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MODEL 352

PRINTER

37403520 REV A

MAY 1982

TECHNICAL MANUAL

TP 7-80

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3/82 Rev. F

MODEL 352

PRINTER

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SECTION 1
GENERAL INFORMATION

1.1 SCOPE OF THIS MANUAL

This technical manual provides detailed information on the theory of operation, maintenance, adjustment and recommended spare parts replacement for the Model 352 printer. The manual is for use by qualified service personnel who maintain electronic and electro-mechanical equipment.

1.2 GENERAL DESCRIPTION

The Model 352 is a high speed, bidirectional, impact printer that uses dot matrix techniques for character generation. The printer is completely self-contained, composed of mechanical, electro-mechanical components and printed circuit boards. The printed circuit boards use 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 352 contains many features to help perform the printing job more easily and efficiently. Some of the more significant features are:

- o 200 CPS Smart, Bidirectional Printing
- o Serial or Parallel Input Interfacing
- o Switch Selectable Forms Length
- o Switch Selectable Characters Per Inch
- o Switch Selectable Lines Per Inch
- o Fanfold Forms or Cut Sheet Forms Handlin
- o Pin Addressable Graphics
- o Self-Test Capability

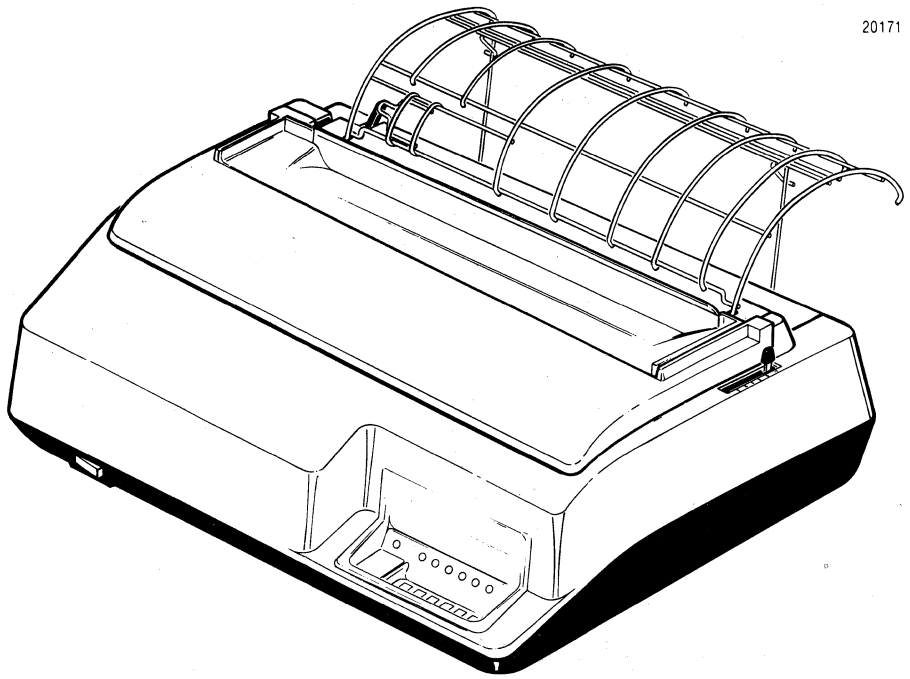


Figure 1-1. MODEL 352 PRINTER

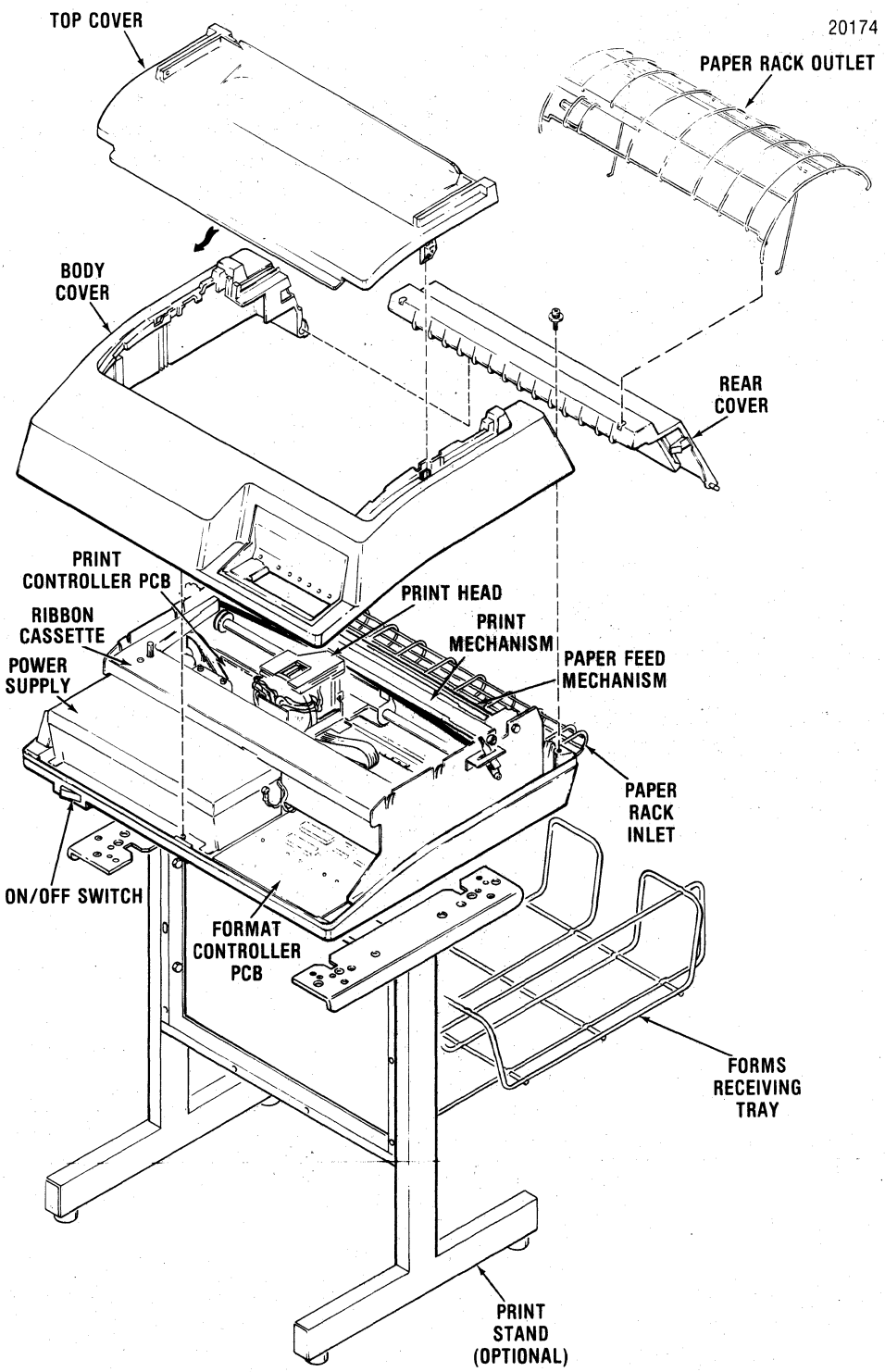


Figure 1-2. MAJOR ASSEMBLIES MODEL 352

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

In addition to the many standard features built into the Model 352, there are many options and accessories that may be added to provide additional capabilities.

1.3 PHYSICAL DESCRIPTION

Physically the Model 352 is compact and lightweight. The printer measures 22 inches wide, 18 inches deep and 8 inches high. The printer weighs 40 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 along the platen.

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 two printed circuit boards (pcb); the Print Controller pcb and the Format Controller pcb. The two boards are located under the printer mechanism and attach to the bottom cover.

The Format Controller pcb contains the control panel assembly and the parallel and serial input connectors.

1.3.4 POWER SUPPLY

The power supply is located in the left front of the printer and is completely enclosed. The power supply, an "off-line" switching type, is used as the primary power source.

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 and formatted by the Format Controller, characters are printed by selectively activating the eight print wires aligned vertically in the print head. A ninth wire in the print head, under microprocessor control, provides the underlining capability in the printer. The print commands to activate the print wires are developed by the Print Controller pcb PROM's.

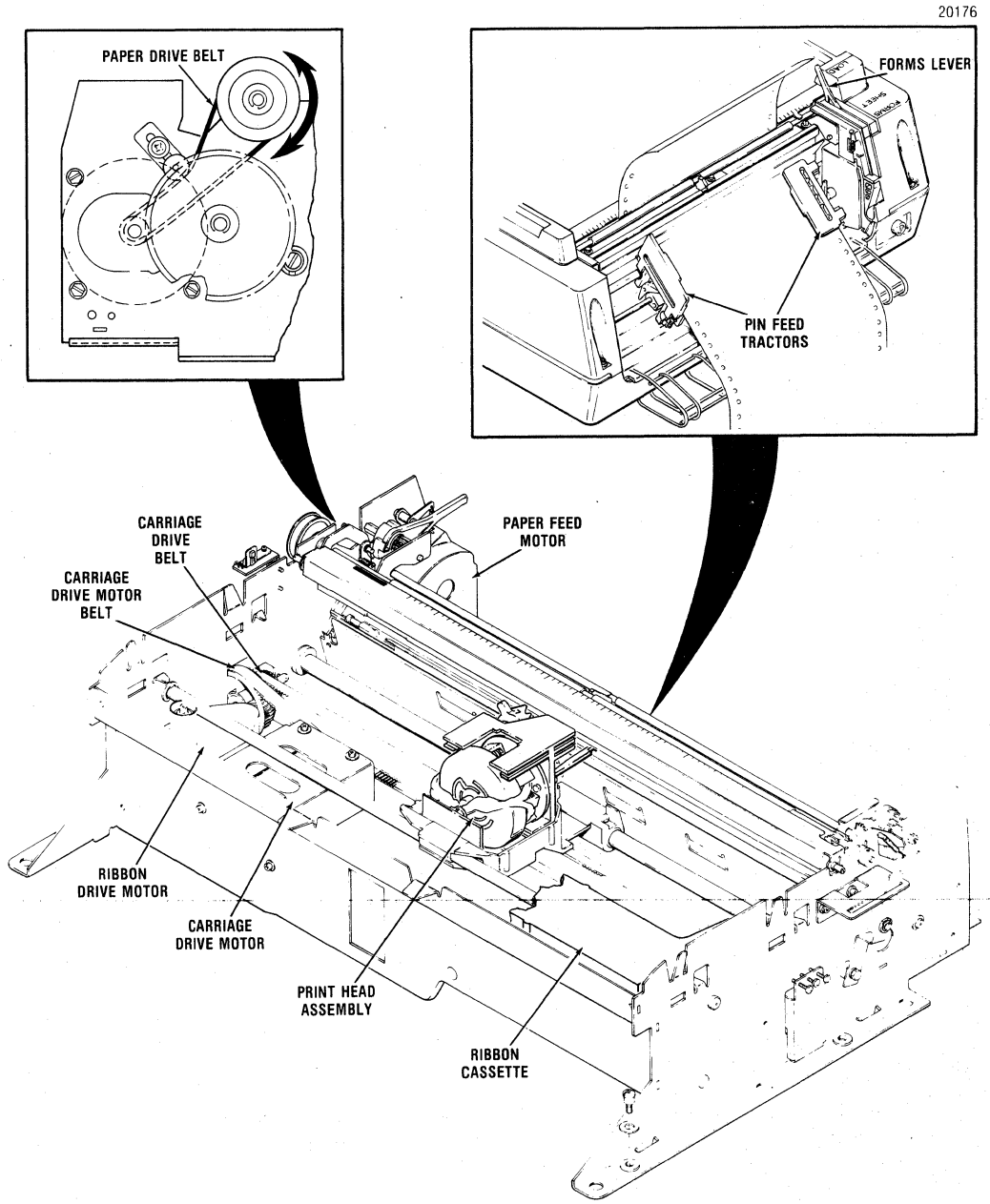


Figure 1-3. CHARACTER PRINTING/PAPER MOTION

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 character.

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 the paper motion switches; line feed (LF) paper forward (PAPER FWD), paper reverse (PAPER REV) or form feed (FORM FEED) located on the Format Controller pcb. The information provided by the Format Controller pcb to the Print Controller pcb establishes the direction and amount of paper motion.

Physically, paper is moved by the torque from the paper stepper motor which is applied to the pin feed tractor drive gears 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 and the graphics program is completely controlled by the input device.

Also as a standard feature, the printer has a self-test capability which is activated by pressing the OVRD TEST switch while the printer is deselected. Test data is continuously printed as long as the switch is pressed.

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 352 printer in detail. These publications are available through the Customer Service Department at Centronics.

1.5.1 UNPACKING/REPACKING INSTRUCTIONS (P/N 37410005-9001)

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 (P/N 37403521-9001)

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

1.5.3 ILLUSTRATED PARTS MANUAL (P/N 37403502-9001)

The illustrated parts manual contains illustrations and lists of materials detailing all assemblies and sub-assemblies 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 an index number.

1.6 SPECIFICATIONS

SERIAL INPUT

Interface	RS-232C
Data Format	1 START bit, 7 or 8 DATA bits, 1 PARITY bit, and 1 or 2 STOP bits
Input Code	96 character ASCII
Buffer	4K character buffer

PARALLEL INPUT

Data Format	7/8 bit ASCII parallel
Input Code	96 character ASCII
Buffer	One line character buffer
Input Gating	Data Strobe is gated with Acknowledge of previous character

PRINTING

Printing Method	Impact, dot matrix, bidirectional, logic seeking
Dot Matrix	7 dots wide by 8 dots high; 9th wire underline
Print Speed	200 characters per second
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, 6.6, 7.5, 8.25, 10, 12, 13.2, 15 and 16.5 characters per inch

Maximum Line Length
(varies with horizontal pitch)

5 cpi	66 columns
6 cpi	79 columns
6.6 cpi	87 columns
7.5 cpi	99 columns
8.25 cpi	109 columns
10 cpi	132 columns
12 cpi	158 columns
13.2 cpi	174 columns
15 cpi	198 columns
16.5 cpi	218 columns

PAPER HANDLING

Vertical Pitch	6 or 8 lines per inch, switch selectable
Vertical Slew Speed	8 inches per second
Forms Length	1 to 192 lines
Paper Movement	Bidirectional

PAPER REQUIREMENTS

Fanfold Forms	
Width	3.0 to 15.0 inches (76 to 381 mm)
Copies	Up to six parts
Cut Sheet	
Width	4.0 to 12.0 inches (101 to 304.8mm)
Copies	Up to six parts
	NOTE: For detailed paper specifications, refer to the Model 352 Users Manual

PHYSICAL/ENVIRONMENTAL

Height	7.5 inches (190.5mm)
Depth	18.25 inches (463.5mm)
Width	22.5 inches (571.5mm)
Weight	40 lbs. (88 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	98 VAC to 125 VAC or 195 VAC to 246 VAC 47 to 63 Hz
Input Current	4A max. at 110 VAC 2A max. at 220 VAC

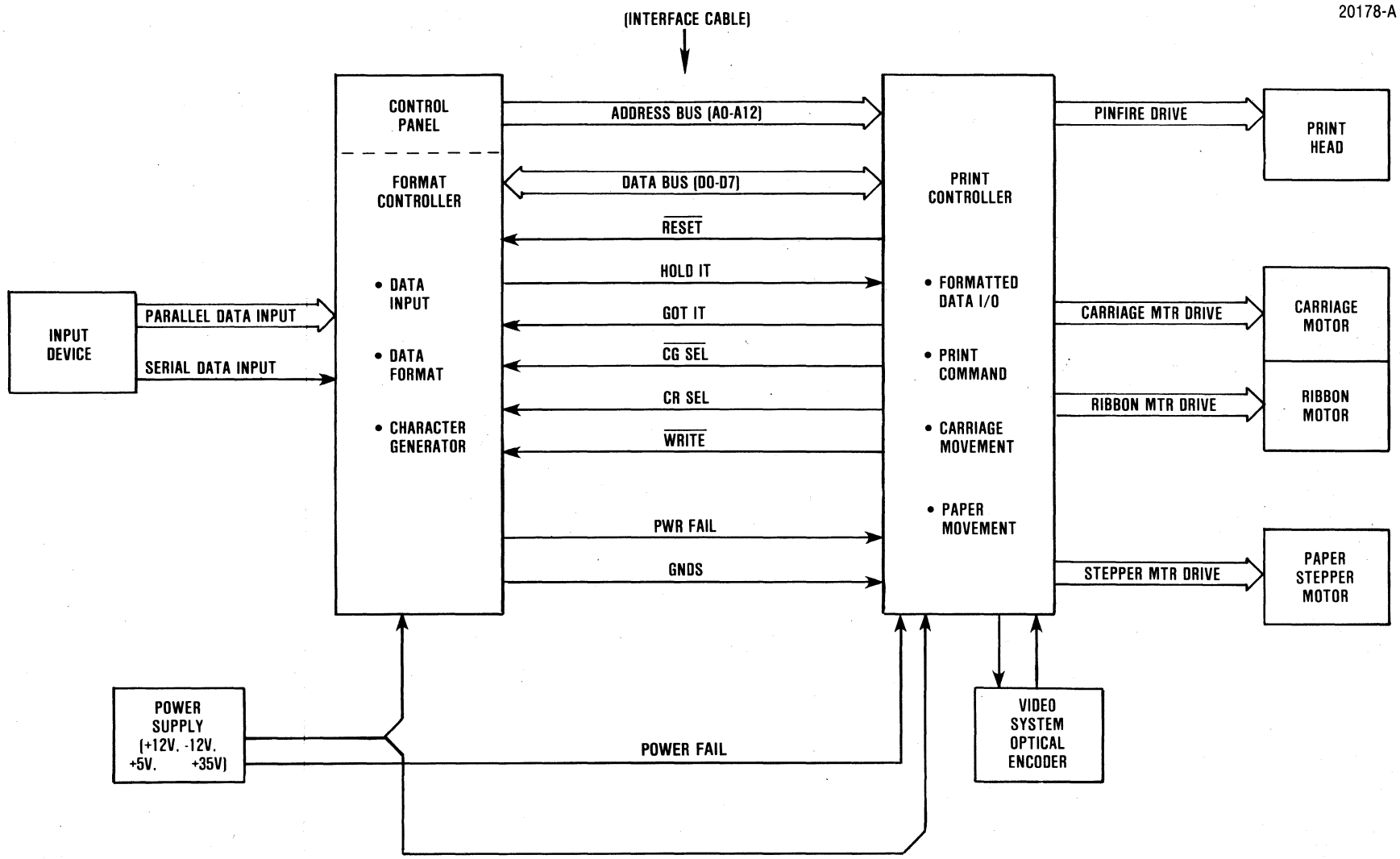


Figure 2-1. MODEL [illegible] OVERALL BLOCK DIAGRAM

SECTION 2
THEORY OF OPERATION

2.1 GENERAL

This section describes the operation of Model 352 printer at the functional block level and includes the active components within the functional block. Refer to Figure 2-1. The electronic control circuits for the printer are primarily divided onto two p.c. boards: the Format Controller and the Print Controller. The Format Controller accepts either serial or parallel input data from the "host" system, serves as an interface to the Print Controller, and determines the operational functions for the printers.

Also, the Format Controller contains the operator accessible controls and indicators. These controls set-up the various printer functions via the Format Controller circuitry. The Print Controller controls paper motion and printing in the mechanism.

2.2 BASIC PRINTER OPERATION

The Format Controller supplies the operating parameters to the Print Controller based on data received from the host device and the control panel. These parameters are written into a shared Communication Random Access Memory (C-RAM) on the Format Controller. The parameters are written according to an address format, which is basically divided into two sections. the first section is the Control Block and occupies memory locations 00_{16} through $0F_{16}$. This part of the memory is also referred to as the print buffer. The second section is referred to as the Data Block.

The Control Block is dedicated to transferring a print command and paper motion arguments from the Format Controller to the Print Controller and transferring status information concerning printer action, paper motion and self-test results from the Print Controller to the Format Controller.

The Data Block is dedicated to transferring information on printable data from the Format Controller to the Print Controller. A detailed description of these parameters, their bit structure, and input timing is found starting with Paragraph 2.5.3 in the Paper Motion Argument Description.

In order to discuss how data is processed in the printer, refer to Figure 2-2, Format Controller Bus Structure and Figure 2-3 Print Controller Bus Structure, and assume that the printer has just been turned on. Turning the printer on causes the microprocessor to go through an initialization routine to set up its electronics and perform the following functions:

- Raise the GOT IT line. The Address Bus (A0-A7) and the Data Bus (D0-D7) are isolated from the buffered data bus (DB0-DB7). Signal information is conveyed to the Format Controller that data cannot be transferred.

- Lower $\overline{WR}$ line from the microprocessor. This line controls the chip enable and read/write function of C-RAM.

- Move the print head to the extreme left margin, if not already there.

- The C-RAM will clear and then write the printer status information into C-RAM location 00_{16}. The Address Bus (A0-A7) and the BData Bus (BD0-BD7) are used by the CPU during the read/write functions to C-RAM.

After the status information is loaded into C-RAM, the microprocessor relinquishes control of the C-RAM to the Format Controller. This enables the Format Controller to take control of the C-RAM with the CRSEL and HOLD IT lines. The lowering of GOT IT signals the Format Controller that it has control of C-RAM and that the HOLD IT line will be monitored by the Print Controller.

On recognition of the deactivated GOT IT line, the Format Controller will then perform the following functions:

- Activates the HOLD IT line to establish that it has C-RAM control.

- Polls the C-RAM status byte 00_{16} to check for the following:

  a. there was an abort on an event,

  b. the printer is out of paper,

  c. a head jam, or

  d. a failure during a requested self-test.

- Polls C-RAM Location 01_{16} and 02_{16} to determine how much paper has been moved since the last top of form.

- Polls C-RAM Location 03_{16} and 04_{16} to determine the number of paper motion steps that were not completed during an aborted paper motion event, if there was one.

After obtaining all the status information and taking the appropriate action on it, the Format Controller can now load the parameters into C-RAM to request various printer operations. The Format Controller writes each parameter into C-RAM according to a certain format. This is done using the Address Bus (A0-A7) and Data Bus (D0-D7) under the control of the SELECT, $\overline{RD}$ and $\overline{WR}$ control lines.

After the parameters are loaded into C-RAM, the Format Controller lowers the HOLD IT line, indicating to the microprocessor on the Print Controller that the parameters are loaded. The microprocessor activates GOT IT to take control of C-RAM with the $\overline{WR}$ line and isolates the BData Bus from the A0-A7 and D0-D7 input busses.

Now that the microprocessor has control of C-RAM, the microprocessor addresses the location of each of the five events in C-RAM starting with Event 1. If data is stored in a location, it is acted on before proceeding to the next location so that the five events are acted on in sequence.

The five events can cause the microprocessor to command the following functions:

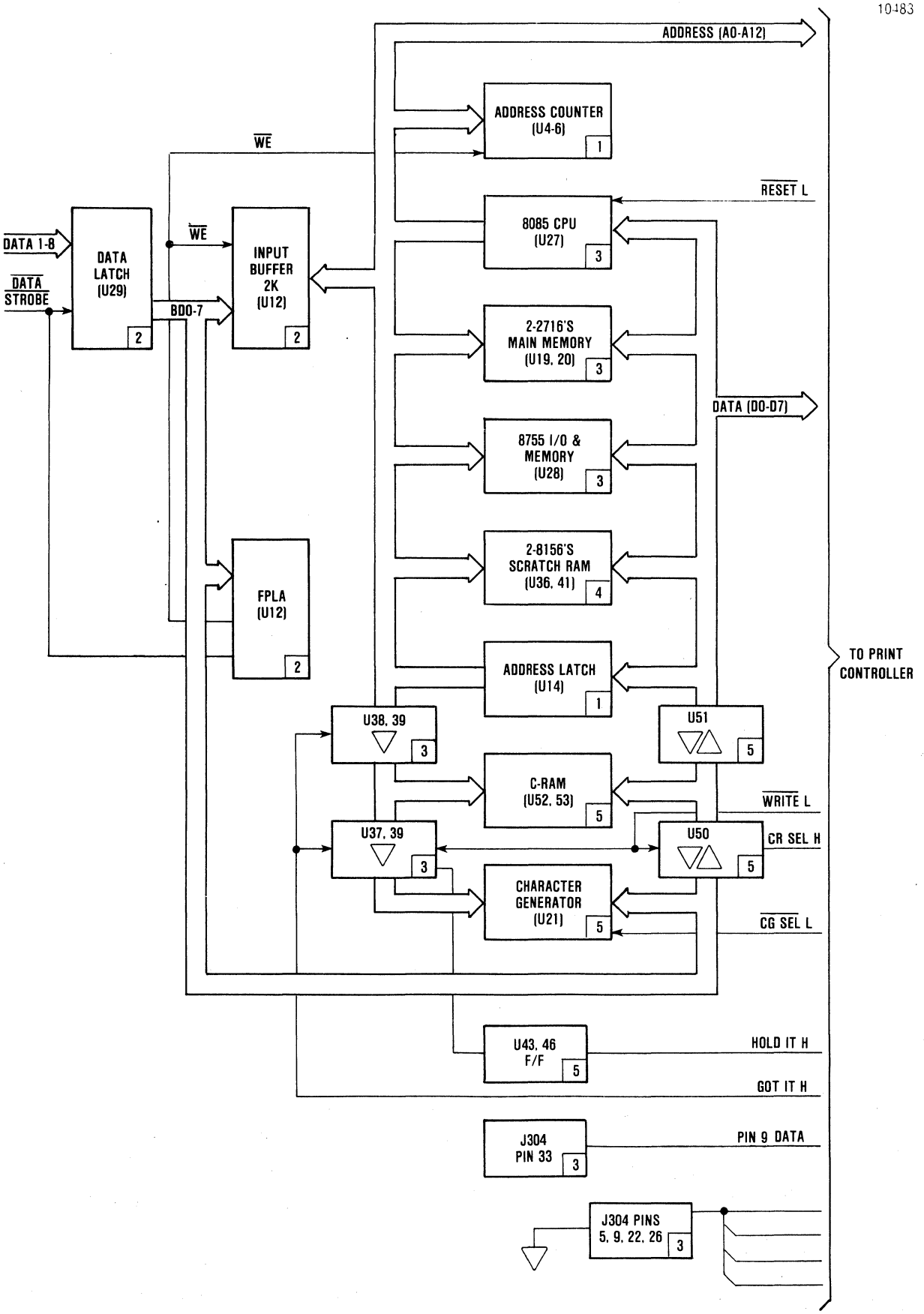


Figure 2-2. FORMAT CONTROLLER BUS STRUCTURE

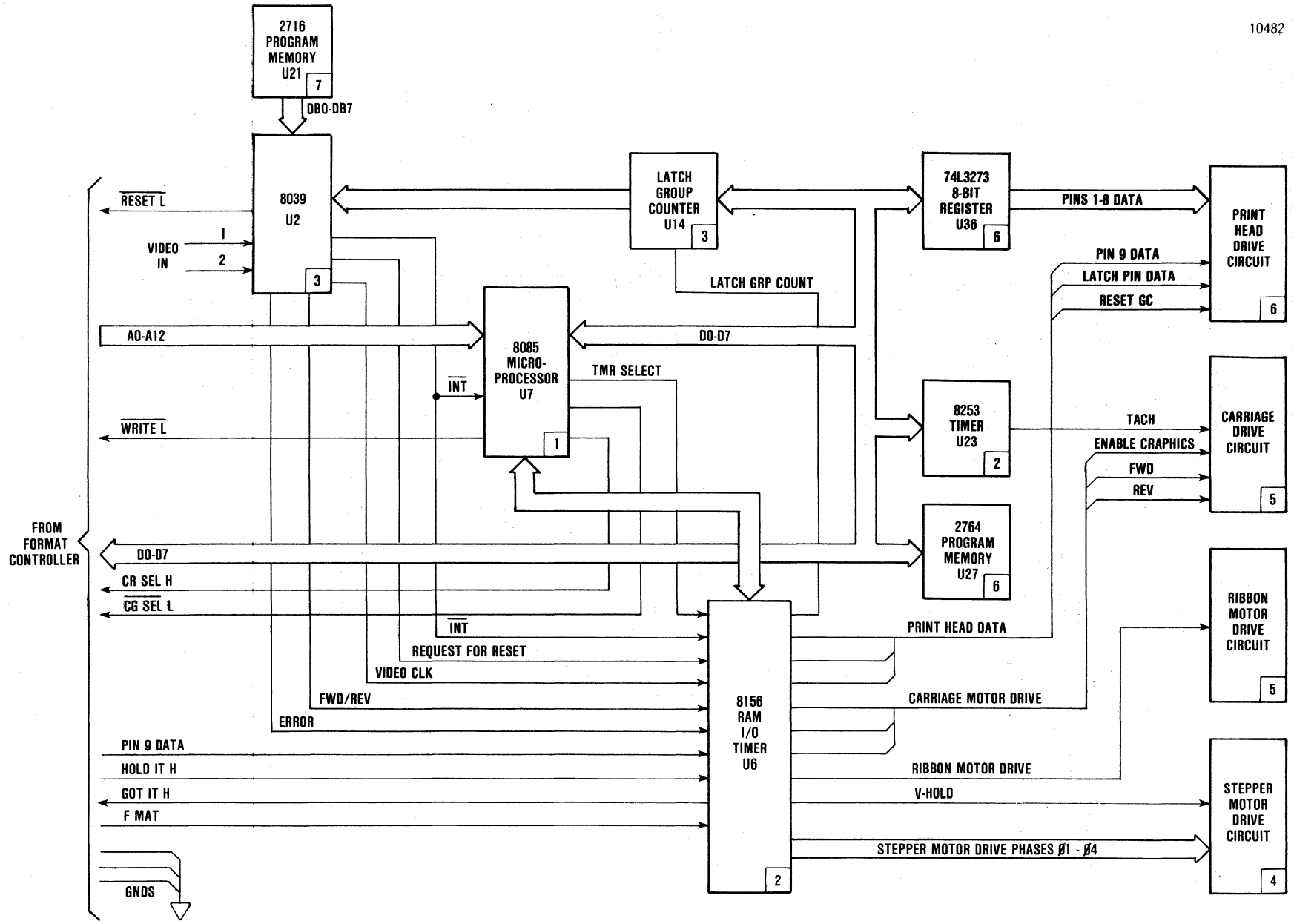


Figure 2-3. PRINT CONTROLLER BUS STRUCTURE

- o EVENT 1 - Reverse paper motion before print.
- o EVENT 2 - Forward paper motion before print.
- o EVENT 3 - Print Command.
- o EVENT 4 - Reverse paper motion after print.
- o EVENT 5 - Forward paper motion after print.

To move paper in the forward direction or reverse direction, the microprocessor will activate the V HOLD signal. This is followed by the microprocessor applying pulses 01-04 on the 4-line bus to the stepper motor driver circuit. The pulses are applied to the four phase inputs of the paper feed stepper motor. This causes incremental motor shaft movement (steps) in either direction, depending on the pulse sequence. The motor shaft, in turn, drives the paper feed mechanism in the forward or reverse direction to move paper at 0.0083 inch per step in fanfold mode and 0.00913 per step in cut sheet mode.

Before each step is executed, the microprocessor updates the status on accumulated and uncompleted paper motion steps as described in this section, Paragraph 2.5.3. If the microprocessor detects a paper out condition during the paper movement operation, the microprocessor will deactivate the stepper motor to stop paper movement and will recognize the situation as an abort during the event. The abort condition is written into the Printer Status byte in C-RAM before the microprocessor returns control of C-RAM to the Format Controller.

The Format Controller can load arguments into C-RAM for events 1, 2, 4, and 5 to request paper movement from 1 step to 4,095 steps (0.0083 to 17.062 inches) in each event. Refer to Paragraph 2.5.3 for details on the paper movement arguments.

A print cycle is initiated when the microprocessor polls the Print Command byte 09_{16}, Event 3, in C-RAM and detects that the Print Data bit, bit 4, is set high. This causes the microprocessor to examine the Data Block (print buffer) in C-RAM for printable data, then uses a logic-seeking routine to determine the minimum head movement prior to printing the next line. To determine minimum head movement, the microprocessor examines the printable data to establish line length and its positions, which is then compared to the print head position. The position of the head is then determined. If it is determined that the first character in the line is closer to the head position than the last character, the head is moved to the left to the beginning of the line. If the head position is closer to the last character in the line, the head is moved to the right to the last character in the line where printing starts with the last character and progresses from right to left to the first character in the line. The location of the print head is determined; this information is continuously updated during head movement to reflect the exact position of the print head.

The following paragraphs describe the operation of the Format Controller and Print Controller in detail.

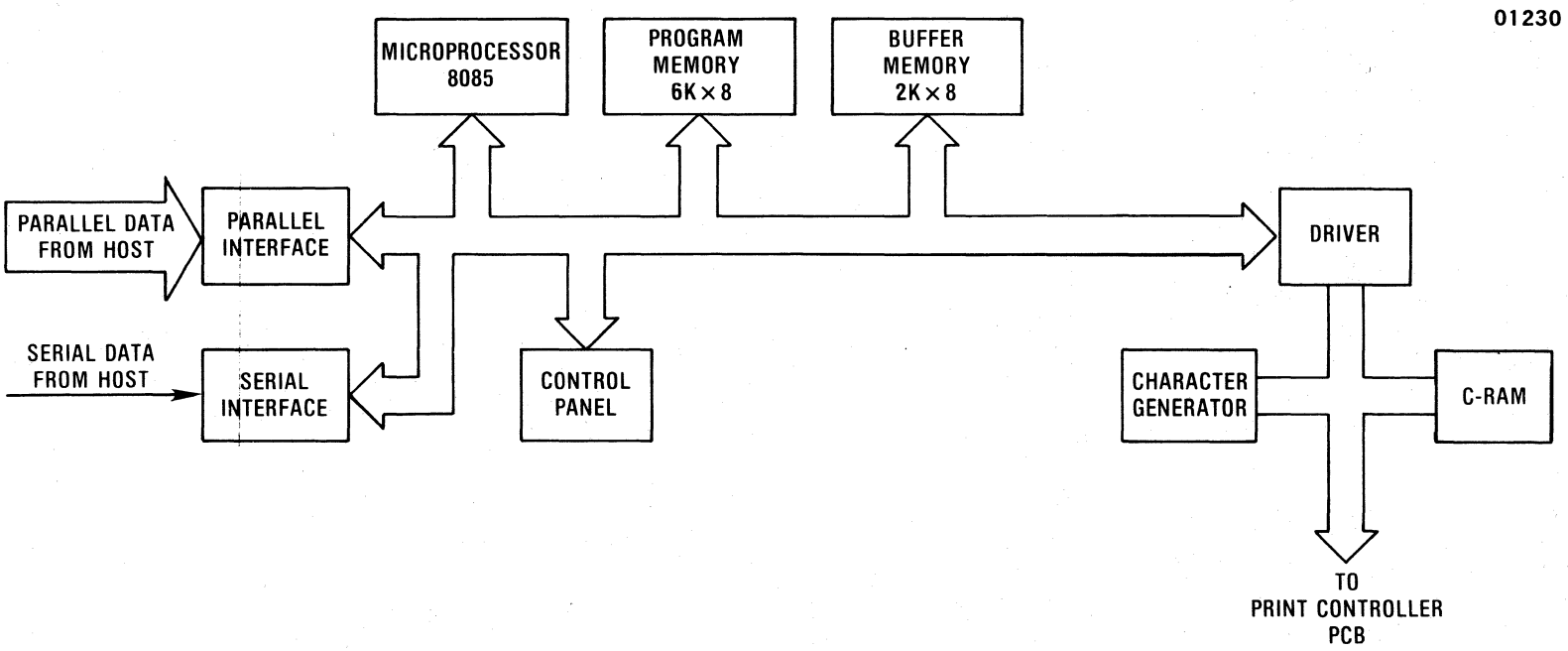


Figure 2-4. FORMAT CONTROLLER BLOCK DIAGRAM

2.3 FORMAT CONTROLLER

The basic architecture of the high performance Format Controller consists of the following:

- o 8085 microprocessor system
- o Character generator
- o Control panel
- o Parallel interface
- o Serial interface
- o Data buffer
- o C-Ram

Refer to the simplified functional block diagram of the Format Controller shown in Figure 2-4.

2.3.1 PARALLEL INTERFACE

Standard parallel communications interfacing is used in the Model 352 printer. The Format Controller provides a parallel interface connection to the "host" device via an Amphenol 57 Series 36-pin connector. The pin-outs of the connector are listed in Table 2-1. A description of the "host" and printer generated parallel signals follow the table.

Table 2-1. Parallel Interface Connector Pin-Outs

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

HOST GENERATED SIGNAL DESCRIPTION - The following signals are generated by the host device.

DATA STROBE - Data strobe is a negative going pulse used to transfer the incoming parallel data into the printer logic. The pulse duration of the signal must be a minimum of 1.0 microsecond. The leading and trailing edges of data strobe and the input data must be as shown in Figure 2-5.

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

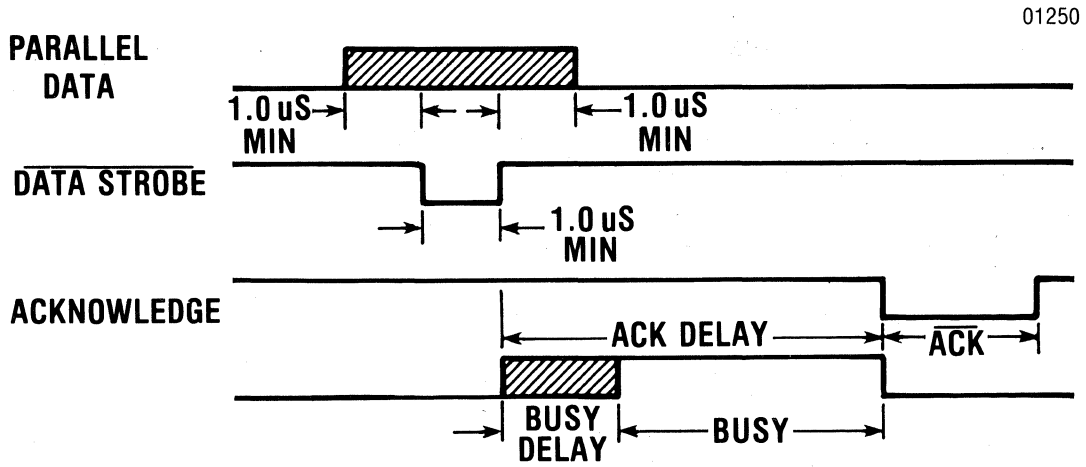


Figure 2-5. PARALLEL INTERFACE TIMING DIAGRAM (PRINTABLE DATA ONLY)

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

NOTE
Data should not be sent during an Input Prime as Centronics reserves this sequence for factory testing.

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

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

BUSY - Busy is an active high signal which inhibits data transmission from the input device. Busy goes active on the trailing edge of ~~acknowledge~~ data strobe or when either the paper empty or fault status line is active high. (after a "busy delay") when strobed code requires busy

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

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

$\overline{\text{FAULT}}$ - Fault is an active low signal that indicates paper empty, deselect or an invalid VFU command.

2.3.2 SERIAL INTERFACE

The serial communications interface provides an EIA-RS-232C compatible interface via an EIA-RS-232C, 25 pin connector. A 20 mA current loop interface capability is provided by four unused pins in the connector. The pin-outs of the 25-pin interface conenctor are listed in Table 2-2 and a description of the host and printer generated signals follow the table.

Table 2-2. Serial Interface Connector Pin-Outs

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

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

NOTE

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

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

RECEIVED DATA - Data source to the printer.

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

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

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

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

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

REQUEST TO SEND - This line is +V when in the X-ON/X-OFF mode.

REVERSE CHANNEL - Used for transmitting the printer/buffer status when in the reverse channel mode. The line is normally in a -V condition. When the buffer is full, this line goes to a +V condition until the printer is able to receive data again. The line is held at buffer empty polarity (-V) when in the X-ON/X-OFF or Data Terminal Ready.

DATA TERMINAL READY - This line is held at +V when selected and not used for the status report line; and is held at -V when not selected.

2.3.3 8085 MICROPROCESSOR SYSTEM

The 8085 microprocessor system consists of the following:

- o 512 bytes of scratchpad RAM
- o 6K bytes of program ROM
- o 2K of buffer RAM

2.3.4 CHARACTER GENERATOR

Although the character generator is physically on the Format Controller board, it is electrically accessed only by the Printer Controller microprocessor bus. The character generator is a 2K x 8 ROM which contains the standard and alternate character sets of 256 printable characters.

2.3.5 DATA BUFFER

The communicatins input data buffer is a 2K x 8 RAM. The entire buffer is used when the printer is operated in the serial communications mode. When the printer is set for parallel operation, the entire buffer would be used in the page mode. This permits the dumping of an entire CRT screen load without the interface going "busy".

In the serial mode, the "buffer full" indication will be sent when room for only 512 characters is left. When the buffer content is 256 characters or less, a "buffer empty" condition will be sent.

2.3.6 C-RAM

Communications between the Format Controller and the Print Controller pcbs occurs via the two-port 1K x 8 C-RAM memory. The C-RAM, along with the character generator, is interfaced to the Print Controller through the C-BUS interface connector described in paragraph 2.4, C-BUS Data Interface Cable.

The C-RAM memory map is shown in Table 2-4, and a detailed description of the C-RAM memory and its interfacing functions begins at paragraph 2.5.

2.4 C-BUS DATA INTERFACE CABLE

The Data Interface Cable, connected between the Print controller 34-pin connector, J204 (Centronics P/N 31240080-1040) and the Format Controller (J304) has a maximum length of 6 inches. This interface cable is used to pass data, control, and character generator information between the Format controller and the Print controller circuit board. Refer to Figure 2-1 for direction of information flow and Table 2-3 for pin identification and functional descrption.

Table 2-3. Interface Connector J204, Pin Identification

PIN NO.	SIGNAL	SOURCE	DESCRIPTION
1	Address 0	Format Controller	Tri-state address lines used to address an 8K block of contiguous memory addresses. Two additional select lines (CGSEL, CRSEL) are used to select either the C-RAM or character generator address block. (Format Controller uses additional decoding logic under firmware control, to allow character generator options the use of the same address block.)
18	Address 1	Format Controller	
2	Address 2	Format Controller	
19	Address 3	Format Controller	
3	Address 4	Format Controller	
20	Address 5	Format Controller	
4	Address 6	Format Controller	
21	Address 7	Format Controller	
14	Address 8	Format Controller	
15	Address 9	Format Controller	
16	Address 10	Format Controller	
17	Address 11	Format Controller	
32	Address 12	Format Controller	
30	Data 0	Format or Print Controller	Bidirectional data lines allow Print Controller to communicate with the character generator ROMs or RAM and the C-RAM buffer.
13	Data 1		
29	Data 2		
12	Data 3		
28	Data 4		
11	Data 5		
27	Data 6		
10	Data 7	Format or Print Controller	
7	$\overline{\text{RESET}}$	Print Controller	Control line used to reset the logic on the Format Controller during "Power On". A low level indicates the RESET condition.

Table 2-3 (cont'd)

PIN NO.	SIGNAL	SOURCE	DESCRIPTION
6	HOLD IT	Format Controller	A handshake signal. A high level indicates that Format Controller has read/write control of the C-RAM. At this time, Print Controller is prohibited from accessing the C-RAM. When low, Format Controller has relinquished C-RAM control and is requesting the P.C. to act on C-RAM data.
23	GOT IT	Print Controller	A handshake signal. When high Print controller has read/write control of the C-RAM and data is being acted on. Format Controller is prohibited from accessing C-RAM. When low, Print Controller relinquished control of C-RAM because action caused by data has been completed.
8	CRSEL	Print Controller	Control line used to select the on block of the memory addressed for C-RAM and graphics RAM buffer. A HIGH indicates a READ or WRITE operation to the buffer is in progress.
31	CGSEL	Print Controller	Control line used to select the 8K block of memory addresses the character generator. When low, indicates that a READ or WRITE operation to the character generator is in progress.
25	$\overline{\text{WRITE}}$	Print Controller	Control line used to strobe delay into either the C-RAM or character generator RAM. When low, indicates a data write to memory.

Table 2-3 (cont'd)

PIN NO.	SIGNAL	SOURCE	DESCRIPTION
5	GROUND		
22	GROUND		Indicates that the Format Controller
9	GROUND		board is installed.
26	GROUND		
24	PWR FAIL		

NOTE: All interface lines are driven by or terminate into a Low Power Schottky device on the Print Controller, but:

1. GOT IT is driven by a TTL (7404) device pulled up to +5V with a 1.2K ohm resistor.

2.5 PRINT CONTROLLER

The Print Controller analyzes arguments and data passed to it by the Format Controller, performs the printer operation, and returns status information. The Print Controller handles the logic seeking and bidirectional printing by analyzing the data and determinging the most efficient method of printing. The printing speed is determined by the pitch of the horizontal dots. Reverse or forward paper motion is defined in actual steps of the stepper motor. With fanfold paper, each step equals 1/120 of an inch; with cut paper, each step equals 1/108 of an inch.

2.5.1 DATA ARGUMENTS DEFINITION

The action performed by the printer is dedicated by the placement of parameters in the C-RAM by the Format Controller and the signaling of the Print Controller (by its lowering of the HOLD IT line) that action is requested. This parameter information stored in the C-RAM is divided into two sections, the Control Block and the Data Area (refer to Table 2-4, C-RAM Memory Map). Control information is located at addresses 00_{16} to IF_{16}. The data area is located from 20_{16} to $7FF_{16}$. Arguments for print functions and status are passed in the control block.

2.5.2 STATUS BYTES

As shown in Table 2-4, memory locations 00_{16} to 04_{16} and $0E_{16}$ are for status bytes, while locations 05_{16} to $0F_{16}$ (except for $0E_{16}$ and $1C_{16}$ to $1F_{16}$) are for the arguments. Arguments for five events are defined as four for paper motion, and one for print action. The five events occur in sequence. Status is updated by the Print Controller before each transfer of control of the C-RAM to the Format Controller. The print function arguments are not changed by the Print Controller, only acted upon. After completion of a "Print Command", the Print Data buffer (C-RAM locations 10_{16}-93_{16}) are returned to a reset mode (i.e., full of null codes), however, the "Print Command" byte is not changed. If not print action is requested (Bit 4 Print Command = 0), the print data buffer is neither interrogated nor changed.

Table 2-4. C-RAM Memory Map

BYTE (HEX)	DESIGNATION	DATA SOURCE
00	Printer Status	Print Controller
01 02	Accumulated Paper Motion Steps (Status Info.)	Print Controller
03 04	Uncompleted Paper Motion Steps (Status Of Failed Motion	Print Controller
05 06	Event 1, Reverse Paper Motion Steps Before Print	Format Controller
07 08	Event 2, Forward Paper Motion Steps Before Print	Format Controller
09	Event 3, Print Command	Format Controller
0A 0B	Event 4, Reverse Paper Motion After Print	Format Controller
0C 0D	Event 5, Forward Paper Motion After Print	Format Controller
0E	Self Test Status	Print Controller
0F	Density Selection	Print Controller/ Format Controller
10 1B	Reserved Reserved	
1C	Color, 900 Extension	Format Controller
1D	Inter-Char. Skip (Optional)	Format Controller
1E	Dot Pitch (Optional)	Format Controller
1F	Matrix Size (Optional)	Format Controller
20 FF	ASCII Data	Format Controller
20 7FF	Graphics Pin Data	Format Controller

2.5.3 PAPER MOTION ARGUMENT DESCRIPTION

The four paper motion arguments (bytes 05_{16} through 08_{16} and $0A_{16}$ through $0D_{16}$) are written into C-RAM as a 2-byte number by the Format Controller. The argument forms a 12-bit binary number. Bits 0-7 of the lower order address byte contain the eight (8) least significant bits of the argument value. Bits 0-3 of the higher order address byte form the four (4) most significant bits of the argument value. Bits 4-7 of the higher order address bytes are ignored. Total paper movement of 4095 half steps will equal 17.062 inches of paper travel. (See Table 2-5).

Table 2-5. Paper Movement Argument

7	6	5	4	3	2	1	0	LS Byte
7	to		4	3	2	1	0	MS Byte

(Do not care)

2 bytes form 12-bit binary number,
which represents the number of steps.
One bit represents 1/2 step = .00417
inch of paper movement (fanfold paper).

240 half steps = 1-inch paper movement
40 half steps = 1/6-inch paper movement
30 half steps = 1/8-inch paper movement

2.5.4 PRINTER STATUS BYTE (ADDRESS 00_{16}, BIT 0 = LSB)

This byte is written by the Print Controller after each printer action (prior to the return of C-RAM control to the Format Controller) to provide printer status information to the Format Controller as shown in Table 2-6. The transfer of control from the Format Controller to the Print Controller with all events zero will only cause the Print Controller to update the status byte.

Table 2-6. Printer Status Byte

BIT NO.	DESIGNATION
7	Event Aborted
6	Abort on Event 1
5	Abort on Event 2
4	Abort on Event 3
3	Abort on Event 4
2	Abort on Event 5
1	Fault/Test Fail
0	Paper Out

The function of each bit set (high) in the Printer Status byte is as follows:

Bit 7 - When set, shows that one of the five events was aborted.

Bits 2 through 6 - When bit 7 is set (indicating an event was aborted), one of the bits 2 through 6 is set to indicate the event in progress when the abort occurred.

Bit 1 - Two conditions will set this bit:

1. If the print head stops moving during a print cycle, bits 7, 4, and 1 will be set, indicating a jam and an incomplete (shortened) print cycle.

2. When a self test has been initiated and a failure has been recognized, the self-test byte should then be polled.

Bit 0 - When set, indicates a "paper out" condition.

Bits 7-2 should be checked to determine if any event in progress was aborted because of this condition.

2.5.5 SELF-TEST STATUS BYTE (ADDRESS OE_{16})

The Format Controller initiates the self test by setting the appropriate bit (Bit 0) in the print command byte (see Table 2-7). The Print Controller performs the self-test, then writes the results in the self-test byte location $0E_{16}$ according to Table 2-8.

On power up, the Print Controller performs the tests associated with Bits 0, 1, and 3 then places the results in the self-test byte location. when a bit is set high, it indicates a failure in the test being performed.

Table 2-7. Print Command Byte

BIT NO.	DESIGNATION
7	Prime
6	Print Underline
5	Print Expanded
4	Print Data
3	Override
2	Character Set
1	Selection
0	Self-Test

(Bit 0 is least significant bit)

Table 2-8. Self-Test Status Byte

BIT NO.	DESIGNATION
7	Head Jam/No Head Movement
6	Bad Video Count
5	Reserved
4	Reserved
3	Scratch Pad 8156 Check
2	Reserved
1	Cram Check
0	CRC on Program ROM

The function of each bit, when set high in the Self-Test Status byte, is as follows:

Bit 0 - Indicates a failure during cyclical redundancy check (CRC) of the firmware program chips on the Print Controller. A high (1) signals an error condition.

Bit 1 - Indicates a failure of reading and writing CRAM when set high.

Bit 2 - reserved.

Bit 3 - Indicates a failure of reading and writing the scratch pad RAM when set high.

Bit 4 - Reserved.

Bit 5 - Reserved for expansion.

Bit 6 - Checks video circuitry. Problem in this area could be no or bad video signals.

Bit 7 - Checks for correct head movement. A high indicates a drive circuitry problem, a head/paper jam, or incorrect head currents.

2.5.6 ACCUMULATED PAPER MOTION STEPS (ADDRESS 01_{16} AND 02_{16})

This two byte, 16-bit number is a two's complement of the number of steps that paper has moved. Zeroes on initialization, forward paper motion steps are added to the number, while reverse steps are subtracted. The Format Controller can zero this number at each logical top of form if the total steps per form are to be accumulated. Each step of motion is equal to 0.00417 inch (240 steps/inch) when using fanfold paper.

2.5.7 PAPER MOTION STEPS REMAINING AFTER ABORT (ADDRESS 03_{16} AND 04_{16})

If the Print Controller is forced to abort a paper motion event, the number of paper motion steps that were not completed during that event are stored in this 16-bit number by the Print Controller.

2.5.8 REVERSE PAPER MOTION BEFORE PRINT (ADDRESS 05_{16} AND 06_{16})

Event No. 1, 12-bit binary number written by the Format Controller to request a number of paper motion steps in the reverse direction before print.

Paper motion Argument Description for details on bit structure.

2.5.9 FORWARD PAPER MOTION BEFORE PRINT (ADDRESS 07_{16} AND 08_{16})

Event No. 2, 12-bit binary number written by the Format Controller to request a number of paper motion steps in the forward direction before print. See Para. 2.5.3, Paper Motion ARgument Description, for details on bit structure.

2.5.10 PRINT COMMAND (ADDRESS 09_{16} BIT 0 = LSB)

Event No. 3, written by the Format Controller to the Print Controller to request action other than paper motion is shown in Table 2-7. Results will be placed in the Status word.

Bit 7 - When set, causes the print head to move to the left margin.

Bit 6 - When set, causes the data in the print buffer to be printed with an underline.

Bit 5 - When set, causes the data in the print buffer to be printed expanded.

Bit 4 - When set, indicates that data is to be printed. This bit must be set to initiate any printer action. To print underline expanded, bits 6, 5, and 4 must be set high (1). For normal print, only bit 4 is set. Bits in the Print Command word are processed MSB to LSB, with the exception of the last bit (bit 0) which is interrogated and acted upon first (any failure will cause an abort). If bit 7 was set in the above examples, this print head would move to the left before printing.

Bit 3 - When set, the requested events will be processed regardless of a paper out condition.

Bits 2 and 1 - The Format Controller will tell the Print Controller (via the C-RAM) which character set to use. The 8K character generator set is divided into four sections. Bits 1 and 2 are used to select which of the character sets is to be used (see Table 2-9).

Table 2-9. Selection of Character Generator Section Using Bits 1 and 2

BIT 2	BIT 1	RELATIVE BASE ADDRESS (HEX)
0	0	0000
0	1	0800
1	0	1000
1	1	1800

Bit 0 - When set, will cause the Print Controller to self-test. This includes a RAM check, program CRC check, and the moving of the print head from the left margin to the right and back to verify the video count. The results will be placed in the Status word.

2.5.11 REVERSE PAPER MOTION AFTER PRINT (ADDRESS $0A_{16}$ AND $0B_{16}$)

Event No. 4, 12-bit binary number written by the Format Controller to request a number of paper motion steps in the reverse direction after print. Refer to Para 2.5.3, Paper Motion Argument Description for details on bit structure..

2.5.12 FORWARD PAPER MOTION AFTER PRINT (ADDRESS $0C_{16}$ AND $0D_{16}$)

Event No. 5, 12-bit binary number written by the Format controller to request a number of paper motion steps in the forward direction after print. Refer to Para. 2.5.3, Paper Motion Argument Description for details on bit structure.

2.5.13 PRINT DENSITY/TYPE (ADDRESS OF_{16})

Bits 0 through 2 are used by the Format Controller for the selection of character density as shown in Table 2-10.

Table 2-10. Print Density Selection Using Bits 0, 1 AND 2

BIT 2	BIT 1	BIT 0	CHARACTERS/INCH
0	0	0	10
0	0	1	(Not Used)
0	1	0	(Not Used)
0	1	1	12
1	0	0	13.2
1	0	1	15
1	1	0	16.5
1	1	1	(Not Used)

Bit 3 is set to indicate the graphic mode. When bit 3 is set, bits 0 through 2 are ignored. When printing graphics, the pin data covers from the Format Controller (see Para. 2.7, Character Pattern Generation).

Bit 4 is set to indicate high density printing. When bit 4 is set, bits 0 through 2 are ignored. Multi-pass printing must be performed by setting bit 4, and changing character set locations with byte 09_{16}.

Bit 5 - Not Used.

Bit 6, used for downstream loading of character set.

2.5.14 MATRIX SIZE (ADDRESS $1F_{16}$)

This binary number indicates the horizontal character width and is used to calculate the address of the character within the character generation (see Para. 2.7, Character Pattern Generation).

When set low (0), the character is assumed to be seven dots wide.

2.5.15 DOT PITCH (ADDRESS $1E_{16}$)

Ths binary number indicates the number of encoder lines between column firing (see Para. 2.6, Positional Information and Use). When set low (0), the standard pitch is assumed.

2.5.16 INTER-CHARACTER SKIP (ADDRESS $1D_{16}$)

This binary number indicates the number of encoder lines between characters (see Para. 2.6, Positional Information and Use). When set low (0), the standard inter-character skip is assumed.

2.6 POSITIONAL INFORMATION AND USE

Positional inforamtion comes in as quadrature from and encoder mounted on the horizontal drive mtoor. This information comes directly into a separate microprocessor which signals the main microprocess with both column and positional information on "divide-by" arguments that are presented to it. The encoder, with dual sensors, gives positional information at a rate of 660 edges per inch (or every 0.0015 inch).

2.6.1 STANDARD CHARACTER PLACEMENT

When not dictated by arguments passed in the C-RAM (locations $1D_{16}$, $1E_{16}$ and $1F_{16}$), the standard 7-dot wide character is assumed to be the standard space. Column spacing is as shown in Table 2-11.

Table 2-11. 7 Dot Wide Standard Character Placement

CPI	LINE/COLUMNS	DOT SPACING (IN.)	LINES/INTER CHAR.	TOTAL LINES
10	6	0.00909	30	66
12	5	0.00757	25	55
13.2	5	0.00757	20	50
15	4	0.00606	20	44
16.5	4	0.00606	16	40

When the character width is changed to a 9-dot wide matrix (with placement of a binary 1001 in argument $1F_{16}$ of the C-RAM with no arguments placed in $1D_{16}$ and $1E_{16}$), the standard spacing for the 9-dot wide character is used. This spacing is shown in Table 2-12.

Table 2-12. 9 Dot Wide Standard Character Placement

CPI	LINE/COLUMNS	DOT SPACING (IN.)	LINES/INTER CHAR.	TOTAL LINES
10	5	0.00757	26	66
12	4	0.00606	23	55
13.2	4	0.00606	18	50
15	3	0.00454	20	44
16.5	3	0.00454	16	40

NOTE: Adjacent dot positions cannot be fired.

2.6.2 GRAPHIC MODE

When bit 3 of the print density argument is set (indicating graphic mode), the dot placement is every 10 encoder lines, or every 0.01515 inch. In this mode, adjacent dots can be fired.

2.7 CHARACTER PATTERN GENERATION

It is the responsibility of the Format Controller to ensure that character generator complies to the method of printing that is requested.

When printing standard characters, the address (as shown in Figure 2-12) and a "ROM Select" are presented by the Print Controller onto the address lines of the interface connector. Eight bits of data, representing pin fire information, are then read. The least significant bit (LSB) represents Pin 1 (top-most pin), and the most significant bit (MSB) is pin 8 information. The Print Controller fires the ninth pin only when this signal is active (printing underline). When printing characters (unless "Graphics mode" is selected), only alternate dots can be fired.

2.7.1 STANDARD 7-DOT WIDE CHARACTER GENERATION

Table 2-13 shows the address presented to the character generator for standrd 7-dot wide characters. For convenience, eight locations are allocated to each character code for this standard (all numbers are hexidecimal).

Table 2-13. Address Locations for Standard 7-Dot Wide Characters

CHAR. CODE	CHAR. GEN. ADDRESS
00	000-006
01	008-00E
02	010-016
03	018-01E
.	
.	
.	
41 (A)	208-20E
.	
.	
.	
7E	3F0-3FG
7F	3F8-3FE
80	400-406
.	
.	
.	

Table 2-13. (cont'd)

CHAR. CODE	CHAR. GEN. ADDRESS
C1	608-60E
.	
.	
.	
FE	7F0-7F6
FF	7F8-7FF

2.7.2 NON-STANDARD WIDTH CHARACTER GENERATION

Addresses for character widths other than 7-dot wide are computed in the following manner:

Character Code X Width = First Column

First Column + Width - 1 = Last Column

Example: For a 9-dot wide character (shown in Hex)

Character Code 00 = (00) x (09) = 00 First Column
00 + 09-1= 08 Last Column

Character Code 03 = (03) x (09) = 1B First Column
1B + 09-1= 23 Last Column

Character Code 41 = (41) x (09) = 249 First Column
1B + 09-1= 23 Last Column

2.7.3 GRAPHIC MODE

When bit 3 is set in the C-RAM print density argument (indicating "Graphics Mode"), the Print Controller takes the pin data for the first dot firing column from C-RAM location 20_{16} and the last column from C-RAM location 387_{16} (872 columns).

2.8 STEPPER DRIVER

Figure 2-6 is a simplified schematic of the driver circuitry for the stepper motor. The energy level in the motor is maintained by chopping the current in each winding with the upper stage drivers. During paper motion, the motor current per winding is 1 Amp with V HOLD at GND. When no paper motion is required, current per winding is approximately 250 mA with V HOLD at +5 VDC. This substantially reduces power loss and holds paper in place when paper motion is not required. Average current per winding:

V HOLD ON = 250 mA
V HOLD OFF = 1 Amp

Voltage Required:

+35 VDC, +5 VDC

Table 2-14 shows the stepper motor excitation sequence.

Talbe 2-14. Stepper Motor Excitation Sequence

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

A. Normal 4-Step Sequence (Full-Step)

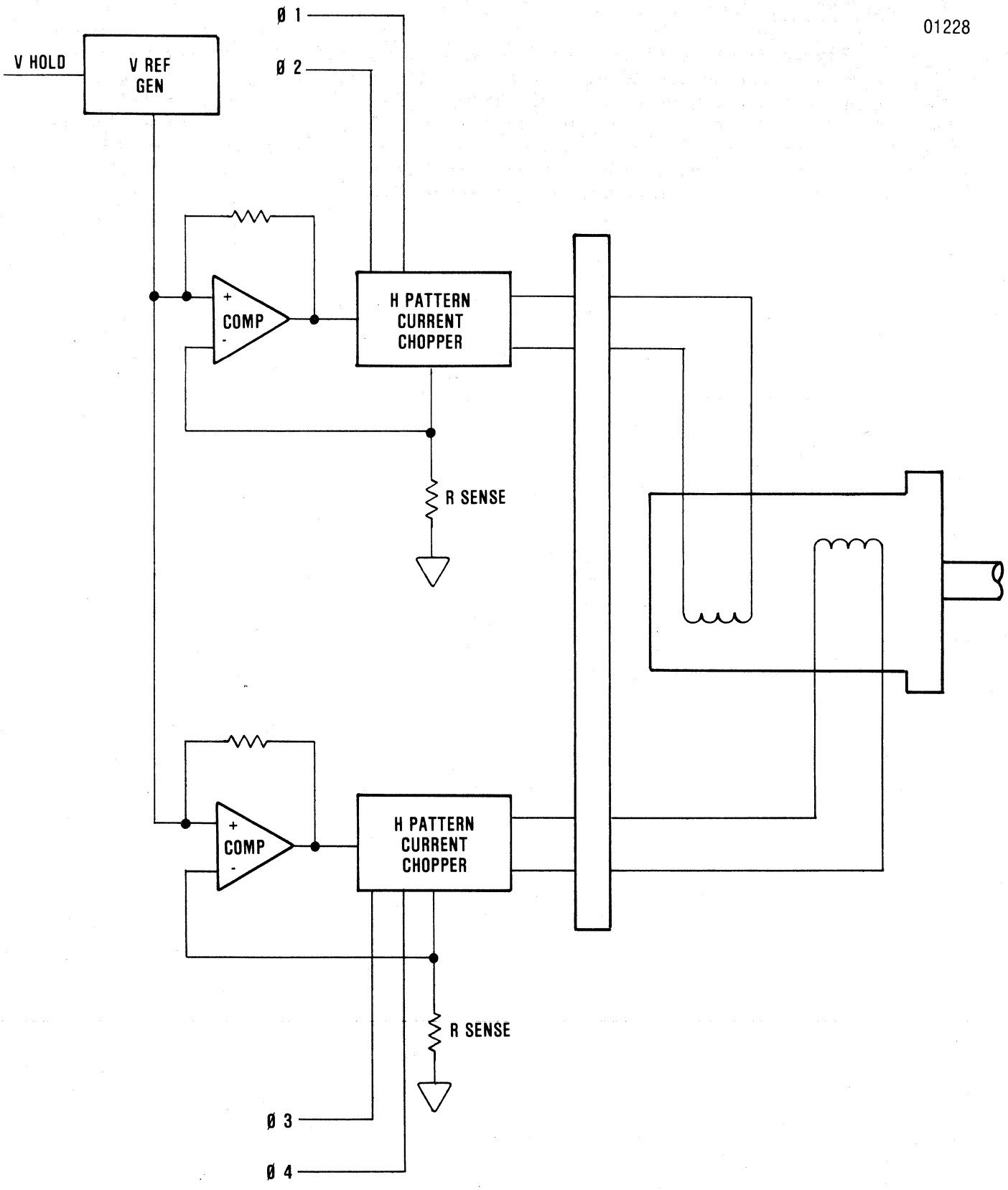


Figure 2-6. STEPPERMOTOR DRIVER

Table 2-14. (cont'd)

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

B. 8-Step Sequence (1/2-Step)

NOTE: ON = 1 = +5 VDC (High)
OFF = 0 = OV (Low)

2.9 CARRIAGE SERVO SYSTEM

Table 2-15 defines the carriage motion control signals that control the DC motor drive circuitry which is shown in simplified form in Figure 2-7.

Table 2-15. Carriage Motion Control Signals

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

NOTE: 1 = ON = +5 VDC = High
0 = OFF = OV = Low

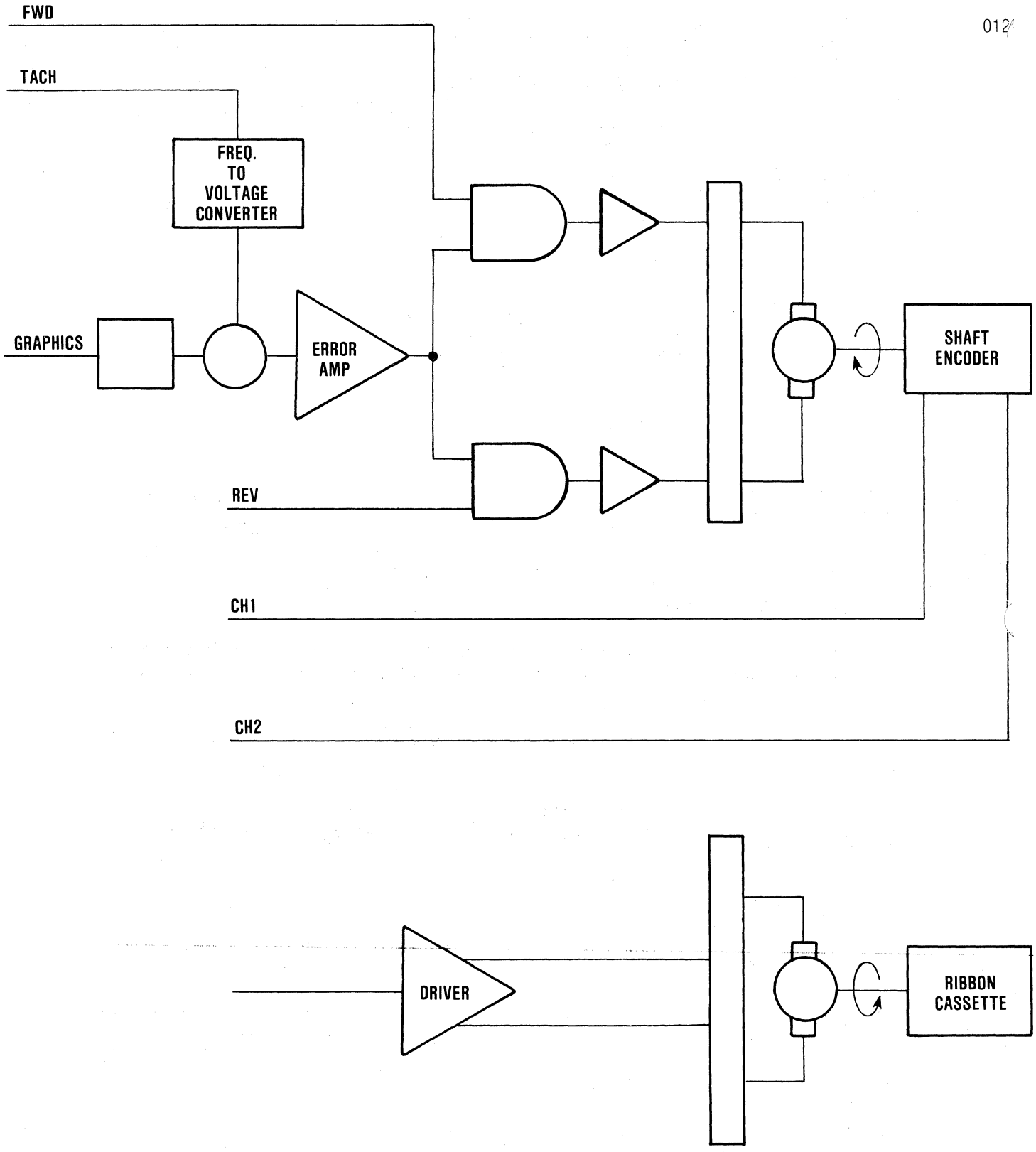


Figure 2-7. CARRIAGE DRIVE - RIBBON DRIVE VELOCITY

Carriage motion is achieved by applying these control signals, and a TACH signal. Control of motor velocity is achieved by maintaining a constraint error voltage between an internal reference (V REF GEN) and the voltage derived as a result of the input TACH frequency. This TACH frequency is derived as a submultiple of the video feedback signal. A variable divider is used with the 660 position feedback points (per linear such of carriage motion) to generate the TACH FREQ for the desired carriage velocity. The count for the divider is selected by considering the repetition rate of the matrix head and the number of possible dot firings per inch.

The head speeds indicated in Table 2-16 are used for the standard densities for a 7-part character.

Table 2-16. Standard 7-Part Character Head Speeds

CHARACTERS PER INCH (CPI)	INCHES PER SEC (IPS)
10	20
12	16.7
13.2	15.6
15	14
16.5	12
Graphics	7.5

NOTE: No speed adjustment needed. The above speeds are maintained within ±5%.

2.10 RIBBON MOTOR DRIVER

Ribbon drive is accomplished with a +12V DC motor, controlled by a single stage (transistor) driver amplifier as shown in Table 2-7. The ribbon motor is turned on only when the carriage is in motion.

2.11 HEAD DRIVER CIRCUIT

The head driver circuit features a "pick and hold" circuit to quickly energize the pin solenoids. This drive technique enables high speed printing with minimum power loss since all stages are run in the saturation mode. The maximum repetition rate per pin is 909 microseconds. All pins (1 through 9) require TTL logic level signals to:

Fire Pin = 1 = ON = +5 VDC
Do Not Fire Pin = 0 = OFF = OV

Pin data strobe uses a 1 to 3 microsecond negative going TTL signal. Voltages required to this circuit are: +35 VDC, and +5V.

SECTION 3
MAINTENANCE

3.1 MAINTENANCE SUMMARY

This section contains information on printer marking and configuration, preventive maintenance, and troubleshooting procedures. The recommended preventive maintenance consists of cleaning and internal inspection of the printer. The troubleshooting procedures will aid in isolating printer malfunctions, defective components or required adjustments.

3.2 PRINTER MARKING AND CONFIGURATION

The following paragraphs provide information on printer identification and configuration. If calling for service on your printer, this information should be supplied to the field service engineer to provide for quicker service.

3.2.1 PRINTER NAMEPLATE

The nameplate is located underneath the printer on the bottom cover. Figure 3-1 illustrates the nameplate and the information it contains.

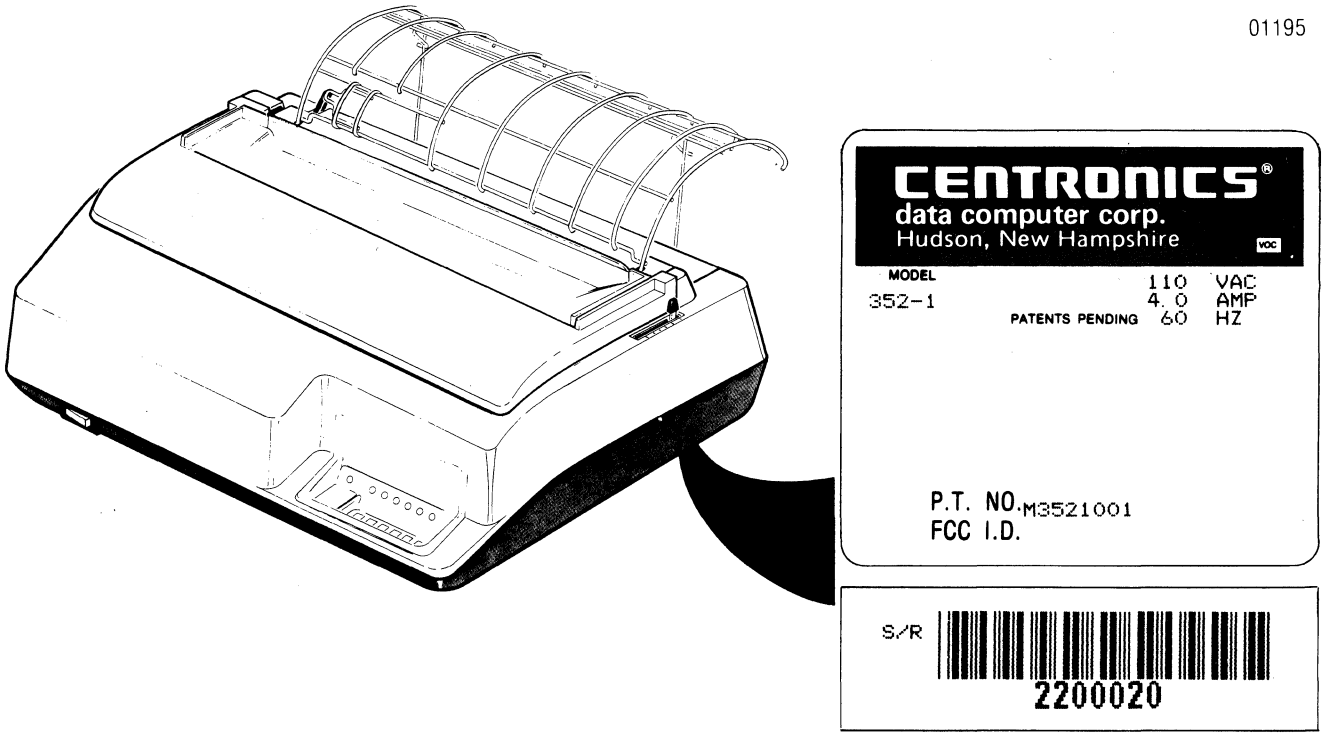


Figure 3-1. PRINTER NAMEPLATE

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

3.2.2 PRINTED CIRCUIT BOARD MARKING

The Print Controller pcb and Format Controller pcb, located under the print mechanism, is marked with its part number, dash configuration and revision. Figure 3-2 shows the pcb's and the marking information.

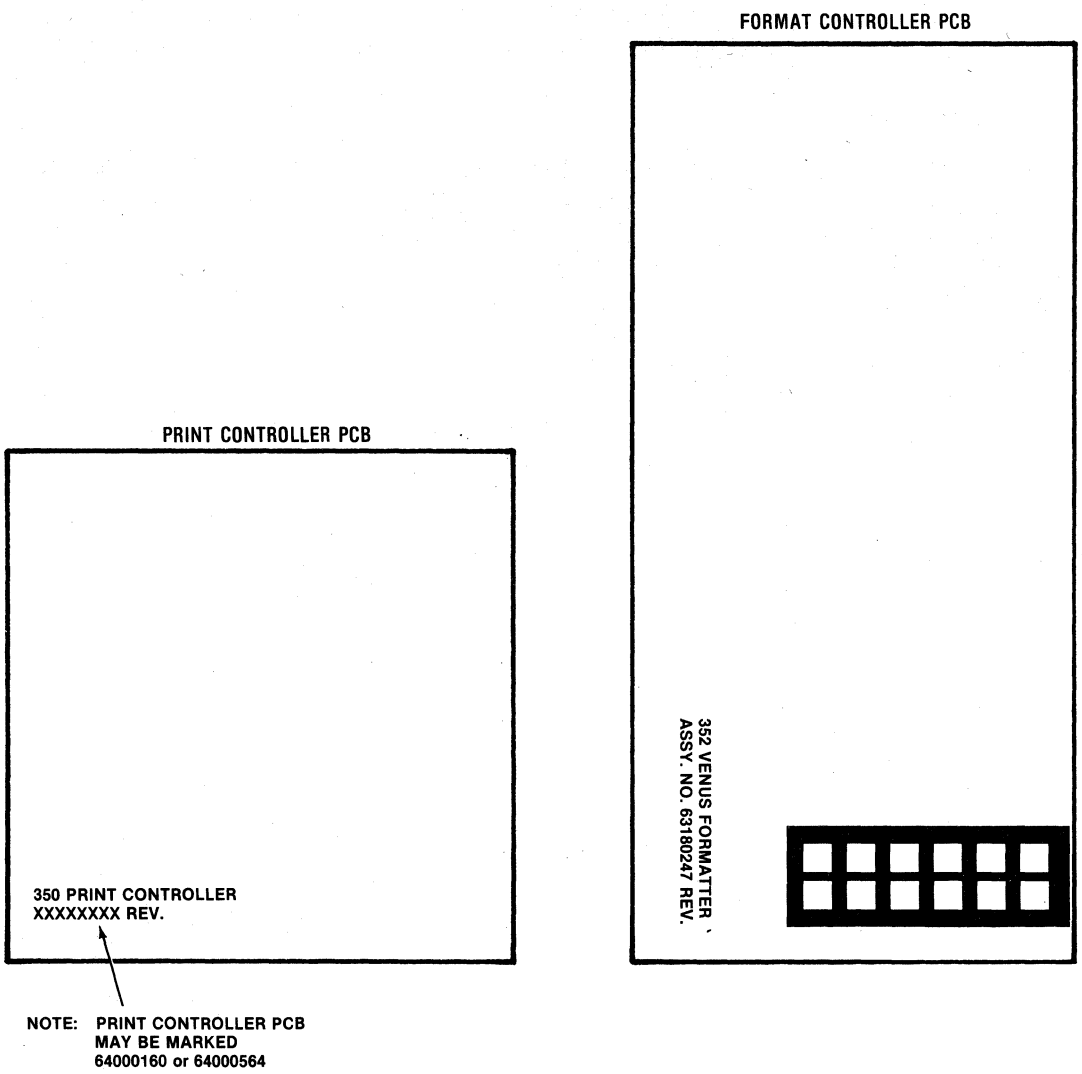


Figure 3-2. PRINTED CIRCUIT BOARD MARKING

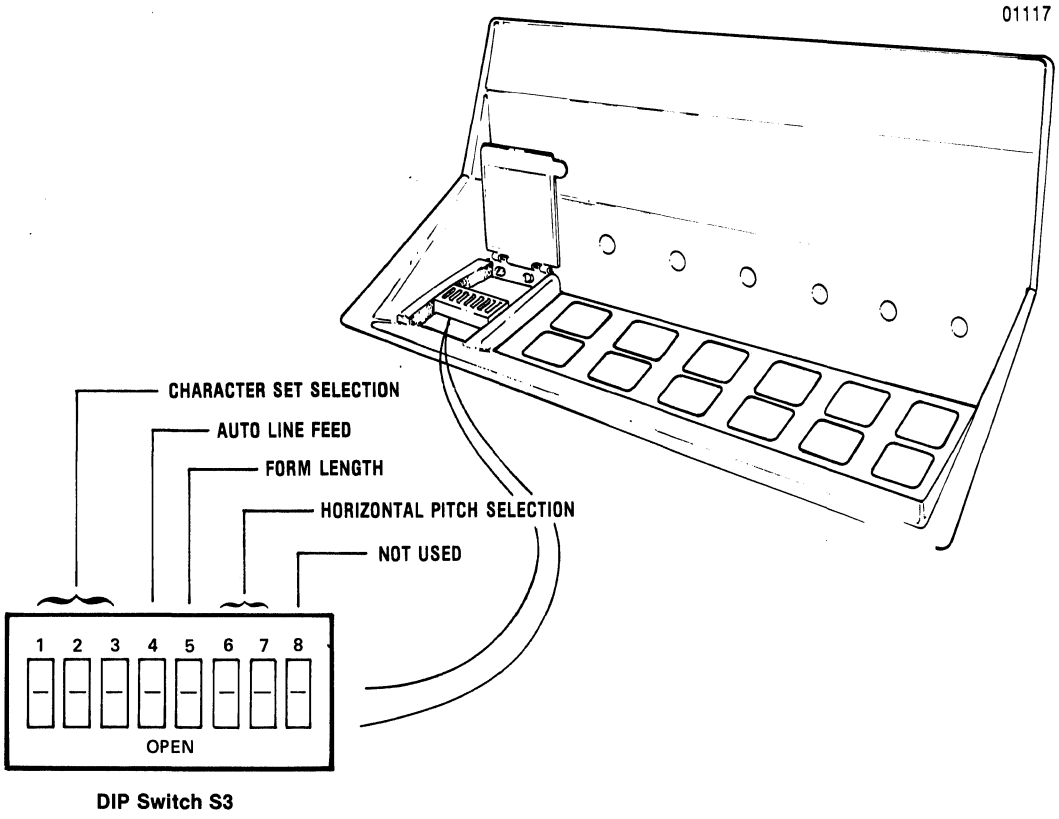
3.2.3 PRINTER CONFIGURATION

The printer contains four DIP switches labelled S1, S2, S3, and S4 used to select printer features. DIP switches S1, S2, and S4 are internal to the printer and are accessible only by removing the DIP switch dust cover. DIP switch S3 is located on the control panel assembly. The following paragraphs describe the settings of each DIP switch for a special feature. The printer is shipped from Centronics with the following features selected.

- o Character Set - USA
- o Auto Line Feed = Disabled
- o Form Length
- o Horizontal Pitch - 10 cpi
- o Baud Rate - 9600
- o Buffer Status - X-ON/X-OFF
- o Printer Status - X-ON/X-OFF
- o ANSI; 730/704 - 703/704 Compatible
- o 7/8 Data Bits - 7 Data Bits
- o Reverse Channel Polarity - Active High
- o Parity - None
- o Data Strobe - Normal
- o Parallel/Serial - Parallel
- o Page Mode - Disabled
- o Print on Paper Motion - Print with no Carriage Return
- o Prime on Select - Disabled
- o Prime on Delete - Disabled

PRINTER FEATURES DIP SWITCH S3

DIP switch S3 controls the following printer features: country character sets, auto line feed, form length, and horizontal pitch. Figure 3-3 illustrates the location of the switch and provides the switch settings for the specific feature. A brief description of each feature is provided below.



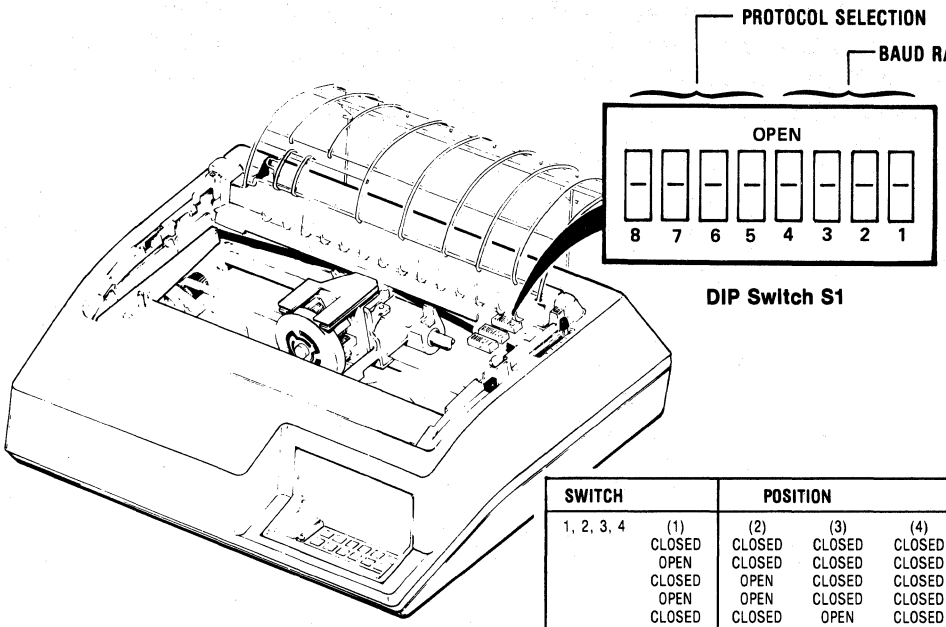
DIP Switch S3

SWITCH	POSITION			FEATURE
1, 2, 3	(1) CLOSED OPEN CLOSED OPEN CLOSED OPEN CLOSED OPEN	(2) CLOSED CLOSED OPEN OPEN CLOSED CLOSED OPEN OPEN	(3) CLOSED CLOSED CLOSED CLOSED OPEN OPEN OPEN OPEN	CHARACTER SET USA France United Kingdom Germany Italy Sweden/Finland Denmark/Norway Spain
4	OPEN CLOSED			Auto Line Feed No Auto Line Feed
5	OPEN CLOSED			11 Inch Forms 12 Inch Forms
6, 7	(6) CLOSED OPEN CLOSED OPEN		(7) CLOSED CLOSED OPEN OPEN	CHARACTER DENSITY 10 cpi 12 cpi 13.2 cpi 15 cpi
8	NOT USED			

Figure 3-3. PRINTER FEATURES DIP SWITCH S3

PRINTER FEATURES DIP SWITCH S1

DIP switch S1 controls the baud rate and serial mode of operation when the printer is in the serial mode. Figure 3-4 locates the DIP switch S1 and provides the switch settings for the specific baud rate or serial mode. A brief description of each is provided below.



DIP Switch S1

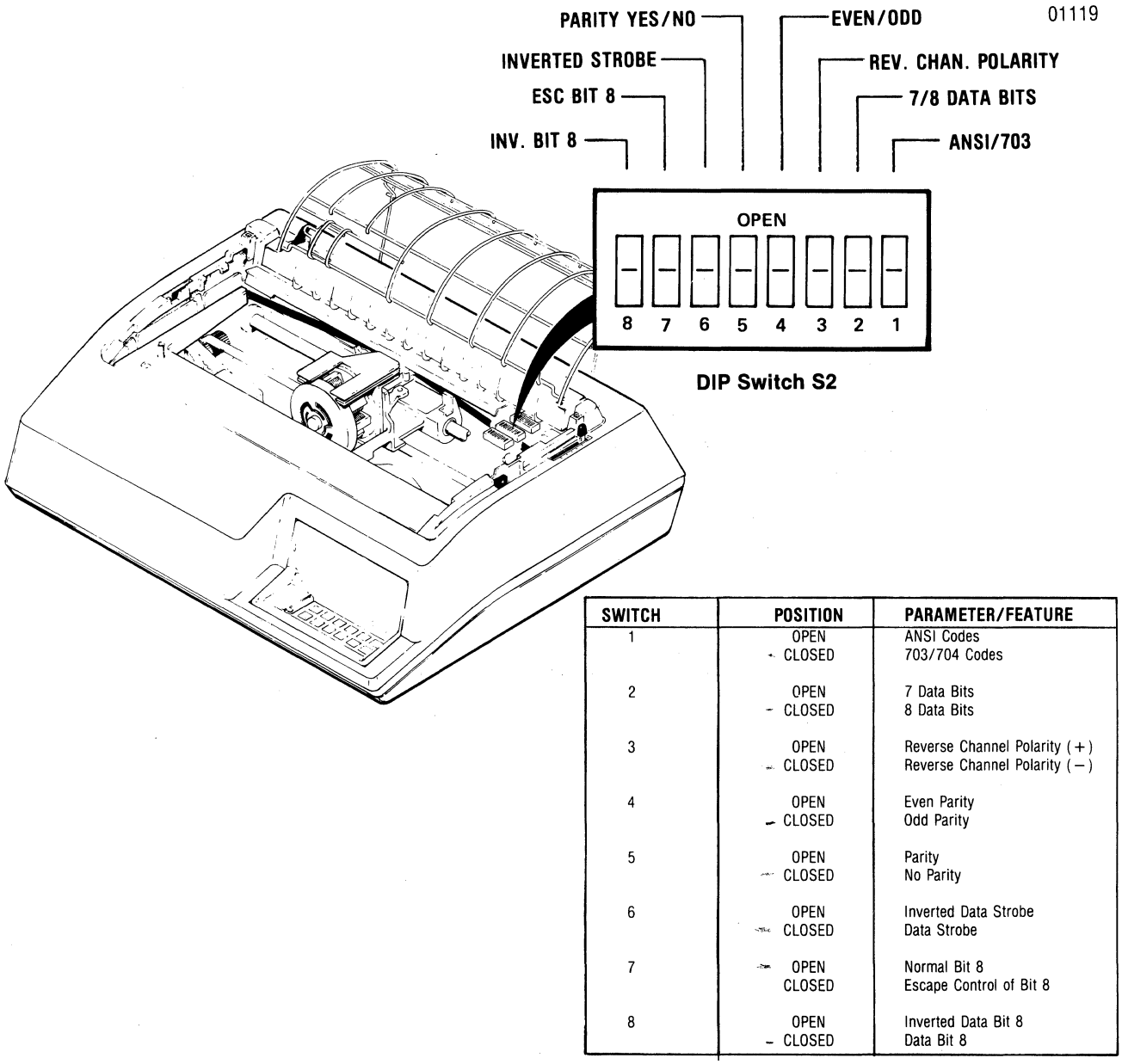
SWITCH		POSITION			PARAMETER
1, 2, 3, 4	(1)	(2)	(3)	(4)	BAUD RATE
	CLOSED	CLOSED	CLOSED	CLOSED	50
	OPEN	CLOSED	CLOSED	CLOSED	75
	CLOSED	OPEN	CLOSED	CLOSED	110
	OPEN	OPEN	CLOSED	CLOSED	134.5
	CLOSED	CLOSED	OPEN	CLOSED	150
	OPEN	CLOSED	OPEN	CLOSED	300
	CLOSED	OPEN	OPEN	CLOSED	600
	OPEN	OPEN	OPEN	CLOSED	1200
	CLOSED	CLOSED	CLOSED	OPEN	1800
	OPEN	CLOSED	CLOSED	OPEN	2000
	CLOSED	OPEN	CLOSED	OPEN	2400
	OPEN	OPEN	CLOSED	OPEN	3600
	CLOSED	CLOSED	OPEN	OPEN	4800
	OPEN	CLOSED	OPEN	OPEN	7200
	CLOSED	OPEN	OPEN	OPEN	9600
	OPEN	OPEN	OPEN	OPEN	19,200

SWITCH		POSITION			PARAMETER
5, 6, 7, 8	(5)	(6)	(7)	(8)	
	CLOSED	CLOSED	CLOSED	CLOSED	Printer Status—None Buffer Status—None
	CLOSED	CLOSED	OPEN	CLOSED	Printer Status—None Buffer Status—RC
	CLOSED	CLOSED	CLOSED	OPEN	Printer Status—None Buffer Status—DTR
	CLOSED	CLOSED	OPEN	OPEN	Printer Status—None Buffer Status—X-ON/X-OFF
	OPEN	CLOSED	CLOSED	CLOSED	Printer Status—RC Buffer Status—None
	OPEN	CLOSED	OPEN	CLOSED	Printer Status—RC Buffer Status—RC
	OPEN	CLOSED	CLOSED	OPEN	Printer Status—RC Buffer Status—DTR
	OPEN	CLOSED	OPEN	OPEN	Printer Status—RC Buffer Status—X-ON/X-OFF
	CLOSED	OPEN	CLOSED	CLOSED	Printer Status—DTR Buffer Status—None
	CLOSED	OPEN	OPEN	CLOSED	Printer Status—DTR Buffer Status—RC
	~~CLOSED~~	~~OPEN~~	~~CLOSED~~	~~OPEN~~	~~Printer Status—DTR~~ Buffer Status—DTR
	CLOSED	OPEN	OPEN	OPEN	Printer Status—DTR Buffer Status—X-ON/X-OFF
	OPEN	OPEN	CLOSED	CLOSED	Printer Status—X-ON/X-OFF Buffer Status—None
	OPEN	OPEN	OPEN	CLOSED	Printer Status—X-ON/X-OFF Buffer Status—RC
	OPEN	OPEN	CLOSED	OPEN	Printer Status—X-ON/X-OFF Buffer Status—DTR
	OPEN	OPEN	OPEN	OPEN	Printer Status—X-ON/X-OFF Buffer Status—X-ON/X-OFF

Figure 3-4. PRINTER FEATURES DIP SWITCH S1

PRINTER FEATURES DIP SWITCH S2

DIP switch S2 control some serial interface parameters and printer features. Figure 3-5 locates DIP switch S2 and provides the switch settings for the specific features.

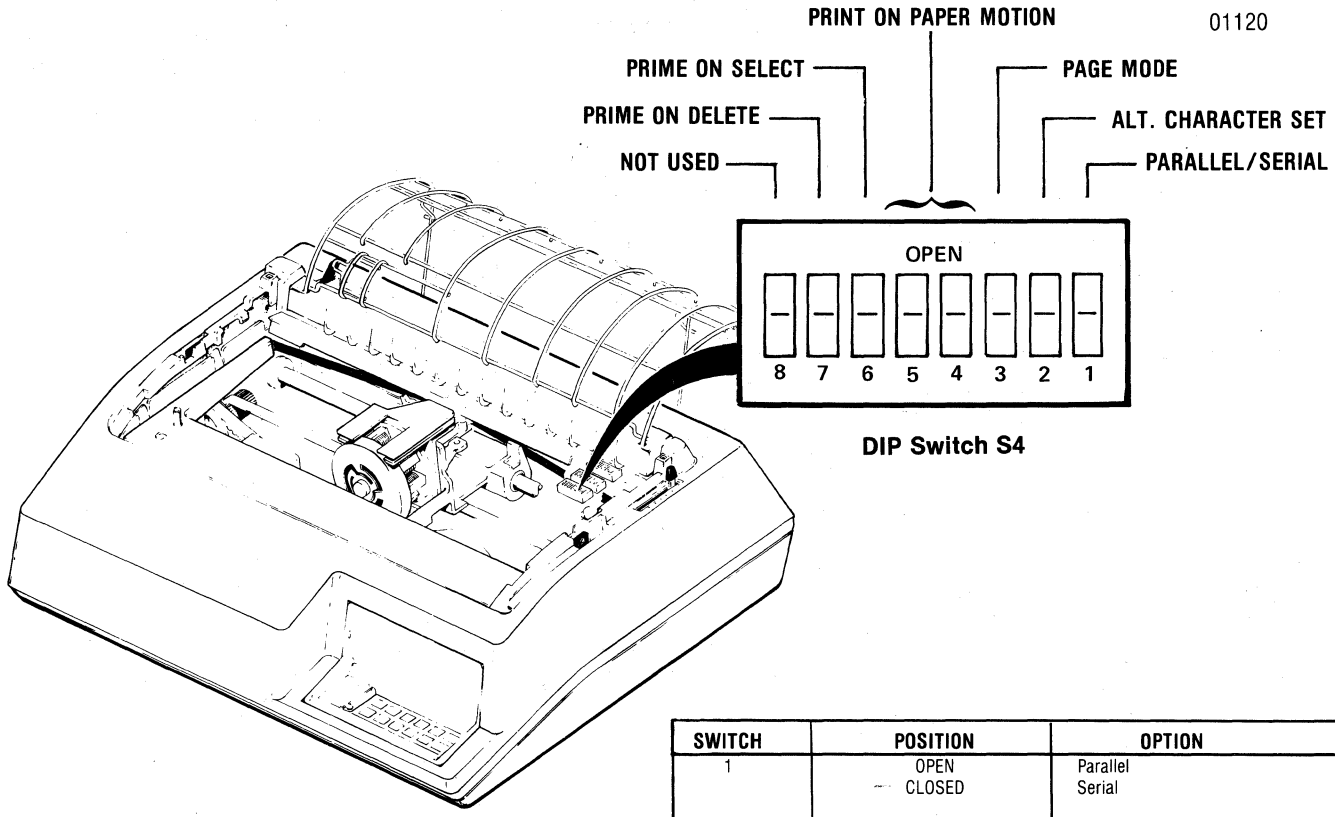


SWITCH	POSITION	PARAMETER/FEATURE
1	OPEN	ANSI Codes
	CLOSED	703/704 Codes
2	OPEN	7 Data Bits
	CLOSED	8 Data Bits
3	OPEN	Reverse Channel Polarity (+)
	CLOSED	Reverse Channel Polarity (−)
4	OPEN	Even Parity
	CLOSED	Odd Parity
5	OPEN	Parity
	CLOSED	No Parity
6	OPEN	Inverted Data Strobe
	CLOSED	Data Strobe
7	OPEN	Normal Bit 8
	CLOSED	Escape Control of Bit 8
8	OPEN	Inverted Data Bit 8
	CLOSED	Data Bit 8

Figure 3-5. PRINTER FEATURES DIP SWITCH S2

PRINTER FEATURES DIP SWITCH S4

DIP switch S4 controls all other selectable features. Figure 3-6 locates DIP switch S4 and provides the switch settings for the specific features. A brief description of each feature is provided below.



SWITCH	POSITION		OPTION
1	OPEN		Parallel
	CLOSED		Serial
2	OPEN		Bit 8 Selects Alternate Character Set
	CLOSED		Bit 8 Ignored
3	OPEN		Page Mode Enable
	CLOSED		Page Mode Disable
4, 5	(4)	(5)	PRINT ON PAPER MOTION
	CLOSED	CLOSED	No Print
	OPEN	CLOSED	Print with Carriage Return
	CLOSED	OPEN	Print without Carriage Return
	OPEN	OPEN	No Print
6	OPEN		Prime on Select
	CLOSED		Inhibit Prime on Select
7	OPEN		Prime on Delete
	CLOSED		Inhibit Prime on Delete
8	NOT USED		

Figure 3-6. PRINTER FEATURES DIP SWITCH S4

3.3 PREVENTIVE MAINTENANCE

NOTE

The Model 352 is basically a maintenance free printer. No oiling, greasing or other lubrication is required. Occassionally, the printer should be inspected and cleaned as described below.

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

Occassionally, 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 3-1 below lists the maintenance occassionally required on certain areas of the printer. This maintenance may be required more or less frequently, depending on the printer application and operating environment.

Table 3-1. 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, carefully remove the dust and residue from the print head and carriage assembly.
Platen Assembly	Clean platen assembly using a mild detergent.

3.4 TROUBLESHOOTING GUIDE

Table 3-2 lists some malfunctions which may occur together with their symptoms, and probable causes. The remedies to the malfunctions should be performed by qualified service personnel.

Table 3-2. Troubleshooting Guide

MALFUNCTION	SYMPTOM	CAUSE
Power Failure	Total	Defective power cord. Defective main fuse.

Table 3-2. Troubleshooting Guide (cont'd)

MALFUNCTION	SYMPTOM	CAUSE
Improper Printing	Print head assembly moves but no print or poor registration or erratic print.	Incorrect print head gap. Print head fingerboard not connected. Improper adjustment of encoder/timing disc and optical sensor. Defective head flex cable. Defective print controller pcb.
	Missing dots or intermittent pin registration all characters.	Print head fingerboard not seated in connector. Improper adjustment of encoder/timing disc and optical sensor assembly. Defective Print Controller pcb. Defective head flex cable.
	Missing or extra dots - certain characters only.	Defective ROM - Print Controller pcb.
	Line across page.	Improper print head gap. Defective print head assembly. Defective head flex cable.
Carriage Drive Failure	Erratic carriage movement.	Improper carriage drive belt tension. Dirty guide bars. Defective idle pulley, drive pulley and drive belt. Poor video adjustment.
	Carriage sticks or binds.	Improper carriage drive belt tension. Head gap too small.
	Carriage moves forward, but does not return.	Defective Print Controller pcb. Missing either video signal V1 or V2.
	Carriage does not move forward.	Forms lever in "LOAD" position. Defective carriage drive motor. Defective Print Controller pcb. Inappropriate input data. Blown fuse.
Ribbon Feed Failure	No ribbon feed.	Defective ribbon drive motor. Ribbon twisted or jammed. Ribbon cassette not seated properly.
Paper Motion Failure	Cut sheet forms do not advance.	Forms lever not in "SHEET" position. Blown fuse.
	Paper skew or jam.	Print head too close to paper. Improper paper alignment on tractor feed units. Improper paper drive belt adjustment.

3.5 ERROR INDICATORS

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 3-3, blink until the SELECT switch is pressed, then all checks are tetested. The audio alarm sounds when a problem is first detected.

Table 3-3. Error Indicators

PROBLEM	INDICATOR				
	SELECT	ALERT	8 LPI	16.5 CPI	CUT SHEET MODE
1st 8156 RAM (U36)		Blinking			Blinking
2nd 8156 RAM (U41)	Blinking	Blinking			
2K Input RAM (U17 & U18)	Blinking	Blinking			Blinking
8755 PROM (U28)		Blinking	Blinking		
1st 2716 PROM (U19)		Blinking	Blinking		Blinking
2nd 2716 PROM (U20)	Blinking	Blinking	Blinking		
Print Controller ROM	Blinking			Blinking	
C-RAM (U52 & U53)		Blinking		Blinking	
Print Controller RAM	Blinking			Blinking	Blinking
Bad Video			Blinking	Blinking	
No Head Movement				Blinking	Blinking

3.6 SELF-TEST

This self-test feature is activated by pressing the OVRD TEST switch on the operators control panel while the printer is deselected and loaded with paper. The test will print out the entire character set(s) and binary codes that indicate printer configuration. Test data is continuously printed as long as the OVRD TEST switchis held pressed. A sample printout is shown in Figure 3-7.

```
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
£à°ç§ñÑ¯éùè¨ÄÖÜäöüßòiìáíÆØóÅæøå !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~¢
 00100111  XXX01100  X0011100  X0000001
```

DIPSWITCH S1 **DIPSWITCH S2** **DIPSWITCH S3** **DIPSWITCH S4**

EXAMPLE: DIPSWITCH S3

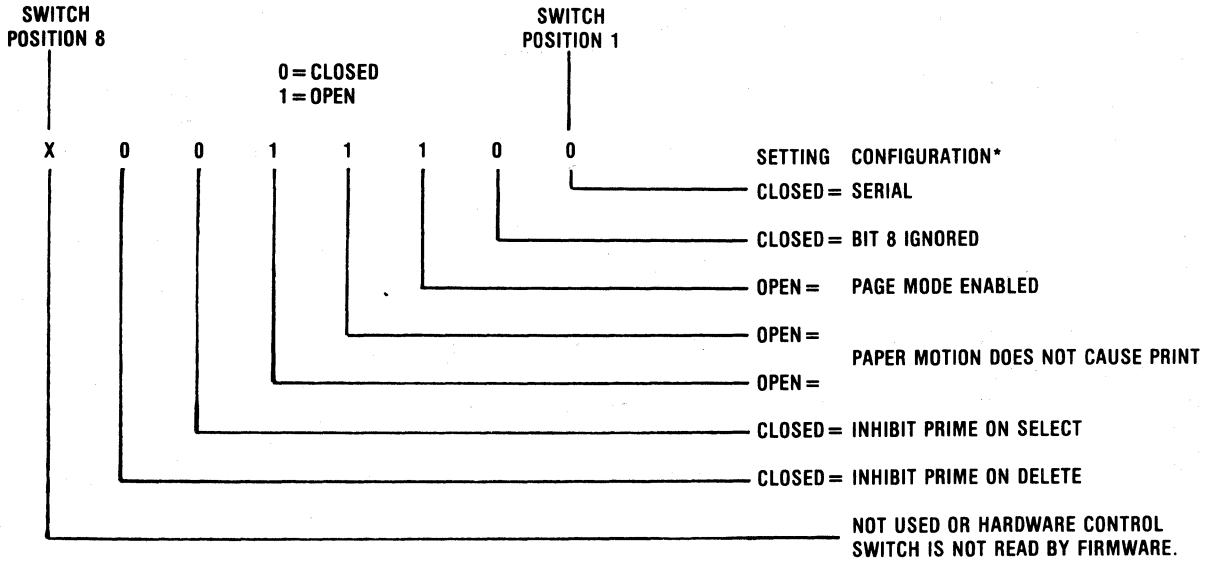


Figure 3-7. SELF-TEST PRINTOUT

SECTION 4
ADJUSTMENTS

4.1 ADJUSTMENT SUMMARY

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

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

All procedures contained in this section are performed with the printer covers removed. Refer to paragraph 5.4 for the removal/replacement procedures of the covers. After performing the adjustment procedure a self-test printout should be generated to ensure proper printer operation.

NOTE

Removing the top cover enables the printer interlock switch. To disable the interlock for adjustments, place a small magnet beside the interlock switch (refer to Figure 5-13) and operate the printer. If the interlock remains enabled, remove the magnet, reverse it to change polarity, then replace it beside the switch.

4.2 CARRIAGE DRIVE

NOTE

The carriage drive motor belt adjustment and the carriage drive belt adjustment must be performed simultaneously.

The tension of the carriage drive motor belt is adjusted so that the carriage starts and stops evenly as the carriage drive motor is turned on and off. A flat blade screwdriver is required to adjust the belt. To adjust the belt, refer to Figure 4-1 and perform the following steps:

1. Ensure the forms lever is in the "SHEET" or "FORMS" position.

2. Move the print head assembly and carriage to the center of the printer.

3 Adjust the belt tension by turning clockwise (tighten) or counter-clockwise (loosen) the two adjusting screws mounting the drive pulley assembly so that the belt deflects 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.

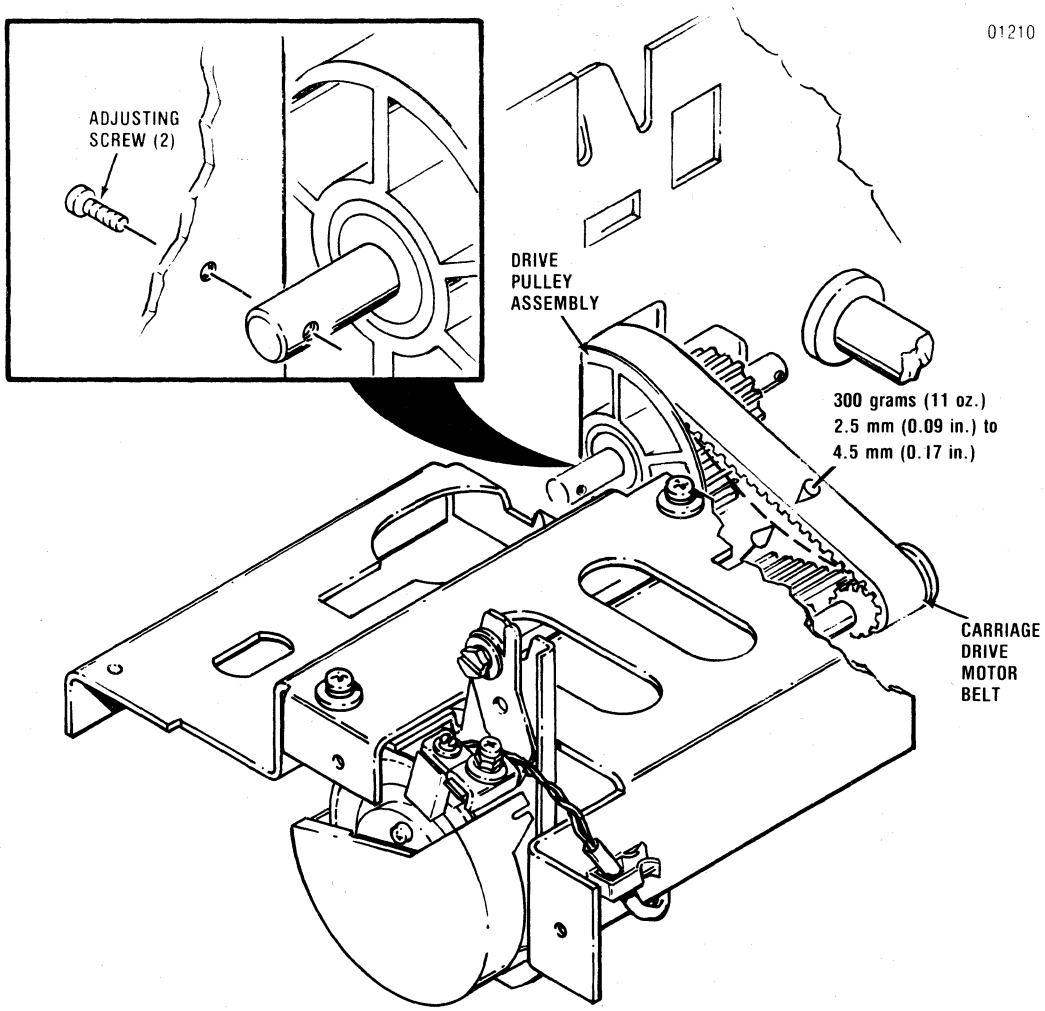


Figure 4-1. CARRIAGE DRIVE MOTOR BELT ADJUSTMENT

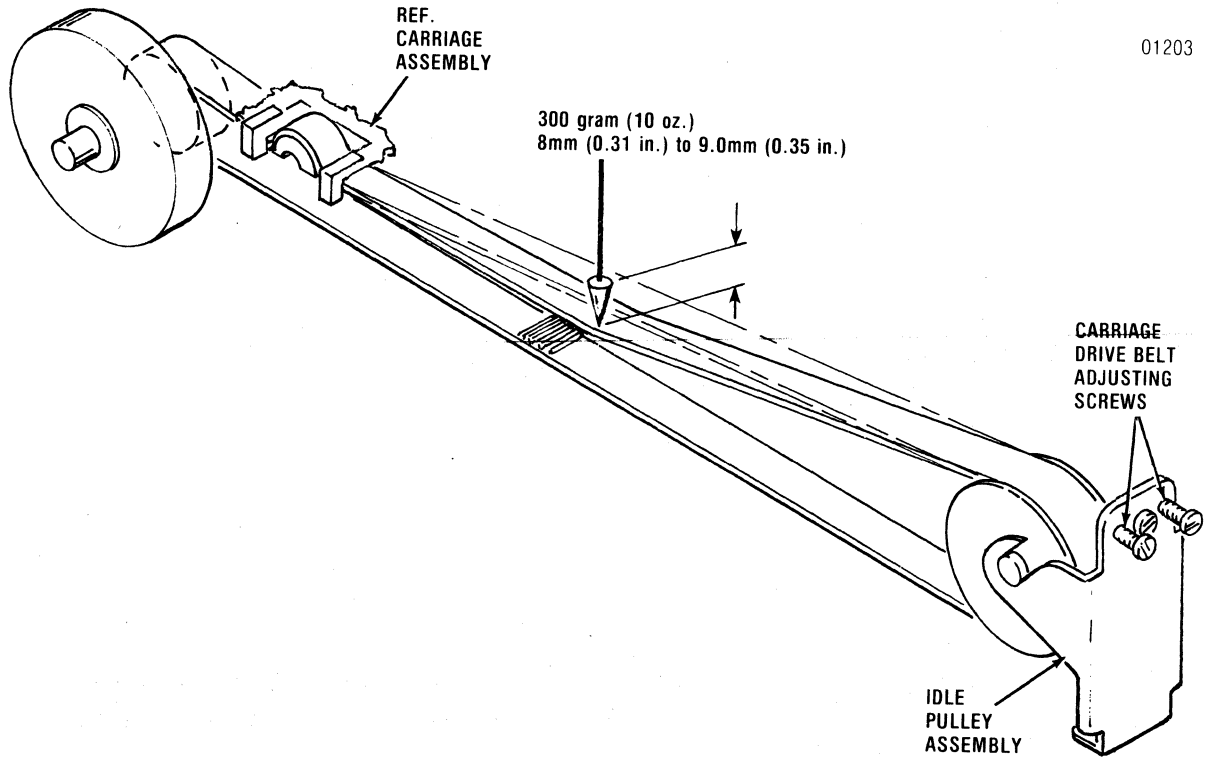


Figure 4-2. CARRIAGE DRIVE BELT ADJUSTMENT

4.3 CARRIAGE DRIVE BELT

NOTE

The carriage drive belt adjustment and the carriage drive motor belt adjustment must be performed simultaneously.

The tension of the carriage drive belt is adjusted for smooth starts and stops of the carriage assembly. The belt is adjusted using a flat blade screwdriver. To adjust the belt, refer to Figure 4-2 and perform the following steps:

1. Position the carriage assembly at the left margin.

2. Adjust the belt tension by turning clockwise (tighten) or counter-clockwise (loosen) the two adjusting screws on the idle pulley assembly so that the belt deflects 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.

4.4 PAPER DRIVE BELT

NOTE

The paper drive belt and the tractor gear backlash must be adjusted simultaneously.

The tension of the paper drive belt is adjusted to provide a positive drive between the paper drive motor and tractor feed assembly. A Phillips head screwdriver and a 7 mm open-end wrench are required to adjust the belt. To adjust the paper drive belt, refer to Figure 4-3 and perform the following steps:

1. Loosen the Phillips head screw mounting the tension roller to the right frame.

2. At a point equidistant from the paper drive gear and paper feed pulley, adjust the tension of the belt by applying a load of 500 grams on the belt with the tension roller.

3. Tighten the Phillips head screw mounting the tension roller.

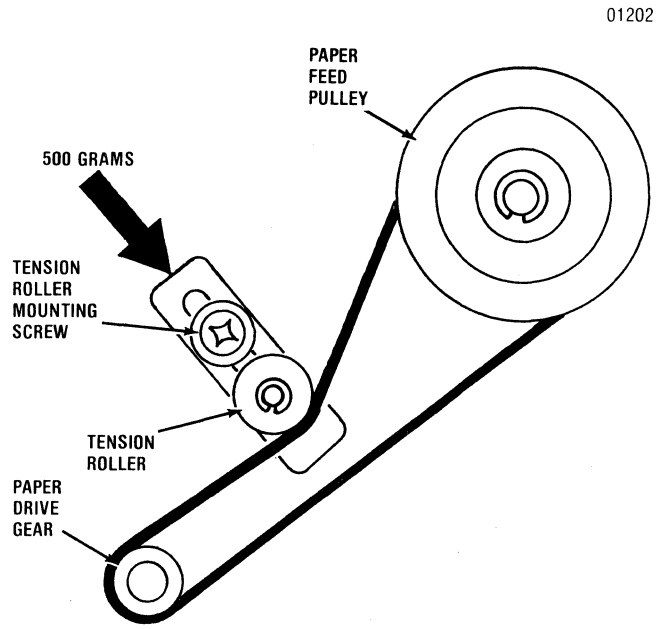


Figure 4-3. PAPER DRIVE BELT ADJUSTMENT

4.5 TRACTOR GEAR BACKLASH

NOTE

The tractor gear backlash and the paper drive belt must be adjusted simultaneously.

The backlash between the paper drive gear and tractor gear is adjusted to provide positive drive between the paper drive motor and tractor feed assembly. A flat blade screwdriver is required for the backlash adjustment. To adjust the backlash of the tractor gear, refer to Figure 4-4 and perform the following steps:

1. Using a flatblade screwdriver, loosen the three slotted head screws mounting the paper drive motor to the right frame.

2. Move the paper drive motor in the forward or reverse direction so that the backlash between the paper drive gear and tractor gear is 0.05 mm (0.001 in.) to 0.30 mm (0.011 in.) for one rotation of the tractor gear.

   NOTE: Check the backlash at three points, approximately 120° apart, for one rotation of the tractor gear.

3. Tighten the three slotted head screws once backlash adjustment is made.

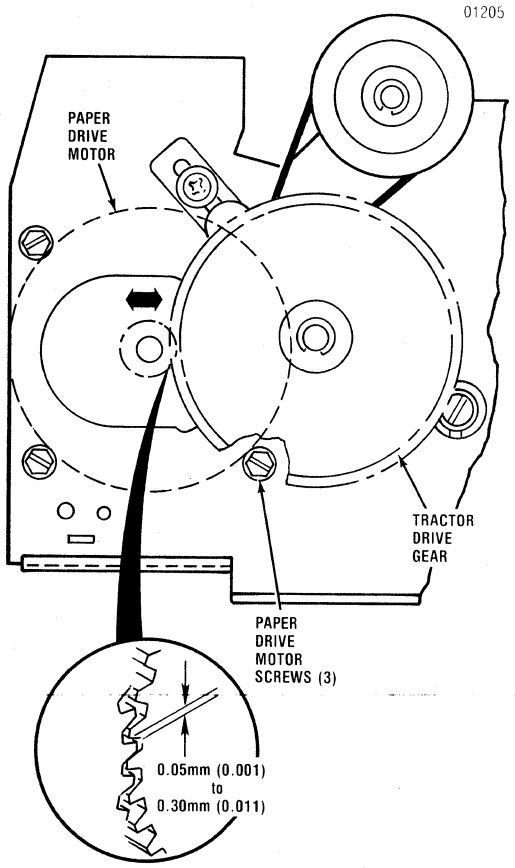


Figure 4-4. TRACTOR GEAR BACKLASH ADJUSTMENT

4.6 PAPER EMPTY SWITCH

The arm of the paper empty switch is adusted to ensure proper contact with the paper. To adjust the paper empty switch arm, refer to Figure 4-5 and perform the following steps:

1. 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 step 2.

2. With the tractor cover closed, gently bend the arm so that the distance between the cover and arm is 2.3 mm (0.09 in.) to 4.0 mm (0.15 mm) is attained.

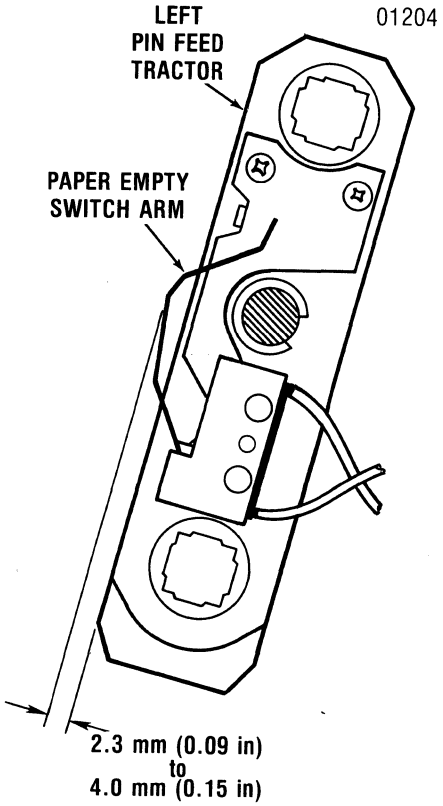


Figure 4-5. PAPER EMPTY SWITCH ADJUSTMENT

4.7 OPTIC SENSOR AND ENCODER/TIMING DISC

The optic sensor and encoder/timing disc is adjusted to provide the correct video signals to the Print Controller pcb. The optic sensor and encoder/timing disc is adjusted both mechanically and electrically. A flat blade screwdriver, Phillips head screwdriver, feeler guage, and dual trace oscilloscope are required to adjust the sensor and disc. To perform the adjustments, refer to figures 4-6 and 4-7 and perform the following steps:

4.7.1 MECHANICAL ADJUSTMENT

1. Remove the ribbon cassette assembly from the printer per paragraph 5.6.

2. Move the print head assembly to the extreme right side of the printer.

3. Loosen the Phillips head screw mounting the optical sensor to the carriage drive motor.

4. Insert a 0.5 mm (0.020 in.) feeler guage between the sensor and disc.

5. Move the sensor left or right until the 0.5 mm (0.020 in.) gap is set.

6. Tighten the Phillips head screw once the gap is set.

7. Reinstall the ribbon cassette assembly.

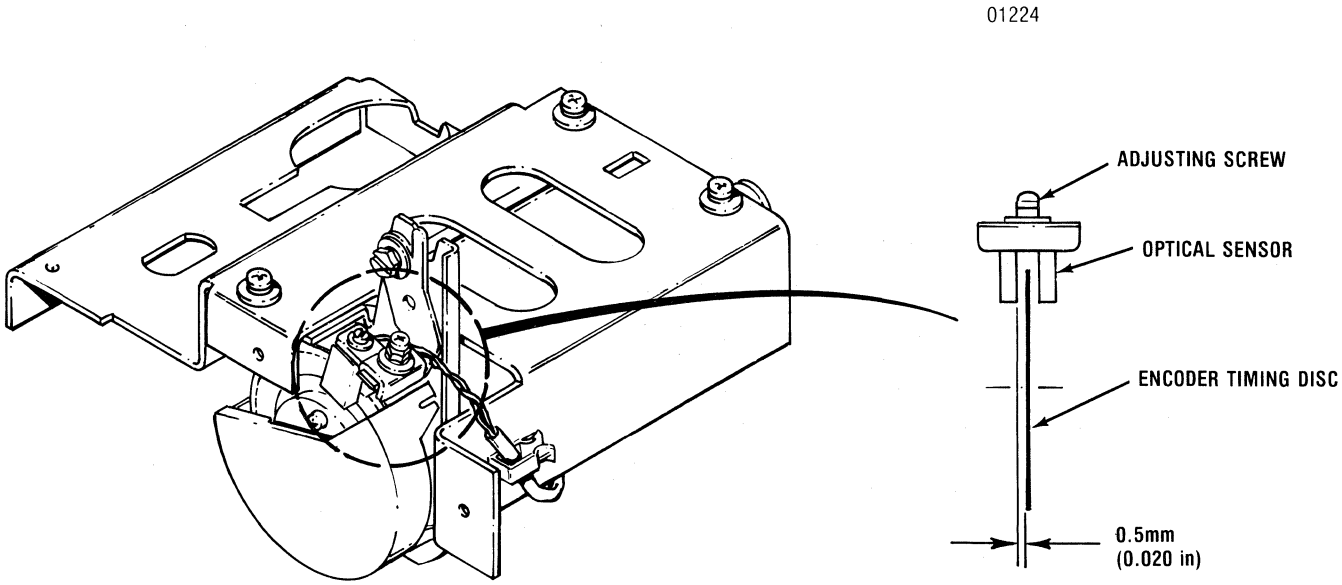


Figure 4-6. MECHANICAL ADJUSTMENT, OPTIC SENSOR AND ENCODER/TIMING DISC

4.7.2 ELECTRICAL ADJUSTMENT

1. Remove the four Phillips head screws mounting the printer mechanism to the printer base.

2. Tilt the front of the mechanism up and hold the mechanism in this position using the mechanism support rod.

3. Connect the oscilloscope ground lead to the negative (-) side of capacitor C1 on the print controller board.

4. Connect oscilloscope channel 1 probe to TP6 and oscilloscope channel 2 probe to TP7 on the print controller board.

5. Set the oscilloscope as follows:

   a. Volts/Div. knobs at "2V/Div.".
   b. Vert. mode switch on "ADD".
   c. Time/Div. Knob at 50 uS/Div.

6. Turn oscilloscope and printer on.

7. While printer is deselected, press and hold the OVRD TEST switch.

   NOTE: Printer will print the self-test pattern continuously as long as the switch is held depressed.

8. Observe the oscilloscope screen to see if levels (1, 2, 3) show an even time duration.

9. If signal does not show an even time duration for each level, adjust as follows:

   a. Slightly loosen the slotted head screw securing the optics bracket to the carriage.

   b. Move the optics bracket slowly, until the signal on the oscilliscope screen shows all three levels of an even duration.

   c. Tighten the screw securing the optics bracket.

   d. Recheck the signal to ensure adjustment is correct.

10. Release "OVRD TEST" switch on control panel.

11. Turn printer power off.

12. Remove oscilloscope probes and ground connections from printer.

13. Lower the printer mechanism and reinstall mounting hardare.

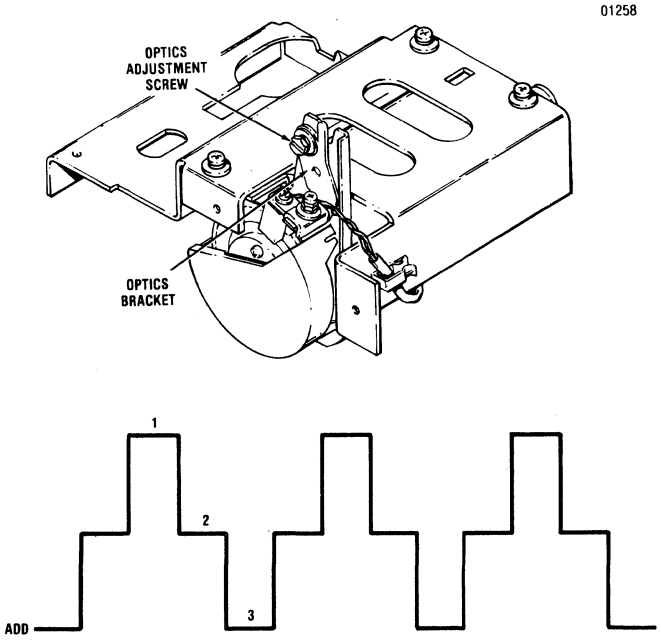


Figure 4-7. ELECTRICAL ADJUSTMENT, OPTIC SENSOR AND ENCODER/TIMING DISC

4.8 HORIZONTAL OFFSET ADJUSTMENT

The Print Controller pcb contains a 5-position dip switch for the horizontal offset adjustment. This procedure adjusts the print position left or right so that the printed character columns are vertically aligned. To adjust the horizontal offset, refer to Figure 4-8 and Tables 4-1 and 4-2 and perform the following steps.

1. Remove the covers from the printer per paragraph 5.4.

2. Remove the four shoulder screws attaching the printer mechanism to the printer base.

3. Raise the front of the printer mechanism and hold the mechanism in this position using the mechanism support rod located under the front of the body cover.

4. Place a small magnet against the cover interlock switch so that the printer will operate with the top cover removed.

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

6. Deselect the printer and compare the first and last columns of printed text to Figure 4-7.

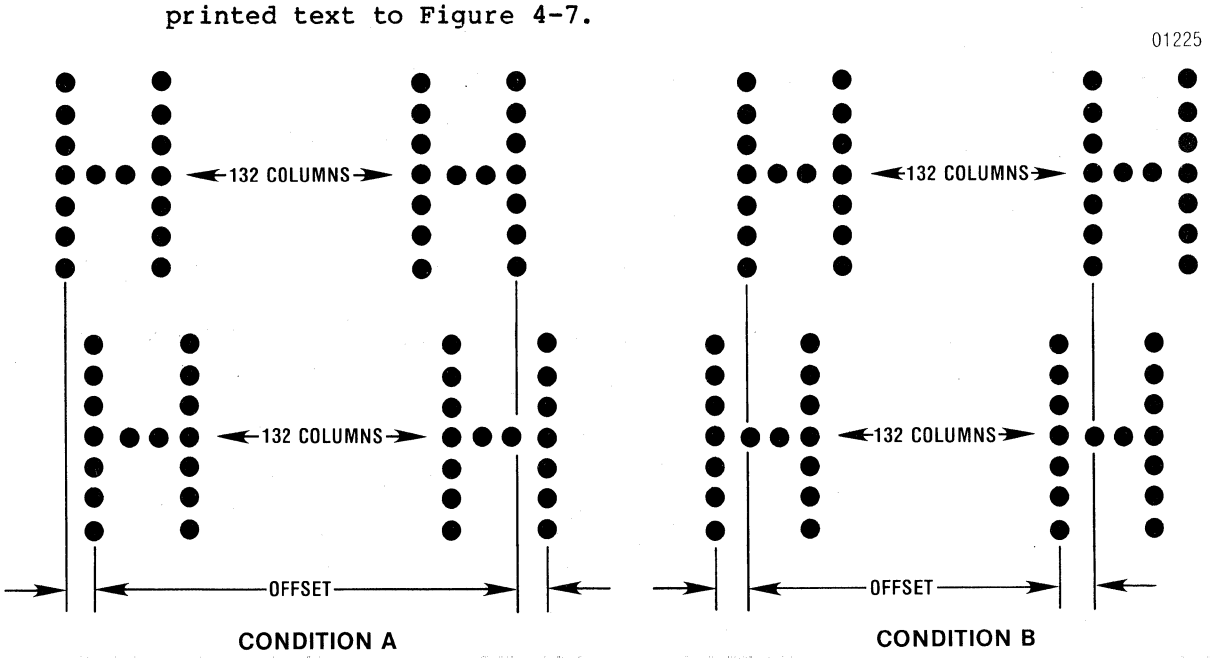


Figure 4-8. HORIZONTAL OFFSET PRINT SAMPLE

7. If printed text is offset as in condition A, close switch #5 (Figure 4-8) which moves the print position to the left.

8. 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.

Table 4-1

Switch #	4	3	2	1
	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

NOTE: The printer must be deselected then selected after each setting of the four switches.

9. If printed text is offset as in condition B, open switch #5 (Figure 4-8) which moves the print position to the right.

10. To adjust the offset for condition B follow the switch list below in Table 4-2 step-by-step until the characters are vertically aligned in the first and last columns.

Table 4-2

Switch #	4	3	2	1
	CLOSED	CLOSED	CLOSED	CLOSED
	CLOSED	CLOSED	CLOSED	OPEN
	CLOSED	CLOSED	OPEN	CLOSED

NOTE: The printer must be deselected then selected after each setting of the four switches.

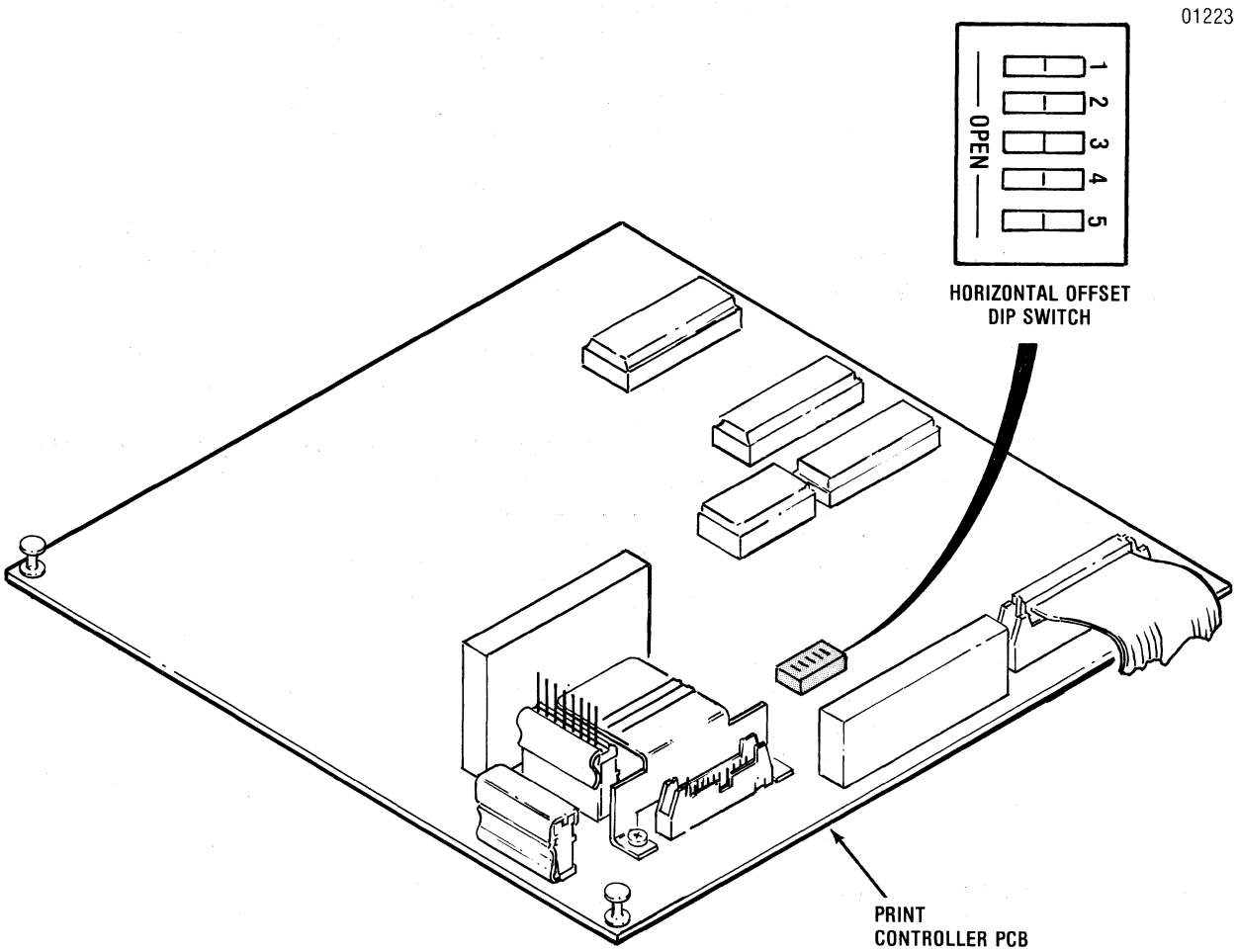


Figure 4-9. HORIZONTAL OFFSET DIP SWITCH

SECTION 5
REMOVAL/REPLACEMENT

5.1 REMOVAL/REPLACEMENT, RECOMMENDED SPARES

This section covers the removal/replacement procedures for the Model 353 recommended spare parts. The section is organized as shown in Table 5-1. At the end of this section is the part number listing of the recommended spares according to figure and index number.

Table 5-1. Model 352 Recommended Spares and Associated Parts

NOTE: Items followed by asterisk are not recommended spares, but must be removed/ replaced when changing spares.

PARAGRAPH	RECOMMENDED SPARE
5.2	Paper Rack Outlet Assembly
5.3	Paper Rack Inlet
5.4	Cover Assemblies*
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	Print Mechanism*
5.11	Dust Cover*
5.12	Carriage Drive Motor Belt
5.13	Carriage Drive Belt
5.14	Carriage Drive Motor/Ribbon Drive Motor Mounting Bracket*
5.15	Optic Sensor Assembly
5.16	Carriage Drive Motor
5.17	Encoder/Timing Disc
5.18	Ribbon Drive Motor
5.19	Cover Interlock Switch
5.20	Paper Drive Belt
5.21	Paper Feed Motor
5.22	Tractor Assemblies, Left/Right
5.23	Paper Empty Switch
5.24	Power Supply Assembly
5.25	Format/Controller Cable
5.26	Print Controller PCB
5.27	Format Controller PCB
5.28	Pico Fuse
5.29	ON/OFF Switch
5.30	Main Fuse
5.31	Power Cord
5.32	Cover Latch Springs
5.33	Recommended Spare Parts Listing

5.2 PAPER RACK OUTLET ASSEMBLY

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

1. Remove the two paper rack mounting rails from the holes in the back of the rear cover.

2. Lift the paper rack (1) from the two mounting holes on top of the rear cover and remove rack from printer.

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

5.3 PAPER RACK INLET

The paper rack inlet, item 2 of Figure 5-1, attaches to the rear of the printer and guides the forms into the paper feed mechanism. To remove the paper rack inlet, refer to Figure 5-1 and perform the following steps.

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

2. Pull the paper rack inlet (2) straight out and remove rack from printer.

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

5.4 COVER ASSEMBLIES

The covers protect the print mechanism and printed circuit boards and are removed using a Phillips head screwdriver. To remove the covers, refer to Figure 5-1 and perform the following steps:

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

REAR COVER

1. Unsnap the top of the rear cover from the body cover.

2. Lower the rear cover until it is in a fully open position.

3. Lift the rear cover up and off the printer.

BODY COVER

1. Remove the top and rear covers from the printer.

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

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

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

5. Remove the cap from the print head adjustment lever.

6. While gently pushing the body cover towards the rear of the printer, lift the cover up and off the printer.

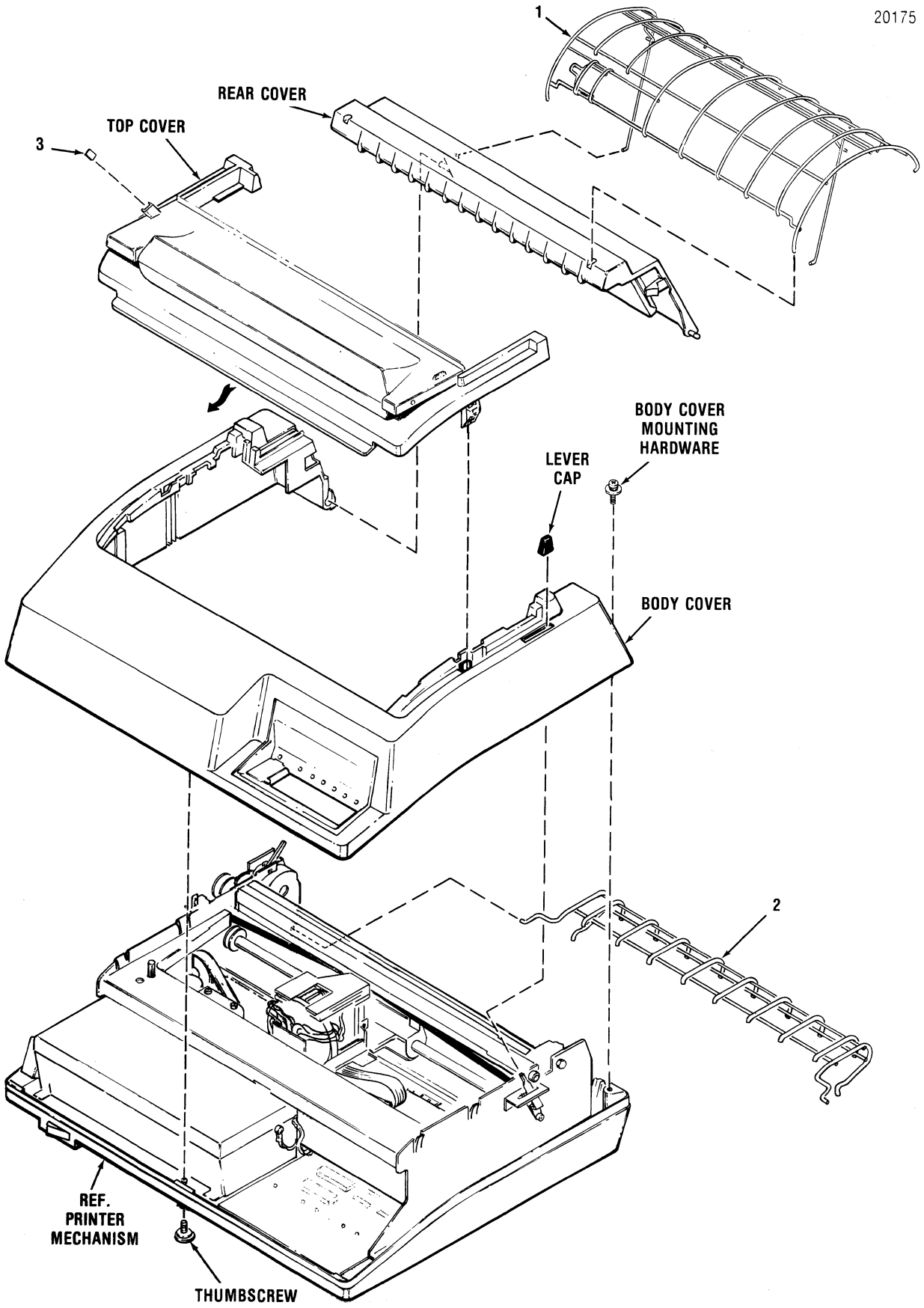


Figure 5-1. REMOVAL/REPLACEMENT PAPER RACK OUTLET ASSEMBLY, PAPER RACK INLET, COVER ASSEMBLIES AND COVER INTERLOCK MAGNET

5.5 COVER INTERLOCK MAGNET

The cover interlock magnet, item 3 of Figure 5-1, is located underneath the left side of the top cover. To replace the magnet, refer to Figure 5-1 and perform the following steps:

1. Place the clear hinged portion of the top cover in the open position.

2. Place a small amount of adhesive onto one side of the magnet (3) to be installed.

3. Place the magnet into the slot on the cover and hold in place until dry.

5.6 RIBBON CASSETTE AND GUIDE

The ribbon cassette is mounted to the left and right side frames and the ribbon guide is mounted over the front of the print head. No tools are required to remove the cassette and guide. To remove the cassette and guide, refer to Figure 5-2 and perform the following steps:

1. Remove the top cover from the printer per paragraph 5.4.

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.

5. Lift the column scale into the up position.

6. Pull the head adjustment lever back to its maximum position.

7. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the ribbon guide and lifting upward.

8. Lift the used ribbon cassette and guide (1) up and out of the printer.

9. To install the new ribbon cassette and guide, reverse steps 1 through 8.

5.7 PRINT HEAD ASSEMBLY

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

1. Remove the top cover from the printer.

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.

5. Lift the column scale into the up position.

6. Pull the head adjustment lever back to its maximum position.

7. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the guide and lifting upward.

8. Remove the print head fingerboard connector P704 from the Head Adapter pcb connector J704 by lifting the connector upward.

9. To remove the print head (2) simultaneously pull the head towards the front of the printer and lift the head up and out of the printer.

10. To replace the print head assembly, reverse steps 1 through 9.

NOTE

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

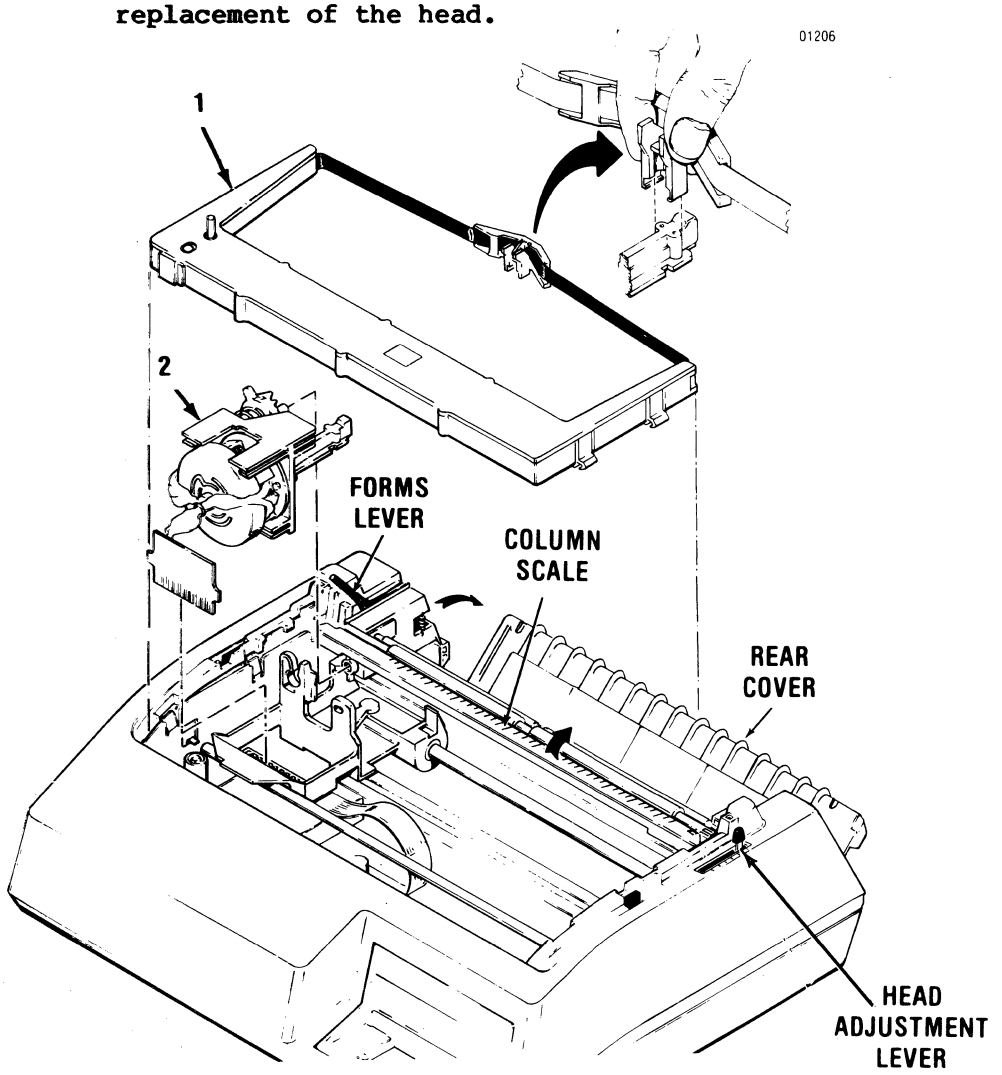


Figure 5-2. REMOVAL/REPLACEMENT, RIBBON CASSETTE AND GUIDE, PRINT HEAD ASSEMBLY

5.8 HEAD FLEX CABLE

The head flex cable, item 1 of Figure 5-3, connects the print head assembly and print controller pcb. To remove the head flex cable, refer to Figure 5-3 and perform the following steps:

1. Remove the top cover from the printer per paragraph 5.4.
2. Move the print head approximately three quarters the length of the guide bar from the extreme left margin.
3. Unhook the rubber band securing the head flex cable to the bracket on the Print Controller pcb.
4. Disconnect the head flex cable connector P203 from connector J203 on the Print Controller pcb.
5. Unhook the rubber band securing the cable to the underside of the carriage.
6. Disconnect the head flex cable connector P703 from connector J703 on the Head Adapter pcb.
7. To replace the head flex cable, reverse steps 1 through 6.

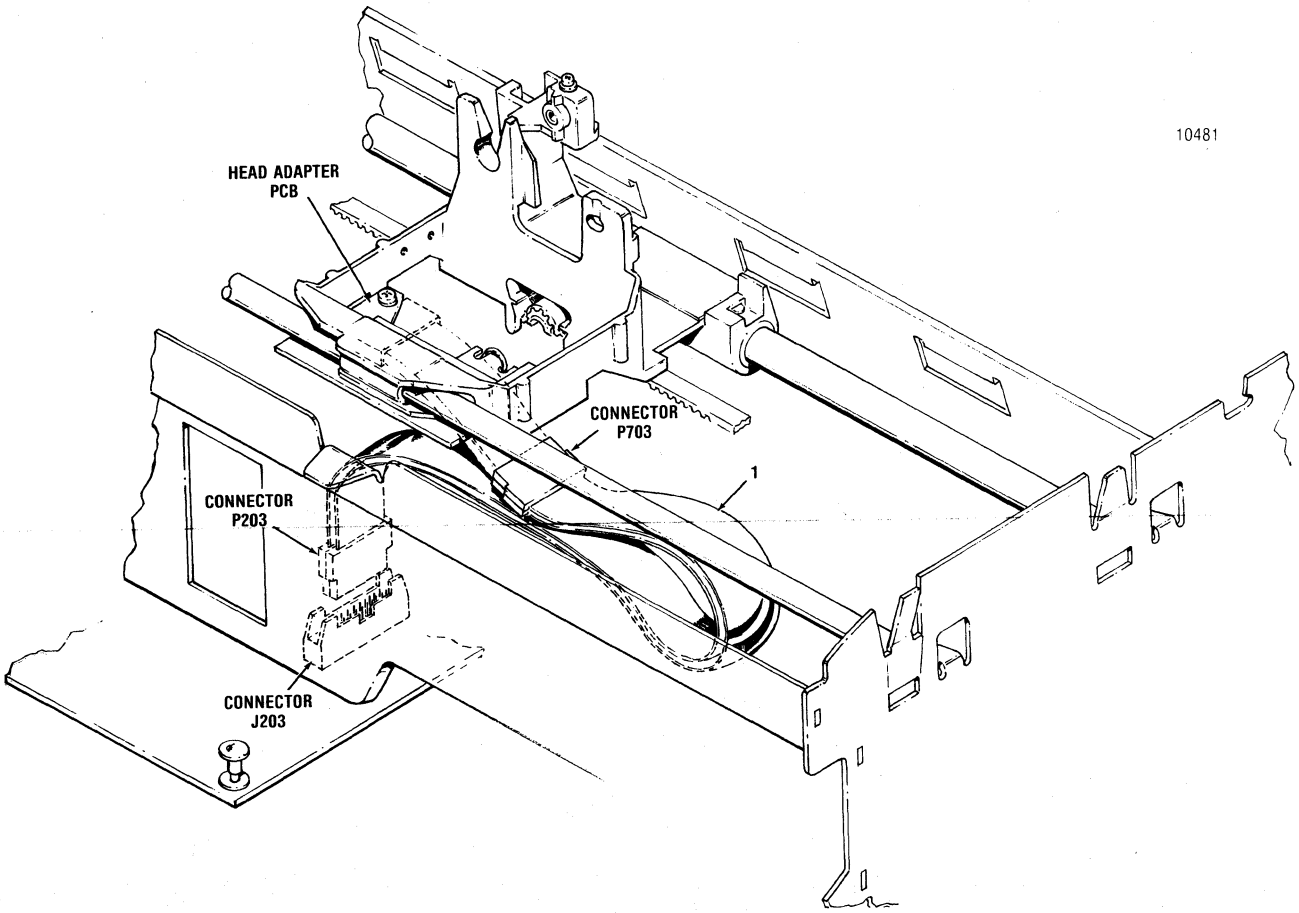


Figure 5-3. REMOVAL/REPLACEMENT, HEAD FLEX CABLE

5.9 HEAD ADAPTER PCB

The Head Adapter pcb, item 1 of Figure 5-4, is attached to the carriage assembly and is removed using a Philips head screwdriver. To remove the Head Adapter pcb, refer to Figure 5-4 and perform the following steps:

1. Remove the top cover from the printer per paragraph 5.4.

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 band 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.

6. Remove the two screws mounting the Head Adapter pcb to the carriage and remove the pcb from the printer.

7. To replace the Head Adapter pcb, reverse steps 1 through 6.

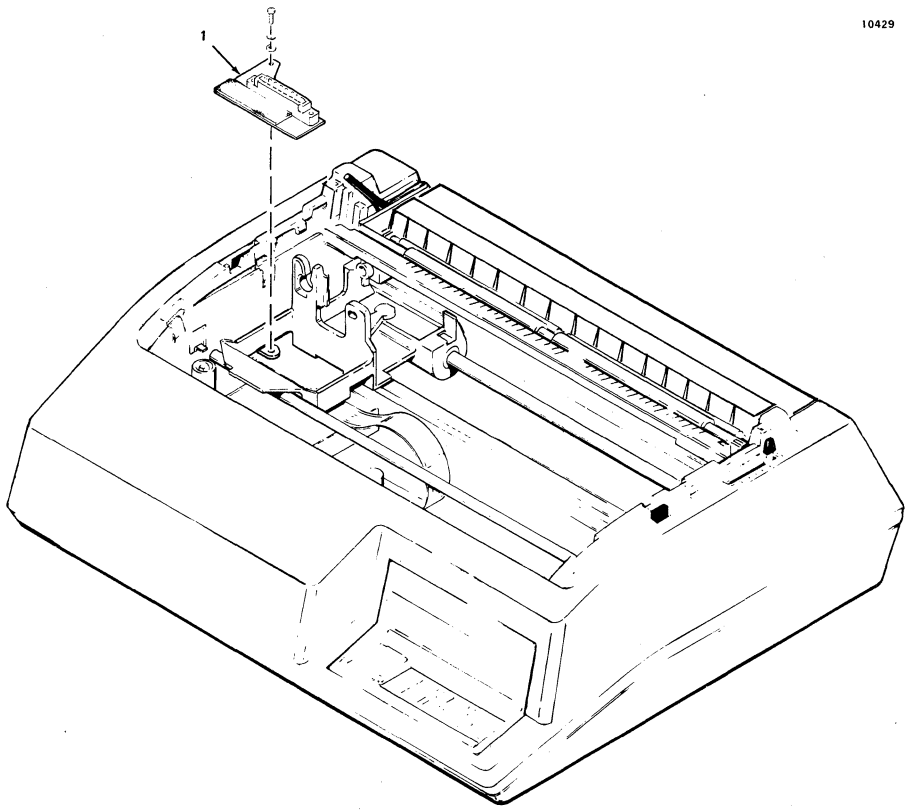


Figure 5-4. REMOVAL/REPLACEMENT, HEAD ADAPTER PCB

5.10 PRINTER MECHANISM

The printer mechanism, illustrated in Figure 5-5, 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. All 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 REMOVAL/REPLACEMENT OF PRINTER MECHANISM

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

1. Remove the printer covers per paragraph 5.4.
2. Remove the four shoulder screws mounting the printer mechanism to the printer base.
3. Disconnect the five printer mechanism cable assemblies from the five connectors on the Print Controller pcb.
4. Remove the head flex cable per paragraph 5.8.
5. Disconnect the green ground wire attached to the left rear of the mechanism.
6. Lift the printer mechanism up and out of the printer.
7. To replace the mechanism, reverse steps 1 through 6.

NOTE

Refer to Figure A-3, Wiring Diagram, when re-connecting the five printer mechanism cable assemblies to the Print Controller pcb.

5.10.2 PLACING PRINT MECHANISM IN TILT POSITION

To place the mechanism in tilt position, perform the following steps:

1. Remove the priinter covers per paragraph 5.4.
2. Remove and keep handy the support rod located inside the front cover.
3. Tilt the front of the mechanism upward about 45°.
4. 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 thorugh the front right shoulder washer hole in the frame.

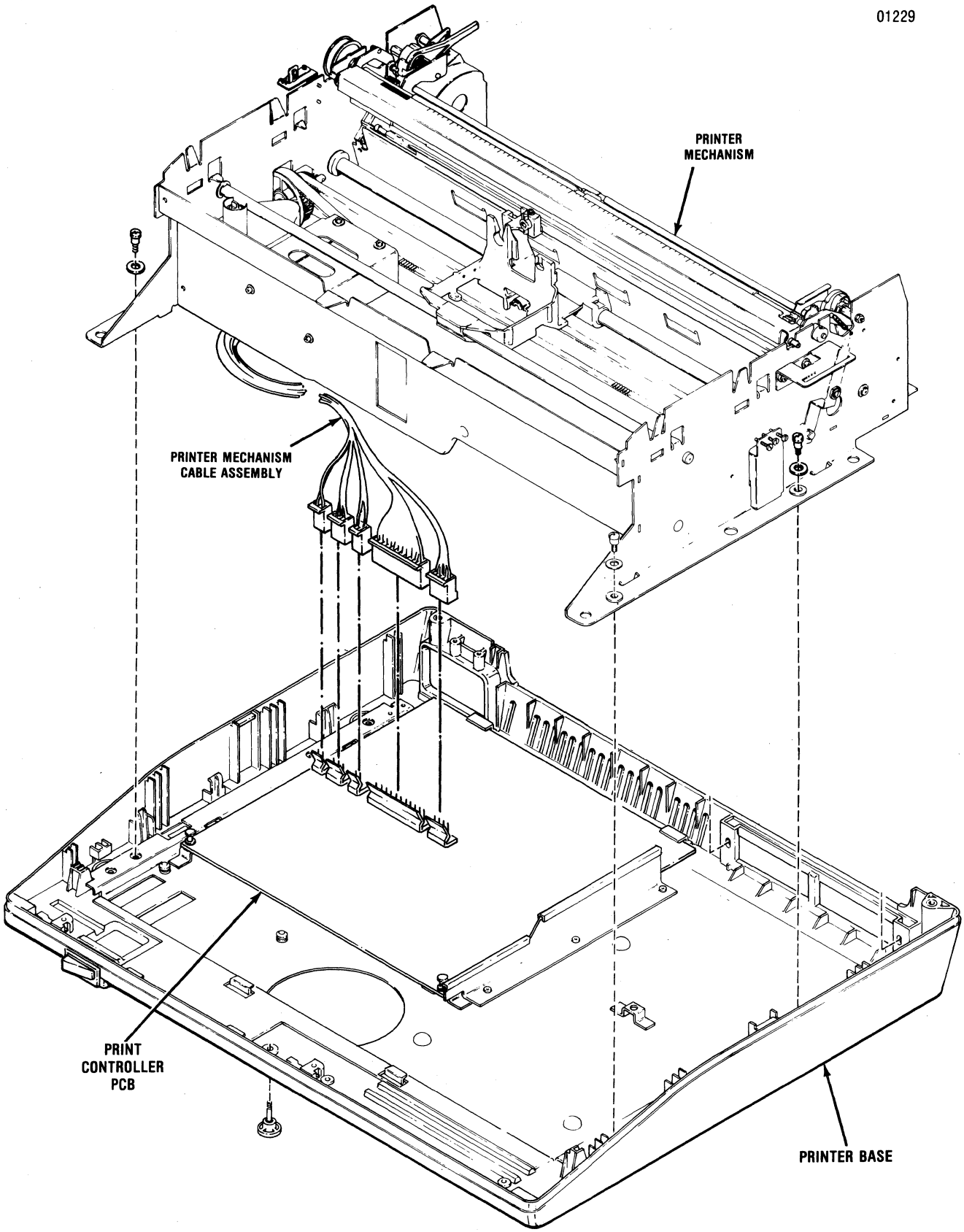


Figure 5-5. REMOVAL/REPLACEMENT, PRINT MECHANISM

5.11 DUST COVER

The dust cover attaches to the bottom of the printer mechanism and protects the Print Controller and Format Controller pcb's. To remove the dust cover, refer to Figure 5-6 and perform the following steps:

1. Remove or tile the printer mechanism per paragraph 5.10.
2. If mechanism is tilted, remove head flex cable from Print Controller pcb.
3. Remove the two white tabs mounting the dust cover to the front and right side of the print mechanism.
4. If mechanism is removed, tip the mechanism up.
5. Gently pull the front of the dust cover down.
6. Pull the dust cover forward from the three rear mounting clips and remove the dust cover from the printer.
7. To replace dust cover, reverse steps 1 through 6.

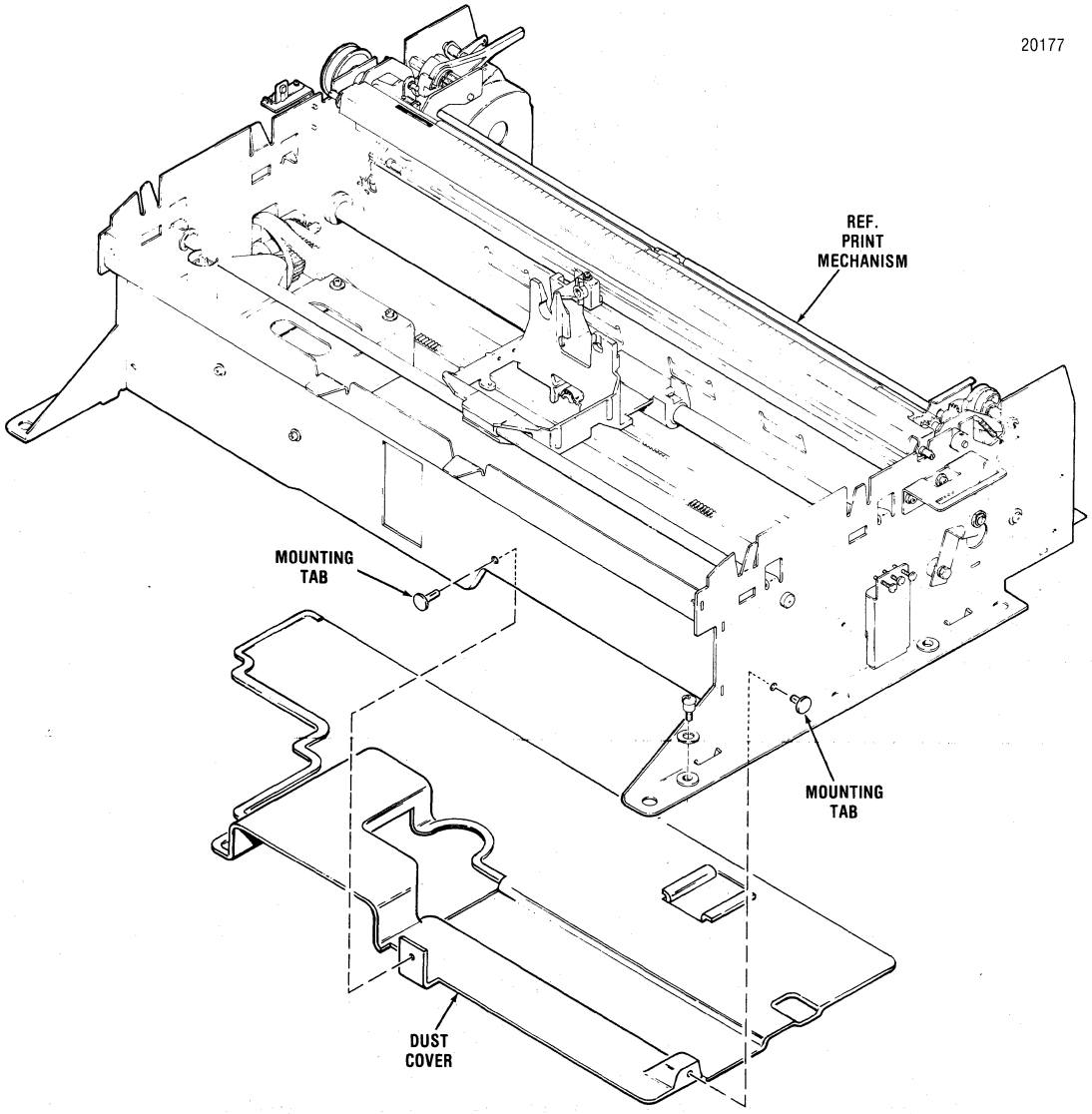


Figure 5-6. REMOVAL/REPLACEMENT DUST COVER

5.12 CARRIAGE DRIVE MOTOR BELT

The carriage drive motor belt, item 1 of Figure 5-7, 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 5-7 and perform the following steps:

1. Remove or tile the printer mechanism per paragraph 5.10.
2. Move the carriage assembly to the middle of the printer.
3. Remove the two slotted head screws securing the drive pulley to the left frame.
4. Remove the belt from the drive pulley and drive motor pulley and remove belt from printer.
5. To replace the belt, reverse steps 1 through 5 and refer to Paragraph 4.2, Section 4.

5.13 CARRIAGE DRIVE BELT

The carriage drive belt, item 2 of Figure 5-7, 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 5-7 and perform the following steps:

1. Remove or tile the printer mechanism per paragraph 5.10.
2. Remove the dust cover per paragraph 5.11.
3. Remove the two slotted head screws securing the drive pulley to the left frame.
4. Loosen the two slotted head adjusting screws mounting the idle pulley assembly to the right side frame and remove the idle pulley from the idle pulley bracket.
5. Remove the belt from the idle pulley, carriage and drive pulley and remove belt from printer.
6. To replace the belt, reverse steps 1 through 5 and refer to Paragraph 4.3, Section 4 for belt adjustments.

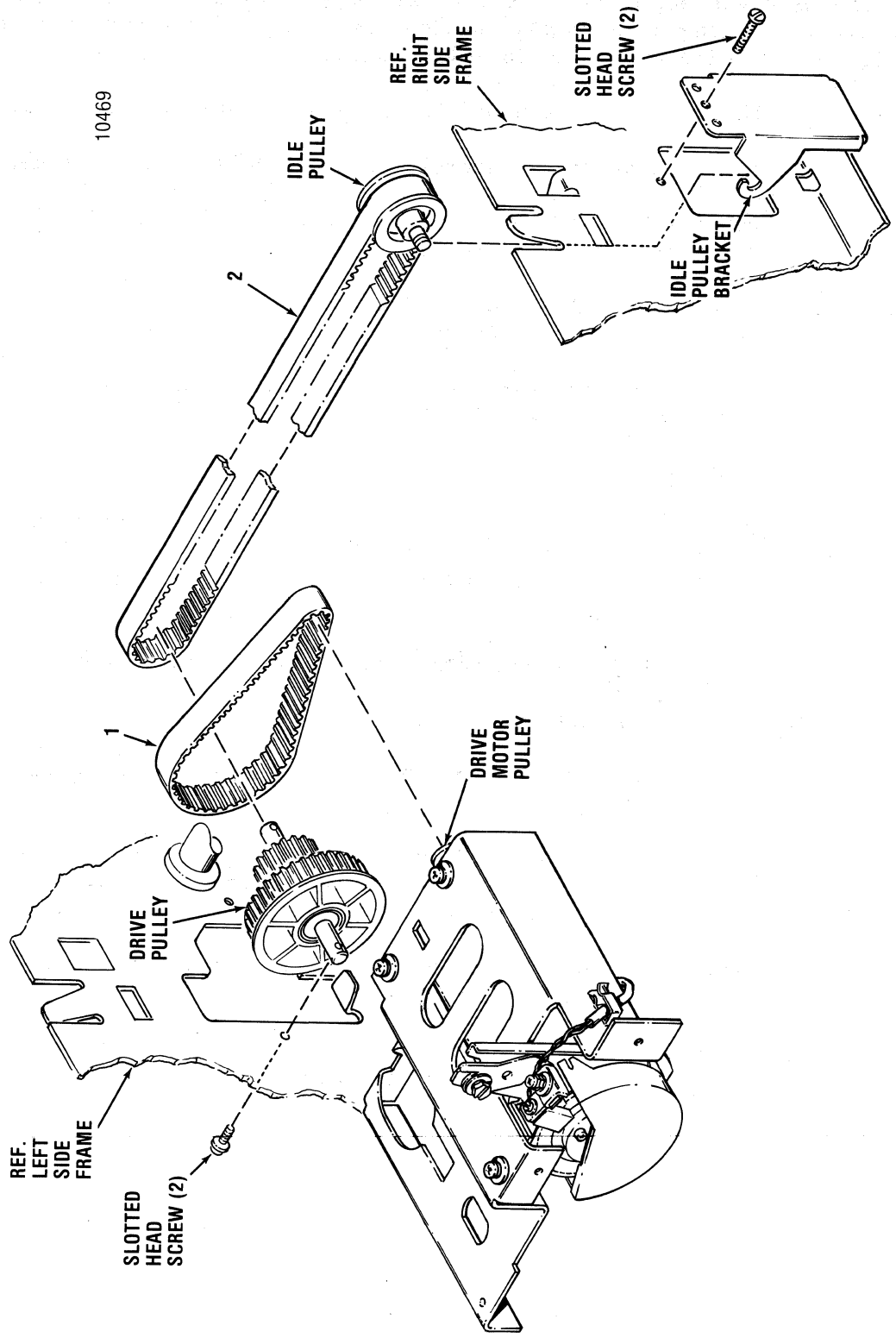


Figure 5-7. REMOVAL/REPLACEMENT, CARRIAGE DRIVE MOTOR BELT CARRIAGE DRIVE BELT

5.14 CARRIAGE DRIVE MOTOR AND RIBBON DRIVE MOTOR MOUNTING BRACKET

The carriage drive motor and ribbon drive motor mounting bracket is removed for ease in removing the two motors. The bracket is removed using a Phillips head screwdriver. To remove the bracket, refer to Figure 5-8 and perform the following steps:

1. Remove the dust cover per paragraph 5.11.

2. Remove the carriage drive motor belt per paragraph 5.12.

3. Remove the four screws attaching the mounting bracket to the frame and remove bracket from printer.

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

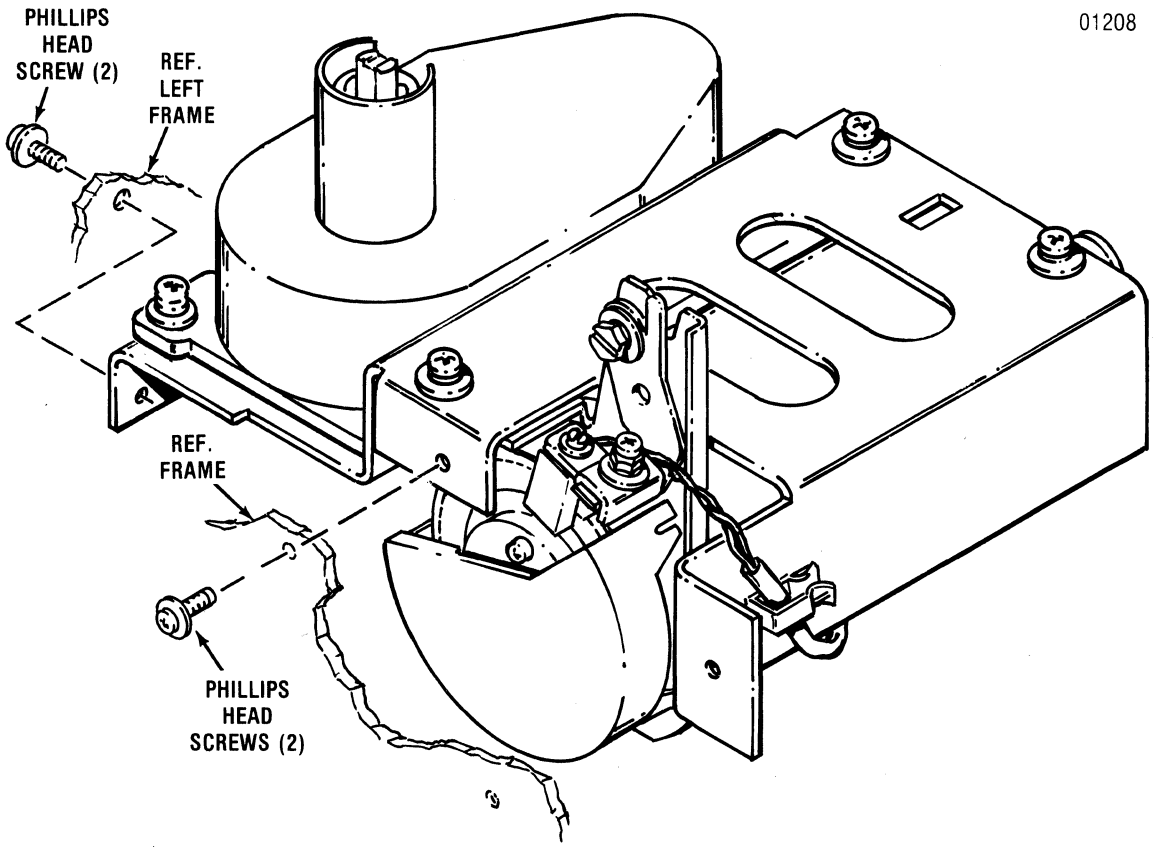


Figure 5-8. REMOVAL/REPLACEMENT, CARRIAGE DRIVE MOTOR AND RIBBON DRIVE MOTOR MOUNTING BRACKET

5.15 OPTIC SENSOR ASSEMBLY

The optic sensor assembly, item 1 of Figure 5-9, is attached to the carriage drive motor and is removed using a flat blade screwdriver. To remove the optic sensor assembly, refer to Figure 5-9 and perform the following steps:

1. Remove the carriage drive motor and ribbon drive motor mounting bracket per paragraph 5.14.

2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the optic cable assembly connector P212 from connector J212 on the Print Controller pcb and from the wire harness mounting clips on the frame.

3. Remove the four carraige drive motor wires from the optic cable assembly connector P212 by lifting the connector tabs and gently removing the wire.

4. Remove the slotted head screw mounting the optic sensor assembly to the carriage drive motor and remove the optic sensor assembly and cable from printer.

5. To replace the optic sensor assembly, reverse steps 1 through 5, add new tie wraps around wire harness, and refer to Section 4 for the optic sensor assembly adjustments.

NOTE
Ensure the four carriage drive wires are reinstalled in the proper slots on the optic cable assembly connector P212. Refer to Figure A-4, Wiring Diagram, Model 352.

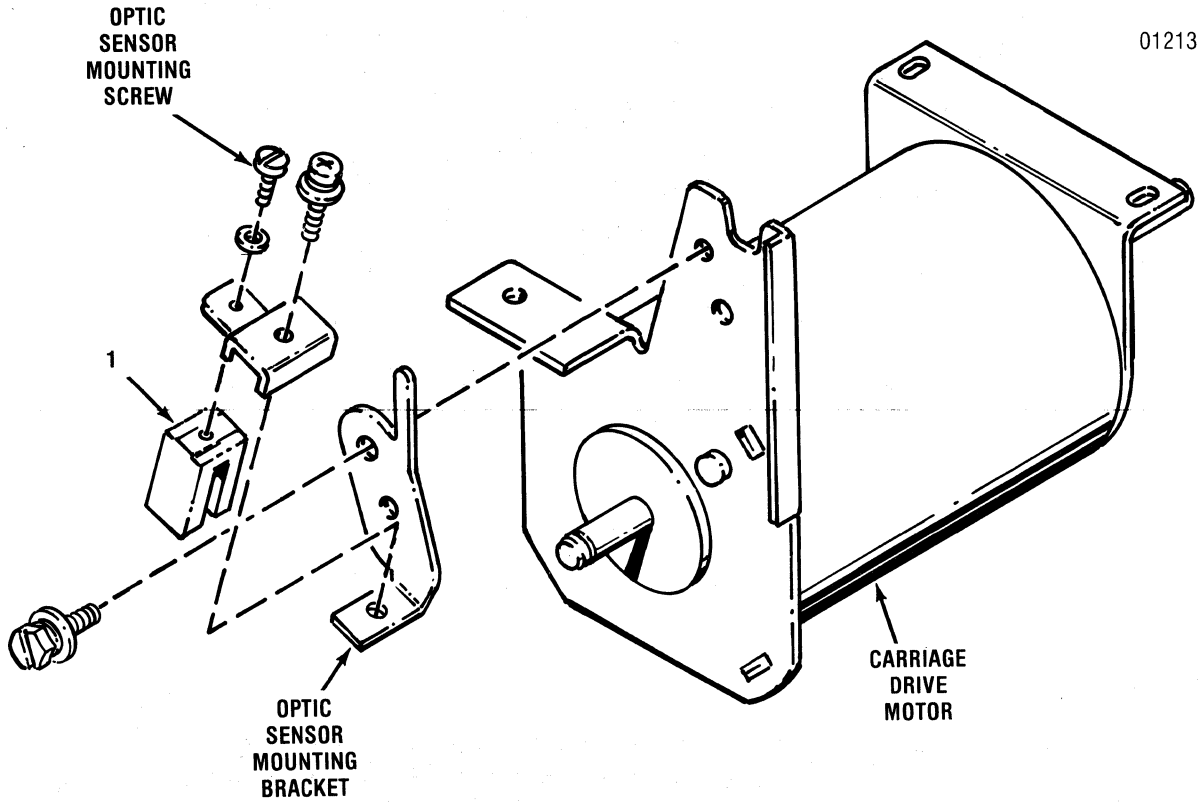


Figure 5-9. REMOVAL/REPLACEMENT, OPTIC SENSOR ASSEMBLY

5.16 CARRIAGE DRIVE MOTOR

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

1. Remove the carriage drive motor and ribbon drive motor mounting bracket per paragraph 5.14.

2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the carriage drive motor cable assembly from the wire harness mounting clips on the frame.

3. Remove the four carraige drive motor wires from the optic sensor cable assembly connector P212 by lifting the connector tabs and gently removing the wires.

4. Remove the three screws attaching the motor to the mounting bracket and remove the motor and cable assembly from the printer.

5. To replace the motor, reverse steps 1 through 4.

NOTE

Ensure the four carriage drive wires are reinstalled in the proper slots on the optic sensor cable assembly connector P212. Refer to Figure A-4, Wiring Diagram, Model 352.

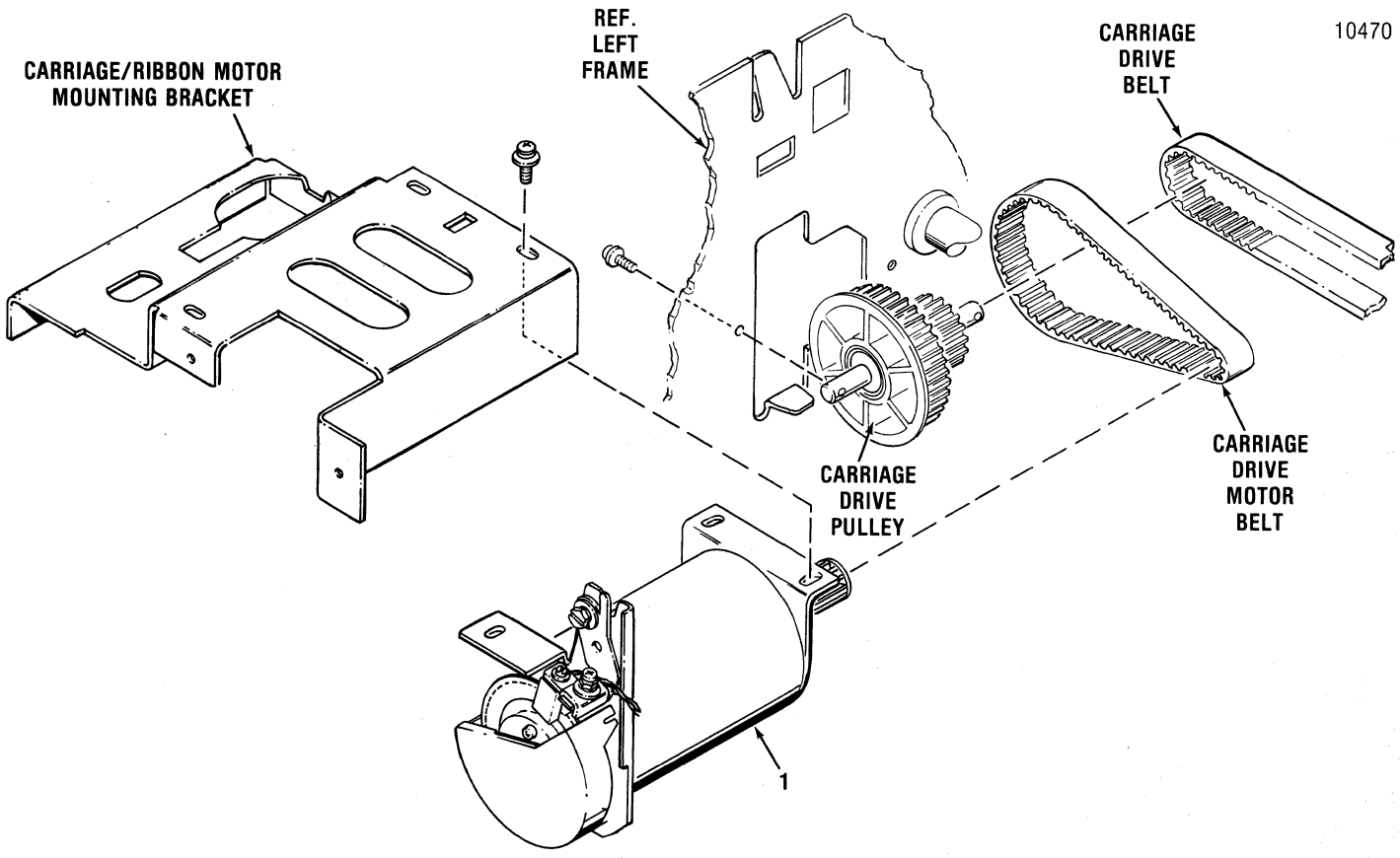


Figure 5-10. REMOVAL/REPLACEMENT, CARRAIGE DRIVE MOTOR

5.17 ENCODER/TIMING DISC

The encoder/timing disc, item 1 of Figure 5-11, is located on the end of the carriage drive motor shaft and is removed using a Phillips head screwdriver. To remove the timing disc, refer to Figure 5-11 and perform the following steps:

1. Remove the carriage drive motor per paragraph 5.16.

2. Unsnap the protective cap from the end of the carriage drive motor.

3. Remove the optic sensor assembly per paragraph 5.15.

4. Remove the snap ring securing the timing disc to the end of the drive motor shaft.

5. Remove the three screws mounting the two plastic discs on the drive motor shaft.

6. Remove the front plastic mounting disc and the encoder/timing disc from the end of the drive motor shaft.

7. To replace the disc, reverse steps 1 through 5 and refer to Paragraph 4.7, Section 4 for the encoder/timing disc adjustments.

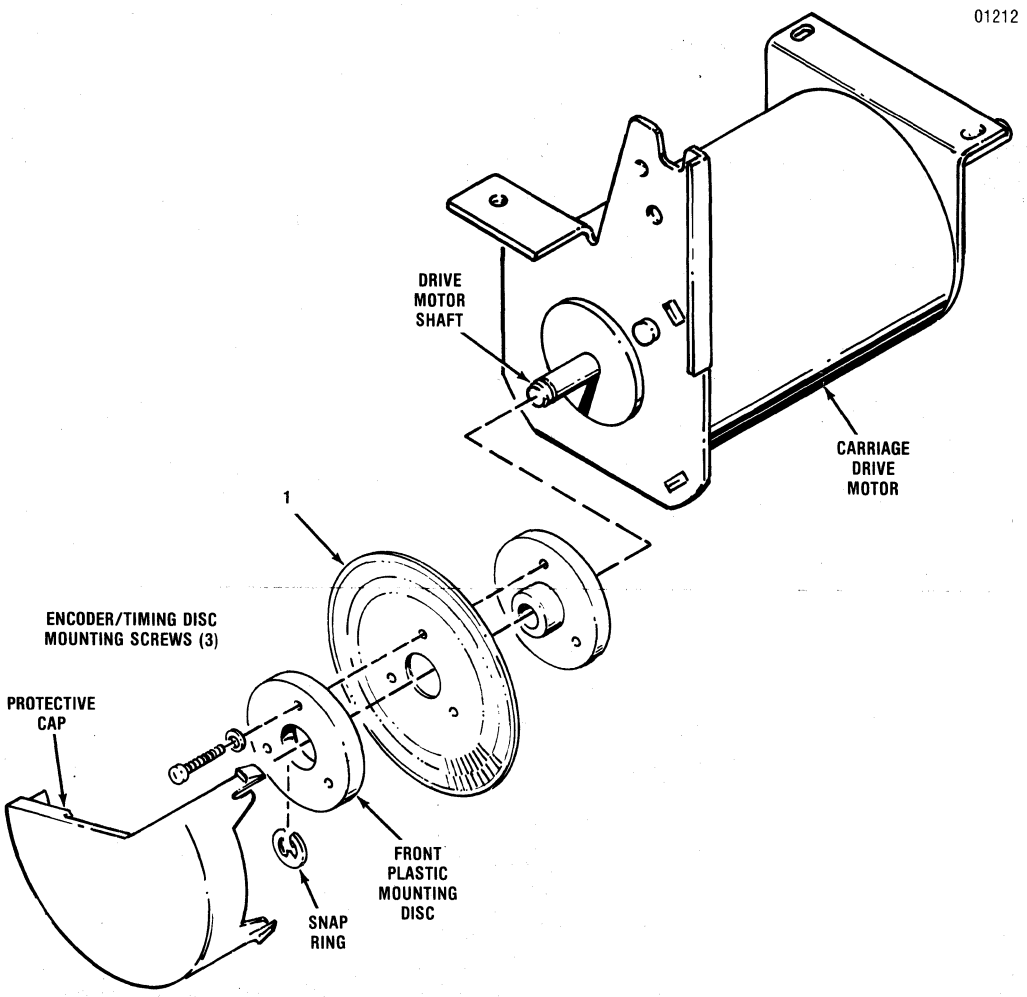


Figure 5-11. REMOVAL/REPLACEMENT, ENCODER/TIMING DISC

5.18 RIBBON DRIVE MOTOR

The ribbon drive motor, item 1 of Figure 5-12, is removed using a Phillips head screwdriver and a flat blade screwdriver. To remove the motor, refer to Figure 5-12 and perform the following steps:

1. Remove the carriage drive motor and ribbon drive motor mounting bracket per paragraph 5.14.

2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the ribbon drive motor cable connector P210 from connector J210 on the Print Controller pcb and from the wire harness ounting clips on the frame.

3. Remove the two Phillips head screws mounting the ribbon drive motor cover and remove the cover from the printer.

4. Remove the two slotted head screws mounting the ribbon drive motor and remove the motor and cable from the printer.

5. To replace the ribbon drive motor, reverse steps 1 through 4.

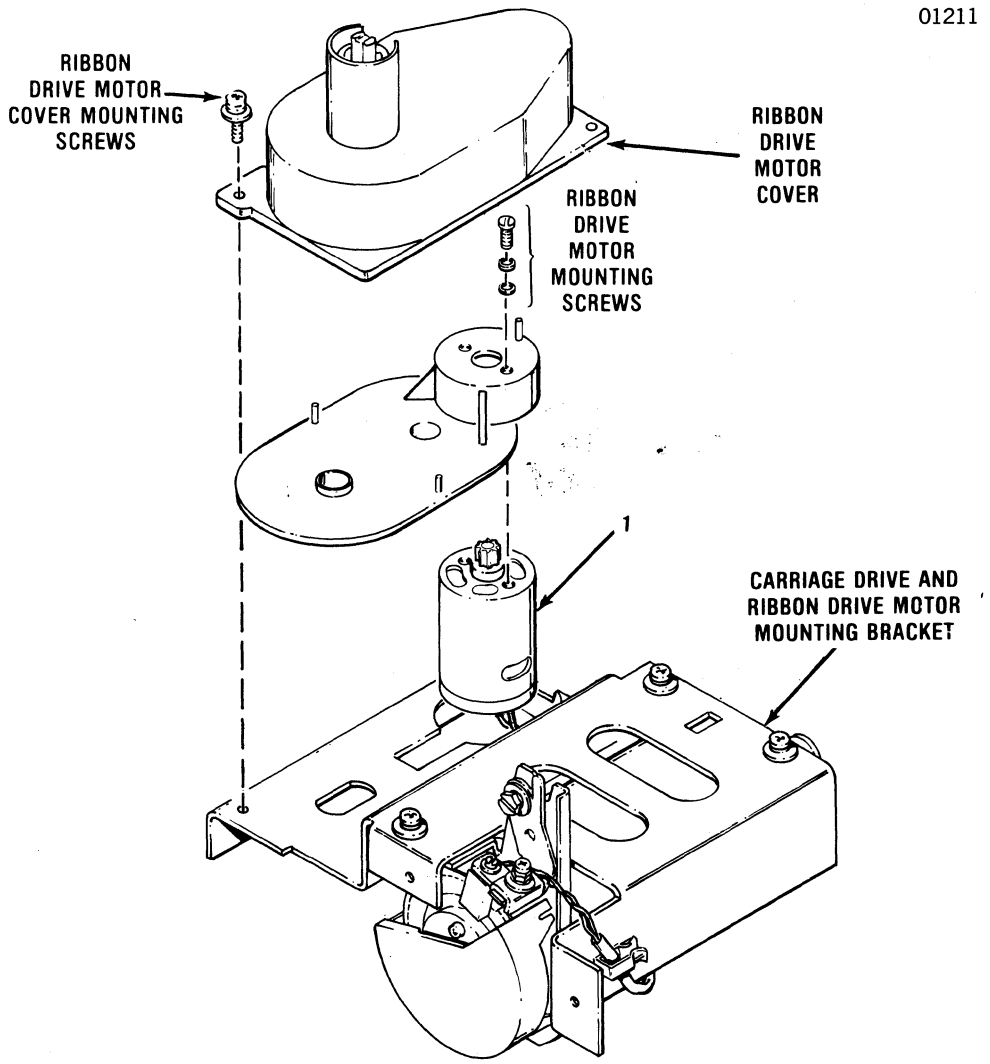


Figure 5-12. REMOVAL/REPLACEMENT, RIBBON DRIVE MOTOR

5.19 COVER INTERLOCK SWITCH

The cover interlock switch, item 1 of Figure 5-13, is attached to the left frame and is removed using a Phillips head screwdriver. To remove the cover interlock switch, refer to Figure 5-13 and perform the following steps:

1. Remove or tile the printer mechanism per paragraph 5.10.

2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the cover interlock switch cable connector P209 from connector J209 on the Print Controller pcb and from the wire harness mounting clips.

3. Remove the rubber grommet from the left frame which the cover interlock switch cable assembly is routed through.

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 and cable assembly from the printer.

6. To replace the switch, reverse steps 1 through 5.

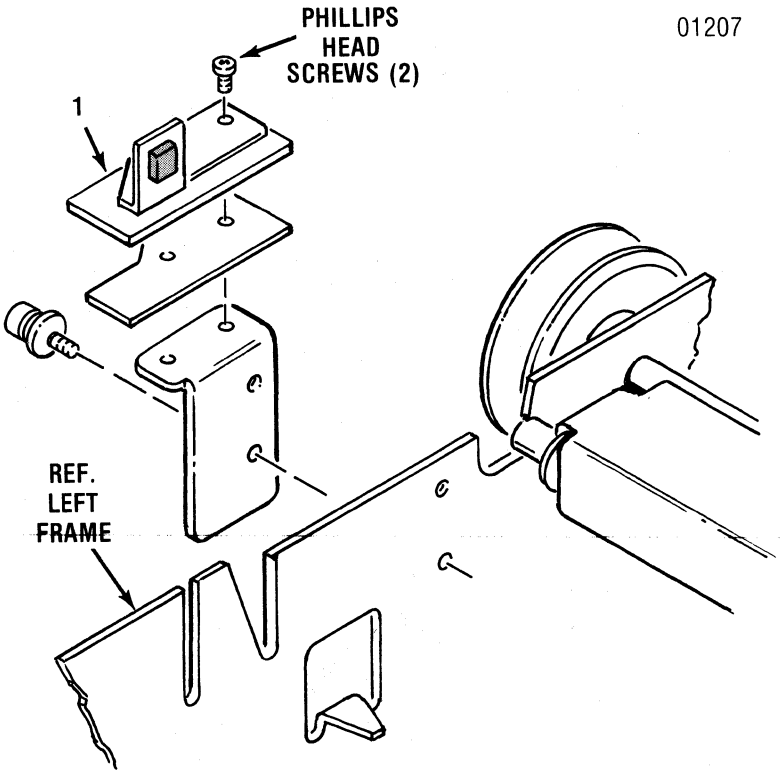


Figure 5-13. REMOVAL/REPLACEMENT, COVER INTERLOCK SWITCH

5.20 PAPER DRIVE BELT

The paper drive belt, item 1 of Figure 5-14, provides the drive from the paper feed motor to the paper feed mechanism. The belt is removed using a snap ring remover and Phillips head screwdriver. To remove the belt, refer to Figure 5-14 and perform the following steps:

1. Remove the covers from the printer per paragraph 5.4.

2. Using a snap ring remover, remove the snap ring holding the paper drive pulley to the tractor drive shaft.

3. Gently pull the paper drive pulley off the tractor drive shaft.

4. Loosen the screw mounting the tensioner bracket to the left frame.

5. Remove the paper drive belt from the paper feed motor pulley and paper feed mechanism pulley.

6. To replace the belt, reverse steps 1 through 5 and refer to Section 4 for the paper drive belt adjustments.

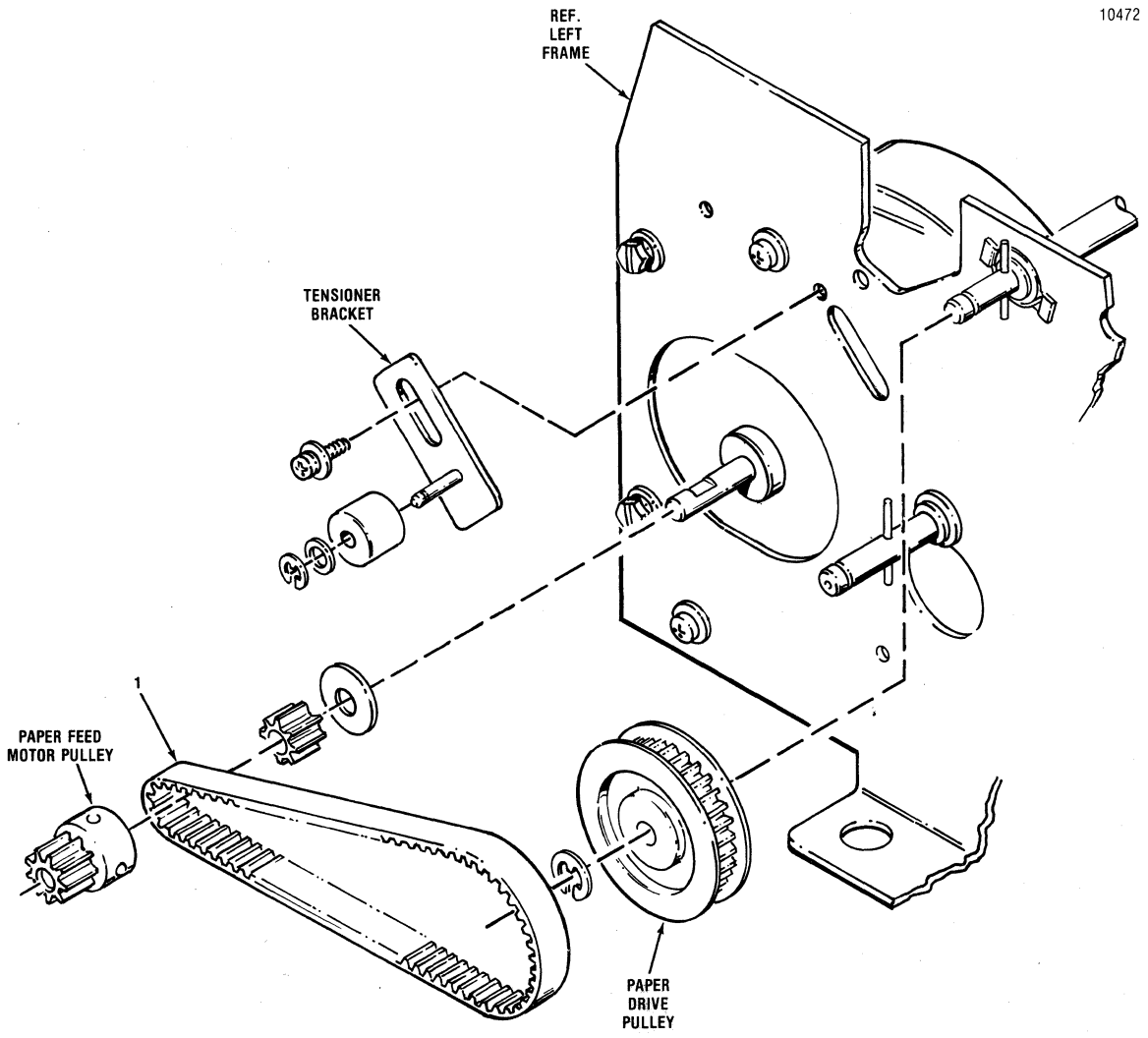


Figure 5-14. REMOVAL/REPLACEMENT, PAPER DRIVE BELT

5.21 PAPER DRIVE MOTOR

The paper drive motor, item 1 of Figure 5-15, 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 5-15 and perform the following steps:

1. Remove or tile the printer mechanism per paragraph 5.10.
2. Remove the paper drive belt per paragraph 5.20.
3. Remove the spring attached to the paper feed motor shroud.

NOTE

Step 4 is performed from the rear of the mechanism.

4. Remove the snap ring from the left inside of the tractor guide bar and slide the guide bar to the left.

NOTE

Retain the collar on the right end of the tractor guide bar.

5. Remove the three Phillips head screws on the outside of the frame mounting the motor shroud and remove the shroud from the printer.

6. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the paper drive motor cable connector P211 from connector J211 on the Print Controller pcb and the wire harness mounting clips on the frame.

7. Remove the three slotted head screws on the outside of the frame mounting the paper drive motor and remove the motor and cable assembly from the printer.

8. To replace the paper drive motor, reverse steps 1 through 7.

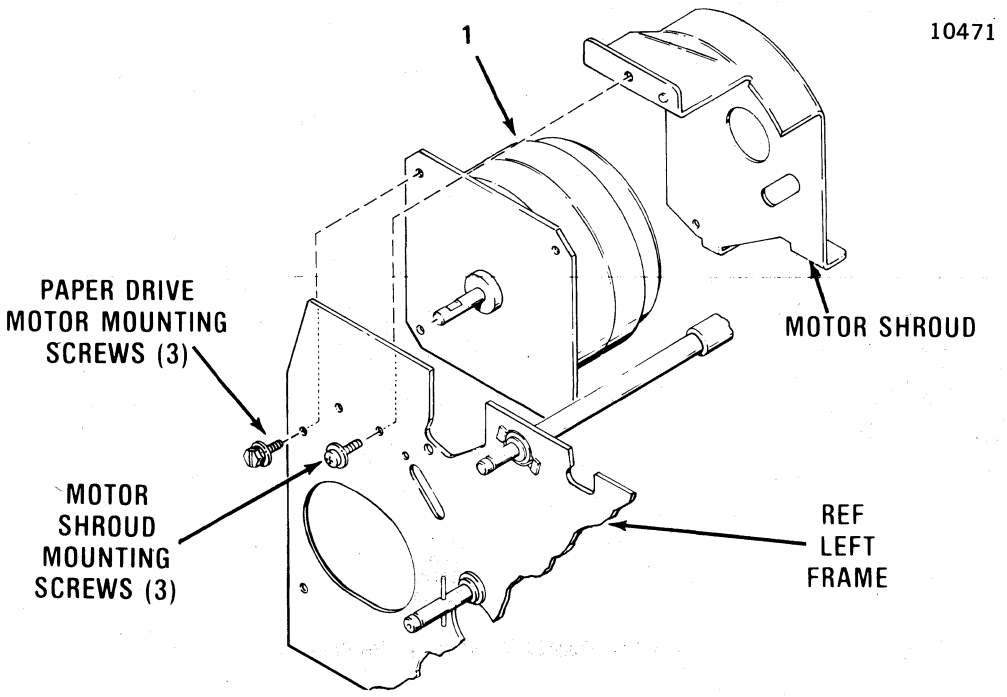


Figure 5-15. REMOVAL/REPLACEMENT, PAPER DRIVE MOTOR

5.22 TRACTOR ASSEMBLIES, LEFT/RIGHT

The left and right tractor assemblies, items 1 and 2 of Figure 5-16, are located on the tractor drive shaft and tractor guide bar. The tractors are removed using a snap ring tool. To remove the tractors, refer to Figure 5-16 and perform the following steps:

1. Remove the print mechanism per paragraph 5.10.

NOTE

The following steps are performed from the rear of the printer.

2. Remove the four snap rings securing the tractor guide bar and slide the bar to the left and through the tractor assemblies.

3. Remove the two snap rings from the ends of the tractor drive shaft.

4. Push the two bearings securing the tractor drive shaft to the frame outward and drop the drive shaft down into the larger holes in the frame.

5. Push the tractor drive shaft to the right, through the tractor assemblies and remove the tractors from the printer.

6. To replace the tractor assemblies, reverse steps 1 through 6.

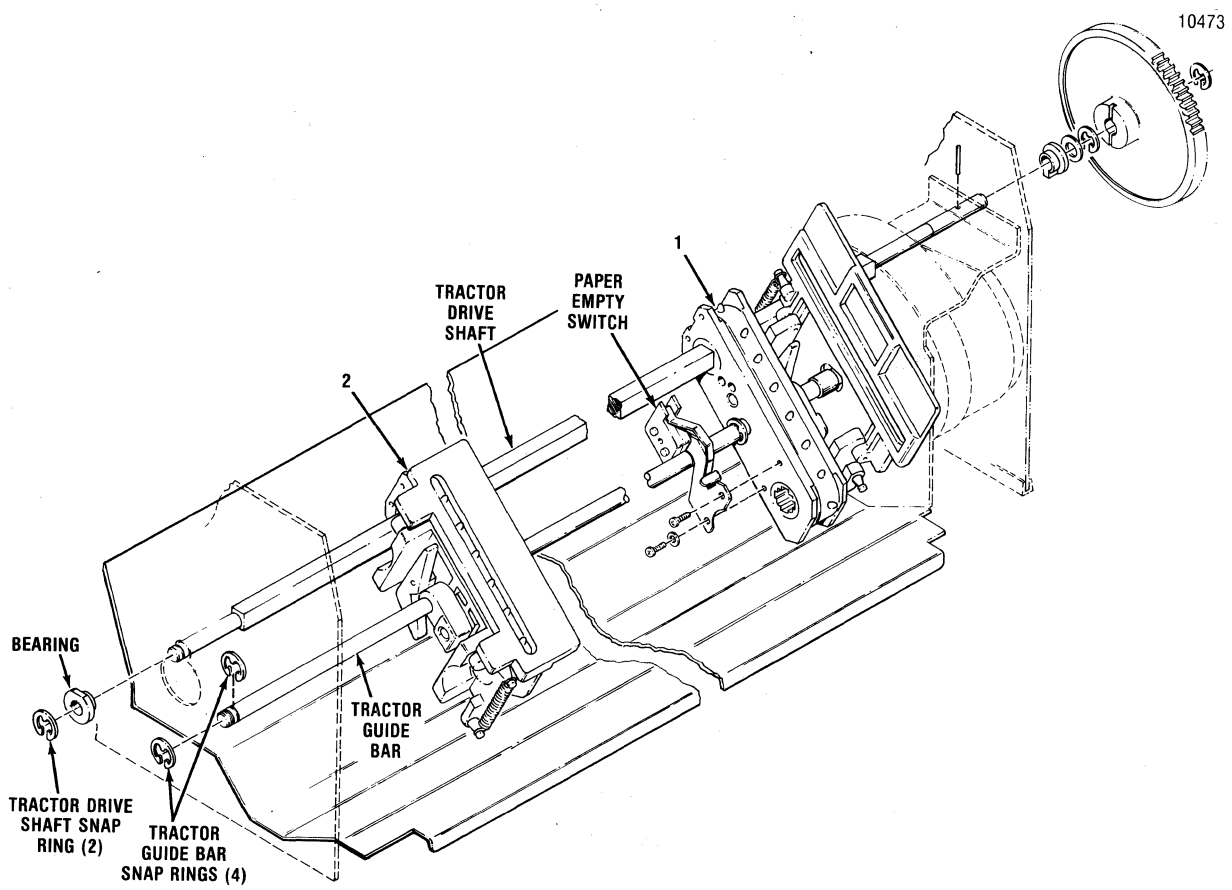


Figure 5-16. REMOVAL/REPLACEMENT, TRACTOR ASSEMBLIES

5.23 PAPER EMPTY SWITCH

The paper empty switch, item 1 of Figure 5-17, 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 5-17 and perform the following steps:

NOTE
This procedure is performed from the rear of the printer.

1. Remove the covers from the printer per paragraph 5.4.

2. Tilt the mechanism upward as described in paragraph 5.10.

3. Disconnect the two pin connector P208 on the paper empty switch cable from the paper empty switch connector J208 on the Print Controller pcb.

4. Remove the two screws mounting the paper empty switch from the right tractor assembly and remove the tractor and cable assembly from the printer.

5. To replace the switch, reverse steps 1 through 4 and refer to paragraph 4.6, Section 4 for the paper empty switch adjustments.

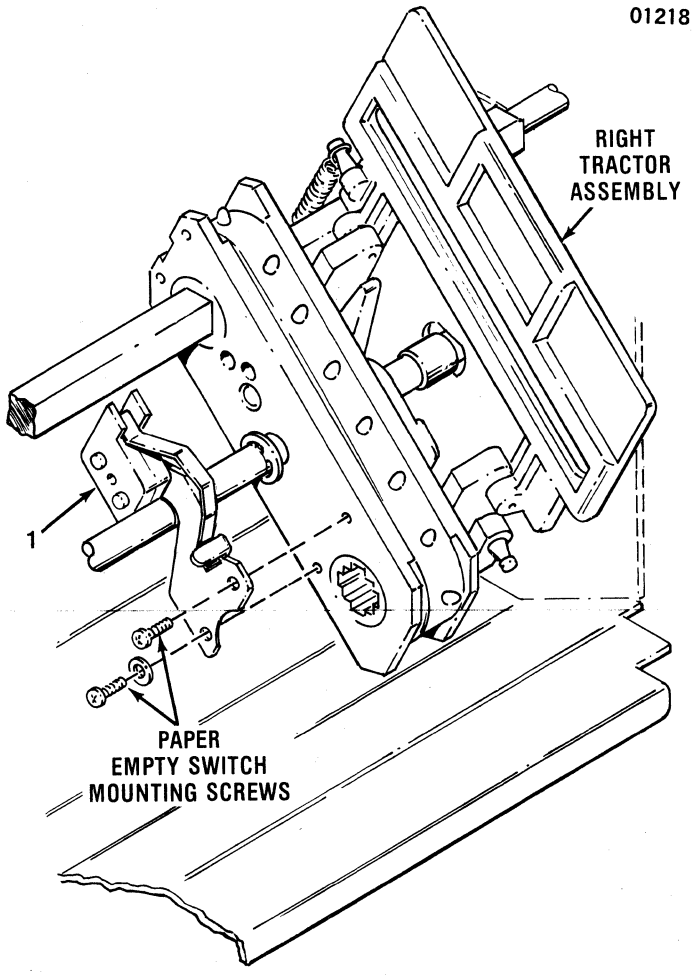


Figure 5-17. REMOVAL/REPLACEMENT, PAPER EMPTY SWITCH

5.24 POWER SUPPLY ASSEMBLY

The power supply assembly, item 1A or 1B of Figure 5-18, is mounted to the printer base and is removed using a Phillips head screwdriver. To remove the power supply, refer to Figure 5-18 and perform the following steps:

1. Remove or tile the printer mechanism per paragraph 5.10.

2. Disconnect the two line filter cable assembly connectors P303 and P507 from the format controller pcb and print 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 from the printer.

6. To replace the power supply assembly, reverse steps 1 through 5.

5.25 FORMAT/CONTROLLER CABLE

The format/controller cable, item 2 of Figure 5-18, connects the Print Controller pcb and Format Controller pcb. To remove the cable, refer to Figure 5-18 and perform the following steps:

1. Tilt the print mechanism upward as described in paragraph 5.10.

2. Snap back the two mounting tabs securing one end of the cable to the Format Controller pcb and remove the cable connector P304 from connector J304 on the pcb.

3. Remove the other connector P204 of the format/controller cable from the Print Controller pcb connector J204 and remove the cable from the printer.

4. To replace the format/controller cable, reverse steps 1 through 4.

5.26 PRINT CONTROLLER PCB

The Print Controller pcb, item 3 of Figure 5-18, is mounted to the printer base and no tools are required to remove the board. To remove the Print Controller pcb, refer to Figure 5-18 and perform the following steps:

1. Remove or tile the printer mechanism per paragraph 5.10.
2. Remove the format/controller cable from the Print Controller pcb.
3. Disconnect the power supply cable from the Print Controller pcb.
4. Lift up on the three quick release fasteners securing the pcb to the printer base.
5. Pull the pcb forward and lift the Print Controller pcb up and out of the printer.
6. To replace the Print Controller pcb, reverse steps 1 through 5 and refer to paragraph 4.8, Section 4 for the adjustments required on the board.

5.27 FORMAT CONTROLLER PCB

The Format Controller pcb, item 4 of Figure 5-18, is mounted to the printer base and no tools are required to remove the board. To remove the Format Controller pcb, refer to Figure 5-18 and perform the following steps:

1. Remove the print mechanism per paragraph 5.10.
2. Remove the I/O cable from the serial or parallel input connector.
3. Remove the format/controller cable from the Format Controller pcb.
4. Disconnect the power supply cable from the Format Controller pcb.
5. Lift up on the three quick release fasteners securing the pcb to the printer base.
6. Pull the Format Controller pcb forward and lift the pcb up and out of the printer.
7. To replace the Format Controller pcb, reverse steps 1 through 6.

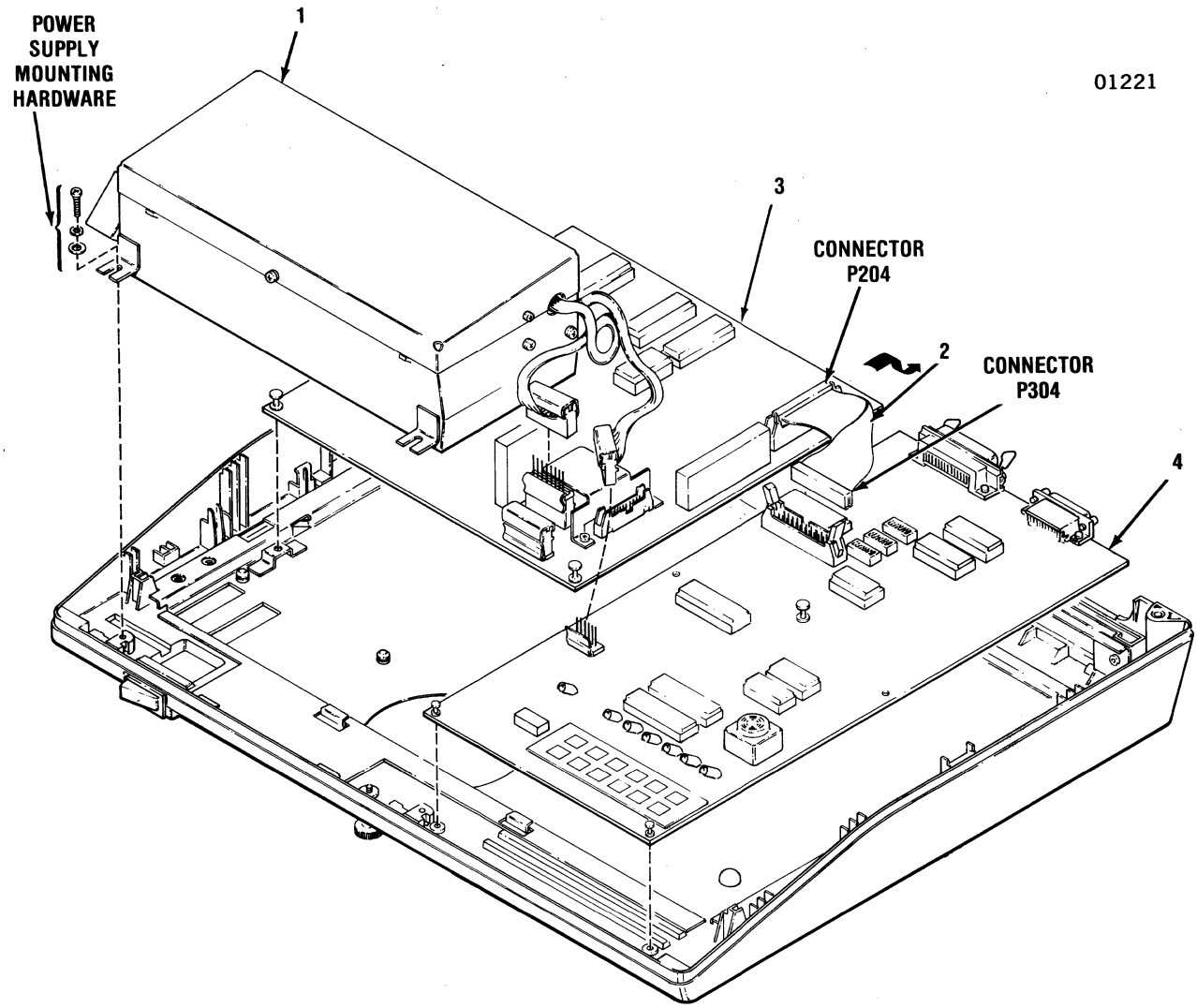


Figure 5-18. REMOVAL/REPLACEMENT POWER SUPPLY ASSEMBLY, FORMAT/CONTROLLER CABLE PRINT CONTROLLER PCB AND FORMAT CONTROLLER PCB

5.28 PICO FUSE

The pico fuses, item 1 of Figure 5-19, are located on the Print Controller pcb and are removed using needle nose pliers. To remove the pico fuses, refer to Figure 5-19 and perform the following steps:

1. Remove the Print Controller pcb per paragraph 5.26.

NOTE

Refer to Figure 5-19 for the locations (F1 through F12) of the pico fuses and to Appendix D for the pico fuse color coding information.

2. Using needle nose pliers, remove the defective fuse from the Print Controller pcb.

3. Install new pico fuse into the Print Controller pcb.

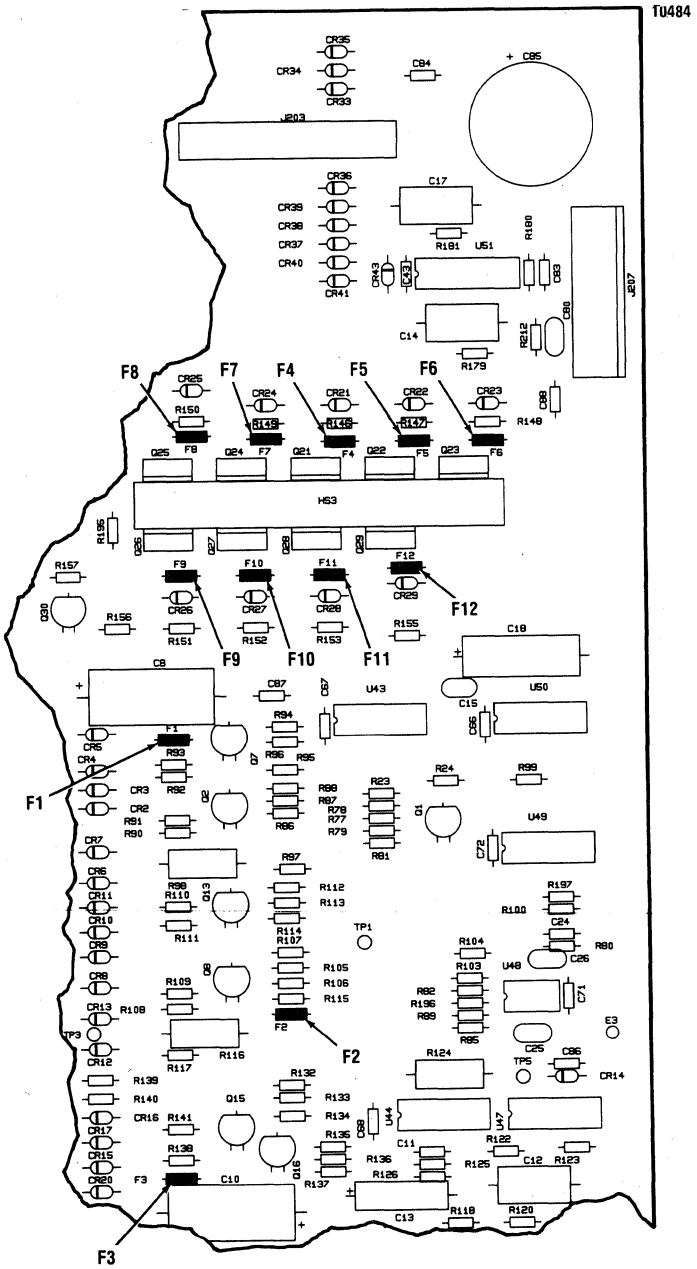


Figure 5-19. REMOVAL/REPLACEMENT PICO FUSE

5.29 ON/OFF SWITCH

The ON/OFF switch item 1 of Figure 5-20 is located on the right 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. Remove or tile the printer mechanism per paragraph 5.10.

2. Remove the power supply assembly per paragraph 5.24.

3. Remove the four push on connectors from the ON/OFF switch.

4. Push the switch forward through the opening in the printer base and remove the switch from the printer.

5. To replace the switch, reverse steps 1 through 4.

NOTE
Ensure the wires are properly connected when replacing the switch. Refer to Figure A-4, Wiring Diagram, Model 352.

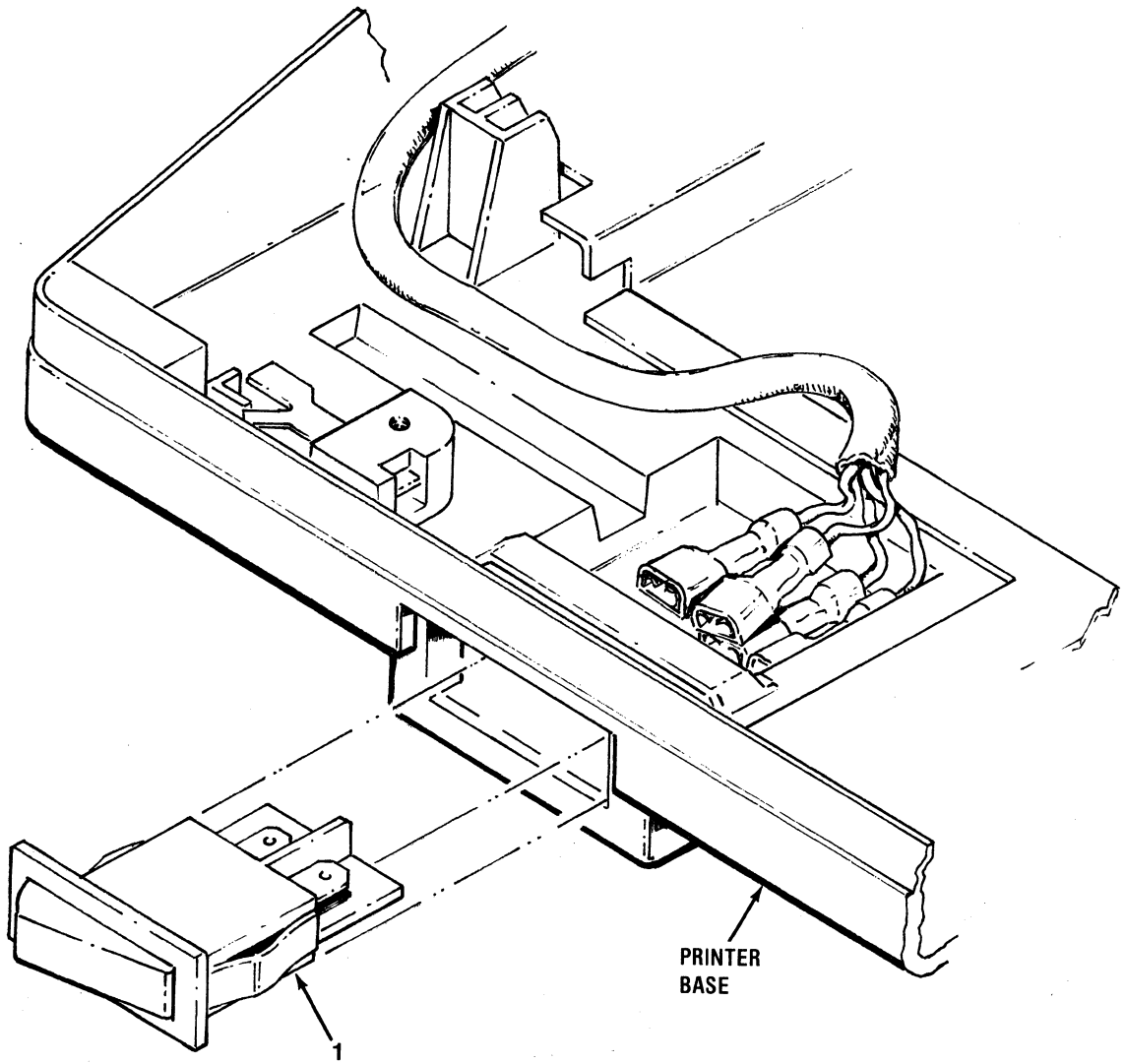


Figure 5-20. REMOVAL/REPLACEMENT, ON/OFF SWITCH

5.30 MAIN FUSE

The main fuse, item 1 of Figure 5-21, is located in the rear of the printer base 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.
2. Using a slotted head screwdriver, turn the fuse holder one quarter of a full turn counterclockwise.
3. Remove the defective fuse from the fuse holder.
4. Install the new fuse into the fuse holder and replace the fuse holder into the printer base.

NOTE

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

5.31 POWER CORD

The eight foot long power cord, item 2 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 simply removed by removing the plug end from the external power source and the receptacle end from the printer. Refer to Figure 5-21.

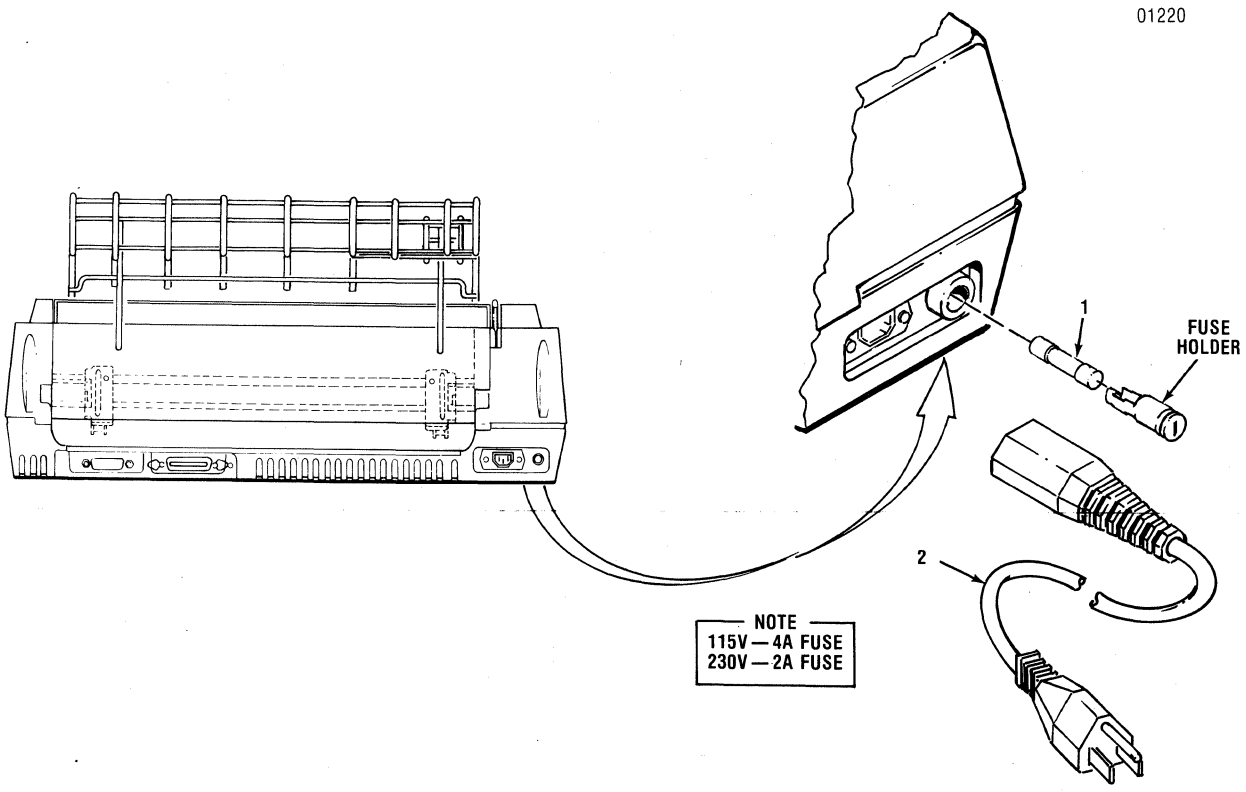


Figure 5-21. REMOVAL/REPLACEMENT, MAIN FUSE AND POWER CORD

5.32 COVER LATCH SPRINGS

Four small springs, item 1 of Figure 5-22, are located on the inside of the body cover. The springs help secure the top and rear covers of the printer to the body cover. To remove any of the four springs, refer to Figure 5-22 and perform the following steps:

1. Remove the body cover per paragraph 5.4.

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 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 1-6 of paragraph 5.4.

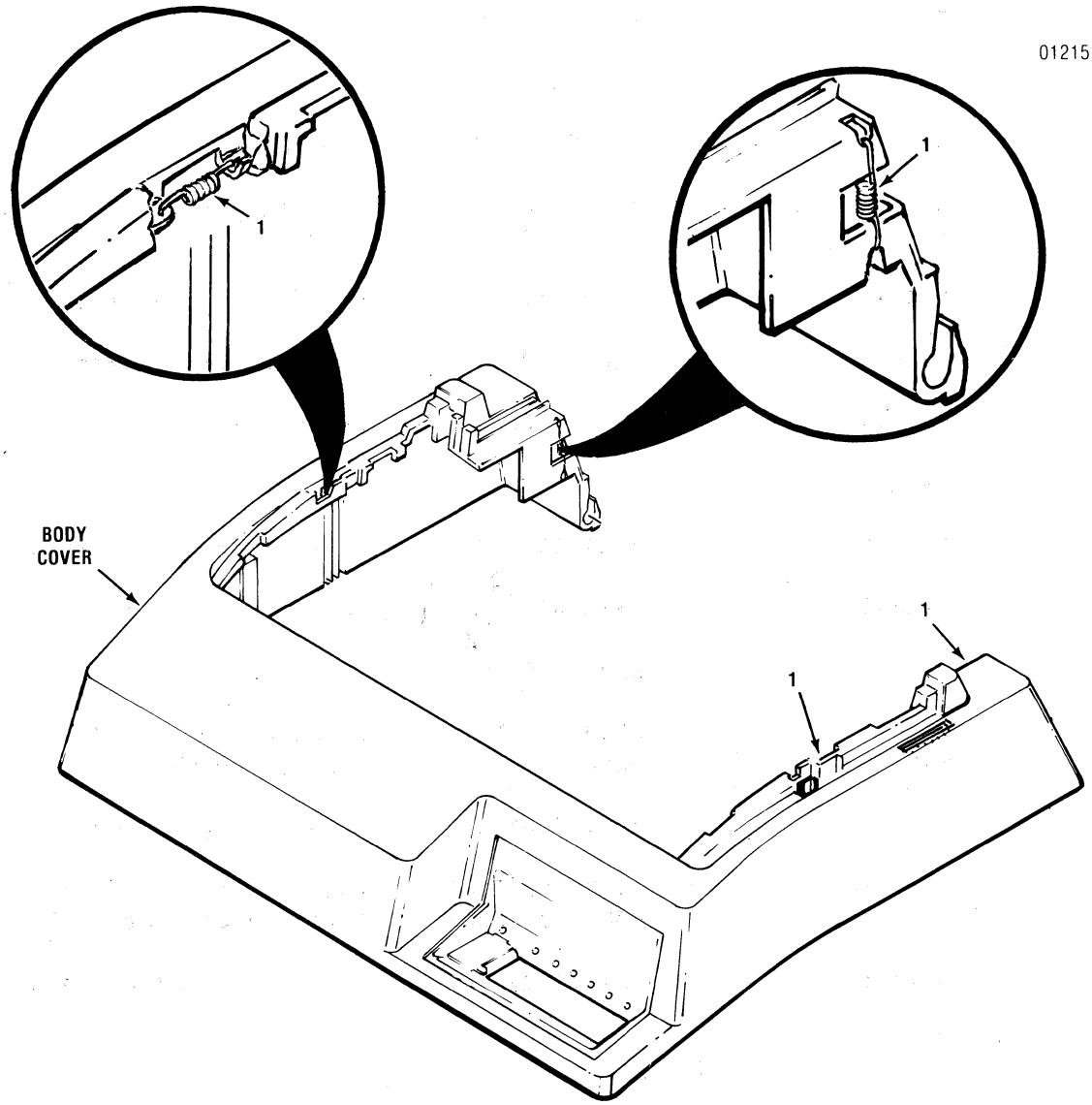


Figure 5-22. REMOVAL/REPLACEMENT, COVER LATCH SPRINGS

5.32 RECOMMENDED SPARE PARTS LISTING

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

5-1-1		63180330-5001	Part Rack Outlet Assembly
Figure Number	Item Number	Recommended Spare Part Number	Recommended Spare Description

Table 5-2. Recommended Spare Parts Listing

Figure and Item Number	Part Number	Description
5-1-1	63180330-5001	Paper Rack Outlet Assembly
5-1-2	63180331-2001	Paper Rack Inlet
5-1-3	u20241001	Cover Interlock Magnet
5-2-1	64000520-6001	Ribbon Cassette
5-2-2	63180315-5001	Print Head Assembly
5-3-1	63180285-4001	Head Flex Cable
5-4-1	63180254-4001	Head Adapter PCB
5-7-1	u20139001	Carriage Drive Motor Belt
5-7-2	u20143001	Carriage Drive Belt
5-9-1	39099011-1001	Optic Sensor Assembly
5-10-1	u20187001	Carriage Drive Motor
5-11-1	u20157000	Encoder/Timing Disc
5-12-1	u20168001	Ribbon Drive Motor
5-13-1	u20242001	Cover Interlock Switch
5-14-1	531335001	Paper Drive Belt
5-15-1	u20070001	Paper Drive Motor
5-16-1	u20073001	Tractor, Left
5-16-2	u20074001	Tractor, Right
5-17-1	u20186001	Paper Empty Switch
5-18-1A	64000399-5002	Power Supply Assy. 50 Hz
5-18-1B	64000399-5001	Power Supply Assy. 60 Hz
5-19-1	63180300-4001	Format/Controller Cable

Table 5-2. Recommended Spare Parts Listing
(cont'd)

Figure and Item Number	Part Number	Description
5-18-3	64000564-8001	Print Controller PCB
5-18-3A	64000160-8001	Print Controller PCB
5-19-1	39030030-1006	Pico Fuse 3 Amp
5-18-4	63180247-8001	Format Controller PCB
5-20-1	39098122-1001	ON/OFF Switch
5-21-1A	39030033-1027	Main Fuse 4 Amp (115V)
5-21-1B	36100736-1007	Main Fuse 2 Amp (230V)
5-21-2A	39620021-1003	Power Cord 115V
5-21-2B	39620021-1004	Power Cord 230V
5-22-1	519927001	Cover Latch Springs

SECTION 6
FIELD INSTALLABLE OPTIONS/ACCESSORIES

6.1 PRINTER OPTIONS/ACCESSORIES

This section details the field installable options and accessories for the Model 352 printer. Installation instructions providing all the necessary information to install and operate the option/accessory are provided with each option and accessory. The options/accessories are available through the Customer Service Department at Centronics. An easy to use option/accessory order form is provided at the end of this section.

6.1.1 OPTIONS

Table 6-1 lists the available options, by part number, for the printer. Each option is described in detail following Table 6-1.

Table 6-1. Printer Options

OPTION	PART NUMBER
Current Loop Interface	63180288-4001
Data Input Cables	-

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

DATA INPUT CABLES - See Model 352 Users Manual

6.1.2 ACCESSORIES

Table 6-2 lists the available accessories, by part number, for the printer. Each accessory is described in detailed following Table 6-2.

Table 6-2. Printer Accessories

ACCESSORY	PART NUMBER
350 Series Print Stand	81100000-6170
Ribbon Cassettes	64000520-6001
Tool Kit	63002399-6001
Series 350 Illustrated Parts Manual	37403520-9001

350 SERIES PRINT STAND - The 350 Series 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.

RIBBON CASSETTES - Throwaway long life ribbon cassettes containing 70 yards of ribbon and ribbon guide are available. The ribbon cassettes come four to a box and are available in black only.

TOOL KIT - A tool kit containing all the necessary tools (screwdrivers, nut drivers, hex keys, etc.) to maintain the printer is available. (Refer to Figure 6-1).

SERIES 350 ILLUSTRATED PARTS MANUAL - The illustrated parts manual (IPM) provides a detailed breakdown of all printer assemblies to the piece part level for parts ordering purposes and depot level repair.

30017

CENTRONICS
data computer corporation
Hudson, New Hampshire 03051
Telephone (603) 883-0111

CENTRONICS TOOL KIT
(63002399-6001)

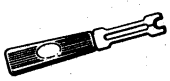
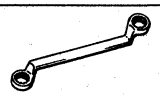
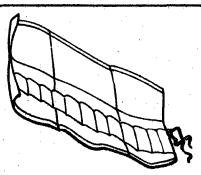
	UNIVERSAL HANDLE	30600002-3001		"T" HANDLE HEX KEY • 3/32-Inch • 5/32-Inch	 30600002-3017 30600002-3018
	EXTENSION • 4-Inch	30600002-3002		HEX KEY • 1/16-Inch • .050-Inch • 1.5mm • 2.0mm • 2.5mm • 3.0mm	 30600002-3025 30600002-3024 30600002-3020 30600002-3021 30600002-3022 30600002-3023
	NUT DRIVER • 4mm • 5.5mm • 7mm • 8mm • 10mm	 30600002-3003 30600002-3004 30600002-3005 30600002-3006 30600002-3007		WRENCH • SPANNER	 63003105-3001
	PHILLIPS INSERT • METRIC NO.1 • METRIC NO.2	 30600002-3030 30600002-3031		SNAP RING HOLDER • 4mm • 5mm	 30600002-3033 30600002-3034
	SCREWDRIVER • SLOTTED HEAD	 30600002-3008		SPRING HOOK	30600002-3032
	PLIERS • NEEDLE NOSE	 30600002-3010		BOX WRENCH • 17/19mm	 30600002-3035
	OPEN END WRENCH • 5x5.5mm • 6x7mm	 30600002-3011 30600002-3012		TOOL POUCH	30600002-3019
	COMBINATION OPEN END, BOX WRENCH • 8mm • 10mm	 30600002-3013 30600002-3014			

Figure 6-1. TOOL KIT

APPENDIX A
ELECTRICAL DRAWINGS

The following pages contain schematic, wiring, and assembly drawings for the Model 352 printer. A list of the drawings follows:

NOTE
The Model 352 Printer may contain either one of the two Print Controller boards referenced above.

REVISIONS				
LTR	DACH NO.	DESCRIPTION	DATE	APPROVED
A	9001	PROD RLSE PER ECO 001253	9-23-81	DLD
b	9001	REV PER ECO 001357	1-23-82	PS
C	9001	REV PER ECO 001367	[illegible]	[illegible]
C1	9001	REV PER ECO 001382	1-23-82	PS
C3	9001	REV PER ECO 001449	3-8-82	PS
C4	9001	REV PER ECO C01458	5/24/82	[illegible]

THIRD ANGLE PROJECTION

9002			
9001	C4		PRODUCTION RELEASED BY CDC ONLY
DASH NO.	LEVEL	REMARKS	CDC STATUS

REVISION LEVEL OF DACH NO'(S)

CONTROL DATA CORP. HUDSON, NEW HAMPSHIRE U.S.A.

TITLE: SCHEMATIC DIAGRAM, PRINT CONTROLLER

SIZE: D | 64000160 | SHEET 1 OF 7

DO NOT SCALE PRINT

THIS INFORMATION CONTAINED HEREIN IS PROPRIETARY AND IS NOT TO BE RELEASED OR REPRODUCED WITHOUT WRITTEN PERMISSION OF CONTROL DATA CORP.

UNLESS OTHERWISE SPECIFIED: CAPACITANCE IN μF, RESISTANCE IN Ω, 1/W ± 10%, DIMENSIONS IN INCHES (MM): TOLERANCE .X ± ___ .XX ± ___ ANGLE ± ___ SUR QLTY

MATERIAL, FINISH, HEAT TREAT:

C000157 | NEXT ASSY | USED ON

DOCMTS (✓) APPL | 1st APPLICATION

ENG APPROVAL DATE | DRAFTING | DES ENG | ENG PROJ MGR | MFG ENG | QA

Figure A-1. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000160-9001 (Sheet 1 of 7)

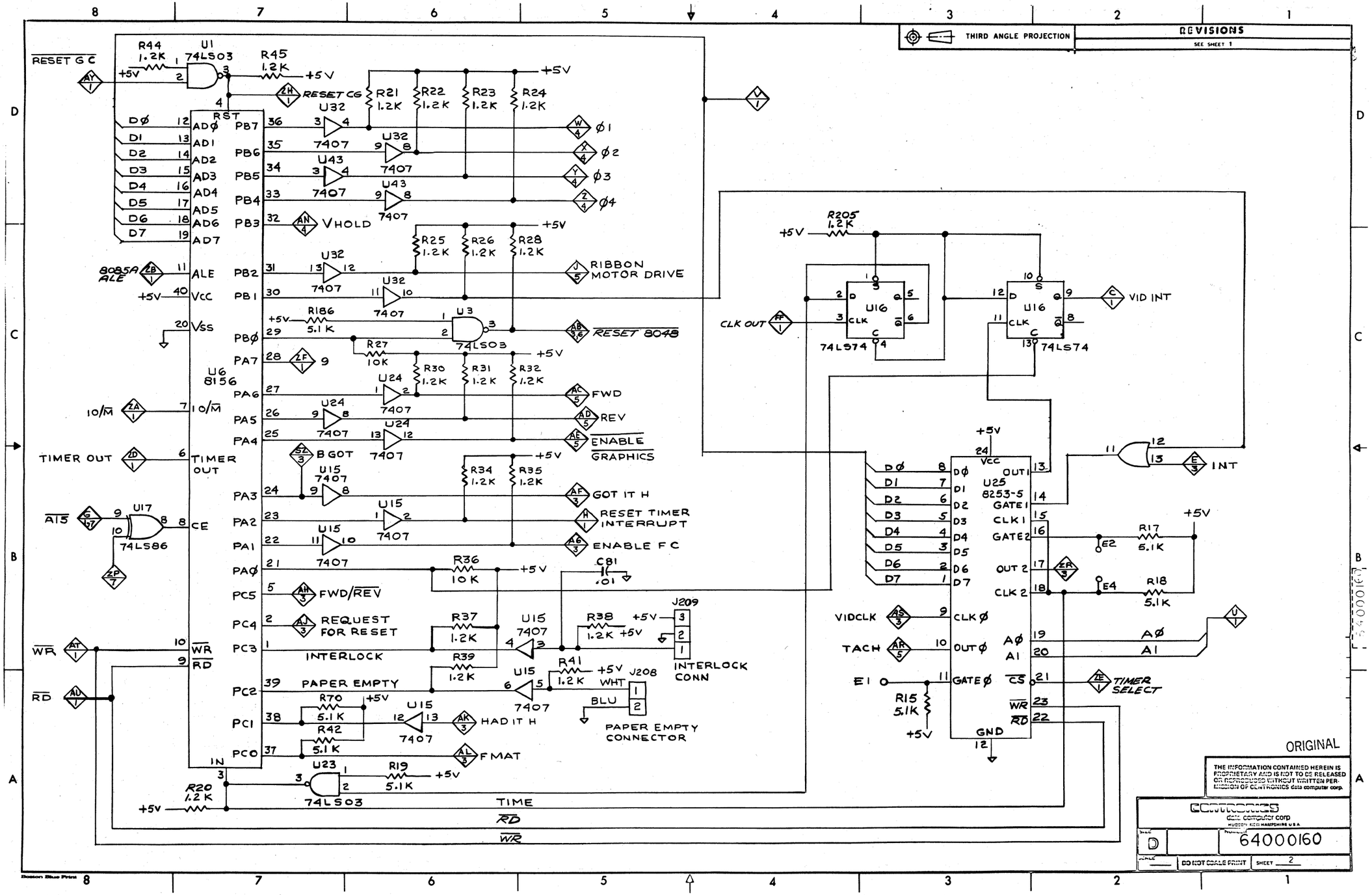


Figure A-1. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000160-9001 (Sheet 2 of 7)

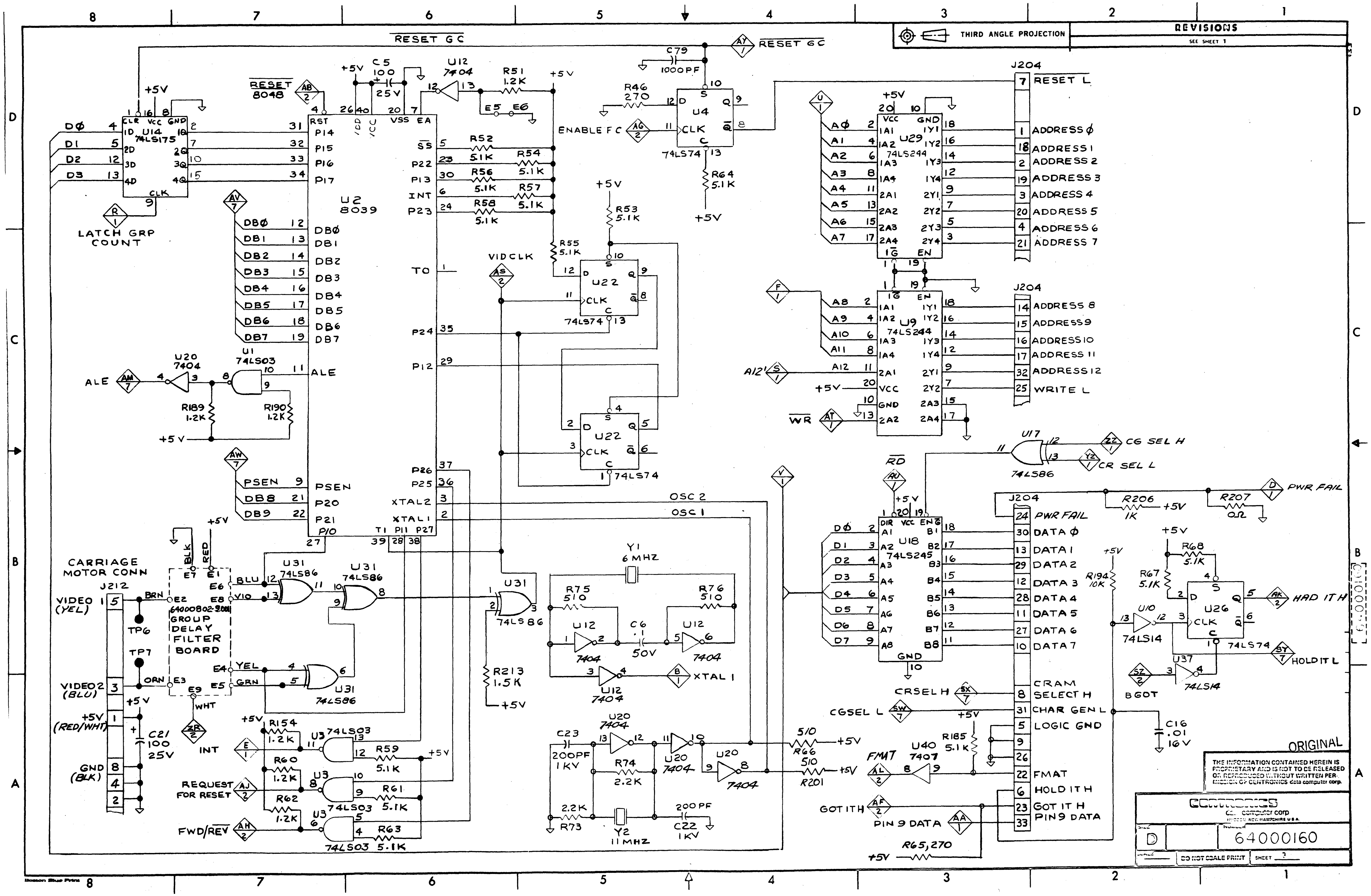


Figure A-1. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000160-9001 (Sheet 3 of 7)

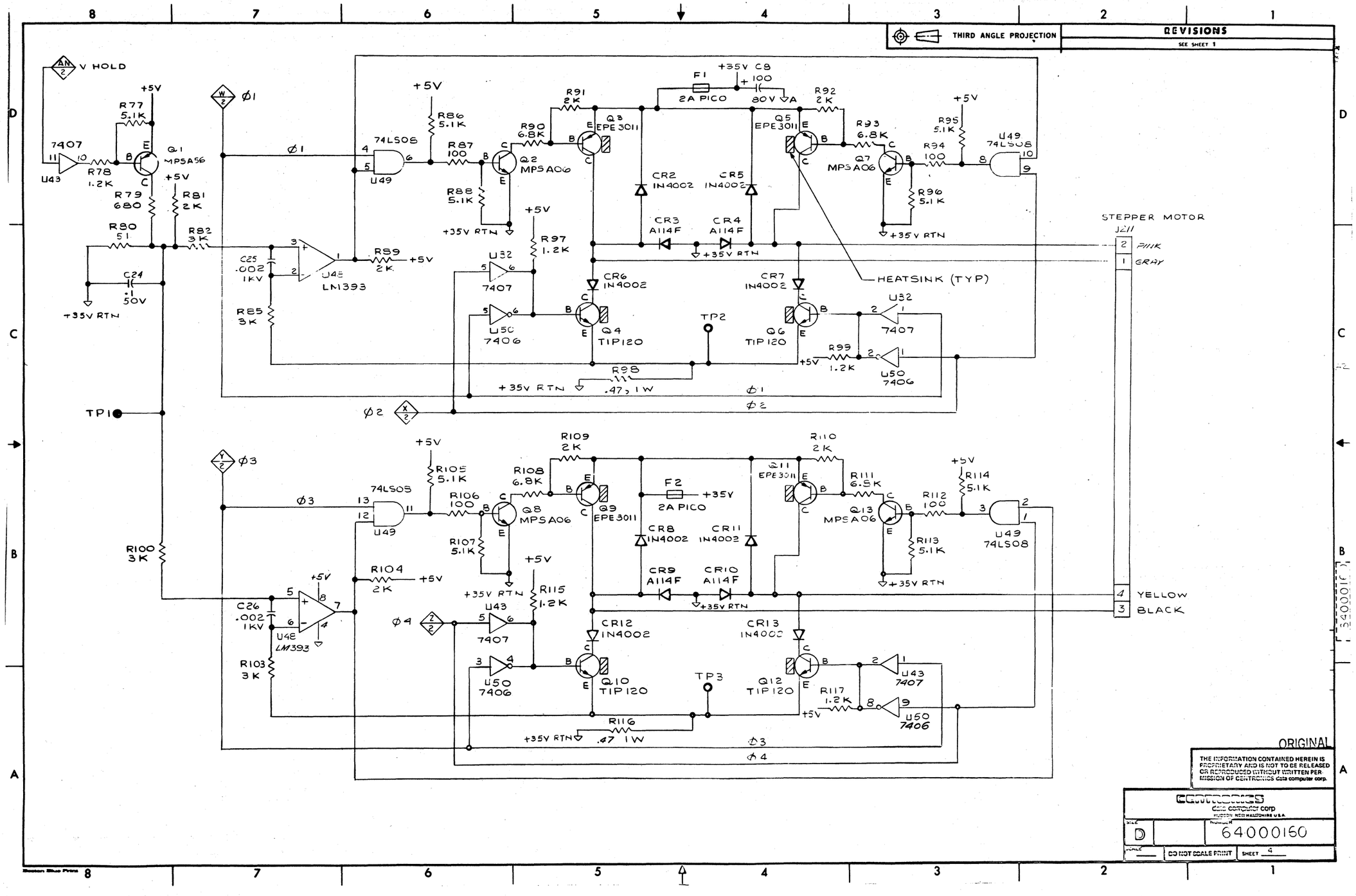


Figure A-1. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000160-9001 (Sheet 4 of 7)

THIRD ANGLE PROJECTION

REVISIONS
SEE SHEET 1

ENABLE GRAPHICS AE 2 — U24 7407 — R118 100K 1% 1/8W — C20 .1 50V

R119 422 1% 1/8W — R120 100K 1% 1/8W — R121 1.1K 1% 1/8W

TP5 — TACH AR 2 — U44 74LS14

R122 150K 1% 1/8W — R123 274K 1% 1/8W — C12 .012 100V 2% — C13 .0012 50V 2%

U47 WA7392

R124 1K 1W — +35V — C86 .1 — CR14 IN4742 — +35V RTN

C11 .22 50V — U30 7407 — +5V — R126 5.1K — R125 240K

U44 74LS14 — REV AD 2

+5V — R127 3.6K — C27 .1 50V — +5V RTN

R129 3K — R191 47K — R192 39K — C28 22PF 1KV

U42 LM393

R130 3K — R144 .47 5W — R128 1K — +35V RTN

R131 2.2K — +5V

TP4

U45 74LS21 — U46 74LS86 — U45 74LS21

R132 5.1K — R135 5.1K — R133 100 — R134 5.1K — R136 100 — R137 5.1K

Q15 MPSA06 — Q16 MPSA06

F3 3A PICO — +35V — C10 100 80V

R139 2K — R138 6.8K — Q17 EPE3011 — R140 2K — R141 6.8K — Q18 EPE3011

CR15 IN4002 — CR16 IN4002

CR17 A114F — CR20 A114F — J212 RED 7 MOT + BLK 6 MOT -

CR18 A114F — CR19 A114F

U24 7407 — R142 1.2K — Q19 TIP120 — Q20 TIP120 — U24 7407 — R143 1.2K — +5V

+5V — R145 1K — Q14 TIP120 — U30 7407 — RIBBON MOTOR DR J 2

J210 (RED) BLK 1 RED 2 — CR32 IN4002 — +12V — C82 .1 — RIBBON MOTOR CONN

+12 RTN

HEATSINK (TYP)

J212 — C77 .1 50V — R197 5.1K — R203 — R196 9.1K — R202 1% — +12V — R198 1.5K — R199 3.65K — +5V

U11 LM393 — R200 43K — R102 5.1K — ZC 7 DC SERVO TEMP SENSE

9002 ONLY

ORIGINAL

CENTRONICS data computer corp HUDSON NEW HAMPSHIRE U.S.A.

SIZE D — NUMBER 64000160 — SCALE — DO NOT SCALE PRINT — SHEET

Boston Blue Print

Figure A-1. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000160-9001 (Sheet 5 of 7)

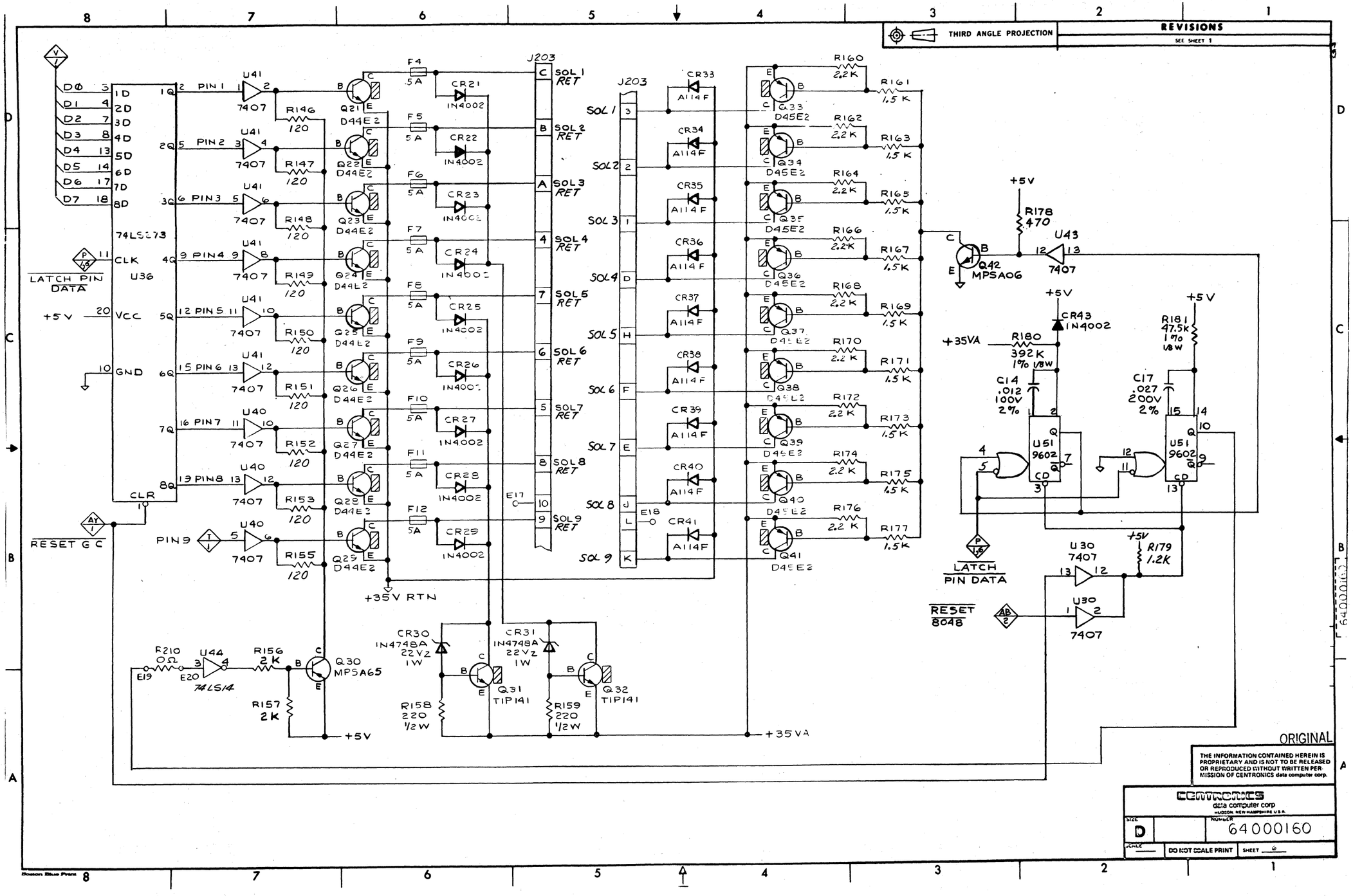


Figure A-1. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000160-9001 (Sheet 6 of 7)

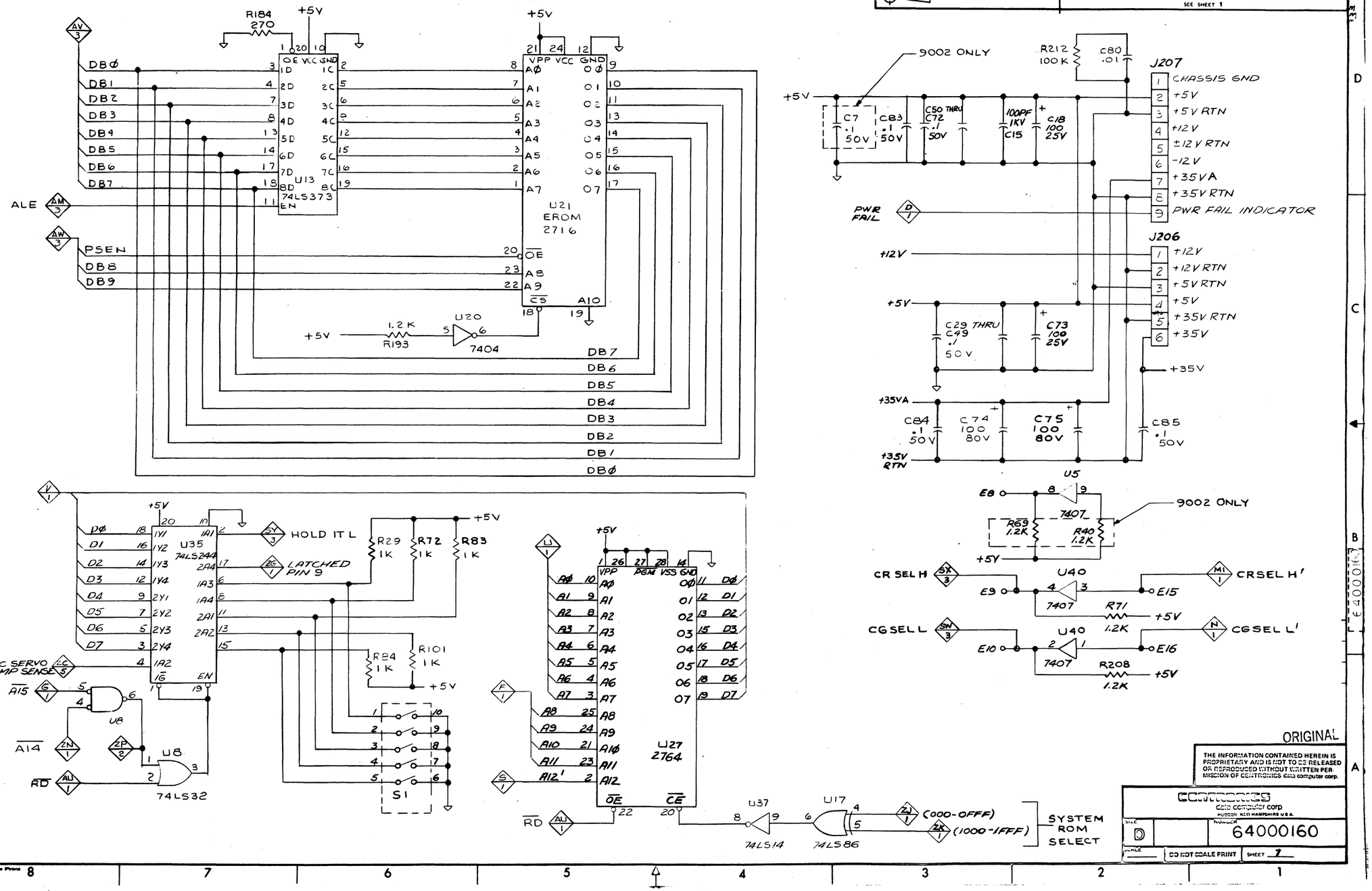


Figure A-1. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000160-9001 (Sheet 7 of 7)

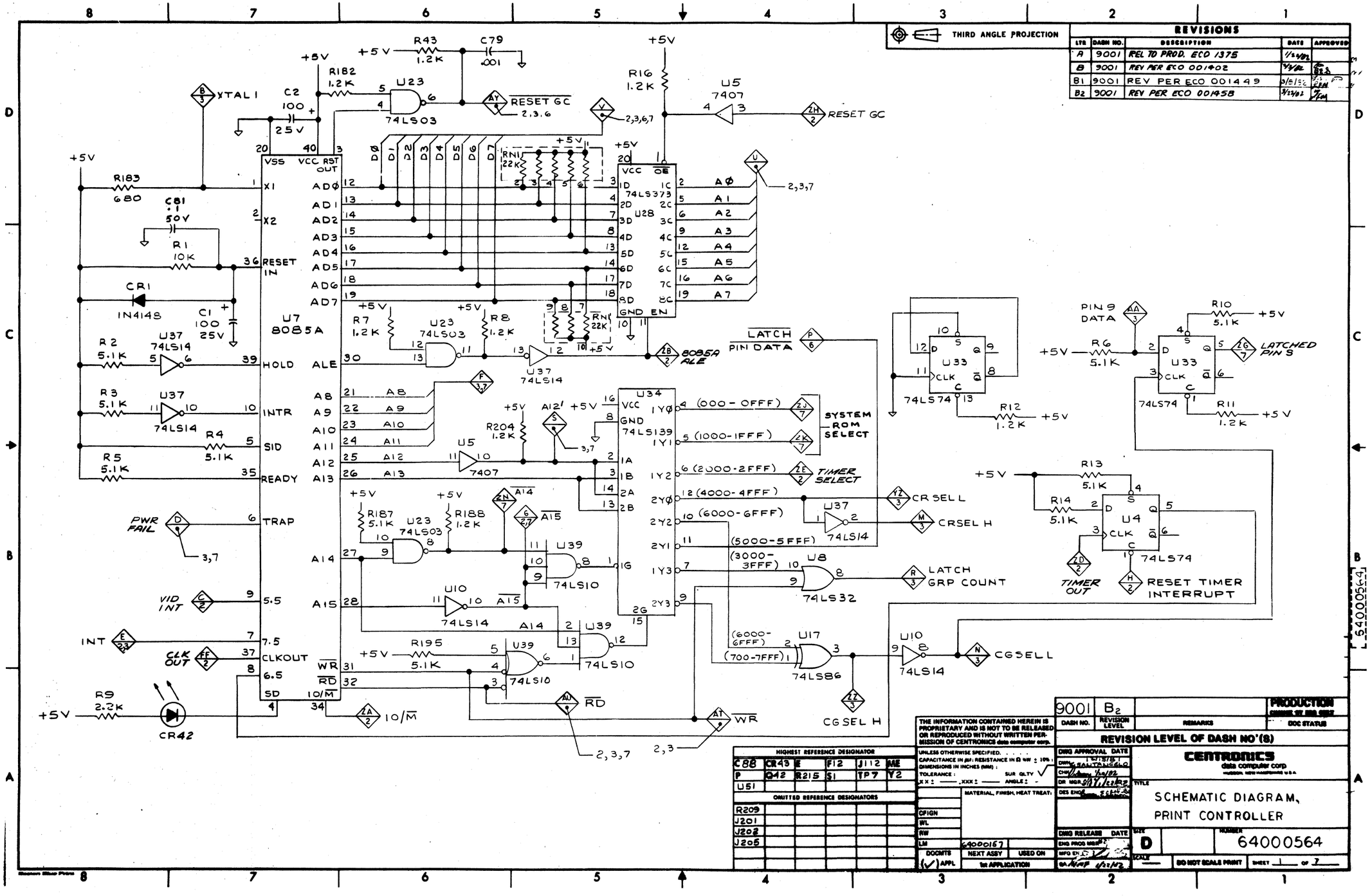


Figure A-2. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000564-9001 (Sheet 1 of 7)

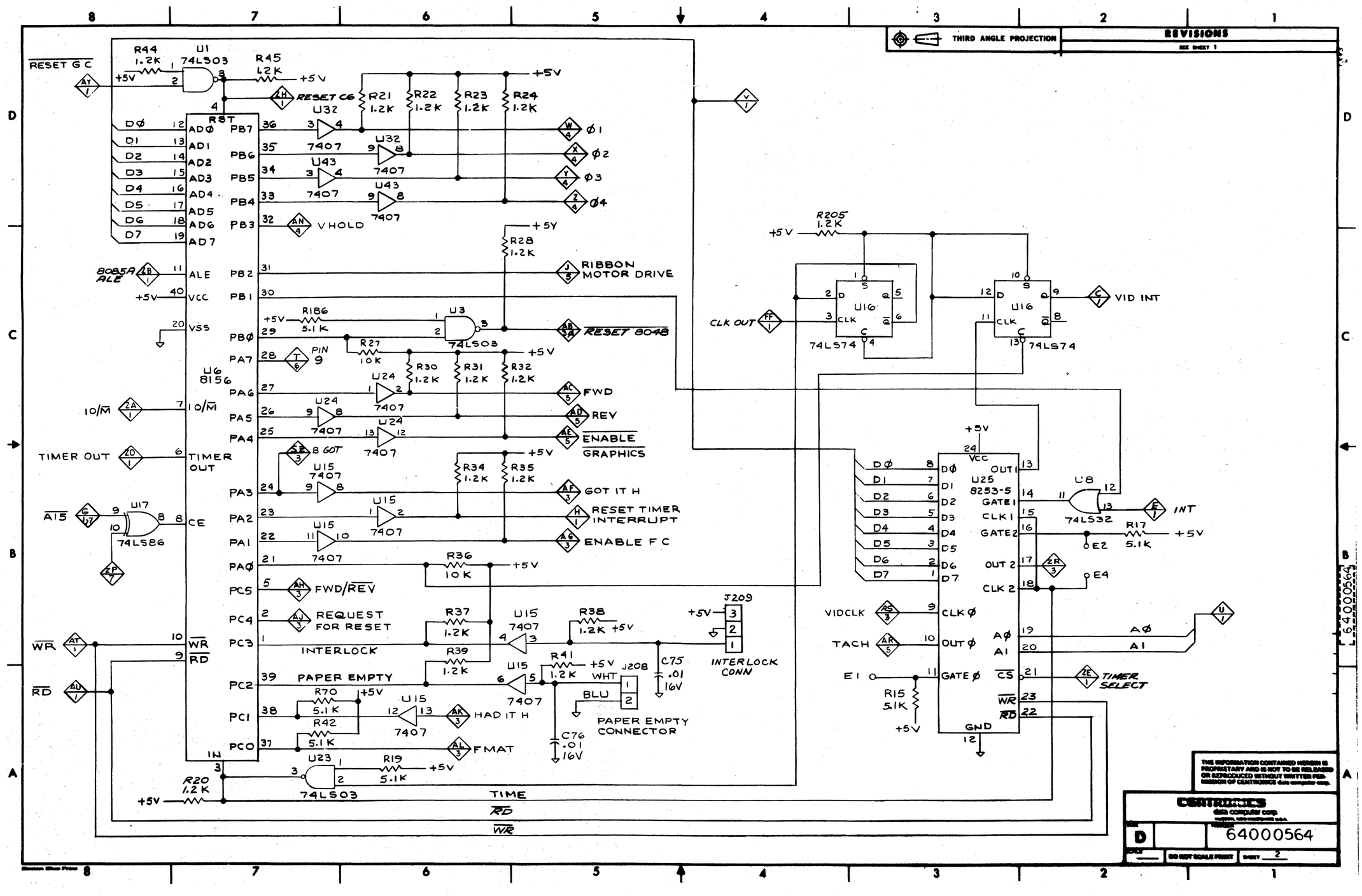


Figure A-2. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000564-9001 (Sheet 2 of 7)

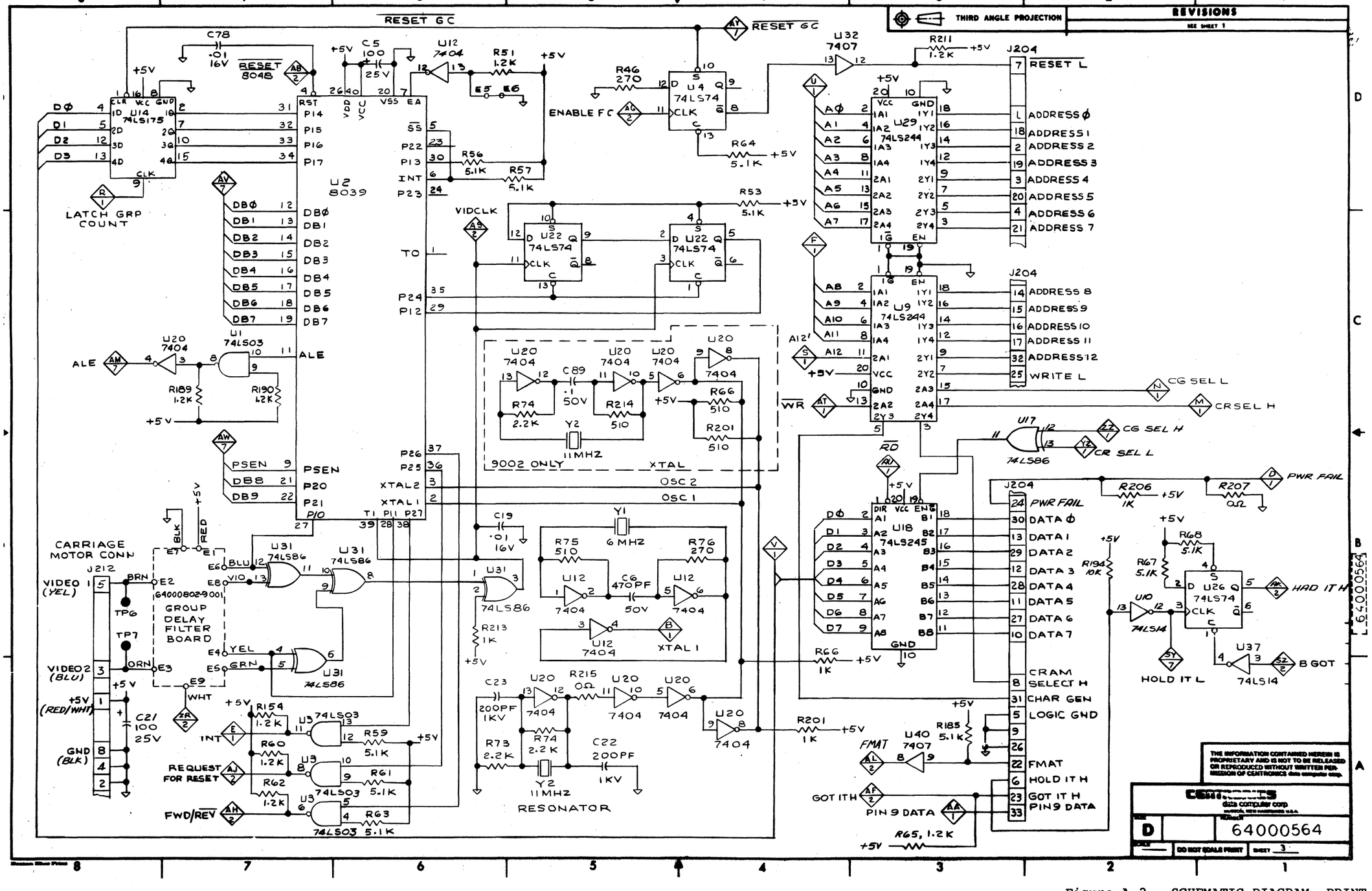


Figure A-2. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000564-9001 (Sheet 3 of 7)

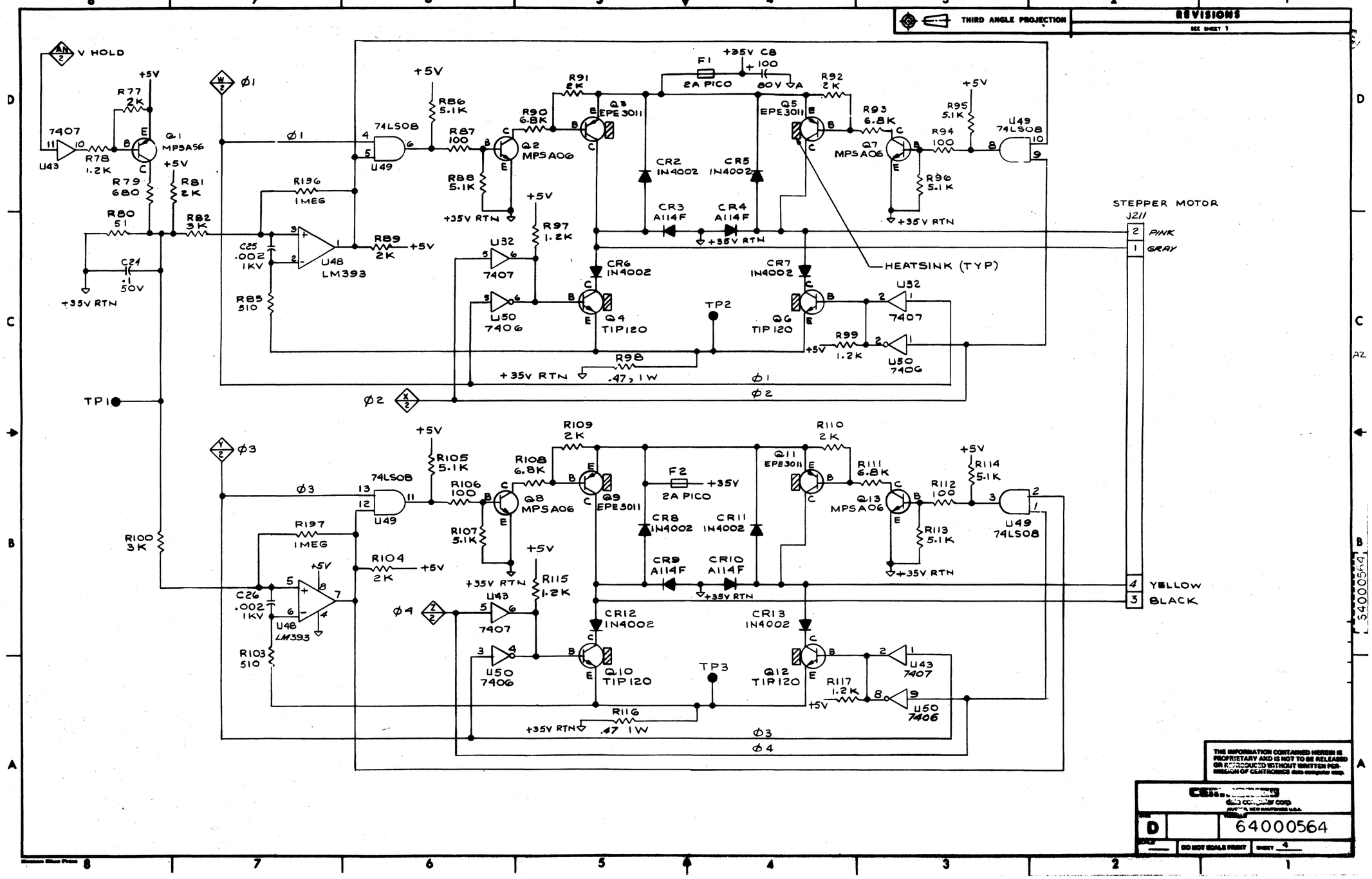


Figure A-2. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000564-9001 (Sheet 4 of 7)

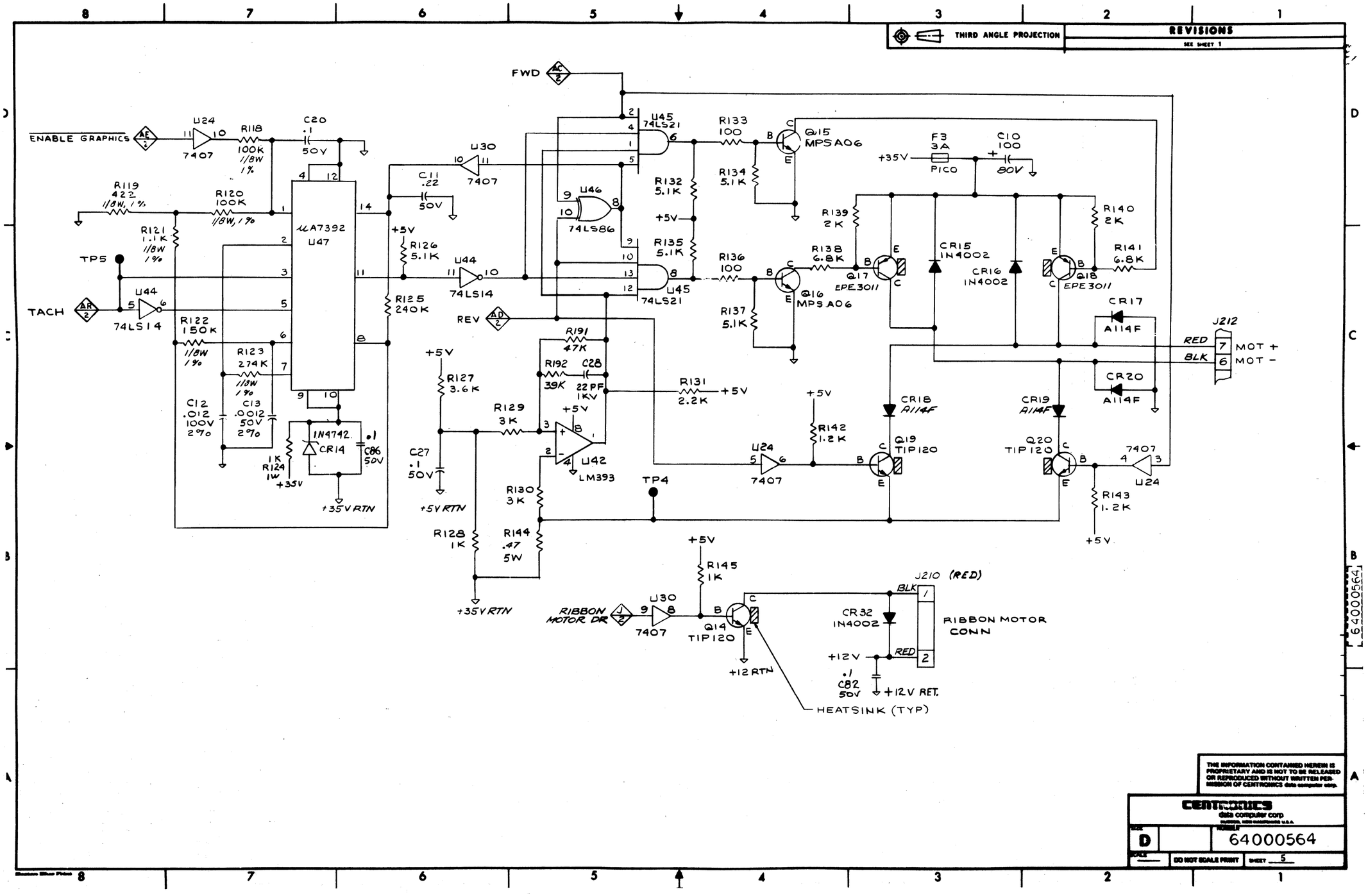


Figure A-2. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000564-9001 (Sheet 5 of 7)

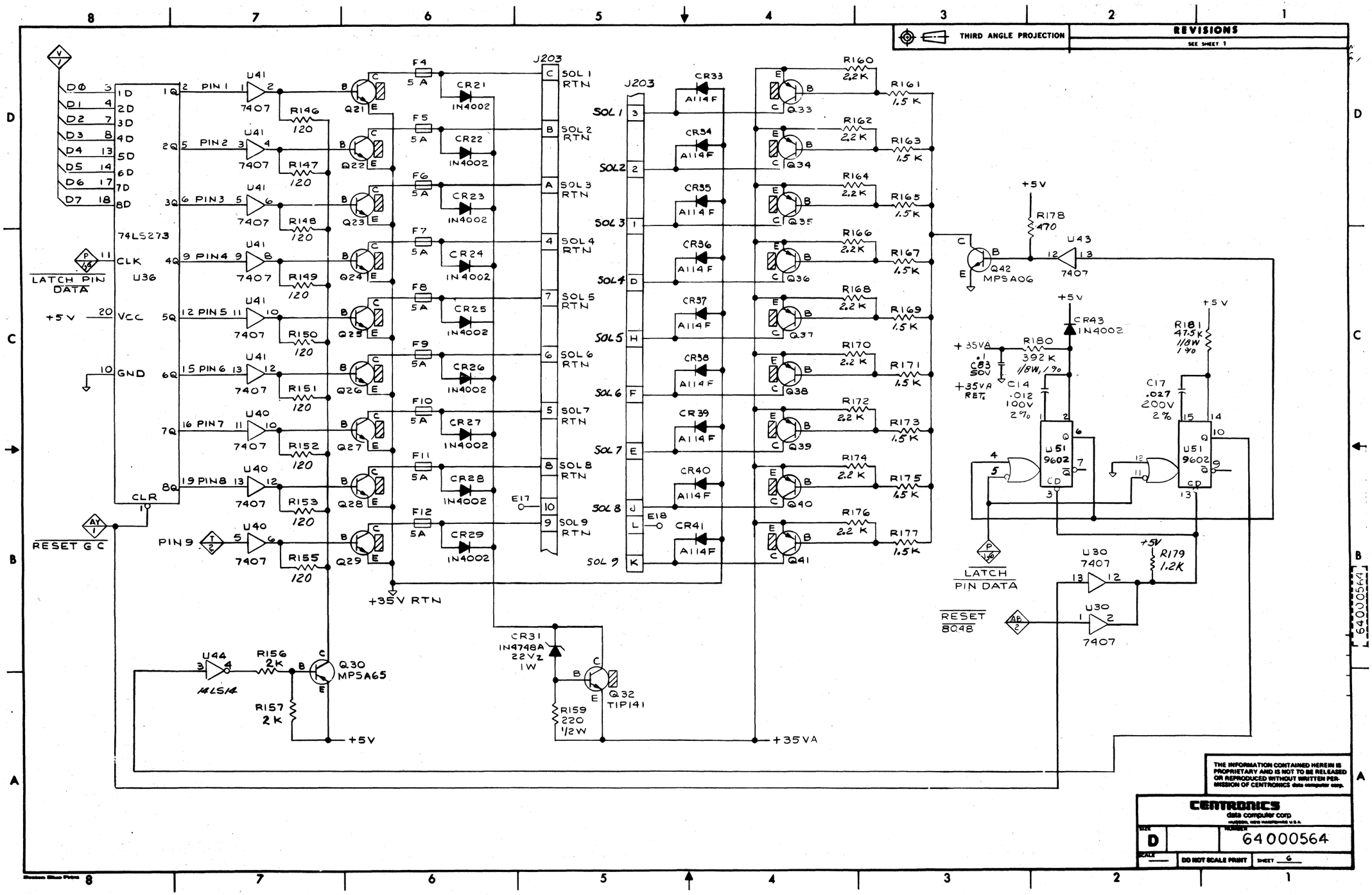


Figure A-2. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000564-9001 (Sheet 6 of 7)

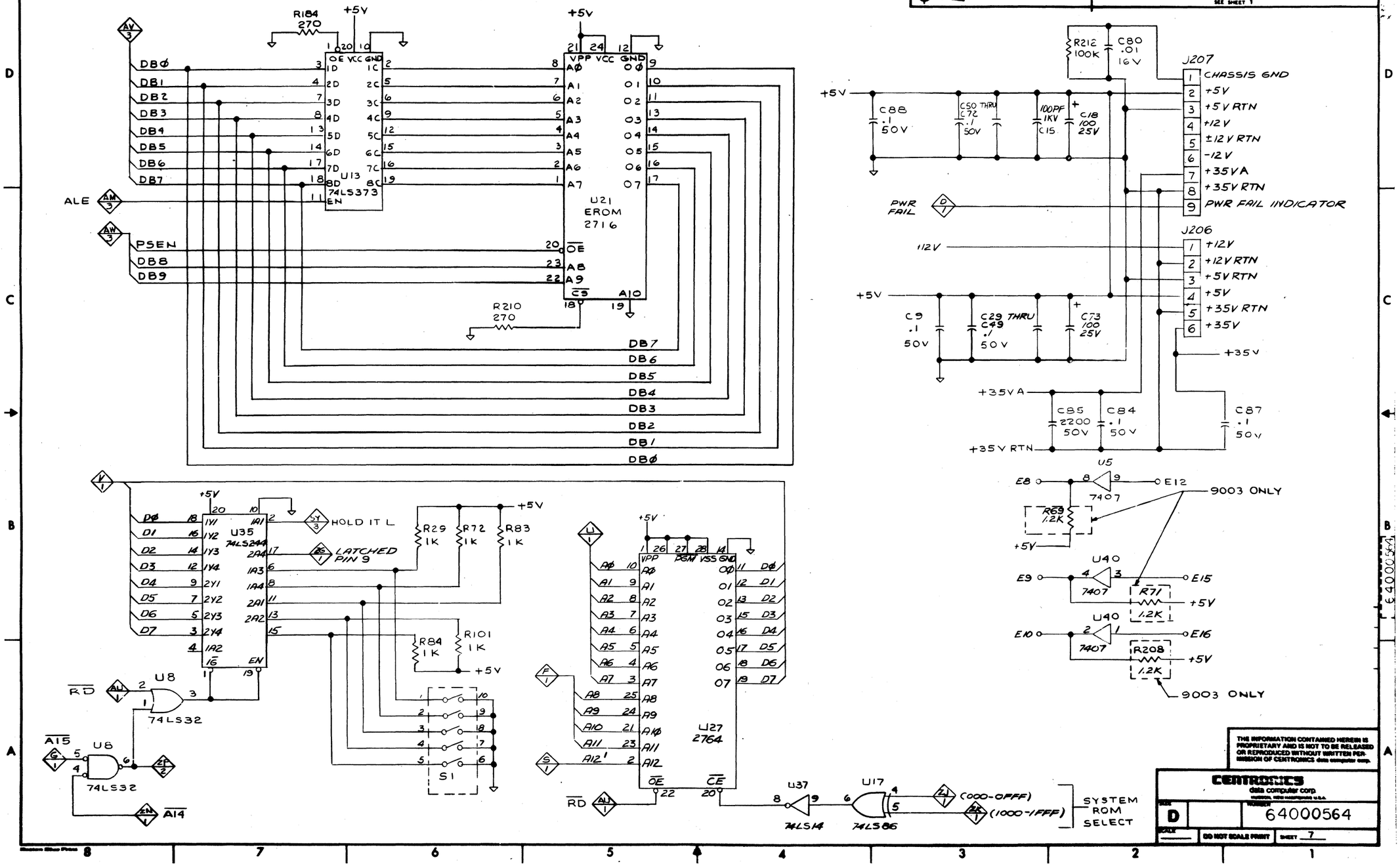


Figure A-2. SCHEMATIC DIAGRAM, PRINT CONTROLLER 64000564-9001 (Sheet 7 of 7)

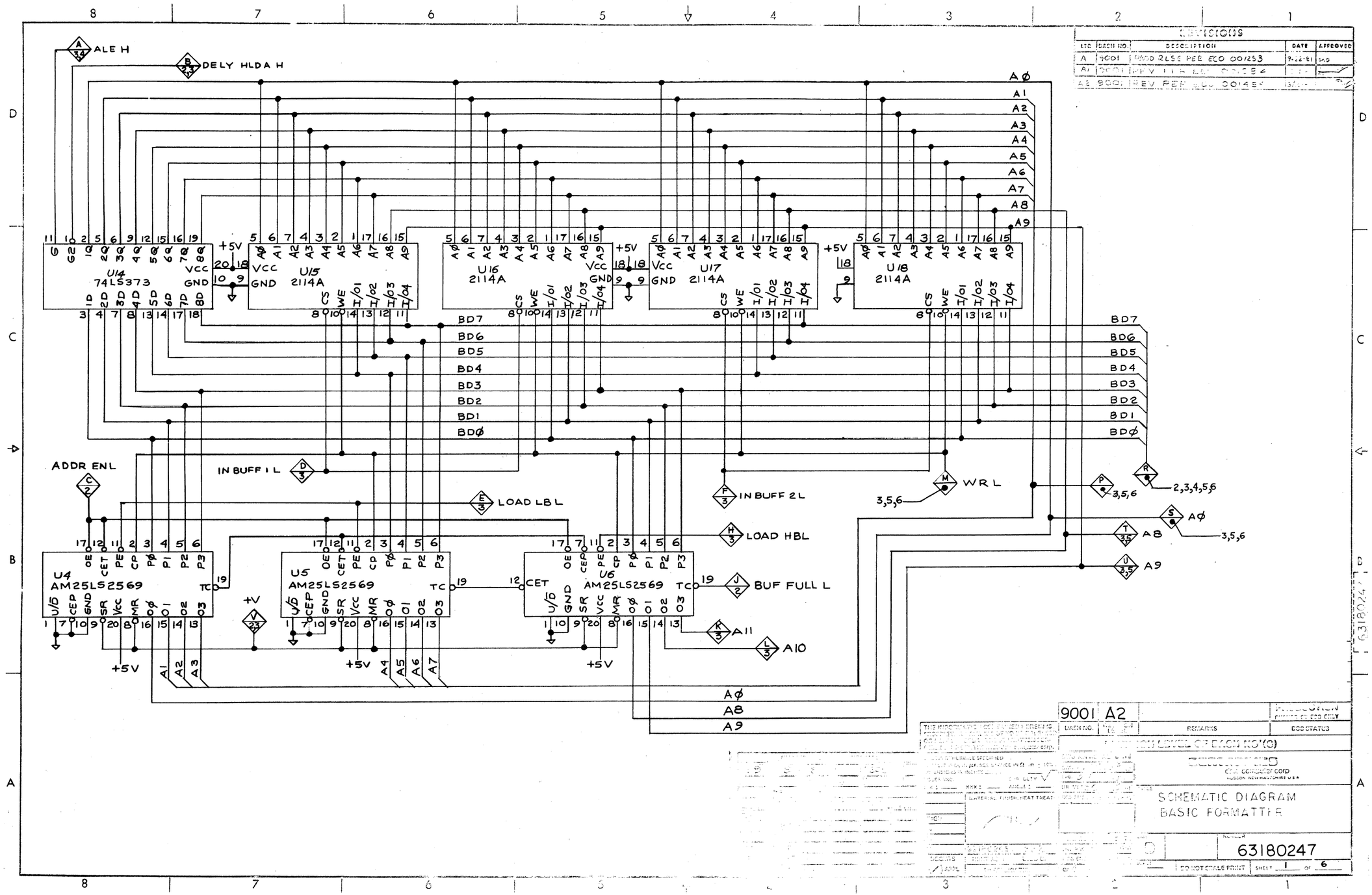


Figure A-3. SCHEMATIC DIAGRAM, FORMAT CONTROLLER 64180247-9001 (Sheet 1 of 6)

Figure A-3. SCHEMATIC DIAGRAM, FORMAT CONTROLLER 63180247-9001 (Sheet 2 of 6)

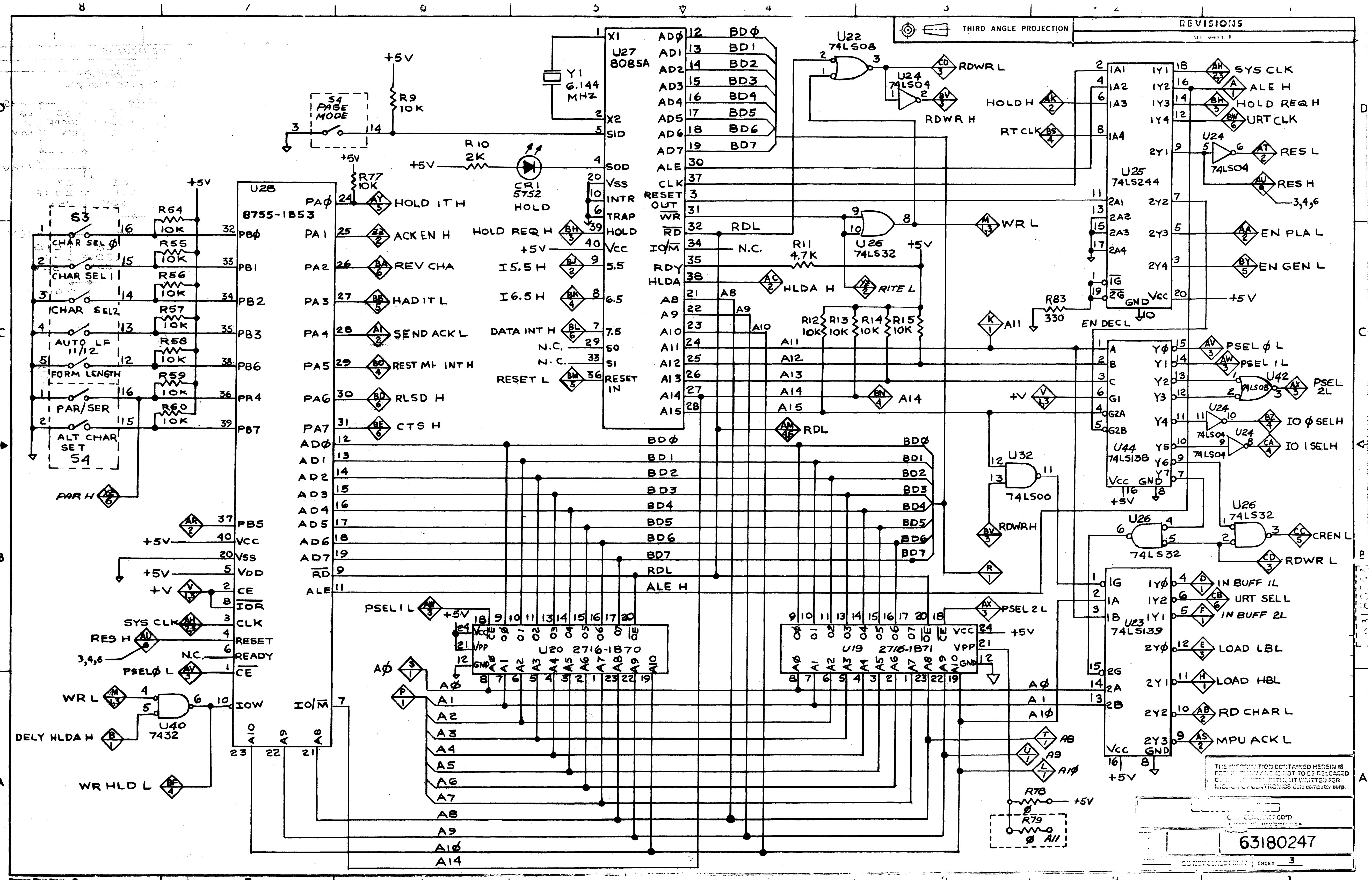


Figure A-3. SCHEMATIC DIAGRAM, FORMAT CONTROLLER
63180247-9001 (Sheet 3 of 6)

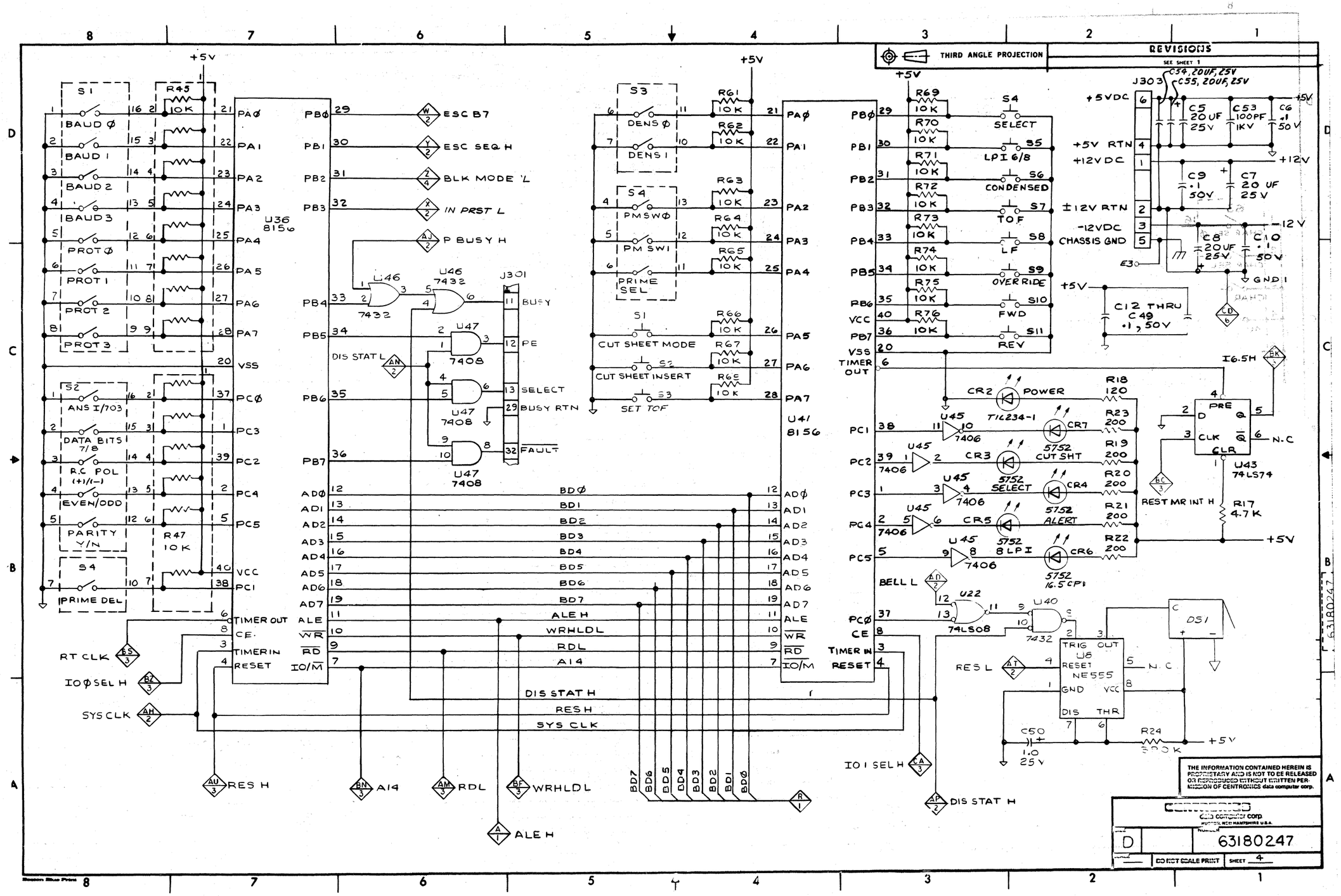


Figure A-3. SCHEMATIC DIAGRAM, FORMAT CONTROLLER 63180247-9001 (Sheet 4 of 6)

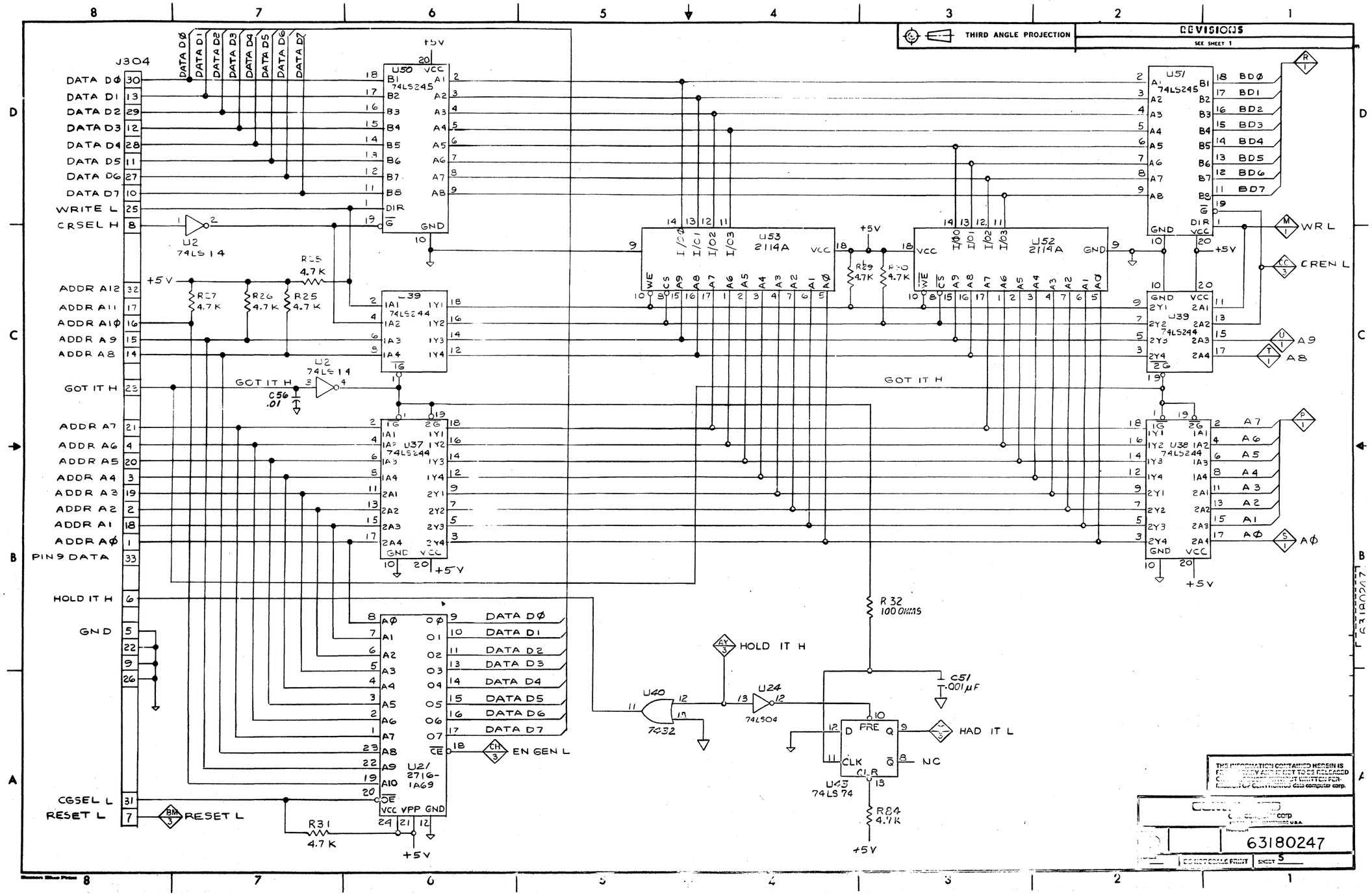


Figure A-3. SCHEMATIC DIAGRAM, FORMAT CONTROLLER 63180247-9001 (Sheet 5 of 6)

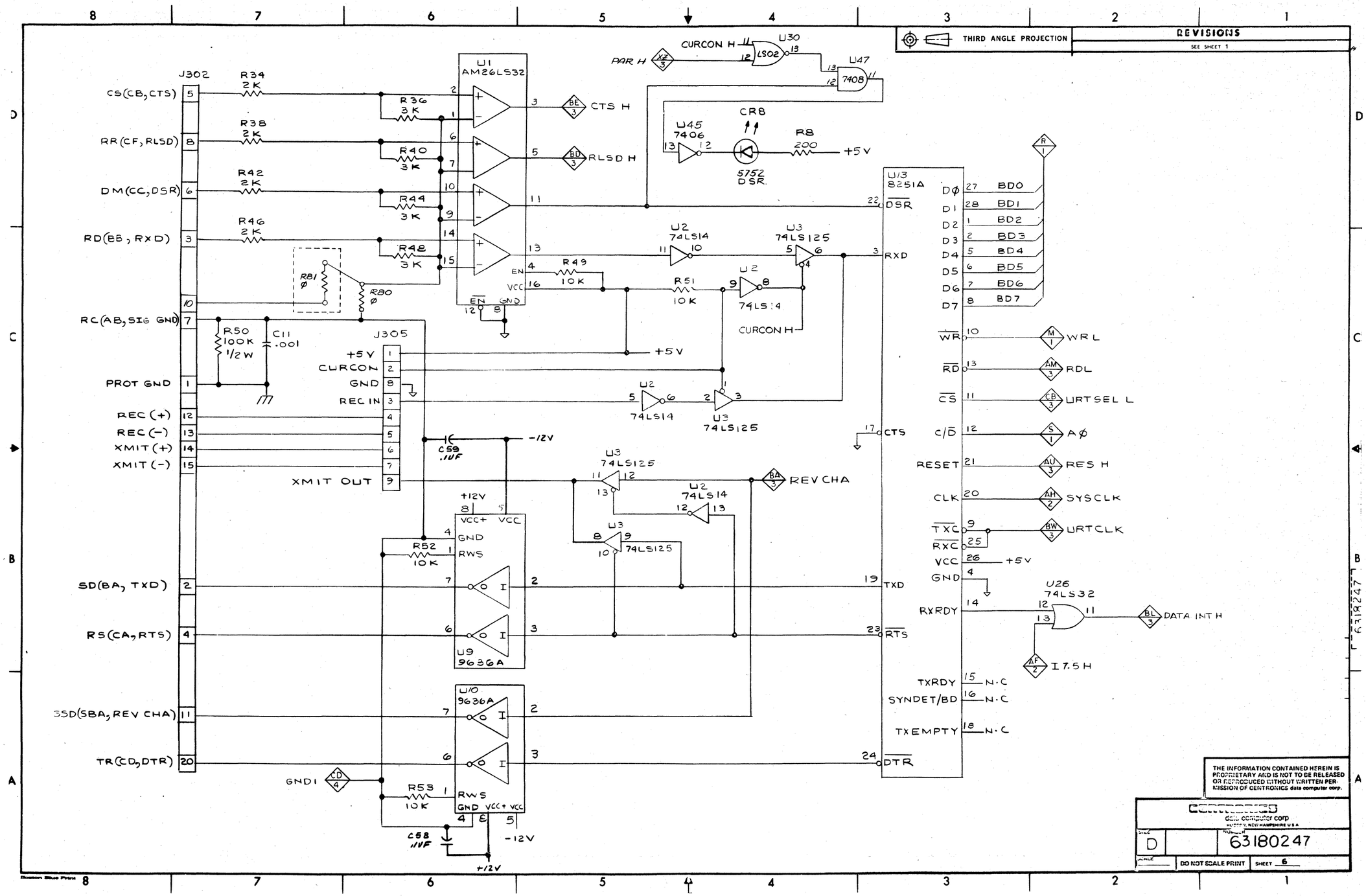


Figure A-3. SCHEMATIC DIAGRAM, FORMAT CONTROLLER 63180247-9001 (Sheet 6 of 6)

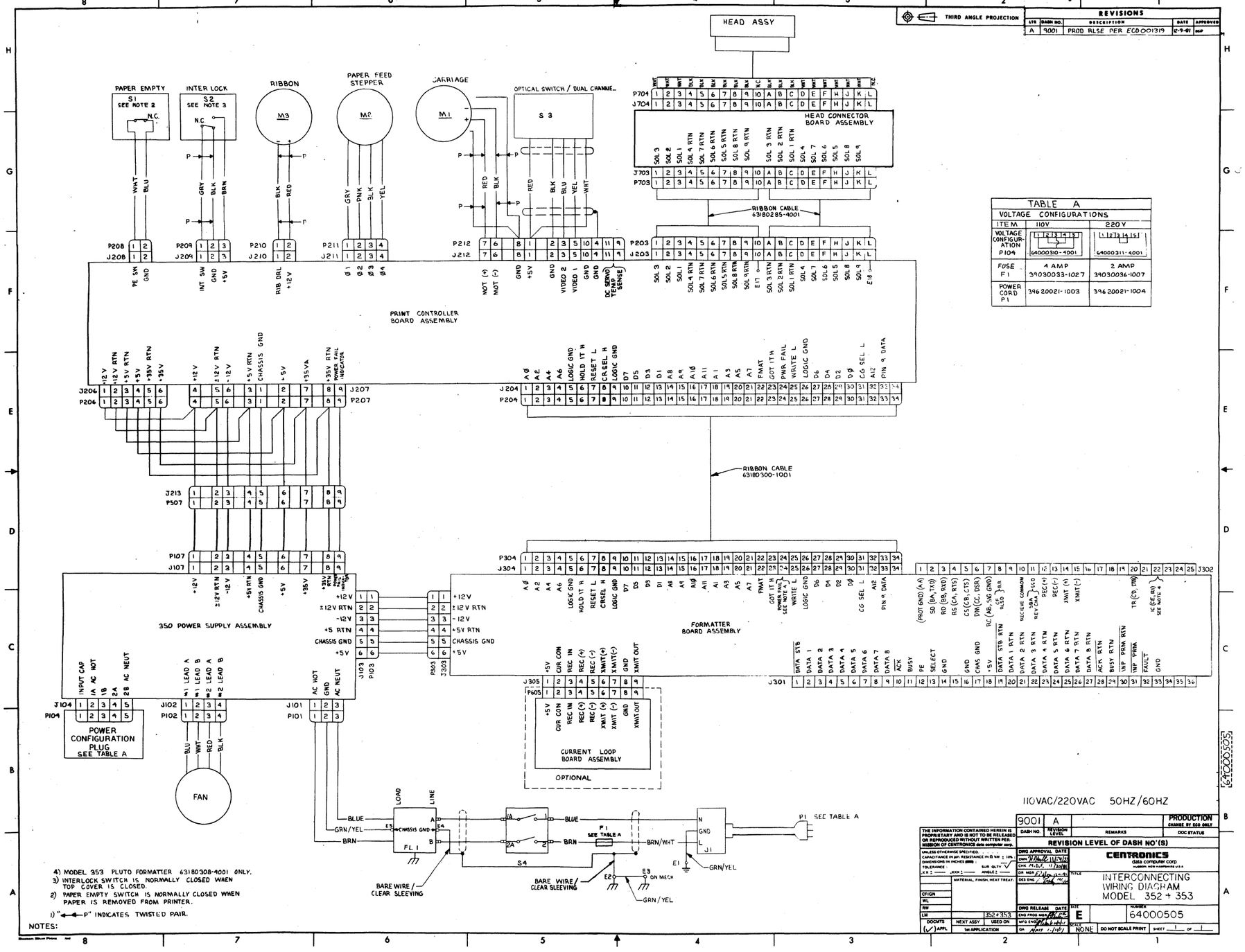


TABLE A		
VOLTAGE CONFIGURATIONS		
ITEM	110V	220V
VOLTAGE CONFIGURATION P104	64000310-4001	64000311-4001
FUSE F1	4 AMP 39030033-1027	2 AMP 39030036-1007
POWER CORD P1	396 20021-1003	396 20021-1004

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.
4) MODEL 353 PLUTO FORMATTER 63180308-4001 ONLY.

THIRD ANGLE PROJECTION

REVISIONS				
LTR	DASH NO.	DESCRIPTION	DATE	APPROVED
A	9001	PROD RLSE PER ECO001319	12-9-91	MP

9001	A		PRODUCTION CHANGE BY ECO ONLY
DASH NO.	REVISION LEVEL	REMARKS	DOC STATUS

REVISION LEVEL OF DASH NO'(S)

THE INFORMATION CONTAINED HEREIN IS PROPRIETARY AND IS NOT TO BE RELEASED OR REPRODUCED WITHOUT WRITTEN PER. MISSION OF CENTRONICS data computer corp.

UNLESS OTHERWISE SPECIFIED. CAPACITANCE IN pF. RESISTANCE IN Ω MF = 10% DIMENSIONS IN INCHES [MM] : TOLERANCE : .XX ± ——— .XXX ± ——— ANGLE ± ———

MATERIAL, FINISH, HEAT TREAT

CFIGN		
WL		
RW		
LM	352+353	
DOCMTS	NEXT ASSY	USED ON
APPL	1st APPLICATION	

DWG APPROVAL DATE
DWN 11/6/91
CHK 11/6/91
QA NOT APPLICABLE
DES ENG

DWG RELEASE DATE
ENG PROG MGR
MFG ENG
QA NOT APPLICABLE

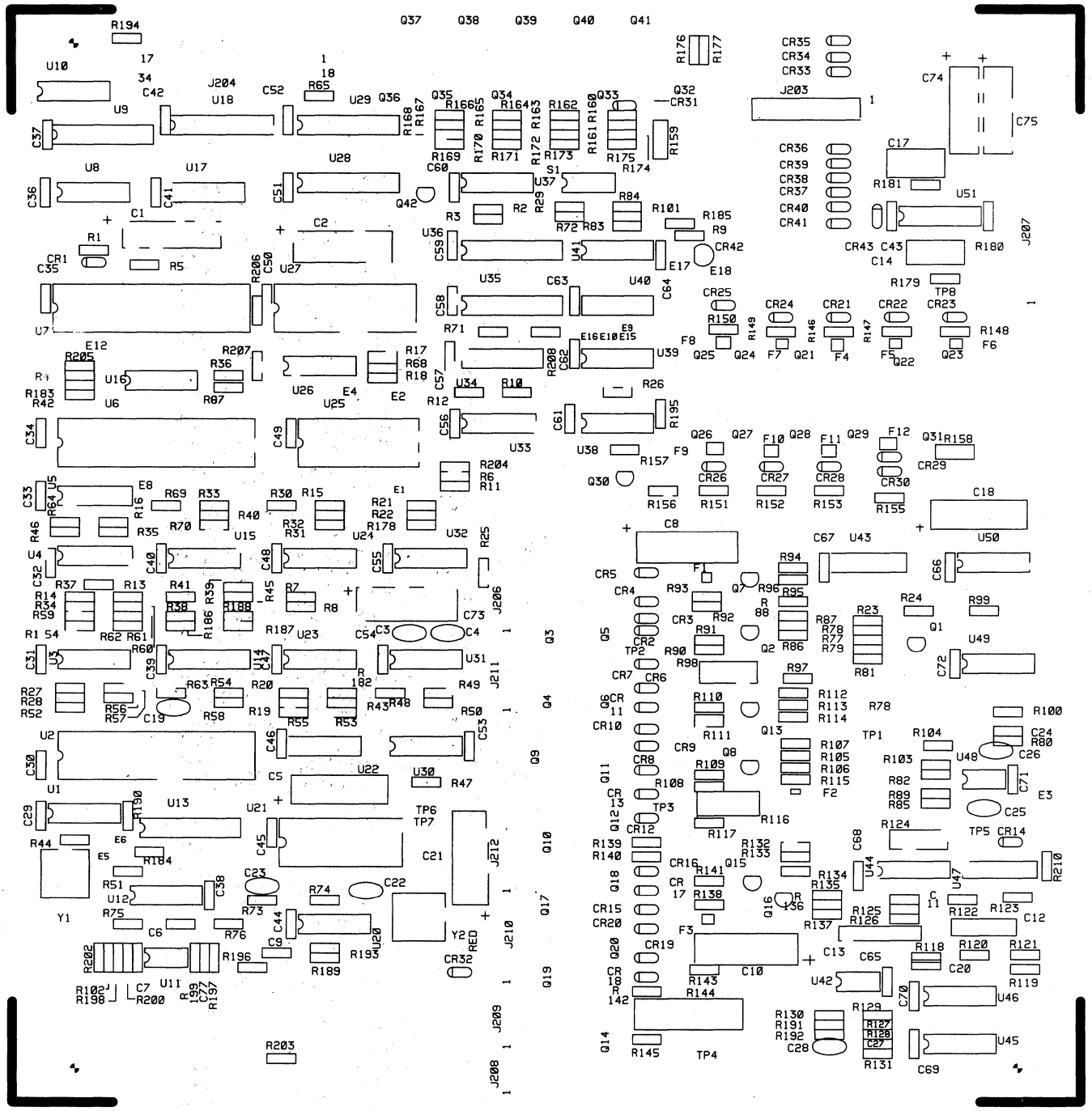
CENTRONICS data computer corp. hudson, new hampshire u.s.a.

TITLE: INTERCONNECTING WIRING DIAGRAM MODEL 352 + 353

SIZE E | NUMBER 64000505 | SCALE NONE | DO NOT SCALE PRINT | SHEET 1 OF 1

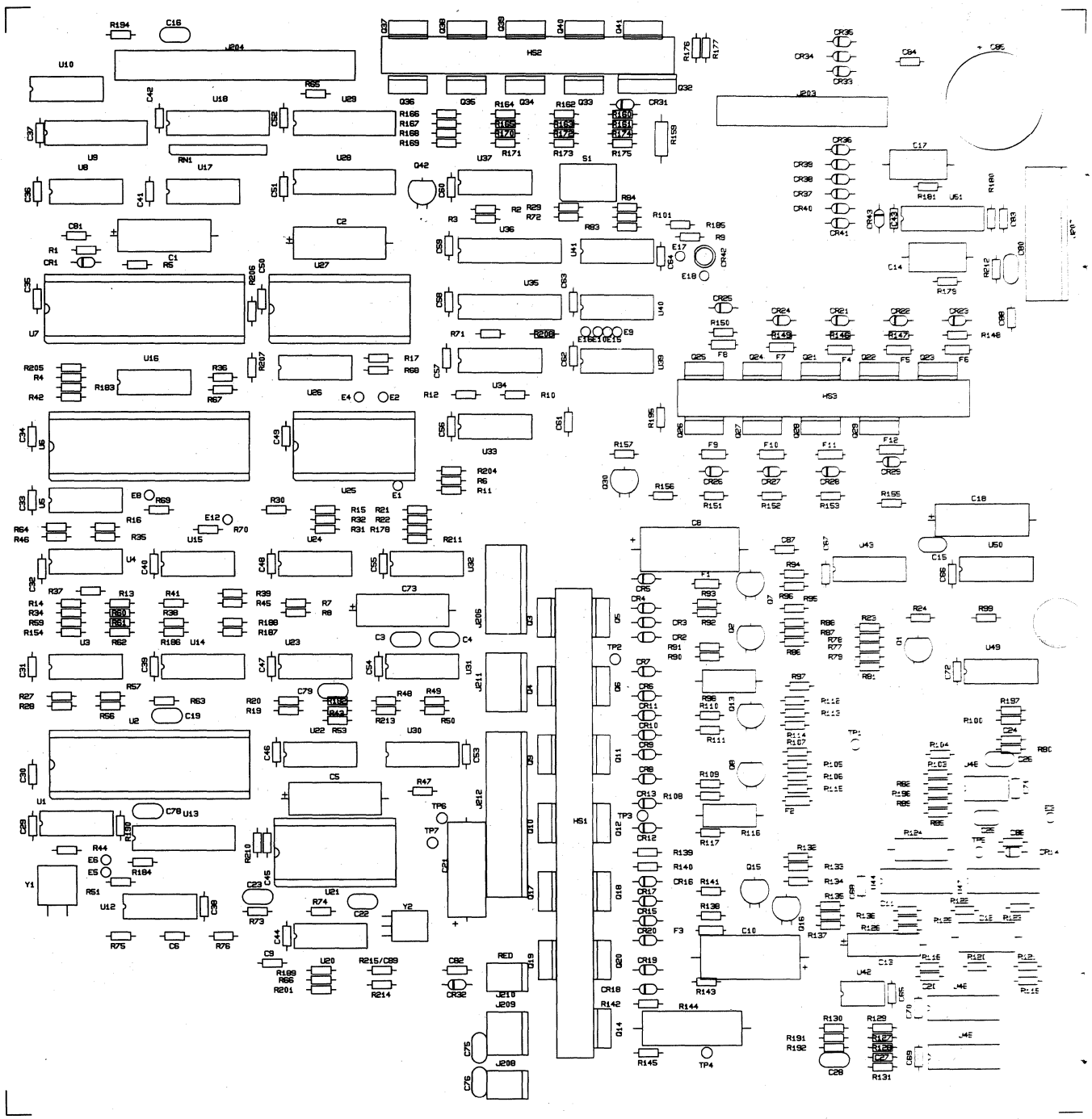
64000505

Figure A-4. WIRING DIAGRAM, MODEL 352



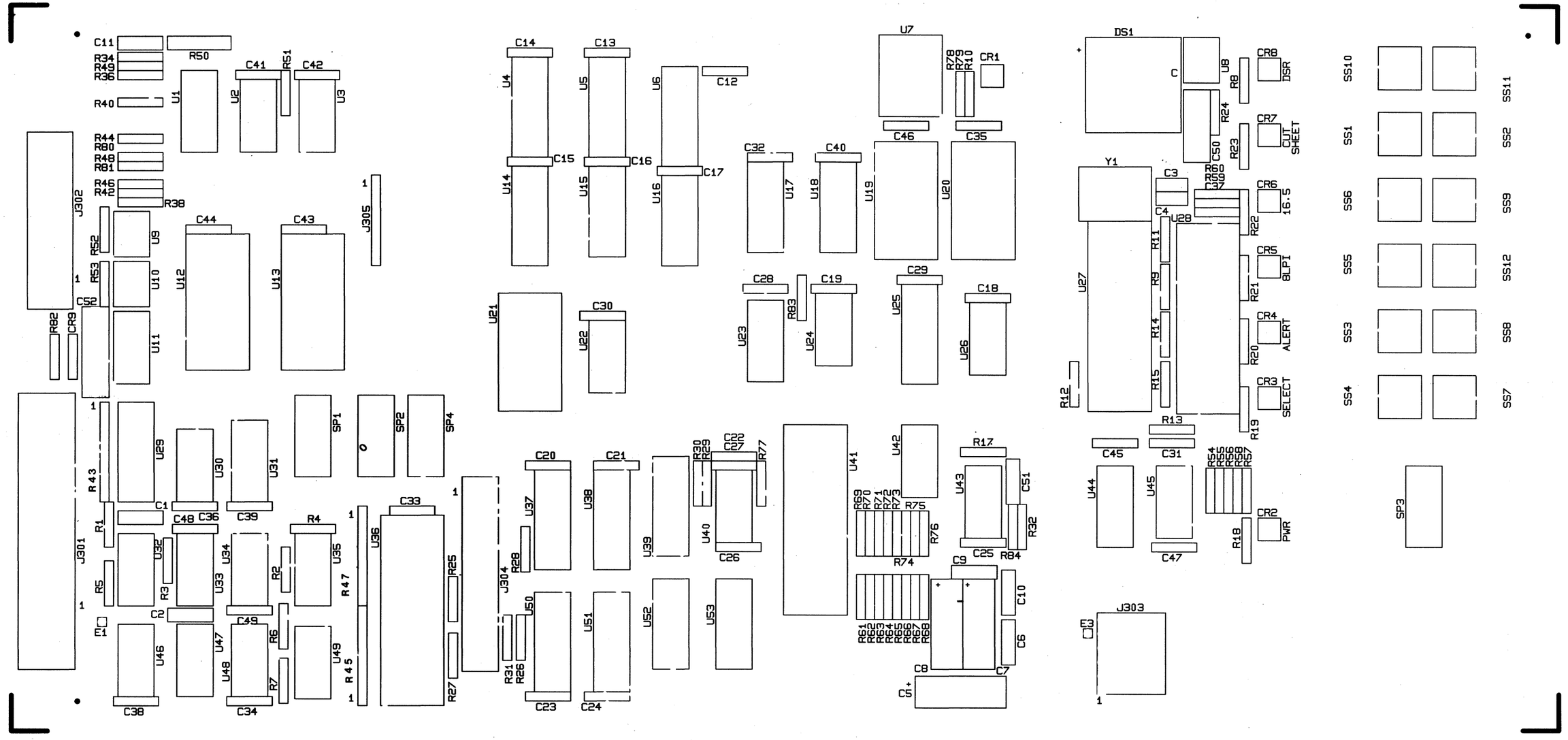
SILKSCREEN NO 64000160-2001 REV B

Figure A-5. ASSEMBLY DIAGRAM, PRINT CONTROLLER (64000160-8001)



AW NO 64000564-2001 REV **B**

Figure A-6. ASSEMBLY DIAGRAM, PRINT CONTROLLER 64000564-8001



SILKSCREEN 63180247-2001 REV A

Figure A-7. ASSEMBLY DIAGRAM, FORMAT CONTROLLER 63180247-8001

APPENDIX B
INTERFACE INFORMATION

B.1 GENERAL INFORMATION

The printer is connected to the input device, via the input cable, for either parallel or serial data input. In the right rear of the printer, the Format Controller p.c. board 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.

B.2 PARALLEL INTERFACE CONNECTION

The following table provides the pin-outs of 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
DATA STROBE	1, 19	INPUT DEVICE	A 1.0 usec pulse (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	"	
ACKNOWLEDGE	10, 28	PRINTER	Acknowledge pulse indicates the input of a character into memory or the end of a functional operation.
BUSY	11, 29	PRINTER	A level indicating that the printer cannot receive data. Also indicates a paper empty or fault condition.

Table B-1. Parallel Interface Connection
(cont'd)

SIGNAL NAME	INTERFACE CONNECTOR	SOURCE	DESCRIPTION
PE	12	PRINTER	A level indicating that the printer is out of paper.
SLCT	13	PRINTER	A level indicating that the printer is selected and ready to receive data.
±OV	14	PRINTER	SIGNAL GROUND
NOT USED	15		
±OV	16	PRINTER	SIGNAL GROUND
CHASSIS GROUND	17	PRINTER	FRAME GROUND
+5V	18	PRINTER	+5 Volt power bus.
$\overline{\text{INPUT PRIME}}$	31, 30	INPUT DEVICE	A level which clears the printer buffer and initializes the logic.
$\overline{\text{FAULT}}$	32	PRINTER	A level that indicates a printer fault condition such as paper empty.

NOTES 1. Second pin number indicates twisted pair return ±OV.

2. Active low signals are specified by a "bar" over the signal name.

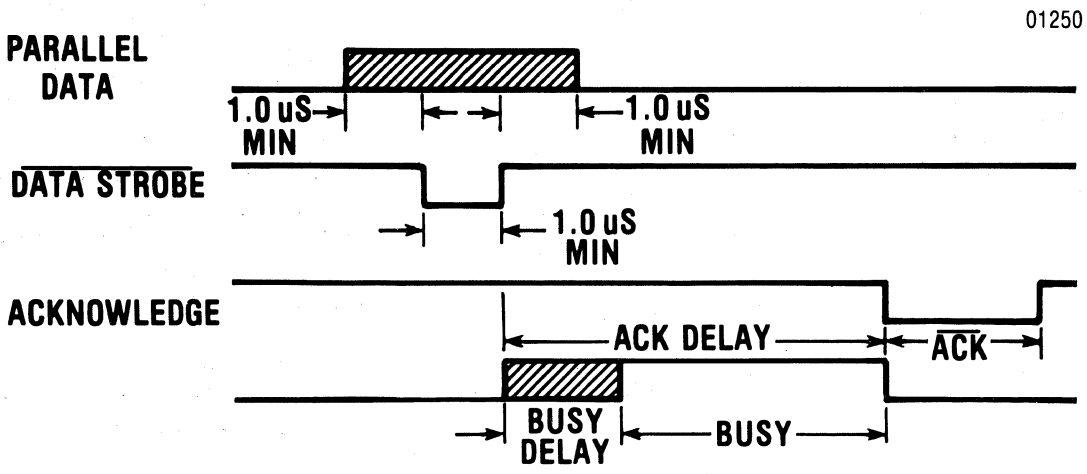


Figure B-1. NORMAL AND BUSY TIMING, PARALLEL INTERFACE

B.3 SERIAL INTERFACE CONNECTION

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/FUNCTION
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~~ PRINTER	Request to Send: This line is at +V when in the X-ON/X-OFF mode.
5	CB	~~Printer~~ DATA SET	Clear to Send: A +V enables 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 printer interface to receive data from data set.
7	AB	Printer	Signal Ground
8	CF	Data Set	Carrier Detect: A +V will allow transmitted data to be accepted by the Format Controller. 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.

Table B-2. Serial Interface Connection (cont'd)

PIN	EIA SIGNAL NAME	SOURCE	DESCRIPTION/FUNCTION
14	XMTLOP(+)	Printer	Transmit Loop (+): Transmit loop printer status (BUSY) signal.
15	XMTLOP(-)	Printer	Transmit Loop (-): Transmit loop return.

B.4 INTERFACE CONNECTOR LOCATIONS AND INTERFACE CABLES

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

01226

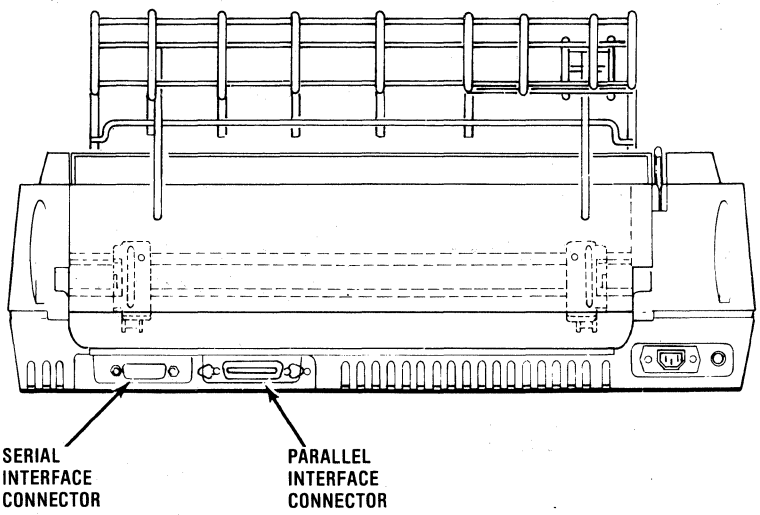


Figure B-2. PARALLEL AND SERIAL INTERFACE CONNECTOR

Table B-3. Interface Cables

CABLE DESCRIPTION	INTERFACE
36 Pin Parallel Interface Input Cable, Male to Male, 15 Ft.	Parallel
RS-232C Input Cable, Male to Male, 10 Ft.	Serial
RS-232C Shielded Input Cable (FCC Compliance) Male to Male, 10 Ft.	Serial
20 MA, Current Loop Interface Input Cable, Male to 4 Ring Terminals, 10 Ft.	Serial
Compatible Adapter EIA RS-449	Serial

APPENDIX C
CONTROL PANEL SWITCHES AND INDICATORS

C.1 CONTROL PANEL SWITCHES AND INDICATORS

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

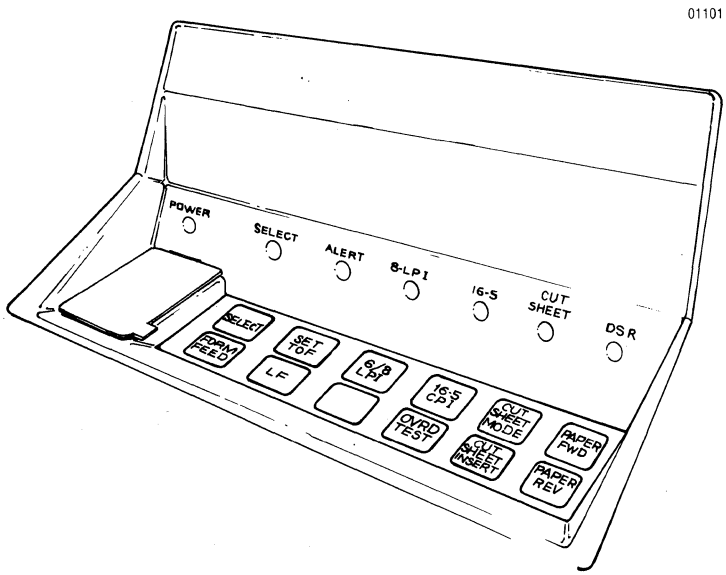


Figure C-1. CONTROL PANEL SWITCHES AND INDICATORS

SWITCH	FUNCTION
SELECT Switch	Selects or deselects the printer as indicated by the SELECT indicator. NOTE When the printer is selected all control panel switches are inhibited, except the SELECT, 6/8 LPI, and 16.5 CPI switches, until the printer is deselected.
SET TOF Switch	Sets the current line (print line) as the top of form. The audio alarm sounds when the SET TOF switch is pressed.
6/8 LPI	Sets the vertical pitch (lines per inch or LPI) to 6 or 8 LPI as indicated by the 8 LPI indicator.
16.5 CPI	Changes the horizontal pitch (characters per inch or CPI) from the current CPI value to 16.5 CPI or from 16.5 CPI to the default value. The change to the new horizontal pitch takes effect at the start of the next line. NOTE The default value is the current horizontal pitch setting on DIP switch S3. (See Section 7).

Figure C-1. CONTROL PANEL SWITCHES AND INDICATORS (cont'd)

SWITCH	FUNCTION
FORM FEED Switch	Advances the paper to next top of form.
CUT SHEET MODE Switch	Places the printer either in or out of the cut sheet mode as indicated by the CUT SHEET indicator. When the printer is not in the cut sheet mode, the alert indicator reflects the fanfold form status.
PAPER FWD Switch	Advances the paper forward in steps of 1/120 of an inch. If the switch is pressed for longer than 1/2 second, paper moves forward until the switch is released.
PAPER REV Switch	The PAPER REV switch 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 half inch as paper handling problems may occur.
CUT SHEET INSERT Switch	When in the cut sheet mode, pressing the CUT SHEET INSERT switch loads the sheet into the printer.
OVRD TEST Switch	The OVRD TEST switch performs two functions as described below.
OVRD TEST Switch	OVERRIDE FUNCTION - When the printer has automatically deselected on a paper empty condition, holding the OVRD TEST switch depressed and selecting the printer allows the printer to continue printing to the end of the form. TEST FUNCTION - When the printer is deselected and loaded with paper, pressing the OVRD TEST switch activates the self-test feature. Test data is continuously printed as long as the OVRD TEST switch is pressed. Refer to paragraph 3.6 for the self-test procedure.
LF Switch	Advances the paper forward one line. If the switch is pressed for longer than 1/2 second, line feeds are repeated until the switch is released.

Figure C-1. CONTROL PANEL SWITCHES AND INDICATORS (cont'd)

INDICATOR	FUNCTION
	NOTE When any of the following indicators are lit, that particular function is deselected.
POWER Indicator	Indicates power is applied to the printer circuits.
SELECT Indicator	Indicates that the printer is in the SELECT mode. Data can be received only when the printer is selected.
ALERT Indicator	Indicates a paper empty condition. During a fault condition, the ALAERT indicator will blink. The indicator is inhibited when in the CUT SHEET Mode.
8 LPI Indicator	Indicates the vertical pitch is set to 8 lines per inch.
16.5 CPI Indicator	Indicates the horizontal pitch is set to 16.5 characters per inch.
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.

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

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