OKI

People to People Technology

MICROLINE 320/321 Elite

Microline Compatible
Printer Handbook

Note to Customers

Every effort has been made to ensure that the information in this document is complete, accurate, and up to date. Oki assumes no responsibility for the results of errors beyond its control. Oki also cannot guarantee that changes in software and equipment made by other manufacturers and referred to in this book will not affect the applicability of the information in this manual.

Written and produced by Oki. Please address any comments to Oki.

This product complies with the requirements of the Council Directives 89/336/EEC and 73/23/EEC on the approximation of the laws of the member states relating to electromagnetic compatibility and low voltage.

IMPORTANT SAFETY INSTRUCTIONS

Your Oki printer has been carefully designed to give you years of safe, reliable performance. As with all electrical equipment, however, there are a few basic precautions you should take to avoid hurting yourself or damaging the printer.

- Read the setup and operating instructions in this Handbook carefully. Be sure to save it for future reference.
- Read and follow all warning and instruction labels on the printer itself.
- Unplug the printer before you clean it. Use only a damp cloth; do not use liquid or aerosol cleaners.
- Place your printer on a firm, solid surface. If you put it on something unsteady, it may fall and be damaged; if you place it on a soft surface, such as a rug, sofa, or bed, the vents may be blocked, causing the printer to overheat.
- To protect your printer from overheating, make sure all openings on the printer are not blocked. Do not put the printer on or near a heat source, such as a radiator. If you put the printer in any kind of enclosure, make sure it is well ventilated.
- The printhead can get quite hot when it has been printing for a length of time. Do not touch the printhead until it has had a chance to cool off.
- Do not use your printer near water, or spill liquid of any kind into it.
- Be certain that your power source matches the rating listed on the back of the printer. If you are not sure, check with your dealer or with your local power company.
- Your printer has an earthed plug as a safety feature, and it will only fit into an earthed socket. If you cannot plug it in, chances are you have an older, non-earthed socket; contact an electrician to have the socket replaced. Do not use an adapter to defeat the earth.
- To avoid damaging the power cord, do not put anything on it or place it where it will be walked on. If the cord becomes damaged or frayed, replace it immediately.

- If you are using an extension cord or power strip with the printer, make sure that the total of the amperes required by all the equipment on the extension is less than the extension's rating. The total ratings of all equipment plugged into the outlet should not exceed 15 amperes.

- Do not poke anything into the ventilation slots on the sides of the printer; you could get a shock or cause a fire.

- Aside from the routine maintenance described in this Handbook, do not try to service the printer yourself; opening the cover may expose you to shocks or other hazards. Do not make any adjustments other than those outlined in the Handbook—you may cause damage requiring extensive repair work.

- If anything happens that indicates that your printer is not working properly or has been damaged, unplug it immediately. These are some of the things to look for:

  The power cord or plug is frayed or damaged.

  Liquid has been spilled into the printer, or it has been exposed to water.

  The printer has been dropped, or the cabinet is damaged.

  The printer does not function normally when you are following the operating instructions.

Table of Contents

Important

You have just bought the best printer, so be sure to use the only ribbons recommended for it. Original Oki ribbons are the only ones that the manufacturers recommend. Ask for them by name.

And please remember that if you buy any other ribbon your warranty may be invalidated.

Purchasing inferior ribbons really does not make sense. They do not last as long. What is more, they are prone to shredding, which can cause damage to your printhead. Any short term savings on cheap ribbons are quickly lost.

So do not waste your time and money ... insist on Oki consumables for your Oki printer.

You can order them from your printer supplier.

Introduction

This Guide is arranged to help you get your new MICROLINE 320 Elite or 321 Elite printer set up and running quickly as well as providing you with more detailed information for future reference. Here's how it's organised:

The first section shows you how to get the printer ready, connect it to your computer, and how to load paper.

Chapter 2 "Operation," describes how to control your printer from the front panel, and gives you some hints on what to do if you're having problems.

In Chapter 3 you will find a few hints and general guidelines on installing and using software with your printer, as well as some specific information on PC/MS-DOS. You'll also find a few tips on BASIC should you want to write your own programs.

Chapter 4 "Control Code Reference," provides details on all of the printer's features and the commands that control them. This chapter will be useful even if you don't do your own programming, because it contains information about how the printer features work and how to use them.

Chapter 5 "Graphics and Custom Characters," describes how to program graphics and custom (downloaded) character sets. These are complex, time-consuming jobs.

There are also a number of appendices at the end of the book containing reference material on control codes, character sets, interfacing, and product specifications.

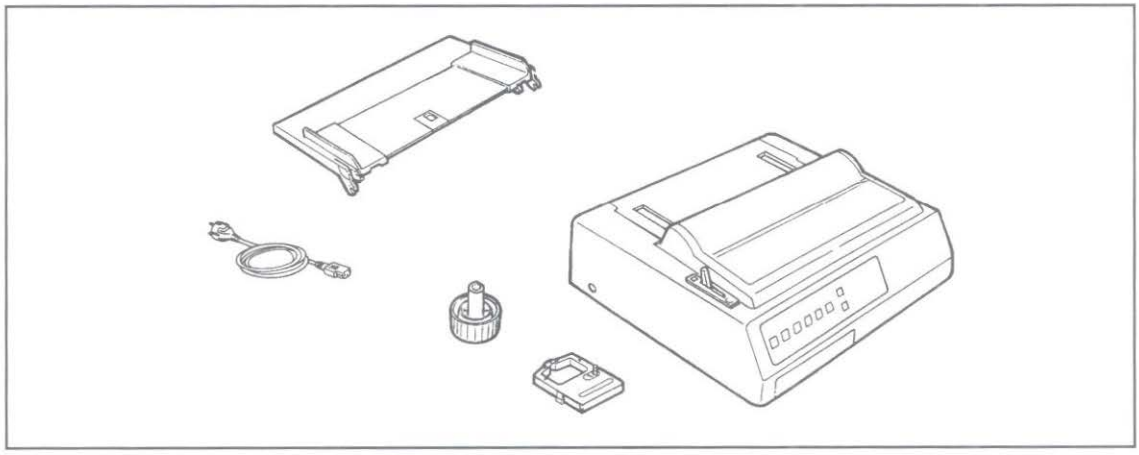
Chapter 1

Setup

Choose a sturdy table, desk or printer stand to place your printer on when you remove it from the carton. Remove the styrofoam sides—be sure to save all packing materials in case you need to ship the printer again—and check the box for these contents:

- ML320/321 Elite printer
- Paper separator
- Power cord
- Platen knob (fitted)
- Ribbon cartridge
- Printer Handbook

Note: Interface cable and paper are sold separately.

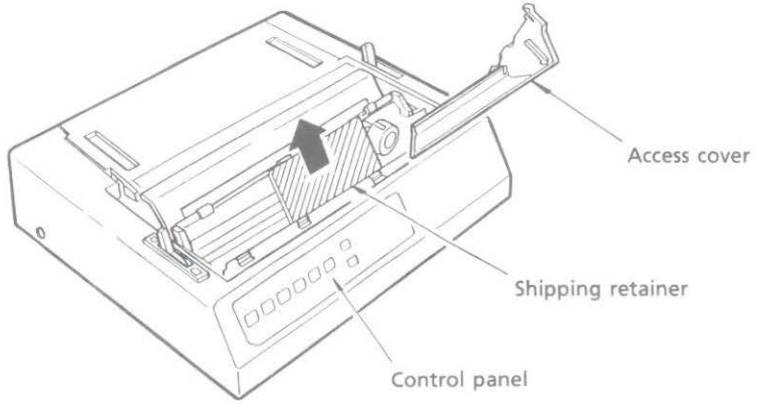


If any of these items are missing or damaged, see your dealer for replacement.

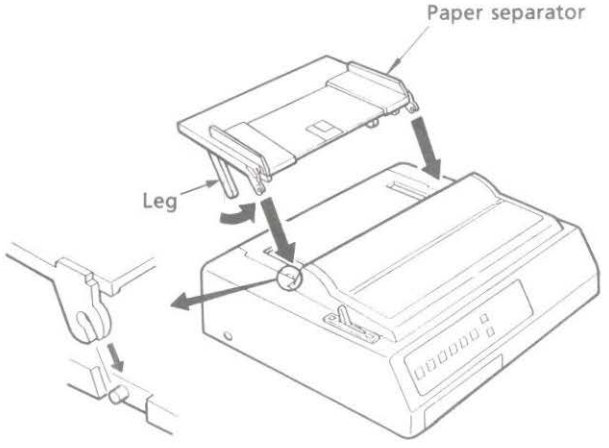
Preliminaries

Don't plug the printer in until it's set up and ready to operate.

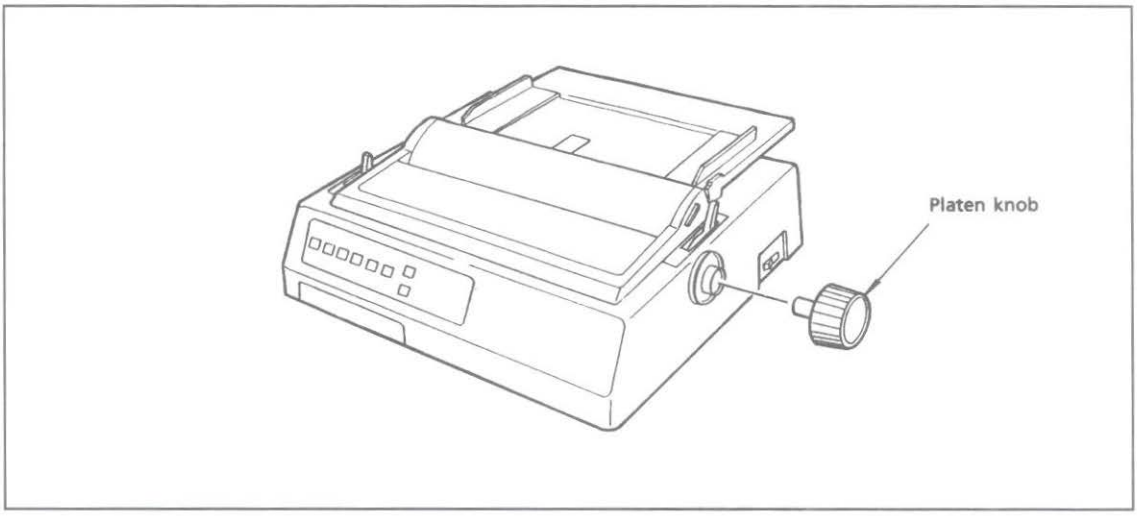
1. Remove the clear protective film from the control panel and access cover.
2. Open the access cover and remove the shipping retainer. Be sure to save it with the other packing materials in case you ship the printer.



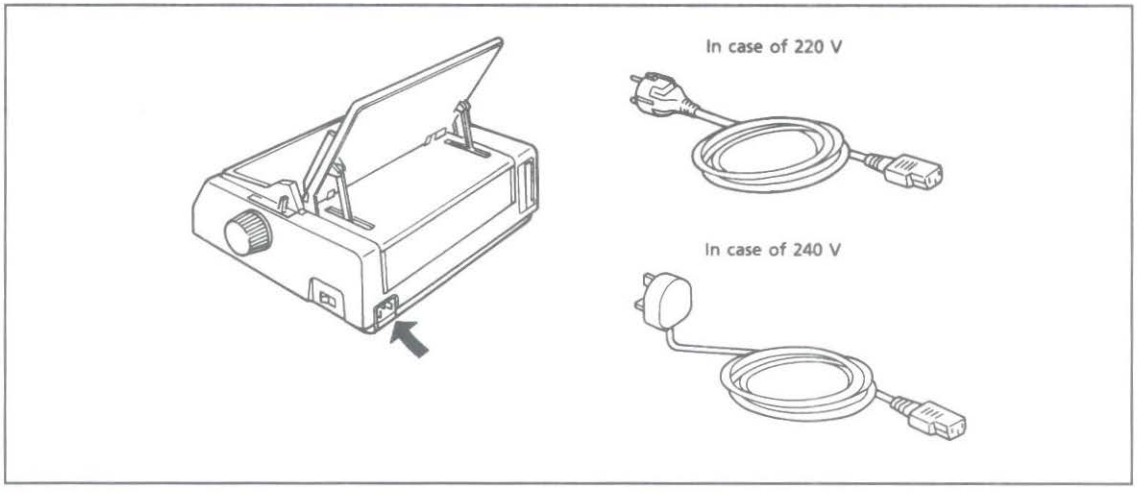
3. Install the paper separator: Open the rear cover of the printer. Holding the legs closed against the paper separator, place the tab on the side of the separator over the stud on the side of the rear cover. Pull gently on the other tab to slide it over the stud on the other side of the rear cover. Then close the rear cover.



4. The platen knob should already be fitted to the right side of the printer. However, if it has been removed for any reason, match the flat side of the knob to the flat side of the platen shaft.



5. Make sure that the power switch is OFF. Plug the power cord into the back of the printer. Plug the other end into an earthed socket.

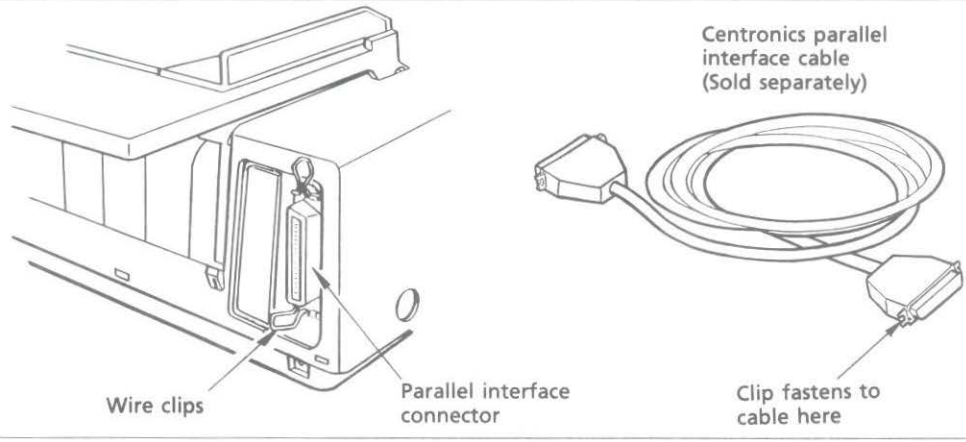


Important: Make sure the socket is earthed. Do not use an adaptor to defeat the earthing.

Connecting with the Computer

These instructions are for the standard parallel interface. If you have the optional serial interface, see the appendix for installation and connection details.

1. Make sure both the printer and the computer are OFF.



2. Plug the interface cable into the port on the back of your printer. Fasten the wire clips on the connector to the cable in order to attach it securely.

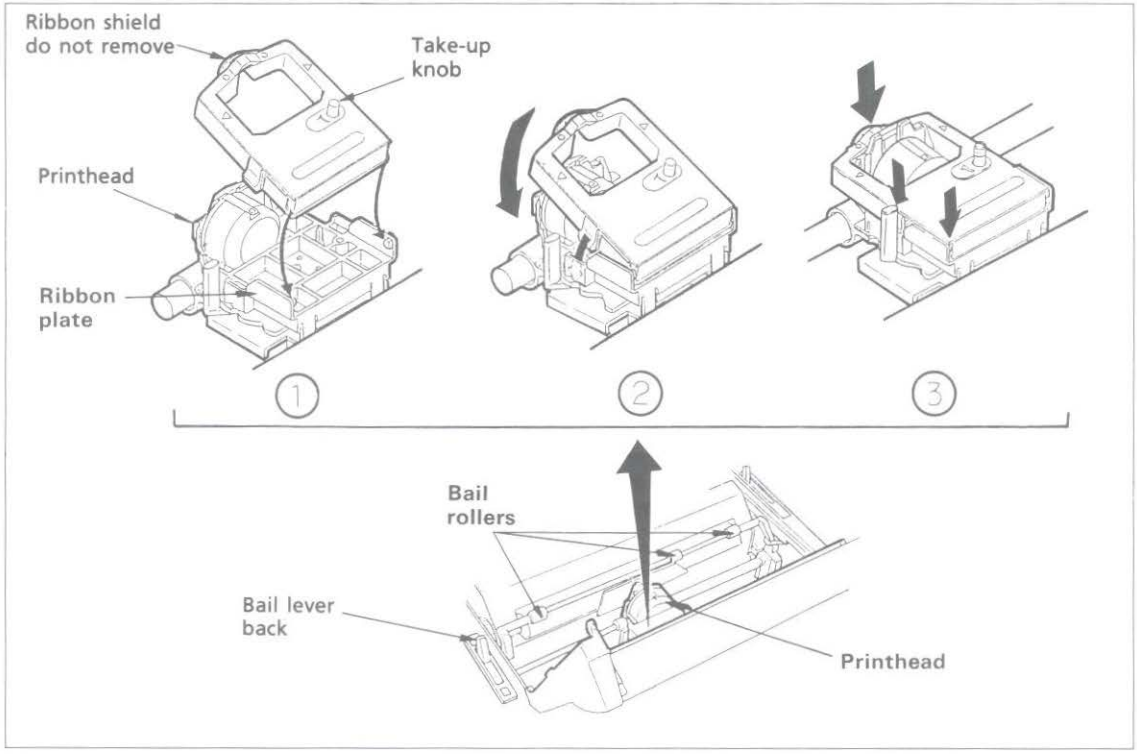
Note: Interface cables are sold separately.

Inserting the Ribbon Cartridge

1. Open the access cover.
2. Position the printhead between the bail rollers. Make sure the bail is closed.

Important: The printhead can get very hot during extended periods of printing—be sure to let it cool off before you touch it.

3. Hold the ribbon cartridge with the blue take-up knob facing up and the flat end toward the front of the printer.
4. Place the flat end into the ribbon plate, then lower the front of the cartridge over the printhead until it snaps into place.

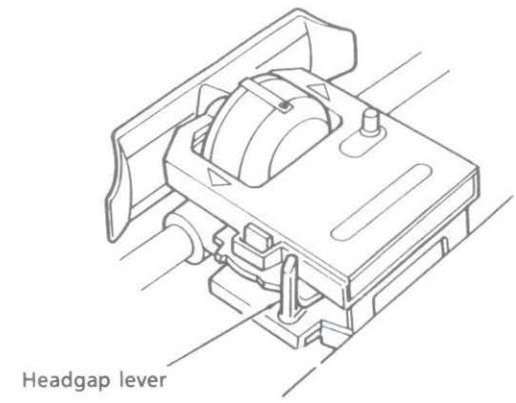


5. Turn the take-up knob in the direction of the arrow on the cartridge to take up the slack in the ribbon.

6. The headgap lever by the side of the cartridge adjusts for different paper thicknesses. Set the headgap to:

    1. for one- or two-part forms,
    2. for three- or four-part forms,
    3. for envelopes or extra-thick paper.

Note: The printer automatically reduces the print speed if the headgap lever is set to 3 in order to improve the print quality with envelopes or extra-thick paper.



To remove the ribbon cartridge, pull up at the positions indicated by the two arrows on the top of the cartridge.

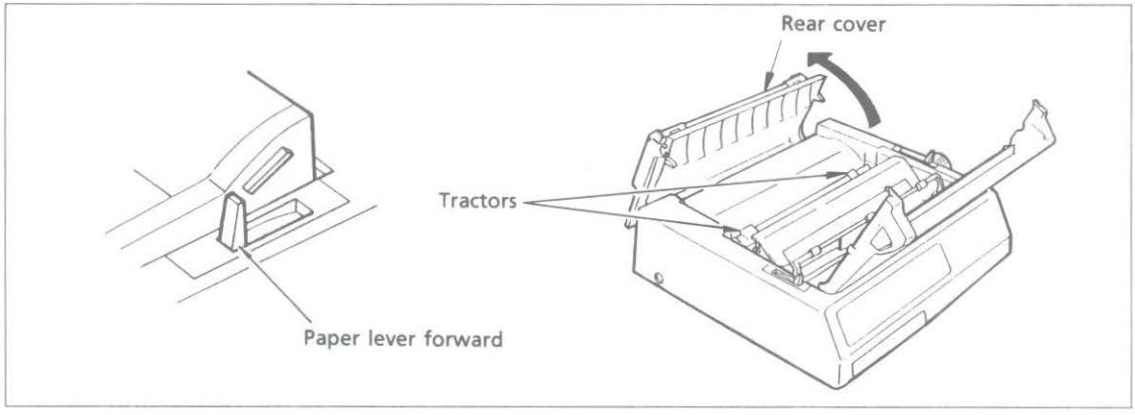
Important: Be sure to use ribbons specifically for use with MICROLINE 320/321 or MICROLINE 100 series printers. Ribbon cartridges for ML390/391 printers look similar, but they do not fit in the ML320/321.

Loading Paper

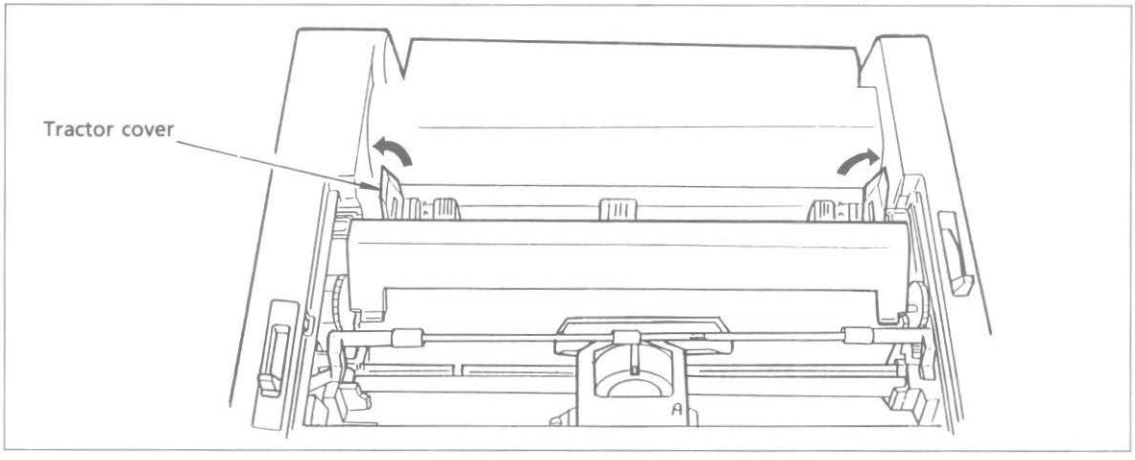
The ML320/321 can handle many different types of paper with pushbutton ease. Check Appendix D for details on paper specifications.

Rear feed, continuous forms

1. Make sure the paper lever is forward.



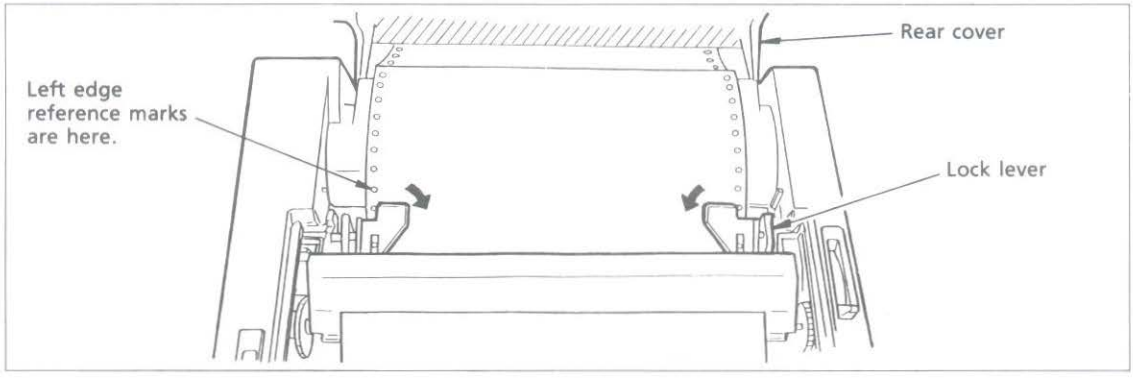
2. Open the rear cover to expose the tractors.
3. Open the tractor covers.



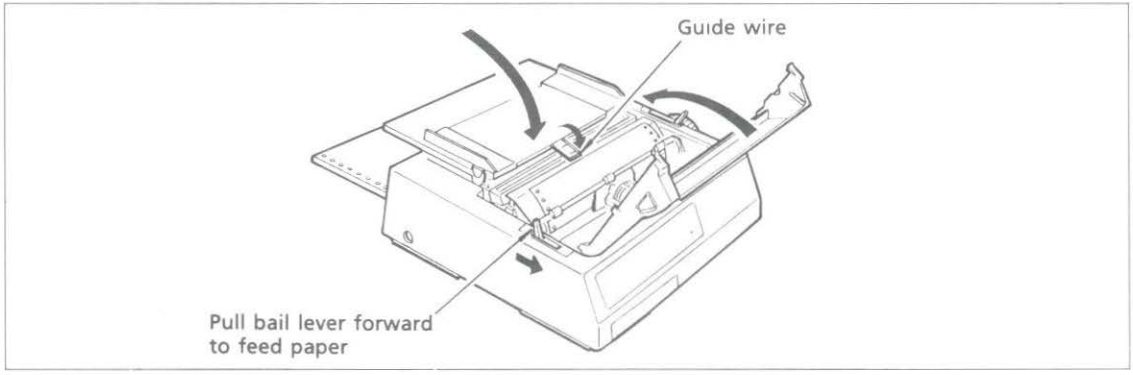
4. Pull the paper through the opening between the printer and the rear cover.
5. Place the first two sprocket holes on each side of the page over the pins. Close tractor covers. To adjust the tractors for the width of the paper, pull the lock levers forward;

slide the tractors into position, then push the levers back to lock. There are reference marks on the printer to show the recommended left edge position for the two most common paper sizes.

Important: Do not position the left edge of the paper more than 1/2 inch from the end of the platen. The paper must cover the groove in the left side of the platen; if it doesn't the printer will signal a paper out alarm.



6. Close the rear and access covers. Make sure the paper separator is flat on the printer. Open the guide wire, which keeps paper from curling back into the printer.
7. Turn the printer on. The printhead will move to the left side of the platen and the control panel will light up. The ALARM light will also come on, but don't be concerned: it's just telling you that there is no paper loaded.



8. Pull the bail lever forward. The paper will automatically feed into the printer and the ALARM light will go out.
9. When the paper has stopped moving push the bail lever back.
10. Adjust the Top of Form (see next page) and press the SEL button (the SEL light will go on) and you're ready to print.

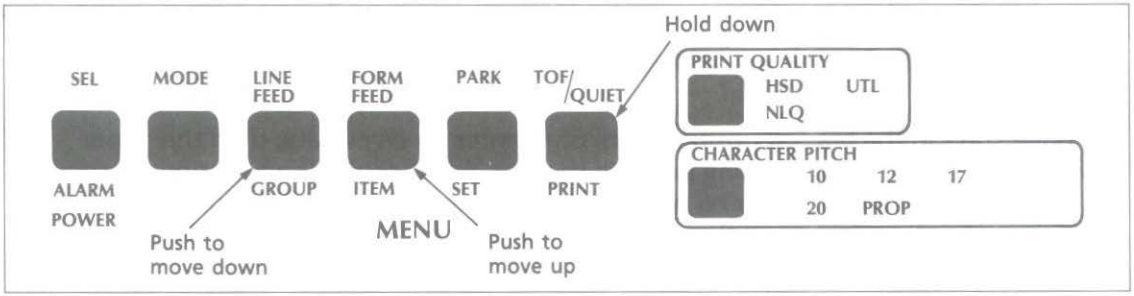
Important: Do not use the Form Feed button to load paper.

Setting Top of Form

If Form Tear Off is ON, hold down the TOF/QUIET button and press:

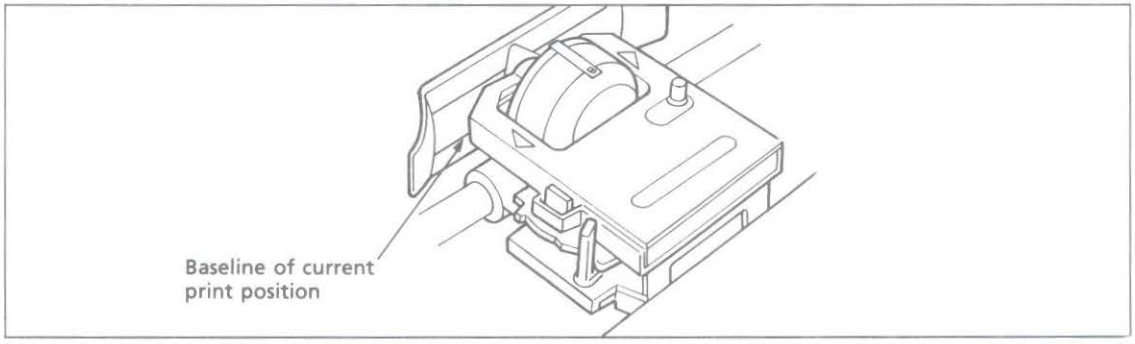
FORM FEED to move the paper up, or
LINE FEED to move the paper down.

This moves the paper in very fine increments—1/144 inch to be exact—so you can position the top of form precisely. The amount you can move the paper down using this method is limited to avoid potential paper jams.



The lower red line on the paper shield shows the baseline of the current printing position to help you place the top of form where you want it.

When the top of form is set where you want it, press the TOF/QUIET button. This will record the position permanently in the printer's memory—even when the printer is turned off—until you reset it.



If Form Tear Off is OFF, adjust the top of form by turning the platen knob, then press the TOF button. (The SEL light should be out). The lower red line on the paper shield shows the baseline of the current print position to help you place the top of form where you want it.

Important: Make sure the paper is held in place by the bail. If the top of the page is set below the bail, paper will catch on the bail and cause a jam.

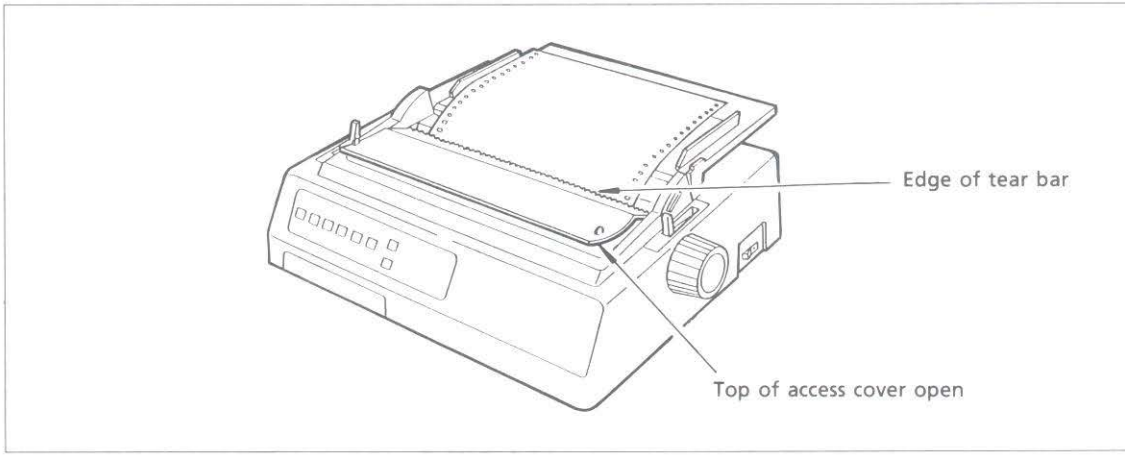
Form tear off

Form tear off makes paper handling even simpler with the MICROLINE 320/321. When you're using rear-fed continuous form paper, you can easily tear off a printed sheet without wasting paper or readjusting the printer.

To activate this feature, enter Menu Select mode and set the FORM TEAR OFF item to ON — it's in the Vertical Control group. Then set top of form as described on the previous page. When you release the TOP/QUIET button, the paper advances from the initial printing position to the tear off position — the top of the page is even with the tear bar, located under the clear top of the access cover.

Note: You can check the initial printing position at any time: press the SEL button to deselect the printer, then press TOF/QUIET: the paper will move down to the initial printing position until you release the button.

The page stays in the tear off position until the printer receives data: then the paper moves down to the initial printing position to print. A few seconds after printing stops, the paper moves up to the tear off position. Now it's easy to tear off the printed page along its perforation: just open the clear top of the access cover and tear the page off against the tear bar.



Note: Some programs, such as high resolution graphics packages, pause occasionally while sending data to the printer. If the pause lasts more than two seconds, the paper will advance to the tear off position until more data is received. No data will be lost, but this extra paper movement can cause uneven print registration in graphics. If you have this problem, use the menu to deactivate forms tear off.

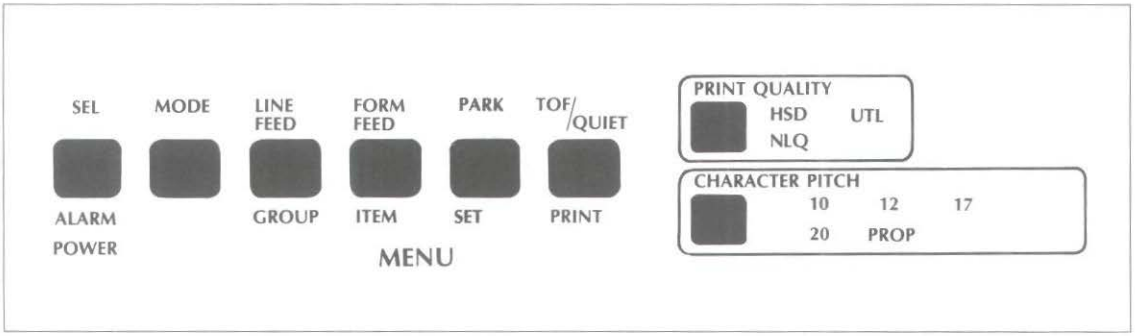
Don't use forms tear off when printing on labels or multipart forms. Labels should only be fed from the bottom of the printer.

Paper park

This handy feature makes it easy for you to switch from continuous forms to single sheet paper and back.

To park the paper:

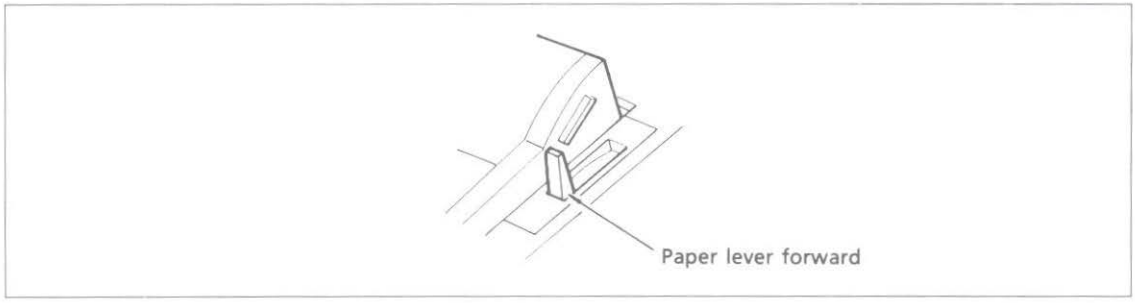
1. Tear off any printed pages.
2. Press the PARK button. The paper will retract from the paper path.



Push the paper lever back to the single sheet setting, and you're ready to insert single sheets. See "Loading Single Sheets".

To return continuous forms to the printer:

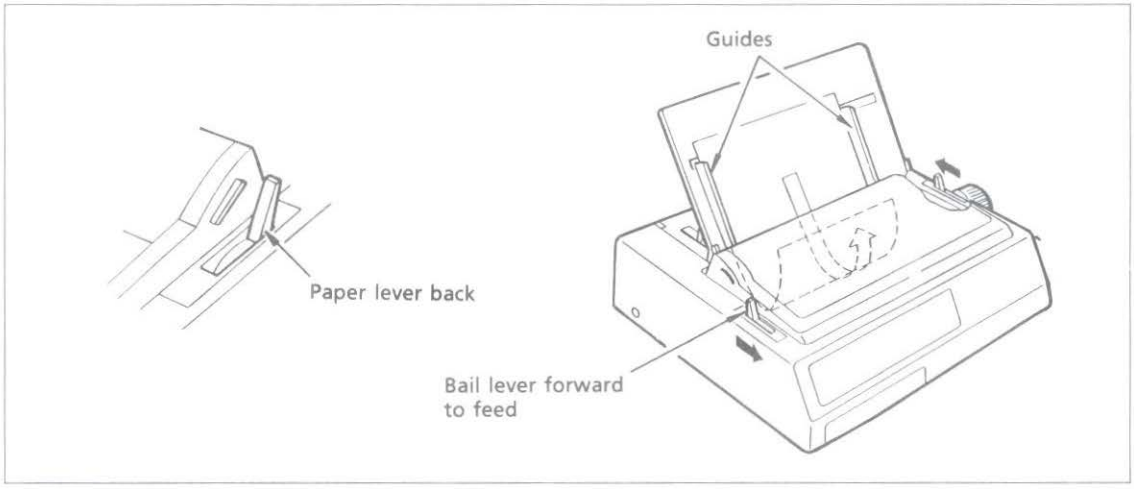
1. Make sure the paper lever is set for continuous forms (lever forward).



2. Pull the bail lever forward. The paper will advance to the front of the platen.
3. Push the bail lever back and adjust the top of form, if necessary.

Loading single sheets

1. If you have continuous form-paper in the printer, use the paper park feature to back it out of the paper path.
2. Push the paper lever to the single sheet setting (toward the back of the printer).

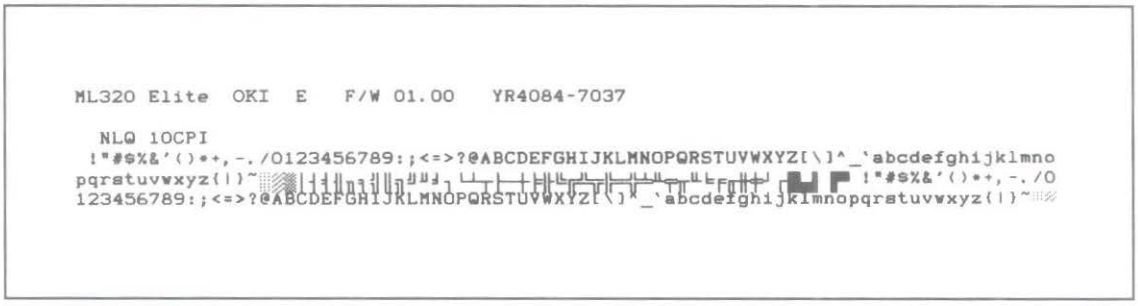


3. Push the guide wire back into its locked position on the paper separator. Raise the separator to its upright position.
4. Set a sheet of paper on the paper separator and adjust the guides so that they're barely touching the edges of the paper. (There's a reference mark on the separator for the left paper edge.)
5. Pull the bail lever forward. The paper will automatically feed into the printer.
6. Push the bail back.
7. If necessary adjust the top of form.

Running a Self Test

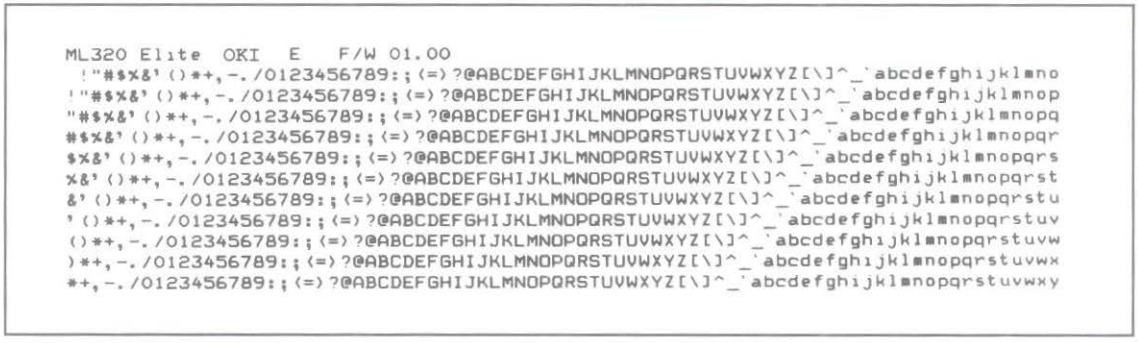
After you have installed ribbon and paper, you are ready to run one of two self tests. Do this any time you want to make sure the printer is functioning properly. Both test patterns print in 8-1/2 inch format in the 320. In the 321 the continuous test is the whole width of the platen.

Holding down LF while turning on the printer produces :



A limited sample of every available print style. When complete (about two pages), the printer stops and the SEL light goes on.

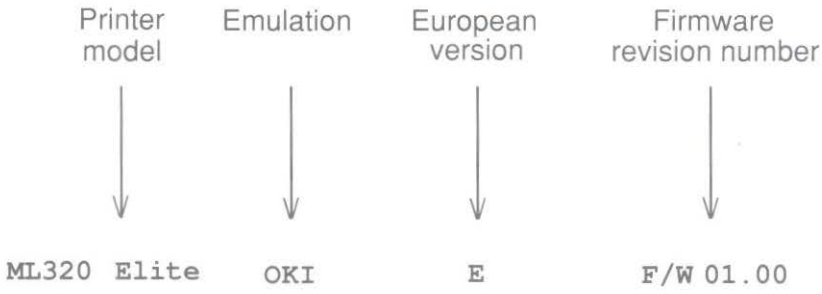
Holding down TOF/QUIET while turning on the printer produces :



A continuous sample of the default print style.

To stop either test, press the MODE button.

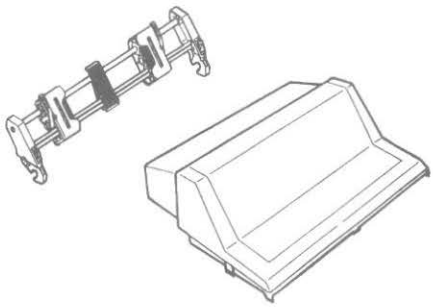
The self test printout also provides information about your printer.



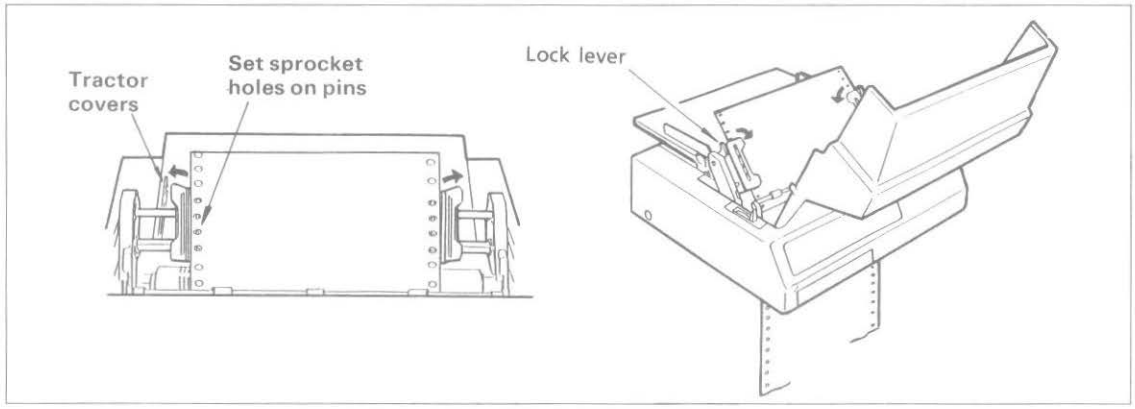
Have this information at hand if you call for service.

Optional Accessories

Pull Tractor Kit

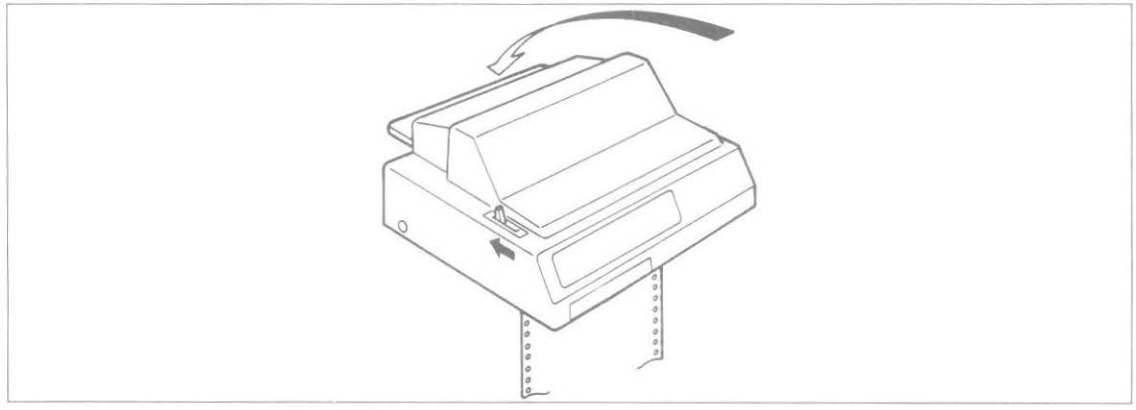


5. Place the sprocket holes over the pins and close the tractor covers. To adjust the tractors for the width of the paper, pull the lock levers forward, slide the tractors into position. then push the levers back to lock.



Important: Do not position the left edge of the paper more than 1/2 inch from the end of the platen. The paper must cover the groove in the left side of the platen; if it doesn't the printer will signal a paper out alarm.

6. Close the access cover. Make sure the paper separator is flat on the printer.



7. Use the platen knob to adjust the top of form—the lower red line on the ribbon shield shows the base line of the current print position. If the printer is on, deselect it, then press the TOF/QUIET button to set the top of form. If the printer is off, top of form will automatically be set when you turn on the power.

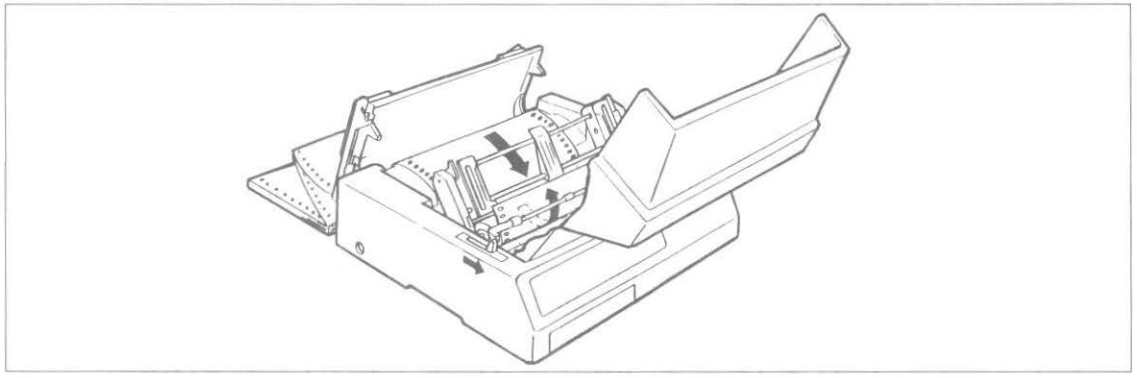
Important: Do not position the top edge of the paper below the bail or you will cause a paper jam.
Do not use the paper park feature as the paper will disengage from the pull tractor if you do so. This will also happen if you use too many reverse line feeds.
Labels should only be fed from the bottom.

Loading rear feed paper using both tractors

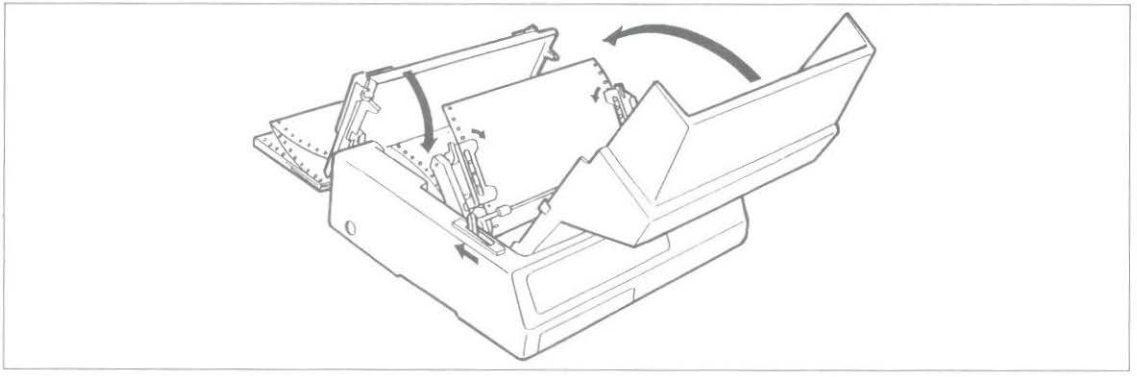
This arrangement feeds continuous-form paper through both the built-in tractor and the optional pull tractor. It's particularly handy when you're printing on multipart forms or when you're using reverse line feeds.

Important: Do not use PARK or too many reverse Line Feeds. (Paper will come out of pull tractors.) Labels should only be fed from the bottom.

1. Follow the instructions 1–5 for loading rear feed paper with the built-in tractor.
2. Using the platen knob, wind the paper up to the pull tractor.



3. Push the paper lever back to the single sheet position. This disengages the built-in tractor so you can adjust the paper on the pull tractor.
4. Open the tractor covers, set the paper holes on the sprocket pins, adjust the tractors and close the tractor covers.



5. Pull the paper release lever forward to continuous position, use the platen knob to take up the slack in the paper and push the bail lever back.

Continuous Form Operation with Cut Sheet Feeder Installed

If you use single part continuous form paper, you can leave the CSF installed on your printer and alternate between printing on continuous form paper or on single sheets inserted from the CSF. The paper lever (on the righthand side of the printer) is used to select between the operating modes.

When the printer is turned on, and there is no paper present on the platen, the CSF mode is established. To activate the continuous form operation with the CSF installed, deselect the printer and set the paper lever to the continuous position (front). The continuous form paper is then loaded by pushing the bail arm towards the platen (the CSF will force the bail arm to return to an open position).

Do not use the FORM FEED button to load continuous form paper, as a sheet from the CSF will also be inserted into the printer. Once the continuous form paper has been loaded, the FORM FEED button advances the paper by the page length set in the menu.

To switch to the CSF operation mode, press the PARK button on the control panel of the printer. The continuous form paper retracts from the platen. Set the paper lever to the single sheets position (back). The CSF mode is now established.

A single sheet is fed from either the CSF loading tray or the manual slot, into the printer, using either the FORM FEED or LINE FEED buttons. Once a sheet has been inserted into the printer, the LINE FEED button advances the sheet one line at a time.

Single sheets cannot be loaded from the CSF manual loading slot using the BASIC command for form feeding — CHR$(12). This command causes the sheet in the manual slot to be immediately ejected from the printer. A CHR$(12) command will eject a sheet from the printer and insert a new one from the CSF loading tray. A BASIC line feed command — CHR$(10) — will insert a sheet from the CSF, if there is no paper in the printer. If a sheet is already present in the printer, the CHR$(10) command will advance the paper by one line.

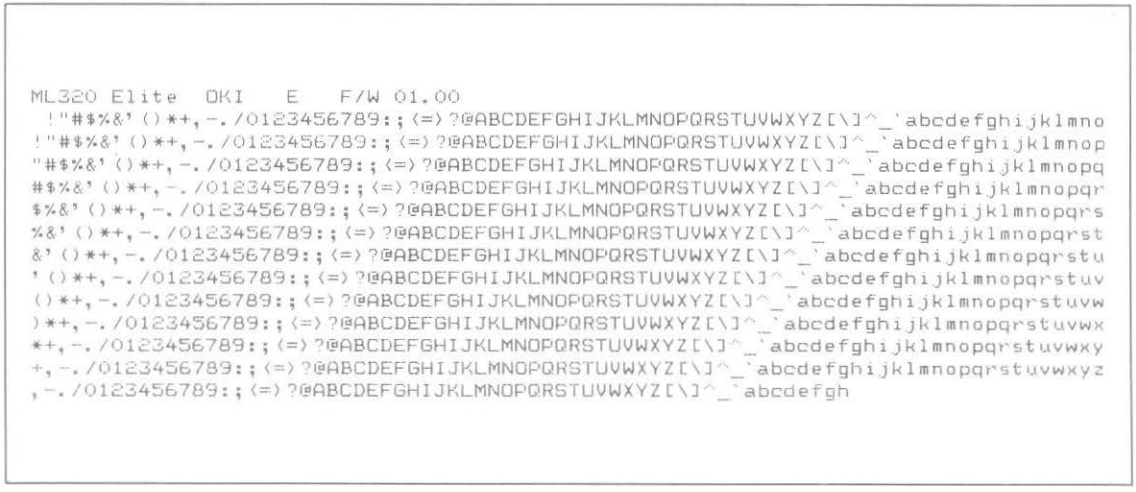
Running a Self Test

After you've installed ribbon and paper, you're ready to run one of two self tests. Do this any time you want to make sure the printer is functioning properly. Both test patterns print in 8-1/2 inch format in the 320. In the 321 the continuous test is the whole width of the platen.

Holding down LF while turning on the printer produces:

A limited sample of each available print style. When complete (about two pages), the printer stops and the SEL light goes on.

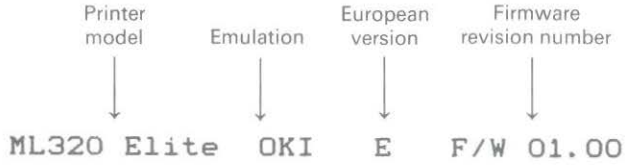
Holding down TOF/QUIET while turning on the printer produces:



A continuous sample of the default print style.

To stop either test, press the MODE button.

The self test printout also provides information about your printer.

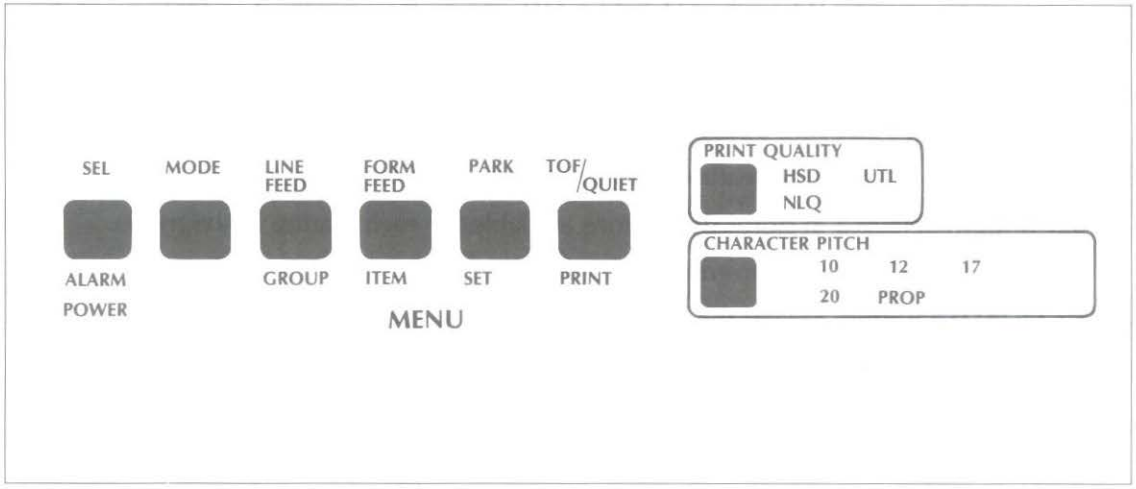


Have this information at hand if you call for service.

Chapter 2
Operation

Using the Control Panel

The ML320/321's control panel does more than manipulate paper: it gives you fingertip command over most of the printing features that affect the look of your documents. You can change basic features of each document straight from the panel. Using the Menu Select mode—entered directly from the panel—you can alter the default settings of other features. (The defaults are those characteristics set automatically when you turn on or reset the printer.) You can also configure the printer for your system without setting hard-to-reach switches.



Button functions

SEL light: When this light is ON, the printer is selected and ready to receive data from the computer. When the light is OFF, the printer is deselected and cannot receive data.

When the light is blinking, the printer is in Print Suppress condition and will ignore all data until the Print Suppress condition is turned off.

SEL button: Push this button to select or deselect the printer (SEL light is ON or OFF).

ALARM light: This light indicates either that paper is out or that there is an internal problem requiring service.

POWER light: This light indicates that the printer is turned on.

MODE button: Selects print mode or menu select mode. (MENU light on or off).

MENU light: When this light is OFF, the printer is in print mode and the functions above the buttons are active. When the light is ON the menu select mode is active and the features below the buttons are in operation.

PRINT MODE

LINE FEED button: advances the paper by one line feed (default line feed unless a new line feed has been set by command).

FORM FEED button: Ejects a sheet of paper from the printer. If the CSF is installed, a new sheet is automatically inserted. The FORM FEED button should not be used to load paper.

PARK button: Retracts continuous form paper from the platen, allows you to switch from single sheet paper to continuous form paper and back again.

TOF/QUIET button: When the SEL light is ON, this button will switch to and from the quiet printing mode. When the SEL light is OFF, this button sets the Top Of Form at the present printhead position.

MENU SELECT MODE

GROUP button: Switches between the broad menu categories.

ITEM button: Displays the features contained in each of the categories.

SET button: Selects and stores the options available for each feature in the menu.

PRINT button: Prints the current menu settings.

PRINT QUALITY button: Selects the quality of print of the typeface.

CHARACTER PITCH button: Selects the size of the printed characters.

COMBINATION FEATURES (Hold down the following buttons while turning power-on).

SEL & MODE: Reset the printer menu to default settings.

SEL & FORM FEED: Enter the hexadecimal dump mode. To exit this mode the printer must be turned OFF then ON again.

LINE FEED: A limited sample of each print style available is produced. This test can be stopped by pressing the MODE button.

TOF/QUIET: A continuous printing test is initiated. This test is terminated by pressing the MODE button.

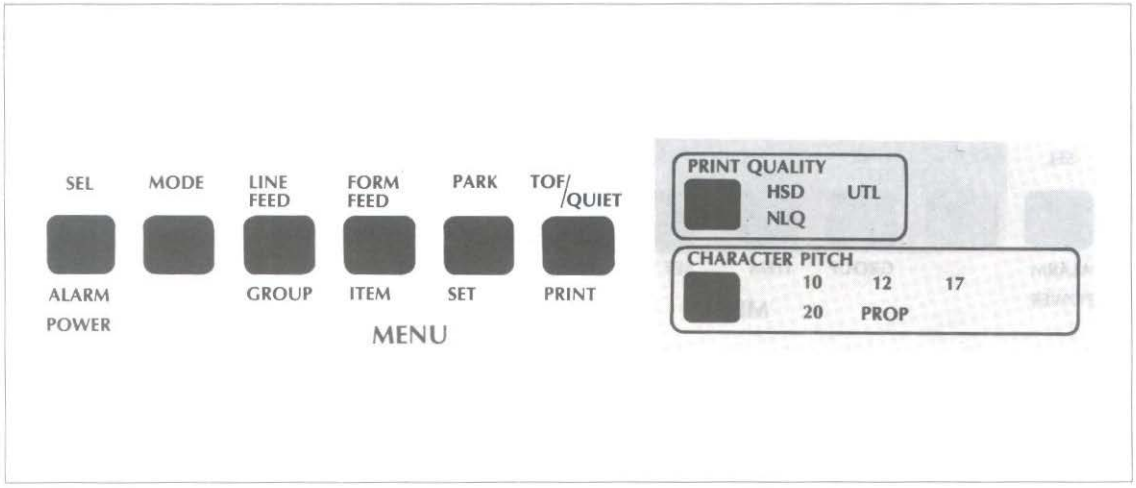
TOF/QUIET & PARK: Reset the paper loading position to the factory default setting.

Note: All buttons on the control panel are active regardless of whether the printer is selected or deselected.

Print Characteristics

These buttons let you control basic printing features without modifying your software. Simply press a button until the selection you want lights up. You can change features when the printer is either selected or deselected.

Note: This part of the panel always reflects the state of the printer; if your software changes one of these features, the corresponding light will change, too.

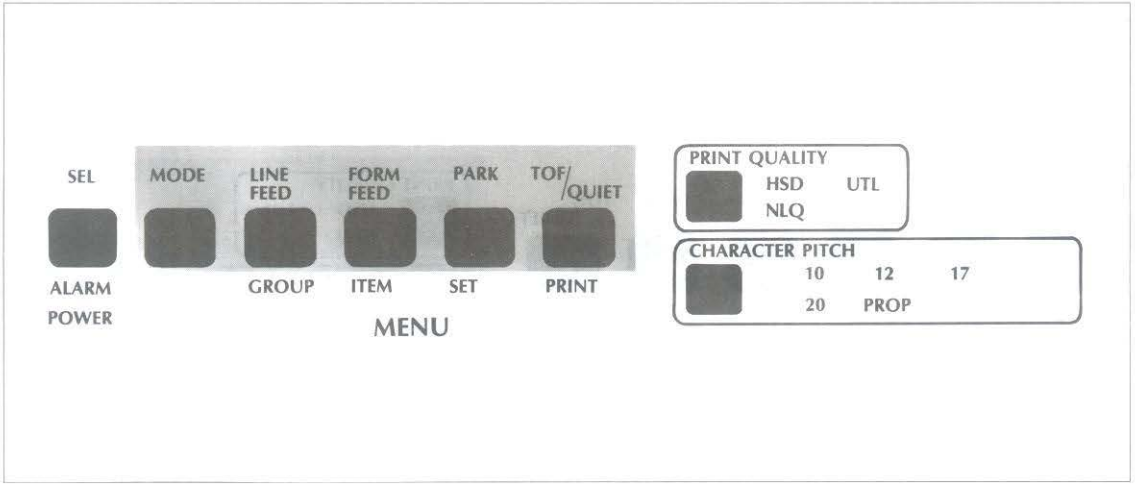


1. **Print quality**
   NLQ: Near Letter Quality. The highest level of print quality for your most important documents.
   UTL: Utility. Higher speed printing for drafts, internal documents, and high-volume data printing.
   HSD: High Speed Draft. Use it for quick printouts of preliminary drafts and long documents. If HSD is set along with 12 cpi, the SSD (Super Speed Draft) is activated. This is the fastest print speed (360 cp

2. **Character pitch**
   10, 12, 17, 20: These determine the width of the characters, indicated in characters per inch (cpi). Normally 10 and 12 pitch are used for standard text; 17 and 20 pitch are used when you want to get more information on a page—in spreadsheets, for example. 15 cpi is selected when both 12 cpi and 17.1 cpi are lit.
   PROP: Proportionally spaced, is not available in HSD. The amount of space allowed for each character varies according to the width of the character; for example, "i" takes less space than "w" does.
   This improves legibility and gives a more polished "typeset" look.

The MODE Button

This button controls the functions of the next four buttons on the panel by switching the printer between Print mode and Menu Select mode. When the printer is in Print mode, the functions shown above the buttons are active: this is the state of the printer when you turn it on. When the printer is in Menu Select mode, the MENU indicator lights, and the functions shown below the buttons are active—this lets you customise the default settings for a number of printer features directly from the control panel.



Print mode

1. **LINE FEED button:** Press this button to advance the paper one line.
2. **FORM FEED button:** Press this button to advance the paper to the first print line of the next page.
3. **PARK button:**Use this button with continuous-form paper. When you press it, the paper retracts from the front of the printer so you can use single sheets without completely removing the continuous forms.
4. **TOF/QUIET button:** When the printer is deselected, press this button to set the position of the first print line on the page ("top of form").

   When the printer is selected, press this button to enter the Quiet mode ("QUIET" lights on the panel). This mode reduces the sound produced by the printer by slowing the printing speed. Return to normal operation by pressing the button again with the printer selected.

Menu select mode

In this special mode, you can customise your printer so that the features you want are automatically active when you turn it on. The selections you make on the menu are stored in the printer's permanent memory and, in effect, become default settings, although they can be changed through software commands, through the control panel, or through resetting the menu.

Note: You can override features set on the menu using either the front panel or commands sent from your computer. However, when you turn off the printer, features set by those methods will be cancelled. Features set on the menu will stay in effect, even when the printer is unplugged.

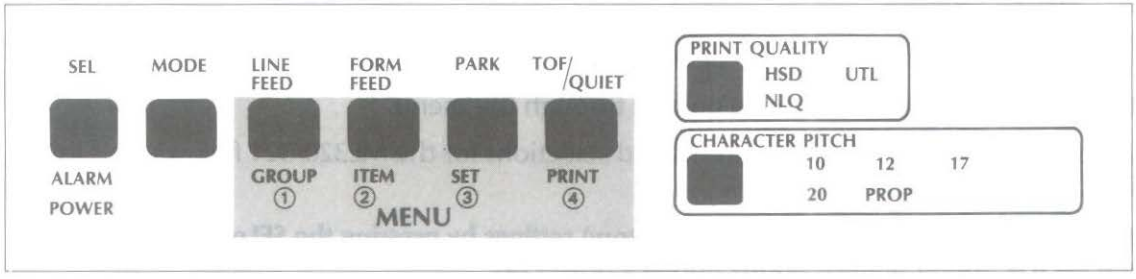
To enter Menu Select mode:

Make sure the printer has ribbon and paper.

Press MODE.

The SEL light goes out, the MENU light goes on, indicating that the menu functions, listed below the print buttons are active. If you want to print out the entire menu with its current settings, press the PRINT button. When you are ready to start changing settings, press GROUP, and the first line of the menu prints. Here's how it's arranged.

Font	Print Mode	Utility
GROUP of	ITEM within	Current
related items	the group	SETting for
		the item



When the MENU light is on, the bottom button functions are active:

①, ②, ③: Press these buttons to move to the next GROUP, ITEM, and SETting, respectively.

④: Press this button at any time to print a complete listing of the menu with its current settings.

Note: We recommend that you print out the menu whenever you change it to keep for reference.

When you've made the changes you want, press MODE to record the changes and return to Print mode. (MENU light goes out.)

Examples

1. When you press SET, this line:

Font	Print Mode	Utility

changes to this:

Font	Print Mode	Utility
Same GROUP	Same ITEM	NLQ Courier New SETting

The printer will now print using NLQ Courier.

2. When you press ITEM, this line:

Font	Print Mode	Utility

changes to this:

Font	Print Mode	Utility
Same GROUP	Next ITEM	10 CPI Current SETting for new item

To change pitch, press SET until the one you want prints.

3. When you press GROUP, this line:

Font	Print Mode	Utility

changes to this:

General Control	Graphics	Bidirectional
Next GROUP	Current ITEM in new group	Current SETting

Use the GROUP button to move quickly through the menu.

A complete listing of the menu items and selections for the ML320/321 follows. This listing is followed by explanatory notes.

The menu can be reset to the default (factory) settings by pressing the SELect button and the MODE button simultaneously during a power on.

Menu selections

Factory settings are printed in bold.

Group	Item	Settings
FONT	PRINT MODE	**UTILITY,**NLQ COURIER, NLQ SANS SERIF, HSD
	PITCH	**10,** 12, 17.1, 20, PROP.
	PROPORTIONAL SPACING	**NO,** YES

Group	Item	Settings
	STYLE	**NORMAL**, ITALICS
	SIZE	**SINGLE**, DOUBLE
GENERAL CONTROL	GRAPHICS	**BIDIRECTIONAL**, UNIDIRECTIONAL
	7 OR 8 BIT GRAPHICS	**7**, 8
	RECEIVE BUFFER	**NORMAL,** REDUCED
	PAPER OUT OVERRIDE	**NO**, YES
	PRINT REGISTRATION	**0**, −1, −2, −3, −4, −5, +5, +4, +3, +2, +1
	7 OR 8 BIT DATA WORD	**8**, 7
	OPERATOR PANEL FUNCTIONS	**FULL OPERATION**, LIMITED OPERATION
	RESET INHIBIT	**NO,** YES
	PRINT SUPPRESS EFFECTIVE	**YES**, NO
	PRINTABLE DEL CODE	**YES**, NO
	PAGE WIDTH (ML321)	**13.6 INCHES,** 8 INCHES
	CPU COMPENSATION	**STANDARD**. SPECIAL
VERTICAL CONTROL	LINE SPACING	**6 LPI**, 8 LPI
	FORM TEAR OFF	**OFF**, ON
	SKIP OVER PERFORATION	**NO**, YES
	AUTO LF	**NO**, YES
	PAGE LENGTH	**12 INCHES,** 11 INCHES, 11-2/3 INCHES, 14 INCHES, 17 INCHES, 3 INCHES, 3.5 INCHES, 4 INCHES, 5.5 INCHES, 6 INCHES, 7 INCHES, 8 INCHES, 8.5 INCHES
	SHEET PAGE LENGTH	**11 2/3 INCHES,** 14 INCHES, 16.57 INCHES, 3 INCHES, 3.5 INCHES, 4 INCHES, 5.5 INCHES, 6 INCHES, 7 INCHES, 8 INCHES, 8.5 INCHES, 12 INCHES, 11 INCHES
	CSF BIN SELECT	**BIN 1,** BIN 2
SYMBOL SETS	CHARACTER SET	**STANDARD**, DLL, LINE GRAPHICS. BLOCK GRAPHICS
	LANGUAGE SET	**AMERICAN (UNSLASHED ZERO)**, BRITISH, GERMAN, FRENCH, SWEDISH I, DANISH, NORWEGIAN, DUTCH, ITALIAN, TRS-80, SPANISH, SWEDISH II. SWEDISH III, SWEDISH IV, TURKISH, SWISS I, SWISS II, AMERICAN (SLASHED ZERO)
SERIAL INTERFACE OPTIONS	PARITY	**NONE**, ODD, EVEN
	SERIAL DATA 7 or 8 BITS	**8**, 7
	PROTOCOL	**READY/BUSY**, X-ON/X-OFF
	DIAGNOSTIC TEST	**NO**, YES
	BUSY LINE	**SSD** −, SSD +, DTR, RTS
	BAUD RATE	**9600 BPS**, 4800 BPS, 2400 BPS, 1200 BPS, 600 BPS, 300 BPS, 19200 BPS
	DSR SIGNAL	**VALID**, INVALID
	DTR SIGNAL	**READY ON POWER UP**, READY ON SELECT
	BUSY TIME	**200 MILLISECONDS**, 1 SECOND

Explanation of menu items

Print Mode: Choose the NLQ (Near Letter Quality) Courier or Sans Serif font, Utility for quicker printing, or HSD (High Speed Draft) for fastest printing speed

Pitch: Choose character width measured in Characters Per Inch (CPI).

Proportional Spacing: Choose Yes for proportionally spaced printing. This option is not available when the Print Mode is set to HSD.

Style: Choose Normal (upright) or Italics (slanted).

Size: Choose Single or Double width and height.

Graphics: Choose unidirectional (left to right only) for better graphics print registration at slower speed. Choose bidirectional for higher print speed.

7 or 8 Bit Graphics: Choose the type of graphics your system uses.

Receive Buffer: When this option is set to normal, the minimum receive buffer size is bytes. If your computer has problems with device time-outs due to the time taken to clear the printer buffer when it becomes full, select the reduced buffer size. This reduces the buffer size to 256 bytes, therefore time taken to empty the buffer is shorter and the computer will be able to resume transmitting the data.

Paper Out Override: The paper out detector senses when less than one inch of paper remains in the printer and stops printing at that point. Choosing Yes overrides the detector so you can print closer to the bottom of the page if you're using single sheets.

Be careful if you use this feature: it lets the printer continue printing when there is no more paper, which causes loss of data and may damage the print head and the platen.

Print Registration: Use this item with bidirectional bit image graphics to improve registration. Although 0 is generally the best selection, choosing another value may compensate for registration problems with some graphics software packages. (See Chapter 5.)

7 or 8 Bit Data Word: Choose the format that your computer uses to send data.

Operator Panel Functions: Full Operation is the normal setting. Choose Limited Operation to deactivate the PRINT QUALITY, CHARACTER PITCH, and MODE buttons on the control panel. Then you can control these features only through your software. This can be useful when several people are using the printer and you don't want its settings changed.

This feature also prevents access to the menu. If you want to reactivate the menu, turn off the printer, then hold down the MODE button and turn the printer on again. Follow the normal menu procedures to reset this item to Full Operation.

Reset Inhibit: Choose yes if you want the printer to ignore your software's initialisation commands. This allows you to set printer features using the control panel which will not be automatically overridden by the initialisation string that is often sent by software package at the beginning of each job.

Print Suppress Effective: The DC3 code places the printer in print suppress mode, in which the printer ignores all data. The DC1 code restores the printer to normal operation. Some systems use these codes for other functions and this may cause you to lose some data. If this happens, choose NO to deactivate the feature.

Printable DEL Code: Choose Yes to make the printer print the DEL code (decimal 127) as a solid box.

Page Width: This feature only appears in the menu in the ML321 printer. 13.6 inches is the default setting. Choose 8 inches when you are printing in A4 portrait orientation.

CPU Compensation: Select Special if the printer is to be used with Microsoft Windows version 2XX. This avoids a centronics parallel interface timing problem.

Line Spacing: Choose 6 Lines Per Inch (1/6 inch line spacing) or 8 LPI (1/8 inch line spacing).

Form Tear Off: If the selection Form Tear Off is on, continuous form paper will automatically advance to its tear of position after the time selected in the menu has elapsed 300 ms, 1 second or 2 seconds).

If the selection is set to OFF, the paper will not advance to the tear of position when no data is received.

Skip Over Perforation: Choose Yes if you want the printer to advance automatically to the next page when it comes within one inch of the bottom of the page. If your software has its own page formatting controls, set this item to No to avoid interference.

Auto LF: Choose Yes to have the printer automatically add a Line Feed command to each Carriage Return command it receives. The choice depends on whether your computer adds a Line Feed. If your printout is consistently double spaced, select No; if it overprints, choose Yes.

Page Length: Choose the length of the paper you're using. This enables the printer to keep track of the initial printing position on each page ("top of form").

Sheet Page Length: Cut sheet Page Length can be set independently from continuous form length.

CSF Bin Select: This option allows you to select each of the bins in a dual bin CSF, and store separate Top Of Form settings for each of the bins. The TOF can be set for each bin after exiting the menu select mode.

Character Set: Standard is the normal Microline character set; Line Graphics (IBM) is the IBM Character Set I; Block Graphics contains a series of graphic characters that let you create designs by combining various block patterns. See Appendix B for details on these character sets. DLL lets you print custom characters designed on your computer and downloaded to the printer; see Chapter 5 for details.

Language Set: These sets replace certain symbols with special characters used in the respective foreign languages. (See Appendix B.) The menu also includes the American Slashed Zero and American Unslashed Zero; choose American Slashed zero when it is important to distinguish between a zero and a capital letter O.

The following items are used only if the optional serial interface has been installed. See the Appendix C for details.

Parity: Selects parity.

Serial Data 7 or 8 Bits: Selects data format. When the Serial Data 7 or 8 Bits is set to 7, the Parity must be set to either ODD or EVEN. 7 Bit Serial Data will not be printed correctly if the Parity is set to NONE.

Protocol: Selects interface protocol.

Diagnostic Test: Activates the printer's interface diagnostic test.

Busy Line: Selects line used for busy signal.

Baud Rate: Selects data transmission speed.

DSR Signal: Sets the Data Set Ready (DSR) signal.

DTR Signal: Selects Data Terminal Ready (DTR) signal status.

Busy Time: Sets busy signal timing.

Cleaning

Every six months (or after about 300 hours of operation), take a clean, dry cloth and dust the area around the carriage shaft and platen. Be sure to remove any loose particles of paper. Don't use solvents or strong detergents on the cabinet. Be sure to turn the printer OFF before cleaning.

Problem Solving

Here are some of the most common printer problems and how to solve them. If you're still having difficulties, get help from your dealer.

What if . . .

. . . nothing happens at all when I turn on the printer?

The printer may not be plugged in. Check the power cord connection to the printer and the outlet. If you're using a power strip, make sure it's turned on.

. . . the ALARM light goes on?

You may be out of paper, or the paper has jammed. The SEL light will also go out, so when you've reloaded paper, the paper must cover the groove in the left side of the platen, press the SEL button. If the ALARM light doesn't go out when you reload paper, then there is probably a malfunction in the printer that requires service.

. . . the printer doesn't print when the computer sends it data?

The printer may de deselected—If the SEL light is out, press the SEL button.

. . . the paper keeps jamming?

Several things can cause paper jams. Here are a few tips on how to avoid them:

- Be sure to set top of form above the bail (column indicator). If you set it below, the top of the page will catch on the bail.
- Always use the bail lever or the platen knob to feed paper into the printer. Don't use the FF button for this: if you do, the paper will catch on the bail or the access cover.

If the paper does jam, back it out of the printer carefully using the platen knob. Be sure to remove any shreds of paper from the printer.

. . . the printer suddenly changes to unidirectional printing, then stops completely and the MENU light flashes?

This is a feature designed to protect the printhead. Heat can build up in the printhead when it's been printing for a long time, so when the printhead reaches a certain temperature, the printer switches to unidirectional printing. If heat continues to increase, the printer will stop until the printhead cools down: then it resumes printing.

. . . there are dots missing in my printouts?

The head gap may not be set correctly. Try moving the head gap lever to a lower setting. If that doesn't help, the printhead may be damaged; call for service.

... my word processor files don't print the way I have the menu and front panel set?

Before sending a file to the printer, many word processors send an "initialisation string." This string contains codes that reset the printer to a default set of features; otherwise the printer might accidentally print using features set for a previous job. The codes will override panel or menu settings. The printer's menu can be set in order to ignore these initialisation commands. Set the menu option RESET INHIBIT to YES to maintain control panel setting for a job.

... the menu and print feature buttons don't work?

The OPERATOR PANEL FUNCTIONS item on the printer menu can be used to disable these features. If the printer is part of a customised system or if it is used by a number of people, the system manager may have used this option to make sure the printer is always set properly.

...I want to cancel all of the changes that I have made to the menu?

By holding down the SEL and MODE buttons simultaneously while you turn on the printer, you will reset the printer menu to the factory default settings.

... I want to check the data my computer is sending to the printer?

Use the hexadecimal dump mode. To enter this mode, hold down the SEL and FF buttons while you turn on the printer. All data sent to the printer, including text and printer commands, will print in both hexadecimal and ASCII format. (In the ASCII format, all non-printable codes will be represented by a period.) For example, this line of BASIC code:

```
LPRINT CHR$(27);"0";CHR$(30);"12345";CHR$(10)
```

would print like this:

```
1B 30 1E 31 32 33 34 35 0A 0D 0A          .0.12345...
```

To return to normal printing, turn the printer off, then on again.

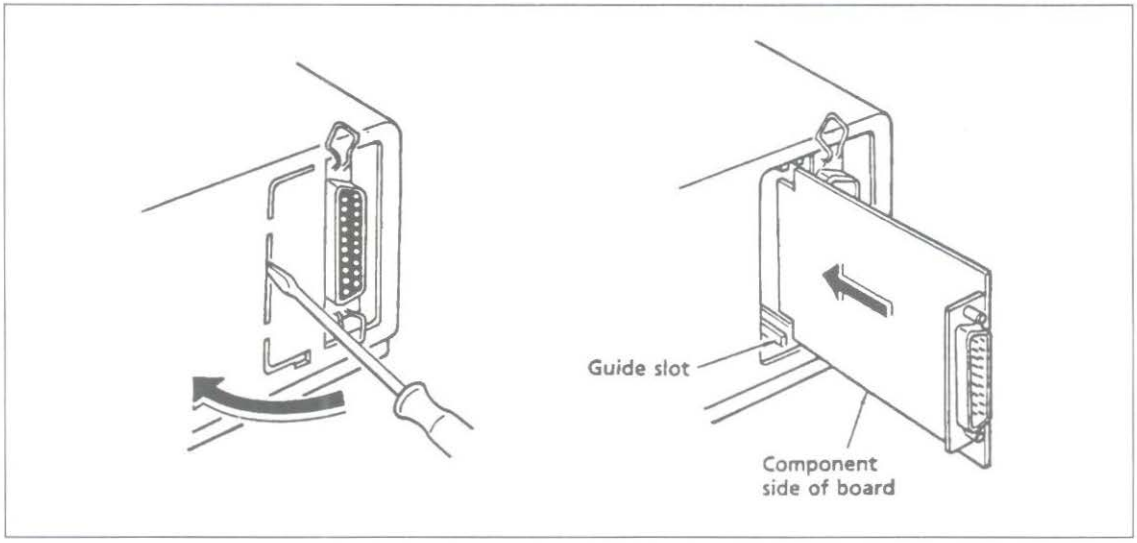
Installing the Optional Serial Interface

This section explains how to install the optional serial interface board RS232C and RS422. For details on menu options, cabling and diagnostic testing, see Appendix C.

Installation

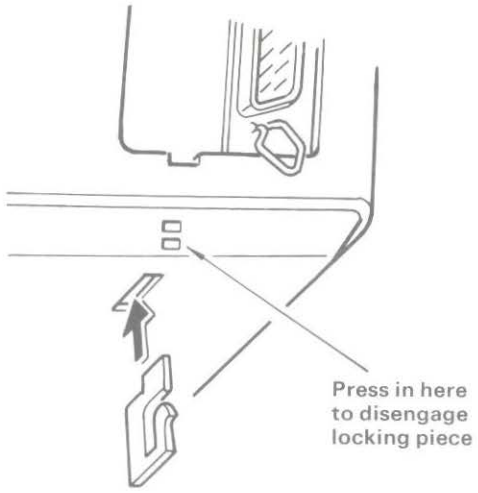
Important: Handle the interface board with care to avoid damaging its components. The components can also be damaged by static discharges. We recommend that you leave the board in its protective packaging until you've read these instructions and are ready to install it. Make sure the printer is unplugged before you install the board.

1. Remove the plastic covering over the serial board opening in the rear of the printer. Use a small knife or flat-head screwdriver to pry it free.



2. Holding the board by the cable connector with the components facing **away** from the parallel interface, gently slide it into the opening against the guides at the top and bottom. Press it firmly into place.

3. Lock the board into place by inserting the plastic locking piece into the hole in the printer base below the board opening. Push the top of the serial board down as you push the locking piece up. The piece will click into place.



4. Connect the interface cable (sold separately) to the printer interface connector and to the serial port of your computer. Be sure to tighten the screws on both ends of the cable to keep it in place.

Important: Make sure that you do not have a parallel cable connected to the printer when you're using the serial interface. You can switch to the parallel interface without removing the serial board, but only one cable can be attached at a time.

Chapter 3

Computer Control

Commercial Software

This chapter explains the fundamentals of controlling the printer through your computer. It covers MS-DOS printing commands, the fundamentals of setting up a software package for use with your printer, and some tips on writing BASIC programs to control your printer. This information should help you get started; be sure to read your software documentation carefully for more details.

DOS 2.0 and higher

Most IBM PC and compatible personal computers use PC-DOS or MS-DOS as their operating system. Although DOS is much more limited in printing capabilities than word processing or graphics software, there are some commands in DOS that you can use to control your printer.

DOS commands for printing ASCII text files

PRINT filename
TYPE filename > devicename
COPY filename devicename

If you've used a word processor or other software package to prepare your document, it's usually easiest to use that package's print commands to print it. This is particularly true if the software lets you control a document's appearance—page length, margins, printing features, and so on.

However, if your software doesn't control these kinds of features, it's just as easy to print using DOS commands. Some packages even have a "print to disk" feature, so you can save the file on a disk in a format that DOS can later read and send to the printer.

PRINT
PRINT is a background utility that lets you print a file while you're running another program. Once you've given the command to print your file, you can go on to another task on your computer, without waiting until printing is finished.

Note: PRINT is not a DOS command but a separate program, so if you want to use it, the file PRINT.COM must be on one of your disks.

—Example—
In this example, we're going to print a file called NOTES.TXT, which is on the WORK subdirectory of the computer's hard disk drive (drive C:). The PRINT.COM program file is in the main (root) directory of the C: drive.

Begin by typing the following at the ▻ prompt:

print c: \ work \ notes.txt [RETURN]

You'll see this display on your screen:

Name of list device [PRN]:

If your printer is connected to the LPT1: parallel printer port, just press [RETURN]; if it's connected to another port (LPT2:, COM1:, or COM2:), type the name of the port and press [RETURN].

Next you'll see this display:

Resident part of PRINT installed
C: \ WORK \ NOTES.TXT is currently being printed

And the file will print.

Note: If you're not sure which printer port your system uses, try pressing return to specify [PRN]. The device name PRN refers to LPT1:, the default DOS port. This is the port most printers are connected to.

Once you've used PRINT during a work session, DOS will "remember" the device you specified and won't have to ask you again where the printer is. Of course, turning off the computer or restarting it will erase this information from memory.

TYPE

If you don't have a copy of PRINT.COM available, you can use TYPE, redirecting the file to your printer. If you're not using LPT1: as your printer port, substitute the name of your port for lpt1 in our example.

—Example—

type c: \ work \ notes.txt > lpt1

COPY

Just as you use this command to copy a file from one disk or directory to another, you can copy a text file to the printer. If you're not using LPT1: as your printer port, substitute the name of your port for lpt1 in our example.

—Example—

copy c: \ work \ notes.txt lpt1

Changing the default printer port

If your system doesn't use LPT1: to connect the printer to the computer, you can specify which port DOS should use as its default. At the DOS prompt, enter the appropriate MODE command(s).

Serial interface
First enter
MODE COM1:9600,N,8,1,P
Then enter:
MODE LPT1:=COM1:

Parallel interface
Enter:
MODE LPT2:

Note: The serial interface board is an option for the Microline 320/321 printer. See your dealer for ordering information.

If your serial interface is COM2:, replace COM1: in the commands shown above with COM2:. Likewise, your parallel interface may be LPT3:, in which case, change the MODE command to MODE LPT3:.

To avoid having to reenter the MODE command(s) every time you reset the computer, enter them in your computer's AUTOEXEC.BAT file. To create an AUTOEXEC.BAT file or edit an existing one, use a text editor or a word processor in a mode that allows you to create ASCII text files. If you're editing your system's AUTOEXEC.BAT file, be sure not to change or delete anything already in the file.

For more information on working with AUTOEXEC.BAT files, see your DOS manual.

Printing with a software package
Software packages and computers also let you control printer features in different ways. The software package itself might have some inherent limitations. For example, many word-processing packages do not offer italics printing, a foreign language alphabet, or formatting features such as the Vertical Format Unit. Review your software package and computer documentation carefully to determine what printing features your package offers and how it controls these features.

When you first use your software package, you probably must run a program that sets up your computer to work with the ML320/321. This program will ask you to select the components of your computer from a series of menus or lists. Select "OKI 320/321", "OKI 192/193" or "OKI ML92/93" if either appears on the printer menu. The software will be adapted automatically to send the control codes for the ML320/321 printer features you request. If the ML320/321 printer is not listed in the printer menu, select "teletype-like printer," the closest general description.

Several software packages allow you to modify the program to accept your printer control codes for printing features. In effect, you can customize the software package to meet your specific printing needs. WordStar is one word-processing package that lets you modify the program by inserting your printer's control codes in user-definable locations in the program. Look in your software manual for instructions on modifying it, or ask your dealer.

The LPRINT command in BASIC makes output go to the printer rather than to the screen. To send text to the printer, simply enclose the words in double quotes:

```
LPRINT "A line of text"
```

The statement above prints the line of text, and then moves the printing position to the beginning of the next line. If you don't want this automatic carriage return and line feed, put a semicolon (;) after the data:

```
LPRINT "A line of text";
LPRINT "... and this text is on the same line"
```

Keep in mind, however, that BASIC automatically adds a carriage return and line feed after the 80th character in a line. If necessary, you can use a WIDTH statement to change this.

For serial printers

If you're using your printer with a serial interface, you have to be sure to redirect output from the computer to the serial port you're using, either COM1: or COM2:, rather than to the default port, LPT1:. There are two ways to do this:

1. If you're using DOS, you can use the MODE command. Then, use the LPRINT command in your BASIC programs, just as we do in our examples.
2. You can also redirect output to COM1: or COM2: from within BASIC, by opening the the port as a file and printing your data to that file. If you want to run any of our sample programs, you'll need to modify them. At the beginning of your program, include one of these statements:

```
OPEN "COM1:9600,N,8,1" AS #1
OR
OPEN "COM2:9600,N,8,1" AS #1
```

Then, to print data, use the PRINT #1 command, being sure to include a comma between the #1 and the data:

```
PRINT #1, "A line of text"
```

Like the PRINT command, PRINT #1 automatically moves the print position to the next line unless you use a semicolon (;) after the data.

When you send an LPRINT statement, the text between the quotation marks is converted to a string of numbers, which are then processed by the printer and output as the dot patterns that make up the individual characters. Each character is assigned a numeric value according to the American Standard Code for Information Interchange (ASCII). Since ASCII is a standard coding system, most computers, printers and other electronic devices can intercept ASCII data.

There are 256 ASCII codes. The codes from 0 to 127 are completely standardised (with a handful of minor exceptions), while those from 128 to 255 are used in a less standard way to represent a variety of special characters.

Although most of the ASCII codes represent alphanumeric and punctuation symbols, you will notice that the codes from 0 to 31, as well as 127, do not correspond to normal characters. These are control codes, special characters used to control a wide range of peripheral equipment, from monitors to modems to the devices that interest us here, printers.

One of the most important control codes is the ESC character, decimal 27, hexadecimal 1B. Many of the more complicated commands begin with ESC, which serves as a signal to the printer that what follows is to be interpreted as a command rather than just a string of characters.

Since the control codes don't represent any character on your keyboard, you can't send them to the printer enclosed in double quotes, as you would with text. Instead, you have to use the CHR$ function, which lets you send the decimal or hexadecimal value for a character. For example, the escape character is represented as CHR$(27), or, in hexadecimal, as CHR$(&H1B). (Notice that hexadecimal numbers in BASIC are preceded by &H to distinguish them from simple letters or decimal numbers.)

Of course, you can also use the CHR$ function to output printable characters; for instance, CHR$(65) represents the letter A. However, it's usually easier to type letters, numbers and punctuation marks, and your BASIC programs will be much easier to read if you use literal characters, enclosed in quotes, wherever possible.

Another use for the CHR$ function is to send the value you are assigning to the variable in a printer command. Some commands expect you to fill in a numeric value, representing tab stops, line spacing, etc. These values have to be given as the argument to a CHR$ function.

Chapter 4

Microline Features

The following explains all the available MICROLINE features that can be changed, and gives you examples of how to access them through programming your computer. (Remember: you can also select other values for many of these features with the Menu Select Mode.)

Character Pitch

The number of characters per inch defines the character pitch. The MICROLINE 320/321 offer you the choice of eight different character sizes:

pica (10 characters per inch (CPI))
elite (12 characters per inch)
fine print (17.1 characters per inch)
condensed (20 characters per inch)

and their expanded or double-width counterparts:

5 CPI (double 10 CPI)
6 CPI (double 12 CPI)
8.5 CPI (double 17.1 CPI)
10 CPI (double 20 CPI)

You will notice that the double-width command expands the characters so that fewer fit in an inch. If you want to separate your text into topics, this feature is ideal for printing headlines.

Although the default setting is 10 CPI, you can change the character pitch anytime by entering the following printer control codes.

Character pitch	Decimal	Hexa-decimal	ASCII
Begin 10 CPI (Pica)	30	1E	RS
Begin 12 CPI (Elite)	28	1C	FS
Begin 17.1 CPI (Fine print)	29	1D	GS
Begin 20 CPI (Condensed)	27 35 51	1B 23 33	ESC # 3

Double width pitch	Decimal	Hexa-decimal	ASCII
Expand characters to double width	31	1F	US

Normally when you want to specify a double-width pitch you must enter two codes, the single-width code and the double-width code. Entering the double-width command, CHR$(31), doubles whatever character pitch is in effect.

For certain applications you may need to know how many characters fit in one line. This depends on both the character pitch and the paper width. Table 1 shows the maximum number of characters per line for each character pitch.

Maximum number of characters per line

Character size	ML320	ML321	Doubled character size	ML320	ML321
Pica (10 CPI) CHR$ (30)	80	136	Double pica (5 CPI) CHR$ (30); CHR$ (31);	40	68
Elite (12 CPI) CHR$ (28)	96	163	Double Elite (6 CPI) CHR$ (28); CHR$ (31);	48	81
Fine Print (17.1 CPI) CHR$ (29)	137	233	Double Fine Print CHR$ (29); CHR$ (31)	68	116
Condensed (20 CPI) CHR$ (27); CHR$ (35); CHR$ (51)	160	272	Double Condensed (10 CPI) CHR$ (27); CHR$ (35); CHR$ (51); CHR$ (31)	80	136

Some versions of BASIC (IBM BASIC, for example) will not normally let you print more than 80 characters on a line. Most versions allow you to enter a WIDTH statement to supersede this limitation. Check your computer's BASIC manual to see what method it uses.

Double height printing	Decimal	Hexa-decimal	ASCII
Double height on	27 31 49	1B 1F 31	ESC US 1
Double height off	27 31 48	1B 1F 30	ESC US 0

The double height command can be combined with the double width command to create more noticeable characters. Double height characters can also be combined with normal height character in the same print line. If the printer is set to HSD the double height printing command will be ignored and the characters will be printed in standard height.

Print Modes

Near Letter Quality, Utility, High Speed Draft and Italics

The first time you turn your printer on, it will automatically print in Utility mode. In this mode the printer prints bidirectionally; that is, printing one line from left to right, the next line from right to left, etc. This printing method increases the printer's speed so it prints 250 Characters Per Second (CPS). You can use this mode for high-volume printing and for printing program listings or rough drafts.

When you want to make a good impression with a memorandum or letter, use OKI's special Near Letter Quality (NLQ) mode. In this mode the printer prints over each line twice. On the second pass, the printer fills in the dot pattern to form a sharp, crisp letter. You get great results when you print your word-processing files in this mode.

If you can sacrifice a little print quality for speed, select High Speed Draft (HSD) mode. In this print mode, you can have printing at 300 CPS in 10 CPI, or 360 CPS in 12 CPI. However, draft mode is unavailable with double width, emphasised, enhanced, italics and proportional spacing.

Often when you are writing you may want to highlight a paragraph or keywords with italics. Italics are printed in Utility or NLQ modes. In the Menu Select Mode, you will notice italics is designated by ITALICS (Italics characters).

Here is a summary of the commands you need to enter.

Print Mode	Decimal	Hexa-decimal	ASCII
Begin utility mode	27 48	1B 30	ESC 0
Begin NLQ courier mode	27 49	1B 31	ESC 1
Begin NLQ sans serif mode	27 51	1B 33	ESC 3
Begin HSD mode	27 35 48	1B 23 30	ESC # 0
Begin italics	27 33 47	1B 21 2F	ESC ! /
Stop italics	27 33 42	1B 21 2A	ESC ! *

Important: These modes can also be selected with the Menu Select Mode. When PRINT MODE appears, you can select UTILITY, NLQ COURIER, NLQ SANS SERIF, DRAFT or ITALICS.

Proportional spacing

Proportional spacing gives a document a typeset look by adjusting the spacing between characters according to the width of the character — for example an **i** would need less space than a **w** would.

Proportional spacing can be combined with all print modes with the exception of HSD. The proportional spacing command can be given anywhere on a line.

Proportional spacing	Decimal	Hexa-decimal	ASCII
Proportional spacing on	27 89	1B 59	ESC Y
Proportional spacing off	27 90	1B 5A	ESC Z

Spacing between characters

Some software packages let you specify the individual character width (see Proportional Spacing in the Menu Select Mode), and the spacing between individual letters. Together, by varying the spacing between characters in proportion to their width, these features produce a more polished, typeset look.

If your software package has this option, you must modify it by entering the control codes explained below. Follow the software package's instructions on modifying it.

The following table shows the standard character spacing when the printer is switched on, and the maximum increase allowed.

	Character spacing	
CPI	Standard	Maximum
10	3/120 inch	14/120 inch
12	3/144 inch	14/144 inch
17	3/206 inch	14/206 inch
20	3/240 inch	14/240 inch

To change the spacing between characters, enter this control code in your program:

Character spacing	Decimal	Hexa-decimal	ASCII
Set character spacing (n = 1 - 11)	27 78 n	1B 4E n	ESC N n
Return to standard spacing	27 78 0	1B 4E 00	ESC N NUL

You can also specify proportional spacing Menu Select Mode by selecting either Yes or No. If you respond YES be sure Utility or NLQ is the current value for **PRINT MODE**.

This command increases spacing between characters in multiples of 1/120, 1/144, 1/206 and 1/240 inch. The maximum variable number is 11, so the maximum possible space between characters is

14/120 inch (3/120 + 11/120) at 10 CPI
14/144 inch (3/144 + 11/144) at 12 CPI
14/206 inch (3/206 + 11/206) at 17 CPI
14/240 inch (3/240 + 11/240) at 20 CPI

After you set the spacing, it stays in effect until you turn off the printer, change the setting, or return to the standard spacing.

Important: This command is ignored when the printer is in bit image graphics, block graphics, or line graphics mode.

Character Sets

Character sets and languages
The MICROLINE 320/321 offers you a wide variety of character sets. These include the IBM character set (Line Graphics), a special set of characters that you design yourself (DLL), Block Graphic and the standard character set. For the "standard" character set you can select any one of the following languages:

- —Two versions of the ASCII character set (one with a slashed zero, one without a slashed zero in Utility mode),
- —Fifteen international language character sets, and
- —The TRS-80 character set, which includes block graphics.

Although these character sets and languages can be selected with the Menu Select Mode (see **Character Set** and **Language Set** in the Menu Select Mode Table) this section explains how to select them with programming commands.

To be consistent with the Menu Select Mode table, we separate these sets into **Character Set** and **Language**.

Character sets	Decimal	Hexa-decimal	ASCII
Select IBM character set	27 33 50	1B 21 32	ESC ! 2
Select block graphics	27 33 49	1B 21 31	ESC ! 1
Select standard character set	27 33 48	1B 21 30	ESC ! 0

When you enter the command for the standard character set, the printer will print the language you selected with either the Menu Select Mode or a programming command.

Being able to select languages with a programming command lets you switch back and forth among several different languages at random. Whenever you want to switch to another language, you simply enter this control code:

CHR$(27);"!"

and the code for the language (French, in this example)

CHR$(68)

National character sets	Decimal	Hexa-decimal	ASCII
Select required language	27 33 64 - 81	1B 21 40 - 51	ESC ! @ - Q

Character set	Character set codes	
	Decimal	Hexadecimal
ASCII (Ø)	64	40
ASCII (0)	65	41
BRITISH	66	42
GERMAN	67	43
FRENCH	68	44
SWEDISH 1	69	45
DANISH	70	46
NORWEGIAN	71	47
DUTCH	72	48
ITALIAN	73	49
TRS-80	74	4A
SPANISH	75	4B
SWEDISH 2	76	4C
SWEDISH 3	77	4D
SWEDISH 4	78	4E
TURKISH	79	4F
SWISS 1	80	50
SWISS 2	81	51

The chart below indicates the ASCII code characters with their counterparts in each of the other character sets. If you want to print an accented letter, for example, you must include the ASCII code for that letter in your program. Just look for the ASCII code directly above the letter in the chart. When you write the program, first enter the software command explained above, followed by the code for the character set. When you type the text, substitute the ASCII code for the accented letters wherever they appear in the text.

National character set table for OKI standard version

ESC ! n	Language	Decimal value														
		35	36	38	48	64	91	92	93	94	96	105	123	124	125	126
@	ASCII (Ø)	#	$	&	Ø	@	[	\	]	^	`	i	{	|	}	~
A	ASCII (0)	#	$	&	0	@	[	\	]	^	`	i	{	|	}	~
B	BRITISH	£	$	&	0	@	[	\	]	^	`	i	{	|	}	~
C	GERMAN	#	$	&	0	§	Ä	Ö	Ü	^	`	i	ä	ö	ü	ß
D	FRENCH	£	$	&	0	à	°	ç	§	^	`	i	é	ù	è	¨
E	SWEDISH I	#	¤	&	0	É	Ä	Ö	Å	Ü	é	i	ä	ö	å	ü
F	DANISH	#	$	&	0	@	Æ	Ø	Å	ü	`	i	æ	ø	å	ü
G	NORWEGIAN	#	$	&	0	@	Æ	Ø	Å	^	°	i	æ	ø	å	~
H	DUTCH	£	$	&	0	@	[	IJ	]	^	`	i	{	ij	}	~
I	ITALIAN	£	$	&	0	§	°	ç	é	^	ù	i	à	ò	è	ì
J	TRS - 80	#	$	&	Ø	@	↑	↓	←	→	`	i	{	|	}	¯
K	SPANISH	!	$	&	0	¡	Ñ	ñ	¿	ü	á	i	é	í	ó	ú
L	SWEDISH II	#	$	&	0	É	Ä	Ö	Å	Ü	é	i	ä	ö	å	ü
M	SWEDISH III	§	$	&	0	É	Ä	Ö	Å	Ü	é	i	ä	ö	å	ü
N	SWEDISH IV	§	¤	&	0	É	Ä	Ö	Å	^	é	i	ä	ö	å	ü
O	TURKISH	ş	$	ğ	0	Ş	ı	Ö	Ü	Ğ	ç	ı	ı	ö	Ü	Ç
P	SWISS I	£	$	&	0	ç	à	é	è	^	`	i	ä	ö	ü	"
Q	SWISS II	£	$	&	0	§	à	ç	è	^	`	i	ä	ö	ü	é

Now that you know how this feature works, you can experiment to learn how to give your prose a foreign flair.

IBM character set

When you select this character set, the ML320/321 printer can print the complete IBM alphanumeric character set and special symbols available on the IBM computer screen. (Appendix B lists the IBM character set for the 7-bit and 8-bit data formats.) Your printer can produce these symbols no matter what type of computer you have. All you have to do is select the IBM character set with the Menu Select Mode or with the programming command. Whenever you want to print any of the special symbols, include their codes in your program.

ASCII defines a standard set of 96 characters for decimal code numbers between 32 and 127. Decimal code numbers 0 through 31 are often reserved for special uses, including printer commands. In the IBM character set, however, decimal code numbers 3 through 6 represent special graphics symbols. The IBM character set printer commands are identical to those used in the standard character set; for example, the Line Feed command is CHR$(10).

The IBM character set also includes non-ASCII characters represented by decimal code numbers 128 through 175. These are mainly foreign language letters. Decimal code numbers 169, 170, and 176 through 223 are shading or grid characters. Decimal code numbers 224 through 253 are commonly used Greek letters and special mathematical symbols. 244 and 245 are the top and bottom parts of the integral sign. If you want to print one of these characters represented by a non-ASCII code, you can include its decimal (or hexadecimal) code in your program. Just use the CHR$ function to enter the code. We will show you how in the program examples.

IBM character sets	Decimal	Hexa-decimal	ASCII
Select IBM character set	27 33 50	1B 21 32	ESC ! 2
Return to standard character set	27 33 48	1B 21 30	ESC ! 0

After you select the IBM character set by entering

```
CHR$(27);"!2"
```

in your program, you enter any text and the decimal codes for whatever symbols you want printed.

Special procedure for 7-bit data format

If your computer uses a 7-bit data format, it will not accept decimal code numbers 128 through 255. For this reason, if you want to print any of the characters respresented by these codes, you must enter an extra command:

7-bit data format	Decimal	Hexa-decimal	ASCII
To print characters in decimal locations 128 - 255	14	0E	SO
To return to characters in decimal locations 1 - 127	15	0F	SI

Then subtract 128 from the decimal code for the character you want to print; enter the result in your program. For example, to print the character located at decimal 171, subtract 128 and enter the result in your program:

```
LPRINT CHR$(14);CHR$(43)
```

This results in the "½" character being printed.

If you are going to use the same character several times, you can make it easier by using a "string variable" in your program. A string variable is named with a series of characters, consisting of letters and numbers but NO semicolons. The variable name must end with $ (see your BASIC manual for more details). Define a string variable as the CHR$ function of the character you want to print. Whenever you want to print that character in your program, just type the variable name instead of the CHR$ statement. You save yourself about six keystrokes each time you type that character:

The IBM character set also has grid characters represented by decimal code numbers 169, 170, and 176 through 223. Certain software packages use them, but you can use them to design patterns, forms, etc. with a little calculation.

Now you can experiment a little on your own. You can use the IBM character set just like any other character set (ASCII, for example), or to print special characters. When you want to print the latter, locate them in Appendix B and enter their decimal equivalents in your program.

Emphasised and enhanced printing

These print styles let you highlight text with bold letters. In both emphasised and enhanced printing the printer prints over the same text twice: the second pass is offset by a half-dot horizontally in emphasised printing, and by a half-dot vertically in enhanced printing.

You cannot use these features when the printer is in HSD mode.

Emphasised and enhanced printing	Decimal	Hexa-decimal	ASCII
Begin emphasised printing	27 84	1B 54	ESC T
Begin enhanced printing	27 72	1B 48	ESC H
End emphasised and enhanced printing	27 73	1B 49	ESC I

Superscripts and subscripts

With this feature you can print characters slightly above the print line (superscripts) for footnotes and exponents, and characters slightly below the print line (subscripts) for formulas.

Superscripts and subscripts are the full width and half the height of standard characters.

Superscript and subscript will not be printed in the HSD mode. If they are entered in this mode the printer will automatically set itself to Utility for the superscript or subscript characters.

For added compatibility with word-processing packages, these two features cancel each other; that is, a subscript code stops superscript printing, and a superscript code cancels subscript printing. You can also use the separate cancelling codes given below.

Superscripts and subscripts	Decimal	Hexa-decimal	ASCII
Begin superscript	27 74	1B 4A	ESC J
End superscript	27 75	1B 4B	ESC K
Start subscript	27 76	1B 4C	ESC L
End subscript	27 77	1B 4D	ESC M

Important: Superscript and subscript printing continue until you stop them.

Underlining

With this feature you can draw an unbroken line under characters and the spaces between characters.

Underlining	Decimal	Hexa-decimal	ASCII
Begin continuous underlining	27 67	1B 43	ESC C
End continuous underlining	27 68	1B 44	ESC D

Page Length, Top of Form, and Form Feed

After you set the page length, the printer knows what size of paper you are using. The Top of Form records the position of the first line of printing on the page; that is; it sets the top margin. (If you are using a software package, it might automatically insert a top margin of about an inch.) Inserting a Form Feed command after printing several lines moves the paper to the first printing line of the next page.

Page Length and Top of Form can be, and usually are, set with the controls on the printer operating panel. They can also be set using the control codes below in a program.

Formatting features	Decimal	Hexa-decimal	ASCII
Set page length	27 70 n1 n2	1B 46 n1 n2	ESC F n1 n2
Set page length in multiples of 1/2 inch	27 71 n1 n2	1B 47 n1 n2	ESC G n1 n2
n1 n2 = 00 to 99. Two digits must be entered. If n1 n2 is less than 10, then n1 must be entered as 0. If n1 n2 equals 00, the pagen length returns to the value set in the menu.			
Set Top Of Form (TOF)	27 53	1B 35	ESC 5
Form Feed	12	0c	FF

Note: TRS-80 computers do not recognise this code.

Suppose you want to print on a 3-inch page with 25.4 mm (1 inch) margins at the top and the bottom. Before running the program, set the print line 1 inch from the top of the paper.

Cut Sheet Feeder

Function	Decimal	Hexa-decimal	ASCII
Single sheet insert	27 83	1B 53	ESC S
Single sheet eject	27 86	1B 56	ESC V

If you have an OKI optional Automatic Cut Sheet Feeder mounted on your Microline you can use the CHR$(27);"S" command to insert a new sheet of paper from the hopper. If paper is already in the printer this sheet will be ejected first before the new sheet is fed in. (In normal use this is achieved by using the FF code).

Should you wish to eject a sheet then use the CHR$(27);"V" command.

Note: A LF command at the end of a page also causes the next sheet to be loaded.

If you are working with a Dual Bin Cut Sheet Feeder you can also use the commands below to select various trays depending on your particular Dual Bin Cut Sheet Feeder version:

Function	Decimal	Hexa-decimal	ASCII
Tray 1	27 25 49	1B 19 31	ESC EM 1
Tray 2	27 25 50	1B 19 32	ESC EM 2

A separate TOF can be set for each of the bins on the CSF. This enables you to print on letter-headed paper, fed from one bin, leaving a large margin, followed by printing on pages fed from the other bin with a smaller margin. (See Chapter 2 for details on setting the Top Of Form).

Line spacing

Unless you changed the print menu, the printer is normally set to print with a line spacing of 6 lines per inch. This means the distance between the bottom of one line and the bottom of the next line is 1/6 inch. (This is the standard line spacing for a typewriter.)

When you want to fit more printing on a page, you can change the line spacing to 8 lines per inch, or for special effects you can change line spacing in multiples of 1/144 inch. This affects only the space between lines, not the character height.

Because changing the line spacing increases or decreases the number of lines per page, it affects the Top of Form position.

Line spacing	Decimal	Hexa-decimal	ASCII
Begin 1/6 inch line spacing	27 54	1B 36	ESC 6
Begin 1/8 inch line spacing	27 56	1B 38	ESC 8
Set line spacing to 1/144 inch per line (n = 0 - 127)	27 37 57 "n"	1B 25 39 n	ESC % 9 n

Note: The maximum line spacing is 127/144 inch per line. When set to 0/144 inch, this control code produces an overstrike with no line feed.

Automatic skip over perforation

With this feature you can specify where the printer will skip from the bottom of one page to the top of form of the next page. In effect you specify the top and bottom margins of the page. The printer automatically skips over the perforation between pages of computer paper, and starts printing again at the next Top of Form. This feature can be used in a software program, eliminating the need for inserting the programming command for Form Feed, FF, after every page in your program. After the automatic skipping distance is set, you can print a program several pages long without worrying about the pages running together.

Before you set the automatic skip it is a good idea to set the page length and Top of Form.

Although you can select automatic skip-over perforation of one inch (bottom and top margins) in the Menu Select Mode, with the following command you can vary the distance skipped:

Skip-over perforation	Decimal	Hexa-decimal	ASCII
Vary skip-over distance	27 37 83 "n"	1B 25 53 n	ESC %S n
n = 0 - 9			

In this command "n" represents the distance skipped from the bottom of one page to the Top of Form of the next page according to the formula:

n = 3 × (distance skipped in inches)

Let's assume that page length is set to 11 inches (the default print menu setting) and Top of Form is set for one inch from the top of the page. If you want to skip one inch at the bottom and the top, or a total of 2 inches, using the above formula you will obtain the value of n:

n = 3 × (2 inches)

or n = 6. Use that value in the above programming command and you will have:

CHR$(27);"%S";"6"

To make it easier, we prepared a chart for you. When you know how many inches you want to skip, use this chart to find the value of n. The chart also includes the number of lines skipped when the printer is set for printing at 6 lines per inch.

Total skipping distance in inches	Value of n	Number of lines skipped at 6 LPI
0	0	0
1/3	1	2
2/3	2	4
1	3	6
4/3	4	8
5/3	5	10
2	6	12
7/3	7	14
8/3	8	16
3	9	18

Always remember to set the Top of Form and page length before you set the automatic skipping distance.

Indenting

With this feature you can indent one line of print for beginning paragraphs, positioning headings, etc. The amount of indentation is calculated in dot columns. (A dot column is the distance from the centre of one dot to the centre of the next dot within a character pattern.) This distance varies according to the size of the character. The following table shows the maximum number of dots that can fit in a line at each character pitch.

	10 CPI	12 CPI	17.1 CPI	20 CPI
ML 320	960	1152	1644	1920
ML 321	1632	1956	2796	3264

You can set the indentation to the exact dot position distance from the print head's home position:

Indenting	Decimal	Hexa-decimal	ASCII
Set indenting position	27 37 66 "n1 n2 n3 n4"	1B 25 42 n1 n2 n3 n4	ESC % B n1 n2 n3 n4

The column number must be a four-digit number (1 would be entered as 0001) and cannot be past the left or right margin. If you are programming in hexadecimal, remember to represent each of the four digits with a two-digit hexadecimal number. Be sure to include the semicolon at the end of this code sequence; otherwise the command will not work.

Setting the page margins

Normally the print head begins printing at its "home position" under the 1 on the column indicator, or at the position set by the software. You can, however, change this left margin to a multiple of 1/120 inch from the normal home position. You can also set the right margin in multiples of 1/120 inch from the print head home position.

Page margin set	Decimal	Hexa-decimal	ASCII
Set left margin (n1 n2 n3 = 001 - 999)	27 37 67 n1 n2 n3	1B 25 43 n1 n2 n3	ESC % C n1 n2 n3
Set left margin to print head home position	27 37 67 "001"	1B 25 43 (30 30 31)	ESC % C 001
Set right margin (n1 n2 n3 n4 = 0001 - 9999)	27 37 82 n1 n2 n3 n4	1B 25 52 n1 n2 n3 n4	ESC % R 0001-9999 n1 n2 n3 n4

You must enter a three-digit number for the left margin. The maximum left margin dot positions (that is distance to the right of the home position) are:

899/120 inches for the ML320
999/120 inches for the ML321

You must enter a four-digit number for the right margin. The right margin must be at least five characters to the right of the left margin and lie within the following range:

$0060 \leqq$ right margin $\leqq 0960$ (ML320)
or
$0060 \leqq$ right margin $\leqq 1632$ (ML321)

Horizontal tabs

When you turn on the printer, tabs are set automatically for every eighth character. As with a typewriter, however, you can set your own horizontal tab stops on the ML320 and ML321. You set the stops with a line at the beginning of your program, and insert an HT code whenever you want to skip to the next tab stop. Some important distinctions will give you more flexibility.

Note: Your computer or software may control horizontal tabs directly; in that case you will not be able to use the printer's horizontal tab feature. Some computers, however, allow you to tab by using CHR$(137) OR 89 (hexadecimal) instead of the standard HT code, CHR$(9). See your computer manual for details.

You can set up to 16 tab stops, but you must enter them in left-to-right sequence or in ascending numeric order.

Tabs can be set at character columns or at dot columns. First, we discuss character column tabs.

Character column tabs

Character column tabs	Decimal	Hexa-decimal	ASCII
Set character column tabs	27 9 "1st tab, 2nd tab..." 13	1B 09 (1st tab, 2nd tab...) 0D	ESC HT 1st tab, 2nd tab... CR
Skip to next tab	9	09	HT
Clear tab stops	27 9 13	1B 09 0D	ESC HT CR

Note: Each character column tab must be a three-digit number. If you are programming in hexadecimal, remember that each digit must be represented by a two-digit hexadecimal number.

The location of the farthest possible tab stop depends on the printer model (the ML321 has a wider carriage) and the character size you are using (there are more characters on a line at 17.1 CPI than at 10 CPI). This chart shows the possible combinations.

Model	Maximum character columns per line at			
	10 CPI	12 CPI	17.1 CPI	20 CPI
ML320	80	96	137	160
ML321	136	163	233	272

If you try to skip to a tab stop set beyond the width of the page, or if you try to skip to a tab where none was set, the printer will advance the paper one line and begin printing at the first column of the next line.

Dot column tabs

This feature lets you set tab stops by dot column, the distance between the centre of one dot and the centre of a dot in the next column. If you use the character spacing feature to create proportional spacing, dot column tabs will help you keep columns of information straight. You can use dot column tabs with either Near Letter Quality or Utility printing. As with character column tabs, you can set as many as 16 different tab stops.

Dot-column tabs	Decimal	Hexa-decimal	ASCII
Set dot-column horizontal tabs	27 3 "1st tab, 2nd tab . . ." 13	1B 03 (1st tab, 2nd tab . . .) 0D	ESC ETX (1st tab, 2nd tab . . .) CR
Skip to next tab stop	9	09	HT
Clear dot-column tabs	27 3 "0000" 13	1B 03 30 30 30 30 0D	ESC ETX 0000 CR

Note: The dot column numbers must have four digits. If you are programming in hexadecimal, remember that each digit must be represented by a two-digit hexadecimal number. The tab stops must be entered in the program in ascending numeric order; for example, 0200, 0400, 0500.

You will notice that this tab command is identical to that used for character column tabs.

As with character column tabs, the width of a dot column changes when you change character size (the characters are made narrower by reducing the distance between dot columns). For reference, this chart shows the width of a dot column for the four character sizes:

		Character width			
		10 CPI	12 CPI	17.1 CPI	20 CPI
Dot column width	(inches)	1/120	1/144	1/206	1/240
	(mm)	0.21	0.18	0.12	0.11

The maximum number of dot columns available on a line varies with the character pitch and printer model:

Model	Maximum dot columns per line at			
	10 CPI	12 CPI	17.1 CPI	20 CPI
ML320	960	1152	1644	1920
ML321	1632	1956	2796	3264

Vertical tabs

The electronic Vertical Format Unit (VFU) lets you pre-program up to 12 different sets of vertical tab stops called channels. For all 12 channels you can load a maximum number of 54 tab stops. You can use the VFU together with horizontal tabs to print information on pre-printed forms or to print your own forms. Lines at the beginning of the program indicate the positions of the stop and a channel code. Whenever the printer receives a VT (vertical tab) code—CHR$(11)—followed by the channel code in the program, it skips to the next tab stop in that channel.

Vertical tabs	Decimal	Hexa-decimal	ASCII
Load vertical tabs	20	14	DC4
End loading sequence	63	3F	?
Tab to next stop in channel n	11 "n"	0B n	VT n
n equals 1 - 12			

Use the following codes to designate the channel:

VFU channel codes		
Channel no.	**Decimal code**	**Character**
1	CHR$(49)	1
2	CHR$(50)	2
3	CHR$(51)	3
4	CHR$(52)	4
5	CHR$(53)	5
6	CHR$(54)	6
7	CHR$(55)	7
8	CHR$(56)	8
9	CHR$(57)	9
10	CHR$(58)	:
11	CHR$(59)	;
12	CHR$(60)	<

Start the loading sequence with CHR$(20). Follow it with a number of spaces (or CHR$(32), the decimal code for a space) equal to the number of the line where you want your first stop and add the channel code. Next add spaces equal to the number of lines to be skipped to the next stop and insert the channel code. Continue in this manner and program the number of space codes and channel codes required for each tab skip. Add enough spaces at the end of the sequence so that the total number of spaces in the sequence equals the number of lines on your page. End the sequence with the decimal equivalent for the ASCII code "?":CHR$(63).

Think of the loading sequence as a representation of the page, with a space (or a space code) representing each line. Wherever you want to set a tab stop on a line, place a channel code directly after the space representing that line. Use one statement to load several channels of stops with the same page length.

An example will be easier to follow. Suppose you want to set up a 12-line (2 inch) form with tabs at the 3rd, 5th, and 9th lines. Use channel number 1. If your version of BASIC has the STRING$ function, you can use the ASCII code for a space (32 in decimal form) easily, like this:

```
10 LPRINT CHR$(20);STRING$(3,32);CHR$(49);STRING$(2,32);CHR$(49);STRING$(4,32);
   CHR$(49);CHR$(3,32);CHR$(63)
```

If your BASIC does not have STRING$, you must replace STRING$(2,32) with CHR$(32);CHR$(32). Whichever method you use, be sure the number of spaces (or space codes) equals the number of lines on your page, including spaces after the last tab stop. If you omit these spaces the Form Feed command will not function correctly.

Tab to the next stop with:

```
LPRINT CHR$(11);CHR$(49)   or   LPRINT CHR$(11);"1"
```

Miscellaneous Features

Carriage Return and Line Feed

When the printer receives a Carriage Return (CR) command, it will print a line of data and return the print head to the left side of the page. When it receives a Line Feed (LF) command, the printer will advance the paper one line. Normally your computer will automatically add a carriage return and line feed at the end of a line, but at times you may want to include these commands in your program.

Note: Normally, either the computer or your printer is set to add a Line Feed command to each CR command. If your printer prints several lines without advancing the paper, you will have to set the print menu option Automatic Line Feed to YES by using the Menu Select Mode.

Line feed	Decimal	Hexa-decimal	ASCII
Insert line feed	10	0A	LF

Carriage return	Decimal	Hexa-decimal	ASCII
Insert carriage return	13	0D	CR

When you enter the following Line Feed Without Carriage Return command in your program, the printer will print the line of data, advance the paper one line, but will not return the print head to the left side of the paper:

Line feed and carriage return	Decimal	Hexa-decimal	ASCII
Line feed without carriage return	27 18	1B 12	ESC DC2
Variable line feed with carriage return	27 37 53	1B 25 35 n	ESC % 5 n
Reverse line feed with carriage return	27 10	1B 0A	ESC LF

With a variable line feed command you can instruct the printer to print data, advance the paper n/144 inch (n = 1 - 127), and return the printhead to the left side.

The reverse line feed command (ESC LF) moves the paper back one line, and returns the printhead to the left side of the platen.

Direct line skip

With this feature you can skip up to 99 lines on the page. When the printer receives this control code, it prints data, returns the carriage and feeds the paper the specified number of lines.

Direct line skip	Decimal	Hexa-decimal	ASCII
Insert direct line skip (n1 n2 = 00 - 99)	27 11 n1 n2	1B 0B n1 n2	ESC VT n1 n2

Note: The direct line skip must be entered as a two digit number. If the skip is less than 10 lines, enter 01 to 09.

Half-speed printing

Half-speed printing	Decimal	Hexa-decimal	ASCII
Begin half-speed printing	27 60	1B 3C	ESC <
Return to normal speed	27 62	1B 3E	ESC >

Print head directional

For some situations, such as printing reports with columns requiring exact alignment, unidirectional printing might improve the graphics print quality. After you specify this feature, the printer will print only in one direction, always from left to right.

Print head direction	Decimal	Hexa-decimal	ASCII
Begin unidirectional printing	27 45	1B 2D	ESC —
Return to bidirectional printing	27 61	1B 3D	ESC =

Backspacing

With this feature you can create a symbol not included on your keyboard, such as a plus/minus sign, a less than/equal to sign, greater than/equal to sign, or a cents symbol. By including the backspace command between two characters, you instruct the printer to print one character, then backspace and print the second character over the first. To combine symbols, follow each character with the BS command plus the overprinted symbol.

Backspace	Decimal	Hexa-decimal	ASCII
Backspace	8	08	BS

Paper-out override

Paper-out override	Decimal	Hexa-decimal	ASCII
Disable paper-out switch	27 69 "1"	1B 45 31	ESC E 49
Enable paper-out switch	27 69 "0"	1B 45 30	ESC E 48

Be careful when using this feature as it allows the printer to print when there is no paper present. This can cause the platen and the printhead to be damaged.

Print suppress model

This feature lets you temporarily "disconnect" your printer from your computer by sending it a control code through your program. After it receives the DC3 code, the printer will ignore any data it gets until it receives a DC1 code releasing it from the Print Suppress state.

Print suppress mode	Decimal	Hexa-decimal	ASCII
Begin print suppress mode	19	13	DC3
End print suppress mode	17	11	DC1

Note: Some computers use the DC1 (Device Control) and DC3 codes to control other functions. Check your computer manual to see if this is true for yours. If so, your printer may get a DC3 code when you do not want to and you may lose data. To solve this problem, reset Option DC1/3 in the Menu Select Mode to N to ignore the DC1 and DC3 codes entirely.

There is a difference between the Print Suppress mode, which is controlled by DC3 and DC1 codes, and the select the deselect states, which are controlled by the SEL switch on the front of the printer. When the printer enters Print Suppress mode (DC3), it continues to receive data, but it does not store or print it, so the data is lost. The SEL indicator blinks. Pushing the SEL switch will NOT select the printer again. The DC1 code must be sent to the printer before it can print again.

Cancel

This code will eliminate a line of data if it has not yet been printed. It will also cancel any special printing features in effect, except:

Horizontal tabs
Vertical tabs
Left and right margins
Downline loadable characters
Paper-out override
Skip over perforation
Top of Form
Page length
Print registration

You can use it at the end of a program to reset the printer to default printing.

Cancel	Decimal	Hexa-decimal	ASCII
Clear buffer and reset printer	24	18	CAN

Print buffer/reset
When the printer receives this command, it first prints all the data in its buffer and performs a line feed, then cancels any special printing features in effect, thus returning to the default settings. The default settings are set by the Menu Select mode.

When the printer receives this command, the following happens:

- —The horizontal tabs are reset to every eighth character.
- —The printer erases the data in the VFU memory, the right and left margin settings, and the Top of Form.
- —The DLL character font memory is not cleared.
- —Underlining, superscripts, and subscripts are cancelled.
- —The printer prints bidirectionally (except in graphics mode, as designated by the Menu Select mode, setting).
- —The standard spacing between characters is restored.
- —Half-speed printing is reset to standard speed.
- —These remaining features return to their default settings set by the Menu Select mode:

  line spacing (LPI)
  character pitch (CPI)
  emphasised printing
  enhanced printing
  double width
  print mode
  character set
  language
  page length
  skip-over perforation
  paper-out override
  Bit Image Graphics
  proportional spacing
  print registration

Use this command to print the data in the buffer, and reset the printer:

Print buffer/reset	Decimal	Hexa-decimal	ASCII
Print data in the buffer and reset the printer	27 24	1B 18	ESC CAN

This command will be ignored if the RESET INHIBIT option command in the menu is set to YES.

Chapter 5

Advanced Features

Downline Loadable Character Generator (DLL)

YOUR OWN CUSTOM CHARACTERS

In addition to the standard 96-character set, the ML320 and ML321 have a separate printer memory reserved for extra characters you may want to use for special purposes. You can create and store up to 160 symbols, or design a complete 96-character font.

The DLL memory has battery backup, and the data is retained when the printer is turned off.

Designing characters involves a little bit of work. First, you have to design your character or symbol as a dot pattern on a matrix. Then you have to translate the pattern into numeric data the printer (and your computer) can understand. After that you have to assign it to a specific address location so you know where it is when you need it. Next you have to include it in a program to load the information into the printer's memory. After you have done all that, you must save the program in a permanent storage device, such as your computer's disk system, so it will be readily available. It sounds difficult, but it is easy after you practice.

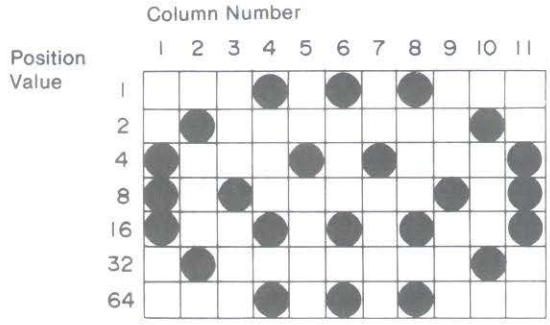
Designing your character

Each character you design will ultimately be printed in a pattern called a matrix. The matrix consists of 11 columns, each with 7 rows of dots, so that there are a total of 77 dot positions available for a character.

Important: Please note that not all 77 positions are available for a single character. You cannot place two dots in the same row in adjoining columns. So, for example, you can place a dot in row 1 of columns 1 and 3 or columns 2 and 4, but you cannot put dots in row 1 of columns 1 and 2. If you accidentially enter dots on the same row of adjacent columns, the second dot will not be printed.

Now it is time to map out your character, once you do this you are ready to convert your matrix into data the printer understands.

Shown below is the design for a character:



Converting dot patterns into printer data

For this step you translate the dot pattern into a numeric code that the printer and computer can understand. To help you, we have assigned a numeric value to each row in the matrix. Just add the values of the rows where you want dots to appear in each column. The following diagram shows the proper values.

If you are familiar with binary numbers: Each column is represented by a 7-bit binary number. A dot is represented by a "1" and a blank space is "0"; the top dot is the LSB (Least Significant Bit), and the bottom dot is the MSB (Most Significant Bit). The bit positions are shown in the following table for reference. You can use the ASCII code chart as a reference.

Row	Dot Position in Column	Decimal Value	Bit
1		1	2^0 LSB
2		2	2^1
3		4	2^2
4		8	2^3
5		16	2^4
6		32	2^5
7		64	2^6 MSB

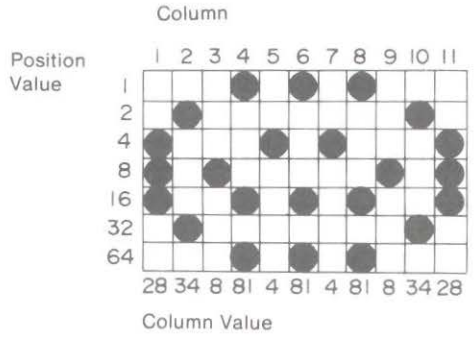
For example, in column 1 of our character there are dots in rows 3, 4, and 5, so add:

$4+8+16 = 28$

Column 2 has dots in rows 2 and 6, so add:

$2+32 = 34$

Continue for the whole pattern:



Ascenders and descenders

Although only seven rows can be printed at a time, the character matrix actually has nine rows. Two rows run below the print line that runs across the bottom of row seven. An ascender character prints in rows one through seven and thus sits on the print line. Descender characters such as g, j, p, q, and y extend below the print line, so they print in rows three through nine. If you want to print the same character as both an ascender and a descender, the numerical data for the columns is the same — only the code sequence to load the data is different. We will load our character both ways to demonstrate this.

Loading the data

There are two ways to load characters into the DLL. They can be loaded one by one, or 96 characters can be copied at once. Character Nos. 32 to 127 in the code table are copied.

Loading the data	Decimal	Hexa-decimal	ASCII
To copy data	27 36	1B 24	ESC $
Load an ascender character	27 37 65	1B 25 41	ESC % A
Load a descender character	27 37 68	1B 25 44	ESC % D

The DLL memory is retained after the printer is turned off. Therefore, it need not be reloaded or copied unless it is to be changed.

At factory shipment, the DLL contains ASCII code character patterns. In our example, we create an ascender and a descender character.

Next, choose a character from the standard character set to represent your new character. Any character numbered between 32 and 127 on the ASCII chart will do. This works well if you are creating an entire character set. However, if you plan to create just a few characters it is a good idea to choose an ASCII character you seldom use, such as ^ or @. You can then combine your custom-designed characters with standard characters easily.

Let's choose the "@" character to represent our custom character.

Our LPRINT statement starts like this:

```
LPRINT CHR$(27);"%A";"@";
```

Next comes the column data:

```
LPRINT CHR$(27);"%A";"@";CHR$(28);CHR$(34);CHR$(8);CHR$(81);CHR$(4);
       CHR$(81);CHR$(4);CHR$(81);CHR$(8);CHR$(34);CHR$(28)
```

The statement automatically ends after the data for the 11th column. You must include data for all 11 columns and you must use a separate statement for each character you want to load.

Load the same character as a descender, using "^" as the representation:

```
LPRINT CHR$(27);"%D";"^";CHR$(28);CHR$(34);CHR$(8);CHR$(81);CHR$(4);CHR$(81);
       CHR$(4);CHR$(81);CHR$(8);CHR$(34);CHR$(28)
```

Printing downline loadable characters
In our example, we used just two ASCII code locations in the DLL.

Printing downline loadable characters	Decimal	Hexa-decimal	ASCII
Switch to DLL character set	27 50	1B 32	ESC 2

After you enter the DLL mode with this command, your custom characters will be printed. If the dot pattern data was not changed, the standard character will be printed. In the program for our example, we loaded the ascender character into ASCII code location decimal 64 ("@") and the descender character into ASCII code location decimal 94 ("^").

Here is the program:

```
10 LPRINT CHR$(27);CHR$(36)
20 LPRINT CHR$(27);"%A";"@";CHR$(28);CHR$(34);CHR$(8);
   CHR$(81);CHR$(4);CHR$(81);CHR$(4);CHR$(81);CHR$(8);
   CHR$(34);CHR$(28)
30 LPRINT CHR$(27);"%D";"^";CHR$(28);CHR$(34);CHR$(8);
   CHR$(81);CHR$(4);CHR$(81);CHR$(4);CHR$(81);CHR$(8);
   CHR$(34);CHR$(28)
40 LPRINT CHR$(27);"2"
50 LPRINT "NORMAL SET MMMMMM@@@^^^NORMAL AGAIN
   MMM"
60 LPRINT CHR$(27);"0"
```

Line 10 loads the standard character set into the DLL RAM (Random Access Memory).

Line 20 loads the dot pattern data for the ascender character in the address represented by "@".

Line 30 loads the dot pattern data for the descender character in the address represented by "^".

Line 40 switches the printer into DLL mode.

Line 50 prints the statement with the ascender and descender characters.

Line 60 exits the DLL mode.

The printout will look like this:

If you would like to print the DLL characters in Near Letter Quality, you can select the simulated Near Letter Quality (NLQ) DLL. In the simulated NLQ downline loadable character set, the dot pattern information for each DLL character that you have designed and loaded is duplicated. In its second pass for near letter quality mode, the printer augments this data, and fills out the character making it appear like an actual Near Letter Quality character.

You must design and load the dot pattern data for your DLL characters as described previously. Then you can select the simulated Near Letter Quality DLL.

Select Near Letter Quality DLL	Decimal	Hexa-decimal	ASCII
Select Near Letter Quality DLL	27 55	1B 37	ESC 7

Bit Image Graphics

With bit image graphics, you can draw almost any kind of illustration with your printer. Using a graphics software package is easiest because the package will "dump" an image you create on the display screen onto the page. Many of these packages will work well with your MICROLINE. When you run the setup section of the package, look for something like "OKI ML320" or "ML321" on the printer menu.

This section tells you how to program graphics by hand and gives you a basic understanding of the concept. Very advanced graphics can be achieved through practice and a good imagination.

Programming graphics

Programming graphics	Decimal	Hexa-decimal	ASCII
Select printer graphics mode	3	03	ETX
End printer graphics mode	3 2	03 02	ETX STX

In this mode, any ASCII code (for a letter, number, or even a control code) sent to the printer is printed as a pattern of dots in a single column.

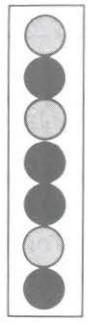
The next question is how do you know what code number to send for the particular dot pattern you want? Each column has 7 (or 8) dot positions having numeric values as shown in the following table. All you have to do is add the values for the positions where you want dots to appear and enter the total into your program.

If you are familiar with binary numbers: Each column is represented by a 7-bit or 8-bit binary number, depending on the setting of Menu Select mode, GRAPHICS-7/8 BIT, and which data format your computer uses. A dot is represented by a "1" and a blank space is "0". The top dot is the LSB (Least Significant Bit), and the bottom dot is the MSB (Most Significant Bit). These bit positions are indicated in the table below. Use the ASCII code as a reference.

Note: If your system can send only seven dots in graphics, select 7-bit image graphics. If your system can send eight dots, select 8-bit image graphics. Remember to select the corresponding data format.

Row	Dot Position in Column	Decimal Value	Bit
1		1	2^0 LSB
2		2	2^1
3		4	2^2
4		8	2^3
5		16	2^4
6		32	2^5
7		64	2^6 MSB or
8		128	2^7 MSB

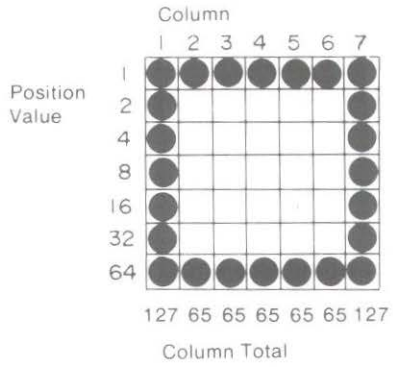
—**Example**—

Dot Position in Column	Decimal Value
	2
	+8
	+16
	+64
	90 as CHR$(90)
Enter	

All our examples were done in 7-bit image graphics. If you want to use 8-bit image simply add the additional row of data.

If you select 8-bit graphics, but only send 7-bit data, horizontal white lines one dot deep will appear in your printout.

The easiest way to design an image is to lay it out on graph paper first. Next, add the decimal values of the positions where you want dots to appear:



Our LPRINT statement begins with CHR$(3) to enter graphics mode, then includes the decimal values of the seven columns and ends with CHR$(3);CHR$(2) to exit graphics mode:

```
10 LPRINT CHR$(3);CHR$(127);CHR$(65);CHR$(65);CHR$(65);
   CHR$(65);CHR$(65);CHR$(127);CHR$(3);CHR$(2)
```

If your version of BASIC has the STRING$ function, you can simplify by using STRING$(5,65) instead of repeating CHR$(65) five times.

When you run the program, the printout should look like this:

□

A word about resolution

Notice that our sample box is not exactly square, even though it is seven dots high and seven dots wide. This is because the spacing of the dots (or resolution) is different horizontally and vertically.

A quick explanation should make it clear. Each dot is 1/72 inch in diameter. Resolution, a measure of how closely spaced the dots are, is measured in dots per inch (DPI). The vertical graphic resolution is 72 DPI, so the dots just touch each other. The horizontal resolution, however, is 60 DPI, so the dots do not quite touch. This means that a horizontal row of seven dots is slightly longer than a vertical column of seven dots, so our sample box is slightly oblong.

This can be corrected easily by adding this line to your program:

```
05 LPRINT CHR$(28)
```

In normal text printing, this command selects Elite (12 CPI) printing. When you switch into the graphics mode, this command changes the horizontal resolution to 72 DPI, so that vertical and horizontal resolution are the same, therefore eliminating distortion.

Here is our sample image printed at 72 × 72 DPI resolution:

Note: If you are using an "intelligent interface" to print screen dumps, 72 × 72 DPI resolution will give you a more accurate representation of the screen image.

The horizontal resolution of the dots changes with the character pitch, as well as with the graphics density commands. The following table shows the horizontal dot resolution for each graphics density mode in each of the possible pitch settings.

	Single Density		Double Density	Quadruple Density
	ESC P	ESC Q	ESC R	ESC # Q
10 CPI	60	60	120	240
12 CPI	72	72	144	288
17.1 CPI	60	60	120	240
20 CPI	60	60	120	120

If you send bit image graphics data to the printer when it is set for 17.1 or 20 CPI, the printer will ignore the charactger pitch settings and print with a horizontal resolution equivalent to 10 CPI. When you exit the graphics mode, the printer will start to print in the previously selected 17.1 or 20 CPI.

Let's try another example. This one uses a FOR - NEXT loop to print all the possible dot patterns in sequence:

```
10 LPRINT CHR$(30)
20 LPRINT CHR$(3);
30 FOR I=1 TO 127
40 LPRINT CHR$(I);
45 IF I=3 THEN LPRINT CHR$(3);
50 NEXT I
60 LPRINT CHR$(3);CHR$(2)
```

Line 10 sets the printer for 10 CPI so the resolution will be 60 × 72 DPI.

Line 20 switches the printer into graphics mode.

Line 30 through 50 print the dot patterns for the values 1 through 127.

Line 40 makes sure the dot pattern for the value 3 is printed. (Because the value 03 is a graphics command, you must send it twice. The printer then knows the second 03 is data, not a graphics command, and prints the dot pattern for 03.)

Line 50 switches the printer out of graphics mode.

Here is the result:

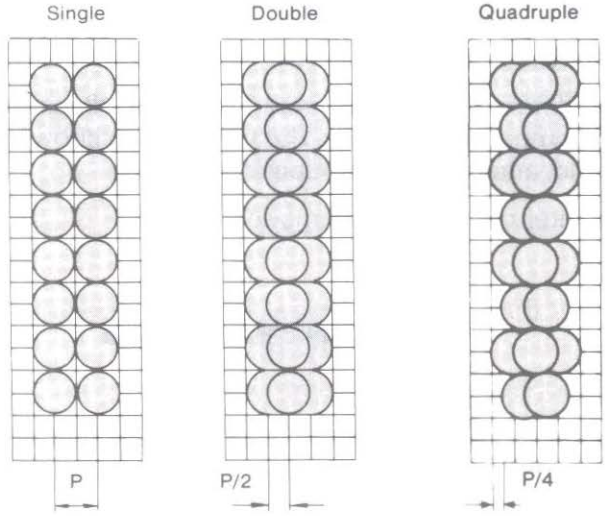
Try 72 × 72 DPI resolution by changing line 10 to LPRINT CHR$(28) and compare the printout:

Note: When the printer is in graphics mode, any ASCII code it receives will be printed as a column of dots. Many computers automatically send a Carriage Return and a Line Feed code after the 80th or 132nd code number; these will be printed as dot patterns. Check your computer manual to find out how to override this feature. (The most common method is a WIDTH statement.)

Single double and quadruple density graphics

Graphic resolution	Decimal	Hexa-decimal	ASCII
Begin single density graphics	27 80	1B 50	ESC P
Begin single density graphics	27 81	1B 51	ESC Q
Begin double density graphics	27 82	1B 52	ESC R
Begin quasi-quadruple density graphics	27 35 81	1B 23 51	ESC # Q

The MICROLINE 320 and 321 offers you the option of selecting single, double or quadruple horizontal density graphics. Double density has twice the horizontal dot resolution of single density, and quadruple density is four times that of single density. The following figure illustrates how single, double and quadruple density differ:



P = 1/60 inch or 1/72 inch.

After the printer receives the command for double or quasi-quadruple density graphics, it automatically prints the horizontal dots closer together. Because the dots are spaced closer together, the dot pattern becomes denser, making the printout darker.

The printer can also be set into the graphics mode by using the composite graphics command ESC * n1 n2. This sequence allows you to select both the graphic mode and density in one command. A more detailed explanation of the composite graphics command can be found later in this chapter under the heading "Composite Commands".

The following program will print the image in double density. We have made the dot pattern for this image simpler by entering STRING$ (5,65) instead of repeating CHR$ (65) five times.

```
10 LPRINT CHR$ (27); CHR$ (82);
20 LPRINT CHR$ (3); CHR$ (127); STRING$ (5,65);
   CHR$ (127); CHR$ (3); CHR$ (2);
30 LPRINT CHR$ (27); CHR$ (37); CHR$ (53); CHR$ (13);
```

Line 10 specifies double-density graphics.
Line 20 enters graphics mode, sends the dot pattern, then exits the graphics mode.
Line 30 performs a line feed of 13/144 inch and returns the printhead to the left.

Here is the printout.

By including more horizontal dot pattern data, we can make our figure look like a square instead of a rectangle:

```
10 LPRINT CHR$ (27); CHR$ (82);
20 LPRINT CHR$ (3); CHR$ (127); STRING$ (10,65);
   CHR$ (127);CHR$ (3); CHR$ (2);
30 LPRINT CHR$ (27); CHR$ (37); CHR$ (53); CHR$ (13);
```

Line 10 specifies double-density graphics.
Line 20 enters graphics mode, sends twice as much dot pattern (with a STRING$ statement that repeats CHR$ (65) ten times), then exists the graphics mode.
Line 30 performs a line feed of 13/144 inch and returns the printhead to the left.

Here is the printout.

Vertical double and quadruple density

Because the printer does not automatically increase the vertical dot density, you must enter each line of the pattern data more than once if you want double and quadruple vertical density.

For vertical double density the pattern for each line is sent twice. A line spacing command of 1/144 inch separates each transmission of the data. The program then spaces 13/144 inch to start printing the next line of the graphic. The result is a vertical overlapping of the dot pattern that creates the double density effect.

The following example illustrates the additional data required to load vertical double density; Your program begins with:

CHR$ (27); CHR$ (82;	to specify double density graphics
CHR$ (3);	to enter graphics mode
DATA	dot pattern data for one line of your design
CHR$ (3); CHR$ (2);	to exit graphics mode
CHR$ (27); CHR$ (37); CHR$ (53); CHR$ (1);	to perform 1/144 inch line feed and carriage return
CHR$ (3);	to re-enter graphics mode
DATA	same dot pattern data as above
CHR$ (3); CHR$ (2);	to exit graphics mode
CHR$ (27); CHR$ (37); CHR$ (53); CHR$ (13);	to perform 13/144 inch line feed and carriage return

Follow the same procedure for the next line of your design. Let's use our box image as an example;

```
10 LPRINT CHR$ (27); CHR$ (82);
20 LPRINT CHR$ (3); CHR$ (127); STRING$ (10,65);
   CHR$ (127); CHR$ (3); CHR$ (2);
30 LPRINT CHR$ (27); CHR$ (37); CHR$ (53); CHR$ (1);
40 LPRINT CHR$ (3); CHR$ (127); STRING$ (10,65);
   CHR$ (127); CHR$ (3); CHR$ (2);
50 LPRINT CHR$ (27); CHR$ (37); CHR$ (53); CHR$ (13);
```

Line 10 specifies quasi-quadruple density graphics.
Line 20 enters graphics mode and sends the decimal values of the first two columns. As adjacent dots are not printed in the quasi-quadruple density graphics mode the second column is assigned a value of zero. This will be printed in the second pass (line 80).
Line 30 informs the printer that the FOR/NEXT information will be sent 9 times.
Line 40 is the information which is sent nine times. The Value of zero is assigned to all of the even numbered dot columns. These will be printed in the second pass (1 line 100).
Line 60 prints the final two columns of the image and exits the graphics mode.
Line 70 performs a carriage return without a line feed. The printhead return to the original starting position of your graphic image.
Line 80 re-enteres the graphics mode and sends the dot pattern data for the first two columns again. This time all the information is sent to print in the even numbered columns. The value for the first column is zero and for the second column is 127 (compare with line 20).
Line 100 sends the even numbered column information. On this pass of the printhead the odd numbered columns are set to zero (CHR$ (0)), so that the printhead only fires on the even numbered columns.
Line 130 performs a line feed of 1/144 inch and returns the printhead to the left. All of the information already sent to the printer to print both passes of the graphic is sent again to achieve the vertical quadruple density effect.
Line 250 performs a line feed of 11/144 inch and returns the printhead to the left side of the carriage. You can now send another line of graphic data.

The printout will look like this.

When you design your graphics, remember that the maximum number of dots per line changes with the graphics density. The following table shows the maximum number of dots per line for each density.

	Density	Model	
		ML320	ML321
	Single	480	816
10 CPI	Double	960	1632
	Quadruple	1920	3264
	Single	576	978
12 CPI	Double	1152	1956
	Quadruple	2304	3912

MULTILINE GRAPHICS

Until now we have concentrated on single-line images. After exiting graphics mode at the end of the line, the computer inserts a Carriage Return code, which tells the printer to print the line, and a Line Feed code, which advances the paper. But you can print more than one line of graphics data without returning to the normal (text) mode. All you need are the special Line Feed codes.

Multiline graphics	Decimal	Hexa-decimal	ASCII
Graphics line feed with carriage return	3 14	03 0E	ETX SO
Graphics line feed without carriage return	3 20	03 14	ETX DC4
Text line feed with carriage return	3 10	03 0A	ETX LF
Text line feed without carriage return	3 18	03 12	ETX DC2

Graphics line feed with carriage return advances the paper 7/72-inch and returns the print head to the left margin. If carriage return is not requested the print head will not return to the left margin. The reason for the 7/72-inch line feed is that one line of graphics printing measures 7/72-inch high, so a normal line feed would leave a gap between lines.

The text line feed command, with carriage return, allows you to print a line of graphics, advance the paper one line and return the print head to the left margin.

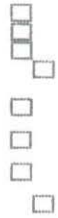
The following example demonstrates these line feed codes using our original box image as a subroutine:

```
 10 LPRINT CHR$(30)
 20 LPRINT CHR$(27);CHR$(80);CHR$(3);
 30 FOR J=1 TO 2
 40 GOSUB 250
 50 LPRINT CHR$(3);CHR$(14);
 60 NEXT J
 70 FOR K=1 TO 2
 80 GOSUB 250
 90 LPRINT CHR$(3);CHR$(20);
100 NEXT K
110   LPRINT CHR$(3);CHR$(14);
120 FOR L=1 TO 2
130 GOSUB 250
140 LPRINT CHR$(3);CHR$(10);
150 NEXT L
160 FOR M=1 TO 2
180 GOSUB 250
190 LPRINT CHR$(3);CHR$(18);
200 NEXT M
210 LPRINT CHR$(3);CHR$(2)
220 STOP
250 LPRINT CHR$(127);STRING$(5,65);CHR$(127);
260 RETURN
```

Lines 250 to 260 are the subroutine to print the box. There are four loops; each prints two boxes separated by a:

Graphics line feed with carriage return (30 to 60)
Graphics line feed without carriage return (70 to 100)
Text line feed with carriage return (120 to 150)
Text line feed without carriage return (160 to 200)

Here is what the printout looks like:



BLOCK GRAPHICS

This feature was originally designed for use with the Radio Shack TRS-80, but it works with other computer systems as well. With Block Graphics you can create bar charts, graphs and designs by combining various shapes and sizes of blocks. You can select this feature either with the Menu Select Mode or by entering the command for switching to the Block Graphics mode.

If you are working with a software package that automatically generates bar charts, with Block Graphics you can obtain an exact printout of what you see on the screen.

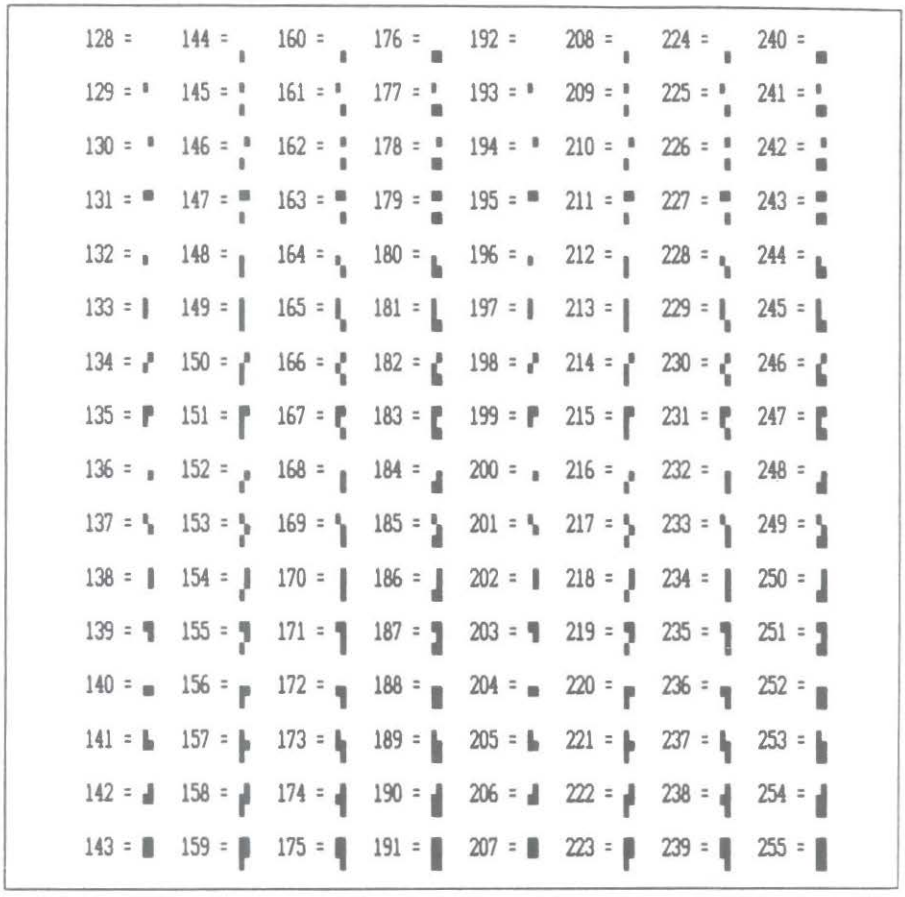
Block graphics	Decimal	Hexa-decimal	ASCII
Enter block graphics	27 33 49	1B 21 31	ESC ! 1
Return to standard printing	27 33 48	1B 21 30	ESC ! 0

You may, however, wish to design a picture or bar chart without a software package. You can combine geometric shapes in many different patterns. First, make a rough sketch of your picture and then enter the Block Graphics mode by typing the command in BASIC:

```
CHR$(27);CHR$(33);CHR$(49)
```

Next, select the shapes that will produce the pattern you want printed from the table below. Incorporate their corresponding decimal codes (from 128 to 191 for the 8-bit data format or from 32 to 95 for the 7-bit data format) in your BASIC program.

8-Bit Graphic Codes



If your system uses 7-bit data format, normally only the low ASCII codes from 32 through 95 are available to you. After you enter Block Graphics mode, the standard characters represented by the low ASCII codes, 32 through 95, will be printed. However, there is a way you can print the shapes represented by the high ASCII codes, 128 through 191. In the area 192-255 the TRS-80 block graphic character set is repeated once again. If you want to access these block graphic characters in 7-Bit mode, first choose it from the table between 160 and 223. While in Block Graphics mode, type:

```
CHR$(14)
```

This code lets you print the geometric shapes represented by the high ASCII codes. Next type in the low ASCII codes for the desired shapes found in the table below. The low ASCII codes are equal to the high ASCII code minus 128 (the calculations have been made in the table).

When you want to print the standard characters represented by the low ASCII codes, 32 through 95, enter:

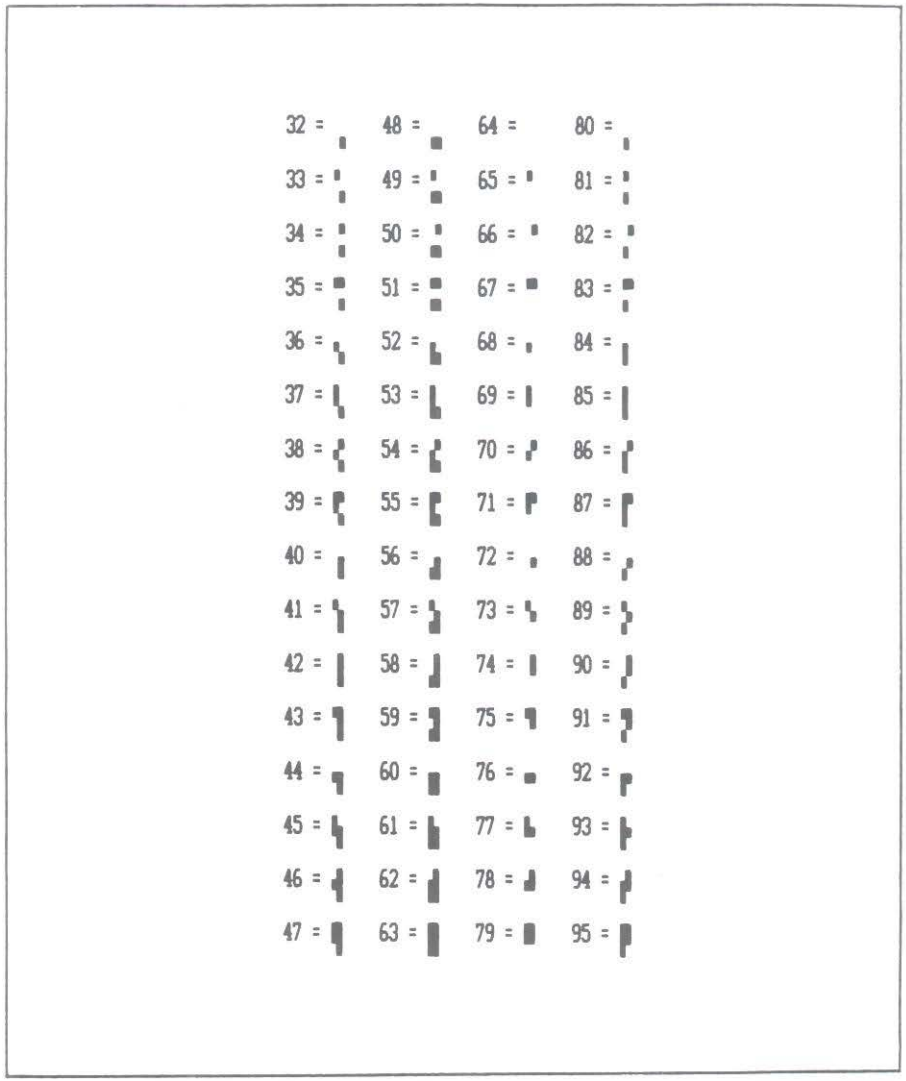
```
CHR$(15)
```

When you want to exit Block Graphics mode and return to the standard mode set by the Menu Select Mode, enter:

```
CHR$(27);"!";CHR$(48)
```

With these two commands you can switch back and forth between block graphics and regular text.

7-Bit Graphic Codes



PRINT REGISTRATION

The Print Registration Menu Select item is a bit image graphics option that is only used with bidirectional printing. It lets you fine-tune the horizontal printing position of a graphic image or table where precise column alignment is important. You'll probably need to experiment with the different settings to find which works best for your printouts. One way to determine the best value is by printing several columns of vertical bar characters (|) at each registration value. Use the setting that produces the straightest vertical column.

Print Registration Settings

Setting	Resulting movement
+5	0.25 mm to the right
+4	0.20 mm to the right
+3	0.15 mm to the right
+2	0.10 mm to the right
+1	0.05 mm to the right
0	no movement
−1	0.05 mm to the left
−2	0.10 mm to the left
−3	0.15 mm to the left
−4	0.20 mm to the left
−5	0.25 mm to the left

Composite Commands

Composite commands save time and memory space by combining control of frequently used functions into one command. The composite print command lets you set character size, print style (enhanced/emphasised, subscript/superscript, or normal), print mode (utility, Near Letter Quality, italics, or custom characters), and print size and/or underlining with just one command. The composite CR/LF command lets you set either reverse line feed, line feed, carriage return plus line feed, or carriage return alone. The composite graphics command lets you set: single or double density and 8- or 7-bit code.

Just as with custom characters and graphics, composite commands require a little calculation as we show here.

Composite commands	Decimal	Hexa-decimal	ASCII
Composite print n3 n4:	27 38 n1 n2 n3 n4 58	1B 26 n1 n2 n3 n4 3A	ESC & n1 n2
Composite CR/LF	27 63 n1 58	1B 3F n1 3A	ESC ? n1 :
Composite graphics	27 42 n1 n2 58	1B 2A n1 n2 3A	ESC * n1 n2 :

where n is the value assigned to each variable in the sequence.

Composite print command

This command lets you set several print features simultaneously, so it can be useful if you change the printing style frequently. The command looks like this:

```
CHR$(27);"&";CHR$(A);CHR$(B);CHR$(C);CHR$(D);CHR$(58)
```

Variables A, B, C and D are numeric representation of the features you select with the Composite Print Command chart. Variable A sets print size and normal or double size; variable B sets enhanced/emphasised, superscript/subscript, or normal print style; variable C selects utility, Near Letter Quality, italics, or custom characters; and variable D sets underlining. Choose the features you want, calculate the variable totals using the following chart, and include the totals in the composite print command above.

Composite Print Command Chart

	Variables			
Values	**A**	**B**	**C**	**D**
1	10 CPI	Normal script	Utility mode	HSD
2	12 CPI	Subscript	NLQ mode	—
4	17.1 CPI	Superscript	Custom characters	Underline
8	20 CPI	Emphasised	Italics	Double Height
16	Double Width	Enhanced	—	*
32	*	—	*	*
64	—	*	*	*
Subtotal:	32	64	96	112
+ values				
Total:				

***Base numbers:** Always add these. We added them for you in the Subtotal for each column.

As you can see in the chart above, each row has a value, ranging from 1 to 64. When you choose a particular feature, find its value in the left column, then add that value to any base number(s) already listed in the column. (The base numbers indicated by asterisks have already been included in the "Subtotal" for each column). Follow the same procedure for each column, then use the totals for columns A through D in the composite command.

For example, if you wanted to print at 12 CPI, double-width printing with normal script in italics mode, and underline the entire text, you would calculate the values in this way:

	Variables			
Values	**A**	**B**	**C**	**D**
1	—	Normal (+1)	—	—
2	12 CPI (+2)	—	—	—
4	—	—	—	Underline (+4)
8	—	—	Italics (+8)	—
16	DW (+16)	—	—	*
32	*	—	*	*
64	—	*	*	*
Subtotal:	32	64	96	112
Add:	18	1	8	4
Total:	50	65	104	116

* **Base numbers:** Always add these. We added them for you in the Subtotal for each column.

When you use these totals for columns A, B, C, and D in your composite command you will have:

```
CHR$(27);"&";CHR$(50);CHR$(65);CHR$(104);CHR$(116);CHR$(58)
```

Composite command cancelled
Line 40 cancels all the features selected with the composite print comand and returns the printer to the default print modes set by the Menu Select mode.

Note: Selecting features with the composite command overrides the manually selected print modes.

Cancelling features set with the composite print command

When you want to cancel the values set by the composite command, in some cases (namely, for enhanced and emphasised printing, underlining, and italics) you merely subtract the particular feature value from the total for the column. For other features, however, you must also specify the normal mode:

After selecting double width characters, you can cancel this feature by specifying either 10 CPI, 12 CPI, or 17.1 CPI. For example, if you had first selected 8.5 CPI (double width 17.1 CPI), change the total of Column A: Make the value of row 5 equal 0, then add the value of one of the character pitches. For example, if you select 12 CPI, the new total for Column A is 34. Use this new total in the composite print command to change this feature.

After setting superscript or subscript printing, you can cancel them by changing the total of Column B. In the case of superscripts, for example, the total of Column B changes from 68 to 65; 68 minus 4 (the feature value) plus 1 (the value for normal script) equals 65. Use the new total for Column B in the composite print command.

After selecting custom characters or NLQ mode, you can cancel them by changing the total of Column C: make the value of row 2 or 3 equal 0, then add 1 for UTILITY mode. Use the new total for Column C in the composite print command.

Composite CR/LF command

With this command you can specify reverse line feed, line feed, carriage return plus line feed, or carriage return alone. There is only one variable in this command.

```
CHR$(27);"?";CHR$(A);CHR$(58)
```

Values	Variable A
1	Carriage Return (CR)
2	Line Feed (LF)
4	—
8	—
16	Reverse Line Feed
32	*
64	—
Subtotal:	32
Add:	
Total:	

* **Base numbers:** Always add these. We added them for you in the Subtotal for each column.

You can combine carriage return and line feed, carriage return and reverse line feed, but obviously not forward line feed and reverse line feed. For example, if you want to set carriage return and line feed, add 1 (CR) and 2 (LF) to the base number 32 and use the total in the command:

```
CHR$(27);"?";CHR$(35);CHR$(58)
```

Composite graphics commands

Composite graphics commands let you set graphics data all in one command. You calculate and write the commands with a method similar to composite print commands. The exception is that there are two variables, A and B, instead of four. The command looks like this:

```
CHR$(27);"*";CHR$(A);CHR$(B);CHR$(58)
```

The variables A and B represent the total values that you determine from the chart below:

	Variables	
Values	**A**	**B**
1	60 dots per inch	—
2	72 dots per inch	—
4	Single-density data	—
8	Double-density data	Double-speed printing command
16	Quadruple-density data	8-bit data
32	*	—
64	*	*
Subtotal:	96	64
Add:		
Total:		

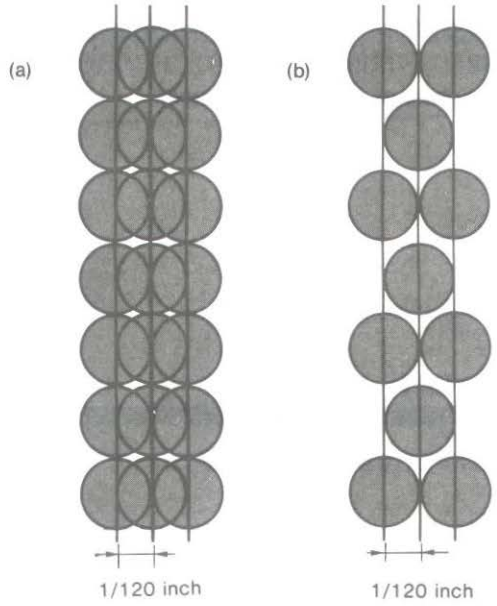
* **Base numbers:** Always add these. We added them for you in the Subtotal for each column.

Note: When sending 7-bit data, the total for Column B is 64.

Double-speed printing command

Double-speed printing can be selected when a double- or quadruple-density command is executed using the composite command. Printing is performed at twice the normal speed. As with quadruple density, at double density double speed direct adjacent dots will not be printed out one after another, each second dot will be ignored.

(*a*) Without the double-speed command, printing looks like this:
(*b*) With the double-speed command, printing looks like this:



For example, suppose you wanted to send single-density data at 72 dots per inch and in 7-bit data format. You would calculate the values this way:

	Variables	
Values	**A**	**B**
1	—	—
2	72 DPI (+ 2)	—
4	Single (+ 4)	—
8	—	—
16	—	(0) 7-bit data
32	*	—
64	*	*
Subtotal:	96	64
Total:	102	64

* **Base numbers:** Always add these. We added them for you in the Subtotal for each column.

Using the total for Columns A and B in your composite command, you have:

```
CHR$(27);"*";CHR$(102);CHR$(64);CHR$(58)
```

Now try this command in a program:

```
10 LPRINT "Text at 10 CPI"
20 LPRINT CHR$(27);"*";CHR$(102);CHR$(64);CHR$(58);
30 LPRINT CHR$(3);STRING$(216,127);CHR$(3);CHR$(2);
40 LPRINT "3 inches of dots, 10 CPI text"
```

Here is the printout:

```
Text at 10 CPI
```

```
3 inches of dots, 10 CPI text
```

Testing Program Data with the Hex Dump Mode

From time to time you might want to check the accuracy of data being sent from the computer to the printer. The hexadecimal dump mode is designed to do just that. In this mode the printer converts all received data into its hexadecimal equivalents.

Initiate the hexadecimal dump by pushing the SEL and FORM FEED switches as you turn on the printer.

The printer starts printing as soon as 16 or more bytes of data (an entire line of data) have been received. When testing less than 16 bytes of data, you must push the SEL switch again after entering this mode before the printer can start printing.

In this mode, all data, including control codes sent to the printer, is printed in hexadecimal form. If data extends for longer than a page, the printer automatically skips over the last inch of one sheet and resumes printing at the next Top of Form provided that Menu Select option 12 is set to YES.

Exit this mode by turning off the printer.

Here is an example of how data from the computer in BASIC format:

```
LPRINT CHR$(&H1B);"0";CHR$(&H1E);"12345";CHR$(&H0A)
```

is converted into hexadecimal format:

```
1B  30  1E  31  32  33  34  35  0A
```

Appendix A

Control Code Tables

Function	Control Code		
	ASCII	Decimal	Hexadecimal
Backspace Moves print head one space backward	BS	08	08
Bit image graphics Enter graphics mode	ETX	03	03
Note: Print density in graphics mode depends on character pitch. Before entering graphics mode, specify: 10 CPI for 60 × 60 or 12 CPI for 72 × 72 print density			
Exits graphics mode	ETX STX	03 02	03 02
Prints graphics data, and feeds paper 14/144 inch (for 7-bit) or 16/144 inch (for 8-bit) and returns carriage	ETX SO	03 14	03 0E
Prints graphics data, and feeds paper 14/144 inch (for 7-bit) or 16/144 inch (for 8-bit) without carriage return.	ETX DC4	03 20	03 14
Prints graphics data, feeds paper one line, and returns carriage	ETX LF	03 10	03 0A
Prints graphics data and feeds paper one line without carriage return	ETX DC2	03 18	03 12
Specify single density 60 × 72 DPI @ 10 CPI 72 × 72 DPI @ 12 CPI	ESC P or ESC Q	27 80 or 27 81	1B 50 or 1B 51
Specify double density: 120 × 72 @ 10 CPI 144 × 72 @ 12 CPI	ESC R	27 82	1B 52
Specify quadruple density	ESC # Q	27 35 81	1B 23 51
Carriage return Return print head to left side	CR	13	0D

Function	Control Code		
	ASCII	Decimal	Hexadecimal
Character sets			
Selects standard set	ESC ! 0	27 33 48	1B 21 30
Selects block graphics	ESC ! 1	27 33 49	1B 21 31
Selects IBM set (line graphics)	ESC ! 2	27 33 50	1B 21 32
Selects foreign language set	ESC ! n	27 33 n	1B 21 n
Character width			
Designates 10 CPI	RS	30	1E
Designates 12 CPI	FS	28	1C
Designates 17.1 CPI	GS	29	1D
Designates 20 CPI	ESC # 3	27 35 51	1B 23 33
Designates double-width characters	US	31	1F
Designates double-height characters n = 1 : ON n = 2 : OFF	ESC US n	27 31 n	1B 1F n
Clear buffer			
Clears buffer and resets printer to defaults. Does not erase data for HT, VT, FF, left margin and right margin, skip over perforation, and paper end detection	CAN	24	18
Composite commands			
Composite print: sets several print modes at once	ESC & n :	27 38 n 58	1B 26 n 3A
Composite CR/LF: sets CR and LF simultaneously	ESC ? n :	27 63 n 58	1B 3F n 3A
Composite graphics: sets graphics	ESC * n :	27 42 n 58	1B 2A n 3A
Cut sheet feeder			
CSF single sheet eject	ESC V	27 86	1B 56
CSF single sheet insert	ESC S	27 83	1B 53
Downline Loadable Character Generator			
Starts loading of one standard character into DLL (ascender)	ESC % A m	27 37 65 32 - 127 and 160 - 223	1B 25 41 20 - 7F and A0 - DF
Starts loading of one descender character into DLL	ESC % D m	27 37 68 m	1B 25 44 m
Designates DLL character set	ESC 2	27 50	1B 32

Function	Control Code		
	ASCII	Decimal	Hexadecimal
Downline Loadable Character Generator (contd.)			
Designates NLQ DLL character set	ESC 7	27 55	1B 37
Copies standard set into DLL character set	ESC $	27 36	1B 24
Emphasised/enhanced printing			
Designates half-dot enhanced printing	ESC H	27 72	1B 48
Designates half-dot emphasised printing	ESC T	27 84	1B 54
Stops emphasised or enhanced printing	ESC I	27 73	1B 49
Formatting			
Top of Form Sets TOF (first line of printing)	ESC 5	27 53	1B 35
Form feed Feeds paper to first line of next page (TOF = top of form)	FF	12	0C
Page length			
Designates page length in lines (n = 00 - 99)	ESC F n	27 70 n	1B 46 n
Designates page length in multiples of 1/2 inch (n = 00 - 99)	ESC G n	27 71 n	1B 47 n
HSD mode			
Designates HSD characters	ESC # 0	27 35 48	1B 23 30
IBM character set			
In 7-bit code, use this to access high ASCII codes (decimal 128 to 255	SO	14	0E
In 7-bit code, use this to access low ASCII codes (decimal 0 to 127)	SI	15	0F
Italicised printing			
Starts italics printing	ESC ! /	27 33 47	1B 21 2F
Stops italics printing	ESC ! *	27 33 42	1B 21 2A

Function	Control Code		
	ASCII	Decimal	Hexadecimal
Line feed			
Moves paper up one line	LF	10	0A
Prints data, then feeds paper one line without carriage return	ESC DC2	27 18	1B 12
Performs line feed in multiple of 1/144 inch (up to 127) and returns the carriage. Works only in text mode and is in effect for one line only	ESC % 5 n	27 37 53 n	1B 25 35 n
Reverse line feed with carriage return	ESC LF	27 10	1B 0A
Line skip			
Skips the designated number of lines, a 2-digit number (n = 00 - 99)	ESC VT n	27 11 n	1B 0B n
Line spacing			
Designates 6 LPI	ESC 6	27 54	1B 36
Designates 8 LPI	ESC 8	27 56	1B 38
Designates line spacing in multiple of 1/144 inch, up to 127/144 inch. Effective only in text mode, not in graphics mode	ESC % 9 n	27 37 57 n	1B 25 39 n
Margins, left and right			
Designates left margin by dot column	ESC % C n1 n2 n3	27 37 67 n1 n2 n3	1B 25 43 n1 n2 n3
Designates right margin by dot column	ESC % R n1 n2 n3 n4	27 37 82 n1 n2 n3 n4	1B 25 52 n1 n2 n3 n4
Near Letter Quality			
Designates NLQ courier/sans serif characters	ESC 1/3	27 49/51	1B 31/33
Character spacing	ESC N n	27 78 n	1B 4E n
Designates space between characters in multiples or 1/120 inch. Maximum space = 14/120 inch. Default space is 3/120 inch at 10 CPI. ESC - N - 0 returns to normal spacing (n = 0 - 11)			
Paper-out switch			
Disables the paper-out switch	ESC E 1	27 69 49	1B 45 31
Enables the paper-out switch	ESC E 0	27 69 48	1B 45 30

Function	Control Code		
	ASCII	Decimal	Hexadecimal
Print buffer/reset Prints all data in buffer; resets print modes to defaults. Print head goes "home". Printer returns to SEL mode	ESC CAN	27 24	1B 18
Print suppress mode Print suppress: printer ignores all data except DC1. The SEL indicator remains lit	DC3	19	13
Cancel print suppress: printer is able to print data	DC1	17	11
Proportional spacing Proportional spacing on Proportional spacing off	 ESC Y ESC Z	 27 89 27 90	 1B 59 1B 5A
Skip over perforation Specifies number of lines automatically skipped at the bottom of a page to top of next page	ESC % S n	27 37 83 n	1B 25 53 n
Superscripts/subscripts Prints characters that follow as superscripts or stops subscripts	ESC J	27 74	1B 4A
Stops superscript printing	ESC K	27 75	1B 4B
Prints characters that follow as subscripts or stops superscripts	ESC L	27 76	1B 4C
Stops subscript printing	ESC M	27 77	1B 4D
Tab, horizontal (p. 59) Sets tab stop at character column number **Note:** must be a 3-digit number	ESC HT n1 n2 n3 CR	27 09 n1 n2 n3 13	1B 09 n1 n2 n3 0D
Sets tab stop at dot column number **Note:** must be a 4-digit number	ESC ETX n1 n2 n3 n4 CR	27 03 n1 n2 n3 n4 13	1B 03 n1 n2 n3 0D
Tab Moves print head to next pre-programmed horizontal tab position	HT	09	09
Clear tabs	ESC HT CR	27 09 13	1B 09 0D
Clears horizontal tab	ESC ETX CR	27 03 48 13	1B 03 0D

Function	Control Code		
	ASCII	Decimal	Hexadecimal
Utility mode Designates UTILITY characters	ESC 0	27 48	1B 30
Underlining Underlines subsequent characters	ESC C	27 67	1B 43
Stops underlining	ESC D	27 68	1B 44
Unidirectional print Starts printing in one direction	ESC -	27 45	1B 2D
Returns to printing bidirectionally	ESC =	27 61	1B 3D
Vertical Format Unit (VFU) Begins loading tab positions of VFU	DC4	20	14
End of VFU load sequence	?	63	3F
Feeds paper to tab position of selected number as pre-programmed in VFU (n = Channel number = 1 - 12)	VT n	11 n	0B n

Character Sets

Standard 7-bit code table (selected by ESC ! 0)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	128	144	á 160	▒ 176	└ 192	╙ 208	α 224	≡ 240
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	í 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	DC2 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	DC3 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	HT 9	25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	· 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	½ 171	╗ 187	╦ 203	▉ 219	δ 235	√ 251
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	FF 140	156	¼ 172	╝ 188	╠ 204	■ 220	∞ 236	n 252
D	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	¡ 173	╜ 189	═ 205	▌ 221	Ø 237	² 253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142	158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	■ 127	SI 143	159	» 175	┐ 191	╧ 207	▄ 223	∩ 239	255

Standard 8-bit code table (selected by ESC ! 0)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	128	144	á 160	▒ 176	└ 192	╙ 208	α 224	≡ 240
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	í 161	▓ 177	┴ 193	╤ 209	ß 225	± 241
2	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	DC2 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	DC3 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	HT 9	25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	· 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	½ 171	╗ 187	╦ 203	▉ 219	δ 235	√ 251
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	FF 140	156	¼ 172	╝ 188	╠ 204	■ 220	∞ 236	n 252
D	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	¡ 173	╜ 189	═ 205	▌ 221	Ø 237	² 253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142	158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	■ 127	SI 143	159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	255

Block graphics 7-bit code table (selected by ESC ! 1)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	128	144	160	176	192	208	224	240
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	161	177	193	209	225	241
2	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	DC2 146	162	178	194	210	226	242
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	DC3 147	163	179	195	211	227	243
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	164	180	196	212	228	244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	165	181	197	213	229	245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	166	182	198	214	230	246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	167	183	199	215	231	247
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	168	184	200	216	232	248
9	HT 9	25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	153	169	185	201	217	233	249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	170	186	202	218	234	250
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	171	187	203	219	235	251
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	FF 140	156	172	188	204	220	236	252
D	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	173	189	205	221	237	253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142	158	174	190	206	222	238	254
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	■ 127	SI 143	159	175	191	207	223	239	255

Block graphics 8-bit code table (selected by ESC ! 1)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	128	144	160	176	192	208	224	240
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	145	161	177	193	209	225	241
2	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	146	162	178	194	210	226	242
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	147	163	179	195	211	227	243
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	148	164	180	196	212	228	244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	165	181	197	213	229	245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	166	182	198	214	230	246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	167	183	199	215	231	247
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	136	152	168	184	200	216	232	248
9	HT 9	25	) 41	9 57	I 73	Y 89	i 105	y 121	137	153	169	185	201	217	233	249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	138	154	170	186	202	218	234	250
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	139	155	171	187	203	219	235	251
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	140	156	172	188	204	220	236	252
D	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	141	157	173	189	205	221	237	253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	142	158	174	190	206	222	238	254
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	127	143	159	175	191	207	223	239	255

IBM 7-bit code table (selected by ESC ! 2)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	128	144	á 160	176	192	208	α 224	≡ 240
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	129	DC1 145	í 161	177	193	209	ß 225	± 241
2	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	130	DC2 146	ó 162	178	194	210	Γ 226	≥ 242
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	131	DC3 147	ú 163	179	195	211	π 227	≤ 243
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	132	DC4 148	ñ 164	180	196	212	Σ 228	⌠ 244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	133	149	Ñ 165	181	197	213	σ 229	⌡ 245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	134	150	ª 166	182	198	214	µ 230	÷ 246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	135	151	º 167	183	199	215	τ 231	≈ 247
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	BS 136	CAN 152	¿ 168	184	200	216	Φ 232	° 248
9	HT 9	25	) 41	9 57	I 73	Y 89	i 105	y 121	HT 137	153	⌐ 169	185	201	217	Θ 233	· 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	LF 138	154	¬ 170	186	202	218	Ω 234	· 250
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	VT 139	ESC 155	½ 171	187	203	219	δ 235	√ 251
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	FF 140	156	¼ 172	188	204	220	∞ 236	n 252
D	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	CR 141	157	¡ 173	189	205	221	Ø 237	² 253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	SO 142	158	« 174	190	206	222	∈ 238	■ 254
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	127	SI 143	159	» 175	191	207	223	∩ 239	255

IBM 8-bit code table (selected by ESC ! 2)

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	0	16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	╙ 208	α 224	≡ 240
1	1	DC1 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▓ 177	┴ 193	╤ 209	ß 225	± 241
2	2	DC2 18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	3	DC3 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	▏ 179	├ 195	╙ 211	π 227	≤ 243
4	4	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	Ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	μ 230	÷ 246
7	7	23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	BS 8	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	HT 9	25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	· 249
A	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	VT 11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	▉ 219	δ 235	√ 251
C	FF 12	28	, 44	< 60	L 76	\ 92	l 108	| 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D	CR 13	29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	Ø 237	² 253
E	SO 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	SI 15	31	/ 47	? 63	O 79	_ 95	o 111	127	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	255

National character set table for OKI standard version

ESC ! n	Language	Decimal value														
		35	36	38	48	64	91	92	93	94	96	105	123	124	125	126
@	ASCII (Ø)	#	$	&	Ø	@	[	\	]	^	`	i	{	|	}	~
A	ASCII (0)	#	$	&	0	@	[	\	]	^	`	i	{	|	}	~
B	BRITISH	£	$	&	0	@	[	\	]	^	`	i	{	|	}	~
C	GERMAN	#	$	&	0	§	Ä	Ö	Ü	^	`	i	ä	ö	ü	ß
D	FRENCH	£	$	&	0	à	°	Ç	§	^	`	i	é	ù	è	¨
E	SWEDISH I	#	¤	&	0	É	Ä	Ö	Å	Ü	é	i	ä	ö	å	ü
F	DANISH	#	$	&	0	@	Æ	Ø	Å	Ü	`	i	æ	ø	å	ü
G	NORWEGIAN	#	$	&	0	@	Æ	Ø	Å	^	°	i	æ	ø	å	~
H	DUTCH	£	$	&	0	@	[	IJ	]	^	`	i	{	ij	}	~
I	ITALIAN	£	$	&	0	§	°	Ç	é	^	ù	i	à	ò	è	ì
J	TRS - 80	#	$	&	Ø	@	↑	↓	←	→	`	i	{	|	}	¯
K	SPANISH	!	$	&	0	¡	Ñ	ñ	¿	ü	á	i	é	í	ó	ú
L	SWEDISH II	#	$	&	0	É	Ä	Ö	Å	Ü	é	i	ä	ö	å	ü
M	SWEDISH III	§	$	&	0	É	Ä	Ö	Å	Ü	é	i	ä	ö	å	ü
N	SWEDISH IV	§	¤	&	0	É	Ä	Ö	Å	^	é	i	ä	ö	å	ü
O	TURKISH	ş	$	ğ	0	Ş	İ	Ö	Ü	ğ	ç	ı	ł	ö	ü	Ç
P	SWISS I	£	$	&	0	ç	à	é	è	^	`	i	ä	ö	ü	"
Q	SWISS II	£	$	&	0	§	à	ç	è	^	`	i	ä	ö	ü	é

Appendix C

Interfacing

This appendix will help you design a SHIELDED interface cable that connects your printer to your computer. This requires some knowledge of electronics—signals, wiring, soldering, and crimping—to be designed properly. If you're not technically oriented, we recommend that you purchase a SHIELDED interface cable from your dealer.

Parallel Interfacing

The printer requires a Centronics-equivalent parallel cable with the following:

- Amphenol 57-30360 or AMP 552274-1 plug (or equivalent) with 36 pins
- AMP 552073-1 (or equivalent) cover
- Beldon (or equivalent) SHIELDED cable with twisted pair conductors. It can't exceed 5 metres in length and must be UL and CSA approved. The cable MUST be shielded.

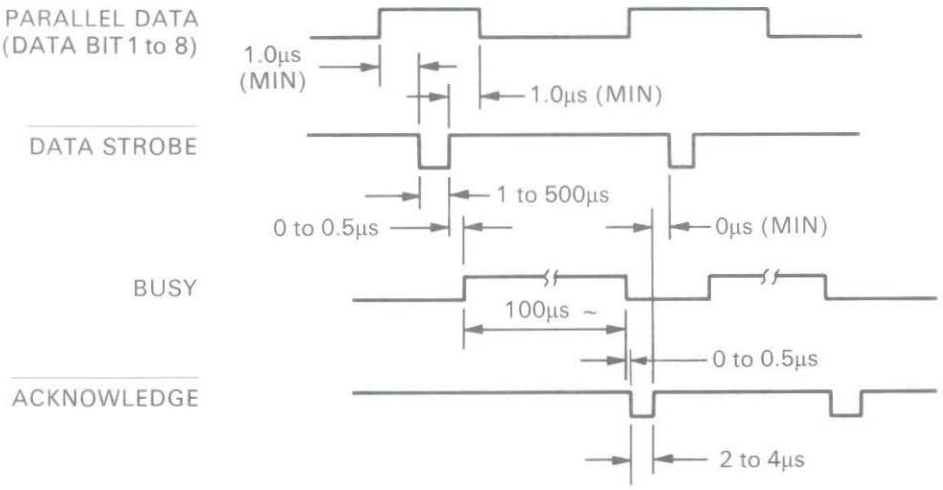
Pin Description

Pin No.	Signal Name	Direction	Description
1	$\overline{\text{DATASTROBE}}$	To printer	When this signal changes from low to high level, input data is sampled.
2	DATABIT 1	To printer	Input data lines. The high level represents 1, and the low level represents 0
3	DATABIT 2		
4	DATABIT 3		
5	DATABIT 4		
6	DATABIT 5		
7	DATABIT 6		
8	DATABIT 7		
9	DATABIT 8		
10	$\overline{\text{ACKNOWLEDGE}}$	From printer	The low level of this signal indicates completion of data input or function operation.
11	Busy	From printer	The high level of this signal indicates that the printer cannot receive data. The low level of this signal indicates that the printer is ready for receiving data.

Pin No.	Signal Name	Direction	Description
12	PAPER END	From printer	The high level of this signal indicates that the paper end has been detected.
13	SELECT	From printer	The high level of this signal indicates that the printer is in the select (online) state.
14, 16, 33	0V	—	Signal ground
17	CHASSIS GROUND	—	Frame ground
18*	+5 V	From printer	+5 V supply (50 mA, maximum)
19 to 30	0 V		Twisted pair return for pins 1 to 11
31	$\overline{\text{INPUT PRIME}}$	To printer	When this signal goes to the low level, printer controller is initialised. The low level should be held for more than 0.5 ms.
32	$\overline{\text{FAULT}}$	From printer	When the paper end is detected, this signal changes from high to low level.
15, 34, 35, 36	—	—	Unused.

* Pin 18 is controlled by a jumper plug in the printer.

Timing



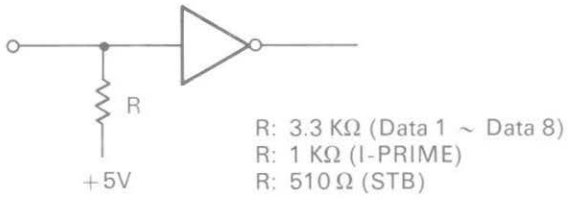
Note: The minimum value of TB (busy-on time) is 20 μs, and the maximum value is the time spent for printing, carriage return, and line feed.

Signal levels

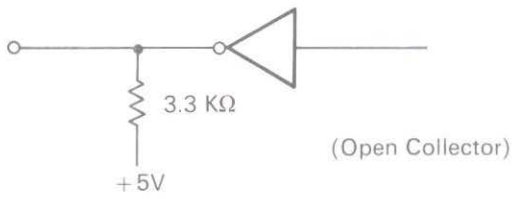
Low level: 0.0 V to 0.8 V
High level: +2.4 V to 5.0 V

Circuit

(1) Receiver



(2) Driver



Serial Interfacing (RS232C)

To construct a cable for an RS232C serial configuration, you will need:

- DB25P equivalent 25-pin plug, shell equivalent to DB-C2-J9.
- Beldon (or equivalent) SHIELDED cable with twisted pair conductors. Must be UL and CSA approved. The cable MUST be shielded.
- The printer has a 25-pin DB-25S receptacle.

Pin description

Pin No.	Signal	Symbol	Direction	Description
1	Frame ground	FG	—	Connected to printer frame (frame ground)
2	Transmitted data	TD	From printer	Serial data signal transmitted from printer
3	Received data	RD	To printer	Serial data signal received by printer
4 (Note 1)	Request to send	RTS	From printer	Signal to indicate that the printer is not ready for receiving data in Ready/Busy protocol.
6 (Note 2)	Data set ready	DSR	To printer	Signal to notify printer that transmitter is ready for transmission. Printer receives data after confirming this signal as a HIGH.
7	Signal ground	SG	—	Signal ground
11 (Note 1)	Supervisory send data.	SSD	From printer	Signal to indicate that the printer is not ready for receiving data in Ready/Busy protocol.

Pin No.	Signal	Symbol	Direction	Description
20 (Note 1)	Data terminal ready	DTR	From printer	Signal to indicate that the printer is not ready for receiving data in Ready/Busy protocol.
5, 8 to 10, 12 to 19 21 to 25	—	—	—	Unused

Notes:
1 SSD signal output can be selected between pins 4, 11, 20 by menu.
2 DSR signal valid/invalid can be set by menu.

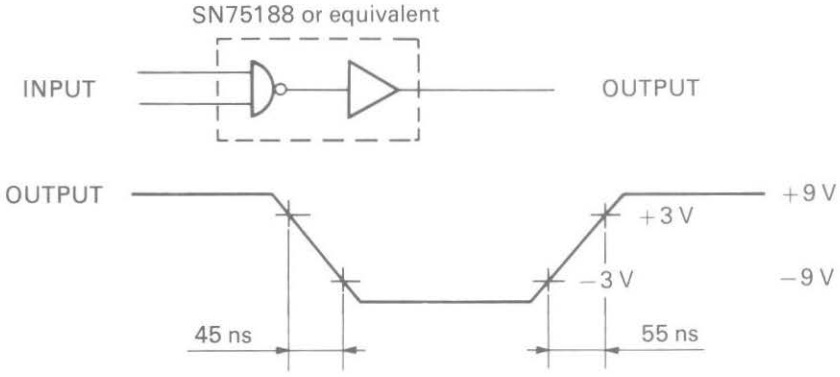
Signal levels

RS232C interface signal levels are as specified below, and meet the EIA Standard RS232C.

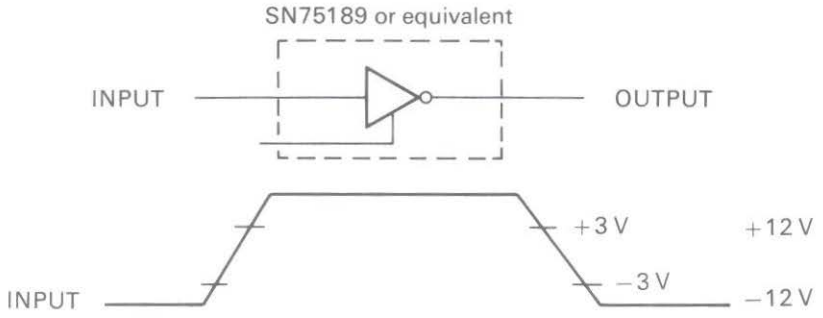
−15 to −3 V: LOW = OFF = LOGIC "1"
+15 to +3 V: HIGH = ON = LOGIC "0"

Circuit

(1) Driver



(2) Receiver



Serial Interfacing (RS422A)

To construct a cable for an RS422A serial configuration, you will need:

- DC-37P equivalent 37-pin plug, shell equivalent to DC-C1-J16.
- Beldon (or equivalent) SHIELDED cable with twisted pair conductors. Must be UL and CSA approved. The cable MUST be shielded.
- The printer has a 37-pin DC-37S receptacle.

Pin description

Pin No.	Signal	Code	Direction	Connection	Function
1	Shield	SHILD	—	—	Cable shield
3 (Note 2)	Supervisory send data	SSD	From printer	A-A′	Signal to indicate printer cannot receive data in Ready/Busy protocol
21	Supervisory send data	SSD	From printer	B-B′	
4	Send data	SD	From printer	A-A′	Data from printer
22	Send data	SD	From printer	B-B′	
6	Receive data	RD	To printer	A-A′	Data to printer
24	Receive data	RD	To printer	B-B′	
7 (Note 2)	Request to send	RS	From printer	A-A′	Signal to indicate printer cannot receive data in Ready/Busy protocol
25	Request to send	RS	From printer	B-B′	

Pin No.	Signal	Code	Direction	Connection	Function
9	Clear to send	CS +	To printer	A-A′	Reply signal to RS. Printer transmits data after confirming this signal as a Space.
27	Clear to send	CS −	To printer	B-B′	
11 (Note 3)	Data mode	DM	To printer	A-A′	Indicates that data can be sent. Printer receives data after confirming this signal as a Space.
29	Data mode	DM	To printer	B-B′	
12 (Note 2)	Terminal RDY	TR	From printer	A-A′	Signal to indicate printer cannot receive data in Ready/Busy protocol
30	Terminal RDY	TR	From printer	B-B′	
19	Signal ground	SG	—	—	Signal ground

Notes:
1 Pins 2, 5, 8, 10, 13 to 18, 20, 23, 26, 28, 31, and 32 to 37 are not used.
2 Pins 3 and 21 (SSD), 7 and 25 (RS), or 12 and 30 (TR) can be set selected as the Busy lines by menu.
3 DM signal valid/invalid can be set by menu.

Signal levels

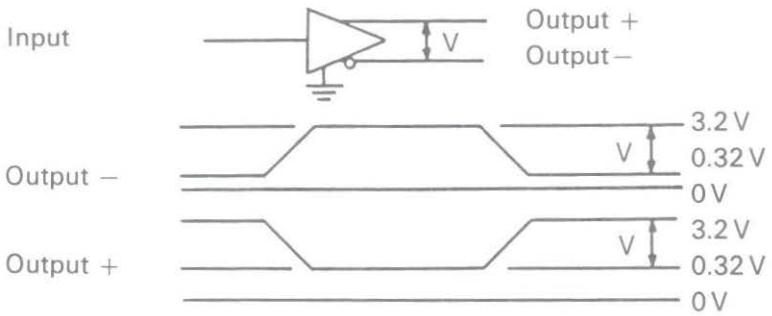
Serial interface signal levels are as specified below, and meet EIA Standard RS422A.

−0.2 V to −6.0 V: Mark = Off = Logic "1"
+0.2 V to +6.0 V: Space = On = Logic "0"

Circuit

(1) Line driver

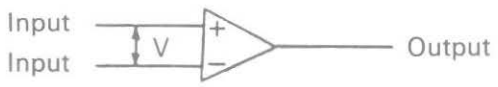
Equivalent to Am26LS31

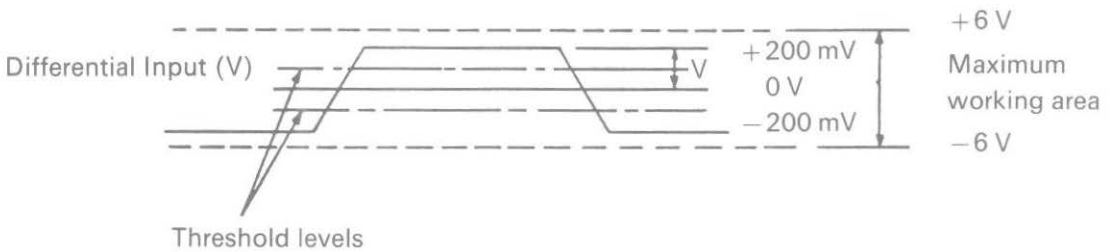


Above values assume a power supply voltage of +5 V.

(2) Line receiver

Equivalent to Am26LS32





Menu Selections for Serial Interfacing (RS232C, RS422A)

Chapter 1 explains how to use your printer's Menu Select mode. If you are using the serial interface, set the following Menu Select options according to your computer's interface requirements.

Printout	Action
PARITY	Does your system use ODD or EVEN parity? ODD parity—select ODD EVEN parity—select EVEN NONE—select NONE
SERIAL DATA 7/8 BITS	Does your system use 7 or 8 bit format? 7 bit format—select 7 8 bit format—select 8
PROTOCOL	What protocol does your system use? Ready-Busy protocol—select READY/BUSY X-ON/X-OFF protocol—select X-ON/X-OFF
DIAGNOSTIC TEST	Do you want to perform a diagnostic test? Yes—select YES Normal operation—select NO
BUSY LINE	Which line will your system use to recognise a busy signal? SSD −9V—select SSD− SSD +9V—select SSD+ DTR −9V—select DTR RTS −9V—select RTS
BAUD RATE	What baud rate does your system use? 19,200 baud—select 19.2 9,600 baud—select 9.6 4,800 baud—select 4.8 2,400 baud—select 2.4 1,200 baud—select 1.2 600 baud—select 0.6 300 baud—select 0.3
DSR SIGNAL	How does your system handle the Data Signal Ready signal? Valid—Select VALID Invalid—Select INVALID

Printout	Action
DTR SIGNAL	When is the DTR signal required? When printer is selected—choose READY ON SELECT When printer is turned ON—choose READY ON POWER UP
BUSY TIME	What is the length of a busy signal? 200ms—select 0.2 1 second—select 1

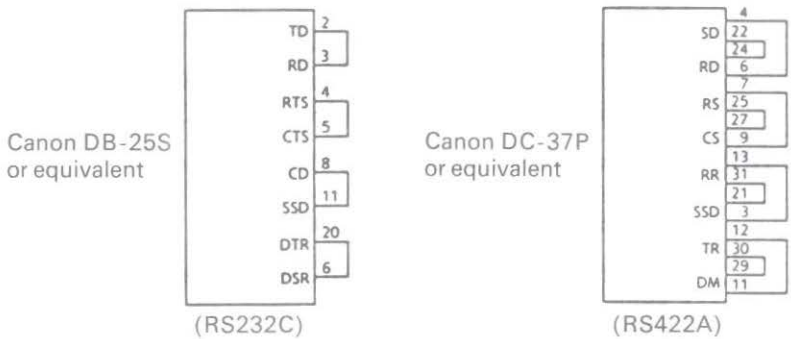
Once you've set the menu, make a printout of it for future reference.

Local tests

Serial interface

After you've configured an interface cable for your computer and printer, you may want to spend a few extra minutes making a test connector. This test connector can be used to monitor the operation of the interface. Simply follow these instructions.

Jumper the following pins:



Place the printer in the circuit test mode by specifying "Y" in response to the menu item DIAG TEST. Now you can run the local test:

1. Plug the test connector into the serial interface receptacle.
2. Turn the printer ON. The serial interface will check the memory function of the printer's message buffer, the interface driver and the receiver circuit, and then print all the characters in a test pattern.
3. This test can be stopped only by turning the printer OFF or pressing the SELECT button.
4. The test produces the following:
   - The printer prints this message: "LOOP TEST".
   - The message buffer size is printed.

- The printer checks the memory function of the message buffer, then prints "OK" if the memory check is good, or "BAD" if the memory check is faulty.
- The signal logic is checked, and if this is faulty, "BAD" is also printed.

Note: If "BAD" is printed, call your dealer for assistance.

- Hexadecimal characters from 20 to 7F are transmitted through the TD (Transmit Data) line, and received through the RD (Receive Data) line, then written to the message buffer. The above stored data is then printed.
- This process repeats until the printer is turned OFF or until you press the SELECT button.

Communication procedures

Two types of communication procedures for the serial interfaces RS323C and RS422A can be selected by menu. These procedures or protocols are briefly described below.

Ready/busy protocol

The busy signal turns on when the space in the interface buffer becomes less than 256 bytes. The busy signal turns off (becomes Ready) after 200 ms or 1 second has passed if the recovery has occurred within 200 ms or 1 second. If the timing of recovery exceeds 200 ms or 1 second, the busy signal turns off (becomes Ready) immediately after the recovery has occurred.

X-ON/X-OFF protocol

This protocol uses the ASCII characters DC3 (decimal 19) and DC1 (decimal 17) as follows. The DC3 will be sent to the transmission side immediately after the room in the interface buffer has become less than 256 bytes to inform that receiving is impossible. The transmission of DC3 stops when the data receiving has stopped. If the timing of recovery of 256 bytes is within 200 ms or 1 second after DC3 is sent, DC1 will be sent 200 ms or 1 second after the recovery to inform that receiving is possible again. If the timing of recovery exceeds 200 ms or 1 second, the DC1 is sent immediately after the recovery has occurred.

200 ms or 1 second busy time for both protocols can be selected by menu.

Appendix D

Specifications

Print method	Impact dot matrix	
Printhead	9 pin	
Print speed		
SSD	360 cps at 12 cpi	
HSD	300 cps at 10 cpi	
Utility	250 cps at 10 cpi	
Near Letter Quality	62.5 cps at 10 cpi	
Characters per line	ML320	ML321
at 10 cpi	80	136
at 12 cpi	96	163
at 17.1 cpi	137	233
at 20 cpi	160	272
Reliability		
Mean Time Between Failures (MTBF)	5000 hours at 25% duty cycle, 35% page density	
Mean Time To Repair (MTTR)	15 minutes	
Printhead life	200 million characters	
Ribbon life	3 million characters	
Electrical characteristics		
Voltage	220/240 V AC	
Frequency	50/60 Hz $\pm$ 2%	
Interface	Centronics parallel standard RS232C serial optional	
Dimensions	ML320	ML321
Size	Depth 345 mm (13.6 inch) Width 398 mm (15.7 inch) Height 116 mm (4.6 inch)	Depth 345 mm (13.6 inch) Width 552 mm (21.7 inch) Height 116 mm (4.6 inch)
Weight	8.4 kg (16 lb)	10.1 kg (20 lb)
Paper specifications		
Width	76.2 mm to 254.0 mm (3 inch to 10 inch) ML320 76.2 mm to 406.4 mm (3 inch to 16 inch) ML321	
Continuous forms		
Single part forms		
Weight	12 to 24 lb. (45 - 90 g/m^2)	
Thickness	0.051 mm to 0.36 mm (0.0020 inch to 0.0049 inch)	

Continuous forms (contd.)	
Multipart—carbon lined or pressure sensitive	
Weight	9 to 11 lb. (34 - 41 g/m²)
Number of copies	Original plus 3 copies
Thickness	0.36 mm max. (0.014 inch max.)
Multipart—interleaf	
Weight	Paper : 10 to 12 lb. (37.5 - 45 g/m²) Carbon: 9 lb.
Number of copies	Original plus 3 copies
Thickness	0.36 mm max. (0.014 inch max.)
Cut sheets	
Single part	
Weight	12 to 24 lb. (45 - 90 g/m²)
Thickness	0.051 mm to 0.124 mm (0.002 inch to 0.0049 inch)
Envelopes (individual)	
Weight	24 lb. max. (90 g/m²)
Thickness	0.406 mm (0.016 inch max.)
Dimensions	165 mm × 92 mm (6 1/2 inch × 3 5/8 inch) 225.4 mm × 98.4 mm (8 7/8 inch × 3 7/8 inch) 241.3 mm × 104.8 mm (9 1/2 inch × 4 1/8 inch)
Card stock	
Weight	40 lb. max. (163 g/m²)
Thickness	0.20 mm (0.008 inch max.)
Dimensions	127 mm × 203 mm max. (5 inch × 8 inch max.)
Note: Use with bottom feed only.	
Labels	
Carrier	208.3 mm max. (8 1/5 inch max.) width
Thickness	0.28 mm max. (0.011 inch max.)
Notes: Use bottom feed only. Do not use fabric labels. Do not print on the edge or perforation of the label.	
Transparencies	
Thickness	0.10 mm max. (0.004 inch max.)
Dimensions	210 mm (8 1/5 inch) W × 297 mm (11 inch) L

Specifications subject to change without notice.

Oki Systems (UK) Limited
550 Dundee Road
Slough Trading Estate
Slough
Berks SL1 4LE
England
Tel: 44 (0) 753 819819
Fax: 44 (0) 753 819899

Oki Systems (Norway) A/S
Hvamsvingen 9
PO Box 174
N-2013 Skjetten
Norway
Tel: 47 (0) 63 89 36 00
Fax: 47 (0) 63 89 36 01

Oki Systems (Ireland) Limited
The Square Industrial Complex
Tallaght
Dublin 24
Ireland
Tel: 353-1-459 8666
Fax: 353-1-459 8840

Oki Systems (Espana)
C/Goya 9
Madrid 28001
Spain
Tel: 34 1 5777336
Fax: 34 1 5762420

Oki Systems (Danmark) a.s.
Park Allé 382
2625 Vallensbæk
Denmark
Tel: 45 (0) 43 666500
Fax: 45 (0) 43 666590

Oki Systems (Sweden) AB
PO Box 131
Stormbyvaegen
S-163 55 Spanga
Sweden
Tel: 46 (0) 8 7955880
Fax: 46 (0) 8 7956527

Oki Systems (Italia) S.p.A.
Centro Commerciale
"Il Girasole"
Palazzo Cellini – 3.05/B
20084 Lacchiarella (MI)
Italy
Tel: 39 (0) 2 90076410
Fax: 39 (0) 2 9007549

Oki Systems (Holland) b.v.
Kruisweg 765 (PO Box 690)
NL-2132 NG (2130 AR)
Hoofddorp
Holland
Tel: 31 (0) 20 6531531
Fax: 31 (0) 20 6531301

Oki Systems (Deutschland) GmbH
Hansallee 187
40549 Düsseldorf
Germany
Tel: 49 (0) 211 5266-0
Fax: 49 (0) 211 5933-45

Oki Systèmes (France) S.A.
44-50 Avenue du Général de Gaulle
94240 L'Hay les Roses
France
Tel: 33 (1) 46158000
Fax: 33 (1) 41240040

Oki Europe Limited
Branch Office (Prague)
IBC, Pobrezni 3
186 00 Praha 8
Czech Republic & Slovakia
Tel: 422 232 66 41 (232 66 42)
Fax: 422 232 66 21

Oki Europe Limited
Branch Office (Poland)
UL Grzybowska 80-82
PL-00840 Warsaw
Poland
Tel: 482 661 5407
Fax: 482 661 5451

Oki Europe Limited
Europa Center
Karoly (Tanacs) KRT 11.5A
H-1075 Budapest
Hungary and Romania
Tel: 361 269 7871 (361 269 7873)
Fax: 361 269 7872

EUROPEAN HEAD OFFICE
Oki Europe Limited
Central House
Balfour Road
Hounslow
Middlesex TW3 1HY
England
Tel: 44 (0) 81 577 9000
Fax: 44 (0) 81 572 7444

EUROPEAN TECH. CENTRE
Oki Europe Limited
750/751 Deal Avenue
Slough Trading Estate
Slough
Berks SL1 4SH
England
Tel: 44 (0) 753 820164
Fax: 44 (0) 753 693797

OKI DATA CORPORATION
4-11-22 Shibaura
Minato-Ku
Tokyo 108
Japan

MICROLINE 320/321 Elite

OKI

People to People Technology

M–520798–2C