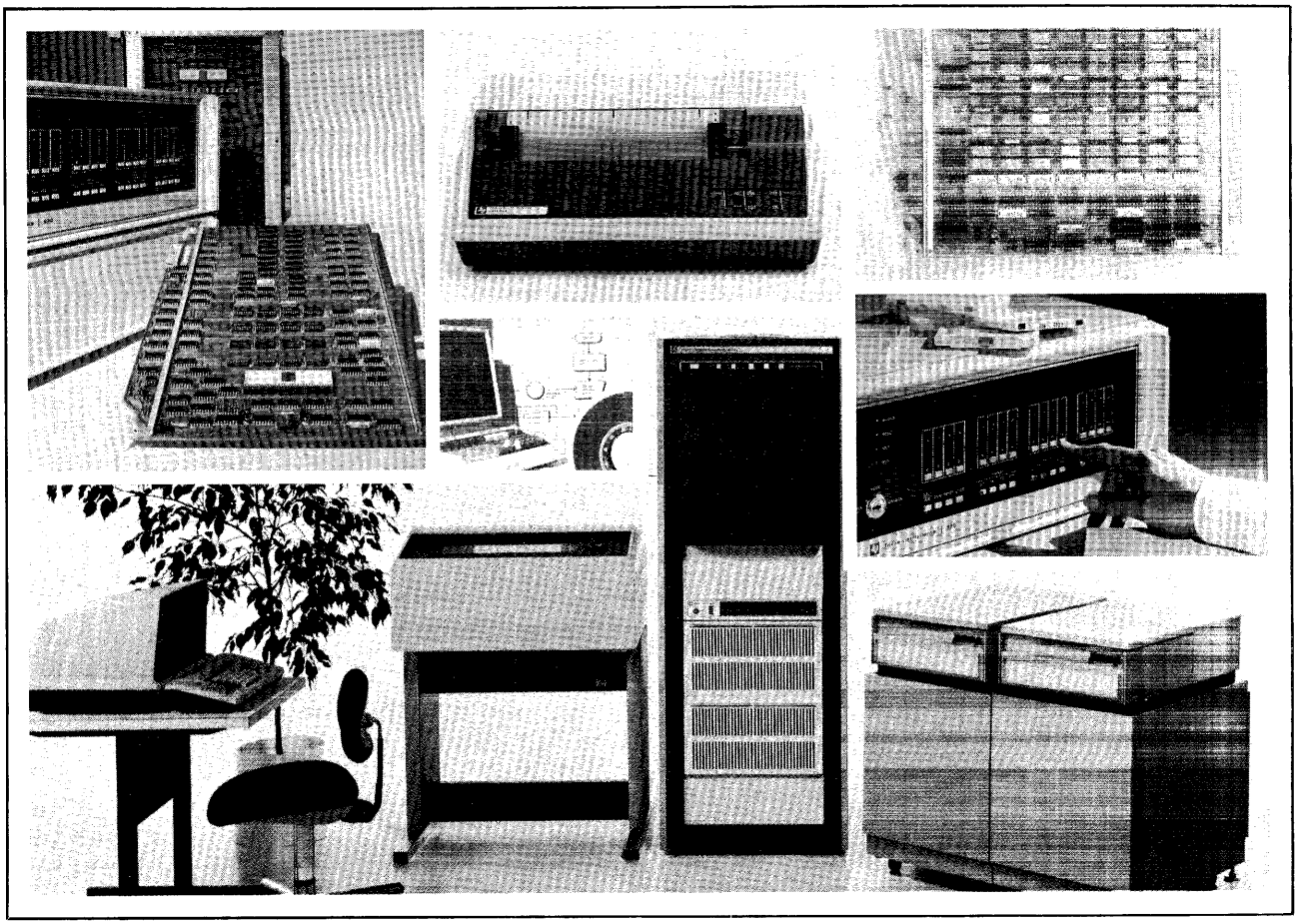
Model 990 Computer
Model LP300 and LP600 Line Printers
Installation and Operation Manual



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MANUAL REVISION HISTORY

Model 990 Computer Model LP300 and LP600 Line Printers
Installation and Operation Manual (2250364-9701 **)

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Preface

This manual provides instructions for installing and operating the Texas Instruments (TI) Model LP300 and LP600 Printers in conjunction with a TI Model 990 Computer. Because the LP300 and LP600 printers are identical except for the number of character lines printed per minute, both printers will be referred to in this manual as the LP300/LP600 printer, unless otherwise noted.

This manual also provides programming information for those users who write input/output (I/O) routines. The information in this manual is divided into the following four sections and one appendix:

Section

1 General Description — Briefly describes the features and major components of the LP300/LP600 printer.

2 Installation — Contains installation and subsystem checkout procedures for the LP300/LP600 printer.

3 Programming — Presents information for use by programmers in designing device service routines (DSRs) to control printer operation.

4 Operation — Describes the LP300/LP600 printer pushbuttons, indicators, and switches. This section also includes operating procedures, operator maintenance procedures, and printer adjustment instructions.

Appendix

A Optional Character Sets — Contains all optional character sets currently available for the LP300/LP600 printer.

If you want to have TIs' service representatives install the LP300/LP600 printer at your site, please contact the local TI sales or service office in your area.

The following documents provide additional information about the LP300/LP600 printer:

Title	Part Number
Model 990 Computer Model LP300 and LP600 Line Printer's Field Maintenance Manual	0945419-9704
Model 990/4 Computer System Hardware Reference Manual	0945251-9701

Title	Part Number
Model 990/5 Computer Hardware User's Manual	0946294-9701
Model 990/10 Computer System Hardware Reference Manual	0945417-9701
Model 990/12 Computer Hardware User's Guide	2264446-9701
Model 990 Computer Diagnostic Handbook (Seven Volumes)	0945400-9701 through 0945400-9707
Model 990 Computer TMS 9900 Microprocessor Assembly Language Programmer's Guide	0943441-9701

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General Description

1.1 GENERAL DESCRIPTION

This section provides a general overview of the LP300/LP600 printer subsystem that includes the following major topics:

- A description of the LP300/LP600 printer.
- A tabular listing of the general characteristics of the LP300/LP600 printer subsystem.

1.2 SUBSYSTEM DESCRIPTION

The LP300/LP600 printer subsystem (Figure 1-1) interfaces with TI Model 990 series computers via the communications register unit (CRU). The subsystem consists of either an LP300 or an LP600 printer, a transistor-transistor-logic (TTL) data module, an interface cable, and a paper catcher. Figure 1-2 illustrates a typical interconnection for the LP300/LP600 printer subsystem.

1.2.1 LP300/LP600 Printer

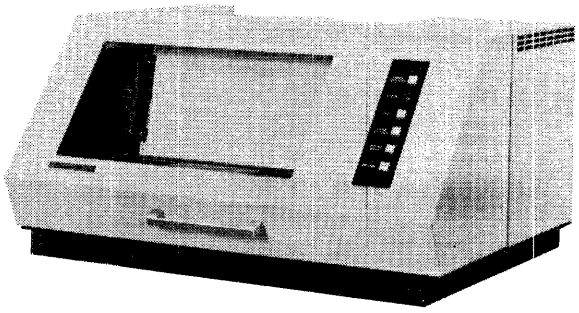
The LP300/LP600 printer (Figure 1-3) is a high speed matrix printer that operates at 300 (LP300) or 600 (LP600) lines per minute (lpm). It offers the following standard features:

- An operator control panel with pushbutton switches and indicators for control of on- and off-line operation, top of form alignment, paper advancement, and check and power printer functions
- A standard 96-character ASCII set
- An electronic vertical format unit (EVFU) for composing forms up to 132 lines long
- Capabilities for printing double-height (elongated) characters, graphic plots, and underlining
- Switch and program selectable line spacing of six or eight lines per inch (lpi)
- A paper out sensor
- Capabilities for printing one to six copies on 6.8 kg (15 lb) to 45.4 kg (100 lb) stock
- A standard electrical interface for TTL logic

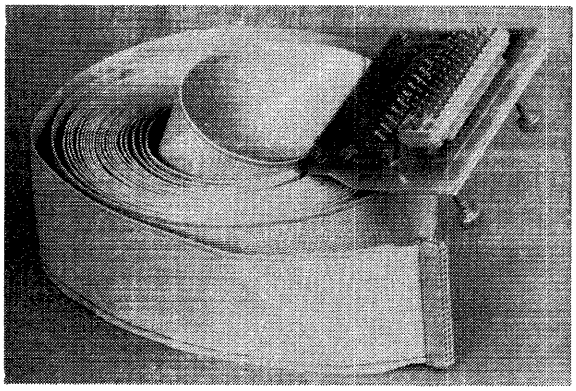
1.2.1.1 Operator Control Panel. Figure 1-3 shows the LP300/LP600 printer operator control panel. It contains the pushbutton switches and indicators that select the mode of operation, character line spacing, and form advancement, or indicate printer status functions.

For a description of these pushbuttons and indicators, refer to Section 4 of this manual.

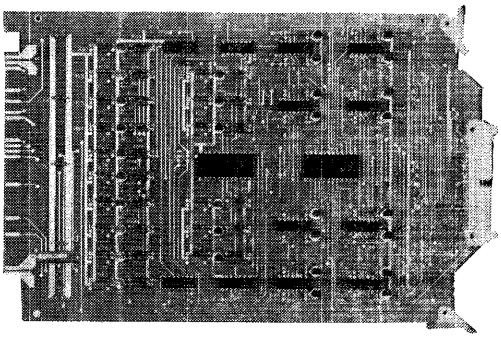
1.2.1.2 Printer Mechanism. The LP300/LP600 printer uses a hammer bank and shuttle arrangement for its printer mechanism (Figures 1-4 and 1-5) that enables the printer to print all characters simultaneously in a full line as the paper advances through the character height.



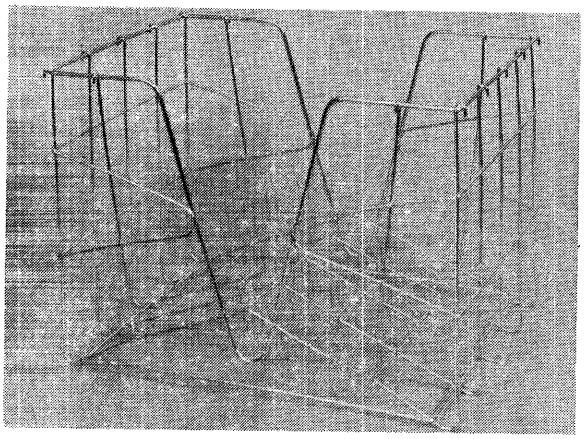
LP300/LP600 PRINTER
PART NO. 2271814-0001 THROUGH -00012(LP300)
PART NO. 2271815-0001 THROUGH -00012(LP600)



LP300/LP600 PRINTER CABLE ASSEMBLY
PART NO. 937490-2



TTL DATA MODULE
PART NO. 0945145-0006



LP300/LP600 PRINTER PAPER CATCHER
PART NO. 2271799-0001

(A) 143353

Figure 1-1. LP300/LP600 Printer Subsystem

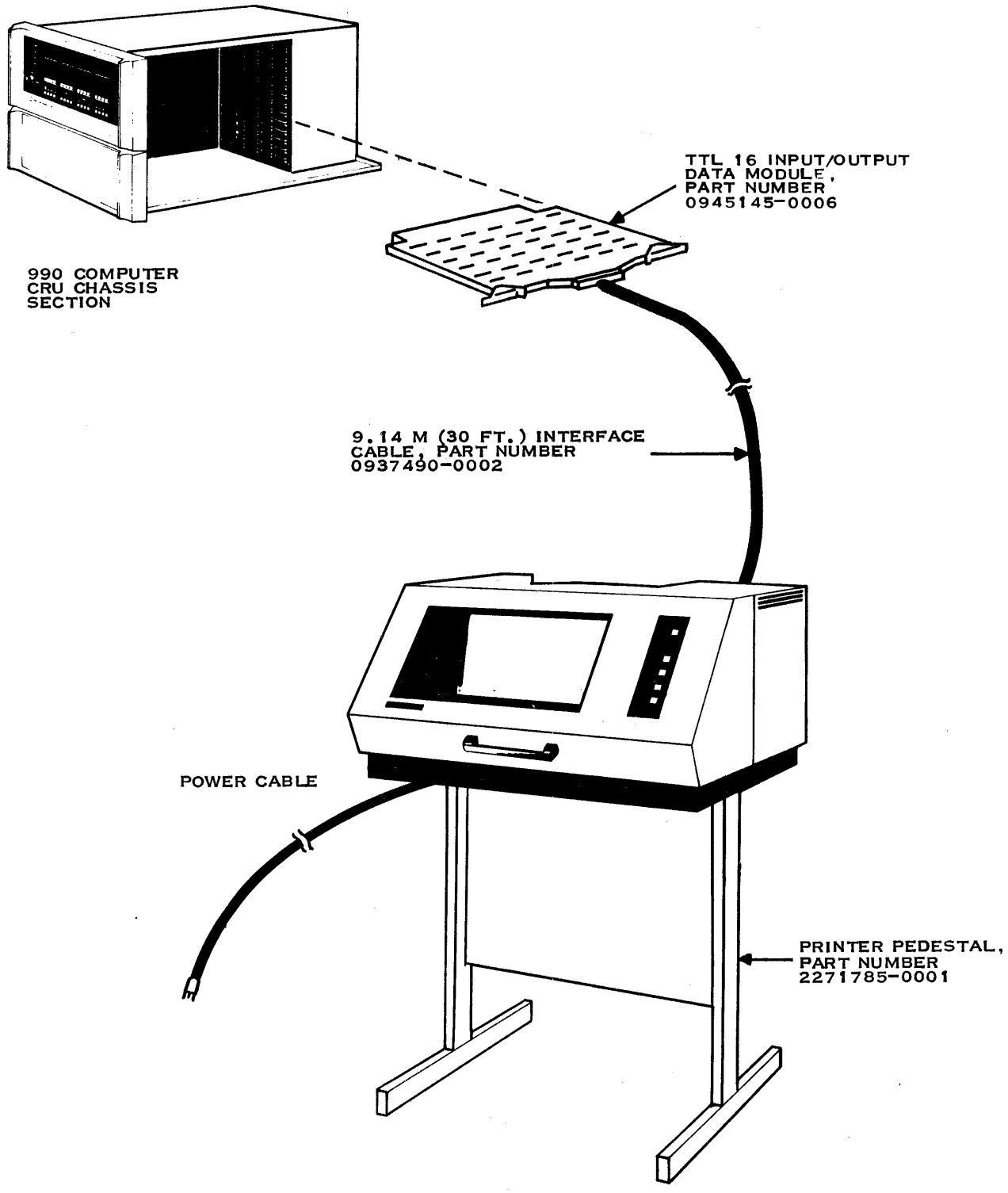


Figure 1-2. LP300/LP600 Printer Subsystem Interconnection Diagram

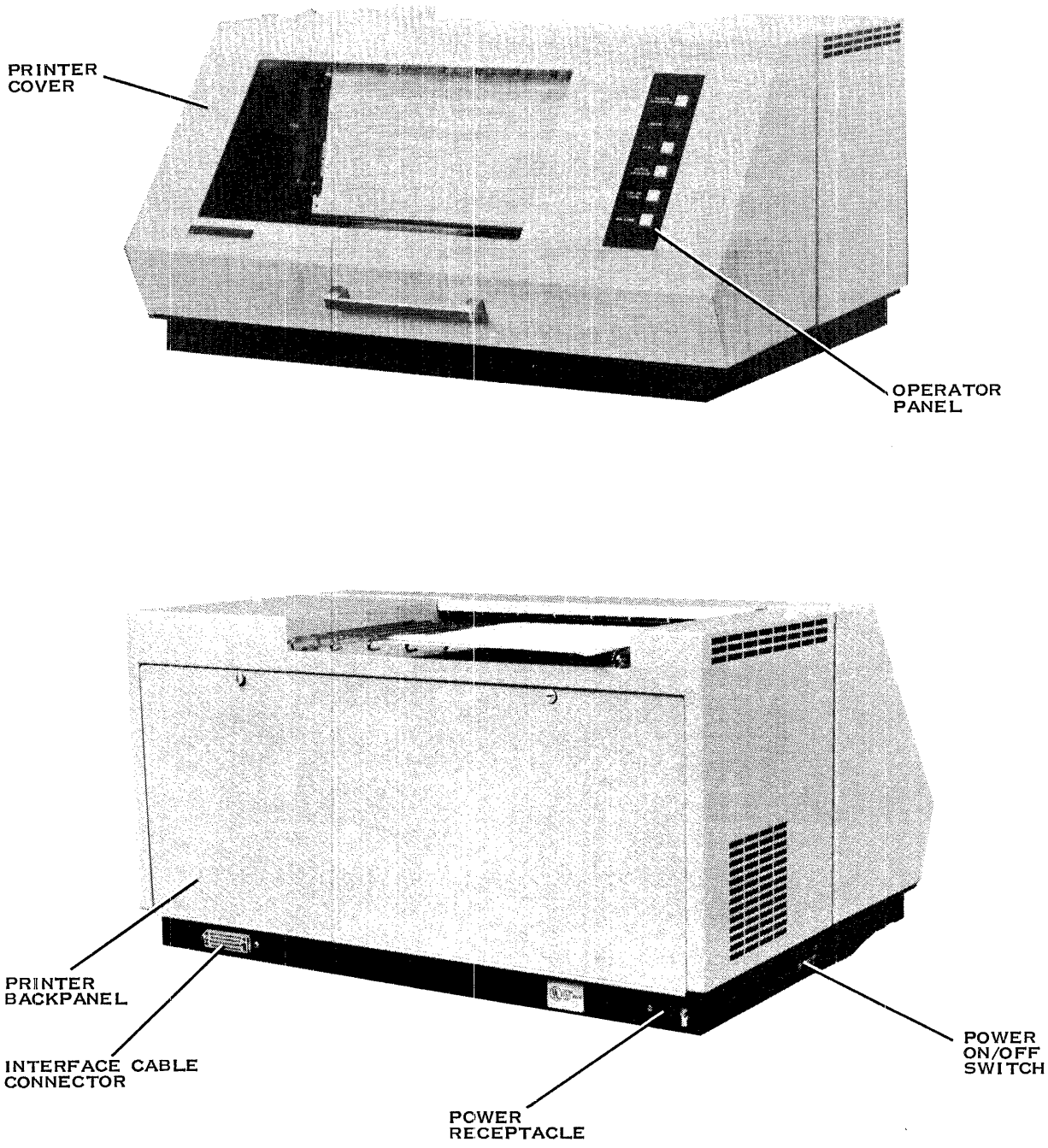


Figure 1-3. LP300/LP600 Printer, Detailed View

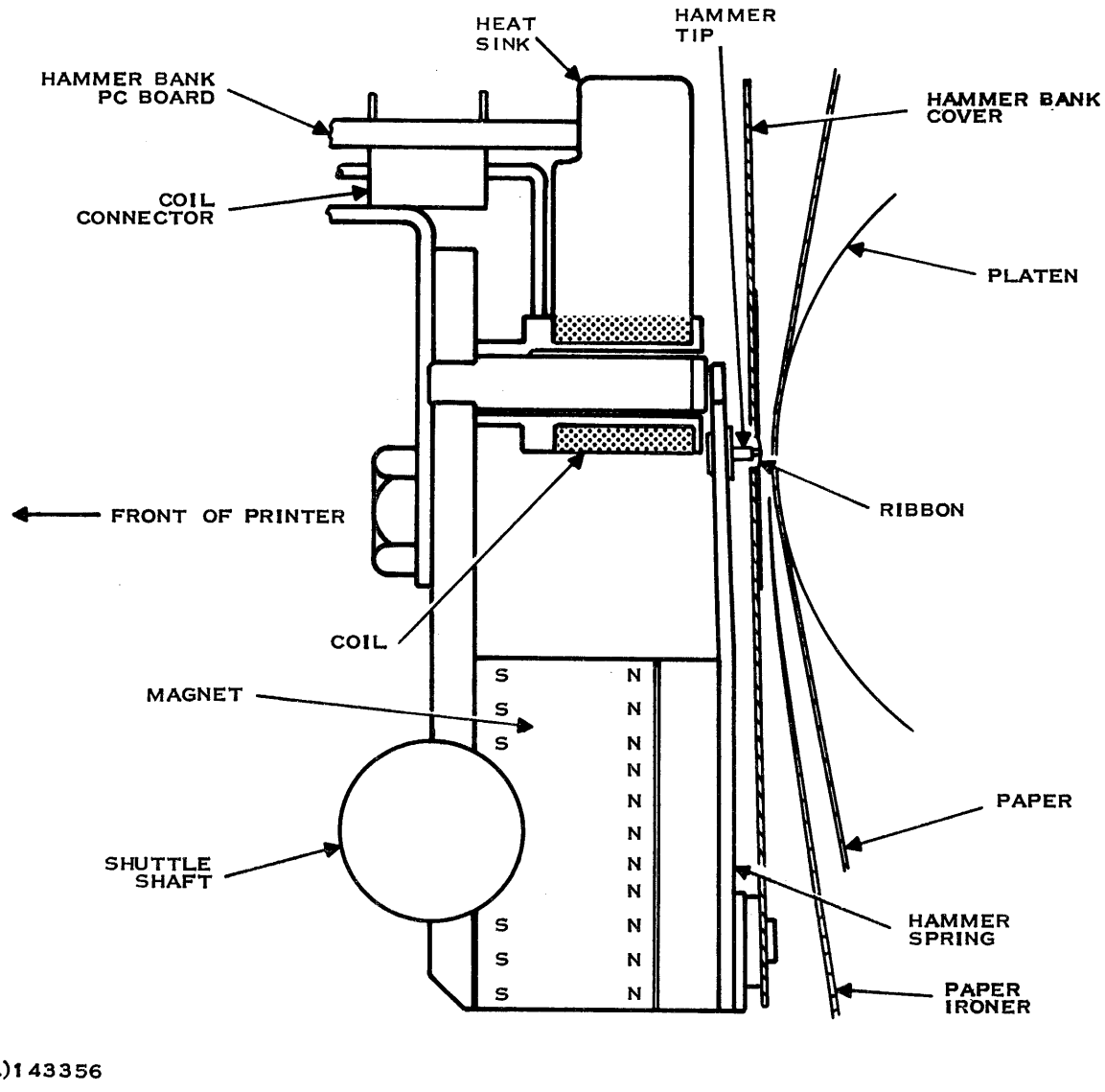


Figure 1-4. LP300 Printer Hammer and Shuttle Arrangement, Cross Section

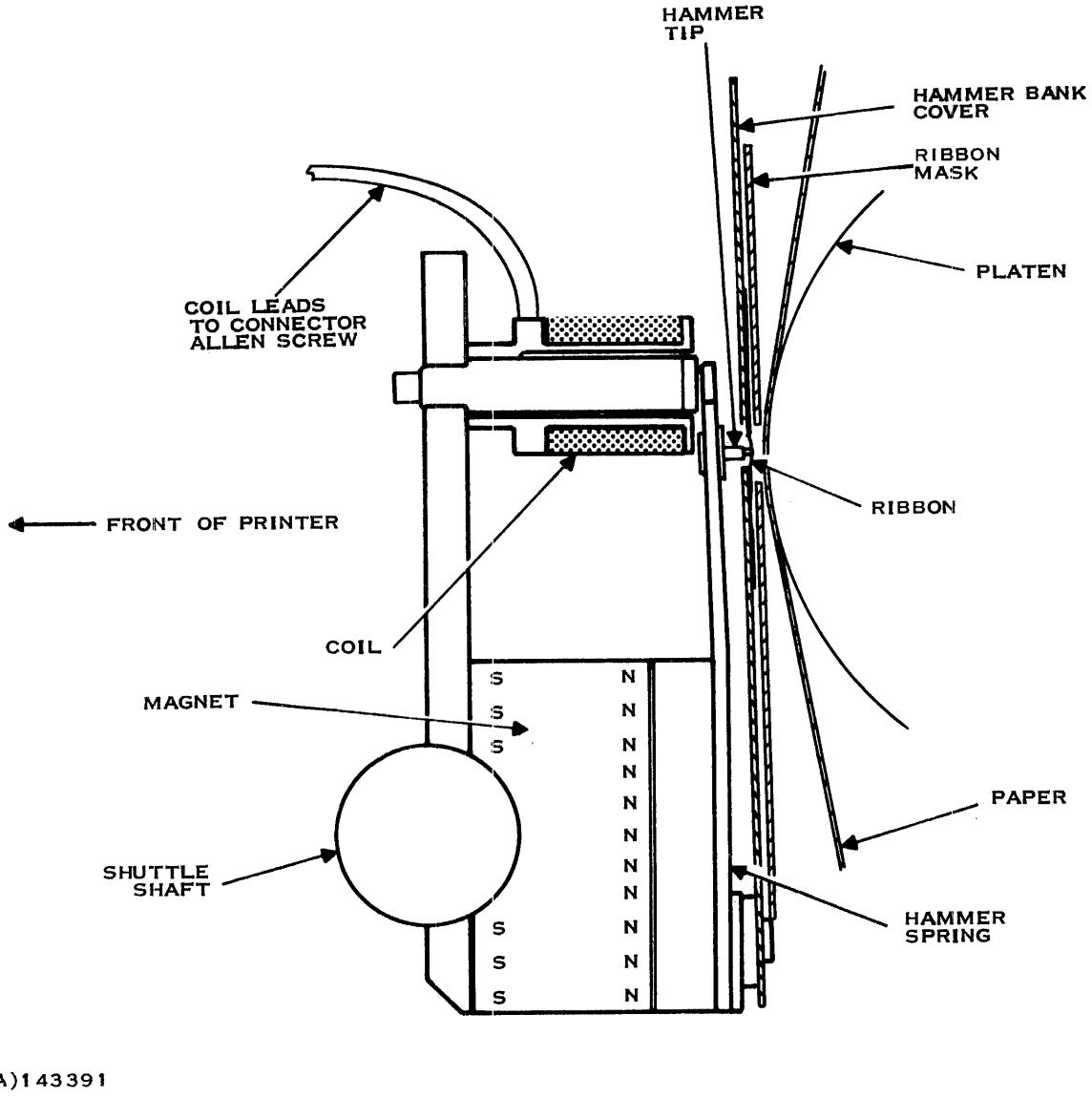


Figure 1-5. LP600 Printer Hammer and Shuttle Arrangement, Cross Section

Table 1-1. Printer Mechanism Characteristics

Model of Printer	Printer Line Speed (lpi)	Number of Print Hammers	Characters Spanned	Shuttle Sweep cm (inch)
LP300	300	44	3	0.756 (0.3)
LP600	600	66	2	0.508 (0.2)

Note:

The number of print hammers times the number of characters spanned = one full line of characters (132).

The hammer bank contains either 44 print hammers (for the LP300 printer) or 66 print hammers (for the LP600 printer). It is fixed to a shuttle that moves horizontally across the paper platen. To compose a full line of 132 character positions, each of the print hammers prints a designated number of character dot positions (three for the LP300 printer and two for the LP600 printer). Table 1-1 summarizes the printing mechanism characteristics of the LP300/LP600 printer.

As the shuttle sweeps across the paper, the print hammers are activated at each position in the dot row where a dot should be printed.

All dots in any dot row of the 9 × 9 matrix are printed in a single scan, as the shuttle moves from one side to the other through either two or three character positions (Figure 1-6). Successive dot rows are printed in this manner as the paper is advanced one dot row at a time, with the shuttle reversing direction for each row of dots. A standard uppercase character consists of seven rows of dots, with the descender of a lowercase character forming the eighth and ninth rows.

Characters are printed with a line spacing of six or eight lines per inch selectable by the operator or the program. The LP300/LP600 printer uses a standard 96-character ASCII set. This character set is defined in Table 1-2 and illustrated in Figure 1-7.

Character form is electronically determined by codes stored in six socket-mounted programmable read only memory (PROM) devices. Additional sockets are provided to enable the standard character set to be expanded to 160 characters. Appendix A lists optional character sets for the LP300/LP600 printer.

Because of the printer's expandable character set capability, virtually any character may be configured within the 9 × 9 dot matrix of possible dot positions.

Paper advance takes place while the shuttle is reversing direction between dot rows. After the last row of dots for a line of characters is printed, the paper is advanced for line separation and the next line of characters is printed. To print six lpi, paper is advanced 12 dot rows per line; to print eight lpi, paper is advanced nine dot rows per line.

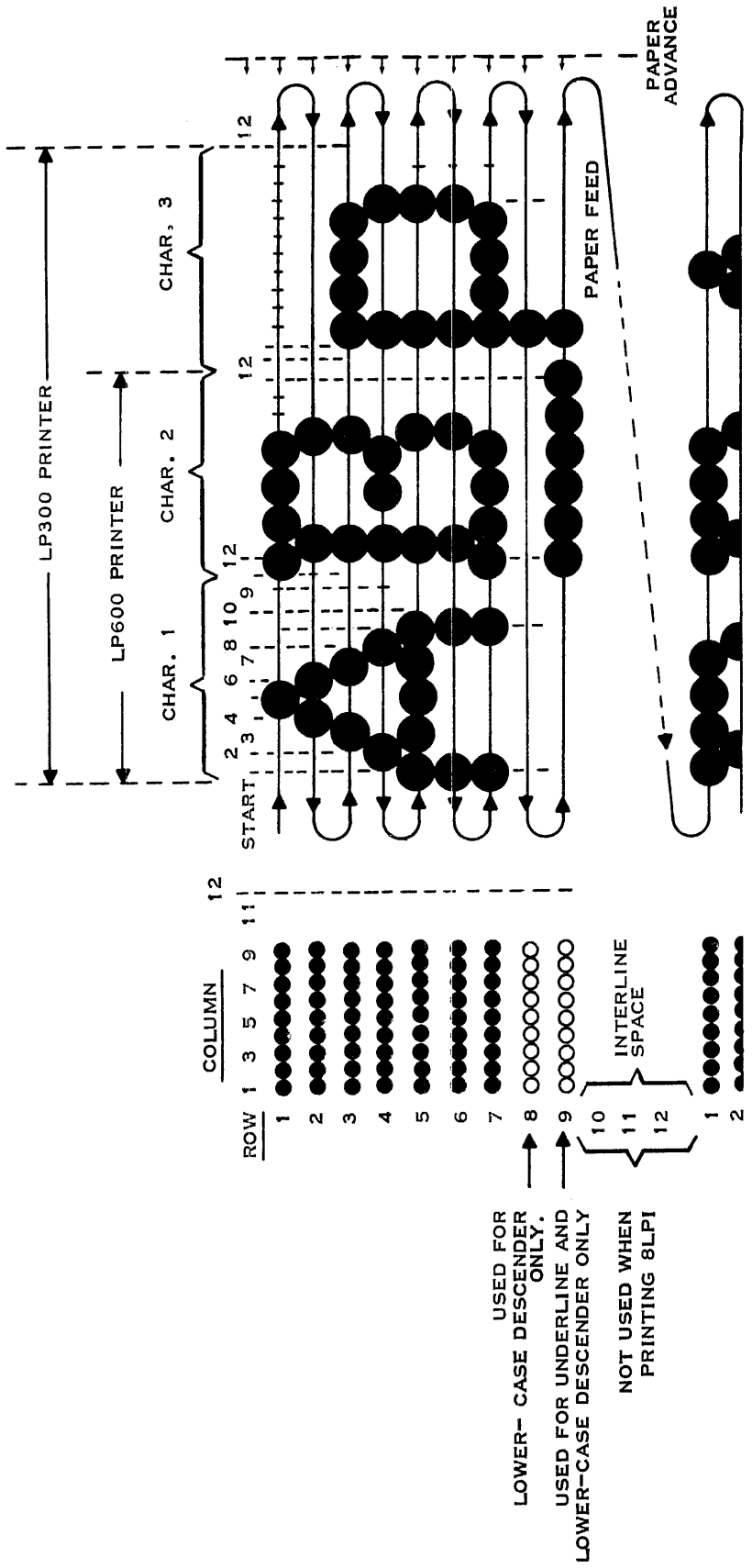


Figure 1-6. Formation of Standard Characters

Table 1-2. Definition of 96-Character ASCII Code

B7	0	0	0	0	1	1	1	1
B6	0	0	1	1	0	0	1	1
B5	0	1	0	1	0	1	0	1
B B B B 4 3 2 1								
0 0 0 0		SPACE	0	@	P	`	p
0 0 0 1		!	1	A	Q	a	q
0 0 1 0		"	2	B	R	b	r
0 0 1 1		#	3	C	S	c	s
0 1 0 0		$	4	D	T	d	t
0 1 0 1	Plot	%	5	E	U	e	u
0 1 1 0	8 lpi	&	6	F	V	f	v
0 1 1 1		'	7	G	W	g	w
1 0 0 0	Elong Char	(	8	H	X	h	x
1 0 0 1		)	9	I	Y	i	y
1 0 1 0	Line Feed	*	:	J	Z	j	z
1 0 1 1	Vert Tab	+	;	K	[	k	{
1 1 0 0	Form Feed	,	<	L	\	l	|
1 1 0 1	Carr Rtn	-	=	M	]	m	}
1 1 1 0		.	>	N	^	n	~
1 1 1 1		/	?	O	—	o	DEL

Notes:

B refers to the CRU ouput bit.

Each ASCII character is defined by a unique series of logic highs and lows on the CRU output bits 0-7 which correspond to bits 0-7 in the above table.

Unassigned bit locations result in no operation of the printer.

Characters 97-160 are codes A0 to DF.

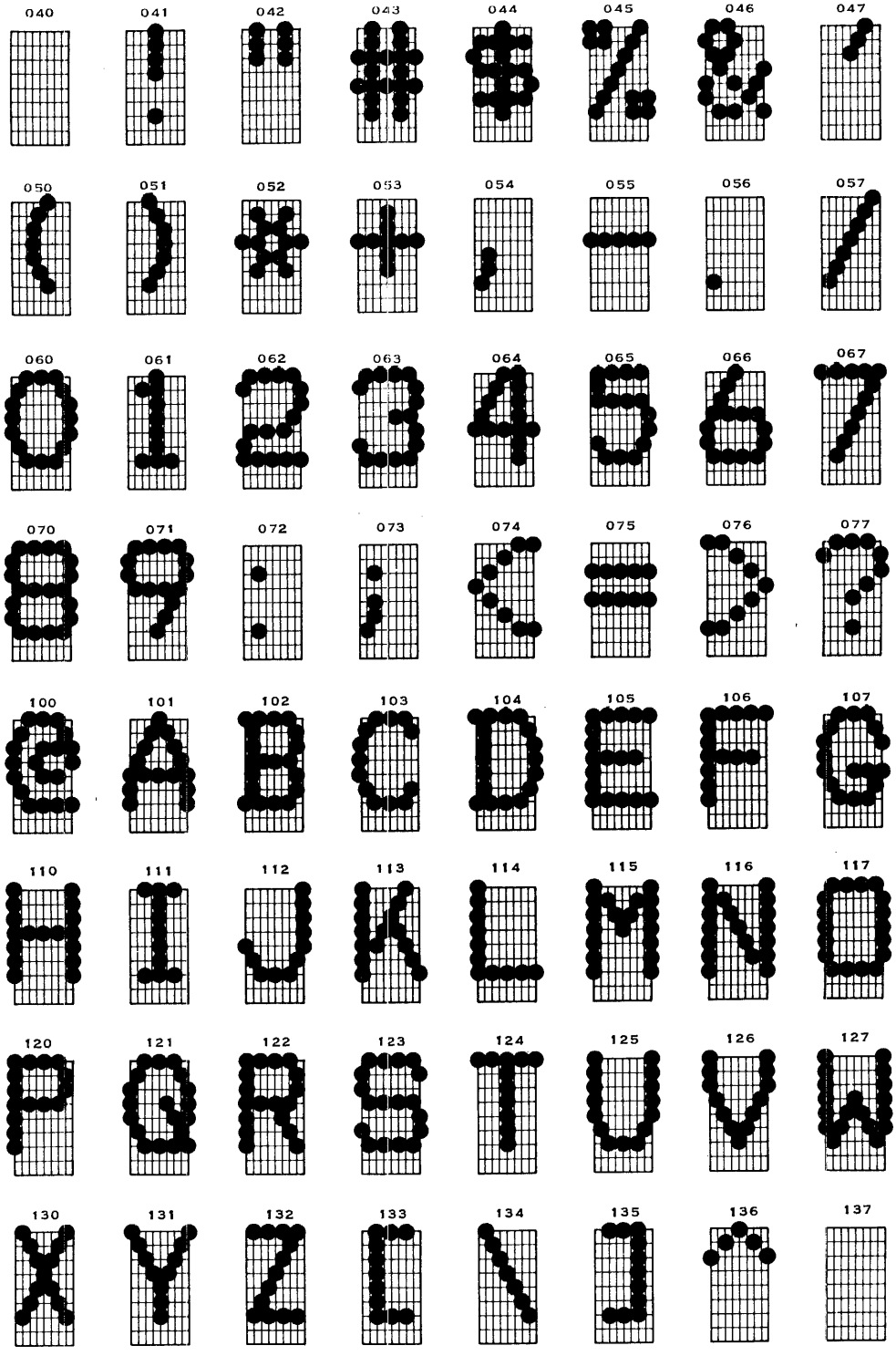


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Figure 1-7. 96-Character ASCII Set (Upper and Lowercase) (Sheet 1 of 2)

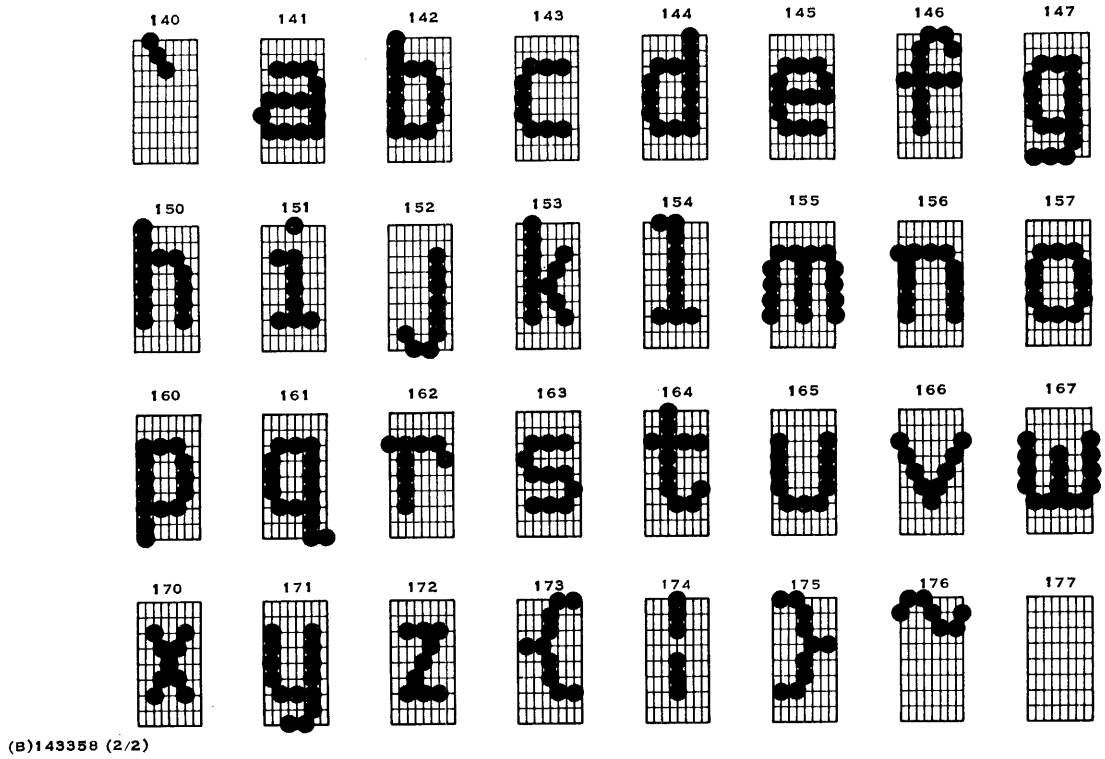


Figure 1-7. 96-Character ASCII Set (Upper and Lowercase) (Sheet 2 of 2)

In addition, vertically elongated characters may be printed (Figure 1-8). The vertically elongated character is formed by duplicating each dot row (except the first and last). Thus, an elongated character is made up of 13 dot rows (instead of seven), or 16 (instead of nine).

The elongated character is printed under software control and is initiated by a command code embedded in the print data stream.

For more information about the elongated command code, refer to Section 3 of this manual.

Operated in the plot mode (graphic mode), the LP300/LP600 printer advances a single dot row when a plot code precedes the line feed code. Thus, each input message defines information in a single dot row, instead of in a line of characters.

For more information about the plot mode, refer to Section 3 of this manual.

1.2.1.3 Ribbon Drive System. The LP300/LP600 printer ribbon drive system consists of an automatic ribbon drive and two ribbon spools.

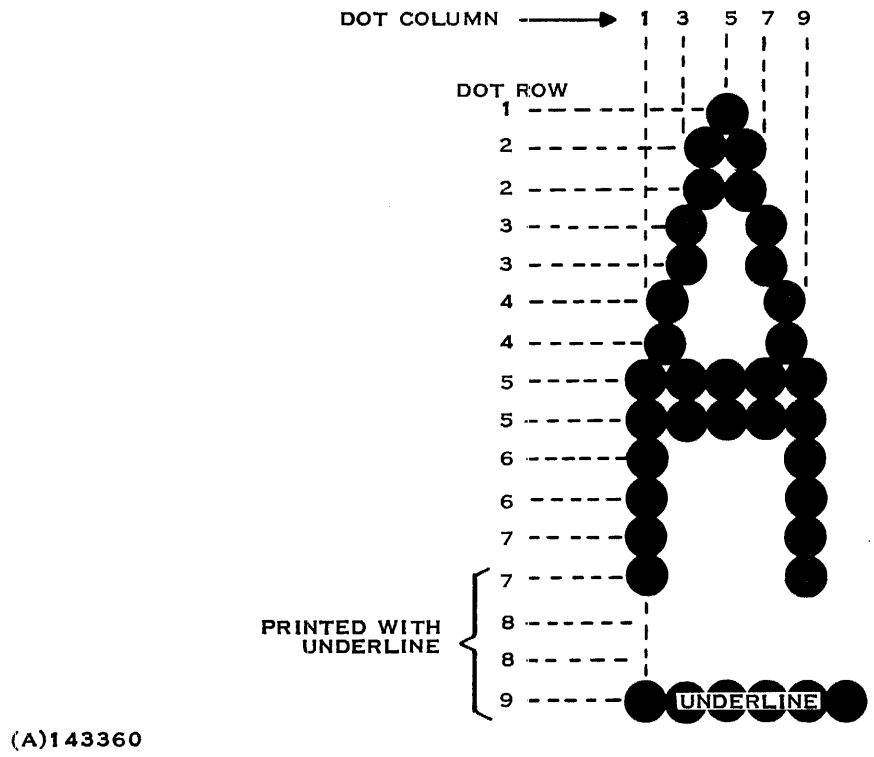


Figure 1-8. Typical Elongated Character

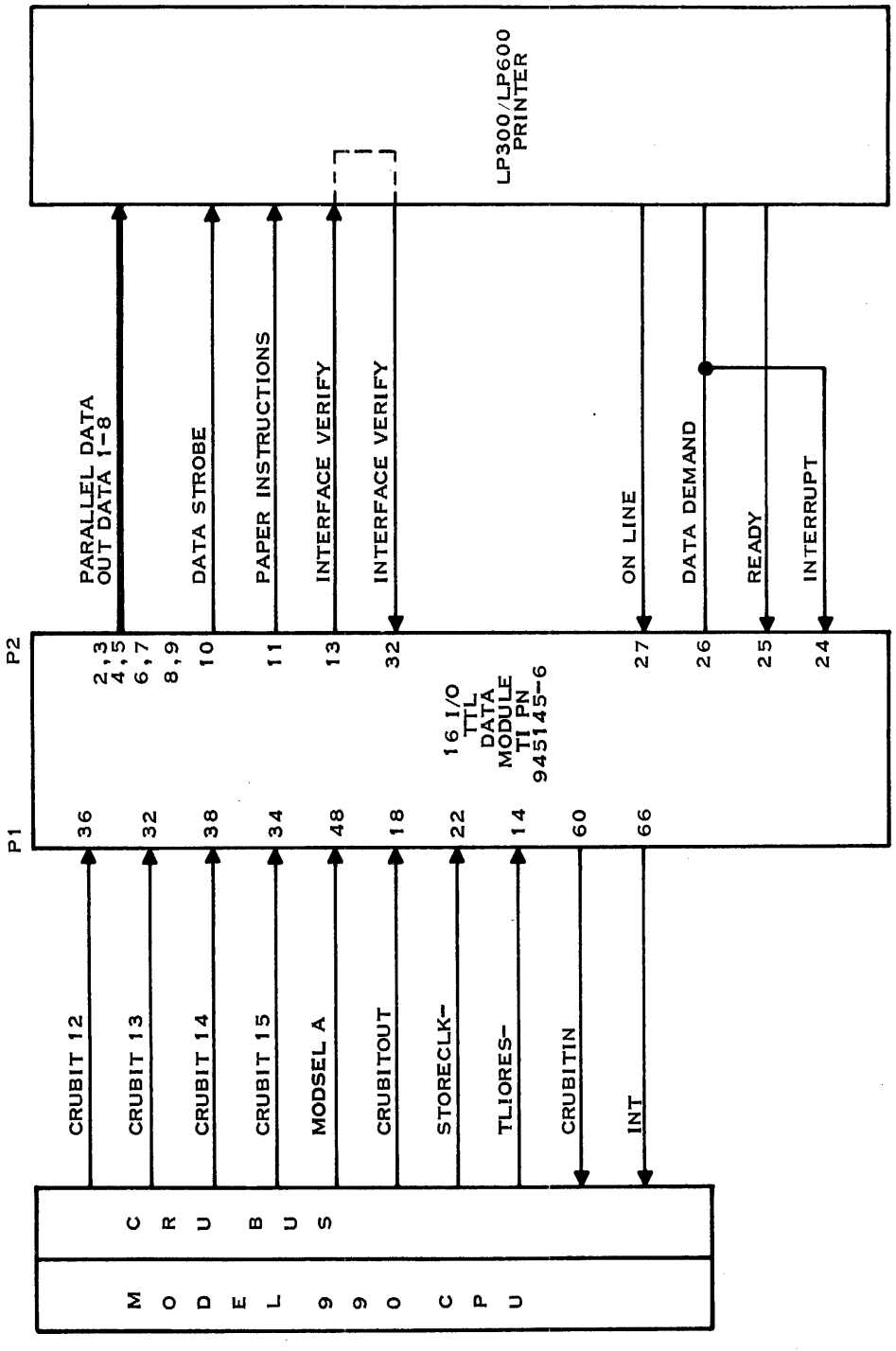
Ribbon life is approximately 150,000 lines of 132 characters per line. A ribbon mask prevents the ribbon from smudging the paper. A 54.9 m (60 yd) spool of ribbon and an empty take-up spool are supplied with each LP300/LP600 printer.

1.2.2 TTL Data Module

The TTL data module is a TI Model 990 series computer half-sized plug-in circuit card assembly. The TTL data module installs into any half slot in the Model 990 computer chassis and becomes part of the Model 990 computer communications register unit (CRU) that interfaces the LP300/LP600 printer via an interface cable.

The TTL data module functions as a 16-bit register in the signal path between the Model 990 central processing unit (CPU) and the parallel input of the LP300/LP600 printer. In the signal path between the parallel output of the printer and the serial or single bit input of the CRU, the TTL data module functions as a 16-bit multiplexer. Figure 1-9 illustrates the flow of interface signals between the Model 990 CPU and the LP300/LP600 printer.

Each bit location on the 16-bit register and the 16-bit multiplexer in the TTL data module is selected by a CRU address bit code (CRUBIT 12-15). To write data or control bits into the 16-bit register of the TTL data



(A)143824

Figure 1-9. LP300/LP600 Printer Subsystem Interface Signals

module via the CRUBITOUT line, the signal STORECLK- (logic zero) must appear at the same time as signal MODSEL- (logic zero) and the CRU address bit code. All bits for each memory word from the Model 990 CPU are written in a similar way one at a time into the TTL data module 16-bit register. When the STORECLK- signal is not active (logic one), and a MODSEL- signal is present, status bits are read from the LP300/LP600 printer, one at a time, through the TTL data module's 16-bit multiplexer to the Model 990 CPU as indicated by the CRU address bit code.

The maskable interrupt circuitry on the TTL data module interrupts the computer on a positive transition of the printer interrupt signal. This interrupt may be masked by CRUBITOUT 14 from the Model 990 CPU.

1.2.3 Subsystem Cabling Description

The LP300/LP600 printer subsystem uses an interface cable (part number 937490-9701) that is 9.14 meters (30 ft) long. The cable has a 50-pin Winchester connector (part number MRAC 50P-J) on one end for connection to the printer and a 40-pin press connector on the opposite end for connection to the TTL data module. Table 1-3 provides a point-to-point wire list for the cable assembly.

Table 1-3. LP300/LP600 Printer Subsystem Cable Assembly Wire List

Signature	LP300/LP600 Printer Interface Connector	TTL Data Module Connector
Data Line 1	B	P2-2
RTN	D	
Data Line 2	F	P2-3
RTN	J	
Data Line 3	L	P2-4
RTN	N	
Data Line 4	R	P2-5
RTN	T	
Data Line 5	V	P2-6
RTN	X	
Data Line 6	Z	P2-7
RTN	b	
Data Line 7	n	P2-8
RTN	k	
Data Line 8	h	P2-9
RTN	e	
Paper Inst	p	P2-11
RTN	s	
Data Strobe	j	P2-10
RTN	m	
Data Request	E	P2-24,26
RTN	C	
Ready	CC	P2-25
RTN	EE	
On Line	Y	P2-27
Interface	x	P2-13
Verification	v	P2-32
GND		P2-1, P2-20, P2-21, P2-40

1.3 GENERAL CHARACTERISTICS

Tables 1-4 and 1-5 list the general characteristics of the LP300/LP600 printer subsystem.

Table 1-4. LP300/LP600 Printer Specifications

Characteristic	Specification
Printer Mechanism	
Printer Speed:	
LP300 Printer	300 lpm, 170 lpm for double height characters, 240 lpm when underlining or printing lowercase characters with descenders (tails below the line)
LP600 Printer	600 lpm, 320 lpm for double height characters, 465 lpm when underlining or printing lowercase characters with descenders (tails below the line)
Printing Technique	9 × 7 dot matrix (uppercase). Horizontal plane has five overlapping dots on nine centers. Vertical plane has seven overlapping dots (nine with decenders). Dot spacing is 0.167 in. horizontal and 0.01389 in. vertical.
Character Format	132 characters per line, 10 characters per inch horizontal, six or eight characters per inch vertical (switch or program selectable).
Character Set	Standard 96-character ASCII set. Provisions for 64-character extended set. Up to 160 different characters may be printed using additional PROM devices.
Character Dot Density	Vertical — 28.3 dots/cm (72 dots/in.) Horizontal — 23.6 dots/cm (60 dots/in.)
Plot Rate:	
LP300 Printer	42.32 cm/min (16.67 in./min)
LP600 Printer	84.64 cm/min (33.33 in./min)
Ribbon Transport	
Ribbon	Nylon fabric, 1 inch wide, 60 yards long
Transport	Dc servo; electrical end-of-ribbon sensing with automatic reversal

Table 1-4. LP300/LP600 Printer Specifications (Continued)

Characteristic	Specification
Paper Transport	
Type	Edge-punched, fanfolded, single to six-part forms
Weight	6.8 kg (15 lb) bond, single copy 5.5 kg (12 lb) bond, multipart 2.7 to 3.6 kg (6-8 lb), Carbons (six part maximum)
Form Thickness	0.51 mm (0.020 in.), maximum
Form Width	10.16 cm (4 in.) (minimum) to 40.64 cm (16 in.) (maximum)
Variable Form Length (EVFU controlled)	10.16 cm (4 in.) (minimum) to 55.88 cm (22 in.) (maximum) at 6 lpi, and 41.91 cm (16.5 in.) (maximum) at eight lpi
Slew Rate:	
LP300 Printer LP600 Printer	20.3 cm/sec (8 in./sec) 40.6 cm/sec (16 in./sec)
Communications Interface	
Input	8-bit parallel ASCII code, TTL logic levels
Buffer Size	132 characters maximum (one line)
Data Transfer Rate	Up to 500,000 characters per second maximum
Signal Connector	9.1 m (30 ft) shielded cable with 50-pin Winchester interface connector, part number MRAC 50P-J, and 40-pin press ribbon connector attached
Acoustic Noise	Nominally 65 db (A weighted) for LP300 printer and 68 db (A weighted) for LP600 printer, measured 914 mm (3 ft) in front of either printer at a height of 1.62 m (5.25 ft) while printing an 80-character line on single-part paper, in a sliding 64-character pattern

Table 1-4. LP300/LP600 Printer Specifications (Continued)

Characteristic	Specification	
Environmental Requirements		
Temperature:		
Operating	10 to 38° C (50 to 100° F)	
Storage	– 40 to 65° C (– 40 to 150° F)	
Humidity:		
Operating	30 to 90% with no condensation	
Storage	5 to 95% with no condensation	
CAUTION		
Failure to maintain the minimum humidity (30% with no condensation) may result in paper jams and unsatisfactory printing. Continued use of the printer under these conditions may also lead to premature failure.		
Altitude:		
Operating	0 to 3048 m (0 to 10,000 ft.)	
Storage	0 to 9144 m (0 to 30,000 ft.)	
Power Requirements		
Voltage	100 Vac @ 50 Hz or 60 Hz 120 Vac @ 60 Hz 220 Vac @ 50 Hz 240 Vac @ 50 Hz	
Power	200 W standby 450 W nominal 800 W maximum	
Current	120 Vac 220 Vac	120 Vac 220 Vac
	Maximum	Average
LP300 Printer	14.2 A 7.7 A	7.5 A 4.1 A
LP600 Printer	25.4 A 13.9 A	6.0 A 3.3 A

Table 1-4. LP300/LP600 Printer Specifications (Continued)

Characteristic	Specification
	NOTE
	This is the maximum starting current, which has a duration of 0.6 seconds.
Physical Dimensions	
Height	105.9 cm (41.7 in.) (with pedestal)
Width	76.20 cm (30.0 in.)
Depth	61.60 cm (24.3 in.)
Weight	84 kg (185 lbs)

Table 1-5. TTL Data Module Specifications

Characteristic	Specification
Peripheral Inputs	+2.4 V to +5.0 V = Logic One 0.0 V to +0.8 V = Logic Zero
Module Outputs	+2.4 V to +5.0 V = Logic One 0.0 V to +0.8 V = Logic Zero
Dc Power Requirements	+5 V @ 0.5 A maximum

2

Installation

2.1 GENERAL DESCRIPTION

This section contains information to aid the user or TI customer service representative (CR) in installing the LP300/LP600 printer with the TI Model 990 series computers. It covers the following topics:

- Site requirements
- Unpacking and installing the LP300/ LP600 printer
- Unpacking and installing the TTL data module
- Printer power cabling
- Power up and operational checkout

2.2 SITE REQUIREMENTS

The LP300/LP600 printer site must meet the following requirements:

1. The printer location must not exceed the environmental requirements listed in Table 1-4.
2. The installation site must accommodate the total physical dimensions of the printer listed in Figure 2-1.
3. Adequate space must be provided for proper cooling and for the movement of maintenance and operating personnel.
4. The power and voltage ratings at the site must not exceed or be less than those specified in Table 1-4 of this manual.
5. The printer cannot be positioned more than 3.05 meters (10 feet) from the power receptacle. The line printer must also be placed within 9.1 meters (30 feet) of the computer chassis, the length of the interface cable.
6. Local and national electrical codes must be satisfied.
7. All local and national safety codes and standards must be fulfilled.
8. Air conditioning equipment that will handle the additional cooling load should be installed and operational.
9. Proper overhead lighting should be installed.
10. The proper fire extinguisher must be installed.
11. Doors and corridors through which the equipment will pass to the computer area should be unrestricted.
12. Cable troughs, channels, or bridges should be placed as required.

2.3 UNPACKING AND INSTALLING THE LP300/LP600 PRINTER

Because of the printer's weight, the printer and mounting pedestal should be transported to the installation site before being unpacked. A fork lift is recommended for transportation. If a hand truck or dolly is used, it should be securely attached to the printer to protect it against slippage and subsequent damage. At the installation site, the procedures described below should be

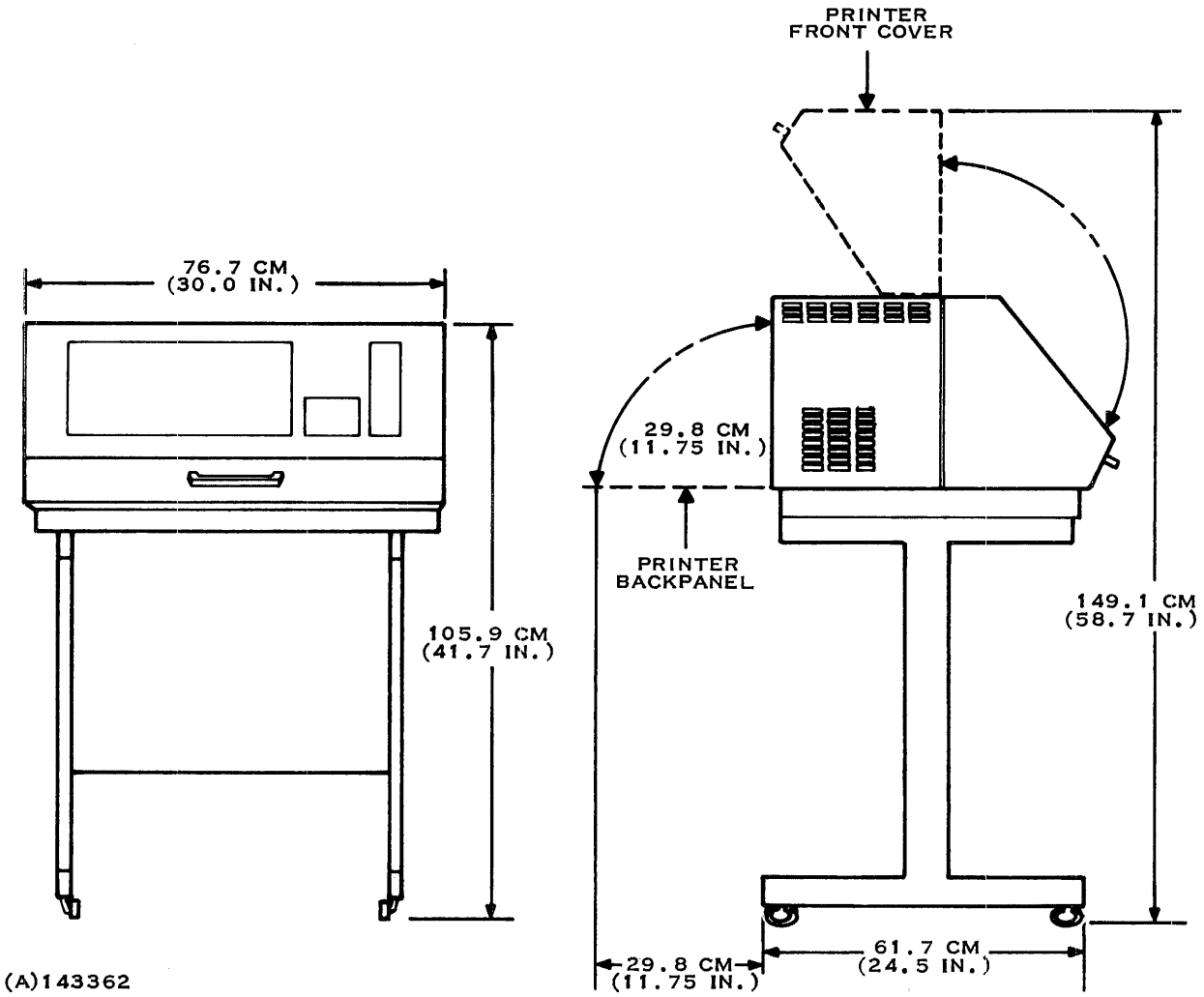


Figure 2-1. Dimensions of LP300/LP600 Printer

followed to unpack and install the LP300/ LP600 printer and pedestal.

2.3.1 Unpacking the LP300/LP600 Printer

The following procedures should be used to unpack the LP300/LP600 printer after it is transported to the installation site:

WARNING

HEAVY EQUIPMENT. The LP300/ LP600 printer weighs 99.8 kg (220 lbs), including shipping materials. To prevent possible back strain, use at least two persons, or mechanical aids, for lifting and placing the printer.

1. Using a pair of metal cutters, cut away the bands that hold the carton to the pallet.

2. Lift the shipping carton off the shipping pallet. The printer should now be exposed.

3. Remove the foam shipping restraint from each side of the printer.

4. Remove the packing material from around the printer. Do not discard. This material may be used in shipping the printer back to the factory for depot maintenance.

5. Refer to the following paragraph for LP300/LP600 printer installation instructions.

2.3.2 Installing the LP300/LP600 Printer
After unpacking the LP300/LP600 printer, install it in the following way:

1. Remove the pedestal from its shipping container.

2. Following the provided instruction sheet, use a Phillips screwdriver and the screws included with the pedestal to assemble the pedestal stand. After assembly, place the pedestal in an upright positon.

3. Place the printer on its backpanel (using cardboard or a similar type of insulation to protect the printer's finish) as illustrated in Figure 2-2.

4. Loosen three shock mounting screws and remove the shipping blocks from printer (see Figure 2-2).

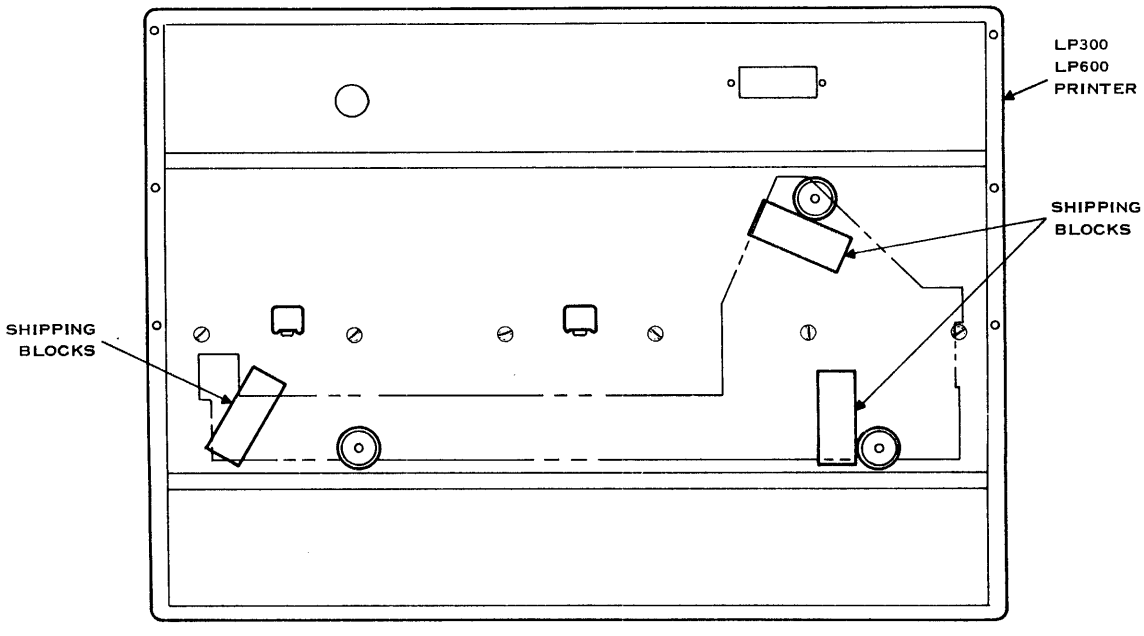


Figure 2-2. Preparing the Printer for Attachment to the Pedestal Stand

5. Locate the four threaded mounting holes on the bottom of the printer that do not hold rubber feet. These holes will be used to attach the printer to the pedestal stand.

6. Using a Phillips screwdriver, remove the four rubber feet attached to the bottom of the printer and discard.

7. Using at least two persons, raise the printer and set it on the pedestal. Align the holes on the bottom of the printer with the matching holes in the top bars of the pedestal (see Figure 2-2).

8. Using the Phillips screwdriver and the four 10-32 × 5/8 screws included with the pedestal, secure the pedestal to the printer.

9. Open the printer's front cover and remove the cable tie that holds the form thickness adjustment lever in its highest raised position (load position).

10. Remove the set screw from the paper platen. The set screw is located on the right-hand side of the paper platen, as viewed from the front of the printer (see Figure 2-3).

11. Refer to Figure 2-4 and remove the screw from the platen spring lug. The screw is located on left-hand side of the paper platen, as viewed from the front of the printer.

12. Install a ribbon as described in Section 4.

13. Load paper in the printer as described in Section 5.

14. Lower and close the front cover.

15. Now place the paper catcher (included with the LP300/LP600 printer) under the printer, with one end against the left side of the pedestal (see Figure 2-5a).

16. Using the Phillips screwdriver, install the ground wire included with the LP300/LP600 printer as shown in Figure 2-5 and by following these steps:

    a. Refer to Figure 2-5 and remove the screw and washer that secure one side of the ac connector to the rear of the printer.

    b. Place the removed screw through the hole in the quick-disconnect terminal and retighten the screw and washer to rear of printer (Figure 2-5b).

    c. Attach the quick-disconnect connector of the ground wire (furnished) to the terminal installed in the above step.

    d. Assemble the opposite end of the ground wire as shown in Figure 2-5c. Attach the clamp connector to the larger wire on the paper catcher.

17. Refer to paragraph 2.4.3 for instructions on connecting the LP300/LP600 printer to the TTL data module.

18. Now install the standard LP300/LP600 printer power cord using the procedures described in paragraph 2.5.

19. Refer to paragraph 2.6 for power-up and operational checkout procedures.

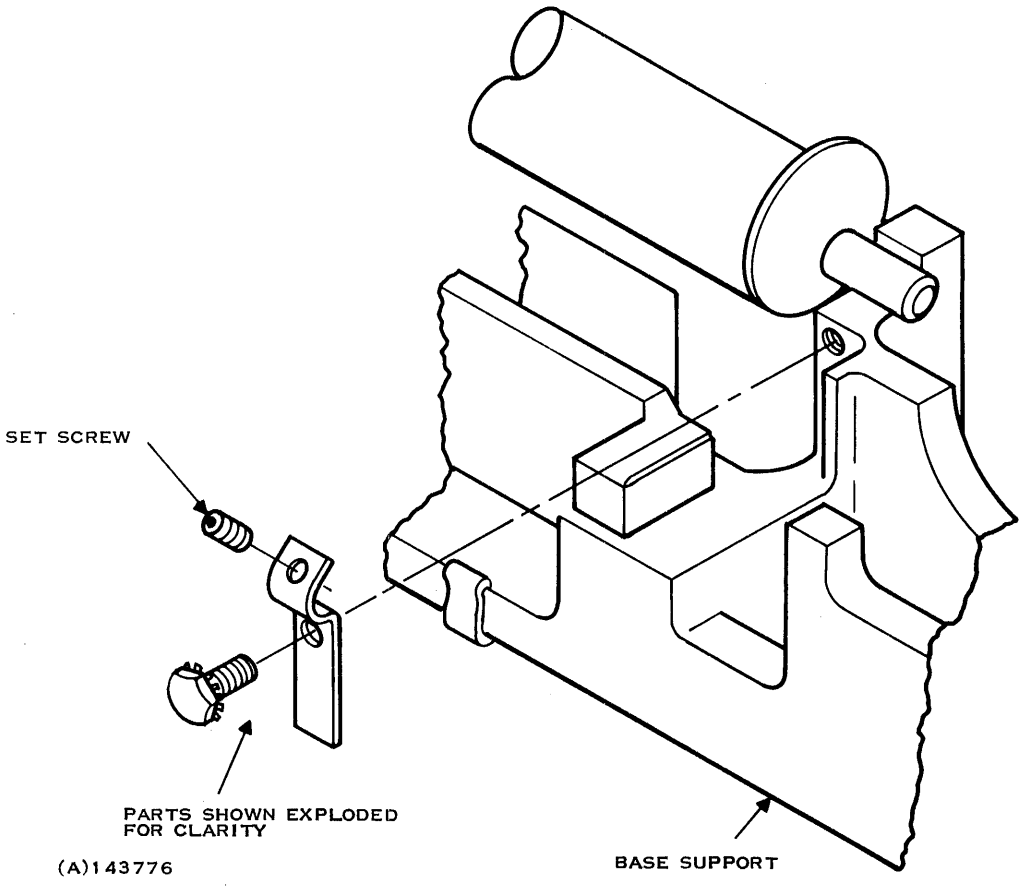


Figure 2-3. Removal of Platen Set Screw

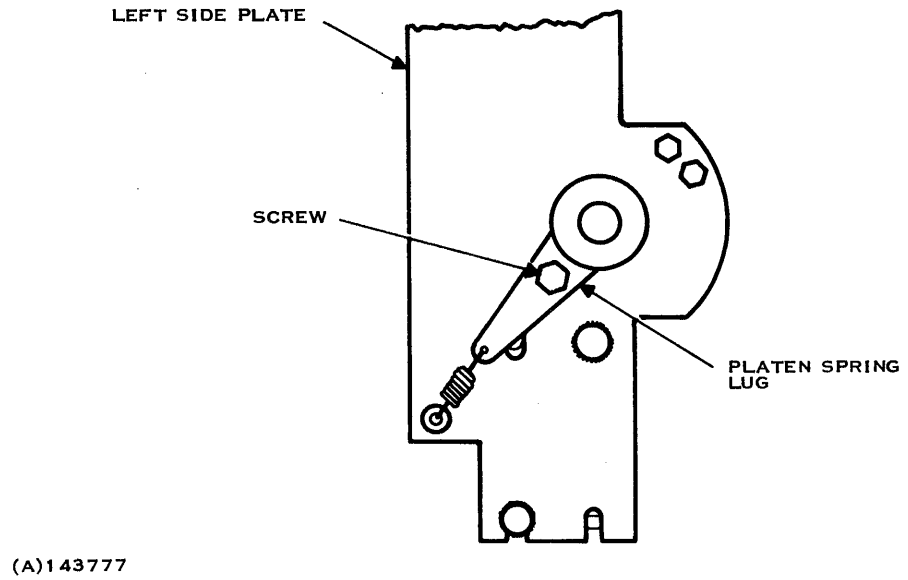


Figure 2-4. Removal of Platen Spring Lug Screw

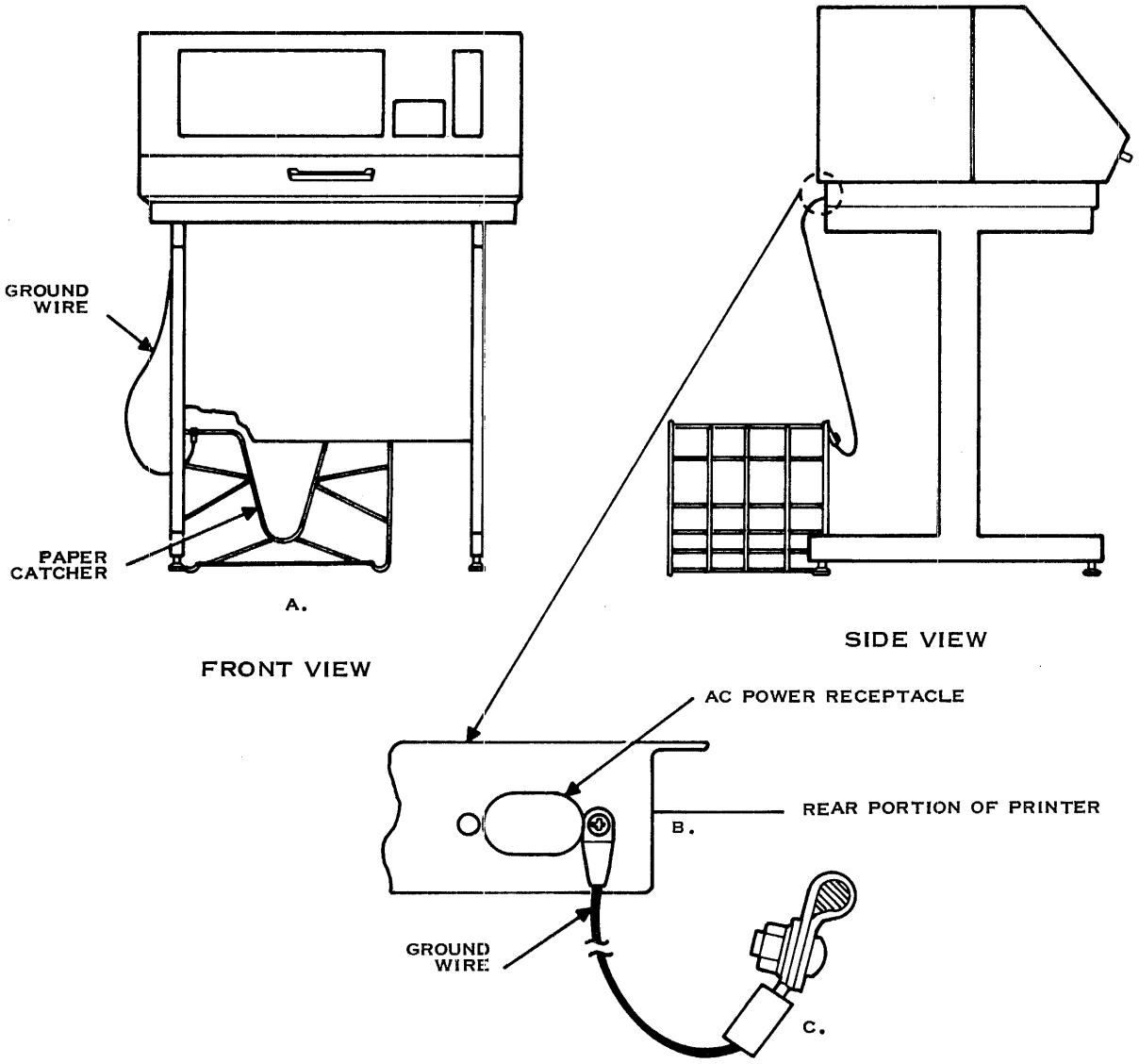


Figure 2-5. Installing the Paper Catcher and Ground Wire

2.4 UNPACKING AND INSTALLING THE TTL DATA MODULE

If the LP300/LP600 printer subsystem is ordered with a Model 990 computer, the TTL data module (part number 0945145-0006) will be shipped installed in the computer chassis. Otherwise, it will be shipped wrapped in air pack and boxed separately from the LP300/LP600 printer and should be unpacked and installed in the following way:

1. Visually inspect the package for signs of damage.
2. Verify that six jumpers have been received (they are shipped installed in the circuit board).
3. Do not discard any packing material until all equipment has been accounted for.

2.4.1 Interrupt Level Connection

If you install the TTL data module in the main computer chassis when you install the computer system, you must connect the interrupt level assignments at the same time. Refer to the appropriate computer hardware reference manual or computer hardware user's manual for detailed instructions on installing the computer and its associated interrupt level network.

2.4.1.1 Interrupt Level Installation and Modification for the 6- and 13-slot Chassis. Figure 2-6 shows the location of the interrupt jumper header and interrupt jumper plugs in a 6-slot or 13-slot chassis.

There are two rows of pins in the header. The top row has 15 pins connected through the motherboard to the 15 interrupt levels of the processor. Additional pins on the top row are provided in the 13-slot chassis for special configurations, such as CRU expansion. The bottom row contains 20 pins in a 6-slot chassis or 48 pins in a 13-slot chassis. Two of these pins are wired to each of the possible circuit board interrupt outputs. This allows multiple interrupts to be connected to one interrupt level (daisy chaining), Figure 2-7.

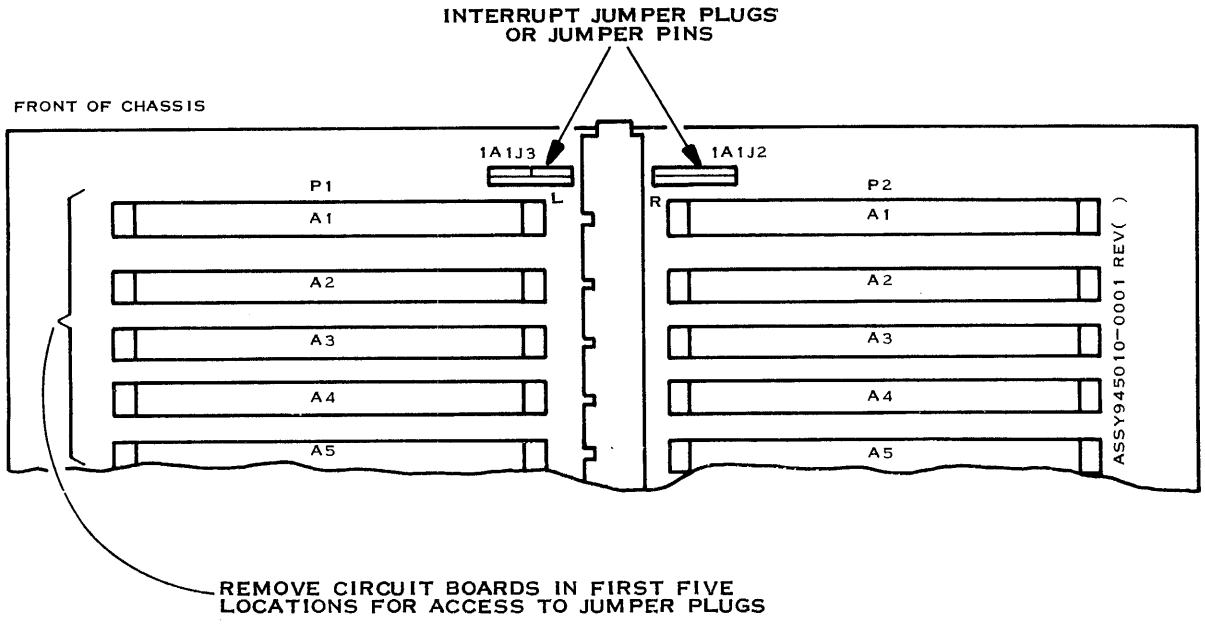


Figure 2-6. Location of Interrupt Jumper Plugs (6-Slot and 13-Slot Chassis)

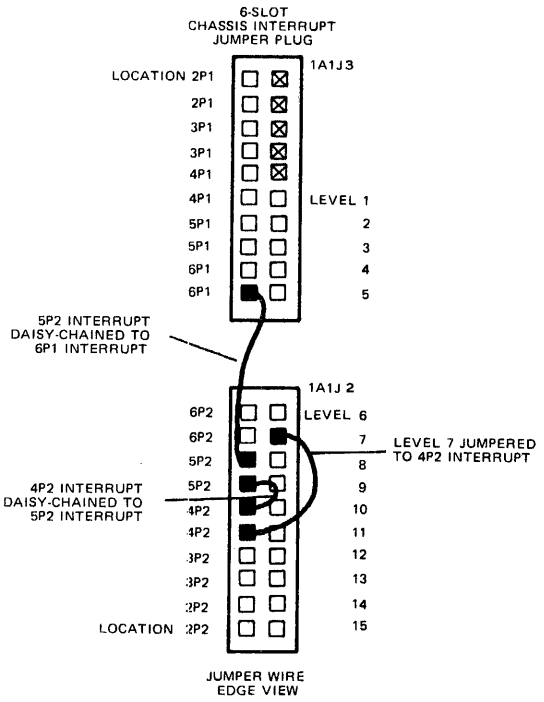


Figure 2-7. Jumper Plug Daisy-Chain Sample Connection

Interrupt pin assignments for the 6- and 13-slot chassis are illustrated in Figures 2-8 and 2-9, respectively. The X marks identify jumper plug positions that have no corresponding pins on the header. (The 0 marks identify jumper plug positions that have no corresponding pins on the early version of the header).

A configuration chart, attached to the top of the chassis, details the interrupt level and chassis slot assignments. Any modifications to the chassis should be recorded on the chart.

Detailed procedures for assigning and changing interrupt levels are presented in the appropriate hardware reference manual for the Model 990 computer. The information contained here is a brief summary of that procedure.

WARNING

SHOCK HAZARD. Do not remove or install any circuit board or modify any jumper while power is applied to the Model 990 chassis.

Assign interrupt levels as follows:

1. Turn off power and unplug the chassis ac power line cord. Allow about 30 seconds for the power supply bleeders to discharge the power supply capacitors.

2. Remove the circuit boards from the first five slots of the chassis to gain access to the interrupt jumper plugs.

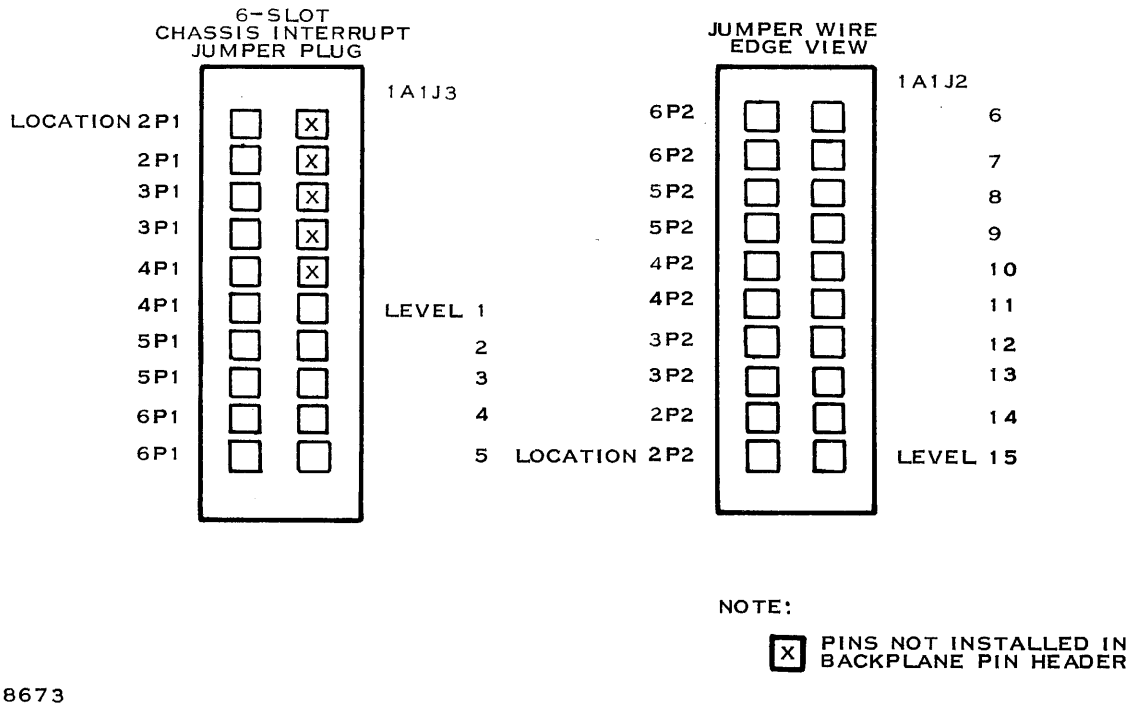


Figure 2-8. 6-Slot Chassis Interrupt Jumper Plugs

3. Use one of the following steps to connect the jumper wire:

   a. Pluggable jumpers. Remove the jumper plugs from the chassis. Insert the specially constructed jumper wire to connect the interrupt level to the chassis slot interrupt pin.

   b. Jumper pins. Connect a jumper wire from the interrupt level pin to the chassis slot interrupt pin.

4. Reinstall the jumper plugs and then the five circuit boards removed earlier.

2.4.1.2 Interrupt Level Connections for the 17-Slot Chassis. Interrupt lines in the 17-slot chassis are wired to a 70-pin connector accessible from the rear of the chassis. A jumper assembly plugs into the connector to make the interrupt-level-to-chassis slot connections. This assembly appears at the lower right of the chassis backplane.

The jumper assembly supplied with the computer is a printed wiring board (PWB), because it should not be necessary to alter the standard interrupt level assignment. If it does become necessary to change interrupt jumpers, the user may purchase a special variable jumper assembly, or may modify the etch on the fixed jumper card. Figure 2-10 shows the pin assignments on the interrupt connector.

To gain access to the interrupt jumper assembly, open the chassis rear area using the following procedure:

1. Turn off power and unplug the chassis ac line cord. Allow about 30 seconds for the power supply bleeders to discharge the power supply capacitors.

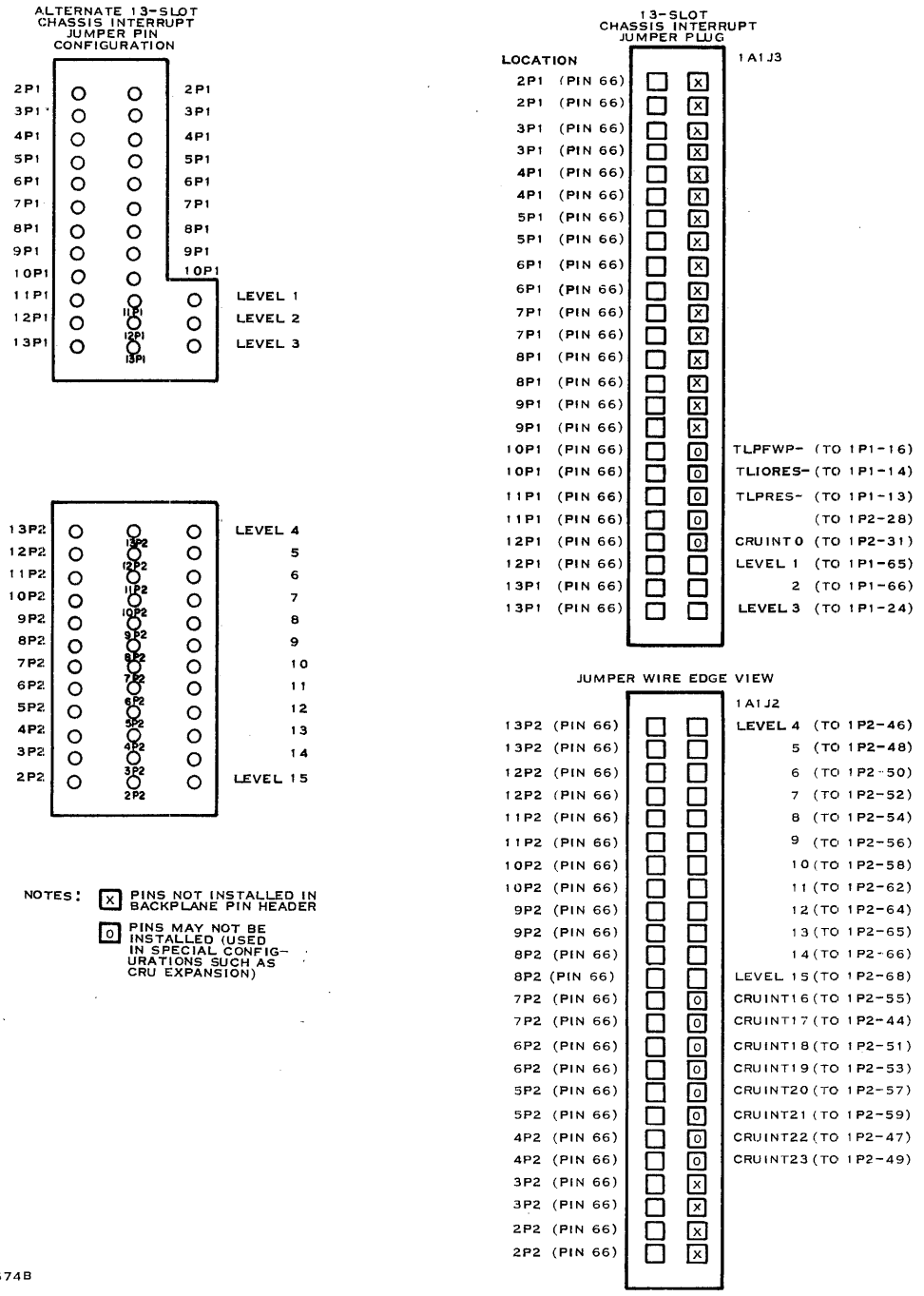


Figure 2-9. 13-Slot Chassis Interrupt Jumper Plugs

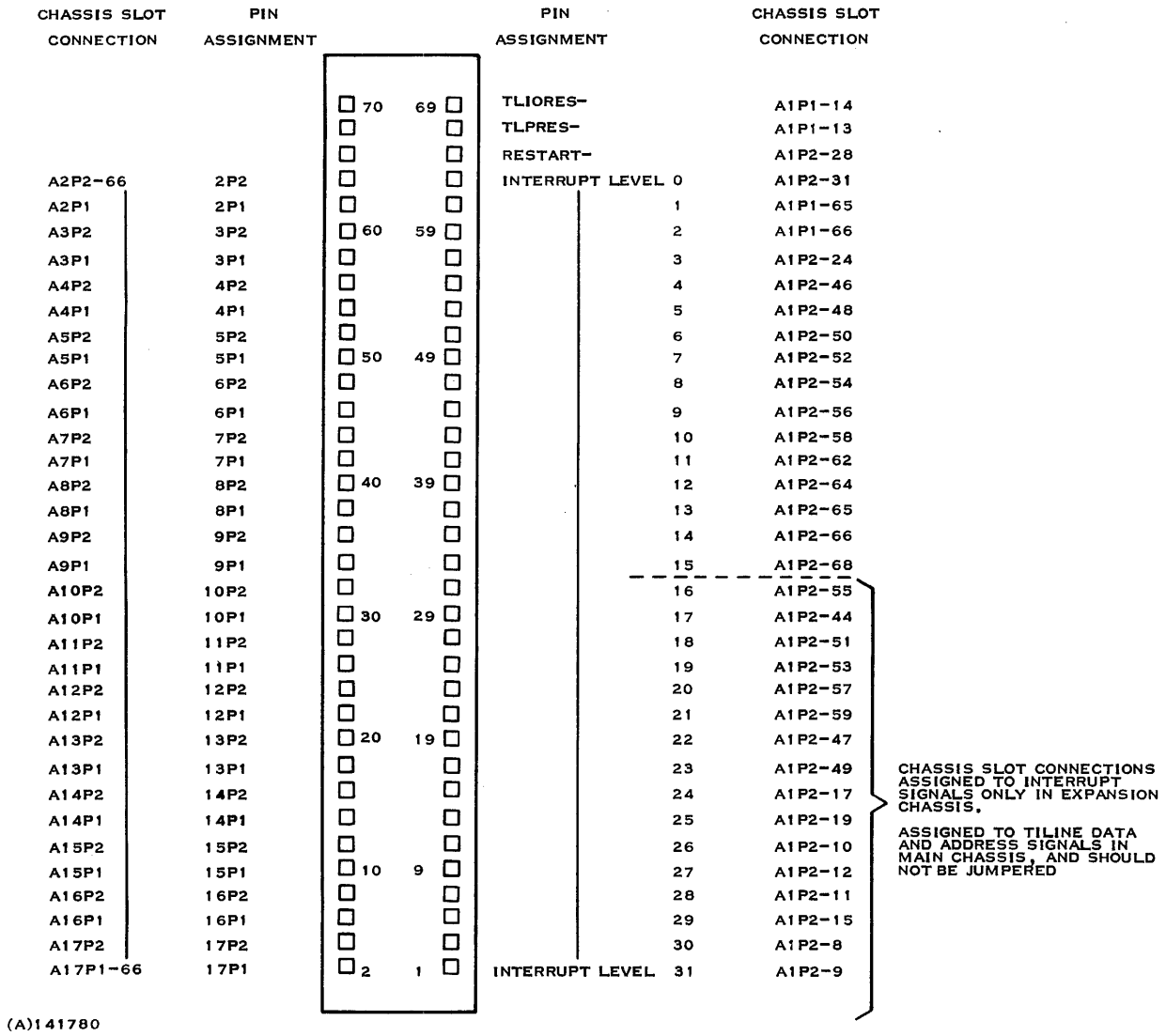


Figure 2-10. 17-Slot Chassis Interrupt Jumper Connector

WARNING

SHOCK HAZARD. Do not remove circuit boards or connectors while power is applied to chassis. Opening the chassis rear cover (power panel) exposes high voltage if the ac line cord is installed in a live socket. Do not touch the large filter capacitors on the power module.

CAUTION

The wire hinges on the chassis rear cover do not allow the cover to pivot beyond 90 degrees. Attempts to open the rear chassis cover beyond this point may damage the hinge mountings.

2. Using a coin or flat-bladed screwdriver, release each of the 11 quarter-turn latches on the chassis rear cover. Pull the cover straight back 38 mm (1.5 in.) to extend the wire hinges, and then open the cover to the 90-degree position. The hinges are on the right of the chassis (as viewed from the rear).

3. Remove the interrupt jumper assembly by gently rocking it up and down to loosen the connector and then pulling it straight back. When reinstalling the assembly, make sure the pins are properly aligned before applying mating force.

CAUTION

It is possible to install the interrupt jumper assembly upside down. Note that pin 1 is at the bottom of the interrupt connector.

2.4.2 Inspection and Chassis Preparation

The following procedure should be performed before installing the TTL data module into a chassis slot:

1. Visually inspect the circuit board for cracks, corrosion, loose components, and loose connectors.

2. Compare the jumper locations on the TTL data module to the locations specified in Table 2-1; move the jumpers as required to match the specified configuration. Figure 2-11 shows the jumper locations.

Table 2-1. TTL Data Module Interrupt Jumper Schedule

Jumper		Jumper	
From	To	From	To
E5	E20	E16	E18
E9	E10	E17	E19
E11	E12	E7	E13

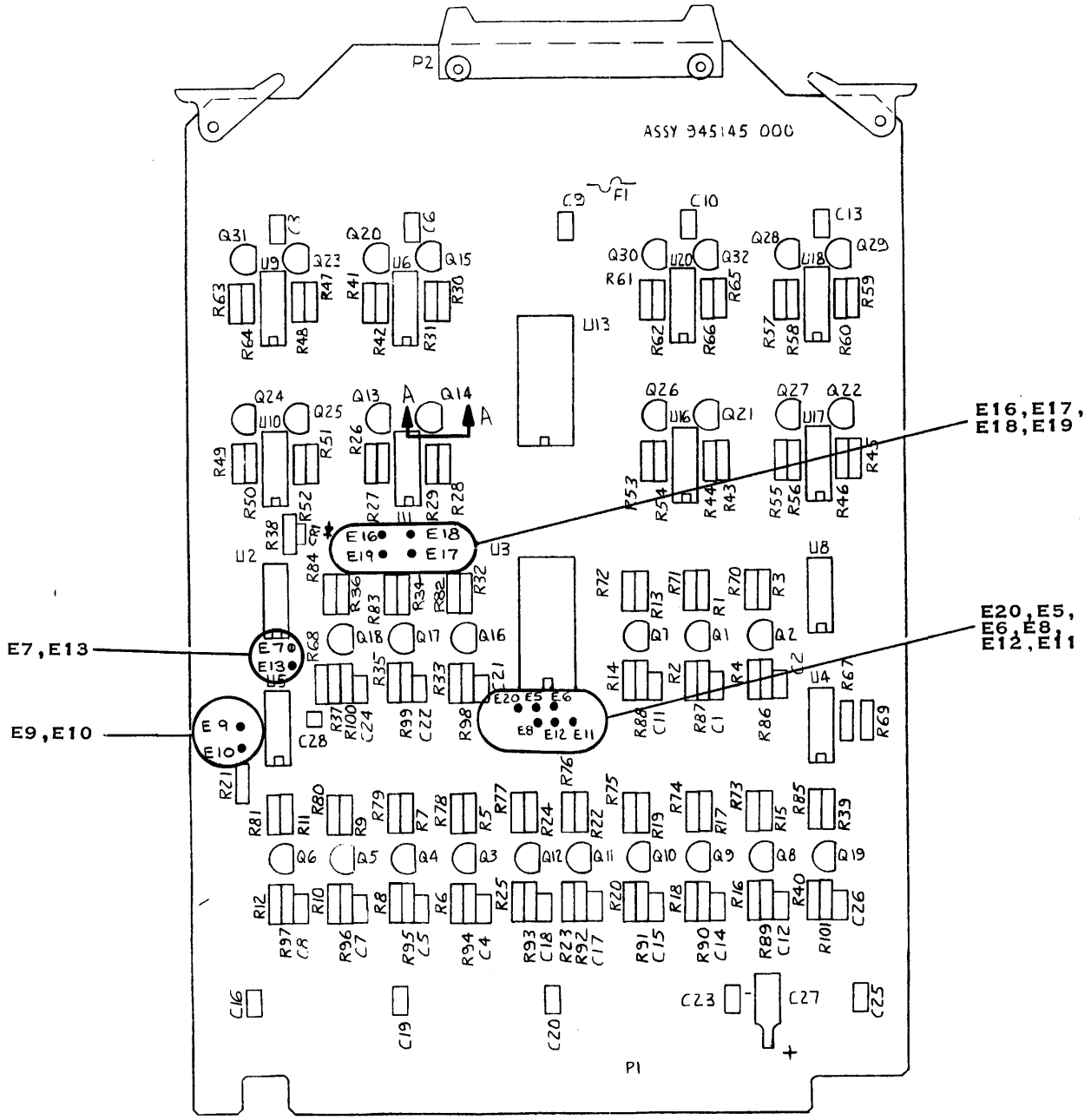


Figure 2-11. Location of Data Module Interrupt Jumpers

3. Install a center card guide in the desired location using the following procedure:

   a. Disconnect the power from the chassis before installing the center card guide.

WARNING

SHOCK HAZARD. Do not attempt to install a card guide when power is applied to chassis.

   b. Examine the card comb located between the two rows of connectors on the front side of the motherboard. If there is a screw between the two connectors in the position where the card guide is to be installed, remove the screw and associated hardware from the motherboard and install in an adjacent hole (either above or below).

   c. Install the center card guide, part number 936404-1, using a flat washer and a screw as in Figure 2-12.

NOTE

Determine if one or two half-sized cards are to be used with the card guide.

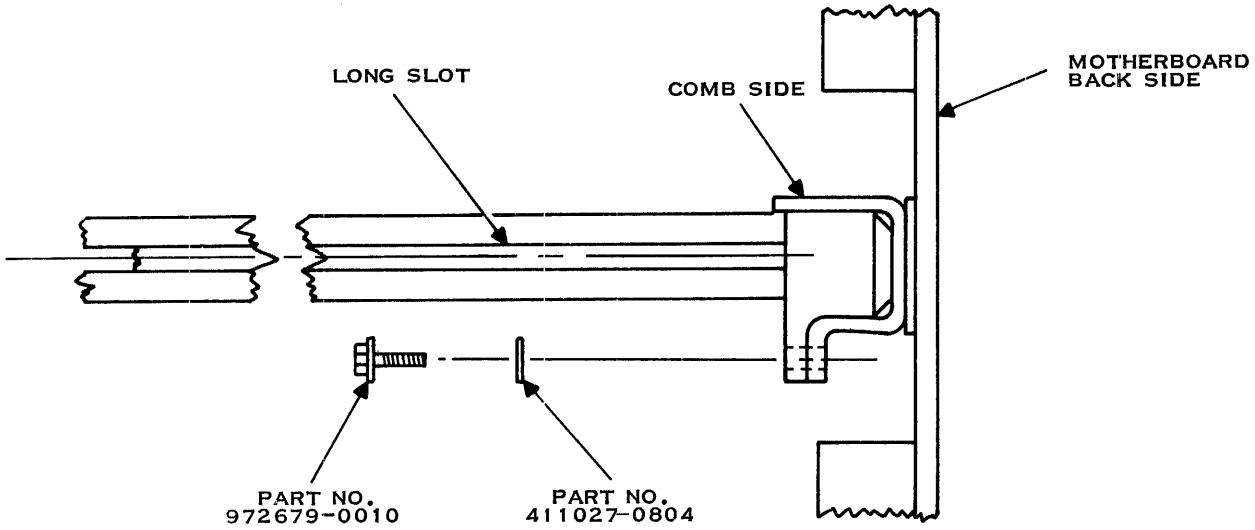


Figure 2-12. Installation of Center Card Guides

- If two cards are to be used, center the card guide as exactly in the middle as possible between the connectors.

- If one card is to be used, install the card guide as close as you can to the side of the chassis in which the card will be installed.

- Inspect the card guide to ensure that it is not rotated with respect to the card comb. If it is rotated, loosen the screw, align the guide, and retighten the screw.

2.4.3 Installation and Cabling

The TTL data module can be installed in any spare CRU half-card slot in the main computer chassis or in a CRU expansion chassis. The location that the user assigns the TTL data module, whether in the computer chassis or expansion chassis, determines the CRU address used by the computer software. Thus the location should be agreed upon before the module is installed. To install the TTL data module and connect it to the LP300/LP600 printer, perform the following steps:

1. Ensure that the power to the computer chassis is off.

NOTE

The TTL data module (Figure 2-11) has two plastic pivot tabs (board ejectors), one on each end of the board. This is the outside edge of the board; the opposite edge inserts into the connector in the computer or expansion chassis.

2. Insert the TTL data module into the chassis location corresponding to the desired address. Ensure that the circuit board connector mates properly with the alignment comb on the backpanel connector.

3. Push the board straight in until the edge connector engages the slotted connector in the backpanel of the chassis.

4. Connect P1 of the interface cable (part number 0937490-0002) to the P2 interface connector of the TTL data module.

5. Connect the other end of the interface cable, P2, to the LP300/LP600 printer communications interface connector (refer to Figure 1-3) and secure the cable plug with the screws included with the connector.

2.5 PRINTER POWER CABLING

The power cord receptacle is located at the rear of the LP300/LP600 printer (Figure 1-3). The printer comes equipped with a 3-prong receptacle for connection to the power source via a power cable.

Connect the LP300/LP600 printer power cable to its power source by following these steps:

1. Ensure that the power ON/OFF switch (see Figure 1-3) is in the OFF position.

2. Install the female end of the 3-wire ac power cord in the recessed male connector at the rear of the printer. Plug the opposite (male) end into a wall socket supplying the specified voltage and frequency.

2.6 POWER UP AND OPERATIONAL CHECKOUT

Before applying power to the LP300/LP600 printer and verifying its operation, check the following items:

1. Check that all connections have been properly made between the Model

990 computer and the LP300/LP600 printer subsystem.

2. Verify that the interrupt functions have been properly installed as described in paragraph 2.4.

3. Check the configuration label at the rear of the printer for its voltage and frequency rating (see Figure 1-3 for its location). Verify that the voltage at the installation site is the same as that listed on the configuration label.

NOTE

Limit power supply reconfiguration at the installation site to changes in either the low voltage range (100 V, 110 V, 120 V) or high voltage range (200 V, 220 V, 240 V). Cross reconfiguration between voltage ranges cannot be made at the installation site.

If cross-reconfiguration changes are desired, contact the TI service office for further assistance. DO NOT ATTEMPT TO MAKE ANY CHANGES YOURSELF.

4. In the event that the voltage rating for the printer and the voltage present at the installation site are not the same, use the following procedure to reconfigure the printer to operate with the available voltage:

WARNING

SHOCK HAZARD. Do not attempt to reconfigure the power supply when power is applied to the printer.

5. Remove the power cable from the rear of the printer.

6. Refer to Figure 1-3 and open the rear access door of the printer.

7. Swing out the card cage to expose the power supply printed circuit board assembly (PCBA) shown in Figure 2-13.

8. Refer to Figure 2-13 and remove the two screws that hold the power supply PCBA to the power supply frame.

9. Move the power supply PCBA to the left to expose the screw that secures the left-hand side of the fuse housing (see Figure 2-13).

10. Refer to Figure 2-13 and remove the two screws that secure the fuse housing.

11. If the power supply is to be reconfigured to 100 V, 110 V, or 120 V and the original factory configured voltage is not 200 V or greater, the following steps should be followed:

    a. Refer to Figure 2-14 for an illustration of the wiring arrangement of voltage taps for line voltages of 100 V, 110 V, and 120 V.

    b. Move the wire from SW1-3 of the power switch to the appropriate transformer tap indicated in Figure 2-15.

    c. Move the transformer tap jumpers as illustrated in Figure 2-15.

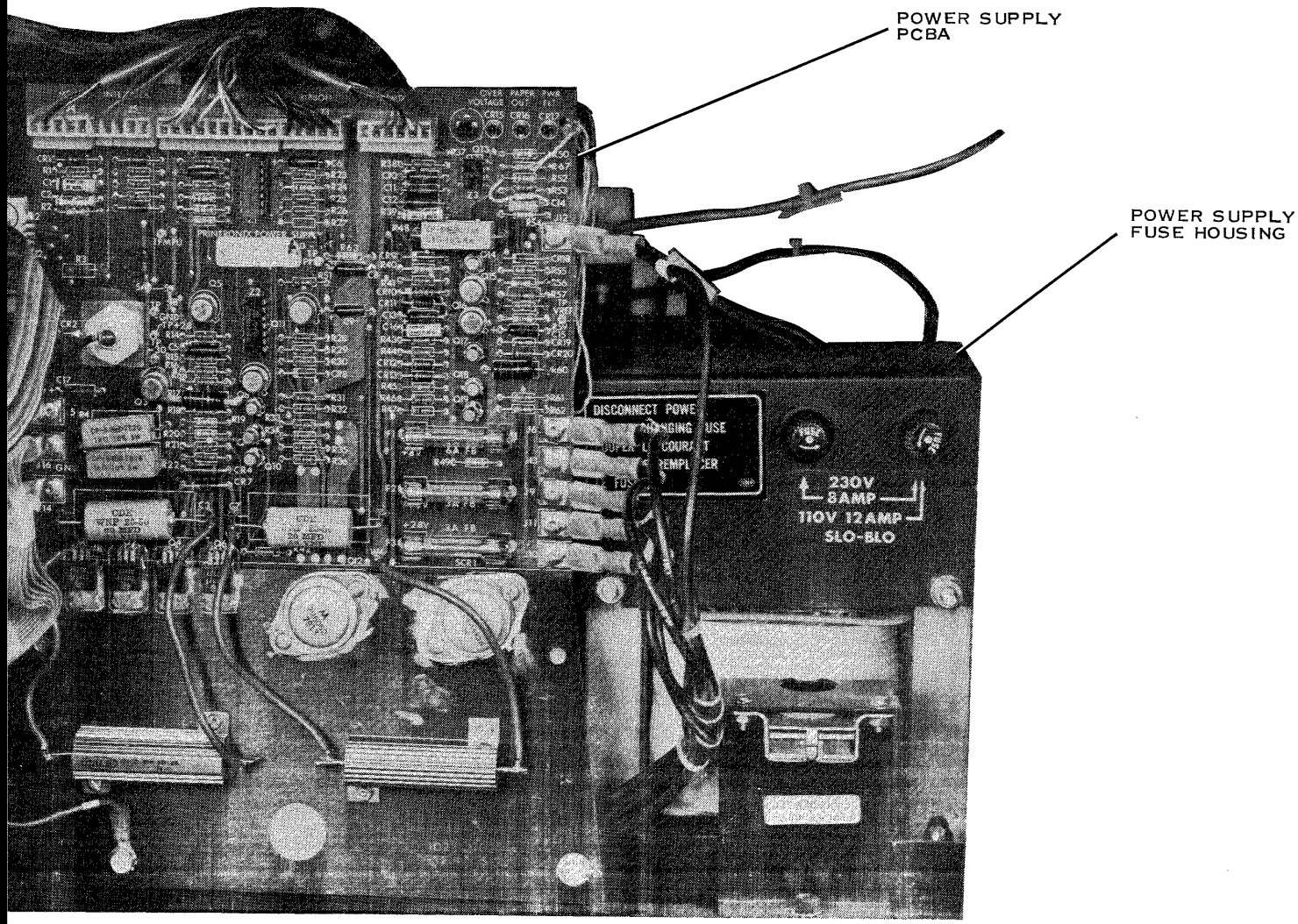


Figure 2-13. LP300 Printer Power Supply PCBA

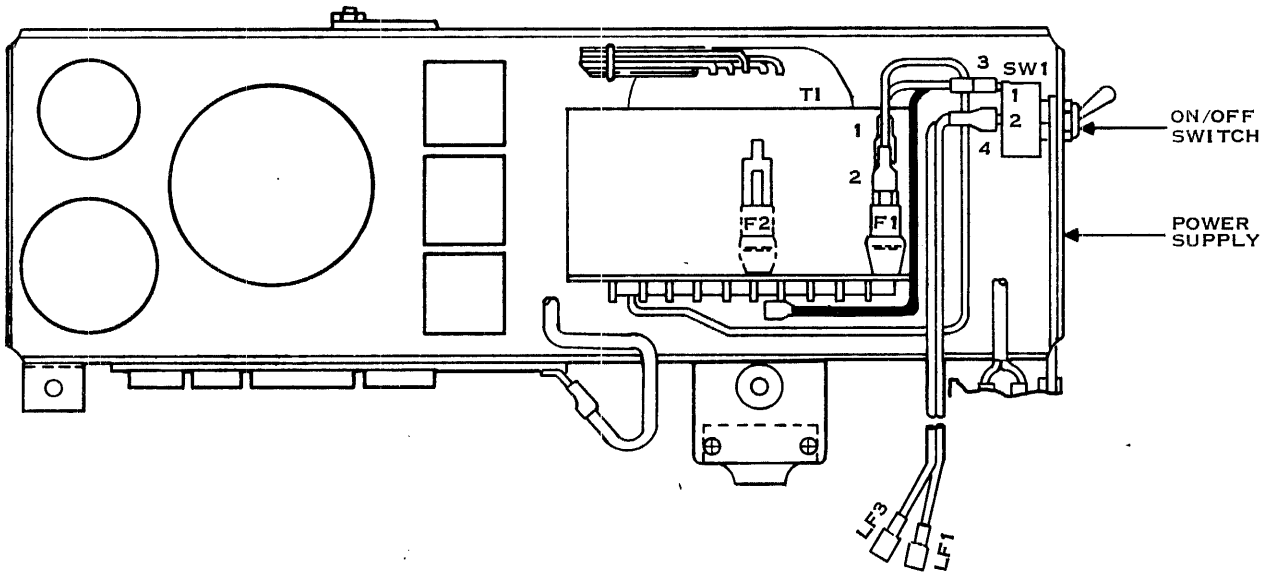


Figure 2-14. Wiring for a 100 V, 110 V, or 120 V LP300/LP600 Printer Power Supply

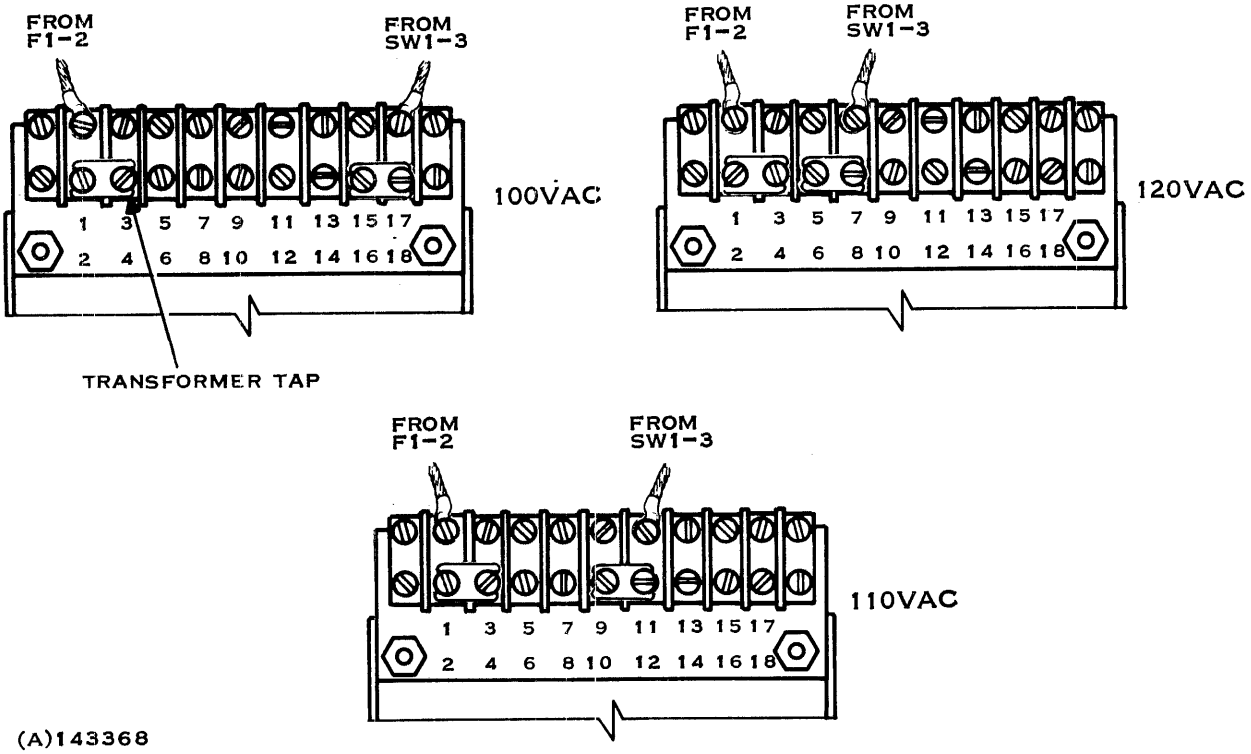


Figure 2-15. Transformer Connections (Taps) for 100 V, 110 V, and 120 V Printer Power Supply

12. If the power supply must be reconfigured for 200 V, 220 V, or 240 V and the original voltage was not 120 V or less, the following steps should be followed:

    a. Refer to Figure 2-16 for a wiring illustration for line voltages of 200 V, 220 V, and 240 V.

    b. Refer to Figure 2-17 and move the jumper wire to the appropriate transformer tap.

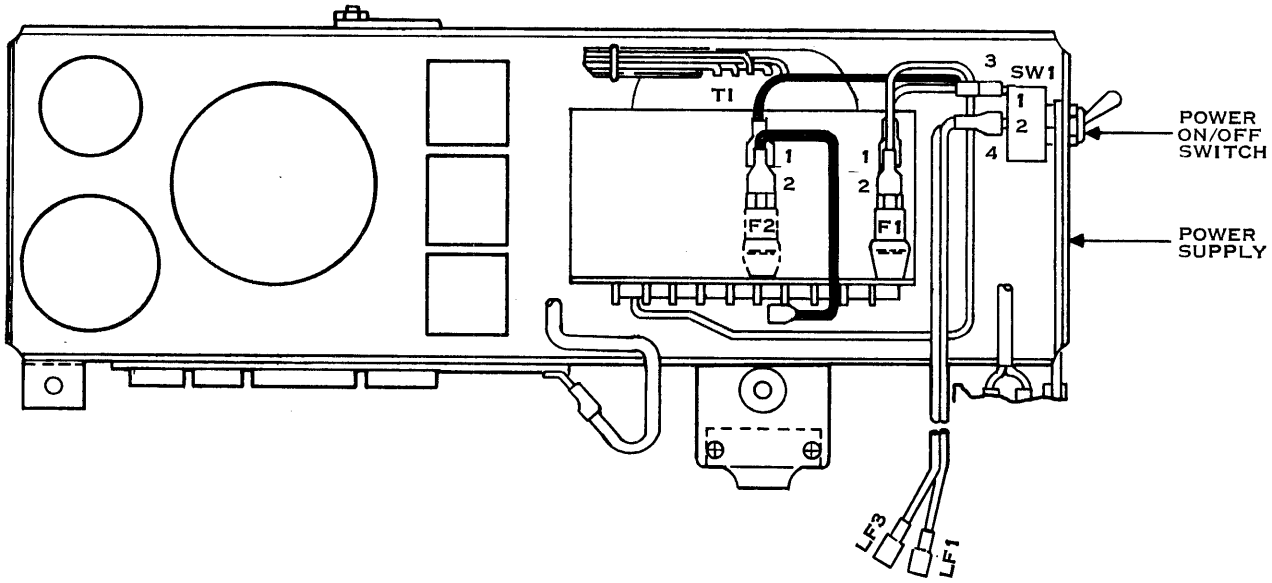


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Figure 2-16. Wiring for a 200 V, 220 V, or 240 V LP300/LP600 Printer Power Supply

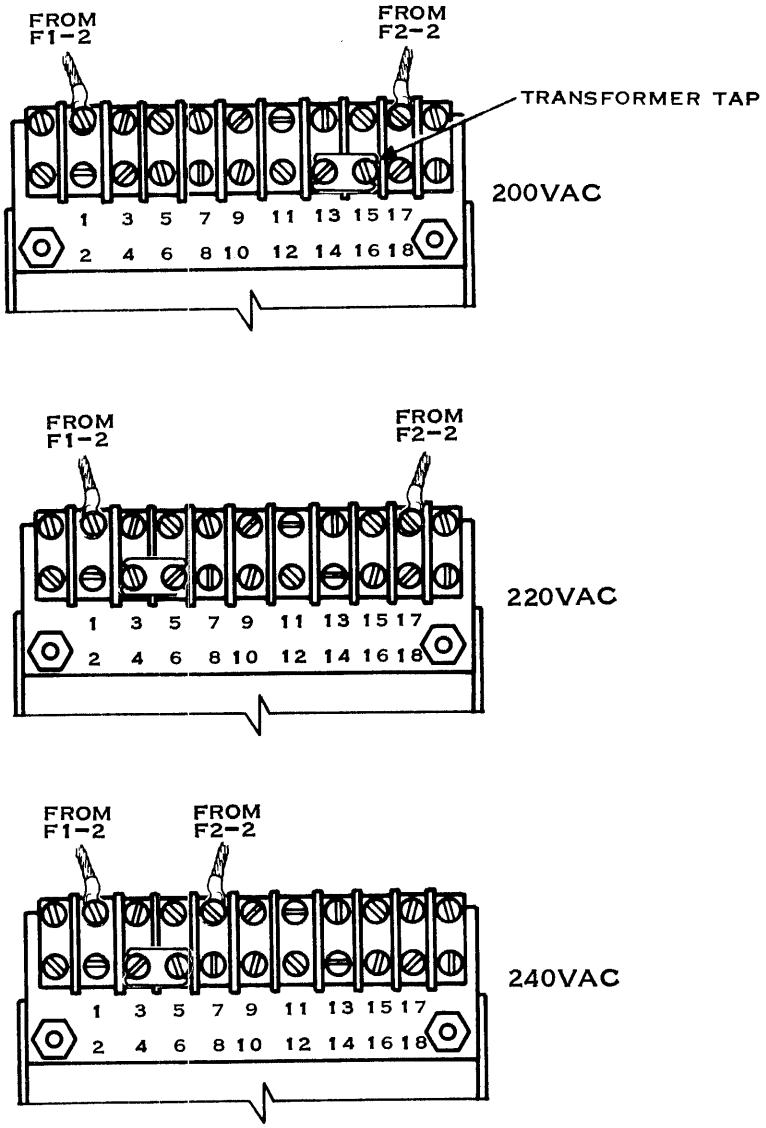


Figure 2-17. Transformer Connections (Taps) for 200 V, 220 V, or 240 V Printer Power Supply

13. Replace the fuse housing on its mounting screws using the hardware removed in Step 10.

14. Hold the power supply PCBA in its normal position and reattach the assembly using the hardware removed in Step 8.

15. Swing the printer card cage inside the cabinet and close the access door.

16. Replace the ac power cord.

The power ON/OFF switch at the side of the printer may now be turned ON. Verify that the POWER INDICATOR illuminates and the ventilator fan runs.

To verify that the LP300/LP600 printer is operating correctly, execute the following self-test:

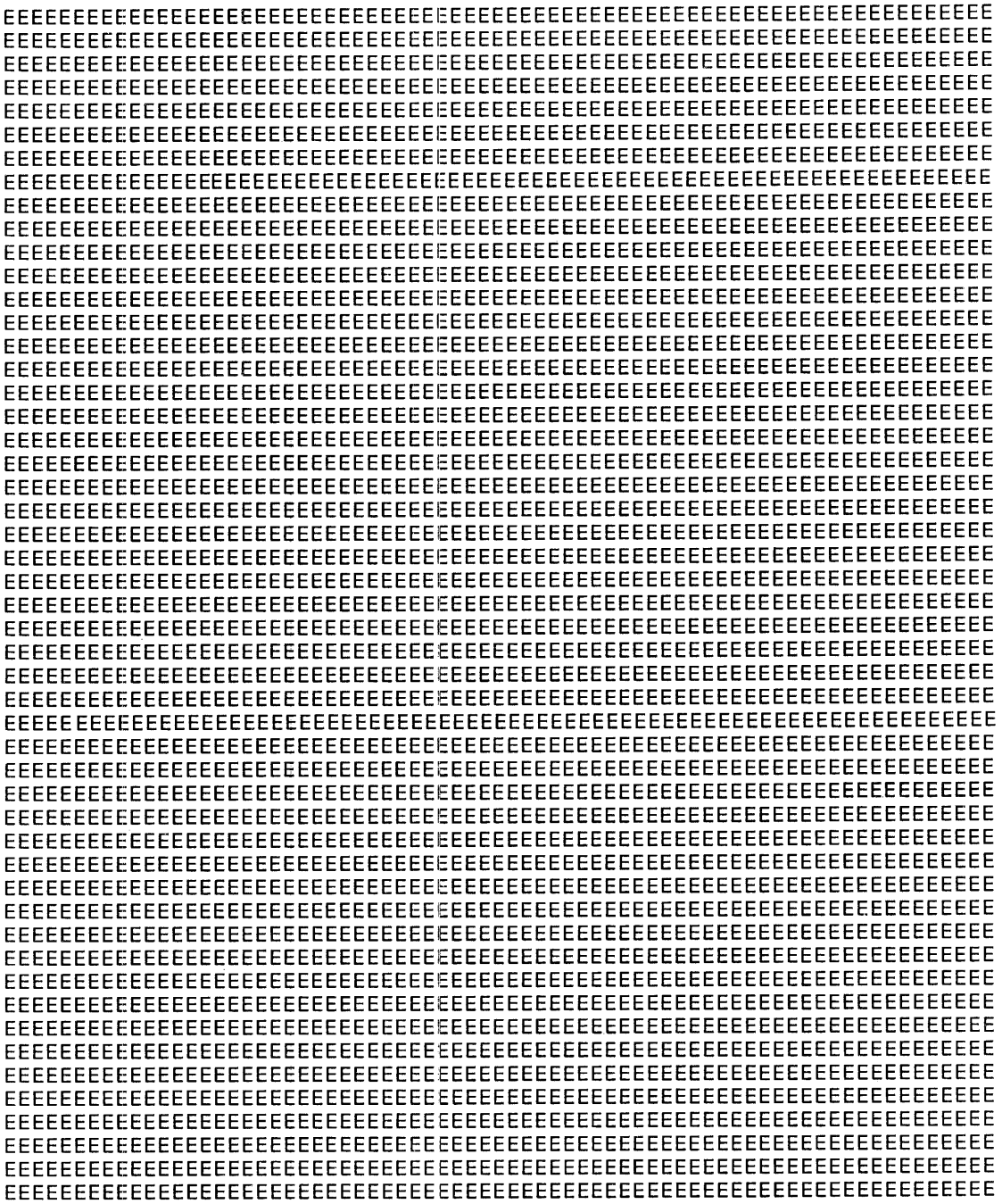
1. Place the printer on-line by depressing the ON LINE indicator/switch located on the printer's operator panel (see Figure 1-3). The ON LINE indicator should illuminate after being depressed.

2. Simultaneously depress and hold both the PAPER ADVANCE and the CHECK indicator/switch in a down position. The printer should respond by printing 132-character lines of capital Es (Figure 2-18).

3. To terminate this test, simply release the PAPER ADVANCE and CHECK indicators.

If a fault status is indicated during the self-test, repeat the above procedure. If the fault status persists after several retry attempts, turn the power switch to the OFF position and discontinue use. Consult the nearest Texas Instruments service office for further assistance.

To execute the diagnostics for the LP300/LP600 printer subsystem, consult the Texas Instruments *Model 990 Computer Diagnostics Handbook*, part number 945400-9701 through 9707, and the Fast Line Printer Test (FLPTST) diagnostic program, part number 2250117-9901.



(A)143371

Figure 2-18. Sample Printout of Normal Self-Test Results

3

Programming

3.1 GENERAL DESCRIPTION

This section describes the interface between the LP300/LP600 printer subsystem and the Model 990 computer and provides information useful for generating software for a specific LP300/LP600 printer subsystem application. The discussion assumes knowledge of assembly language programming of the TI Model 990 series computers and familiarity with the programming information contained in the *Model 990 Computer TMS 9900 Microprocessor Assembly Language Programmer's Guide*, part number 094344-9701. Therefore, only basic programming requirements are given in this text.

3.2 MODEL 990 COMPUTER CRU DESCRIPTION

The Model 990 CRU provides communications between the Model 990 CPU and the TTL data module for the LP300/LP600 printer. CRU communication signals originate on the CPU, located in slot 1 of the main Model 990 computer chassis. The CRU signals are connected through the computer chassis backpanel to connector P1 and P2 of the remaining chassis slots. The TTL data module for the LP300/LP600 printer is plugged into a chassis slot where contact is made with the CRU signals. Thus, the TTL data module is an extension of the CRU when plugged into a chassis slot.

CRU data is transferred from the Model 990 CPU to the TTL data module over a one-bit output bus and a one-bit input bus. A 12-bit CRU address (Figure 3-1) selects the destination in the TTL data module for each CRU output bit, or the data source in the TTL data module for each CRU input bit. Inputs and outputs may be treated individually or in groups of up to 16 bits. Multibit read or write operations are performed by addressing the individual bits in sequence.

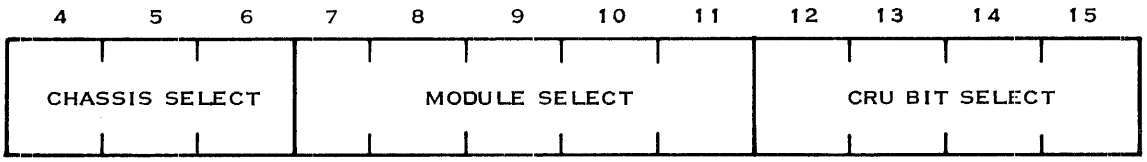
The 12-bit CRU address consists of three parts: a chassis select field, a module select field, and a CRU bit select field. The chassis select field specifies the Model 990 computer chassis or one of the seven possible CRU expansion chassis units. The chassis select decode is performed in the main chassis by the arithmetic unit (AU) board(s) and in the expansion chassis by the CRU buffer cards. The module select field specifies half slots within the selected chassis.

NOTE

The hardware slot location must be coordinated with the software address using this address positioning scheme.

The remaining 4 least significant bits (CRUBIT 12-15) of the CRU address are used to define a 16-bit interface between the computer and the selected module. The Model 990 CPU instructions (Figure 3-2) that drive the Model 990 CRU consist of single-bit and multiple-bit transfer instructions. Single-bit transfer instructions (SBO, SBZ, and TB) are used for control functions and include the following:

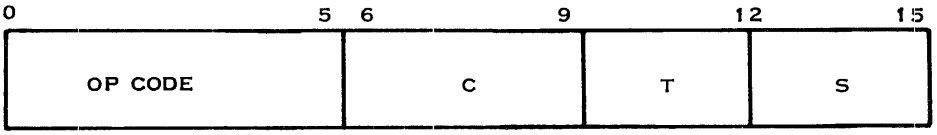
- Set Bit to Logic One (SBO) — This instruction sets the addressed CRU output bit to a logic one, which is stored in the TTL data module register. The output of the data module register is inverted to pro-



(A)136375

Figure 3-1. CRU Address Field Assignments

MULTIPLE-BIT INSTRUCTION FORMAT

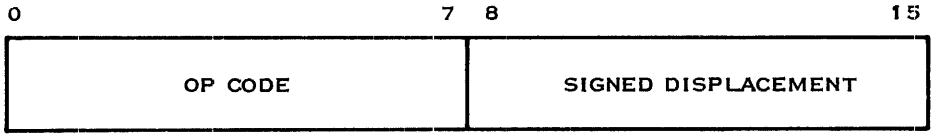


001100 = LDCR(LOAD COMMUNICATIONS REGISTER)
001101 = STCR(STORE COMMUNICATIONS REGISTER)

C = NO. OF BITS TO TRANSFER(C = 0 TRANSFERS 16 BITS)
T = SOURCE ADDRESS MODIFIER 00 = DIRECT 10 = INDEXED
01 = INDIRECT 11 = INDIRECT WITH AUTO INCREMENT

S = SOURCE REGISTER
STARTING CRU ADDRESS IS DETERMINED BY BITS 3-14 OF CRU BASE ADDRESS IN WORKSPACE REGISTER 12(R12)

SINGLE-BIT INSTRUCTION FORMAT



>1D = SBO	TWO'S COMPLEMENT DISPLACEMENT
>1E = SBZ	RELATIVE TO BITS 3-14 OF CRU BASE
>1F = TB	ADDRESS IN WORKSPACE REGISTER R12

NOTE:
THE SYMBOL ">" DENOTES A HEX BIT

(A)143372

Figure 3-2. CRU Instruction Formats

duce a logic zero at the TTL data module output for the selected bit.

- Set Bit to Logic Zero (SBZ) — This instruction sets the addressed CRU output bit to a logic zero, which is stored in the data module register. The output of the data module register is inverted to produce a logic one at the TTL data module output for the selected bit.

- Test Bit (TB) — This instruction reads the addressed CRU input bit from the data module, and sets the equal status bit in the Model 990 CPU status register to the value of the addressed CRU bit.

NOTE

The CRU address of the SBO, SBZ, and TB instructions is determined as follows:

CRU base address + the user-supplied displacement instruction (with sign bit extended) = the effective CRU address.

Multiple-bit transfer instructions (LDCR and STCR) are used to transfer a specified number of data bits between the data module and the source register in the Model 990 CPU (refer to Figure 3-3). These instructions function as follows:

- Load Communications Register (LDCR) — This instruction transfers the number of bits (1-16) specified by the C field of the instruction from the source register to the addressed bit registers in the TTL data module. These transferred bits constitute data, such as print character codes, paper feed, form feed, or carriage return. The CRU base address is determined by bits 3-14 of R12.

- Store Communications Register (STCR) — This instruction transfers the number of bits (1-16) specified by the C field of the instruction from the addressed bit multiplexer locations in the TTL data module to the source register. The transferred bits constitute data, such as read, on-line, or data demand signals.

The relationship between the bits in the CPU memory word and the CRU data module input and output lines are shown in Figures 3-4 and 3-5.

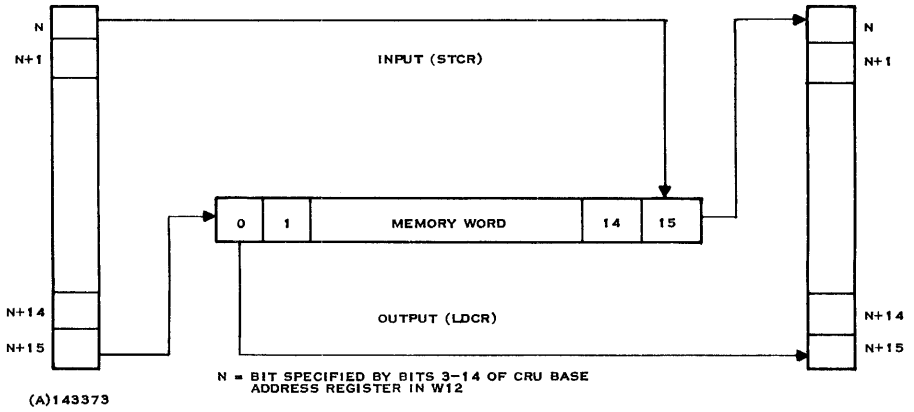


Figure 3-3. Model 990 Memory/CRU Data Transfer (LDCR and STCR Instructions)

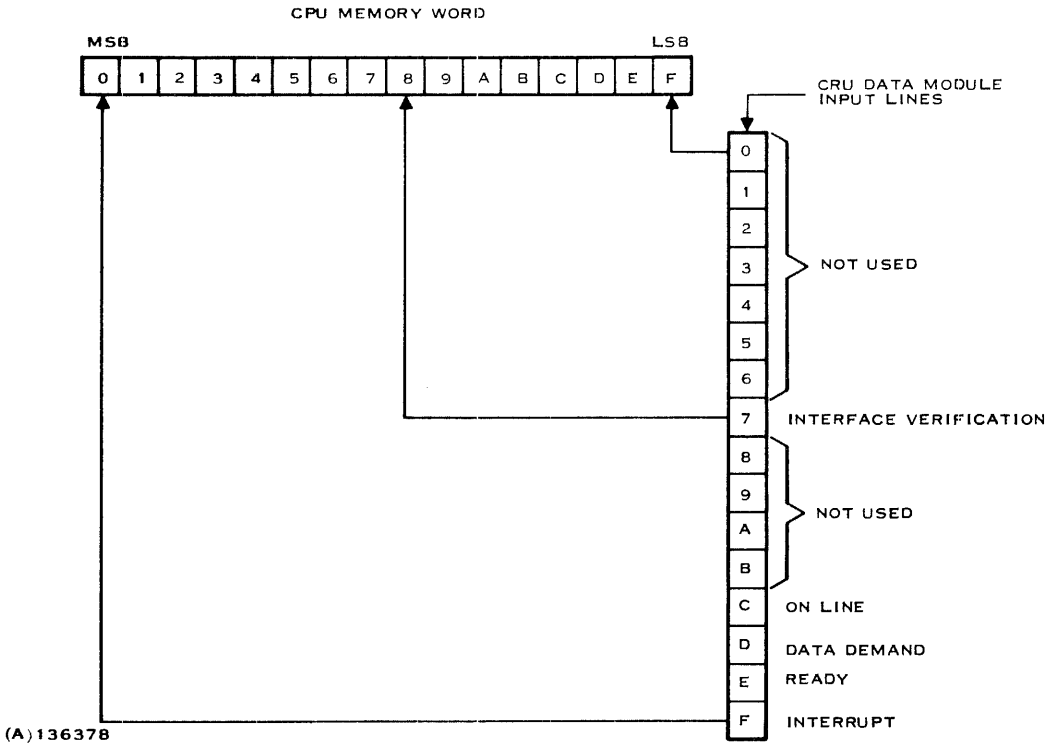


Figure 3-4. CRU Input from the TTL Data Module

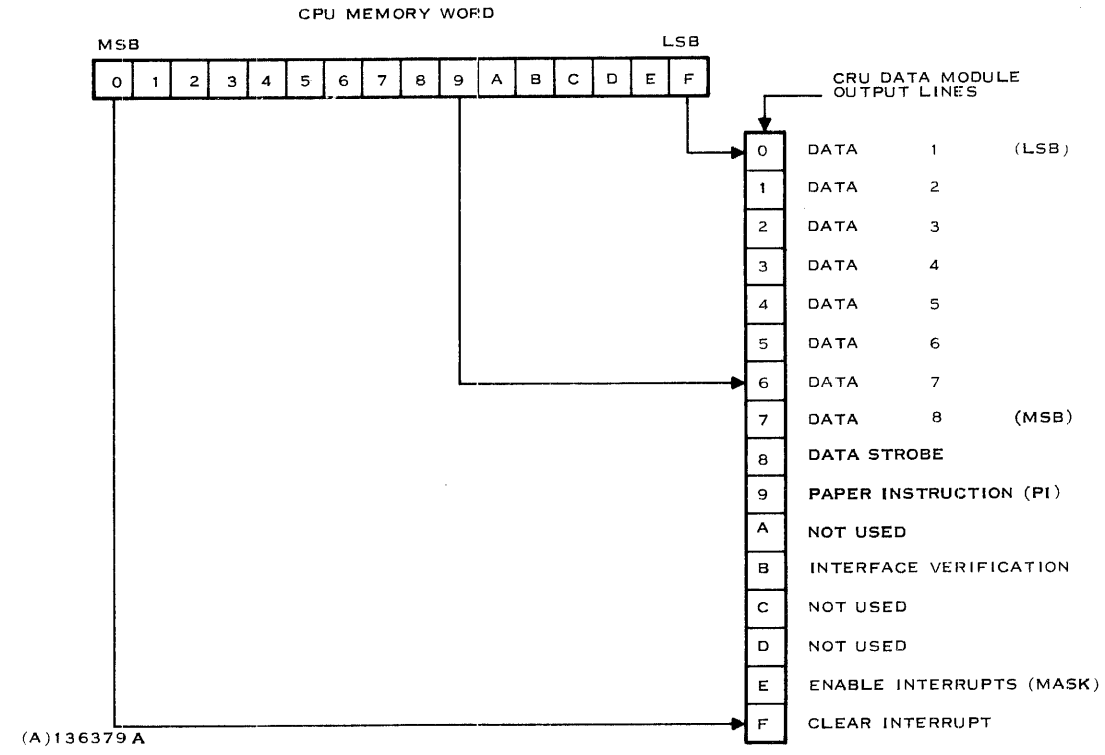


Figure 3-5. CRU Output to the TTL Data Module

3.2.1 CRU Interface Input Signal Description The following paragraphs briefly describe the CRU input bit assignments from the TTL data module to the Model 990 CRU.

NOTE

CRU input bits zero to six and eight to B are not used in this application.

3.2.1.1 Interface Verification. CRU input bit seven is the interface verification bit. It functions as a status bit that verifies the correct installation of the LP300/LP600 printer interface cable. This bit should be the opposite logic level (one or zero) from the CRU output bit B.

3.2.1.2 On Line. When at a logic one, the on line bit (CRU input bit C) informs the Model 990 CPU that the printer can receive data. A logic zero (0) indicates the printer is not able to receive data.

3.2.1.3 Data Demand. When at a logic one (1), the data demand status bit (CRU ouput bit D) signals the Model 990 CPU that the printer is ready to accept a character code. This bit will also generate an interrupt pulse when it changes from a logic zero (0) to a logic one (1) level, which causes an interrupt to be generated, if interrrupts are enabled.

3.2.1.4 Ready. The ready status bit (CRU bit E), when at a logic one (1) level, indicates to the CPU that the printer is ready to be put on-line.

3.2.1.5 Interrupt. When at a logic level one (1), the interrupt status bit (CRU input bit F) indicates to the CPU that the data module has generated a CRU interrupt signal. The data module is jumpered as shown in Table 2-1 to provide software controlled maskable interrupts. An interrupt pulse is generated at the same time that the data demand line goes true (indicating the printer is awaiting a character code). Because the computer has control of the interrupt signal, the interrupt pulse may be either masked or enabled.

3.2.2 CRU Interface Output Signal Description The following paragraphs briefly describe the CRU output bit assignments to the TTL data module from the Model 990 CRU.

3.2.2.1 Data Lines 1-8. The data line signals consist of CRU output bits zero through seven. These signals provide a transfer path for the 96 ASCII code characters, the command codes (Table 3-1), and the vertical form codes (Tables 3-2 and 3-3).

3.2.2.2 Data Strobe. The data strobe signal (CRU output bit eight) is controlled by the user's software to define when information on the data lines is to be accepted by the printer. Data is accepted by the printer whenever CRU output bit eight goes from a logic one to a logic zero.

3.2.2.3 Paper Instruction. The PI signal (CRU output bit nine) is controlled by the user's software and is used with the printer's EVFU. Whenever CRU output bit nine is at a logic zero (0), the information contained on data lines 1-8 will be interpreted as a vertical format instruction.

3.2.2.4 Interface Verification. The interface verification signal (CRU output bit B) is used in conjunction with CRU input bit seven to verify the proper installation of the printer's interface cable. To verify this installation, the interface verification bit and CRU input bit seven are intentionally kept at the same logic level.

3.2.2.5 Enable Interrupts (Mask). The enable interrupts signal (CRU output bit E) is used either to mask or to enable interrupts. When at a logic zero, this signal prevents the data demand bit (CRU input bit D) from generating an interrupt. A logic zero output signal enables CRU input bit D to generate an interrupt.

Table 3-1. LP300/LP600 Printer Command Code Summary

Hex Code	Code Name	Function
04	Double Density Plotting	This code causes the characters to be interpreted as binary dot patterns rather than normal character patterns (even dots only).
05	Normal Plot	This code causes the character dot pattern to be printed on odd dot positions.
06	Select 8LPI	This code causes the printer to go to line spacing of 8 lpi.
08	Elongated Character Printing	This code causes the printer to go to elongated character printing.
0A	Line Feed	This code causes the contents of the input buffer to be printed and paper to be advanced one character line. If operated in Plot Mode, this code causes the paper to be advanced one dot row, and the printer to revert to the character print mode.
0B	Vertical Tab	This code causes the printer to skip to VFU Channel 12.
0C	Form Feed	This code causes printer to skip to the top of form.
0D	Carriage Return	This code resets the pointer of the input buffer to the first character column.
5F	Underline	This code causes printer to underline characters at positions marked by its presence.
7F	Delete	This code causes the printer to delete characters at positions marked by its presence.

3.2.2.6 Clear Interrupt. The clear interrupt signal (CRU output bit F) is an output from the Model 990 CPU and is used to clear the CRU interrupt from the printer. A logic zero output to CRU input bit F clears the interrupt.

3.3 SOFTWARE CONTROL OF THE LP300/LP600 PRINTER

The following paragraphs describe brief procedures and instructions for using software-controlled features contained with the LP300/LP600 printer.

3.3.1 Electronic Vertical Format Unit (EVFU)

The EVFU is a vertical formatter that is operated entirely under software control from the Model 990 computer. The EVFU enables the user to print various types of forms up to 132 lines long. With the EVFU, the user may skip a specified number of lines at slewing speed or may skip to a preassigned point in the form specified by an EVFU channel number.

NOTE

Slewing is the process by which the printer mechanism advances paper (without printing characters) until commanded to stop.

The EVFU accommodates up to 14 EVFU channels. Each of the 14 EVFU channels may be used as a line reference for the EVFU's 132-location memory.

The computer program causes the 132-location EVFU semiconductor memory to be automatically loaded through the printer's parallel interface data lines. Subsequent channel control codes (Table 3-1) cause paper to advance in steps that define the vertical format of the form as it is printed.

To print new forms, the Model 990 computer simply reloads the EVFU with the new form program. The printer then advances paper to the top of the new form and automatically prints it.

To operate the EVFU, four steps are followed:

1. The form to be printed is loaded and adjusted to the TOP OF FORM mark (refer to Section 4 for TOP OF FORM adjustment procedures).

2. The ON LINE pushbutton is depressed and released (Figure 4-1).

3. The computer program loads the EVFU memory and turns on the printer's TOP OF FORM indicator (see Figure 4-1).

4. The printer is now loaded with the EVFU program. However, it still requires the program software to control its execution.

3.3.1.1 Loading the EVFU. The following steps load the EVFU memory:

1. A PI signal is sent to the printer (via CRU output bit nine). This signal allows command code interpretation of the printer's parallel interface data lines.

2. A Start Load (STL) code (>6E) initializes the EVFU for loading.

3. A series of codes (Table 3-2) specifies the EVFU channel number for each line of the body of the form. For the lines not assigned channel numbers, the program sends a filler number not used in the EVFU form program (this number is used in the load program). Filler numbers are used to advance the control program to the last line of space allotted to the form.

4. An End Load (ELD) code (>6F) initializes the EVFU for loading.

Table 3-2. Interpretation of the Parallel Interface Data Lines

	Parallel Interface Data Lines (CRU Output Bits 0-7)							
PI	7	6	5	4	3	2	1	EVFU Channel Selected
1	x	x	0	0	0	0	0	1 (Top of Form)
1	x	x	0	0	0	0	1	2
1	x	x	0	0	0	1	0	3
1	x	x	0	0	0	1	1	4
1	x	x	0	0	1	0	0	5
1	x	x	0	0	1	0	1	6
1	x	x	0	0	1	1	0	7
1	x	x	0	0	1	1	1	8
1	x	x	0	1	0	0	0	9
1	x	x	0	1	0	0	1	10
1	x	x	0	1	0	1	0	11
1	x	x	0	1	0	1	1	12 (Vertical Tab)
1	x	x	0	1	1	0	0	13
1	x	x	0	1	1	0	1	14
1	1	1	0	1	1	1	0	Start Load
1	1	1	0	1	1	1	1	End Load

Notes:

x — denotes undefined data line
PI — denotes Paper Instruction signal

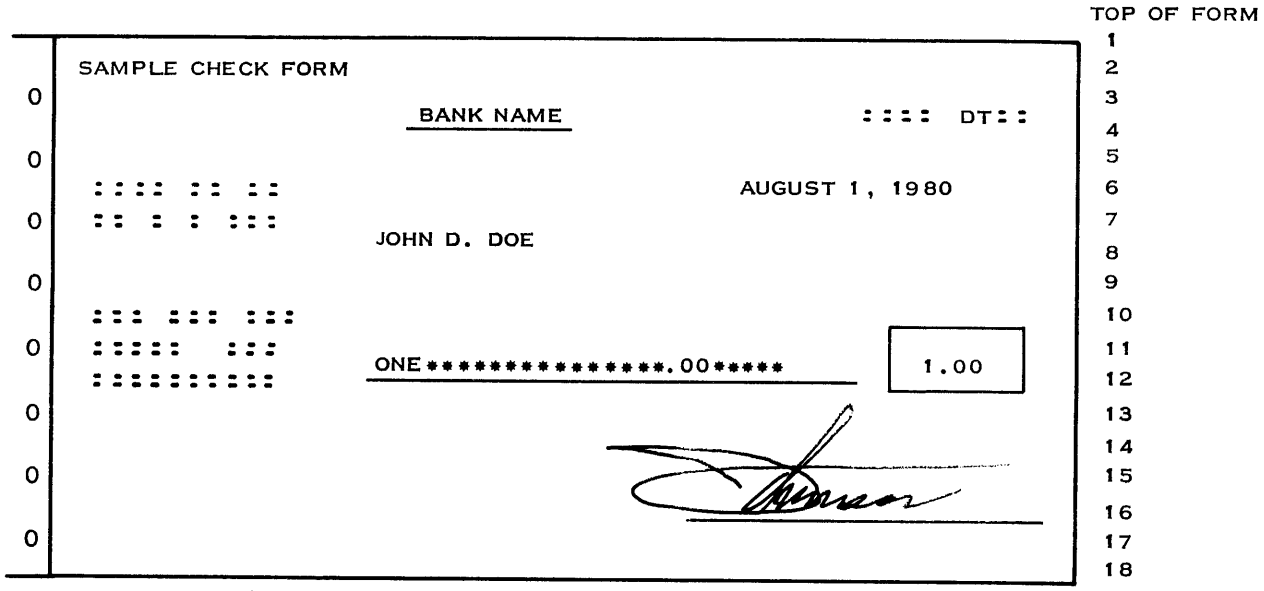
3.3.1.2 Using the EVFU to Print Variable Form Lengths. The EVFU may be used to select and print any form length from one to 132 lines. This is done simply by loading the EVFU memory to the desired number of lines.

For example, assume that you want to print checks which are three inches high, using the EVFU as a TOP OF FORM controller. The check is 18 lines high (3.0 × 6 lines/in.), so 18 codes (plus STL and ELD) are needed to load the EVFU memory (see Figure 3-6).

In the previous example, channel three was used as a filler. However, any channel (other than channel one) could have been used.

When the EVFU memory is loaded, the ELD code will turn on the TOP OF FORM indicator. At this time, either a form feed code (>0A), or operation of the TOP OF FORM pushbutton, will slew paper until channel 1 is found at the top of the next form. A line feed code (>0A) will advance paper to the next character line.

3.3.1.3 Using the EVFU as a Vertical Tab Stop. EVFU channel 12 is the only EVFU channel used for vertical tab stops. To use the EVFU as a vertical tab stop, the vertical tab control code (>0B) is put at the end of a line of print data. The data is then printed and paper is advanced until the next vertical tab control code is read from the EVFU memory.



TOP OF FORM

LOAD PROGRAM	LINE OF FORM	RUN PROGRAM	
FUNCTION		DATA AND FORMAT CODE	COMMENTS
STL		(>0A)	SLEW TO TOP OF FORM
CHANNEL 1	1	(>0A)	LINE FEED
3	2	(>0A)	‖
3	3	(>0A)	‖
3	4	JUNE 15, 1980 (>0A)	PRINT AND LINE FEED
3	5	(>0A)	LINE FEED
3	6	JOHN D. DOE (>0A)	PRINT AND LINE FEED
3	7	(>0A)	LINE FEED
3	8	(>0A)	‖
3	9	(>0A)	‖
3	10	ONE*******.00****1.00(>0C)	PRINT AND SLEW TO TOP OF NEXT FORM
3	11		
3	12		
3	13		
3	14		
3	15		
3	16		
3	17		
3	18		
ELD			

(A)143374

Figure 3-6. Example, Using EVFU for Variable Form Length

Channel 12 may be loaded into any line position except line 1 (TOP OF FORM), and may be used an unlimited number of times within the form.

Figure 3-7 illustrates the way the EVFU memory is loaded with vertical tab stop control codes.

3.3.1.4 Paper Slew Operation. Because the LP300/LP600 printer uses a PI interface signal for interface control, paper loaded in the printer may be made to slew to a specified number of lines (one to 16), instead of seeking a specified channel number. For this particular application, the EVFU memory is not used.

LOAD PROGRAM	LINE OF FORM	RUN PROGRAM	
FUNCTION		PRINT DATA AND FORMAT CONTROL CODE	REMARKS
STL		(>0C)	SLEW TO TOP OF FORM
CHANNEL 1	1	(>0B)	SLEW TO TAB STOP
3	2		
3	3		
3	4		
12	5	JULY 15, 1980(>0B)	PRINT AND SLEW TO TAB STOP
3	6		
12	7	JOHN C. DOE(>0B)	PRINT AND SLEW TO TAB STOP
3	8		
3	9		
3	10	----	
12	11	ONE****.00*****!1.00 !(>0C) ----	PRINT AND SLEW TO TOP OF NEXT FORM
3	12		
3	13		
3	14		
3	15		
3	16		
3	17		
3	18		
ELD			

(A)143375

Figure 3-7. Example, Using EVFU for Vertical Tab Stop

To initialize this operation, for each line slewed, the conditions presented in Table 3-2 must be met for the PI interface signal and the parallel interface lines:

Table 3-3. Interpretation of Line Slew Codes

	Parallel Interface Data Lines							
PI	7	6	5	4	3	2	1	Lines Slewed
1	x	x	1	0	0	0	0	1
1	x	x	1	0	0	0	1	2
1	x	x	1	0	0	1	0	3
1	x	x	1	0	0	1	1	4
1	x	x	1	0	1	0	0	5
1	x	x	1	0	1	0	1	6
1	x	x	1	0	1	1	0	7
1	x	x	1	0	1	1	1	8
1	x	x	1	1	0	0	0	9
1	x	x	1	1	0	0	1	10
1	x	x	1	1	0	1	0	11
1	x	x	1	1	0	1	1	12
1	x	x	1	1	1	0	0	13
1	x	x	1	1	1	0	1	14
1	x	x	1	1	1	1	0	15
1	x	x	1	1	1	1	1	16

3.3.1.5 Multichannel Operation of the EVFU. The multichannel operation of the EVFU allows each of the 14 EVFU channels to be used to specify a different line in the form. This is accomplished by loading into the EVFU a selected channel number code to identify a line in the form, and then specifying that channel number code in the print data when the form is to be advanced to that line.

Any of the 14 EVFU channels (except channel one) may be loaded in any form line location. When a channel is requested, the printer slews paper at a rate of eight inches per second (LP300) or 16 inches per second (LP600) to that line in the form, as the EVFU memory is searched for the stored channel number. The printer stops slewing paper when the specified channel is read from the EVFU memory.

Figure 3-8 shows a typical program application of multichannel program operation of the EVFU.

A special application uses different channel numbers to implement the vertical tab function when several different forms of the same length are to be printed. Note that this application requires that the PI interface line be used to request a vertical tab.

3.3.1.6 Other EVFU Features and Capabilities. The following additional features and capabilities also aid use of the EVFU:

- Program Runaway — If the EVFU control program is requested to slew to a given EVFU channel or vertical tab stop, and that channel is not loaded into the EVFU's memory, the printer will slew to the second TOP OF FORM and stop.

- Data Saved — If a channel is requested by the controlling software but is not loaded into the EVFU's memory, the printer treats that request as a line feed control code (>0A). Any data which followed that command in the print data is printed on successive character lines without formatting.

- Line Spacing — Six or eight lpi line spacing may be used during EVFU operation. However, it should be noted that line spacing affects form length. That is, if the check illustrated in Figure 3-6 were formatted at eight lpi instead of six lpi, 24 lines, instead of 18, would have to be loaded into the EVFU memory.

LOAD PROGRAM	LINE OF FORM	RUN PROGRAM	
FUNCTION CODE		PRINT DATA AND FORMAT CONTROL CODE	REMARKS
STL			
CHANNEL 1	1	PI=LOGIC 1, DL=XX00100	SLEW TO CHANNEL 5
3	2		
3	3		
3	4		
5	5	JULY 15, 1980(PI=LOGIC 1, DL=XX00110)	PRINT AND SLEW TO CHANNEL 7
3	6		
7	7	JOHN D. DOE(PI=LOGIC 1, DL=XX01010)	PRINT AND SLEW TO CHANNEL 11
3	8		
3	9		
3	10		
11	11	ONE****.00*****!1.00!	PRINT AND SLEW TO CHANNEL 5
		PI=LOGIC 1, DL=XX00100	
3	12		
3	13		
3	14		
3	15		
3	16		
3	17		
3	18		
ELD			

NOTE:

(A)143376

PI=DENOTES PAPER INSTRUCTION SIGNAL

DL=DENOTES PARALLEL INTERFACE DATA LINES (CRU OUTPUT BITS 0-7)

Figure 3-8. Typical Program Application for Multichannel Operation of EVFU

3.3.2 Using the Plot Mode

The LP300/LP600 printer's plot mode allows the printing of virtually any graphic material that can be represented in a 792 × 792 dot position matrix (for 11 × 14 7/8 paper only). The plot mode is initiated under software control by an imbedded channel command code (>05) in the data stream, causing the data character to be interpreted as a binary dot pattern rather than as a normal character (see Figure 3-9).

There are a total of 792 possible dot positions horizontally at 60 dots/inch and 792 dots vertically in the normal plot mode. This corresponds to the matrix for a normal character and utilizes odd-numbered dot positions.

A programmed plot data line consists of up to 132 bytes of data; a plot mode code; and a line feed, form feed, or carriage return command.

The first data byte received by the printer controls printing of dots in the first character column, and each subsequent data byte specifies dots to be printed in the next character column to the right. For example, for a plot six inches wide, the computer must send, for each dot row, 60 data bytes (six inches × 10 characters/inch); a plot mode code (>05); and a line feed (>0A) and form feed (>0C) command.

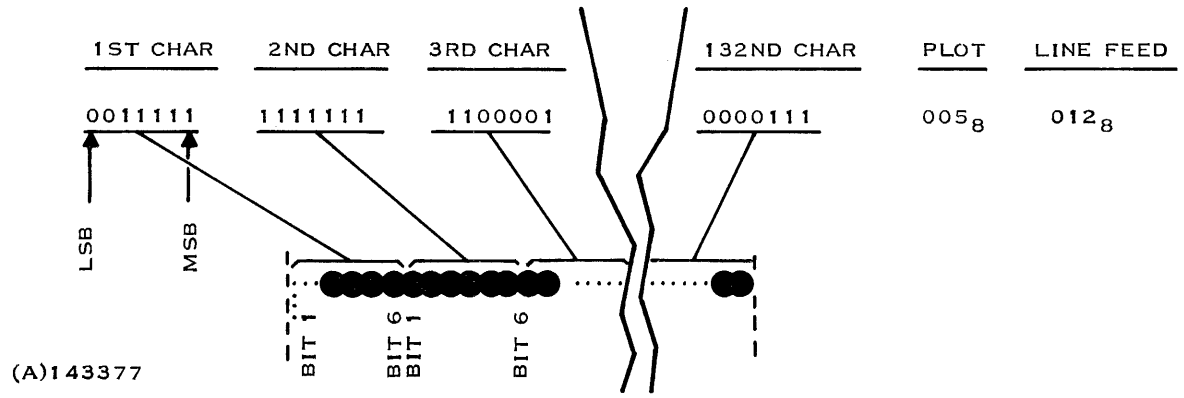


Figure 3-9. Data Byte Interpretation of Data Row Positions

Figure 3-10 illustrates a sample program application for the plot mode.

The LP300/LP600 printer cannot mix characters and plot data on the same line. However, under software control, characters may be printed by programming dots in appropriate patterns in a 5 × 9 matrix.

NOTE

When leaving the plot mode to print normal characters, program an extra line feed following the last row of the plot. If the extra line feed code is omitted, the first line of characters may be cut off at the top.

When operated in normal plot mode, the LP300/LP600 printer responds to other character control codes in the following way:

- Line Feed [LF] (>0A) — Prints the contents of the printer buffer and advance paper to the next dot row. This code will advance paper to the next dot row even if there is no data in the buffer.

- Form Feed [FF] (>0C) — Prints the contents of the buffer and then advances paper to the top of the next form.

- Carriage Return [CR] (>0D) — Resets the pointer of the input buffer to the first character column.

- EVFU Commands — If used, these commands will print the contents of the buffer and slew paper until the requested command is found. Plot data should never be terminated with a EVFU command.

For applications requiring printing on both odd and even numbered dot positions, e.g., double density plotting, a command code of >04 expands the number of possible dot positions from 792 to 1584. Operation and encoding is similiar to normal plotting, except that data encoding for this option requires

that the data be segmented into odd and even dot halves (representing the odd and even dot positions, respectively) and be transmitted to the printer as follows:

>04. . (odd dot location pattern). . L/F. . >05. . (even dot pattern) . . . L/F

It should also be noted that double density plotting decreases the printer plot speed by one half.

3.3.3 Printing Elongated Characters

Elongated characters may be initiated in the

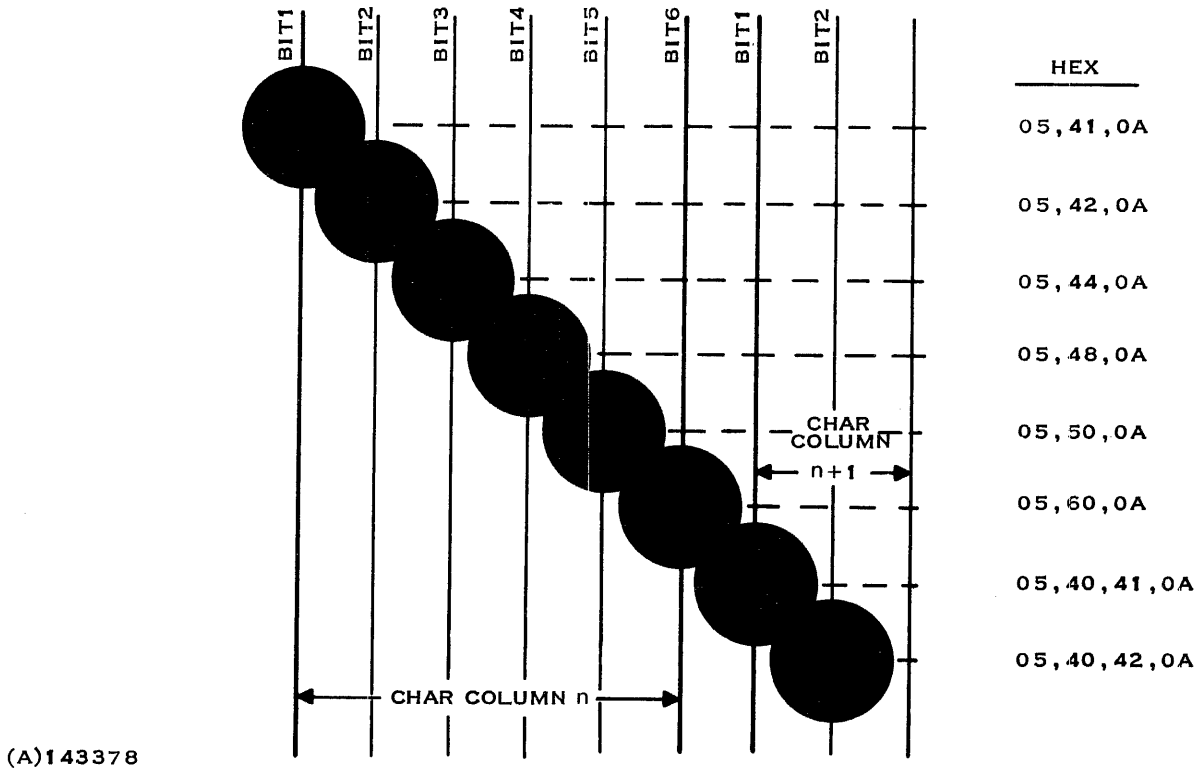


Figure 3-10. Programming a Diagonal Line Using the Plot Mode

print format by imbedding a command code of >08 in the data stream.

Elongated character form has a normal character width of five columns with an uppercase character height of 12 dot rows. Descender characters have a total height of 14 dot rows.

When elongated characters are printed, line density decreases to one half the selected density of six or eight lpi.

3.3.4 Underlining Characters

The underline command, >1F, when imbedded in the data stream, causes the printer to underline characters at positions marked by the command code. The line of characters to be underlined must be terminated by a carriage return command code (>0C). Refer to the following example:

- last message: THE PRINTRONIX 300 (CR) (stored)
- 2nd message: ssss _____ (LF) (underline)
- Print: THE PRINTRONIX 300

3.3.5 Printing at Six or Eight LPI

Line density is selectable by either operator or program control. The operator may select eight lpi by depressing the 8LPI button while the printer is off line. Under program control, eight lpi shall be selectable on a line by line basis by imbedding a command code of >06.

3.4 SOFTWARE SAMPLE PROGRAMS

The following programs (Figures 3-11 and 3-12) are sample routines that can be used to program the operation of the LP300/LP600 printer. They will help to clarify the software associated with the printer.

```
LDEVFU     SDSMAC 3.2.0 78.274   09:20:01 WEDNESDAY, JUL 16, 1980.
                                                          PAGE 0002

0001                    IDT  'LDEVFU'
0002                ************************************************************
0003                *                                                          *
0004                * TASK TO LOAD THE EVFU OF A LP300 OR LP600 PRINTER         *
0005                *                                                          *
0006                * ASSIGN LUNO 18 TO THE PRINTER BEFORE EXECUTION           *
0007                * CRUBAS MUST BE ASSIGNED THE CRU BASE OF THE PRINTER      *
0008                *                                                          *
0009                ************************************************************
0010 0000 0006'         DATA @WS,@START,0
0011 0006               WS      BSS  32
0012 0026   04          EOT     BYTE 4                          END OF TASK CALL CODE
0013 0028               EVEN
0014 0028 0000          OPNTRM  DATA 0,>018,0,0,0,0             SUPERVISOR CALL BLOCKS
0015 0034 0000          WRITE   DATA 0,>B18,0,@DATE,0,14,0      FOR MORE INFO REFER TO
0016 0042 0000          WRITE1  DATA 0,>B18,0,@NAME,0,12,0      VOLUME 3 OF DX10
0017 0050 0000          WRITE2  DATA 0,>B18,0,@AMOUNT,0,21,0
0018 005E 0000          CLSTRM  DATA 0,>118,0,0,0,0
0019 006A   4A          DATE    TEXT 'JULY 15, 1980'            MESSAGE
0020 0077   0A                  BYTE >0A                        LINE FEED
0021 0078   4A          NAME    TEXT 'JOHN D. DOE'
0022 0083   0A                  BYTE >0A
0023 0084   4F          AMOUNT  TEXT 'ONE ****.00*****1.00'
0024 0098   0A                  BYTE >0A
0025       0460         CRUBAS  EQU  >460                       SET FOR YOUR SYSTEM
0026 0099   00          CHAN1   BYTE 0                          CODE FOR CHANNEL 1
0027 009A   02          CHAN3   BYTE 2                                "          3
0028 009B   04          CHAN5   BYTE 4                                "          5
0029 009C   06          CHAN7   BYTE 6                                "          7
0030 009D   0A          CHAN11  BYTE 10                               "          11
0031 009E   6E          STRTLD  BYTE >6E                        EVFU START LOAD CODE
0032 009F   6F          ENDLD   BYTE >6F                        CODE TO END EVFU LOAD
0033                    DXOP SVC,15
0034 00A0               EVEN
0035                ************************************************************
0036                *                                                          *
0037                * THIS SECTION LOADS THE EVFU FOR THE FORM SHOWN IN        *
0038                * FIGURE 3-6                                               *
0039                *                                                          *
0040                ************************************************************
0041 00A0 2FE0  START   SVC  @OPNTRM                    OPEN PRINTER FOR I/O
     00A2 0028'
0042 00A4 020C          LI   R12,CRUBAS                 LOAD ADDRESS OF PRINTE
     00A6 0460
0043 00A8 1E09          SBZ  9                          SET PI LINE
0044 00AA D260          MOVB @STRTLD,R9                 START LOAD CODE
     00AC 009E'
0045 00AE 06A0          BL   @STROBE                    TELL PRINTER DATA VALI
     00B0 015C'
0046 00B2 D260          MOVB @CHAN1,R9                  CHANNEL 1
     00B4 0099'
0047 00B6 06A0          BL   @STROBE
     00B8 015C'
0048 00BA D260          MOVB @CHAN3,R9                  CHANNEL 3
     00BC 009A'
0049 00BE 06A0          BL   @STROBE
     00C0 015C'
0050 00C2 06A0          BL   @STROBE                    CHANNEL 3
     00C4 015C'
0051 00C6 06A0          BL   @STROBE                    CHANNEL 3
```

Figure 3-11. Sample Programming Routine for the EVFU (Page 1 of 3)

```
LDEVFU     SDSMAC 3.2.0 78.274    09:20:01 WEDNESDAY, JUL 16, 1980.
                                                          PAGE 0003

      00C8 015C'
0052  00CA D260          MOVB  @CHAN5,R9                 CHANNEL 5
      00CC 009B'
0053  00CE 06A0          BL    @STROBE
      00D0 015C'
0054  00D2 D260          MOVB  @CHAN3,R9                 CHANNEL 3
      00D4 009A'
0055  00D6 06A0          BL    @STROBE
      00D8   5C'
0056  00DA D260          MOVB  @CHAN7,R9                 CHANNEL 7
      00DC 009C'
0057  00DE 06A0          BL    @STROBE
      00E0 015C'
0058  00E2 D260          MOVB  @CHAN3,R9                 CHANNEL 3
      00E4 009A'
0059  00E6 06A0          BL    @STROBE
      00E8 015C'
0060  00EA 06A0          BL    @STROBE                   CHANNEL 3
      00EC 015C'
0061  00EE 06A0          BL    @STROBE                   CHANNEL 3
      00F0 015C'
0062  00F2 D260          MOVB  @CHAN11,R9                CHANNEL 11
      00F4 009D'
0063  00F6 06A0          BL    @STROBE
      00F8 015C'
0064  00FA D260          MOVB  @CHAN3,R9                 CHANNEL 3
      00FC 009A'
0065  00FE 06A0          BL    @STROBE
      0100 015C'
0066  0102 06A0          BL    @STROBE                   CHANNEL 3
      0104 015C'
0067  0106 06A0          BL    @STROBE                   CHANNEL 3
      0108 015C'
0068  010A 06A0          BL    @STROBE                   CHANNEL 3
      010C 015C'
0069  010E 06A0          BL    @STROBE                   CHANNEL 3
      0110 015C'
0070  0112 06A0          BL    @STROBE                   CHANNEL 3
      0114 015C'
0071  0116 06A0          BL    @STROBE                   CHANNEL 3
      0118 015C'
0072  011A D260          MOVB  @ENDLD,R9                 END LOAD CODE
      011C 009F'
0073  011E 06A0          BL    @STROBE
      0120 015C'
0074  0122 1D09          SBO   9                         FINISHED LOADING EVFU
0075                ************************************************************
0076                *                                                          *
0077                * THIS SECTION IS AN EXAMPLE OF THE SOFTWARE WHICH WOULD   *
0078                * MAKE USE OF THE FORMAT SPECIFIED IN THE ABOVE CODE.      *
0079                *                                                          *
0080                ************************************************************
0081  0124 1E09          SBZ   9                         GET READY TO SLEW
0082  0126 D260          MOVB  @CHAN5,R9                 TO CHANNEL 5
      0128 009B'
0083  012A 06A0          BL    @STROBE
      012C 015C'
0084  012E 1D09          SBO   9                         CAN'T PRINT WITH PI=1
0085  0130 2FE0          SVC   @WRITE                    PRINT DATE OF CHECK
      0132 0034'
```

Figure 3-11. Sample Programming Routine for the EVFU (Page 2 of 3)

```
LDEVFU     SDSMAC 3.2.0 78.274   09:20:01 WEDNESDAY, JUL 16, 1980.
                                                              PAGE 0004

 0086 0134 1E09          SBZ  9
 0087 0136 D260          MOVB @CHAN7,R9                  CHANNEL 7
      0138 009C'
 0088 013A 06A0          BL   @STROBE
      013C 015C'
 0089 013E 1D09          SBO  9
 0090 0140 2FE0          SVC  @WRITE1                    PRINT NAME
      0142 0042'
 0091 0144 1E09          SBZ  9
 0092 0146 D260          MOVB @CHAN11,R9                 CHANNEL 11
      0148 009D'
 0093 014A 06A0          BL   @STROBE
      014C 015C'
 0094 014E 1D09          SBO  9
 0095 0150 2FE0          SVC  @WRITE2                    PRINT AMOUNT OF CHECK
      0152 0050'
 0096              *A SLEW TO CHANNEL 5 WOULD ADVANCE PAPER TO THE DATE LINE OF
 0097              *THE NEXT CHECK.  THIS IS QUICKER THAN LINE FEEDS.
 0098 0154 2FE0          SVC  @CLSTRM                    CLOSE TERMINAL
      0156 005E'
 0099 0158 2FE0          SVC  @EOT                       END OF TASK SUPERVISOR
      015A 0026'
 0100              ****************************************************************
 0101 015C 1F0D  STROBE TB   13                          PRINTER READY FOR DATA
 0102 015E 13FE          JEQ  STROBE                     NO
 0103 0160 0549          INV  R9                         CORRECTS FOR 16IO
 0104 0162 3209          LDCR R9,8                       OUTPUT DATA
 0105 0164 1E08          SBZ  8                          DATA STROBE LINE
 0106 0166 1000          NOP
 0107 0168 1D08          SBO  8
 0108 016A 045B          B    *R11                       RETURN FROM ROUTINE
 0109      00A0'         END  START
NO ERRORS,      NO WARNINGS
```

Figure 3-11. Sample Programming Routine for the EVFU (Page 3 of 3)

```
program PLOT;
const LENGTH = 500;
      COLUMNS = 80;
type ROWS = packed array [1..6*COLUMNS] of boolean;
     PAGE = array [1..LENGTH] of ROWS;
var  THETA, R, X, Y : real;
common DATA : PAGE;
access DATA;
(*************************************************************************
*                                                                        *
*    Procedure WRITEDATA takes an array of data and formats it for       *
*    plotting by the LP300 or LP600 printer.  The array should be        *
*    named DATA and LENGTH and COLUMNS must be defined                   *
*                                                                        *
*************************************************************************)
procedure WRITEDATA;
type TEMP = packed array [1..16] of boolean;
var  BITS : TEMP;
access DATA;
begin                                          (* contains plot data  *)
  rewrite(output);
  BITS[9] := false;                            (* bits 9 & 10 define  *)
  BITS[10] := true;                            (* data as codes 40-7F *)
  for VERTICAL := 1 to LENGTH do begin         (* number of dot rows  *)
    write('#05');                              (* code for plot mode  *)
    for HORIZONTAL := 1 to COLUMNS do begin    (* width of output     *)
      for DOT := 0 to 5 do                     (* reverse data        *)
        BITS[DOT+11] := DATA[VERTICAL,HORIZONTAL*6-DOT];
      write(BITS::char);                       (* and output the data *)
      end;                                     (* for horizontal      *)
    writeln;                                   (* line feed           *)
    end;                                       (* for vertical        *)
  end;                                         (* procedure writedata *)
(*************************************************************************
*                                                                        *
*    Main program plots r*cos(theta) and r*sin(theta).                   *
*                                                                        *
*************************************************************************)
begin
  for I := 1 to LENGTH do DATA[I,240] := true;         (* draw axes    *)
  for I := 1 to COLUMNS*6 do DATA[240,I] := true;
  THETA := 0.0;
  while THETA < 360.0 do begin                         (* r*cos(2theta)*)
    R := 225.0 * cos(2.0 * THETA);
    X := 240.0 + R * cos(THETA) * 0.8333;
    Y := 240.0 + R * sin(THETA);
    DATA[round(Y), round(X)] := true;
    THETA := THETA + 0.2;
  end;
  THETA := 0.0;
  while THETA < 360.0 do begin                         (* r*sin(2theta)*)
    R := 100.0 * sin(2.0 * THETA);
    X := 240.0 + R * cos(THETA) * 0.8333;
    Y := 240.0 + R * sin(THETA);
    DATA[round(Y), round(X)] := true;
    THETA := THETA + 0.2;
  end;
  WRITEDATA;                                           (* call plot    *)
end.
```

NOTE:
THE FOLLOWING IS A GRAPHIC REPRESENTATION OF THE ABOVE PLOT PROGRAM

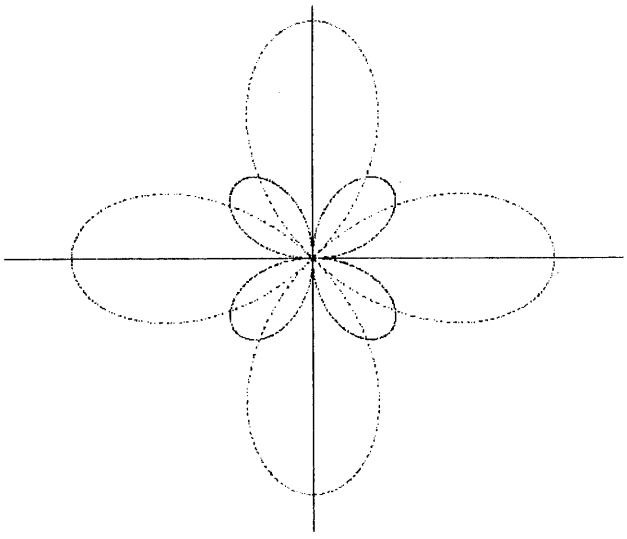


Figure 3-12. Sample Programming Routine for the Plot Mode

4

Operation

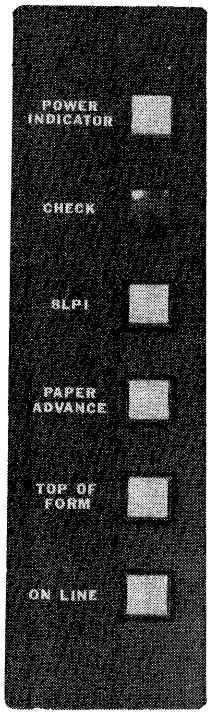
4.1 GENERAL DESCRIPTION

This section contains operating instructions for the LP300/LP600 printer, presented under the following major headings:

- LP300/LP600 printer operator panel controls and indicators
- Other LP300/LP600 printer controls
- Ribbon installation/changing instructions
- Paper loading instructions
- Operating procedures
- Operator preventive maintenance

4.2 LP300/LP600 PRINTER OPERATOR PANEL CONTROLS AND INDICATORS

Figure 4-1 shows the LP300/LP600 printer operator panel. The following six paragraphs describe the controls and indicators con-



(A)143379

Figure 4-1. LP300/LP600 Printer Operator Panel

tained on this panel. Other controls and indicators, which are mounted internally on the printer, are discussed in the next division (4.3) of this section.

4.2.1 POWER INDICATOR

The POWER INDICATOR illuminates after power is applied to the printer and the ac power switch is thrown to the ON position. It operates only when the printer is off-line.

4.2.2 CHECK Pushbutton/Indicator

The CHECK pushbutton/indicator is both a control switch and status indicator. Used as control switch, the CHECK pushbutton/indicator is depressed and released to reset the printer after a fault condition is cleared. If the CHECK pushbutton/indicator remains illuminated, an additional fault condition exists. All such conditions must be cleared before the printer will become operational.

As an indicator, CHECK provides status information about certain printer functions and will illuminate for one or more of the following reasons:

- Form thickness adjustment lever is in load position.
- Paper has run out.
- There is no paper motion when the printer is operating.
- Internal voltage is abnormal.

NOTE

If the CHECK pushbutton/indicator remains lighted after all noticeable faults have been corrected, power should be removed from the printer and the nearest Texas Instruments service office should be contacted for further assistance.

4.2.3 8LPI Pushbutton/Indicator

The 8LPI pushbutton/indicator is both an indicator and momentary action switch which selects line spacing of either eight lpi (lighted) or six lpi (unlighted). This pushbutton/indicator is operational only when the printer is not on-line to the Model 990 computer.

4.2.4 PAPER ADVANCE Pushbutton

The PAPER ADVANCE pushbutton, when held down, causes the printer's paper to advance.

4.2.5 TOP OF FORM Pushbutton/Indicator

The TOP OF FORM pushbutton/indicator is both a momentary-action switch and a status indicator. When depressed, this pushbutton/indicator causes the paper to advance to the top of the next form. The TOP OF FORM pushbutton/indicator is operational only when the printer is off-line. When lighted, the TOP OF FORM pushbutton/indicator indicates that the EVFU is loaded.

4.2.6 ON LINE Pushbutton/Indicator

The ON LINE pushbutton/indicator is both a momentary-action switch and indicator which, when depressed (lighted), places the printer on-line with the Model 990 computer. When this indicator is not lighted, the printer is off-line and cannot receive data from the computer.

4.3 OTHER LP300/LP600 PRINTER CONTROLS

The following paragraphs describe four controls not located on the LP300/LP600 printer operator panel:

- Power ON/OFF switch (see Figure 1-3)
- Form width adjustment
- Form thickness adjustment
- Vertical positioning adjustment

Figure 4-2 shows the location of the form width and thickness adjustments and the vertical positioning adjustment.

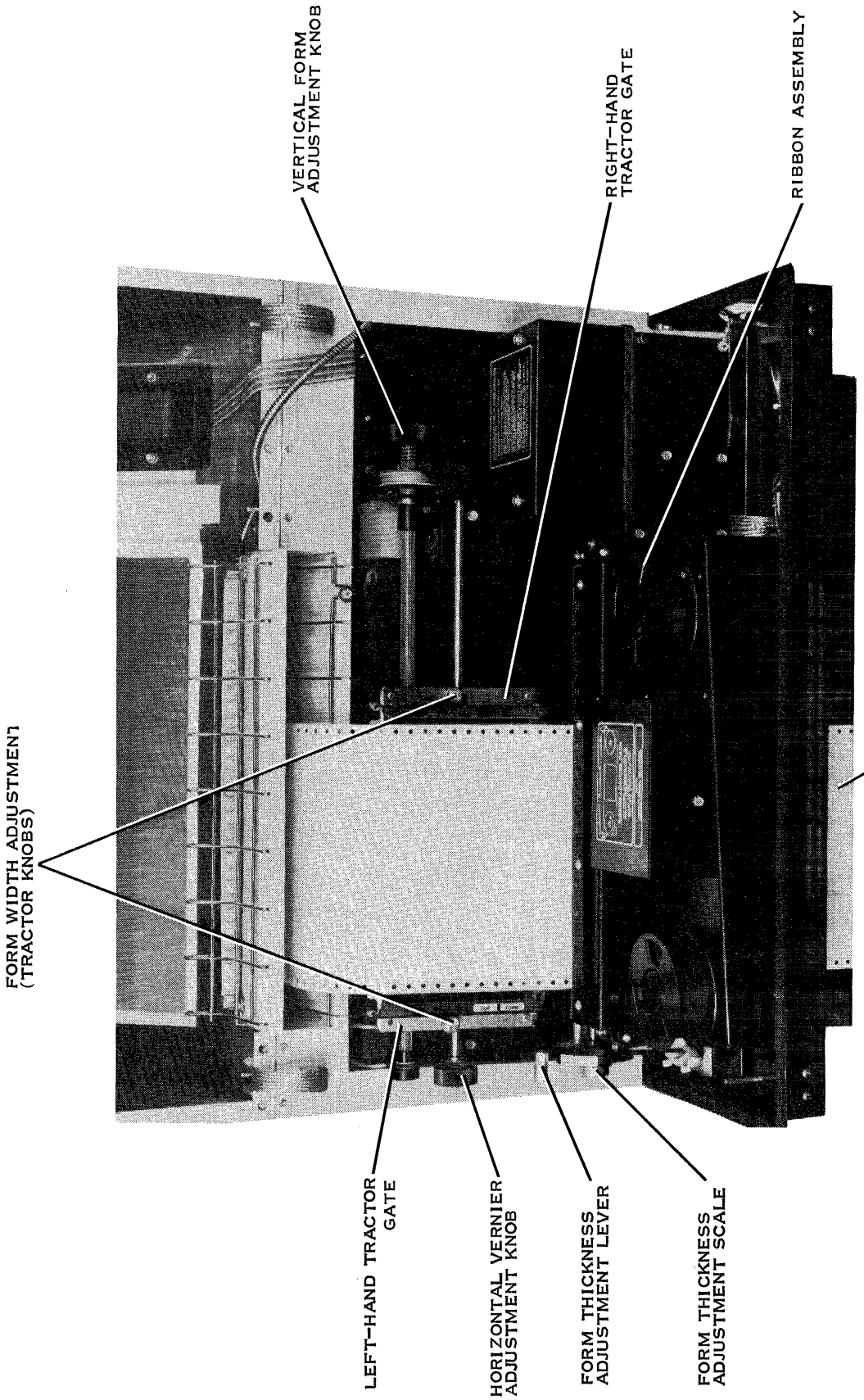


Figure 4-2. LP300/LP600 Printer, Detailed Internal View

4.3.1 POWER ON/OFF Switch

A toggle switch on the left side of the LP300/LP600 printer (Figure 1-3) controls ac power. Refer to Section 2 for the LP300/LP600 printer power-up procedure.

4.3.2 Form Width Adjustment

The LP300/LP600 printer may be adjusted for the form width in two ways. First, the printer mechanism may be adjusted to accept paper forms from 10 to 40 cm wide (four to 16 inches), by unlocking and repositioning the tractor knobs and repositioning the tractors that engage the holes in the paper (see Figure 4-2). Once the tractor knobs are unlocked, the right hand tractor may be moved the full width of the hammer bank. However, the left-hand tractor may be moved only 2.8 cm (1.1 inches) outward (left) from print column one. This tractor also has a top of form (TOF) mark for use in setting the TOF.

In the second method of form width adjustment, the horizontal Vernier adjustment knob allows both tractors to be moved simultaneously a maximum distance of two columns in either direction.

The procedure for adjusting the top of form is contained in the instructions for loading paper in paragraph 4.5 .

4.3.3 Form Thickness Adjustment

The form thickness adjustment lever is located on the left side of the printer mechanism (Figure 4-2). The lever scale is marked with approximate locations (Figure 4-3) for various thicknesses of forms. The actual thickness of form will determine the proper lever setting.

To position the lever satisfactorily, initiate the self-test described in Section 2 and

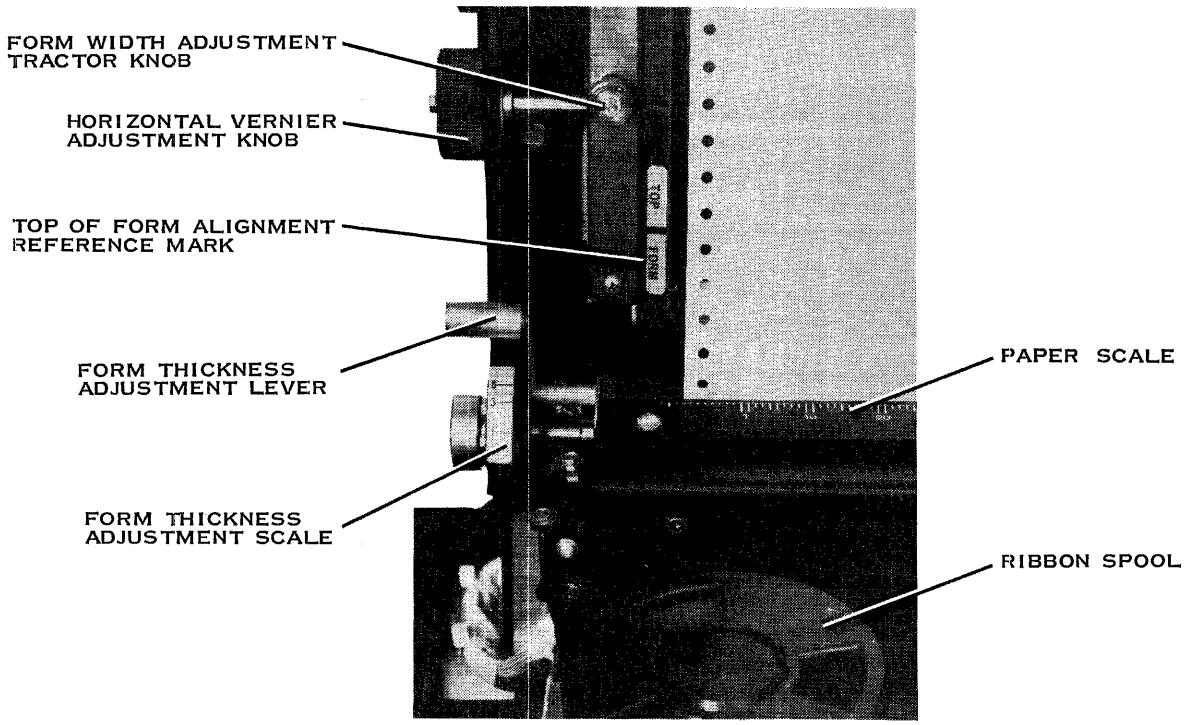


Figure 4-3. Form Thickness Adjustment Control

observe the results. If the printed characters are too light, move the lever toward the rear of the printer. If the printed characters are too dark, move the lever toward the front of the printer.

4.3.4 Vertical Positioning Adjustment Knob

The vertical positioning adjustment knob (Figure 4-2) moves the paper up or down. It is used primarily in conjunction with the TOF tractor marks to set the TOF. The procedure for setting the TOF is included in the paper loading instructions contained in Paragraph 4.5.

4.4 RIBBON INSTALLATION/ CHANGING INSTRUCTIONS

The LP300/LP600 printer uses 1-inch wide nylon ribbon (part number 2271784-0001) mounted on two spools. Install or change the ribbon in the following way:

NOTE

Power does not have to be turned off to install or change ribbon.

1. Raise the front cover of the printer.

NOTE

If the original form thickness adjustment is to be maintained, note the position of the lever before going on to Step 2.

2. Place the form thickness adjustment lever in its fully raised position (Figure 4-3).

3. If the old ribbon is being replaced, follow these steps:

   a. Unlock both ribbon spools by pulling the latches toward the center of the lugs (Figure 4-4).

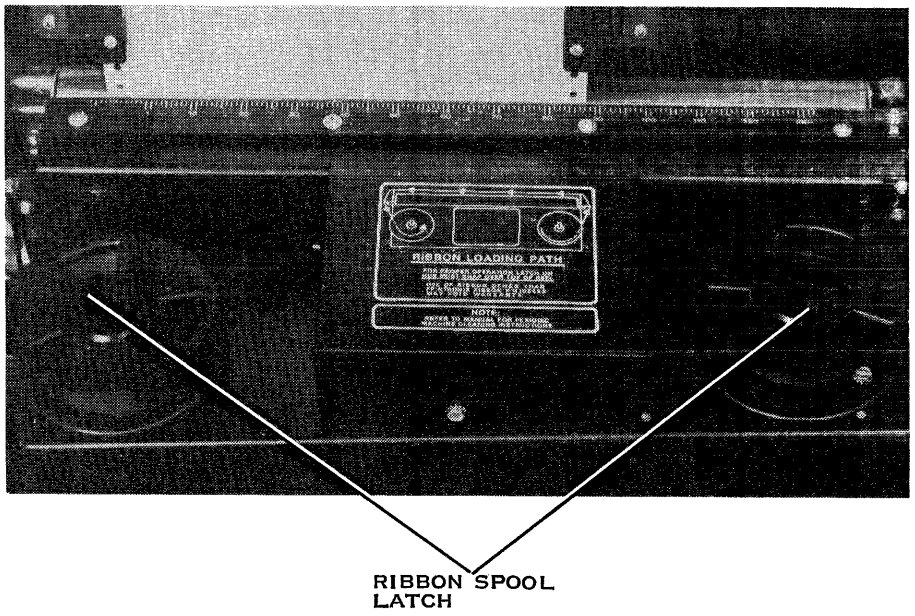


Figure 4-4. LP300/LP600 Printer Ribbon Assembly

b. Lift the old ribbon spools from the hubs, clearing loose ribbon from the guides and ribbon slot. Discard used ribbon and spools.

4. Place one new ribbon spool on the left spool hub with the feed-out side of the spool toward the front of the printer, and feed the ribbon out along the ribbon path as shown in Figure 4-5.

5. Place the remaining new ribbon spool on the right spool hub and rotate either spool to remove any ribbon slack.

CAUTION

Be sure the ribbon runs smoothly over the ribbon guides. A twisted ribbon or improperly installed ribbon will cause missing characters, paper jams, shorter ribbon life, and possible damage to the print hammers.

6. Readjust the form thickness adjustment lever to the desired setting.

7. Close the cover of the printer.

4.5 PAPER LOADING INSTRUCTIONS

The LP300/LP600 printer uses continuous-form paper with standard perforations on each edge. Paper widths from 10.16 to 40.64 cm (four to 16 inches) can be accommodated. Single or multipart forms (up to one original with five carbon copies) can be printed on paper with the following weight specifications:

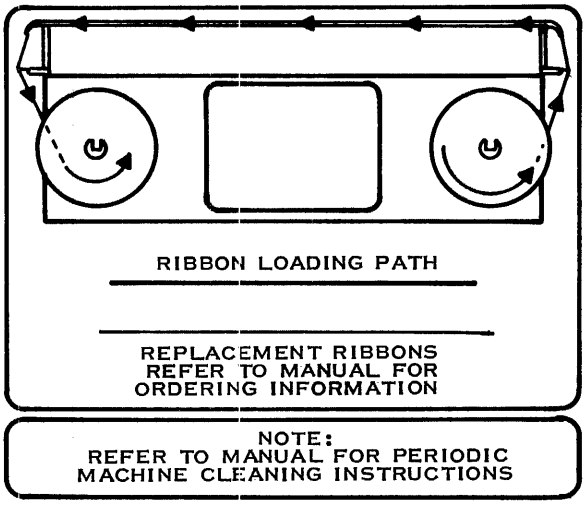
- Single-part forms:

  —6.8 kg (15 lb) stock minimum

- Multiple-part forms:

  —Original: 5.4 kg (12 lb) bond

  —Copies: Six maximum



(A)143383

Figure 4-5. Ribbon Loading Path

— Carbon Paper: 2.7 to 3.6 kg (6 to 8 lbs) stock

Card stock up to 0.635 mm (0.025 inch) thick may be used for either single or multipart forms.

To load paper into the LP300/LP600 printer, follow this procedure:

1. Refer to Section 2 of this manual and turn on power to the printer. Check the POWER ON indicator. If the indicator is not lighted, verify power cable connections and site voltages.

2. Place the fanfold paper under the printer and line it up with the printer's paper loading slot (see Figure 4-2).

3. Depress and release the TOP OF FORM pushbutton.

4. Open the front cover of the printer.

NOTE

If the original form thickness adjustment is to be maintained, note the position of the lever before going to Step 5.

5. Refer to Figure 4-3 and move the form thickness adjustment lever to its fully raised position.

6. Open the left and right hand tractor gates on each paper tractor (Figure 4-2).

7. Insert the top edge of the paper through the slot in the printer's base and pass it above the left and right hand tractors.

8. Loosen and reposition the tractor lock knobs (Figure 4-2) as necessary to accommodate the width of the paper.

9. Move paper up and down in both tractors until the holes are engaged in corresponding tractor pins.

10. Close tractor gates. Adjust tractors to provide very slight tension across the form. Position paper and tractors so that the first character position on the paper scale falls in approximately the desired first-column position on the paper (see Figure 4-3).

NOTE

The horizontal Vernier knob (Figure 4-2) may be adjusted at any time to move the character to the correct location in the form within a 3-character range.

11. Tighten the tractor lock knobs.

12. Turn the vertical form adjustment knob (Figure 4-2) until the top edge of the form is opposite the TOP OF FORM mark on the left-hand tractor.

13. Rotate the white reference mark on the vertical form positioner disk until it is aligned with the fixed pointer (Figure 4-6).

14. Rotate the vertical form position knob exactly one full revolution to lower the paper and leave the white reference marker aligned with the fixed pointer.

15. Move the form thickness adjustment lever downward to a suitable position for the paper or form in the printer (see Figure 4-3). The CHECK indicator should not be lighted.

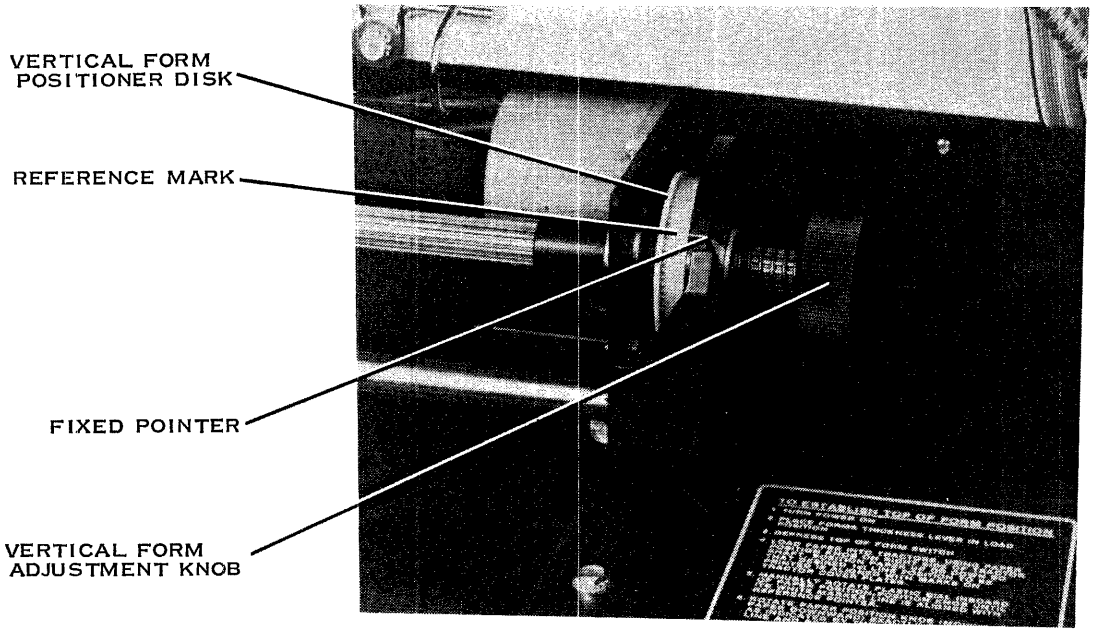


Figure 4-6. LP300/LP600 Printer Paper Positioning

NOTE

If the form thickness adjustment lever is not adjusted properly, data may print too dark or too light. If necessary, refer to paragraph 4.3.3 for the way to correct the problem.

4.6 OPERATING PROCEDURES

The LP300/LP600 printer has only the following operator controlled functions:

- Turning power on and off to the printer
- Verifying printer readiness, and placing the printer on-line with the Model 990 computer

All other operating functions for the LP300/LP600 printer are software controlled. These functions were described in detail in Section 3 of this manual.

4.6.1 On-Line Start Up Procedure

The following procedure places the LP300/LP600 printer subsystem in the on-line mode of operation. Ascertain that the ribbon and paper are properly installed before operation and proceed as follows:

1. Verify that the POWER INDICATOR is lighted. If it is not, make sure that the following installation procedures have been performed:

   a. Power has been checked at the power source.

b. The power cable has been connected to the proper power source as prescribed in Section 2, paragraph 2.4.

c. The power ON/OFF switch has been thrown from OFF to ON.

2. If the above installation procedures have been verified and the POWER INDICATOR does not light, turn the power switch to the OFF position and discontinue use. Consult the nearest Texas Instruments sales or service office for further assistance.

3. Set the top of form by pressing and releasing the TOP OF FORM pushbutton (see Figure 4-1).

4. Place the LP300/LP600 printer subsystem on-line by pressing and releasing the ON LINE indicator/pushbutton (see Figure 4-1). Verify that the ON LINE indicator illuminates.

5. Observe printer operation. If necessary, refer to Steps 12 through 15 of the paper loading instructions for form alignment procedures.

4.6.2 Shut-Down Procedures

The following provides simple instructions for placing the LP300/LP600 printer in the off-line mode and turning the printer off.

1. Press and release the ON LINE indicator/pushbutton (Figure 4-1); observe that the indicator goes out.

2. Set the power switch (Figure 1-3) to the OFF position; observe that the POWER INDICATOR goes out.

4.7 OPERATOR PREVENTIVE MAINTENANCE

Operator performed preventive maintenance for the LP300/LP600 printer is limited to cleaning the exterior of the printer and vacuuming certain internal areas every three months or 250 hours. Depending upon varying site conditions, more frequent cleaning and vacuuming may be necessary.

The exterior of the LP300/LP600 printer may be cleaned by using a mild detergent and a clean cloth.

To clean the interior of the LP300/LP600 printer, follow this procedure:

1. Open the front cover and unload the paper from the printer.

2. Using a soft brush and vacuum, remove dust, ribbon lint and bits of paper from the printer's interior.

3. Reload paper into the printer.

4. Close the front cover of the printer.

5. Throw the printer's power switch to the ON position and resume normal operation.

Appendix A

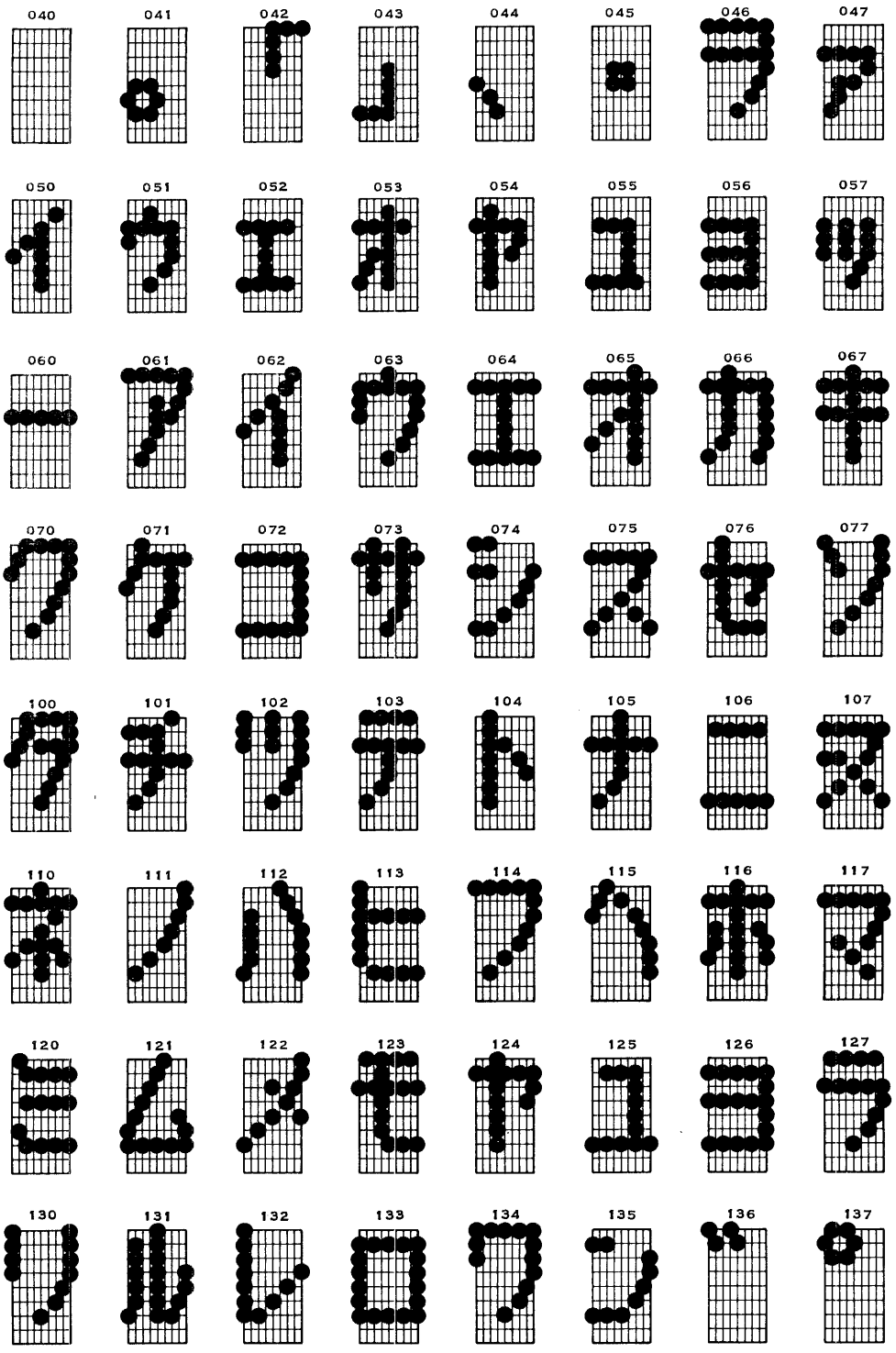
Optional Character Sets

Table A-1 lists the optional character sets available for use with the LP300/LP600 printer. Each character set is illustrated in a separate figure in this appendix.

Table A-1. Optional Character Sets

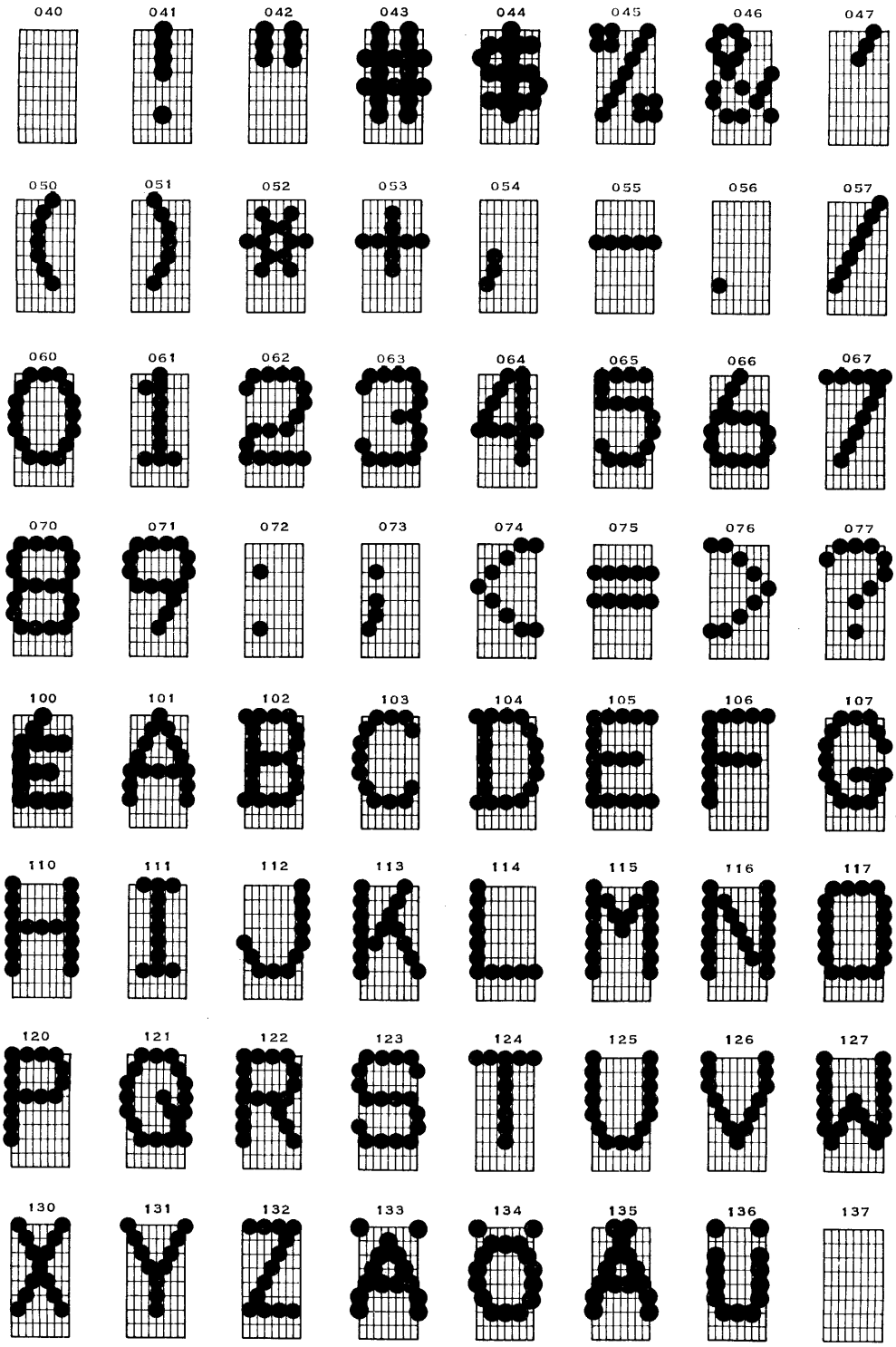
Type of Character Set	TI Part Number	Reference Figure No.
Katakana	2271782-0006	A-1
Swedish/Finnish	2271782-0003	A-2
Danish/Norwegian	2271782-0004	A-3
Spanish	2271782-0002	A-4
Great Britain	2271782-0005	A-5
German	2271782-0001	A 6

If you want to have an optional character set installed in your printer, please contact the Texas Instruments sales or service office in your area for assistance.



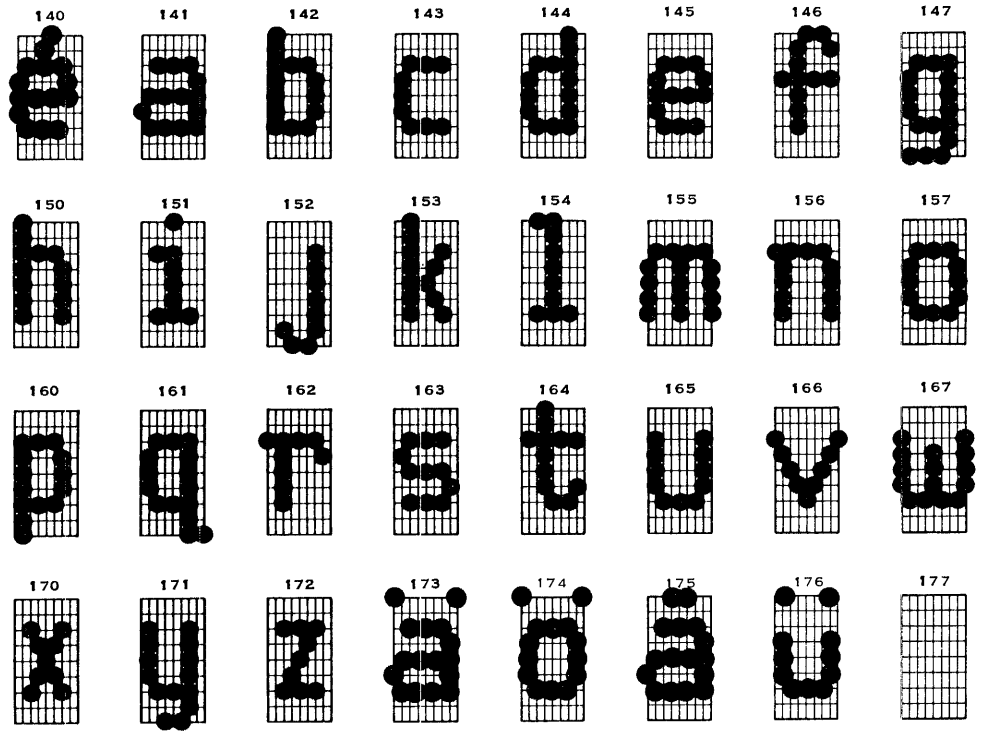
(B) 143385

Figure A-1. 64-Character Katakana Set



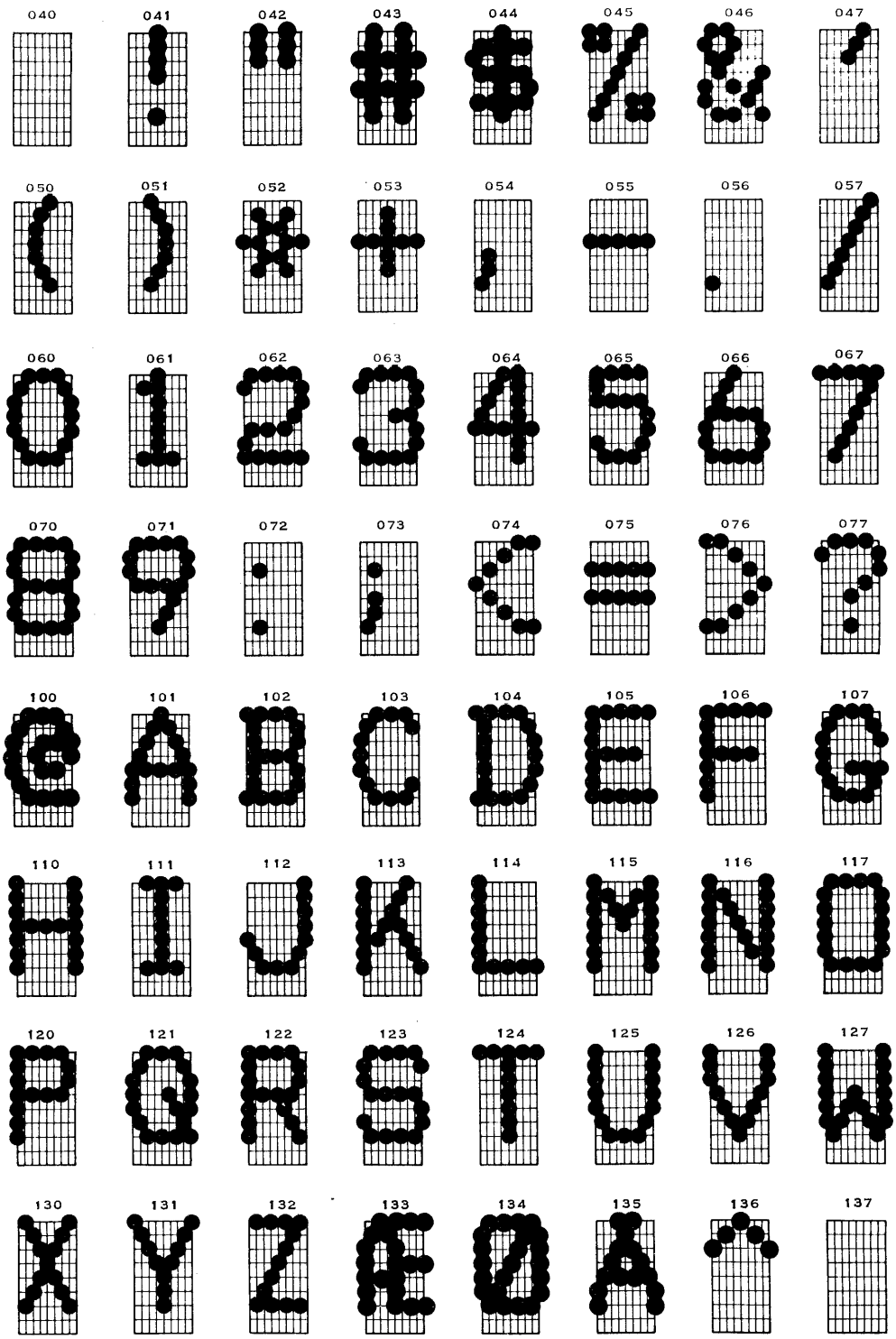
(B) 143386 (1/2)

Figure A-2. 96-Character Swedish/Finnish Set (Sheet 1 of 2)



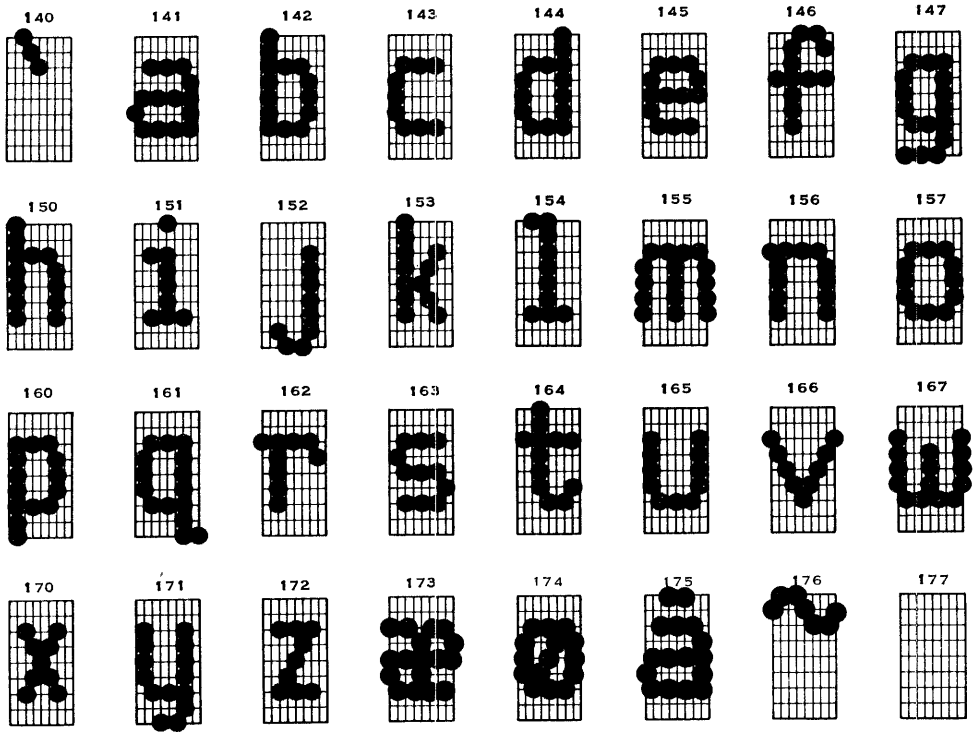
(B) 143386 (2/2)

Figure A-2. 96-Character Swedish/Finnish Set (Sheet 2 of 2)



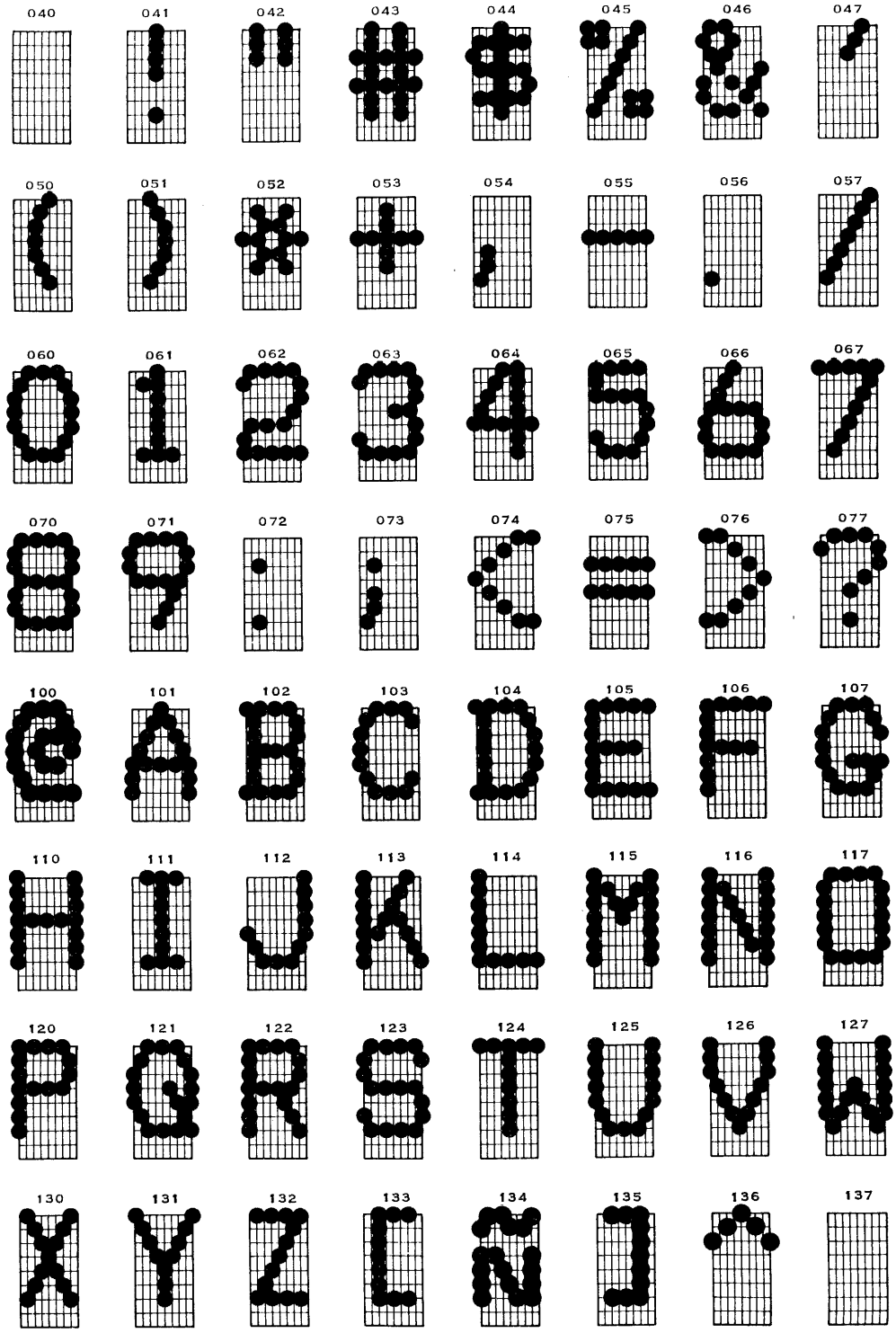
(B) 143387 (1/2)

Figure A-3. 96-Character Danish/Norwegian Set (Sheet 1 of 2)



(B) 143387 (2/2)

Figure A-3. 96-Character Danish/Norwegian Set (Sheet 2 of 2)



(B) 143388 (1/2)

Figure A-4. 96-Character Spanish Set (Sheet 1 of 2)

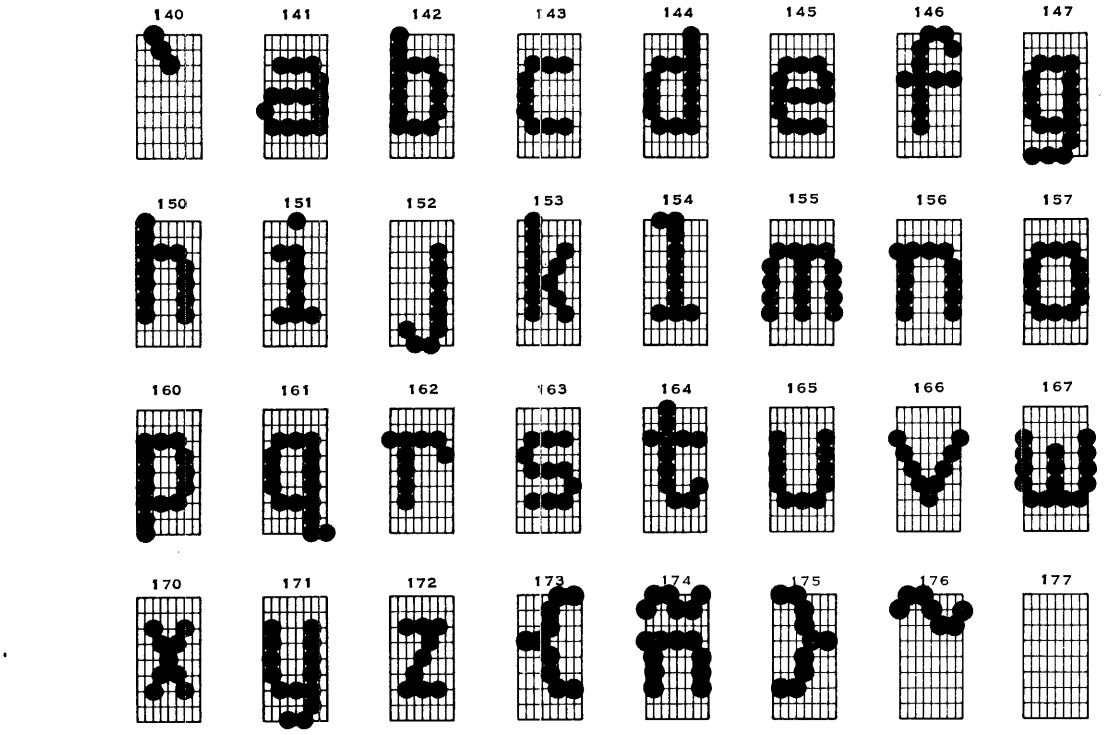
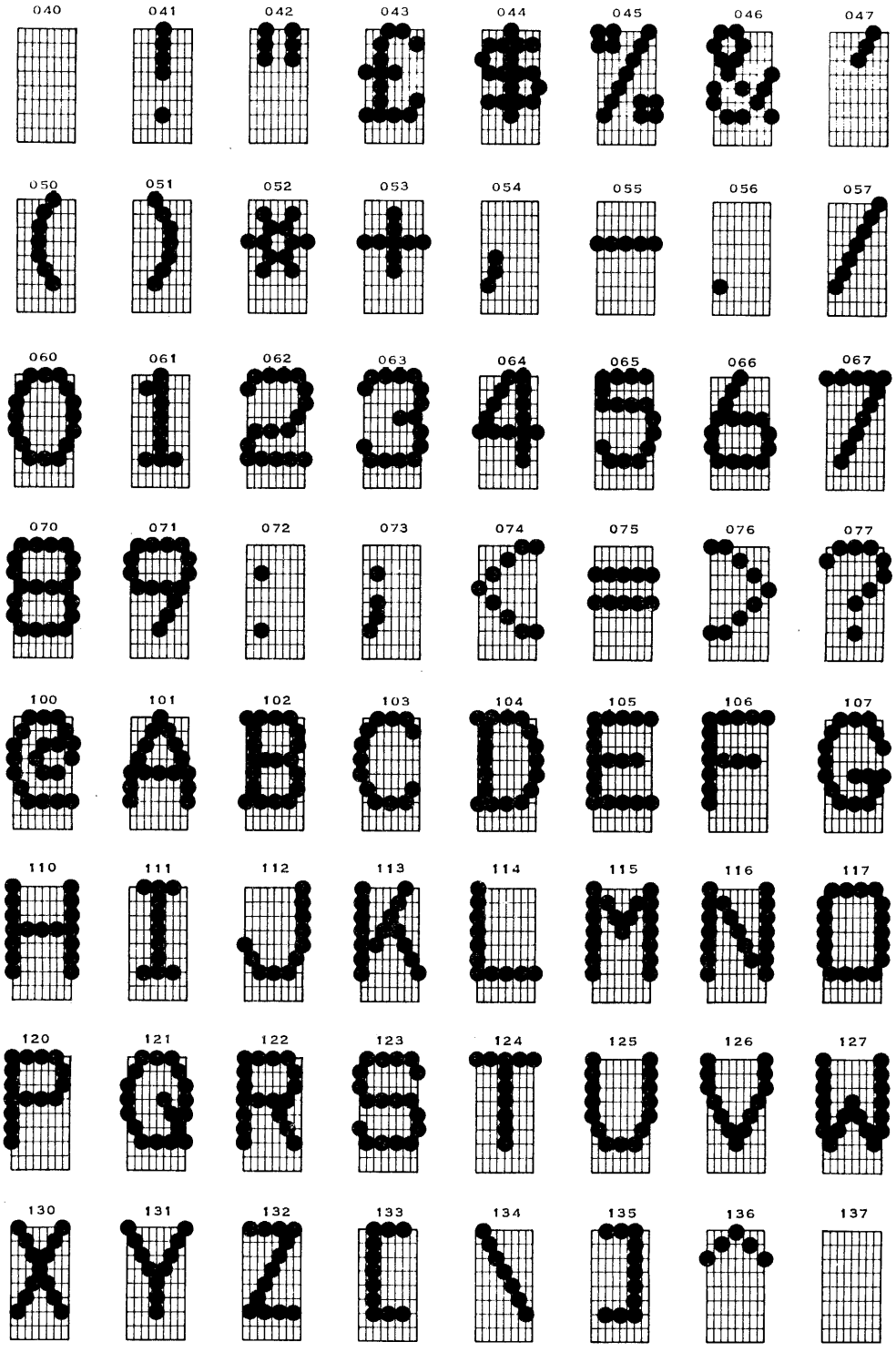


Figure A-4. 96-Character Spanish Set (Sheet 2 of 2)



(B) 143389 (1/2)

Figure A-5. 96-Character Great Britain Set (Sheet 1 of 2)

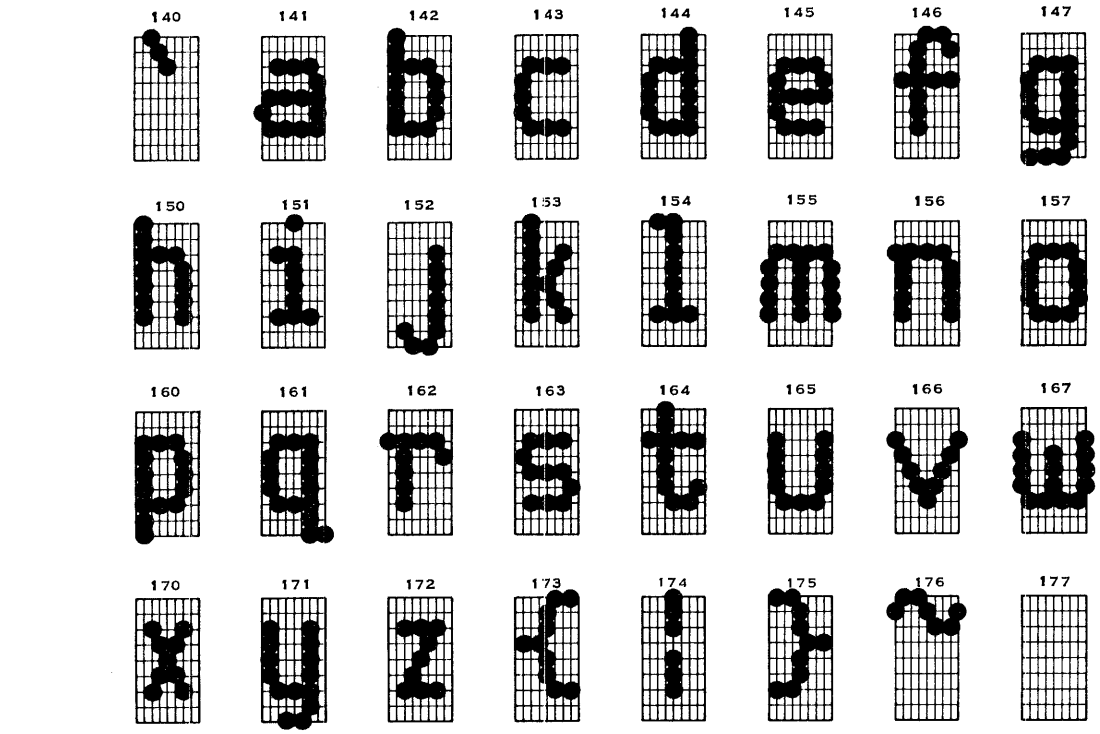
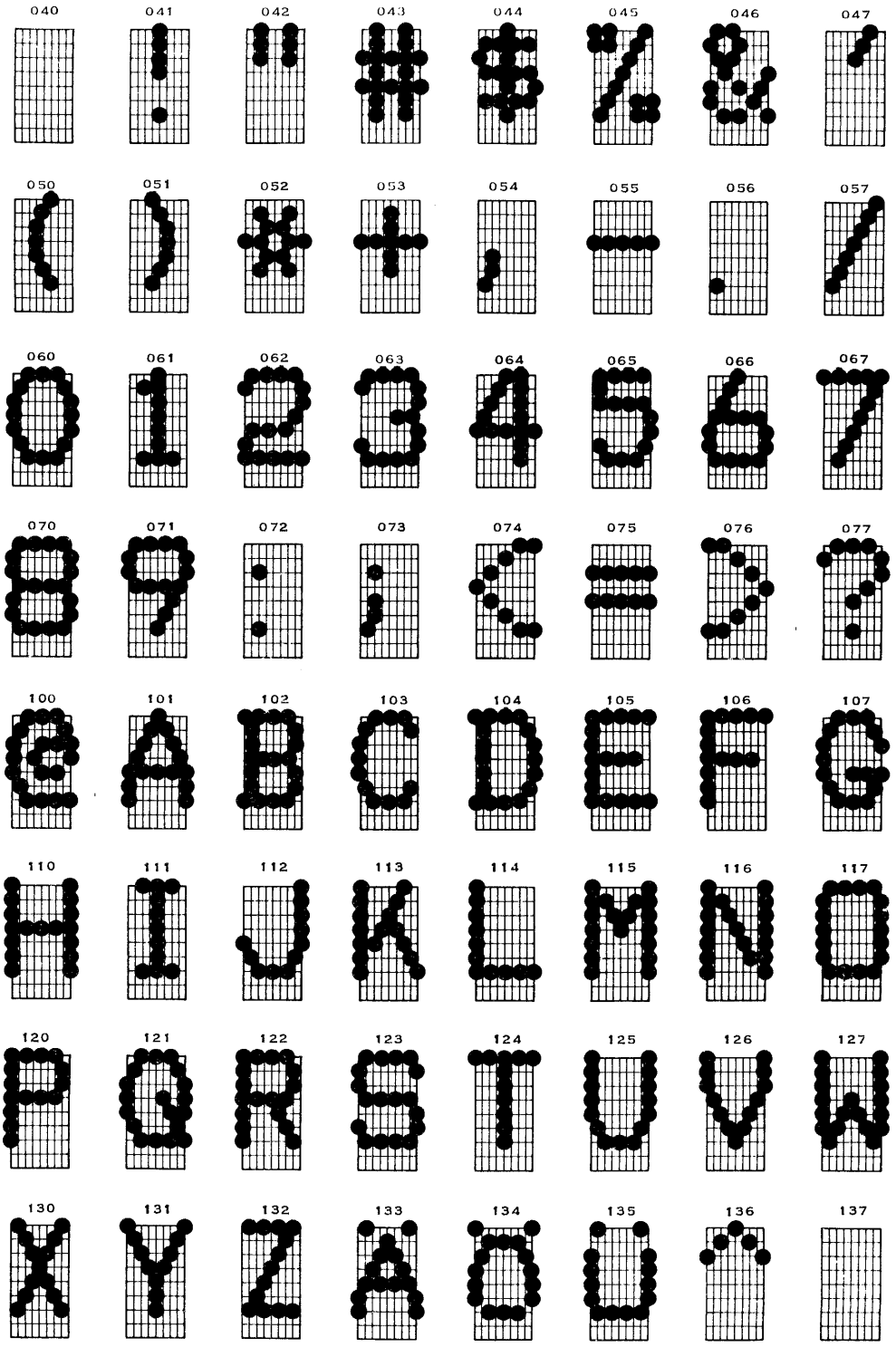


Figure A-5. 96-Character Great Britain Set (Sheet 2 of 2)



(B)143390 (1/2)

Figure A-6. 96-Character German Set (Sheet 1 of 2)

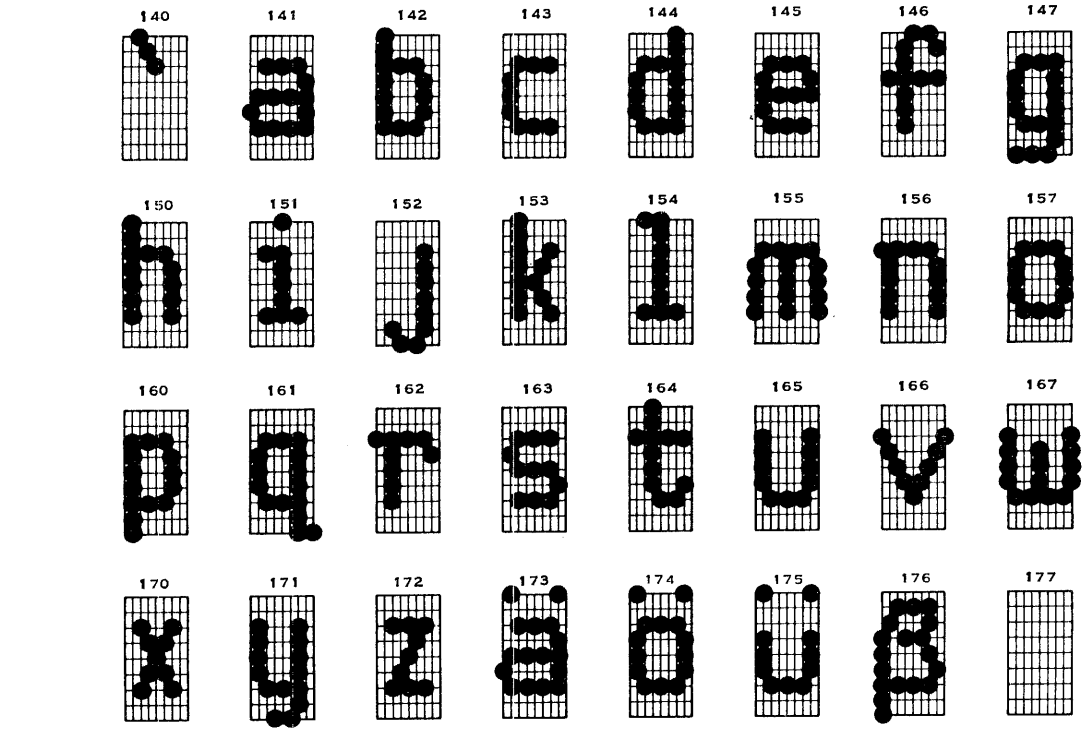


Figure A-6. 96-Character German Set (Sheet 2 of 2)

Alphabetical Index

The following index lists key words and concepts from the subject material of the manual together with the area(s) in the manual that supply major coverage of the listed concept. The numbers along the right side of the listing reference the following manual areas:

- Sections — References to Sections of the manual appear as "Section x" with the symbol x representing any numeric quantity.

- Appendixes — References to Appendixes of the manual appear as "Appendix y" with the symbol y representing any capital letter.

- Paragraphs — References to paragraphs of the manual appear as a series of alphanumeric or numeric characters punctuated with decimal points. Only the first character of the string may be a letter; all subsequent characters are numbers. The first character refers to the section or appendix of the manual in which the paragraph is found.

- Tables — References to tables in the manual are represented by the capital letter T followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the table). The second character is followed by a dash (-) and a number:

  Tx-yy

- Figures — References to figures in the manual are represented by the capital letter F followed immediately by another alphanumeric character (representing the section or appendix of the manual containing the figure). The second character is followed by a dash (-) and a number:

  Fx-yy

CUT ALONG LINE

USER'S RESPONSE SHEET

Manual Title: Model 990 Computer Model LP300 and LP600 Line Printers Installation and Operation Manual (2250364-9701 **)

Manual Date: 15 September 1980 **Date of This Letter:** _____

User's Name: _____ **Telephone:** _____

Company: _____ **Office/Department:** _____

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Please list any discrepancy found in this manual by page, paragraph, figure, or table number in the following space. If there are any other suggestions that you wish to make, feel free to include them. Thank you.

Location in Manual	Comment/Suggestion
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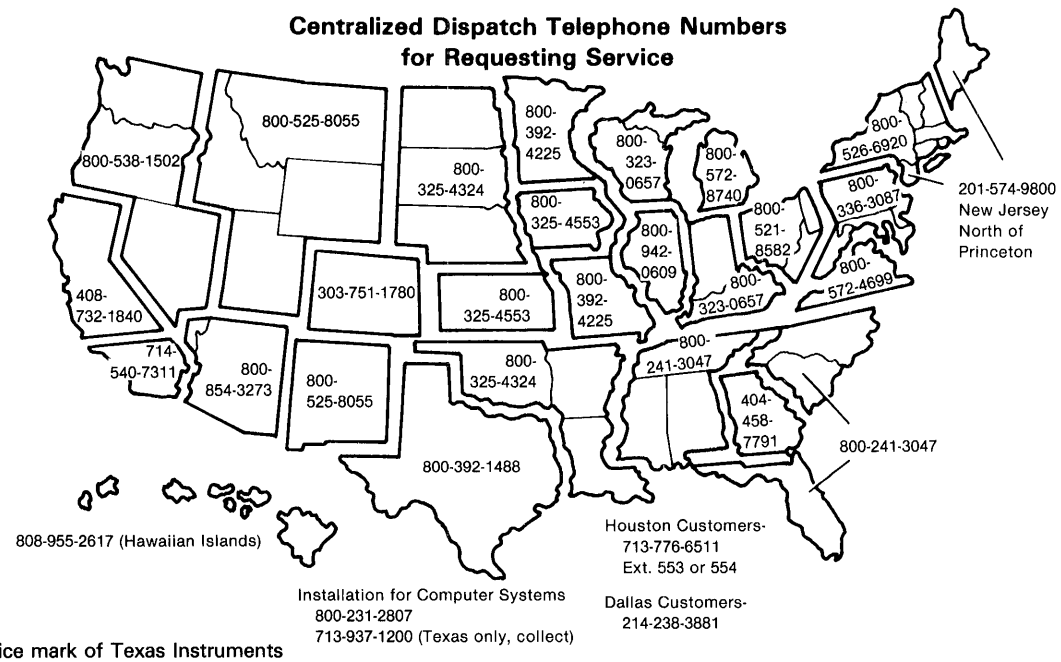

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