LG06 / LG12
Text and Graphics Printers

User’s Manual

digital™

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Digital Equipment Corporation • Merrimack, NH 03054

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For the Federal Republic of Germany

Pour la République féderale d'Allemagne

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NOTICE:

This equipment generates, uses, and may emit radio frequency. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such radio frequency interference. Operation of this equipment in a residential area may cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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1 Introduction

Chapter Contents

About This Manual

This manual is designed so you can quickly find the information you need to operate and maintain your LG06 or LG12 printer.

How to Locate Information

- Use the Table of Contents at the front of the manual.
- Use the Chapter Contents listed on the first page of each chapter.
- Use the alphabetical Index at the back of the manual.

Warnings and Special Information

Read and comply with all information highlighted under special headings:

WARNING

Conditions that could harm you as well as damage the equipment.

CAUTION

Conditions that could damage the printer or related equipment.

IMPORTANT

Information vital to proper operation of the printer.

NOTE: Information affecting printer operation.

Glossary

The Glossary defines computer terms and acronyms used in this manual. It is located just before the Index.

Printing Conventions in This Manual

Switches, indicators, and switch positions labeled on the printer are printed uppercase. Example: Press the ON LINE switch.

Messages that appear on the control panel display are printed in initial capital letters and set off with quotation marks (except for conjunctions, which are all lowercase). Example: “Save Config” appears on the message display.

The LG06 / LG12 Text and Graphics Printers

LG06 and LG12 line matrix printers use variable–speed shuttles, micro–step paper feed control, and multi–phase hammer firing. These printers generate a wide range of horizontal and vertical dot densities with no speed penalties.

The LG06 and LG12 printers use the same operating and emulation firmware. The printers differ mainly in size, the number of hammers on the hammer bank, and speed of printing. The LG12 is larger and faster than the LG06. The LG12 has 88 print hammers, the LG06 has 49 hammers. The electromechanical drive elements of the hammer banks also differ, but are transparent to the user. Both printers are fast and quiet, designed for years of trouble–free operation.

Printer Features

Printer Command and Control:

- Three command code protocols (emulations) are selectable from the control panel and controlled by software —
  1) Digital (emulates the Digital LG02 printer and is the default operating mode)
  2) IBM Proprinter III XL
  3) Epson FX 850/1050
- Three built–in interfaces: Centronics parallel, Dataproducts parallel, RS–232D serial

Output Control:

- Five printing modes —
  1) Data Processing (DP)
  2) Correspondence
  3) High Speed (HS)
  4) OCR–A (10 cpi only)
  5) OCR–B (10 cpi only)
- Selectable alternate horizontal and vertical dot densities enable you to tailor output to a wider variety of printing requirements
- Selectable forms length
- Character–by–character attribute specification—
  1) Selectable pitch: normal, expanded, and compressed
  2) Emphasized (shadow) print
  3) Bold print
  4) Italic print
  5) Overscoring
  4) Single underline
  6) Double underline
  5) Superscript and subscript printing
- Block characters
- Bar codes
- Resident multinational character sets

Graphics and Vertical Formatting:

- Two resident graphics protocols—
  1) DEC sixel graphics
  2) IBM Proprinter bit–image graphics
- Programmable electronic vertical formatting provides rapid vertical paper movement to specified lines for printing repetitive and continuous forms. Two methods are available—
  1) Electronic Vertical Format Unit (EVFU)
  2) Vertical Tabs

Diagnostics:

- Built–in diagnostic self–tests
- Configuration printout
- Test pattern printout
- Data stream hexadecimal code printout

Line Matrix Printing

The LG06 and LG12 are line matrix impact printers: they create characters by printing patterns of ink dots on paper, an entire line at a time. The dot pattern of each text character is stored in printer memory on a logical grid called the dot matrix. (See Figure 1–1.)

The printed dots are made by a row of hammer springs mounted on a shuttle that sweeps rapidly back and forth. Printer logic divides every printable line into horizontal dot rows. With each lateral sweep of the shuttle, the hammer springs put dots at the required positions for the entire line by striking a moving ink ribbon and the paper.

When the shuttle reaches the end of a sweep, it reverses direction, the paper is advanced one dot row, and the hammers print the next row of dots as the shuttle moves in the opposite direction. (See Figure 1–2.)

After a line of characters is printed, hammer action stops while the paper is advanced to the first dot row of the next print line. The number of rows allowed for line separation depends on the line spacing you select.

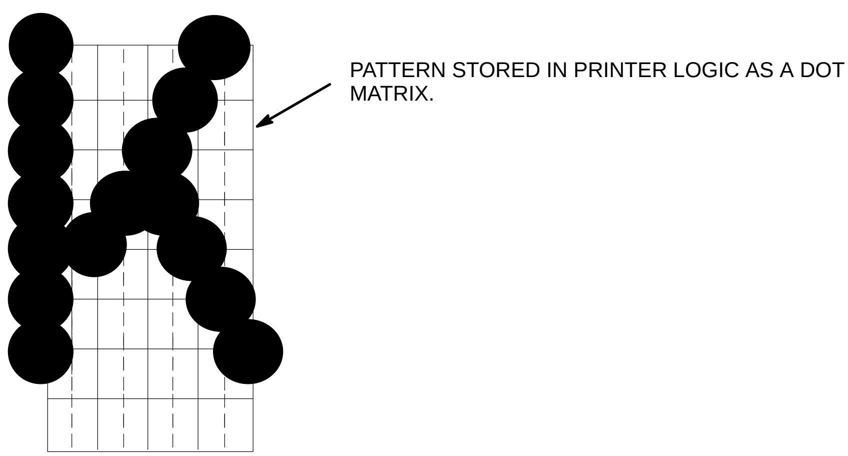


Figure 1–1. Dot Matrix Character Formation

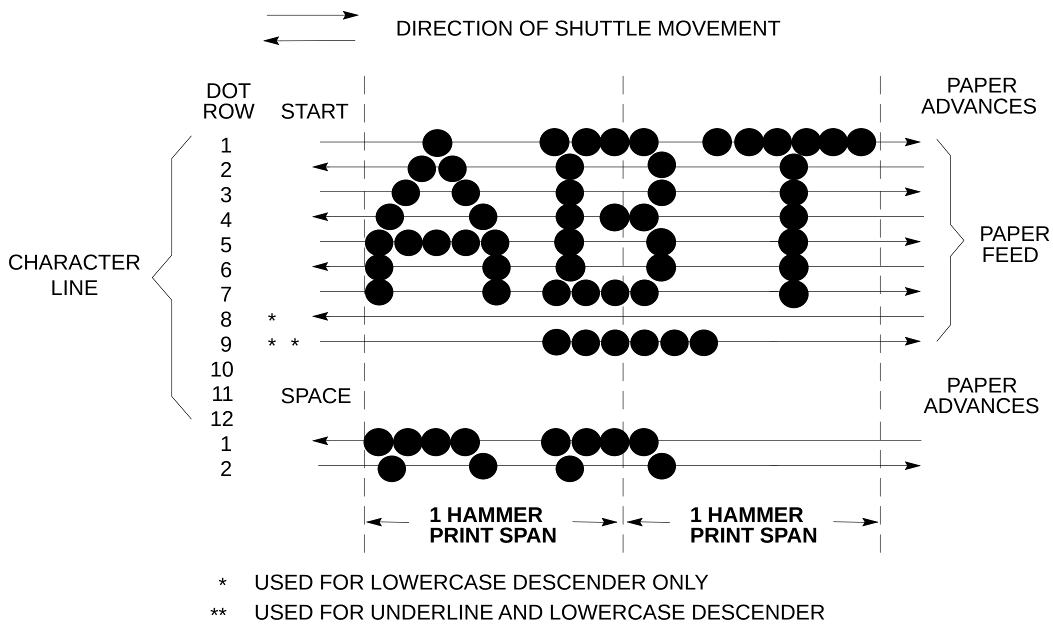


Figure 1–2. Dot Matrix Line Printing

Printing Speed

The speed of text printing is measured in lines per minute (lpm). This speed is directly proportional to the number of dot rows required to produce a character line, regardless of the number of characters in the line. More dot rows are required to print lowercase characters with descenders; consequently, those character lines print at a fractionally lower rate.

The LG06 and LG12 also print dot–addressable graphic images. The speed of graphics plotting is measured in inches per minute (ipm). Unidirectional plotting produces slightly better print quality, and takes about twice as long as bidirectional plotting. You can select either plotting mode from the control panel.

Printing and plotting rates also vary according to the print mode you select. Print mode refers to the way you instruct the printer to create characters. If, for example, you select near letter quality (NLQ) mode, the printer uses more dot rows to form characters than if you choose high speed (HS) mode. Character formation and print speed are faster in HS mode because fewer dot rows are used to form characters. Vertical dot density is thus a factor in printing speed. Nominal printing rates for both printers are in Appendix B.

2 Installation

Chapter Contents

Before You Begin...

Read this chapter carefully before installing and operating the printer. The LG06 and LG12 are easy to install, but for your safety, and to protect valuable equipment, perform all the procedures in this chapter in the order presented.

Power Requirements

Connect the printer to a power outlet rated at 100–120 Vac or 200–240 Vac at 50 or 60 Hz. The printer automatically senses and adjusts itself to conform to the correct voltage range. Primary circuit protection is built into the printer: the power switch is also a circuit breaker. Consult an electrician if printer operation affects local electrical lines. See Appendix B for power specifications.

IMPORTANT

It is recommended that printer power be supplied from a separate ac circuit protected at 20 amperes for 120 volts or 10 amperes for 230 volts at 50 or 60 Hertz.

Select a Site

Select a printer site that:

- Permits complete opening of the printer cover and both doors of the floor cabinet. (See Figure 2–1.)
- Allows at least three feet of clearance behind the printer. (This permits air to circulate freely around the printer and provides access to the paper stacking area.)
- Has a proper power source
- Is relatively dust–free.
- Is located within 9 meters (30 feet) of the host computer when using the parallel interface and 15 meters (50 feet) when using the serial interface
- Has a temperature range of 10° C to 35° C (50° F to 95° F) and a relative humidity from 10% to 90%.

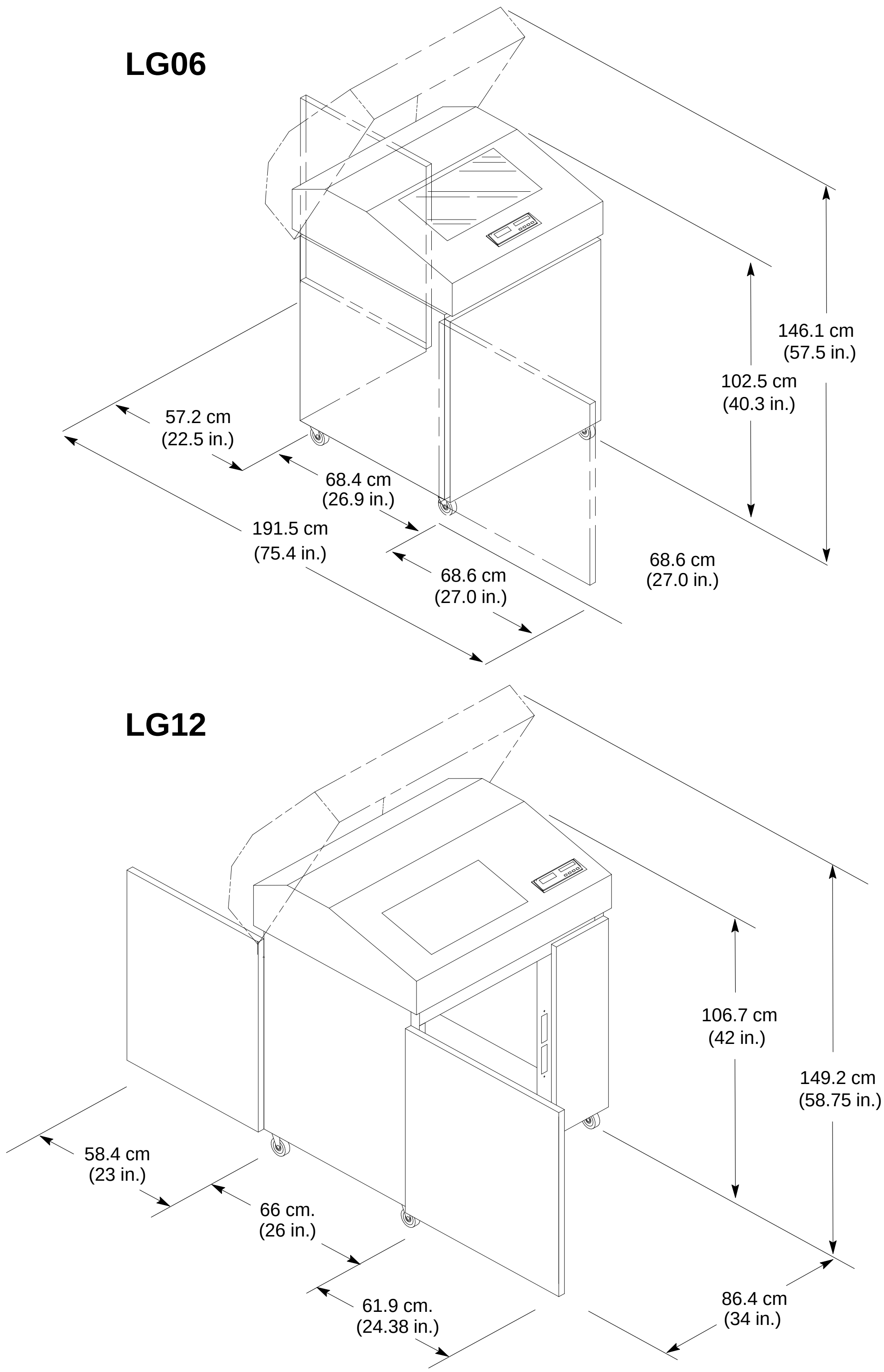


Figure 2–1. Printer Space Requirements

Remove the Shipping Restraints

WARNING

To prevent possible injury, do not connect the AC power source before removing the shipping restraints. If the power source has been connected, disconnect it before performing the shipping restraint removal procedures.

WARNUNG

Um mögliche Verletzungen zu vermeiden, darf die Netzverbindung erst nach dem Entfernen der Transportbefestigungen hergestellt werden.

ATTENTION

Pour éviter tout danger, ne branchez pas le cordon d'alimentation avant d'avoir ôté les cales de transport. Si l'alimentation est déjà raccordée, débranchez–la avant d'effectuer les procédures d'enlèvement des cales.

CAUTION

To avoid shipping damage, reinstall the shipping restraints whenever you move or ship the printer.

VORSICHT

Um Versandschäden zu verhindern, die Versand–Einspannungen wieder einbauen, wenn der Drucker versetzt oder versand wird.

PRÉCAUTIONS

Pour éviter tout dégât lors du transport, remettez les cales en place chaque fois que l'imprimante est déplacée ou transportée.

Tie wraps and foam pads protect the equipment from damage during shipment. You must remove these shipping restraints before you operate the printer. Save the foam pads and extra tie wraps with other packing materials.

To reinstall the shipping restraints, simply reverse the steps in this section. If you have the LG06 printer, go to page 2–5. If you have the LG12 printer, turn to page 2–10.

LG06 Shipping Restraints

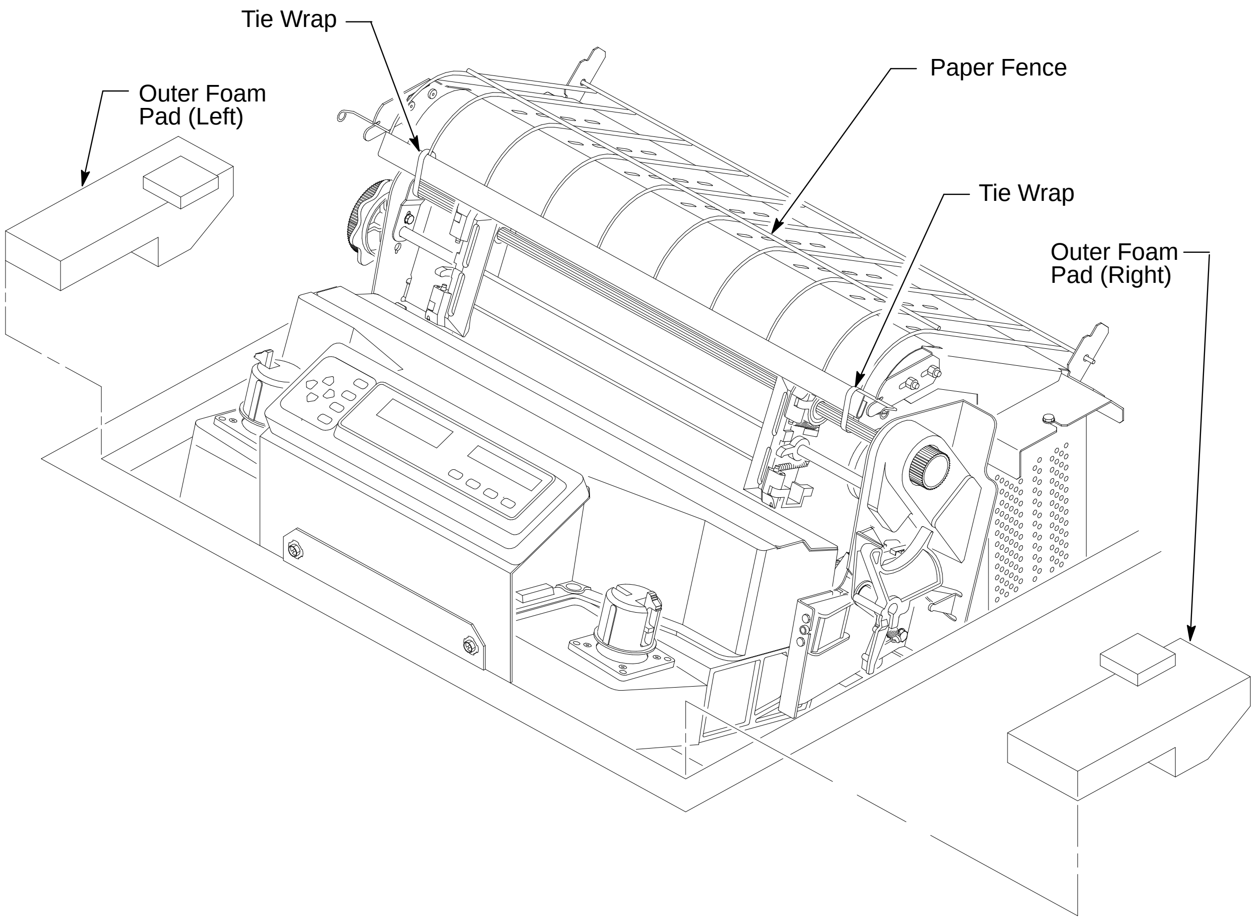


Figure 2–2. LG06: Tie Wraps and Outer Foam Pads

Remove the Tie Wraps and Outer Foam Pads

1. Raise the printer cover.
2. Cut and remove the tie wraps securing the paper fence. (See Figure 2–2.)
3. Remove the outer foam pads.

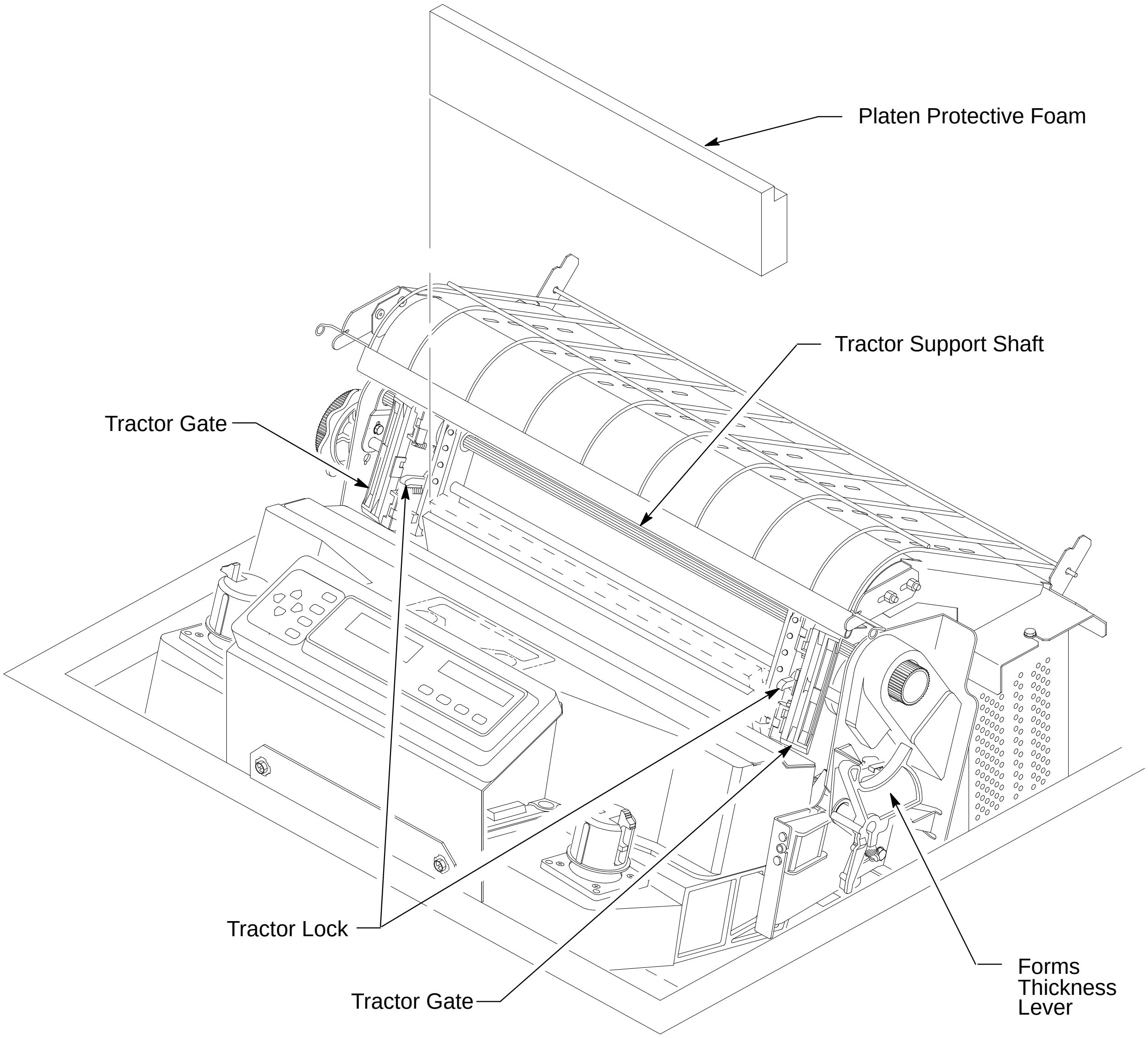


Figure 2–3. LG06: Platen Protective Foam

Remove the Platen Protective Foam

1. Open the tractor gates. Push the tractor locks down. Move the tractors outward as far as they will go. (See Figure 2–3.)
2. Rotate the forms thickness lever away from you as far as it will go; this is the fully open position.
3. Rotate the platen protective foam toward the front of the printer and remove it from under the tractor support shaft.

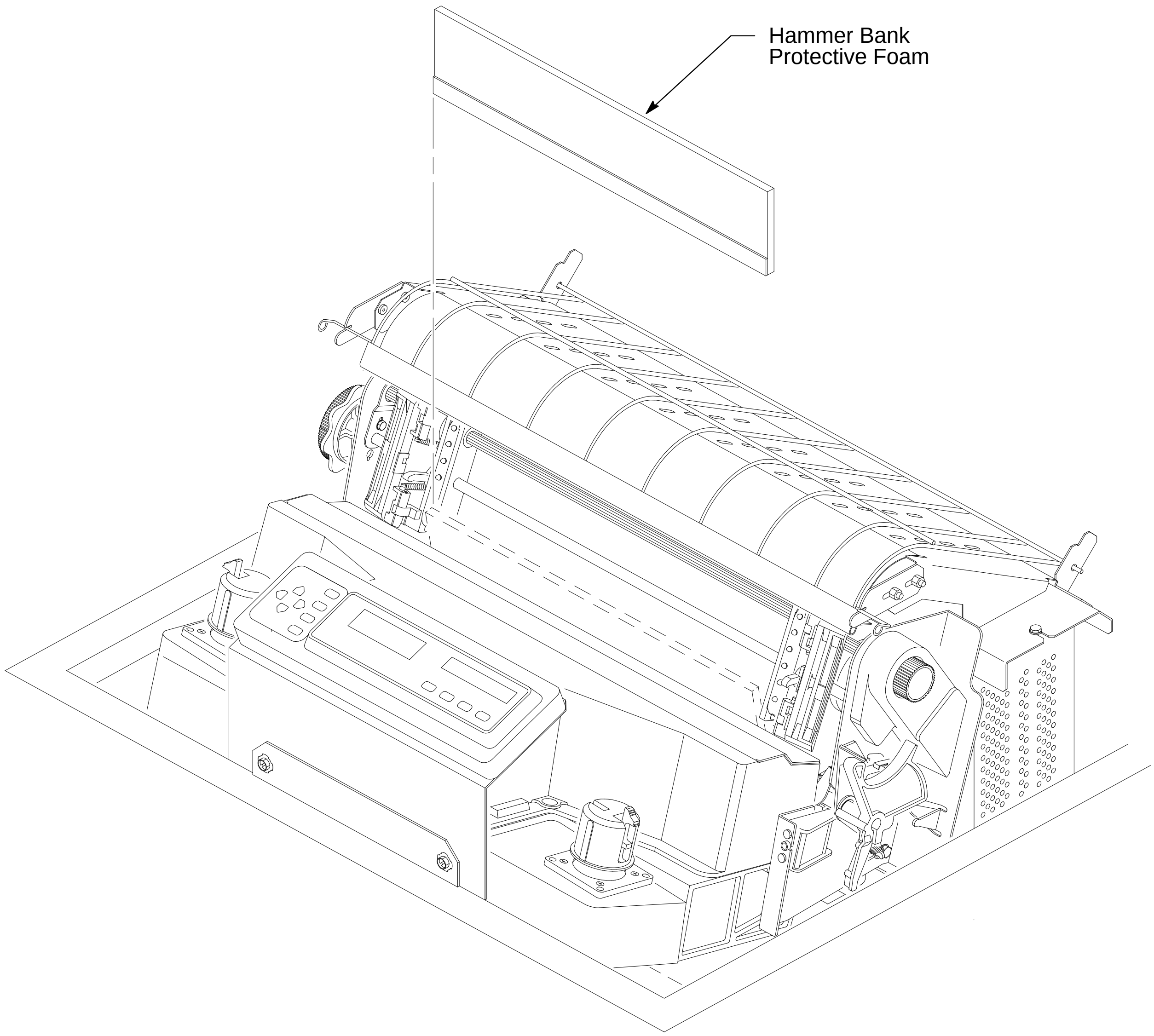


Figure 2–4. LG06: Hammer Bank Protective Foam

Remove the Hammer Bank Protective Foam

1. Rotate the hammer bank protective foam toward the front of the printer and remove it from between the ribbon mask and hammer bank. (See Figure 2–4.)

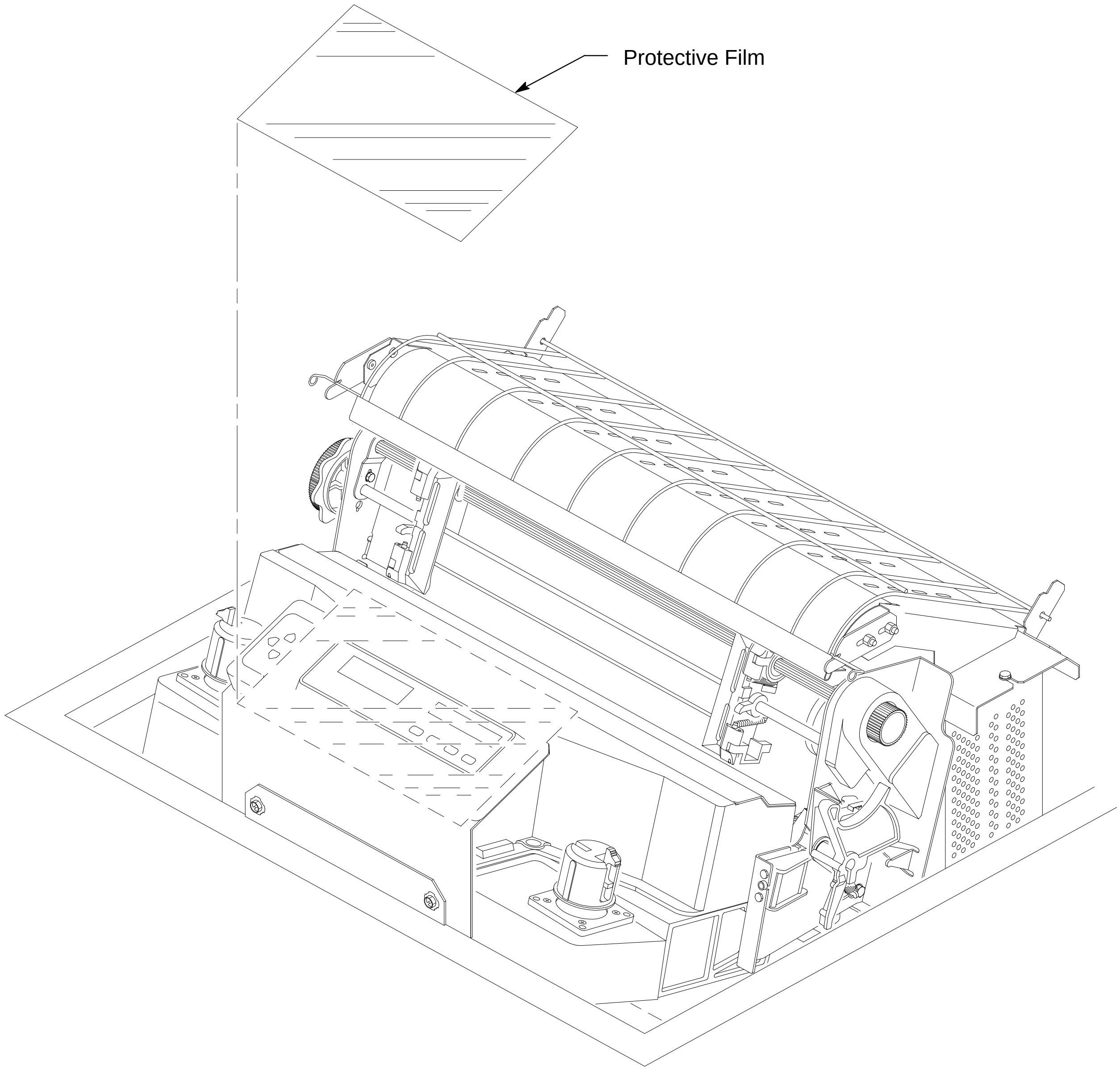


Figure 2–5. LG06: Protective Film

Remove the Protective Film

1. Carefully peel the protective film off the control panel. (See Figure 2–5.)

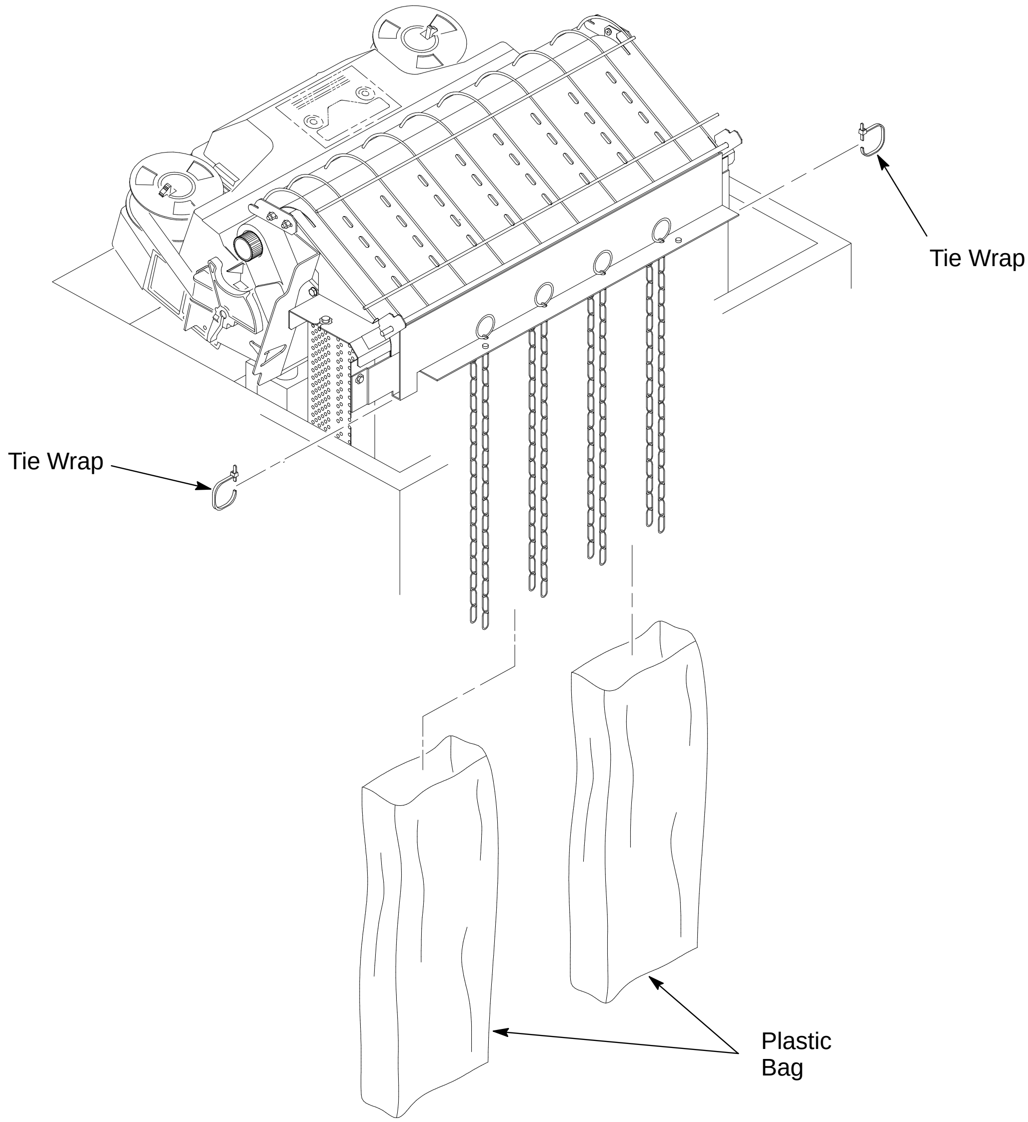


Figure 2–6. LG06: Releasing Paper Chains

Release LG06 Paper Chains

1. Open the rear cabinet door.
2. Cut the tie wraps and release the paper chains from the bags at the rear of the printer frame. Remove the tie wraps and bags. (See Figure 2–6.)
3. Make sure each chain hangs freely, with no kinks or knots.
4. Close the rear cabinet door.

LG12 Shipping Restraints

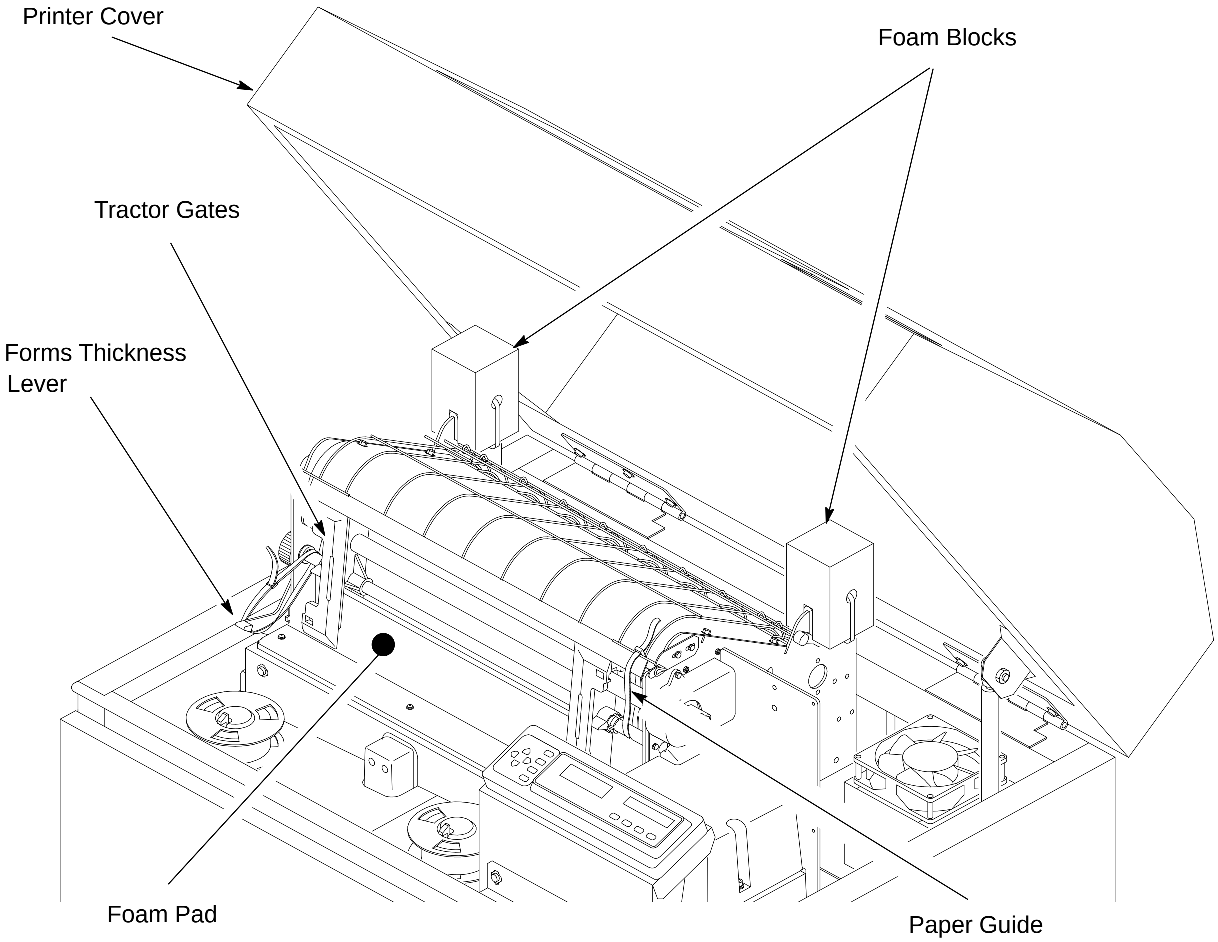


Figure 2–7. LG12: Removing Tie Wraps, Foam Pad and Blocks

Remove the Tie Wraps, Foam Pad, and Foam Blocks

1. Open the printer’s top cover.
2. Untie the two tie wraps that hold the two foam blocks near the back of the printer. Remove the foam blocks. Set packing materials to the side.
3. Open the left and right tractor gates. Remove the foam pad and the envelope (which contains a print sample) from the paper path in front of the platen. Store the foam pad with the other packing materials.
4. Cut and remove the tie wraps securing the forms thickness lever and the paper guide.
5. Close the top cover.

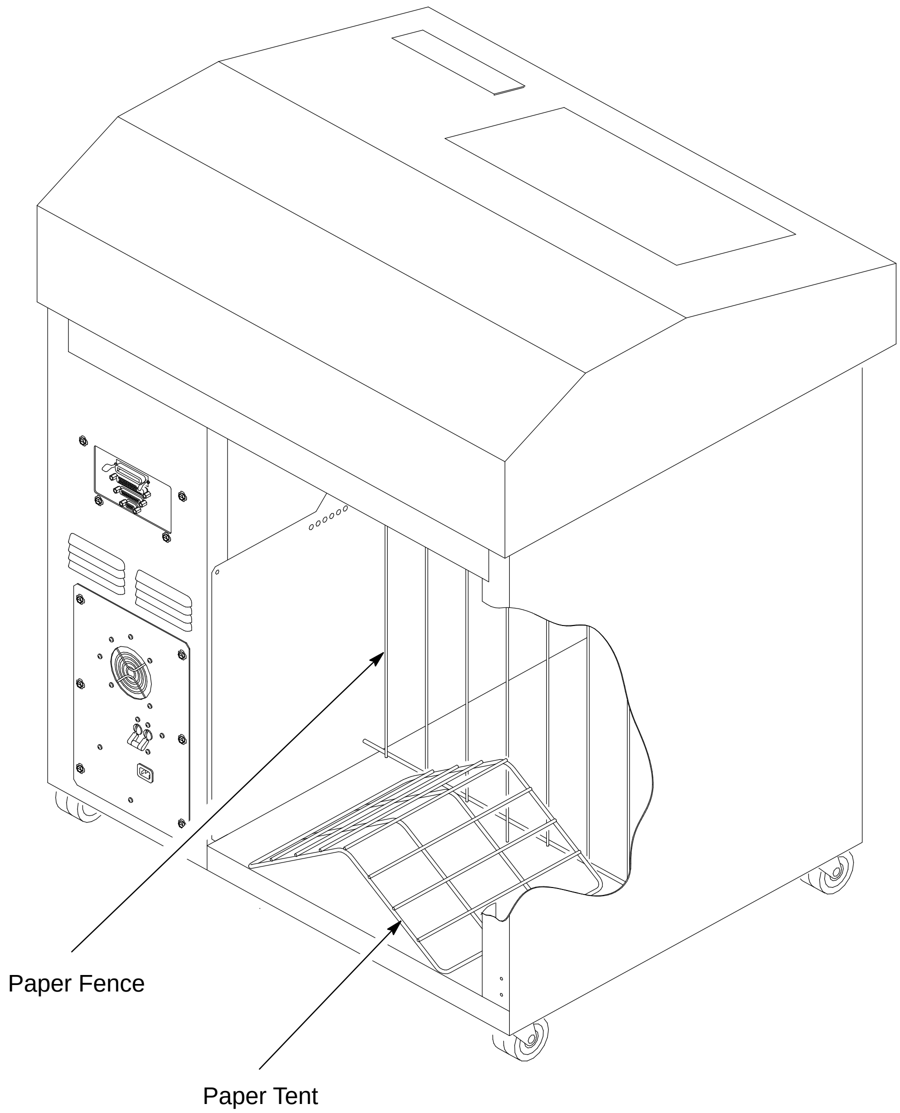


Figure 2–8. LG12: Installing the Paper Tent

Install the Paper Tent

6. Open the back cover.

7. Remove the bubble packaging and cardboard piece from the paper tent.

8. Place the tent inside the printer.

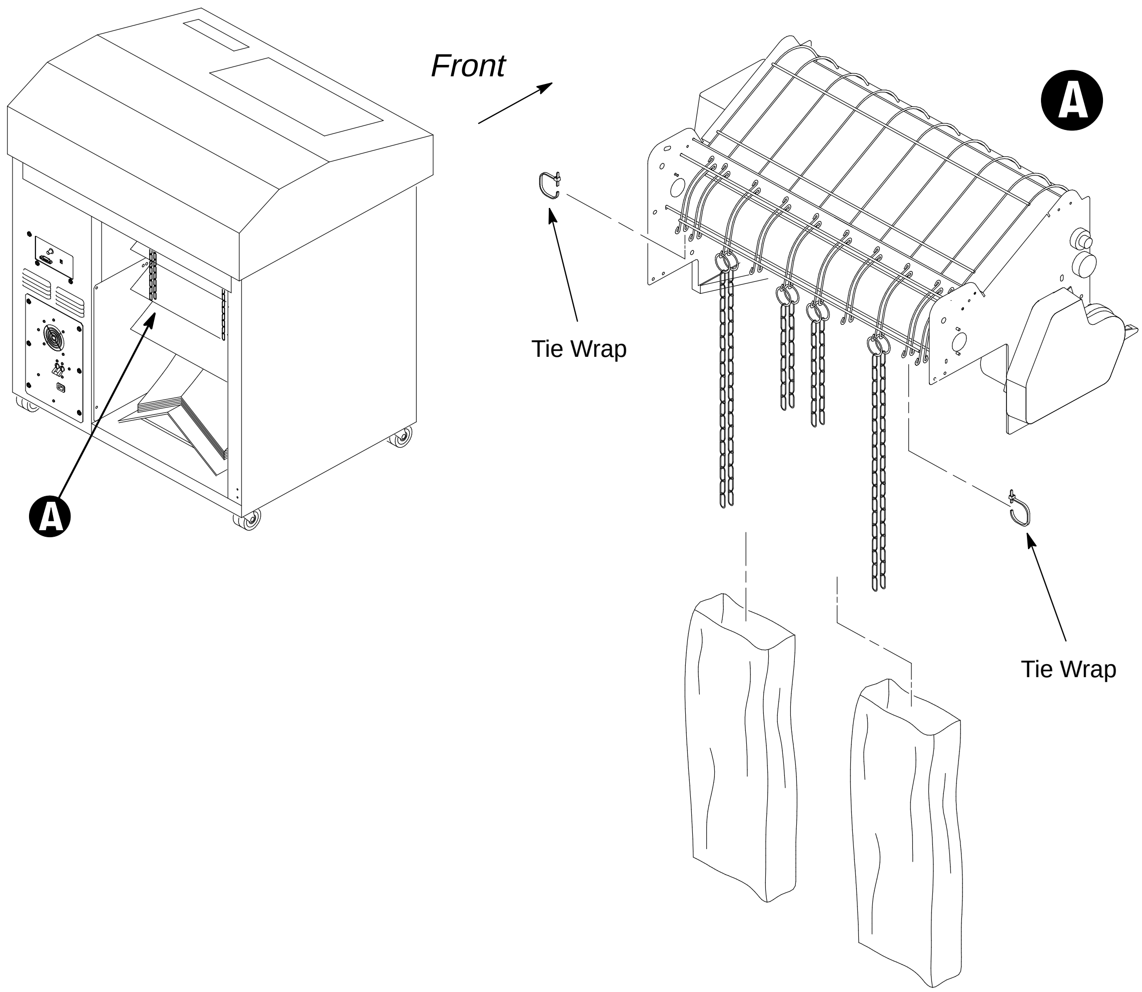
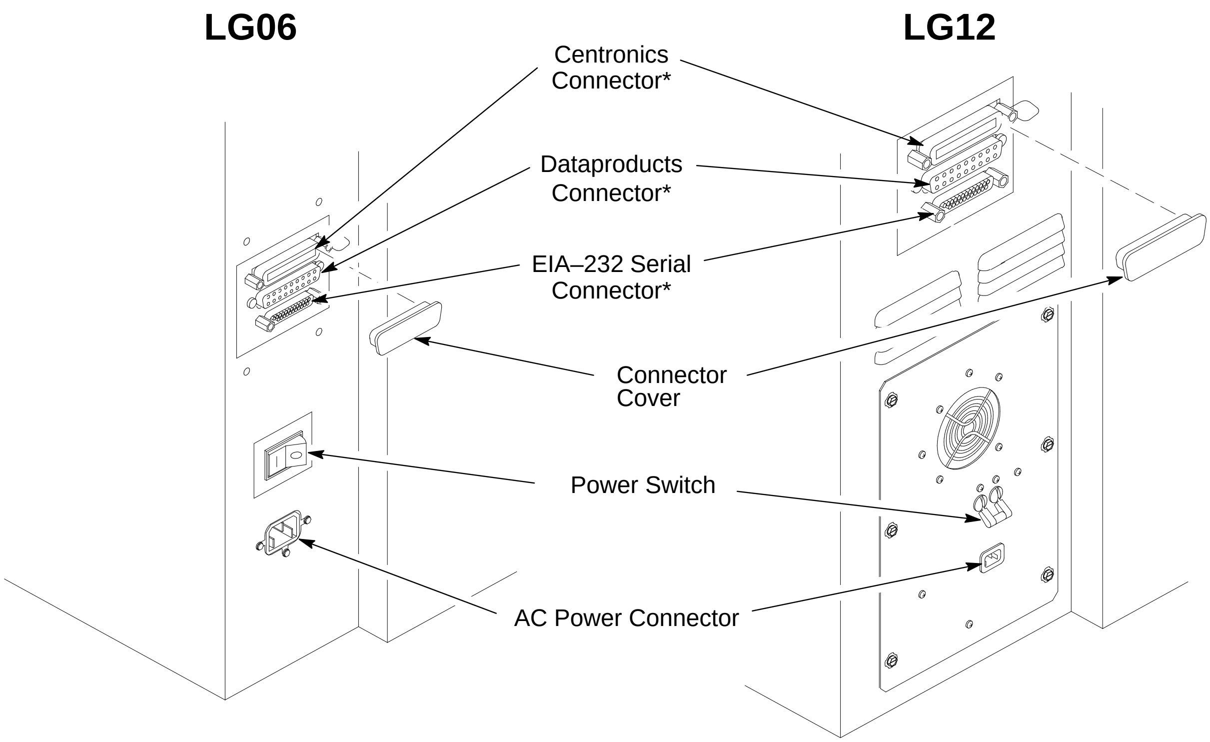


Figure 2–9. LG12: Releasing Paper Chains

Release LG12 Paper Chains

1. Open the back cover if it is closed.
2. Cut the tie wraps and release the paper chains from the bags at the rear of the printer frame. Remove the tie wraps and bags.
3. Make sure each chain hangs freely, with no kinks or knots.
4. Close the back cover.

Connect the Interface and Power Cables



NOTE: Refer to Chapter 5, *Interfaces*, for descriptions of the connectors and the pin assignments.

* Suggested DEC cables:

Dataproducts parallel	BC27A–30
	BC27L–30
Centronics parallel	BC19M–10
Serial	BC22D–25

Figure 2–10. Cable Connections

1. Make sure the voltage source at the printer site conforms to the requirements specified on page 2–2.
2. Verify that the printer power switch is set to off.
3. Connect the power cord to the printer's AC power connector and to the AC line receptacle. (See Figure 2–10.)
4. Connect the interface cable (not supplied with the printer) to the appropriate printer interface connector and to the host computer.
5. Install the supplied connector covers on the unused interface connectors.
6. Refer to Chapter 4 to configure the printer interface.

Test the Printer

NOTE: Control panel switches and indicators are described in Chapter 3, “Operating the Printer.”

To test your printer:

1. Turn the printer on (page 3–3).
2. Install the ribbon (page 3–20).
3. Load full–width (132 column) computer paper (page 3–10).
4. Set top–of–form (page 3–16).
5. Press the ON LINE switch to place the printer off–line. “Off–line/Emulation” displays.
6. Open the printer cover. Press the DOWN switch, then repeatedly press the NEXT switch until “Emulation/Self Test” displays.
7. Press UP and DOWN simultaneously to unlock the panel. “Unlocked” displays briefly. (If “Locked” displays, simply press UP and DOWN again.)
8. Press ENTER; this selects the self test emulation. An asterisk (*) appears after the display message. (“Emulation/Self Test * ” displays.)
9. Press the DOWN switch, then press the NEXT switch until “Self Test ASCII Swirl” displays.
10. Press the R/S (Run/Stop) switch: Shifted lines of the ASCII character set will print across the full width of the paper.
11. Press the R/S switch to stop the print test.
12. Press **C**LEAR. The printer returns to the off–line state, and “Off–line/Emulation” displays.
13. Press DOWN, then press NEXT until the desired emulation appears. (For example: “Emulation/LG06”)
14. Press ENTER to select the emulation. An asterisk (*) appears after the display message. (For example: “Emulation/LG06 * ”)
15. Simultaneously press the UP and DOWN switches to lock the ENTER switch. “Locked” displays briefly.
16. Close the printer cover.

17. Examine the print quality: Printed characters should be fully formed and of uniform density. If the test does not run or characters appear malformed, contact your authorized service representative.

18. Press the ON LINE switch to place the printer on–line.

3 Operating the Printer

Chapter Contents

Turning the Printer On and Off

To Turn the Printer On:

1. Make sure the printer is installed and plugged into a power source in accordance with the instructions in Chapter 2, *Installation*.
2. Set the power switch to the on position. (See Figure 3–1.)

To Turn the Printer Off:

1. Make sure all print jobs are finished.
2. Set the power switch to the off position. (See Figure 3–1.)

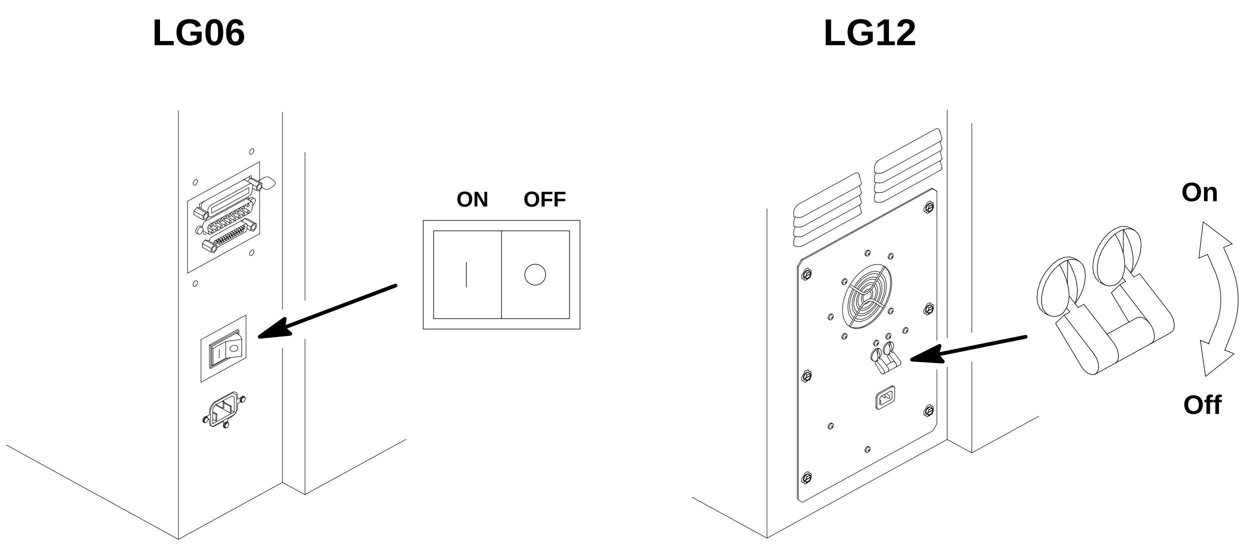


Figure 3–1. Power Switch

Operating States

On–Line

On–line refers to the printing state. When the printer is on–line, it is ready to receive data and control commands from the host computer, and it prints the data immediately.

The message display on the operator control panel displays “On–Line.” The printer must be on–line to receive data from the host computer.

Off–Line

Off–line refers to the non–printing state. When the printer is off–line, communication between the printer and the host computer is temporarily stopped and the message “Off–line/Emulation” appears on the display.

Set the printer off–line to perform the following non–printing tasks:

- Load paper
- Adjust paper tractors
- Advance paper
- View forms
- Replace ribbon
- Change the font
- Set or advance to top–of–form
- Change printer emulation
- Run printer self–tests
- Display or change configuration
- Enter hex dump mode

The Operator Control Panel

The operator control panel is at the front of the printer. (See Figure 3–2.) With the printer cover closed, the status lamps, message display, and four switches governing normal printer operation are accessible. With the printer cover raised, eight more switches are accessible. The eight additional switches are used to set printer operating parameters, run self tests, and set paper position. You also use the operator control panel to clear a fault condition and resume printing.

The printer will not provide immediate switch response when it is printing or receiving data from the host.

Configuring the Printer with the Control Panel

Certain operating characteristics must be set in the printer so that it can communicate with the host computer and print data. The process of determining and setting these characteristics is called printer configuration.

Dedicated function keys on the control panel and menus stored in printer firmware are used to configure the printer. Additional menu selections and display messages are also incorporated to allow for special Digital functions.

Printer configuration is covered in Chapter 4, *Printer Configuration*.

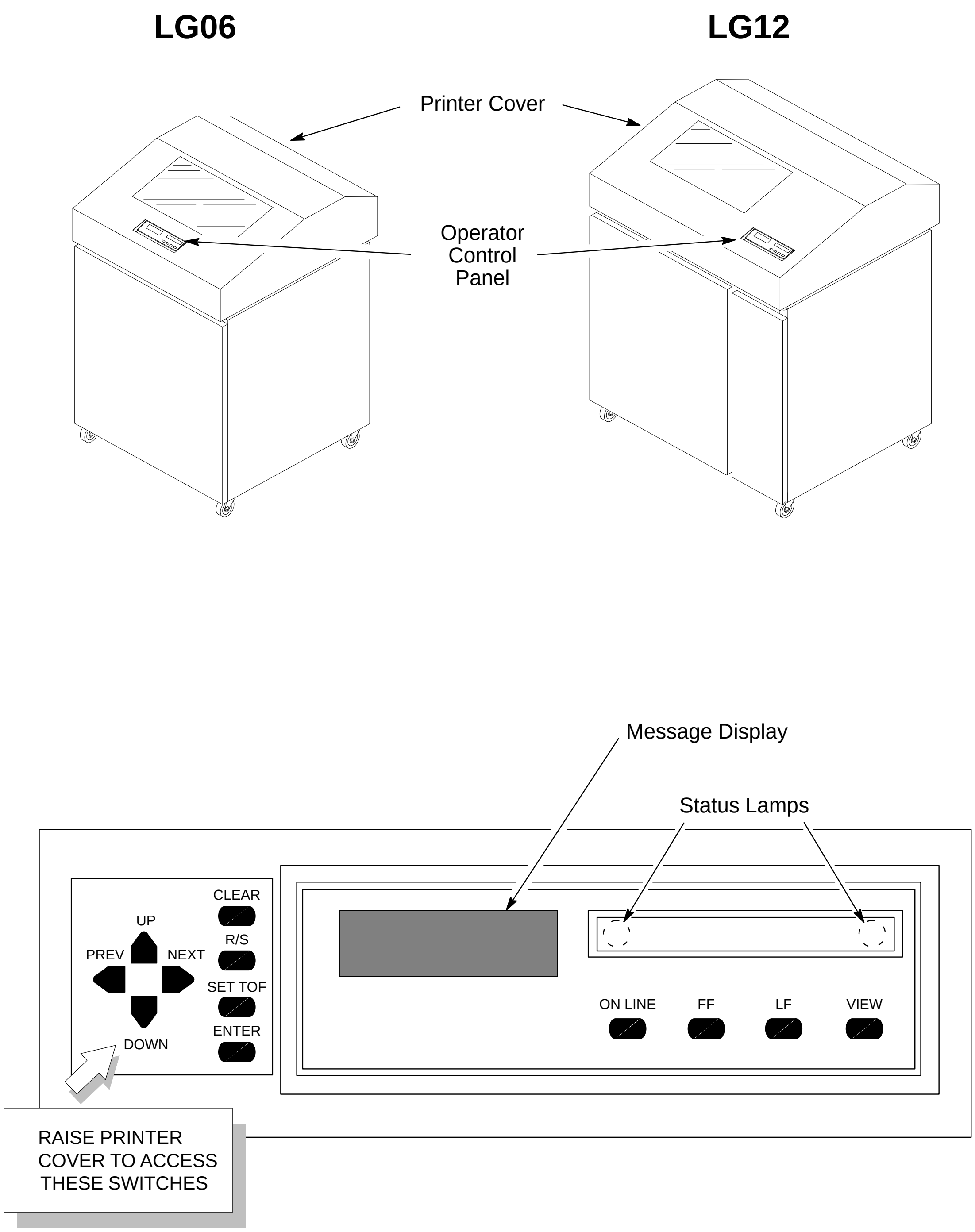


Figure 3–2. Operator Control Panel

Switches and Indicators

Control panel switches allow you to change printer operating states and other tasks. The status lamps illuminate to signal various operating conditions. This section describes the function of every switch and indicator on the operator control panel.

See Figure 3–2 for the locations of control panel switches and indicators.

Message Display

The message display is a 2–line by 16–character alphanumeric liquid crystal display (LCD). During normal operation, it shows the print state (on–line or off–line) and displays configuration parameter options. If a fault condition occurs, it displays a fault message.

Status Lamps

Two status lamps illuminate continuously when the printer is on–line to the host and are off when the printer is off–line.

The status lamps flash alternately if a fault condition exists in the printer.

ON LINE Switch

The ON LINE switch toggles the printer on–line and off–line.

When the printer is on–line, it is ready to receive data and control commands from the host computer, and prints the data immediately.

To take the printer off–line, press the ON LINE switch when the printer is on–line. The interface to the host computer becomes busy and input character processing stops. (Printing may continue for a maximum of two seconds.) The display then reads: “Off–Line/Emulation”.

To return the printer on–line, simply press the ON LINE switch again. The display then reads: “On–Line”.

The printer must be off–line to change printer configuration or to run self–tests. The printer will automatically go off–line if a fault occurs.

FF (Form Feed) Switch

This switch is active only when the printer is off–line. Press FF to advance the paper to the top–of–form of the next page. Any unprinted data remaining in the print buffer will print before the paper moves.

This switch is not active during a fault condition.

LF (Line Feed) Switch

This switch is active only when the printer is off–line. Press this switch to advance the paper to the top of the next print line. Any unprinted data remaining in the buffer will print before paper motion occurs.

This switch is not active during a fault condition.

VIEW Switch

This switch is active only when the printer is off–line. Press this switch to advance the paper for viewing through the window on the printer cover. Press VIEW again to move the paper back into the print position.

CLEAR Switch

The CLEAR switch operates only when the printer is off–line. If a fault condition occurs, an error message appears on the display and the status lamps flash alternately. Correct the problem, then press the CLEAR switch to tell the printer that a fault condition has been corrected. When all faults are corrected, the display indicates the printer is off–line. If CLEAR is pressed when a configuration parameter value is displayed, the printer returns to off–line status (“Off–line/Emulation”).

R/S (Run/Stop) Switch

R/S performs the following functions:

- With a diagnostic test showing on the display, press R/S to start the test. Press R/S again to stop the test.
- Simultaneously press the Clear and R/S switches to reset the printer to the last saved configuration.

- With “Off–line/Print Config” showing on the display, press R/S to print out the current configuration. (Refer to Chapter 4, *Printer Configuration*.)

SET TOF (Top–Of–Form) Switch

The SET TOF switch functions only when the printer is off–line. It moves the paper backwards from the top–of–form notch to the print station. (See page 3–16.)

This switch is not active during a fault condition.

ENTER Switch

The ENTER switch loads the value shown on the message display into printer RAM and indicates this by displaying an asterisk (*****) to the right of the value. The previous value is replaced by the displayed value.

The ENTER switch must be unlocked before making configuration changes. Simultaneously press UP and DOWN when the display shows “Off–line Emulation” to lock and unlock the ENTER switch. (This sequence protects against accidental reconfiguration.) No other switches are affected by this action. The display reads either “Unlocked” or “Locked” for one second, then returns to “Off–line Emulation.”

Resetting the printer or turning the power off and on automatically locks the ENTER switch.

UP, DOWN, NEXT, and PREV Switches

Simultaneously press UP and DOWN to lock and unlock the ENTER switch.

The UP, DOWN, NEXT, and PREV switches also display configuration parameter main menus, submenus, and diagnostic tests. A value shown on the display with an asterisk (*****) is the currently active parameter value retained in printer memory. (Refer to Chapter 4, *Printer Configuration*.)

NOTE: When the printer is off–line, configuration menus and parameter values may be viewed at any time, but they may only be changed by unlocking and using the ENTER switch. The ENTER switch loads a displayed value into printer RAM. This switch can only be unlocked when the printer is off–line.

Micro–Stepping

Micro–steps are small vertical paper movements you can make at the control panel by pressing a key combination. In Digital emulation, paper will move 1/600 inch. In Proprinter and Epson emulations, paper will move 1/72 inch. To micro–step the paper, take the printer off–line and simultaneously press the LF and NEXT switches.

Loading Paper in an Empty Printer

NOTE: Paper specifications are in Appendix B.

1. If the printer is on–line, press the ON LINE switch to place it off–line. Raise the printer cover.
2. Raise the forms thickness lever all the way. (See Figure 3–3.) Open both tractor gates.
3. Open the cabinet front door and align the paper supply with the label on the floor of the cabinet. Feed the paper up through the paper slot until it appears behind and above the ribbon mask.
4. Load the paper on the tractor sprockets and close the tractor gates. Press the tractor locks down, slide the tractors to align the paper and to remove slack in the paper. Use the paper scale on the shuttle cover to align or center the paper as desired. (You can also use the paper scale to count print columns.) Lift the tractor locks to lock them.
5. Press FF four times to ensure that the paper is feeding and stacking properly. Make sure the first sheet clears the paper guide chains without snagging.
6. If you need to make fine adjustments to the left margin, turn the horizontal adjustment knob.
7. Close the forms thickness lever and the front door.
8. Set the top–of–form (page 3–16).

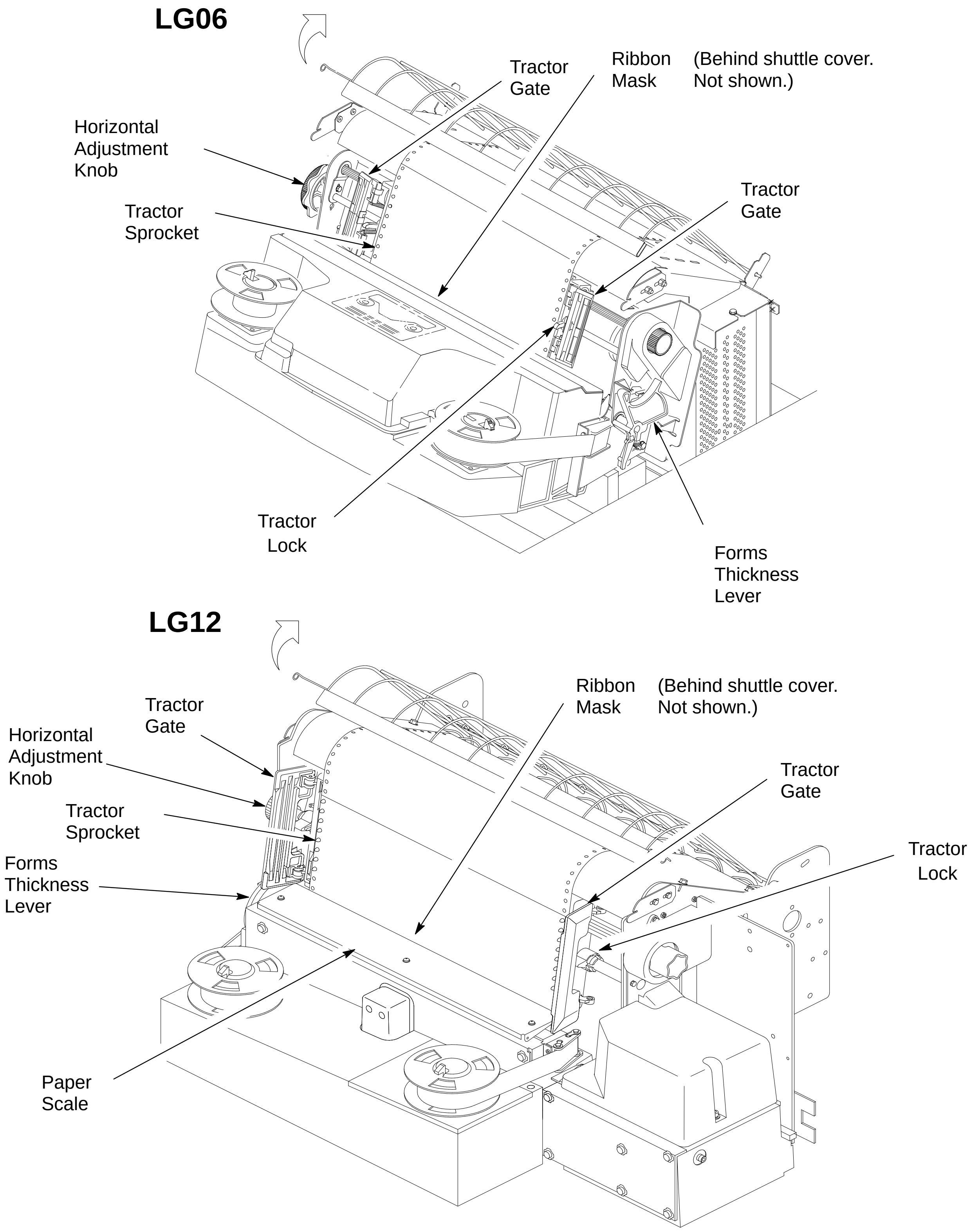


Figure 3–3. Loading and Unloading Paper

Loading Paper After a “Paper Out” Message

NOTE: This procedure allows you to load paper without having to reset the top–of–form.

1. Raise the printer cover.
2. Raise the forms thickness lever all the way. (See Figure 3–4.)
3. Press the CLEAR switch to silence the alarm.
4. Open the floor cabinet front door and align the paper supply with the label on the floor of the cabinet.
5. Without removing the existing paper, feed the new paper up through the paper slot until it appears behind and above the ribbon mask, but in front of the existing paper. You may have to gently press the existing paper back.
6. Line up the edge of the new paper with the perforation of the existing paper.
7. Open the right tractor gate by swinging it out. Lay the new paper over the existing paper on the tractor sprockets and close the right tractor gate.
8. Open the left tractor gate by swinging it out. Lay the new paper over the existing paper on the tractor sprockets and close the left tractor gate.
9. Close the forms thickness lever and the front door.
10. Press the ON LINE switch to place the printer on–line. Resume printing.

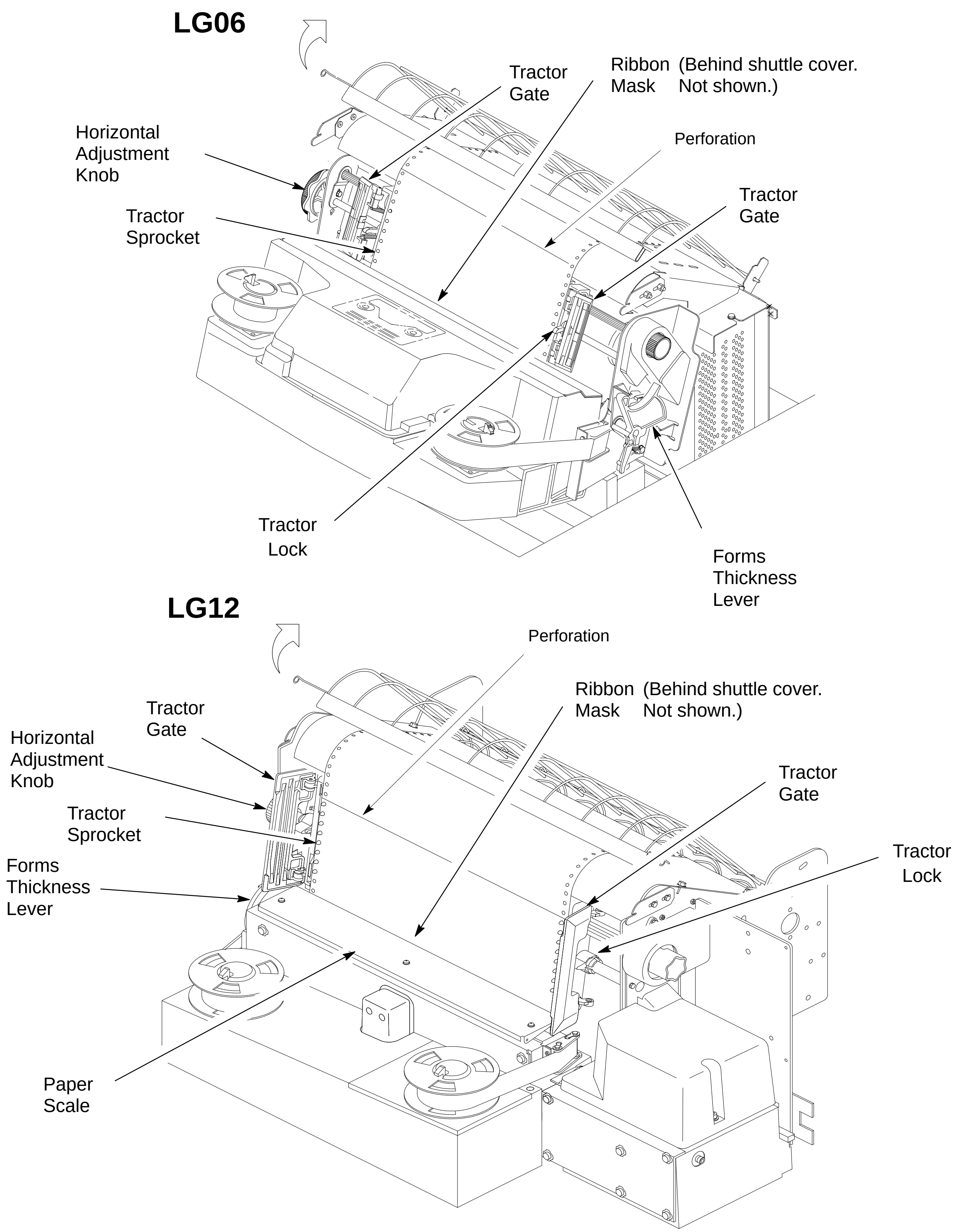


Figure 3–4. Loading and Unloading Paper

Unloading Paper

1. If the printer is on–line, press the ON LINE switch to place it off–line. Raise the printer cover.
2. Open the printer cabinet front door and tear off the paper near the paper slot.
3. Fully raise the forms thickness lever. (See Figure 3–5.) When it is completely opened, you will hear a beep and a fault condition exists.
4. Open both tractor gates and remove the paper from the tractor sprockets.
5. Gently pull the paper up through the paper slot. Be careful not to let paper perforations or sprocket holes snag on the ribbon mask behind the shuttle cover.
6. Unload the stacked paper from the cabinet floor.

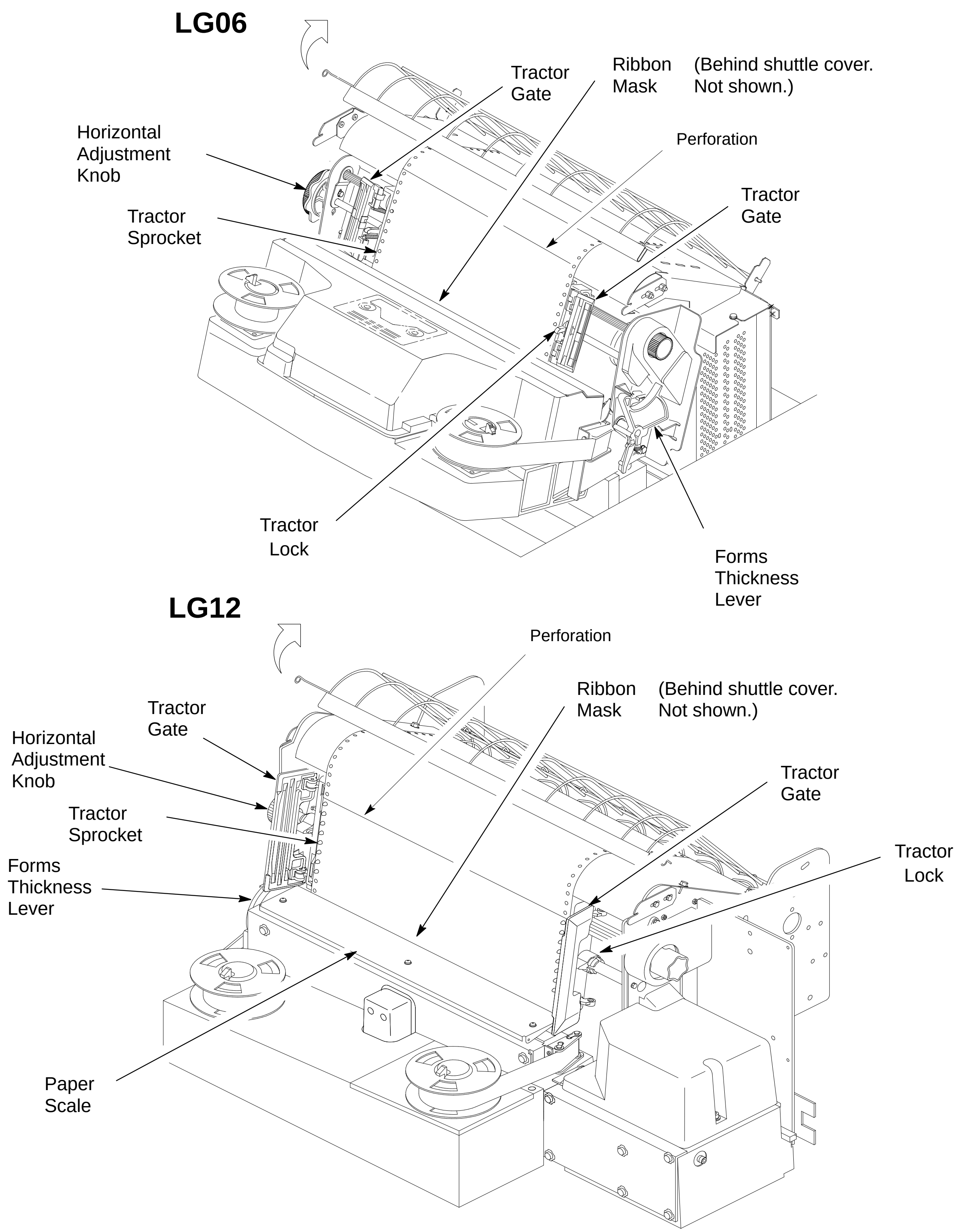


Figure 3–5. Loading and Unloading Paper

Setting Top–of–Form

Top–of–form (TOF) determines where the first line of print will appear. (One–half inch below the paper perforation is a commonly used location.) Unless otherwise configured, the printer assumes you are using paper that is 11 inches long. (To select other form lengths at the control panel, refer to Chapter 4, *Printer Configuration*.)

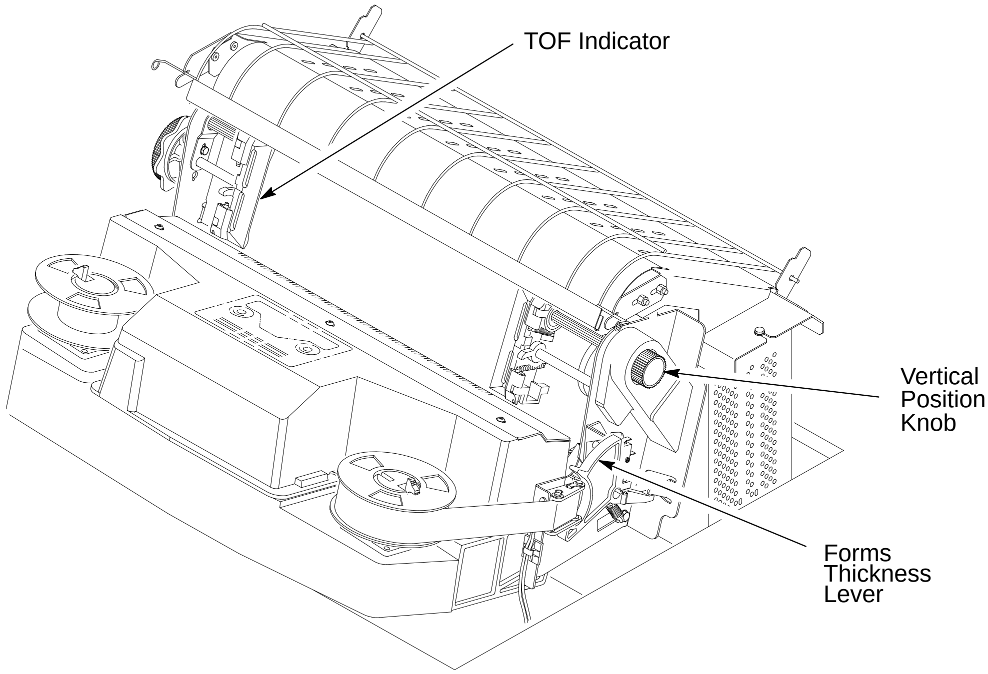
Refer to Figure 3–6 and follow these steps:

1. If the printer is on–line, press the ON LINE switch to place it off–line. Raise the printer cover.
2. Make sure several sheets of paper extend past the tractors. If necessary, press the FF switch twice to feed a couple of sheets beyond the tractors and into the paper guide assembly.
3. Fully raise the forms thickness lever. When it is completely opened, you will hear a beep and a fault condition exists.
4. Rotate the vertical position knob to set the center of the first printable line at the TOF indicator on the left tractor gate.
5. Set the forms thickness lever to match the paper thickness you are using. (A is recommended for thin paper, B for medium, and C for thicker paper.) Adjust until you have the desired print quality. The fault condition clears automatically.

NOTE: If the forms thickness lever is set incorrectly, wavy vertical lines will print. If it is over–tightened, excessive friction may cause the shuttle to smear ink, tear the paper, damage labels, or incorrectly position forms.

6. Press and release the SET TOF switch. The paper reverse feeds to the print position and the message display reads “Off–Line/Emulation.”
7. Close the printer cover.
8. Press the ON LINE switch to place the printer on–line.

LG06



LG12

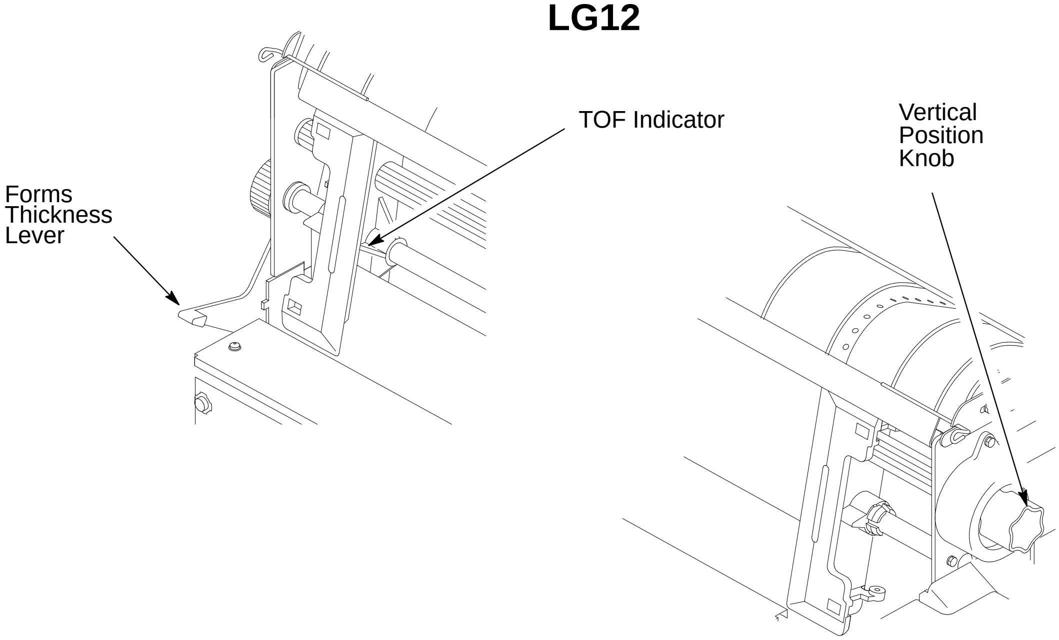


Figure 3–6. Setting Top–of–Form

Selecting a Font

NOTE: The procedure below selects a font in Digital emulation. The procedure is the same for the Proprinter XL and Epson FX emulations, but the font options differ. (Both procedures are charted on the Configuration Diagram in Chapter 4, *Printer Configuration*.)

To select a font from the control panel:

1. If the printer is on–line, press the ON LINE switch to place it off–line.
2. Raise the printer cover.
3. Press UP and DOWN simultaneously to unlock the ENTER switch. "Unlocked" displays momentarily. (If "Locked" displays, simply press UP and DOWN again.)
4. Press DOWN. "Emulation/LG06 * " displays.
5. Press DOWN. "LG06/Font" displays.
6. Press DOWN. "Font/Style" displays.
7. Press DOWN. "Style/[font]" displays.
8. Press NEXT or PREV to cycle through the font options. DP 10 6 is default. The first number is characters per inch; the second number is lines per inch. The font options are abbreviated on the display:
   DP = Data Processing
   CORESPON = Correspondence
   COMPRESS = Compressed
   HS = High Speed
   OCR A = Optical Character Recognition, Set A
   OCR B = Optical Character Recognition, Set B
9. When the desired font shows on the display, press ENTER. An asterisk (*) appears on the display, indicating that this font will print.
10. Press CLEAR to return the printer to off–line status. The display reads "Off–Line/Emulation."
11. Press UP and DOWN simultaneously to lock the ENTER switch. "Locked" displays momentarily.

12. Close the printer cover.

13. Press the ON LINE switch to place the printer on–line.

14. To make the font selection occur automatically when the printer is turned on, save the printer configuration. (Refer to Chapter 4, *Printer Configuration*.)

NOTE: You can also select a font with control codes, which are discussed in Chapters 7, 8, and 9. Sending these codes overrides the font selected at the control panel.

Removing and Installing the Ribbon

NOTE: Ribbon specifications are in Appendix B.

1. If the printer is on–line, press the ON LINE switch to place it off–line.
2. Raise the printer cover.
3. Remove the old ribbon:
   a. Fully raise the forms thickness lever (See Figure 3–7).
   b. Unlatch both ribbon spools and carefully lift them off the hubs. Raise the ribbon out of the ribbon path. Discard the ribbon and spools.
4. Install the new ribbon:
   a. Place new ribbon spools on the hubs with the ribbon to the outside, as shown in Figure 3–7.
   b. Press each spool down until the latch snaps in place.
   c. Thread the ribbon around the two ribbon guides and through the ribbon path, as shown in the diagram on the hammer bank cover or ribbon deck. Manually turn the ribbon spools to ensure that the ribbon tracks correctly in the ribbon path.
5. Set the forms thickness lever to match the paper thickness you are using. (A is recommended for thin paper, B for medium, and C for thicker paper.)
6. Close the printer cover.
7. Press the ON LINE switch to place the printer on–line.

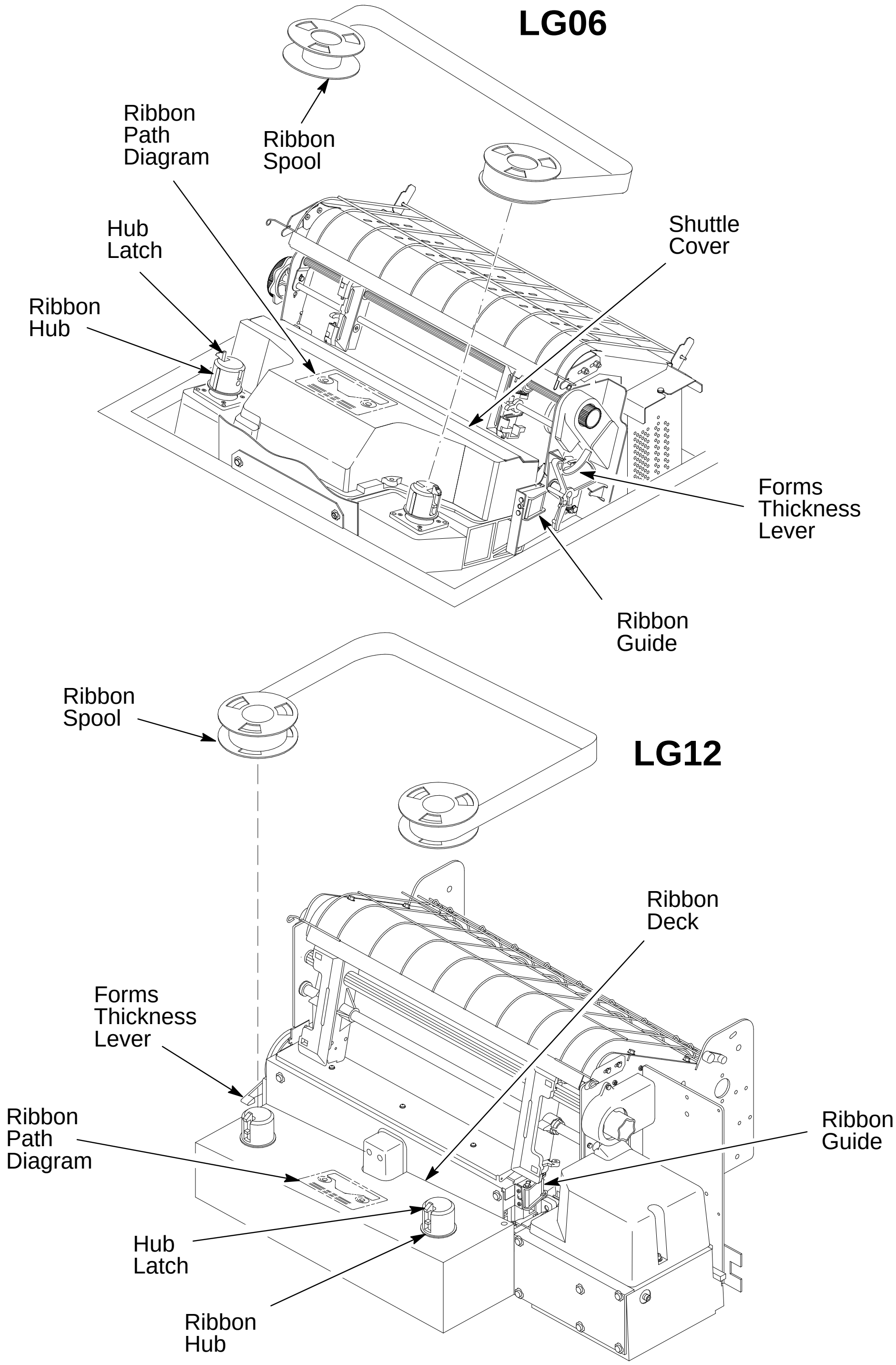
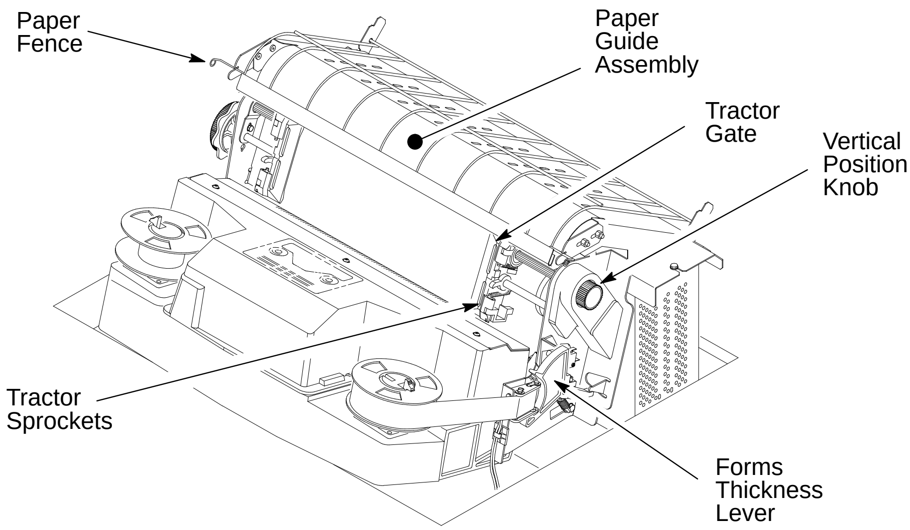


Figure 3–7. Removing and Installing the Ribbon

Clearing Paper Jams

1. Open the floor cabinet front door and tear off the paper near the paper slot.
2. Open the printer cover.
3. Fully raise the forms thickness lever.
4. Open both tractor gates and remove the paper from the tractor sprockets.
5. Open the paper fence.
6. Gently pull the paper up through the paper slot. Slide the paper over the paper guide assembly and down into the paper stacking area in the rear of the cabinet.
7. Check the paper path for bunched or torn paper. Remove any pieces of paper in the paper path.
8. Check the narrow passageway between the face of the platen and the ribbon mask for bits of torn paper or ribbon lint. Check the holes in the ribbon mask surrounding each hammer tip. Gently remove paper or lint particles with a wooden stick or pair of tweezers. (Do not pry or apply force to the hammer tips.)
9. Check that the ribbon mask has not been deformed in such a way as to block the paper path. (If the ribbon mask is damaged or bent, contact an authorized service representative.)
10. Press CLEAR to clear the “Paper Jam” fault message.
11. Close the paper fence.
12. Load paper (page 3–10).

LG06



LG12

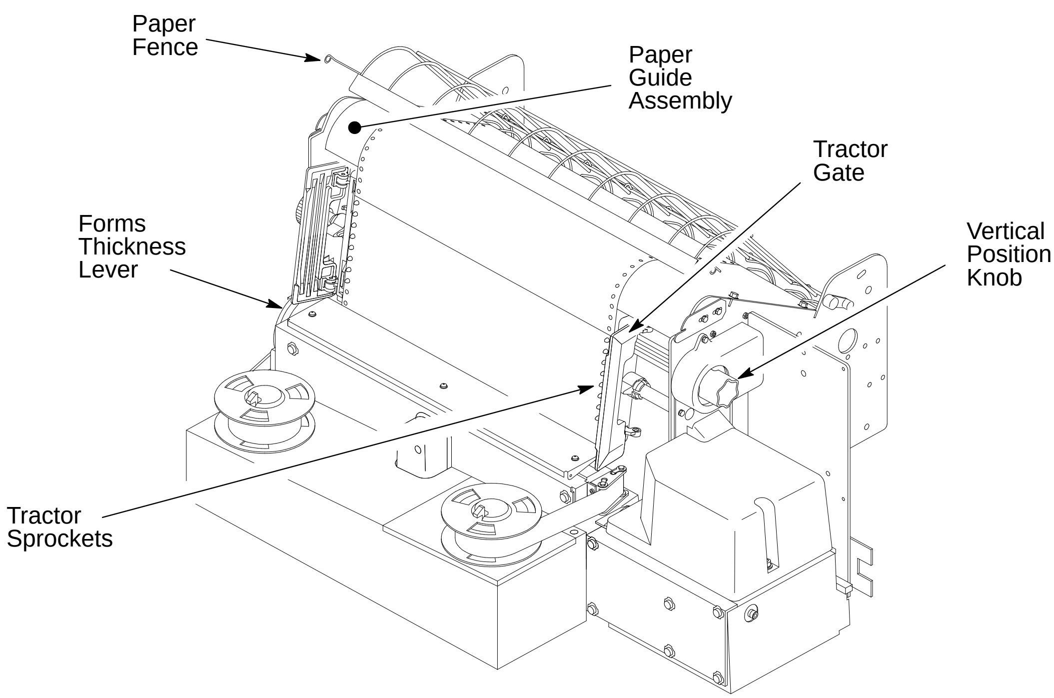


Figure 3–8. Clearing Paper Jams

4 Printer Configuration

Chapter Contents

Printer Configuration

IMPORTANT

Configuration directly affects printer operation. Do not change the configuration of your printer until you are thoroughly familiar with the procedures in this chapter.

Configuration refers to the operating properties that define how the printer responds to signals and commands received from the host computer. These properties, the configuration parameters, are set to match the operating characteristics of the host computer system.

Most configuration parameters are selected at the control panel. Some parameters can be set either by a control code from the host computer or at the control panel. In such cases, a host–generated command will override the control panel selection. (If you save configuration values after such an override, the control code value is saved, not the value you selected at the control panel.)

Configuration Printout

The configuration printout lists the configuration parameters currently in use. Figure 4–1 shows a typical configuration printout. When the printer exits configuration printout mode all print attributes are canceled. All other format parameters remain unaffected.

To obtain a configuration printout:

1. If the printer is on–line, press the ON LINE switch to place it off–line. Raise the printer cover.
2. Press the UP and DOWN switches simultaneously to unlock the panel. “Unlocked” appears momentarily.
3. Press NEXT until “Off–line/Print Config” appears on the message display.
4. Press the R/S (Run/Stop) switch. The configuration listing prints.
5. Press UP and DOWN simultaneously to lock the panel. “Locked” appears momentarily.
6. Press CLEAR and close the printer cover.

7. Press the ON LINE switch to place the printer on–line.

```
P4980A FONT Version 2.902B, 24–SEP–1992 Part No. 151029
CCB RTPU Version 2.05C,  01–Apr–1993 Part No. 151262
600–9 PFC Version 4.00E,  02–Apr–1993 Part No. 134727
P9/CCB RSP Version 3.01A,  01–Apr–1993 Part No.  134726
CCB–DX DPU Version 2.00C,  04–Mar–1993 Part No.  134710

    Emulation
        LG06
            Font
                Style                     DP  10   6

                Character Set
                    DEC Multinat’l        U.S. ASCII

            Vert. Forms                   Bot Frm   66/6”
                                          Top Mrg   0/6”
                                          Bot Mrg   66/6”

            Horiz. Forms                  Left Mrg   0”
                                          Right Mrg  13.2”

            Autowrap                      No

            CR                            =  CR

            LF                            =  LF

            Unsol. Reports?               No

    Interface
        Serial EIA–232
            Data Rate                     9600 Baud
                                          Word Length 8
                                          Stop Bits 1

            Parity                        None

            Data Term Ready               True

            Request to Send               On–Line and BNF

            Reverse Channel               On–Line and BNF

    Print Engine
        Unidirectional                    No

        PMD Fault                         Yes

        Paperout Adjust                   128 dots

    Panel Language                        English

    Statistics                            ON: 18.9 Hrs
                                          Print: 4.7 Hrs

                                          Print Strokes
                                          1396722

                                          Print Lines
                                          720880

                                          11” Pages
                                          2533

                                          Phase Value
                                          86
```

Figure 4–1. Typical Configuration Printout

Configuration Procedure

Use the following procedure to configure the printer from the control panel:

1. Obtain a configuration printout (page 4–2).

2. Determine the parameter values that must be changed to meet your requirements. The Configuration Diagram (page 4–8) shows all menus and parameter values.

3. Take the printer off–line by pressing the ON LINE switch. Open the printer cover.

NOTE: The ENTER switch must be unlocked to change a configuration value. (You can examine—but not change—the current configuration by leaving the ENTER switch locked.)

4. Press UP and DOWN simultaneously to unlock the ENTER switch. “Unlocked” appears briefly on the message display. (If “Locked” appears, simply press UP and DOWN again.)

5. Locate the desired menu by pressing DOWN and then NEXT or PREV until the menu name appears on the display. Use the Configuration Diagram (page 4–8) as your road map.

6. Locate the desired value in the menu by pressing DOWN, then pressing NEXT or PREV until the desired value appears on the display.

7. Press ENTER when the desired value shows on the message display. (An asterisk [*] will appear next to the value, indicating it is now the active value.)

8. Press UP, then NEXT or PREV to move to the next desired menu. Repeat steps 6 and 7.

9. After you have made all required parameter changes, press CLEAR. The display goes to “Off–line Emulation.” Press NEXT until “Off–line Save Config” displays. Press ENTER. This saves the parameter values as the power–up default values. (See “Saving Configuration Values” on page 4–5.)

10. Lock the ENTER switch by pressing UP and DOWN simultaneously. “Locked” appears briefly on the message display.

11. Close the printer cover.

12. Press the ON LINE switch to place the printer on–line. Your selected values are now active and will remain set as long the printer is not reset or cleared.

Saving Configuration Values

When you save a set of configuration values they become the power–up default configuration.

To save a set of configuration values:

1. If the printer is on–line, press the ON LINE switch to take it off–line. “Off–line Emulation” appears on the message display.

2. Open the printer cover.

3. Press UP and DOWN simultaneously to unlock the Enter switch. “Unlocked” appears briefly on the message display. (If “Locked” appears, simply press UP and DOWN again.)

4. Press NEXT or PREV until “Off–line Save Config” appears on the display.

5. Press ENTER. The printer saves the parameters in nonvolatile memory then displays “Done.”

6. Press CLEAR to return to “Off–line Emulation”.

7. Press UP and DOWN simultaneously to lock the ENTER switch. “Locked” appears briefly on the message display.

8. Close the printer cover.

9. Press the ON LINE switch to place the printer on–line.

Loading Configuration Values

Configuration values saved using the Save Config menu (page 4–5) become the power–up default configuration. Although the factory settings remain permanently stored in printer memory, they are overridden by the last set of configuration values saved.

The Load Config menu then gives you the choice of loading either the saved or the factory configuration values.

NOTE: If you have not saved a set of configuration values, this procedure loads the factory value set.

To load a set of configuration values:

1. If the printer is on–line, press the ON LINE switch to take it off–line. “Off–line Emulation” appears on the message display.
2. Open the printer cover.
3. Press UP and DOWN simultaneously to unlock the Enter switch. “Unlocked” appears briefly on the message display.
4. Press NEXT or PREV until “Off–line Load” appears on the display.
5. Press DOWN, then press NEXT or PREV to select either “Load Saved” or “Load Factory”.
6. Press ENTER when the desired selection displays. The printer loads the parameters then displays “Done”.
7. Press CLEAR to return to “Off–line Emulation”.
8. Press UP and DOWN simultaneously to lock the ENTER switch. “Locked” appears briefly on the message display.
9. Close the printer cover.
10. Press the ON LINE switch to place the printer on–line.

Changing Printer Emulations

Emulation refers to the ability of the LG06 and LG12 to execute the commands of a Digital printer, an IBM Proprinter III XL, or an Epson FX 850/1050 series printer.

The Digital emulation is the default mode when the printer power is turned on, but you can select Proprinter or Epson emulations at any time.

To change printer emulations:

1. If the printer is on–line, press the ON LINE switch to place it in the off–line state. “Off–line Emulation” appears on the message display.
2. Open the printer cover.
3. Press UP and DOWN simultaneously to unlock the ENTER switch. “Unlocked” appears briefly on the message display.
4. Press DOWN to enter the emulation menu.
   The current emulation displays. (Default is Digital emulation.)
5. Press NEXT (or PREV) until the desired emulation displays.
6. Press ENTER.
   The printer sets all configuration values associated with that emulation. The values are those previously saved when that emulation was selected. If no values were altered, the factory default values are loaded.
7. Press CLEAR to return to “Off–line Emulation.”
8. Press UP and DOWN simultaneously to lock the ENTER switch. “Locked” appears briefly on the message display.
9. Close the printer cover.
10. Press the ON LINE switch to place the printer on–line to the host computer.

Configuration Diagram

The Configuration Diagram is a series of block diagrams showing the configuration menu structure and the parameter options available in each menu. The Configuration Diagram begins on the next page.

How to Read the Configuration Diagram

Boxes on the diagram represent the message display. Messages that appear on the display are printed inside the boxes. The letters outside the boxes represent control panel switches. When a switch is pressed, an arrow points to the displayed result.

The symbols used in the Configuration Diagram are summarized in Figure 4–2.

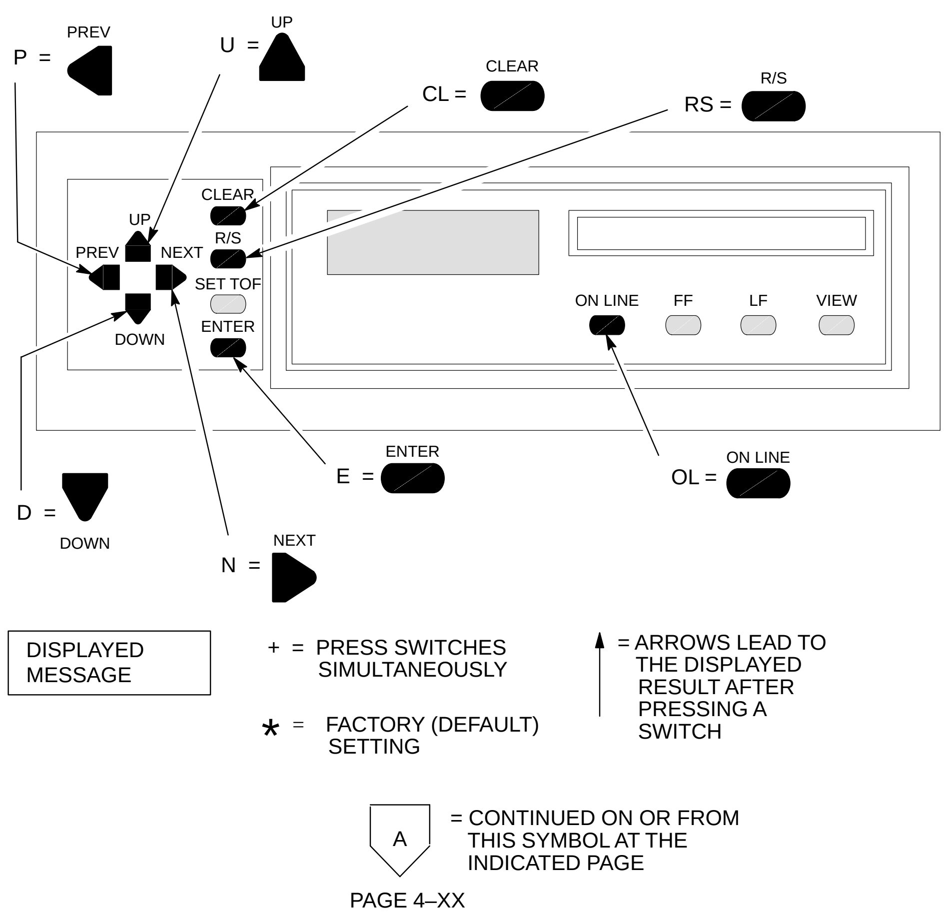
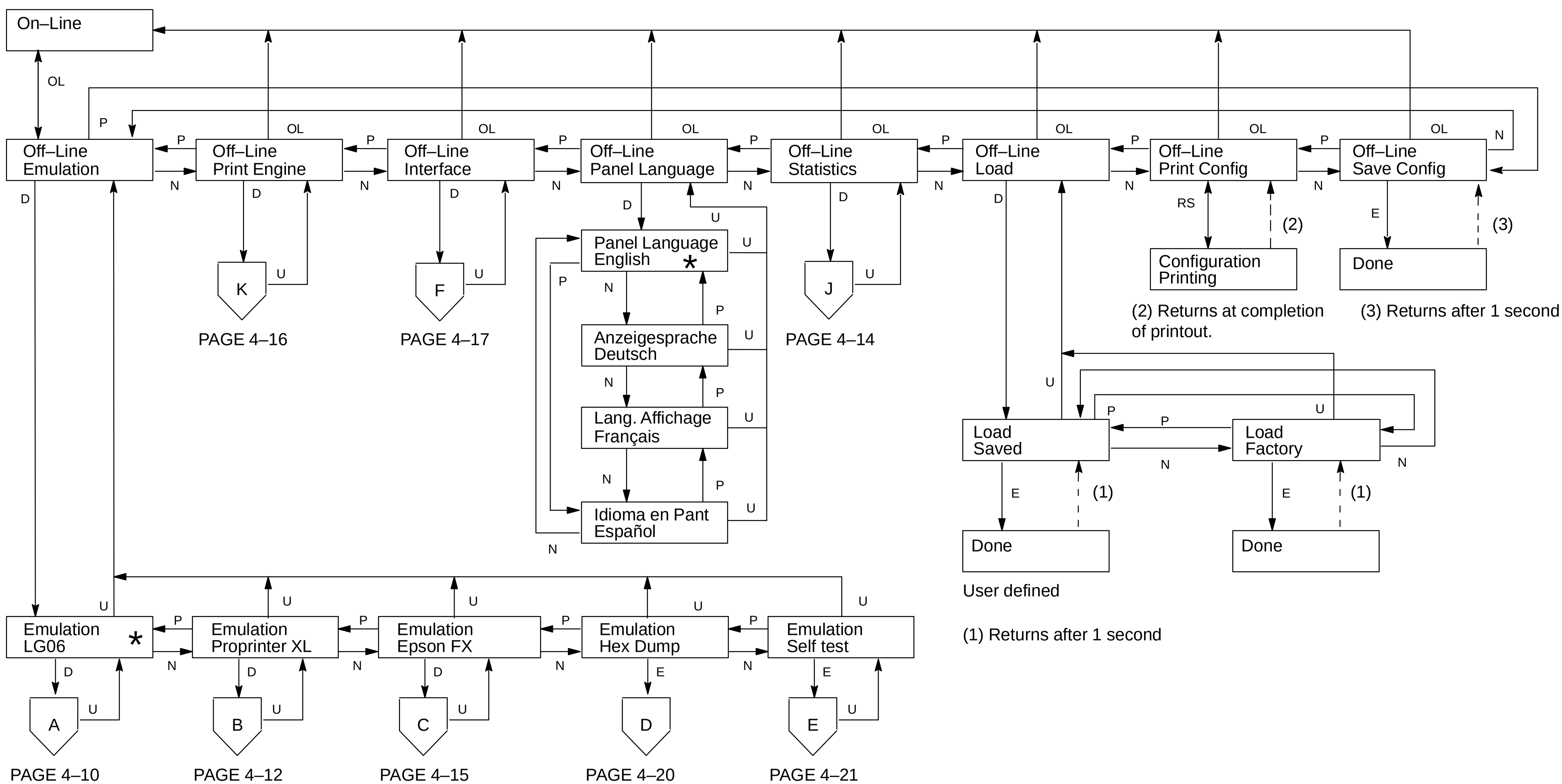
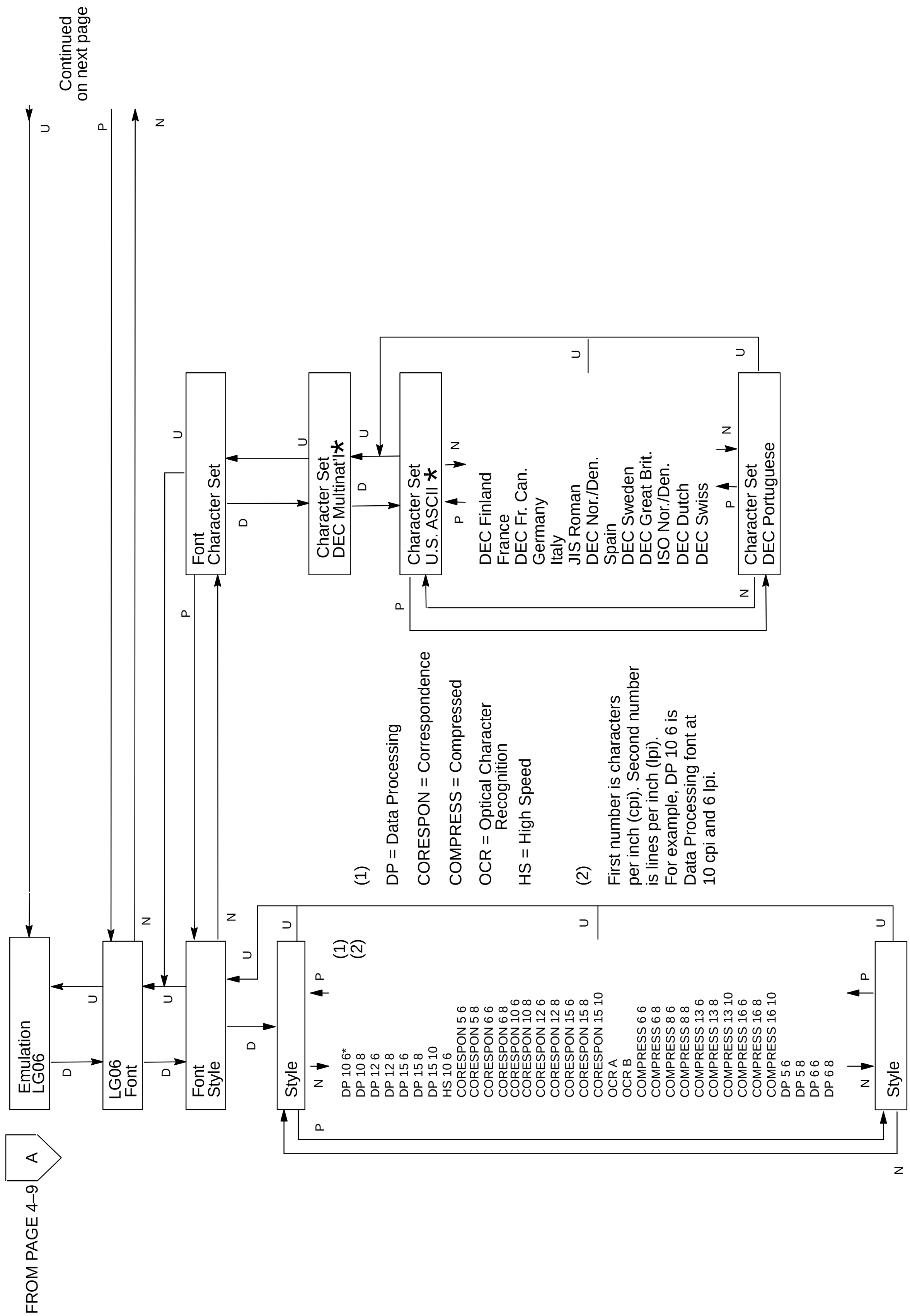


Figure 4–2. Configuration Diagram Symbol Key

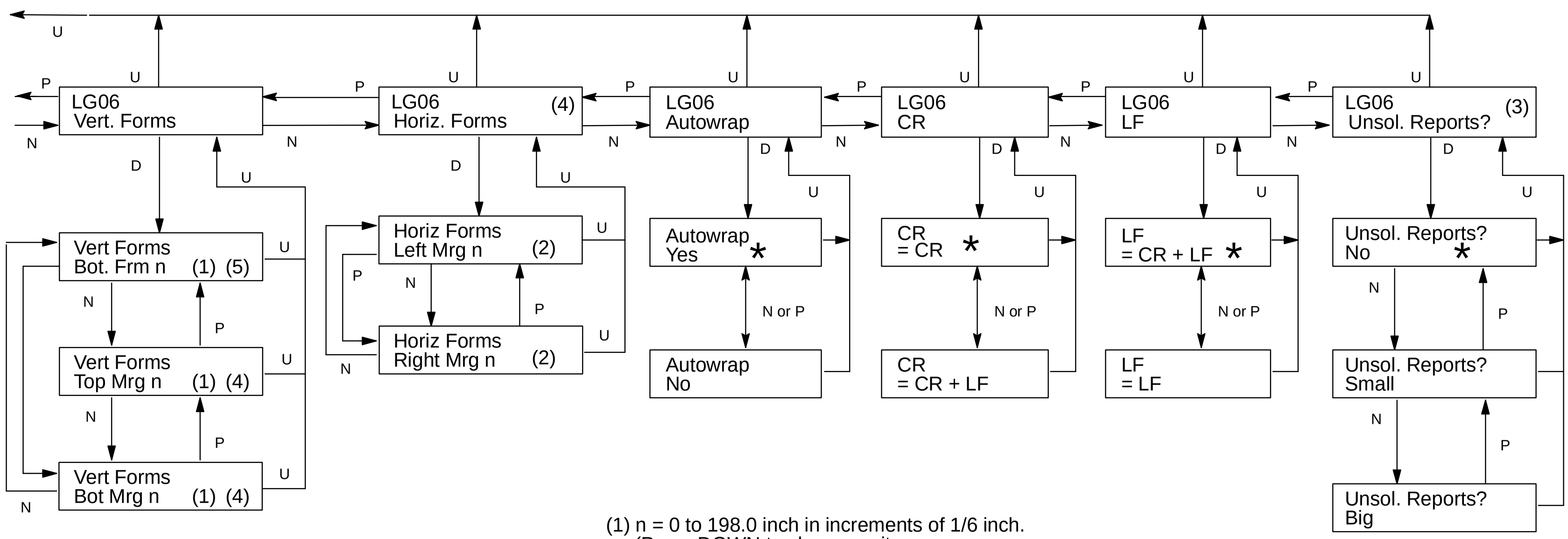
CONFIGURATION DIAGRAM

IMPORTANT: To make configuration changes, unlock the ENTER switch at “Off–Line Emulation” by simultaneously pressing UP and DOWN.




FROM PAGE 4–9
A
Emulation LG06
LG06 Font
Font Style
Font Character Set
Character Set DEC Multinat'l*
Character Set U.S. ASCII *
DEC Finland
France
DEC Fr. Can.
Germany
Italy
JIS Roman
DEC Nor./Den.
Spain
DEC Sweden
DEC Great Brit.
ISO Nor./Den.
DEC Dutch
DEC Swiss
Character Set DEC Portuguese
Style
(1)
(2)
DP 10 6*
DP 10 8
DP 12 6
DP 12 8
DP 15 6
DP 15 8
DP 15 10
HS 10 6
CORESPON 5 6
CORESPON 5 8
CORESPON 6 6
CORESPON 6 8
CORESPON 10 6
CORESPON 10 8
CORESPON 12 6
CORESPON 12 8
CORESPON 15 6
CORESPON 15 8
CORESPON 15 10
OCR A
OCR B
COMPRESS 6 6
COMPRESS 6 8
COMPRESS 8 6
COMPRESS 8 8
COMPRESS 13 6
COMPRESS 13 8
COMPRESS 13 10
COMPRESS 16 6
COMPRESS 16 8
COMPRESS 16 10
DP 5 6
DP 5 8
DP 6 6
DP 6 8
Style
(1)
DP = Data Processing
CORESPON = Correspondence
COMPRESS = Compressed
OCR = Optical Character Recognition
HS = High Speed
(2)
First number is characters per inch (cpi). Second number is lines per inch (lpi).
For example, DP 10 6 is Data Processing font at 10 cpi and 6 lpi.
Continued on next page
U
P
N
D

Continued from
previous page



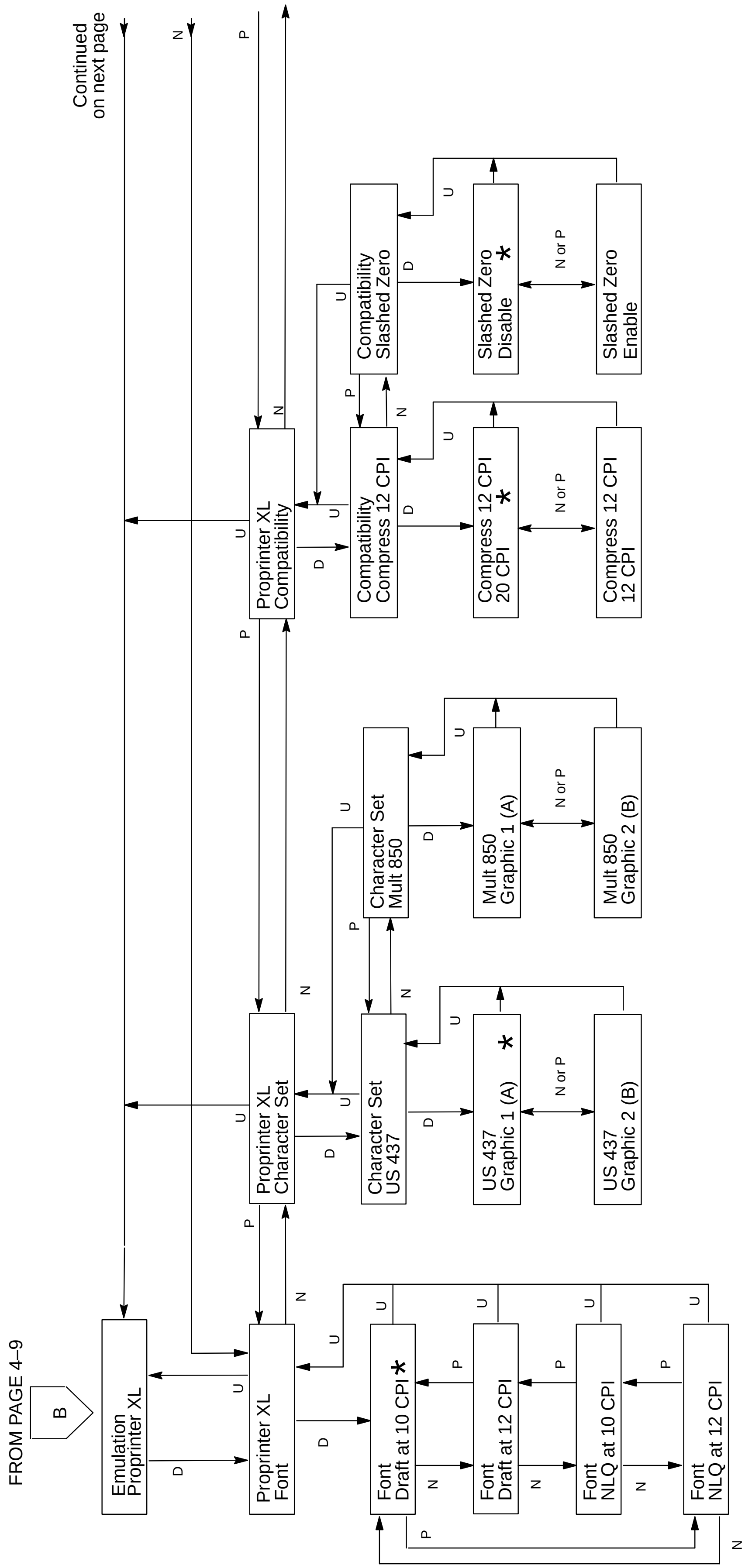
(1) n = 0 to 198.0 inch in increments of 1/6 inch.
(Press DOWN to change units:
NEXT increases, PREV decreases.)

(2) n = 0 to 13.6 inch in increments of 0.1 inch.
(Press DOWN to change units:
NEXT increases, PREV decreases.)

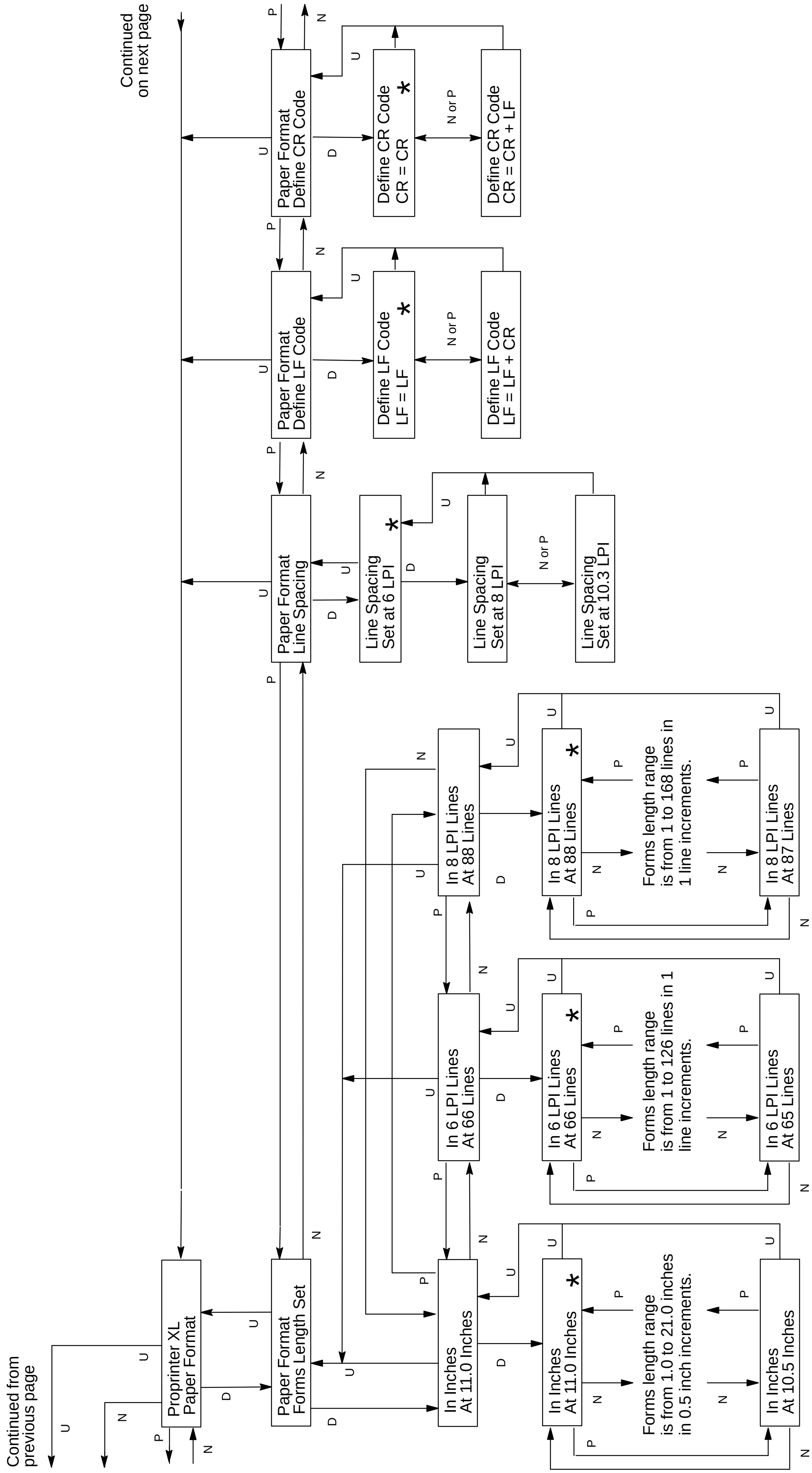
(3) Status reports are only sent when
the RS–232 interface is selected.

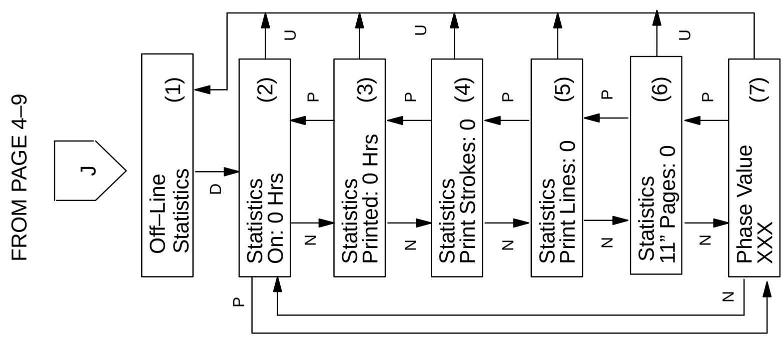
(4) Margins will automatically adjust
so that left/right and top/bottom margins
cannot cross one another.

(5) Setting the Bot Frm n automatically
sets the top margin to zero and the
bottom margin to n. Setting Bot Mrg n
does not affect the top margin.



FROM PAGE 4–9
B
Continued on next page
Emulation Proprinter XL
Proprinter XL Font
Font Draft at 10 CPI *
Font Draft at 12 CPI
Font NLQ at 10 CPI
Font NLQ at 12 CPI
Proprinter XL Character Set
Character Set US 437
US 437 Graphic 1 (A) *
US 437 Graphic 2 (B)
Character Set Mult 850
Mult 850 Graphic 1 (A)
Mult 850 Graphic 2 (B)
Proprinter XL Compatibility
Compatibility Compress 12 CPI
Compress 12 CPI 20 CPI *
Compress 12 CPI 12 CPI
Compatibility Slashed Zero
Slashed Zero Disable *
Slashed Zero Enable
N or P
U
D
N
P


Continued from previous page
Proprinter XL Paper Format
Paper Format Forms Length Set
In Inches At 11.0 Inches
In 6 LPI Lines At 66 Lines
In 8 LPI Lines At 88 Lines
In Inches At 11.0 Inches
Forms length range is from 1.0 to 21.0 inches in 0.5 inch increments.
In Inches At 10.5 Inches
In 6 LPI Lines At 66 Lines
Forms length range is from 1 to 126 lines in 1 line increments.
In 6 LPI Lines At 65 Lines
In 8 LPI Lines At 88 Lines
Forms length range is from 1 to 168 lines in 1 line increments.
In 8 LPI Lines At 87 Lines
Paper Format Line Spacing
Line Spacing Set at 6 LPI
Line Spacing Set at 8 LPI
Line Spacing Set at 10.3 LPI
Paper Format Define LF Code
Define LF Code LF = LF
Define LF Code LF = LF + CR
Paper Format Define CR Code
Define CR Code CR = CR
Define CR Code CR = CR + LF
N or P
Continued on next page



(1) All set to zero after factory burn–in.

(2) 0 to 30,000

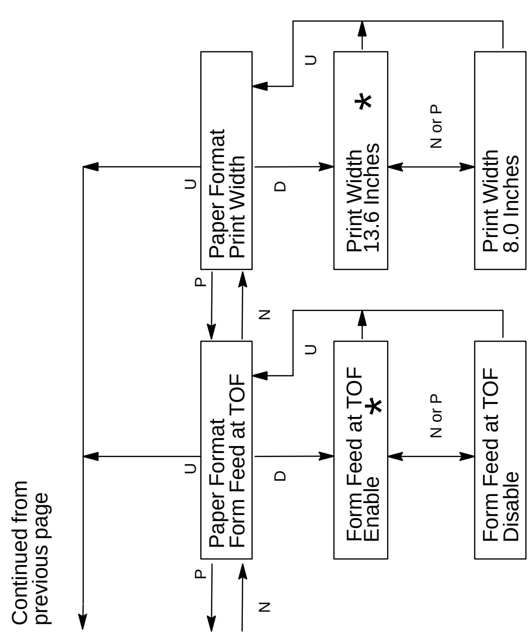
(3) 0 to 30,000

(4) 0 to 4,000,000,000

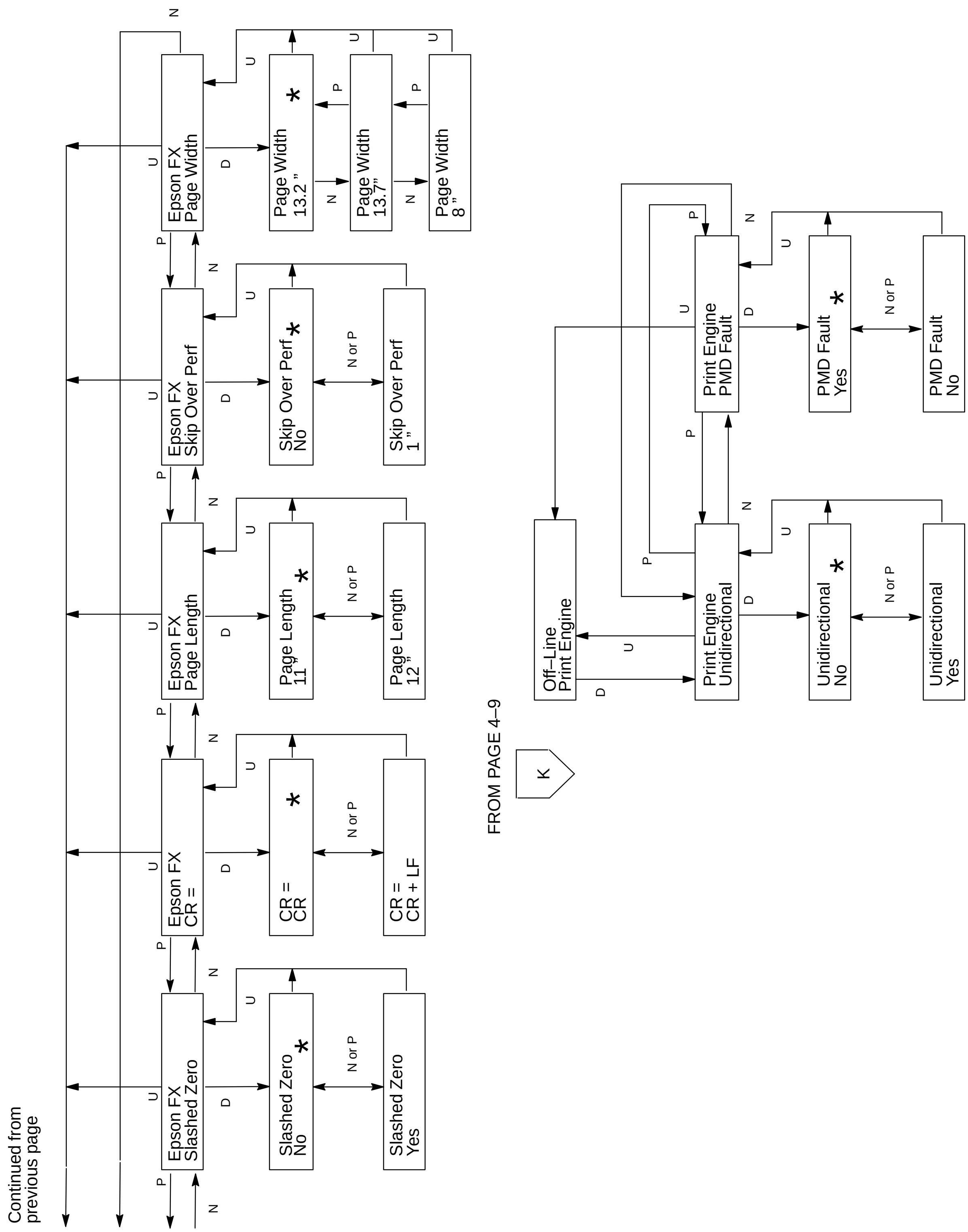
(5) 0 to 4,000,000,000

(6) 0 to 4,000,000,000; total inches of paper movement /11

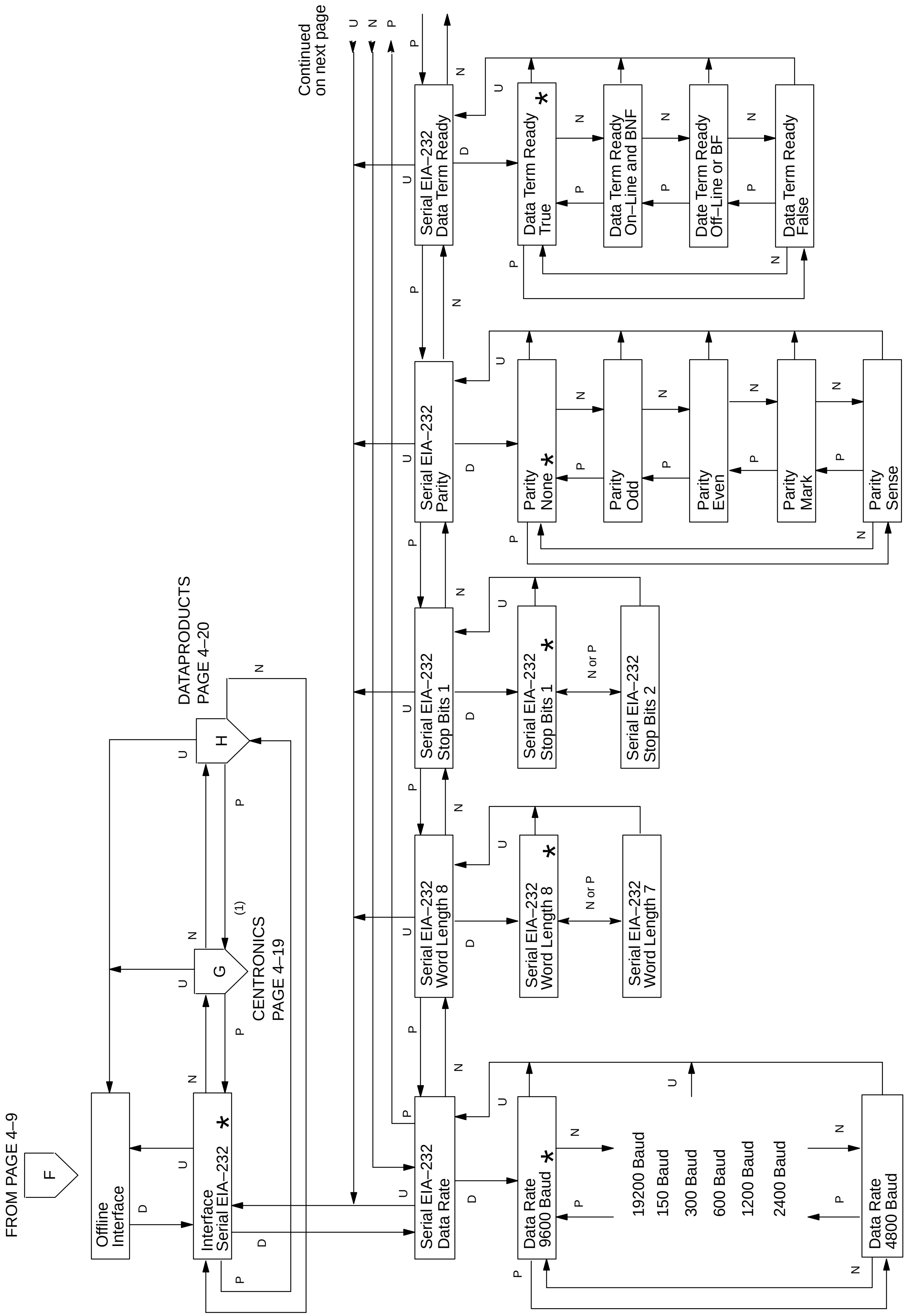
(7) Phase Value range is 0 to 315.



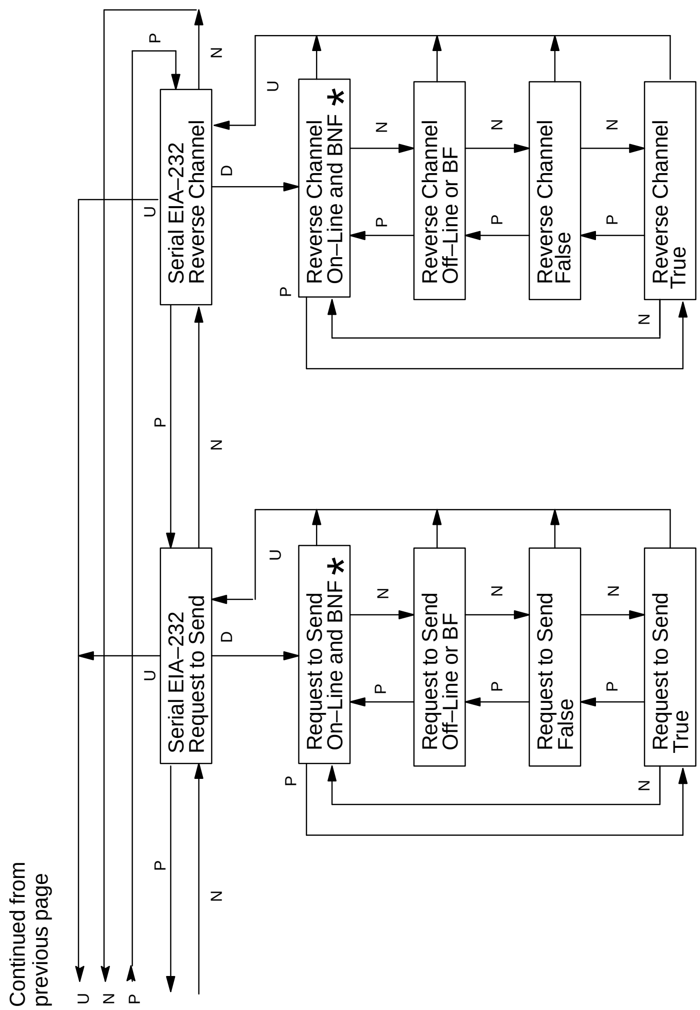

FROM PAGE 4–9
C
Emulation
Epson FX
Epson FX
Font
Font
HS Draft 10
Font
HS Draft 12
Font
HS Draft 15
Font
Draft 10
Font
Draft 12
Font
Draft 15
Font
NLQ 10
Font
NLQ 12
Font
NLQ 15
Epson FX
Condensed
Condensed
No
Condensed
Yes
Epson FX
Draft Speed
Draft Speed
High
Draft Speed
Low
Epson FX
Character Set
Character Set
Epson
Character Set
IBM Graphics
Epson FX
International Set
International Set
USA
France
Germany
UK
Denmark I
Sweden
Italy
Spain I
Japan
Norway
Denmark II
Spain II
International Set
Latin Am
Continued
on next page

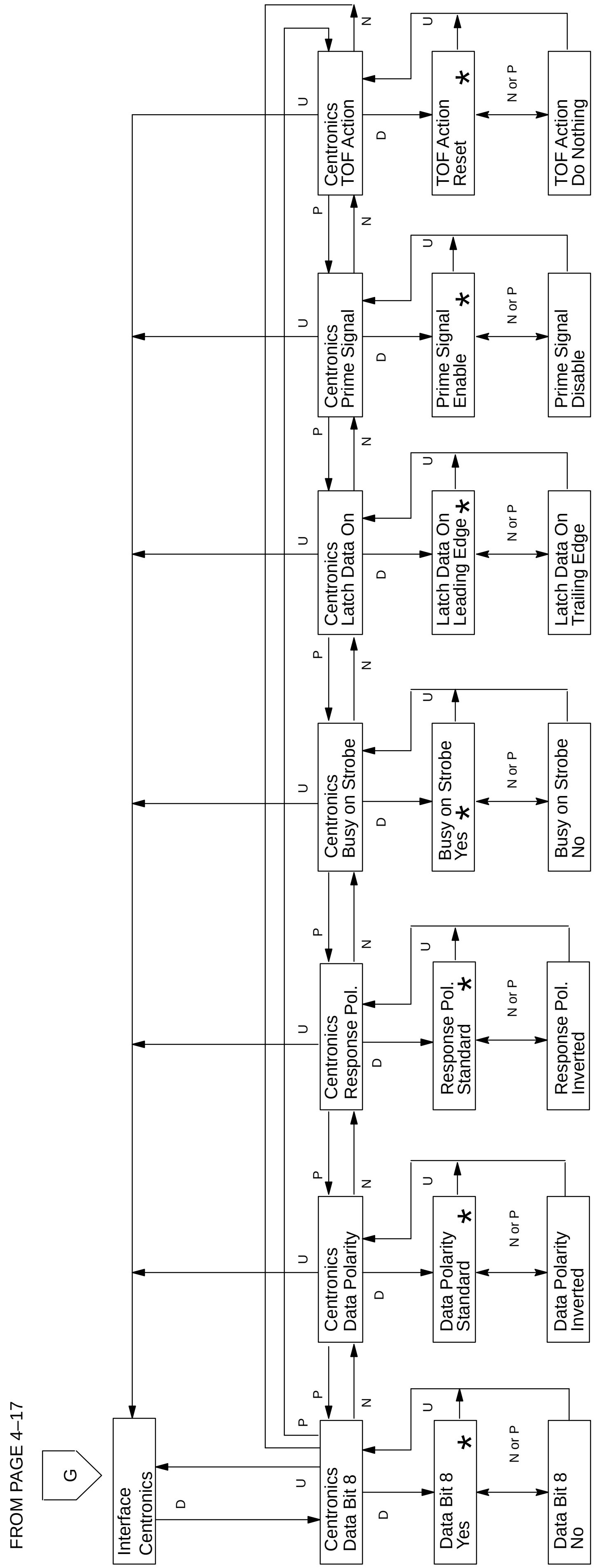


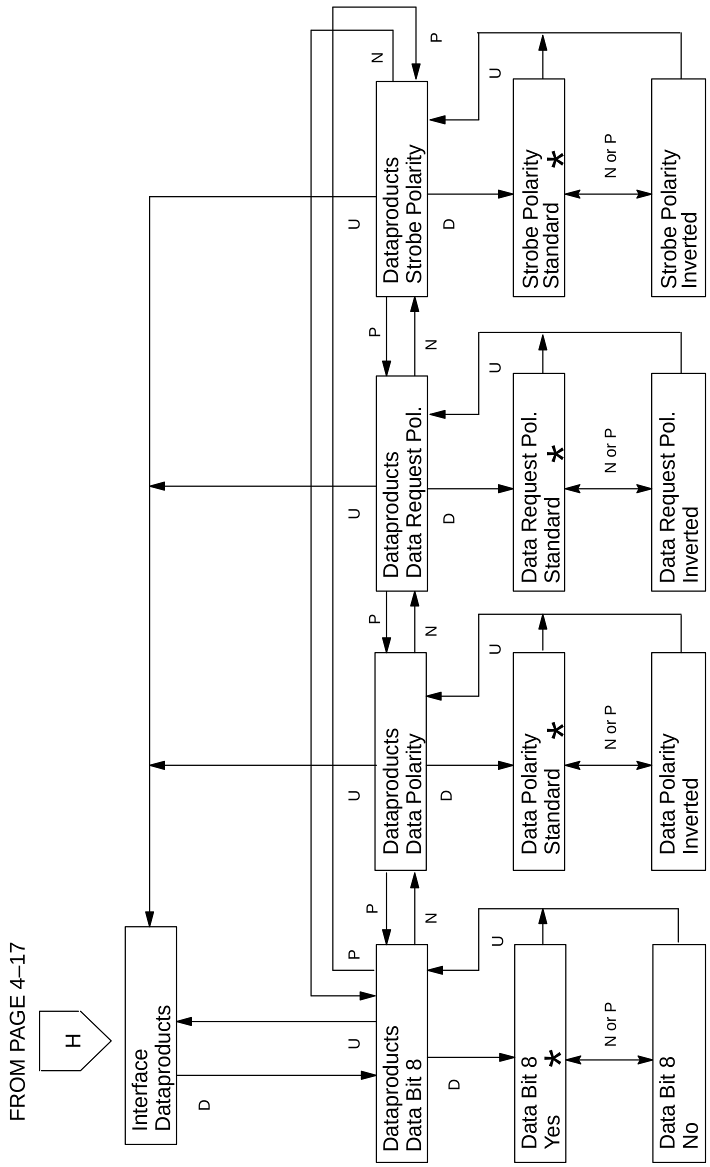
Continued from previous page
Epson FX Slashed Zero
Slashed Zero No *
Slashed Zero Yes
Epson FX CR =
CR = CR *
CR = CR + LF
Epson FX Page Length
Page Length 11" *
Page Length 12"
Epson FX Skip Over Perf
Skip Over Perf No *
Skip Over Perf 1"
Epson FX Page Width
Page Width 13.2" *
Page Width 13.7"
Page Width 8"
N or P
FROM PAGE 4–9
K
Off–Line Print Engine
Print Engine Unidirectional
Unidirectional No *
Unidirectional Yes
Print Engine PMD Fault
PMD Fault Yes *
PMD Fault No

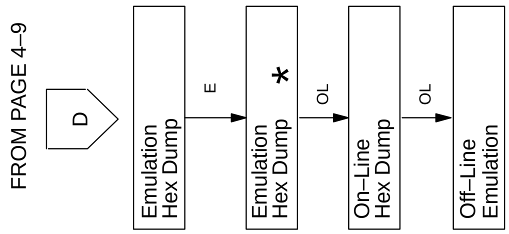


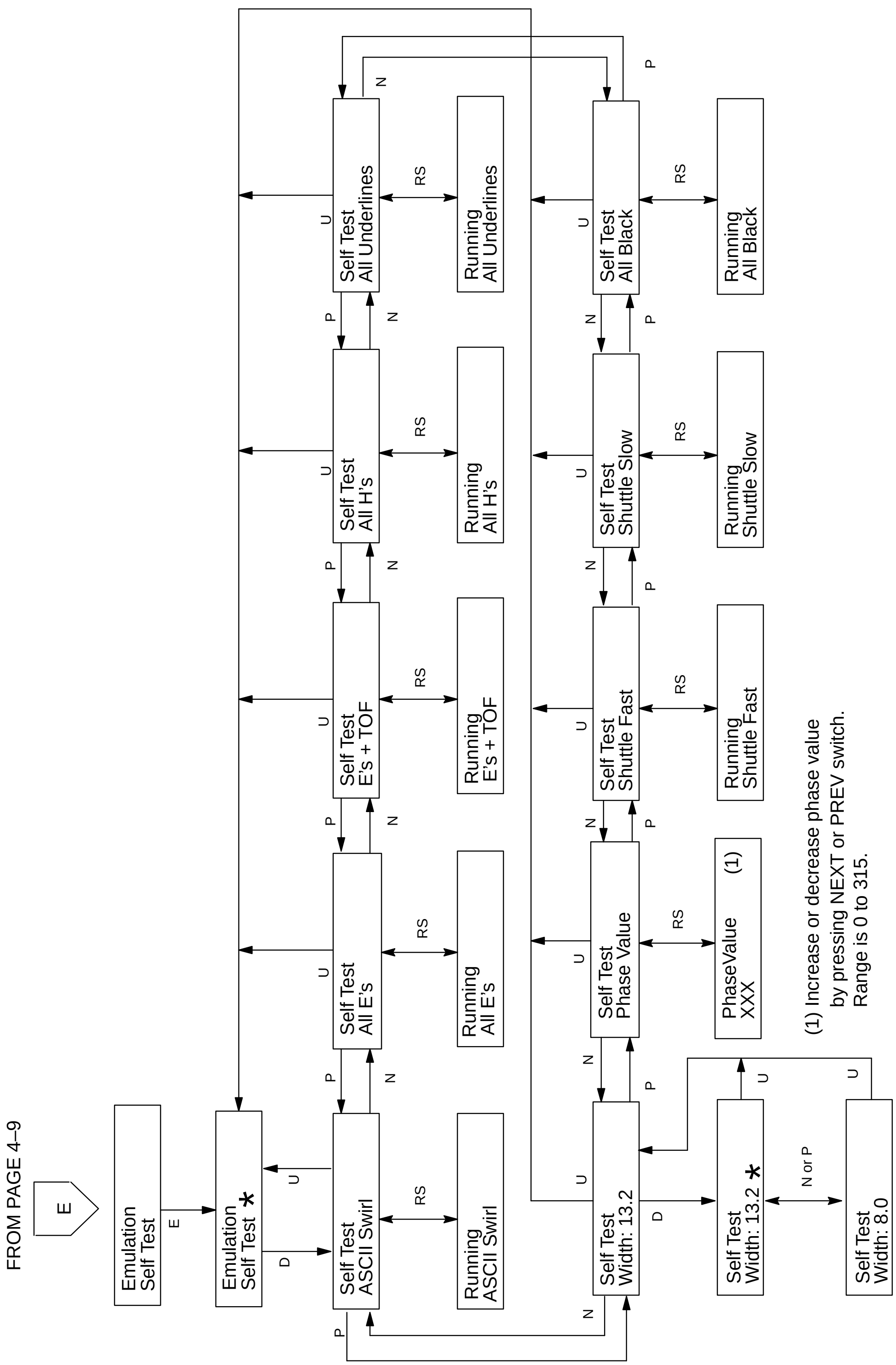
FROM PAGE 4–9
F
Offline Interface
Interface Serial EIA–232 *
G
CENTRONICS PAGE 4–19
(1)
H
DATAPRODUCTS PAGE 4–20
Serial EIA–232 Data Rate
Data Rate 9600 Baud *
19200 Baud
150 Baud
300 Baud
600 Baud
1200 Baud
2400 Baud
Data Rate 4800 Baud
Serial EIA–232 Word Length 8
Serial EIA–232 Word Length 8 *
N or P
Serial EIA–232 Word Length 7
Serial EIA–232 Stop Bits 1
Serial EIA–232 Stop Bits 1 *
N or P
Serial EIA–232 Stop Bits 2
Serial EIA–232 Parity
Parity None *
Parity Odd
Parity Even
Parity Mark
Parity Sense
Serial EIA–232 Data Term Ready
Data Term Ready True *
Data Term Ready On–Line and BNF
Date Term Ready Off–Line or BF
Data Term Ready False
Continued on next page
U N P


Continued from previous page
Serial EIA–232 Reverse Channel
Reverse Channel On–Line and BNF *
Reverse Channel Off–Line or BF
Reverse Channel False
Reverse Channel True
Serial EIA–232 Request to Send
Request to Send On–Line and BNF *
Request to Send Off–Line or BF
Request to Send False
Request to Send True


FROM PAGE 4–17
G
Interface
Centronics
Centronics
Data Bit 8
Data Bit 8
Yes
Data Bit 8
No
Centronics
Data Polarity
Data Polarity
Standard
Data Polarity
Inverted
Centronics
Response Pol.
Response Pol.
Standard
Response Pol.
Inverted
Centronics
Busy on Strobe
Busy on Strobe
Yes
Busy on Strobe
No
Centronics
Latch Data On
Latch Data On
Leading Edge
Latch Data On
Trailing Edge
Centronics
Prime Signal
Prime Signal
Enable
Prime Signal
Disable
Centronics
TOF Action
TOF Action
Reset
TOF Action
Do Nothing
N or P
U
D
P
N
*


FROM PAGE 4–17
H
Interface
Dataproducts
Dataproducts
Data Bit 8
Data Bit 8
Yes *
Data Bit 8
No
Dataproducts
Data Polarity
Data Polarity
Standard *
Data Polarity
Inverted
Dataproducts
Data Request Pol.
Data Request Pol.
Standard *
Data Request Pol.
Inverted
Dataproducts
Strobe Polarity
Strobe Polarity
Standard *
Strobe Polarity
Inverted
D
U
P
N
N or P


FROM PAGE 4–9
D
Emulation
Hex Dump
E
Emulation
Hex Dump *
OL
On–Line
Hex Dump
OL
Off–Line
Emulation



FROM PAGE 4–9
E
Emulation Self Test
Emulation Self Test *
Self Test ASCII Swirl
Running ASCII Swirl
Self Test All E's
Running All E's
Self Test E's + TOF
Running E's + TOF
Self Test All H's
Running All H's
Self Test All Underlines
Running All Underlines
Self Test Width: 13.2
Self Test Phase Value
PhaseValue XXX (1)
Self Test Shuttle Fast
Running Shuttle Fast
Self Test Shuttle Slow
Running Shuttle Slow
Self Test All Black
Running All Black
Self Test Width: 13.2 *
Self Test Width: 8.0
N or P
RS
U
D
N
P
(1) Increase or decrease phase value by pressing NEXT or PREV switch. Range is 0 to 315.

5 Interfaces

Chapter Contents

Printer Interfaces

The printer interface is the point where the data line from the host computer plugs into the printer. The interface processes all communications signals and data to and from the host computer. It consists of a printed circuit board assembly (PCBA) and a connector for the data cable from the host computer.

IMPORTANT

The LG06 and LG12 are equipped with two parallel interfaces and one serial interface. Only one interface can be used at a time and is selected via control panel configuration. (Refer to Chapter 4, “Printer Configuration.”) Only one data input cable can be plugged in at any time.

Printer set–up characteristics for using the printer with the VMS operating system are in Appendix D.

Dataproducts Parallel Interface

The Dataproducts parallel interface allows the printer to operate with a 50–pin AMP Ampilite HDH–20 male data cable connector. The length of the data cable from the host computer to the printer must be no longer than 30 feet.

Dataproducts Interface Signals

Dataproducts–compatible interface signals between the computer and the printer are defined as follows:

Ready Line – A high true signal from the printer indicating ac power and dc voltages are present, paper is loaded properly, and the printer is not in a fault condition.

On Line – A high true signal from the printer indicating the Ready Line is true and the ON LINE switch on the control panel has been activated. The printer is ready to accept data from the host.

Demand – A high true signal from the printer to indicate that the printer is ready to accept character data from the host. The signal changes to false shortly after the leading edge of the data strobe signal.

Data Strobe – A high true pulse from the host to indicate that data is ready. The data strobe remains high until the Data Request line goes false. The active edge of the strobe signal can be configured as leading (default) or trailing.

Data Lines – Eight standard or inverted levels from the host that specify character data, plot data, or a control code. Sensing Data Line 8 is controlled by printer configuration.

Interface Verify – Two pins on the interface connector are jumpered to allow the user to verify proper installation of the interface connector.

Table 5–1 lists the Dataproducts interface connector pin assignments.

Table 5–1. Connector Pin Assignments for Dataproducts Interface with AMP Connector

OUTPUT Signal	OUTPUT Pin	INPUT Signal	INPUT Pin
Ready	22	Data Line 1	19
Return	6	Return	3
On Line	21	Data Line 2	20
Return	5	Return	4
Demand	23	Data Line 3	1
Return	7	Return	2
Interface	46	Data Line 4	41
Verify	45	Return	40
Paper Instr.	30	Data Line 5	34
Return	14	Return	18
		Data Line 6	43
		Return	42
		Data Line 7	36
		Return	35
		Data Line 8	28
		Return	44
		Data Strobe	38
		Return	37
Note: Pins not listed are not connected.			

Dataproducts Parallel Interface Configuration

The printer is configured at the factory to default settings, but you can also configure the printer with the operator control panel. (Refer to Chapter 4, *Printer Configuration*.) Verify or change the following parameters, displayed under the Interface Dataproducts menu, to meet your application requirements:

- Data Bit 8 (yes or no) Data Bit 8 comes through on the PI line because of the BC27A cable. Internal to the printer and selectable via the control panel, pin 30 of the Dataproducts interface is recognized as either Data Bit 8 or PI.
- Data Polarity (standard or inverted)

- Response Polarity (standard or inverted)
- Strobe Polarity (standard or inverted)
- Latch Data On Leading or Trailing Edge of Strobe

Refer to the Configuration Diagram in Chapter 4, *Printer Configuration*, for information on selecting parameter values.

Some application programs may require a unique configuration. If the printer is not working properly in the configuration you selected, contact your authorized service representative.

Centronics Parallel Interface

The Centronics parallel interface enables the printer to operate with controllers designed for buffered Centronics printers. Note that the length of the data cable from the host computer to the printer must not exceed 40 feet.

Centronics Interface Signals

Centronics interface signals between the computer and the printer are defined as follows:

PE (Paper End) – A high true level from the printer that indicates it has run out of paper.

SLCT (Select) – A high true level from the printer that indicates the printer is ready for data transfer and the ON LINE switch has been activated.

Busy – A high true level from the printer to indicate the printer cannot receive data.

ACKNLG (Acknowledge) – A low true pulse from the printer indicating the character or function code has been received and the printer is ready for the next data transfer.

Data Strobe – A low true, 100 ns pulse from the host that clocks data into the printer.

Data Lines – Eight standard or inverted levels from the host that specify a character or function code. Sensing Data Line 8 is controlled by printer configuration.

Table 5–2 lists the Centronics interface connector pin assignments.

Table 5–2. Centronics Interface Connector Pin Assignments

INPUT SIGNALS Signal	Pin	OUTPUT SIGNALS Signal	Pin
Data Line 1	2	ACKNLG	10
Return	20	Return	33
Data Line 2	3	Fault/ SLCT	32, 13
Return	21	PE	12
Data Line 3	4	Busy	11
Return	22	Return	28
Data Line 4	5	Chassis Ground	17
Return	23	Prime	31
Data Line 5	6	Return	30
Return	24	Spare	14, 34 35, 36
Data Line 6	7	Prime	31
Return	25	Return	30
Data Line 7	8	Logical CND	16
Return	26		
Data Line 8	9		
Return	27		
Paper Instruction	15		
Return	29		
Data Strobe	1		
Return	19		

Centronics Parallel Interface Configuration

The printer is configured at the factory to default settings, but you can also configure the printer with the operator control panel. (Refer to Chapter 4, *Printer Configuration*.) Verify or change the following parameters, displayed under the Interface Centronics menu, to meet your application requirements:

- Data Bit 8 (yes or no)
- Data Polarity (standard or inverted)
- Response Polarity (standard or inverted)
- Busy on Strobe (yes or no)

- Strobe Polarity (standard or inverted)
- Latch Data On Leading or Trailing Edge of Strobe
- Prime Signal (enable or disable)
- TOF Action (reset or do nothing)

Refer to the Configuration Diagram in Chapter 4, “Printer Configuration,” for information on selecting parameter values.

Some application programs may require a unique configuration. If the printer is not working properly in the configuration you selected, contact your authorized service representative.

Terminating Resistors

For parallel interface configurations, the LG06 and LG12 printers are equipped with 470 ohm pull–up terminating resistors, located at 12C on the Common Controller Board (CCB) and 1K ohm pull–down terminating resistors at location 12D. These are suitable for most applications.

If the standard terminating resistor pack is not compatible with the particular interface driver requirements of the host computer, other values of pull–up and pull–down resistors may be required. Digital provides the 220 ohm pull–up and 330 ohm pull–down alternate terminating resistors. If the 220 ohm pull–up resistor is installed, the 330 ohm pull–down resistor must also be installed. Possible terminating resistor combinations are shown below.

Pull–up at 12C	470 ohm	220 ohm	1K ohm
Pull–down at 12D	1K ohm	330 ohm	none

Removing and installing terminating resistors requires removal and modification of the CCB. This procedure is not recommended for end users; if required, it should be performed by a trained field service technician.

EIA–232D Serial Interface

The EIA–232D serial interface enables the printer to operate with bit serial devices compatible with an EIA–232D controller. The interface circuit characteristics are compatible with the Electronic Industry Association Specification EIA–232D. Input serial data transfer rates of 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 baud are selectable at the control panel.

The input format consists of a single start bit, 7 or 8 data bits, and one or two stop bits. The number of data bits is determined by printer configuration. The data bits are interpreted with the least significant bit first. Parity checking is determined by printer configuration options selected from the control panel.

The printer interface uses a first–in/first–out buffer. The asynchronous interface accepts data as they are provided by the host. The length of the data cable from the host computer to the printer must be no longer than 50 feet.

EIA–232D Interface Signals

The EIA–232D connector mounted on the printer is a 25–pin DB–25S type. The mating connector is a DB–25P. Signal pin assignments are listed in Table 5–3. EIA–232D compatible serial interface signals are defined as follows:

Received Data – Serial data stream to the printer.

Transmitted Data – Serial data stream from the printer for transmitting status and control information to the host. Subject to protocol selection.

Request To Send (RTS) – Control signal from the printer. Subject to configuration.

Clear To Send (CTS) – Status signal to the printer indicating the host is ready to receive data/status signals from the printer.

Data Set Ready (DSR) – Status signal to the printer indicating the host is in a ready condition.

Carrier Detect (CD) – Status signal to the printer. The ON condition is required for the printer to receive data. Available as a configuration setup option.

Reverse Channel Send – Control signal from the printer. Subject to configuration.

Data Terminal Ready (DTR) – Control signal from the printer. Subject to configuration.

Table 5–3. Serial Interface Pin Assignments

Input Signals: Signal	Pin	Output Signals: Signal	Pin
Received Data	3	Transmitted Data	2
Clear To Send	5	Request To Send	4
Data Set Ready	6	Reverse Channel Send	14
Carrier Detect	8	Data Terminal Ready	20
		Chassis Ground	1
		Signal Ground	7

EIA–232D Serial Interface Protocol

You can select the following serial interface protocol parameters from the control panel to meet host interface requirements:

X–ON/X–OFF – The printer transmits an X–ON character (hex 11) when it goes on–line or when the buffer is almost empty. The printer transmits an X–OFF character (hex 13) when it goes off–line or when the buffer is almost full.

EIA–232D Serial Interface Configuration

Verify or change the following serial interface options at the control panel to meet your application requirements. (Refer to Chapter 4, *Printer Configuration.*)

- Data Rate (Baud rate selected from the control panel)
- Data Word Length (7 or 8 bits)
- Stop Bits (1 or 2 bits)
- Parity (none, odd, even, mark, or sense)
- Data Terminal Ready response logic (true, false, on–line buffer not full, off–line buffer full)
- Request to Send response logic (true, false, on–line and buffer not full, off–line or buffer full)
- Reverse Channel response logic (true, false, on–line buffer not full, off–line buffer full)

6 Routine Service and Diagnostics

Chapter Contents

Routine Service

Periodic cleaning is the only maintenance your printer requires. If print quality deteriorates even after cleaning, contact your authorized service representative.

Cleaning Requirements

Periodic cleaning ensures efficient operation and clear print quality. Clean the printer every six months or after every 1000 hours of operation, whichever occurs first.

If the printer is located in a dusty area or is used for heavy duty printing, clean it more often.

WARNING

Disconnect the power source before cleaning the printer.

ACHTUNG

Vor dem Säubern des Druckers ist die Netzverbindung zu unterbrechen.

ADVERTENCIA

Desconecte la fuente de poder antes de limpiar la impresora.

AVERTISSEMENT

Débranchez l'alimentation avant de nettoyer l'imprimante.

Exterior Cleaning

Clean the outside of the cabinet with a soft, lint–free cloth and mild detergent soap. (Dishwashing liquid works well.) Do not use abrasive powders or chemical solvents. Clean the windows with plain water or mild window cleaner. Always apply the cleaning solution to the cloth; never pour cleaning solution directly onto the printer.

Interior Cleaning

Over time, particles of paper and ink accumulate inside impact printers. This is normal. Paper dust and ink build–up must be periodically removed to avoid degraded print quality. Most paper dust accumulates around the ends of the platen and ribbon path.

To clean the interior of the printer, perform the following steps and refer to Figure 6–1.

1. Turn off the printer power and unplug the printer power cord.
2. Unload paper (page 3–14).
3. Fully raise the forms thickness lever.
4. Unlatch both ribbon spools and carefully lift them off the hubs. Raise the ribbon out of the ribbon path.

CAUTION

Vacuum carefully around the hammer bank and surrounding area to avoid damage.

VORSICHT

Sehr vorsichtig um die Hammer Bank und Umgebung herum staubsaugen, um Schaden zu vermeiden.

PRECAUCION

Aspire cuidadosamente alrededor del banco de martillo y el área alrededor del mismo para evitar averías.

ATTENTION

Aspirez soigneusement autour du marteau et de la zone environnante pour éviter tout dommage.

5. Using a soft–bristled brush and vacuum cleaner, brush and vacuum paper and dust particles from the paper path, ribbon guides, ribbon path, and base pan.
6. Check the ribbon mask and hammer bank cover for bits of torn paper or ribbon lint. Check the holes in the ribbon mask surrounding each hammer tip. Gently remove paper or lint particles with a wooden stick or pair of tweezers. (Do not pry or apply force to the hammer tips.)
7. Using a soft cloth lightly moistened with anhydrous alcohol, remove dust and ink from the platen. (The platen is the thick silver bar behind the hammer bank cover that rotates when the forms thickness lever is rotated.)
8. Brush and vacuum up dust or residue that has accumulated inside the lower cabinet.
9. Wipe the lower cabinet interior with a clean, lint–free cloth dampened (not wet) with water and mild detergent, or spray the surfaces lightly with window cleaning solution. Dry the lower cabinet interior by wiping it with a clean, lint–free cloth.
10. Install the ribbon (page 3–20).

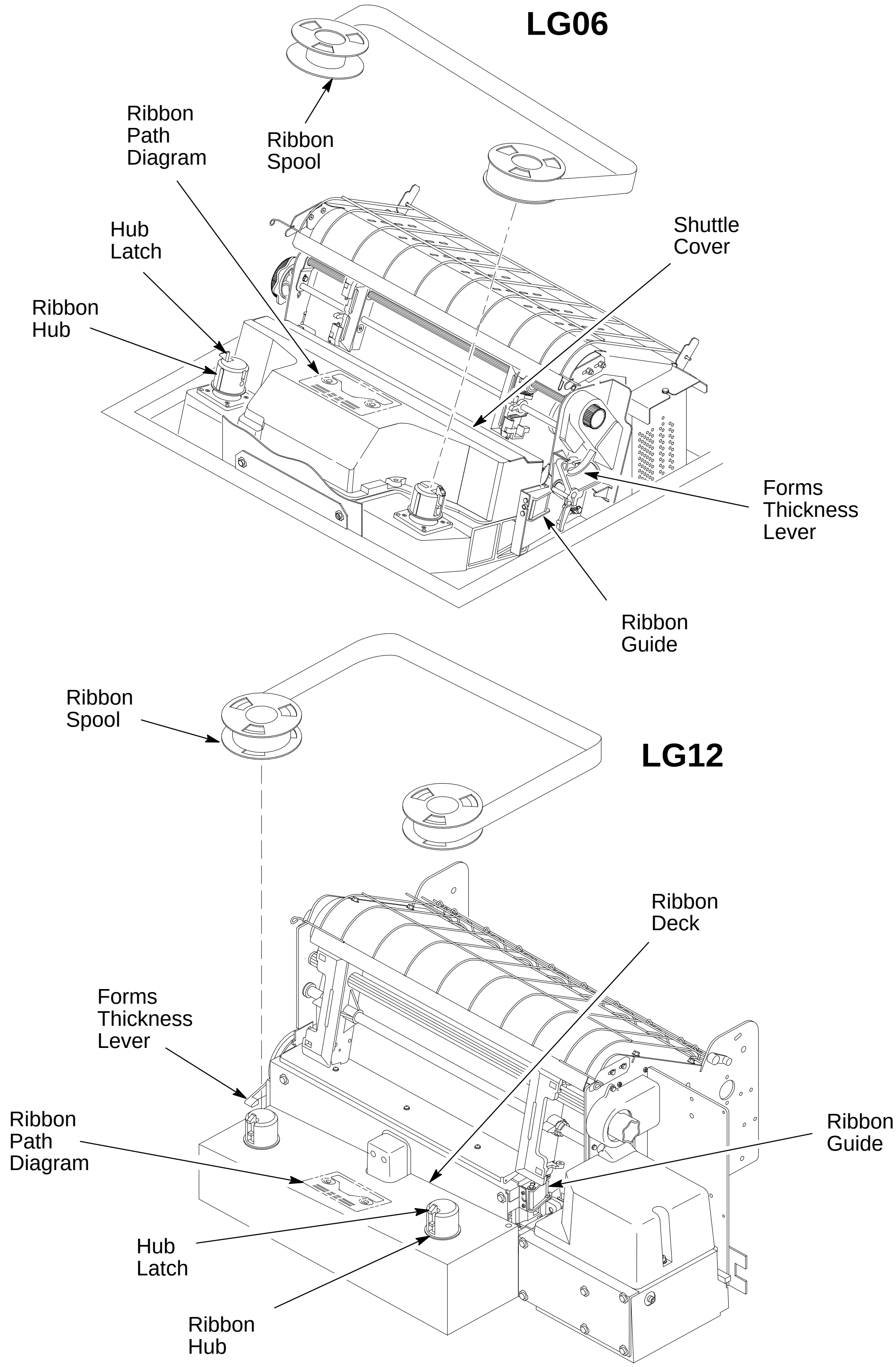


Figure 6–1. Interior Cleaning

Printer Self–Tests

Run the printer self–tests to check the print quality and operation of your printer. The self–tests include:

- **ASCII Swirl** – A sliding alphanumeric pattern that identifies missing or malformed characters, improper vertical alignment, or vertical compression.
- **All Es** – A pattern of all uppercase letter Es that identifies missing characters, misplaced dots, smeared characters, improper phasing problems, or light/dark character variations.
- **Es plus TOF** – A pattern of all Es followed by a form feed to the next page top of form, that identifies paper motion or feeding problems.
- **All Hs** – A pattern of all uppercase letter Hs used to detect missing characters, misplaced dots, smeared characters, or improper phasing.
- **All Underlined** – An underline pattern useful for identifying hammer bank misalignment.
- **All Black** – A condition where all dot positions are printed, creating a solid black band.
- **Shuttle Slow** – Verifies proper operation by exercising shuttle and ribbon motion at low speed.
- **Shuttle Fast** – Verifies proper operation by exercising shuttle and ribbon motion at high speed.
- **Phasing** – A timing parameter used by service personnel to adjust vertical alignment of dots in character printing.
- **Test Width** – Permits you to run tests at all available print widths.

NOTE: Printer self–tests are also charted on the Configuration Diagram in Chapter 4, *Printer Configuration*.

Running the Self Tests

To run the self–tests:

1. On the control panel, press the ON LINE switch to place the printer off–line. “Off–line/Emulation” displays.

2. Raise the printer cover.

3. On the control panel, press the DOWN switch. “Emulation/LG06” displays.

4. Press the NEXT switch until “Emulation/Self Test” displays.

5. Press UP and DOWN simultaneously to unlock the panel. “Unlocked” briefly displays. (If “Locked” displays, simply press UP and DOWN again.)

6. Press ENTER. This selects the self–test emulation and an asterisk (*) appears after the display message. (“Emulation/Self Test * ” displays.)

7. Decide which of the tests listed on page 6–6you want to run. Press DOWN, then press NEXT or PREV until that test displays.

8. Press R/S to start the self–test. Press R/S again to stop the test.

9. Examine the print quality. Characters should be horizontally and vertically aligned and solidly formed. If print quality problems exist, contact your authorized service representative.

10. Press UP for “Emulation/Self–test *”. Press NEXT until the desired emulation appears. (For example: “Emulation/LG06”)

11. Press ENTER to select the emulation. An asterisk (*) appears after the emulation. (For example: “Emulation/LG06 * ”)

12. Press UP and DOWN simultaneously to lock the panel. “Locked” briefly displays.

13. Press CLEAR. “Off–line/Emulation” displays.

14. Close the printer cover.

15. Press the ON LINE switch to place the printer on–line.

Hex Code Printout

A hex code printout (or hex dump) is basically a translation of all host interface data to its hexadecimal equivalent. A hex dump lists all ASCII character data received from the host computer with their corresponding two–digit hexadecimal codes. Hex dumps are used to troubleshoot printer data reception problems.

Printable characters print as the assigned symbol; nonprintable characters are indicated by a period (.). To make a hex printout:

1. Press ON LINE to place the printer off–line. “Off–line/Emulation” displays.
2. Raise the printer cover.
3. Simultaneously press the UP and DOWN switches to unlock the ENTER switch. “Unlocked” displays briefly. (If “Locked” displays, simply press UP and DOWN again.)
4. Press DOWN. “Emulation/LG06” displays.
5. Press NEXT until “Emulation/Hex Dump” displays.
6. Press ENTER. This selects the hex dump emulation and an asterisk (*) appears after the display message. (“Emulation/Hex Dump * ” displays.)
7. Press ON LINE. The display indicates that the printer is on–line in hex dump mode (“On–Line/Hex Dump”).
8. Send the data from the host — the data print in hex dump format. (Any data remaining in the buffer print before the hex code printout starts.)
9. Press ON LINE again to stop the hex dump. The display reads “Off–line/Emulation”.
10. Press DOWN. “Emulation/Hex dump * ” displays. Press NEXT until the desired emulation appears. (For example: “Emulation/LG06”)
11. Press ENTER to select the desired emulation. An asterisk (*) appears after the display message. (For example: “Emulation/LG06 * ”)
12. Simultaneously press the UP and DOWN switches to lock the ENTER switch. “Locked” displays briefly.
13. Close the printer cover.
14. Press ON LINE to place the printer on–line.

Fault Messages

If a fault condition occurs in the printer, the status lamps on the message display flash on and off and the first line of the display indicates “Fault Condition.” The second line of the display indicates the specific fault. Fault messages are summarized in Table 6–1.

Displayed faults fall into one of two categories:

- Operator correctable.
- Field service required—indicated by an asterisk [*****] after the fault message.

After correcting a displayed fault, press the CLEAR switch to continue printing. If the fault message reappears, contact your authorized service representative.

Fault Messages Requiring Field Service Attention

An asterisk (*****) following a fault message means the attention of an authorized field service representative is required.

Before you call the service representative, do two things to try to clear the fault:

1. Set the printer power switch to off, wait fifteen seconds, then turn the printer on again. Run your print job again. If the message does not appear, it was a false indication and no further attention is required.

2. If the message reappears, press the CLEAR switch. If the message goes away, it was a false indication and no further attention is required. If the message reappears, call your authorized service representative.

Table 6–1 shows the fault messages and offers suggestions for corrections.

Table 6–1. Fault Messages

Message Displayed	Operator Correctable?	Explanation	Solution
48 Volt Failed *	No	Internal power failure.	Contact your authorized service representative.
Dynamic RAM Fault *	No	RAM failure.	Contact your authorized service representative.
Ham. Bank Hot *	No	One or more hammer coils are overheating.	Stop printing. Allow printer to cool. If fault recurs, contact your authorized service representative.
Ham. Coil Open *	No	Electrical malfunction of one or more hammer coils.	Contact your authorized service representative.
Ham. Coil Short *	No	Electrical malfunction of one or more hammer coils.	Contact your authorized service representative.
Ham. Drv. Short *	No	Electrical malfunction of hammer driver system.	Contact your authorized service representative.
Mech Driver Hot *	No	Mechanism driver board is overheating.	Allow printer to cool. Check that card cage fan and hammer bank fan operate and are not obstructed. If problem persists, contact your authorized service representative.
Mech Driver Link *	No	Electronic fault between controller board and mechanism driver board.	Contact your authorized service representative.
Paper Jam	Yes	No paper motion.	Clear paper jam. See page 3–22. Reset forms thickness lever.
Paper Out	Yes	Printer out of paper.	Load paper. See page 3–10.
Platen Open	Yes	Forms thickness lever raised to open position.	Close forms thickness lever.

* Cycle power; if message reappears contact your authorized field service representative.

Continued on next page

Table 6–1. Fault Messages (continued)

Message Displayed	Operator Correctable?	Explanation	Solution
Ribbon Stall	Yes	No ribbon movement or wrong speed.	Reset forms thickness lever. Check for obstruction to ribbon or ribbon hub. Remove and install ribbon. See page 3–20. If fault continues, contact an authorized service representative.
Shttl Cover Open	Yes	Shuttle cover open.	Reinstall the shuttle cover. Make sure the cover lies flat and the two captive screws are fully seated.
Shuttle Fan *	No	Shuttle fan failure.	Contact your authorized service representative.
Shuttle Jam	Yes	No shuttle movement or shuttle moving at wrong speed.	Check for obstruction to shuttle, a twisted ribbon, or forms thickness lever closed too tightly. If fault source is not apparent, contact your authorized service representative.
Software Error *	No	Internal software problem.	Contact your authorized service representative.
* Cycle power; if message reappears contact your authorized field service representative.			

7 Digital Emulation

Chapter Contents

Digital Emulation

Emulation refers to the ability of a printer to execute the commands of other printer control languages. Digital emulation mode (displayed as “LG06” on the control panel) enables the LG06 and LG12 to print files coded for a Digital LG02 printer. Digital emulation is the default mode when the printer is turned on.

A printer control language (also called a printer protocol) is the coding system used to convey, manipulate, and print data. It contains character codes and command sequences.

A printer and its host computer must use the same printer control language. In this manual, the terms printer control language, emulation, and protocol are synonymous.

Selecting Digital Emulation

Digital emulation is the default mode when the printer is turned on. You can return to Digital emulation from another emulation by following these steps:

1. If the printer is on–line, press the ON LINE switch to place it in the off–line state. “Off–Line Emulation” appears on the message display.
2. Open the printer cover.
3. Press the UP and DOWN switches simultaneously to unlock the ENTER switch. “Unlocked” appears briefly on the message display. (If “Locked” appears, simply press UP and DOWN again.)
4. Press DOWN to enter the emulation menu. The current emulation displays. If the display reads “Emulation LG06 * ” proceed to step 7.
5. Press NEXT or PREV until “Emulation LG06” displays.
6. Press ENTER. An asterisk (*) appears after the display message; that is, “Emulation LG06 * ” displays. This means that the printer has set all configuration values associated with Digital emulation mode. The values are those previously saved when Digital emulation was selected. If no values were altered, the factory default values are loaded. (Default values are listed on page 7–130.)
7. Press CLEAR to return to “Off–Line Emulation.”

8. Press UP and DOWN simultaneously to lock the ENTER switch. “Locked” appears briefly on the message display.

9. Close the printer cover.

10. Press the ON LINE switch to place the printer on–line to the host computer.

Bar Code Printing

Bar code printing is selected by control sequences, not via the operator control panel.

Bar code printing is covered in Appendix A.

Character Printing

Print data sent to the printer consist of two types of character codes:

- Printable Characters are codes representing alphabet characters, punctuation marks, and graphic symbols
- Control Codes are one or more bytes that instruct the printer how to process and print characters and graphics

The LG06 and LG12 process the character codes of the DEC Multinational Character Set (shown on page 7–5). Characters and codes from this chart are identified and located by their column and row numbers. For example, the ASCII character SUB is identified as 1/10, which means that it is located at column 1 row 10).

You may send data from the host computer in either 7–bit or 8–bit form. (The conversion processes from 7–bit to 8–bit form and vice versa are described on page 7–11.)

Printable Characters

Columns 0 through 7 of the DEC Multinational Character Set (page 7–5), are the standard ASCII printable character set used in a 7–bit environment. If you choose an 8–bit environment, the printable character set expands to include columns 8 through 15.

If word length is 7–bits, printable characters are only generated from columns 2 through 7. If word length is set at 8–bits, printable characters can be generated from columns 2 through 7 and columns 10 through 15. (Note that in an 8–bit environment, columns 0 through 7 have the 8th bit set to zero, while columns 8 through 15 always have the 8th bit set to 1.)

NOTE: The actual characters printed may not always be those shown in the DEC Multinational Character Set because printable characters in the column/row positions vary, depending upon the character set used.

Control Codes

Control codes drive printer activity. Control codes do not print. The printer recognizes two kinds of control codes:

- Control Characters
- Escape Sequences

DEC Multinational Character Set

KEY

BITS B8 B7 B6 B5 / B4 B3 B2 B1	0 0 0 1
1 0 1 1	ESC 33 27 1B

33 = OCTAL, 27 = DECIMAL, 1B = HEX, ESC = CHARACTER

7–bit mode or bit 8 set to zero

Columns 8 and 9 can be converted to 7–bit Escape sequences.

Columns 10 thru 15 are only accessed in 8–bit mode.

BITS B4 B3 B2 B1	ROW	COLUMN 0 0 0 0 0	1 0 0 0 1	2 0 0 1 0	3 0 0 1 1	4 0 1 0 0	5 0 1 0 1	6 0 1 1 0	7 0 1 1 1
0 0 0 0	0	NUL 0 0 0	20 16 10	SP 40 32 20	0 60 48 30	@ 100 64 40	P 120 80 50	` 140 96 60	p 160 112 70
0 0 0 1	1	1 1 1	DC1 (XON) 21 17 11	! 41 33 21	1 61 49 31	A 101 65 41	Q 121 81 51	a 141 97 61	q 161 113 71
0 0 1 0	2	2 2 2	22 18 12	″ 42 34 22	2 62 50 32	B 102 66 42	R 122 82 52	b 142 98 62	r 162 114 72
0 0 1 1	3	3 3 3	DC3 (XOFF) 23 19 13	# 43 35 23	3 63 51 33	C 103 67 43	S 123 83 53	c 143 99 63	s 163 115 73
0 1 0 0	4	EOT 4 4 4	24 20 14	$ 44 36 24	4 64 52 34	D 104 68 44	T 124 84 54	d 144 100 64	t 164 116 74
0 1 0 1	5	5 5 5	25 21 15	% 45 37 25	5 65 53 35	E 105 69 45	U 125 85 55	e 145 101 65	u 165 117 75
0 1 1 0	6	6 6 6	26 22 16	& 46 38 26	6 66 54 36	F 106 70 46	V 126 86 56	f 146 102 66	v 166 118 76
0 1 1 1	7	7 7 7	27 23 17	’ 47 39 27	7 67 55 37	G 107 71 47	W 127 87 57	g 147 103 67	w 167 119 77
1 0 0 0	8	BS 10 8 8	CAN 30 24 18	(50 40 28	8 70 56 38	H 110 72 48	X 130 88 58	h 150 104 68	x 170 120 78
1 0 0 1	9	HT 11 9 9	31 25 19	) 51 41 29	9 71 57 39	I 111 73 49	Y 131 89 59	i 151 105 69	y 171 121 79
1 0 1 0	10	LF 12 10 0A	SUB 32 26 1A	* 52 42 2A	: 72 58 3A	J 112 74 4A	Z 132 90 5A	j 152 106 6A	z 172 122 7A
1 0 1 1	11	VT 13 11 0B	ESC 33 27 1B	+ 53 43 2B	; 73 59 3B	K 113 75 4B	[133 91 5B	k 153 107 6B	{ 173 123 7B
1 1 0 0	12	FF 14 12 0C	34 28 1C	, 54 44 2C	< 74 60 3C	L 114 76 4C	\ 134 92 5C	l 154 108 6C	| 174 124 7C
1 1 0 1	13	CR 15 13 0D	35 29 1D	– 55 45 2D	= 75 61 3D	M 115 77 4D	] 135 93 5D	m 155 109 6D	} 175 125 7D
1 1 1 0	14	SO 16 14 0E	36 30 1E	. 56 46 2E	> 76 62 3E	N 116 78 4E	^ 136 94 5E	n 156 110 6E	~ 176 126 7E
1 1 1 1	15	SI 17 15 0F	37 31 1F	/ 57 47 2F	? 77 63 3F	O 117 79 4F	_ 137 95 5F	o 157 111 6F	DEL 177 127 7F

BITS B4 B3 B2 B1	ROW	8 1 0 0 0	9 1 0 0 1	10 1 0 1 0	11 1 0 1 1	12 1 1 0 0	13 1 1 0 1	14 1 1 1 0	15 1 1 1 1
0 0 0 0	0	200 128 80	DCS 220 144 90	(Not Used) 240 160 A0	ƒ 260 176 B0	À 300 192 C0	320 208 D0	à 340 224 E0	360 240 F0
0 0 0 1	1	201 129 81	221 145 91	¡ 241 161 A1	± 261 177 B1	Á 301 193 C1	Ñ 321 209 D1	á 341 225 E1	ñ 361 241 F1
0 0 1 0	2	202 130 82	222 146 92	¢ 242 162 A2	2 262 178 B2	Â 302 194 C2	Ò 322 210 D2	â 342 226 E2	ò 362 242 F2
0 0 1 1	3	203 131 83	223 147 93	£ 243 163 A3	3 263 179 B3	Ã 303 195 C3	Ó 323 211 D3	ã 343 227 E3	ó 363 243 F3
0 1 0 0	4	IND 204 132 84	224 148 94	244 164 A4	264 180 B4	Ä 304 196 C4	Ô 324 212 D4	ä 344 228 E4	ô 364 244 F4
0 1 0 1	5	NEL 205 133 85	225 149 95	¥ 245 165 A5	µ 265 181 B5	Å 305 197 C5	Õ 325 213 D5	å 345 229 E5	õ 365 245 F5
0 1 1 0	6	206 134 86	226 150 96	246 166 A6	¶ 266 182 B6	Æ 306 198 C6	Ö 326 214 D6	æ 346 230 E6	ö 366 246 F6
0 1 1 1	7	207 135 87	227 151 97	§ 247 167 A7	• 267 183 B7	Ç 307 199 C7	Œ 327 215 D7	ç 347 231 E7	œ 367 247 F7
1 0 0 0	8	HTS 210 136 88	230 152 98	¤ 250 168 A8	270 184 B8	È 310 200 C8	Ø 330 216 D8	è 350 232 E8	ø 370 248 F8
1 0 0 1	9	211 137 89	231 153 99	© 251 169 A9	! 271 185 B9	É 311 201 C9	Ù 331 217 D9	é 351 233 E9	ù 371 249 F9
1 0 1 0	10	VTS 212 138 8A	232 154 9A	ª 252 170 AA	º 272 186 BA	Ê 312 202 CA	Ú 332 218 DA	ê 352 234 EA	ú 372 250 FA
1 0 1 1	11	PLD 213 139 8B	CSI 233 155 9B	« 253 171 AB	» 273 187 BB	Ë 313 203 CB	Û 333 219 DB	ë 353 235 EB	û 373 251 FB
1 1 0 0	12	PLU 214 140 8C	ST 234 156 9C	254 172 AC	¼ 274 188 BC	Ì 314 204 CC	Ü 334 220 DC	ì 354 236 EC	ü 374 252 FC
1 1 0 1	13	RI 215 141 8D	235 157 9D	255 173 AD	½ 275 189 BD	Í 315 205 CD	Ÿ 335 221 DD	í 355 237 ED	ÿ 375 253 FD
1 1 1 0	14	SS2 216 142 8E	236 158 9E	256 174 AE	276 190 BE	Î 316 206 CE	336 222 DE	î 356 238 EE	376 254 FE
1 1 1 1	15	SS3 217 143 8F	237 159 9F	257 175 AF	¿ 277 191 BF	Ï 317 207 CF	b 337 223 DF	ï 357 239 EF	(Not Used) 377 255 FF

Columns 0–1: ASCII Control Codes. Columns 2–7: U.S. ASCII CHARACTER SET. Columns 8–9: Additional Control Codes. Columns 10–15: DEC SUPPLEMENTAL CHARACTER SET.

Figure 7–1. DEC Multinational Character Set

Control Codes

A control code is a single (one byte) non–printing character that instructs the printer to perform a specific operation. When the printer receives a control character, it immediately performs the control operation instead of printing a graphic character. LG06 and LG12 printers recognize two sets of control characters:

- ASCII Control Codes (7–bit codes)
- Additional Control Codes (8–bit codes)

ASCII Control Codes

Table 7–1 defines the ASCII control codes recognized by the printer in Digital emulation mode. These codes are located in columns 0 and 1 of the DEC Multinational Character Set (page 7–5), and the column/row coordinates from this chart are printed beneath the Mnemonic category in Table 7–1. These control codes are available in a 7–bit data environment or in an 8–bit environment if bit 8 is zero.

NOTE: On many computers, an ASCII control code can be sent from the input keyboard by holding down the CTRL key while depressing the key specified in Table 7–1.

Additional Control Codes

The additional control codes are 8–bit control characters defined by ANSI and Digital unique sequences, and are available in an 8–bit data environment when bit 8 is set to 1. Table 7–2 defines the additional control codes recognized by the printer in Digital emulation mode. These codes are in columns 8 and 9 of the DEC Multinational Character Set (page 7–5), and the column/row coordinates from this chart are printed beneath the Mnemonic category in Table 7–2.

The 8–bit additional control codes may be sent in 7–bit form as equivalent escape sequences. Equivalent 7–bit escape sequences for the 8–bit additional control codes are listed in Table 7–3. Control code conversion from 7–bit to 8–bit data environments, and vice versa, is discussed on page 7–11.

Table 7–1. ASCII Control Codes

Mnemonic Column/Row	**Name**	**Key Pressed with CTRL**	**Function**
BEL 0/7	Bell	None	When a <BEL> control code is received, the printer produces a short audible tone.
HT 0/9	Horizontal Tab	I	HT advances the active tab position to the next horizontal tab stop on the line, or to the right margin if there are no more tab stops. The printer initially sets a horizontal tab stop every eight characters. Tab stops may be located either at column numbers or at physical positions on the page.
LF 0/10	Line Feed	J	LF advances the active line vertically by one line. If less than one vertical line space remains on the page, LF sets the active line to the first line on the next page. If line feed/new line (LNM) is set, LF also advances the active column to the left margin.
VT 0/11	Vertical Tab	K	VT moves the active line to the next vertical tab stop. The LG06 printer initially sets a vertical tab stop for every line on the page.
FF 0/12	Form Feed	L	FF advances the active line to the first printable line on the next page.
CR 0/13	Carriage Return	M	CR returns the active column to the left margin. If carriage return/new line mode is set, CR also advances the active line to the next line.
SO 0/14	Shift Out	N	SO locks character set G1 into GL.
SI 0/15	Shift In	O	SI locks character set G0 into GL.
DC1 (XON) 1/1	Device Control 1	Q	DC1 informs the host computer that the printer is ready to receive data.
DC3 (XOFF) 1/3	Device Control 3	S	DC3 tells the host computer to pause before sending more data until the printer sends DC1.

Continued on the next page

Table 7–1. ASCII Control Codes (Continued)

Mnemonic Column/Row	**Name**	**Key Pressed with CTRL**	**Function**
CAN 1/8	Cancel	X	CAN immediately ends an escape or control sequence. The printer interprets the characters following CAN as normal. CAN also cancels a Device Control String (DCS) when received within the command string of that DCS.
SUB 1/10	Substitute	Z	SUB immediately ends an escape or control sequence. SUB replaces a character received with an error in the sequence. SUB prints as a space character for sixel data.
ESC 1/11	Escape	3	ESC introduces an escape or control sequence. If received in the middle of a sequence, ESC immediately ends the sequence and starts a new sequence. ESC also immediately ends a Device Control String (DCS).
BS 0/8	Backspace	3	None; DEL is ignored by the printer.

Table 7–2. Additional Control Codes

Mnemonic Column/Row	**Name**	**Function**
IND 8/4	Index	IND moves the active position down to the same position on the next line. If the new position is below the bottom margin, the active position moves to the top of the next page.
NEL 8/5	Next Line	NEL moves the active position to the left margin on the next line. If the new position is below the bottom margin, the active position moves to the top of the nex page.
HTS 8/8	Horizontal Tab Set	HTS sets a horizontal tab at the active column.
VTS 8/10	Vertical Tab Set	VTS sets a vertical tab at the active line.
PLD 8/11	Partial Line Down	PLD moves the active position down one–half line. The distance moved is specified as a parameter of the font, not by vertical spacing escape sequences.
PLU 8/12	Partial Line Up	PLD moves the active position up one–half line. The distance moved is specified as a parameter of the font, not by vertical spacing escape sequences.
RI 8/13	Reverse Index	RI moves the active line position up to the same position on the preceding line.
SS2 8/14	Single Shift 2	SS2 moves character set G2 into Gl, to print one character.
SS3 8/15	Single Shift 3	SS3 moves character set G3 into Gl, to print one character.
DCS 9/0	Device Control String	DCS introduces a device control string.
CSI 9/11	Control String Introducer	CSI introduces a sequence of one or more bytes that define a control function.
ST 9/12	String Terminator	ST indicates the end of a device control string (DCS).
9/DH–9/FH		<OSC>, <PM>, <APC>: See “note”

NOTE: The LG06 and LG12 recognize the start of this control string but ignore all data that follow until this sequence is either aborted or terminated by an <ST> sequence.

Table 7–3. Equivalent 7–Bit and 8–Bit Additional Control Codes

Name	8–Bit Character Column/Row	7–Bit Sequence Column/Row
Index	**IND** 8/4	**ESC D** 1/11 4/4
Next Line	**NEL** 8/5	**ESC E** 1/11 4/5
Horizontal Tab Set	**HTS** 8/8	**ESC H** 1/11 4/8
Vertical Tab Set	**VTS** 8/10	**ESC J** 1/11 4/10
Partial Line Down	**PLD** 8/11	**ESC K** 1/11 4/11
Partial Line Up	**PLU** 8/12	**ESC L** 1/11 4/12
Reverse Index	**RI** 8/13	**ESC M** 1/11 4/13
Single Shift 2	**SS2** 8/14	**ESC N** 1/11 4/14
Single Shift 3	**SS3** 8/15	**ESC O** 1/11 4/15
Device Control String	**DCS** 9/0	**ESC P** 1/11 5/0
Control String Introducer	**CSI** 9/11	**ESC [** 1/11 5/11
String Terminator	**ST** 9/12	**ESC ** 1/11 5/12

NOTE: Printable characters in columns 10 through 15 of 8–bit character sets are not converted.

8–Bit to 7–Bit Control Code Conversion

Convert 8–bit additional control codes to 7–bit escape sequences as follows:

1. Insert the ESC character.
2. Set the eighth bit of the final character to 0 and set its seventh bit to 1.

NOTE: Only control codes found in columns 8 and 9 of the character sets may be converted as shown. Printable characters in columns 10 through 15 are not converted.

7–Bit to 8–Bit Control Code Conversion

Convert 7–bit escape sequences to 8–bit additional control codes as follows:

1. Remove the ESC character.
2. Set the eighth bit of the final character to 1 and set its seventh bit to 0.

Escape Codes

The control codes discussed in the previous section are single byte control codes. The number of printer capabilities is greatly increased, however, by combining character codes into escape sequences. Escape sequences always begin with the ASCII ESCape character (location 1/11).

An ESC character in the data stream signals the printer to wait for special instructions. The character codes following the ESC character tell the printer what to do.

The printer in Digital emulation mode recognizes three escape sequence formats:

- Escape Sequences
- Control Sequences
- Device Control Strings

Escape Sequences

NOTE: Code sequences appear in this manual with spaces inserted between command elements. This is done for readability; do not insert spaces between code characters when you are programming unless the ASCII space character is part of a code sequence. For example, a code sequence printed in this manual as ***ESC [1 ; 4 m*** is programmed as ***ESC[1;4m***

An escape sequence uses two or more bytes to define a specific printer control function, but does not include any variable parameters (although there may be intermediate characters). The format for an escape sequence is:

ESC	**I**	**F**
1/11	2/0 – 2/15	3/0 – 7/14
Escape Sequence Introducer	Intermediate character(s)	Final character

After the escape sequence introducer, ESC, intermediate characters may or may not follow in the sequence. These characters always come from the 2/0 through 2/15 (column/row) range of the DEC Multinational Character Set (page 7–5). The final character signals the end of the escape sequence and always comes from the 3/0 through 7/14 range of the DEC multinational character set. For example, if the intermediate character is SP (hex 20) and the final character is G (hex 47), the resulting escape sequence is ESC SP G (hex 1B 20 47). This particular sequence tells the printer how to process data it sends back to the host computer: send data in 7–bit form and send additional control characters as 7–bit escape sequences.

If the characters following the ESC code are not within the defined ranges, or if they are within the defined ranges but not recognized as a function of this printer, the entire sequence is ignored.

Control Sequences

Control sequences begin with the control sequence introducer, CSI (9/11), in an 8–bit data environment. They are also escape sequences, however, because the 8–bit CSI control character can be represented by the 7–bit escape sequence, ESC [. Control sequences may contain variable parameters within the command sequence. The format for control sequences is:

CSI	**P**	**I**	**F**
9/11	3/0 to 3/15	2/0 to 2/15	3/0 to 7/14
8–Bit Control Sequence Introducer	Parameter character(s)	Intermediate character(s)	Final character
or			
ESC [			
1/11 5/11			
7–Bit Escape Code CSI equivalent			

Parameter characters modify the action or interpretation of the command sequence. There may be up to, but no more than, 16 parameters per sequence. The **;** (3/11) (semicolon) character is the delimiter that separates parameters. This delimiter must be used whenever there are multiple parameters in the control sequence.

Two kinds of parameters are used: numeric and selective.

A numeric parameter represents a numerical value. Numeric parameters are represented in this manual as `Pn, Pn1, Pn2`, etc. A selective parameter chooses an action associated with the parameter value. Selective parameters are represented in this manual as `Ps, Ps1, Ps2,` etc.

Parameters are interpreted as unsigned decimal integers with the most significant digit first. Parameter values greater than the maximum allowable 65535 will be set to 65535. Do not use a decimal point in any parameter — the printer will ignore the entire command. If no value is specified, zero (0) is assumed. A value of zero or an omitted parameter indicates the printer default value should be used for that sequence.

If the printer receives the parameter characters 3AH, 3DH, or 3EH anywhere in the parameter string, it performs no action until the final character is received, then ignores the entire sequence. These parameter characters are sixel control codes and must not conflict with CSI sequences.

A CSI sequence containing one or more group(s) of invalid parameters is still processed, but only the valid parameters are used. If all parameters in a sequence are out of range or invalid, the printer waits for the final character, then ignores the entire sequence.

Intermediate and final characters define the control function. For example, the sequence, ESC [3 m (hex 1B 5B 33 6D), turns italic printing on. This sequence uses one selective parameter [3], no intermediate characters, and the final character [m].

The LG06 and LG12 process control sequences with one intermediate character only. If more than one intermediate character is received, the printer waits for the final character, then ignores the entire control sequence.

If no intermediate characters are in the sequence, the final character determines the control function.

Special Parsing Requirements

Parsing is the process of separating a programming statement into basic units that can be translated into machine instructions. Special parsing requirements are necessary when invalid parameters are specified, when invalid control functions are specified, and when control characters are embedded in control functions. Generally, the printer recovers from these conditions by performing as much of the function as possible (or, parsing the valid parameter from the invalid).

When control sequences are not recognized by the printer or when selective parameters are invalid, the printer ignores them. Parameter values greater than the specified limit are set to the maximum allowable value for that parameter. If a CO (7–bit) control character is received within a control sequence, the control character is executed by the printer as if it was received before the control sequence. Parsing then resumes. The exceptions to this rule follow:

- When the control character is <CAN> (18H) or <SUB> (1AH), the sequence is aborted and the control character processed.
- If the control character is ESC (1BH), the sequence is aborted and a new sequence begins.
- If a C1 (8–bit) control character is received within an escape or control sequence, the sequence is aborted and the C1 control character is then processed, if it is applicable to the printer. If not, it is ignored.
- When the (A0H) character is received within a control sequence, it is processed as a <Space> (20H) character, and parsing then resumes.
- If character (FFH) is received within a control sequence, it is processed as a <DEL> (7FH) character, then parsing resumes.
- When a GR character is received during a control sequence, the eighth bit is ignored. The remaining seven bits define a GL character.

The following messages explain error codes that might arise when using the single shift control character:

- If a C0 or C1 control character is received after a single shift control character <SS2> (8EH) or <SS3> (8FH), the control character is processed and the single shift flag remains set. If a control sequence is received after <SS2> (8EH) or <SS3> (8FH), the sequence is processed and the single shift flag remains set.

When the characters <SP> (20H) or <DEL> (7FH) are received after a SS2 or SS3, the following occurs:

- If the (94) character set resides in the set being accessed (either G2 or G3), the <Space> or <DEL> keys are processed and the single shift flag remains set.
- If the (94) character set resides in the set being accessed (either G2 or G3), the printer images the corresponding character of that set (A0H or FFH), then reset the single shift flag.
- If a GR character is received after an SS2 or SS# sequence, the eighth bit is ignored. The single shift function then applies the remaining seven bits to define a GL character.

CAUTION

An error condition exists any time a GR character follows an SS2 or SS3 sequence. The software should never send a GR character after an SS2 or SS3 character.

WARNUNG

Eine Fehlerbedingung besteht jedesmal, wenn sich ein GR–Zeichen einer SS2– oder SS3–Folge anschliesst. Die Software solite niemals ein GR–Zeichen nach einem SS2– oder SS3–Zeichen senden.

ADVERTENCIA

Existe una condición de error siempre que un caracter GR aparezca después de una secuencia SS2 o SS3. El software nunca deberá enviar un caracter GR después de un caracter SS2 o SS3.

AVERTISSEMENT

Une condition d’erreur existe chaque jois qu’un caractère GR suit une séquence SS2 ou SS3. Le logiciel ne doit donc jamals transmettre un caractère GR après un caractère SS2 ou SS3.

If either (A0H) or (FFH) are received after SS2 or SS3, the following occurs:

- The LG06 and LG12 print the error character (a reverse question mark) and resets the single shift flag when a (94) character resides in the set being accessed (either G2 or G3).
- If a (96) character resides in the set being accessed (either G2 or G3), the printer images the corresponding character, (A0H) or (FFH), of that set, then resets the single shift flag.

How Control Codes Are Described in This Chapter

The rest of this chapter discusses the control codes in detail. Where applicable, the following information is listed for each control code sequence:

Name The title or function of the control code. The Digital or ASCII mnemonic is in parentheses after the name.

ASCII Code The ASCII name for the control code. Escape sequences are in 7–bit (ASCII) form.

NOTE: In the code descriptions, the ASCII space character (2/0, hex 20, decimal 32) is represented by SP.

Hex Code The code or escape sequence in hexadecimal numbers.

Dec Code The code or escape sequence in decimal numbers.

Purpose The function(s) of the control code.

Discussion A discussion of the uses of the sequence, and descriptions of any exceptions or limitations to use.

Control Code Index and Descriptions

The Digital emulation mode control codes listed below are grouped by related functions.

Control code sequences in this manual are shown in 7–bit form. They can be either 7–bit or 8–bit form, depending on your requirements. Code conversion instructions are on page 7–11.

For commands that turn features on and off (set/reset, enable/disable), the page number for the enabling command is listed. The disabling command is on the same page.

IMPORTANT

In the index below SP represents the ASCII space character (decimal 32, 20_H). (A two–digit number followed by a subscripted capital H is a hexadecimal number. Numbers without subscripts are decimal numbers.)

Function	Code	Page
Set/Reset Mode	`ESC[Psh`	7–22
Line Feed/New Line Mode (LNM)	`ESC[20h`	7–23
Carriage Return/New Line Mode (DECCRNLM)	`ESC[?40h`	7–24
Autowrap Mode (DECAWM)	`ESC[?7h`	7–25
Pitch Select Mode (DECPSM)	`ESC[?29h`	7–26
Set Page Orientation (DECSPO)	`ESC[Ps&z`	7–27
Position Unit Mode (PUM)	`ESC[1lh`	7–28
Force Plot Mode (DECFPM)	`ESC[?70h`	7–30
Select Size Unit (SSU)	`ESC[PsSPI`	7–31
Graphic Size Selection (GSS)	`ESC[PnSPC`	7–32
Graphic Size Modification (GSM)	`ESC[Pn1;Pn2SPB`	7–33

Function	Code	Page
Spacing		7–37
Spacing Pitch Increment (SPI)	ESC[Pn1;Pn2SPG	7–38
Select Vertical (Line) Spacing (SVS)	ESC[PsSPL	7–39
Set Vertical Pitch (DECVERP)	ESC[Psz	7–40
Select Horizontal (Character) Spacing (SHS)	ESC[PsSPK	7–41
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Deleting Logos Sequence (DECDLG)	CSIP1;P2;Pn&|	7–60
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Logo Status Report (DECLGSR)	DCS&w	7–61
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Set Top and Bottom Margins (DECSTBM)	ESC[Pn1;Pn2r	7–69
Set Left and Right Margins (DECSLRM)	ESC[Pn1;Pn2s	7–70

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Horizontal Position Absolute (HPA)	ESC[Pn‘	7–74
Horizontal Position Relative (HPR)	ESC[Pna	7–74
Horizontal Position Backward (HPB)	ESC[Pnj	7–75
Vertical Position Absolute (VPA)	ESC[Pnd	7–75
Vertical Position Relative (VPR)	ESC[Pne	7–76
Vertical Position Backward (VPB)	ESC[Pnk	7–76
Cursor Up (CUU)	ESC[PnA	7–77
Partial Line Up (PLU) – Superscripting	ESCL	7–78
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Set Vertical Tab Stops (DECSVTS)	ESC[Pnv	7–82
Tab Clear (TBC)	ESC[Psg	7–83
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Enable Unsol. Brief Reports and Send Ext. Report	ESC[?2n	7–88
Enable Unsol. Ext. Reports and Send Ext. Report	ESC[?3n	7–88
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Function	Code	Page
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Sixel Graphics Processing		7–108
Select Graphics Density (DECSGD)		7–35
7–Bit and 8–Bit Transmissions and Interpretations		7–128
Draft Mode Printing		
Enter Draft Mode	`ESC%/3`	7–129
Exit Draft Mode	`ESC%@`	7–129

Set/Reset Mode

	Set (Enable)	Reset (Disable)
ASCII Code	`ESC [ Ps h`	`ESC [ Ps l`
Hex Code	`1B 5B Ps 68`	`1B 5B Ps 6C`
Dec Code	`27 91 Ps 104`	`27 91 Ps 108`

Purpose Turns basic printing features on (set) or off (reset).

Discussion Set/Reset Mode controls certain printer features that have two settings: on or off. One sequence may be used to turn several features on or off. Parameter values `Ps` determine different printer modes.

Parameter values are either ANSI or Digital private. All parameters in a given sequence must be of the same type. Digital private parameters are preceded by the question mark character ? (3/15).

On Set/Reset features, default settings go into effect when the printer is powered–up or a reset (RIS or DECSTR) sequence is sent.

Table 7–4. Set/Reset Mode Parameter Values

Ps (Parameter Values)	Printer Mode	Page No.
ANSI		
11	Position Unit Mode (PUM)	7–28
20	Line feed/New line Mode (LNM)	7–23
DEC Private		
?7	Autowrap Mode (DECAWM)	7–25
?29	Pitch Select Mode (DECPSM)	7–26
?40	Carriage Return/New Line Mode (DECCRNLM)	7–24
?70	Force Plot Mode (DECFPM)	7–30

Line Feed/New Line Mode (LNM)

	Set (Enable)	Reset (Disable)
ASCII Code	`ESC [ 2 0 h`	`ESC [ 2 0 l`
Hex Code	`1B 5B 32 30 68`	`1B 5B 32 30 6C`
Dec Code	`27 91 50 48 104`	`27 91 50 48 108`

Purpose Defines the paper position according to how the line feed features are enabled.

Discussion Advance the paper up one line by pressing the line feed key once. A half–second pause ensues, then the paper will feed one line. To feed paper continuously, hold down the line feed key. After the half–second pause, the paper feeds up one line in 3 hertz intervals.

To enable further line feed features, (i.e., microstepping), raise the printer cover and locate the control panel on the left side. Four keys—UP, NEXT, DOWN, and PREV—control additional line feed capabilities:

To move paper up 1/600 inch, depress the LINE FEED key and the NEXT key together. After a half–second interval, paper feeds continuously at 3 hertz intervals. For continuous forward paper feed at 1/600 inch, hold down the LINE FEED key and the NEXT key, and paper will feed at 3 Hertz intervals after a half–second pause.

Whether Line Feed/New Line mode is enabled or disabled, a Carriage Return <CR> control code is interpreted according to the DECCRNLM mode in use. (See “Carriage Return/New Line Mode,” page 7–24.)

LNM remains as selected from the last power–on session. Factory default is LNM reset.

Carriage Return/New Line Mode (DECCRNLM)

	Set (Enable)	Reset (Disable)
ASCII Code	`ESC [ ? 4 0 h`	`ESC [ ? 4 0 l`
Hex Code	`1B 5B 3F 34 30 68`	`1B 5B 3F 34 30 6C`
Dec Code	`27 91 63 52 48 104`	`27 91 63 52 48 108`

Purpose Defines printer response to the Carriage Return (CR) character.

Discussion When the printer receives the CR character with Carriage Return/New Line Mode enabled (set), it returns the active column to the left margin and advances paper one line.

When the printer receives the CR character with Carriage Return/New Line Mode disabled (reset), it returns the active column to the left margin without advancing the active line.

LNM remains as selected from the last power–on session. Factory default is LNM reset.

Autowrap Mode (DECAWM)

	Set (Enable)	Reset (Disable)
ASCII Code	`ESC [ ? 7 h`	`ESC [ ? 7 l`
Hex Code	`1B 5B 3F 37 68`	`1B 5B 3F 37 6C`
Dec Code	`27 91 63 55 104`	`27 91 63 55 108`

Purpose Determines what happens when text exceeds the right margin of the page.

Discussion When autowrap is enabled (set) and text runs past the right margin, the active position moves to the left margin on the next line, and no data are lost.

When autowrap is disabled (reset) and text runs past the right margin, the data are lost.

DECAWM remains as selected from the last power–on session. Factory default is DECAWM reset.

Pitch Select Mode (DECPSM)

	Set (Enable)	Reset (Disable)
ASCII Code	`ESC [ ? 2 9 h`	`ESC [ ? 2 9 l`
Hex Code	`1B 5B 3F 32 39 68`	`1B 5B 3F 32 39 6C`
Dec Code	`27 91 63 50 57 104`	`27 91 63 50 57 108`

Purpose Controls the Set Horizontal Pitch (DECSHORP) sequence.

Discussion When Pitch Select Mode is enabled (set), the current font determines the horizontal pitch.

When Pitch Select Mode is disabled (reset), the printer uses the horizontal pitch selected by the Set Horizontal Pitch (DECSHORP) sequence.

The power–up default is DECPSM reset. DECPSM is overridden by an SPI command (page 7–38) or an SHS command (page 7–41).

Set Page Orientation (DECSPO)

ASCII Code `ESC [ Ps & z`

Hex Code `1B 5B Ps 26 7A`

Dec Code `27 91 Ps 38 122`

Purpose Sets the intended reading orientation of the page with respect to the paper feed direction.

Discussion DECSPO is similar to the page orientation defined by PFS, but has no effect on the page size or number of lines and columns. All page related functions are interpreted in relation to page orientation (margins, line and character spacing). The default value is `Ps = 0`.

The selective parameters indicate the following:

Ps	Function
0	Portrait: Page orientation is in line with the paper feed direction
1	Landscape: Page orientation is perpendicular to the paper feed direction.

Position Unit Mode (PUM)

	Set (Enable)	Reset (Disable)
ASCII Code	`ESC [ 1 l h`	`ESC [ 1 1 l`
Hex Code	`1B 5B 31 31 68`	`1B 5B 31 31 6C`
Dec Code	`27 91 49 49 104`	`27 91 49 49 108`

Purpose Selects a unit of measurement used with the escape sequences that control spacing parameters.

Discussion When Position Unit mode is enabled (set), it selects either decipoints or pixels, depending on the setting of the Select Size Unit (SSU) sequence.

When Position Unit mode is disabled (reset), it selects a spacing unit equal to one character position called a character cell. The width and height of the cell is equal to the currently selected horizontal and vertical spacing increment.

Power–up default is PUM reset.

Table 7–5 lists the escape sequences affected by the PUM and SSU settings.

Table 7–5. Escape Sequences With Spacing Parameters

Sequence Name	DEC Mnemonic	Page No.
Spacing Pitch Increment *	SPI *	7–38
Set Lines Per Physical Page	DECSLPP	7–68
Set Top and Bottom Margins	DECSTBM	7–69
Set Left and Right Margins	DECSLRM	7–70
Horizontal Position Absolute	HPA	7–74
Horizontal Position Relative	HPR	7–74
Horizontal Position Backward	HPB	7–75
Vertical Position Absolute	VPA	7–75
Vertical Position Relative	VPR	7–76
Vertical Position Backward	VPB	7–76
Set Horizontal Tab Stops	DECSHTS	7–81
Set Vertical Tab Stops	DECSVTS	7–82
Drawing Vectors *	DECVEC *	7–121
Select Barcode Parameters	DECBAR	???

*Not affected by PUM setting.

Force Plot Mode (DECFPM)

	Reset (Disable)	Set (Enable)
ASCII Code	`ESC [ ? 7 0 1`	`ESC [ ? 7 0 h`
Hex Code	`1B 5B 3F 37 30 31`	`1B 5B 3F 37 30 68`
Dec Code	`27 91 63 55 48 49`	`27 91 63 55 48 49`

Purpose Forces the printer to enter or stay in Plotting mode.

Discussion The printer normally operates in Printing mode (the default) to achieve maximum throughput of standard fonts and spacing. Plotting mode sacrifices speed but offers greater flexibility, such as special fonts, font sizes, character spacing.

Force Plot mode prevents accidental shifting between the printed and plotted fonts, and can reduce unnecessary paper shift. The default for DECFPM = reset state.

Select Size Unit (SSU)

ASCII Code `ESC [ Ps SP I`

Hex Code `1B 5B Ps 20 49`

Dec Code `27 91 Ps 32 73`

Purpose Works with the Position Unit Mode (PUM) sequence to select a unit of measurement for spacing parameters.

Discussion When PUM is enabled (set), Select Size Unit selects either decipoints or pixels as the spacing unit, depending on the parameter settings shown below.

If the printer receives an SSU while PUM is disabled (reset), the selected unit will take effect when PUM is set and will then remain in effect until the printer receives either another SSU or a reset sequence.

Default value at power–up or reset is decipoints. The printer will ignore all `Ps` values other than 2 or 7.

Ps	Spacing Unit
2	Decipoint (1/720 inch)
7	Pixel (1/600 inch)

The printer converts decipoints (D) into pixel (P) values by using the formula shown below and rounding off the result to the nearest integer:

$$P = \frac{D \text{ x } 5}{6}$$

All arithmetic operations are performed using integer instructions. For example, the formula above converts decipoints to the nearest pixel.

NOTE: If you select decipoint units, do not use horizontal position relative (HPR) and vertical position relative (VPR) sequences. Using these commands with decipoint units produces cumulative positioning errors because they are rounded–off.

Graphic Size Selection (GSS)

ASCII Code `ESC [ Pn SP C`

Hex Code `1B 5B Pn 20 43`

Dec Code `27 91 Pn 32 67`

Purpose Sets the height and width of all characters in the selected font that start after the control sequence.

Discussion `Pn` is a decimal value that species the height of the font in units determined by the Select Size Unit (SSU) sequence. The width of the font is implicitly defined by the height. For example, the width of a 10–point font is 10 pitch. The initial value for Pn is `Pn = 100.`

If the desired font height cannot be matched exactly, the next smallest available font is selected. The GSS sequence remains in effect until the printer receives another GSS sequence or a Graphic Size Modification (GSM) sequence.

Graphic Size Modification (GSM)

ASCII Code `ESC [ Pn1 ; Pn2 SP B`

Hex Code `1B 5B Pn1 3B Pn2 20 42`

Dec Code `27 91 Pn1 59 Pn2 32 66`

Purpose Modifies the height and width for all designated fonts as set by the GSS sequence.

Discussion `Pn1` is a decimal value that specifies the height of the font as a percentage of the height set by the GSS sequence. `Pn2` is a decimal value that specifies the width as a percentage of the width set by the GSS sequence. Data processing fonts can be modified by two or three times their default height.

GSM affects only the current print or plot mode. In Print mode, GSM always changes the current pitch according to the newly selected font. In Plot mode, the pitch is changed only if Pitch Select mode is set.

The GSM sequence is effective until the printer receives another GSM or GSS sequence.

NOTE: The GSM command will only work if the base font is DP 10. See the DECATFF command.

Setting Plot Density

The printer can plot in several different densities (dots per inch), from 30 dots per inch to 200 dpi.

The Plot mode fonts contain the information for the vertical and horizontal densities they use. Determine non–text imaging densities (for sixels, bar codes) by using these innate commands. Default values for both the vertical and horizontal densities for graphic work are 100.

While density changes can occur anywhere on a page, they can also cause vertical negative paper motion while printing. Judicious planning minimizes this effect.

Plot speed is adversely effected by changes in density: the higher the density, the slower the speed. Hence, plotting in 50 x 50 density is four times faster than plotting in 100 x 100. If speed is a consideration, select lower density plotting. The lowest density plot font available is the 60 x 75 density.

Set Graphics Density (DECSGD)

ASCII Code `ESC [ Psh ; Psv & {`

Hex Code `1B 5B Psh 3B Psv 26 7B`

Dec Code `27 91 Psh 59 Psv 38 123`

Purpose Sets the darkness of drawn images.

Discussion DECSGD controls darkness via the density of the physical pixels. It does not change the resolution of the image (logical pixels), only the darkness of the segments drawn.

NOTE: Psh and Psv do not affect the density of plotted text. Text density comes from the current font.

DECSGD sets the density for graphics (sixels, logos, vectors, block characters, and bar codes). The selective parameters, Psh and Psv, designate the horizontal and vertical dot densities used for plotting graphics.

- Psh Parameter (Psh) selects the horizontal dot density.
- Psv Parameter (Psv) selects the vertical dot density.

The actions of Psh and Psv are dependent on the print orientation because x–direction print densities differ significantly from y–direction print densities. (This is the only printer instruction that is directly dependent on the current orientation setting.) Table 7–6 defines how orientation is designated by Psh and Psv.

Table 7–6. Psh and Psv Orientation

Direction	Portrait (Default)	Landscape
horizontal (Psh)	same as x	same as y
vertical (Psv)	same as y	same as x
x–density	same as horizontal	same as vertical
y–density	same as vertical	same as horizontal

Use Table 7–7 and Table 7–8 with Table 7–6 to establish the exact orientations designated by Psh and Psv.

Table 7–7. X–Density Values

Psh (Portrait–dflt)	X–Density (Dots/Inch)
0	No change
1	50
2	60
3	70
4	80
5	90
6	100
7	110
8	120
9	130
10	140
11	150
12	200

Table 7–8. Y–Density Values

Psh (Portrait–dflt)	Y–Density (Dots/Inch)
0	No change
1	30
2	40
3	50
4	60
5	66.67
6	75
7	86
8	100
9	120
10	150
11	200

Spacing

The five spacing sequences covered in this section affect the spacing of lines and characters on the page but do not affect character size. Horizontal pitch affects character spacing in characters per inch (cpi). Vertical pitch affects line spacing in lines per inch (lpi).

Table 7–9. Line and Character Spacing Sequences

Sequence Name	DEC Mnemonic	Page No.
Spacing Pitch Increment	SPI	7–38
Select Vertical (Line) Spacing	SVS	7–39
Set Vertical Pitch	DECVERP	7–40
Select Horizontal (Character) Spacing	SHS	7–41
Set Horizontal Pitch	DECSHORP	7–42

Horizontal and vertical pitch values can be changed by using the Select Horizontal Spacing (SHS) and Select Vertical Spacing (SVS) sequences or the Spacing Pitch Increment (SPI) sequence. These sequences can accept two spacing units: decipoints or pixels. To select the unit of measurement, use the Position Unit Mode (PUM) and Select Size Unit (SSU) sequences. Alternatively, you can use Set Horizontal Pitch (DECSHORP) and Set Vertical Pitch (DECVERP) sequences to alter spacing.

Except for DECSHORP, all spacing commands are acted upon as soon as they are received, and the new spacing increments take effect immediately.

Spacing Pitch Increment (SPI)

ASCII Code `ESC [ Pn1 ;  Pn2 SP G`

Hex Code `1B 5B Pn1 3B Pn2 20 47`

Dec Code `27 91 Pn1 59 Pn2 32 71`

Purpose Sets the vertical and horizontal spacing increments for all characters that follow in the data stream. You can select one or both increments with a single Spacing Pitch Increment sequence. The SPI sequence gives you the greatest flexibility in adjusting white space (pitch) between characters and lines.

Discussion This command sequence uses decipoints or pixels as units. Select the unit with the Select Size Unit (SSU) sequence. Spacing Pitch Increment is not affected by the Position Unit Mode (PUM) sequence or by the page orientation. For example, if you set a vertical increment of 100 pixels (or 1/6 inch), the printer uses this setting for both portrait and landscaped pages.

`Pn1` selects the vertical spacing increment. `Pn2` selects the horizontal spacing increment. Parameters must be positive integers. If you use a decimal point, the printer will ignore the command. Printer default values are `Pn1` = 0 and `Pn2` = 0, which selects the spacing of the current font.

You can change the SPI setting for horizontal spacing three ways:
1) Use another SPI sequence.
2) Use a Select Horizontal Spacing (SHS) sequence.
3) Use a combination of the Pitch Select Mode (DECPSM) and Select Horizontal Pitch (DECSHORP) sequences. Most combinations are acceptable for this function.

You can change the SPI setting for vertical spacing two ways:
1) Use a Set Vertical Spacing (SVS) sequence.
2) Use a Set Vertical Pitch (DECVERP) sequence.

NOTE: If `Pn1` or `Pn2` is 0 (or omitted), the printer defaults to the font file pitch setting.

This command can force the printer into plot mode.

Spacing Pitch Increment (SPI) (continued)

If a position command does not precede the printable (graphic) character, the printer will place that character to the right of the previously received character. The distance between characters depends on the values of `Pn1` and `Pn2` in the most recent SPI, SHS, or DECSHORP sequence. If you set the `Pn1` or `Pn2` values to 0, or if you do not send an SPI sequence, the printer uses the default horizontal and vertical spacing for the font currently in use. Horizontal spacing is the same for all font styles.

Select Vertical (Line) Spacing (SVS)

ASCII Code `ESC [ Ps SP L`

Hex Code `1B 5B Ps 20 4C`

Dec Code `27 91 Ps 32 76`

Purpose Selects the vertical spacing (pitch) between lines that is used by all fonts.

Discussion `Ps` selects the vertical pitch and vertical character position unit. SVS does not affect the vertical size of the selected font.

Ps	Vertical Pitch	Vertical Character Positioning Unit
0	6 lines per inch	1/6 inch (default)
1	4 lines per inch	1/4 inch
2	3 lines per inch	1/3 inch
3	12 lines per inch	1/12 inch
4	8 lines per inch	1/8 inch
5	5 lines per 30 inches	1/5 inch
9	2 lines per inch	1/2 inch
10	10 lines per inch	1/10 inch

Set Vertical Pitch (DECVERP)

ASCII Code `ESC [ Ps z`

Hex Code `1B 5B Ps 7A`

Dec Code `27 91 Ps 122`

Purpose Selects the number of lines printed per inch on the page.

Discussion Selects the line spacing (vertical pitch) used with all fonts.

`Ps` selects the vertical pitch (lines per inch).

Ps	Vertical Pitch
0	6 lines per inch (current default)
2	8 lines per inch
7	10 inches per line (This setting is accomplished by reversing the paper.)

Changing vertical pitch to 8 lpi or 10 lpi alters the physical size of the form, since form length is specified in terms of lines per page.

Vertical tab stops are not affected by changes to vertical pitch. For example, a vertical tab at line 15 remains set even if you change vertical pitch from 6 lpi to 10 lpi.

Select Horizontal (Character) Spacing (SHS)

ASCII Code `ESC [ Ps SP K`

Hex Code `1B 5B Ps 20 4B`

Dec Code `27 91 Ps 32 75`

Purpose Selects character spacing (horizontal pitch).

Discussion `Ps` selects the horizontal pitch and the horizontal character position unit. By setting this parameter, the white space between characters varies, but the character size is not affected.

Ps	Horizontal Pitch	Horizontal Character Position Unit
0	10 characters per inch	1/10 inch
1	12 characters per inch	1/12 inch
2	15 characters per inch	1/15 inch
3	6 characters per inch	1/6 inch

NOTE: This command can force the printer into plot mode.

Set Horizontal Pitch (DECSHORP)

ASCII Code `ESC [ Ps w`

Hex Code `1B 5B Ps 77`

Dec Code `27 91 Ps 119`

Purpose Selects the character spacing for monospaced fonts. This sequence selects the number of characters printed per horizontal inch on a line.

NOTE: DECSHORP varies the white space between characters, not the actual character size.

Discussion Pitch Select Mode (DECPSM) activates the Set Horizontal Pitch (DECSHORP) sequence. When DECPSM is set (enabled), the printer uses the horizontal pitch of the current font. When DECPSM is reset (disabled), the printer uses the horizontal pitch selected by the last DECSHORP sequence.

In addition to changing the amount of white space around characters, this sequence enacts the following:

- Resets the left and right margins to the printable limits.
- Resets the line home and line end positions to the printable limits. (Refer to the Page Format Select [PFS] sequence on page 7–64.)
- The current horizontal tabs remain as set.
- Can force the printer into plot mode.

`Ps` selects the horizontal pitch (characters per inch).

Ps	Horizontal Pitch (cpi)
0	Current font pitch
1	10 characters per inch
2	12 characters per inch
3	13.3 characters per inch
4	16.7 characters per inch
5	5 characters per inch (normal width characters)
6	6 characters per inch
8	8.33 characters per inch
9	15 characters per inch

Vertical Format

Vertical format consists of two control codes that program the printer to make fast vertical paper movements (slewing) during print jobs. Vertical formatting increases printer efficiency and reduces printing time for repetitive printing jobs.

Vertical channels in the form are defined by downloading the Vertical Format Unit (VFU) from the host to the printer. Subsequent data is then printed on the form at the specified channel. These functions are achieved by using control sequences.

Two control sequences, Load VFU and End VFU, are used to enact the VFU load procedure. Besides loading the VFU, top–of–form is also defined. Top–of–form is determined by the actual paper position when the load VFU command is sent to the printer; therefore, be sure to align the paper at the desired top–of–form *before* sending the LOAD VFU command.

Load Vertical Format Unit (VFU)

ASCII Code `ESC [ < 1 h`

Hex Code `1B 5B 3C 31 68`

Dec Code `27 91 60 49 104`

Purpose Downloads the VFU from the host to the printer.

Discussion All data following the begin load sequence is placed in VFU memory except ASCII control codes. Any command entered during load VFU is ignored except the End Load sequence. During VFU load, a unique code is displayed on the control panel.

All data must be in the VFU load format. If an error occurs during the load, the load is cancelled. If a load overruns the maximum forms length, the load is cancelled and any remaining VFU data is printed. Cancelled loads default to the current form length setting (as set from the control panel or with the DECSLPP escape sequence).

VFU load format consists of 2 bytes (one byte pair) for each line on the page. The structure of each byte follows:

Table 7–10. Byte 1 Structure (First Character of Pair)

Bits:	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Values:	x	1	C6	C5	C4	C3	C2	C1

The following define the values in Table 7–10:

Bit 7 is not used.

Bit 6 is always 1.

Bits 5 – 0 represent channels with binary 1s and 0s.

Bit 1 has a channel present.

Bit 0 has no channel.

Load Vertical Format Unit (VFU) (continued)

Table 7–11. Byte 2 Structure (Second Character of Pair)

Bits:	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Values:	x	1	C12	C11	C10	C9	C8	C7

The following define the values in Table 7–11:

C1 – C12 are channels 1 through 12.

C1 identifies top–of–form (TOF).

C12 identifies bottom–of–form (BOF).

End Load (VFU)

ASCII Code `ESC [ < 1 l`

Hex Code `1B 5B 3C 31 6C`

Dec Code `27 91 60 49 108`

Purpose Ends the Vertical Format Unit load.

Discussion When all VFUs are loaded, enact End Load VFU and the form length set is complete.

Channel Command

ASCII Code `ESC [ nnn & y`

Hex Code `1B 5B nnn 26 79`

Dec Code `27 91 nnn 38 121`

Purpose The channel commands control paper motion.

`nnn` is the channel number. When the first n equals 0, forward paper motion occurs. When the first n equals 9, reverse paper motion occurs. If the first n equals any value other than 0 or 9, the entire sequence is ignored.
Table 7–12 gives the values of nnn for each channel.

Table 7–12. Channel Values

nnn	Move Forward to Channel	nnn	Move Backward to Channel
000	1	900	1
001	2	901	2
002	3	902	3
003	4	903	4
004	5	904	5
005	6	905	6
006	7	906	7
007	8	907	8
008	9	908	9
009	10	909	10
010	11	910	11
011	12	911	12*
Selecting any other channel than those in this table results in a default to channel 12.			

Beware of the following conditions when the selected channel is in the forward direction:

- If you try to print text at a channel not previously defined, the text prints at channel 12 (BOF).
- If you try to print text at a channel not previously defined and channel 12 is also undefined, text prints at the next line.

Channel Command (continued)

- If a VFU table is not loaded and channel commands are sent to it, a line feed occurs then the text prints.
- If you load a VFU table with more than one TOF and/or more than one BOF already defined, the load is terminated and a warning message is displayed on the front panel.

Beware of the following conditions when the selected channel is in the reverse direction:

- If you try to print text at a channel not previously defined, a reverse line feed occurs then the text prints.
- If you try to print text at a channel not previously defined and channel 12 is also undefined, a reverse line feed occurs then the text prints.
- If a VFU table is not loaded and channel commands are sent to it, a reverse line feed occurs then the text prints.
- If you load a VFU table with more than one TOF and/or more than one BOF already defined, the load is terminated and an error code of ??? is displayed on the front panel.

Forms

A form contains data. This data is a sequence of self–contained commands and text that can occupy one or more pages of the form. The data form can be downloaded then stored in printer memory for later use. The status report lists the form IDs loaded in the printer.

Once a form is downloaded, it is selectable. Stored data is merged with the fill–in data stream, and the merged data is printed as a completed form. When selected, the printed form can be printed repeatedly with different sets of fill–in data.

Fill–in data is a sequence of commands and text, usually variable and not repeated data, used to fill in the empty fields of a form. Each fill–in data field is terminated with a switch character, as explained in the following section. The fill–in data for the last field of a page must terminate with a switch character unless it is the last page of a form. In this case, use the Terminate Form sequence.

Forms and fill–in data conform to the following :

- Forms cannot be nested.
- Up to 32 forms can be loaded into the printer, subject to available memory.
- Form size must not exceed 65K bytes.
- Each form page must terminate with FF (0/12) and have at least one field.
- Do not use a form–feed character for fill–in data.

The following sections describe how to load a form into memory, select the form for printing, terminate form generation, and delete the form from storage.

Loading Forms Sequence (DECLFM)

ASCII Code `DCS P1 ; P2 & p RECORD ST`

Hex Code `90 P1 3B P2 26 70 RECORD 9C`

Dec Code `144 P1 59 P2 38 112 RECORD 156`

Purpose Allows you to load forms into printer memory.

Discussion The `Pn` parameters define the format of the form as well as which forms to delete. Forms can be loaded at any time except during another download operation, or while a form is printing. Once loaded, forms are selectable until:

- New forms are loaded with the P2 = 3 (replace all forms) command
- Another form with the same number is loaded (replacing the old form)
- System power is turned off (all loaded forms are lost)

P1 and P2 can be defined as follows:

- P1 is the form file indicator that specifies the form file format used in the command string. The value must be 0 and the file must be in the form file format, otherwise the entire load form sequence is ignored.

P1	Function
0	LG02 form file format
Other	Sequence is ignored

- P2 defines the replacement action: which forms to delete before the new form is loaded. If you choose to replace all forms, note that the forms are deleted even if the new form is not successfully loaded.

P2	Function
0/Missing	Replace the named form
3	Replace all forms

Loading Forms Sequence (DECLFM) (continued)

The form record includes a form header that defines form parameters and size, and the form data string. This information is contained in the format header and includes:

- ID length is a two digit number (01 – 99) that defines the length of the form ID.
- Form ID is a string of 1 – 99 printable characters. IDs exceeding 10 characters are truncated.

The control–character encoding character indicates the start of control–character encoding. The character is always in the 2/0 through 7/14 range and is followed by a two digit hexadecimal number equivalent to the ASCII value of the control character to be encoded.

Every control character must be entered in its hexadecimal format and preceded by the control character. Do not embed a control character (0/0 through 1/15) in the form string. The following control characters and their hexadecimal values are allowable:

Control Char.	Function	Control Char.	Function
BEL	07	ESC	1B
BS	08	IND	84
HT	09	NEL	85
LF	0A	HTS	86
VT	0B	VTS	87
FF	0C	PLD	8A
CR	0D	PLU	8B
SO	0E	RI	8C
SJ	0F	SS2	8E
CAN	18	SS3	8E
SUB	1A	CSI	8E

All printable characters (except control characters) are encoded in the same manner. For example, to embed the control sequence: ESC [100 ‘, (CSI 100 ‘) into the form, replace ESC with the control–character encoding character (^) and the hexadecimal value for ESC (1B). The form’s sequence is ^1B[100‘.

Loading Forms Sequence (DECLFM) (continued)

- Form Data Switch Character designates the insertion of the form's fill–in data. The character, considered a field indicator character, is always in a range from 2/0 through 7/14. The form–data switch character must be different from the control–character encoding character. The form data switch character is not printable within the form and should not be used in any control sequence in the form.
- Form length is a five digit number, 00001 through 65,000) that defines the length of the string to follow. The string count includes all character other than uncoded control characters (0/0 through 1/15).
- Form Data String is the constant portion of the form: the data. Form data is a string of text and command sequences with encoded control characters. Terminate the string with an ST command. Uncoded control characters (other than ESC), act as formatting characters for editors. Though you can embed them in the form data string, they are not part of the form.

Form Types

A form can be printed in Print mode, in Plot mode, or in a combination of Print and Plot mode.

- In Plot mode, all positioning should be fully specified by the Digital positioning commands. The entire form is plotted if the following conditions exist:

  Contains any graphics (block characters, bar codes, vectors, logos)

  The pitch of the font does not exist in print mode

  The form uses justified text

- In Print mode, all positioning is controlled by the CR, LF, and tabs control characters. The entire form is printed if:

  It contains justified text and no font changes occur within a line

  It does not violate any other conditions of Print mode

Start Forms Sequence (DECIFM)

ASCII Code `DCS P1 & r FORM NAME ST`

Hex Code `90 P1 26 72 FORM NAME 9C`

Dec Code `144 P1 38 114 FORM NAME 156`

Purpose Selects any form loaded in RAM.

Discussion P1 is the Select Form Switch character. With this sequence, a form loaded in RAM is selectable for printing. When you select the form, the printer enters Form mode. The variable fill–in data is merged and printed with the form data. When the printer encounters a FF character in the form data portion of a multiple page form, it advances to the next page and continues merging with the fill–in data that follows. If there is more than one set of fill–in data, the same form constant data is merged with the new fill–in data to create additional forms.

The select form switch character always ranges from 2/0 through 7/14 decimal and designates the print source to switch back to form data (to the character after the form data switch character). The character does not have to be the same as the form data switch character; however, it is not printable within the fill–in data string.

The form name is the first ten characters of the loaded form's ID (or the full form ID if it is ten characters or less in length). If no such form exists, an error message displays and the fill–in data is printed as text data.

Note that the text and command strings corresponding to the last field of a multi–page form page must terminate with a switch character. However, the last field in the last page of a form must terminate with the Stop Form sequence and not with the switch character. To exit Form mode, enter a Terminate sequence.

Many special conditions might affect the printer output or performance in its various uses. See "Forms Considerations," page 7–55, for further information regarding these conditions.

Terminate Forms Sequence (DECTFM)

ASCII Code `ESC # SP 1`

Hex Code `1B 23 20 31`

Dec Code `27 35 32 49`

Purpose Terminates the printing of a form.

Discussion If no form is selected, this sequence is ignored.

Many special conditions might affect the printer output or performance in its various uses. See “Forms Considerations,” page 7–55, for further information regarding these conditions.

Delete Forms Sequence (DECDFM)

ASCII Code `DCS Ps & q FORMS ID ST`

Hex Code 90 Ps 26 71 FORMS ID 9C

Dec Code 144 Ps 38 113 FORMS ID 156

Purpose Deletes forms from printer memory.

Discussion Ps selects the forms to be deleted. The Form ID string identifies the forms to be deleted. If more than one Form ID is listed, separate them with colons. Form IDs with more than ten characters are ignored.

Ps	Function
0	Delete forms with the same name
3	Delete all stored forms

If you try to delete forms, logos, or fonts while they are printing, the printer will ignore the delete command.

Many special conditions might affect the printer output or performance in its various uses. See “Forms Considerations,” page 7–55, for further information regarding these conditions.

Forms Considerations

The following commands are not to be included in form data or fill–in data:

- Load a form, logo, or font
- Delete a form, logo, or font
- Invoke a Digital sequence
- Invoke a ESCc (RIS) sequence. This will exit you from the Form mode.

Be aware of the following conditions, which can affect the printer's output/performance in Forms mode:

- To minimize paper movement, print all text together and print all graphics together. Most importantly, print all of the same density material together.
- Encoded Escape sequences cannot start in the form and continue in the fill–in data, nor can the reverse occur.
- Changes made to the font, cursor position, density, or mode are not restored after you terminate a Form sequence.
- Block character used in a form must begin and end on the same page. Form data switch characters and select form sequence switch characters are not printable as block characters unless they are encoded.
- Since mode settings, fonts, and spacing parameters can be changed between the time the form is loaded and the item it is selected, the environment of the form (PUM or SSU) should be established in the form data.
- If ESC, CAN, or SUB is embedded in the form string, it will terminate form loading and the form will be discarded. Encoding DCS, RIS, CAN, or SUB in a form string will also stop form loading.
- If the form length in the header does not agree with the length of the form string received, the form is discarded.
- If the form is not terminated by a form feed (0/12), and does not contain at least one form–switch character, a form–switch character and an 0/12 are added at the end of the form.
- In general, the number of switch characters in the form data should be one more than the number of switch characters in the fill–in data.

Forms Considerations (continued)

When using bar codes, note the following:

- When using bar codes as part of the form data, make sure that the control character encoding character in the bar code differs from the control character encoding character and the switch character in the Loading Form sequence.
- When using bar codes as part of the fill–in data, make sure that the control character encoding character of the bar code differs from the switch character in the Select Form sequence.
- Bar codes must start and end on the same page of a form.

Request Forms Status (DECFMSR)

ASCII Code `CSI & ~`

Hex Code 9B 26 7E

Dec Code 155 38 126

Purpose Requests a status report of the forms available for printing.

Discussion Invoke this request if you need to know what forms are available for printing.

Form Status Report (DECRFMS)

ASCII Code `DCS & s FORM STRING ST`

Hex Code 90 26 73 FORM STRING 9C

Dec Code 144 38 115 FORM STRING 156

Purpose Printer response to a DECRMFS sequence.

Discussion The status string contains a list of all valid forms loaded in the printer. Each form name starts on a new line and is separated by commas.

Logos

A logo is a graphic image stored in the printer. Once a logo is downloaded, it can be printed repeatedly by referring to its identifying number. Up to 16 logos can reside in the printer, with a maximum size of 65,000 bytes per logo. The following subsections explain various ways in which to utilize the logo feature.

Loading Logos Sequence (DECLLG)

ASCII Code `DCS P1 ; P2 & t RECORD ST`

Hex Code 90 P1 3B P2 26 `74 RECORD`

Dec Code 144 P1 59 P2 38 `116 RECORD`

Purpose Loads logos into printer memory.

Discussion `Pn` parameters select the format and the logos to be deleted before loading this form.

- P1 specifies the logo file indicator that chooses the logo file format used in the command string. The indicator number must be 0 and the file must be in the LG02 logo file format. If not, the entire load logo set is ignored. Default: P1 = 0.
- P2 lists the logos to be deleted.

P2	Function
0	Delete all logos
Others	Delete any logo with the same Logo ID as this one

Logos can be loaded at any time except during another download operation and during a form printing operation. When loaded, they are available for selection until:

- New logos are loaded with P2 = 3 (replace all logos).
- A logo with the same number is loaded (the new logo, though the same number, will replace the old).
- System power is turned off (all loaded logos are lost).

Loading Logos Sequence (DECLLG) (continued)

The logo record includes all data after the final character (t) and up to the string terminator, as well as the logo header portion and the row data strings portion. The logo header contents identify the logo and the size (number of characters) of the row data string. The logo record variables include:

- ID Length is a one digit number (1 through 4) that defines the length of the logo ID.
- Logo ID is a string of one to four numerals that identify the log.
- Comment Length is a one digit number (0 through 7) that defines the length of the comment field. The comment field provides additional logo information, and appears in the status report; however, it is not part of the logo identification. Also listed on the status report are the IDs and the comment field of the logos available in the printer.
- Logo Length is a five digit number (00001 through 65,000), that defines the length of the logo record. The logo length includes all characters other than CO control characters (0/0 through 1/15).

The row data string consists of one or more row records describing the format of the logo image. Within this string is a row record, which is a sequence of parameters that define the height and length of the black and white segments in mils. A row sequence has the following format: r;s; n1;n2;...\ where the following is true:

r = height of the segment in mils
s = row starting color. Defines whether the row starts with a white (0) or a black (1) segment.
ni = length of the segment in mils
\ = row terminator

Note that none of the above parameters should exceed 65,000 in value. Editing control characters such as CR and LF, can be embedded within the logo record.

Select Logo Sequence (DECILG)

ASCII Code `CSI Pn & }`

Hex Code 9B Pn 26 7D

Dec Code 155 Pn 38 125

Purpose Prints selected logos present in printer memory.

Discussion Pn defines the ID of the selected logo. If no logo exists for that ID, the sequence is ignored. Logos are printed in the current page orientation and graphics density.

Before you select a logo sequence, set the logo density with DECSGD and the orientation. When the logo sequence is complete, reset the density and the cursor position. At the end of a Select Logo sequence, the cursor returns to the logo starting position.

If the height of the segments is not an integral multiple of the density selected, the size of the printed logo might change due to accumulated round–off errors. To maintain a uniform size, only print logos in the densities for which they were designed.

Deleting Logos Sequence (DECDLG)

ASCII Code `CSI P1 ; P2 ; ... ; Pn & |`

Hex Code 9B P1 3B P2 3B 2E2E2E 3B

Dec Code 155 P1 59 P2 59 464646 59

Purpose Deletes logos from printer memory.

Discussion P1 defines the logos to be deleted:

P1	Function
0	Delete all logos whose IDs are listed
3	Delete all stored logos

When P1 = 0, parameters P2 through P16 make up the ID of the logos to be deleted. You can select up to 16 logo IDs to delete. Deleting a logo within a form is not allowed.

Request Logo Status (DECRLGS)

ASCII Code `CSI ‘ p`

Hex Code `1B 27 70`

Dec Code `27 39 112`

Purpose Gives a status report of the logos available for printing.

Discussion Invoke this request if you need to know what logos are available for printing.

Logo Status Report (DECLGSR)

ASCII Code `DCS & w LOGO STRING ST`

Hex Code `90 26 77 LOGO STRING 9C`

Dec Code `144 38 119 LOGO STRING 156`

Purpose Reports the logo status in response to the DECRLGR sequence.

Discussion The logo string contains a list of all the valid logos loaded in the printer and their comment strings. Each logo number and comment start on a new line and is separated by commas, as shown in the following example:

Logo #	Comment
1	Square
3	Rectangle
12	Rhombus

Page Print Area and Margins

The LG06 and LG12 have no print area limitations; however, smaller page areas can be selected by using the Page Format Select (PFS) sequence.

Figure 7–1 shows the two types of page orientation: portrait and landscape. If you select the suggested fonts, the print areas are:

Portrait font:	66 lines per page 132 characters per line
Landscape font:	66 lines per page 132 characters per line

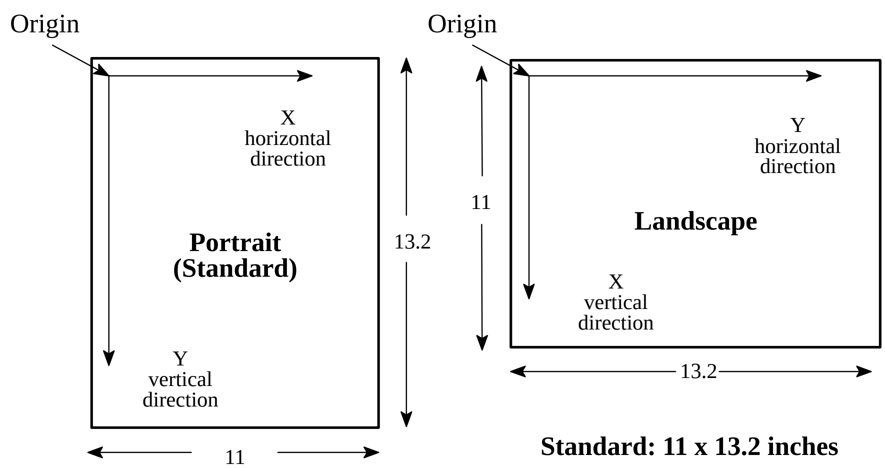


Figure 7–1. Page Printing Orientations

In portrait mode, text or graphics prints horizontally (across the paper loaded in the printer). The maximum printed area is 6600. In landscape mode, text or graphics prints vertically (from bottom to top of the paper loaded in the printer). The maximum printed area is 7920.

Changing the Print Area

You can change the print area two ways:

1. Set the printed page to one of the predefined formats using the Page Format Select (PFS) sequence (see page 7–64). PFS permits you to set page format with one command.

2. Change the page margins and the number of lines per page with these sequences:

   d. Set Lines Per Physical Page (DECSLPP)

   e. Set Top and Bottom Margins (DECSTBM)

   f. Set Left and Right Margins (DECSLRM)

Page Format Select (PFS)

ASCII Code `ESC [ Ps SP J`

Hex Code `1B 5B Ps 20 4A`

Dec Code `27 91 Ps 32 74`

Purpose Selects a page format from a list of predefined formats.

Discussion `Ps` selects one of 12 page formats. Two kinds of format are available: normal and extended.

In the normal page format, the page home line is 0.5 inches below the top margin, and the page end line is 0.833 (5/6) inches above the bottom margin. Normal page formats are:

Ps	Format
0	Portrait text communication (default)
1	Landscape text communication
2	Portrait A4 (210 mm x 297 mm)
3	Landscape A4
4	Portrait North American (NA) letter
5	Landscape North American letter

In the extended page format, the page home line is at the top margin, and the page end line is at the bottom margin. Extended page formats are:

Ps	Format
6	Portrait extended (extend) A4 format
7	Landscape A4
?20	Portrait North American Digital private
?21	Landscape North American Digital private
?22	Portrait A4 Digital private
?23	Portrait A4 Digital private
?28	Portrait line printer: 11 inches high x 13.2 inches wide
?29	Landscape line printer: 13.2 inches high x 11 inches wide

The line home and line end positions serve as the left and right edges of the printed page for justified text. The line home position is the active position after a carriage return (CR). A carriage return may move the active position forward or backward in order to reach the line home position.

Page Format Select (PFS) (continued)

The page home line is the active line after a form feed (FF). The index (IND), next line (NL), and carriage return characters cause a form feed when they pass the page end line. Use the vertical position absolute and relative (VPA and VPR) sequences to move below the page end line. If a line feed passes the page end line, the printer prints the current page and performs a form feed to get to the next page.

`Ps` parameters 0 through 7 are public (ANSI) parameters: ASCII values 0 through 7. The other four `Ps` parameters are defined by Digital and are called Digital private parameters. These always start with the **?** (3/15) character. The kind of parameters used affect page format. If you chain commands, do not mix Digital private parameters with public parameters.

Table 7–13 shows the printable area selected with each PFS format. Text area is for justified text.

Table 7–13. Paper Dimensions Using PFS Formats

Minimum Paper Dimensions Ps	Width	Length	Print Area (Inches) Width	Length	Text Area (Inches) Width	Length	Default Lines*
Normal Page Formats:							
0	8.5	11.0	7.7	10.5	7.2	9.17	55
1	11.0	8.5	10.5	7.7	10.0	6.34	38
2	8.0	11.5	7.7	11.0	7.2	9.83	58
3	11.5	8.0	11.0	7.67	10.5	6.33	37
4	8.5	11.0	8.0	10.5	7.5	9.17	55
5	11.0	8.5	10.5	8.0	10.0	6.5	39
Extended Page Formats:							
6	8.0	11.0	7.7	11.0	7.2	11.0	66
7	11.0	7.5	11.0	7.33	10.5	7.33	44
?20	8.5	11.0	8.0	10.56	8.0	10.56	63
?21	11.0	8.5	10.0	8.5	9.68	8.0	48
?22	8.0	11.0	7.73	10.88	7.73	10.56	57
?23	10.5	8.0	9.68	7.92	9.68	7.92	47
?28	14.0	11.0	13.2	11.0	13.2	11.0	66
?29	11.0	14.87	11.0	13.2	11.0	13.2	79
*The number of lines available at the initial vertical spacing of 6 lines per inch.							

Page Format Select (PFS) (continued)

Table 7–14 shows the lines per page and the characters per line selected with the normal and extended PFS formats.

Table 7–14. Lines Per Page and Characters Per Line Using PFS Formats

Ps	Format Description	Lines Per Page in Text Area (Lines Per Inch)				Chars. Per Line in Text Area (Characters Per Inch)			
		8	6	4	3	1	12	15	6
Normal Page Formats:									
0	Portrait text comm.	73	59	36	27	72	86	108	43
1	Landscape text comm.	50	38	25	19	100	120	115	60
2	Portrait A4	79	59	39	29	72	86	108	43
3	Landscape A4	50	38	25	19	105	126	157	63
4	Portrait NA letter	73	55	36	27	75	90	112	45
5	Landscape NA letter	52	33	26	19	100	120	150	60
Extended Page Formats:									
6	Portrait extended A4	88	66	44	33	72	86.4	108	115.2
7	Landscape A4 format	58.4	43.98	29.32	21.99	105	126	157.5	168
?20	Portrait NA Digital	85	63	36	27	80	96	120	48
?21	Landscape NA Digital	63	47	26	19	100	116	150	60
?22	Portrait A4 Private Digital	84	63	42	31	73	87	109	43
?23	Landscape A4 Private Digital	63	47	31	23	96	116	145	79
?28	Portrait line printer	88	66	44	33	132	158	198	79
?29	Landscape line printer	105	79	52	39	110	132	165	66

Table 7–15 shows the printable area extending beyond the text area when working in normal and extended PFS formats.

Table 7–15. Printable Area Extending Beyond Text Area in PFS Formats

Ps	Format Description	Lines Above/Below Text Area (Lines Per Inch)				Char. Pos. to Left/Right of Text (Characters Per Inch)			
		8	6	4	3	10	12	15	6
Normal Page Formats:									
0	Portrait text comm.	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
1	Landscape text comm.	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
2	Portrait A4	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
3	Landscape A4	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
4	Portrait NA letter	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
5	Landscape NA letter	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
Extended Page Formats:									
6	Portrait extended A4	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
7	Landscape A4 format	4/6	3/5	2/3	1/2	5/2	6/2	7/3	3/0
?20	Portrait NA Digital	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
?21	Landscape NA Digital	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
?22	Portrait A4 Private Digital	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
?23	Landscape A4 Private Digital	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
?28	Portrait line printer	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
?29	Landscape line printer	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0

NOTE: After a power–up or reset sequence, no page format is selected. Reset the printer with the Soft Terminal Reset (DECSTR) or the Reset to Initial State (RIS) sequence.

Backward Compatibility

The page formats described in this section are compatible with previous Digital printers. That is, the line home position is the first printable position on the left of the page, and the page home line is the top line on the page.

Likewise, the private PFS values, ?20 through ?23, set the margins, the line home position, and the page home line to the edge of the printable area, for compatibility with previous Digital printers. The PFS values depend upon the values in effect for character and line spacing.

Set Lines Per Physical Page (DECSLPP)

ASCII Code `ESC [ Pn t`

Hex Code `1B 5B Pn 74`

Dec Code `27 91 Pn 116`

Purpose Defines form length.

Discussion A form's length equals the maximum distance the paper moves when a form feed command is issued. Maximum form length is 33 inches.

DECSLPP sets the top margin to 1 and the bottom margin to the form length. Form length limits the range of possible settings for the Set Top and Bottom Margins (DECSTBM) sequence.

`Pn` sets the form length, subject to the limits discussed above. If `Pn` is 0 or is greater than the maximum size for the paper and origin, the form length will automatically be set to the maximum for the paper and origin. Units of measurement are character cells, decipoints, or pixels. Select the unit by using the Position Unit Mode (PUM) and Select Size Unit (SSU) sequences. If you use character cells, the height of each cell equals the current line height setting. You can change line height by changing the vertical spacing.

Initial value: `Pn` = 0. If a `Pn` value is not set, the form length is set to 66 lines.

Other control sequences are specified in "Forms," page 7–48.

Set Top and Bottom Margins (DECSTBM)

ASCII Code `ESC [ Pn1 ;  Pn2 r`

Hex Code `1B 5B Pn1 3B Pn2 72`

Dec Code `27 91 Pn1 59 Pn2 114`

Purpose Sets the top and bottom margins, and the page home line. These settings are relative to the current origin point for page coordinates. (Refer to "Page Format Select" on page 7–64.)

Discussion `Pn1` sets the top margin and the page home line. `Pn2` sets the bottom margin. If the first parameter is greater than the second parameter, the printer will ignore the sequence. The unit of measurement can be character cells, decipoints, or pixels. Select the unit by using the Position Unit Mode (PUM) and Select Size Unit (SSU) sequences. If you use character cells, the height of each cell equals the current line height setting. Change line height by changing the vertical spacing.

The top vertical margin defines the first printable line on a page. The bottom vertical margin defines the last printable line. These are called hard margins because you cannot print outside the area defined by the margins. The page home line is the position of the first printable line on the page after a form feed (FF).

Margins settings go into effect as soon as they are received. The printer will set the margins where specified, except in the following cases:

- If `Pn1` = 0 or is omitted, the top margin is unchanged.
- If `Pn2` = 0 or is omitted, the bottom margin is unchanged.
- If `Pn2` is greater than the form length, the bottom margin is set at the bottom of the form.
- If the active position is less than the new top margin, the active position is set to the new top margin. If the active line is greater than the new bottom margin, the next printable character causes a form feed (FF).
- If the sequence sets the top margin below the bottom margin, the command is ignored.
- The printer does not permit any part of the character box to be greater than the bottom margin line or less than the top margin line.

If the form length is changed, the printer sets the top margin to line 1 and the bottom margin to the form length.

Set Left and Right Margins (DECSLRM)

ASCII Code `ESC [ Pn1 ;  Pn2 s`

Hex Code `1B 5B Pn1 3B Pn2 73`

Dec Code `27 91 Pn1 59 Pn2 115`

Purpose Sets the left and right margins.

Discussion `Pn1` sets the left margin and the line home position. `Pn2` sets the right margin. If the first parameter is greater than the second parameter, the printer will ignore the sequence. The unit of measurement can be character cells, decipoints, or pixels. The maximum allowable value of the `Pn1` parameter is always one less than the `Pn2` parameter.

The left horizontal margin defines the first printable position on a line. The right horizontal margin defines the last printable position on a line. These are called hard margins because you cannot print outside the area defined by the margins, except under two conditions:

1. Using the Drawing Vectors (DECVEC) sequence, you can draw lines outside the margins.

2. If you justify text, but the spacing between words is less than the minimum specified width of the space character, the text will print unjustified and will exceed the right margin.

Margins settings go into effect as soon as they are received. The printer will set the margins where specified, except in the following cases:

- If `Pn1` = 0 or is omitted, the left margin is unchanged.
- If `Pn2` = 0 or is omitted, the right margin is unchanged.
- If `Pn2` is greater than the printable width, the right margin is set to the right printable limit.
- If the sequence sets the left margin to the right of the right margin, the command is ignored.
- If the active position is less than the new left margin, the active position is set to the new left margin.

Set Left and Right Margins (DECSLRM) (continued)

- If Autowrap is enabled and the active position is grater than the specified right margin, the next printable character causes a carriage return/line feed before the next character is printed. If Autowrap is disabled (truncated), the characters that follow this command are ignored until the cursor is returned to the printable area.
- When character pitch is changed but the same physical margins are desired, reset the margins using this escape sequence before sending data. Changing horizontal pitch resets the left and right margins to their printable limits (column 1 and the furthest right position, respectively).

Active Column and Active Line (Cursor Motion)

This section describes cursor positioning command sequences. Line printers do not have a cursor like the blinking place–marker on most computer screens. The cursor position on a line printer is the space where the next character will print. In this manual, cursor refers to the currently active print position. Its location is the intersection of the active column and active line. Horizontal and vertical positioning command sequences allow you to move the active position anywhere on the logical page.

You can also specify either absolute or relative motion. Absolute motion specifies the distance to move from a specific point on the logical page. Relative motion specifies the distance to move from the currently active print position.

The Partial Line Up (PLU) and Partial Line Down (PLD) command sequences set half line increments for superscripting and subscripting.

NOTE: Next Line (NEL), Reverse Index (RI), and Index (IND) control characters also move the active position. (Refer to Table 7–2.)

Forward Index (IND)

ASCII Code `ESC D`

Hex Code `1B 44`

Dec Code 27 68

Purpose Causes the active position to move to the following line's corresponding horizontal character position.

Discussion `Pn` specifies the active position.

Attempts to move the cursor below the bottom margin cause the cursor to move to the corresponding horizontal position on the first printable line of the next form.

In 8–bit mode, the Forward Index 8–bit control code can be used for this function (refer to "Control Characters," page 7–6).

Reverse Index (RI)

ASCII Code `ESC M`

Hex Code `1B 4D`

Dec Code 27 77

Purpose Causes the active position to move to the corresponding character position of the preceding line.

Discussion `Pn` specifies the active position. The Reverse Index command causes the active position to stop at the top of the margin.

In 8–bit mode, the Reverse Index 8–bit control code can be used for this function (refer to “Control Characters,” page 7–6).

Next Line (NEL)

ASCII Code `ESC E`

Hex Code `1B 45`

Dec Code 27 69

Purpose Causes the active position to move to the first character position on the following line.

Discussion If you try to move the cursor past the bottom margin, the cursor moves to the corresponding horizontal position on the first printable line of the next form.

In 8–bit mode, the Next Line 8–bit control code can be used for this function.

Horizontal Position Absolute (HPA)

ASCII Code `ESC [ Pn ‘`

Hex Code `1B 5B Pn 60`

Dec Code `27 91 Pn 96`

Purpose Selects the active column on the active line.

Discussion `Pn` value specifies the new active column. Default value: `Pn` = 1.

If you try to move the active column to the right of the last position on the line, the active position stops at the last position on the line.

Horizontal Position Relative (HPR)

ASCII Code `ESC [ Pn a`

Hex Code `1B 5B Pn 61`

Dec Code `27 91 Pn 97`

Purpose Moves the active column by adding the value `Pn` to the currently active column.

Discussion `Pn` is the value added to the currently active column. Default value: `Pn` = 1.

If you try to move the active column to the right of the last position on the line, the active position stops at the last position on the line.

Horizontal Position Backward (HPB)

ASCII Code `ESC [ Pn j`

Hex Code `1B 5B Pn 6A`

Dec Code `27 91 Pn 106`

Purpose Moves the active column backward by subtracting the value `Pn` from the currently active column.

Discussion `Pn` is the value subtracted from the currently active column. Default value: `Pn` = 1.

If you try to move the active column to the left of the first position on a line, the active position stops at the first position on that line.

Vertical Position Absolute (VPA)

ASCII Code `ESC [ Pn d`

Hex Code `1B 5B Pn 64`

Dec Code `27 91 Pn 100`

Purpose Causes the active position to be moved to the corresponding horizontal position at vertical position `Pn`.

Discussion `Pn` is the new active line at the currently active column. Default value: Pn = 1.

If Pn is less than the current active line, the active line moves backwards on the current page. If you try to move the active line below the bottom line, the active position stops at the bottom.

Vertical Position Relative (VPR)

ASCII Code `ESC [ Pn e`

Hex Code `1B 5B Pn 65`

Dec Code `27 91 Pn 101`

Purpose Moves the active line to the corresponding horizontal position by adding `Pn` the value to the currently active line.

Discussion `Pn` is the value added to the currently active line. Default value: `Pn` = 1.

If you try to move the active line below the bottom line, the active position stops at the bottom line.

Vertical Position Backward (VPB)

ASCII Code `ESC [ Pn k`

Hex Code `1B 5B Pn 6B`

Dec Code `27 91 Pn 107`

Purpose Moves the active position to the corresponding column at the preceding vertical position set by the `Pn` value.

Discussion `Pn` is the value subtracted from the currently active line. Default value: `Pn` = 1.

If you try to move the active line above the top line, the active position stops at the top line.

Cursor Up (CUU)

ASCII Code `ESC [ Pn A`

Hex Code `1B 5B Pn 41`

Dec Code `27 91 Pn 65`

Purpose Causes the active position to move to the corresponding column at the preceding vertical position set by the `Pn` value.

Discussion If you try to move the active position above the top line, the active position stops at the top line.

`Pn` is the number of lines that the active line moves up at the current active column. Default value: `Pn` = 1.

Partial Line Up (PLU) — Superscripting

ASCII Code `ESC L`

Hex Code `1B 4C`

Dec Code `27 76`

Purpose Print superscripted characters.

Discussion This sequence moves the active position up a distance equal to 1/2 a vertical line increment, as determined by the currently active font. The Partial Line Down (PLD) sequence returns the active position to the previous baseline.

The printer prints superscripted characters that go over the top page margin without disrupting the baseline of the superscripted characters. If PLU occurs while the active position is over the top margin, it has no effect; however, other active line affecting control functions still produce their distinctive effect.

For example, if the active line is over the top margin, a carriage return <CR> places the active line at the top of the margin and characters are imaged as superscript until disabled. If the active line is below the bottom margin, a carriage return <CR> performs a form feed and characters are imaged as superscripts until disabled.

Partial Line Down (PLD) — Subscripting

ASCII Code `ESC K`

Hex Code `1B 4B`

Dec Code `27 75`

Purpose Print subscripted characters.

Discussion This sequence moves the active position down a distance equal to 1/2 a vertical line increment, as determined by the currently active font. The Partial Line Up (PLU) sequence returns the active position to the previous baseline.

The printer prints superscripted characters that go over the top page margin without disrupting the baseline of the superscripted characters. If PLD occurs while the active position is over the top margin, it has no effect; however, other active line affecting control functions still produce their distinctive effect.

For example, if the active line is over the top margin, a carriage return <CR> places the active line at the top of the margin and characters continue to be imaged as superscript until disabled. If the active line is below the bottom margin, a carriage return <CR> performs a form feed and characters continue to be imaged as superscripts until disabled.

Tab Stops

A tab stop is a predetermined point to which the active position moves when you send the HT and VT tab commands. The active position is where the next character will print. A page can have a maximum of 32 horizontal tabs, and a maximum of 67 vertical tabs.

You can set horizontal and vertical tabs. The printer will ignore tab setting commands for tabs already set. Likewise, the printer will ignore tab clearing commands for tabs already cleared. The current origin of printing is the reference point for tabs.

Set Horizontal Tab Stops (DECSHTS)

ASCII Code `ESC [ Pn ;  ... ;  Pn u`

Hex Code `1B 5B Pn 3B ... 3B Pn 75`

Dec Code `27 91 Pn 59 ... 59 Pn 117`

Purpose `Pn` denotes a horizontal tab stop location.

Discussion DECSHTS allows you to select up to 16 horizontal tab stops at one time. Thirty–two possible horizontal tab stops are available, however, any sequence beyond 16 is ignored. The Pn values can be in any order in the escape sequence.

The unit of measurement can be character cells, decipoints, or pixels. It is selected by using the Position Unit Mode (PUM) and Select Size Unit (SSU) sequences. If you select character cells, the width of each cell equals the current character width setting. Character width is determined by setting the horizontal spacing.

When you assign a new tab stop value, each new tab stop value is inserted into the current tab stop list, starting after the old tab stop with the next lower value. If you assign more than the maximum of 16 new tab settings, the printer discards the old tab stop with the highest value before entering each additional new tab stop. If the new tab stop has the highest value and you have set the maximum allowed number of tab stops, the printer ignores the new tab stop.

If a tab stop is not on the boundary of a character cell, tabbing to that tab stop in print mode forces the printer to the nearest character position.

Set Horizontal Tab Stops (HTS)

ASCII Code `ESC H`

Hex Code `1B 48`

Dec Code `27 72`

Purpose Causes a horizontal tab stop to be set at the current position.

Discussion A horizontal tab stop can also be achieved in 8–bit mode by sending the HTS 8–bit control code.

Set Vertical Tab Stops (DECSVTS)

ASCII Code `ESC [ Pn ;  ... ;  Pn v`

Hex Code `1B 5B Pn 3B ... 3B Pn 76`

Dec Code `27 91 Pn 59 ... 59 Pn 118`

Purpose Sets vertical tabs at the rows indicated.

Discussion `Pn` denotes a vertical tab stop location. Select up to 16 vertical tabs in one sequence. Up to 67 vertical tab stops can be set per page. The default is set to stop at every line.

The unit of measurement can be character cells, decipoints, or pixels. It is selected by using the Position Unit Mode (PUM) and Select Size Unit (SSU) sequences. If you select character cells, the height of each cell equals the current character line–height setting. Character height is determined by setting the vertical spacing.

The printer sets vertical tab stops at positions you select. New tab stop values are added to the current tab stop list, starting with the lowest value to be added. If the number of tab settings exceeds the number of available positions, the printer ignores any tab stop after the 67 values are stored.

Set Vertical Tab Stops (VTS)

ASCII Code `ESC J`

Hex Code `1B 4A`

Dec Code `27 74`

Purpose Causes a vertical tab stop to be set at the current position.

Discussion A vertical tab stop can also be achieved in 8–bit mode by sending the HTS 8–bit control code.

Tab Clear (TBC)

ASCII Code `ESC [ Ps g`

Hex Code `1B 5B Ps 67`

Dec Code `27 91 Ps 103`

Purpose Clear one or all horizontal or vertical tab stops.

Discussion `Ps` selects which tab stops to clear.

Ps	Tab Clear Action
0	Clear one horizontal tab stop at the active position
1	Clear one vertical tab stop at the active line
2 or 3	Clear all horizontal tab stops
4	Clear all vertical tab stops

Soft Terminal Reset (DECSTR)

ASCII Code `ESC [ ! p`

Hex Code `1B 5B 21 70`

Dec Code `27 91 33 112`

Purpose Resets the value or state of several operating features.

Discussion After receiving a DECSTR, the printer positions itself at the next top of form, then resets the value or state of several operating features. Additionally, this command resets any event not reported in a Device Status Report (see "Device Status Reports," page 7–89). An event occurs when more than two intermediate characters are received by the printer. The printer notes this event, waits for the final character, then ignores the entire sequence.

Another way to reset the printer is via the RIS code. See 7–125 for specifics concerning this type of reset.

Character Set Selection

To make a character set available for printing, you must designate the set as either G0, G1, G2, or G3. The designated set is then invoked into GL or GR using single or locking shift, and can be used for printing.

National Replacement Characters (NRCs) are created by replacing the relevant characters in the U.S. ASCII character set upon receipt of the appropriate control sequences.

Single and Locking Shifts

A single shift (SS2 or SS3), effects only the first printable GL character following the single shift sequence (refer to “Special Parsing Requirements,” page 7–15).

A locking shift (LS2, LS3, LS1R, LS2R, or LS3R) persists until another locking shift is invoked.

Table 7–16 give the sequences that select the active character sets.

Table 7–16. Selecting Active Character Sets Using Single and Locking Shifts

Name	Mnemonic	Sequence (Escape/Hex)	Function
Single Shift 2	SS2	`ESC N` `1BH 4EH`	The character that follows SS2 selects from the G2 character set.
Single Shift 3	SS3	`ESC O` `1BH 4FH`	The character that follows SS3 selected from the G3 character set.
Locking Shift 0	LS0	`<SI>` `0FH`	The G0 character set becomes the active GL character set.
Locking Shift 1	LS1	`<SO>` `0EH`	The G1 character set becomes the active GL character set.
Locking Shift 2	LS2	`ESC n` `1BH 6EH`	The G2 character set becomes the active GL character set.
Locking Shift 3	LS3	`ESC o` `1BH 6FH`	The G3 character set becomes the active GL character set.
Locking Shift 1 Right	LS1R	`ESC ~` `1BH 7EH`	The G1 character set becomes the active GR character set.
Locking Shift 2 Right	LS2R	`ESC }` `1BH 7DH`	The G2 character set becomes the active GR character set.
Locking Shift 3 Right	LS3R	`ESC |` `1BH 7CH`	The G3 character set becomes the active GR character set.

Select Character Set Sequences (SCS)

The Select Character Set Sequence (SCS) assigns a character set to the G0, G1, G2, or G3 character set designators.

Table 7–17 give the sequences that select the available language sets.

Table 7–17. Selecting Language Sets Using Single and Locking Shifts

Character Set	G0	G1	G2	G3
U. S. ASCII	ESC (B	ESC) B	ESC * B	ESC + B
United Kingdom	ESC (A	ESC) A	ESC * A	ESC + A
Digital Finnish	ESC (5	ESC) 5	ESC * 5	ESC + 5
French (France)	ESC (R	ESC) R	ESC * R	ESC + R
Digital French (Canada)	ESC (9	ESC) 9	ESC * 9	ESC + 9
German	ESC (K	ESC) K	ESC * K	ESC + K
Italian	ESC (Y	ESC) Y	ESC * Y	ESC + Y
JIS Roman	ESC (J	ESC) J	ESC * J	ESC + J
Digital Norwegian/Danish	ESC (6	ESC) 6	ESC * 6	ESC + 6
Spanish	ESC (Z	ESC) Z	ESC * Z	ESC + Z
Digital Swedish	ESC (7	ESC) 7	ESC * 7	ESC + 7
Digital VT100 Special Graphics	ESC (0	ESC) 0	ESC * 0	ESC + 0
Digital Technical Set	ESC (>	ESC) >	ESC * >	ESC + >
ISO Norwegian/Danish	ESC (‘	ESC) ‘	ESC * ‘	ESC + ‘
Digital Dutch	ESC (4	ESC) 4	ESC * 4	ESC + 4
Digital Swiss	ESC (=	ESC) =	ESC * =	ESC + =
Digital Portugal	ESC (%6	ESC) %6	ESC * %6	ESC + %6
Digital Supplemental	ESC (%5 or ESC (<	ESC) %5 or ESC) <	ESC * %5 or ESC * <	ESC + %5 or ESC + <
ISO Latin		ESC – A	ESC . A	ESC / A
ISO Latin 2		ESC – B	ESC . B	ESC / B
ISO Latin 5		ESC – M	ESC . M	ESC / M
ISO Cyrillic		ESC – L	ESC . L	ESC / L
ISO Greek		ESC – F	ESC . F	ESC / F
ISO Hebrew		ESC – H	ESC . H	ESC / H
NOTE: Any other character following the above escape sequences cause the entire sequence to be ignored.				

Product Identification (DA)

ASCII Code	`ESC [ c`	`or`	`ESC [ 0 c`
Hex Code	`1B 5B 63`		`1B 5B 30 63`
Dec Code	`27 91 99`		`27 91 48 99`

Purpose Shows the product identification.

Discussion When the host computer sends a device attributes (DA) sequence, the printer immediately sends an answering sequence that identifies the printer. The printer will answer as follows:
LG06 Product ID ESC [? <45>c
1B 5B 3F 34 35 63

Printer Status Requests and Reports

The host computer can send Device Status Requests (DSRs) to the printer, which will then respond with status reports about its operational condition.

The printer will send brief or extended and solicited or unsolicited reports to the host. Unsolicited status reports are sent only when an error occurs and only when unsolicited status reports are specifically enabled. Unsolicited status reports are sent after the current page prints, and list each error type once.

Printer default is unsolicited reports disabled.

Device Status Requests (DSRs) and Printer Responses

The host computer sends the DSR sequences listed below to request status reports and to enable or disable unsolicited status reports.

Table 7–1. DSR Sequences

Request Sequence	Printer Response
CSI n *or* CSI 0 n	Send an extended status report
CSI 6 n	Send a cursor position report
CSI ? 1 n	Disable all unsolicited status reports from printer
CSI ? 2 n	Enable brief, unsolicited status reports and send an extended status report
CSI ? 3 n	Enable extended, unsolicited status reports and send an extended status report

NOTE: Unsolicited status reports, when enabled, are sent when any reportable status or error condition occurs. (Unsolicited reports are initially disabled.)

Printer responses to these commands are discussed on the following pages.

Device Status Requests (DSRs) (continued)

Printer Status Reports

The printer sends a Device Status Report (DSR) to the host via the serial line when requested by the host (DSR) or when unsolicited reports have been previously enabled and a reportable status condition has occurred. The host can request a brief or extended status report, as follows:

NOTE: The question mark (?) character occurs only once per DSR sequence.

- Brief, Unsolicited Messages Enabled:

Request Sequence	Printer Response
CSI n1 n	n1 = 3 If a malfunction is detected n1 = 0 After error condition has been corrected or if no malfunction exists

- Extended, Unsolicited Messages Enabled:

Request Sequence	Printer Response	
CSI 0 n	CSI ? 2 0 n	After error condition has been corrected or if no malfunction exists
CSI 3 n	CSI ? Pn ; ... Pn n	If a malfunction is detected

Specific error code (See Table 7–18.)

Generic error code (See Table 7–18.)

- Cursor Position Report: The unit of measurement can be character cells, decipoints, or pixels. It is selected by using the Position Unit Mode (PUM) and Select Size Unit (SSU) sequences.

Device Status Requests (DSRs) (continued)

Request Sequence	Cursor Position Report
CSI Pn1 ; Pn2 R	Pn1 is the active line Pn2 is the active column

Values of Pn (up to three digits) are defined in Table 7–18. Printer status codes are reported in pairs: a generic error code first, then a specific error code.

A hardware failure consists of any errors listed in “Self–test error messages” and “Font Checksum Errors found at Initialization.”

1. Communication failures are usually attributed to parity errors, framing errors, or receipt of an erroneous character.
2. Failures designated as events are reset only when an extended report is sent. If set for solicited reports, the events are reset only after the report is requested and reported. If set for unsolicited reports, the report is immediately sent and the event cleared.
3. RIS and DECSTR reset any event not reported.
4. All non–events are not latched, but continuously reflect the current state of the relevant parameter.

Table 7–18. Printer Status Error Codes

Generic Fault Codes	Specific Number Codes	LCD Display Message
21	134	Req Font Deleted
24	125	Off–Line
25		Paper Jam
26		Cover Open
27	206	Paper Out
31	907	Err in Font S/W*
31		Emul Switch Err*
32	216	Paper Fault
36	220	Platen Open
37	222	Bad Font Data
38	229	Ribbon Stall
40	124	Char. Not In Font
41	101	Page Too Complex
41	102	Margins Exceeded
41	105	Page Too Big
41	108	Out of Form Mem
42	112	Font Load Fault
43	116	Invalid Params
44	103	Too Many Fonts
44	108	Too Many Forms
44	109	Too Many Logos
47	113	Too Many Errors
48	118	Bad Form Data
48	119	Bad Logo Data
48	140	VFU Seq. Error
48	141	VFU Load Fmt Err
48	142	VFU TOF/BOF Err

Assigning and Selecting Font Files

Each font file stored in printer ROM includes data for one of the three standard character sets: ASCII, DEC Supplemental, and DEC Technical.

Each font file also includes data for one font, which is part of a type family. You can identify font files by *type family ID*, *font ID*, and *font file ID*. (Refer to Appendix E.)

The type family ID consists of seven characters. The type family IDs for the standard type families used with ROM–resident font files are listed below.

Type Family	**Identification (ID) String**
Data Processing	DBULTN1
Compressed Print	DCMPRSS
Correspondence Plot	DCRRSPL
Correspondence Print	DCRRSPN
Draft Plot	DDRAFT0
High Speed Draft Print	DDRAFT1
LG Near Letter Quality	DLGNRLQ
Low Density Plot	DLODENS
OCR A	ROCRA00
OCR B	ROCRB00

The font ID has 16 characters (no lowercase letters permitted) and describes the seven basic font attributes (including type family) of the ROM–resident fonts. Appendix E lists the standard type family, font, and font file IDs for the ROM–resident files.

To make a font file available for printing, you must assign a Select Graphic Rendition (SGR) number (page 7–93) to the file. Then you can select the SGR number for printing (page 7–95).

Default Fonts

When you power up or reset the printer, it selects SGR number 10 for printing and data processing, and SGR number 19 for plotting and LG Near Letter Quality, unless you have selected and saved another default.

Assign Type Family or Font (DECATFF)

ASCII Code `DCS Ps1 ; Ps2 } ID String ST`

Hex Code `90 Ps1 3B Ps2 7D ID String 9C`

Dec Code `144 Ps1 59 Ps2 125 ID String 156`

Purpose Assigns a GSR number to a font ID or type family ID.

Discussion To select fonts for printing or plotting graphics, you must assign a Select Graphic Rendition (SGR) number to the type family ID (seven characters) or font ID (16 characters). Each font file contains an ID string as part of its font record.

The assign font number sequence assigns a type family ID or a font ID to the indicated SGR number. You can then use the select font sequence to select the font for printing.

Ps1 Parameter

Ps1 selects which font assignment to perform:

Ps1	Function
0	Same as 1 (default)
1	Assign font ID to SGR number
2	Assign type family ID to SGR number

Ps2 Parameter

Ps2 selects the SGR number to assign to the type family ID or font ID. The following table indicates the SGR number assignment at power–up:

Ps2 SGR	Assignment	ID	Font or Type Family
10	Type Family	DBULTN1	Data Processing (print font)
11	Type Family	DCRRSPN	Correspondence Print (print font)
12	Font	ROCRA00	OCR A (print font)
13	Font	ROCRB00	OCR B (print font)
14	Type Family	DCMPRSS	Compressed (print font)
15	Type Family	DDRAFT1	High Speed Draft (print font)
16	Type Family	DLODENS	Low Density Plot (plot font)
17	Type Family	DCRRSPL	Correspondence Plot (plot font)
18	Type Family	DDRAFT0	Draft Plot (plot font)
19	Type Family	DLGNRLQ	LG Near Letter Quality (plot font)

Type Family ID or Font ID String

The type family ID or font ID identifies which font file to assign to the SGR number (Ps2). You must use only uppercase letters for a type family ID or a font ID.

You can assign up to 10 fonts at one time. Font Assignments may occur anywhere in the data stream. You can send an unlimited number of assign–font–number sequences to the printer.

The printer will accept an ID for a font file not currently stored, but if you try to print or plot a character from the missing font file the printer prints a filled–in rectangle instead. If you assign an ID to an SGR number that already has an ID assigned, the new assignment replaces the old one.

Selecting Fonts for Printing (SGR)

ASCII Code `CSI Ps m`

Hex Code `9B Ps 6D`

Dec Code `155 Ps 109`

Purpose Selects fonts for printing or plotting.

NOTE: This SGR sequence format is also used to select several character attributes. (Refer to page 7–99.) You can combine several SGR sequences by separating Ps values with semicolons (;).

Discussion Ps values from 10 through 19 select the font or type family used for printing. (Initial SGR number assignments are covered on page 7–93.) If you want to print more than 10 fonts or type families on a page, you must reassign other IDs to these SGR numbers.

If you select a specific font, all seven font attributes are already assigned. If you select a type family, you have two choices for the other six font attributes (type size, spacing, etc.): you can use the default values for those attributes or you can change one or more attributes with control sequences. Thus, selecting a type family gives you more options.

You can use the select font sequence anywhere in the data stream. The selected font remains in effect until the printer receives another select font sequence or a Reset to Initial State (RIS) sequence. After a power–up RIS sequence, the printer uses SGR number 10 for print mode and SGR number 19 for plot mode.

If you send an assign type family or font (DECATFF) sequence for the current SGR number, the sequence takes effect immediately. You do not have to select the current SGR number.

If you select an SGR number that does not have a type family ID or a font ID assigned and you try to plot, the filled rectangle will print.

Deleting Fonts from RAM (DECLFF)

ASCII Code `DCS 0 ; 1 ; 0 y ST`

Hex Code `90 30 3B 31 3B 30 79 9C`

Dec Code `144 48 59 49 59 48 121 156`

Purpose Deletes fonts from RAM.

Discussion Digital LG printer emulation fonts are in portrait orientation by default. Each time you request a landscape orientation and select a font, the printer creates a rotated font in RAM. The RAM may fill if you create a number of fonts. The following command sequence lets you delete fonts from RAM.

NOTE: This command is also used in the LN03 printer for loading font files. This function is not present in the LG02 printer.

Font Status Sequences

Font status sequences help the host computer control and manage font memory. The host sends a request font status sequence, and the printer responds by sending a font status report. The font status report tells the host which fonts are currently available in the printer.

Request Font Status (DECRFS)

ASCII Code `CSI Ps ; Ps ″ {`

Hex Code `9B Ps 3B Ps 22 7B`

Dec Code `155 Ps 59 Ps 34 123`

Purpose The host computer sends this sequence to request a report of the fonts available for printing, the memory bytes available for loading new fonts, or both.

NOTE: This command works only when the printer is connected to the host through the serial interface.

Discussion The Ps parameter selects the type of font status requested:

Ps	Function
0	Send both reports (same as 1 and 2) (default)
1	Send status of ROM fonts
2	Send amount of RAM available for rotating fonts, forms, and logos

Font Status Report (DECFSR)

The printer uses this sequence to report the font status requested by the DECRFS sequence (page 7–97). There is a separate report for the two types of status requests.

NOTE: This command works only when the printer is connected to the host through the serial interface.

Response to a DECRFS request with a Ps parameter of 1:

ASCII Code `DCS 1 ″ { IDstring ST`

Hex Code `90 31 22 7B IDstring 9C`

Dec Code `144 49 34 123 IDstring 156`

Discussion The ID string includes the type family name, the type family ID in parentheses, a colon (:), then a new line(s) with each font name. Each new type family starts with on a new line after a semicolon. A blank line indicates the end of the previous family. For example,

type family name (type family ID):
    font file ID,
    font file ID;
type family name (type family ID):
    font file ID;

Response to a DECRFS request with a Ps parameter of 2:

ASCII Code `DCS 2 ″ nnn ST`

Hex Code `90 32 22 nnn 9C`

Dec Code `144 50 34 nnn 156`

Discussion nnn represents a decimal number indicating the number of bytes available in RAM for rotating fonts.

Character Attributes (SGR)

Character attributes are enhancements that let you highlight your printed text. You can select ten character attributes by using Select Graphic Rendition (SGR) sequences:

- Select font (DEC multinational character set, NLQ, OCR–A, OCR–B)
- Character Expansion via Graphic Size Modification (GSM) sequences (Double height characters, triple height characters, double width characters), if the font was selected by family.
- Select Graphic Rendition (Bold, Italics, Underline, Strike through)

Character attribute sequences share the same basic format as the select font sequence. This type of sequence is called a Select Graphic Rendition (SGR) sequence:

```
ESC [ Ps m
```

You can select more than one character attribute in the same sequence by including several `Ps` values separated by semicolons:

```
ESC [ Ps ; Ps ; Ps m
```

Once set, a character attribute remains active until you turn it off or reset the printer.

`Ps` = 0 (zero) turns off all character attributes.

Character Expansion (GSM)

ASCII Code `ESC [ Ps1 ; n2 SP B`

Hex Code `1B 5B Ps1 3B  n2 20 42`

Dec Code `27 91 Ps1 109 n2 32 66`

Purpose Ps1 multiplies height; n2 multiplies width.

Discussion The Character Expansion control sequence allows characters to be multiplied in both height and width.

Multiply Height

The printer prints double and triple height characters by expanding the single height character matrix to produce twice or three times the number of vertical dots per character, respectively. Blank lines are expanded to either twice or three times the normal height, equal to the height requested. To alter character height, choose from the following options:

Current Vertical Pitch (LPI)	Double Height (LPI)	Triple Height (LPI)
2	1	
3	1.5	
4	2	
5	2.5	1.7
6	3	2
8	4	2.7
10	5	3.3
12	6	6

When double/triple height mode is selected, the printer expands vertical print until the feature is disabled. This feature can be combined with double width characters. Mixing single height, double and triple height characters on the same horizontal line is allowable.

Multiply Width

The printer prints double width characters by expanding the single width character matrix to produce twice the number of horizontal dots per character. When double width characters are selected, the Space character also expands to twice the normal width. To double character width, invoke the following cpi:

Current Width Pitch (CPI)	Double Width (CPI)
10	5
12	6
13.3	6.6
15	7.5
16.7	8.3

NOTE: The OCR–A and OCR–B fonts cannot be enlarged. If multiplication escape sequences are used with them, the escape sequence is ignored.

Double width characters are considered one–column wide by the printer. Therefore, existing tab stops are positioned with respect to double width columns. When double width characters are disabled, the tab stops reposition to normal width columns.

A default of 100 is used if no values are set for `Pn1` or `n2`.

When vertical expansion is selected, blank lines are also expanded by the appropriate factor. Likewise, when double width characters are selected, spaces are expanded to the appropriate factor.

Bold Printing

ASCII Code `ESC [ Ps m`

Hex Code `1B 5B Ps 6D`

Dec Code `27 91 Ps 109`

Purpose Turn bold printing on or off.

Discussion This sequence causes the printer to print bold text in the same font currently selected. `Ps` turns bold printing on or off.

If the currently selected type family does not have a bold font on the system diskette, the printer will double–strike with a slight offset (“shadow print”) when you turn on bold printing. Printing speed is reduced during shadow printing because each character is created twice. Note that bolding is not available for OCR–A and OCR–B fonts.

Ps	**Printer Action**
1	Turn on bold printing
22	Turn off bold printing
0	Turn off all character attributes

Crossed–Out Text

ASCII Code `ESC [ 29`

Hex Code `1B 5B 1D`

Dec Code `27 91 29`

Purpose Turn crossed–out printing on or off.

Discussion When enabled, one or more characters print with a cross–through mark. `Ps = 29` is a toggle code that turns crossed–out text printing on or off.

Note that crossed–through text printing is not available for OCR–A and OCR–B fonts.

Double Underlined Text

ASCII Code `ESC [ Ps m`

Hex Code `1B 5B Ps 6D`

Dec Code `27 91 Ps 109`

Purpose Turns double underlining on or off.

Discussion With double underlining on, the printer double underlines all following printable characters, including spaces. Double underlining remains in effect (even across page boundaries) until turned off. Note that if you use a tab with double underline enabled, the space is doubly underlined. `Ps` turns double underlining on or off.

Ps	Printer Action
21	Turn on double underlining
24	Turn off double underlining

This feature is available to all fonts and pitch settings, only when the printer is in Print mode and portrait. Double underlining is disabled when the printer is reset or powered–off.

Italic Printing

ASCII Code `ESC [ Ps m`

Hex Code `1B 5B Ps 6D`

Dec Code `27 91 Ps 109`

Purpose Turn italic printing on or off.

Discussion Text prints in italics only when the Data Processing or Near Letter Quality (NLQ) fonts are in use and italic printing is selected. The values of `Ps` turn italic printing on or off.

The italic font is available at the following cpi's: 5, 10, 12, 13.3, 15, and 16.7, and at all horizontal pitch settings except 16.7.

Ps	Printer Action
3	Turn on italic printing
23	Turn off italic printing

Overlined

ASCII Code `ESC [ Ps m`

Hex Code `1B 5B Ps 6D`

Dec Code `27 91 Ps 109`

Purpose Turn overlined printing on or off.

Discussion When enabled, all characters and spaces following the code is overlined. The values of `Ps` turn overlined printing on or off.

Ps	Printer Action
53	Turn on overlined printing
55	Turn off overlined printing

Overlined text is only applicable in Print mode.

Turn Off All Attributes

ASCII Code `ESC [ 0 m`

Hex Code `1B 5B 0 6D`

Dec Code `27 91 0 109`

Purpose Turns off all font attributes.

Underlined Text

ASCII Code `ESC [ Ps m`

Hex Code `1B 5B Ps 6D`

Dec Code `27 91 Ps 109`

Purpose Turn underlining on or off.

Discussion With underlining on, the printer underlines all following printable characters, including spaces. Underlining remains in effect (even across page boundaries) until turned off. Note that if you use a tab with underline enabled, the space will be underlined. `Ps` turns underlining on or off.

Ps	Printer Action
4	Turn on underlining
24	Turn off underlining

This feature is available to all fonts and pitch settings. Underlining is disabled when the printer is reset or powered–off.

Justification (JFY)

ASCII Code `ESC [ Ps SP F`

Hex Code `1B 5B Ps 20 46`

Dec Code `27 91 Ps 32 70`

Purpose Aligns text at left and right margins.

Discussion Justification changes the spacing between words. With a justified line, the first character of the first word is flush with the left margin, or at the line home position if it differs from the margin setting. The last character of the line will be at the right margin. Once enabled, justification remains on until you turn it off.

Justification places the printer in plot mode. Subsequent text is then printed in the plot font selected. If you do not select a font, solid rectangles are plotted.

The printer evenly spaces each word on a justified line. The space character (SP) indicates a word space to the printer, and you set the limits for word spacing with the `Ps` parameter, as follows:

Ps	Printer Action
0	Turn off justification (default)
2	Turn on justification with limits
?2	Turn on justification without limits

When justification with limits is set (`Ps` = 2), the printer does not shrink or expand the space character beyond the limits set by the current font (usually in the 50–200% range). If you select justification without limits (`Ps` = ?2), the printer can shrink the space character to zero.

The printer will not make hyphenation or end–of–line determinations when justification is turned on, nor will autowrap operate with justification turned on. Use the following sequences or control characters to make End–of–line determinations:

- Carriage Return <CR>
- Form Feed (FF)
- Line Feed (LF)

Justification (JFY) (continued)

- Vertical Table (VT)
- Next Line (NEL)
- Forward Index (IND)
- Reverse Index (RI)
- Vertical Position Absolute (VPA)

The active font determines the distance between characters in a word. The printer will not autowrap text with justification turned on; therefore, text that exceeds the printable area is lost.

The printer does not justify leading spaces; instead, it uses the default width of the space character (SP). The printer will not shrink or expand the value of Horizontal Position Relative (HPR) sequences in the text. If a line contains Horizontal Tab (HT) or Horizontal Position Absolute (HPA), the printer justifies text between the last HT and the end of the line only.

Sixel Graphics Processing

A sixel is a group of six vertical picture elements (six pixels) that represents a section of a graphic image. It can be sent in one byte (7 or 8 bits). A bit value of 1 means print a pixel; a bit value of 0 means leave a space.

The sixel protocol is a bit–imaged rasterised method of transmitting and displaying graphic images. The printer receives and prints sixel files sent from the host. These images are printed in monochrome.

NOTE: Sixel graphics is invoked in one of two ways: for use with the new software and for use with older software versions. This section describes how to run sixel graphics with the new software. If you are running older software versions, refer to the appropriate Digital manual for sixel graphics information.

Sixel protocol is contained within an ANSI defined Device Control String (DCS) control code. It is invoked by a String Introducer (SI) and is terminated by the String Terminator (ST) control code. The following components make up the complete Device Control String for the sixel protocol:

1. String Introducer

2. Protocol Selector

3. Picture Data

4. String Terminator

The Device Control String is assembled as follows:

DCS Ps1 ; Ps2 ; Pn3 ... Pn q <Sixel data> ST

Protocol Selector

Picture Data

String Introducer

String Terminator

String Introducer

The String Introducer Control code (DCS) identifies the start of the sixel protocol. The DCS code is `90H` in 8–bit mode. In 7–bit mode, it is `1BH, 50H`.

Protocol Selector

The protocol selector consists of a string of zero, one, or more numeric parameters, each separated by the parameter separator character, ; (semicolon, 3BH). A valid numeric parameter consists of zero, one, or more digits in the range of 30H – 39H. The protocol selector has the following format:

ASCII Code Ps1 ; Ps2 ; Pn3 ... Pn q
This selector is defined as follows:

- Set Ps1 to zero and explicitly define the Horizontal Grid Size with the Pn3 parameter. Set the aspect ratio numerator and denominator using the Pn1 and Pn2 parameters in the Sixel Data Control sequence, “Set Raster Attributes,” page 7–114

Macro Value	Horizontal Grid Size (Inches)	Aspect Ratio (Vert. Pxls:Horz. Pxls)
0 or none	1/140 in (.0071)	200:100
1	1/140 in (.0071)	200:100
1	1/140 in (.0071)	200:100
2, default to:	1/180 in (.0056)	250:100
3, default to:	1/180 in (.0056)	250:100
4	1/180 in (.0056)	250:100
5, default to:	1/140 in (.0071)	200:100
6, default to:	1/140 in (.0071)	200:100
7, default to:	1/140 in (.0071)	200:100
8, default to:	1/140 in (.0071)	200:100
9, default to:	1/70 in (.0143)	100:100

- Macro values 2,3, and 5 through 8 are default definitions required by this printer. If Ps1 is greater than 9, default to Ps1 = 0.
- Ps2 is the background select parameter. It is not used by this printer.
- Pn3 selects horizontal grid size in decipoints (1/720in). This parameter, used with the aspect ratio, defines grid size.

The printer performs default horizontal grid sizes for some decipoint values. The following table identifies the horizontal grid size used for each parameter value.

Decipoints (1/720")	**Horizontal Grid Size**
0 or none	No change to HGS defined by Ps1
1, 2, 3	1/180in (.0056 in)
4	1/180in (.0056 in)
5	1/180in (.0056 in)
6 default to:	1/180in (.0056 in)
7 default to:	1/180in (.0056 in)
8	1/180in (.0056 in)
9 default to:	1/180in (.0056 in)
10	1/180in (.0056 in)
11 – 19 default to:	1/180in (.0056 in)
20	1/180in (.0056 in)
21, 22, etc. default to:	1/180in (.0056 in)

If Pn3 is set to 0 or not present, the horizontal grid size is determined by the macro parameter (Ps1). Otherwise, Pn3 overrides the Horizontal Grid Size (HGS) portion of the macro parameter while attempting to preserve the aspect ratio (A/R). Therefore, when the 250:100 aspect ratio is selected by Ps1, Pn3 must take on one of the following values:

1/180 in, maintain 250:100 A/R and HGS = 1/180 in
1/140 in, maintain 250:100 A/R and HGS = 1/180 in
1/90 in, maintain 250:100 A/R and maintain HGS = 1/90 in
1/70 in, maintain 250:100 A/R and change to HGS = 1/90 in
1/35 in, maintain 250:100 A/R and change to HGS = 1/90 in

When the 200:100 aspect ratio is selected by Ps1, Pn3 must take on one of the following values:

1/180 in, change to 200:100 A/R and maintain HGS = 1/180 in
1/140 in, maintain 200:100 A/R and HGS = 1/140 in
1/90 in, maintain 200:100 A/R and change to HGS = 1/140 in
1/70 in, maintain 200:100 A/R and change to HGS = 1/70 in
1/35 in, maintain 200:100 A/R and change to HGS = 1/70 in

When the 100:100 aspect ratio is selected by Ps1, Pn3 must take on one of the following values:

1/180 in, change to 200:100 A/R and maintain HGS = 1/180 in
1/140 in, maintain 200:100 A/R and change to HGS = 1/140 in
1/90 in, maintain 200:100 A/R and change to HGS = 1/140 in
1/70 in, maintain 200:100 A/R and HGS = 1/70 in
1/35 in, maintain 200:100 A/R and change to HGS = 1/35 in

- Pn is reserved for future use. If parameters are received, they will be ignored without terminating this sequence.
- The final character is designated by the lowercase letter, q, where q identifies the sequence as the sixel protocol selector and places the printer in Sixel Graphics mode.

Three control characters cause the Protocol Selector sequence to terminate and enter Text mode. They are SUB, CAN, and ESC. After the sequence is terminated and Text mode is entered, the process (SUB, CAN, or ESC) enacts. All other codes, if received within the Protocol Selector sequence, are honored without terminating the sequence.

All C1 control codes received while you are defining the Protocol Selector sequence cause the sequence to terminate and the printer to exit from sixel character processing. C1 control codes applicable to this printer are then processed.

Picture Data

Picture data is made up of sixel printable characters and sixel control characters. All picture data is processed while in Sixel Graphics mode. In this mode, instead of standard ASCII Text mode processing, characters are processed by the printer as sixel data, and a graphic image prints.

String Terminator

When the Device Control String parameters have been entered, exit Sixel Graphics mode using the String Terminator (ST) control code. Exit always returns the printer to normal text processing.

Character Processing in Sixel Graphics Mode

In Sixel Graphics mode, characters are made up of standard ASCII text processed as sixel printable characters and sixel control characters.

Sixel Printable Characters

Sixel printable characters are GL characters in the 3FH – 7EH range decoded as printable characters. Each of these 64 values represent an encoding of six vertical pixels to be printed. The actual pixel size is defined by the Horizontal Grid Size parameter and the pixel aspect ratio.

For each bit set to 1, a corresponding print element (or group of elements in double scale), is activated to form a dot. The least significant bit (0) is associated with the top print element or group of elements.

An offset of 3FH is subtracted from each graphics printable character received. this produces a binary value in the 00H – 3FH range. The 6–bit binary value obtained after this subtraction represents a six–pixel column definition. Note that GR characters in the BFH – FEH range are processed as GL characters by setting the eighth bit to 0. Table 7–19 shows the binary values for six–pixel column definition.

Table 7–19. Six–Pixel Column Definition

HEX Code	ASCII Symbol	Binary Value	Pixels	Action
3F	?	000000	None	Advance by a sixel space
40	@	000001	Top	Print top pixel only
5F	–	100000	Bottom	Print bottom pixel only
7E	~	111111	All	Print one full column

If you try to print past the furthest right position, the printer will truncate all remaining sixel data until the next Graphics Carriage Return ($) or Graphics New Line (–).

Sixel Control Codes

Sixel control codes are GL characters in the 20H – 3EH range. The parameter separator (3BH) and the parameter digits (30H – 39H) are also included in this range. GR characters in the A0H – BEH range are processed as GL characters by setting the eighth bit to 0. Table 7–20 show how the assigned control characters are processed.

Table 7–20. Assigned Control Characters

HEX Code	ASCII Symbol	Action
21	!	Repeat Introducer
22	”	Set Raster Attributes
24	$	Graphic Carriage Return
2D	–	Graphic New Line
30 – 39	0 – 9	Numeric Parameters
3B	;	Parameter Separator

A Sixel Graphics Mode sequence begins with a sixel control character (30H – 39H, 3BH exclusive) and ends with a printable character or another sixel control character. If the following data is received:

```
! – 200 ~
```

the printer ignores the repeat control character, process the Graphic New Line, ignores 200 (it is meaningless by itself), and prints the tilde character once.

Any unassigned control characters, parameters, or parameter separators are ignored by the printer until the next valid control character or ST is received.

Repeat Introducer (!) and Sequence

A repeat sequence allows repetition of certain characters when a valid printable character follows an exclamation point (!), the repeat introducer symbol. For example, the following sequence:

!	1	0	?
21H	31H	30H	3FH

is interpreted to mean “repeat 10 graphic spaces.”

The numeric parameter specifies the number of times to print the character that follows the repeat introducer. The numeric parameter is a string of characters in the 30H – 39H range, which is evaluated as a decimal number. If a numeric parameter is not received or if the parameter is 0, a value of 1 is assumed. If the parameter is a value larger than the maximum value of 65535, the printer defaults to 65535. All decimal digits are processed as part of the count.

A repeat sequence is equivalent to receiving the printable character as many times as specified by the numeric parameter count. A printable character ends the repeat sequence processing and causes the printer to print.

Set Raster Attributes

Setting the raster attributes determines the size, shape, and position of the pixels to be drawn.

After entering Sixel Graphics mode, a valid Set Raster Attributes sequence must be received before the first sixel printable character is received. The Set Raster Attributes sequence effects all sixel data that follows.

If a Set Raster Attributes sequence is received after a sixel printable character is received, the printer still recognizes the sequence but disregards all parameters and continues processing all sixel data and control codes that follow the sequence, as if the sequence was never received.

If a Set Raster Attributes sequence is received after a sixel control code (21H – 24H, 2DH), the printer processes the control code and recognizes but ignores all Set Raster Attributes sequences that follow. If a Set Raster Attributes sequence is received after an unspecified Digital control code (20H, 25H – 2CH, 2EH, 2FH, 30H – 3EH), the printer ignores the code and processes the Set Raster Attribute sequence that follows. Because of this, you can specify a future control code to be received first, and it will be ignored without consequence to the Set Raster Attributes sequence until the code is recognized by the printer.

If a Set Raster Attributes sequence is received before any other sixel control code, the sequence is processed. The protocol selector has the following format:

ASCII Code ” Pn1 ; Pn2 ; Pn3 ; Pn4
This selector is defined as follows:

- The double quote (”) sets the raster attributes control characters.

- Pn1 sets the pixel aspect ratio numerator.
- Pn2 sets the pixel aspect ratio denominator.

Pn1 and Pn2 are numeric parameters. A numeric parameter is a string of characters in the 30H – 39H range that is evaluated by the printer as a decimal number. If the parameter is a value larger than the 65535 maximum, the printer defaults to 65535.

The pixel aspect ratio defines the shape of the pixel needed to reproduce the picture without distortion. This ratio is defined by two numbers, a numerator (Pn1) and a denominator (Pn2). It is the ratio of the vertical to the horizontal shape of the pixel. For example, an aspect ratio of 2:1 (or 200:100) represents a pixel twice as high as it is wide. The aspect ratio multiplied by the Horizontal Grid Size (HGS) yields the ideal Vertical Grid Size (VGS). That is:

Pixel Aspect Ratio x HGS = Ideal VGS.

Table 7–21 gives the aspect ratios supported by the printer.

Table 7–21. Aspect Ratios Supported by the LG06 and LG12

Aspect Ratio	Sixel Scale	HGS	Horiz. Dots/Pixel	VGS	Vert. Dots/Pixel
2.5:1	Full 2X	1/180 in 1/90 in	1 2	1/72 in 1/36 in	1 2
2:1	Full 2X	1/140 in 1/70 in	1 2	1/72 in 1/36 in	1 2
1:1	.5 Full 2X	1/140 in 1/70 in 1/35 in	1 1 2	1/144 in 1/72 in 1/36 in	1/2 1 2

When other aspect ratios (A/R) are requested, they are processed in the following manner:

– An aspect ratio of less than 1.5:1 uses 1:1 A/R.
– An A/R equal to or greater than 1.5:1, but less than 2.25:1 uses 2:1 A/R.
– An A/R equal to or greater than 2.25:1 uses 2.5:1 A/R.

When determining pixel size, the printer will attempt to preserve the A/R without exceeding the selected HGS. Therefore, note the following:

When 2.5:1 A/R is selected and the HGS is:

- 1/180 in, the printer maintains a 2.5:1 A/R and a HGS of 1/180 in
- 1/140 in, the printer maintains a 2.5:1 A/R and a HGS of 1/180 in
- 1/90 in, the printer maintains a 2.5:1 A/R and changes HGS to 1/90 in
- 1/70 in, the printer maintains a 2.5:1 A/R and changes HGS to 1/90 in
- 1/35 in, the printer maintains a 2.5:1 A/R and changes HGS to 1/90 in

Pixel Aspect Ratio x HGS = Ideal VGS.

When 2:1 A/R is selected and the HGS is:

- 1/180 in, change the printer to 2.5:1 A/R and HGS to 1/180 in
- 1/140 in, the printer maintains a 2:1 A/R and a HGS of 1/140 in
- 1/90 in, the printer maintains a 2:1 A/R and a HGS of 1/140 in
- 1/70 in, the printer maintains a 2:1 A/R and changes HGS to 1/70 in
- 1/35 in, the printer maintains a 2:1 A/R and changes HGS to 1/70 in

When 1:1 A/R is selected and the HGS is:

- 1/180 in, the printer maintains a 1:1 A/R and a HGS of 1/180 in
- 1/140 in, the printer maintains a 1:1 A/R and changes HGS to 1/140 in
- 1/90 in, the printer maintains a 1:1 A/R and changes HGS to 1/140 in
- 1/70 in, the printer maintains a 1:1 A/R and a HGS of 1/70 in
- 1/35 in, the printer maintains a 1:1 A/R and changes HGS to 1/35 in

Graphic Carriage Return ($)

The Graphic Carriage Return (GCR) control code causes the active position to move back to the furthest left position where the first sixel data was printed after entering Sixel Graphics mode. GCR allows sixel data to overprint lines by consecutively starting at the same horizontal position. For example, if the first sixel data prints at column 10, the GCR causes the next line of sixel data to start at column 10 and not at the left margin.

Graphic New Line (–)

The Graphic New Line (GNL) control code initiates printing, causes the active position to move to the furthest left position, and advances paper by one sixel height.

Numeric Parameters (0 – 9)

Some graphic control codes may be followed by a numeric value that is encoded as an ASCII decimal number (0 – 9) in the 30H – 39H range. A numeric value is terminated by any non–digit, specifically another control code or a graphics printable character. The default for any numeric parameter is 0.

Parameter Separator (;)

The parameter separator is used to separate a series of numeric parameters. If a number does not precede the separator or does not follow the separator, the printer assumes a value of zero.

ASCII Control Characters

In Sixel Graphics mode, the printer ignores all CO control characters received except CAN, SUB, and ESC. When the printer receives a CAN control character, it terminates Sixel graphics mode. A SUB control character is processed as 3FH (one sixel space), which limits the effect of some communication line errors. An ESC character terminates Sixel Graphics mode, but the printer still processes the ESC character.

In Sixel Graphics mode, all C1 control codes terminate Sixel Graphics mode, then process the C1 control code if it is recognized by the printer.

Graphic Substitute

In Sixel Graphics mode, the SUB character is interpreted as an error character. The printer remains in Sixel Graphics mode and processes SUB as a sixel space (3FH). If a repeat sequence is processing when SUB is selected, the number of sixel spaces required by the repeat count is printed.

Exit Sixel Graphics Mode

The printer exits Sixel Graphics mode when CAN, ESC, or ST are received. CAN causes the printer to exit Sixel Graphics mode. ESC causes the printer to exit Sixel Graphics mode and begin processing the ESC sequence. ST terminates Sixel Graphics mode.

Note that all stored sixel data is printed before the printer exits Sixel Graphics mode.

State After Exiting Sixel Graphics Mode

After exiting Sixel Graphics mode, the printer returns to the following conditions:

- The horizontal position before entering Sixel Graphics mode
- The horizontal pitch before entering Sixel Graphics mode
- The vertical position might be modified by control characters received while in Sixel Graphics mode
- The vertical pitch is the same as before entering Sixel Graphics mode
- All SGR attributes are restored to the state before entering Sixel Graphics mode
- Additionally, the first Text mode vertical motion command (LF, VT, etc.) causes the printer to advance to the next Text mode line before executing the command.

Processing Unused Control Strings

The printer ignores all unused control strings. Unused control strings include all Operating System commands (OSC), Privacy Messages (PM), and Application Program commands (APC), as well as all Device Control strings (DCS), unless they are within Sixel Graphics mode. The following table describes the different control strings:

Types of Control Strings	**8–bit Mnemonic/ HEX**	**7–bit Mnemonic/ HEX**
Device Control Strings	DCS 90H	ESC P 1BH 50H
Operating System Commands	OSC 9DH	ESC] 1BH 5DH
Privacy Messages	PM 9EH	ESC ^ 1BH 5EH
Application Program Commands	APC 9FH	ESC _ 1BH 5FH

Control string formats appear in the following ways:

Control String Introducer	**Data String**	**String Terminator**
DCS P...P I...I F	D...D	ST
OSC	D...D	ST
PM	D...D	ST
APC	D...D	ST

In the above table, P = parameters; I = intermediate characters; F = final character; D = data; and ST = string terminator (9CH).

Process unused control strings as follows:

- After DCS begins processing the introducer sequence, it will:

  1) enter Sixel Graphics mode if the final character is a q

  2) process any applicable CO received

  3) enter Text mode if ESC, CAN, SUB, ST, or a C1 is received

  4) ignore any GL or GR code received

- After OSC receives an ESC, CAN SUB, ST or C1, it will:

  1) enter Text mode

  2) ignore any other characters

- After PM receives an ESC, CAN SUB, ST or C1, it will:

  1) enter Text mode

  2) ignore any other characters

- After APC receives an ESC, CAN SUB, ST or C1, it will:

  1) enter Text mode

  2) ignore any other characters

Drawing Vectors (DECVEC)

ASCII Code `ESC [ Pn1 ; Pn2 ; Pn3 ; Pn4 ; Pn5 ; ! |`

Hex Code `1B 5B Pn1 3B Pn2 3B Pn3 3B Pn4 3B Pn5 3B 21 7C`

Dec Code `27 91 Pn1 59 Pn2 59 Pn3 59 Pn4 59 Pn5 59 33 124`

Purpose Draw horizontal or vertical lines with length and width

Discussion Margins do not affect line drawing so you can draw lines to the physical limits of the page. The DECVEC command sequence draws vectors without changing the currently active position.

Use the `Pn` parameters to select the length, width, and direction of the line. An incorrect `Pn` value cancels the entire sequence.

P1	Operation
0	Draw an x line; that is, horizontal with respect to page orientation.
1	Draw a y line; that is, vertical with respect to page orientation. orientation.

- P2 selects the x start position on the page in decipoints.
- P3 selects the y start position on the page in decipoints.
- P4 Selects the line length in the x direction for an x line.
  For a y line, it specifies the y direction length.
  0 value is equal to a line one decipoint in length.
- P5 Selects the line width in the y direction for a y line.
  For an x line, it specifies the x direction width.
  0 value is equal to a line one decipoint in length.

For an x line, `Pn4` specifies the length in the x direction, and `Pn5` specifies the width in the y direction. For a y line, `Pn4` specifies the length in the y direction, and `Pn5` specifies the width in the x direction.

Block Characters

The block character sequences define the parameters of the block characters, initiate the generation of block characters, and return the printer to normal printing. The following subsections describe how to enact these features.

Setting Block Character Parameters (DECBCS)

ASCII Code `ESC [ P1; P2;...P5‘r`

Hex Code `1B 5B P1 3B P2 3B...P5 27 72`

Dec Code `27 91 P1 59 P2 59...P5 39 114`

Purpose Defines the parameters for block characters.

Discussion The Pn parameters define the height, width, background color, and character set of the block characters. If any parameters are illegal, the entire sequence is ignored. When block character parameters are defined, they remain valid until:

- A new valid Block Character Select Parameter sequence is sent
- A reset command occurs (setting the default values)
- The default values are set by powering–up

The character exists entirely and centrally within the character cell. The line feed distance is equal to the basic cell height multiplied by the vertical magnification factor. The magnification values specified in P1 and P2 are operated on the basic character cell.

Block character parameters are set according to the following choices.

- P1 defines the horizontal magnification factor.

P1	Function
0/missing	Magnification of 2 (default)
1–156	Defines the horizontal magnification factor
>156	Magnification factor of 156 used

Setting Block Character Parameters (DECBCS) (continued)

The horizontal intercharacter gap for 0 degrees and for 180 degrees rotation is 1/60 in times the horizontal magnification factor. Characters rotated 90 degrees and 270 degrees have a horizontal intercharacter gap of 3/60 in times the vertical magnification factor.

- P2 defines the vertical magnification factor. The maximum value of P2 is limited by page length.

P2	Function
0/missing	Magnification of 2 (default)
1–156	Defines the vertical magnification factor
>156	Magnification factor of 156 used

- P3 defines the background color.

P3	Function
0/missing	White background (default)
1	Black background (inverse video)

- P4 designates the international character set.

P4	Function
0/missing	U. S. ASCII (default)
1	Germany
2	Digital Norway/Denmark
3	France
4	United Kingdom
5	Spain
6	Sweden

Setting Block Character Parameters (DECBCS) (continued)

- P5 specifies the block character's orientation.

P5	Function
0/missing	Same as current orientation
1	Portrait (0 degree rotation
2	Landscape (90 degree rotation)
3	Reverse landscape (270 degree rotation)
4	Portrait upside down (180 degree rotation)

NOTE: When the sequence selects character rotation, each character is rotated around its axis by the above specified degree.

Start Block Character Mode (DECBLOCKC)

ASCII Code `ESC % SP 1`

Hex Code `1B 25 20 31`

Dec Code `27 37 32 49`

Purpose Generates the block characters from the characters that follow the sequence.

Discussion The block characters inherit the last set of parameters defined. If no prior sequence exists, the block characters are printed with:

- 0 degree rotation
- In the U. S. ASCII character set
- With a horizontal and vertical magnification factor of 2
- With a white background

Stop Block Character Mode

ASCII Code `ESC % @`

Hex Code `1B 25 40`

Dec Code `27 37 64`

Purpose Stops the generation of block characters

Discussion Once the block character sequence is stopped, the font attributes, the CPI settings, and the LPI settings are returned to their previous values.

Printer Reset

The sequences below reset the printer to predetermined operating features and conditions. These default operating conditions are listed in the next section. The two sequences below perform the same function.

Reset to Initial State (RIS)

ASCII Code: `ESC c`

Hex Code: `1B 63`

Dec Code: `27 99`

Soft Terminal Reset (DECSTR)

ASCII Code: `ESC [ ! p`

Hex Code: `1B 5B 21 70`

Dec Code: `27 91 33 112`

Selecting IBM Proprinter Emulation via DECIPEM

Digital emulation is the default when printer power is turned on, but you can select IBM Proprinter emulation with one control sequence, the Enter IBM Proprinter Emulation sequence (DECIPEM):

ASCII:	CSI	?	5	8	h
Hex:	9BH	3FH	35H	38H	68H

This sequence performs the same function as the Select Other Coding System (SOCS) sequence. DECIPEM resets IBM emulation mode to its initial conditions, which include:

- Downloaded buffer
- Character and line pitch
- Character attributes
- Print density
- Form length
- Tabs
- Active Character Set

The only valid Digital–compatible commands in IBM emulation mode are DECIPEM, RIS, and DECSTR.

To exit IBM Proprinter emulation, enter the following escape sequence:

ASCII:	ESC	[	?	5	8	1
Hex:	1BH	5BH	3FH	35H	38H	6CH

NOTE: Though the CSI control code is used to the enter IBM Proprinter emulation mode, it cannot be used to exit Proprinter emulation. In IBM mode, CSI is processed as an ESC code. In the exit command above, notice that you use ESC [instead of CSI.

Selecting IBM Proprinter Emulation via SOCS

Digital emulation is the default when printer power is turned on, but you can select Proprinter emulation with one control sequence, the Select Other Coding System (SOCS) sequence:

ASCII:	ESC	%	=
Hex:	1BH	25H	3DH

SOCS resets IBM emulation mode to its initial conditions, which include:

- Downloaded buffer
- Character and line pitch
- Character attributes
- Print density
- Form length
- Tabs
- Active Character Set

The only valid Digital–compatible commands in IBM emulation mode are ROCS, RIS, and DECSTR.

To exit IBM Proprinter emulation, enter the following escape sequence:

ASCII:	ESC	%	@
Hex:	1BH	25H	40H

You can also exit from IBM Proprinter emulation mode by issuing a Reset to Initial State (RIS) or a Soft Terminal Reset (DECSTR). Both of these sequences perform the same reset function. Do not use the CSI control code in the DECSTR control sequence; instead, use its 7–bit equivalent of ESC [.

7–Bit and 8–Bit Transmissions and Interpretations

This section explains how to select 7–bit or 8–bit encoding of control strings.

Select 7–Bit C1 Transmission (S7C1T)

The sequence below causes the printer to use 7–bit encoding for all C1 control characters transmitted. All C1 characters are then represented as two–character ESC sequences.

ASCII:	ESC	SP	F
Hex:	1BH	20	46

Select 8–Bit C1 Transmission (S8C1T)

The sequence below causes the printer to use 8–bit encoding for all C1 control characters transmitted. All C1 characters are then represented as one–character CSI sequences.

ASCII:	ESC	SP	G
Hex:	1BH	20	47

Select 7–Bit Code (S7C)

In a 7–bit environment, this sequence allows receipt of 7–bit control strings only.

ASCII:	ESC	SP	J
Hex:	1BH	20	4A

Select 8–Bit Code (S8C)

In an 8–bit environment, this sequence allows receipt of 8–bit control strings only.

ASCII:	ESC	SP	K
Hex:	1BH	20	4B

Enter Draft Mode

ASCII Code `ESC % / 3`

Hex Code `1B 25 2F 33`

Dec Code `27 37 47 51`

Purpose Puts the emulation into high speed draft print mode.

Discussion All text following this command will be printed in the high speed draft font. This mode is slightly faster than the normal printing mode because of the simplified font.

The high speed draft font can also be selected using the operator's control panel. (Refer to Chapter 4.)

Exit Draft Mode

ASCII Code `ESC % @`

Hex Code `1B 25 40`

Dec Code `27 37 64`

Purpose Exit high speed draft mode.

Discussion Upon receipt of this command, the printer returns to the previously selected font and resumes printing or plotting.

Default Values and States

The printer stores a set of typical operating states and conditions in ROM. The first time you power up the printer, the factory settings in Table 7–22 are automatically invoked.

Table 7–22. Factory Settings

Selectable Parameter	Control Function	Factory Set Condition
Printing Status	———	Off–line
Horizontal Pitch	DECSHORP	10 characters per inch
Vertical Pitch	DECVERP	6 lines per inch
Font	SGR	Data Processing
Forms Length	DECSLPP	66 lines (11 inches)
Active Position	———	Column 1, line 1
Top Margin	———	Line 1
Bottom Margin	———	Line 66
Left Margin	———	Column 1
Right Margin	———	Column 136
Underlining	SGR	Disabled
Bolding	SGR	Disabled
Italics	SGR	Disabled
Double Underline	SGR	Disabled
Overline	SGR	Disabled
Expansion	GSM	No character expansion
GL Character Set	———	US ASCII
GR Character Set	———	Digital Supplemental
G0 Character Set	———	US ASCII
G1 Character Set	———	VT100 Graphic Character Set
G2 Character Set	———	Digital Supplemental
G3 Character Set	———	US ASCII
Autowrap	DECAWM	Disabled
Line Feed/New Line Mode	LNM	Reset
Horizontal Tabs	———	Stop at every 8 columns (9, 17...137)
Unsolicited Reports	DSR	Disabled
Super/Subscripts	———	Disabled
Carriage Return/NLM	DECCRNLM	Reset
Vertical Tabs	———	Stop at every line (1–66)

Upon receipt of a reset, the printer uses the default values in Table 7–23.

Table 7–23. Reset Condition

Selectable Parameter	Control Function	Factory Set Condition
Printing Status	———	On–line (Ready)
Horizontal Pitch	DECSHORP	10 characters per inch
Vertical Pitch	DECVERP	6 lines per inch
Font	SGR	Data Processing
Forms Length	DECSLPP	66 lines (11 inches)
Active Position	———	Column 1 on the current active line
Top Margin	———	Line 1
Bottom Margin	———	Line 66
Left Margin	———	Column 1
Right Margin	———	Column 136
Underlining	SGR	Disabled
Bolding	SGR	Disabled
Italics	SGR	Disabled
Double Underline	SGR	Disabled
Overline	SGR	Disabled
Expansion	GSM	No character expansion
GL Character Set	———	US ASCII
GR Character Set	———	Digital Supplemental
G0 Character Set	———	US ASCII or the last NRC if selected
G1 Character Set	———	VT100 Graphic Character Set
G2 Character Set	———	Digital Supplemental
G3 Character Set	———	US ASCII
Autowrap	DECAWM	Disabled
Line Feed/New Line Mode	LNM	Reset
Horizontal Tabs	———	Stop at every 8 columns (9, 17...137)
Unsolicited Reports	DSR	Disabled
Super/Subscripts	———	Disabled
Carriage Return/New Line Mode	DECCRNLM	Reset
Vertical Tabs	———	Stop at every line (1–66)
Note: The “All Interface Settings” and “National Replacement Character Set” remain as previously selected via escape sequences or the control panel.		

At power–up, the parameter values in Table 7–24 are automatically retained from the previous power–on session.

Table 7–24. Power–up Conditions

Selectable Parameter	Control Function	Factory Set Condition
Horizontal Pitch	DECSHORP	———
Vertical Pitch	DECVERP	———
Font	SGR	———
Forms Length	DECSLPP	———
Top and Bottom Margin	DECSTBM	———
Left and Right Margin	DECSLRM	———
Autowrap	DECAWM	———
Line Feed/New Line Mode	LNM	———
Carriage Return/New Line Mode	DECCRNLM	———
Horizontal Tabs	———	———
Vertical Tabs	———	———
Interface Settings	———	———
GL Character Set	———	US ASCII or the last NRC selected
GR Character Set	———	Digital Supplemental
G0 Character Set	———	US ASCII or the last NRC if selected
G1 Character Set	———	VT100 Graphic Character Set
G2 Character Set	———	Digital Supplemental
G3 Character Set	———	US ASCII
Printing Status	———	Off–line
Active Position	———	Column 1 on the current active line
Underlining	SGR	Disabled
Bolding	SGR	Disabled
Italics	SGR	Disabled
Double Underline	SGR	Disabled
Overline	SGR	Disabled
Expansion	GSM	No character expansion
Unsolicited Reports	DSR	Disabled
Super/Subscripts	———	Disabled
Justification	SSU	Disabled

8 IBM Proprinter Emulation

Chapter Contents

IBM Proprinter Emulation

Emulation refers to the ability of a printer to execute the commands of other printer control languages. In IBM Proprinter Emulation mode, the printer prints files coded for the Proprinter. You can choose one of three ways to select Proprinter emulation, as explained in “Selecting IBM Proprinter Emulation” below.

A printer control language (also called a printer protocol) is the coding system used to convey, manipulate, and print data. It contains character codes and command sequences.

A printer and its host computer must use the same printer control language. In this manual, the terms printer control language, emulation, and protocol are synonymous.

Selecting IBM Proprinter Emulation

You can select IBM Proprinter emulation three ways.

Selecting IBM Proprinter Emulation via the Control Panel

Digital emulation is the default mode when the printer is turned on, but you can select Proprinter emulation at any time from the control panel:

1. If the printer is on–line, press the ON LINE switch to place it in the off–line state. “Off–line Emulation” appears on the message display.
2. Open the printer cover.
3. Press the UP and DOWN switches simultaneously to unlock the ENTER switch. “Unlocked” appears briefly on the message display. (If “Locked” appears, simply press UP and DOWN again.)
4. Press DOWN to enter the emulation menu. The current emulation displays. (Default is Digital emulation.) If “Emulation Proprinter XL *” displays, go to step 7.
5. Press NEXT or PREV until “Emulation Proprinter XL” displays.

6. Press ENTER. An asterisk (*) appears after the display message; that is, “Emulation Proprinter XL * ” displays. This means that the printer has set all configuration values associated with the emulation. The values are those previously saved when the Proprinter emulation was selected. If no values were altered, the factory default values for Proprinter emulation are loaded.

7. Press CLEAR to return to “Off–line Emulation.”

8. Press UP and DOWN simultaneously to lock the ENTER switch. “Locked” appears briefly on the message display.

9. Close the printer cover.

10. Press the ON LINE switch to place the printer on–line to the host computer.

Selecting IBM Proprinter Emulation via DECIPEM

Digital emulation is the default when printer power is turned on, but you can select Proprinter emulation with one control sequence, the enter IBM Proprinter emulation sequence, DECIPEM:

ASCII:	CSI	?	5	8	h
Hex:	9BH	3FH	35H	38H	68H

This sequence performs the same function as the Select Other Coding System (SOCS) sequence. DECIPEM resets IBM emulation mode to its initial conditions, which include:

- Downloaded buffer
- Character and line pitch
- Character attributes
- Print density
- Form length
- Tabs
- Active Character Set

Once the printer is in IBM emulation mode the only valid Digital–compatible commands are RIS and DECSTR.

To exit IBM Proprinter emulation, enter the following escape sequence:

ASCII:	ESC	[	?	5	8	1
Hex:	1BH	5BH	3FH	35H	38H	6CH

Note that the CSI sequence (the Enter DECIPEM sequence) cannot be used in place of the Exit IBM Proprinter Emulation mode. In IBM mode, the CSI is processed as an ESC.

Selecting IBM Proprinter Emulation via SOCS

Digital emulation is the default when the printer is turned on, but you can select Proprinter emulation with one control sequence, the Select Other Coding System sequence, SOCS:

ASCII:	ESC	%	=
Hex:	1BH	25H	3DH

SOCS resets IBM emulation mode to its initial conditions, which include:

- Downloaded buffer
- Character and line pitch
- Character attributes
- Print density
- Form length
- Tabs
- Active Character Set

The only valid Digital–compatible commands in IBM emulation mode are RIS and DECSTR.

Exiting IBM Proprinter Emulation

To exit IBM Proprinter emulation, enter the following escape sequence:

ASCII:	ESC	%	@
Hex:	1BH	25H	40H

You can also exit from IBM Proprinter emulation mode by issuing a Reset to Initial State (RIS) command:

ASCII: ESC c
Hex: 1B 63

or by sending a Soft Terminal Reset (DECSTR) control sequence:

ASCII: ESC [! p
Hex: 1B 5B 21 70

These sequences accomplish the same reset function. Do not use the CSI command sequence for the DECSTR control string.

Graphics

Proprinter emulation provides one data protocol for printing graphics information. Bit Image graphics protocol allows an image block to be printed.

When using Bit Image protocol, you can mix text and graphics on the same line.

Setting Bit Image Modes via Control Codes

Control codes select bit image modes. The following Bit Image modes can be mixed on the same line and with characters:

Control Code	Bit Image Mode
ESC K n1 n2 data	Normal density
ESC L n1 n2 data	Double density
ESC Y n1 n2 data	Double density, double speed
ESC Z n1 n2 data	Quadruple density

Parameters `n1` and `n2` together represent a 16–bit unsigned number of the quantity n1 + 256 x n2, which equals the number of bit image characters to follow. If n1 and n2 are programmed so that data extends past the last character position, the data is truncated at the last character position. If n1 and n2 are both zero, the ESC sequence is ignored.

Dot Density Versus Printing Speed

When you select ESC K (normal density), the dot columns are printed at 60 dpi horizontally and 75 dpi vertically. This does not decrease the speed of the print engine.

If ESC L (double density) is selected, the dot columns are printed at 120 dpi horizontally and 75 dpi vertically. Double density reduces the speed of the print engine by one half.

With ESC Y (double density, double speed), dot columns are printed at 120 dpi horizontally and 75 dpi vertically, but adjacent dots are not printed. Double density, double speed does not decrease the speed of the print engine.

When ESC Z (quadruple density) is selected, the dot columns are printed at 240 dpi horizontally and 75 dpi vertically. Quadruple density reduces the speed of the print engine by one half.

All by–line character print attributes are ignored in Bit Image graphics. The most significant bit for each data character is the uppermost dot position in the vertical dot image pattern. A bit value of 1 indicates a dot; a value of 0 indicates a blank. In 7–bit RS–232D serial interface protocol, the most significant bit (bit 8) is cleared to 0.

Fault Detection

If a fault is detected, the operator control panel displays an appropriate message, the fault indicator lights, and an audible alarm is activated.

When a fault is cleared, the printer returns to the off–line state. In some cases, the printer might have data in the buffer. If it is possible to recover from the fault by pressing the Clear switch, all data held in the buffer will print, even though the fault state might cause distorted or illegible printing of some or all of the data.

Fault conditions are described in Chapter 6.

Character Sets

The printer emulates IBM's Code Page 437 and Code Page 850, which are shown in Appendix C.

Code Pages

A code page is a set of symbols printed by the Proprinter emulation. These symbols consist of letters, numbers, or graphic elements. The Proprinter emulation supports different language requirements by utilizing different code pages.

The Proprinter emulation uses characters from code pages 437 and 850. These pages are set up in a table format, as described in the following subsection.

Code Page Tables

The code page tables in Appendix C give the octal, hexadecimal, and decimal representation of each character in the code page. Character Sets 1 and 2 are shown for IBM code pages 437 and 850.

How Control Codes are Described in This Manual

In this chapter, the following information is listed for each command sequence where applicable:

Name The title or function of the command.

ASCII Code The ASCII mnemonic for the command is shown for both Digital and Proprinter protocols. Command sequences are in 7–bit (ASCII) form.

Hex Code The code or command sequence in hexadecimal numbers.

Dec Code The code or command sequence in decimal numbers.

Purpose The function(s) of the command.

Discussion A discussion of the uses of the code or command sequence, including exceptions or limitations to its use.

Example A sample written in BASIC programming language is provided when it is possible to illustrate the effect of a control code or if a specific syntax is required. The programs in this chapter were run on an IBM Personal Computer using Microsoft GW–BASIC version 3.22.

Ignored Codes

Table 8–1 lists control codes that are ignored by the Proprinter emulation.

Table 8–1. Ignored Codes

Hex Code	Symbol	Note
00	NUL	1
01	SOH	1
02	STX	1
03	ETX	1, 2
04	EOT	1
05	ENQ	1
06	ACK	1
15 – 17	——	1
19	——	1
1A	——	1
1C – 1F	——	1
21 – 7E	——	See Configuration Structure Menu, Chapter 4.
7F	DEL	1
80 – FF	——	See “Configuration Structure Menu,” Chapter 4, for command/ character mapping.
ESC 00 – 2C	——	1
ESC 2E – 2F	——	1
ESC 38 – 39	——	1
ESC 3E – 40	——	1
ESC 4A	ESC J	1
ESC 4D	ESC M	1
ESC 51	ESC Q	1
ESC 56	ESC V	1
ESC 58	ESC X	1
ESC 5D	ESC]	1

Table 8–1. Ignored Codes (continued)

ESC 60 – FF	——	1
Note 1: Can occur at any place in the datastream and is acted upon immediately.		
Note 2: If this code is also used in the Serial Interface Protocol (SIP), the SIP function takes precedence over the control code definition.		

Table 8–2 lists control codes not implemented at this time. The codes are usually followed by large blocks of data. The Proprinter emulation ignores the control code and any data applicable to that control code.

Table 8–2. Codes Not Implemented

Hex Code	Symbol Code	Function
ESC 3D	ESC =	Download Characters
ESC 50	ESC P	Proportional Spacing
ESC 5C	ESC \	Print all Characters
ESC 5E	ESC ^	Print Next Character

Control Code Index and Descriptions

This index lists each printer command by function, ASCII mnemonic, and the page where the command is explained in detail. N/A means not applicable.

Function	Code	Page
Select Character Set 1 (A)	ESC 7	8–48

Print Mode

Character Pitch 12 cpi	ESC :	8–19
Condensed Print Select	SI	8–20
Condensed Print Cancel and Set to 10 cpi	DC2	8–21
Double Strike Printing (Set)	ESC G	8–22
Double Strike Printing (Cancel)	ESC H	8–23
Double Wide Print	ESC W n	8–24
Double Wide Print (One Line Only)	SO	8–25
Double Wide Print (Cancel)	DC4	8–26
Emphasized Print (Set)	ESC E	8–27
Emphasized Print (Cancel)	ESC F	8–28
Near Letter Quality Print	ESC I n	8–45
Overscoring	ESC _ n	8–46
Select Attributes	ESC [@	8–47
Superscript/Subscript Printing	ESC S n	8–50
Superscript/Subscript Printing (Cancel)	ESC T	8–49
Underline	ESC – n	8–51
Vertical Tab Set/Clear	ESC B	8–54

Bit Image

Bit Image Double Density	ESC L n1 n2	8–14
Bit Image Double–speed Double Density	ESC Y n1 n2	8–15
Bit Image Normal Density	ESC K n1 n2	8–13
Bit Image Quadruple Density	ESC Z n1 n2	8–16

Other Functions

Bell	BEL	8–12
Initialize Parameters	ESC [K	8–36
Unidirectional Printing (Toggle)	ESC U n	8–52
Escape Sequence	ESC	8–29
Ignored Codes	—–	8–8

The following sections define the above control code functions for Proprinter Emulation mode. The commands are listed in alphabetical order.

Backspace

ASCII Code BS

Hex Code 08

Dec Code 08

Purpose Moves the logical print head left one character space toward the first character column.

Discussion This code locks the current data in the string buffer, which allows certain control codes to emulate immediate printing of the buffer. CAN clears data in the buffer that should be printed. This code is ignored if the logical print head is positioned at the first character column. When the backspace code is received, printing speed will be reduced.

If the printer is in double width mode, the backspace code moves the print head left two normal character spaces.

Example Print and backspace two character positions.

```
10 LPRINT "TTTTT";
20 LPRINT CHR$(8);CHR$(8);
30 LPRINT "=="
```

```
TTT₸₸
```

Bell

ASCII Code BEL

Hex Code 07

Dec Code 07

Purpose Sounds a buzzer/beeper.

Discussion The BEL function will sound one beep upon receipt of this command.

Bit Image Mode, Normal Density

ASCII Code ESC K n1 n2

Hex Code 1B 4B

Dec Code 27 75 n1 n2

Expression CHR$(27);″K″;CHR$(n1);CHR$(n2);″DATA″

Purpose Selects Single (Normal) Density Bit Image graphics.

where n1 + 256 n2 define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

Discussion For more information, see “Graphics,” page 8–5.

This code can occur at any place in the datastream and is acted upon immediately.

Example The following example produces a pattern of Single Density Bit Image graphics. The 9 data bit pattern is repeated 27 times. Compare this example to the double density and quadruple density examples. Depending on the host computer system, it may be necessary to include a width statement in the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Single Density Bit Image Graphics"
30 LPRINT CHR$(27);"K";CHR$(244);CHR$(0);
40 FOR N=1 TO 27
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Single Density Bit Image Graphics
```

Bit Image Mode, Double Density

ASCII Code ESC L n1 n2

Hex Code 1B 4C

Dec Code 27 76 n1 n2

Expression CHR$(27);″L″;CHR$(n1);CHR$(n2);″DATA″

Purpose Selects Double Density Bit Image graphics.

where n1 + 256 n2 define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

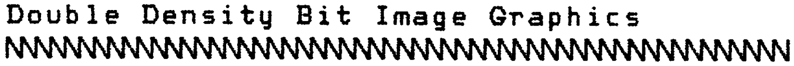
Discussion All data following this code are printed in bit image graphics at double the current horizontal dot density. The current vertical dot density is unchanged. This code can occur at any place in the datastream and is acted upon immediately, though print speed is reduced by half.

For detailed information, see “Graphics,” page 8–5.

Example The following example produces Double Density Bit Image graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be doubled for double density (the data is used 54 times rather than 27). Depending on the host computer system, it may be necessary to include a width statement in the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Bit Image Graphics"
30 LPRINT CHR$(27);"L";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

Double Density Bit Image Graphics



Bit Image Mode, Double Density, Double Speed

ASCII Code ESC Y n1 n2

Hex Code 1B 59

Dec Code 27 89 n1 n2

Expression CHR$(27);″Y″;CHR$(n1);CHR$(n2);″DATA″

Purpose Prints double density graphics at twice the speed of double density by ignoring adjacent dots.

where n1 + 256 n2 define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

Discussion This code can occur at any place in the datastream and is acted upon immediately. For more information, see “Graphics,” page 8–5.

Example The following example produces Double Density Double Speed Bit Image graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be doubled for double density (the data is used 54 times rather than 27). Depending on the host computer system, it may be necessary to include a width statement in the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Double Speed Bit Image Graphics"
30 LPRINT CHR$(27);"Y";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

Double Density Double Speed Bit Image Graphics

Bit Image Mode, Quadruple Density

ASCII Code ESC Z n1 n2

Hex Code 1B 5A n1 n2

Dec Code 27 90 n1 n2

Expression CHR$(27);″Z″;CHR$(n1);CHR$(n2);″DATA″

Purpose Selects Quadruple Density Bit Image graphics.

where n1 + 256 n2 define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

Discussion This code can occur at any place in the datastream and is acted upon immediately. Print speed is reduced by half. For detailed information, see “Graphics,” page 8–5.

Example The following example produces quadruple density graphics of the pattern used in the Single Density Bit Image Mode example. Note that the amount of data must be quadrupled for quadruple density (the data is used 108 times rather than 27). Depending on the host computer system, it may be necessary to include a width statement within the BASIC program.

```
10 WIDTH "lpt1:",255
20 LPRINT "Quad Density Bit Image Graphics"
30 LPRINT CHR$(27);"Z";CHR$(205);CHR$(3);
40 FOR N=1 TO 108
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

Quad Density Bit Image Graphics

Bottom Margin Set

ASCII Code ESC N n

Hex Code 1B 4E n

Dec Code 27 78 n

Purpose Sets the bottom margin.

Discussion n defines the number of lines above the bottom of the form to set as the bottom margin. n has a range from 1 through 255.

If a line feed command causes the active position to advance below the bottom margin, the paper advances to the top of the next form. If the page length is equal to or greater than the form length, the length is reset to the length of the form. If the forms length is changed by the ESC C code (Forms Length sequence), the bottom margin is set to zero.

An ESC N code can occur at any place in the datastream and is acted upon immediately. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps.

Bottom Margin Clear

ASCII Code ESC O

Hex Code 1B 4F

Dec Code 27 79

Purpose Clears the bottom margin.

Discussion ESC O sets the parameter defined by ESC N to 0. This code can occur at any place in the datastream and is acted upon immediately.

Cancel

ASCII Code CAN

Hex Code 18

Dec Code 24

Purpose Clears the print buffer of all printable symbols since the last paper motion command was received.

Discussion The CAN command cancels all printable characters sent to the printer from the last paper motion command. If any attribute command is sent before a CAN command, all data before the attribute command are printed unless the attribute command is a Horizontal Tab command.

This command will cancel the double wide attribute if set by SO. No other print attributes are affected. A Cancel command can occur at any place in the datastream and is acted upon immediately.

Carriage Return

ASCII Code CR

Hex Code 0D

Dec Code 13

Purpose Returns the logical print head to the first character column (resets the pointer to the first character position).

Discussion If this code is configured for CR = CR + LF, command CR is converted to perform a carriage return and line feed function. Refer to the subsection entitled "Line Feed," page 8–38.

The CR = CR configuration causes the character position indicator to be positioned at character column one. Subsequent printable data preceding a paper motion command overstrikes previous printable data.

The CR code in Proprinter emulation cancels expanded (double wide) print when set by code SO. A carriage return can occur at any place in the datastream and is acted upon immediately.

Character Pitch 12 cpi

ASCII Code ESC :

Hex Code 1B 3A

Dec Code 27 58

Purpose Sets character pitch to 12 cpi.

Discussion Character pitch can also be set via front panel controls. Refer to Chapter 4, “Configuration,” for instructions. An ESC : code overrides any front panel setting. An ESC : code can occur at any place in the datastream and is acted upon immediately.

Clear Tabs

ASCII Code ESC R

Hex Code 1B 52

Dec Code 27 82

Purpose Clears all horizontal and vertical tab stops.

Discussion When ESC R is invoked, horizontal tab stops reinitialize to every eight columns, starting at column 9 (9, 17, 25,...), and the vertical tabs are cleared.

Condensed Print Select

ASCII Code	SI	ESC SI
Hex Code	0F	1B 0F
Dec Code	15	27 15

Purpose Selects up to 20 characters per inch (cpi) condensed print format.

Discussion The condensed print command SI affects all subsequent characters. After receiving code SI, all characters are printed in condensed print until reset by the Condensed Print Cancel command, DC2, printer reset, or a new print mode command. The Proprinter SI code (hex 0F) is equivalent to the ESC SI code. When condensed printing is selected, the following character pitches go into effect:
Printing at 5 cpi changes to 8.55 cpi.
Printing at 10 cpi changes to 17.1 cpi.
Printing at 12 cpi changes to 20 cpi.(Be sure the printer is printing at 12 cpi before enabling compressed print.)

Condensed print can occur at any place in the datastream and is acted upon immediately.

Example The following sample program illustrates condensed character printing and reset.

```
10 LPRINT "Control code"
20 LPRINT "SI selects"
30 LPRINT CHR$(15);
40 LPRINT "condensed character printing."
50 LPRINT "Control code DC2"
60 LPRINT CHR$(18);
70 LPRINT "resets condensed character printing."
```

```
Control code
SI selects
condensed character printing.
Control code DC2
resets condensed character printing.
```

Condensed Print Cancel and Set to 10 CPI

ASCII Code	DC2	ESC DC2
Hex Code	12	1B 12
Dec Code	18	27 18

Purpose Cancels condensed character printing and sets pitch to 10 cpi.

Discussion The Cancel Condensed Print command resets 6, 8.55, 12, 17.1, or 20 cpi pitch to 10 cpi character pitch. Other print attributes are not affected. Cancel Condensed Print command can occur at any place in the datastream and is acted upon immediately.

Define Carriage Return

ASCII Code ESC 5 n

Hex Code 1B 35 n

Dec Code 27 53 n

Purpose Defines the CR code as “do a carriage return only” (CR) or as “do a carriage return followed by a line feed” (CR + LF).

Discussion IF n = odd, CR = CR +LF.
If n = even, CR = CR

The value of n is from 0 to 255.

This command overrides the operator control panel setting.

Double Strike Printing (Select)

ASCII Code ESC G

Hex Code 1B 47

Dec Code 27 71

Purpose Selects double strike (bold) character printing.

Discussion When this command is received, all characters are printed in double strike until reset by the Double Strike Print reset command or printer reset.

Double strike printing is ignored for scripts and double high printing. Double strike printing can occur at any place in the datastream, is acted upon immediately, and reduces the print speed.

Example The following sample program illustrates double strike (bold) character printing.

```
10 LPRINT "Control code ESC G"
20 LPRINT CHR$(27);"G";
30 LPRINT "selects bold character printing,"
40 LPRINT "for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp."
50 LPRINT "Control code ESC H"
60 LPRINT CHR$(27);"H";
70 LPRINT "cancels bold character printing."
```

```
Control code ESC G
selects bold character printing,
for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp.
Control code ESC H
cancels bold character printing.
```

Double Strike Printing (Cancel)

ASCII Code ESC H

Hex Code 1B 48

Dec Code 27 72

Purpose Cancel double strike character printing.

Discussion The Double Strike Print Cancel command only cancels the double strike print character attribute. Other print attributes such as double wide printing are not affected. An ESC H code can occur at any place in the datastream and is acted upon immediately.

Double Wide Print

ASCII Code ESC W n

Hex Code 1B 57 n

Dec Code 27 87 n

Purpose Selects or cancels double wide print.

Discussion An ESC W code sets or cancels double wide print as follows:

The value of n is in the 00 to FF hex range.

If n = odd, double wide print is selected for all following lines.

If n = even, double wide print is cancelled for all following lines.

When expanded print using ESC W is received, all characters print double wide until cancelled by an even parameter hex code. An ESC W code can occur at any place in the datastream and is acted upon immediately.

Double wide print can also be set via the command SO and ESC SO, double wide print for one line only. An ESC W code overrides these settings.

Example The following sample program illustrates expanded character printing and expanded character printing reset.

```
10 LPRINT "Control code"
20 LPRINT "ESC W 1 selects"
30 LPRINT CHR$(27);"W";CHR$(1);
40 LPRINT "expanded character printing."
50 LPRINT "Control code"
60 LPRINT "ESC W 0 resets"
70 LPRINT CHR$(27);"W";CHR$(0);
80 LPRINT "expanded character printing."
```

```
Control code
ESC W 1 selects
e x p a n d e d   c h a r a c t e r   p r i n t i n g .
C o n t r o l   c o d e
E S C   W   0   r e s e t s
expanded character printing.
```

Double Wide Print (One Line Only)

ASCII Code SO

Hex Code 0E

Dec Code 14

Purpose Selects double wide print for one line only.

Discussion This expanded print command is a line–by–line print attribute; when the SO or ESC SO command is received, the current line will be printed double wide and automatically reset. This command can be reset by a paper motion command (LF, VT, CR), by the DC4 (double wide cancel) code, CAN or ESC W (double wide print). When you invoke double wide print, the characters per inch expand to the following:

If the Proprinter emulation is printing at 10 cpi, double wide print increases character size to 5 cpi.

If the Proprinter emulation is printing at 12 cpi, double wide print increases character size to 6 cpi.

If the Proprinter emulation is printing at 17.1 cpi, double wide print increases character size to 8.55 cpi.

Double wide print can occur at any place in the datastream and is acted upon immediately.

Example The following sample program illustrates Expanded Print for one line only.

```
10 LPRINT "Control code"
20 LPRINT "SO selects"
30 LPRINT CHR$(14);
40 LPRINT "expanded character printing"
50 LPRINT "for one line only."
```

```
Control code
SO selects
e x p a n d e d   c h a r a c t e r   p r i n t i n g
for one line only.
```

Double Wide Print (Cancel)

ASCII Code	DC4	ESC DC4
Hex Code	14	1B 14
Dec Code	20	27 20

Purpose Cancels double wide print, if it was set by command SO.

Discussion The DC4 code cancels Double Wide Print command SO. If Double Wide Print is not enabled, the DC4 code is ignored. A DC4 code can occur at any place in the datastream and is acted upon immediately.

When you cancel double wide print, the characters per inch revert to the following:

- If the Proprinter emulation is printing at 5 cpi, cancelling double wide print causes the print to revert to 10 cpi.
- If the Proprinter emulation is printing at 6 cpi, cancelling double wide print causes the print to revert to 12 cpi.
- If the Proprinter emulation is printing at 8.55 cpi, cancelling double wide print causes the print to revert to 17.1 cpi.

Emphasized Print (Select)

ASCII Code ESC E

Hex Code 1B 45

Dec Code 27 69

Purpose Selects emphasized character print format.

Discussion When the emphasized print command is received, all characters will be printed in emphasized print until reset by the Emphasized Print Reset command or printer reset. The emphasized print attribute can be used in either NLQ or Draft mode.

An ESC E code can occur at any place in the datastream and is acted upon immediately. Emphasized print reduces the current print speed. Use caution when combining this command with other print attributes: arbitrary combinations might yield unexpected results.

Example The following sample program illustrates emphasized character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC E selects"
30 LPRINT CHR$(27);"E";
40 LPRINT "emphasized character printing."
42 LPRINT "Control code ESC F"
50 LPRINT CHR$(27);"F";
60 LPRINT "cancels emphasized character printing."
```

```
Control code
ESC E selects
emphasized character printing.
Control code ESC F
cancels emphasized character printing.
```

Emphasized Print (Cancel)

ASCII Code ESC F

Hex Code 1B 46

Dec Code 27 70

Purpose Cancels emphasized character printing.

Discussion The emphasized print reset command only resets the emphasized print character attribute. An ESC F code can occur at any place in the datastream and is acted upon immediately.

Escape

Printer capability is greatly increased by combining character codes into escape sequences. Escape sequences always begin with the ASCII escape sequence introducer, ESC (hex 1B).

An ESC sequence introducer in the data stream signals the printer to wait for special instructions. The character codes following the ESC character tell the printer what to do.

NOTE: For readability, code sequences appear in this manual with spaces inserted between command elements. Do not insert spaces between code characters when you are programming unless the ASCII space character (SP) is part of a code sequence. For example, a code sequence printed in this manual as ***ESC [1*** is programmed as ***ESC[1***

An escape sequence uses two or more bytes to define a specific printer control function. The format for an escape sequence is:

ESC	**X**	**n**
1B	2D – 5F	0 – FF
Escape Sequence Introducer	Character(s)	Numerical parameter(s)

After the ESC character are one or more characters which indicate the action of the control code. One or more numerical parameters may in turn follow these characters. For example, the sequence ***ESC S n*** tells the printer to begin the superscript print attribute if n is an even number, or to begin the subscript attribute if n is an odd number.

If the characters following the ESC code are not within the defined ranges, or if they are within the defined ranges but not recognized as a function of this printer, the entire sequence is ignored.

An Escape code can occur anywhere in the datastream and is acted upon immediately.

Form Feed

ASCII Code FF

Hex Code 0C

Dec Code 12

Purpose Prints the data in the buffer, advances the paper to the next top–of–form, and moves the printhead to the first character column.

Discussion The default forms length is determined by the configuration in nonvolatile memory. Forms length is set by using the control panel form length setting or forms length commands. Code FF cancels double wide (expanded) characters if set by the SO command.

Form feed can occur at any place in the datastream and is acted upon immediately.

Forms Length Set (Inches)

ASCII Code ESC C 0 n

Hex Code 1B 43 00H n

Dec Code 27 67 0 n

Purpose Sets the length of forms (paper) in inches.

Discussion When ESC C 0 n sets the forms length, n alone is measured in inches, with a range of 1 through 21. All other values are ignored.

If the active print position is set to column 1, line 1 and printing has occurred on the page, perform a form feed to clear the buffer. If no printing has occurred, you need not invoke a form feed command. Forms length is defined in inches; therefore, subsequent line spacing changes do not affect the result of this command.

Forms length can also be set by the form length setting on the control panel. The command forms length setting from the host computer overrides the control panel setting and is reflected on the display when F/L is pressed.

A Forms Length Set code can occur at any place in the datastream and is acted upon immediately. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps.

NOTE: To check the exact value of the current forms length with the printer off–line, activate the forms length setting on the operator control panel.

Forms Length Set (Lines)

ASCII Code ESC C n

Hex Code 1B 43 n

Dec Code 27 67 n

Purpose Sets the length of a form (paper) in lines.

Discussion When forms length is set by the ESC C n sequence, it is the product of the parameter n and the current line spacing. The range of n is 1 through the total number of lines that total 21 inches at the current line spacing. When necessary, the form length is rounded to the nearest dot row position.

If the page length is set smaller than the line spacing, a line feed moves the current line spacing and a form feed advances paper to the next top–of–form position.

A line spacing change does not affect the forms length. If forms length is set with the ESC C code, it becomes the current forms length and the bottom margin is set to zero.

If the calculated forms length in lines is not an exact multiple of the paper step distance, the forms length value will be adjusted down to the next possible multiple.

A Forms Length Set code can occur at any place in the datastream and is acted upon immediately. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps.

NOTE: To check the exact value of the current forms length with the printer off–line, activate the forms length setting on the operator panel.

Horizontal Tab

ASCII Code HT

Hex Code 09

Dec Code 09

Purpose Moves the logical printhead right to the next horizontal tab stop.

Discussion Power–on default horizontal tabs are set at every eighth character in the Proprinter protocol. If there are no horizontal tabs set or the logical printhead is located at the last character column, the code is ignored and no movement occurs.

If double wide, double high attributes are enabled, single wide character spacing is used.

This code can be given at any place in the datastream and is acted upon immediately.

Horizontal Tab Set

ASCII Code ESC D n1 n2 nk 0

Hex Code 1B 44 n1 n2 nk 30

Dec Code 27 68 n1 n2 nk 48

Purpose Sets up to 28 horizontal tab positions.

Discussion n denotes the character column position, at the current character pitch, for each tab stop in relation to character column one. n can range from 1 through 255, inclusive, and all parameters must be in ascending order. Any out–of–order symbols are ignored, though the remainder of the sequence is processed. k defines the number of possible tab position settings, and ranges from 1 through 28. All parameters after 28 are ignored.

If defining a sequence of tabs, terminate the string with a 00H (*not* an ESC D 00H). Any change in character pitch within a line changes the tab positions for the entire line. If you want every column to be set with a horizontal tab, use ESC D 00H. If only one tab position is set and it is beyond the right margin, every column is set as a horizontal tab. An ESC D code can occur at any place in the datastream and is acted upon immediately. All control codes that define horizontal distance expressed in units of characters are stored internally in character columns. A different physical position results for each character density.

Example The following example illustrates horizontal tab setting and accessing.

Horizontal Tab Set (continued)

```
10 LPRINT "Control code"
20 LPRINT "ESC D CHR$(4);CHR$(10);CHR$(0)"
30 LPRINT "sets tab stops at columns 4 and 10."
40 LPRINT "Control code HT"
50 LPRINT "accesses the tab stops as follows:"
60 LPRINT CHR$(27);"D";CHR$(4);CHR$(10);CHR$(0);
70 LPRINT CHR$(9);
80 LPRINT "column 4"
90 LPRINT CHR$(9);CHR$(9);
100 LPRINT "column 10"
```

```
Control code
ESC D CHR$(4);CHR$(10);CHR$(0)
sets tab stops at columns 4 and 10.
Control code HT
accesses the tab stops as follows:
    column 4
          column 10
```

Initialize Parameters

ASCII Code ESC [K 4 0 n1 n2 n3 n4

Hex Code 1B 5B 4B 34 30 n1 n2 n3 n4

Dec Code 27 91 75 52 48 n1 n2 n3 n4

Purpose Sets the printer's initial condition.

Discussion Values n1, n3, and n4 define the bits that set various conditions for the printer.

Setting parameter n1 performs two functions: 1) Values 00–01 load and change the bits for parameters n3 and n4 to pre–configured settings. 2) Values FE and FF save the custom settings for parameters n3 and n4. The following table delineates the different load configurations:

n1 Hex Value	Function
00	Load configuration stored in NOVRAM
01	Load configuration stored in NOVRAM
04	Ignored
05	Ignored
FE	Save modified configuration in NOVRAM
FF	Save modified configuration in NOVRAM

Parameter n2, defines the printer as a Proprinter. If 03 or hex 16 is not used, the other commands are ignored.

Parameters n3 and n4 allow you to customize printer functionality at the bit level, as follows:

Initialize Parameters (continued)

n3 Bit	ON (1)	OFF (0)	Function
7	Ignore	Process	Process this byte
6	Reserved	Reserved	Reserved
5	——	——	N/A
4	LF + CR	LF	LF =
3	CR + LF	CR	CR =
2	12”	11”	Set form length
1	Enable	Disable	Slashed zero
0	2 (B)	1 (A)	Character Set

n4 Bit	ON (1)	OFF (0)	Function
7	Ignore	Process	Process this byte
6	850	437	Code page
5	uni	bi	Unidirectional printing
4	12	20	Compressed 12 cpi
3	——	——	N/A
2	Ignore	Enable	Form feed at TOF
1	8 inch	13.6 inch	Print width
0	N/A	N/A	Sheet feeder

This command sets the current line as top–of–form. It also clears vertical tabs and sets the horizontal tabs at every eight columns, starting at column 9.

An `ESC [ K` code can occur at any place in the datastream and is acted upon immediately. All numerical parameters are in the 00 to FF hex range unless stated otherwise. Unspecified parameters are ignored to the point where the error is detected, then subsequent symbols are interpreted.

Line Feed

ASCII Code LF

Hex Code 0A

Dec Code 10

Purpose Prints the data in the buffer (if any) and advances the paper one line at the current line space setting.

Discussion If configured for LF equals new line (LF = CR + LF), the logical print head is positioned at character column 1 of the new line. Otherwise, the logical print head does not move when configured for LF function only (LF = LF ONLY). The LF function cancels double wide (expanded) characters if set by the SO command.

Line feed can occur at any place in the datastream and is acted upon immediately.

Line Feed n/216 Inch

ASCII Code ESC J n

Hex Code 1B 4A n

Dec Code 27 74 n

Purpose Advances paper n/216 inches for one line only.

Discussion The range of n is 1 through 255. The value of n must be an integer multiple of 3 to move paper exactly n/216 inches.

Example The following example illustrates n/216–inch line spacing.

```
10 LPRINT "Control code ESC J 200
20 LPRINT CHR$(27);"J";CHR$(200);
30 LPRINT "performs a 200/216 inch"
40 LPRINT "line feed function for one line only."
```

```
Control code ESC J 200




performs a 200/216 inch
line feed function for one line only.
```

Line Spacing 1/8 Inch (8 lpi)

ASCII Code ESC 0

Hex Code 1B 30

Dec Code 27 48

Purpose Specifies continuous line spacing at 1/8–inch increments (8 lpi).

Discussion When the 1/8–inch line spacing command is received, all lines will be printed at 8 lpi until a new line spacing is selected or power is recycled. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps.

A line spacing command can occur at any place in the datastream and is acted upon immediately.

Example The following example illustrates 1/8–inch line spacing.

```
10 LPRINT "Control code ESC 0 sets"
20 LPRINT CHR$(27);"0";
30 LPRINT "line spacing at"
40 LPRINT "1/8 (8 lpi) inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 0 sets
line spacing at
1/8 (8 lpi) inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 7/72 Inch (10.3 lpi)

ASCII Code ESC 1

Hex Code 1B 31

Dec Code 27 49

Purpose Specifies the line spacing at 7/72–inch (10.3 lpi) increments.

Discussion When the 7/72–inch line spacing command is received, all lines will be printed at the 7/72–inch line spacing until a new line spacing is selected or power is recycled. The line spacing will be set at 10.3 lines per inch. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps.

A line spacing command can occur at any place in the datastream and is acted upon immediately.

Example The following example illustrates 7/72–inch line spacing.

```
10 LPRINT "Control code ESC 1 sets"
20 LPRINT CHR$(27);"1";
30 LPRINT "line spacing at"
40 LPRINT "7/72 inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 1 sets
line spacing at
7/72 inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing n/72 Inch (Executes)

ASCII Code ESC 2

Hex Code 1B 32

Dec Code 27 50

Purpose Executes line spacing as set by ESC A.

Discussion All NL or LF commands move the paper n/72–inch line spacing until a new line spacing is selected or power is recycled. If a distance has not been selected by ESC A, the default setting, 1/6–inch, is used. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps.

A line spacing command can occur at any place in the datastream and is acted upon immediately. See "Line Spacing n/72 Inch (Storage)," page 8–43 for storage information.

Example The following example illustrates 1/6–inch line spacing and assumes that a distance has not been set by ESC A.

```
10 LPRINT "Control code ESC 2 sets"
20 LPRINT CHR$(27);"2";
30 LPRINT "line spacing at"
40 LPRINT "6 lpi for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 2 sets
line spacing at
6 lpi for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing n/72 Inch (Storage)

ASCII Code ESC A n

Hex Code 1B 41 n

Dec Code 27 65 n

Purpose Stores a line spacing of n/72–inch increments.

Discussion Line spacing can be set in any increment from 1 to 255, inclusive. All other n values cause the command sequence to be ignored up to the point of the detected error. Subsequent symbols are then interpreted. To execute this setting, refer to “Line Spacing n/72 Inch (Execution),” page 8–42.

Line spacing can occur at any place in the datastream and is acted upon immediately. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps.

Example The following example illustrates 20/72–inch line spacing.

```
10 LPRINT "Control code ESC A 20 sets"
20 LPRINT CHR$(27);"A";CHR$(20);CHR$(27);"2";
30 LPRINT "line spacing at 20/72 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC A 20 sets
line spacing at 20/72 inch

increments for all subsequent lines

until reset or another spacing is selected.
```

Line Spacing n/216 Inch

ASCII Code ESC 3 n

Hex Code 1B 33 n

Dec Code 27 51 n

Purpose Sets graphic line spacing of n/216 for bit–image graphics using 8 bits.

Discussion The range of n = 1 – 255. The value of n must be an integer multiple of 3 to move exactly n/216 inch.

Example The following example illustrates n/216–inch line spacing.

```
10 LPRINT "Control code ESC 3 50 sets"
20 LPRINT CHR$(27);"3";CHR$(50);
30 LPRINT "line spacing at 50/216 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 3 50 sets
line spacing at 50/216 inch
increments for all subsequent lines
until reset or another spacing is selected.
```

Near Letter Quality Print

ASCII Code ESC I

Hex Code 1B 49 n

Dec Code 27 73 n

Purpose Selects a font.

Discussion Select a font using the following choices:

n Hex	Function
X0	Draft
X1	Draft
X2	NLQ
X3	NLQ
X4	Draft
X5	Draft
X6	NLQ
X7	NLQ
XB	NLQ underlined
XF	NLQ

The current pitch is not affected.

Overscoring

ASCII Code ESC _ n

Hex Code 1B 5F n

Dec Code 27 95 n

Purpose Enables or disables automatic overscoring of all characters.

Discussion When automatic overscore is enabled, all characters (including spaces and spaces resulting from tabs) are overscored until disabled. Full–height graphic characters are not printed with overscores.

An ESC _ code enables or disables automatic overscoring, as follows:
If n = odd, the overscore attribute is enabled and all printable characters following (spaces included) are printed with an overscore.
If n = even, the overscore attribute is cancelled.

An ESC _ code can occur at any place in the datastream and is acted upon immediately. All numerical parameters are in the 00 to FF hex range unless stated otherwise. Unspecified parameters are ignored to the point where the error is detected, then subsequent symbols are interpreted.

Use caution when combining this command with other print attributes: arbitrary combinations might yield unexpected results.

Example The following sample program illustrates automatic overscoring and overscoring reset.

```
10 LPRINT "Control code ESC _ 1"
20 LPRINT CHR$(27);"_";CHR$(1);
30 LPRINT "enables automatic overscoring."
40 LPRINT "Control code ESC _ 0"
50 LPRINT CHR$(27);"_";CHR$(0);
60 LPRINT "disables automatic overscoring."
```

```
Control code ESC _ 1
enables automatic overscoring.
Control code ESC _ 0
disables automatic overscoring.
```

Select Attributes

ASCII Code ESC [@ n1 0 0 0 n2 n3

Hex Code 1B 5B 40 n1 0 0 0 n2 n3

Dec Code 27 91 64 n1 0 0 0 n2 n3

Purpose Selects double high and double wide attributes, and single or double high line spacing.

Discussion Parameter n1 selects the attributes from n2 and n3, as follows:

n1 Hex Value	Function
03	Set character height and line feed settings according to the value of n2.
04	Set character height, line feed, and character settings according to the values of n2 and n3.

Parameter n2 defines the height attributes, as follows:

n2 Hex Value	Function
01	Set single line height characters
02	Set double height characters
10	Set single line spacing
11	Set single height characters and single line spacing
12	Set double high characters and single line spacing
20	Set double line spacing
21	Set single height characters and double line spacing
22	Set double high characters and double line spacing

Parameter n3 defines the width attributes, as follows:

n3 Hex Value	Function
01	Set single wide characters
02	Set double wide characters

Select Attributes (continued)

An `ESC [ @` code can occur at any place in the datastream and is acted upon immediately.

All numerical parameters are in the 00 to FF hex range unless stated otherwise. Unspecified parameters are ignored to the point where the error is detected, then subsequent symbols are interpreted.

Select Character Set 1 (A)

ASCII Code ESC 7

Hex Code 1B 37

Dec Code 27 55

Purpose Selects Character Set 1.

Discussion The character set is also selectable from the front panel, however, ESC 7 (or 6—Select Character Set 2) overrides the front panel command. This code can occur at any place in the datastream and is acted upon immediately.

Select Character Set 2 (B)

ASCII Code ESC 6

Hex Code 1B 36

Dec Code 27 54

Purpose Selects Character Set 2.

Discussion The character set is also selectable from the front panel, however, ESC 6 (or 7—Select Character Set 1) overrides the front panel command. This code can occur at any place in the datastream and is acted upon immediately.

Superscript/Subscript Printing

ASCII Code ESC S n

Hex Code 1B 53 n

Dec Code 27 83 n

Purpose Selects superscript or subscript printing.

Discussion An ESC S code can be set for superscript or subscript printing, as follows:
If n = odd, the subscript attribute is selected.
If n = even, the superscript attribute is selected.

When the super/subscript command is received, all characters will be superscript or subscript until reset by the super/subscript reset command or printer reset. Super/Subscript Print modes are not available for the double high attribute. An ESC S code can occur at any place in the datastream and is acted upon immediately, though super/subscript reduces the current print speed. Use caution when combining this command with other print attributes: arbitrary combinations might yield unexpected results.

Example The following sample program illustrates superscript/subscript printing.

```
10 LPRINT "Control Code ESC S 0 selects";
20 LPRINT CHR$(27);"S";CHR$(0);" SUPERSCRIPT";CHR$(27);"T"
30 LPRINT "A";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
40 LPRINT "+B";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
50 LPRINT "=C";CHR$(27);"S";CHR$(0);"2";
60 LPRINT CHR$(27);"T"
70 LPRINT "Control Code ESC S 1 selects";
80 LPRINT  CHR$(27);"S";CHR$(1);" SUBSCRIPT";CHR$(27);"T"
90 LPRINT "31";CHR$(27);"S";CHR$(1);"HEX";CHR$(27);"T";
100 LPRINT "=48";CHR$(27);"S";CHR$(1);"DEC";
110 LPRINT CHR$(27);"T"
120 LPRINT "Control Code ESC T cancels"
130 LPRINT "superscript/subscript printing."
```

Control Code ESC S 0 selects $^{\text{SUPERSCRIPT}}$
$A^2+B^2=C^2$
Control Code ESC S 1 selects $_{\text{SUBSCRIPT}}$
$31_{HEX}=48_{DEC}$
Control Code ESC T cancels
superscript/subscript printing.

Superscript/Subscript Printing (Cancel)

ASCII Code ESC T

Hex Code 1B 54

Dec Code 27 84

Purpose Cancels superscript and subscript printing. This code can occur at any place in the datastream and is acted upon immediately.

Set Top–of–Form

ASCII Code ESC 4

Hex Code 1B 34

Dec Code 27 52

Purpose Sets the current paper position as the top–of–form.

Discussion A top–of–form command can occur at any place in the datastream and is acted upon immediately.

Underline

ASCII Code ESC – n

Hex Code 1B 2D n

Dec Code 27 45 n

Purpose Enables or disables automatic underlining of all characters.

Discussion When automatic underline is enabled, all characters, including spaces are underlined until disabled. Enable/disable underline as follows:

n = odd enables automatic underlining (hex 00 or hex FF).

n = even disables automatic underlining (hex 01 or hex FF).

An underline command can occur at any place in the datastream and is acted upon immediately. Use caution when combining this command with other print attributes: arbitrary combinations might yield unexpected results.

Example The following sample program illustrates automatic underlining and underlining reset.

```
10 LPRINT "Control code ESC -1"
20 LPRINT CHR$(27);"-";CHR$(1);
30 LPRINT "enables automatic underlining."
40 LPRINT "Control code ESC -0"
50 LPRINT CHR$(27);"-";CHR$(0);
60 LPRINT "disables automatic underlining."
```

```
Control code ESC -1
enables automatic underlining.
Control code ESC -0
disables automatic underlining.
```

Unidirectional Printing

ASCII Code ESC U n

Hex Code 1B 55 n

Dec Code 27 85 n

Purpose Sets or cancels unidirectional printing for text.

Discussion An ESC U code sets or cancels unidirectional printing for text, as follows:

n = odd selects unidirectional text printing.

n = even cancels unidirectional text printing.

An ESC U code can occur at any place in the datastream and is acted upon immediately.

All numerical parameters are in the 00 to FF hex range unless stated otherwise.

Vertical Tab

ASCII Code VT

Hex Code 0B

Dec Code 11

Purpose Prints the data in the buffer and advances the paper to the next vertical tab position.

Discussion If a vertical tab format is not defined, the paper is advanced to the next line at the current line spacing. If a vertical tab format is defined but no vertical tab positions are set between the current print position and the end of the form, the paper is advanced to the next line at the current line spacing. If the printing crosses the page boundary, the VT terminator causes the paper to advance to the next top–of–form. The VT code cancels double wide (expanded) characters if set by the SO command.

If configured for LF = CR + LF (LF equals new line), the character position indicator is positioned at character column 1 of the new line. Otherwise, the character position indicator does not move.

A vertical tab can occur at any place in the datastream and is acted upon immediately.

Vertical Tab Set/Clear

ASCII Code ESC B n1 n2 nk 0

Hex Code 1B 42 n1 n2 nk 30

Dec Code 27 66 n1 n2 nk 48

Purpose Sets or clears vertical tab positions.

Discussion The physical position on the paper is defined by n and the current line spacing. n is the number of column settings. k equals the number of tab position settings possible. The value of n can both be defined in the range of 1 to 255, inclusive, while k is defined in the range of 1 to 64. Any value for k over 64 is ignored. Subsequent line spacing changes affect the tab position. If the value of n exceeds the forms length, that tab position is ignored. In Proprinter protocol, vertical tab positions are set by command ESC B and executed by command VT. The tab positions must be in ascending order or the Proprinter emulation ignores the out–of–order symbols. If the ESC B command is followed immediately by 00H, the vertical tab positions are cleared. All control codes that define vertical distance expressed in inches are stored internally in units of paper drive steps. The ESC B code can occur at any place in the datastream and is acted upon immediately.

Example The following sample program illustrates Vertical Tab Setting. To run the sample below, set your printer at top–of–form.

Vertical Tab Set/Clear (continued)

```
10 LPRINT "Line one - The control code"
20 LPRINT "ESC B 5 10 0 sets a vertical tab at line 5 and at line 10."
30 LPRINT CHR$(27);"B";CHR$(5);CHR$(10);CHR$(0);
40 LPRINT "Control code VT moves paper to the next vertical tab."
50 LPRINT CHR$(11);
60 LPRINT "Control code VT moves paper to the next vertical tab."
70 LPRINT CHR$(11);
80 LPRINT "This is line ten."
```

```
Line one - The control code
ESC B 5 10 0 sets a vertical tab at line 5 and at line 10.
Control code VT moves paper to the next vertical tab.

Control code VT moves paper to the next vertical tab.



This is line ten.
```

9 Epson FX Emulation

Chapter Contents

Epson Emulation

Emulation refers to the ability of a printer to execute the commands of other printer control languages. In Epson emulation mode, the printer prints files coded for Epson FX series printers and emulates certain features of Epson 850/1050 printers. You can configure the printer from the control panel to respond to Epson FX series control codes. (See “Selecting Epson FX Emulation” on page 9–3.)

Emulation Exceptions and Differences

Because of mechanical differences between LG06 and LG12 printers (line matrix printers) and Epson printers (moving printhead serial matrix printers), some Epson features are approximated or not supported.

- Italic printing is approximated by underlining the text. Sans serif NLQ fonts are substituted for Epson roman fonts. Justification and proportional spacing are not supported; the codes will have no effect on printing, but their effects on other control codes are emulated. Characters cannot be downloaded, but the download data are removed from the data stream.
- Codes that produce non–Epson behavior in the printer are indicated by a “dagger” (†) in the Control Code Index and code section.
- The Epson emulation supports the following fonts: Draft, and NLQ Gothic, with 10 cpi, 12 cpi, and 15 cpi in either condensed or normal widths. Condensed printing at 10 cpi in draft mode maps to 17 cpi. Character pitches other than 10 draft cpi map to 20 cpi in Draft and 16.4 cpi in NLQ. The NLQ Gothic fonts are all sans serif.
- Epson bit–image graphics are supported, including all plotter and CRT densities. Two character sets are used: IBM–PC Graphics (Proprinter Code Page 437) and Italics. You can configure the zero character to be slashed or unslashed.

IBM Proprinter Emulation

Epson printers have an “IBM compatibility” mode. The Proprinter emulation in the printer satisfies this requirement. (Refer to Chapter 8.)

Selecting Epson Emulation

You select the Epson emulation from the control panel:

1. If the printer is on–line, press the ON LINE switch to place it in the off–line state. “Off–Line Emulation” appears on the message display.
2. Open the printer cover.
3. On the control panel, press UP and DOWN simultaneously to unlock the ENTER switch. “Unlocked” appears briefly on the message display. (If “Locked” appears, simply press UP and DOWN again.)
4. Press DOWN to enter the emulation menu. The current emulation displays. If the display reads “Emulation Epson FX * ” go to step 8.
5. Press NEXT or PREV until “Emulation Epson FX” displays.
6. Press ENTER. An asterisk (*) appears after the display message. (“Emulation Epson FX * ” displays.) This indicates that the printer has set all configuration values associated with Epson emulation mode. The values are those previously saved when Epson emulation was selected. If no values were altered, the factory default values are loaded. (See Table 9–1.)
7. If you want to change the default values of the Epson emulation, refer to the configuration diagram and procedures in Chapter 4. When the configuration options are set to your satisfaction, go to step 8.
8. Press CLEAR to return to “Off–Line Emulation.”
9. Press UP and DOWN simultaneously to lock the ENTER switch. “Locked” appears briefly on the message display.
10. Close the printer cover.
11. Press the ON LINE switch to place the printer on–line to the host computer.

Default Values and States, Epson Emulation

The printer stores a set of typical operating states and conditions in ROM. The first time you power up the printer, the factory settings in Table 9–1 are automatically invoked.

Table 9–1. Factory Settings, Epson Emulation

Characteristic	Default Setting
Font	Draft 10
Condensed	No
Character Set	Epson
International Set	USA
Slashed Zero	No
CR =	CR
Default Page Length	11 inches
Default Skip Over Perf	No
Default Page Width	13.6 inches

Epson printers use two character sets. One is the IBM Graphics Code Page 437. The other set is unique to Epson. The Epson character set is basically the ASCII character set with the upper, non–ASCII set defined as italics, and the usually unprintable codes reassigned as international characters. In the LG06 and LG12 printer, the Epson italic character set prints underlined. (See Figure 9–1.)

hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	§	SP	0	@	P	`	p	à	§	SP	0	@	P	`	p
1	è	DC1	!	1	A	Q	a	q	è	ß	!	1	A	Q	a	q
2	ù	DC2	"	2	B	R	b	r	ù	Æ	"	2	B	R	b	r
3	ò	DC3	#	3	C	S	c	s	ò	æ	#	3	C	S	c	s
4	ì	DC4	$	4	D	T	d	t	ì	Ø	$	4	D	T	d	t
5	°	ø	%	5	E	U	e	u	°	ø	%	5	E	U	e	u
6	£	¨	&	6	F	V	f	v	£	¨	&	6	F	V	f	v
7	BEL	Ä	'	7	G	W	g	w	¡	Ä	'	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x	¿	Ö	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y	Ñ	Ü	)	9	I	Y	i	y
A	LF	ä	*	:	J	Z	j	z	ñ	ä	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[	k	{	¤	ö	+	;	K	[	k	{
C	FF	ü	,	<	L	\	l	|	₧	ü	,	<	L	\	l	|
D	CR	E	–	=	M	]	m	}	Å	E	–	=	M	]	m	}
E	SO	é	.	>	N	^	n		å	é	.	>	N	^	n	
F	SI	¥	/	?	O	_	o	DEL	ç	¥	/	?	O	_	o	Ø

Figure 9–1. Epson Character Set

The international characters in 00–1F and 80–9F appear when you invoke control code *ESC I 1*. Normally, these characters are either blank or control codes. The implementation is that the control codes hide the non–italic international characters, even in hex 00 to 1F, and DEL. DEL conceals the non–italic slashed zero.

Escape Sequences

An Epson control code consisting of more than one character is called an escape sequence because the first charcter in the sequence is always the ASCII ESCape character. ESC alerts the printer that a special function command—not printable characters—follows.

The general format for an escape sequence is:

(ESC)(parameter 1)(parameter 2)...(parameter n)

For example, to select emphasized (offset) print, send the ESC character followed by the E character (do *not* add a space character):

ASCII: ESC E **Hex:** 1B 45 **BASIC:** CHR$(27);“E”;

NOTE: ESC sequences must be end with a semicolon (;) in a BASIC program or with text following the escape sequence. A paper motion command directly following an escape sequence may result in unwanted paper movement.

Set and Reset Codes

Set and reset mean the same thing as turn on and off, select and deselect, or enable and disable. Some printer features are set and reset with an escape sequence and the numbers 1 or 0. In such cases you can represent 1 and 0 as hexadecimal codes 01 and 00, or as the ASCII codes for the numerals 1 and 0 (hexadecimal 31 and 30).

How Control Codes are Described in this Chapter

The following information is listed for each code (where applicable and possible):

ASCII Mnemonic – The ASCII name for the control code.

Hex Code – The hexadecimal equivalent of the code. (For decimal and octal equivalents, refer to Appendix A.)

Purpose – The function(s) of the control code.

Comment – A description of exceptions or limitations to normal use.

Example – A sample expression written in BASIC programming language is provided for some control codes to illustrate how the code is used. The example programs in this chapter were run on an IBM Personal Computer using Microsoft GW–BASIC, version 3.22.

† **(“dagger”)** symbol means the code produces non–Epson behavior in the printer.

Control Code Index and Descriptions

The following index lists the control codes by function, ASCII mnemonic, and page number. Some control code functions can also be selected at the control panel.

† = Produces non–Epson behavior in the printer.

† = Produces non–Epson behavior in the printer.

†	Set Intercharacter Spacing in 1/120”.	ESC SP	9–30
	Character Pitch 12 cpi	ESC M	9–31
	Character Pitch 10 cpi	ESC P	9–31
	Set Left Margin	ESC l	9–31
	Set Right Margin	ESC Q	9–32
†	Select Justification	ESC a	9–32
†	Proportional Spacing, Select/Deselect	ESC p	9–33

Emphasis

	Double Wide Print (1 line)	SO (or ESC SO)	9–34
	Double Wide Print	ESC W	9–35
	Double High Print, Set/Reset	ESC w	9–36
	Double Wide Print (1 line) Reset	DC4	9–36
	Condensed Print	SI (or ESC SI)	9–37
	Condensed Print Reset	DC2	9–38
	Underline	ESC –	9–38
†	Select Italic Printing	ESC 4	9–39
†	Select Italic Set	ESC t	9–39
	Cancel Italic Printing	ESC 5	9–39
	Emphasized (Offset) Print	ESC E	9–40
	Cancel Emphasized (Offset) Print	ESC F	9–40
	Bold Print Select	ESC G	9–41
	Bold Print Cancel	ESC H	9–41
	Select Superscript Printing	ESC S 0	9–42
	Select Subscript Printing	ESC S 1	9–42
	Cancel Superscript or Subscript Printing	ESC T	9–43

Font Control

†	Master Font and Emphasis Select	ESC !	9–43
†	Select User–Defined Font	ESC %	9–44
†	Define a Download Draft Font	ESC &	9–44
†	Remove Downloaded Characters	ESC :	9–44
†	Character Pitch 15 cpi	ESC g	9–45
†	Select Serif or Sans Serif Font	ESC k	9–45
	Select NLQ or Draft Font	ESC x	9–45

† = Produces non–Epson behavior in the printer.

Character Set Manipulation

	Make 80–9F Hex Printable	ESC 6	9–46
	Make 80–9F Control Codes	ESC 7	9–46
	Enable Printing of Hex Codes 00–1F and 80–9F	ESC I	9–48
	Set International Character Set	ESC R	9–50

Data Manipulation

	Cancel Line	CAN	9–51
	Delete Character	DEL	9–52
	Pass Bit 7 from Host	ESC #	9–52
	Clear Bit 7 of Incoming Data Bytes to 0	ESC =	9–52
	Set Bit 7 of Incoming Data Bytes to 1	ESC >	9–53

Graphics

	Select Graphics Mode	ESC *	9–53
	Reassign Graphics Mode	ESC ?	9–54
	Select 9–Pin Graphics Mode	ESC ^	9–54
	Single Density Bit–image Graphics	ESC K	9–55
	Double Density Bit–image Graphics	ESC L	9–56
	Double Density with No Adjacent Dots	ESC Y	9–57
	Quadruple Density Graphics	ESC Z	9–58

Miscellaneous Printer Control

	Initialize Printer	ESC @	9–59
	Printer Select, Remote	DC1	9–59
	Printer Deselect, Remote	DC3	9–59
	Unidirectional Print (1 line)	ESC <	9–60
	Turn Unidirectional Printing On or Off	ESC U	9–60
†	Turn Half–Speed Mode On or Off	ESC s	9–61
	Bell (Printer beeps 200 ms)	BEL	9–61
†	Cut–Sheet/Paper Feed Control	ESC EM	9–61

Line Feed

ASCII Code LF

HEX Code 0A

Purpose Prints the data in the buffer (if any) and advances the vertical character postion a distance of one line at the current line spacing.

Comment The simulated print head keeps the same distance from the margin. The current line is printed and the simulated printhead moves down a distance equal to the current line spacing. If there are no dots, paper moves and no printing occurs. When possible, successive line feeds are accumulated and moved at once.

This code cancels all one–line–only emphasis and font selections: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Carriage Return

ASCII Code CR

HEX Code 0D

Purpose Prints the data in the buffer, then returns the simulated print head to the left margin.

Comment A line feed may be appended if the printer is configured from the control panel for CR = CR + LF. Subsequent data are overstruck. If a CR occurs after a character sequence that generates no dots, the dot–less data are not printed. When CR = CR + LF, this code cancels all one–line–only emphasis and font controls: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Line Feed n/216 Inch

ASCII Code ESC J *n*

HEX Code 1B 4A *n*

Purpose Immediately advances the paper n/216 inch.

where *n* = 0 to 255 inclusive

Comment *n* = 0 is ignored. Paper movement occurs in multiples of 3/216 inch. This command produces an immediate line feed but does not affect line spacing or produce a carriage return. Any one–line–only print attributes in effect are canceled.

Small values of *n* may result in overlapping lines. Overlapping lines may also occur if print attributes such as double high, superscript, or subscript characters are used on the same line.

Example The following example illustrates n/216–inch line spacing.

```
10 LPRINT "Control code ESC J 200
20 LPRINT CHR$(27);"J";CHR$(200);
30 LPRINT "performs a 200/216 inch"
40 LPRINT "line feed function for one line only."
```

```
Control code ESC J 200




performs a 200/216 inch
line feed function for one line only.
```

Backward Line Feed n/216 Inch (One Line)

ASCII Code ESC j *n*

HEX Code 1B 6A *n*

Purpose Immediately moves the paper backward n/216 inch.

where *n* = 0 to 255 inclusive

† **Comment** This command is ignored by the printer.

Form Feed

ASCII Code FF

HEX Code 0C

Purpose Prints the data in the buffer, if any, then moves the paper to the top of the next form

Comment The simulated print head moves to the left margin. This code cancels all one–line–only emphasis and font controls: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Set Page Length by Lines

ASCII Code ESC C *n*

HEX Code 1B 43 *n*

Purpose Sets the page length by lines.

where *n* = hex 1 to hex 7F, to specify the number of lines per page at the current line spacing.

Comment The current line becomes the first line of the form. The forms length units are always defined in inches; therefore, subsequent line spacing changes do not affect the result of this command. Changing lpi does not change the forms length.

The forms length is set to the number of lines defined by the quotient of *n* and the current line spacing so that the units are in inches.

If the calculated forms length in lines is not an exact multiple of the target machine dot size, the forms length value will be adjusted down to the next possible multiple.

When forms length is set by an ESC C sequence, the skip–over perforation set by ESC N is cancelled.

Set Page Length in Inches

ASCII Code ESC C 0 *n*

HEX Code 1B 43 30 *n*

Purpose Sets page length to *n* inches.

where *n* = whole numbers (hex values) from 1 to 24 to specify the number of inches on a page.

Comment Upon receipt of this code, the current line becomes the first line of the form, and the form length set becomes the current forms length. Vertical tab positions set below the bottom of the form are ignored. Forms length is defined in inches; therefore, subsequent line spacing changes do not affect the result of this command.

Values of *n* greater than 24 are ignored.

When forms length is set by an ESC C sequence, the skip–over perforation set by ESC N is cancelled.

This control code overrides forms length set at the control panel.

Skip Over Perforation

ASCII Code ESC N *n*

HEX Code 1B 4E *n*

Purpose Selects the number of lines (at the current line spacing) for the paper to skip at the bottom of the perforated page.

where *n* = 1 to 127.

Comment *n* is the number of lines skipped between the last line printed on one page and the first line on the next page. The actual distance set is the product of *n* and the current line spacing. If the value of *n* exceeds the current form length, the skip is set to one line smaller than the form length or to 0, whichever is greater.

Skip over perforation set by this command overrides control panel settings. This feature is canceled by ESC O, ESC C, ESC C 0.

Skip Over Perforation Cancel

ASCII Code ESC O

HEX Code 1B 4F

Purpose Cancels the skip over perforation set by ESC N and resets the bottom margin to zero.

Comment O is ASCII uppercase o, not zero (0).

Vertical Tab, Execute

ASCII Code VT

HEX Code 0B

Purpose Advances the simulated print head to the next vertical tab position selected by *ESC /*.

Comment If no vertical channel was selected, channel 0 is used. If no vertical tabs were set, the paper advances one line.

The simulated print head moves to left margin. If a tab position is on the current line, the paper is moved to the next tab position. If there are no tab positions between the current line and the end of the form, the paper is moved to the top of the next form. If the printing crosses the page boundary, the VT command causes the paper to move to the top of the next form.

This code cancels all one–line–only emphasis and font controls: double–wide from SO and ESC SO, and unidirectional printing from ESC <.

Vertical Tab, Set/Clear

ASCII Code ESC B n*1 n2 n3...nk* NUL

HEX Code 1B 42 *n1 n2 n3...nk* 00

Purpose Sets up to 16 vertical tab positions.

where *n* = 0 to 255 and *k* = 1 to 16
n1 through *nk* specify the line number for the vertical tab(s), up to a maximum of 16 tab positions. NUL must end the sequence.

To clear the tab settings, send ESC B NUL (1B 42 00).

Expression CHR$(27);"B";CHR$(*n1*);...CHR$(*nk*);CHR$(0);

Comment The values of *n* range from 1 to 255 and must be in ascending order. The most significant bit of all *n* values is cleared when read, so that hex 81 becomes hex 1, and hex 80 becomes hex 0 and ends the load. The distance of each tab stop from TOF is the current line spacing times the number of lines given in *n*. If the value of *n* exceeds the form length, commands to move to that tab position are ignored.

If values of *n* are not in ascending order, the sequence up to and including the out–of–sequence number is ignored, and the rest of the load is processed. Skip over perforation is ignored.

This command always sets channel 0. You can clear channel 0 by sending ESC B 0. (See also the channel selection command, *ESC /*, and the channel loading command, *ESC b*.)

Example The following program illustrates Vertical Tab Setting.
(`10 LPRINT “Control Code”` is line 1. If you run the program first, instead of the listing, your print out will look different from the example.)

```
10 LPRINT "Control code"
20 LPRINT "ESC B 15 20 0 sets a vertical tab at line 15 and at line 20."
30 LPRINT CHR$(27);"B";CHR$(15);CHR$(20);CHR$(0);
40 LPRINT "Control code VT moves paper to the next vertical tab."
50 LPRINT CHR$(11);
60 LPRINT "Control code VT moves paper to the next vertical tab."
70 LPRINT CHR$(11);
80 LPRINT "This is line twenty."
```

```
Control code
ESC B 15 20 0 sets a vertical tab at line 15 and at line 20.
Control code VT moves paper to the next vertical tab.

Control code VT moves paper to the next vertical tab.




This is line twenty.
```

Select Vertical Tab Channel

ASCII Code ESC / *c*

HEX Code 1B 2F *c*

Purpose Selects a vertical tab channel set by ESC b.

where *c* = 0 through 7.

Comment Subsequent VT (Hex 0B) commands use tab table specified by *c*. If no tab table is selected, table 0 is used.

Set Vertical Tabs in Channels

ASCII Code ESC b *c n1 n2 n3* ... *nk* 0

HEX Code 1B 62 *c n1 n2 n3* ... *nk* 00

Purpose Assigns vertical tabs to channels established by ESC /.

where *c* = 0 through 7
nx = 0 through 255

Comment Channels are selected by ESC /. The most significant bit of all the *n* values is cleared when read, so that hex 81 becomes hex 1, and hex 80 becomes hex 0 which ends the load. The distance of each tab stop from TOF is the current line spacing times the number of lines given in *n*.

If paper movement is commanded to a value of *n* greater than the page length, the paper movement command is ignored. The values of *n* must be ascending order. If they are not, the sequence up to and including the out of sequence number is ignored. The rest of the load is processed. Skip over perforation is ignored.

You can clear any channel by sending ESC b *c* 0, where *c* is the channel number.

Line Spacing 1/6 Inch (6lpi)

ASCII Code ESC 2

HEX Code 1B 32

Purpose Sets the line spacing to 1/6 inch for subsequent line feeds.

Comment The 2 is ASCII *character* 2, not hex 2.

This control code overrides line spacing set at the control panel.

Example The following example illustrates 1/6–inch line spacing.

```
10 LPRINT "Control code ESC 2 sets"
20 LPRINT CHR$(27);"2";
30 LPRINT "line spacing at"
40 LPRINT "6 lpi for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 2 sets
line spacing at
6 lpi for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 1/8 Inch (8 lpi)

ASCII Code ESC 0

HEX Code 1B 30

Purpose Sets the line spacing to 1/8 inch (8 lpi) for subsequent line feeds.

Comment When ESC 0 is received, all lines are printed at 8 lpi until a new line spacing is selected or power is reset. This control code overrides line spacing set at the control panel.

Example The following example illustrates 1/8–inch line spacing.

```
10 LPRINT "Control code ESC 0 sets"
20 LPRINT CHR$(27);"0";
30 LPRINT "line spacing at"
40 LPRINT "1/8 (8 lpi) inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 0 sets
line spacing at
1/8 (8 lpi) inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing 7/72 Inch

ASCII Code ESC 1

HEX Code 1B 31

Purpose Sets the line spacing to 7/72 inch (10.3 lpi) for subsequent line feeds.

Comment All lines are printed at the 7/72–inch line spacing until a new line spacing is selected or power is reset. This control code overrides line spacing set at the control panel.

Printing speed is reduced if printed lines overlap.

Example The following example illustrates 7/72–inch line spacing.

```
10 LPRINT "Control code ESC 1 sets"
20 LPRINT CHR$(27);"1";
30 LPRINT "line spacing at"
40 LPRINT "7/72 inch for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 1 sets
line spacing at
7/72 inch for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing n/216 Inch

ASCII Code ESC 3 n

HEX Code 1B 33 n

Purpose Specifies the line spacing at n/216–inch increments.

where n = 1 to 255

Comment All line feeds following receipt of this code are at n/216 inch line spacing until a new line spacing is selected or power is reset. Line spacing set by this control code overrides line spacing setting set at the control panel.

If the vertical distance to move is other than a multiple of the n/216 inch, the remainder is added to the next paper motion command.

Paper movement occurs in multiples of 3/216 only.

Use caution when combining this control code with other print attributes such as Elongated (Double High), Superscript, or Subscript; overlapping lines may occur. Print speed is reduced if lines overlap.

Example The following example illustrates n/216–inch line spacing.

```
10 LPRINT "Control code ESC 3 50 sets"
20 LPRINT CHR$(27);"3";CHR$(50);
30 LPRINT "line spacing at 50/216 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC 3 50 sets
line spacing at 50/216 inch
increments for all subsequent lines
until reset or another spacing is selected.
```

Line Spacing n/72 Inch

ASCII Code ESC A *n*

HEX Code 1B 41 *n*

Purpose Sets a line spacing of n/72 inch for subsequent line feeds.

where *n* = 0 to 85 (all other values are ignored)

Comment When this control sequence is received, all subsequent line feeds are n/72–inch until a new line spacing is selected or power is reset. This setting overrides line spacing set at the control panel.

Small values of n may result in overlapping lines. Overlapping lines may also occur if print attributes such as Elongated (Double High), Superscript, or Subscript characters are used on the same line. If lines overlap, printing speed is reduced. Any values set by ESC 3 (line spacing n/216 inch) are replaced.

Example The following example illustrates 20/72–inch line spacing.

```
10 LPRINT "Control code ESC A 20 sets"
20 LPRINT CHR$(27);"A";CHR$(20);CHR$(27);"2";
30 LPRINT "line spacing at 20/72 inch"
40 LPRINT "increments for all subsequent lines"
50 LPRINT "until reset or another spacing is selected."
```

```
Control code ESC A 20 sets
line spacing at 20/72 inch

increments for all subsequent lines

until reset or another spacing is selected.
```

Disable Paper Out Detection

ASCII Code ESC 8

HEX Code 1B 38

Purpose Enable printing to the end of the paper supply when a paper out condition is sensed.

† Comment The printer decodes and ignores this command. This command is defined for the Epson FX–850 and FX, but not for the DFX–8000.

Enable Paper Out Detection

ASCII Code ESC 9

HEX Code 1B 39

Purpose Asserts a paper out condition immediately when the end of the paper supply is sensed.

† Comment The printer decodes and ignores this command. This command is defined for the Epson FX–850 and FX, but not for the DFX–8000.

Backspace

ASCII Code BS

HEX Code 08

Purpose Moves the simulated print head to the left one character space toward the first character column.

Comment Assures that the previous printable characters will be printed, then moves the simulated print head one character space to the left at the current pitch setting (which includes double wide and *ESC SP*).

If the simulated print head bumps into the left margin, it stops. This command is ignored if a justification mode of *ESC a n* is set with n $\neq$ 0, emulating the FX. If this code is sent immediately after graphics printing, it moves the simulated print head back to the beginning of the graphics.

Example Print and backspace two character positions.

```
10 LPRINT "TTTTT";
20 LPRINT CHR$(8);CHR$(8);
30 LPRINT "=="
```

```
TTT╪╪
```

Horizontal Tab Execute

ASCII Code HT

HEX Code 09

Purpose Moves the simulated print head to the next horizontal tab stop.

Comment Power–on default horizontal tabs are set at every eighth character at the current character spacing. Tab positions are not affected by a change of font or character width. Blank spaces between HT stops are not underlined in underline mode.

This command is ignored if a justification mode *ESC a n* is set with $n \neq 0$, emulating the FX.

Horizontal Tab Set/Release

ASCII Code ESC D *n1 ... nk*

HEX Code 1B 44 *n1 ... nk*

Purpose Sets up to 32 horizontal tab positions.

Expression CHR$(27);″D″;CHR$(n1);...CHR$(n32);CHR$(0);

where *n1* through *n32* specify the character column of the tab positions.
CHR$(0) is the sequence terminator.
n = 0 clears all tabs.

Comment The values of *n* must be listed in ascending order or they are ignored. Tabs greater than 32 or those positioned beyond the right margin are ignored. The physical tab position is the product of *n* and the current cell width (1/pitch), excluding double wide.

After tabs are set, HT moves the simulated print head to the next tab stop. Turning the printer off then on resets the tabs to every eighth character column.

Example The following example illustrates how to set horizontal tabs.

```
10 LPRINT "Control code"
20 LPRINT "ESC D CHR$(4);CHR$(10);CHR$(0)"
30 LPRINT "sets tab stops at columns 4 and 10."
40 LPRINT "Control code HT"
50 LPRINT "accesses the tab stops as follows:"
60 LPRINT CHR$(27);"D";CHR$(4);CHR$(10);CHR$(0);
70 LPRINT CHR$(9);
80 LPRINT "column 4"
90 LPRINT CHR$(9);CHR$(9);
100 LPRINT "column 10"
```

```
Control code
ESC D CHR$(4);CHR$(10);CHR$(0)
sets tab stops at columns 4 and 10.
Control code HT
accesses the tab stops as follows:
    column 4
          column 10
```

Set Absolute Horizontal Print Position in 1/60 Inch

ASCII Code ESC $ *n1 n2*

HEX Code 1B 24 *n1 n2*

Purpose Moves the simulated print head to an absolute horizontal print position, using 1/60 inch increments.

where $\frac{n1 + (n2 \times 256)}{60}$ = the unsigned distance in inches from the left margin.

Comment If the distance goes beyond right margin, the sequence is ignored.

Set Relative Horizontal Print Position in 1/120 Inch

ASCII Code ESC \ *n1 n2*

HEX Code 1B 5C *n1 n2*

Purpose Moves the simulated print head to an relative horizontal print position, using 1/120 inch increments.

Comment Adds (n1 + (n2 * 256))/120 to the horizontal position of the simulated print head. The number sent is two's complement, with negative numbers moving to the left. The command is ignored if it would move the simulated print head beyond the page margins.

Set Intercharacter Spacing in 1/120 Inch

ASCII Code ESC SP n

HEX Code 1B 20 n

Purpose Permits character spacing adjustments in 1/120 inch increments.

† Comment This command is decoded and ignored by the printer.

Character Pitch 12 CPI

ASCII Code ESC M

HEX Code 1B 4D

Purpose Sets character pitch to 12 characters per inch (cpi).

Comment This command is available in both DP and NLQ print modes.

Character Pitch 10 CPI

ASCII Code ESC P

HEX Code 1B 50

Purpose Sets character pitch to 10 characters per inch (cpi).

Comment This command is available in both DP and NLQ print modes. This command is normally used to cancel 12 cpi.

Set Left Margin

ASCII Code ESC l *n*

HEX Code 1B 6C *n*

Where *n* = number of columns from the left edge of the physical page to the beginning of the print line.

Purpose Sets the left margin to *n* columns in the current font.

Comment Be sure to use lowercase l (as in left) instead of the numeral 1 (one) for this command. The number of inches of margin does not vary if the font, character width, or horizontal dot density changes. This command automatically clears and resets horizontal tabs to every eight characters, then performs a CAN operation. The smallest possible space between the left and right margins is the width of one double wide 10 cpi character. If a margin control code violates this minimum distance, it is ignored.

Set Right Margin

ASCII Code ESC Q *n*

HEX Code 1B 51 *n*

where *n* = number of columns from the right edge of the physical page to the end of the print line.

Purpose Sets the right margin to *n* columns at the current character width.

Comment The number of inches of margin does not vary if the font, character width, or horizontal dot density changes. This command automatically clears and resets horizontal tabs to every eight characters, then performs a CAN operation. The smallest possible space between the left and right margins is the width of one double wide 10 cpi character. If a margin control code violates this minimum distance, it is ignored.

Select Justification

ASCII Code ESC a *n*

HEX Code 1B 61 *n*

Where *n* is an integer specifying the type of justification

Purpose Justifies text left, centered, right, or full (left and right).

† Comment This command is ignored by the printer, except that if $n \neq 0$ BS and HT are also ignored, and if $n = 3$ DEL is ignored. Epson is inconsistent: In an FX, when $n \neq 0$ BS and HT are disabled. In a DFX–8000, when $n = 3$ BS and DEL are ignored. In an Okidata KX–P1180, no disable is documented. $n = 0$ is the factory default in Epson printers.

Select Proportional Spacing

ASCII Code ESC p *n*

HEX Code 1B 70 *n*

Where *n* is an integer

Purpose Turns proportional mode on and off.

† Comment This command is ignored by the printer.

Double Wide Print (One Line)

ASCII Code SO
ESC SO

HEX Code 0E
1B 0E

Purpose Selects double wide print for one line only.

Comment This control code is a line–by–line print attribute; when SO or ESC SO is received, the current line prints twice as wide then automatically resets.

This control code is cancelled by the DC4 code, by a paper motion control code (LF, VT, etc.), or by CR.

Example The following program illustrates double wide print for one line only.

```
10 LPRINT "Control code"
20 LPRINT "SO selects"
30 LPRINT CHR$(14);
40 LPRINT "expanded character printing"
50 LPRINT "for one line only."
```

```
Control code
SO selects
e x p a n d e d   c h a r a c t e r   p r i n t i n g
for one line only.
```

Double Wide Print

ASCII Code ESC W *n*

HEX Code 1B 57 *n*

Purpose Turns double wide print on and off.

where *n* = hex 1 or hex 31 turns double wide print on
n = hex 0 or hex 30 turns double wide print off

Comment When ESC W is received, all characters are printed twice as wide until reset. This command overrides SO, ESC SO, and DC4.

Example The following program illustrates double wide character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC W 1 selects"
30 LPRINT CHR$(27);"W";CHR$(1);
40 LPRINT "expanded character printing."
50 LPRINT "Control code"
60 LPRINT "ESC W 0 resets"
70 LPRINT CHR$(27);"W";CHR$(0);
80 LPRINT "expanded character printing."
```

```
Control code
ESC W 1 selects
e x p a n d e d   c h a r a c t e r   p r i n t i n g .
C o n t r o l   c o d e
E S C   W   0   r e s e t s
expanded character printing.
```

Double High Print, Set/Reset

ASCII Code ESC w *n*

HEX Code 1B 77 *n*

Purpose Turns double high character printing on and off. Double high characters are standard width but twice as high.

where *n* = hex 1 or hex 31 turns double high printing on
n = hex 0 or hex 30 turns double high printing off

† Comment Superscript, subscript, and condensed modes are not available in double high mode, but resume when this mode is turned off.

Double Wide Print (One Line), Cancel

ASCII Code DC4

HEX Code 14

Purpose Cancels the double wide print for one line only selected by SO or ESC SO.

Comment This command cancels the double wide print selected by SO or ESC SO, but does not cancel double wide printing selected by ESC W or ESC !.

Condensed Print

ASCII Code SI
ESC SI

HEX Code 0F
1B 0F

Purpose Condenses print pitch as close to 60% of the former character width as possible.

Comment Draft 10 cpi condenses to Draft 17 cpi.
Draft 12 and 15 cpi condense to Draft 20.
NLQ 10, 12, or 15 cpi condense to NLQ 16.4 cpi.

Control code SI affects all subsequent characters. After receiving code SI, all characters are printed condensed until the printer is reset by ESC M, ESC P, DC2, a printer reset, or a new print mode control code. SI code (hex 0F) is equivalent to the ESC SI code.

If condensed print is not allowed in the current font, this code is ignored.

Example The following program illustrates condensed character printing and reset.

```
10 LPRINT "Control code"
20 LPRINT "SI selects"
30 LPRINT CHR$(15);
40 LPRINT "condensed character printing."
50 LPRINT "Control code DC2"
60 LPRINT CHR$(18);
70 LPRINT "resets condensed character printing."
```

```
Control code
SI selects
condensed character printing.
Control code DC2
resets condensed character printing.
```

Condensed Print Reset

ASCII Code DC2

HEX Code 12

Purpose Cancels the condensed print mode set by SI, ESC SI, or the control panel.

Comment This returns the printer to font that was active before condensed print occurred. Other print attributes are not affected.

Example See the Condensed Print control code (page 9–37) for an example of Condensed Print Reset.

Underline

ASCII Code ESC – *n*

HEX Code 1B 2D *n*

Purpose Turns automatic underlining on and off.

where *n* = NUL or 0 (hex 00 or hex 30) to turn off underlining
n = SOH or 1 (hex 01 or hex 31) to turn on underlining

Comment Spaces are underlined, but graphics and gray scale characters are not. White space skipped by HT are not underlined.

Example The following program illustrates underlining.

```
10 LPRINT "Control code ESC -1"
20 LPRINT CHR$(27);"-";CHR$(1);
30 LPRINT "enables automatic underlining."
40 LPRINT "Control code ESC -0"
50 LPRINT CHR$(27);"-";CHR$(0);
60 LPRINT "disables automatic underlining."
```

```
Control code ESC -1
enables automatic underlining.
Control code ESC -0
disables automatic underlining.
```

Select Italic Printing

ASCII Code ESC 4

HEX Code 1B 34

Purpose Turns on italic character printing.

† Comment The printer substitutes underlining for italic character printing. White spaces skipped by HT are not underlined. Character graphics (IBM graphic set hex B0 to DF and F0 to FE) cannot be italicized.

Cancel Italic Printing

ASCII Code ESC 5

HEX Code 1B 35

Purpose Turns off italic character printing.

† Comment This command turns off the underlining the printer substituted for italic character printing.

Select Italic Character Set

ASCII Code ESC t *n*

HEX Code 1B 74 *n*

Purpose Selects the italics character as characters from hex 80 to hex FF.

where *n* = hex 1 selects the roman character set
n = hex 0 selects the italics character set

† Comment The roman character set is assumed to be the IBM Graphics Code Page 437. The printer substitutes underlining for italics, but must change the upper character set to have the same characters as the lower character set. In underline mode, blank spaces between HT stops are not underlined when they are skipped by the1 HT command.

Emphasized Print

ASCII Code ESC E

HEX Code 1B 45

Purpose Selects emphasized character print format.

Comment Emphasized print makes text bolder by printing each dot twice, the second dot offset to the right of the first by a distance equal to 1/2 the width of a dot. This command is available in both draft and NLQ modes.

Example The following program illustrates emphasized character printing.

```
10 LPRINT "Control code"
20 LPRINT "ESC E selects"
30 LPRINT CHR$(27);"E";
40 LPRINT "emphasized character printing."
42 LPRINT "Control code ESC F"
50 LPRINT CHR$(27);"F";
60 LPRINT "cancels emphasized character printing."
```

```
Control code
ESC E selects
emphasized character printing.
Control code ESC F
cancels emphasized character printing.
```

Cancel Emphasized Print

ASCII Code ESC F

HEX Code 1B 46

Purpose Cancels emphasized character printing selected by ESC E or ESC !.

Comment This command is available in both draft and NLQ modes.

Select Double Strike

ASCII Code ESC G

HEX Code 1B 47

Purpose Makes text bolder by double printing each dot twice.

† Comment This command makes text bolder by printing each dot twice, the second dot offset to the right of the first by a distance equal to 1/2 the width of a dot, the same as with ESC E. Double strike is disabled in NLQ mode (emulating all Epson printers).

Example The following program illustrates double strike character printing.

```
10 LPRINT "Control code ESC G"
20 LPRINT CHR$(27);"G";
30 LPRINT "selects bold character printing,"
40 LPRINT "for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp."
50 LPRINT "Control code ESC H"
60 LPRINT CHR$(27);"H";
70 LPRINT "cancels bold character printing."
```

```
Control code ESC G
selects bold character printing,
for example: AaBbCcDdEeFfGgHhIiJjKkLlMmNnOoPp.
Control code ESC H
cancels bold character printing.
```

Cancel Double Strike

ASCII Code ESC H

HEX Code 1B 48

Purpose Turns off the double strike printing set by ESC G or ESC !.

Comment This control code resets only the double strike print attribute. Other print attributes, such as double wide printing, are not affected.

Superscript and Subscript Printing

ASCII Code ESC S *n*

HEX Code 1B 53 *n*

Purpose Selects superscript or subscript printing.

where *n* = NUL (hex 00) or 0 (hex 30) to enable superscript printing
n = SOH (hex 01) or 1 (hex 31) to enable subscript printing

Comment Superscript prints full–sized characters 3/72 inch higher than the normal characters. Subscript prints full–sized characters 3/72 inch lower than the normal characters. When the control code is received, all characters are superscript or subscript until reset by ESC T or printer reset.

You can print both superscript and subscript characters in the same character column by using the Backspace (BS) control code, but these characters will not print when double high printing is in effect.

Example The following program illustrates superscript and subscript printing.

```
10 LPRINT "Control Code ESC S 0 selects";
20 LPRINT CHR$(27);"S";CHR$(0);" SUPERSCRIPT";CHR$(27);"T"
30 LPRINT "A";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
40 LPRINT "+B";CHR$(27);"S";CHR$(0);"2";CHR$(27);"T";
50 LPRINT "=C";CHR$(27);"S";CHR$(0);"2";
60 LPRINT CHR$(27);"T"
70 LPRINT "Control Code ESC S 1 selects";
80 LPRINT CHR$(27);"S";CHR$(1);" SUBSCRIPT";CHR$(27);"T"
90 LPRINT "31";CHR$(27);"S";CHR$(1);"HEX";CHR$(27);"T";
100 LPRINT "=48";CHR$(27);"S";CHR$(1);"DEC";
110 LPRINT CHR$(27);"T"
120 LPRINT "Control Code ESC T cancels"
130 LPRINT "superscript/subscript printing."
```

Control Code ESC S 0 selects $^{\text{SUPERSCRIPT}}$
$A^2+B^2=C^2$
Control Code ESC S 1 selects $_{\text{SUBSCRIPT}}$
$31_{HEX}=48_{DEC}$
Control Code ESC T cancels
superscript/subscript printing.

Cancel Superscript and Subscript Printing

ASCII Code ESC T

HEX Code 1B 54

Purpose Cancels superscript and/or subscript printing as set by ESC S *n*.

Master Font and Emphasis Select

ASCII Code ESC ! *n*

HEX Code 1B 21 *n*

Purpose Selects or changes print attributes in a single command.

where *n* = an 8–bit number with the bits set to specify fonts and attributes, as shown in Table 9–2 below.

Table 9–2. Epson Master Select Options

Bit No.	Bit = 0	Bit = 1
0	10 cpi	12 cpi
1	Monospaced	† Proportional
2	Normal	† Condensed
3	Normal	† Emphasized
4	Normal	† Double Strike
5	Normal	† Double Wide
6	Normal	† Italic
7	Normal	Underlined

† Comment Proportional has no effect. Emphasized is substituted for double strike. Underlining is substituted for italic. Graphics and grey scale characters are not underlined. Blank spaces between HT stops are not underlined in either underline or italic mode when they are skipped by a HT.

Select User–Defined Font

ASCII Code ESC % *n*

HEX Code 1B 25 *n*

Purpose Selects a user–defined font.

† Comment The printer ignores this command and removes all sent font data from the data stream.

Define a Download Character

ASCII Code ESC &

HEX Code 1B 26

Purpose Defines a download character.

† Comment The printer ignores this command and removes all sent font data from the data stream.

Remove Downloaded Characters

ASCII Code ESC : 0 *n* 0

HEX Code 1B 3A 00 *n* 00

Purpose Erases all downloaded characters.

† Comment The printer ignores this command but removes all data sent.

Character Pitch 15 CPI

ASCII Code ESC g

HEX Code 1B 70

Purpose Sets character pitch to 15 characters per inch (cpi).

† Comment This command is not defined in Epson printers. It is included in this emulation for compatibility with the Okidata KX–P1180 printer.

Select Serif or Sans Serif Font

ASCII Code ESC k *n*

HEX Code 1B 78 *n*

Purpose To select an NLQ font.

where *n* = hex 0, hex 30, hex 1, or hex 31 selects a sans serif NLQ font

† Comment In the LG06 and LG12, this command is ignored because the NLQ fonts are sans serif. In Epson printers, n = hex 0 or 30 selects a roman NLQ font with serifs, while n = hex 1 or 31 selects a sans serif NLQ font.

Select NLQ or Draft Font

ASCII Code ESC x *n*

HEX Code 1B 78 *n*

Purpose To select correspondence or draft printing mode.

where *n* = hex 0 or hex 30 selects draft mode
n = hex 1 or hex 31 selects NLQ mode

Comment When you select NLQ mode, the font is sans serif. Fonts selected with this command override control panel selections.

Make 80–9F Hex Printable

ASCII Code ESC 6

HEX Code 1B 36

Purpose Makes codes 80–9F hex of IBM Code Page 437 printable characters.

Comment This is the default when the IBM PC graphics character set (Code Page 437) is selected as the default set at the control panel.

The characters printable are shown in Figure 9–2.

Make 80–9F Hex Control Codes

ASCII Code ESC 7

HEX Code 1B 37

Purpose Makes codes 80–9F hex of IBM Code Page 437 control codes.

Comment This is the default when the Epson italic character set is selected as the default set at the control panel.

KEY

BITS (B7 B6 B5 / B4 B3 B2 B1)	0 0 1	
1 0 1 1	ESC	33 27 1B

OCTAL
DECIMAL
HEX
CHARACTER

BITS B8 B7 B6 B5		1 0 0 0		1 0 0 1	
B4 B3 B2 B1	ROW	COLUMN 8		9	
0 0 0 0	0	à	200 128 80	§	220 144 90
0 0 0 1	1	è	201 129 81	ß	221 145 91
0 0 1 0	2	ù	202 130 82	Æ	222 146 92
0 0 1 1	3	ò	203 131 83	æ	223 147 93
0 1 0 0	4	ì	204 132 84	Ø	224 148 94
0 1 0 1	5	º	205 133 85	ø	225 149 95
0 1 1 0	6	£	206 134 86	¨	226 150 96
0 1 1 1	7	¡	207 135 87	Ä	227 151 97
1 0 0 0	8	¿	210 136 88	Ö	230 152 98
1 0 0 1	9	Ñ	211 137 89	Ü	231 153 99
1 0 1 0	10	ñ	212 138 8A	ä	232 154 9A
1 0 1 1	11	¤	213 139 8B	ö	233 155 9B
1 1 0 0	12	₧	214 140 8C	ü	234 156 9C
1 1 0 1	13	Å	215 141 8D	É	235 157 9D
1 1 1 0	14	å	216 142 8E	é	236 158 9E
1 1 1 1	15	ç	217 143 8F	¥	237 159 9F

Figure 9–2. Epson Printable Codes (Hex 00–1F and 80–9F)

Enable Printing of Hex Codes 00–1F and 80–9F

ASCII Code ESC I *n*

HEX Code 1B 49 *n*

Purpose Permits you to print hex codes 00–1F and 80–9F.

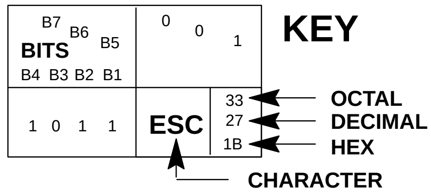
where *n* = 1 allows hex codes 00–1F and 80–9F to be printable and to be used for user–defined characters.

n = 0 returns hex 00–1F and 80–9F to control codes.

Comment The printable characters that are included in hex codes 00 through1F and 80 through 9F are usually not printable in the default state on Epson printers. Sending *ESC I 1* enables you to print characters in this range. Sending *ESC I 0* returns the codes to non–printable status.

The printable codes in the Epson character set are shown in Figure 9–3. The mapping of 00 through 1F and 80 through 9F are the same in this case. (Figure 9–3 shows the types of characters and their addresses; it is not a sample of printer output.)

In the IBM character set, the codes are the same as those in Code Page 437.



BITS B8 B7 B6 B5 →		0 0 0 0		0 0 0 1	
B4 B3 B2 B1	**ROW**	**COLUMN 0**		**1**	
0 0 0 0	0	à	0 0 0	§	20 16 10
0 0 0 1	1	è	1 1 1	ß	21 17 11
0 0 1 0	2	ù	2 2 2	DC2	22 18 12
0 0 1 1	3	ò	3 3 3	DC3	23 19 13
0 1 0 0	4	ì	4 4 4	DC4	24 20 14
0 1 0 1	5	°	5 5 5	ø	25 21 15
0 1 1 0	6	£	6 6 6	¨	26 22 16
0 1 1 1	7	BEL	7 7 7	Ä	27 23 17
1 0 0 0	8	BS	10 8 8	CAN	30 24 18
1 0 0 1	9	HT	11 9 9	Ü	31 25 19
1 0 1 0	10	LF	12 10 0 A	ä	32 26 1A
1 0 1 1	11	VT	13 11 0 B	ESC	33 27 1B
1 1 0 0	12	FF	14 12 0 C	ü	34 28 1C
1 1 0 1	13	CR	15 13 0 D	É	35 29 1D
1 1 1 0	14	SO	16 14 0 E	é	36 30 1E
1 1 1 1	15	SI	17 15 0 F	¥	37 31 1F

Figure 9–3. Epson Printable Codes (Hex 00–1F and 80–9F)

Character Set Select: International Languages

ASCII Code ESC R *n*

HEX Code 1B 52 *n*

Purpose Specifies a language overlay that prints the characters shown in Figure 9–4 when the specified code is invoked.

where *n* = hex 0 to E to determine the language overlay shown in Figure 9–4 below. Epson only defines character sets through hex C.

	n	Hex Codes 23	24	40	5b	5c	5d	5e	60	7b	7c	7d	7e
hex:	0:USA	#	$	@	[	\	]	^	`	{	|	}	~
	1:France	#	$	à	°	ç	§	^	`	é	ù	è	¨
	2:Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
	3:UK	£	$	@	[	\	]	^	`	{	|	}	~
	4:Denmark I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
	5:Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
	6:Italy	#	$	@	°	\	é	^	ù	à	ò	è	ì
	7:Spain I	Pt	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
	8:Japan	#	$	@	[	¥	]	^	`	{	|	}	~
	9:Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
	a:Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
	b:Spain I	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
	c:Latin Am	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú

Figure 9–4. Epson International Character Sets

Comment This control code setting overrides a character set selection made at the control panel. Values of *n* not in Figure 9–4 are ignored.

Example The following example illustrates international character selection using the IBM PC character set.

Character Set Select: International Languages (continued)

```
10 LPRINT "Control code ESC R 5 selects"
20 LPRINT "the Swedish character set shown beneath"
30 LPRINT "the USA (ASCII) characters."
40 LPRINT
50 LPRINT "A B C D [ \ ] ^ - ` { | } ~"
60 LPRINT CHR$(27);"R";CHR$(5);
70 LPRINT "A B C D [ \ ] ^ - ` { | } ~"
80 LPRINT CHR$(27);"R";CHR$(0);
```

```
Control code ESC R 5 selects
the Swedish character set shown beneath
the USA (ASCII) characters.

A B C D [ \ ] ^ - ` { | } ~
A B C D Ä ö Å ü - é ä ö å ü
```

Cancel Line

ASCII Code CAN

HEX Code 18

Purpose Clears all unprinted data from a line, but does not affect control codes.

Comment You can use this control code to delete a line, but do so with caution to avoid possible misprinting. This control code cancels the double wide attribute set by SO. No other print attributes are affected. The simulated print head goes to the print position it had after the last CR or paper motion command.

Delete Character

ASCII Code DEL

HEX Code 7F

Purpose Deletes the previous character on a line.

Comment This command is ignored if it occurs immediately after a CR, a paper motion command, or if a justification mode of *ESC a 3* is set (emulates a DFX–8000.) Characters truncated due to line length restrictions are not affected by this code.

Pass Bit 7 from Host

ASCII Code ESC #

HEX Code 1B 23

Purpose Passes bit 7 (the eighth and most significant bit) whether it is 1 or 0, thereby cancelling ESC > and ESC =.

Comment This command affects only text and control code data; bit 8 of graphics data is always passed through.

Clear Bit 7 of Incoming Data Bytes to 0

ASCII Code ESC =

HEX Code 1B 3D

Purpose Sets the most significant bit (MSB) of all incoming data to 0.

Comment The MSB is bit number 7. This command only affects text and control code data. Graphics data pass through unchanged. Some applications always set the MSB of print data to one (1), which results in italic or graphics printing in Epson printers. This command overcomes the problem.

Set Bit 7 of Incoming Data Bytes to 1

ASCII Code ESC >

HEX Code 1B 3E

Purpose Sets the most significant bit (MSB) of all incoming data to 1.

Comment The MSB is bit number 7. This command only affects text and control code data. Graphics data pass through unchanged.

Select Graphics Mode

ASCII Code ESC * *m n1 n2*

HEX Code 1B 2A *m n1 n2*

Purpose Turns on 8–pin bit image graphics mode *m*. Table 9–3 charts the graphics modes available.

Comment The total number of columns = *n1 + (n2 x 256)*.

Table 9–3. Epson Graphics Modes

m	**Option**	**Alternate Code**	**Density * (dots per inch)**	**Resolution ** (dots per inch)**
0	Single density	ESC K	60	120
1	Double density	ESC L	120	120 [1]
2	High–speed double density	ESC Y	60	120 [2]
3	Quadruple density	ESC Z	120	240 [1, 2, 3]
4	CRT I	none	80	160
5	Plotter (1:1)	none	72	144
6	CRT II	none	90	180
7	Double density plotter	none	144	144 [1]

[1] Prints at half speed.

[2] Data can be sent incorrectly. In these modes, no dots can be closer horizontally than the current font dot density. Sending incorrect data does not damage the printer.

[3] 240 DPI is simulated by combining the dots from two adjacent columns into one 120 DPI dot column.

* Number of horizontal dots per inch the printer can make.

** Number of dot columns available.

Reassign Graphics Mode

ASCII Code ESC ? *s m*

HEX Code 1B 3F *s m*

Purpose Changes one graphics mode to another.

Comment *s* is character K, L, Y, or Z, which is changed to mode *m* (0–7) from Table 9–3 (page 9–53). Thereafter, sending data to the bit image command makes the data print according to the graphics mode you select with *m*.

Select 9–Pin Graphics Mode

ASCII Code ESC ^ *m n1 n2 d1 ... dk*

HEX Code 1B 5E *m n1 n2 d1 ... dk*

Purpose Turns on 9–pin bit image graphics mode.

Comment *m* defines the plot density as shown in Table 9–4, on page 9–53. *n1 + (n2 x 256)* = The total number of columns.

This mode requires two bytes of graphic data for every column of print. Each column is sent as a pair: *d1, d3, ... d(k–1)* set the top 8 bits of a normal dot column, just like ESC K; *d2, d4, ... dk* set the ninth dot in the column (the most significant bit) just below the bottom–most dot of columns *d1, d3, ... d(k–1)*.

Graphics, Standard Density

ASCII Code ESC K *n1 n2*

HEX Code 1B 4B *n1 n2*

Purpose Selects normal density bit image graphics of 60 dots per inch horizontally and 72 dots per inch vertically.

Expression CHR$(27);″K″;CHR$(n1);CHR$(n2);″DATA″

where *n1 + 256 n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: “DATA” consist of 8–bit dot columns, with the MSB at the top, and “1” bits producing dots. For more information, refer to the bit image section in the Graphics chapter.

Comment You can change graphics density with the *ESC ?* command.

Example The following example produces a pattern of standard density bit image graphics. The 9 data bit pattern is repeated 27 times. Compare this example to the double density and quadruple density examples.

```
10 WIDTH "lpt1:",255
20 LPRINT "Single Density Bit Image Graphics"
30 LPRINT CHR$(27);"K";CHR$(244);CHR$(0);
40 FOR N=1 TO 27
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Single Density Bit Image Graphics
```

Graphics, Double Density

ASCII Code ESC L *n1 n2*

HEX Code 1B 4C *n1 n2*

Purpose Selects double density bit image graphics of 120 dots per inch.

Expression CHR$(27);″L″;CHR$(n1);CHR$(n2);″DATA″

where *n1 + 256 n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

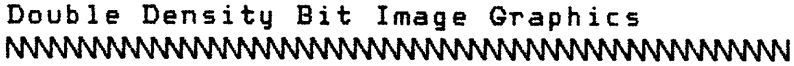
NOTE: "DATA" consist of 8–bit dot columns, with the MSB at the top, and "1" bits producing dots. For more information, refer to the bit image section in the Graphics chapter.

Comment Double density printing reduces print speed. You can change graphics density with the *ESC ?* command.

Example The following example produces double density bit image graphics of the pattern used in the standard density bit image mode example. The amount of data must be doubled for double density (the data are used 54 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Bit Image Graphics"
30 LPRINT CHR$(27);"L";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Double Density Bit Image Graphics
```



Graphics, Double Density Double Speed

ASCII Code ESC Y *n1 n2*

HEX Code 1B 59 *n1 n2*

Purpose Selects double density, double speed bit image graphics of 120 dpi horizontally and 72 dpi vertically.

Expression CHR$(27);″Y″;CHR$(n1);CHR$(n2);″DATA″

where *n1 + 256 n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: “DATA” consist of 8–bit dot columns, with the MSB at the top, and “1” bits producing dots. For more information, refer to the bit image section in the Graphics chapter.

Comment This mode prints double density with no adjacent dots. It is similar to ESC L, except that if the graphics data contain horizontally adjacent dots, the data may print incorrectly. This feature is widely used to move the print head precisely, by printing blank dot columns.

Example The following example produces a double density double speed graphic image of the pattern used in the standard density example. The amount of data must be doubled for double density (the data are used 54 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Double Density Double Speed Bit Image Graphics"
30 LPRINT CHR$(27);"Y";CHR$(231);CHR$(1);
40 FOR N=1 TO 54
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

Double Density Double Speed Bit Image Graphics

Graphics, Quadruple Density

ASCII Code ESC Z *n1 n2*

HEX Code 1B 5A *n1 n2*

Purpose Selects Quadruple Density Bit Image graphics of 240 dpi horizontally and 72 dpi vertically.

Expression CHR$(27);″Z″;CHR$(n1);CHR$(n2);″DATA″

where *n1 + 256 n2* define the number of data bytes to follow.
DATA = ASCII characters for the dot pattern bytes.

NOTE: “DATA” consist of 8–bit dot columns, with the MSB at the top, and “1” bits producing dots. For more information, refer to the bit image section in the Graphics chapter.

Comment This mode is similar to ESC L, except that four dot columns are printed in the space normally taken by two columns. You can change graphics density with the *ESC ?* command.

Example The following example produces quadruple density graphics of the pattern used in the standard density example. The amount of data must be quadrupled for quadruple density (the data are used 108 times rather than 27).

```
10 WIDTH "lpt1:",255
20 LPRINT "Quad Density Bit Image Graphics"
30 LPRINT CHR$(27);"Z";CHR$(205);CHR$(3);
40 FOR N=1 TO 108
50 RESTORE
60 FOR I=1 TO 9
70 READ R
80 LPRINT CHR$(R);
90 NEXT I
100 NEXT N
110 LPRINT CHR$(255)
120 DATA 255,128,64,32,16,8,4,2,1
```

```
Quad Density Bit Image Graphics
```

Initialize Printer

ASCII Code	ESC @
HEX Code	1B 40
Purpose	Resets all print–related parameters to values previously saved.
Comment	Resets the previously saved values and the print buffer is cleared of printable data on the line preceding the command. Current position is set as top–of–form. Font, international language selection, form length, skip–over perforation, and character pitch are reset to previously saved values. Other values are returned to default values. Character–by–character and line–by–line attributes are canceled. All channels of the vertical format unit are cleared. This command resets the horizontal tabs to every eighth character column. Interface parameters and printer protocol selection are not affected.

Printer Select, Remote

ASCII Code	DC1
HEX Code	11
Purpose	Places printer in the selected state.
Comment	This control code allows the printer to receive and print data from the host if it was deselected by DC3. If the printer was not deselected by DC3, this code is ignored.

Printer Deselect, Remote

ASCII Code	DC3
HEX Code	13
Purpose	Places printer in the deselected state.
Comment	When the printer receives this command it stops receiving and printing data until a DC1 (Printer Select) command is received.

Unidirectional Printing, 1 line

ASCII Code ESC <

HEX Code 1B 3C

Purpose Causes printing to occur from left to right for one line only.

Comment Printing normally occurs in both directions of shuttle movement. This command causes the printer to print from right to left for one line. The command is cancelled by a CR.

Unidirectional Printing, Set/Reset

ASCII Code ESC U *n*

HEX Code 1B 55 *n*

Purpose Causes printing to occur in only one direction of shuttle movement (left to right).

where *n* = NUL or 0 (hex 00 or 30) turns unidirectional mode off
n = SOH or 1 (hex 01 or 31) turns unidirectional mode on

Comment Printing normally occurs in both directions of shuttle movement. Unidirectional printing slows the printer down approximately 50%, but is sometimes used when very accurate dot placement is desired in graphics.

Half Speed Mode, On/Off

ASCII Code ESC s *n*

HEX Code 1B 73 *n*

Purpose Reduces printer speed 50%

where *n* = hex 00 or 30 turns half speed mode off
n = hex 01 or 31 turns half speed mode on

† Comment This is simulated in the printer by unidirectional printing.

Bell

ASCII Code BEL

HEX Code 07

Purpose Sounds the printer's buzzer/beeper.

Comment The BEL function will sound the buzzer/beeper for 0.2 seconds upon receipt of this command.

Cut–Sheet / Paper Feed Control

ASCII Code ESC EM n

HEX Code 1B 19 n

Purpose This code that controls the paper feed mechanism on Epson printers.

† Comment This code is ignored by the printer.

10 Graphics

Chapter Contents

Printing Graphic Images

The printer can produce bit image graphics when it is in Proprinter emulation mode. In either emulation, however, text printing is the default mode. Consequently, every line of graphics data must include the necessary plot mode command to enable the printer to perform graphics functions.

You can combine text and graphics on the same line when using the bit image protocol in the Proprinter Emulation mode.

Proprinter Compatible Bit Image Graphics

Bit image graphics are produced when the printer is in Proprinter Emulation mode. Bit image graphics are created by vertically printing the binary bit pattern of a series of data bytes. This mode prints the 1 (true) bits of each binary data byte. These data bytes are actually the binary equivalent of ASCII character decimal values 0 through 255. In bit image mode, the data byte is rotated to the vertical position, with the most significant bit (MSB) at the top.

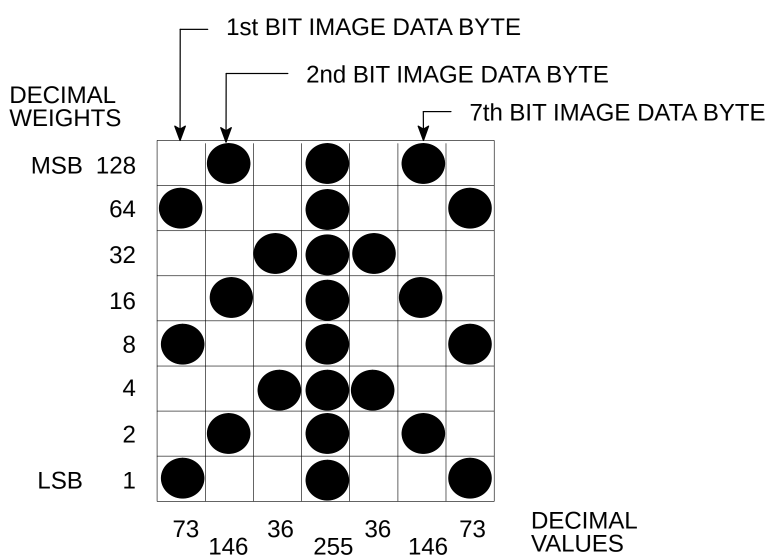


Figure 10–1. Bit Image Pattern Plan

Making a Bit Image Pattern

A Bit Image pattern is produced in four steps:

1. On a quadrille pad or graph paper, lay out the graphic pattern you want to print and divide the pattern into vertical data bytes.
2. Determine the decimal equivalent of each bit image data byte required to produce your pattern. (See Figure 10–1.)
3. Write a program to generate the complete pattern.
4. Enter and run the program on the host computer.

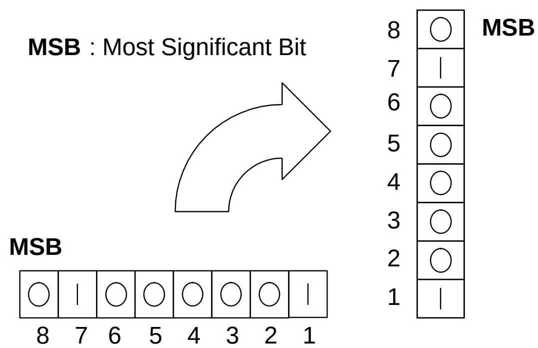


Figure 10–2. Vertical Data Byte Pattern

How to Produce Bit Images

The binary data byte bit pattern for the ASCII character A (hex 41, decimal 65) is pictured in Figure 10–2. If we rotate this data byte clockwise, the result is a vertical data byte pattern with the most significant bit (MSB) at the top. If we print each 1 (true) bit as a dot, the result is a bit image of ASCII character A. The relationship of the ASCII character, its decimal value, and its bit image plot is shown in Figure 10–3. All 8 bits of a data byte are used in the Correspondence (NLQ) and Data Processing (DP) print modes. The High Speed (HS) print mode uses only the six most significant bits of the data byte. Data bytes are identified by either their binary, octal, hexadecimal, or decimal equivalents. These numeric equivalents are combined to form a graphic pattern, such as that illustrated in Figure 10–1.

Bit Image plotting is not limited to printable ASCII characters. You can print bit Image patterns for any 8–bit data byte with decimal values ranging from 0 to 255. (The U.S. ASCII character set is in Appendix C.)

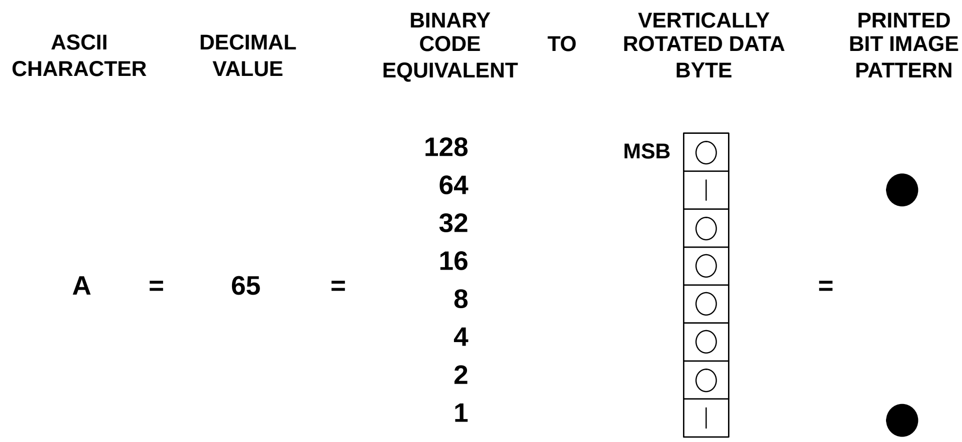


Figure 10–3. Bit Image Pattern from an ASCII Character

Bit Image Density

You can print bit image graphics in different dot densities. Select dot densities by sending a control code in the datastream:

- ESC K selects the Single Density mode.

  Single Density bit image graphics are printed at 60 dots per inch (dpi) horizontally and 75 dpi vertically.

- ESC L selects the Double Density mode.

  The Double Density mode prints up to twice the number of dots per inch horizontally in the same space as used for Single Density. The vertical dot density remains the same as in the Single Density mode. Double horizontal density requires twice the number of input data bytes to print the same length line as for Single Density. Printing double density reduces the printing speed by half.

- ESC Y selects the Double Speed, Double Density mode.

  When the Double Density, Double Speed control code is received, the data will be printed at double the horizontal dot density of single density graphics, but adjacent dots are not printed. Since Double Density graphics are printed at half speed, Double Speed, Double Density graphics are printed at the same speed as are Single Density graphics.

- ESC Z selects the Quadruple Density mode.

When printing Quadruple Density graphics, the printer pairs adjacent quadruple density bit image bytes. The compounded data are then printed in the Double Density mode. Printing at quadruple density reduces the printing speed by half.

Bit Image Programming Format

The Bit Image command format is:

ESC CC(n1)(n2)DATA

where:

ESC	=	the Proprinter compatible header
CC	=	K, L, Y or Z to select dot density (K=single, L=double, Y=double–density, double speed, Z=quadruple density)
n1,	=	(Number of DATA bytes) – 256(n2)
n2	=	(Number of DATA bytes)/256
DATA	=	the dot pattern bytes

The syntax of the Bit Image expression must be correct.

The number of data bytes and the n1, n2 definition must be equal.

Any characters following n1 and n2 will be interpreted and plotted as data until the n1, n2 definition is satisfied.

If n1 = n2 = 0, then control codes K, L, Y, or Z are ignored.

The maximum number of data bytes that can be included in the DATA portion of the program statement (when using 132 column paper) varies according to the dot density:

At 60 dpi, Single Density = 792 bytes;

Double Density = 1584 bytes

Quadruple Density = 3168 bytes

Data in excess of the right margin are discarded.

Bit Image Sample Program

The following sample program written in BASIC produces the Single Density bit image pattern shown in Figure 10–4. The 7–bit pattern is repeated 40 times.

```
10 LPRINT ″Single Density Bit Image Graphics″
20 LPRINT CHR$(27);″K″;CHR$(24);CHR$(1);
30 FOR N=1 TO 40
40 RESTORE
50 FOR I=1 TO 7
60 READ R
70 LPRINT CHR$(R);
80 NEXT I
90 NEXT N
100 DATA 73, 146, 36, 255, 36, 146, 73
110 LPRINT
```

Figure 10–4. Sample Single Density Bit Image Graphics

11 Character Sets

Chapter Contents

Introduction

The Digital, Proprinter, and Epson emulations offer different character sets and language overlays. The character sets shown in this chapter are accessable only in Digital emulation mode. Digital and Proprinter character set matrices and language substitution tables are provided in Appendix C. Epson FX printers can access two character sets: the Epson character set illustrated in Chapter 9 and the Proprinter Code (Page 437) shown in Appendix C.

Selecting the Character Set and Language

Most languages and fonts within each character set can be selected at the printer control panel and are illustrated in the Configuration Menu Diagram in Chapter 4. Select the appropriate language and character set as follows:

1. At the control panel, cycle through the character set selections and choose the desired character set.

2. Cycle through the international language selections available within the selected character set and select the language.

NOTE: Character set and language selection can also be made from the host computer using the DECAUPSS control string described in Chapter 7 or the ESC 6/ESC 7 sequence described in Chapter 8. In Digital emulation mode, some character sets can only be selected by the host computer.

OCR–A and OCR–B

OCR print modes are selected from the Print Mode feature at the Print Format (Level 1) of the Configuration Diagram shown in Chapter 4.

OCR print modes do not contain complete character sets. (OCR character set charts are located in Appendix C.) Available OCR–A standard characters are dictated by American National Standard Institute (ANSI) #X3.17–1981, and OCR–A international characters are in accordance with International Organization for Standardization (ISO) #646–1973. Available OCR–B standard and extended characters are dictated by ANSI #X3.49–1975. Undefined OCR characters are replaced with spaces. When an international language substitution is selected for a non–existent character, no substitution will occur.

Numeric Character Location Listing

Graphic symbols of the ASCII character set are listed in numeric order by hexadecimal address. Included is the decimal code and the symbol's name.

Table 11–1. Graphic Symbols for the ASCII Character Set

Hexadecimal Value	Decimal Code	Symbol Name
020	032	Space
021	033	Exclamation Point
022	034	Quotation Marks
023	035	Number Sign
024	036	Dollar Sign
025	037	Percent Sign
026	038	Ampersand
027	039	Apostrophe
028	040	Open Parenthesis
029	041	Closed Parenthesis
02A	042	Asterisk
02B	043	Plus
02C	044	Comma
02D	045	Hyphen or Minus
02E	046	Period or Decimal Point
02F	047	Slash
030	048	Zero (Not Slashed)
031	049	One
032	050	Two
033	051	Three
034	052	Four
035	053	Five
036	054	Six
037	055	Seven
038	056	Eight
039	057	Nine

Continued

Table 11–1. Graphic Symbols for the ASCII Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
03A	058	Colon
03B	059	Semicolon
03C	060	Less Than Symbol
03D	061	Equals Symbol
03E	062	Greater Than Symbol
03F	063	Question Mark
040	064	At Sign
041	065	Uppercase A
042	066	Uppercase B
043	067	Uppercase C
044	068	Uppercase D
045	069	Uppercase E
046	070	Uppercase F
047	071	Uppercase G
048	072	Uppercase H
049	073	Uppercase I
04A	074	Uppercase J
04B	075	Uppercase K
04C	076	Uppercase L
04D	077	Uppercase M
04E	078	Uppercase N
04F	079	Uppercase O
050	080	Uppercase P
051	081	Uppercase Q
052	082	Uppercase R
053	083	Uppercase S
054	084	Uppercase T
055	085	Uppercase U
056	086	Uppercase V
057	087	Uppercase W
058	088	Uppercase X
059	089	Uppercase Y
05A	090	Uppercase Z

Continued

Table 11–1. Graphic Symbols for the ASCII Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
05B	091	Open Bracket
05C	092	Backslash
05D	093	Closed Bracket
061	094	Circumflex
05E	095	Underline
05F	096	Open Single Quotation Mark/Grave Accent
060	097	Lowercase a
062	098	Lowercase b
063	099	Lowercase c
064	100	Lowercase d
065	101	Lowercase e
066	102	Lowercase f
067	103	Lowercase g
068	104	Lowercase h
069	105	Lowercase i
06A	106	Lowercase j
06B	107	Lowercase k
06C	108	Lowercase l
06D	109	Lowercase m
06E	110	Lowercase n
06F	111	Lowercase o
070	112	Lowercase p
071	113	Lowercase q
072	114	Lowercase r
073	115	Lowercase s
074	116	Lowercase t
075	117	Lowercase u
076	118	Lowercase v
077	119	Lowercase w
078	120	Lowercase x
079	121	Lowercase y
07A	122	Lowercase z
07B	123	Open Brace
		Continued

Table 11–1. Graphic Symbols for the ASCII Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
07C	124	Solid Vertical Line
07D	125	Closed Brace
07E	126	Tilde
07F	127	Delete

User Preference Supplemental (UPS) Character Sets

A symbol set is the alphabet of a font; it is a character set that can be printed regardless of the font characteristics designated for the print job. The default symbol set for the fonts in the printer is the U.S. ASCII set. The U.S. ASCII set is the base onto which other symbol set overlay sequences may be loaded. The default UPS character set is comprised of the DEC Supplemental character set and the ISO Latin 1 Supplemental character set. Select one of the character sets via the front panel or the control sequence, DECAUPSS, as described in Chapter 7.

The printer contains fourteen multinational character set overlays:

- DEC English
- DEC Dutch
- DEC Finnish
- French
- DEC French (Canadian)
- DEC Portuguese
- German
- Italian
- JIS Roman
- DEC Norwegian/Danish
- Spanish
- DEC Swedish
- DEC Swiss
- ISO Norwegian/Danish

Character set overlays contain characters and symbols that replace certain ASCII characters to create international alphabets. The following tables list the replacement characters used to make up language–specific symbols. Language symbol characters (National Replacement Characters, or NRCs) are substituted from the U.S. ASCII set at a maximum of twelve locations.

Table 11–2. DEC English Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Pound Sign

Table 11–3. DEC Dutch Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Pound Sign
040	064	Superscript Three
05B	091	Lowercase y with Umlaut
05C	092	Fraction One–Half
05D	093	Solid Vertical Bar
07B	123	Umlaut
07C	124	Lowercase f (with Fallback for Florin)
07D	125	Fraction One–Quarter
07E	126	Acute Accent

Table 11–4. DEC Finnish Character Set

Hexadecimal Value	Decimal Code	Symbol Name
05B	091	Uppercase A with Umlaut
05C	092	Uppercase O with Umlaut
05D	093	Uppercase A with Ring
05E	094	Uppercase U with Umlaut
060	096	Lowercase e with Acute Accent
07B	123	Lowercase a with Umlaut
07C	124	Lowercase o with Umlaut
07D	125	Lowercase a with Ring
07E	126	Lowercase u with Umlaut

Table 11–5. French Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Pound Sign
040	064	Lowercase a with Grave Accent
05B	091	Degree Sign
05C	092	Lowercase c with Cedilla
05D	093	Section Sign
07B	123	Lowercase e with Acute Accent
07C	124	Lowercase u with Grave Accent
07D	125	Lowercase e with Grave Accent
07E	126	Diaeresis (Trema, Umlaut)

Table 11–6. DEC French (Canadian) Character Set

Hexadecimal Value	Decimal Code	Symbol Name
040	064	Lowercase a with Grave Accent
05B	091	Lowercase a with Circumflex Accent
05C	092	Lowercase c with Cedilla
05D	093	Lowercase e with Circumflex Accent
05E	094	Lowercase i with Circumflex Accent
060	096	Lowercase o with Circumflex Accent
07B	123	Lowercase e with Acute Accent
07C	124	Lowercase u with Grave Accent
07D	125	Lowercase e with Grave Accent
07E	126	Lowercase u with Circumflex Accent

Table 11–7. German Character Set

Hexadecimal Value	Decimal Code	Symbol Name
040	064	Section Sign
05B	091	Uppercase A with Umlaut
05C	092	Uppercase O with Umlaut
05D	093	Uppercase U with Umlaut
07B	123	Lowercase a with Umlaut
07C	124	Lowercase o with Umlaut
07D	125	Lowercase u with Umlaut
07E	126	Sharp S

Table 11–8. Italian Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Pound Sign
040	064	Section Sign
05B	091	Degree Sign
05C	092	Lowercase c with Cedilla
05D	093	Lowercase e with Acute Accent
060	096	Lowercase u with Grave Accent
07B	123	Lowercase a with Grave Accent
07C	124	Lowercase o with Grave Accent
07D	125	Lowercase e with Grave Accent
07E	126	Lowercase i with Grave Accent

Table 11–9. JIS Roman Character Set

Hexadecimal Value	Decimal Code	Symbol Name
05C	092	Yen Sign

Table 11–10. DEC Norwegian/Danish Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Uppercase A with Umlaut
05B	091	Uppercase AE Diphthong
05C	092	Uppercase O with Slash
05D	093	Uppercase A with Ring
05E	094	Uppercase U with Umlaut
060	096	Lowercase a with Umlaut
07B	123	Lowercase ae Diphthong
07C	124	Lowercase o with Slash
07D	125	Lowercase a with Ring
07E	126	Lowercase u with Umlaut

Table 11–11. Spanish Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Pound Sign
040	064	Section Sign
05B	091	Inverted Exclamation Mark
05C	092	Uppercase N with Tilde
05D	093	Inverted Question Mark
07B	123	Degree Sign
07C	124	Lowercase n with Tilde
07D	125	Lowercase c with Cedilla

Table 11–12. DEC Swedish Character Set

Hexadecimal Value	Decimal Code	Symbol Name
040	064	Uppercase E with Acute Accent
05B	091	Uppercase A with Umlaut
05C	092	Uppercase O with Umlaut
05D	093	Uppercase A with Ring
05E	094	Uppercase U with Umlaut
060	096	Lowercase e with Acute Accent
07B	123	Lowercase a with Umlaut
07C	124	Lowercase o with Umlaut
07D	125	Lowercase a with Ring
07E	126	Lowercase u with Umlaut

Table 11–13. DEC Swiss Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Lowercase u with Grave Accent
040	064	Lowercase a with Grave Accent
05B	091	Lowercase e with Acute Accent
05C	092	Lowercase c with Cedilla
05D	093	Lowercase e with Circumflex Accent
05E	094	Lowercase i with Circumflex Accent
05F	095	Lowercase e with Grave Accent
060	096	Lowercase o with Circumflex Accent
07B	123	Lowercase a with Umlaut Mark
07C	124	Lowercase o with Umlaut Mark
07D	125	Lowercase u with Umlaut Mark
07E	126	Lowercase u with Circumflex Accent

Table 11–14. DEC Portuguese Character Set

Hexadecimal Value	Decimal Code	Symbol Name
040	064	Uppercase E with Acute Accent
05B	091	Uppercase A with Umlaut
05C	092	Uppercase O with Umlaut
05D	093	Uppercase A with Ring
05E	094	Uppercase U with Umlaut
060	096	Lowercase e with Acute Accent
07B	123	Lowercase a with Umlaut
07C	124	Lowercase o with Umlaut
07D	125	Lowercase a with Ring
07E	126	Lowercase u with Umlaut

Table 11–15. ISO Norwegian/Danish Character Set

Hexadecimal Value	Decimal Code	Symbol Name
023	035	Lowercase u with Grave Accent
040	064	Lowercase a with Grave Accent
05B	091	Lowercase e with Acute Accent
05C	092	Lowercase c with Cedilla
05D	093	Lowercase e with Circumflex Accent
05E	094	Lowercase i with Circumflex Accent
05F	095	Lowercase e with Grave Accent
060	096	Lowercase o with Circumflex Accent
07B	123	Lowercase a with Umlaut Mark
07C	124	Lowercase o with Umlaut Mark
07D	125	Lowercase u with Umlaut Mark
07E	126	Lowercase u with Circumflex Accent

Character Sets Without National Character Sets

The printer prints nine character sets in addition to the DEC multinational character sets. These are:

- DEC Supplemental Character Set
- VT100 Line Drawing (DEC Special Graphics) Character Set
- DEC Technical Character Set
- ISO 8859 Cyrillic
- ISO 8859 Greek
- ISO 8859 Hebrew
- ISO 8859 Latin 1
- ISO 8859 Latin 2
- ISO 8859 Latin 5

The Numeric Character listings for each character set follow. (Specific character set matrices are provided in Appendix C.)

Table 11–16. ISO Cyrillic Character Set

Hexadecimal Value	Decimal Code	Symbol Name
021	033	Uppercase IO
022	034	Uppercase Dje
023	035	Uppercase Gje
024	036	Uppercase Ie
025	037	Uppercase Dze
026	038	Uppercase I
027	039	Uppercase Yi
028	040	Uppercase Je
029	041	Uppercase Lje
02A	042	Uppercase Nje
02B	043	Uppercase Chje
02C	044	Uppercase Kje
02D	045	Space
02E	046	Uppercase short u
02F	047	Uppercase Dze
030	048	Uppercase A
031	049	Uppercase Be
032	050	Uppercase Ve
033	051	Uppercase Ghe
034	052	Uppercase De
035	053	Uppercase Ie
036	054	Uppercase Zhe
037	055	Uppercase Ze
038	056	Uppercase I
039	057	Uppercase I Kratkoe
03A	058	Uppercase Ka
03B	059	Uppercase El
03C	060	Uppercase Em
03D	061	Uppercase En
03E	062	Uppercase O
03F	063	Uppercase Pe
040	064	Uppercase Er
041	065	Uppercase Es
042	066	Uppercase Te
		Continued

Table 11–16. ISO Cyrillic Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
043	067	Uppercase U
044	068	Uppercase Ef
045	069	Uppercase Ha
046	070	Uppercase Tse
047	071	Uppercase Che
048	072	Uppercase Sha
049	073	Uppercase Shcha
04A	074	Uppercase Hard Sign
04B	075	Uppercase Yeru
04C	076	Uppercase Soft Sign
04D	077	Uppercase E
04E	078	Uppercase Yu
04F	079	Uppercase Ya
050	080	Lowercase A
051	081	Lowercase Be
052	082	Lowercase Ve
053	083	Lowercase Ghe
054	084	Lowercase De
055	085	Lowercase Ie
056	086	Lowercase Zhe
057	087	Lowercase Ze
058	088	Lowercase I
059	089	Lowercase I Kratkoe
05A	090	Lowercase Ka
05B	091	Lowercase El
05C	092	Lowercase Em
05D	093	Lowercase En
05E	094	Lowercase O
05F	095	Lowercase Pe
060	096	Lowercase Er
061	097	Lowercase Es
062	098	Lowercase Te
063	099	Lowercase U
064	100	Lowercase Ef

Continued

Table 11–16. ISO Cyrillic Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
065	101	Lowercase Ha
066	102	Lowercase Tse
067	103	Lowercase Che
068	104	Lowercase Sha
069	105	Lowercase Shcha
06A	106	Lowercase Hard Sign
06B	107	Lowercase Yeru
06C	108	Lowercase Soft Sign
06D	109	Lowercase E
06E	110	Lowercase Yu
06F	111	Lowercase Ya
070	112	Number Acronym
071	113	Lowercase Io
072	114	Lowercase Dje
073	115	Lowercase Gje
074	116	Lowercase Ie
075	117	Lowercase Dze
076	118	Lowercase I
077	119	Lowercase Yi
078	120	Lowercase Je
079	121	Lowercase Lje
07A	122	Lowercase Nje
07B	123	Lowercase Chje
07C	124	Lowercase Kje
07D	125	Section Sign
07E	126	Lowercase Short u
07F	127	Lowercase Dze

Table 11–17. ISO Greek Character Set

Hexadecimal Value	Decimal Code	Symbol Name
021	033	Grave Mark
022	034	Single Quotation Mark
023	035	Pound Sign
024–025	036–037	Space
026	038	Broken Bar
027	039	Section Sign
028	040	Diaeresis
029	041	Copyright
02A	042	Space
02B	043	Left Angle Quotation Mark
02C	044	Not Sign
02D–02E	045–046	Space
02F	047	Horizontal Bar
030	048	Degree Sign
031	049	Plus or Minus Sign
032	050	Superscript Two
033	051	Superscript Three
034	052	Rough
035	053	Diaeresis Accent Mark
036	054	Uppercase A with Rough
037	055	Small Dot
038	056	Uppercase Epsilon with Rough
039	057	Uppercase Eta with Rough
03A	058	Uppercase Iota with Rough
03B	059	Right Angle Quotation Mark
03C	060	Uppercase Omicron with Rough
03D	061	Fraction One–Half
03E	062	Uppercase Upsilon with Rough
03F	063	Uppercase Omega with Rough
040	064	Lowercase Iota with Rough & Diaeresis
041	065	Uppercase Alpha
042	066	Uppercase Beta
043	067	Uppercase Gamma
044	068	Uppercase Delta
		Continued

Table 11–17. ISO Greek Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
045	069	Uppercase Epsilon
046	070	Uppercase Zeta
047	071	Uppercase Eta
048	072	Uppercase Theta
049	073	Uppercase Iota
04A	074	Uppercase Kappa
04B	075	Uppercase Lamda
04C	076	Uppercase Mu
04D	077	Uppercase Nu
04E	078	Uppercase Ksi
04F	079	Uppercase Omicron
050	080	Uppercase Pi
051	081	Uppercase Rho
052	082	Space
053	083	Uppercase Sigma
054	084	Uppercase Tau
055	085	Uppercase Upsilon
056	086	Uppercase Phi
057	087	Uppercase Khi
058	088	Uppercase Psi
059	089	Uppercase Omega
05A	090	Uppercase I with Diaeresis
05B	091	Uppercase Upsilon with Diaeresis
05C	092	Lowercase Alpha with Rough
05D	093	Lowercase Epsilon with Rough
05E	094	Lowercase Eta with Rough
05F	095	Lowercase Iota with Rough
060	096	Lowercase Epsilon with Umlaut and Rough
061	097	Lowercase Alpha
062	098	Lowercase Beta
063	099	Lowercase Gamma
064	100	Lowercase Delta
065	101	Lowercase Epsilon
066	102	Lowercase Zeta
		Continued

Table 11–17. ISO Greek Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
067	103	Lowercase Eta
068	104	Lowercase Theta
069	105	Lowercase Iota
06A	106	Lowercase Kappa
06B	107	Lowercase Lambda
06C	108	Lowercase Mu
06D	109	Lowercase Nu
06E	110	Lowercase Ksi
06F	111	Lowercase Omicron
070	112	Lowercase Pi
071	113	Lowercase Rho
072	114	Lowercase Terminal Sign
073	115	Lowercase Sigma
074	116	Lowercase Tau
075	117	Lowercase Upsilon
076	118	Lowercase Phi
077	119	Lowercase Khi
078	120	Lowercase Psi
079	121	Lowercase Omega
07A	122	Lowercase Iota with Y with Diaeresis
07B	123	Lowercase Upsilon with Diaeresis
07C	124	Lowercase Omicron with Rough
07D	125	Lowercase Upsilon with Rough
07E	126	Lowercase Omega with Rough
07F	127	Space

Table 11–18. ISO Hebrew Character Set

Hexadecimal Value	Decimal Code	Symbol Name
021	033	Space
022	034	Cent Sign
023	035	Pound Sign
024	036	Currency Sign
025	037	Yen Sign
026	038	Broken Bar
027	039	Section Sign
028	040	Diaeresis
029	041	Copyright Symbol
02A	042	Multiply Sign
02B	043	Left Angle Quote
02C	044	Not Sign
02D	045	Space
02E	046	Registered Trade Mark
02F	047	Line Above
030	048	Degree Symbol
031	049	Plus or Minus
032	050	Superscript Two
033	051	Superscript Three
034	052	Single Quote
035	053	Lowercase Mu
036	054	Paragraph Sign
037	055	Small Dot
038	056	Cedilla
039	057	Superscript One
03A	058	Divide Sign
03B	059	Right Angle Quote
03C	060	Fraction One–Quarter
03D	061	Fraction One–Half
03E	062	Fraction Three–Quarters
03F	063	Space
040 – 05E	064 – 94	Space
05F	95	Double Low Line
		Continued

Table 11–18. ISO Hebrew Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
060	096	Aleph
061	097	Bet
062	098	Gimel
063	099	Dalet
064	100	He
065	101	Waw
066	102	Zain
067	103	Chet
068	104	Tet
069	105	Yod
06A	106	Kaph with Terminal
06B	107	Kaph
06C	108	Lamed
06D	109	Mem with Terminal
06E	110	Mem
06F	111	Nun with Terminal
070	112	Nun
071	113	Samech
072	114	Ayin
073	115	Pe with Terminal
074	116	Pe
075	117	Zade with Terminal
076	118	Zade
077	119	Qoph
078	120	Resh
079	121	Shin
07A	122	Taw
07B – 07F	123 – 127	Space

Table 11–19. ISO Latin 2 Character Set

Hexadecimal Value	Decimal Code	Symbol Name
021	033	Uppercase A with Ogonek
022	034	Breve
023	035	Uppercase L with Bar
024	036	Currency Sign
025	037	Uppercase L with Caron
026	038	Uppercase S with Acute
027	039	Section Sign
028	040	Diaeresis
029	041	Uppercase S with Caron
02A	042	Uppercase S with Cedilla
02B	043	Uppercase T with Caron
02C	044	Uppercase Z with Acute
02D	045	Space
02E	046	Uppercase Z with Caron
02F	047	Uppercase Z with Dot
030	048	Degree
031	049	Lowercase A with Ogonek
032	050	Ogonek
033	051	Lowercase L with Bar
034	052	Acute Accent
035	053	Lowercase L with Caron
036	054	Lowercase S with Acute
037	055	Caron Mark
038	056	Cedilla
039	057	Lowercase S with Caron
03A	058	Lowercase S with Cedilla
03B	059	Lowercase T with Caron
03C	060	Lowercase Z with Acute
03D	061	D with Acute Accent
03E	062	Lowercase Z with Caron
03F	063	Lowercase 2 with Dot
040	064	Uppercase R with Acute
		Continued

Table 11–19. ISO Latin 2 Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
041	065	Uppercase A with Acute
042	066	Uppercase A with Circumflex
043	067	Uppercase A with Breve
044	068	Uppercase A with Diaeresis
045	069	Uppercase L with Acute
046	070	Uppercase C with Acute
047	071	Uppercase C with Cedilla
048	072	Uppercase C with Caron
049	073	Uppercase E with Acute
04A	074	Uppercase E with Ogonek
04B	075	Uppercase E with Diaeresis
04C	076	Uppercase E with Caron
04D	077	Uppercase I with Acute
04E	078	Uppercase I with Circumflex
04F	079	Uppercase D with Caron
050	080	Uppercase D with Stroke
051	081	Uppercase N with Acute
052	082	Uppercase N with Caron
053	083	Uppercase O with Acute
054	084	Uppercase O with Circumflex
055	085	Uppercase O with Acute
056	086	Uppercase O with Diaeresis
057	087	Multiply Sign
058	088	Uppercase R with Caron
059	089	Uppercase U with Ring Above
05A	090	Uppercase U with Acute
05B	091	Uppercase UD with Acute
05C	092	Uppercase U with Diaeresis
05D	093	Uppercase Y with Acute
05E	094	Uppercase T with Cedilla
05F	095	Sharp S
060	096	Lowercase R with Acute
061	097	Lowercase A with Acute
062	098	Lowercase A with Circumflex
		Continued

Table 11–19. ISO Latin 2 Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
063	099	Lowercase A with Breve
064	100	Lowercase A with Diaeresis
065	101	Lowercase L with Acute
066	102	Lowercase C with Acute
067	103	Lowercase C with Cedilla
068	104	Lowercase C with Caron
069	105	Lowercase E with Acute
06A	106	Lowercase E with Ogonek
06B	107	Lowercase E with Diaeresis
06C	108	Lowercase E with Circumflex
06D	109	Lowercase I with Acute
06E	110	Lowercase I with Circumflex
06F	111	Lowercase D with Caron
070	112	Lowercase D with Stroke
071	113	Lowercase N with Acute
072	114	Lowercase N with Caron
073	115	Lowercase O with Acute
074	116	Lowercase O with Circumflex
075	117	Lowercase OD with Acute
076	118	Lowercase O with Diaeresis
077	119	Divide Sign
078	120	Lowercase R with Caron
079	121	Lowercase U with Ring Above
07A	122	Lowercase U with Acute
07B	123	Lowercase UD with Acute
07C	124	Lowercase U with Diaeresis
07D	125	Lowercase Y with Acute
07E	126	Lowercase T with Cedilla
07F	127	Superscript Dot

Table 11–20. ISO Latin 5 Character Set

Hexadecimal Value	Decimal Code	Symbol Name
021	033	Inverted Exclamation Mark
022	034	Cent Sign
023	035	Pound Sign
024	036	Currency Sign
025	037	Yen Sign
026	038	Broken Bar
027	039	Section Sign
028	040	Diaeresis
029	041	Copyright Symbol
02A	042	Feminine Ordinal Indicator
02B	043	Left Angle Quotation Mark
02C	044	Not Sign
02D	045	Space
02E	046	Registered Trade Mark
02F	047	Macron
030	048	Degree Sign
031	049	Plus or Minus Sign
032	050	Superscript Two
033	051	Superscript Three
034	052	Single Quotation Mark
035	053	Lowercase Mu
036	054	Paragraph Sign
037	055	Small Dot
038	056	Cedilla
039	057	Superscript One
03A	058	Masculine Ordinal Indicator
03B	059	Right Angle Quotation Mark
03C	060	Fraction One–Quarter
03D	061	Fraction One–Half
03E	062	Fraction Three–Quarters
03F	063	Inverted Question Mark
040	064	Uppercase A with Grave
041	065	Uppercase A with Acute
042	066	Uppercase A with Circumflex
		Continued

Table 11–20. ISO Latin 5 Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
043	067	Uppercase A with Tilde
044	068	Uppercase A with Diaeresis
045	069	Uppercase A with Ring
046	070	Uppercase AE Diphthong
047	071	Uppercase C with Cedilla
048	072	Uppercase E with Grave
049	073	Uppercase E with Acute
04A	074	Uppercase E with Circumflex
04B	075	Uppercase E with Diaeresis
04C	076	Uppercase I with Grave Mark
04D	077	Uppercase I with Acute
04E	078	Uppercase I with Circumflex
04F	079	Uppercase I with Diaeresis
050	080	Uppercase G with Breve
051	081	Uppercase N with Tilde
052	082	Uppercase O with Grave
053	083	Uppercase O with Acute
054	084	Uppercase O with Circumflex
055	085	Uppercase O with Tilde
056	086	Uppercase O with Diaeresis
057	087	Multiply Sign
058	088	Uppercase O with Slash
059	089	Uppercase U with Grave
05A	090	Uppercase U with Acute
05B	091	Uppercase U with Circumflex
05C	092	Uppercase U with Diaeresis
05D	093	Uppercase I with Ring Above
05E	094	Uppercase S with Cedilla
05F	095	Sharp S
060	096	Lowercase A with Grave
061	097	Lowercase A with Acute
062	098	Lowercase A with Circumflex
063	099	Lowercase A with Tilde
064	100	Lowercase A with Diaeresis
		Continued

Table 11–20. ISO Latin 5 Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
065	101	Lowercase A with Ring Above
066	102	Lowercase AE Diphthong
067	103	Lowercase C with Cedilla
068	104	Lowercase E with Grave
069	105	Lowercase E with Acute
06A	106	Lowercase E with Circumflex
06B	107	Lowercase E with Diaeresis
06C	108	Lowercase I with Grave
06D	109	Lowercase I with Acute
06E	110	Lowercase I with Circumflex
06F	111	Lowercase I with Diaeresis
070	112	Lowecase G with Breve
071	113	Lowercase N with Tilde
072	114	Lowercase O with Grave
073	115	Lowercase O with Acute
074	116	Lowercase O with Circumflex
075	117	Lowercase O with Tilde
076	118	Lowercase O with Diaeresis
077	119	Divide Sign
078	120	Lowercase O with Slash
079	121	Lowercase U with Grave
07A	122	Lowercase U with Acute
07B	123	Lowercase U with Circumflex
07C	124	Lowercase U with Diaeresis
07D	125	Lowercase I
07E	126	Lowercase S with Cedilla
07F	127	Uppercase Y with Diaeresis

DEC Supplemental Graphic Character Set

The DEC Supplemental character set consists of graphic alphabetical symbols not included in the ASCII character set. Character positions identified as “reserved for future use” print the error character (reverse question mark).

The following table gives the 7–bit code for each character. The equivalent 8–bit code is obtained by adding octal 200 or hex 80 to the 7–bit code.

Table 11–21. DEC Supplemental Graphic Character Set

Hexadecimal Value	Decimal Code	Symbol Name
020	032	Space
021	033	Inverted Exclamation Mark
022	034	Cent Sign
023	035	Pound Sign
024	036	Reserved for Future Use
025	037	Yen Sign
026	038	Reserved for Future Use
027	039	Section Sign
028	040	General Currency Sign
029	041	Copyright Sign
02A	042	Feminine Ordinal Indicator
02B	043	Angle Quotation Mark—Left
02C–02F	044–047	Reserved for Future Use
030	048	Degree Sign
031	049	Plus/Minus Sign
032	050	Superscript 2
033	051	Superscript 3
034	052	Reserved for Future Use
035	053	Micro Sign
036	054	Paragraph Sign (Pilcrow)
037	055	Middle Dot
038	056	Reserved for Future Use
039	057	Superscript 1
03A	058	Masculine Ordinal Indicator

Continued

Table 11–21. DEC Supplemental Graphic Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
03B	059	Angle Quotation Mark (Right)
03C	060	Fraction One–Quarter Mark
03D	061	Fraction One–Quarter Mark
03E	062	Reserved for Future Use
03F	063	Inverted Question Mark
040	064	Uppercase A with Grave Accent
041	065	Uppercase A with Acute Accent
042	066	Uppercase A with Circumflex Accent
043	067	Uppercase A with Tilde
044	068	Uppercase A with Diaeresis
045	069	Uppercase A with Ring
046	070	Uppercase AE Diphthong
047	071	Uppercase C with Cedilla
048	072	Uppercase E with Grave
049	073	Uppercase E with Acute
04A	074	Uppercase E with Circumflex Accent
04B	075	Uppercase E with Diaeresis
04C	076	Uppercase I with Grave
04D	077	Uppercase I with Acute
04E	078	Uppercase I with Circumflex Accent
04F	079	Uppercase I with Diaeresis
050	080	Reserved for Future Use
051	081	Uppercase N with Tilde
052	082	Uppercase O with Grave
053	083	Uppercase O with Acute
054	084	Uppercase O with Circumflex Accent
055	085	Uppercase O with Tilde
056	086	Uppercase O with Diaeresis
057	087	Uppercase OE Ligature
058	088	Uppercase O with Slash
059	089	Uppercase O with Grave
05A	090	Uppercase U with Acute
05B	091	Uppercase U with Circumflex Accent
05C	092	Uppercase U with Diaeresis or Diaeresis
		Continued

Table 11–21. DEC Supplemental Graphic Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
05D	093	Uppercase Y with Diaeresis
05E	094	Reserved for Future Use
05F	095	Sharp S
060	096	Lowercase a with Grave
061	097	Lowercase a with Acute
062	098	Lowercase a with Circumflex Accent
063	099	Lowercase a with Tilde
064	100	Lowercase a with Diaeresis
065	101	Lowercase a with Ring
066	102	Lowercase ae Diphthong
067	103	Lowercase c with Cedilla
068	104	Lowercase e with Grave
069	105	Lowercase e with Acute
06A	106	Lowercase e with Circumflex Accent
06B	107	Lowercase e with Diaeresis
06C	108	Lowercase i with Grave
06D	109	Lowercase i with Acute
06E	110	Lowercase i with Circumflex Accent
06F	111	Lowercase i with Diaeresis
070	112	Reserved for Future Use
071	113	Lowercase n with Tilde
072	114	Lowercase o with Grave
073	115	Lowercase o with Acute
074	116	Lowercase o with Circumflex Accent
075	117	Lowercase o with Tilde
076	118	Lowercase o with Diaeresis
077	119	Lowercase oe Ligature
078	120	Lowercase o with Slash
079	121	Lowercase u with Grave
07A	122	Lowercase u with Acute
07B	123	Lowercase u with Circumflex Accent
07C	124	Lowercase u with Diaeresis
07D	125	Lowercase y with Diaeresis
07E	126	Reserved for Future Use
07F	127	Delete

VT100 Special Graphic Character Set

The VT100 Special Graphic Character Set contains ASCII graphic symbols as well as special graphic symbols. The line drawing characters are available in all fonts and pitches, and are identified by an asterisk after the hexadecimal value in Table 11–22.

Table 11–22. VT100 Special Graphic Character Set

Hexadecimal Value	Decimal Code	Symbol Name
020	032	Space
021	033	Exclamation Point
022	034	Double Quotation Mark
023	035	Number Sign
024	036	Dollar Sign
025	037	Percent Sign
026	038	Ampersand
027	039	Single Quotation Mark
028	040	Open Parenthesis
029	041	Closed Parenthesis
02A	042	Asterisk
02B	043	Plus
02C	044	Comma
02D	045	Hyphen or Minus
02E	046	Period or Decimal Point
02F	047	Slash
030	048	Zero (Not Slashed)
031	049	One
032	050	Two
033	051	Three
034	052	Four
035	053	Five
036	054	Six
037	055	Seven
038	056	Eight
039	057	Nine
		Continued

Table 11–22. VT100 Special Graphic Character Set (Continued)

Hexadecimal Value	Decimal Code	Symbol Name
03A	058	Colon
03B	062	Semicolon
03C	060	Less Than Symbol
03D	061	Equals Symbol
03E	059	Greater Than Symbol
03F	063	Question Mark
040	064	At Sign
041	065	Uppercase A
042	066	Uppercase B
043	067	Uppercase C
044	068	Uppercase D
045	069	Uppercase E
046	070	Uppercase F
047	071	Uppercase G
048	072	Uppercase H
049	073	Uppercase I
04A	074	Uppercase J
04B	075	Uppercase K
04C	076	Uppercase L
04D	077	Uppercase M
04E	078	Uppercase N
04F	079	Uppercase O
050	080	Uppercase P
051	081	Uppercase Q
052	082	Uppercase R
053	083	Uppercase S
054	084	Uppercase T
055	085	Uppercase U
056	086	Uppercase V
057	087	Uppercase W
058	088	Uppercase X
059	089	Uppercase Y
05A	090	Uppercase Z
05B	091	Open Bracket

Continued

Table 11–22. VT100 Special Graphic Character Set (Continued)

Hexadecimal Value	Octa Code	Symbol Name
05C	092	Backslash
05D	093	Closed Bracket
05E	094	Circumflex
05F*	095	Space
060*	096	Solid Diamond
061*	097	Solid Box
062*	098	Horizontal Tab
063*	099	Form Feed
064*	100	Carriage Return
065*	101	Line Feed
066*	102	Degree Symbol[2]
067*	103	Plus/Minus Sign[2]
068*	104	New Line
069*	105	Vertical Tab
06A*	106	Graphics Bar Lower Right Corner
06B*	107	Graphics Bar Upper Right Corner
06C*	108	Graphics Bar Upper Left Corner
06D*	109	Graphics Bar Lower Left Corner
06E*	110	Crossing Lines
06F*	111	Horizontal Line, Scan 1
070*	112	Horizontal Line, Scan 3
071*	113	Horizontal Line, Scan 5
072*	114	Horizontal Line, Scan 7
073*	115	Horizontal Line, Scan 9
074*	116	Left T
075*	117	Right T
076*	118	Bottom T
077*	119	Top T
078*	120	Vertical Bar
079*	121	Less Than or Equal To Sign[1]
07A*	122	Greater Than or Equal To Sign[1]
07B*	123	Lowercase Greek Letter Pi[1]
07C*	124	Not Equal Sign[1]
		Continued

Table 11–22. VT100 Special Graphic Character Set (Continued)

Hexadecimal Value	Octal Code	Symbol Name
07D*	125	Pound Sign[2]
07E*	126	Big Dot[2]
07F	127	Delete

*Denotes those characters used for line drawing.
[1]Denotes characters also found in the DEC Technical Character Set.
[2]Denotes characters also found in the DEC Supplemental Character Set.

DEC Technical Character Set

The DEC Technical Character Set contains Greek letters, mathematical symbols, and logical symbols. Additionally, it contains characters that may be used to construct larger mathematical symbols on character cell devices, such as large integral and summation signs. Select this character set via the control sequence, DECAUPSS, as described in Chapter 7.

The technical character set is output to the terminal via software that responds to the ANSI/ISO Single Shift 3 (SS3) non–locking shift control function. SS3 is already terminal–resident—just enter the hex value from Table 11–23 to produce the appropriate character. The set has no duplicate ASCII or DEC Supplemental characters. Eleven positions are reserved for future standardization, including the corners, 20H and 7FH.

The printer conforms to the following:

- Responds to the escape sequence that determines the DEC Technical Character Set. The printer cannot designate or invoke the DEC Technical Character Set by default.
- Positions reserved for future standardization in the DEC technical set are imaged as the error character (reverse question mark).
- Component characters are imaged so that adjacent component characters form connected lines at all pitches.
- Selecting the DEC Technical Character Set forces the horizontal and vertical pitch settings to be 10 cpi and 6 lpi regardless of the current settings.

Table 11–23. DEC Technical Character Set

Hex Value	Decimal Code	Symbol Name
Greek:		
044	068	Uppercase Delta
046	070	Uppercase Phi
047	071	Uppercase Gamma
04A	074	Uppercase Theta
04C	076	Uppercase Lambda
050	080	Uppercase Pi
051	081	Uppercase Psi
		Continued

Table 11–23. DEC Technical Character Set (Continued)

Hex Value	Decimal Code	Symbol Name
053	083	Uppercase Sigma
057	087	Uppercase Omega
058	088	Uppercase Ksi
059	089	Uppercase Upsilon
061	097	Lowercase Alpha
062	098	Lowercase Beta
063	099	Lowercase Gamma
064	100	Lowercase Delta
065	101	Lowercase Epsilon
066	102	Lowercase Phi
067	103	Lowercase Gamma
068	104	Lowercase Eta
069	105	Lowercase Iota
06A	106	Lowercase Theta
06B	107	Lowercase Kappa
06C	108	Lowercase Lambda
06E	110	Lowercase Nu
070	112	Lowercase Pi
071	113	Lowercase Psi
072	114	Lowercase Rho
073	115	Lowercase Sigma
074	116	Lowercase Tau
077	119	Lowercase Omega
078	120	Lowercase Ksi
079	121	Lowercase Upsilon
07A	122	Lowercase Zeta
Mathematical:		
03C	060	Less Than or Equal To
03D	061	Not Equal
03E	062	Greater Than or Equal To
03F	063	Integral
041	065	Variation or Proportional To[1]
042	066	Infinity
043	067	Division or Divided By
		Continued

Table 11–23. DEC Technical Character Set (Continued)

Hex Value	Decimal Code	Symbol Name
045	069	Nabla or Del
048	072	Is Approximate To
049	073	Similar or Equal To
04B	075	Times or Cross Product
056	086	Radical
06F	111	Partial Derivative
076	118	Function
07B	123	Left Arrow
07C	124	Upward Arrow
07D	125	Right Arrow
07E	126	Downward Arrow
Logic:		
040	064	Therefore
04D	077	If and Only If
04E	078	Implies
04F	079	Identical To
05A	090	Is Included In
05B	091	Includes
05C	092	Intersection
05D	093	Union
05E	094	Logical And
05F	095	Logical Or
060	096	Logical Not

Building Large Mathematical Symbols

Table 11–24 shows how to build large mathematical symbols. The characters are designed to connect to adjacent character cells at 10 cpi and 6 lpi to form technical characters that can occupy several vertically adjacent and/or horizontally adjacent character positions.

To use Table 11–24, find the character you want to build (along the top of the table). On the left side of the table are various pieces of the characters needed to create the whole. Follow the top row choice, say, Integral, all the way down the table. Designate the hex value called out beside the symbol names. For example, to build an oversize integral, you will need a top integral (022H), bottom integral (025H), and vertical connector (026H).

Table 11–24. Component Characters

Symbol Name/Hex Value		Radical	Integral	Square Bracket	Curly Bracket	Parenthesis	Summations
Left Radical	021	X					
Top Left Radical	022	X					
Horizontal Connector	023	X					X
Top Integral	024		X				
Bottom Integral	025		X				
Vertical Connector	026	X	X	X	X	X	
Top Left Square Bracket	027			X			
Bottom Left Square Bracket	028			X			
Top Right Square Bracket	029			X			
Bottom Right Square Bracket	02A			X			
Top Left Parenthesis	02B				X	X	
Bottom Left Parenthesis	02C				X	X	
Top Right Parenthesis	02D				X	X	
Bottom Right Parenthesis	02E				X	X	
Left Middle Curly Brace	02F				X		
Right Middle Curly Brace	030				X		
Top Left Summation	031						X
Bottom Left Summation	032						X
Top Vertical Summation Connector	033						X
Bottom Vertical Summation Connector	034						X
Top Right Summation	035						X
Bottom Right Summation	036						X
Right Middle Summation	037						X

A Bar Codes

Contents

Bar Codes

A bar code is a graphic representation of alphanumeric characters that can be read by a scanning device.

In Digital emulation, three escape sequences enable the printer to print bar codes. One escape sequence sets the bar code parameters, another starts bar code production, and the third sequence stops bar code printing.

Select Bar Codes Attributes Sequence (DECSBCA)

ASCII Code: `ESC [ P1; P2;...P9‘q`

Hex Code: `1B 5B P1 3B P2 3B...P9 27 71`

Dec Code: `27 91 P1 59 P2 59...P9 39 113`

Purpose: Selects bar code type and orientation.

Discussion: Once defined, bar code parameters remain in effect until:

- A new bar code select parameter sequence is sent
- A reset command returns settings to default values
- On power–up, the default values are set

Bar code parameters are set according to the following choices:

- `P1` defines parameters for the various bar code styles:

P1	Function	P1	Function
0/missing	Code 39 (default)	8	Codabar b/n
1	Interleaved 2 of 5	9	Codabar c/*
2	Code 39	10	Codabar d/e
3	Extended Code 39	11	UPC–A
4	EAN–8	12	UPC–E
5	EAN–13	13	Postnet
6	Code 11	14	Code 128
7	Codabar a/t	15	Code 128–UCC

- P2 sets the width for the narrow bars and spaces in units specified by the SSU code.

Default value = 10 pixels = 12 decipoints
Minimum value = 9 pixels = 11 decipoints

This does not apply to all UPC, EAN, and Postnet bar codes.

- P3 sets the width for the quiet zone. The printer's quiet zone is a constant pixel value of 150 pixels (180 decipoints) or ten times the narrow bar, whichever is greater.

  This does not apply to all UPC, EAN, and Postnet bar codes.

- P4 sets the width of the wide bars and wide spaces in units specified by the SSU code.

  Default value = 2.5 times the value of P2
  Minimum value = 2.4 times the narrow bar when the narrow bar is less than or equal to twelve pixels

  This does not apply to all UPC, EAN, Code 11, Code 128, and Postnet bar codes.

- P5 sets the intercharacter gap in units specified by the SSU code.

  Default value = 136 pixels

  This does not apply to the Interleaved 2 of 5 code, or to all UPC, Code 128, EAN, and Postnet bar codes.

- P6 sets the height of bars in units specified by the SSU code.

  Minimum value = 144 pixels = 173 decipoints
  Default value = 300 pixels = 360 decipoints

- P7 defines the control character encoding character (CCEC). Any character within a range of 2/0 through 7/15 indicates the start of control character encoding. The CCEC is followed by a two–digit hexadecimal number equal to the ASCII value of the character to be encoded. To bar code the ESC character, enter the CCEC, then the ESC character's hexadecimal format. The default is P7 = 0.

P7	**Function**
0/missing	No encoding of control characters
n	The decimal ASCII value representing the control character encoding character.

This only applies to Extended Code 39.

- P8 sets the orientation for the bar codes. Bar codes can be rotated to four different positions, though any characters beneath them are printed only in portrait or landscape orientations. The default is `P8 = 0`.

P8	Function
0/missing	Same as current page orientation
1	Horizontal (portrait)
2	Vertical, rotation of –90º (landscape)
3	Horizontal, upside down, rotation of 180º
4	Vertical, rotation of +90º (landscape)

- P9 sets the human–readable character option.

P9	Function
0/missing	No human–readable characters printed
1	No human–readable characters printed
2	human–readable characters printed in current font
3	human–readable characters printed in OCR–A
4	human–readable characters printed in OCR–B

NOTE: When printing the human–readable line for any rotations other than zero degrees (horizontal portrait mode), the special bar code font is used regardless of how the P9 parameter is set (2, 3, or 4). OCR–A and OCR–B are available only in portrait orientation.

This does not apply to the Postnet bar code.

If an illegal parameter sequence is requested, the sequence is ignored and the last bar code parameter remains unchanged.

Start Bar Coding (DECBARC)

ASCII Code: `ESC % SP 0`

Hex Code: `1B 25 20 30`

Dec Code: `27 37 32 48`

Purpose: Generates bar codes using data that follow the sequence.

Discussion: Bar code parameters are defined by the last DECSBCA sequence. The printer continues to encode bar codes until it receives the Stop Bar Code sequence.

The printer begins to generate a bar code at the upper left–hand corner of the left quiet zone and ends at the lower right–hand corner of the right quiet zone. Bar codes that extend beyond the margins are truncated.

Stop Bar Coding (Return from Other Coding System: ROCS)

ASCII Code: `ESC % @`

Hex Code: `1B 25 40`

Dec Code: `27 37 64`

Purpose: Stops bar code printing.

Discussion: Once bar coding is stopped, the font selection and associated attributes are restored to the conditions prevailing prior to bar code printing.

Bar Code Characteristics

The printer supports fifteen bar code styles:

- Code 39 (default or user–selectable settings)
- Extended Code 39
- Interleaved 2 of 5
- EAN 8
- EAN 13
- Code 11
- Codebar a/t
- Codebar b/n
- Codebar c/*
- Codebar d/e
- UPC–A
- UPC–E
- Postnet
- Code 128 – USS (regular)
- Code 128 – UCC (serial shipping container code)

All bar code styles differ, though the differences can be subtle or obvious. The following subsections discuss bar code characteristics that are pertinent to printing readable bar codes.

Number of Bars per Character

Each bar code style is made up of a specific number of light and dark bars. Dark bars are the inked, machine–readable lines; light bars are the unprinted spaces between the dark bars. Several styles of light and dark bar combinations exist. For example:

- In the Code 39 style, both light and dark bars are encoded to define a single character.
- In the Interleaved 2 of 5 style, the light bars decode one character while the dark bars decode another character.

The light bars and dark bars can also be narrow or wide. These width variations are unique to each bar code style.

Bar Code Character Set

Different bar code styles allow certain parts of the ASCII character set to be used. Some styles allow only the numerals 0 – 9, while others allow the full ASCII character set, and still others allow variations in between.

START, STOP, and CENTER Code Characters

The START/STOP characters identify the beginning and end of the bar code symbol to the bar code reader. The START code is at the left end of the symbol, next to the most significant character. The STOP code is at the right end of the symbol, next to the least significant character.

Some bar code styles have a CENTER character code. This code divides the characters so that a digit that appears on both sides of the CENTER code can have a certain bar pattern on the left side that differs from the pattern on the right side. This is possible because the digits to the left of the CENTER character code are usually coded in odd parity, while the digits to the right of the CENTER bar are coded in even parity.

Quiet Zone

Both ends of the bar code structure require blank quiet zones. The quiet zones should be at least 0.25 inches wide and completely blank to ensure accurate reading of the START/STOP codes and to prevent adjacent bar codes from overlapping. The operator is responsible for providing sufficient space on the form for the quiet zones.

Intercharacter Gap

The intercharacter gap separates the last bar in one character from the first bar of the next character. The intercharacter gap is required in styles where each character begins and ends with a dark bar.

Number of Characters in a Bar Code

There is no set number of characters for all bar codes. Some styles have a specific number of characters necessary for making individual bar codes (for example, UPC–A uses an 11–character symbol). Code 39, however, uses character symbols of variable length.

Checksums

Checksums can be included within the bar code symbol. If a checksum digit is required for a particular style, it is computed by the user and sent along with the rest of the characters that make up the bar code symbol. The printer automatically computes the check digit and embeds it at the end of the bar code for the UPC, EAN, Code 11, Code 128, and Postnet bar codes.

Parity

You can use odd or even parity to send an individual character in styles EAN–8, EAN–13, UPC–A, and UPC–E. The individual digits (0 through 9, since these are the only allowable characters in these styles) might have different bar patterns, depending on whether the character is coded in odd or even parity.

Multiple Bar Codes

The printer can make multiple bar codes on the same line. To do this, use the following sequence:

POSITION	START	Print	Stop	POSITION	Start next	Print	Stop
(VPA)	bar code	bar code	bar code	(VPA)	bar code	bar code	bar code

The above method prints multiple bar codes on one line by means of multiple passes. For example, the printer will print the first bar code, reverse the paper, then print the next bar code on the same line.

The sequence for printing multiple barcodes is shown below, implemented via control codes described on the indicated pages:

```
<esc>[3d<esc>%0data<esc>%@<esc>[3d<esc>%0data<esc>%@
|________ __| |______|      |________| |__________| |_______|      |________|
   ↑         ↑              ↑        ↑         ↑             ↑
  VPA     DECBARC          ROCS     VPA     DECBARC         ROCS
  7–75      A–6             A–6     7–75      A–6            A–6
```

Bar Code Styles

The following sections discuss the bar codes the printer can make. The characteristics of bar code styles, P1 – P9 values, and their defaults are also discussed.

Code 39

In the Code 39 style, there are five dark bars and four light bars for a total of nine bars. Three bars are wide and the other six are narrow. Both light and dark bars are coded to define the character. A narrow light/dark bar is assigned a binary 0 and a wide light/dark bar is assigned a binary 1.

Code 39 has the following characteristics:

- Character set includes ten digits (0 – 9), uppercase letters A – Z, plus eight additional characters (– . $ / + % SP *)
- START and STOP codes
- No CENTER code
- Definable intercharacter gap
- Variable length characters per complete symbol
- If a checksum is required for bar code readability, you must include it as part of the data.

Extended Code 39

For printable characters, Extended Code 39 prints like Code 39. With control characters, Extended Code 39 decodes and prints the control characters as their combined printable codes. See Table A–1 for the Extended Code 39 ASCII character set.

Table A–1. Extended Code 39 ASCII Character Set

ASCII	Code 39	ASCII	Code 39	ASCII	Code 39	ASCII	Code 39
NUL	%U	SP	Space	@	%V	‘	%W
SOH	$A	’	/A	A	A	a	+A
STX	$B	“	/B	B	B	b	+B
ETX	$C	#	/C	C	C	c	+C
EOT	$D	$	/D	D	D	d	+D
ENQ	$E	%	/E	E	E	e	+E
ACK	$F	&	/F	F	F	f	+F
BEL	$G	’	/G	G	G	g	+G
BS	$H	(	/H	H	H	h	+H
HT	$I	)	/I	I	I	i	I
LF	$J	*	/J	J	J	|	+J
VT	$K	+	/K	K	K	k	+K
FF	$L	,	/L	L	L	l	+L
CR	$M	—	—	M	M	m	+M
SO	$N	.	.	N	N	n	+N
SI	$O	/	/O	O	O	o	+O
DLE	$P	0	0	P	P	p	+P
DC1	$Q	1	1	Q	Q	q	+Q
DC2	$R	2	2	R	R	r	+R
DC3	$S	3	3	S	S	s	+S
DC4	$T	4	4	T	T	t	+T
NAK	$U	5	5	U	U	u	+U
SYN	$V	6	6	V	V	v	+V
ETB	$W	7	7	W	W	w	+W
CAN	$X	8	8	X	X	x	+X
EM	$Y	9	9	Y	Y	y	+Y
SUB	$Z	:	/Z	Z	Z	z	+Z
ESC	%A	;	%F	[	%K	{	%P
FS	%B	<	%G	\	%L	|	%Q
GS	%C		%H	]	%M	}	%R
RS	%D	>	%I	^	%N	~	%S
US	%E	?	%J	_	%O	DEL	%T %X %Y %Z

Code 11

In the Code 11 style, there are three dark bars and two light bars for a total of five bars. Both light and dark bars are coded to define the character. A narrow light/dark bar is assigned a binary 0 and a wide light/dark bar is assigned a binary 1.

Code 11 has the following characteristics:

- Character set includes ten digits (0 – 9) and the dash (–) character
- START and STOP codes
- No CENTER code
- Definable intercharacter gap
- Variable length characters per complete symbol
- Two checksums are computed automatically and embedded at the end of the bar code. The checksum data is not printed as part of the human–readable data field.

Codabar a/t

Codabar a/t has four dark bars and three light bars for a total of seven bars. Both light and dark bars are coded to define the character. A narrow light/dark bar is assigned a binary 0 and a wide light/dark bar is assigned a binary 1.

Codabar a/t has the following characteristics:

- Character set includes ten digits (0 – 9) plus six characters (– . $ / + :)
- Illegal characters are not processed and are ignored.
- START and STOP codes
- No CENTER code
- Definable intercharacter gap
- Variable length characters per complete symbol
- If a checksum is required for bar code readability, you must include it as part of the data.

Codabar b/n

Codabar b/n has four dark bars and three light bars for a total of seven bars. Both light and dark bars are coded to define the character. A narrow light/dark bar is assigned a binary 0 and a wide light/dark bar is assigned a binary 1.

Codabar b/n has the following characteristics:

- Character set includes ten digits (0 – 9) plus six characters (: / . + $ –)
- START and STOP codes
- No CENTER code
- Definable intercharacter gap
- Variable length characters per complete symbol
- If a checksum is required for bar code readability, you must include it as part of the data.

Codabar c/*

Codabar c/* has four dark bars and three light bars for a total of seven bars. Both light and dark bars are coded to define the character. A narrow light/dark bar is assigned a binary 0 and a wide light/dark bar is assigned a binary 1.

Codabar c/* has the following characteristics:

- Character set includes ten digits (0 – 9) plus six characters (: / . + $ –)
- Illegal characters are not processed and are ignored.
- START and STOP codes
- No CENTER code
- Definable intercharacter gap
- Variable length characters per complete symbol
- If a checksum is required for bar code readability, you must include it as part of the data.

Codabar d/e

Codabar d/e has four dark bars and three light bars for a total of seven bars. Both light and dark bars are coded to define the character. A narrow light/dark bar is assigned a binary 0 and a wide light/dark bar is assigned a binary 1.

Codabar d/e has the following characteristics:

- Character set includes ten digits (0 – 9) plus six characters (: / . + $ –)
- START and STOP codes
- No CENTER code
- Definable intercharacter gap
- Variable length characters per complete symbol
- If a checksum is required for bar code readability, you must include it as part of the data.

EAN–8

EAN–8 contains two dark bars and two light bars for a total of four bars. Each light and dark bar is 1 – 4 modules wide. A module is the smallest increment that can represent data. Zeros are represented by light modules and ones by dark modules. Each character contains some combination of seven modules that total two dark bars and two light bars.

The above is always true except with the START/STOP and CENTER character codes. The START/STOP character bar pattern consists of two dark bars and one light bar for a total of three bars. The CENTER character bar pattern has two dark bars and three light bar for a total of five bars.

Parameters P2 through P5 and P7 are not applicable and will be ignored.

EAN–8 has the following characteristics:

- Ten digit character set (0 – 9)
- START and STOP codes
- CENTER code
- Intercharacter gap not definable

- Fixed length of seven characters per complete symbol. The first digit is the number system code, followed by six digits of data. The printer computes the check digit automatically and embeds it in the bar code as the eighth digit. All eight digits are encoded in the bar code symbol with four digits to the left of the CENTER code in odd parity, and four digits to the right of the CENTER code in even parity.
- If more or less than seven characters are used, or if any of the characters used are illegal, an error message is printed.

EAN–13

EAN–13 has two dark bars and two light bars for a total of four bars. Each light/dark bar is 1 – 4 modules wide. A module is the smallest increment that can represent data. Zeros are represented by light modules and ones by dark modules. Each character contains some combination of seven modules that total two dark bars and two light bars.

The above is always true except with the START/STOP and CENTER character codes. The START/STOP character bar pattern consists of two dark bars and one light bar for a total of three bars. The CENTER character bar pattern has two dark bars and three light bar for a total of five bars.

Parameters P2 through P5 and P7 are not applicable and will be ignored.

EAN–13 has the following characteristics:

- Ten digit character set (0 – 9)
- START and STOP codes
- CENTER code
- Intercharacter gap not definable
- Fixed length of twelve characters per complete symbol. The first digit is the number system code, followed by eleven digits of data, then the check digit. Only twelve of the digits (the second through the thirteenth) are encoded in the bar code symbol with six digits to the left of the CENTER code and six to the right of it. An EAN–13 number can have three different bar patterns depending on its position and number system code. The printer computes the check digit automatically and embeds it in the bar code as the thirteenth digit. All thirteen digits are printable in the human–readable line.

- If more or less than twelve characters are used, or if any of the characters used are illegal, an error message is printed.

Interleaved 2 of 5

The bar code symbol uses a series of wide and narrow bars and spaces to represent numeric characters. The structure is 2 wide elements (bars or spaces) and 3 narrow elements. In the bar code, two characters are interleaved (paired); bars are used to represent the first character in the pair and spaces are used to represent the second character in the pair.

The above is always true except with the START and STOP character codes. The START character bar pattern consists of two dark bars and two light bars for a total of four bars. The STOP character bar pattern has two dark bars and one light bar for a total of three bars.

This style includes the following characteristics:

- Ten digit character set (0 – 9)
- START and STOP codes
- Illegal characters are not processed and are ignored.
- No CENTER code
- Intercharacter gap not definable
- A variable length of characters per complete symbol. If an odd number of input digits is sent, the printer inserts a leading 0 to the data stream. This encodes in the bar code symbol and prints in the human–readable line.
- If a checksum is required for bar code readability, you must include it as part of the data.

UPC–A

UPC–A has two dark bars and two light bars for a total of four bars. Each light/dark bar is 1 – 4 modules wide. A module is the smallest increment that can represent data. Zeros are represented by light modules and ones by dark modules. Each character contains some combination of seven modules that total two dark bars and two light bars.

The above is always true except with the START/STOP and CENTER character codes. The START/STOP character bar pattern consists of two dark bars and one light bar for a total of three bars. The CENTER character bar pattern has two dark bars and three light bar for a total of five bars. Parameters P2 through P5 and P7 are not applicable and are ignored.

UCP–A has the following characteristics:

- Ten digit character set (0 – 9)
- START and STOP codes
- CENTER code
- Intercharacter gap not definable
- Fixed length of eleven characters per complete symbol. The first digit is the number system code, usually followed by a five digit vendor number. The next five digits are typically the product number. The printer automatically computes the check digit and embeds it at the end of the bar code. All twelve digits are encoded in the bar code symbol, with six digits to the left of the CENTER code in odd parity and six to the right of the CENTER code with even parity.
- If more or less than eleven characters are used or if any of the characters are illegal, an error message.

UPC–E

UPC–E has two dark bars and two light bars for a total of four bars. Each light/dark bar is 1 – 4 modules wide. A module is the smallest increment that can represent data. Zeros are represented by light modules and ones by dark modules. Each character contains some combination of seven modules that total two dark bars and two light bars.

The above is always true except with the START and STOP character codes. The START character bar pattern consists of two dark bars and one light bar for a total of three bars. The STOP character bar pattern has three dark bars and three light bar for a total of six bars.

Parameters P2 through P5 and P7 are not applicable and are ignored.

UPC–E has the following characteristics:

- Ten digit character set (0 – 9)

- START and STOP codes
- No CENTER code
- Intercharacter gap not definable
- Fixed length of eleven digits per complete symbol. The first character of the data field is interpreted as the number system code and must always equal 0. The next five digits represent the vendor number and the last five represent the product number.
- If more or less than eleven characters are used or if any of the characters are illegal, an error message is printed.

Six of the eleven digits are encoded into the bar code symbol. These six digits are taken from the eleven digit UPC input code as follows:

- If the vendor number (the first five digits after the number system code) ends in 000, 100, or 200, the product number (the second five digits) must fall between 00000 and 00999. The six digits that make up the bar code symbol are the first two characters of the vendor number, the last three characters of the product number, and the third character of the vendor number, in that order. Therefore, the sequence of digits taken is 1st, 2nd, 8th, 9th, 10th, 3rd.
- If the vendor number ends in 300, 400, 500, 600, 700, 800, or 900, the product number must fall between 00000 and 00099. The six digits that make up the bar code are the first three characters of the vendor number, the last two characters of the product number, then a 3. Therefore, the sequence of digits taken is 1st, 2nd, 3rd, 9th, 10th, 3.
- If the vendor number ends in 10, 20, 30, 40, 50, 60, 70, 80, or 90, the product number must fall between 00000 and 00009. The six digits that make up the bar code symbol are the first four characters of the product number, followed by a 4. Therefore, the sequence of digits taken is 1st, 2nd, 3rd, 4th, 10th, 4.
- If the vendor number does not end in a zero, the product number must fall between 00005 and 00009. The six digits that make up the bar code symbol are all five digits of the vendor number, followed by the product number’s last character. Therefore, the sequence of digits taken is 1st, 2nd, 3rd, 4th, 5th, 10th.
- If the digit input does not fall into one of the above four categories, it is considered invalid and an error message is printed.

- The printer computes a modulus 10 checksum digit so that the six digits to be encoded in the bar code symbol are selected correctly. However, the check digit is not encoded as part of the bar code symbol and is not printed in the human–readable line.

Table A–2. UPC–E Number Pattern Sequences

If the Vendor Number is:	And the Product Number is:	Then the Encoded UPC–E Bar Code Symbol is:
X X 0 0 0	0 0 0 0 0	X X 0 0 0 0
X X 1 0 0	: : :	X X : : : 1
X X 2 0 0	0 0 9 9 9	X X 9 9 9 2
X X 3 0 0	0 0 0 0 0	X X 3 0 0 3
:	: :	X X : : : 3
X X 9 0 0	0 0 0 9 9	X X 9 9 9 3
X X X 1 0	0 0 0 0 0	X X X 1 0 4
:	:	X X X : : 4
X X X 9 0	0 0 0 0 9	X X X 9 9 4
X X X X 1	0 0 0 0 5	X X X X 1 5
:	:	X X X X : :
X X X X 9	0 0 0 0 9	X X X X 9 9
NOTE: X may range from 0 to 9		

Postnet

The Postnet bar code has two tall bars and three short bars for a total of five bars. These five bars represent a numeric digit with valid values from 0 to 9.

The above is always true except with the START/STOP character codes. The START character bar pattern has one tall bar and one space. The STOP character has one space and one tall bar.

Parameters P2 through P5, P7, and P9 are not applicable and are ignored.

Postnet has the following characteristics:

- Ten digit character set (0 – 9)
- Illegal characters are not processed and are ignored.
- START and STOP codes
- No CENTER code
- Variable length characters per complete symbol
- A checksum is calculated automatically then embedded at the end of the bar code.
- The human–readable data field is not printed.

Code 128 – USS

Code 128 includes three character subsets: A, B, and C. (Code 128–UCC uses subset C only.) All contain the same bar patterns, except for the unique start character that tells the bar code reader which subset is in use. Special characters are available for switching between the subsets in order to generate the shortest possible bar code. (Only subset C is used for 128–UCC, so mode selection is not allowed.)

The Code 128 and 128–UCC structure is shown in Figure A–1 and described on the following pages.

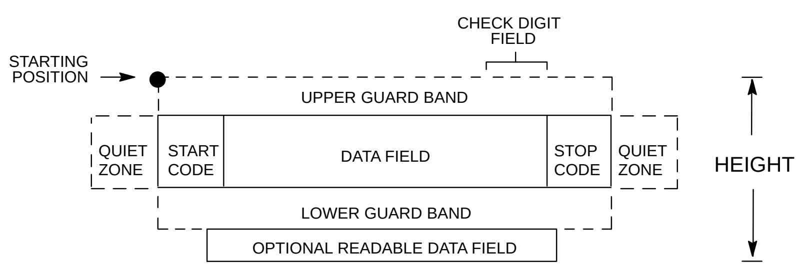


Figure A–1. Code 128 Structure

Start/Stop Codes

Code 128 contains special characters which use unique start/stop codes to identify the leading and trailing end of the bar code. In the automatic mode, start and stop codes are generated automatically. In the manual mode, you must supply the start code, but the stop code is generated automatically.

Data Field

Code 128 bar codes support a full ASCII character set: Subset A provides standard alphanumeric keyboard characters, control and special characters; subset B includes all standard alphanumeric keyboard characters, lowercase alphabetical characters, and special characters; subset C provides 100 digit pairs, from 00 to 99 inclusive, plus special characters. Table A–3 lists the full Code 128 character set. The “greater than” symbol (>), followed by one of various characters, allows you to manually shift between subsets, specify a particular subset to start with, or to include several non–printable control characters in the data set. (To include the “greater than” symbol itself, you must use >0.) This is described in the Mode Selection section below. The bars and spaces in the printed Code 128 bar code vary in width from 1 to 4 modules. Each character consists of 3 bars and 3 spaces that total 11 modules.

Readable Data

The optional readable data field provides a readable interpretation of the bar code data. Bar code data is printed below the horizontal bar code. The lower guard band is provided when the readable data field is selected. The readable data field is available only in the automatic mode. For 128–UCC, the optional readable data is broken up by spaces to denote 128–UCC data fields.

Check Digit

For Code 128, the modulo–103 check digit is automatically calculated and inserted in the bar code symbol. The check digit verifies accurate scanning. The start code is included in the modulo–103 check digit algorithm.

For 128–UCC, the modulo–10 and 103 check digits are automatically calculated and inserted in the bar code symbol. The check digit verifies accurate scanning.

Code 128 Mode Selection

The printer generates Code 128 bar codes in one of two modes: automatic or manual.

Automatic Mode

The printer creates the shortest possible bar code by automatically sending the subset switch character to switch from subset B into subset C whenever strings of four or more consecutive numeric characters are detected in the input data. As long as the data includes ordinary keyboard characters and no subset switch, the printer switches in and out of subsets B and C automatically before and after numeric character strings. Start codes, stop codes, and check digits are generated automatically.

NOTE: You must use >0 to represent the > character. The printer recognizes >0 as the "greater than" character (>) on a standard ASCII chart.

Manual Mode

Manual mode is selected by inputting a subset switch character (characters preceded by >) anywhere in the bar code data. In the manual mode, you must insert the special codes into the bar code to switch to another subset. When the printer finds a special code in the data, all automatic switching features are suspended, the readable data field option is cancelled, and the printer expects you to provide all special code switching commands. In manual mode, you must supply the start code; if no start code is provided, the printer inserts a subset B start code. Stop codes and check digits are generated automatically in the manual mode. More information about Manual Mode is provided in the following section.

Code 128 Manual Mode Operation

NOTE: In the manual mode, you are responsible for correct implementation of Code 128 in accordance with the Code 128 Standards Manual.

The Code 128 character set is shown in Table A–3. The **Alternate** column identifies the special subset switch characters that switch the printer to the manual mode. These > characters are also horizontally aligned with functions also performed in an automatic mode. For example, >/ represents SI in subset A, o in subset B, and value 79 in subset C. Thus, the following commands generate the same bar code using **Alternate** characters, or subsets B or C:

Subset Switch Characters:	>7>,>–>.>/
Subset C:	>576777879
Subset B:	>6lmno

Non–ASCII characters are specified by using the subset switch characters (from >1 through >8 in the **Alternate** column on Table A–3) which corresponds to your application. The **Value** column is used when manually translating subset B and C bar codes into their briefest form.

NOTE: The subset switch start codes, >5, >6, and >7 have two functions. At the beginning of a line, they start manual mode data in subset C, B, or A, respectively. When these codes are used anywhere in the data other than at the start of a line, they are interpreted as the non–ASCII characters in Table A–3.

Subset B and C Switching – In the automatic mode, the printer creates the briefest, most compact bar code by automatically switching from subset B to subset C when necessary. For example, the data LT436682 could be entered directly into a typed bar code command as ESC%0LT436682ESC%@. The printer automatically selects the appropriate start code, and switches to subset C to compact the continuous numeric data characters (436682).

In the manual mode, however, you must specify the start code and all special function codes to switch subsets. For example, to create the same bar code as generated automatically in the previous paragraph (data of LT436682), the subset B start code is entered, followed by the alpha data (LT), and the subset switch character to switch to subset C is entered followed by the continuous numeric characters. A typical bar code command, in the manual mode, for the data is: ESC%0>6LT>5KbrESC%@. The pairs of continuous numeric data were manually translated to subset B, data Kbr, corresponding to the subset C values of 436682, respectively, as shown in Table A–3. If the data (LT436682) had been entered directly into the bar code command as ESC%0>6LT>5436682ESC%@ the bar code generated would have been: Start Code B: LT, subset C: 20 19 22 22 24 18, as determined by the value of the individual data characters in Table A–3.

NOTE: If a start code is not entered in the manual mode, the printer provides a subset B start code.

Subset A – Subset A operates in the manual mode only. Subset A data characters include mostly normal printable ASCII characters which require no subset switching and can be entered directly. For example, the data ABC123 in subset A is input in the bar code command as: ESC%0>7ABC123ESC%@. Switching to another subset will not generate a shorter bar code.

You can generate non–printable control characters in subset A by:

1) using the subset B lowercase character equivalent from Table A–3 (‘ through ~), which map to NUL through RS; or

2) using the subset switch characters (>1 through >8, or >SP through >/) from the **Alternate** column of Table A–3.

Table A–3. Code 128 Character Set

Value	Subset A	Subset B	Subset C
0	SP	SP	00
1	!	!	01
2	″	″	02
3	#	#	03
4	$	$	04
5	%	%	05
6	&	&	06
7	’	’	07
8	(	(	08
9	)	)	09
10	*	*	10
11	+	+	11
12	,	,	12
13	–	–	13
14	.	.	14
15	/	/	15
16	0	0	16
17	1	1	17
18	2	2	18
19	3	3	19
20	4	4	20
21	5	5	21
22	6	6	22
23	7	7	23
24	8	8	24
25	9	9	25
26	:	:	26
27	;	;	27
28	<	<	28
29	=	=	29
30	>	>	30
31	?	?	31
32	@	@	32
33	A	A	33
34	B	B	34
35	C	C	35
36	D	D	36
37	E	E	37
38	F	F	38
39	G	G	39
40	H	H	40
41	I	I	41
42	J	J	42
43	K	K	43
44	L	L	44
45	M	M	45
46	N	N	46
47	O	O	47
48	P	P	48
49	Q	Q	49
50	R	R	50
51	S	S	51
52	T	T	52
53	U	U	53

Value	Subset A	Subset B	Subset C	Alternate
54	V	V	54	
55	W	W	55	
56	X	X	56	
57	Y	Y	57	
58	Z	Z	58	
59	[	[	59	
60	\	\	60	
61	]	]	61	
62	^	^	62	
63	—	—	63	
64	NUL	‘	64	>SP
65	SOH	a	65	>!
66	STX	b	66	>″
67	ETX	c	67	>#
68	EOT	d	68	>$
69	ENQ	e	69	>%
70	ACK	f	70	>&
71	BEL	g	71	>’
72	BS	h	72	>(
73	HT	i	73	>)
74	LF	j	74	>*
75	VT	k	75	>+
76	FF	l	76	>,
77	CR	m	77	>–
78	SO	n	78	>.
79	SI	o	79	>/
80	DLE	p	80	
81	DC1	q	81	
82	DC2	r	82	
83	DC3	s	83	
84	DC4	t	84	
85	NAK	u	85	
86	SYN	v	86	
87	ETB	w	87	
88	CAN	x	88	
89	EM	y	89	
90	SUB	z	90	
91	ESC	{	91	
92	FS	¦	92	
93	GS	}	93	
94	RS	~	94	
95	US	DEL	95	>1
96	FNC3	FNC3	96	>2
97	FNC2	FNC2	97	>3
98	SHIFT	SHIFT	98	>4
99	CODE C	CODE C	99	>5
100	CODE B	FNC4	CODE B	>6
101	FNC4	CODE A	CODE A	>7
102	FNC1	FNC1	FNC1	>8
103	START CODE A*			>7
104	START CODE B*			>6
105	START CODE C*			>5

*Used at the beginning of manual mode commands.

Code 128 Examples

The following commands generate the horizontal default ratio Code 128 bar code below in the automatic mode. In the Start Bar Code sequence (DECBARC), SP represents the ASCII space character (hex 20).

ESC[14;;;;;;;;2’q
ESC%SP0ABC123456ESC%@

ABC123456

The following command generated the Code 128 bar code below in the automatic mode using data of 22446688ABC123456. The bar code data begins in subset B and automatically switches to subset C for the numeric data. In the Start Bar Code sequence (DECBARC), SP represents the ASCII space character (hex 20).

ESC[14;;;;;;;;2’q
ESC%SP022446688ABC123456ESC%@

22446688ABC123456

The command below generates the following vertical Code 128 bar code with data of 123@25% in manual mode, subset A. In the Start Bar Code sequence (DECBARC), SP represents the ASCII space character (hex 20).

ESC[14;;;;;;;;3;’q
ESC%SP0>7123@25%ESC%@

The command below generates the same vertical Code 128 bar code in the automatic mode, subset B. Because less than 4 consecutive numeric digits were provided in the data, no subset switching occurred, and the bar code remained in subset B. In the Start Bar Code sequence (DECBARC), SP represents the ASCII space character (hex 20).

ESC[14;;;;;;;;3;'q
ESC%SP0123@25%ESC%@

Code 128 – UCC

The 128–UCC Serial Shipping Container Code is a restricted subset of the Code 128–USS standard. It is used as a standard for labeling shipping containers.

The 128–UCC Serial Shipping Container Code has the following parts:

- **Start Code** – The 128–UCC Serial Shipping Container Code consists of numeric data only, so the start code is always Start–C. This is followed by the function code 1 character, which is part of the 128–UCC standard. These are automatically generated by the printer.
- **Qualifier** – This 2–digit number helps identify the symbol as a 128–UCC Serial Shipping Container Code. It is always 00, and uses one character subset C symbol. This is automatically generated by the printer.
- **Data** – 17 numbers you choose to describe a particular shipping container. These are the only numbers that you need to specify; the printer generates the other elements of the bar code automatically.
- **Check Characters** – The 128–UCC Serial Shipping Container Code uses two check characters. The first is a modulus 10 check digit generated from your input data, and printed in human–readable characters. The second is the normal Code 128 modulus 103 check character. The printer calculates both of these numbers automatically.
- **Stop Code** – This is the normal stop code used in the Code 128 bar code. This character is automatically generated by the printer.

Code 128–UCC Example

A Code 128–UCC bar code created on the printer is shown below. The label data are **11223344556677889**. The DESBCA sequence selects UCC–128 with P1 = 15 and P9 = 2 for human readable characters. The DECBARC command starts the bar coding, and ROCS stops the bar coding. Notice that the printer automatically generated the start code, the qualifier, the check digits, and the stop code.

ESC[15;;;;;;;;2‘q
ESC%SP01122334455667789ESC%@

Start Code
(StartC/Func1)

Stop Code

00 1 1223344 556677889 9

Qualifier

Data

Mod 10
Check Digit

Density and Spacing Between Bar Codes

The following subsections describe the spacing between different combinations of horizontal and vertical spacings between the bar codes.

Horizontal Bar Codes (0 and 180 Degree Rotation)

The width of a horizontal bar code is a function of the number of characters in the bar code symbol, the style of the bar code symbol, and the ratio of wide light/dark bars to narrow light/dark bars. The bar code height is specified as a parameter where the default is 0.75 inches. The human–readable line is not included. If the human–readable line is printed, a gap of 0.1 inch is inserted between the bottom of the bar code symbol and the human–readable line. The human–readable line is printed below the bar code symbol.

Horizontal bar codes (0 and 180 degree rotation), are printed at 100 dots per inch (dpi) horizontally and 100 dpi vertically.

Horizontal Spacing Between Horizontal Bar Codes

A 0.25 inch leading space always appears before a bar code symbol and a 0.25 inch trailing space is inserted after a bar code symbol for a total of 0.5 inches of space between any two bar codes. The leading and trailing spaces are called quiet zones.

Three delimiters are allowed for all bar code styles:

- Space character (20H), except for bar code 39
- Comma character (2CH)
- Horizontal tab character (09H)

The space character adds an extra 0.1 inches of white space between the bar code, the comma adds no extra white space, and the horizontal tab adds the amount set by the tabs. This additional white space is added to the 0.5 inches of the quiet zones that separate the two bar codes.

The horizontal limit is specified by the width of the paper, typically 13.2 inches. Therefore, the width of the encoded bar code symbol plus any spacing between two or more symbols cannot exceed 13.2 inches. If a bar code symbol exceeds the right margin, the printable portion is printed and the remainder is truncated.

Vertical Spacing Between Horizontal Bar Codes

The vertical limit is equal to the maximum allowable height for a bar code symbol: 10 inches. If the human–readable line is printed, then a 0.1 inch gap plus character size is added to compute a total vertical distance.

If the human–readable line is printed, a space the size of the intercharacter gap exists between the human–readable line and the top of the bar code symbol on the next line, plus any linefeeds you have specified.

If there is no human–readable line, the vertical spacing is dependent on the user for how many linefeeds have been specified.

Vertical Bar Codes (90 and 270 Degree Rotation)

The width of the rotated bar code is close in size to the height of the original horizontal bar code (they are not quite the same since the density changes). If the human–readable line is printed, it is accounted for in the total horizontal distance travelled.

The vertical height of the rotated bar code includes the 0.25 inch leading space, the light and dark bars the comprise the bar code symbol, and the 0.25 inch trailing space.

Vertical bar codes are printed with a horizontal density of 100 DPI and a vertical density of 100 DPI.

Horizontal Spacing Between Vertical Bar Codes

The horizontal limit is the width of the paper (or 13.2 inches). The following equation applies with rotated bar codes, where N equals the number of bar code symbols to be printed and HEIGHT equals the height parameter entered for the original bar code:

(N)*(HEIGHT) + any spacing between two or more symbols must be less than or equal to 13.2 inches

Ensure proper horizontal spacing between two vertical bar codes. Note that the leading and trailing spaces rotate with the vertical bar codes.

The space character (20H) and the horizontal tab character (09H) produce the white spaces horizontally across the page, just as they do for the horizontal bar codes. The comma delimiter does not separate bar code symbols on the paper. Therefore, if a line of input is rotated with the comma as the delimiter, the bar code symbols are printed one against another. You must use either the space character (20H) or the horizontal tab character (09H) to keep this from occurring.

If a human–readable line is printed, its 0.1 inch gap is computed into the total horizontal distance.

Vertical Spacing Between Vertical Bar Codes

Vertical spacing is achieved via user–supplied linefeeds.

The vertical limit of any vertical bar code (90 or 270 degree rotation) is the current forms length. The encoded bar code symbols, including quiet zones, are less than or equal to the current printable forms length for a given line of ASCII input.

If paper length is exceeded during printing, the bar code symbol prints as far as possible, then terminates.

B Printer Specifications

Contents

Cleaning Interval

Clean the printer every 6 months or 1000 hours of operation, whichever occurs first. Refer to Chapter 6 for cleaning procedures.

NOTE: Using the control panel, you can determine hours of operation from the printer Statistics menu. (Refer to Chapter 4, *Printer Configuration*.)

Ribbon Specifications

NOTE: For best print quality, only use ribbons that meet the specifications listed below. Use of ribbons that do meet Digital specifications may void your printer warranty.

LG06: Carbon Black, OCR: LG6XX–BC

Fabric: Nylon, 1 inch x 60 yards spool–to–spool; metal reversing tabs on each end

LG12: Carbon Black, OCR: LG12R–BC

Fabric: Nylon, 1 inch x 100 yards spool–to–spool; metal reversing tabs on each end

Paper Specifications

Paper

Type:	Edge–perforated, fanfold, 3 to 16 inches wide
Thickness:	Single–part – 15 to 100 pound stock; Multi–part – 1– to 6–part forms, carbon and carbonless
Sheet Thickness:	0.025 inches maximum
Drive:	Adjustable tractors (LG06: 6–pin engagement; LG12: 8–pin engagement)
Slew Rate:	LG06: 16 inches–per–second maximum LG12: 20 inches–per–second maximum

Labels

On Backing:	One–part continuous perforated fanfold back form. Labels must be placed at least 1/6 inch from the fanfold perforation. Backing adhesive must not be squeezed out during printing.
Sheet Size:	3– to 16–inches wide, including the two standard perforated tractor feed strips. A maximum sheet size of 12 inches between top and bottom perforations.
Thickness:	Not to exceed 0.025–inch (including backing sheet)

Printer Dimensions

LG06

Height:	108 cm (42.5 inches)
Width:	68.6 cm (27 inches)
Depth:	72.9 cm (28.7 inches)
Weight:	Approximately 102 kg (225 lbs.) – Unpacked Approximately 129 kg (285 lbs.) – Packaged for shipping

LG12

Height:	105.9 cm (42 inches)
Width:	86.4 cm (34 inches)
Depth:	72.4 cm (29 inches)
Weight:	Approximately 156 kg (345 lbs.) – Unpacked Approximately 201 kg (450 lbs.) – Packaged for shipping

Interfaces

Type:	Resident parallel (two) and serial (one)
Logic Levels:	TTL/EIA–232D
Data Format:	ASCII
Compatibility:	Centronics, Dataproducts, EIA–232D
Buffer Size:	2 lines parallel, 1 KB serial

Environmental Characteristics

Temperature

Operating	10° C to 35° C (50° F to 95° F)
Storage	– 40° C to 70° C (–40° F to 158° F)

Relative Humidity

Operating	10% to 90% (noncondensing)
Storage	5% to 95% (noncondensing)

Acoustic Noise Level

LG06	52 dBA (tested per ISO 7779)
LG12	Less than 55 dBA (tested per ISO 7779)

Electrical Characteristics

Input Power

Voltage	100–120 / 200–240 Vac
Phase	Single

Frequency	50 Hz or 60 Hz (47 Hz to 62 Hz)

Power Rating

LG06

Standby	165 VA 60 Hz (120 Watts)
Operating	480 VA 60 Hz (360 Watts)

LG12

Standby	330 VA 60 Hz (200 Watts)
Operating	830 VA 60 Hz (520 Watts)

Data Input Rate (maximum)

LG06

Dataproducts	Up to 30,000 characters per second
Centronics	Up to 30,000 characters per second
RS–232	Up to 19.2K baud

LG12

Dataproducts	Up to 500,000 characters per second
Centronics	Up to 200,000 characters per second
RS–232	Up to 19.2K Baud

Radio Frequency Interference (RFI)

Radio Frequency Interference tested/certified to RFI standards FCC 15.B Class A; VDE 0871 Class B; CISPR–22.

Print Rates

The printing speed of text is a function of the selected font and dot density, and is measured in lines per minute (LPM). Print speed is independent of the number of characters configured in the character set. Text containing attributes such as bold or emphasized printing, superscripts, subscripts, or elongated attributes cause print rates to decrease to not less than half the rates of the font without such attributes. Table B–1 provides typical printing rates. The plotting speed of graphics is measured in inches per minute (ipm), and is calculated as follows:

$$\frac{1}{\text{Shuttle Speed} \times \text{Vertical Density}} \times 60{,}000 = \text{Plotting speed in inches/minute}$$

Shuttle speed varies with the horizontal dot density:

	Horizontal Density (dots/inch)	Shuttle Speed (LG06) (milliseconds/stroke)	Shuttle Speed (LG12) (milliseconds/stroke)
Selectable by graphics control codes	50	12.5	6.25
	60	12.5	6.25
	70	12.5	6.25
	80	12.5	6.25
	90	12.5	6.25
	100	12.5	6.25
	110	12.5	6.25
	120	12.5	6.25
	130	13.5	6.75
	140	14.5	7.25
	150	15.6	7.8
	180	18.75	9.375
	200	20.8	10.4

NOTES:

1. The theoretical plot speed will be reduced in half if there are adjacent dots in a dot row (as in the case of RASTER plot in the LG06/LG12). This limitation is due to the hammer fire cycle time.
2. The theoretical plot speed will be further reduced in half if the number of non–adjacent dots in a row exceeds 86% of the maximum number of non–adjacent dots for a given horizontal print resolution (this limitation is due to power consumption requirement).

Table B–1. Printing Rates

Print Application			Performance			
			Uppercase Only (lines/minute)		Descenders & Underline (lines/minute)	
Emulation, Font, and Characters /inch (cpi)	**Dot Density[1]**	**Dot Matrix[2]**	**LG06**	**LG12**	**LG06**	**LG12**
LG06 DP 5	60 (120) x 66.6	10 (18) x 7 + 2	600	900	480	720
LG06 DP 6	60 (120) x 66.6	8 (14) x 7 + 2	600	900	480	720
LG06 DP 10	60 (120) x 66.6	5 (9) x 7 + 2	600	900	480	720
Pro[3] DP 10	60 (120) x 75	5 (9) x 7 + 2	600	900	480	720
LG06 DP 12	60 (120) x 66.6	4 (7) x 7 + 2	600	900	480	720
Pro DP 12	60 (120) x 75	4 (7) x 7 + 2	600	900	480	720
LG06 DP 15	60 (120) x 100	3 (5) x 7 + 2	600	900	480	720
Pro DP 17	60 (120) x 75	3 (5) x 7 + 2	600	900	480	720
Pro DP 20	60 (120) x 75	3 (5) x 7 + 2	600	900	480	720
LG06 NLQ[4] 5	90 (180) x 85.7	14 (26) x 9 + 3	320	480	245	370
LG06 NLQ 6	90 (180) x 85.7	12 (22) x 9 + 3	320	480	245	370
LG06 NLQ 10	90 (180) x 85.7	7 (13) x 9 + 3	320	480	245	370
Pro NLQ 10	90 (180) x 100	7 (13) x 9 + 3	320	480	245	370
LG06 NLQ 12	90 (180) x 85.7	6 (11) x 9 + 3	320	480	245	370
Pro NLQ 12	90 (180) x 100	6 (11) x 9 + 3	320	480	245	370
LG06 NLQ 15	90 (180) x 85.7	5 (9) x 9 + 3	320	480	245	370
LG06 CMP 6.6	60 (120) x 85.7	4 (7) x 7 + 2	600	900	480	720
LG06 CMP 8.3	75 (150) x 85.7	4 (7) x 7 + 2	480	720	384	575
LG06 CMP 13.3	60 (120) x 85.7	4 (7) x 7 + 2	600	900	480	720
LG06 CMP 16.6	75 (150) x 85.7	4 (7) x 7 + 2	480	720	384	575
LG06 HS 10	60 (120) x 50	5 (9) x 5 + 1	800	1200	685	1030
LG06 OCR–A 10	120 (120) x 150	12 (12) x 15 + 1	300 (best) 450 155 (worst) 232			
LG06 OCR–B 10	120 (120) x 150	12 (12) x 15 + 1	300 (best) 450 155 (worst) 232			

[1] A (B) x C where: A = maximum horizontal dot density; B = horizontal dot placement density; C = vertical dot density.

[2] D (E) x F + G where: D = maximum number of dots to be placed on horizontal dot positions; E = horizontal dot positions; F = number of vertical dots for uppercase symbols; G = number of dots available for descenders.

[3] Pro = Proprinter emulation

[4] NLQ = correspondence, CMP = compressed, HS = high speed

Duty Cycle

The LG06 can print 75,000 pages per month and the LG12 can print 150,000 pages per month under the following conditions:

1. Uppercase only
2. 6 lines per inch (lpi)
3. 10 characters per inch (cpi)
4. 50% character density, or 66 characters per line
5. 50% line density, or 33 lines per 11–inch page
6. Single part (18 lb) paper
7. Printer is maintained in accordance with the maintenance manual
8. Printer is installed in accordance with Chapter 2, *Installation*

C Character Set Charts

Contents

Introduction

IMPORTANT

The character sets in this Appendix are address reference charts, not print samples. These charts were not generated on the LG06 printer. Not all characters are available in all fonts.

This appendix contains character address charts for the character sets and language overlays available in the LG06 and LG12 printers. The first four tables show the character sets available only in the Proprinter emulation mode. They can be selected at the control panel or by control codes from the host computer. These character sets are not available in Digital emulation. The Digital character sets are available only in Digital emulation mode. The Digital Emulation Languages Substitution Table (page C–9) identifies specific character substitutions available in the selected language. For example, if you select the U.S. ASCII character set, 023 hex represents the number sign (**#**). If you then select Digital Dutch, 023 hex represents the English pound symbol (**£**) instead of the number sign. For each language, only the characters that may differ from the ASCII character set are shown. If a character is not shown on the Digital Emulation Languages Substitution Table, it is the same as in the ASCII character set.

Proprinter Code Page 437
Character Set 1

KEY

B7 B6 B5 / BITS B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 (OCTAL) 27 (DECIMAL) 1B (HEX)

CHARACTER

BITS B4 B3 B2 B1	ROW	COLUMN 0	1	2	3	4	5	6	7	COLUMN 8	9	10	11	12	13	14	15
B8*		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
B7 B6 B5		0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
0 0 0 0	0	NUL 0/0/0	20/16/10	SP 40/32/20	0 60/48/30	@ 100/64/40	P 120/80/50	` 140/96/60	p 160/112/70	200/128/80	220/144/90	á 240/160/A0	░ 260/176/B0	└ 300/192/C0	╨ 320/208/D0	α 340/224/E0	≡ 360/240/F0
0 0 0 1	1	1/1/1	DC1 21/17/11	! 41/33/21	1 61/49/31	A 101/65/41	Q 121/81/51	a 141/97/61	q 161/113/71	201/129/81	DC1 221/145/91	í 241/161/A1	▒ 261/177/B1	┴ 301/193/C1	╤ 321/209/D1	β 341/225/E1	± 361/241/F1
0 0 1 0	2	2/2/2	DC2 22/18/12	″ 42/34/22	2 62/50/32	B 102/66/42	R 122/82/52	b 142/98/62	r 162/114/72	202/130/82	DC2 222/146/92	ó 242/162/A2	▓ 262/178/B2	┬ 302/194/C2	╥ 322/210/D2	Γ 342/226/E2	≥ 362/242/F2
0 0 1 1	3	3/3/3	DC3 23/19/13	# 43/35/23	3 63/51/33	C 103/67/43	S 123/83/53	c 143/99/63	s 163/115/73	203/131/83	223/147/93	ú 243/163/A3	│ 263/179/B3	├ 303/195/C3	╙ 323/211/D3	π 343/227/E3	≤ 363/243/F3
0 1 0 0	4	4/4/4	DC4 24/20/14	$ 44/36/24	4 64/52/34	D 104/68/44	T 124/84/54	d 144/100/64	t 164/116/74	204/132/84	DC4 224/148/94	ñ 244/164/A4	┤ 264/180/B4	─ 304/196/C4	╘ 324/212/D4	Σ 344/228/E4	⌠ 364/244/F4
0 1 0 1	5	5/5/5	25/21/15	% 45/37/25	5 65/53/35	E 105/69/45	U 125/85/55	e 145/101/65	u 165/117/75	205/133/85	225/149/95	Ñ 245/165/A5	╡ 265/181/B5	┼ 305/197/C5	╒ 325/213/D5	σ 345/229/E5	⌡ 365/245/F5
0 1 1 0	6	6/6/6	26/22/16	& 46/38/26	6 66/54/36	F 106/70/46	V 126/86/56	f 146/102/66	v 166/118/76	206/134/86	226/150/96	ª 246/166/A6	╢ 266/182/B6	╞ 306/198/C6	╓ 326/214/D6	µ 346/230/E6	÷ 366/246/F6
0 1 1 1	7	BEL 7/7/7	27/23/17	´ 47/39/27	7 67/55/37	G 107/71/47	W 127/87/57	g 147/103/67	w 167/119/77	BEL 207/135/87	227/151/97	º 247/167/A7	╖ 267/183/B7	╟ 307/199/C7	╫ 327/215/D7	τ 347/231/E7	≈ 367/247/F7
1 0 0 0	8	BS 10/8/8	30/24/18	(50/40/28	8 70/56/38	H 110/72/48	X 130/88/58	h 150/104/68	x 170/120/78	BS 210/136/88	230/152/98	¿ 250/168/A8	╕ 270/184/B8	╚ 310/200/C8	╪ 330/216/D8	Φ 350/232/E8	° 370/248/F8
1 0 0 1	9	HT 11/9/9	31/25/19	) 51/41/29	9 71/57/39	I 111/73/49	Y 131/89/59	i 151/105/69	y 171/121/79	HT 211/137/89	231/153/99	⌐ 251/169/A9	╣ 271/185/B9	╔ 311/201/C9	┘ 331/217/D9	Θ 351/233/E9	• 371/249/F9
1 0 1 0	10	LF 12/10/0A	32/26/1A	* 52/42/2A	: 72/58/3A	J 112/74/4A	Z 132/90/5A	j 152/106/6A	z 172/122/7A	LF 212/138/8A	232/154/9A	¬ 252/170/AA	║ 272/186/BA	╩ 312/202/CA	┌ 332/218/DA	Ω 352/234/EA	· 372/250/FA
1 0 1 1	11	VT 13/11/0B	ESC 33/27/1B	+ 53/43/2B	; 73/59/3B	K 113/75/4B	[133/91/5B	k 153/107/6B	{ 173/123/7B	VT 213/139/8B	ESC 233/155/9B	1/2 253/171/AB	╗ 273/187/BB	╦ 313/203/CB	█ 333/219/DB	δ 353/235/EB	√ 373/251/FB
1 1 0 0	12	FF 14/12/0C	34/28/1C	, 54/44/2C	< 74/60/3C	L 114/76/4C	\ 134/92/5C	l 154/108/6C	¦ 174/124/7C	FF 214/140/8C	234/156/9C	1/4 254/172/AC	╝ 274/188/BC	╠ 314/204/CC	▄ 334/220/DC	∞ 354/236/EC	n 374/252/FC
1 1 0 1	13	CR 15/13/0D	35/29/1D	– 55/45/2D	= 75/61/3D	M 115/77/4D	] 135/93/5D	m 155/109/6D	} 175/125/7D	CR 215/141/8D	235/157/9D	¡ 255/173/AD	╜ 275/189/BD	═ 315/205/CD	▌ 335/221/DD	φ 355/237/ED	2 375/253/FD
1 1 1 0	14	SO 16/14/0E	36/30/1E	. 56/46/2E	> 76/62/3E	N 116/78/4E	^ 136/94/5E	n 156/110/6E	~ 176/126/7E	SO 216/142/8E	236/158/9E	≪ 256/174/AE	╛ 276/190/BE	╬ 316/206/CE	▐ 336/222/DE	∈ 356/238/EE	■ 376/254/FE
1 1 1 1	15	SI 17/15/0F	37/31/1F	/ 57/47/2F	? 77/63/3F	O 117/79/4F	_ 137/95/5F	o 157/111/6F	177/127/7F	SI 217/143/8F	237/159/9F	≫ 257/175/AF	┐ 277/191/BF	╧ 317/207/CF	▀ 337/223/DF	∩ 357/239/EF	377/255/FF

Proprinter Code Page 437
Character Set 2

KEY

BITS B7 B6 B5 / B4 B3 B2 B1	0 0 1
1 0 1 1	ESC (33 27 1B)

33 ← OCTAL, 27 ← DECIMAL, 1B ← HEX, ESC ← CHARACTER

BITS B4 B3 B2 B1	ROW	COLUMN 0	1	2	3	4	5	6	7	COLUMN 8	9	10	11	12	13	14	15
B8*		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
B7 B6 B5		0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
0 0 0 0	0	NUL (0 0 0)	(20 16 10)	SP (40 32 20)	0 (60 48 30)	@ (100 64 40)	P (120 80 50)	` (140 96 60)	p (160 112 70)	Ç (200 128 80)	É (220 144 90)	á (240 160 A0)	░ (260 176 B0)	└ (300 192 C0)	╨ (320 208 D0)	α (340 224 E0)	≡ (360 240 F0)
0 0 0 1	1	(1 1 1)	DC1 (21 17 11)	! (41 33 21)	1 (61 49 31)	A (101 65 41)	Q (121 81 51)	a (141 97 61)	q (161 113 71)	ü (201 129 81)	æ (221 145 91)	í (241 161 A1)	▒ (261 177 B1)	┴ (301 193 C1)	╤ (321 209 D1)	β (341 225 E1)	± (361 241 F1)
0 0 1 0	2	(2 2 2)	DC2 (22 18 12)	" (42 34 22)	2 (62 50 32)	B (102 66 42)	R (122 82 52)	b (142 98 62)	r (162 114 72)	é (202 130 82)	Æ (222 146 92)	ó (242 162 A2)	▓ (262 178 B2)	┬ (302 194 C2)	╥ (322 210 D2)	Γ (342 226 E2)	≥ (362 242 F2)
0 0 1 1	3	♥ (3 3 3)	DC3 (23 19 13)	# (43 35 23)	3 (63 51 33)	C (103 67 43)	S (123 83 53)	c (143 99 63)	s (163 115 73)	â (203 131 83)	ô (223 147 93)	ú (243 163 A3)	│ (263 179 B3)	├ (303 195 C3)	╙ (323 211 D3)	π (343 227 E3)	≤ (363 243 F3)
0 1 0 0	4	♦ (4 4 4)	DC4 (24 20 14)	$ (44 36 24)	4 (64 52 34)	D (104 68 44)	T (124 84 54)	d (144 100 64)	t (164 116 74)	ä (204 132 84)	ö (224 148 94)	ñ (244 164 A4)	┤ (264 180 B4)	─ (304 196 C4)	╘ (324 212 D4)	Σ (344 228 E4)	⌠ (364 244 F4)
0 1 0 1	5	♣ (5 5 5)	§ (25 21 15)	% (45 37 25)	5 (65 53 35)	E (105 69 45)	U (125 85 55)	e (145 101 65)	u (165 117 75)	à (205 133 85)	ò (225 149 95)	Ñ (245 165 A5)	╡ (265 181 B5)	┼ (305 197 C5)	╒ (325 213 D5)	σ (345 229 E5)	⌡ (365 245 F5)
0 1 1 0	6	♠ (6 6 6)	(26 22 16)	& (46 38 26)	6 (66 54 36)	F (106 70 46)	V (126 86 56)	f (146 102 66)	v (166 118 76)	å (206 134 86)	û (226 150 96)	ª (246 166 A6)	╢ (266 182 B6)	╞ (306 198 C6)	╓ (326 214 D6)	µ (346 230 E6)	÷ (366 246 F6)
0 1 1 1	7	BEL (7 7 7)	(27 23 17)	´ (47 39 27)	7 (67 55 37)	G (107 71 47)	W (127 87 57)	g (147 103 67)	w (167 119 77)	ç (207 135 87)	ù (227 151 97)	º (247 167 A7)	╖ (267 183 B7)	╟ (307 199 C7)	╫ (327 215 D7)	τ (347 231 E7)	≈ (367 247 F7)
1 0 0 0	8	BS (10 8 8)	(30 24 18)	((50 40 28)	8 (70 56 38)	H (110 72 48)	X (130 88 58)	h (150 104 68)	x (170 120 78)	ê (210 136 88)	ÿ (230 152 98)	¿ (250 168 A8)	╕ (270 184 B8)	╚ (310 200 C8)	╪ (330 216 D8)	Φ (350 232 E8)	° (370 248 F8)
1 0 0 1	9	HT (11 9 9)	(31 25 19)	) (51 41 29)	9 (71 57 39)	I (111 73 49)	Y (131 89 59)	i (151 105 69)	y (171 121 79)	ë (211 137 89)	Ö (231 153 99)	⌐ (251 169 A9)	╣ (271 185 B9)	╔ (311 201 C9)	┘ (331 217 D9)	Θ (351 233 E9)	• (371 249 F9)
1 0 1 0	10	LF (12 10 0A)	(32 26 1A)	* (52 42 2A)	: (72 58 3A)	J (112 74 4A)	Z (132 90 5A)	j (152 106 6A)	z (172 122 7A)	è (212 138 8A)	Ü (232 154 9A)	¬ (252 170 AA)	║ (272 186 BA)	╩ (312 202 CA)	┌ (332 218 DA)	Ω (352 234 EA)	· (372 250 FA)
1 0 1 1	11	VT (13 11 0B)	ESC (33 27 1B)	+ (53 43 2B)	; (73 59 3B)	K (113 75 4B)	[(133 91 5B)	k (153 107 6B)	{ (173 123 7B)	ï (213 139 8B)	¢ (233 155 9B)	1/2 (253 171 AB)	╗ (273 187 BB)	╦ (313 203 CB)	█ (333 219 DB)	δ (353 235 EB)	√ (373 251 FB)
1 1 0 0	12	FF (14 12 0C)	(34 28 1C)	, (54 44 2C)	< (74 60 3C)	L (114 76 4C)	\ (134 92 5C)	l (154 108 6C)	¦ (174 124 7C)	î (214 140 8C)	£ (234 156 9C)	1/4 (254 172 AC)	╝ (274 188 BC)	╠ (314 204 CC)	▄ (334 220 DC)	∞ (354 236 EC)	n (374 252 FC)
1 1 0 1	13	CR (15 13 0D)	(35 29 1D)	– (55 45 2D)	= (75 61 3D)	M (115 77 4D)	] (135 93 5D)	m (155 109 6D)	} (175 125 7D)	ì (215 141 8D)	¥ (235 157 9D)	¡ (255 173 AD)	╜ (275 189 BD)	═ (315 205 CD)	▌ (335 221 DD)	φ (355 237 ED)	2 (375 253 FD)
1 1 1 0	14	SO (16 14 0E)	(36 30 1E)	. (56 46 2E)	> (76 62 3E)	N (116 78 4E)	^ (136 94 5E)	n (156 110 6E)	~ (176 126 7E)	Ä (216 142 8E)	₧ (236 158 9E)	« (256 174 AE)	╛ (276 190 BE)	╬ (316 206 CE)	▐ (336 222 DE)	∈ (356 238 EE)	■ (376 254 FE)
1 1 1 1	15	SI (17 15 0F)	(37 31 1F)	/ (57 47 2F)	? (77 63 3F)	O (117 79 4F)	_ (137 95 5F)	o (157 111 6F)	(177 127 7F)	Å (217 143 8F)	ƒ (237 159 9F)	» (257 175 AF)	┐ (277 191 BF)	╧ (317 207 CF)	▀ (337 223 DF)	∩ (357 239 EF)	(377 255 FF)

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Character Set 1

KEY

B7 B6 B5 BITS B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 / 27 / 1B

ESC ← CHARACTER; 33 ← OCTAL; 27 ← DECIMAL; 1B ← HEX

B8*	0	0	0	0	0	0	0	0
B7 B6 B5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
BITS B4 B3 B2 B1 / ROW	COLUMN 0	1	2	3	4	5	6	7
0 0 0 0 / 0	NUL 0 0 0	20 16 10	SP 40 32 20	0 60 48 30	@ 100 64 40	P 120 80 50	` 140 96 60	p 160 112 70
0 0 0 1 / 1	1 1 1	DC1 21 17 11	! 41 33 21	1 61 49 31	A 101 65 41	Q 121 81 51	a 141 97 61	q 161 113 71
0 0 1 0 / 2	2 2 2	DC2 22 18 12	" 42 34 22	2 62 50 32	B 102 66 42	R 122 82 52	b 142 98 62	r 162 114 72
0 0 1 1 / 3	3 3 3	DC3 23 19 13	# 43 35 23	3 63 51 33	C 103 67 43	S 123 83 53	c 143 99 63	s 163 115 73
0 1 0 0 / 4	4 4 4	DC4 24 20 14	$ 44 36 24	4 64 52 34	D 104 68 44	T 124 84 54	d 144 100 64	t 164 116 74
0 1 0 1 / 5	5 5 5	25 21 15	% 45 37 25	5 65 53 35	E 105 69 45	U 125 85 55	e 145 101 65	u 165 117 75
0 1 1 0 / 6	6 6 6	26 22 16	& 46 38 26	6 66 54 36	F 106 70 46	V 126 86 56	f 146 102 66	v 166 118 76
0 1 1 1 / 7	BEL 7 7 7	27 23 17	´ 47 39 27	7 67 55 37	G 107 71 47	W 127 87 57	g 147 103 67	w 167 119 77
1 0 0 0 / 8	BS 10 8 8	30 24 18	(50 40 28	8 70 56 38	H 110 72 48	X 130 88 58	h 150 104 68	x 170 120 78
1 0 0 1 / 9	HT 11 9 9	31 25 19	) 51 41 29	9 71 57 39	I 111 73 49	Y 131 89 59	i 151 105 69	y 171 121 79
1 0 1 0 / 10	LF 12 10 0A	32 26 1A	* 52 42 2A	: 72 58 3A	J 112 74 4A	Z 132 90 5A	j 152 106 6A	z 172 122 7A
1 0 1 1 / 11	VT 13 11 0B	ESC 33 27 1B	+ 53 43 2B	; 73 59 3B	K 113 75 4B	[133 91 5B	k 153 107 6B	{ 173 123 7B
1 1 0 0 / 12	FF 14 12 0C	34 28 1C	, 54 44 2C	< 74 60 3C	L 114 76 4C	\ 134 92 5C	l 154 108 6C	¦ 174 124 7C
1 1 0 1 / 13	CR 15 13 0D	35 29 1D	– 55 45 2D	= 75 61 3D	M 115 77 4D	] 135 93 5D	m 155 109 6D	} 175 125 7D
1 1 1 0 / 14	SO 16 14 0E	36 30 1E	. 56 46 2E	> 76 62 3E	N 116 78 4E	^ 136 94 5E	n 156 110 6E	~ 176 126 7E
1 1 1 1 / 15	SI 17 15 0F	37 31 1F	/ 57 47 2F	? 77 63 3F	O 117 79 4F	_ 137 95 5F	o 157 111 6F	177 127 7F

B8*	1	1	1	1	1	1	1	1
B7 B6 B5	0 0 0	0 0 1	0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1
BITS B4 B3 B2 B1 / ROW	COLUMN 8	9	10	11	12	13	14	15
0 0 0 0 / 0	200 128 80	220 144 90	á 240 160 A0	░ 260 176 B0	└ 300 192 C0	ð 320 208 D0	Ó 340 224 E0	− 360 240 F0
0 0 0 1 / 1	201 129 81	DC1 221 145 91	í 241 161 A1	▒ 261 177 B1	┴ 301 193 C1	Đ 321 209 D1	β 341 225 E1	± 361 241 F1
0 0 1 0 / 2	202 130 82	DC2 222 146 92	ó 242 162 A2	▓ 262 178 B2	┬ 302 194 C2	Ê 322 210 D2	Ô 342 226 E2	‗ 362 242 F2
0 0 1 1 / 3	203 131 83	223 147 93	ú 243 163 A3	│ 263 179 B3	├ 303 195 C3	Ë 323 211 D3	Ò 343 227 E3	3/4 363 243 F3
0 1 0 0 / 4	204 132 84	DC4 224 148 94	ñ 244 164 A4	┤ 264 180 B4	─ 304 196 C4	È 324 212 D4	õ 344 228 E4	¶ 364 244 F4
0 1 0 1 / 5	205 133 85	225 149 95	Ñ 245 165 A5	Á 265 181 B5	┼ 305 197 C5	1 325 213 D5	Õ 345 229 E5	§ 365 245 F5
0 1 1 0 / 6	206 134 86	226 150 96	ª 246 166 A6	Â 266 182 B6	ã 306 198 C6	Í 326 214 D6	µ 346 230 E6	÷ 366 246 F6
0 1 1 1 / 7	BEL 207 135 87	227 151 97	º 247 167 A7	À 267 183 B7	Ã 307 199 C7	Î 327 215 D7	þ 347 231 E7	¸ 367 247 F7
1 0 0 0 / 8	BS 210 136 88	230 152 98	¿ 250 168 A8	© 270 184 B8	╚ 310 200 C8	Ï 330 216 D8	Þ 350 232 E8	° 370 248 F8
1 0 0 1 / 9	HT 211 137 89	231 153 99	® 251 169 A9	╣ 271 185 B9	╔ 311 201 C9	┘ 331 217 D9	Ú 351 233 E9	¨ 371 249 F9
1 0 1 0 / 10	LF 212 138 8A	232 154 9A	¬ 252 170 AA	║ 272 186 BA	╩ 312 202 CA	┌ 332 218 DA	Û 352 234 EA	· 372 250 FA
1 0 1 1 / 11	VT 213 139 8B	ESC 233 155 9B	1/2 253 171 AB	╗ 273 187 BB	╦ 313 203 CB	█ 333 219 DB	Ù 353 235 EB	1 373 251 FB
1 1 0 0 / 12	FF 214 140 8C	234 156 9C	1/4 254 172 AC	╝ 274 188 BC	╠ 314 204 CC	▄ 334 220 DC	ý 354 236 EC	3 374 252 FC
1 1 0 1 / 13	CR 215 141 8D	235 157 9D	¡ 255 173 AD	¢ 275 189 BD	═ 315 205 CD	¦ 335 221 DD	Ý 355 237 ED	2 375 253 FD
1 1 1 0 / 14	SO 216 142 8E	236 158 9E	« 256 174 AE	¥ 276 190 BE	╬ 316 206 CE	Ì 336 222 DE	▪ 356 238 EE	■ 376 254 FE
1 1 1 1 / 15	SI 217 143 8F	237 159 9F	» 257 175 AF	┐ 277 191 BF	¤ 317 207 CF	▀ 337 223 DF	´ 357 239 EF	377 255 FF

Proprinter Code Page 850

Character Set 2

KEY

BITS B7 B6 B5 / B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 27 1B

OCTAL, DECIMAL, HEX (top to bottom); CHARACTER

B8* B7 B6 B5		0 000		0 001		0 010		0 011		0 100		0 101		0 110		0 111	
BITS B4 B3 B2 B1	ROW	COLUMN 0		1		2		3		4		5		6		7	
0 0 0 0	0	NUL	0 0 0		20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	`	140 96 60	p	160 112 70
0 0 0 1	1		1 1 1	DC1	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	a	141 97 61	q	161 113 71
0 0 1 0	2		2 2 2	DC2	22 18 12	″	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	b	142 98 62	r	162 114 72
0 0 1 1	3	♥	3 3 3	DC3	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	c	143 99 63	s	163 115 73
0 1 0 0	4	♦	4 4 4	DC4	24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	d	144 100 64	t	164 116 74
0 1 0 1	5	♣	5 5 5	§	25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	e	145 101 65	u	165 117 75
0 1 1 0	6	♠	6 6 6		26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	f	146 102 66	v	166 118 76
0 1 1 1	7	BEL	7 7 7		27 23 17	′	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	g	147 103 67	w	167 119 77
1 0 0 0	8	BS	10 8 8		30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	h	150 104 68	x	170 120 78
1 0 0 1	9	HT	11 9 9		31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	i	151 105 69	y	171 121 79
1 0 1 0	10	LF	12 10 0A		32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	j	152 106 6A	z	172 122 7A
1 0 1 1	11	VT	13 11 0B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	k	153 107 6B	{	173 123 7B
1 1 0 0	12	FF	14 12 0C		34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	l	154 108 6C	¦	174 124 7C
1 1 0 1	13	CR	15 13 0D		35 29 1D	–	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	m	155 109 6D	}	175 125 7D
1 1 1 0	14	SO	16 14 0E		36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	n	156 110 6E	~	176 126 7E
1 1 1 1	15	SI	17 15 0F		37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	_	137 95 5F	o	157 111 6F		177 127 7F

B8* B7 B6 B5		1 000		1 001		1 010		1 011		1 100		1 101		1 110		1 111	
BITS B4 B3 B2 B1	ROW	COLUMN 8		9		10		11		12		13		14		15	
0 0 0 0	0	Ç	200 128 80	É	220 144 90	á	240 160 A0	░	260 176 B0	└	300 192 C0	ð	320 208 D0	Ó	340 224 E0	–	360 240 F0
0 0 0 1	1	ü	201 129 81	æ	221 145 91	í	241 161 A1	▒	261 177 B1	┴	301 193 C1	Ð	321 209 D1	β	341 225 E1	±	361 241 F1
0 0 1 0	2	é	202 130 82	Æ	222 146 92	ó	242 162 A2	▓	262 178 B2	┬	302 194 C2	Ê	322 210 D2	Ô	342 226 E2	‗	362 242 F2
0 0 1 1	3	â	203 131 83	ô	223 147 93	ú	243 163 A3	│	263 179 B3	├	303 195 C3	Ë	323 211 D3	Ò	343 227 E3	3/4	363 243 F3
0 1 0 0	4	ä	204 132 84	ö	224 148 94	ñ	244 164 A4	┤	264 180 B4	─	304 196 C4	È	324 212 D4	õ	344 228 E4	¶	364 244 F4
0 1 0 1	5	à	205 133 85	ò	225 149 95	Ñ	245 165 A5	Á	265 181 B5	┼	305 197 C5	1	325 213 D5	Õ	345 229 E5	§	365 245 F5
0 1 1 0	6	å	206 134 86	û	226 150 96	a	246 166 A6	Â	266 182 B6	ã	306 198 C6	Í	326 214 D6	µ	346 230 E6	÷	366 246 F6
0 1 1 1	7	ç	207 135 87	ù	227 151 97	o	247 167 A7	À	267 183 B7	Ã	307 199 C7	Î	327 215 D7	þ	347 231 E7	¸	367 247 F7
1 0 0 0	8	ê	210 136 88	ÿ	230 152 98	¿	250 168 A8	©	270 184 B8	╚	310 200 C8	Ï	330 216 D8	Þ	350 232 E8	°	370 248 F8
1 0 0 1	9	ë	211 137 89	Ö	231 153 99	®	251 169 A9	╣	271 185 B9	╔	311 201 C9	┘	331 217 D9	Ú	351 233 E9	¨	371 249 F9
1 0 1 0	10	è	212 138 8A	Ü	232 154 9A	¬	252 170 AA	║	272 186 BA	╩	312 202 CA	┌	332 218 DA	Û	352 234 EA	·	372 250 FA
1 0 1 1	11	ï	213 139 8B	¢	233 155 9B	1/2	253 171 AB	╗	273 187 BB	╦	313 203 CB	█	333 219 DB	Ù	353 235 EB	1	373 251 FB
1 1 0 0	12	î	214 140 8C	£	234 156 9C	1/4	254 172 AC	╝	274 188 BC	╠	314 204 CC	▄	334 220 DC	ý	354 236 EC	3	374 252 FC
1 1 0 1	13	ì	215 141 8D	Ø	235 157 9D	¡	255 173 AD	¢	275 189 BD	═	315 205 CD	¦	335 221 DD	Ý	355 237 ED	2	375 253 FD
1 1 1 0	14	Ä	216 142 8E	×	236 158 9E	«	256 174 AE	¥	276 190 BE	╬	316 206 CE	Ì	336 222 DE	¯	356 238 EE	■	376 254 FE
1 1 1 1	15	Å	217 143 8F	ƒ	237 159 9F	»	257 175 AF	┐	277 191 BF	¤	317 207 CF	▀	337 223 DF	´	357 239 EF		377 255 FF

LG06 Emulation Character Set Charts

The following languages comprise the multinational character sets. These languages are only available in the Digital emulation. Included are:

- U.S. ASCII
- Digital British
- Digital Dutch
- Digital Finnish
- French
- Digital French (Canadian)
- German
- Italian
- JIS Roman
- Digital Norwegian/Danish
- Spanish
- Digital Swedish
- ISO Norwegian/Danish
- Digital Portuguese

The Digital Emulation Languages Substitution Table (page C–9) identifies specific character substitutions available in the selected language. Hex addresses not shown on the substitution tables use the character in the hex address shown on the standard character set matrix.

U.S. ASCII Character Set

KEY

B7 B6 B5 BITS B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 27 1B

33 → OCTAL
27 → DECIMAL
1B → HEX
ESC → ASCII CHARACTER

B7 B6 B5 BITS B4 B3 B2 B1	ROW	0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
		COLUMN 0		1		2		3		4		5		6		7	
0 0 0 0	0	**NUL**	0 0 0	**DLE**	20 16 10	**SP**	40 32 20	**0**	60 48 30	**@**	100 64 40	**P**	120 80 50	`	140 96 60	**p**	160 112 70
0 0 0 1	1	**SOH**	1 1 1	**DC1** (XON)	21 17 11	**!**	41 33 21	**1**	61 49 31	**A**	101 65 41	**Q**	121 81 51	**a**	141 97 61	**q**	161 113 71
0 0 1 0	2	**STX**	2 2 2	**DC2**	22 18 12	**″**	42 34 22	**2**	62 50 32	**B**	102 66 42	**R**	122 82 52	**b**	142 98 62	**r**	162 114 72
0 0 1 1	3	**ETX**	3 3 3	**DC3** (XOFF)	23 19 13	**#**	43 35 23	**3**	63 51 33	**C**	103 67 43	**S**	123 83 53	**c**	143 99 63	**s**	163 115 73
0 1 0 0	4	**EOT**	4 4 4	**DC4**	24 20 14	**$**	44 36 24	**4**	64 52 34	**D**	104 68 44	**T**	124 84 54	**d**	144 100 64	**t**	164 116 74
0 1 0 1	5	**ENQ**	5 5 5	**NAK**	25 21 15	**%**	45 37 25	**5**	65 53 35	**E**	105 69 45	**U**	125 85 55	**e**	145 101 65	**u**	165 117 75
0 1 1 0	6	**ACK**	6 6 6	**SYN**	26 22 16	**&**	46 38 26	**6**	66 54 36	**F**	106 70 46	**V**	126 86 56	**f**	146 102 66	**v**	166 118 76
0 1 1 1	7	**BEL**	7 7 7	**ETB**	27 23 17	**’**	47 39 27	**7**	67 55 37	**G**	107 71 47	**W**	127 87 57	**g**	147 103 67	**w**	167 119 77
1 0 0 0	8	**BS**	10 8 8	**CAN**	30 24 18	**(**	50 40 28	**8**	70 56 38	**H**	110 72 48	**X**	130 88 58	**h**	150 104 68	**x**	170 120 78
1 0 0 1	9	**HT**	11 9 9	**EM**	31 25 19	**)**	51 41 29	**9**	71 57 39	**I**	111 73 49	**Y**	131 89 59	**i**	151 105 69	**y**	171 121 79
1 0 1 0	10	**LF**	12 10 0 A	**SUB**	32 26 1A	*	52 42 2A	**:**	72 58 3A	**J**	112 74 4A	**Z**	132 90 5A	**j**	152 106 6A	**z**	172 122 7A
1 0 1 1	11	**VT**	13 11 0 B	**ESC**	33 27 1B	**+**	53 43 2B	**;**	73 59 3B	**K**	113 75 4B	**[**	133 91 5B	**k**	153 107 6B	{	173 123 7B
1 1 0 0	12	**FF**	14 12 0 C	**FS**	34 28 1C	**,**	54 44 2C	**<**	74 60 3C	**L**	114 76 4C	****	134 92 5C	**l**	154 108 6C	**|**	174 124 7C
1 1 0 1	13	**CR**	15 13 0 D	**GS**	35 29 1D	**–**	55 45 2D	**=**	75 61 3D	**M**	115 77 4D	**]**	135 93 5D	**m**	155 109 6D	}	175 125 7D
1 1 1 0	14	**SO**	16 14 0 E	**RS**	36 30 1E	**.**	56 46 2E	**>**	76 62 3E	**N**	116 78 4E	**^**	136 94 5E	**n**	156 110 6E	**~**	176 126 7E
1 1 1 1	15	**SI**	17 15 0 F	**US**	37 31 1F	**/**	57 47 2F	**?**	77 63 3F	**O**	117 79 4F	_	137 95 5F	**o**	157 111 6F	**DEL**	177 127 7F

DEC Multinational Character Set

KEY

B8 B7 B6 B5 BITS B4 B3 B2 B1	0 0 0 1	
1 0 1 1	ESC	33 27 1B

OCTAL, DECIMAL, HEX, CHARACTER

7–bit mode or bit 8 set to zero

Columns 8 and 9 can be converted to 7–bit Escape sequences.

Columns 10 thru 15 are only accessed in 8–bit mode.

B8 B7 B6 B5 BITS		0 0 0 0	0 0 0 1	0 0 1 0	0 0 1 1	0 1 0 0	0 1 0 1	0 1 1 0	0 1 1 1
B4 B3 B2 B1	ROW	COLUMN 0	1	2	3	4	5	6	7
0 0 0 0	0	NUL 0 0 0	20 16 10	SP 40 32 20	0 60 48 30	@ 100 64 40	P 120 80 50	` 140 96 60	p 160 112 70
0 0 0 1	1	1 1 1	DC1 (XON) 21 17 11	! 41 33 21	1 61 49 31	A 101 65 41	Q 121 81 51	a 141 97 61	q 161 113 71
0 0 1 0	2	2 2 2	22 18 12	″ 42 34 22	2 62 50 32	B 102 66 42	R 122 82 52	b 142 98 62	r 162 114 72
0 0 1 1	3	3 3 3	DC3 (XOFF) 23 19 13	# 43 35 23	3 63 51 33	C 103 67 43	S 123 83 53	c 143 99 63	s 163 115 73
0 1 0 0	4	EOT 4 4 4	24 20 14	$ 44 36 24	4 64 52 34	D 104 68 44	T 124 84 54	d 144 100 64	t 164 116 74
0 1 0 1	5	5 5 5	25 21 15	% 45 37 25	5 65 53 35	E 105 69 45	U 125 85 55	e 145 101 65	u 165 117 75
0 1 1 0	6	6 6 6	26 22 16	& 46 38 26	6 66 54 36	F 106 70 46	V 126 86 56	f 146 102 66	v 166 118 76
0 1 1 1	7	7 7 7	27 23 17	' 47 39 27	7 67 55 37	G 107 71 47	W 127 87 57	g 147 103 67	w 167 119 77
1 0 0 0	8	BS 10 8 8	CAN 30 24 18	(50 40 28	8 70 56 38	H 110 72 48	X 130 88 58	h 150 104 68	x 170 120 78
1 0 0 1	9	HT 11 9 9	31 25 19	) 51 41 29	9 71 57 39	I 111 73 49	Y 131 89 59	i 151 105 69	y 171 121 79
1 0 1 0	10	LF 12 10 0A	SUB 32 26 1A	* 52 42 2A	: 72 58 3A	J 112 74 4A	Z 132 90 5A	j 152 106 6A	z 172 122 7A
1 0 1 1	11	VT 13 11 0B	ESC 33 27 1B	+ 53 43 2B	; 73 59 3B	K 113 75 4B	[133 91 5B	k 153 107 6B	{ 173 123 7B
1 1 0 0	12	FF 14 12 0C	34 28 1C	, 54 44 2C	< 74 60 3C	L 114 76 4C	\ 134 92 5C	l 154 108 6C	| 174 124 7C
1 1 0 1	13	CR 15 13 0D	35 29 1D	– 55 45 2D	= 75 61 3D	M 115 77 4D	] 135 93 5D	m 155 109 6D	} 175 125 7D
1 1 1 0	14	SO 16 14 0E	36 30 1E	. 56 46 2E	> 76 62 3E	N 116 78 4E	^ 136 94 5E	n 156 110 6E	~ 176 126 7E
1 1 1 1	15	SI 17 15 0F	37 31 1F	/ 57 47 2F	? 77 63 3F	O 117 79 4F	_ 137 95 5F	o 157 111 6F	DEL 177 127 7F

B8 B7 B6 B5 BITS		1 0 0 0	1 0 0 1	1 0 1 0	1 0 1 1	1 1 0 0	1 1 0 1	1 1 1 0	1 1 1 1
B4 B3 B2 B1	ROW	8	9	10	11	12	13	14	15
0 0 0 0	0	200 128 80	DCS 220 144 90	(Not Used) 240 160 A0	ƒ 260 176 B0	À 300 192 C0	320 208 D0	à 340 224 E0	360 240 F0
0 0 0 1	1	201 129 81	221 145 91	¡ 241 161 A1	± 261 177 B1	Á 301 193 C1	Ñ 321 209 D1	á 341 225 E1	ñ 361 241 F1
0 0 1 0	2	202 130 82	222 146 92	¢ 242 162 A2	2 262 178 B2	Â 302 194 C2	Ò 322 210 D2	â 342 226 E2	ò 362 242 F2
0 0 1 1	3	203 131 83	223 147 93	£ 243 163 A3	3 263 179 B3	Ã 303 195 C3	Ó 323 211 D3	ã 343 227 E3	ó 363 243 F3
0 1 0 0	4	IND 204 132 84	224 148 94	244 164 A4	264 180 B4	Ä 304 196 C4	Ô 324 212 D4	ä 344 228 E4	ô 364 244 F4
0 1 0 1	5	NEL 205 133 85	225 149 95	¥ 245 165 A5	µ 265 181 B5	Å 305 197 C5	Õ 325 213 D5	å 345 229 E5	õ 365 245 F5
0 1 1 0	6	206 134 86	226 150 96	246 166 A6	¶ 266 182 B6	Æ 306 198 C6	Ö 326 214 D6	æ 346 230 E6	ö 366 246 F6
0 1 1 1	7	207 135 87	227 151 97	§ 247 167 A7	• 267 183 B7	Ç 307 199 C7	Œ 327 215 D7	ç 347 231 E7	œ 367 247 F7
1 0 0 0	8	HTS 210 136 88	230 152 98	¤ 250 168 A8	270 184 B8	È 310 200 C8	Ø 330 216 D8	è 350 232 E8	ø 370 248 F8
1 0 0 1	9	211 137 89	231 153 99	© 251 169 A9	! 271 185 B9	É 311 201 C9	Ù 331 217 D9	é 351 233 E9	ù 371 249 F9
1 0 1 0	10	VTS 212 138 8A	232 154 9A	ª 252 170 AA	º 272 186 BA	Ê 312 202 CA	Ú 332 218 DA	ê 352 234 EA	ú 372 250 FA
1 0 1 1	11	PLD 213 139 8B	CSI 233 155 9B	« 253 171 AB	» 273 187 BB	Ë 313 203 CB	Û 333 219 DB	ë 353 235 EB	û 373 251 FB
1 1 0 0	12	PLU 214 140 8C	ST 234 156 9C	254 172 AC	¼ 274 188 BC	Ì 314 204 CC	Ü 334 220 DC	ì 354 236 EC	ü 374 252 FC
1 1 0 1	13	RI 215 141 8D	235 157 9D	255 173 AD	½ 275 189 BD	Í 315 205 CD	Ÿ 335 221 DD	í 355 237 ED	ÿ 375 253 FD
1 1 1 0	14	SS2 216 142 8E	236 158 9E	256 174 AE	276 190 BE	Î 316 206 CE	336 222 DE	î 356 238 EE	376 254 FE
1 1 1 1	15	SS3 217 143 8F	237 159 9F	257 175 AF	¿ 277 191 BF	Ï 317 207 CF	ß 337 223 DF	ï 357 239 EF	(Not Used) 377 255 FF

ASCII Control Codes (columns 0–1) | U.S. ASCII CHARACTER SET (columns 2–7) | Additional Control Codes (columns 8–9) | DEC SUPPLEMENTAL CHARACTER SET (columns 10–15)

Digital Emulation Languages Substitution Table

LANGUAGE	Hex Address 0023	0040	005B	005C	005D	005E	005F	0060	007B	007C	007D	007E
ASCII	#	@	[	\	]	^	_	`	{	|	}	~
English	£	@	[	\	]	^	_	`	{	|	}	~
French	£	à	°	ç	§	^	_	`	é	ù	è	¨
German	#	§	Ä	Ö	Ü	^	_	`	ä	ö	ü	β
Italian	£	§	°	ç	é	^	_	ù	à	ò	è	ì
JIS Roman	#	@	[	¥	]	^	_	`	{	|	}	~
Spanish	£	§	¡	Ñ	¿	^	_	`	°	ñ	ç	~
Digital Dutch	£	3	ÿ	1/2	|	^	_	`	¨	f	1/4	´
Digital Finnish	#	@	Ä	Ö	Å	Ü	_	é	ä	Ö	å	ü
Digital French Canadian	#	à	â	ç	ê	î	_	ô	é	ù	è	û
Digital Norwegian/ Danish	#	Ä	Æ	Ø	Å	Ü	_	ä	æ	ø	å	ü
Digital Portuguese	#	@	Ã	Ç	Õ	^	_	`	ã	ç	õ	~
Digital Swiss	ù	à	é	ç	ê	î	è	ô	ä	ö	ü	û
Digital Swedish	#	É	Ä	Ö	Å	Ü	_	é	ä	ö	å	ü
ISO Norwegian/ Danish	#	@	Æ	Ø	Å	^	_	`	æ	ø	å	~

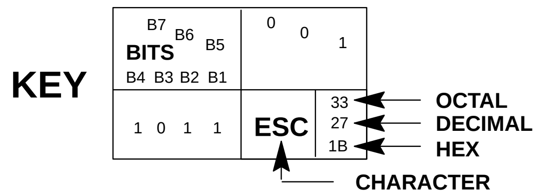
Digital Special Character Sets and ISO Charts

The following character charts comprise the multinational font sets. Included are:

The following character matrices show the character sets available for each language and special character set.

Digital Supplemental Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all fonts.



BITS B4 B3 B2 B1	ROW	B7 B6 B5 = 0 0 0, COLUMN 0 / 8		B7 B6 B5 = 0 0 1, GL 1 / GR 9		B7 B6 B5 = 0 1 0, GL 2 / GR 10		B7 B6 B5 = 0 1 1, GL 3 / GR 11		B7 B6 B5 = 1 0 0, GL 4 / GR 12		B7 B6 B5 = 1 0 1, GL 5 / GR 13		B7 B6 B5 = 1 1 0, GL 6 / GR 14		B7 B6 B5 = 1 1 1, GL 7 / GR 15	
0 0 0 0	0		0 0 0		20 16 10	SP	40 32 20	°	60 48 30	À	100 64 40	⸮	120 80 50	à	140 96 60	⸮	160 112 70
0 0 0 1	1		1 1 1	¡	21 17 11	±	41 33 21	Á	61 49 31	Ñ	101 65 41	á	121 81 51	ñ	141 97 61		161 113 71
0 0 1 0	2		2 2 2	¢	22 18 12	²	42 34 22	Â	62 50 32	Ò	102 66 42	â	122 82 52	ò	142 98 62		162 114 72
0 0 1 1	3		3 3 3	£	23 19 13	³	43 35 23	Ã	63 51 33	Ó	103 67 43	ã	123 83 53	ó	143 99 63		163 115 73
0 1 0 0	4		4 4 4	⸮	24 20 14	⸮	44 36 24	Ä	64 52 34	Ô	104 68 44	ä	124 84 54	ô	144 100 64		164 116 74
0 1 0 1	5		5 5 5	¥	25 21 15	µ	45 37 25	Å	65 53 35	Õ	105 69 45	å	125 85 55	õ	145 101 65		165 117 75
0 1 1 0	6		6 6 6	⸮	26 22 16	¶	46 38 26	Æ	66 54 36	Ö	106 70 46	æ	126 86 56	ö	146 102 66		166 118 76
0 1 1 1	7		7 7 7	§	27 23 17	·	47 39 27	Ç	67 55 37	Œ	107 71 47	ç	127 87 57	œ	147 103 67		167 119 77
1 0 0 0	8	//	10 8 8	¤	30 24 18	⸮	50 40 28	È	70 56 38	Ø	110 72 48	è	130 88 58	ø	150 104 68		170 120 78
1 0 0 1	9		11 9 9	©	31 25 19	¹	51 41 29	É	71 57 39	Ù	111 73 49	é	131 89 59	ù	151 105 69		171 121 79
1 0 1 0	10		12 10 0 A	ª	32 26 1A	º	52 42 2A	Ê	72 58 3A	Ú	112 74 4A	ê	132 90 5A	ú	152 106 6A		172 122 7A
1 0 1 1	11		13 11 0 B	«	33 27 1B	»	53 43 2B	Ë	73 59 3B	Û	113 75 4B	ë	133 91 5B	û	153 107 6B		173 123 7B
1 1 0 0	12		14 12 0 C	⸮	34 28 1C	1/4	54 44 2C	Ì	74 60 3C	Ü	114 76 4C	ì	134 92 5C	ü	154 108 6C		174 124 7C
1 1 0 1	13		15 13 0 D	⸮	35 29 1D	1/2	55 45 2D	Í	75 61 3D	Ÿ	115 77 4D	í	135 93 5D	ÿ	155 109 6D		175 125 7D
1 1 1 0	14		16 14 0 E	⸮	36 30 1E	⸮	56 46 2E	Î	76 62 3E	⸮	116 78 4E	î	136 94 5E	⸮	156 110 6E		176 126 7E
1 1 1 1	15		17 15 0 F	⸮	37 31 1F	¿	57 47 2F	Ï	77 63 3F	β	117 79 4F	ï	137 95 5F	DEL	157 111 6F		177 127 7F

Digital Technical Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all print modes.

KEY

B7 B6 B5 BITS B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 27 1B

33 → OCTAL
27 → DECIMAL
1B → HEX
ESC → CHARACTER

BITS B7 B6 B5 / B4 B3 B2 B1	ROW	0 0 0 COLUMN 0	8	0 0 1 GL 1	GR 9	0 1 0 GL 2	GR 10	0 1 1 GL 3	GR 11	1 0 0 GL 4	GR 12	1 0 1 GL 5	GR 13	1 1 0 GL 6	GR 14	1 1 1 GL 7	GR 15
0 0 0 0	0		200 128 80		220 144 90		240 160 A0	⎬	260 176 B0	∴	300 192 C0	╥	320 208 D0	¬	340 224 E0	π	360 240 F0
0 0 0 1	1		201 129 81		221 145 91	⎷	241 161 A1	⎲	261 177 B1	∝	301 193 C1	Ψ	321 209 D1	α	341 225 E1	ψ	361 241 F1
0 0 1 0	2		202 130 82		222 146 92	┌	242 162 A2	⎳	262 178 B2	∞	302 194 C2	·	322 210 D2	β	342 226 E2	ρ	362 242 F2
0 0 1 1	3		203 131 83		223 147 93	─	243 163 A3	╲	263 179 B3	÷	303 195 C3	Σ	323 211 D3	χ	343 227 E3	σ	363 243 F3
0 1 0 0	4		204 132 84		224 148 94	⌠	244 164 A4	╱	264 180 B4	Δ	304 196 C4		324 212 D4	δ	344 228 E4	τ	364 244 F4
0 1 0 1	5		205 133 85		225 149 95	⌡	245 165 A5	┐	265 181 B5	∇	305 197 C5		325 213 D5	∈	345 229 E5		365 245 F5
0 1 1 0	6		206 134 86		226 150 96	│	246 166 A6	┘	266 182 B6	Φ	306 198 C6	√	326 214 D6	φ	346 230 E6	ƒ	366 246 F6
0 1 1 1	7		207 135 87		227 151 97	⎡	247 167 A7	〉	267 183 B7	Γ	307 199 C7	Ω	327 215 D7	γ	347 231 E7	ω	367 247 F7
1 0 0 0	8		210 136 88		230 152 98	⎣	250 168 A8		270 184 B8	∼	310 200 C8	Ξ	330 216 D8	η	350 232 E8	ξ	370 248 F8
1 0 0 1	9		211 137 89		231 153 99	⎤	251 169 A9		271 185 B9	≃	311 201 C9	T	331 217 D9	ι	351 233 E9	υ	371 249 F9
1 0 1 0	10		212 138 8A		232 154 9A	⎦	252 170 AA		272 186 BA	Θ	312 202 CA	⊂	332 218 DA	Θ	352 234 EA	ζ	372 250 FA
1 0 1 1	11		213 139 8B		233 155 9B	⎛	253 171 AB		273 187 BB	χ	313 203 CB	⊃	333 219 DB	κ	353 235 EB	←	373 251 FB
1 1 0 0	12		214 140 8C		234 156 9C	⎝	254 172 AC	≤	274 188 BC	Λ	314 204 CC	∩	334 220 DC	λ	354 236 EC	↑	374 252 FC
1 1 0 1	13		215 141 8D		235 157 9D	⎞	255 173 AD	=	275 189 BD	⇔	315 205 CD	∪	335 221 DD		355 237 ED	→	375 253 FD
1 1 1 0	14		216 142 8E		236 158 9E	⎠	256 174 AE	≥	276 190 BE	⇒	316 206 CE	∧	336 222 DE	ν	356 238 EE	↓	376 254 FE
1 1 1 1	15	∓	217 143 8F		237 159 9F	⎨	257 175 AF	∫	277 191 BF	≡	317 207 CF	∨	337 223 DF	∂	357 239 EF		377 255 FF

Digital Special Graphics (VT100 Line Drawing) Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all fonts.

KEY

BITS B7 B6 B5 / B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC (CHARACTER)	33 (OCTAL) 27 (DECIMAL) 1B (HEX)

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
B4 B3 B2 B1	ROW	COLUMN 0	8	GL 1	GR 9	GL 2	GR 10	GL 3	GR 11	GL 4	GR 12	GL 5	GR 13	GL 6	GR 14	GL 7	GR 15
0 0 0 0	0	NUL	0 0 0		20 16 10	SP	40 32 20	0	60 48 30	@	100 64 40	P	120 80 50	◆	140 96 60	⎺ SCAN 3	160 112 70
0 0 0 1	1		1 1 1	DC1 (XON)	21 17 11	!	41 33 21	1	61 49 31	A	101 65 41	Q	121 81 51	■	141 97 61	⎻ SCAN 5	161 113 71
0 0 1 0	2		2 2 2		22 18 12	″	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	HT	142 98 62	─ SCAN 7	162 114 72
0 0 1 1	3		3 3 3	DC3 (XOFF)	23 19 13	#	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	FF	143 99 63	⎽ SCAN 9	163 115 73
0 1 0 0	4		4 4 4		24 20 14	$	44 36 24	4	64 52 34	D	104 68 44	T	124 84 54	CR	144 100 64	├	164 116 74
0 1 0 1	5		5 5 5		25 21 15	%	45 37 25	5	65 53 35	E	105 69 45	U	125 85 55	LF	145 101 65	┤	165 117 75
0 1 1 0	6		6 6 6		26 22 16	&	46 38 26	6	66 54 36	F	106 70 46	V	126 86 56	°	146 102 66	┴	166 118 76
0 1 1 1	7		7 7 7		27 23 17	´	47 39 27	7	67 55 37	G	107 71 47	W	127 87 57	±	147 103 67	┬	167 119 77
1 0 0 0	8	BS	10 8 8	CAN	30 24 18	(	50 40 28	8	70 56 38	H	110 72 48	X	130 88 58	NL	150 104 68	│	170 120 78
1 0 0 1	9	HT	11 9 9		31 25 19	)	51 41 29	9	71 57 39	I	111 73 49	Y	131 89 59	VT	151 105 69	≤	171 121 79
1 0 1 0	10	LF	12 10 0 A	SUB	32 26 1A	*	52 42 2A	:	72 58 3A	J	112 74 4A	Z	132 90 5A	┘	152 106 6A	≥	172 122 7A
1 0 1 1	11	VT	13 11 0 B	ESC	33 27 1B	+	53 43 2B	;	73 59 3B	K	113 75 4B	[	133 91 5B	┐	153 107 6B	π	173 123 7B
1 1 0 0	12	FF	14 12 0 C		34 28 1C	,	54 44 2C	<	74 60 3C	L	114 76 4C	\	134 92 5C	┌	154 108 6C	≠	174 124 7C
1 1 0 1	13	CR	15 13 0 D		35 29 1D	–	55 45 2D	=	75 61 3D	M	115 77 4D	]	135 93 5D	└	155 109 6D	£	175 125 7D
1 1 1 0	14	SO	16 14 0 E		36 30 1E	.	56 46 2E	>	76 62 3E	N	116 78 4E	^	136 94 5E	┼	156 110 6E	●	176 126 7E
1 1 1 1	15	SI	17 15 0 F		37 31 1F	/	57 47 2F	?	77 63 3F	O	117 79 4F	(BLANK)	137 95 5F	⎺ SCAN 1	157 111 6F	DEL	177 127 7F

ISO 8859–7 Cyrillic Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all print modes.

KEY

B7 B6 B5 BITS B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 27 1B

33 — OCTAL
27 — DECIMAL
1B — HEX
ESC — ASCII CHARACTER

B7 B6 B5 BITS		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
B4 B3 B2 B1	ROW	COLUMN 0	8	GL 1	GR 9	GL 2	GR 10	GL 3	GR 11	GL 4	GR 12	GL 5	GR 13	GL 6	GR 14	GL 7	GR 15
0 0 0 0	0		0 0 0		20 16 10	NBSP	40 32 20	А	60 48 30	Р	100 64 40	а	120 80 50	р	140 96 60	№	160 112 70
0 0 0 1	1		1 1 1		21 17 11	Ё	41 33 21	Б	61 49 31	С	101 65 41	б	121 81 51	с	141 97 61	ё	161 113 71
0 0 1 0	2		2 2 2		22 18 12	Ђ	42 34 22	В	62 50 32	Т	102 66 42	в	122 82 52	т	142 98 62	ђ	162 114 72
0 0 1 1	3		3 3 3		23 19 13	Ѓ	43 35 23	Г	63 51 33	У	103 67 43	г	123 83 53	у	143 99 63	ѓ	163 115 73
0 1 0 0	4		4 4 4		24 20 14	Є	44 36 24	Д	64 52 34	Ф	104 68 44	д	124 84 54	ф	144 100 64	є	164 116 74
0 1 0 1	5		5 5 5		25 21 15	Ѕ	45 37 25	Е	65 53 35	Х	105 69 45	е	125 85 55	х	145 101 65	ѕ	165 117 75
0 1 1 0	6		6 6 6		26 22 16	І	46 38 26	Ж	66 54 36	Ц	106 70 46	ж	126 86 56	ц	146 102 66	і	166 118 76
0 1 1 1	7		7 7 7		27 23 17	Ї	47 39 27	З	67 55 37	Ч	107 71 47	з	127 87 57	ч	147 103 67	ї	167 119 77
1 0 0 0	8		10 8 8		30 24 18	Ј	50 40 28	И	70 56 38	Ш	110 72 48	и	130 88 58	ш	150 104 68	ј	170 120 78
1 0 0 1	9		11 9 9		31 25 19	Љ	51 41 29	Й	71 57 39	Щ	111 73 49	й	131 89 59	щ	151 105 69	љ	171 121 79
1 0 1 0	10		12 10 0 A		32 26 1A	Њ	52 42 2A	К	72 58 3A	Ъ	112 74 4A	к	132 90 5A	ъ	152 106 6A	њ	172 122 7A
1 0 1 1	11		13 11 0 B		33 27 1B	Ћ	53 43 2B	Л	73 59 3B	Ы	113 75 4B	л	133 91 5B	ы	153 107 6B	ћ	173 123 7B
1 1 0 0	12		14 12 0 C		34 28 1C	Ќ	54 44 2C	М	74 60 3C	Ь	114 76 4C	м	134 92 5C	ь	154 108 6C	ќ	174 124 7C
1 1 0 1	13		15 13 0 D		35 29 1D	SHY	55 45 2D	Н	75 61 3D	Э	115 77 4D	н	135 93 5D	э	155 109 6D	§	175 125 7D
1 1 1 0	14		16 14 0 E		36 30 1E	Ў	56 46 2E	О	76 62 3E	Ю	116 78 4E	о	136 94 5E	ю	156 110 6E	ў	176 126 7E
1 1 1 1	15		17 15 0 F		37 31 1F	Џ	57 47 2F	П	77 63 3F	Я	117 79 4F	п	137 95 5F	я	157 111 6F	џ	177 127 7F

ISO 8859–7 Greek Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all print modes.

KEY

BITS B7 B6 B5 / B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 27 1B

33 — OCTAL
27 — DECIMAL
1B — HEX
ESC — CHARACTER

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
B4 B3 B2 B1	ROW	COLUMN 0	8	GL 1	GR 9	GL 2	GR 10	GL 3	GR 11	GL 4	GR 12	GL 5	GR 13	GL 6	GR 14	GL 7	GR 15
0 0 0 0	0		200 128 80		220 144 90	SP	240 160 A0	°	260 176 B0	ΐ	300 192 C0	Π	320 208 D0	ΰ	340 224 E0	π	360 240 F0
0 0 0 1	1		201 129 81		221 145 91	‘	241 161 A1	±	261 177 B1	Α	301 193 C1	Ρ	321 209 D1	α	341 225 E1	ρ	361 241 F1
0 0 1 0	2		202 130 82		222 146 92	’	242 162 A2	2	262 178 B2	Β	302 194 C2		322 210 D2	β	342 226 E2	ς	362 242 F2
0 0 1 1	3		203 131 83		223 147 93	£	243 163 A3	3	263 179 B3	Γ	303 195 C3	Σ	323 211 D3	γ	343 227 E3	σ	363 243 F3
0 1 0 0	4		204 132 84		224 148 94		244 164 A4	΄	264 180 B4	Δ	304 196 C4	Τ	324 212 D4	δ	344 228 E4	τ	364 244 F4
0 1 0 1	5		205 133 85		225 149 95		245 165 A5	΅	265 181 B5	Ε	305 197 C5	Υ	325 213 D5	ε	345 229 E5	υ	365 245 F5
0 1 1 0	6		206 134 86		226 150 96	¦	246 166 A6	Ά	266 182 B6	Ζ	306 198 C6	Φ	326 214 D6	ζ	346 230 E6	φ	366 246 F6
0 1 1 1	7		207 135 87		227 151 97	§	247 167 A7	·	267 183 B7	Η	307 199 C7	Χ	327 215 D7	η	347 231 E7	χ	367 247 F7
1 0 0 0	8		210 136 88		230 152 98	¨	250 168 A8	Έ	270 184 B8	Θ	310 200 C8	Ψ	330 216 D8	θ	350 232 E8	ψ	370 248 F8
1 0 0 1	9		211 137 89		231 153 99	©	251 169 A9	Ή	271 185 B9	Ι	311 201 C9	Ω	331 217 D9	ι	351 233 E9	ω	371 249 F9
1 0 1 0	10		212 138 8A		232 154 9A		252 170 AA	Ί	272 186 BA	Κ	312 202 CA	Ϊ	332 218 DA	κ	352 234 EA	ϊ	372 250 FA
1 0 1 1	11		213 139 8B		233 155 9B	<<	253 171 AB	>>	273 187 BB	Λ	313 203 CB	Ϋ	333 219 DB	λ	353 235 EB	ϋ	373 251 FB
1 1 0 0	12		214 140 8C		234 156 9C	¬	254 172 AC	Ό	274 188 BC	Μ	314 204 CC	ά	334 220 DC	μ	354 236 EC	ό	374 252 FC
1 1 0 1	13		215 141 8D		235 157 9D	SHY	255 173 AD	1/2	275 189 BD	Ν	315 205 CD	έ	335 221 DD	ν	355 237 ED	ύ	375 253 FD
1 1 1 0	14		216 142 8E		236 158 9E		256 174 AE	Ύ	276 190 BE	Ξ	316 206 CE	ή	336 222 DE	ξ	356 238 EE	ώ	376 254 FE
1 1 1 1	15		217 143 8F		237 159 9F	—	257 175 AF	Ώ	277 191 BF	Ο	317 207 CF	ί	337 223 DF	ο	357 239 EF		377 255 FF

ISO 8859–7 Hebrew Character Set

Note: The characters in this chart are for reference only; they are not examples of how the printer generates the characters. Not all characters are available in all print modes.

KEY

B7 B6 B5 BITS	0 0 1	
B4 B3 B2 B1		
1 0 1 1	ESC	33 27 1B

33 → OCTAL
27 → DECIMAL
1B → HEX
ESC → ASCII CHARACTER

B7 B6 B5 BITS		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
B4 B3 B2 B1	ROW	COLUMN 0	8	GL 1	GR 9	GL 2	GR 10	GL 3	GR 11	GL 4	GR 12	GL 5	GR 13	GL 6	GR 14	GL 7	GR 15
0 0 0 0	0		0 0 0		20 16 10		40 32 20	°	60 48 30	@	100 64 40	P	120 80 50	א	140 96 60	נ	160 112 70
0 0 0 1	1		1 1 1		21 17 11		41 33 21	±	61 49 31	A	101 65 41	Q	121 81 51	ב	141 97 61	ס	161 113 71
0 0 1 0	2		2 2 2		22 18 12	¢	42 34 22	2	62 50 32	B	102 66 42	R	122 82 52	ג	142 98 62	ע	162 114 72
0 0 1 1	3		3 3 3		23 19 13	£	43 35 23	3	63 51 33	C	103 67 43	S	123 83 53	ד	143 99 63	ף	163 115 73
0 1 0 0	4		4 4 4		24 20 14	¤	44 36 24	’	64 52 34	D	104 68 44	T	124 84 54	ה	144 100 64	פ	164 116 74
0 1 0 1	5		5 5 5		25 21 15	¥	45 37 25	µ	65 53 35	E	105 69 45	U	125 85 55	ו	145 101 65	ץ	165 117 75
0 1 1 0	6		6 6 6		26 22 16	¦	46 38 26	¶	66 54 36	F	106 70 46	V	126 86 56	ז	146 102 66	צ	166 118 76
0 1 1 1	7		7 7 7		27 23 17	§	47 39 27	■	67 55 37	G	107 71 47	W	127 87 57	ח	147 103 67	ק	167 119 77
1 0 0 0	8		10 8 8		30 24 18	”	50 40 28	,	70 56 38	H	110 72 48	X	130 88 58	ט	150 104 68	ר	170 120 78
1 0 0 1	9		11 9 9		31 25 19	©	51 41 29	1	71 57 39	I	111 73 49	Y	131 89 59	י	151 105 69	ש	171 121 79
1 0 1 0	10		12 10 0 A		32 26 1A	x	52 42 2A	÷	72 58 3A	J	112 74 4A	Z	132 90 5A	ך	152 106 6A	ת	172 122 7A
1 0 1 1	11		13 11 0 B		33 27 1B	<<	53 43 2B	>>	73 59 3B	K	113 75 4B	[	133 91 5B	כ	153 107 6B		173 123 7B
1 1 0 0	12		14 12 0 C		34 28 1C	¬	54 44 2C	1/4	74 60 3C	L	114 76 4C	\	134 92 5C	ל	154 108 6C		174 124 7C
1 1 0 1	13		15 13 0 D		35 29 1D		55 45 2D	1/2	75 61 3D	M	115 77 4D	]	135 93 5D	ם	155 109 6D		175 125 7D
1 1 1 0	14		16 14 0 E		36 30 1E	®	56 46 2E	3/4	76 62 3E	N	116 78 4E	^	136 94 5E	מ	156 110 6E		176 126 7E
1 1 1 1	15		17 15 0 F		37 31 1F	—	57 47 2F		77 63 3F	O	117 79 4F	=	137 95 5F	ן	157 111 6F		177 127 7F

ISO Latin 1 Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all fonts.

KEY

BITS B7 B6 B5 / B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 ← OCTAL 27 ← DECIMAL 1B ← HEX

↑ CHARACTER

BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
		COLUMN		GL	GR	GL	GR	GL	GR	GL	GR	GL	GR	GL	GR	GL	GR
B4 B3 B2 B1	ROW	**0**	**8**	**1**	**9**	**2**	**10**	**3**	**11**	**4**	**12**	**5**	**13**	**6**	**14**	**7**	**15**
0 0 0 0	0		0 0 0		20 16 10	NBSP	40 32 20	°	60 48 30	À	100 64 40	Đ	120 80 50	à	140 96 60	đ	160 112 70
0 0 0 1	1		1 1 1		21 17 11	¡	41 33 21	±	61 49 31	Á	101 65 41	Ñ	121 81 51	á	141 97 61	ñ	161 113 71
0 0 1 0	2		2 2 2		22 18 12	¢	42 34 22	²	62 50 32	Â	102 66 42	Ò	122 82 52	â	142 98 62	ò	162 114 72
0 0 1 1	3		3 3 3		23 19 13	£	43 35 23	³	63 51 33	Ã	103 67 43	Ó	123 83 53	ã	143 99 63	ó	163 115 73
0 1 0 0	4		4 4 4		24 20 14	¤	44 36 24	´	64 52 34	Ä	104 68 44	Ô	124 84 54	ä	144 100 64	ô	164 116 74
0 1 0 1	5		5 5 5		25 21 15	¥	45 37 25	µ	65 53 35	Å	105 69 45	Õ	125 85 55	å	145 101 65	õ	165 117 75
0 1 1 0	6		6 6 6		26 22 16	¦	46 38 26	¶	66 54 36	Æ	106 70 46	Ö	126 86 56	æ	146 102 66	ö	166 118 76
0 1 1 1	7		7 7 7		27 23 17	§	47 39 27	·	67 55 37	Ç	107 71 47	×	127 87 57	ç	147 103 67	÷	167 119 77
1 0 0 0	8		10 8 8		30 24 18	¨	50 40 28	¸	70 56 38	È	110 72 48	Ø	130 88 58	è	150 104 68	ø	170 120 78
1 0 0 1	9		11 9 9		31 25 19	©	51 41 29	¹	71 57 39	É	111 73 49	Ù	131 89 59	é	151 105 69	ù	171 121 79
1 0 1 0	10		12 10 0 A		32 26 1A	ª	52 42 2A	º	72 58 3A	Ê	112 74 4A	Ú	132 90 5A	ê	152 106 6A	ú	172 122 7A
1 0 1 1	11		13 11 0 B		33 27 1B	«	53 43 2B	»	73 59 3B	Ë	113 75 4B	Û	133 91 5B	ë	153 107 6B	û	173 123 7B
1 1 0 0	12		14 12 0 C		34 28 1C	¬	54 44 2C	1/4	74 60 3C	Ì	114 76 4C	Ü	134 92 5C	ì	154 108 6C	ü	174 124 7C
1 1 0 1	13		15 13 0 D		35 29 1D	SHY	55 45 2D	1/2	75 61 3D	Í	115 77 4D	Ý	135 93 5D	í	155 109 6D	ý	175 125 7D
1 1 1 0	14		16 14 0 E		36 30 1E	©	56 46 2E	3/4	76 62 3E	Î	116 78 4E	Þ	136 94 5E	î	156 110 6E	þ	176 126 7E
1 1 1 1	15		17 15 0 F		37 31 1F	—	57 47 2F	¿	77 63 3F	Ï	117 79 4F	β	137 95 5F	ï	157 111 6F	ÿ	177 127 7F

ISO Latin 2 Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all fonts.

KEY

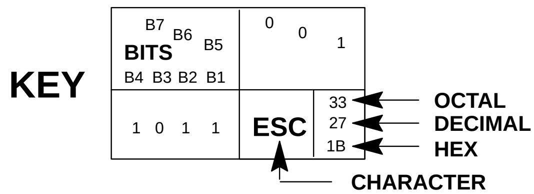
B7 B6 B5 BITS B4 B3 B2 B1	0 0 1	
1 0 1 1	ESC	33 27 1B

33 → OCTAL; 27 → DECIMAL; 1B → HEX; ESC → CHARACTER

BITS B7 B6 B5 / B4 B3 B2 B1	ROW	0 0 0 COLUMN 0	8	0 0 1 GL 1	GR 9	0 1 0 GL 2	GR 10	0 1 1 GL 3	GR 11	1 0 0 GL 4	GR 12	1 0 1 GL 5	GR 13	1 1 0 GL 6	GR 14	1 1 1 GL 7	GR 15
0 0 0 0	0		200 128 80		220 144 90	NBSP	240 160 A0	°	260 176 B0	Ŕ	300 192 C0	Đ	320 208 D0	ŕ	340 224 E0	đ	360 240 F0
0 0 0 1	1		201 129 81		221 145 91	Ą	241 161 A1	ą	261 177 B1	Á	301 193 C1	Ń	321 209 D1	á	341 225 E1	ń	361 241 F1
0 0 1 0	2		202 130 82		222 146 92	˘	242 162 A2	˛	262 178 B2	Â	302 194 C2	Ň	322 210 D2	â	342 226 E2	ň	362 242 F2
0 0 1 1	3		203 131 83		223 147 93	Ł	243 163 A3	ł	263 179 B3	Ă	303 195 C3	Ó	323 211 D3	ă	343 227 E3	ó	363 243 F3
0 1 0 0	4		204 132 84		224 148 94	¤	244 164 A4	´	264 180 B4	Ä	304 196 C4	Ô	324 212 D4	ä	344 228 E4	ô	364 244 F4
0 1 0 1	5		205 133 85		225 149 95	Ľ	245 165 A5	ľ	265 181 B5	Ĺ	305 197 C5	Ő	325 213 D5	ĺ	345 229 E5	ő	365 245 F5
0 1 1 0	6		206 134 86		226 150 96	Ś	246 166 A6	ś	266 182 B6	Ć	306 198 C6	Ö	326 214 D6	ć	346 230 E6	ö	366 246 F6
0 1 1 1	7		207 135 87		227 151 97	§	247 167 A7	ˇ	267 183 B7	Ç	307 199 C7	×	327 215 D7	ç	347 231 E7	÷	367 247 F7
1 0 0 0	8		210 136 88		230 152 98	¨	250 168 A8	¸	270 184 B8	Č	310 200 C8	Ř	330 216 D8	č	350 232 E8	ř	370 248 F8
1 0 0 1	9		211 137 89		231 153 99	Š	251 169 A9	š	271 185 B9	É	311 201 C9	Ů	331 217 D9	é	351 233 E9	ů	371 249 F9
1 0 1 0	10		212 138 8A		232 154 9A	Ş	252 170 AA	ş	272 186 BA	Ę	312 202 CA	Ú	332 218 DA	ę	352 234 EA	ú	372 250 FA
1 0 1 1	11	¨	213 139 8B		233 155 9B	Ť	253 171 AB	ť	273 187 BB	Ë	313 203 CB	Ű	333 219 DB	ë	353 235 EB	ű	373 251 FB
1 1 0 0	12		214 140 8C		234 156 9C	Ź	254 172 AC	ź	274 188 BC	Ě	314 204 CC	Ü	334 220 DC	ě	354 236 EC	ü	374 252 FC
1 1 0 1	13		215 141 8D		235 157 9D	SHY	255 173 AD	˝	275 189 BD	Í	315 205 CD	Ý	335 221 DD	í	355 237 ED	ý	375 253 FD
1 1 1 0	14		216 142 8E		236 158 9E	Ž	256 174 AE	ž	276 190 BE	Î	316 206 CE	Ţ	336 222 DE	î	356 238 EE	ţ	376 254 FE
1 1 1 1	15		217 143 8F		237 159 9F	Ż	257 175 AF	ż	277 191 BF	Ď	317 207 CF	ß	337 223 DF	ď	357 239 EF	˙	377 255 FF

ISO Latin 5 Character Set

Note: The character examples provided herein are representative and not exact replications generated by the printer. All characters are shown in 10 cpi; not all characters are available in all fonts.



BITS B7 B6 B5		0 0 0		0 0 1		0 1 0		0 1 1		1 0 0		1 0 1		1 1 0		1 1 1	
B4 B3 B2 B1	ROW	COLUMN 0	8	GL 1	GR 9	GL 2	GR 10	GL 3	GR 11	GL 4	GR 12	GL 5	GR 13	GL 6	GR 14	GL 7	GR 15
0 0 0 0	0		0 0 0		20 16 10	NBSP	40 32 20	°	60 48 30	À	100 64 40	Ğ	120 80 50	à	140 96 60	ğ	160 112 70
0 0 0 1	1		1 1 1		21 17 11	¡	41 33 21	±	61 49 31	Á	101 65 41	Ñ	121 81 51	á	141 97 61	ñ	161 113 71
0 0 1 0	2		2 2 2		22 18 12	¢	42 34 22	2	62 50 32	Â	102 66 42	Ò	122 82 52	â	142 98 62	ò	162 114 72
0 0 1 1	3		3 3 3		23 19 13	£	43 35 23	3	63 51 33	Ã	103 67 43	Ó	123 83 53	ã	143 99 63	ó	163 115 73
0 1 0 0	4		4 4 4		24 20 14	¤	44 36 24	´	64 52 34	Ä	104 68 44	Ô	124 84 54	ä	144 100 64	ô	164 116 74
0 1 0 1	5		5 5 5		25 21 15	¥	45 37 25	µ	65 53 35	Å	105 69 45	Õ	125 85 55	å	145 101 65	õ	165 117 75
0 1 1 0	6		6 6 6		26 22 16	¦	46 38 26	¶	66 54 36	Æ	106 70 46	Ö	126 86 56	æ	146 102 66	ö	166 118 76
0 1 1 1	7		7 7 7		27 23 17	§	47 39 27	·	67 55 37	Ç	107 71 47	×	127 87 57	ç	147 103 67	÷	167 119 77
1 0 0 0	8		10 8 8		30 24 18	¨	50 40 28	¸	70 56 38	È	110 72 48	Ø	130 88 58	è	150 104 68	ø	170 120 78
1 0 0 1	9		11 9 9		31 25 19	©	51 41 29	1	71 57 39	É	111 73 49	Ù	131 89 59	é	151 105 69	ù	171 121 79
1 0 1 0	10		12 10 0 A		32 26 1A	ª	52 42 2A	º	72 58 3A	Ê	112 74 4A	Ú	132 90 5A	ê	152 106 6A	ú	172 122 7A
1 0 1 1	11		13 11 0 B		33 27 1B	«	53 43 2B	»	73 59 3B	Ë	113 75 4B	Û	133 91 5B	ë	153 107 6B	û	173 123 7B
1 1 0 0	12		14 12 0 C		34 28 1C	¬	54 44 2C	1/4	74 60 3C	Ì	114 76 4C	Ü	134 92 5C	ì	154 108 6C	ü	174 124 7C
1 1 0 1	13		15 13 0 D		35 29 1D	SHY	55 45 2D	1/2	75 61 3D	Í	115 77 4D	İ	135 93 5D	í	155 109 6D	ı	175 125 7D
1 1 1 0	14		16 14 0 E		36 30 1E	®	56 46 2E	3/4	76 62 3E	Î	116 78 4E	Ş	136 94 5E	î	156 110 6E	ş	176 126 7E
1 1 1 1	15		17 15 0 F		37 31 1F	—	57 47 2F	¿	77 63 3F	Ï	117 79 4F	ß	137 95 5F	ï	157 111 6F	ÿ	177 127 7F

D Interface Configuration with the VMS Operating System

Parallel Interface

When using the parallel interface with the VMS operating system, configure the printer with the SET PRINTER command, as shown below:

Printer LCA0:, device type unknown, is on–line, allocated record–oriented device, carriage control, device is spooled through an intermediate device, error logging is enabled.

Error count	0
Owner process	“SYMBIONT_0001”
Owner process ID	00000087
Reference Count	2
Page width	132
Carriage return	Formfeed
No passall	No Wrap
No Fallback	Tab
Intermediate device:	DUA1
Associated queue:	LCA0
Operations completed	1
Owner UIC	[0, 0]
Dev Prot	S:RWLP, 0:RWLP, W:RWLP
Default buffer size	132
Page length	66
Lowercase	
Printall	
No Truncate	

Serial Interface

When using the serial interface with the VMS operating system, configure the terminal characteristics with the SET TERM command, as shown below:

Terminal: _TXA3:	Device_Type: Unknown	Owner: SYMBIONT_0001
		Username: SYSTEM

Input: 9600*	LFfill: 0	Width: 132	Parity: None
Output: 9600*	CRfill: 0	Page: 66	

Terminal Characteristics:

Interactive	Echo	Type_ahead	No Escape
No Hostsync	TTsync	Lowercase	Tab
No Wrap	Scope	No Remote	No Eightbit
No Broadcast	No Readsync	Form	Fulldup
No Modem	No Local_echo	No Autobaud	No Hangup
No Brdcstambx	No DMA	No Altypeahd	Set_speed
Line Editing	Overstrike editing	No Fallback	No Dialup
No Secure server	No Disconnect	No Pasthru	No Syspassword
No SIXEL Graphics	No Soft Characters	No Printer Port	Numeric Keypad
No ANSI_CRT	No Regis	No Block mode	No Advanced_video
No Edit_mode	No DEC_CRT	No DEC_CRT	

Device spooled to _DUAL:

* Match baud rate to printer settings.

E Type Family IDs, Font IDs, and Font File IDs

Contents

“Built–In” Font File IDs

This appendix explains the values used in the font file identification strings (IDs) for the font files stored in printer ROM. It also lists all the font file IDs available in Digital emulation mode.

The Font File ID Field Definitions table on page E–3 lists and defines all the values in a font file ID. The values are based on 36 possible values (0–9, A–Z).

The table shows the relationship between type family IDs, font IDs, and font file IDs.

Notice, for example, that the 31–character **font file ID** also contains the type family ID and font ID. The **type family ID** is field 1 (the first 7 characters) of the 31–character font file ID. The **font ID** consists of fields 1 through 7 (the first 16 characters) of the 31–character font file ID.

Font File ID Field Definitions

	Field	Bytes	Field Name	Value	Meaning
Font ID	1	1 to 7	**Type family ID**	R	Registered internationally or in the public domain
				D	DIGITAL reserved
	2	8	Spacing	E	5 pitch
				I	6 pitch
				G	7 pitch
				W	8.33 pitch
				J	10 pitch
				2	10.3 pitch
				L	12 pitch
				4	13.3 pitch
				1	13.6 pitch
				O	15 pitch
				5	16.7 pitch
	3	9 to 11	Type Size	02S	10 point
				03C	12 point
				050	18 point
	4	12	Scale Factor	K	No scaling (1:1)
	5	13 to 14	Style	00	Normal
				01	Italic
	6	15	Weight	G	Regular
	7	16	Proportion	G	Regular
	8	17 to 18	Rotation	00	No rotation
	9	19 to 21	Character Set	01C	VT100
				01O	DEC supplemental
				01Q	DEC technical
				01U	ASCII
				GDE	ISO Latin 2
				GDI	ISO Greek
				GDK	ISO Hebrew
				GDO	ISO Cyrillic
				GDP	ISO Latin 5
	10	22 to 25	Character	ZZZZ	Full character set subset
	11	26 to 27	File encoding	02	Binary (See NOTE below.)
				B	100 dots per inch
	12	28	Resolution	D	200 dots per inch
				Z	Other
	13	29	Reserved	0	Reserved
	14	30	Reserved	0	Reserved
	15	31	Reserved	0	Reserved

NOTE: This field is used only for the file name and not to distinguish between a sixel file and a binary file.

Type Family IDs

The type families available in Digital emulation mode have the following names and identification strings:

Type Family Name	Identification String (ID)
Compressed Print	DCMPRSS
Correspondence Plot	DCRRSPL
Correspondence Print	DCRRSPN
Data Processing	DBULTN1
Draft Plot	DDRAFT0
High Speed Draft Print	DDRAFT1
LG Near Letter Quality	DLGNRLQ
Low Density Plot	DLODENS
OCR A	ROCRA00
OCR B	ROCRB00

The D in the ID string for DCRRSPN means the name Correspondence Print is registered with DIGITAL, but is not registered internationally. The R in the ID strings for OCR A and OCR B means these names are registered internationally or are in the public domain.

Font File IDs

This section lists all type family names, type family IDs, font IDs, and font file IDs available in Digital emulation mode.

The 31–character **font file ID** also contains the type family ID and font ID. The **type family ID** is the first 7 characters of the font file ID. The **font ID** is the first 16 characters of the 31–character font file ID.

Pitch	Type Size	Character Set	Font File ID (entire string) Font ID (First 16 characters)

1. Type Family Name: **DEC Built–in 1 (Data Processing)** Type Family ID: DBULTN1

Pitch	Type Size	Character Set	Font File ID
5	12	ASCII	DBULTN1 E 03C K 00 G G 00 01U ZZZZ 02 Z 0 0 0
5	12	DEC supp.	DBULTN1 E 03C K 00 G G 00 01O ZZZZ 02 Z 0 0 0
5	12	DEC tech.	DBULTN1 E 03C K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
5	12	ISO Latin 2	DBULTN1 E 03C K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
5	12	ISO Cyrillic	DBULTN1 E 03C K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
5	12	ISO Greek	DBULTN1 E 03C K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
5	12	ISO Hebrew	DBULTN1 E 03C K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
5	12	ISO Latin 5	DBULTN1 E 03C K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
6	12	ASCII	DBULTN1 I 03C K 00 G G 00 01U ZZZZ 02 Z 0 0 0
6	12	DEC supp.	DBULTN1 I 03C K 00 G G 00 01O ZZZZ 02 Z 0 0 0
6	12	DEC tech.	DBULTN1 I 03C K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
6	12	ISO Latin 2	DBULTN1 I 03C K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
6	12	ISO Cyrillic	DBULTN1 I 03C K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
6	12	ISO Greek	DBULTN1 I 03C K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
6	12	ISO Hebrew	DBULTN1 I 03C K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
6	12	ISO Latin 5	DBULTN1 I 03C K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
10	12	ASCII	DBULTN1 J 03C K 00 G G 00 01U ZZZZ 02 Z 0 0 0
10	12	DEC supp.	DBULTN1 J 03C K 00 G G 00 01O ZZZZ 02 Z 0 0 0
10	12	DEC tech.	DBULTN1 J 03C K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
10	12	ISO Latin 2	DBULTN1 J 03C K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
10	12	ISO Cyrillic	DBULTN1 J 03C K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
10	12	ISO Greek	DBULTN1 J 03C K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
10	12	ISO Hebrew	DBULTN1 J 03C K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
10	12	ISO Latin 5	DBULTN1 J 03C K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
10	12	VT100	DBULTN1 J 03C K 00 G G 00 01C ZZZZ 02 Z 0 0 0
12	12	ASCII	DBULTN1 L 03C K 00 G G 00 01U ZZZZ 02 Z 0 0 0
12	12	DEC supp.	DBULTN1 L 03C K 00 G G 00 01O ZZZZ 02 Z 0 0 0
12	12	DEC tech.	DBULTN1 L 03C K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
12	12	ISO Latin 2	DBULTN1 L 03C K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
12	12	ISO Cyrillic	DBULTN1 L 03C K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
12	12	ISO Greek	DBULTN1 L 03C K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
12	12	ISO Hebrew	DBULTN1 L 03C K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
12	12	ISO Latin 5	DBULTN1 L 03C K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
15	10	ASCII	DBULTN1 O 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
15	10	DEC supp.	DBULTN1 O 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
15	10	DEC tech.	DBULTN1 O 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
15	10	ISO Latin 2	DBULTN1 O 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
15	10	ISO Cyrillic	DBULTN1 O 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
15	10	ISO Greek	DBULTN1 O 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
15	10	ISO Hebrew	DBULTN1 O 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
15	10	ISO Latin 5	DBULTN1 O 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0

NOTE: The font file IDs are spaced for clarity. The spaces are not part of the actual ID strings.

Pitch	Type Size	Character Set	Font File ID (entire string) Font ID (First 16 characters)

2. Type Family Name: **Correspondence Print** Type Family ID: DCRRSPN

5	10	ASCII	DCRRSPN E 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
5	10	DEC supp.	DCRRSPN E 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
5	10	DEC tech.	DCRRSPN E 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
5	10	ISO Latin 2	DCRRSPN E 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
5	10	ISO Cyrillic	DCRRSPN E 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
5	10	ISO Greek	DCRRSPN E 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
5	10	ISO Hebrew	DCRRSPN E 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
5	10	ISO Latin 5	DCRRSPN E 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
6	10	ASCII	DCRRSPN I 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
6	10	DEC supp.	DCRRSPN I 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
6	10	DEC tech.	DCRRSPN I 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
6	10	ISO Latin 2	DCRRSPN I 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
6	10	ISO Cyrillic	DCRRSPN I 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
6	10	ISO Greek	DCRRSPN I 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
6	10	ISO Hebrew	DCRRSPN I 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
6	10	ISO Latin 5	DCRRSPN I 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
10	10	ASCII	DCRRSPN J 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
10	10	DEC supp.	DCRRSPN J 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
10	10	DEC tech.	DCRRSPN J 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
10	10	ISO Latin 2	DCRRSPN J 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
10	10	ISO Cyrillic	DCRRSPN J 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
10	10	ISO Greek	DCRRSPN J 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
10	10	ISO Hebrew	DCRRSPN J 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
10	10	ISO Latin 5	DCRRSPN J 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
12	10	ASCII	DCRRSPN L 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
12	10	DEC supp.	DCRRSPN L 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
12	10	DEC tech.	DCRRSPN L 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
12	10	ISO Latin 2	DCRRSPN L 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
12	10	ISO Cyrillic	DCRRSPN L 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
12	10	ISO Greek	DCRRSPN L 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
12	10	ISO Hebrew	DCRRSPN L 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
12	10	ISO Latin 5	DCRRSPN L 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
15	10	ASCII	DCRRSPN O 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
15	10	DEC supp.	DCRRSPN O 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
15	10	DEC tech.	DCRRSPN O 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
15	10	ISO Latin 2	DCRRSPN O 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
15	10	ISO Cyrillic	DCRRSPN O 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
15	10	ISO Greek	DCRRSPN O 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
15	10	ISO Hebrew	DCRRSPN O 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
15	10	ISO Latin 5	DCRRSPN O 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0

NOTE: The font file IDs are spaced for clarity. The spaces are not part of the actual ID strings.

Pitch	Type Size	Character Set	Font File ID (entire string) Font ID (First 16 characters)

3. Type Family Name: **OCR A** Type Family ID: ROCRA00

10	10	ASCII	ROCRA00 J 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0

4. Type Family Name: **OCR B** Type Family ID: ROCRB00

10	10	ASCII	ROCRB00 J 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0

5. Type Family Name: **Compressed Print** Type Family ID: DCMPRSS

6.67	10	ASCII	DCMPRSS I 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
6.67	10	DEC supp.	DCMPRSS I 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
6.67	10	DEC tech.	DCMPRSS I 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
6.67	10	ISO Latin 2	DCMPRSS I 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
6.67	10	ISO Cyrillic	DCMPRSS I 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
6.67	10	ISO Greek	DCMPRSS I 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
6.67	10	ISO Hebrew	DCMPRSS I 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
6.67	10	ISO Latin 5	DCMPRSS I 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
8.33	10	ASCII	DCMPRSS W 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
8.33	10	DEC supp.	DCMPRSS W 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
8.33	10	DEC tech.	DCMPRSS W 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
8.33	10	ISO Latin 2	DCMPRSS W 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
8.33	10	ISO Cyrillic	DCMPRSS W 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
8.33	10	ISO Greek	DCMPRSS W 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
8.33	10	ISO Hebrew	DCMPRSS W 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
8.33	10	ISO Latin 5	DCMPRSS W 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
13.3	10	ASCII	DCMPRSS 4 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
13.3	10	DEC supp.	DCMPRSS 4 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
13.3	10	DEC tech.	DCMPRSS 4 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
13.3	10	ISO Latin 2	DCMPRSS 4 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
13.3	10	ISO Cyrillic	DCMPRSS 4 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
13.3	10	ISO Greek	DCMPRSS 4 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
13.3	10	ISO Hebrew	DCMPRSS 4 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
13.3	10	ISO Latin 5	DCMPRSS 4 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0
16.7	10	ASCII	DCMPRSS 5 02S K 00 G G 00 01U ZZZZ 02 Z 0 0 0
16.7	10	DEC supp.	DCMPRSS 5 02S K 00 G G 00 01O ZZZZ 02 Z 0 0 0
16.7	10	DEC tech.	DCMPRSS 5 02S K 00 G G 00 01Q ZZZZ 02 Z 0 0 0
16.7	10	ISO Latin 2	DCMPRSS 5 02S K 00 G G 00 GDE ZZZZ 02 Z 0 0 0
16.7	10	ISO Cyrillic	DCMPRSS 5 02S K 00 G G 00 GDO ZZZZ 02 Z 0 0 0
16.7	10	ISO Greek	DCMPRSS 5 02S K 00 G G 00 GDI ZZZZ 02 Z 0 0 0
16.7	10	ISO Hebrew	DCMPRSS 5 02S K 00 G G 00 GDK ZZZZ 02 Z 0 0 0
16.7	10	ISO Latin 5	DCMPRSS 5 02S K 00 G G 00 GDP ZZZZ 02 Z 0 0 0

6. Type Family Name: **High Speed Draft Print** Type Family ID: DDRAFT1

10	12	ASCII	DDRAFT1 J 03C K 00 G G 00 01U ZZZZ 02 Z 0 0 0

NOTE: The font file IDs are spaced for clarity. The spaces are not part of the actual ID strings.

Pitch	Type Size	Character Set	Font File ID (entire string) Font ID (First 16 characters)

7. Type Family Name: **LG Near Letter Quality** Type Family ID: DLGNRLQ

7	18	ASCII	DLGNRLQ G 050 K 00 G G 00 01U ZZZZ 02 D 0 0 0
7	18	DEC supp.	DLGNRLQ G 050 K 00 G G 00 01O ZZZZ 02 D 0 0 0
7	18	VT100	DLGNRLQ G 050 K 00 G G 00 01C ZZZZ 02 D 0 0 0
7	18	ISO Latin 1	DLGNRLQ G 050 K 00 G G 00 6DD ZZZZ 02 D 0 0 0
10	12	ASCII	DLGNRLQ J 03C K 00 G G 00 01U ZZZZ 02 D 0 0 0
10	12	DEC supp.	DLGNRLQ J 03C K 00 G G 00 01O ZZZZ 02 D 0 0 0
10	12	DEC tech.	DLGNRLQ J 03C K 00 G G 00 01Q ZZZZ 02 D 0 0 0
10	12	VT100	DLGNRLQ J 03C K 00 G G 00 01C ZZZZ 02 D 0 0 0
10	12	ISO Latin 1	DLGNRLQ J 03C K 00 G G 00 6DD ZZZZ 02 D 0 0 0
10	12	VT100 italic	DLGNRLQ J 03C K 01 G G 00 01C ZZZZ 02 D 0 0 0
10	12	ASCII italic	DLGNRLQ J 03C K 01 G G 00 01U ZZZZ 02 D 0 0 0
10	12	DEC supp. ital.	DLGNRLQ J 03C K 01 G G 00 01O ZZZZ 02 D 0 0 0
10	12	ISO Latin 1 ital.	DLGNRLQ J 03C K 01 G G 00 6DD ZZZZ 02 D 0 0 0
14.1	5	VT100	DLGNRLQ N 01N K 00 G G 00 01C ZZZZ 02 D 0 0 0
14.1	5	DEC supp.	DLGNRLQ N 01N K 00 G G 00 01O ZZZZ 02 D 0 0 0
14.1	5	ASCII	DLGNRLQ N 01N K 00 G G 00 01U ZZZZ 02 D 0 0 0
14.1	5	ISO Latin 1	DLGNRLQ N 01N K 00 G G 00 6DD ZZZZ 02 D 0 0 0

8. Type Family Name: **Draft Plot** Type Family ID: DDRAFT0

10	12	ASCII	DDRAFT0 J 03C K 00 G G 00 01U ZZZZ 02 B 0 0 0
10	12	DEC supp.	DDRAFT0 J 03C K 00 G G 00 01O ZZZZ 02 B 0 0 0
10	12	DEC tech.	DDRAFT0 J 03C K 00 G G 00 01Q ZZZZ 02 B 0 0 0
10	12	VT100	DDRAFT0 J 03C K 00 G G 00 01C ZZZZ 02 B 0 0 0
10	12	ISO Latin 1	DDRAFT0 J 03C K 00 G G 00 6DD ZZZZ 02 B 0 0 0

9. Type Family Name: **Low Density Plot** Type Family ID: DLODENS

10	10	ASCII	DLODENS J 03C K 00 G G 00 01U ZZZZ 02 Z 0 0 0

10. Type Family Name: **Correspondence Plot** Type Family ID: DCRRSPL

10	10	ASCII	DCRRSPL J 02S K 00 G G 00 01U ZZZZ 02 D 0 0 0
10	10	DEC supp.	DCRRSPL J 02S K 00 G G 00 01O ZZZZ 02 D 0 0 0
10	10	VT100	DCRRSPL J 02S K 00 G G 00 01C ZZZZ 02 D 0 0 0
10	10	ISO Latin 1	DCRRSPL J 02S K 00 G G 00 6DD ZZZZ 02 D 0 0 0
10	10	VT100 italic	DCRRSPL J 02S K 01 G G 00 01C ZZZZ 02 D 0 0 0
10	10	DEC supp. ital.	DCRRSPL J 02S K 01 G G 00 010 ZZZZ 02 D 0 0 0
10	10	ASCII italic	DCRRSPL J 02S K 01 G G 00 01U ZZZZ 02 D 0 0 0
10	10	ISO Latin 1 ital.	DCRRSPL J 02S K 01 G G 00 6DD ZZZZ 02 D 0 0 0

NOTE: The font file IDs are spaced for clarity. The spaces are not part of the actual ID strings.

F Print Samples

Contents

Introduction

This appendix contains sample programs that illustrate how to use Digital control sequences and bar code control sequences in applications.

Digital control sequences are described in Chapter 7, “Digital Emulation.” Bar code control sequences are described in Appendix A.

NOTE: The print samples in this appendix were printed on an LG06 printer.

Creating Block Characters

The block character examples use the following escape sequences:

```
ESC[P1;P2’r Set Block Character Parameters (DECBCS)
ESC%SP1 Start Block Character Mode (DECBLOCKC)
ESC%@   Stop Block Character Mode
```

The following command sequences create the block characters shown in Figure F–1:

Black Characters, White Background

```
CSI3;3;0;0;0’r
ESC% 1BLOCK CHARACTERSESC%@
```

White Characters, Black Background

```
CSI4;2;1;0;0’r
ESC% 1BLACK BACKGROUNDESC%@
```

Landscape Character Orientation

```
CSI2;4;0;0;2’r
ESC% 1LANDSCAPEESC%@
```

BLOCK CHARACTERS

BLACK BACKGROUND

LANDSCAPE

Figure F–1. Block Characters

Bar Codes

Bar code escape sequences determine the type of bar code, its attributes, and start and stop bar code printing. Bar code escape sequences are defined in Appendix A.

The bar code examples in this section use the following escape sequences:

CSIP1;P2; ... P9’q Select Bar Code Attributes (DECSBCA)
ESC%**SP**0 Start Bar Coding (DECBARC)
ESC%@   Stop Bar Coding

Interleaved 2 of 5

The following command sequences create the bar code shown in Figure F–2. The bar code is oriented portrait and coded to include human–readable characters in the OCR–A font.

CSI1;;;;;;;;3’q
ESC% 00123456789**ESC**%@

0123456789

Figure F–2. Interleaved 2 of 5 Bar Code

Code 39

The following command sequences create the bar code shown in Figure F–3. This bar code is rotated –90 degrees for landscape orientation and is coded to include human–readable characters in the currently active font.

CSI2;;;;;;;2;2’q
ESC% 00123456789ABC**ESC**%@

0123456ABC

Figure F–3. Code 39 Bar Code

Logos

The following command sequences create the logo graphic shown in Figure F–4:

```
DCS0;1&t400016Square00086
250;1;1500\
333;1;250;1000;250\
333;1;250;333;333;333;250\
333;1;250;1000;250\
250;1;1500\
ST
CSI1&}
```

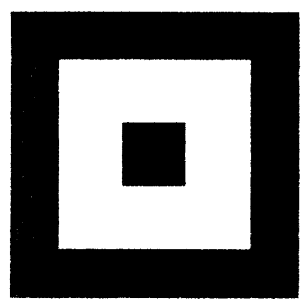


Figure F–4. Box Logo

Sixel Graphics

The command sequences listed below create the sixel graphics output shown in Figure F–5:

```
ESCP;;6q
!200~!200?!200~-
!200~!200?!200~-
!200~!200?!200~-
!200?!200~!200?-
!200?!200~!200?-
!200?!200~!200?-
!200~!200?!200~-
!200~!90?~!18`~!90?!200~-
!200~!200?!200~-
!200?!200~!200?-
!200?!200~!200?-
!200?!200~!200?-
!200~!200?!200~-
!200~!200?!200~-
!200~!200?!200~-
ST
```

Figure F–5. Sixel Graphic

Forms

The memo form shown in Figure F–6 was created with the program illustrated below.

```
ESCcDCS0;3&p04Memo%@00234
%1B[2g%1B[11l%1B[5;127s%1B[2;66r%1B[45u
****************%0D%0A
* d i g i t a l *%09INTEROFFICE MEMO%0D%0A
****************%0D%0A%0A
TO: @%09DATE: @
%09FROM: @
%09DEPT: @
%09EXT:  @
%09LOC/MAIL STOP: @
%09ENG. NET.: @%1B[2e
SUBJECT: @%0D%1B[2e
@ST

DCS0;64&rMemoSTTest and Verification@20 January 1992
@Susan Smith
@Engineering
@555-1212
@ENG/HDO
@NODE::SMITHDCS0&qMemoST
@LG06 PERFORMANCE ANALYSIS
@Please do a performance analysis on the following functions.
ESC# 1
```

```
*****************
* d i g i t a l *                        INTEROFFICE MEMO
*****************

TO: Test and Verification                DATE: 20 January 1992
                                         FROM: Susan Smith
                                         DEPT: Engineering
                                         EXT:  555-1212
                                         LOC/MAIL STOP: ENG/HDO
                                         ENG. NET.: NODE::SMITH

SUBJECT: LG06 PERFORMANCE ANALYSIS

Please do a performance analysis on the following functions.
```

Figure F–6. Memo Form

The payroll deduction form shown in Figure F–7 (see page F–12) was created with the program illustrated below.

```
CSI300;5000sCSI300;6300r

DCS0;3&p07Payroll^~01367
^1B[11h^1B[7 I

^1B[0;200;1100;4600;5!¦
^1B[1;4800;1100;5000;5!¦
^1B[0;200;6100;4605;5!¦
^1B[1;200;1100;5000;5!¦

^1B[300`^1B[1300d^1B[3&}
^1B[2;2;0;0;0'r
^1B[300`^1B[1500d^09^09^09^1B[2;2;0;0;0'r^1B%   1PAYROLL
DEDUCTIONS^1B%@
^1B[0;300;1900;4400;10!¦
^1B[0;300;2600;4400;10!¦
^1B[1600`^1B[2000d^1B[2;1;0;0;0'r^1B% 1INSTRUCTIONS^1B%@
^1B[300`^1B[2300d1. Complete the Appropriate section(s) below.
^1B[300`^1B[2400d2. Be sure to sign, date and write your employee
number
^1B[300`^1B[2500d   in each section you complete.
^1B[600`^1B[2700d^1B% 1EMPLOYEE'S WITHHOLDING EXEMPTION^1B%@

^1B[0;300;2900;2000;10!¦
^1B[0;300;4300;2000;10!¦
^1B[1;300;2900;1400;10!¦
^1B[1;2300;2900;1400;10!¦
^1B[0;300;3100;2000;10!¦

^1B[0;420;3300;200;10!¦
^1B[0;420;3500;200;10!¦
^1B[1;420;3300;200;10!¦
^1B[1;620;3300;200;10!¦

^1B[0;420;3600;200;10!¦
^1B[0;420;3800;200;10!¦
^1B[1;420;3600;200;10!¦
^1B[1;620;3600;200;10!¦

^1B[0;420;3900;200;10!¦
^1B[0;420;4100;200;10!¦
^1B[1;420;3900;200;10!¦
^1B[1;620;3900;200;10!¦

^1B[0;300;4800;2000;10!¦
^1B[2300`^1B[4790dDate
^1B[0;2600;4800;1000;10!¦
```

```
^1B[1050`^1B[3050dTax Status
^1B[650`^1B[3400dSingle
^1B[650`^1B[3700dMarried
^1B[650`^1B[4000dMarried/higher single rate
^1B[300`^1B[5200dEmployee Signature

^1B[0;;;;;;;1;2'q
^1B[2400`^1B[5500d
^1B% 00123456789^1B%@

^1B[470`^1B[3350d^1B% 1~^1B%@
^1B[470`^1B[3650d^1B% 1~^1B%@
^1B[470`^1B[3950d^1B% 1~^1B%@
^1B[300`^1B[4790d~
^1B[2700`^1B[4790d~
^0C
ST
CSI18mCSI?70h
DCS0;126&rPayrollSTX~~~John Q. Smith~Jan 28,1992ESC# 1
```

PAYROLL DEDUCTIONS

INSTRUCTIONS

1. Complete the Appropriate section(s) below.
2. Be sure to sign, date and write your employee number
   in each section you complete.

EMPLOYEE'S WITHHOLDING EXEMPTION

Tax Status

[X] Single

[ ] Married

[ ] Married/higher single rate

John Q. Smith Date Jan 28,1992

Employee Signature

0123456789

Figure F–7. Payroll Deduction Form

Glossary

active column The horizontal location on the paper where the next character will print. After printing a character, the printer advances the active column.

active line The vertical location on the paper where the next character will print. After printing a line, the printer advances the active line.

active position The position on the paper where the next character will print. The active position is defined by the horizontal position (active column) and the vertical position (active line).

ASCII Abbreviation of American Standard Code for Information Interchange.

baud A unit of speed that measures the rate at which information is transferred. Baud rate is the reciprocal of the length in seconds of the shortest pulse used to carry data. For example, a system in which the shortest pulse is 1/1200 second operates at 1200 baud. On RS–232 serial lines, the baud rate equals the data flow rate in bits per second (bps). To communicate properly, a printer must be configured to operate at the same baud rate as its host computer.

bold A dark thick character weight produced by a double strike print method. *See also* shadow printing, character weight.

buffer A reserved area in printer memory that data is written to and read from during data transfers.

character cell The invisible rectangular space occupied by a character, including the white space around the character. Used as a unit of spacing. The height of a cell is equal to the current line spacing, and the width of a cell is equal to the current character spacing.

character set Instructions telling the printer how to construct a related group of printable characters, including symbols, punctuation, numbers, diacritical markings, and alphabet characters. Each character in a set is assigned a unique address in memory.

character weight The degree of lightness and thickness of printed text. For example: **Bold refers to a heavy or thick character weight.** Medium, normal, or book weight refer to the character weight used in this sentence.

control sequence Two or more bytes that instruct the printer to perform a special function. A control sequence begins with the control sequence introducer, CSI, in an 8–bit data environment. A control sequence can also be an escape sequence, however, because the 8–bit CSI control character can be represented by the 7–bit escape sequence, ESC [.

compressed Refers to a typeface with a smaller than normal character width, but no change to character height.

cpi characters per inch: a measurement of monospaced fonts indicating the horizontal character density. For example, 10 cpi is 10 characters produced in a one–inch (horizontal) space.

CSI Control Sequence Introducer: A non–printing control character (decimal 155, hex 9B) that is always the first byte of a control sequence in an 8–bit data environment. *See also* Control sequence.

decipoint One tenth of a point. A unit of measurement equal to 1/720 inch. *See also* point.

default A value, parameter, attribute, or option assigned by a program or system when another is not specified by the user.

diagnostic Pertains to the detection and isolation of printer malfunctions or mistakes.

DIP Dual In–line Package: a method of packaging semiconductor components in rectangular cases with parallel rows of electrical contacts.

DIP switch A DIP equipped with toggle switches.

disable To deactivate or set to OFF.

IA–232D Electronic Industry Association Specification: RS–232D interface that conforms to EIA standards.

Elite A name indicating a monospaced font with 12 cpi pitch (and usually 10 points in height).

Em A font width term equal to the maximum character width obtainable in a given font. (Derived from the width of an uppercase M, usually the widest character in a set.)

emulation Refers to the ability of a printer to execute the commands of another printer language or protocol.

En A font width term equal to one half em.

enable To activate or set to ON.

escape sequence Two or more bytes that describe a specific printer control function. In an escape sequence, the first byte is always the ASCII ESC character (decimal 27, hex 1B). *See also* control sequence.

expanded Refers to larger–than–normal character width with no change in character height.

false Off or zero. *Compare* true.

family (or type) A set of all variations and sizes of a type style.

fixed–pitch fonts *See* font, monospaced.

font The complete set of a given *size* of type, including characters, symbols, figures, punctuation marks, ligatures, signs, and accents. To fully describe a font, seven characteristics are usually specified:
1) Type family
2) Spacing (proportional or monospaced)
3) Type size (12 point, 14 point, etc.)
4) Scale factor (character height/width ratio)
5) Type style

6) Character weight
7) Character proportion (normal, condensed, expanded).

font name — *See* typeface.

font pattern — A font pattern is the matrix of pels which represents a character, symbol, or image.

font, landscape — A font printed parallel to the long edge of a page, or a font capable of being produced on a landscape page orientation.

font, monospaced — Also called fixed–pitch fonts. Every character, regardless of actual horizontal size, occupies the same amount of font pattern space. All monospaced fonts use specific pitch size settings. Monospaced fonts are sometimes used when strict character alignment is desired (tables, charts, spreadsheets, etc.).

font, portrait — A font printed parallel to the short edge of a page.

font, proportional — A font in which the width of the character cell varies with the width of the character. For example, "i" takes less space to print than "m." Using proportional fonts generally increases the readability of printed documents, giving text a typeset appearance. This manual is printed in proportional fonts.

font weight — *See* character weight.

font width — The measurement of the width of a character cell in dots.

GL Characters — Graphic left: Graphic left characters map half of the character set table. The GL characters reside at 0 – 127 hex and comprise the ASCII portion of the table.

GR Characters — Graphic right: Graphic right characters map half of the character set table. The GR characters reside at 128 – 255 hex and comprise the Digital portion of the table.

hex dump — A hex dump is a translation of all host interface data to its hexadecimal equivalent. A hex dump is a printer self–test typically used to troubleshoot printer data reception problems.

HGS — Horizontal Grid Size

host computer The host computer stores, processes, and sends data to be printed, and which communicates directly with the printer. The term host indicates the controlling computer, since modern printers are themselves microprocessor–controlled computer systems.

ipm inches per minute: The speed at which graphics are plotted.

interface The hardware components used to link two devices by common physical interconnection, signal, and functional characteristics. *See also* Printer Interface.

invoke To put into effect or operation.

italic A type style in which the characters are slanted. *This sentence is set in italics. Compare* Roman.

lpi lines per inch: a measurement indicating the vertical spacing between successive lines of text. For example, 8 lpi is 8 printed lines per vertical inch.

lpm lines per minute: A speed measurement indicating the number of lines printed every minute. (lpm usually defines the speed at which *text* prints.)

logical link The parameters that specify data transfer, control, or communication operations.

memory *See* RAM.

NLQ Near letter quality.

nonvolatile memory Nonvolatile memory stores variables that must be preserved when the printer is turned off, such as configuration parameters and printer usage statistics. Nonvolatile memory is preserved by means of an independent, battery–operated power supply. When printer power is turned off, the battery supplies the power needed to keep stored data active.

NOVRAM *Acronym for* nonvolatile random access memory. *See also* nonvolatile memory.

OCR Optical Character Recognition is the process by which a machine reads characters printed in a special standardized font. Data are read by a photoelectric optical scanner and recorded on magnetic tape or disk. OCR–A and OCR–B are two widely used fonts.

off–line The non–printing operational state of the printer. When the printer is off–line, communication between the printer and the host computer is temporarily stopped and the message "Off–line/Emulation" appears on the display. Non–printing operations, such as printer configuration, paper loading, changing the ribbon, etc., are done with the printer off–line.

on–line The printing state. When the printer is on–line, it is ready to receive data and control commands from the host computer, and prints the data immediately. "On–line" appears on the message display and the control panel status lamps illuminate continuously.

ON LINE A switch on the operator control panel that toggles the printer between the on–line and off–line states.

parity (check) Parity checking is the addition of non–data bits to data, resulting in the number of 1 bits being either always even or always odd. Parity is used to detect transmission errors. Parity represents the value in the check digit of the received or transmitted data.

parsing Parsing is the process of separating a programming statement into basic units that can be translated into machine instructions. A printer can recover from an erroneous code sequence by performing as much of the function as possible or, parsing the valid parameter from the invalid.

PCBA Printed Circuit Board Assembly.

pel *See* pixel.

PI Paper instruction: A signal from the host with the same timing and polarity as the data lines.

Pica A name indicating a monospaced font with a pitch of 10 cpi and usually a 12 point height. Pica is also used in typography as a unit of measurement: 1 pica = 1/6 inch.

pin configuration Establishes the physical attachment and protocol conversion connections for the host interface.

pitch The number of text characters printed per horizontal inch. Specified in characters per inch or cpi.

pixel Acronym of picture element or picture cell. Also called a pel. The smallest displayable picture element on a video monitor or printable unit in a printer.

point A unit of measure in printing and typography, used to specify type sizes, heights of font characters, etc. There are 72 points in a vertical inch; thus, one point equals 1/72 inch, or approximately 0.0138 inch. Examples: This is 6 point type. This is 11 point type. This is 16 point type.

port A channel used for receiving data from or transmitting data to one or more external devices.

printer configuration The operating properties that define how the printer responds to signals and commands received from the host computer. These properties are set to match the operating characteristics of the host computer system.

printer interface The point where the data line from the host computer plugs into the printer.

protocol A set of rules or conventions governing the exchange of information between computer systems. For computer printers, a protocol is the coding convention used to convey and print data. A printer protocol includes character codes, printer function codes, and machine–to–machine communication codes.

RAM Random Access Memory. Also called “main memory” or “working memory,” this is the active memory of a printer, into which programs are loaded. This memory can be read from or written to at any time, hence the name random access. RAM is said to be volatile because all data are lost when power is turned off or interrupted. *Compare* ROM

read To retrieve data from memory or mass storage (hard disk, floppy diskette, RAM, etc.).

reset To turn off, deactivate, disable, or return to a previous state.

resolution A measure expressing the number of component units in a given range used to create an image; in printing, expressed as the number of dots per inch (dpi) horizontally and vertically.

ROCS Return from Other Coding System: A control sequence that allows you to return the printer to the previous emulation from any point in the printer's configuration.

ROM Read–Only Memory. Programs, instructions, and routines permanently stored in the printer. ROM is not lost when power is turned off and cannot be written to—hence the name "read only." ROM–resident fonts are permanently stored in a printer and available at any time via software commands. *Compare* RAM.

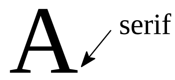
roman A type style in which characters are upright. This sentence is printed in a roman type style. *Compare* Italic.

sans serif A typeface or font in which the characters do not have serifs. This font is sans serif.

serial communications The sequential transmission of data, in which each element (bit) is transferred in succession.

serial matrix Refers to the manner in which text characters are printed. In a serial matrix printer, a moving printhead uses pins to form whole characters one at a time and one after the other. The pins print dots according to programmed matrix patterns. Although data are sent to the printer interface either a serially or in parallel, the printhead receives the data serially in order to form each character. The LG06 printer also forms characters with dots in matrix patterns, but it feeds print data in parallel to many hammers mounted on a rapidly oscillating shuttle. The hammers fire simultaneously to print entire lines at a time.

serif A short line stemming from and at an angle to the upper or lower end of the stroke of a letter or number character.



set To turn on, activate, invoke, or enable.

shadow printing A typeface with a heavy line thickness produced by doublestriking. The printer forms a character, then prints it again, but fractionally offset from the first position. *See also* bold, character weight.

sixel A vertical column consisting of six pixels and treated as a unit in graphics applications.

slewing Rapid vertical paper movement.

SOCS Select Other Coding System: A control sequence that allows you to enable another emulation.

start bit The signal that indicates the start of a character or element in a serial data stream.

stop bits The signal that indicates the end of a character or element in a serial data stream.

string Two or more bytes of data or code treated as a unit.

symbol set *See* character set.

true On or 1. “High true” refers to a positive relative voltage representing the ON state; “low true” refers to a negative relative voltage representing the ON state.

type style Refers to either the upright (roman) or italic character style within a specific font family.

typeface A descriptive name or brand name that identifies a particular design of type.

typographic font *See* font, proportional.

weight *See* character weight.

write A process in which data is placed (written) into memory or mass storage (RAM, hard disk, floppy diskette).

X–off A character transmitted by the printer announcing that the printer is off–line or the buffer is almost full.

X–on A character transmitted by the printer announcing that the printer is on–line or the buffer is almost empty.

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