CENTRONICS
SALES & SERVICE CORPORATION

MICROPRINTER
WARRANTY TERMS

This Product is warranted on a "return-to-factory" basis against defects in workmanship and material under normal and proper use in an unmodified condition for a period of ninety (90) days from date of initial shipment by Centronics. As a condition of this warranty, Customer must (i) obtain a Centronics Printer Return Authorization Number, (ii) ship the Product transportation prepaid, to one of the Centronics repair centers (Hudson, N.H.; Costa Mesa, Calif.; Toronto, Canada; Drogheda, Ireland; London, England; Frankfurt, Germany; Paris, France; or Milan, Italy) designated by Centronics and (iii) include with the returned Product a written description of the claimed defect. Transportation charges for the return of Products hereunder to Customer shall be paid by Centronics within the fifty (50) United States and District of Columbia. The warranty outside this designated area excludes all costs of shipping, customs clearance and other related charges. If Centronics determines that the Product is not defective as herein defined, Customer shall pay all costs of handling, repair and transportation.

Centronics' sole responsibility under the above warranty shall be, at its option, to either repair or replace any Product (or subassembly) which fails during the warranty period due to defects in workmanship and material. All replaced Product (or subassemblies) shall become Centronics property.

This warranty is not transferable.

EXCEPT FOR THE EXPRESS WARRANTIES STATED ABOVE, CENTRONICS DISCLAIMS ALL WARRANTIES ON PRODUCTS INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, and the stated express warranties are in lieu of all obligations or liabilities on the part of CENTRONICS for damages, including but not limited to special, indirect or consequential damages, arising out of or in connection with the use of performance of the Products.

TABLE OF CONTENTS

SECTION 1
INTRODUCTION

SECTION 2
INSTALLATION

SECTION 3
OPERATION

TABLE OF CONTENTS (cont'd)

SECTION 4
THEORY OF OPERATION

SECTION 5
MAINTENANCE

SECTION 6
ADJUSTMENTS

SECTION 7
REMOVAL/REPLACEMENT PROCEDURES

SECTION 8
ELECTRICAL DRAWINGS

SECTION 9
EXPLODED VIEWS AND PARTS LISTS

LIST OF TABLES

LIST OF ILLUSTRATIONS

SECTION 1

INTRODUCTION

1.1 SCOPE

This manual provides depot level information necessary to maintain, repair and troubleshoot the Centronics line of microprinters. Four models are covered as follows:

Suffix	Part No.	Description
P1/115V	63013100-5001	115 VAC, Parallel Input
P1/230V	63013100-5002	230 VAC, Parallel Input
S1/115V	63013100-5003	115 VAC, Serial Input
S1/230V	63013100-5004	230 VAC, Serial Input

For example, a serial printer wired for 115 VAC operation is designated Microprinter S1/115V. An external view of this printer is shown in Figure 1-1.

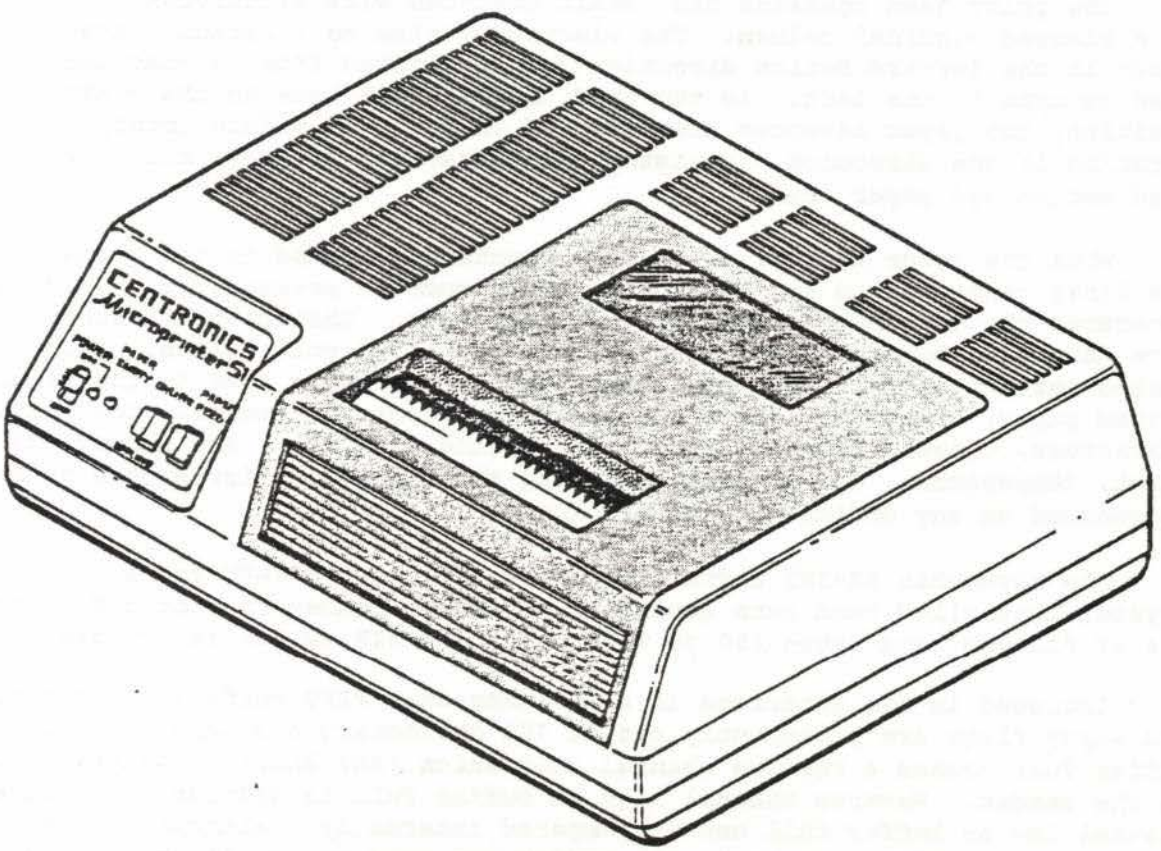


Figure 1-1. MICROPRINTER EXTERNAL VIEW

1.2 DESCRIPTION

Standard features of the non-impact S1 and P1 printers include software selectable printing of 5, 10, or 20 characters per inch, software-controlled underlining, standard 96 USASCII character set for upper and lower case printing, and an out-of-paper buzzer. Both of the quiet, lightweight desk-top units are available for either 115 volt or 230 volt operation. They print 80 character lines at 2.5 lines per second on a standard 4-3/4" aluminized roll of paper.

Some of the microprinter's main characteristics include:

COMPACT SIZE. The printer and two rolls of print paper fit inside a briefcase.

UNCOMPLICATED DESIGN. All logic elements can be purchased from any electronics supply source.

ECONOMICAL OPERATION. Only consumable item is the paper since ribbons and toners are not required.

EFFICIENT OPERATION. Power consumption is less than 40 watts during printing.

The print head contains nine stiff tungsten wire electrodes arranged in a slanted vertical column. The electrodes ride on aluminum-coated paper in the forward motion direction and are lifted from it when the head returns to the left. As the head travels left back to the start position, the paper advances one-fifth of an inch. A single motor, rotating in one direction, initiates all mechanical motion, including head motion and paper feed.

When the motor starts, an address counter is loaded to the address of the first character on the line. The ASCII code is presented to a ROM that generates the dot information for that character. Characters measuring five dots wide by eight dots high are printed by 32 volt pulses. This causes current to pass from the electrodes in the print head to the aluminum-coated paper, thereby exposing the permanent black background. The printed characters, created by this discharge printing principle, are impervious to light, temperature, and humidity allowing the finished printed page to be reproduced on any office copying machine.

The seven-bit RS-232 serial interface (S1) uses a UART and a crystal controlled baud rate generator. Parity, number of stop bits, and one of fifteen baud rates (50 to 9600 baud) are DIP switch selectable.

Included in the interface is a 256 character FIFO buffer. Buffer full and empty flags are permanently set at 192 characters and zero, respectively. Buffer full causes a reverse channel indication (SA) which is transmitted to the sender. Reverse channel high on buffer full is standard. Reverse channel low on buffer full can be jumpered internally. Although buffer full occurs at 192 characters, the buffer can hold up to 256 characters before losing data.

1.3 SPECIFICATIONS

Tables 1-1 through 1-5 list the performance, interface, electrical, mechanical, and environmental specifications.

TABLE 1-1

PERFORMANCE SPECIFICATIONS

Printing Speed	~~180~~ 150 lines per minute (200 characters per second)
Characters Per Line	80, 40 or 20 maximum (selectable by input device)
Print Width	4 inches maximum (102mm)
Character Structure	5x8 Dot Matrix (Ninth dot used only for underlining - selectable by input device)
Vertical Spacing	5 lines per inch
Horizontal Spacing	5/10/20 characters per inch
Print Head Life	1 million characters
MTBF	100 hours continuous or intermittent operation

TABLE 1-2

INTERFACE SPECIFICATIONS

Parallel Input Connector	36 Pin Amphenol 57-40360 Series (Centronics 31310019)
Serial Input Connector	Standard RS-232 25 Pin Cinch DB-25P-7N
Code	Standard USASCII-2
Character Set	Standard 96 alpha-numeric characters plus 8 control codes. (May be strapped to recognize lower case alphas as upper case with 64 printable characters).
Character Format	7 Serial/Parallel data bits

TABLE 1-2 (Cont'd)

Printable Transfer Rates	2000 chars/sec @ 20 char/inch 1000 chars/sec @ 10 char/inch 500 chars/sec @ 5 char/inch
Parallel Data Input Levels . . . . . (TTL Compatible)	Logic 0 = 0V to 0.8 Volts (Sink 1 mA through 1K Ohm load) Logic 1 = 2.4V to 5.0 Volts (Sink 50 uA through 1K Ohm load)
Data Strobe Pulse . . . . . (TTL Compatible)	Logic 0 = 0V to 0.8 Volts (Sink 1.5 mA through 470 Ohm load) Logic 1 = 2.4V to 5.0 Volts (Sink __ uA through 470 Ohm load)
Output Levels . . . . . (TTL Compatible)	Logic 0 = 7.0 mA Source
Acknowledge Busy Paper Out/Printer Busy	Logic 1 = 0.6 mA Source
Serial Data Input	RS-232C Compatible

Input Device Codes
(Software Control)

Octal Code	ASCII Mnemonic	Function
07	BEL	Sounds buzzer for 2-3 seconds
12	LF	Initiates printing and moves paper up one line.
15	CR	Same as LF.
16	SO	Stops underlining.
17	SI	Starts underlining.
35	GS	Initiates 20 char/inch printing.
36	RS	Initiates 10 char/inch printing.
37	US	Initiates 5 char/inch printing.

TABLE 1-3

ELECTRICAL SPECIFICATIONS

Input Voltage Frequency	
Model P1/115V, S1/115V.	115 VAC, 50/60 Hz
Model P1/230V, S1/230V.	230 VAC, 50/60 Hz
Power Requirements	
Non-Printing	30 Watts
Printing	40 Watts

TABLE 1-3 (Cont'd)

Fuse Complement	6 Internal
Input AC Supply	1 Amp (115 VAC) or 1/2 Amp (230 VAC)
DC Power Supplies	
+12V (Motor Drive)	2 Amp
-34V (Styli Electrodes)	1 Amp
+ 5V (TTL Logic)	2 Amps
+12V (Rom Power) (EIA Level Shifting)	1/2 Amp
- 5V (Rom Power)	1/2 Amp
-12V (EIA Level Shifting)	1/2 Amp
Drive Motor	+12 Volt, permanent magnet, brush type. Starting surge current 3.8 amps; operating current 550 mA.
Styli Electrodes	9 stiff wire tungsten electrodes arranged vertically in a comb style. A -34 volt pulse discharges through each electrode with approximately 12 mA.

TABLE 1-4

MECHANICAL SPECIFICATIONS

Case Construction	Polycarbonate S-3000 plastic approved by UL.
Size	4-1/2"H x 13"W x 10-1/2"D (108mm) x (330mm) x (267mm)
Weight	10 lbs. (4.5 kg)
Electrosensitive Paper	
Composition	1 micron aluminum coat over black resin
Width	4.72" (120mm)
Roll Diameter	2.28" (58mm)
Core Diameter	1.00" (25mm)
Length	131' (40m) - 7860 lines max.
Thickness	.0019" (.047mm)
Finish	Shiny or matte
Shelf Life	Same as standard computer paper when stored in its protective plastic bag within the specified environmental conditions.

TABLE 1-4 (Cont'd)

Stylus	
Material	Tungsten
Pressure	10 grams/stylus

TABLE 1-5

ENVIRONMENTAL SPECIFICATIONS

Microprinter	
Operating Temperature	32°F to 104°F (0°C to 40°C)
Storage Temperature	-40°F to 140°F (-40°C to 60°C)
Operating Humidity	10% to 90% (no condensation)
Storage Humidity	5% to 95% (no condensation)
Paper	
Temperature	14°F to 156°F (-10°C to +70°C)
Humidity	10% to 90%

1.4 PAPER ORDERING INFORMATION

CENTRONICS DATA COMPUTER CORPORATION
Hudson, New Hampshire 03051
Attention: Sales Department

Order Quantity	Price Per Roll
5 Rolls	$2.95
10 Rolls	2.75
25 Rolls	2.50
50 Rolls & Up	1.90

Roll Length: 132' (40m)

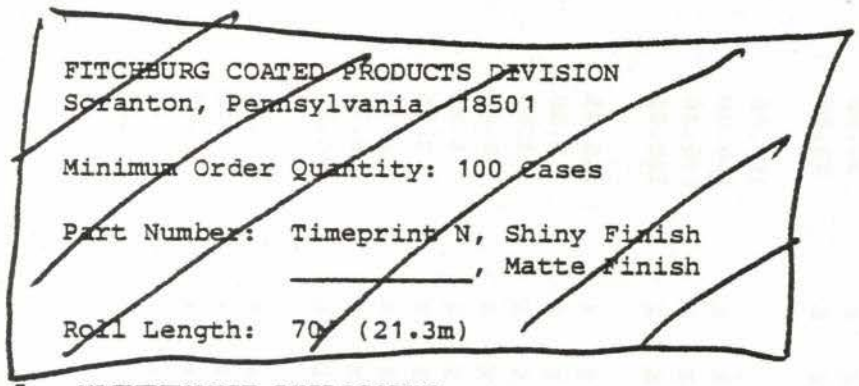
Part Number: 30860005-3002, Shiny Finish

NICOLET PAPER COMPANY
DePere, Wisconsin 54115

Minimum Order Quantity: 1-4 Cases

Part Number: ESP-120 (XXM-194), Shiny Finish
ESP-120 (XXM-245), Matte Finish

Roll Length 132' (40m)



1.5 MAINTENANCE PHILOSOPHY

The basic philosophy of Microprinter maintenance is depot repair. Whether the service required is warranty or normal repair, the Microprinter is serviced at one of Centronics' repair centers (Hudson, New Hampshire; Costa Mesa, California; Toronto, Canada; Drogheda, Ireland; London, England; Frankfurt, Germany; Paris, France; or Milan, Italy). Field service is not provided for the Microprinter.

1.5.1 Warranty Repairs

The Microprinter is warranteed for ninety (90) days from date of shipment against defects in workmanship and materials. Warranty repair will be performed under the stated terms and conditions. Under warranty repair, Centronics customers' expense is limited to freight incurred in shipping the unit to a Centronics repair depot.

1.5.2 Normal Repair

Repair service will be accomplished at Centronics depots for a flat rate charge. In the continental United States, this fee is $75.00 per unit excluding all transportation charges and any customs or related expense.

The repair price for each sub-assembly, with the exception of heads is 15% of the list price of the sub-assembly (see Table 1-6). All sub-assemblies must be complete; additional charges will be billed for missing parts. Non-repairable items will be returned to the customer and a $5.00 evaluation fee will be billed.

1.5.3 Customer Depots

Customers with large volume work may choose to establish their own repair depots. Centronics' recommended depot spare parts list is for field populations of 100 to 1,000 units as shown in Table 1-6. Hudson is the primary parts source for customers performing their own service. Other repair depots serve as back-up parts sources.

1.5.4 Return Authorization

Prior to returning a Microprinter for repair, contact Centronics for a return authorization number. Warranty is void without this number authorizing prepaid shipment.

TABLE 1-6

RECOMMENDED DEPOT SPARE PARTS

Description	Centronics Part Number	Quantity Recommended Units 100-250	Units 250-500	Units 501-1000	Microprinter Model P1 115V	P1 230V	S1 115V	S1 230V	Unit Price
Cabinet Upper Unit	63013107-2001	1	2	4	X	X			$ 19.90
Cabinet Upper Unit	63013107-2002	1	2	4			X	X	19.90
Cabinet Lower Unit (115V)	63013108-2001	1	2	4	X				19.90
Cabinet Lower Unit (115V)	63013108-2002	1	2	4			X		19.90
Cabinet Lower Unit (230V)	63013108-2003	1	2	4		X			19.90
Cabinet Lower Unit (230V)	63013108-2004	1	2	4				X	19.90
Panel Unit	63013105-5001	1	2	4	X	X	X	X	26.75
*Transformer Unit (115V)	63013114-5001	1	2	2	X	X	X	X	92.80
*Transformer Unit (230V)	63013114-5002	1	2	2	X	X	X	X	92.80
*Main Logic Board	63013112-4001	2	3	6	X	X			350.00
*Main Logic Board	63013112-4002	2	3	6			X	X	350.00
*Serial Logic Board (Rear)	63013240-4001	2	3	6			X	X	116.30
*Serial Logic Board (Front)	63013241-4001	2	3	6			X	X	128.05
*Print Mechanism	63013116-5001	1	2	4	X	X	X	X	105.05
Printer Cover	63013117-2001	2	3	4	X	X	X	X	5.00
Paper Shaft	63013128-2001	1	2	4	X	X	X	X	1.60
Photo Transistor Unit	63013104-2001	2	4	6	X	X	X	X	8.65
Timing Belt Unit	63013106-2001	2	4	6	X	X	X	X	4.25
Pick-up Coil Unit	63013109-1001	1	2	4	X	X	X	X	3.55
Motor Unit	63013111-4001	2	3	6	X	X	X	X	12.15
Platen Unit	63013113-5001	1	2	4	X	X	X	X	6.75
Head Unit	63013110-5001	4	6	10	X	X	X	X	14.95
Fuse 0.5 amp (mini)	63013163-1001	10	20	30	X	X	X	X	.80
Fuse 2.0 amp (mini)	63013164-1001	10	20	30	X	X	X	X	.55
Fuse 1.0 amp (mini)	63013165-1001	10	20	30	X	X	X	X	.25
Fuse 1.0 amp (115V)	39030020-1001	10	20	30	X		X		.25
Fuse 0.5 amp (230V)	39030016-1001	10	20	30		X		X	.25

*Repairable Units

Prices are subject to Centronics' normal terms and conditions of sale, F.O.B. Hudson, New Hampshire. Net 30 days. Prices are subject to change without notice.

SECTION 2

INSTALLATION

2.1 UNPACKING

The Microprinter is shipped fully assembled in a cardboard shipping carton with the model designation and applicable input voltage stamped on the outside of the carton. Check the markings carefully before unpacking.

NOTE:

PAPER MUST BE ORDERED SEPARATELY. IT IS NOT SHIPPED INSTALLED IN THE PRINTER.

Carefully open the shipping carton and remove the contents. It contains the following items:

(1) Microprinter (less paper roll),
(2) Owner's Manual,
(3) Styrofoam packing.

2.2 INSPECTION

Visually inspect the Microprinter for signs of damage received during shipment. Notify the common carrier immediately of any discrepancies.

NOTE:

ANY ATTEMPT TO OPERATE A DAMAGED PRINTER VOIDS THE WARRANTY AND MAY CAUSE FURTHER EXTENSIVE DAMAGE.

2.3 SERIAL INTERFACE

The two serial interface boards provide internal strapping and DIP switch selection of several EIA functions. The printer is shipped with the configuration shown in Table 2-1. If changes are required, refer to Figures 2-1 and 2-2. Refer to Figure 7-1 to gain access to the interface boards.

TABLE 2-1

SELECTABLE EIA PARAMETERS

Parameter	Location	As Shipped
SA Line (Reverse Channel)	Rear Serial Board (Figure 2-1)	Strapped to provide +12 Volts (SPACE) on buffer full. Idle condition is -12 Volts (MARK).
Baud Rate	Rear Serial Board (Figure 2-1)	DIP swith set for 1200 baud operation.
Character Structure	Front Serial Board (Figure 2-2)	Seven data bits. No parity bit. One stop bit.

NOTES:

1. DIP SWITCH IS PRESET AT FACTORY FOR 1200 BAUD OPERATION.
2. E1 TO E3 JUMPER SETS SA LINE HIGH ON BUFFER FULL (AS SHIPPED).
3. E1 TO E2 JUMPER SETS SA LINE LOW ON BUFFER FULL.

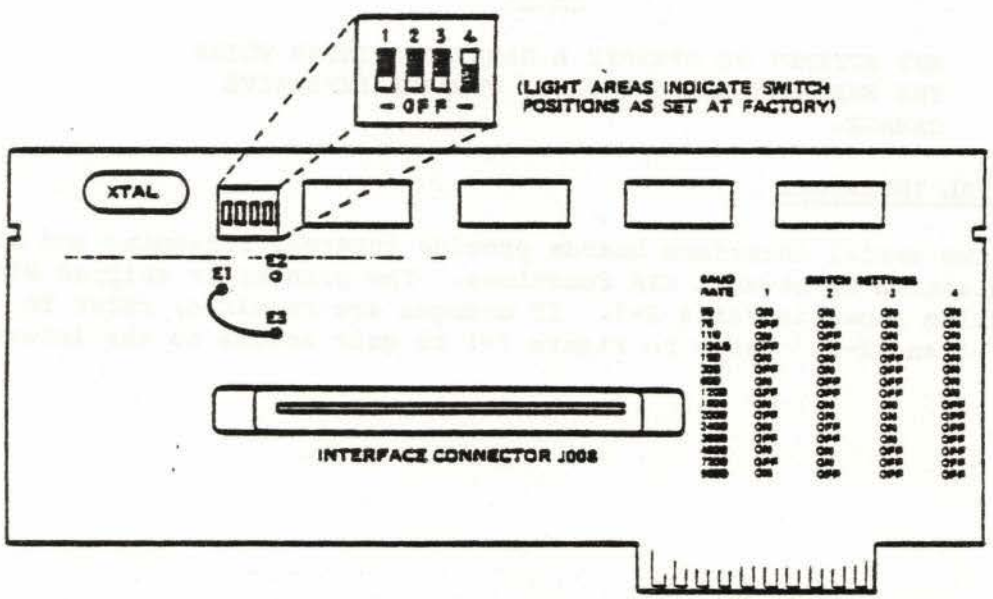


Figure 2-1. REAR SERIAL INTERFACE BOARD
(Selectable EIA Parameters)

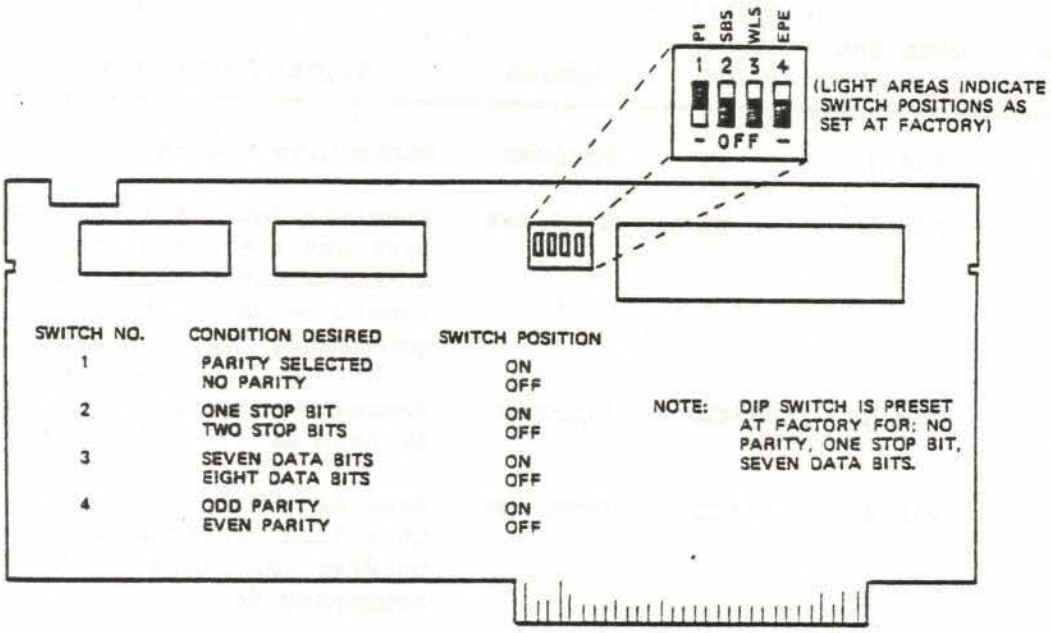


Figure 2-2. FRONT SERIAL INTERFACE BOARD
(Selectable EIA Parameters)

2.4 STANDARD SERIAL INTERFACE CONNECTIONS

Microprinter S1 is provided with an attached ten-foot serial I/O cable terminated with a standard EIA data set connector (Figure 2-3). For normal serial interface requirements, this connector connects to the standard EIA connector on the data set. For non-standard connections, the EIA connector may be removed and a different connector attached. Interface connector pin out information is shown in Table 2-2.

2.5 STANDARD PARALLEL INTERFACE CONNECTIONS

For the P1 standard parallel interface, connect the 36-pin input device connector to the connector at the rear of the printer, as shown in Figure 2-4. Interface pinouts and relative timing are shown in Figure 2-5.

TABLE 2-2

SERIAL INTERFACE CONNECTOR PINOUTS

Printer Connector	Data Set Connector	RS-232 Signal Name	Source	Signal Description
Pin 1	Pin 1	AA	Printer	Protective Ground
Pin 3	Pin 3	BB	Data Set	Received Data: A-V(1) is a Mark and a +V is a Space. When released, this line should be in the Mark condition.
Pin 4	Pin 4	(2)CA	Printer	Request to Send: This line is held at -V.
Pin 6	Pin 6	(2)CC	Data Set	Data Set Ready: A -V on this line prevents the printer interface from accepting data.
Pin 7	Pin 7	AB	Printer	Signal Ground.
Pin 8	Pin 8	(2)CF	Data Set	Data Carrier Detector: A -V on this line prevents the printer interface from accepting data.
Pin 11	Pin 11	SA	Printer	Reverse Channel: Used for transmitting printer status to the data set. It is normally in a Mark (-V) condition. When the buffer is full (192 characters), this line goes to a Space condition (+V) until the printer is able to receive data again.
Pin E	Pin 20	(2)CD	Printer	Data Terminal Ready: This line is held at +V.

All other connector pins are open.

(1) +V indicates a voltage greater than +3 Volts.
-V indicates a voltage less than -3 Volts.
(2) These lines are pulled to the active state by the interface. They may be de-activated externally.
(3) ±V from printer = ± 12V.

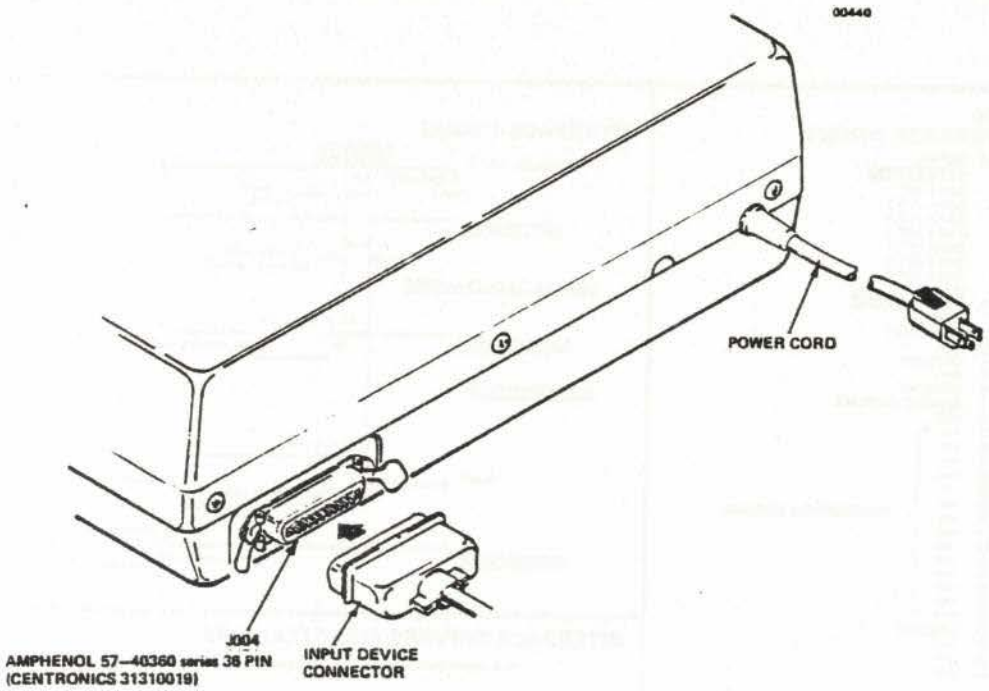


Figure 2-3. SERIAL INTERFACE CONNECTIONS

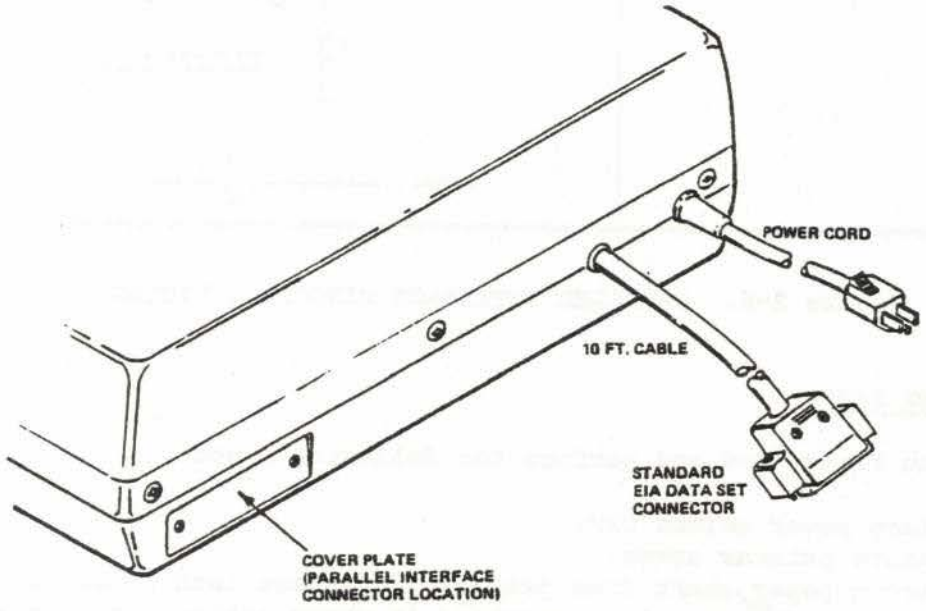


Figure 2-4. PARALLEL INTERFACE CONNECTIONS

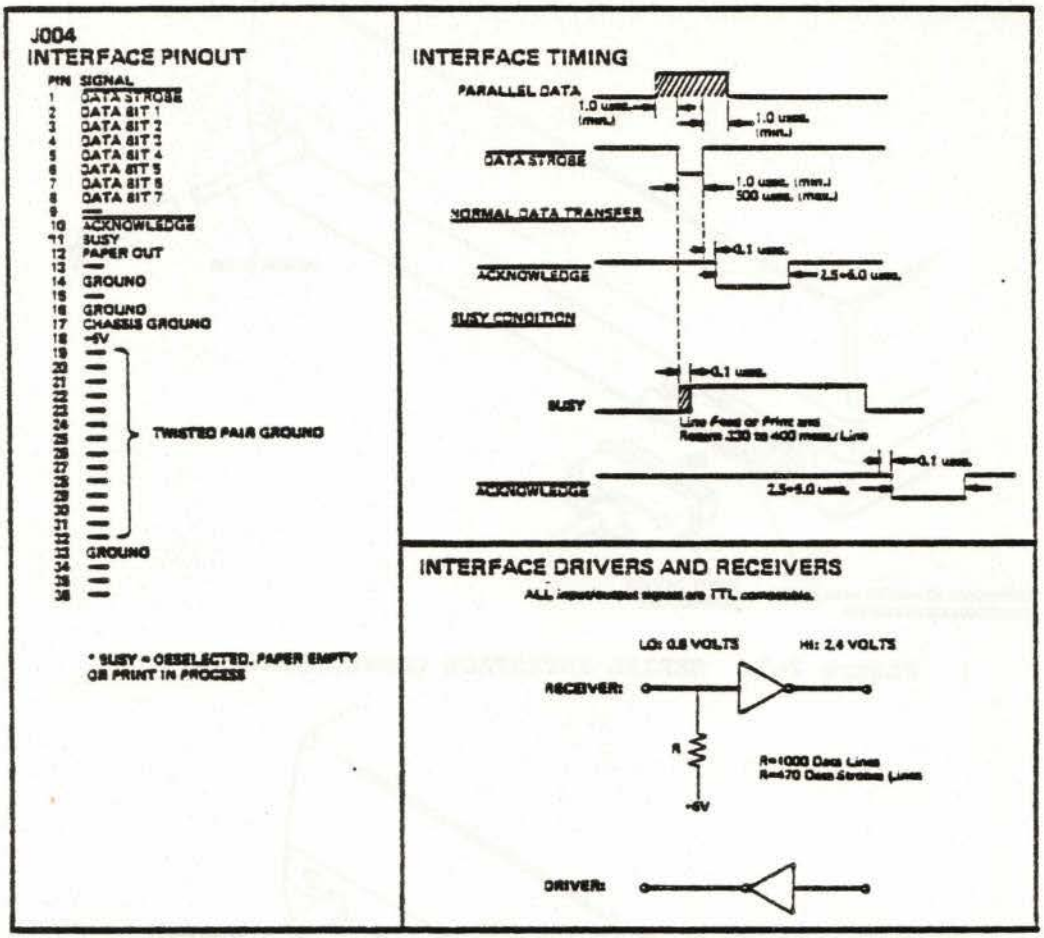


Figure 2-5. PARALLEL INTERFACE PINOUTS & TIMING

2.7 LOADING PAPER

Refer to Figure 2-6 and perform the following steps:

(1) Place power switch OFF.
(2) Remove printer cover.
(3) Remove paper shaft from printer and insert into paper roll.
(4) Place shaft into slots provided in upper cabinet of printer with paper existing from bottom as shown in Figure 2-6.
(5) Feed paper between platen and friction feed roller. Use care not to bend paper sensor.
(6) Rotate platen by hand until paper exits between platen and print head.
(7) If necessary, grasp the edges of the paper and adjust its position to insure a straight feed path.
(8) Replace printer cover.

NOTE:

CHECK THAT ALUMINIZED SURFACE TOUCHES METAL PAPER GUIDES ON EACH END OF PLATEN. GUIDES PROVIDE GROUND CIRCUIT TO PAPER SENSOR.

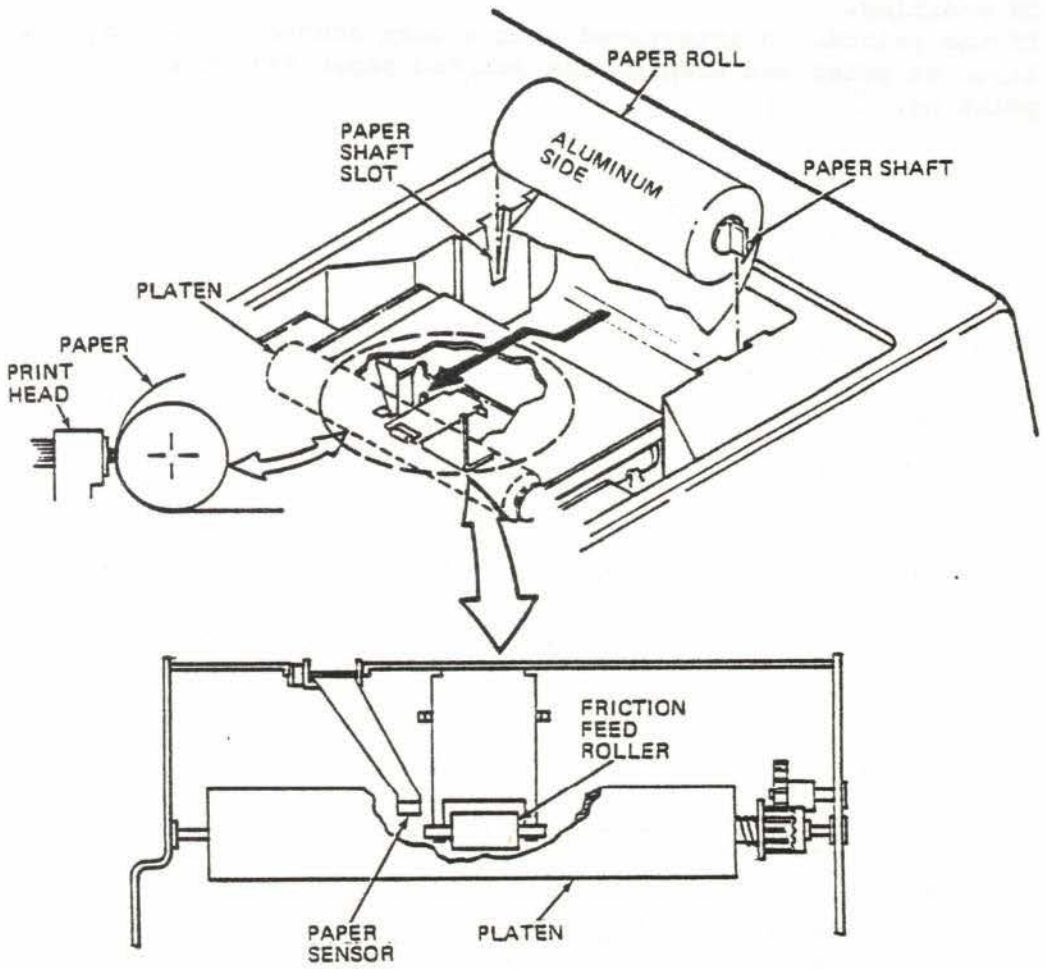


Figure 2-6. LOADING PAPER

2.8 INSTALLATION CHECKOUT

(1) Plug power cord into AC outlet (115 VAC or 230 VAC as appropriate).
(2) Slide POWER switch up and observe that red ON lamp lights.
(3) Press SELECT switch to ON (in) position.
(4) Hold PAPER FEED switch pressed and observe that paper feeds and head assembly moves back and forth.
(5) Release paper feed switch. Paper feed and head motion should stop. Observe aluminized paper for presence of faint horizontal lines created by the head pressure against the nine styli.
(6) Remove printer cover and wind paper back onto roll. Note that buzzer sounds for 2-3 seconds and red PAPER EMPTY lamp lights as paper passes away from paper sensor.
(7) Re-load paper (para. 2.7) and note that PAPER EMPTY lamp goes out.
(8) Release SELECT switch to OFF (out) position and repeat steps (4) through (7). All indications should be the same.
(9) On P1 model, check for +5 volts between pins 10 and 20 on rear connector J004 (BUSY signal). Operate SELECT switch on and off and note that signal is present in OFF position and absent in ON position.
(10) If the printer is interfaced with a data source, allow several lines to print and examine the printed paper for quality of printing.

SECTION 3

OPERATION

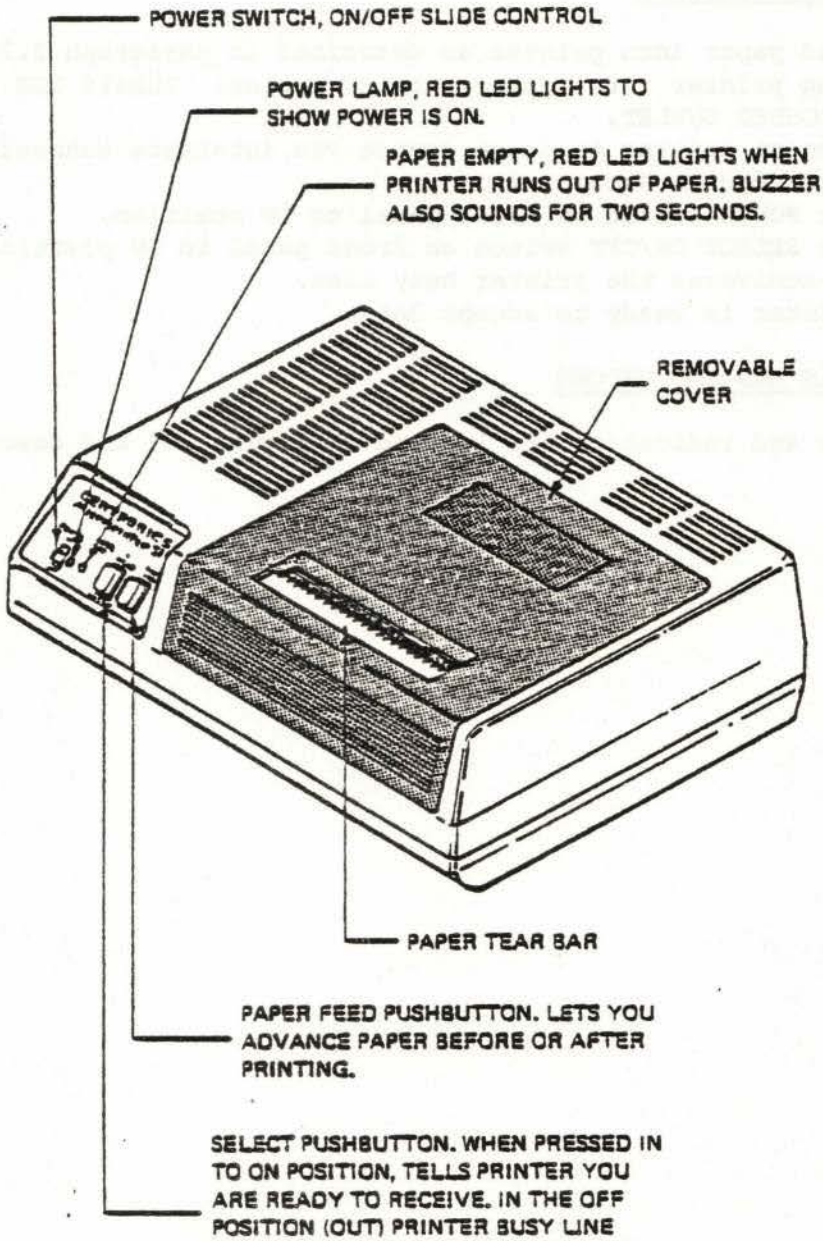
3.1 SET-UP PROCEDURES

(1) Load paper into printer as described in paragraph 2.7.
(2) Plug printer into appropriate AC outlet. ALWAYS USE A 3-WIRE GROUNDED OUTLET.
(3) Connect printer to input device via interface connector, as described in Section 2.
(4) Set POWER switch on front panel to ON position.
(5) Set SELECT ON/OFF switch on front panel to ON position. This de-activates the printer busy line.
(6) Printer is ready to accept data.

3.2 CONTROLS AND INDICATORS

Controls and indicators are located in Figure 3-1 and described in Table 3-1.

Figure 3-1. CONTROLS AND INDICATORS


POWER SWITCH, ON/OFF SLIDE CONTROL
POWER LAMP, RED LED LIGHTS TO SHOW POWER IS ON.
PAPER EMPTY, RED LED LIGHTS WHEN PRINTER RUNS OUT OF PAPER. BUZZER ALSO SOUNDS FOR TWO SECONDS.
REMOVABLE COVER
PAPER TEAR BAR
PAPER FEED PUSHBUTTON. LETS YOU ADVANCE PAPER BEFORE OR AFTER PRINTING.
SELECT PUSHBUTTON. WHEN PRESSED IN TO ON POSITION, TELLS PRINTER YOU ARE READY TO RECEIVE. IN THE OFF POSITION (OUT) PRINTER BUSY LINE IS ALWAYS ACTIVE AND DATA CANNOT BE RECEIVED.

CONTROLS

TABLE 3-1

CONTROLS AND INDICATORS

CONTROL	FUNCTION
POWER Switch:	Turns power on and off in the printer.
POWER Lamp:	Red LED indicates power is applied to printer.
PAPER EMPTY Lamp:	Red LED indicates printer is out of paper, (approximately 3 lines remaining). When paper first runs out, a buzzer sounds for 2 seconds. The printer BUSY line activates until paper supply is replenished.
SELECT ON/OFF Switch:	When ON, printer BUSY line to input device is inactive. When OFF, line is active. Controls data transfer to printer.
PAPER FEED Switch:	Paper continues to advance as long as switch is pressed.

3.3 OPERATING NOTES

(1) Always plug printer into a 3-wire grounded outlet.
(2) Avoid leaving or placing objects on any part of printer.
(3) Turn power off before loading paper.
(4) Automatic motor control turns motor off when no data is being received.
(5) Do not subject printer to high or low temperatures, to sudden changes in temperature, to dust or to extreme shock.
(6) Use only a dry, soft cloth to clean printer surfaces. Do not use harsh detergents or chemicals.
(7) Do not touch print head styli.
(8) If paper jams, pull head slider away from platen, then remove paper and reinsert. Make sure paper does not touch head or roller.
(9) Clean discharge residue from front of mechanism every 3 to 5 paper rolls.
(10) Do not turn power off while the print head is in motion. This may cause the head to stay on the paper when the power is reapplied. If the condition should occur, depress the PAPER FEED switch to return the head to the normal position.

SECTION 4

THEORY OF OPERATION

NOTE:

THIS SECTION DESCRIBES THE SERIAL VERSION (S1) OF THE MICROPRINTER. FOR PARALLEL VERSIONS (P1), IGNORE ALL REFERENCES TO SERIAL DATA.

4.1 OVERALL OPERATION

Operation is controlled by a mechanical printer assembly, a main electronics pc board with an integral "on board" dc power supply and two serial interface pc boards that plug into the main pc board. As serial data is received, it is accumulated in a 192 character buffer in the serial interface. This buffer stores 2-1/2 lines of 80 characters each. When the printer is not busy, characters are transferred to an 80 character print buffer in the main electronics pc board. Data is accumulated in this buffer until a PRINT command is issued. This occurs when a LF character or CR character is received or when the buffer contains 80 characters, whichever occurs first. The PRINT command initiates operation of the printer assembly.

The "flying" print head carries the nine vertical styli electrodes across the paper to form the required characters. As the "flying" head moves from left to right, the electronics "fires" the corresponding styli which vaporizes the one micron coating of aluminum from the black background of the paper. The styli are fired in a 5x9 dot matrix sequence to form the appropriate character. For character densities of 20 characters per inch, the styli fire 100 times as the head moves one inch (5 dots wide x 20 characters).

NOTE:

A PAUSE IN THE FIRING EQUIVALENT TO ONE DOT TIME OCCURS BETWEEN EACH CHARACTER FOR SPACING. THUS 120 TIME SLOTS ARE USED FOR EACH LINE OF HEAD MOTION.

For 10 characters per inch, the styli fire only 50 times; however, they remain "on" for twice the duration of the 20 character per inch density. This exposes a double size, horizontal line of the black background as the head moves. For 5 characters per inch, the styli fire 25 times per inch and they remain "on" four times as long as for 20 characters per inch. This technique creates short, horizontal lines instead of dots which provide elongated characters for 10 and 5 characters per inch. During 10 or 5 characters per inch operation, a pause equivalent to 2 or 4 dot times, respectively, occurs for character spacing.

When the print head reaches the right margin, a gear mechanism moves the paper up one line and the head moves left to the "rest" position. When the PRINT command is activated again, the printer operation described above continues for the next line of characters.

4.2 MECHANICAL OPERATION

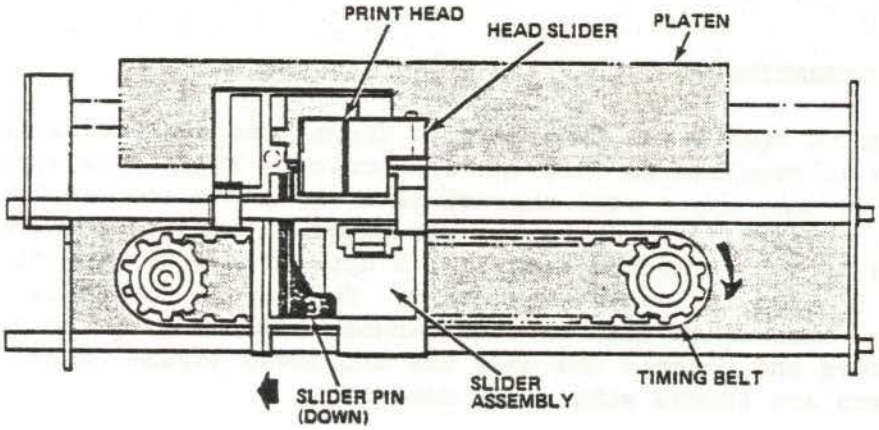
The printer assembly consists of a 12 volt motor which drives a continuous loop timing belt. The belt is positioned below the paper platen and moves one continuous revolution horizontally whenever a line is to be printed or the paper is advanced. As the belt moves, it carries the attached print head across the platen from left to right and then right to left at a constant speed. Variations in input data rates are accomodated by the line buffer in the electronics and changes in character density are accomplished by firing the styli for shorter or longer time periods as described previously. This constant speed, in conjunction with performing one complete revolution of the timing belt regardless of the line length to be printed or the number of paper feeds to be made, results in a very simple, reliable print mechanism.

4.2.1 HEAD MOTION

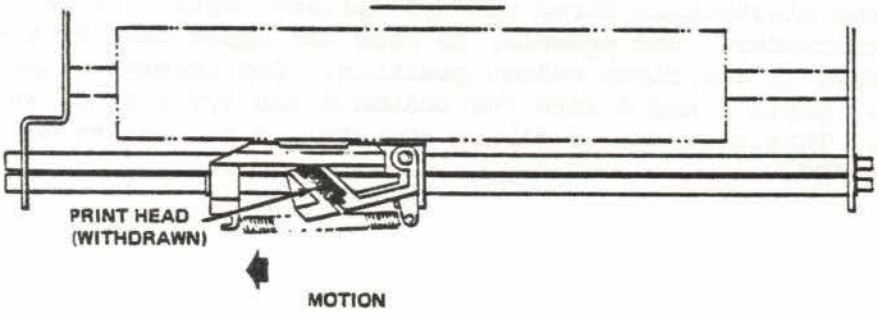
The print head is mounted in a holder and connected to the electronics with a flexible pc cable. Two horizontal rods support the head holder assembly. Head motion operation is shown in Figure 4-1. The 12 volt drive motor moves a rubber toothed timing belt via nylon gears in a clockwise direction as viewed from the front. The head holder assembly is permanently attached to the timing belt via an L-shaped slider pin which rides in two vertical guides.

Figure 4-1 shows the motion as the head moves from the "at rest" position to the "print" position. As the holder moves to the leftmost position, it carries the head along with it. At the left side, the timing belt moves the slider pin up and around the left gear. Head motion stops during this transition. When the slider pin reaches the top of the left gear, head motion to the right begins. This is the start print position. Printing may continue until the slider pin begins to pass around the right gear. As the slider pin moves down, the head motion stops momentarily and then moves left back to the rest position. This process repeats each time the printer assembly is activated for printing one line of characters or for paper feeding.

FRONT VIEW

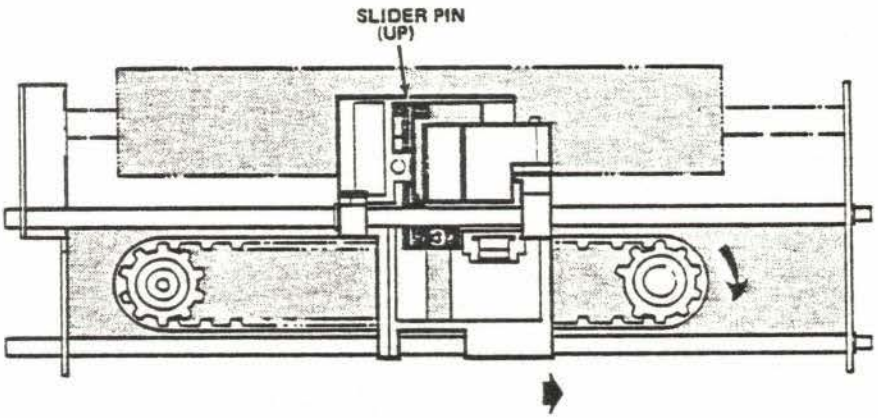


TOP VIEW

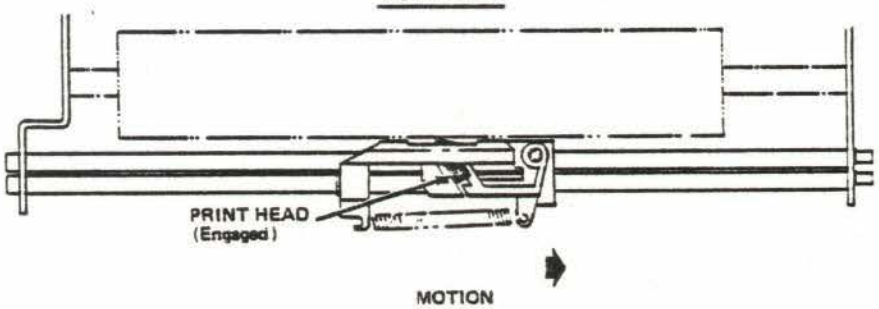


VIEW A "AT REST" MOTION
Figure A - HEAD MOTION

FRONT VIEW



TOP VIEW



VIEW B "PRINT" POSITION
Figure B - HEAD MOTION

4.2.2 STYLI OPERATION

As the print head moves from left to right, the nine vertical styli are energized as required to form the characters. Figure 4-2 shown the sequence for forming upper case characters D, E, and F and for lower case characters e, f and g. The character generator in the electronics provides drive signals for a 5x9 matrix, that is, 5 dots wide by 9 dots high. The ninth stylus is used for underlining only. The eighth stylus is used only for lower case characters that have descenders such as g, p and q. All other characters and symbols use only the top seven styli. Thus, the most used characters are formed with a 5x7 matrix.

As shown in Figure 4-2, the head moves to the right at a constant speed while the electronics fires the appropriate styli 5 successive times to form one character. For example, to form the upper case D, the top seven styli fire in the first column position. For columns 2 and 3, styli 1 and 7 fire. Styli 2 and 6 fire for column 4 and styli 3, 4, and 5 fire for column 5. This sequence of firing the styli 5 successive times forms the character "D".

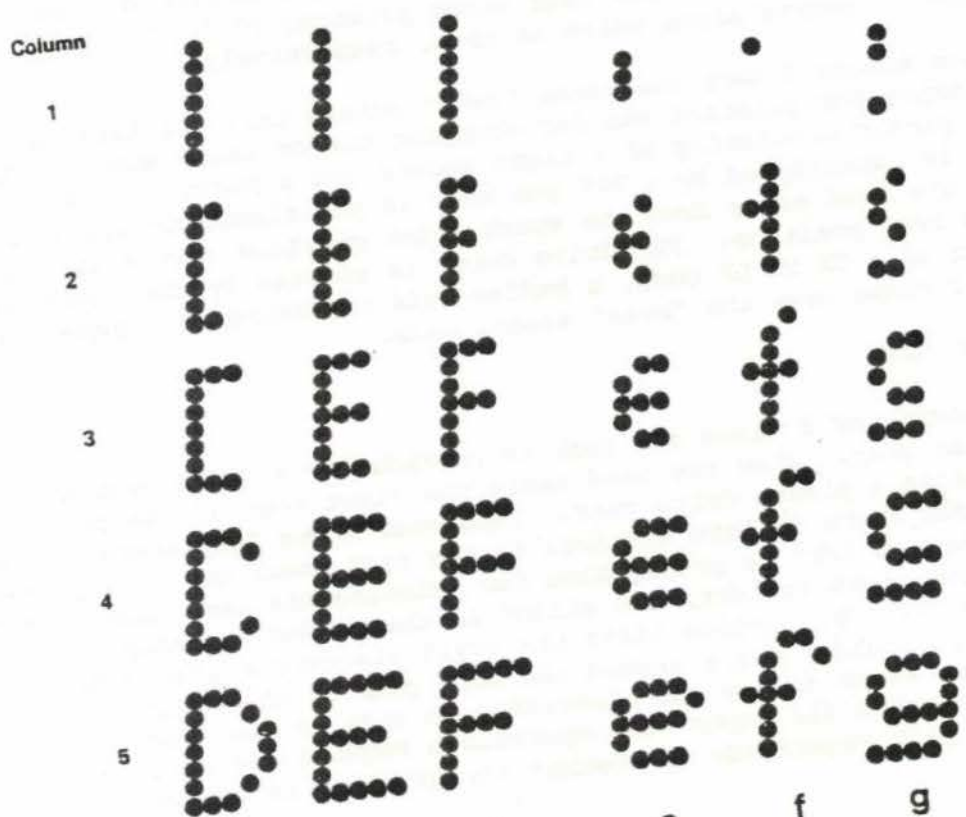


Figure 8. CHARACTER FORMATION

Figure 4-2. CHARACTER FORMATION

4.2.3 ELONGATED CHARACTERS

Character density refers to the number of characters per inch on the printed line. This may be 5, 10 or 20 characters per inch (CPI). The basic 20 CPI structure is simply "stretched" to occupy more space and provide wider characters for emphasis or increased clarity. Figure 4-3 shows the relationship between 20, 10 and 5 CPI, from top to bottom. The time allowed for each styli to fire and vaporize the aluminum on the paper is doubled for 10 CPI and then doubled again for 5 CPI. This results in tiny lines of aluminum vaporizing which "stretches" the characters as shown.

4.2.4 TIMING PICKUPS

An inductive pickup and associated timing wheel provide "alpha" timing pulses for character generation. The circumference of the timing wheel is serated with 36 teeth. It is attached directly to the dc drive motor. As the wheel spins, the inductive pickup senses the gap between adjacent teeth and generates an "alpha" pulse. For every inch of head motion, 120 alpha pulses occur. Each pulse sets the timing for one column of dots in a character for the most dense printing of 20 CPI. Since there are 5 columns per character in the matrix, 100 alpha pulses are used for the character formation while the remaining 20 pulses provide one column of spacing between the 20 characters. For less dense printing of 10 CPI and 5 CPI, every second or fourth alpha pulse is used, respectively.

Another timing pickup generates "beta" pulses that initiate the once per line timing for printing and for stopping the dc drive motor. This in an optical pickup consisting of a light source and a phototransistor. The light beam is interrupted by a 90° cam that is positioned to allow light to pass as the head moves from the start print position across the page and back to the rest position. The drive motor is started by the electronics upon receipt of a CR or LF code, a buffer full condition or a paper feed command. It stops when the "beta" signal ends.

4.2.5 PAPER FEED

Line spacing of 5 lines per inch is provided by a drive mechanism that controls a cam gear. When the head nears the right edge of the paper, the cam gear engages a platen drive gear. This gear moves "one tooth" as the head moves from right to left and back to the rest position. The platen moves the paper up 1/5" in preparation for printing the next line. As the head moves from right to left, the slider in the holder assembly drops down (see Figure 4-1). This action lifts the styli electrodes away from the paper. When the holder moves around the left gear of the timing belt, the slider moves up which allows the electrodes to ride on the paper prior to printing. Note that all paper feed operations require one full revolution of the timing belt regardless of whether any printing is accomplished.

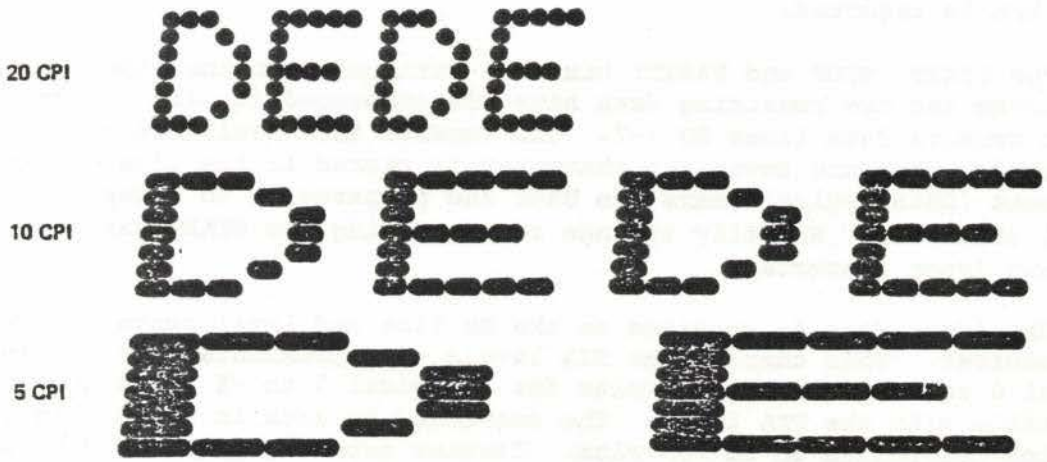


Figure 4-3. ELONGATED CHARACTERS

4.3 SERIAL INTERFACE ELECTRONICS OPERATION (See Figure 4-4)

The serial electronics consists of a front and rear pc board. Both boards plug into the main electronics pc board. This interface receives EIA RS-232 serial data and formats it into a 7-bit parallel data for inputting to the main electronics. It has 14 DIP switch selectable baud rates and DIP switch selectable UART operation for odd/even parity, number of stop bits, no parity and number of data bits. The serial interface has a 256 character input buffer that allows characters to be stored temporarily if the printer is busy. Read and write counters access the input buffer and control a buffer full counter. Each time a character is written into the buffer, the counter is incremented. When a character is read from the buffer, the counter is decremented. If the data is received faster than it can be printed, a buffer full condition is reached (192 characters). This activates the SA line (buffer full or reverse channel sensing line) to the input device signaling it to stop transmitting until the input buffer is ready to receive.

4.3.1 DE-SERIALIZATION

The asynchronous serial bit stream for each character is converted to seven parallel data bits. This is accomplished by a universal asynchronous receiver-transmitter chip (UART). Data bits are presented on the receive serial input line (RSI) of the UART along with receive clock pulses on the RCP line. RCP is obtained from a programmable, crystal-controlled baud rate oscillator. Its frequency is set to match the input bit rate multiplied by 16, as shown in Table 4-1. When the UART detects a mark-to-space transition on the RSI line, it gates the RCP pulses on. The eighth pulse shifts the first bit (start bit) into the UART. By allowing the RCP pulses to run 16 times faster than the baud rate and then shifting on the eighth pulse, all serial bits are shifted in near the middle of the bit time. This increases overall reliability and decreases false alarms since input transitions must be present for at least eight clock times in order to be shifted in. The shifting process continues until the RSI line returns to the mark condition for at least two bit times. This signals receipt of the stop bit(s) and gates off the RCP pulses until the next start bit is detected.

The START, STOP and PARITY bits are stripped from the input character bit stream and the remaining data bits are presented in parallel on the output receive data lines RD 1-7. The receive data available line (RDA) is activated. When the seven bit character is stored in the line buffer, an RDA reset (RDAR) pulse clears the UART and prepares it to accept the next serial character. Normally storage occurs during the START bit time for the next input character.

The input data is received on the BB line and level converted by an EIA receiver. This charges the EIA levels of approximately +12 volts for a logical 0 to 0 volts and -12 volts for a logical 1 to +5 volts to be compatible with the TTL logic. The converted BB data is gated with CF and CC which are pulled up to +5 volts. Carrier detected (CF) and data set ready (may be left open (always high) or may be used by the external data set to inhibit communications.

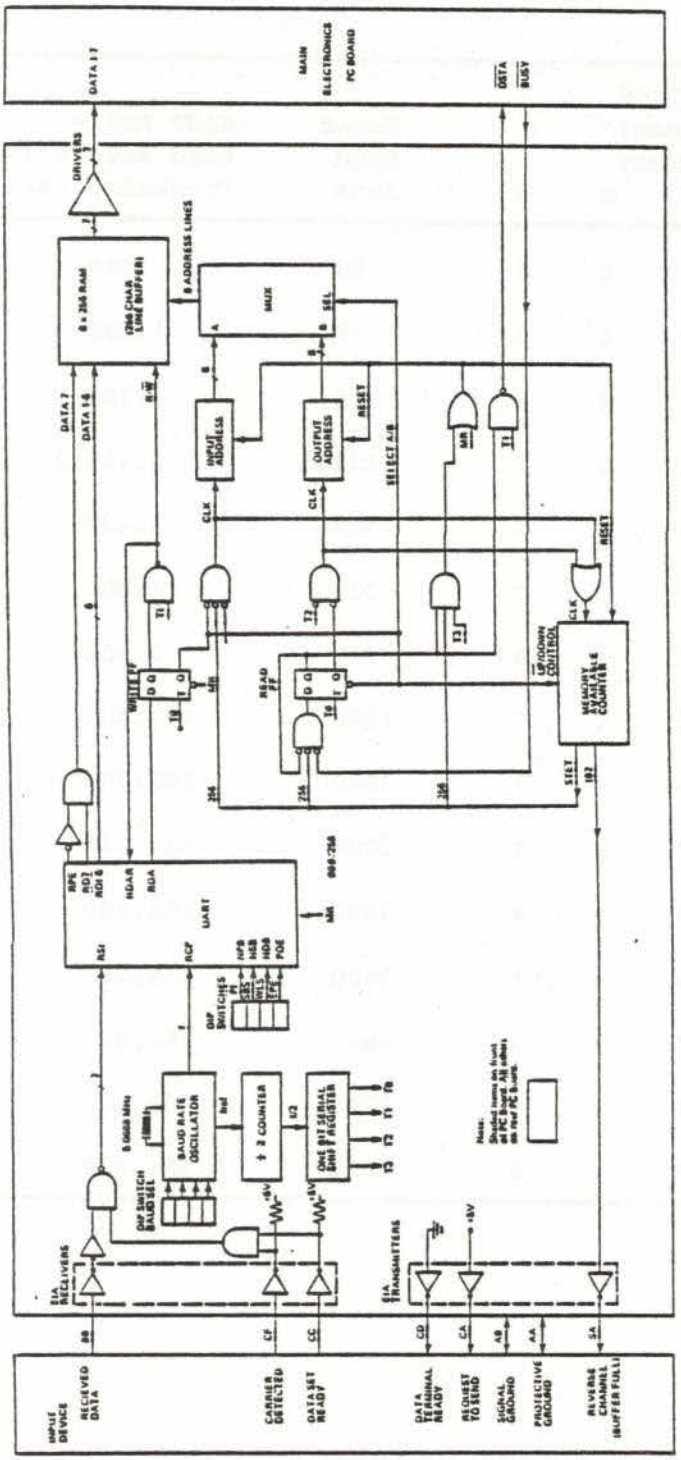


Figure 4-4. SERIAL INTERFACE BLOCK DIAGRAM

TABLE 4-1

BAUD RATE SELECTION

DIP SWITCH SETTINGS (Input Address) Binary						
Decimal	D	C	B	A	Input Baud Rate	UART RCP = Baud Rate x 16 Frequency (Hz)
0	0	0	0	0	50	800
1	0	0	0	1	75	1,200
2	0	0	1	0	110	1,760
3.	0	0	1	1	134.5	2,152.3
4	0	1	0	0	150	2,400
5	0	1	0	1	300	4,800
6	0	1	1	0	600	9,600
7	0	1	1	1	1200	192,000
8	1	0	0	0	1800	288,000
9	1	0	0	1	2000	320,810
10	1	0	1	0	2400	384,000
11	1	0	1	1	3600	576,000
12	1	1	0	0	4800	768,000
13	1	1	0	1	7200	1,152,000
14	1	1	1	0	9600	1,536,000

The 4-pole DIP switch associated with the UART allows for selection of the following input parameters to match the microprinter operation with the input device character parameters.

TABLE 4-2

UART DIP SWITCH DEFINITIONS

Dip Switch Marking Mnemonic	Meaning	UART Chip Name Mnemonic	Meaning
P1	Parity Inhibit	NPB	No Parity Bit
SBS	Stop Bits	NSB	Number of Stop Bits
WLS	Word Lengths	NDB	Number of Data Bits
EPE	Even Parity Enable	POE	Parity Odd or Even

Switch positions are shown in Table 4-3.

TABLE 4-3

UART DIP SWITCH POSITIONS

SWITCH	POSITION ON	OFF
P1	Parity Bit	No Parity Bit
SBS	One Stop Bit	Two Stop Bits
WLS	Seven Data Bits	Eight Data Bits
EPE	Odd Parity	Even Parity

If a parity error is received (RPE) by the UART, it forces output bits 1-6 high and bit 7 low (0111111). This replaces the normal output character with the code for a question mark. For example, a parity error in the character "L" in the word "SELECT" prints as "SE?ECT".

4.3.2 LINE BUFFER OPERATION

The 256 character line buffer writes 7-bit parallel data characters from the UART into its memory with each R/W pulse it receives at the address determined by the input (write) counter. Initially, both the output (read) and input (write) counters are reset to zero by MR. They increment independently as characters are written and read from memory. The write flip-flop sets whenever the UART has receive data available (RDA). The read flip-flop sets whenever the write flip-flop resets. Setting the write flip-flop indicates that a character is being stored; therefore, it must be read out from memory into the print buffer on the main electronics pc board.

Until a print command is received, the read/write sequence is interlaced in time. That is, a character is written into the line buffer and then immediately read from the line buffer into the print buffer. When a CR/LF character is detected by the main electronics, the print cycle is initiated and $\overline{\text{BUSY}}$ becomes active. This signal keeps the read flip-flop reset during the time the current line in the print buffer is being printed. Data received during this 400 millisecond print cycle is stored in the line buffer; however, it cannot be read into the print buffer until the print buffer is empty 400 milliseconds later.

When $\overline{\text{BUSY}}$ goes high, the read flip-flop is enabled again. It resumes the reading of data from one buffer to the other. Write cycles may again be interlaced with read cycles as required until a CR/LF character is detected again and the print/busy cycle resumes.

The sequence of operations may be followed using the functional block diagram, Figure 4-4 and the timing diagram, Figure 4-5. When the UART assembles the data bits for one character, it activates RDA. On the next TØ pulse, the WRITE flip-flop sets. Its low $\overline{Q}$ output resets the read flip-flop. At T1, the RDA flag is reset by RDAR and simultaneously a R/W pulse stores the 7-bit character in the line buffer at the address selected by the input (write) address counter. The low $\overline{Q}$ output of the write flip-flop controls the multiplexer SEL line to switch the write counter outputs to the line buffer address inputs. It also enables the buffer full counter to count up during T2.

At T2, a clock pulse increments the write counter to the next sequential address and also increments the "memory available" or buffer full counter. This completes the write cycle for one character.

NOTE:

T3 IS USED ONLY IF THE READ/WRITE COUNTERS ARE TO BE RESET. THIS OCCURS WHEN THE BUFFER EMPTIES AND COUNTS DOWN TO Ø.

The next TØ pulse resets the write flip-flop and sets the read flip-flop as long as $\overline{\text{BUSY}}$ is not active and a count of 256 is not reached from the buffer full counter. The high $\overline{Q}$ output of the write flip-flop selects the B inputs to the multiplexer which connects the read address counter to the line buffer address inputs. The buffer reads the character at that address onto the DATA 1-7 lines to the main electronics pc board.

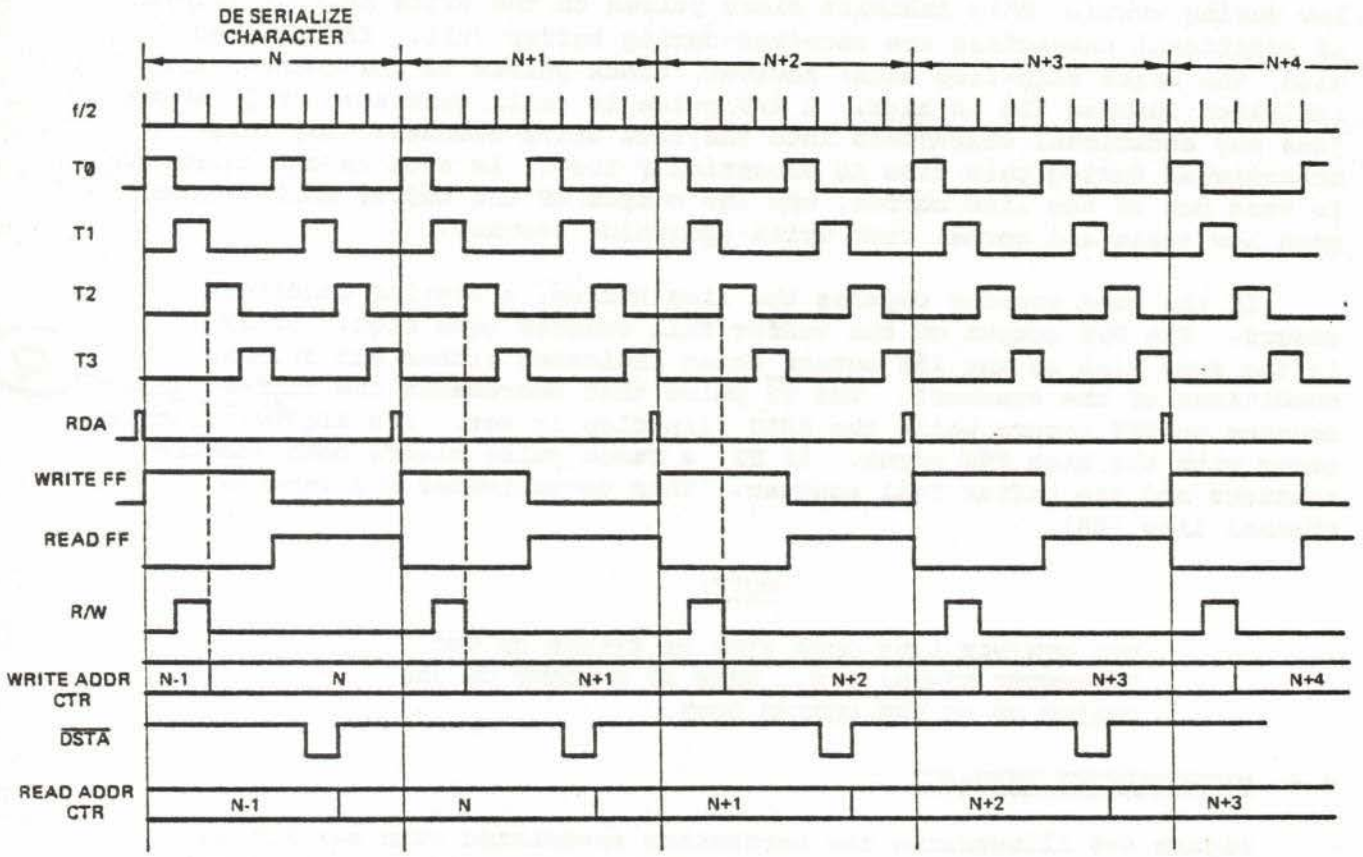


Figure 4-5. SERIAL INTERFACE TIMING DIAGRAM

At T1, a data strobe pulse ($\overline{\text{DSTA}}$) loads the seven parallel bits into the print buffer. At T2, a clock pulse increments the read counter and decrements the buffer full counter. This completes the read cycle for one character.

If read and write cycles occur as shown in Figure 4-5, the buffer full counter would always increment one count and then decrement one count, effectively staying at the same address. This occurs only if data characters are continuously transferred from the line buffer to the print buffer. Generally this occurs only at very slow input baud rates or when long pauses occur between lines of data.

If data is received by the line buffer while the print buffer is being emptied, the buffer full counter receives more up counts than down counts. If it reaches 192, the reverse channel line (SA) to the input device is activated. It stays active until the line buffer is empty. This indicates that a potential buffer full condition is developing with the possibility of losing data. If the input device is not monitoring the SA line or does not cease transmitting, the buffer full counter reaches a count of 256 by the count up pulses during write.

The 256 output of the buffer full counter goes high when SELECT A/B is low during write. This inhibits clock pulses to the write address counter if additional characters are received during buffer full. If RDA goes high, the write flip-flop sets; however, clock pulses to the counter are inhibited because 256 is high. A R/W pulse is still generated at T1 which jams any additional characters into the last write address. Any data transmitted during this time is essentially lost. As soon as one character is read out of the line buffer, the 256 output of the buffer full counter goes low again and normal read/write operation resumes.

If the read counter empties the line buffer, a similar condition occurs. The ØØØ output of the buffer full counter goes high. (This is the same line as the 256 output which indicates either min or max conditions of the counter). The T2 pulse that decrements the buffer full counter to ØØØ occurs while the READ flip-flop is set. Its high ouput is gated with the high ØØØ ouput. At T3, a reset pulse clears both address counters and the buffer full counter. This de-activates the reverse channel line (SA).

NOTE:

THE MIN/MAX LINE GOES HIGH AT EITHER OF TWO DIFFERENT TIMES; I.E., WHEN AT A COUNT OF 256 DURING UP OR ØØØ DURING DOWN.

4.4 MICROPRINTER THRU-PUT

Figure 4-6 illustrates the parameters associated with maximizing thru-put without monitoring reverse channel (SA) or adding pad characters to fill the print buffer with non-printing characters. Reduced thru-put occurs when either of two conditions exist:

(1) CR/LF characters are received at a faster rate than the printer can accommodate. This results from very short lines or multiple LF characters which allow the line buffer to fill.

(2) Received data characters are transmitted so slowly that the print buffer is always waiting for data. This causes pauses between printed lines with a reduction in thru-put.

Since the printer always requires 400 milliseconds to complete one cycle of operation, thru-put is a function of the other variables; namely input baud rate and how often a print command is issued. Once a print command is received, the 400 millisecond busy interval begins and data transfer from the line buffer to the print buffer is interrupted.

The print command is issued at the end of each line (CR/LF), thus the shorter the line, the more often the print command is issued.

As shown in Figure 4-6, in order to sustain the maximum thru-put of 2.5 lines per minute, line length must be increased as the baud rate increases. Increasing line length (characters per line) does not alter the fixed 400 milliseconds required for the print cycle. It decreases the frequency

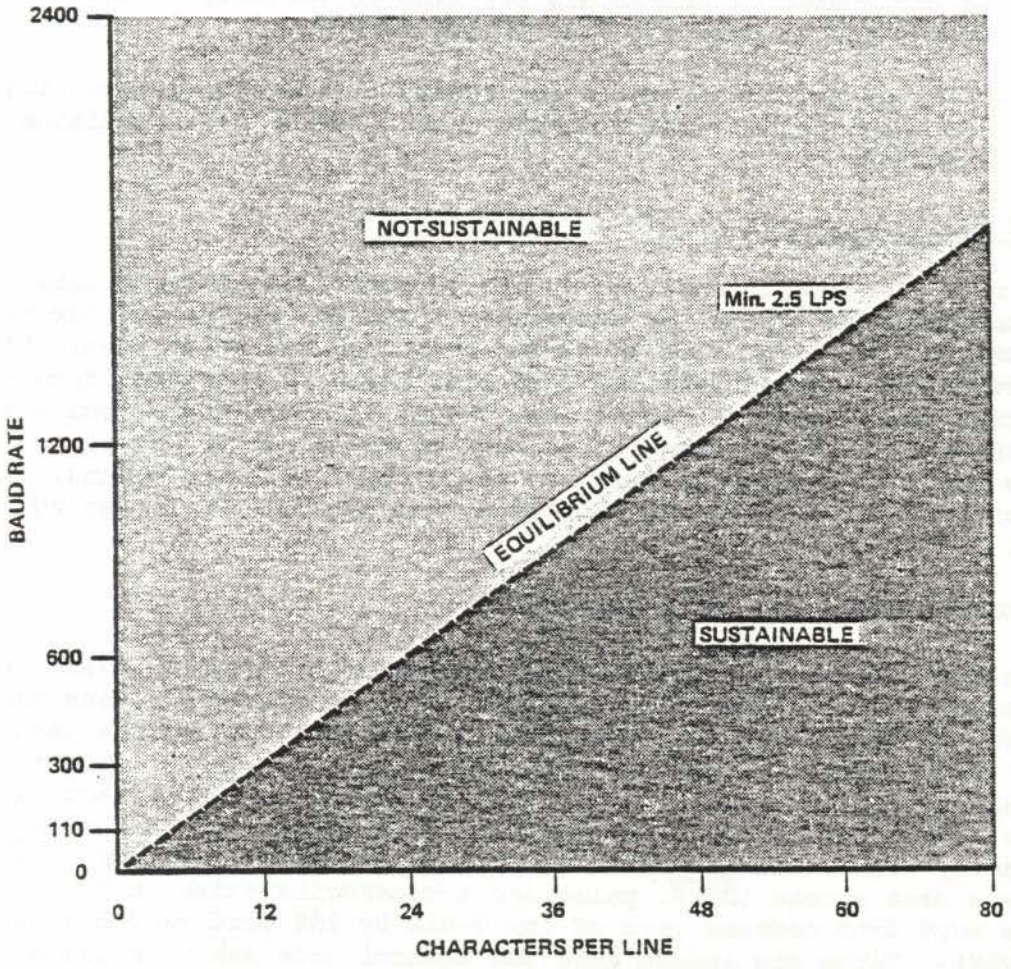


Figure 4-6. BAUD RATE VS CPL

of initiating the print cycle. This, in turn, allows more data to be transmitted at a faster rate. If short lines are received at a fairly fast rate (see Figure 4-6), the print cycle is initiated so often that the line buffer overflows. This may be avoided by decreasing the baud rate or by adding pad characters (non-printing characters, such as NULL) to increase the apparent line length so that the print cycle is entered at a slower rate.

Figure 4-6 shows that any combinations that fall along the equilibrium line result in maximum thru-put. Higher baud rates with fewer characters per line cannot be sustained. The line buffer overflows and data is lost. Conversely, low baud rates with long lines result in the print buffer waiting for characters with a corresponding reduction in thru-put.

The following alternatives should be considered:

(1) Select a baud rate vs. character per line combination that falls along the equilibrium line on Figure 4-6.

(2) If the number of characters per line is variable, always add pad characters to make the line length constant.

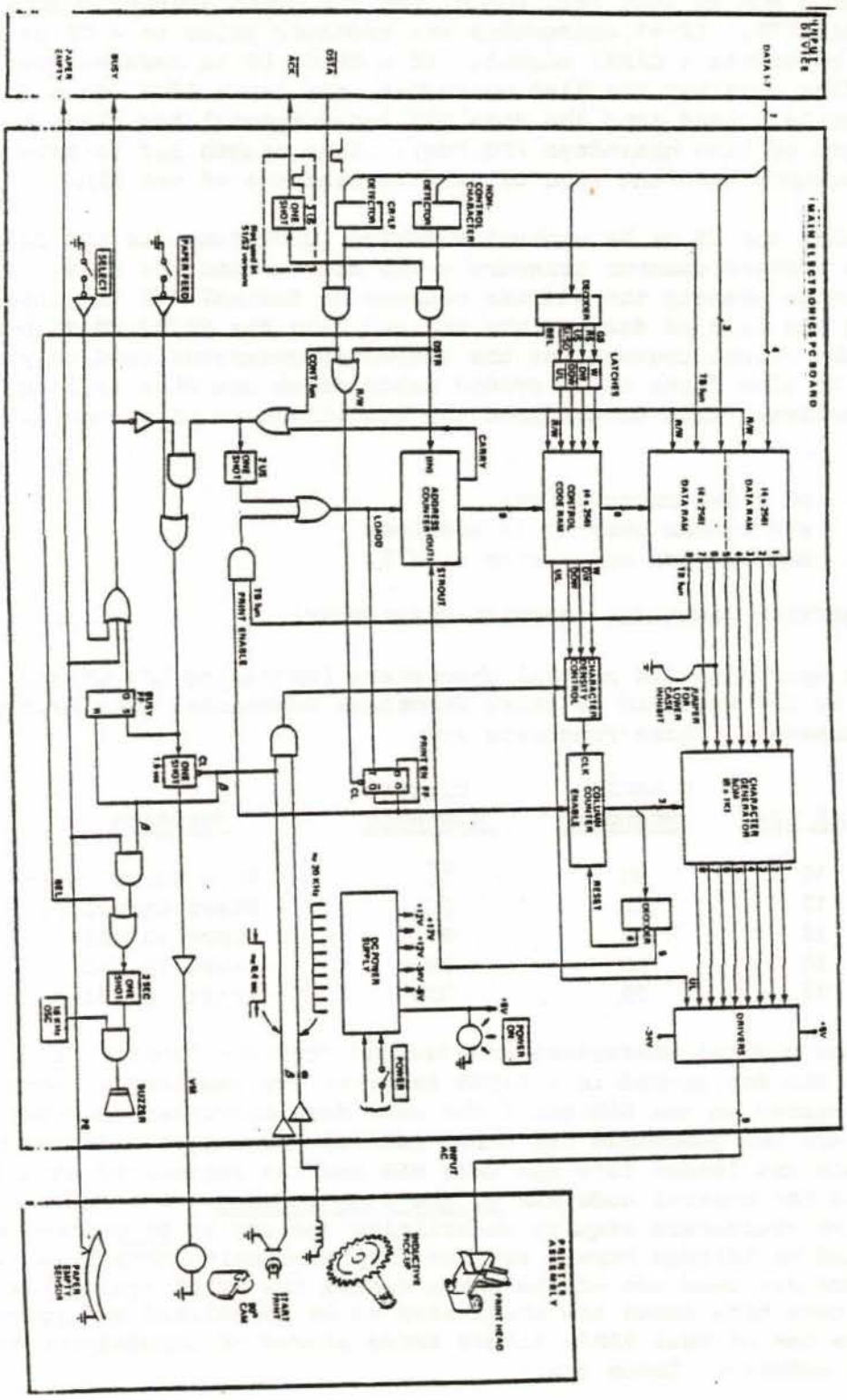
(3) Transmit as desired while monitoring the reverse channel line (SA) and inhibit transmissions when a buffer full condition is imminent.

4.5 MAIN ELECTRONICS OPERATION

The main electronics consists of one pc board containing a line buffer, character generator and associated logic for timing and for performing control functions such as buzzer operation and paper feed. The main electronics receives parallel data bits for each character from the serial interface along with "alpha" and "beta" timing signals from the printer assembly. It controls the voltage to the dc drive motor and fires the styli electrodes as required in response to these inputs. It also received input ac power and generates the required dc operating voltages.

4.5.1 RECEIVE OPERATION (DATA CHARACTERS)

When the microprinter is initially turned on, a power on reset (POR) pulse clears all flip-flops and counters. This automatically sets the printer for 20 cpi operation. Operation is initiated whenever a data strobe A (DSTA) pulse is received from the serial interface. This pulse simultaneously fires a three microsecond acknowledge one shot (ACK) and loads the 7-bit ASCII input data word into an 8-bit by 256 word random access memory (RAM). If the ASCII word is not a control character, DSTA generates a data strobe (DSTR) pulse and a read/write pulse (R/W). R/W loads the word into address zero of the 8-bit by 256 word random access memory (RAM). Zeros are loaded into the control code RAM. At the end of the DSTA pulse, DSTR increments the address counter to one. Loading of the line buffer data RAM continues until 81 characters are received or a carriage return (CR) or line feed (LF) control character is received.


MAIN ELECTRONICS PC BOARD
DATA 1-7
BUSY
PAPER EMPTY
ACK
STB
SELECT
PAPER FEED
DECODER
LATCHES
CONT func
R/W
CARRY
ADDRESS COUNTER
LOAD0
STROUT
CONTROL CODE RAM
DATA RAM
CHARACTER DENSITY CONTROL
CLK
COLUMN COUNTER
ENABLE
RESET
CHARACTER GENERATOR ROM
DRIVERS
PRINT ENABLE
PRINT EN. FF
ONE SHOT
DC POWER SUPPLY
POWER
POWER ON
BUZZER
INPUT AC
PRINT HEAD
INDUCTIVE PICK UP
HEART POINT
PAPER SENSOR

During POR or load data $\overline{\text{LOADD}}$, the 256 count address counter is preset to decimal 175. If 81 characters are received prior to a CR or LF, the counter generates a CARRY signal. If a CR or LF is received before the line buffer receives the 81st character, the 7-bit ASCII code for the CR/LF character is loaded into the data RAM and a special bit flags that character as the end of line character (TB fun). This eighth bit is used to end the print sequence when the line of data is read out of the RAM.

Either the CR or LF control function (CONT fun), or the CARRY signal from the address counter triggers a two microsecond one shot. Its LOADD output pulse presets the address counter to decimal 175 in preparation for printing the line of data in the RAM and sets the PRINT EN flip-flop to enable the column counter for the character generator read only memory (ROM). It also fires a 1.5 second motor drive one shot as long as BUSY is not active. This establishes the conditions to print one line of data. That is:

(1) DC drive motor is on.
(2) ROM column counter is enabled.
(3) RAM address counter is at 175.

4.5.2 RECEIVE OPERATION (CONTROL CHARACTERS)

The operation for control characters (excluding LF, CR and BEL) uses a 4 bit by 256 word RAM to store functions associated with each printed data character. These functions are:

Octal Code	ASCII Mnemonic	Circuit Mnemonic	Function
16	SO	$\overline{\text{UL}}$	Stop Underlining
17	SI	UL	Start Underlining
35	GS	W	Start 20 CPI
36	RS	DW	Start 10 CPI
37	US	DDW	Start 5 CPI

These control characters are decoded from the 7-bit ASCII input as received and are stored in a latch reserved for each code. Note that they are not stored in the RAM until the next data character is received. DSTR and R/W are not generated for these control characters. Subsequent data characters are loaded into the data RAM and the associated control code is stored in the control code RAM at the same address. For example, if five successive characters require underlining and are to be printed at 10 CPI, the UL and DW latches remain set for five successive DSTA pulses. When the characters are read out of the RAM's during the print cycle, the corresponding control code bits cause the characters to be underlined and printed at 10 CPI. The use of dual RAM's allows three pieces of information to be stored for each address. These are:

(1) The character to be printed,
(2) The relative density of the line,
(3) Whether the character should be underlined.

Until a control code is cancelled by the input device, the latch remains set and all subsequent characters are flagged with that code.

4.5.3 SUCESSIVE CR CONTROL CODES

Printer operation is inhibited if successive CR codes are received. This is accomplished by the circuit shown in Figure 4-8. Unless at least one data character is received between CR codes, the CR is ignored. At POR, flip-flop 2D resets and its Q output goes low. This inhibits NAND gate 2A until a data character is loaded. Data characters may be distinguished from control characters by DSTR which increments the address counter for data characters only. The DSTR pulse sets flip-flop 2D, its Q output goes high and any subsequent CR code enables gates 2A, 2B and 2C.

NOTE:

R10, R13 AND CO ARE DECODED BITS CORRESPONDING TO CR AND LF.

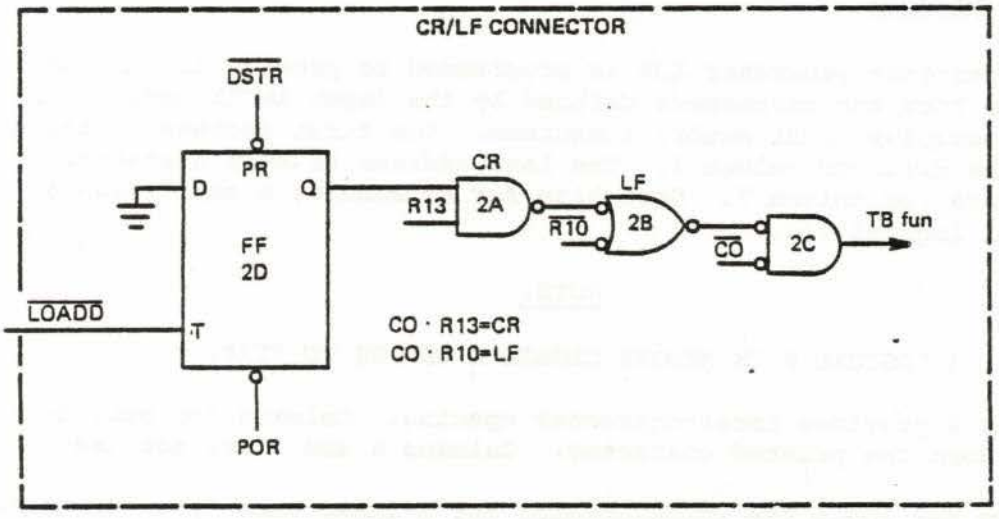


Figure 4-8. CR INHIBIT SIMPLIFIED SCHEMATIC

TB fun is gated with $\overline{\text{DSTA}}$ (see Figure 4-7) to generate R/W and $\overline{\text{CONT}}$ fun. CONT fun presets the address counter via LOADD which also toggles flip-flop 2D to the reset state (Q Low). This inhibits CR detection again until another data character is loaded by DSTR, as described previously.

Multiple LF codes are not inhibited. This provides for remote paper feed.

4.6 PRINTING OPERATION

One line of data is printed by the nine styli as the print head attached to the timing belt makes one complete revolution. Operation is initiated as described previously when CONT fun is detected, more than 80 characters are received or the paper feed (PF) switch is pressed.

The motor drive signal fires a 1.5 second one shot which turns on the dc drive motor. Normally, the one shot is cleared when the "beta" timing signal ends approximately 0.4 seconds later. If, for any reason, the "beta" signal does not stop the motor, damage is prevented by forcing the motor to shut off when the one shot runs down.

With the PRINT EN flip-flop set and the RAM address counter preset to the address of the first character (175 decimal), the print cycle begins. As the drive motor turns the timing belt, "alpha" pulses are received immediately from the inductive pick-up in the printer as the head assembly moves from the "rest position" around the left pulley. Alpha pulses occur at approximately 10 kHz, however, they are gated off until the head is positioned at the first print position. This is determined by the 90° cam and phototransistor that generates the "beta" signal. When "beta" goes high, the "alpha" pulses are gated to the character density control circuits and the print phase begin.

4.6.1 ROM PROGRAM

The character generator ROM is programmed to provide the matrix required to form the characters defined by the input ASCII code. Each character occupies eight memory locations. The first address location contains the data for column Ø. The last address of each character group contains data for column 7. Data bits for columns Ø, 6 and 7 always contain all logical 1's.

NOTE:

A LOGICAL Ø IN MEMORY CAUSES A STYLUS TO FIRE.

Column Ø provides inter-character spacing. Columns 1-5 provide the pulses to form the printed character. Columns 6 and 7 are not used.

Figure 4-9 shows the relationships for a lower case "y". The ASCII code at the ROM address input is 171 octal. The ROM decodes this as 030 decimal and outputs the data for column Ø. This is always all logical 1's (hexadecimal code FF) which prevents the styli from firing and provides space between adjacent characters. The column counter (see Figure 4-7) increments the ROM address to 31, 32, 33, 34 and 35 while the corresponding

data bits fire the styli to form the lower case "y". At a count of 36, the column counter immediately resets to Ø and the next ASCII character from the RAM is presented to the ROM.

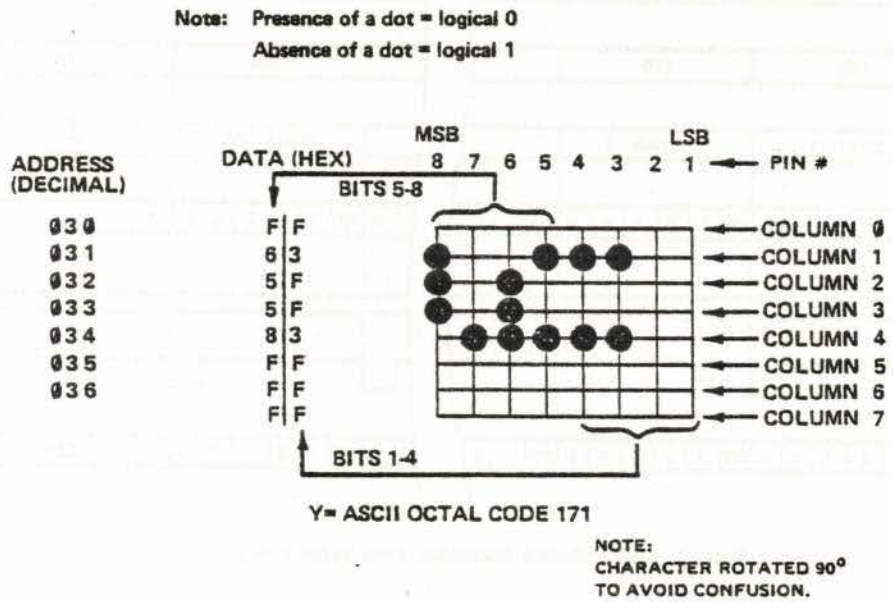


Figure F. ROM CONTENTS FOR "Y"

Figure 4-9. ROM CHARACTER FORMATION

4.6.2 PRINT CONTROL TIMING

Figure 4-10 shows the timing relationships during the print cycle. LOADD is a two microsecond pulse that occurs coincident with the motor drive pulse. It sets the PRIN EN flip-flop and presets the RAM address counter to 175 decimal, the first address used during receive. The ROM input at that time is the first ASCII character received for that line. The output to the styli drivers is FF (Hex) which keeps them turned off. When PRINT START (beta) is received, it gates the "alpha" pulses to the character density control circuits. Depending on which of the three inputs is active, clock pulses at 2.5 kHz, 5 kHz or 10 kHz are applied to the column counter for line densities of 5, 10 or 20 CPI respectively. The first five clock pulses increment the counter to access ROM addresses 1, 2, 3, 4 and 5. The stored character is printed as the head continues to move. At the decoded count of 5, a strobe out (STROUT) pulse increments the RAM address counter to one. This occurs on the rising edge of the pulse which is coincident with the decoded count of six. This resets the column counter to Ø and the process repeats for character two.

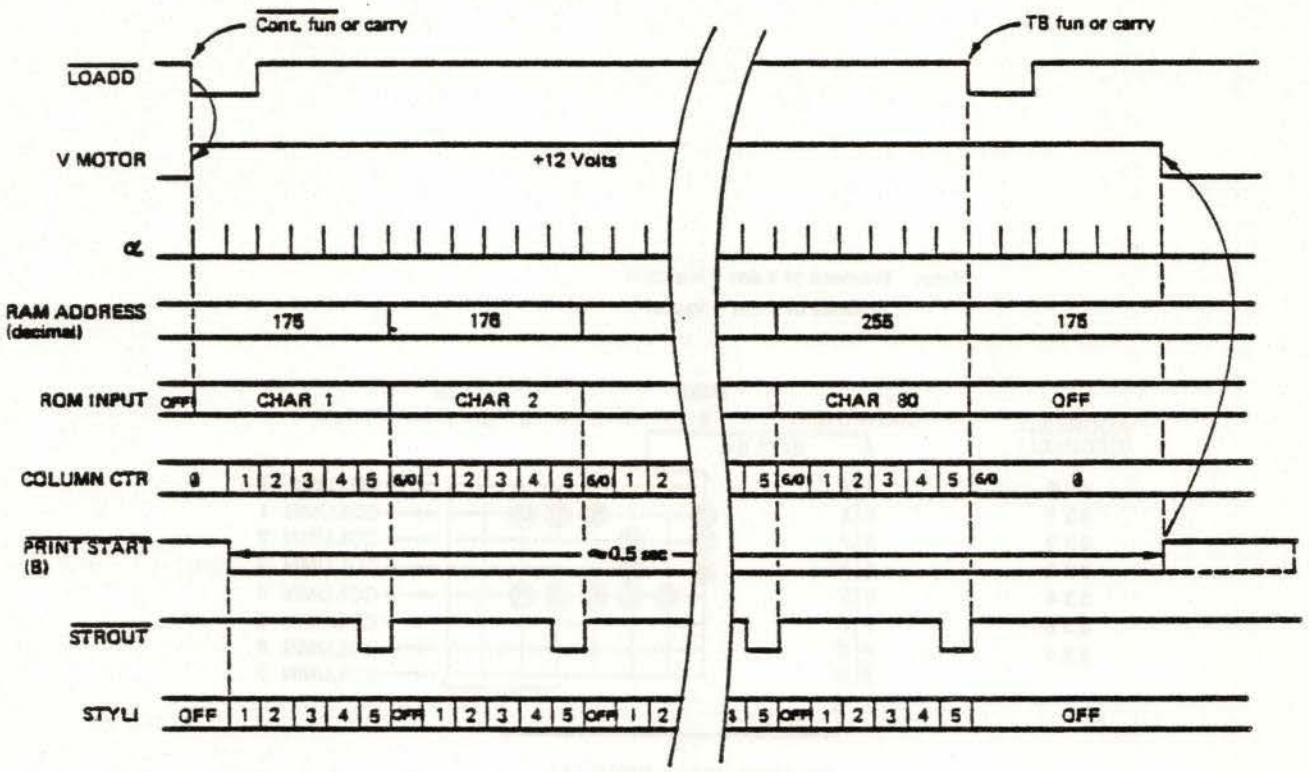


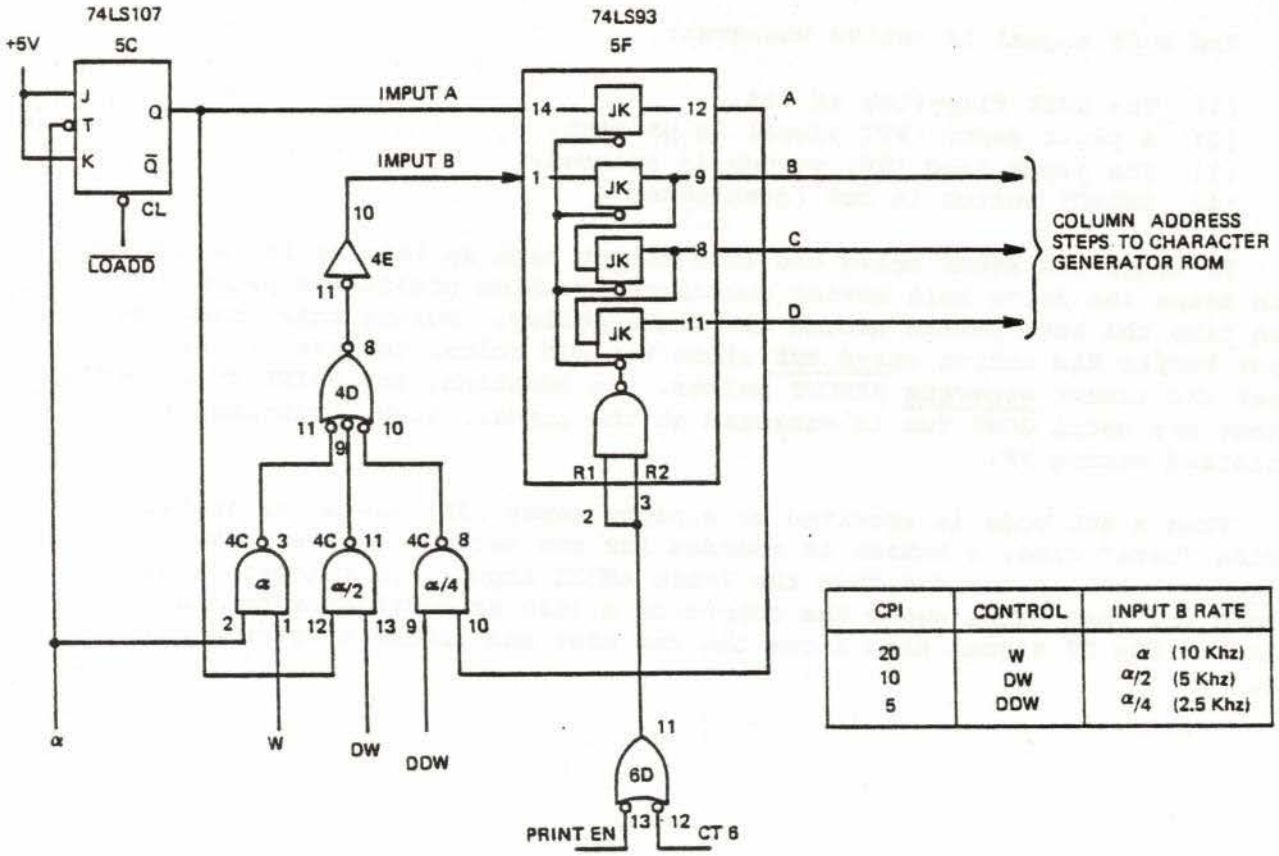
Figure G. PRINT TIMING DIAGRAM (ONE 20 CPI LINE)

Figure 4-10. PRINT TIMING DIAGRAM

When the 80th character position on the paper is reached, the drive belt moves the head slider pin down and around the right pulley. This action moves the head styli away from the paper and prevents additional printing. Since the RAM input buffer is allowed to store only 80 characters, it is always empty at this point.

TB fun becomes active at the end of the line in the RAM buffer. It is gated with the high output of the PRINT EN flip-flop to generate another LOADD pulse. This pulse presets the RAM address counter back to 175 and toggles the PRINT EN flip-flop to the reset state. Its low Q output holds the ROM column counter reset until the next print cycle is initiated.

"Beta" remains high until the head rest position is reached at which time the phototransistor turns off. "Alpha" pulses gated through prior to the end of "beta" have no effect since the column counter is held reset and the styli are unable to expose the paper because they are withdrawn. When "beta" ends, it clears the motor drive one shot which stops the motor with the head at the rest position. It also resets the BUSY flip-flop which signals the serial interface or input device that the print buffer is empty and ready to receive the next line of data.



CPI	CONTROL	INPUT B RATE
20	W	α (10 Khz)
10	DW	α/2 (5 Khz)
5	DDW	α/4 (2.5 Khz)

Figure H. CHARACTER DENSITY CONTROL & COLUMN COUNTER SCHEMATIC DIAGRAM

Figure 4-11. CHARACTER DENSITY CONTROL SIMPLIFIED SCHEMATIC DIAGRAM

4.6.3 CHARACTER DENSITY CONTROL

Figure 4-11 shows the logic circuits for controlling character density. When the print cycle is initiated, LOADD clears J-K flip-flop 5C and PRINT EN goes high which releases binary counter 5F from the reset state.

As the drive motor moves the timing belt, "alpha" pulses are received from the inductive pick-up. These 10 kHz pulses are used directly to clock INPUT B of counter 5F for 20 CPI operation or they are divided to 5 kHz by flip-flop 5C for 10 CPI or to 2.5 kHz by flip-flop 5C and the top J-K flip-flop on counter 5F. The divide process is selected by one of the three 4C NAND gates that is enabled by the W, DW or DDW output of the control code latches (see Figure 4-7). The enabled gate receives the corresponding "alpha" clock pulses which increment three-stage binary counter 5F via INPUT B. The B, C and D outputs increment binarily to access the five sequential data addresses in the character generator ROM. When the counter increments to a count of 6 (CT6), it immediately resets to Ø and the process starts over for the next character. Each data character has one of the three density codes associated with it stored in the control code RAM.

4.6.4 MISCELLANEOUS OPERATIONS

The BUSY signal is active whenever:

(1) The BUSY flip-flop is set.
(2) A paper empty (PE) signal is present.
(3) The paper feed (PF) switch is pressed.
(4) SELECT switch is out (deselected).

PF keeps the motor drive one shot output high as long as it is pressed. This keeps the drive belt moving continuously which provides a paper feed each time the head passes around the right pulley. During this time, the input buffer RAM output stays off since the ROM column counter is held reset and cannot generate STROUT pulses. In addition, the PRINT EN flip-flop cannot set until CONT fun is detected at the input. Thus, printing is inhibited during PF.

When a BEL code is received or a paper empty (PE) signal is present during "beta" time, a buzzer is sounded for two seconds to alert the operator. BEL is decoded from the 7-bit ASCII input. It triggers a two second one shot which gates the output of a 1600 Hz oscillator to the buzzer. The PE signal also fires the one shot and lights a front panel LED.

SECTION 5

MAINTENANCE

5.1 TOOLS

Tools and materials required for maintenance of the Microprinter are listed in Table 5-1.

TABLE 5-1

TOOLS REQUIRED

Tool	Size/Type
Screwdriver	Flat Blade
Screwdriver	Phillips Head
Box End Wrench	7.0mm
Hex Wrench	1.5mm
Retaining Ring Holder	2.0mm
Retaining Ring Holder	2.5mm
Retaining Ring Holder	3.0mm
Retaining Ring Holder	4.0mm
Soldering Iron	10 Watt
Pliers	Cutting
Pliers	Needle Nose
Silicon Grease	KS-64 (Centronics 3005004-0001)
Feeler Gauge	.2mm
Loctite	Or Equivalent
Abrasive Paper	Supplied with Printer

5.2 PREVENTIVE MAINTENANCE

Routine preventive maintenance should be performed at scheduled intervals to insure satisfactory performance. Maintenance consists of lubrication, head alignment and printer cleaning.

5.3 LUBRICATION

To insure normal printer operation, silicon grease KS-64 or equivalent should be applied to the items shown in Figure 5-1 at the recommended intervals.

5.4 HEAD ALIGNMENT (Figure 5-2)

This procedure should be performed at regular intervals to correct the effects of normal head wear. The styli which expose the aluminum coated paper are not used equally since the bottom two are used only for lower case characters with descenders (8th styli) and for underlining (9th styli). As a result, styli 1-7 erode slightly more than 8 & 9. After repeated use, they rest further away from the paper than normal causing less aluminum to be exposed with correspondingly fainter characters. This procedure removes a tiny amount of tungsten carbide from the 8th and 9th electrodes which allows all styli to rest evenly on the aluminum coating with the correct force for forming high quality characters.

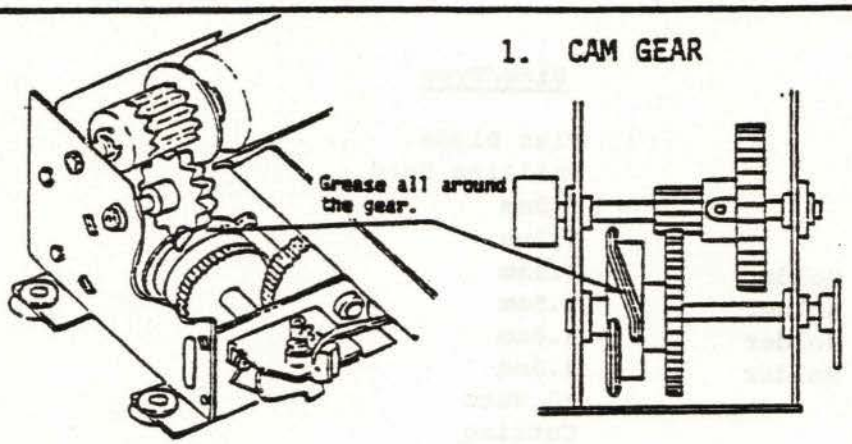
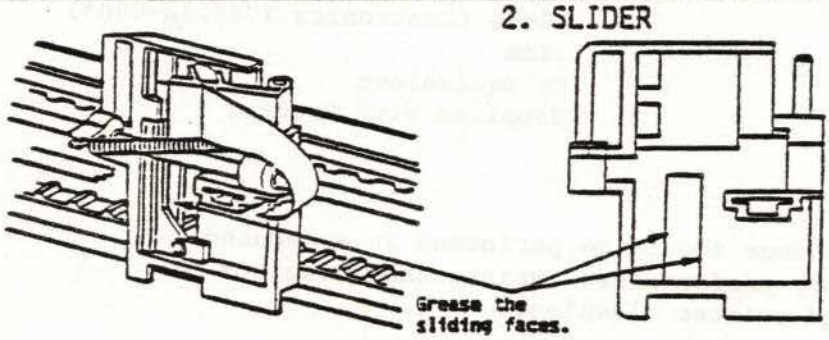
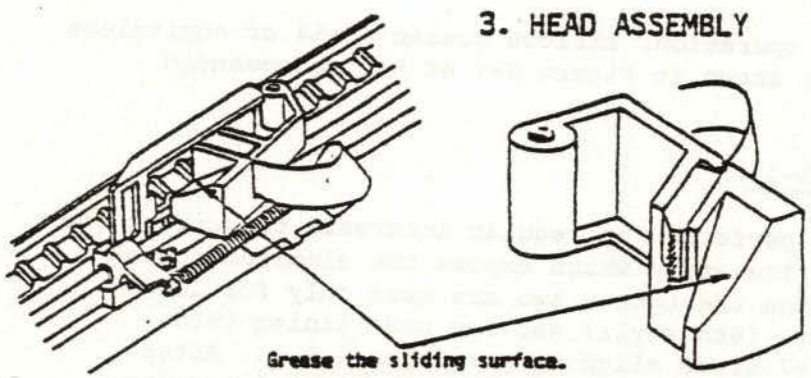
ITEM	PROCEDURE
1. CAM GEAR 	Apply .5 gram of grease on all contact surfaces.
2. SLIDER 	Apply .2 gram of grease to slider guide edges.
3. HEAD ASSEMBLY 	Apply .1 gram of grease to beveled surface of head assembly where slider rides.

Figure 5-1. LUBRICATION CHART

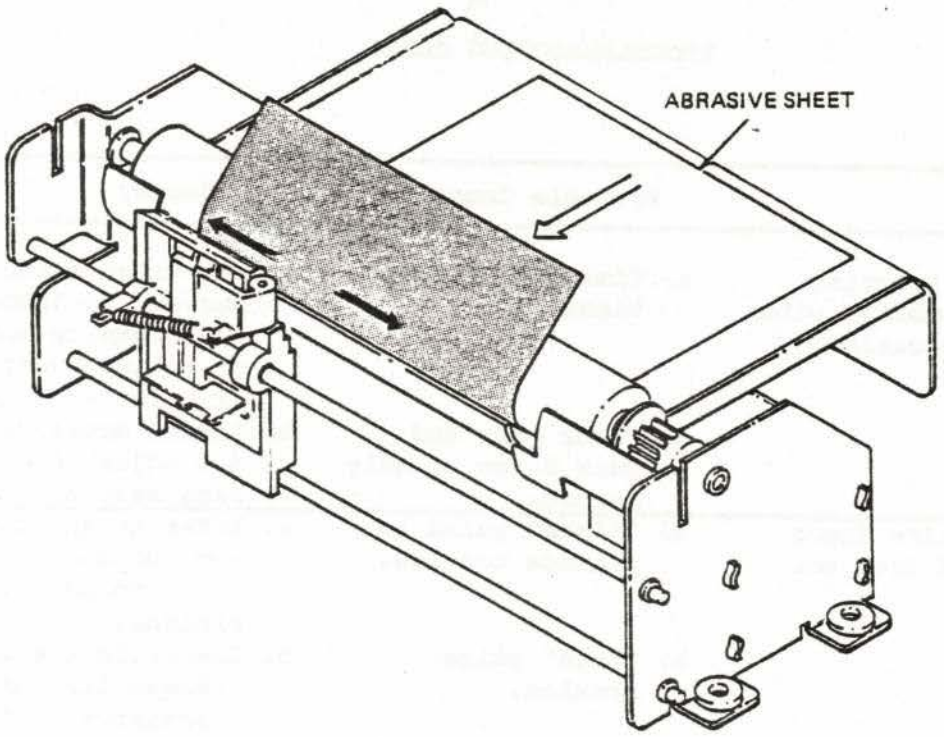


Figure 5-2. HEAD SANDING

Material Required: Sheet of fine abrasive paper (supplied with printer).

Procedure:
(1) Remove paper roll from printer.
(2) Place POWER switch on.
(3) Make sure SELECT switch is in the out position (deselected).
(4) Insert abrasive paper sheet into printer with the abrasive side facing down in the same manner as paper is loaded.
(5) Hold PAPER FEED switch down until abrasive sheet finishes feeding through the printer.
(6) Repeat steps (4) and (5).
(7) Remove abrasive sheet and insert paper roll.
(8) Place POWER switch off.

Maintenance Interval: This procedure should be performed after 20 rolls of paper are used or as required.

5.5 CLEANING

Visually inspect the printer assembly for accumulation of aluminum dregs. Clean periodically with soft bristled brush to prevent dust build-up on greased parts.

5.6 TROUBLESHOOTING

Refer to Table 5-1 to help isolate malfunctions to a replaceable part or for corrective adjustment procedures.

TABLE 5-1

TROUBLESHOOTING CHART

Trouble	Probable Cause	Remedy
1. Reduced printing speed combined with noisy operation.	a. Timing belt too tight	a. Set drive motor current to 550ma by loosening screw on pulley shaft. (Figure 7-5, View B)
	b. Motor gear and gear B too tightly meshed.	b. Loosen motor bracket and adjust for correct mesh (Figure 7-4).
2. Platen line feeds but head does not print.	a. "Alpha" pulse amplitude too low.	a. Refer to adjustments section and set pulse for 2 volts p/p minimum.
	b. "Beta" pulse problem.	b. Check/replace incandescent lamp or phototransistor. Check/adjust pulse timing.
3. Print inoperative.	a. Paper empty sensor causing continuous "BUSY" condition.	a. Check physical contact between copper sensor and paper. Check electrical continuity to ground through paper guides. Replace sensor.
	b. Drive motor failure	b. Check/replace motor.
4. Character distortion, dot shading or skewing.	Print head adjustment.	Replace head.
5. Light printing.	a. Paper resistance too high (more than 4 ohms).	a. Replace paper roll.
	b. Styli discharge voltage too low.	b. Check drivers on main pc board for -33 volt to -36 volt pulses.
6. Dark printing	a. Paper resistance too low (less than 1 ohm).	a. Replace paper roll.
	b. Styli discharge voltage erratic.	b. Check/replace drivers on main pc board.

TABLE 5-2 (Cont.)

TROUBLESHOOTING CHART

Trouble	Probable Cause	Remedy
7. Erratic printing with secondary discharges.	a. Insufficient pressure between paper and platen.	a. Adjust paper roller at bottom center of platen to 600-800 grams by moving sliding bracket.
	b. Paper dust sticks to paper roller.	b. Clean roller.
8. Paper feeds crooked.	a. Two paper guides not evenly adjusted.	a. Check/adjust paper guides to 25-50 grams.
	b. Paper inserted crooked.	b. Re-thread paper.
9. Printing margin shifts right or left.	"Beta" timing erratic.	Check/adjust "beta" disk.
10. Buzzer rings when paper is inserted.	Paper sensor pressure too low.	Check electrical continuity from chassis ground to sensor. Adjust sensor pressure to 50 grams as required.
11. Printer completely inoperative in local and remote.	One or more power supply outputs missing.	Refer to Figure 5-3 and check all fuses.

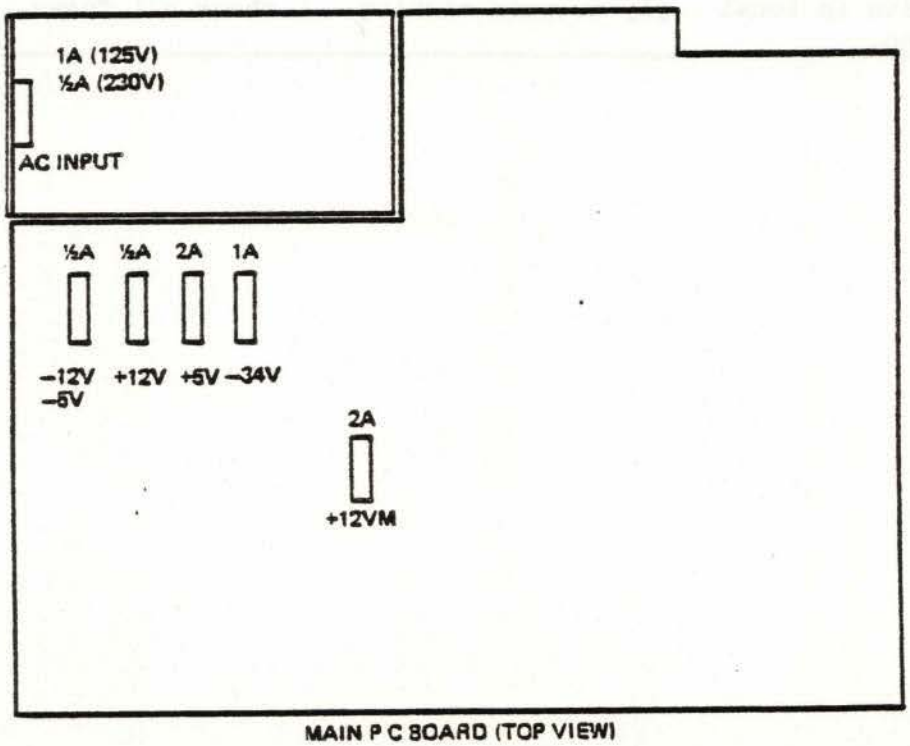


Figure 5-3. FUSE LOCATIONS

SECTION 6

ADJUSTMENTS

6.1 SCOPE

Adjustment procedures should be performed whenever an affected printer part is replaced or to correct improper operation. Adjustments are provided for paper feed, alpha timing pulses and beta timing pulses. Check the adjustment parameters before proceeding with the adjustment to be sure it is necessary.

6.2 PAPER FEED ADJUSTMENT (See Figure 6-1)

Performing the following procedure insures that the platen begins to feed up one line (1/5") when the slider pin is at the very bottom position around the right pulley. This insures that the head is fully withdrawn and that sufficient time is available to complete the line feed before the motor shuts off.

(1) Loosen two set screws on gear B shaft.
(2) Turn gear B by hand to the right until red alignment dot on cam gear is at top position.
(3) Hold gear B in position and slide bottom of timing belt to the left until right pulley is positioned as shown in Figure 6-1.

CAUTION

DO NOT MOVE BOTTOM OF TIMING BELT TO THE RIGHT.
DAMAGE TO THE HEAD AND PLATEN MAY RESULT.

(4) Tighten two set screws on gear B shaft.

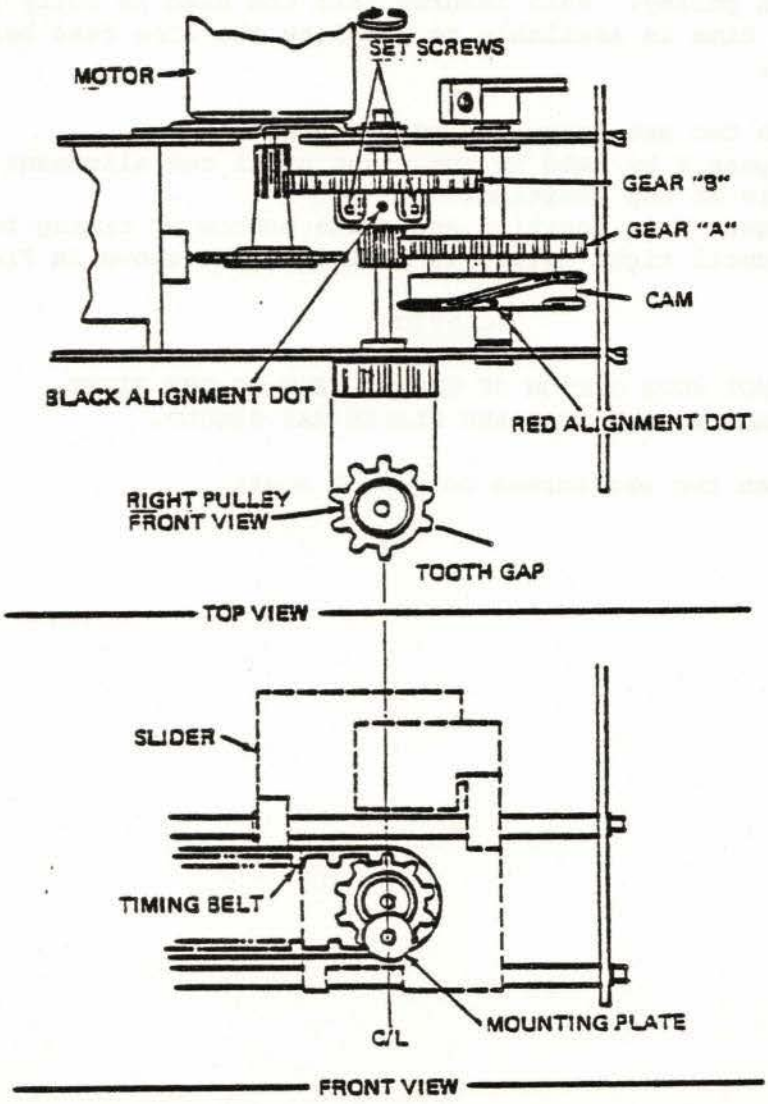


Figure 6-1. PRINTER "HOME" POSITION

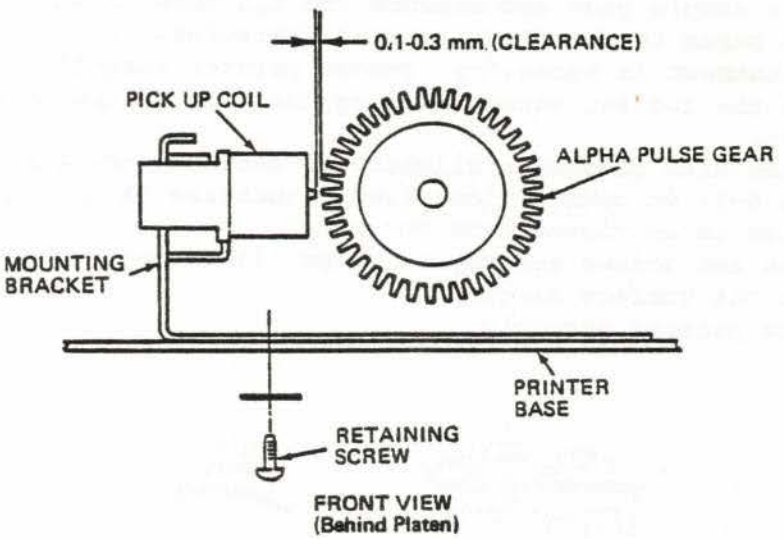


Figure 6-2. "ALPHA" PULSE TIMING ADJUSTMENT

6.3 ALPHA SIGNAL ADJUSTMENT (See Figure 6-2)

Performing this procedure insures that the output alpha signal amplitude is more than 2 volts p/p. This is accomplished by checking the physical distance between the teeth on the pulse gear and the inductive pick-up.

(1) Remove printer assembly from upper cabinet.
(2) Loosen the retaining screw securing the pick-up coil mounting bracket to the printer base.
(3) Place a 0.2mm feeler gauge between the pulse gear and the inductive pick-up and adjust clearance for 0.1mm to 0.3mm.
(4) Tighten retaining screw.
(5) Connect an oscilloscope across the inductive pick-up (orange and brown leads with slip-on connectors).

CAUTION

TURN THE PULSE GEAR BY HAND AND CONFIRM THAT THERE IS NO CONTACT BETWEEN THE PICK-UP AND THE GEAR.

(6) Energize the printer and hold the PAPER FEED switch pressed down.
(7) Observe a 10 kHz pulse train with a minimum amplitude of 2 volts p/p.
(8) Replace printer assembly.

6.4 BETA SIGNAL ADJUSTMENT (See Figure 6-3)

Performing these procedures sets the start print position on the paper between 9mm and 12mm from the left edge of the paper.

(1) Print a sample page and measure the distance from the left edge of the paper to the first printed character.
(2) If adjustment is necessary, remove printer assembly from cabinet.
(3) Loosen the two set screws secuing the disk to the mounting bracket.
(4) Move the disk clockwise slightly to decrease the margin (B in Figure 6-3) or counterclockwise to increase (A in Figure 6-3). Rotation is as viewed from the rear.
(5) Tighten set screws and repeat steps (1) through 4) as required to obtain the correct margin.
(6) Replace printer assembly.

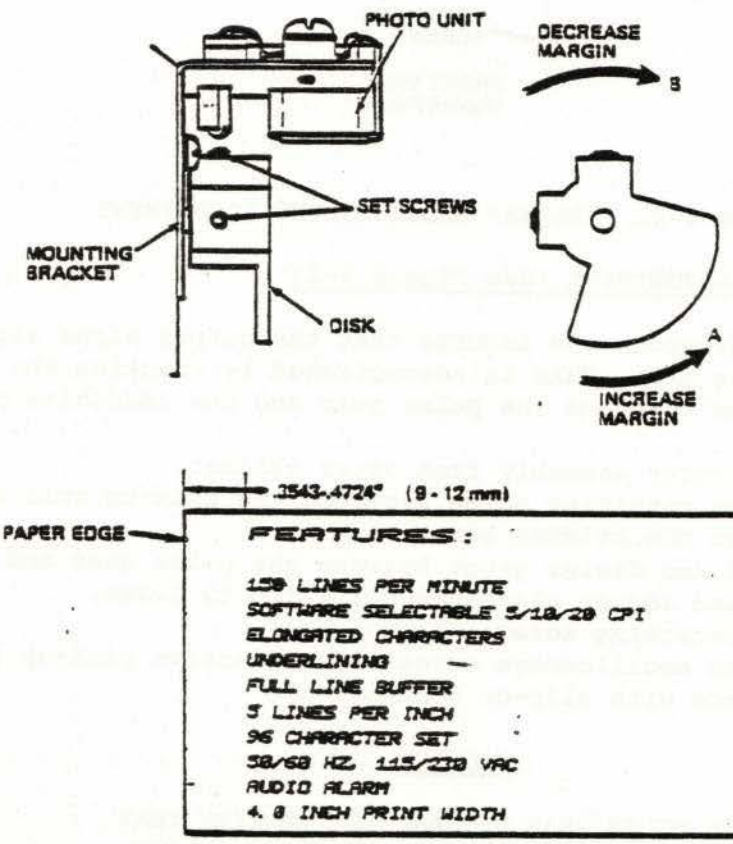


Figure 6-3. "BETA" PULSE TIMING ADJUSTMENT

SECTION 7

REMOVAL/REPLACEMENT PROCEDURES

7.1 SCOPE

This section contains procedures for removing and replacing the following parts:

(1) Head Unit
(2) Printer Assembly
(3) Motor Unit
(4) Timing Belt

7.2 HEAD UNIT REPLACEMENT

This part may be replaced by separating the upper cabinet from the lower cabinet and then removing the head unit with its attached pc cable and connector. Proceed as follows:

(1) Refer to Figure 7-1. Remove the two screws from the bottom cabinet and the three screws from the rear of the top cabinet. Retain hardware.
(2) Refer to Figuer 7-2. Rest the upper cabinet on the bottom cabinet. It is not necessary to remove any connectors except for the head unit connector (P005) on the main pc board.
(3) Follow steps 1-3 of Figure 7-2 and remove the head unit.

CAUTION

THE PC RIBBON CABLE IS GLUED TO THE BOTTOM OF TOP CABINET. CAREFULLY PULL THE CABLE FREE FROM THE CABINET.

(4) Head unit replacement is done in the reverse order of removal. Use care to install DIP connector P005 correctly.
(5) Glue the pc ribbon cable to the cabinet and re-assembly the upper and lower cabinets with the hardware removed in step (1).

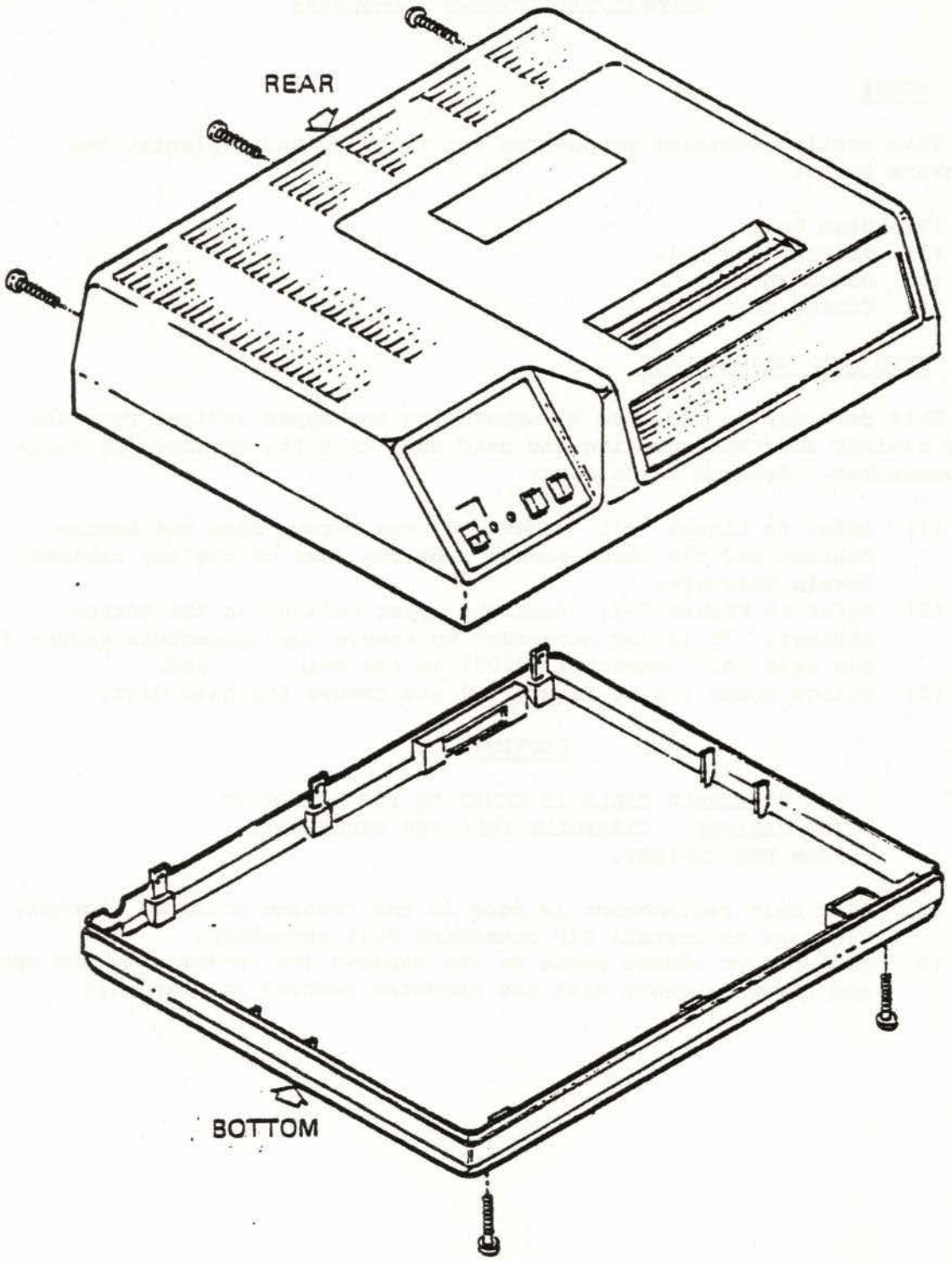


Figure 7-1. UPPER/LOWER CABINET REMOVAL

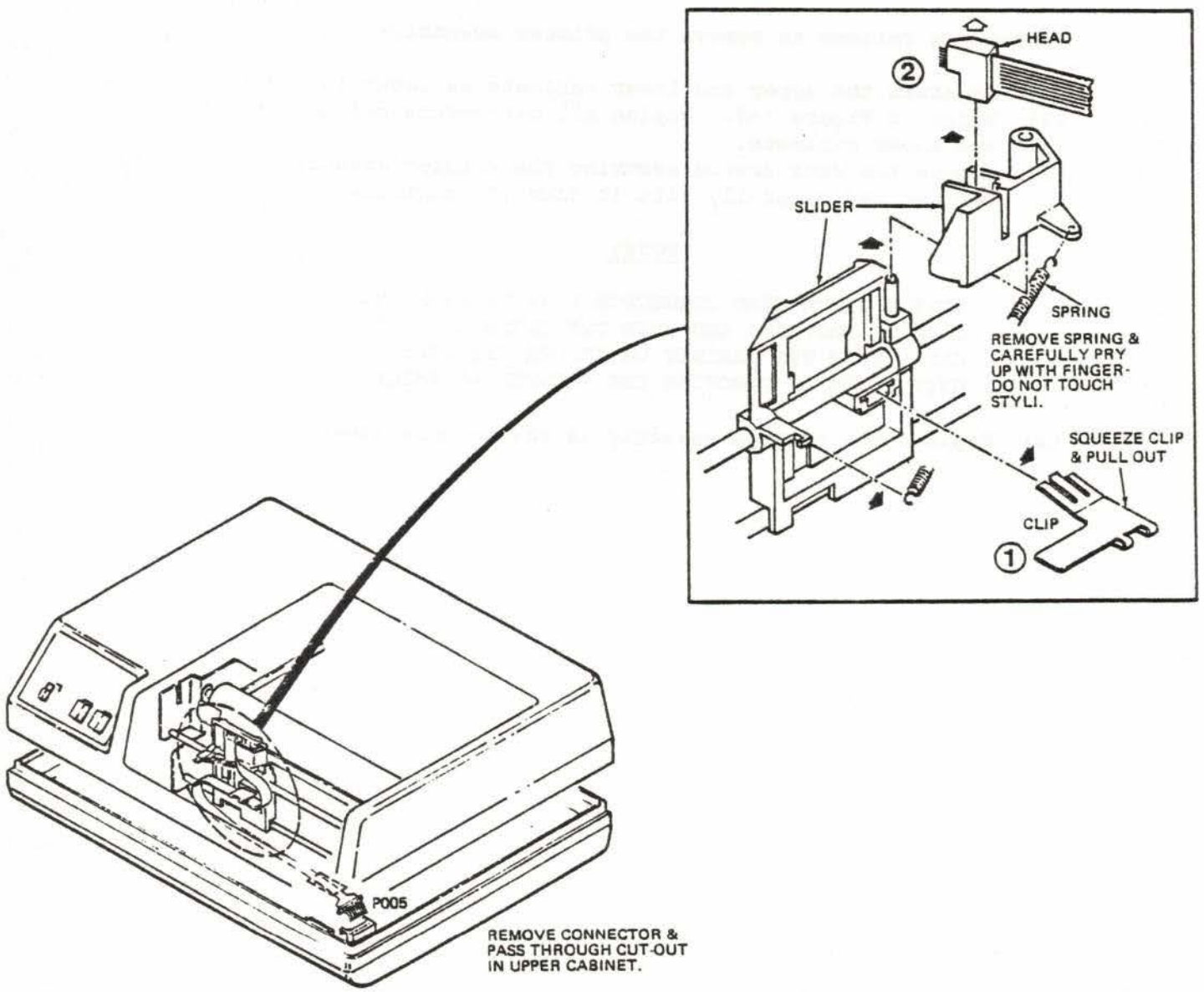


Figure 7-2. HEAD UNIT REMOVAL

7.3 PRINTER ASSEMBLY REMOVAL

This assembly must be removed in order to gain access to the motor unit and the timing belt. It must also be removed to adjust the alpha and beta timing pulses.

NOTE:

THE HEAD UNIT MAY REMAIN INSTALLED ON THE PRINTER ASSEMBLY.

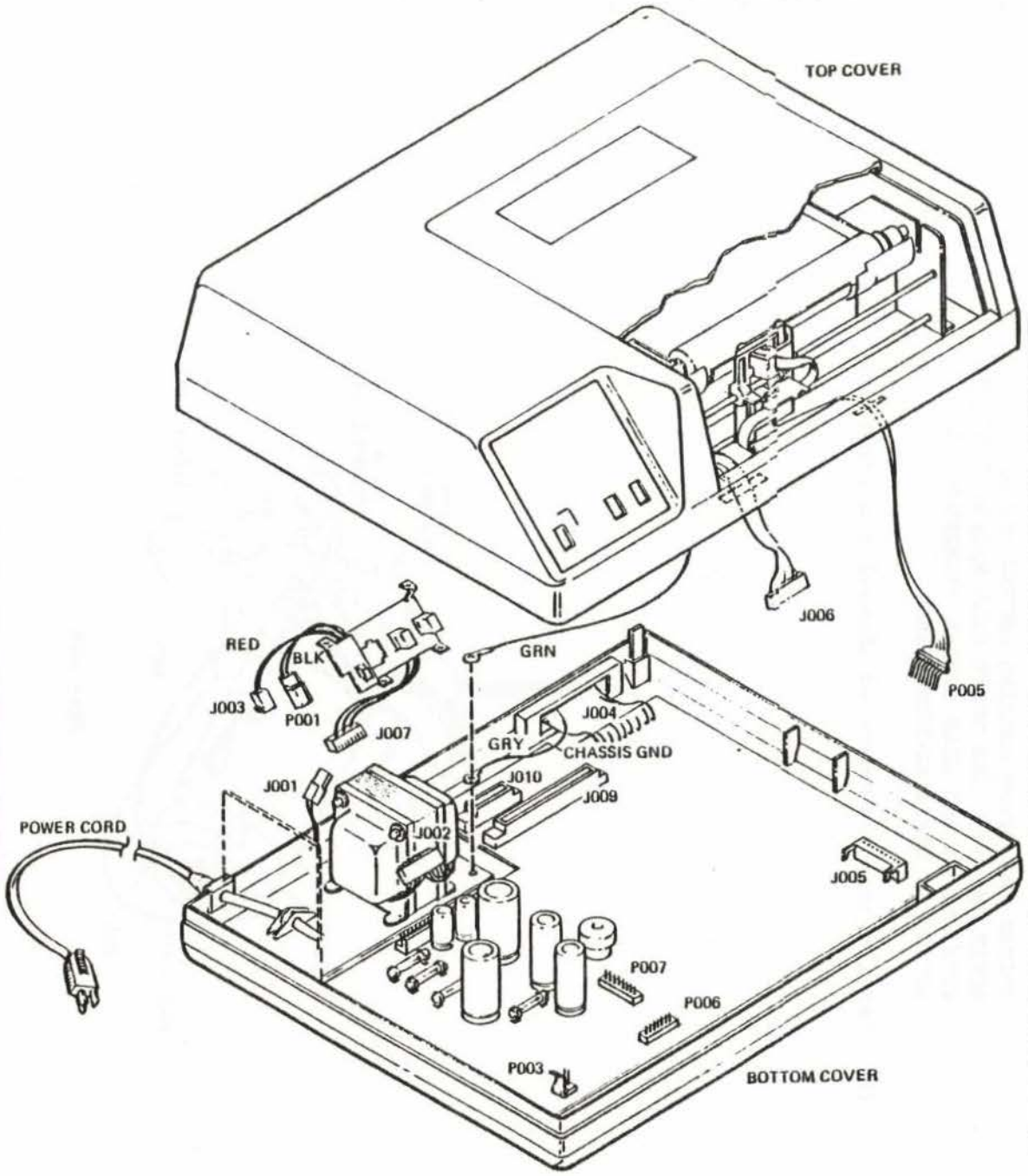
Proceed as follows to remove the printer assembly:

(1) Separate the upper and lower cabinets as shown in Figure 7-1.
(2) Refer to Figure 7-3. Unplug all connectors between the upper and lower cabinets.
(3) Remove the four screws securing the printer assembly to the upper cabinet and carefully lift it from the cabinet.

NOTE:

EITHER ROUTE HEAD CONNECTOR P005 THROUGH THE OPENING PROVIDED AND FREE THE GLUED HEAD PC CABLE FROM THE CABINET OR REMOVE THE HEAD UNIT PRIOR TO REMOVING THE PRINTER ASSEMBLY.

(4) Replace the printer assembly in the reverse order of removal.



CONNECTOR	FUNCTION
J001/P001	SWITCHED AC RETURN (BLK)
J002/P002	SWITCHED TRANSFORMER OUTPUTS
J003/P003	SWITCHED MOTOR POWER (RED)
J004/P004	PARALLEL INTERFACE INPUT (NOTE 2)
J005/P005	PRINT HEAD
J006/P006	PRINTER ELECTRONICS
J007/P007	SWITCH PANEL
J008/P008	SERIAL INTERFACE INPUT (On rear serial brand)
J009/P009	SERIAL INTERFACE OUTPUT (NOTE 3)
J010/P010	INTERCONNECTIONS (NOTE 3) (front and Rear Serial Boards)

NOTES

1. J00X= FEMALE PINS
   P00X= MALE PINS
2. NOT INSTALLED ON S1/S2 MODELS
3. NOT INSTALLED ON P1/P2 MODELS

Figure 7-3. CONNECTOR LOCATION DIAGRAM

7.4 MOTOR UNIT (See Figure 7-4)

The motor unit consists of the 12-volt dc drive motor with the attached "alpha" pulse disc and mounting bracket. To remove the unit, refer to Figure 7-4 and perform the following steps:

(1) Remove the printer assembly.
(2) Remove the two screws, flat washers and lockwashers securing the motor bracket to the printer assembly.
(3) Carefully lift the motor unit out of the printer assembly using caution not to damage the wires to the photodetector assembly.
(4) If necessary, unsolder the red and blue leads on the motor noting the wire color connected to each motor terminal.

CAUTION

ADJUST THE MOTOR HOUSING AROUND ITS AXIS OF ROTATION UNTIL THE DRIVE GEAR MESHES CORRECTLY WITH THE MATING GEAR BEFORE TIGHTENING BOTH SCREWS IN THE FOLLOWING STEP.

(5) Reverse this procedure to install the motor unit.

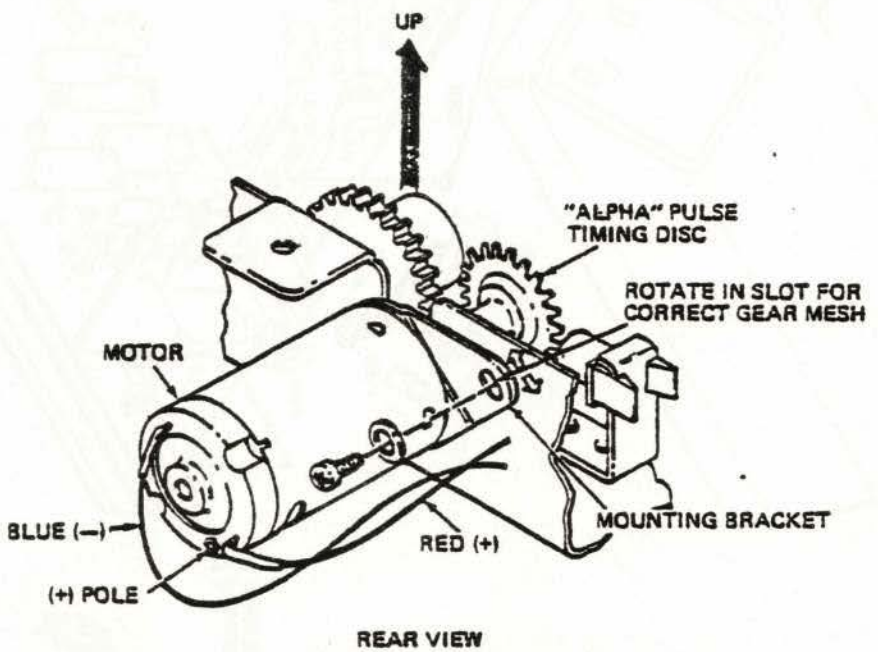


Figure 7-4. MOTOR UNIT REPLACEMENT

7.5 TIMING BELT (See Figure 7-5)

To replace the timing belt, proceed as follows:

(1) Remove printer assembly.
(2) Unhook head spring from slide (View A).
(3) Remove E-ring holding slider to timing belt bracket.
(4) Remove E-rings retaining both slider shafts.
(5) Hold slider assembly and pull both shafts out of printer.
(6) Release belt tension by loosening screw on left pulley shaft (View B).
(7) Remove timing belt with slider bracket attached.

To install the timing belt, proceed as follows:

(1) Position left and right pulleys as shown on View C.
(2) Install timing belt with plate positioned as shown over missing tooth on right pulley.
(3) Install slider shafts through printer assembly and slider assembly and secure with two E-rings.
(4) Secure slider to timing belt bracket with remaining E-ring.
(5) Hook head spring onto slider.
(6) Check/adjust beta signal timing and feed position.

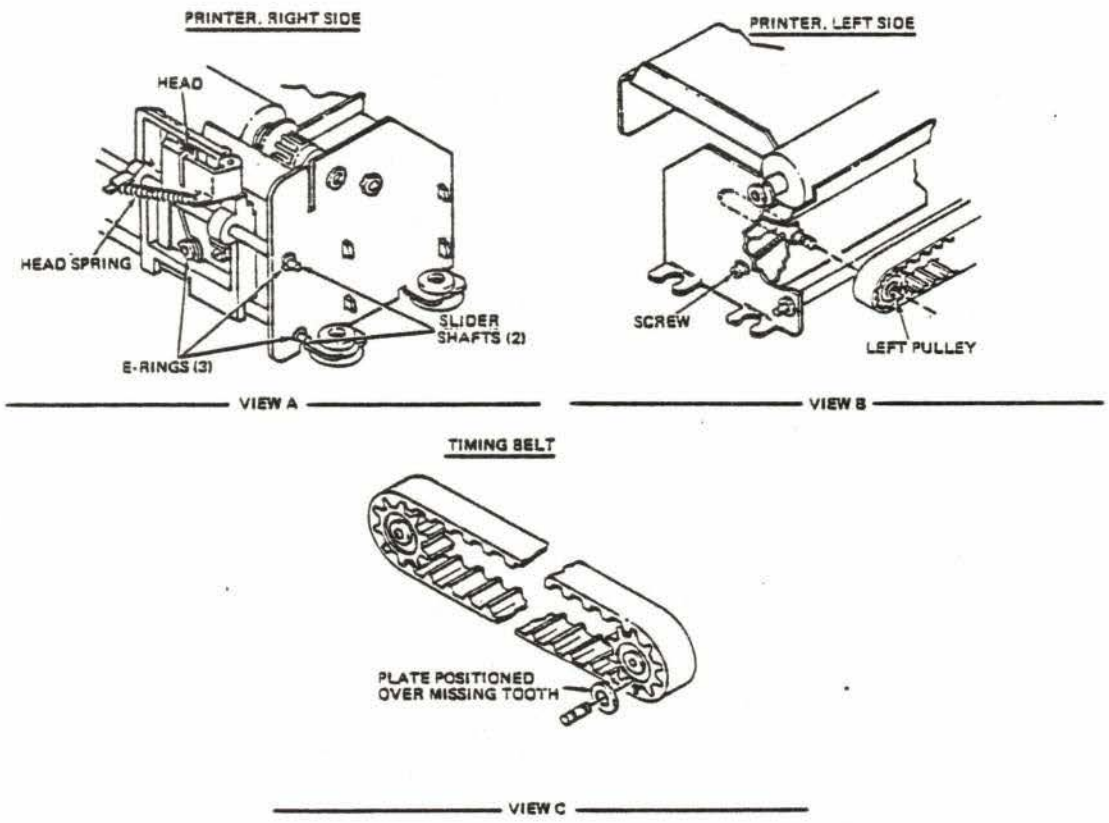


Figure 7-5. TIMING BELT REPLACEMENT

SECTION 8
ELECTRICAL DRAWINGS

This section contains schematic diagrams for the two serial pc boards and the main electronics pc board.

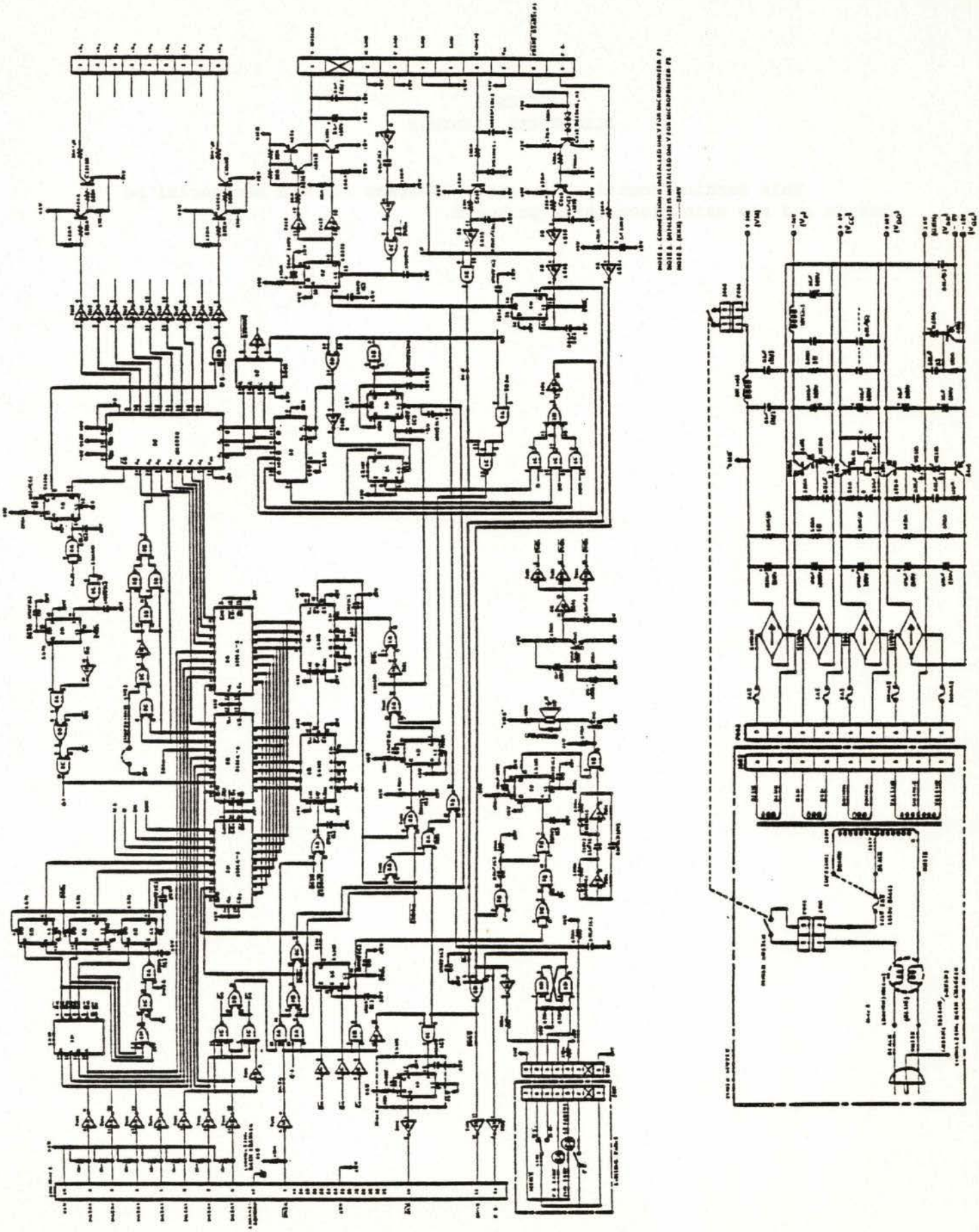


Figure 8-1. REAR SERIAL PC BOARD SCHEMATIC

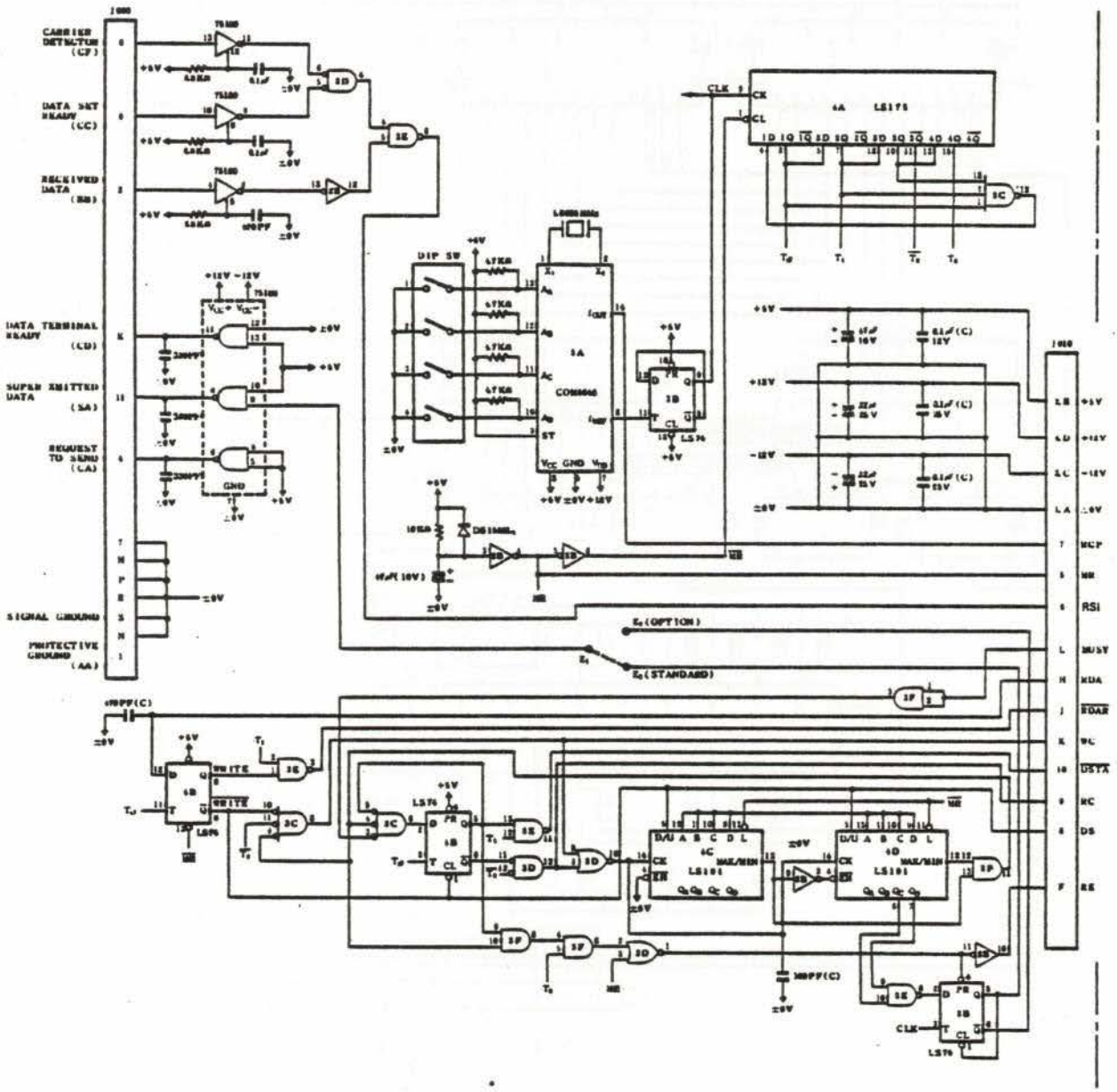


Figure 8-2. FRONT SERIAL PC BOARD SCHEMATIC

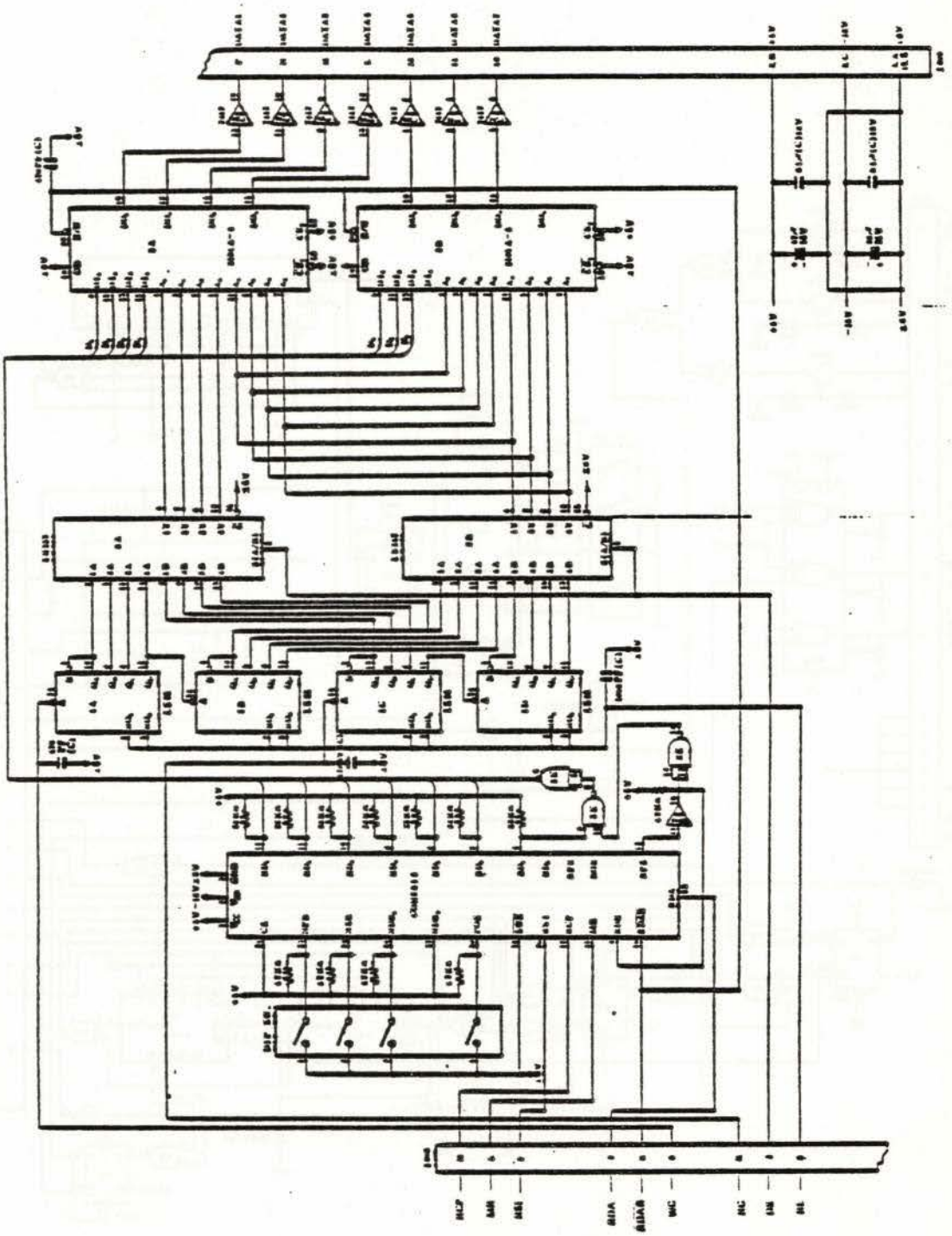


Figure 8-3. MAIN ELECTRONICS PC BOARD SCHEMATIC (SHEET 1 OF 2)

Figure 8-2. FRONT SERIAL PC BOARD SCHEMATIC

SECTION 9
ILLUSTRATED PARTS BREAKDOWN

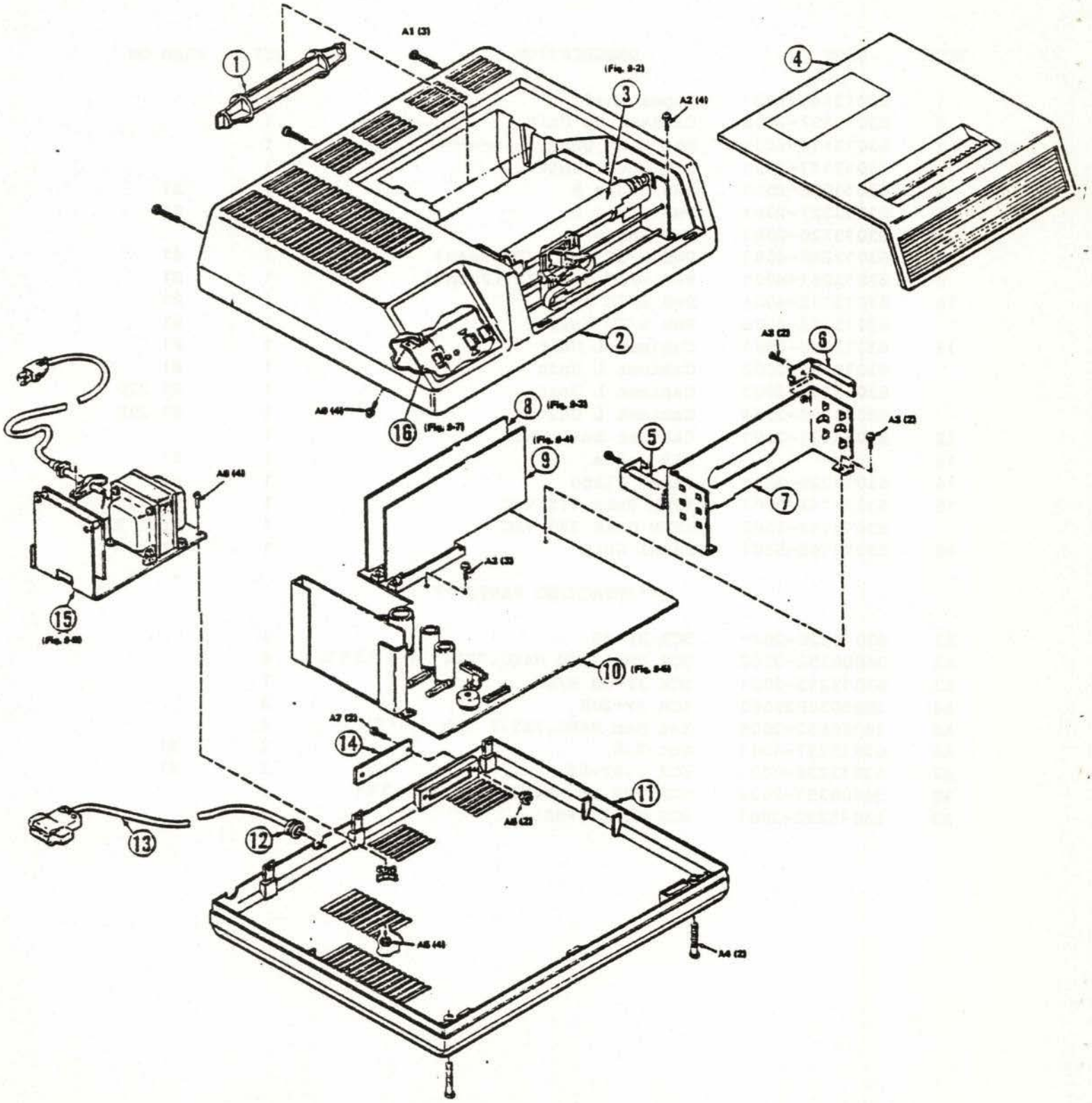
This section illustrates all parts of the Microprinter for ease of identification. Exploded views with associated parts list completely identify all parts.

If the number of a part is not known, locate the part in one of the following exploded views. Determine the appropriate index number and then refer to the associated parts list for complete identification of the part.

If a part number is known, the part may be located by referring o the numerical index at the end of this section. This list shows by figure and index number every occurence of the part in the microprinter.

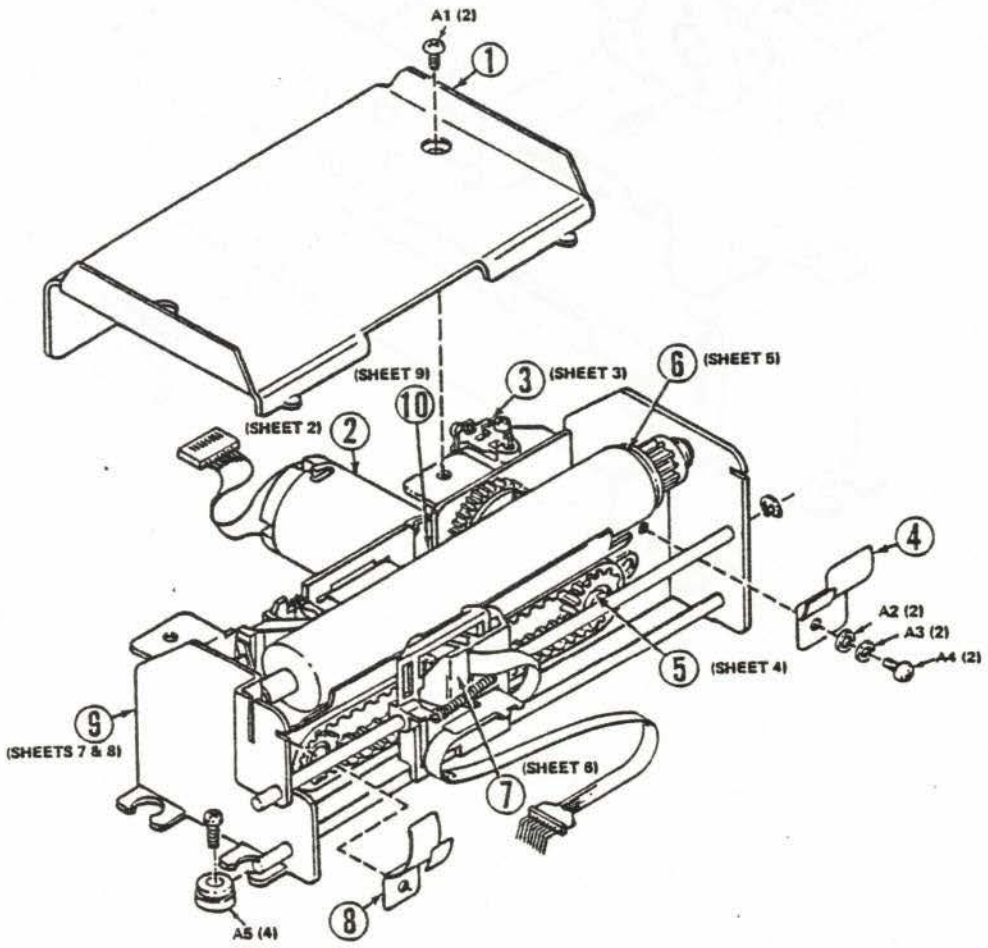
INDEX FOR FIGURE 9-1
MICROPRINTER OVERALL ASSEMBLY 63013100-5001,-5002,-5003,-5004

ITEM	PART NO.	DESCRIPTION	QTY.	USED ON
1	63013148-2001	Paper Shaft	1	
2	63013107-2002	Cabinet Up Unit	1	
3	63013116-5001	Ptr Mech Unit Breakdown	1	
4	63013117-2001	Ptr Cover Unit	1	
5	63013228-2001	PWB Angle B	1	S1
6	63013227-2001	PWB Angle A	1	S1
7	63013226-2001	PWB Angle	1	
8	63013240-4001	PWB w/IC Ser I/F (Rear)	1	S1
9	63013241-4001	PWB w/IC Ser I/F (Front)	1	S1
10	63013112-4001	PWB w/IC Assy.	1	P1
	63013112-4002	PWB w/IC Assy.	1	S1
11	63013108-2001	Cabinet L Unit	1	P1
	63013108-2002	Cabinet L Unit	1	S1
	63013108-2003	Cabinet L Unit	1	P1 230
	63013108-2004	Cabinet L Unit	1	S1 230
12	63013121-2001	Cabinet Bush Unit	1	
13		EIA Cable	1	S1
14	63013229-2001	Fixed Plate	1	S1
15	63013114-5001	XFMR Unit 115 VAC	1	PY 115
	63013114-5002	XFRM Unit 230 VAC	1	PYS1 230
16	63013105-5001	Panel Unit	1	P1
		ATTACHING PARTS		
A1	63013220-2001	SCR 3T+8S	3	
A2	34000352-2062	SCR PNH SLTD M4X0.7X14 HD-1392	4	
A3	63013215-2001	SCR 3P+6S W/WR	7	
A4	XBP5D30P20000	SCR 3P+20S	2	
A5	34000652-2006	Nut Hex M4X0.7X3.2 Thk HD-7116	4	
A6	63013237-1001	Nut 2.6	2	S1
A7	63013236-1001	SCR 2.6T+8S	2	S1
A8	34000351-2039	SCR PNH REC M4X0.7X12 HD-1389	4	
A9	63013222-2001	SCR TB 2.6+8S	4	


A1 (3)
(Fig. 8-2)
A2 (4)
A3 (2)
A4 (2)
A5 (4)
A6 (4)
A7 (2)
A8 (2)
(Fig. 8-3)
(Fig. 8-4)
(Fig. 8-5)
(Fig. 8-6)
(Fig. 8-7)
(Fig. 8-8)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

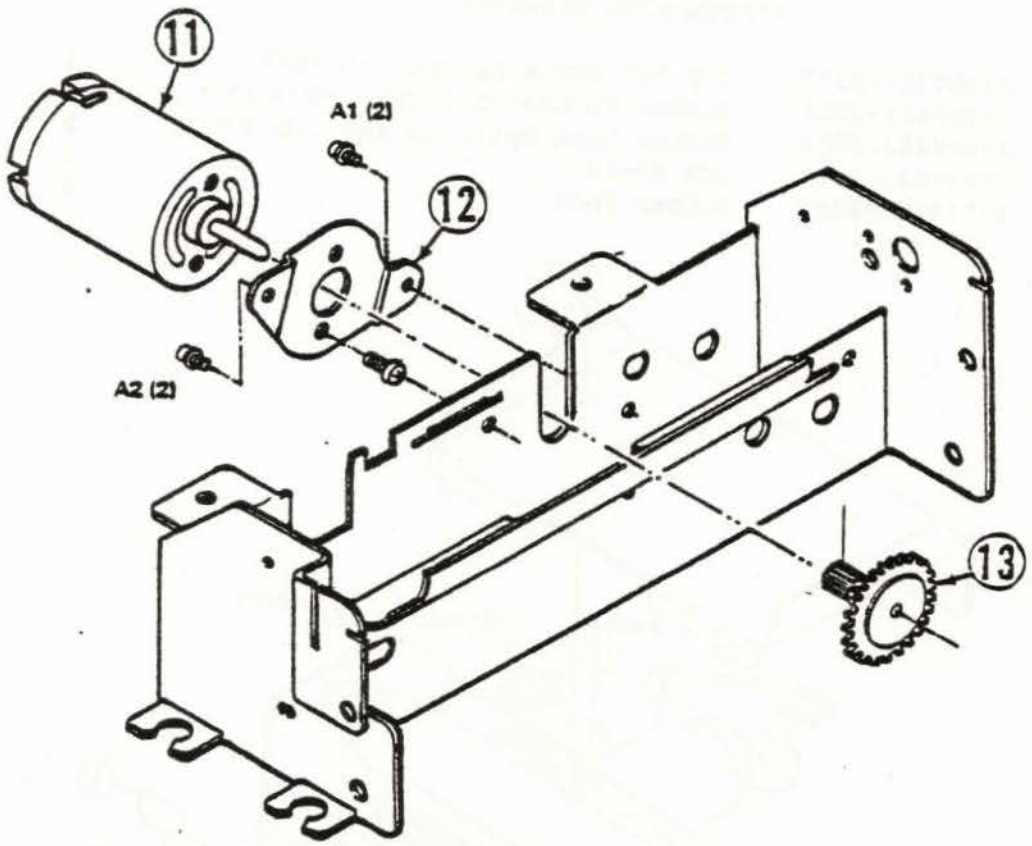
INDEX FOR FIGURE 9-2 (SHEET 1 OF 9)
PRINTER MECHANICAL UNIT 63013116-5001

ITEM	PART NO.	DESCRIPTION	QTY.
1	63013152-2001	Cover	1
2	63013111-4001	Motor Unit Breakdown	1
3	63013104-2001	XSTR Unit, Photo Breakdown	1
4	63013124-2001	Paper Guide, R	1
5	63013106-2001	Timing Belt Unit Breakdown	1
6	63013113-5001	Platen Unit Breakdown	1
7	63013110-5001	Head Unit Breakdown	1
8	63013123-2001	Paper Guide, L	1
9	63013122-2001	Base Breakdown	1
10	63013109-1001	Coil Unit Breakdown	1
		ATTACHING PARTS	
A1	34000351-2017	SCR PNH REC M3X0.5X6 HD-1388	2
A2	34000452-2004	Washer FL M3X7X0.5 Thk HD-8337	2
A3	34000454-2004	Washer Lock Split M3 SST HD-8324	2
A4	63013221-2001	SCR 3T+6S	2
A5	63013153-2001	Rubber Foot	4



INDEX FOR FIGURE 9-2 (SHEET 2 OF 9)
MOTOR UNIT (63013111-4001)

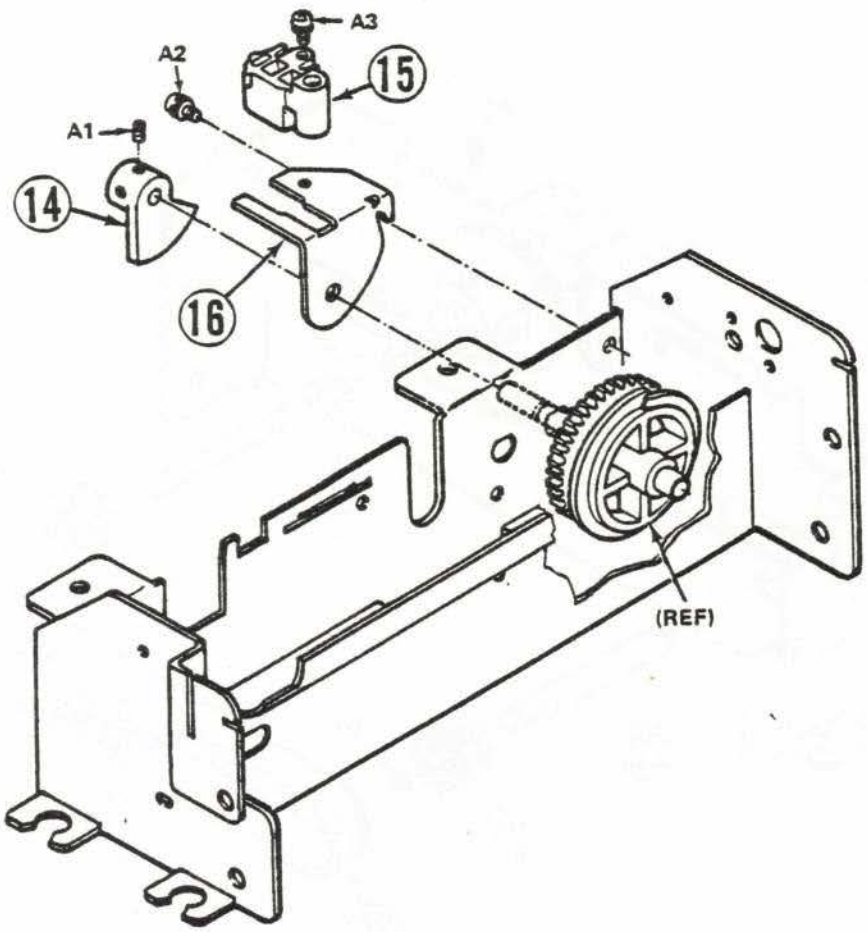
ITEM	PART NO.	DESCRIPTION	QTY.
11	P/O 63013111-4001	Motor	1
12	P/O 63013111-4001	Bracket	1
13	P/O 63013111-4001	Pulse Gear	
	ATTACHING PARTS		
A1	63013216-2001	SCR 3P+8S W/WR	2
A2	P/O 63013111-4001	Screw	2



MOTOR UNIT

INDEX FOR FIGURE 9-2 (SHEET 3 OF 9)
PHOTOTRANSISTOR UNIT (63013104-2001)

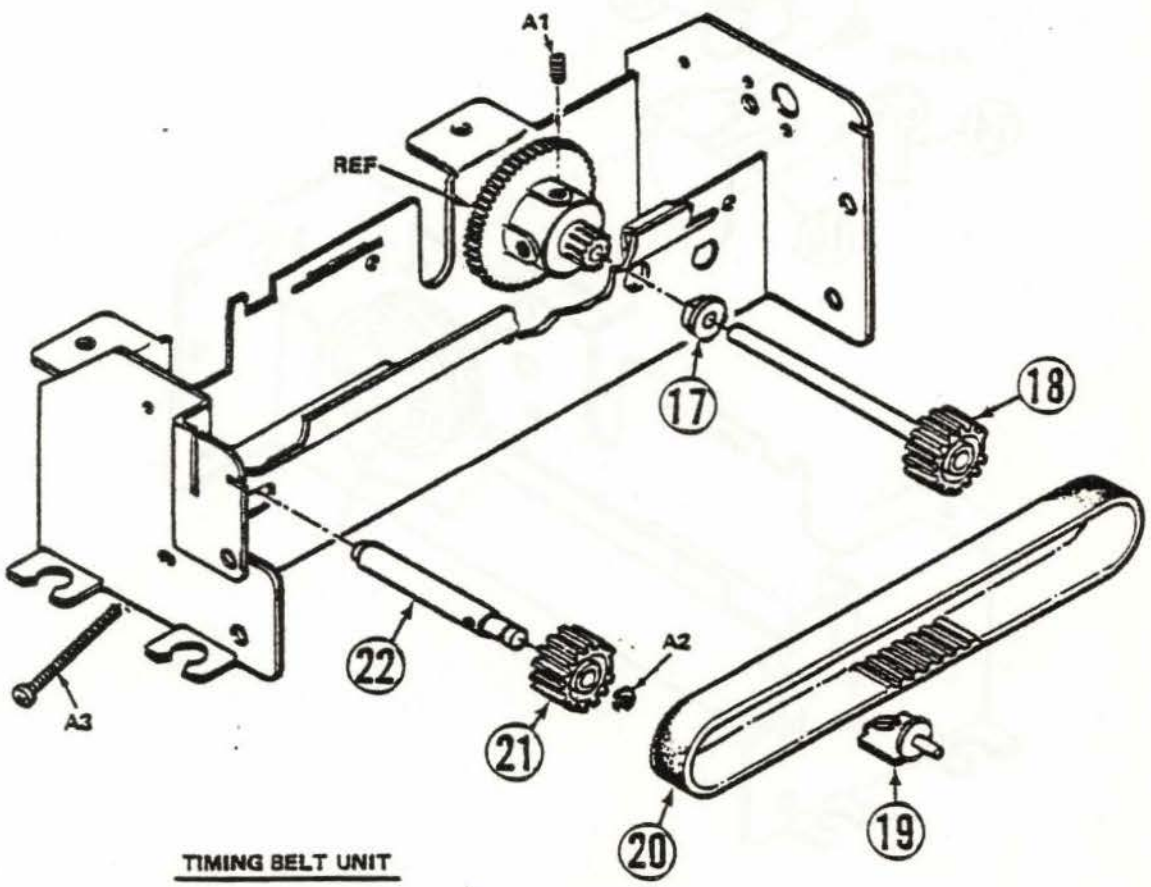
ITEM	PART NO.	DESCRIPTION	QTY.
14	63013138-2001	Disc	1
15	P/O 63013104-2001	Phototransistor	1
16	P/O 63013104-2001	Bracket	1
	ATTACHING PARTS		
A1	63013225-2001	Worm Screw	1
A2	63013216-2001	SCR 3P+8S W/WR	1
A3	63013221-2001	SCR 3T+6S	1



PHOTOTRANSISTER UNIT (B)

INDEX FOR FIGURE 9-2 (SHEET 4 OF 9)
TIMING BELT UNIT (63013106-2001)

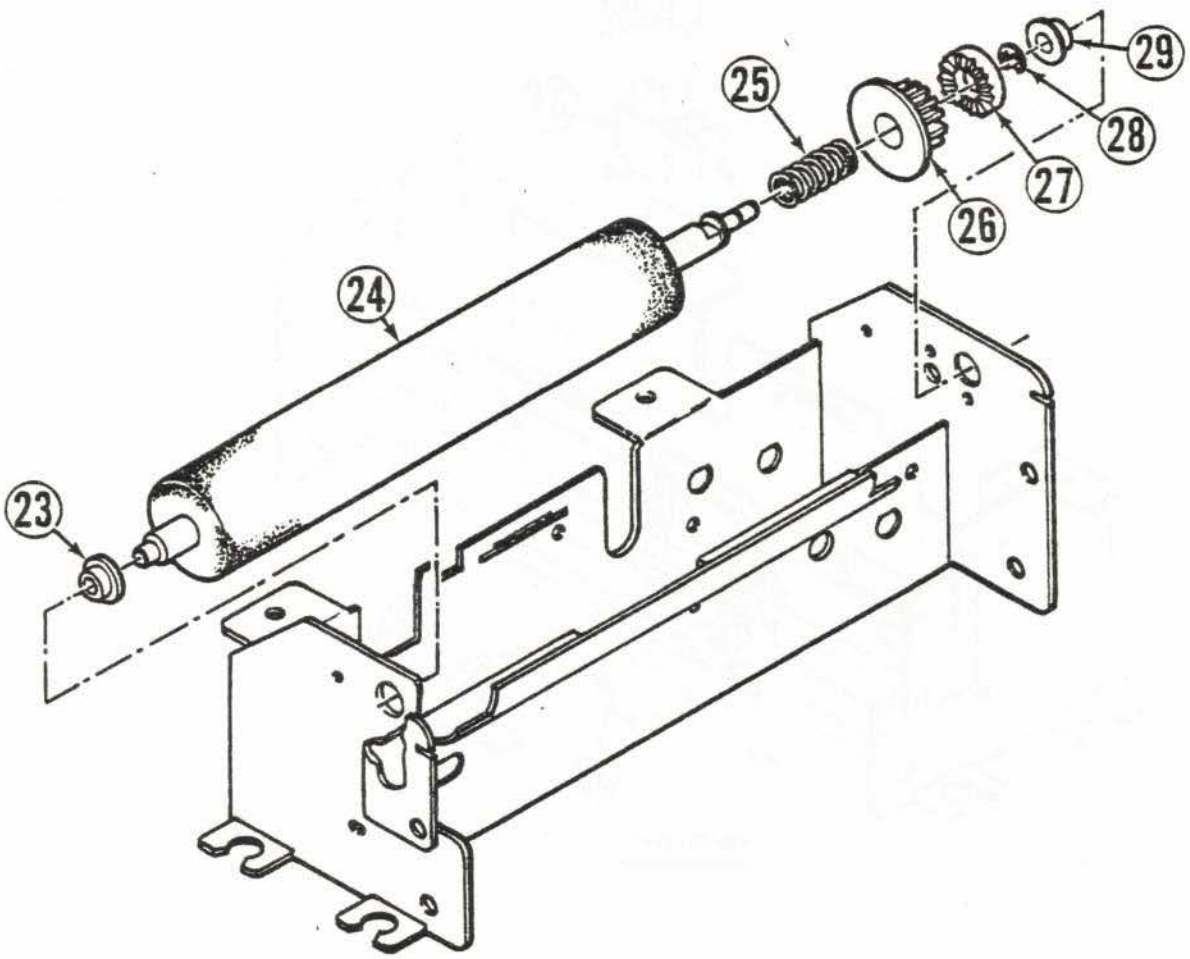
ITEM	PART NO.	DESCRIPTION	QTY.
17	63013136-2001	Bearing B	1
18	63013145-2001	Pulley, Right	1
19	P/O 63013106-2001	Slider Pin	1
20	P/O 63013106-2001	Belt	1
21	63013144-2001	Pulley, Left	1
22	63013150-2001	Shaft, T Pulley	1
	ATTACHING PARTS		
A1	63013224-2001	Ring RTNG 3 MM	1
A2	63013223-2001	Ring RTNG 3 MM	1
A3	63013219-2001	SCR 3P+3OS	1



TIMING BELT UNIT

INDEX FOR FIGURE 9-2 (SHEET 5 OF 9)
PLATEN UNIT (63013113-5001)

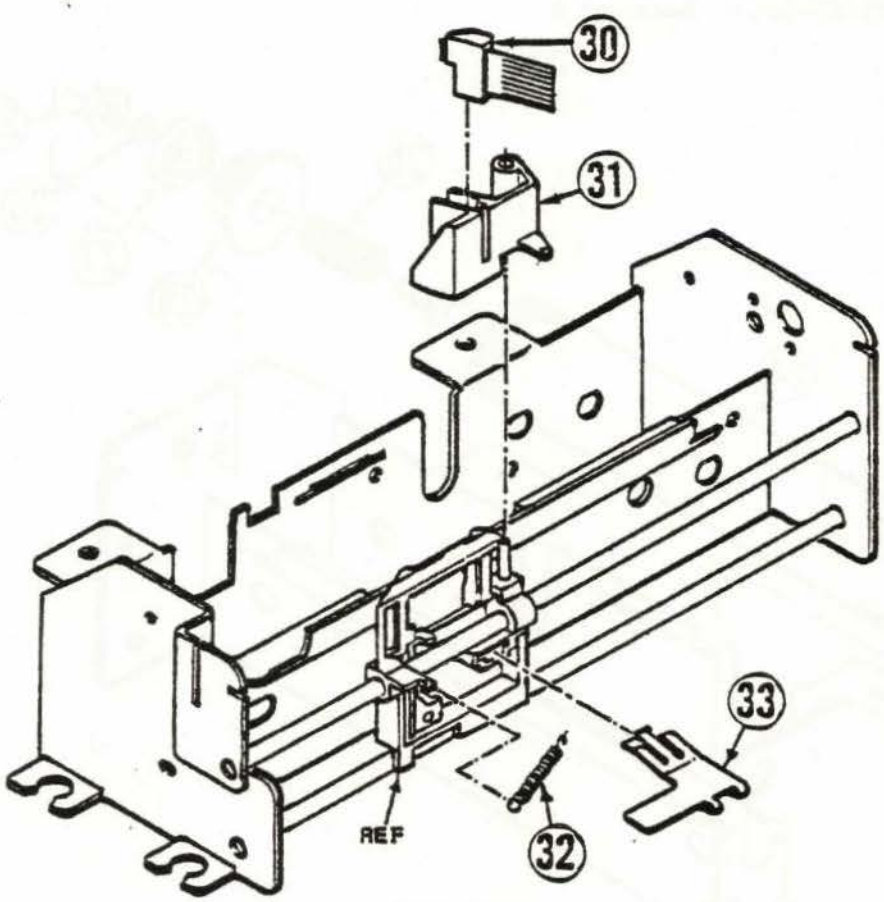
ITEM	PART NO.	DESCRIPTION	QTY.
23	63013135-2001	Bearing A	1
24	P/O 63013113-5001	Platen	1
25	P/O 63013113-5001	Spring	1
26	P/O 63013113-5001	Gear	1
27	P/O 63013113-5001	Rachet	1
28	P/O 63013113-5001	E-Type Ring	1
29	63013135-2001	Bearing A	1



PLATEN UNIT

INDEX FOR FIGURE 9-2 (SHEET 6 OF 9)
HEAD UNIT (63013110-5001)

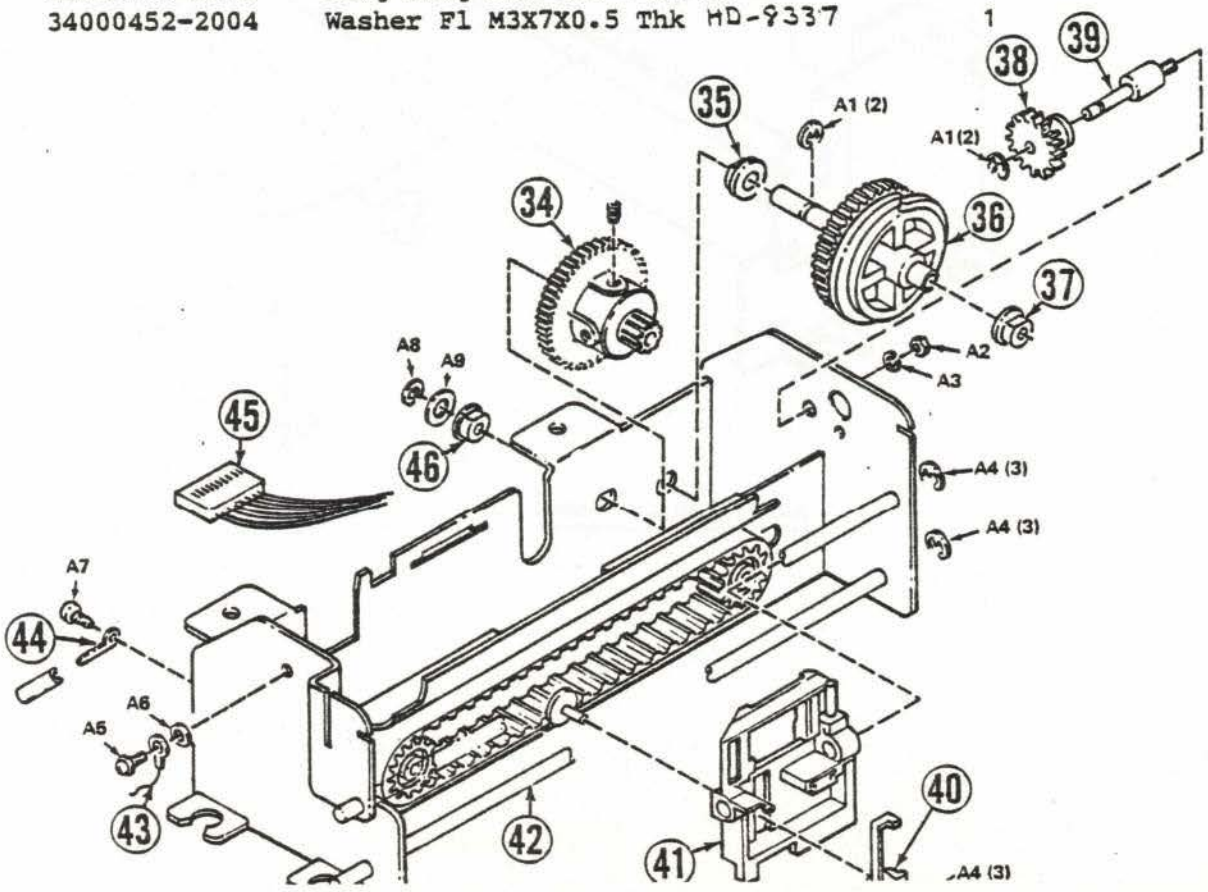
ITEM	PART NO.	DESCRIPTION	QTY.
30	P/O 63013110-5001	Head	1
31	63013131-2001	Head Slider	1
32	63013134-2001	Head Spring	1
33	63013127-2001	Clip	1



HEAD UNIT

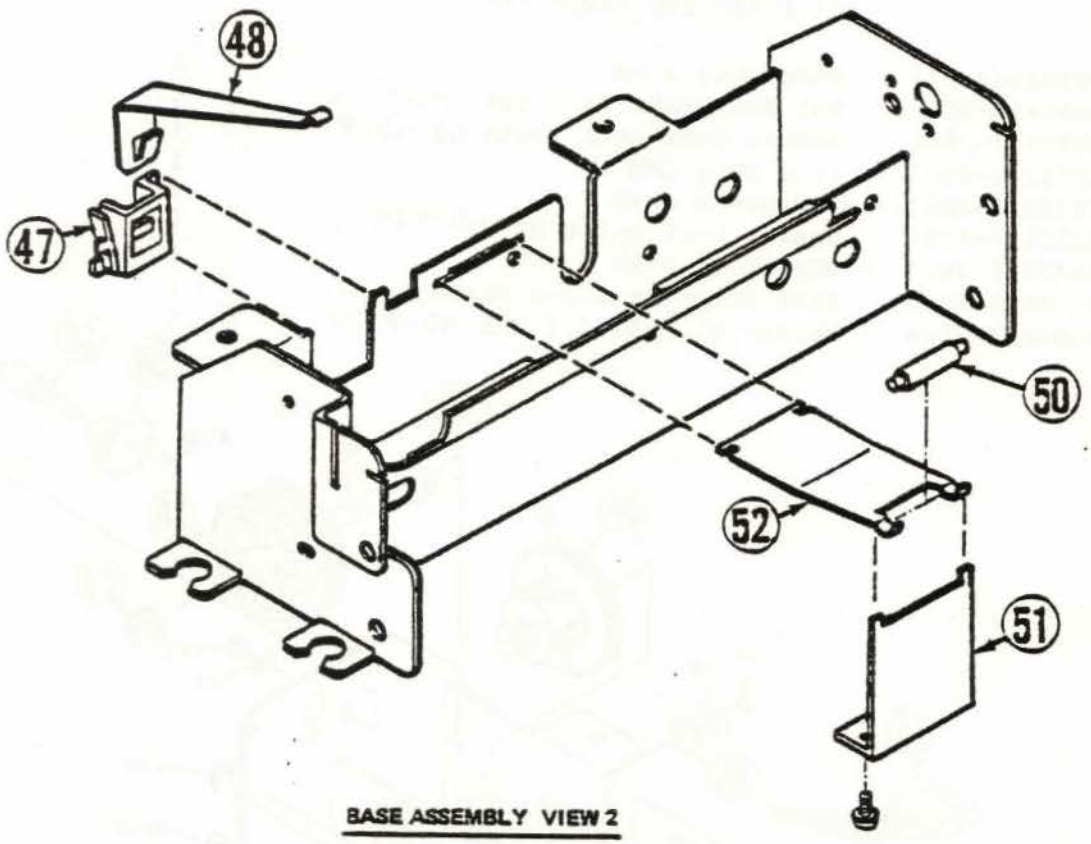
INDEX FOR FIGURE 9-2 (SHEET 7 OF 9)
BASE ASSEMBLY VIEW 1 (63013122-2001)

ITEM	PART NO.	DESCRIPTION	QTY.
34	63013142-2001	Gear B	1
35	63013137-2001	Bearing C	1
36	63013129-2001	CAM Gear	1
37	63013137-2001	Bearing C	1
38	63013139-2001	Idler Gear	1
39	63013149-2001	Idler Shaft	1
40	63013130-2001	Slider Pin	1
41	63013132-2001	Slider	1
42	63013151-2001	Slider Shaft	2
43	31460015-2001	Term Ring Insul	1
44	63013126-2001	Wire Holder	1
45	63013161-1001	Conn	1
46	63013136-2001	Bearing B	1
		*** ATTACHING PARTS ***	
A1	63013224-2001	Ring Rtng 3 MM	2
A2	34000652-2006	Nut Hex M4X0.7X3.2 Thk HD-7116	1
A3	34000451-2004	Washer Lock Intl Tooth M3 HD-8322	1
A4	63013223-2001	ring Rtng 2MM	3
A5	63013216-2001	SCR 3P+8S W/WR	1
A6	34000455-2006	Washer Lock Split M4 HD-8351	1
A7	63013215-2001	SCR 3P+6S W/WR	1
A8	33110002-2004	Ring Rtng Ext 3.2-4 Shaft	1
A9	34000452-2004	Washer Fl M3X7X0.5 Thk HD-9337	1



INDEX FOR FIGURE 9-2 (SHEET 8 OF 9)
BASE ASSEMBLY VIEW 2 (63013122-2001)

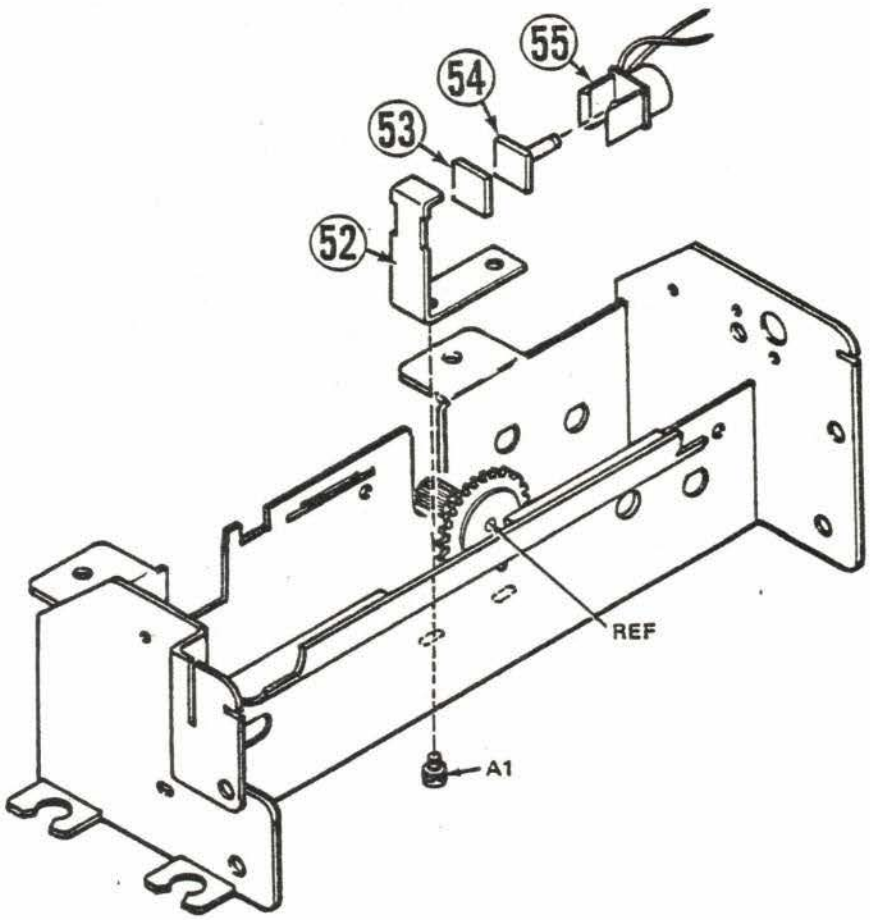
ITEM	PART NO.	DESCRIPTION	QTY.
47	63013128-2001	Holder	1
48	63013162-1001	Sensor	1
49	63013125-2001	Roller Holder	1
50	63013146-2001	Roller C	1
51	63013119-2001	Head Angle	1
39	63013149-2001	Idler Shaft	1
		*** ATTACHING PARTS ***	
A1	63013216-2001	SCR 3P+8S W/WR	1



BASE ASSEMBLY VIEW 2

INDEX FOR FIGURE 9-2 (SHEET 9 OF 9)
COIL UNIT (63013109-1001)

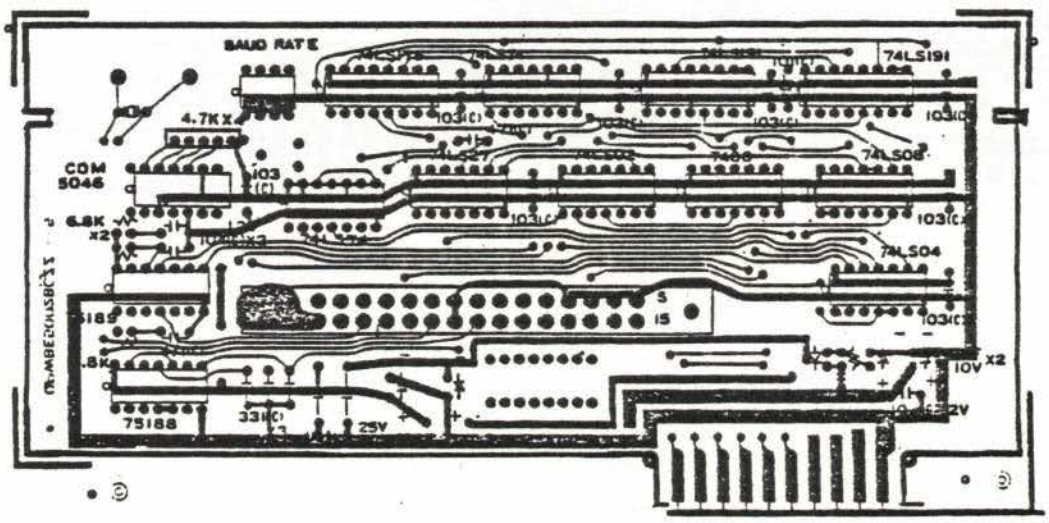
ITEM	PART NO.	DESCRIPTION	QTY.
52	P/O 63013109-1001	Holder	1
53	P/O 63013109-1001	Magnet	1
54	P/O 63013109-1001	Pick Up	1
55	P/O 63013109-1001	Coil	1
	*** ATTACHING PARTS ***		
A1	63013214-2001	SCR 2.6P+6S W/WR	1



COIL UNIT

INDEX FOR FIGURE 9-3
REAR SERIAL PC BOARD (63013240-4001)

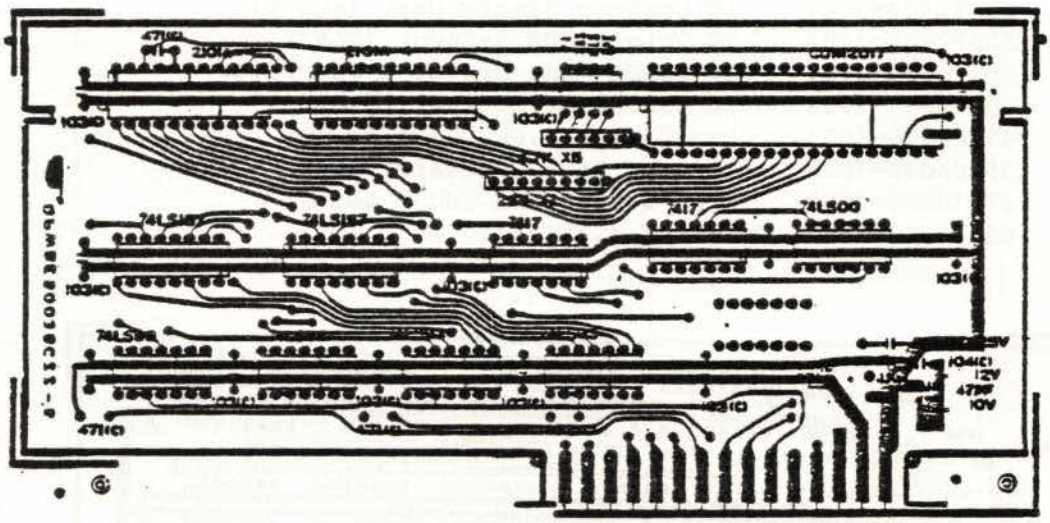
ITEM	PART NO.	DESCRIPTION	QTY.
1	21102000-1001	Cap Cer Disc 1000 pf 1KV 20%	2
2	21103003-1001	Cap Cer Disc .01 uf 1KV 20%	5
3	21471003-1001	Cap Cer Disc 470 pf 1KV 20%	1
4	21104002-1001	Cap Cer Disc .1 uf 500V 20%	2
5	21104001-1001	Cap Cer Disc .1 uf 16V -2+80%	3
6	38100904-1001	Semicond Diode TBAX 1IN4148	1
7	35674002-1001	IC QUADR Nor 2-Input 74LS02	1
8	35577404-1001	IC Hex Inverter 74LS04	1
9	35577408-1001	IC QUADR and 2-Input 74LS08	1
10	35577474-1001	IC Dual D-Type FF 74LS74	2
11	41103926-1001	Res Carbon 10K Ohm 1/4W 10%	1
12	31230020-1001	Conn Edge 15 Posn 2-Row MDM	1
13	31240456-2002	Key Plz Betw Contact RT-1475	1
14	63013239-1001	Switch 4 Pos Dip	1
15	63013233-1001	Cap 47uf 10WV	2
16	63013234-1001	Cap 22 uf 25WV	2
17	21331001-1001	Cap Cer Disc 330 pf 1KV 20%	3
18	35474000-1001	IC QUADR NAND 2-Input 7400 MX-3674	1
19	35574175-1001	IC QUADR D-Type FF 74LS175	1
20	35674191-1001	IC Up/Down Binary Cntr 74LS191	2
21	35577427-1001	IC Triple NOR 3-Input 74LS27	1
22	35214881-1001	IC QUADR Line Driver 2-Inp 75188	1
23	35214891-1001	IC QUADR Inv Rcvr ST 75189	1
24	41682926-1001	Res Carbon 6.8K Ohm 1/4W 10%	3
25	35205046-1001	IC Baud Rate Generator 5046	1
26	37810689-1001	XTAL 5.0688 MHZ HSC 2 Lead	1
27	63013230-1001	Res 4E 4.7K 1/16	1



0PW8E50028CZZ—5

INDEX FOR FIGURE 9-4
FRONT SERIAL PC BOARD (63013241-4001)

ITEM	PART NO.	DESCRIPTION	QTY.
1	21102000-1001	Cap Cer Disc 1000 pf 1KV 20%	2
2	21103003-1001	Cap Cer Disc .01 uf 1KV 20%	6
3	21104002-1001	Cap Cer Disc .1 uf 500V 20%	1
4	21104001-1001	Cap Cer Disc .1 uf 16V -20+80%	1
5	35577400-1001	IC QUADR NAND 2-Input 74LS00	1
6	35577493-1001	IC 4-Bit Counter 74LS93	4
7	35474170-1001	IC Hex Buffer/Driver 7417	2
8	35514039-1003	IC Rndm Access Mem 256x4 4039 MX-3664	2
9	63013239-1001	Switch 4 Pos Dip	1
10	63013233-1001	Cap 47 uf 10 WV	1
11	63013234-1001	Cap 22 uf 25 WV	1
12	63013232-1001	Res 7E 22K 1/16	1
13	63013231-1001	Res 5E 4.7K 1/16	1
14	35574158-1001	IC 2 to 1 Line SEL/MUX 74LS157	2
15	35203117-1001	IC Univ Asynchronous Rcvr 3117	1



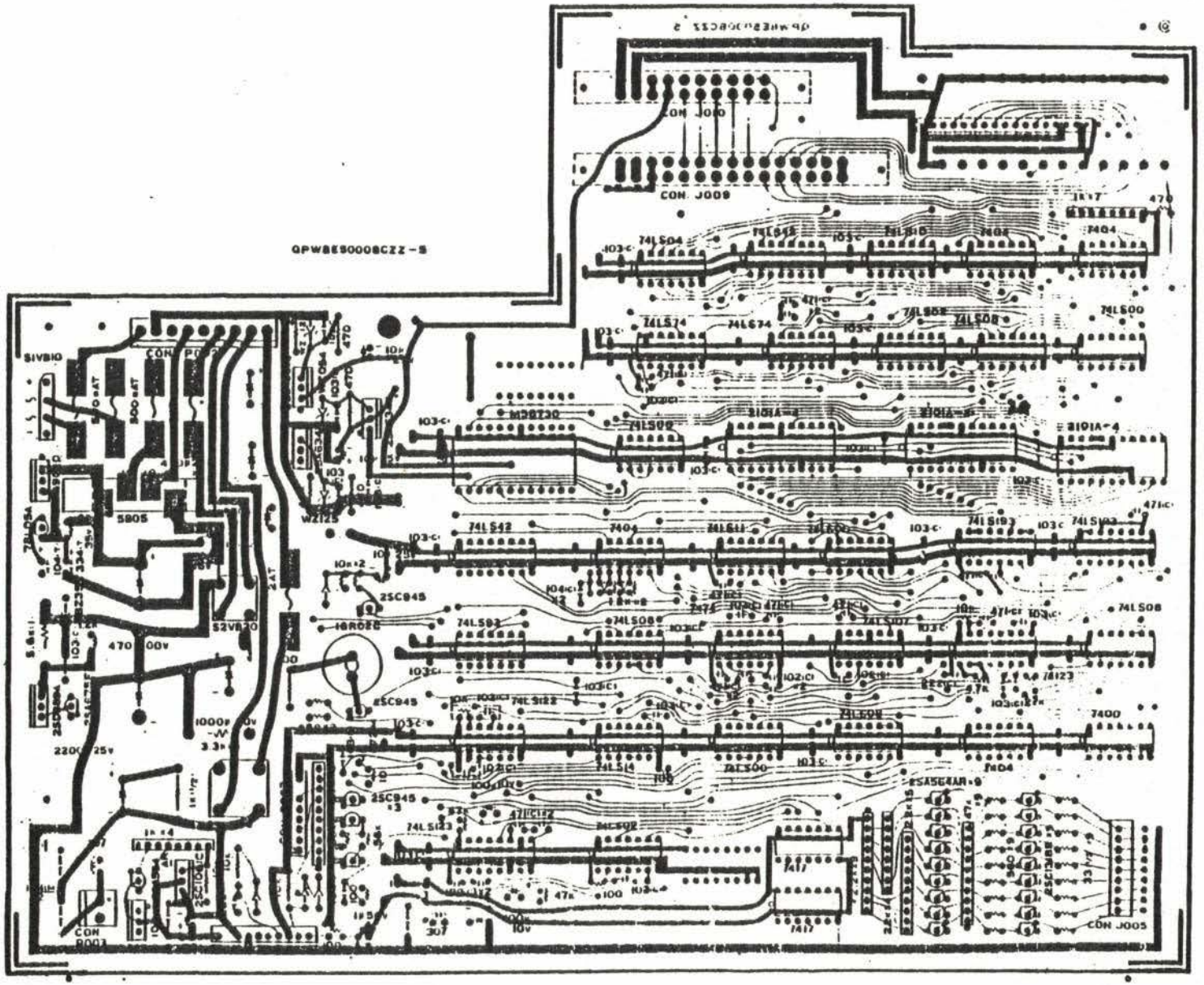
DPWBE50038CZZ-5

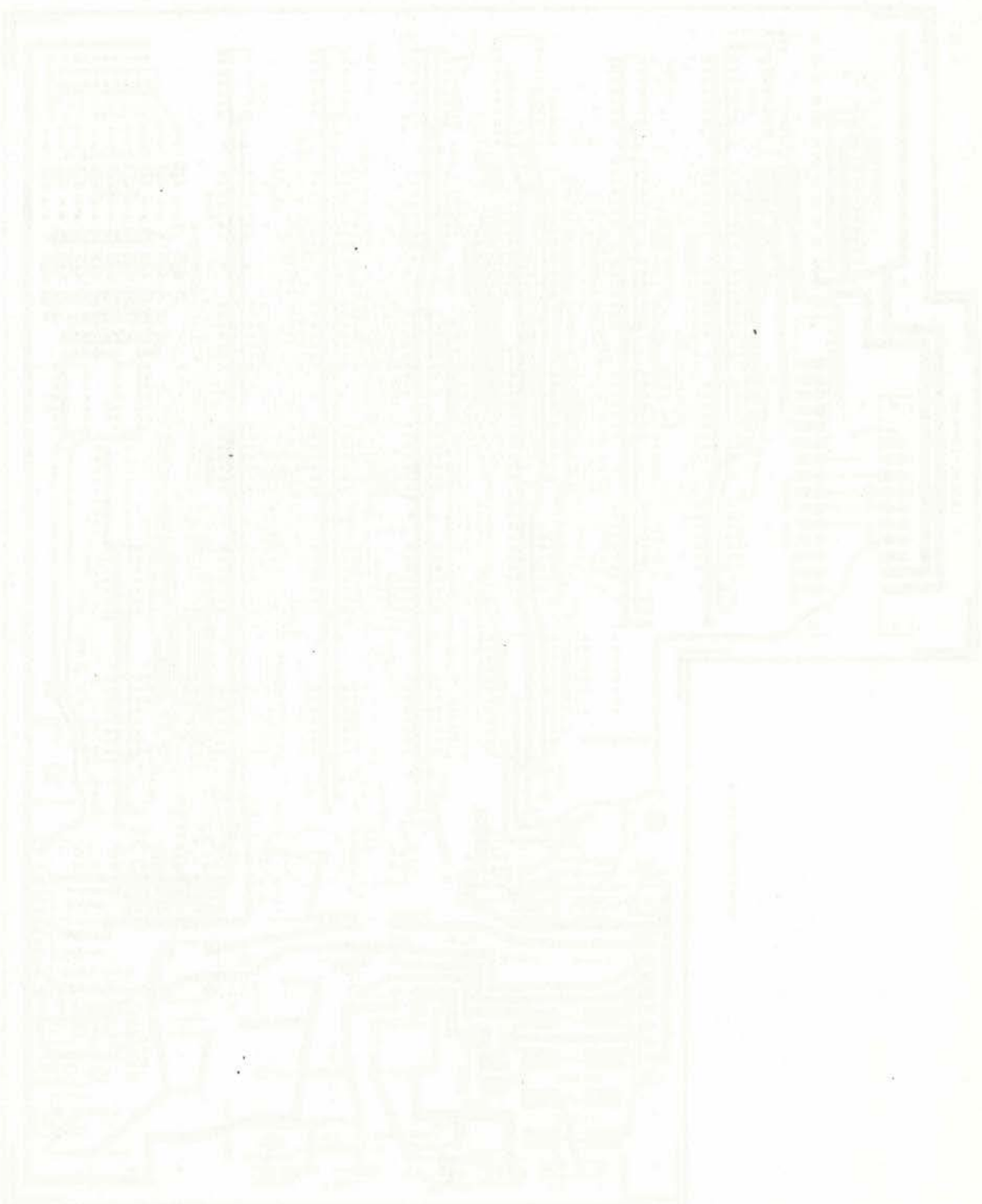
INDEX FOR FIGURE 9-5
MAIN PC BOARD (63013112-4001, 4002)

ITEM	PART NO.	DESCRIPTION	QTY.	USED ON
1	63013154-2001	Radiator	1	
2	63013155-1001	Conn, 9 Pin	1	
3	63013157-1001	Conn, 2 Pin	1	
4	63013158-1001	Conn, 7 Pin		
5	63013157-1001	Conn/Trans, 9 Pin	1	
6	63013163-1001	Fuse, Mini, 0.5A	2	
7	63013164-1001	Fuse, Mini, 2A	2	
8	63013165-1001	Fuse, 1A	1	
9	63013166-2001	Fuse Holder	10	
10	63013171-1001	Buzzer	1	
11	63013172-1001	Cap 4700 uf 16 WV	1	
12	63013173-1001	Cap 470 uf 100 WV	1	
13	63013175-1001	Res 7E 1K 1/16 W	1	
14	63013176-1001	Res 9E 4.7K 1/16 W	2	
15	63013177-1001	Res 9E 47K 1/16 W	1	
16	63013178-1001	Res 4E 1K 1/8W	1	
17	63013179-1001	Res 4E 2.2K 1/8W	1	
18	63013180-1001	Res 5E 2.2K 1/8W	1	
19	63013181-1001	Cap 100 uf 10 WV		S1 (1), P1 (2)
20	63013183-1001	Cap 10 uf 10 WV	3	
21	63013235-1001	Cap 1000 uf 50 WV	1	
22	63013184-1001	Cap 470 uf 25 WV	2	
23	63013238-1001	Cap 2200 uf 25 WV	1	
24	63013185-1001	Cap 3.3 uf 50 WV	2	
25	21102000-1001	Cap Cer Disc 1000 pf 1KV 20%	16	
26	21103003-1001	Cap Cer Disc .01 uf 1KV 20%	32	
27	21471003-1001	Cap Cer Disc 470 pf 1KV 20%	1	
28	63013186-1001	Cap 0.1 uf 50 WV	1	
29	63013187-1001	Cap 0.0022 uf 50 WV	2	
30	21472000-1001	Cap Cer Disc 4700 pf 1KV 10%	2	
31	21104002-1001	Cap Cer Disc .1 uf 500V 20%	1	
32	63013188-1001	Cap 0.33 uf .35 WV	1	
33	21104001-1001	Cap Cer Disc .1 uf 16V -20+80%	4	
34	63013190-1001	Dio Bridge Rect	1	
35	63013191-1001	Dio Bridge Rect	1	
36	63013192-1001	Dio Bridge Rect	1	
37	38100904-1001	Semicond Diode TBAX 1N4148 DX-1152	6	
38	63013189-1001	Dio Bridge Rect	1	
39	63013196-1001	IC Char Gen	1	
40	63013159-1001	Conn, 9 Pin	1	
41	35577400-1001	IC QUADR NAND 2-Input 74LS00	6	
42	35674002-1001	IC QUADR NOR 2-Input 74LS02	2	
43	35577404-1001	IC Hex Inverter 74LS04	2	
44	35577408-1001	IC QUADR and 2-Input 74LS08	3	
45	35674010-1001	IC Triple NAND 3-Input 74LS10	1	
46	63013197-1001	IC 74LS107N	1	
47	35577411-1001	IC Triple and 3-Input 74LS11	1	
48	63013198-1001	IC 74LS122N	1	
49	63013199-1001	IC 74LS123N	2	

INDEX FOR FIGURE 9-5
MAIN PC BOARD (63013112-4001, 4002)
(CONT'D)

ITEM	PART NO.	DESCRIPTION	QTY.	USED ON
50	35574193-1001	IC 4-Bit Up/Down Cntr 74LS193	2	
51	35577442-1001	IC 4-10 Line Decoder 74LS42	2	
52	35577474-1001	IC Dual D-Type FF 74LS74	3	
53	35577493-1001	IC 4-Bit Counter 74LS93	1	
54	35474040-1001	IC Hex Inverter 7404 mx-3655	2	
55	35474140-1001	IC Hex Inverter ST 7414	1	
56	35474170-1001	IC Hex Buffer/Driver 7417	2	
57	63013200-1001	IC 78L05A-1 5V	1	
58	35514039-1003	IC Rndm Access Mem 256x4 4039	3	mx-36604
59	41103926-1001	Res Carbon 10K Ohm 1/4W 10%	1	S1 (6), P1 (7)
60	41104926-1001	Res Carbon 100K Ohm 1/4W 10%	1	
61	41122926-1001	Res Carbon 1.2K Ohm 1/4W 10%	3	
62	41153926-1001	Res Carbon 15K Ohm 1/4W 10%	1	
63	41331926-1001	Res Carbon 330 Ohm 1/4W 10%	2	
64	41471926-1001	Res Carbon 470 Ohm 1/4 10%	4	
65	41472926-1001	Res Carbon 4.7K Ohm 1/4W 10%	10	
66	41561926-1001	Res Carbon 560 Ohm 1/4W 10%	9	
67	41563926-1001	Res Carbon 56K Ohm 1/4W 10%	1	
68	41100926-1001	Res Carbon 10 Ohm 1/4W 10%	1	
69	41101926-1001	Res Carbon 100 Ohm 1/4W 10%	5	
70	41220926-1001	Res Carbon 22 Ohm 1/4W 10%	1	
71	41102946-1001	Res Carbon 1K Ohm 1/2W 10%	2	
72	63013202-1001	Res Carbon 333 Ohm 1/2W	9	
73	63013203-1001	Res Carbon 3.3K Ohm 1W	1	
74	63013204-1001	Res Carbon 5.6K Ohm 1W	1	
75	63013205-1001	XSTR 2SA490	1	
76	63013206-1001	XSTR 2SA564	10	
77	63013207-1001	XSTR 2SA634	3	
78	63013208-1001	XSTR 2SA675	1	
79	63013210-1001	XSTR 2SC1318	9	
80	63013211-1001	XSTR 2SC945	5	
81	63013212-1001	XSTR 2SD389	1	
82	63013182-1001	Cap 22 uf 10 WV	2	
83	63013193-1001	Dio Zener 5.4V	1	
84	63013194-1001	Dio Zener 12.5V	2	
85	63013195-1001	Dio Zener 35V	1	
86	41224926-1001	Res Carbon 220K Ohm 1/4W 10%	2	
87	63013209-1001	XSTR 2SC1061	2	
88	35474107-1001	IC Dual J-K Flip-Flop 74107	1	
- 89	31310019-1016	Conn Rcpt Pnl 36 Posn Non-Plz	1	P1
90	31230020-1001	Conn Edge 15 Posn 2-Row MDM	1	S1
91	31330011-1001	Conn Edge 10 Posn 2-Row MDM	1	S1


QPWBES0008CZZ-S
CON J009
CON J005
74LS04
74LS74
74LS08
74LS00
74LS42
74LS02
74LS14
74LS123
74LS193
74LS27
74LS32
74LS51
74LS86
74LS107
74LS109
74LS112
74LS157
74LS158
74LS244
74LS273
74LS374
74LS393
74LS640
7404
7400
7417
2SC945
2SA562AR
M38730
S2VB20
S905
S1VB10
3101A-4

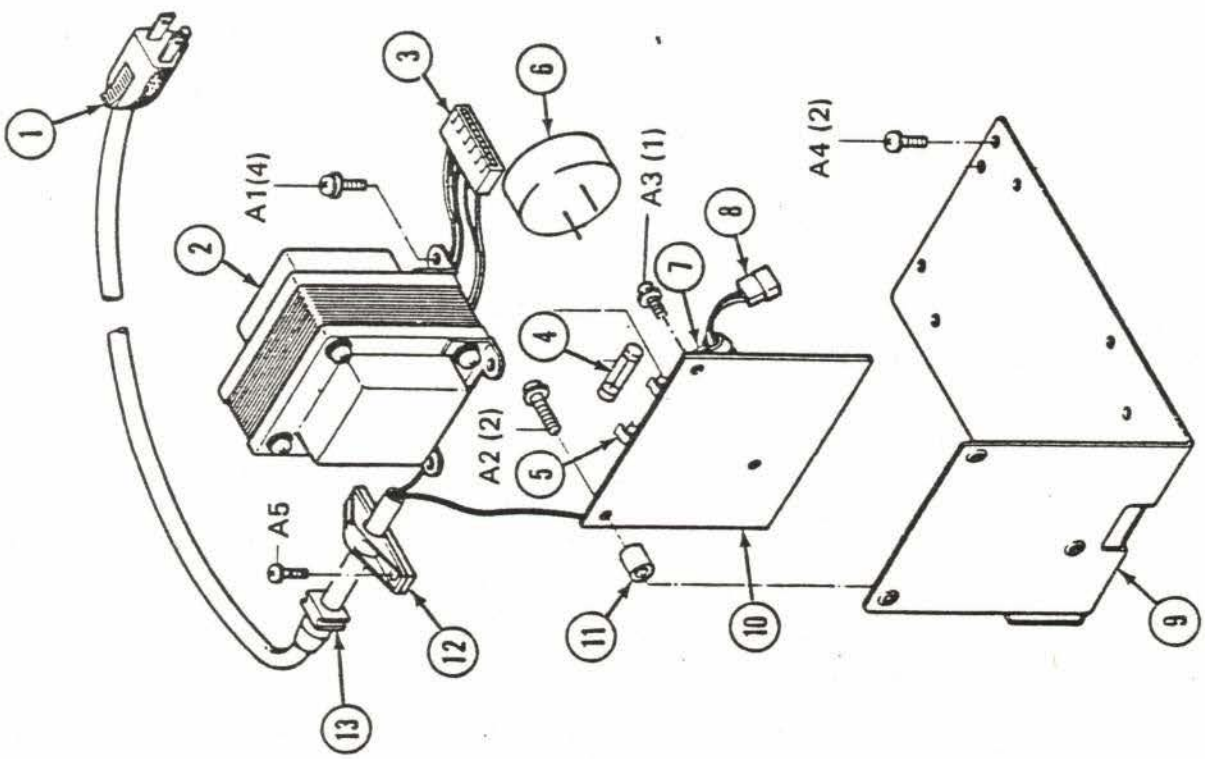


INDEX FOR FIGURE 9-6
TRANSFORMER UNIT (63013114-5001, 5002)

ITEM	PART NO.	DESCRIPTION	QTY.	USED ON
1	P/O 63013114-5001	Power Cord	1	
2	P/O 63013114-5001	Transformer	1	
3	P/O 63013114-5001	Connector (J002)	1	
4	39030020-1001	Fuse GL .25 Dia HF-1139 1A 250V 1.25L	1	S1/P1 115V
	39030016-1001	Fuse GL .25 Dia .5A Slow 1.25L	1	S1/P1 230V
5	63013167-2001	Fuse Holder	1	
6	P/O 63013114-5001	Arrestor	1	
7	P/O 63013114-5001	Cable Clamp	1	
8	P/O 63013114-5001	Connector (J001)	1	
9	P/O 63013114-5001	Mounting Bracket	1	
10	P/O 63013114-5001	PC Board	1	
11	P/O 63013114-5001	Spacer	4	
12	P/O 63013114-5001	Cable Clamp	1	
13	P/O 63013114-5001	Strain Relief	1	

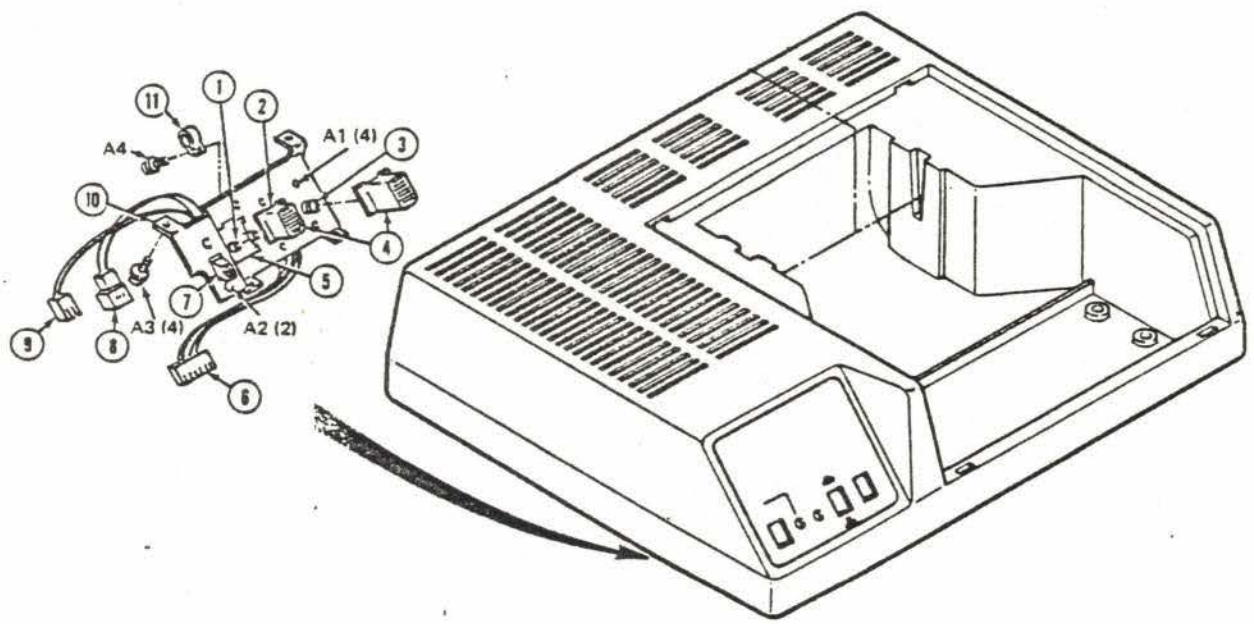
*** ATTACHING PARTS ***

A1	34000351-2037	SCR PNH REC M 4X0.7X8	4	
A2	3400353-2036	SCR PNH SLT M 3X0.5X14	2	
A3	34000351-2021	SCR PNH REC M 3X0.5X16	1	
A4	63013215-2001	SCR 3P+6S W/WR	2	
A5	63013216-2001	SCR 3P+8S W/WR	2	



INDEX FOR FIGURE 9-7
PANEL UNIT (63013105-5001)

ITEM	PART NO.	DESCRIPTION	QTY.
1	63013201-1001	LED	2
2	63013168-1001	Switch w/Lock	1
3	63013169-1001	Non Lock Switch	1
4	63013118-2001	Pushbutton	2
5	P/O 63013105-5001	PC Board (LED's)	1
6	63013159-1001	Connector J007	1
7	63013170-1001	Switch for Pwr	1
8	31305451-1002	Connector J003	1
9	63013160-1001	Connector P001	1
10	63013120-2001	Panel, Angle	1
11	P/O 63013105-5001	Cable Clamp	1
	*** ATTACHING PARTS ***		
A1	34000351-2002	SCR PNH REC M2X0.4X5	4
A2	34000351-2016	SCR PNH REC M3X0.5X5	2
A3	63013222-2001	SCR TB 2.6+8S	4
A4	63013216-2001	SCR 3P+8S w/WR	1



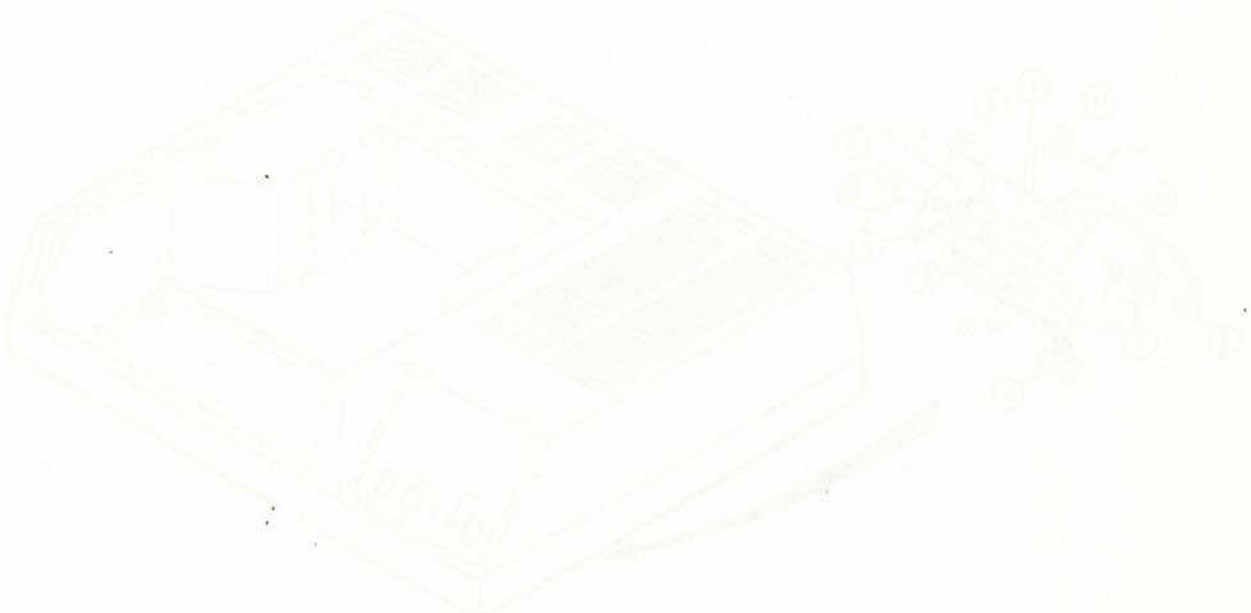


Table 9-1
Numerical Index

Part No.	Description	Figure	Index No.	Qty.
21102000-1001	Cap Cer Disc 1000pf 1KV 20%	9-3	-	2
		9-4	-	2
		9-5	-	16
21103003-1001	Cap Cer Disc .01 uf 1KV 20%	9-3	-	5
		9-4	-	6
		9-5	-	32
21104001-1001	Cap Cer disc .1 uf 16V -20+80%	9-3	-	3
		9-4	-	1
		9-5	-	4
21104002-1001	Cap Cer Disc .1 uf 500V 20%	9-3	-	2
		9-4	-	1
		9-5	-	1
21331001-1001	Cap Cer Disc 330 pf 1KV 20%	9-3	-	3
21471003-1001	Cap Cer Disc 470 pf 1KV 20%	9-3	-	1
		9-5	-	1
21472000-1001	Cap Cer Disc 4700 pf 1KV 10%	9-5	-	2
31230020-1001	Conn Edge 15 Posn 2-Row MDM	9-3	-	1
		9-5	-	1
31240456-2002	Key Plz Betw Contact	9-3	-	1
31305451-1002	Connector J003	9-7	8	1
31310019-1016	Conn Rcpt Pnl 36 Posn Non-PL2	9-5	-	1
31330011-1001	Conn Edge 10 Posn 2-Row MDM	9-5	-	1
31460015-2001	Term Ring Insull	9-2	43	1
33110002-2004	Ring Rtng Ext 3.2-4 Shaft	9-2	A8 (Sht 7)	1
34000351-2002	Scr Pnh Rec M2 x 0.4 x 5	9-7	A1	4
34000351-2016	Scr Pnh Rec M3 x 0.5 x 5	9-7	A2	2
34000351-2017	Scr Pnh Rec M3 x 0.5 x 6	9-2	A1 (Sht 1)	2
34000351-2021	Scr Pnh Rec M3 x 0.5 x 16	9-6	A3	1
34000351-2037	Scr Pnh Rec M4 x 0.7 x 8	9-6	A1	4

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
34000351-2039	Scr Pnh Rec M4 x 0.7 x 12	9-1	A8	4
34000352-2062	Scr Pnh Sltd M4 x 0.7 x 14	9-1	A2	4
34000353-2036	Scr Pnh Slt M3 x 0.5 x 14	9-6	A2	2
34000451-2004	Wshr Lock Intl Tooth M3	9-2	A3 (Sht 7)	1
34000452-2004	Wshr Fl M3 x 7 x 0.5 Thk	9-2	A2 (Sht 1)	2
34000454-2004	Wshr Lock Split M3 SST	9-2	A3 (Sht 1)	2
34000452-2004	Wshr Fl M3 x 7 x 0.5 Thk	9-2	A9 (Sht 7)	1
34000455-2006	Wshr Lock Split M4	9-2	A6 (Sht 7)	1
34000652-2006	Nut Hex M4 x 0.7 x 3.2 Thk	9-1 9-2	A5 A2 (Sht 7)	4 1
35203117-1001	IC Univ Asynchronous Rcvr 3117	9-4	-	1
35205046-1001	IC Baud Rate Generator 5046	9-3	-	1
35214881-1001	IC Quadr Line Drvr 2-Inp	9-3	-	1
35214891-1001	IC Quadr Inv Rcvr St 75189	9-3	-	1
35474000-1001	IC Quadr Nand 2-Input 7400	9-3	-	1
35747040-1001	IC Hex Inverter 7404	9-5	-	2
35474107-1001	IC Dual J-K Flip-Flop 74107	9-5	-	1
35474140-1001	IC Hex Inverter St 7414	9-5	-	1
35474170-1001	IC Hex Buffer/Driver 7417	9-4 9-5	- -	2 2
35514039-1003	IC Rndm Access Mem 256 x 4 4039	9-4 9-5	- -	2 3
35574158-1001	IC 2 to 1 Line SEL/MUX 74LS157	9-4	-	2
35574175-1001	IC QUADR D-Type FF 74LS175	9-3	-	1
35574193-1001	IC 4-Bit Up/Down Cntr 74LS193	9-5	-	2
35577400-1001	IC Quadr Nand 2-Input 74LS00	9-4	-	1
35577400-1001	IC Quadr Nand 2-Input 74LS00	9-5	-	6
35577404-1001	IC Hex Inverter 74LS04	9-3 9-5	- -	1 2

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
35577408-1001	IC Quadr And 2-Input 74LS08	9-3	-	1
		9-5	-	3
35577411-1001	IC Triple And 3-Input 74LS11	9-5	-	1
35577427-1001	IC Triple Nor 3-Input 74LS27	9-3	-	1
35577442-1001	IC 4-10 Line Decoder 74LS42	9-5	-	2
35577474-1001	IC Dual D-Type FF 74LS74	9-3	-	2
		9-5	-	3
35577493-1001	IC 4-Bit Counter 74LS93	9-4	-	4
		9-5	-	1
35674002-1001	IC Quad Nor 2-Input 74LS02	9-3	-	1
35674002-1001	IC Quadr Nor 2-Input 74LS02	9-5	-	2
35674010-1001	IC Triple Nand 3-Input 74LS10	9-5	-	1
35674191-1001	IC Up/Down Binary Cntr 74LS191	9-3	-	2
37810689-1001	Xtal 5.0688 Mhz HSC 2 Lead	9-3	-	1
38100904-1001	Semicond Diode TBAX IN4148	9-3	-	1
38100904-1001	Semicond Diode TBAX 1N4148	9-5	-	6
39030016-1001	Fuse GL .25 Dia .5A Slow 1.25L	9-6	4	1
39030020-1001	Fuse GL .25 Dia 1A 250V 1.25L	9-6	4	1
41100926-1001	Res Carbon 10 Ohm 1/4W 10%	9-5	-	1
41101926-1001	Res Carbon 100 Ohm 1/4W 10%	9-5	-	1
41102946-1001	Res Carbon 1K Ohm 1/2W 10%	9-5	-	2
41103926-1001	Res Carbon 10K Ohm 1/4W 10%	9-3	-	1
		9-5	-	7
41104926-1001	Res Carbon 100K Ohm 1/4W 10%	9-5	-	1
41122926-1001	Res Carbon 1.2 K Ohm 1/4W 10%	9-5	-	3
41153926-1001	Res Carbon 15K Ohm 1/4W 10%	9-5	-	1
41220926-1001	Res Carbon 22 Ohm 1/4W 10%	9-5	-	1
		9-5	-	2
41331926-1001	Res Carbon 330 Ohm 1/4W 10%	9-5	-	2
41471926-1001	Res Carbon 470 Ohm 1/4W 10%	9-5	-	4

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
41472926-1001	Res Carbon 4.7K Ohm 1/4W 10%	9-5	-	10
41561926-1001	Res Carbon 560 Ohm 1/4W 10%	9-5	-	9
41563926-1001	Res Carbon 56K Ohm 1/4W 10%	9-5	-	1
41682926-1001	Res Carbon 6.8K Ohm 1/4W 10%	9-3	-	3
63013104-2001	XSTR Unit, Photo	9-2	3	1
63013105-5001	Panel Unit	9-1	16	1
63013106-2001	Timing Belt Unit	9-2	5	1
63013107-2002	Cabinet Up Unit	9-1	2	1
63013108-2001	Cabinet L Unit	9-1	11	1
63013108-2002	Cabinet L Unit	9-1	11	1
63013108-2003	Cabinet L Unit	9-1	11	1
63013108-2004	Cabinet L Unit	9-1	11	1
63013109-1001	Coil Unit	9-2	10	1
63013110-5001	Head Unit	9-2	7	1
63013111-4001	Motor Unit	9-2	2	1
63013112-4001	PWB w/IC Assy	9-1	10	1
63013112-4002	PWB w/IC Assy	9-1	10	1
63013113-5001	Platen Unit	9-2	6	1
63013114-5001	XFMR Unit 115 VAC	9-1	15	1
63013114-5002	XFMR Unit 230 VAC	9-1	15	1
63013116-5001	Ptr Mech Unit	9-1	3	1
63013117-2001	Ptr Cover Unit	9-1	4	1
63013118-2001	Pushbutton	9-7	4	2
63013119-2001	Head Angle	9-2	51	1
63913120-2001	Panel, Angle	9-7	10	1
63013121-2001	Cabnt Bush Unit	9-1	12	1
63013122-2001	Base	9-2	9	1

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
63013123-2001	Paper Guide, L	9-2	8	1
63013124-2001	Paper Guide, R	9-2	4	1
63013125-2001	Roller Holder	9-2	49	1
63013126-2001	Wire Holder	9-2	44	1
63013127-2001	Clip	9-2	33	1
63013128-2001	Holder	9-2	47	1
63013129-2001	Cam Gear	9-2	36	1
63013130-2001	Slider Pinn	9-2	40	1
63013131-2001	Head Slider	9-2	31	1
63013132-2001	Slider	9-2	41	1
63013134-2001	Head Spring	9-2	32	1
63013135-2001	Bearing A	9-2	23	1
		9-2	29	1
63013136-2001	Bearing B	9-2	17	1
		9-2	46	1
63013137-2001	Bearing C	9-2	35	1
		9-2	37	1
63013138-2001	Disc	9-2	14 (Sht 3)	1
63013139-2001	Idler Gear	9-2	38	1
63013142-2001	Gear B	9-2	34	1
63013144-2001	Pulley, Left	9-2	21	1
63013145-2001	Pulley, Right	9-2	18	1
63013146-2001	Roller C	9-2	50	1
63013148-2001	Paper Shaft	9-1	1	1
63013149-2001	Idler Shaft	9-2	39	1
63013150-2001	Shaft, T Pulley	9-2	22	1
63013151-2001	Slider Shaft	9-2	42	2
63013152-2001	Cover	9-2	1	1
63013153-2001	Rubber Foot	9-2	A5 (Sht 1)	4

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
63015154-2001	Radiator	9-5	-	1
63013155-1001	Conn, 9 Pin	9-5	-	1
63013156-1001	Conn/Trans, 9 Pin	9-5	-	1
63013157-1001	Conn, 2 Pin	9-5	-	1
63015158-1001	Conn, 7 Pin	9-5	-	1
63013159-1001	Conn, 9 Pin	9-5	-	1
63013159-1001	Connector J007	9-7	6	1
63013160-1001	Connector P001	9-7	9	1
63013161-1001	Conn	9-2	45	1
63013162-1001	Sensor	9-2	48	1
63013163-1001	Fuse, Mini, 0.5A	9-5	-	2
63013164-1001	Fuse, Mini, 2A	9-5	-	2
63013165-1001	Fuse, 1A	9-5	-	1
63013166-2001	Fuse Holder	9-5	-	10
63013167-2001	Fuse Holder	9-6	5	1
63013168-1001	Switch w/Lock	9-7	2	1
63013169-1001	Non Lock Switch	9-7	3	1
63013170-1001	Switch for Pwr	9-7	7	1
63013171-1001	Buzzer	9-5	-	1
63013172-1001	Cap 4700 uf 16WV	9-5	-	1
63013173-1001	Cap 470 uf 100WV	9-5	-	1
63013175-1001	Res 7E 1K 1/16W	9-5	-	1
63013176-1001	Res 9E 4.7K 1/16W	9-5	-	2
63013177-1001	Res 9E 47K 1/16W	9-5	-	1
63013178-1001	Res 4E 1K 1/8W	9-5	-	1
63013179-1001	Res 4E 2.2K 1/8W	9-5	-	1
63013180-1001	Res 5E 2.2K 1/8W	9-5	-	1

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
63013181-1001	Cap 100 uf 10WV	9-5	-	2
63013182-1001	Cap 22 uf 10WV	9-5	-	2
63013183-1001	Cap 10 uf 10WV	9-5	-	3
63013184-1001	Cap 470 uf 25WV	9-5	-	2
63013185-1001	Cap 3.3 uf 50WV	9-5	-	2
63013186-1001	Cap 0.1 uf 50WV	9-5	-	1
63013187-1001	Cap 0.002 uf 50WV	9-5	-	2
63013188-1001	Cap 0.33 uf 35WV	9-5	-	1
63013189-1001	Dio Bridge Rect	9-5	-	1
63013190-1001	Dio Bridge Rect	9-5	-	1
63013191-1001	Dio Bridge Rect	9-5	-	1
63013192-1001	Dio Bridge Rect	9-5	-	1
63013193-1001	Dio Zener 5.4V	9-5	-	1
63013194-1001	Dio Zener 12.5V	9-5	-	2
63013195-1001	Dio Zener 35V	9-5	-	1
63013196-1001	IC Char Gen	9-5	-	1
63013197-1001	IC 74LS107N	9-5	-	1
63013198-1001	IC 74LS122N	9-5	-	1
63013199-1001	IC 74LS123N	9-5	-	2
63013200-1001	IC 78L05A-1 5V	9-5	-	1
63013201-1001	LED	9-7	1	2
63013202-1001	Res 33 Ohm 1/2W	9-5	-	9
63013203-1001	Res 3.3K Ohm 1WW	9-5	-	1
63013204-1001	Res 5.6K Ohm 1WW	9-5	-	1
63013205-1001	XSTR 2SA490	9-5	-	1
63013206-1001	XSTR 2SA564	9-5	-	10
63013207-1001	XSTR 2SA634	9-5	-	3

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
63013208-1001	XSTR 2SA675	9-5	-	1
63013209-1001	STR 2SC1061	9-5	-	2
63013210-1001	XSTR 2SC1318	9-5	-	9
63013211-1001	XSTR 2SC945	9-5	-	5
63013212-1001	XSTR 2SD389	9-5	-	1
63013214-2001	SCR 2.6P+6S w/WR	9-2	A1 (Sht 9)	1
63013215-2001	SCR 3P+6S w/WR	9-1	A3	7
63013215-2001	SCR 3P+6S w/WR	9-2	A7 (Sht 7)	1
63013215-2001	SCR eP+6S w/WR	9-6	A4	2
63013216-2001	SCR 3P+8S w/WR	9-2	A1 (Sht 2)	2
63013216-2001	SCR 3P+8S w/WR	9-2	A2 (Sht 3)	1
63013216-2001	SCR 3P+8S w/WR	9-2	A5 (Sht 7)	1
63013216-2001	SCR 3P+8S w/WR	9-2	A1 (Sht 8)	1
63013216-2001	SCR 3P+8S w/WR	9-6	A5	2
63013216-2001	SCR 3P+8S w/WR	9-7	A4	1
63013219-2001	SCR 3P+30S	9-22	A3 (Sht 4)	1
63013220-2001	SCR 3T+8S	9-1	A1	3
63013221-2001	SCR 3T+6S	9-2	A3 (Sht 3)	1
63013222-2001	SCR TB 2.6+8S	9-1	A9	4
63013222-2001	SCR TB 2.6P+8S	9-7	A3	4
63013223-2001	Ring Rtng 2 MM	9-2	A2 (Sht 4)	1
63013223-2001	Ring Rtng 2 MM	9-2	A4 (Sht 7)	3
63013224-2001	Ring Rtng 3 MM	9-2	A1 (Sht 4)	1
63013224-2001	Ring Rtng 3 MM	9-2	A1 (Sht 7)	2
63013225-2001	Wormscrew	9-2	A1 (Sht 3)	1
63013226-2001	PWB Angle	9-1	7	1
63013227-2001	PWB Angle A	9-1	6	1

Table 9-1 (cont'd)

Part No.	Description	Figure	Index No.	Qty.
63013228-2001	PWB Angle B	9-1	5	1
63013229-2001	Fixed Angle	9-1	14	1
63013230-1001	Res 4E 4.7K 1/16 1	9-3	-	1
63013231-1001	Res 5E 4.7K 1/16	9-4	-	1
63013232-1001	Res 7E 22K 1/16	9-4	-	1
63013233-1001	Cap 47 uf 10WV	9-3	-	2
63013233-1001	Cap 47 uf 10WV	9-4	-	1
63013234-1001	Cap 22 uf 25WV	9-3	-	2
63013234-1001	Cap 22 uf 25WV	9-4	-	1
63013235-1001	Cap 1000 uf 50WV	9-5	-	1
63013236-1001	SCR 2.6T+8S	9-1	A7	2
63013237-1001	Nut 2.6	9-1	A6	2
63013238-1001	Cap 2200 uf 25WV	9-5	-	1
63013239-1001	Switch 4 Pos Dip	9-3	-	1
63013239-1001	Switch 4 Pos Dip	9-4	-	1
63013240-4001	PWB w/IC Assy Ser IF (Rear)	9-1	8	1
63013241-4001	POW w/IC Assy Ser IF (Front)	9-1	9	1
XBPSD30-P20000	SCR 3P+20S	9-1	A4	2
To Be Assigned	EIA Cable	9-1	13	1