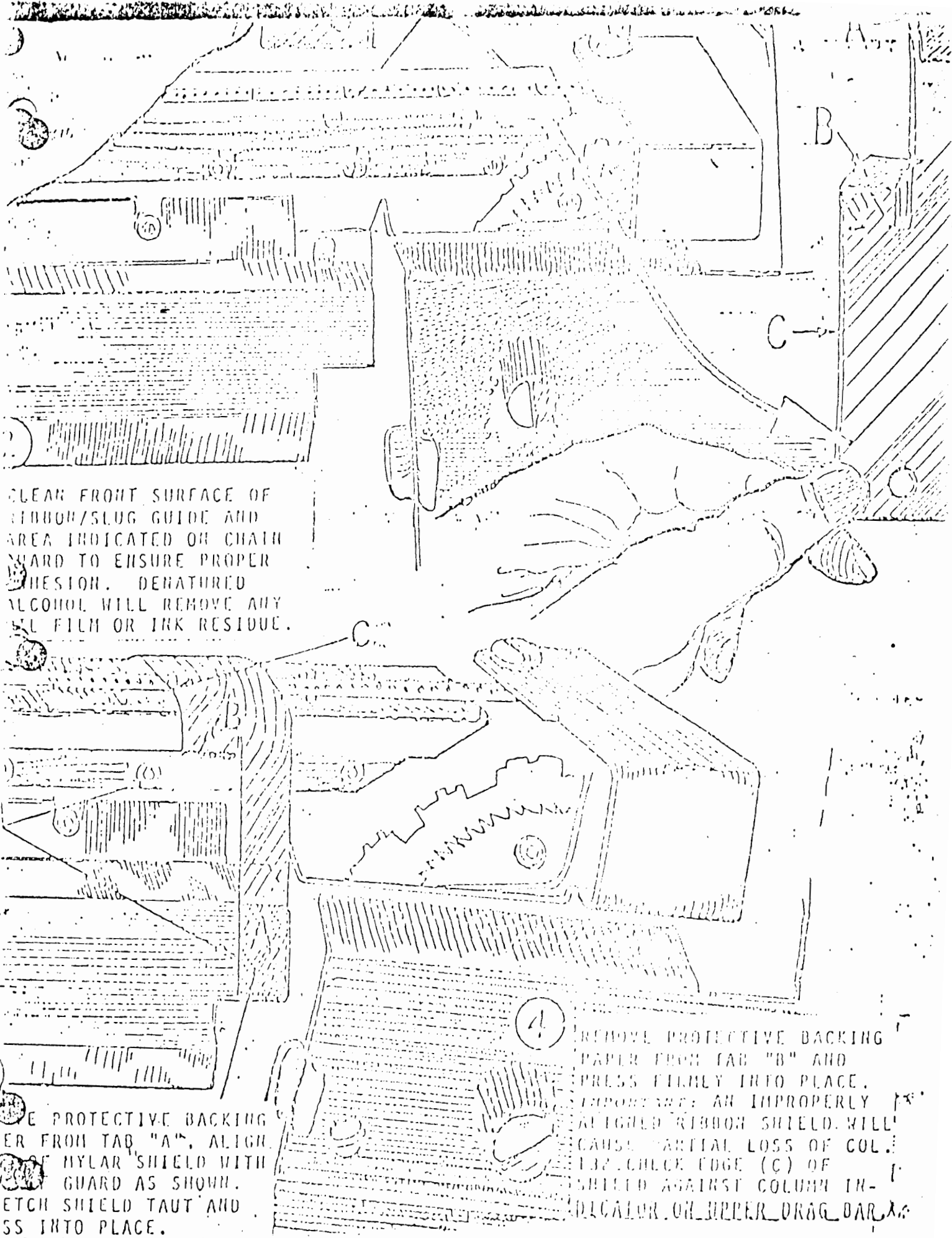


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CLEAR FRONT SURFACE OF RIBBON/SLUG GUIDE AND AREA INDICATED ON CHAIN WARD TO ENSURE PROPER FRICTION. DENATURATED ALCOHOL WILL REMOVE ANY OIL FILM OR INK RESIDUE.

REMOVE PROTECTIVE BACKING PAPER FROM TAB "A". ALIGN EDGE OF MYLAR SHIELD WITH CHAIN GUARD AS SHOWN. STRETCH SHIELD TAUT AND PRESS INTO PLACE.

REMOVE PROTECTIVE BACKING PAPER FROM TAB "B" AND PRESS FIRMLY INTO PLACE. IMPORTANT: AN IMPROPERLY ALIGNED RIBBON SHIELD WILL CAUSE PARTIAL LOSS OF COLOR. CHECK EDGE (C) OF SHIELD AGAINST COLUMN INDICATOR OR UPPER DRAG BAR.





**OPERATING INSTRUCTIONS**

DPC 1200 Series

CHAINTRAIN™ Line Printers

**Models CT-1260, CT-1290, and CT-1210**

May 1979

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**DATA PRINTER CORP**

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## CHAPTER 1

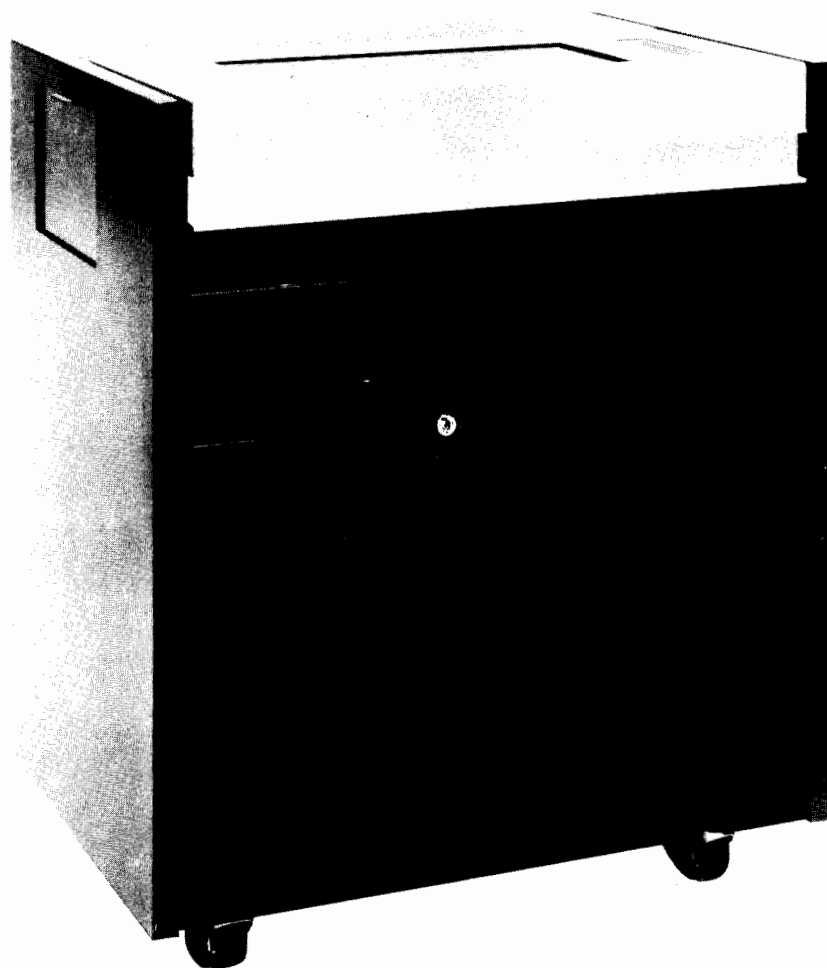
## INTRODUCTION

## 1.1 OBJECTIVES

The Data Printer Corp (DPC) Models CT-1260, CT-1290, CT-1210, and CT-1200 in the 1200 Series CHAINTRAIN™ Line Printers (Figure 1-1) are complete computer-driven impact printer systems, featuring a lateral-motion chain type carrier. Hardcopy printout is produced a line at a time from stored digital data transferred to the printer in the form of print character and paper advance instruction codes from a microprocessor controller. Printout is recorded in fully formed character imprints on single-part or multi-part continuous, sprocket-fed forms.

The standard printer has 132 print positions (columns) spaced horizontally ten to the inch. Standard vertical spacing is six lines per inch. Vertical spacing and skipping are performed under independent program control for each paper advance operation. Spacing is controlled by the printer buffer; skipping is controlled by a standard 8-channel vertical format unit (VFU). A single-line paper advance requires 15 milliseconds: multiple-line spacing and skipping are performed at the rate of 20 (or 40) inches per second. Various form widths from 3-1/2 inches to 19-1/2 inches over-all are readily accommodated.

The basic character arrangements for the printer are the standard 48-character (upper case) EBCDIC, 64-character (upper case) ASCII, 96-character (upper and lower case) ASCII, and 128-character (upper and lower case) EBCDIC printable subset arrangements. With each arrangement, any of the different characters provided can be printed in each print position. A variety of unique print character arrangements can be provided to meet specific applications.



**Figure 1-1. DPC 1200 Series CHAINTRAIN™ Line Printers,  
Models CT-1260, CT-1290, CT-1210, and CT-1200**

## 1.2 GENERAL DESCRIPTION

The printer system consists of an electro-mechanical printing mechanism, printer drive, control and line buffer electronics, printer power supply, and all necessary operator controls, indicators, and adjustments contained in a free-standing steel enclosure that is designed for maximum safety and sound control. The printing mechanism consist of two major subassemblies: a stationary frame, and a yoke that pivots away from the frame for access to the print area. The paper feed components and the print hammers are mounted on the stationary frame behind the paper path. The ribbon feed components and the chaintrain are mounted on the moveable yoke in front of the paper path.

Operator access to the printer is shown in Figure 1-2. A hinged, balanced canopy at the top of the printer opens manually for access to the yoke, mechanism controls, left-hand control panel, and right-hand Alarm Indicator panel. The yoke opens manually and swings forward and down for full access to the print area for forms loading and ribbon changing. Vertical forms positioning and tension controls are collectively arranged at the upper left side of the printer. A sliding panel manually opens for access to this area for vertical forms positioning and format tape loading.

Forms enter the printer at the front from the paper bay directly below the yoke, and leave the back of the printer case and drop into a paper catcher.

The printer system includes test switches that provide for operating in the LOCAL mode, permitting operator adjustments to be performed on the printer. These switches mounted on the I/O control board located at the lower right rear of printer.

In addition, there are five light-emitting diodes (LED's) mounted on the bottom of the CPU board which provide diagnostic failure indications during power-up and normal operation. When the ALARM indicator on the right hand control panel is lighted — and either the CALL SERV or the V.F. ERROR indicator on the top panel is lighted — the five diagnostic LED's pin-point the problem for a service man.

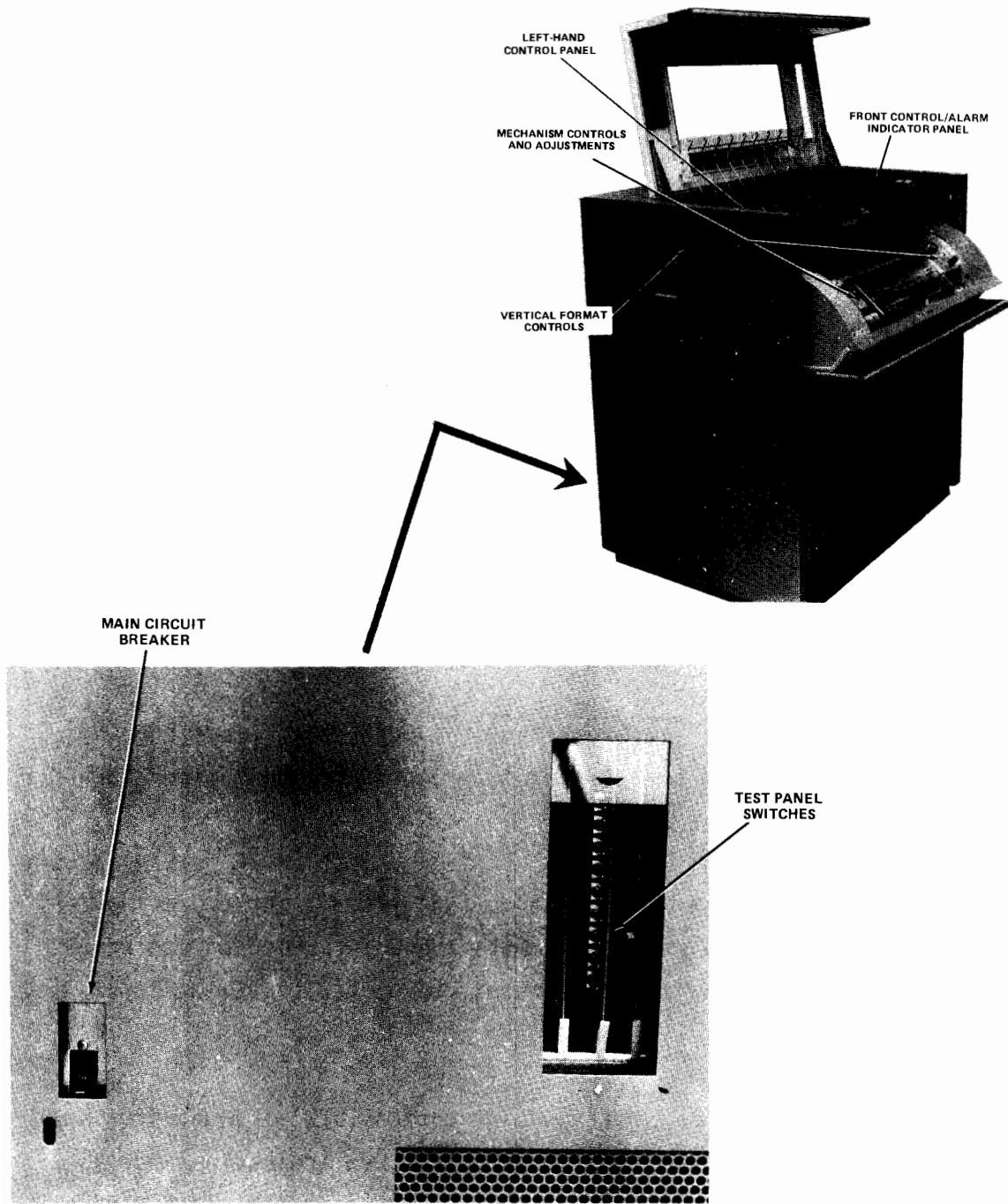


Figure 1-2. Operator Control Locations

### 1.3 METHOD OF OPERATION

Printing is accomplished by an electromagnetically-actuated print hammer in each print position, which impacts the form from behind, pushing a small area of the form against a ribbon and a character type face on the chaintrain in front of the form. The chaintrain is composed of 384 fully-formed character type faces arranged in multiple identical arrays (sets) on 48, 8-character links that are mounted end-to-end in an endless loop. This arrangement permits all of the character type faces to be presented for printing in every print position repeatedly as the motor-driven chaintrain moves laterally at a constant speed in front of the print hammers.

A complete line is printed in one array-segment of a chaintrain revolution, during which time the form is stationary. Printing occurs only when a comparison by the microprocessor controller indicates that the character in alignment opposite a print hammer is identical to the stored data for that print position. The compare-print process is repeated for all print positions as each successive character on the chaintrain moves into print position, until all stored print data has been printed out.

When a line has been completed, the form is advanced under buffer or tape control to the program-designated position for the next line of print.

Ribbon feeding is continuous, and ribbon reversing and tracking are automatically performed to maximize ribbon life.





## CHAPTER 2

## CONTROLS AND INDICATORS

## 2.1 INTRODUCTION

The pushbutton switches and indicators on the right-hand and left-hand control panels (Figure 2-1) provide operator control and visual indications of printer status during setup, local test operation, and print-run interruptions that require the attention of the operator.

Depending upon the condition(s) detected, the switch indicators are illuminated or extinguished for the various combinations shown in Table 2-1.

## 2.2 RIGHT-HAND CONTROL PANEL

## 2.2.1 "ON" (Green)

Pressing the "ON" button provides power to the printer, lights the indicator, and indexes the paper tractors to the next strobe position.

## 2.2.2 "OFF" (Red)

Pressing the "OFF" button turns off power in the printer and illuminates the indicator. Whenever the power is on, the "OFF" indicator will be lighted when the printer is in stand-by condition (power disconnected from the chain-train and ribbon feed drive).

In addition, the indicator is also lighted whenever a printer power supply voltage is not present, hammer driver overcurrent condition is detected, or the yoke latch lever is open.

### 2.2.3 "ALARM" (Red)

The alarm indicator/switch is illuminated for any of the following conditions:

- Yoke is open or yoke latch lever is unlatched,
- Paper out or paper jam/tear condition is detected,
- Hammer driver circuit-board interlock circuit is open,
- One or more of five LED's on the CPU board is lighted, or
- Vertical format tape information is not in machine.

When "ALARM" is lighted, printer operation in the RUN mode is inhibited. However, pressing the "ALARM" button will perform a master clear sequence, which may allow the machine to continue operation. If the "ALARM" indicator remains lighted, the printer requires further attention from the operator or maintenance personnel. During power turn-on and turn-off, the "ALARM" indicator will be momentarily lighted.

To further assist operator and maintenance personnel, there are eight additional indicators located to the right of the right-hand control panel, which can be seen by opening the canopy.

The YOKE/LATCH indicator will light whenever the YOKE LATCH lever is placed in the OPEN position or the yoke is fully opened.

PAPER OUT lights when a paper low (last form) condition is sensed in vertical format Channel 1 "home", or Top-of-Form position). When paper is out, follow the procedure described under "Forms Loading" for loading new forms and locating the first line of print.

PAPER LOW lights when less than 5-1/2 inches of paper supply remains in the printer. Operation with the external device is automatically stopped, upon detection of paper low. However, holding the "RUN" button down permits continued operation for the (last) form currently in printing position until paper is out. A paper-low condition overrides a paper-jam indication.

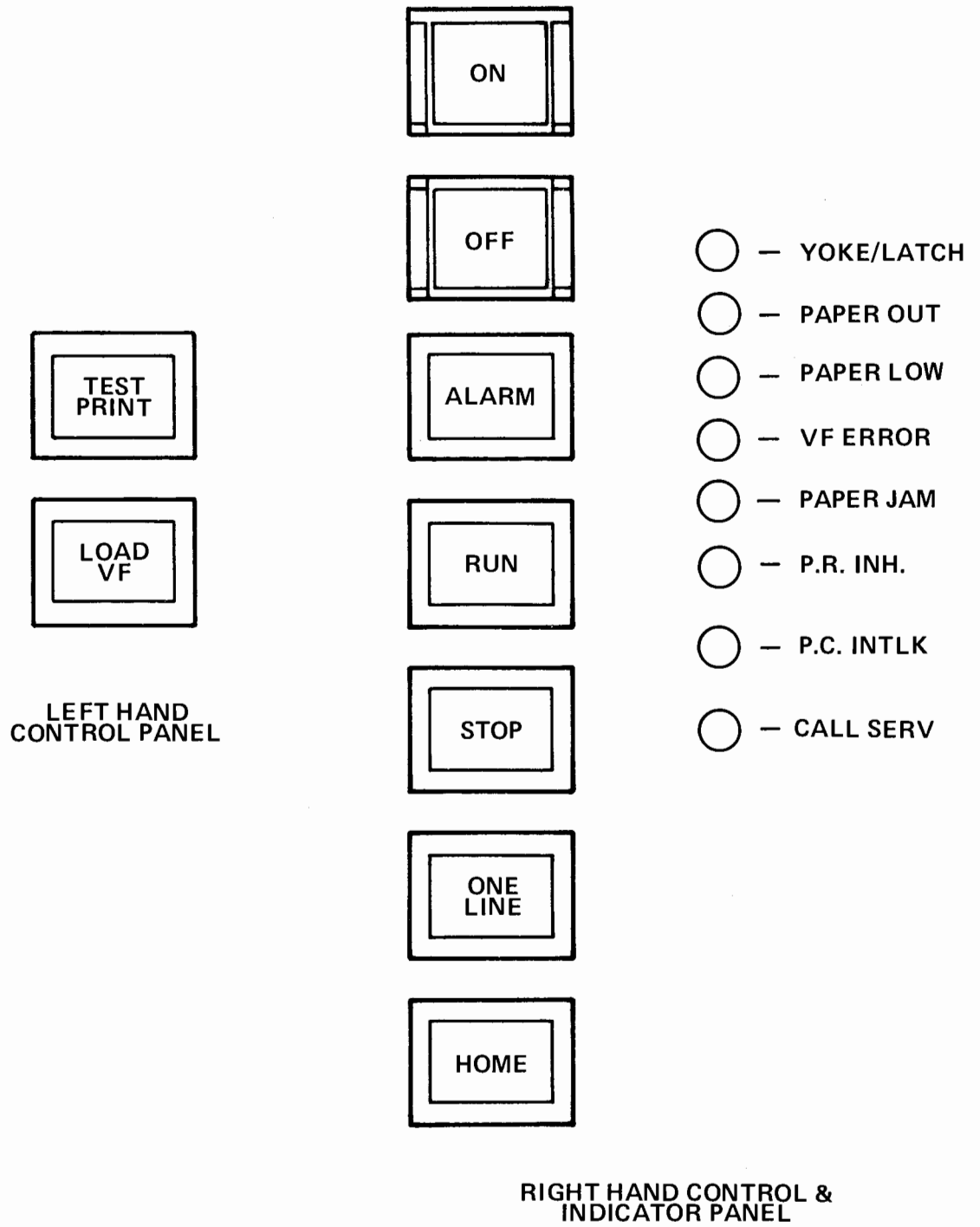


Figure 2-1. Control Panels and Indicators

Table 2-1. Front Panel Alarm Status Indications

Front Panel Indicators OFF ON ALARM RUN STOP	Condition(s) Detected	Corrective Action(s)
● ● ● ● ●	Primary power not applied <sup>1</sup>	Check main circuit breaker; primary service
○ ● ● ● ●	Printer voltage not available Hammer driver overcurrent	Normal if power OFF; otherwise maintenance attention required
○ ○ ● ○ ●	Printer in stand-by state <sup>1,2</sup>	Generally normal; if prolonged, check external device, program
○ ○ ○ ● ○	Yoke open <sup>3</sup> Yoke latch open <sup>3</sup>	Close yoke Close yoke latch
● ○ ○ ● ○	Paper out <sup>2,3</sup>	Insert new forms
	Paper jam/tear <sup>1,3</sup> Paper runaway <sup>1,3</sup>	Re-insert forms; check tractor positioning Press ONE LINE or HOME switch to clear; check format tape program reposition forms as required
	Hammer driver interlock circuit open <sup>3</sup>	Maintenance attention required
	Vertical format tape information incorrect <sup>1</sup>	Install proper tape and press the LOAD TAPE indicator
	One of five indicators on CPU board is illuminated <sup>3</sup>	Maintenance attention required (CALL SERV)
● ○ ● ● ○	Paper low <sup>2,3</sup>	Press RUN to complete form
● ○ ● ○ ●	Printer ready <sup>1</sup> Normal operating status	If no printing occurs and printer does not revert to stand-by after about 1 minute, check interface cabling, interface, program
<p>NOTES: — In the table, an open circle ○ (light) denotes indicator is "on" and a filled circle ● (dark) denotes indicator is "off".</p> <p>— Momentary illumination of ALARM indicator during power turn-on/off is normal.</p> <p><sup>1</sup>Frequent recurrence or persistence of condition requires maintenance attention.</p> <p><sup>2</sup>Condition not sensed or normally occurring in local, internal test mode.</p> <p><sup>3</sup>Separately indicated on the Alarm Indicator Panel.</p>		

V.F. ERROR lights whenever the system receives a paperfeed command that it cannot execute. This can occur if the format tape used is not punched in all channels and the printer receives a Skip-to-Channel instruction that designates an unpunched format tape channel. This alarm condition can be cleared by pressing either the ONE LINE or HOME switch.

PAPER JAM lights whenever paper is not sensed to be moving through the print area during a paper advance operation.

In the event of any indicator alarm condition listed above, the printer immediately inhibits continued operation in the RUN mode until the condition is corrected and the "ALARM" indicator is turned off. Press and release the "ALARM" button to see if the condition will correct itself.

P.R. INH. (print inhibited) will light when the PRINT/INHIBIT switch on the rear of the I/O CONT board is in the INHIBIT position. With the exception of actual printing (hammer firing) the machine will operate normally.

P.C. INTLK will light whenever the Hammer Driver circuit boards are not fully inserted into the motherboard connectors.

If one or more of the five LED indicators, on the rear of the CPU board is lighted — and either CALL SERV or V.F. ERROR is lighted — see Section 3.6 of the Maintenance Instructions manual (DPC Form 1260/90/10-3).

#### 2.2.4 "RUN" (Green)

Pressing the "RUN" button switch enables the printer to operate with the external device. The indicator will light, provided that printer power is on and the "ALARM" indicator is off.

A paper-low (last form) condition inhibits continuous operation in the RUN mode. In the event of a paper-low condition, pressing the "RUN" switch allows continued operation for the form currently in printing position; that is, until the next Top-of-Form (TOF) position is detected.

Upon being enabled, the printer remains in a stand-by state with the power to the chaintrain and ribbon feed drive motors turned off (both the "ON" and "OFF" indicators illuminated) until the transfer of the first print command from the external device. Similarly, the printer automatically switches to the stand-by state if a print command is not transferred within 30 seconds after the last print operation, to conserve power. (Note Paperfeed commands are executed independent of print commands, and have no effect on the stand-by state of the printer.)

#### 2.2.5 "STOP" (Red)

Pressing the "STOP" button inhibits operation at the completion of the current operation and lights the button. In addition, the "STOP" button will light if the "ALARM" indicator lights.

If a data transfer is in progress at the time "STOP" is pressed, operation with the external device is continued for about 500 milliseconds to allow for completion of the transfer. At the end of this time, if the transfer has not been completed, the printer automatically initiates the appropriate operation for whatever data has been transferred at the time, and subsequently inhibits continued operation upon completion of that operation.

#### 2.2.6 "ONE LINE" (Yellow)

When the printer is in STOP mode, pressing the "ONE LINE" button advances the paper one line space.

#### 2.2.7 "HOME" (Yellow)

When the printer is in STOP mode, pressing the "HOME" button switch advances the paper tractors and forms to the next "home", or Top-of-Form (TOF) position as designated by a punched hole in Channel 1 of the format tape. (Note — If no format tape is installed, the paper tractors and forms will be advanced a single linespace.)

### 2.2.8 Slew Paper Controls

When the printer is in the STOP mode, pressing the "ONE LINE" and "HOME" button together will continuously advance the paper tractors and slew-feed the forms.



## 2.3 LEFT-HAND CONTROL PANEL

The left-hand control panel can only be viewed and operated when the canopy is in the raised position.

### 2.3.1 "LOAD VF" (White) – Optional Feature

The "LOAD VF" button will light and stay on until a VFU tape has been installed on the VFU, the "LOAD VF" switch pressed, and the tape information forwarded to memory. Until this is done, you will only be able to print one line before the printer stops and the "ALARM" and V.F. ERROR lamps come on. You must load a VFU tape.

### 2.3.2 "TEST PRINT" (White) - Optional Feature

The "TEST PRINT" button may be used to exercise the printer before you start on-line operation. The machine will operate according to the information that you have set on the Test Panel in the rear of the printer. (See Chapter 6, Local Test.)

## 2.4 MECHANISM CONTROLS AND ADJUSTMENTS

The printer mechanism controls and adjustments (Figure 2-2) provide operator access to and adjustment of the printer during setup and operation.

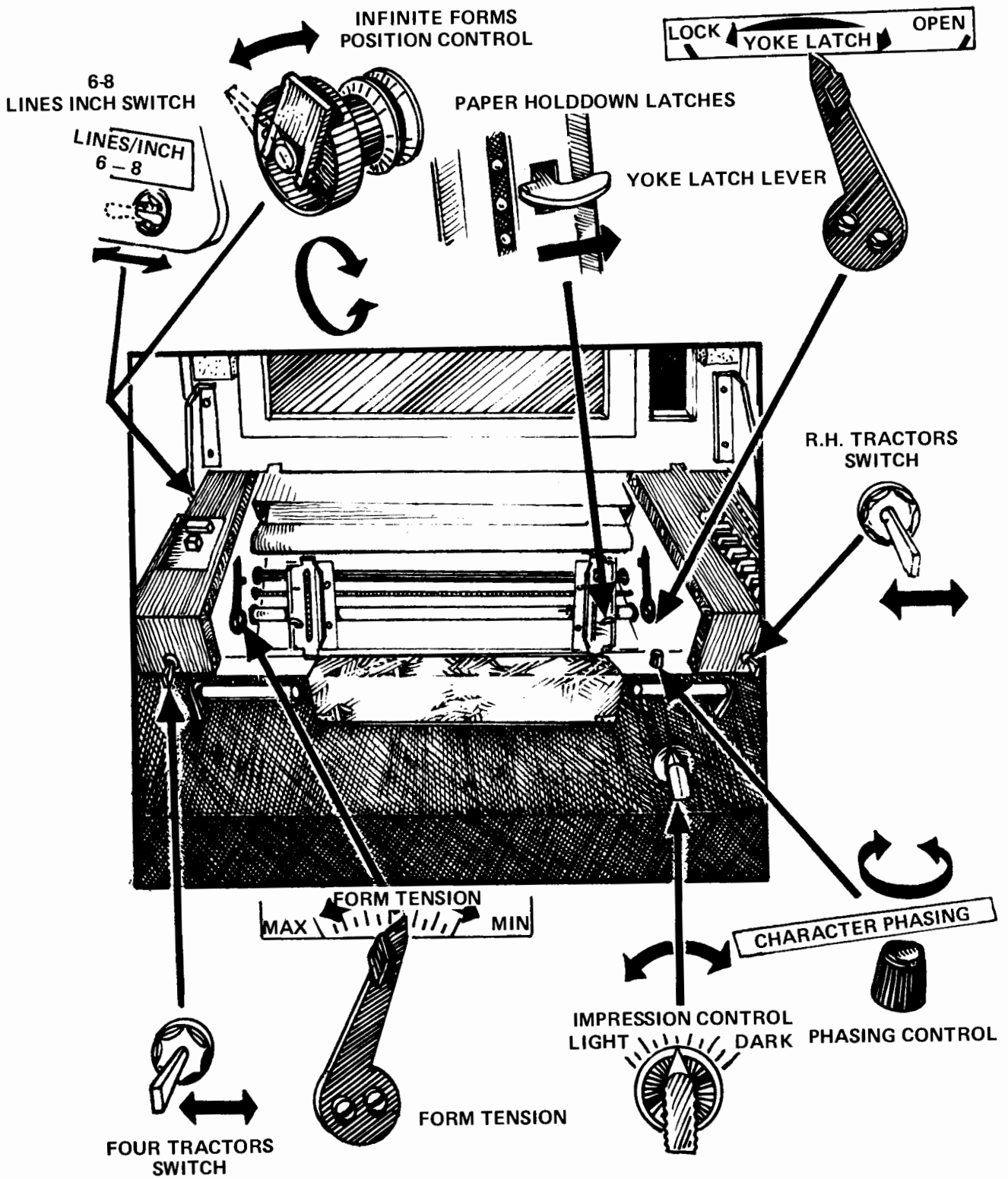


Figure 2-2. Mechanism Controls and Adjustments



### 2.4.1 6-8 LINES/INCH (Optional Feature)

The optional 6-8 LINES/INCH toggle switch is used to select either six or eight lines-per-inch line spacing. This option must be used with a 12-channel VFU.

### 2.4.2 Infinite Forms Position Control

This control permits the vertical position of the forms to be adjusted independently of the vertical format unit, when the printer is in the STOP mode.



Do not attempt to position forms while the printer is operating. This control is directly coupled to the paperfeed drive system and turns as paper is being advanced through the printer mechanism.

Positioning the lever in the center of the control to the extended position disengages mechanical drive to the tractors. The forms can then be repositioned by turning the knurled knob to raise or lower the forms.

### 2.4.3 Paper Holddown Latches

Pushing each latch to the right or left will spring release the right upper and lower or left upper and lower holddown plates for forms removal or loading.

### 2.4.4 Tractor Positioning Switches

The two tractor-positioning spring-loaded switches are (ALL TRACTORS and RIGHT HAND TRACTOR) located below the left- and right-hand control panels. Push and hold the left-hand ALL TRACTORS switch to move both sets of tractors left or right, simultaneously. Push and hold the RIGHT HAND TRACTORS switch to move just the two right-hand tractors left or right.

#### 2.4.5 Yoke Latch Lever

Moving the YOKE LATCH lever to the OPEN position allows the yoke to be manually pivoted forward by pulling the front left- and right-side yoke handles. This allows full access to the print area for forms loading and ribbon changing. Yoke movement is damped, to prevent opening or closing the yoke too quickly.

The yoke should be opened only when the printer is in the STOP mode or printer power is off. Moving the lever to the OPEN position, while the printer is operating, will put the printer in the STOP mode (chaintrain and ribbon drive disabled) and light the "STOP", "ALARM", and YOKE/LATCH indicators. Loss of print data or incorrect vertical formatting may also occur.

With the lever in the OPEN position the yoke can be closed by pushing the yoke handles up and in. Moving the lever fully to the LOCK position latches the yoke in the closed position for printing.

#### 2.4.6 IMPRESSION CONTROL KNOB

The IMPRESSION CONTROL allows the operator to adjust the overall print density of characters (light or dark) for printing on forms and for ribbons of different thickness and characteristics. Print impression is adjusted by turning the detent control switch to the right or left.

#### 2.4.7 CHARACTER PHASING Control Knob

Adjustment of the CHARACTER PHASING control knob will modify the chain-hammer fire relationship so that full characters are printed (left or right side is not cut off). If portions of all characters are clipped off, a small adjustment of this control will ensure that the chain is in the proper position when the hammers fire so that full characters will be printed.

#### 2.4.8 FORM TENSION Lever

The FORM TENSION detent control lever allows the operator to increase or decrease the tension on the tractor belt which in turn maintains vertical wrinkle-free paper feeding.



## CHAPTER 3

## VERTICAL FORMAT CONTROL

## 3.1 VERTICAL FORMAT UNITS (VFU's)

The feeding of forms by the printer is controlled by either the external sending device or the vertical format unit (VFU). Selection of control is determined by the Paperfeed Command code sent from the external device, via the interface, by the system programmer. A listing of Paperfeed Command codes can be found in the Appendix (Table A-4).

The VFU consists of a photoelectric tape reader and drive mechanism which, for each application, requires a vertical format tape that corresponds in length to the number of linespaces on one or more forms. This tape is prepared with punched holes, arranged in channels, along the length of the tape. Each hole represents a selected line on the corresponding form at which a paper advance is to stop. The tape is read, in synchronism with the moving forms in the printer, by the photoelectric reader.

The standard interface configuration also provides an Automatic Linefeed feature which, when programmed from the external device, will automatically advance paper either a single or double linespace after printing each line. This allows "list" printout to be produced without the necessity of programming a Paperfeed Command for each line of print.

When operating in the Automatic Linefeed mode and using a properly punched tape, this feature also provides an automatic skip from bottom-of-form (BOF) to top-of-form (TOF). However, with the exception of a skip-to-BOF command punched on the tape, all channel skip instructions result in a skip to the specified channel, regardless of the state of Automatic Linefeed.

The tape used for format control depends upon the VFU provided on the printer (8- or 12-channel). Tape characteristics are listed in Table A-5 and tape supplies and accessories are listed in Table A-6.

Historically, the 8-channel tape is derived from punched paper tape teletype equipment, while the 12-channel tape is derived from punched card tabulating equipment.

### 3.2 FORMAT TAPE PREPARATION

The following general instructions should be observed when preparing a format tape:

- At least one punch is required in each channel for each form, to avoid the possibility of a paper runaway if the printer is instructed to skip an unpunched channel.
- A Channel 1 punch is required for each form to place the tractors in the TOF or "home" position, to stop the printer when it runs out of forms, and to stop paper movement during an automatic BOF-to-TOF paper skip upon command.
- A Channel 8 (or 12) punch is required for each form to initiate an automatic BOF-to-TOF paper skip upon command.
- Holes on the tape must conform to the hole size and pitch dimensions given in Table A-5.
- Tapes should be carefully stored, to avoid creasing and contamination from grease or oil.

#### 3.2.1 Eight-channel, 6 LPI Tape Preparation

Eight-channel tape is pre-punched with round holes to one side of the center of the tape from the sprocket-feed drive, as shown on Figure 3-1. Holes can be punched in up to eight columns, called channels, throughout the

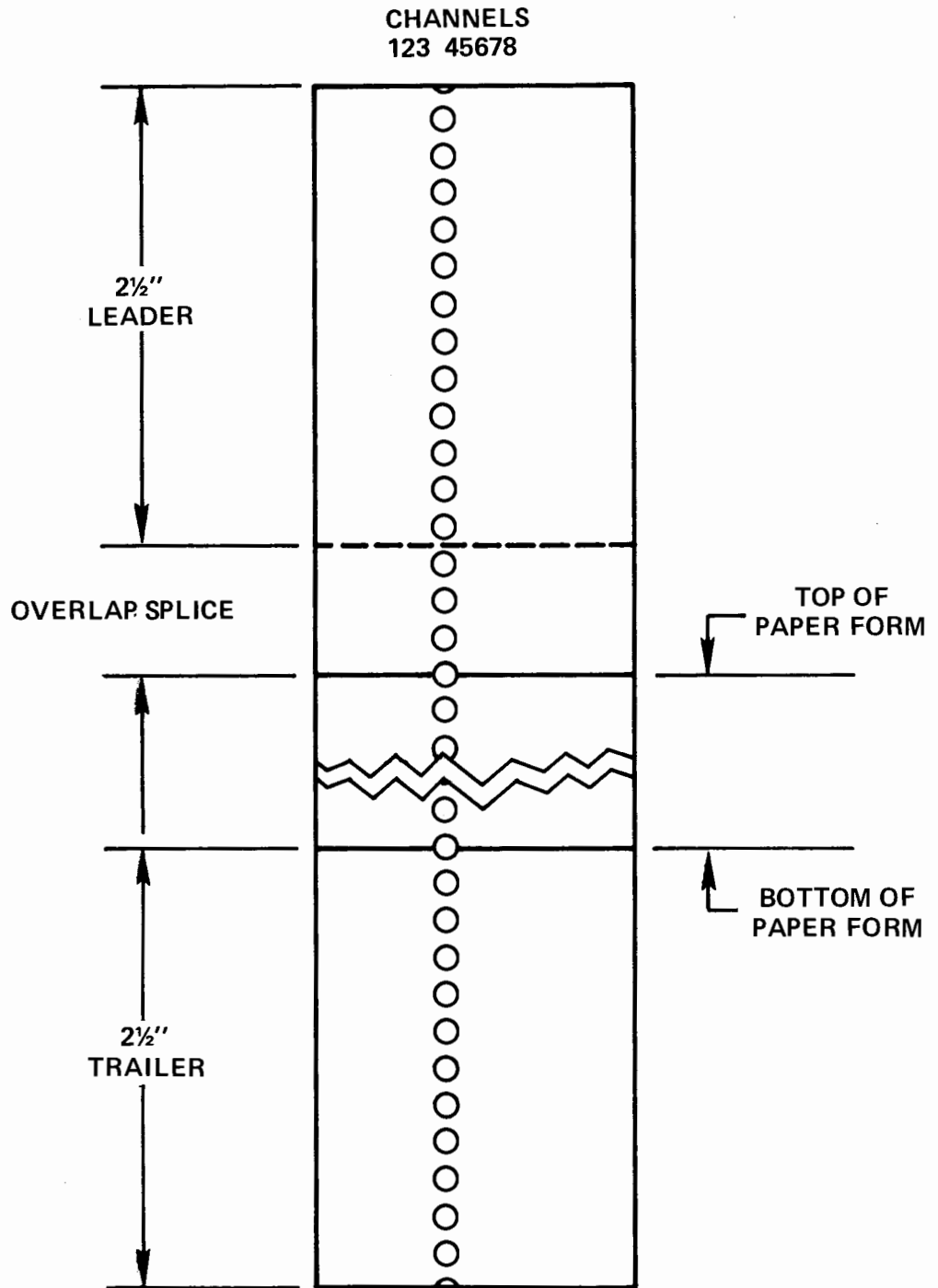


Figure 3-1. Eight Channel Format Tape Preparation

length of the tape. Three channels are arranged to the left of the feed holes and are designated Channels 1, 2, and 3. The remaining five channels to the right of the feed holes are designated Channels 4 through 8.

Because 8-channel tape is usually machine-punched, it is not preprinted with guide lines. However, punching and splicing operations can be made with a simple pencil layout on the tape.

Referring again to Figure 3-1, draw a dashed line between two feed holes 2-1/2 inches from the top end. Counting from the dashed line, draw a solid line through the fourth feed hole. The leader is used for locating the tape in the punch, and the tape between the dashed line and the solid line is used for making the splice. The solid line represents the top edge of the form (not TOF). Determine the equivalent tape length by multiplying the form length in inches by 0.6, or by counting feed holes (each hole represents one line at 6 LPI).

Starting from the top solid line measure off the length and draw another solid line through the feed hole at that point. The second solid line represents the bottom edge of form (not BOF).

The marking off of a form should be repeated as many times as the normal tape length allows 6.6 inches — the equivalent of a standard 11-inch, fan-fold form. Cut the tape about 2-1/2 inches to the bottom of the last solid line, to form a trailer.

The tape should next be marked opposite each feed hole where a hole is to be punched for each paper-skip stop (remember that Channel 1 is normally reserved for TOF and Channel 8 is normally reserved for BOF). A format tape may be prepared for use with several different forms provided the line-spacing, TOF, and BOF are common. Any holes punched in the last four positions on the tape should be repeated in the four positions in the overlap splice section.



After the tape is punched it should be cut on the dashed line and bottom solid line. It is then looped into an endless belt with the bottom solid line overlapping the splice section as shown on Figure 3-2.

Use a rubber-based contact cement and — with the feed holes together — cement the two ends together. Remove any excess cement and clear the holes in the spliced area.

### 3.2.2 Twelve-channel, 6 LPI Tape Preparation

Twelve channel format tape is preprinted with guide lines to assist layout, manual punching, and splicing, as shown in Figure 3-3. The tape has 12 columns, called channels, indicated by numbered vertical lines. The solid line through the fourth feed hole from the top of the tape represents the top edge of the form (not TOF). The consecutively numbered horizontal lines and feed holes are spaced six to the inch.

Starting from the solid line, measure off the form length on the tape and draw another solid line through the feed hole at that point. The second solid line represents the bottom edge of the form (not BOF).

The tape should next be marked with a pencil at each point where a hole is to be punched, recalling that Channel 1 is normally reserved for TOF and Channel 12 is normally reserved for BOF. Any holes punched in the last four positions on the tape should be duplicated in the overlap splice area.

After a tape is punched, using the #4567 6-8LPI Tape Punch, it should be cut, looped, and cemented, as shown in Figure 3-3. Be sure that the end of the tape is aligned with the solid line near the top end.

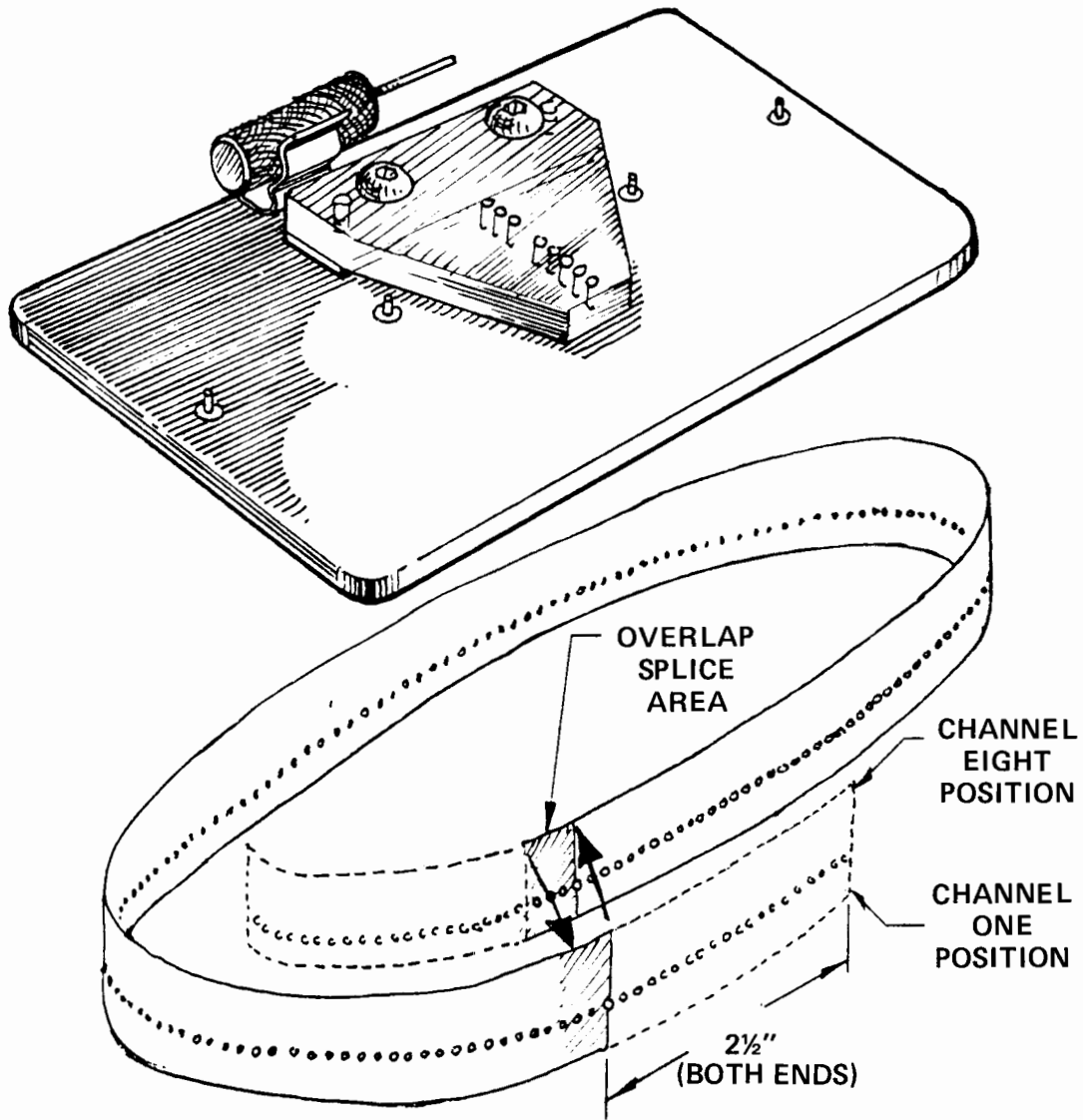


Figure 3-2. Eight Channel 6 LPI Punch and Tape

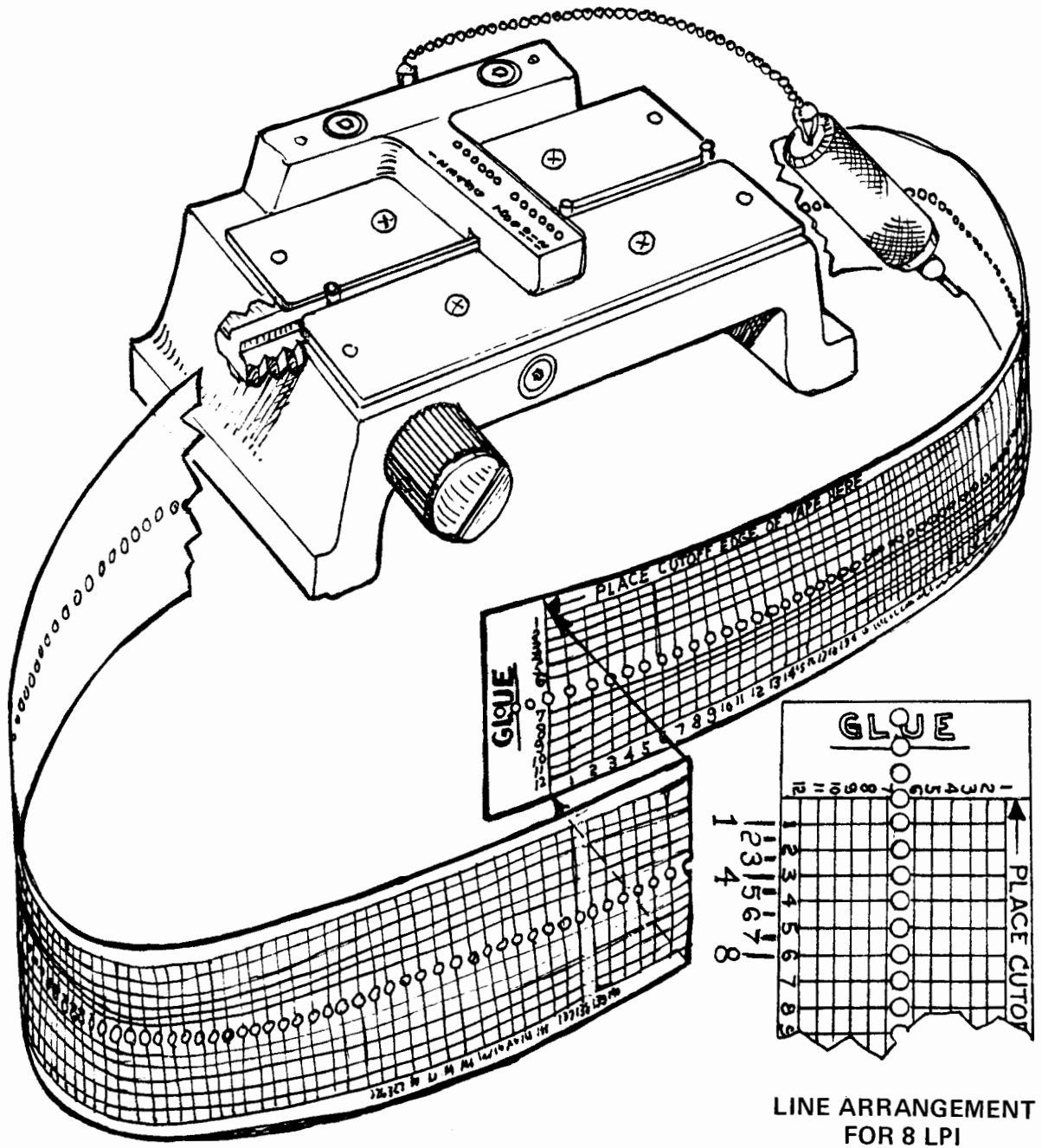


Figure 3-3. Twelve-Channel 6-8 LPI Punch and Tape

### 3.2.3 Twelve-channel, 8 LPI Tape Preparation

Remember that the numbered horizontal lines and feed holes on a 12-channel format tape are spaced at 6 LPI and prepare a tape as follows:

1. Using an inch ruler, measure from top edge of form (fourth feed hole from top of tape) to bottom edge of form.
2. Multiply the number of measured inches by 8, to find the establish area for punching holes. For example, if the form is 11 inches you would draw a solid line through the feed hole at the 88th horizontal line position, which then represents the bottom edge of form.
3. The tape should then be marked with a pencil at each point where a hole is to be punched (recall that Channel 1 is normally reserved for TOF and Channel 12 is normally reserved for BOF). Any holes punched in the last four positions on the tape should be duplicated in the overlap splice area.
4. After a tape is punched, it should be cut, looped, and cemented as shown in Figure 3-3. Be sure that the end of the tape is aligned with the solid line near the top end.
5. Condition the printer for operation and install the tape in the VFU according to the instructions in Section 4.1 (steps 1 through 4).
6. Place the 6/8 LPI switch to the 6 LPI position.
7. Perform steps 6 and 7 given in Section 4.1.
8. Place the 6/8 LPI switch to the 8 LPI position.
9. Perform steps 8, 9 and 10 given in Section 4.1.

## CHAPTER 4

## LOADING PROCEDURES

## 4.1 FORMAT TAPE MOUNTING

1. Press the printer "OFF" button (initial set-up or after power loss) and slide open the panel at the upper left side of the printer to get at the VFU and optional 6/8 LPI switch, as shown on Figure 4-1.

## NOTE

If you are changing vertical format because form length has changed, or different punched tape information is to be entered, press the printer "STOP" button and proceed.

2. Orient the tape loop to be installed as follows:

8-Channel VFU – Tape Channel 1 should be outermost. Printing should be on the outside, and the line position numbers should be on the left side of the tape loop as viewed from the front of the printer.

12-Channel VFU – Tape Channel 12 should be outside. Printing should be on the outside, and the line position numbers should be on the left side of the tape loop as viewed from the front of the printer.

3. Insert the tape loop into the narrow gap of the tape sensor and place the top of the loop over the tape drive sprocket (and grounding rod for 12-channel) so that the feed pins engage the feed holes in the tape. Position 12-channel tape so that the feed hole representing the top of form (TOF) is engaged on a short, flat-top feed pin to properly index the tape with the paperfeed mechanism.
4. Lightly holding the tape loop taut, lower the tape hold-down.

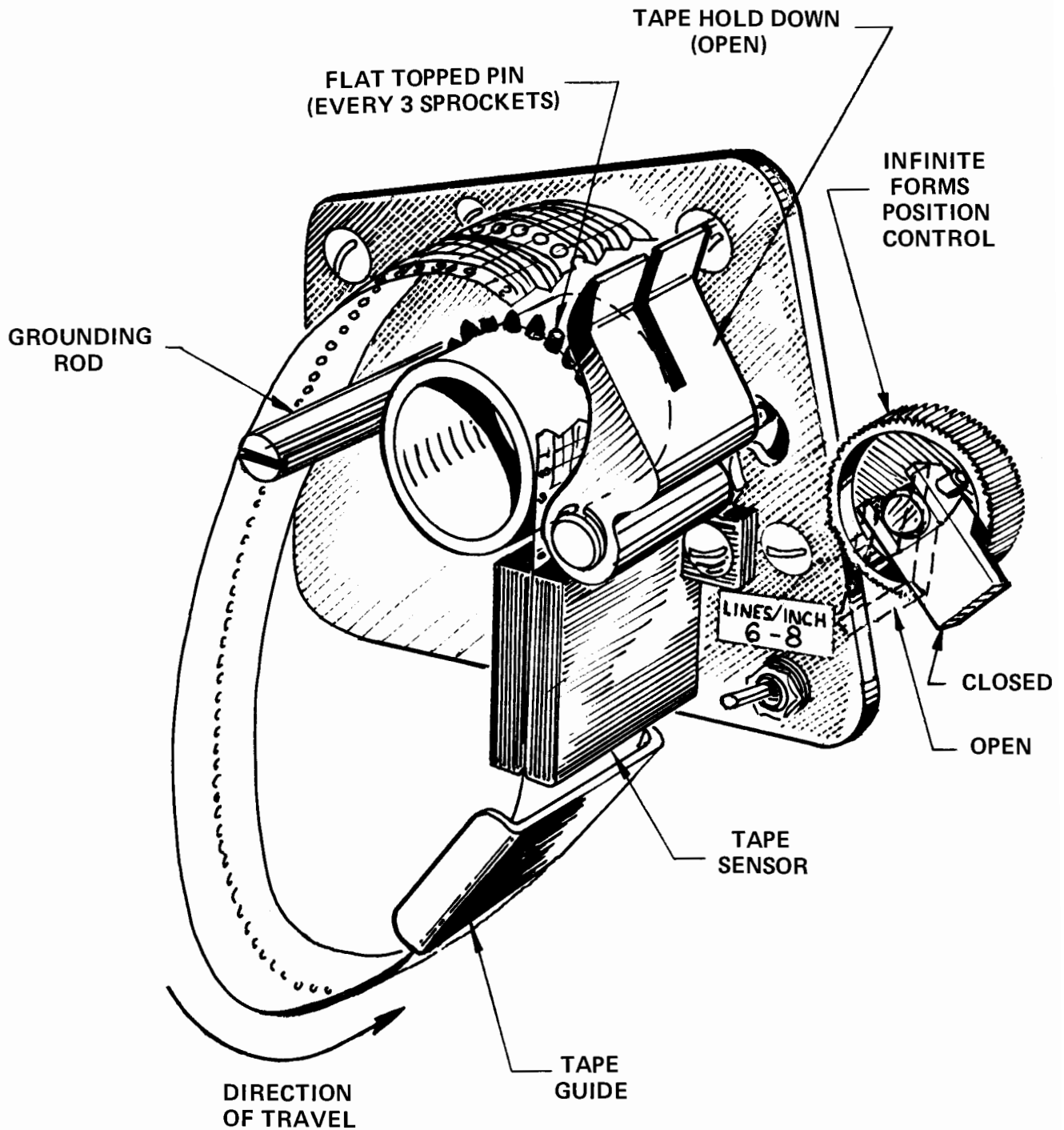


Figure 4-1. Twelve-Channel VFU and 6-8 LPI Switch (Optional)

5. Place the 6/8 LPI switch in the appropriate position.
6. If in the OFF mode, press the flashing "LOAD TAPE" button and observe that the indicator stops flashing, but remains lighted, and that the tape is moving through the VFU.
7. When the VFU stops moving, observe that "LOAD TAPE" light is out.

#### NOTE

During the STOP mode, LOAD TAPE will not illuminate. However, after tape is properly installed, pressing LOAD TAPE will illuminate the indicator and tape will move through the VFU. Indicator will be extinguished when the VFU stops moving.

8. Press the "HOME" button to position tractors.
9. Raise the spring-loaded tape holddown to the open position and carefully remove the tape by lifting it up to clear the feed pins (and grounding rod on 12-channel) then out.
10. Properly store the tape and close the sliding panel.

#### 4.2 FORMS LOADING

1. Place the printer in the STOP mode, raise the canopy to gain access to the printer yoke and yoke latch lever, and open the front doors to gain access to the paper supply area.
2. Unlatch and pivot the yoke to the fully open position by pulling the YOKE LATCH lever forward and then pulling the yoke toward you by its handles.
3. Referring to Figure 4-2, set the paper tractors to their approximate

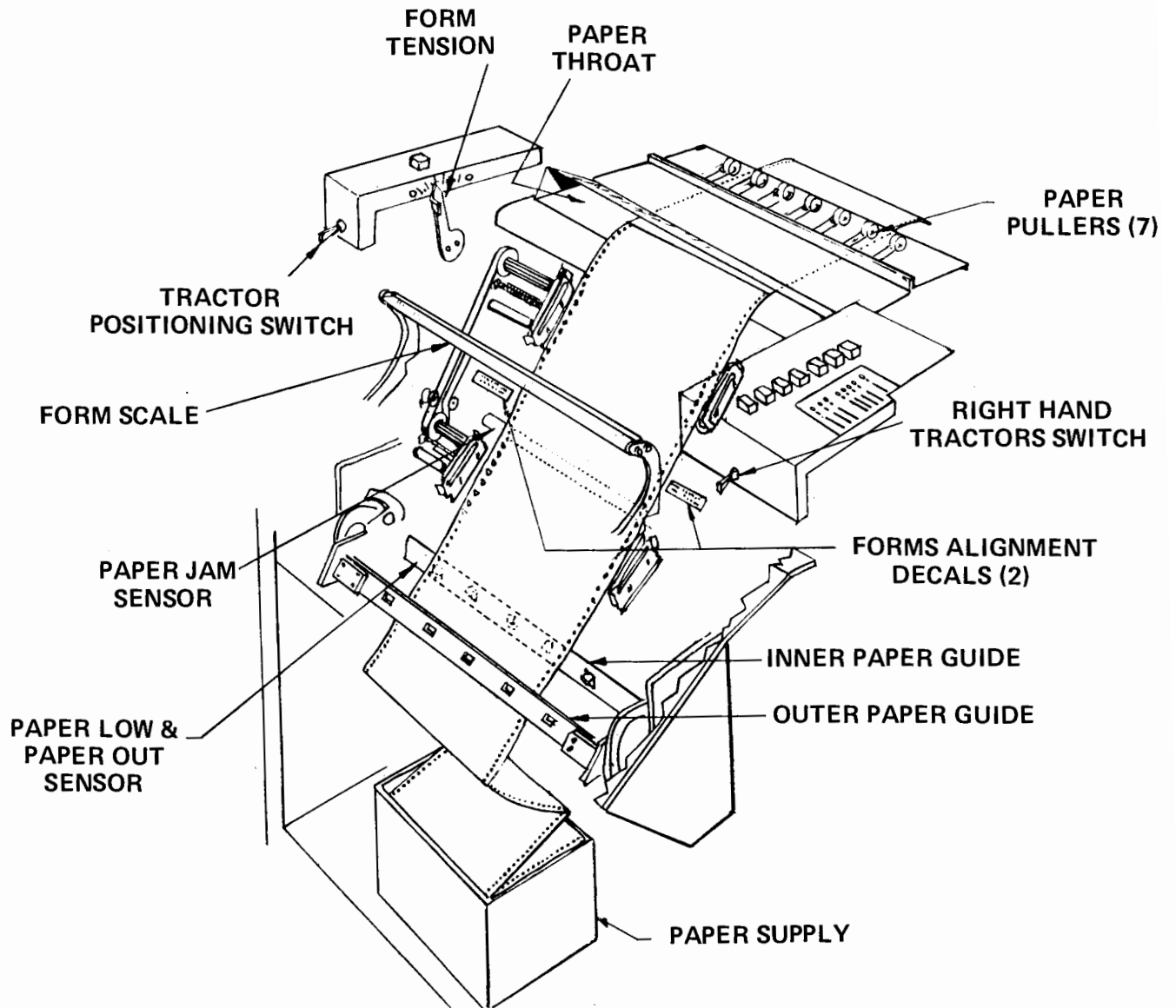


Figure 4-2. Paperfeed Path and Adjustments



final position with the paper tractor switches. Normally, the left-hand tractors are positioned slightly to the left of the first printing position.

4. Open the left-hand and right-hand tractor plates by sliding the hold down latches to the left and right, respectively.
5. Thread the forms, printing side up, through the opening between the inner and outer paper guides into the paper throat and out the top rear of the machine. Place the form on the left-hand paper tractors, with the margin feed holes engaged on the tractor pins. When loading multiple-part forms, fold the first page over, before threading, so that the parts will not come apart in the machine.
6. Position the right-hand tractors, with the RIGHT HAND TRACTORS switch, until the tractor pins align with the margin feed holes and place the form in tractors. With feed holes properly engaged on feed pins of all four tractors, close the hold-down plates.
7. Push the form scale, from the yoke, fully forward over at the print-line.
8. Referring to Figure 4-2, horizontally position the paper tractors and form to the desired print location by using the left-hand ALL TRACTORS switch.
9. Tighten the cross-tension on the form by touching and releasing the RIGHT HAND TRACTORS switch. The form should be taut, but without distortion of the margin holes.
10. Tighten the vertical tension on the form by adjusting the FORM TENSION control on the inside of the left hand side. The form should be taut, but should not tear the paper.
11. Open the sliding at the upper left side of the printer to gain access

to the VFU and the Infinite Forms Position Control (Figure 4-1). Be sure that the proper format tape information was put into memory and that the optional 6/8 LPI switch is in the proper position.

12. Press the "HOME" button to advance the paper tractors to the next Top-of-Form position.

**WARNING**

Do not attempt to position forms while the printer is operating. The INFINITE FORMS POSITION control is directly coupled to the paper drive system, and you could damage your finger.

13. Decouple the forms control by opening the clutch release lever, and turn the control knob until the line on which the first line of print is to appear is between the horizontal lines on the FORM ALIGNMENT decals. Re-engage the paperfeed drive by pushing the clutch release to closed position. close the upper left side panel.

**WARNING**

Before attempting to close the yoke, be sure that the print area is free of any obstructions that could jam paper feed operation or damage the machine.

14. With the YOKE LATCH control in the OPEN position, fully close the yoke by pulling up and pushing in on the yoke handles. Position the YOKE LATCH to the LOCK position (as far back as it will go. The YOKE LATCH indicator should go out.)
15. Check for proper setting of the IMPRESSION and PHASING controls, particularly if the thickness or number of parts of the new form is different from that of the old forms (refer to Chapter 5 for details).

16. Close the canopy and arrange the forms supply under the printer yoke so that forms will feed straight into the printer. If forms are fed from a carton, be sure that no flaps or ragged edges can snag the forms. Close the paper bay doors.
17. After the paper catcher has been installed, check that the banana plug at the left bottom rear of the catcher is plugged into its receptacle at the left bottom rear of the frame.
18. When printing begins, check for proper printing and forms handling. The first forms fed out of the printer should be guided into the paper catcher so that they fold properly and lay flat.

#### 4.3 RIBBON CHANGING



1. Place the printer in the STOP mode, raise the canopy, and unlatch and pivot the printer yoke to the fully open position.
2. Swing the form scale away from the yoke towards the forms area and open the plastic ribbon cover to gain access to the ribbon and its mechanism, shown in Figure 4-3.
3. Push the dog of the upper reversing lever toward the machine.
4. Using the disposable plastic gloves supplied with the new ribbon, remove the old ribbon by pushing the upper mandrel to left and removing the mandrel from both hubs. Slide ribbon to the right to remove it from under the metal plate of the ribbon skew sensor and temporarily place mandrel on the form scale.
5. Pull the dog of the upper reversing lever to the forward position.
6. Push the lower ribbon mandrel to the left and remove the mandrel from the hubs. Remove both mandrels from the printer.

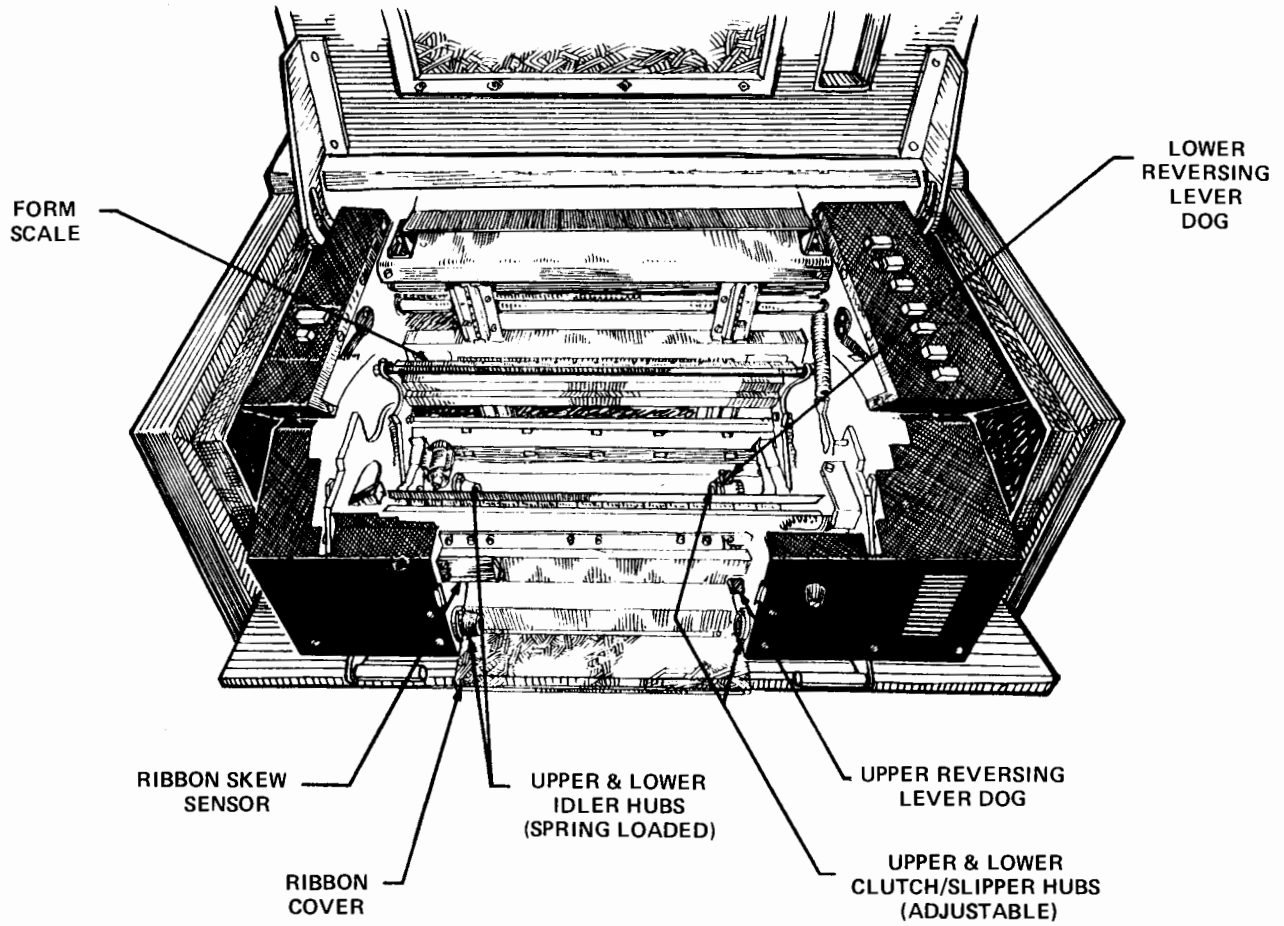


Figure 4-3. Ribbonfeed Mechanism

7. When installing a new ribbon, load the full mandrel onto the lower ribbon drive first. Place the left end of the mandrel onto the lower left spring-loaded hub, with one of the slots on the mandrel engaged with a slotted key on the hub. Push the mandrel to the left and place the right end onto the lower right hub, engaging a slot to a slotted key.
8. Wind the ribbon over the chaintrain and be sure that the left edge of the ribbon is threaded under the metal plate of the ribbon skew sensor.
9. Push the dog of the upper reversing lever toward the machine. Install the second mandrel onto the upper hubs following the instructions in step 7.
10. Manually turn the upper ribbon mandrel to take up any slack in the ribbon from in front of the chaintrain. Close the ribbon cover.
11. Close and latch the printer yoke. Check for proper settings of the IMPRESSION and PHASING controls. (Refer to Chapter 5 for details.) Check that the ribbon is feeding properly and close the canopy.

In some applications, when the majority of printout utilizes only one half of the ribbon, the useful life of the ribbon can be prolonged by re-installing the ribbon and mandrels turned end-for-end. Be sure that the ribbon does not have a ragged left edge or any holes, because either could cause improper ribbon mechanism operation.



## CHAPTER 5

## PRINT QUALITY ADJUSTMENTS

## 5.1 GENERAL

To ensure satisfactory print quality, the IMPRESSION and CHARACTER PHASING controls, on the printer yoke, should be checked each time a new form and/or a new ribbon is installed. In addition, the recommended forms and ribbon should be used, and the chaintrain should be cleaned regularly.

## NOTE

Always adjust the IMPRESSION control first and then the CHARACTER PHASING control, because these adjustments are interactive.

## 5.2 IMPRESSION

The IMPRESSION control should be adjusted to provide the best impression (light or dark) obtainable for the particular form and ribbon being used.

At certain intervals check and adjust the IMPRESSION control to maintain the best possible results, according to Table 5-1.

## 5.3 CHARACTER PHASING

The CHARACTER PHASING control should be adjusted, after you adjust the IMPRESSION control, to horizontally align the printout in all print positions for full character imprints. Referring to Table 5-1, if portions of the characters are clipped off, a small adjustment of the control will ensure that the chain is in the proper form position when the hammers fire, so that full characters will be printed.

When printing on multi-part forms, be sure to check the bottom, as well as the top, part of the form for proper phasing.

#### 5.4 CHAINTRAIN CLEANING

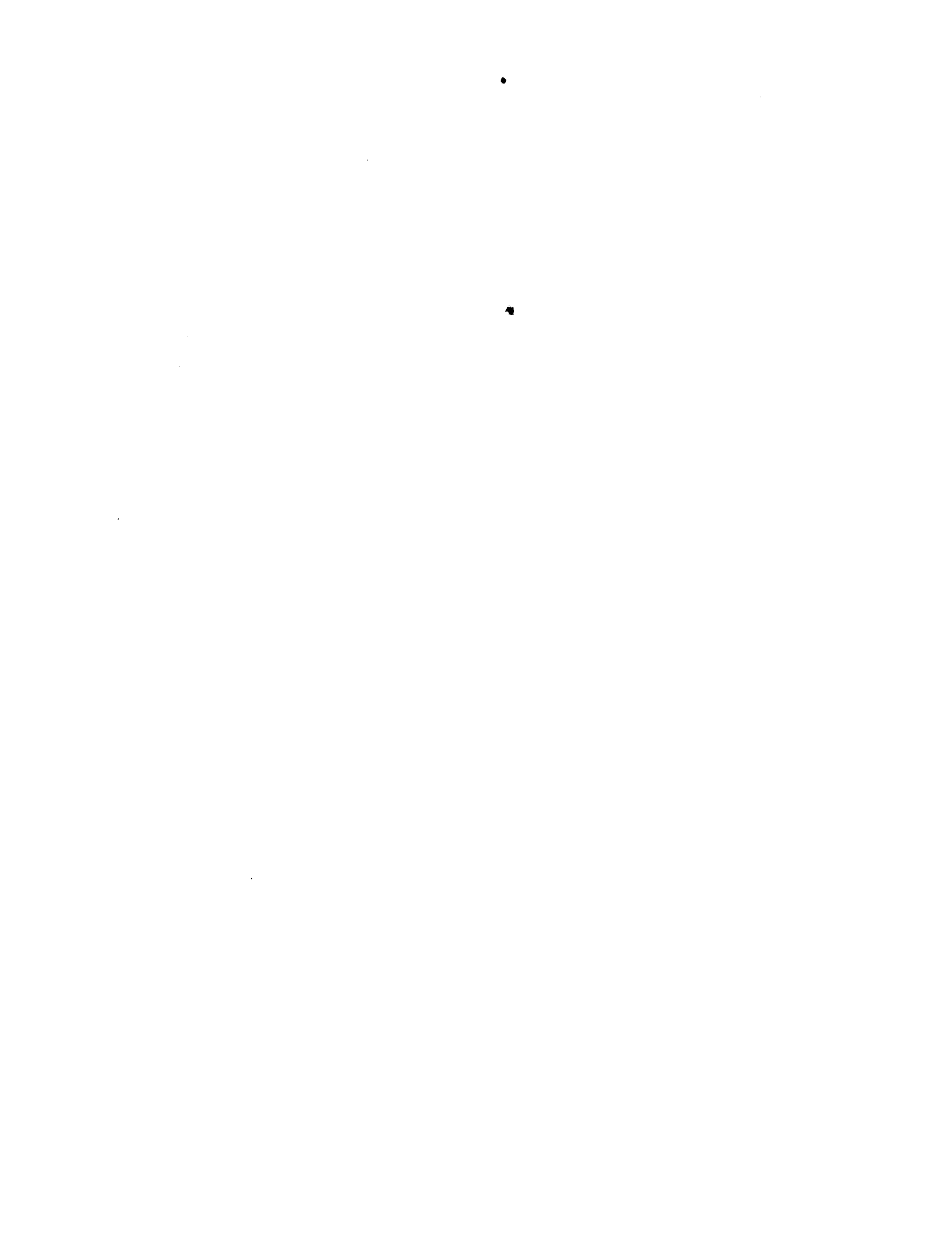
The chaintrain should be cleaned monthly, or more often, depending on print quality requirements. During printing, small particles of paper and ink tend to accumulate in the open spaces of the typefaces on the chaintrain and cause poor print quality. To clean the chaintrain:

1. Flip the main circuit breaker, located at the left rear of the printer, to OFF (down).
2. Fully open the yoke and remove ribbon and any forms in the tractors.
3. Open the paper bay panel doors, disconnect the hose from the vacuum cannister at left side and attach the clean-up hose provided in the compartment below the cannister. Instructions are printed on the vacuum cleaner.
4. Flip the fan toggle switch at the right side of the paper bay to ON, and flip the main circuit breaker ON (up).
5. Press the top panel "ON" button and vacuum the entire printer mechanism area. Flip the main circuit breaker OFF (down).
6. Construct a trough of forms paper and place it between the open yoke and the paper feed mechanism.
7. Using a soft wire brush, clean the characters and spaces while rotating the chaintrain by hand through a full revolution.
8. Flip the main circuit breaker ON (up). Vacuum the chaintrain area and remove the paper trough.
9. Reverse the procedures in step 4, and then for step 3.
10. Install paper and ribbon, and close and latch the yoke.



Table 5-1. Operator Correctable Printed Character Conditions

PRINTOUT	CONDITION	ADJUSTMENT
<b>MMM</b>	Dark Print, Smudging, Extraneous Inking	Decrease IMPRESSION adjustment.
<i>l</i> MMM	Light Print, Voids	Increase IMPRESSION adjustment.
<b>M M M</b>	Left Cutoff	Increase PHASING adjust- ment for full-character im- print in all positions.
<b>M M M</b>	Right Cutoff	Decrease PHASING adjust- ment for full-character im- print in all positions.
<b>MMM</b>	Filled Characters	Clean chaintrain



## CHAPTER 6

## LOCAL TEST PROCEDURES

**6.1 GENERAL**

The internal test mode exercises all logic functions of the printer system which allows operator adjustments to be performed, independent of the external device input and output circuitry.

Printing is automatically performed in a print-then-feed manner, printing complete lines of an operator-selected single character or all the different characters on the chain. Printout can be spaced either single line or multiple line.

**6.2 TEST PANEL CONTROLS**

By proper setting of the switches on the test panel, shown on Figure 6-1, printing and form feeding operations may be simulated.

The test panel switches are located on the outer edge of the I/O Control board, in position 5 of the electronics bay, and are accessible through a sliding panel in the lower right rear of the printer.

**6.2.1 REMOTE/LOCAL Switch**

This switch controls the mode of operation of the printer. When the switch is in REMOTE, printer operation is controlled by the external device connected at the interface and none of the other switches work.

In the LOCAL position, printer interface with the external device is logically inhibited and the printer is conditioned to operate under control of the remaining switches.

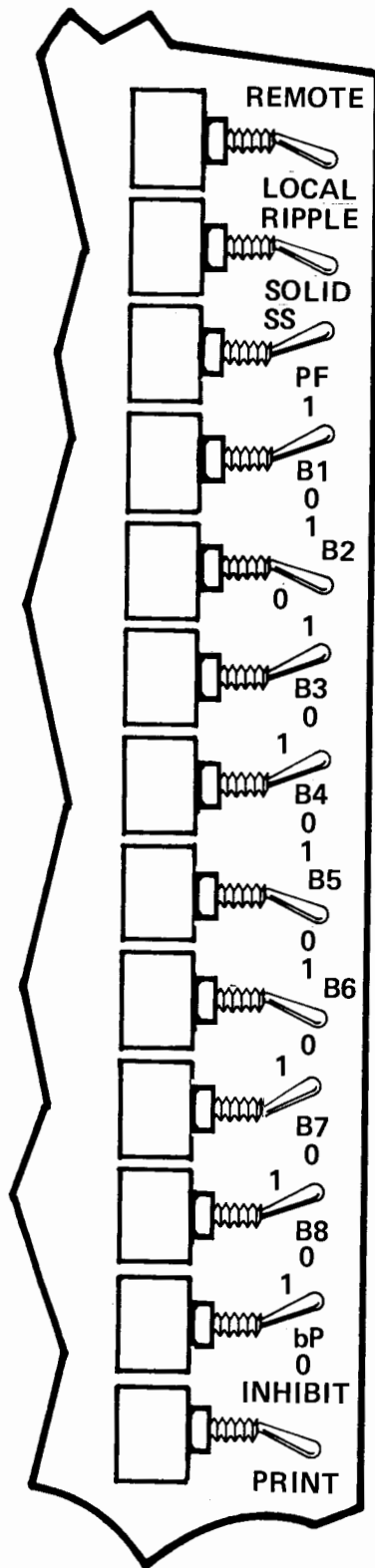


Figure 6-1. Test Panel Switches

## NOTE

Change the REMOTE/LOCAL switch to the opposite mode only when the printer is in the STOP mode.

**6.2.2 RIPPLE/SOLID Switch**

With this switch in the RIPPLE mode all the character arrangements on the chaintrain (see Table A-3) will be produced on a single line. This allows the operator to observe the print quality of all characters.

During the SOLID mode, the operator selects a particular character to be printed continuously on a line so that, if needed for good print quality, the IMPRESSION and CHARACTER PHASING controls can be adjusted. (The standard character for this is the capital letter "M".)

**6.2.3 SS/PF (Single Space/Program Feed) Switch**

Position of this switch controls the mode of form feed. In the SS position, the form will be advanced a single linespace after each print operation. With the switch in the PF position, the paper will be advanced according to the pattern set by bit switches B1 through B7. (See Table A-4.)

**6.2.4 Test Data Bit Switches**

These switches provide a manual means of programming the printer. The data bits designated B1 through B7 (or optional B8) correspond to the bit positions on the printer interface with the external device. During the SS mode, mentioned above, they are used to set up the code of the character to be printed. The character printed depends on the character sequence arrangements provided on the particular unit.

During the PF mode, the switches are used to set up the code for the number of lines to be advanced.

On printers equipped with a parity check bit, switch bP is used to complete the odd or even check of the transmitted binary character code. Incorrect parity will prevent character printing, which causes "blanks" (no print-out) at the columns that have the wrong parity. During the PF mode, incorrect parity will prevent paper advance.

### 6.2.5 INHIBIT/PRINT Switch

This switch disables hammer action (printing) in the INHIBIT position. All other functions, while in the LOCAL mode, will be enabled.

## 6.3 INTERNAL TEST OPERATION

An example of switch settings for operation in the internal test mode is shown on Figure 6-1. The data bit switches are shown set to decimal 77 (1011001). With the standard 64-character USASCII chaintrain arrangement this bit pattern represents the upper-case letter "M". With the SS/PF switch set in the SS position and the RIPPLE/SOLID switch set to SOLID, the printout will be a full line of M's and the form will feed a single line. With the SS/PF switch set to PF position, printout will still be a full line of M's, but form-feeding will be controlled by the decimal 77 (84 line spaces after each line of print).

Internal test is also useful for checking out VFU tapes. With the SS/PF switch in the SS position, VFU Channels 1 and 8 (or 12) are operable. With the SS/PF switch in the PF position, and the B7 switch set to "1", the other data bit switches can be set to correspond to the number of the VFU channel that you want to enable.

## APPENDIX

### REFERENCE DATA

Table A-1 shows the characters printed from "ASCII" input data with the standard 64- or 96-character ASCII chaintrain arrangements. Space (SP) is represented on these arrangements by an open diamond (◇), but its printing is suppressed.

Table A-2 shows the characters printed from EBCDI-Coded input data with the 48-character AN, HN or LC chaintrain arrangement and appropriate code converter.

The characters provided by a particular chaintrain arrangement are shown in Table A-3. All bit patterns not represented by a character on the chaintrain provided are treated as a space character.

#### NOTE

The printer Data Bus In Line and the Test Data Bit switch designations correspond to ASCII bit positions. The EBCDIC-to-ASCII bit correspondenc is:

EBCDIC	ASCII	EBCDIC	ASCII
7.....	1	3.....	5
6.....	2	2.....	6
5.....	3	1.....	7*
4.....	4	0.....	8*

\*Not used with 48-character arrangements.

Table A-4 shows the standard Paperfeed Command Codes and Instructions for the DPC Chaintrain Line Printer.

Vertical Format Tape characteristics are listed in Table A-5, and Format Tape Supplies and Accessories are listed in Table A-6.

**Table A-1. American Standard Code for Information Interchange (ASCII)  
64- and 96-Character Subsets**  
(for Character Arrangement on Chaintrain, see Table A-3)

Bits					b7	0	0	0	0	1	1	1	1
					b6	0	0	1	1	0	0	1	1
					b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1	COL ROW	0	1	2	3	4	5	6	7	
0	0	0	0	0			SP	0	␣	P	'	p	
0	0	0	1	1			!	1	A	Q	a	q	
0	0	1	0	2			"	2	B	R	b	r	
0	0	1	1	3			#	3	C	S	c	s	
0	1	0	0	4			\$	4	D	T	d	t	
0	1	0	1	5			%	5	E	U	e	u	
0	1	1	0	6			&	6	F	V	f	v	
0	1	1	1	7			'	7	G	W	g	w	
1	0	0	0	8			(	8	H	X	h	x	
1	0	0	1	9			)	9	I	Y	i	y	
1	0	1	0	10			*	:	J	Z	j	z	
1	0	1	1	11			+	;	K	[	k	{	
1	1	0	0	12			,	<	L	\	l		
1	1	0	1	13			-	=	M	]	m	}	
1	1	1	0	14			.	>	N	^	n	~	
1	1	1	1	15			/	?	O	_	o		
64-Character Subset													
96-Character Subset													

Graphics enclosed in heavy outlines correspond to the indicated subset.

Only bits b6 through b1 (Octal 00 through 77) are significant with the standard 64-Character chaintrain arrangement.

Only codes 2/0 through 7/15 (Octal 040 through 177) are significant with the standard 96-Character chaintrain. Control codes 0/0 through 1/15 (Octal 000 through 037) are treated as SPace, and DElete, 7/15 (Octal 177) is treated as a printable character ( ||| ).





Table A-3. DPC Chaintrain Arrangements (Printout Representation)

**USASCII Arrangements**

Standard 64-Character Subset (Consists of 6 identical arrays of 8 links each; 1 array shown)

Q	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	^	_	◇	!	"	#	\$	%	&	'	(	)	*	+	,	-	.	/	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Standard 96-Character Subset (Consists of 4 identical arrays of 12 links each; 1 array shown)

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

**EBCDIC Arrangements**

AN (48 characters. Consists of 8 identical arrays of 6 links each; 1 array shown)

0	1	2	3	4	5	6	7	8	9	*	+	,	-	.	/	&	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	\$	@	#	%	□
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----	---	---	---	---

HN (48 characters. Consists of 8 identical arrays of 6 links each; 1 array shown)

0	1	2	3	4	5	6	7	8	9	*	+	,	-	.	/	&	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	\$	'	=	(	)
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----	---	---	---	---

LC (48 characters. Consists of 8 identical arrays of 6 links each; 1 array shown)

0	1	2	3	4	5	6	7	8	9	*	+	,	-	.	/	&	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	\$	@	#	%	'
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	----	---	---	---	---

(Note - Layouts are neither scaled, nor do the fonts used represent the type style available.)

**Table A-4. Standard Paperfeed Command Codes**  
(For Systems With 8- or 12-Channel Vertical Format Unit)

Octal	Bit Pattern							Paperfeed Function		
	Bit Pos.	b7	b6	b5	b4	b3	b2		b1	
000		0	0	0	0	0	0	0	No Paper Advance [Overprint]	
001		0	0	0	0	0	0	1	Space 1 Line	
.									Thru	
077		0	1	1	1	1	1	1	Space 63 Lines	
100 } 120 } 140 } 160 }		1	X	X	0	0	0	0	Skip to Channel 1	
101		1	X	X	0	0	0	1		Skip to Channel 1
102		1	X	X	0	0	1	0		Skip to Channel 2
103		1	X	X	0	0	1	1		Skip to Channel 3
104		1	X	X	0	1	0	0	Skip to Channel 4	
105		1	X	X	0	1	0	1	Skip to Channel 5	
106		1	X	X	0	1	1	0	Skip to Channel 6	
107		1	X	X	0	1	1	1	Skip to Channel 7	
110 } 130 } 150 } 170 }		1	X	X	1	0	0	0	Skip to Channel 8	
111		1	X	X	1	0	0	1		8-Channel VFU: Space 1 Line
112		1	X	X	1	0	1	0		12-Channel VFU: Skip to Channel 9
113		1	X	X	1	0	1	1		8-Channel VFU: Space 1 Line
114		1	X	X	1	1	0	0	12-Channel VFU: Skip to Channel 11	
115		1	X	X	1	1	0	1	8- or 12-Channel VFU: Space 1 Line	
116		1	X	X	1	1	1	0	Space 1 Line	
117		1	X	X	1	1	1	1	Space 1 Line	

Note: X denotes bit may be "1" or "0"; state does not affect function

Table A-5. Format Tape Characteristics

<b>FORMAT TAPE CHARACTERISTICS:</b>			
<b>VFU Channels:</b>	<b>8 (Standard)</b>	<b>12 (Optional)</b>	
<b>Linespacing:</b>	6 LPI	6 LPI	8 LPI
<b>Tape Width:</b>	1.00 in.	1.625 in.	
<b>Feed Hole Pitch:</b>	0.100 in.	0.167 in.	
<b>Feed Hole Diameter:</b>	0.046 in.	0.103 in.	
<b>Punched Hole Pitch:</b>	0.100 in.	0.167 in.	0.125 in.
<b>Punched Hole Size: Diameter (preferred):</b>	0.072 in.	0.070 in.	0.070 in.
<b>Rectangular (Alternate):</b>		0.070 by 0.094 in.	(*)

**NOTE:** \* Corresponding hole size listed for 6 LPI may be used provided that punching is limited to alternate positions within a channel.

Table A-6. Format Tape Supplies and Accessories

DPC Part	Description	Manufacturer & Catalog No.	
<u>Ribbon:</u> D 47500-4  D 47500-7	5-mil nylon ribbon 14 inches 15 yards long Black record medium ink  4-mil nylon ribbon 14 inches (35,6 cm) 18 yards (19,8m) long OCR black		
<u>Format Tape:</u> A 4524  A 4568	1 inch wide 10-foot rolls perforated tape (8-chan)  12-Channel Format Tape 24,95 inch (63,3 cm) long 25 Lengths (Std package)	IBM Corp. MDS Corp.	P/N 429754 P/N 018772302 (Box of 25)
<u>Adhesive:</u> A 4569	Rubber-based Contact cement; 3-oz. Can (w/applicator)		
<u>Punches:</u> A 4523*  A 4566*	8-Channel, 6-LPI Format Tape Punch  12-Channel, 6-LPI Format  12-Channel, 6&8-LPI Format Tape Punch	Burroughs Corp. OEM Product Sales Los Angeles, CA  IBM Corp. Airmonk, NY  Mohawk Data Sciences Corp. Herkimer, NY	Model 453 P/N 16226979  P/N 120910  P/N 015238401 (See Note **)
NOTES: *DPC Part Number is for identification purposes only; for best delivery, format tape punches should be ordered directly from the manufacturer, using the manufacturer's catalog or part number. ** Formerly MDS Part No. 52384-G1.			

## PAPER FORM SPECIFICATIONS

DPC 1200 Series printers are designed to accommodate a variety of continuous, single-or multi-part, sprocket-fed paper forms. Basic form requirements can be summarized as follows:

Forms Width:	3.5 inches to 19.5 inches overall
Fold Length:	Up to 11 inches maximum between fanfolds with paper bay doors closed
Weight:	15 pounds minimum
Thickness:	0.020 inch with standard tractor adjustment
Sprocket Holes	
Diameter:	5/32 inch Spacing: 1/2 inch center-to-center
Location:	1/4 inch to near edge

As shown in Figure A-1, the maximum form width that can be accommodated, with the left-hand tractors in the fully left position and the right-hand tractors in the fully right position, is 19.5 inches. The maximum form width that will allow a typeline of 132 print positions to be positioned anywhere on the body of the form between the margin perforations is 16.78 inches. The minimum form width that will accommodate a typeline of 132 print positions is 14.2 inches.

The enclosed paper supply compartment cannot accept fanfold forms having a length greater than 14 inches. If longer forms are used, you must purchase a paper receptacle that will accommodate them from another manufacturer.

The maximum length of the VF Memory, which is 143 lines (192 optional), also imposes constraints on maximum form length. When paper is transported with 6 LPI vertical spacing, the maximum form length that can be accommodated by the VF Memory is 143 lines ÷ 6 LPI or 23.8 inches. When paper is transported with 8 LPI vertical spacing, the maximum form length that can be

accommodated by the VF Memory is 143 lines  $\pm$  8 LPI or 17.9 inches. If your printer has the optional 192 line VF Memory, the maximum form lengths are 32 inches at 6 LPI and 24 inches at 8 LPI.

The minimum weight of single-part paper is 15 pounds. Lighter paper will be cut through when "sharp" characters (such as punctuation marks) are printed and the life of the ribbon will be reduced accordingly. Single-part forms made from card stock should be no thicker than 0.007 inch.

Multi-part forms can be made by interleaving carbon paper within the paper forms, or by using multi-part carbonized or carbonless paper. The total thickness of multi-part forms should not exceed 0.020 inches, otherwise the printer will require special adjustment for proper feeding.

Paper forms should be free of mechanical fasteners (such as staples, stitching, etc.) that can interfere with proper paperfeeding or come loose and damage the printer mechanism.

Multi-part forms should be glued outside the printing area on the form. Glue tends to alter the printing characteristics of the form so that uniform print quality is difficult to achieve on both the glued and unglued parts of the form. Also, multi-part forms should be glued along one margin only — not along both margins, between successive forms, or at subdivisions of a fanfold, etc. The reason for this is that multiple gluing restricts the escape of air from between the layers of the form, cushions the impact of the print hammers, and reduces image transfer from layer to layer.

The construction of multi-part forms should be carefully considered before making a substantial investment in multi-part forms. Because the acceptance of carbon copies is often a subjective matter, a "write test" with a variety of form construction materials and techniques should be performed before purchase, especially if the forms have more than four parts or are otherwise unusual (for example, made up of combinations of paper and card stock, envelopes, plastic cards, etc.). The primary objective of a "write test" is the evaluation of the image transfer characteristics of the form. However,

the manner in which the forms are perforated and glued should also be carefully evaluated.

The following is a list of guidelines that may be of help when you design or select ready-made paper forms:

1. If one part of a multi-part form is to be of heavier stock than the rest, it should be on the bottom for best results.
2. The bottom part of a multi-part form should be white for best legibility.
3. For best print alignment, the sprocket-feed holes in the margins should be clean-cut holes,  $0.156 \pm 0.003$  inches in diameter.
4. All perforations should be consistent with normal bursting requirements and with normal tractor-feeding requirements. Weak "perfs" can result in accidental bursting while feeding; inadequate perforation can make bursting difficult and time consuming.
5. Forms should be free of serrations, protrusions, or large openings to avoid "picking" while feeding.

Major suppliers of business forms are well acquainted with the printing and paperfeeding characteristics of back-impact line printers and can provide a comprehensive variety of form constructions for evaluation.