the character whose decimal value matches that number. If a number greater than 127 is selected, 128 will be subtracted from it and the result will be used.

The dot spacing varies according to the print mode that is currently active. Dot spacings are listed below.

Print Mode	Dot Spacing
Draft	1/120 inch
Draft Condensed	1/240 inch
Draft Expanded	1/60 inch
Letter Quality	1/180 inch
Letter Quality Condensed	1/360 inch
Letter Quality Expanded	1/90 inch

Downloadable Character Sets

Using the printer's ability to accept downloaded characters and character sets, you can define and print characters of your own design.

Note

In order to use the printer features described in this section you must have installed an optional character cartridge with RAM, and you must have allocated the RAM to downloaded characters by setting function switch B2 UP. (Character cartridges are sold as accessories. Check the Ordering Information in the Appendix, or call your local HP Sales outlet for more detailed information on the cartridges.)

Download Process Overview

Downloading characters to the printer involves the steps listed below.

Step 1: Design the character or characters you plan to download.

Step 2: Set the print features that you want the downloaded characters to exhibit (print density, proportional space, and sub/superscripts.)

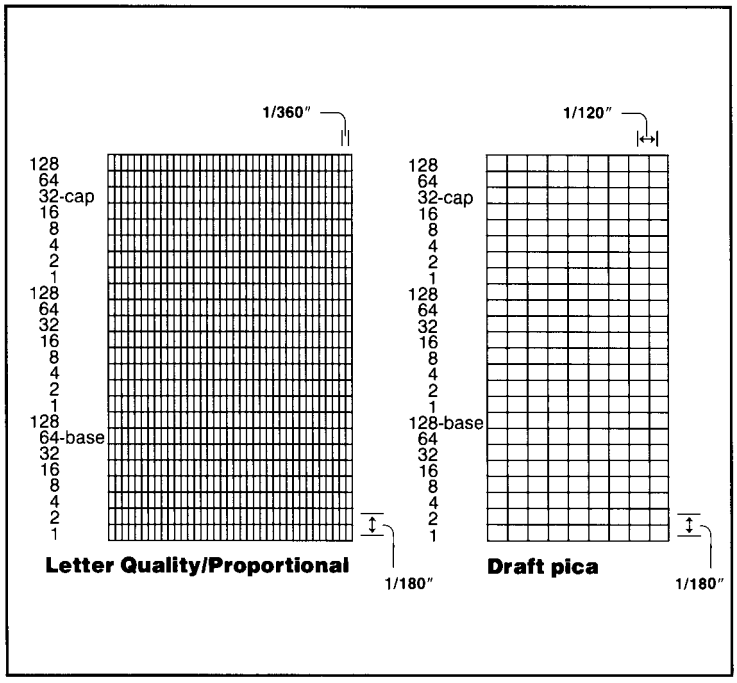
Step 3: Copy ROM font to RAM by sending
$E_C : N_U N_U N_U$

Step 4: Download the character data by sending
E_C & N_U n1 n2 d0 d1 d2 ⟨data⟩

Considerations for Designing Characters

Characters printed by the RuggedWriter 480 printer are either Draft Quality or Letter Quality. The print density that you want to use for your downloaded characters will determine what kind of character grid you must use in designing them.

Character grids for the two print densities are shown in the illustration below. Letter Quality characters can contain more than twice the number of dot-columns that Draft characters have. Both print densities, though, have the same grid height, and some constraints apply to both kinds of characters.



The baseline for each character is usually placed at row 18 for Letter Quality and 17 for Draft. From this baseline, capital letters extend up to row 3, and lowercase letters to row 7. Descenders extend down to the area of rows 22 to 24.

Characters of every density have a specific design requirement: there must be a blank dot on each side of every printed dot. If you neglect to put a blank on each side of each printed dot, the printer will do the task for you, following an algorithm to "throw out" enough dots so that each dot is surrounded by blanks; and if that happens, your printed character may differ significantly from the character you expected to see.

In addition, letter quality characters cannot exceed a maximum number of dots per cell, even though it is possible to define a character cell containing more dots. This maximum varies, depending on the print pitch currently in use. The maximum number of dots a character can use in each of the print pitches is decided by dividing 1440 by the print pitch you are using

Maximum number of dots: 1440 divided by 10 = 144
1440 divided by 12 = 120
1440 divided by proportional space = dependent on character width.

If a character contains more than the maximum number of dots, it cannot be printed, and the printer will "throw it out" at the time of printing. Dense characters which contain a legal number of dots will be printed, but due to the dot density will be printed slower.

Note

Epson Mode download characters always print slower than ROM fonts.

Introduction to Font and Character Control

The printer's standard fonts and the fonts supplied in the optional character cartridge reside in ROM (Read Only Memory), and any characters that you download to the printer will reside in RAM (Random Access Memory). This has a number of implications.

First, ROM provides permanent storage, while RAM storage is volatile and will be cleared whenever you turn the printer off or Reset the printer. (See the discussion of Printer Reset in this section.) Therefore, if you have downloaded a character set, and the printer is turned off or reset, the character set must be downloaded again before you can use it.

Copy ROM Font to RAM

This command clears any character data from the RAM in preparation for the download of new characters. It also copies the contents of the currently-selected character set ROM into RAM. By issuing this command at the beginning of the download process, you can ensure that the RAM will contain only the data that you have specifically put there.

This method of creating a font is particularly useful if you want to use a character set that is almost, but not quite, just like a character set already available in the printer. When ROM is copied into RAM, a complete duplicate font is created, and the few characters that you wish to change can be easily defined.

If you do not copy the ROM font into RAM, the RAM will contain only those characters that you specifically define, and all other characters will be undefined. Undefined characters are ignored.

The escape sequence is as follows:

$E_C : N_U N_U N_U$ – Copy ROM Font into RAM

Downloading Characters

When you download a character set, the printer stores the characters in the print density (draft, NLQ, proportional) that the printer is currently selected to use. For this reason, when you are downloading characters make sure that the printer is set up to print the way you want the downloaded characters printed. For example: Letter Quality sub or superscript, Draft sub or superscript, etc.

The escape sequence that downloads the character data can download a single character or an entire character set. The escape sequence to send is:

E_C & N_U n1 n2 d0 d1 d2 ⟨data⟩

The "n1" and "n2" in the escape sequence are the starting and ending characters in the range you want to download. If you are downloading only a single character, n1 and n2 will be the same. If you are redefining the uppercase alphabet, n1 would be "A" and n2 would be "Z". These two characters, n1 and n2, can be any characters with values in the range from 32 to 127, decimal.

The "d0", "d1", and "d2" in the escape sequence are characters which specify the width of the character and the space which should surround it. "d0" defines the left space in dot-columns. "d1" defines the number of dot-columns that make up the character, and "d2" defines the right space in dot-columns. "d0," "d1," "d2" must be sent for each character being defined. The maximum values of these width definitions are shown in the following table.

Print Density	**Maximum Char Width** (d1)	**Maximum Cell Width** (d0+d1+d2)
Draft Quality Print	9	12
Letter Quality Print	29	36
Proportional Space Print	37	42

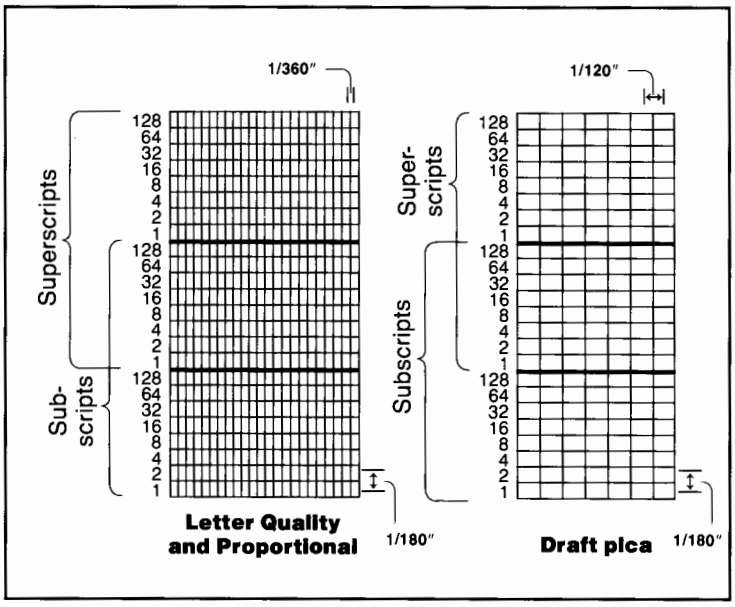
The following example demonstrates the design of a download character, illustrates the process of converting the image into data bytes, then presents a sample BASIC program which performs the character download and runs a short demonstration to prove that it succeeded.

Sub/Superscript Width Limits

Sub/superscript characters are defined whenever subscript or superscript mode is active. Subscripted characters can be used for superscripts, and vice versa: only their placement differs.

The design of sub/superscript characters differs from normal characters in that there are only 16 rows in a cell. Therefore, when defining a sub/superscript character only two bytes of data are needed to define each column of dots.

The design grids for sub/superscript characters are pictured below.



Also, superscript/subscript characters have different width limitations. The maximum values of the widths are shown below.

Print Density	Maximum Char Width (d1)	Maximum Cell Width (d0+d1+d2)
Draft Quality Print	7	12
Letter Quality Print	23	36
Proportional Space Print	23	42

Binary Representation

		Column # 0 1	1 0	2 0	2 9
	1	. . . . .			
	2	. . . . .			
	3	. . . . .			
Byte #1	4	. . . . .			
	5	. . . . .			
	6	. . . . . X . X . X . X . X . X . X . X . X . X . X . X			
	7	. . . . X . . . . X . X			
	8	. . X . . . . X . . . X			
	9	X . X . X . X . X . X . X . X . X . X . X . X . X . X X			
	10	X . . . . . X X			
	11	X . . . . . X X			
Byte #2	12	X . . . . . X X			
	13	X . . . . . X X			
	14	X . . . . . X X			
	15	X . . . . . X X			
	16	X . . . . . X X			
	17	X . . . . . X X			
	18	X . . . . . X . . . X . .			
	19	X . . . . . X . X			
Byte #3	20	X . X . X . X . X . X . X . X . X . X . X . X			
	21	. . . . .			
	22	. . . . .			
	23	. . . . .			
	24	. . . . .			

Note: for visual clarity: X = 1 (black dot); · = 0 (white dot)

Decimal Conversion of the Pixel Information

Column #1			Column #2			...	Column #29		
byte 1	byte 2	byte 3	byte 1	byte 2	byte 3	...	byte 1	byte 2	byte3
00000000	11111111	11110000	00000000	00000000	00000000	...	00000111	11111111	10000000
↓	↓	↓	↓	↓	↓		↓	↓	↓
0	255	240	0	0	0		7	255	128

To download this character: ❐

```
10 REM *** BASIC program to download a box-shaped character in Epson mode ***
20 REM
30 REM
40 WIDTH "lpt1:",255                  :REM   Disable auto CR-LF
50 OPEN "lpt1:" AS #1                 :REM   Open printer as a file
60 REM
70 PRINT #1,CHR$(27);"x";CHR$(1);     :REM   Select the NLQ font
80 REM
90 PRINT #1,CHR$(27);":";CHR$(0);CHR$(0);CHR$(0);   :REM  Copy NLQ font to RAM
100 REM
110 REM   Download the character
120 REM
130 PRINT #1,CHR$(27);"&";CHR$(0);
140 REM
150 REM  Start at "@" and end at "@".  Only download one character.
160 REM
170 PRINT #1,"@@";
180 REM
190 REM   Send the left margin, number of columns, and the right margin.
200 REM
210 PRINT #1,CHR$(2);CHR$(29);CHR$(2);
220 REM
230 REM   Begin loop to download the character data
240 REM
250 FOR I = 1 TO 87      :REM   (29 columns) * (3 bytes per column) = 87 bytes
260    READ A
270    PRINT #1,CHR$(A);
280 NEXT I
290 REM
300 REM   Now select the downloaded font.
310 REM
320 PRINT #1,CHR$(27);"%";CHR$(1);
330 REM
340 LPRINT "Here is the downloaded character:  @"
350 LPRINT "Done."
360 REM
370 CLOSE
380 REM
390 REM   This is the data for the box-shaped character
400 REM
410 DATA 0,255,240
420 DATA 0,0,0
430 DATA 1,128,16
440 DATA 0,0,0
450 DATA 2,128,16
460 DATA 0,0,0
470 DATA 4,128,16
480 DATA 0,0,0
490 DATA 4,128,16
500 DATA 0,0,0
510 DATA 4,128,16
520 DATA 0,0,0
530 DATA 4,128,16
540 DATA 0,0,0
550 DATA 4,128,16
560 DATA 0,0,0
570 DATA 4,128,16
580 DATA 0,0,0
590 DATA 4,128,16
600 DATA 0,0,0
610 DATA 4,128,16
620 DATA 0,0,0
630 DATA 4,255,240
640 DATA 0,0,0
650 DATA 5,0,32
660 DATA 0,0,0
670 DATA 6,0,64
680 DATA 0,0,0
690 DATA 7,255,128
```

Notes

Notes

Data Communications 5

The data communications interfaces of the RuggedWriter 480 printer, RS-232-C, Parallel, and HP-IB, provide a means of communication between the printer and its host.

When the printer is turned ON, both interfaces on the printer are alive, awaiting data. The first byte of data received by either interface disables the other interface until the printer is turned OFF, then ON again.

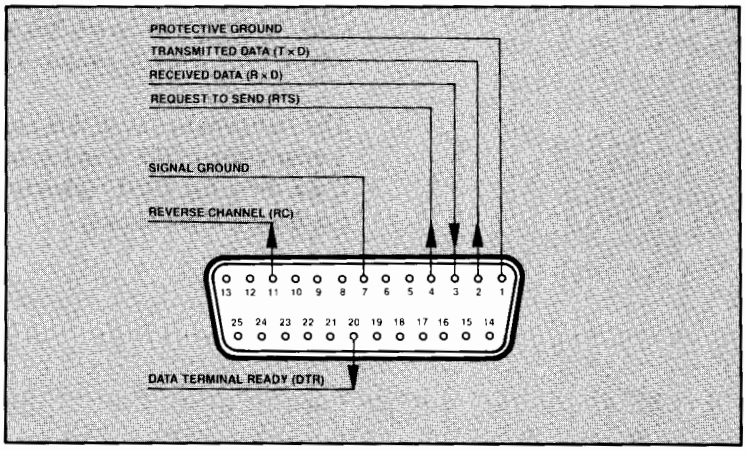
Serial Interface

The RuggedWriter 480 printer uses a standard serial interface which is compatible with many computers and terminals.

Printer Connector Pin Assignments

The direction conventions used in the table below are:
In – The signal is received by the printer from the host.
Out – The signal is transmitted by the printer to the host.

2–
3–
8–
9–



Signal Descriptions

Pin 1, Protective Ground: This conductor serves as an electrical ground line for connecting the cable shield.

Pin 2, Transmitted Data: Bit serial data transmitted to the computer system or terminal from the printer. This line is used with XON/XOFF handshaking.

Pin 3, Received Data. Bit serial data transmitted to the printer from the computer.

Pin 4, Request to Send: An output from the printer that is always at +10V (SPACE or logic 0) when the printer is ON.

Pin 7, Signal Ground. The established reference potential for all data communication.

Pin 11, Reverse Channel. Signal line from the printer to the computer for enabling and disabling data transmission. Data transmission is enabled with a +10V (SPACE or logic 0) and is disabled with −10V (MARK or logic 1).

Pin 20, Data Terminal Ready and Reverse Channel: Outputs from the printer to enable and disable transmission of data to the printer. Data transmission is enabled when at +10V (SPACE or logic 0) and is disabled when at −10V (MARK or logic 1).

Handshaking Protocol

Handshaking involves the printer and its host exchanging signals to prevent the printer's buffer overflowing and losing data. The type of handshaking you use will depend on which type your computer system or terminal uses.

The handshakes available are XON/XOFF (Transmission ON/Transmission OFF, also known as software handshakes) and Data Terminal Ready (also known as DTR, Printer Busy, or Hardware Handshake).

XON/XOFF. When the printer's buffer has room for only 100 more characters, the printer will send the host an XOFF character to stop data transmission. The XOFF character used by your printer is an ASCII DC3.

The printer will continue printing after sending the XOFF character, thus making more room in its buffer. When the buffer has room for 223 more characters, the printer sends the host an XON character to resume data transmission. The XON character used by the printer is the ASCII DC1.

Data Terminal Ready. Unlike the XON/XOFF handshake, DTR or hardware handshakes use electrical signals to signal the host that it is ready to receive data. The printer will accept data until it has room for only 100 more characters. It will then turn off its hardware signal to the host device, indicating that it is no longer ready to receive data. The signal used is on pin 11 or 20. The off state is at −10V (MARK or logic 1).

When the printer's buffer has room for 223 more characters it will turn on the hardware signal, enabling the host to resume data transmission. The on state is at +10V (SPACE or logic 0).

Note: Transmitting data to the printer without using handshaking may result in the loss of data, and is therefore not recommended.

Parallel Interface

The RuggedWriter 480 printer uses a standard parallel printer interface which is compatible with many personal computers.

Printer Connector Pin Assignments

The printer interface connector is compatible with a standard amphenol type 36-pin connector.

The direction conventions used in the following table are:
In–The signal is received by the printer from the computer.
Out–The signal is transmitted by the printer to the computer.

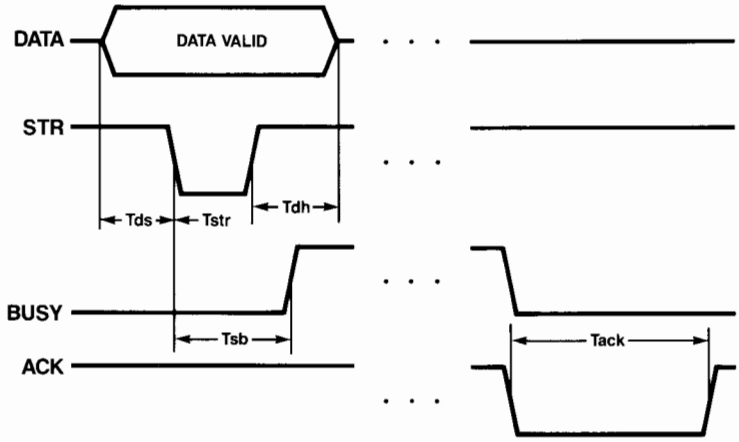
Pin Assignments

Pin No.	Signal	Direction	Description
1	$\overline{\text{Strobe}}$	In	A LOW pulse of width greater than 0.5 μs causes the printer to read one byte of data.
2	DATA 1	In	Data bit 0
3	DATA 2	In	Data bit 1
4	DATA 3	In	Data bit 2
5	DATA 4	In	Data bit 3
6	DATA 5	In	Data bit 4
7	DATA 6	In	Data bit 5
8	DATA 7	In	Data bit 6
9	DATA 8	In	Data bit 7
10	$\overline{\text{Acknlg}}$	Out	The printer sends a LOW pulse to indicate that it has accepted a byte of data and is ready for more data.
11	Busy	Out	A HIGH logic level indicates the printer cannot receive data due to data entry, a full buffer, or error status.
12	OOP	Out	A HIGH logic level indicates the printer is out of paper.
13	Selected	Out	A HIGH level indicates the printer is ON LINE.
14, 15			Not used
16, 17	Logic Gnd		
18			Not used
19 to 30	Logic Gnd		
31	$\overline{\text{Input}}$ Prime	In	A LOW pulse of width greater than 10 μs resets the printer and clears the print buffer.
32	$\overline{\text{Error}}$	Out	A LOW level indicates the printer has reached an error state: self test failed or carriage position lost.
33	Logic GND		
34 to 36			Not Used

Printer Timing Diagram

The timing diagram below illustrates the data and handshake lines during transfer of one data byte to the computer. DATA 1 trough DATA 8 and the Strobe line are driven by the computer; the Acknlg line is driven by the printer.

Interval	Description	Minimum Value	Typical Value
T_{ds}	Delay from DATA written to data $\overline{\text{Strobe}}$	0.5 μs	
T_{str}	Data $\overline{\text{Strobe}}$ width.	0.5 μs	
T_{ack}	$\overline{\text{Acknlg}}$ pulse width.		4 μs
T_{dh}	Duration of valid data after $\overline{\text{Strobe}}$.	0.5 μs	
T_{sb}	Delay from falling edge of $\overline{\text{Strobe}}$ to rising edge of Busy	0.5 μs (max)	



HP-IB Interface

The Hewlett-Packard Interface Bus (HP-IB) is among the most common interfaces between two HP devices. The HP-IB is a 16-line bus, consisting of three handshake lines, five control lines, and eight data I/O lines.

With these lines, the HP-IB ties a group of devices together into a system. The devices on the HP-IB may include terminals, desktop computers, personal computers, plotters, calculators, instruments, and printers.

A device on the HP-IB may function as a Listener, a Talker, or a Controller. The Controller, as its name implies, regulates the interaction of the devices on the HP-IB system. A Listener receives data that is sent over the bus. A Talker transmits data to other devices on the bus.

Your printer is usually a Listener, but will sometimes also function as a Talker, as explained later in this section. The printer will never function as a Controller.

Pin	Function	Signal
1	Data Bus 1	DI01
2	Data Bus 2	DI02
3	Data Bus 3	DI03
4	Data Bus 4	DI04
5	End or Identify	EOI
6	Data Valid	DAV
7	Not Ready for Data	NRFD
8	Not Data Accepted	NDAC
9	Interface Clear	IFC
10	Service Request	SRQ
11	Attention	ATN
12	Earth Ground	SHIELD
13	Data Bus 5	DI05
14	Data Bus 6	DI06
15	Data Bus 7	DI07
16	Data Bus 8	DI08
17	Remote Enable	REM
18-24	Signal Ground	GND

Setting the Switches

Mode function switches B4 through B9 on the printer's rear panel control a number of HP-IB settings. (Switch B10 is not used for HP-IB configuration.) Note that these same switches (except B9) configure the RS-232-C interface. The switches perform "double-duty," and their active definitions depend on which mode is currently in use.

HP-IB Address

The HP-IB address is a number which identifies each device on the bus. Using HP-IB addresses, the Controller can talk to the various devices on the bus and individually address them to Talk or Listen.

The table below shows the switch settings required to assign the printer its HP-IB address.

Switch B4	Switch B5	Switch B6	Resulting HP-IB Address
Down	Down	Down	Address 0
Down	Down	Up	Address 1
Down	Up	Down	Address 2
Down	Up	Up	Address 3
Up	Down	Down	Address 4
Up	Down	Up	Address 5
Up	Up	Down	Address 6
Up	Up	Up	Address 7

The RuggedWriter 480 printer will usually be a Listener. It can "listen" in either of two ways.

First, it can be Addressed to Listen. This means that the printer will receive only data that is sent specifically to its address, and will ignore everything else coming over the HP-IB.

Secondly, the printer can Listen Always. This means that the printer will receive everything that comes over the data lines, even if it is intended for another device on the HP-IB.

These two listening modes are described in greater length under the Listen Always discussion which follows.

Service Request (SRQ)

The Service Request (SRQ) is a signal which the printer sends to interrupt the controlling device when some kind of attention is required (out of paper or door open). With some systems, the Service Request cannot be used because the system will not recognize it.

Function switch B7 enables or disables the use of SRQ:

Switch B7	Resulting Function
Down	SRQ Disabled
Up	SRQ Enabled

When the Service Request is enabled, the printer will assert the SRQ control line whenever it runs out of paper or the printer door is opened. When it recognizes the signal, the Controller should respond by polling the devices on the bus to find out which of them requested service. (Polling is discussed in detail later.)

The printer will assert the SRQ signal until the Controller performs a serial poll or the Paper Out/Door Open condition is corrected.

Note

If Listen Always mode or Secondary Command mode is enabled, the printer will not be able to assert SRQ.

Listen Always Mode

The Listen always mode is enabled or disabled with function switch B8:

Switch B8	Resulting Function
Down	Listen Always mode disabled
Up	Listen Always mode enabled

When Listen Always is enabled, the HP-IB address will not be used in sending data to the printer. Instead, the printer will print all data that is on the bus. Listen Always mode is useful when there is no Controller on the bus. For example, if the printer is supposed to log data from an instrument with an HP-IB interface, and that instrument is configured as a talker (i.e., no Controller will be directing the data to the printer), the printer's Listen Always mode will allow the data logging to take place.

When Listen Always is disabled, the HP-IB address is used to direct data to the printer. Listen Always mode should be disabled whenever you plan to use bus commands to control the devices on the HP-IB.

Note

The Listen Always mode cannot be enabled if secondary command mode is turned on.

Secondary Command Mode

Secondary Command Mode is a bus command mode in which a number of secondary commands are enabled. (Secondary commands may be referred to as Amigo Mode in other literature.) (Bus commands are discussed at length later in this section.) Function switch B9 selects Secondary Command Mode or Standard HP-IB control mode:

Switch B9	Resulting Function
Down	Standard HP-IB Control Mode
Up	Secondary Command Mode

When Standard HP-IB Control Mode is selected, the printer will respond to only the primary level of talk and listen commands, as it is defined later in this section.

When Secondary Command Mode is selected, the printer will accept and respond to an additional, secondary level of commands.

Secondary Command Mode must be disabled whenever you are using the printer on a system that does not support secondary commands. Enabling Secondary Command Mode will automatically disable Listen Always and the Service Request.

ID_Byte

When in Secondary Commands Mode, switches B7 and B8 are redefined to give different ID_Byte numbers. These switches only change the ID_Byte returned in Secondary Command Mode. They do *not* change the functionality of the printer to truly emulate the other printers' escape sequences. Use of these switches helps in configuring printers with older operating systems that would not recognize the 2235 ID_byte.

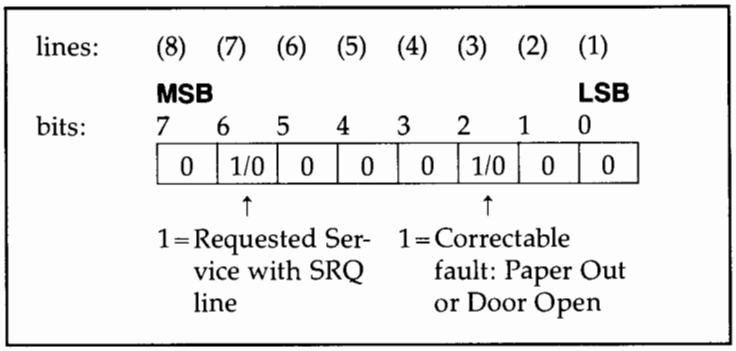
Switch B7	Switch B8	Result
Down	Down	2235A
Up	Down	2673A
Down	Up	2934A
Up	Up	2235A

Polling

The controller on the HP-IB may run periodic checks of the devices on the bus to find out which, if any, of the devices requires service; or a device may request service, which may prompt the controller to check the devices on the bus. These checks are called "Polling." Two kinds of polling may be performed over HP-IB: serial and parallel.

Serial Polling

The controller will perform a serial poll either in search of information or in response to an SRQ. In a serial poll, the controller requests status of one specific device on the bus by addressing only that device to respond. The printer returns an eight-bit byte, which is shown on the next page. Data In/Out (DIO) line numbers are shown in parentheses.



Signal Lines used in serial polling are: ATN (Attention), and DIO (Data In/Out) lines one through eight.

Parallel Polling

Parallel polling provides a fast way for a controller to periodically check to see if any devices need service or to determine which device sent an SRQ. Each of the HP-IB devices with addresses from 0 to 7 is assigned a DIO (Data In/Out) line for polling. The lines correspond to the addresses in the following manner:

Address:	0	1	2	3	4	5	6	7
	↓	↓	↓	↓	↓	↓	↓	↓
Line:	8	7	6	5	4	3	2	1

The controller performs a parallel poll by asserting the EOI (End or Identify) and ATN (Attention) lines. Each device responds by asserting its signed DIO line if it requires service.

When Secondary Command Mode is enabled, the printer will respond to a parallel poll to request service for any of the following conditions: Ready For Data, Ready to Output Data, Power Failure Recovery, Paper Out, or Door Open. When Secondary Command Mode is disabled, the printer will respond to a parallel poll to request service only if paper is out or door open is detected. Signal Lines used in parallel polling are: EOI (End or Identify), ATN (Attention), and DIO lines one through eight.

Bus Commands

The devices on the HP-IB receive special instructions in the form of commands. To send a command over the bus, the controller sets the bus into command mode by asserting the ATN line. Once the ATN line is asserted, the devices on the bus will understand that what follows will not be data, but a command.

The RuggedWriter 480 printer can respond to two different command structures, depending on which HP-IB mode has been selected by the setting of function switch B9. In Standard HP-IB Mode, the printer will respond to primary commands only. In Secondary Command Mode, the printer can respond to primary commands with accompanying secondary commands. Primary commands address each device as either a Talker or a Listener. Secondary commands, which (when enabled) follow the primary commands, give the printer additional instructions as to what kind of talking or listening it will be required to do.

Primary Commands

The Primary commands put each device on the interface bus into either Listen or Talk mode by addressing the device as a Listener or a Talker.

When Secondary Command Mode is disabled, the primary commands are used alone. When Secondary Command Mode is enabled, the primary commands function as the first stage of a two-part command and must be accompanied by a secondary command.

The primary commands supported in both Standard HP-IB and Secondary Command Modes are listed in the following table. The "X" in the representation of the command byte occupies the place that would be used by the parity bit. The parity bit (which is MSB) will be ignored, so its value doesn't matter.

Command Byte	Command Meaning
X 1 0 0 0 A A A	Address to Talk
X 0 1 0 0 A A A	Address to Listen
X 1 0 1 1 1 1 1	Untalk
X 0 1 1 1 1 1 1	Unlisten
X 0 0 1 0 1 0 0	Device Clear

In addition, one primary command is supported in Standard HP-IB Mode, but not in Secondary Command Mode. That command is:

X 0 0 0 0 1 0 0 Selected Device Clear

The first four commands listed are the means by which the bus Controller can maintain order in bus communications. The "Address to Talk," "Untalk," "Address to Listen," and "Unlisten" commands are issued, with the ATN (Attention) line asserted, by the HP-IB Controller as a way of policing access to the shared data bus.

The "AAA" which appears in the "Address to Talk" and "Address to Listen" commands represents the HP-IB address of the device for which the command is intended.

The Controller dictates the role of each of the devices on the bus by asserting the ATN line and sending Talk or Listen addresses on the data lines. For as long as the Controller is asserting the ATN line, all devices must listen to the data lines. When the Controller de-asserts the ATN line, only those devices that have been addressed will actively send or receive data, and all the other devices on the bus will ignore the data lines.

Several Listeners may be active at any one time, but only one device may be active as a Talker. Thus, when the Controller has addressed a device to Talk, that device, and only that device, is allowed to place data on the bus.

Similarly, when the Controller (or the assigned Talker) places data on the bus, the only devices which will accept the data are the ones which have been specifically Addressed to Listen (or the ones which have been set to Listen Always).

When the active Talker sends the last byte of its sequence, it asserts the EOI (End or Identify) line to signify that it is finished.

All data placed on the bus remains on the bus until the last (slowest) Listener has acknowledged receipt of the data byte. The two Device Clear commands are identical in all ways but one: Device Clear will be recognized by all devices on the bus, regardless of their address state, and Selected Device Clear will be recognized only by those devices which are Addressed to Listen.

Secondary Commands

The secondary commands have a two-byte structure to carry their more detailed instructions. The first byte is one of the primary commands, and it sets up the second byte as either a Listen or Talk instruction. The second byte describes what type of Listen or Talk operation is to be performed.

Secondary commands can be used only when Secondary Command Mode is enabled (with function switch B9). Note that if Secondary Command Mode is enabled, the printer will require a secondary command for all Talk and Listen operations.

Secondary Listen Commands

The printer supports three Secondary Listen commands: Device Clear, Print and Slew, and Listen to Data.

The secondary Device Clear command instructs the printer to reset the interface to a known condition and clear any output pending to the HP-IB controller. The command does not cause any changes in the programmed features of the printer. This secondary command is followed by one additional byte, which is used by other devices for parity enabling, but which the printer ignores. The form of the Device Clear command is:

X 1 1 1 0 0 0 0	Device Clear

The Print and Slew command is an instruction controlling the printer's paper feed. The printer receives the primary Listen command followed by the secondary Print and Slew command and one additional byte. If the value of the byte is 64 decimal (40 hex), the printer will perform a Carriage Return and Form Feed. Any other value of the byte will cause the printer to execute a Carriage Return and Line Feed. The form of the Print and Slew command is:

X 1 1 0 1 0 0 0 Print and Slew

The Listen to Data command tells the printer that the bytes following the command represent data to be printed. For maximum bus throughput, the printer should receive data bursts of 32 bytes in length. The burst length can be shorter, but it must be terminated with an Unlisten command, and the last data byte should be sent with EOI asserted. Burst lengths may also be longer than 32 bytes; but all bytes in excess of the first 32 in a burst may be processed at a slightly reduced rate. In addition, bursts which are sent without the controller's first checking whether or not the printer is ready for data (see the Talk DSJ command discussion which follows) may be accepted at a reduced rate.

X 1 1 0 0 0 0 0 Listen to Data

Secondary Talk Commands

The printer supports three Secondary Talk commands: Talk Device Specified Jump (DSJ), Talk I/O Status, and Talk Data.

The Talk DSJ command causes the printer to respond by sending one data byte while asserting the End or Identify (EOI) signal. The byte the printer returns will have a value of 0, 1, or 2, as shown below.

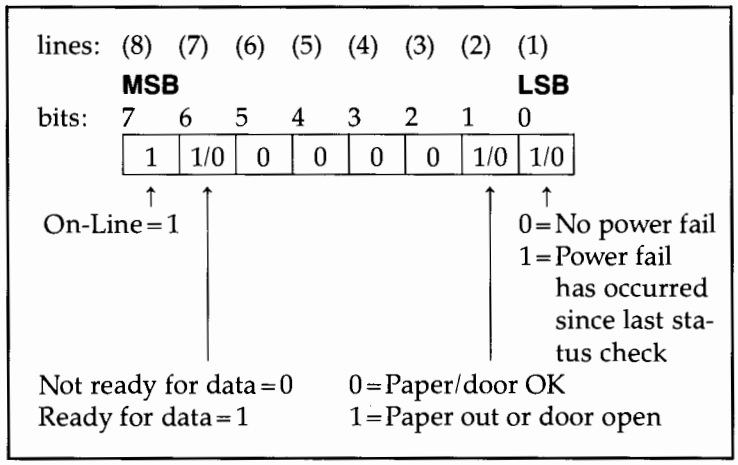
00000000 = Ready to Receive Data.
The printer is ready to receive a data burst of up to 32 bytes in 5 milliseconds.

00000001 = Ready to Send Data.
The printer has data to send (model number, for example) and wants to be Addressed to Talk Data. The appropriate system response to this is to send the primary Talk command followed by the secondary Talk Data command.

00000010 = Read Status.
The printer has some kind of problem, such as a Paper Out condition, and the system should check printer status.

X1110000 Talk DSJ

The Talk I/O Status command is a request from the controller for the printer to report on its current status. When the printer receives the primary Talk command followed by the secondary Talk I/O Status command, the printer responds by asserting EOI and sending the status byte shown below.



The secondary Talk Data command instructs the printer to send data bytes over the interface bus. (Data transmitted by the printer is usually status or model number information.) Data bytes transmitted by the printer are terminated with a Carriage Return, followed by a Line Feed with EOI asserted.

If the printer has no data to send, it will send a null data byte with EOI asserted.

Unrecognized Secondary Commands

If the printer receives a secondary command that it does not recognize, it will respond in one of two ways.

If the unrecognized command was a secondary Listen command, the printer will acknowledge the command as valid, then read and ignore all incoming data bytes until it encounters either an Unlisten command or a data byte with EOI asserted.

If the unrecognized command was a secondary Talk command, the printer responds by sending one ASCII Null character (0) while asserting EOI.

Universal Identify Command

The Universal Identify command is a means for the Controller to accurately pinpoint the identity of devices on the bus. The command consists of two bytes: the first byte is the primary Untalk command, and the second is a secondary command addressing a specific device.

The RuggedWriter 480 printer responds to the Universal Identify command with two data bytes. The first byte of the response is a general device classification which tells the Controller that the printer is a printer/terminal device. The second byte of the response tells the Controller that the printer is an HP2235B printer. These response bytes are shown below.

			Switches		
			B7	B8	
Byte 1:	0 0 1 0 0 0 0 0	(20 Hex)			
Byte 2:	0 0 0 0 1 1 0 1	(0D Hex)	Up Down	Up Down	or =2235B
Byte 2:	0 0 0 1 0 0 0 1	(11 Hex)	Up	Down	=2934A
Byte 2:	0 0 0 0 1 0 1 1	(0B Hex)	Down	Up	=2673A

Interface Reset

All Interface Reset commands return the printer interface to a known state, clear any output pending to the HP-IB controller, and cause the printer to wait in an idle state for the next instruction. The interface reset commands include: InterFace Clear, Device Clear, Untalk, and Unlisten.

These commands affect the interface only. If your intent is to reset the printer, you should use an Esc E and not an Interface Clear command.

6

Help!

The following information is provided to help you solve problems that do not require the gelp of a trained service person. (The telephone numbers of frequently called HP numbers are listed on the inside front cover of this manual. If your printer is not operating properly, follow the suggestions below, then if you still need help with printer operation or set up (configuration), call HP Personal Peripherals Assist at 208-323-2551.

No Power, Keypad Lights Aren't ON:

CHECK...

1. That the printer is turned ON.
2. That the printer is connected completely to the computer, and to the electrical power outlet.
3. That the voltage selection switch is set to the appropriate setting for your area.

Power ON, Keypad Lights are ON, Printer Doesn't Print:

CHECK...

1. That the printer is ON LINE (the ON LINE light will be ON).
2. That the correct interface cable is connected completely to the printer and to the computer.
3. That the printer's cover is completely closed.
4. That the printer is set up correctly for your computer. See Chapter 2 of this manual.

Paper Path Light is Blinking:

CHECK . . .

Z-fold Paper . . .

1. That the printer hasn't run out of paper. Load paper as described in Section 1, Getting Started.
2. That the printer isn't waiting for you to tear-off the last sheet of paper.

Hand Fed Paper . . .

1. That the printer hasn't run out of paper. Load paper as described in Section 1, Getting Started.

Sheet Feeder Paper . . .

1. That the paper cassette hasn't run out of paper. Load paper as described in Section 1, Getting Started.

All Paper Path Lights Are Blinking Simultaneously:

The printer has detected a paper jam. See pages 6-5 to 6-10 of this section for help in clearing a paper jam.

The ON LINE Light is Flashing:

A power on self test error has been detected. Check with qualified HP service personnel.

Paper Does Not Load, Hand Fed:

CHECK . . .

1. That the paper is inserted far enough in the printer for the printer to detect it and advance it.

Printing/Paper Is Skewed or Slanted:

CHECK, Z-fold Paper . . .

1. That the paper is loaded evenly in the tractors.
2. That the paper is torn off cleanly at the perforation.

Hand Fed Paper . . .

1. That the paper is loaded squarely in the printer.
2. That the paper is inserted far enough in the printer for the printer to detect it and advance it.
3. That the paper is not dog-eared, torn, or wrinkled. If it is use the FF key to eject the paper, and load a new sheet.

Poor Print Quality: Faint Print

CHECK . . .

1. The head-gap adjustment lever. It should be set to reflect the quality of print you wish and the thickness of paper you are using. See page 1-13 in Getting Started.
2. That the ribbon cartridge is loaded properly. See page 1-9 in Getting Started.
3. The ribbon. Does it need to be replaced? If yes, see page 1-11 in Getting Started.
4. The print head. Does it need to be replaced? If yes, check with qualified HP service personnel.

Complete Letters Aren't Printing:

CHECK . . .

1. That the ribbon cartridge is loaded properly. See page 1-9 in Getting Started.
2. The ribbon. Does it need to be replaced? If yes, see page 1-11 in Getting Started.
3. The head gap adjustment lever. It should be set to reflect the quality of print you wish and the thickness of paper you are using. See page 1-13 in Getting Started.
4. The print head. Is it worn? If yes, adjust the print head closer to the paper.
5. The print head. Does it need to be replaced? If yes, check with qualified HP service personnel.

Printer Continues to Print After It Has Run Out of Paper:

CHECK . . .

1. That a piece of paper isn't loaded under the platen covering the out-of-paper detector.
2. That the printer is sitting on a level surface.

Printer is Printing on the Platen:

CHECK . . .

1. That function switch A6 is DOWN when you are using 11 inch paper. If you are using A4 paper, set function switch A6 Up. See the Summary of Switch Settings on page 7-2 in the Appendix.
2. That the paper you are using is at least 11 inches long if your software doesn't specify a page length. For landscape mode, your software must specify an 8½-inch page length.
3. That the printer and your PC or terminal are set up properly. See Chapter 2, Setting Up Your Computer or Terminal, for proper settings for your system.

Print Head Doesn't "Home", or Behaves Strangely:

CHECK . . .

1. That the print head path is unobstructed. Open the front cover and look for bits of paper or small objects that might obstruct the print head.
2. That the print head can be moved to the right and left. Turn the printer OFF and try to manually move the print head to the right and back again. If it won't move, contact qualified HP service personnel. Be careful, print head may be HOT.

Printer Won't Print Self Test:

CHECK . . .

1. That you have followed the self test instructions on page 1-21 in Getting Started.
2. That paper hasn't jammed in the printer. See Clearing Paper Jams, pages 6-5 to 6-9.

3. That the print head is moving. If it won't move, contact qualified HP service personnel.
4. That the ribbon cartridge is loaded properly. See page 1-9 in Getting Started.

Self Test Doesn't Resemble Example Shown:

CHECK . . .

1. With qualified HP service personnel.

Clearing Paper Jams:

If a paper jam occurs follow these steps to clear it. **Do not turn the printer OFF to clear a paper jam, or data waiting to print will be lost.** If your attempts to clear the paper jam fail, the paper may be jammed in the rear of the printer and it may be necessary to remove the front and back covers to clean it. This is discussed on pages 6-6 to 6-9. Note that the printer must be turned OFF before the back cover is removed.

General:

1. Press the ON LINE key to stop printing. Press and hold the ON LINE key until the printer stops printing, if necessary.
2. Open the front cover as instructed in Chapter 1, Getting Started.
3. Use the UP or DOWN arrow keys to remove the paper.
4. If the paper jam doesn't clear, try pulling the paper out.
5. Check for, and remove, bits of paper that might obstruct the paper path.
6. Load a new sheet of paper using the FF key.

If paper is caught under the paper bail:

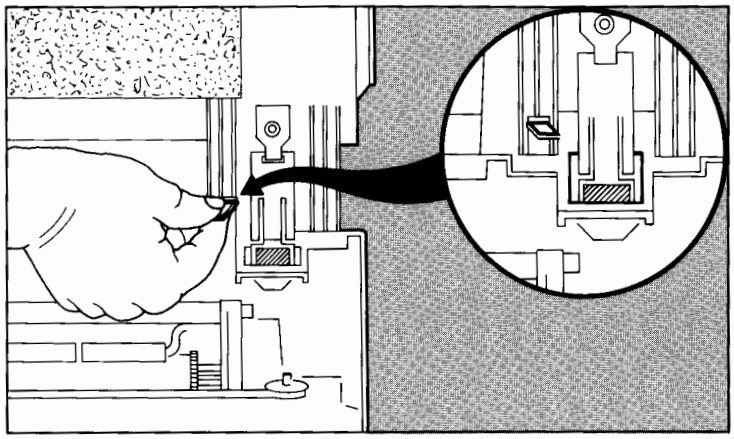
1. Open the front cover as instructed in Chapter 1, Getting Started.
2. Remove the ribbon cartridge for easy access to the jam.

3. Turn OFF the printer and move the print head to the extreme left side of the print carriage.
4. Pull out the jammed paper.
5. Slide the print head to the right and replace the ribbon (see page 1-9).
6. Turn ON the printer and load a new sheet of paper using the FF key.
7. Close the printer's cover.

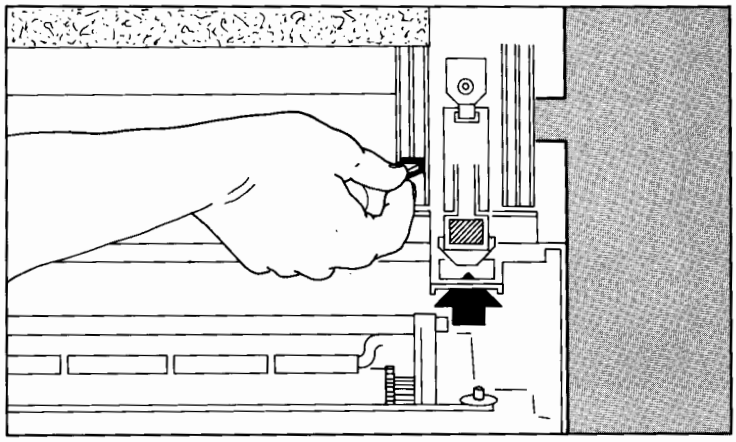
If you are using the sheet feeder and the paper jam is not accessible with the front cover open, remove the paper cassette, and if possible, pull out the jammed paper.

Removing the Front Cover:

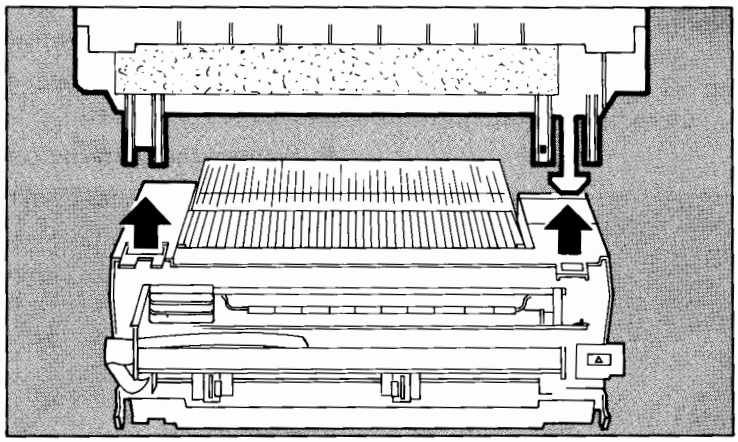
1. Begin with the printer OFF.
2. Unplug the power cord from the connector on the printer's back panel and from the wall outlet.
3. Open the front cover as instructed in Chapter 1, Getting Started.
4. Pull the metal clip, located to the left of the green cover latch, toward you while closing the cover slightly. See below.



5. When you hear the cover latch disengage, pull up on the right side of the cover. See below.



6. Lift the left side of the cover to free it from the printer and lift the cover off. See below.

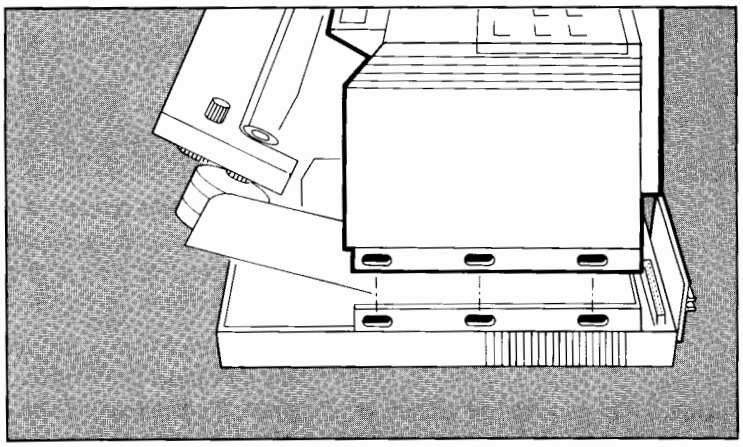


Clearing the Paper Jam:

1. Locate the paper jam and firmly pull out the paper.
2. Check for and remove bits of paper that might obstruct the paper path.

Replacing the Back Cover:

1. Position the back cover over the printer assembly, making sure that the side strip slots on both sides of the cover are aligned with the slots on both sides of the printer housing. See below.



2. Lower the cover into place, then reach back and open the character cartridge door before pushing down on the cover to seat it.
3. Replace the side strips on both sides of the printer and slide them back into place.
4. Replace the front cover as shown on page 6-8.

Preventing Paper Jams:

General:

1. Always use the FF key to load paper. Do not use the LF key or UP and DOWN arrow keys to load paper.

2. Always remove single sheets of paper from the printer by using the FF key, before turning OFF the printer.
3. Do not leave single sheets of paper resting against the paper support. A sheet could slip down into the paper path and block it.
4. Do not attempt to load envelopes in your printer.
5. Make sure that there is no slack in the ribbon. Excessive ribbon slack can partially block the paper path.

Z-fold Paper: **CHECK . . .**

1. That the paper is held taut between the two tractor feed gates.
2. That the paper is loaded evenly in the tractor feed gates.
3. That the tractor feed gates are completely closed over the paper.
4. That the paper is not dog eared, torn, or wrinkled.
5. That the paper has been torn off cleanly at the perforation and the perforation is positioned at the tear edge. Flip the sound muffler forward for easy last form tear off.
6. That the paper's perforation is positioned at the printer's tear edge before changing paper paths, or paper won't retract out of the way of single sheets.
7. That the printer does not print on the first and/or last line of a page. Make sure that your software designates a top and bottom margin.

Hand Fed Paper: **CHECK . . .**

1. That paper was loaded squarely in the printer.
2. That the paper is not dog eared, torn, or wrinkled.
3. That multipart forms are not loaded via the hand fed path.

4. That a single sheet of paper isn't already in the printer. Do not turn the printer OFF with a single sheet of paper loaded in it.
5. That single sheets of paper are removed from the printer before attempting to change paper paths. If paper is not removed, the printer will load paper from both paper paths and cause a paper jam.

Sheet Feeder: CHECK . . .

1. That the paper cassette does not contain more than a ½" thick stack of paper (less than 100 sheets).
2. That the paper is loaded properly in the cassette and that paper at the head of the cassette is loaded under the metal retaining clips and velcro strip. See Paper Loading instructions in Chapter 1, Getting Started.
3. That the cassette is loaded properly in the printer. See Getting Started.
4. That the paper is not dog eared, torn, or wrinkled.
5. That multipart forms are not loaded via the sheet feeder paper path.
6. That a single sheet of paper isn't left in the printer when it's turned OFF.
7. That rubber bands, paper clips, etc. are kept from falling into the paper cassette. These small objects will cause a paper jam if they are loaded into the printer with a sheet of paper.
8. That the printer does not print on the first and/or last line of a page. Make sure that your software designates a top and bottom margin.

Clearing Label Jams

If a label jam occurs follow these steps to clear it:

1. Turn the printer OFF.
2. Open the printer's front cover and remove the ribbon cartridge to allow easy access to the jam.

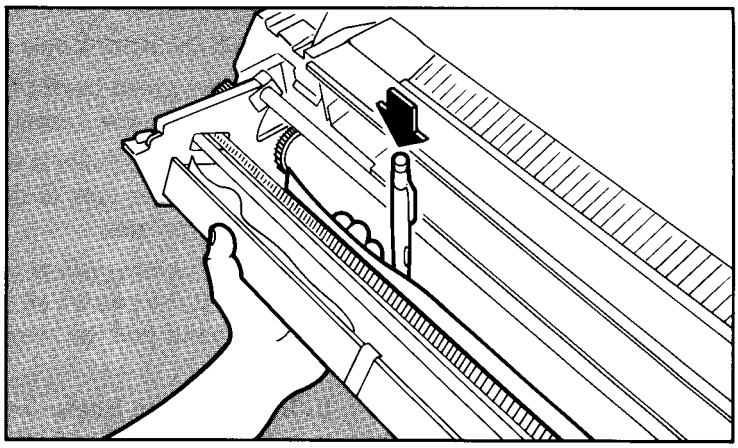
3. Slide the print head away from the jam.
4. Peel off the loose labels that you can reach.
5. Open the green tractor feed gates and tear off the labels remaining in the printer.
6. If the remaining labels were advanced above the tear edge, grasp the top of the labels and firmly pull them from the printer.
7. If the remaining labels are positioned below the tear edge, lift the paper bail with one hand and with the other hand pull the labels out from under the paper bail.
8. If the jammed labels were removed intact, replace the ribbon cartridge and load a new sheet of labels.
9. If the jammed labels were not removed intact, torn pieces may be sticking to other areas of the printer. Removing these pieces is discussed in the next series of steps.

Labels Stuck Behind Paper Tension Spring:

1. Slide the right tractor feed gate to the right side of the printer.
2. Reach one hand up into the printer through the label path located between the green tractor feed gates, and gently pull the paper tension spring about ½" (12 mm) away from the platen. Insert a pen between the paper tension spring and the platen to hold the spring away from the platen. See next page.

Warning

The paper tension spring will be permanently damaged if it is pulled more than ½" (12 mm) away from the platen.



3. Peel off the label from behind the paper tension spring, and remove the pen from the printer.
4. If the jammed labels were removed intact, replace the ribbon cartridge and load a new strip of labels.
5. If pieces of the jammed labels remain on the print head, contact qualified HP service personnel.

Preventing Label Jams

1. Use only labels designed for use with personal computer printers.
2. Avoid using labels that are less than 1 inch (2.5 cm) in height.
3. Avoid using the ON LINE and DOWN arrow keys to retract the labels to the tear edge.

4. Always remove labels from the printer by using the following steps:
   a. Tear off labels at the entrance of the printer.
   b. Press the FF key to advance the remaining labels from the printer.
5. Always remove labels from the printer when the label printing job is complete or before the printer is turned OFF.

Maintenance

Although your RuggedWriter 480 printer doesn't require periodic maintenance, we suggest that you perform the following maintenance to keep your printer in good operating condition.

Exterior

Clean smudges, dust, etc., with a soft cloth moistened with a mild detergent and water. Blow out or vacuum out accumulated paper dust.

Platen

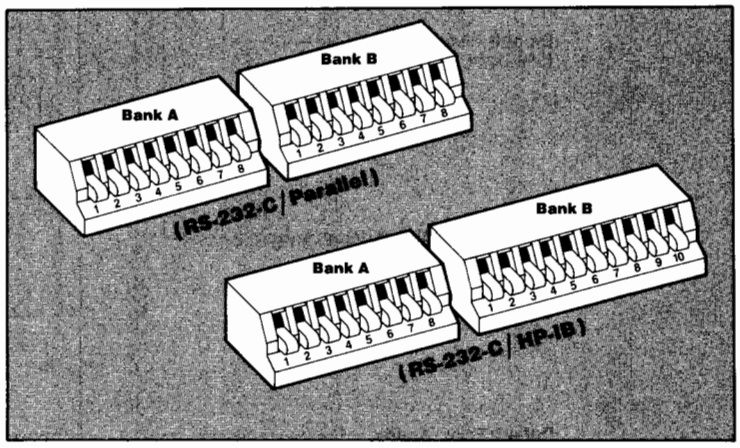
Clean ink off platen with the Platen Cleaner Pak. Call 1-800/538-8787 to order the Platen Cleaner Pak #92193T. Do not clean the platen with isopropyl alcohol.

Notes

Appendix 7

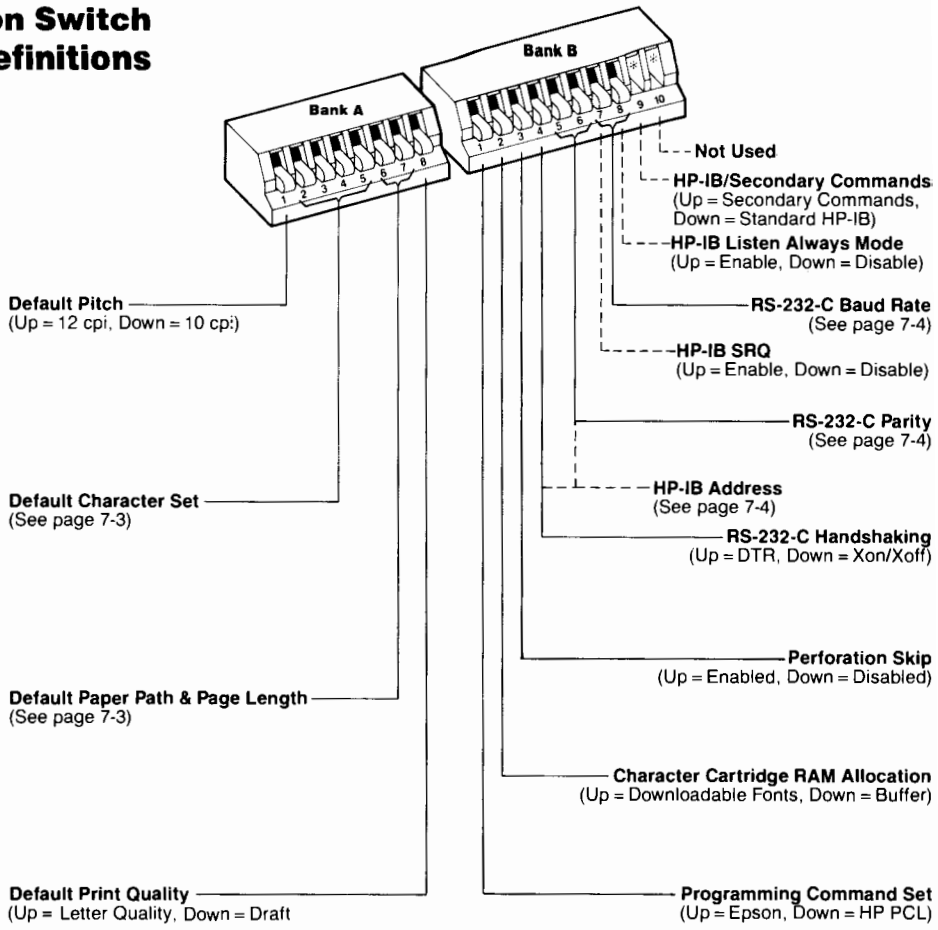
Summary of Switch Settings

RuggedWriter 480 printers have two banks of mode function switches located on the printer's back panel. These switches define a number of printer settings, ranging from page length to data communications settings. The illustration below shows the function switches in their default positions.



Factory Default Settings

Function Switch Definitions



* = Only present on printers with HP-IB Interface.

Character Set Selection

HP PCL Mode (B1 Down)	Epson Mode (B1 Up)	Switch A2	Switch A3	Switch A4	Switch A5
Roman 8 (Default)	Epson USA (Default)	Down	Down	Down	Down
PC-8	PC-8	Down	Down	Down	Up
PC-8 Europe	PC-8 Europe	Down	Down	Up	Down
ISO UK (04)	Epson England	Down	Down	Up	Up
ISO Germany (21)	Epson Germany	Down	Up	Down	Down
ISO France (69)	Epson France	Down	Up	Down	Up
ISO Italy (15)	Epson Italy	Down	Up	Up	Down
ISO Norway (60)	Epson Norway	Down	Up	Up	Up
ISO Sweden (11)	Epson Sweden	Up	Down	Down	Down
ISO Spain (17)	Epson Spain	Up	Down	Down	Up
JIS ASCII (14)	Epson Japan	Up	Down	Up	Down
ECMA-94 Latin 1	Epson Denmark	Up	Down	Up	Up
Terminal Mode	Epson Denmark II	Up	Up	Down	Down
ISO Portugal (16)	Epson Spain II	Up	Up	Down	Up
ISO Sweden (10)	Epson Latin America	Up	Up	Up	Down
Reserved	Reserved	Up	Up	Up	Up

Default Paper Path and Page Length Definitions

Default Paper Path	Page Length	Switch A6	Switch A7
Z-fold	11″	Down	Down
Sheet Feeder	11″	Down	Up
Z-fold*	12″	Up	Down
Z-fold*	11″	Up	Up

*If switch A6 is Up, and the sheet feeder is selected through the keypad, page length will become European A4.

RS-232-C Parity Selection

Switch B5	Switch B6	Parity	Word Length
Down	Down	None	8 Data Bits
Down	Up	Odd	7 Data Bits
Up	Down	Even	7 Data Bits
Up	Up	One	7 Data Bits

RS-232-C Baud Rate Selection

Switch B7	Switch B8	Baud Rate
Down	Down	9600 Baud
Down	Up	19200 Baud
Up	Down	2400 Baud
Up	Up	1200 Baud

HP-IB Address Selection

Switch B4	Switch B5	Switch B6	Address Selected
Down	Down	Down	0
Down	Down	Up	1
Down	Up	Down	2
Down	Up	Up	3
Up	Down	Down	4
Up	Down	Up	5
Up	Up	Down	6
Up	Up	Up	7

Character Set Selection–HP Mode

HP Roman8 Character Set Chart

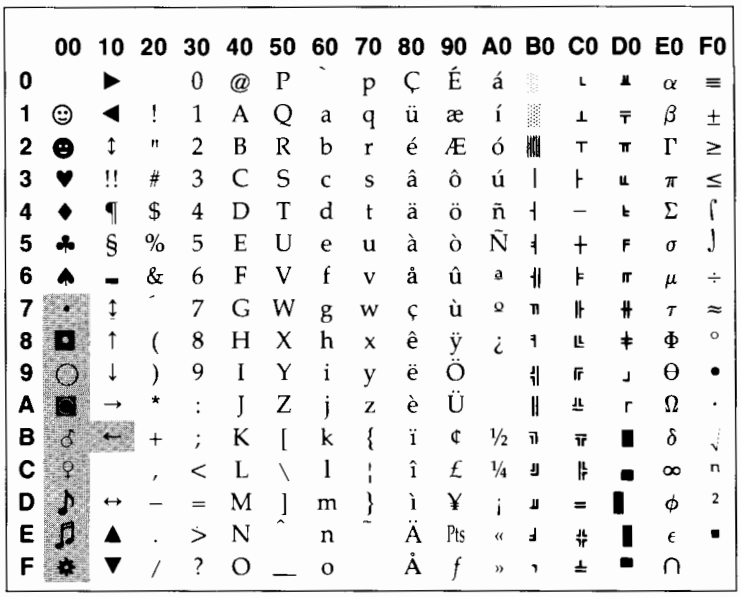
	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
0				0	@	P	`	p				–	â	Å	Á	þ
1			!	1	A	Q	a	q			À	Ý	ê	î	Ã	þ
2			"	2	B	R	b	r			Â	ý	ô	Ø	ã	•
3			#	3	C	S	c	s			È	°	û	Æ	Ð	µ
4			$	4	D	T	d	t			Ê	Ç	á	å	ð	¶
5			%	5	E	U	e	u			Ë	ç	é	í	Í	¾
6			&	6	F	V	f	v			Î	Ñ	ó	ø	Ì	–
7			´	7	G	W	g	w			Ï	ñ	ú	æ	Ó	¼
8			(	8	H	X	h	x			´	¡	à	Ä	Ò	½
9			)	9	I	Y	i	y			`	¿	è	ì	Õ	ª
A			*	:	J	Z	j	z			^	¤	ò	Ö	õ	º
B			+	;	K	[	k	{			¨	£	ù	Ü	Š	«
C			,	<	L	\	l	|		~	¥	ä	É	š	▪
D			–	=	M	]	m	}			Ù	§	ë	ï	Ú	»
E			.	>	N	^	n	~			Û	ƒ	ö	ß	Ÿ	±
F			/	?	O	_	o				£	¢	ü	Ô	ÿ	

International Character Set Chart (ISO)

	ASCII	Swedish Names	Swedish	Spanish	French	German	UK	Portuguese	Norwegian1	Italian	JASCII
ISO Reg. #	6	11	10	17	69	21	4	16	60	15	14
Decimal code 35	#	#	#	£	£	#	£	#	#	£	#
36	$	¤	¤	$	$	$	$	$	$	$	$
64	@	É	@	§	à	§	@	§	@	§	@
91	[	Ä	Ä	¡	°	Ä	[	Ã	Æ	°	[
92	\	Ö	Ö	Ñ	ç	Ö	\	Ç	Ø	ç	¥
93	]	Å	Å	¿	§	Ü	]	Õ	Å	é	]
94	^	Ü	^	^	^	^	^	^	^	^	^
96	`	é	`	`	µ	`	`	`	`	ù	`
123	{	ä	ä	°	é	ä	{	ã	æ	à	{
124	|	ö	ö	ñ	ù	ö	|	ç	ø	ò	|
125	}	å	å	ç	è	ü	}	õ	å	è	}
126	~	ü	~	~	¨	ß	~	°	~	ì	~

PC-8 Character Set Chart

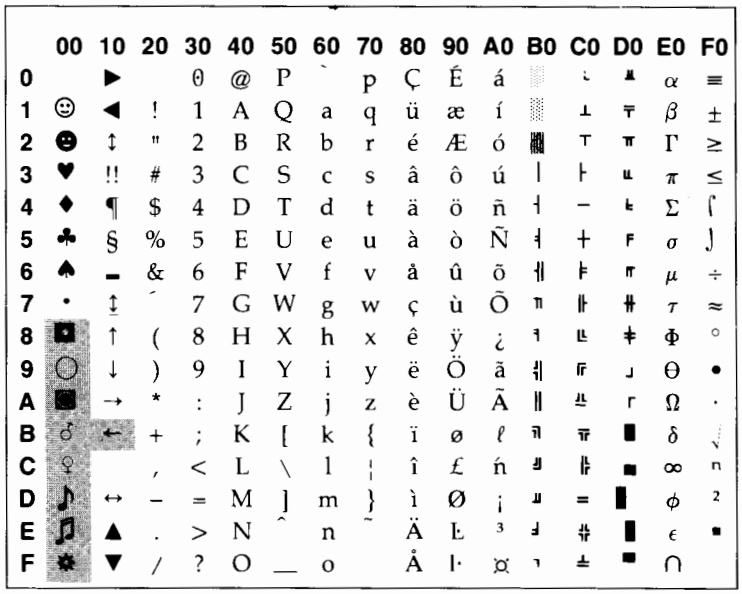
(Characters in shaded area accessible only with Display Functions ON)



	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
0		▶		0	@	P	`	p	Ç	É	á	░	└	╨	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
3	♥	!!	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	å	û	ª	╢	╞	╓	μ	÷
7	•	↨	´	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	Θ	•
A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	ï	¢	½	╗	╦	█	δ	√
C	♀		,	<	L	\	l	¦	î	£	¼	╝	╠	▄	∞	n
D	♪	↔	–	=	M	]	m	}	ì	¥	¡	╜	═	▌	φ	2
E	♫	▲	.	>	N	^	n	~	Ä	Pts	«	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o		Å	ƒ	»	┐	╧	▀	∩	

PC-8 Danish/ Norwegian Character Set Chart

(Characters in shaded area accessible only with Display Functions ON)



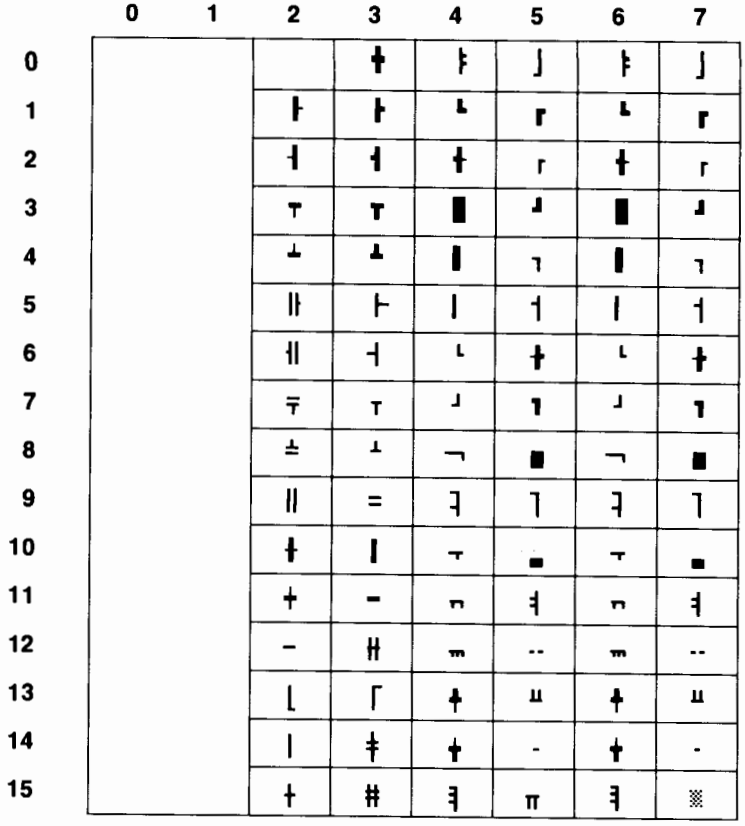
	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
0		▶		θ	@	P	`	p	Ç	É	á	░	└	╨	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
3	♥	!!	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	å	û	õ	╢	╞	╓	μ	÷
7	•	↨	´	7	G	W	g	w	ç	ù	Õ	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	ã	╣	╔	┘	Θ	•
A	◙	→	*	:	J	Z	j	z	è	Ü	Ã	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	ï	ø	ℓ	╗	╦	█	δ	√
C	♀		,	<	L	\	l	¦	î	£	ń	╝	╠	▄	∞	n
D	♪	↔	–	=	M	]	m	}	ì	Ø	¡	╜	═	▌	φ	2
E	♫	▲	.	>	N	^	n	~	Ä	Ł	³	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o		Å	ł·	¤	┐	╧	▀	∩	

ECMA-94 Latin 1 Character Set Chart

	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
0				0	@	P	`	p				°	À	Ð	à	ð
1			!	1	A	Q	a	q			¡	±	Á	Ñ	á	ñ
2			"	2	B	R	b	r			¢	²	Â	Ò	â	ò
3			#	3	C	S	c	s			£	³	Ã	Ó	ã	ó
4			$	4	D	T	d	t			¤	´	Ä	Ô	ä	ô
5			%	5	E	U	e	u			¥	µ	Å	Õ	å	õ
6			&	6	F	V	f	v			¦	¶	Æ	Ö	æ	ö
7			´	7	G	W	g	w			§	•	Ç	×	ç	÷
8			(	8	H	X	h	x			¨	¸	È	Ø	è	ø
9			)	9	I	Y	i	y			©	¹	É	Ù	é	ù
A			*	:	J	Z	j	z			ª	º	Ê	Ú	ê	ú
B			+	;	K	[	k	{			«	»	Ë	Û	ë	û
C			,	<	L	\	l	|		¬	¼	Ì	Ü	ì	ü
D			-	=	M	]	m	}				½	Í	Ý	í	ý
E			.	>	N	^	n	~			®	¾	Î	Þ	î	þ
F			/	?	O	_	o				¯	¿	Ï	ß	ï	ÿ

HP Line Draw Character Set (Seven Bit)

(Available only on optional character cartridge, HP P/N 12235A)



HP Proportional Space Widths

This table contains the HP Roman8 Character Set widths for each of the supported typefaces for the RuggedWriter 480 printer. All of the values are shown in 1/360th's of an inch.

Roman8 Character Set Chart

Symbol	Draft	Cour	Micro	Pres Elite	Letter Gothic	Times Roman	Helvetica
Space	36	36	18	30	29	27	29
!	11	13	10	13	12	13	13
"	20	19	16	23	19	27	19
#	35	35	23	31	28	36	35
$	29	25	20	24	23	26	27
%	29	32	25	29	32	35	32
&	32	31	21	28	28	38	31
'	20	14	12	15	15	13	14
(	17	16	14	18	16	18	16
)	17	16	14	18	16	18	16
*	29	27	21	29	27	21	27
+	29	33	21	29	27	27	33
,	17	16	12	15	14	13	16
-	29	33	18	27	24	24	33
.	11	12	9	12	12	13	12
/	35	36	24	23	26	31	36
0	35	30	23	28	29	27	29
1	35	30	23	28	29	27	29
2	35	30	23	28	29	27	29
3	35	30	23	28	29	27	29
4	35	30	23	28	29	27	29
5	35	30	23	28	29	27	29
6	35	30	23	28	29	27	29
7	35	30	23	28	29	27	29
8	35	30	23	28	29	27	29
9	35	30	23	28	29	27	29
:	17	12	10	12	12	12	12
;	17	16	12	15	14	12	15
<	29	25	19	25	26	17	25
=	29	27	21	30	24	21	27
>	29	25	19	25	26	17	25
?	29	28	18	22	23	22	26

Roman8 Character Set Chart cont.

Symbol	Draft	Cour	Micro	Pres Elite	Letter Gothic	Times Roman	Helvetica
@	32	28	23	29	28	28	28
A	29	39	23	35	30	38	33
B	32	34	19	29	26	32	28
C	29	33	20	29	26	32	34
D	29	35	21	30	27	34	30
E	29	33	19	29	25	33	27
F	29	33	19	30	25	33	27
G	29	35	20	32	27	36	34
H	29	34	20	30	26	37	30
I	23	29	15	27	19	20	9
J	29	35	20	32	26	32	23
K	32	36	21	33	26	38	30
L	29	33	19	31	25	33	27
M	35	39	24	35	30	40	35
N	32	36	22	35	26	40	30
O	29	36	22	31	27	34	36
P	29	33	20	32	25	33	28
Q	29	36	22	31	27	34	36
R	29	37	20	31	27	35	28
S	29	30	20	27	26	27	28
T	35	35	21	31	29	32	31
U	29	37	20	33	27	35	29
V	29	39	23	35	30	39	31
W	29	39	24	37	29	41	41
X	29	35	20	35	28	37	32
Y	29	33	23	33	29	37	33
Z	29	29	21	28	27	33	30
[	23	18	16	18	18	18	18
\	35	36	24	25	26	32	36
]	23	18	16	18	18	18	18
^	23	25	23	21	27	21	25
_	41	42	27	39	39	39	42
`	20	14	12	15	15	13	14
a	32	33	20	28	26	29	28
b	29	35	20	30	27	29	26
c	29	31	19	26	26	25	24
d	29	37	20	28	27	28	26
e	35	32	20	28	27	26	27
f	29	30	20	24	27	25	18
g	29	36	20	29	27	28	26
h	29	37	20	31	25	30	24
i	17	27	15	25	17	17	9
j	23	26	18	22	23	21	14
k	26	32	19	32	25	32	23
l	17	32	15	27	16	17	9
m	38	41	23	34	30	41	37
n	29	37	20	30	25	31	24
o	29	32	20	29	27	28	27

Roman8 Character Set Chart cont.

Symbol	Draft	Cour	Micro	Pres Elite	Letter Gothic	Times Roman	Helv
p	29	36	20	30	27	30	26
q	29	36	20	29	27	30	26
r	26	35	19	28	26	29	18
s	32	28	18	26	22	24	24
t	29	32	21	25	28	25	19
u	29	37	20	31	25	30	24
v	29	35	21	31	24	30	29
w	29	41	23	36	31	41	39
x	29	34	21	32	25	29	26
y	29	33	24	31	29	30	29
z	29	28	18	25	25	24	24
{	20	19	17	19	23	23	19
|	11	9	9	9	9	9	9
}	20	19	17	19	23	23	19
~	32	31	22	27	31	26	31
DEL	29	34	23	33	29	33	34
À	35	39	23	35	30	38	33
Á	35	39	23	35	30	38	33
È	29	33	19	29	25	33	27
Ê	29	33	21	29	25	33	27
Ë	29	33	19	29	25	33	27
Î	23	29	21	27	19	20	9
Ï	23	29	15	27	19	20	9
´	14	36	15	30	30	31	36
`	17	36	15	30	30	31	36
^	23	36	21	30	30	31	36
¨	23	36	17	30	30	31	36
~	32	36	21	30	30	31	36
Ù	35	37	20	33	27	35	29
Û	35	37	21	33	27	35	29
£	35	30	23	30	30	33	30
–	41	42	24	36	36	42	42
Y	29	33	23	33	29	37	33
y	29	33	24	31	29	30	29
•	23	22	20	22	20	22	22
Ç	29	33	20	29	26	32	34
ç	29	29	19	26	26	25	24
N	35	36	22	35	26	40	30
n	32	37	21	30	25	31	24
¡	11	13	9	13	12	13	13
¿	29	26	18	22	23	22	26
¤	35	36	24	33	33	27	31
£	35	30	23	30	30	35	30
¥	35	33	23	33	29	37	33
§	29	24	20	24	24	27	24
f	38	33	20	33	32	35	33
¢	29	29	19	26	26	25	24

Roman8 Character Set Chart cont.

Symbol	Draft	Cour	Micro	Pres Elite	Letter Gothic	Times Roman	Helvetica
â	32	33	21	28	26	29	28
ê	29	32	21	28	27	26	27
ô	29	32	21	29	27	28	27
û	29	37	21	31	25	30	24
á	32	33	20	28	26	29	28
é	29	32	20	28	27	26	27
ó	29	32	20	29	27	28	27
ú	29	37	20	31	25	30	24
à	32	34	20	28	26	29	28
è	29	33	20	28	27	26	27
ò	29	33	20	29	27	28	27
ù	29	37	20	31	25	30	24
ä	32	33	20	28	26	29	28
ë	29	32	20	28	27	26	27
ö	29	32	20	29	27	28	27
ü	29	37	20	31	25	30	24
Å	35	39	23	35	30	38	33
î	26	27	21	25	16	17	9
Ø	35	36	22	31	28	34	36
Æ	38	41	24	37	37	40	36
å	32	33	20	28	26	29	28
í	23	27	16	25	16	17	9
ø	29	33	24	29	26	28	27
æ	41	42	24	37	37	38	42
Ä	35	39	23	35	30	38	33
ì	23	27	15	25	16	17	9
Ö	35	36	22	31	27	34	36
Ü	35	37	20	33	27	35	29
É	29	33	19	29	25	33	27
ï	26	27	17	25	16	17	9
ß	32	28	23	28	28	31	28
Ô	35	36	22	31	27	34	27
Á	35	39	23	35	30	38	33
Ã	35	39	23	35	30	38	33
ã	32	33	21	28	26	29	28
Đ	35	38	24	30	33	34	33
ð	35	28	23	28	27	32	28
Í	23	29	15	27	19	20	9
Î	23	29	15	27	19	20	9
Ó	35	36	22	31	27	34	36
Ò	35	36	22	31	27	34	36
Õ	35	36	22	31	27	34	36
õ	32	32	21	29	27	28	27
S	35	30	21	27	26	27	28
s	32	28	18	26	22	24	24
Ú	35	37	20	33	27	35	29
Ÿ	29	33	23	33	29	37	29
ÿ	29	33	24	31	29	30	29

Roman8 Character Set Chart cont.

Symbol	Draft	Cour	Micro	Pres Elite	Letter Gothic	Times Roman	Helvetica
Þ	35	34	24	36	32	31	27
þ	32	37	20	30	24	25	26
·	23	16	20	16	16	16	16
µ	32	35	21	35	35	36	35
¶	41	34	23	34	34	34	34
¾	29	27	21	27	27	27	27
–	35	33	24	33	33	33	33
¼	29	27	21	27	27	27	27
½	29	27	21	27	27	27	27
ª	29	27	21	27	27	27	27
º	29	27	21	27	27	27	27
«	32	27	24	27	27	27	27
▪	23	24	18	24	24	24	24
»	32	27	24	27	27	27	27
±	35	33	21	33	33	33	33

ASCII-Decimal-Hex Table

The Roman-8 symbol set is an 8-bit symbol set. In addition to the symbols of the standard ASCII symbol set, it also contains international characters and symbols.

ASCII-Decimal-Hex Table

CHAR.	DEC.	HEX.
CTL@	0	00
CTLA	1	01
CTLB	2	02
CTLC	3	03
CTLD	4	04
CTLE	5	05
CTLF	6	06
CTLG	7	07
CTLH	8	08
CTLI	9	09
CTLJ	10	0A
CTLK	11	0B
CTLL	12	0C
CTLM	13	0D
CTLN	14	0E
CTLO	15	0F
CTLP	16	10
CTLQ	17	11
CTLR	18	12
CTLS	19	13
CTLT	20	14
CTLU	21	15
CTLV	22	16
CTLW	23	17
CTLX	24	18
CTLY	25	19
CTLZ	26	1A
CTL[	27	1B
CTL\	28	1C
CTL]	29	1D
CTL^	30	1E
CTL_	31	1F

CHAR.	DEC.	HEX.
	32	20
!	33	21
"	34	22
#	35	23
$	36	24
%	37	25
&	38	26
'	39	27
(	40	28
)	41	29
*	42	2A
+	43	2B
,	44	2C
-	45	2D
.	46	2E
/	47	2F
0	48	30
1	49	31
2	50	32
3	51	33
4	52	34
5	53	35
6	54	36
7	55	37
8	56	38
9	57	39
:	58	3A
;	59	3B
<	60	3C
=	61	3D
>	62	3E
?	63	3F

CHAR.	DEC.	HEX.
@	64	40
A	65	41
B	66	42
C	67	43
D	68	44
E	69	45
F	70	46
G	71	47
H	72	48
I	73	49
J	74	4A
K	75	4B
L	76	4C
M	77	4D
N	78	4E
O	79	4F
P	80	50
Q	81	51
R	82	52
S	83	53
T	84	54
U	85	55
V	86	56
W	87	57
X	88	58
Y	89	59
Z	90	5A
[	91	5B
\	92	5C
]	93	5D
^	94	5E
_	95	5F

CHAR.	DEC.	HEX.
`	96	60
a	97	61
b	98	62
c	99	63
d	100	64
e	101	65
f	102	66
g	103	67
h	104	68
i	105	69
j	106	6A
k	107	6B
l	108	6C
m	109	6D
n	110	6E
o	111	6F
p	112	70
q	113	71
r	114	72
s	115	73
t	116	74
u	117	75
v	118	76
w	119	77
x	120	78
y	121	79
z	122	7A
{	123	7B
|	124	7C
}	125	7D
~	126	7E
▒	127	7F

ASCII-Decimal-Hex (continued)

CHAR.	DEC.	HEX.
8_0	128	80
8_1	129	81
8_2	130	82
8_3	131	83
8_4	132	84
8_5	133	85
8_6	134	86
8_7	135	87
8_8	136	88
8_9	137	89
8_A	138	8A
8_B	139	8B
8_C	140	8C
8_D	141	8D
8_E	142	8E
8_F	143	8F
9_0	144	90
9_1	145	91
9_2	146	92
9_3	147	93
9_4	148	94
9_5	149	95
9_6	150	96
9_7	151	97
9_8	152	98
9_9	153	99
9_A	154	9A
9_B	155	9B
9_C	156	9C
9_D	157	9D
9_E	158	9E
9_F	159	9F

CHAR.	DEC.	HEX.
	160	A0
A	161	A1
Â	162	A2
È	163	A3
É	164	A4
Ê	165	A5
Ì	166	A6
Í	167	A7
¨	168	A8
©	169	A9
ª	170	AA
«	171	AB
¬	172	AC
Ù	173	AD
Û	174	AE
¯	175	AF
¯	176	B0
Ý	177	B1
ý	178	B2
°	179	B3
Ç	180	B4
ç	181	B5
Ñ	182	B6
ñ	183	B7
¡	184	B8
¿	185	B9
¤	186	BA
£	187	BB
¥	188	BC
§	189	BD
ƒ	190	BE
ç	191	BF

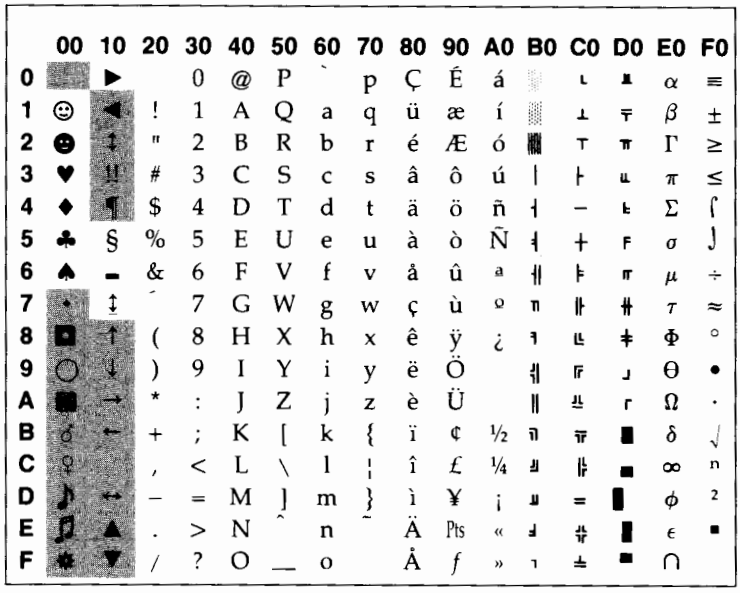
CHAR.	DEC.	HEX.
ã	192	C0
ê	193	C1
ô	194	C2
ù	195	C3
ä	196	C4
ë	197	C5
ö	198	C6
ü	199	C7
à	200	C8
è	201	C9
ò	202	CA
ù	203	CB
ã	204	CC
ë	205	CD
õ	206	CE
ü	207	CF
Å	208	D0
ì	209	D1
Ø	210	D2
Æ	211	D3
å	212	D4
ì	213	D5
ø	214	D6
æ	215	D7
Ä	216	D8
ì	217	D9
Ö	218	DA
Ü	219	DB
É	220	DC
ı	221	DD
ß	222	DE
Ô	223	DF

CHAR.	DEC.	HEX.
A	224	E0
À	225	E1
ã	226	E2
Ð	227	E3
d	228	E4
Ì	229	E5
Ì	230	E6
Ó	231	E7
Ò	232	E8
Ô	233	E9
õ	234	EA
Š	235	EB
š	236	EC
U	237	ED
Ý	238	EE
y	239	EF
Þ	240	F0
þ	241	F1
•	242	F2
µ	243	F3
¶	244	F4
¾	245	F5
—	246	F6
¼	247	F7
½	248	F8
ª	249	F9
º	250	FA
«	251	FB
■	252	FC
»	253	FD
±	254	FE
DEL	255	FF

Character Set Selection– Epson Mode

PC-8 Character Set Chart

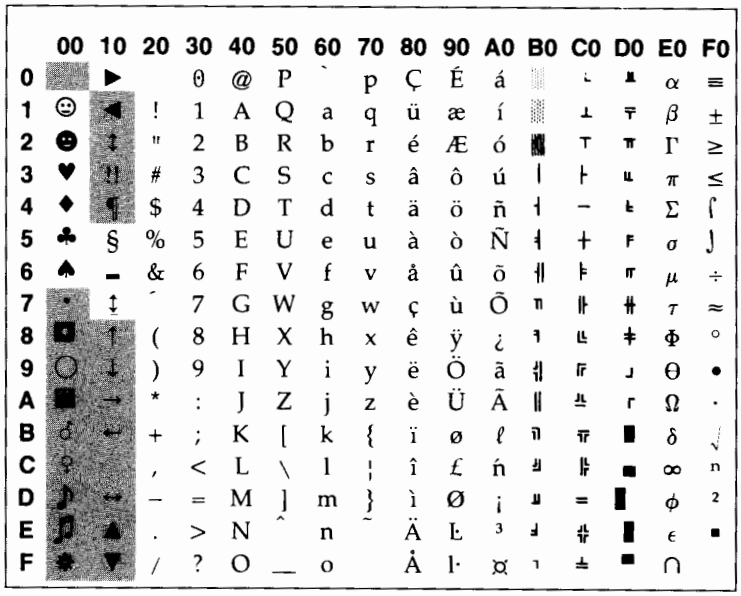
(Characters in shaded area not printable)



	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
0		▶		0	@	P	`	p	Ç	É	á	░	└	╨	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
3	♥	‼	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	å	û	ª	╢	╞	╓	μ	÷
7	•	↨	´	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	Θ	•
A	◙	→	*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	ï	¢	½	╗	╦	█	δ	√
C	♀	∟	,	<	L	\	l	¦	î	£	¼	╝	╠	▄	∞	n
D	♪	↔	–	=	M	]	m	}	ì	¥	¡	╜	═	▌	φ	²
E	♫	▲	.	>	N	^	n	~	Ä	₧	«	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o		Å	ƒ	»	┐	╧	▀	∩	

PC-8 Danish/ Norwegian Character Set Chart

(Characters in shaded area not printable)



	00	10	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
0		▶		0	@	P	`	p	Ç	É	á	░	└	╨	α	≡
1	☺	◀	!	1	A	Q	a	q	ü	æ	í	▒	┴	╤	β	±
2	☻	↕	"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
3	♥	‼	#	3	C	S	c	s	â	ô	ú	│	├	╙	π	≤
4	♦	¶	$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
5	♣	§	%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
6	♠	▬	&	6	F	V	f	v	å	û	õ	╢	╞	╓	μ	÷
7	•	↨	´	7	G	W	g	w	ç	ù	Õ	╖	╟	╫	τ	≈
8	◘	↑	(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
9	○	↓	)	9	I	Y	i	y	ë	Ö	ã	╣	╔	┘	Θ	•
A	◙	→	*	:	J	Z	j	z	è	Ü	Ã	║	╩	┌	Ω	·
B	♂	←	+	;	K	[	k	{	ï	ø	ℓ	╗	╦	█	δ	√
C	♀	∟	,	<	L	\	l	¦	î	£	ń	╝	╠	▄	∞	n
D	♪	↔	–	=	M	]	m	}	ì	Ø	¡	╜	═	▌	φ	²
E	♫	▲	.	>	N	^	n	~	Ä	Ł	³	╛	╬	▐	ε	■
F	☼	▼	/	?	O	_	o		Å	ł	¤	┐	╧	▀	∩	

International Character Set Chart–Epson

Dec. Code:	35	36	64	91	92	93	94	96	123	124	125	126
USA	#	$	@	[	\	]	^	'	{	¦	}	~
France	#	$	à	°	ç	§	^	'	é	ù	è	¨
Germany	#	$	§	Ä	Ö	Ü	^	'	ä	ö	ü	ß
UK	£	$	@	[	\	]	^	'	{	¦	}	~
Denmark I	#	$	@	Æ	Ø	Å	^	'	æ	ø	å	~
Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
Spain	Pt	$	@	¡	Ñ	¿	^	'	¨	ñ	}	~
Japan	#	$	@	[	¥	]	^	'	{	¦	}	~
Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Spain II	#	$	á	¡	Ñ	¿	é	'	í	ñ	ó	ú
Latin America	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú

Epson Proportional Space Widths

This table contains the Epson character set widths for the default font. For widths of other supported typefaces, consult the HP Proportional Space Widths table on page 7-9.

Character	Code	Size
Space	32	30
!	33	18
"	34	30
#	35	30
$	36	30
%	37	36
&	38	36
'	39	18
(	40	24
)	41	24
*	42	30
+	43	30
,	44	18
-	45	30
.	46	18
/	47	30
0	48	30
1	49	30
2	50	30
3	51	30
4	52	30
5	53	30
6	54	30
7	55	30
8	56	30
9	57	30
:	58	18
;	59	18
<	60	30
=	61	30
>	62	30
?	63	30
@	64	36
A	65	36
B	66	36
C	67	36
D	68	36
E	69	36
F	70	36
G	71	36
H	72	36
I	73	24
J	74	30
K	75	36

Character	Code	Size
L	76	36
M	77	42
N	78	36
O	79	36
P	80	36
Q	81	36
R	82	36
S	83	36
T	84	36
U	85	42
V	86	36
W	87	42
X	88	36
Y	89	36
Z	90	30
[	91	24
\	92	30
]	93	24
^	94	30
_	95	42
`	96	18
a	97	30
b	98	36
c	99	30
d	100	36
e	101	30
f	102	24
g	103	36
h	104	36
i	105	18
j	106	24
k	107	36
l	108	18
m	109	42
n	110	36
o	111	30
p	112	36
q	113	36
r	114	30
s	115	30
t	116	24
u	117	36
v	118	36
w	119	42

cont.

Character	Code	Size
x	120	30
y	121	36
z	122	30
{	123	24
¦	124	18
}	125	24
~	126	30
•		24
·o·		30
ß		36
Ø		36
ø		30
¨		30
§		30
ü		36
é		30
ä		30
à		30
å		30
ç		30
è		30
ì		18
Ä		36
Å		36
É		36
æ		42
Æ		42
ö		30
ò		30
ù		36
Ö		36
Ü		42
£		30
¥		36
Pt		42
ñ		36
Ñ		36
¿		30
¡		30

Sub/Super Proportional Space

Space	32	20
!	33	12
"	34	20
#	35	20
$	36	20
%	37	24
&	38	24
'	39	12
(	40	16

Character	Code	Size
)	41	16
*	42	20
+	43	20
,	44	12
-	45	20
.	46	12
/	47	20
0	48	20
1	49	20
2	50	20
3	51	20
4	52	20
5	53	20
6	54	20
7	55	20
8	56	20
9	57	20
:	58	12
;	59	12
<	60	20
=	61	20
>	62	20
?	63	20
@	64	24
A	65	24
B	66	24
C	67	24
D	68	24
E	69	24
F	70	24
G	71	24
H	72	24
I	73	16
J	74	20
K	75	24
L	76	24
M	77	28
N	78	24
O	79	24
P	80	24
Q	81	24
R	82	24
S	83	24
T	84	24
U	85	28
V	86	24
W	87	28
X	88	24
Y	89	24
Z	90	20
[	91	16

cont.

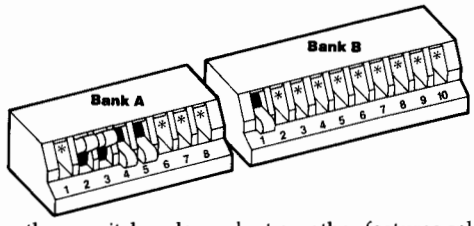
Character	Code	Size
\	92	20
]	93	16
^	94	20
_	95	28
`	96	12
a	97	20
b	98	24
c	99	20
d	100	24
e	101	20
f	102	16
g	103	20
h	104	24
i	105	12
j	106	16
k	107	24
l	108	12
m	109	28
n	110	24
o	111	20
p	112	24
q	113	24
r	114	20
s	115	20
t	116	16
u	117	24
v	118	24
w	119	28
x	120	20
y	121	24
z	122	20
{	123	16
¦	124	12
}	125	16

Character	Code	Size
~	126	20
°	3	16
◌̣		20
ß		24
Ø		24
ø		20
¨		20
§		20
ü		24
é		20
ä		20
à		20
å		20
ç		20
è		20
ì		12
Ä		24
Å		24
É		24
æ		28
Æ		28
ö		20
ò		20
ù		24
Ö		24
Ü		28
£		20
¥		24
Pt		28
ñ		24
Ñ		24
¿		20
¡		12

Printing Line Draw Characters from an HP Terminal

Line draw printing requires installing the optional HP12235A character cartridge. The line draw characters displayed on your HP terminal can be printed on RuggedWriter 480 printers by using your terminal's normal print controls (shift/print, log, copy page, etc.).

Follow the hardware configuration for your terminal as described in Chapter 2. You may need to set your printer's mode function switches to Terminal Mode as shown below. Note that Terminal Mode selects the Roman8 character set.



*Settings for these switches dependent on other features selected.

Line Spacing for HP Line Draw Characters

The line draw characters displayed by many terminals are special characters 1/6" high. The HP Line Draw characters printed by your printer are the same height as "normal" capital letters. When the default line spacing of 6 lpi is used the printer's line draw characters will not connect line-to-line. To set the line spacing to 8 lines per inch, ensuring that the line draw characters connect, follow these steps from the terminal's keyboard:

1. Home the cursor.
2. Move through the softkeys until the **modes** keys are displayed. This is usually done by pressing **f4**.
3. Press **f7** to turn on **DISPLAY FUNCTNS**. Be sure that an asterisk (*) appears in the DISPLAY FUNCTNS field.
4. Press the **ESC** key, then type **&18D**.
5. Press **f7** to turn off **DISPLAY FUNCTNS**. Be sure that the asterisk (*) disappears from the DISPLAY FUNCTNS field.

Before printing be sure to position the cursor at the beginning of the escape sequence you have just entered.

Character Cartridge

The following fonts are available on the optional 12235A Character Cartridge.

Letter Gothic 12

```
@ABC  DEFGHIJK  LMNOPQRS  TUVWXYZ[  \]^_`abc  !"#$%&´()*+defghijk  ,-./0123lmnopqrs  456789:;tuvwxyz{  <=>?|}~
âêôû  áéóúàèòù  äëöüÅîØÆ  åíøæÄìÖÜ  ÉïßÔÁÃãÐ  ÀÂÈÊËÎÏ˙¨ˆ˜…ðÌÍÓÒÕõŠ  ˜ÙÛ£¯Ýý°šÚŸÿÞþ·µ  ÇçÑñ¡¿¤£¶¼–½¾ª«  ¥§ƒ¢■»±
```

Prestige Elite 12

```
@ABC  DEFGHIJK  LMNOPQRS  TUVWXYZ[  \]^_`abc  !"#$%&´()*+defghijk  ,-./0123lmnopqrs  456789:;tuvwxyz{  <=>?|}~
âêôû  áéóúàèòù  äëöüÅîØÆ  åíøæÄìÖÜ  ÉïßÔÁÃãÐ  ÀÂÈÊËÎÏ˙¨ˆ˜…ðÌÍÓÒÕõŠ  ˜ÙÛ£¯Ýý°šÚŸÿÞþ·µ  ÇçÑñ¡¿¤£¶¼–½¾ª«  ¥§ƒ¢■»±
```

Times Roman PS

```
@ABC  DEFGHIJK  LMNOPQRS  TUVWXYZ[  \]^_‘abc  !"#$%&’()*+defghijk  ,-./0123lmnopqrs  456789:;tuvwxyz{  <=>?|}~
âêôû  áéóúàèòù  äëöüÅîØÆ  åíøæÄìÖÜ  ÉïßÔÁÃãÐ  ÀÂÈÊËÎÏ˙¨ˆ˜…ðÌÍÓÒÕõŠ  ˜ÙÛ£¯Ýý°šÚŸÿÞþ·µ  ÇçÑñ¡¿¤£¶¼–½¾ª«  ¥§ƒ¢■»±
```

Helvetica 10

```
@ABC  DEFGHIJK  LMNOPQRS  TUVWXYZ[  \]^_‘abc  !"#$%&’()*+defghijk  ,-./0123lmnopqrs  456789:;tuvwxyz{  <=>?|}~
âêôû  áéóúàèòù  äëöüÅîØÆ  åíøæÄìÖÜ  ÉïßÔÁÃãÐ  ÀÂÈÊËÎÏ˙¨ˆ˜…ðÌÍÓÒÕõŠ  ˜ÙÛ£¯Ýý°šÚŸÿÞþ·µ  ÇçÑñ¡¿¤£¶¼–½¾ª«  ¥§ƒ¢■»±
```

Escape Sequences

Send the following HP Mode escape sequences to select these fonts and their default attributes:

E_C(8UE_C(s0p12h12v0s0b6t1Q= **This is an example of Letter Gothic 12.**
E_C(8UE_C(s0p12h12v0s0b8t1Q= **This is an example of Prestige ELite 12.**
E_C(8UE_C(s1p10h12v0s0b5t1Q= **This is an example of Times Roman PS**
E_C(8UE_C(s0p10h12v0s0b4t1Q= This is an example of Helvetica 10.

Send the following Epson Mode escape sequences to select these fonts and their default attributes:

E_CR$s_H$$E_CpN_U$$E_CxS_H$$E_C$k~$E_C$M= **This is an example of Letter Gothic 12.**
E_CR$s_H$$E_CpN_U$$E_CxS_H$$E_CkE_X$$E_C$M= **This is an example of Prestige ELite 12.**
E_CR$s_H$$E_CpS_H$$E_CxS_H$$E_C$k}$E_C$P= **This is an example of Times Roman PS**
E_CR$s_H$$E_CpN_U$$E_CxS_H$$E_CkS_H$$E_C$P= This is an example of Helvetica 10.

Ordering Information

HP2235A - Centronics parallel and RS-232 dual I/O without sheetfeeder
HP2235B - HP-IB and RS-232 dual I/O without sheetfeeder
HP2235C - Centronics and RS-232 dual I/O with sheetfeeder
HP2235D - HP-IB and RS-232 dual I/O with sheetfeeder

The standard unit includes: printer, power cord, ribbon, owner's manual. Sheetfeeder accessory is included for HP2235C and HP2235D. Power supply voltage is user-configurable to 100, 120, 220, or 240V. Cables must be ordered separately.

Supplies and Accessories

Product Number	Description
12235A	Font Cartridge (4 additional fonts and 16K RAM) Includes: Prestige Elite 12, Letter Gothic 12, Times Roman PS, Helvetica 10, 16K RAM for downloads
12235C	Demo Cartridge
12239A	Single-bin Sheet Feeder (US letter-size paper tray)
12239B	Single-bin Sheet Feeder (EUR A-4 size paper tray)
92166A	Desktop Printer Stand
92214P	Floor Printer Stand
92156S	Standard Ribbon (5 million draft characters/ribbon)
02235-90002	HP RuggedWriter 480 Owner's Manual
02235-90003	HP RuggedWriter 480 Service Manual

Fast phones for price and availability by location:
Austria: (0222) 25 00 or 615/616 • Belguim/Luxembourg: (02) 7 62 32 00 • Denmark: (02) 8166 40, Ext. 258 • Finland: (90) 4 55 0211 • France: (6) 9 28 32 64 • Greece: (01) 6473360-1 • Italy: (02) 92 36 91 or (06) 5 48 31 • Middle East: Athens – (01) 808-0359 • Norway: (02) 17 1180 • South Africa: Johannesburg – (011) 802 5111; Cape Town – (021) 53 7954; Durban – (031) 28 4178 • Spain: (01) 6 38 4013 • Sweden: (08) 750 20 28 • The Netherlands: (020) 47 0639 • Switzerland: (057) 312254/59 • United Kingdom: (0734) 69 72 01 • United States: 800-538-8787; California – 408-738-4133 • West Germany: 0130 33 22

Interface and Cable Requirements

HP/NON-HP SYSTEM SERIES/MODEL	PRINTER I/O	HOST INTERFACE	CABLE
Touchscreen PC/150	Serial	Built-in	13242G
	HP-IB	Built-in	10833A/B/C/D
Vectra PC	Parallel	HP24540A	24542D
	Serial	HP24541A (25-pin)	13242G
		HP24540A/41A (9-pin)	24542G
HP 250/260	Serial	See 250/260 documentation	13242N/M
	HPIB	See 250/260 documentation	10833A/B/C/D
HP1000 A/E/F	Serial	12040 C/D/ Multiplexer	92219G
	HP-IB	See HP1000 documentation, 12009A HP-IB Interface	10833 A/B/C/D
HP3000 (3X, 4X, 5X, 6X, 70, Micro3000, Micro3000XE)	Serial	ADCC and ATP (25 pin) or ATP (3-pin)	13242Y, 92219G, 13242N 13242N
HP9000(200,300,500)	HPIB	Built-in	10833 A/B/C/D
HP2392/93/94/97 Terminal	Parallel	Opt. 093 or HP40210P	13242D or 40242D
	Serial	Opt. 092 or HP40210R	13242G or 40242G
IBM PC Family and compatibles	Parallel	IBM Parallel Printer Adaptor or HP24540A	24542D
	Serial	IBM Asyn. Com. Adaptor (25-pin) IBM Serial/Parallel Adaptor (9-pin)	13242H 24542G

Specifications

Print Speed	Draft mode: 480 cps (12 cpi); 400 cps (10 cpi) Letter-quality mode: 240 cps (12 cpi); 200 cps (10 cpi)
Character Structure	Draft mode: 12×12 Letter-quality mode: 36×24 Wire size: .28 mm (.011")
Character Sets	PCL Mode: Roman8, PC-8(Dk/No), JISASCII, ECMA-94Latin1, ISO 7-bit languages (support UK, Germany, France, Italy, Norway, Sweden, Spain, Portugal) EPSON Mode: PC-8(DN), Epson 7-bit languages (support USA, England, Germany, France, Italy, Norway, Sweden, Spain, Japan, Denmark, DenmarkII, SpainII, and Latin America)
Graphics	Resolution for PCL mode format: 90×90 normal, 180×180 high resolution Resolution for Epson mode format: 60×60, 60×180, 80×60, 90×180, 90×60, 120×180, 120×60, 180×180, 240×60, 360×180
Printing Format	For PCL mode control format: 10 - Pica (136 columns), 12 - Elite (163 columns), 16.7 - Compressed (227 columns), 20 - Compressed (272 columns), 5 - Expanded (68 columns), Proportional space, True sub/superscript (Italics, bold, and underline available in all pitches). For Epson mode control format: 10 - Pica (136 columns), 12 - Elite (163 columns), 15 - Elite (204 columns), 17.13 - Compressed (232 columns), 20 - Compressed (272 columns), 5 - Expanded (68 columns), 6 - Expanded (81 columns), 7.5 Expanded (102 columns), 8.53 - Expanded (116 columns), Proportional space, True sub/superscript (Italics, bold, and underline available in all pitches). Line spacing variable
Operational Modes	Switch selectable Epson and HP modes
Command Language and Emulation	HP Printer Command Language PCL Level 3; Epson Esc/P (LQ-1000/LQ-1500)
Paper Handling	Triple paper path: Adjustable tractors, Friction feed, Single bin sheet feeder accessory (up to 100 sheet capacity). Auto paper load 6-part forms Last-form tearoff

Forms Requirements	Paper widths: 76.2mm (3") to 380mm (14.95") Paper length minimum: 104.14mm (4.1") Forms tractor minimum width between holes: 76.2mm (3") Printable line: 345.4mm (13.6") maximum Paper thickness maximum (pack): .3mm (.01")
Key Pad	Keys: On-line, Select Print Mode, Up Arrow, Down Arrow, Select Paper Path, Form Feed, Line Feed Indicators: Ready, Tractor Fed, Bin Fed, Hand Fed, Draft, Compressed, Letter Quality
Power Requirements	Input voltage: 100, 120, 220, 240 volts AC (+10%, −10%), user selectable All voltages: 47.5/63 Hz Power consumption: 20 W. maximum non-printing; 80 W. maximum printing
Interface and Datacomm	Dual I/O: Centronics Parallel, RS-232 Serial (HP2235A/C), HP-IB, RS-232 Serial (HP2235B/D) Xon/Xoff Protocol, DTR Busy Handshake
Environmental	Operating temperature: 5°C (50°F) to 40°C (104°F) Storage temperature: −40°C (−22°F) to 70°C (140°F) Acoustics per ISO SP 7779 standard: Sound pressure level-Lpa: 58 dB(A) @ 1 meter bystander position. Humidity: 15% to 80% RH, noncondensing
Physical Specifications	209mm (8.2") H×600mm (23.6") W×350mm (13.7") D 15.9 kg (35 lbs.) net weight
Product Certifications	UL, CSA, IEC Compliance. FCC Class B certified per FCC Rules, Part 15, subpart J, when used with a Class B computing device.
Buffer	2K (Optional 16K with character cartridge)
Reliability and Duty Cycle	No duty cycle limitations; 125,000 page life MTBF 20,000 hours based on 10% AFR, 2000 hours power-on and 25,000 printed pages annual usage.

Escape Sequence/ Control Code Summary–HP Mode

Print Features	Escape Sequence or Control Code	ASCII Decimal Equiv.	ASCII Hex. Equiv.
FONT CONTROL			
Set # ID as Character Set	E_C (#ID	27, 40, #, #	1B, 28, #, #
Secondary Character Set	E_C) #ID	27, 41, #, #	1B, 29, #, #
Select Print Pitch	E_C (s # H	27, 40, 115, #, 72	1B, 28, 73, #, 48
Set Pitch to 10 cpi	E_C & k 0 S	27, 38, 107, 48, 83	1B, 26, 6B, 30, 53
Set Pitch to 5 cpi	E_C & k 1 S	27, 38, 107, 49, 83	1B, 26, 6B, 31, 53
Set Pitch to 16.7 cpi	E_C & k 2 S	27, 38, 107, 50, 83	1B, 26, 6B, 32, 53
Set Pitch to 12 cpi	E_C & k 4 S	27, 38, 107, 52, 83	1B, 26, 6B, 34, 53
Return Proportional Spacing	E_C (s 0 P	27, 40, 115, 48, 80	1B, 28, 73, 30, 50
Select Proportional Spacing	E_C (s 1 P	27, 40, 115, 49, 80	1B, 28, 73, 31, 50
Disable Font Style–Normal	E_C (s 0 S	27, 40, 115, 48, 83	1B, 28, 73, 30, 53
Enable Font Style–Italic	E_C (s 1 S	27, 40, 115, 49, 83	1B, 28, 73, 31, 53
BOLD OR EMPHASIZED			
Disable Stroke Weight–Normal	E_C (s 0 B	27, 40, 115, 48, 66	1B, 28, 73, 30, 42
Enable–Bold	E_C (s 3 B	27, 40, 115, 51, 66	1B, 28, 73, 33, 42
Enable–Emphasized Print	E_C (s 7 B	27, 40, 115, 55, 66	1B, 28, 73, 37, 42
UNDERLINE			
Enable Underline	E_C & d D	27, 38, 100, 68	1B, 26, 64, 44
Disable Underline	E_C & d @	27, 38, 100, 64	1B, 26, 64, 40
SUB/SUPERSCRIPTS			
Begin Subscript	E_C (s –1 U	27, 40, 115, 45, 49, 85	1B, 28, 73, 2D, 31, 55
Begin Superscript	E_C (s 1 U	27, 40, 115, 49, 85	1B, 28, 73, 31, 55
Resume Normal Printing	E_C (s 0 U	27, 40, 115, 48, 85	1B, 28, 73, 30, 55
SELECTING CHARACTER SETS			
HP Roman 8	E_C (8 U	27, 40, 56, 85	1B, 28, 38, 55
PC8-US	E_C (10 U	27, 40, 49, 48, 85	1B, 28, 31, 30, 55
PC8-Denmark/Norway	E_C (11 U	27, 40, 49, 49, 85	1B, 28, 31, 31, 55
ECMA-94 Latin 1	E_C (0 N	27, 40, 48, 78	1B, 28, 30, 4E
HP Line Draw	E_C (0 L	27, 40, 48, 76	1B, 28, 30, 4C
TYPEFACE			
Select Typeface–Courier	E_C (s 3 T	27, 40, 115, 51, 84	1B, 28, 73, 33, 54
Select Typeface–Line Printer	E_C (s 0 T	27, 40, 115, 48, 84	1B, 28, 73, 30, 54

*Typeface available on optional font cartridge.

Print Features (Cont.)	Escape Sequence or Control Code	ASCII Decimal Equiv.	ASCII Hex. Equiv.
Select Typeface–Gothic*	E_C (s 6 T	27, 40, 115, 54, 84	1B, 28, 73, 36, 54
Select Typeface–Pres. Elite*	E_C (s 8 T	27, 40, 115, 56, 84	1B, 28, 73, 38, 54
Select Typeface–Tms Rmn*	E_C (s 5 T	27, 40, 115, 53, 84	1B, 28, 73, 35, 54
Select Typeface–Helv*	E_C (s 4 T	27, 40, 115, 52, 84	1B, 28, 73, 34, 54
Select Draft Quality	E_C (s 0 Q	27, 40, 115, 48, 81	1B, 28, 73, 30, 51
Select Letter Quality	E_C (s 2 Q	27, 40, 115, 50, 81	1B, 28, 73, 32, 51
Char. Height–12 point	E_C (s 12 V	27, 40, 115, 49, 50, 86	1B, 28, 73, 31, 32, 56
Char. Height–8 point	E_C (s 8 V	27, 40, 115, 56, 86	1B, 28, 73, 38, 56
PAGE FORMAT			
Define Text Length	E_C & ℓ # F	27, 38, 108, #, 70	1B, 26, 6C, #, 46
Define Page Length	E_C & ℓ # P	27, 38, 108, #, 80	1B, 26, 6C, #, 50
Enable Perf-Skip	E_C & ℓ 1 L	27, 38, 108, 49, 76	1B, 26, 6C, 31, 4C
Disable Perf-Skip	E_C & ℓ 0 L	27, 38, 108, 48, 76	
MARGINS			
Clear Margins	E_C 9	27, 57	1B, 39
Set Left Margin	E_C & a # L	27, 38, 97, #, 76	1B, 26, 61 #, 4C
Set Right Margin	E_C & a # M	27, 38, 97, #, 77	1B, 26, 61, #, 4D
Set Top Margin	E_C & ℓ # E	27, 38, 108, #, 69	1B, 26, 6C, #, 45
PAPER PATH CONTROL			
Eject Current Page	E_C & ℓ 0 H	27, 38, 108, 48, 72	1B, 26, 6C, 30, 48
Feed from SheetFeeder	E_C & ℓ 1 H	27, 38, 108, 49, 72	1B, 26, 6C, 31, 48
Feed from Handfed Path	E_C & ℓ 2 H	27, 38, 108, 50, 72	1B, 26, 6C, 32, 48
Feed from Tractor	E_C & ℓ –1 H	27, 38, 108, 45, 49, 72	1B, 26, 6C, 2D, 31, 48
PRINT POSITIONING			
HORIZONTAL MOTION			
Define HMI	E_C & k # H	27, 38, 107, #, 72	1B, 26, 6B, #, 48
Horiz position–Dots	E_C * p # X	27, 42, 112, #, 88	1B, 2A, 70, #, 58
Horiz position–Decipoints	E_C & a # H	27, 38, 97, #, 72	1B, 26, 61, #, 48
Move to column #	E_C & a # C	27, 38, 97, #, 67	1B, 26, 61, #, 43
VERTICAL MOTION			
Define VMI	E_C & ℓ # C	27, 38, 108, #, 67	1B, 26, 6C, #, 43
Perform Half Line Feed	E_C =	27, 61	1B, 3D
Set spacing to # lpi	E_C & ℓ # D	27, 38, 108, #, 68	1B, 26, 6C, #, 44
Move Print Pos.–Dots	E_C * p # Y	27, 42, 112, #, 89	1B, 2A, 70, #, 59
Move Print Pos.–Decipoints	E_C & a # V	27, 38, 97, #, 86	1B, 26, 61, #, 56
Move Print Pos. Row	E_C & a # R	27, 38, 97, #, 82	1B, 26, 61, #, 52
GRAPHICS			
Transfer one Raster Row	E_C * b # W	27, 42, 98, #, 87	1B, 2A, 62, #, 57
Raster Graphics ON	E_C * r # A	27, 42, 114, #, 65	1B, 2A, 72, #, 41
Raster Graphics OFF	E_C * r B	27, 42, 114, 66	1B, 2A, 72, 42

*Typeface available on optional font cartridge.

Print Features (Cont.)	Escape Sequence or Control Code	ASCII Decimal Equiv.	ASCII Hex. Equiv.
Specify Raster Width	E_C * r # S	27, 42, 114, #, 83	1B, 2A, 72, #, 53
Set Graphics Res. to 90	E_C * t 90 R	27, 42, 116, 57, 48, 82	1B, 2A, 74, 39, 30, 52
Set Graphics Res. to 180	E_C * t 180 R	27, 42, 116, 49, 56, 48, 82	1B, 2A, 74, 31, 38, 30, 52
Temporary X offset	E_C * b # X	27, 42, 98, #, 88	1B, 2A, 62, #, 58
Temporary Y offset	E_C * b # Y	27, 42, 98, #, 89	1B, 2A, 62, #, 59
CHARACTER & FONT DOWNLOAD			
Copy ROM to RAM	E_C * c 6 F	27, 42, 99, 54, 70	1B, 2A, 63, 36, 46
Delete Char.	E_C * c 3 F	27, 42, 99, 51, 70	1B, 2A, 63, 33, 46
Download One Character	E_C (s # W	27, 40, 115, #, 87	1B, 28, 73, #, 57
Define New Font	E_C) s # W	27, 41, 115, #, 87	1B, 29, 73, #, 57
Set Character Code	E_C * c # E	27, 42, 99, #, 69	1B, 2A, 63, #, 45
Clear RAM Font	E_C * c 0 F	27, 42, 99, 48, 6A	1B, 2A, 63, 30, 46
Select RAM as Primary Font	E_C) 0 X	27, 40, 48, 88	1B, 26, 30, 58
Select RAM as Secondary Font	E_C (0 X	27, 40, 48, 88	1B, 28, 30, 58
DISPLAY FUNCTIONS MODE			
Enable Display Functions	E_C Y	27, 89	1B, 59
Disable Display Functions	E_C Z	27, 90	1B, 5A
MISCELLANEOUS			
Printer Reset	E_C E	27, 69	1B, 45
Perform Self Test	E_C z	27, 122	1B, 7A
Transparent Print Data	E_C & p # X	27, 38, 112, #, 88	1B, 26, 70, #, 58
Line by Line Enhance Ctrl	E_C & k 0 E	27, 38, 107, 48, 69	1B, 26, 6B, 30, 45
SI/SO Control	E_C & k # F	27, 38, 107, # 70	1B, 26, 6B, #, 46
Select Line Terminator	E_C & k # G	27, 38, 107, #, 71	1B, 26, 6B, #, 47
Enable Wrap-around Mode	E_C & s 0 C	27, 38, 115, 48, 67	1B, 26, 73, 30, 43
Disable End-of-Line Wrap	E_C & s 1 C	27, 38, 115, 49, 67	1B, 26, 73, 31, 43
Mode Enhancement Ctrl.	E_C & k 1 E	27, 38, 107, 49, 69	1B, 26, 6B, 31, 45
Mode Basis (Default) SI/SO	E_C & k 1 F	27, 38, 107, 49, 70	1B, 26, 6B, 31, 46
Auto View Mode	E_C & k 0 V	27, 38, 107, 48, 86	1B, 26, 6B, 30, 56
Manual View Mode (Default)	E_C & k 1 V	27, 38, 107, 49, 86	1B, 26, 6B, 31, 56
Request Model Number	E_C * r k	27, 42, 114, 75	1B, 2A, 72, 4B
Request I/O Status	E_C ? D_C 1	27, 63, 17	1B, 3F, 11

Escape Sequence/ Control Code Summary–EPSON Mode

Print Features	Escape Sequence or Control Code	ASCII Decimal Equiv.	ASCII Hex. Equiv.
PITCH CONTROL			
Print Pica–10 cpi	E_C P	27, 80	1B, 50
Print Elite–12 cpi	E_C M	27, 77	1B, 4D
Print Fifteen–15 cpi	E_C g	27, 103	1B, 67
Select Condensed	S_I	15	0F
Select Condensed	E_C S_I	27, 15	1B, 0F
Cancel Condensed	D_C2	18	12
Select Double-width	E_C W S_H	27, 87, 1	1B, 57, 01
Cancel Double-width	E_C W N_U	27, 87, 0	1B, 57, 00
Select Double-width by Line	S_O	14	0E
Select Double-width by Line	E_C S_O	27, 14	1B, 0E
Cancel Double-width by Line	D_C4	20	14
QUALITY & ENHANCEMENTS			
Select Letter Quality	E_C x S_H	27, 120, 1	1B, 78, 01
Select Draft Quality	E_C x N_U	27, 120, 0	1B, 78, 00
Select Emphasized print	E_C E	27, 69	1B, 45
Cancel Emphasized print	E_C F	27, 70	1B, 46
Select Double-strike	E_C G	27, 71	1B, 47
Cancel Double-strike	E_C H	27, 72	1B, 48
UNDERLINE			
Select Underline	E_C – S_H	27, 45, 1	1B, 2D, 01
Cancel Underline	E_C – N_U	27, 45, 0	1B, 2D, 00
ITALICS			
Select Italics	E_C 4	27, 52	1B, 34
Cancel Italics	E_C 5	27, 53	1B, 35
SUB/SUPERSCRIPTS			
Select Subscript	E_C S S_H	27, 83, 1	1B, 53, 01
Select Superscript	E_C S N_U	27, 83, 0	1B, 53, 00
Cancel Sub/Superscript	E_C T	27, 84	1B, 54
MASTER SELECT	E_C ! #	27, 33, #	1B, 21, #
SELECT CHARACTER SET	E_C R #	27, 82, #	1B, 52, #

Print Features (Cont.)	Escape Sequence or Control Code	ASCII Decimal Equiv.	ASCII Hex. Equiv.
PROPORTIONAL SPACING			
Select Proportional Spacing	E_C p S_H	27, 112, 1	1B, 70, 01
Cancel Proportional Spacing	E_C p N_U	27, 112, 0	1B, 70, 00
TYPESTYLE			
Courier	E_C k N_U	27, 107, 0	1B, 6B, 00
Helvetica*	E_C k S_H	27, 107, 1	1B, 6B, 01
Pres. Elite*	E_C k E_X	27, 107, 3	1B, 6B, 03
Times Roman*	E_C k }	27, 107, 125	1B, 6B, 7D
Letter Gothic*	E_C k ~	27, 107, 126	1B, 6B, 7E
PAGE FORMAT			
Line Feed	L_F	10	0A
Form Feed	F_F	12	0C
Set Line Spacing–6 lpi	E_C S_X	27, 50	1B, 32
Set Line Spacing–8 lpi	E_C N_U	27, 48	1B, 30
Set Line Spacing 180/# lpi	E_C 3 #	27, 51, #	1B, 33, #
Set Line Spacing 60/# lpi	E_C A #	27, 65, #	1B, 41, #
Set Page Length–Lines	E_C C #	27, 67, #	1B, 43, #
Set Page Length–Inches	E_C C N_U #	27, 67, 0, #	1B, 43, 00, #
Define/Enable Perf-skip–Lines	E_C N #	27, 78, #	1B, 4E, #
Cancel Perf-skip	E_C O	27, 79	1B, 4F
Set Right Margin	E_C Q #	27, 81, #	1B, 51, #
Set Left Margin	E_C ℓ #	27, 108, #	1B, 6C, #
Set Horizontal Tab Stops	HT	09	09
Set Horizontal Tabs	E_C D # # . . ., N_U	27, 68, #, . . ., 0	1B, 44, #, . . ., 00
Set Relative Tabs–Horiz.	E_C e N_U #	27, 101, 0, #	1B, 65, 00, #
Set Vertical Tab	VT	11	0B
Set Vertical Tab Stops	E_C B # # . . ., N_U	27, 66, #, . . ., 0	1B, 42, #, . . ., 00
Set Relative Tabs–Vert	E_C e S_H #	27, 101, 1, #	1B, 65, 01, #
Set Vert Tabs–Channels	E_C b # # . . ., # N_U	27, 98, #, . . ., 0	1B, 62, #, . . ., 00
Select Vert Tab Channel	E_C / #	27, 47, #	1B, 2F, #
PRINT POSITIONING			
Select Justification	E_C a #	27, 97, #	1B, 61, #
Select Char. Space	E_C S_P #	27, 32, #	1B, 20, #
Absol. Horiz. Pos.	E_C $ # #	27, 36, #	1B, 24, #
Relative Horiz. Pos.	E_C \ #, #	27, 92, #1, #2	1B, 5C, #1, #2
Relative Vert. Pos.	E_C J #	27, 74, #	1B, 4A, #
Horiz. Relative Move	E_C f N_U #	27, 102, 0, #	1B, 66, 00, #
Vert. Relative Move	E_C f S_H #	27, 102, 1, #	1B, 66, 01, #

*Typeface available with optional font cartridge.

Print Features (Cont.)	Escape Sequence or Control Code	ASCII Decimal Equiv.	ASCII Hex. Equiv.
GRAPHICS			
Single Density Graphics	E_C K n1 n2	27, 75, #1, #2	1B, 4B, #1, #2
Double Density Graphics	E_C L n1 n2	27, 76, #1, #2	1B, 4C, #1, #2
Double Density Graphics	E_C Y n1 n2	27, 89, #1, #2	1B, 59, #1, #2
Quad Density Graphics	E_C Z n1 n2	27, 90, #1, #2	1B, 5A, #1, #2
Print Graphic Image	E_C * * #1 #2	27, 42, #, #1, #2	1B, 2A, #, #1, #2
Reassign Graphics Mode	E_C ? # #	27, 63, #, #	1B, 3F, #, #
USER-DEFINED CHARACTERS			
Select RAM font	E_C % S_H	27, 37, 1	1B, 25, 01
Deselect RAM font	E_C % N_U	27, 37, 0	1B, 25, 00
Copy ROM into RAM	E_C : N_U N_U N_U	27, 58, 0, 0, 0	1B, 3A, 00, 00, 00
Define User-defined Char.	E_C & 0 # . . .	27, 38, 0, #, . . .	1B, 26, 00, #, . . .
MOST SIGNIFICANT BIT CONTROL			
Set MSB = 0	E_C =	27, 61	1B, 3D
Set MSB = 1	E_C >	27, 62	1B, 3E
Cancel MSB Control	E_C #	27, 35	1B, 23
MISCELLANEOUS			
Back space	B_S	08	08
Carriage Return	C_R	13	0D
Space	SP	32	20
Initialize Printer	E_C @	27, 64	1B, 40
Eject Current Page	E_C E_M R	27, 25, 82	1B, 19, 52
Activate Tractor Feed	E_C E_M 0	27, 25, 48	1B, 19, 30
Feed from Bin 1	E_C E_M 1	27, 25, 49	1B, 19, 31
Feed from Manual Insertion	E_C E_M 2	27, 25, 50	1B, 19, 32
Activate Sheet Feeder	E_C E_M 4	27, 25, 52	1B, 19, 34
Cancel Line	CAN	24	18
Delete Character	DEL	127	7F

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02235-90002

Reorder Number 02235-90002
Part Number 02235-90002
Printed in U.S.A. 1/91 CMP

HEWLETT PACKARD