DX2300/2400 User's Manual
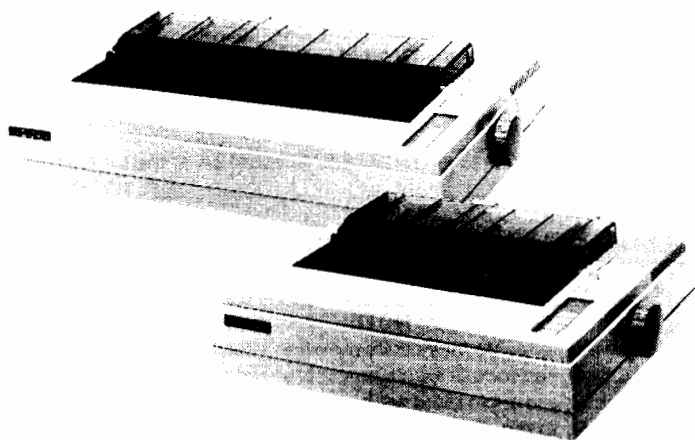
Includes 80-column and 136-column

Monochrome and Color Printers

with DEC LA50 and Okidata
192 / 193 + Emulation

Federal Communications Commission Radio Frequency Interference Statement for United States Users

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance white the manufacturer's instructions, may cause interference to radio and television reception It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
− Reorient the receiving antenna
− Relocate the computer with respect to the receivr
− Move the computer away from the receiver
− Plug the computer into a different outlet so that computer and receiver are on different branch circuits

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

(This equipment has been tested as the M3348A/M3349A of the model number)

NOTE:
The length of power cord must be 3m or less

NOTE:
An unshielded plug or cable may cause radiation interference The printer is designed for use with a properly shielded interface cable. A non-shielded interface cable must not be used The shield must be connected directly to the chassis of the printer. The cable length must be 3m or less.

Notice for German Users

Dieses Gerät entsprincht als Einzelgerät den Funkentstörungsanforderungen der Postverfugung Nr. 1046/1984 bzw. der Grenzflache B nach VDE 0871/6.78
Das Kabel muß abgeschirmt und unter 3 Meter lang sein.

i

***** PREFACE *****

This manual represents your Fujitsu printer as manufactured at the time of publication. Every effort has been made to ensure that information in this manual is complete and accurate. Fujitsu America has reviewed this manual but cannot be held responsible for errors and omissions.

Fujitsu also publishes a Maintenance Manual and a Parts Catalog for this printer. Please request additional publications from your dealer or authorized Fujitsu Representative.

We reserve the right to make changes and improvements to this product without obligation to incorporate these changes and improvements into units previously shipped. The contents of this manual may be changed without prior notice.

***** TRADEMARK ACKNOWLEDGEMENT *****

Centronics is a trademark of Centronics Data Computer Corporation

Okidata is a trademark of Okidata Corporation

Microsoft BASIC is a trademark of Microsoft

BDT is a trademark of Buro and Datentechnick GmbH

DEC and LA50 are trademarks of Digital Equipment Corporation

Edition A   October 1988

*** SUPPLIES, OPTIONS AND PUBLICATIONS ***

The following items are available for your printer. Contact your Dealer/Distributor or Fujitsu representative for additional information.

SUPPLIES:

Ribbon Cassettes
Color (D30L-9001-0401)

Black (D30L-2014-0096)

Print Head Mechanism
(D86B-1127-C154)

OPTIONS:

Cut Sheet Feeders
Single Bin for the 80 Column Printer (ASF300-FJ2101)

Single Bin for the 136 Column Printer (ASF300-FJ2201)

Color Option
Color Option Assembly (D86B-1144-D001)

Interface Circuit Cards
Parallel Interface (D86B-1144-C011)

RS-232 Serial Interface (D86B-1144-C021)

Memory Circuit Cards
IBM/Epson Dual Emulation Board with Manual and 8K RAM (D05B-2910-C202)

PUBLICATIONS:
Maintenance Manual (B-69298)
Parts Catalog (B-69510)
Schematic Drawings (B-69300)
Product Description (B-69301)

**** STANDARD FEATURES ****

Thank you for purchasing this high quality Printer. You have made a wise selection. Your printer will provide years of high speed, reliable, and versatile printing.

Your printer has been designed to satisfy most word processing, data processing, and graphic printing requirements when interfaced to a small or medium sized host system.

Features found in your printer are listed in the following Table of Features.

TABLE OF FEATURES
HIGH SPEED & QUIET PRINTING Up to 270 characters per second with automatic bidirectional printing logic and 4 inches of line feeds per second saves printing time and increases productivity. Printing noise is 55 dB.
HIGH THROUGHPUT This printer can print 135 lines per minute (LPI) when printing 80 columns per line.
MULTI-EMULATION Two different printer emulation modes are available by setting two switches. Emulation modes are DEC LA50 or Okidata 192/193+.
NEAR LETTER QUALITY Print characters consists of 19 horizontal and 16 vertical dots in Near Letter Quality (NLQ) mode.
COLOR OR MONOCHROME PRINTING Color printing is achieved when the optional color kit and a four-color ribbon cassette are installed.

PAPER HANDLING

Load paper with the Auto Load function for both cut sheet paper and continuous forms with the 80 column printer, and with the 136-column printer for cut sheet paper within the Auto Load range. A change from continuous form to cut sheet paper is easily achieved without removing the continuous forms. An optional single bin cut sheet paper feeder is available.

OUTSTANDING RELIABILITY

A simplified print mechanism results in outstanding reliability and ease of maintenance.

CHARACTER SETS & GRAPHICS

Standard Okidata, IBM, ASCII, or DEC LA50 character sets are available depending on the selected emulation mode. Character sets are shown in Appendix G.

CHARACTER SPACING

Characters per inch (CPI) may be 10, 12, (16.5 for DEC LA50), or 17.1.

LINE SPACING

Line spacing is selected by a command (1/6, 1/8, 7/72, n/72, or n/216).

SERIAL & PARALLEL INTERFACES

RS-232 Serial or Centronics Type Parallel Interface Circuit Boards allows easy interfacing to your host system. LA50 emulation is limited to the RS232 interface.

EXCHANGEABLE MEMORY BOARDS

Memory Circuit Boards are available with an 8K input buffer. For DEC LA50, an optional 8K may also be added for a total input buffer of 16K.

**** APPLICATION SOFTWARE SET UP ****

Don't be alarmed if your printer is missing from the list of printer options in the installation instructions for your application software.

Simply instruct your software package that it is working with a DEC LA50 or Okidata 192/193+ Printer and your printer will perform as specified.

**** PURPOSE OF GUIDE ****

This manual is designed to help you install, set up, and use your printer. Our goal is to explain the many features of your printer in a clear, easy to understand manner.

This series includes the 80-column printer and 136-column printer. The 80-column printer has an 8 inch print line and the 136-column printer has a 13.6 inch print line. Except for print line length and minor differences in paper handling, the printers are identical. The material In this manual applies to both versions unless otherwise noted.

This manual is written for both the novice and the experienced user. We have included procedures, tables and illustrations. Summary information is given in concise terms and you will find a reference to additional detail where applicable.

This manual is organized to present Information in the order that it is most likely to be required. You will find the Table of Contents helpful when you are trying to locate a particular procedure or specific information.

***** QUICK START CHART *****

Your printer is user friendly. Still you'll find it easier to master if you take just a few moments to review this manual completely before you try to connect and use your printer.
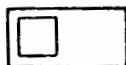
You may be tempted to connect your printer and learn how to use its many features as you gain experience. You may also be tempted to leave this manual on a shelf and read it only in an emergency. Please resist these temptations.

The following Quick Start Chart is a summary of the steps we recommend you follow to set up and operate your printer.

QUICK START CHART		
What You Do:	**What You Check:**	**Refer To:**
Unpack printer	All received items	Page 1-2
Open front cover & remove shipping restraints	Print Carriage for smooth side to side movement	Page 1-4
Install Memory & Interface Boards	Installations instructions	Page 1-8 and B-1
Prepare printer for host operation	DIP switch settings shown below	Page 1-10 and 3-1

DIP SWITCHES ON MEMORY CIRCUIT BOARD
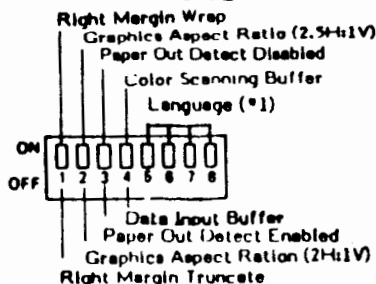
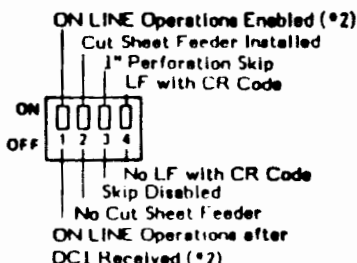## DEC TYPE (LA50 Printer) EMULATION

SW3 Emulation Setup

F←→I

F=DEC/I=Okidata

SW1

Right Margin Wrap
  Graphics Aspect Ratio (2.5H:1V)
   Paper Out Detect Disabled
    Color Scanning Buffer
     Language (*1)

ON
OFF 1 2 3 4 5 6 7 8

Data Input Buffer
Paper Out Detect Enabled
Graphics Aspect Ration (2H:1V)
Right Margin Truncate

SW2

ON LINE Operations Enabled (*2)
  Cut Sheet Feeder Installed
   1" Perforation Skip
    LF with CR Code

ON
OFF 1 2 3 4

No LF with CR Code
Skip Disabled
No Cut Sheet Feeder
ON LINE Operations after
DC1 Received (*2)

*1 = All Switches OFF is American. See page 1-13 for other Language Selections.

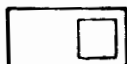*2 = ON - On Line lamp is lit at power on and all data sent to printer is printed.

OFF - On Line lamp is lit at power on, but data sent to the printer is ignored
until a DC1 Control Code is received.
When the printer receives a DC1 all data sent to the printer is printed.
When the printer receives a DC3 all data sent to the printer is ignored.

OKIDATA TYPE (192/193+ Printer) EMULATION

SW3 Emulation Setup

EPSON F←→I IBM

F=DEC/I=Okidata

SW1

Form Length (*1)
  Language (*2)

ON
OFF 1 2 3 4 5 6 7 8

SW2

Paper Out Detect Enabled
  Cut Sheet Feeder Installed
   DEL as a Block
    LF with CR Code

ON
OFF 1 2 3 4

No LF with CR Code
DEL Ignored
No Cut Sheet Feeder
Paper Out Detect Disabled
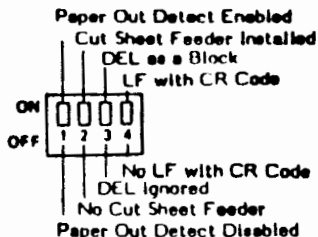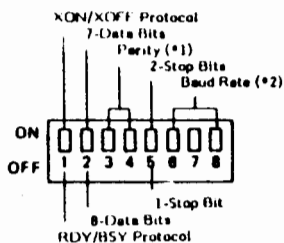
*1 = All Switches ON is 8.5" page length. See page 1-14 for other page lengths.

*2 = All Switches OFF is ASCII. See page 1-15 for other Language Selections.

SWITCHES ON SERIAL INTERFACE CIRCUIT BOARD

*1 - Parity Selection is shown in the following Table.

Parity	Even		Odd		None		None	
ON	□	□	□				□	
OFF				□	□		□	□
Switch	3	4	3	4	3	4	3	4

XON/XOFF Protocol
7-Data Bits
Parity (*1)
2-Stop Bits
Baud Rate (*2)

ON
OFF 1 2 3 4 5 6 7 8

1-Stop Bit
8-Data Bits
RDY/BSY Protocol

*2 - Baud Rate Selection is shown in the following Table.

Baud Rate	Note		4800		2400		1200		600		300		200	
ON	□	□	□		□				□	□	□		□	
OFF				□		□	□	□	□			□	□	□
Switch	6	7	8	6	7	8	6	7	8	6	7	8	6	7	8

Note: This setting is 9600 baud in OKI Data Emulation and 110 Baud in DEC Emulation.
DEC LA50 Emulation does not support 9600 Baud.

What You Do:	What You Check:	Refer To:
Install Color Kit (if ordered)	Installation instructions	Page A-1
Install ribbon cassette	Ribbon path between print head and platen	Carton or Page 2-8
Attach AC cord	Ensure voltage is OK	Page 1-18
Insert paper	Paper width/position	Page 2-14 or 2-21
Run Self-Test	Printer performance	Page 1-19
Connect interface cable	Type of interface & cable connection	Page 1-23
Use the printer with your host computer and check the printer's performance.		
Refer to Section 4 for printer Troubleshooting hints. Refer to computer documentation for system faults.		

TABLE OF CONTENTS   Page

TABLE OF CONTENTS (Continued)   Page

LIST OF ILLUSTRATIONS (Continued)   Page

SECTION 1

INSTALLATION AND SELF-TEST

1.1 UNPACK THE PRINTER

Refer to Figure 1-1.

Open the shipping carton.

Remove the items from the vinyl bags.

Note: You will find a Color Kit, Memory Circuit Board, and Interface Circuit Board in the shipping carton, only if they were ordered with your printer.

Open the printer's front cover, by lifting the clear cover and then pulling the cover assembly upward.

If shipping damage is noticed, immediately notify your distributor or shipping agent.

Keep all shipping material for reshipment or storage of the printer.
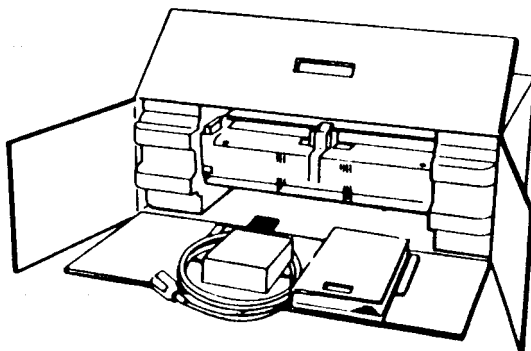
(Accessories removed from bags)

Figure 1-1 Opened Shipping Carton and Accessories

1.2 CHECK ITEMS RECEIVED

Items normally shipped with each printer are shown below. Circuit Boards may already be installed.
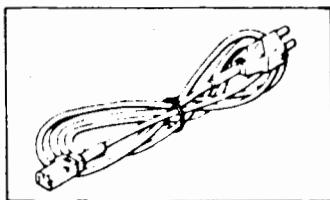
AC Power Cord
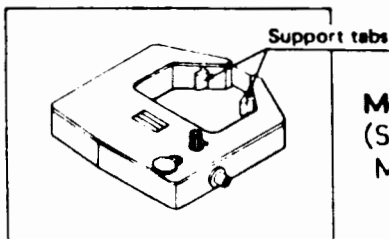
Support tabs

Monochrome Ribbon Cassette
(Support Tabs are only on
 Monochrome Cassette)
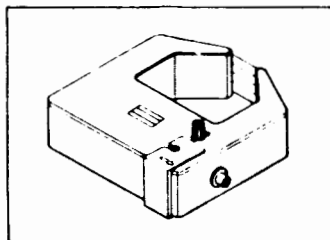
Color Ribbon Cassette
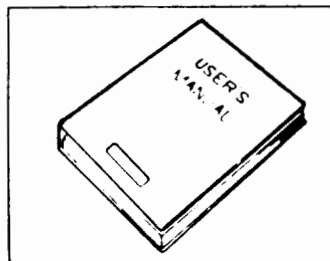
User's Guide

Figure 1-2 Items Shipped With Printer (1 of 2)
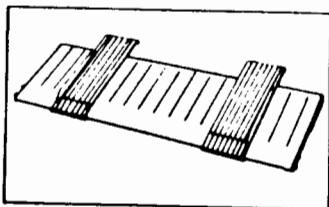
Rear Cover
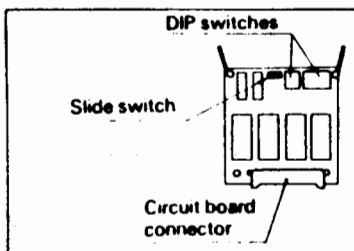
Memory Circuit Board
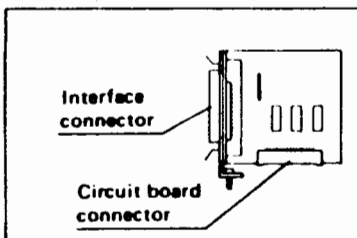
Parallel Interface
Circuit Board
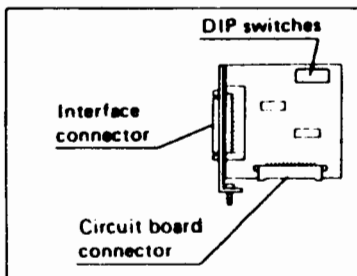
Serial Interface
Circuit Board

Figure 1-2 Items Shipped With Printer (2 of 2)

1.3 SHIPPING RESTRAINTS

Refer to Figure 1-3.

Open the soundproof, front and top covers and remove the shipping restraint by lifting it out of the printer.

Slide the print head from side to side, along the print line. The print head must be able to move without binding to allow the printer to operate correctly.
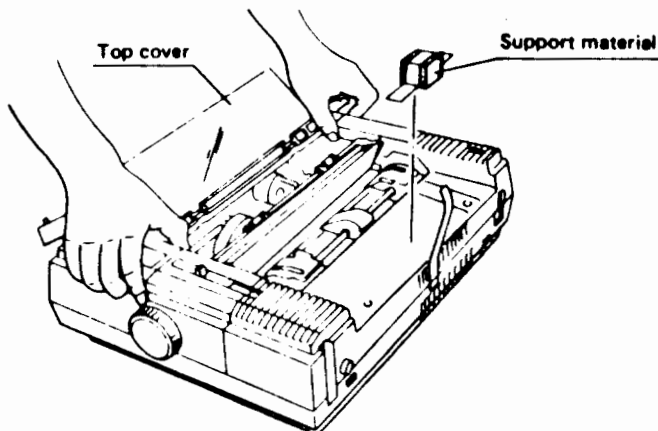
Open the Soundproof, Front and Top Covers
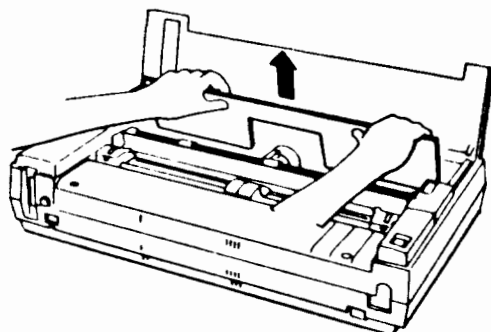
Remove the Shipping Restraint

Figure 1-3 Shipping Restraint Removal

1.4 INSTALLATION PRECAUTIONS

Install your printer on a level surface to avoid excess vibrations.

Do not install your printer in a location where it may become overheated. Avoid locations in direct sunlight and near heaters.

Do not block the ventilation around your printer.

Use a power outlet that is not shared with equipment that may generate electrical noise.

Use only the proper AC voltage.

1.5 PRINTER ELEMENTS

Refer to Figure 1-4. Major printer elements are:

1. Top Cover - raise for access into printer for ribbon installation, paper thickness adjustment and other user maintenance items.

2. Paper Thickness Lever - move this lever to change the gap between the print head and the platen for various paper weights.

3. Bail Roller Unit - holds the paper against the platen.

4. Power Switch - initializes the printer and illuminates the power lamp when turned ON.

5. Rear Cover - used to load cut sheets of paper and guide continuous forms. Use the Guides (on the rear cover) to position cut sheets of paper.

6. Platen - supports the paper when printing.

7. Forms Tractor - holds and feeds continuous forms (can be seen with the Rear Cover raised or removed).

8. Card Cover - remove for access to the Interface and Memory Circuit Boards.

9. Paper Release Lever - sets Cut Sheet friction feed or Continuous Form tractor feed mode.

10. Platen Knob - used to manually feed paper.

11. Operator Panel - used for manual control of the printer. Indicates condition of the printer. The panel is explained in Section 2.

Paper thickness lever

Platen

Power switch

Rear cover

Guides

Front cover

Bail roller unit

Forms tractor

Card cover

Soundproof cover

Paper release lever

Platen knob

Top cover

Operator panel
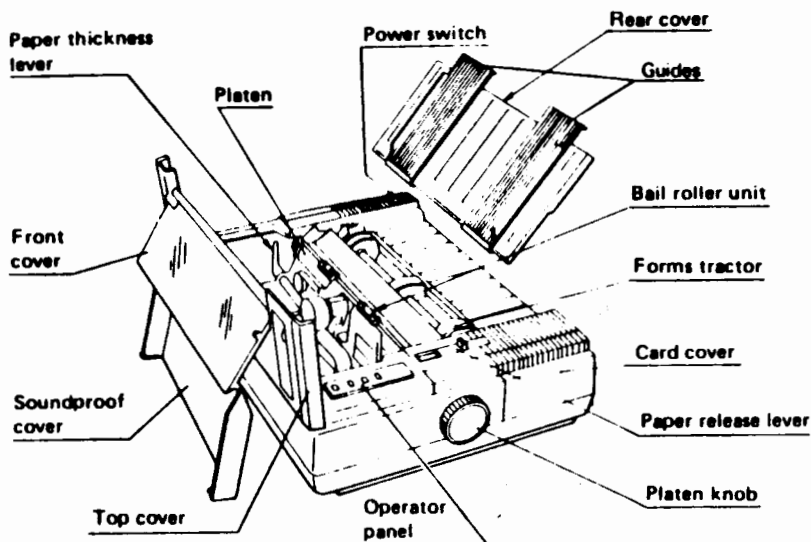
Figure 1-4 Major Printer Elements

1.6 REAR VIEW OF PRINTER

Figure 1-5 identifies the components on the rear of the printer.

Interface connector

Guides

Fuse

AC power connector

Card cover screw

Frame ground
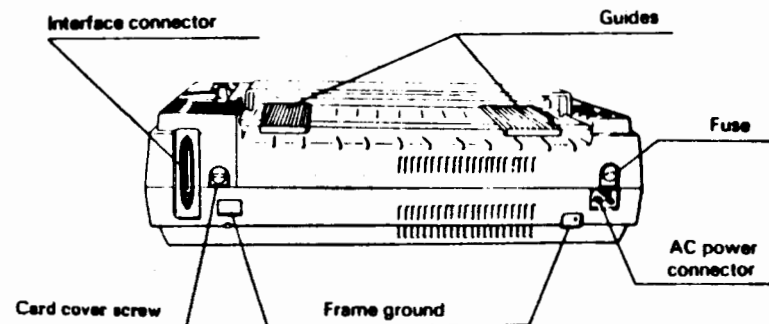
Figure 1-5 Rear View of Printer

1.7 INTERFACE AND MEMORY CIRCUIT CARDS

The printer is designed to allow the user to install the required Interface and Memory Circuit Boards as a part of the installation process. These Circuit Boards establish the printer's interface (as Serial or Parallel), printer characteristics and the amount of optional RAM storage.

The Interface Circuit Board contains either the Serial or Parallel Interface circuits and the interface cable connector (at the rear of the printer).

> A Serial Interface Circuit Board contains DIP switches associated with serial interface options, and allows a serial interface cable to be fastened with screws as explained in Appendix F.

> A Parallel Interface Circuit Board allows a parallel interface cable to be fastened with clips as explained in Appendix E (there are no DIP switches on the parallel interface circuit card).

Note: DEC Type emulation does not support the parallel interface.

The Memory Circuit Board contains control circuits that establish printer characteristics, and DIP switches that are set by the user to establish default print parameters. Optional RAM memory is also installed on the Memory Circuit Board.

> A summary of DIP switch functions is presented in paragraph 1-8.
> Section 3 explains these DIP switch functions in greater detail.

Circuit board installation instructions are summarized in this paragraph and explained in Appendix B.

Refer to Figure 1-6. The Interface and Memory circuit cards are located beneath the Card Cover.

Remove the Card Cover to gain access to the circuit boards, install a circuit board, set the DIP switches, or exchange a circuit board.

CAUTION
Make sure your computer and printer are turned OFF before installing or removing a circuit board.

Place the Paper Release Lever towards the front of the printer (Cut Sheet position).

Loosen the Card Cover screw in the back of the Card Cover using a coin or screw driver.

Slide the Card Cover rearward (off the printer), lift it upward and remove it.
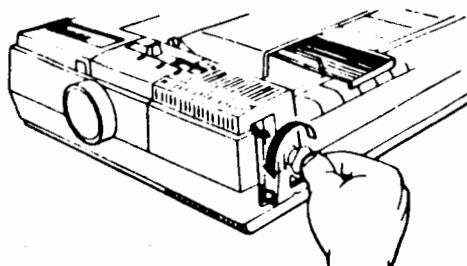
Loosen the Screw
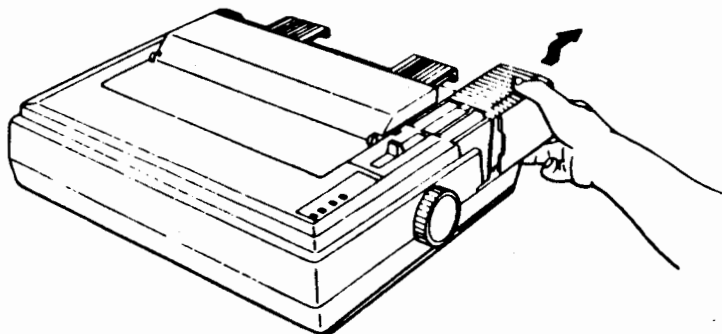
Remove the Card Cover
Figure 1-6 Access to Circuit Boards & DIP Switches

Install the Memory Circuit Board in the innermost connector, by carefully aligning the connectors and then pressing the board into place.

Install the desired interface circuit board in the outermost connector, by carefully aligning the connectors and then pressing the circuit board into place. Using a long shank Philips screwdriver, tighten the screw on the interface board (see Appendix B), to ensure a good ground connection for the circuits.

1.8 SUMMARY OF SWITCH SETTINGS

The printer emulates a DEC LA50 or Okidata 192/193+ Printer without installing any option. Emulation type is changed by SW3, the slide switch on the Memory Circuit Board. The slide switch selects either F (DEC LA50 Printer) or I (Okidata 192/193+ Printer).

Throughout this manual the slide switch position that selects DEC LA50 emulation is called DEC Type and the position that selects the Okidata printer is called the OKI Type.

Note that the functions assigned to DIP switches differ between DEC Type and OKI Type.

To select an emulation mode suitable for your program or software package; use the slide switch to select DEC Type or OKI Type as shown in Figure 1-7.

WARNING
To avoid damage to your printer, make sure it is turned OFF before changing the emulation mode.
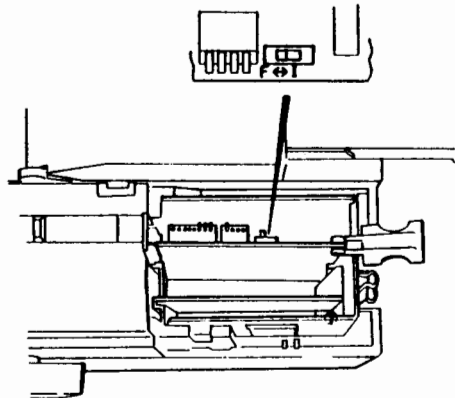
Figure 1-7 Selecting DEC or OKIDATA Type Emulation

See Section 3 for a complete description of DIP switch settings. Refer to Figure 1-8 for the DIP switches installed on the Memory Circuit Board.

Memory Circuit Board
Switch-1 Position

Memory Circuit Board
Switch-2 Position

Memory circuit board

Parallel interface board
(No DIP switch)
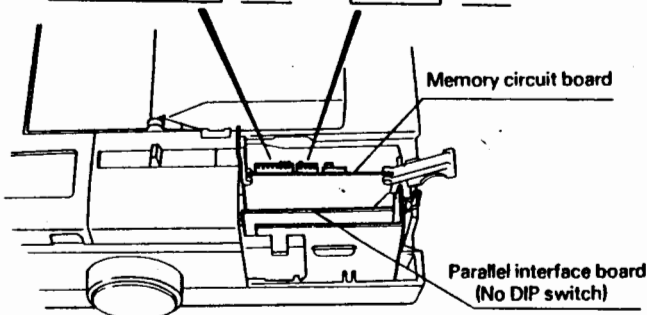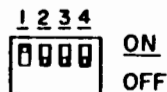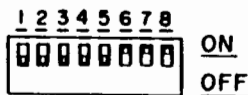
Figure 1-8 Memory Circuit Board DIP Switches

DEC Type - MEMORY CIRCUIT BOARD SWITCHES

Table 1-1 shows the functions selected by Switch-1 on the Memory Circuit Board with DEC Type emulation.

Table 1-1 DIP Switch-1 Functions
DEC Type Emulation

#	Function when OFF	Function when ON
1	*Right Margin Truncate	Right Margin Wrap
2	*Graphics Aspect Ratio 2:1	Graphics Aspects Ratio 2.5:1
3	*Paper Out Detect	No Paper Out Detect
4	*Data Input Buffer	Color Scanning Buffer
5	*See Table 1-3	See Table 1-3
6	*See Table 1-3	See Table 1-3
7	*See Table 1-3	See Table 1-3
8	*See Table 1-3	See Table 1-3

* = Factory and most common setting.

Table 1-2 shows the functions selected by Switch-2 on the Memory Circuit Board with DEC Type emulation.

Table 1-2 DIP Switch-2 Functions
DEC Type Emulation

#	Function when OFF	Function when ON
1	ON-Line with DC1	*ON-Line with Power On
2	*No Cut Sheet Feeder	C/S Feeder Installed
3	*Print on Perforation	Skip Over Perforation
4	*No LF with CR	LF with CR

* = Factory and most common setting.

With DEC Type emulation selected, DIP Switch-1 on
the Memory Circuit Board positions #5, #6, #7 and
#8 select the international character set (Language
unique symbols) as shown in Table 1-3.

In Table 1-3:

Canadian is French Canadian.

Danish includes Norwegian.

Table 1-3 Language Selection
DEC Type Emulation

Selected Language	DIP Switch-1 Setting			
	#5	#6	#7	#8
U.S.A.	*OFF	*OFF	*OFF	*OFF
British	ON	OFF	OFF	OFF
Finnish	OFF	ON	OFF	OFF
French	ON	ON	OFF	OFF
Canadian	OFF	OFF	ON	OFF
German	ON	OFF	ON	OFF
Italian	OFF	ON	ON	OFF
Japanese	ON	ON	ON	OFF
Danish	OFF	OFF	OFF	ON
Spanish	ON	OFF	OFF	ON
Swedish	OFF	ON	OFF	ON

* = Factory setting.

OKI Type - MEMORY CIRCUIT BOARD SWITCHES

When OKI Type emulation is selected, DIP Switch-1 (SW1) on the Memory Circuit Board positions SW1-1, SW1-2, SW1-3 and SW1-4 selects page length as shown in Table 1-4.

Table 1-4 Page Length Selection
OKI Type Emulation

Page Length in Inches	DIP Switch-1 Setting			
	#1	**#2**	**#3**	**#4**
*11" Page	ON	ON	OFF	ON
3" Page	ON	ON	OFF	OFF
3.5" Page	OFF	OFF	OFF	OFF
4" Page	OFF	OFF	ON	OFF
4.5" Page	ON	OFF	OFF	OFF
5" Page	ON	OFF	ON	OFF
5.5" Page	OFF	ON	OFF	OFF
6" Page	OFF	ON	ON	ON
7" Page	ON	ON	ON	OFF
8" Page	OFF	OFF	OFF	ON
8.5" Page	ON	ON	ON	ON
9" Page	ON	OFF	OFF	ON
10" Page	OFF	ON	OFF	ON
12" Page	OFF	OFF	ON	ON
13" Page	ON	OFF	ON	ON
14" Page	OFF	ON	ON	ON

* = Factory Setting.

When OKI Type emulation is selected, DIP Switch-1 (SW1) on the Memory Circuit Board positions SW1-5, SW1-6, SW1-7 and SW1-8 select the international character set (Language unique symbols) as shown in Table 1-5.

Table 1-5 Language Selection
OKI Type Emulation

Selected Language	DIP Switch-1 Setting			
	#5	#6	#7	#8
ASCII (∅)	*OFF	*OFF	*OFF	*OFF
ASCII (0)	ON	OFF	OFF	OFF
British	OFF	ON	OFF	OFF
German	ON	ON	OFF	OFF
French	OFF	OFF	ON	OFF
Swedish	ON	OFF	ON	OFF
Danish	OFF	ON	ON	OFF
Norwegian	ON	ON	ON	OFF
Dutch	OFF	OFF	OFF	ON
Italian	ON	OFF	OFF	ON
Canadian**	OFF	ON	OFF	ON
Spanish	ON	ON	OFF	ON
Japanese	OFF	OFF	ON	ON
ASCII (0)	ON	OFF	ON	ON
ASCII (0)	OFF	ON	ON	ON
ASCII (0)	ON	ON	ON	ON

* = Factory setting.
**Canadian is French Canadian.

When OKI Type emulation is selected, DIP Switch-2 (SW2) on the Memory Circuit Board, positions SW2-1, SW2-2, SW2-3 and SW2-4, selects the functions shown in Table 1-6.

Table 1-6 DIP Switch-2 Selections
OKI Type Emulation

#	Function when OFF	Function when ON
1	No Paper Out Detect	*Paper Out Detect
2	*No Cut Sheet Feeder	Cut Sheet Paper Feeder
3	*Ignore DEL Code	DEL = Printed (L)
4	*CR = CR (No LF)	CR = CR + LF

* = Factory Setting.

SERIAL INTERFACE CIRCUIT BOARD DIP SWITCHES

Refer to Figure 1-7 and 1-8 for DIP switches installed on the Serial Interface Circuit Board.
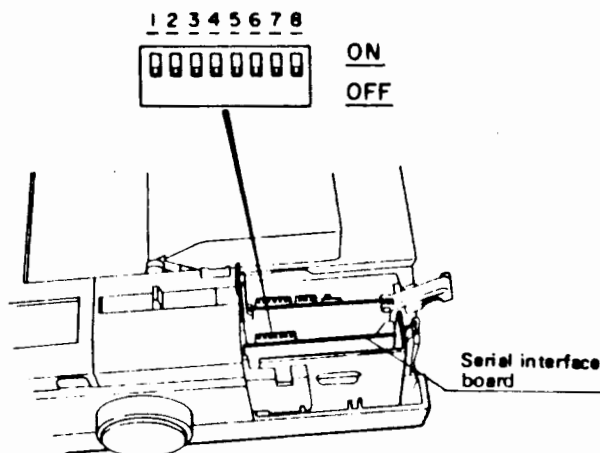
Figure 1-9 Serial Interface DIP Switches

Table 1-7 shows the functions selected by the DIP switches on the Serial Interface Circuit Board. These functions do not change when the emulation type is changed.

Table 1-7 Serial Interface Circuit Board
DIP Switch Functions

#	Function when OFF	Function when ON
1	PRT RDY/BUSY Protocol	*XON/XOFF Protocol
2	*8-Bit Data Length	7-Bit Data Length
3	*Parity OFF	Parity ON
4	*Parity ODD	Parity EVEN
5	*1-Stop bit	2-Stop bits
6	Baud Rate, See Table 1-8	*See Table 1-8
7	*Baud Rate, See Table 1-8	See Table 1-8
8	Baud Rate, See Table 1-8	*See Table 1-8

* = Factory and most common setting.

Table 1-8 shows DIP switch positions #6, #7 and #8 on the Serial Interface Circuit Board, used to select a Baud Rate that is compatible with the host system.

Table 1-8 Baud Rate Selection
Serial Interface Circuit Board
DIP Switch #6, #7, and #8

Selected Baud Rate	Switch Setting		
	#6	#7	#8
Undefined	ON	ON	ON
Note	ON	ON	OFF
4800	*ON	*OFF	*ON
2400	ON	OFF	OFF
1200	OFF	ON	ON
600	OFF	ON	OFF
300	OFF	OFF	ON
200	OFF	OFF	OFF

* = Factory setting.

Note: This setting is 9600 Baud in OKI Emulation and 110 Baud in DEC Emulation. 9600 Baud is not supported in DEC Type emulation.

1.9 ATTACH THE AC POWER CORD

Your printer normally operates from any standard wall outlet (110-120 Volts AC or 220-240 Volts AC). The required power is printed on the printer's name-plate on the rear of your printer (see Figure 1-5). Carefully check the power requirements for your printer before attaching the AC cord and turning power ON.

For safety reasons ensure that the ground pin in the power cord is connected to electrical ground in your power outlet.

Do not turn on the power switch (to run Self-Test) until paper and a ribbon cassette are installed.

Refer to Figure 1-10.
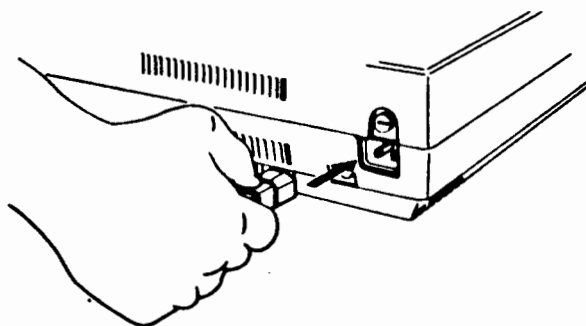
Align the Power Cord
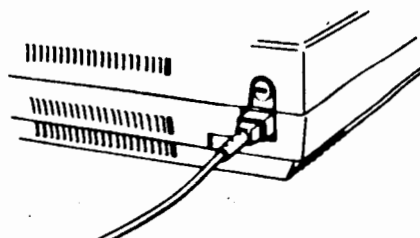
Correctly Installed Power Cord

Figure 1-10 Attaching the AC Power Cord

1.10 RUN SELF-TEST

Before running Self-Test, ensure paper and a ribbon cassette are installed. See Section 2 for paper loading and ribbon cassette installation instructions.

Check for a normal printer initialization cycle by turning the Power switch OFF and then ON, before starting Self-Test.

During a normal printer initialization cycle, when power is turned ON:

The power lamp will light.

If the print head is at the left side, it moves towards the center of the print line and then back to the left side. Otherwise it moves only to the left side.

The On-Line lamp will light (if paper is inserted).

See the Troubleshooting hints, in Section 4, if you have different results.

Start the Self-Test print pattern as follows:

We recommend that you use continuous forms (more than 9" wide for the 80 column printer and more than 15" wide for the 136-column printer). The Self-Test prints the maximum characters per print line and if printing occurs off the paper the print head and Platen may be damaged.

Load paper into the printer (refer to paragraphs 2.6 and 2.7) and then turn Power OFF.

While pressing the LF (Line Feed) switch (on the Operator Panel) turn power ON - continue pressing the LF switch until the initialization cycle is complete and Self-Test printing starts.

Release the LF switch when Self-Test printing starts.

Self-Test continues until power is turned OFF.

The Self-Test print-out consists of repeated printing, and character stepping, of the character set selected by the DIP switch settings.

If the color option is installed, each color is repeated after seven (7) lines of print.

We suggest you retain a copy of the Self-Test print pattern for reference.

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEF.
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGH
 "#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJ
 #$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJK
 $%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKL
 %&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLM
 &'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN
 '()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
 ()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO'
 )*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO'
 *+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO'
 +,-./0123456789:;<=>?@ABCDEFGHIJKLMNO'
 ,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
 -./0123456789:;<=>?@ABCDEFGHIJKLMNOP(
 ./0123456789:;<=>?@ABCDEFGHIJKLMNOPQF
 /0123456789:;<=>?@ABCDEFGHIJKLMNOPQRS
 0123456789:;<=>?@ABCDEFGHIJKLMNOPQRST
 123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUV
 23456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVW)
 3456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXY.
 456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
 56789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]
 6789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^.
 789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
 89:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_'.
 9:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`a
 :;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`at
 ;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`at
 <=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`at
 =>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`ab
 >?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abr
 ?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abc
```

Figure 1-11 Self-Test Print Pattern (DEC Type)

```
!"#$%&'()∗+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQR
qrstuvwxyz{¦}˜áíóúñÑªⁱ¿⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
ΓπΣσμτ♦θΩδ∞øЄ∩Ξ±≥≤∫J±×°•·√ⁿ²■!"#$%& ()∗+,-./012345
TUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{¦}˜áíóúñÑª
╫╬╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αβΓπΣσμτ♦θΩδ∞øЄ∩Ξ±≤∫J±
789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefgh
¿⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
•·√ⁿ²■!"#$%& ()∗+,-./0123456789:;<=>?@ABCDEFGHIJK
jklmnopqrstuvwxyz{¦}˜áíóúñÑªⁱ¿⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
█▄▌▐▀αβΓπΣσμτ♦θΩδ∞øЄ∩Ξ±≤∫J±×°•·√ⁿ²■!"#$%& ()∗+,-.
MNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{¦}˜
╜╛╝╫╬╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αβΓπΣσμτ♦θΩδ∞øЄ∩
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`a
íóúñÑªⁱ¿⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
±≤∫J±×°•·√ⁿ²■!"#$%& ()∗+,-./0123456789:;<=>?@ABCD
cdefghijklmnopqrstuvwxyz{¦}˜áíóúñÑªⁱ¿⌐¬½¼¡«»    ║╠╣
╘╒╓╫╪┘┌█▄▌▐▀αβΓπΣσμτ♦θΩδ∞øЄ∩Ξ±≤∫J±×°•·√ⁿ²■!"#$%&
FGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
╗╜╛╝╫╬╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αβΓπΣσμτ♦
)∗+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ
yz{¦}˜áíóúñÑªⁱ¿⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
Ωδ∞øЄ∩Ξ±≤∫J±×°•·√ⁿ²■!"#$%& ()∗+,-./0123456789:;<=
\]^_`abcdefghijklmnopqrstuvwxyz{¦}˜áíóúñÑªⁱ¿⌐¬½¼¡«
╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αβΓπΣσμτ♦θΩδ∞øЄ∩Ξ±≤∫J±×°•·√ⁿ²■
?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
║╠╣╤╦╗╜╛╝╫╬╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αβ
"#$%& ()∗+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRS
rstuvwxyz{¦}˜áíóúñÑªⁱ¿⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
πΣσμτ♦θΩδ∞øЄ∩Ξ±≤∫J±×°•·√ⁿ²■!"#$%& ()∗+,-./0123456
UVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{¦}˜áíóúñÑªⁱ
╫╬╤╥╙╘╒╓╫╪┘┌█▄▌▐▀αβΓπΣσμτ♦θΩδ∞øЄ∩Ξ±≤∫J±×
89:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
•·√ⁿ²■!"#$%& ()∗+,-./0123456789:;<=>?@ABCDEFGHIJKL
klmnopqrstuvwxyz{¦}˜áíóúñÑªⁱ¿⌐¬½¼¡«»    ║╠╣╤╦╗╜╛╝
█▄▌▐▀αβΓπΣσμτ♦θΩδ∞øЄ∩Ξ±≤∫J±×°•·√ⁿ²■!"#$%& ()∗+,-./
NOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{¦}˜á
```

Figure 1-12 Self-Test Print Pattern (OKI Type)

1.11 CONNECTING AN INTERFACE CABLE

Refer to your system documentation to determine the type of interface required for your system.

A 36-pin interface cable receptacle will be exposed at the rear of your printer when a Parallel Interface Circuit Board is installed.

Note: DEC Type emulation does not support a Parallel Interface

A 25-pin interface cable receptacle will be exposed at the rear of the printer when a RS-232C Serial Interface Circuit Board is installed.

CAUTION
Make sure your computer and printer are turned OFF before connecting an interface cable.

Connect one end of the interface cable to the interface circuit board receptacle at the back of your printer and the other end into your system.

Refer to Figure 1-13 if connecting a Parallel Interface.

Refer to Figure 1-14 if connecting a Serial Interface.
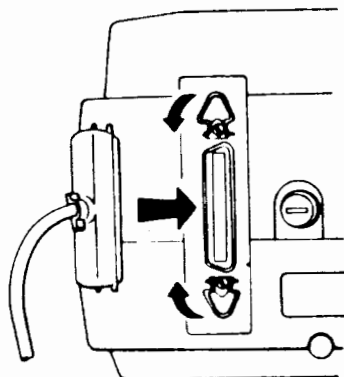
Figure 1-13 Parallel Interface Cable Connector
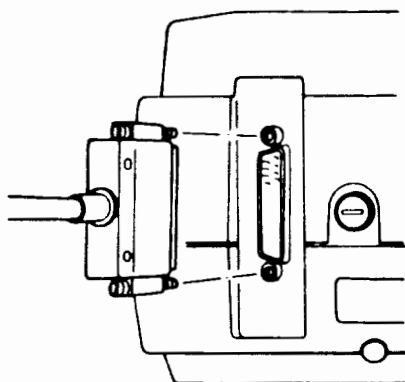
Figure 1-14 Serial Interface Cable Connector

SECTION 2

OPERATION

This section describes the Operator Panel, Ribbon Cassette installation, the Paper Thickness Adjustment and Loading/Exchanging Paper.

2.1 OPERATOR PANEL

Refer to Figure 2-1, paragraphs 2.2 (Lamps), and 2.3 (Switches). There are four lamps and four switches on the operator panel.

Operator Panel	Functions
□ POWER □ PAPER OUT □ (ONLINE) □ (NLQ) (FF) (LF)	POWER - Lamp (Green) Lit when Power switch is ON. PAPER OUT - Lamp (Amber) Lit when Out-of-Paper is detected, flashes when Operator Setup mode (see paragraph 2.3.3) is selected. ON LINE - Lamp (Green) Lit when the printer is ON LINE with the host system. ON LINE - Switch Sets ON LINE or OFF LINE mode. NLQ - Lamp (Green) Lit when Near Letter Quality print mode is set. NLQ - Switch Sets NLQ or Selected print mode. FF and LF - Switches Explained in paragraph 2.3

Figure 2-1 Operator Panel

2.2 OPERATOR PANEL LAMPS

POWER Lamp (Green) -   Lit when the Power switch
is turned ON and power is applied to the printer.

PAPER OUT Lamp (Amber) - Lit when Out-of-Paper
is detected.   Flashes when the printer is in the
Operator Setup mode (see paragraph 2.3.3).

ON LINE Lamp (Green) - Lit when the printer is
ON LINE with the host system.

NLQ Lamp (Green) - Lit when Near Letter Quality
print mode is selected. See NLQ Switch.

2.3 OPERATOR PANEL SWITCHES

ON LINE Switch

Sets **ON LINE** or **OFF LINE** mode.

Press this switch, **in ON LINE mode**, to place the
printer in OFF LINE mode. In OFF LINE mode, the
ON LINE lamp is off and printing from the host
system is stopped.   Use OFF LINE mode to change
the ribbon cassette or load paper.

Press this switch, **in OFF LINE mode**, to place the
printer in ON LINE mode and allow it to
communicate with your host system (Power must be
ON before the printer enters ON LINE mode).

When the printer is **OFF LINE**, any Print data
transferred by your computer and waiting to be
printed, is stored in the printer's data buffer.   If
power remains ON, this stored print data is printed
when the printer is returned ON LINE.

NLQ Switch

Sets NLQ (Near Letter Quality) or selected print quality mode.

Press the **NLQ** switch to change from the present print quality to Near Letter Quality printing.

Press this switch a second time to return to the selected print quality.

If you press this switch while printing, print quality changes on the next print line.

FF (Form Feed) Switch

Function depends on:
1. On Line/Off Line status of the printer.
2. Position of the Paper Release Lever.
3. Paper loaded/unloaded status.

When the printer is **OFF LINE**, press this switch to automatically load paper onto the Platen, if Paper Release Lever is set towards the front of the printer, and paper is not loaded - (when using paper less than 8.5" wide with 80- or 136-column printer).

Note:

With the 136-column printer, load cut sheet paper wider than 8.5" manually.

When the printer is **OFF LINE**, press this switch to automatically load paper onto the Platen, if Paper Release Lever is set towards the rear of the printer, and paper is not loaded - (With the 80-column printer).

With the 136-column printer, this switch has no effect.

When the printer is **ON LINE**, press this switch to eject the paper, if Paper Release Lever is set toward the front of the printer, and paper is loaded. The **PAPER OUT** lamp will light.

When the printer is **ON LINE,** press this switch to
retract the continuous form by 15" or off the Platen,
but still in the forms tractor; and to prepare for cut
sheet paper operations if the Paper Release Lever is
set towards the rear of the printer, and continuous
form is loaded .

When the printer is **OFF LINE,** press this switch to
eject the paper, if the Paper Release Lever is set
towards the front of the printer, and if paper is
loaded. The PAPER OUT lamp will light.

When the printer is **OFF LINE,** press this switch to
feed the form by one page length, if the Paper
Release Lever is set towards the rear of the printer,
and continuous form is loaded.

LF (Line Feed) Switch

When the printer is **OFF LINE,** press this switch
momentarily to move the paper one line in the
forward direction (regardless of the Paper Release
Lever setting). Hold this switch down to move paper
continuously.

When the printer is **OFF LINE,** press the FF switch
while holding the LF switch down to move the paper
continuously in the backward direction - until the
switches are released.

When the printer is **ON LINE,** pressing this switch will
have no effect.

2.3.1 Self-Test

Start Self-Test printing by turning the Power Switch
ON while holding the LF switch down. Turn the
power switch OFF to stop Self-Test. See paragraph
1-10 for more Self-Test information.

2.3.2 Hexadecimal-Dump

Set Hex Dump mode by holding both the LF and FF switches down while turning the power switch ON. This mode causes print data from the host system to print in hexadecimal (rather than ASCII). This mode is helpful when analyzing a suspected printer malfunction. Turn the power switch OFF to stop the Hexadecimal-Dump mode.

2.3.3 Operator Setup Mode

When the printer is ON LINE, enter Operator Setup mode by pressing the ON LINE and the FF switches at the same time. The PAPER OUT lamp will flash and a buzzer will sound twice when the printer is in the Operator Setup mode.

Operator Setup mode allows you to set the functions listed in Table 2-1. Note that you cannot change a function if data is loaded in the buffer.

1. Press ON LINE and FF switches at the same time to enter Operator Setup mode in ON LINE mode.

2. Press ON LINE switch to select a function. A buzzer will sound each time the switch is pressed. For example, press the ON LINE switch twice to select the function - Double-width Characters.

3. Press the FF switch to set the selected function. A buzzer will sound. In the above example, pressing the FF switch would cause Double-width Characters to be set.

    You may set more than one function by pressing the ON LINE switch and then pressing the FF switch. For example, after setting - Double-width Characters, press ON LINE two more times (total of four times) to select Unidirectional Print mode, then press FF to set it into the printer.

4. Press the LF switch to terminate the Operator Setup mode. PAPER OUT lamp will go off.

5. Press the ON LINE switch to return to the ON LINE mode.

Table 2-1 Operator Setup Mode Functions

Press ON LINE	Function Selected
0	All Functions Reset if FF is pressed
1	Condensed Characters
2	Double-width Characters
3	Elite Pitch Characters
4	Unidirectional Print mode
5	Disable Paper Out Detect
6	Change Form Length (11" to 12" or 12" to 11")
7	Set Form Length at 8.5"
8	Enable Skip Over Perforations
9	Set line spacing at 8 lines per inch
10	Use only the Blue Ribbon
11	Use only the Red Ribbon
12	Half speed Print mode
13	*View Print mode
14	*Proportional Print on

*OKI Only

2.3.4 Buzzer

A buzzer will sound when a Paper-Out condition is detected in ON LINE mode and also when the Operator Setup mode is set.

2.3.5 Summary of Switch Functions

Table 2-2 gives a summary of the switch functions.

POSITION OF PAPER RELEASE LEVER		
FORWARD (Cut Sheet Paper)		**REARWARD (Continuous Form)**
SWITCH PRESSED	WHEN THE PRINTER IS <u>ON LINE</u>	
ON LINE	Changes to OFF LINE.	Changes to OFF LINE.
NLQ	Changes print quality from Selected to Near Letter Quality and vice versa.	Changes print quality from Selected to Near Letter Quality and vice versa.
FF	Form Feed.	Retracts form by 15" or out of Platen, but form remains in Tractors.
LF	No response when ON LINE.	No response when ON LINE.
SWITCH PRESSED	WHEN THE PRINTER IS <u>OFF LINE</u>	
ON LINE	Changes to ON LINE.	Changes to ON LINE
NLQ	Changes print quality from Selected to Near Letter Quality and vice versa.	Changes print quality from Selected to Near Letter Quality and vice versa.
FF	If paper is <u>loaded</u>, Form Feed is performed. If paper is <u>not loaded</u>, in the 80-column and the 136-column printer, with less than 8.5", a Paper Auto Load is performed.	If paper is <u>loaded</u>, it is advanced one page length. If paper is <u>not loaded</u>, in the 80-column printer only, a Paper Auto Load is performed.
LF	Line Feed is performed Press the FF switch while holding the LF switch down to perform Line Feed in the backward direction.	Line Feed is performed Press the FF switch while holding the LF switch down to perform Line Feed in the backward direction.

Table 2-2 Summary of Operator Panel Switches

2.4 INSTALLING/REMOVING A RIBBON CASSETTE

Your printer uses either a monochrome or four-color ribbon cassette.

The monochrome ribbon must have support tabs as previously shown in Figure 1-2.

The optional color kit must be installed to print in color.

RIBBON CASSETTE NOTES:

Do not attempt to move the print head <u>if power is ON.</u> Power should remain ON if print data is in the printer waiting to be printed.

If power is OFF, slide the print head from side to side to ensure the ribbon advances.

2.4.1 Removing a Ribbon Cassette

Refer to Figure 2-2.

1. Open the soundproof, front and top covers. If power is OFF, move the print head to the center of the print line.

2. Remove the ribbon cartridge by pulling one of the cassette release levers towards the front of the printer.

3. Lift the cassette out of the printer.
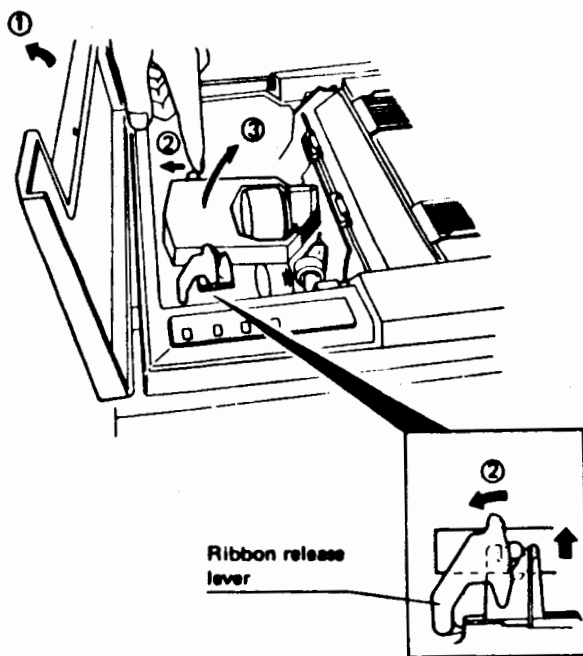
Figure 2-2 Removal of Ribbon Cassette

2.4.2 Installing a Ribbon Cassette

Take the ribbon cassette out of its package and remove the ribbon stop, as shown below in Figure 2-3.

Support tabs

(Monochrome ribbon cassette)   (Color ribbon cassette)
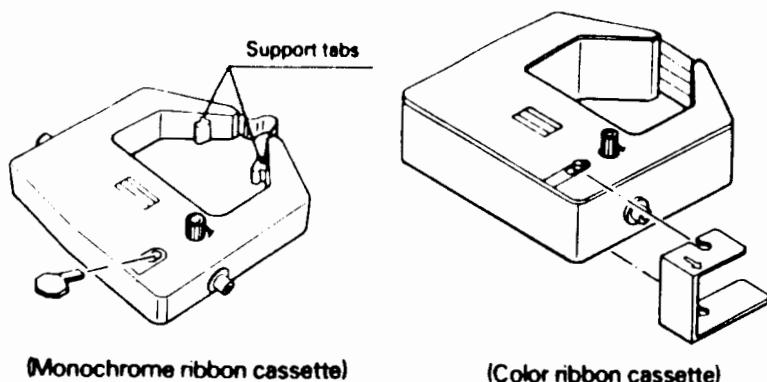
Figure 2-3 Removing the Ribbon Stop

If using a monochrome ribbon, ensure the support tabs are present on the cassette, as shown in Figure 2-4.

Rotate the ribbon advance knob, on the ribbon cassette, in the direction indicated by the arrow. This is done to remove ribbon slack.

NOTE:

Move the print head to the left side when the Sheet Feeder is installed.

Refer to Figure 2-4.

1. With the top cover open, insert the pins protruding from both sides of the cassette into the gaps between the ribbon release levers and the carriers.

NOTE:

Make sure that the ribbon is set between the print head and the card guide without a fold.

---

2. Press down lightly on the ribbon cassette while rotating the Ribbon Advance Knob, until you hear it click into a locked position.

Ribbon release lever

pin
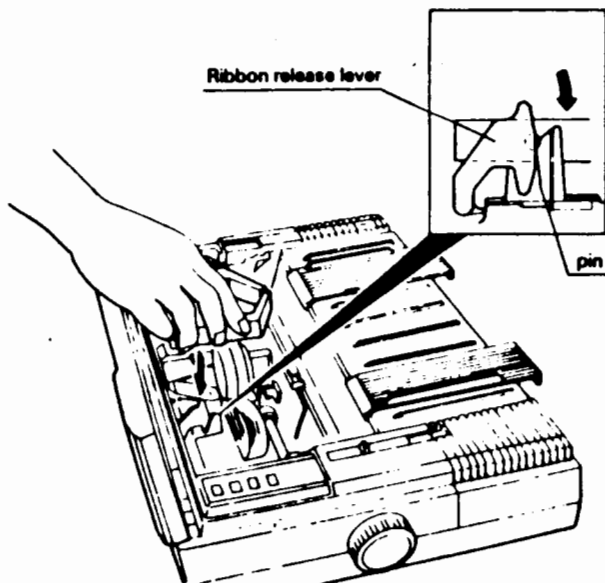
Figure 2-4 Installation of Ribbon Cassette

2.5 ADJUSTING PAPER THICKNESS

You can use up to 3-part paper in your printer.
Adjust the Paper Thickness Lever to change the gap
between the print head and the platen to correspond
to the number of copies and the thickness of paper
you are using.

The print head moves about 0.07mm (0.0027"),
towards or away from the platen, for each notch
position of the Paper Thickness Lever.

One notch difference corresponds to about one sheet
of paper.

Set the Paper Thickness Lever before loading paper.

Adjust the Paper Thickness Lever as follows:

Refer to Figure 2-5. Locate the Paper Thickness
Lever at the left side frame of the printer.
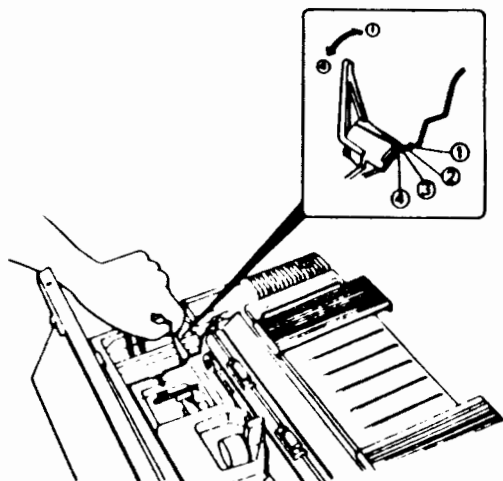
Figure 2-5 Paper Thickness Lever

Select an initial Paper Thickness Lever setting, using the values shown in Table 2-3 as a guide. The first notch position is the one nearest the platen.

Table 2-3 Paper Thickness Lever Settings

Type of Paper	Notch Position
Single part	2
Two part	2 or 3
Three part	3 or 4

When using thick paper, use a higher notch position number to allow for a wider gap, regardless of the number of sheets.

Total paper thickness may vary with the thickness of carbon paper and glue.

Adjust the Paper Adjust Lever to obtain the best print quality for the paper you are currently using (maximum form thickness is 0.011 inches).

If the printed characters appear faint, due to a wide gap, use a lower notch position number to decrease the size of the gap.

If the setting of the Paper Adjust Lever is too narrow:

> The ribbon may smear the paper as it is advanced.

If the setting of the Paper Adjust Lever is too wide:

> The images may be printed too light to read.

2.6 LOADING CUT SHEET PAPER

If you have been printing on continuous forms refer to paragraph 2.8 to change to cut sheet paper.

If you plan to run Self-Test, we recommend that you use continuous forms (more than 9" wide for the 80-column printer and more than 15" for the 136-column printer). Self-Test prints the maximum characters per print line and if printing occurs off the paper the print head and platen may be damaged.

2.6.1 Loading Cut Sheet Paper with Auto Load Function

The following procedures apply to both the 80-column and 136-column printers. When using the 136-column printer, use paper less than 8.5" wide.

1. Open the soundproof and the front cover.

2. Lift the Rear Cover to the vertical position as shown in Figure 2-6.

3. Move the Guides (on the Rear Cover) to help align the paper to the desired position.

   With the 80-column printer, set the bail rollers about 1" inward from the edges of the paper being loaded as shown in Figure 2-7.

   With the 136-column printer, set the left roller about 1" inward from the left edge of the paper and the right roller about 1" from the right edge of the paper, as shown in Figure 2-8.
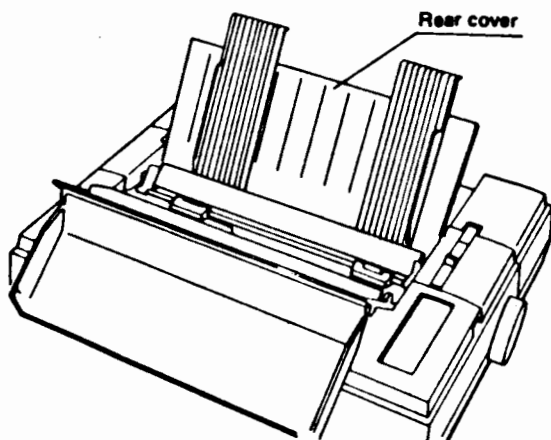
Figure 2-6 Setting the Rear Cover
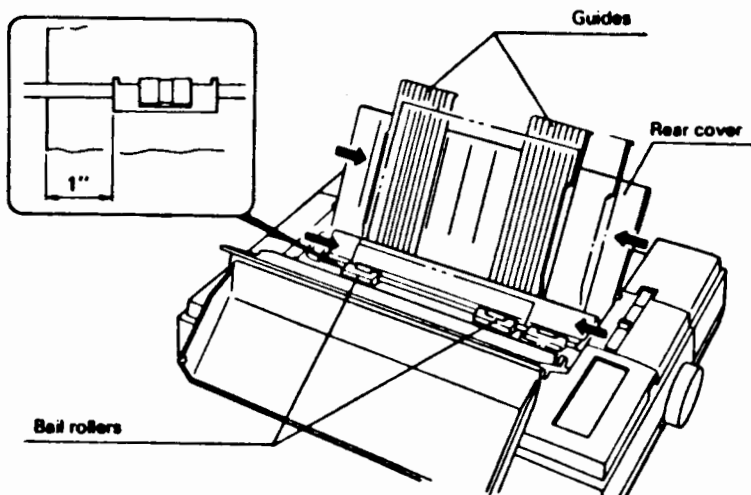
**Figure 2-7 Setting the Bail Rollers and Guides
(80-column Printer)**

Left

Right
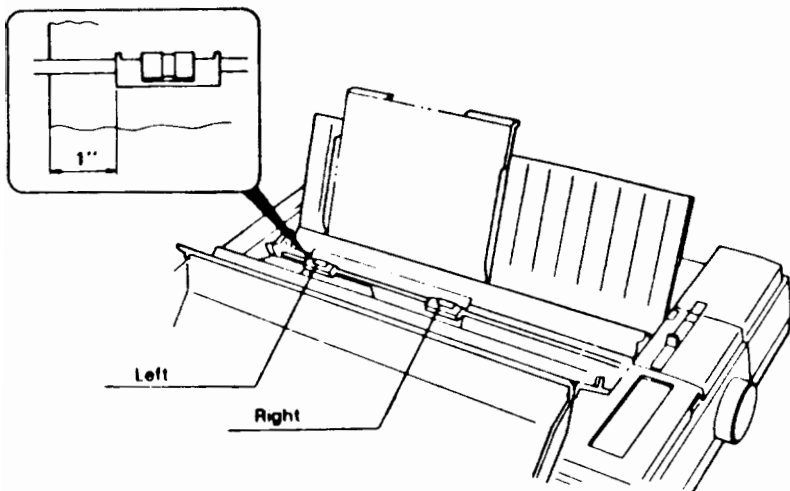
Figure 2-8 Setting the Bail Rollers
(136-column Printer)

4. If required, adjust the Paper Thickness Lever to
    correspond to the paper being loaded, refer to
    paragraph 2.5.

5. Close the covers. The soundproof cover should be
    against the Rear Cover, as shown in Figure 2-9.

6. Pull the Paper Release Lever towards the front of
    the printer (cut sheet paper mode) as shown in
    Figure 2-9.

    Turn the Power Switch ON.
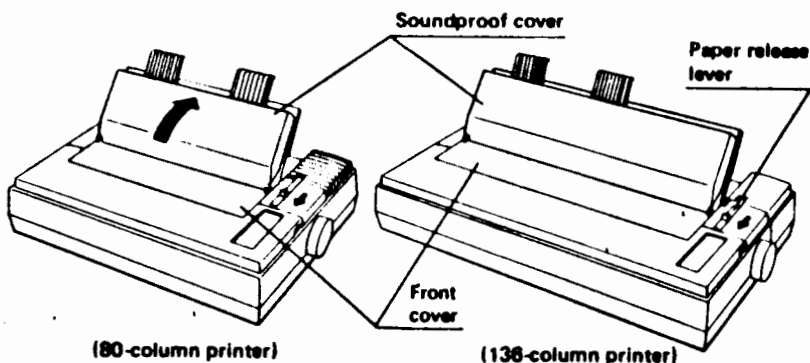
Figure 2-9 Closing the Covers

7. Place a sheet of paper into the Rear Cover. It
    will slide behind the Platen, see Figure 2-10. If
    the paper is not inserted correctly, a paper feed
    error or skewed feeding may occur.

NOTE:

Make sure that the cut sheet paper is neither
curled or damaged, because it may cause a
paper jam or misfeed.
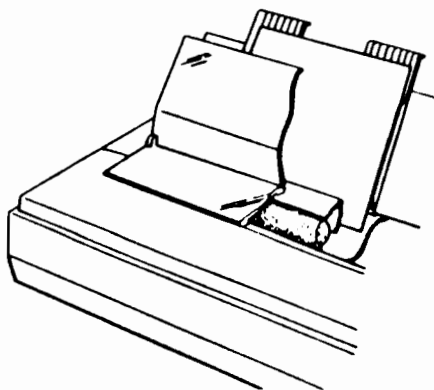
Figure 2-10 Placing the Paper

8. Press the FF switch. The print head moves into its paper load position, and the sheet of paper is automatically fed into the printer and advanced 1/6 on an inch below the leading edge of the form.

9. Press the ON LINE switch to set the printer to the ON LINE mode.

2.6.2 Manually Loading Cut Sheet Paper

When using paper more than 8.5" wide with the 136-column printer, use the following procedure.

1. Open the soundproof and the front cover.

2. Lift the Rear Cover to the vertical position and move the Guides (on the Rear Cover) to help align the paper to the desired position, see Figure 2-11.
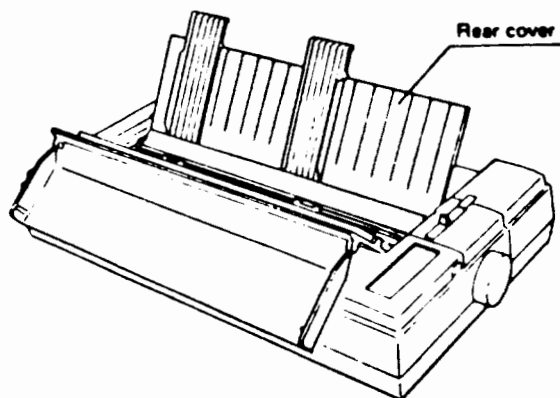
Figure 2-11 Setting the Rear Cover

3. If required, adjust the Paper Thickness Lever to correspond to the paper being loaded, refer to paragraph 2.5.

4. Pull the Paper Release Lever towards the front of the printer (cut sheet paper mode).

5. Place a sheet of paper into the Rear Cover. It will slide behind the Platen, see Figure 2-12.
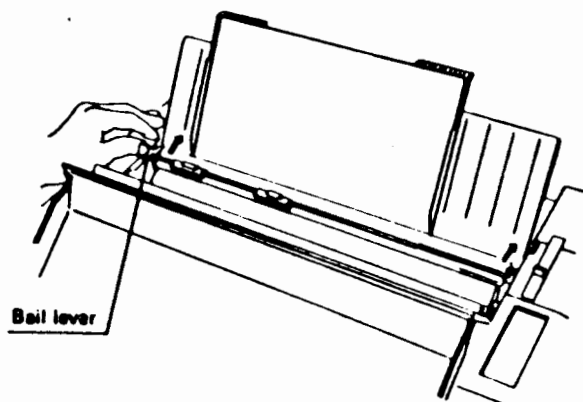
Figure 2-12 Loading Paper and Opening the Bail Rollers

6. Manually turn the Platen Knob in the direction shown by the arrow in Figure 2-13, until the paper is held between the platen and the bail rollers.
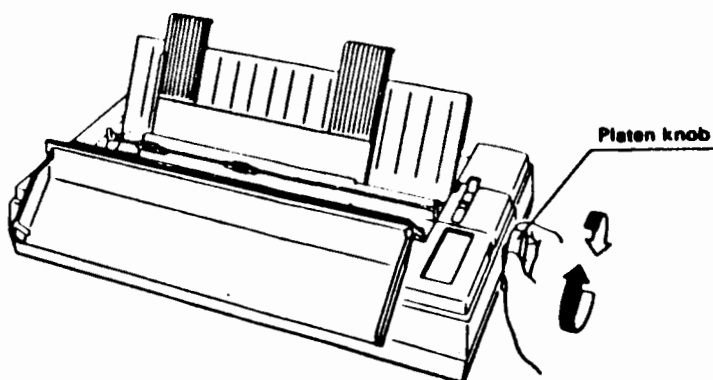
Figure 2-13 Loading the Paper

7. Set the left roller about 1" inward from the left edge of the paper and the right roller about 1" inward from the right edge of the paper, as shown in Figure 2-14. Close the bail rollers.

NOTE:

Make sure the paper is set between the Platen and the rollers.

Bail lever
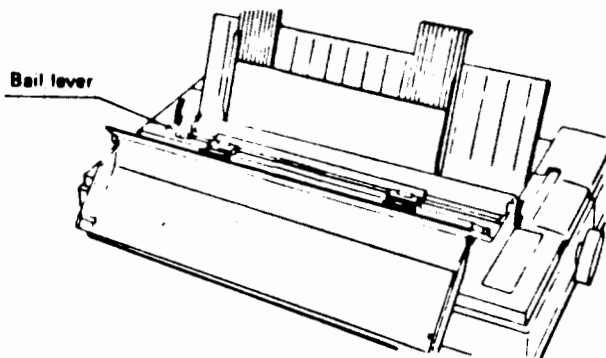
Figure 2-14 Setting the Bail Rollers

8. Close the covers. The soundproof cover should be against the rear Cover, as shown in Figure 2-15.

Soundproof cover
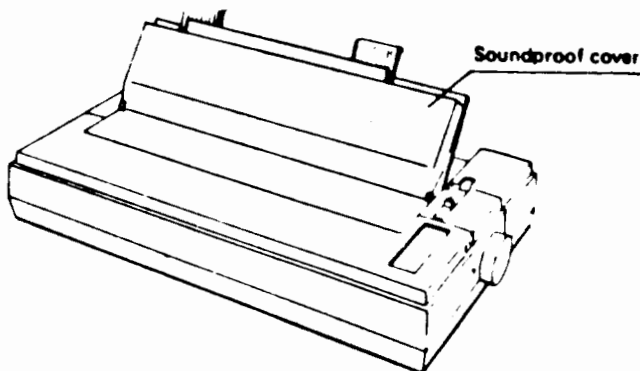
Figure 2-15 Closing the Covers

9. Press the ON LINE switch to set printer ON LINE.

2.7 LOADING CONTINUOUS FORM

If you plan to run Self-Test, we recommend that you use continuous forms (more than 9" wide for the 80-column printer, and more than 15" wide for the 136-column printer). Self-Test prints the maximum characters per print line and if printing occurs off the paper the print head and platen may be damaged.

Once you load continuous form into the printer, your printer makes it easy for you to change between cut sheets and continuous forms. See paragraph 2.8 if continuous forms are loaded in the form tractors.

The following procedures apply to both the 80-column and 136-column printers.

1. Open the soundproof cover and remove the Rear Cover as shown in Figure 2-16.

2. If required, adjust the Paper Thickness Lever to correspond to the paper being loaded, refer to paragraph 2.5.

(80-column printer)   (136-column printer)

Soundproof cover
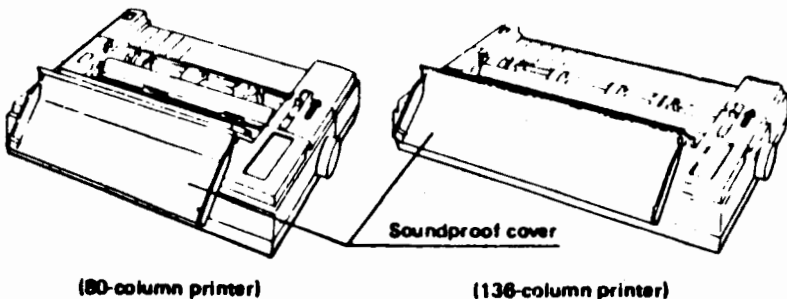
Figure 2-16 Loading Continuous Forms (1)

3. Push the Paper Release Lever towards the rear of
   the printer (Continuous Forms mode).

4. Set the bail rollers about 1" inward from the edges
   of the paper being loaded, as shown in Figure 2-
   17.

NOTE:

With the 136-column printer, it is not necessary
to set the bail rollers at this time.
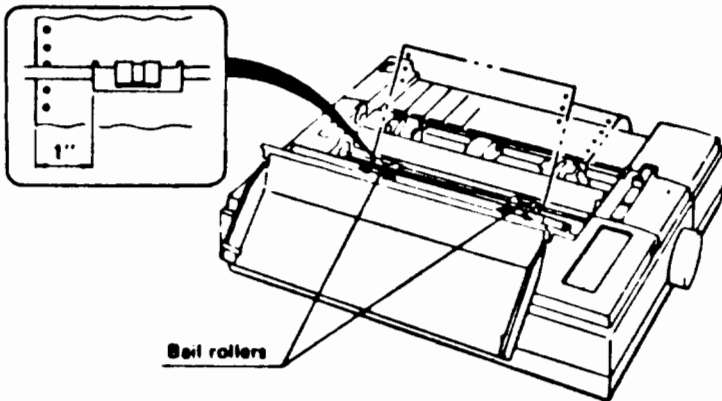
Figure 2-17 Setting the Bail Rollers
(80-Column Printer)

5. Before trying to move a form tractor, set the
   form tractor's lock lever towards the rear of the
   printer (into it's unlocked position), as shown in
   Figure 2-18. Slide the right forms tractor towards
   the right side of the printer (just to get it out of
   the way).

Forms tractor lock
lever
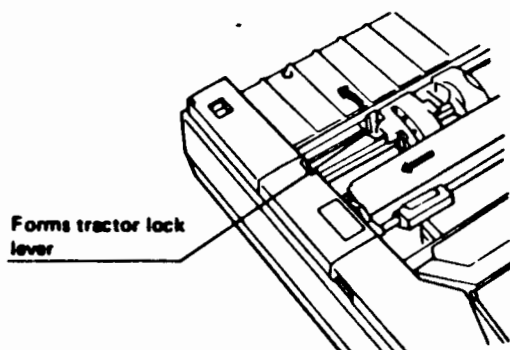
Figure 2-18 Unlocking the Forms Tractor

6. Place the left forms tractor at the approximate position for printing the left margin.

7. Lock the left form tractor into position by setting the tractor lock lever towards the front of the printer, as shown in Figure 2-19.
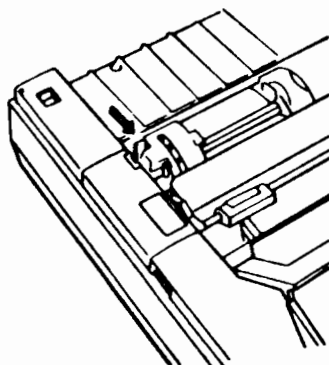
Figure 2-19 Loading Continuous Forms (2)

8. Open the paper holders on both tractors, as shown in Figure 2-20.

(80-column printer)   (136-column printer)
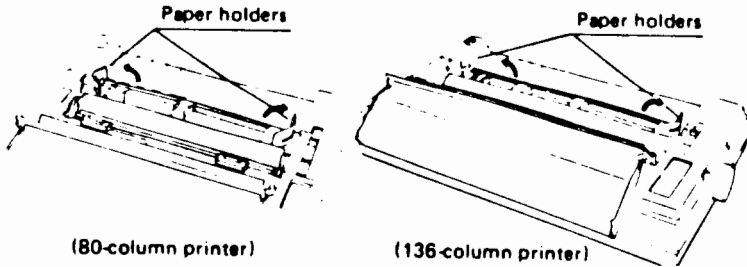
Figure 2-20 Opening the Tractor Paper Holders

9. Place the holes (down the left side of the form) over the pins on the left tractor and close the paper holder.

10. Move the right tractor under the paper. Place the holes (down the right side of the form) over the pins in the right tractor and close the paper holder.

   After moving the right tractor (and installed form), as required to remove slack from the paper, lock it by setting the lock lever towards the front of the printer.

   NOTE:

   Make sure the leading edge of the form is neither curled or damaged, because it may cause a jam.
   ---

11. With the 80-column printer:
   Confirm that the Power switch is ON, then press the FF switch. The print head moves into its forms load position and the form is automatically fed into the printer and advanced about 1 inch below the leading edge of the form.

With the 136-column printer:

a) Lift up the bail lever to open the bail rollers, as shown in Figure 2-21.
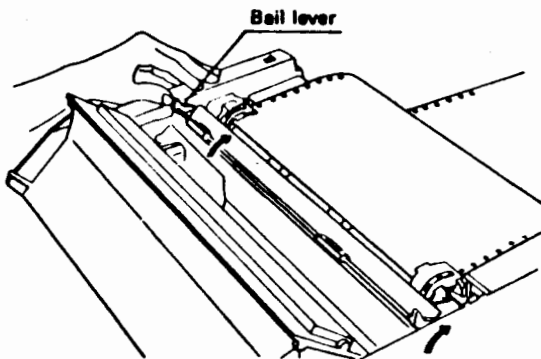
Figure 2-21 Opening the Bail Rollers

b) Manually turn the Platen Knob in the direction shown by the arrow in Figure 2-22, until the paper is held between the platen and the bail rollers.
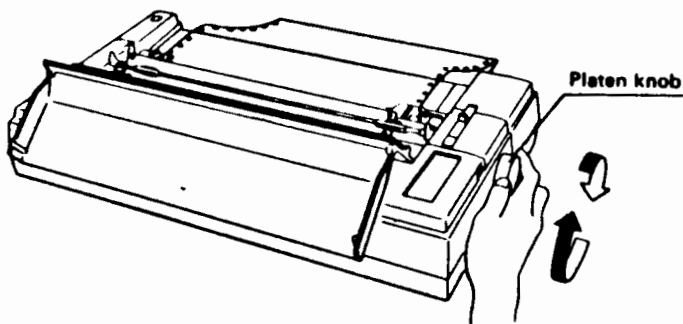
Figure 2-22 Loading the Paper

c) Close the bail rollers and set them as follows:

<u>Forms less than 8.5" wide</u> - Set the left roller about 1" inward from the left edge of the paper, and the right roller about 1" from the right edge of the paper, as shown in Figure 2-23.
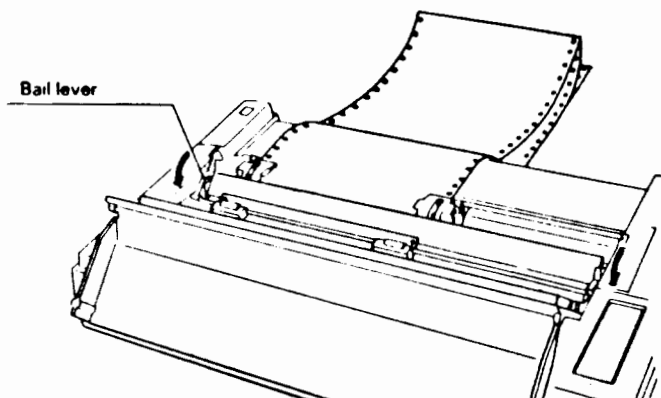
Figure 2-23 Forms Less than 8.5" Wide

<u>Forms more than 8.5" wide</u> - Set the left roller about 1" inward from the left edge of the paper, and the right roller about 1" inward from the right edge of the paper, as shown in Figure 2-24.
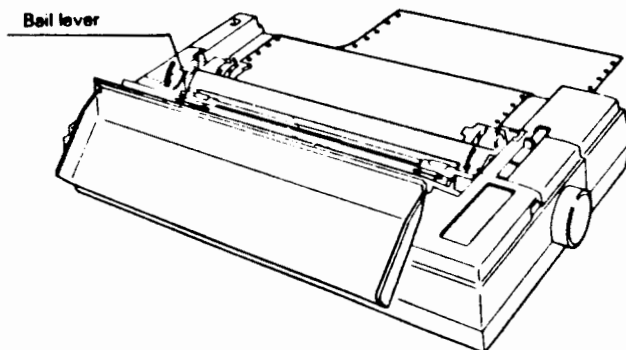
Figure 2-24 Forms More than 8.5" Wide

NOTE:

Make sure the paper is between the Platen and the rollers.

---

12. Replace the Rear Cover and close the front and the soundproof covers.

NOTE:

The Guides (on the Rear Cover) should be adjusted for the forms width.

---

13. Press ON LINE switch to set the printer ON LINE.

14. Continuous forms feed through the printer as shown in Figure 2-25.
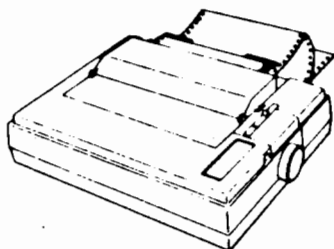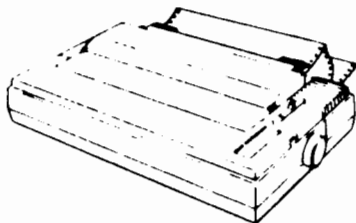
(80-column printer)   (136-column printer)

Figure 2-25 Feeding Continuous Forms

2.8 CHANGING FROM CONTINUOUS FORMS
TO CUT SHEETS

When continuous forms are in the printer, change to cut sheet paper as follows:

1. Retract the continuous form out of the platen, with the printer ON LINE and the Paper Release Lever pushed toward the rear of the printer, by pressing the FF switch (or by manually turning the Platen).

2. After pulling the Paper Release Lever towards the front of the printer and placing the Rear Cover in its vertical position, load cut sheet paper into the printer as described in paragraph 2.6.

NOTE:

The continuous form remains in the form tractors but does not move, when the Paper Release Lever is in the forward (Cut Sheet Paper) position.

Paper release lever
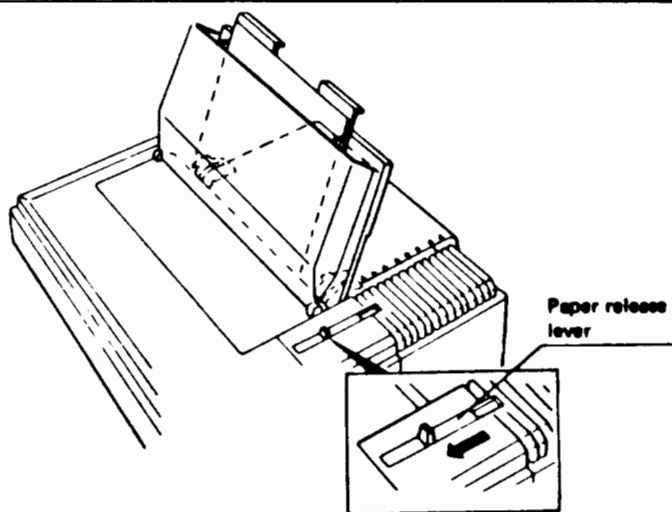
Figure 2-26 Continuous Forms to Cut Sheet Paper

2.9 CHANGING BACK TO CONTINUOUS FORMS

2.9.1 For the 80-Column Printer

When you have finished printing on cut sheet paper, change back to continuous forms as follows:

1. Place the Paper Release Lever in its rearmost position.

2. Press the FF switch. As described in paragraph 2.7 the continuous forms will automatically re-load.

2.9.2 For the 136-Column Printer

When you have finished printing on cut sheet paper, change back to continuous forms as follows:

1. Place the Paper Release Lever in its rearmost position.

2. Open the Soundproof cover.

3. Lift the Bail Lever to open the Bail Rollers, as shown in Figure 2-21.

4. Turn the Platen Knob manually to re-load the continuous forms.

> **NOTE:**
> Make sure the paper is between the Platen and the bail rollers.

5. Close the Bail Lever and if necessary, reset the Bail Rollers as previously described.

6. Close the Soundproof cover.

SECTION 3

DIP SWITCH FUNCTIONS

This section provides additional information on the default print functions selected by the switches installed on the Memory Circuit Board and the Serial Interface Circuit Board (the Parallel Interface Circuit Board does not have switches).

The printer emulates a DEC LA50 or Okidata 192/193+ Printers. Each emulation mode changes the function selected by some of the DIP switches.

The two position "slide" switch (SW3) on the Memory Circuit Board is set to "F" for DEC LA50 emulation, and set to "I" for Okidata 192/193+ emulation. Be sure the slide switch is correctly set before changing any DIP switch.

Refer to paragraph 1.7 for information on how to access these DIP switches.

Use a pointed object, like the tip of a mechanical pencil, to push a DIP switch ON or OFF.

If you change a DIP switch setting while power is turned ON there will be no change to the selected function until power has been turned OFF and then turned ON, or until an INIT command is received from the host system.

Functions selected by a DIP switch may be overridden by your application software.

We suggest you record the DIP switch settings that provide the best performance with your applications.

3.1 DEC TYPE MEMORY CIRCUIT BOARD DIP SWITCHES

DEC Type D, Memory Circuit Board DIP switch functions are described below.

Refer to paragraph 3.1.1 for DIP switch-1 functions.

Refer to paragraph 3.1.2 for DIP switch-2 functions.

Note that Okidata Memory Circuit Board DIP switch functions are described in paragraph 3.2 and Serial Interface Circuit Board DIP switch functions are described in paragraph 3.3 (the Parallel Interface Circuit Board does not have switches).

3.1.1 DEC Type - DIP Switch-1 (DEC LA50 Printer)

DIP Switch-1 - Position #1

Selects the printer's action at the right margin.

Table 3-1 DIP SWITCH-1 #1
DEC Type Emulation

Setting	Right Margin
OFF	Truncates Printing
ON	Wrap Around Printing

DIP Switch-1 - Position #2

Select the horizontal to vertical aspect ratio.

Table 3-2 DIP SWITCH-1 #2
DEC Type Emulation

Setting	Graphics Aspect Ratio
OFF	2.0 Horizontal to 1 Vertical
ON	2.5 Horizontal to 1 Vertical

DIP Switch-1 - Position #3

Enables or disables the Paper Out Detector as shown in Table 3-3. The Paper Out Detector is normally disabled to allow printing on the bottom 1" of cut sheet paper or on the last continuous form.

Table 3-3 DIP SWITCH-1 #3
DEC Type Emulation

Setting	Paper Out Detector
OFF	Enable Paper Out Detector
ON	Disable Paper Out Detector

With the Paper Out Detector underline disabled; when paper runs out:

    The PAPER OUT lamp lights
    *The printer stays in ON LINE mode
    The Buzzer will not sound
    *Printing continues

Operations marked with an "*" occur when continuous forms are used.

DEC Type Memory Circuit Board DIP Switches
(Continued)

DIP Switch-1 - Position #4

Selects RAM storage usage as shown in Table 3-4.

Table 3-4 DIP SWITCH-1 #4
DEC Type Emulation

Setting	RAM Storage Usage
OFF	All RAM storage is used for Data Input Buffer
ON	RAM storage is used as Scanning Buffer of four colors and Data Data Input Buffer.

When Switch 4 is Off, the RAM is selected as a Data Input Buffer. Print data from the host is loaded into the RAM and data transfer time is minimized.

When Switch 4 is On, the RAM is selected as the Color Scanning Buffer (and as a Data Input Buffer).

DIP Switch-1 - Positions #5, #6, #7 and #8

Selects an international character set as shown in Table 3-5. This allows the unique symbols in the selected language to be printed.

In Table 3-5:

Canadian is French Canadian.

Danish includes Norwegian.

Table 3-5 DIP SWITCH-1 #5, #6, #7, and #8
DEC Type Emulation

Selected Language	Switch Setting			
	#5	#6	#7	#8
U.S.A.	OFF	OFF	OFF	OFF
British	ON	OFF	OFF	OFF
Finnish	OFF	ON	OFF	OFF
French	ON	ON	OFF	OFF
Canadian	OFF	OFF	ON	OFF
German	ON	OFF	ON	OFF
Italian	OFF	ON	ON	OFF
Japanese	ON	ON	ON	OFF
Danish	OFF	OFF	OFF	ON
Spanish	ON	OFF	OFF	ON
Swedish	OFF	ON	OFF	ON

DEC Type - Memory Circuit Board DIP Switch-2

3.1.2 DEC Type - DIP Switch-2 (DEC LA50 Printer)

DIP Switch-2 - Position #1

Selects when the Printer's ON LINE operations are enabled.

When this switch is set ON, the ON LINE lamp is illuminated when power is turned ON, and all data sent to the printer is printed.

When this switch is set OFF, the ON LINE lamp still illuminates when power is turned ON, however, data is not printed until a DC1 control code is received by the printer. Any data sent prior to the DC1 control code will be ignored.

Table 3-6 DIP SWITCH-2 #1
DEC Type Emulation

Setting	Mode when Power is Turned ON
OFF	Enable ON LINE operations after DC1 Control Code received
ON	ON LINE operations enabled

Set this switch OFF if your host system issues a DC1/DC3 to select/deselect the printer.

DIP Switch-2 - Position #2

Enables or disables the Cut Sheet Paper Feeder. This switch must be set ON to enable the Cut Sheet Paper Feeder when it is installed. See Appendix C for additional information on the Cut Sheet Paper Feeder.

Table 3-7 DIP SWITCH-2 #2
DEC Type Emulation

Setting	Cut Sheet Feeder
OFF	No Cut Sheet Paper Feeder
ON	Cut Sheet Paper Feeder Installed

DIP Switch-2 - Position #3

Selects skipping 1" or printing over the perforation located at the end of each form (when continuous forms are used), as shown in Table 3-8.

Table 3-8 DIP SWITCH-2 #3
DEC Type Emulation

Setting	Skip Over Perforation
OFF	Disabled (Print over perforation)
ON	Enabled (Skip 1" at perforation)

Set this switch OFF if your host system or software causes a skip over the perforation.

DEC Type Memory Circuit Board DIP Switches
(Continued)

DIP Switch-2 - Position #4

Enables or disables a Line Feed to occur with each Carriage Return, as shown in Table 3-9.

Table 3-9 DIP SWITCH-2 #4
DEC Type Emulation

Setting	Line Feed with Carriage Return
OFF	Disabled (No LF with CR)
ON	Enabled (LF with CR)

Set this switch OFF if the host system or software causes a LF (Line Feed) code to be issued with each CR (Carriage Return) code.

3.2 OKIDATA TYPE MEMORY CIRCUIT BOARD DIP SWITCHES

Okidata Type Memory Circuit Board DIP switch functions are described below.

Refer to paragraph 3.2.1 for DIP switch-1 functions and paragraph 3.2.2 for DIP switch-2 functions.

Serial Interface Circuit Board DIP switch functions are described in paragraph 3-3 (the Parallel Interface Circuit Board does not have any switches).

3.2.1 Okidata Type - DIP Switch-1

DIP Switch-1 - Positions #1, #2, #3, and #4

Selects Page Length, as shown in Table 3-10.

Table 3-10 DIP Switch-1 #1, #2, #3, and #4
Okidata Type Emulation

Page Length in Inches	DIP Switch-1 Setting			
	#1	#2	#3	#4
*11" Page	ON	ON	OFF	ON
3" Page	ON	ON	OFF	OFF
3.5" Page	OFF	OFF	OFF	OFF
4" Page	OFF	OFF	ON	OFF
4.5" Page	ON	OFF	OFF	OFF
5" Page	ON	OFF	ON	OFF
5.5" Page	OFF	ON	OFF	OFF
6" Page	OFF	ON	ON	ON
7" Page	ON	ON	ON	OFF
8" Page	OFF	OFF	OFF	ON
8.5" Page	ON	ON	ON	ON
9" Page	ON	OFF	OFF	ON
10" Page	OFF	ON	OFF	ON
12" Page	OFF	OFF	ON	ON
13" Page	ON	OFF	ON	ON
14" Page	OFF	ON	ON	ON

* = Factory Setting.

Okidata Type Memory Circuit Board DIP Switches
(Continued)

DIP Switch-1 - Position #5, #6, #7 and #8

Selects international character set (Language unique symbols), as shown in Table 3-11.

Table 3-11 DIP Switch-1 #5, #6, #7 and #8
Okidata Type Emulation

Selected Language	DIP Switch-1 Setting			
	#5	#6	#7	#8
ASCII (∅)	*OFF	*OFF	*OFF	*OFF
ASCII (0)	ON	OFF	OFF	OFF
British	OFF	ON	OFF	OFF
German	ON	ON	OFF	OFF
French	OFF	OFF	ON	OFF
Swedish	ON	OFF	ON	OFF
Danish	OFF	ON	ON	OFF
Norwegian	ON	ON	ON	OFF
Dutch	OFF	OFF	OFF	ON
Italian	ON	OFF	OFF	ON
Canadian**	OFF	ON	OFF	ON
Spanish	ON	ON	OFF	ON
Japanese	OFF	OFF	ON	ON
ASCII (0)	ON	OFF	ON	ON
ASCII (0)	OFF	ON	ON	ON
ASCII (0)	ON	ON	ON	ON

* = Factory setting.
** = Canadian is French Canadian.

3.2.2 Okidata Type - DIP Switch-2

DIP Switch-2 - Position #1

Enables or disables the Paper Out Detector as shown in Table 3-12. The Paper Out Detector is normally disabled to allow printing on the bottom 1" of cut sheet paper or on the last form.

Table 3-12 DIP Switch-2 #1
Okidata Type Emulation

Setting	Paper Out Detector
ON	Enable Paper Out Detector
OFF	Disable Paper Out Detector

With Paper Out Detector <u>disabled</u>, when the paper runs out:

> The PAPER OUT lamp lights
> *The printer stays in ON LINE mode
> The Buzzer will not sound
> *Printing continues

Operations marked with an "*" occur when continuous forms are used.

DIP Switch-2 - Position #2

The Cut Sheet Paper Feeder option is enabled or disabled as shown in Table 3-13.

This switch must be set ON to enable the optional Cut Sheet Paper Feeder when it is installed.

See Appendix C for additional information on the Cut Sheet Paper Feeder option.

Okidata Type Memory Circuit Board DIP Switches
(Continued)

Table 3-13 DIP SWITCH-2 #2
Okidata Type Emulation

Setting	Cut Sheet Paper Feeder
OFF	No Cut Sheet Paper Feeder
ON	Cut Sheet Paper Feeder Installed

DIP Switch-2 - Position #3

Determines printer response to the DEL code (7F hex), shown in Table 3-14.

Table 3-14 DIP Switch-2 #3
Okidata Type Emulation

Setting	DEL Code Response
OFF	DEL code ignored
ON	DEL code printed as a block

DIP Switch-2 - Position #4

Determines printer response to the CR code, shown in Table 3-15.

Table 3-15 DIP Switch-2 #4
Okidata Type Emulation

Setting	CR Code Response
OFF	CR = CR
ON	CR = CR + LF

3.3 SERIAL INTERFACE BOARD DIP SWITCH

The DIP switch selections on the Serial Interface Board remain the same with either DEC or Okidata Type emulation. The only exception is DEC Type emulation does not support a 9600 baud rate.

DIP Switch - Position #1

Serial Interface Circuit Board DIP switch position #1 selects Protocol as Printer READY/BUSY or XON/XOFF, as shown in Table 3-16.

Table 3-16 SERIAL INTERFACE
DIP SWITCH #1

Setting	Data Protocol
OFF	Printer Ready/Busy Protocol
ON	XON/XOFF Protocol

DIP Switch - Position #2

Serial Interface Circuit Board DIP switch position #2 selects a 7-bit or an 8-bit data word length, as shown in Table 3-17.

Table 3-17 SERIAL INTERFACE
DIP SWITCH #2

Setting	Data Length
OFF	8-bit Data Word Length
ON	7-bit Data Word Length

Serial Interface Circuit Board DIP Switch (Continued)

DIP Switch - Position #3

Serial Interface Circuit Board DIP switch position #3 selects parity checking or no-parity checking, as shown in Table 3-18.

Table 3-18 SERIAL INTERFACE DIP SWITCH #3

Setting	Parity Checking
OFF	No-Parity Check
ON	Parity Check

DIP Switch - Position #4

If parity checking is enabled (DIP switch #3 ON), Serial Interface Circuit Board DIP switch position #4 selects even or odd parity, as shown in Table 3-19.

Table 3-19 SERIAL INTERFACE DIP SWITCH #4

Setting	Even or Odd Parity
OFF	Odd Parity
ON	Even Parity

DIP Switch - Position #5

Serial Interface Circuit Board DIP switch position #5 selects 1-stop bit or 2-stop bits in the data stream, as shown in Table 3-20.

Table 3-20 SERIAL INTERFACE DIP SWITCH #5

Setting	Number of Stop Bits
OFF	1-Stop Bit
ON	2-Stop Bits

CAUTION

Data must consist of 10 or 11 bits, i.e. a start bit, 7 or 8 data bits, a parity bit (or no parity bit), and 1 or 2 stop bits.

DIP Switch - Positions #6, #7, and #8

Serial Interface Circuit Board DIP switch positions #6, #7 and #8 select the Baud Rate (Data transmission rate) between the host system and printer, as shown in Table 3-21.

NOTE

A baud rate of 9600 is not supported in DEC Type (DEC LA50 Printer) emulation.

Serial Interface Circuit Board DIP Switch (Continued)

DIP Switch - Positions #6, #7, and #8 (Continued)

Baud rate is set as shown in Table 3-21

Table 3-21 SERIAL INTERFACE DIP SWITCH #6, #7 and #8

Selected Baud Rate	Switch Setting		
	#6	#7	#8
Undefined	ON	ON	ON
Note	ON	ON	OFF
4800	ON	OFF	ON
2400	ON	OFF	OFF
1200	OFF	ON	ON
600	OFF	ON	OFF
300	OFF	OFF	ON
200	OFF	OFF	OFF

Note: This setting is 9600 Baud in OKI Emulation and 110 Baud in DEC Emulation. 9600 Baud is not supported in DEC Type emulation.

SECTION 4

PRINTER CARE

This section describes a printer's initialization cycle, gives basic troubleshooting hints, explains cleaning and lubricating procedures. This section also describes how to repack the printer for storage or transport.

4.1 PRINTER INITIALIZATION

A printer initialization cycle occurs when:

1. The Power switch is turned ON
2. An INIT signal is received from the host system
3. When an Escape Code Sequence is received from the host system (ESC CAN in Okidata emulation and ESC c in DEC emulation).

A normal initialization cycle causes the printer to:

Perform a basic internal check on its circuits

Light the POWER lamp.

Move the print head to column one.

Enter the ON LINE mode (if paper is inserted).

Light the ON LINE lamp.

Read the DIP Switch settings and set the default print parameters.

Set the current print line as Top of Form.

Set the left margin at print position 1.

Clear previously stored download and data buffer information.

Self-Test will start if the LF (Line Feed) switch is held down while the Power switch is turned ON.

4.2 REMOVING A PAPER JAM

Refer to Figure 4-1.

1. Turn Power OFF and open the soundproof, front and top covers.

2. Push the Paper Release Lever towards the rear of the printer.

3. Place the Paper Thickness Lever into position 4 (away from the platen).

4. Place the print head at either end of the print line, or at a location where it does not interfere with removing the forms.

5. If using continuous forms, open the tractor's paper holders, remove the forms, and close the paper holders. Carefully pull the jammed forms or paper from the feed path. Try to avoid tearing the paper. While turning the Platen Knob, remove all scraps of paper from beneath the Platen.

6. Move the print head to the center of the print line.

7. Put the Paper Release Lever and the Paper Thickness Lever into their operating positions.

8. Insert fresh paper into printer and rotate the Platen Knob to advance the paper through the printer (Do not use the Auto Load function).

9. Close the covers and turn power ON.

4.3 CLEANING AND LUBRICATING

Operator maintenance is limited to cleaning the printer, ensuring there is lubrication on the print head carriage guide shaft, and cleaning the platen.

(Continuous forms)

(Cut sheet paper)
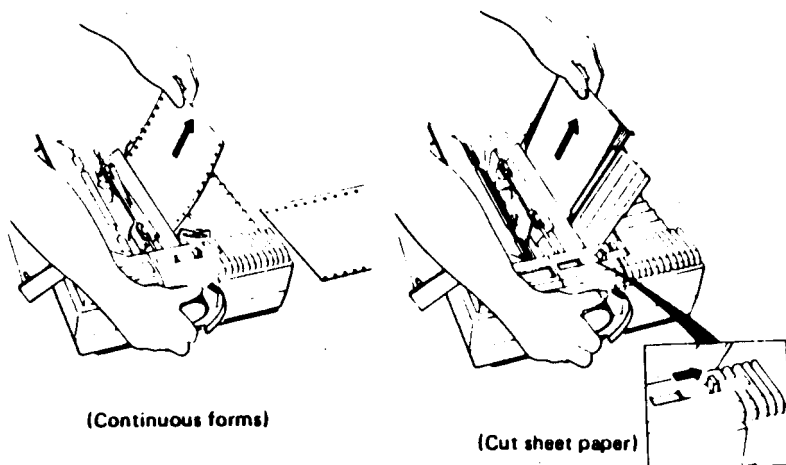
Figure 4-1 Removing a Paper Jam

CLEANING AND LUBRICATING NOTES:

Printer lubrication is generally not required and is best performed by a service technician.

Do not use alcohol to clean rubber parts (platen, rollers, etc.). Alcohol may cause rubber to harden.

Be sure the AC power cord is disconnected before cleaning or lubricating the printer.

Clean the outer surfaces of the printer with a soft cloth dampened with a mild detergent.

Remove accumulations of paper dust and particles, from the printer, with a small vacuum cleaner.

Clean the Platen by applying a dry cloth to it.

4.4 BASIC TROUBLESHOOTING

Your printer is designed to provide reliable operation. If it happens to malfunction use Table 4-1 to help identify and resolve the difficulty.

4.4 BASIC TROUBLESHOOTING (Continued)

Check your computer and application software manual for additional suggestions. If Self-Test performs correctly, you should check the interface connection and other elements in the system.

Table 4-1 Troubleshooting Hints

Symptom	Check
Power Lamp fails to light.	Power cord and connection. Fuse, replace if bad.
Printer fails to operate.	Circuit boards are installed, refer to paragraph 1.7.
Interface cable fails to connect.	Interface cable and circuit board, refer to paragraph 1.7 or 1.11.
Printer will not initialize.	Carriage for easy side to side movement. Power cord and connection. Memory Circuit Board.
Paper feed problem.	Paper path for obstruction. Forms tractor for correct side to side settings. Paper Release Lever for correct location.
Print is light.	Ribbon, replace if worn. Paper thickness control lever.
Printed characters have voids or vary in darkness.	Paper, ribbon and platen. Paper thickness control lever. Print head wear causing missing dots.

Symptom	Check
Poor print quality.	Paper Thickness Lever and ribbon cassette.
Will not print.	Check DIP switch 2-1 (Only with DEC Type emulation). If the Paper Out lamp is lit, check the paper path and sensor. If the ribbon is correctly installed between the print head and platen. Print head cable and connection. Also check the interface cable and connection.
Wrong characters printed.	DIP switch settings. Host system Control code or Data code may not agree with the printer's DIP switch settings.
Ribbon breaks or jams.	Installation of ribbon and Paper Thickness Lever.
Extra line feed, or no line feed.	DIP Switch-2 #4 for Line Feed and Carriage Return control see Section 3.
Paper jam.	Turn the Power switch OFF, push the Paper Release Lever towards rear of printer, and carefully pull the paper out of the paper path.
Continuous Alarm.	Position F of Emulation Switch (SW3) is invalid with parallel interface board installed.

4.5 REPLACING THE FUSE

The fuse replacement procedure is as follows:

1. Unplug the power cord. Turning the Power Switch to OFF is not sufficient.

2. Turn the fuse holder counterclockwise, while pushing it with a screwdriver to spring-out the fuse holder. Then remove the fuse holder with the fuse.

3. Replace the fuse, if defective, with one of the same type and rating.

4. Reinstall the fuse holder into its socket.
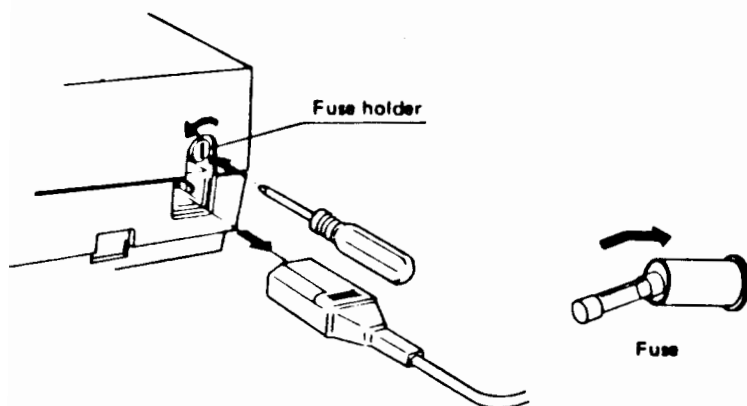
Figure 4-2 Replacing the Fuse

4.6 REPACKING YOUR PRINTER

Refer to Figure 1-1.

Use the carton and packing material supplied with the printer if you have to store or transport your printer.

Turn computer and printer Power OFF.

Remove the interface cable, power cord, and ribbon cassette. Place these items into plastic bags.

Clean the printer, if required.

Position the print head at the center of the print line and install the shipping restraint to prevent the print head from moving. See paragraph 1.3.

Close the front and top covers. Insert the support material into the soundproof cover, and tape it to the printer as shown in Figure 4-3.
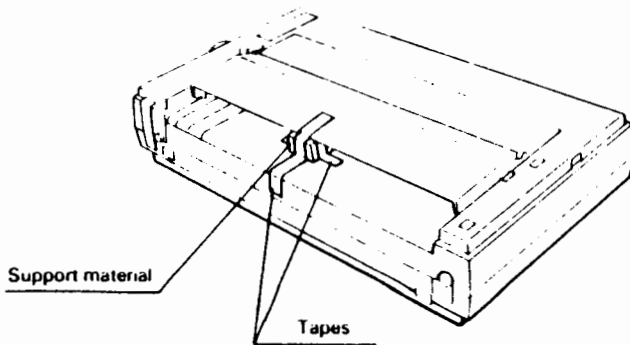
Figure 4-3 Taping Support Material to Printer

4.6 REPACKING YOUR PRINTER (Continued)

Put the printer into its plastic bag.

Install the polystyrol pads on each side of the printer and slide it into the shipping carton.

Place the printer accessories inside the open spaces between the printer and the shipping carton.

Close and secure the flaps on the shipping carton.

APPENDIX A

COLOR KIT INSTALLATION

A.1 OPTIONAL COLOR KIT

The optional color unit can be ordered when you order your printer, and is also available as a separate item.

If the color kit is ordered with the printer it will be shipped with the printer, for you to install.

The color kit includes:

Ribbon Shift Unit - shifts the four-color ribbon cassette to place the selected color in front of the print head.

Ribbon Cassette - contains a four-color ribbon (black, blue, red and yellow).

A.2 INSTALLATION OF COLOR KIT

Proceed as follows to install the color kit.

1.   Make sure the your computer and the printer are turned OFF.

2.   Open the top cover and remove the ribbon cassette.

Refer to Figure A-1.

3.   Slide the carrier frame to the right side and loosen the two screws on the carrier frame.

4.   Insert the color kit's flat cable into the space between the print head and the carrier frame.

5.   Install the color kit and tighten the two screws.
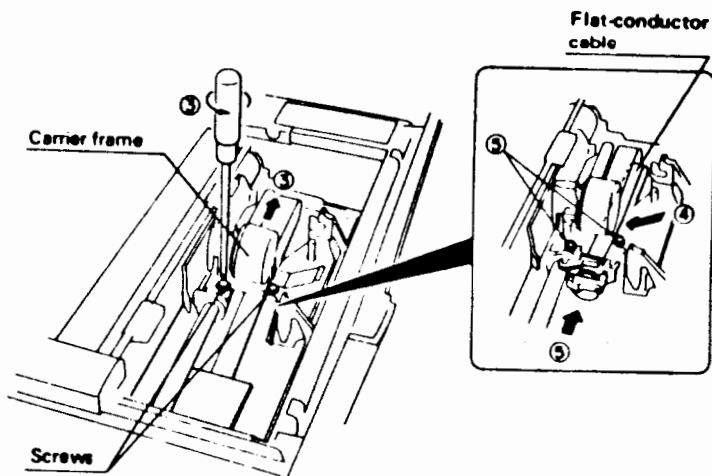
Figure A-1 Installation of Color Kit (1)

Refer to Figure A-2.

6.   Slide the connector cover towards the right side and remove it.

7.   After unlocking the connector (for the color kit), insert the flat-conductor cable into the connector. Lock the connector and attach the connector cover.

Install the color ribbon cassette, as described in paragraph 2.2.

This completes the installation of the color unit.

Connector cover

Flat-conductor cable

Connector for
color kit

Connector for
head

Locked position

Unlocked position
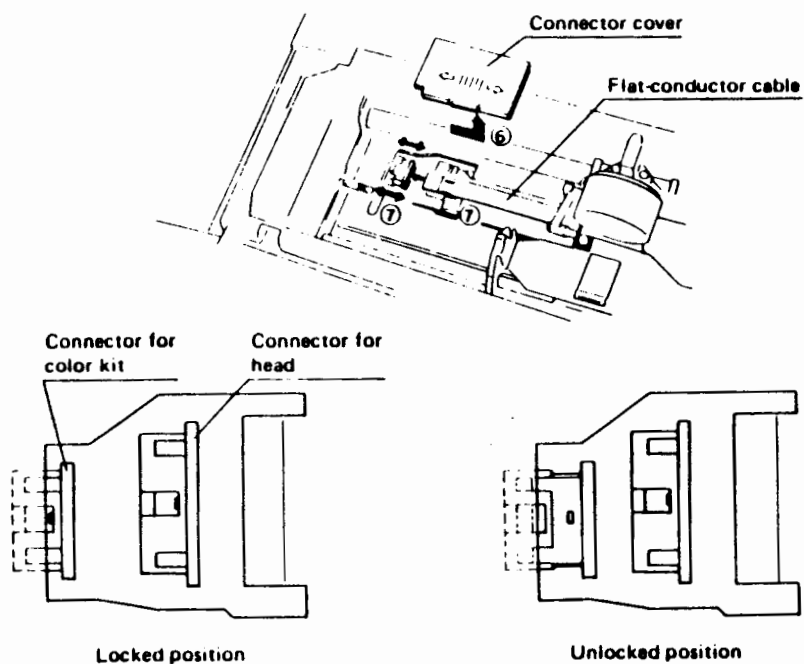
Figure A-2 Installation of Color Kit (2)

APPENDIX B

CIRCUIT BOARDS

B.1 EXCHANGEABLE CIRCUIT BOARDS

Refer to paragraph 1.7 for summary information on the installation of circuit boards.

This printer allows the user to exchange the Interface Circuit Board and the Memory Circuit Board. These boards are located beneath the Card Cover at the right rear corner of the printer.

An Interface Circuit Board contains either a RS-232C Serial or a Centronics Type Parallel Interface. The board contains the interface circuits and the interface cable receptacle (which is exposed at the rear of the printer). The Serial Interface Board has DIP switches, the Parallel Interface Board does not have switches.

The Memory Circuit Board contains RAM and ROM memory, the two-position slide switch (set to establish emulation type), and two DIP switches (set to establish default print parameters).

RAM Memory Circuit Boards are offered:

   With 8K bytes of RAM Memory

   With 16K bytes of RAM Memory

At least 8K bytes of RAM Memory is recommended before installing an optional Color Kit.

With the 80 column printer, 2.4K bytes of RAM is installed on the Main Circuit Board for the use by the user. With the 136 column printer, this RAM is used for addressing the additional print columns.

B.2 INSTALLATION OF A CIRCUIT BOARD

Proceed as follows to install a Circuit Board.

Make sure the power switch is turned OFF.

Refer to Figure B-1.

1. Loosen the Card Cover holding screw with a screw driver or coin.

2. Remove the cover by sliding it rearward while raising it upward.

3. Carefully align the circuit card into its guide slots and push it downward until the connector is fully seated.

4. If installing an Interface Board, tighten the mounting screw to ensure an electrical ground.

5. Install the Card Cover and fasten the holding screw.
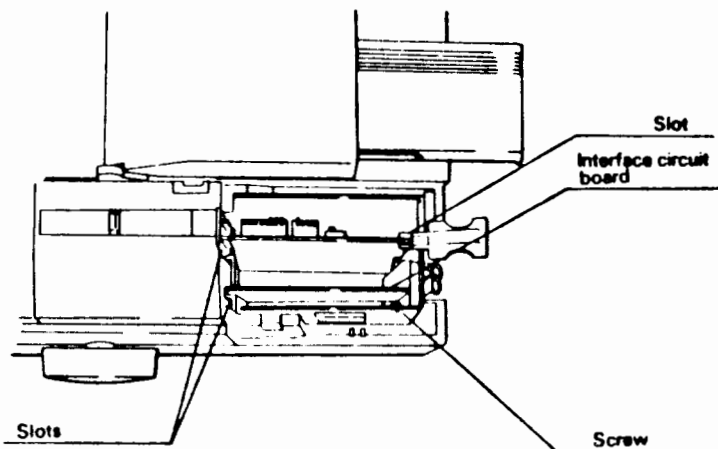
Figure B-1 Circuit Board Installation

APPENDIX C

CUT SHEET PAPER FEEDER

An optional Cut Sheet Paper Feeder is available from your dealer. This section gives the model numbers of the currently supported Cut Sheet Paper Feeders. Installation and operation information is also given.

C.1 SUPPORTED MODELS

Your printer can be equipped with the following Single Bin Cut Sheet Paper Feeder model numbers.

ASF300-FJ2101   For the 80-column printer

ASF300-FJ2201   For the 136-column printer

These Cut Sheet Paper Feeders are produced by BDT (Buro und Datentechnick).

Consult your dealer for additional performance data on available Cut Sheet Paper Feeders.

C.2 CUT SHEET PAPER FEEDER INSTALLATION

1.   Turn OFF the printer Power Switch.

2.   Open the soundproof, front and top covers.

3.   Push downward on the rear end of the Cut Sheet Paper Feeder cover and then remove the cover by raising it upward, as shown in Figure C-1.
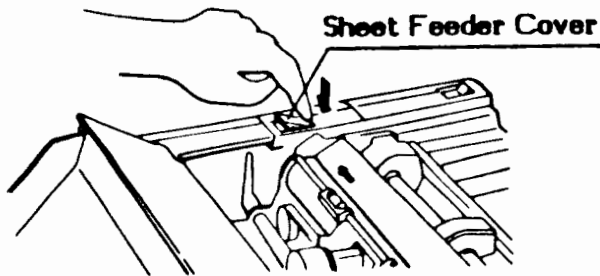
Figure C-1 Remove Cut Sheet Paper Feeder Cover

4.   Remove the rear cover.

5.   Refer to Figure C-2.   Remove the Bail Roller
      Unit by rotating it towards the front of the
      printer, to snap it out, and then pull it upwards,
      to remove it.
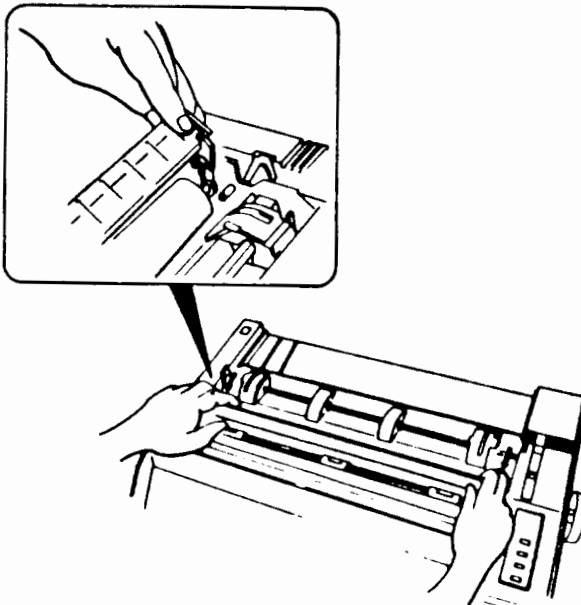
Figure C-2 Removing the Bail Roller Unit

6. Set DIP Switch-2 #2 ON, to enable the Cut Sheet Paper Feeder (refer to paragraph 1.8, or Section 3).

NOTE

On Okidata Type emulation, ensure DIP Switch-1 positions #1, #2, #3 and #4 are set to the paper length to be used in the Feeder.

---

7. Re-install the rear cover and move the Guides to the center of the cover, as shown in Figure C-3.
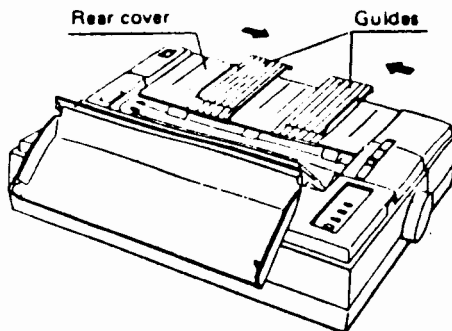
Figure C-3 Install the Rear Cover

8. Remove the Cut Sheet Paper Feeder from its package and remove the Paper Stacker from the Cut Sheet Paper Feeder, as shown in Figure C-4.

9. Install the Cut Sheet Paper Feeder on the printer, so the Sheet Feeder's clamps fit over studs on the printer as shown in Figure C-5.
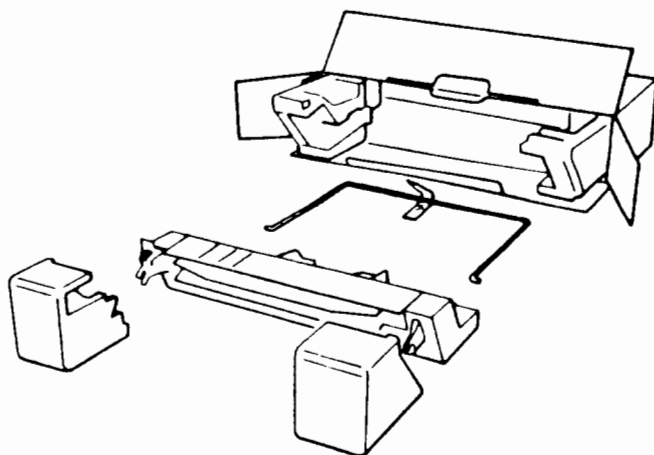
Figure C-4 Unpacking the Cut Sheet Paper Feeder
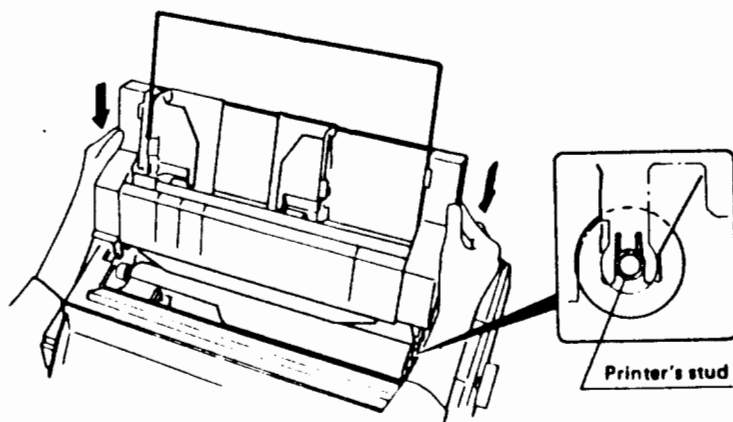
Figure C-5 Installation of Cut Sheet Paper Feeder

Printer's stud

10 Put the printer's front covers against the front
    face of the Cut Sheet Paper Feeder and set the
    Paper Release Lever towards the front of the
    printer, see C-6.
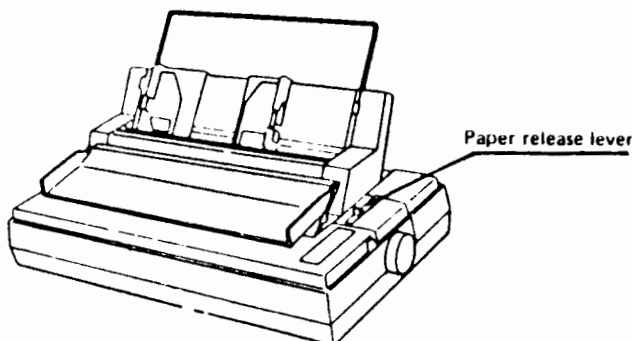
Figure C-6 Setting the Front Cover

11. Turn on the Power Switch.

C.3 LOADING PAPER

1. Place the Paper Stacker for the length of paper
    being used, into the holes in the Cut Sheet Paper
    Feeder.

2. Push the Sheet Feeder's tabs, by gripping the
    whole part, and open the paper bin, refer to
    Figure C-7.

3. Adjust the width of the bin for the paper being
    used.
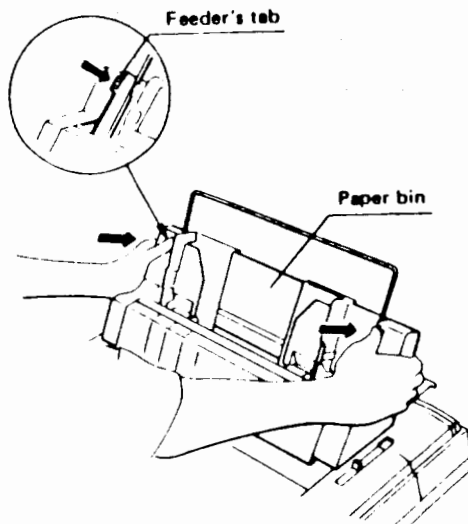
Figure C-7 Opening the Paper Bin

NOTE

Do not try to open the paper bin as shown below in Figure C-8
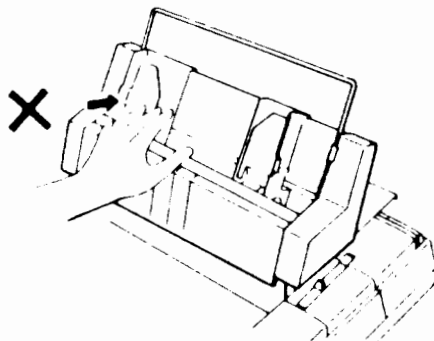
Figure C-8 Prohibited Operation

4.   Fan the cut sheet paper as shown in Figure C-9,
     and align the edges before placing it in the Paper
     Stacker.

     Letterhead paper is loaded with the printed face
     towards the rear of the bin and with the top edge
     down.
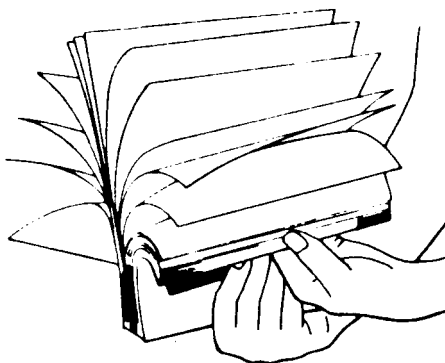
Figure C-9 Fanning the Paper

5.   Close the paper bin by pushing the Paper Stacker
     and clamp as shown in Figure C-10.
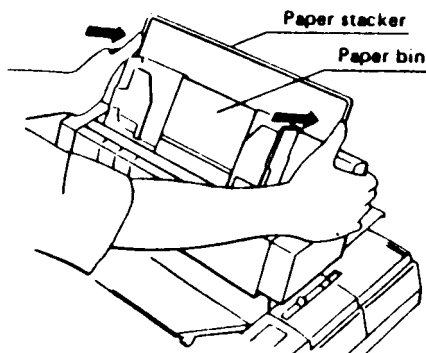
Figure C-10 Closing the Paper Bin

7. Press the FF switch to feed the first sheet of
    paper to the first print line (Top of Form).

    The printer will feed subsequent sheets to this
    same Top of Form position.

C.4 OPERATION

Cut Sheet Paper will advance through the printer:

When a paper feed command is received from the
host system.

When the Platen knob is turned.

When the LF (Line Feed) switch is pressed on the
Operator Panel, when the printer is OFF LINE.

Loaded cut sheet paper is ejected from the Sheet
Feeder when the FF switch on the Operator Panel is
pressed.

If the paper bin runs out of paper, the "PAPER OUT"
lamp, on the Operator Panel, will light.

To resume printing after a Paper Out condition:

Insert paper into the empty bin (paragraph C.3).

Press the FF switch on the Operator Panel.

Paper will load and the "PAPER OUT" lamp will
go out.

Press the ON-LINE switch to continue printing.

C.5 CUT SHEET FEEDER REMOVAL

1. Turn off the Power Switch and open the front cover.

2. Pull the Cut Sheet Paper Feeder upward and lift it off the printer, as shown in Figure C-11.
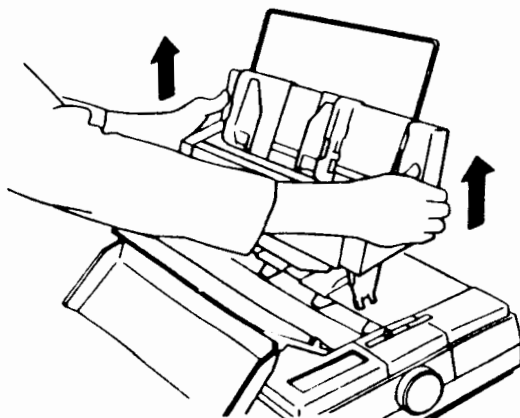
Figure C-11 Removing the Cut Sheet Paper Feeder

3. Remove the Rear Cover.

4. Install the Bail Roller Unit as follows:

a) Set the slot of the Bail Roller Unit onto the studs which support the Platen, as shown in Figure C-12.

b) Rotate the Bail Roller Unit in the direction shown in Figure C-13, until it is locked into place by the printer's front studs.

c) Disable Sheet Feeder operations by setting DIP Switch-2 position #2 to the OFF setting.

d) Reinstall the Rear Cover, and the Cut Sheet
    Paper Feeder Cover, and close the soundproof,
    top and front covers.
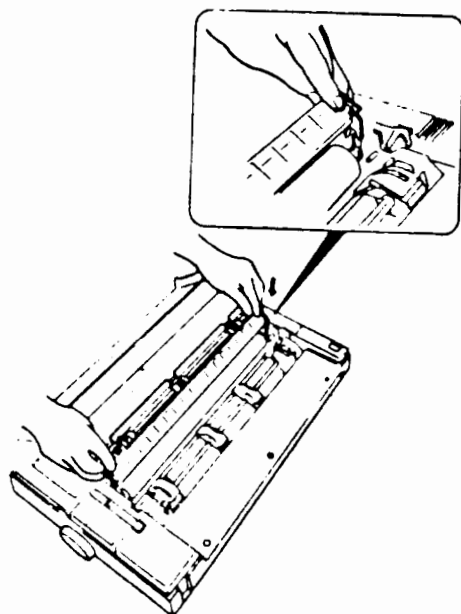
Figure C-12 Installation of Bail Roller Unit
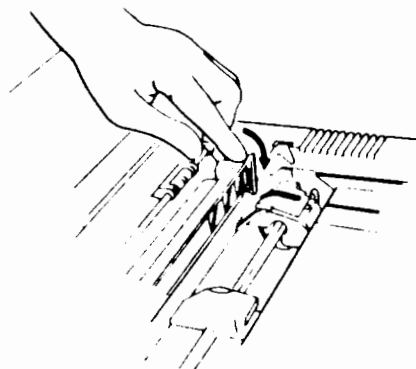
Figure C-13 Latching the Bail Roller Unit

C.6 PAPER SPECIFICATIONS

1.   Paper dimensions are shown below:

	FJ2101 (80-Column)	FJ2201 (136-Column)
Maximum Length	12" (305mm)	12" (305mm)
Minimum Length	5" (127mm)	5" (127mm)
Maximum Width	8.5" (216mm) (A4 Portrait)	14.4" (365mm) (B4 Landscape)
Minimum Width	5.7" (145mm)	5.7" (145mm)

2.   Paper weight:

Maximum Paper Weight is 20 lbs (81 g/m^2)

Minimum Paper Weight is 15 lbs (60 g/m^2)

Refer to the Operator's Manual ASF300-FJ2101/2201, in the Cut Sheet Paper Feeder package for additional details.

APPENDIX D

PRINTER SPECIFICATIONS

Print Method:

Impact dot matrix with a 9-wire print head

Printing Speed:

Draft Quality mode prints 270 characters per second at 10 CPI and 324 characters per second at 12 CPI

Condensed mode prints 231 characters per second at 17.1 CPI

Near Letter Quality mode prints 54 characters per second at 10 CPI

Line Feed Speed:

100 milliseconds at 6 lines per inch

Form Feed Speed:

4 inches per second

Character Matrix (Horizontal X Vertical):

Draft Quality is 9 X 7 dots

Near Letter Quality is 18 X 16 dots

Character Set

DEC LA50 or Okidata 192/193+ Type Emulation:

266 total printable characters
(94 ASCII, 81 Multi-national, 63 JIS Katakana, 27 Special Graphics and 1 error indicator).

Downloadable Characters (Resident RAM)

As described in Appendix J and K.

Character Spacing

DEC Type Emulation:
   1/10", 1/12", 1/16.5"

Okidata Type Emulation:
   1/10", 1/12", 1/17.1"

Print Line

80-column Printer:
   80 Characters per line at 10 CPI
   96 Characters per line at 12 CPI
   132 Characters per line at 16.5 CPI
   137 Characters per line at 17.1 CPI

136-column Printer:
   136 Characters per line at 10 CPI
   163 Characters per line at 12 CPI
   224 Characters per line at 16.5 CPI
   233 Characters per line at 17.1 CPI

Line Spacing:
1/6", 1/8", 7/72", n/72" or n/216"

Number of Copies:
Up to 3, including the original

Forms
80-column Printer:
Up to 0.011" thick
4" (101.6mm) to 10" (254mm) wide with Cut Sheet Paper
4" (101.6mm) to 10.5" (266.7mm) wide with Continuous Forms

136-column Printer:
Up to 0.011" thick
4" (101.6mm) to 15" (381mm) wide with Cut Sheet Paper
4" (101.6mm) to 16.5" (420mm) wide with Continuous Forms

Ribbon:
Monochrome fabric ribbon or 4-color fabric ribbon in an easily installed cassette

Paper Handling:
Friction feed platen and rear feed continuous forms tractors are standard

Auto Load:
Auto Load with cut sheet paper less than 8.5" wide on both the 80- and 136-column printers

The 80-column printer will also Auto Load continuous form, (which is not available on the 136-column printer)

Interface:

Mounted on user exchangeable circuit board

Centronics Type Parallel and RS-232C Serial Interface Circuit Boards are available

Note: DEC Type emulation does not function with the parallel interface.

AC Power:

100V AC to 120V AC ±10%, 50/60 Hz

or

220V AC to 240V AC ±10%, 50 Hz

Operating Environmental Requirements:

5°C to 38°C, 10% to 90% RH

Storage Environmental Requirements:

-20°C to 60°C, 50% to 95% RH

Physical Dimensions:

80-column Printer:

Height:	4.7 inches (120mm)
Width:	17.2 inches (438mm)
Depth:	13.6 inches (345mm)
Weight:	20.2 pounds (9.2Kg)

136-column Printer

Height:	4.7 inches (120mm)
Width:	22.8 inches (580mm)
Depth:	13.6 inches (345mm)
Weight:	25.7 pounds (11.7Kg)

APPENDIX E

PARALLEL INTERFACE

Your printer has a user exchangeable interface circuit board. A RS-232C Serial or Centronics Type Parallel Interface Circuit Board is presently available. Refer to paragraphs 1.7 and 1.11 for additional information.

When an interface board is installed in the printer its connector is exposed through an opening at the rear of the printer.

This Appendix describes the Parallel Interface and Appendix F describes the Serial Interface.

E.1 PARALLEL INTERFACE OVERVIEW

Most variations of the Centronics Type Parallel Interface can be supported by these printers.

Note: Selection of DEC Type emulation with a parallel interface installed is invalid and will result in continuous sounding of the printer's alarm.

The interface connector plug, for the cable, is an Amphenol-DDK (57FE-30360) or equivalent.

Figure E-1 illustrates the connector layout.
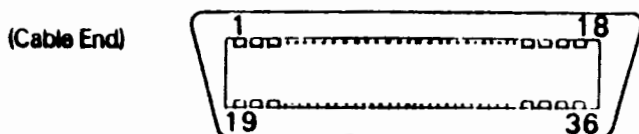
Figure E-1 Parallel Interface Connector Layout

E.2 PARALLEL INTERFACE PIN ASSIGNMENTS

Table E-1 lists the Centronics Type Parallel Interface signals, gives the signal and return pin numbers, and defines each signal.

Table E-1 Centronics Type Parallel Interface Signal Definitions

Signal Name	Signal Pin #	Return Pin #	Signal Definition
-DSTB* (-Data Strobe)	1	19	Low level pulse of 0.5 micro-second, used to strobe the DATA signals into the printer. The printer reads the data bus at the Low level of this signal. Ensure an -Acknowledge has been returned before issuing the next -Data Strobe. -Data Strobe is ignored if BUSY is high.
DATA 1* DATA 2* DATA 3* DATA 4* DATA 5* DATA 6* DATA 7* DATA 8* tt	2 3 4 5 6 7 8 9	20 21 22 23 24 25 26 27	8 data lines from the host. High level represents binary 1, Low level represents binary 0. DATA 8 is the most significant bit. Signal must be High at least 0.5 microsecond before the falling edge of the -Data Strobe signal and held 0.5 microsecond after the rising edge.
-ACK (-Acknowledge)	10	28	Low level pulse of 2 to 6 micro-seconds indicates input of a character into the print data buffer, or the end of an operation (i.e. indicates printer has received data and is ready for the next input).
BUSY	11	29	High level indicates printer cannot receive data. Typical conditions that cause a High BUSY level are buffer full or ERROR condition.

* = Signal generated by the host system.

Signal Name	Signal Pin #	Return Pin #	Signal Definition
PE (Paper Empty)	12		High level indicates the printer is out of paper.
SLCT (Select)	13		High level indicates the printer is ON-LINE (Selected).
-AUTO FEED XT*	14		Low level indicates LF (Line Feed) occurs after each CR (Carriage Return) code.
No Connection	15		Reserved signal line.
Signal Ground (SG)		16	Logic/Signal ground level (0 Volts).
Frame Ground (FG)		17	Printer Cabinet/Frame ground line.
No Connection	18		Reserved signal line.
Signal Ground (SG)		19/30	Twisted pair cable return lines.
-INIT* (-Initialize)	31		Low level pulse of 50 micro-seconds or more, resets the buffer and initializes the printer.
-ERROR	32		Low level indicates the printer is OFF-LINE, has a PAPER OUT or has sensed an ERROR condition.
Signal Ground (SG)	33		Logic/Signal ground level (0 Volts),
No Connection	34		Not used
+5 Volts Regulate	35		Connected to the +5 Volt source through a 3.3K Ohm resistor.
-SLCT IN* (-Select In)	36		Low level indicates the printer is placed ON LINE (Selected) when Power is turned ON.

* = Signal generated by the host system.

E.3 PARALLEL INTERFACE SIGNAL TIMING

The timing relationship of the handshake (or protocol)
signals in the Centronics Type Parallel Interface is
given in Figure E-2.

```
DATA 1-8  _____┌──────────┐_____

DSTB      ─────────┐  ┌─────────────────────────────────
                   └──┘

BUSY      ───────────┌──────────────────────┐_____
                     │                      └───────────

ACK       ───────────────────────────┐  ┌──────────────
                                      └──┘

               T1 │T2│ T3              T4 │ T5
```
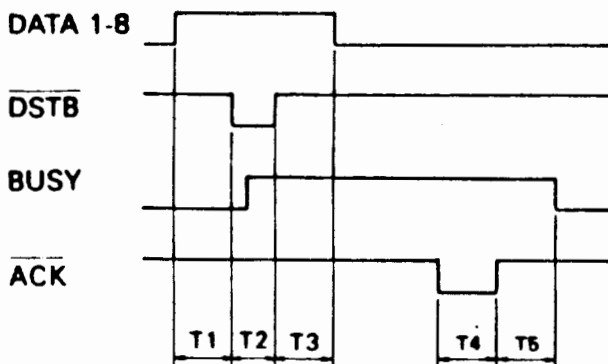
T1 ⩾ 0.5 microsecond
T2 ⩾ 0.5 microsecond
T3 ⩾ 0.5 microsecond
T4 = 7.0 microseconds
T5 = 5.0 microseconds

Figure E-2 Parallel Interface Signal Timing

E.4 PARALLEL DRIVER/RECEIVER CIRCUITS

Figure E-3 shows the Parallel Interface output
(Driver) circuit. A SN7406, SN74LS06, or equivalent
driver circuit is used.

Figure E-4 shows the Parallel Interface input
(Receiver) circuit. A SN74LS14, a 8255A, or
equivalent receiver circuits are used. Voltage levels
are 0V and +5V (nominal).
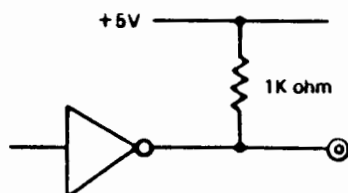
Figure E-3 Parallel Interface Output Circuit
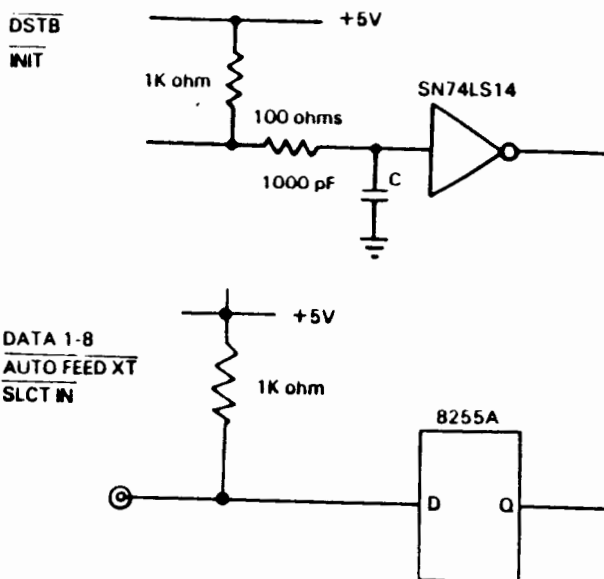
Figure E-4 Parallel Interface Input Circuit

APPENDIX F

SERIAL INTERFACE

Your printer has a user exchangeable interface circuit board. A RS-232C Serial or Centronics Type Parallel Interface Circuit Board is presently available. Refer to paragraphs 1.7 and 1.11 for additional information.

When an interface card is installed in the printer its connector is exposed through an opening at the rear of the printer.

This Appendix describes the Serial Interface.

Appendix E describes the Parallel Interface.

F.1 OVERVIEW OF SERIAL INTERFACE

The printer transmits and receives (switch selectable) 7-bit or 8-bit asynchronous data at (switch selectable) baud rates of 200, 300, 600, 1200, 2400, 4800 or 9600. The operator sets the bit configuration and baud rate with DIP switches installed on the Serial Interface Card as described in paragraphs 1.8 and 3.3.

Note: 9600 baud is not supported with DEC Type emulation.

The interface connector plug, for the cable, is a Cannon Cinch DB-25P or equivalent. Figure F-1 illustrates the connector layout

(Cable End)

```
  1                          13
  o o o  o o o o o o o o  o o
   o o o o o o o o o o o  o o
 14                          25
```
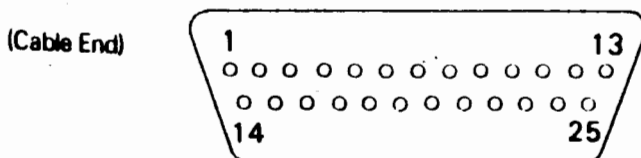
Figure F-1 Serial Interface Connector

F.2 COMMUNICATIONS PROTOCOL

A communications protocol is used with the Serial Interface that will prevent a buffer overflow condition when print data is received faster than the printer can empty the print buffer.

The operator selects either XON/XOFF or Printer Ready/Busy Protocol, with DIP Switch #1 on the Serial Interface Circuit Board.

The communication protocol responds to conditions within the printer as described in the following paragraphs.

F.2.1 XON/XOFF (DC1/DC3) Protocol

This protocol is selected and used when DIP switch #1, on the Serial Interface Circuit Board, is set ON.

In DEC LA50 Emulation the printer sends a DC1 code to the host when the number of empty bytes in the print buffer are more than 224, and sends a DC3 code to the host when the number of empty bytes are less than 128. The printer also sends a DC3 to the host when the number of empty bytes in the print buffer are less than 64.

In Okidata Emulation the printer sends a DC1 code to the host when its print buffer can receive additional data and no error conditions exist, and sends a DC3 code to the host when the print buffer is nearly full (within 16 bytes).

The host system should stop transmitting data when a DC3 control code is received, and wait for the printer to send a DC1 Control Code. When the printer is first turned on, the +DTR signal is set true, and a DC1 (XON) code is transmitted from the printer.

F.2.2 Data Terminal Ready (DTR) Protocol

This protocol is selected when DIP switch #1 on the Serial Interface Circuit Board is set OFF.

This protocol will cause the Data Terminal Ready (+DTR) interface signal to become LOW when the print buffer is nearly full (within 16 bytes)

The +DTR interface line will go high to indicate the printer is ready to receive 256 or more bytes of print data in the print buffer and no error conditions exist.

F.3 SERIAL DATA FORMAT

Serial data consists of a start bit, 7 or 8 data bits, a parity (or no parity) bit, and 1 or 2 stop bits. A bit is in the mark (true) state when it is low and in the space (false) state when it is high.

The number of data bits, parity, and number of stop bits are DIP switch selectable (see Section 3).

A typical transmission of the character "K" (with 7 data bits and even parity) is shown in Figure F-2.
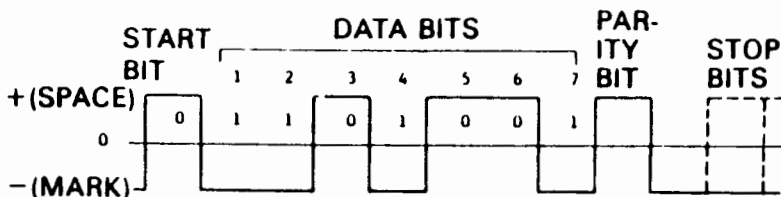
Figure F-2 Serial Data Format

F.4 SERIAL INTERFACE DRIVER/RECEIVER

Figure F-3 shows the Serial Interface output (Driver) circuit. The printer uses a SN75188N or equivalent to convert TTL signal levels (+5 to 0 Volts) to Serial Interface signal levels (+12 to -12 Volts). A 1000 pF capacitor mutes noise on the output signal line.

+12 V

CL = 1000 pF

-12 V
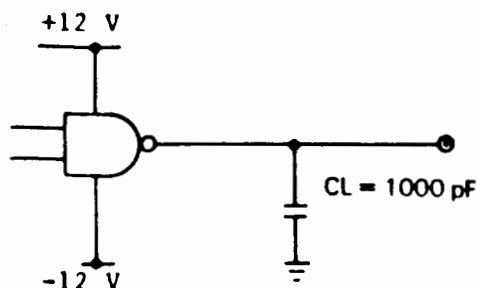
Figure F-3 Serial Interface Output Circuit

Figure F-4 shows the Serial Interface input (Receiver) circuit. The printer uses a SN75189AN or equivalent to convert Serial Interface signal levels (+12 to -12 Volts) to TTL signal levels (+5 to 0 Volts).

Figure F-4 Serial Interface Input Circuit

F.5 SERIAL INTERFACE PIN ASSIGNMENTS

Table F-1 lists the Serial Interface signals and gives the name of each signal

Table F-1 Serial Interface Signal Definitions

Signal Name	Printer Pin #	CCITT	TelCo Circuit
FG Frame Ground	1	101	AA
TD -Transmitted Data	2	103	BA
RD -Received Data	3	104	BB
RTS +Request to Send	4	105	CA
CTS +Clear to Send	5	106	CB
DSR +Data Set Ready	6	107	CC
SG Signal Ground	7	102	AB
DCD +Data Carrier Detect	8	109	CF
DTR +Data Terminal Ready	20	108	CD

Pins 9 through 19, and 21 through 25, are unused.

- = Low active signal

+ = High active signal.

F.6 SIGNAL DEFINITIONS

Frame (Chassis) Ground
  Safety ground.

Signal Ground
  Common signal ground.

Transmitted Data

Serial data bits are sent to the host over this line.

Received Data

Serial data bits are received from the host over this line.

Request to Send

High level is sent to the host when printer initialization is complete. Request to Send stays high until power is shut off.

Clear to Send

The host sets this signal high when it is ready to receive transmitted data from the printer.

Data Set Ready

Indicates transmission and reception are enabled. The host must set this signal high when data is to be sent or received.

Data Carrier Detect

Indicates carrier signal from the host has been received. The host must set this signal high before transmitting data to the printer.

Data Terminal Ready

High state indicates that the printer is ready to receive or transmit data.

APPENDIX G

CODE TABLES

This section contains a printed copy of the Okidata and DEC LA50 character set symbols in the sequence listed below.

Okidata Type Emulation:

Special International Character Set Symbols
Standard Character Set
IBM Character Set

DEC LA50 Type Emulation:

ASCII Character Set
United Kingdom Character Set
Finnish Character Set
French Character Set
French Canadian Character Set
German Character Set
Italian Character Set
JIS Roman Character Set
Norwegian/Danish Character Set
Spanish Character Set
Swedish Character Set
JIS Katakana Character Set
Multi-national Character Set
VT100 Special Character Set

International Character Set Symbols – Okidata Type Emulation

ASCII Ø
ASCII
British
German
French
Swedish
Danish
Norwegian
Dutch
Italian
French Canadian
Spanish

Standard Character Set – Okidata Type Emulation

Char	Code	Char	Code	Char	Code	Char	Code
(space)	= 32	(	= 40	0	= 48	8	= 56
!	= 33	)	= 41	1	= 49	9	= 57
"	= 34	*	= 42	2	= 50	:	= 58
#	= 35	+	= 43	3	= 51	;	= 59
$	= 36	,	= 44	4	= 52	<	= 60
%	= 37	-	= 45	5	= 53	=	= 61
&	= 38	.	= 46	6	= 54	>	= 62
'	= 39	/	= 47	7	= 55	?	= 63

Char	Code	Char	Code	Char	Code	Char	Code
@	= 64	H	= 72	P	= 80	X	= 88
A	= 65	I	= 73	Q	= 81	Y	= 89
B	= 66	J	= 74	R	= 82	Z	= 90
C	= 67	K	= 75	S	= 83	[	= 91
D	= 68	L	= 76	T	= 84	\	= 92
E	= 69	M	= 77	U	= 85	]	= 93
F	= 70	N	= 78	V	= 86	^	= 94
G	= 71	O	= 79	W	= 87	_	= 95

Char	Code	Char	Code	Char	Code	Char	Code
`	= 96	h	= 104	p	= 112	x	= 120
a	= 97	i	= 105	q	= 113	y	= 121
b	= 98	j	= 106	r	= 114	z	= 122
c	= 99	k	= 107	s	= 115	{	= 123
d	= 100	l	= 108	t	= 116	|	= 124
e	= 101	m	= 109	u	= 117	}	= 125
f	= 102	n	= 110	v	= 118	~	= 126
g	= 103	o	= 111	w	= 119	■	= 127

IBM Character Set - Okidata Type Emulation

128	136	144	152	160	168	176	184	192	200	208	216	224	232	240	248
129	137	145	153	161	169	177	185	193	201	209	217	225	233	241	249
130	138	146	154	162	170	178	186	194	202	210	218	226	234	242	250
131	139	147	155	163	171	179	187	195	203	211	219	227	235	243	251
132	140	148	156	164	172	180	188	196	204	212	220	228	236	244	252
133	141	149	157	165	173	181	189	197	205	213	221	229	237	245	253
134	142	150	158	166	174	182	190	198	206	214	222	230	238	246	254
135	143	151	159	167	175	183	191	199	207	215	223	231	239	247	255

ASCII Character Set – DEC LA50 Emulation

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

United Kingdom Character Set - DEC LA50 Emulation

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

Finnish Character Set - DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	@	P	é	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	#	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	Ä	k	ä
C	,	<	L	Ö	l	ö
D	–	=	M	Å	m	å
E	.	>	N	Ü	n	ü
F	/	?	O	_	o	

French Character Set - DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	à	P	`	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	£	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	°	k	é
C	,	<	L	ç	l	ù
D	-	=	M	§	m	è
E	.	>	N	^	n	¨
F	/	?	O	_	o	

French Canadian Character Set – DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	à	P	ô	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	#	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	à	k	é
C	,	<	L	ç	l	ù
D	-	=	M	ê	m	è
E	.	>	N	î	n	û
F	/	?	O	_	o	

German Character Set – DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	§	P	`	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	#	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	Ä	k	ä
C	,	<	L	Ö	l	ö
D	-	=	M	Ü	m	ü
E	.	>	N	^	n	ß
F	/	?	O	_	o	

Italian Character Set - DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	§	P	ù	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	£	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	°	k	à
C	,	<	L	ç	l	ò
D	-	=	M	é	m	è
E	.	>	N	^	n	ì
F	/	?	O	_	o	

JIS Roman Character Set - DEC LA50 Emulation

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

Norwegian/Danish Character Set - DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	À	P	ä	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	#	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	Æ	k	æ
C	,	<	L	Ø	l	ø
D	–	=	M	Å	m	å
E	.	>	N	ü	n	ü
F	/	?	O	_	o	

Spanish Character Set – DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	§	P	`	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	£	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	[	k	•
C	,	<	L	Ñ	l	ñ
D	–	=	M	¿	m	ç
E	.	>	N	^	n	~
F	/	?	O	_	o	

Swedish Character Set – DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	É	P	é	p
1	!	1	A	Q	a	q
2	"	2	B	R	b	r
3	#	3	C	S	c	s
4	$	4	D	T	d	t
5	%	5	E	U	e	u
6	&	6	F	V	f	v
7	'	7	G	W	g	w
8	(	8	H	X	h	x
9	)	9	I	Y	i	y
A	*	:	J	Z	j	z
B	+	;	K	Ä	k	ä
C	,	<	L	Ö	l	ö
D	-	=	M	Å	m	å
E	.	>	N	Ü	n	ü
F	/	?	O	_	o	

JIS Katakana Character Set – DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		—	タ	ミ	?	?
1	.	ア	チ	ム	?	?
2	｢	イ	ツ	メ	?	?
3	」	ウ	テ	モ	?	?
4	、	エ	ト	ヤ	?	?
5	・	オ	ナ	ユ	?	?
6	ヲ	カ	ニ	ヨ	?	?
7	ァ	キ	ヌ	ラ	?	?
8	ィ	ク	ネ	リ	?	?
9	ゥ	ケ	ノ	ル	?	?
A	ェ	コ	ハ	レ	?	?
B	ォ	サ	ヒ	ロ	?	?
C	ャ	シ	フ	ワ	?	?
D	ュ	ス	ヘ	ン	?	?
E	ョ	セ	ホ	゛	?	?
F	ッ	ソ	マ	゜	?	

Multi-national Character Set - DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		°	À	¿	à	¿
1	¡	±	Á	Ñ	á	ñ
2	¢	²	Â	Ò	â	ò
3	£	³	Ã	Ó	ã	ó
4	¿	¿	Ä	Ô	ä	ô
5	¥	µ	Å	Õ	å	õ
6	¿	¶	Æ	Ö	æ	ö
7	§	·	Ç	Œ	ç	œ
8	¤	¿	È	Ø	è	ø
9	©	¹	É	Ù	é	ù
A	ª	º	Ê	Ú	ê	ú
B	«	»	Ë	Û	ë	û
C	¿	¼	Ì	Ü	ì	ü
D	¿	½	Í	Ý	í	ÿ
E	¿	¿	Î	¿	î	¿
F	¿	¿	Ï	ß	ï	

VT100 Special Character Set - DEC LA50 Emulation

HEX	2	3	4	5	6	7
0		0	@	P	♦	—
1	!	1	A	Q	✻	—
2	"	2	B	R	⊣	—
3	#	3	C	S	⊦	—
4	$	4	D	T	⊦	⊢
5	%	5	E	U	↓	⊣
6	&	6	F	V	•	⊥
7	'	7	G	W	±	⊤
8	(	8	H	X	⌐	│
9	)	9	I	Y	↓	≤
A	*	:	J	Z	⌐	≥
B	+	;	K	[	⌐	π
C	,	<	L	\	⌐	≠
D	-	=	M	]	∟	£
E	.	>	N	^	+	·
F	/	?	O		—	

APPENDIX H

CODE CONVERSION TABLE

This table omits the ASCII characters with the most significant bit ON, and control characters not used with this printer.

Decimal	Hexa-decimal	Binary	ASCII Character
0	00	00000000	(NUL)
1	01	00000001	
2	02	00000010	
3	03	00000011	
4	04	00000100	
5	05	00000101	
6	06	00000110	
7	07	00000111	(BEL)
8	08	00001000	(BS)
9	09	00001001	(HT)
10	0A	00001010	(LF)
11	0B	00001011	(VT)
12	0C	00001100	(FF)
13	0D	00001101	(CR)
14	0E	00001110	(SO)
15	0F	00001111	(SI)
16	10	00010000	
17	11	00010001	(DC1)
18	12	00010010	(DC2)
19	13	00010011	(DC3)
20	14	00010100	(DC4)
21	15	00010101	
22	16	00010110	
23	17	00010111	
24	18	00011000	(CAN)
25	19	00011001	
26	1A	00011010	
27	1B	00011011	(ESC)
28	1C	00011100	
29	1D	00011101	

Decimal	Hexa-decimal	Binary	ASCII Character
30	1E	00011110	
31	1F	00011111	
32	20	00100000	(SP)
33	21	00100001	!
34	22	00100010	"
35	23	00100011	#
36	24	00100100	$
37	25	00100101	%
38	26	00100110	&
39	27	00100111	'
40	28	00101000	(
41	29	00101001	)
42	2A	00101010	*
43	2B	00101011	+
44	2C	00101100	,
45	2D	00101101	-
46	2E	00101110	.
47	2F	00101111	/
48	30	00110000	0
49	31	00110001	1
50	32	00110010	2
51	33	00110011	3
52	34	00110100	4
53	35	00110101	5
54	36	00110110	6
55	37	00110111	7
56	38	00111000	8
57	39	00111001	9
58	3A	00111010	:
59	3B	00111011	;
60	3C	00111100	<
61	3D	00111101	=
62	3E	00111110	>
63	3F	00111111	?
64	40	01000000	@
65	41	01000001	A
66	42	01000010	B
67	43	01000011	C
68	44	01000100	D
69	45	01000101	E

Decimal	Hexa-decimal	Binary	ASCII Character
70	46	01000110	F
71	47	01000111	G
72	48	01001000	H
73	49	01001001	I
74	4A	01001010	J
75	4B	01001011	K
76	4C	01001100	L
77	4D	01001101	M
78	4E	01001110	N
79	4F	01001111	O
80	50	01010000	P
81	51	01010001	Q
82	52	01010010	R
83	53	01010011	S
84	54	01010100	T
85	55	01010101	U
86	56	01010110	V
87	57	01010111	W
88	58	01011000	X
89	59	01011001	Y
90	5A	01011010	Z
91	5B	01011011	[
92	5C	01011100	\
93	5D	01011101	]
94	5E	01011110	^
95	5F	01011111	_
96	60	01100000	`
97	61	01100001	a
98	62	01100010	b
99	63	01100011	c
100	64	01100100	d
101	65	01100101	e
102	66	01100110	f
103	67	01100111	g
104	68	01101000	h
105	69	01101001	i
106	6A	01101010	j
107	6B	01101011	k
108	6C	01101100	l
109	6D	01101101	m

Decimal	Hexa-decimal	Binary	ASCII Character
110	6E	01101110	n
111	6F	01101111	o
112	70	01110000	p
113	71	01110001	q
114	72	01110010	r
115	73	01110011	s
116	74	01110100	t
117	75	01110101	u
118	76	01110110	v
119	77	01110111	w
120	78	01111000	x
121	79	01111001	y
122	7A	01111010	z
123	7B	01111011	{
124	7C	01111100		
125	7D	01111101	}
126	7E	01111110	-
127	7F	01111111	(DEL)
128	80	10000000	
129	81	10000001	
130	82	10000010	
131	83	10000011	
132	84	10000100	
133	85	10000101	
134	86	10000110	
135	87	10000111	
136	88	10001000	
137	89	10001001	
138	8A	10001010	
139	8B	10001011	
140	8C	10001100	
141	8D	10001101	
142	8E	10001110	
143	8F	10001111	
144	90	10010000	
145	91	10010001	
146	92	10010010	
147	93	10010011	
148	94	10010100	
149	95	10010101	

Decimal	Hexa-decimal	Binary	ASCII Character
150	96	10010110	
151	97	10010111	
152	98	10011000	
153	99	10011001	
154	9A	10011010	
155	9B	10011011	
156	9C	10011100	
157	9D	10011101	
158	9E	10011110	
159	9F	10011111	
160	A0	10100000	
161	A1	10100001	
162	A2	10100010	
163	A3	10100011	
164	A4	10100100	
165	A5	10100101	
166	A6	10100110	
167	A7	10100111	
168	A8	10101000	
169	A9	10101001	
170	AA	10101010	
171	AB	10101011	
172	AC	10101100	
173	AD	10101101	
174	AE	10101110	
175	AF	10101111	
176	B0	10110000	
177	B1	10110001	
178	B2	10110010	
179	B3	10110011	
180	B4	10110100	
181	B5	10110101	
182	B6	10110110	
183	B7	10110111	
184	B8	10111000	
185	B9	10111001	
186	BA	10111010	
187	BB	10111011	
188	BC	10111100	
189	BD	10111101	

Decimal	Hexa-decimal	Binary	ASCII Character
190	BE	10111110	
191	BF	10111111	
192	C0	11000000	
193	C1	11000001	
194	C2	11000010	
195	C3	11000011	
196	C4	11000100	
197	C5	11000101	
198	C6	11000110	
199	C7	11000111	
200	C8	11001000	
201	C9	11001001	
202	CA	11001010	
203	CB	11001011	
204	CC	11001100	
205	CD	11001101	
206	CE	11001110	
207	CF	11001111	
208	D0	11010000	
209	D1	11010001	
210	D2	11010010	
211	D3	11010011	
212	D4	11010100	
213	D5	11010101	
214	D6	11010110	
215	D7	11010111	
216	D8	11011000	
217	D9	11011001	
218	DA	11011010	
219	DB	11011011	
220	DC	11011100	
221	DD	11011101	
222	DE	11011110	
223	DF	11011111	
224	E0	11100000	
225	E1	11100001	
226	E2	11100010	
227	E3	11100011	
228	E4	11100100	
229	E5	11100101	

Decimal	Hexa-decimal	Binary	ASCII Character
230	E6	11100110	
231	E7	11100111	
232	E8	11101000	
233	E9	11101001	
234	EA	11101010	
235	EB	11101011	
236	EC	11101100	
237	ED	11101101	
238	EE	11101110	
239	EF	11101111	
240	F0	11110000	
241	F1	11110001	
242	F2	11110010	
243	F3	11110011	
244	F4	11110100	
245	F5	11110101	
246	F6	11110110	
247	F7	11110111	
248	F8	11111000	
249	F9	11111001	
250	FA	11111010	
251	FB	11111011	
252	FC	11111100	
253	FD	11111101	
254	FE	11111110	
255	FF	11111111	

APPENDIX I

PAGE FORMAT

I.1 PAPER TYPES AND SIZES

The types and sizes of paper that can be used in this printer are shown in Table I-1.

Table I-1 Paper Types and Sizes

Printer	Paper Type	Paper Size
80-column	Continuous	Width 4" (101.6mm) to 10.5" (266.7mm)
80-column	Cut Sheet	Width 4" (101.6mm) to 10.25" (257mm) Length 3" (76mm) to 14.5" (364mm)
136-column	Continuous	Width 4" (101.6mm) to 16.5" (420mm)
136-column	Cut Sheet	Width 4" (101.6mm) to 16.5" (420mm) Length 3" (76mm) to 14.5" (364mm)

1.2 PRINT AREAS

The 80-column printer has the print areas shown in Figures 1-1 and 1-2 (for continuous forms and cut sheet paper).

The 136-column printer has the print areas shown in Figures 1-3 and 1-4 (for continuous forms and cut sheet paper).
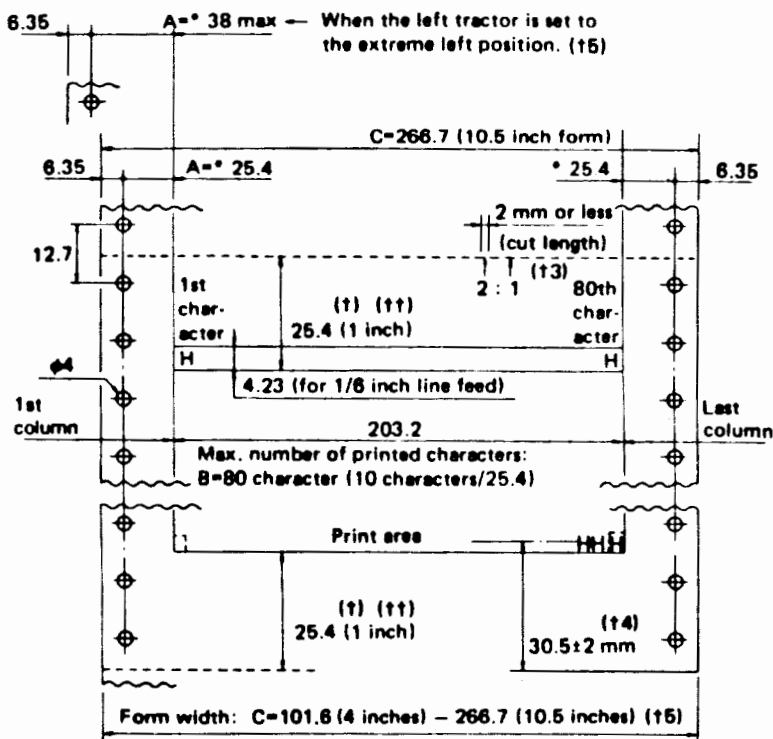
Figure I-1 Print Area on Continuous Forms (80-column Printer)

Notes for Figure I-1:

1. Units are mm. Sizes marked * are ±2.5mm.

2. "Out of Paper" may be detected if printing is performed on paper already having dark printing or lettering (or other than standard lines or frames) within 24/25 characters from the left edge.

Notes for Figure I-1:

(Continued)

*   If the printed form is to be cut into single sheets, leave a margin of 25.4mm (1 inch) from each of the perforations.

**   Since there is a possibility of line displacement near the perforations, leave a margin of more than 25.4mm (1 inch) from the perforations.

*3   The cut/un-cut ratio on the perforated line is 2:1.

*4   "End of Paper" detection is activated when the distance from the lower edge of the paper to the center of the printing line is 30.5 ± 2mm (1.25").

*5   There are restrictions on the initial print position for forms wider than 9.5 inches.

Notes for Figure I-2:

1.   Units are mm. Sizes marked * are ± 2.5mm.

2.   If the cut sheet form has horizontal ruled lines, it is difficult to align the lines when setting the form. Therefore, unruled forms are recommended.

3.   "Out of Paper" may be detected if printing is performed on paper already having dark printing or lettering (or other than standard lines or frames) within 24/25 characters from the left edge.

*   "End of Paper" detection is activated when the distance from the lower edge of the paper to the center of the printing line is 30.5 ± 2mm (1.25").

When the form is set
to the extreme right
position.

A=•42 max — When the form is set _ max   •42
in the extreme left
position.

C=257 (Equivalent to the length of a
B4 sheet)

A=•26.9 — When the form is set •26.9
with equal clearance
on the left and right.

| 1st character | Upper margin 2.1 | 80th character |
| H | Line spacing 4.23 (1/6 inch line feed) | H |

1st column   203.2   Last column

Maximum number of print characters:
B=80 characters (10 characters/25.4)

Detect line

Print area

Bottom margin 5

Form width: C=100 (4 inches) — 257 (Equivalent to the
length of a B4 sheet)

Length T=76 (3 inches) — 364 (Equivalent to the
length of a B4 sheet)   30.5±2 mm
(†)

Length T
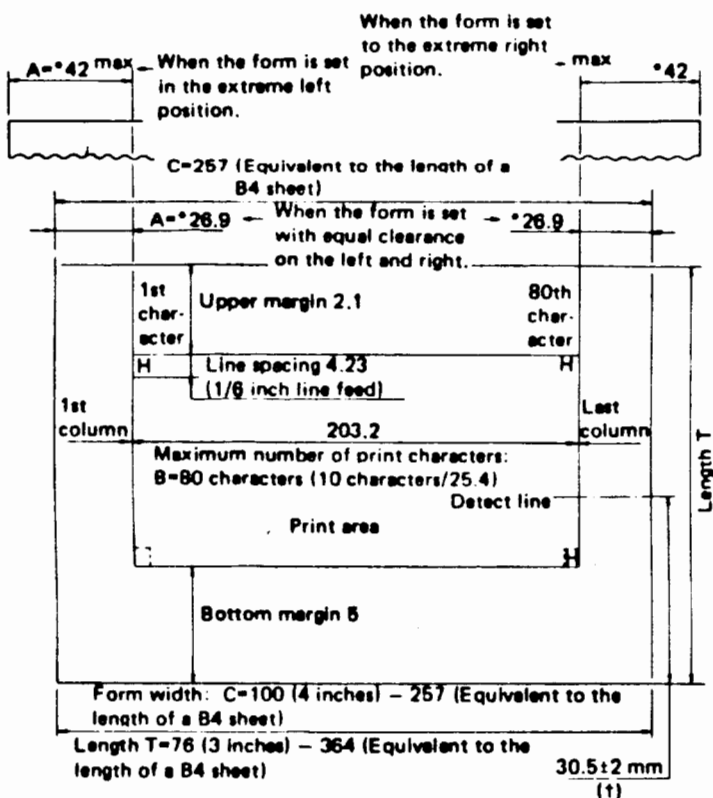
Figure I-2 Print Area on Cut Sheet Paper
(80-column Printer)
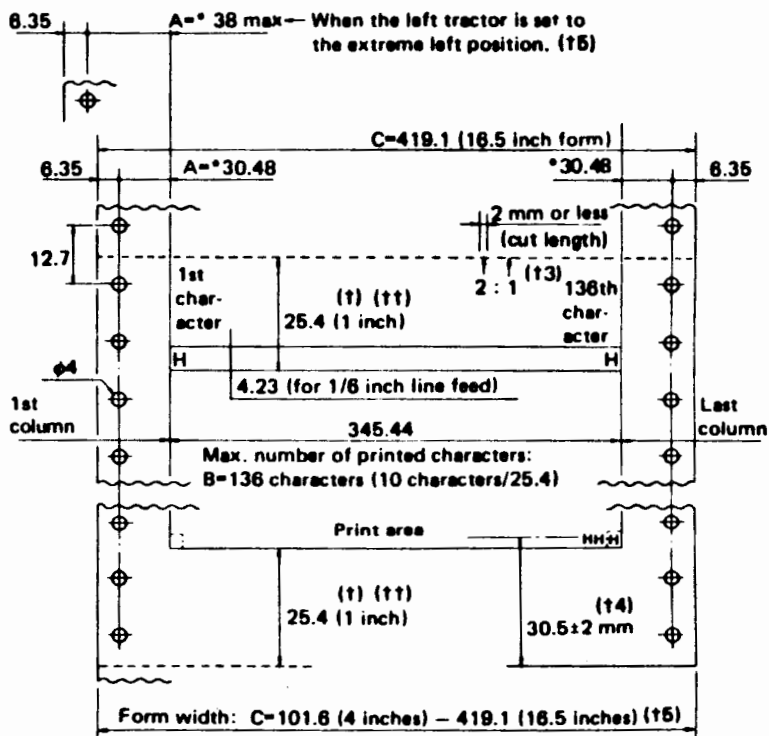
**Figure I-3 Print Area on Continuous Forms
(136-column Printer)**

Notes for Figure I-3:

1. Units are mm. Sizes marked * are ±2.5mm.

2. "Out of Paper" may be detected if printing is performed on paper already having dark printing or lettering (or other than standard lines or frames) within 24/25 characters from the left edge.

Notes for Figure I-3:

(Continued)

*   If the printed form is to be cut into single sheets, leave a margin of 25.4mm (1 inch) from each of the perforations.

**   Since there is a possibility of line displacement near the perforations, leave a margin of more than 25.4mm (1 inch) from the perforations.

*3   The cut/un-cut ratio on the perforated line is 2:1.

*4   "End of Paper" detection is activated when the distance from the lower edge of the paper to the center of the printing line is 30.5 ± 2mm (1.25").

*5   There are restrictions on the initial print position for forms wider than 9.5 inches.

Notes for Figure I-4:

1.   Units are mm. Sizes marked * are ± 2.5mm.

2.   If the cut sheet form has horizontal ruled lines, it is difficult to align the lines when setting the form.   Therefore,   unruled   forms   are recommended.

3.   "Out of Paper" may be detected if printing is performed on paper already having dark printing or lettering (or other than standard lines or frames) within 24/25 characters from the left edge.

*   "End of Paper" detection is activated when the distance from the lower edge of the paper to the center of the printing line is 30.5 ± 2mm (1.25").

A=°42 max When the form is set When the form is set max °42
      in the extreme left to the extreme right
      position.   position.

C=420 (Equivalent to the length of an
A3 sheet)

A=°37.28 — When the form is set — °37.28
     with equal clearance
     on the left and right.

1st char-acter	Upper margin 2.1	136th char-acter

H Line spacing 4.23
  (1/6 inch line feed)

1st column   Last column

345.44

Maximum number of print characters:
B=136 characters (10 characters/25.4)

Detect line

Print area

Bottom margin 5

Length T

Form width: C=100 (4 inches) — 420 (Equivalent to the
width of an A3 sheet)

Length T=76 (3 inches) — 364 (Equivalent to the
length of a B4 sheet)   30.5±2 mm
              (t)
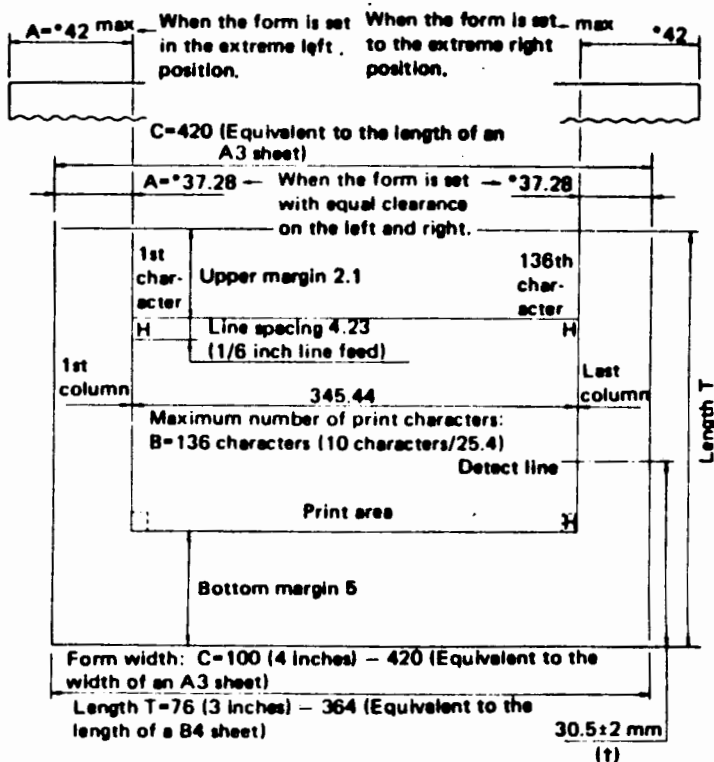
Figure I-4 Print Area on Cut Sheet Paper
(136-column Printer)

1.3 NUMBER OF COPIES AND BINDING FORMS

Follow the descriptions given below to copy continuous forms and cut sheet paper, and to bind them.

1.3.1 Number of Copies for Continuous Forms

Number of copies and paper weight (thickness) are as shown in Table I-2.

Table I-2 Continuous Forms Copies and Paper Weight

Number of Copies	Paper Weight (lb.)	Condition
3	10, 15, 17	Only the bottom sheet can be 15 or 17 pound paper.
2	15, 17, 20	Only the bottom sheet can be 20 pound paper.
1	15, 17, 20	

Notes:

1. Number of Copies includes the original.

2. For copies, use carbon coated or NCR forms.

3. If carbon paper is inserted between forms, the carbon paper is counted as one sheet. Therefore, the number of sheets of carbon paper that are inserted will have to be subtracted from the number of copies.

4. Total thickness must be 0.011" (0.28mm) or less.

1.3.2 Binding Continuous Forms

When making multi-part continuous forms, having adhesive on both sides are recommended.

Several methods of gluing can be used; however, the forms on which adhesive is used at alternate points on each copy is recommended.
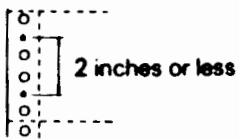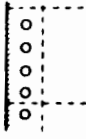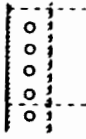
In the figure on page I-10, only one side of the form is shown. Make sure that there are no bulges along the perforated line (as shown below) after the forms have been bound together.

Notes:

Metal or paper staples are likely to cause print displacement and feed problems. Use of staples should be avoided.

Use forms having a tractor hole alignment tolerance of 0.4mm or less.

	Spot adhesive	Line adhesive	
		1 line	2 lines
Illus- tration	2 inches or less		
Evalu- ation	Good	Acceptable	
Remarks	— Adhesive intervals should be 2 inches or less. — Adhesive spots should be as close to the perforations as possible. — Adhesive spots should be as small as possible and be at alternate positions on each copy.		

1.3.3 Number of Copies for Cut Sheet Paper

Cut Sheet Paper number of copies and paper weight (thickness) are shown in Table I-3.

Table I-3 Cut Sheet Paper Copies and Paper Weight

Number of Copies	Paper Weight (lb.)	Condition
3	10, 15, 17	Two copies of 10 pound paper with 15 or 17 pound paper as the bottom sheet.
2	10, 15, 17, or 20	One copy 10 or 15 pound paper with 17 or 20 pound paper as the bottom sheet.
1	15, 17, 20	

Notes:

1)   Number of Copies includes the original.

2)   For copies, use carbon coated or NCR forms.

3)   Do not insert carbon paper between forms.

4)   Total thickness must be 0.011" (0.28mm) or less.

1.3.4 Binding Cut Sheet Paper

Cut sheet paper is generally bound together as follows:

```
      ┌─(1)  Upper edge ─┐
──────┼─(2)  Side        ├──┬─(a)  Glued          ─ ─ ┐
      └─(3)  Lower edge ─┘  └─(b)  Stapled (metal) ───┘───
```
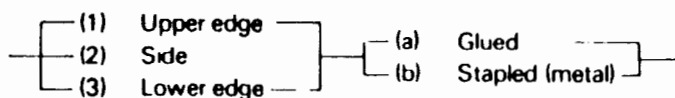
The standard method for binding cut sheet paper for this printer is gluing the upper edge of the form.

I.4 OTHER PRECAUTIONS

Use high-quality types of paper forms.

Make sure that cut sheet paper is not curled.

Handle and store forms carefully. Make sure that they are not deformed or damaged.

APPENDIX J

DEC TYPE COMMAND SET

J1 COMMAND OVERVIEW

This Appendix explains the Command Set used by the printer when Emulation switch 3 on the Memory circuit board is set to "F" - DEC Type Emulation.

Refer to Appendix K if Emulation switch 3 is set to "I" - Okidata Type Emulation.

Most users will operate with application software and will not use the information in this section.

Specify your printer as a DEC LA50 printer in your application program and your printer will interact correctly with your system.

J2 7-BIT AND 8-BIT ENVIRONMENTS

When a serial interface is used, the printer may be set to send and receive 7-bit or 8-bit data with DIP Switch #2 on the Serial Interface Board (Refer to Section 3).

In 7-bit mode, 128 control and printable character codes are available.

In 8-bit mode, 256 control and printable character codes are available. The 8-bit character set has twice as many characters as the 7-bit set. The left half of the 8-bit set is identical to the 7-bit set.

The Code tables, in Appendix G, show the characters in each character set. In this appendix a character is represented by its position (column/row) in an ASCII Code table.

J3 PRINTABLE CHARACTERS

Each ASCII Character is either a control or printable character. This paragraph defines printable characters (text processing is defined in paragraph J11 and control characters are defined in paragraphs J6 and J7).

The print head has 9 wires at 1/72" spacing. Characters are printed using up to 9 vertical dots in Draft mode, and up to 16 vertical dots in Near Letter Quality mode.

The printer stores two sets of printable characters. The two active sets of printable characters are stored in areas GL (Graphic Left) and GR (Graphic Right).

GL characters are 7-bit printable characters. The characters from 2/1 to 7/E are GL characters.

GR characters are 8-bit printable characters. The characters from A/1 to F/E in an 8-bit table are GR characters.

The printer uses one GL set and one GR set at a time. Each set has 94 character codes. In a 7-bit environment the printer uses only the GL set (codes 2/1 to 7/E). In an 8-bit environment the printer uses both the GL set plus the 94 GR set (codes A/1 to F/E).

Printable characters are grouped into sets of 94 and any two available character sets may be mapped into GL and GR. For applications that require more than 188 printable characters, up to four sets may be designated (G0, G1, G2, and G3), one of those sets may be mapped into GL or GR for printing.

Figures J-1 and J-2 show how to designate and map character sets in an 8-bit and 7-bit environment. Commands used to select specific character sets are explained in this section.

Note: There are 96 printable characters in the ISO supplemental character set. All 96 characters may be accessed from the GR set using locations A/0 and F/F as printable characters.
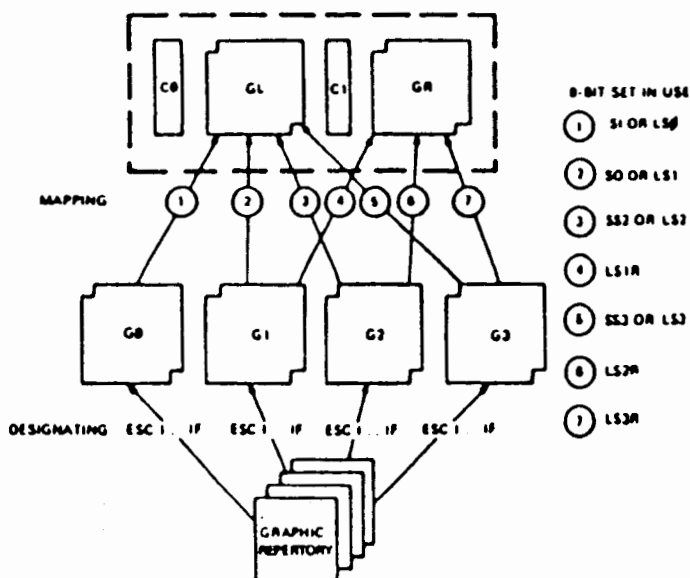
Figure J-1 Designating and Mapping Character Sets
(8-Bit Environment)
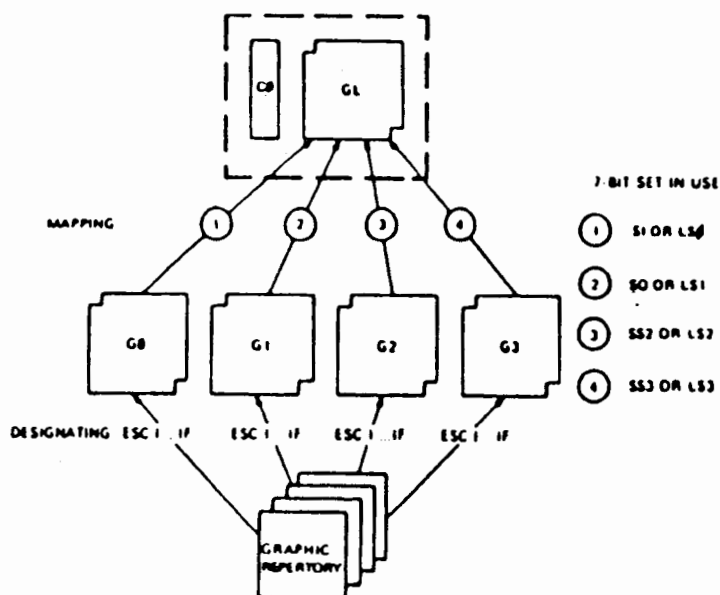
Figure J-2 Designating and Mapping Character Sets
(7-Bit Environment)

The printer interprets characters in the column/row range of 2/0 to 7/E (GL) and A/1 to F/E (GR) as printable characters. The printable character is printed at the active column and line position. Each printable or space character then increases the active column by one, causing the print head to move one column at the current horizontal pitch.

The DEL character (7/F) is normally ignored.

The characters at A/0 and F/F have a special effect on printer operation. In text mode, the printer normally processes the A/0 character as an error character (reverse question mark).

The printer normally ignores the DEL character (7/F) and the character at F/F.

J4 CONTROL CHARACTERS

Control characters are not printed. Each control character is a single character that starts, modifies, or stops a printer function. Each control character is assigned a mnemonic.

J5 C0 and C1

There are two sets of Control Characters, C0 and C1.

Control Character set C0 are 7-bit characters (the eighth bit is set to 0). ASCII characters from 0/0 to 1/F are C0 Control Characters, see Table J-1.

Control Character set C1 are 8-bit characters (the eighth bit is set to 1). ASCII characters from 8/0 to 9/F (in an 8-bit ASCII Code table) are C1 Control Characters, see Table J-2.

Paragraphs J6 and J7 describe the functions performed by each control character.

J6 C0 (7-Bit) Control Characters

Table J-1 lists the C0 control characters recognized by
the printer in Text Mode.   Table J-1 also provides the
C0 control character mnemonic and lists its function.

Note: The   printer   ignores   all   other   ASCII   control
characters.

Paragraphs J6.1 through J6.15 define each of the C0
(7-bit) text mode control characters (graphic mode is
defined in paragraph J12).

Table J-1 C0 (7-Bit) Text Mode Control Characters

Column/Row	Mnemonic	Function
Printer Control Function		
0/7	BELL	Bell
0/8	BS	Backspace
0/9	HT	Horizontal tab
0/A	LF	Line feed
0/B	VT	Vertical tab
0/C	FF	Form Feed
0/D	CR	Carriage Return
Character Set Control Functions		
0/E	SO	Shift-out
0/F	SI	Shift-in
Communication Control Functions		
0/0	NUL	Null
1/1	DC1	XON
1/3	DC3	XOFF
1/8	CAN	Cancel
1/A	SUB	Substitute
1/B	ESC	Escape

J6.1 Bell (BEL)

This character causes the bell to sound for 100 milliseconds.

J6.2 Backspace (BS)

This character decreases the active column by one column, at the current horizontal pitch. If the active column is at the left margin, the BS character is ignored.

If the active column is one column beyond the right margin, the BS character may be used to print or overprint at the right margin.

J6.3 Horizontal Tab (HT)

A horizontal tab is a preselected print position on a line. When the printer receives an HT character, the print head advances to the next tab position on the line. The printer has default horizontal tab stops every 8 columns, starting at column 9. When the horizontal pitch is changed, the horizontal tab positions will change appropriately.

When there are no more tab stops to the right of the active column, the right margin selection in the DIP Switch set-up controls the effect of an HT character.

   o   If the right margin switch is set to wrap and an HT is received, a printable character (including a space) causes the printer to perform a carriage return and line feed.

   o   If the right margin switch is set to truncate and an HT is received, the printer ignores printable characters (including spaces) until the active column returns to the printable area.

J6.4 Line Feed (LF)

This character increases the active line by one line at the current vertical pitch. If less than one line remains unprinted on the current page, the LF character sets the active line to the top-of-form position on the next page.

J6.5 Vertical Tab (VT)

The VT character is processed as a LF character.

J6.6 Form Feed (FF)

This character advances the active line to the next top-of-form position.

J6.7 Carriage Return (CR)

This character sets the active column to the left most position.

J6.8 Shift Out (SO)

This character selects the G1 character set as the GL active character set.

J6.9 Shift In (SI)

This character selects the G0 character set as the GL active character set.

J6.10 Null (NUL)

This character does not affect printer operation

J6.11 XON (DC1)

This character performs no action. It is sent to the host (by the printer) for input buffer control.

J6.12 XOFF (DC3)

This character performs no action. It is sent to the host (by the printer) for input buffer control.

J6.13 Cancel (CAN)

The CAN control character immediately cancels (without executing) any escape sequence, control sequence, or control string – currently being processed.

J6.14 Substitute (SUB)

This character immediately stops the processing of any escape or control sequence. The SUB character prints as the error character (reverse question mark).

J6.15 Escape (ESC)

This character introduces an escape sequence.

J7 C1 (8-Bit) Text Control Characters

Table J-2 lists the C1 control characters recognized by the printer in text mode. Table J-2 also provides the C1 control character mnemonic and lists its function.

Note: The printer ignores all other C1 Control Characters

Paragraphs J7.1 through J7.8 define each of the C1 (8-bit) text mode control characters (graphic mode is defined in paragraph J12).

Table J-2 Cl (8-Bit) Text Mode Control Characters

Column/Row	Mnemonic	Function
Printer Control Functions		
8/B	PLD	Partial Line Down
8/C	PLU	Partial Line Up
Character Set Control Functions		
8/E	SS2	Single Shift 2
8/F	SS3	Single Shift 3
Communication Control Functions		
9/0	DCS	Device Control String
9/B	CSI	Control Sequence Introducer
9/C	ST	String Terminator
9/D	OSC	Operating System Command
9/E	PM	Privacy Message
9/F	APC	Application Program Command

J7.1 Partial Line Down (PLD)

This character advances the paper 1/12 inch.

J7.2 Partial Line UP (PLU)

This character reverses the paper 1/12 inch.

J7.3 Single Shift 2 (SS2)

This character selects the next printable character from the G2 character set.

J7.4 Single Shift 3 (SS3)

This character selects the next printable character from the G3 character set.

J7.5 Device Control String (DCS) Introducer

This character introduces a device control string. See paragraph J8.3 for a description of DCS format

J7.6 Control Sequence Introducer (CSI)

This character introduces a control sequence. See paragraph J8.2 for a description of CSI format.

J7.7 String Terminator (ST)

ST terminates a control string. See paragraph J8.3 for a description and a list of control strings.

J7.8 OSC, PM, and APC

These control characters introduce unused control strings. See paragraph J8.3 for more information on unused control strings.

J8 ESCAPE/CONTROL SEQUENCES AND CONTROL STRING FORMATS

The printer uses Escape and Control sequences standardized by the American National Standards Institute (ANSI) to control many of its functions. ANSI standards X3.4-1977 and X3.32-1973 define the Escape and Control sequences used in this chapter.

Characters are defined by symbol or the hexadecimal numbers that correspond to their position in an ASCII Code Table. For example, ESC or 1/B (which corresponds to column 1 and row B) both indicate the same ESC character.

J8.1 Escape Sequence

The format for an Escape Sequence is:

ESC	I	F
1/B	2/0 to 2/F	3/0 to 7/E
Escape Sequence Introducer	Intermediate Characters	Final Character

When the printer receives the ESC character, the printer processes the characters that follow it, as part of the Escape Sequence, rather than printing them. The characters must be in the Escape Sequence format to be processed correctly. The printer ignores sequences it does not recognize.

A character received after ESC in the 2/0 to 2/F range is an intermediate character. The printer may process zero, one, or more intermediate characters in a valid escape sequence.

A character received after ESC in the 3/0 to 7/E range is a final character. The final character indicates the end of the escape sequence.

The intermediate and final characters together define the function of the sequence. The printer performs the action specified by the sequence, then continues to process received characters, as specified.

Example:

An Escape sequence, used to assign the U.S. ASCII character set as the G0 set, is shown below:

ESC   (B

1/B   2/8   4/2

└ Final Character

└ Intermediate Character

└ Escape Sequence Introducer

J8.2 Control Sequence

The format for a Control Sequence is:

CSI	P...P	I	F
9/B	3/0 - 3/F	2/0 - 2/F	4/0 - 7/E
Control Sequence Introducer	Parameter Character (0 or more characters)	Intermediate Character (0 or more characters)	Final Character (1 character)

Control Sequence Introducer

The control sequence introducer (CSI) is an 8-bit C1 control character (9/B). The 7-bit equivalent is ESC (1/B, 5/B). After receiving the CSI, the printer stores (but does not print) the next received characters as part of the control sequence. The characters must be in the CSI format shown above.

Parameter Characters

Characters received after a CSI, in the 3/0 to 3/F range.

A parameter character (usually an ASCII digit) modifies the action or interpretation of the sequence. Parameter characters are interpreted as unsigned decimal integers, with the most significant digit sent first. Leading zeros are allowed but are not necessary. Plus and minus signs are not allowed in parameter characters. Separate parameter characters with a semicolon ; (3/B).

The printer has two types of parameters, numeric and selective. A numeric parameter (Pn) indicates an actual numeric value, such as a tab or margin location. A selective parameter (Ps) indicates a numeric value associated with a specific action. For example, in the printer's device status report sequence (paragraph J15.3), the Ps value of 21 indicates a hardware failure.

If a parameter character is not specified, the printer
assumes a value of 0.   There is a limit of 16 numeric
parameters per string.   The printer will store the first
16 parameters received and ignore any that follow.

If the printer receives an out-of-range parameter in a
string of parameters, the printer ignores the out-of-
range parameter and processes the other parameters.

When all parameters in a sequence are out of range or
the sequence is invalid, the printer performs no action.

If the printer receives the ?   (3/F) character at the
beginning of a string of parameters, the printer notes
the event for later reference.   When the final character
of the string is received, the presence or absence of the
event determines the validity and meaning of the
sequence.

If the printer receives the ":" (3/A), ">" (3/C), "=" (3/D),
or "<" (3/E) characters while processing a parameter
string, or if the "?" (3/F) character is received after the
first character of a parameter string, the printer
processes the sequence, but performs no action.

Intermediate Characters

Characters received after the CSI in the 2/0 to 2/F
range are intermediate characters.   The printer may
process zero, one, or more intermediate characters in a
valid printer control sequence.

Final Character

A single character received after the CSI in the 4/0 to
7/E range is the final character.   The final character
indicates the end of a control sequence and defines the
function of the sequence.

J8.2 Control Sequence (Continued)

After receiving the final character, the printer performs
the action specified by the sequence.   The printer
ignores sequences it does not recognize.

Example:

A control sequence, used to set horizontal pitch at 17.1
characters per inch, is shown below:

```
CSI    4     w
9/B   3/4   7/7
 |     |     └ Final Character
 |     └ Intermediate Character
 └ Control Sequence Introducer
```

J8.3 Device Control String

A device control string is a delimited string of
characters that is used in a data stream as a logical
entity for control. Control string formats are:

String Introducer	Protocol Selector	Data String	String Terminator
DCS	P. . .P I. . .I F	D. . .D	ST
OSC		D. . .D	ST
PM		D. . .D	ST
APC		D. . .D	ST

where: P. . .P are parameters

I. . .I are intermediate characters

F is a final character

D. . .D is data

ST is a string terminator.

String Introducers are one the following C1 control characters:

> Device Control String (DCS)
> Operating System Command (OSC)
> Privacy Message (PM) and
> Application Program Command (APC)

DCS (9/0) character introduces the sixel graphic mode control string. DCS is an 8-bit control character. It is also expressed as ESC P when coding in a 7-bit system.

OSC, PM, and APC characters are unused and perform no action.

String Terminator (9/C) can also be expressed in a 7-bit environment as ESC   (5C).

The following Table describes processing of the Device Control String (DCS) and unused control string data.

8-bit Mnemonics	7-bit Sequence	Processing After String Introducer is Received
DCS (9/0)	ESC P 1/B 5/0	Processing begins. If a C0 is received, the printer processes it, if applicable. If ESC, CAN, SUB, ST, or a C1 character is received, the printer enters text mode and processes the control command. If the final character is "q", the printer enters the sixel graphic mode. If the final character is other than "q", the DCS data string is ignored until ESC, CAN, ST, SUB, or a C1 character is received.

The following Table describes processing of the Operating System Command (OSC), Privacy Message (PM), and Application Program Command (APC).

8-bit Mnemonics	7-bit Sequence	Processing After String Introducer is Received
OSC 9/D	ESC [1/B 5/D	If ESC, CAN, SUB, ST or a C1 Character is received, the printer enters Text mode and processes the control command. Otherwise, the data string is ignored.
PM 9/E	ESC ^ 1/B 5/E	Same as above.
APC 9/F	ESC _ 1/B 5/F	Same as above.

J9 ERROR HANDLING

This paragraph describes what happens when the printer receives an invalid parameter, invalid sequence, or a sequence with embedded control characters. The printer generally recovers from such errors by performing as much of the sequence as possible.

o   Sequences not recognized by the printer are ignored.

o   If a sequence has an invalid parameter, the printer ignores the sequence.

o   If a numeric parameter exceeds its numeric limit, the printer uses the maximum allowable value for that parameter.

o   If a sequence includes a C0 control character, except for cancel (CAN), substitute (SUB), or escape (ESC), the printer processes those characters as if they were received before the sequence. The printer then continues to process the sequence.

o   A CAN (1/8) or SUB (1/A) character in a sequence cancels that sequence and returns the printer to Text mode character processing. The CAN or SUB is then processed.

o   An ESC (1/B) character in a sequence cancels that sequence. The printer then starts processing the new escape sequence.

o   If the printer receives a C1 control character within an escape sequence, the sequence is aborted and the C1 character is processed if it is applicable to the printer. If the A/0 character is received, it is treated as a SPACE (2/0) character, within the sequence. The F/F character is processed as a DELETE (7/F) character, and is ignored.

Note: The F/F character is treated as DELETE and is ignored if it is found inside the escape sequence.

o   If the printer receives a GR character during an escape or control sequence, the character will be stripped of the eighth bit and processed as a GL character.

o   C0 and C1 control characters do not change the status or processing of a single shift (SS2 or SS3) control character. The printer processes control characters in sequence.

J10   7-BIT AND 8-BIT CONVERSIONS

Converting from 7-bit to 8-bit coding is not necessary. However, such conversion could improve the data transmission rate.

If you need to operate in a 7-bit environment, you must convert 8-bit codes into 7-bit equivalents.

J10.1   Converting a 7-Bit Control Sequence to an Equivalent 8-Bit C1 Control Character

The 7-bit C1 control functions are coded as 2-character sequences of the form ESC Fe. Where Fe is a final character from columns four and five on a standard 8-bit character chart. The following steps convert the C1 equivalent control functions to a 1-byte C1 control characters.

    1. Remove the ESC character.

    2. Set the eighth bit of the final character to (1).

    3. Clear the seventh bit of the final character.

J10.2   Converting an 8-Bit C1 Control Character to an Equivalent 7-Bit Control Sequence

The 8-bit C1 control characters are coded as single characters from columns eight and nine on a standard 8-bit character chart. Convert C1 control characters to equivalent 2-character ESC Fe sequences as follows.

    1. Insert an ESC character.

    2. Clear the eighth bit of the C1 code.

    3. Set the seventh bit of the C1 code (to 1).

The following table summarizes valid printer C1 control characters and their 7-bit escape sequence equivalents.

Control Function Equivalents

8-Bit Control Character		7-Bit Escape Sequence	
PLD	(8/B)	ESC K	(1/B 4/B)
PLU	(8/C)	ESC L	(1/B 4/C)
SS2	(8/E)	ESC N	(1/B 4/E)
SS3	(8/F)	ESC O	(1/B 4/F)
DCS	(9/0)	ESC P	(1/B 5/0)
CSI	(9/B)	ESC [	(1/B 5/B)
ST	(9/C)	ESC]	(1/B 5/C)
OSC	(9/D)	ESC \	(1/B 5/D)
PM	(9/E)	ESC ^	(1/B 5/E)
APC	(9/F)	ESC _	(1/B 5/F)

J10.3   Converting 8-Bit GR Selections to a 7-Bit Equivalent

Use the character set designation sequences (paragraph J11.5) to designate the desired set as G2. Then, for any GR code, send an SS2 function followed by the code with the eighth bit set to 0.

J11 TEXT PROCESSING FUNCTIONS

The following paragraphs describes escape and control sequences for text processing.

J11.1 Horizontal Pitch (DECSHORP)

Horizontal pitch determines the width and spacing of printed characters. The printer has 6 horizontal pitch selections: 5, 6, 8.25, 10, 12, and 16.5 characters per inch (CPI). Any combination of these pitch selections may be used on a single print line.

When the horizontal pitch changes, the printer converts the active column to the grid of the new horizontal pitch. If the conversion yields a fraction, it is rounded to the next highest integer. This rounding allows printing on the correct column grid for the new pitch.

The following formula determines the precise location of the active column when the horizontal pitch changes.

$$\text{New column} = \frac{1 + \text{New pitch} \times (\text{Old column} - 1)}{\text{Old pitch}}$$

where:

New column   = new active column.

New pitch   = new pitch in characters per inch

Old column   = old active column, and

Old pitch   = old pitch in characters per inch.

Note: Any nonzero remainder is rounded to the next higher integer.
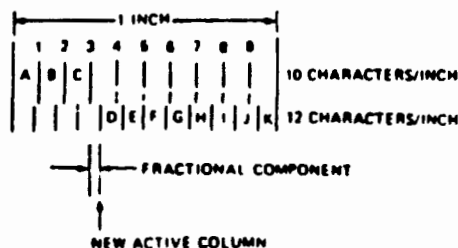
Figure J-3 Changing Horizontal Pitch

Changing horizontal pitch sets the left margin to column 1 and the maximum column at the new horizontal pitch.

Horizontal pitch also determines if single- or double-width character printing occurs, as shown below:

Horizontal Pitch Characters Per Inch	Maximum Characters Per Line		Character Width
	80 Column	136 Column	
10	80	136	Single
12	96	163	Single
16.5	132	224	Single
5	40	68	Double
6	48	81	Double
8.25	66	112	Double

The printer considers double-width characters to be one column wide (not two columns wide). Therefore, tab stops are reset to the appropriate double-width column grid when horizontal pitch is changed.

The following control sequences set Single-Width Horizontal Pitches:

Mnemonic	Sequence			Function
DECSHORP 9/B	CSI 7/7	w		Sets pitch to default of 10 CPI
	CSI 9/B	0 3/0	w 7/7	Same as above
	CSI 9/B	1 3/1	w 7/7	Sets pitch to 10 CPI
	CSI 9/B	2 3/2	w 7/7	Sets pitch to 12 CPI
	CSI 9/B	4 3/4	w 7/7	Sets pitch to 16.5 CPI

The following control sequences set Double-Width
Horizontal Pitches:

Mnemonic	Sequence	Function
DECSHORP	CSI 5 w 9/B 3/5 7/7	Sets pitch to 5 CPI
	CSI 6 w 9/B 3/6 7/7	Sets pitch to 6 CPI
	CSI 8 w 9/B 3/8 7/7	Sets pitch to 8.25 CPI

Note: The printer ignores any other parameter values.

J11.2 Vertical Pitch (DECVERP)

Vertical pitch determines the spacing between lines of
text.   Changing vertical pitch does not change the
height of the printed character or the top-of-form
position.   The printer has six vertical pitch selections:
2, 3, 4, 6, 8, and 12 lines per inch (LPI).

When you change vertical pitch, the printer converts the
active line to the grid of the new vertical pitch. If the
conversion yields a fraction, the active line is rounded
to the next integer.   Then, after receiving a paper
motion command, the printer advances the paper to the
next line on the new vertical grid.

The following control sequences set Vertical Pitches:

Mnemonic	Sequence	Function
DECVERP	CSI z 9/B 7/A	Sets pitch to default of 6 LPI
	CSI 0 z 9/B 3/0 7/A	Same as above

Vertical Pitch Control Sequences (Continued)

Mnemonic	Sequence			Function
DECVERP	CSI 9/B	1 3/1	z 7/A	Sets pitch to 6 LPI
	CSI 9/B	2 3/2	z 7/A	Sets pitch to 8 LPI
	CSI 9/B	3 3/3	z 7/A	Sets pitch to 12 LPI
	CSI 9/B	4 3/4	z 7/A	Sets pitch to 2 LPI
	CSI 9/B	5 3/5	z 7/A	Sets pitch to 3 LPI
	CSI 9/B	6 3/6	z 7/A	Sets pitch to 4 LPI

J11.3 Page Length (DECSLPP)
Select the default page length with a Form Length selection. The factory default page length setting is 11 inches. An 11-inch page gives 66 lines at the default vertical pitch of 6 lines per inch.

The page length control sequence lets you set the page length by selecting the number of lines (0 to 252) per page at the current vertical pitch. If the distance specified exceeds 21 inches, the printer sets the page length to the maximum of 21 inches.

Select any page length from 1/12 inch to 21 inches with the number of lines at the current vertical pitch. If the page length is set to 0, the printer ignores paging and treats all form feed characters as line feed characters.

The following table shows Page Length and Lines per Page as a function of vertical pitch.

Page Length (inches)	Lines per Page when Selected Vertical Pitch (Lines per Inch) is set at:					
	2	3	4	6	8	12
11	22	33	44	66	88	132
14	28	42	56	84	112	168

If the vertical pitch changes after page length has been set, the page may contain a non-integral number of lines. In this case, the fractional line portion is added to the last full line on that page.

For example, suppose you select 22 lines per page at 6 lines per inch, then change the vertical pitch to 8 lines per inch. The form length is now 29 lines per page, with 28 lines at 8 lines per inch and 1 line at 6 lines per inch, preserving the selected physical form length of 3.67 inches.

The following control sequence sets Page Length:

Mnemonic	Sequence	Function
DECSLPP	CSI Pn t 9/B ••• 7/4	Sets the active line to the top-of-form position and sets the page length to Pn units of the current vertical pitch.

J11.4 Partial-Line Paper Motion (PLD and PLU)

The following escape sequences move the paper in 1/12 inch increments. Paper is advanced with a Partial Line Down (PLD) sequence. Paper is reversed with a Partial Line Up (PLU) sequence. These sequences modify the printer's active line counter.

Mnemonic (8-bit)	Sequence (7-bit)	Function
PLD	ESC K 1/B 4/B	Advances paper 1/12 inch
PLU	ESC L 1/B 4/C	Reverses paper 1/12 inch

J11.5 Select Character Set Sequences (SCS)

Select Character Set (SCS) escape sequences are used to assign any of the printer character sets to the G0, G1, G2, and G3 character set designators. These designators define the contents for the GL and GR printable sets and may be controlled with the single and locking shift command (paragraph J11.6). The following table lists the SCS sequences and corresponding character sets.

Character Set Assignment

G0	G1	G2	G3	Character Set
ESC (B	ESC) B	ESC * B	ESC + B	U.S. ASCII
ESC (A	ESC) A	ESC * A	ESC + A	Great Britain
ESC (5	ESC) 5	ESC * 5	ESC + 5	Finland
ESC (R	ESC) R	ESC * R	ESC + R	France
ESC (9	ESC) 9	ESC * 9	ESC + 9	French Canada
ESC (K	ESC) K	ESC * K	ESC + K	Germany

Character Set Assignment

G0	G1	G2	G3	Character Set
ESC (Y	ESC) Y	ESC * Y	ESC + Y	Italy
ESC (J	ESC) J	ESC * J	ESC + J	JIS Roman
ESC (I	ESC) I	ESC * I	ESC + I	JIS Katakana
ESC (6	ESC) 6	ESC * 6	ESC + 6	Norway/Denmark
ESC (Z	ESC) Z	ESC * Z	ESC + Z	Spain
ESC (7	ESC) 7	ESC * 7	ESC + 7	Sweden
ESC (<	ESC) <	ESC * <	ESC + <	Multinational
ESC (0	ESC) 0	ESC * 0	ESC + 0	Note 1
ESC (C	ESC) C	ESC * C	ESC + C	Finland
ESC (Q	ESC) Q	ESC * Q	ESC + Q	French Canada
ESC (E	ESC) E	ESC * E	ESC + E	Norway/Denmark
ESC (H	ESC) H	ESC * H	ESC + H	Sweden

Note 1: VT100 Special Graphics Character Set

J11.6 Single and Locking Shifts

In a 7-bit environment, only the GL active character set is available. Sequences that refer to the GR active character set have no effect in a 7-bit character environment.

In an 8-bit environment, the printer uses the GL active character set if the character's eighth bit is 1.

The following Table lists the control characters and escape sequences that assign the available character sets to the active character set (GL or GR).

Note: A Locking Shift (SI, SO, LS2, LS3, LS1R, or LS3R) remains in effect until the printer receives another locking shift.

Active Character Set Selection

Name	Mnemonic	Sequence	Function
Single Shift 2	SS2*	ESC N 1/B 4/E	Character after SS2 is selected from the G2 character set.
Single Shift 3	SS3*	ESC O 1/B 4/F	Character after SS3 is selected from the G3 character set.
Shift In	SI	N/A	G0 character set becomes the GL active character set.
Shift Out	SO	N/A	G1 character set becomes the GL active character set.
Locking Shift 2	LS2	ESC n 1/B 6/E	G2 character set becomes the GL active character set.
Locking Shift 3	LS3	ESC o 1/B 6/F	G3 character set becomes the GL active character set.
Locking Shift 1 Right	LS1R	ESC 1/B 7/E	G1 character set becomes the GR active character set.
Locking Shift 2 Right	LS2R	ESC 1/B 7/D	G2 character set becomes the GR active character set.
Locking Shift 3 Right	LS3R	ESC 1/B 7/C	G3 character set becomes the GR active character set.

* SS2 and SS3 only affect the first printable character following the single-shift sequence.

In an 8-bit environment, the eighth bit of the printable character following the single shift (SS2 or SS3) is ignored providing a character code in the range of 2/1 to 7/E. The A/0 character clears the single shift code and is processed as an error character.

J11.7 Printing Density Selection (DECDEN)

Two font generated printing densities are available:

1. Draft
2. Near Letter Quality (NLQ)

The following control sequences select draft, or near letter quality print density.

Mnemonic	Sequence			Function
DECDEN	CSI 9/B	" 2/2	z 7/A		Defaults to Draft
	CSI 9/B	0 3/0	" 2/2	z 7/A	Defaults to Draft
	.CSI 9/B	1 3/1	" 2/2	z 7/A	Sets Draft
	CSI 9/B	2 3/2	" 2/2	z 7/A	Sets NLQ

Note: If you use any other parameter values, the printer will ignore the sequence.

J11.8 Highlighting Printing (SGR)

One or more SGR highlight attributes may be specified in one sequence. All printable characters following the SGR sequence are printed using the selected highlighting features, until the next SGR sequence. The printer evaluates Ps parameters sequentially from left to right.

The Select Graphic Rendition (SGR) sequence is:

SGR	CSI	Ps	;	...	;	Ps	m
	9/B	*** 3/B		...	3/B	***	6/D

Ps	Function
0 or none	Turns off bold, underline printing, and selects black color.
1 (3/1)	Turns on bold printing.
4 (3/4)	Turns on underline printing.
22 (3/2 3/2)	Turns off bold printing.
24 (3/2 3/4)	Turns off underline printing.
30 (3/3 3/0)	Selects Black color.
31 (3/3 3/1)	Selects Magenta color.
32 (3/3 3/2)	Selects Cyan color.
33 (3/3 3/3)	Selects Violet color.
34 (3/3 3/4)	Selects Yellow color.
35 (3/3 3/5)	Selects Orange color.
36 (3/3 3/6)	Selects Green color.

When you enter graphic mode, the printer stores the current parameter values for the SGR sequence. When you return to text mode, the printer uses these parameters.

The printer ignores all other parameter values received
in this control sequence, But still executes the valid
parameter values. The printer executes the parameters
in the order received.

J12 GRAPHICS MODE OVERVIEW

Paragraphs J13 and J14 describe how to select and
process graphic data.

Sixel data is used to print graphics.

> Pixels are individual dots on a video terminal
> screen or a dot matrix printer and a sixel is a
> column of six vertical pixels.

A sixel represents bit map data. Each pixel of a sixel
represents one bit of information. A bit value of 1
means to print a pixel, while a bit value of 0 means to
leaves a space. The printer decodes the sixel data into
bits of information and maps them to the 9 wire print
head for printing.

Sixel data consists of characters that are represented by
a binary bit pattern. To encode picture data into valid
sixel data, first convert each six-bit binary sixel to a
hexadecimal value. In each sixel column, the least
significant bit corresponds to the top pixel, and the
most significant bit corresponds to the bottom pixel.

Because sixel column codes are restricted to characters
in the range from 3/F through 7/E, you must add the
hexadecimal offset 3/F (decimal 63) to each sixel
column value. For example, the binary value of 000000
is converted to hexadecimal 3/F, binary 110101 is
converted to hexadecimal 7/4 (3/5 plus 3/F), and binary
111111 is converted to hexadecimal 7/E (3/F plus 3/F).

After this binary-to-hexadecimal conversion, convert the hexadecimal values for each sixel into the equivalent characters using an ASCII table.

J13 SELECT GRAPHIC MODE

Select Graphic mode by sending a special device control string (DCS). Include all sixel graphic and formatting information in the device control string.

The device control string starts with the "DCS" control code, called a string introducer. The string terminator "ST" control code ends the string (the ST code also ends Graphic mode).

Device Control String (DCS) Format

DCS	q	sixel data	ST
9/0	7/1	* * * * *	9/C

J13.1 String Introducer

Send the string introducer in text mode, to identify the start of the device control string.

Sixel graphic mode is one of the three valid uses of the device control strings. Use the 8-bit DCS (9/0) control code or the 7-bit ESC P (1/B 5/0) escape sequence for the string introducer.

J13.2 Final Character

The final character "q" (7/1) identifies this sequence as a sixel protocol selector and places the printer in Graphics mode.

J13.3 Picture Data

Picture data includes sixel printable characters and sixel control characters. The printer processes picture data in graphics mode, as defined in paragraphs J12 and J14. In graphics mode, only unidirectional printing is performed.

J13.4 String Terminator (ST)

The string terminator (ST) control code causes the printer to leave Graphic mode and enter Text mode. Use the 8-bit control code ST (9/C) or the 7-bit escape sequence ESC \ (1/B 5/C) for the string terminator.

J14 CHARACTER PROCESSING IN GRAPHIC MODE

In Graphic mode, printable character codes define specific columns of dots to print.

J14.1 Sixel Printable Characters

In sixel graphic mode, the printer interprets GL (Graphic Left) characters in the column/row range of 3/F to 7/E as printable characters. Each of these 64 values represents a code of 6 vertical pixels (1 sixel) to print. The actual pixel size is defined by the horizontal grid size (HGS) parameter and the aspect ratio.

The printer subtracts a hexadecimal offset of 3/F from each graphic printable character received, resulting in a binary value in the range of 0/0 to 3/F. The 6-bit binary value obtained represents a sixel column definition.

For each bit set to 1, the printer activates a print head element, or group of elements, to print a dot. The least significant bit (bit 0) is the top pixel of a sixel.

The printer processes GR (Graphic Right) characters in the B/F to F/E range as GL characters, by setting the eighth bit to 0 and subtracting the 3/F hexadecimal offset from the graphic printable character.

Column & Row	ASCII Symbol	Binary Value	Pixels Activated	Action Performed
3/F	?	000000	None	Advance by a sixel space
4/0	@	000001	Top	Print only top pixel
5/F	_	100000	Bottom	Print only bottom pixel
7/E	~	111111	All	Print one full column

If you try to print past the right margin, the printer truncates all remaining sixel data until it receives the next graphic carriage return ($) or graphic new line (-) character.

J14.2 Sixel Control Codes

Sixel control codes are GL characters in the 2/0 to 3/E range.   The printer recognizes the following sixel control characters.

Column/Row	ASCII Character	Function
2/1	!	Repeat introducer
2/4	$	Graphic carriage return
2/D	_	Graphic new line
3/0 to 3/9	0 to 9	Numeric parameters

A control sequence in Graphic mode begins with a sixel control character (not including the 0 to 9 characters) and ends with either a printable character or another sixel control character.

The printer ignores unassigned sixel control characters (along with any parameters or parameter separators) until receiving the next valid sixel control character, printable character, or string terminator (ST).

J14.2.1 Repeat Introducer (!)

Use the following sequence to print the same character a consecutive number of times.

> !   Pn   **Printable Character**
> 2/1   ∗ ∗ ∗

Pn specifies the number of times the printable character is printed.

The numeric parameter is a string of characters in the 3/0 to 3/9 range that the printer interprets as a decimal number, from 0 to 65,535. If you omit Pn or set Pn to 0, the printer uses 1. If you use a Pn value larger than 65,535, the printer uses the maximum value of 65,535.

Note: Sixel control characters received during a repeat sequence cancel the repeat sequence. The printer will process these control characters.

The printer prints the printable character (in the 3/F to 7/E range) as many times as specified by Pn. The printable character terminates the repeat sequence, as examples:

Repeat Sequence				Function
!	1	0	?	Repeats 10 graphic spaces
2/1	3/1	3/0	3/F	
!	6	@		Repeats 6 patterns of top dot
2/1	3/6	4/0		

J14.2.2 Graphic Carriage Return ($)

The graphic carriage return (GCR) control code $ (2/4) returns the carriage to the graphic left margin. The graphic left margin is the active position where the printer enters the Graphic mode. This allows over-printing lines of sixel data.

J14.2.3 Graphic New Line (-)

The graphic new line (GNL) control code (2/D) ends a printed graphic sixel line by:

o Returning the print head to the graphic left margin.

o Advancing the paper to print the next sixel line. The active vertical position is advanced by 1/12".

J14.2.4 Numeric Parameters (0-9)

Some graphic control codes must be followed by a numeric value. The numeric value is a decimal number, coded by using the ASCII digits 0 to 9 (3/0 to 3/9). A numeric value is ended by any non-digit, specifically another control code or a graphic printable character. The default value for any numeric parameter is 0.

J14.3 Graphic C0 Control Characters

In Graphic mode, the printer ignores all C0 control characters except CAN, SUB and ESC. When these control characters are received, the printer performs the following actions.

C0 Control Character	Printer Action
CAN	Exits Graphic mode, enters Text mode, and then processes CAN
SUB	Processes SUB as a sixel space (3/F) to limit communication line errors
ESC	Leaves Graphic mode, enters Text mode, and then processes ESC

Note: When the printer receives any C1 control code in Graphic mode, the printer leaves Graphic mode and enters Text mode. The printer then processes the C1 control codes, if recognized.

J14.4 Graphic Substitute (SUB) Character

The printer interprets the substitute character SUB (1/A) as being in place of a character or characters received in error. In Graphic mode, the printer processes SUB as a sixel space character (3/F).

If the printer is processing a repeat sequence, the sequence is terminated. The printer then prints a number of sixel spaces equal to the repeat number specified in the repeat sequence. The printer remains in Graphic mode.

J14.5 Leaving Graphic Mode

The control characters shown in the following table will cause the printer to leave Graphic mode and perform the indicated action.

C0 Control Character	Printer Action
CAN	Enters Text mode and processes the CAN character.
ESC	Enters Text mode and begins processing another escape sequence.
ST	Enters Text Mode

J14.6 Printer State After Leaving Graphic Mode

After leaving Graphic mode, the printer enters the following state.

o   Horizontal position returns to the last active position before entering Graphic mode.

o   Horizontal pitch returns to the last value used before entering Graphic mode.

o   Vertical position is modified by the vertical control characters received in Graphic mode.

o   Vertical pitch returns to the last value used before entering Graphic mode.

J15 ATTRIBUTES, STATUS REPORT, AND RESET SEQUENCES

The following paragraphs describe the escape and control sequences used to obtain device attributes, request status reports, and reset the printer.

J15.1 Device Attribute (DA) Sequences

The printer sends a reply to a request from the computer for device attributes. The printer sends the reply after printing all data received before the DA request.

The reply sequence provides printer ID as shown below:

DA Request from Computer

CSI	0	c	**or**	CSI	c
9/B	3/0	6/3		9/B	6/3

DA reply from printer (LA50 Emulation)

ESC		?	1	7	c
1/B	5/B	3/F	3/1	3/7	6/3

The printer sends LA50 reply (1 7).

J15.2 Device Status Request (DSR)

The Device Status Request sequences that control the printer's status reports, and enables or disables unsolicited reports are listed in the following table.

Mnemonic	Sequence				Function
DSR	CSI	n			Send extended status report
	9/B	6/E			
	or				
	CSI	0	n		Same as above
	9/B	3/0	6/E		
	CSI	?	1	n	Disable all unsolicited status reports
	9/B	3/F	3/1	6/E	

Mnemonic	Sequence	Function
DSR	CSI ? 2 n 9/B 3/F 3/2 6/E	Enable unsolicited brief status and send extended status report
	CSI ? 3 n 9/B 3/F 3/3 6/E	Enable unsolicited extend-status reports and send extended status report

J15.3 Device Status Report

The printer can send both brief and extended status reports. The reports may be solicited or unsolicited. Solicited reports are sent immediately upon request. The printer sends unsolicited reports (if enabled) when there is a change in any reportable status condition (such as a failure and subsequent printer's reset). Unsolicited status reports are initially disabled.

When solicited, DSR must be processed on its way into the input buffer. Therefore, the printer immediately responds to DSR, even when the buffer is full and an XOFF has been sent to the host computer. The printer may receive and answer an unlimited number of status requests.

The control sequence and contents of the brief Device Status Reports are as follows.

Mnemonic	Sequence	Function
DSR	ESC [0 n 1/B 5/B 3/0 6/E	No malfunction detected
	ESC [3 n 1/B 5/B 3/3 6/E	Malfunction detected.

The control sequence and contents of the <u>extended</u>
Device Status Reports are as follows.

Mnemonic	Sequence
DSR	ESC [0 n 1/B 5/B 3/0 6/E followed by: ESC [? 2 0 n 1/B 5/B 3/F 3/2 3/0 6/E Indicates "No malfunction detected" ESC [3 n 1/B 5/B 3/3 6/E followed by: ESC [? Pn ; ... Pn n 1/B 5/B 3/F *** 3/B ... *** 6/E Indicates "Malfunction Detected"

"Pn" can be any valid combination of the following
values:

Pn	Failure
21 (3/2 3/1)	Hardware failure.*
22 (3/2 3/2)	Communication failure.**
23 (3/2 3/3)	Input buffer overflow.***
24 (3/2 3/4)	Printer deselected.
26 (3/2 3/6)	Access cover open.
27 (3/2 3/7)	Paper out.

*   The only reportable hardware failure is a print
head position failure. This occurs when the print
head loses track of position and attempts to move
beyond the physical left side-frame stop.

**   A communication failure can be a parity or framing error; or an erroneous character received by the printer.

***   Failures designated as events (communication failure and buffer overflow) are automatically reset when an extended report is sent, and are only reported when they occur (not when they are idle).

J15.4 Reset to Initial State (RIS)

This resets all DEC-compatible features to the initial state without running the power-up self-test. Data in the buffer is preserved (including the DECDLD buffer).

Mnemonic	Sequence	Function
RIS	ESC c 1/B 6/3	Reset printer to its DEC-compatible initial state.

J16 PRINTING SELF-TEST

Start this self-test by pressing the LINE FEED switch while turning power on. The printer should print 94 ASCII characters in a continuously swirl pattern.

To stop the printing test, turn the printer off.

A sample of the Self-Test print pattern follows:

```
LASO EMULATION  Ver. IC2A

 '"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHI
'"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJ
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJK
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKL
$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLM
%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMN
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNO
'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
)*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQR
*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRS
+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRST
,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTU
-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUV
./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVW
/0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWX
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXY
123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ
23456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[
3456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\
456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]
56789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^
6789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`
89:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`a
9:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`ab
:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abc
;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcd
<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcde
=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdef
>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefg
?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefgh
@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghij
BCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijk
```

APPENDIX K

OKIDATA TYPE COMMAND SET

K.1 COMMAND OVERVIEW

This Appendix explains the Command Set used by the printer when Emulation switch 3 on the Memory circuit board is set to "I" - Okidata Emulation.

Refer to Appendix J if Emulation switch 3 is set to "F" - DEC Type Emulation.

Most users will operate with application software and will not use the information in this section.

Specify your printer as an Okidata. 192/193+ in your application software install procedure and your printer will interact correctly with your system.

This section of the manual is written for advanced users and others who may need information on the printer's Command Set. A Programmers manual with additional command information is also available. Consult your authorized Dealer for availability.

Commands, given as a Control Code or Escape Code sequence, cause the printer to:

Exchange, store and print data

Establish and reset different print modes (Double-Width, Condensed, Emphasized, Underscore, Draft)

Format the printer's output

Control other functions performed by the printer

When a command specifies a change to a DIP switch setting, the DIP switch setting is over-ridden.

The host computer sends commands (and data) to the printer via the interface, under software control.

For example, a LPRINT statement (in BASIC) allows entry of a command. The LPRINT statement uses the following formats to send information to the printer:

LPRINT "w"   ASCII Character

LPRINT CHR$(119)   Decimal Character

LPRINT CHR&(H77)   Hexadecimal Character

Refer to your application program or computer manual for additional information.

Table K-1 lists the commands that are available for Okidata 192/193+ printer emulation, and gives the control/escape code sequence in ASCII, Decimal and Hexadecimal format. Also shown in Table K-1 is a paragraph, or Appendix reference, where additional information on the command type is given.

Table K-1 Command Set Summary

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
PRINT MODES (Refer to K.2)			
Near Letter Quality	ESC 1	(27)(49)	(1B)(31)
Draft Mode	ESC 0	(27)(48)	(1B)(30)
Italicized (Start)	ESC ! /	(27)(33)(47)	(1B)(21)(2F)
Italicized (Stop)	ESC ! *	(27)(33)(42)	(1B)(21)(2A)
Emphasized	ESC T	(27)(84)	(1B)(54)
Enhanced	ESC H	(27)(72)	(1B)(48)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
Stop Enhanced or Emphasized	ESC I	(27)(73)	(1B)(49)
Superscript	ESC J	(27)(74)	(1B)(4A)
Stop Superscript	ESC K	(27)(75)	(1B)(4B)
Subscript	ESC L	(27)(76)	(1B)(4D)
Stop Subscript	ESC M	(27)(77)	(1B)(4E)
PITCH and SPACE (Refer to K.3)			
10 CPI	RS	(30)	(1E)
12 CPI	FS	(28)	(1C)
17.1 CPI	GS	(29)	(1D)
Double-wide Characters	US	(31)	(1F)
Change Space be- tween characters n is 01 to 11	ESC N n	(27)(78)(n)	(1B)(4E)(n)
Restore Normal Character Space	ESC N NUL	(27)(78)(00)	(1B)(44)(00)

CPI is Characters Per Inch

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
CHARACTER SETS (Refer to K.4)			
Standard Set	ESC ! 0	(27)(33)(48)	(1B)(21)(30)
IBM Character Set	ESC ! 2	(27)(33)(50)	(1B)(21)(32)
Use in 7-bit mode to access low ASCII code characters (decimal 001-127)	SI	(15)	(0F)
Use in 7-bit mode to access high ASCII code character (decimal 128-255)	SO	(14)	(0E)
ASCII Set with (∅)	ESC ! @	(27)(33)(64)	(1B)(21)(40)
ASCII Set with (0)	ESC ! A	(27)(33)(65)	(1B)(21)(41)
International Sets (See Appendix D)	ESC ! n	(27)(33)(n)	(1B)(21)(n)
BLOCK GRAPHICS (Refer to K.12)	ESC ! 1	(27)(33)(49)	(1B)(21)(31)
CUSTOM CHARACTERS (Refer to K.14)			
Designates font of custom set	ESC 2	(27)(50)	(1B)(32)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
CUSTOM CHARACTERS			
Copy Character Set to Custom Character Set Memory	ESC $	(27)(36)	(1B)(24)
Load a Standard Character into the Custom Character Set Memory m is 32-127 decimal or 20-7F hex nl..nll is pattern	ESC % A m nl..nll	(27)(37) (65)(m) (nl..nll)	(1B)(25)(41) (m)(nl..nll)
Load a Descender Character into the Custom Character Set Memory m is 32-127 decimal or 20-7F hex nl..nll is pattern	ESC % D m nl..nll	(27)(37) (68)(m) (nl..nll)	(1B)(25)(44) (m)(nl..nll)
LINE SPACING (Refer to K.5)			
6 Lines per Inch	ESC 6	(27)(54)	(1B)(36)
8 Lines per Inch	ESC 8	(27)(56)	(1B)(38)
n/144" Lines per Inch n is 000 to 127 127/144" is max	ESC % 9 n	(27)(37) (57)(n)	(1B)(25)(39) (n)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
PRINT FEATURES (Refer to K.6)			
Start Underline	ESC C	(27)(67)	(1B)(67)
Stop Underline	ESC D	(27)(68)	(1B)(68)
Backspace	BS	(08)	(08)
Delete Character	ESC DEL	(27)(127)	(1B)(7F)
Carriage Return Prints data in print buffer, then returns print head to left side	CR	(13)	(0D)
Indent Sets dot column of next print position n is 0001 to 9999	ESC % B n	(27)(37) (66)(n)	(1B)(25) (42)(n)
Unidirectional Print	ESC -	(27)(45)	(1B)(2D)
Bi-directional Print	ESC =	(27)(61)	(1B)(3D)
Enter Print Suppress SEL light blinks and printer ignores all data except DC1	DC3	(19)	(13)
Exit Print Suppress	DC1	(17)	(11)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
PAGE FORMAT (Refer to K.7)			
Set Left Margin at n/120" n is 000 to 999	ESC % C n	(27)(37) (67)(n)	(1B)(25) (43)(n)
Set Right Margin at n/120" n is 0000 to 9999	ESC % R n	(27)(37) (82)(n)	(1B)(25) (52)(n)
Set Top of Form	ESC 5	(27)(53)	(1B)(35)
Set Form Length in lines per page n is 00 to 99	ESC F n	(27)(70) (n)	(1B)(46) (n)
Set Form Length in $\frac{1}{2}$" increments n is 00 to 99	ESC G n	(27)(71) (n)	(1B)(47) (n)
Form Feed	FF	(12)	(0C)
LINE FEED (Refer to K.8)			
Advance Paper One Line	LF	(10)	(0A)
Print Data then Advance Paper One Line	ESC DC2	(27)(18)	(1B)(12)
Line Feed n multiples of 1/144" with each Carriage Return n is 000 to 127	ESC % 5 n	(27)(37) (53)(n)	(1B)(25) (35)(n)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
LINE FEED (Continued)			
Skip n number of lines n is 0 to 9	ESC VT n	(27)(11) (n)	(1B)(0B) (n)
Skip Perforation n specifies distance skipped from bottom of one page to top of next page n is 0 to 9	ESC % 5 n	(27)(37) (83)(n)	(1B)(25) (53)(n)
HORIZONTAL TAB (Refer to K.9)			
Set Tab at character columns n1, n2, nx n is 000 to 999	ESC HT n1 n2 nx CR	(27)(09) (n1)(n2) (nx)(13)	(1B)(09) (n1)(n2) (nx)(0D)
Set Tab at dot columns d1, d2, dx d is 0000 to 9999	ESC ETX d1 d2 dx CR	(27)(03) (d1)(d2) (dx)(13)	(1B)(03) (d1)(d2) (dx)(0D)
Clear Horizontal Tab	ESC HT CR	(27)(09) (13)	(1B)(09) (0D)
Execute Horizontal Tab	HT	(09)	(09)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
VERTICAL FORMAT UNIT (VFU) (Refer to K.10)			
Load VFU Tab Position	DC4	(20)	(14)
End of VFU Load	?	(63)	(3F)
Advance Paper to VFU Channel n n is 01 to 12	VT n	(11) (n)	(0B)(n)
BIT IMAGE GRAPHICS (Refer to K.13)			
Enter Bit Image Graphics	ETX	(03)	(03)
Set Single Density Graphics 60 x 72 DPI @ 10 CPI 72 x 72 DPI @ 12 CPI	ESC P	(27)(80)	(1B)(50)
Set Double Density Graphics 120 x 72 DPI @ 10 CPI 144 x 72 DPI @ 12 CPI	ESC R	(27)(82)	(1B)(52)
Print Bit Image Paper moves 14/144" in 7-bit mode and 16/144" in 8-bit mode	ETX SO	(03)(14)	(03)(0E)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
BIT IMAGE (Continued)			
Print Bit Image, paper moves 14/144" in 7-bit and 16/144" in 8-bit mode	ETX DC4	(03)(20)	(03)(14)
Print Bit Image, paper moves one line <u>with</u> CR	ETX LF	(03)(10)	(03)(0A)
Print Bit Image, paper moves one line <u>without</u> CR.	ETX DC2	(03)(18)	(03)(12)
Exit Bit Image Graphics	ETX STX	(03)(02)	(03)(0E)
COMPOSITE (Refer to K.15)			
Composite Print sets several print modes at once.	ESC & n :	(27)(38) (n)(58)	(1B)(26) (n)(3A)
Composite CR/LF sets CR and LF simultaneously	ESC ? n :	(27)(63) (n)(58)	(1B)(3F) (n)(3A)
Composite Graphics sets several graphics values	ESC * n :	(27)(42) (n)(58)	(1B)(2A) (n)(3A)

Table K-1 Command Set Summary (Continued)

COMMAND	CONTROL CODE		
	ASCII	DECIMAL	HEX
MISCELLANEOUS (Refer to K.11)			
Paper-out Switch n=1 is ignore switch n=0 is enable switch	ESC E n	(27)(69) (n)	(1B)(45) (n)
Operate @ half speed	ESC <	(27)(60)	(1B)(3C)
Operate @ full speed	ESC >	(27)(62)	(1B)(3E)
Reset Buffer and printer to default	CAN	(24)	(18)
Printer/Buffer Reset Prints data in buffer and resets printer to default settings	ESC CAN	(27)(24)	(1B)(18)

5.2 PRINT MODES

Print mode commands are given below.

DESCRIPTION	DECIMAL	HEX	ASCII
Near Letter Quality	27 49	1B 31	ESC 1
Draft Mode	27 48	1B 30	ESC 0
Italic Start	27 33 47	1B 21 2F	ESC ! /
Italic Stop	27 33 42	1B 21 2A	ESC ! *
Emphasized Start	27 84	1B 54	ESC T

K.2 PRINT MODES (Continued)

DESCRIPTION	DECIMAL	HEX	ASCII
Start Enhanced	27 72	1B 48	ESC H
Emphasized/Enhanced Stop	27 73	1B 49	ESC I
Start Superscript	27 74	1B 4A	ESC J
Stop Superscript	27 75	1B 4B	ESC K
Start Subscript	27 76	1B 4C	ESC L
Stop Subscript	27 77	1B 4D	ESC M

Each print mode is effective until another print mode command is received.

Near Letter Quality (NLQ)
In NLQ each print line is printed twice. The second pass creates a darker image. NLQ print mode is not available with 17.1 characters per inch or with graphics.

Draft Mode
Selected when speed is needed. Up to 220 characters per seconds are printed in this mode with any of the standard character sizes. Draft mode can be combined with double width, emphasized, enhanced and italic.

Italic
Used to make a word or phrase stand-out. Italic printing is a one pass printing mode and cannot be combined with NLQ.

Emphasized/Enhanced
Used to highlight text, create headlines and subtitles. With enhanced printing each print line is printed twice, during the second pass printing is offset $\frac{1}{2}$ dot vertically to create a darker character.

With emphasized printing each character is offset $\frac{1}{2}$ dot horizontally to create a wider darker character.

Emphasized and Enhanced printing cannot be combined with NLQ, Superscript or Subscript.

Superscript/Subscript

Used to print above and below the standard print line for footnotes, exponents, trademarks, and other offset printing. Superscript and subscript characters are half the height of normal characters. For compatibility with word processing application packages, a subscript command cancels superscript and a superscript command cancels subscript.

K.3 CHARACTER PITCH/SPACING

Pitch and spacing commands are given below.

DESCRIPTION	DECIMAL	HEX	ASCII
10 CPI - Pica	30	1E	RS
12 CPI - Elite	28	1C	FS
17.1 CPI - Condensed	29	1D	GS
Double Wide Characters	31	1F	US
Change Space Between Characters	27 78 n	1B 4E n	ESC N n
Return Normal Spacing	27 78 0	1B 4E 00	ESC N NUL

Each character pitch and space between characters command is effective until another character pitch or space command is received.

Character Pitch

There are three character pitches:

Pica - 10 characters per inch

Elite - 12 characters per inch

Condensed - 17.1 characters per inch.

Double-wide Characters

Double wide characters provide three more character pitches:

5 characters per inch

6 characters per inch

8.5 characters per inch

A print sample of each character pitch and double wide character printing is given below:

10 CPI Sample   ΄ABCDEFGHIJ

Double-wide
5 CPI Sample   ABCDEFGHIJ

12 CPI Sample   ABCDEFGHIJKL

Double-wide
6 CPI Sample   ABCDEFGHIJKL

17.1 CPI Sample   ABCDEFGHIJKLMNOPQ

Double-wide
8.5 CPI Sample   ABCDEFGHIJKLMNOPQ

Change Space Between Characters

With each print mode a standard space is placed between each character. This space is changed in 1/120" increments (designated by n) with this command. The value of n is 1 to 11.

Standard space for each character pitch is:

10 CPI	3/120"	5 CPI	6/120"
12 CPI	3/144"	6 CPI	6/144"
17.1 CPI	3/206"	8.5 CPI	6/206"

The maximum space that may be set for each character pitch is:

10 CPI	14/120"	5 CPI	17/120"
12 CPI	14/144"	6 CPI	17/144"
17.1 CPI	14/206"	8.5 CPI	17/206"

K.4 CHARACTERS SETS AND LANGUAGES

Character set commands are given below.

DESCRIPTION	DECIMAL	HEX	ASCII
Standard Characters	27 33 48	1B 21 30	ESC ! 0
IBM Character Sets	27 33 50	1B 21 32	ESC ! 2
ASCII (∅)	27 33 64	1B 21 40	ESC ! @
ASCII (0)	27 33 65	1B 21 41	ESC ! A
International Sets			
British	27 33 66	1B 21 42	ESC ! B
German	27 33 67	1B 21 43	ESC ! C
French	27 33 68	1B 21 44	ESC ! D
Swedish	27 33 69	1B 21 45	ESC ! E
Danish	27 33 70	1B 21 46	ESC ! F
Norwegian	27 33 71	1B 21 47	ESC ! G
Dutch	27 33 72	1B 21 48	ESC ! H
Italian	37 33 73	1B 21 49	ESC ! 1
French-Canadian	27 33 74	1B 21 4A	ESC ! J
Spanish	27 33 75	1B 21 4B	ESC ! K
Block Graphics	27 33 49	1B 21 31	ESC ! 1
Custom Characters	27 50	1B 32	ESC 2

K.4 CHARACTERS SETS AND LANGUAGES
(Continued)

Each character set is effective until another character set command is received. A default character set is selected by DIP switches when power is turned ON.

Enter the following to access between characters in low ASCII code (decimal 1 to 127) and high ASCII code (decimal 128 to 255):

Decimal	Hexadecimal	ASCII
14	0E	SO
15	0F	SI (Cancel)

Standard Character Set
The set of characters shown in Appendix G.

IBM Character Set
Prints the complete IBM alphanumeric character set and special symbols shown on the system's monitor, as given in Appendix G.

ASCII Character Sets
Choose between the ASCII character set which prints zero with a slash through it (∅) or the ASCII set that prints the zero without a slash through it (0).

International Language Sets
These character sets contain the special characters and symbols used with each language, shown in Appendix G.

Block Graphics

Additional information on Block Graphics is given later in this Appendix.

Custom Character Set

Additional information on Custom Characters is given later in this Appendix.

K.5 LINE SPACING

Line spacing commands are given below. Also refer to paragraph K.8 for additional commands that affect paper movement.

DESCRIPTION	DECIMAL	HEX	ASCII
6 Lines per Inch	27 54	1B 36	ESC 6
8 Lines per Inch	27 56	1B 38	ESC 8
n/144" Line Space	27 37 57 n	1B 25 39 n	ESC % 9 n

Line spacing is set until another line space command is received.

6 Lines Per Inch

Paper is advanced 1/6" with each line feed.

8 Lines Per Inch

Paper is advanced 1/8" with each line feed.

n/144" Line Space

Paper is advanced n/144" with each line feed. n is 0 to 127. The printer prints over previously printed data (no paper advance) if line space is set to 0/144". Maximum paper movement is 127/144".

K.6 PRINT FEATURES

Commands that control print features are given below.

DESCRIPTION	DECIMAL	HEX	ASCII
6 Lines per Inch	27 54	1B 36	ESC 6
Underline Start	27 67	1B 43	ESC C
Underline Stop	27 68	1B 44	ESC D
Backspace	8	08	BS
Delete	27 127	1B 7F	ESC DEL
Carriage Return	13	0D	CR
Dot Columns Indent	27 37 66 nnnn	1B 25 42 nnnn	ESC % B nnnn
Uni-directional Print	27 45	1B 2D	ESC -
Bi-directional Print	27 61	1B 3D	ESC =
Enter Print Suppress	19	13	DC3
Exit Print Suppress	17	11	DC1

Underline

Provides an unbroken line under designated characters and spaces between designated characters.

Backspace

May be used for creating symbols not included on the keyboard such as plus/minus ($\pm$), cent ($\cent$), less than (<) and greater than (>) symbols. The backspace command is not acted upon unless a character or print command is given after it. To backspace repeatedly, add the BS command after each character followed by the over-printed character. A backspace cannot be performed beyond the left margin.

Delete

Causes the last entered character to be deleted (will not print).

Carriage Return

Causes the data in the print buffer to be printed and returns the print head to the left margin. If line feed is on, a line feed occurs with each Carriage Return.

Indent by Dot Column

Causes the print line to indent by the number of dot columns specified by n (0001 to 9999). Dot column number must not exceed the left or right margin. The indent command is valid for only one line. Dot column width, and corresponding size of indent, varies with character pitch as shown below.

Character Pitch	Dot Column Width
10 CPI	1/120"
12 CPI	1/144"
17.1 CPI	1/206"

Uni-directional Printing

When uni-directional printing is selected, the printer will only print from left to right. This mode of printing may provide a more exact alignment of graphic symbols.

Bi-directional Printing

Allows left to right and right to left printing. This mode of printing allows faster printing (less carriage return time) by alternating the direction after every line.

K.6 PRINT FEATURES (Continued)

Enter Print Suppress

Temporarily disconnects the printer from the computer. The DC3 code tells the printer to ignore all data except the DC1 code (which causes the printer to exit print suppress mode). When the printer is in print suppress mode the SEL light blinks and the printer does not store or print data. The printer must receive a DC1 code before it exits the print suppress mode.

Note: Because some computers may use the DC1/DC3 signals for other functions, be sure the DC1/DC3 DIP switch selection is set Off.

Exit Print Suppress

Reactivates the printer after a print suppress command.

K.7 PAGE FORMAT

Commands that control print format functions are given below.

DESCRIPTION	DECIMAL	HEX	ASCII
Set Left Margin	27 37 67 nnn	1B 25 43 nnn	ESC % C nnn
Set Right Margin	27 37 82 dddd	1B 25 52 dddd	ESC % R dddd
Set Top of Form	27 53	1B 35	ESC 5
Set Form Length in Lines per Page	27 70 nn	1B 46 nn	ESC F nn

Note: Neither margin may exceed page width.

DESCRIPTION	DECIMAL	HEX	ASCII
Set Form Length in 1/2" Increments	27 71 nn	1B 47 nn	ESC G nn
Cancel Form Length Setting	27 70 0	1B 46 00	ESC F NUL
Form Feed	12	0C	FF

Set Left Margin

Changes the left margin in multiples of n/120".
nnn is 3-digits from 000 to 999.

Set Right Margin

Changes the right margin in multiples of n/120". The right margin must be at least five characters from the left margin at 10 CPI (six at 12 CPI and nine at 17.1 CPI).
dddd is 4-digits from 0000 to 9999.

Top of Form

Defines the first print line on a page. This command sets the current vertical position of the print head as the first print line of the page. Each new page will begin at this top of form, until a new top of form command is received, or until printer power is turned off and then on.

Form Length

Defines length of paper in lines per page or in 1/2" increments. If nn is 00, in either command, the default form length set by the DIP switches is used.

Form length is usually set by the DIP switches.

K.7 PRINT FORMAT (Continued)

Lines per Page command sets form length of 01 to 99 lines per page (nn must be 2-digits). When using 11" paper and printing 6 lines per inch, this command normally sets form length at 66 lines.

1/2" Increment command sets form length of 01 to 99 1/2" increments per page. When using 11" paper and printing 6 lines per inch, this command normally sets form length at 22 (number of 1/2" increments in 11").

Cancel Form Length Setting

Selects the form length set by the DIP switches.

Form Feed

Advances the paper to the next top of form.

K.8 LINE FEED

DESCRIPTION	DECIMAL	HEX	ASCII
Line Feed with CR	10	0A	LF
Line Feed - no CR	27 18	1B 12	ESC DC2
n/144" Line Feed	27 37 53 n	1B 25 35 n	ESC % 5 n
Skip n Lines	27 11 n	1B 0B n	ESC VT n
Skip d Lines	27 11 d	1B 0B d	ESC VT d
Skip Perforation	27 37 83 n	1B 25 53 n	ESC % S n

Line Feed with CR

Causes the printer to print the data in the buffer and advance the paper, with or without a Carriage Return depending on the command, by one line (paper advances 1/6" at 6 LPI, 1/8" at 8 LPI).

n/144" Line Feed

Causes the printer to print the data in the buffer and advance the paper n/144" (up to a maximum of 127/144") with a Carriage Return. If line feed is set to 0/144" there is no paper advance.

Skip n Lines

Causes the printer to advance the paper n number of lines. n is 3-digits from 000 to 127.

Skip d Lines

Causes the printer to print the data in the print buffer, perform a carriage return, and then advance the paper by d lines.

Skip Perforation

Allows the printer to skip over perforations on continuous form and resume printing at the top of the next form. Before using this command, set form length, top of form, and select automatic skip with the DIP switches (to set top and bottom margins at one inch). Value of n is 0 - 9. The distance skipped with each value of n is given below:

Value of n	Distance Skipped	Lines Skipped (6 LPI)
0	0	0
1	1/3"	2
2	2/3"	4
3	1"	6
4	4/3"	8
5	5/3"	10
6	2"	12
7	7/3"	14
8	8/3"	16
9	3"	18

K.9 HORIZONTAL TABS

DESCRIPTION	DECIMAL	HEX	ASCII
Set Character Tab	27 9 nnn 13	1B 09 nnn 0D	ESC HT nnn CR
Clear Character Tab	27 9 13	1B 09 0D	ESC HT CR
Set Dot-Column Tab	27 3 dddd 13	1B 03 dddd 0D	ESC ETX dddd CR
Clear Dot-Column Tab	27 3 13	1B 03 0D	ESC ETX CR
Skip to Next Tab	9	09	HT

nnn is 3-digits (000-999) designates character column.
dddd is 4-digits (0000-9999) designates dot column.

When printer power is turned on, a tab is set at every eighth character.

Set Character or Dot-Column Tab Command
Sets up to 16 tab stops (entered in a left to right sequence or in ascending numerical order). Tabs are set at either character columns or dot columns.

Clear Character or Dot-Column Tab Command
Clears all tabs.

Skip to Next Tab
Sends print head to next tab location. This command is ignored when the skip is to a tab stop set beyond the width of the page or to a tab where none is set.

Character Column Tabs

The right-most tab location depends on paper size and character size requested. The maximum number of character columns for 8½" and 14" paper, at the printer's three character pitches, is shown below:

Paper Size	10 CPI	12 CPI	17.1 CPI
8½" Wide	80	96	136
14" Wide	136	163	233

Dot Column Tabs

The right-most tab location depends on paper size and character size requested. The maximum number of dot columns for 8½" and 14" paper, at the printer's three character pitches, is shown below:

Paper Size	10 CPI	12 CPI	17.1 CPI
8½" Wide	960	1152	1632
14" Wide	1632	1956	2796

K.10 VERTICAL FORMAT UNIT (VFU)

DESCRIPTION	DECIMAL	HEX	ASCII
Load VFU Tabs	20	14	DC4
End of VFU Load	63	3F	?
Tab to Next Channel	11 n	0B n	VT n

The Vertical Format Unit (VFU) has 12 different channels (sets of vertical tabs). A maximum of 54 tab stops may be set in these channels.

Load VFU Tabs

Start the VFU load with a DC4 code, enter the number of spaces (decimal 32, hex 20) that is equal to the number of lines to the first vertical tab, then enter the value of n to set a channel number. Continue entering spaces and channel numbers until all desired vertical tabs have been entered. Enter additional spaces, after the last vertical tab, to equal the total number of lines on the page.

End of VFU Load

Terminates the VFU Load.

Tab to Next Channel

This command, followed by a channel code, causes the printer to advance paper to the channel code. Channel numbers and corresponding value of n is shown below:

Channel Number	Value of n	
	Decimal	Hexadecimal
1	49	31
2	50	32
3	51	33
4	52	34
5	53	35
6	54	36
7	55	37
8	56	38
9	57	39
10	58	3A
11	59	3B
12	60	3C

K.11 MISCELLANEOUS COMMANDS

Note that Bit Image and Composite commands follow this paragraph.

DESCRIPTION	DECIMAL	HEX	ASCII
Enable Paper-out	27 69 48	1B 45 30	ESC E 0
Disable Paper-out	27 69 49	1B 45 31	ESC E 1
Reduce Printing Speed	27 60	1B 3C	ESC
Normal Printing Speed	27 62	1B 3E	ESC
Clear Buffer	24	18	CAN
Printer/Buffer Reset	27 24	1B 18	ESC CAN

Enable Paper-out

Allows printing to stop when the paper-out detector senses the end of paper.

Disable Paper-out

Allows printing to continue after the paper-out detector senses the end of paper. Useful when printing on single sheets of paper, because paper-out is sensed about one inch from the bottom of the page, and this command will allow printing additional lines.

Reduce Printing Speed

Causes the printer to operate at 1/2 its normal speed.

Normal Printing Speed

Causes the printer to operate at its standard speed.

Clear Buffer

Resets the printer to the default conditions set by the
DIP switches.   Data in the print buffer will be
cleared (not printed).

Printing functions that will not be cleared are:

Horizontal Tabs	Vertical Tabs
Left Margin	Right Margins
Paper-out Disable	Skip Over Perforation
Top of Form	Page Length
Custom Character Memory	

Printer/Buffer Reset

Prints data in the buffer, performs a line feed, and:

Sets Horizontal Tabs every eighth character.

Clears all VFU data, right and left margins, and
top of form.

Clears superscripts, subscripts, and underline.

Sets bi-directional print mode.

Sets standard spacing between characters.

Sets standard printing speed.

Sets DIP switch settings in the printer.

K.12 Block Graphics

DESCRIPTION	DECIMAL	HEX	ASCII
Enter Block Graphics	27 33 49	1B 21 31	ESC ! 1
Exit Block Graphics	27 33 48	1B 21 30	ESC ! 0

Symbols, printed in block graphics mode are shown on
the following page. By combining these symbols the
user creates bar charts, graphs and other designs.

If creating a design without an application package, select the symbols which will produce the desired pattern and incorporate the corresponding decimal codes (32 to 95 for 7-bit data, and 128 to 256 for 8-bit data) into the print program.

In 7-bit format, the SO code allows printing of block graphics symbols between 32 and 95 decimal, as shown below, and the SI code returns the printer to the normal print mode.

32	░	33	▪	34	▪	35	▬
36	▪	37	▌	38	▟	39	▛
40	▪	41	▜	42	▌	43	▜
44	▬	45	▙	46	▟	47	▩
48	▪	49	▮	50	▪	51	▮
52	▌	53	▌	54	▛	55	▛
56	▪	57	▮	58	▙	59	▜
60	▛	61	▙	62	▟	63	▛
64	▪	65	▪	66	▮	67	▬
68	▪	69	▙	70	▟	71	▙
72	▮	73	▜	74	▮	75	▜
76	▜	77	▙	78	▟	79	▟
80	▬	81	▪	82	▪	83	▬
84	▙	85	▙	86	▟	87	▙
88	▟	89	▟	90	▟	91	▟
92	▪	93	▙	94	▟	95	▮

In 8-bit format the SO code allows printing of block graphics symbols between 128 and 256 decimal, as shown below, and the SI code returns the printer to the normal print mode.

128	=	129	= ●	130	= ●	131	= ▬
132	= ▪	133	= ▌	134	= ▪	135	= ▛
136	= ▪	137	= ▪	138	= ▌	139	= ▜
140	= ▬	141	= ▙	142	= ▟	143	= ▉
144	= ▪	145	= ▪	146	= ▪	147	= ▬
148	= ▐	149	= ▌	150	= ▛	151	= ▛
152	= ▪	153	= ▪	154	= ▐	155	= ▜
156	= ▟	157	= ▙	158	= ▟	159	= ▐
160	= ▪	161	= ▪	162	= ▪	163	= ▬
164	= ▪	165	= ▐	166	= ▪	167	= ▛
168	= ▐	169	= ▐	170	= ▌	171	= ▜
172	= ▜	173	= ▙	174	= ◀	175	= ▐
176	= ▬	177	= ▪	178	= ▪	179	= ▪
180	= ▙	181	= ▌	182	= ▙	183	= ▐
184	= ▟	185	= ▪	186	= ▟	187	= ▐
188	= ▉	189	= ▌	190	= ▟	191	= ▉

K.13 BIT IMAGE GRAPHICS

DESCRIPTION	DECIMAL		HEX		ASCII
Select Bit Image	3		03		ETX
Return to Text	3	2	03	02	ETX STX
Double Density	27	82	1B	52	ESC R
Single Density	27	80	1B	50	ESC P
Quadruple Density	27	81	1B	51	ESC Q
14/144" Line Feed	3	14	03	0E	ETX SO
Graphics Line Feed	3	20	03	14	ETX DC4
Line Feed with CR	3	10	03	0A	ETX LF
Line Feed - no CR	3	18	03	12	ETX DC2
Print One Dot	3	3	03	03	ETX ETX

Note: Select 7-bit mode with DIP switches if the host computer uses 7-bit data.

A step by step procedure for programing Bit Image Graphics follows:

Step 1: Programming Graphics

Use ETX to select Bit Image Graphics mode (causes data sent to the printer to be printed as graphics data, not as numbers, letters or symbols). Use ETX STX to return to text mode. Select the standard character set when doing Bit Image Graphics.

Sample Basic program is:

   10 LPRINT   CHR$(3): CHR$(127): CHR$(65):
                  CHR$(65); CHR$(65); CHR$(65):
                  CHR$(65): CHR$(127): CHR$(3):
                  CHR$(2)

The resultant printout is: ☐

Step 2: Determining Resolution

Note that the printed box is not exactly square, even though it is 7 dots high and 7 dots wide, because horizontal and vertical dot spacing is different.

Add the following command to the graphics program to print an exactly square image:

   05 LPRINT   CHR$(28)

This command selects 12 CPI printing, which changes the horizontal resolution to 72 DPI (which matches the vertical resolution).

The resultant printout is: ☐

Step 3: Selecting Density

Single, double or quadruple print density may be selected for Bit Image Graphics. Dots per inch for each density is shown below:

Pitch	Single	Double	Quadruple
10 CPI	60	120	240
12 CPI	72	144	288

Enter ESC P, before entering graphics mode to select
single density, enter ESC R for double density and use
a composite command (refer to K.15) for quadruple
density.

The printer does not automatically increase vertical
density when double density is selected, and the dot
pattern data must be entered twice.   When the
program is executed, the printer will print the first
transmittal of data, perform a 1/144" line space, then
space 13/144" and start printing the next transmittal
of the same data.   The resulting vertical overlapping,
of the dot pattern, creates the double density effect.

The loading procedure is:

```
  2  WIDTH "LPT1": ",255: REM  SET  PRINTER
     WIDTH TO 255 CHARACTERS
  5  A$=STRING$(200,127): REM  SET  A$  =  200
     BYTES OF BIT PATTERN 127
 10  LPRINT CHR$(27); CHR$(82); : REM SELECT
     DOUBLE DENSITY GRAPHICS
 20  LPRINT CHR$(3); : REM SELECT GRAPHICS
     PRINT MODE
 30  LPRINT A$; :REM GRAPHICS DATA
 40  LPRINT  CHR$(3);  CHR$(2);  :  REM  EXIT
     GRAPHICS PRINT MODE
 50  LPRINT  CHR$(27);  "%5";  CHR$(1);  :REM
     PERFORM 1/144 TEXT LINE FEED
 60  LPRINT CHR$(3); : REM REENTER GRAPHICS
     PRINT MODE
 70  LPRINT A$; :REM GRAPHICS DATA
 80  LPRINT  CHR$(3);  CHR$(2);  :  REM  EXIT
     GRAPHICS PRINT MODE
 90  LPRINT  CHR$(27);  "%5";  CHR$(13);  :  REM
     PERFORM 13/144 TEXT LINE FEED
100  LLIST
```

Step 4: Graphic Dot Columns

The following chart shows the maximum number of graphic dot columns on a line for 8½" paper and for 14" paper.

Selection	8½" Paper	14" Paper
10 CPI		
Single Density	480	816
Double Density	960	1632
Quadruple Density	1920	3264
12 CPI		
Single Density	576	979
Double Density	1152	1958
Quadruple Density	2304	3916

Step 5: Multi-line Graphics

Print more than one line of graphics, without exiting the graphics mode, by using any of four graphics line feed commands.

To print a line and advance the paper 7/72", followed by a CR, use the ETX SO code.

To print a line and advance the paper 7/72", without a CR, use the ETX DC4 code.

To insert a standard text line feed (1/6" or 1/8" followed by a CR), use the ETX LF code.

The same line feed without a CR can be entered using the ETX DC2 code.

K.14 CUSTOM CHARACTER SET

DESCRIPTION	DECIMAL	HEX	ASCII
Load Standard Character	27 36	1B 24	ESC $
Load Ascender Character	27 37 65 n	1B 25 41 n	ESC % A n
Load Descender Character	27 37 68 n	1B 25 44 n	ESC % D n
Select Utility Character	27 50	1B 32	ESC 2

n is the ASCII character to be replaced by a custom character.

The printer has a separate memory reserved for custom characters. This memory will store up to 160 separate characters/symbols or an entire 96-character font.

A step by step procedure for using this custom character memory follows:

Step 1: Design a Character
Each custom character is printed in a pattern called a matrix.

The print matrix is 11 columns wide and 7 rows high for a total of 77 dot positions. A sample matrix is given on the following page.

Note: If dots are adjoining in the same row only the first dot will print.

7-Rows Binary Value	Columns 1 - 11										
	1	2	3	4	5	6	7	8	9	10	11
1				●		●		●			
2		●								●	
4	●				●		●				●
8	●		●						●		●
16	●			●		●		●			●
32		●								●	
64				●		●		●			

Step 2: Convert the Dot Pattern

A binary value is assigned to each row in the matrix to translate the dot pattern into code via a column value.   To obtain a column value, add the value assigned to each row where a dot is to be printed.

For example, in column 1 of the following matrix, a dot appears at rows with binary values of 4, 8 and 16, the total column value is therefore 28.

The column values for the matrix are shown below each column in the following illustration.

Step 3: Ascender or Descender

Although only seven rows can be printed at one time, the character matrix has nine rows (2 rows below the print line to allow printing of descender characters g, p, q, and y).

Ascender (standard) characters print with vertical rows 1 - 7.

Descender characters (g, p, q and y) print with vertical rows 3 - 9.

Binary Values	Columns 1 - 11										
	1	2	3	4	5	6	7	8	9	10	11
1				●		●		●			
2		●								●	
4	●				●		●				●
8	●		●						●		●
16	●			●		●		●			●
32		●								●	
64				●		●		●			
Column Values	28	34	8	81	4	81	4	81	8	34	28

The value, for each column of the character, does not change for an ascender or descender character. Only the code sequence to load the character is different (the code sequence for a descender character shifts the character down allowing the lower two rows to print below the print line).

Step 4: Load the Data

When loading a custom character for the first time, use the ESC $ command to copy the dot pattern data for the entire standard set into decimal 32-127. Use the ESC $ command with care. If this command is repeated after loading the first custom character, it erases any previously created and loaded characters.

For example, to put the customer character in the above matrix into the location of the @ symbol. Start with the ascender code followed by the character to be replaced, then the eleven column values.

**10 LPRINT   CHR$(27); CHR$(37); CHR$(65);
                CHR$(64); CHR$(28); CHR$(34);
                CHR$(08); CHR$(81); CHR$(04);
                CHR$(81); CHR$(04); CHR$(81);
                CHR$(08); CHR$(34); CHR$(28)**

Note: To load this matrix as a descender character, replace **CHR$(65)** in the above command with **CHR$(68)**.

The statement automatically ends after the data from the eleventh column is entered. Data from all eleven columns must be entered as a separate statement for each column.

Step 5: Print the Custom Character

Issue an ESC 2 code to print the custom characters.

For example: In the above program the character was stored into decimal 64(@). Now when the @ sign is to be printed, the special character from the matrix (instead of the @) will print.

**20 LPRINT   CHR$(27); "%A"; CHR$(64); "@";
                CHR$(27); "0";**

"Print custom character located at character @"

Note: The custom character memory stores only the dot pattern, not the program. Save the program used to generate any custom characters at a separate location or diskette.

K.15 COMPOSITE COMMANDS

Composite commands combine several functions into one command.   One Composite Print command can set any combination of character size, print style, or print mode. Composite commands are:

DESCRIPTION	DECIMAL	HEX	ASCII
Composite Print Command	27 38 A B C D 58	1B 26 A B C D 3A	ESC & A B C D :
Composite LF/CR Command	27 63 A 58	1B 3F A 3A	ESC ? A :
Composite Graphic Command	27 42 A B 58	1B 2A A B 3A	ESC * A B :

K.15.1 COMPOSITE PRINT COMMAND

Function and value of variables A, B, C and D in a Composite Print Command are:

Value	A	B	C	D
1	10 CPI	Normal	Utility	- -
2	12 CPI	Subscript	NLQ	- -
4	17 CPI	Superscript	Custom Set	Under line
8	- -	Emphasized	Italics	- -
16	Double Wide	Enhanced	- -	- -
Base Value	32	64	96	112
Totals				

Add the value of the desired features in each column to the base number in the same column.

Place the total of each column into the n value of the composite print command.

For example:

To print 6 CPI (12 CPI Double Wide) with normal script in italic with underlining:

For Column A:		
12 CPI has a value of	2	
Double width has a value of	16	
Added to base number	32	
For a Column A total of		50
For Column B:		
Normal script has a value of	1	
Added to the base number	64	
For a Column B total of		65
For Column C:		
Italic has a value of	8	
Added to the base number	96	
For a Column C total of		104
For Column D:		
Underline has a value of	4	
Added to the base number	112	
For a Column D total of		116

Place each column total into its A, B, C or D value
in the composite print command:

10 LPRINT   CHR$(27);CHR$(38);CHR$(50);CHR$(65);
             CHR$(104);CHR$(116);CHR$(58)

20 LPRINT   "6 CPI, NORMAL SCRIPT,"

30 LPRINT   "ITALIC AND UNDERLINED"

TO CANCEL A COMPOSITE FUNCTION

To cancel one function set by a composite command,
perform the corresponding steps:

Emphasized, Enhanced, Italic and Underlining:

1. Subtract their values from the column total.
2. Put the new column total into the command.

Double Wide Printing:

1. Subtract its value (16) from column A total.
2. Add the value of the character pitch selected
   (10,12 or 17.1 CPI) to the column A total.
3. Put the new column A total into the command.

Superscript and Subscript:

1. Subtract the value of superscript (4) or
   subscripts (2) from the column B total.
2. Add the value of normal script (1) to the column
   B total.
3. Put the new column B total into the command.

Custom Characters or NLQ:

1. Subtract the value of Custom Characters (4) or
   NLQ (2) from the column C total.
2. Add the value for Utility mode (1) to the
   column C total.
3. Put the new column C total into the command.

K.15.2 COMPOSITE CR/LF COMMAND

Specifies Carriage Return, Line Feed, or Reverse Line Feed. Choose the options from the following chart and add the value to the base number:

Option	Value
Carriage Return (CR)	1
Line Feed (LF)	2
Reverse Line Feed	16
Base Number	32
' Total	

Place the total value into the A value in the composite CR/LF command.

For example, to perform a carriage return and a line feed, add 3 to the base 32 and place the total (35) into the composite CR/LF command as follows:

CHR$(27); CHR$(63); CHR$(35); CHR$(58)

Note: Do not combine line feed and reverse line feed.

Reverse line feed cannot feed paper at less than 1/3" from the top of the page.

Do not use reverse line feed with the tractor feed unit.

K.15.3 COMPOSITE GRAPHICS COMMAND

Specifies dots per inch, density, speed and 8-bit data, in exactly the same manner as the other composite commands.

Add the values within each column to the base number in the same column, and place the total into the composite graphics command.

Value	A	B
1 2 4 8 16	60 Dots per Inch 72 Dots per Inch Single Density Double Density Quadruple Density	- - - - - - Double Speed 8-bit Data
Base Value	96	64
Total		

For Example

To send single density data at 72 DPI in an 8-bit format, the values and their totals are:

For Column A:		
72 DPI has a value of	2	
Single Density has a value of	4	
Add to the base number of	96	
For a total of		102

For Column B:		
8-bit data has a value of	16	
Added to the base number of	64	
For a total of		80

Place the total, from each column, into its respective A and B position of the composite graphics command. The command will appear as follows:

CHR$(27); CHR$(42); CHR$(102); CHR$(80); CHR$(58)

Note: If double speed is selected, no consecutive dots are allowed.

If quadruple density is selected, double speed is selected automatically (and therefore no consecutive dots can be used in quadruple density).