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MODEL 351

PRINTER

37403510-9B10 REV. B1 APRIL 1984

TECHNICAL MANUAL

TP 7-80

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3/82 Rev. F

MODEL 351

PRINTER

37403510-9B10 REV. B1 APRIL 1984

TECHNICAL MANUAL

REVISION HISTORY

Publication Number—37403510-9B10

The revision history page provides a record of each revision made to the manual. The page reflects the revision sequence starting from the Preliminary release of the manual to the Production release of the manual. Preliminary manuals are revised using a number sequence, 1, 2, 3, etc., while Production release manuals are revised using a letter sequence, A, B, C, etc. The history page also provides a brief description of each manual revision. In between manual updates, Publication Change Pages (PCPs) are generated and shipped with each manual. These PCPs are incorporated into the manual of the next revision update and should be retained as a record of the change.

REVISION	DESCRIPTION
1 (July 1982)	Preliminary release of manual.
A (August 1982)	Production release of manual.
B (June 1983)	a. Specifications for printer weight changed (Section 1). b. Character set ROM memory changed from 4K to 8K (paragraph 2.3). c. Printhead drive circuit fuse rating changed from 3A to 5A (paragraph 2.13). d. Data Link information updated (paragraph 2.18). e. Minor corrections made to flow chart figures (Section 3). f. Adjustment procedures updated (Section 4). g. Removal/Replacement procedures updated (Section 6). h. Bar Code/Large Character Prom kit option added (Section 6). i. Demand Document Window Tear Bar option added (Section 6). j. Table Top Forms Stacker kit option added (Section 6). k. Electrical drawings updated to current revision level (Appendix A). l. Information on control panel switches and indicators expanded (Appendix C). m. Information on Data Link Usage is removed from Technical Manual and added to Users Manual (formerly Appendix E). n. Information on new Model 351-3 and 351-4 printers added (New Appendix E).
B1 (April 1984)	a. Incorporated PCP 37403510-9B01.

TABLE OF CONTENTS

SECTION 1—GENERAL INFORMATION

SECTION 2—THEORY OF OPERATION

SECTION 3—MAINTENANCE

SECTION 4—ADJUSTMENTS

SECTION 5—REMOVAL/REPLACEMENT

SECTION 6—OPTIONS/ACCESSORIES

APPENDIX A—ELECTRICAL DRAWINGS

APPENDIX B—INTERFACE INFORMATION

APPENDIX C—CONTROLS AND INDICATORS

APPENDIX D—PICO FUSE COLOR CODE

APPENDIX E—MODEL 351-3 & 351-4 PRINTERS

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS

SECTION 1
GENERAL INFORMATION

1.1 SCOPE

This technical manual provides detailed information on the theory of operation, maintenance, adjustment, and recommended spare parts replacement for the Centronics Model 351 printer. The manual is for use by qualified service personnel who are proficient in maintaining electronic and electro-mechanical equipment.

1.2 GENERAL DESCRIPTION

The Model 351 is a single board, 200 cps, bidirectional, logic seeking printer that uses dot matrix techniques for character generation. A 9-wire print head is used to create any one of a number of operator selectable horizontal pitches, proportional print with descenders, and pin-addressable graphics in both unidirectional and bidirectional modes. The single printed circuit board uses microprocessor technology to minimize components and increase reliability.

Maximum throughput is achieved with bidirectional printing which seeks the shortest path to the next line of characters when printing successive lines of data. Paper is moved through the printer by means of a stepper motor.

The Model 351 printer contains many features to help perform the printing function more easily and efficiently. The following list includes some of the more significant features.

- 96 ASCII Characters
- 200 cps, "Data Processing" Printing
- Serial and Parallel Input Interfacing
- Switch Selectable Forms Length
- Single Character Expanded or Condensed Print
- Switch Selectable Lines per Inch
- Fanfold/Cut Sheet Forms Handling
- Pin Addressable Graphics
- Self-Test Capability
- 16 Switch Selectable Baud Rates
- Proportional Printing
- Single Pass and Multipass

The printer is easy to install, operate and maintain, and is compatible with both EIA and ANSI standards. In addition to the many standard features built into the Model 351, there are many options and accessories that may be added to provide additional capabilities.

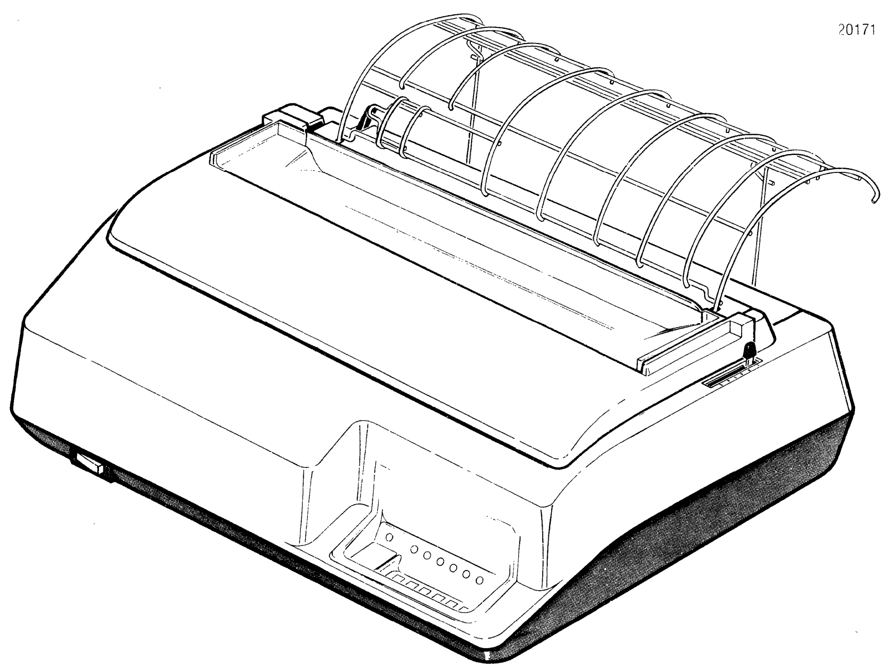


Figure 1-1 Model 351 Printer

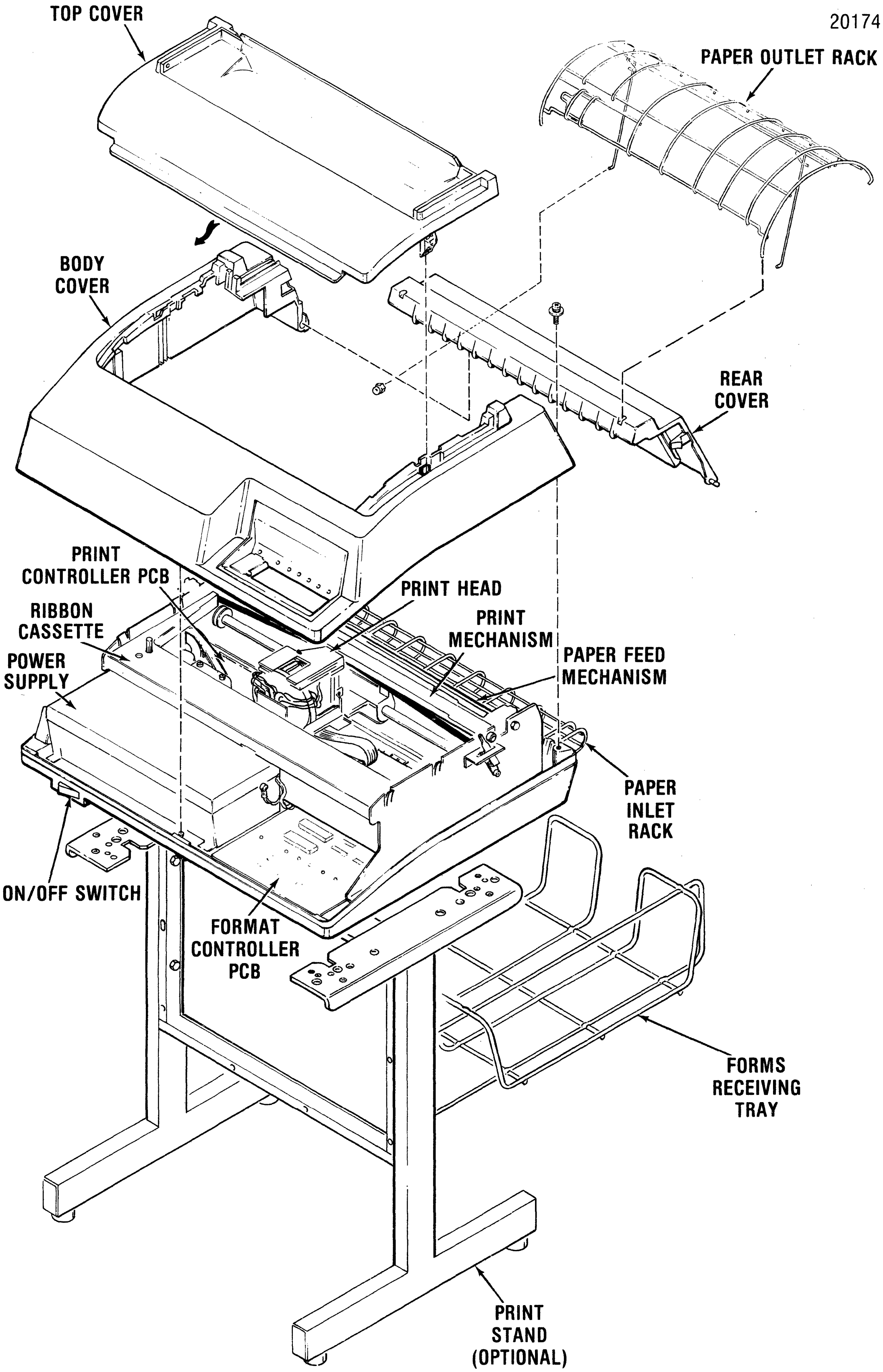


Figure 1-2 Major Assemblies Model 351

1.3 PHYSICAL DESCRIPTION

Physically the Model 351 is compact and lightweight. The printer measures approximately 22 inches wide, 18 inches deep, and 8 inches high, and weighs 47 lbs.

The printer covers include several plastic covers; the top cover, body cover, rear cover, and base cover. The body cover has an opening in the lower right corner for the control panel.

There are four major assemblies within the printer: the printing mechanism, paper handling mechanism, electronics, and power supply.

1.3.1 PRINTING MECHANISM—The printing mechanism consists of the print head assembly, carriage assembly, and carriage drive components. The carriage drive components are the dc drive motor, drive belts, pulleys, encoder/timing disc, and optical sensor. These components drive the carriage and attached print head back and forth and provide the video signals necessary for character generation.

1.3.2—PAPER HANDLING MECHANISM—The paper handling mechanism is capable of handling either fanfold forms or cut sheet forms. The mechanism consists of a stepper motor, pin feed tractors, paper guides, and drive rollers. Fanfold forms are moved through the printer using the pin feed tractors. Cut sheets are moved through the printer by the paper drive rollers. The mechanism handles up to six parts using either form.

1.3.3 ELECTRONICS—The printer electronics consists of a printed circuit board (pcb) which contains the format and print control logic circuits. This Formatter/Controller pcb is located under the printer mechanism and is attached to the printer base. The pcb also contains the control panel assembly and the parallel and serial input connectors.

1.3.4 POWER SUPPLY—The fan-cooled and line-filtered power supply is located in the left front of the printer and is completely enclosed. The power supply is of the switching type and is used as the source of regulated dc voltage for the printer.

1.4 PRINTER OPERATION

Basically, all printer functions can be grouped into one of three categories: (1) character printing, (2) paper motion, and (3) special functions.

1.4.1 CHARACTER PRINTING—Once the data has been received from the host device and formatted by the Formatter/Controller circuit, the characters are printed by selectively activating the nine print wires aligned vertically in the print head.

As the print head moves across the paper, the appropriate print wires are momentarily activated driving them against the ribbon, paper, and platen to form the dot matrix pattern.

As shown in Figure 1-3, the print head is attached to the carriage assembly, which in turn is attached to a carriage drive belt. The carriage is driven in the forward or reverse direction by the carriage drive motor which rotates the belt clockwise (forward direction) or counterclockwise (reverse direction).

1.4.2 PAPER MOTION—Paper is moved by pressing one of the paper motion switches: line feed (LF), paper forward (PAPER FWD), paper reverse (PAPER REV) or form feed (FORM FEED) located on the pcb, or by receiving a paper motion command from the host device.

Physically, paper is moved by the torque from the paper stepper motor which is applied to the pin feed tractor drive gears and the rollers which move the paper up or down as shown in Figure 1-3.

1.4.3 SPECIAL FUNCTIONS—As a standard feature, the printer is capable of printing in a unidirectional graphics mode or bidirectional graphics mode. The graphics mode is selected by an escape sequence control code and the graphics program is completely controlled by the host device.

Also as a standard feature, the printer has a self-test capability which is activated by placing a Dip switch (S2-4) on and depressing the **SELECT** switch. Printing of test data will be repeated each time the **SELECT** switch is depressed.

In addition to the printable character codes, the printer also recognizes certain special control codes and escape sequences. Refer to the users manual for a list of the codes and the printer action performed on receiving these codes.

1.5 RELATED PUBLICATIONS

The following publications document the Model 351 printer in detail. These publications can be ordered using the accessory order form contained in the back of this manual.

1.5.1 UNPACKING/REPACKING INSTRUCTIONS— The unpacking/repacking instructions are attached to the outside of the shipping container and provide the necessary information to unpack or repack the printer.

1.5.2 USERS MANUAL—The users manual provides a general description of the printer and information necessary to install, program, operate, and maintain the printer on a users/operators level. This information includes set-up procedures, operating instructions and programming instructions.

1.5.3 ILLUSTRATED PARTS MANUAL—The illustrated parts manual contains illustrations and lists of materials detailing all assemblies and subassemblies down to a piece part level. The manual also contains a numerical index listing every part in numerical order and referencing the part to a figure and index number.

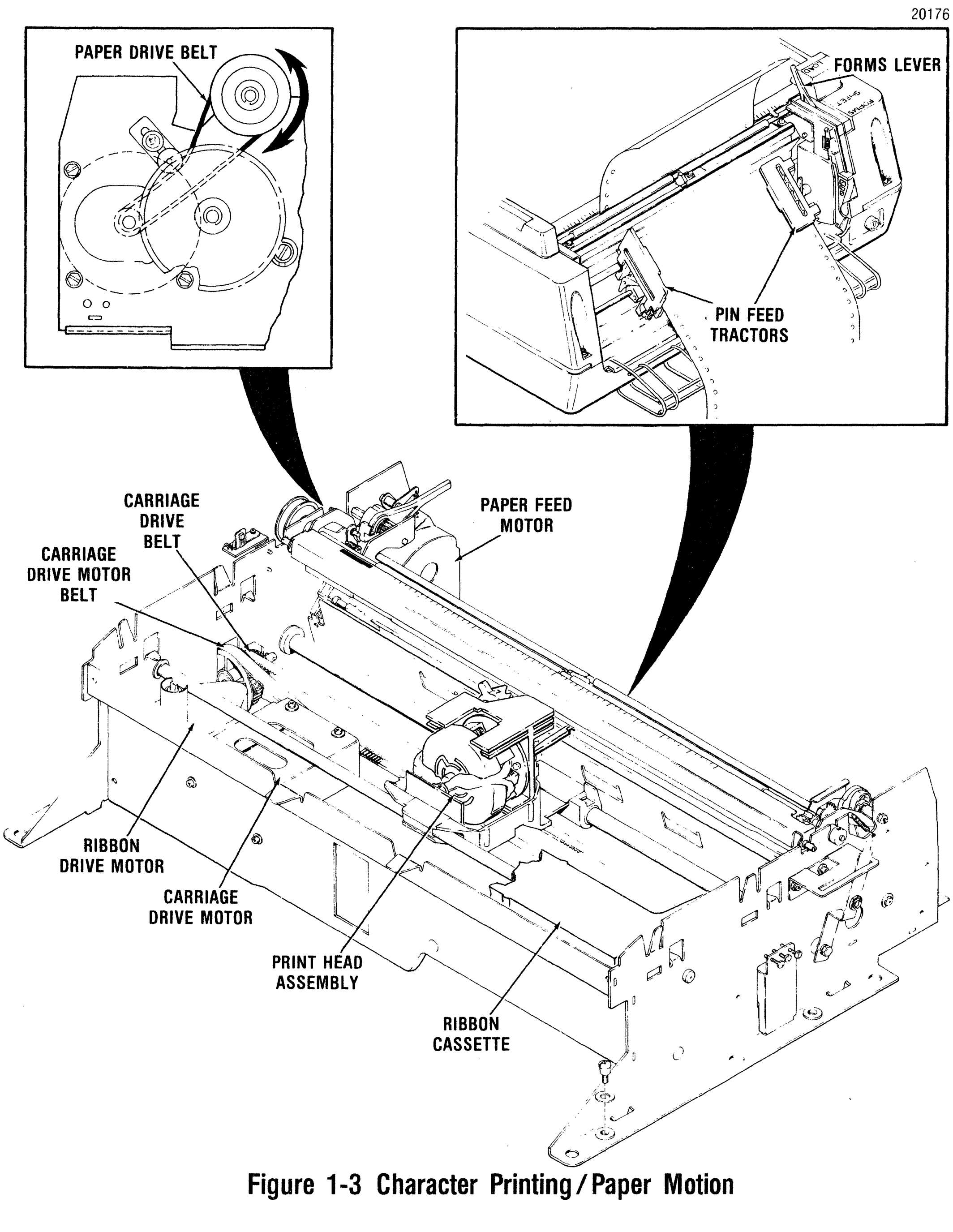


Figure 1-3 Character Printing/Paper Motion

1.6 MODEL 351 SPECIFICATIONS

SERIAL INPUT

Interface RS-232C

Data Format . . . . 1 START bit, 7 or 8 DATA bits, none or 1 PARITY bit, and 1 or more STOP bits

Input Code . . . . ASCII

Buffer. . . . . 2K character buffer

PARALLEL INPUT

Data Format . . . . 7 bit ASCII parallel

Input Code . . . . 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

Print Speed . . . . 200 characters per second (cps)

Country Character Sets . . . . Dip switch selectable for U.S.A., Great Britain, 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 . . . . Dip switch selectable for 6 or 8 lpi

Vertical Slew Speed . . . . 6 ips (152.4 mm/s) for line feeds
8 ips (203.2 mm/s) for form feeds

Forms Length . . . . 1 to 192 lines

Paper Movement . . . . Bidirectional (cut sheet mode only)

PAPER REQUIREMENTS

Fanfold Forms
- Width .... 3.0 to 15.0 inches (76 to 381 mm)
- Copies .... Up to six parts
- Maximum Thickness .... 0.0204 in. (0.52 mm)

Cut Sheet
- Width .... 4.0 to 12.0 inches (101 to 304.8 mm)
- Copies .... Up to six parts
- Maximum Thickness .... 0.0204 in. (0.52 mm)
  NOTE: For detailed paper specifications, refer to the Model 351 Users Manual.

PHYSICAL/ENVIRONMENTAL/ELECTRICAL

Height .... 7.5 inches (190.5 mm)

Depth .... 18.25 inches (463.5 mm)

Width .... 22.5 inches (571.5 mm)

Weight .... 46 lbs (22 kg)

Temperature .... Operating: 50° to 104°F (10° to 40°C)
Storage: −40° to 151°F (−40° to 66°C)

Humidity .... Operating: 10% to 90% (no condensation)
Storage: 10% to 95% (no condensation)

Power
- Switcher Power Supply .... 90 Vac to 128 Vac or 180 Vac to 256 Vac
  47 to 63 Hz
- Input Current .... 4A max. at 110 Vac
  2A max. at 220 Vac

SECTION 2
THEORY OF OPERATION

2.1 GENERAL

This section describes the operation of the printer at the functional block level.

As shown in Figures 2-1 and 2-2, all of the formatting and print controlling circuitry is situated on a single formatter/controller printed circuit board (pcb). Either serial or parallel data from the "host" system is accepted by the printer's electronics which controls the input of data flow, starts paper motion, and the printing of data.

Refer to Appendix C for the description of the printer's format and control switches and indicators and their features and functions.

2.2 8085 MICROPROCESSOR SYSTEM

The 8085 microprocessor system controls the functioning of the Model 351 printer. The microprocessor is interrupt driven; it does not wait for the different events to happen, but instead is interrupted from its current task by a higher priority event. When that even has been evaluated and processed, the 8085 resumes its former task.

The following interrupts have been used:

TRAP
RST 7.5
RST 6.5
RST 5.5

TRAP—is used for input prime. Everything is aborted, data is lost, and the system is restarted whenever TRAP is received by the 8085A.

RST 7.5—is used to monitor the incoming video signal. The 8085A microprocessor examines the video byte for directional information, and this interrupt increments an interval counter to provide the exact position of the print head. Every RST 7.5 interrupt is either an "up" count or a "down" count.

RST 6.5—is used to interrupt the microprocessor when the programmable time has timed out. This interrupt is used for paper motion only.

RST 5.5—is the lowest priority interrupt used in the printer. It is used to indicate that a byte of data has been received.

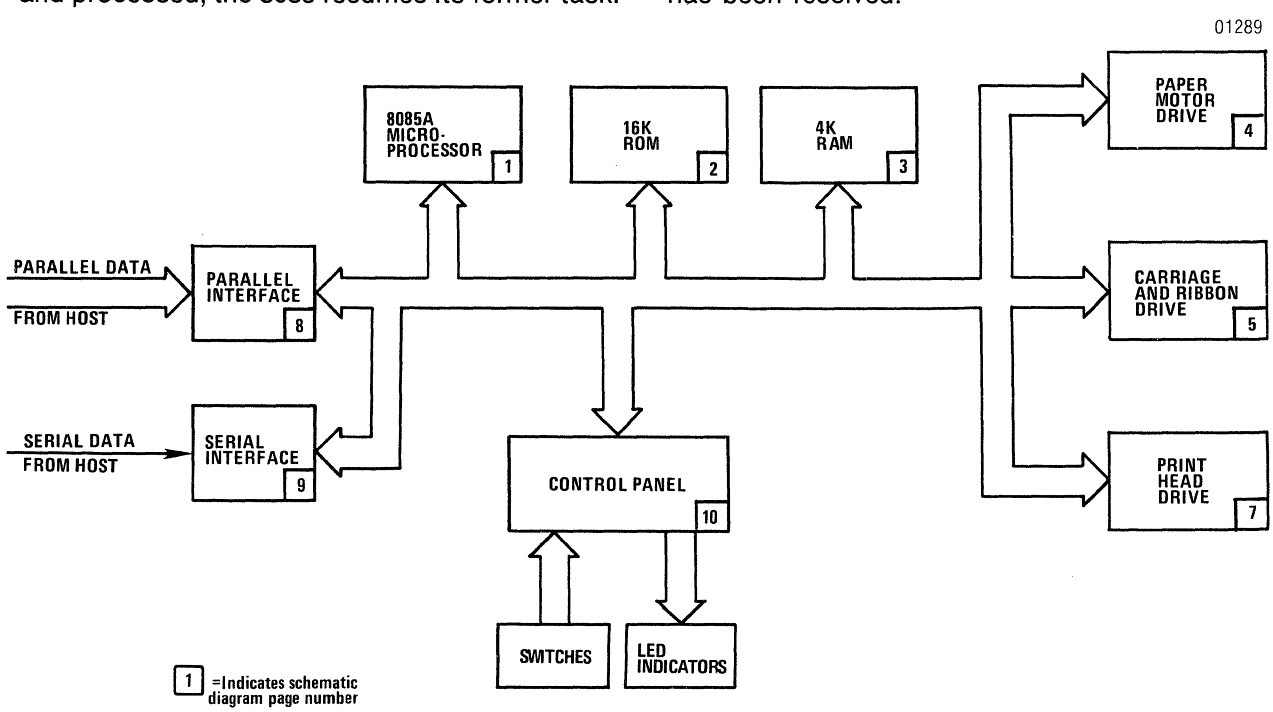


Figure 2-1 Model 351 Basic Functional Block Diagram

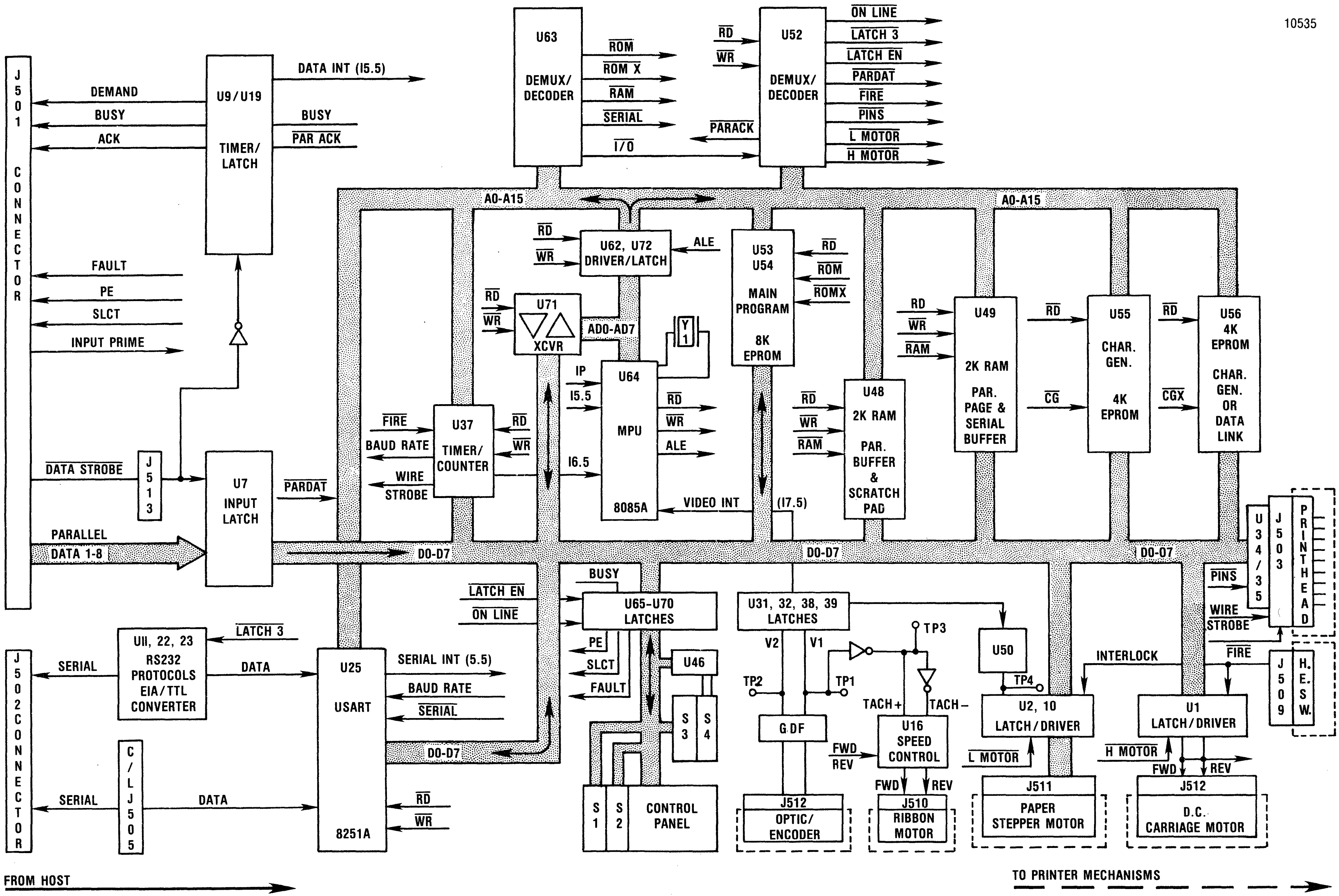


Figure 2-2 Model 351 Formatter/Controller Board

2.3 MEMORY/INTERFACE

The basic architecture of the memory and interface for the printer is as follows:

MEMORY/INTERFACE	DESCRIPTION
PROM/ROM	
1. Program:	8K bytes
2. Character Sets:	8K bytes
3. Link/Multipass Character Set:	4K bytes
RAM	
1. Scratch Pad:	512 bytes
2. Pin Buffer:	512 bytes
3. Line Buffer:	1K bytes
4. Input Buffer:	2K bytes
INTERFACE	
1. Parallel:	Via 36-pin, Amphenol, 57-Series compatible connector.
2. Serial:	Via 25-pin, EIA, RS-232 connector (four unused pins for current loop connections).

2.4 PROGRAM MEMORY

The 8K bytes of program memory in PROM govern the operation of the entire printer. 3K bytes of the 4K character generator resident in PROM contain the standard character sets, while 1K is reserved for a custom option character set.

The Data Link contains 4K bytes of PROM (jumper selectable to 2K bytes) which is available to the user to make software modifications to the following:

- Parallel Interface
- Serial Interface
- 2 Membrane Switches
- Serial Buffer Level
- 1 Dip Switch Position (All other dip switches can be overridden)
- Single-Step Enabling of the Paper Motor
- Self-Test Printout
- Initialization
- 160 bytes of RAM are available

2.5 RANDOM ACCESS MEMORY (RAM)

2K bytes of the 4K bytes of RAM in the printer are used for: scratch pad memory (512 bytes, with 160 bytes of this reserved for the data link), pin buffer (512 bytes), and line buffer (1K bytes). The remaining 2K bytes are used as an input buffer.

2.6 PARALLEL INTERFACE

Table 2-1 lists the functions of the lines and the associated pin connections to the Amphenol 57-Series Parallel Interface connector. Figure 2-2 illustrates the timing diagram of the interface control signals.

Table 2-1 Parallel Interface Connector Pin-Outs

PIN	SIGNAL	PIN	SIGNAL
1	$\overline{\text{DATA STROBE}}$	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	$\overline{\text{ACKNOWLEDGE (ACKNLG)}}$	28	Twisted Pair Ground
11	BUSY	29	Twisted Pair Ground
12	PAPER OUT (PE)	30	$\overline{\text{INPUT PRIME RETURN}}$
13	SELECT	31	$\overline{\text{INPUT PRIME}}$
14	GROUND	32	$\overline{\text{FAULT}}$
15	Not Used	33	GROUND
16	GROUND	34	In
17	CHASSIS GROUND	35	Out
18	+5V (80 mA Max.)	36	Demand

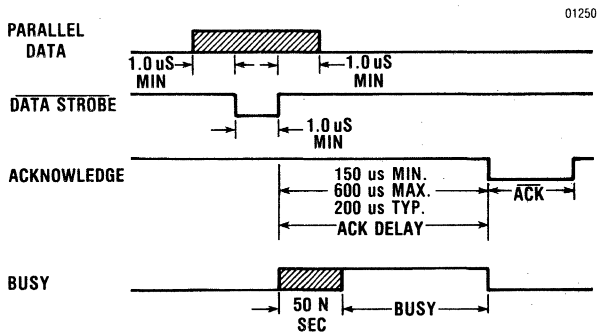


Figure 2-3 Parallel Interface Control Signals

2.6.1 DATA STROBE (PIN 1)—A jumper block (J513) on the Formatter/Controller pcb is factory set to permit a "host" system with a negative-going data strobe pulse to transfer data into the printer's electronic circuitry. (The jumper on this block may be changed from Pins 1 & 2 to Pins 2 & 3 to enable the acceptance of a host-provided, positive-going data strobe pulse.)

The pulse duration must be a minimum of 1.0 microsecond. The relationship of the leading and trailing edges of the data strobe with the data lines is described in paragraph 2.7. This signal drives TTL logic and is terminated by a 470 ohm resistor to +5 volts.

2.6.2 DATA LINES (PINS 2 THROUGH 9)—The 8 incoming data lines drive TTL logic and are terminated by a 1K ohm resistor to +5 volts. The high logic level of each data line must be settled at least 1.0 microsecond before the leading edge of the data strobe pulse and must remain at this high level until at least 1.0 microsecond after the trailing edge of the strobe pulse is completed.

2.6.3 INPUT PRIME (PIN 31)—This incoming negative-going pulse (1.0 microsecond, minimum) causes the printer logic to be reset after the trailing edge of the pulse is completed.

2.6.4 $\overline{\text{ACKNOWLEDGE}}$ (PIN 10)—The host system is sent this negative-going signal either to verify the transfer of incoming data or to signify the end of a functional operation. Once the host system has sent a code to the printer, an $\overline{\text{ACKNOWLEDGE}}$ pulse must be received by the host before a new code can be sent. The $\overline{\text{ACKNOWLEDGE}}$ pulse is sourced from a TTL logic-circuit.

2.6.5 BUSY (PIN 11)—This high-going signal is used to give a positive, DC-level, signal indication during the time the printer cannot receive data. It is also positive when either the PAPER EMPTY or FAULT status line is true.

2.6.6 DEMAND (PIN 36)—This high-going signal is the logical inversion of BUSY.

2.6.7 IN (PIN 34)—This signal is used to complete the loop (with OUT signal) for proper interface with a 730-type parallel interface. It may also be used to verify that the printer is connected.

2.6.8 OUT (PIN 35)—This signal is described in the preceding paragraph.

2.6.9 PAPER EMPTY (PIN 12)—This high level signal, when present, indicates that the printer is out of paper.

2.6.10 SELECT (PIN 13)—This high level signal indicates that the SELECT pushbutton switch has been depressed or a "select" code has been received and the printer is available for data transfer.

2.6.11 FAULT (PIN 32)—This low level signal indicates that the printer is not ready to receive data. The conditions that will cause a fault are: Paper Empty, Deselect, and Diagnostic Error.

2.7 PARALLEL DATA RECEPTION

When data is presented on the parallel data lines, a one microsecond (minimum) pulse is applied to the $\overline{\text{DATA STROBE}}$ line. The trailing edge of this pulse will enable the loading of the data lines into a tri-state latch. The $\overline{\text{DATA STROBE}}$ pulse will also clock a flip-flop which in turn sets both the BUSY flag and the RST 5.5 line. The 8085A microprocessor will then read the contents of the latch. Some time later at its convenience, the microprocessor will send an acknowledge ($\overline{\text{ACKNLG}}$) pulse. The interface is now ready to accept another byte of data which will reset the BUSY flag.

Data will be lost if either INPUT PRIME is received, or power is lost. Data may also be lost if a character is sent before an $\overline{\text{ACKNLG}}$ pulse is received by the host system.

2.8 SERIAL INTERFACE

The serial interface to the printer uses an 8251A USART for the conversion of data from serial to parallel format. The serial interface is asynchronous. The X-On/X-Off characters may optionally be sent to indicate buffer status or Reverse Channel or DTR (Data Terminal Ready).

2.9 LINE TRANSCEIVERS

The line transceivers and drivers are compatible with the new RS449 standard, however, the serial data connector is compatible with the RS-232C standard DB 25 connector. For ease of connection with a null modem, the unused pins float to the active state. Therefore, no pull-up or pull-down networks are needed to tie the unused signal to their proper state.

2.10 SERIAL DATA CONNECTOR

The printer provides an RS-232C 25-pin, male body connector with female contacts (J502). The pinout for the serial data connector is given in Table 2-2.

Table 2-2 J502 Serial Data Connector Pin-Out

PIN	SIGNAL NAME	SIGNAL DESCRIPTION
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

+V indicates a voltage greater than +3 volts.

−V indicates a voltage less than −3 volts.

Maximum input voltage may not exceed ±30 volts.

2.11 CURRENT LOOP OPTION

In the RS-232C serial format, pins 12, 13, 14, and 15 are not used. When the current loop option is installed, pins 12 through 15 are assigned the following signals:

- Pin 12—Current Loop connector host receive current loop +.
- Pin 13—Host receive current loop −.
- Pin 14—Printer Xmit Status +.
- Pin 15—Printer Xmit Status −.

The current loop is passive. The host system provides the current source. 20/60 mA current loop capability is provided by an optional plug-in pcb. The printer and buffer status is selected via the X-On/X-Off or Reverse Channel mode DIP switch (S3).

2.12 MOTOR DRIVE CIRCUITS

The printer has three motors in the printer mechanism, which are:

- Carriage Motor
- Paper Feed Motor
- Ribbon Motor

The three following paragraphs describe the drive circuits for these motors.

2.12.1 CARRIAGE MOTOR DRIVE—Table 2-3 defines the carriage motion control signals that control the DC motor drive circuitry shown in simplified form in Figure 2-3.

Table 2-3 Carriage Motion Control Signals

CONTROL	SIGNAL	DC MOTOR SHAFT ROTATION	CARRIAGE DIRECTION
FWD REV	0 0	None	
BRAKE	X		
FWD REV	0 1	CCW	Forward (from left side frame to right side frame).
BRAKE	1		Decelerate Forward
FWD REV	1 0	CW	Reverse (from right side frame to left side frame)
BRAKE	1		Decelerate Reverse
FWD REV	1 1	None	
BRAKE	X		

NOTE: 1 = ON = +5 VDC = High
0 = OFF = 0V = Low
Don't Care

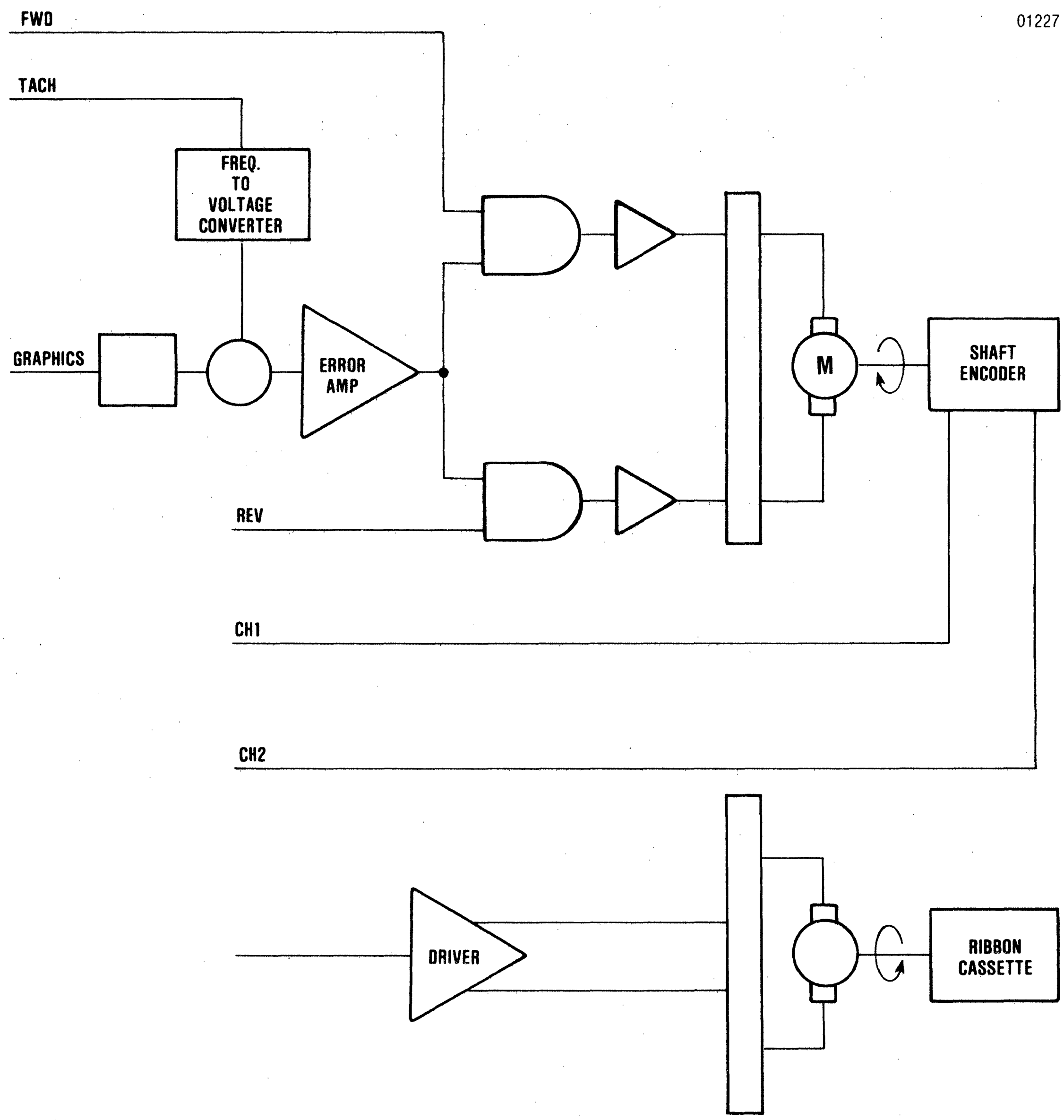


Figure 2-4 Carriage Drive and Ribbon Drive Circuits

An H-Pattern driver operates the permanent magnet DC motor. A closed loop, pulse-width modulated speed control maintains the print head velocity at one of two set speeds. A pulse-width modulation circuit is used to minimize transistor head sink requirements by operating the transistors in a saturated mode rather than in a linear mode.

To limit the acceleration motion of the carriage, a current limiting circuit is used to shut down the motor drive if the motor is activated and no tachometer (TACH) pulses are received within 40 milliseconds. Gating circuitry prevents adjacent legs of the H pattern from conducting simultaneously.

2.12.2 RIBBON MOTOR DRIVE—Ribbon drive is accomplished with a 12V DC motor, controlled by a single-stage (transistor) drive amplifier as shown in Figure 2-3. This motor will be on whenever the print head is commanded to move. A diode connected across the motor is used to protect the transistor driver.

2.12.3 PAPER FEED MOTOR DRIVE—Figure 2-4 shows a simplified schematic of the driver circuitry for the paper feed stepper motor. A pick and hold circuit is employed to get performance (high pick current) and low standby current (low hold current) with the bipolar, stepping motor used for paper motion. A chopper maintains the current level in the stepper motor. The pick signal sets a high current threshold for the chopper. During paper motion, the motor current per winding is at a high level with −HOLD at GND. When paper motion is not required (pick is not asserted), current per winding is lowered to a low level for the hold current. (−HOLD is at +5 VDC). The hold current maintains the forms registration and also substantially reduces power consumption.

Average current per winding is:

−HOLD ON = 250 mA (low current threshold)

−HOLD OFF = 850 mA (high current threshold)

Voltage required:

−35 VDC, +5 VDC

Table 2-4 shows the stepper motor excitation sequence.

Table 2-4 Stepper Motor Excitation Sequence

	01	02	03	04
CLOCKWISE ROTATION	ON	OFF	ON	OFF
	ON	OFF	OFF	ON
	OFF	ON	OFF	ON
	OFF	ON	ON	OFF

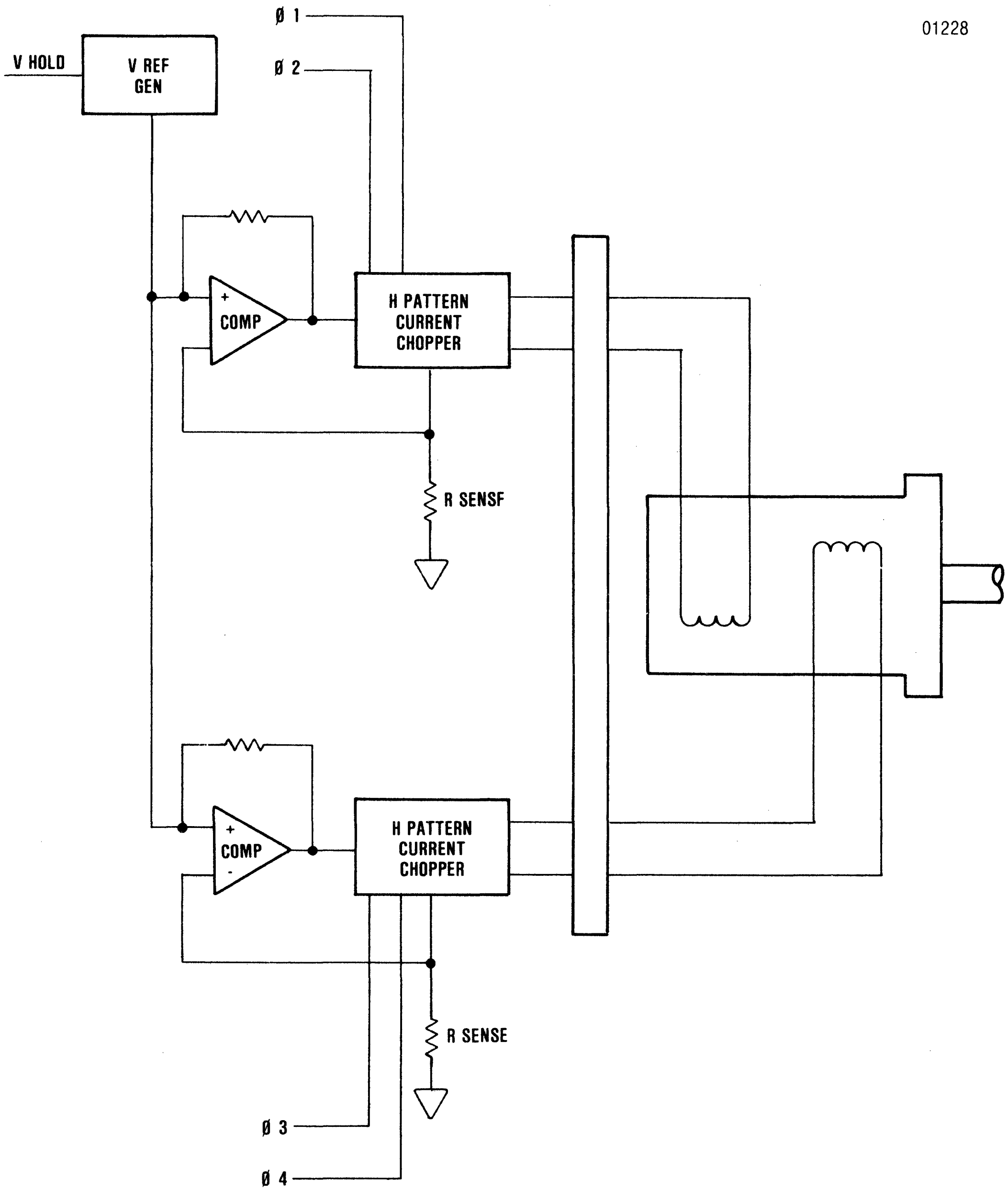


Figure 2-5 Paper Feed Stepper Motor Driver

2.13 PRINT HEAD DRIVE CIRCUIT

A recirculating current circuit is employed to drive the power transistor/solenoid circuitry that is used to fire the print wires. When a print wire is commanded to print, a 35 volt pulse is applied to the print wire solenoid. The duration of the 35 volt pulse is controlled by a timer set to 140 microseconds. After the timer times out, the energy stored in the solenoid is discharged by a diode clamp.

The main driver is shut off when the programmable one-shot times out at 370 microseconds. As protection for the main driver stage, a power zener circuit clamps the collectors of the transistor drivers to 55 volts. For additional protection, each print wire transistor driver has a 5A fuse in series with its collector.

2.14 VIDEO TIMING CIRCUIT

An optic sensor is used to detect the pattern changes generated by an optical encoder mounted on the carriage motor shaft. The dual channel optical encoder, with a nominal 90° quadrature, provides two phase-related pulse signals to the printer's 8085A microprocessor. Every other pulse edge is detected and applied directly to the RST 7.5 interrupt input on the 8085A while the signal direction, indicating the direction towards which the printhead is moving, is also made available to the microprocessor by means of the data bus.

2.14.1 TACH (−) AND TACH (+) SIGNALS—The TACH (−) and TACH (+) tachometer signals are applied to the voltage-to-frequency converter that drives the carriage motor drive circuit. The two signals are derived from the 0A pulse signal in the video timing circuit where they are buffered and phase differentiated.

2.15 PROGRAMMABLE INTERVAL TIMER CIRCUIT

The programmable interval timer circuit uses an 8254 to perform various timing functions on the printer.

Timer/counter #0 is set up in the single shot mode and is used to strobe the main print wire drivers. The pin latch is first loaded with pin fire data, the timer is fired, and the data is then presented to the pins.

- Timer/counter #1 is used as a general purpose paper motion timer. The output of this timer is connected to the RST 6.5 interrupt input pin on the 8085A microprocessor.
- Timer/counter #2 is used as the clock source for baud rate generation.

2.16 PRINTER INTERLOCK CIRCUIT

The printer interlock circuit consists basically of a magnetically actuated switch. The interlock circuit is opened when the top clear cover of the printer is lifted. This action moves the actuating magnet away from the proximity of the switch. In this condition, all carriage motion is disabled and the ALERT indicator blinks. This condition is cleared by first closing the cover and then depressing the SELECT button. No data is lost; if opening of the interlock circuit occurred in the middle of a line of print, the line of data is overprinted with the same data.

2.17 DC POWER REQUIREMENTS

The printer requires the following voltages and currents to function correctly:

Voltage	Current
+4.90 VDC to +5.10 VDC	2.0 Amps
+11.4 VDC to +12.6 VDC	0.5 Amps
−11.4 VDC to −12.6 VDC	0.25 Amps
+35.0 VDC to +42.6 VDC	3.0 Amps

These DC voltages are obtained from the power supply via a cable connected to cable connector J507. The pinout for the cable and connector is listed in Table 2-5.

Table 2-5 Power Supply Cable Connector Pin-Out

J507 PIN	SIGNAL
1	+12 VDC
2	+12 VDC RTN
3	−12 VDC
4	+5 VDC RTN
5	CHASSIS GROUND
6	+5 VDC
7	+35 VDC
8	+35 VDC RTN
9	N.C.

(N.C. = No Connection)

2.18 DATA LINK

The Model 351 printer is normally shipped with one of its PROMs programmed for unidirectional and bidirectional multipass operation. This E-PROM, a 32K (4K x 8) type 2732, is located at IC socket location U56 (refer to schematic diagram Figure A-1 sheet 2 and assembly diagram A-3 in Appendix A).

As an optional feature, this PROM may be replaced with a custom programmed E-PROM for Data Link Usage. The Data Link PROM option permits the assembly language programmer/user to operate the 351 printer in a non-standard mode of communication, enabling software modification of the following printer features and functions:

- Serial interface
- Parallel interface
- Two control panel membrane switches (F1 and F2)
- Serial buffer level
- One dip switch position
- Enabling of single-step paper motion
- Self-test printout
- Initialization
- Power-up switch settings

With the use of the Data Link PROM option, all dip switches (except the Data Link switch) can be overridden. 160 bytes of RAM are available. The user addressable locations in the Data Link PROM are located from 3000 (H) to 3FFF(H). The area from 3024(H) to 3FFF(H) may be used for programming the printer. If the user wishes to retain the multipass character set, the program area must be limited to the 256 bytes from 3800(H) to 3900(H). Refer to Appendix A in the Model 351 Users Manual for additional information on Data Link usage.

SECTION 3
MAINTENANCE

3.1 MAINTENANCE SUMMARY

This section contains information on troubleshooting, preventive maintenance, and printer marking. This information will help service personnel to repair a defective printer and to properly maintain a working printer. The section is organized as follows:

The descriptions and functions of the printer controls and indicators are contained in Appendix C.

3.2 BASIC TROUBLESHOOTING

The printer performs a number of self-diagnostic operations that are extremely useful when troubleshooting a defective printer. The results of these self-diagnostic operations are indicated through the control panel indicators and a self-test printout.

3.2.1 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** membrane switch is depressed, then all checks are retested. The audio alarm sounds when a problem is first detected.

Table 3-1 Internal Self-Test Error Indications

PROBLEM AREA CHECKED	LED INDICATORS		
	SELECT	ALERT	CUT SHEET
CRC1			BLINKING
CRC2	BLINKING		BLINKING
RAM1		BLINKING	BLINKING
RAM2	BLINKING	BLINKING	
HEAD JAM/BAD VIDEO	BLINKING		
INTERLOCK		BLINKING	
CPU	BLINKING	BLINKING	BLINKING

3.2.2 SELF-TEST PRINTOUT—The operator initiated self-test printout provides additional self-diagnostic operations.

During the self-test printout, the printer:

- Checks for no video/bad video
- Prints out the entire character set, the binary codes that indicate printer configuration, and the revision level of the printer's firmware.

To generate the self-test printout:

1. Load the printer with fanfold paper. Use 15″ paper as the lines printed are approximately 13″ long.
2. Place the forms lever in the FORMS position.
3. Place the Self-Test dip switch (S2, Section 4) on the operator control panel in the ON position.
4. Power up the printer and depress the **SELECT** membrane switch on the operator control panel.
5. The self-test printout will now be generated. On completion of the printout, a new self-test printout will be made each time that the **SELECT** switch is depressed.
6. Return the Self-Test dip switch to the OFF position after testing.

A typical self-test printout is shown in Figure 3-1. This printout is for a 351 printer with standard E-PROM firmware installed. If the firmware is modified or replaced, the self-test printout will reflect such a change. Also, note that any changes made in the printer dip switch settings will be reflected in the self-test printout.

Figure 3-2 shows the sequence of operations and events that occur within the printer during a normal self-test printout.

3.3 TROUBLESHOOTING FLOW CHARTS

Figure 3-3 is a basic troubleshooting flow chart that shows not only how a normally operating printer should function, but also shows the references to the operational steps, checks, and repairs that need to be performed on the occurrence of a malfunction.

Figures 3-4 through 3-10 provide detailed procedures for the remedy of any such malfunction.

3.4 TROUBLESHOOTING GUIDE

Table 3-2 provides a detailed listing of printer malfunctions which may occur, the probable cause, and the remedy. The remedies to the malfunctions should be performed by trained, qualified service personnel.

DIP SWITCH SETTINGS SW1 00010110 SW2 00011000 SW3 00010001 SW4 10001011 **1K17**

01240

10 CPI

```
USA !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
FRA !"£$%&'()*+,-./0123456789:;<=>?àABCDEFGHIJKLMNOPQRSTUVWXYZ°ç§^_`abcdefghijklmnopqrstuvwxyzéùè¨
UK  !"£$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}‾
GER !"#$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÜ^_`abcdefghijklmnopqrstuvwxyzäöüß
ITL !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ°é|^_ùabcdefghijklmnopqrstuvwxyzàòèì
S/F !"#$%&'()*+,-./0123456789:;<=>?éABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÅÜ_`abcdefghijklmnopqrstuvwxyzäöåü
D/N !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅÜ_`abcdefghijklmnopqrstuvwxyzæøåü
ESP !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ¡Ñ¿áé`abcdefghijklmnopqrstuvwxyzíñóú
ALT !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

12 CPI

```
USA !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
FRA !"£$%&'()*+,-./0123456789:;<=>?àABCDEFGHIJKLMNOPQRSTUVWXYZ°ç§^_`abcdefghijklmnopqrstuvwxyzéùè¨
UK  !"£$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}‾
GER !"#$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÜ^_`abcdefghijklmnopqrstuvwxyzäöüß
ITL !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ°é|^_ùabcdefghijklmnopqrstuvwxyzàòèì
S/F !"#$%&'()*+,-./0123456789:;<=>?éABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÅÜ_`abcdefghijklmnopqrstuvwxyzäöåü
D/N !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅÜ_`abcdefghijklmnopqrstuvwxyzæøåü
ESP !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ¡Ñ¿áé`abcdefghijklmnopqrstuvwxyzíñóú
ALT !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

16.5 CPI

```
USA !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
FRA !"£$%&'()*+,-./0123456789:;<=>?àABCDEFGHIJKLMNOPQRSTUVWXYZ°ç§^_`abcdefghijklmnopqrstuvwxyzéùè¨
UK  !"£$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}‾
GER !"#$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÜ^_`abcdefghijklmnopqrstuvwxyzäöüß
ITL !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ°é|^_ùabcdefghijklmnopqrstuvwxyzàòèì
S/F !"#$%&'()*+,-./0123456789:;<=>?éABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÅÜ_`abcdefghijklmnopqrstuvwxyzäöåü
D/N !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅÜ_`abcdefghijklmnopqrstuvwxyzæøåü
ESP !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ¡Ñ¿áé`abcdefghijklmnopqrstuvwxyzíñóú
ALT !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
```

PROPORTIONAL PRINTING

```
USA !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
FRA !"£$%&'()*+,-./0123456789:;<=>?àABCDEFGHIJKLMNOPQRSTUVWXYZ°ç§^_`abcdefghijklmnopqrstuvwxyzéùè¨
UK !"£$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}‾
GER !"#$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÜ^_`abcdefghijklmnopqrstuvwxyzäöüß
ITL !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ°é|^_ùabcdefghijklmnopqrstuvwxyzàòèì
S/F !"#$%&'()*+,-./0123456789:;<=>?éABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÅÜ_`abcdefghijklmnopqrstuvwxyzäöåü
D/N !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅÜ_`abcdefghijklmnopqrstuvwxyzæøåü
ESP !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ¡Ñ¿áé`abcdefghijklmnopqrstuvwxyzíñóú
```

MULTIPASS PRINTING

```
USA !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~
FRA !"£$%&'()*+,-./0123456789:;<=>?àABCDEFGHIJKLMNOPQRSTUVWXYZ°ç§^_`abcdefghijklmnopqrstuvwxyzéùè¨
UK !"£$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}‾
GER !"#$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÜ^_`abcdefghijklmnopqrstuvwxyzäöüß
ITL !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ°é|^_ùabcdefghijklmnopqrstuvwxyzàòèì
S/F !"#$%&'()*+,-./0123456789:;<=>?éABCDEFGHIJKLMNOPQRSTUVWXYZÄÖÅÜ_`abcdefghijklmnopqrstuvwxyzäöåü
D/N !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZÆØÅÜ_`abcdefghijklmnopqrstuvwxyzæøåü
ESP !"£$%&'()*+,-./0123456789:;<=>?§ABCDEFGHIJKLMNOPQRSTUVWXYZ¡Ñ¿áé`abcdefghijklmnopqrstuvwxyzíñóú
```

NOTE 1: 0 = CLOSED, 1 = OPEN
NOTE 2: ORDER OF SWITCH DISPLAY IS: 87654321

Figure 3-1 Model 351 Self-Test Printout

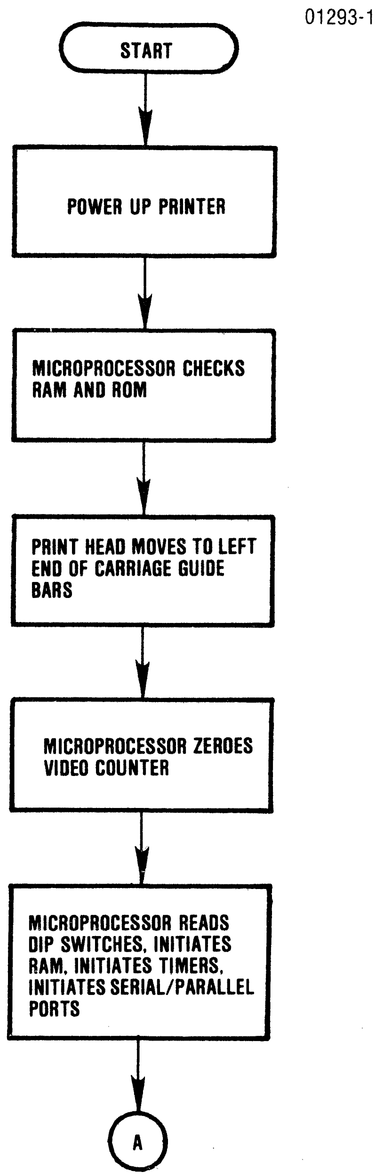


Figure 3-2 Self-Test on Power-up Flow Chart (Sheet 1 of 3)

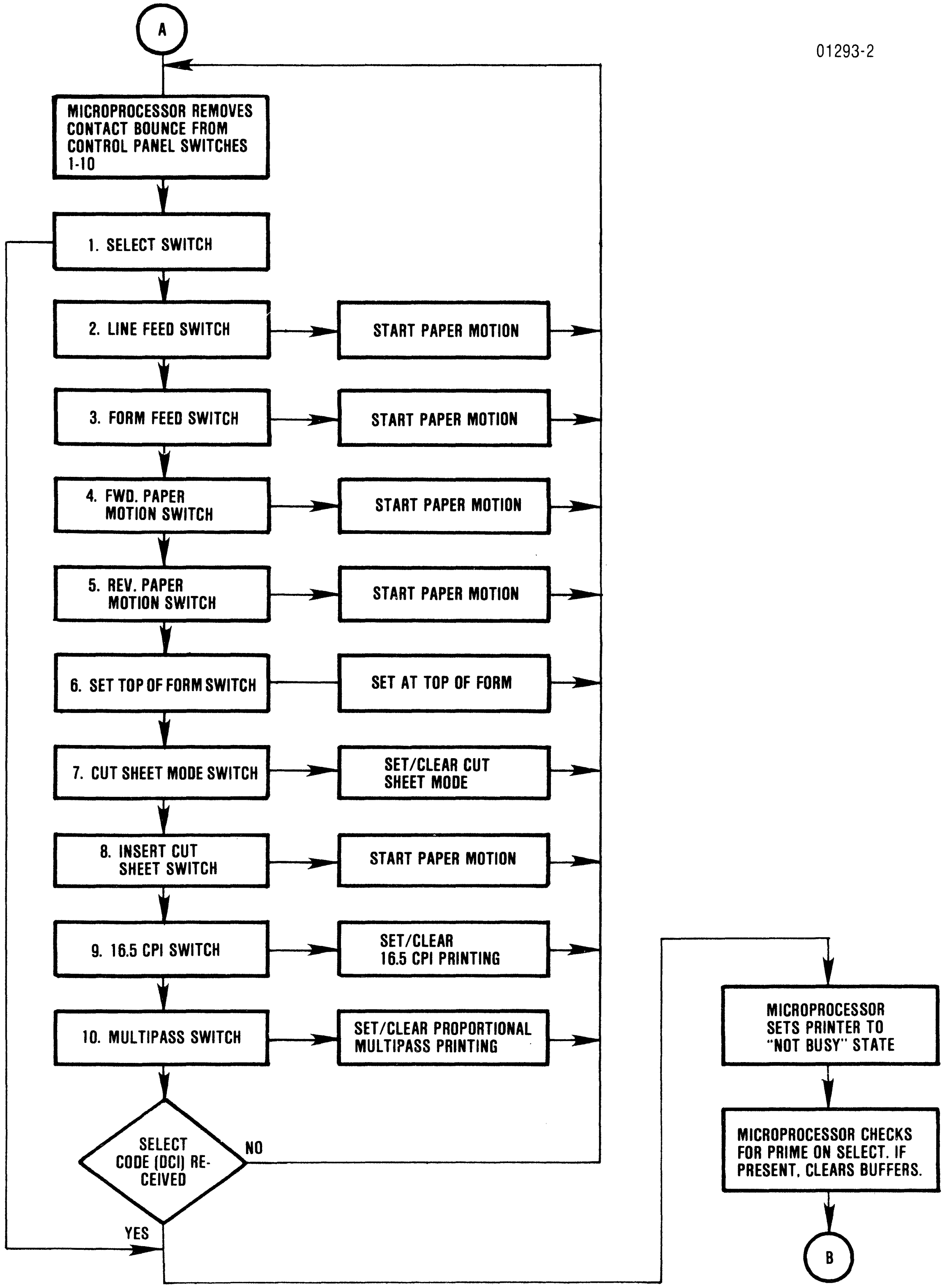


Figure 3-2 Self-Test on Power-up Flow Chart (Sheet 2 of 3)

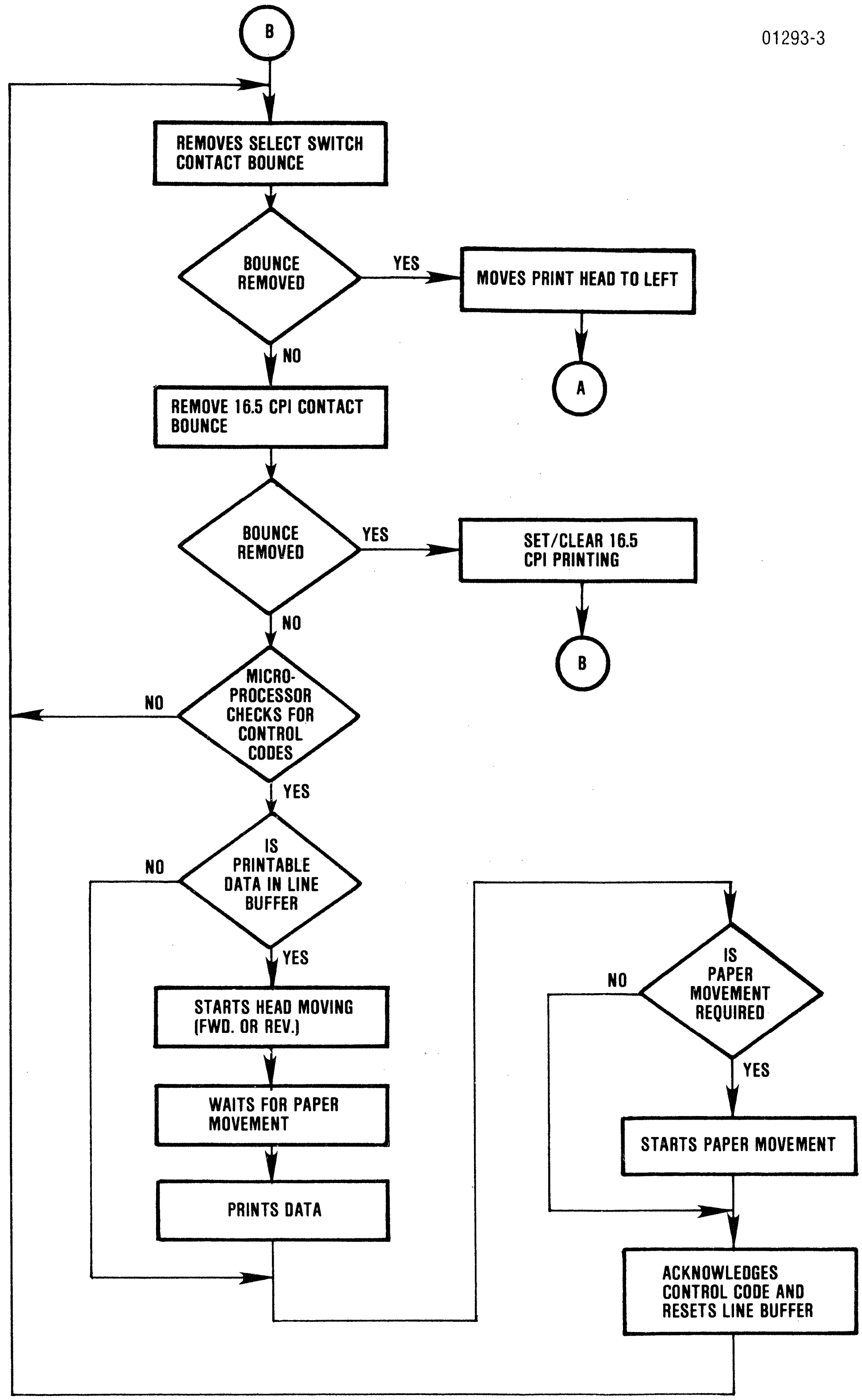


Figure 3-2 Self-Test on Power-up Flow Chart (Sheet 3 of 3)

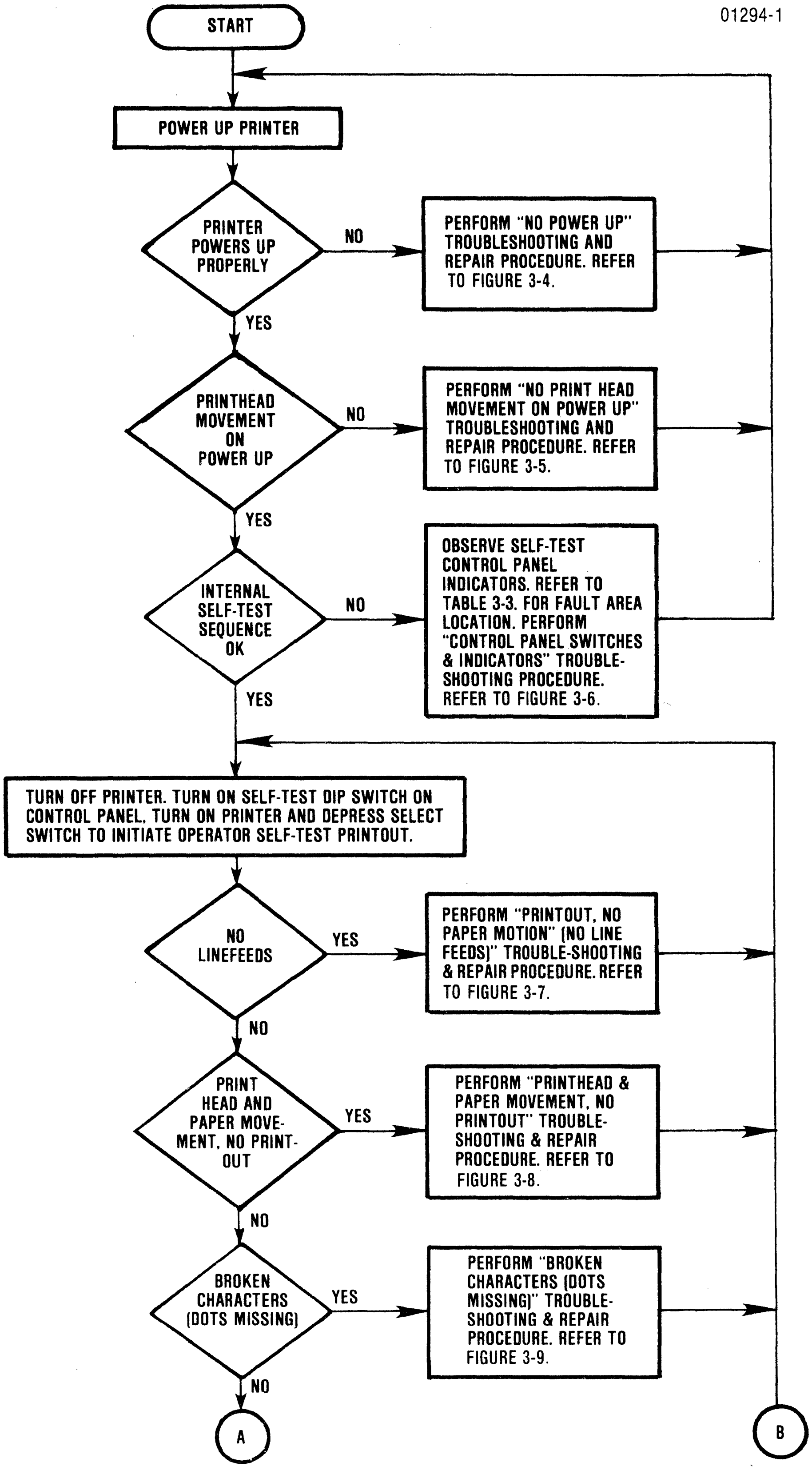


Figure 3-3 Basic Troubleshooting Flow Chart (Sheet 1 of 2)

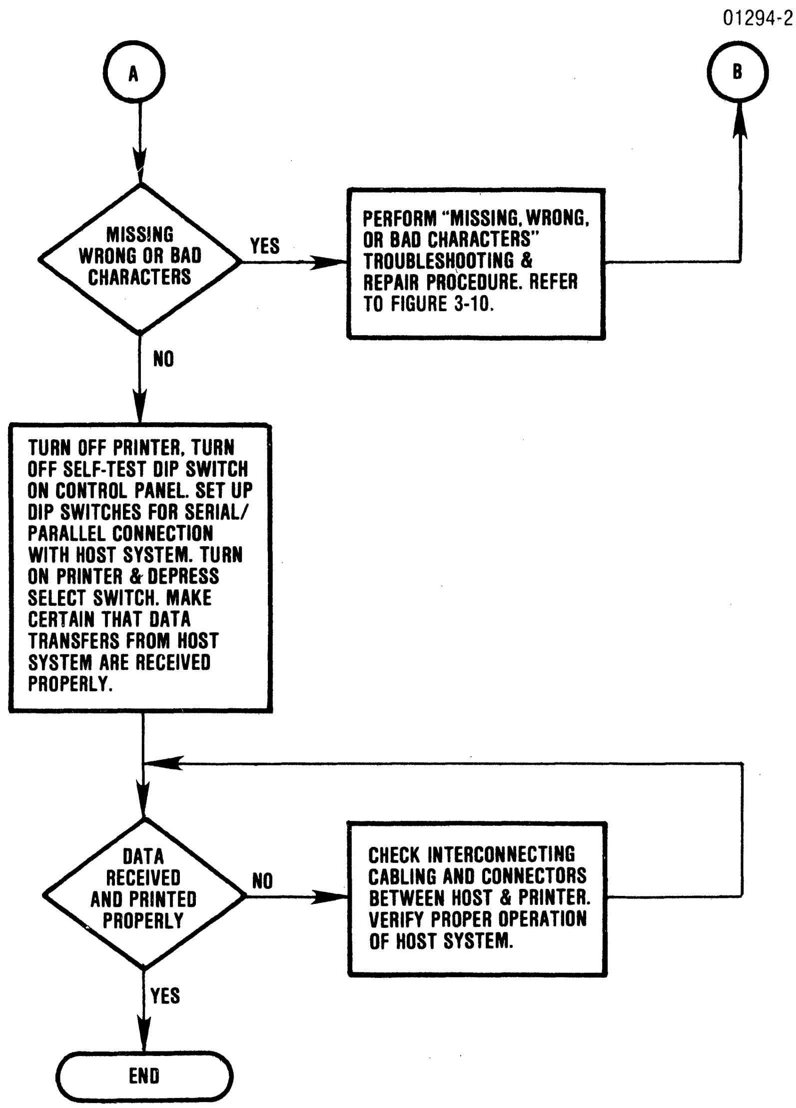
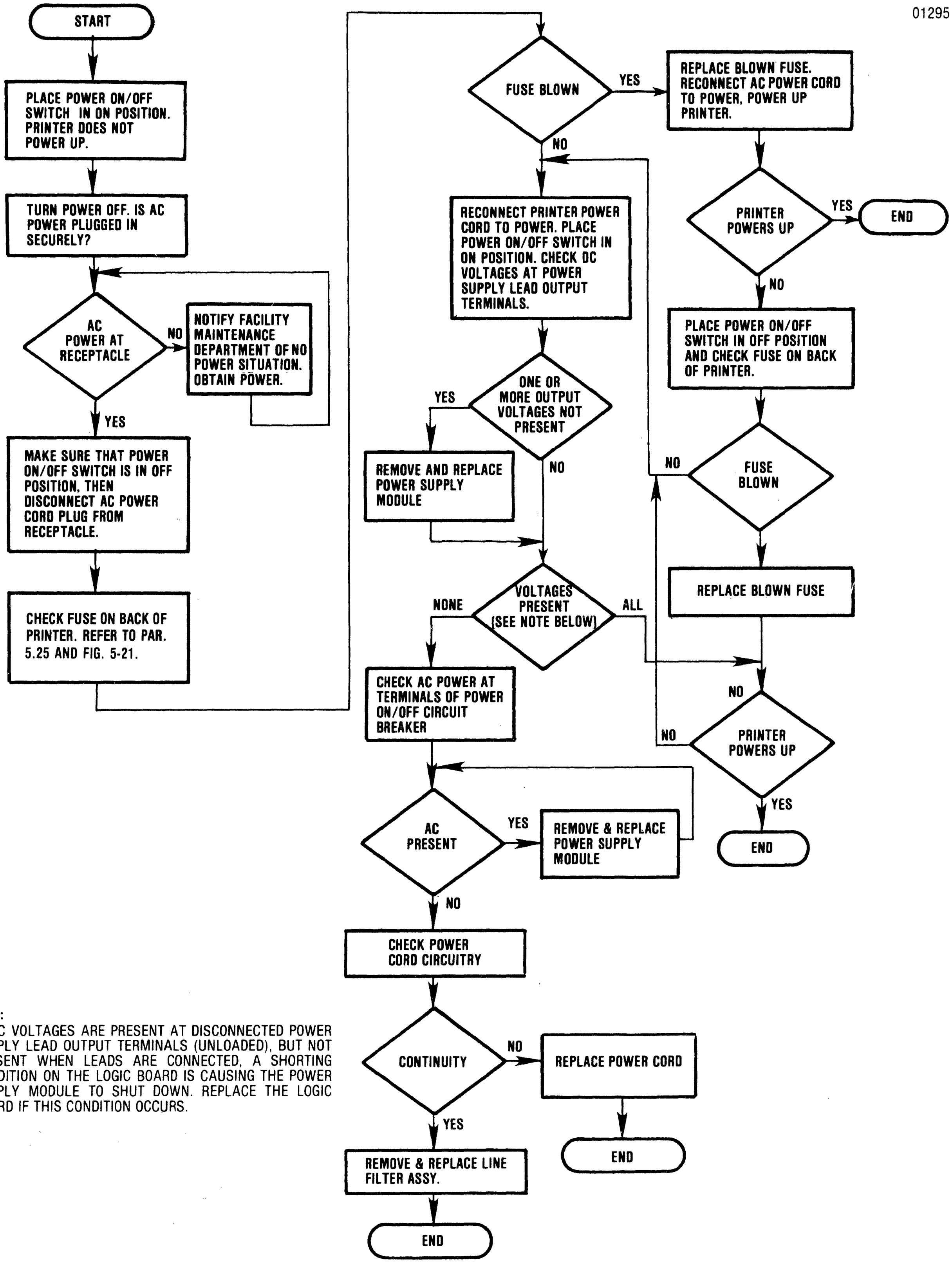


Figure 3-3 Basic Troubleshooting Flow Chart (Sheet 2 of 2)



NOTE:
IF DC VOLTAGES ARE PRESENT AT DISCONNECTED POWER SUPPLY LEAD OUTPUT TERMINALS (UNLOADED), BUT NOT PRESENT WHEN LEADS ARE CONNECTED, A SHORTING CONDITION ON THE LOGIC BOARD IS CAUSING THE POWER SUPPLY MODULE TO SHUT DOWN. REPLACE THE LOGIC BOARD IF THIS CONDITION OCCURS.

Figure 3-4 No Power-Up (Dead Printer) Troubleshooting Flow Chart

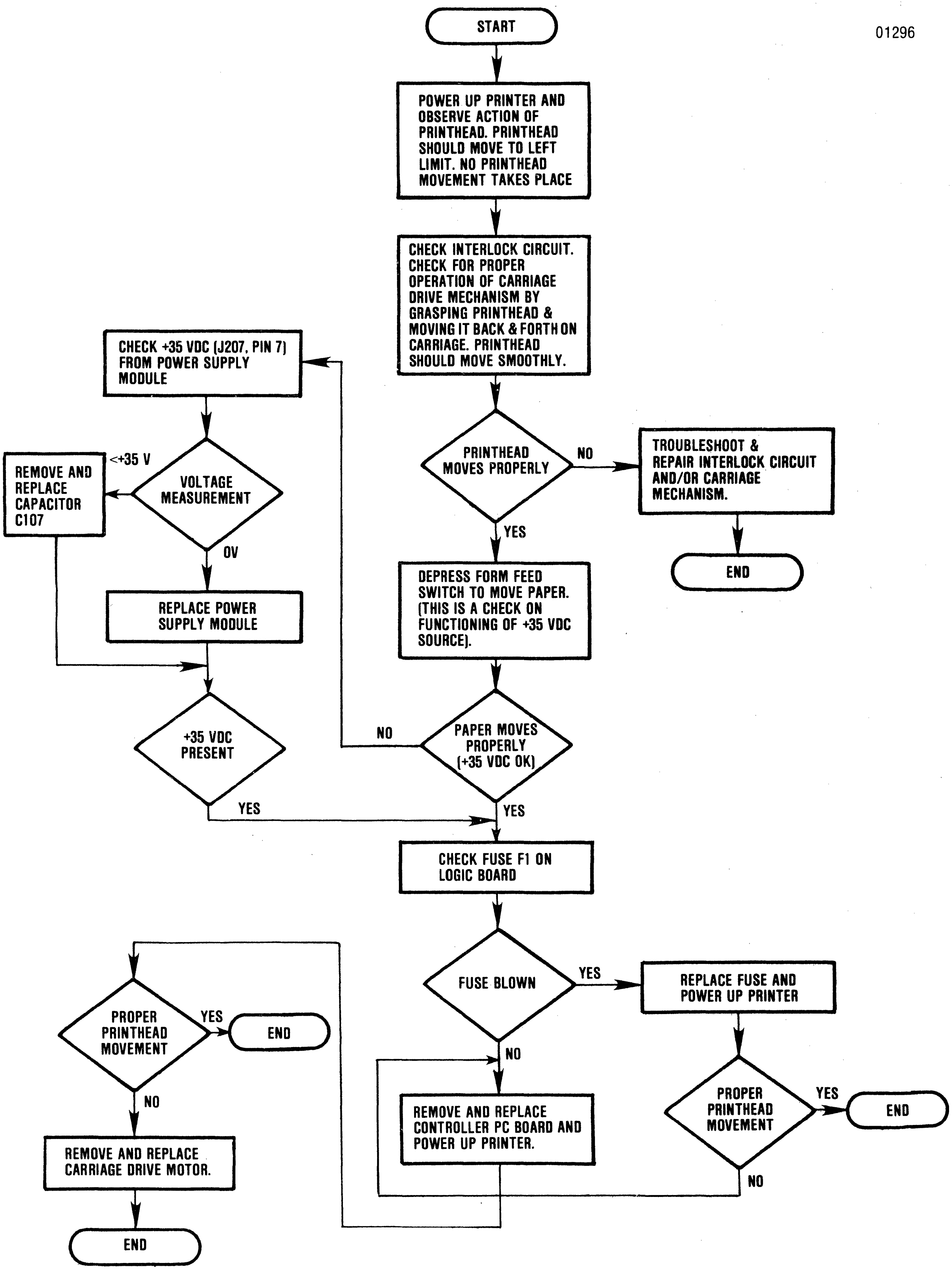


Figure 3-5 No Print Head Movement on Power-Up Troubleshooting Flow Chart

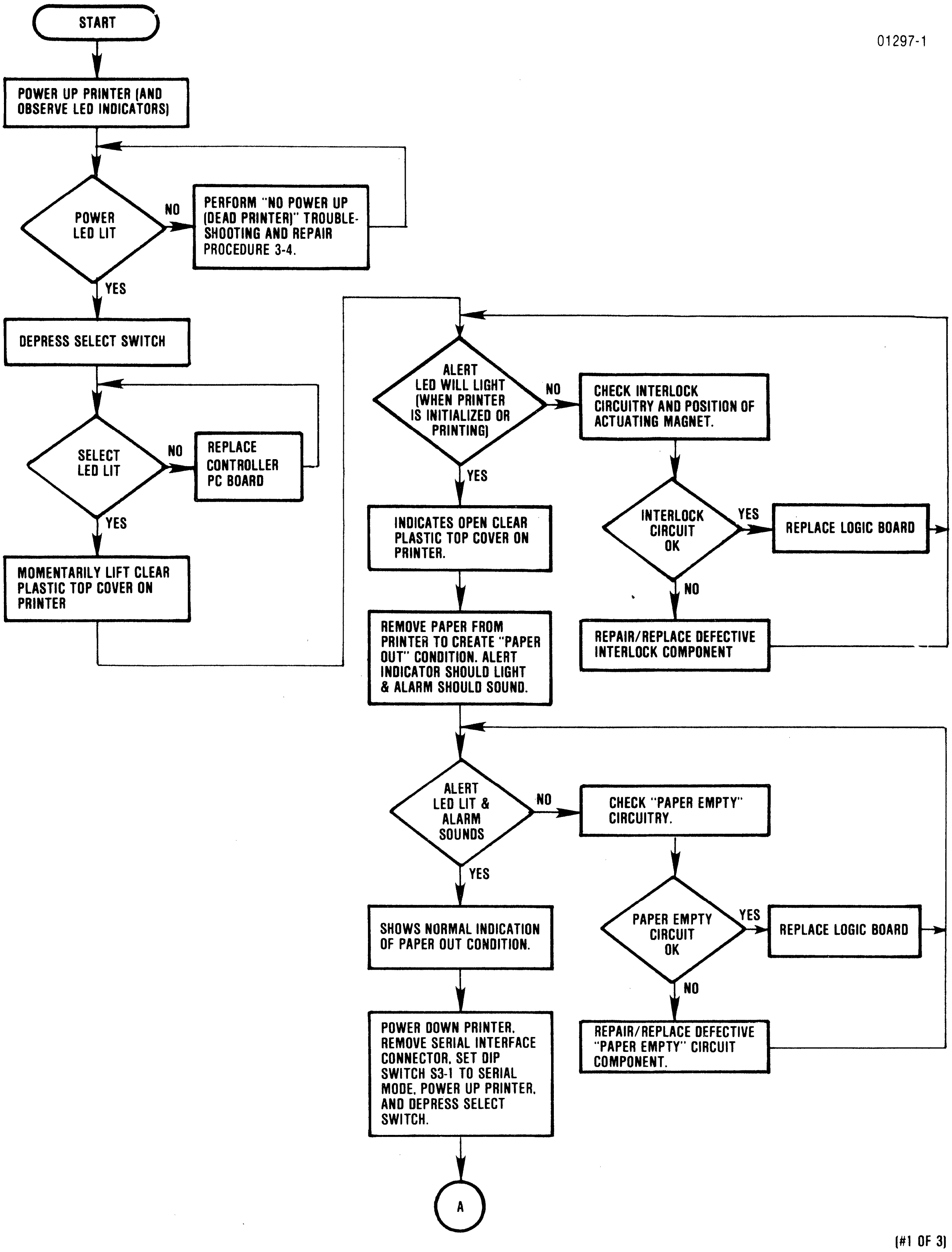


Figure 3-6 Control Panel Switches and Indicators Troubleshooting Flow Chart (Sheet 1 of 3)

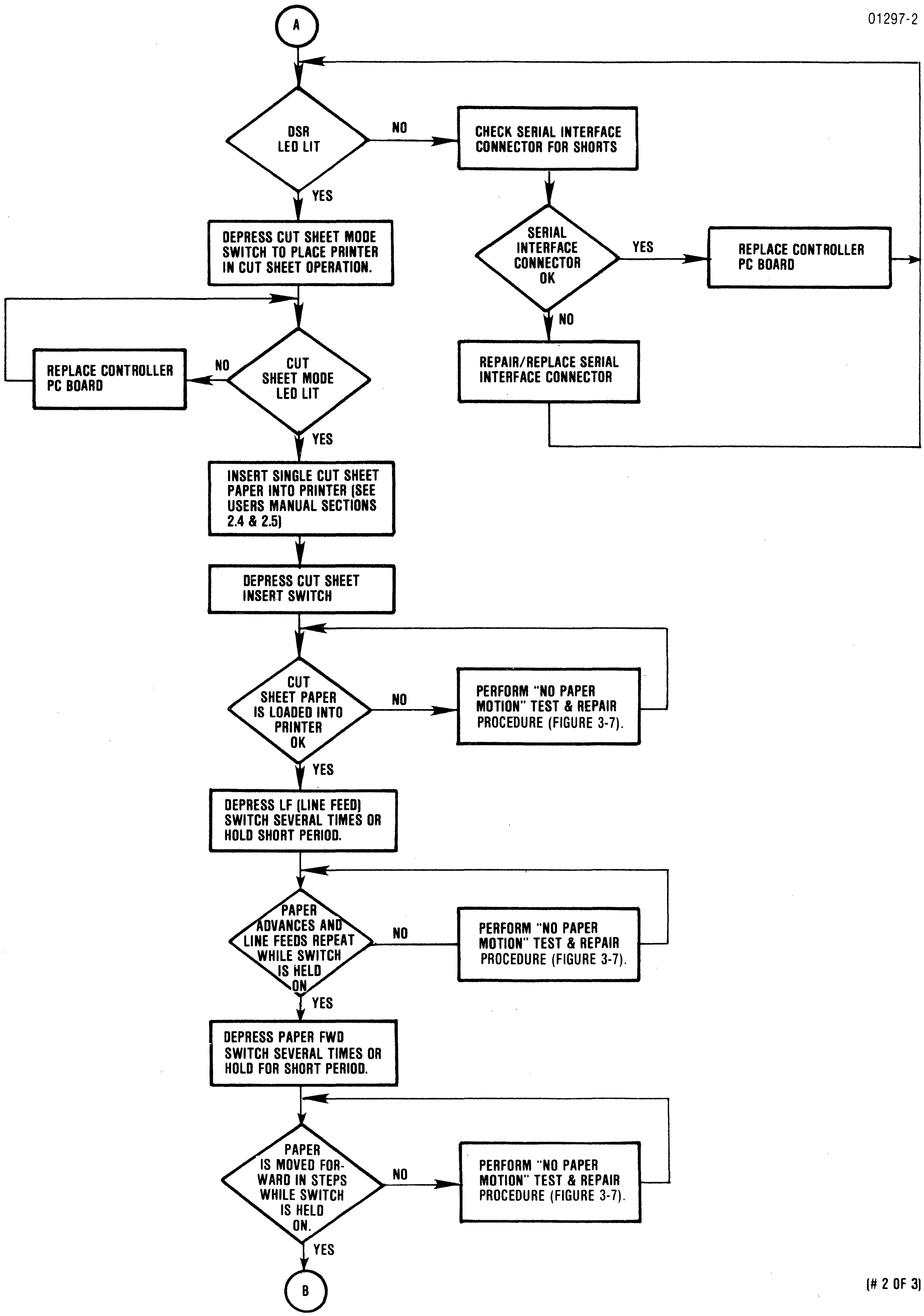


Figure 3-6 Control Panel Switches and Indicators Troubleshooting Flow Chart (Sheet 2 of 3)

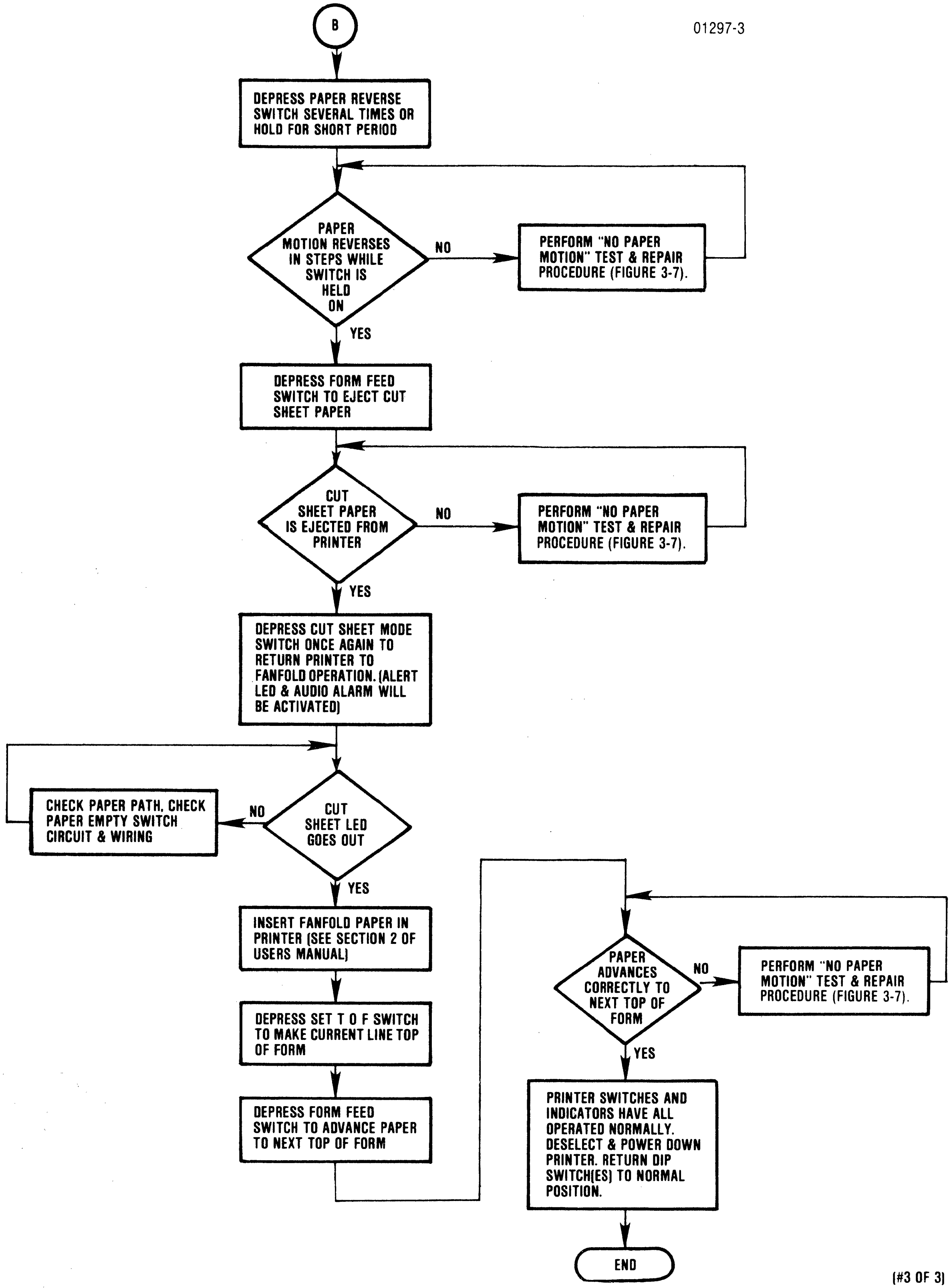


Figure 3-6 Control Panel Switches and Indicators Troubleshooting Flow Chart (Sheet 3 of 3)

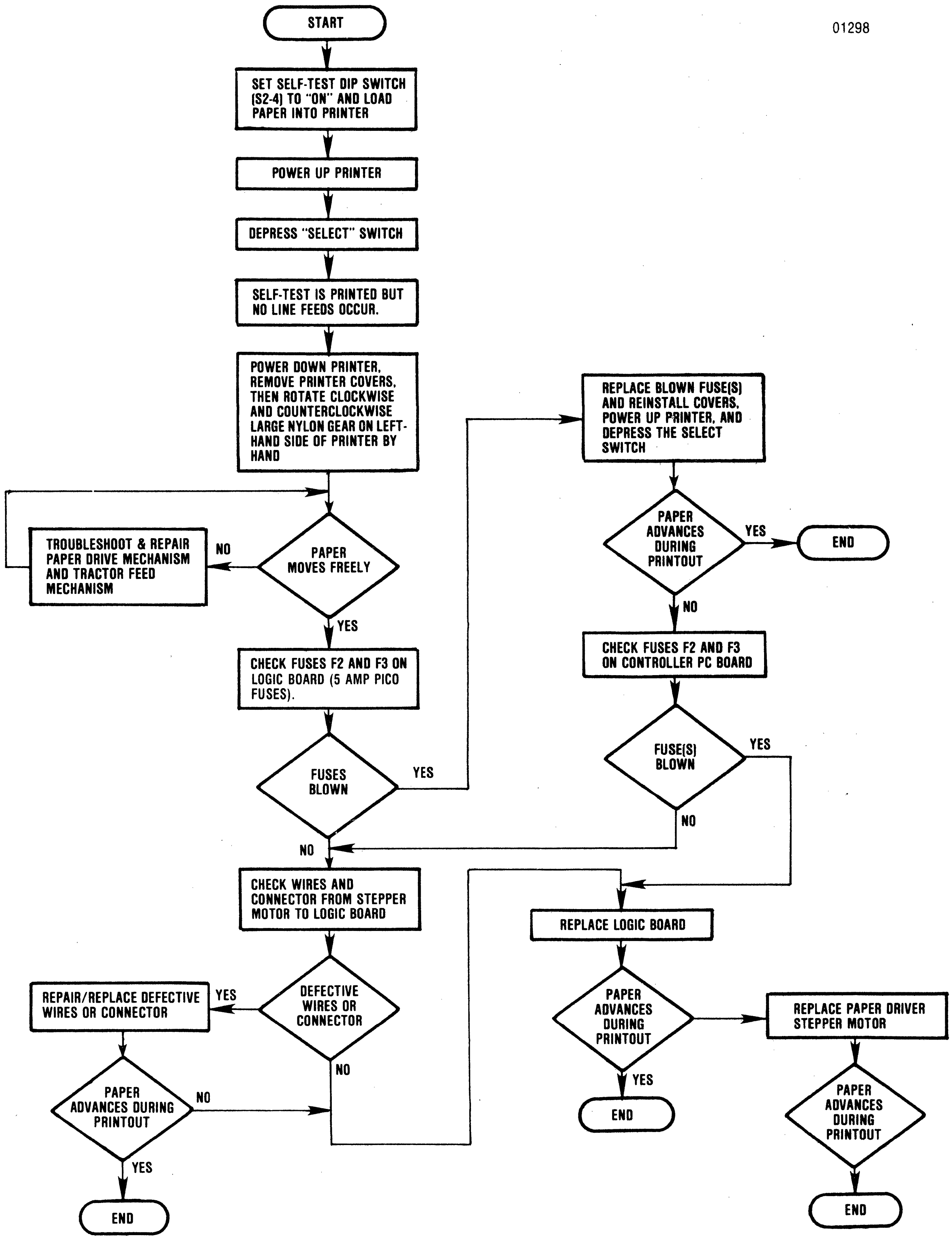


Figure 3-7 Printout, No Paper Motion (No Line Feeds) Troubleshooting Flow Chart

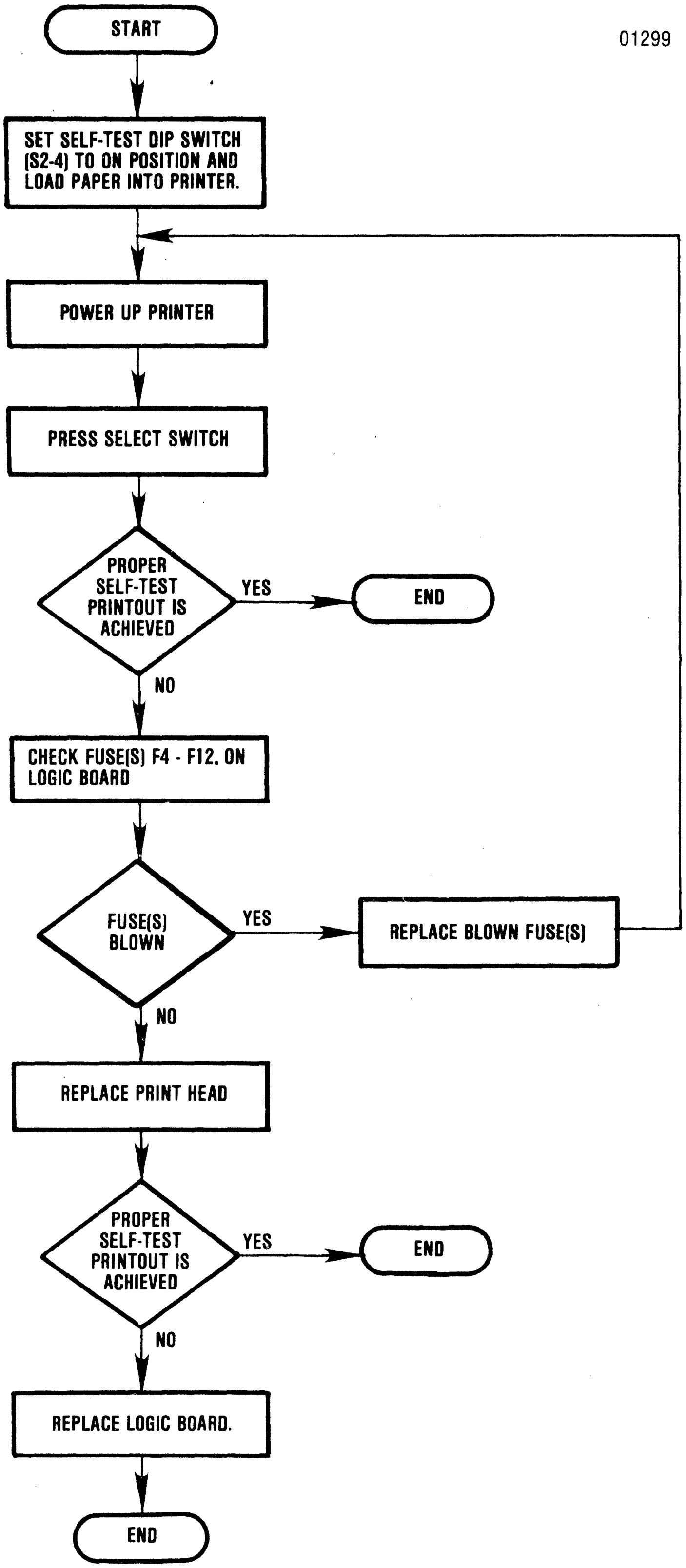


Figure 3-8 Print Head Movement, Paper Movement, No Printout Troubleshooting Flow Chart

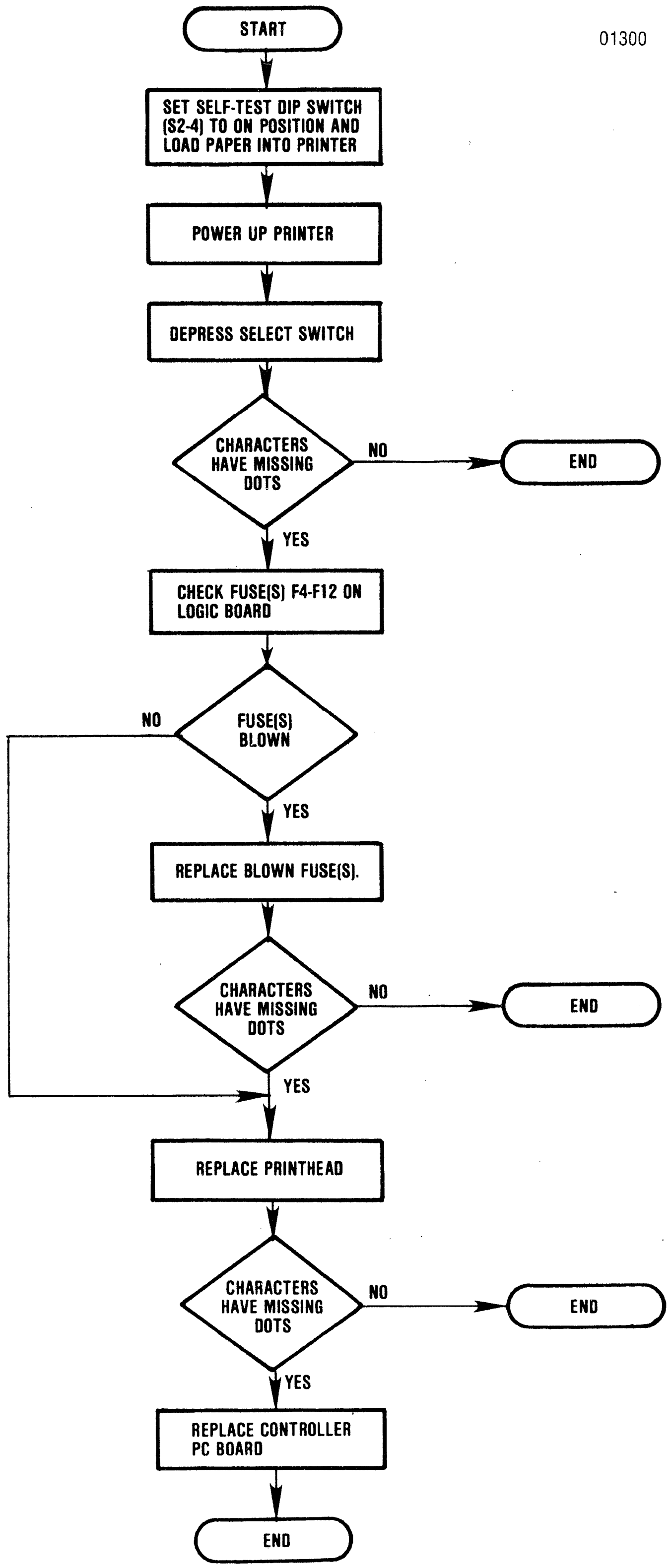


Figure 3-9 Broken Characters (Missing Dots) Troubleshooting Flow Chart

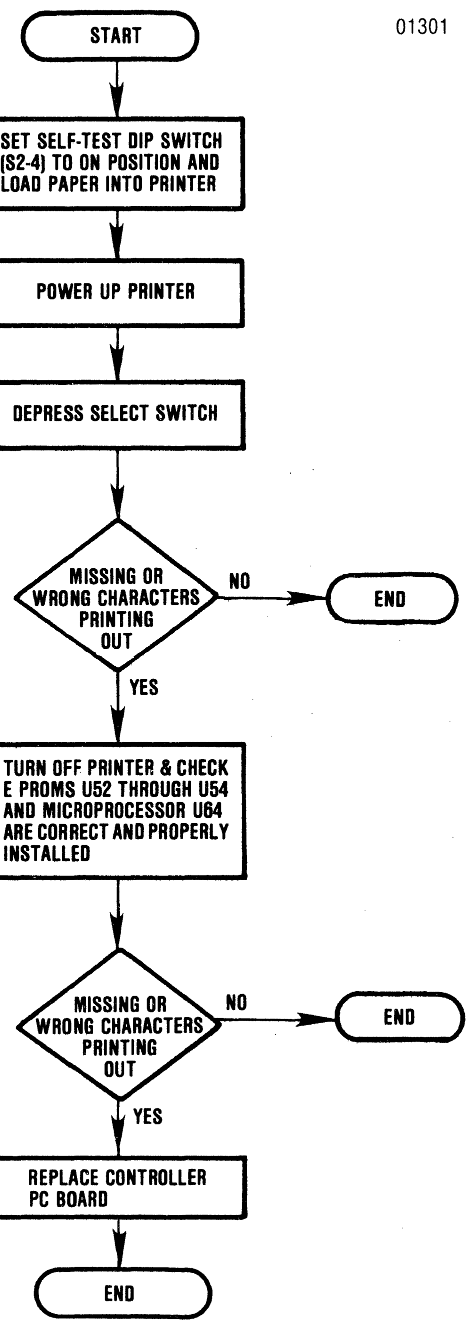


Figure 3-10 Missing or Wrong Characters Troubleshooting Flow Chart

Table 3-2 Detailed Troubleshooting Guide

MALFUNCTION	SYMPTOM	PROBABLE CAUSE	REMEDY
POWER FAILURE	Total	Defective power cord.	Replace power cord per paragraph 5.26.
		Main fuse blown.	Replace main fuse per paragraph 5.25.
		Line filter connector(s) unplugged.	Check line filter connections.
	Partial	Power supply connector(s) to Formatter/ Controller pcb unplugged.	Check power supply connections.
		Improper AC line voltage.	Ensure proper AC line voltage is proveded.
CARRIAGE DRIVE	Carriage does not move.	Cover interlock switch enabled.	Close top clear cover.
		Loose connector from carriage drive motor to Formatter/Controller pcb.	Check drive motor-Formatter/Controller connection.
		Defective carriage drive motor.	Replace carriage drive motor per paragraph 5.15.
		Defective Formatter/Controller pcb.	Replace Formatter/Controller pcb per paragraph 5.30.
		Forms lever in LOAD position.	Ensure forms lever is in SHEET or FORM position.
		Blown pico fuse F1 on Formatter/Controller pcb.	Replace pico fuse F1 per paragraph 5.28
	Carriage moves forward, but does not return.	Defective Formatter/Controller pcb.	Replace Formatter/Controller pcb per paragraph 5.30.
		Missing either video signal VIDEO 1 or VIDEO 2.	Check optic sensor assembly adjustment per paragraph 4.7
	Erractic carriage movement.	Improper carriage drive belt tension.	Check drive belt tension per paragraph 4.2.
		Dirty carriage guide bars.	Clean carriage guide bars using a soft clean cloth.
		Defective idle pulley, drive pulley or belt.	Check idle pulley, drive pulley and belt, replace if defective.
		Incorrect video adjustment.	Check optic sensor assembly adjustment per paragraph 4.7.

Table 3-2 Detailed Troubleshooting Guide (Cont.)

MALFUNCTION	SYMPTOM	PROBABLE CAUSE	REMEDY
CARRIAGE DRIVE FAILURE	Carriage sticks or binds.	Improper carriage drive belt tension.	Check carriage drive belt tension per paragraph 4.2.
		Print head too close or contacting forms.	Adjust print head penetration using the head adjustment lever.
PAPER MOTION FAILURE	Fanfold or cut sheet forms do not advance.	Blown pico fuse(s) F2 or F3 on Formatter/ Controller pcb.	Replace pico fuses F2 or F3 per paragraph 5.28.
		Loose connector from paper drive stepper motor to Formatter/Controller pcb.	Check stepper motor-Formatter/Controller connections.
		Defective Formatter/Controller pcb.	Replace Formatter/Controller pcb per paragraph 5.30.
	Cut sheet forms do not advance.	Printer is not in cut sheet mode.	Press CUT SHEET MODE switch on the control panel.
		Forms lever not in SHEET position.	Place the forms lever in the SHEET position.
	Paper skew or jam.	Print head too close to forms.	Adjust print head penetration using the head adjustment lever.
		Improper paper drive belt adjustment.	Check paper drive belt tension per paragraph 4.5.
		Improper forms alignment on tractor feed unit. (Fanfold forms only)	Ensure fanfold forms are properly installed. (Refer to Section 2, Paper Loading, Model 351 Users Manual)
RIBBON FEED FAILURE	No ribbon feed.	Ribbon twisted or jammed.	Check ribbon and remove jam.
		Ribbon cassette not seated properly.	Ensure cassette is installed properly. (Refer to Section 2, Ribbon Replacement, Model 351 Users Manual)
		Loose connector from ribbon drive motor to Formatter/Controller pcb.	Check ribbon drive motor-Formatter/Controller connection.
		Defective ribbon drive motor.	Replace ribbon drive motor per paragraph 5.18.

Table 3-2 Detailed Troubleshooting Guide (Cont.)

MALFUNCTION	SYMPTOM	PROBABLE CAUSE	REMEDY
IMPROPER PRINTING	Print head moves, but no print or erratic print.	Loose print head fingerboard connector.	Ensure print head fingerboard connector is seated properly.
		Loose head flex cable connection.	Ensure head flex cable is properly connected to Head Adapter pcb and Print Controller pcb.
		Improper adjustment of optic sensor/encoder timing disc.	Ensure optic sensor/encoder timing disc is properly adjusted per paragraph 4.7.
		Incorrect print head penetration.	Adjust head adjustment lever to required print position.
		Defective Formatter/Controller pcb.	Replace Formatter/Controller pcb per paragraph 5.30.
		Defective print head assembly.	Replace print head assembly per paragraph 5.7.
	Missing dots, all characters.	Loose print head fingerboard connector.	Ensure print head fingerboard connector is seated properly.
		Loose head flex cable connection.	Ensure head flex cable is properly connected to Head Adapter pcb and Formatter/Controller pcb.
		Improper adjustment of optic sensor/encoder timing disc	Ensure optic sensor/encoder timing disc is properly adjusted per paragraph 4.7.
		Incorrect print head penetration.	Adjust head adjustment lever to required print position.
		Blown pico fuse(s) F4-F12 on Formatter/ Controller pcb.	Replace pico fuse(s) F4-F12 per paragraph 5.28.
		Defective Formatter/Controller pcb.	Replace Formatter/Controller pcb per paragraph 5.30.
		Defective print head assembly.	Replace print head assembly per paragraph 5.7.
	Missing dots, certain characters only.	Defective character generator chip.	Replace Formatter/Controller pcb per paragraph 5.30.
	Line across page.	Incorrect print head penetration.	Adjust head adjustment lever to required print position.
		Defective head flex cable.	Replace head flex cable per paragraph 5.8.
		Defective print head assembly.	Replace print head assembly per paragraph 5.7.

3.5 PREVENTIVE MAINTENANCE

NOTE

The Model 351 is basically a maintenance free printer. No oiling, greasing or other lubrication is required. Occasionally, the printer should be inspected and cleaned as described below.

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

Table 3-3
Preventive Maintenance

ASSEMBLY	MAINTENANCE
Covers	Clean all cover assemblies using a mild detergent and a lint free cloth.
Internal Inspection	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 and Carriage	After removing ribbon, use a light bristle brush to carefully remove the dust and residue from the print head and carriage assembly.
Platen Assembly	Clean platen assembly using a mild detergent.

Occasionally, during paper loading or ribbon replacement, inspect the printer for a build up of lint or foreign material. If a build up of material is evident, clean the area with a lint free cloth.

Table 3-3 below lists the maintenance occasionally required on certain areas of the printer. This maintenance may be required more or less frequently, depending on the printer application and operating environment.

3.6 PRINTER MARKINGS

Identification markings on the underside of the base cover and on each pcb identify components that are peculiar to your printer. The following paragraphs provide a detailed explanation of the markings. The information that is marked should be relayed to service personnel whenever you call for field service.

3.6.1 PRINTER NAMEPLATE—The nameplate is located underneath the printer, on the bottom cover. Figure 3-11 illustrates the nameplate and the information it contains.

In the event of a field conversion of the operating voltage, amperage, and frequency, it is recommended that the information on the plate be changed to reflect the conversion.

3.6.2 PRINTED CIRCUIT BOARD MARKINGS—The Formatter/Controller pcb, located under the print mechanism, is marked with its part number, dash configuration, and revision level. Also located on the pcb are two labels—one for serial number and the other for assembly configuration code. Figure 3-12 illustrates the pcb and the identification markings.

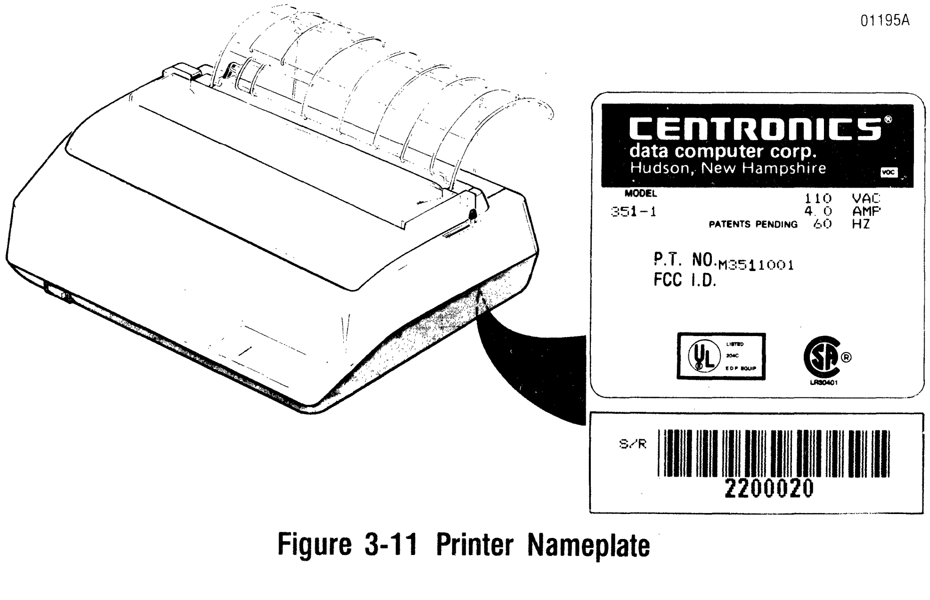


Figure 3-11 Printer Nameplate

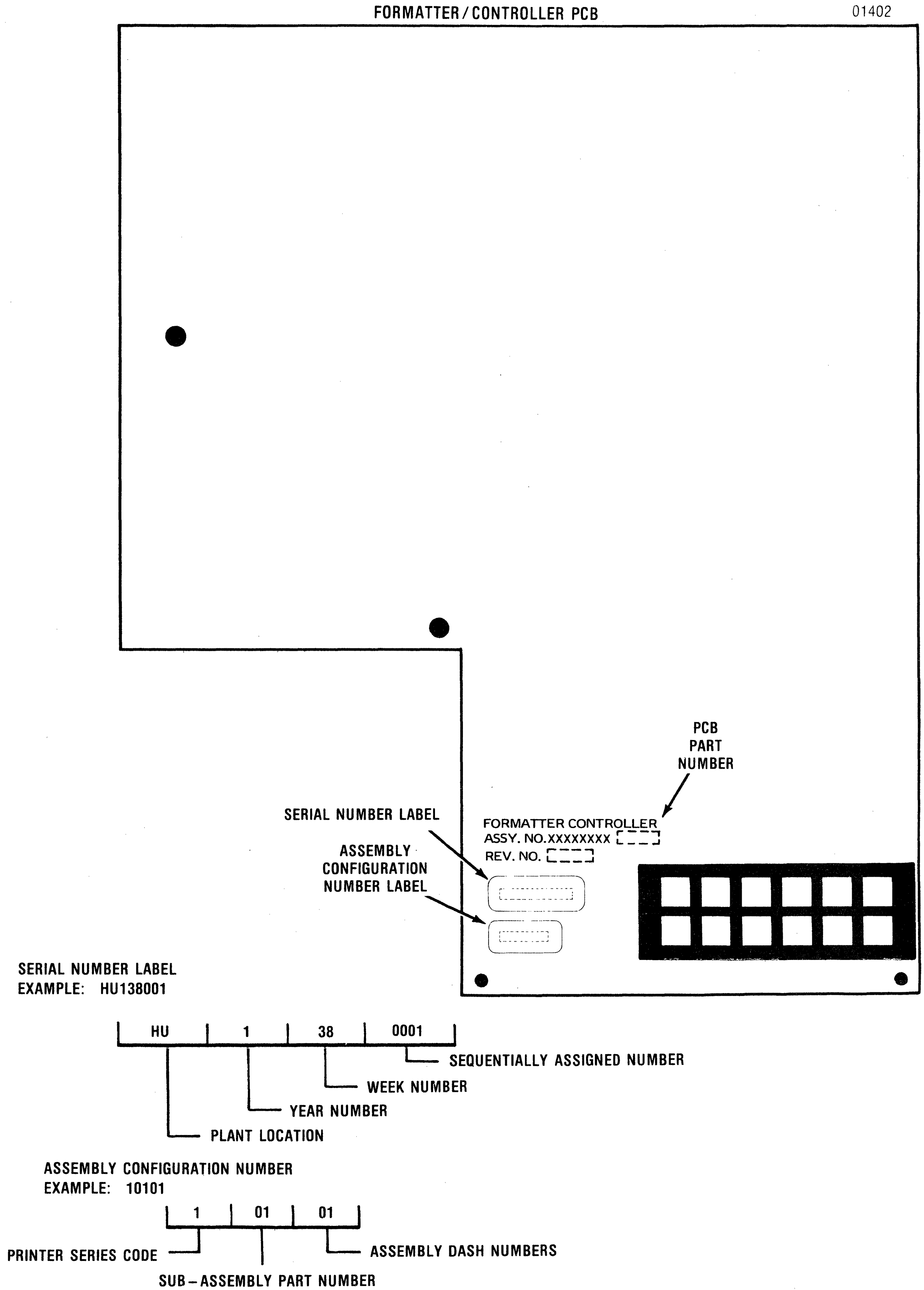


Figure 3-12 Printed Circuit Board Markings

SECTION 4
ADJUSTMENTS

4.1 ADJUSTMENT SUMMARY

Adjustment procedures should be performed whenever an affected assembly is replaced or to correct an improper/marginal printer operation. Adjustment parameters should be checked before performing the procedure to ensure it is necessary. This section contains the following adjustment procedures.

4.2 Carriage Drive Belt
4.3 Carriage Drive Motor Belt
4.4 Tractor Gear Backlash
4.5 Paper Drive Belt
4.6 Paper Empty Switch
4.7 Optical Sensor and Encoder/Timing Disc
4.8 Horizontal Offset

After performing the adjustment procedure a self-test printout should be generated to ensure proper printer operation. Refer to paragraph 3.6 for the self-test procedure.

NOTE

Removing the top cover enables the cover interlock switch and disables the printer. To operate the printer with the cover removed place a small magnet against the interlock switch (refer to Figure 5-15). If the printer remains inoperative reverse the polarity of the magnet against the switch.

4.2 CARRIAGE DRIVE BELT

The carriage drive belt tension is adjusted for smooth starts and stops of the carriage assembly. To adjust the belt refer to Figure 4-1 and perform the following steps:

1. Remove the printer covers as described in paragraph 5.2.
2. Position the print head/carriage assembly at the left margin.
3. Using a flat blade screwdriver adjust the belt tension by turning clockwise (tighten) or counterclockwise (loosen) the two adjusting screws on the idle pulley assembly so the belt is taut and the carriage moves smoothly from side to side.

NOTE

Factory adjustment calls for the belt to deflect 8 mm (0.31 in) to 9 mm (0.35 in) when a 300 gram (11 oz) load is applied at the center of the belt.

4. Disable the cover interlock switch and generate a self-test printout to ensure proper printer operation.
5. Replace the printer covers.

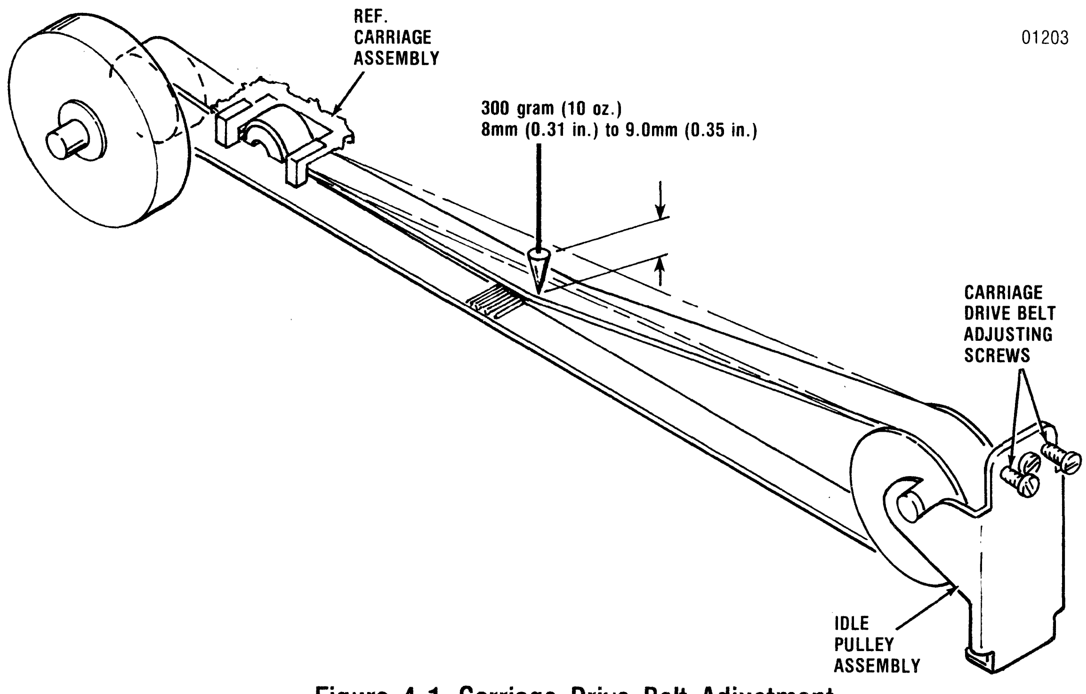


Figure 4-1 Carriage Drive Belt Adjustment

4.3 CARRIAGE DRIVE MOTOR BELT

The carriage drive motor belt tension is adjusted so the carriage starts and stops evenly as the carriage drive motor is turned on and off. To adjust the belt refer to Figure 4-2 and perform the following steps:

1. Remove the printer covers as described in paragraph 5.2.
2. Remove the ribbon cassette per steps 3 through 8 of paragraph 5.6.
3. Place the forms lever in the **SHEET** or **FORMS** position.
4. Move the print head/carriage assembly to the center of the printer.
5. Using a Phillips head screwdriver, loosen the three screws mounting the carriage drive motor and move the motor left or right so the belt is taut and tracks properly and the carriage moves smoothly from side to side.

NOTE

Factory adjustment calls for the belt to deflect 2.5 mm (0.09 in) to 4.5 mm (0.17 in) when a 300 gram (11 oz) load is applied at the center of the belt.

6. Tighten the three screws mounting the carriage drive motor.
7. Replace the ribbon cassette.
8. Disable the cover interlock switch and generate a self-test printout to ensure proper printer operation.
9. Check the self-test printout for horizontal offset of characters. If characters are offset, adjust per paragraph 4.8.
10. Replace the printer covers.

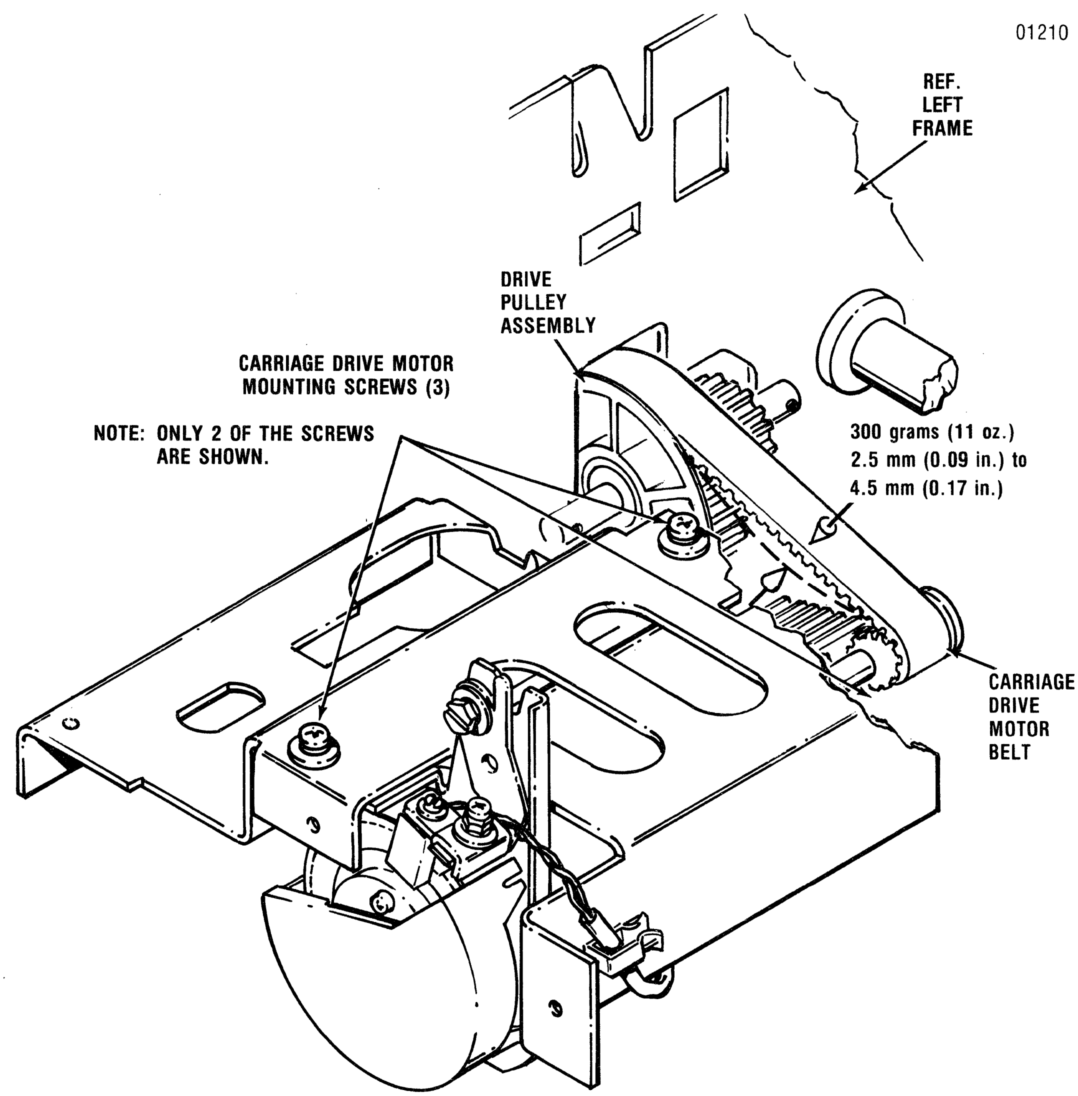


Figure 4-2 Carriage Drive Motor Belt Adjustment

4.4 TRACTOR GEAR BACKLASH

> **NOTE**
> After adjusting the tractor gear backlash (paragraph 4.4), the paper drive belt adjustment (paragraph 4.5) must be performed to ensure proper operation of the paper drive mechanism.

The backlash between the paper drive gear and tractor gear is adjusted to provide a positive drive between the paper drive stepper motor and tractor feed assembly. To adjust the backlash of the tractor gear, refer to Figure 4-3 and perform the following steps:

1. Remove the printer covers as described in paragraph 5.2.

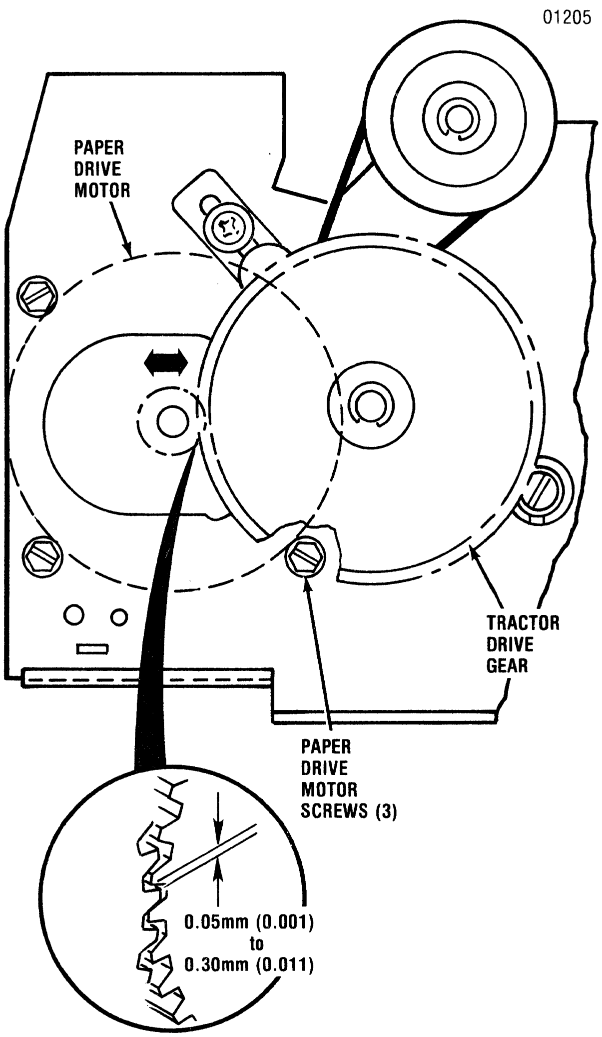


Figure 4-3 Tractor Gear Backlash Adjustment

2. Using a Phillips head screwdriver loosen the screw mounting the paper drive belt tension roller to the left frame.
3. Using a 7 mm wrench loosen the three hex head screws mounting the paper drive stepper motor to the left frame.
4. Move the paper drive stepper motor to the front or back so there is a minimal backlash between the paper drive gear and tractor drive gear.

> **NOTE**
> Factory adjustment calls for 0.05 mm (0.001 in) to 0.30 mm (0.011 in) backlash for one rotation of the tractor drive gear. Check the backlash at three points, approximately 120° apart, for one rotation of the tractor gear.

5. Tighten the three hex head screws mounting the paper drive stepper motor to the left frame.
6. Perform the paper drive belt adjustment per paragraph 4.5.

4.5 PAPER DRIVE BELT

The paper drive belt tension is adjusted to provide a positive drive between the paper drive stepper motor and tractor feed assembly. To adjust the belt refer to Figure 4-4 and perform the following steps:

1. Remove the printer covers as described in paragraph 5.2.
2. Using a Phillips head screwdriver, loosen the screw mounting the tension roller to the left frame.
3. At a point equidistant from the paper feed motor pulley and paper feed pulley adjust the belt tension by pushing down on the belt with the tension roller until the belt is taut.

> **NOTE**
> Factory adjustment calls for a 500 gram (17.5 oz) load to be applied at the center of the belt using the tension roller.

4. Tighten the Phillips head screw mounting the tension roller.
5. Disable the cover interlock switch and generate a self-test printout to ensure proper printer operation.
6. Replace the printer covers.

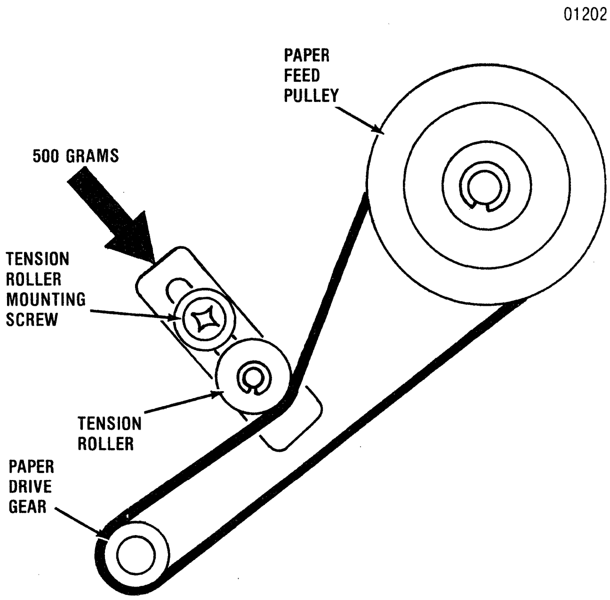


Figure 4-4 Paper Drive Belt Adjustment

4.6 PAPER EMPTY SWITCH

The paper empty switch arm is adjusted to ensure proper contact with the paper as the paper moves through the printer. To adjust the paper empty switch arm, refer to Figure 4-5 and perform the following steps:

1. Remove the printer covers as described in paragraph 5.2.
2. The paper empty switch arm on the left pin feed tractor should measure 2.3 mm (0.09 in) to 4.0 mm (0.15 in) above the surface of the tractor assembly. If the arm does not meet these parameters, adjust as described in steps 3 and 4.
3. Loosen the bottom screw attaching the paper empty switch to the right tractor assembly.
4. Move the paper empty switch up or down so the distance between the tractor surface and paper empty switch arm is 2.3 mm (0.09 in) to 4.0 mm (0.16 in).
5. Generate a self-test printout to ensure the printer is operating properly.
6. Replace the rear cover.

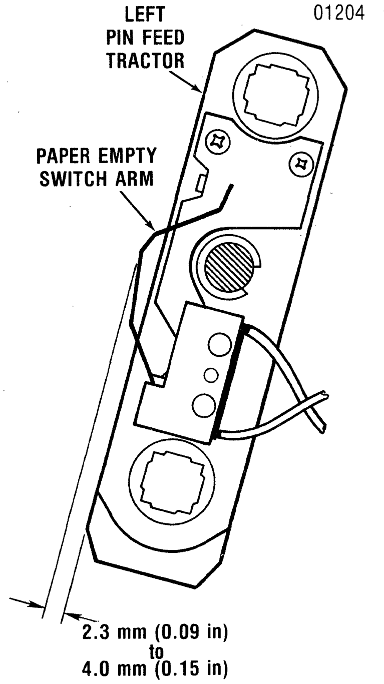


Figure 4-5 Paper Empty Switch Adjustment

4.7 OPTICAL SENSOR AND ENCODER/ TIMING DISC

The optical sensor and encoder/timing disc are adjusted both mechanically and electrically to provide the correct video signals to the print controller circuitry. To adjust the sensor and disc, refer to Figure 4-6 and 4-7 and perform the following steps:

1. Tilt the printer mechanism as described in paragraph 5.10.1.
2. Remove the ribbon cassette as described in steps 3 through 8 of paragraph 5.6.
3. Disable the cover interlock switch by placing a small magnet against the switch. Refer to paragraph 5.5.
4. Refer to paragraphs 4.7.1 and 4.7.2 for the mechanical and electrical adjustment procedures.

4.7.1 MECHANICAL ADJUSTMENT

1. Place the forms lever in the "SHEET" or "FORMS" position and move the print head/carriage assembly to the extreme right side of the printer.

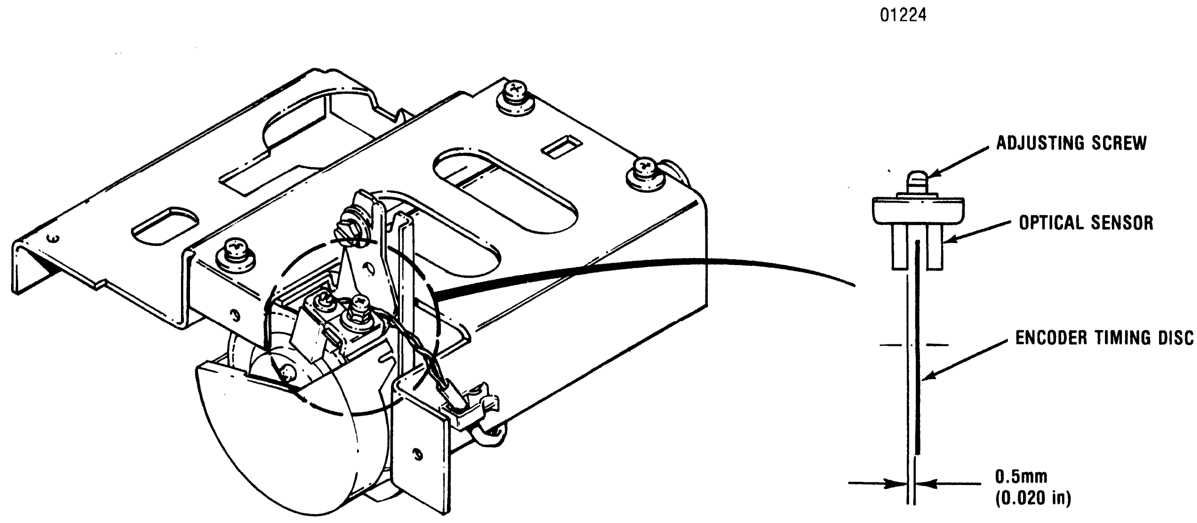


Figure 4-6 Mechanical Adjustment, Optical Sensor and Encoder/Timing Disc

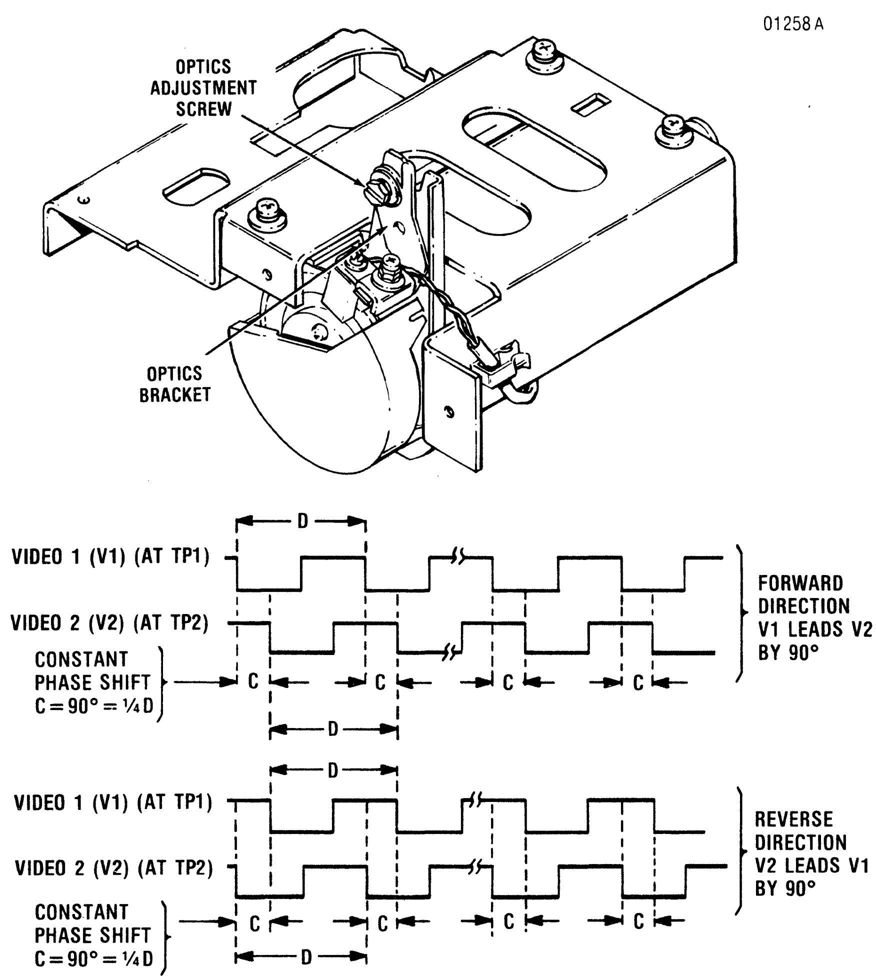


Figure 4-7 Electrical Adjustment, Optical Sensor and Encoder/Timing Disc

2. Using a Phillips head screwdriver, loosen the screw mounting the optical sensor to the carriage drive motor.

3. Move the sensor left or right until the encoder/timing disc is centered in the middle of the sensor.

> **NOTE**
> Factory adjustment calls for a gap of 0.5 mm (0.020 in) between the sensor and disc.

4. Tighten the sensor mounting screw once sensor is adjusted.

4.7.2 ELECTRICAL ADJUSTMENT

1. Disable the cover interlock switch by placing a magnet against the switch.

2. Using a dual trace oscilloscope, connect the oscilloscope ground lead to the negative (−) side of capacitor C127 on the Formatter/Controller pcb.

3. Connect oscilloscope channel 1 probe to TP1 and oscilloscope channel 2 probe to TP2 on the Formatter/Controller pcb.

4. Set the oscilloscope as follows:
   - Volts/Div. knobs at "2V/DIV"
   - Vert. Mode knob at "ALT"
   - Time/Div. knob at "50 us/DIV"
   - Internal Trigger on Channel 1.

5. Turn oscilloscope on.

6. Set dip switch S2, section 4, to "ON"; turn on printer, and then depress the **SELECT** switch.

> **NOTE**
> Printer will print the self-test pattern each time the **SELECT** switch is depressed.

7. Simultaneously monitor VIDEO 1 at TP1 and VIDEO 2 at TP2 on the Formatter/Controller pcb while the print head is moving at a constant speed.

8. Check the phase relationships between VIDEO 1 and VIDEO 2 as the carriage moves in the forward and reverse direction. The phase difference between VIDEO 1 and VIDEO 2 should be a constant 90° over the entire travel of the carriage (i.e.: width C equals 90° when it equals ¼ width D). If the phase adjustment is necessary, proceed to step 9.

9. Deselect the printer and slightly loosen the slotted head screw securing the optics bracket to the carriage.

10. Press the **SELECT** switch and move the optics bracket right or left until the VIDEO 1 and VIDEO 2 signals are adjusted as shown in Figure 4-7.

11. Deselect the printer and tighten the screw securing the optics bracket.

12. Turn the printer and oscilloscope off.

13. Remove the oscilloscope probes and ground leads from the Formatter/Controller pcb.

14. Lower the printer mechanism and reinstall the mounting hardware.

15. Reinstall the ribbon cassette assembly.

16. Replace the printer covers.

4.8 HORIZONTAL OFFSET

The Formatter/Controller pcb uses 5 positions of dip switch S4 for the horizontal offset adjustment. This procedure adjusts the print position of the line printed in the reverse direction to the left or right so the printed character columns are vertically aligned. To adjust the horizontal offset, refer to Figures 4-8 and 4-9 and perform the following steps:

1. Tilt the printer mechanism as described in paragraph 5.10.1.

2. Disable the cover interlock switch by placing a small magnet against the switch.

3. Turn the printer power on, select the printer and print a dozen or so 132 column lines of the character H (octal 110).

4. Deselect the printer and compare the first and last columns of printed text to Figure 4-8.

5. If printed text is offset as in condition A of Figure 4-8, close switch #8 if dip switch S4 on the Formatter/Controller pcb (Figure 4-9) to move the print position to the left.

6. To adjust the offset for condition A follow the switch list below in Table 4-1 step-by-step until the characters are vertically aligned in the first and last columns.

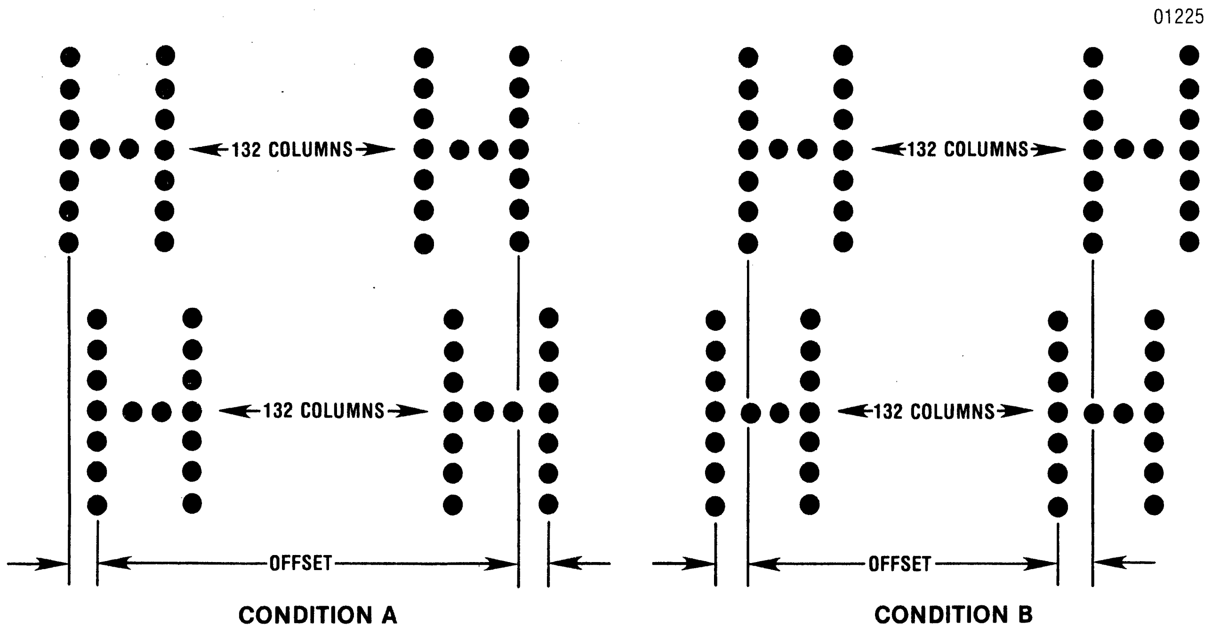


Figure 4-8 Horizontal Offset Print Sample

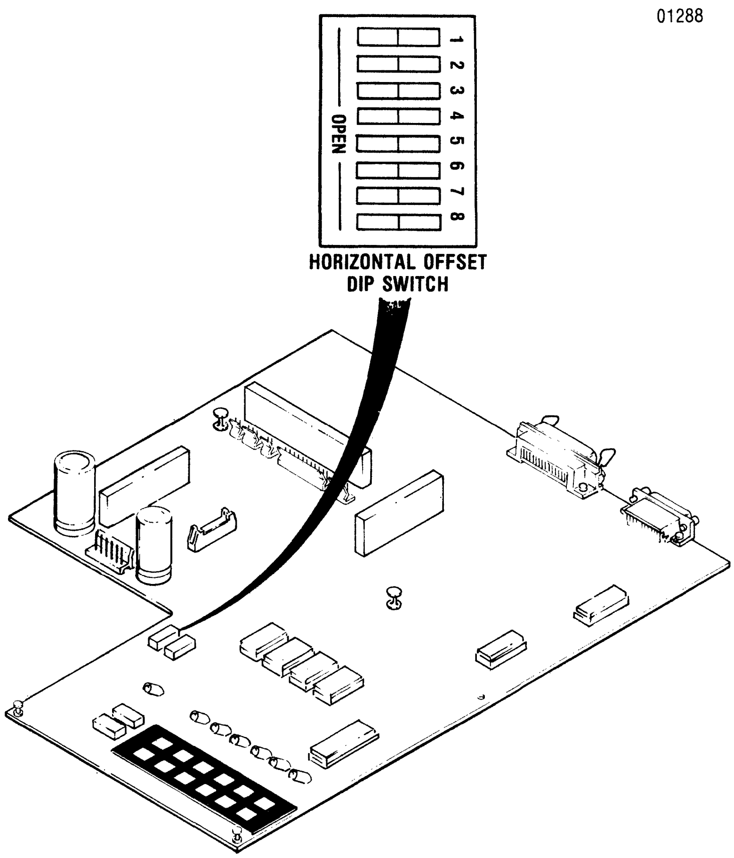


Figure 4-9 Horizontal Offset Dip Switch

Table 4-1
S4 Switch Selection

7	6	5	4
CLOSED	CLOSED	CLOSED	CLOSED
CLOSED	CLOSED	CLOSED	OPEN
CLOSED	CLOSED	OPEN	CLOSED
CLOSED	CLOSED	OPEN	OPEN
CLOSED	OPEN	CLOSED	CLOSED
CLOSED	OPEN	CLOSED	OPEN
CLOSED	OPEN	OPEN	CLOSED
CLOSED	OPEN	OPEN	OPEN
OPEN	CLOSED	CLOSED	CLOSED
OPEN	CLOSED	CLOSED	OPEN
OPEN	CLOSED	OPEN	CLOSED
OPEN	CLOSED	OPEN	OPEN
OPEN	OPEN	CLOSED	CLOSED
OPEN	OPEN	CLOSED	OPEN
OPEN	OPEN	OPEN	CLOSED
OPEN	OPEN	OPEN	OPEN

7. If printed text is offset as in condition B of Figure 4-8 open switch #8 of dip switch S4 on the Formatter/Controller pcb (Figure 4-9) to move the print position to the right.

8. To adjust the offset for condition B follow the switch list in Table 4-1 until the characters are vertically aligned in the first and last columns.

9. Lower the printer mechanism and reinstall the mounting hardware.

10. Reinstall the printer covers.

11. Generate a self-test printout to ensure the horizontal offset is properly adjusted.

SECTION 5
REMOVAL/REPLACEMENT

5.1 REMOVAL/REPLACEMENT, RECOMMENDED SPARES

This section describes the removal and replacement procedures for the recommended spare parts. The section is organized as shown in Table 5-1. The final paragraph of this section provides the part numbers of the recommended spares, which are listed according to figure and item number.

Table 5-1 Recommended Spares and Associated Parts

(Items followed by an asterisk are associated parts; they are not recommended spares, but must be removed/replaced when a spare is changed.)

PARAGRAPH	RECOMMENDED SPARE
5.2	Cover Assemblies*
5.3	Paper Inlet Rack
5.4	Paper Outlet Rack Assembly
5.5	Cover Interlock Magnet
5.6	Ribbon Cassette and Guide
5.7	Print Head Assembly
5.8	Head Flex Cable
5.9	Head Adapter PCB
5.10	Printer Mechanism*
5.11	Dust Cover*
5.12	Carriage Drive Motor Belt
5.13	Carriage Drive Belt
5.14	Optic Sensor Assembly
5.15	Carriage Drive Motor
5.16	Encoder/Timing Disc
5.17	Ribbon Drive Motor Bracket*
5.18	Ribbon Drive Motor
5.19	Cover Interlock Switch
5.20	Paper Drive Belt
5.21	Paper Drive Motor
5.22	Paper Empty Switch
5.23	Tractor Assemblies, Left/Right
5.24	ON/OFF Switch
5.25	Main Fuse
5.26	Power Cord
5.27	Cover Latch Springs
5.28	Pico Fuses
5.29	Power Supply Assembly
5.30	Formatter/Controller PCB
5.31	Recommended Spare Parts Listing

The removal/replacement of any given part often requires the removal/replacement of other parts. Figure 5-1 shows the interrelationship of the removal/replacement procedures in this section.

Each procedure shown in the diagram involves the procedure(s) it is connected to in the rows above.

Example:
Locate the PAPER DRIVE MOTOR procedure in the diagram (look to far right). By working up the diagram, it can be seen that the PAPER DRIVE MOTOR procedure is connected to two procedures in the row above—the PAPER DRIVE BELT procedure and the TILT PRINTER MECHANISM procedure; those two are then connected above to the COVER ASSEMBLIES procedure, which in turn is connected to the AC PLUG procedure. Accordingly, those four procedures are involved in the removal/replacement of the paper drive motor.

5.2 COVER ASSEMBLIES

The covers, which protect the printer mechanism and pcbs, are removed using a Phillips head screwdriver. To remove the three different covers, refer to Figure 5-2 and perform the steps listed below.

5.2.1 TOP COVER—Remove the top cover by lifting the rear edge of the cover up and then off the printer.

NOTE

Removing the top cover enables the printer interlock, preventing most printer operations. To disable the interlock for quick tests after part replacement place a small magnet next to the interlock (Figure 5-15). If interlock remains enabled, reverse polarity of magnet.

5.2.2 REAR COVER

1. Face the rear of the printer.
2. Gently pull the top of the cover to release it from the catches inside the body cover.

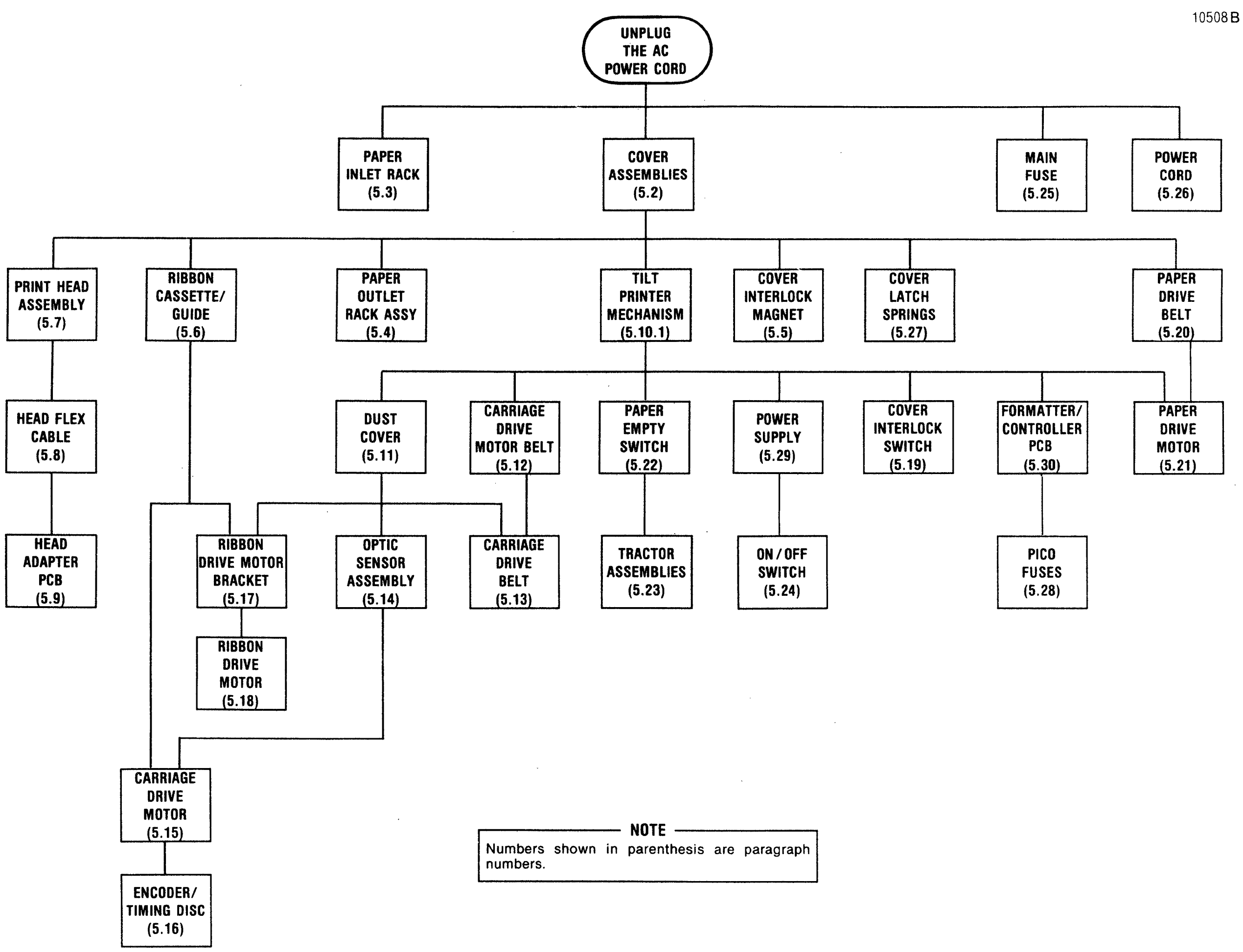


Figure 5-1 Removal/Replacement Procedure Diagram

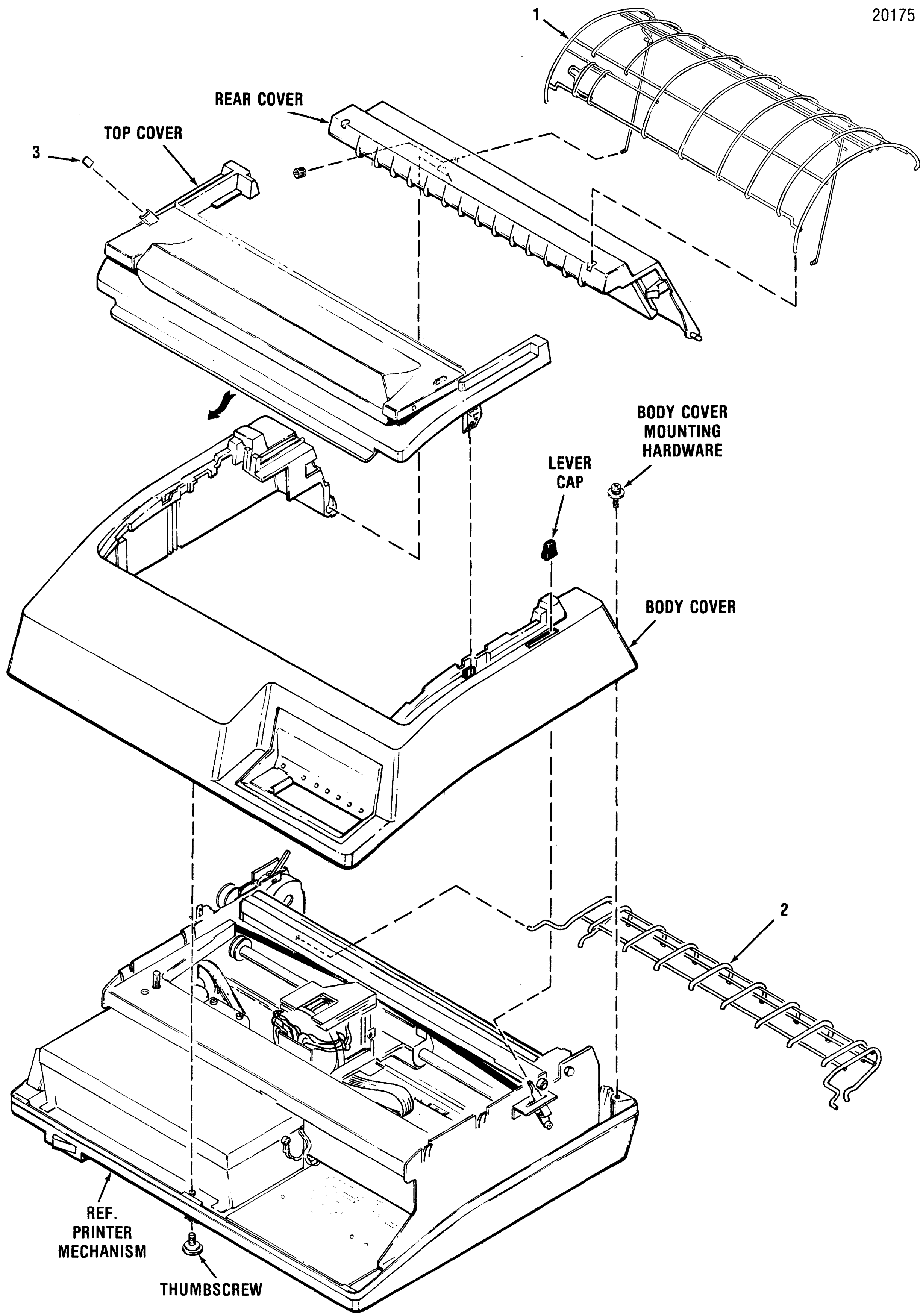


Figure 5-2 Removal/Replacement, Paper Outlet Rack Assy, Paper Inlet Rack, Cover Assemblies, and Cover Interlock Magnet

3. Draw the rear cover toward you until it reaches the end of its travel.

4. Lift the cover out of its grooved hinges and remove.

5.2.3 BODY COVER

1. Remove the top and rear covers, as explained above.

2. Remove the two Phillips head screws at the rear of the printer, mounting the cover to the printer base.

3. Loosen the thumbscrew underneath the front of the printer, mounting the cover to the base.

4. Place the forms lever in the **LOAD** position.

5. Gently pull up on the rear of the cover, then guide the cover back while simultaneously lifting it off the printer.

5.3 PAPER INLET RACK

The paper inlet rack, item 2 of Figure 5-2, attaches to the lower rear of the printer and guides the forms into the paper feed mechanism. To remove the inlet rack, refer to Figure 5-2 and perform the following steps:

1. Remove the two rack mounting tabs from the mounting holes on the inside of the left/right side frames.

2. Pull the inlet rack (2) straight out, and then away from the printer.

3. To replace the rack, reverse steps 1 and 2.

5.4 PAPER OUTLET RACK ASSEMBLY

The paper outlet rack assembly, item 1 of Figure 5-2, attaches to the rear cover and guides the printed forms over the printer and into the paper basket. To remove the outlet rack assembly, refer to Figure 5-2 and perform the following steps:

1. Remove the rear cover per paragraph 5.2.

2. Remove the two nylon thumbnuts securing the rack mounting rails to the back of the rear cover.

NOTE

In some printers the rack mounting rails are secured to the cover by tabs instead of thumbnuts; tab mounted rails are removed by gently pulling on the rails until they are free from the cover.

3. Pull the outlet rack (1) out of the mounting holes on the top of the rear cover.

4. To replace the rack, reverse steps 1 through 3.

5.5 COVER INTERLOCK MAGNET

The cover interlock magnet, item 3 of Figure 5-2, is located in a slot on the underside of the clear cover. The purpose of the magnet is to disable the Hall effect interlock switch when the cover is closed, and to enable the switch when the cover is open. To replace the magnet, refer to Figure 5-2 and perform the following steps:

1. Place the clear cover in the open position, as shown in Figure 5-2.

2. Place the magnet (3) into the slot.

3. Using electrical tape, tape over and around the slot, temporarily securing the magnet in place.

4. Close the panel and place the forms lever in the "FORMS" (rear-most) position.

5. Move the print head to the right margin and power up the printer.

6. If the print head travels to the left margin and stops, the magnet is properly positioned in the slot; if the print head remains at the right, reverse the position of the magnet.

7. Open the panel and obtain an adhesive compound.

8. Carefully remove the tape and then the magnet, noting how it must be positioned when it is cemented in place.

9. Place a small amount of adhesive onto the side of the magnet (3).

10. Place the magnet into the slot and hold in place until the adhesive dries.

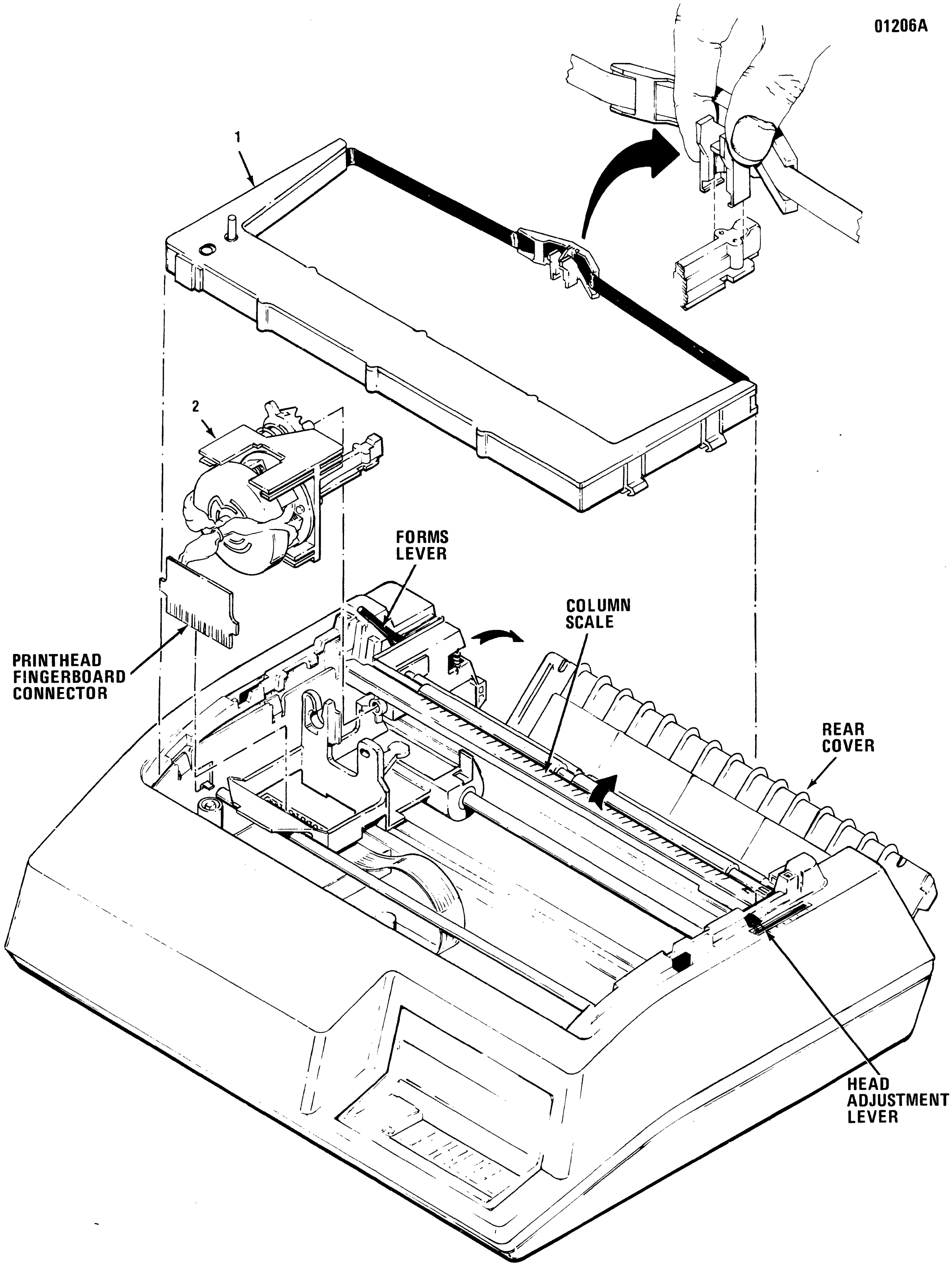


Figure 5-3 Removal/Replacement, Ribbon Cassette and Guide, Print Head Assembly

5.6 RIBBON CASSETTE AND GUIDE

The ribbon cassette, item 1 of Figure 5-3, is mounted to the left and right side frames. The ribbon guide is mounted over the front of the print head. No tools are required to remove the cassette or guide. To remove the cassette and guide, refer to Figure 5-3 and perform the following steps:

1. Remove the top cover per paragraph 5.2.1.
2. Unsnap the top 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 as shown in Figure 5-3.
5. Lift the column scale into the up position.
6. Pull the head adjustment lever to its maximum position, as shown in Figure 5-3.
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 guide (1) up and out of the printer.
9. To install the new ribbon cassette and guide, remove the cardboard tab from the new cassette and reverse steps 1 through 8.

5.7 PRINT HEAD ASSEMBLY

The print head assembly, item 2 in Figure 5-3, attaches to the carriage; no tools are required to remove the print head. To remove the print head, refer to Figure 5-3 and perform the following steps:

1. Remove the top cover per paragraph 5.2.1.
2. Unsnap the top 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, as shown in Figure 5-3, and lift the column scale into the up position.
5. Position the head adjustment lever in the maximum position, as shown in Figure 5-3.
6. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the guide and lifting upward.
7. Remove the print head finger board connector P704 from the Head Adapter pcb connector J704 by lifting the connector upward.
8. To remove the print head (2), simultaneously pull the head toward the front of the printer and lift the head up and out of the printer.
9. To replace the print head assembly, reverse steps 1 through 8.

NOTE

Ensure the cam located on the front of the print head is in position "A" following replacement of the head.

5.8 HEAD FLEX CABLE

The head flex cable, item 1 of Figure 5-4, connects the print head assembly and the Formatter/Controller pcb. To remove the head flex cable, refer to Figure 5-4 and perform the following steps:

1. Remove the top cover per paragraph 5.2.1.
2. Place forms lever in "FORMS" (rear-most) position.
3. Move the print head about three quarters the length of the guide bar from the extreme left margin.
4. Remove the print head fingerboard connector P704 from the head adapter pcb connector J704 by lifting the connector upward (see Figure 5-3).
5. Remove the print head by simultaneously pulling the head toward the front of the printer and lifting the head up and out of the printer.
6. Unhook the rubber O-ring securing the head flex cable to the bracket on the Formatter/Controller pcb.
7. Disconnect the head flex cable connector P203 from connector J203 on the Formatter/Controller pcb.

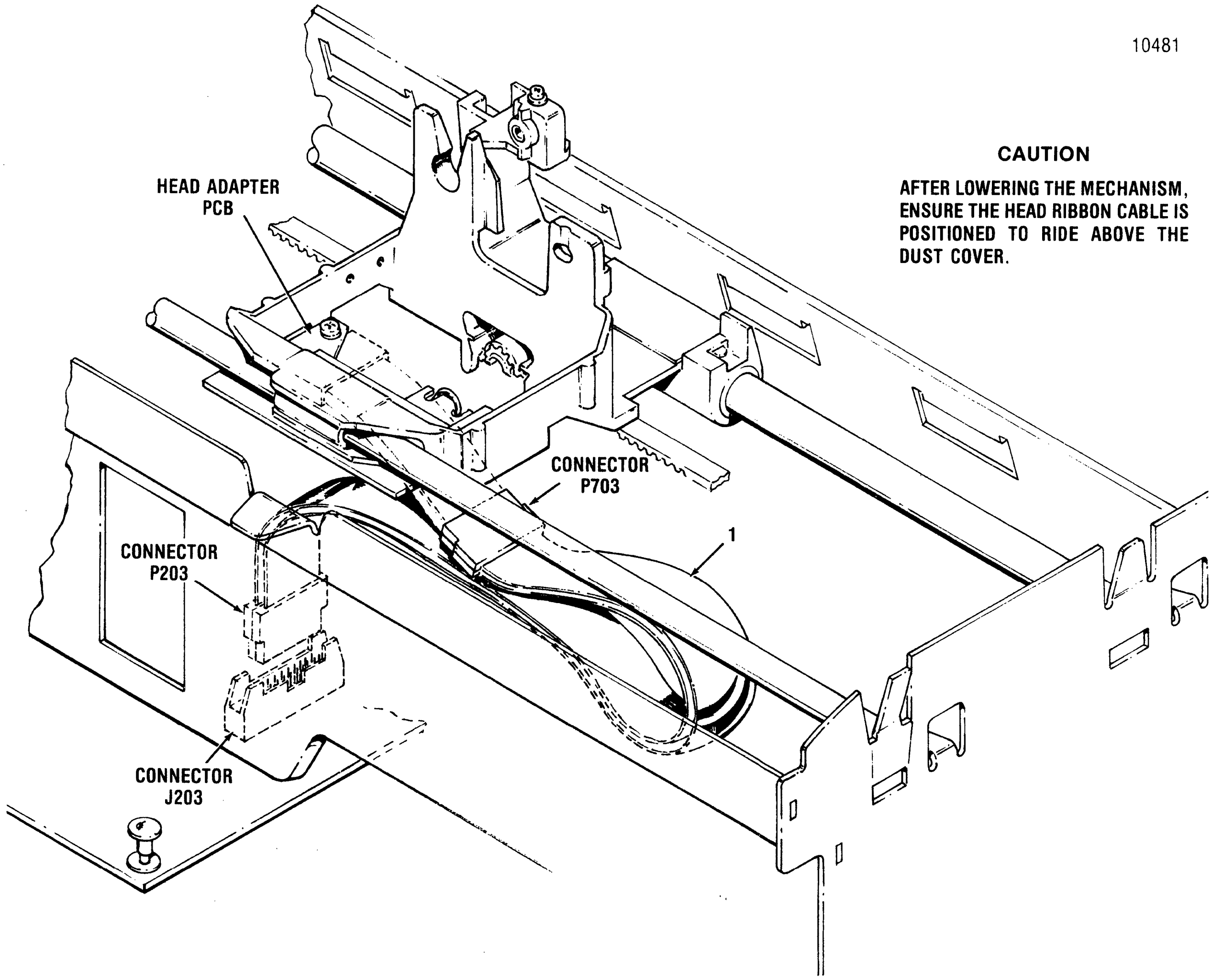


Figure 5-4 Removal/Replacement, Head Flex Cable

8. Unhook the rubber O-ring securing the cable to the underside of the carriage.

9. Disconnect the head flex cable (1) connector P703 from connector J703 on the Head Adapter pcb.

10. To replace the head flex cable, reverse steps 1 through 9.

5.9 HEAD ADAPTER PCB

The Head Adapter pcb, item 1 of Figure 5-5, is attached to the carriage assembly and is removed using a Phillips head screwdriver. To remove the Head Adapter pcb, refer to Figure 5-5 and perform the following steps:

1. Remove the top cover from the printer per paragraph 5.2.1.

2. Remove the ribbon cassette and guide per paragraph 5.6.

3. Remove the print head assembly per paragraph 5.7.

> **NOTE**
>
> Ensure the column scale is down and the forms lever is in the "SHEET" or "FORMS" position before performing step 4.

4. Move the carriage approximately three quarters the length of the guide bar from the extreme left margin.

5. Unhook the rubber O-ring securing the head flex cable to the underside of the carriage and disconnect the head flex connector P703 cable from connector J703 on the Head Adapter pcb.

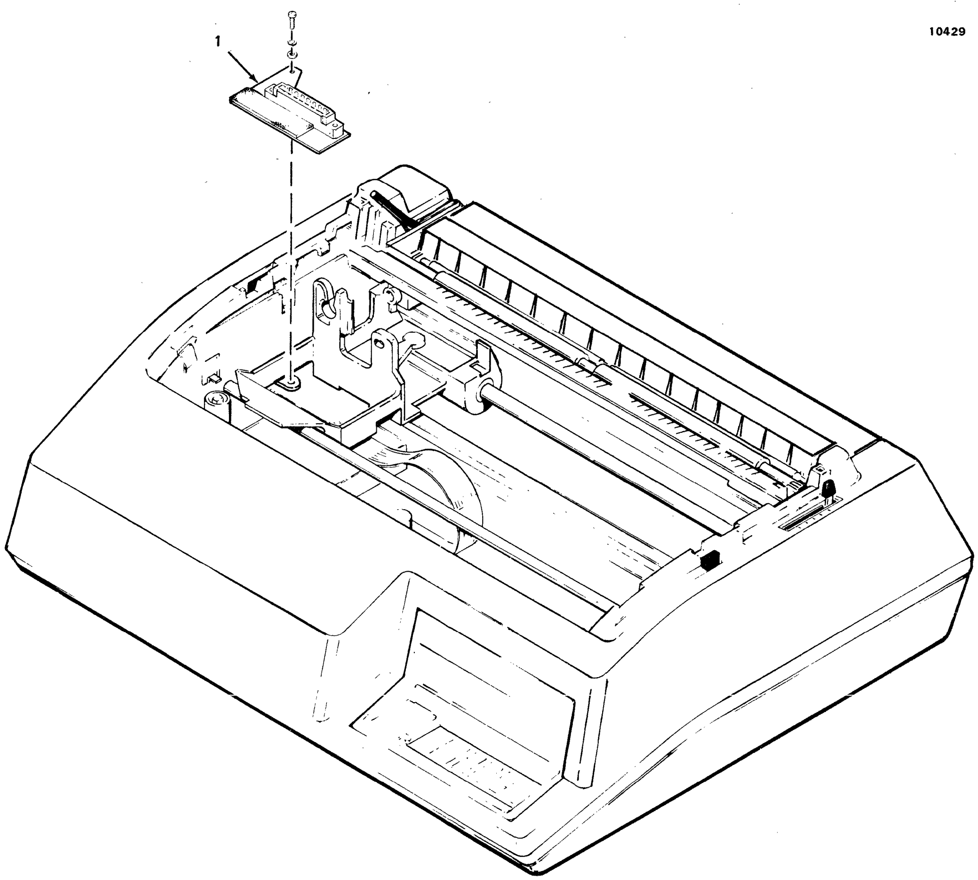


Figure 5-5 Removal/Replacement, Head Adapter PCB

6. Remove the two screws mounting the Head Adapter pcb (1) to the carriage and remove the pcb from the printer.
7. To replace the Head Adapter pcb, reverse steps 1 through 6.

5.10 PRINTER MECHANISM

The printer mechanism, illustrated in Figures 5-6 and 5-7, contains the frame assemblies and most of the mechanical assemblies used in the printer.

Several removal/replacement procedures described in subsequent paragraphs cannot be performed unless the printer mechanism is detached from the printer base and repositioned for greater accessibility. The necessary accessibility can be gained by (1) placing the mechanism in a tilt position within the printer, or (2) removing the mechanism from the printer. The paragraphs below describe the procedure used to reposition the mechanism in either of these two ways.

NOTE

Tilting the mechanism is a simpler and less time consuming operation than removing it. Under normal circumstances, tilting is more efficient than removing the mechanism.

5.10.1 TILTING PRINTER MECHANISM—To place the mechanism in tilt position, refer to Figure 5-6 and perform the following steps:

1. Remove the printer covers per paragraph 5.2.
2. Remove and keep handy the support rod located inside the front cover.
3. Remove the four shoulder screws securing the printer mechanism to the base.
4. Unhook the rubber O-ring securing the head flex cable to the bracket on the Formatter/Controller pcb.
5. Tilt the front of the mechanism upward about 45°.
6. Position one end of the support rod into the opening provided in the front right corner of the base, then position the other end of the rod through the front right shoulder washer hole in the frame.

5.10.2 REMOVING PRINTER MECHANISM—The mechanism is removed using a Phillips head screwdriver. To remove the printer mechanism, refer to Figure 5-7 and perform the following steps:

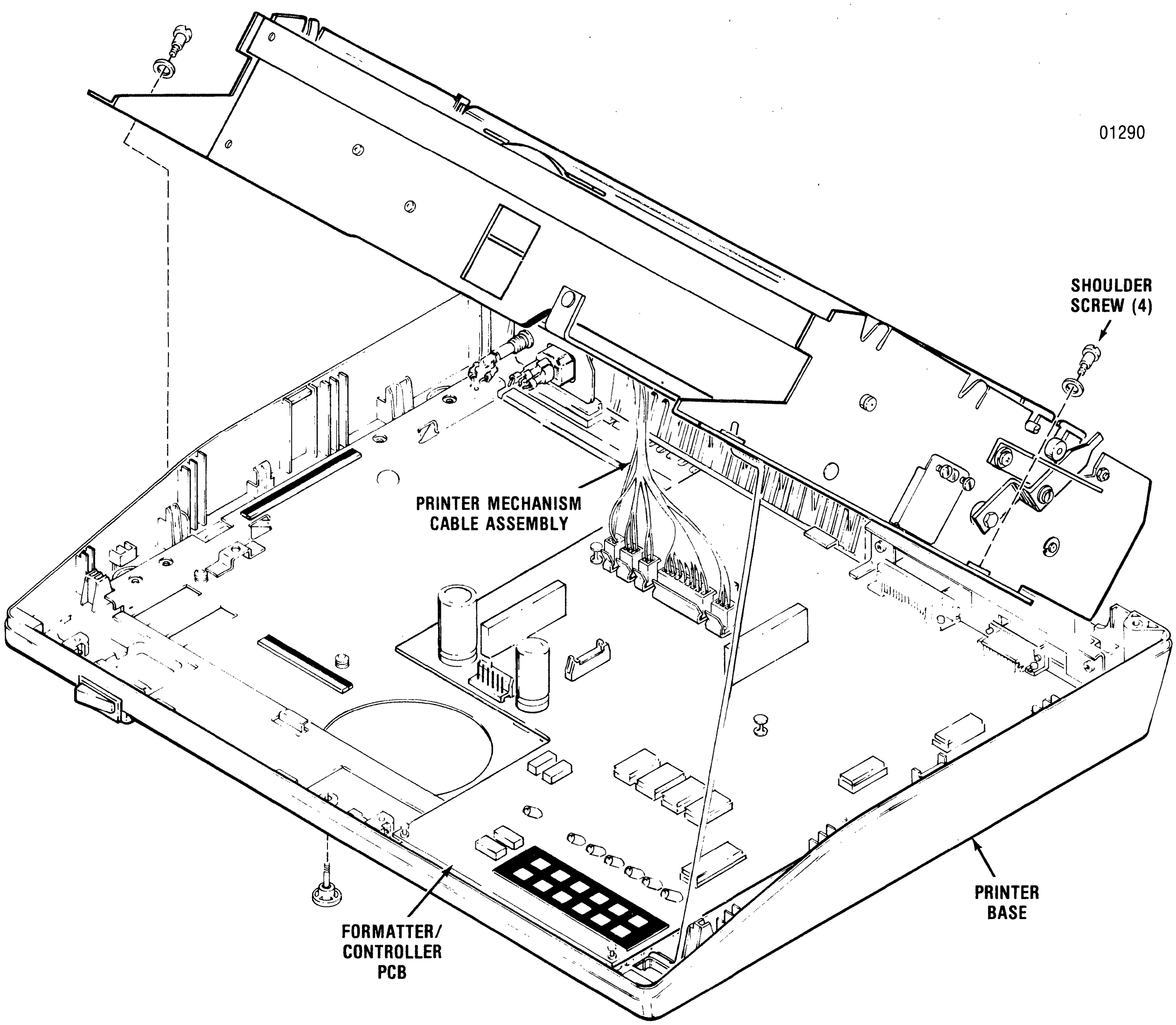


Figure 5-6 Tilting Printer Mechanism

1. Remove the printer covers per paragraph 5.2.
2. Remove the four shoulder screws mounting the printer mechanism to the printer base.
3. Unhook the rubber O-ring securing the head flex cable to the bracket on the Formatter/Controller pcb.
4. Tilt the front of the mechanism upward about 45°.
5. Position one end of the support rod into the opening provided in the front right corner of the base, then position the other end of the rod through the front right shoulder washer hole in the frame.
6. Disconnect the five printer mechanism cable assemblies from the five connectors on the Formatter/Controller pcb.
7. Remove the head flex cable per paragraph 5.8.
8. Disconnect the green ground wire attached to the left rear of the mechanism.
9. Lift the printer mechanism up and out of the printer.
10. To replace the mechanism, reverse steps 1 through 9.

NOTE

Refer to Appendix A for the printer wiring diagram when reconnecting the five printer mechanism cable assemblies to the Formatter/Controller pcb.

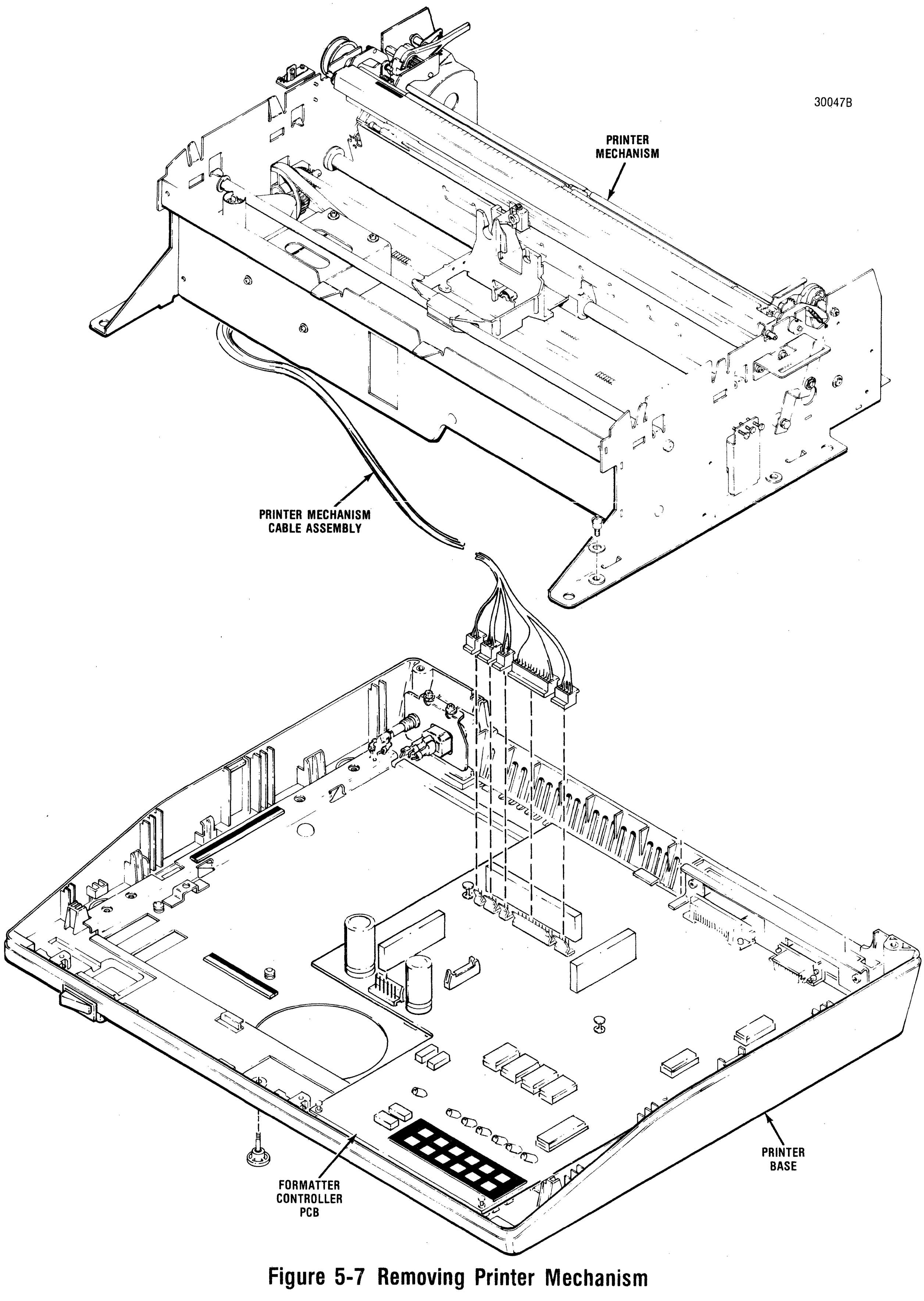


Figure 5-7 Removing Printer Mechanism

5.11 DUST COVER

The dust cover (see Figure 5-8) attaches to the bottom of the printer mechanism and protects the Formatter/Controller pcb. To remove the dust cover, refer to Figure 5-8 and perform the following steps:

1. Remove the ribbon cassette and guide per paragraph 5.6.
2. Tilt the printer mechanism per paragraph 5.10.1.
3. Disconnect the head flex cable from the Formatter/Controller pcb.
4. Remove the two tabs mounting the dust cover to the front and right sides of the mechanism.

NOTE

Remove tabs by placing the tip of a flat blade screwdriver against the inside ends of the tabs and gently pushing out.

5. Gently pull the front of the dust cover down.
6. Pull the cover forward from the rear mounting clips and remove the dust cover from the printer.
7. To replace the dust cover, reverse steps 1 through 6.

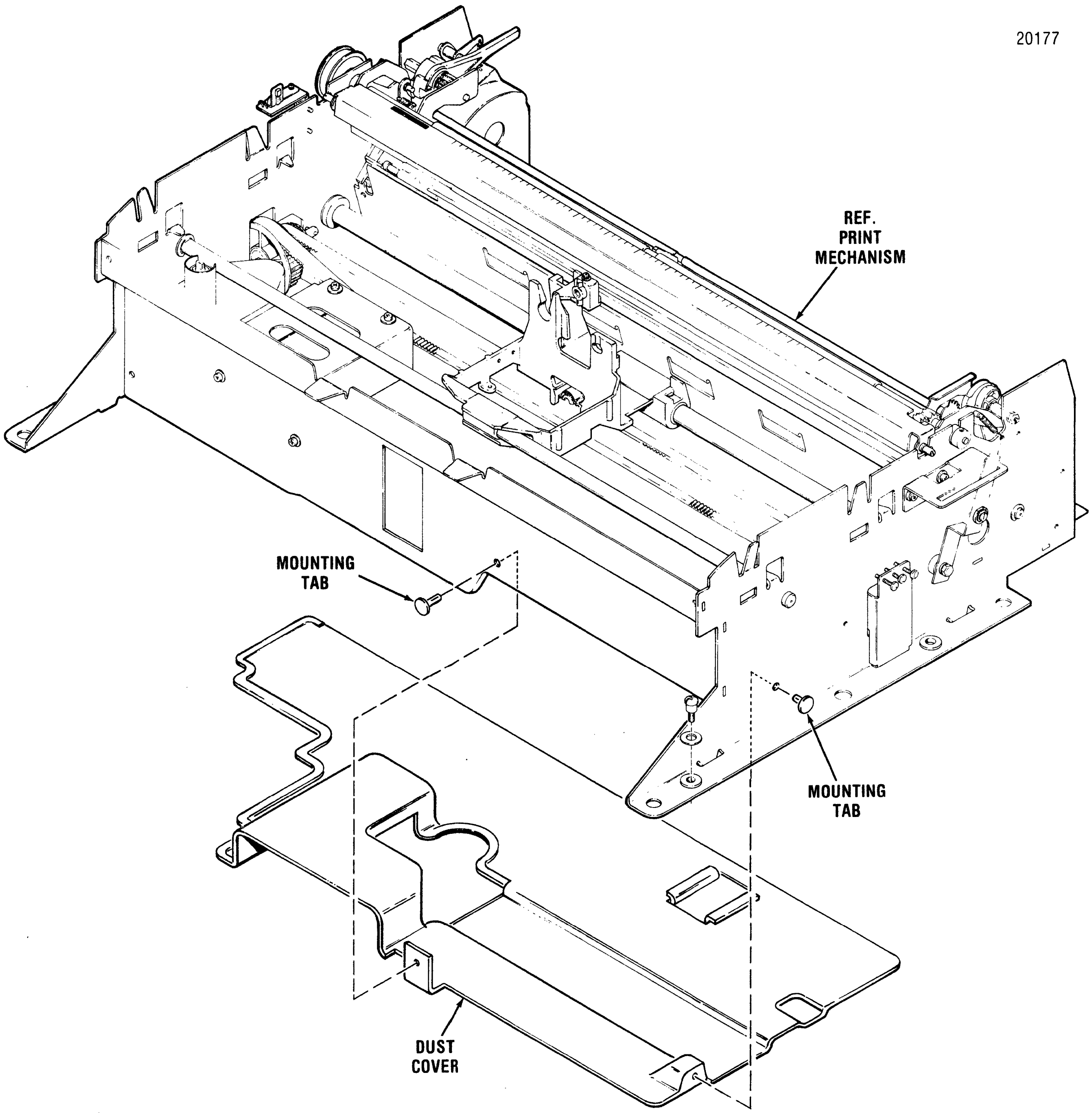


Figure 5-8 Removal/Replacement, Dust Cover

5.12 CARRIAGE DRIVE MOTOR BELT

The carriage drive motor belt, item 1 of Figure 5-9, provides the drive from the carriage drive motor to the carriage drive belt, thus moving the carriage. The belt is removed using a flat blade screwdriver. To remove the belt, refer to Figure 5-9 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Release tension on the idler pulley by loosening the two, outside, slotted head screws on the idler pulley bracket.
3. Remove the two slotted head screws securing the drive pulley to the left frame.
4. Remove the carriage drive belt (2) from the drive pulley.
5. Remove the carriage drive motor belt (1) from the drive pulley.
6. To replace the belt, reverse steps 1 through 5 and refer to paragraph 4.3 for belt adjustment.

5.13 CARRIAGE DRIVE BELT

The carriage drive belt, item 2 of Figure 5-9, attaches to the carriage and is driven by the carriage drive motor belt. The belt is removed using a flat blade screwdriver. To remove the belt, refer to Figure 5-9 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Remove the printer dust cover per paragraph 5.11.
3. Loosen the three slotted head screws mounting the idler pulley assembly to the right side frame and remove the pulley from the bracket.
4. Remove the two slotted head screws attaching the drive pulley to the left frame.

NOTE

Two small washers (one on either end of the pulley) are on the pulley shaft. Remove and retain these washers after detaching the pulley from the frame.

5. Remove the carriage drive belt (2) from the idler pulley and the drive pulley, then remove the belt from the printer.
6. To replace the belt, reverse steps 1 through 5. Be sure to replace the small pulley washers during replacement.
7. After replacement, refer to paragraph 4.2 for belt adjustment.

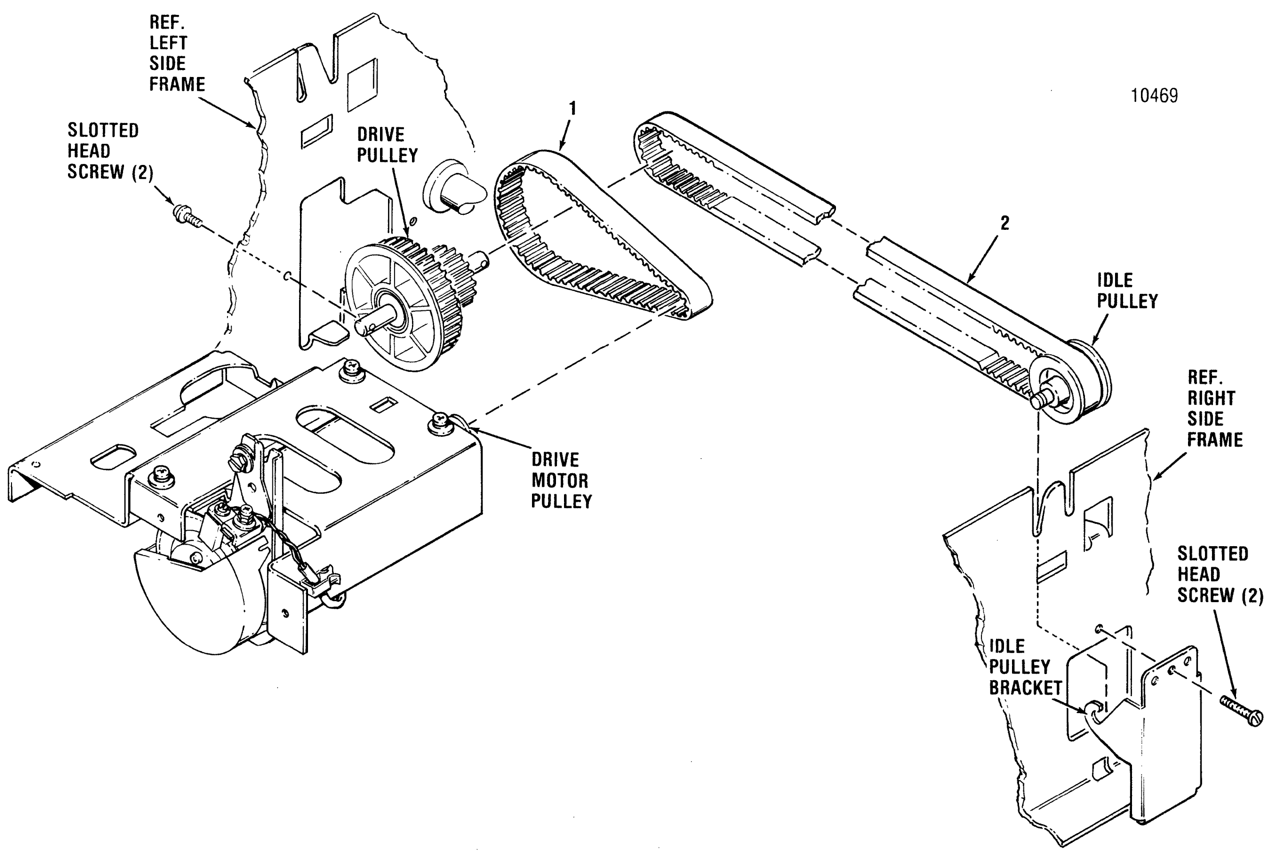


Figure 5-9 Removal/Replacement, Carriage Drive Motor Belt, Carriage Drive Belt

5.14 OPTIC SENSOR ASSEMBLY

The optic sensor assembly, item 1 of Figure 5-10, is attached to the carriage drive motor and is removed using a Phillips head and a flatblade screwdriver. To remove the optic sensor assembly, refer to Figure 5-10 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Remove the dust cover per paragraph 5.11.
3. Remove the Phillips head screw mounting the sensor assembly to the assembly bracket.
4. Remove the optic sensor cable from the clip on the drive motor mounting bracket.
5. Remove the sensor cable from all clips on the mechanism frame.
6. Cut the tie wraps that bind the optic cable.
7. Remove connector P212 from the Formatter/Controller pcb.
8. Remove the carriage drive motor wires from connector P212 by pressing the three connector tabs (use tip of small flatblade screwdriver) while gently lifting the wires from the connector.
9. Remove the optic sensor assembly from the printer.
10. To replace the optic sensor assembly, reverse steps 1 through 9. Refer to wiring diagram in Appendix A when plugging the drive motor wires back into connector P212.

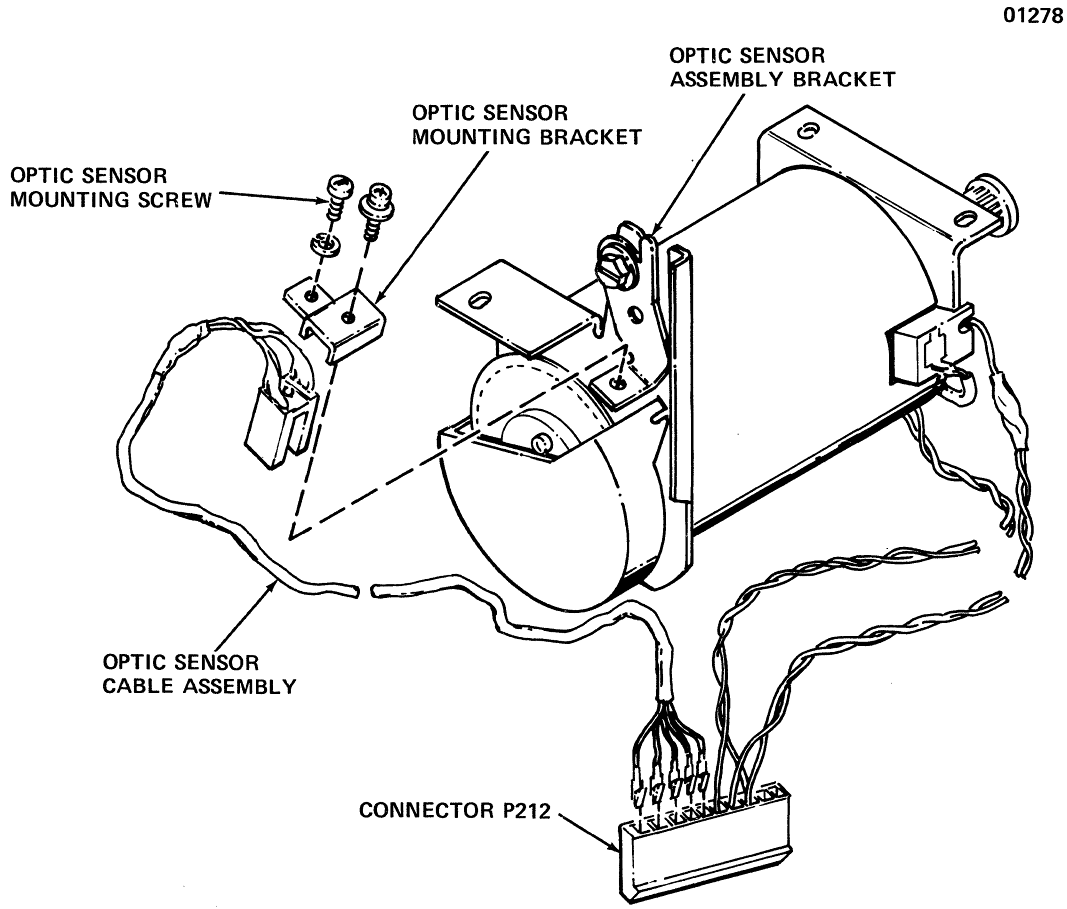


Figure 5-10 Removal/Replacement, Optic Sensor Assembly

5.15 CARRIAGE DRIVE MOTOR

The carriage drive motor, item 1 of Figure 5-11, is attached to a motor mounting bracket and is removed using a Phillips head screwdriver. To remove the carriage drive motor, refer to Figure 5-11 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Remove the dust cover per paragraph 5.11.
3. Remove the ribbon cassette and guide per paragraph 5.6.
4. Remove the drive motor cables from the harness clips on the frame.
5. Cut the tie wraps used to bind the drive motor cables.
6. Remove the Phillips head screw mounting the optic sensor assembly to the assembly bracket.
7. Remove the three Phillips head screws attaching the carriage drive motor to the motor mounting bracket.

> **CAUTION**
> Firmly grasp BOTH the motor and the front frame while removing the screws to prevent either from falling suddenly.

8. Remove the motor/cables from the printer.
9. To replace the motor, reverse steps 1 through 8.

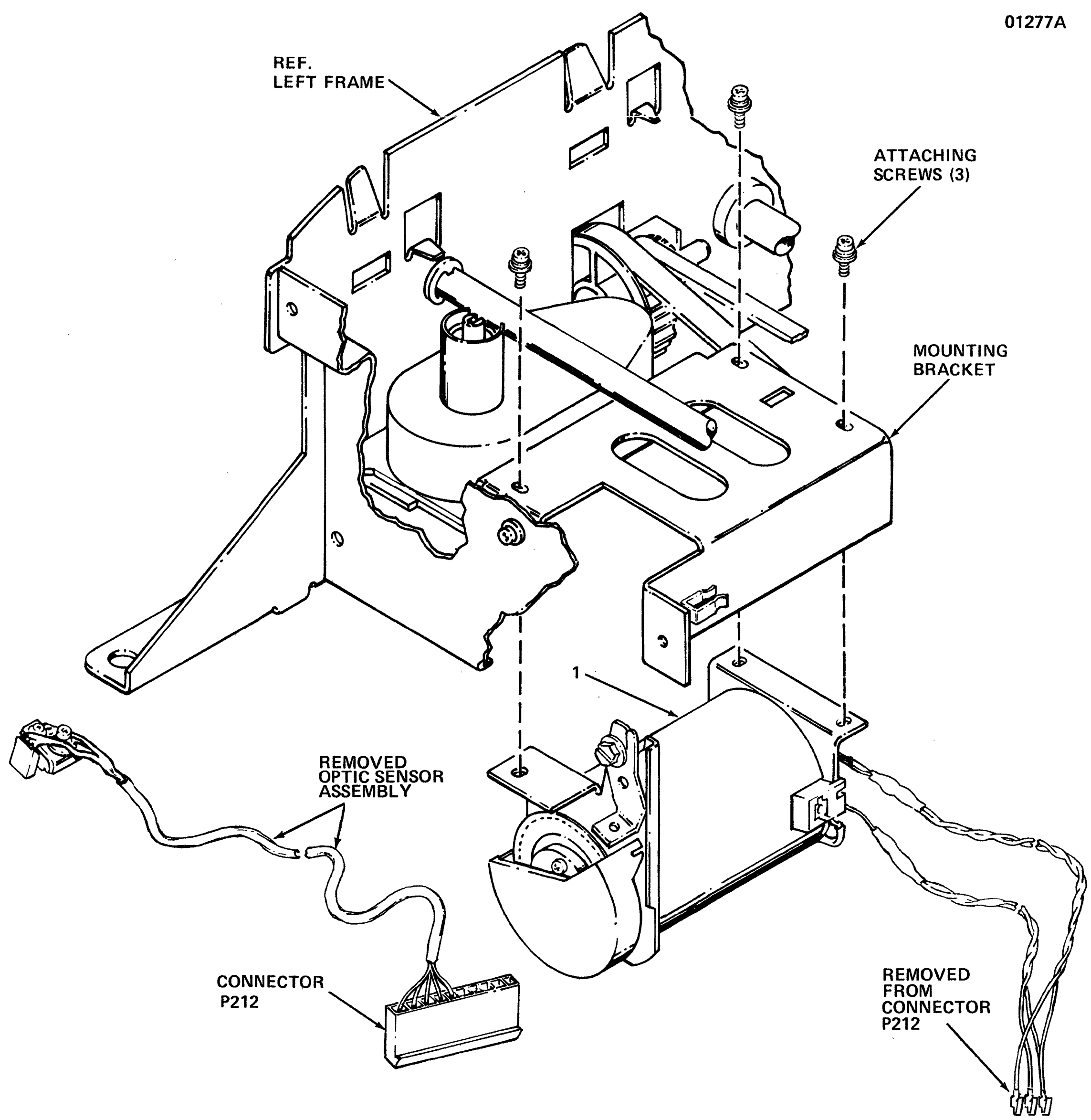


Figure 5-11 Removal/Replacement, Carriage Drive Motor

5.16 ENCODER/TIMING DISC

The encoder/timing disc, item 1 in Figure 5-12, is located at the end of the carriage drive motor shaft and is removed using a Phillips head screwdriver. To remove the disc, refer to Figure 5-12 and perform the following steps:

CAUTION

Always use care when working with the timing disc. It is extremely thin and can be bent or damaged if mishandled.

1. Remove the carriage drive motor per paragraph 5.15.
2. Carefully unsnap the protective cap from the carriage drive motor.
3. Remove the snap ring securing the timing disc to the drive motor shaft.
4. Remove the three screws from the front plastic mounting disc.
5. Remove the front mounting disc and the encoder/timing disc (1) from the motor shaft.
6. To replace the disc, reverse steps 1 through 5.
7. Adjust timing disc per paragraph 4.7.

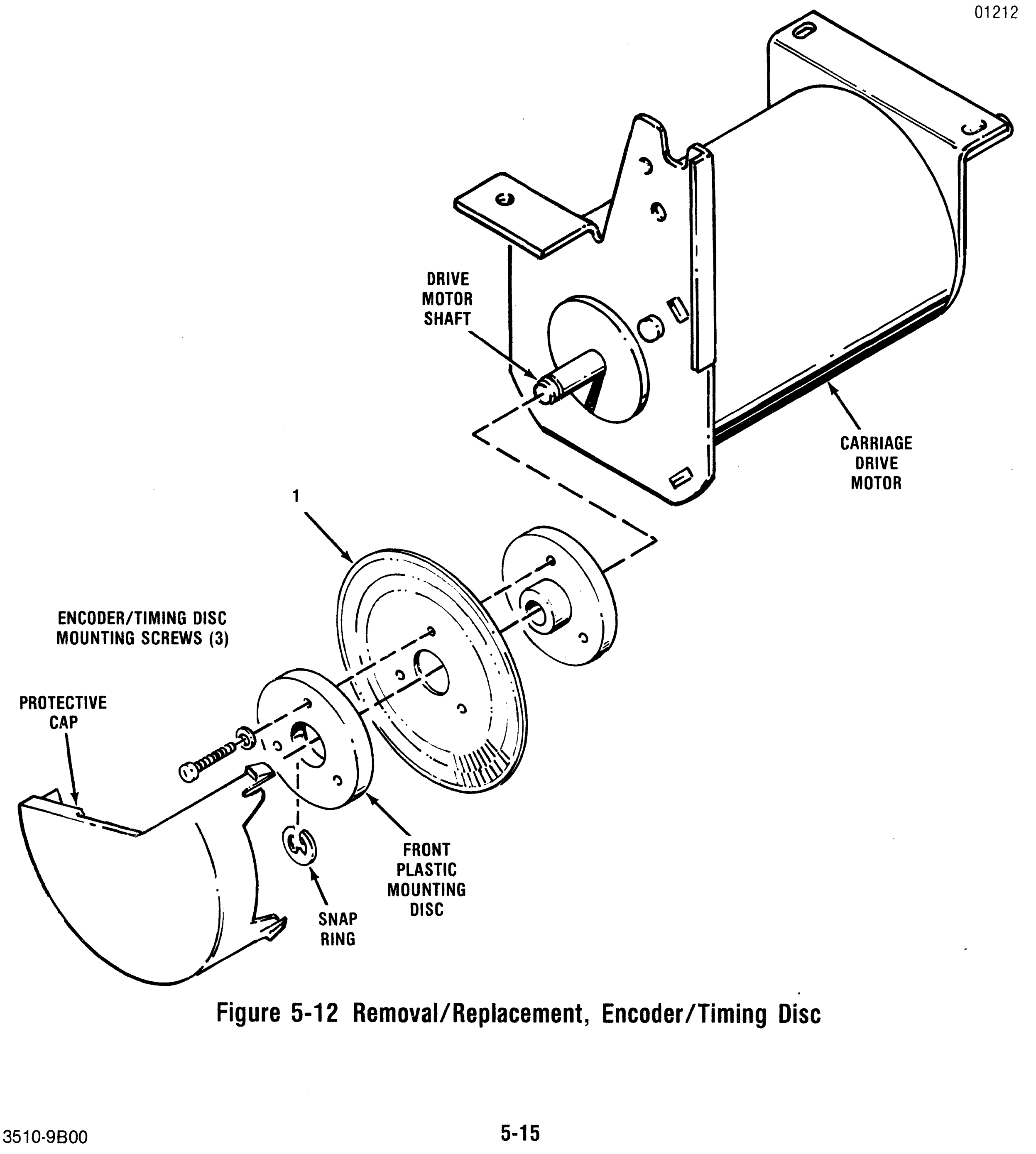


Figure 5-12 Removal/Replacement, Encoder/Timing Disc

5.17 RIBBON DRIVE MOTOR MOUNTING BRACKET

The ribbon drive motor mounting bracket supports both the ribbon drive and carriage drive motors. The bracket must be removed to remove/replace the ribbon drive motor. The bracket is secured to the left and front frames by four Phillips head screws. To remove the bracket, refer to Figure 5-13. and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Remove the dust cover per paragraph 5.11.
3. Remove the ribbon cassette/guide per paragraph 5.6.
4. Loosen the three Phillips head screws mounting the carriage drive motor to the mounting bracket and remove the carriage drive motor belt from carriage drive motor.
5. Locate and disconnect connectors J210 and J212 on the Formatter/Controller pcb. Refer to Appendix A, Assembly Diagram, Formatter/Controller .
6. Remove the disconnected cables from all mounting clips and tie wraps.
7. Remove the four screws attaching the mounting bracket to the front and left frames, and remove the bracket from the printer.
8. To replace the bracket, reverse steps 1 through 7.

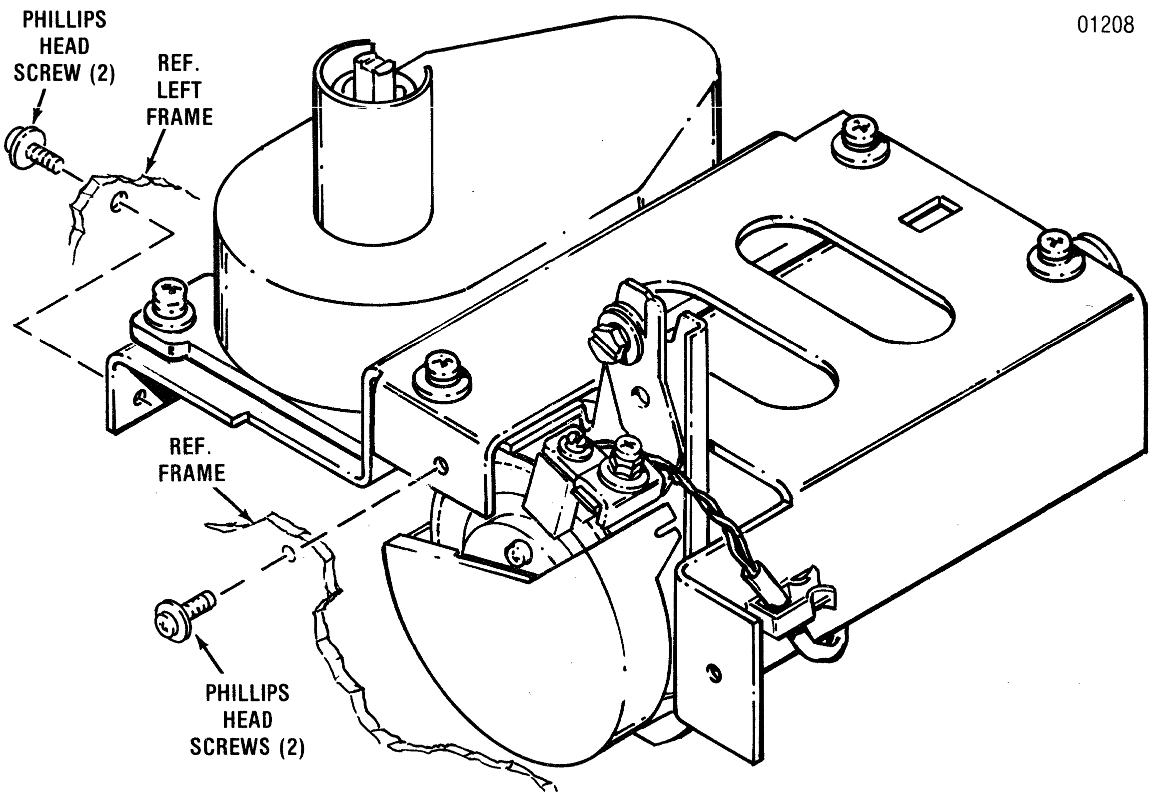


Figure 5-13 Removal/Replacement, Ribbon Drive Motor Mounting Bracket

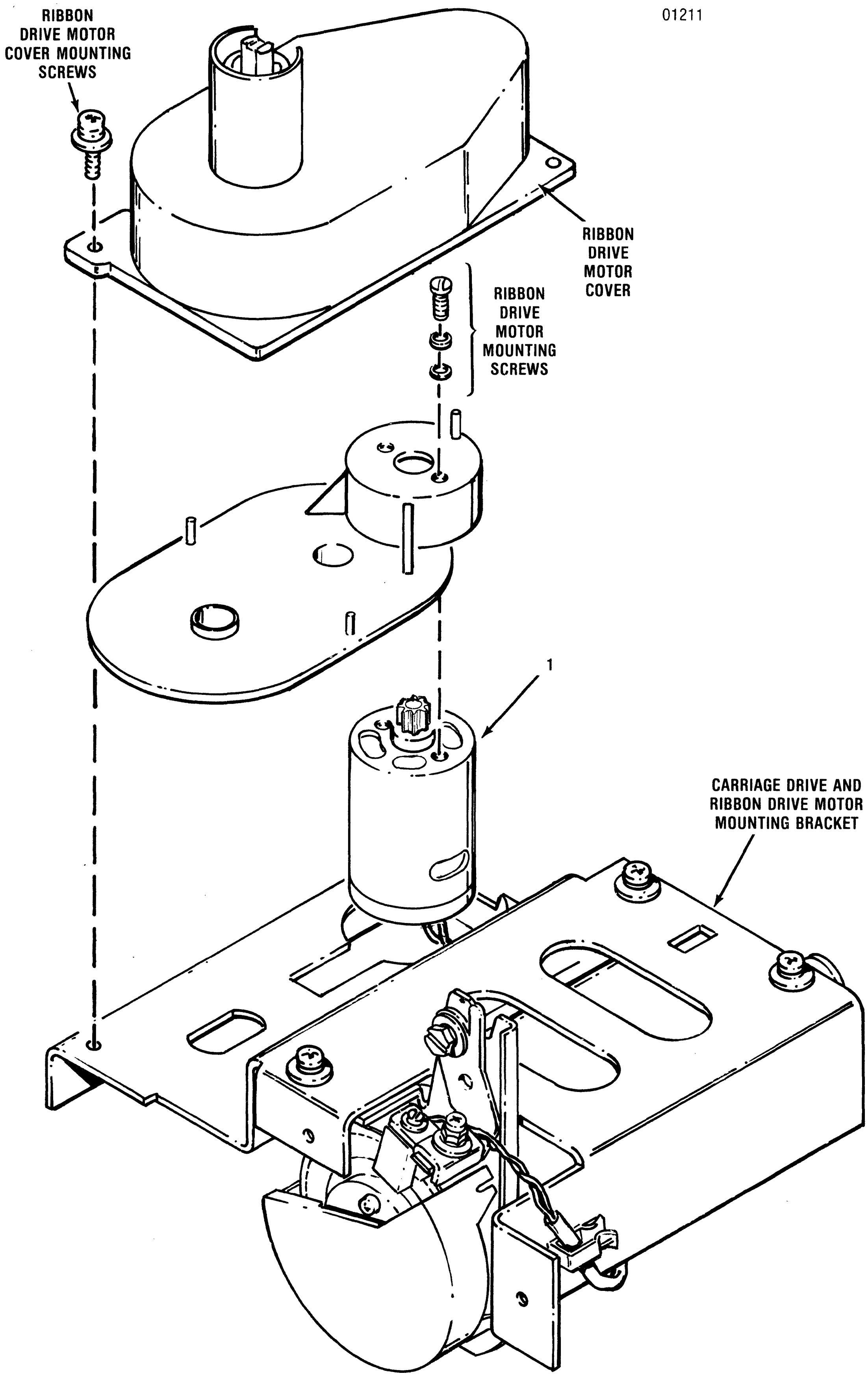


Figure 5-14 Removal/Replacement, Ribbon Drive Motor

5.18 RIBBON DRIVE MOTOR

The ribbon drive motor, item 1 of Figure 5-14, is removed using a Phillips head screwdriver and a flat blade screwdriver. To remove the motor, refer to Figure 5-14 and perform the following steps:

1. Remove the ribbon drive motor mounting bracket per paragraph 5.17.
2. Remove the two Phillips head screws mounting the ribbon drive motor cover and remove the cover from the mounting bracket.
3. Remove the two slotted head screws mounting the ribbon drive motor and remove the motor (1) and attached cables from the bracket.
4. To replace the ribbon drive motor, reverse steps 1 through 3.

5.19 COVER INTERLOCK SWITCH

The cover interlock switch, item 1 of Figure 5-15, is attached to the left frame and is removed using a Phillips head screwdriver. To remove the cover interlock switch, refer to Figure 5-15 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Remove the cover interlock switch cable connector P209 from the Formatter/Controller pcb and remove the cable from the wire harness mounting clips and tie wraps that secure the cable.
3. Remove the rubber grommet from the left frame through which the cover interlock switch cable assembly is routed.
4. Remove the Phillips head screw mounting the cable clamp to the left frame and remove the clamp from the printer.
5. Remove the two Phillips head screws mounting the cover interlock switch to the top of the left frame and remove the switch (1) and cable assembly from the printer.
6. To replace the switch, reverse steps 1 through 5.

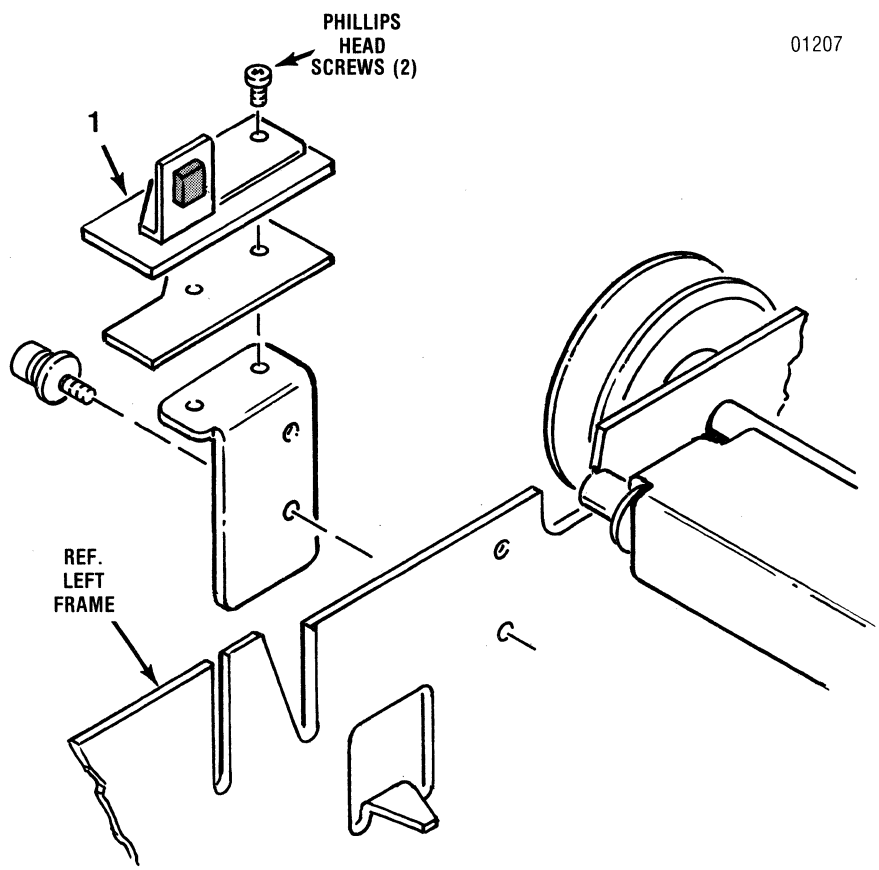


Figure 5-15 Removal/Replacement, Cover Interlock Switch

5.20 PAPER DRIVE BELT

The paper drive belt, item 1 of Figure 5-16, provides the drive from the paper feed motor to the paper feed mechanism. The belt is removed using a snap ring remover and a Phillips head screwdriver. To remove the belt, refer to Figure 5-16 and perform the following steps:

1. Remove the covers from the printer per paragraph 5.2.
2. Using a snap ring remover, remove the snap ring holding the tractor gear to the tractor drive shaft.
3. Gently pull the tractor gear off the tractor drive shaft.
4. Loosen the screw mounting the tensioner bracket to the left frame.
5. Remove the paper drive belt (1) from the paper feed motor pulley and the paper drive pulley.

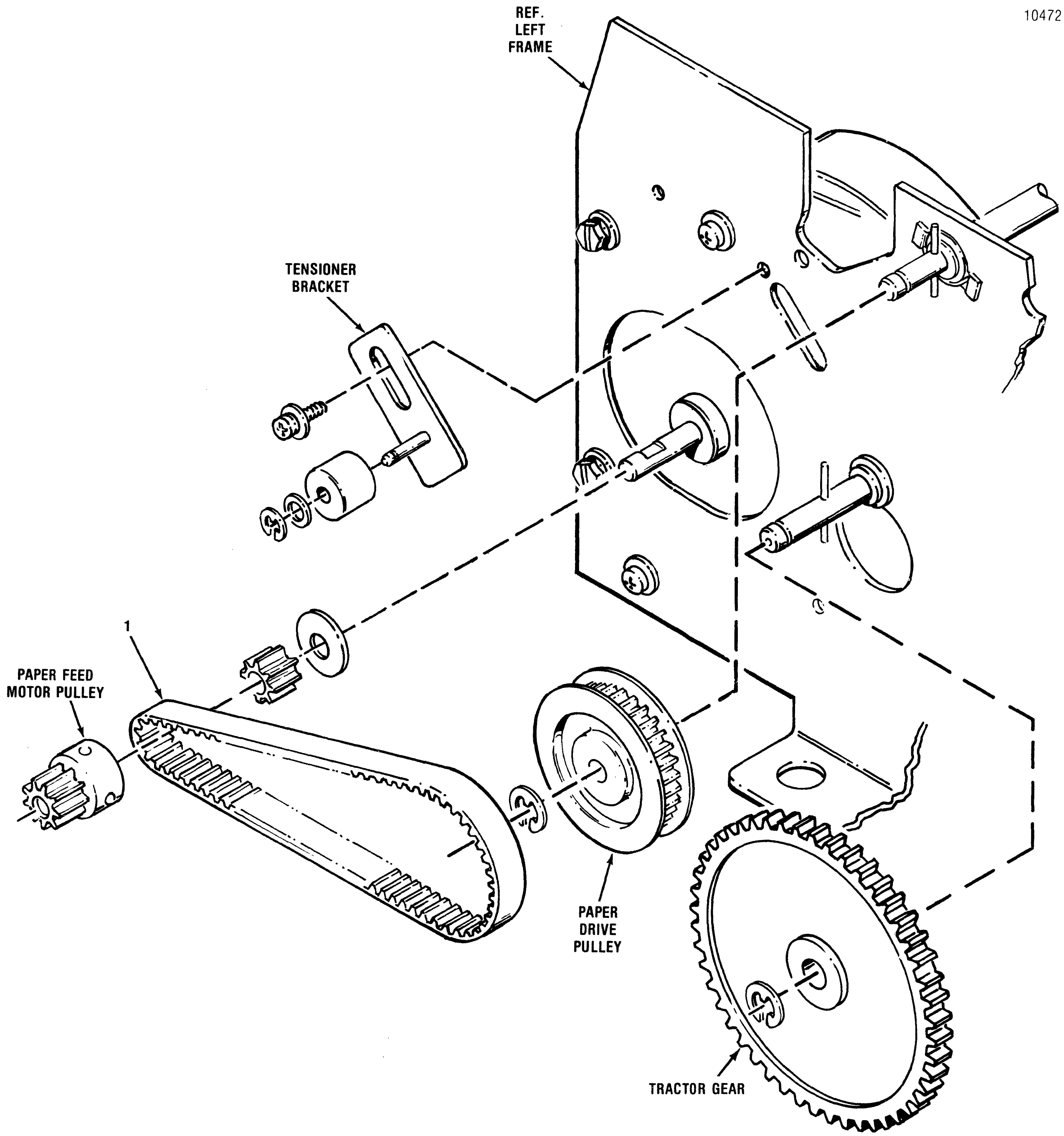


Figure 5-16 Removal/Replacement, Paper Drive Belt

6. To replace the belt, reverse steps 1 through 5 and refer to paragraph 4.4 for belt adjustment procedures.

5.21 PAPER DRIVE MOTOR

The paper drive motor, item 1 of Figure 5-17, is attached to the inside of the left frame and is removed using a Phillips head screwdriver and a flat blade screwdriver. To remove the motor, refer to Figure 5-17 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Remove the paper drive belt per paragraph 5.20.
3. Unhook the small spring stretching from the motor shroud to the forms lever assembly.

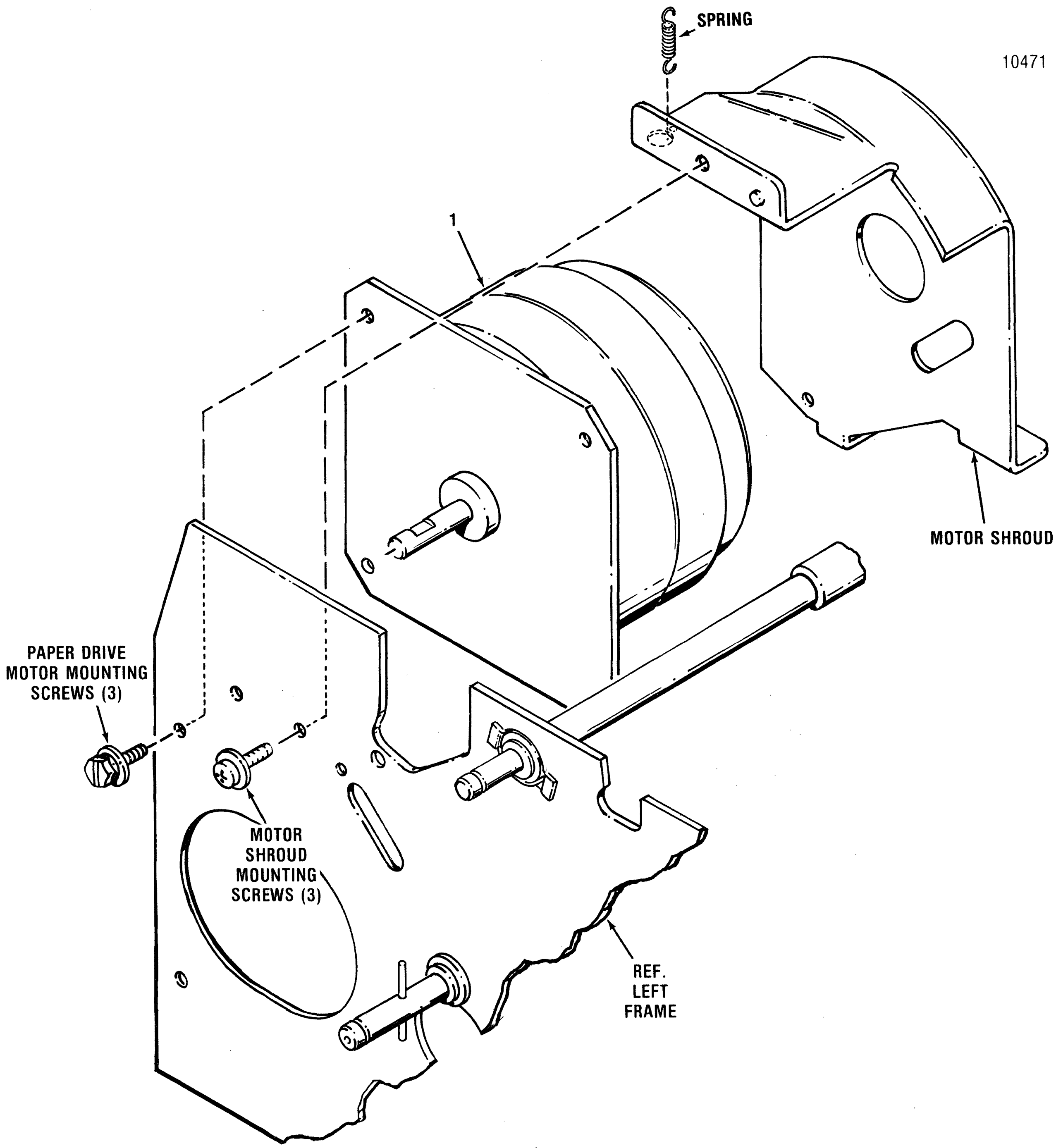


Figure 5-17 Removal/Replacement, Paper Drive Motor

4. Face the rear of the mechanism; note that one of the snap rings on the guide bar is against the inside of the side frame to your left.

5. Remove the snap ring on the inside of the frame and slide the guide bar to the left.

NOTE

After sliding the guide bar to the left, remove and retain the collar on the right end of the guide bar.

6. Remove the three Phillips head screws mounting the motor shroud and remove the shroud from the printer.

7. Remove the paper drive motor cable from all clips and tie wraps holding the cable, then remove cable connector P211 from the Formatter/Controller pcb.

8. Remove the three slotted head screws mounting the paper drive motor to the side frame and remove the motor (1) and cable assembly from the printer.

9. To replace the motor, reverse steps 1 through 8.

5.22 PAPER EMPTY SWITCH

The paper empty switch, item 1 of Figure 5-18, is located on the right pin feed tractor and is removed using a Phillips head screwdriver. To remove the paper empty switch, refer to Figure 5-18 and perform the following steps:

NOTE

Perform this procedure facing the rear of the printer.

1. Remove the printer covers per paragraph 5.2.

2. Tilt the printer mechanism per paragraph 5.10.1.

3. Remove the two-pin connector P208 on the paper empty switch cable from connector J508 on the Formatter/Controller pcb.

4. Remove the switch cable from any clips or tie wraps used to support the cable.

5. Remove the two screws mounting the paper empty switch to the right tractor assembly.

6. Remove the grommet shown in the figure by pressing it out from the inside of the chassis.

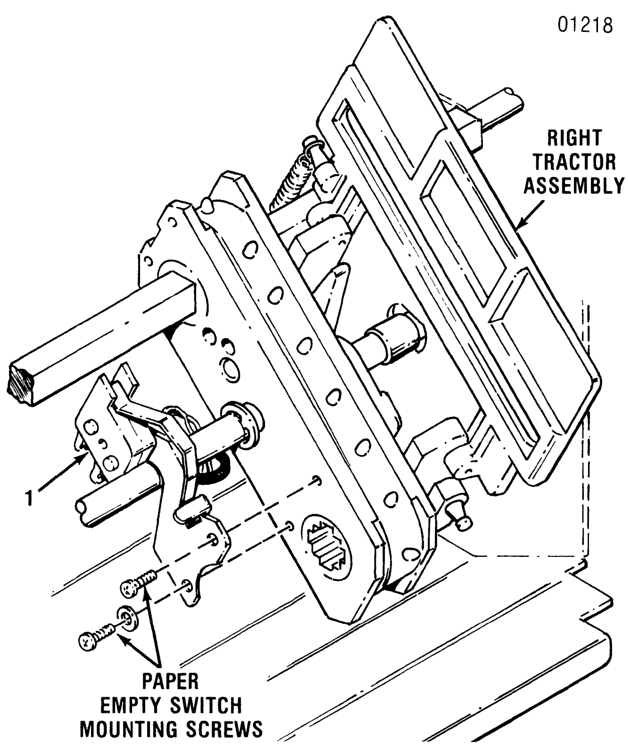


Figure 5-18 Removal/Replacement, Paper Empty Switch

7. Remove the switch, grommet, and cable/connector from the printer.

8. To replace the switch, reverse steps 1 through 7 and adjust the switch per Section 4.

5.23 TRACTOR ASSEMBLIES, LEFT/RIGHT

The left and right tractor assemblies, items 1 and 2 of Figure 5-19, are located on the tractor drive shaft and the tractor guide bar. The tractors are removed using a snap ring tool. To remove the tractors, refer to Figure 5-19 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.

2. Remove the paper drive pulley per paragraph 5.20.

3. Remove the paper empty switch per paragraph 5.22.

4. Facing the rear of the printer, remove the three snap rings securing the guide bar and slide the bar to the left and through the tractor assemblies.

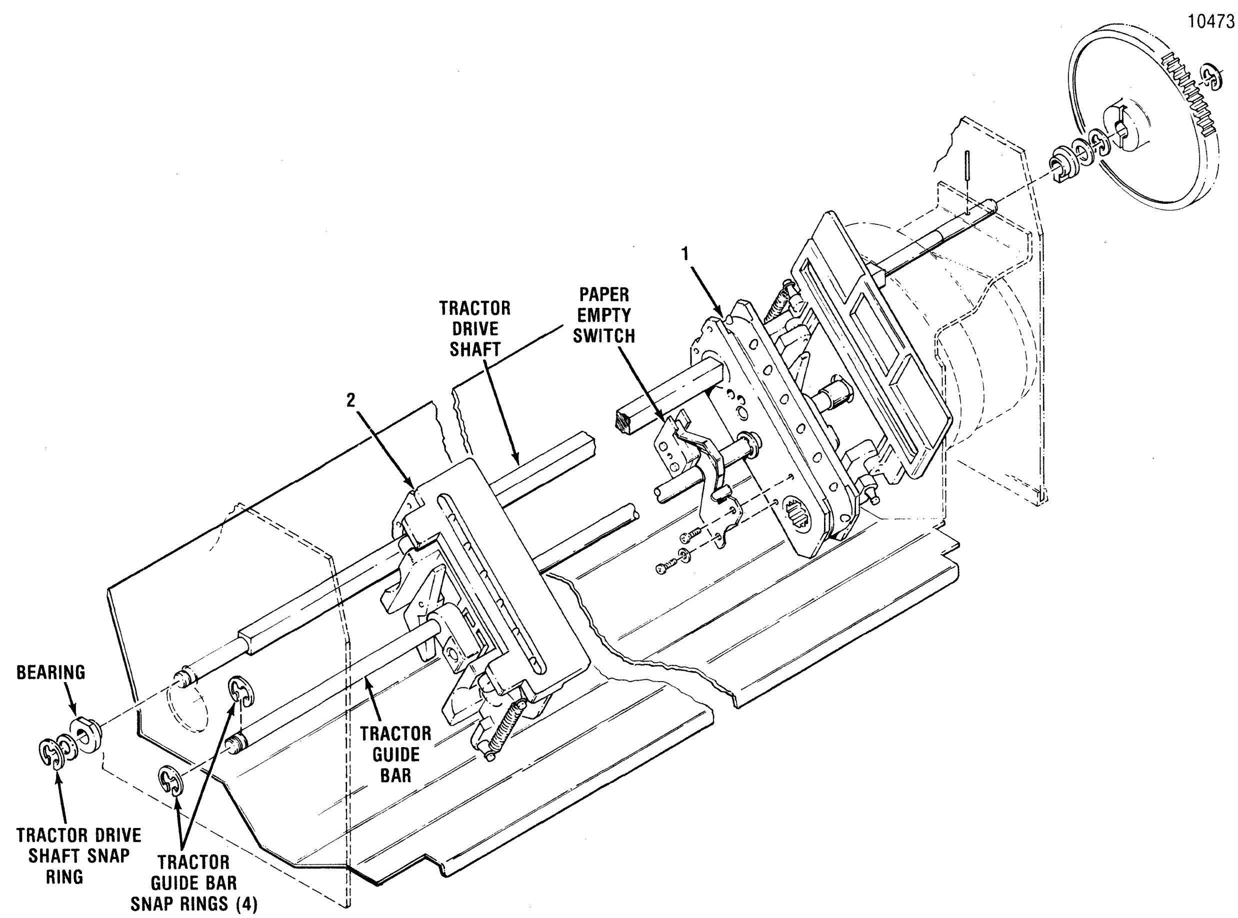


Figure 5-19 Removal/Replacement, Tractor Assemblies

5. Remove the tractor drive shaft snap ring and washer from the left end of the shaft (ring & washer are labeled in Figure 5-19).
6. Slide the bearing labeled in Figure 5-19 to the left, causing the guide shaft to drop to the hole below.
7. Move the shaft to the right, and lower right side of the shaft into the hole below.
8. Push the tractor shaft to the right, through the tractor assemblies, and remove the tractors from the printer.
9. To replace the tractor assemblies, reverse steps 1 through 8.

NOTE

Verify tractor pin alignment when replacing tractors on guide shaft.

5.24 ON/OFF SWITCH

The ON/OFF switch, item 1 of Figure 5-20, is located on the left front of the printer base and no tools are required to remove the switch. To remove the ON/OFF switch, refer to Figure 5-20 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Remove the power supply assembly per paragraph 5.29.
3. Remove the four connectors from the switch.
4. Push the switch forward through the opening in the printer base and remove the switch (1) from the printer.
5. To replace the switch, reverse steps 1 through 4.

NOTE

Ensure the wires are connected properly when replacing the switch. Refer to Appendix A for a wiring diagram of the printer.

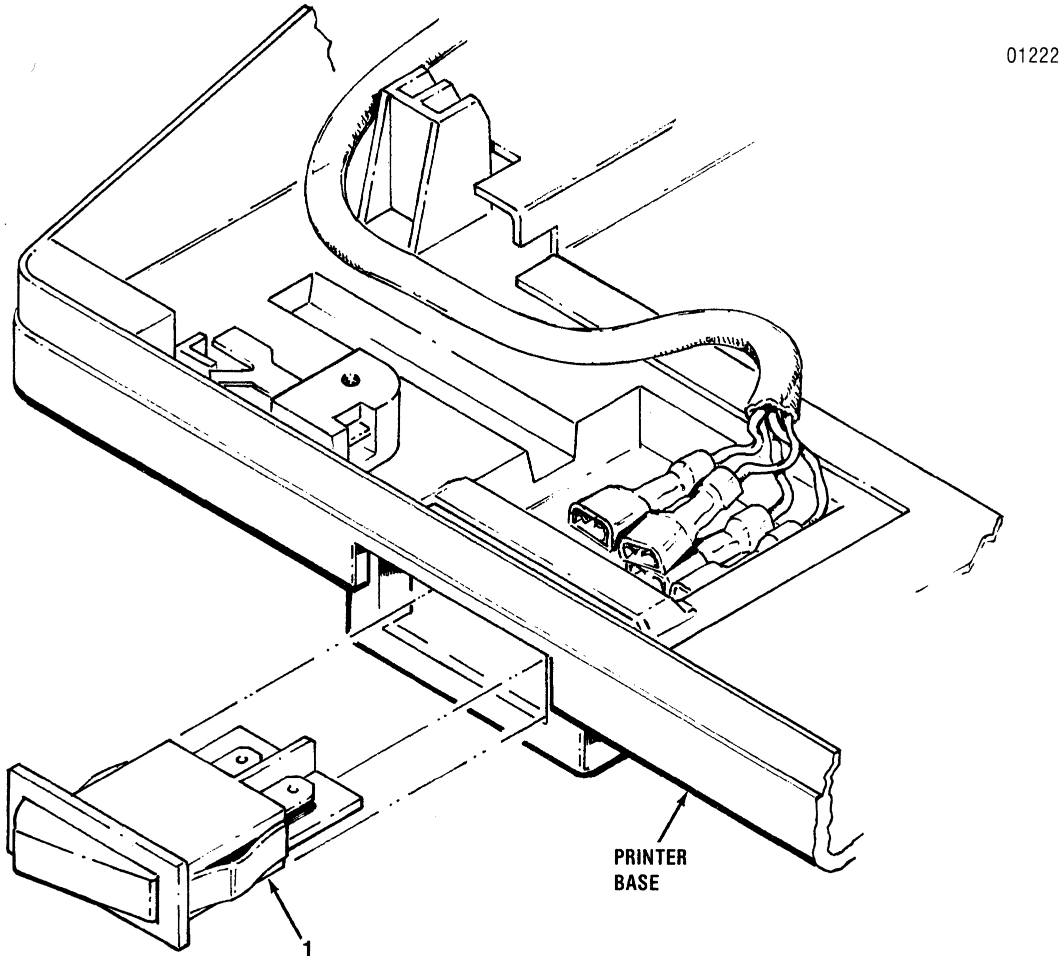


Figure 5-20 Removal/Replacement, On/Off Switch

5.25 MAIN FUSE

The main fuse, item 1A or 1B of Figure 5-21, is located in the rear of the printer and is removed using a slotted head screwdriver. To remove the fuse, refer to Figure 5-21 and perform the following steps:

1. Remove the power cord from wall socket.
2. Using a slotted head screwdriver, turn the fuse holder one quarter of a full turn, counterclockwise.
3. Remove the defective fuse (1A or 1B) from the fuse holder.
4. Install the new fuse into the fuse holder and replace the fuse holder back into the printer base.

NOTE

Ensure the same type rated fuse is installed when replacing the fuse. Refer to Figure 5-21.

5.26 POWER CORD

The 8 foot power cord, item 2A or 2B of Figure 5-21, is terminated on one end with a 3-prong grounded plug and terminated on the other end with a 3-prong receptacle. The cord is removed from the printer by removing the plug end from the external power source, then the receptacle end from the printer. Refer to Figure 5-21.

5.27 COVER LATCH SPRINGS

Four small springs, item 1 of Figure 5-22 are located on the inside of the body cover to help secure the top and rear covers to the body cover.

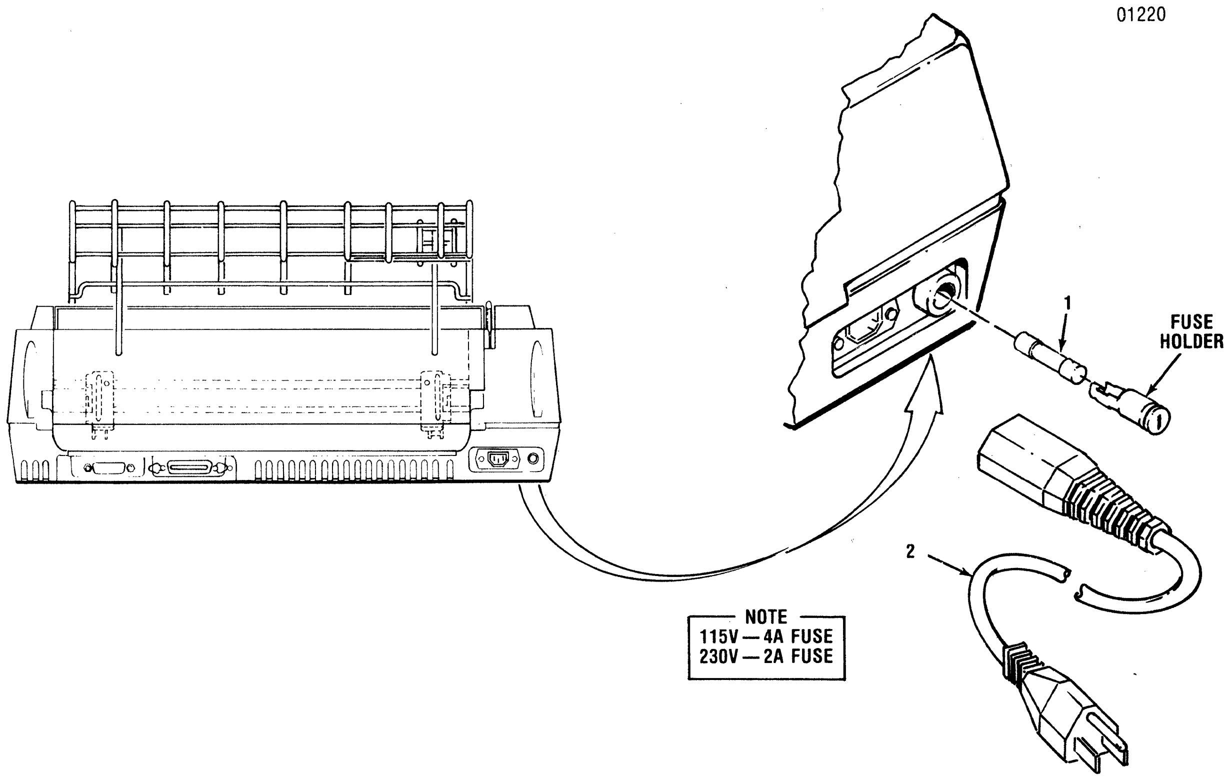


Figure 5-21 Removal/Replacement, Main Fuse and Power Cord

To remove any of the four springs, refer to Figure 5-22 and perform the following steps:

1. Remove the body cover per paragraph 5.2.3.
2. Turn cover over to expose the inside, then stretch the spring enough to free one end of the spring from its catch.
3. Slide the other end of the spring (1) off the other catch, and remove.
4. To replace spring, attach one end of spring to cover catch, stretch spring, and slide other end of spring over the other catch.
5. Replace body cover by reversing steps 1 through 6 of paragraph 5.2.3.

5.28 PICO FUSE

The pico fuses, items F1 through F12 of Figure 5-23 are located on the Formatter/Controller pcb and are removed using needle-nose pliers. To remove the pico fuses, refer to Figure 5-23 and perform the following steps:

1. Remove the Formatter/Controller pcb per paragraph 5.31.

> **NOTE**
>
> Refer to Figure 5-23 for the locations (F1 through F12) of the pico fuses and to Appendix E for pico fuse color coding information.

2. Remove the defective fuse from the Formatter/Controller pcb.
3. Install new pico fuse by pushing fuse into place.

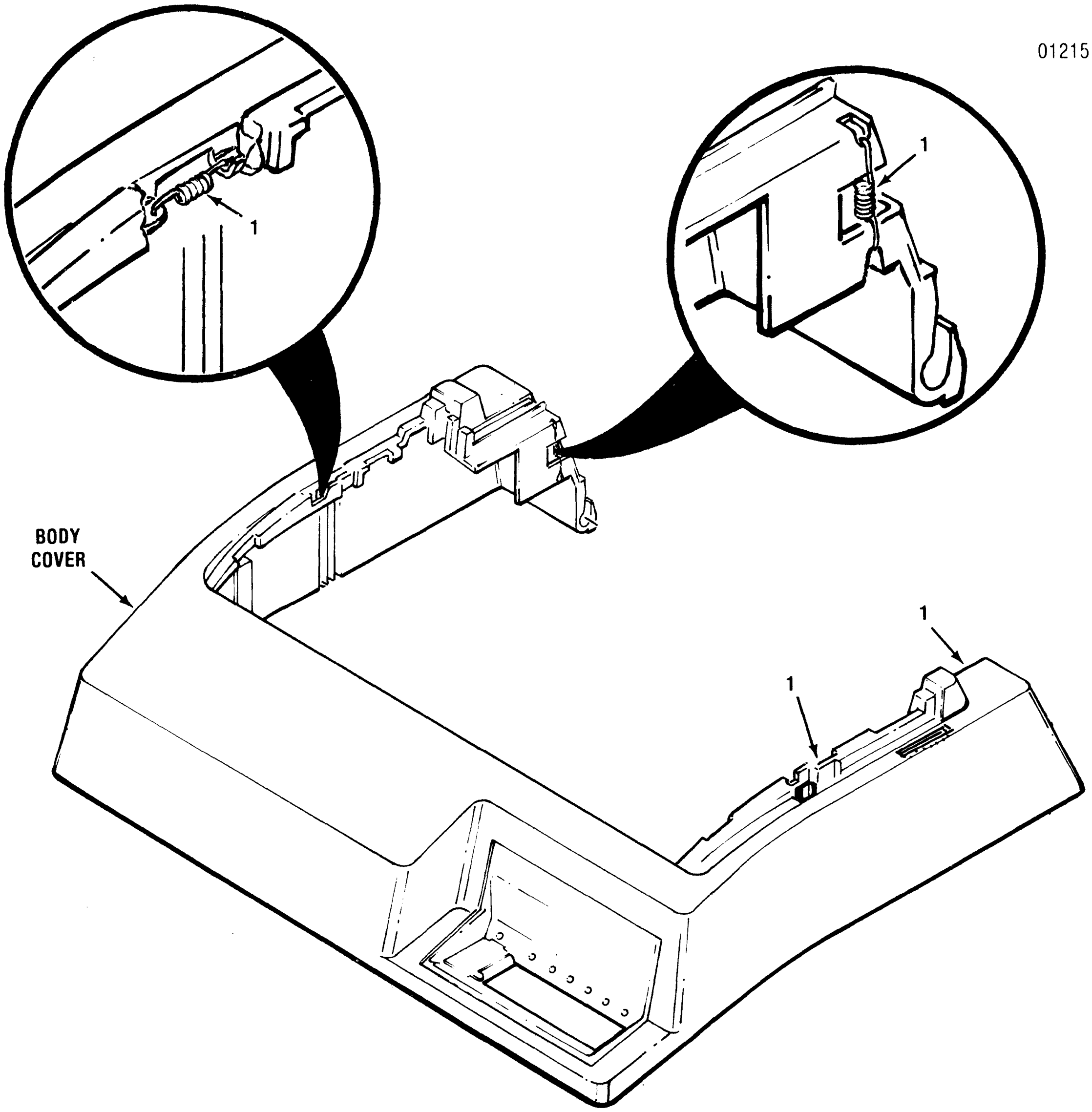


Figure 5-22 Removal/Replacement, Cover Latch Springs

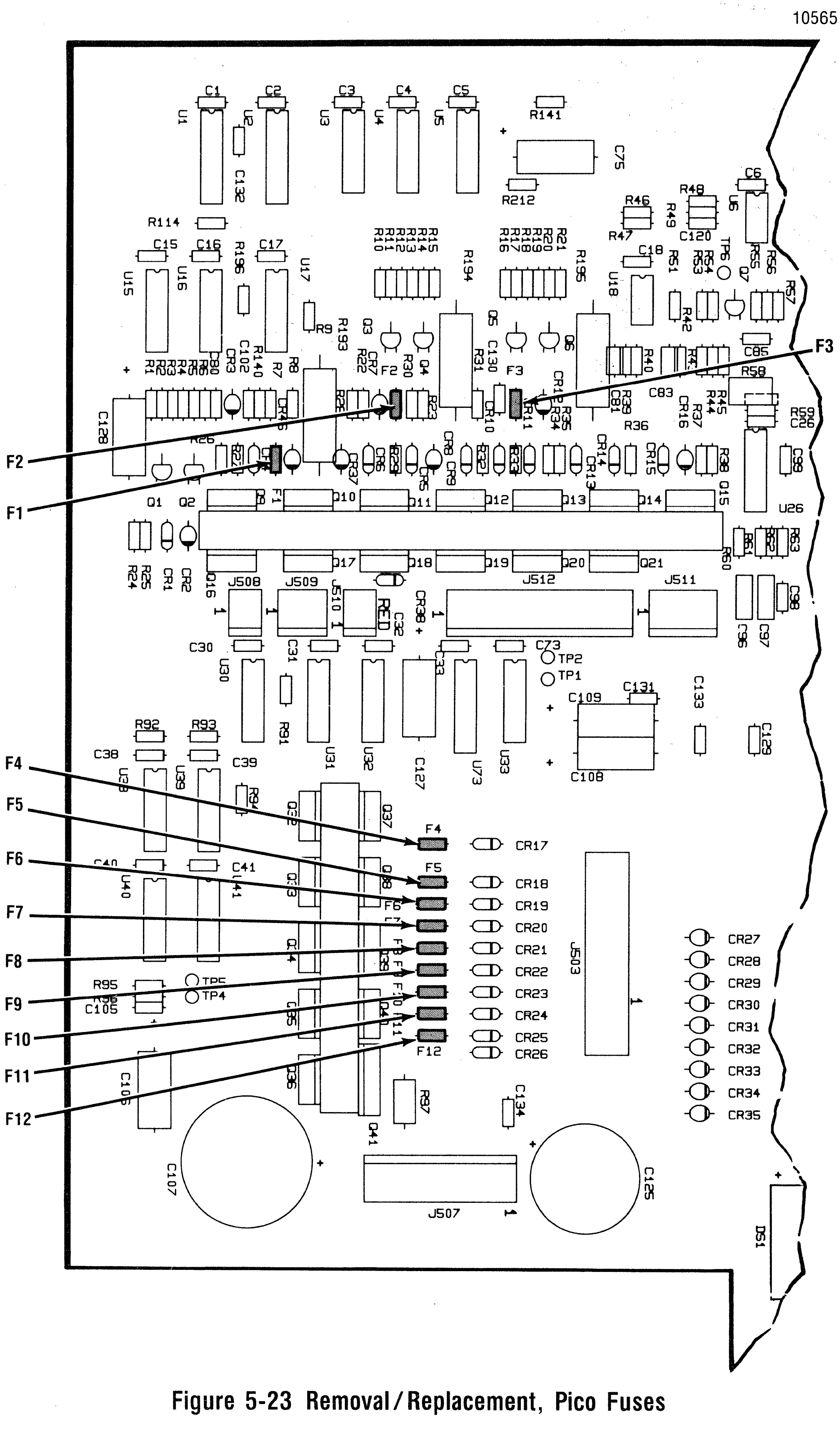


Figure 5-23 Removal/Replacement, Pico Fuses

5.29 POWER SUPPLY ASSEMBLY

The power supply assembly, item 1A or 1B of Figure 5-24, is mounted to the printer base and is removed using a Phillips head screwdriver. To remove the power supply, refer to Figure 5-24 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Disconnect the cable assembly connector P507 from the Formatter/Controller pcb.
3. Remove the two Phillips head screws mounting the front of the power supply to the printer base.
4. Disconnect the three connectors from the bottom of the line filter assembly which is attached to the left side of the power supply.
5. Pull the power supply forward, off the two mounting tabs, and remove the power supply assembly (1A or 1B) from the printer.
6. To replace the power supply assembly, reverse steps 1 through 5.

5.30 FORMATTER/CONTROLLER PCB

The Formatter/Controller pcb, item 2 of Figure 5-24, is mounted to the printer base by quick release fasteners. No tools are required to remove the pcb. To remove the Formatter/Controller pcb, refer to Figure 5-24 and perform the following steps:

1. Tilt the printer mechanism per paragraph 5.10.1.
2. Disconnect the power supply cable from the Formatter/Controller pcb.
3. Detach connectors P208, P209, P210, P211, and P212 from the Formatter/Controller pcb.
4. Lift up on the five quick release fasteners securing the pcb to the printer base.
5. Pull the pcb forward and lift the Formatter/Controller pcb up and out of the printer.
6. To replace the Formatter/Controller pcb, reverse steps 1 through 5.
7. Refer to paragraph 4.8 for the adjustment required after replacing the Formatter/Controller pcb.

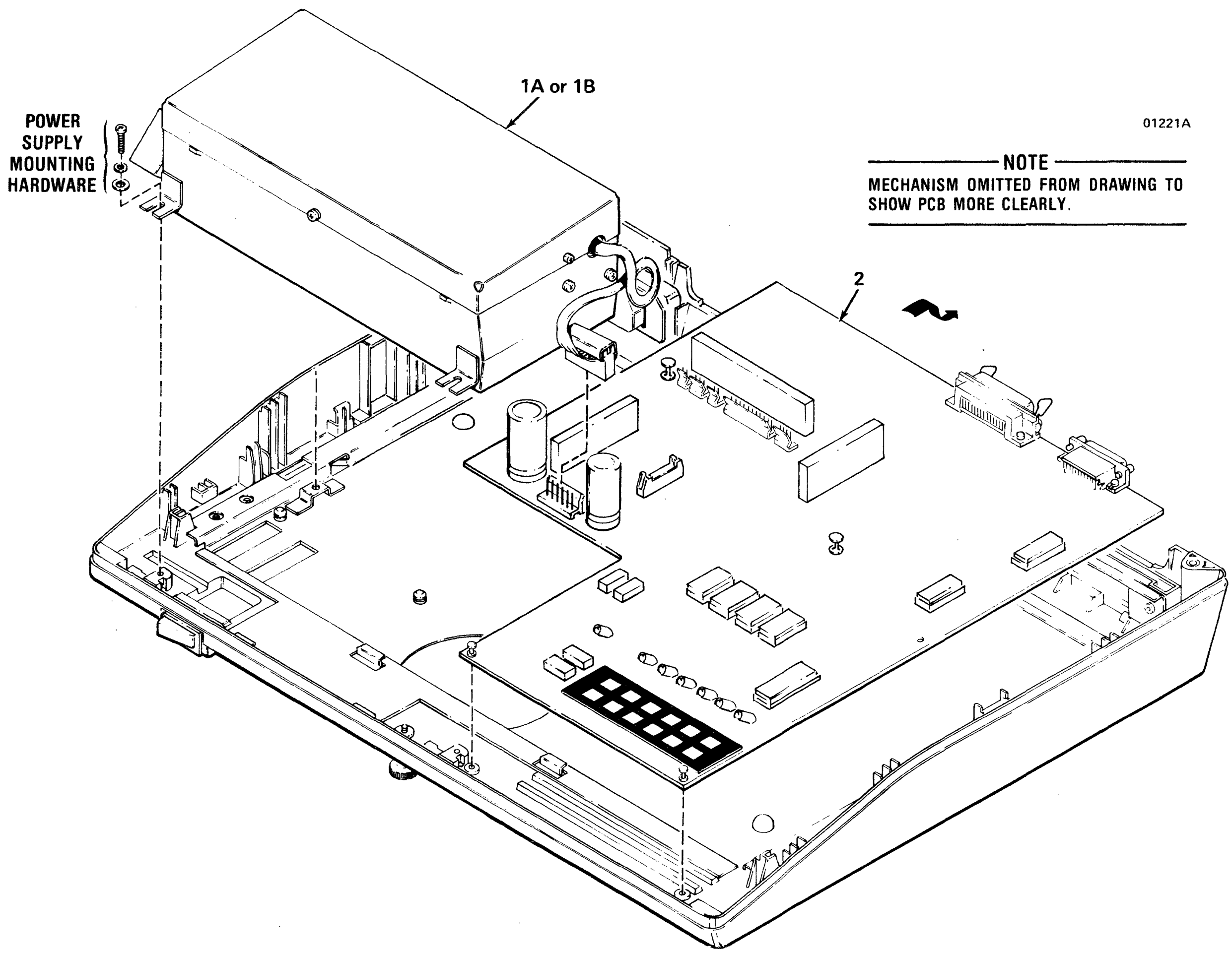


Figure 5-24 Removal/Replacement, Power Supply Assembly and Formatter/Controller PCB

5.31 RECOMMENDED SPARE PARTS LISTING

The following table lists the recommended spares according to Figure and item number, and provides a description of the recommended spare and its part number. An example is shown below:

5-2	**1**	**63180330-5001**	**Paper Outlet Rack Assembly**
Figure in which recommended spare is shown.	Item number used in figure to identify spare.	Recommended spare part number.	Description of recommended spare part.

Table 5-2 Recommended Spare Part Listing

FIGURE	ITEM	PART NUMBER	DESCRIPTION
5-2	1	63180330-5001	Paper Outlet Rack Assembly
	2	63180331-2001	Paper Inlet Rack
	3	U20241001	Cover Interlock Magnet
5-3	1	64000520-6001	Ribbon Cassette
	2	63180315-5001	Print Head Assembly
5-4	1	63180285-4001	Head Flex Cable
5-5	1	63180254-4001	Head Adapter PCB
5-9	1	U20139001	Carriage Drive Motor Belt
	2	U20143001	Carriage Drive Belt
5-10	1	39099012-1001	Optic Sensor Assembly
5-11	1	U20187001	Carriage Drive Motor
5-12	1	U20157000	Encoder/Timing Disc
5-14	1	U20166001	Ribbon Drive Motor
5-15	1	U20242001	Cover Interlock Switch
5-16	1	531335001	Paper Drive Belt
5-17	1	U21024001	Paper Drive Motor
5-18	1	U21014001	Paper Empty Switch
5-19	1	U20073001	Tractor Assembly, Left
	2	U20074001	Tractor Assembly, Right
5-20	1	39098122-1001	ON/OFF Switch
5-21	1A	39030033-1027	Main Fuse, 4 Amp (115V)
	1B	39030036-1007	Main Fuse, 2 Amp (230V)
	2A	39620021-1003	Power Cord, 115V
	2B	39620021-1004	Power Cord, 230V
5-22	1	519927001	Cover Latch Springs (4)
5-23	F1-F12	39030030-1006	Pico Fuse, 3 Amp
5-24	1A	64000399-5002	Power Supply Assembly, 50 Hz
	1B	64000399-5001	Power Supply Assembly, 60 Hz
	2	64001101-4001	Formatter/Controller PCB

SECTION 6
OPTIONS AND ACCESSORIES

6.1 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

6.2 OPTIONS

The following options are available:

CURRENT LOOP CONVERSION—A 20 MA current loop capability is provided by an optional plug-in-adapter board and current loop cable.
ORDER P/N 64000547-6001

DATA INPUT CABLES—There are four data input cables available.

- **Standard Parallel Cable**—This is the Centronics standard parallel interface cable. The 15 foot cable is terminated at either end with a 36-pin Molex connector.
  ORDER P/N 39620034-1001

- **RS232 Cable**—This is the Centronics standard RS232 serial interface cable. The 10 foot cable is terminated at either end with a 25-pin connector.
  ORDER P/N 39620033-1001

- **Current Loop Cable**—The 20 MA current loop cable is required when using the current loop interface. The 10 foot cable is terminated at one end with a 25-pin connector and at the other end with four ring terminals.
  ORDER P/N 39620031-1001

- **IBM to Centronics Parallel Cable**—The cable is used to connect the Centronics printer to an IBM personal computer. The cable terminates at one end with a 36-pin connector (printer connection) and at the other end with a 25-pin "D" series male connector (host connection).
  ORDER P/N 39620035-1001

60/50 HZ CONVERSION—An optional field kit available to convert the printer from 115 VAC, 60 Hz to 220 VAC, 50 Hz or vice versa.
Order P/N 64000546-6001

PROM KITS—There are several PROM option kits currently available for the Model 351 which are described as follows.

- **Model 351 Modification Kit**—This PROM kit permits a firmware modification so that the user may designate the monospaced character set as the alternate character set. Via escape sequences, the user may disignate either the unidirectional or bidirectional character set.
  Order P/N 64001101-6003

- **Model 351 Bar Code & Large Character Option Kit**—This PROM kit removes the proportional multipass printing feature of the Model 351 and replaces it with bar code/large character printing capability. The bar code formats include: Alpha 39 and 2 of 5 Interleaved. (Note: Remaining 351 firmware must be at Rev. J or later.)
  Order P/N 64000193-6701

6.3 ACCESSORIES

The following accessories are available.

UNIVERSAL PRINTER 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 P/N 81100000-6170

RIBBON CASSETTES—70 yard throwaway ribbon cassettes are available in 4-pack kits.
ORDER P/N 64000520-6001

MODEL 351 TECHNICAL MANUAL—Provides detailed theory of operation, adjustment, and

removal/replacement procedures.
ORDER P/N 37403510-6001

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

ORDER P/N 37403502-6001

TOOL KIT—A tool kit containing all the necessary tools to maintain the printer.
ORDER P/N 63002399-6001

REPLACEABLE PRINT HEAD ASSSEMBLY—The standard nine-wire print head used in Model 351. The print head removal/replacement procedure is described in Section 5 of this manual.
ORDER P/N 63180315-5001.

APPENDIX A
ELECTRICAL DRAWINGS

A.1 GENERAL INFORMATION

The following pages contain schematic, wiring and assembly diagrams for the Model 351 printer. A list of the drawings follows:

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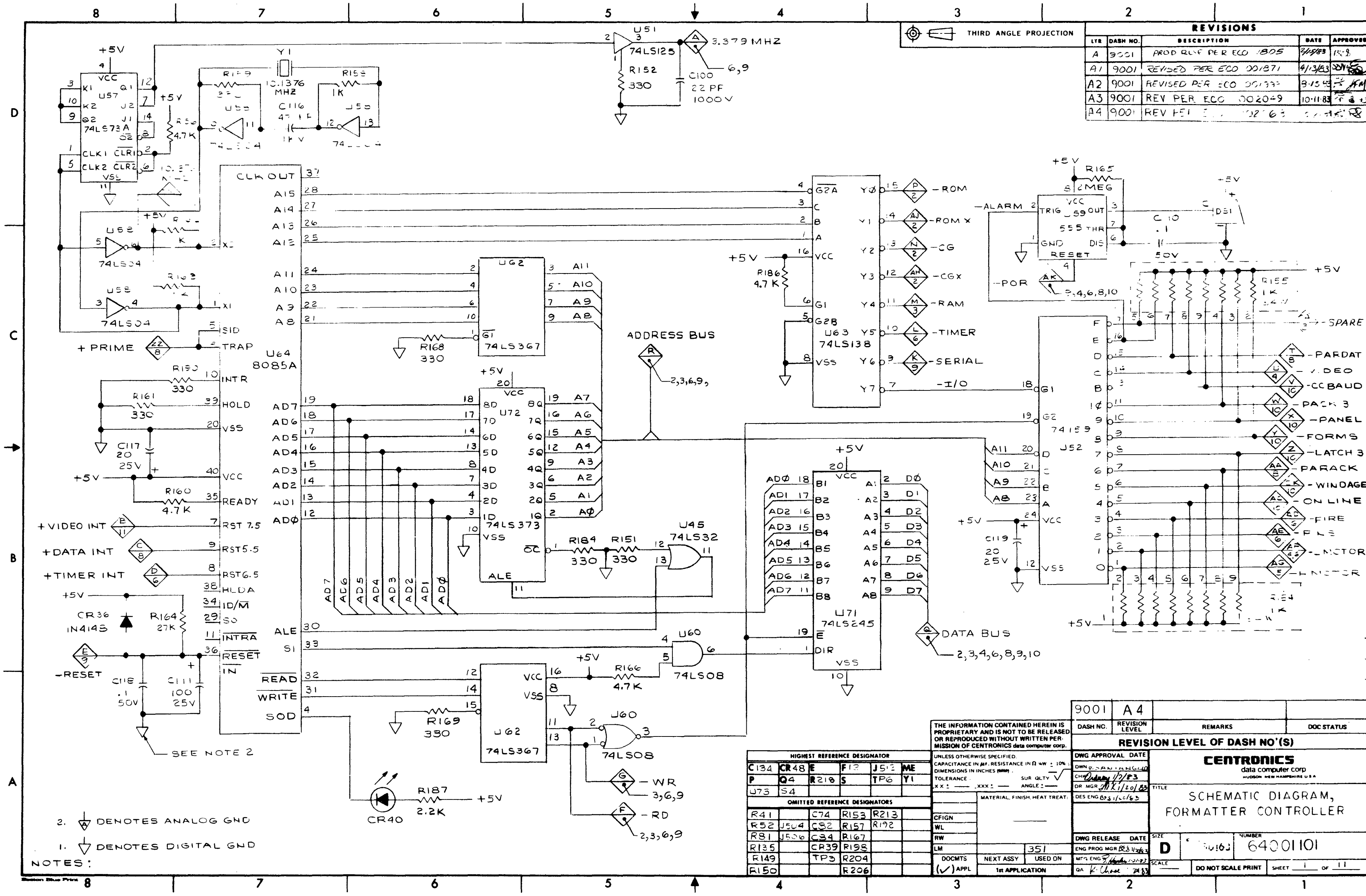

Figure A-1 Schematic Diagram, Formatter/Controller 64001101-9001 (Sheet 1 of 11).

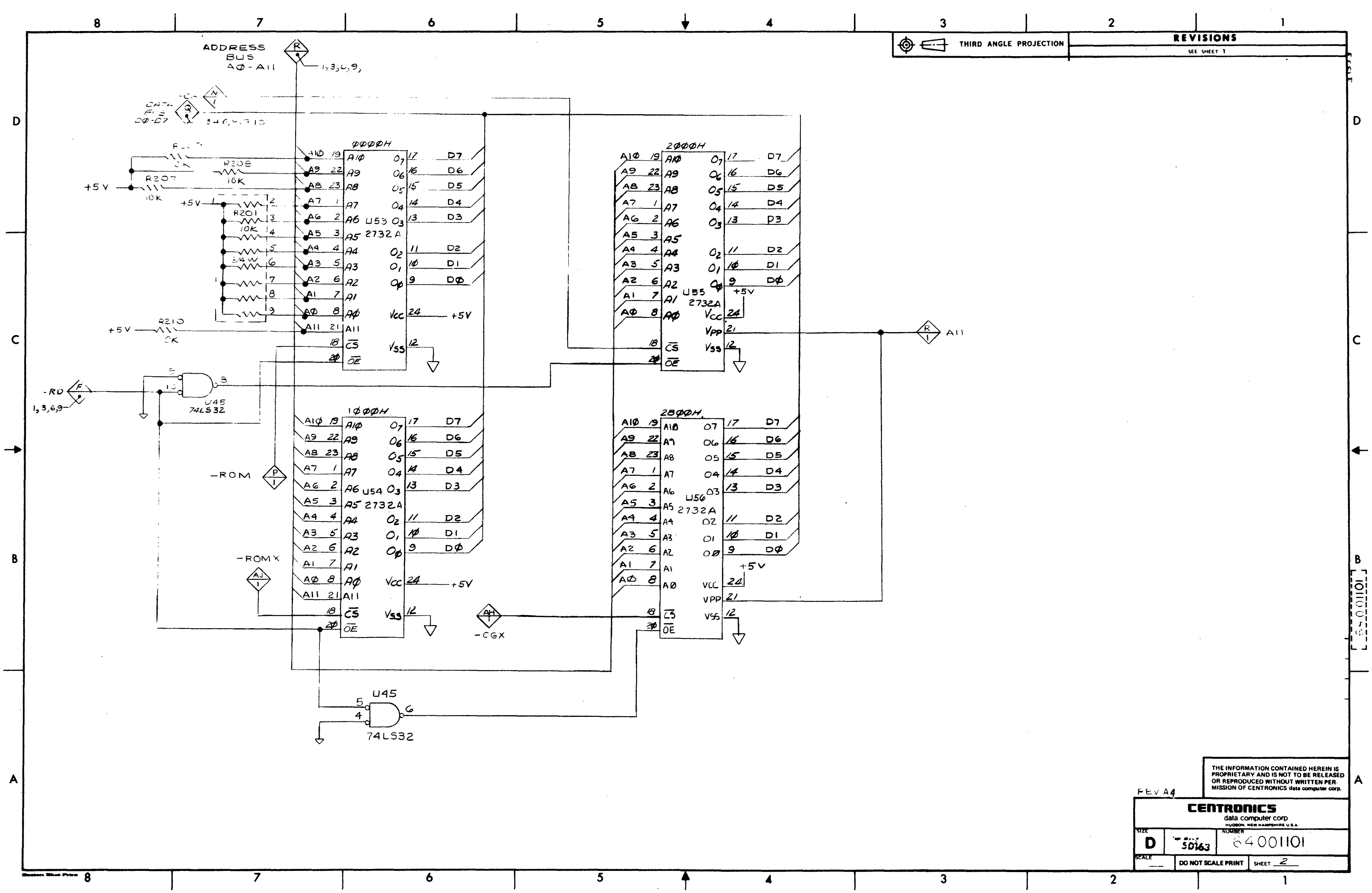

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 2 of 11).

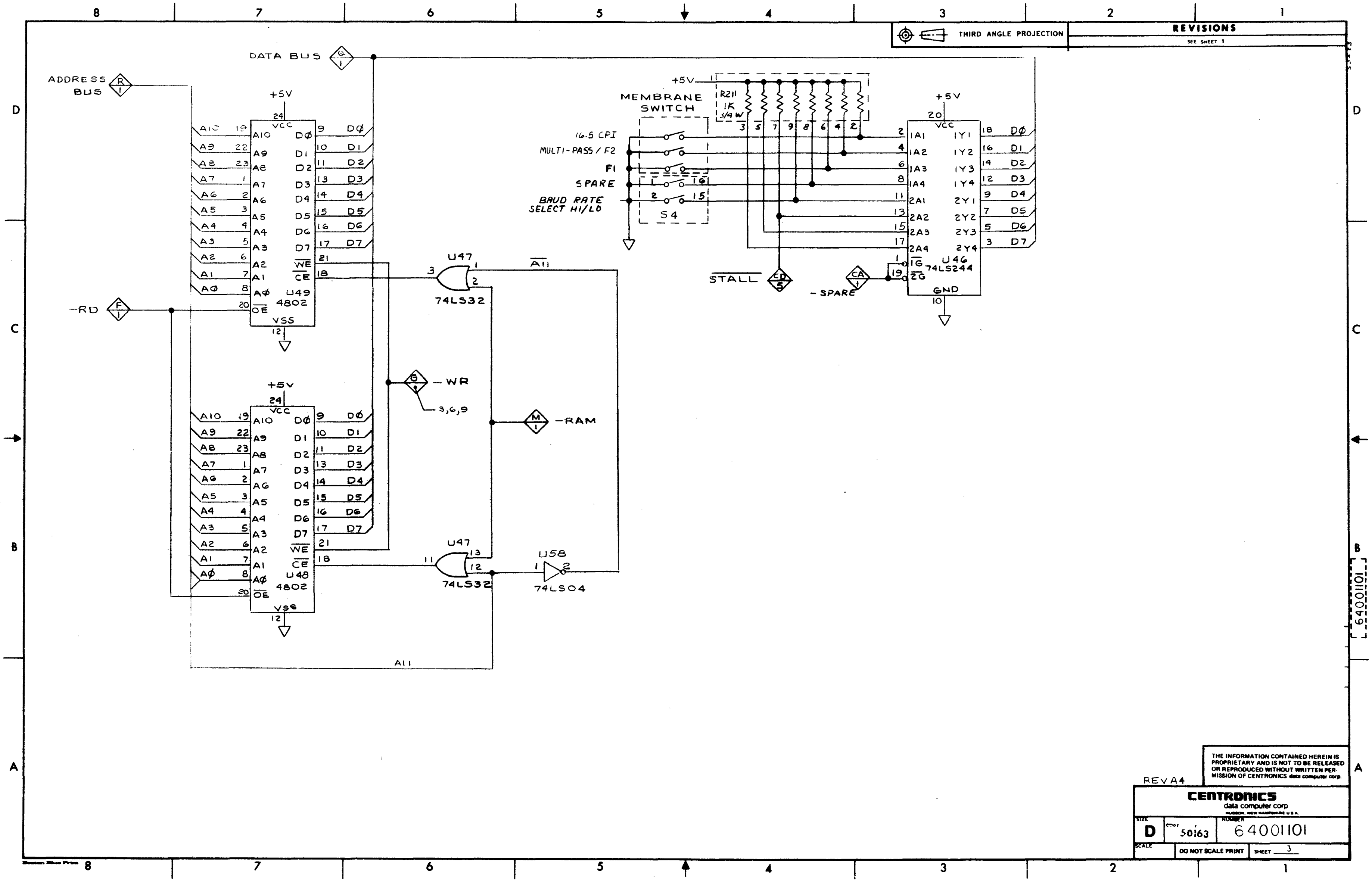

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 3 of 11).

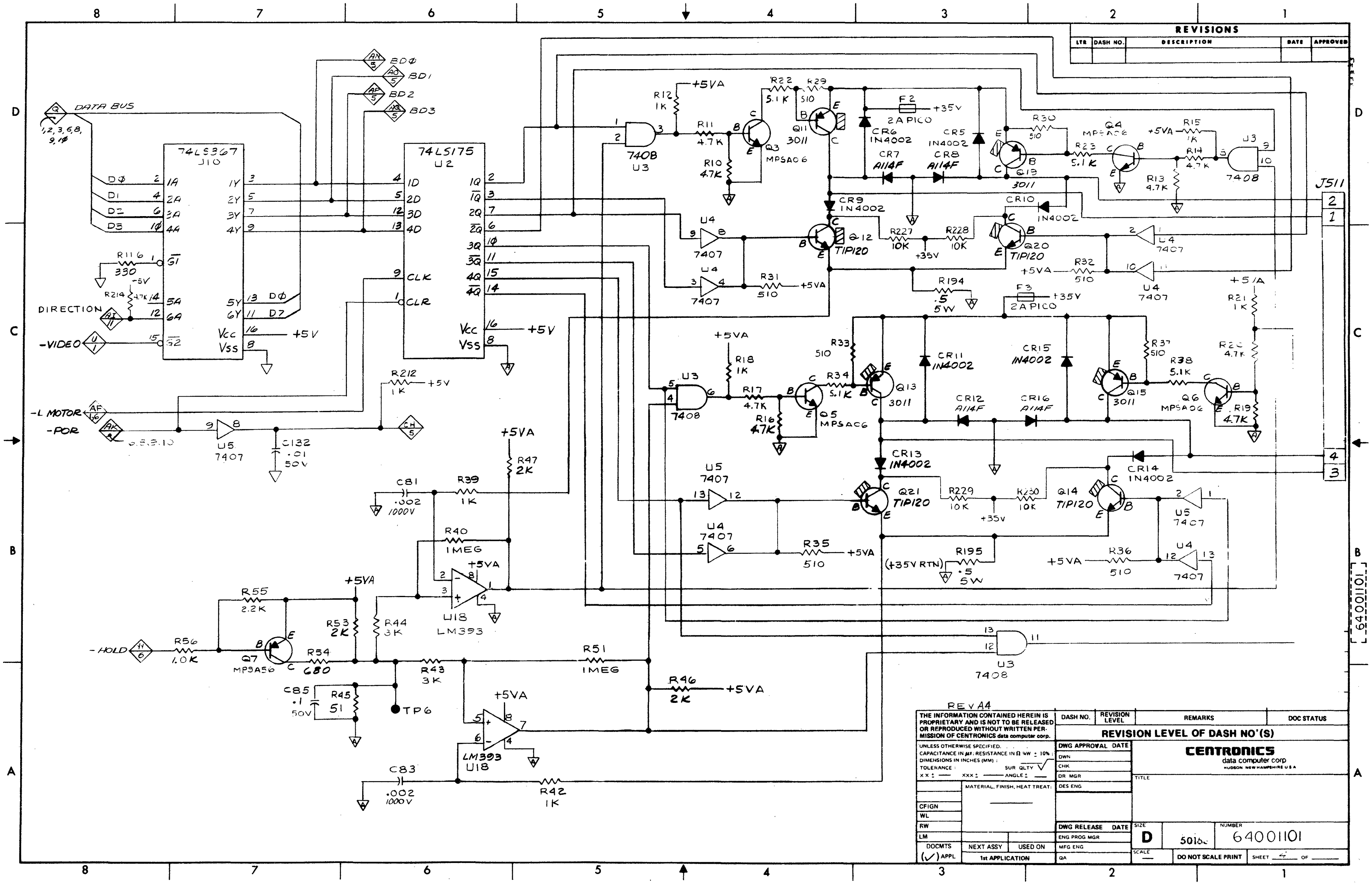

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 4 of 11).

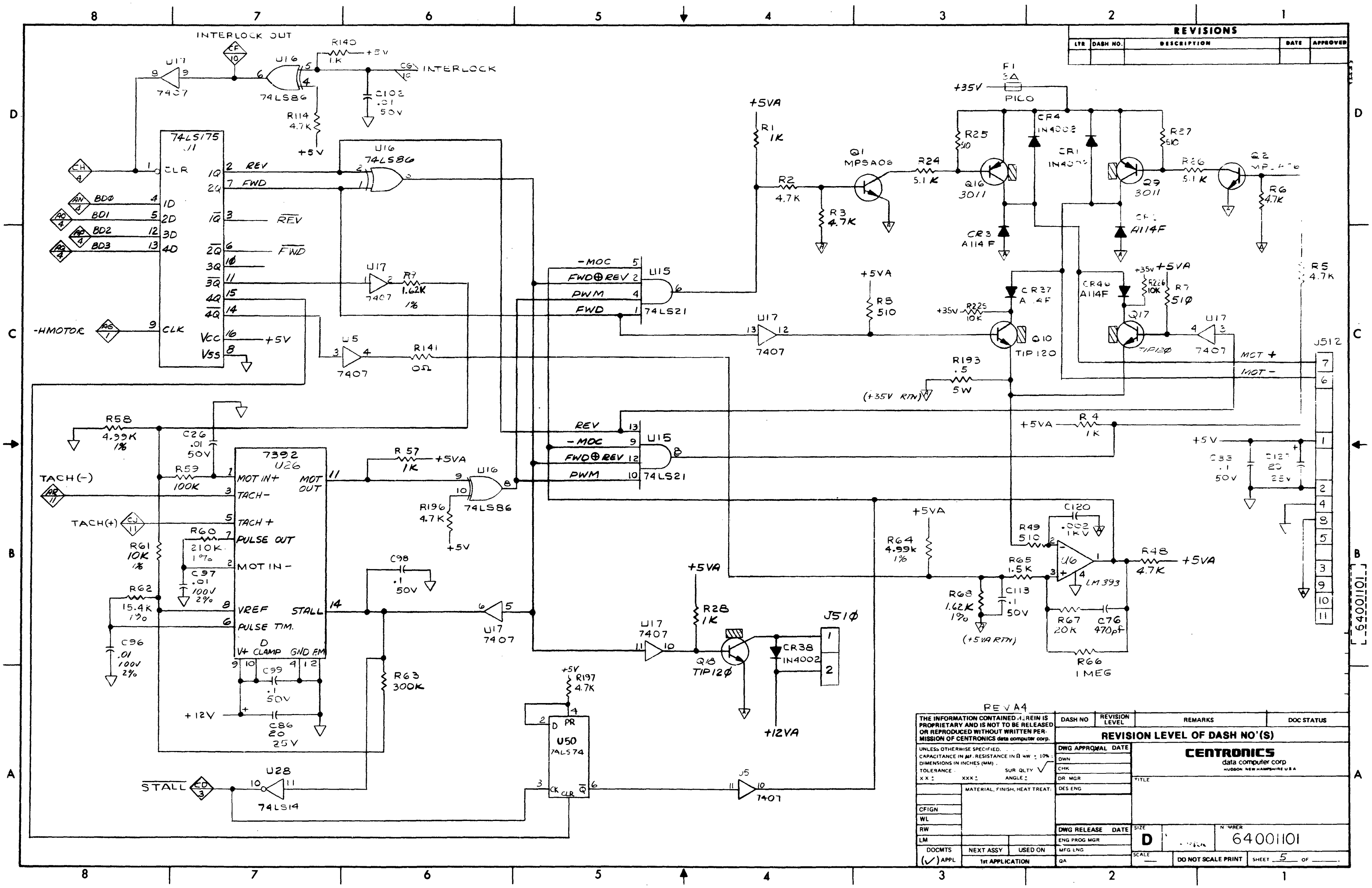

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 5 of 11).

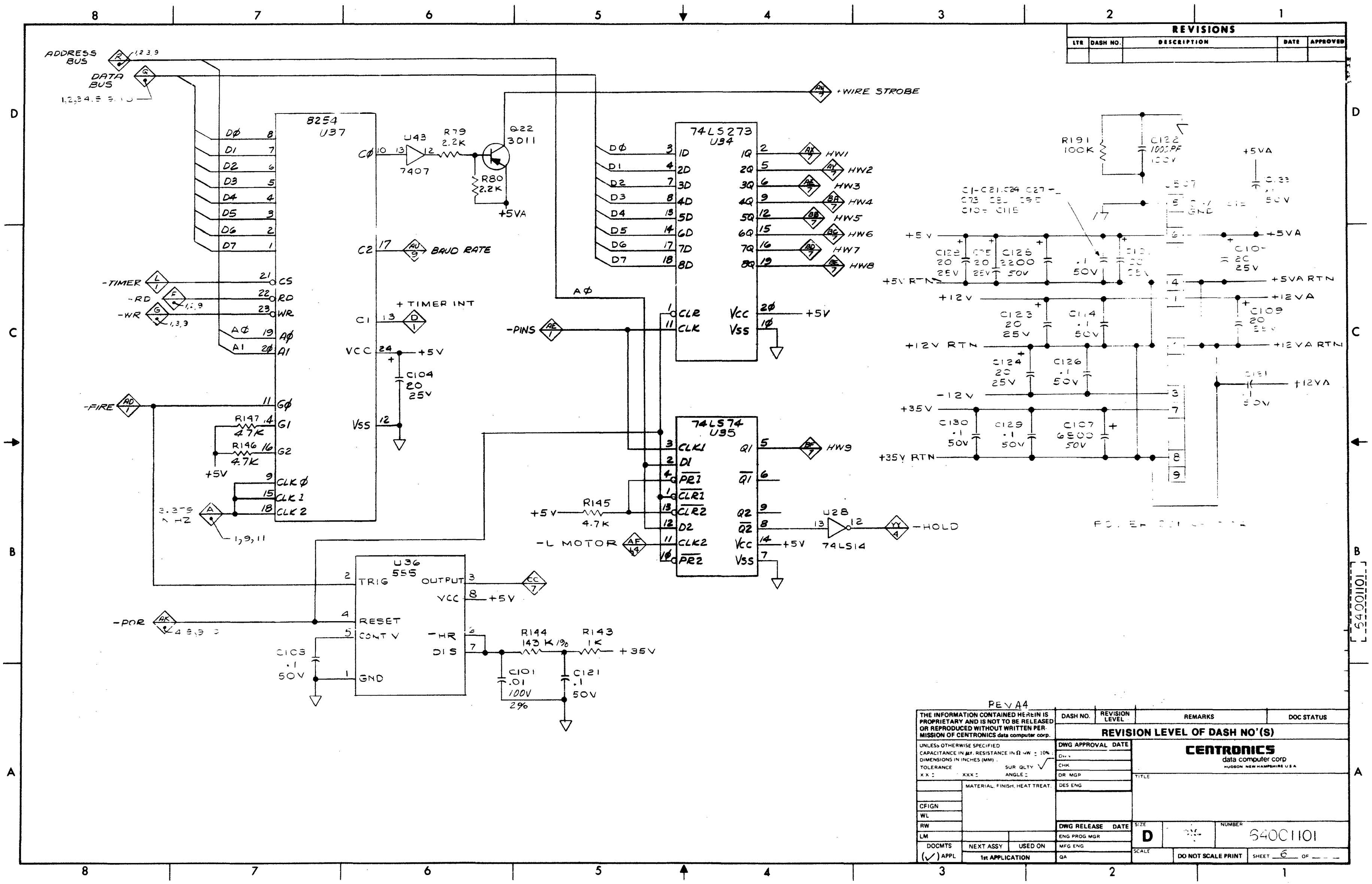

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 6 of 11).

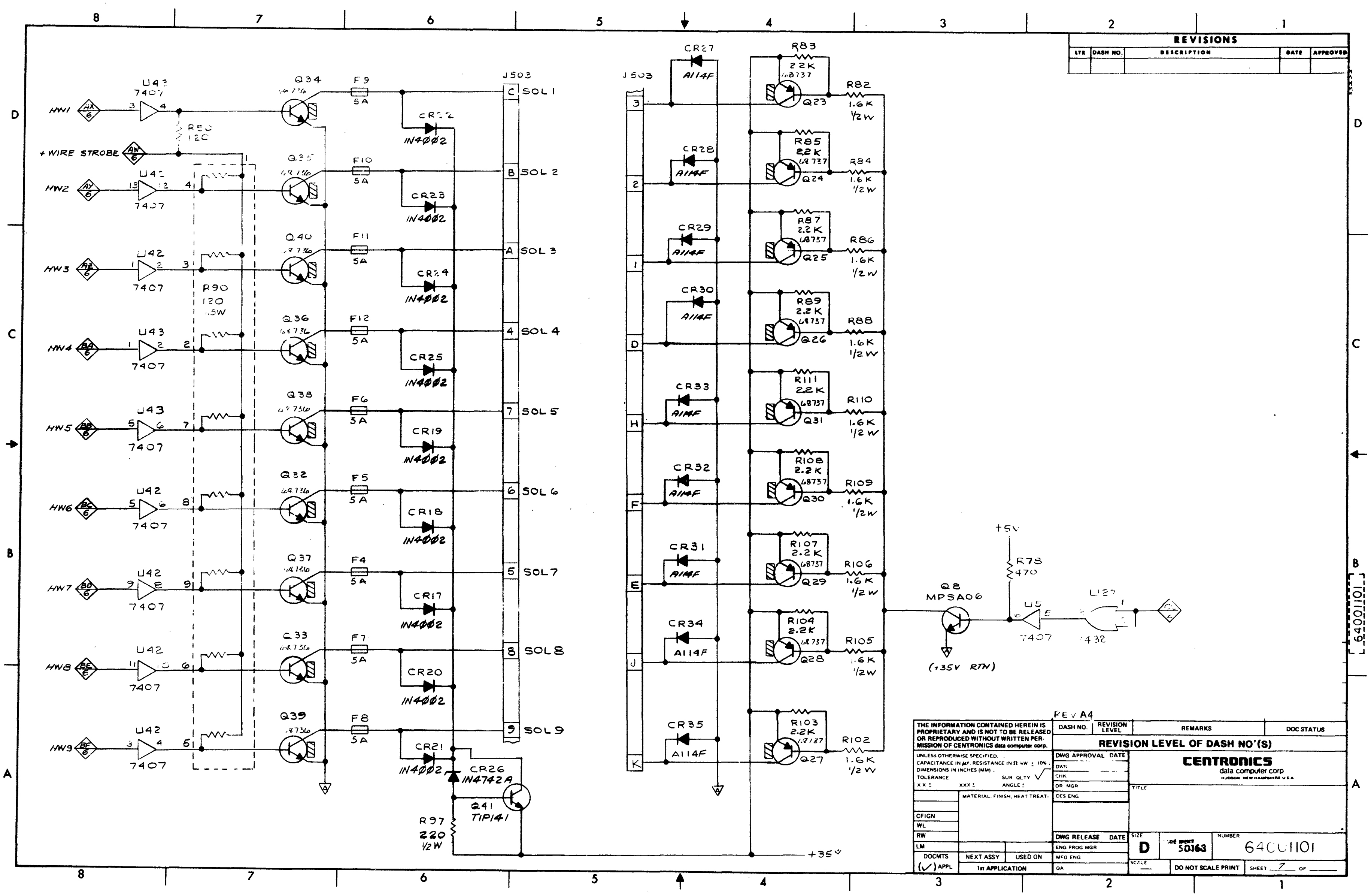

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 7 of 11).

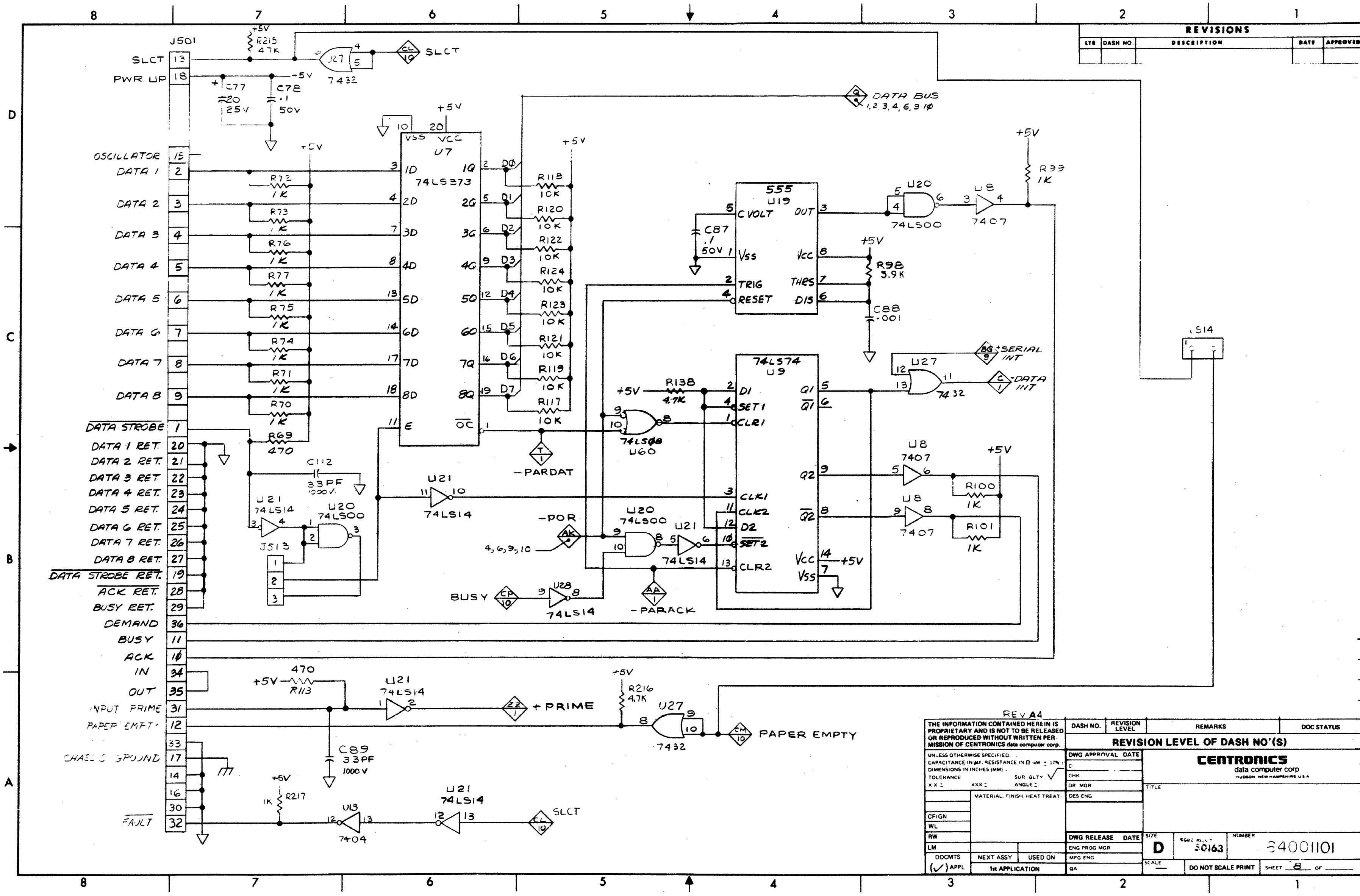

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 8 of 11).

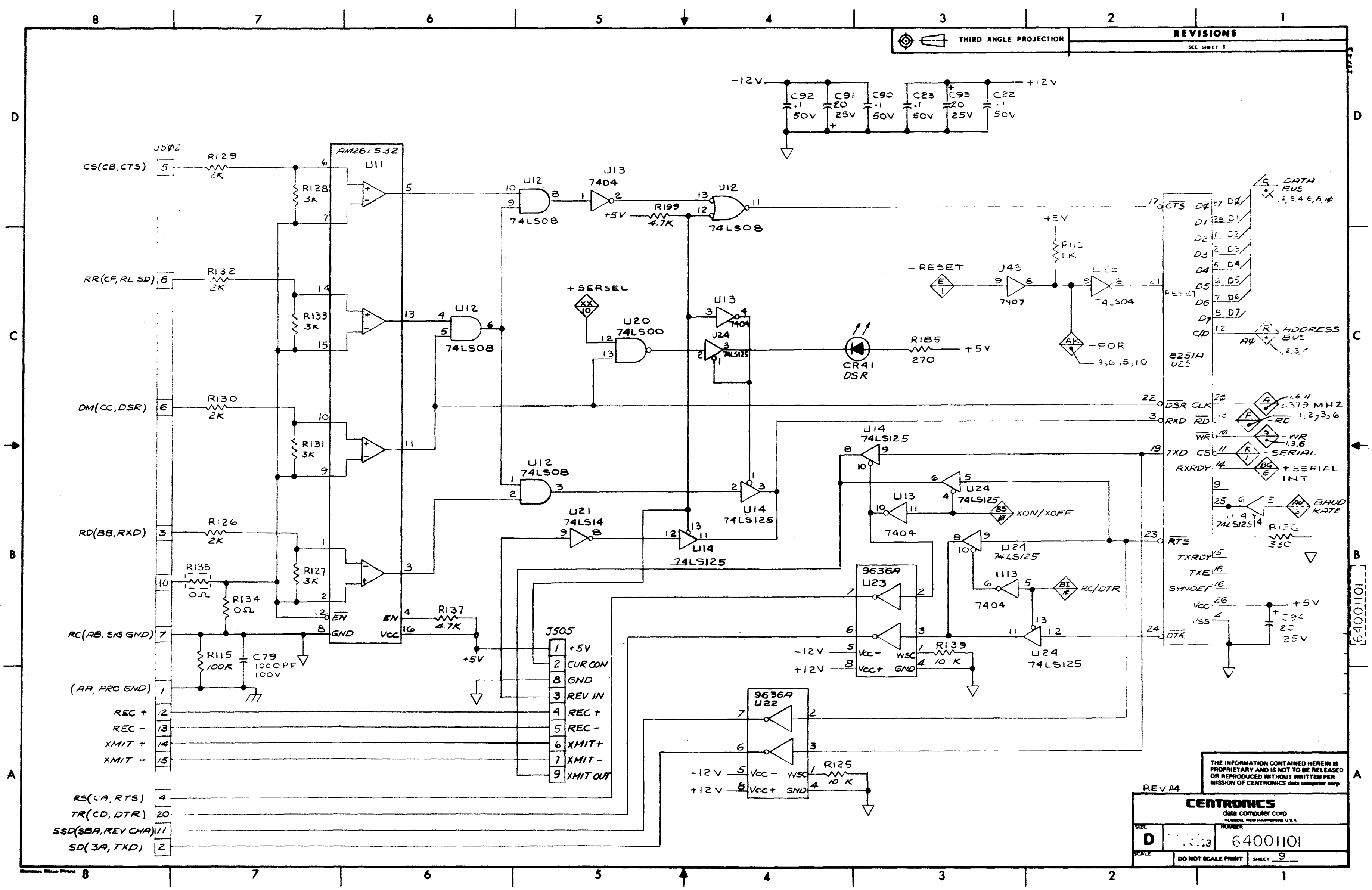

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 9 of 11).

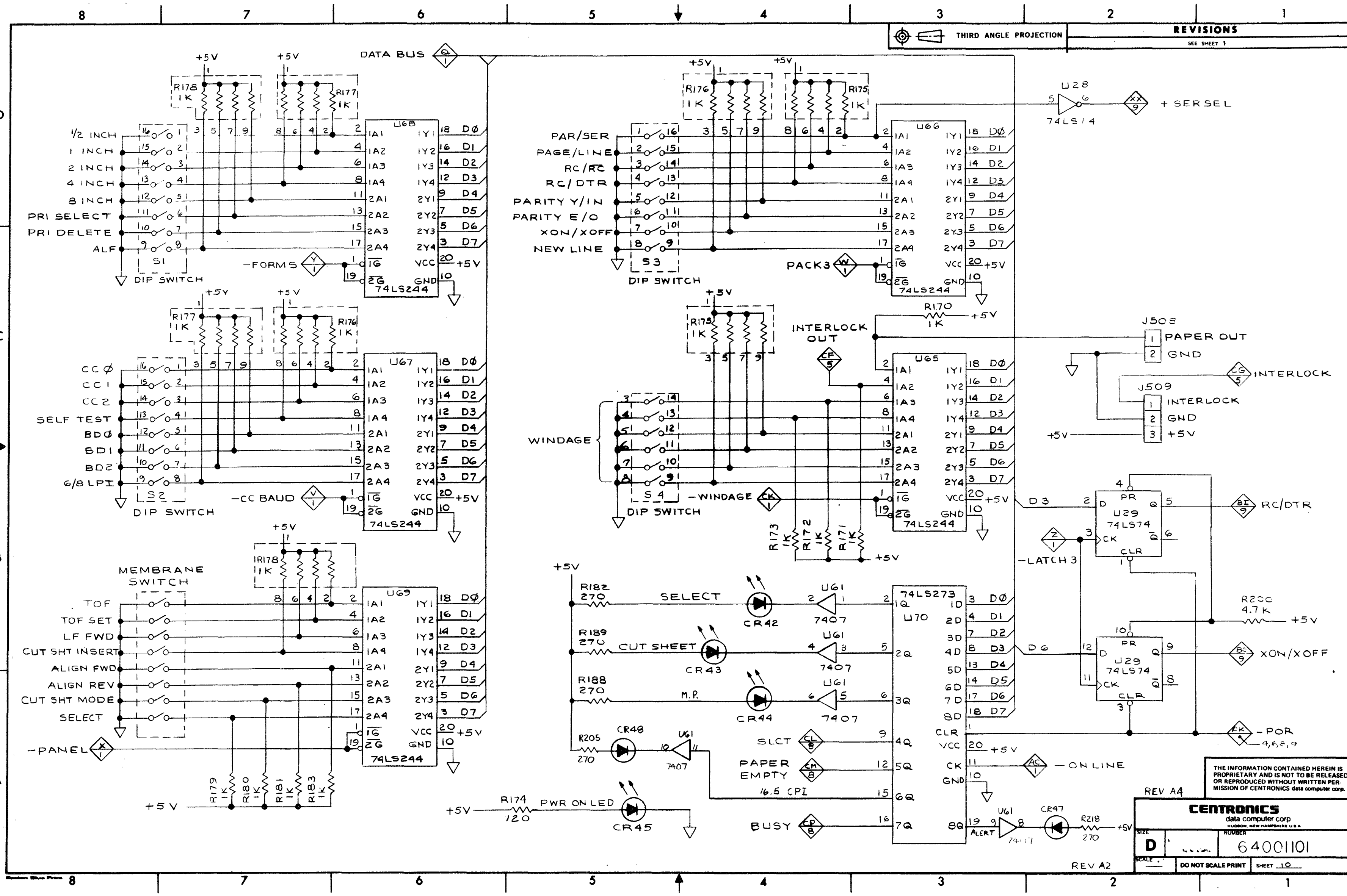

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 10 of 11).

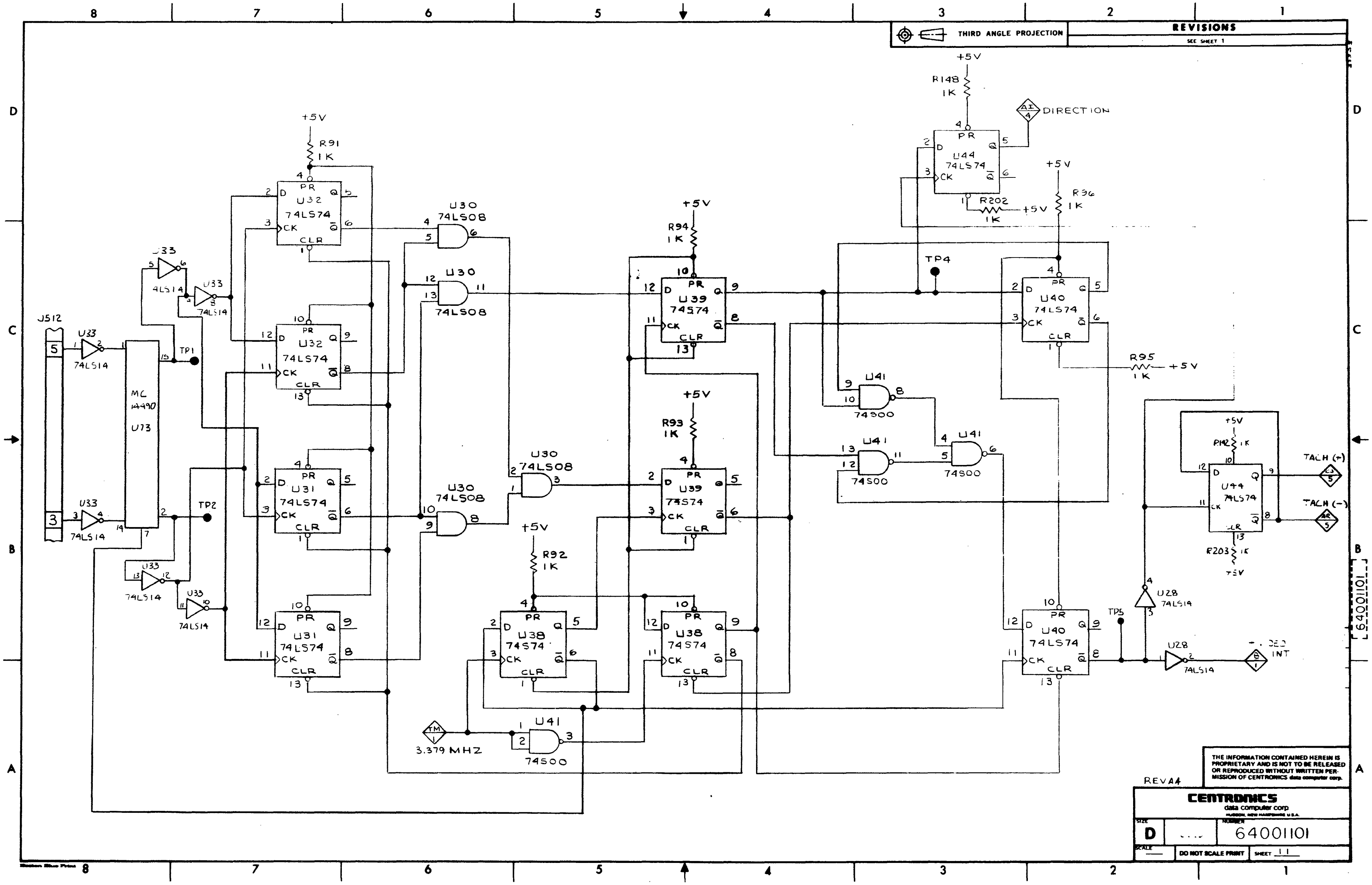

Figure A-1 Schematic Diagram, Formatter/Controller, 64001101-9001 (Sheet 11 of 11).

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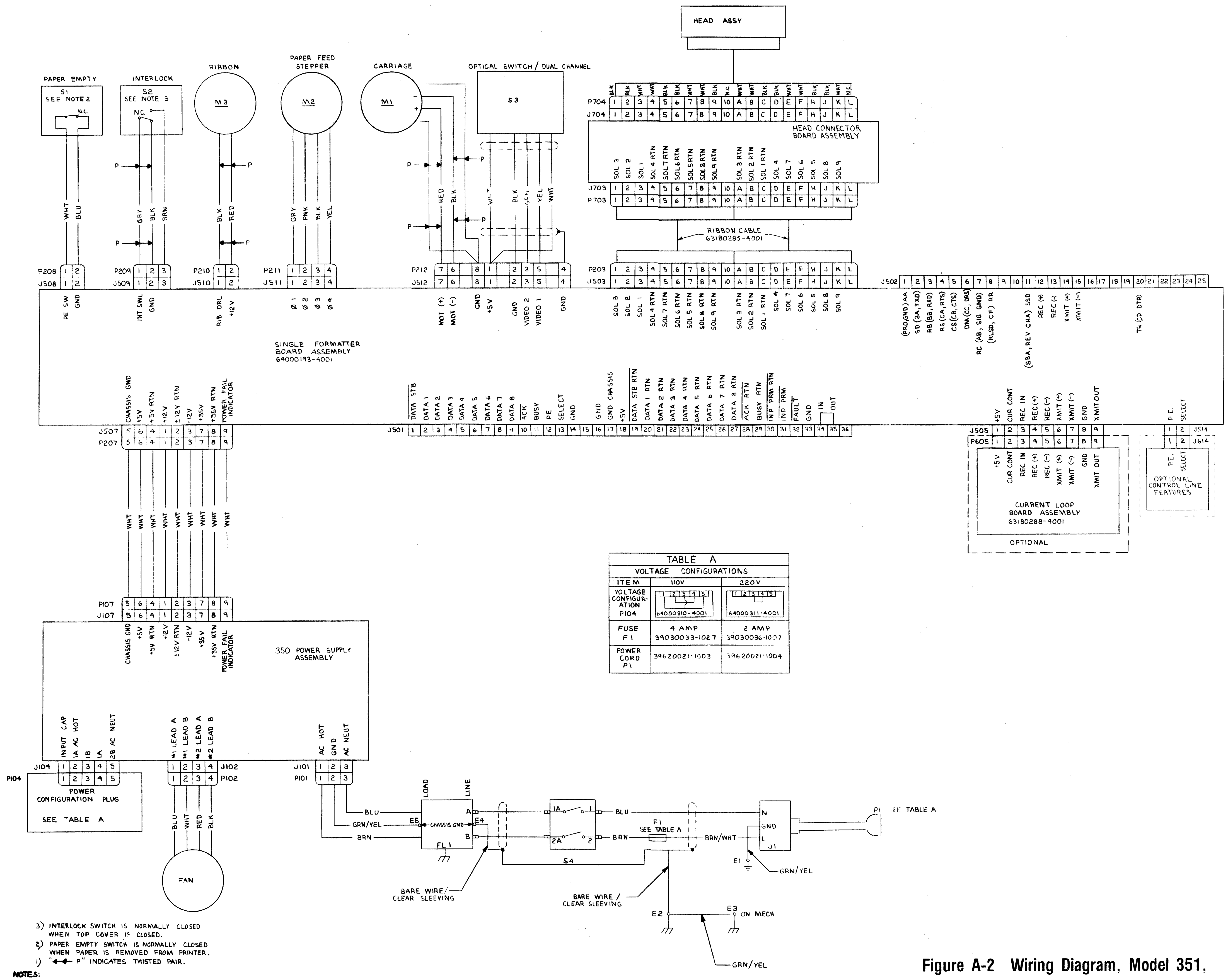


TABLE A		
VOLTAGE CONFIGURATIONS		
ITEM	110V	220V
VOLTAGE CONFIGUR-ATION P104	64000310-4001	64000311-4001
FUSE F1	4 AMP 39030033-1027	2 AMP 39030036-1007
POWER CORD P1	39620021-1003	39620021-1004

NOTES:
1) "←◄ P" INDICATES TWISTED PAIR.
2) PAPER EMPTY SWITCH IS NORMALLY CLOSED WHEN PAPER IS REMOVED FROM PRINTER.
3) INTERLOCK SWITCH IS NORMALLY CLOSED WHEN TOP COVER IS CLOSED.

Figure A-2 Wiring Diagram, Model 351, 64000504-9001.

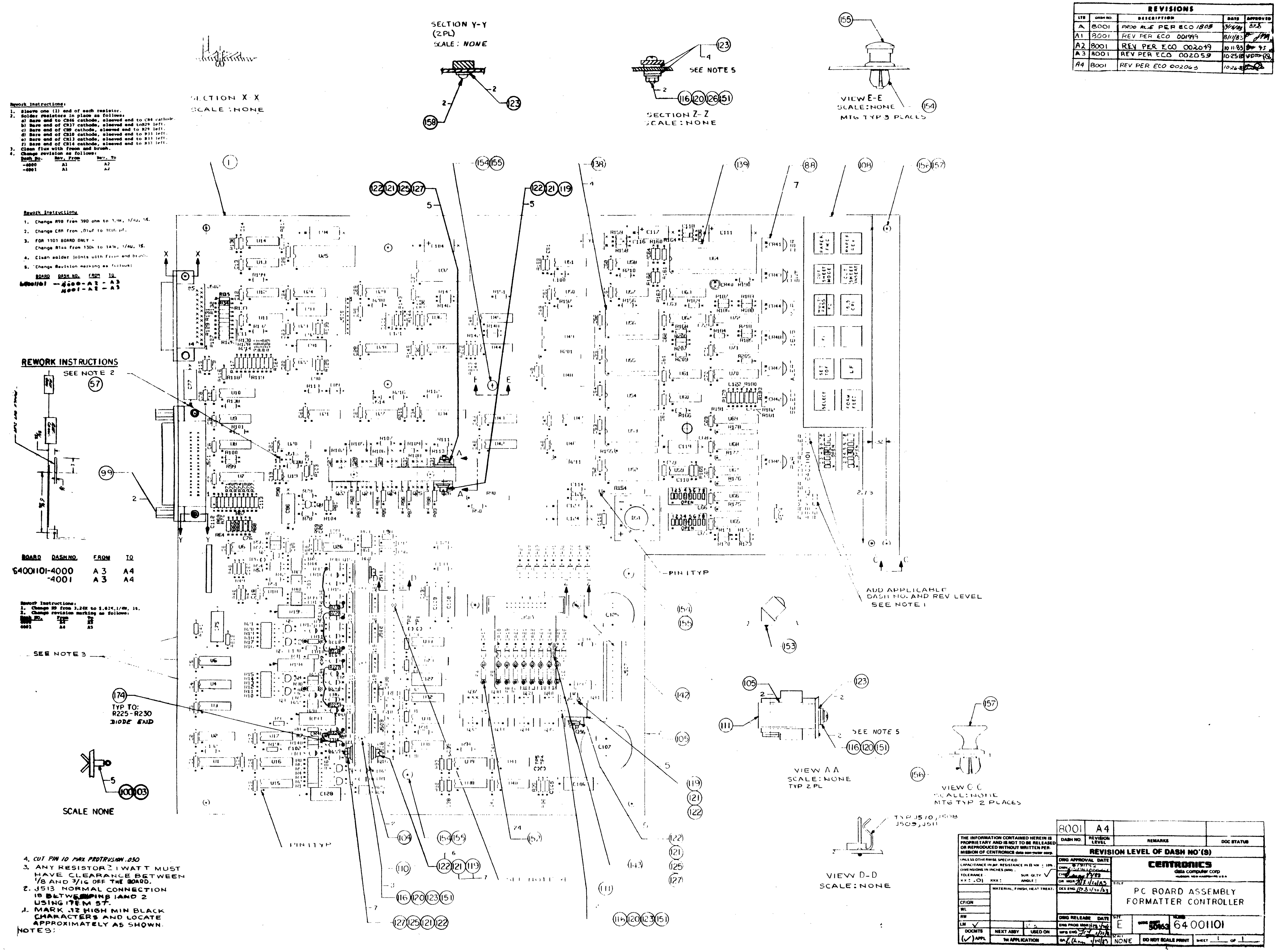


Figure A-3 Assembly Drawing, Formatter/Controller, 64001101-8001.

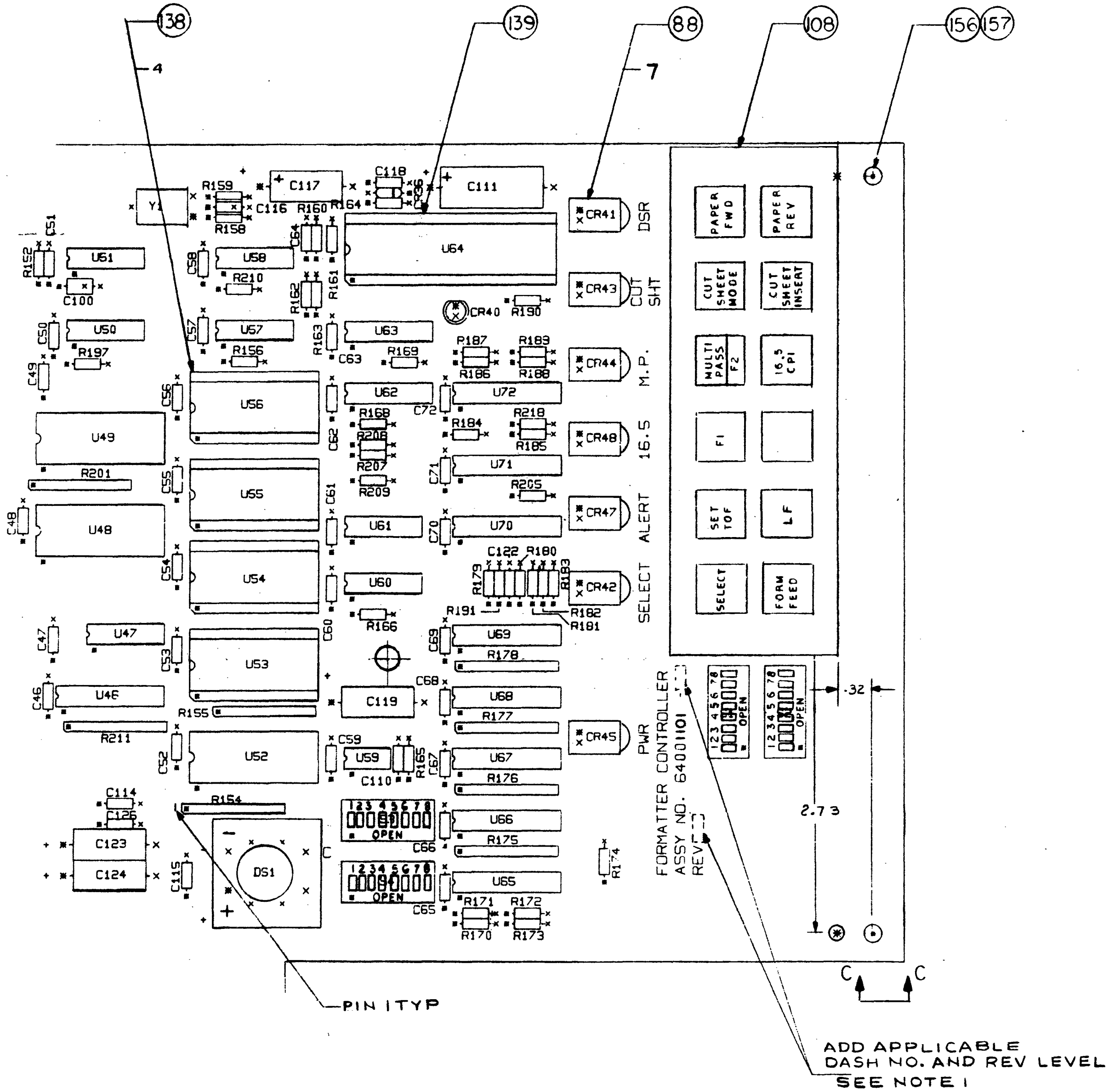


Figure A-4 Assembly Drawing, Control Panel and Memory Section, Formatter/Controller PCB Assembly

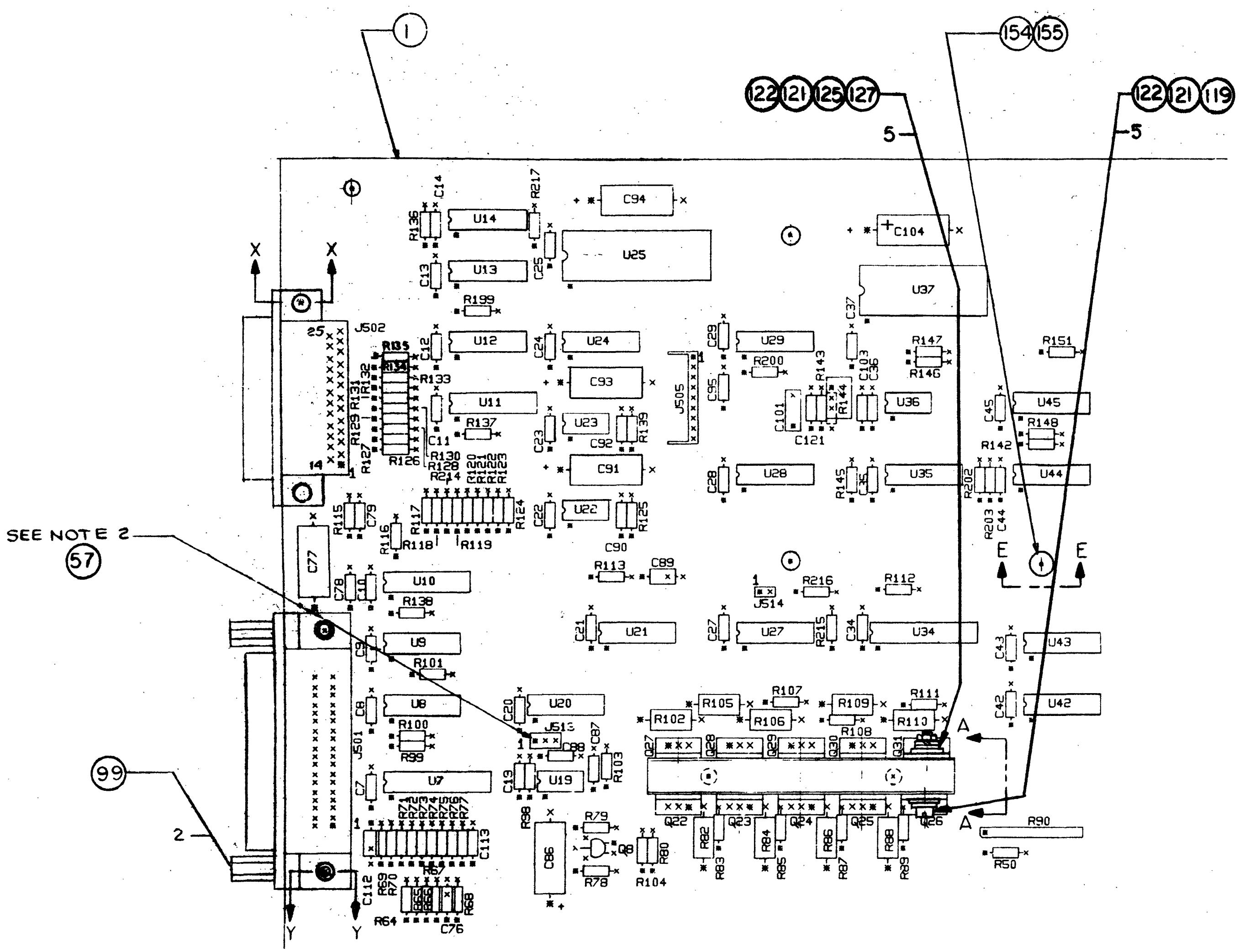


Figure A-5 Assembly Drawing, Serial and Parallel Input Section, Formatter/Controller PCB Assembly

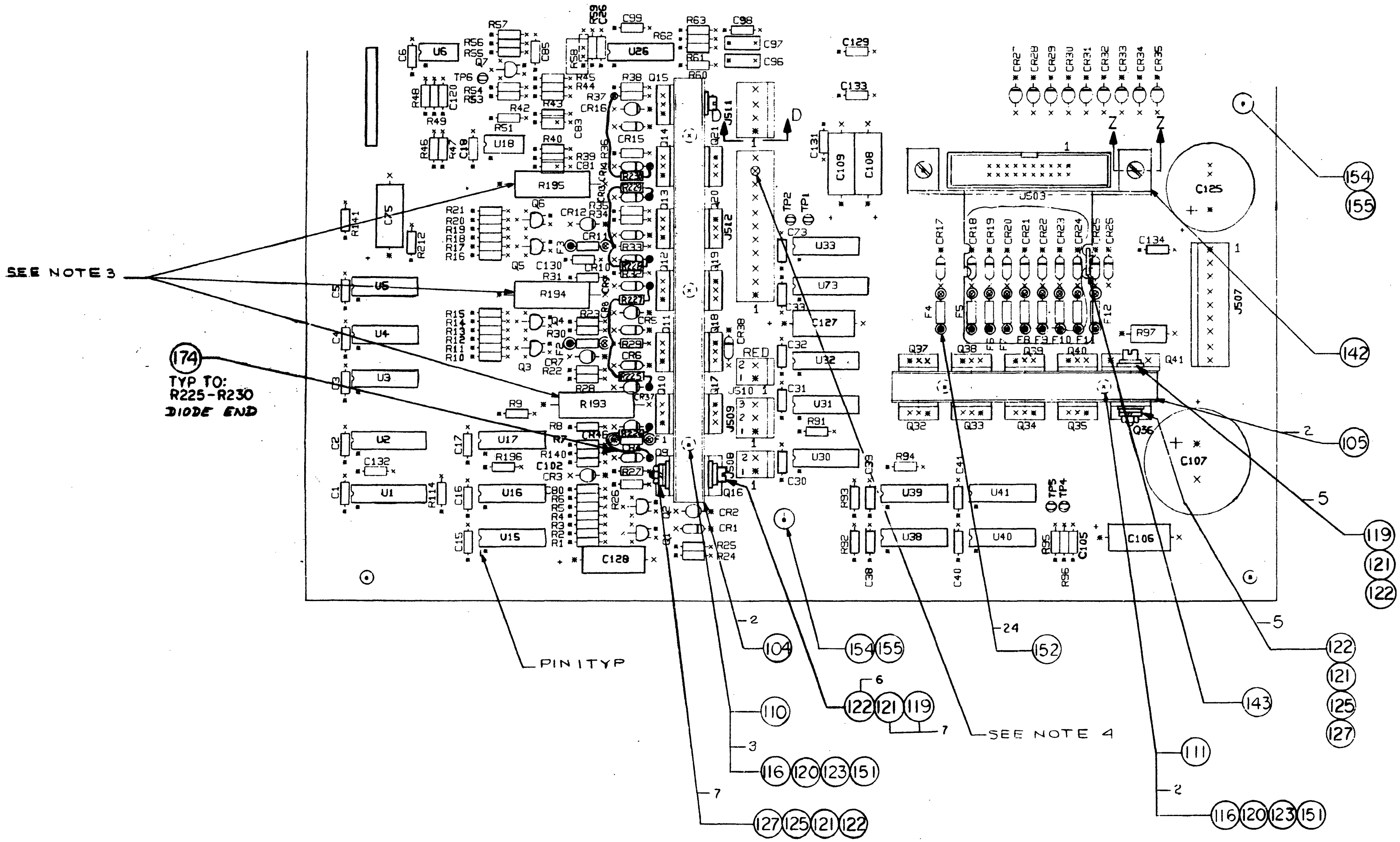


Figure A-6 Assembly Drawing, Print Head Driver and D.C. Power Entry Section, Formatter/Controller PCB Assembly

APPENDIX B
INTERFACE INFORMATION

B.1 GENERAL INFORMATION

The printer is connected to the input device, via the data input cable, for either parallel or serial data input. In the right rear of the printer, the Formatter/Controller pcb provides a parallel interface connection via an Amphenol 57 Series, 36-pin connector, and a serial interface connection via the EIA-RS232C, 25-pin connector.

Four unused pins in the serial interface connector are used for the optional current loop interface. The following paragraphs describe the parallel and serial interfaces and interface cables.

B.2 PARALLEL INTERFACE CONNECTION

The following table provides the pin-outs of the 36-pin parallel interface connector and a description of the external and printer generated signals. Figure B-1 illustrates the normal and busy timing for the parallel interface.

Table B-1. Parallel Interface Connection

SIGNAL NAME	INTERFACE CONNECTOR	SOURCE	DESCRIPTION
$\overline{\text{DATA STROBE}}$	1, 19	Input Device	A 1.0 usec signal (minimum) used to clock incoming data into the printer logic.
DATA 1	2, 20	Input Device	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 usec before the leading edge of the data strobe pulse and remain at its logic level until at least 1.0 usec after the trailing edge of the data strobe pulse.
DATA 2	3, 21		
DATA 3	4, 22		
DATA 4	5, 23		
DATA 5	6, 24		
DATA 6	7, 25		
DATA 7	8, 26		
DATA 8	9, 27	Input Device	
$\overline{\text{ACKNOWLEDGE}}$	10, 28	Printer	Acknowledge signal indicates the input of a character into memory or the end of a functional operation.
BUSY	11, 29	Printer	A signal indicating that the printer cannot receive data. Also indicates a paper empty or fault condition.
PE	12	Printer	A signal indicating that the printer is out of paper.
SLCT	13	Printer	A signal indicating that the printer is selected and ready to receive data.
±0V	14	Printer	Signal ground.
—	15	—	Not used.
±0V	16	Printer	Signal ground.
CHASSIS GROUND	17	Printer	Frame ground.
+5V	18	Printer	+5 Volt power bus.
$\overline{\text{INPUT PRIME}}$	30, 31	Input Device	A signal which clears the printer buffer and initializes the logic.
$\overline{\text{FAULT}}$	32	Printer	A signal that indicates a printer fault condition such as paper empty.

Notes: 1. Second pin number indicates twisted pair return ±0V.
2. Active low signals are specified by a "bar" over the signal name.

B.3 SERIAL INTERFACE CONNECTOR

The following table provides the pin-outs of the 25-pin serial interface connector and a description of the data set and printer generated signals.

Table B-2 Serial Interface Connection

PIN	EIA SIGNAL NAME	SOURCE	DESCRIPTION
1	AA	Printer	Protective Ground.
2	BA	Printer	Transmitted Data: Used to indicate the buffer status when in the X-ON/X-OFF mode.
3	BB	Data Set	Received Data: Data source to the printer.
4	CA	Data Set	Request to Send: This line is at +V when in the X-ON/X-OFF mode.
5	CB	Printer	Clear to Send: A +V enables the X-ON/X-OFF to be transmitted. A −V disables the transmitter.
6	CC	Data Set	Data Set Ready: Must be +V in order for the printer interface to receive data from the data set.
7	AB	Printer	Signal Ground.
8	CF	Data Set	Carrier Detect: A +V allows transmitted data to be accepted by the Format Controller pcb. A −V will not allow data to be accepted.
11	SBA	Printer	Reverse Channel: Used for transmitting printer/buffer status when in the reverse channel mode. It is normally in a Mark (−V) condition. When the buffer is full, this line goes to a SPACE (+V) condition until the printer is able to receive data. Held at buffer empty polarity when in the X-ON/X-OFF or Data Terminal Ready mode.
20	CD	Printer	Data Terminal Ready: This line is held at +V when in the X-ON/X-OFF or Reverse Channel mode. Used for transmitting buffer status when in the Data Terminal Ready mode: Buffer Full = −V; Buffer Empty = +V.
12	RECLOP(+)	Data Set	Receive Current Loop(+): Receive current loop data line.
13	RECLOP(−)	Data Set	Receive Current Loop(−): Receive loop return.
14	XMTLOP(+)		Transmit Loop(+): Transmit loop printer status (BUSY) signal.

B.4 INTERFACE CONNECTOR LOCATIONS AND CABLES

Figure B-2 below shows the location of the parallel and serial interface connectors. Table B-3 lists the available interface cable.

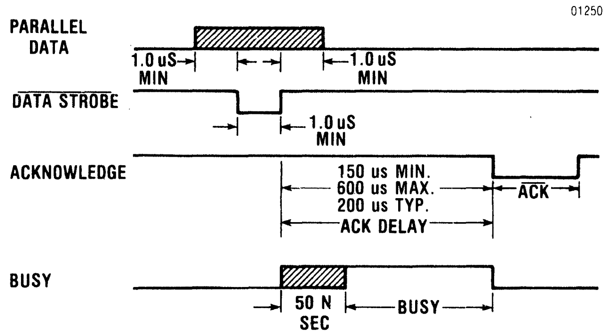


Figure B-1 Normal and Busy Timing, Parallel Interface

Table B-3 Interface Cables

CABLE DESCRIPTION	INTERFACE	PART NUMBER
STANDARD PARALLEL CABLE—This is Centronics standard parallel interface cable. The 15 foot cable is terminated at either end with a 36-pin male connector.	Parallel	39620034-1001
RS232 CABLE—This is Centronics standard RS232 serial interface cable. The 10 foot cable is terminated at either end with a 25-pin connector.	Serial	39620033-1001
CURRENT LOOP CABLE—The 20 mA current loop cable is required when using the current loop interface. The 10 foot cable is terminated at one end with a 25 pin connector and at the other end with 4 ring terminals.	Serial	39620031-1001
IBM TO CENTRONICS PARALLEL CABLE—This cable is used to connect the Centronics printer to an IBM PC computer only. The cable is terminated at one end with a 36-pin connector (printer connection) and is terminated at the other end with a 25-pin "D" series male connector (host connection).	Parallel	39620035-1001

Note: All interface cables are shielded and meet U.L./CSA requirements.

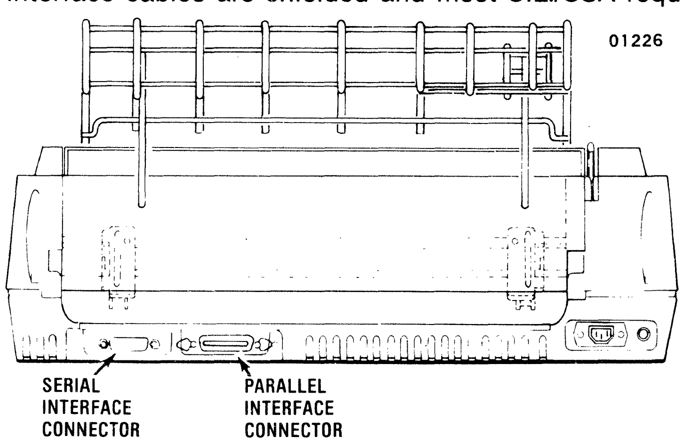


Figure B-2 Parallel and Serial Interface Connectors

APPENDIX C
CONTROL PANEL SWITCHES AND INDICATORS

C.1 GENERAL

A number of controls, switches and indicators are used to control printer operation. This section describes the controls and indicators and is organized as follows:

C.2 Mechanism Controls and Switches

C.3 Control Panel Switches and Indicators

C.4 Control Panel Dip Switches

C.5 Internal Dip Switches

C.2 MECHANISM CONTROLS AND SWITCHES

Figure C-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 printer 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 into the "LOAD" position.

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 stopping the printer and sounding 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** membrane switches on the control panel are depressed.

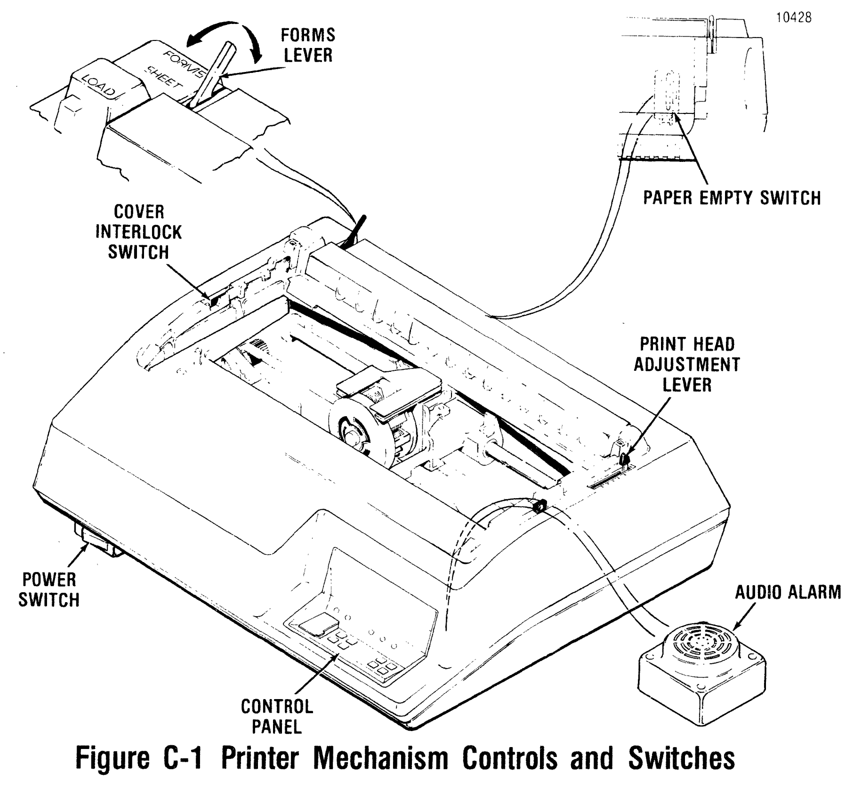


Figure C-1 Printer Mechanism Controls and Switches

C.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 (Selected) or off line (Deselected). When selected, data reception and printer action are allowed. When deselected, printer action will stop, and the **SELECT** LED will be extinguished. On a "paper empty" condition, pressing the **SELECT** switch will override the deselect mode and will allow the printer to continue printing to the end of the form.

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 TOF 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 ½ 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.

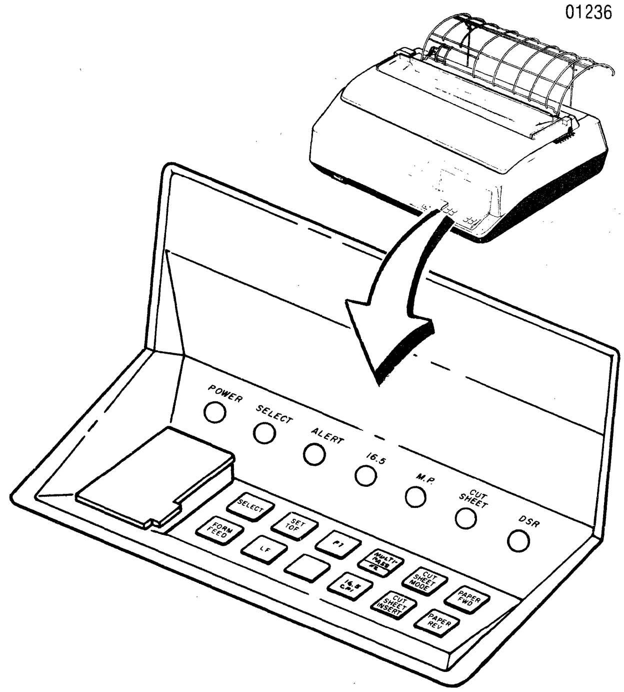


Figure C-2 Control Panel Switches and Indicators

16.5 CPI When actuated, this switch will change the horizontal pitch from 10 cpi (or 12 cpi) to 16.5 cpi, or from 16.5 cpi to 10 cpi. This is also true for expanded printing; when the 16.5 cpi switch is actuated, the horizontal pitch will change from 5 cpi (or 6 cpi) to 8.25 cpi, or from 8.25 cpi to 5 cpi. 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

The printer can use either the Multipass function or the Data Link capability but not both at the same time. The type of operation allowed will depend on which PROM 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.

16.5 Indicator—Indicates that the horizontal pitch is set to 16.5 cpi.

M.P. Indicator—Indicates the printer is in the multipass proportional mode.

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.

C.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 the following paragraphs. Figure C-3 illustrates the location of the two control panel dip switches.

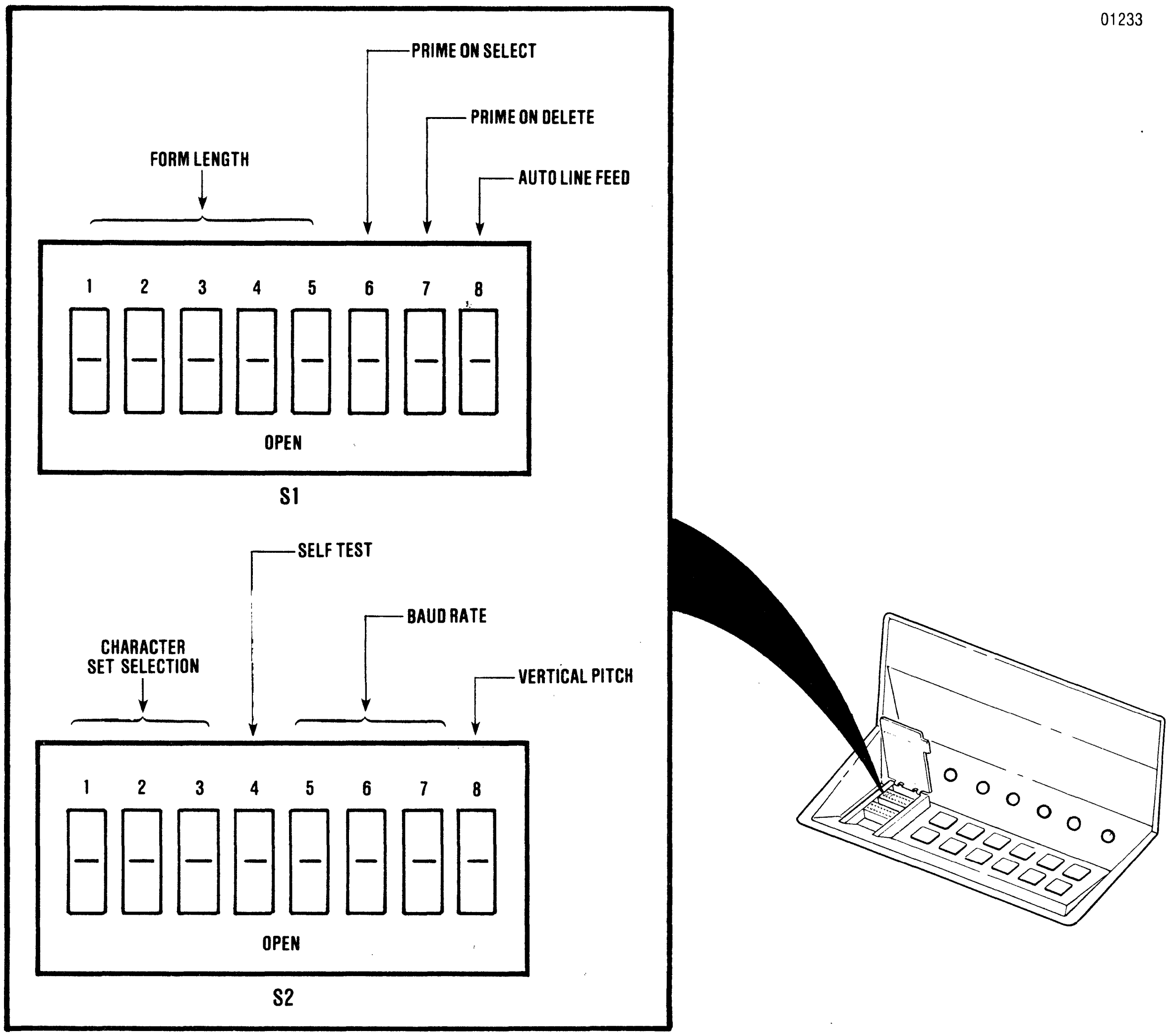
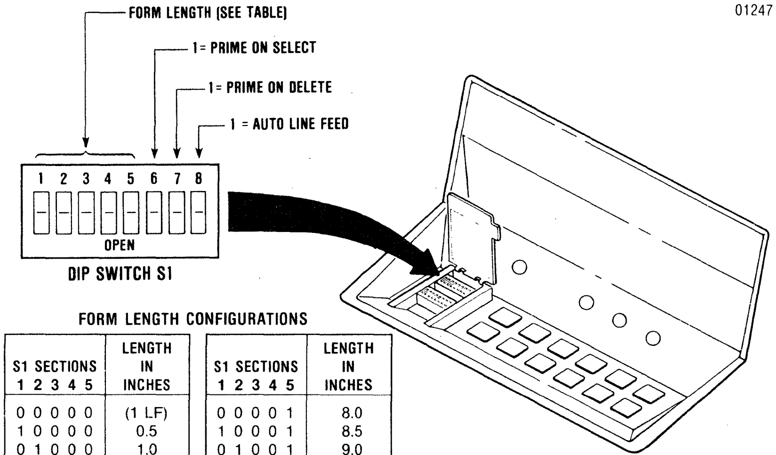


Figure C-3 Control Panel Dip Switches

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 C-4 for the location and feature selections of dip switch S1.

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 C-5 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.

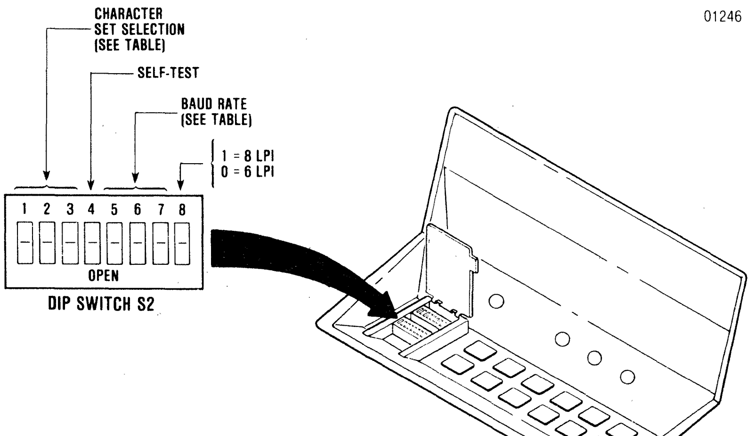


FORM LENGTH CONFIGURATIONS

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

NOTE:
0 = CLOSED
1 = OPEN

Figure C-4 Printer Features Dip Switch S1



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

NOTE: REFER TO PARAGRAPH C.5.2 FOR HI/LO BAUD RATE SWITCH POSITIONS ON DIP SWITCH S4-2.

NOTE:
0 = CLOSED
1 = OPEN

Figure C-5 Printer Features Dip Switch S2

C.5 INTERNAL DIP SWITCHES

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 C-6 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 C.5.1 and C.5.2, 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.

C.5.1 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 C-6 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.

PAGE MODE (ENABLE/DISABLE)—This switch is used (in Parallel Mode) 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.

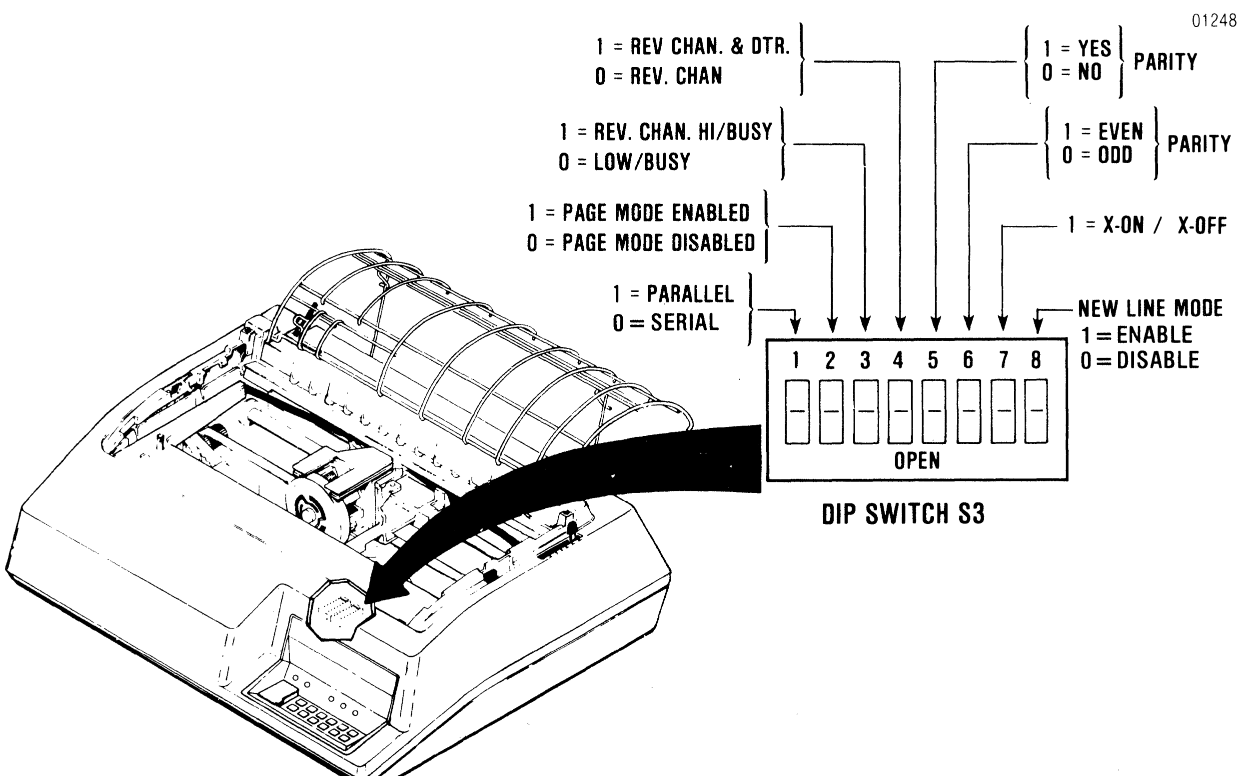


Figure C-6 Printer Features Dip Switch S3

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 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.

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 (LF) E (CR) X (CR)

NEW LINE MODE:

ENABLED	DISABLED
A	A
B	B
C	C
D	D
E	E
X	X

C.5.2 PRINTER FEATURES DIP SWITCH S4

DATA LINK—Section 1 of dip switch S4: refer to Appendix A in the Model 351 Users Manual for technical information and usage of this switch.

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 C-5 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 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. Refer to paragraph 4.8, for the offset adjustment procedure.

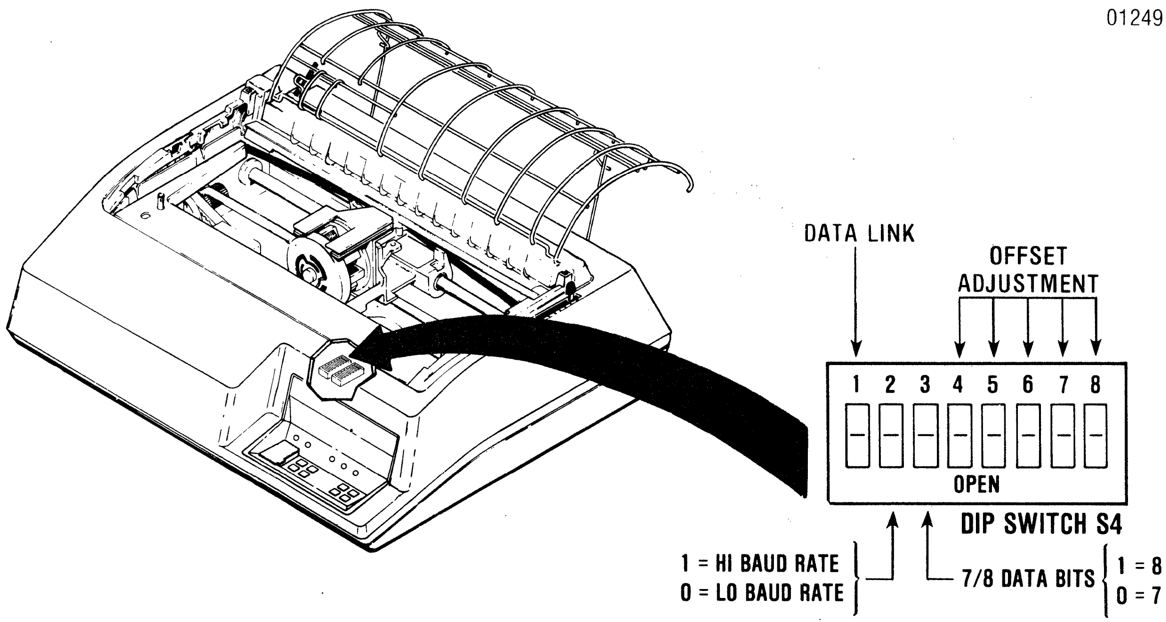


Figure C-7 Printer Features Dip Switch S4

APPENDIX D
PICO FUSE COLOR CODE

D.1 GENERAL INFORMATION

Some pico fuse manufacturers mark the outer covering of their fuses with four colored bands. The first three bands are of the same width and indicate the current rating of the fuse. The fourth band is wider than the other three and indicates the time-current characteristics of the fuse.

Table D-1 shows the pico fuse color code for fuses with "normal blo" time characteristics.

Table D-1. Pico Fuse Color Code
(I.E.C. Standards, Publication 127)

RATED CURRENT MA	FIRST BAND	SECOND BAND	THIRD BAND	FOURTH BAND
62	Blue	Red	Black	Red
100	Brown	Black	Brown	Red
125	Brown	Red	Brown	Red
250	Red	Green	Brown	Red
375	Orange	Violet	Brown	Red
500	Green	Black	Brown	Red
750	Violet	Green	Brown	Red
1000	Brown	Black	Red	Red
1500	Brown	Green	Red	Red
2000	Red	Black	Red	Red
2500	Red	Green	Red	Red
3000	Orange	Black	Red	Red
3500	Orange	Green	Red	Red
4000	Yellow	Black	Red	Red
5000	Green	Black	Red	Red
7000	Violet	Black	Red	Red
10000	Brown	Black	Orange	Red
12000	Brown	Red	Orange	Red
15000	Brown	Green	Orange	Red

APPENDIX E
MODEL 351-3 & 351-4 PRINTERS

E.1 MODEL 351-3 PRINTER

The Model 351-3 printer is identical, both functionally and mechanically, to the Model 351 printer described previously, except the proportional spaced multipass character set is replaced by a monospaced multipass character set. This feature is determined by the EPROM (P/N 35522732-1A28) situated in socket location U56. The Model 351-3 is powered by 110 Vac, 60 Hz.

E.2 MODEL 351-4 PRINTER

The Model 351-4 printer is identical to the Model 351-3 printer described above, except it is a 220 Vac, 50 Hz model.

E.3 DOCUMENTATION

All documentation and manuals cited for the Model 351 printer in Section 1 of this manual are applicable to the Model 351-3 and 351-4 printers.

READERS COMMENTS

Publications Title 351 Technical Manual

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