

**MODEL 351**  
**USERS MANUAL**  
Operator, Installation &  
Programming Instructions

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# **WARNING**

**This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the operators manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.**

**JANUARY 1, 1981**

**APPROVED, CLASS A**

**Note: Must be used with shielded data cables only.**

# TABLE OF CONTENTS

<b>INTRODUCTION</b>	<b>I</b>
<b>OPERATORS INFORMATION</b>	<b>II</b>
<b>SECTION 1—CONTROLS AND INDICATORS</b>	
1.1 GENERAL	1-1
1.2 PRINTER MECHANISM CONTROLS AND SWITCHES	1-1
1.3 CONTROL PANEL SWITCHES AND INDICATORS	1-2
1.4 CONTROL PANEL DIP SWITCHES	1-3
<b>SECTION 2—PAPER LOADING/RIBBON REPLACEMENT</b>	
2.1 GENERAL	2-1
2.2 INITIAL LOADING, FANFOLD FORMS	2-1
2.3 RELOADING FANFOLD FORMS	2-2
2.4 INITIAL LOADING, CUT SHEET FORMS	2-2
2.5 RELOADING CUT SHEET FORMS	2-4
2.6 RIBBON CASSETTE REPLACEMENT	2-4
2.7 PRINT HEAD IMPRESSION ADJUSTMENT	2-4
2.8 FORMS DESIGN	2-5
<b>SECTION 3—PRINTER OPERATION</b>	
3.1 OPERATING NOTES	3-1
3.2 OPERATING PROCEDURES	3-1
3.3 SELF-TEST	3-2
<b>SECTION 4—OPERATOR MAINTENANCE</b>	
4.1 PREVENTIVE MAINTENANCE	4-1
4.2 TROUBLESHOOTING GUIDE	4-2
<b>SECTION 5—REMOVAL/REPLACEMENT</b>	
5.1 GENERAL	5-1
5.2 REMOVAL COVER ASSEMBLIES	5-1
5.3 REMOVAL/REPLACEMENT PRINT HEAD ASSEMBLY	5-2
5.4 REMOVAL/REPLACEMENT INPUT FUSE	5-3

## **INSTALLATION, INTERFACE & SPECIFICATIONS III**

### **SECTION 6—INSTALLATION**

6.1 GENERAL .....	6-1
6.2 PRINTER INSPECTION .....	6-1
6.3 SITE CONSIDERATIONS .....	6-1
6.4 PRINTER SET-UP .....	6-2

### **SECTION 7—PRINTER FEATURES**

7.1 PRINTER FEATURES SELECTION .....	7-1
7.2 PRINTER FEATURES DIP SWITCH S1 .....	7-1
7.3 PRINTER FEATURES DIP SWITCH S2 .....	7-1
7.4 ACCESSING DIP SWITCHES S3 AND S4 .....	7-3
7.5 PRINTER FEATURES DIP SWITCH S3 .....	7-3
7.6 PRINTER FEATURES DIP SWITCH S4 .....	7-4
7.7 DATA STROBE SWITCH .....	7-5

### **SECTION 8—INTERFACE INFORMATION**

8.1 GENERAL INFORMATION .....	8-1
8.2 PARALLEL INTERFACE CONNECTION .....	8-1
8.3 SERIAL INTERFACE CONNECTION .....	8-2

### **SECTION 9—SPECIFICATIONS**

9.1 MODEL 351 SPECIFICATIONS .....	9-1
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## **PROGRAMMING INFORMATION IV**

### **SECTION 10—PROGRAMMING INFORMATION**

10.1 GENERAL PROGRAMMING INFORMATION .....	10-1
10.2 CONTROL CODES .....	10-1
10.3 ESCAPE SEQUENCES .....	10-2
10.4 PROGRAMMING CONSIDERATIONS .....	10-6

## **OPTIONS AND ACCESSORIES V**

### **SECTION 11—OPTIONS AND ACCESSORIES**

11.1 GENERAL .....	11-1
11.2 OPTIONS .....	11-1
11.3 ACCESSORIES .....	11-1

# **CONTENTS**

<b>INTRODUCTION</b>	<b>I</b>
<b>OPERATOR INFORMATION</b>	<b>II</b>
<b>INSTALLATION, INTERFACE AND SPECIFICATIONS</b>	<b>III</b>
<b>PROGRAMMING INFORMATION</b>	<b>IV</b>
<b>OPTIONS AND ACCESSORIES</b>	<b>V</b>

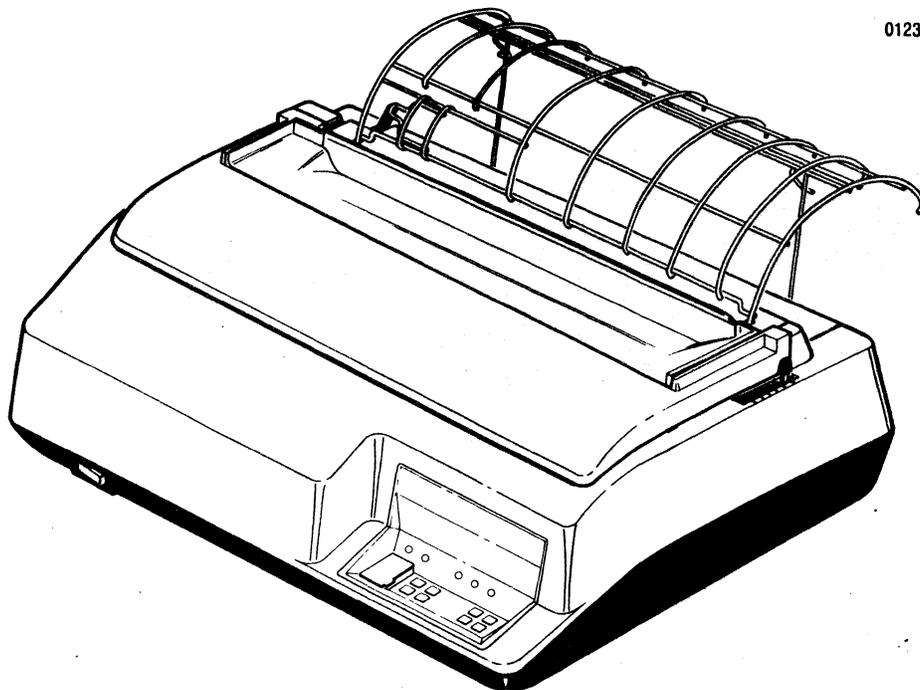
# INTRODUCTION

The Model 351 printer is a high quality product with many features to help you perform your job more efficiently. Some of the more significant features of the printer are:

- 200 CPS, "Data Processing" Printing
- Serial or Parallel Data Input
- Operator Selectable Forms Length
- Pin Addressable Graphics
- Self-Test Capability
- Audible Alarm
- Demand Document Capability
- Fanfold or Cut Sheet Forms Handling
- Forward or Reverse Paper Motion (Cut sheet mode)
- Selectable Vertical Pitch
- Selectable Proportional Printing
- Selectable Multipass Proportional Printing

The printer is lightweight, easy to install and operate, and compatible with both EIA and ANSI standards.

This manual provides the necessary information to install, program, operate, and maintain your Model 351 printer.



01234

## Introduction

## **CONTENTS**

<b>Section 1</b>	<b>Controls and Indicators</b>
<b>Section 2</b>	<b>Paper Loading/Ribbon Replacement</b>
<b>Section 3</b>	<b>Printer Operation</b>
<b>Section 4</b>	<b>Operator Maintenance</b>
<b>Section 5</b>	<b>Removal/Replacement</b>

# **Operators Information**

# SECTION 1

## CONTROLS AND INDICATORS

### 1.1 GENERAL

As the operator of the Model 351 printer, you will be printing a variety of jobs. The controls and indicators provide the communications path between you and the printer. Using the controls and indicators, you set-up the printer to print a specific form, sheet, etc. All operator controls and indicators are located on either the printer mechanism or the control panel.

### 1.2 PRINTER MECHANISM CONTROLS AND SWITCHES

Figure 1-1 illustrates the printer mechanism controls and switches with which an operator should be familiar. A brief description of each control and switch is provided below.

**POWER SWITCH**—When placed in the ON position, applies power to the printer circuits.

**COVER INTERLOCK SWITCH**—A safety feature which automatically stops the printing when the top cover is opened.

**FORMS LEVER**—The forms lever can be set to any one of three positions: LOAD, SHEET or FORMS.

**NOTE**  
Ensure the carriage is at the extreme left margin before moving the forms lever.

**Load**—In this position, either fanfold forms or cut sheet forms can be loaded into the printer.

**Sheet**—In this position, the printer is set-up to handle cut sheet (non-tractor type) forms.

**Forms**—In this position, the printer is set-up to handle continuous fanfold forms.

**PAPER EMPTY SWITCH**—Detects a paper empty condition, automatically stops the printer and sounds the audio alarm.

**PRINT HEAD ADJUSTMENT LEVER**—Adjusts the print head in or out for optimum print quality.

**AUDIO ALARM**—Sounds a one second tone on a paper empty condition, fault condition, receipt of a BEL code, or when the SET TOF 16.5 CPI or Multipass keys are pressed.

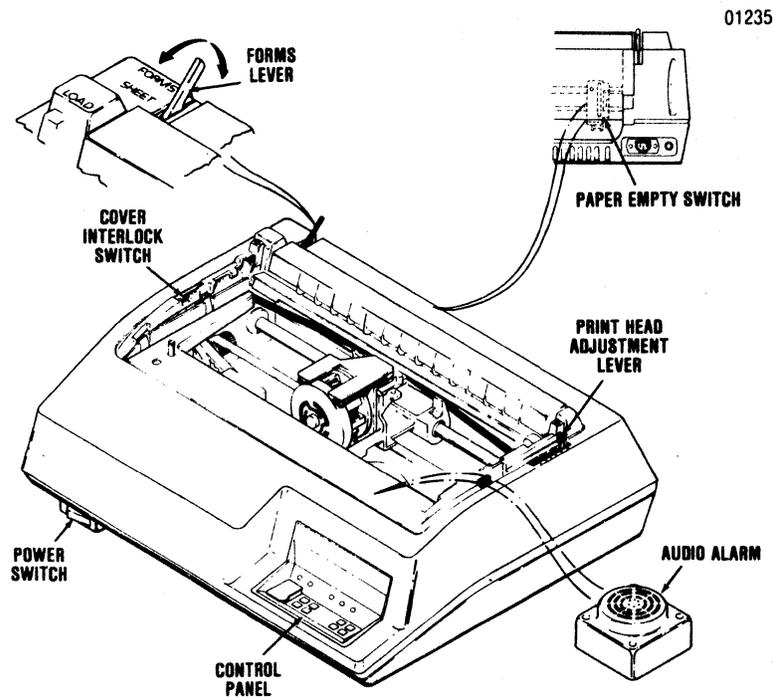


Figure 1-1 Printer Mechanism Controls and Switches

## 1.3 CONTROL PANEL SWITCHES AND INDICATORS

The control panel switches set specific features in the printer. All switches are membrane switches which are activated by lightly pressing the switch. Figure 1-2 illustrates the control panel switches and indicators, and a brief description of each switch and indicator is provided below:

### CONTROL PANEL SWITCHES

**SELECT** Places the printer on line (**SELECT**) or off line (**DESELECT**). When selected, data reception and printer action are allowed. When deselected, printer action will stop, a busy signal will be given, and the **SELECT** LED will be extinguished.

**CUT SHEET MODE** Places the printer either in or out of the cut sheet mode as indicated by the **CUT SHEET** indicator.

**CUT SHEET INSERT** When in the cut sheet mode, loads the sheet into the printer.

**FORM FEED** Advances the form to the next top of form or ejects a cut sheet form from the printer.

**SET TOP** Sets the current print line as the top of form.

**LF** Advances the paper forward one line. If the switch is pressed for longer than 1/2 second, line feeds are repeated until the switch is released.

**PAPER FWD** Advances fanfold paper forward in steps of 1/120 an inch and cut sheet forms in steps of 1/108 an inch. If the switch is pressed for longer than 1/2 second, paper moves forward until the switch is released.

**PAPER REV** Performs the same function as the **PAPER FWD** switch except it moves paper in the reverse direction.

#### NOTE

Fanfold forms should not be reversed more than one half inch as paper handling problems may occur.

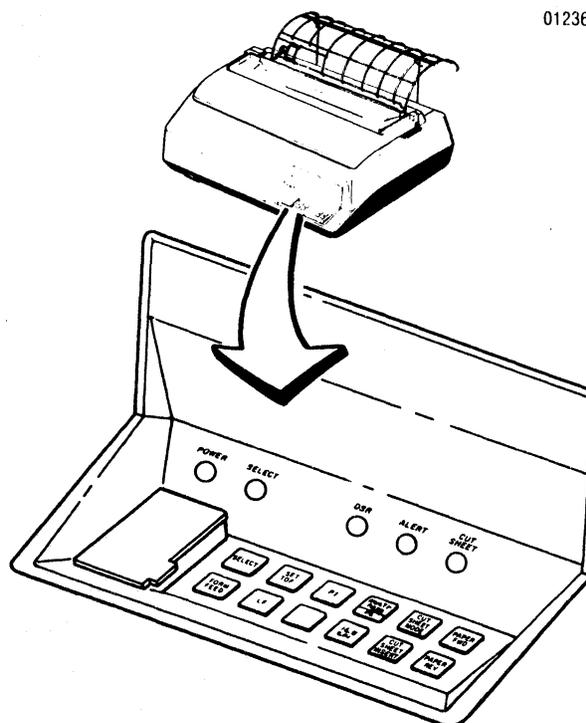


Figure 1-2 Control Panel Switches and Indicators

**16.5 CPI** When actuated, this switch will change the horizontal pitch from 10 or 12 cpi to 16.5 cpi, or from 16.5 cpi to 10 cpi. If the current horizontal pitch is proportional, this switch is ignored. The **16.5 CPI** switch is active when the printer is either selected or deselected. (When selected, it is only active between lines.) Depressing the switch will sound the audio alarm.

**MULTI-PASS F2** The function of this switch is to start or stop multipass proportional printing in the unidirectional mode. The multipass switch is active only when the printer is deselected and not in the graphics mode. Changing into or out of the multipass mode will sound the audio alarm.

**F1** This switch enables the user defined Link Prom when the Link Prom has been installed in the printer in place of the Multipass Prom.

#### NOTE

Only the Multipass Prom operation of the user defined Data Link Prom may be used at any one time depending upon which device is installed in the printer.

## CONTROL PANEL INDICATORS

### NOTE

When any of the following indicators are lit, that particular function is selected.

**POWER Indicator**—Indicates power is applied to the printer circuits.

**SELECT Indicator**—Indicates that the printer is in the SELECT mode.

**ALERT Indicator**—Indicates a paper empty condition. During a fault condition, the ALERT indicator will blink. When in CUT SHEET mode, the ALERT indicator will not indicate a paper out condition.

**CUT SHEET Indicator**—Indicates the printer is in the cut sheet mode.

**DSR Indicator**—Indicates the printer is in the serial mode of operation and that the RS-232C interface line CC (Data Set Ready) is active (+V) or not connected to the data set.

## 1.4 CONTROL PANEL DIP SWITCHES

The control panel contains 2 eight-position DIP switches used for operator selection of country character sets, auto line feed, form length, horizontal pitch, and baud rate. The setting of the DIP switches for specific functions is detailed in Section 7, Printer Features. The printer feature section also covers the settings of the internal DIP switches. Figure 1-3 illustrates the location of the switches on the control panel.

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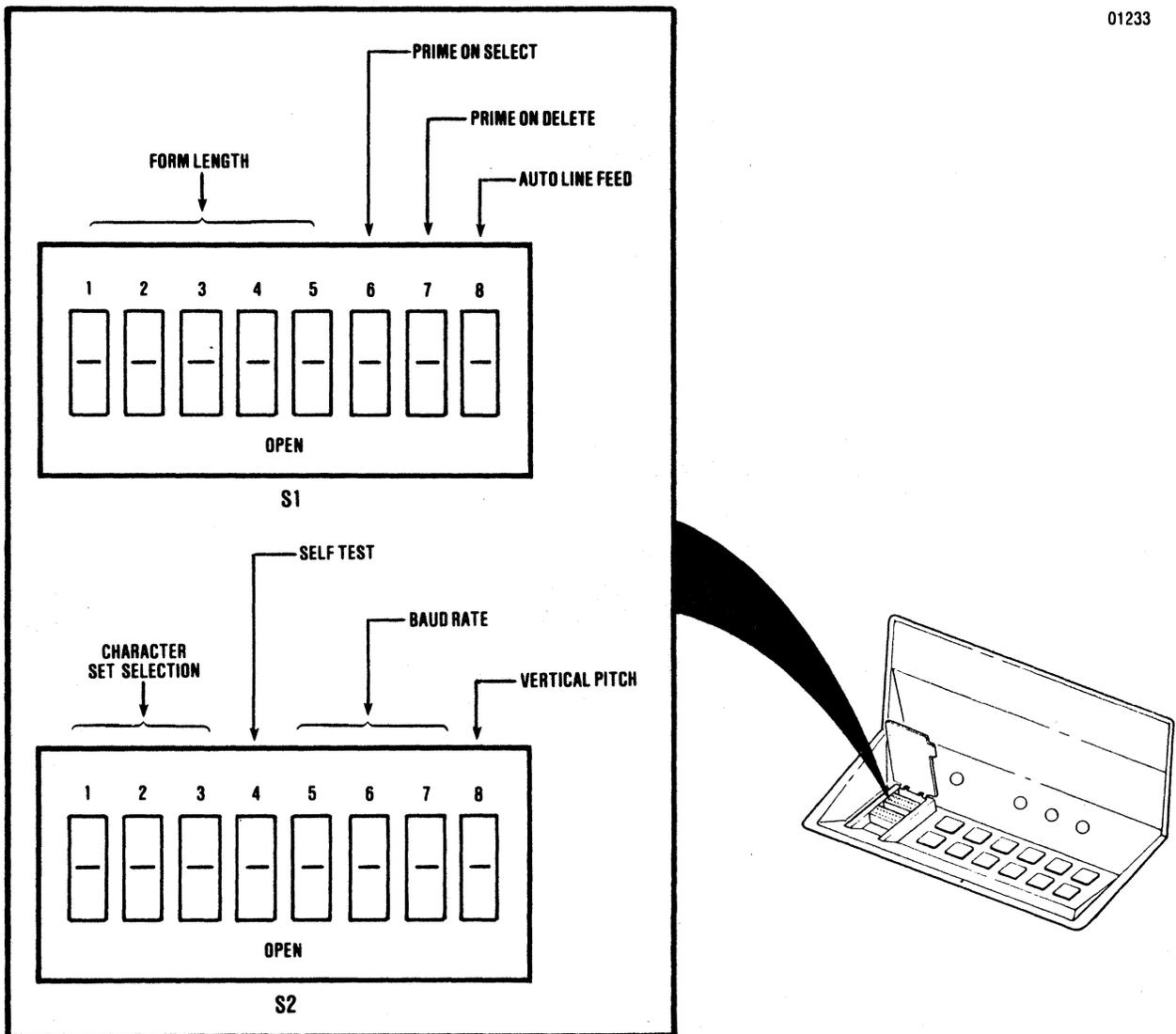


Figure 1-3 Control Panel Dip Switches

# SECTION 2

## PAPER LOADING/ RIBBON REPLACEMENT

### 2.1 GENERAL

This section details the procedures for loading paper, replacing the ribbon, and adjusting the print head for optimum print quality. Two types of paper, either continuous fanfold forms or cut sheet forms, can be installed in the printer. A forms design guide detailing the specifications of both forms is defined in paragraph 2.8. The paper loading, ribbon replacement, and head adjustment procedures are described in the following paragraphs.

#### NOTE

*The following procedures are performed from the front of the printer.*

### 2.2 INITIAL LOADING, FANFOLD FORMS

The following procedure describes the first time loading of fanfold forms once the printer has been installed. The procedure is for both single and multi-part forms. Refer to Figure 2-1 and perform the following steps:

1. Move the forms lever to the "LOAD" position.
2. Pull the head adjustment lever towards the front of the printer to its maximum position.
3. Unsnap and lift the rear cover from the printer.
4. Locate the left and right pin feed tractors.
5. Loosen the tractor locking lever on the left pin feed tractor and slide the tractor to the left-most position. Tighten the locking lever to secure the tractor.
6. Place the forms to be installed slightly behind the printer.
7. Open the left and right tractor paper guides.
8. Install the forms onto the drive pins of the left pin feed tractor and close the left tractor paper guide.

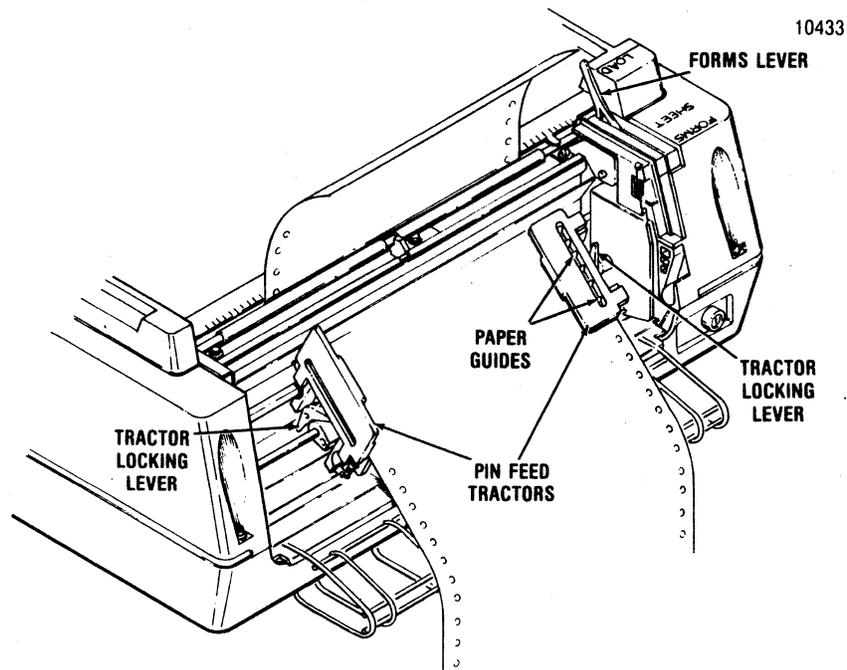


Figure 2-1 Loading Fanfold Forms

9. Loosen the tractor locking lever on the right pin feed tractor and slide the tractor left or right to accommodate the forms width. Once adjusted, tighten the locking lever to secure the tractor.
10. Install the forms onto the drive pins of the right pin feed tractor and close the paper guide.
11. Turn the printer power on and depress the LF switch which loads the forms into the printer.
12. Release the LF switch at the desired print position.
13. Press the SET TOF switch to set the current print line as the top of form.
14. Place the forms lever in the "FORMS" position.
15. Perform the print head impression adjustment per paragraph 2.7.
16. Install the rear cover retaining tabs into the body cover slots and snap the top closed.
17. Press the SELECT switch to enable the printer to receive data.

### 2.3 RELOADING FANFOLD FORMS

The Model 351 operates until the last form passes through the paper empty switch on the left pin feed tractor. When out of paper, printing stops, the ALERT indicator lights, the audio alarm sounds, and the printer deselected. To reload forms refer to Figure 2-1 and perform the following procedure.

**NOTE**

*To move the last form through the printer on a paper empty condition hold the SELECT switch depressed. This will allow the printer to print the last form. DO NOT TURN POWER OFF TO RELOAD FORMS.*

1. Move the forms lever to the "LOAD" position.

### **NOTE**

*Before performing step 2 note the position of the head adjustment lever. If installing the same form as previous, return the lever to this position once the form is installed.*

2. Pull the head adjustment lever towards the front of the printer to its maximum position.
3. Unsnap and lift the rear cover from the printer.
4. Open the left and right tractor guides and load the forms onto the drive pins of the tractors.
5. Close the tractor guides.
6. Hold the LF switch depressed, which loads paper up into the printer.
7. Release the LF switch at the desired print position.
8. Place the forms lever in the "FORMS" position.
9. Return head adjustment lever to its original position or, if a different size form is installed perform the print head impression adjustment per paragraph 2.7.
10. Install the rear cover retaining tabs into the body cover slots and snap the top closed.
11. Press the SELECT switch to enable the printer to print.

### 2.4 INITIAL LOADING, CUT SHEET FORMS

The Model 351 is designed to allow semi-automatic insertion of cut sheet forms and documents. The following procedure describes the first time loading of either single or multi-part cut sheet forms once the printer has been installed. Refer to Figure 2-2 and perform the following steps:

1. Unsnap the top portion of the rear cover and place in the open position and slide the left/right pin feed tractors to the extreme left/right positions. Once tractors are positioned snap the rear cover closed.

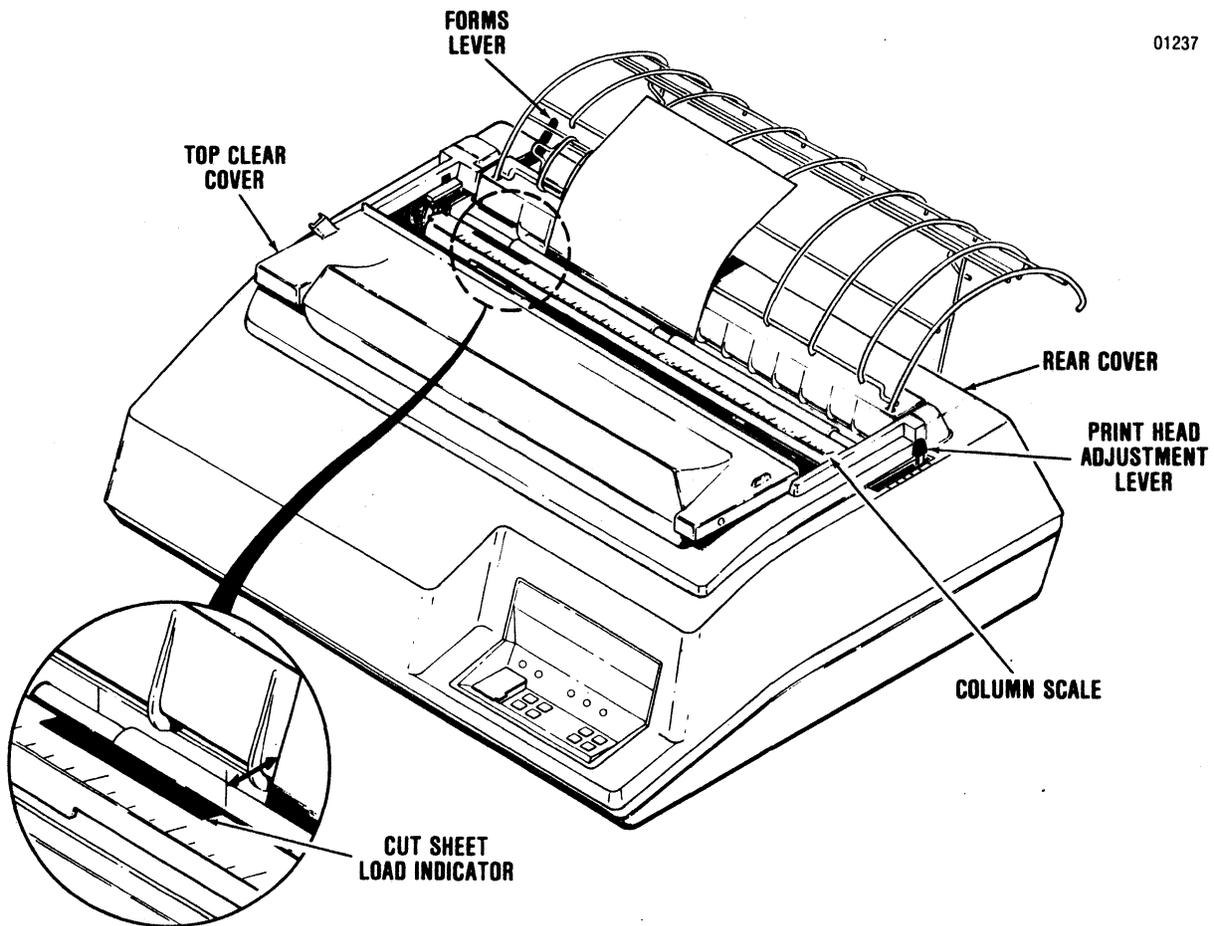
2. Set the form length for the cut sheet by making the appropriate selection on DIP switch S1 (see Section 7, paragraph 7.2).
3. Turn the printer power on and enter into the cut sheet mode by pressing the CUT SHEET MODE switch on the control panel.

**NOTE**

*Form length can optionally be set by sending the form length escape sequence code. Refer to paragraph 10.3.*

4. Move the forms lever to the "LOAD" position.
5. Move the print head away from the platen by pulling the head adjustment lever back to its maximum position.
6. Insert the bottom edge of the cut sheet form between the rollers on the column scale and the paper drive roller until the mechanical stops prevent further insertion.

7. Slide the cut sheet form left or right until the left edge of the form aligns with the right edge of the cut sheet load indicator.
8. Move the left hand forms guide on the wire paper rack outlet to the left or right for proper form alignment.
9. Place the forms lever in the "SHEET" position.
10. Press the CUT SHEET INSERT switch on the control panel which loads the cut sheet form into the printer.
11. Perform the print head impression adjustment per paragraph 2.7.
12. Press the SELECT switch to enable the printer to receive data.



**Figure 2-2 Loading Cut Sheet Forms**

## 2.5 RELOADING CUT SHEET FORMS

In the cut sheet mode the Model 351 prints the cut sheet form, moves the form through the printer, and then deselected. To insert additional cut sheet forms once in the cut sheet mode, refer to Figure 2-2 and perform the following steps:

### NOTE

*If inserting the same type of form as was previously used, skip steps 1 and 7 in the following procedure. DO NOT TURN POWER OFF TO RELOAD FORMS.*

1. Pull the head adjustment lever towards the front of the printer to its maximum position.
2. Move forms lever to the "LOAD" position.
3. Insert the bottom edge of the cut sheet form between the rollers on the column scale and the paper drive roller until the mechanical stops prevent further insertion.
4. Slide the cut sheet form left or right until the left edge of the form aligns with the right edge of the cut sheet load indicator.
5. Place the forms lever in the "SHEET" position.
6. Press the CUT SHEET INSERT switch on the control panel which loads the cut sheet form into the printer.
7. If a different size form is installed, perform the print head adjustment per paragraph 2.7.
8. Press the SELECT switch to enable the printer to receive data.

## 2.6 RIBBON CASSETTE REPLACEMENT

The Model 351 contains a 70 yard long life ribbon cassette. To replace the cassette, refer to Figure 2-3 and perform the following steps:

1. Lift the top cover up and off the printer.
2. Unsnap the top portion of the rear cover and place in the open position.
3. Ensure the print head is at the extreme left margin.
4. Place the forms lever in the "LOAD" position.
5. Lift the column scale into the up position.

### NOTE

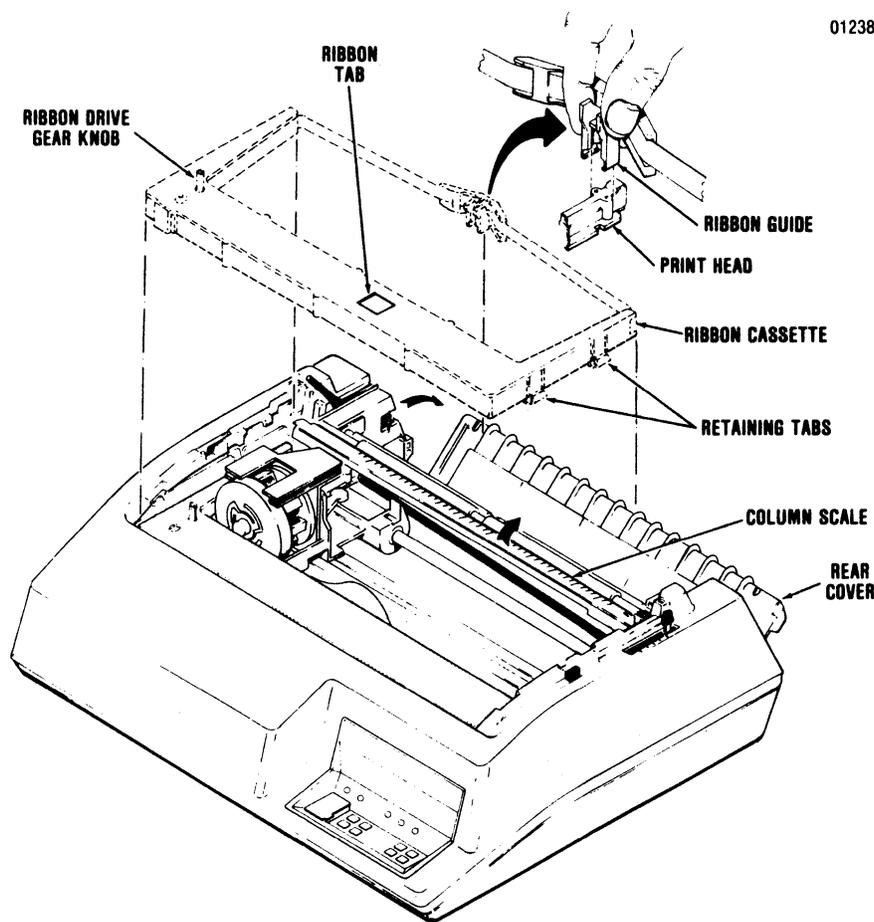
*Before performing step 6 note the position of the head adjustment lever. Once the new ribbon cassette has been installed return the lever to this position.*

6. Move the print head away from the platen by pulling the head adjustment lever back to its maximum position.
7. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the ribbon guide and lifting upward.
8. Lift the used ribbon cassette and attached ribbon guide up and out of the printer.
9. Snap the two left and two right retaining tabs of the new ribbon cassette into the four slots on the left and right side frames.
10. Install the new ribbon guide by squeezing the two tabs at the top of the guide and pushing the guide downward onto the front of the print head.
11. Pull the ribbon tab off the ribbon cassette.
12. Rotate the ribbon drive gear knob counter-clockwise several turns to ensure the ribbon is feeding properly.
13. Place the column scale in the down position and move the forms lever to the type of form (SHEET or FORMS) being printed.
14. Lift and snap the rear cover closed.
15. Insert the front lip of the top cover under the body cover and close the top cover.

## 2.7 PRINT HEAD IMPRESSION ADJUSTMENT

The print head can be adjusted in or out for different form thickness to provide optimum print quality. To adjust the print head impression, refer to Figure 2-4 and perform the following steps:

1. Ensure paper is loaded and the forms lever is in the "FORMS" or "SHEET" position.
2. While manually moving the print head from side to side move the head adjustment lever in or out until the smudging occurs or paper ripping occurs, then, move the head adjustment lever back one position.



**Figure 2-3 Ribbon Cassette Replacement**

3. Initiate a self-test printout by placing self-test dip switch (S 2-4) in the on position and pressing the SELECT pushbutton.
4. Check the printout to ensure good clean print quality. If the print is too dark or too light adjust the print head in or out as required.

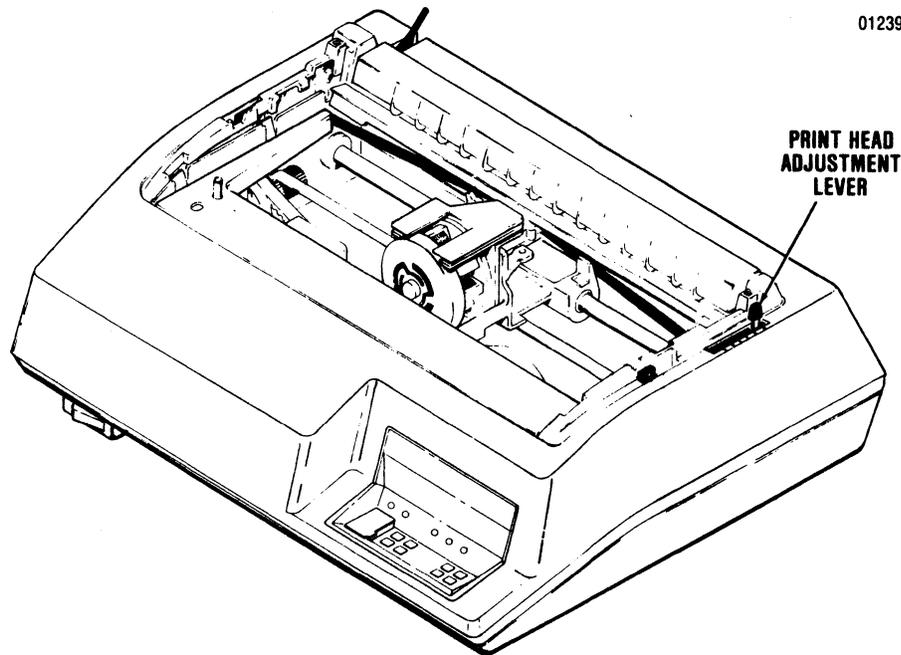
## 2.8 FORMS DESIGN

The following paragraphs provide detailed information on fanfold forms or cut sheet forms design. The forms should conform to the following specification. If not, paper handling problems may occur.

### FANFOLD FORMS

**Forms Construction**—When fanfold forms are fastened with crimps they must be spaced a minimum of 2 in. (508 mm) along both edges of the forms. Crimps must not come within 0.5 in. (12.7 mm) of the fanfold. Metal staples cannot be used.

**Sprocket Holes**—The forms must have sprocket holes punched along both margins  $0.25 \pm 0.03$  in. ( $6.4 \pm 0.7$  mm) from the paper edge to the hole center lines. The distance between hole center lines must be  $0.5 \pm 0.005$  in. ( $12.7 \pm 0.05$  mm) non-accumulative in any 5 inch (127 mm) length and the diameter of the holes must be  $0.156 \pm 0.005$  in. ( $4.0 \pm 0.1$  mm). The distance across the sheets between sprocket hole center lines must be uniform within 0.015 in. (0.381 mm).



**Figure 2-4 Print Head Impression Adjustment**

#### Size and Weight

Length: 2.0 (5.08 mm) minimum

Width: 3.0 to 15.0 in. (7.6 to 38.1 cm)

Thickness:

Single Part—15 lb paper minimum

Multi-Part—Up to six part with carbon, 0.0204 in.  
(.52 mm) maximum.

Weight:

Single Part—15-20 lb. bond (56 g/m<sup>2</sup> to 75 g/m<sup>2</sup>)

Multi-Part—

Ply	Paper	Carbon
2	15 lb (56 g/m <sup>2</sup> ) bond	#7 (16.5 g/m <sup>2</sup> ) tissue
3	15 lb (56 g/m <sup>2</sup> ) bond 12 lb (45 g/m <sup>2</sup> ) bond	#7 (16.5 g/m <sup>2</sup> ) tissue
4-6	12 lb (45 g/m <sup>2</sup> ) except last copy 15 lb (56 g/m <sup>2</sup> )	#7 (16.5 g/m <sup>2</sup> ) tissue

#### CUT SHEET FORMS

##### Forms Construction

- Stapled forms may not be used.
- Split forms with each side containing a different thickness or number of sheets are not recommended.
- On multi-part forms, use 12 lb (45 g/m<sup>2</sup>) as first copies with heaviest copy last.

- On multi-part forms over four parts, use a 5 lb (12 g/m<sup>2</sup>) carbon tissue.

#### Size and Weight

Length: 3.0 to 15.5 in. (7.6 to 39.4 cm)

Width: 4.0 to 12.0 in. (10.1 to 30.5 cm)

Thickness:

Single Part—15 lb paper (56 g/m<sup>2</sup>) minimum

Multi-Part—Up to six part with carbon, 0.0204 in.  
(0.52 mm) maximum as follows:

Ply	Paper	Carbon
2	15 lb (56 g/m <sup>2</sup> ) bond	#7 (16.5 g/m <sup>2</sup> ) tissue
3	15 lb (56 g/m <sup>2</sup> ) bond 12 lb (45 g/m <sup>2</sup> ) bond	#7 (16.5 g/m <sup>2</sup> ) tissue
4-6	12 lb (45 g/m <sup>2</sup> ) except last copy 15 lb (56 g/m <sup>2</sup> )	#7 (16.5 g/m <sup>2</sup> ) tissue

#### Recommendations for Improved Cut Sheet Forms

##### Handling

- Use a 20 lb (75 g/m<sup>2</sup>) bond for single part forms.
- Glued forms will improve multi-part forms handling.
- For forms having wide and narrow copies in the same form, the top copy should always be the fullest width.

# SECTION 3

## PRINTER OPERATION

### 3.1 OPERATING NOTES

Before operating the printer, check the following to ensure proper operation.

- Always plug the printer into a 3-wire grounded outlet.
- Ensure all covers are closed and secured before operation.
- Never operate the printer without paper installed.
- Avoid leaning or placing objects on any part of the printer.

### 3.2 OPERATING PROCEDURES

Operation of the printer involves power-up of the printer, deselect mode of operation, select mode of operation and power-down of the printer. The following procedures describe how to enter into each mode and the functions that can be performed while in that mode.

**POWER-UP**—To power-up the printer, first set all DIP switches (see Section 7 for DIP switch settings), ensure that paper is loaded, then set the POWER switch to the ON position. Placing the POWER switch in the ON position illuminates the POWER indicator and places the printer in the deselect mode. On power-up the printer automatically performs the internal self-test operation.

**DESELECT MODE**—The printer is deselected by any one of the following actions:

1. Setting the POWER switch to the ON position.
2. Pressing the SELECT switch on the control panel while the printer is selected.
3. Receiving a DC3 control code from the input device or computer while the printer is selected.
4. Moving the sheet out of the printer when in the cut sheet mode.

5. Generating a paper empty condition while using fanfold forms.

When the printer is deselected, the POWER Indicator is illuminated and the SELECT indicator is extinguished. In the deselect mode the following functions can be performed.

1. Select the printer locally by pressing the SELECT switch, or remotely by receiving a DC1 control code from the input device or computer.
2. Set the current line as the top of form position by pressing the SET TOF switch on the control panel.
3. Move the paper in either the forward or reverse direction by pressing either the PAPER FWD or PAPER REV switch on the control panel.

#### NOTE

*The top of form and vertical tab positions are offset by the number of steps moved when the PAPER FWD or PAPER REV switches are actuated.*

4. Move the form forward by pressing the LF switch.
5. Move the form to the next sequential top of form by pressing the FORM FEED switch.
6. Enter or exit the cut sheet mode as long as fanfold forms are removed.
7. Insert a cut sheet form, if in the cut sheet mode.

**SELECT MODE**—The printer is selected by either of the following two methods:

1. Pressing the SELECT switch on the control panel while the printer is deselected.
2. Receiving a DC1 control code from the input device or computer while the printer is deselected.

When the printer is selected, the POWER and SELECT indicators are lit. In this mode of operation, the printer performs the following functions:

1. Receives data from the input device and prints the data.
2. Advances the paper by receiving paper motion control codes from the input device.

**POWER-DOWN**—To power-down the printer, deselect the unit and set the POWER switch to the OFF position.

### 3.3 SELF-TEST

The printer performs two self-test operations. The first is an internal self-test which is performed on power-up of the printer. The second self-test is preset by the operator placing the SELF TEST switch on the operator control panel-mounted

DIP switch S2 while the printer is in the powered off state. (The test is performed after power up.)

**INTERNAL SELF-TEST**—On power-up, the printer performs an internal self-test to check and verify the printer logic. If any problems are located, the control panel indicators, listed in Table 3-1, blink until the SELECT switch is pressed, then all checks are retested. The audio alarm sounds when a problem is first detected. If an error condition still exists after reselecting the printer, record the error indication and call for service.

**OPERATOR SELF-TEST**—This self-test feature is set by placing the SELF-TEST DIP SWITCH switch on the operator control panel to the ON position before the printer is powered on. The test will print out the entire character set(s) and binary codes that indicate printer configuration. Test data is reprinted each time the printer is selected. A sample printout is shown in Figure 3-1. Return the SELF-TEST switch to the OFF position after the test is performed.

**Table 3-1 Control Panel Fault Indicators**

AREA CHECKED	LED INDICATORS		
	SELECT	ALERT	CUT SHEET
CRC 1			BLINKING
CRC 2	BLINKING		BLINKING
RAM 1		BLINKING	BLINKING
RAM 2	BLINKING	BLINKING	
HEAD JAM	BLINKING		
INTERLOCK		BLINKING	
CPU	BLINKING	BLINKING	BLINKING



# SECTION 4

## OPERATOR MAINTENANCE

### 4.1 PREVENTIVE MAINTENANCE

Although there are no regularly scheduled operator preventive maintenance procedures, it is advisable to periodically inspect and clean the printer area immediately accessible under the top cover.

During paper loading or ribbon replacement, the printer should be inspected for a build-up of dried

ink, lint, or foreign material. If a build-up of material is evident, clean the area with a light bristle brush or lint free cloth.

Table 4-1 below lists the maintenance required on certain areas of the printer. The maintenance may be required more or less frequently, depending on the printer application and operating environment.

**Table 4-1 Preventive Maintenance**

ASSEMBLY	FREQUENCY	MAINTENANCE
Covers	As Required	Clean all the cover assemblies using a mild detergent and a lint-free cloth.
Internal Inspection	Each Ribbon Change	Remove the top cover and visually inspect interior of printer for loose wires, connectors, and hardware, chafing of cables, and worn or damaged parts.
Print Head Assembly	Each Ribbon Change	Using a lint-free cloth gently remove all dried ink from the front of the print head.
Print Head and Carriage	Each Ribbon Change	After removing ribbon, use a light bristle brush to carefully remove the dust and residue from the print head and carriage assembly.
Platen Assembly	As Required	Clean platen assembly using a mild detergent.

## 4.2 TROUBLESHOOTING GUIDE

The troubleshooting guide, Table 4-2 lists some malfunctions which may occur, the probable causes, and the remedies. If the printer remains

inoperative after performing the remedies indicated, the printer should be serviced by qualified service personnel.

Table 4-2 Troubleshooting Guide

TROUBLE	PROBABLE CAUSE	REMEDY
Print too light.	Print head adjustment cam improperly adjusted. Worn or defective ribbon.	Adjust head adjustment cam to desired print quality. Replace ribbon cassette.
Cut sheet form does not advance.	Not in cut sheet mode. Forms lever not in cut sheet position.	Press CUT SHEET MODE switch on the operators control panel. Move forms lever to the cut sheet position.
Ribbon does not feed properly.	Ribbon twisted or improperly loaded.	Check ribbon cassette replacement procedures.
Printer completely inoperative.	AC input plug not connected. AC input fuse blown.	Connect AC input plug to power source. Check if "POWER" indicator is lit. If indicator is not lit, replace AC input fuse.
Power On/Data Sent-printer does not print.	Input cable not connected. Printer not selected.	Check that connectors at both ends of data input cable are properly connected to mating connectors. Press SELECT switch on the operators control panel.

# SECTION 5

## REMOVAL/REPLACEMENT

### 5.1 GENERAL

This section details the operator removal/replacement procedures. The covers, print head assembly, and input fuse are all operator replaceable. For detailed removal/replacement procedures of all recommended spare parts refer to the Model 351 Technical Manual.

#### NOTE

Ensure the power cord is removed from the power outlet before performing any removal/replacement procedures.

### 5.2 REMOVAL COVER ASSEMBLIES

The following procedures detail the removal of the top, rear, and body covers. To remove the covers, refer to Figure 5-1 and perform the following:

#### TOP COVER

1. Remove the top cover by lifting the rear edge of the cover up and off the printer.

#### REAR COVER

1. Unsnap the top portion of the rear cover from the body cover.
2. Rotate the cover to the extreme rear (open) position.
3. Lift the rear cover up and off the printer.

#### BODY COVER

1. Remove the top and rear covers from the printer.
2. Remove the two Phillips head screws at the rear of printer mounting the body cover to the printer base.
3. Loosen the thumb screw mounting the front of the body cover to the printer base.
4. Lift the body cover up and off the printer.

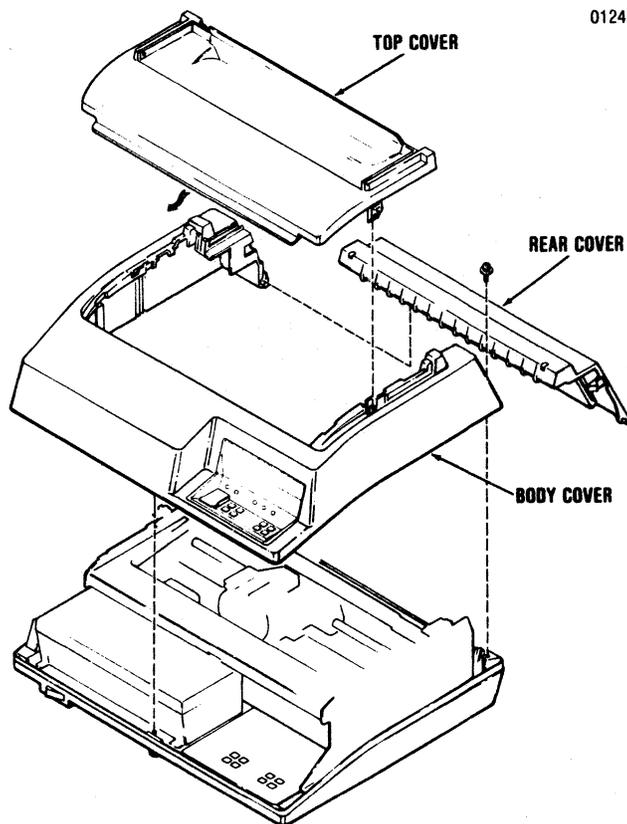


Figure 5-1 Removal Cover Assemblies

### 5.3 REMOVAL/REPLACEMENT PRINT HEAD ASSEMBLY

To remove and replace the print head assembly, refer to Figure 5-2 and perform the following steps:

1. Remove the top cover by lifting the rear edge of the cover up and off the printer.
2. Unsnap the top portion of the rear cover and place in the open position.
3. Move the forms lever to the "LOAD" position.
4. Lift the column scale to the up position.
5. Pull the head adjustment lever towards the front of the printer to its maximum position.
6. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the ribbon guide and lifting upward.
7. Remove the print head fingerboard connector.
8. While pulling the print head towards the front of the printer, lift the head up and out of the printer.
9. To replace the print head assembly, reverse steps 1 through 8 above.
10. Ensure the black, numbered cam located on the front of the print head is in position "A" following replacement of the print head.

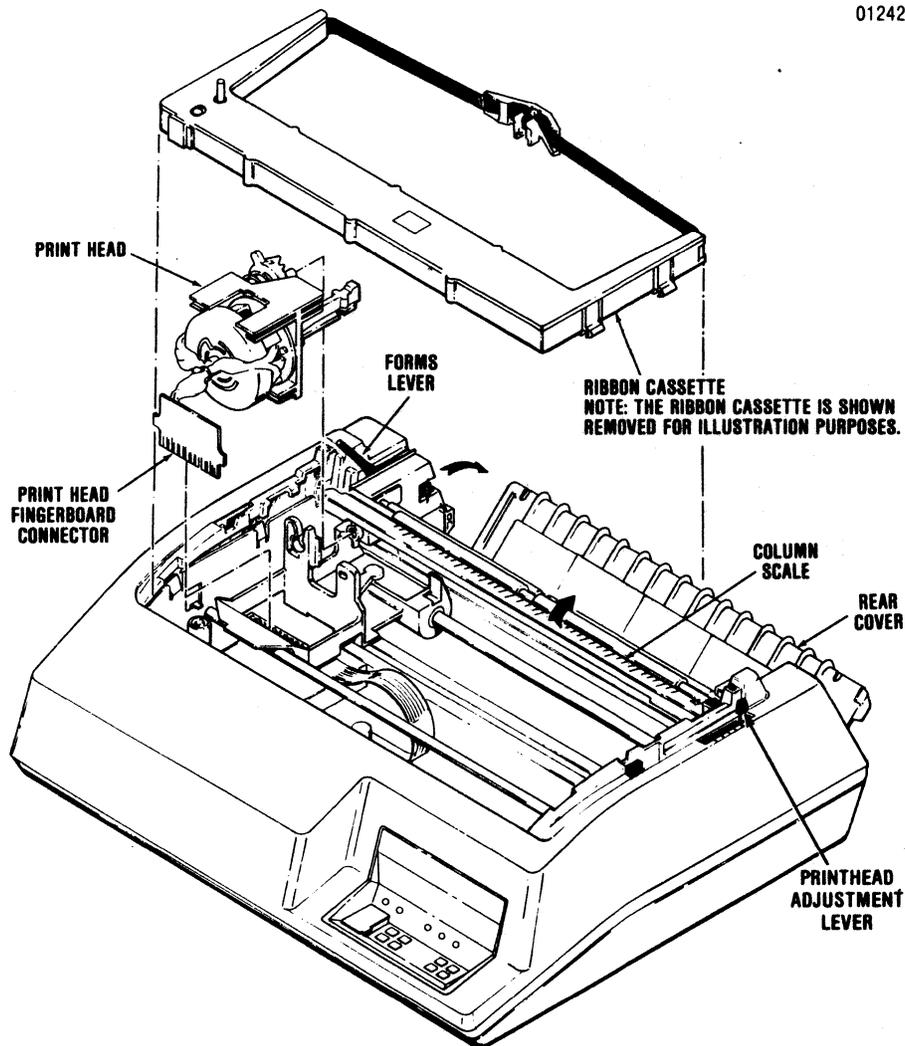


Figure 5-2 Removal Print Head Assembly

## 5.4 REMOVAL/REPLACEMENT INPUT FUSE

To remove and replace the input fuse, refer to Figure 5-3 and perform the following steps:

1. Locate the input fuse at the left rear of the printer.
2. Using a flat blade screwdriver rotate the fuse holder cap counterclockwise until loose, then remove the cap and defective fuse.
3. Install new fuse in the fuse holder and reinstall the cap by turning it clockwise with the screwdriver.

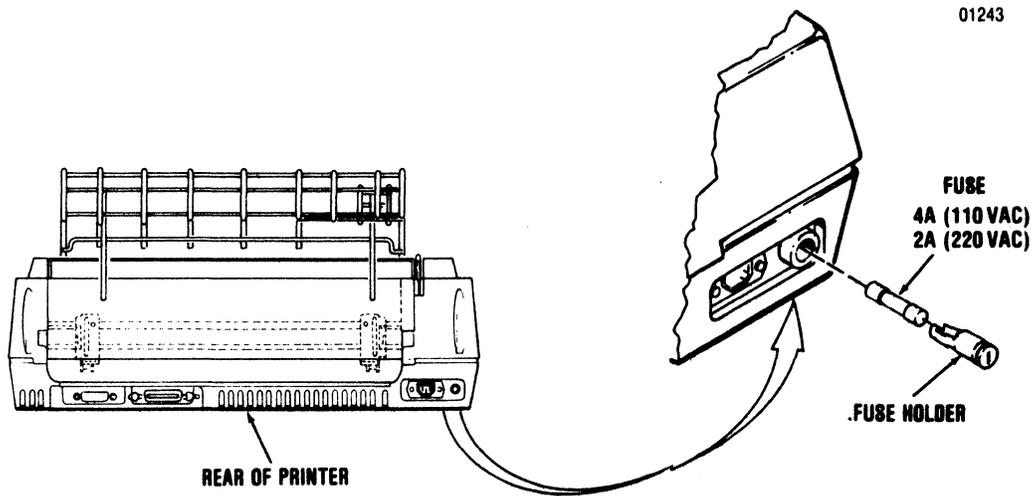


Figure 5-3 Removal Input Fuse

## **CONTENTS**

<b>Section 6</b>	<b>Installation</b>
<b>Section 7</b>	<b>Printer Features</b>
<b>Section 8</b>	<b>Interface Information</b>
<b>Section 9</b>	<b>Specifications</b>

# **Installation, Interface and Specifications**

# SECTION 6 INSTALLATION

## 6.1 GENERAL

This section contains information on installing and setting-up the printer. The Model 351 should be installed in an area that is free from excessive dust and dirt and is easily accessible from all sides.

## 6.2 PRINTER INSPECTION

After unpacking, visually inspect the printer for signs of damage received during shipment. Immediately notify the common carrier of any damage.

## 6.3 SITE CONSIDERATIONS

When selecting a site to install the printer the following should be taken into consideration.

**PRINTER DIMENSIONS**—Refer to Figure 6-1.

**PRINTER INSTALLATION SPECIFICATIONS**—Refer to the following printer specifications before installing the printer.

### WEIGHT

Printer: 47 lbs.  
Stand: 22.5 lbs.

### HUMIDITY

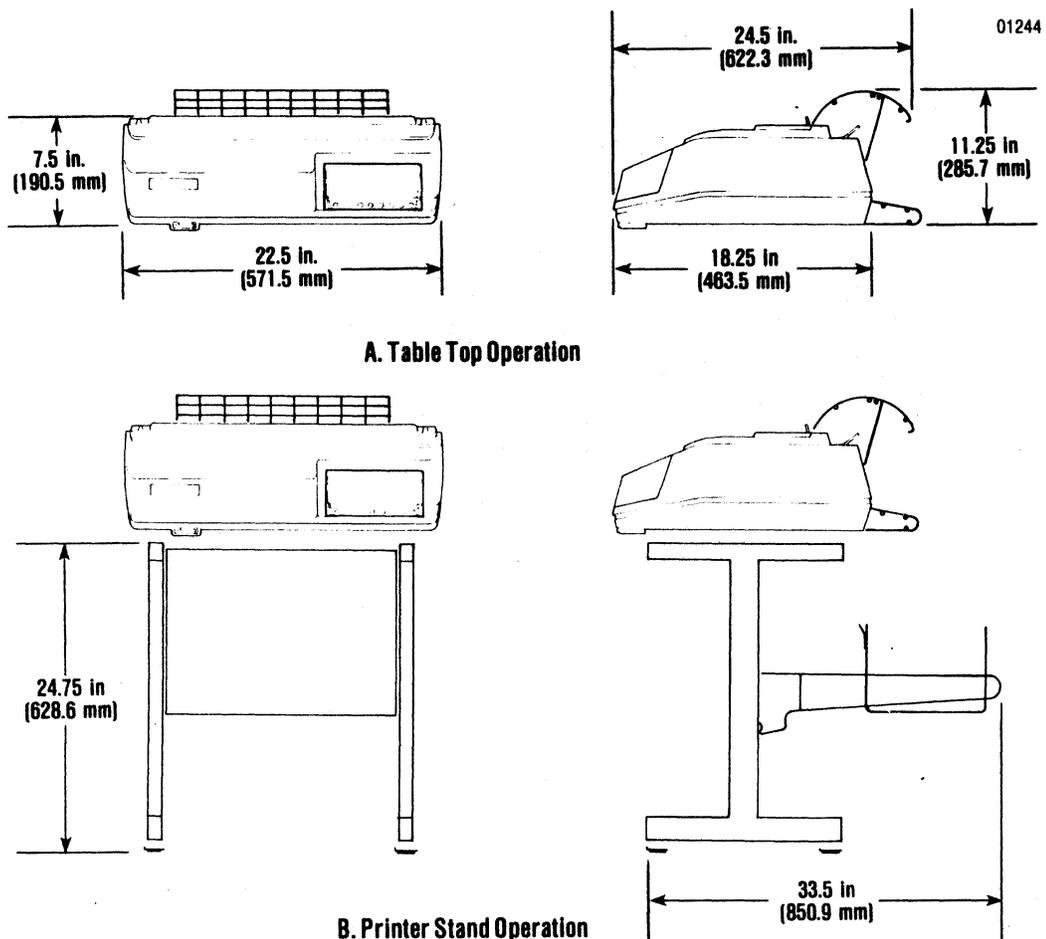
Operating: 10% to 90% (Non-Condensing)  
Storage: 10% to 95% (Non-Condensing)

### TEMPERATURE

Operating: 50° to 104°F (10° to 40°C)  
Storage: -40° to 151°F (-40° to 66°C)

### ELECTRICAL

115 VAC +10%, -15%; 60 Hz ±1 Hz  
230 VAC +10%, -15%; 50 Hz ±1 Hz



A. Table Top Operation

B. Printer Stand Operation

Figure 6-1 Printer Dimensions

## 6.4 PRINTER SET-UP

The following procedures detail the set-up of the printer prior to operation at the installation site. Refer to Figure 6-2 and perform the following steps:

1. Plug the printer into the appropriate power outlet.

**NOTE**

*Always use a 3-wire grounded outlet.*

2. Ensure the power switch is OFF and connect the printer to the input device using the appropriate data cable.

3. Install the form (fanfold or cut sheet) to be printed as described in Section 2, Paper Loading/Ribbon Replacement.

4. Check the settings of DIP switches S1, S2, S3, and S4 per Section 7, to ensure the desired printer features are selected.

5. Set the power switch to the ON position.

6. Press the SELECT switch, lighting the SELECT indicator, to enable the printer to receive data.

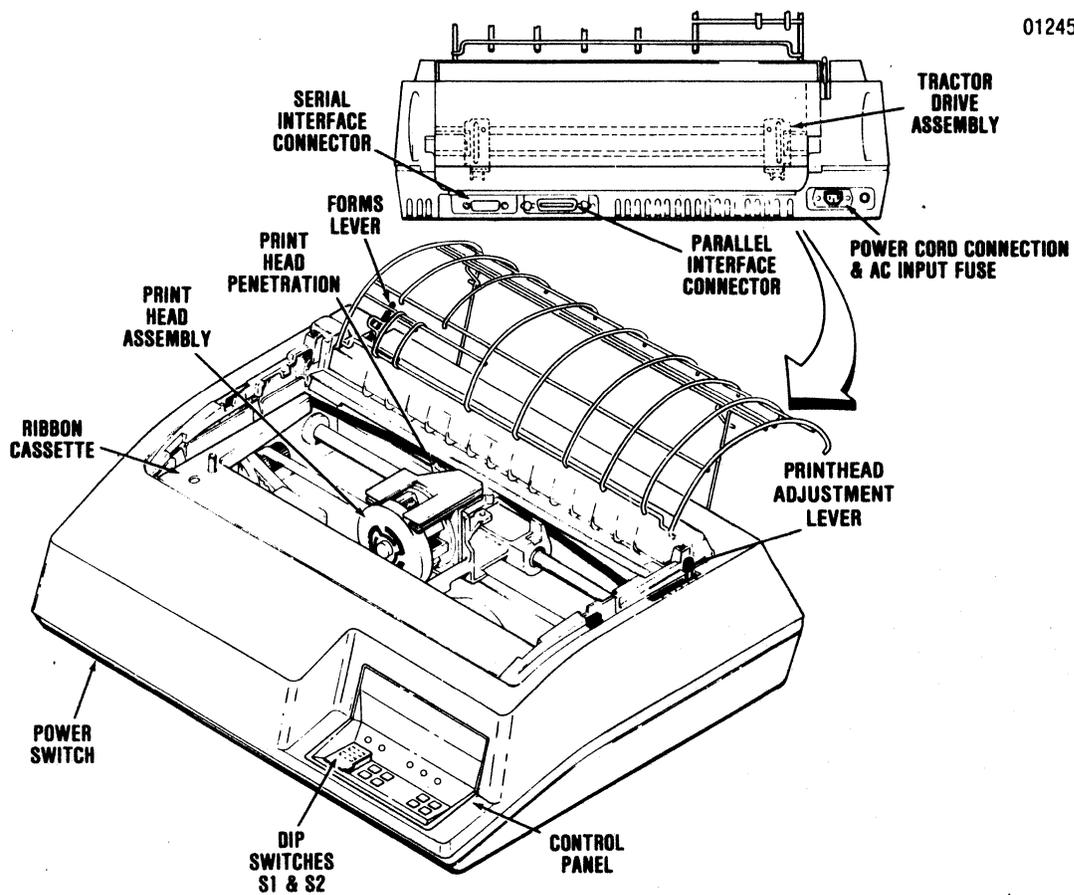


Figure 6-2 Printer Set-Up

# SECTION 7

## PRINTER FEATURES

### 7.1 PRINTER FEATURE SELECTION

The printer contains four DIP switches labelled S1, S2, S3, and S4. These switches are used to select printer features. DIP switches S1 and S2 are located on the control panel assembly. DIP switches S3 and S4 are located within the printer and are accessible only by removing the printer body cover (refer to Body Cover Removal in paragraph 7.7). The paragraphs in this section describe the settings of each DIP switch for the following list of features:

- Auto Line Feed
- Prime on Delete
- Prime on Select
- Form Length
- 6/8 Lines per Inch
- Baud Rate
- Self Test
- Country Character Set Selection
- Reverse Channel Polarity
- DTR (Data Terminal Ready) and Reverse Channel
- X-ON/X-OFF
- Parallel/Serial Input
- Page Mode Enable
- New Line Mode

#### NOTE

*The switch settings are read and acknowledged only on power-up of the printer. To select a printer feature, set the switch to the desired position, power-down the printer, then power up the printer. The new printer feature is now selected.*

### 7.2 PRINTER FEATURES DIP SWITCH S1

DIP switch S1, on the control panel, is used to select Auto Line Feed, Prime on Delete, Prime on Select, and Form Length. Refer to Figure 7-1 for the location of DIP switch S1 and the table of switch positions for these features.

**AUTO LINE FEED**—If the Auto Line Feed feature is selected, a line feed is performed on receipt of a carriage return (CR) code or at the end of printing a line. If the CR code is the first character in the buffer, a line feed is not performed.

**PRIME ON DELETE**—When prime on delete is selected and a delete code is received, the line buffer is cleared and the print head is returned to the left margin.

**PRIME ON SELECT**—When this feature is selected and the printer is selected, the print head is returned to the left margin and the input buffer is cleared.

**FORM LENGTH**—Switch sections 1 through 5 of DIP switch S1 are used to select the form length which may be settable from 0.5 inches to 15.5 inches as shown in the table in Figure 7-1. Form length is measured in the number of lines per form. Software changing of the vertical pitch will change the form length.

### 7.3 PRINTER FEATURES DIP SWITCH S2

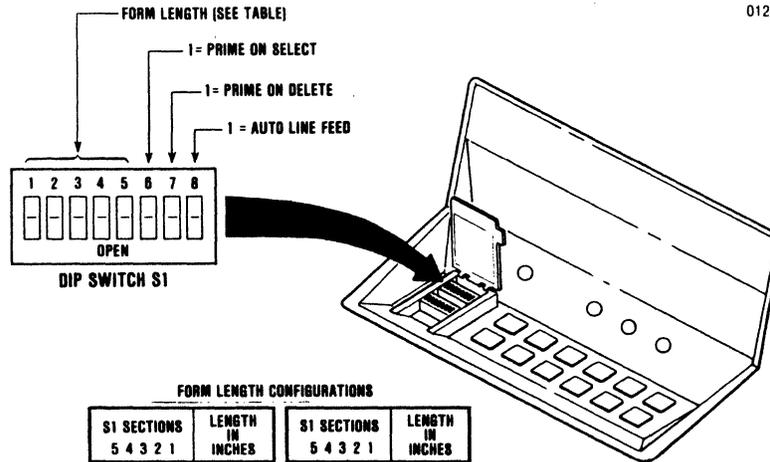
DIP switch S2, on the control panel, is used to select the number of lines per inch (6/8 lpi), Baud rate, Self Test, and character set selection. Figure 7-2 shows the location of DIP switch S2 on the printer control panel and includes a table that lists the switch positions for Baud rate and character set selection.

**CHARACTER SET SELECTION**—Switch sections 1, 2, and 3 of DIP switch S2 are used to select the character set as determined by the binary value indicated for these switches in Figure 7-2. These three switch sections select one of eight possible countries (USA always included) for which substitute characters will be printed.

**SELF-TEST**—DIP switch (S2) section 4 overrides all other communications switches and places the system in self-test mode. This test includes character set display and a list of the switch settings that are operative when the printer is selected.

**BAUD RATE**—DIP switch S2 sections 5, 6, and 7 are used to select printer Baud rate as determined by the binary values indicated for these switches in Figure 7-2.

**6/8 LINES PER INCH**—DIP switch S2 section 8 is used to set the vertical pitch (spacing between lines) at either 6 or 8 lines per inch. The height of the printer characters is not affected.



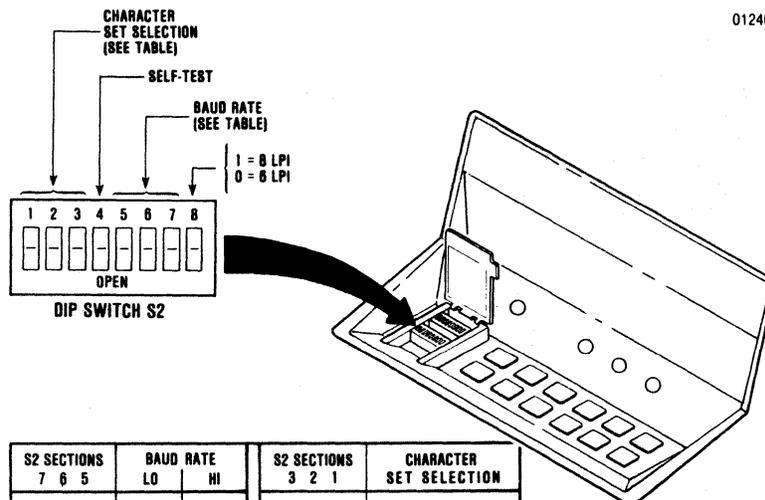
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**FORM LENGTH CONFIGURATIONS**

S1 SECTIONS 5 4 3 2 1		LENGTH IN INCHES	S1 SECTIONS 5 4 3 2 1		LENGTH IN INCHES
0 0 0 0 0		1LF	1 0 0 0 0		8.0
0 0 0 0 1		0.5	1 0 0 0 1		8.5
0 0 0 1 0		1.0	1 0 0 1 0		9.0
0 0 0 1 1		1.5	1 0 0 1 1		9.5
0 0 1 0 0		2.0	1 0 1 0 0		10.0
0 0 1 0 1		2.5	1 0 1 0 1		10.5
0 0 1 1 0		3.0	1 0 1 1 0		11.0
0 0 1 1 1		3.5	1 0 1 1 1		11.5
0 1 0 0 0		4.0	1 1 0 0 0		12.0
0 1 0 0 1		4.5	1 1 0 0 1		12.5
0 1 0 1 0		5.0	1 1 0 1 0		13.0
0 1 0 1 1		5.5	1 1 0 1 1		13.5
0 1 1 0 0		6.0	1 1 1 0 0		14.0
0 1 1 0 1		6.5	1 1 1 0 1		14.5
0 1 1 1 0		7.0	1 1 1 1 0		15.0
0 1 1 1 1		7.5	1 1 1 1 1		15.5

**NOTE:**  
0 = CLOSED  
1 = OPEN

**Figure 7-1 Printer Features DIP Switch S1**



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S2 SECTIONS 7 6 5			BAUD RATE		S2 SECTIONS 3 2 1			CHARACTER SET SELECTION
			LO	HI				
0 0 0			50	1800	0 0 0			U S A
0 0 1			75	2000	0 0 1			FRANCE
0 1 0			110	2400	0 1 0			UNITED KINGDOM
0 1 1			134.5	3600	0 1 1			GERMANY
1 0 0			150	4800	1 0 0			ITALY
1 0 1			300	7200	1 0 1			SWEDEN/FINLAND
1 1 0			600	9600	1 1 0			DENMARK/NORWAY
1 1 1			1200	19200	1 1 1			SPAIN

**NOTE:** REFER TO PARAGRAPH 7.6 FOR HI/LO  
BAUD RATE SWITCH POSITIONS ON  
DIP SWITCH S4-2.

**NOTE:**  
0 = CLOSED  
1 = OPEN

**Figure 7-2 Printer Features DIP Switch S2**

## 7.4 ACCESSING DIP SWITCHES S3 AND S4

DIP switches S3 and S4 are located inside the printer on the printed circuit board and are set by first removing the body cover. Figure 7-3 shows the location of the switches.

### NOTE

*The switch settings are read only on power-up of the printer. To select a printer feature, set the switch to the desired position, power-down the printer, then power up the printer. The new printer feature is now selected.*

1. Remove the top cover from the printer.
2. Referring to paragraph 7.5 and 7.6, set the DIP switches to the desired position using the tip of a ball point pen.

3. Once the switches are set, replace the top cover.

## 7.5 PRINTER FEATURES DIP SWITCH S3

DIP switch S3 is used to select: serial or parallel operation, page mode, reverse channel high or low for busy, reverse channel with or without DTR, parity or no parity, odd or even parity, X-ON/X-OFF, and new line mode. Figure 7-3 includes a table that identifies the switch positions for the printer features that can be obtained with DIP switch S3.

**PARALLEL/SERIAL**—This switch is used to set either parallel or serial mode of data transfer.

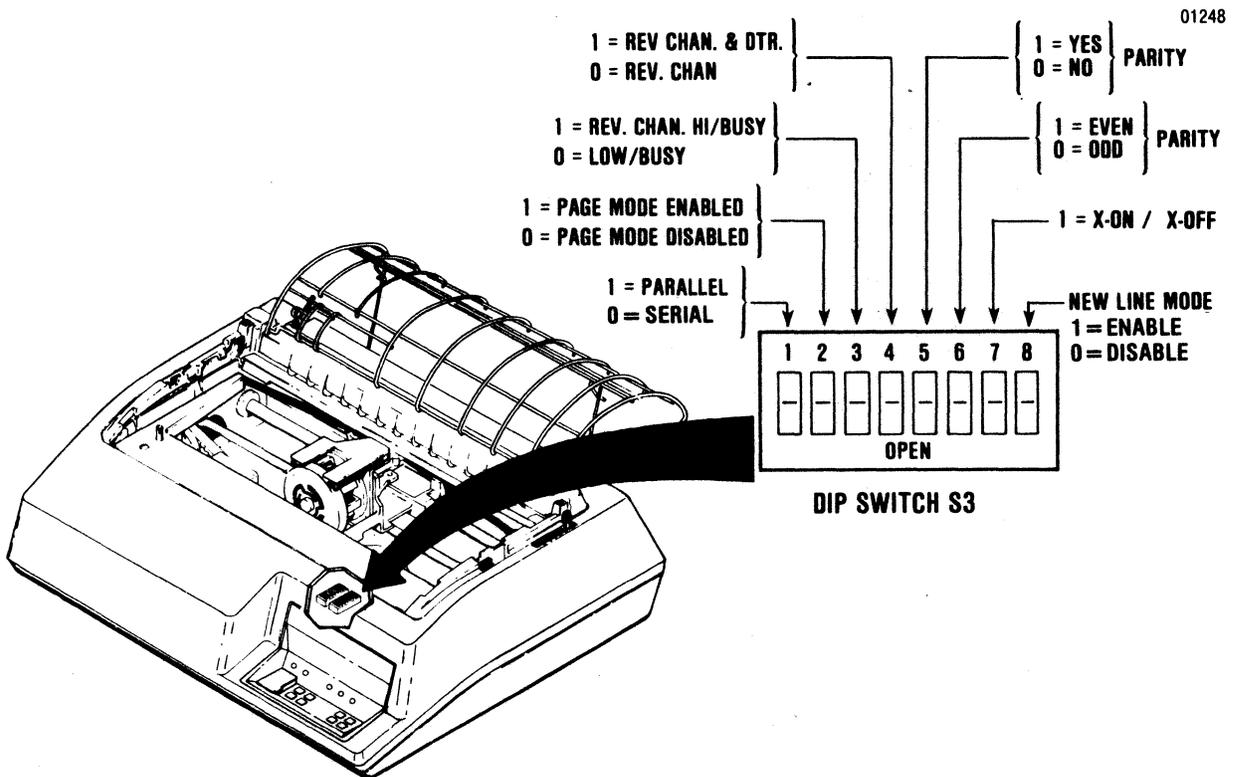


Figure 7-3 Printer Features DIP Switch S3

**PAGE MODE (ENABLE/DISABLE)**—This switch is used to determine if the control code (STX) will start the page mode or is acknowledged and ignored. In page mode, the printer will not print any of the data received until 2048 bytes of data have been received or an ETX control code is received.

**REVERSE CHANNEL POLARITY (+/-)**—This switch is used to determine whether reverse channel or inverted reverse channel is to indicate busy.

**REVERSE CHANNEL AND DTR**—This switch is used to determine if busy is to be indicated by Reverse Channel or Reverse Channel and DTR.

**PARITY**—This switch is used to determine if a parity bit will be included to provide a check for accuracy. If a character is read as having the wrong parity, the @ sign will be substituted for that character to provide indication of the error.

**ODD/EVEN PARITY**—When parity is included, this switch is used to determine if the parity bit will be odd or even.

**X-ON/X-OFF**—This switch is used to select X-ON/X-OFF transmission as an alternate method of indicating busy/not busy.

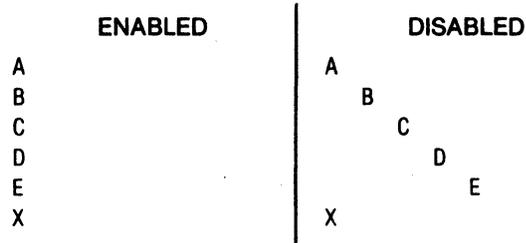
**LF & CR/LF ONLY**—This switch is used to initiate either a carriage return (CR) after a line feed (LF) or a line feed (LF) only. A line feed (LF) only will ensure that the Character Position Pointer will be set high (1) when printing is completed.

**NEW LINE MODE (ENABLE/DISABLE)**—This switch is used to enable or disable new line mode. If new line mode is enabled, the characters Line Feed (LF), Vertical Tab (VT), or Form Feed (FF) each cause the data following it to be printed at the left margin.

EXAMPLE:

DATA: A (LF) B (LF) C (VT) D (FF) E (CR) X (CR)

NEW LINE MODE:



## 7.6 PRINTER FEATURES DIP SWITCH S4

**HI/LO BAUD RATE**—Section 2 of DIP switch S4 is used to select either the upper or lower baud rate ranges that are available via the various positions of sections 5, 6 and 7 of DIP switch S2. Refer to the table shown in Figure 7-2 for the required switch positions for the desired baud rate.

**7/8 DATA BITS**—Section 3 of DIP switch S4 is used to set the number of data bits in the word

01249

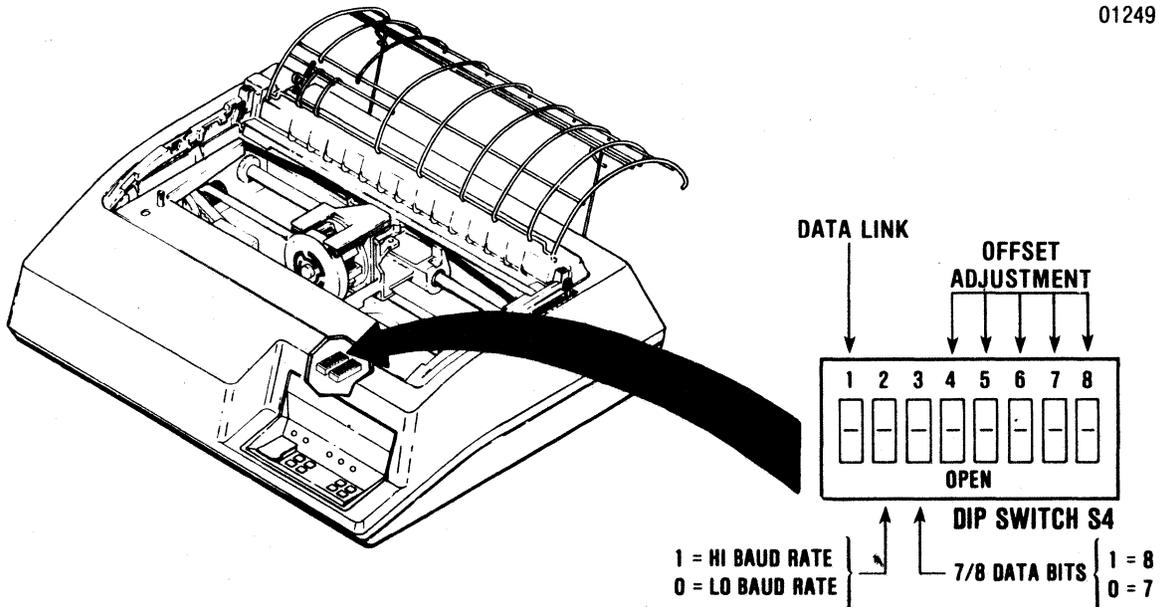


Figure 7-4 Printer Features DIP Switch S4

length. The closed position will permit 7 bit operation, while the open position will permit 8 bits.

**OFFSET ADJUSTMENT**—Sections 4 (LSB), 5, 6 and 7 (MSB) of DIP switch S4 provide a fine horizontal adjustment for aligning forward to reverse printing. Sixteen variations in offset adjustment, in increments of .003 inch, are possible. Section 8 of DIP switch S4 determines the direction of this offset, either to the left or to the right.

## **7.7 DATA STROBE SWITCH**

When shipped, the Model 351 printer is normally set to accept noninverted data strobe signals from the host system.

If the host system supplies inverted data strobe signals to the printer, call your Centronics Field Service representative for this configuration change.

# SECTION 8

## INTERFACE INFORMATION

### 8.1 GENERAL INFORMATION

The printer is connected to the input device, via the input data cable, for either parallel or serial operation. In the right rear of the printer the pcb provides a parallel interface connection via an Amphenol 57 series 36-pin connector and a serial interface connection via an EIA-RS232C, 25 pin connector. Four unused pins in the serial interface connector are used for the optional current loop connection. The following paragraphs describe the parallel and serial interfaces in detail.

### 8.2 PARALLEL INTERFACE CONNECTION

The pin-outs of the 36-pin parallel interface connector are listed in Table 8-1. A description of the external and printer generated parallel signals follow the table.

#### EXTERNAL GENERATED SIGNAL DESCRIPTION—

The following signals are generated by the input device.

**DATA STROBE**—Data strobe is a negative or positive going pulse used to transfer the incoming parallel data into the printer logic. The pulse duration of the signal must be a minimum of 1.0 microsecond. The leading and trailing edges of data strobe and the input data must be as shown in Figure 8-1.

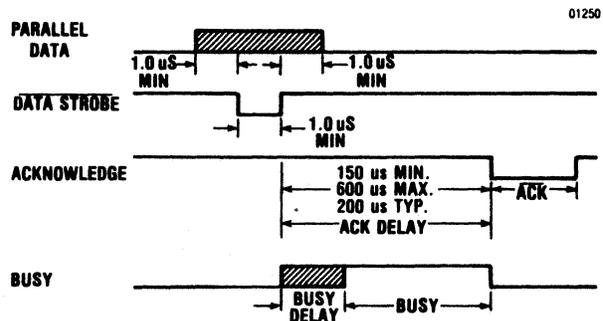


Figure 8-1 Parallel Interface Timing Diagram

Table 8-1 Parallel Interface Connector Pin-Outs

PIN	SIGNAL	PIN	SIGNAL
1	DATA STROBE	19	Twisted Pair Ground
2	Data Bit 1	20	Twisted Pair Ground
3	Data Bit 2	21	Twisted Pair Ground
4	Data Bit 3	22	Twisted Pair Ground
5	Data Bit 4	23	Twisted Pair Ground
6	Data Bit 5	24	Twisted Pair Ground
7	Data Bit 6	25	Twisted Pair Ground
8	Data Bit 7	26	Twisted Pair Ground
9	Data Bit 8	27	Twisted Pair Ground
10	ACKNOWLEDGE	28	Twisted Pair Ground
11	BUSY	29	Twisted Pair Ground
12	PAPER OUT	30	INPUT PRIME RETURN
13	SELECT	31	INPUT PRIME
14	GROUND	32	FAULT
15	Not Used	33	GROUND
16	GROUND	34	Not Used
17	CHASSIS GROUND	35	Not Used
18	+5V	36	Not Used

**DATA BITS 1-8**—Data bits 1 through 8 contain the ASCII character and control code information. The logic level of each data line must be settled at least 1.0 microsecond before the leading edge of the data strobe pulse and remain at its logic level until at least 1.0 microsecond after the trailing edge of the data strobe pulse.

**INPUT PRIME**—Input prime is an active low signal which causes the print head to return to the left margin and resets the printer logic on the trailing edge of the signal.

**PRINTER GENERATED SIGNAL DESCRIPTION**—The following signals are generated by the printer.

**ACKNOWLEDGE**—Acknowledge is an active low signal used to verify the transfer of incoming data from the input device to printer logic or to signify the end of a functional operation. Once a code is sent to the printer, an acknowledge pulse must be received before a new code can be sent.

**BUSY**—Busy is an active high signal which inhibits data transmission from the input device. Busy goes active on the trailing edge of **DATA STROBE** or when either the paper empty or fault status line is active high.

**PAPER EMPTY**—Paper empty is a positive-going signal that indicates the printer is out of paper.

**SELECT**—An active high select signal indicates either the **SELECT** switch has been pressed or a **SELECT** code has been received and that the printer is in a ready condition.

**FAULT**—Fault is an active low signal that indicates paper empty, deselect or a “not ready” state.

### 8.3 SERIAL INTERFACE CONNECTION

The pin-outs of the 25-pin serial interface connector are listed in Table 8-2. A description of the data set and printer generated signals follow the table.

**DATA SET GENERATED SIGNAL DESCRIPTION**—The following signals are generated by the data set.

#### NOTE

A +V or Mark condition indicates a voltage greater than +3 volts. A -V or Space condition indicates a voltage less than -3 volts.

Signals **CLEAR TO SEND**, **DATA SET READY** and **CARRIER DETECT** will be interpreted as a logical 1 if they are not connected to the data set.

Table 8-2 Serial Interface Connector Pin-Outs

PIN	EIA SIGNAL NAME	SIGNAL
1	AA	Protective Ground
2	BA	Transmitted Data
3	BB	Received Data
4	CA	Request to Send
5	CB	Clear to Send
6	CC	Data Set Ready
7	AB	Signal Ground
8	CF	Carrier Detect
11	SBA	Reverse Channel
20	CD	Data Terminal Ready
12	---	Host Receive Current Loop +
13	---	Host Receive Current Loop -
14	---	Printer Transmit Status +
15	---	Printer Transmit Status -

**RECEIVED DATA**—Data source to the printer.

**CLEAR TO SEND**—A +V will enable X-ON/X-OFF or printer status to be transmitted. A -V will disable the transmitter.

**DATA SET READY**—A +V will allow transmitted data to be accepted by the printer. A -V will not allow data to be accepted.

**CARRIER DETECT**—A +V will allow transmitted data to be accepted by the printer. A -V will not allow data to be accepted.

**PRINTER GENERATED SIGNAL DESCRIPTION**—The following signals are generated by the printer.

**TRANSMITTED DATA**—Used to indicate the buffer status when in the X-ON/X-OFF mode.

**REQUEST TO SEND**—This line is +V when in the X-ON/X-OFF mode. When not, it is -V.

**REVERSE CHANNEL**—Used for transmitting the printer/buffer status when in the reverse channel mode. The line is normally in a -V condition. When the buffer is full, this line goes to a +V condition until the printer is able to receive data again. This may be inverted by changing the setting of the reverse channel polarity dip switch. The line is held at buffer empty polarity (-V) when in the X-ON/X-OFF.

**DATA TERMINAL READY**—This line is held at +V when not used for the status report line. When it is used for status, then it follows Reverse Channel.

# SECTION 9

## SPECIFICATIONS

### 9.1 MODEL 351 SPECIFICATIONS

#### SERIAL INPUT

Interface ..... RS-232C  
Data Format ..... 1 START bit, 7 or 8 DATA bits, 1 possible PARITY bit, 1 or more  
S T O P  
bits.  
Input Code ..... 96 character ASCII.  
Buffer ..... 2K character buffer.

#### PARALLEL DATA

Data Format ..... 7 bit ASCII parallel.  
Input Code ..... 96 character ASCII.  
Buffer ..... One line character buffer.  
Input Gating ..... Data Strobe is gated with Acknowledge of previous character.  
Input Speed ..... 5000 cps (typical)

#### PRINTING

Printing Method ..... Impact, dot matrix, bidirectional, logic seeking.  
Dot Matrix ..... 7 dots wide by 9 dots high; 9th wire underline (DP);  
N dots wide by 9 dots high (proportional).  
Print Speed ..... 200 characters per second (DP)  
100 characters per second (proportional).  
Country Character Sets ..... U.S.A., Great Britian, Sweden/Finland, Norway/Denmark,  
Germany, Italy, France and Spain.  
Horizontal Pitch ..... Programmable for 5, 6, 8.25, 10, 12, and 16.5 characters per  
inch, and proportional print.

#### Maximum Line Length

(varies with horizontal pitch)

5 cpi ..... 66 columns  
6 cpi ..... 79 columns  
8.25 cpi ..... 109 columns  
10 cpi ..... 132 columns  
12 cpi ..... 158 columns  
16.5 cpi ..... 218 columns

#### PAPER HANDLING

Vertical Pitch ..... 6/8 lines per inch.  
Single Line Feed Time ..... 30 msec.  
Vertical Slew Speed ..... 6 ips (152.4 mm/s) for line feeds (30 millisecs/line);  
8 ips (203.2 mm/s) for form feeds (20 millisecs/line).  
Forms Length ..... 1 to 192 lines.  
Paper Movement ..... Bidirectional.

## **CONTENTS**

Section 10      Programming Information

# **Programming Information**

# SECTION 10

## PROGRAMMING INFORMATION

### 10.1 GENERAL PROGRAMMING INFORMATION

The Model 351 printer accepts ANSI compatible control codes and escape sequences. Using the control codes and escape sequences described in this section, the programmer can program the printer for the following features:

- Page Mode
- Primary Character Set Selection
- Alternate Character Set Selection
- Country Set Selection
- Horizontal Pitch
- Vertical Pitch
- Form Length

- Horizontal Tabs
- Vertical Tabs
- Subscript/Superscript
- Underline
- Expanded Print
- Top/Bottom Margins
- Variable Spacing
- Graphics

### 10.2 CONTROL CODES

Control codes are sent to the printer with character codes via the input data lines. These codes are interpreted as instructions by the printer and initiate a specific function. Table 10-1 lists the ANSI control codes that are valid for the Model 351 printer.

**Table 10-1 ANSI Control Codes**

MNEMONIC	DECIMAL	OCTAL	HEXA- DECIMAL	FUNCTION
STX	2	002	02	Page Mode start
ETX	3	003	03	Page Mode end
BEL	7	007	07	Audio Alarm
HT	9	011	09	Print at next sequential horizontal tab
LF	10	012	0A	One line feed forward
VT	11	013	0B	Paper motion to next vertical tab location
FF	12	014	0C	Paper motion to next top of form location
CR	13	015	0D	Carriage Return
SO	14	016	0E	Alternate character set
SI	15	017	0F	Primary character set
DLE ENQ	16 5	020 005	10 05	Serial status
DCI	17	021	11	Select printer command
DC3	19	023	13	Deselect printer command
ESC	27	033	1B	Escape sequence start
DEL	127	177	7F	Clears line buffer if in PRIME ON DELETE mode

### 10.3 ESCAPE SEQUENCES

The Model 351 accepts and interprets ANSI escape sequences. In the escape sequences which follow, the escape character (octal 033) is designated as ESC. The second character in the sequence, if not a terminating character, may be a “[” (octal 133), “(” (octal 050), “)” (octal 051), or “%” (octal 045) depending on the function of the sequence. Numeric parameters are designated as  $n$ ,  $n_1$ ,  $n_2$ ...etc. The graphic characters in the escape sequences shown are from the US ASCII character set illustrated in Figure 10-2. The characters are spaced apart for clarity only.

A numeric parameter is a sequence of ASCII decimal digits (octal 060 through 071). The parameter is interpreted as an unsigned decimal integer, with the most significant digit transmitted first. Leading zeros are allowed, but not necessary. Skipped or unspecified parameters have a value of zero; extra parameters are ignored. Invalid terminators cause the sequence to be ignored. Up to 16 parameters may be inputted with a “;” (octal 073) between each.

#### NOTE

*Escape sequences must not be sent during an INPUT PRIME. Centronics reserves this sequence for in-house testing.*

**COUNTRY SET SELECTION**—The Model 351 is capable of printing character sets of eight countries. If more than one country set selection is made for the printing of a line, only the last selection will be printed; all prior selections will be ignored. The escape sequences to select the country character sets are as follows:

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC ( A	(101) Select Great Britain Character Set
ESC ( B	(102) Select USA Character Set
ESC ( 2	(062) Select Sweden/Finland Character Set
ESC ( 3	(063) Select Norway/Denmark Character Set
ESC ( K	(113) Select Germany Character Set
ESC ( 1	(061) Select Italy Character Set
ESC ( R	(122) Select France Character Set
ESC ( 4	(064) Select Spain Character Set

**HORIZONTAL TABS**—There are a maximum of 16 horizontal tab stops. These are associated with specific character positions (columns). Thus, changing the horizontal pitch will change the physical location of the tabs.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC H	(110) Set horizontal tab stop at current column.
ESC [ g	(147) Clear horizontal tab stop at current column.
ESC [ 0g	Clear horizontal tab stop at current column.
ESC [ 2g	Clear all horizontal tab stops.
ESC [ 3g	Clear all horizontal tab stops.
ESC [ nu	(165) Set horizontal tab stop at column $n$ .
ESC [ $n_1$ ; $n_2$ ... $n_x$ u	Set horizontal tab stops at columns $n_1, n_2, \dots, n_x$ ( $x \leq 16$ ).

**HORIZONTAL PITCH**—Horizontal pitch determines the width of printed characters as well as their spacing. The horizontal pitch may be changed at any time within a line. The following escape sequences set horizontal pitch.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC [ w	(167) Select 10 cpi Horizontal Pitch
ESC [ 1 w	Select 10 cpi Horizontal Pitch
ESC [ 2 w	Select 12 cpi Horizontal Pitch
ESC [ 4 w	Select 16.5 cpi Horizontal Pitch
ESC [ 5 w	Select 5 cpi Horizontal Pitch
ESC [ 6 w	Select 6 cpi Horizontal Pitch
ESC [ 8 w	Select 8.25 cpi Horizontal Pitch

**VERTICAL PITCH**—Vertical pitch determines the spacing between lines, not the height of printed characters. Changing vertical pitch also clears vertical margins. The following escape sequences set vertical pitch. Changing vertical pitch clears margins.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC [ z	(172) Select 6 LPI Vertical Pitch
ESC [ 1 z	Select 6 LPI Vertical Pitch
ESC [ 2 z	Select 8 LPI Vertical Pitch

**FORM LENGTH**—Form length is defined in lines, not physical units. Therefore, changing vertical pitch will alter the physical form length. Forms may be from 1 to 192 lines in length. Changing form length clears vertical margins and defines the current line as line one.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC [ n t	(164) Set form length to n lines Set top margin to line 1 Set bottom margin to line n Set current line to line 1

Example:

ESC [ 66t—Sets the form length to 66 lines.

**VERTICAL MARGINS**—Printing is permitted only on lines within the inclusive top and bottom margins. When form length is changed, these margins are cleared; that is, the top margin is set to line one and the bottom margin is set to the form length. The following must be true to successfully set new vertical margins:

$$1 \leq \text{top margin} \leq \text{bottom margin} \leq \text{form length.}$$

If it is ever the case that: current line is less than the top margin or current line is greater than the bottom margin, the current line is set to the top margin. For example, a line feed performed at the bottom margin will execute a form feed.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC [ n r	(162) Set top margin to line n.
ESC [ ; n r	Set bottom margin to line n.
ESC [ n <sub>1</sub> ; n <sub>2</sub> r	Set top margin to line n <sub>1</sub> , and set bottom margin to line n <sub>2</sub> .

Example:

ESC [ 1r—sets top margin to line 1.

ESC [ ; 66r—sets bottom margin to line 66.

The following escape sequence can be sent at one time to set both top and bottom margins.

ESC [ 1; 66r—sets the top margin to line 1 and the bottom margin to line 66.

**VERTICAL TABS**—The printer has 16 vertical tab stops. Vertical tab stops are associated with specific line numbers, not physical positions on the paper. Thus, changing vertical pitch changes the printing position of vertical tabs. The following escape sequences set or clear vertical tab stops.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC J	(112) Select vert. tab stop at current line.

ESC [ 1 g	(147) Clear vert. tab stop at current line.
ESC [ 4 g	Clear all vert. tab stops.
ESC [ n v	(166) Set vert. tab stop at line n.
ESC [ n <sub>1</sub> ; n <sub>2</sub> . . . n <sub>x</sub> v	Set vert. tab stop at line n <sub>1</sub> , n <sub>2</sub> , . . . n <sub>x</sub> (x = 16).

Example:

ESC [ 4 g—Clears all vertical tabs.

ESC [ 6; 16; 26; 36v—Sets vertical tabs at lines 6, 16, 26, and 36.

**REVERSE LINE FEEDS**—The printer accepts reverse line feed commands using the escape sequence below in the cut sheet mode only with reverse line feeds, it is possible to move paper out of the rollers.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC [ n T	(124) Move n reverse line feeds.

Example: ESC [ 6 T—Moves 6 reverse line feeds.

**NOTE**

*Reverse line feeds are not allowed in fanfold mode of operation.*

**SUBSCRIPT/SUPERSCRIP**—The printer accepts subscript and superscript commands. The paper movement doesn't necessarily coincide with a half line feed, but is only used to offset by a partial line. If the same command is received more than once, all but the first is ignored. If a standard paper motion command is received while subscript or superscript is active, the print head moves to the base of the next line feed position.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC K	(113) Set subscript on or superscript off.
ESC L	(114) Set superscript on or subscript off.

**UNDERLINE**—The printer accepts start and stop underline commands. Underlining may be invoked in any portion or portions of the line.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC [ 4 m	(155) Start underline
ESC [ m or ESC [ 0 m	Stop underline

**GRAPHICS**—The graphics program is completely controlled by the input device or computer, with the exception of the printer logic forcing a carriage return (CR) when the graphics buffer is full (872 codes). Figure 10-1 contains all 64 possible graphic code patterns.

In the graphics mode, a data byte consists of six bits of information representing one column of six adjacent rows. The host offsets the transmitted graphic data by adding 40 octal which puts the data out of the control code range of ASCII and into the printable range (octal 40-137). Control codes, transmitted without the offset (plus 40 octal), works the same way in the graphics mode with a vertical pitch of 12 LPI. The escape sequences for underline and change in horizontal pitch are ignored. Vertical margins are cleared by entering into the graphics mode.

In the graphics mode, if 872 graphic codes are sent in one line, the printer software forces a car-

riage return. With the automatic line feed enabled, a one-half line feed follows the carriage return. If the auto line feed is disabled, an overprint occurs unless a line feed code is sent after the 872 byte. In the graphics program the software converts the line feed code to a one-half line feed to prepare for the next graphic line.

A graphic line of less than 872 bytes can be terminated by sending a carriage return code. The auto line feed function also applies in this case.

ESC. SEQ./ CONT. CODE	FUNCTION/COMMENT
ESC % 0	Initiate unidirectional graphics mode.
ESC % 1	Initiate bidirectional graphics mode.
SO	(016) Exit graphics mode by selecting alternate character set.
SI	(017) Exit by selecting the primary character set.

01059

1 2 3 4 5 6	○ 32D 20H	● 33D 21H	○ 34D 22H	● 35D 23H	○ 36D 24H	● 37D 25H	○ 38D 26H	● 39D 27H
1 2 3 4 5 6	○ 40D 28H	● 41D 29H	○ 42D 2AH	● 43D 2BH	○ 44D 2CH	● 45D 2DH	○ 46D 2EH	● 47D 2FH
1 2 3 4 5 6	○ 48D 30H	● 49D 31H	○ 50D 32H	● 51D 33H	○ 52D 34H	● 53D 35H	○ 54D 36H	● 55D 37H
1 2 3 4 5 6	○ 56D 38H	● 57D 39H	○ 58D 3AH	● 59D 3BH	○ 60D 3CH	● 61D 3DH	○ 62D 3EH	● 63D 3FH
1 2 3 4 5 6	○ 64D 40H	● 65D 41H	○ 66D 42H	● 67D 43H	○ 68D 44H	● 69D 45H	○ 70D 46H	● 71D 47H
1 2 3 4 5 6	○ 72D 48H	● 73D 49H	○ 74D 4AH	● 75D 4BH	○ 76D 4CH	● 77D 4DH	○ 78D 4EH	● 79D 4FH
1 2 3 4 5 6	○ 80D 50H	● 81D 51H	○ 82D 52H	● 83D 53H	○ 84D 54H	● 85D 55H	○ 86D 56H	● 87D 57H
1 2 3 4 5 6	○ 88D 58H	● 89D 59H	○ 90D 5AH	● 91D 5BH	○ 92D 5CH	● 93D 5DH	○ 94D 5EH	● 95D 5FH

Figure 10-1 Graphic Pin Address Codes

**VARIABLE SPACING**—Variable spacing allows any character set to be right justified using a host device program. Right justification is accomplished by adjusting the width of the space between the words and/or characters. One space of variable spacing is = 1/330 inch in width which is = 1/2 of a print column.

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC [ n a	(141) Variable spacing (n = 1 to 255)

**ALTERNATE CHARACTER SETS**—The five character sets in the Model 351 printer:

- Standard (7 × 9) alternate character set
- Proportional alternate character set
- Expanded proportional alternate character set
- Multipass proportional alternate character set
- Expanded multipass proportional alternate character set

**NOTE**  
*On power up, the default character set will be Proportional Alternate Character Set.*

**Standard Alternate Character Set**—The standard alternate character set, as set by the factory, is the United States character set.

To call up any of the following alternate character sets, use:

CONTROL CODE	FUNCTION/COMMENT
SO	(016)

To return to the primary character set, use:

CONTROL CODE	FUNCTION/COMMENT
SI	(017)

The standard alternate character set may be intermixed with any other character set on the same line.

To designate the standard alternate character set use:

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC ) 0	(060)

**Proportional Alternate Character Set** —The proportional alternate character set is a variable width character set, the width of which varies from 6-23 dots.

To designate the proportional alternate character set as the alternate character set, use:

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC ) 3	(063)

The proportional alternate character set may be intermixed with any other character set on the same line.

**Expanded Proportional Alternate Character Set**—The expanded proportional alternate character set is an expansion of the proportional alternate character set that was previously described.

To designate the expanded proportional alternate character set as the alternate character set, use:

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC ) 4	(064)

Figure 10-2, US ASCII Character Set, and figure 10-3, European Character Set illustrations indicate the width of the individual characters.

**MULTIPASS PROPORTIONAL ALTERNATE CHARACTER SET**—This is a variable width character set (the same width as the proportional alternate character set) and requires two passes of the print head to complete printing of the set.

The multipass proportional set is designated by one of the following sequences:

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC ) 5	(065) Bidirectional Multipass
ESC ) 6	Unidirectional Multipass

**EXPANDED MULTIPASS PROPORTIONAL ALTERNATE CHARACTER SET**—This is an expanded version of the multipass proportional character set described above.

The expanded multipass proportional set is designated by one of the following sequences:

ESCAPE SEQUENCE	FUNCTION/COMMENT
ESC ) 7	(067) Bidirectional Multipass
ESC ) 8	(070) Unidirectional Multipass

This character set may be intermixed with any other character set on the same line.

## 10.4 PROGRAMMING CONSIDERATIONS

The printer is controlled by the host device which must be programmed to provide the proper instructions to the printer for the desired outputs. The following is a summary of items which should be considered when programming the printer.

- On power-up the printer automatically defaults to the DIP switch settings on the control panel.
- ESC sequences should not be sent during an INPUT PRIME. Centronics reserves this sequence for in-house testing.
- Underline is NOT terminated at the end of a line and continues until a stop underline command (ESC [ 4 m) is received.
- When the auto line feed after carriage return is disabled, paper is NOT advanced after printing. When in this mode all carriage return (CR) commands should immediately be followed by a line feed (LF) command to prevent overprinting.

01112

CODE CHAR WIDTH	040 <i>Space</i> 7	041 <i>!</i> 7	042 <i>"</i> 12	043 <i>#</i> 15	044 <i>\$</i> 15	045 <i>%</i> 21	046 <i>&amp;</i> 15	047 <i>Acute</i> 10
CODE CHAR WIDTH	050 <i>(</i> 9	051 <i>)</i> 9	052 <i>*</i> 15	053 <i>+</i> 15	054 <i>Comma</i> 7	055 <i>Hyphen</i> 15	056 <i>Period</i> 7	057 <i>Slash</i> 16
CODE CHAR WIDTH	060 <i>0</i> 15	061 <i>1</i> 15	062 <i>2</i> 15	063 <i>3</i> 15	064 <i>4</i> 15	065 <i>5</i> 15	066 <i>6</i> 15	067 <i>7</i> 15
CODE CHAR WIDTH	070 <i>8</i> 15	071 <i>9</i> 15	072 <i>:</i> 7	073 <i>:</i> 7	074 <i>&lt;</i> 15	075 <i>=</i> 15	076 <i>&gt;</i> 15	077 <i>?</i> 13
CODE CHAR WIDTH	100 <i>@</i> 19	101 <i>A</i> 17	102 <i>B</i> 16	103 <i>C</i> 16	104 <i>D</i> 17	105 <i>E</i> 15	106 <i>F</i> 15	107 <i>G</i> 15
CODE CHAR WIDTH	110 <i>H</i> 17	111 <i>I</i> 9	112 <i>J</i> 14	113 <i>K</i> 15	114 <i>L</i> 14	115 <i>M</i> 21	116 <i>N</i> 17	117 <i>O</i> 17
CODE CHAR WIDTH	120 <i>P</i> 15	121 <i>Q</i> 17	122 <i>R</i> 15	123 <i>S</i> 15	124 <i>T</i> 15	125 <i>U</i> 16	126 <i>V</i> 17	127 <i>W</i> 21
CODE CHAR WIDTH	130 <i>X</i> 17	131 <i>Y</i> 17	132 <i>Z</i> 15	133 <i>[</i> 10	134 <i>\</i> 16	135 <i>]</i> 10	136 <i>^</i> 15	137 <i>Underline</i> 12
CODE CHAR WIDTH	140 <i>Grave</i> 10	141 <i>a</i> 13	142 <i>b</i> 15	143 <i>c</i> 12	144 <i>d</i> 15	145 <i>e</i> 13	146 <i>f</i> 11	147 <i>g</i> 14
CODE CHAR WIDTH	150 <i>h</i> 15	151 <i>i</i> 9	152 <i>j</i> 11	153 <i>k</i> 13	154 <i>l</i> 9	155 <i>m</i> 23	156 <i>n</i> 15	157 <i>o</i> 13
CODE CHAR WIDTH	160 <i>p</i> 15	161 <i>q</i> 15	162 <i>r</i> 12	163 <i>s</i> 12	164 <i>t</i> 11	165 <i>u</i> 15	166 <i>v</i> 13	167 <i>w</i> 21
CODE CHAR WIDTH	170 <i>x</i> 13	171 <i>y</i> 15	172 <i>z</i> 13	173 <i>{</i> 12	174 <i>Rule</i> 13	175 <i>}</i> 12	176 <i>~</i> 15	177 <i>DEL</i> 13

Figure 10-2 US ASCII Character Set

OCT	43	100	133	134	135	136	137	140	173	174	175	176
HEX	23	40	5B	5C	5D	5E	5F	60	7B	7C	7D	7E
USA WIDTH	# 15	@ 19	[ 10	\ 16	] 10	^ 15	_ 12	` 10	{ 12	 13	} 12	~ 15
FRA WIDTH	£ 15	à 13	° 15	ç 12	§ 12	^ 15	_ 12	` 10	é 13	ù 15	è 13	ï 17
UK WIDTH	£ 15	@ 19	[ 10	\ 16	] 10	^ 15	_ 12	` 10	{ 12	 13	} 12	~ 15
GER WIDTH	# 15	§ 12	Ä 17	Ü 17	Ů 17	^ 15	_ 12	` 10	ä 13	ü 13	ü 15	ß 14
ITL WIDTH	£ 15	§ 12	° 15	é 13	ì 13	^ 15	_ 12	ù 15	è 13	ò 14	è 13	ì 9
S/F WIDTH	# 15	é 15	Ä 17	Ü 17	À 17	Ů 13	_ 12	` 10	ä 13	ü 13	ä 13	ü 15
D/N WIDTH	# 15	@ 19	Æ 21	Ø 17	À 17	Ů 13	_ 12	` 10	Æ 20	Ø 13	ä 13	ü 15
ESP WIDTH	£ 15	§ 12	í 7	ñ 17	ç 13	à 13	é 13	` 10	í 9	ñ 15	ó 13	ó 15

Figure 10-3 European Character Set

## **CONTENTS**

Section 11      Options and Accessories

# **Options and Accessories**

# SECTION 11

## OPTIONS AND ACCESSORIES

### 11.1 GENERAL

The standard printer may be equipped with various options and accessories to provide additional capabilities and easier operation. For easy installation, detailed instructions are provided with each option and accessory.

Purchase orders for options and accessories should be forwarded to:

Centronics Data Computer Corp.  
Customer Service Department  
1 Wall Street  
Hudson, New Hampshire 03051

### 11.2 OPTIONS

The following options are available:

**CURRENT LOOP INTERFACE**—A 20 MA current loop capability is provided by an optional plug-in adapter board.

**DATA INPUT CABLES**—The data input cables provide the connection from the printer to the input devices. Both serial and parallel input cables are available.

**RS232C Input Cable, Male to Male, 10 Ft.**

**RS232C Shielded Input Cable (FCC Compliance) Male to Male, 10 Ft.**

**36 Pin Parallel Interface Input Cable, Male to Male, 15 Ft.**

**20 MA Current Loop Interface Input Cable, Male to 4 Ring Terminals, 10 Ft.**

**Compatible Adapter EIA RS-449**

### 11.3 ACCESSORIES

The following accessories are available.

**UNIVERSAL PRINT STAND**—The universal print stand provides a rigid pedestal for mounting the printer. The stand contains a paper basket to catch, fold and stack the printouts. The stand is available unassembled.

**ORDER NO. 81100000-6170**

**RIBBON CASSETTES**—Throwaway 10 million character, long life ribbon cassettes with unique "clean hands" ribbon guide are available in 4-pack kits.

**ORDER NO. 64000520-6001**

**MODEL 351 TECHNICAL MANUAL**—Provides detailed theory of operation, adjustment, and removal/replacement procedures.

**ORDER NO. 37403510-9001**

**SERIES 350 ILLUSTRATED PARTS MANUAL**—Provides a detailed breakdown of all printer assemblies down to the piece part level for parts ordering purposes.

**ORDER NO. 37403502-9001**

**PRINT HEAD ASSEMBLY**—The print head assembly is operator replaceable in the Model 351 printer. No tools are required to remove or replace the print head assembly.

**ORDER NO. 63180315-5001**

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REPLACEMENT PAGES	DELETE PAGES	ADD PAGES
<u>6-2</u>		<u>6-3</u>

## COMMENTS

The following Publication Change Page (PCP) updates the printer set-up procedure for the Model 351 printer. The procedure now includes the installation of the paper rack outlet assembly and paper rack inlet.

**NOTE:**

Some users may have printers which are accurately documented by the contents of the current manual prior to this PCP. These users should retain both sets of pages for complete documentation.

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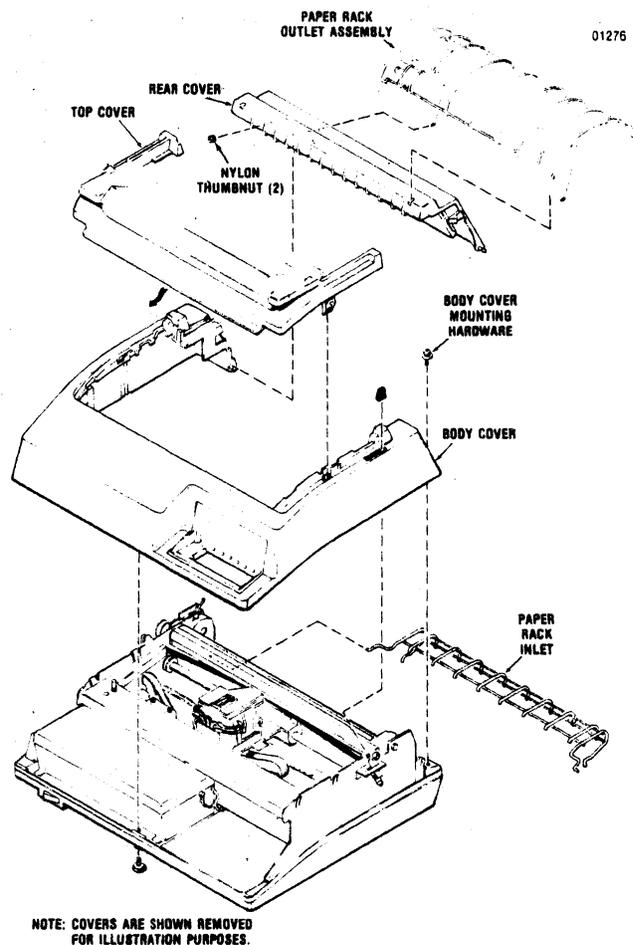
## 6.4 PRINTER SET-UP

The following procedures detail the set-up of the printer prior to operation at the installation site. Refer to Figure 6-2 and 6-3 and perform the following steps.

### NOTE

Refer to Figure 6-2 and 6-3 for steps 1 through 6.

1. Locate the paper rack inlet and facing the rear of the printer install the rack into the two mounting holes on the left and right frames.
2. Locate the paper rack outlet assembly and remove the two nylon thumbnuts from the two mounting arms. Retain the thumbnuts.
3. Facing the rear of the printer, install the two end mounting tabs on the paper rack outlet assembly into the two mounting holes on top of the rear cover.
4. Install the two threaded mounting arms of the paper rack outlet assembly into the mounting holes in the middle of the rear cover.
5. Open the rear cover and install the two nylon thumbnuts onto the threaded portion of the mounting arms.
6. Close the rear cover.



**Figure 6-2 Installation Paper Rack Outlet and Paper Rack Inlet**

7. Plug the printer into the appropriate power outlet.

**NOTE**

*Always use a 3-wire grounded outlet.*

8. Ensure the power switch is OFF and connect the printer to the input device using the appropriate data cable.

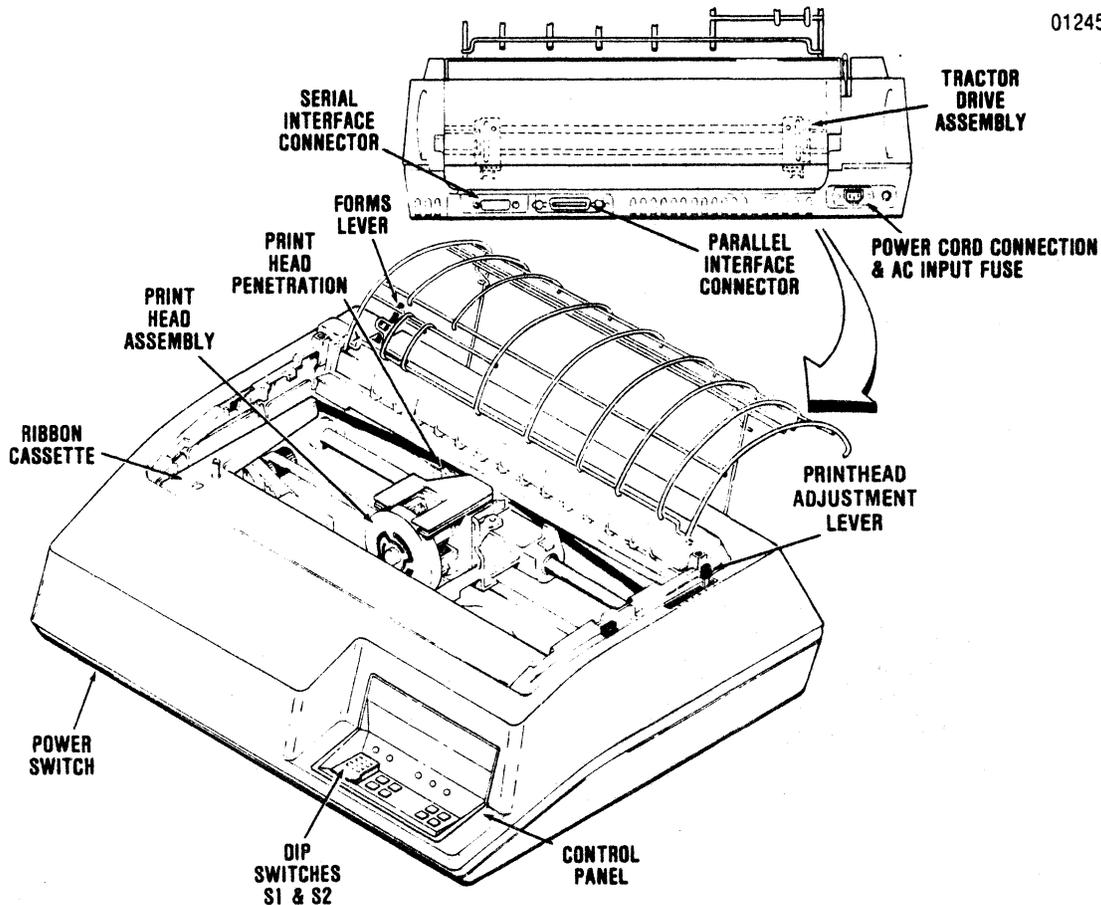
9. Install the form (fanfold or cut sheet) to be

printed as described in Section 2, Paper Loading/Ribbon Replacement.

10. Check the settings of DIP switches S1, S2, S3, and S4 per Section 7, to ensure the desired printer features are selected.

11. Set the power switch to the ON position.

12. Press the SELECT switch, lighting the SELECT indicator, to enable the printer to receive data.



**Figure 6-3 Printer Set-Up**

# PUBLICATION CHANGE PAGES

PCP NO. 37403511-9A01       CLERICAL CHANGE       DESIGN CHANGE      DATE November 1982

PUBLICATION AFFECTED	REV	PCP SEQ. NO.	ASSEMBLY AFFECTED			
351 U.M.	A	1	NUMBER	OLD REV.	NEW REV.	ECO
37403511-9001			--	--	--	1734

These PCP sheets reflect changes to the equipment that have not yet been documented in the technical publications or are simply clerical corrections to the specific pages in the manual. For documentation on your unit, always replace/delete/add the pages as noted below and verify the changes are applicable to your particular printer.

## PUBLICATION ACTIONS

REPLACEMENT PAGES	DELETE PAGES	ADD PAGES
5-1/5-2		

## COMMENTS

A new nylon thumbscrew was added to the printer carriage assembly after this manual was printed. The new thumbscrew makes the removal/replacement procedure described in paragraph 5.3 outdated. This PCP provides a replacement page (page 5-2) which contains an updated removal/replacement procedure.

The new nylon thumbscrew was added to prevent possible head vibration while the printer is operating in the bidirectional multipass mode.

**NOTE:**  
 Some users may have printers which are accurately documented by the contents of the current manual prior to this PCP.  
 These users should retain both sets of pages for complete documentation.

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# SECTION 5

## REMOVAL/REPLACEMENT

### 5.1 GENERAL

This section details the operator removal/replacement procedures. The covers, print head assembly, and input fuse are all operator replaceable. For detailed removal/replacement procedures of all recommended spare parts refer to the Model 351 Technical Manual.

#### NOTE

Ensure the power cord is removed from the power outlet before performing any removal/replacement procedures.

### 5.2 REMOVAL COVER ASSEMBLIES

The following procedures detail the removal of the top, rear, and body covers. To remove the covers, refer to Figure 5-1 and perform the following:

#### TOP COVER

1. Remove the top cover by lifting the rear edge of the cover up and off the printer.

#### REAR COVER

1. Unsnap the top portion of the rear cover from the body cover.
2. Rotate the cover to the extreme rear (open) position.
3. Lift the rear cover up and off the printer.

#### BODY COVER

1. Remove the top and rear covers from the printer.
2. Remove the two Phillips head screws at the rear of printer mounting the body cover to the printer base.
3. Loosen the thumb screw mounting the front of the body cover to the printer base.
4. Lift the body cover up and off the printer.

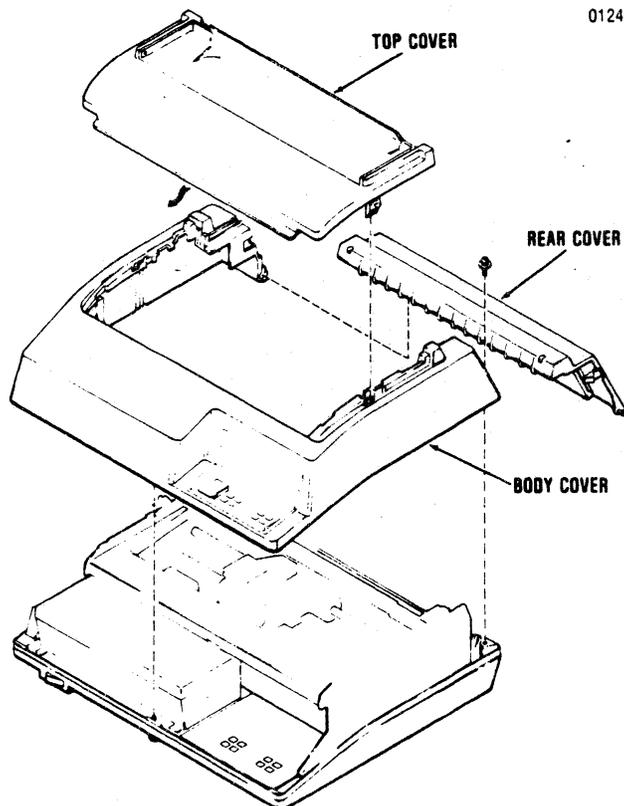


Figure 5-1 Removal Cover Assemblies

### 5.3 REMOVAL/REPLACEMENT PRINT HEAD ASSEMBLY

To remove and replace the print head assembly, refer to Figure 5-2 and perform the following steps:

1. Remove the top cover by lifting the rear edge of the cover up and off the printer.
2. Unsnap the top portion of the rear cover and place in the open position.
3. Move the forms lever to the "LOAD" position.
4. Lift the column scale to the up position.
5. Move the forms lever to "CUT SHEET" or "FAN FOLD" position.
6. Move the print head/carriage assembly to the middle of the printer.
7. Loosen the nylon thumbscrew on the carriage assembly.
8. Pull the head adjustment lever towards the front of the printer to its maximum position.
9. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the ribbon guide and lifting upward.
10. Remove the print head fingerboard connector.
11. While pulling the print head towards the front of the printer, lift the head up and out of the printer.
12. Replace the print head by performing steps 8-11 in reverse order.
13. Tighten the nylon thumbscrew until the screw makes contact with the head heatsink. **DO NOT OVERTIGHTEN THE SCREW.**
14. Perform steps 1-6 in reverse order.

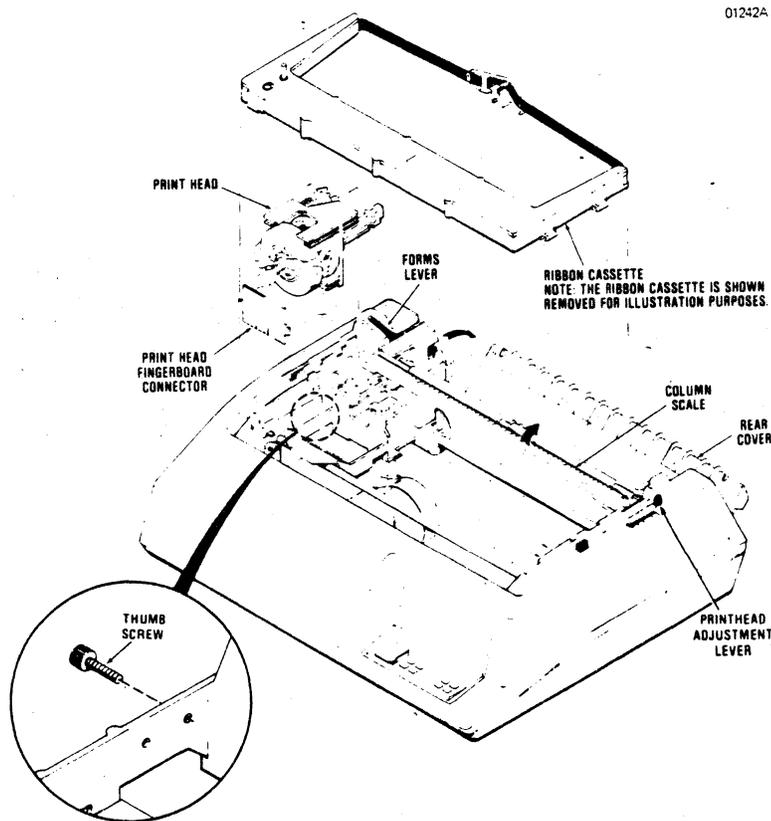


Figure 5-2 Removal Print Head Assembly