

CHAPTER 1 INTRODUCTION

1.1 SCOPE

The LP11/LS11/LA11 Line Printer systems are high-speed printer systems designed to interface with the PDP-11 family of processors to provide impact line printing at speeds up to 1250 lines per minute (speed is dependent on line length).

The LP11 system consists of two major components: a Data Products Corporation line printer (Model 2230, 2310, 2410, or 2470); and an M7930 or M7258 interface unit, referred to as the LP11 controller. The Data Products line printers (Models 2230, 2310, 2410, and 2470) are designated by DEC as LP05, LP01, LP02, and LP04, respectively. These DEC designations are used throughout this guide. Figures 1-1 through 1-4 respectively show the LP01, LP02, LP04, and LP05 line printers.

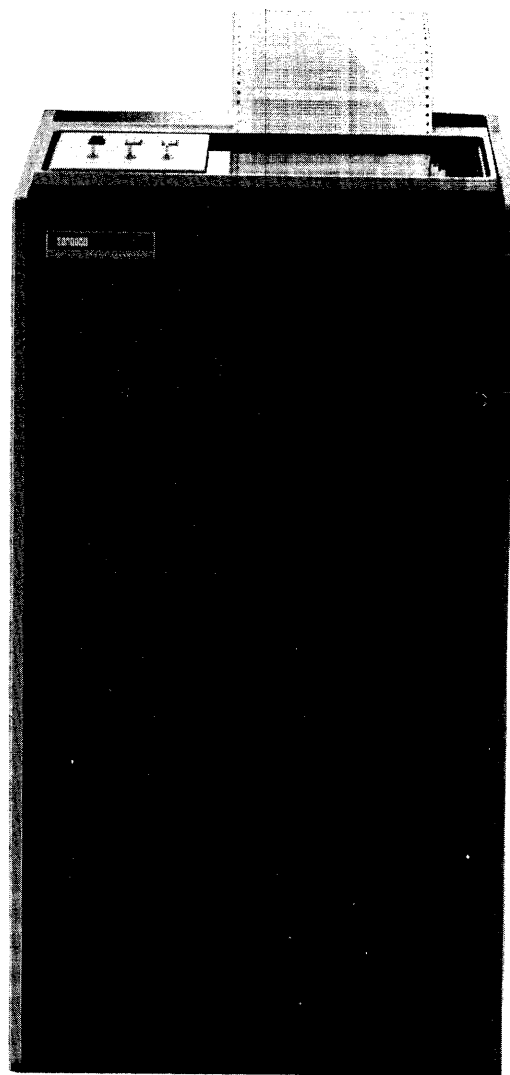
The LS11 system consists of two components: a Centronics line printer (Model 101, 101A*, 101D, 102A, or 303); and an M7258 interface unit, referred to as the LS11 controller.

The LA11 system also consists of two components: a DEC line printer LA180 (Model LA11-PA, LA11-PB, LA11-PC, or LA11-PD) and an M7258 interface unit, referred to as the LA11 controller.

This manual and the applicable line printer manual must be used together for a complete understanding of the LP11/LS11/LA11 system. The prime subject of this manual is the LP11/LS11/LA11 controller. In addition to providing complete coverage of the controller, this manual includes sections covering system installation, system operating procedures, and programming. The prime subject of the line printer manual is the line printer itself; the manual presents a detailed discussion of the print mechanism including installation, operation, and principles of operation.

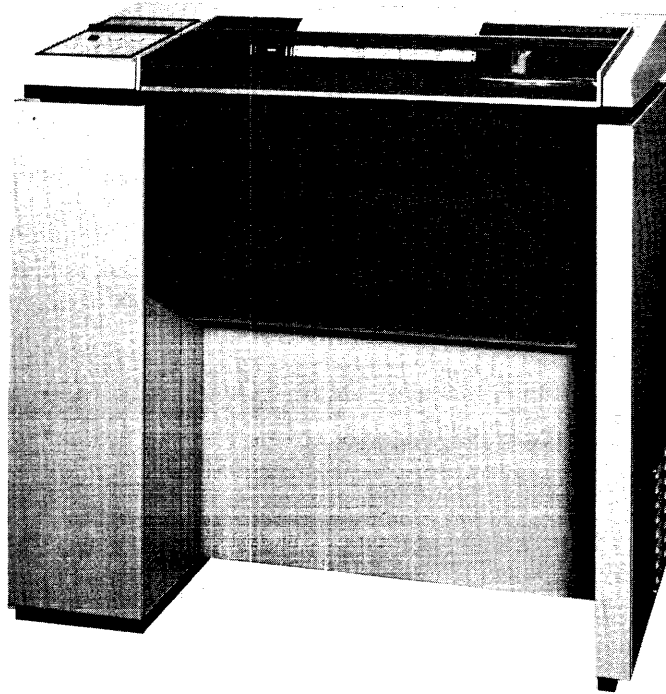
Table 1-1 lists other PDP-11 documents that are applicable to the LP11, LS11 and LA11 systems.

*Product Line standard.



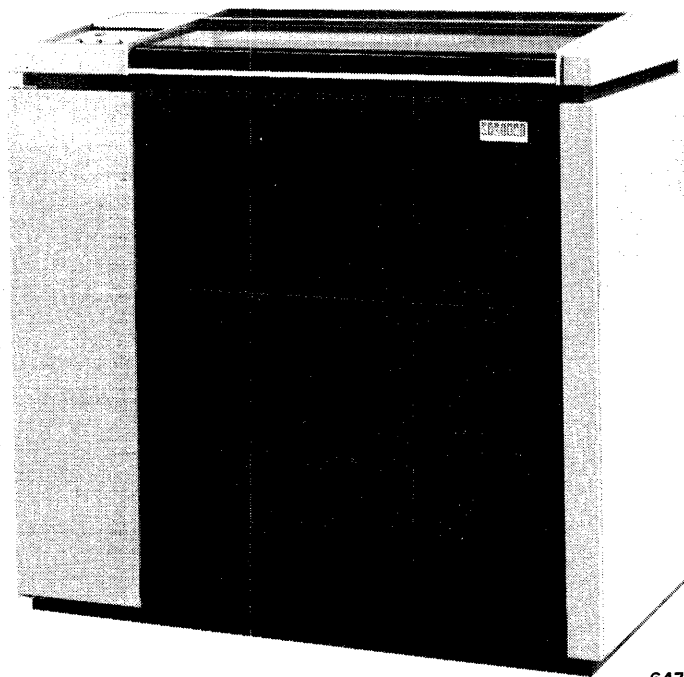
M-0214

Figure 1-1 LP01 Line Printer



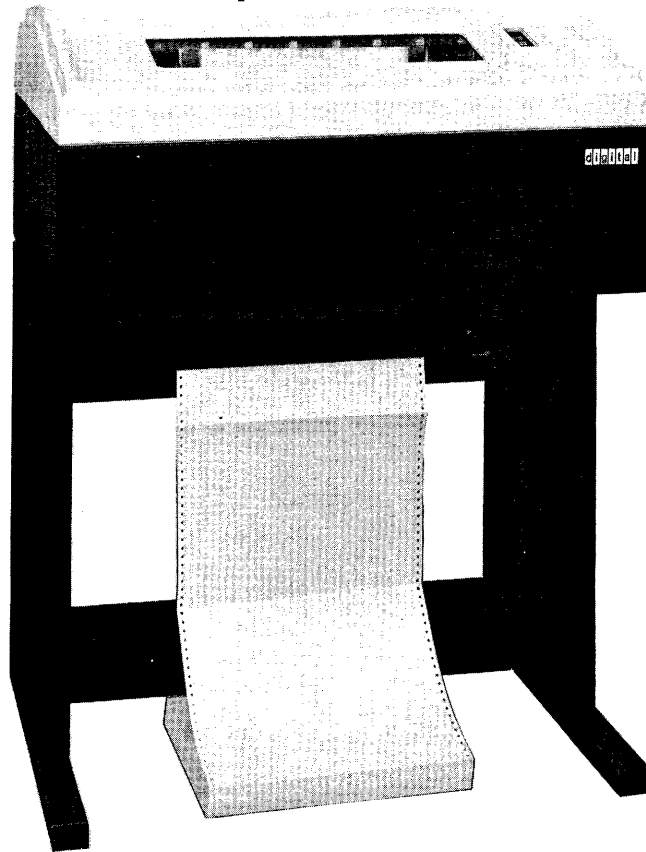
5550-1

Figure 1-2 LP02 Line Printer



6476-1

Figure 1-3 LP04 Line Printer



6996-2

Figure 1-4 LP05 Line Printer

1.2 GENERAL DESCRIPTION

1.2.1 LP11

The LP11 Line Printer system is designed to operate on-line with the PDP-11 system and associated peripherals such as paper tape readers, magnetic tape units, card readers, or communications terminals. The line printer is mounted in a free-standing cabinet. The controller, which interfaces the line printer to the Unibus is a single quad module that occupies one of the four slots in the DD11 or one of the two small peripheral controller slots in the KA11, KC11, or other PDP-11 Processor system unit.

When the printer memory is full, a print cycle is initiated and the characters are automatically printed in the first zone (columns 1–20). During the print cycle, the stored characters are scanned and compared in synchronism with the rotating characters on the drum. The printer actuates the appropriate hammer as the desired character approaches the print position. If the comparison indicates an invalid character, that character is erased from the memory.

After the first zone has been printed, the next 20 characters are loaded and printed out on the second zone (columns 21–40) provided no special control character (paper feed, form feed, or carriage return) is recognized by the printer. This process continues until all four zones have been printed. Any time that one of the three control characters is

recognized, the current buffer contents are printed and the printer returns to the first zone rather than continuing printing of the remaining zones.

The printer responds only to codes representing the character set and the three control characters. All other codes are ignored.

The line printer is a high-speed printer that produces hard copy output at rates up to 1250 lines per minute. The printer employs an impact type mechanism with a revolving character drum and one hammer per column. Forms making up to six copies can be used when multiple copy printing is desired. The printer is available in three versions: 80 columns with a speed of up to 356 lines per minute for a full line; 132 columns with a speed of up to 245 lines per minute for a full line; 132 columns with a speed of up to 1250 lines per minute for a full line; or 132 columns with a speed of up to 300 lines per minute for a full line. All of the preceding print rates are based on the 64-character drum. The four line printer models can be ordered with either a 64- or 96-character drum. The DEC model designations are listed in Table 1-2.

**Table 1-2
Model Designations**

Line Printer	Designation	Number of Characters	Power
LP01 80 Column (DP 2310)	LP11-FA	64	115 V, 60 Hz
	FB	64	230 V, 50 Hz
	HA	96	115 V, 60 Hz
	HB	96	230 V, 50 Hz
LP02 132 Column (DP 2410)	LP11-JA	64	115 V, 60 Hz
	JB	64	230 V, 50 Hz
	KA	96	115 V, 60 Hz
	KB	96	230 V, 50 Hz
LP04 132 Column (DP 2470)	LP11-RA	64	115 V, 60 Hz
	RB	64	230 V, 50 Hz
	SA	96	115 V, 60 Hz
	SB	96	230 V, 50 Hz
LP05 132 Column (DP 2230)	LP11-VA	64	115 V, 60 Hz
	VB	64	230 V, 60 Hz
	VC	64	115 V, 50 Hz
	VD	64	230 V, 50 Hz
	WA	96	115 V, 60 Hz
	WB	96	230 V, 60 Hz
	WC	96	115 V, 50 Hz
	WD	96	230 V, 50 Hz

A brief description of the four line printer models and both character sets is contained in subsequent paragraphs.

1.2.1.1 LP11-F, H – The LP11-F, H 80-column line printer has a maximum line length of 80 columns and prints at a rate of 356 full lines per minute. If the line length is decreased to 20 columns the maximum printing rate is 1110 lines per minute. These rates are based on a 64-character set. If a 96-character set is used, printing rates decrease because of the larger character drum.

A single 80-character line is composed of four 20-character zones. This permits the 20 hammer drivers to be time-shared by the four zones. The printer contains a 20-character memory that stores the image of one zone. The character string is serially loaded into this memory by means of the line printer data buffer register (LPDB) in the LP11 Controller. Although the bits comprising an individual character are parallel loaded the zone is serially loaded, character by character.

1.2.1.2 LP11-J, K – The LP11-J, K 132-column line printer has a maximum line length of 132 columns and prints at a rate of 245 full lines per minute or 1100 lines per minute, if the line length is decreased to 24 columns. It is essentially the same as the 80-column model, except that the memory holds 24 characters and a line is composed of six zones.

1.2.1.3 LP11-R, S – The LP11-R, S 132-column line printer has a maximum line length of 132 columns and prints at a rate of 1250 full lines per minute when using the 64-character set and 925 full lines per minute when using the 96-character set. The LP11-R, S is distinguished from the two previous versions because it contains one 132-character memory; there are no zones. A print hammer is assigned to each of the 132 print positions. The LP11-R, S will print a line only after one of three control characters is sent to it.

1.2.1.4 LP11-V, W – The LP11-V, W 132-column line printer has a maximum line length of 132 columns and prints at a rate of 300 lines per minute when using the 64-character set, and 240 lines per minute when using the 96-character set. A 132-column memory is contained within the line printer. Printing is accomplished by dividing the 132 columns into odd and even positions and sharing a hammer and associated drive circuit between two positions. The LP11-V, W will print a line only after one of three control characters is sent to it.

1.2.2 LS11

The LS11 is capable of interfacing a family of Centronics line printers to the Unibus, including Models 101, 101A*, 101D, 102A, and 303. These models are medium-speed serial matrix printers. The 101 model uses a 5 × 7 matrix, the 101A uses a 9 × 7 matrix. The 101 and 101A line printers have the following basic characteristics:

- a. The average printing speed is 132 characters/second, including the return time of the printing head.
- b. The line printing speeds are 60 lines/minute on full lines and up to 200 lines/minute on short lines.
- c. The print size is 10 characters/inch horizontally and 6 lines/inch vertically.

The line printer contains a 132-character memory buffer, which is loaded character by character via the LS11 Controller. Once the 132-character memory is full, the Centronics printer automatically prints the 132 characters on a line and then performs an automatic carriage return. There is, however, a carriage return command which is performed for lines containing less than 132 characters as specified by the programmer.

Each character is transferred to the line printer in a parallel 7-bit format. These 7-bit characters are in ASCII code. The Centronics line printer does not print lower case characters. Of the ASCII character set, the line printer uses nine commands. These commands and their functions are listed in Table 4-2. For more detailed printer information, refer to the applicable Centronics technical manual.

*Product line standard.

CHAPTER 4 PROGRAMMING

4.1 GENERAL

4.1.1 LP11

Characters are serially loaded into the line printer one character at a time under program control. The characters are loaded into the printer memory by means of the line printer data buffer (LPDB) in the LP11 Controller. When the printer memory becomes full (20 characters for LP01 model and 24 characters for LP02 model) the characters are automatically printed out. In the LP04 and LP05 models, the characters in the buffer are printed out only when one of three special non-printing characters is recognized. This process continues until the full 80 columns (or 132 columns) have been printed, or until one of three special non-printing characters is recognized. These special characters are described in Table 4-1.

Table 4-1
LP11 Non-Printing Characters

Mnemonic	Octal Code	Name	Function
CR	015	Carriage Return	Causes the currently stored characters to be printed; then resets column counter to 1 (next printing character loaded is printed in column 1). Does not advance paper.
PF	012	Paper Feed	Causes the currently stored characters to be printed; then resets column counter to 1 and advances paper one line.
FF	014	Form Feed	Functions the same as PF above except paper is advanced to top of next page.

Note: In all cases of paper advance (PF and FF), the printer automatically skips the last line on the page and spaces two lines at the top of the next page.

4.1.2 LS11

ASCII-coded characters are loaded into the line printer one character at a time. The characters are loaded into the printer memory from the LS11 programmable data buffer register. When the printer memory is full (132 characters), the characters are automatically printed out. Special nonprinting characters serve as line printer commands and direct line printer functions as shown in Table 4-2.