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# LQ-510/AP-4000

**T E C H N I C A L M A N U A L**

# EPSON

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## FCC COMPLIANCE STATEMENT FOR AMERICAN USERS

This equipment uses and generates radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with limits for a Class B computing device in accordance with Sub-part J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient the receiving antenna
- relocate the computer with respect to the receiver
- move the computer away from the receiver
- plug the computer into a different outlet so that the computer and receiver are on different branch circuits.

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

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Epson America, Inc.  
Customer Service Department  
23610 Telo Avenue  
Torrance, California 90505

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## PRECAUTIONS

Precautionary notations throughout the text are categorized relative to 1) personal injury, and 2) damage to equipment:

**DANGER** Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be exercised in performing procedures preceded by a DANGER heading.

**WARNING** Signals a precaution which, if ignored, could result in damage to equipment.

The precautionary measures itemized below should always be observed when performing repair/maintenance procedures.

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### DANGER

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1. *ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND PERIPHERAL DEVICES BEFORE PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURE.*
  2. *NO WORK SHOULD BE PERFORMED ON THE UNIT BY PERSONS UNFAMILIAR WITH BASIC SAFETY MEASURES AS DICTATED FOR ALL ELECTRONICS TECHNICIANS IN THEIR LINE OF WORK.*
  3. *WHEN PERFORMING TESTING AS DICTATED WITHIN THIS MANUAL, DO NOT CONNECT THE UNIT TO A POWER SOURCE UNTIL INSTRUCTED TO DO SO. WHEN THE POWER SUPPLY CABLE MUST BE CONNECTED, USE EXTREME CAUTION IN WORKING ON POWER SUPPLY AND OTHER ELECTRONIC COMPONENTS.*
- 

### WARNING

1. *Repairs on Epson products should be performed on/y by an Epson-certified repair technician.*
2. *Make certain that the source voltage is the same as the rated voltage, listed on the serial number/rating plate. If the Epson product has a primary AC rating different from the available power source, do not connect it to the power source.*
3. *Always verify that the Epson product has been disconnected from the power source before removing or replacing printed circuit boards and/or individual chips.*
4. *In order to protect sensitive microprocessors and circuitry, use static discharge equipment, such as anti-static wrist straps, when accessing internal components.*
5. *Replace malfunctioning components only with those components recommended by the manufacturer; introduction of second-source ICs or other nonapproved components may damage the product and void any applicable Epson warranty.*

**REVISION SHEET**

<b>REVISION</b>	<b>DATE ISSUED</b>	<b>UPDATES</b>
A	May 1, 1989	1st issue

# FCC Compliance Statement for American Users

This equipment has been tested and found to comply with limits for a Class B digital device, pursuant to Part 16 of the FCC Rules. These limits are designed to provide reasonable protections against harmful interference in a residential installation. This **equipment** generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on. The user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and the receiver
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help.

**WARNING: The connection of a nonshielded interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels that exceed the limits established by the FCC for this equipment. If this equipment has more than one interface connector, do not leave cables connected to unused interfaces.**

## For Canadian Users

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of the Canadian Department of Communications.

Le **présent** appareil **numérique n'émet** pas de bruits **radioélectriques dépassant** les **limites applicables aux** appareils **numériques** de Classe B **prescrites** dans le **règlement** sur le brouillage **radioélectriques édicté** par le **Ministère** des Communications du Canada.

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Subsequent product modifications will be brought to your attention via service bulletins. Please revise the text when you receive these bulletins.

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## Addendum

The AP4000 is mechanically and electronically the same as the LQ-510.

All the information contained herein is equally applicable to both printers.

Below is a list of unique parts for the Epson ActionPrinter 4000:

Part Number	Description
1002192	Logo plate
5000119	Individual carton box
5000133	Pad sleeve

ActionPrinter 4000 parts not listed above are identical to those for the LQ-510.

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# CHAPTER 1

## GENERAL DESCRIPTION

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**1.1 FEATURES**

The LQ-510 is a small, light-weight, low-cost printer, comparable to the LQ-500 with advanced paper-handling. Its main features are as follows:

1. Advanced paper handling: auto back-out and cut-sheet loading.
2. Expanded ESC/P-code printing, implemented as a standard feature.
3. Printing speeds in characters per second (cps):
  - 180 cps (alphanumeric Draft 12 cpi)
  - 150 cps (alphanumeric Draft 10 cpi)
  - 60 cps (alphanumeric LQ 12 cpi)
  - 50 cps (alphanumeric LQ 10 cpi)
4. Optional 8100 series interface.
5. Clear, easy-to-read printing with a standard Epson font.
6. Two built-in LQ fonts (Roman and Sans Serif).
7. An optional multi-font module can provide a wide variety of fonts.
8. Control panel switch selection of Draft, Roman, Sans Serif, or slot-mounted (optional multi-font module) font.
9. Control panel switch selection of normal or condensed printing.
10. Optional cut-sheet feeder (CSF) for easy handling of cut sheets.

The LQ-510 is equipped with the standard Epson 8-bit parallel interface. Various interface options allow printing from a wide variety of computers, Table I-I lists the interface options, Table 1-2 lists the optional units available, and Figure I-I shows an exterior view of the printer.

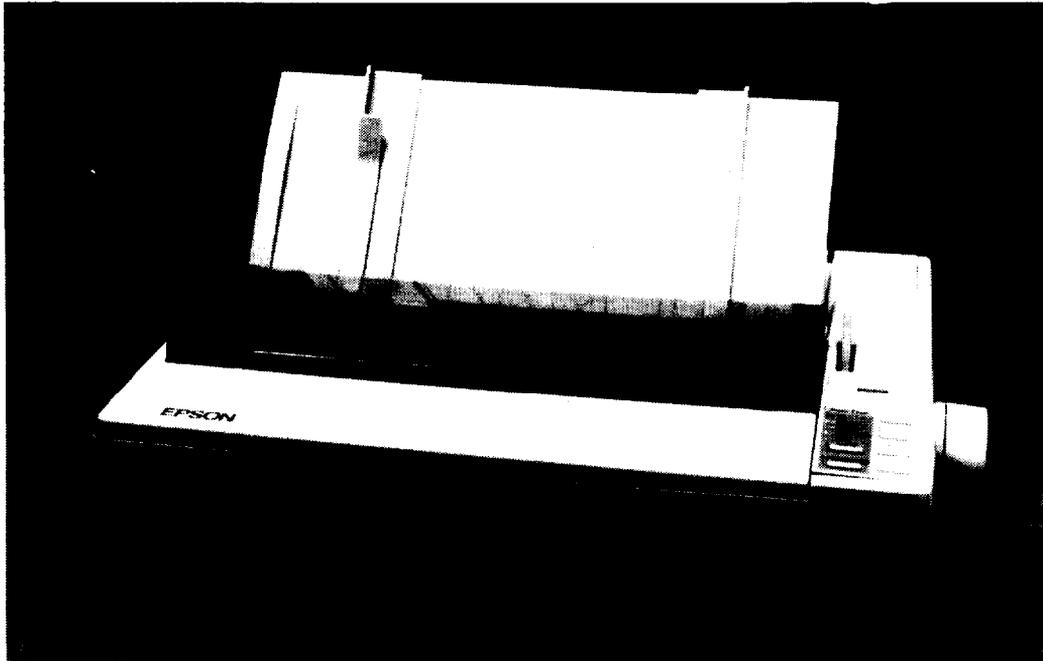
**Table I-I. Interface Options**

<b>Model</b>	<b>Description</b>
8143	New serial interface board
8148	Intelligent serial interface board
8165	Intelligent IEEE-488 interface board

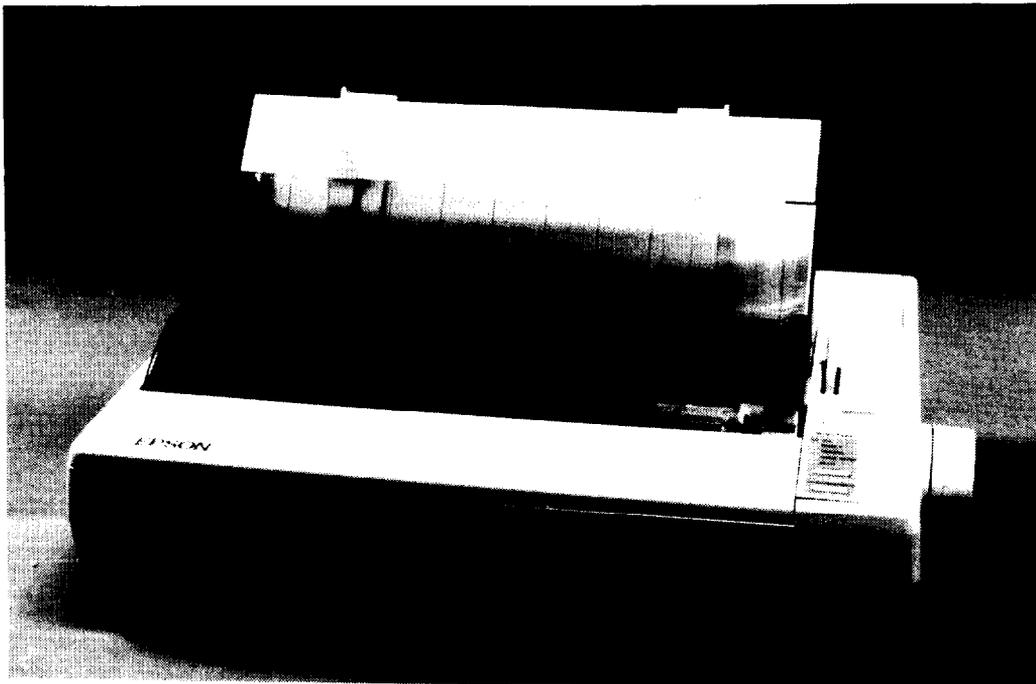
**NOTE:** Refer to the "Optional Interface Technical Manual" for details.

**Table 1-2. Optional Units**

<b>Model</b>	<b>Description</b>
C80612	Single-bin cut-sheet feeder
C80006	Pull tractor unit
7753	Ribbon cartridge (black)
7768	Film ribbon cartridge
7407	Multi-font cartridge



(Printer Cover A)



(Printer Cover B)

**Figure I-I. Exterior Views of the LQ-510**

## 1.2 SPECIFICATIONS

This section describes the specifications for the LQ-510 printer.

### 1.2.1 HARDWARE SPECIFICATIONS

Printing Method                      Serial, impact, dot matrix  
Pin Configuration                    24 wires (12 x 2, staggered, 0.2 mm diameter)

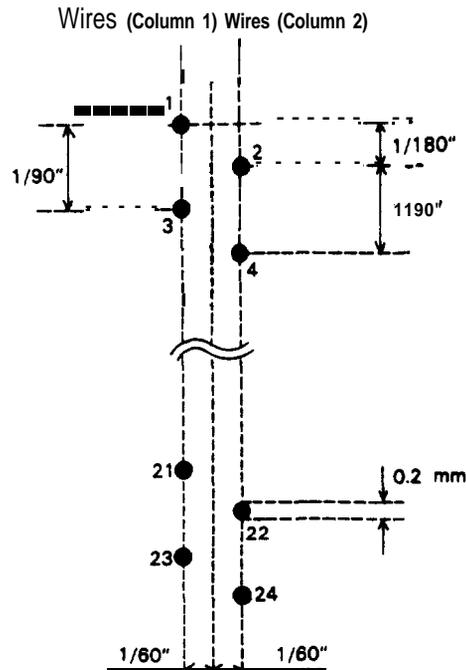


Figure 1-2. Pin Configuration

Feeding Method                      Friction feed, tractor feed (push tractor: standard; pull tractor: optional)

**NOTE:** Be aware of the following points regarding paper handling.

#### Friction Feed:

1. Do not use continuous paper.
2. Do not use a single sheet shorter than 7.28 inches (182 mm) or longer than 10.28 inches (257 mm).
3. Do not perform a reverse paper feed when the paper is within .34 inch (8.5 mm) from the top or within .88 inch (22 mm) from the bottom.
4. Do not perform a reverse feed greater than 1/6 inch after the paper end has been detected.
5. Use the pull-out unit.
6. Do not use multi-part single-sheet forms.

#### Tractor Feed

1. Release the friction-feed mechanism.
2. Multiple copies must be joined by pasting at the perforation or tractor holes.
3. Paper for copies must be carbonless, multi-part paper.

**Push Tractor Feed**

1. Use the pull-out unit.
2. Do not perform reverse feeding for distances greater than 1/6 inch.
3. Accuracy of paper feed cannot be assured, and reverse feeding cannot be performed, after the paper end is detected.

**Push-Pull Feed**

1. Remove the pull-out unit and attach the pull tractor unit.
2. Do not lose the paper between the platen and pull tractor unit.
3. Precisely adjust the horizontal positions of the pull and the push tractors.
4. Do not perform reverse feeding for distances greater than 1/6 inch.
5. Do not perform reverse feeding after the paper end is detected.

**Pull Tractor Feed**

1. Remove the pull-out unit and attach the pull tractor unit.

Line Spacing	1/6 inch, or programmable in units of 1/360 inch	
Paper Insertion	From rear	
Paper-Feed Speed	Friction, without CSF	100 ms/line (at 1/6-inch line feed) 2.2 inches per second (continuous feed)
	Friction, with CSF	100 ms/line (at 1/6-inch line feed) 2.2 inches per second (continuous feed)
	Tractor	100 ms/line (at 1/6-inch line feed)
		2.2 inches per second (continuous feed)
Paper Specifications	See Tables 1-3 through 1-6.	

**Table 1-3. Cut-Sheet Specifications**

Width	7.15 to 10.1 inches (182 to 257 mm)
Length	14.3 inches, maximum (364 mm, maximum)
Thickness	0.0025 to 0.0055 inch (0.065 to 0.14 mm)
Weight	14 to 24 pounds (52.3 g/m <sup>2</sup> to 90 g/m <sup>2</sup> )
Quality	Xerographic, bond, airmail paper, etc.
Copies	Not available

**Table 1-4. Continuous-Paper Specifications**

Width	4 to 10 inches (101 to 254 mm)
Copies	3 sheets (1 original and 2 copies)
Quality	Bond, xerographic, airmail, etc.
Total Thickness	0.0025 to 0.01 inch (0.065 to 0.25 mm)
Weight	1 sheet - 14 to 22 pounds (52.3 g/m <sup>2</sup> to 82 g/m <sup>2</sup> )
	3 sheets - 12 to 15 pounds (40 g/m <sup>2</sup> to 58.2 g/m <sup>2</sup> ) each

**Table 1-5. Envelope Specifications**

Size	Number 6: 6.64 x 3.68 inches (166 x 92 mm) Number 10: 9.6 x 4.16 inches (240 x 104 mm)
Quality	Bond paper, xerographic paper, airmail
Thickness	0.0063 to 0.0197 inch (0.16 to 0.52 mm) (Within the printing area, the thickness differential must not exceed 0.0098 inch [0.25 mm].)
Weight	12 to 24 pounds (45 g/m <sup>2</sup> to 91 g/m <sup>2</sup> )

**NOTES:**

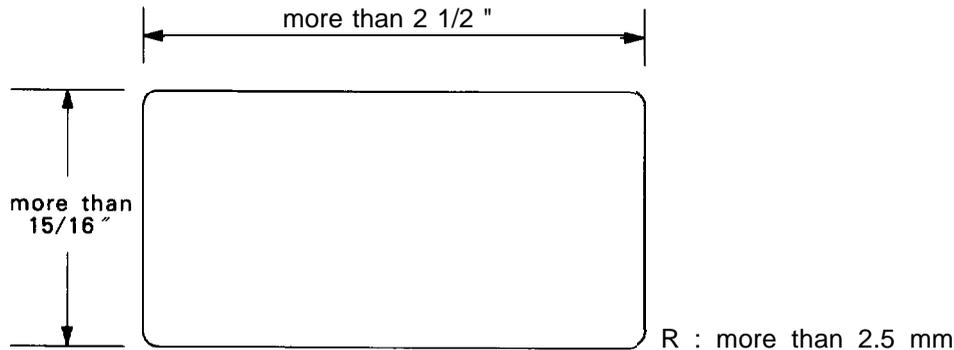
1. Printing on envelopes can be performed only when the temperature is normal.
2. Envelopes should be positioned horizontally.
3. For Number 6 envelopes, set the left side so that it matches the setting mark on the sheet guide.

**Table 1-6. Label Specifications**

Size	Greater than 2½ x 15/16 inches (63.5 x 23.8 mm)
Thickness	0.0063 to 0.0075 inch (0.16 to 0.19 mm) *Thickness of the base paper must be 0.0028 to 0.0031 inch (0.07 to 0.09 mm)

**NOTES:**

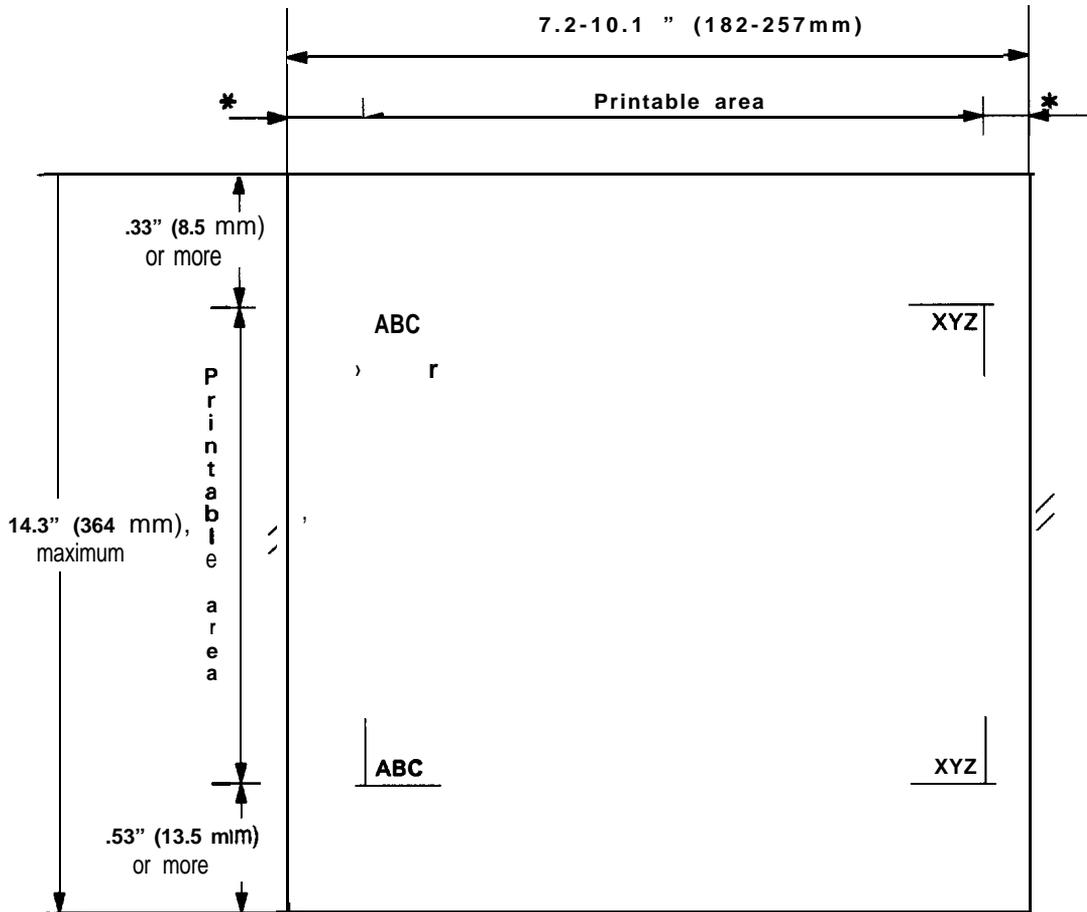
1. Printing on labels is available only at normal temperatures.
2. Labels must be fanfold.
3. For printing on labels with pressure sensitive paper, the following conditions must be met:
  - (1) sheets of labels must be joined at the perforation or tractor holes.
  - (2) the total thickness may not be greater than 0.0118 inch (0.3 mm)
  - (3) the temperature must be between + 41 °F and + 95 °F (+ 5° and + 35°C), and relative humidity between 10% and 80%
4. Examples of acceptable labels: Avery Continuous-Form Labels  
Avery Mini-Line Labels
5. Do not perform reverse feed.



**Figure 1-3. Label Dimensions**

**Printable Area**

The figure below illustrates the printable area for cut sheets.



**Figure 1-4. Printable Area for Cut Sheets**

\* At least 0.12 inch (3 mm) when paper width is less than 9 inches (229 mm); at least .9 inch (24 mm) when the paper width is 10.1 inches (257 mm).

Printing is possible approximately 1.12 inches (28 mm) from the paper's detected bottom edge; the .53 inch (13.5 mm) value (lowest print position) is for reference only. Paper feed accuracy cannot be assured within 0.87 inch (22 mm) of either the top or bottom edge.



**Ink Ribbon**

Fabric Model: 7753 ribbon cartridge  
 Color: black  
 Reliability: 2 million (LQ characters at 48 dots/character)  
 Dimensions: 11.6 (width) x 1.36 (height) x 2.84 (depth) inches  
 (290 mm x 34 mm x 71 mm)

Film Model: 7768 ribbon cartridge  
 Color: black  
 Reliability: 2 million characters at 48 dots/character  
 Dimensions: 11.6 (width) x 1.36 (height) x 2.84 (depth) inches  
 (290 mm x 34 mm x 71 mm)

**Reliability**

Mean Cycles Between Failures (MCBF): 3 million lines (excluding printhead)  
 Mean Time Before Failure (MTBF): 4000 Power-On Hours (25% duty)

**Printhead Life**

200 million strokes/wire

**Safety Approvals**

Safety Standards UL478 (U.S. version)  
 CSA22.2#154  
 VDE0806 (TUV) (European version)

Radio Frequency Interference (RFI) FCC class B (U.S. version)  
 VDE0871 (self-certification) (European version)

**Electrical Specifications**

Power Conditions 108 VAC to 132 VAC (120 V version)  
 198 VAC to 264 VAC (220/240 V version)  
 Frequency Range 49.5 to 60.5 Hz  
 Rating Current 1.8 A AC (120 V version)  
 1 A AC (220/240 V version)  
 Insulation Resistance 10 megohms minimum (between AC line and chassis)  
 Dielectric Strength 1250 VAC (rms), 1 minute (120 V version) (between AC line and chassis)  
 3750 VAC (rms), 1 minute (220/240 V version)

**Environmental Requirements**

Temperature 41° to 95°F (5 to 35°C) - operating  
 -22° to 140° F (-30 to 60° C) - with shipment container  
 Humidity 10 to 80% RH - operating  
 5 to 85% RH - non-operating  
 Shock Resistance 1 G, within 1 ms - operating  
 2 G, within 1 ms - non-operating  
 Resistance to Vibration 0.25 G, 55 Hz maximum - operating  
 0.50 G, 55 Hz maximum - storage

**Physical Specifications**

Weight 13.23 pounds (6 kg)  
 Dimensions 16.72 (width) x 13.88 (depth) x 5.6 (height) inches  
 (418 x 347 x 139.9 mm), excluding knobs and paper guides

**1.2.2 FIRMWARE SPECIFICATIONS (ESC/P)**

Control Codes	ESC/P-84 (Epson Standard Code for Printers)
Printing Direction	Bidirectional (text) Bidirectional (bit-image) (when SW 2-6 is ON and control command [ESC U 1] input) Unidirectional (bit-image)
Input Data Buffer	8K bytes (when SW 2-5 is ON)* 1K byte (when SW 2-5 is OFF) * If DIP SW 2-5 is set to ON, downloading will be ignored.
Character Code	8-bit
Character Sets	96-character ASCII and 15 international character sets
Family	Epson Roman (Family number: 0) Epson Sans Serif (Family number: 1)
Font	Epson Roman 10, Epson Roman 12, Epson Roman 15, Epson Roman Proportional Epson Sans Serif 10, Epson Sans Serif 12, Epson Sans Serif 15, Epson Sans Serif Proportional Epson Draft 10, Epson Draft 12, Epson Draft 15
Printing Mode	Selection and mixing of the following modes are allowed (except that 15 cpi Condensed Mode is not available): <ul style="list-style-type: none"> <li>● Printing quality (draft/letter quality)</li> <li>● Character pitch (10, 12, 15, or proportional)</li> <li>● Condensed</li> <li>● Double-width</li> <li>● Double-height</li> <li>● Bold</li> <li>● Double-strike</li> <li>● Italic</li> <li>● Underlined</li> <li>● Double-underlined</li> <li>● Overscore</li> <li>● Strike-through</li> <li>● Outline</li> <li>● Shadow</li> </ul>
Printing Speed	See Table 1-7.
Printing Columns	See Table 1-7.
Character Matrix	See Table 1-8.
Character Size	See Table 1-8.

Table 1-7. Printing Mode

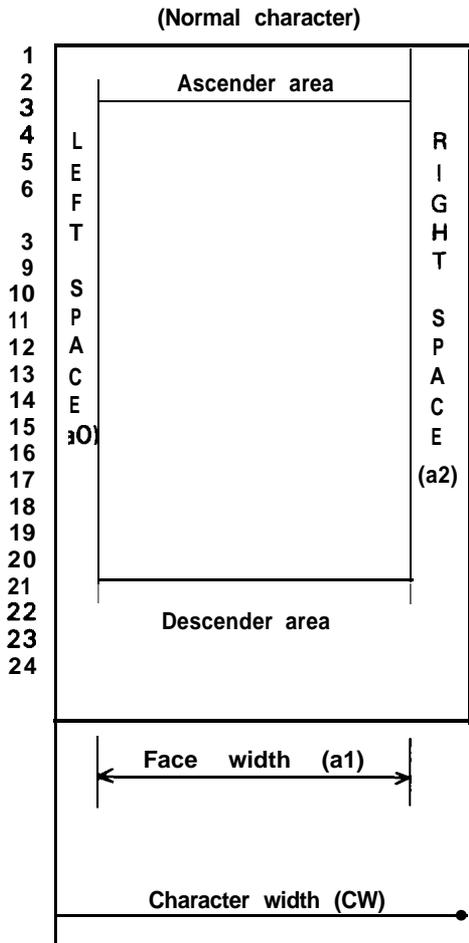
Print pitch	Condensed	Emphasized	Double width		Printable columns	Character pitch (cpi)	Printing speed (cps)	
							Draft	LQ
10	0	0	0		80	10	150	50
	0	0	1		40	5	75	25
	0	1	0		80	10	75	50
	0	1	1		40	5	37.5	25
	1	x	0		137	17.1	128.6	85.7
	1	x	1		69	8.5	64.3	42.9
12	0	0	0		96	12	180	60
	0	0	1		48	6	90	30
	0	1	0		96	12	90	60
	0	1	1		48	6	45	30
	1	x	0		160	20	150	100
	1	x	1		80	10	75	50
15	0	0	0		120	15	225	75
	0	0	1		60	15	112.5	37.5
	0	1	0		120	7.5	12.5	75
	0	1	1		60	7.5	56.3	37.5
	1	x	x		Condensed not available			
Proportional	0	x	0	maximum	69	8.6	—	42.9
				minimum	160	20	—	100
	0	x	1	maximum	34	4.3	—	21.4
				minimum	80	10	—	50
	1	x	0	maximum	137	17.1	—	85.7
				minimum	320	40	—	200
1	x	1	maximum	69	8.6	—	42.9	
			minimum	160	20	—	100	
Proportional super/subscript	0	x	0	maximum	103	12.8	—	64.3
				minimum	240	30	—	150
	0	x	1	maximum	51	6.4	—	32.1
				minimum	120	15	—	75
	1	x	0	maximum	206	25.7	—	128.6
				minimum	480	60	—	300
1	x	1	maximum	103	12.8	—	64.3	
			minimum	240	30	—	150	

- NOTES:** 1. The “maximum” value applies when only characters of maximum width are printed.  
 2. The “minimum” value applies when only characters of minimum width are printed.  
 3. “-” indicates that the “LQ” character set is automatically selected when proportional pitch is specified.

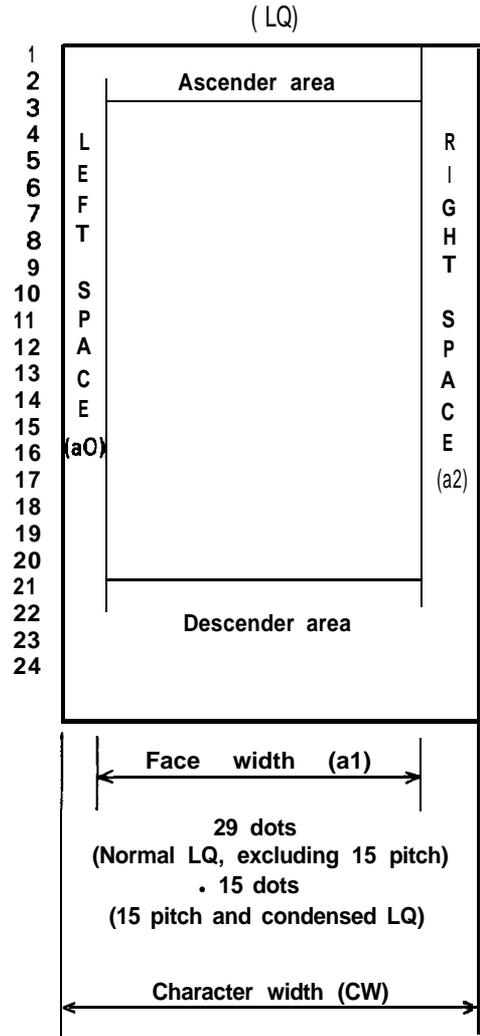
Table 1-8. Character Matrix and Character Size

Printing mode	Face matrix	HDD	Character size H x V (mm)	Unit ESC sp
Draft 10-pitch	9 x 23	120	1.9 x 3.2	120
Draft 12-pitch	9 x 23	120	1.9 x 3.2	120
Draft 15-pitch	9 X 16	120	1.0 x 2.3	120
Draft 10-pitch, condensed	-	240	-	240
Draft 12-pitch, condensed	-	240	-	<b>240</b>
LQ 10-pitch	29 x 23	360	2.0 x 3.2	180
LQ 12-pitch	29 x 23	360	2.0 x 3.2	180
LQ 15-pitch	15 x 16	360	1.0 x 2.3	180
LQ 10-pitch, condensed	-	360	-	<b>360</b>
LQ 12-pitch, condensed	-	360	-	360
LQ proportional	37 x 23 maximum 18 x 23 minimum	360 360	2.6 x 3.2 1.0 x 3.2	180 180
LQ proportional, condensed	— —	<b>360</b> <b>360</b>	— —	360 360
LQ proportional, super/ subscript	28 x 16 maximum 12 x 16 minimum	360 360	1.8 x 2.3 0.7 x 2.3	180 180
LQ proportional, super/ subscript, condensed	- -	360 360	- -	360 360

- NOTES:**
1. HDD is horizontal dot density in dots per inch.
  2. Face matrix and character size indicate maximum character size. This value changes according to differences in paper, ribbon, etc.
  3. Unit ESC sp (which also can be sent as the unit followed by the character string CHR\$( &h20)) indicates the minimum length to be added to the right of the character that can be specified with the ESC sp control code.
  4. “—” indicates that character matrix is reshaped by printer firmware. Character width becomes half of noncondensed character width.



- 12 dots (10 pitch) 120 DPI
- 15 dots (12 pitch) 180 DPI
- 16 dots (15 pitch) 240 DPI
- 14 dots (condensed 10 pitch) 240 DPI
- 12 dots (condensed 12 pitch) 240 DPI



- 36 dots (10 pitch) 360 DPI
- 30 dots (12 pitch) 360 DPI
- 24 dots (15 pitch) 360 DPI
- 21 dots (condensed 10 pitch) 360 DPI
- 18 dots (condensed 12 pitch) 360 DPI

\* 15 dots are made from 29 dots by printer firmware.

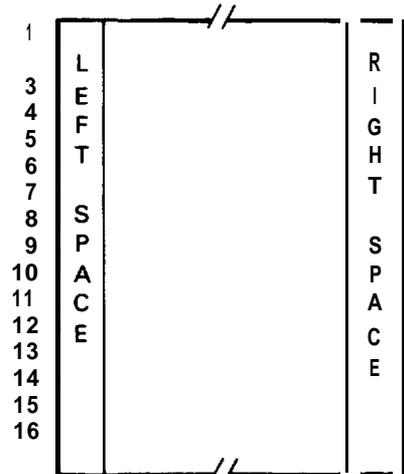
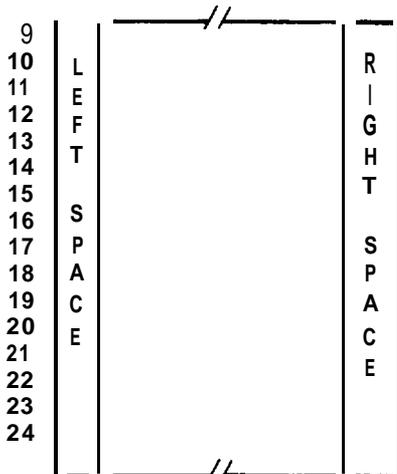


Figure 1-6. Character Matrix

### 1.3 INTERFACE OVERVIEW

The standard 8-bit parallel interface has the following specifications:

Data Format	8-bit parallel
Synchronization	By $\overline{\text{STROBE}}$ pulse
Handshaking	By $\text{BUSY}$ and $\overline{\text{ACKNLG}}$ signals
Signal Level	TTL-compatible
Connector	57-30360 (Amphenol) or equivalent
Data Transmission Timing	See Figure 1-7.

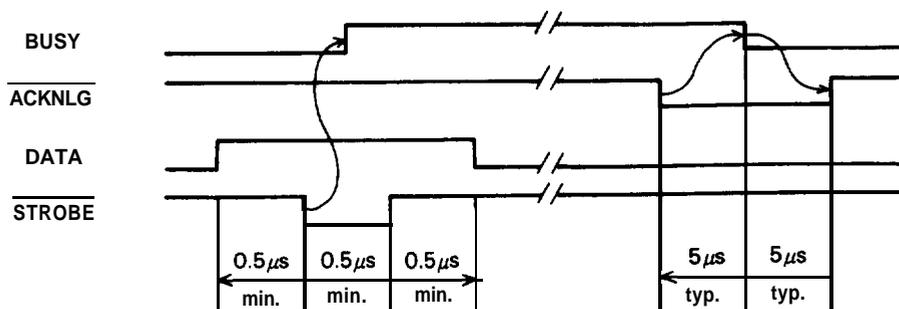


Figure 1-7. Data Transmission Timing

Table 1-9 shows the connector pin assignments and signal functions of the 8-bit parallel interface.

Table 1-9. Connector Pin Assignments and Signal Functions

Pin No.	Signal Name	Return Pin No.	Dir.	Functional Description
1	$\overline{\text{STROBE}}$	19	In	Strobe pulse to read the input data. Pulse width must be more than $0.5\ \mu\text{s}$ . Input data is latched at the falling edge of this signal.
2	DATA 1	20	In	Parallel input data to the printer. "HIGH" level means data "1." "LOW" level means data "0."
3	DATA 2	21	In	
4	DATA 3	22	In	
5	DATA 4	23	In	
6	DATA 5	24	In	
7	DATA 6	25	In	
8	DATA 7	26	In	
9	DATA 8	27	In	
10	$\overline{\text{ACKNLG}}$	28	out	This pulse indicates data was received and the printer is ready to accept more data. Pulse width is $11\ \mu\text{s}$ , approximate.
11	$\text{BUSY}$	29	out	"HIGH" indicates the printer cannot accept more data.

Table 1-9 Connector Pin Assignments and Signal Functions (Cont.)

Pin No.	Signal Name	Return Pin No.	Dir.	Functional Description
12	PE	30	out	"HIGH" indicates paper out. This signal is effective only when the ERROR signal is "LOW."
13	SLCT	-	out	Always "HIGH" output. (Pulled up to +5 V through 3.3K-ohm register.)
14	AUTOFEED-XT	-	In	If "LOW" when the printer is initialized, a line feed is automatically performed when the carriage return (CR) code is received (auto LF).
15				Not used.
16	GND			Ground for twisted pair grounding.
17	Chassis GND	-	-	Chassis ground level of printer.
18				Not used.
19 - 30	GND			Grounds for twisted pair grounding.
31	INIT	16	In	Pulse (width: 50 $\mu$ s, minimum, active "LOW") input for printer initialization.
32	ERROR	-	out	"LOW" indicates an error occurred in the printer.
33	GND	-	-	Ground for twisted pair grounding.
34		-	-	Not used.
35		-	out	Always "HIGH." (Pulled up to +5 V through 3.3K-ohm register.)
36	SLCT-IN	-	In	If "LOW," when printer is initialized, DC1/DC3 control is disabled.

- NOTES:**
1. "Dir." refers to the signal flow direction as viewed from the printer.
  2. "Return" denotes a twisted-pair return line.
  3. The cable used must be shielded to prevent noise.
  4. All interface conditions are based on TTL levels. Both the rise and fall times of all signals must be less than 0.2  $\mu$ s.
  5. The  $\overline{\text{AUTO FEED-XT}}$  signal can be set to LOW by DIP switch 2-4.
  6. The  $\overline{\text{SELECT-IN}}$  signal can be set to LOW by jumper 10.
  7. Printing tests, including those of the interface circuits, can be performed without using external equipment by setting DATA 1-8 of the interface connector to certain codes and connecting the  $\overline{\text{ACKNLG}}$  signal to the  $\overline{\text{STROBE}}$  signal.

Table 1-10 shows the printer select/deselect (DC1/DC3) control, including relations among ON-LINE,  $\overline{\text{SELECT-IN}}$  input, DC1/DC3, and interface signals.

**Table 1-10. Printer Select/Deselect Control**

ON-LINE SW	$\overline{\text{SLCT-IN}}$	DC1 / DC3	$\overline{\text{ERROR}}$	BUSY	$\overline{\text{ACKNLG}}$	DATA ENTRY
Off-Line	HIGH/LOW	DC1 / DC3	LOW	HIGH	No pulse	Disable
On-Line	HIGH	DC1	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	Enable (normal process)
		DC3	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	Enable (waits for DC1, see Note 2.)
	LOW	DC1	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	Enable (normal process)
		DC3	HIGH	LOW/HIGH (during data entry)	Pulse output after entry	

- NOTES:**
1. In Table 1-10, it is assumed that no  $\overline{\text{ERROR}}$  status exists other than that attributable to OFF-LINE mode.
  2. Once the printer has been put in the deselected state by the DC3 code, the printer will not revert to the selected state unless the DC1 code is input again. (In the deselected state, the printer ignores input data until the DC1 code is received.)
  3. The DC1 and DC3 codes are enabled only when the  $\overline{\text{SLCT-IN}}$  signal (Input Connector Number 36 for the parallel interface unit) is HIGH and printer power is initialized.
  4. If the  $\overline{\text{SLCT-IN}}$  signal is LOW when the printer is initialized, DC1 /DC3 printer select/deselect control is invalidated, and these control codes are ignored.
  5. If the  $\overline{\text{SLCT-IN}}$  signal is HIGH, and is not set to LOW by jumper 10 when the printer is initialized, the printer starts from the selected (DC1) state.

## 1.4 DIP SWITCHES AND JUMPER SETTING

This section describes the DIP switch selections and jumper setting for the LQ-510 printer.

### 1.4.1 DIP SWITCH SETTINGS

The two DIP switches for the printer are located on the control panel, and function as shown in Tables 1-11 through 1-15. (Note that the status of the DIP switches is read only at power up or upon receipt of the INIT signal.)

**Table 1-11. Settings for DIP Switch 1 (SW1)**

No.	Description	On	Off
1 2 3	International character set selection	See Table 1-13.	
4 5	Font selection (LQ-510 ROM versions SD6-W6 or below) (LQ-1010 ROM versions TAA04C or below) Page length (LQ-510 ROM versions TBD00A or above) (LQ-1010 ROM versions TBC00A or above)	See Table 1-14.	
6	Condensed printing	On	Off
7	Code table selection	Graphic	Italic
8	Cut-sheet feeder (CSF) mode	On	Off

**Table 1-12. Settings for DIP Switch 2 (SW2)**

No.	Description	On	Off
1	Page length (LQ-510 ROM versions SD6-W6 or below) (LQ-1010 ROM versions TAA04C or below) Not used (LQ-510 ROM versions TBD00A or above) (LQ-1010 ROM versions TBC00A or above)	12 inches _____	11 inches _____
2	Tear-off mode	On	Off
3	1-inch skip	On	Off
4	Auto LF	On	Off
5	Input data buffer	8KB	1KB
6	Print direction for graphics *	Bidirectional	Unidirectional
7-8	Character pitch selection	See Table 1-15 below.	

\* When this switch is ON and ESC U 0 is input, multi-pass characters are printed bidirectionally. Bit image graphics are always printed unidirectionally.

**Table 1-13. International Character Set Selection**

1-1	1-2	1-3	Country	1-1	1-2	1-3	Country
On	On	On	U.S.	Off	On	On	Denmark 1
On	On	Off	France	Off	On	Off	Sweden
On	Off	On	Germany	Off	Off	On	Italy
On	Off	Off	U.K.	Off	Off	Off	Spain 1

*Table 1-14. Font Select&n  
(ROM Version SD6-W6 or Below  
or TAA04C or Below)*

1 - 4	1 - 5	Font
Off	Off	Roman
On	Off	Sans serif
Off	On	Slot
On	On	Draft

*Tab& 1-14. Page Length Selection  
(ROM Version TBD00A or Above  
or TBC00A or Above)*

1 - 4	1 - 5	Page Length
Off	Off	11 inches
On	Off	12 inches
Off	On	8.5 inches
On	On	11.7 inches

*Table 1-15. Character Pitch Selection*

2 - 7	2-6	Character Pitch (In characters per inch)
Off	Off	10 cpi
On	Off	12 cpi
Off	On	15 cpi
On	On	Proportional

### 1.4.2 JUMPER SETTING

Jumper 10, which is user-selectable, is located inside the option board cover. If the jumper is connected, the SLCT-IN signal is fixed to LOW, and DC1 /DC3 printer select control is ignored.

## 1.5 SELECTYPE FUNCTION

**SelectType** enables easy selection of fonts and **printing modes**, and can be used to select any of the fonts listed on the control panel for either condensed or normal printing. If the printer uses an optional slot-mounted multi-font (ROM cartridge), these fonts also can be selected from the control panel. **SelectType** functions only when the printer is not printing, at which time the font can be selected by pressing the **FONT** switch. The printing mode is selected by pressing the **CONDENSED** switch (again, only when the printer is not printing). The selected font and mode are indicated on the printer's control panel.

## 1.6 SHEET LOADING AND SHEET EJECTION

The release lever enables disengaging of the push tractor unit drive mechanism. The printer therefore provides some improved paper-handling functions through combination of the release lever and LOAD/EJECT control panel switch.

### **Cut-Sheet Loading and Ejection**

To load a sheet of paper, position the paper-release lever back, place the sheet along the paper guide, and press the LOAD/EJECT switch. This loads the paper to the top-of-form position. Pressing the LOAD/EJECT switch after the paper has been loaded will cause the paper to be ejected.

### **Continuous-Paper Loading and Ejection (Back-Out)**

To load fanfold paper, move the paper-release lever forward, and insert the paper into the push tractor. Pressing the LOAD/EJECT switch will then cause paper to be automatically loaded to the top-of-form position. Pressing the LOAD/EJECT switch after the fanfold paper has been loaded causes the printer to eject the paper backward from the push tractor. To back out several pages, press the LOAD/EJECT switch several times (reverse feed is performed on a page-by-page basis).

The MULTI-PART LED will flash only when the paper is loaded and the ON LINE switch pressed. This indicates that the printer has entered "top-of-form adjust" mode, and that the user may adjust the top-of-form position, as well as the loading positions for subsequent forms. Adjustment is made using the FORM FEED button, which will increment the paper forward, and the LINE FEED switch, which will increment the paper in reverse. (The minimum feed amount is 1/80 inch.) When the cut-sheet feeder is used, the adjusted position for the top of form will be lost after the printer is reinitialized, and the top of form will be reset to the default value. When continuous paper is used, however, printer memory maintains the adjusted top-of-form position even after printer initialization.

## 1.7 TEAR-OFF FUNCTION

If the tear-off function is enabled by making the appropriate DIP switch setting, it operates when the release lever is set to the tractor position. In this case, if the input data buffer is empty and the printer is on line, the paper is automatically fed to the tear-off position, and the MULTI-PART LED flashes to indicate that the FORM FEED and LINE FEED switches are now available to perform micro-adjustment. The user may then adjust the paper to the desired tear-off position. This position becomes the new tear-off position default, and will remain valid even if the printer is reset and reinitialized, and regardless of whether the main power has been interrupted. When new data is input to the printer, the paper is automatically returned to its original position, and printing then starts. Paper that was advanced to the tear-off position will also be returned to its original position if the ON LINE switch is pressed (switching the printer from on line to off line).



1.8.2 HEXADECIMAL DUMP FUNCTION

HEX dump mode is activated if the printer is switched on while both the LINE-FEED and FORM-FEED buttons are depressed. When this mode is in effect, the hexadecimal representation of the input data is printed beside the corresponding printable ASCII characters. Periods (.) are printed beside control code input data. This function is useful for checking the data the printer is receiving from the host.

Data Dump Mode

1B 40 0D 1B 55 00 1B 33 1E 00 0D 0A 0D 0A 0D 0A	.@...U..3.....
12 1B 70 00 1B 78 01 1B 57 00 1B 4D 20 20 20 20 20	. .p..X..W..M
43 48 41 50 54 45 52 20 31 0D 0A 20 20 20 20 47	CHAPTER 1.. G
45 4E 45 52 41 4C 20 44 45 53 43 52 49 50 54 49	ENERAL DESCRIPTI
4F 4E 0D 0A 0D 0A 20 20 20 20 31 2E 31 20 46 45	ON.... 1.1 FE
41 54 55 52 45 53 0D 0A 20 20 20 20 31 2E 32 20	ATURES.. 1.2
53 50 45 43 49 46 49 43 41 54 49 4F 4E 53 0D 0A	SPECIFICATIONS..
20 20 20 20 20 20 20 20 31 2E 32 2E 31 20 46 61	1.2.1 Ha
72 64 77 61 72 65 20 53 70 65 63 69 66 69 63 61	rdware Specifica
74 69 6F 6E 73 0D 0A 20 20 20 20 20 20 20 31	tions.. 1
2E 32 2E 32 20 46 69 72 6D 77 61 72 65 20 53 70	.2.2 Firmware Sp
65 63 69 66 69 63 61 74 69 6F 6E 73 20 28 45 53	ecifications (ES
43 2F 50 29 0D 0A 20 20 20 20 31 2E 33 20 49 4E	C/P).. 1.3 IN
54 45 52 46 41 43 45 20 4F 56 45 52 56 49 45 57	TERFACE OVERVIEW
0D 0A 20 20 20 20 31 2E 34 20 44 49 50 20 53 57	1.4 DIP SW
49 54 43 40 45 53 20 41 4E 44 20 4A 55 4D 50 45	ITCHES AND JUMPE
52 20 53 45 54 49 4E 47 0D 0A 20 20 20 20 20	R SETTING..
20 20 20 31 2E 34 2E 31 20 44 49 50 20 53 77 69	1.4.1 DIP Swi
74 63 68 20 53 65 74 74 69 6E 67 73 0D 0A 20 20	tch Settings..
20 20 20 20 20 31 2E 34 2E 32 20 4A 75 6D 70	1.4.2 Jump
65 72 20 53 65 74 74 69 6E 67 0D 0A 20 20 20 20	er Setting..
31 2E 35 20 53 45 4C 45 43 54 59 50 45 20 46 55	1.5 SELECTYPE FU
4E 43 54 49 4F 4E 0D 0A 20 20 20 20 31 2E 36 20	NCTION.. 1.6
53 48 45 45 54 20 4C 4F 41 44 49 4E 47 20 41 4E	SHEET LOADING AN
44 20 53 48 45 54 20 45 4A 45 43 54 49 4F 4E	D SHEET EJECTION
0D 0A 20 20 20 20 31 2E 37 20 54 45 41 52 2D 4F	.. 1.7 TEAR-O
46 46 20 46 55 4E 43 54 49 4F 4E 0D 0A 20 20 20	FF FUNCTION..
20 31 2E 38 20 4F 50 45 52 41 54 49 4E 47 20 49	1.8 OPERATING I
4E 53 54 52 55 43 54 49 4F 4E 53 0D 0A 20 20 20	NSTRUCTIONS..
20 20 20 20 20 31 2E 38 2E 31 20 53 65 6C 66 2D	1.8.1 Self-
54 65 73 74 0D 0A 20 20 20 20 20 20 20 31 2E	Test.. 1.
30 2E 32 20 48 65 78 61 64 65 63 69 6D 61 6C 20	8.2 Hexadecimal
44 75 6D 70 20 46 75 6E 63 74 69 6F 6E 0D 0A 20	Dump Function..
20 20 20 20 20 31 2E 38 2E 33 20 42 69 74	1.8.3 Bit
2D 49 6D 61 67 65 20 50 72 69 6E 74 69 6E 67 0D	-Image Printing.
0A 20 20 20 20 20 20 20 31 2E 38 2E 34 20 45	1.8.4 E
72 72 6F 72 20 43 6F 6E 64 69 74 69 6F 6E 73 0D	rror Conditions.
0A 20 20 20 20 20 31 2E 38 2E 35 20 42	1.8.5 B
75 7A 7A 65 72 20 4F 70 65 72 61 74 69 6F 6E 0D	uzzer Operation.
0A 20 20 20 20 20 31 2E 38 2E 36 20 50	1.8.6 P
72 69 6E 74 65 72 20 49 6E 69 74 69 61 6C 69 7A	rinter Initializ
61 74 69 6F 6E 0D 0A 20 20 20 20 20 20 31	ation.. 1
2E 38 2E 37 20 44 65 66 61 75 6C 74 20 56 61 6C	.8.7 Default Val
75 65 73 0D 0A 20 20 20 20 20 20 20 31 2E 38	ues.. 1.8
2E 38 20 41 64 6A 75 73 74 20 4C 65 76 65 72 20	.8 Adjust Lever
4F 70 65 72 61 74 69 6F 6E 0D 0A 20 20 20 20	Operation..
20 20 20 31 2E 38 2E 39 20 50 72 69 6E 74 65 72	1.8.9 Printer
20 50 72 6F 74 65 63 74 69 6F 6E 20 66 6F 72 20	Protection for
48 65 61 76 79 2D 44 75 74 79 20 50 72 69 6E 74	Heavy-Duty Print
69 6E 67 0D 0A 20 20 20 20 31 2E 39 20 4D 41 49	ing.. 1.9 MAI
4E 20 43 4F 4D 50 4F 4E 45 4E 54 53 0D 0A 20 20	N COMPONENTS..
20 20 20 20 20 31 2E 39 2E 31 20 53 41 4D 41	1.9.1 SAMA
20 42 6F 61 72 64 0D 0A 20 20 20 20 20 20 20	Board. _
31 2E 39 2E 32 20 53 41 4E 50 4E 4C 20 42 6F 61	1.9.2 SANPNL Boa
72 64 0D 0A 20 20 20 20 20 20 20 31 2E 39 2E	rd.. 1.9.
33 20 53 41 4E 50 53 28 45 29 20 42 6F 61 72 64	3 SANPS(E) Board
0D 0A 20 20 20 20 20 20 20 31 2E 39 2E 34 20	.. 1.9.4
50 72 69 6E 74 65 72 20 4D 65 63 68 61 6E 69 73	Printer Mechanis
6D 20 28 4D 2D 35 37 31 30 29 0D 0A 20 20 20 20	m (M-5710)..
20 20 20 31 2E 39 2E 35 20 48 6F 75 73 69 6E	1.9.5 Housin
67 0D 0A 0D 0A 20 20 20 31 2E 31 20 46 45 41	g... 1.1 FEA
54 55 52 45 53 0D 0A 0D 0A 20 20 20 54 68 65	TURES.... The
20 4C 51 2D 35 31 30 2F 35 35 30 20 69 73 20 61	LQ-510/550 is a

Figure 1-9. Hexadecimal Dump Function

**1.8.3 BIT-IMAGE PRINTING**

This printer offers the following four standard print densities (“dpi” indicates “dots per inch”):

120 dpi (including half dots): Triple speed

180 dpi (including half dots): Double speed

240 dpi (including half dots): 1.5 speed

360 dpi (including half dots): Normal speed

The firmware implements the print densities as shown in Table 1-16.

**Table 1-16. Print Density**

Pins	m	Bit Image Printing Mode	Dot Density (dpi)	Dot Printing	$256 \times n2 + 1$	Print Speed (ips)
8	0	Single-density	60	yes	660	15
8	1	Dual density	120	yes	1320	7.5
8	2	Double speed, dual density	120	no	1320	15
8	3	Quadruple density	240	no	2640	7.5
8	4	CRT graphics	80	yes	880	7.5
8	6	CRT graphics II	90	yes	990	10
24	32	Single density	60	yes	660	15
24	33	Dual density	120	yes	1320	7.5
24	38	CRT graphics II	90	yes	990	10
24	39	Triple density	180	yes	1980	5
24	40	Hex. density	360	no	3960	5

**NOTES:** 1. Dot density is in dots per inch; print speed is in inches per second.

2. The format of the graphics command is ESC\* m n1 n2 [DATA]. Column 2 of the table shows the significance of the various options for m.

The firmware handles the print densities as shown in Table 1-17.

**Table 1-17. Bit-Image Printing**

Dot Density	Printing Method
80 dpi	Prints at 240 dpi by expanding the bit image by three: $80 \times 3 = 240$