Digital ANSI-Compliant Printing Protocol

Level 2 Programming Supplement

Order Number: EK–PPLV2–PS. C01

This document contains device-specific information about level 2 of the Digital ANSI-Compliant Printing Protocol (DEC PPL2). This protocol is used by Digital's advanced character cell printers. For general information on DEC PPL2, refer to the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*.

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Preface

The *Level 2 Programming Supplement* contains supplemental information about Digital's ANSI-Compliant Printing Protocol level 2 (DEC PPL2). This manual contains information that is specific to the Digital printers that implement this protocol. It is assumed that the reader has the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*, which provides general information about DEC PPL2.

Purpose of this Manual

This manual provides device-specific information for Digital ANSI-Compliant Printing Protocol level 2 (DEC PPL2) on the LA75 Plus Companion Printer, the LA310 MultiPrinter, and the LA600 MultiPrinter.

Intended Audience for this Manual

The *Level 2 Programming Supplement* is for programmers interested in:

- Creating applications for specific Digital ANSI-Compliant Printing Protocol level 2 printers.
- Understanding how and why documents may appear different if printed on different Digital printers.

Organization of this Manual

This manual is divided into four parts:

- Part 1 contains device-specific information about the implementation of DEC PPL2 for the LA75 Plus Companion printer.
- Part 2 contains device-specific information about the implementation of DEC PPL2 for the LA310 MultiPrinter.
- Part 3 contains device-specific information about the implementation of DEC PPL2 for the LA600 MultiPrinter.

- Part 4 contains appendixes of reference information.

Conventions Used In This Manual

The term DEC PPL2 is used throughout the manual to indicate the Digital ANSI-Compliant Printing Protocol level 2. The following conventions are used throughout this manual:

Convention	Meaning
UPPERCASE	Symbols for Digital ANSI-Compliant Printing Protocol level 2 commands are printed in text in uppercase.
Italics	Indicates variables in Digital ANSI-Compliant Printing Protocol level 2 commands.

`monospaced type`	Illustrates a Digital ANSI-Compliant Printing Protocol level 2 command. Below each character is a column/row number that indicates the coded character's position in a standard code table. For example:
	`CSI 2 ! v`
	`9/11 3/2 2/1 7/6`

DEC PPL2	Digital ANSI-Compliant Printing Protocol level 2
Command Dictionary	Refers to Chapter 7 in the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*

Part I

LA75 Plus Companion Printer

Part I of the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Supplement* describes the DEC PPL2 protocol as implemented by the LA75 Plus Companion Printer.

- Chapter 1 describes the basic features and characteristics of the LA75 Plus Companion Printer.
- Chapter 2 describes the printing of the physical page on the LA75 Plus Companion Printer.
- Chapter 3 describes the initial state of the printer.
- Chapter 4 describes how status and error messages are handled.
- Chapter 5 describes the fonts and font cartridges available on the LA75 Plus Companion Printer.
- Chapter 6 describes the sixel graphics considerations for the LA75 Plus Companion Printer.
- Chapter 7 describes the control characters and their functions on the LA75 Plus Companion Printer.

1

General Information About the LA75 Plus Companion Printer

This chapter contains the following information about the LA75 Plus Companion Printer:

- Description of the LA75 Plus Companion Printer, Section 1.1
- Protocol extensions and exceptions, Section 1.2
- Alternate protocols for this printer, Section 1.3
- Color printing, Section 1.4
- Cartridges, Section 1.5

1.1 Description of the LA75 Plus Companion Printer

The LA75 Plus Companion Printer is a narrow-carriage, impact dot-matrix printer. Designed for personal desktop printing, it is also suitable for general business applications. It has flexible paper handling, and it is capable of printing on continuous pinfeed paper, single sheets, multiple-part forms, and envelopes. An Automatic Sheet Feeder (LA75Y-SF) is available, as an option, to hold and automatically load up to 80 sheets of cut paper. The print quality is suitable for limited word processing in a small-to-medium computer environment.

The LA75 Plus Companion Printer:

- Is a 24-pin printer.
- Can print in six colors, in addition to black, once the color ribbon (PN LA75R-KC) is installed.
- Has a Document on Demand capability (automatic or manual), which prevents wasting forms or paper between printing jobs.
- Has an Automatic Viewing capability, which allows the user to see the last printed line after a job has finished.

- Can be connected simultaneously to serial and parallel ports, and switches automatically between them when data is received.
- Is compatible with the IBM Proprinter X24E, which is the default protocol at power-up when the parallel port is used.

Refer to the *LA75 Plus Companion Printer Installation and User Guide* for information about installing and using the LA75 Plus Companion Printer.

1.2 DEC PPL2 Extensions and Exceptions

Note

References are made in this manual to Chapter 7 (Command Dictionary) of the associated manual *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*. For brevity, that chapter is called "Command Dictionary."

The implementation of DEC PPL2 on the LA75 Plus Companion Printer involves a number of extensions and exceptions, which are summarized in Table 1–1 and Table 1–2. For further information, see Table 18–1, and also refer to the Command Dictionary.

Table 1–1 DEC PPL2 Extensions

Extensions
Sixel graphics
Sheet feeder
Hebrew character sets
Katakana character set
Greek character sets
Turkish character sets
Color
Metric line spacing
Download Font (DECDLD)

Table 1–2 DEC PPL2 Exceptions

Exceptions
Bell
LA210, LA120, LA50 alias Device Attributes Report (DAR) parameters
Control Representation Mode (CRM)
Protocol switching
Horizontal Page Width Alignment (DECHPWA)
Bar code printing (DECSBA, DECBAR)

1.3 Alternate Protocols Supported by the LA75 Plus Companion Printer

This part of the manual describes the DEC PPL2 protocol as implemented on the LA75 Plus Companion Printer. The LA75 Plus Companion Printer also emulates the protocol for printing on the IBM Proprinter X24E. The protocol is changed using either the Select Other Coding System (SOCS)/Return from Other Coding System (ROCS) command combination, or the Select IBM Proprinter Mode (DECIPEM) command. These commands are described in the Command Dictionary.

1.4 Color Printing

For color printing the LA75 Plus Companion Printer uses a ribbon with four colors. The four ribbon colors can be selected individually and in combinations, making it possible to print up to eight different colors:

Yellow — (ribbon color)
Magenta — (ribbon color)
Cyan — (ribbon color)
Black — (ribbon color)
Red — (magenta and yellow)
Green — (yellow and cyan)
Blue — (magenta and cyan)
White — (no printing)

The LA75 Plus Companion Printer supports the Select Graphic Rendition (SGR) color text parameters listed in the Command Dictionary.

In Sixel Graphics mode, the LA75 Plus Companion Printer prints black and white or color sixels, using the 8-color columns from the HLS and RGB color maps in the Sixel Graphics chapter of the Reference Manual.

1.5 Cartridges Supported by the LA75 Plus Companion Printer

The LA75 Plus Companion Printer supports optional font cartridges. To insert the cartridge, turn the printer power off, insert the cartridge, and turn the power back on. If you insert the cartridge while the printer is powered on, the printer may not be able to select and use the cartridge.

Cartridges contain alternate character sets or typestyles. Select “print setup” while in setup mode to print full details of the contents of the installed cartridge. See Chapter 5, Fonts and Character Attributes on the LA75 Plus Companion Printer, for further information.

2

Physical Page Characteristics of the LA75 Plus Companion Printer

This chapter explains how the LA75 Plus Companion Printer handles the transfer of the logical page in memory to the physical paper. Topics include:

- Paper handling, Section 2.1
- Response to a Form Feed request, Section 2.2
- Horizontal text resolution, Section 2.3
- Vertical text resolution, Section 2.4
- Limits on partial line motion, Section 2.5
- Tab support, Section 2.6
- Automatic sheet feeder control, Section 2.7

In this chapter the top of form paper position is defined as the position of line 1 on the page. This position does not change with the top margin setting. The form length is defined by the setup feature or by the Set Lines Per Page (DECSLPP) command.

2.1 Paper Handling

This section summarizes the paper feed modes and loading processes for the LA75 Plus Companion Printer.

Fanfold Paper — Rear Feed/Top or Rear Output (Push Tractor Mode)

Paper is considered autoloaded when the printer loads it automatically at power-up or when the user presses the Form Feed (FF) button.

Paper is considered manually loaded when the user inserts it using the platen knob.

The LA75 Plus Companion Printer can detect the top of the first form only.

The LA75 Plus Companion Printer uses the form length, as determined by the setup feature or by the Set Lines Per Page (DECSLPP) command, to compute the tops of forms other than the first.

Fanfold Paper — Bottom Feed/Rear Output (Pull Tractor Mode)

In this mode there is no autoload function, so the printer cannot detect the top of form.

The power-up paper position is assumed to be the top of form.

Cut Sheet Paper — Manual Feed/Top Insertion and Top Output (Friction Mode)

Paper is considered autoloaded when the printer loads it automatically at power-up or when the user presses the Form Feed (FF) button.

Paper is considered manually loaded when the user inserts it using the platen knob.

Automatic Sheet Feeder (Friction Mode)

When the sheet feeder is installed and selected there is no manual load function.

Sheets are automatically loaded when the user presses the Form Feed (FF) button or when characters are received to be printed.

Manual Feed Mode with Sheet Feeder Installed

The sheet feeder can be deselected by the DECASFC command.

When the sheet feeder is deselected, paper can be inserted manually.

In this mode, the printer works as in Cut sheet paper/Manual feed, except that the backward motion features (Parking and Viewing) are disabled.

To reactivate Automatic Sheet Feed mode, the DECASFC command must be used. Alternatively, the sheet feeder can be reselected by turning the printer power off, then on again.

2.2 Response to Form Feed (FF)

The following information refers to paper motion when the Form Feed (FF) control code is received; actions that occur when the user presses the Form Feed (FF) button are not covered.

Fanfold Paper — Rear Feed

When paper is autoloaded, Form Feed (FF) advances the paper to the next top of form.

Fanfold Paper — Bottom Feed

The LA75 Plus Companion Printer assumes that the paper position prior to any paper motion is the reference for the first top of form. Form Feed (FF) advances the paper to the next top of form.

Cut Sheet Paper — Manual Feed

If paper is not currently loaded, Form Feed (FF) is stored and does not load paper. If paper is currently loaded, Form Feed (FF) ejects the current sheet if the physical paper length is equal to, or shorter than, the logical paper length, as defined during setup or by DECSLPP. If the physical paper length is larger that the logical paper length, Form Feed (FF) advances paper to the next top of form.

Automatic Sheet Feeder

When the sheet feeder is installed and paper is currently loaded, Form Feed (FF) ejects the current sheet. If no paper is currently loaded, Form Feed (FF) inserts a sheet to top of form. When the sheet feeder is not selected (deselected by DECASFC), Form Feed (FF) is treated the same as in Cut sheet paper, Manual feed.

2.3 Horizontal Text Resolution

The LA75 Plus Companion Printer uses approximations for some of the pitches listed under Set Horizontal Pitch (DECSHORP) in the Command Dictionary. These approximations, or fallbacks for text resolution, are given in Table 2–1. All other pitches, as listed in the Command Dictionary, are printed exactly by the LA75 Plus Companion Printer without fallbacks.

Note

For Sixel Graphics mode resolution fallbacks, see Table 6–1.

Table 2–1 Horizontal Text Resolution and Fallbacks

Target Pitch	Actual 1/2880 inch	Fallback Pitch
6.6	436	6.605
8.25	348	8.2759
13.2	218	13.21
16.5	174	16.55
10.3	288	10

2.4 Vertical Text Resolution

The LA75 Plus Companion Printer supports the metric line spacing parameters under Set Vertical Pitch (DECVERP) in the Command Dictionary.

The LA75 Plus Companion Printer uses approximations for the metric line spacing parameters. These approximations are given in Table 2–2.

Table 2–2 Text Vertical Pitch Fallbacks

Target Pitch	Actual 1/720 inch	Fallback Pitch
1 line/cm (2.54 line/in)	283	1.002 line/cm 2.544 line/in
2 line/cm (5.08 line/in)	142	1.996 line/cm 5.070 line/in
4 line/cm (10.16 line/in)	71	3.992 line/cm 10.141 line/in

2.5 Limits on Partial Line Motion

When the automatic sheet feeder is installed, the LA75 Plus Companion Printer limits the PLU count to 12, or 1 inch. This is due to vertical backup limitations.

In bottom feed mode, the LA75 Plus Companion Printer ignores PLU and PLD sequences due to mechanical limitations.

In all feed modes, the LA75 Plus Companion Printer ignores PLU and PLD sequences when within 1.3 inches (3.3 cm) from the bottom of the paper.

2.6 Tabs

The LA75 Plus Companion Printer supports a maximum of 144 horizontal tabs and a maximum of 252 vertical tabs.

2.7 Automatic Sheet Feeder Control (DECASFC)

The automatic sheet feeder supported by the LA75 Plus Companion Printer has only one tray. This causes the DECASFC sequence to perform a conditional Sheet Feed.

If the sheet feeder is not installed, the printer performs a conditional Sheet Feed on receipt of DECASFC.

2.7 Automatic Sheet Feeder Control (DECASFC)

The sheet feeder is selected automatically if it is installed at the time of power-up. The actions taken by the LA75 Plus Companion Printer in response to the DECASFC sequence are given in Table 2–3.

Table 2–3 DECASFC Response

Ps	Action
0 to 98	Performs a conditional Sheet Feed and selects the sheet feeder if not already selected.
99	Performs a conditional Sheet Feed and deselects the sheet feeder, then enters manual feed mode.

When the sheet feeder option is installed, but is deselected by sending DECASFC with Ps = 99, you can insert a single sheet manually in the appropriate slot on the sheet feeder and load it by pressing the Form Feed (FF) button.

3

Initial State Values for the LA75 Plus Companion Printer

This chapter lists the values used by the LA75 Plus Companion Printer for:

- A power-up reset or a recall of factory default values
- The Select Conformance Level (DECSCL) command
- The Soft Terminal Reset (DECSTR) or Reset to Initial State (RIS) commands

3.1 Initial States

Table 3–1 lists the initial state values used by the LA75 Plus Companion Printer. The printer always powers up in Ready mode if no error is detected.

Table 3–1 Initial State Values

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Protocol	Unchanged	NVM[3]	Unchanged	Port dependent
Origin (DECHPWA)	Unchanged	0	Unchanged	0
Vertical pitch	6 line/in	NVM	NVM	6 line/in
Horizontal pitch	10 char/in	NVM	NVM	10 char/in
Active position	Origin	Origin	Origin	Origin[4]

[3]NVM indicates that the initial state value is stored in nonvolatile memory.

[4]Device performs conditional Form Feed on exit from setup.

(continued on next page)

Table 3–1 (Cont.) Initial State Values

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Horizontal Tabs[1]	Every eight	Every eight	Every eight	Every eight
Line Feed/New Line	Reset	NVM	NVM	Reset
CR/New Line Mode	Reset	NVM	NVM	Reset
SGR Attributes	Disabled	Disabled	Disabled	Disabled
DECGCI — All color numbers (Pc)	Black	Black	Black	Black
Density control (SW or forced)	Unchanged	NVM	Unchanged	SW control
Density (SW control)	Draft	Draft	Draft	Draft
Unidirectional Print Mode	Reset	Reset	Reset	Reset
Vertical Tabs[2]	Every line	Every line	Every line	Every line
G0 Character Set	ASCII	NVM	NVM	ASCII
G1 Character Set	ASCII	ASCII	ASCII	ASCII
G2 Character Set	User Pref.	User Pref.	User Pref.	User Pref.
G3 Character Set	User Pref.	User Pref.	User Pref.	User Pref.
GL Character Set	G0	G0	G0	G0
GR Character Set	G2	G2	G2	G2
Autowrap Mode	Set	NVM	NVM	Set
User Preference Set	DEC Supp.	NVM	Unchanged	DEC Supp.
Unsolicited Status Reports	Disabled	Disabled	Unchanged	Disabled
Initialization Message	Unchanged	NVM	Unchanged	Disabled
Downloaded Fonts	Deleted	None	Unchanged	None

[1]Horizontal tabs are set every eight columns, starting with column 9 (9,17, . . .). All entries in the tab table are initialized. It is incorrect to initialize only those entries that are addressable on the currently selected paper size.

[2]Vertical tabs are set every line or Vertical Advance Increment (VAI). All entries in the tab table are initialized. It is incorrect to initialize only those entries that are addressable on the currently selected paper size.

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Table 3–1 (Cont.) Initial State Values

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Typestyle (SGR #)	10	NVM	NVM	10
Auto Advance	Unchanged	NVM	Unchanged	Disabled
Bell	Unchanged	NVM	Unchanged	1 beep
CRM	Unchanged	Read button	Unchanged	Reset
C1 Receive	8-bit	8-bit	Unchanged	8-bit
Device ID (DA)	Unchanged	NVM	Unchanged	Conformance level 2
Form Length	11 in.	NVM	NVM	11 in.
Margins	Paper edge	Paper edge	Paper edge	Paper edge

4

Status and Error Reporting for the LA75 Plus Companion Printer

This chapter explains how the LA75 Plus Companion Printer provides status information and handles error conditions. The topics include:

- Device Attributes Report, Section 4.1
- Secondary Device Attributes Report, Section 4.2
- Device Status Report, Section 4.3

Note

Device attribute and status reports are applicable only to the serial interface. Reports are not sent across the parallel interface.

4.1 Device Attributes Report (DAR)

The Device Attributes Report identifies the LA75 Plus Companion Printer to the host. During setup the user may specify that the printer identify itself as a generic level 2 printer or as a previous model Digital printer. See DAR in the Command Dictionary for more information.

When the Printer ID setup feature is set to conformance level 2, the generic DAR response is returned. The generic DAR response always begins with Ps1 = ?72. Subsequent parameters are shown in Table 4–1. Parameters are separated by a semicolon (;).

Table 4–1 Generic DAR Replies

Ps	Description	Comment
1	Color	Sent only if a color ribbon is installed
4	Sixels	
5	Katakana extension	
6	Sheet feeder	Sent only if the sheet feeder is installed
7	Dynamically Reloadable Character Sets (DRCS), also known as “download extension”	Sent only if downline load capability is enabled by the setup facility
12	Hebrew extension	
23	Metric line spacing extension	
24	Greek extension	
26	Turkish extension	

When the Printer ID setup feature is set to LA50, LA120, or LA210, an alias DAR response is returned. The alias DAR responses are shown in Table 4–2. Parameters are separated by a semicolon (;).

Table 4–2 Alias DAR Replies

Ps1	Additional Parameter	Printer ID Selection
?2		LA120
?10	3	LA210
?17		LA50

4.2 Secondary Device Attributes Report (DA2R)

The Secondary Device Attributes Report (DA2R) sent by the LA75 Plus Companion Printer uses the value 54 for parameter Ps1. This value identifies the printer model as the LA75 Plus Companion Printer. Parameter Ps2 provides the firmware version. There are no additional parameters.

4.3 Device Status Report (DSR)

The codes generated by the LA75 Plus Companion Printer for the extended Device Status Report (DSR) are given in Table 4–3. When the LA75 Plus Companion Printer sends more than one code, only the first is preceded by a question mark (?).

Table 4–3 DSR Codes

Ps	Description	Reference
?20	No malfunction	
?21	Hardware failure (State)	
?22	Communication failure (Event)	
?23	Input buffer overflow (Event)	
?24	Printer deselected (State)	
?26	Cover open (State)	
?27	Paper out (State)	
?30	ASF installed — no ASF error (State)	
?32	Paper jam or ASF error (State)	
?40	Character set not available (Event)	Section 4.3.1
?42	Downline load error (Event)	Section 4.3.2
?45	Character beyond right margin (Event)	
?55	Alternate protocol error (Event)	Section 11.3.3
?57	First report since initialization (Event)	Section 4.3.4

Definitions for “Event” and “State” in Table 4–3 are given in the Command Dictionary, under DSR.

The following table gives two DSR examples:

Extended Report	Meaning
ESC [0 n ESC [? 20 ; 30 n	No error, ASF installed
ESC [3 n ESC [? 32 n	ASF installed, cannot clear paper path

4.3.1 Character Set Not Available

The character set not available code is sent if the device attempts to print from a character set that has been addressed by Select Character Set (SCS), but is not available in any print density, from any source. Sources include built-in, cartridge, and downloaded fonts.

4.3.2 Downline Load Error

A downline load error is sent under any of the following conditions:

- The downloaded font file sent to the printer exceeds the printer's download capacity.
- The entire download sequence is ignored. See DECDLD (download font) in the Command Dictionary.
- A DECDLD sequence is received, but the printer has been set to extended input buffer size (no download capability) by the setup facility.

4.3.3 Alternate Protocol Error

The alternate protocol error code is sent by the printer if a user attempts to select an alternate protocol that is not available in the printer.

4.3.4 Initialization Messages

Whenever the LA75 Plus Companion Printer completes a power-on sequence, and the setup feature DEC 9 (Initialization Message) is enabled, an unsolicited extended Device Status Report (DSR) is sent, reflecting the state of the LA75 Plus Companion Printer at this point. The parameter value of the initial brief report is Device Ready (Ps = 0) or Device Not Ready (Ps = 3), as appropriate.

The first parameter value of the extended report uses the "First report since initialization" value from Table 4–3. If any additional error conditions are present, the parameter values for these errors are also reported.

Table 4–4 shows the possible initialization messages.

Table 4–4 Initialization Messages

Extended Report	Meaning
ESC [0 n ESC [? 5 7 ; 2 0 n	Printer just switched on, ready to print
ESC [0 n ESC [? 5 7 ; 2 0 ; 3 0 n	Printer just switched on, ready to print, ASF installed
ESC [3 n ESC [? 5 7 ; 2 7 n	Printer just switched on, paper out

If an error condition other than paper out exists when the printer is powered up (hardware failure; cover open; carriage error; ASF installed, paper path cannot be cleared), the initialization message is not sent until the error condition is cleared.

The extended report is sent after the initial XON character is sent, following a power-up. It is provided for applications or symbionts that need to know if the device has been powered on recently and may be reset to an unknown state. This feature can be enabled or disabled during setup. Refer to Section A.4 for information on the interaction of this feature with automatic port selection.

5

Fonts and Character Attributes on the LA75 Plus Companion Printer

This chapter gives information on:

- The built-in font repertory, Section 5.1
- Additional character sets, Section 5.2
- Cartridge font repertory, Section 5.3
- Select Graphic Rendition (SGR) command for cartridge font selection, Section 5.4
- Font status reporting, Section 5.5
- Density selection, Section 5.6
- Download font, Section 5.7
- Slant, Section 5.8
- Bar code printing, Section 5.9

5.1 Built-In Font Repertory

The built-in font repertory of the LA75 Plus Companion Printer includes all character sets listed in Table 5–1 (at all pitches and densities), with two exceptions:

- ISO Latin-2 Supplemental
- ISO Latin-Cyrillic Supplemental

These two character sets are supported by means of a cartridge, and are selectable by DECAUPSS.

Fonts and Character Attributes on the LA75 Plus Companion Printer
5.1 Built-In Font Repertory

Table 5–1 Supported Character Sets

Character Set	I_2 F Designator Characters	Code
94-Character Sets		
British	A	4/1
ASCII	B	4/2
DEC Dutch	4	3/4
DEC Finnish	5	3/5
French	R	5/2
DEC French-Canadian	9	3/9
German	K	4/11
DEC Hebrew Supplemental[1]	"4	2/2, 3/4
DEC 7-Bit Hebrew[1]	%=	2/5, 3/13
ISO Italian	Y	5/9
Legal	%4	2/5, 3/4
JIS Katakana[1]	I	4/9
JIS Roman	J	4/10
DEC Norwegian/Danish	6	3/6
ISO Spanish	Z	5/10
DEC Swedish	7	3/7
DEC Swiss	=	3/13
Norwegian/Danish	`	6/0
DEC Supplemental[1]	%5	2/5, 3/5
DEC Technical[1]	>	3/14
DEC Special Graphics	0	3/0
DEC Portuguese	%6	2/5, 3/6
DEC 7-Bit Turkish[1]	%2	2/5, 3/2
DEC 8-Bit Turkish Supplemental[1]	%0	2/5, 3/0
DEC Greek Supplemental[1]	"?	2/2, 3/15

[1]Character sets that can be designated by DECAUPSS

(continued on next page)

Table 5–1 (Cont.) Supported Character Sets

Character Set	I_2 F Designator Characters	Code
96-Character Sets		
ISO Latin-1 Supplemental[1]	A	4/1
ISO Latin-2 Supplemental[1]	B	4/2
ISO Latin-Greek Supplemental[1]	F	4/6
ISO Latin-Hebrew Supplemental[1]	H	4/8
ISO Latin-Cyrillic Supplemental[1]	L	4/12
ISO Latin-5 Supplemental[1]	M	4/13

[1]Character sets that can be designated by DECAUPSS

5.2 Additional Character Sets

Additional character sets in a character set cartridge are available for selection if the cartridge was installed at the time the printer was powered up. These additional character sets are addressable in the same way as the built-in sets:

- Through setup selection (G0 Character set or User Preference Character set)
- Through the Select Character Set (SCS) escape sequence or the Assign User Preference Supplemental Set (DECAUPSS) escape sequence if the character set selected is a valid choice (see Table 5–1).

The Select Graphic Rendition (SGR) escape sequence is not needed for selecting fonts when the character sets provided by the cartridge are designed in the built-in typestyle.

5.3 Cartridge Font Repertory

Cartridge fonts that are available are listed in Table 5–2.

Fonts and Character Attributes on the LA75 Plus Companion Printer
5.3 Cartridge Font Repertory

Table 5–2 Available Cartridge Fonts

Part Number	Cartridge Name	Character Sets in the Cartridge
LA75Y-CA	Letter Gothic Font	DEC PPL2 mode: ASCII, 14 National Replacement Character (NRC)[1] sets, DEC Supplemental, Legal, ISO Latin-1 Supplemental Proprinter mode, IBM code pages: USA (437), Multilingual (850), Portugal (860), Norway (865), Spain (220), Canada-French (863), German GS (190)
LA75Y-CB	Orator Font	DEC PPL2 mode: ASCII, 14 NRC[1] sets, DEC Supplemental, Legal, ISO Latin-1 Supplemental Proprinter mode, IBM code pages: USA (437), Multilingual (850), Portugal (860), Norway (865), Spain (220), Canada-French (863), German GS (190)
LA75Y-CC	Prestige Elite Font	DEC PPL2 mode: ASCII, 14 NRC[1] sets DEC Supplemental, Legal, ISO Latin-1 Supplemental Proprinter mode, IBM code pages: USA (437), Multilingual (850), Portugal (860), Norway (865), Spain (220), Canada-French (863), German GS (190)
LA75Y-CD	OCR-A Font	DEC PPL2 mode: ASCII Proprinter mode, IBM code page: USA (437)
LA75Y-CE	OCR-B Font	DEC PPL2 mode: ASCII, ISO Latin-1 Supplemental Proprinter mode, IBM code pages: USA (437), Multilingual (850)
LA75Y-CF	ISO Latin-2 Cyrillic Hebrew	DEC PPL2 mode: ISO Latin-2 Supplemental, ISO Latin-Cyrillic Supplemental Proprinter mode, IBM code pages: ISO Latin-2 (852), Russian (866), Hebrew (862)

[1]For the list of National Replacement Character (NRC) sets that are available, see Appendix A in the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*.

(continued on next page)

Table 5–2 (Cont.) Available Cartridge Fonts

Part Number	Cartridge Name	Character Sets in the Cartridge
LA75Y-CG	ISO Latin-2 Cyrillic Hebrew-David	DEC PPL2 mode: ISO Latin-2 Supplemental, ISO Latin-Cyrillic Supplemental Proprinter mode, IBM code pages: ISO Latin-2 (852), Russian (866), Hebrew (862)

A comprehensive listing of the contents of the installed cartridge is performed by the printer in setup mode.

For details of other cartridges that may be available, contact your Digital sales representative.

The LA75 Plus Companion Printer applies all built-in algorithmic transformations (bold, slant, density, underlining, and so on) to the alternative typestyle or character set in the same way as it does to the built-in fonts. All characters in the alternative typestyle or character sets can be printed at any of the horizontal pitches supported by the printer.

5.4 Select Graphic Rendition (SGR) — Cartridge Font Selection

The supported font selection Ps values for Select Graphic Rendition (SGR) are given in Table 5–3.

Table 5–3 SGR Values for Cartridge Font Selection

Ps	Assignment
10	Built-in typestyle, downloaded font, or character set cartridge
11–16	Downloaded font
17	Cartridge typestyle or downloaded font
18–19	Downloaded font

Each downloaded font file is assigned one of the above SGR numbers. Different downloaded font files may be assigned the same SGR if they are of different character sets or different densities.

5.5 Font Status Report (DECFSR)

The SGR parameter, described under DECFSR in the Command Dictionary, is always 17 if a font cartridge is installed. DECFSR does not report built-in fonts or downloaded fonts.

5.6 Density Selection (DECDEN)

Supported Ps values for DECDEN are given in Table 5–4.

Table 5–4 DECDEN Ps Selection

Ps	Selection
0	Selects the default (draft) print density (highest speed).
1	Selects draft print density (highest speed).
2	Selects letter-quality print density (highest quality).
3	Select memo, falls back to near letter-quality print quality.
4	Selects near letter-quality print quality.

Printing in draft and letter-quality requires dedicated fonts. Near letter-quality is generated algorithmically from the draft font.

Note

There is an interaction between DECDEN and the setup feature Generic 5 (Print Quality Control).

If the Print Quality Control feature is set to “software control,” DECDEN is active. If the Print Quality Control feature is set to “Draft locked” or “LQ locked,” the print quality is locked to draft or LQ and subsequent DECDEN commands are stored. When the print quality is unlocked by the front panel switch, the LA75 Plus Companion Printer processes the stored DECDEN command.

5.7 Download Font (DECDLD)

The LA75 Plus supports the values given in Table 5–5 for the DECDLD parameters Pu (font usage), Pss (font set size), Pcmw and Pcmh (character cell matrix size), and only the combinations given in Table 5–5 are supported.

Any sequence with other values or any other combination of values is ignored or changed to a valid configuration as given in Table 5–6.

Table 5–5 DECDLD Recommended Parameters Matrix

Pu Font Usage	Pss Font Set Size	Pcmw Matrix Width	Pcmh Matrix Height	Print Density
1	1	9	24	Normal text draft
1	3	27	24	Normal text letter-quality
2	1	12	30	Full cell draft
2	3	36	30	Full cell letter-quality

Table 5–6 DECDLD Acceptable Parameters Matrix

Pu Font Usage	Pss Font Set Size	Pcmw Matrix Width	Pcmh Matrix Height	Print Density
1	0	9	24	Normal text draft
2	0	12	30	Full cell draft
1	0 or 1	12	30	Normal text draft
1	3	36	30	Normal text letter-quality

The LA75 Plus font file download capability is limited by the following considerations :

- The LA75 Plus supports font file downloading if the input buffer size is configured to standard size by the setup facility.
- The LA75 Plus supports two font buffers only. As a result, only the Pf*n* "Font Number" values 1 and 2 are supported, and any other value causes the DECDLD sequence to be ignored.
- Each buffer has sufficient capacity for one full-cell 96-character character set.

- If the input buffer size is configured to extended size by the setup facility, the LA75 Plus has no download capability. As a result, any DECDLD sequence is ignored.

5.8 Slant

The LA75 Plus supports the Select Graphic Rendition (SGR) attribute for slant by algorithmically slanting the characters. See SGR in the Command Dictionary.

5.9 Bar Code Printing

The LA75 Plus Companion Printer supports built-in bar code 3 of 9 through the DECBAR and DECSBCA commands.

5.9.1 Select Bar Code Attributes (DECSBCA)

Table 5–7 shows the bar code attributes supported by the LA75 Plus Companion Printer.

Table 5–7 Bar Code Attributes

Parameter	Description	Supported Values	Default if Zero
Pn2	Narrow bars and spaces	9 (0.0125 inch, 4.7 pitch) 18 (0.025 inch, 2.3 pitch)	9
Pn3	Quiet zone	180 (0.25 inch, leading and trailing edges)	180
Pn4	Wide bars and spaces	27 (0.0375 inch, 4.7 pitch) 54 (0.075 inch, 2.3 pitch)	27
Pn5	Intercharacter gap	18 (0.025 inch, 4.7 pitch) 36 (0.050 inch, 2.3 pitch)	18
Pn6	Height of bars	96 (0.133 inch)	96
Ps7	Control characters	None (parameter is ignored)	
Ps8	Orientation	None (parameter is ignored)	
Ps9	Human-readable characters	All Ps9 values for DECSBCA in the Command Dictionary	

The LA75 Plus Companion Printer ignores the following values:

- Received values for Pn3 and Pn6. The printer always used the value given in Table 5–7.

- Parameter Ps7. The LA75 Plus Companion Printer does not support control characters in bar codes.
- Parameter Ps8. The LA75 Plus Companion Printer always uses portrait orientation.

The values assigned to Pn2, Pn4, and Pn5 must be consistent with the pitch. Table 5–8 shows the allowed combinations of Pn parameters and pitch.

Table 5–8 Allowed Combinations of Pn Values and Pitch

Pn2	Pn4	Pn5	Pitch
9	27	18	4.7
18	54	36	2.3

Human-readable characters are printed centered below the bar code equivalent. They are printed at 10 characters/inch in the currently selected print density, with no printing attribute enabled.

6

Sixel Graphics Considerations on the LA75 Plus Companion Printer

This chapter explains the graphics resolution capability of the LA75 Plus Companion Printer.

6.1 Graphics Resolution

Table 6–1 shows the values that the printer uses for macro value Ps1 of the Sixel Graphics mode protocol selector.

Table 6–1 Graphics Pitch Fallbacks

Macro Value	Horizontal Grid Size (Inches)	Aspect Ratio (Vertical:Horizontal)
0 or none	1/144 in (0.0069)	200:100
1	1/144 in (0.0069)	200:100
2, fall back to:	1/180 in (0.0056)	250:100
3, fall back to:	1/180 in (0.0056)	250:100
4	1/180 in (0.0056)	250:100
5, fall back to:	1/144 in (0.0069)	200:100
6, fall back to:	1/144 in (0.0069)	200:100
7, fall back to:	1/144 in (0.0069)	200:100
8, fall back to:	1/144 in (0.0069)	200:100
9	1/72 in (0.0139)	100:100

In Table 6–1 the comments “fall back to:” mean that for the given macro value, the horizontal grid size and aspect ratio values on that row are fallback values.

Sixel Graphics Considerations on the LA75 Plus Companion Printer
6.1 Graphics Resolution

Table 6–2 shows the horizontal grid size (HGS) and vertical grid size (VGS) fallbacks relative to the requested horizontal grid size and the aspect ratio. The printer attempts to preserve the requested aspect ratio without exceeding the requested horizontal grid size (as defined by Pn3 of the protocol selector).

The aspect ratio is provided by Ps1 or Set Raster Attributes (DECGRA).

First the printer ensures that the aspect ratio is one of the supported values (1:1, 2:1, 2.5:1):

- If aspect ratio is less than 1.5:1, fall back to 1:1
- If aspect ratio is greater than or equal to 1.5:1 and less than 2.25:1, fall back to 2:1
- If aspect ratio is greater than or equal to 2.25:1, fall back to 2.5:1

Then the printer computes the HGS and VGS values that best match the aspect ratio and requested Pn3 value.

Table 6–2 Graphics Grid Size Fallbacks

		Vertical Grid Size by Aspect Ratio with HGS Fallbacks (If Any)		
Pn3 Decipoints	**Horizontal Grid Size**	**1:1**	**2:1**	**2.5:1**
0 or none	No change to HGS and VGS defined by Ps1			
1, 2 and 3	Fall back to 4 decipoints			
4	1/180 in	1/180 in	1/90 in	1/72 in
5	1/144 in	1/144 in	1/72 in	VGS fall back to 1/72 in HGS fall back to 1/180 in
6, 7	Fall back to 5 decipoints			
8	1/90 in	1/90 in	1/45 in	1/36 in
9	Fall back to 8 decipoints			
10	1/72 in	1/72 in	1/36 in	VGS fall back to 1/36 in HGS fall back to 1/90 in
11–15	Fall back to 10 decipoints			
16	1/45 in	1/45 in	VGS fall back to 1/36 in HGS fall back to 1/72 in	VGS fall back to 1/36 in HGS fall back to 1/90 in
17–19	Fall back to 16 decipoints			
20	1/36 in	1/36 in	VGS fallback to 1/36 in HGS fall back to 1/72 in	VGS fall back to 1/36 in HGS fall back to 1/90 in
> 20	Fall back to 20 decipoints			

7

Control Characters for the LA75 Plus Companion Printer

This chapter describes the control characters for the LA75 Plus Companion Printer and their functions. The control characters are:

- Bell, described in Section 7.1
- EOT, described in Section 7.2

7.1 Bell

The LA75 Plus Companion Printer has an audio indicator, or bell. The bell can be configured using setup to sound one beep, sound three beeps, sound continuously, or not to sound at all when an error occurs. When the device receives a BEL (Bell) control character, it always sounds one beep.

7.2 EOT

When Disconnect on EOT is enabled by the setup facility, the DTR signal on the serial port is dropped for 5 seconds when the EOT control code is received. This feature applies only if the serial port is active. See the setup feature Disconnect on EOT (DEC 8), in the *LA75 Plus Companion Printer Installation and User Guide*.

Part II

LA310 MultiPrinter

Part II of the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Supplement* describes the DEC PPL2 protocol as implemented by the LA310 MultiPrinter.

- Chapter 8 describes the basic features and characteristics of the LA310 MultiPrinter.
- Chapter 9 describes the the printing of the physical page on the LA310 MultiPrinter.
- Chapter 10 describes the initial state of the printer.
- Chapter 11 describes how status and error messages are handled.
- Chapter 12 describes the fonts and font cartridges available on the LA310 MultiPrinter.
- Chapter 13 describes the sixel graphics considerations for the LA310 MultiPrinter.
- Chapter 14 describes the control characters and their functions on the LA310 MultiPrinter.

8

General Information About the LA310 MultiPrinter

This chapter contains the following information about the LA310 MultiPrinter:

- Description of the LA310 MultiPrinter, Section 8.1
- Protocol extensions and exceptions, Section 8.2
- Alternate protocols, Section 8.3
- Cartridges, Section 8.4

8.1 Description of the LA310 MultiPrinter

The LA310 MultiPrinter is a wide-carriage impact dot-matrix printer, designed for general business applications. It has flexible paper handling, and is capable of printing on continuous pinfeed paper, single sheets, multiple-part forms, and envelopes. A Pull Tractor is available as an option for greater accuracy in positioning multiple-part forms. The print quality is suitable for word processing in a small-to-medium computer environment.

The LA310 MultiPrinter:

- Is a 9-pin printer.
- Has a Document on Demand capability (automatic or manual), which prevents wasting forms or paper between printing jobs.
- Has an Automatic Viewing capability, which allows the user to see the last printed line after a job has finished.
- Can be connected at the same time to serial and parallel ports, and switches automatically between them when data is received.
- Has protocol switching. The protocol can be switched from the front panel or by software (see Section 8.3). Also, different protocols can be assigned to the serial and parallel ports. The printer will switch to the assigned protocol when a port is selected.

- Has a slot for optional cartridges for one of the following:

  Additional protocol emulations
  Fonts
  Additional character sets

  Refer to Section 8.4.

For information about installing and using the LA310 MultiPrinter, see the *LA310 MultiPrinter Installation/User's Guide*.

8.2 DEC PPL2 Extensions and Exceptions

Note

References are made in this manual to Chapter 7 (Command Dictionary) of the associated manual *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*. For brevity in this document, that chapter is called "Command Dictionary."

The implementation of DEC PPL2 on the LA310 MultiPrinter involves a number of extensions and exceptions, which are summarized in Table 8–1 and Table 8–2. For further information, see Table 11–1, and also refer to the Command Dictionary.

Table 8–1 DEC PPL2 Extensions

Extensions
Download font (DECDLD)
Sixel graphics
Hebrew character sets
Katakana character set
Greek character sets
Turkish character sets
Metric line spacing

Table 8–2 DEC PPL2 Exceptions

Exceptions
Bell
LA210, LA120, LA50 alias Device Attributes Report (DA) parameters
Control Representation Mode (CRM)
Protocol switching
Horizontal Page Width Alignment (DECHPWA)
Loading Factory NVR (DECFNVR)
Answerback (DECLANS, ENQ)
Automatic Test Mode (DECSATM, DECCKSR)

8.3 Alternate Protocols Supported by the LA310 MultiPrinter

This part of the manual describes the DEC PPL2 protocol as implemented on the LA310 MultiPrinter. The LA310 MultiPrinter also emulates the protocols for printing on the following devices:

- IBM Proprinter III
- Epson FX-1050

The protocol mode is changed using either the Select Other Coding System (SOCS)/Return from Other Coding System (ROCS) command combination or the IBM Proprinter Emulation Mode (DECIPEM) command. These commands are described in the Command Dictionary.

Table 8–3 lists the SOCS/ROCS command sequence to enter emulation mode for each of the protocols supported by the LA310 MultiPrinter.

Table 8–3 SOCS/ROCS Commands for Each Emulation Mode

Emulation Mode	SOCS/ROCS Command
IBM Proprinter	ESC % =
EPSON ESC/P	ESC % SP 2
Return to DEC PPL2	ESC % @

8.4 Cartridges Supported by the LA310 MultiPrinter

The LA310 MultiPrinter has a slot for an optional cartridge. Cartridges are available to supply the following additional capabilities:

- Fonts
- Protocol emulations
- Additional character sets

To insert the cartridge, turn the printer power off, insert the cartridge, and turn the power back on. If you insert the cartridge while the printer is powered on, the printer may not be able to select and use the cartridge. Select PRINT while in setup mode to print full details of the contents of the installed cartridge. See the *LA310 MultiPrinter Installation/User's Guide* for further information about installing and using cartridges.

9

Physical Page Characteristics of the LA310 MultiPrinter

This chapter explains how the LA310 MultiPrinter printer handles the transfer of the logical page in memory to the physical paper. Topics include:

- Paper handling, Section 9.1
- Response to a Form Feed request, Section 9.2
- Horizontal text resolution, Section 9.3
- Vertical text resolution, Section 9.4
- Limits on partial line motion, Section 9.5
- Tab support, Section 9.6

In this chapter the top of form paper position is defined as the position of line 1 on the page. This position does not change with the top margin setting. The form length is defined by the setup feature or by the Set Lines Per Page (DECSLPP) command.

9.1 Paper Handling

This section summarizes the paper feed modes and loading processes for the LA310 MultiPrinter.

Note

In both paper-feed modes, if paper is loaded before the printer is powered on, the paper position is assumed to be the top of form.

Fanfold Paper — Rear Feed/Top or Rear Output (Push Tractor Mode and Pull Tractor Option)

Paper is considered autoloaded when the printer loads it automatically at power-up or when the user presses the Form Feed (FF) button.

Paper is considered manually loaded when the user inserts it using the platen knob.

The LA310 MultiPrinter can detect the top of the first form only.

The LA310 MultiPrinter uses the form length, as determined by the setup feature or by the Set Lines Per Page (DECSLPP) command, to compute the tops of forms other than the first.

Cut Sheet Paper — Manual Feed/Top Insertion and Top Output (Friction Mode)

Paper is considered autoloaded when the printer loads it automatically at power-up or when the user presses the Form Feed (FF) button.

Paper is considered manually loaded when the user inserts it using the platen knob.

9.2 Response to Form Feed (FF)

The following information refers to paper motion when the Form Feed (FF) control code is received; actions that occur when the user presses the Form Feed (FF) button are not covered.

Fanfold Paper — Rear Feed

When paper is autoloaded, Form Feed (FF) advances the paper to the next top of form.

Cut Sheet Paper — Manual Feed

If paper is not currently loaded, Form Feed (FF) is stored and does not load paper. If paper is currently loaded, Form Feed (FF) ejects the current sheet if the physical paper length is equal to, or shorter than, the logical paper length, as defined during setup or by DECSLPP. If the physical paper length is larger that the logical paper length, Form Feed (FF) advances paper to the next top of form.

9.3 Horizontal Text Resolution

The LA310 supports a horizontal resolution of 1/7920" internally, allowing it to maintain accurate positioning for all horizontal pitches. When translating to the physical resolution of 1/720", positioning accuracy will be lost for the pitches indicated in Table 9–1, but in all cases it will be no more than 1/1440". This error does not accumulate from character to character so there is no overall error accumulation across a line of text.

Note

For Sixel Graphics mode resolution fallbacks, see Table 13–2.

Table 9–1 Horizontal Text Resolution and Error

Target Pitch	Actual in 1/7920"	Actual in 1/720"	Error
5	1584	144	None
6	1320	120	None
6.6	1200	109.091	±1/1440"
8.25	960	87.273	±1/1440"
10	792	72	None
12	660	60	None
13.2	600	54.545	±1/1440"
15	528	48	None
16.5	480	43.637	±1/1440"
17.1 (14/240")	462	42	None
18	440	40	None

9.4 Vertical Text Resolution

The LA310 MultiPrinter supports the metric line spacing parameters under Set Vertical Pitch (DECVERP) in the Command Dictionary.

The LA310 MultiPrinter uses approximations for the metric line spacing parameters. These approximations are given in Table 9–2.

Table 9–2 Text Vertical Pitch Fallbacks

Target Pitch	Actual in 1/2160"	Fallback pitch	Error per A4 page
1 lpcm (2.54 lpi)	850	1.0046318 lpcm 2.54117647 lpi	0.14 mm
2 lpcm (5.08 lpi)	425	2.00092635 lpcm 5.08235294 lpi	0.13 mm
4 lpcm (10.16 lpi)	213	3.99245869 lpcm 10.14084507 lpi	0.57 mm

9.5 Limits on Partial Line Motion

The LA310 MultiPrinter limits the Partial Line Up (PLU) count to 12, due to mechanical limitations.

When using cut sheet media, due to mechanical limitations in the LA310 MultiPrinter, partial line movement is limited to two levels between 125 mm and 50 mm from the bottom of the sheet. The number of levels of partial line movement is maintained similarly, but with a limit of 2 instead of 12.

When the printer detects the end of the media, when using continuous or cut-sheet media, although printing is enabled, the Partial Line Up (PLU) command and the Partial Line Down (PLD) command are not executed. As a result, there is no partial line motion for the last 50 mm of the media.

9.6 Tabs

The LA310 MultiPrinter supports a maximum of 256 horizontal tabs and a maximum of 252 vertical tabs.

10

Initial State Values for the LA310 MultiPrinter

This chapter lists the values used by the LA310 MultiPrinter printer for:

- A power-up reset or a recall of factory default values
- The Select Conformance Level (DECSCL) command
- The Soft Terminal Reset (DECSTR) or Reset to Initial State (RIS) commands

10.1 Initial States

Table 10–1 lists the initial state values used by the LA310 MultiPrinter. The printer always powers up in Ready mode if no error is detected.

Table 10–1 Initial State Values for LA310

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Protocol	Unchanged	NVM[1]	Unchanged	Port Dependent
Origin (DECHPWA)	Unchanged	0	Unchanged	0
Vertical pitch	6 lpi	NVM	NVM	6 lpi
Horizontal pitch	10 cpi	NVM	NVM	10 cpi
Active position	Origin	Origin	Origin	Origin[2]

[1]NVM indicates that the initial state value is stored in the nonvolatile memory of the LA310.

[2]Device performs conditional form feed on exit from setup

(continued on next page)

Table 10–1 (Cont.) Initial State Values for LA310

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Horizontal tabs[3]	Every eight	Every eight	Every eight	Every eight
Line Feed/New Line	Reset	NVM	NVM	Reset
CR/New Line Mode	Reset	NVM	NVM	Reset
SGR attributes	Disabled	Disabled	Disabled	Disabled
Density (DECDEN)	Draft	NVM	NVM	Draft (Software control)
Unidirectional Print Mode	Reset	Reset	Reset	Reset
Vertical tabs[4]	Every line	Every line	Every line	Every line
G0 character set	ASCII	NVM	NVM	ASCII
G1 character set	ASCII	ASCII	ASCII	ASCII
G2 character set	User Pref.	User Pref.	User Pref.	User Pref.
G3 character set	User Pref.	User Pref.	User Pref.	User Pref.
GL character set	G0	G0	G0	G0
GR character set	G2	G2	G2	G2
User Preference Set	DEC Supp.	NVM	Unchanged	DEC Supp.
Autowrap Mode	Set	NVM	NVM	Set
Unsolicited status reports	Disabled	Disabled	Unchanged	Disabled
Initialization Message	Unchanged	NVM	Unchanged	Disabled
Downloaded fonts	Deleted	None	Unchanged	None
Typestyle (SGR #)	10	NVM	NVM	10
Auto Advance	Unchanged	NVM	Unchanged	Disabled

[3]Horizontal tabs are set every eight columns, starting with column 9 (9,17, . . .). All entries in the tab table are initialized. Initializing only those entries that are addressable on the currently selected paper size is incorrect.

[4]Vertical tabs are set every line or Vertical Advance Increment (VAI). All entries in the tab table are initialized. Initializing only those entries that are addressable on the currently selected paper size is incorrect.

(continued on next page)

Table 10–1 (Cont.) Initial State Values for LA310

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Paper Position at power-up	Unchanged	Line 1	Unchanged	Line 1
CRM	Unchanged	Disabled[5]	Unchanged	Disabled
C1 Receive	8-Bit	8-Bit	Unchanged	8-Bit
Device ID (DA)	Unchanged	NVM	Unchanged	DEC PPL2
Form Length	11"	NVM	NVM	11"
Margins	Paper edge	Paper edge	Paper edge	Paper edge
Automatic Test Mode	Unchanged	Disabled	Unchanged	Disabled

[5]When CRM is enabled by software, it can only be disabled by software or by powering down the printer. When CRM is enabled, the protocol switching commands that cause a power-up reset are not performed. The LA310 can also enable DUMP printing from the printer front panel. This mode cannot be disabled by software.

11

Status and Error Reporting for the LA310 MultiPrinter

This chapter explains how the LA310 MultiPrinter printer provides status information and handles error conditions. The topics include:

- Device Attributes Report, Section 11.1
- Secondary Device Attributes Report, Section 11.2
- Device Status Report, Section 11.3

Note

Device attribute and status reports are applicable only to the serial interface. Reports are not sent across the parallel interface.

11.1 Device Attributes Report (DAR)

The Device Attributes Report identifies the LA310 MultiPrinter to the host. During setup the user may specify that the printer identify itself as a generic level 2 printer or as a previous model Digital printer. See DAR in the Command Dictionary for more information.

When the Printer ID setup feature is set to conformance level 2, the generic DAR response is returned. The generic DAR response always begins with Ps1 = ?72. Subsequent parameters are shown in Table 11–1. Parameters are separated by a semicolon (;).

Table 11–1 Generic DAR Replies

Ps	Description
4	Sixels
5	Katakana character set
7	Dynamically Redefinable Character Sets (DRCS), also known as “download font extension”
12	Hebrew character set
23	Metric line spacing extension
24	Greek extension
26	Turkish extension

When the Printer ID setup feature is set to LA50, LA120, or LA210, an alias DAR response is returned. The alias DAR responses are shown in Table 11–2. Parameters are separated by a semicolon (;).

Table 11–2 Alias DAR Replies

Ps1	Additional Parameter	Printer ID Selection
?2		LA120
?10	3	LA210
?17		LA50

11.2 Secondary Device Attributes Report (DA2R)

The Secondary Device Attributes Report (DA2R) identifies the following information about the LA310:

- The printer model
- The major and minor firmware revision
- The presence of protocols other than DEC PPL2
- The firmware edit revision

The parameters of the DA2R response cannot be changed by software or from the front panel. Table 11–3 lists the DA2R parameters supported by the LA310.

The optional pull tractor cannot be detected by the LA310 firmware because of a hardware limitation; therefore, it cannot be reported by the DA2R.

Table 11–3 DA2R Response Parameters for LA310

Character Form	Code	Description
		Ps1
59	3/5 3/9	LA310
		Ps2
xx	3/*x* 3/*x*	Firmware version *x.x*
10	3/1 3/0	Version 1.0-yy
		Ps3
0	3/0	Always reported as “0”
		Ps4
20	3/2 3/0	IBM + EPSON FX-1050 emulation
??	3/? 3/?	IBM + Optional emulation†
		Ps5
yy	3/*y* 3/*y*	Firmware edit revision *yy*
00	3/0 3/0	Version x.x-00

†The value of Ps4 when an optional emulation cartridge is installed is equal to 4 plus the parameter supplied by the emulation cartridge. The value of 4 reflects the IBM Proprinter III emulation, which is always present. The EPSON FX-1050 emulation is assigned a value of 16, making the normal value of Ps4 20 (4+16).

11.3 Device Status Report (DSR)

The codes generated by the LA310 MultiPrinter for the extended Device Status Report (DSR) are given in Table 11–4. When the LA310 MultiPrinter sends more than one code, only the first is preceded by a question mark (?).

Table 11–4 DSR Codes

Ps	Description	Reference
?20	No malfunction	
?22	Communication failure (Event)	
?23	Input buffer overflow (Event)	
?24	Printer deselected (State)	
?26	Cover open (State)	
?27	Paper out (State)	
?40	Character set not available (Event)	Section 11.3.1
?42	Downline load error (Event)	Section 11.3.2
?45	Character beyond right margin (Event)	
?55	Alternate protocol error (Event)	Section 11.3.3
?57	First report since initialization (Event)	Section 11.3.4

Definitions for “Event” and “State” in Table 11–4 are given in the Command Dictionary, under DSR.

The following table gives two DSR examples:

Extended Report	Meaning
ESC [0 n ESC [? 20	No error
ESC [3 n ESC [? 24 ; 26 n	Printer offline; cover open

11.3.1 Character Set Not Available

This error occurs when a character is to be printed and the currently designated character set is not available at any print density from any source, including built-in, cartridge, or downloaded font files.

11.3.2 Download Font Error

This error occurs when Download Font (DECDLD) sequence is ignored because of some error condition. Refer to the discussion of DECDLD in the Command Dictionary.

Note

When the "Input Buffer" feature is set to 32K, no fonts can be downloaded into the LA310 MultiPrinter and the DECDLD sequence is ignored.

11.3.3 Alternate Protocol Error

This error occurs when an alternate protocol that is not available in the printer (built-in or in a cartridge) is selected with the Select Other Coding System (SOCS) command.

11.3.4 Initialization Messages

If the serial port becomes active when the automatic port selection is enabled, and this feature is enabled with the INIT. REPORT feature in the DEC PPL2 sub-menu, an unsolicited extended Device Status Report (DSR) is issued reflecting the state of the printer when the LA310 MultiPrinter completes a power-on.

The parameter value of the initial brief report indicates "Device Ready" (Ps=0) or "Device Not Ready" (Ps=3), as appropriate.

The first parameter value of the extended report uses the "First report since initialization" value from Table 11–4. If any additional error conditions are present, the parameter values for these errors are also reported.

Table 11–5 shows the possible initialization messages.

Table 11–5 Initialization Messages

Extended Report	Meaning
ESC [0 n ESC [? 5 7 ; 2 0 n	Printer ready to print; just switched on
ESC [3 n ESC [? 5 7 ; 2 6 n	Printer just switched on; cover open
ESC [3 n ESC [? 5 7 ; 2 7 n	Printer just switched on; paper out

If an error condition other than paper out exists when the printer is powered up (hardware failure, carriage error), the initialization message is not sent until the error condition is cleared.

The extended report is sent after the initial XON character is sent, following a power-up. It is provided for applications or symbionts that need to know if the device has been powered on recently and may be reset to an unknown state.

Status and Error Reporting for the LA310 MultiPrinter
11.3 Device Status Report (DSR)

This feature can be enabled or disabled during setup. Refer to Section A.4 for information on the interaction of this feature with automatic port selection.

12

Fonts and Character Attributes on the LA310 MultiPrinter

This chapter gives information on:

- The built-in font repertory, Section 12.1
- Additional character sets, Section 12.2
- The optional cartridge, Section 12.3
- Select Graphic Rendition (SGR) command for cartridge font selection, Section 12.4
- Density selection, Section 12.5
- Download font, Section 12.6
- Slant, Section 12.7

12.1 Built-In Font Repertory

The built-in font repertory of the LA310 MultiPrinter includes all character sets listed in Table 12–1 (at all pitches and densities), with two exceptions:

- ISO Latin-2 Supplemental
- ISO Latin-Cyrillic Supplemental

These two character sets are provided in an optional cartridge. Refer to Section 12.3.

Fonts and Character Attributes on the LA310 MultiPrinter
12.1 Built-In Font Repertory

Table 12–1 Supported Character Sets

Character Set	I_2 F Designator Characters	Code
94-Character Sets		
British	A	4/1
ASCII	B	4/2
DEC Dutch	4	3/4
DEC Finnish	5	3/5
French	R	5/2
DEC French-Canadian	9	3/9
German	K	4/11
DEC Hebrew Supplemental[1]	"4	2/2, 3/4
DEC 7-Bit Hebrew[1]	%=	2/5, 3/13
ISO Italian	Y	5/9
Legal	%4	2/5, 3/4
JIS Katakana[1]	I	4/9
JIS Roman	J	4/10
DEC Norwegian/Danish	6	3/6
ISO Spanish	Z	5/10
DEC Swedish	7	3/7
DEC Swiss	=	3/13
Norwegian/Danish	`	6/0
DEC Supplemental[1]	%5	2/5, 3/5
DEC Technical[1]	>	3/14
DEC Special Graphics	0	3/0
DEC Portuguese	%6	2/5, 3/6
DEC 7-Bit Turkish[1]	%2	2/5, 3/2
DEC 8-Bit Turkish Supplemental[1]	%0	2/5, 3/0
DEC Greek Supplemental[1]	"?	2/2, 3/15

[1]Character sets that can be designated by DECAUPSS

(continued on next page)

Table 12–1 (Cont.) Supported Character Sets

Character Set	I_2 F Designator Characters	Code
96-Character Sets		
ISO Latin-1 Supplemental[1]	A	4/1
ISO Latin-2 Supplemental[1]	B	4/2
ISO Latin-Greek Supplemental[1]	F	4/6
ISO Latin-Hebrew Supplemental[1]	H	4/8
ISO Latin-Cyrillic Supplemental[1]	L	4/12
ISO Latin-5 Supplemental[1]	M	4/13

[1]Character sets that can be designated by DECAUPSS

12.2 Additional Character Sets

Additional character sets in a character set cartridge are available for selection if the cartridge was installed at the time the printer was powered up. These additional character sets are addressable in the same way as the built-in sets:

- Through setup selection (G0 Character set or User Preference Character set)
- Through the Select Character Set (SCS) escape sequence or the Assign User Preference Supplemental Set (DECAUPSS) escape sequence if the character set selected is a valid choice (see Table 12–1)

The Select Graphic Rendition (SGR) escape sequence is not needed for selecting fonts when the character sets provided by the cartridge are designed in the built-in typestyle.

12.3 Optional Cartridge

The optional cartridge is described in Table 12–2.

Table 12–2 Available Optional Cartridge

Part Number	Cartridge Name	Character Sets in the Cartridge
LA31X-CA	ISO Latin-2 Cyrillic	DEC PPL2 mode: ISO Latin-2 Supplemental,ISO Latin-Cyrillic Supplemental Proprinter and EPSON modes, IBM code pages: ISO Latin-2 (852), Russian (866)

A comprehensive listing of the contents of the installed cartridge is performed by the printer in setup mode.

For details of other cartridges that may be available, contact your Digital sales representative.

The LA310 MultiPrinter applies all built-in algorithmic transformations (bold, slant, density, underlining, and so on) to the alternative typestyle or character set in the same way as it does to the built-in fonts. All characters in the alternative typestyle or character sets can be printed at any of the horizontal pitches supported by the printer.

12.4 Select Graphic Rendition (SGR) — Cartridge Font Selection

In the LA310 MultiPrinter, all ten font selection parameter values of the Select Graphic Rendition (SGR) command are assigned the built-in Courier typestyle. Font cartridges, when present, override these default font assignments.

The LA310 MultiPrinter suports one font cartridge position. Each typestyle in the font cartridge will provide an SGR parameter value that will be assigned to the typestyle, overriding the default assignment of the built-in typestyle at power-up. Each LA310 font cartridge may provide one or two typestyles.

12.5 Density Selection (DECDEN)

The LA310 MultiPrinter supports built-in fonts for the Draft, High-Speed Draft, and Near Letter Quality 2 (NLQ2) densities. An additional Near Letter Quality (NLQ1) font is generated algorithmically from the Draft font.

Table 12–3 specifies the supported values for the DECDEN command.

Table 12–3 DECDEN Parameters for LA310

Ps	Selection
0	Selects High Speed Draft print density.
1	Selects High Speed Draft print density.
2	Selects Near Letter Quality 2 (NLQ2) print density.
3	Selects Draft print density.
4	Selects Near Letter Quality 1 (NLQ1) print density.

Note

There is an interaction between DECDEN and the PRINT QUALITY feature in the GENERAL set-up menu.

If the PRINT QUALITY feature is set to "software control," DECDEN is active. If it is set to "HSD Locked," "NLQ1 Locked," or "NLQ2 Locked," the print quality is locked to the appropriate setting and subsequent DECDEN commands are stored. When the print quality is unlocked by the front panel switch, the LA310 MultiPrinter processes the stored DECDEN commands.

The bold, overline, and slant attributes are not available in High Speed Draft (HSD) mode. When these attributes and the High Speed Draft density are both specified, the LA310 MultiPrinter will temporarily use the Draft density for printing.

12.6 Download Font—DECDLD

The Pss parameter of the DECDLD command indicates the print density for the downloaded font. The font set sizes associated with the print densities supported by the LA310 are given in Table 12–4. For more information on DECDLD, refer to the Command Dictionary.

Table 12–4 DECDLD Font Set Sizes (Pss)

Pss	Print Density
0	Draft

(continued on next page)

Table 12–4 (Cont.) DECDLD Font Set Sizes (Pss)

Pss	Print Density
1	Draft
3	Near Letter Quality 2
4	High Speed Draft

The Near Letter Quality (NLQ1) density for a downloaded font file is generated algorithmically by the LA310 from the downloaded Draft font file.

The supported DECDLD matrix widths for the LA310 are given in Table 12–5.

Table 12–5 DECDLD Matrix Width (Pcmw)

Pcmw	Print Density
8	Normal text High Speed Draft
11	Normal text Draft (default)
23	Normal text Near Letter Quality 2

The DECDLD matrix heights for the LA310 MultiPrinter are given in Table 12–6.

Table 12–6 DECDLD Matrix Heights (Pcmh)

Pcmh	Print Density
8	Normal text High Speed Draft
8	Normal text Draft (default)
16	Normal text Near Letter Quality 2

Any sequence with inconsistent density parameters (Pss and Pcmw) is ignored. For instance, a Pss value of 0, meaning Draft, with a Pcmw of 16, meaning a Near Letter Quality 2 matrix width, will cause the sequence to be ignored.

The Erase Control (Pe) parameter differs from the description in the Command Dictionary. The parameter values recognized by the LA310 are given in Table 12–7.

Table 12–7 DECDLD Erase Control (Pe)

Pe	Erase Control
0	Erase all characters in all set sizes in the specified font buffer.
1	Erase only the characters that are loaded.
2	Erase all characters in all set sizes in all font buffers.
3	Erase all characters in the specified set size and font buffer.

The LA310 Multiprinter allows you to load fonts for three different densities into a font buffer. You must use a Pe value of 3 when downloading more than one density into a font buffer to prevent previously loaded fonts in a different density from being erased.

The LA310 font file download capability is limited by the following considerations:

- Full cell fonts (Pu = 2) are not supported by the LA310 MultiPrinter. A DECDLD protocol selector with a Pu value of 2 will be ignored by the LA310 MultiPrinter.
- The LA310 MultiPrinter supports 2 font buffers, each supporting Draft, High-Speed Draft, and Near Letter Quality 2 (NLQ2) densities. The Near Letter Quality (NLQ1) density for the downloaded font file can be generated algorithmically by the printer from the downloaded Draft font file.

DECDLD control string error handling differs from the description in the Command Dictionary. If the Dscs string is found to be invalid, the remainder of the control string is ignored, but the effects of any parameters (such as Pe, Erase Control) will take effect.

12.7 Slant

The LA310 MultiPrinter supports the Select Graphic Rendition (SGR) attribute for slant by algorithmically slanting the characters.

Slant is performed in one pass with double horizontal resolution. In draft and HSD modes, printing is slower in slant than in normal draft mode. Slant is performed in the same way for NLQ1 and and NLQ2 modes, but without any impact on the normal printing speed for these densities.

See SGR in the Command Dictionary.

13

Sixel Graphics Considerations on the LA310 MultiPrinter

This chapter explains the graphics resolution capability of the LA310 MultiPrinter.

13.1 Graphics Resolution

Since the LA310 does not support a physical horizontal resolution of 1/660", it needs to "fall back" to a different grid size when some grid sizes are requested. Table 13–1 shows the values that the LA310 uses for the macro parameter (Ps1) of the Sixel Graphics mode protocol selector.

Table 13–1 Graphics Pitch Fallbacks

Macro Value	Horizontal Grid Size (inches)	Actual Aspect Ratio (Vert pixels:horiz pixels)	Target Aspect Ratio
0 or None	1/144" (.0069)	200:100	200:100
1	1/144" (.0069)	200:100	200:100
2, fallback to:	1/180" (.0056)	250:100	450:100
3, fallback to:	1/180" (.0056)	250:100	300:100
4,	1/180" (.0056)	250:100	250:100
5, fallback to:	1/144" (.0069)	200:100	183:100
6, fallback to:	1/144" (.0069)	200:100	150:100
7, fallback to:	1/144" (.0069)	200:100	130:100
8, fallback to:	1/144" (.0069)	200:100	112:100
9 fallback to:	1/72" (.0139)	100:100	100:100
>9	1/144" (.0069)	200:100	200:100

Table 13–2 shows the horizontal grid size (HGS) and vertical grid size (VGS) fallbacks relative to the requested horizontal grid size and the aspect ratio.

Sixel Graphics Considerations on the LA310 MultiPrinter
13.1 Graphics Resolution

The printer attempts to preserve the requested aspect ratio without exceeding the requested horizontal grid size (as defined by Pn3 of the protocol selector).

The aspect ratio is provided by Ps1 or Set Raster Attributes (DECGRA).

First the printer ensures that the aspect ratio is one of the supported values (1:1, 2:1, 2.5:1):

- If aspect ratio is less than 1.5:1, fall back to 1:1
- If aspect ratio is greater than or equal to 1.5:1 and less than 2.25:1, fall back to 2:1
- If aspect ratio is greater than or equal to 2.25:1, fall back to 2.5:1

Then the printer computes the HGS and VGS values that best match the aspect ratio and requested Pn3 value.

Table 13–2 Graphics Grid Size Fallbacks

		Vertical Grid Size by Aspect Ratio with HGS Fallbacks (If Any)		
Pn3 Decipoints	**Horizontal Grid Size**	**1:1**	**2:1**	**2.5:1**
0 or none	No change to HGS and VGS defined by Ps1			
1–3	Fallback to 4 decipoints			
4	1/180"	1/144"[1,2]	1/72"[1]	1/72"
5	1/144"	1/144"[2]	1/72"	VGS fallback to 1/72" HGS fallback to 1/180"
6–9	Fallback to 5 decipoints			
10	1/72"	1/72"	VGS fallback to 1/72" HGS fallback to 1/144"[2]	VGS fallback to 1/72" HGS fallback to 1/180"
> 10	Fallback to 10 decipoints			

[1]Aspect ratio is not preserved with this combination.

[2]The vertical grid size of 1/144" is approximated by two passes of the printhead shifted by 1/216".

14

Control Characters for the LA310 MultiPrinter

This chapter describes the control characters for the LA310 MultiPrinter and their functions. The control characters are:

- Bell, described in Section 14.1
- EOT, described in Section 14.2
- ENQ, described in Section 14.3

14.1 Bell

The LA310 MultiPrinter has an audio indicator, or bell. The bell can be configured using setup to sound one beep, to sound three beeps, to sound continuously, or not to sound at all when an error occurs. When the device receives a Bell (BEL) control character, it always sounds one beep.

14.2 EOT

When "DISCON/EOT" is enabled by the setup facility, the DTR signal on the serial port is dropped for 5 seconds when the End of Transmission (EOT) control code is received. This feature applies only if the serial port is active. See the setup feature DISCON/EOT, in the *LA310 MultiPrinter Installation /User's Guide*.

14.3 ENQ

When "ANSWERBACK/ENQ" is enabled by the setup facility, the answerback message is sent by the printer on receipt of the Enquire (ENQ) character. This feature only applies when the serial port is active. See the setup feature ANSWERBACK/ENQ in the *LA310 MultiPrinter Installation/User's Guide*. Also see the Load Answerback (DECLANS) command in Appendix C.

Part III

LA600 MultiPrinter

Part III of the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Supplement* describes the DEC PPL2 protocol as implemented by the LA600 MultiPrinter.

- Chapter 15 describes the basic features and characteristics of the LA600 MultiPrinter.
- Chapter 16 describes the the printing of the physical page on the LA600 MultiPrinter.
- Chapter 10 describes the initial state of the printer.
- Chapter 18 describes how status and error messages are handled.
- Chapter 19 describes the fonts and font cartridges available on the LA600 MultiPrinter and its bar code capability.
- Chapter 21 describes the sixel graphics considerations for the LA600 MultiPrinter.
- Chapter 22 describes the control characters and their functions on the LA600 MultiPrinter.

15

General Information About the LA600 MultiPrinter

This chapter contains the following information about the LA600 MultiPrinter:

- Description of the LA600 MultiPrinter, Section 15.1
- Protocol extensions and exceptions, Section 15.2
- Alternate protocols, Section 15.3
- Additional interfaces with additional protocols, Section 15.4
- Color printing, Section 15.5
- Cartridges, Section 15.6

15.1 Description of the LA600 MultiPrinter

The LA600 MultiPrinter is a high-speed impact dot-matrix printer, designed for general business applications. With flexible paper-handling capabilities, the LA600 MultiPrinter can print on continuous pinfeed paper and multiple part forms, single sheets, envelopes, and labels. The automatic sheet feeder can accept up to three input trays, for standard single sheets, heavy stock, multicopy forms, and envelopes. The print quality is suitable for word processing in a small-to-medium computer environment.

The LA600 MultiPrinter:

- Is a 24-pin printer, with a vertical density of 180 dpi.
- Can print in six colors, in addition to black and white.
- Has a Document on Demand capability (automatic or manual), which prevents wasting forms or paper between printing jobs.
- Accepts optional boards called Personality Modules that provide other interfaces and protocols.

- Can be connected at the same time to serial and parallel ports, and switches automatically between them when data is received.
- Has a slot for optional cartridges for additional fonts or character sets.

15.2 DEC PPL2 Extensions and Exceptions

Note

References are made in this manual to Chapter 7 (Command Dictionary) of the associated manual *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*. For brevity in this document, that chapter is called "Command Dictionary."

The implementation of DEC PPL2 on the LA600 MultiPrinter involves a number of extensions and exceptions, which are summarized in Table 15–1 and Table 15–2. For further information, refer to the Command Dictionary.

Table 15–1 DEC PPL2 Extensions

Extensions
Sixel graphics
Cyrillic character sets
Hebrew character sets
Katakana character set
Greek character sets
Turkish character sets
Metric line spacing
Color
Sheet feeder

Table 15–2 DEC PPL2 Exceptions

Exceptions
LA210, LA120, LA50 alias Device Attributes Report (DA) parameters
Control Representation Mode (CRM)

(continued on next page)

Table 15–2 (Cont.) DEC PPL2 Exceptions

Exceptions
Protocol switching
Horizontal Page Width Alignment (DECHPWA)
Answerback (DECLANS, ENQ)
Proportional Spacing (DECPSP)
Graphic Size Modification (GSM)
Select Input Tray Failover (DECSITF)
Paper Exit Control (DECPEC)
Printhead Gap Setting (DECPHGC)
Bar Code Printing (DECSBCA, DECBAR)

15.3 Alternate Protocols Supported by the LA600 MultiPrinter

This part of the manual describes the DEC PPL2 protocol as implemented on the LA600 MultiPrinter. The LA600 MultiPrinter also emulates the protocols for printing on the following devices:

- IBM Proprinter XL24
- Epson LQ1060/2550

The protocol mode is changed using either the Select Other Coding System (SOCS)/Return from Other Coding System (ROCS) command combination or the IBM Proprinter Emulation Mode (DECIPEM) command. These commands are described in the Command Dictionary.

Table 15–3 lists the SOCS/ROCS command sequence to enter emulation mode for each of the protocols supported by the LA600 MultiPrinter.

Table 15–3 SOCS/ROCS Commands for Each Emulation Mode

Emulation Mode	SOCS/ROCS Command
IBM Proprinter	ESC % =
EPSON ESC/P	ESC % SP 2
Return to DEC PPL2	ESC % @

15.4 Additional Interfaces with Additional Protocols

Optional boards, called Personality Modules, are available for the LA600 MultiPrinter, as follows:

LA60X-SI Serial/Parallel with IBM, EPSON, and Philips protocols
LA60X-CX IBM COAX
LA60X-TX IBM TWINAX
LA60X-ET Ethernet

15.5 Color Printing Provided by the LA600 MultiPrinter

With the optional four-color ribbon installed, the LA600 MultiPrinter produces up to eight different colors:

Yellow
Magenta
Cyan
Black
Red (magenta and yellow)
Green (yellow and cyan)
Blue (magenta and cyan)
White (no printing)

Eight colors can be produced from the four-color ribbon (yellow, magenta, cyan, and black) because they can be selected individually and in combinations.

The LA600 MultiPrinter supports the Select Graphic Rendition (SGR) color text parameters listed in the Command Dictionary. In Sixel Graphics mode, the LA600 MultiPrinter prints black and white or color sixels, using the 8-color columns from the HLS and RGB color maps in the Sixel Graphics chapter of the Reference Manual.

15.6 Cartridges Supported by the LA600 MultiPrinter

The LA600 MultiPrinter has a slot for an optional cartridge, and cartridges are available to supply additional fonts and character sets. For more information, consult your Digital Sales Representative.

Before inserting the cartridge, turn the printer power off. Then insert the cartridge, and turn the power back on. If you insert the cartridge while the printer is powered on, the printer may not be able to select and use the cartridge. Select PRINT TEST 3 in setup mode to print the fonts and character sets including the cartridge-based fonts and character sets supported by the printer. A few lines of text in each font are also printed.

16

Physical Page Characteristics of the LA600 MultiPrinter

This chapter explains how the LA600 MultiPrinter printer handles the transfer of the logical page in memory to the physical paper. Topics include:

- Paper handling, Section 16.1
- Automatic Sheet Feeder control, Section 16.3
- Response to a Form Feed request, Section 16.2
- Paper tray selection, Section 16.4
- Paper exit selection, Section 16.5
- Printhead gap control, Section 16.6
- Horizontal text resolution, Section 16.7
- Vertical text resolution, Section 16.8
- Limits on partial line motion, Section 16.9
- Size of the print area, Section 16.10
- Logical page to physical sheet mapping, Section 16.11
- Tab support, Section 16.12

In this chapter the top of form paper position is defined as the position of line 1 on the page. This position does not change with the top margin setting. The form length is defined by the setup feature or by the Set Lines Per Page (DECSLPP) command.

16.1 Paper Handling

This section summarizes the three paper feed modes and loading processes for the LA600 MultiPrinter.

Fanfold Paper — Front Feed/Rear Output (Tractor Mode)

Paper in parked position loads automatically when data is received.

At power-up, when the LA600 MultiPrinter is not at line 1, column 1, or in parked position, the printer performs a conditional Form Feed to reset Top of Form (TOF). The LA600 MultiPrinter can detect the top of the first form only.

The LA600 MultiPrinter uses the form length, as determined by the setup feature or by the Set Lines Per Page (DECSLPP) command, to compute the tops of forms other than the first.

Cut Sheet Paper — Manual Feed/Front Insertion and Top or Front Output (Friction Mode)

Paper is automatically ejected if present in the paper path at power-up.

Paper is automatically loaded when paper is pre-inserted and the first data is received.

Cut Sheet Paper — Automatic Sheet Feed/Top Insertion and Top or Front Output (Friction Mode)

Paper is automatically ejected if present in the paper path at power-up.

Paper is automatically loaded when paper is already inserted and the first data is received.

16.2 Response to Form Feed (FF)

The following information refers to paper motion when the Form Feed (FF) control code is received; actions that occur when the user presses the Form Feed button are not covered.

Fanfold Paper — Front Feed

When paper is loaded, FF advances the paper to the next top of form.

Cut Sheet Paper — Manual Feed

If paper is not present, FF causes no action. If paper is pre-inserted, FF causes no action (paper remains unaffected). If paper is loaded, FF ejects the sheet.

Automatic Sheet Feeder — Top Feed

If the selected bin is empty of paper, FF has no action. If the selected bin contains paper, FF has no action (paper remains unaffected). If paper is loaded into the bin, FF ejects the sheet.

Note

If the paper source is modified via the command DECASFC or the Operator Panel, the current cut sheet is ejected and the fanfold paper is parked automatically.

16.3 Automatic Sheet Feeder Control

To control its optional Automatic Sheet Feeder (ASF), the LA600 MultiPrinter uses the Automatic Sheet Feeder Control (DECASFC) command. If the sheet feeder is not installed, the LA600 performs a conditional sheet feed on receipt of the DECASFC. Table 16–1 provides the DECASFC parameters.

Table 16–1 Ps Parameters for DECASFC

Ps	Action
0	No selection change; conditional sheet feed is performed
1–3	Select tray 1–3; conditional sheet feed is performed
4	Tractor feed
99	Manual feed

If the active selection was tractor feed (Ps = 4) prior to a selecting a cut sheet tray input (Ps = 1–3 or 99), the LA600 attempts to perform a parking function automatically, under the following conditions:

1. The latest printed fanfold form is fed forward to tear-off position.
2. The printer goes offline, waiting for the Start/Stop key to be pressed. (At this stage, the user must remove the last form by tearing it off, and then press Start/Stop.)
3. The fanfold paper is moved back to the park position.

DECASFC resets the printhead gap control setting to the Automatic Gap Control (AGC) mode.

16.4 Paper Tray Selection (DECSITF)

The LA600 supports the command Select Input Tray Failover (DECSITF). When all of the paper trays in the composite tray definition are empty, a "paper out" condition occurs. Printing resumes when any of these trays is reloaded.

The LA600 supports the Ps2–Psn values from 1 to 3, with a maximum of 3 parameters. The printer does **not** support the combination Ps2, Ps3=1,3.

DECSITF causes a conditional sheet feed.

16.5 Paper Exit Control (DECPEC)

The LA600 supports the Paper Exit Control command, which applies to cut sheets only, as defined in Table 16–2.

Table 16–2 Ps Parameters for DECPEC

Ps	Selected Paper Exit
0 or 1	Paper stacker (top)
2	Front paper exit—confirmed by Start/Stop [1]
3	Front paper exit—**not** confirmed by Start/Stop [2]

[1]To resume printing, the user must remove the printed cut sheet from the front paper exit and press the Start/Stop key on the Operator Panel.

[2]The application controls the printing of the next sheet.

16.6 Printhead Gap Control (DECPHGC)

The LA600 supports the Printhead Gap Control (DECPHGC) command, which sets the distance between the printhead and the platen, as defined in Table 16–3.

Table 16–3 Ps Parameters for DECPHGC

Ps	Selected Mode
0	Automatic Gap Control (AGC)
1–6	Programmable Copy Control (PCC), defined by number of copies

The default mode is AGC. The AGC procedure is automatically activated when the paper is inserted and one of the following conditions occurs:

- The paper source has changed.
- Paper is inserted manually.
- Fanfold paper has moved from the parked position.
- Power-up has occurred.
- Printing resumes after an offline condition, which the resulted from either user action on the Start/Stop key or a fault.
- A DECPHGC command is received with Ps=0 on the previous page or prior to loading the paper.
- Paper is loaded at the time DECPHGC with Ps=0 is processed.

In AGC mode, the printer adjusts the printhhead after performing a paper thickness measurement at the active position. This reference point is the first print line, and the horizontal position is defined by setup, “ADJUSTMENT” feature, “AGC” function.

In PCC mode, the AGC function is inhibited. PCC mode remains active as long as the current paper or form is not ejected and the paper source does not change. The mode is reset when a DECASFC command with Ps=0 is received.

16.7 Horizontal Text Resolution

The LA600 maintains accurate positioning for all horizontal pitches. When translating to the physical resolution of 1/720", positioning accuracy will be lost for the pitches indicated in Table 16–4, but in all cases it will be no more than 1/1440". This error does not accumulate from character to character, so there is no overall error accumulation across a line of text.

Note

For Sixel Graphics mode resolution fallbacks, see Table 21–2.

Table 16–4 Horizontal Text Resolution and Error

Target Pitch	Selected HAI in Centipoints	Actual in 1/720"	Error
5	1440	144	None

(continued on next page)

Table 16–4 (Cont.) Horizontal Text Resolution and Error

Target Pitch	Selected HAI in Centipoints	Actual in 1/720"	Error
6	1200	120	None
6.6	1090	108.667	±1/2160" (6.625)
8.25	872	86.667	±1/2160" (8.308)
8.55 (28/240")	840	84	None 8.57
9	800	80	None
10	720	72	None
12	600	60	None
13.2	545	54.333	±1/2160" (13.252)
15	480	48	None
16.5	436	43.333	±1/2160" (16.615)
17.1 (14/240")	420	42	None
18	400	40	None

Horizontal pitch is modified by the Graphic Size Modification (GSM) command, as described in Section 19.6. Horizontal pitch is not modified by the typestyle selection, except for Data Block, for which proportional spacing is forced, described in Section 19.7.

16.8 Vertical Text Resolution

The LA600 MultiPrinter supports a vertical resolution of 1/2160" internally, allowing it to maintain accurate positioning for all line spacings using English units.

The LA600 MultiPrinter also supports the metric line spacing parameters under Set Vertical Pitch (DECVERP) in the Command Dictionary.

The LA600 MultiPrinter uses approximations for the metric line spacing parameters. These approximations are given in Table 16–5.

Table 16–5 Text Vertical Pitch Fallbacks

Target Pitch	Actual in 1/2160"	Fallback pitch	Error per A4 page
1 lpcm (2.54 lpi)	850	1.0046318 lpcm 2.54117647 lpi	0.14 mm
2 lpcm (5.08 lpi)	425	2.00092635 lpcm 5.08235294 lpi	0.13 mm
4 lpcm (10.16 lpi)	213	3.99245869 lpcm 10.14084507 lpi	0.57 mm

16.9 Limits on Partial Line Motion

The LA600 MultiPrinter does not limit the Partial Line Up (PLU) and Partial Line Down (PLD) motions within the printable area. Therefore, for cut sheet media fed manually or with the Automatic Sheet Feeder (ASF), the LA600 does not limit the PLU/PLD motion within the printable area.

16.10 Printable Area

The maximum print line length for the LA600 is 13.6 inches.

The maximum form length for fanfold paper, set by the command DECSLPP, is 21.8 inches, while it is 22 inches if set via the Operator Panel. For manually fed single sheets, the maximum length is 16.3 inches, and for single sheets fed by the ASF, it is 12.2 inches.

For the LA600, the minimum print line length set by the command Set Page Width Alignment (DECHPWA) is 5/12 inch; set by the command Set Left and Right Margins (DECSLRM), the minimum print line length is 4/10 inch. When the page width requested via DECHPWA is less than 5/12", the LA600 sets the page width to 5/12" and the origin as defined by *Pn1*. When the left and right margins selected via DECSLRM are less than 4/10" (converting the number of columns into distance using the active horizontal pitch), the LA600 sets the left margin according to *Pn1* and sets the right margin at a distance of 4/10" from the left margin.

The minimum vertical print space, set by the command DECSTBM, is 4/6 inch. When set via the Operator Panel, the minimum page length is 3 inches.

An attempt to set margins below the minimum value causes the printer to interpret top margin *Pn1* and to set bottom margin *Pn2* below 4/6".

If *Pn=0*, the device enters *no forms mode*. This mode is accessible via command sequence only. In this mode the Form Feed button on the Operator Panel is **not** processed as a Line Feed. The function of the button is unchanged.

16.11 Logical Page to Physical Sheet Mapping

To control page length for cut-sheet paper, the LA600 MultiPrinter uses the paper-in sensor. (The printer does not use a page-length setup menu nor the Set Lines Per Physical Page—DECSLPP—command.)

Simulating page length with cut-sheet paper can be achieved, however, with the command Set Top and Bottom Margins (DECSTBM). This method is effective because the bottom margin acts as the end of the page.

16.12 Tabs

The LA600 MultiPrinter supports a maximum of 128 horizontal tabs and a maximum of 128 vertical tabs.

17

Initial State Values for the LA600 MultiPrinter

This chapter lists the values used by the LA600 MultiPrinter printer for:

- A power-up reset or a recall of factory default values
- The Select Conformance Level (DECSCL) command
- The Soft Terminal Reset (DECSTR) or Reset to Initial State (RIS) commands

17.1 Initial States

Table 17–1 lists the initial state values used by the LA600 MultiPrinter. The printer always powers up in Ready mode if no error is detected.

Table 17–1 Initial State Values for LA600

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Active Macro	Unchanged	NVM[1]	Unchanged	Macro 1
Protocol	Unchanged	NVM	DEC PPL2[8]	DEC PPL2
Origin (DECHPWA)	Unchanged	0	Unchanged	0
Vertical pitch	6 lpi	NVM	NVM	6 lpi
Proportional mode	Reset	Reset	Reset	Reset
Horizontal pitch	10 cpi	NVM	NVM	10 cpi

[1]NVM indicates that the initial state value is stored in the nonvolatile memory of the LA600.

[8]RIS does not affect protocol (different behavior than DECSTR).

(continued on next page)

Table 17–1 (Cont.) Initial State Values for LA600

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
Vertical tabs	Reset	Reset	Reset	Reset
Active position	Origin[2]	Origin	Origin	Origin[2]
Horizontal tabs[3]	Every eight	Every eight	Every eight	Every eight
Line Feed/New Line	Reset	NVM	NVM	Reset
CR/New Line Mode	Reset	NVM	NVM	Reset
SGR attributes	Disabled	Disabled	Disabled	Disabled
SGR fonts	Courier	NVM	NVM	Courier
GSM	100%	100%	100%	100%
Density (DECDEN)	Draft	NVM[6]	NVM[6]	Draft
Bar Coding (DECBAR)	Reset	Reset	Reset	Reset
Bar Code Attributes (DECSBCA)	Code 39—Default	Code 39—Default	Code 39—Default	Code 39—Default
DECGCI—All color numbers (Pc)	Black	Black	Black	Black
Unidirectional Print Mode	Reset	Reset	Reset	Reset
Vertical tabs[4]	Every line	Every line	Every line	Every line
G0 character set	ASCII	NVM	NVM	ASCII
G1 character set	ASCII	ASCII	ASCII	ASCII
G2 character set	User Pref.	User Pref.	User Pref.	User Pref.
G3 character set	User Pref.	User Pref.	User Pref.	User Pref.
GL character set	G0	G0	G0	G0

[2]Device performs conditional form feed on exit from setup.

[3]Horizontal tabs are set every eight columns, starting with column 9 (9,17, . . .). All entries in the tab table are initialized. Initializing only those entries that are addressable on the currently selected paper size is incorrect.

[4]Vertical tabs are set every line or Vertical Advance Increment (VAI). All entries in the tab table are initialized. Initializing only those entries that are addressable on the currently selected paper size is incorrect.

[6]Print density at power-up is determined by two set-up features: the "FONT" feature provides a selection between *Draft* and any other type style that is available in the NLQ or LQ print densities; the "PRINT QUALITY" feature provides a selection between NLQ and LQ, on if "FONT" is not set to *Draft*.

(continued on next page)

Table 17–1 (Cont.) Initial State Values for LA600

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
GR character set	G2	G2	G2	G2
User Preference Set	DEC Supp.	NVM	NVM	DEC Supp.
Autowrap Mode	Set	NVM	NVM	Set
Unsolicited status reports	Disabled	Disabled	Unchanged	Disabled
Initialization message	Disabled	NVM	NVM	Disabled
Typestyle (SGR #)	10	NVM	NVM	10
CRM	Unchanged	Disabled[5]	Unchanged	Disabled
C1 Receive	8-Bit	8-Bit	Unchanged	8-Bit
Device ID (DA)	Unchanged	NVM	NVM	DEC PPL2
Form length	11"	NVM	NVM	11"
Paper Source (DECASFC) and Tray Failover (DECSITF)	Unchanged	NVM	NVM	Tractor
Paper Exit (DECPEC)	Unchanged	NVM	NVM	Stacker
Printhead Gap Control (DECPHGC)	AGC mode	AGC mode	AGC mode	AGC mode
Margins	Paper edge	NVM	NVM	Paper edge
Answerback message	Unchanged	NVM	Unchanged	Message unchanged in NVM[7]
Answerback/ENQ	Unchanged	NVM	NVM	Message unchanged in NVM[7]
Tear off	Unchanged	NVM	NVM	Disabled
Pre-Separation	Unchanged	NVM	NVM	Disabled

[5]Note that, when CRM is enabled by software, it can be disabled only by software or by powering down the printer. Protocol switching commands that would cause a reset are not performed when CRM is enabled. The LA600 can also enable DUMP printing from the printer front panel. This mode cannot be disabled by software.

[7]The factory default answerback message is no answerback message. The LA600 will send no message even if answerback is enabled through Set-Up.

(continued on next page)

Table 17–1 (Cont.) Initial State Values for LA600

Variable or Control Function	DECSCL	Power-Up	DECSTR RIS	Recall Factory Defaults (Setup)
EOT Disconnect	Unchanged	NVM	NVM	Disabled

18

Status and Error Reporting for the LA600 MultiPrinter

This chapter explains how the LA600 MultiPrinter printer provides status information and handles error conditions. The topics include:

- Device Attributes Report, Section 18.1
- Secondary Device Attributes Report, Section 18.2
- Device Status Report, Section 18.3

Note

Device attribute and status reports are applicable only to the serial interface. Reports are not sent across the parallel interface.

18.1 Device Attributes Report (DAR)

The Device Attributes Report identifies the LA600 MultiPrinter to the host. During setup the user may specify that the printer identify itself as a generic level 2 printer or as a previous model Digital printer. See DAR in the Command Dictionary for more information.

When the Printer ID setup feature is set to conformance level 2, the generic DAR response is returned. The generic DAR response always begins with Ps1 = ?72. Subsequent parameters are shown in Table 18–1. Parameters are separated by a semicolon (;).

Table 18–1 Generic DAR Replies

Ps	Description
1	Color
4	Sixels
5	Katakana character set
6	Sheet feeder (if installed)
12	Hebrew character set
23	Metric line spacing extension
24	Greek extension
25	Cyrillic
26	Turkish extension
29	Cutting device (if installed)

When the Printer ID setup feature is set to LA120, or LA210, an alias DAR response is returned. The alias DAR responses are shown in Table 18–2. Parameters are separated by a semicolon (;).

Table 18–2 Alias DAR Replies

Ps1	Additional Parameter	Printer ID Selection
?2		LA120
?10	3	LA210

18.2 Secondary Device Attributes Report (DA2R)

The Secondary Device Attributes Report (DA2R) identifies the LA600 by providing the following information:

- The printer model
- The major and minor firmware revision
- The presence of protocols other than DEC PPL2
- The firmware edit revision

The parameters of the DA2R response cannot be changed by software or from the front panel. Table 18–3 lists the DA2R parameters supported by the LA600.

Table 18–3 DA2R Response Parameters for LA600

Character Form	Code	Description
		Ps1
63	3/6 3/3	LA600
		Ps2
xx	3/*x* 3/*x*	Firmware version *x.x*
10	3/1 3/0	Version 1.0-yy
		Ps3
0	3/0	No ASF, no Cutting Device installed
1	3/1	ASF installed, no Cutting Device
2	3/2	No ASF, Cutting Device installed
12	3/1 3/2	ASF and Cutting Device installed
		Ps4
20	3/2 3/0	IBM XL24 + EPSON LQ2550 emulation
		Ps5
yy	3/*y* 3/*y*	Firmware edit revision *yy*
00	3/0 3/0	Version x.x-00

18.3 Device Status Report (DSR)

The codes generated by the LA600 MultiPrinter for the extended Device Status Report (DSR) are given in Table 18–4. When the LA600 MultiPrinter sends more than one code, a question mark (?) precedes only the first.

Table 18–4 DSR Codes

Ps	Description	Reference
?20	No malfunction	
?21	Hardware failure (State)	
?22	Communication failure (Event)	
?23	Input buffer overflow (Event)	
?24	Printer offline (State)	
?26	Cover open (State)	
?27	Paper out (State)	
?30	ASF installed (State)	
?32	Paper jam or ASF error (Event)	
?45	Character beyond right margin (Event)	Section 18.3.1
?57	First report since initialization (Event)	Section 18.3.2
?58	Cutting device installed (State)	
?61	Cutting device error (Event)	

Definitions for “Event” and “State” in Table 18–4 are given in the Command Dictionary, under DSR.

The following table gives two DSR examples:

Extended Report	Meaning
ESC [0 n ESC [? 20	No error
ESC [3 n ESC [? 24 ; 26 n	Printer offline; cover open

Some errors, including all that require operator intervention, trigger unsolicited error reports when they occur, if unsolicited error reports are enabled. (In a shared environment, any action that would block a printer queue requires notification of the host system.)

The LA600 maintains a minimum of 30 error conditions. When the error buffer is full, a status message is stored in a status message buffer for transmission. If another event occurs and the transmission of the previous message did not start within a timeout of 600 milliseconds, the new message buffer is skipped. As soon as the interface is enabled, a message stored in the status message buffer is transferred. In any case, therefore, the power-on status message is transmitted.

18.3.1 Character beyond the Right Margin

This error occurs when a character is to be printed beyond the right margin and is truncated as a result. It does not occur when Autowrap Mode (DECAWM) is set.

18.3.2 Initialization Messages

If the serial port becomes active when the automatic port selection is enabled, and this feature is enabled with the INIT. REPORT feature in the DEC PPL2 sub-menu, an unsolicited extended Device Status Report (DSR) is issued reflecting the state of the printer when the LA600 MultiPrinter completes a power-on.

The parameter value of the initial brief report indicates “Device Ready” (Ps=0) or “Device Not Ready” (Ps=3), as appropriate.

The first parameter value of the extended report uses the “First report since initialization” value from Table 18–4. If any additional error conditions are present, the parameter values for these errors are also reported.

Table 18–5 shows the possible initialization messages.

Table 18–5 Initialization Messages

Extended Report	Meaning
ESC [0 n ESC [? 5 7 ; 2 0 n	Printer ready to print; just switched on
ESC [3 n ESC [? 5 7 ; 2 6 n	Printer just switched on; cover open
ESC [3 n ESC [? 5 7 ; 2 7 n	Printer just switched on; paper out

If an error condition other than paper out exists when the printer is powered up (hardware failure, carriage error), the initialization message is not sent until the error condition is cleared.

The extended report is sent after the initial XON character is sent, following a power-up. It is provided for applications or symbionts that need to know if the device has been powered on recently and may be reset to an unknown state. This feature can be enabled or disabled during setup.

19

Fonts and Character Attributes on the LA600 MultiPrinter

This chapter gives information on:

- The built-in font repertory, Section 19.1
- Additional fonts and character sets, Section 19.2
- Font selection, Section 19.3
- Density selection, Section 19.4
- Attribute selection, Section 19.5
- Character size selection, Section 19.6
- Proportional spacing selection, Section 19.7
- Printing control characters, Section 19.8

Note

The LA600 MultiPrinter does not support downloaded fonts.

19.1 Built-In Font Repertory

The built-in font repertory of the LA600 MultiPrinter includes the following typestyles:

Courier
Roman
Sans Serif
Prestige
Script
Orator-C
Orator

OCR-A
OCR-B
Data Block

The built-in font repertory of the LA600 MultiPrinter includes all character sets, selectable by the command Select Character Set (SCS), listed in Table 19–1 (at all pitches and densities), with the following exceptions:

- OCR-A and OCR-B: For characters not addressed by these fonts, the fallback is to Courier.
- Data Block: For characters not addressed by this font, the "dotted square" character is printed.

Table 19–1 Supported Character Sets

Character Set	I_2 F Designator Characters	Code
94-Character Sets		
British	A	4/1
ASCII	B	4/2
DEC Dutch	4	3/4
DEC Finnish	5	3/5
French	R	5/2
DEC French-Canadian	9	3/9
German	K	4/11
DEC Hebrew Supplemental	"4	2/2, 3/4
DEC 7-Bit Hebrew	%=	2/5, 3/13
ISO Italian	Y	5/9
Legal	%4	2/5, 3/4
JIS Katakana	I	4/9
JIS Roman	J	4/10
DEC Norwegian/Danish	6	3/6
ISO Spanish	Z	5/10

(continued on next page)

Table 19–1 (Cont.) Supported Character Sets

Character Set	I_2 F Designator Characters	Code
DEC Swedish	7	3/7
DEC Swiss	=	3/13
Norwegian/Danish	`	6/0
DEC Supplemental	%5	2/5, 3/5
DEC Technical	>	3/14
DEC Special Graphics	0	3/0
DEC Portuguese	%6	2/5, 3/6
DEC 7-Bit Turkish(1)	%2	2/5, 3/2
DEC 8-Bit Turkish Supplemental	%0	2/5, 3/0
DEC Greek Supplementa	"?	2/2, 3/15
96-Character Sets		
ISO Latin-1 Supplemental	A	4/1
ISO Latin-2 Supplemental	B	4/2
ISO Latin-Greek Supplemental	F	4/6
ISO Latin-Hebrew Supplemental	H	4/8
ISO Latin-Cyrillic Supplemental	L	4/12
ISO Latin-5 Supplemental	M	4/13

In the LA600 MultiPrinter only these built-in character sets can be selected with SCS. When the combination of a Ps parameter (94 or 96 character set) with an SCS designating sequence does not match with any character set available in the device, the whole sequence is ignored.

Note

Because the LA600 does not have separate glyphs for diagonal composite characters in different pitches, characters such as large square root signs printed in pitches other than 5 or 10 cpi and 6 lpi many not have contiguous diagonal lines.

19.2 Additional Cartridge-based Fonts and Character Sets

The LA600 can accept cartridges that supply additional fonts or character sets. Cartridge-based fonts are addressable by the Select Graphic Rendition (SGR) command, using parameter Ps17. For details, see Section 19.3.

Additional cartridge-based character sets cannot be selected by the command SCS. Rather, the user selects a character set manually by gaining access to the Character Setup Menu through the LA600 MultiPrinter Operator Panel.

When the user selects a cartridge-based character set and assigns it to the User Preference Supplemental set through the Character Setup Menu, this selection assigns the character set to G2, G3 and GR. And since this character set is designated as the User Preference Supplemental set, it is identified with the character < and thus can be assigned via SCS to any G-set: G0 . . . G3, GL, GR.

Further, if the LA600 MultiPrinter receives an Assign User Preference Supplemental Set (DECAUPSS), this sequence assigns another resident character set to the User Preference Supplemental set. Thus, the selection of the cartridge character set cannot be retrieved through another SCS, and only a Soft Terminal Reset (DECSTR) command or a Reset to Initial State (RIS) command can return the cartridge character set back to the User Preference Supplemental set.

For details of the font and character set cartridges that may be available, contact your Digital sales representative.

19.3 Font Selection (SGR)

The LA600 MultiPrinter supports the font selection command SGR with the parameters in Table 19–2.

Table 19–2 SGR Parameters for Font Selection

This Ps...	selects this typestyle...
10	Courier
11	Roman
12	Sans Serif
13	Prestige
14	Script

(continued on next page)

Table 19–2 (Cont.) SGR Parameters for Font Selection

This Ps...	selects this typestyle...
15	Orator-C
16	Orator
17	Optional cartridge font [1]
18	OCR-A
19	OCR-B
?12	Data Block

[1]When a font cartridge contains more than one font file, the SGR sequence addresses the first font found on the cartridge. All of the cartridge fonts are listed at the end of the print Font menu.

As indicated above, when additional character sets are available in a character set cartridge installed at power-up, the character sets are addressable through Setup (G0 Character set or User Preference Supplemental character set). Therefore, when the cartridge-based character sets are designed in the built-in typestyle, it is not necessary to use the SGR escape sequence.

19.4 Density Selection (DECDEN)

The LA600 MultiPrinter supports built-in fonts for three printing densities: Draft, Near Letter Quality (NLQ), and Letter Quality densities.

Table 19–3 specifies the supported values for the DECDEN command.

Table 19–3 DECDEN Parameters for LA600

Ps...	selects this print density...
0	Draft
1	Draft
2	Letter Quality
3	NLQ
4	NLQ

Table 19–4 provides the available print densities (addressed by DECDEN) for each typestyle (addressed by SGR-fonts). In addition, the table provides the fallback rules that apply when the requested density is not available in the active typestyle.

19.4 Density Selection (DECDEN)

Table 19–4 Typestyles and Print Densities

Typestyle	Draft	NLQ	LQ
Courier	Y	Y	Y
Roman	See a.	Y	Y
Sans Serif	See a.	Y	Y
Prestige	See a.	Y	Y
Script	See a.	Y	Y
OCR-A	See a.	See b.	Y
OCR-B	See a.	See b.	Y
Orator	See a.	Y	Y
Orator-C	See a.	Y	Y
Data Block [1]	Y	See c.	See c.

[1]Data Block forces proportional spacing, and accepts combinations of attributes (bold, slant, etc.).

Key to Font Selection:
Y: Available combination
a. - Font selection falls back to Courier, draft
b. - Font selection falls back to the selected typestyle, LQ
c. - Font selection falls back to Data Block, draft

The SGR and DECDEN commands should be used together to produce the fonts described in Table 19–4. For example, to select Roman in the LQ print density send the DECDEN sequence:

```
CSI 2 " z
```

and the SGR sequence:

```
CSI 11 m
```

To select Script in NLQ print density, send DECDEN sequence:

```
CSI 3 " z
```

and the SGR sequence

```
CSI 14 m
```

19.5 Attribute Selection

The LA600 MultiPrinter supports the SGR attributes underline, overline, double underline, strikethrough, superscript and subscript, bold, and slant by algorithmically transforming the characters. The bold attribute, the various line attributes, and the superscript and subscript attributes, are each applied with one pass of the printhead. The combination of these attributes results in multiple passes.

The bold attribute affects the line attributes. The LA600 MultiPrinter does not apply slant or script attributes to full cell or component characters.

Note

Full cell characters use the whole height of the printhead (all needles are used) to build a character.
Component characters are used for constructing larger mathematical symbols such as large integral and summation signs (some of which are full cell characters).

See SGR in the Command Dictionary.

19.6 Character Size Selection

The LA600 MultiPrinter supports characters in point sizes 10, 12 (Orator-C), and 54 (Data Block), a “point” being 1/72". Additional character sizes can be produced via the Graphic Size Modification (GSM) command. The GSM command can be used with both fixed and proportional spacing and all typestyles, print densities, and character attributes.

As described in Table 19–5, GSM modifies the size of the characters, including Data Block, by a factor of from 1 to 4 in height and width. The width multiplier affects the horizontal pitch, which is defined by the Set Horizontal Pitch (DECSHORP) command, by the same factor. The height multiplier, however, does not affect the vertical pitch defined by Set Vertical Pitch (DECVERP).

Table 19–5 Graphic Size Modification Parameters

Ps1 Height Multiplier		
Character Scale		
100	3/1 3/0 3/0	Normal height
200	3/2 3/0 3/0	Double height
300	3/3 3/0 3/0	Triple height
400	3/4 3/0 3/0	Quadruple height
Ps2 Width Multiplier		
Character Scale		
100	3/1 3/0 3/0	Normal width
200	3/2 3/0 3/0	Double width
300	3/3 3/0 3/0	Triple width
400	3/4 3/0 3/0	Quadruple width

Table 19–6 shows the varying widths of Data Block characters in proportional spacing.

Table 19–6 Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
SP	Space	216
!	Exclamation Point	72
"	Double Quote	216
#	Number Sign	252
$	Dollar Sign	252
5	Percent Sign	216
&	Ampersand	252
’	Apostrophe	72
(	Left Parenthesis	108
)	Right Parenthesis	108

(continued on next page)

Table 19–6 (Cont.) Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
*	Asterisk	252
+	Plus Sign	216
,	Comma	72
-	Minus Sign/Hyphen	216
.	Period	72
/	Slash	216
0	Zero	216
1	One	216
2	Two	216
3	Three	216
4	Four	216
5	Five	216
6	Six	216
4	Four	216
5	Five	216
6	Six	216
7	Seven	216
8	Eight	216
9	Nine	216
:	Colon	72
;	Semicolon	72
<	Less Than	180
=	Equal Sign	216
>	Greater Than	180
?	Question Mark	216
@	At Sign	252
A	Upper Case A	324
B	Upper Case B	216

(continued on next page)

Table 19–6 (Cont.) Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
C	Upper Case C	252
D	Upper Case D	216
E	Upper Case E	216
F	Upper Case F	216
G	Upper Case G	252
H	Upper Case H	252
I	Upper Case I	144
J	Upper Case J	216
K	Upper Case K	252
L	Upper Case L	216
M	Upper Case M	288
N	Upper Case N	252
O	Upper Case O	252
P	Upper Case P	216
Q	Upper Case Q	252
R	Upper Case R	252
S	Upper Case S	252
T	Upper Case T	252
U	Upper Case U	252
V	Upper Case V	324
W	Upper Case W	396
X	Upper Case X	252
Y	Upper Case Y	252
Z	Upper Case Z	252
[	Left Square Bracket	108
\	Back Slash	216
]	Right Square Bracket	108
^	Circumflex	180

(continued on next page)

Table 19–6 (Cont.) Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
_	Underline	252
`	Grave Accent	144
a	Lower Case a	216
b	Lower Case b	216
c	Lower Case c	180
d	Lower Case d	180
e	Lower Case e	216
f	Lower Case f	180
g	Lower Case g	216
h	Lower Case h	216
i	Lower Case i	72
j	Lower Case j	108
k	Lower Case k	216
l	Lower Case l	72
m	Lower Case m	288
n	Lower Case n	216
o	Lower Case o	216
p	Lower Case p	216
q	Lower Case q	216
r	Lower Case r	216
s	Lower Case s	180
t	Lower Case t	180
u	Lower Case u	216
v	Lower Case v	252
w	Lower Case w	396
x	Lower Case x	252
y	Lower Case y	252
z	Lower Case z	216

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Table 19–6 (Cont.) Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
{	Left Brace	144
|	Vertical Bar	72
}	Right Brace	144
~	Tilde	216
Ç	Capital C cedilla	252
ü	Small u umlaut	216
é	Small e acute accent	216
â	Small a circumflex	216
ä	Small a umlaut	216
à	Small a grave accent	216
å	Small a with ring (angstrom)	216
ç	Small c cedilla	180
ê	Small e circumflex	216
ë	Small e umlaut	216
è	Small e grave accent	216
ï	Small i accent	144
î	Small i circumflex	144
ì	Small i grace accent	108
Ä	Capital A umlaut	324
Å	Capital A with ring (angstrom)	324
É	Captil E acute accent	216
æ	Small diphthong (ae)	360
Æ	Capital diphthong (AE)	360
ô	Small o circumflex	216
ö	Small o umlaut	216
ò	Small o grave accent	216
û	Small u circumflex	216
ù	Small u grave accent	216

(continued on next page)

Table 19–6 (Cont.) Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
ÿ	Small y umlaut	252
Ö	Capital O umlaut	324
Ü	Capital U umlaut	252
¢	Cent sign	180
£	Pound Sterling sign	252
¥	Yen sign	252
	Function sign (curved f)	252
á	Small a acute accent	216
í	Small i acute accent	108
ó	Small o acute accent	216
ú	Small u acute accent	216
ñ	Small n tilde	216
Ñ	Capital n tilde	252
ª	Feminine ordinal (small underline a)	216
º	Masculine ordinal (small underline o)	216
¿	Inverted question mark	216
	Upper left corner (H1 V1)	216
½	One half fraction	324
¼	One quarter fraction	324
¡	Inverted exclamation point	72
«	Double open angle brackets	288
»	Double close angle brackets	288
	Dark grey block	216
	Vertical line (H0 V1)	216
	Left “T” (H1 V1)	216
	Upper right corner (H1 V1)	216
	Lower right corner (H1 V1)	216
	Bottom “T” (H1 V1)	216

(continued on next page)

Table 19–6 (Cont.) Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
	Top "T" (H1 V1)	216
	Right "T" (H1 V1)	216
	Horizontal line (H1 V0)	216
	Center cross (H1 V1)	216
	Bottom right corner (H1 V1)	216
	Bottom left corner (H1 V1)	216
α	Small alpha	252
B	Capital Beta	216
Γ	Capital Gamma	180
Π	Capital Pi	288
Σ	Capital Sigma	216
σ	Small sigma	252
μ	Small mu	216
τ	Smal tau	216
Φ	Capital Phi	216
Θ	Capital Theta	216
Ω	Captial Omega	252
δ	Small delta	216
∞	Infinity sign	288
ϕ	Diameter sign (small phi)	216
ϵ	Small epsilon	216
$\in$	Intersection sign	216
$\equiv$	Identity sign (equivalence)	216
$\pm$	Plus-or-minus sign	216
$\geq$	Greater-than-or-equal-to sign	216
$\leq$	Less-than-or-equal-to sign	216
	Top half of integral sign	144
	Bottom half of integral sign	144

(continued on next page)

Table 19–6 (Cont.) Data Block Proportional Character Width

Character	Character Description	Width in *n/360"*
÷	Division sign	216
≈	Approximate (roughly-equals) sign	216
°	Degree sign	180
·	Product sign (middle dot)	180
√	Radical sign	252
¨	Diaresis	180
¤	Currency sign	288
§	Section sign	180
²	Superscript 2	180
70[1]	Lower Case g with breve	216
7E[1]	Lower Case s with cedilla	180
5E[1]	Upper Case S with cedilla	252

[1]Character number (HEX) for Data Block proportional ISO Latin-5 supplemental character

19.7 Proportional Spacing Mode (DECPSP)

The LA600 MultiPrinter supports proportional spacing by centering a proportional font character within a monospaced character cell. For this purpose each glyph in the font file has right and left bearings specified.

The command DECPSP is used to select proportional spacing. When the LA600 is in proportional spacing mode and receives the command Set Horizontal Pitch (DECSHORP), the new horizontal pitch becomes active when the proportional spacing mode is reset.

In this mode, the space unit for the commands Horizontal Position Absolute (HPA) and Horizontal Position Relative (HPR) and space and backspace depends on the active font.

The DECPSP command can be combined with the commands DECDEN for selecting print density, SGR for selecting attributes (e.g., lining, bold, and slant), and GSM for controlling the size of characters.

19.8 Printing Control Characters

The LA600 MultiPrinter supports Control Representation Mode (CRM), which can be set by the CRM command or by the "HEX DUMP" selection from the Operator's Panel. If CRM is set by command, it can be disabled by command only; likewise, if CRM is set from the Operator's Panel, the mode must be disabled the same way.

With CRM set, the LA600 MultiPrinter provides simultaneously a hexadecimal representation of the data received and the character representation for printable characters, in the format illustrated by Figure 19–1.

Figure 19–1 CRM Output Example

```
HEX DUMP MODE

Page 01

      0  1  2  3  4  5  6  7  8  9  A  B  C  D  E  F

  00 31 32 33 34 35 36 37 38 39 30 1B 5B 31 6D  41 42       1234567890.[1mAB
  01 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50  51 52       CDEFGHIJKLMNOPQR
  02 53 54 55 56 57 58 59 5A 1B 5B 30 6D 0A                  STUVWXYZ. [0m.
```

When it is set for CRM, the LA600 uses the factory default values for:

Character set
Line space
Font
GSM
Proportional mode spacing
Attributes
Print density
Top, bottom, left, and right margins

The printer uses the currently active settings for paper source and paper exit and forces horizontal pitch 12 cpi. When the printer exits CRM, the modified settings return to the values that were active before CRM was initiated.

20

Bar Code Printing on the LA600 MultiPrinter

This chapter gives information on:

- Bar code styles supported and escape sequences that enable bar code printing, Section 20.1
- Start or Stop Bar Codes (DECBAR) command, Section 20.2
- Select Bar Code Attributes (DECSBCA) command, Section 20.3
- The Active Position (AP) in different printer emulation modes and implications for printing consecutive bar codes, Section 20.4 and Section 20.5
- Bar code characteristics and their support by the LA600 MultiPrinter, Section 20.6
- Particular characteristics of the bar code styles supported by the LA600 MultiPrinter, Section 20.7

20.1 Bar Codes Supported

Through the DECBAR and DECSBCA commands, the LA600 MultiPrinter supports 15 bar code styles:

Code 39
Code 93
Code 128 (EAN 128)
Codabar a/t
Codabar b/n
Codabar c/*
Codabar d/e
EAN 8
EAN 13
Industrial 2 of 5

Interleaved 2 of 5
MSI mod 10/10
POSTNET
UPC-A
UPC-E

Three escape sequences enable the LA600 MultiPrinter to print bar codes:

1. DECSBCA Select Bar Code Attributes

   ```
   CSI Ps1 ; Pn2 ; . . .  ; Ps9  ′  q
   ```

2. DECBAR Start Bar Coding

   ```
   ESC % SP 0
   ```

3. DECBAR Stop Bar Coding

   ```
   ESC % @
   ```

20.2 Start or Stop Bar Codes (DECBAR)

This command generates bar codes using the data between the Start sequence and the Stop sequence.

20.3 Select Bar Code Attributes (DECSBCA)

Table 20–1 shows the bar code attributes supported by the LA600 MultiPrinter.

Table 20–1 Bar Code Attributes

Parameter	Description	Supported Values
Ps1	Bar code endcoding	0, 2, or none: Code 39 1: Interleaved 2 of 5 4: EAN 8 5: EAN 13 7: Codabar a/t 8: Codabar b/n 9: Codabar c/* 10: Codabar d/e 11: UPC-A 12: UPC-E 13: POSTNET 14: Industrial 2 of 5 15: Code 93 16: MSI mod 10/10 17: Code 128 (EAN 128)
Pn2	Width of narrow bars and spaces	See Table 20–2.
Pn3	Quiet zone width	180 decipoints
Pn4	Width of wide bars and spaces	See Table 20–2.
Pn5	(Parameter is ignored.)	
Pn6	Height of bars in decipoints	Minimum= 60 Maximum = 2400 Default = 120[1]
Pn7	(Parameter is ignored; the LA600 does not support control characters in bar codes).	
Ps8	Orientation	0, 1, or none: Horizontal symbol (portrait bars, read left to right) 3: Vertical symbol (90" rotation; landscape bars, read bottom to top) Parameter ignored for bar code styles EAN 8, EAN 13, UPC A, UPC E, and POSTNET.
Ps9	Human-readable characters (HRC)	0, 1, or none: No HRC 2,3 or 4: Print HRC, OCR-B font Parameter ignored for POSTNET.

[1]For EAN and UPC bar code styles, the default=180 when bar code symbols are coded with add-on two and add-on five digits. For details see the EAN and UPC sections in Section 20.7.

Table 20–2 shows the settings, in decipoints, that the LA600 MultiPrinter supports for wide and narrow bars of both landscape and portrait bar code orientations.

Table 20–2 Supported Values for the Widths of Wide and Narrow Bars

Narrow Bars (Pn2)[1]	Wide Bars (Pn4)[2]	Wide Bars —Pn4 Missing or Invalid
Portrait orientation: Ps8 = 0,1		
10[3]	20, 25, 30, 35	25
15	30, 38, 45, 53	38
20	40, 50, 60, 70	50
25	50, 63, 75, 88	63
30	60, 75, 90, 105	75
35	70, 88, 105, 123	88
40	80, 100, 120, 140	100
45	90, 113, 135, 158	113
Landscape orientation: Ps8 = 3		
8[3]	16, 20, 24, 28	20
12	24, 30, 36, 42	30
16	32, 40, 48, 56	40
20	40, 50, 60, 70	50
24	48, 60, 72, 84	60
28	56, 70, 84, 98	70
32	64, 80, 96, 112	80
36	72, 90, 108, 126	90

[1]Pn2 has priority over Pn4.

[2]Pn4 is ignored for Code 93, MSI 10/10, and Code 128.

[3]Default if Pn2 is missing or invalid.

Note

The POSTNET bar code style is fixed to 0.0217" for bars, and to 0.0255" for spaces. Pitch is 21.18 bars/inch.

For EAN 8, EAN 13, UPC A, and UPC E, Pn2 is ignored; size values are:

SC3: Pn4=20
SC6: Pn4=25 (default if Pn4 is missing or invalid)

SC9: Pn4=30

For Code 39 only, the following settings are also supported:

Ps8=0, Pn2=9, Pn4=27
The device defaults to Pn2=10, Pn4=25, Pn6=120.
Ps8=0, Pn2=18, Pn4=54
The device defaults to Pn2=20, Pn4=50, Pn6=120.

20.4 Active Print Position

The active position (AP) is the position where the next data will be printed (if no control code or escape sequence is sent). *After* a bar code symbol is printed, the handling of the AP is different depending on the bar code emulation in effect.

The LA600 MultiPrinter supports the Line Printer bar code emulation as well as the DEC PPL2 bar code emulation:

- In Line Printer emulation, the default mode, the AP is the upper right corner of the bar code. After a bar code is printed, when a single LF is sent, the next bar code will be printed one line space down, the line space being defined by the bar code height including the HRC. This technique prevents consecutive bar codes from overlapping.
- In DEC PPL2 emulation, the AP is the same position as before the bar code was printed, and line space is defined by the active Set Vertical Pitch (DECVERP) selection. In this mode, there is a risk of overlapping symbols, depending on the line spacing and symbol height, if two consecutive bar code sequences are separated by CR LF *only*. Instead of using CR LF, use the following commands to position consecutive bar codes:

  Vertical Position Absolute (VPA)
  Vertical Position Relative (VPR)
  Horizontal Position Absolute (HPA)
  Horizontal Position Relative (HPR)

For examples of bar code sequences for these two different emulation modes, see Section 20.5.

To set the bar code emulation mode, the user accesses the Setup Menu via the Operator Panel and selects the option “BARCODE EMULTN” under “Change Macro and DEC Modes”.

20.5 Bar Code Examples

This section provides a comparison of bar code sequences for the two different emulation modes described above in Section 20.4.

20.5.1 Line Printer Emulation

1. The following sequence

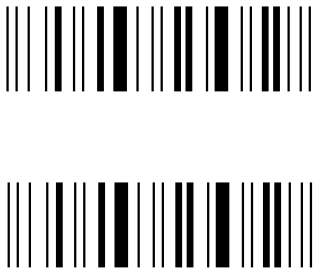
   ```
   DECSBCA (CSI 11;;;;;;;;'q)
   DECBAR (start) data DECBAR (stop)
   DECBAR (start) data DECBAR (stop)
   ```

   produces two horizontal bar codes (with portrait bars) in UPC A, side by side, on the same line:

2. The following sequence

```
DECSBCA (CSI 4;;;;;;;;'q)
DECBAR (start) data DECBAR (stop) CR LF
DECBAR (start) data DECBAR (stop)
```

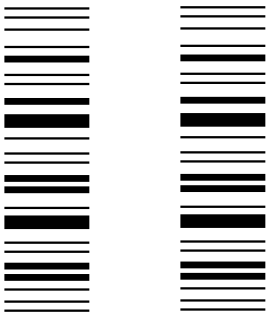
produces two horizontal bar codes (with portrait bars) in EAN 8 one above the other:



3. The following sequence

```
DECSBCA (CSI 0;;;;;;;3;'q)
DECBAR (start) data DECBAR (stop)
DECBAR (start) data DECBAR (stop)
```

produces two vertical bar codes (with landscape bars) in Code 39 side by side:



4. The following sequence

```
DECSBCA (CSI 1;;;;;;;3;'q)
DECBAR (start) data DECBAR (stop) CR LF
DECBAR (start) data DECBAR (stop)
```

   produces two vertical bar codes (with landscape bars) in Interleaved 2 of 5 one above the other:

20.5.2 DEC PPL2 Emulation

1. The following sequence

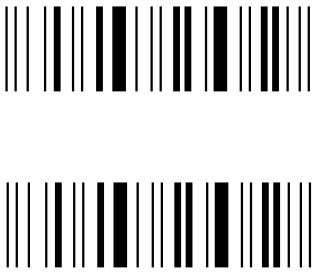
   ```
   DECSBCA (CSI 0;;;;;;;;'q)
   DECBAR (start) data DECBAR (stop) HPA (or HPR) Pn
   DECBAR (start) data DECBAR (stop)
   ```

   produces two horizontal bar codes (with portrait bars) in Code 39 on the same line:

2. The following sequence

```
DECSBCA (CSI 12;;;;;;;;'q)
DECBAR (start) data DECBAR (stop) VPA (or VPR) Pn
DECBAR (start) data DECBAR (stop)
```

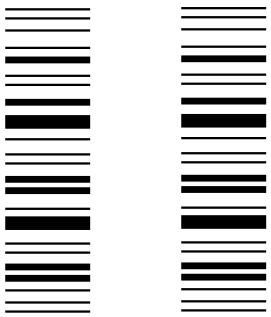
produces two horizontal bar codes (with portrait bars) in UPC-E one above the other:



3. The following sequence

```
DECSBCA (CSI 17;;;;;;;3;'q)
DECBAR (start) data DECBAR (stop) HPA (or HPR) Pn
DECBAR (start) data DECBAR (stop)
```

produces two vertical bar codes (with landscape bars) in Code 128 side by side:



4. The following sequence

   ```
   DECSBCA (CSI 17;;;;;;;;3;'q)
   DECBAR (start) data DECBAR (stop) VPA (or VPR) Pn
   DECBAR (start) data DECBAR (stop)
   ```

   produces two vertical bar codes (with landscape bars) in Code 128 one above the other:

20.6 Bar Code Characteristics

This section describes how the LA600 MultiPrinter supports the various bar code characteristics.

20.6.1 Start and Stop Codes

In a bar code, the Start and Stop characters identify, respectively, the beginning and end of the bar code symbol to the bar code reader:

- For horizontal bar codes (composed of individual bars in portrait orientation), the Start code is positioned at the left end of the symbol, before the most significant character of the bar code. The Stop code is positioned at the right end of the symbol, after the least significant character.
- For vertical bar codes (composed of individual bars in landscape orientation), the Start code is at the bottom and the Stop code is at the top.

The LA600 MultiPrinter generates Stop and Start characters automatically, precluding the need to program these codes in the application.

20.6.2 Parity and the Center Code

In the bar code styles EAN 8, EAN 13, UPC A, and UPC E, which use only the characters 0 through 9, an individual character is sent in either odd or even parity, in order to expand the number of unique patterns possible. In these bar code styles, the Center code is used to divide the characters on the left, typically sent in odd parity, from those on the right, sent in even parity. With this approach, a digit that appears on both sides of the Center code can have a bar code pattern on the left that differs significantly from its bar code pattern on the right.

The LA600 produces the Center code automatically; it does not have to be programmed by the application.

20.6.3 Quiet Zone

“Quiet zones” are completely blank areas at least .25 inches wide before and after a bar code structure. Quiet zones ensure the accurate reading of the Start and Stop codes, and prevent adjacent bar codes from overlapping.

The operator is responsible for providing sufficient space on the form for the quiet zones.

20.6.4 Intercharacter Gap

The intercharacter gap separates the last bar in one character from the first bar of the next. The intercharacter gap is required in styles where each character begins and ends with a dark bar.

20.6.5 Number of Characters in a Bar Code

The number of characters that form the bar code varies among the bar code styles. While some styles specify the number of characters for a bar code structure, others use character symbols of variable length.

While there is no standard number of characters for bar codes among the various styles, each style does specify a maximum data length, and data exceeding it are truncated. Exceeding the maximum data length in POSTNET, EAN 8, EAN 13, UPC A, and UPC E causes the LA600 MultiPrinter to ignore the bar code sequence.

20.6.6 Check Digits

Check digits, or “checksums”, are supported by the LA600 MultiPrinter. For the POSTNET and Code 128 bar code styles, the printer automatically computes the check digits and embeds them at the end of the bar code symbols.

20.7 Characteristics of the Supported Bar Code Styles

This section describes the 15 different bar code styles supported by the LA600 MultiPrinter. Below, Table 20–3 summarizes the characteristics of each style. Following sections, arranged alphabetically by style name, provide details.

Table 20–3 Bar Code Styles: Characteristics Summary

Style	Code Range	Data Length	Start/Stop Code[1]
Code 39	10 digits: 0–9 Upper case letters: A–Z 7 characters: - . $ / + % SP Control characters for Extended Code 39 ASCII Character Set	Variable Maximum=50	* / *

[1]Represented in human readable characters (HRC) in this table.

(continued on next page)

Table 20–3 (Cont.) Bar Code Styles: Characteristics Summary

Style	Code Range	Data Length	Start/Stop Code[1]
Code 93	10 digits: 0–9 Upper case letters: A–Z 7 characters: - . $ / + % SP Control characters for Extended Code 39 ASCII Character Set	Variable Maximum=50	Box symbol
Code 128	All characters, plus functions: FNC1: 5D4331H FNC2: 5D4332H FNC3: 5D4333H FNC4: 5D4334H	Variable: Maximum=50	
Codabar a/t	10 digits: 0–9 6 characters: - . $ / + :	Variable Maximum=50	a / t
Codabar b/n	10 digits: 0–9 6 characters: - . $ / + :	Variable Maximum=50	b / n
Codabar c/*	10 digits: 0–9 6 characters: - . $ / + :	Variable Maximum=50	c / *
Codabar d/e	10 digits: 0–9 6 characters: - . $ / + :	Variable Maximum=50	d / e
EAN 8	10 digits: 0–9	Fixed to 8	
EAN 13	10 digits: 0–9	Fixed to 13	
Industrial 2 of 5	10 digits: 0–9	Variable Maximum=50	: / ;
Interleaved 2 of 5	10 digits: 0–9	Variable Maximum=50	: / ;
MSI mod 10/10	10 digits: 0–9	Variable Maximum=50	: / ;
POSTNET	10 digits: 0–9	Variable Maximum=11	
UPC A	10 digits: 0–9	Fixed to 12	
UPC E	10 digits: 0–9	Fixed to 8	

[1]Represented in human readable characters (HRC) in this table.

20.7.1 Code 39

As shown in Figure 20–1, the Code 39 bar code style provides the means to encode the entire ASCII character set. This system supports all 128 ASCII characters by using four prefixes for the 26 letters of the alphabet. These four prefixes are the Extended Code 39 symbols:

$
/
%
+

Extended Code 39 prints like Code 39. Extended Code 39 decodes and prints the control characters as their combined printable codes.

The following characteristics also apply to Code 39:

- A check digit, though not required, can be calculated by the application based on modulo 43.
- The recommended ratio of wide to narrow elements is 2.5, though the ratio can range from 2.0 to 3.0.
- Minimum symbol height is 25% of symbol length—at least 20 millimeters.
- Maximum number of characters encoded is 20.
- Minimum quiet zone width is 10 times the width of the narrow element.

Figure 20–1 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	+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

20.7.2 Code 93

As shown in Figure 20–2, the Code 93 bar code style provides the means to encode the entire ASCII character set. This system supports all 128 ASCII characters by using prefixes for the 26 letters of the alphabet. These prefixes include seven characters:

-
.
$
/
+
%
SP

and four Extended Code 93 symbols:

($)
(/)
(%)
(+)

Extended Code 93 prints like Code 93. Extended Code 93 decodes and prints the control characters as their combined printable codes.

The following characteristics also apply to Code 93:

- Two symbol check characters, “C” and “K”, are required and must be programmed in the application. Figure 20–3 and Figure 20–4 together illustrate how to encode the required check characters for Code 93.
- Minimum symbol height is 15% of symbol length—at least 0.25 inches.
- Minimum quiet zone width is 10 times the width of the narrow element.

Figure 20–3 and Figure 20–4 together illustrate how to encode the required check characters for Code 93.

Figure 20–2 Extended Code 93 ASCII Character Set

ASCII	Code 93	ASCII	Code 93	ASCII	Code 93	ASCII	Code 93
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
ENQ	($)E	%	%	E	E	e	(+)E
ACK	($)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	(+)J
VT	($)K	+	+	K	K	k	(+)K
FF	($)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

Note: ($)=6/7 Hex (%)=6/8 Hex (/)=6/9 Hex (+)=6/10 Hex

Figure 20–3 Reference Table for Code 93 Check Character Calculation

```
0  1  2  3  4  5  6  7  8  9  A   B    C     D   E   F
0  1  2  3  4  5  6  7  8  9  10  11   12    13  14  15

G  H  I  J  K  L  M  N  O  P  Q   R    S     T     U   V
16 17 18 19 20 21 22 23 24 25 26  27   28    29    30  31

W  X  Y  Z  -- .  SP $  /  +  %  ($)  (%)   (/)   (+)
32 33 34 35 36 37 38 39 40 41 42 (43) (44)  (45)  (46)
```

Figure 20–4 Example: Code 93 Characters for “Code 93”

Check Character	
Check Character C	W (weighted 1,2,3 . . . ,20, 1,2 . . . from right to left
Check Character K	I (weighted 1,2,3 . . . ,15, 1,2 . . . from right to left)
Original number	C + O + D + E SP 9 3
Reference values	12 41 24 41 13 41 14 38 9 3
Weight multiplier for Check Character C	10 9 8 7 6 5 4 3 2 1
Weight multiplier for Check Character K	11 10 9 8 7 6 5 4 3 2 1
Sum of the products for Check Character C	(12*10) + (41*9) + . . . + (3*1) = 1 4 4 2
Modulo 47	1442 Mod. 47 = 32 (1442/47 = 30 remainder 32)
Reference Number	32 (represents W)
Sum of the products for Check Character K	(12*11) + (41*10) + . . . + (3*2) + (32*1) = 1 7 1 0
Modulo 47	1710 Mod. 47 = 18 (1710/47 = 36 remainder 18)
Reference Number	18 (represents I)
Final Number	C + O + D + E SP 9 3 W I

20.7.3 Code 128

As shown by Figure 20–5, Code 128 encodes a character repertoire of 128 ASCII characters, 4 control characters (FNC1, FNC2, FNC3, FNC4), and 4 special characters (CODE A, CODE B, CODE C, SHIFT).

Code 128 includes three character subsets:

- Subset A provides standard alphanumeric keyboard characters, control, and special characters.
- Subset B includes all standard alphanumeric keyboard characters, lower case alphabetical characters, and special characters.
- Subset C provides 100 digit pairs from 00 to 99 inclusive, plus special characters. Code 128-UCC/EAN uses subset C only.

Three start characters and one stop character are automatically printed. All printable ASCII characters may be printed as HRC. The following codes at the beginning of a Code 128 bar code symbol have special meaning:

- FNC1 (5D 43 31 hex) identifies a Code 128-UCC/EAN.
- FNC2 (5D 43 32 hex) may control the reader equipment for multiple read operations.
- FNC3 (5D 43 33 hex) is reserved for special functions of the reader equipment.
- FNC4 (5D 43 34 hex) is reserved for special advanced applications.

The following characteristics also apply to Code 128:

- Check digit for Code 128 is a modulo 103 check digit, as illustrated by Figure 20–6, automatically calculated and inserted in the bar code symbol. The start code is included in the modulo 103 check digit algorithm.
- Check digit for Code 128-UCC/EAN is a modulo 10 check digit that must be programmed by the application.
- Minimum symbol height is 15% of symbol length—at least 0.25 inches.

Figure 20–5 Extended Code 128 ASCII Character Set

Value	Subset A	Subset B	Subset C	Value	Subset A	Subset B	Subset C	Value	Subset A	Subset B	Subset C
0	SP	SP	00	35	C	C	35	70	ACK	f	70
1	!	!	01	36	D	D	36	71	BEL	g	71
2	"	"	02	37	E	E	37	72	BS	h	72
3	#	#	03	38	F	F	38	73	HT	i	73
4	$	$	04	39	G	G	39	74	LF	j	74
5	%	%	05	40	H	H	40	75	VT	k	75
6	&	&	06	41	I	I	41	76	FF	l	76
7	'	'	07	42	J	J	42	77	CR	m	77
8	(	(	08	43	K	K	43	78	SO	n	78
9	)	)	09	44	L	L	44	79	SI	o	79
10	*	*	10	45	M	M	45	80	DLE	p	80
11	+	+	11	46	N	N	46	81	DC1	q	81
12	,	,	12	47	O	O	47	82	DC2	r	82
13	-	-	13	48	P	P	48	83	DC3	s	83
14	.	.	14	49	Q	Q	49	84	DC4	t	84
15	/	/	15	50	R	R	50	85	NAK	u	85
16	0	0	16	51	S	S	51	86	SYN	v	86
17	1	1	17	52	T	T	52	87	ETB	w	87
18	2	2	18	53	U	U	53	88	CAN	x	88
19	3	3	19	54	V	V	54	89	EM	y	89
20	4	4	20	55	W	W	55	90	SUB	z	90
21	5	5	21	56	X	X	56	91	ESC	{	91
22	6	6	22	57	Y	Y	57	92	FS	|	92
23	7	7	23	58	Z	Z	58	93	GS	}	93
24	8	8	24	59	[	[	59	94	RS	~	94
25	9	9	25	60	\	\	60	95	US	DEL	95
26	:	:	26	61	]	]	61	96	FNC3	FNC3	96
27	;	;	27	62	^	^	62	97	FNC2	FNC2	97
28	<	<	28	63	_	_	63	98	SHIFT	SHIFT	98
29	=		29	64	NUL	`	64	99	CODE C	CODE C	99
30	>	>	30	65	SOH	a	65	100	CODE B	FNC4	CODE B
31	?	?	31	66	STX	b	66	101	FNC4	CODE A	CODE A
32	@	@	32	67	ETX	c	67	102	FNC1	FNC1	FNC1
33	A	A	33	68	EOT	d	68	103	START CODE A		
34	B	B	34	69	ENQ	e	69	104	START CODE B		
								105	START CODE C		

Figure 20–6 Example: Code 128 Characters for "00340123451234567 89"

Original number	0	0	3	4	0	1	2	3	4	5	1	2	3	4	5	6	7	8	9
Weight factor (Product digit)	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3	1	3
x (Weight factor)	0	0	9	4	0	1	6	3	12	5	3	2	9	4	15	6	21	8	27
Sum	135																		
Modulo 10	135 Modulo 10 = 13 remainder 5																		
Check character	10 - 5 = 5																		
Final number	0	0	3	4	0	1	2	3	4	5	1	2	3	4	5	6	7	8	9	5

20.7.4 Codabar

The bar code styles Codabar a/t, Codabar b/n, Codabar c/*, and Codabar d/e all share the following characteristics:

- A check digit, though not required, can be calculated if needed by the application based on modulo 10 weighted by 3.
- The recommended ratio of wide to narrow elements is 2.5, though the ratio can range from 2.0 to 3.0.
- Minimum symbol height is 25% of symbol length—at least 20 millimeters.
- Minimum quiet zone width is 10 times the width of the narrow element.

20.7.5 EAN 8

In bar code style EAN 8, bar code symbols are structured as follows:

- First digit is the code for this bar code style.
- Next six digits are the data.
- Final digit is the check digit. (For an illustration of its calculation, refer to Figure 20–7. While this figure provides an example of check digit calculation for an EAN 13 bar code symbol, EAN 8 takes exactly the same approach.)

The first four digits are coded to the left of the Center code in odd parity, and the final four are coded to the right in even parity.

The bar code symbol is ignored if more or fewer characters are used or if any are illegal. In publishing applications, however, two or five digits may be added to the basic eight. In these applications, when the data is equal to 10 or 13 digits, the additional digits are encoded automatically and are not considered in the calculations for the check digit.

EAN 8 bar code symbols are printed in three sizes, each of which requires a different minimum quiet zone, as shown in the table below. While the symbol height is thus variable, it should be about the same as the symbol length.

Symbol Size	Minimum Quiet Zone
SC3	0.1023"
SC6	0.1417"
SC9	0.1850"

Figure 20–7 Example: EAN 13 Characters for "401234598765"

```
Original number                    4  0  1  2  3  4  5  9  8  7  6  5
Weight factor                      1  3  1  3  1  3  1  3  1  3  1  3
(Product digit) x (Weight factor)  4  0  1  6  3 12  5 27  8 21  6 15
Sum                                108
Modulo 10                          108 Modulo 10 = 10 remainder 8
Check character                    10 - 8 = 2
Final number                       4  0  1  2  3  4  5  9  8  7  6  5  2
```

20.7.6 EAN 13

In bar code style EAN 13, bar code symbols are structured as follows:

- First digit is the country code.
- Second digit is the code for this bar code style.
- Next ten digits are the data.
- Final digit is the check digit, which must be calculated by the application. (For an illustration of its calculation, refer to Figure 20–7.)

Of the symbol's thirteen digits, the first stands at the left of the symbol, then six digits to the left of the Center code followed by six to the right. All thirteen digits are printable in the HRC line.

The bar code symbol is ignored if more or fewer characters are used or if any are illegal. In publishing applications, however, two or five digits may be added to the basic thirteen. In these applications, when the data is equal to 15 or 18 digits, the additional digits are encoded automatically and are not considered in the calculations for the check digit.

EAN 13 bar code symbols are printed in three sizes, each of which requires a different minimum quiet zone, as shown in the table below. While the symbol height is thus variable, it should be about the same as the symbol length.

Symbol Size	Minimum Quiet Zone
SC3	0.1574"
SC6	0.2165"
SC9	0.2874"

20.7.7 Industrial 2 of 5

The bar code style Industrial 2 of 5 allows for large tolerances, ranging from plus or minus 15% to 20%. Specifically, the style has the following characteristics:

- Start and Stop characters are:

  : / ;

- A check digit, thought not required, can be calculated by the application if needed based on modulo 10 weighted by 3.
- The recommended ratio of wide to narrow elements is 2.5, though the ratio can range from 2.0 to 3.0.
- Minimum quiet zone width is 10 times the width of the narrow element.

20.7.8 Interleaved 2 of 5

The bar code style Interleaved 2 of 5 has the following characteristics:

- Start and Stop characters are:

  : / ;

- A check digit, thought not required, can be calculated by the application if needed based on modulo 10 weighted by 3.
- The recommended ratio of wide to narrow elements is 2.5, though the ratio can range from 2.0 to 3.0.
- Minimum quiet zone width is 10 times the width of the narrow element.

20.7.9 MSI mod 10/10

For this bar code style, a modulo 10-based check digit is required, and it must be programmed by the application. Figure 20–8 illustrates the calculation of a check digit for a number encoded in MSI mod 10/10.

20.7.10 POSTNET

The POSTNET bar code style has the following characteristics:

- The check digit is calculated automatically and embedded at the end of the bar code symbol.
- The HRC line is not printed.
- All bars and spaces have the same width.

Figure 20–8 Example: MSI mod 10/10 Characters for "987654"

```
Original number                              9  8  7  6  5  4
New number formed from odd position digits      8     6     4
Multiply by 2 (x2)                           1728
Sum of digits                                1 + 7 + 2 + 8 = 18
Sum of previous summation and unused
digits from the original number              18 + 9 + 7 + 5 = 39
Modulo 10                                    39 Modulo 10 = 3 remainder 9
Check character                              10 - 9 = 1
Final number                                 9  8  7  6  5  4  1
```

- Pitch is fixed to 21.18 bars per inch. The bar width is nominal 0.021 inch, and the space is nominal 0.0255 inch.

20.7.11 UPC A

In bar code style UPC A, bar code symbols are structured as follows:

- First digit is the code for this bar code style.
- Next five digits form the vendor number.
- Second set of five digits is, typically, the product number.
- Final digit is the check digit, which must be calculated by the application. For a sample calculation, see Figure 20–9.

Of the symbol's twelve digits, six stand to the left of the Center code in odd parity and six to the right in even parity. Digits in the second through the eleventh position are printed on an HRC line.

The bar code symbol is ignored if more or fewer characters than 12 are used or if any are illegal. In publishing applications, however, two or five digits may be added. In these applications, when the data is equal to 14 or 17 digits, the additional digits are encoded automatically and are not considered in the calculations for the check digit. UPC A bar code symbols are printed in three sizes, each of which requires a different minimum quiet zone, as shown in the table below. While the symbol height is thus variable, it should be about the same as the symbol length.

Symbol Size	Minimum Quiet Zone
SC3	0.1287"
SC6	0.1755"
SC9	0.234"

Figure 20–9 Example: UPC A Characters for "01234567890"

```
Original number                  0  1  2  3  4  5  6  7  8  9  0
Weight factor                    3  1  3  1  3  1  3  1  3  1  3
(Product digit) x (Weight factor) 0  1  6  3 12  5 18  7 24  9  0
Sum                              85
Modulo 10                        85 Modulo 10 = 8 remainder 5
Check digit                      10 - 5 = 5
Final number                     0  1  2  3  4  5  6  7  8  9  0  5
```

20.7.12 UPC E

Bar code style UPC E, consisting of eight digits, is a shorter version of UPC A, with the following characteristics:

- The first digit is always null (0), and the final digit is the check digit.
- Digits in the second through the seventh positions are printed on the HRC line.
- The symbol height is variable but should be about the same as the length.
- The check digit must be calculated by the application, according to the method that bar code style UPC A uses. (For an illustration of this calculation, refer to Figure 20–9.)

The bar code symbol is ignored if more or fewer than eight characters are used or if any are illegal. In publishing applications, however, two or five digits may be added. In these applications, the additional digits are encoded automatically and are not considered in the calculations for the check digit.

For code sizes, see Section 20.7.11.

21

Sixel Graphics Considerations on the LA600 MultiPrinter

This chapter explains the graphics resolution capability of the LA600 MultiPrinter.

21.1 Graphics Resolution

Since the LA600 MultiPrinter does not support a physical horizontal resolution of 1/720", it needs to "fall back" to a different grid size when some grid sizes are requested. Table 21–1 shows the values that the LA600 uses for the macro parameter (Ps1) of the Sixel Graphics mode protocol selector.

Table 21–1 Graphics Pitch Fallbacks

Macro Value	Horizontal Grid Size (inches)	Actual Aspect Ratio (Vert pixels:horiz pixels)	Target Aspect Ratio
0 or None	1/144" (.0069)	200:100	200:100
1	1/144" (.0069)	200:100	200:100
2, fallback to:	1/180" (.0056)	250:100	450:100
3, fallback to:	1/180" (.0056)	250:100	300:100
4,	1/180" (.0056)	250:100	250:100
5, fallback to:	1/144" (.0069)	200:100	183:100
6, fallback to:	1/144" (.0069)	200:100	150:100
7, fallback to:	1/144" (.0069)	200:100	130:100
8, fallback to:	1/144" (.0069)	200:100	112:100
9 fallback to:	1/72" (.0139)	100:100	100:100
>9	1/144" (.0069)	200:100	200:100

Table 21–2 shows the horizontal grid size (HGS) and vertical grid size (VGS) fallbacks relative to the requested horizontal grid size and the aspect ratio.

Sixel Graphics Considerations on the LA600 MultiPrinter
21.1 Graphics Resolution

The printer attempts to preserve the requested aspect ratio without exceeding the requested horizontal grid size (as defined by Pn3 of the protocol selector).

The aspect ratio is provided by Ps1 or Set Raster Attributes (DECGRA).

First the printer ensures that the aspect ratio is one of the supported values (1:1, 2:1, 2.5:1):

- If aspect ratio is less than 1.5:1, fall back to 1:1
- If aspect ratio is greater than or equal to 1.5:1 and less than 2.25:1, fall back to 2:1
- If aspect ratio is greater than or equal to 2.25:1, fall back to 2.5:1

Then the printer computes the HGS and VGS values that best match the aspect ratio and requested Pn3 value.

Table 21–2 Graphics Grid Size Fallbacks

		Vertical Grid Size by Aspect Ratio with HGS Fallbacks (If Any)		
Pn3 Decipoints	**Horizontal Grid Size**	**1:1**	**2:1**	**2.5:1**
0 or none	No change to HGS and VGS defined by Ps1			
1–3	Fallback to 4 decipoints			
4	1/180"	1/180"	1/90"	1/72"
5	1/144"	VGS fallback to 1/180" HGS fallback to 1/180"	1/72"	VGS fallback to 1/72" HGS fallback to 1/180"
6, 7	Fallback to 5 decipoints			
8	1/90"	1/90"	1/45"	1/36"
9	Fallback to 8 decipoints			
10	1/72"	1/72"	1/36"	VGS fallback to 1/36" HGS fallback to 1/72"
11–19	Fallback to 10 decipoints			
20	1/36"	1/36"	VGS fallback to 1/36" HGS fallback to 1/72"	VGS fallback to 1/36" HGS fallback to 1/90"
> 20	Fallback to 20 decipoints			

22

Control Characters for the LA600 MultiPrinter

This chapter describes the control characters for the LA600 MultiPrinter and their functions. The control characters are:

- EOT, described in Section 22.1
- ENQ, described in Section 22.2

Note

Although the LA600 MultiPrinter has an audio indicator, the device ignores the bell (0/7) command received from the host.

22.1 EOT

When "EOT DISCONNECT" is enabled by the setup facility, the DTR signal on the serial port is dropped for 5 seconds when the End of Transmission (EOT) control code is received. This feature applies only if the serial port is active.

22.2 ENQ

When "ANSWERBACK/ENQ" is enabled by the setup facility, the answerback message is sent by the printer on receipt of the Enquire (ENQ) character. This feature only applies when the serial port is active. See the Load Answerback (DECLANS) command in Appendix C.

Part IV
Appendixes

Part IV of the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Supplement* contains reference information about the DEC PPL2 protocol as implemented on Digital's printers.

- Appendix A describes the printer communication interfaces.
- Appendix B contains a list of DEC PPL2 commands and compares the implementation of each command on each of the Digital printers.
- Appendix C describes additional commands that are not described in the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*.

A

Printer Communication Interfaces

This appendix provides information on the serial and parallel interfaces of the printer and describes the mechanism for the automatic port selection. Sections include:

- Data communication interfaces, Section A.1
- The serial port, Section A.2
  - Serial data character format, Section A.2.1
  - Serial data synchronization, Section A.2.2
- The parallel port, Section A.3
- Automatic port selection, Section A.4

A.1 Data Communication Interfaces

The printer works as part of your computer system, providing hardcopy output of text and graphics. You connect the printer to the computer through either the serial or parallel data communication interface at the rear of the printer. The interface is typically referred to as the “serial port” or the “parallel port.”

A.2 The Serial Port

The serial port used by the printer conforms to the CCITT X21 and X23 standards. The interface cables needed to make the communication link depend on the system to which your printer is connected. See the printer installation guide for details.

A.2.1 Serial Data Character Format

The serial data character format used by the printer is the format used for normal asynchronous transmission, that is:

- A start bit (space)
- 7 or 8 data bits (1 = mark, 0 = space)
- A parity bit (selectable)
- One or more stop bits

During setup, the use of the parity bit (on or off) and the number of data bits (7 or 8) that you assign must agree with the computer to which the printer is connected.

The stop bits do not need to be modified during setup:

- In the printer-to-computer direction, at least 2 stop bits of idle time are guaranteed, so the printer can send to a computer that requires either 1, 1.5, or 2 stop bits.
- In the computer-to-printer direction, the printer requires only 1 stop bit of idle time and can handle data sent to it with 1, 1.5, or 2 stop bits.

A.2.2 Serial Data Synchronization

Serial data synchronization is achieved by the printer continuously monitoring the number of characters in its input buffer and controlling the data flow when the number of characters reaches a predefined upper or lower threshold value.

During setup, either the XON/XOFF protocol or DTR handshake protocol can be selected to perform the data flow control function. The protocol selected must be the same as that used by the data source.

Note

Only the LA600 MultiPrinter supports the communication protocol XON/XOFF + DTR.

Input Buffer Size and Threshold Values

The input buffer size is selectable during setup.

The input buffer threshold values are the character counts in the buffer at which data flow control is triggered. Threshold values are usually as follows:

- Normal Upper Level = 128 (number of characters short of the buffer size)

- Emergency Upper Level = 64
- Lower Level = 256

Input buffer sizes are listed in Table A–1.

Table A–1 Input Buffer Values

	LA75 Companion Printer	LA310 MultiPrinter	LA600 MultiPrinter
Small	8K	16K	1K[1]
			8K[1]
			16K[1]
			32K[1]
Large[1]	32K	32K	47K[2]

[1]Select this feature through setup.

[2]This value is the default.

XON/XOFF Control

While XON/XOFF is enabled, DTR remains high. Data flow control is then achieved as follows:

- When just powered up and ready, the printer sends one XON character to signal to the data source that transmission may begin.
- When the number of characters in the input buffer reaches the upper threshold, the printer sends an XOFF character, signaling the data source to stop transmitting.
- When the number of characters in the input buffer falls to the lower threshold, the printer sends the XON character to signal that transmission may resume.
- If the first XOFF character from the printer is missed by the data source and the input buffer continues to fill, a second XOFF character is sent when the input buffer fills to its emergency upper threshold.

No special action occurs with XON/XOFF (or XON/XOFF + DTR for the LA600 printer) in the event of an error condition such as “out of paper” or “cover open.” XOFF is sent as usual after the input buffer reaches the upper threshold.

Similarly, the printer does not send XON after the error condition is corrected until the input buffer reaches the lower threshold.

DTR Handshaking Control

When DTR handshaking protocol is selected, the DTR (Data Terminal Ready) signal of the serial interface is raised and lowered to control data flow, as follows:

- When just powered up and ready, the printer forces DTR high, signaling to the data source that transmission may begin.
- When the number of characters in the input buffer reaches its upper threshold, the printer forces DTR low, signaling the data source to stop transmitting.
- When the number of characters in the input buffer falls to the lower threshold, the printer forces DTR high again so that transmission may resume.

If the Disconnect on Fault setup feature is set to "Not selected," no special action occurs with DTR in the event of an error condition, such as "out of paper" or "cover open." DTR is forced low (turned off) after the input buffer reaches the upper threshold.

Similarly, when the error condition is removed, DTR will not be raised (turned on) until the input buffer reaches the lower threshold.

When the Disconnect on Fault setup feature is selected, any condition that brings up the fault indicator causes the DTR signal on the serial interface to be dropped (turned off) until the fault is cleared.

XON/XOFF + DTR Handshaking Control

While XON/XOFF + DTR protocol is enbabled, DTR toggles between high and low states at the same time that XON and XOFF characters are sent to the host.

Note

This protocol applies to the LA600 MultiPrinter only.

A.3 The Parallel Port

The parallel port of the printer uses a Centronics type, 36-pin connector, and the interface signals conform to the Centronics handshaking protocol. If you intend to use only the parallel interface, the Communication Port Selection feature should be set to "Parallel" by means of the setup facility.

A.4 Automatic Port Selection

When the Communication Port Selection feature is set to “automatic” (for the LA75 Plus and the LA310 MultiPrinter) or to “shared” (for the LA600 MultiPrinter) during setup, either the serial or parallel port automatically becomes active when valid data is received on it. In the case of the serial port, valid data means data without a parity error.

At completion of the automatic power-up self-test, both the serial and parallel ports are disabled. Communication then takes place according to the following rules:

- Communication on the serial port is enabled by any of the following events, after which it enters the standby state:
  - XON is sent by the printer, if XON/XOFF (or XON/XOFF + DTR for the LA600) control is selected.
  - If DEC PPL2 protocol is selected, the Answerback message (when auto-answerback is enabled in setup) and then the power-up initialization message (when enabled in setup) are sent.
  - The DTR signal is set high by the printer.
- Communication on the parallel port is enabled by any of the following events, after which it enters the standby state:
  - An ACKNLG (pin 10) pulse is sent.
  - BUSY (pin 11) is set low.
  - SLCT (pin 13) is set high.
- When one port becomes active, data flow on the other port is disabled. This control is achieved as follows:
  - When the parallel port becomes active, an XOFF code is sent from the serial port (if XON/XOFF control is enabled during setup, or XON/XOFF + DTR for the LA600 printer) and the DTR signal is set low. As long as the parallel port is active, the DTR signal remains low and data flow on the serial port is inhibited.
  - When the serial port becomes active, the parallel port is disabled by setting the following signals :

    ACKNLG (pin 10) is set high
    BUSY (pin 11) is set high
    SLCT (pin 13) is set low

- As long as there is data in the printer's input buffer, the currently active port remains active.
- If the input buffer of the active port remains empty for 2 seconds, the port is disabled by placing it in the standby state. At this time the other port is enabled.
- When the parallel port has just been put into the standby state, the serial port is enabled as follows:
  - XON is sent by the printer, if XON/XOFF control is enabled (or XON /XOFF + DTR for the LA600 printer).
  - The DTR signal is set high by the printer.
  - If DEC PPL2 protocol is selected, the Answerback message (when auto-answerback is enabled in setup) and then the power-up initialization message (when enabled in setup) are sent.
- When the serial port has just been put into the standby state, the parallel port is enabled as follows:
  - An ACKNLG (pin 10) pulse is sent by the printer.
  - BUSY (pin 11) is set low.
  - SLCT (pin 13) is set high.

Note

Please note the following:

- The Data Set Ready (DSR) signal from the serial port is not monitored for the purpose of automatic port selection.
- During self-tests (including the automatic power-up test) and when the printer is in setup mode, both ports are disabled.
- The Answerback function is not supported by the LA75 Plus printer.
- In the LA310 MultiPrinter, the Answerback and power-up initialization messages (when enabled) are sent when the serial port becomes active, not when it enters the standby state.
- When the Answerback function is used with the LA600 MultiPrinter, set the interface communications to the serial port.

B

Comparison of DEC PPL2 Commands by Printer

Appendix B compares the DEC PPL2 commands supported by the Digital Level 2 printers. The LA50, a Level 1 printer, is included for reference.

Each command is described as belonging to a level of the protocol or an extension to the protocol.

Each level of the protocol includes the commands of the lower-numbered levels of the protocol. Therefore, level 2 of the protocol (DEC PPL2) includes the commands of level 1 (DEC PPL1).

- Table B–1 compares the DEC PPL2 commands as implemented on each type of printer.
- Table B–2 compares commands that are extensions to the protocol.
- Table B–3 compares commands that are exceptions to the protocol.
- Table B–4 compares the printers' alternative protocol capabilities.

Comparison of DEC PPL2 Commands by Printer

Table B–1 Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL1 Commands							
C0 Control Characters							
BEL — Bell	o	o	o	o	o	o	–
BS — Backspace	o	o	o	o	o	o	o
CAN — Cancel	o	o	o	o	o	o	o
CR — Carriage Return	o	o	o	o	o	o	o
FF — Form Feed	o	o	o	o	o	o	o
HT — Horizontal Tab	o	o	o	o	o	o	o
LF — Line Feed	o	o	o	o	o	o	o
LS0 (SI) — Locking Shift 0 (Shift In)	o	o	o	o	o	o	o
LS1 (SO) — Locking Shift 1 (Shift Out)	o	o	o	o	o	o	o
NUL — Null	o	o	o	o	o	o	o
SUB — Substitute	o	o	o	o	o	o	o
VT — Vertical Tab	o	o	o	o	o	o	o
C1 Control Characters							
PLD — Partial Line Down	o	o	o	o	o	o	o
PLU — Partial Line Up	o	o	o	o	o	o	o
SS2 — Single Shift 2	o	o	o	o	o	o	o
SS3 — Single Shift 3	o	o	o	o	o	o	o

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL1 Commands							
Understanding 8-bit C1 characters	o	o	o	o	o	o	o
Understanding 7-bit ESC Fe form of C1	o	o	o	o	o	o	o
Ignore unimplemented control strings	o	o	o	o	o	o	o
Character Set Repertoire and Designation							
ASCII	o	o	o	o	o	o	o
British	o	o	o	o	o	o	o
French	o	o	o	o	o	o	o
German	o	o	o	o	o	o	o
Norwegian/Danish	–	o	o	–	o	o	o
DEC Finnish	o	o	o	o	o	o	o
DEC French-Canadian	o	o	o	o	o	o	o
DEC Dutch	–	o	o	–	o	o	o
DEC Norwegian/Danish	o	o	o	o	o	o	o
DEC Swedish	o	o	o	–	o	o	o
DEC Swiss	–	o	o	–	o	o	o
DEC Portuguese	–	o	o	–	o	o	o
ISO Italian	o	o	o	o	o	o	o
ISO Spanish	o	o	o	o	o	o	o
JIS Roman	o	o	o	–	o	o	o

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Comparison of DEC PPL2 Commands by Printer

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL1 Commands							
DEC Special Graphics	o	o	o	o	o	o	o
DEC Supplemental	o	o	o	o	o	o	o
DEC Technical	–	o	o	–	o	o	o
LA120 fallback DEC Finnish	o	o	o	o	o	o	o
LA120 fallback DEC French-Canadian	o	o	o	o	o	o	o
LA120 fallback DEC Norwegian/Danish	o	o	o	o	o	o	o
LA120 fallback DEC Swedish	o	o	o	o	o	o	o
Command Dictionary							
DECSCL — Reset to Digital defaults	–	o	o	–	o	o	o
DECSHORP — Set HAI[1] to desired value	o[3]	o	o	n[3]	o	o	o
DECSLPP — Set Lines Per Page	o	o	o	o	o	o	o
DECSTR — Soft Terminal Reset (RIS)	–	o	o	–	o	o	o

[1]Horizontal Advance Increment.

[3]For specific information on the implementation of this command, refer to the documentation for the device.

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL1 Commands							
DECVERP — Set VAI[2] to desired value	o[3]	o	o	n[3]	o	o	o
LS2 — Locking Shift for G2	o	o	o	o	o	o	o
LS3 — Locking Shift for G3	o	o	o	o	o	o	o
LS1R — Locking Shift for G1 Right	o	o	o	o	o	o	o
LS2R — Locking Shift for G2 Right	o	o	o	o	o	o	o
LS3R — Locking Shift for G3 Right	o	o	o	o	o	o	o
RIS — Reset to Initial State (DECSTR)	–	o	o	–	o	o	o
SGR — Off, bold, underline — Ps = 0,1,22, 4,24	o	o	o	n[3]	o	o	o
SP — Space	o	o	o	o	o	o	o
Interrogation							
DA — Request Device Attributes	o	o	o	o	o	o	o

[2]Vertical Advance Increment.

[3]For specific information on the implementation of this command, refer to the documentation for the device.

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Comparison of DEC PPL2 Commands by Printer

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL1 Commands							
DAR — Report CSI?71c — Level 1 Printer	n[3]	–	–	–	–	–	–
DA2 — Request Device Attributes (Secondary)	–	o	o	–	o	o	o
DA2R — Report Device Attributes (Secondary)	–	o	o	–	o	o	o
DSR — Request Device Status Report	o	o	o	–	o	o	o
DSR — Base solicited responses — Ps = 0,3,5	o	o	o	–	o	o	o
DSR — Unsolicited/ generic format — Ps = ?1,2,3	o	o	o	–	o	o	o
DEC PPL2 Commands							
C1 Control Characters							
HTS — Horizontal Tab Set	–	o	o	o	o	o	o
IND — Forward Index	–	o	o	o	o	o	o
NEL — Next Line	–	o	o	o	o	o	o
VTS — Vertical Tab Set	–	o	o	o	o	o	o

[3]For specific information on the implementation of this command, refer to the documentation for the device.

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL2 Commands							
Character Set Repertoire and Designation (DEC PPL2)							
DEC Supplemental [new sequence]	–	o	o	–	o	o	o
ISO Latin-1 Supplemental [96]	–	o	o	–	o	o	o
User-Preference Supplemental	–	o	o	–	o	o	o
Legal	–	o	o	–	o	o	o
Command Dictionary							
ASCEF — Announce Subset of Code Extension Facilities (F = L,M,N)	–	o	o	–	o	o	o
CUU — Cursor Up	–	–	–	o[4]	–	–	–
DECAUPSS — Assign User Preference Supplemental Set	–	o	o	–	o	o	o
DECAWM — Autowrap Mode	–	o	o	o	o	o	o
DECCAHT — Clear All Horizontal Tabs (TBC = 3)	–	o	o	o	o	o	o

[4]Not recommended for DEC PPL2.

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Comparison of DEC PPL2 Commands by Printer

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL2 Commands							
DECCAVT — Clear All Vertical Tabs (TBC = 4)	–	o	o	o	o	o	o
DECCRNLM — Carriage Return/New Line Mode	–	o	o	o	o	o	o
DECHTS — Horizontal Tab Set (HTS)	–	o	o	o	o	o	o
DECPSM — Horizontal Pitch Select Mode	–	NA[5]	NA[5]	o	NA[5]	NA[5]	NA[5]
DECSHTS — Set Horizontal Tab Stops	–	o	o	o	o	o	o
DECSLRM — Set Left and Right Margins	–	o	o	o	o	o	o
DECSTBM — Set Top and Bottom Margins	–	o	o	o	o	o	o
DECSVTS — Set Vertical Tabs	–	o	o	o	o	o	o
DECVTS — Vertical Tab Set (VTS)	–	o	o	o	o	o	o
LNM — Line Feed/New Line Mode	–	o	o	o	o	o	o
HPA — Horizontal Position Absolute	–	o	o	o	o	o	o
HPR — Horizontal Position Relative	–	o	o	o	o	o	o

[5]Not applicable

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL2 Commands							
S7C1R — Select 7-bit C1 Receive	–	o	o	o	o	o	o
S8C1R — Select 8-bit C1 Receive	–	o	o	o	o	o	o
SGR — Italics — Ps = 3,23	–	o	o	–	o	o	o
SGR — Strike-through — Ps = 9,29	–	o	o	–	o	o	o
SGR — Font selection — Ps = 10—19	–	o	o	o	o	o	o[3]
SGR — Subscript /superscript — Ps = ?0,?4,?5, ?24	–	o	o	–	o	o	o
SGR — Overline — Ps = 53,55,?0,?6,?26	–	o	o	–	o	o	o
SGR — Double-underline — Ps = 21,24	–	o	o	–	o	o	o
TBC — Tabulation Clear — Ps = 0,1,2,3,4	–	o	o	o	o	o	o
VPA — Vertical Position Absolute	–	o	o	o	o	o	o
VPR — Vertical Position Relative	–	o	o	o	o	o	o

[3]For specific information on the implementation of this command, refer to the documentation for the device.

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Comparison of DEC PPL2 Commands by Printer

Table B–1 (Cont.) Comparison of DEC PPL2 Commands

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DEC PPL2 Commands							
Interrogation							
DAR — Report CSI?72c — Level 2 Printer	–	o	o	–	o	o	o
DECFSR — Font Status Report — Ps = 3 (cartridge)	–	o	o	–	o	o	o
DECRFS — Request Cartridge Font Status	–	o	o	–	o	o	o

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

Table B–2 Comparing Extensions to the DEC PPL2 Protocol

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
Color Extension (1)							
SGR — Color printing — Ps = 30—37,39	–	–	o[1]	–	–	o	o
Interrogation							
DA — Report extension parameter — ;1	–	–	o[1]	–	–	o	o
Sixel Extension (4)							
Command Dictionary							
DCS—Sixel Graphics Mode –q(7/01)	n[2]	o	o	n[2]	o	o	o
Interrogation							
DA — Report extension parameter — ;4	–	o	o	–	o	o	o
Katakana Extension (5)							
Character Set Repertoire and Designation							
JIS Katakana	o	o	o	–	o	o	o
Interrogation							
DAR — Report extension parameter — ;5	–	o	o	–	o	o	o

[1]LA75 Plus only

[2]For specific information on the implementation of this command, refer to the documentation for the device.

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–2 (Cont.) Comparing Extensions to the DEC PPL2 Protocol

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
Sheetfeed Extension (6)							
Command Dictionary							
DECASFC — Sheet Feeder (one tray) — Ps = 0,1	–	o	o	–	–	o	o
DECASFC — Two-tray control Ps = 2	–	–	–	–	–	o	o
DECASFC — Three-tray control Ps = 3	–	–	–	–	–	o	o
DECASFC — Manual feed Ps = 99	–	–	o	–	–	–	o
DECASFC — Tractor control Ps = 4	–	–	–	–	–	–	o
Interrogation							
DAR — Report extension parameter — ;6	–	–	o	–	–	o	o
Download Extension (7)							
Command Dictionary							
DECDLD—Download Font	–	o	o	–	o	–	–

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–2 (Cont.) Comparing Extensions to the DEC PPL2 Protocol

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
Download Extension (7)							
Interrogation							
DAR — Report extension parameter — ;7	–	o	o	–	o	–	–
Hebrew Extension (12)							
Character Set Repertoire and Designation							
DEC Hebrew-7	–	o	o	–	o	o	o
DEC Hebrew Supplemental	–	o	o	–	o	o	o
ISO Latin-Hebrew Supplemental	–	o	o	–	o	o	o
Interrogation							
DAR — Report extension parameter — ;12	–	o	o	–	o	o	o
Metric Line Spacing (23)							
Command Dictionary							
DECVERP – Ps=21-23, 31-33	–	–	o[1]	–	o	–	o
Interrogation							

[1]LA75 Plus only

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–2 (Cont.) Comparing Extensions to the DEC PPL2 Protocol

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
Metric Line Spacing (23)							
DAR — Report extension parameter — ;23	–	–	o[1]	–	o	–	o
Greek Extension (24)							
Character Set Repertoire and Designation							
DEC Greek Supplemental	–	–	o[1]	–	o	–	o
ISO Latin-Greek Supplemental	–	–	o[1]	–	o	–	o
Interrogation							
DAR — Report extension parameter — ;24	–	–	o[1]	–	o	–	o
Turkish Extension (26)							
Character Set Repertoire and Designation							
DEC 7-bit Turkish	–	–	o[1]	–	o	–	o
DEC 8-bit Turkish	–	–	o[1]	–	o	–	o
ISO Latin-5 Supplemental	–	–	o[1]	–	o	–	o
Interrogation							

[1]LA75 Plus only

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

(continued on next page)

Table B–2 (Cont.) Comparing Extensions to the DEC PPL2 Protocol

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
Turkish Extension (26)							
DAR — Report extension parameter — ;26	–	–	o[1]	–	o	o	o

[1]LA75 Plus only

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

Comparison of DEC PPL2 Commands by Printer

Table B–3 Comparing Exceptions to the Protocol

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DAR — Compatibility Reports							
CSI ? 17 c — LA50	o	o	o	–	o	o	o
CSI ? 2 c — LA120	–	o	o	–	o	o	o
CSI ? 10;3 c — LA100	–	o	o	o	o	o	o
DECID — Request ID	–	–	–	o	–	–	–
Character Sets							
DEC APL	–	–	–	o[1]	–	–	–
DEC Symbol 10	–	–	–	o[1]	–	–	–
Command Dictionary							
CRM — Control Representation Mode	–	o	o	–	o	o	o
Request Font Configuration	–	–	–	o[1]	–	–	–
DECLANS—Load Answerback	–	–	–	n[1]	o	–	o
DECHPWA—Set Page Width Alignment	–	o	o	o	o	o	o
DECBAR—Bar Code Printing	–	–	o[2]	–	–	o	o[1]

[1]For specific information on the implementation of this command, refer to the documentation for the device.

[2]LA75 Plus only

Table Key:

o — Command present

n — Command present, partial implementation

– — Command not present

Table B–4 Alternative Protocols

Command	LA50	LA70	LA75 /LA75 Plus	LA210	LA310	LA324 /LA424	LA600
DECIPEM — IBM Proprinter Emulation Mode	–	o	o	–[1]	o	o	o
SOCS — Select Other Coding System (IBM Proprinter)	–	o	o[2]	–	o	o	o
SOCS — Select Other Coding System (EPSON)	–	–	–	–	o	–	o
ROCS — Return from Other Coding System	–	o	o[2]	–	o	o	o
DECPSP — Proportional Spacing Mode	–	–	–	–	–	–	o
GSM — Graphic Size Modification	–	–	–	–	–	–	o
DECSITF — Select Input Tray Failover	–	–	–	–	–	–	o
DECPEC — Paper Exit Control	–	–	–	–	–	–	o
DECPHGC — Printhead Gap Control	–	–	–	–	–	–	o

[1]Only from Set-up.

[2]LA75 Plus only

Table Key:

o — Command present

– — Command not present

C

DEC PPL2 Command Dictionary Supplement

This appendix provides the definition of new DEC PPL2 commands not listed in the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual*. These commands are implemented on some DEC PPL2 printers only (see Appendix B).

DECLANS — Load Answerback

Loads a coded string as the Answerback message and optionally stores it into nonvolatile RAM (NVRAM).

Source: Symbiont **Destination:** Levels 1, 2, 3 Exception

Format

Without password:

```
DCS  Ps1  v    D . . . D                 ST
9/0  ***  7/6  encoded_message_string  9/12
```

With password:

```
DCS  Ps1  ;     Pn2  ;     Pn3  v    D . . . D                 ST
9/0  ***  3/11  ***  3/11  ***  7/6  encoded_message_string  9/12
```

Description

Selective parameters for DECLANS are as follows:

Ps	Action
1	Hex encoded message; do not store into nonvolatile RAM (NVRAM)
2	Hex encoded message; store into NVRAM
3	Hex encoded message and password; store into NVRAM

The message, once decoded, must contain 30 or fewer characters. It may contain any combination of 7-bit or 8-bit control and graphic characters.

Any of the following circumstances may cause transmission of the answerback message. Not all circumstances may be supported by the device. See Appendix B for the availability of auto-answerback and for the interaction with setup or the front panel, if any.

- Receipt of an Enquire (ENQ, 0/5) control character
- Direct user request through the front panel (For example, the “Here Is” key)
- Automatically (if auto-answerback is enabled) 500 ms after a full-duplex modem connection is established
- Automatically (if auto-answerback is enabled) 500 ms after power up

The printer supports a method to lock the answerback message via the DEC PPL2 protocol. A decimal password can be given along with the answerback message being loaded. When a password is loaded into the printer, it must be specified in a subsequent DECLANS command in order to change the answerback message in the future. The password as well as the answerback are stored in non-volatile memory. This feature is selected with a Ps1 value of 3.

When this parameter value is specified, two additional numeric parameters must be provided in the introducer of the control string. Pn2 specifies the previous password and Pn3 specifies the new password. The encoding of these passwords are the same as for normal parameter values.

The value of Pn2 is checked against the password stored in non-volatile memory. If they match, the answerback message and the new password, given by Pn3, are written into non-volatile memory. These fields may have the same value.

The factory default password is 0 (zero). When this password is active—either from the factory default or set through a subsequent DECLANS command—any DECLANS command may alter the answerback message. When the password is set to anything other than this value, only a DECLANS command with a value of 3 for Ps1 and the correct password for Pn2 can alter the answerback message.

Error Handling

If Ps is an unsupported value, the printer ignores the DECLANS control string.

See the *Digital ANSI-Compliant Printing Protocol Level 2 Programming Reference Manual* for special handling of control and GR characters. The device ignores all printable characters in *Encoded Message String* other than the ASCII digits 0–9 and A–F. Space (2/0 or 10/0) is also ignored.

If *encoded_message_string* contains an odd number of digits, the device processes the last digit individually (as a low order nibble). If the decoded string is longer than 30 characters, the device processes the first 30 and ignores the rest.

If Pn2 or Pn3 are omitted when Ps1 has a value of 3, they are treated as a value of 0.

DECPSP — Proportional Spacing Mode

When set, enables proportional spacing of characters. When reset, selects monospaced printing.

Source: Application **Destination:** Level 2 Extension, Level 3

Format

CSI ? 2 7 h 9/11 3/15 3/2 3/7 6/8	Sets Proportional Spacing Mode.
CSI ? 2 7 l 9/11 3/15 3/2 3/7 6/12	Resets Proportional Spacing Mode.

Description

When a proportional font is in use and DECPSP is reset, the device prints characters on a monospaced grid.

DECPSP has no effect on tab settings.

When a proportional font is in use, and DECPSP is reset (monospaced), each character should be centered in the character cell. If the device absolutely *cannot* do centering, left-aligned is acceptable.

DECPEC — Paper Exit Control

Selects the paper exit path for cut sheets.

Source: Symbiont **Destination:** Level 2 Exception

Format

```
CSI   Ps    -    t
9/11  ***  2/13  7/4
```

Description

The selective parameters are as follows:

Ps	Meaning
0	Paper exits stacker
1	Paper exits stacker
2	Paper exits front side (confirmed by user)
3	Paper exits front side (not confirmed by user)

This command applies to cut sheets only. Paper source is selected by the DECASFC command.

When confirmation by user is selected (Ps= 2), the printer stops operations after each page is printed and ejected through the front exit. Printing is resumed when the confirmation is provided by the user through a dedicated key on the device front panel.

When confirmation by the user is not selected (Ps= 3), the printer does not stop printing after each page is printed and ejected through the front exit. Thus, the application software shall control whether a next page can be printed after each page is printed and ejected.

DECPHGC — Printhead Gap Control

Controls the distance between the printhead and the platen.

Source: Symbiont **Destination:** Level 2 Exception

Format

```
CSI   Ps    -    s
9/11  ***  2/13  7/3
```

Description

The selective parameters are as follows:

Ps	Meaning
0	Automatic Gap Control mode (AGC)
n	Programmable Copy Control mode (PCC)—*n*= distance measured in number of copies

In AGC mode, the gap between the printhead and the platen is controlled by the device automatically.

In PCC mode, the gap between the printhead and the platen is proportional to *n*.

DECSITF — Select Input Tray Failover

Designates the input trays used for failover.

Source: Symbiont

Destination: Level 2 Exception, Level 3 Extension

Format

```
CSI   Ps1  ;    Ps2  ;      . . .  Psn  SP   w
9/11  ***  3/11 ***  3/11   ***  ***  2/0  7/7
```

Description

This command defines the paper tray failover rules for the printer. A **composite tray** may be defined by the DECSITF command, across which paper tray failover may occur. When a paper tray that is part of a composite tray becomes empty, the printer will failover to the next tray in the composite tray definition, instead of reporting a “paper out” error condition.

Selective parameters for DECSITF are as follows:

Ps1	Action
0	Disable all composite input trays
1	Define composite tray 1

Subsequent parameters identify the trays that comprise the composite tray specified by Ps1. The value of these parameters is equal to the input tray selection parameter value for the Automatic Sheet Feeder Control (DECASFC) command.

Ps2–Psn	Action
n	Designates the tray as a member of a composite tray.

The number of composite trays and the specific paper trays that may be part of a composite tray are device-dependent settings. The trays comprising a composite tray must all have the same paper size. This is determined at the time of failover, not when the command is received.

This command only affects sheets printed subsequent to the receipt of this command. DECSITF cannot be used to clear a “paper out” condition. A member of the composite tray need not be present when the command is received, but must be present at the time of failover, or the device considers the next tray in the composite tray definition.

When all of the paper trays in the composite tray definition are empty, a “paper out” condition occurs. Printing resumes when any of the trays in the composite tray definition are reloaded. If multiple trays are reloaded, the device resumes printing from the same tray the last page was printed from.

Side Effects

When the printer receives a DECSITF sequence, it performs a conditional sheet feed.

The Automatic Sheet Feeder Control (DECASFC) command and DECSITF interact as follows:

- The device always attempts to print the first page after DECASFC (n) from tray (n). If tray (n) is empty, the device checks the composite tray definition for possible failover.
- DECSITF (a, b...) changes the composite tray definition. The device always attempts to print the first page after DECSITF from tray (n) (established by DECASFC). If tray n is empty at imaging time, the device checks the new composite tray definition (a, b...) for failover possibilities.
- The device images all other pages from the same tray as the previous page. If there is a paper out condition in that tray, the device checks the composite tray definition (a, b...) for failover possibilities.

Error Handling

If an unsupported Ps1 is received, the command is ignored and a conditional Sheet Feed is performed.

If a subsequent parameter is received that is not associated with an input tray, or with an input tray that is not supported for failover, only that parameter is ignored.

GSM — Graphic Size Modification

Expands the character height and width to a defined multiplication factor.

Source: Symbiont **Destination:** Level 2 Exception

Format

```
CSI   Pn1  ;     Pn2  SP    B
9/11  ***  3/11  ***   2/0   4/2
```

Description

The numeric parameters are as follows:

Pn	Meaning
Pn1	Height multiplier
Pn2	Width multiplier

For the supported parameters, and the interaction with the horizontal pitch (defined by DECSHORP) and the vertical pitch (defined by DECVERP), refer to information in the section of the Programming Supplement for the LA600 printer.

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