Qume Manual

Maintenance/Training
December 1976
Printers
Sprint Micro 3 Series

?323 Industrial Parkway West • Hayward, California 94545 • TWX 910-383-0192 • (415) 783-6100

Qume®

Reorder Number 30010

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CHAPTER I

INTRODUCTION AND DESCRIPTION

1.0 SCOPE AND ORGANIZATION OF THIS MANUAL

This manual provides information for installation, operation, and maintenance of the Qume Sprint Micro 3 Series Printers. Complete procedures for repair are included with schematic diagrams and an illustrated parts list to aid the maintenance technician.

This chapter provides a brief description of the printer and lists its capabilities. In Chapter II you will find descriptions for unpacking and initial installation. Chapter III describes the theory of operation in sufficient detail to allow troubleshooting and repair of the printer.

A consolidated list of support equipment is found in Chapter IV. Listed in this chapter are the special tools, test equipment, spare parts, and miscellaneous items required in routine servicing of the printer.

Chapter V outlines routine maintenance and sets forth a recommended schedule of cleaning, lubrication, and adjustment.

Troubleshooting is covered in Chapter VI. This section describes procedures for locating faults within the mechanical and electrical portions of the printer. Procedures are given to enable the service technician to isolate faults to the board level.

Repair techniques are discussed in Chapter VII. Procedures for removal and replacement of defective components are described, as well as detailed mechanical alignment.

Chapter VIII contains an illustrated parts list, showing the mechanical portion of the printer. This serves to identify parts for ordering purposes and also serves as an assembly guide during servicing of the printer.

Complete wiring and schematic diagrams are provided in Chapter IX as well as assembly drawings for the printed circuit boards.

1.1 DESCRIPTION OF THE PRINTER

The Sprint Micro 3 Series Printer is a high-performance, low-cost printer intended for use in automatic data systems. Its light weight and compactness, its ease of operation and dependability are important features in any application calling for a printer with intermediate output capacity. Such applications include small business systems in which printers constitute the principle output device, as well as larger data systems calling for a flexible terminal printer with high-quality print. The printwheel provides a full 96-character set, with a variety of optional type styles. Upper and lower case alphabetic characters are provided together with numeric and special characters.

On typical sequential text, the printer attains print speeds as high as 55 characters per second. The usefulness of the printer is not restricted to the line-sequential output, however. Both the vertical and horizontal placement of each character are under program control, with four degrees of freedom (right and left carriage movement; forward and reverse paper movement). A unique method of optical control permits accurate character placement. These features make the Sprint Micro 3 Series Printer suitable for X-Y plotting, and for applications where it is more convenient to have random output rather than conventional left-to-right or top-to-bottom operation. Character placement is done is increments of 1/120th inch horizontally and 1/48th inch vertically. Horizontal displacements up to 13.1 inches and vertical displacements up to 21.3 inches may be programmed.

Control and data interface are fully TTL-compatible. The printer uses a 13-bit weighted data bus and three unweighted strobe lines to enter the data into the printer input buffer. The strobe lines distinguish the operation to be performed and initiate the appropriate action on the part of the printer.

Miscellaneous input functions include Printer Select, Ribbon Lift, and Restore (a "reset" function following a "check" condition such as a carriage or printwheel travel malfunction or power supply failure). Status outputs are also included, allowing the external data source to monitor printer functional status.

Perhaps the most significant feature of the printer is its mechanical simplicity. Mechanical functions have been replaced by electrical functions wherever possible, and the mass and inertia of the mechanism has been minimized through the use of lightweight components. Electrical reliability is enhanced through the us of LSI (large-scale integration) components in the input and control circuits. By minimizing the number of electrical and mechanical components, Qume has produced an exceptionally fast, quiet, and reliable serial printer. Plug-in serviceability permits on-site repair and minimum downtime.

1.2 SPECIFICATIONS

TABLE 1-1

PRINT SPEED:

Qume printer speed varies according to the sequence of characters being printed and whether the various capabilities of the printer (high speed electronic tab, printing right to left, etc.) are used properly. Speeds shown below are for average English text on one line, with electronic tab over spaces between words, and are shown in characters per second (cps).

Sprint Micro 3/35:	35 cps
Sprint Micro 3/45:	45 cps
Sprint Micro 3/55:	55 cps
Sprint Micro 3/X30:	30 cps (metallized wheel)
Sprint Micro 3/X40:	40 cps (metallized wheel)
Sprint Micro 3/WideTrack:	40 cps

1.2 SPECIFICATIONS (continued)

TABLE 1-1
(continued)

PRINT:	Full character of electric typewriter quality, printed serially: variable intensity ballistic hammer automatically adjusts to one of six intensities according to character size.
FORMS:	Single sheets and continuous forms, with or without sprocket holes. The Sprint Micro 3 printers maximum forms width is 15 inches (38.1 cm). WideTrack maximum forms width: 28 inches (71.1 cm).
FONT:	96 CHARACTER POSITIONS ON "daisy" printwheel: Wide variety of standard font styles in 10 and 12 pitch and proportional spacing.
FORMAT:	Horizontal: Sprint Micro 3: 132 columns at 10 characters per inch; 158 columns at 12 characters per inch; left or right. Electronic tabbing and carriage return up to 13.1 inches (33.3 cm). Vertical: Spacing in increments of 1/48th inch, up or down: slew rate at 5 inches (12.7 cm) per second. WideTrack slew rate: 5 inches (10.2 cm) per second.
PLOTTING:	Resolution of 5760 points per square inch.
PAPER FEED:	Pressure Platen: pin feed platens, forms tractor, optional.
RIBBON:	Easy to handle cartridge with multi-strike carbon, single strike carbon or fabric ribbon.
PRINTWHEEL:	Easily operator changeable.
OPERATOR CONTROLS:	Horizontal forms positioning; vertical forms positioning; forms thickness; ribbon advance.
TEMPERATURE:	Operating 50 to 105 degrees F (10 to 40 degrees C). Storage -40 to 170 degrees F (-40 to 76 degrees C).
HUMIDITY:	Operating 10% to 90% RH (no condensation). Storage 2% to 98% RH (no condensation).
PHYSICAL:	Sprint Micro 3 Weight: 28 pounds (12.7 kg) Width: 23.63 inches (60 cm) Height: 7.11 inches (18 cm) Depth: 13.5 inches (34.3 cm)

1.2 SPECIFICATIONS (continued)

TABLE 1-1
(continued)

PHYSICAL:	WideTrack Weight: 37.2 pounds (16.9 kg) Width: 36.5 inches (92.8 cm) Height: 7.11 inches (18 cm) Depth: 13.5 inches (34.3 cm)
DATA INPUT:	13-bit parallel TTL levels plus control lines.
POWER REQUIREMENTS:	(For all Sprint Micro 3 Models.) + 5 VDC ± 3% 3.5 amps DC +15 VDC ∓ 10% 4.5 amps average (14 amps peak 20 ms max.) -15 VDC ± 10% 4.5 amps average (14 amps peak 20 ms max.)
INTERFACE CONNECTORS:	Power: Molex #09-01-1121 Data and control: 3M #3415-0000 Dual 25-pin PC edge connector
OPTIONS:	End of ribbon detector Out of paper detector Top of form Bottom feed slot
ACCESSORIES:	Friction platen Pin feed platen Forms tractor Receive-only printer cover Keyboard printer cover Power supply

CHAPTER II

RECEIVING

2.0 INTRODUCTION

This chapter describes installation of the Sprint Micro 3 Series Printers, including receiving, quality assurance inspection, and electrical interface.

2.1 RECEIVING

Each printer is shipped in an individual carton. The following items are included:

Printer Assembly
Power Connector (Part number 80033)
Hole Plugs (Printer with covers only)
Interface Connector Hood (Part number 80034)

Remove the printer from its shipping carton:

(1) Inspect the container for external signs of damage. If any damage is observed, have the delivery agent note the damage on the shipping document.

(2) Open the outer container and remove the inner carton.

(3) Open the inner carton from the top and remove the cardboard spacer. The printer, bolted to its shipping pallet and wrapped in plastic, may now be withdrawn.

(4) Remove the plastic bag surrounding the printer.

(5) Using a wrench, remove the four screws securing the printer to its shipping pallet.

(6) Install hole plugs in the printer cover (if ordered) in holes vacated by pallet screws.

(7) Remove any paper wrapped around the platen.

(8) Remove the top front cover.

(9) Using diagonal cutting pliers, cut and remove the two plastic ties used to secure the paper bail during shipping.

(10) Cut and remove the plastic tie used to secure the carriage assembly to the printer chassis.

(11) Examine the packing material closely to ensure that any small items ordered have been recovered (e.g. Power Connector Assembly #80033 or Logic Connector Hood Assembly #80034).

2.1 RECEIVING (continued)

(12) Retain all packing materials for possible reshipment.

Inspect the printer for scratches, dents, loose or damaged parts or other signs of damage. Note any evidence of such damage on the invoice, and file a claim with the carrier immediately, if the condition of the unit so warrants.

Remove the middle cover of the printer, and inspect the interior of the entire unit. Look for loose or broken parts, evidence of electrical damage, or other signs of damage. Be sure that all printed circuit boards are seated securely in their sockets by pressing down on each one of the boards.

If damage that might impair printer operation is detected, do not attempt to operate the printer. Contact Qume for advice and instructions.

Install a ribbon cartridge and printwheel on the Carriage Assembly (refer to Operator's Manual). The unit is now ready for electrical inspection and testing.

2.2 INSTALLATION

The following paragraphs outline procedures for installing the printer.

2.2.1 POWER CONNECTIONS

The printer requires three power supply voltages, as listed in Table 2-1. Qume offers two power supplies (Model 530 and Model 531) that are designed to run our printers. Seperate modular power supplies having the required characteristics may be used.

TABLE 2-1

POWER REQUIRED

SUPPLY/TOLERANCE	CURRENT REQUIRED
+15 VDC $\pm$ 10%	4.5 amps avg/14 amp peaks - 20 msec max.
-15 VDC $\pm$ 10%	4.5 amps avg/14 amp peaks - 20 msec max.
+ 5 VDC $\pm$ 3%	3.5 amps

All voltages must reach 90% of their final values in no less than 4 msecs and no more than 100 msecs. The absolute values of the +15 and -15 volt input must not differ by more than 2.0 volts during their rise or fall. The +5 volt input must reach 90% of its final value within 50 msecs of the +15 and -15 volt input.

All power connections are made through a single connector (Molex #09-01-1121-1), which attaches to a corresponding connector (see Figure 2-1) on the left side of the printer, viewed from the rear. Pin allocations on the power connector are given in Table 2-2. Note that seperate lines for high and low current supply distributions must be provided for all three supplies to prevent noise from being

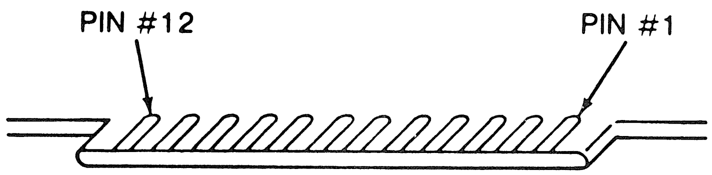
2.2.1 POWER CONNECTIONS (continued)

coupled from the carriage and printwheel motor drive circuits into the signal processing circuits. It is suggested that the recommended wire sizes (see Table 2-2) be used for installation. For proper noise isolation, the +5 V logic supply return path must be isolated from the +15 V and -15 V supply ground return paths in the power supply and the power cable.

TABLE 2-2

POWER CONNECTOR

POWER	PIN	WIRE SIZE
+15V High Current	3,4	2x18 AWG
+15V Low Current	6	1x18 AWG
-15V High Current	1,2	2x18 AWG
-15V Low Current	5	1x18 AWG
+ 5V Logic Current	7,8	2x18 AWG
+ 5V Power Current	12	1x18 AWG
Ground	9, 10, 11	3x18 AWG (or 7/32" tinned copper braid)



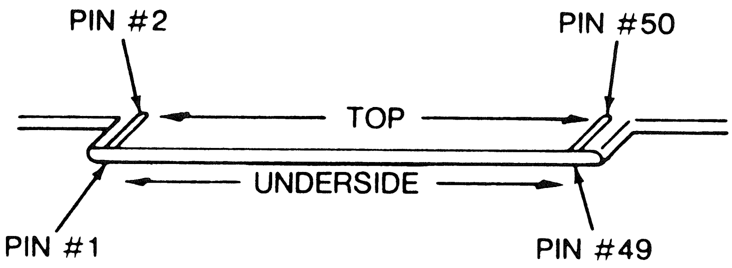
As Viewed From Rear Of Printer

FIGURE 2-1

POWER CONNECTOR (J2) ORIENTATION

2.2.2 DATA AND CONTROL CONNECTIONS

Input control and data signals are connected to the printer through J1 (right side of chassis viewed from the rear). The connector consists of a dual 25-pin edge card connector (0.1 inch contact centers). Recommended connector is 3M #3415-0000. Recommended interconnecting cable is 3M #3365, 50-conductor ribbon. Pin assignments on the control connector are given in Table 2-3 and shown in Figure 2-2.

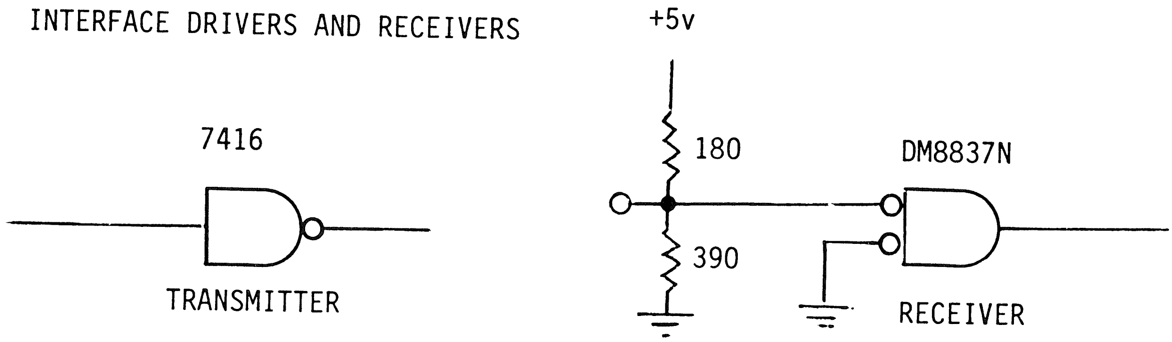


As Viewed From Rear Of Printer

FIGURE 2-2

CONTROL CONNECTOR (J1) ORIENTATION

INTERFACE DRIVERS AND RECEIVERS



All input/output signals are active low.
Logic: ≤ 0.4V Logic: ≥ 2.4V
Data 1/2 thru 2048 have 1K pull-up resistors and are received by 74412's.

TABLE 2-3

INTERFACE SIGNALS AND PIN ASSIGNMENTS

Connector: 3M #3415-0000

PIN	SIGNAL NAME	PIN	SIGNAL NAME
1	GND	26	TOP OF FORM (OPT)
2	DATA 1/2	27	GND
3	DATA 1	28	RIBBON LIFT COMMAND
4	DATA 2	29	GND
5	DATA 4	30	RIBBON OUT (OPT)
6	DATA 8	31	GND
7	DATA 16	32	PRINTER SELECT
8	DATA 32	33	GND
9	DATA 64	34	COVER INTERLOCK (OPT)
10	DATA 128	35	GND
11	DATA 256	36	GND
12	DATA 512	37	CHECK
13	DATA 1024	38	GND
14	DATA 2048 (OPT)	39	INPUT BUFFER READY
15	GND	40	GND
16	RESTORE	41	INPUT BUFFER READY
17	GND	42	GND
18	CHARACTER STROBE	43	INPUT BUFFER READY
19	GND	44	GND
20	CARRIAGE STROBE	45	(Not Used)
21	GND	46	GND
22	PAPER FEED MAIN STROBE	47	PRINTER READY
23	GND	48	GND
24	PAPER FEED AUXILIARY STROBE (OPT)	49	PAPER OUT (OPT)
25	GND	50	GND

NOTE

Pin 39 was previously named CHARACTER READY.
Pin 41 was previously named CARRIAGE READY.
Pin 43 was previously named PAPER FEED RIGHT READY.

These three signals have been consolated (but gate isolated) and occur simultaneously. Only one of these INPUT BUFFER READY lines needs to be tested prior to each CHARACTER, CARRIAGE or PAPER FEED STROBE.

All input/output signals are active low. Logic 1: $\leq$ 0.4Volts Logic 0: $\geq$ 2.4Volts

2.2.3 BASIC SIGNAL INPUTS

PRINTER SELECT LINE (Pin 32)

This signal is used to select the printer for operation, and enables the input and output lines in the interface. All interface lines are disabled until the select line is low.

RESTORE (Pin 16)

This signal initiates a restore sequence, normally following a printer malfunction or power failure which causes a "check" condition (see Basic Signal Outputs). The restore sequence consists of positioning the carriage at the leftmost position, synchronizing the printwheel, and resetting the carriage, printwheel, and interface logic. The internal "check" circuits are also reset.

DATA LINES (Pins 2 - 14)

These thirteen lines contain binary-coded information representing an ASCII character, a carriage movement command, or a paper feed command.

When representing an ASCII character, only the low-order seven lines (D1-D64) are used; the remaining lines are ignored. Refer to Table 2-5 for a cross-reference between printwheel addresses and ASCII inputs.

When representing a carriage movement command, the eleven low-order bits designate the distance the carriage is to be moved in multiples of 1/60th of an inch. The D-1/2 bit indicates 1/2 times 1/60th, or 1/120th of an inch. A value of six is required for one character at 10 character/inch. The high-order bit (1024) determines the direction of carriage travel. If this bit is a logic "0" the carriage travels to the right; if a logic "1" the carriage travels to the left. D2048 bit is used in the WideTrack model to represent 1024 steps.

When representing a paper feed command, the ten low-order bits designate the number of vertical position increments to be moved, in multiples of 1/48th of an inch. The high-order bit (1024) determines the direction of paper movement; a logic "0" moves the paper upward, and logic "1" moves the paper downward.

CHARACTER STROBE (Pin 18)

When this signal is pulled low with valid character data on the data lines, the character data will be transferred into the input buffer register. Timing is shown in Figure 2-3.

CARRIAGE STROBE (Pin 20)

This signal enters carriage movement data into the input buffer when pulled low.

2.2.3 BASIC SIGNAL INPUTS (continued)

RIBBON LIFT COMMAND (Pin 28)

This signal raises and lowers the ribbon. If the level on this line is high (false), the ribbon will drop to the lower position; if the level is low (true), the ribbon will be raised to the printing position.

PAPER FEED MAIN STROBE (Pin 22)

When pulled low this signal enters paper movement data into the input buffer in operations where a single platen is used, or enters righthand platen movement data when the split platen option is installed.

PAPER FEED AUXILARY STROBE (Pin 24)

When pulled low this signal enters left platen paper movement data when the split platen option is installed.

TOP OF FORM COMMAND (Pin 26) (ROM Version Only)

This signal advances the paper to its starting point at the Top Of Form. There is sixteen programmable lengths of form feed available. The length of form to be used should be programmed prior to applying the TOF strobe by initiating a character strobe co-incidental with the ASCII FF code with data bits D128, D256, D512 and D1024 determing the length of feed. See Table 2-4. If FF code is not used, the Top Of Form increment will automatically be set at eleven inches.

Character Strobe	D1	0
ASCII FF Code	D2	0
	D4	1
	D8	1
	D16	0
	D32	0
	D64	0
	*D128	A
	*D256	B
	*D512	C
	*D1024	D

TABLE 2-4

TOP-OF-FORM

DATA BITS OF FF COMMAND				FORM LENGTH (INCHES)
D1024	D512	D256	D128	
0	0	0	0	11 Note 2
0	0	0	1	3
0	0	1	0	3.5
0	0	1	1	4
0	1	0	0	5
0	1	0	1	5.5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	8.5
1	0	1	0	9
1	0	1	1	10
1	1	0	0	11-2/3 (70 lines)
1	1	0	1	12
1	1	1	0	14
1	1	1	1	17

Notes:

1. Other data bits in command are (D64 to D1): 0001100.
2. Eleven inches is the default value after a Restore command.

TABLE 2-5

ASCII CODE

CHAR-ACTER	ASCII BINARY CODE	ASCII HEX CODE	DECIMAL PRINTWHEEL ADDRESS	RELATIVE HAMMER FORCE	RIBBON ADVANCE
A	1000001	41	022	5	4
B	1000010	42	016	5	4
C	1000011	43	020	4	3
D	1000100	44	044	5	4
E	1000101	45	030	4	3
F	1000110	46	018	4	3
G	1000111	47	048	5	4
H	1001000	48	034	5	4
I	1001001	49	040	4	3
J	1001010	4A	058	5	3
K	1001011	4B	056	5	4
L	1001100	4C	042	4	3
M	1001101	4D	012	6	4
N	1001110	4E	038	5	4
O	1001111	4F	036	5	4
P	1010000	50	052	4	3
Q	1010001	51	054	5	4
R	1010010	52	026	5	4
S	1010011	53	028	4	3
T	1010100	54	032	4	4
U	1010101	55	046	5	4
V	1010110	56	060	4	4
W	1010111	57	008	6	4
X	1011000	58	064	5	3
Y	1011001	59	050	4	4
Z	1011010	5A	014	4	4
a	1100001	61	168	4	4
b	1100010	62	156	4	3
c	1100011	63	158	4	3
d	1100100	64	152	4	3
e	1100101	65	166	3	3
f	1100110	66	178	3	3
g	1100111	67	148	4	3
h	1101000	68	174	4	3
i	1101001	69	170	3	3
j	1101010	6A	144	3	3
k	1101011	6B	186	4	3
l	1101100	6C	154	3	3
m	1101101	6D	142	6	4
n	1101110	6E	164	4	3
o	1101111	6F	160	4	3
p	1110000	70	180	4	4
q	1110001	71	184	4	4
r	1110010	72	162	4	3
s	1110011	73	176	4	3
t	1110100	74	172	4	3
u	1110101	75	182	4	3
v	1110110	76	146	3	4

TABLE 2-5

ASCII CODE *(continued)*

CHAR-ACTER	ASCII BINARY CODE	ASCII HEX CODE	DECIMAL PRINTWHEEL ADDRESS	RELATIVE HAMMER FORCE	RIBBON ADVANCE
w	1110111	77	000	5	4
x	1111000	78	150	4	3
y	1111001	79	188	4	4
z	1111010	7A	190	4	3
0	0110000	30	074	4	3
1	0110001	31	066	3	3
2	0110010	32	068	4	3
3	0110011	33	070	4	3
4	0110100	34	072	4	3
5	0110101	35	076	4	3
6	0110110	36	078	4	3
7	0110111	37	080	4	3
8	0111000	38	082	4	3
9	0111001	39	084	4	3
¢	0100000	20	004	4	3
!	0100001	21	136	3	2
"	0100010	22	140	2	3
#	0100011	23	092	4	3
$	0100100	24	088	5	3
%	0100101	25	094	6	4
&	0100110	26	138	5	4
'	0100111	27	108	2	2
(	0101000	28	120	4	2
)	0101001	29	116	4	2
*	0101010	2A	122	3	3
+	0101011	2B	090	3	3
,	0101100	2C	006	1	2
-	0101101	2D	086	2	3
.	0101110	2E	010	1	2
/	0101111	2F	132	4	3
:	0111010	3A	024	1	2
;	0111011	3B	062	1	2
<	0111100	3C	114	3	3
=	0111101	3D	096	3	3
>	0111110	3E	100	3	3
?	0111111	3F	130	3	3
@	1000000	40	124	6	4
[	1011011	5B	106	4	2
\	1011100	5C	126	4	4
]	1011101	5D	102	4	2
^	1011110	5E	128	2	3
—	1011111	5F	110	1	5
`	1100000	60	112	2	2
{	1111011	7B	098	4	3
|	1111100	7C	118	4	2
}	1111101	7D	134	4	3
~	1111110	7E	104	3	3
¬	1111111	7F	002	2	3

NOTE: The character set shown in the preceding pages is that of the Prestige Elite 12 character set. The character faces will change with different fonts; however, the ASCII code relationship to the printwheel address location will always remain constant.

TABLE 2-6

HAMMER INTENSITY

HAMMER INTENSITY	HAMMER "ON" TIME (ms)
1	1.60
2	1.70
3	1.85
4	2.00
5	2.25
6	2.50

TABLE 2-7

PROPORTIONAL RIBBON ADVANCE

(RIBBON MOTOR STEPS)

CURRENT CHARACTER WIDTH (Ribbon Motor Steps)	LAST CHARACTER WIDTH (Ribbon Motor Steps)			
	5	4	3	2
5	5	4	4	3
4	4	4	3	3
3	4	3	3	3
2	3	3	3	2

2.2.4 BASIC SIGNAL OUTPUTS

These signals indicate the status of internal printer functions, and can be used by the external processor as flags for initiating data and control inputs.

PRINTER READY (Pin 47)

This signal indicates that the printer is ready to accept data and control inputs.

INPUT BUFFER READY (Pin 39) Previously called CHARACTER READY.
INPUT BUFFER READY (Pin 41) Previously called CARRIAGE READY.
INPUT BUFFER READY (Pin 43) Previously called PAPER FEED RIGHT READY.

These signals indicate that the printer is ready to accept an input command. These three signals have been consolidated (but gate isolated) and occur simultaneously. The INPUT BUFFER READY line must be tested before every character, carriage, and paper feed command. The input commands are stored in a single command hardware buffer and transferred to a 15 command, software controlled, first in/first out buffer.

(Pin 45) (Not Used)

CHECK (Pin 37)

This signal indicates that one or more printer malfunctions has occurred:

1. the carriage has been commanded to move, but no movement has been detected; or

2. the printwheel has been commanded to move, but, no movement has been detected; or

3. the power supplies have failed.

Under these circumstances, the CHECK signal will be true and no input commands will be accepted until the check condition has been cleared by clearing the malfunction and initiating a "restore" sequence.

PAPER OUT (Pin 49)

This signal indicates that the printer is out of paper. In printers not equipped with the paper out option, this line will always indicate a "paper available" condition.

2.2.4 BASIC SIGNAL OUTPUTS (continued)

RIBBON OUT (Pin 30)

This signal indicates that the printer is out of ribbon. This signal does not disable the printer. The RIBBON OUT line provides a status signal to the interface. In printers not equipped with the RIBBON OUT option, this line will always indicate a "ribbon available" condition.

COVER INTERLOCK (Pin 34)

This signal indicates that the printers top cover is in place. In printers not equipped with the COVER INTERLOCK, this line will always indicate the cover is in place.

2.2.5 TIMING CONSIDERATIONS

The timing diagram shown in Figure 2-3 illustrates the relationships between the data lines, the strobe input, and the internal ready line. The illustration shown is for a character input, but, the carriage and paper feed command timing is the same.

TYPICAL CHARACTER COMMAND SEQUENCE

The commands that are sent to the printer will be executed in order of receipt. A carriage motion and paper feed may be executed simultaneously. The character command inhibits any paper or carriage motion during the second portion of its execution cycyl. The print cycle is divided into two parts:

(1) Motion of the printwheel.

(2) Firing the printhammer.

Hammer firing will be executed only when the printwheel, carriage, and paper feed are all at rest. During the hammer firing cycle, and execution of the printwheel rotation, carriage movement and paper feed is deferred until completion of the hammer firing cycle. There is no restriction on overlapping printwheel motion, carriage movement and paper feed.

A carriage strobe followed by a character strobe will cause both the carriage and printwheel to move. Printing will occur when both the carriage and the printwheel are stopped. This is termed a space before print sequence.

TIMING

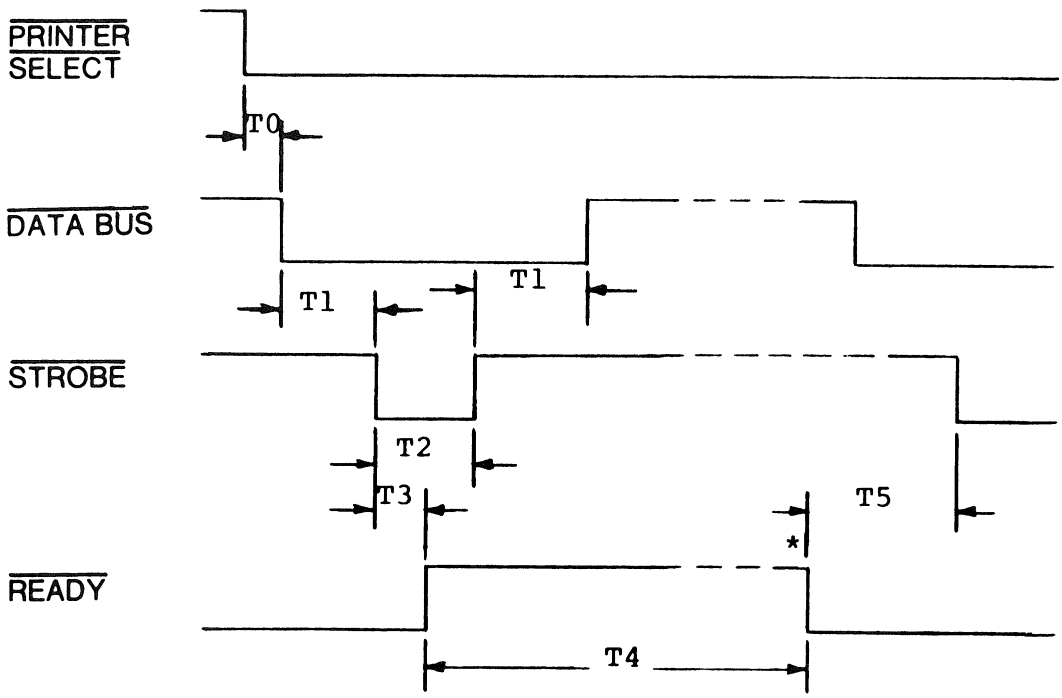


FIGURE 2-3

CONTROL TIMING

	T0 >	0 ns	
	T1 >	200 ns	
	T2 >	750 ns	
250 ns <	T3 <	950 ns	
	T4 >	20 usec	
	T5 >	000 ns	

*Any STROBE arriving during the time that the INPUT BUFFER READY line is false ($\geq$ 2.4 Volts) will be ignored.

The INPUT BUFFER READY lines will go false for 20 to 800 usec upon receipt of any strobe. If the input buffer is full, INPUT BUFFER READY lines will reamin false until completion of the command being executed. Commands are executed in order of receipt.

The Sprint Micro 3 Series Printers have a sixteen command input buffer. The character, carriage and paper feed commands are stored in a single-command hardware buffer and transferred to a 15 command software-controlled first in/first out buffer.

2.3 INITIAL PERFORMANCE CHECK

The ideal performance check is to install the printer in the system with which it will be used, and execute a suitable exercise routine.

An alternate performance test using the Qume Printer Exerciser (either bench or portable model) is described below:

(1) Connect the printer to the Power Supply. Turn power on and verify that supply voltages are within specification. On S3 printers check +5 V supply at test point indicated on P.C.B. #2; check +15 V supply at the emitters of carriage drive transistors Q2 and Q1 (Q2 and Q1 are mounted on the heat sink at the right rear of the printer frame).

$$+\ 5\ \text{VDC} \pm 3\%$$
$$+\ 15\ \text{VDC} \pm 10\%$$
$$-\ 15\ \text{VDC} \pm 10\%$$

Turn power off.

Install any covers that have been removed.

(2) Connect printer to Printer Exerciser/Tester. Apply power and verify that the carriage "restores" to the extreme left limit at a moderate velocity.

(3) Press the ribbon advance switch on the printer and verify that the ribbon both lifts and advances correctly.

(4) Insert a piece of paper into the platen. Pull the feed roller release lever forward and verify that this allows the paper to be aligned. Push feed roller release lever to the rear.

(5) On printers ordered with cover assemblies and cover interlock switch, verify that removal of the top cover disables the printer (printer exerciser CHAR RDY, CARR RDY, PF RT RDY, and PF LFT RDY LED's will be OFF, only the PTR RDY LED will be ON). Replace top cover.

(6) If Top Of Form option has been ordered, verify that it works correctly. This function can be operated from the printer exerciser or, if ordered, from the "TOF" switch on the printer cover.

(7) Install a known good printwheel on the printwheel hub, making certain that the printwheel is fully seated. Secure the printwheel motor latch.

(8) Install a Qume MULTI-STRIKE carbon ribbon cartridge (Qume #80029-01) on the carriage assembly. Remove any slack in the ribbon by operating the printer's ribbon advance switch.

(9) Print one line of Test 5-1 from the exerciser. Verify that the characters are printed approximately as dark on their top and bottom, and on their right and left.

2.3 INITIAL PERFORMANCE CHECK (continued)

(10) Complete a 15 minute warm-up using printer exerciser Test 5-1 with vertical line spacing of six lines to the inch. Verify that print is equally dark through-out the printout (verifies proper ribbon advance).

In the Sprint Micro 3 Series printers the end of ribbon option does not disable the printer. The End of Ribbon option is only a status condition which provides a status signal to the interface. The Qume exerciser does not monitor this line.

An alternate check may be performed by grounding pin 2 of the 40 pin test point strip on P.C.B. #2. The printer should be powered down when securing a jumper between ground and pin 2. In this test the printer relies on a diagnostic test stored in its own micro processor memory. This test may be monitored and controlled by the Sprint Micro 3 ActivityMonitor (part #80740). For further explanation of this test and ActivityMonitor refer to chapter VI.

The diagnostic test performs the following:

(1) ROM test.

(2) I/0 lines.

(3) Executes a restore.

(4) Carriage moves 114 times back and forth in diminishing movements.

(5) Printwheel moves 96 times clockwise and counter clockwise.

(6) Executes various combinations of forward and reverse paper feeds.

(7) Concludes test with "Self Test" printed vertically. Ribbon lift, hammer actuation and ribbon advance are exercised during this print cycle.

2.4 WARRANTY

Qume products are warranted free from defects in material and workmanship for a period of 90 days after delivery. Qume's obligation under this warranty is limited to replacing or repairing, at its option, at its factory, any of the products (except expendable parts thereof) that within the warranty period are returned to Qume and that are found to be defective in proper usage. Printers within warranty will be repaired at no charge. Buyer shall prepay transportation charges to the Qume factory.

Before returning materials to Qume, the customer must request a Material Return Authorization Number. Qume will only accept authorized Replacement Assemblies (see Service Policy) or complete printers for replacement or repair. Individual components will not be authorized for replacement or repair if removed from assemblies.

Qume will ship repaired or replaced assemblies to customers within 30 days from receipt of assemblies.

2.5 SERVICE POLICY

Qume will accept the assemblies listed below for repair at the charges shown. Any other parts and/or subassemblies will be accepted for repair at Qume's discretion.

FIXED FEE ITEMS:

Description	Charge
Printed circuit board (other than catastrophic failure)	$ 50.
Carriage motor encoder:	
In printer	$150.
Seperate assembly	$100.
Printwheel motor encoder:	
In carriage and in printer	$200.
In carriage only	$150.
Seperate assembly	$100.

All other items will be repaired on a time and materials basis, with time calculated at $35/hour and materials at list price.

The above prices are subject to change without notice.

TIME AND MATERIAL CHARGES:

Unless the customer advises to the contrary, Qume will request a purchase order for all estimated time and material charges before beginning any work.

SCHEDULES:

Qume will return repaired or replaced parts to customers within 30 days from receipt of parts. If the customer desires parts returned within three working days, a $50 expediting fee will be charged.

SHIPPING CHARGES:

Shipping charges will be prepaid by customer when parts are returned to Qume. Qume will return parts C.O.D.

LOCATION:

All repair work will be done at Qume's factory in Hayward, California, unless otherwise designated by Qume.

RETURN AUTHORIZATION:

Before returning materials to Qume, the customer must first request a Material Return Authorization number. The MRA number must be affixed to materials returned, as well as the shipping container.

2.6 TECHNICAL TRAINING POLICY

Training classes in the repair and maintenance of Qume printers are conducted on a regularly scheduled basis at Qume headquarters in Hayward, California.

Each scheduled class takes three days. The cost of this class is $210 per student, and covers all necessary course materials. Transportation, motel, and similar expenses are the responsibility of the student or his company.

To support its customers, Qume provides a number of free student/enrollments (one student for one three-day class) in these scheduled classes, according to the number of printers ordered:

Printers Ordered	Student/Enrollments
0 - 9	0
10 - 99	1
100 - 249	2
250 - 499	3
500 - 999	4
1000 - 1999	5

Note that these free student/classes apply only to regularly scheduled classes at Qume; they do not apply to special classes at Qume or at the customer's site.

In order to reserve an appropriate number of places in the class of their choice, customers should enroll at least three weeks in advance by contacting the Customer Training Department at Qume/Hayward. Schedules of classes are available from our local Qume salesman.

In some cases, it may be more convenient or lower in cost for the customer to schedule a special class at his location or at Qume. The following applies:

(1) Such classes will be scheduled according to the availability of a Qume instructor.

(2) Class size is limited to 12 students.

(3) Customer provides necessary training materials -- manuals, notebooks, etc., and a conference or classroom. Customer can buy our manuals or copy them for this purpose.

(4) Qume fee is $280/instructor day (class is usually 3 days) plus actual travel and living expenses (motel, car rental, meals, etc.), if any.

CHAPTER III
THEORY OF OPERATION

3.0 INTRODUCTION

This chapter describes both mechanical and electrical operating principles of the printer. The information contained in this chapter is intended to help the service technician understand the printer and thus facilitate maintenance and repair.

The description begins with the mechanisms involved in the various printer functions: paper feed, carriage motion, character selection, ribbon motion, and ribbon lift. Following this discussion is an introduction to the printer's overall operating principles and then a discussion of the electronic interface and microprocessor control section, the printwheel and carriage servosystems, and the paper and ribbon electronics. Also included is a discussion of miscellaneous functions such as the "check" circuit.

3.1 MECHANICAL OPERATION OF THE PRINTER

Mechanical operation of the printer can be compared to the operation of an office typewriter such as the Selectric® typewriter manufactured by IBM Corporation. In both the Qume printer and the Selectric® typewriter, there is a means of moving the carriage, selecting the character to be printed by rotating the type font, a way of striking the ribbon with the font, and a way of moving the paper, In the Qume printer, the means consists of rotating a "daisy" printwheel so that the correct die is alligned in the printing position, striking the die against a carbon or ink-impregnated ribbon, and creating an impression of the die on the paper. As a part of this cycle, the paper is also moved vertically as each line is printed.

® Selectric is a registered trademark of IBM Corporation.

A typewriter-style platen roller feeds paper and positions the paper vertically in front of the printing die. In the standard version of the printer, paper is held in place by pressure from spring-loaded pinch rollers mounted beneath the platen itself. The rubber surfaces of the platen and pinch rollers restrain the paper in a mechanism termed friction feed.

Pin feed and tractor feed are available optionally, as more positive methods of controlling paper movement. In the pin feed arrangement, sprocket wheels on either side of the platen engage pre-punched holes in the margins of the forms to be printed. In tractor feed printers a flexible driven belt engages the perforations in the margin of the form, replacing the platen as the driving mechanism.

Rotation of the platen moves the paper vertically, as shown in Figure 3-1. This is done manually during initial loading of paper into the printer paper feed mechanism, using the knobs provided on either side of the platen roller. Once the paper has been loaded, however, paper feed is automatic. A stepping motor and gear train mounted on the right side of the chassis engage the teeth of a drive gear attached to the platen's axial shaft. External commands, operating through the printer's electronics, control the stepping motor to move the paper in multiples of the basic 1/48th. inch increment. Each command may feed the paper up or down, a maximum of 21.3 inches in either direction.

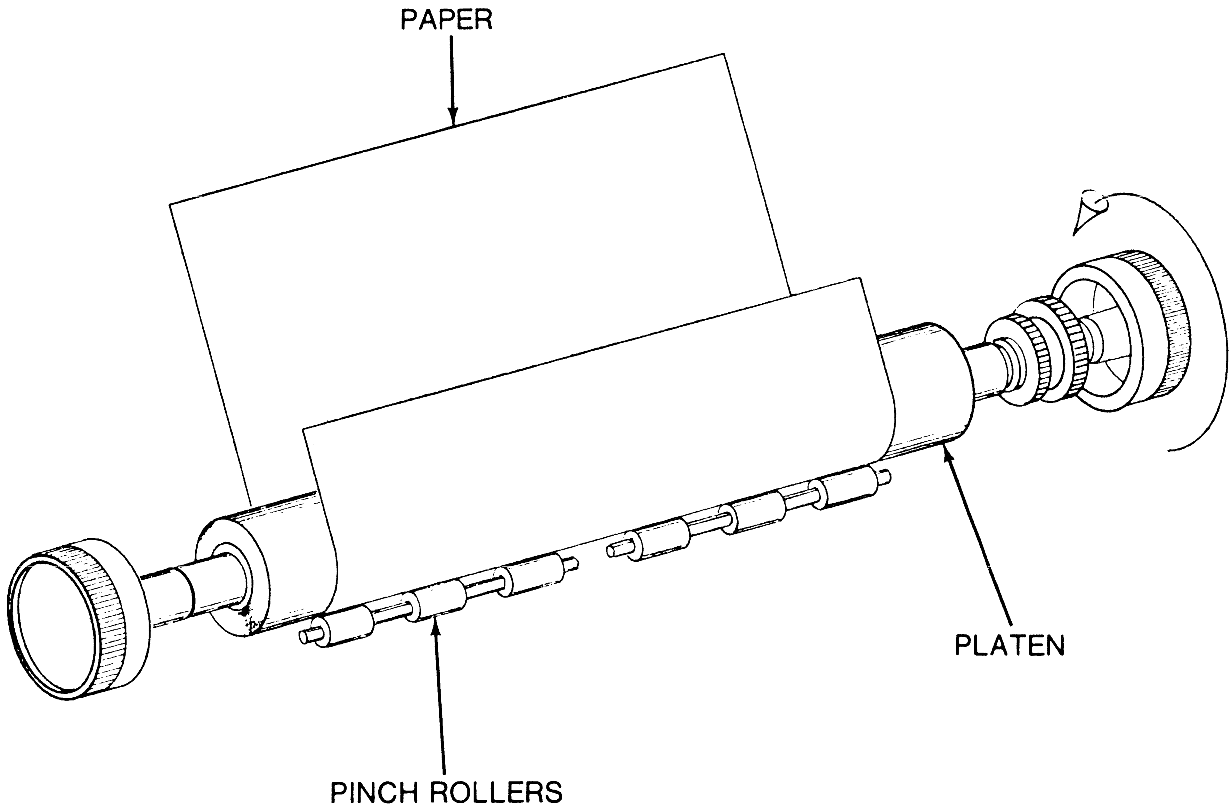


FIGURE 3-1

PAPER FEED DETAIL

An optional version of the printer provides independent left and right paper feed mechanisms. This version contains two half-width platens mounted on a common shaft, so that each may be rotated without affecting the other. The right-hand platen is driven by the standard paper feed mechanism, while the left-hand platen is driven by a similar mechanism installed on the left side of the printer chassis.

The dies used to print characters are molded into a light-weight plastic disk, called the printwheel. Ninety-six (optionally 94) spokes radiate from the center hub, and the tip of each spoke carries a relief image of one alphanumeric character. The printwheel rotates in a vertical plane that is parallel to the axis of the platen. The printwheel is positioned so that the character on the uppermost spoke is in the proper position to strike the ribbon, platen, and paper squarely (see Figure 3-2). Printing a character is accomplished by activating a solenoid-operated printhammer mounted directly behind the uppermost printwheel position. A current pulse applied to the solenoid causes the printhammer to strike the uppermost spoke, and the flexible nature of the plastic printwheel permits the die to contact the ribbon and transfer the image to the paper.

Character selection is determined by the angular position of the printwheel at the time the printhammer is activated. A servo-system, controlled by the printer electronics, positions the printwheel according to the character input command.

The printwheel motor, printwheel, and printhammer are mounted on a mechanical assembly known as the "carriage". Also mounted on this assembly is the ribbon cartridge, the ribbon drive motor, a ribbon lift solenoid, and an end of ribbon sensor.

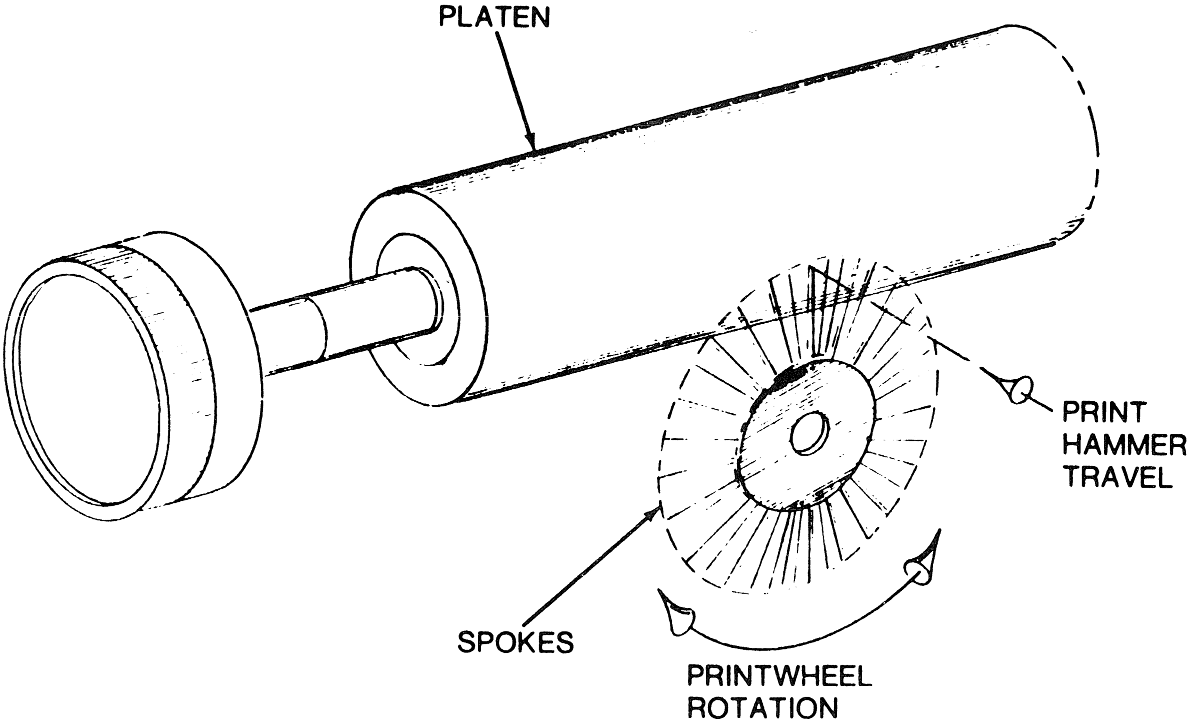


FIGURE 3-2
PRINTWHEEL DETAIL

The carriage assembly travels the width of the chassis on two rails which parallel the axis of the platen roller. A flexible cable attached to the carriage carries all drive and control signals between the carriage and the printers electronics. Rubber stops on both ends of the rail limit carriage travel, and an optical sensing unit next to the left deceleration stop indicates the left electrical limit during initialization.

The location of the carriage assembly on its guide rails determines the horizontal position of the printed character. A DC servomotor on the printer's chassis positions the carriage by means of a cable, pulley, and a tensioner arrangement, as shown in Figure 3-3. Control signals position the servomotor in response to external commands, permitting programmed bi-directional movement of the carriage up to 13.1 inches (26.2 inches in the Wide Track model). An optical encoder enables the controlling device to position the carriage in 1/120th. inch increments.

Ribbon feed and ribbon lift are controlled by individual sub-systems, although the stepper motor which controls the ribbon advance and the solenoid which lifts the ribbon into position are both located physically on the carriage assembly. The solenoid is used to lift the ribbon into printing position, between the uppermost spoke of the printwheel and the paper surface, under external program control. A drive dog on the shaft of the stepper motor engages internal splines on the hub of the drop-in ribbon cartridge, so that rotation of the stepper motor advances the ribbon incrementally, just prior to the firing of the printhammer.

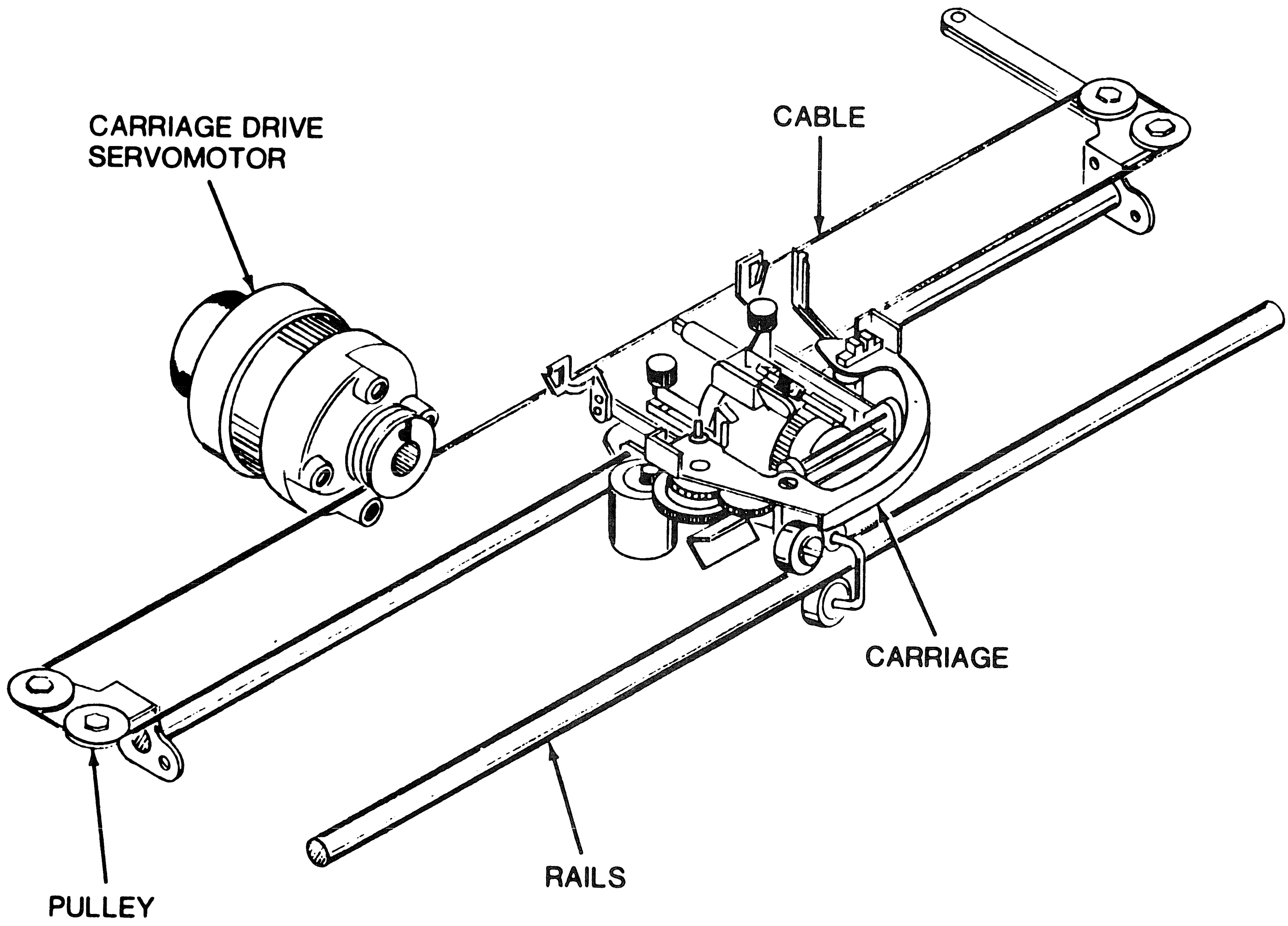


FIGURE 3-3

CARRIAGE POSITIONING

3.2 ELECTRICAL OPERATION OF THE PRINTER

An overall block diagram of the printer is shown in Figure 3-4. The printer's electronic and electromechanical circuits can be broken down into subsystems for purposes of discussion. This section will describe the electromechanical portion of the printer, giving the reader a better foundation for the discussion of control electronics that follows.

3.2.1 SPLIT-PHASE STEPPER MOTORS

Split-phase stepper motors are used in the paper feed and ribbon drive mechanisms. These motors are conventional in design and may be similar to motors that the reader has encountered already in servicing of other equipment.

The motor consists essentially of two field windings and an armature. The windings are oriented so that the magnetic field produced by each winding intersects the other's field at an angle of approximately 90 degrees. The field in the interpole cavity is thus the resultant of two fields as shown in Figure 3-5.

The armature in this kind of motor is magnetized by a current derived from the field voltages. This current is passed through a full-wave rectifier, before being applied to the field coils. As a result, the field produced in the armature is constant in its relationship to the armature's physical core. Given this observation, it will be convenient to visualize the armature simply as a strong permanent magnet.

The natural tendency of the magnetized armature is to align itself with the resultant magnetic field produced by the two field coils. Directional rotation will occur, if the current applied to the individual field coils vary in phase relationship. This rotation is shown in Figure 3-5.

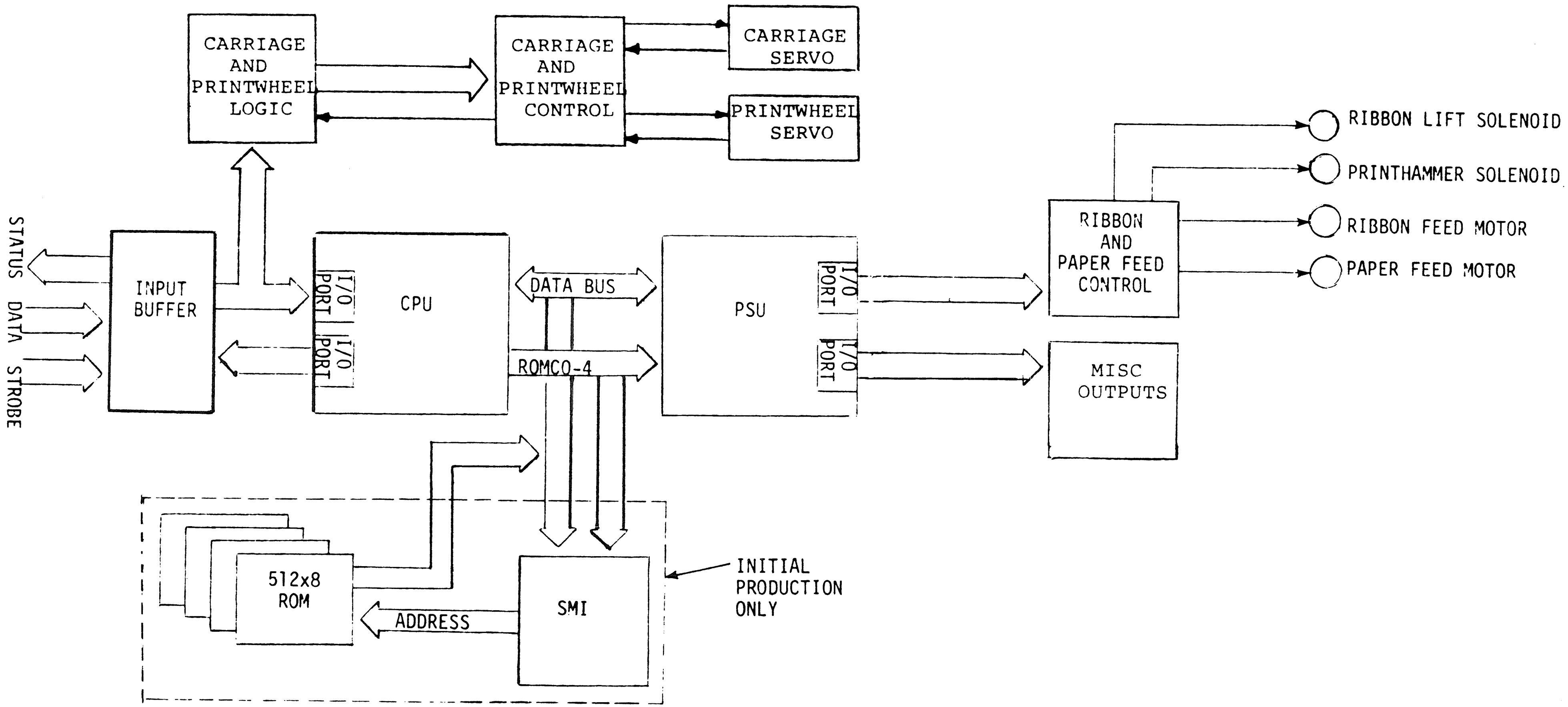


FIGURE 3-4

PRINTER OVERALL BLOCK DIAGRAM

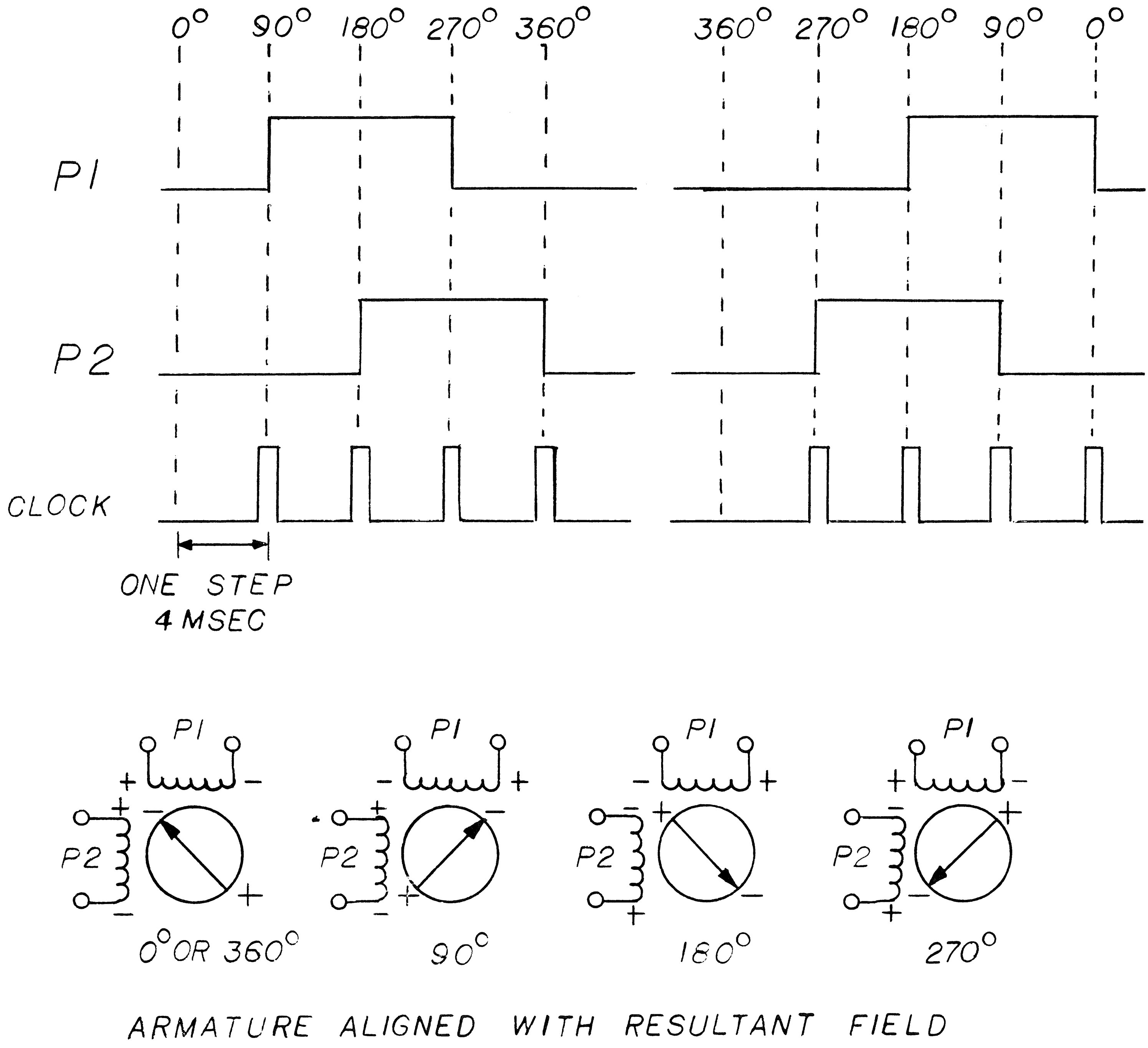


FIGURE 3-5

STEPPER MOTOR POSITIONING

The driving signals vary in quadrature, and may be thought of as being 90 degrees out of phase electrically. Under these circumstances, the motor bears resemblance to the splitphase AC induction motor. Note, however, that armature slippage in a stepper motor is abnormal, and that this kind of motor therefore never develops the large armature current and the high torque that is characteristic of induction motors.

Nevertheless, the motor's performance is quite satisfactory under light load conditions. Its chief advantage is that it lends itself to the precise positioning of light mechanisms, in fixed increments that bear a relationship to the 90 degree increment of rotation. This kind of motor is ideally suited to mechanisms such as ribbon and paper feed. In the former case, the load is extremely light. In the latter, the motions are relatively infrequent, so that the motor's slow response is not a serious disadvantage.

3.2.2 OPTICALLY POSITIONED DC SERVOMOTORS

When it comes to the printwheel and carriage positioning mechanisms, however, the weaknesses inherent in stepper motors cannot be overlooked. Both the carriage and the printwheel are in motion almost continuously during normal printing. Frequent acceleration and deceleration makes severe demands on the motor, and the rapid positioning of these relatively massive assemblies calls for a motor with a high torque.

The foregoing considerations dictate the choice of a DC motor. At the same time, however, we can sacrifice nothing in the precision of motor positioning. Actually the two mechanisms we are presently considering are even more sensitive to positioning errors than are the ribbon and paper feed mechanisms. Given the DC motor assumption, this further dictates a servomechanism of some kind, in which a position-dependent feed-back is used to control the rotation of the motor. Unfortunately, the methods available for doing this, up until now, have been both limited and cumbersome.

It was in this context that the optical positioning mechanism used in the Sprint 3 Series printers was developed. This technique relies on optoelectronic devices to generate both the rate and the position information on which the servo feed-back loops are based. The method is described briefly in the following paragraphs.

The basic DC servomotor consists of a reversible DC motor. Attached to the motor's frame is the photohead assembly which contains three photo-voltaic cells and a light emitting diode. In this simple configuration, all three cells are illuminated continuously by the light from the LED, producing output voltages which are proportional both to the light intensity and to the illuminated area of the cell.

The LED's sensitivity to temperature makes it an inherently unstable light source. And since the reliable function of the servo will depend on the stability of the output from the photohead, external means are used to ensure a stable output. Once cell (CLEAR) monitors the output from the LED. The output of this cell drives an inverting amplifier, which in turn supplies the drive current for the diode. Negative feed-back damps fluctation in the output of the LED, producing a stable reference illumination and hence a relatively stable peak voltage output from all three cells.

Attached to one end of the motor's armature shaft is an external rotating disc. Changes in the shaft's angular position are thus coupled directly to the disc. The edge of the disc extends into a slot in the side of the photohead, as shown in Figure 3-6, masking the diode, and casting a shadow on two of the three photovoltaic cells (the CLEAR cell is not affected).

This would naturally preclude any output whatsoever from the A and B photocells were it not for the fact that the opaque circumference of the disc is constructed with openings of uniform size. Rotation of the disc thus casts a varying shadow on the A and B photocells, whose output is directly proporational to the area illuminated, other factors being equal.

Dimensions of the assembly are controlled carefully, so that the electrical fluctuations produced in the output of the photocells closely approximate a sine wave. The A and B cells are placed geometrically so that the outputs produced are 90 degrees out of phase with respect to one another. These signals furnish the basis for controlling both the angular position and the speed of the servomotors. Before they can be used, however, an intermediate set of signals must be generated. This process is described below.

Raw A and B outputs from the encoder are first amplified, and translated to levels roughly symmetrical about ground, with a nominal peak-to-peak amplitude of 12 volts. Preconditioning assures the reliable operation of the subsequent circuitry.

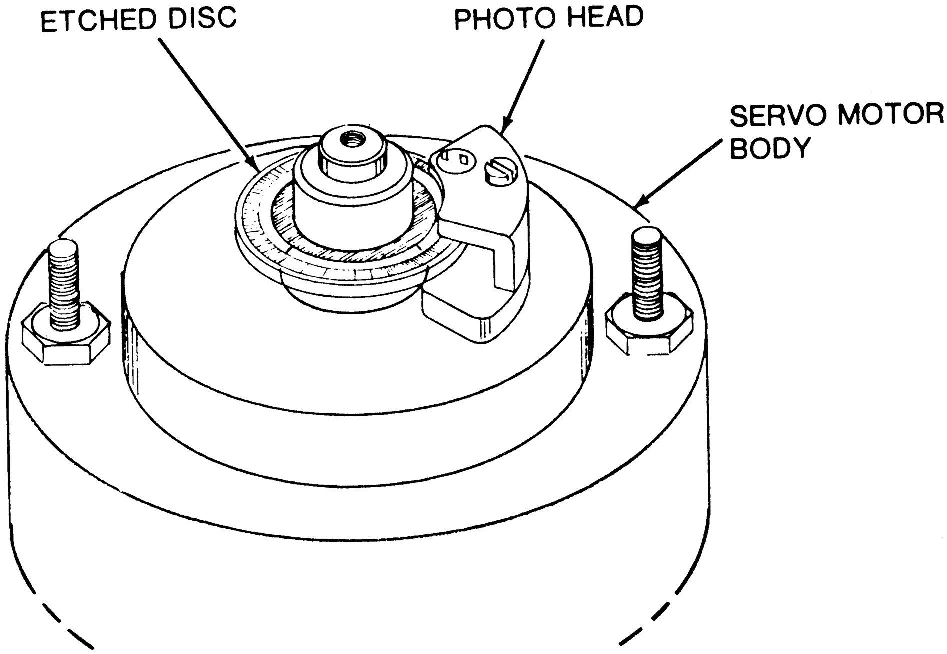


FIGURE 3-6(a)

OPTICAL ENCODER PHOTO HEAD DETAIL

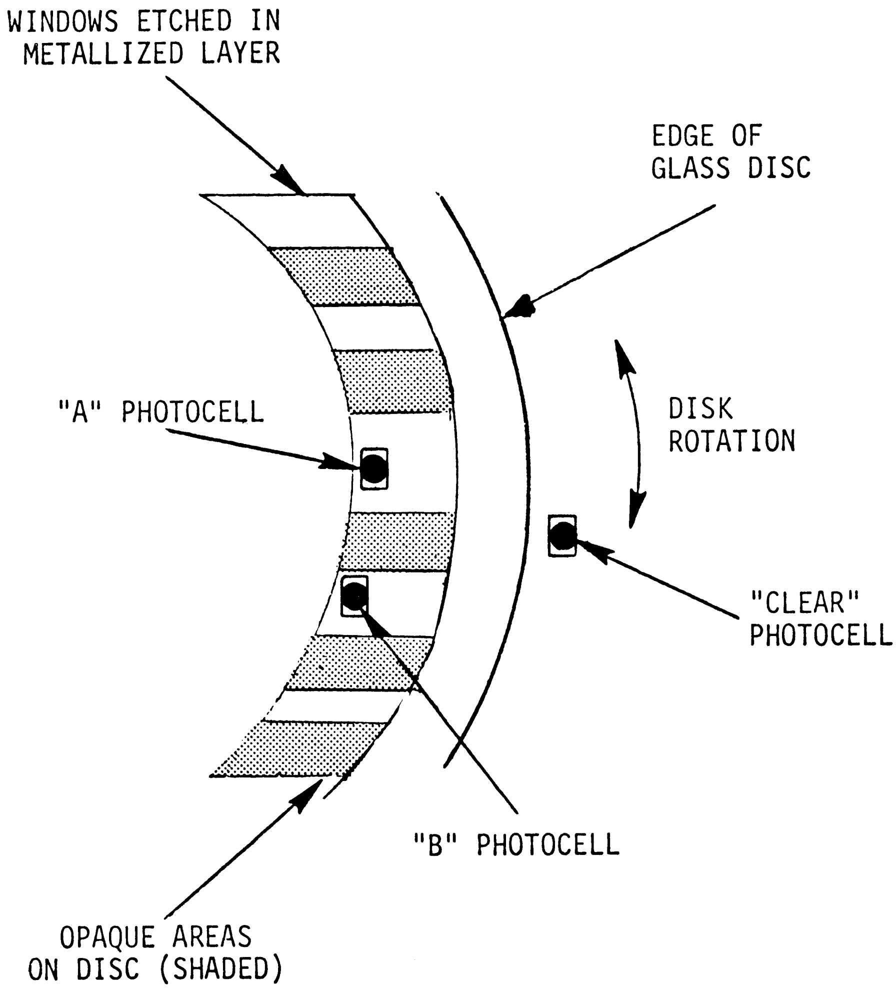


FIGURE 3-6(b)

OPTICAL ENCODER PHOTO HEAD DETAIL

As indicated, the A and B signals are applied to the inputs of three Schmitt squaring circuits. These are adjusted to trigger at specific points on the input waveforms, hence the importance of accurate signal preconditioning. The idealized outputs obtained are shown in Figure 3-7. They are labeled X, Y, and Z.

By splitting the X, Y, and Z signals and combining selected functions in suitable gates, we obtain the entire range of outputs depicted in Figure 3-7. These include the Carriage Clock signals, and the $\Phi 1$ - $\Phi 4$ sampling signals. Together, these derived outputs permit control of the motor's speed and position.

To visualize the positioning mechanism, consider the waveforms shown in Figure 3-7. Stable positions of the armature are established at zero crossings of the encoder's A output. In the position mode, negative feedback derived directly from the A waveform causes the motor to settle in the nearest available "trough"; that is, the nearest negative-going null. Because these stable positions suggest a mechanical analogy, they are referred to as "detents". There are 192 such detents in each revolution of the printwheel, and 400 per turn of the carriage drive motor. Motors left to their own devices in the position mode will always react by seeking the closest detent.

Re-positioning of the motor requires a temporary interruption in the continuity of the positioning loop. During the time that feedback is suspended, the motor may be re-positioned accurately, by counting the intervening number of encoder impulses. When the count establishes that the motor is in the vicinity of the desired new position, the feedback loop is restored, and the motor promptly settles in the proximate detent.

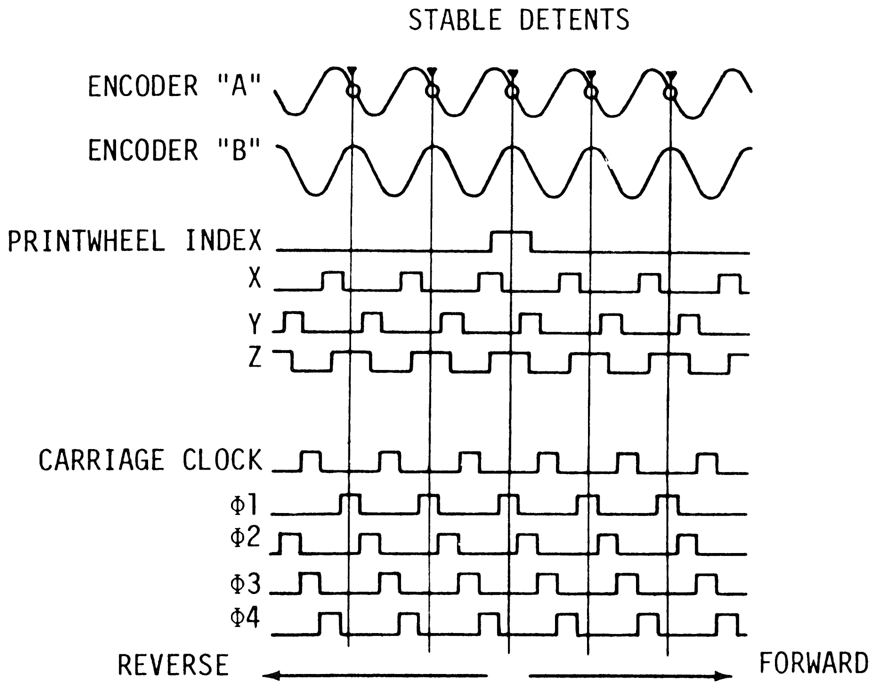


FIGURE 3-7

GATING LOGIC: IDEALIZED OUTPUTS

When it is necessary to re-position the motor, the first action taken is to suspend the position mode. We then begin by moving the servo toward its new position, counting Carriage Clock pulses as we go. Once the count indicates that the desired position has been reached, we simply re-establish the position mode. Completion of this sequence will find the motor settled in the desired angular detent.

While the positioning loop is suspended, the servomotor operated as a rate servo. In the rate mode, the servomotor's speed and direction of rotation are controlled by an external reference which is related to the gross magnitude of the position error. Negative feedback proportional to the motor's speed is combined in a summing network with the reference level input. When the two exactly cancel, the net rate error applied to the servo is zero, and the stable speed of the motor is established accordingly.

The frequency of the encoder's output is a direct indication of motor velocity. Unfortunately, simple counting would not produce a velocity indication fast enough to permit precise control of the servomotor. Other means must be used, to monitor the motor's rotational velocity.

You will observe that the change in the encoder waveform is roughly linear in the immediate vicinity of the null points. This is true over the interval which extends from about 45 degrees preceding the detent, to about 45 degrees past. Moreover, the slope of this waveform is directly proportional to the motor's angular velocity. By differentiating this portion of the encoder's output, we can obtain a voltage level which directly indicates the speed of the servomotor.

The chief problem with the differentiation technique is that the output obtained is not continuous; that is, there is an interval of 270 degrees during which we have no indication whatever of the motor's rate. This naturally defeats the kind of precise velocity control required of these servos.

To circumvent this basic difficulty, we rely on the Φ1 through Φ 4 signals derived in the gating logic. The input to the differentiator at any given time is a logical composite, formed from the coincidence of one of the Φ1 through Φ4 gating signals and one of the four encoder outputs (A, B, $\bar{A}$ or $\bar{B}$). During the interval from 315 degrees to 45 degrees, the A output is sampled, and from 45 degrees to 135 degrees the differentiator samples the B encoder output. From 135 to 225 degrees and from 225 degrees to 315 degrees, the $\bar{A}$ and $\bar{B}$ outputs, respectively, are sampled. In this way, the differentiator is able to produce an output which is continuous over the entire 360 degree interval between adjacent detents, thus enabling constant control of the motor's velocity. Velocity control systems of this kind are used in both the printwheel and carriage servos.

Note that the photohead associated with the printwheel motor contains a fourth photovoltaic cell. This cell matches a single opening in the encoder's rotating shadow mask, so that an INDEX output is produced at one particular position of the motor shaft. The ENCODER INDEX is conditioned separately, in yet another Schmitt squaring circuit, and used to indicate the motor's absolute position to the printwheel control logic. Since carriage motion is always a relative displacement, it is not necessary to know the motor's absolute angular position. For this reason the index feature is omitted from the carriage encoder.

3.2.3 PRINTWHEEL SERVO

The printwheel sub-system performs the functions immediately associated with the printing of each character. These functions include the positioning of the printwheel, and the firing of the printhammer. The printwheel logic also controls ribbon feed indirectly, by exercising control over the ribbon feed logic.

The printwheel servomotor and the printhammer solenoid are situated on the movable carriage assembly. A flexible cable carries all drive and control signals between the carriage and the printer's electronics.

Inputs to the printwheel servo include delta counter lines, position mode and direction lines. An optional END OF RIBBON input from an optical sensor on the carriage is activated whenever the ribbon cartridge is exhausted.

3.2.4 FUNCTIONAL DESCRIPTION OF THE PRINTWHEEL SERVO

Figure 3-8 shows a functional block diagram of the printwheel servo subsystem.

Between the time that a print cycle is complete and the next character strobe is received, the printwheel is static, resting in the "position" mode. In this mode, the input to the error amplifier is clamped to a level near the center of encoder signal A, forcing the printwheel servomotor to remain at rest.

The printwheel's position determines the character to be printed. Because of this, the printwheel logic must have some way of keeping track of the current printwheel address.

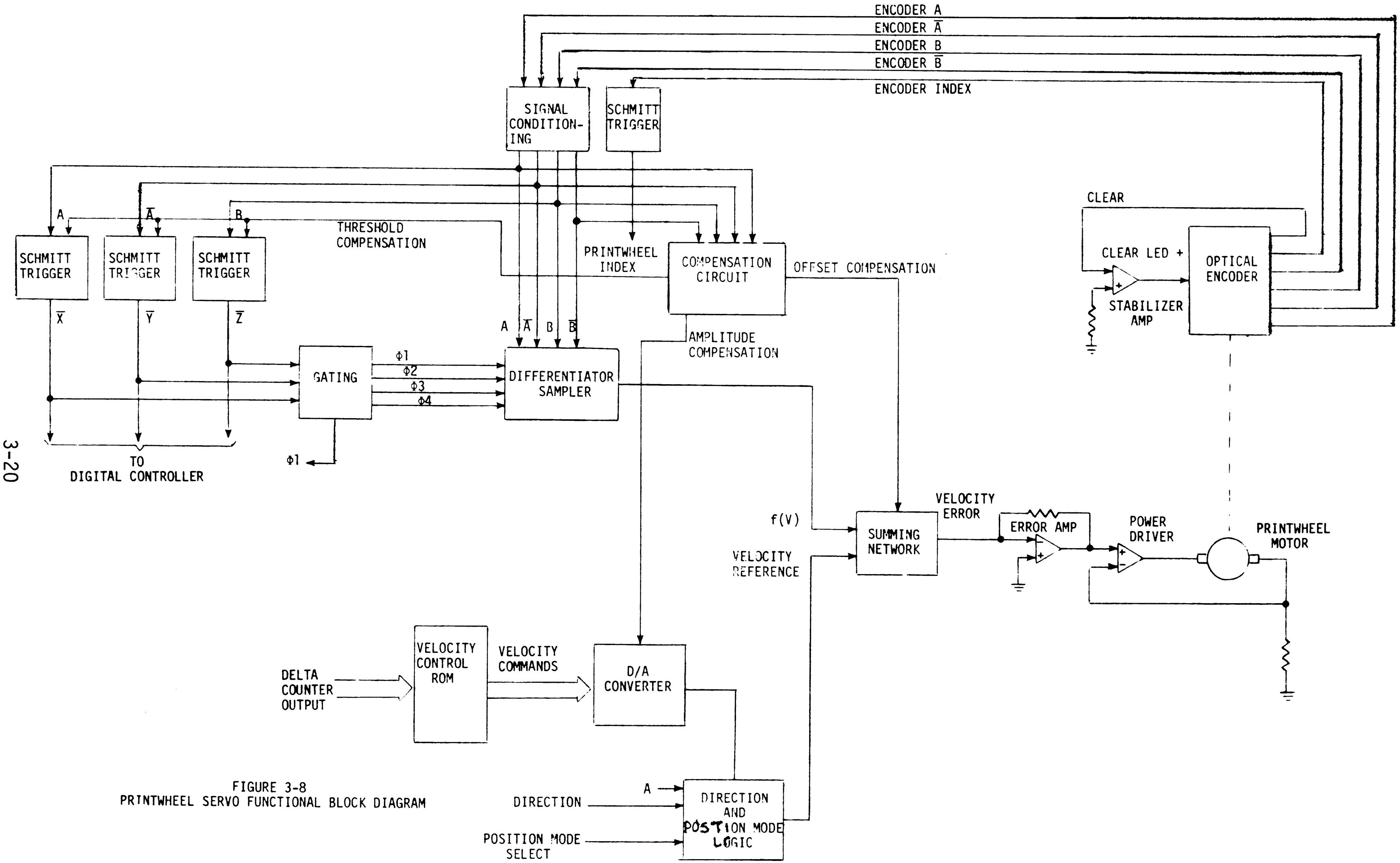


FIGURE 3-8
PRINTWHEEL SERVO FUNCTIONAL BLOCK DIAGRAM

This function is performed by the printwheel counter logic and the microcomputer sub-system. Each time there is a coincidence between the 1 and INDEX signals, the counter is reset to zero. Thereafter, each 1 signal increments or decrements the counter. By this means the counter is able to track the printwheel position at all times.

When a character has been strobed into the input logic, the printwheel cycle begins. The microcomputer sub-system performs a "table look-up" to determine the absolute address of the character to be printed. An arithmetic operation is then performed to determine the direction of rotation to reach the required address in the shortest time, and a delta count is also determined, based on the amount of rotation required.

The printwheel cycle begins when the position mode select line causes the printwheel position mode circuit to release the error amplifier input. At the same time, a velocity command is input to the D/A converter, which outputs a DC level proportional to the input command weighting. The servomotor now begins to accelerate (see Figure 3-9) until the output of the differentiator reaches the required level to stabilize the motor at the speed commanded by the D/A converter. During this time, the printwheel counter logic is counting down and reducing the delta count. This decrements the velocity commands in steps determined by the velocity deceleration profile stored in the velocity control ROM.

When the printwheel counter and logic have reached the correct address, the printwheel servosystem switches to the "position" mode. In this mode, the position switch inputs signal A to the error amplifier and brings the printwheel motor to a stop at the "detent" where the correct character spoke is at the uppermost position.

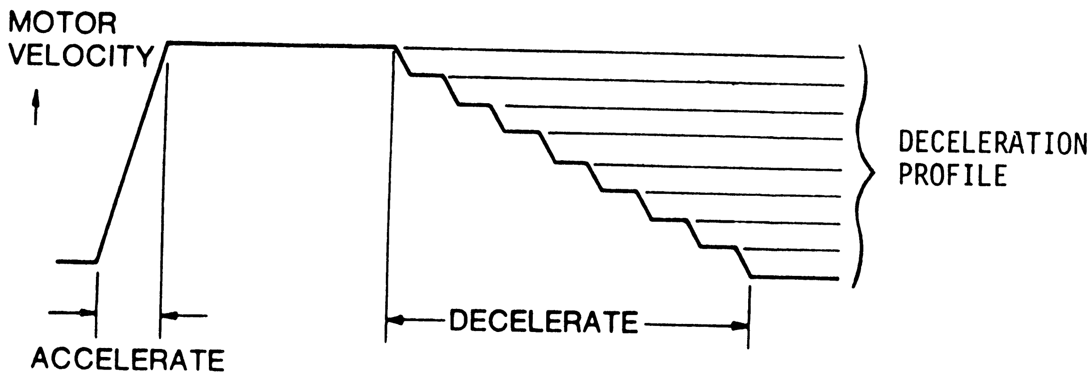


FIGURE 3-9

PRINTWHEEL ACCELERATION/DECELERATION PROFILE

Because there may be changes in photocell output due to temperature drift and changes in ambient light, a compensation circuit monitors the photocell output and applies a correction to the D/A output, the error amplifier offset, and the squaring circuit thresholds when a change is detected. The compensation circuit consists of two peak followers which track the absolute peak-to-peak output of the photocells. This circuit is followed by a sample-and-hold circuit which holds a DC level proportional to the photocell peak-to-peak output when the position mode is entered. This allows the acceleration profile to remain constant for each printwheel rotation cycle. It should be noted that the compensation circuit eliminates any adjustments by the maintenance technician and allows total interchangeability of boards between units.

3.2.5 FUNCTIONAL DESCRIPTION OF THE CARRIAGE SERVO

The carriage servo is shown in the functional block diagram of Figure 3-10. It can be seen that the diagram is very similar to the diagram of the printwheel servo. Electrically, the servomotor is a heavy-duty type, due to the larger mass of the carriage mechanism, and the driver circuits therefore must handle higher currents.

Operation of the servo is nearly identical to that of the printwheel servo. Initially, the servomotor is stopped by the action of the position circuit. When a carriage movement command is received by the servo sub-system, the D/A converter outputs a voltage level proportional to the input velocity command. At the same time, the position mode is released and the motor begins to accelerate. When the output of the differentiator matches the output of the D/A converter, the motor stabilizes at the desired speed. As the carriage counter circuits count down toward zero, the deceleration sequence begins. The velocity commands are decremented in accordance with a predetermined, stored profile. It should be noted that because of the difference in mass and velocity of the carriage mechanism, the deceleration profile used in the carriage servosystem is different from the one used in the printwheel servosystem.

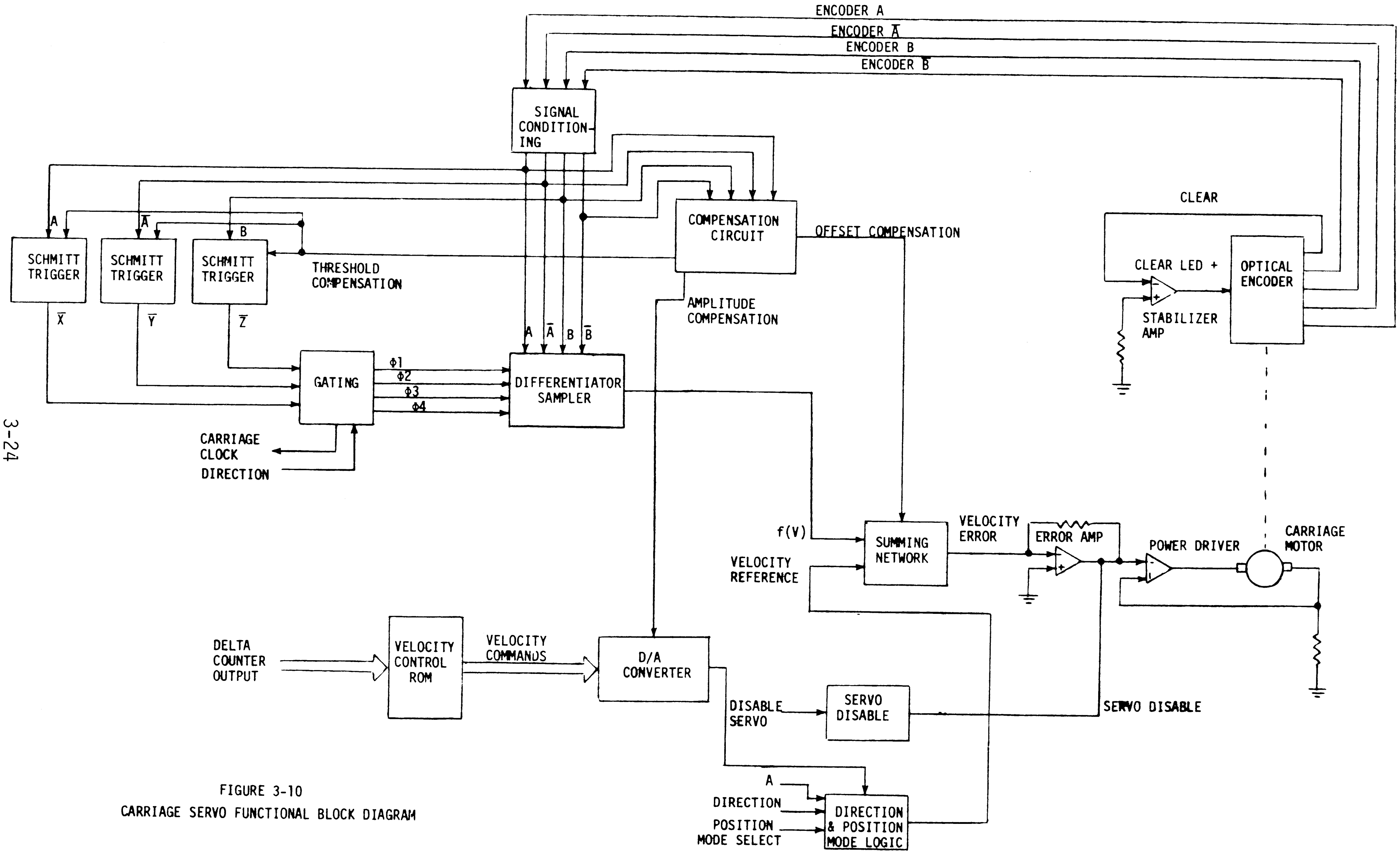


FIGURE 3-10
CARRIAGE SERVO FUNCTIONAL BLOCK DIAGRAM

As with the printwheel servo, when the carriage servo delta counter has counted down to zero, meaning that the programmed carriage movement increment has been reached, the servosystem is placed in the position mode and the motor (and carriage mechanism) comes to a stop at the selected position.

If, for some reason, a CHECK condition occurs (either through failure of the power supplies or failure of the carriage to move when commanded), the carriage servo is disabled by the servo disable circuit, which clamps the input of the servomotor power drivers to ground.

Temperature and ambient light drift compensation is employed in the same manner as the printwheel servo: peak followers and sample-and-hold circuits monitor the photocell output and apply a correction signal to the summing amplifier, Schmitt trigger circuits, and the D/A converter. In addition, LED current is also compensated for changes in photocell output in a manner similar to that used in the printwheel servo.

The carriage servo generates two signals used in timing and control. The first signal is the CARRIAGE CLOCK signal which is generated by gating the X and Y outputs from the Schmitt trigger circuit. The CARRIAGE CLOCK is the signal for the carriage counter, and is timed so that it occurs on the negative-going portion of the photocell output. It should be noted that an error in position would occur if CARRIAGE CLOCK was always in the same phase with respect to the photocell output, because the direction of carriage travel determines the phase of the two photocell outputs. Depending on the direction of travel, gating logic changes the phase of the CARRIAGE CLOCK signal so that it occurs just before the required "detent" position of the carriage.

A second signal of interest is the CARRIAGE LIMIT signal generated by a photosensor located at the extreme left position of carriage travel (this is not shown in Figure 3-10). The photosensor output triggers a Schmitt squaring circuit which generates a pulse whenever the carriage is at the left limit to signal the control logic that the limit has been reached. This is used in initialization routines and as an error flag.

3.2.6 PAPER FEED OPERATING PRINCIPLES

As shown in the block diagram of Figure 3-11, the paper feed drive consists of two driver circuits which are connected to the field coils of the paper feed stepping motor. Depending on the desired direction of paper movement, the phase of the two paper feed clock signals P1 and P2 differs. To move the paper upward, P1 leads P2 and the motor steps in one direction; to move the paper downward, P2 leads P1 and the motor steps in the other direction. It should be noted that no movement is possible unless the paper feed hold signal has dropped to a low level. It is held at a high level to hold the stepper motor in a fixed position between paper movements. When the paper feed hold is low, the motor is released to step in either direction as determined by the input clock signals.

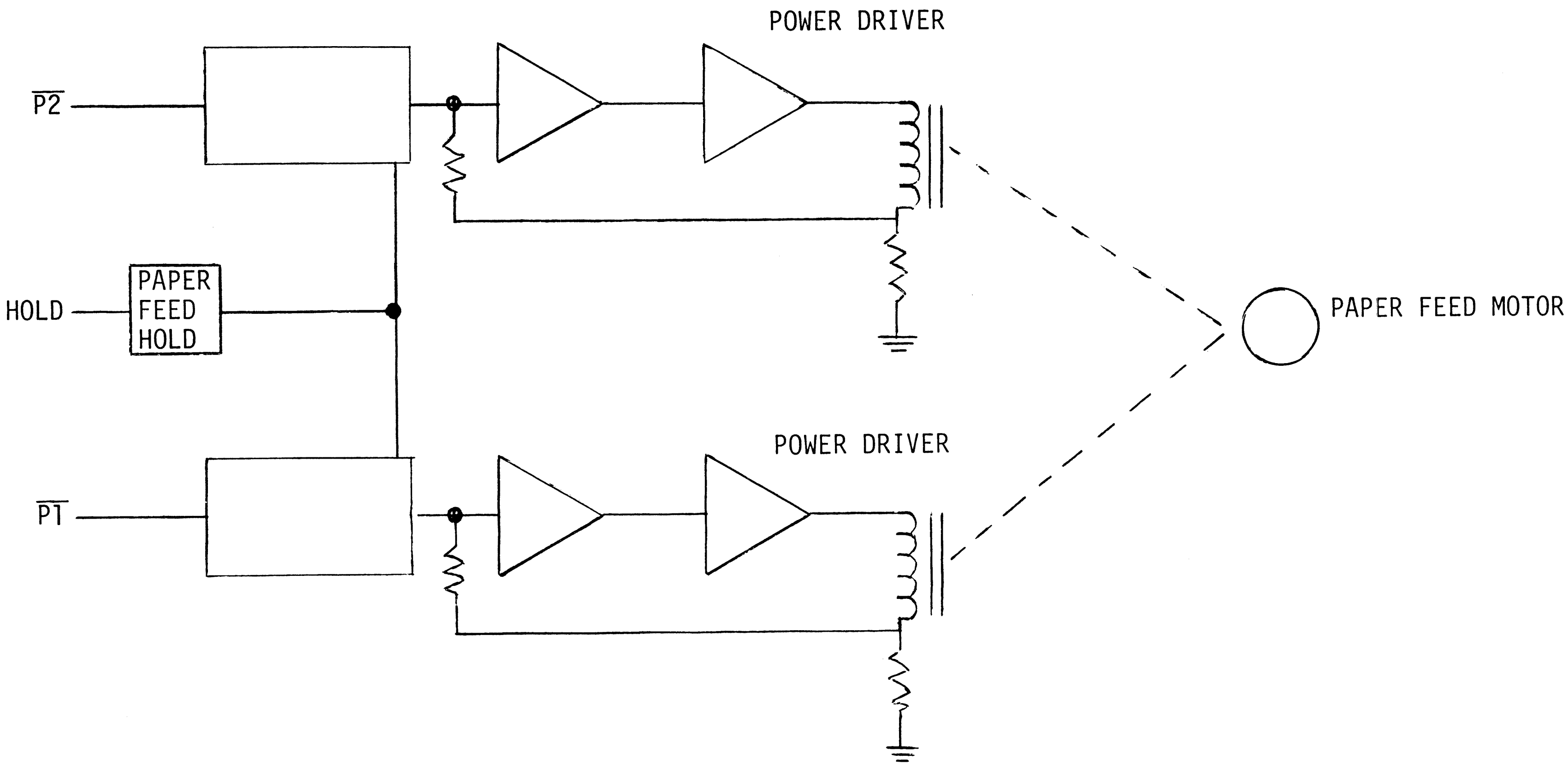


FIGURE 3-11
SIMPLIFIED BLOCK DIAGRAM, PAPER FEED DRIVE

3.2.7 RIBBON FEED OPERATING PRINCIPLES

Ribbon feed is very similar to paper feed, except that the ribbon feed motor moves only in one direction. The stepping motor is driven by ribbon feed signals R1 and R2, which alternately switch current through the motor field coils to step the motor and move the ribbon.

3.2.8 HAMMER DRIVE OPERATING PRINCIPLES

A simplified diagram of the hammer drive circuit is shown in Figure 3-12. When the HAMMER signal goes low, current will flow through the hammer solenoid and move the hammer forward to strike the ribbon. Hammer striking intensity is a function of the HAMMER pulse width, varying from approximately 1.6 ms to approximately 2.5 ms. Intensity is a function of the character to be printed, with a capital "W" having the widest pulse and a period (.) the narrowest. To protect the hammer from overheating due to logic failure, a 35 ms one-shot is triggered by the leading edge of the HAMMER pulse. If the HAMMER pulse has not terminated before the one-shot times out, the trailing edge of the one-shot output will disable the AND gate driving the hammer solenoid driver and cut off current to the hammer solenoid.

3.2.9 RIBBON LIFT OPERATING PRINCIPLES

A simplified diagram of the ribbon lift circuit is shown in Figure 3-13. When the ribbon is in the lowered position, no current flows through the ribbon lift solenoid. Initiated by a ribbon lift command and a part of the print cycle, two signals are generated: RIBBON RAISE and RIBBON LIFT HOLD. Two current levels are required: a high current to raise the ribbon and a lower current to hold the ribbon in the raised position. The higher current is generated by the action of RIBBON RAISE, which is activated at the beginning of the lift cycle. The holding current is generated by RIBBON LIFT HOLD, which remains activated to hold the ribbon in the raised position during the print cycle. Note also that the protection pulse signal prevents any ribbon lift coil from overheating due to logic failure.

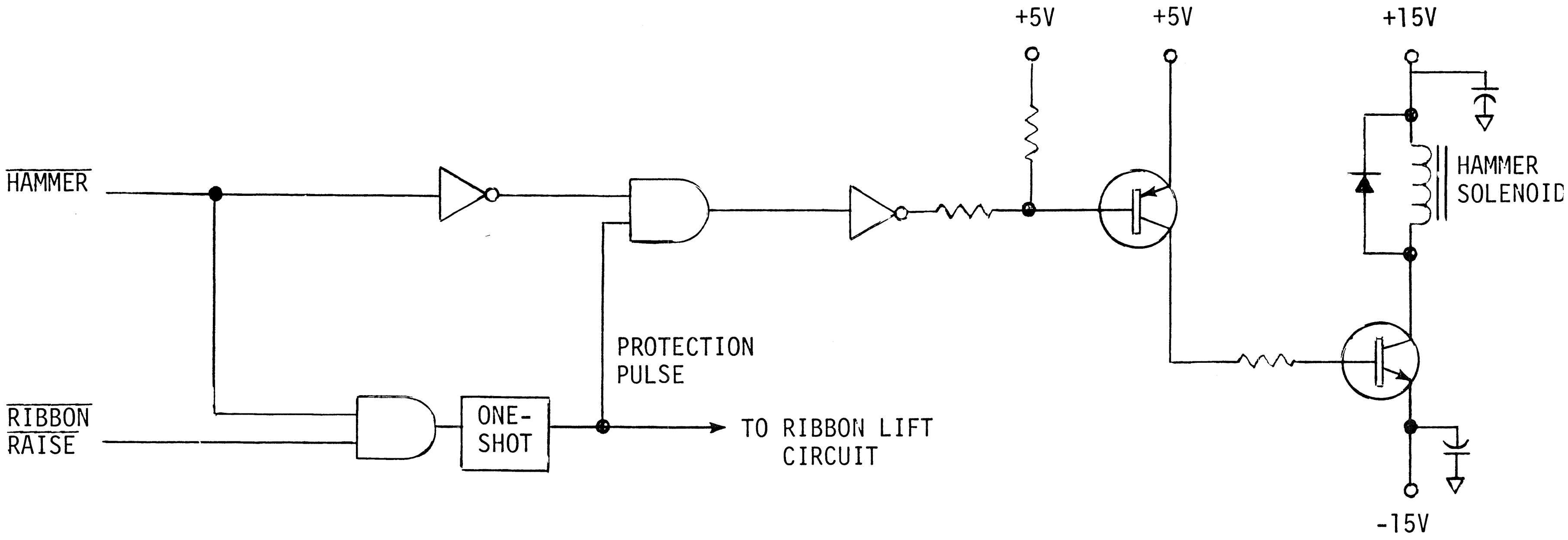


FIGURE 3-12
SIMPLIFIED SCHEMATIC, HAMMER DRIVE CIRCUIT

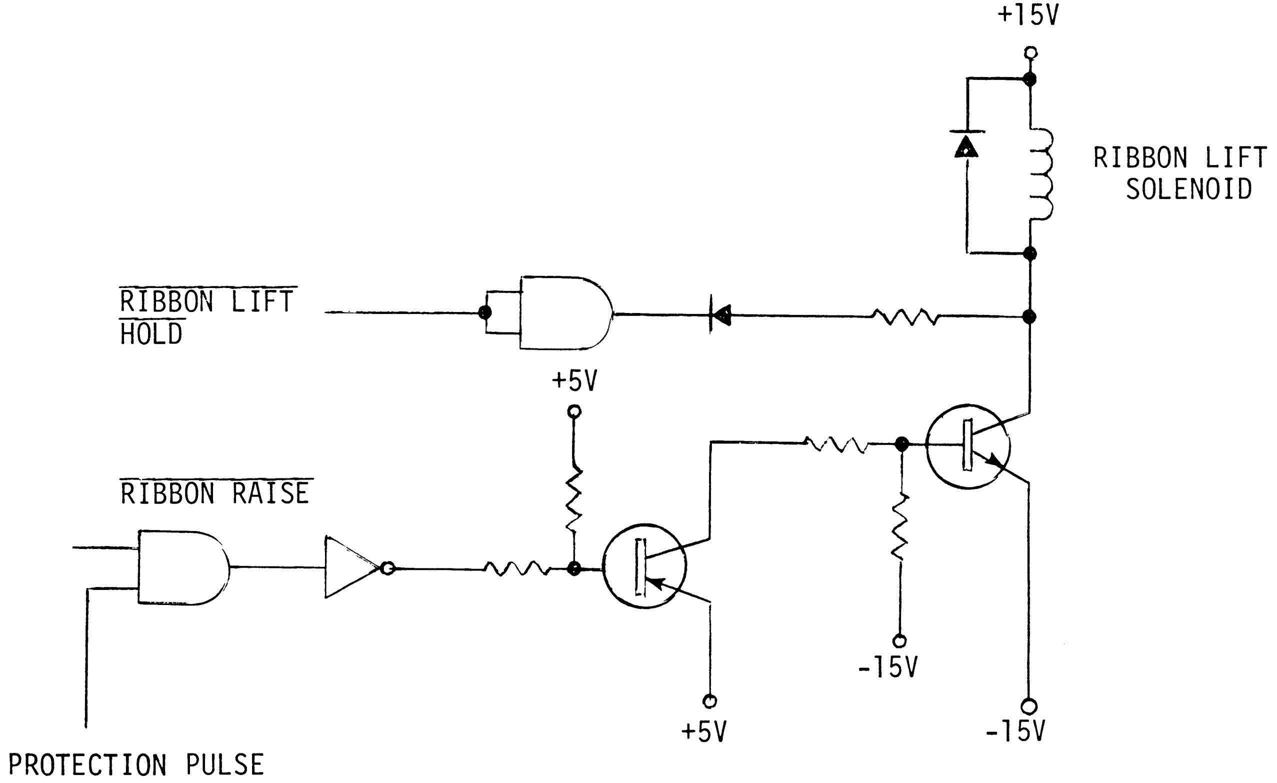


FIGURE 3-13
RIBBON LIFT SIMPLIFIED DIAGRAM

3.2.10 CHECK CIRCUIT OPERATING PRINCIPLES

The check circuit shown in Figure 3-14 monitors power supply voltages and carriage movement to ensure that improper operation of the printer due to power supply failure or carriage failure will not go unnoticed by the operator or the system.

Each of the three supplies (+15V, -15V and +5V) is monitored by comparator circuits referenced to precision Zener diodes. If the 15V supplies vary more than 2 volts for more than approximately 1.5 ms, the comparators will trigger and set the CHECK flip-flop. This output disables the carriage servo and sends a CHECK output to the system connected to the printer. In the same manner, the +5 supply is monitored by a comparator circuit with a much shorter time constant. If the +5V supply varies more than 0.5 volt for a period exceeding approximately 1 microsecond, the comparator triggers and initiates a CHECK condition.

To prevent operation with the carriage jammed or disabled in any manner, the check circuit monitors the carriage clock output after a carriage movement command has been issued. The first carriage clock pulse triggers are re-triggerable one-shot circuit. If further clock pulses are received within the time-out constant of the one-shot (8ms) the one-shot is re-triggered and stays in the triggered state. If no carriage clock pulses occur within the 15ms period, the one-shot times out and initiates a check condition.

When a check condition has been initiated by either a power supply failure or a carriage motion failure, the check flip-flop will be set and no further printer action can be accomplished until the check flip-flop is reset by the RESTORE command. If one or more of the power supplies is inoperative and a restore sequence is attempted, the check flip-flop will remain set and will not allow operation until the problem is cleared.

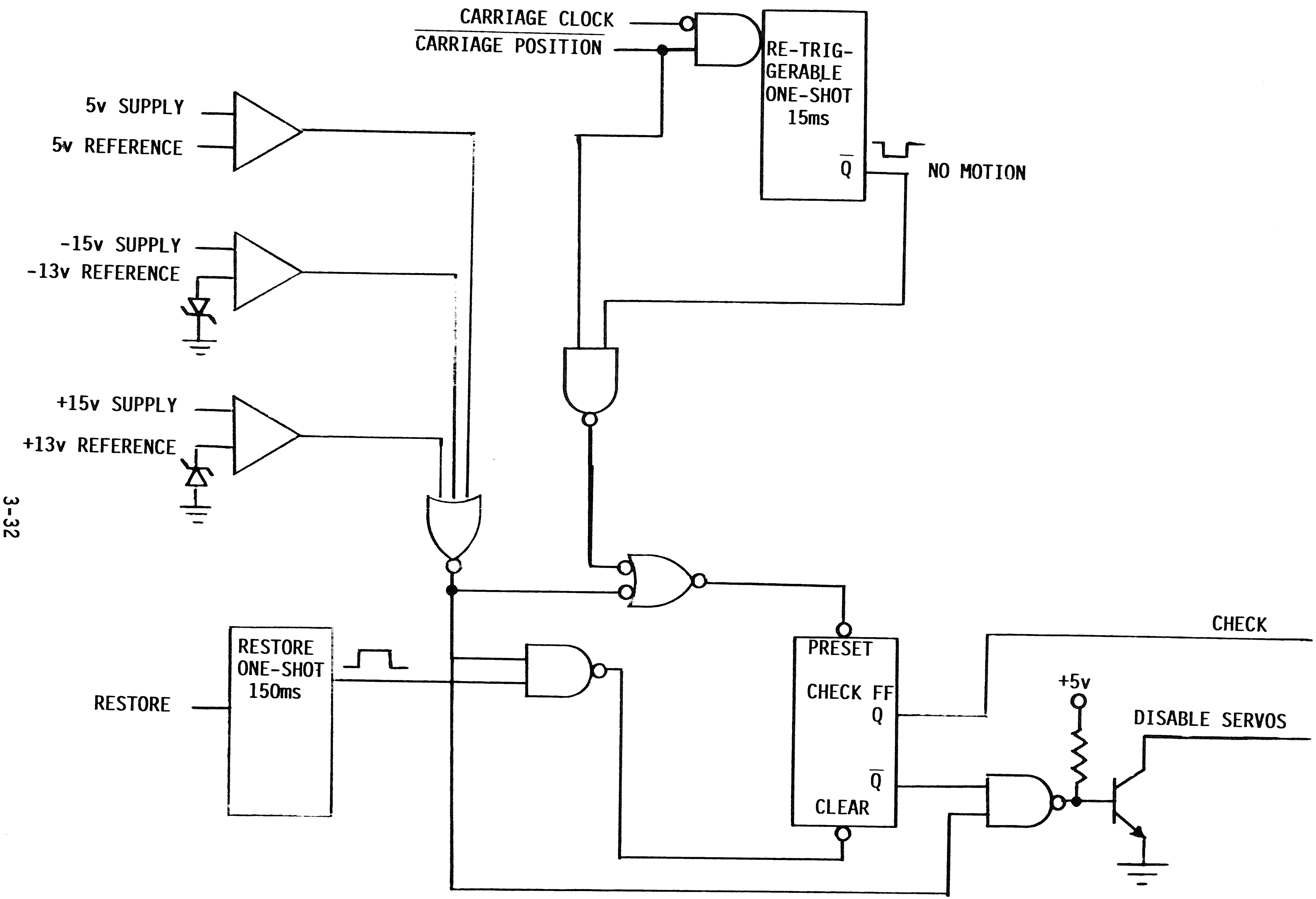


FIGURE 3-14
CHECK CIRCUIT SIMPLIFIED DIAGRAM

3.3 DIGITAL CONTROLLER

The digital control section of the printer transforms the data input to the interface to command for the analog section. The following paragraphs provide an introduction to the concept of a microprocessor and its related support devices. Refer to Figures 3-15, 3-16 and Schematic Diagram Section 9 throughout this discussion.

3.3.1 MICROPROCESSOR

The basic controller for the digital section is the 3850 CPU. This is a single 40-pin device containing the necessary computing functions necessary to perform arithmetic and logic operations on the input data and output control signals for the analog section. The 3850 also generates signals to control supporting devices used in this application (3851 Program Storage Unit, and in initial production units, a 3853 Static Memory Interface). The 3850 has two integral I/O ports and a 64 X 8 - bit "scratchpad" RAM.

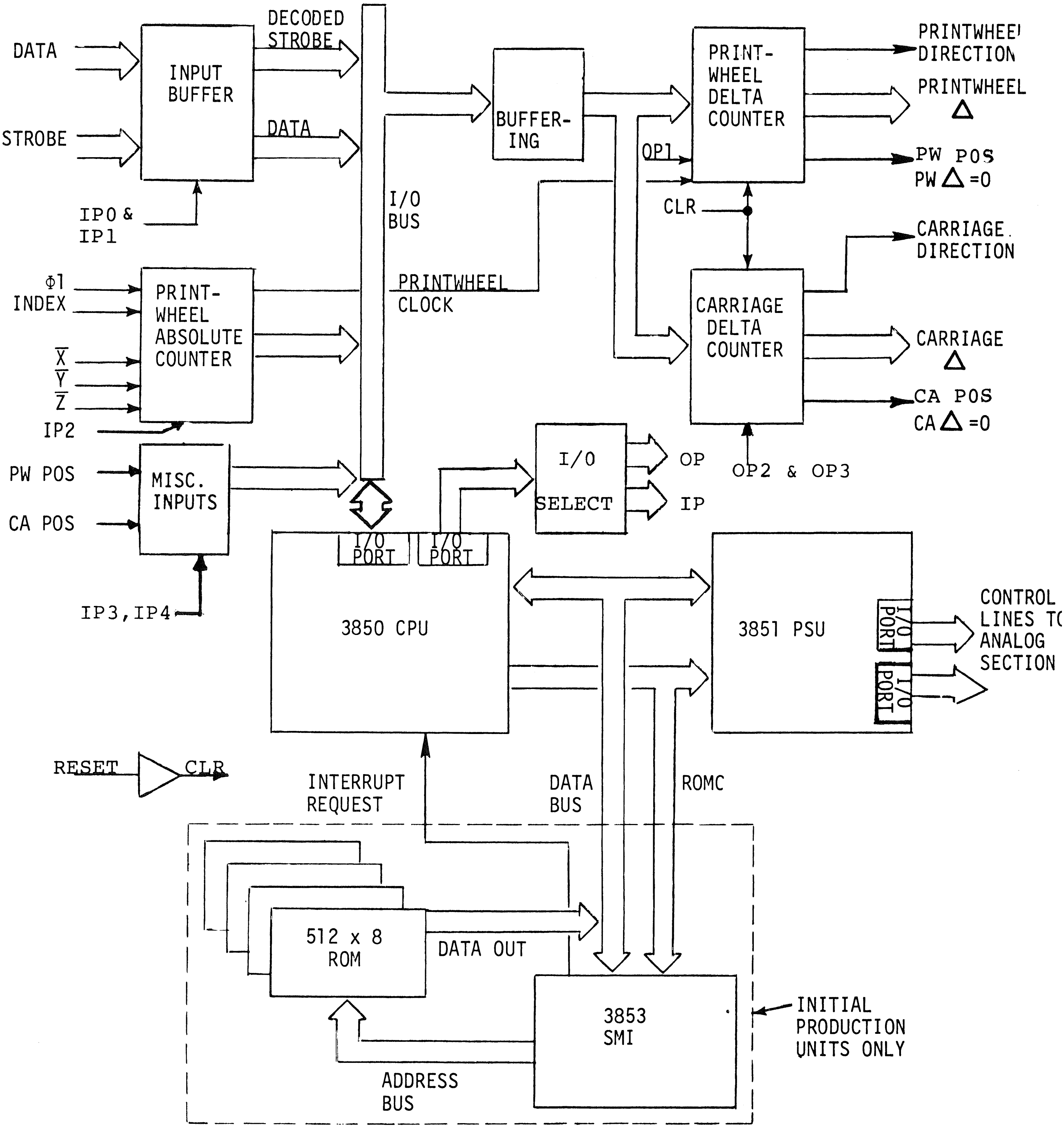


FIGURE 3-15

DIGITAL CONTROLLER BLOCK DIAGRAM

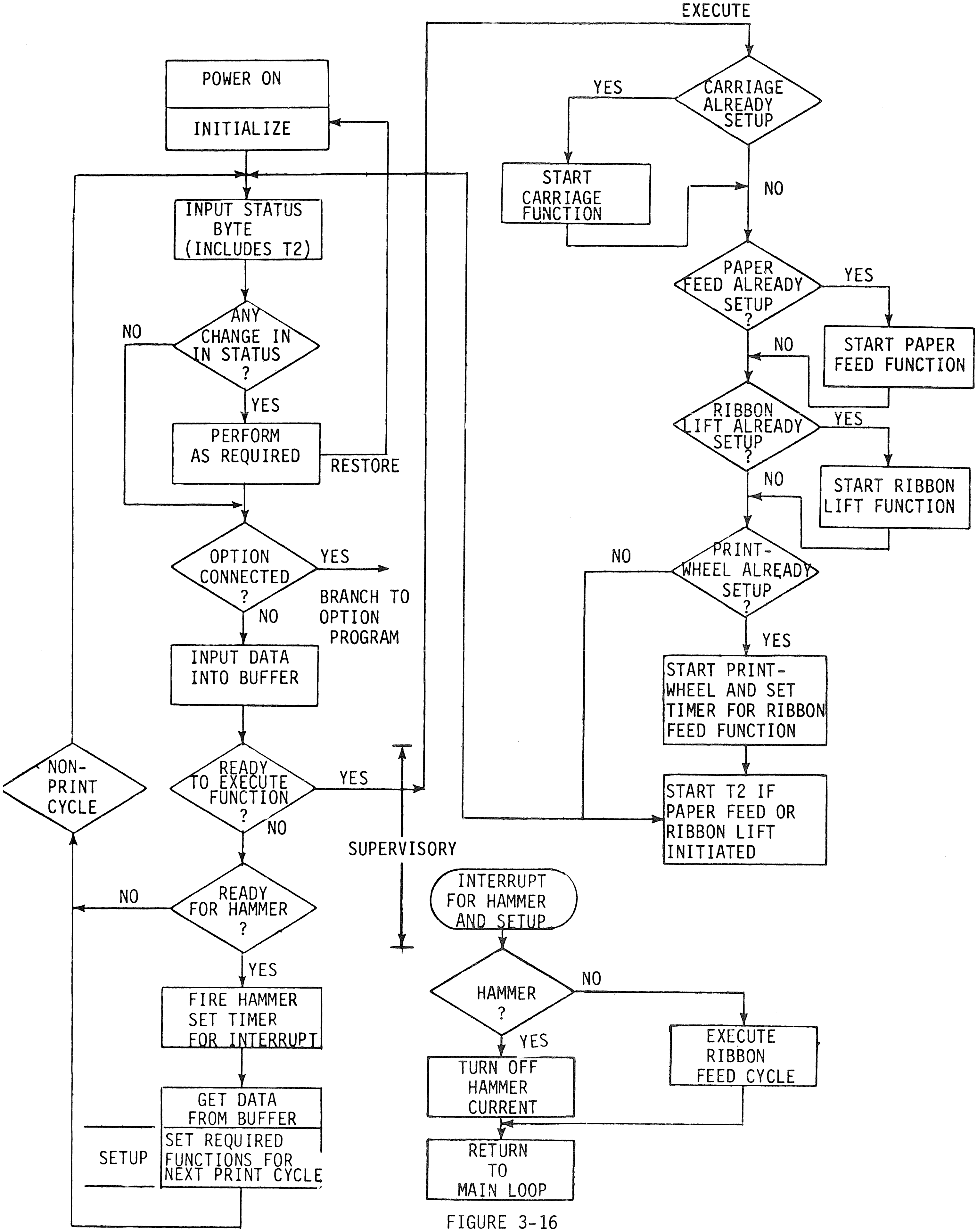


FIGURE 3-16
SPRINT 3 DIGITAL CONTROLLER OVERALL FLOW CHART

3.3.2 PROGRAM STORAGE UNIT

In initial production units, the 3851 PSU is used solely for its I/O capability. After initial production, the 3851 will be used to store 2048 eight-bit program words in its read-only memory (ROM). In initial units the printer's operating program is stored in programable read-only memory (prom) devices capable of storing 2048 eight-bit words. These devices are controlled by a 3853 Static Memory Interface (see below).

3.3.3 STATIC MEMORY INTERFACE

The 3853 SMI provides an interface between the ROM devices and the CPU. Following instructions provided by the CPU, the 3853 "addresses" the ROM devices by outputting a binary-coded word on the address bus. Each ROM has a unique set of addresses, so that for each word on the address bus, one and only one device will output the data contained at the location specified by the address. This data is forwarded to the CPU as part of a series of predetermined "instructions" on what function to perform next in the sequence of operations.

3.3.4 ROM DEVICES

Each ROM device consists of a matrix that can be visualized (although this is not actually how the device is constructed) as having eight rows and 512 columns. The eight address bits, plus, a "chip select" line are decoded to address one of the 512 columns. At the proper time in the operating sequence, the binary-coded word contained at the memory location is output on the data bus and stored in the CPU's internal data registers.

3.4 OPERATING SEQUENCE

Figure 3-16 is a flow chart of the operating sequence used by the digital controller to perform the functions required by the printer to move the carriage, lift the ribbon, and print the character. The following paragraphs describe steps in the operating sequence.

3.4.1 INITIALIZATION

When power is first applied, the states of the digital control logic are random. Therefore, an initialization sequence is performed to be certain that all functions are reset and ready for the first operating sequence. The 3850 CPU has its own power-on cycle: when power is detected, all registers are reset and the CPU asks for an instruction located in memory at address 00. This is the first instruction in an initialization sequence to be discussed later. The analog circuitry also contains a power-on reset circuit which outputs a signal designated RESET. This, in turn, generates CLR, which is a negative-going pulse with a duration of approximately 150 ms. This signal clears the input buffer and resets the printwheel and carriage delta counters to zero.

The next step in initialization is to move the carriage to the extreme left margin and establish an absolute count in the printwheel counter to determine the current printwheel address. This step is done in two stages: the first stage outputs a count to the carriage delta counter (strobed by OP2 and OP3) which results in an output from the counter of CAV4 (carriage velocity 4, an intermediate velocity), and movement in a left-hand direction. The carriage thus moves relatively slowly toward the left stop, containing an optical sensor. When the carriage reaches the sensor, the sensor outputs a signal

(CA LIMIT) to the CPU via the I/O bus after IP4 selection. The carriage then stops and moves in a right-hand direction to the first "detent".

The printwheel logic is initialized by spinning the printwheel motor at an intermediate velocity, much as the carriage was moved, until there is a coincidence between the printwheel INDEX output and the printwheel Φ1 output. This resets the printwheel absolute counter to zero. The printwheel is then allowed to coast to a stop. Meanwhile, the absolute counter, having been reset to zero, counts printwheel clock pulses and establishes the absolute position of the printwheel. RAM registers are initialized. This completes the initialization process.

3.4.2 DATA BUFFERING

All carriage, printwheel, paper feed, and ribbon lift commands are moved from the hardware buffer to a 15-character, software-controlled RAM buffer. When the printer is ready to set up another command, data is moved out of the buffer in the same order that it came in (i.e., a FIFO buffer).

3.4.3 PRINT CYCLE

When the initialization sequence is complete, the controller is ready for data input. Data is strobed into the input buffer by an accompanying strobe signal. All 16 bits are stored simultaneously, and when stored, the RDY EN line from the buffer disables the "ready" lines output to the external data source. The buffer output is now input to the CPU, eight bits at a time controlled by enabling lines IPO and IPI. During the input portion of the program, the CPU tests the I/O bus for an input.

The strobe lines are encoded by the hardware and later decoded by the software to enable the CPU to determine which strobe line has been activated and to decide which portion of the program will be used to process the data.

Figure 3-16 shows a flow chart of the print cycle. It can be seen that although there is a standard sequence of events, if some functions have been performed previously, they are skipped in the flow of the program. The only constant is that the printhammer operation is the last operation in the cycle.

A typical print cycle begins with the input of carriage data. When it is ready for execution, the CPU transfers from a RAM register set up for the command, the number of carriage clock pulses for the increment of movement to the carriage delta counter. The carriage counter then outputs a velocity code to the carriage servo velocity control ROM. During the "Supervisory" portion of the program, the CPU tests the "position mode" bit of the I/O bus to determine if the carriage has reached position mode. During carriage positioning, the CPU allows new data to be entered into the buffer and executes and supervises other operations.

The second part of the normal print cycle is printwheel positioning. Printwheel data is in the form of an ASCII character which must be converted to a printwheel delta counter value. When the command is ready to be set up for execution, the CPU loads the data into internal read/write (scratchpad) memory and performs a series of operations to determine printwheel rotational direction and the number of printwheel clock pulses to be loaded into the printwheel delta counter. When these computations have been made, the CPU loads the delta counter with the required information and the printwheel positioning cycle required begins. While the printwheel is moving, the paper feed and ribbon feed cycles are also being executed.

Ribbon feed is determined by the character to be printed, and the CPU "looks up" the character width code in ROM and outputs the number of ribbon feed clock cycles to advance the ribbon the required amount. This function is not programmed by the external data source.

Paper feed data is moved from the buffer to a RAM register which counts the required number of paper feed clock cycles. Timing is determined by a counter which counts down the system master clock (termed the   Clock) to generate a square wave with a 4 ms period. The CPU outputs the paper feed clock in synchronism with this clock signal.

The last action in any print cycle is firing the printhammer. When all other functions have been performed, the CPU outputs a hammer command consisting of a pulse whose width varies with the density of the character to be printed. Timing is determined by the programmable timer which is loaded with a pulse width count and interrupts the CPU when the timer has timed out. This shuts off the hammer drive and returns the CPU to the main program.

3.4.4 TIMING

Unlike previous printers, the Sprint 3 Series digital controller is mainly software-dependent for cycle timing. The master clock for the controller is the " " clock from the CPU whose frequency is controlled by a 2MHz crystal. This signal is buffered to provide MCLK, which is used for snychronization throughout the controller.

Through software, input and output data timing signals are generated by the CPU and transmitted to the rest of the controller using CPU selector I/O port A. The data input control lines are IP0 - IP4 and the output control lines are OP1 - OP3. These are decoded by a one-of-ten decoder shown in the lower right portion of the schematic diagram.

Ribbon and paper feed are similarly software-controlled. Paper feed is synchronized by a frequency divider which divides down MCLK to provide a square wave with a period of 8 ms. When a paper feed function is programmed, the software enables the frequency divider. At the first negative-going transition of the T2 clock, the paper feed clock signals are output from 3851 I/O port A. The number of clock pulses output is determined by the number of paper feed increments given in the paper feed command. Ribbon feed is accomplished by using the timer to control the duration of ribbon feed pulses.

CHAPTER IV

SUPPORT EQUIPMENT LIST

This chapter contains a consolidated listing of the supplies and equipment required to support the Sprint printers at the field service or depot maintenance levels.

4.1 TOOLS AND TEST EQUIPMENT

Table 4-1 list the tools and test equipment required for the maintenance and repair of the high-speed character printers. If equivalent items are available, they may be substituted for those listed. Repairmen on rountine field service calls should be provided with one of each of the items in Table 4-1, in addition to the normal complement of hand tools.

4.2 SPARES

Repairmen making rountine service calls should have one each of the complete subassemblies listed in Table 4-3 in addition to a spare printwheel and ribbon cartridge.

TABLE 4-1

TOOLS AND TEST EQUIPMENT

TOOLS	PART NUMBER
PCB Extractors	#80462
Printwheel Adjustment Tool, Outer Collett	#80471
Printwheel Adjustment Tool, Inner Collett	#80472
Printwheel Adjustment Tool, Disc	#80758
Platen Guage Adjustment Tool	#80751
Hammer Adjustment Tool	#80739
Printed Circuit Extender Set	#99025-03
Cable Tension Gauge	#80738
TEST EQUIPMENT	**PART NUMBER**
Printer Exerciser	#99000
Portable Exerciser	#80630
Oscilloscope	Tektronix 465
Multimeter	Simpson 260
Activity Monitor	#80740
LUBRICANTS	**PART NUMBER**
Watch Oil (Moebius Oil "Art. 8000")	#80341
Tellus Oil (Shell Oil "Tellus 25")	#80342
Polygrease	#80346
MISCELLANEOUS	**PART NUMBER**
Isopropyl Alcohol	-----
Platen Cleaning Fluid	Fedron ®
Heavy Duty Degreaser	Formula 409 ®
Thread Locking Fluid, Loctite #222	#85160-01
Loctite #06, Super Bonder Adhesive	#85161-01
Dusting Brush, Soft Bristle	-----
Type Cleaning Brush, Stiff Bristle	-----
Lint-Free Cloths	-----

TABLE 4-2
RECOMMENDED DEPOT LEVEL SPARES

PART #	DESCRIPTION	PRINTER POPULATION 100	500	1000
80023	Carriage Motor Final Asy	1	3	8
80032	Cradle Asy	1	1	2
80037	Pulley Asy-Idler	1	2	3
80046	Paper Feed Motor Asy	1	2	4
80057	Clutch And Magnet Asy, Ribbon Drive	2	4	8
80142	Bail-Feed Roller	2	4	8
80160	Lever-Feed Roller Disable	1	2	3
80186	Lever-Impression Control	1	1	2
80202	Gear-Idler, Paper Drive	1	1	2
80207	Ribbon Drive, Stepper Motor	1	1	2
80336	P/W Motor-Encoded	1	4	7
80368	Photon Module-Carriage Home	2	5	8
80369	Armature Asy-Hammer	1	1	2
80374-01	Pad-P.W. Motor Stop	2	5	10
80374-02	Pad-Ribbon Bail Stop	2	5	10
80379	Coil Ribbon Lift	2	4	8
80380	Bail Asy-Ribbon Lift	1	1	2
80358	Link Asy-Guide Bearing	1	2	3
80610	Power Risistor 5 OHM	1	2	3
80686	Hammer	1	3	5
80687	Hammer Guide	1	1	2
80713	Spring Hammer	1	3	5
85127	Cable Carriage Drive	1	3	5
90612	P.C. Asy Card #1	1	3	5
90622	P.C. Asy Card #2	1	3	5
90632	P.C. Asy Card #3	1	3	5

TABLE 4-3

RECOMMENDED FIELD SERVICE SPARES

MODEL 3/35	PART #
Printed Circuit Board 1	90612-00
Printed Circuit Board 2	90622-00
Printed Circuit Board 3	90632-00
Carriage Assembly	80028-14
MODEL 3/45	**PART #**
Printed Circuit Board 1	90612-01
Printed Circuit Board 2	90622-00
Printed Circuit Board 3	90632-01
Carriage Assembly	80028-15
MODEL 3/55	**PART #**
Printed Circuit Board 1	90612-02
Printed Circuit Board 2	90622-00
Printed Circuit Board 3	90632-02
Carriage Assembly	80028-16
MODEL 3/X30	**PART #**
Printed Circuit Board 1	90612-03
Printed Circuit Board 2	90622-01
Printed Circuit Board 3	90632-03
Carriage Assembly	80028-17
MODEL 3/X40	**PART #**
Printed Circuit Board 1	90612-04
Printed Circuit Board 2	90622-01
Printed Circuit Board 3	90632-04
Carriage Assembly	80028-18
MODEL 3/WIDETRACK	**PART #**
Printed Circuit Board 1	90612-05
Printed Circuit Board 2	90622-00
Printed Circuit Board 3	90632-01
Carriage Assembly	80028-15

CHAPTER V

MAINTENANCE

Periodic cleaning and lubrication are necessary to keep the Sprint Series printers in good working order. This chapter describes the scheduled maintenance procedures. Observe carefully all precautions with regard to the use of solvents and lubricants. Refer to Chapter IV for the Qume part numbers of maintenance items mentioned below.

5.1 MONTHLY

The printer should be checked monthly for general interior cleanliness, and the accumulated buildup of paper fibers should be removed. Use a soft-bristle brush to clean the carriage assembly carefully. Follow up with a soft cloth, using this to wipe the carriage guide rails and to mop up the interior generally. Clean up any ink residue on plastic or metal parts with a cloth moistened in FORMULA ® cleaner. DO NOT SPRAY SOLVENTS DIRECTLY INTO THE INTERIOR OF THE MACHINE, since they may contaminate lubrication points.

5.2 SEMI-ANNUALLY

Every six months, in normal operation, or after 300 hours of continuous printing use a medium grade oil (Shell "Tellus 25") to saturate the eight oiler pads of the ribbon feed drive gears. Refer to Figure 5-1.

5.3 ANNUALLY

Once a year, in normal service, the middle cover section should be removed, and the entire printer given a thorough cleaning.

Remove the printed circuit boards from their connector slots and examine them for general cleanliness and electrical integrity. Be alert for the discoloration that indicates overheating of components. Clear away any dust accumulation, using a soft-bristle brush. Grease film may be removed by rinsing in isopropyl alcohol and scrubbing gently with the brush. Take care not to get alcohol on any of the printer's rubber parts.

With the printed circuit boards removed, clean the interior of the printer. Use low velocity compressed air, if available. If not, brush-and-wipe will be sufficient. The object is to remove any dust that might clog the mechanism or impede the transfer of heat from electrical components. Test the carriage and paper feed mechanisms by hand for smoothness and freedom of operation.

Replace the printed circuit boards carefully, making sure that they have been seated properly in their mating connectors. Re-install the printed circuit board clamp, paying special attention to selecting the proper grooves to correctly space the boards. Re-install the printer's covers.

5.4 AS REQUIRED

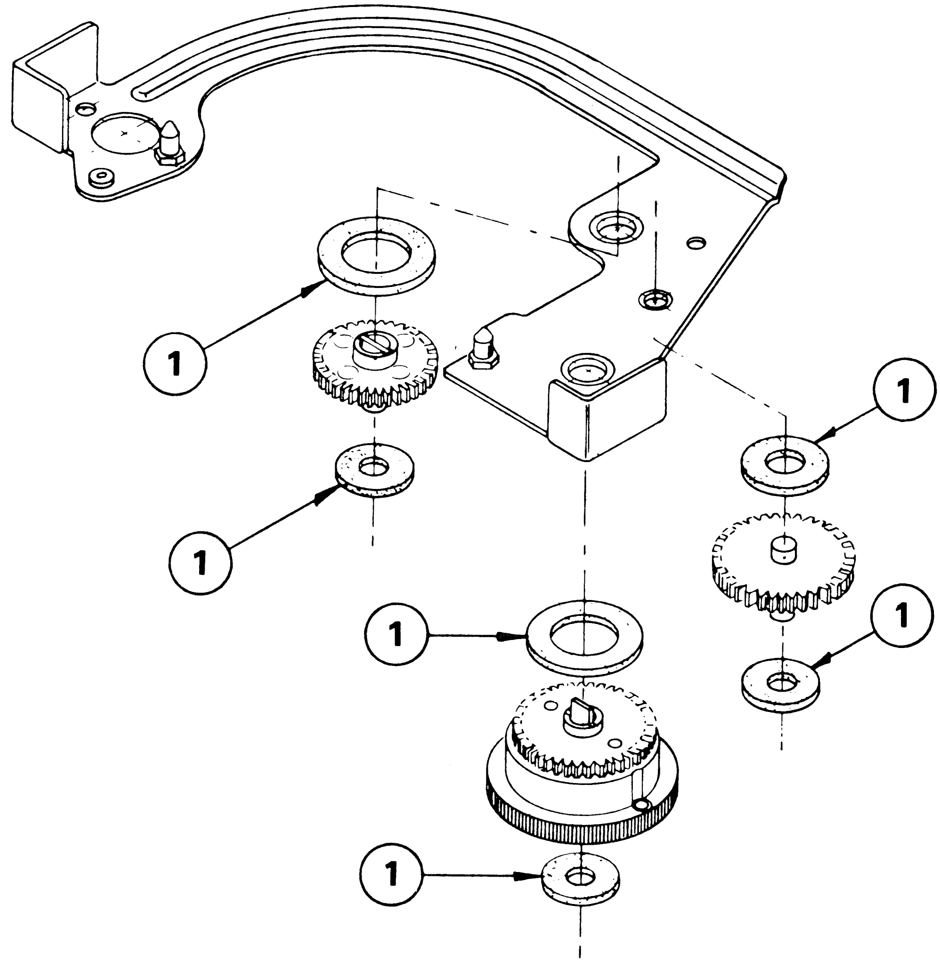
In time, ink from the ribbon will accumulate on the plastic card guide, obscuring the operator's view of the printing area. The card guide may be cleaned easily with a soft cloth moistened in FORMULA 409®. Use a clean cloth, to avoid scratching the transparent surface. If you use isopropyl alcohol to clean the card guide, avoid contact with the platen and with the paper feed rollers. Alcohol tends to harden the rubber surface, causing accelerated deterioration and erratic paper feed.

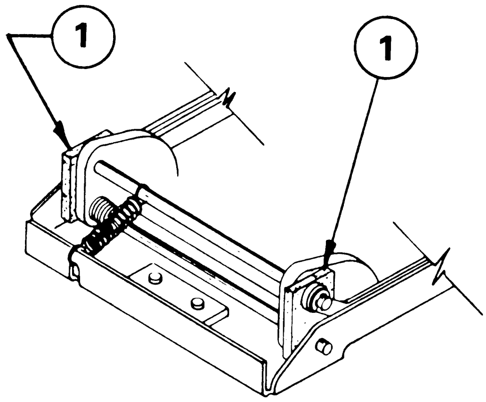
Occasional cleaning of the hammer and hammerguide may be necessary. Flush the hammer and guide with Freon or Alcohol, dry thoroughly, lubricate with a small drop of Moebius 800 (Watch Oil) at the front and rear. Caution, do not over-lubricate.

After the printer has been in service for some time, the printwheel may become clogged with ink and paper fibers. This problem is most acute in printers that use the nylon ribbon, where the printwheel die actually contacts the ribbon's inked surface during printing. Cleaning will be necessary whenever there is a noticeable deterioration in the clarity and definition of the characters printed. The need will vary, according to the severity of use and the quantity of output.

Remove the printwheel from the carriage for cleaning. Select a stiff brush with short, fine bristles (a regular type cleaning brush, or even a medium toothbrush works fine). Saturate this in FORMULA 409® cleaner, and use it to brush away all traces of greasy residue embedded in the printing dies. PROTECT YOUR CLOTHING FROM INK SPATTERS DURING THE CLEANING OPERATION. When you have finished, wipe the printwheel dry with a clean, lint-free cloth and re-install it on the carriage.

When it is necessary to clean the platen, or other rubber parts of the paper feed mechanism, use FEDRON® platen cleaner only. It is best to remove the platen entirely from the printer, to gain access to the feed rollers underneath. DO NOT GET PLATEN CLEANER ON ANY PLASTIC PARTS. Note that FEDRON® is highly flammable. Observe all precautions on the label.





(1) Saturate with 80342 Tellus Oil.

* Service is recommended every 6 months or 40 Million Print Cycles (300 hrs. continuous printing) whichever comes first.

FIGURE 5-1

LUBRICATION CHART

When the printer's plastic cover becomes soiled, it may be cleaned, using a cloth moistened with FORMULA 409® cleaner. Do not spray cleaners on the printer, since they may inadvertently get into portions of the printing mechanism.

CHAPTER VI

TROUBLESHOOTING

GENERAL

Troubleshooting is complicated by the interrelationship between printer and controller. The printer obeys the commands of the external controller without question: if the carriage is commanded to move in the wrong direction, it will do so. Before attempting to troubleshoot the printer, be sure that the controller and interface are operating properly. If it is determined that the controller and interface are operating correctly, use the procedures below to isolate the problem so that you can either replace the defective board or be advised by Qume customer service personnel what action to take to correct the problem.

DIAGNOSTIC PROCEDURES

This procedure utilitzes the optional Micro 3 Activity Indicator to isolate faults. The other equipment required is a digital voltmeter capable of measuring the power supply voltages.

(1) Remove the printer top covers.

(2) Either disable the external controller so that no data will be input during the diagnostics or disconnect the data cable from the printer.

(3) Using the digital voltmeter, measure the power supply voltages at the test points on each board. They should be within the tolerances specified in below.

+ 5V	±	3%	-	4.85V	to	5.15V
+15V	±	10%	-	13.5 V	to	16.5 V
-15V	±	10%	-	13.5 V	to	16.5 V

ACTIVITY MONITOR OPERATING INSTRUCTIONS

The diagnostic will begin running at the first test whenever the Micro 3 Activity Monitor is connected, the ON/OFF switch in "ON", and the program starts execution at location hexadecimal 0000. The program begins execution there after power up, after a Restore command is input, and when the RESTART button is depressed.

The printer exerciser may be connected when the diagnostic is run -- in fact, it is an advantage having it connected because the status lights may provide additional clues in cases of trouble, and it may be used to input a Restore command whenever necessary.

1. Turn power off. Connect the Micro 3 Activity Monitor cable connector to board 2 40 pin connector at the top of the board.

   IMPORTANT: The connector on the Micro 3 Activity Monitor must be oriented so the "FRONT" label marking is facing you when you are at the front of the printer, and the connector must be plugged in so pins 1 and 40 align on both connectors.

2. Turn the ON/OFF switch to "ON".

3. Turn on the power. The diagnostic will begin immediately.

4. If the test stops, note the TEST lights. The interpretation of these lights can be found in table 6-1 and also on the bottom of the Micro 3 Activity Monitor. The 4 test lights indicate the test that failed, see Test Light Pattern in the following table, and the 8 bit lights indicate the test mode, see Error Indicators On Error Stop.

   If the stop is in the ROM, I/O Lines, or Restore tests, the problem should be corrected before proceeding.

   If the stop is in the Carriage or Print Wheel tests, the CONTINUE button may be depressed to skip to the next test if the program stops in a <u>tested</u> error condition (see test descriptions above); and the bit lights will be effective in providing the reason for the stop (interpretation as in 3 above).

5. The diagnostic will automatically restart itself after finishing the Paper Feed Test. To stop the diagnostic and enable input to the printer through the I/O interface, turn the ON/OFF switch to "OFF" and depress the RESTART button. The exerciser may now be used for input.

6. To restart the diagnostic, turn the ON/OFF switch to "ON" and depress the RESTART button.

   A description of the diagnostic program can be found beginning on page 6-4.

TABLE 6-1

DIAGNOSTIC TEST PATTERN

TEST	TEST LIGHT PATTERN	OPERATION	ERROR INDICATORS ON ERROR STOP
ROM	0011	Adds all bytes of printer and diagnostic ROM programs. Sum must be zero.	Actual Sum.
I/O LINES	0001	Writes and reads each bit of I/O lines for isolation of bus line shorts. Compares written pattern to read pattern.	Actual pattern that caused error. Expected pattern can be deduced from lighting sequence.
RESTORE	0110	Executes Restore part of Printer program.	Not meaningful. Malfunctions can be seen by visual inspection.
CARRIAGE	0010	Carriage moves 114 times, back and forth, in diminishing movements, and sent to home and Limit. All bit positions of carriage delta are checked.	0 0 0 0 0 0 0 1 - Check 0 0 0 0 0 0 1 0 - Timed Out 0 0 0 0 0 1 0 0 - Limit on home 0 0 0 0 1 0 0 0 - Limit not found
PRINT WHEEL	0100	Slowly moves printwheel and stops at position 00. Printwheel moves 96 times, clockwise and counter clockwise in diminishing movements, and sent to index. All bit positions of printwheel delta are checked.	0 0 0 0 0 0 0 1 - Counter 0 0 0 0 0 0 1 0 - Timed out 0 0 0 0 0 1 0 0 - No index at end
PAPER FEED	0101	Executes various combinations of forward and reverse paper feeds and character printing. Ends with "QUME CORP" printed vertically. Test uses PRINTER program.	Does not stop. Errors seen in visual inspection.
TEST OVER	0111		

Notes: Continue test button is effective only after an error stop in either the CARRIAGE test, or the PRINT WHEEL test after the initial move to position 00.
A second RESTORE is performed just before the PAPER FEED test. Restore, Paperfeed, Ribbon Lift, Hammer, and Ribbon Advance errors are detected exclusively by visual inspection (during PAPER FEED test except RESTORE). Diagnostic does not test Ribbon Drop; nor does it test the external I/O interface which includes status lines, control lines, and data lines and associated circuitry.

TEST DESCRIPTIONS

ROM TEST

This test is to determine if the 3851 ROM* containing the diagnostic and the printer programs on board 2 is good. It adds all the bytes in the main program and the diagnostic program to develop a single-byte sum, excluding carries, which should be zero. The last byte in the diagnostic program is adjusted to be the two's complement of the sum of all the previous bytes.

Since the microprocessor is very fast, this test executes in a fraction of a second and will be seen as a fast blink on the TEST lights if the ROM is O. K.

A ROM failure causes the test to stop and the eight I/O bit lights display the actual sum. The CONTINUE button will not be active, since continuing the diagnostic may cause unusual things to occur because the main program or the diagnostic program is incorrectly stored in the ROM.

IMPORTANT: The test itself may not finish if the diagnostic program part of the ROM or the 3850 CPU or the power-up logic is defective.

I/O LINES TEST

This test is to determine if the I/O lines are operating properly. These lines are used for data communication between the microprocessor and the 74412 buffers, printwheel absolute counter, printer status, and printwheel and carriage delta counters. Any shorts to ground, +5, or each other either directly or through faulty components will cause improper operation.

The test sends out a pattern which will light a single bit light, starting with bit zero and proceeding sequentially to bit 7. After each pattern is output, it is input and compared to the pattern output. If the two patterns are different, the test stops and the bit lights display the erronous pattern input. The bit lights should be watched during the test so that if it fails the expected pattern (the pattern output), will be known. If the line is low (ground), the light lights.

The CONTINUE button will not be active because the tests following are dependent on the I/O lines working satisfactorily.

RESTORE TEST

This test is necessary at this time to establish a reference for the carriage and printwheel tests following it. It uses the actual Restore part of the printer program.

The carriage should be observed during this test. Failure to execute the Restore will cause the test to "hang up" in one of four program loops described below.

* Initial production printers use PROMS.

In the first loop, the carriage is slowly moved to the left until the carriage limit is sensed. The carriage may not move, in which case any one of a number of things can be wrong. Maybe the carriage delta counter is not receiving the data (hexadecimal 1007) or the counter output is not getting to the analog section, or the latter is inoperative, or the carriage limit sensing is faulty. If the carriage delta counter is not receiving the data, the port selection logic may be inoperative. OP2 and OP3 should be going low and high. The carriage may go in the wrong direction if the direction bit is lost. Or the carriage may travel at the wrong speed, indicating a faulty delta counter, velocity ROM, or analog section. Finally, the carriage may not find the limit and go into check, in which case maybe the carriage limit senser is faulty or selection logic IP4 is inoperative or the connection between the limit senser and the I/O lines is missing.

In the second loop, the carriage is sent to the right out of the limit. If the carriage doesn't move right, make sure it is not in check. The data output to the carriage delta counter is hexadecimal 0001.

In the third loop, a hexadecimal 07 is repeatedly sent to the printwheel delta counter until the printwheel passes position 00, the printwheel index position, at lower case "w". The printwheel may not turn, or it may turn too fast and/or it may never stop. Similar reasoning may be applied to the printwheel that was applied to the carriage. The senser in this case is the printwheel index which also uses IP4 selection.

In the fourth loop, printwheel position mode is sensed and the program loops until the condition is true. IP3 is selected for this sensing.

IMPORTANT: The CONTINUE button will not be active if the printer fails the Restore test, and the bit lights will not be relevant.

CARRIAGE TEST

This test contains two program loops. The first and main loop does the following:

1. Removes and saves the direction bit from a RAM register containing the last carriage delta output to the carriage delta counter.

2. Subtracts a constant from the resulting delta magnitude of 1 above.

3. Tests the result of 2 above. If it is less than zero, the main loop is done and the program branches to the second loop.

4. Complements the direction bit saved in 1 above and combines it with the new delta of 2 above.

5. Sets a time limit for the carriage travel.

6. Outputs the delta of 4 above.

7. Tests position mode. If true, goes to step 1.

8. Tests the elapsed time. It if is over the value set in 5 above, sets bit light value and jumps to error routine (described later).

9. Tests if check occurred. If so, sets bit light value and jumps to error routine.

10. Jumps to step 7.

Initialization for the main loop is with the first carriage delta value and a jump to step 5.

Following the successful completion of the main loop, the program outputs a carriage delta which should send the carriage almost to home position, initializes a 1/2 step counter, and then jumps into the second loop at step 2. The second loop:

1. Outputs a hexadecimal 1001 (1/2 step left) to the carriage delta counter.

2. Tests for carriage position mode and carriage limit. If both are true, exists loop. If not in position, repeats this step.

3. If in position mode but not at limit, decrements 1/2 step counter and tests it. If it is not zero, jumps to step 1.

4. If the 1/2 step counter is at zero, sets bit light pattern and jumps to error routine.

Following completion of the second loop, the 1/2 step counter is tested. If it is at the value it was initialized to, the bit light pattern is set and program jumps to error routine. The carriage should not be at the limit on the 'home'.

IMPORTANT: Notice that the second loop does not test for a check condition. After passing the first loop without a check, the chances of having a check in the second loop are remote. A check in the second loop will "hang up" the test, and the bit lights will not be relevant. Furthermore, the CONTINUE button will not be operative.

PRINTWHEEL TEST

This test also has two program loops, of which the second loop is the main one.

The first loop does one thing--send the printwheel to the index. It does this by testing whether the printwheel is in position 00, outputting a hexadecimal 01 to the printwheel delta counter if it is not at the index, briefly waiting, and then jumping to the beginning of the loop.

IMPORTANT: If the printwheel absolute position counter is faulty, the printwheel may not stop and will "hang up" at this point in the test. The bit lights will not be relevant if this happens and the CONTINUE button will not be effective.

After completion of the first loop (not necessarily proving that the printwheel is really at the index), the program initializes the first printwheel delta value and the first value of the software-controlled printwheel absolute position counter and jumps into the main loop at step 7. The main loop:

1. Removes and saves the direction bit from a RAM register containing the last printwheel delta output to the printwheel delta counter.

2. Subtracts a constant from the resulting delta magnitude of 1 above.

3. Tests the result of 2 above. If it is less than zero, the main loop is done and the program branches to the final operation in this test.

4. Complements the direction bit saved in 1 above.

5. Updates the software-controlled printwheel absolute counter using the new delta in step 2 and based on the direction bit in 4 above (either adds or subtracts the delta to/from the counter).

6. Combines the new direction with the new delta.

7. Sets a time limit for the printwheel motion.

8. Outputs the delta of 6 above to the printwheel delta counter.

9. Checks for printwheel position mode. If false, tests elapsed time. If not over the value in 7 above, repeats this step. Otherwise, sets bit light pattern and branches to error routine (described later).

10. In position mode, the printwheel absolute position counter is input and compared to its software-controlled counterpart. If the two counters are not equal, sets bit light pattern and branch to error routine.

11. Jumps to step 1.

Following successful completion of the main loop, the program outputs a printwheel delta that should send the printwheel to the index. The index is tested after position mode is established and a short delay. If the printwheel is not at the index, the bit light pattern is set and the program jumps to the error routine.

Another Restore is performed at this point to initialize the carriage to home, and to initialize the RAM registers for main printer program use for the following test.

PAPER FEED TEST

This test uses the main printer program. Just prior to the command input part of the main program, the program branches to the diagnostic program if the Micro 3 Activity Monitor is connected. The diagnostic then loads a printwheel or a paper feed command into the next available position in the software input buffer, tests the buffer to see if it is full, and sets an appropriate 'comeback code'. The diagnostic then jumps to the point in the main printer program which is just after where it stores a command into the software input buffer.

As long as the 'comeback code' is not a buffer full type, the above happens and the main program executes the commands in the buffer as though they came in through the external I/O interface.

When the software input buffer is full, the diagnostic ceases to load it until it becomes empty so it can adjust buffer pointers. It does this because four bytes at the end of that buffer are used by the diagnostic program.

The result of the paper feed test is a vertical printing of "QUME CORP" produced by a series of complex combinations of printwheel and paper feed commands. If the printer is working satisfactorily, the printing is reasonably evenly spaced (allowing for paper slippage) and spelled as above (without quote marks).

At the beginning of this test the ribbon should lift. It is <u>not</u> dropped at the conclusion of this test but is dropped at the beginning of the diagnostic. During the test, take note of the ribbon feed operating just prior to the printing of each letter.

IMPORTANT: This test has no internal checks and does not stop if a malfunction occurs. The results are seen during and after the test as mentioned above.

ERROR ROUTINE

This routine is used for all <u>tested</u> error conditions. Just before the program branches to it, it sets the bit light pattern to be displayed in the bit lights for the identification of the error, and it also sets the address of where the program may jump when the CONTINUE button is depressed. The routine displays the bit light pattern, delays, tests the CONTINUE button, and either branches to the address set if it was depressed, or branches back to the beginning of the error routine.

In the case of the ROM Test and the I/O Lines Test, the address set is the error routine so the CONTINUE button is not effective. In the Carriage Test it is the start of the Printwheel Test, and in the Printwheel Test it is the start of the Paper Feed Test.

CHAPTER VII

REPAIR

This section tells how to restore the high-speed printer to normal operation following replacement or repair of its major parts and subassemblies. Step-by-step procedures are given for the mechanical alignment of the printer.

A preliminary word of caution is in order. Despite its apparent mechanical simplicity, the printer is a highly sophisticated piece of machinery. In many cases, the tolerances and adjustments that are carefully established on the assembly line are simply not obvious to the untrained eye. Yet, failure to observe these tolerances can result in degraded output quality, in excessive stress, in accelerated wear, and in unnecessary premature failures. Only qualified personnel should attempt the repair of the high-speed character printers, and even these should be sure beforehand that they have read and understood the instructions thoroughly. At all costs, resist the impulse to tamper with adjustments or to disassemble parts of the mechanism indiscriminately. If in doubt, contact the factory service department for advice and instructions.

Every effort has been made to adjust your printer within the tolerances shown in this manual, however, individual measurement techniques and instruments vary and may indicate dimensions slightly outside of tolerances shown. This is not an indication that your printer won't perform perfectly, as generous safety margins exist outside of the tolerances. If readjustment is required every effort should be made to readjust to the specifications shown.

For the most part, the tools and equipment required for these adjustments are already available in the serviceman's tool kit. Whenever special tools, alignment fixtures, or test equipment are called for, they are noted prominently in the text. Section IV contains a consolidated listing of special tools and support equipment.

7.1 ROUTINE PROCEDURES

COVER REMOVAL

The high-speed character printer is equipped with a three-piece plastic cover. The uppermost section is a snap-on lid which protects the carriage mechanism during normal operation. To remove it simply grasp its front edge firmly, and lift upward. Removal of this cover trips an interlock switch which disables the printwheel and the carriage servomotors, protecting the operator from possible injury when changing ribbons or printwheels. Maintenance personnel may find it necessary to bypass this switch during routine servicing of the printer.

To obtain access to the interior, it will be necessary to remove the middle section of the cover. It is secured by three screws at the rear of the printer, and by several screws on the inside periphery of the cover itself. The latter are readily accessible when the top cover is removed. With the retaining screws loosened and the platen removed, the middle section may be lifted free of the printer chassis, exposing the remainder of the mechanism and the control electronics.

The bottom section is a dished cover which is bolted to the printer's chassis. Routine servicing does not require removal of the bottom cover.

REMOVAL OF PRINTED CIRCUIT BOARDS

The printer's control electronics is contained on three printed circuit boards, each having etched connector tongues which mate with corresponding slot connectors on the mother board.

For purposes of identification, these assemblies are numbered sequentially, beginning at the rear of the printer. The board at the rear of the unit is thus PCB #1; that nearest the front of the unit is PCB #3.

Removal and replacement of the electronic assemblies is routine. Use of an extractor, however, makes this task easier and minimizes the possibility of damage to the printed circuit boards. Always turn power OFF before removing or replacing any assembly. Connectors on the mother board are staggered, making it impossible to insert a printed circuit board in the wrong mother board position. When replacing printed circuit boards, be certain that they are seated firmly in their mating connectors.

7.2 MECHANICAL ALIGNMENT

Although mechanical misalignment can result in noisy operation or in damage to the equipment, the first indication is usually a visible deterioration of the print quality. Symptoms frequently observed include characters that are too light or dark, characters that are heavier at the top or at the bottom edge, characters that appear to taper and become uneven at one or both extremes of carriage travel, and characters that seem to fade out as the horizontal line is scanned. Maladjustment occasionally produces positional inaccuracies that are most evident in the smeared appearance of overprinted characters or in the ragged "picket-fence" aspect of the horizontal lines.

Misalignment of the printer is seldom the result of ordinary wear. More often it is attributable to an accident, or to physical abuse of the printer. Any unit subjected to a violent shock should be checked carefully for visible evidence of such maladjustment. However, re-adjustment will also be indicated as a matter of routine, whenever any of the following components and subassemblies are repaired or replaced:

(a) printwheel carriage
(b) printwheel servomotor
(c) printhammer solenoid
(d) ribbon lift solenoid
(e) carriage servomotor
(f) paper feed stepper motor
(g) platen, paper feed rollers, and/or platen drive gears
(h) plastic card guide

A complete re-alignment will seldom be called for, but, you must be careful to restore any and all adjustments that may have been disturbed. We therefore recommend that you read the following section carefully before beginning any repair. The preface to each procedure enumerates the conditions that make that particular adjustment necessary.

Note that the alignment procedures are grouped, as follows:

(a) printhammer adjustments
(b) platen adjustments
(c) paper feed roller adjustments
(d) carriage adjustments
(e) ribbon adjustments
(f) mother board alignment

There may be some interaction between adjustments that are grouped together, and we therefore recommend that all the procedures in a given group be performed at the same time. Observe the order of adjustments carefully, and take special note of those few cases where adjustments in one group necessitate re-checking adjustments in another.

7.2.1 PRINTHAMMER ALIGNMENT

Misalignment of printhammer adjustments usually produces characters that are too light or too dark, or characters that are uneven. Ocassionally, however, a faulty adjustment can cause noisy operation or printwheel breakage. In a few cases the serviceman will observe some slippage of the printwheel hub in relation to the servomotor's armature shaft, resulting in an uneven character impression, in chipping of the printwheel spokes, or in actual misprinting. Any of these symptoms may indicate the need for re-alignment of the printhammer. The adjustments should be performed as a group, in the order indicated below. All adjustments are performed with power OFF, except as noted.

Complete realignment of the printhammer assembly is also indicated whenever any of the following parts have been removed or replaced:

(a) printhammer
(b) printhammer actuating solenoid
(c) armature limit bumpers
(d) printwheel servomotor

PRINTHAMMER VERTICAL ALIGNMENT

Alignment may be performed with the top cover off, and with the printwheel and the platen removed from the printer. Correct adjustment requires the use of a special alignment tool (#80739). A screwdriver and a 3/16" wrench (or nut driver) will also be needed. Refer to Figure 7-1.

(1) Remove all power to the printer.

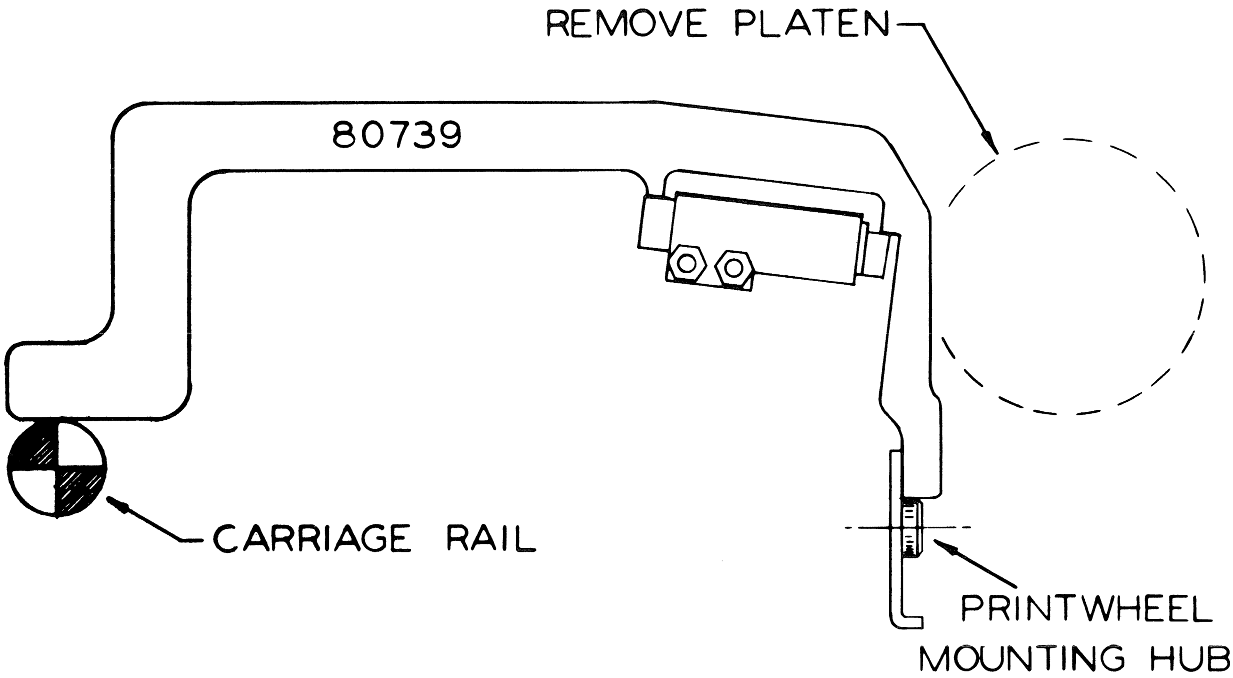
(2) Loosen the two printhammer retaining screws, which secure the printhammer housing to the carriage.

(3) Install the printhammer alignment gauge (#80739), as shown in Figure 7-1. Be certain that the upper carriage is locked in its normal operating position.

(4) Move the printhammer assembly into alignment. The movable hammer should contact the fixture lightly at both ends, as shown in the diagram.

(5) While holding the housing in this aligned position, re-tighten the two retaining screws. This completes the vertical alignment.

After adjusting the printhammer's vertical position, it is a good idea to run a print sample and check the evenness of the impression. Vertical misalignment produces characters that are darker at their top or bottom edge. If characters are heavier at the top, it may be necessary to raise the adjustment slightly, so that the hammer is more nearly horizontal. Characters that are darker at the bottom, on the other hand, suggest the need for lowering the hammer tip. Uniform appearance of the sample is the ultimate criterion to be applied.



PRINTHAMMER VERTICLE ALIGNMENT

FIG. 7-1

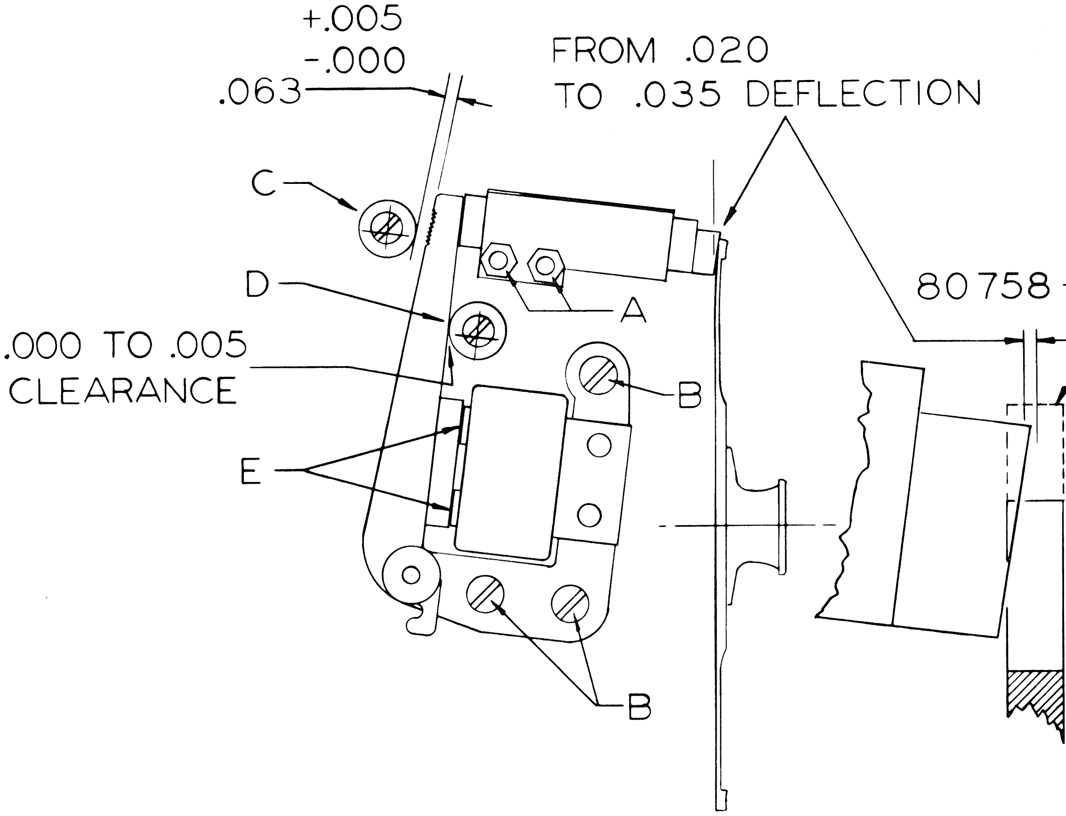


FIG. 7-1.1

Before re-adjusting the hammer, however, be sure to check the platen height adjustment as described in Section 7.2.2. Maladjustment of the platen can produce much the same result as faulty printhammer alignment, so the platen should be checked before concluding that the printhammer is to blame for a visible defect.

HAMMER ARMATURE CORE ADJUSTMENT

Adjustment may be performed with the top cover of the printer removed. This adjustment is preceded by the vertical alignment of the printhammer, as described previously. Tools required include the printwheel alignment disc and a screwdriver. Refer to Figure 7-2.

(1) Remove the printwheel from the carriage, and install the alignment disc in its place, so that the imprinted legend "THIS SIDE UP" is visible to the serviceman making the adjustment. Rotate the disc so that the round O.D. Section is near the hammer.

(2) Using a 3/16" wrench, loosen the retaining nut which secures the armature's eccentric forward limit bumper, and rotate the bumper itself to obtain maximum clearance between the bumper (D) and the armature lever. Refer to Figure 7-1.1.

(3) Now loosen the three armature core retaining screws (B) that hold the core in place.

(4) While using your left hand to pinch the armature lever against the core piece (E) , position the entire assembly so that the top of the printhammer protrudes inside the disc .020 "to .035", as illustrated in Figure 7.1.1.

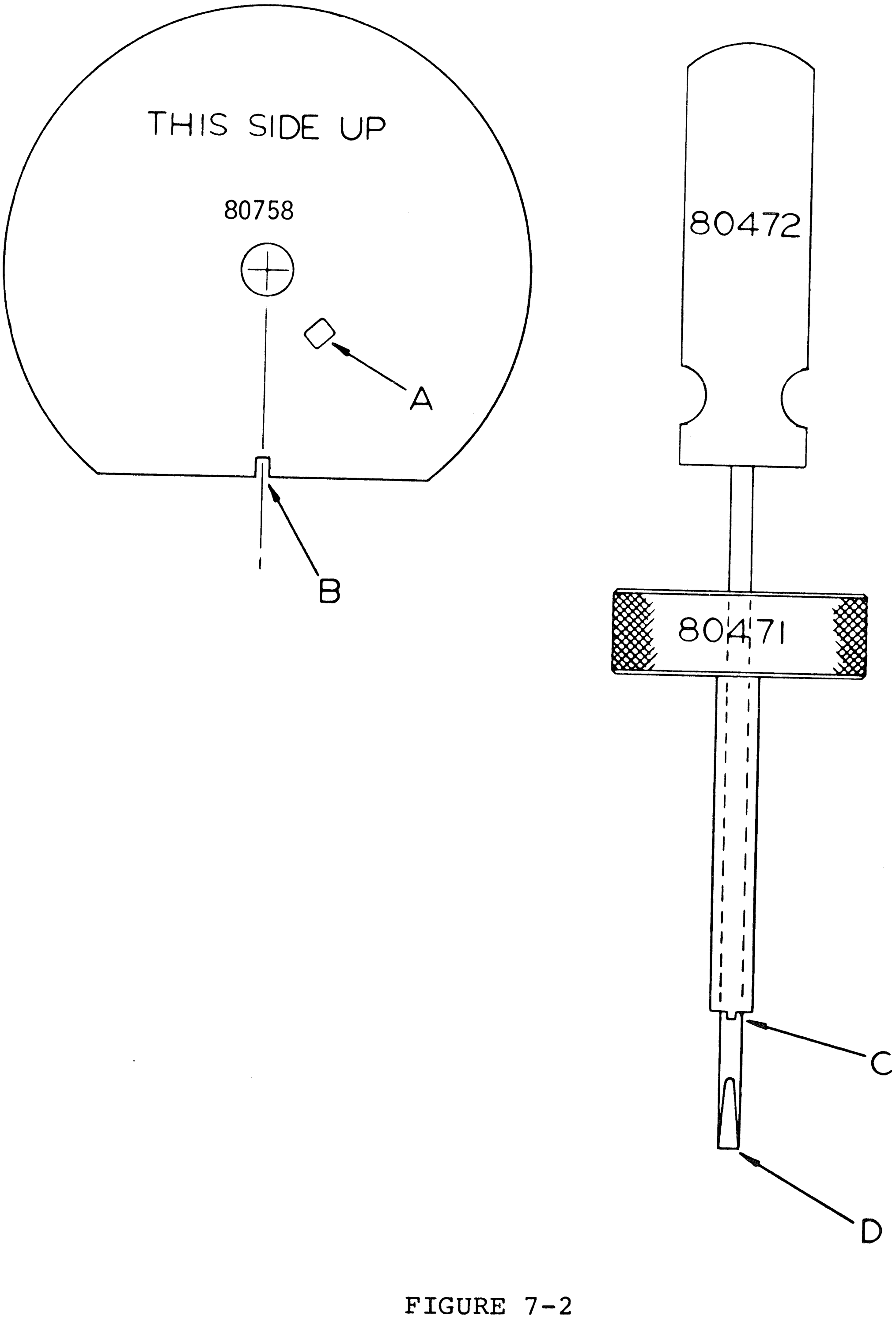


FIGURE 7-2
PRINTWHEEL ALIGNMENT TOOLS

(5) Hold the solenoid assembly in this position, and retighten the three core retaining screws. This completes the adjustment.

HAMMER ARMATURE FORWARD LIMIT ADJUSTMENT

Adjustment to the forward limit bumper is performed with the top cover removed from the printer. This adjustment should always be preceded by the armature core adjustment just described. A screwdriver and a 3/16" wrench will be required. Refer to Figure 7-1.1.

(1) Loosen the nut which retains the forward limit bumper.

(2) With one hand, pinch the armature lever to the core piece (E) .

(3) With a screwdriver, rotate the eccentric bumper, until the indicated clearance is obtained.

(4) Hold the forward limit bumper in that angular position with your screwdriver, and tighten the bumper's retaining nut. This completes the adjustment.

HAMMER ARMATURE RETURN LIMIT ADJUSTMENT

Adjustment of the hammer armature return limit bumper is accomplished with the top cover removed from the printer. This adjustment is always preceded by the forward limit adjustment, as just described. A screwdriver, a 3/16" wrench, and a .063 feeler gauge are necessary. Refer to Figure 7-1.1.

(1) Loosen the retaining nut that secures the return limit bumper (C) .

(2) With your left hand pinch the armature lever against the core. Rotate the return limit bumper to dimension shown. The feeler gauge should slide between armature bumper.

(3) Hold the bumper in this position with a screwdriver, and secure it by tightening the retaining nut. This completes the adjustment.

PRINTWHEEL INDEX ADJUSTMENT (HUB)

Although it is not technically a printhammer adjustment, printwheel alignment is normally performed at the same time as the other adjustments in that group. The printwheel's relative position can affect the accuracy with which the hammer tip strikes the uppermost spoke, and misalignment therefore produces symptoms such as uneven character impressions that are similar to those resulting from vertical misalignment of the printhammer. Extreme cases of maladjustment may result in broken spokes, or in printing of the wrong characters.

The printwheel hub adjustment is made to ensure that the printwheel mounted on the hub is in the correct angular relationship to the absolute index of the servomotor's encoder which is mounted on the other end of the shaft. Three special tools are required:

(a) hub collet adjusting tool, #80471
(b) a 1/8" diameter screwdriver, #80472
(c) reference disc, #80758

These are illustrated in Figure 7-2.

Adjustments are made with the printer energized. The printer's top cover must be removed and the cover interlock switch bypassed. Proceed as follows:

(1) Turn the printer on.

(2) Release the carriage locking lever by depressing the "0" button, and tilt the carriage all the way back.

(3) Remove the printwheel.

(4) Refer to Figure 7-3. Use the hub collet adjusting tool to loosen the hub collet. Hold the armature shaft stationary with the screwdriver handle, and twist the knurled knob counterclockwise slightly to loosen the hub collet.

CAUTION

Be extremely careful not to let the screwdriver tool slip out of the slot in the motor shaft. Insert the blade squarely, and use enough hand pressure to keep it seated firmly. If it slips, you may damage the tip of the screwdriver tool. This in turn may lead on some future occasion to a damaged armature shaft. The only alternative, once that happens, is total replacement of the printwheel motor-encoder assembly.

Never try to loosen the hub collet with an obviously damaged tool. Either obtain a new tool, or dress the

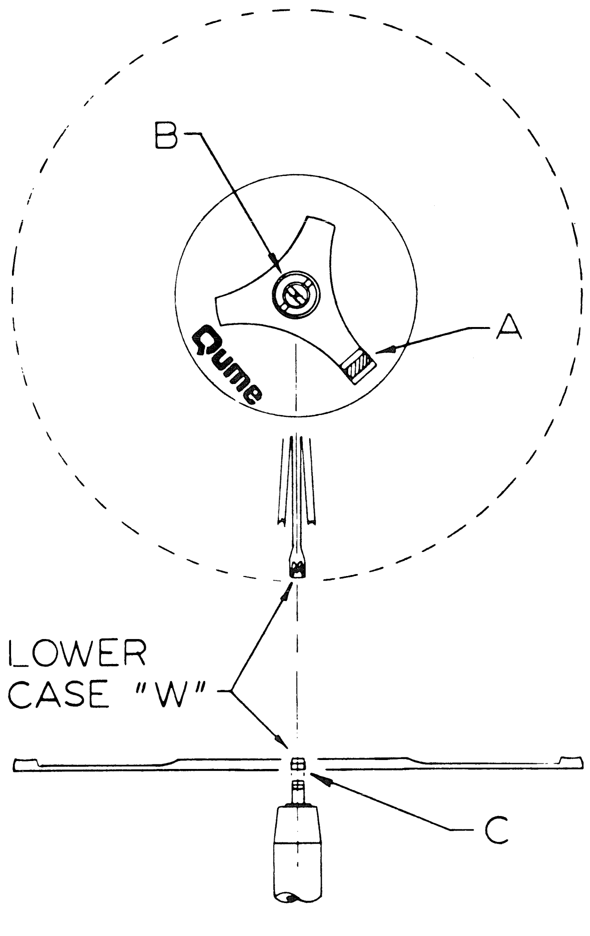


FIGURE 7-3
PRINTWHEEL INDEX ADJUSTMENT

blade carefully on a grinding wheel. If you have initial difficulty in breaking a collet loose, you would be wise to use a screwdriver with a slightly wider blade, which is less likely to slip out of the slot. The blade on the stock tool is deliberately narrower, to allow for complete removal of the collet.

(5) Use a test lead to ground pin #28 of the interface connector momentarily (the interface connector is located on the right side of the chassis as viewed from the rear. Refer to Figure 2-2 for orientation). This will cause the ribbon lift mechanism to operate briefly. When it returns to its rest position, the servomotor's shaft will be at the index (lower case "w").

(6) Mount the alignment disc on the printwheel hub, so that the imprinted legend "THIS SIDE UP" is visible to the serviceman making the adjustment.

(7) Wedge a folded bit of paper between the printhammer's armature and the spring-loaded printhammer, so that the tip of the printhammer is in an extended position.

(8) Rotate the alignment disc, and the hub, (but NOT the motor's shaft), until the extended tip of the printhammer engages the notch that is cut in the flatted edge of the disc (see Figure 7-2).

(9) Now use the collet adjusting tool to re-tighten the collet, taking care not to disturb the motor's angular position. Hold the armature stationary with the screwdriver and turn the knurled knob clockwise to secure the adjustment.

(10) Remove the alignment disc, and the paper wedge, and re-install the printwheel.

(11) Once again, use a test lead to ground pin #28 of the interface connector.

(12) Verify that the lower case "w" is in the 12 o'clock printwheel position.

(13) Move the printhammer slug forward by hand, and ensure that the tip of the slug meets the uppermost spoke squarely. Re-adjust the hub slightly, if necessary. Refer to Figure 7-3.

(14) Return the printwheel carriage to its operating position, and press the "C" button to lock it in place. This completes the hub adjustment.

7.2.2 PLATEN ADJUSTMENTS

Misalignment of the platen adjustments usually manifests itself in print quality that varies over the width of the page. Ragged lines, lines that taper, and lines that gradually fade from one side to the other are possible indications of platen misalignment. Difficulty in obtaining accurate overprinting or accurate vertical positioning may also indicate the need for platen adjustment. The platen should be re-aligned whenever any of the following are replaced:

(a)	paper feed stepper motor	} adjust drive gear
(b)	paper feed idler gear	
(c)	carriage	} adjust platen height/depth
(d)	printwheel servo motor	

NOTE: All adjustments are made with power OFF.

PLATEN DEPTH ADJUSTMENT

Adjustment of the platen's depth is performed to ensure that the forward surface of the platen is perfectly parallel to the rails on which the printwheel carriage travels. Misalignment produces characters that are too light or too dark, or characters that are darker on one side of the page than on the other.

The middle section of the printer's cover must be removed for access to this adjustment. Tools required include a screwdriver, a 5/8" open-end wrench, and the alignment gauge, #80751 shown in Figure 7-4.

(1) Place the forms thickness selector lever in its extreme forward position.

(2) Refer to Figure 7-5 which shows the right platen carrier side plate. Loosen the two screws (B) and (C) which secure the depth adjustment.

(3) Position the alignment gauge #80751 on the right side of the printer, as shown in Figure 7-4. The gauge rests on the printwheel hub (A) and on the forward carriage guide rail (B) and must be balanced or supported by hand. Try to keep the gauge approximately perpendicular to the platen's principal axis.

(4) Use a 5/8" open-end wrench to rotate the eccentric anchor shown at (B) in Figure 7-5. Adjust this anchor so that the forward edge of the platen just touches the flattened vertical face on the alignment gauge (Figure 7-4).

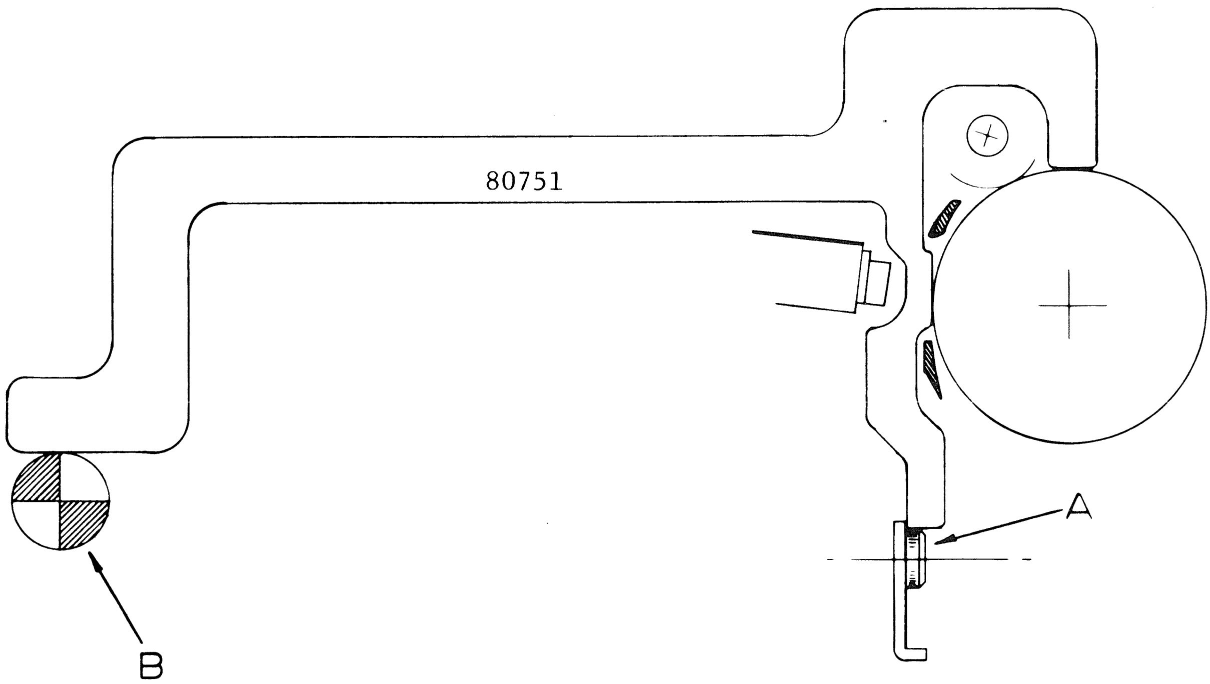


FIGURE 7-4
PLATEN HEIGHT AND DEPTH GAUGE

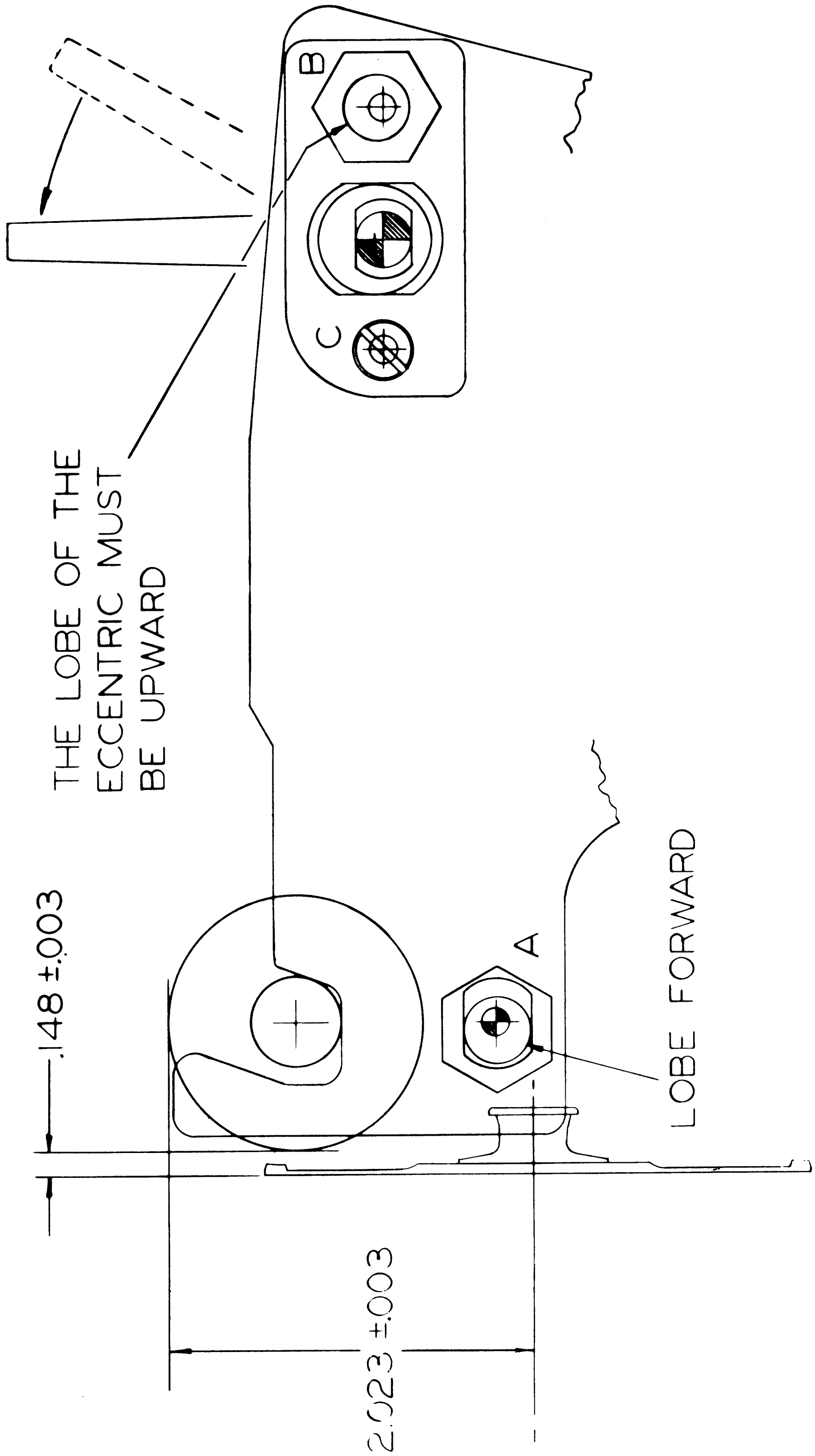


FIGURE 7-5

PLATEN ADJUSTMENTS

(5) When you are sure that the adjustment is correct, tighten the two retaining screws that were loosened in Step #2 above. This locks the anchor and completes the right depth adjustment.

(6) Repeat Steps #2 through #5 on the left side of the machine.

PLATEN HEIGHT ADJUSTMENT

The platen height adjustment is performed to ensure that the top surface of the platen is perfectly parallel to the carriage guide rails and that the entire platen is at the proper printing height. Maladjustment produces lines that are darker at top or bottom, or lines that appear to taper horizontally. If vertical adjustment of the printhammer has failed to produce an even character impression, then the platen height adjustment is the most probable cause of trouble.

This adjustment will normally be preceded by the platen depth adjustment just described. The printer's middle cover must be removed. The procedure calls for screwdriver, 5/8" open-end wrench, and the alignment gauge shown in Figure 7-4.

(1) Refer to Figure 7-5, which shows the right side of the plate of the platen carrier. Loosen the screw (A) which secures the height adjustment.

(2) Position the alignment gauge on the right side of the printer, as shown in Figure 7-4. The gauge rests on the printwheel hub (A) and on the forward carriage guide rail (B) and must be balanced or supported by hand. For the most accurate adjustment, try to keep the gauge perpendicular to the platen's principal axis.

(3) Use a 5/8" open-end wrench to rotate the eccentric anchor shown at (A) in Figure 7-5. Adjust this anchor so that the upper edge of the platen just touches the horizontal face on the alignment gauge (Figure 7-4).

(4) When you are sure that the adjustment is correct, tighten the retaining screw that was loosened in Step #1 above. This locks the anchor and completes the right side height adjustment.

(5) Repeat Steps #1 through #4 on the left side of the machine.

PLATEN DRIVE GEAR ADJUSTMENT

The platen drive gear adjustment is performed to obtain the minimum amount of backlash in the paper feed gear train. A drive mechanism which is too tight will bind, causing poor vertical positioning and leading to possible fracture of the motor shaft. A mechanism that is too loose, on the other hand, will cause poor registration and overprinting, and may even produce uneven horizontal lines.

This adjustment is performed initially at the factory, and seldom requires attention thereafter. It should be checked, however, when the other platen adjustments are performed. Alignment will also be required whenever the paper feed motor or the drive gear itself are replaced.

The printer's middle cover must be removed, to gain access to the paper feed mechanism. A ¼" nut driver or a ¼" open-end wrench will be required.

(1) Refer to Figure 7-6, showing the paper feed mechanism on the right side of the printer's chassis. Locate and loosen the two ¼" hex head screws which secure the triangular idler gear mounting plate (Figure 7-6 (A) and (B)).

(2) Move the large idler gear simultaneously into mesh with the drive motor pinion and with the platen drive gear. Adjustment is optimal at that point where the greatest depth of penetration is achieved, <u>short of bottoming</u> which would cause binding of the gear train.

(3) When this point is found, lock the idler gear in position by re-tightening the two hex head screws that were loosened in Step #1 above.

(4) Test the adjustment by first removing power from the machine and checking the mechanism by hand for any evidence of binding. With power off, the platen should rotate freely.

(5) Now restore power to the printer, and check for excessive backlash by rocking the platen gently against the restraining torque of the paper feed stepper motor.

(6) If necessary, repeat Steps #1 through #3 to obtain the best adjustment. Excessive play that cannot be adjusted out of the gear train must be corrected by replacement of worn parts. Output quality is the final criterion to be considered.

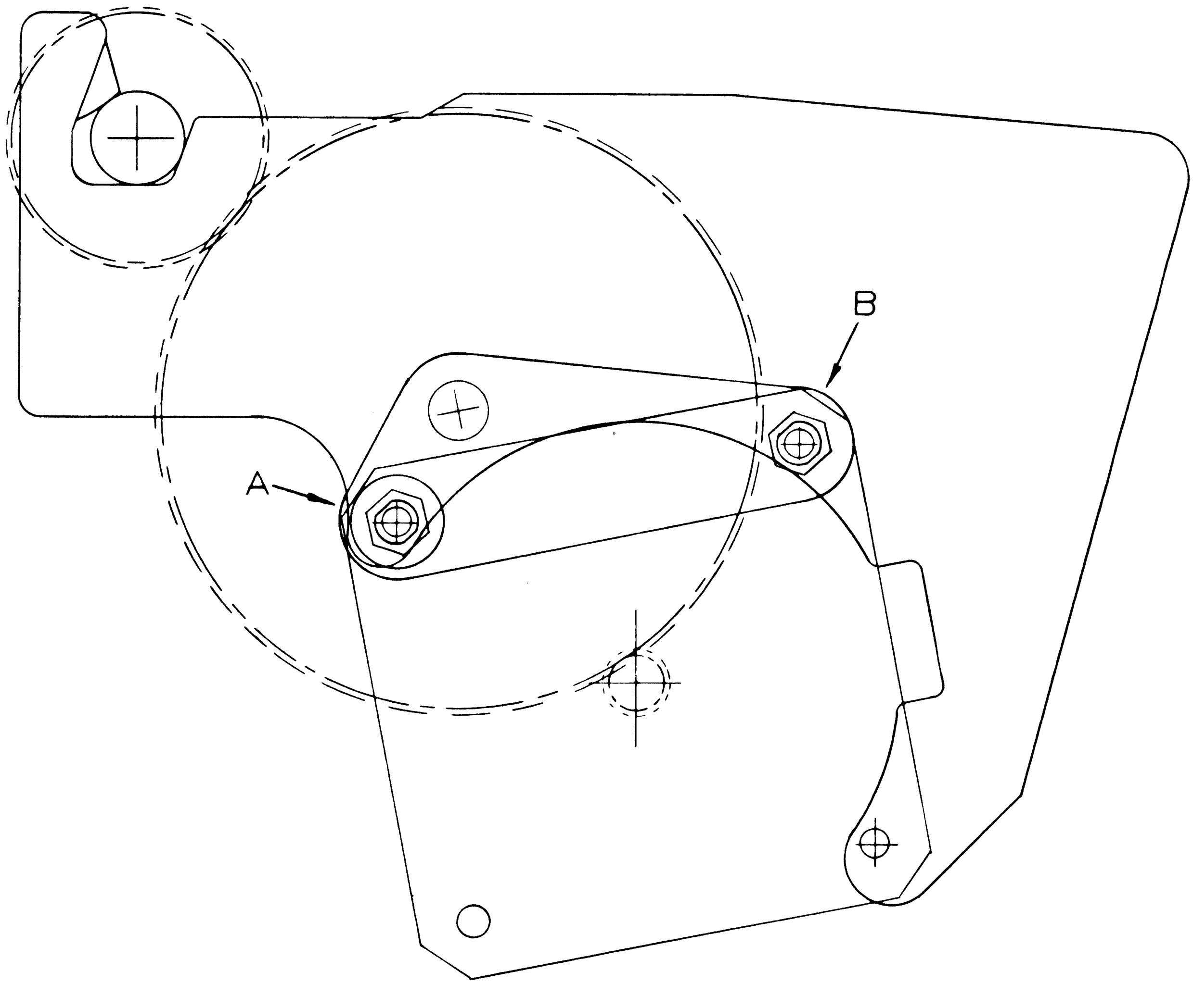


FIGURE 7-6

DRIVE GEAR ADJUSTMENT

PLATEN LATCH ADJUSTMENT

The platen latching levers are adjusted initially during manufacture and will not normally require further attention. Their alignment should be checked, however, at the same time the other platen adjustments are made. Re-adjustment of the levers is indicated if these parts are removed or replaced for any reason.

The adjustment is performed with the top cover of the printer removed. A 7/32" open-end wrench is required.

(1) Figure 7-7 shows the latch mechanism and indicates the critical dimension.

(2) If re-adjustment is necessary, remove the platen from the machine. Any attempt to make the adjustment while the platen is still in place can result in bending of the latch lever.

(3) With the platen removed, loosen the clamp screw that is used to retain the eccentric anchor.

(4) Use the 7/32" wrench to turn the eccentric in the direction of desired adjustment. Then re-tighten the retaining screw.

(5) Re-install the platen assembly.

(6) Again check the critical lever dimension, to determine the direction and amount of change.

(7) If the adjustment is not within acceptable tolerances, repeat Steps #3 through #6 until the desired adjustment is achieved.

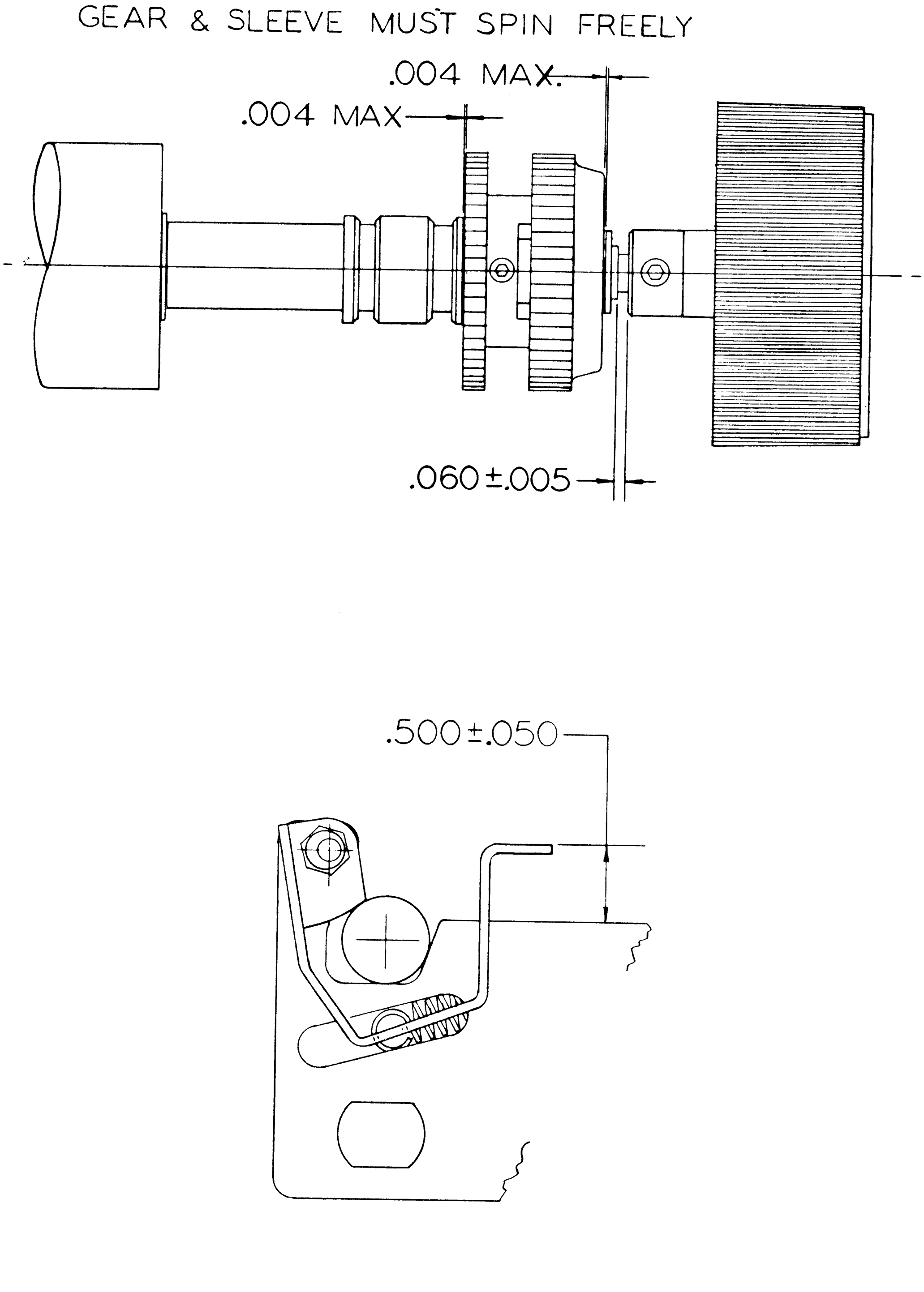


FIGURE 7-7
PLATEN LATCH ADJUSTMENT

(8) Repeat Steps #1 through #7 on the opposite side of the chassis.

(9) Check to be sure that the platen is released cleanly when the latch levers are operated. This completes the adjustment.

7.2.3 PAPER FEED ROLLER ADJUSTMENTS

Minor maladjustment of the paper feed rollers usually results in uneven paper feed, causing the paper to "creep" sideways as it passes through the feed mechanism. A more serious case of misalignment, however, can produce inadequate clearance between the feed rollers and the printwheel carriage, causing collision and possible damage. The paper feed rollers should be checked and re-adjusted following alignment of the platen, or any time that parts of the roller mechanism are removed or replaced.

These adjustments are interdependent. They should be performed as a group, in the order specified below. All adjustments are made with power OFF.

FEED ROLLER DEPTH ADJUSTMENT

Refer to Figure 7-8, which shows the mechanical details of one of the feed roller levers. There are four such arms in the printer. Note that the arm is anchored at a single pivot point (the hexagonal screw shown in the diagram), and that the feed rollers attached to this lever are held in place against the platen roller by spring tension. The object of the depth adjustment is to shift the anchor points of the four individual arms, relative to the platen, so that the feed rollers contact the platen evenly at the proper points.

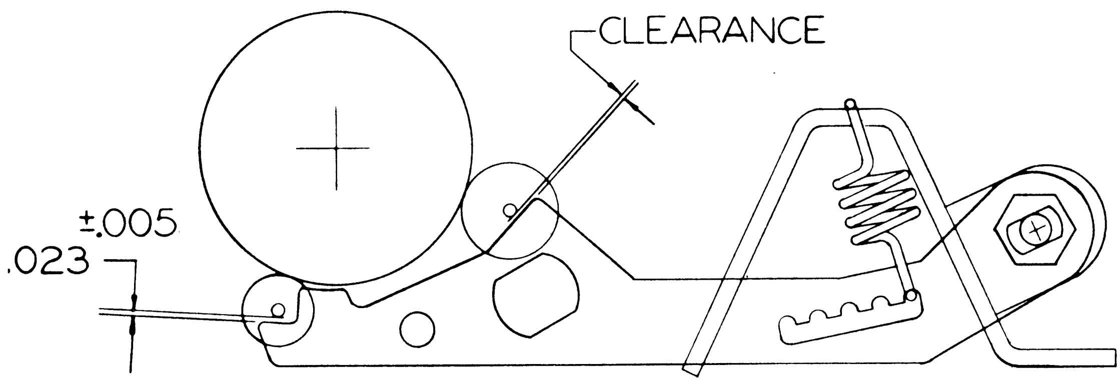


FIGURE 7-8

PAPER FEED ROLLER DEPTH ADJUSTMENT

With reference again to Figure 7-8, observe that the individual feed rollers are mounted on shafts which rotate in the journals of four crescent-shaped metal carriers (not shown in the diagram). Each crescent, in turn, is attached to one of the feed roller levers at a point midway between the two roller shafts. The crescent is therefore free to rock about the pivot point, distributing the tension of the retaining spring evenly between the two individual rollers.

As a result of this arrangement, the clearance between the shaft of the foremost roller and the feed roller arm will increase as the anchor point is shifted toward the platen. At the same time, the corresponding clearance between the rear feed roller shaft and the feed roller lever will decrease. By measuring these gaps with a feeler gauge, we are able to determine the proper setting of each of the lever anchors.

In order to perform this adjustment, it will be necessary to remove the middle cover from the printer. The two forward printed circuit boards must then be removed, to obtain access to the anchor points of the feed roller levers.

(1) Use two wrenches to loosen the anchor of the rightmost feed roller arm. Loosen the adjustment just enough to permit shifting the anchor with the pressure of your fingers.

(2) Push the feed roller arm all the way toward the front of the printer. Then use your screwdriver blade as a lever to move the anchor backwards, until the clearance is correct. Use a 0.023" feeler gauge to verify the dimension. See Figure 7-8.

(3) When the proper clearance is achieved, use your wrenches to retighten the anchor.

(4) After locking the adjustment, re-check the critical clearance, to be sure that it is correct.

(5) Repeat Steps #1 through #4 at each of the three remaining anchors, in turn. This completes the depth adjustment.

FEED ROLLER DISABLING LEVER ADJUSTMENT

Adjustment of the feed roller disabling levers insures that paper in the feed mechanism can be released smoothly, and that adequate clearance is established between the foremost feed rollers and the moving parts of the printwheel carriage assembly. This adjustment should be performed following readjustment of the paper feed roller depth and will normally be preceded by that adjustment. Refer to Figure 7-9.

(1) Remove the cradle (curved paper guide under the platen)

(2) Place the paper release lever in its extreme forward position.

(3) Wedge a ".135" feeler gauge at each location between the platen and the feed roller arms, as shown in Figure 7-9.

(4) Loosen the pinch bolts which clamp the four release levers to their actuating shaft.

(5) Rotate the release levers, until their protruding flanges rest lightly on the bottom edge of the oval cutouts in the feed roller arms, as shown in the diagram.

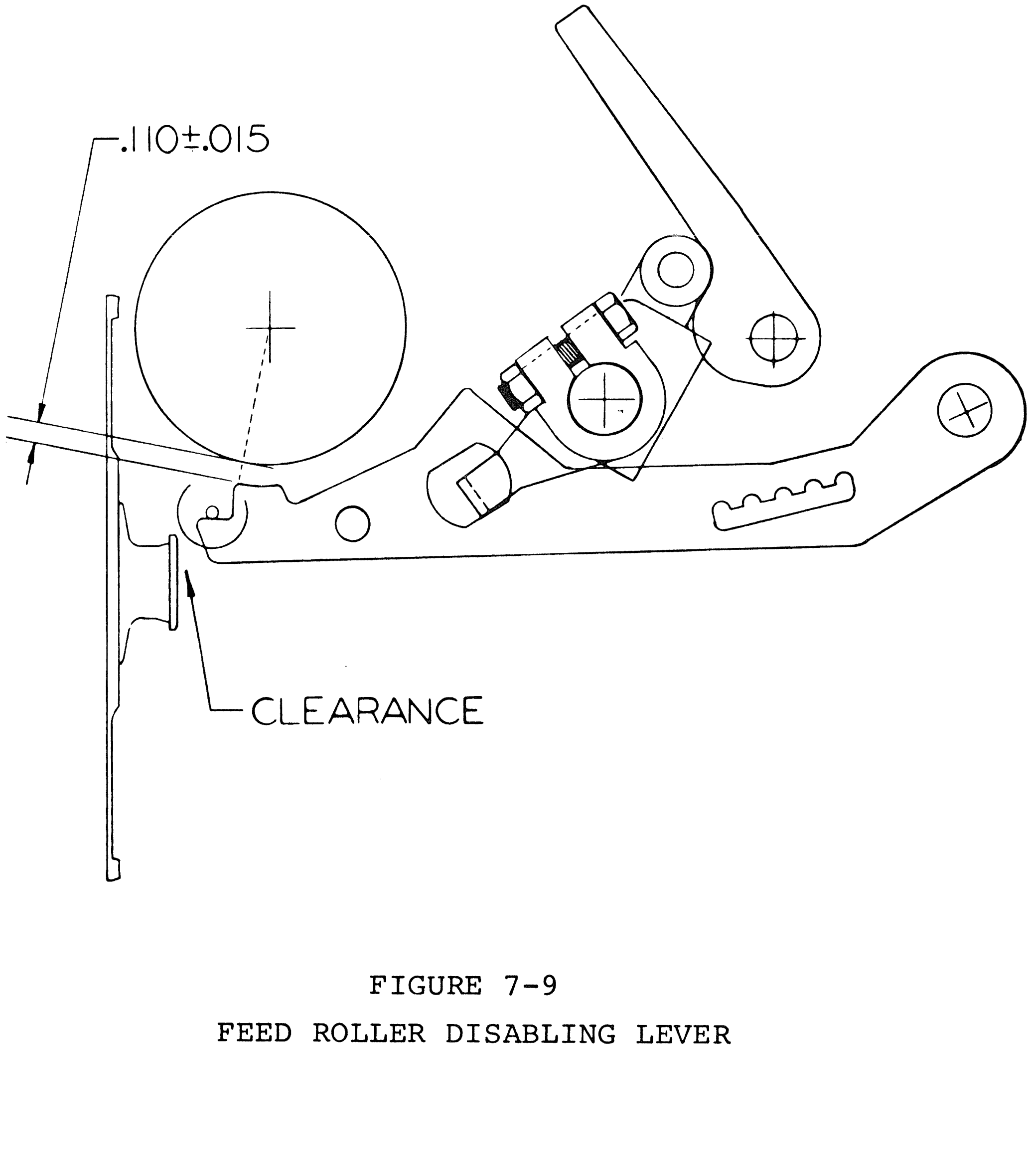


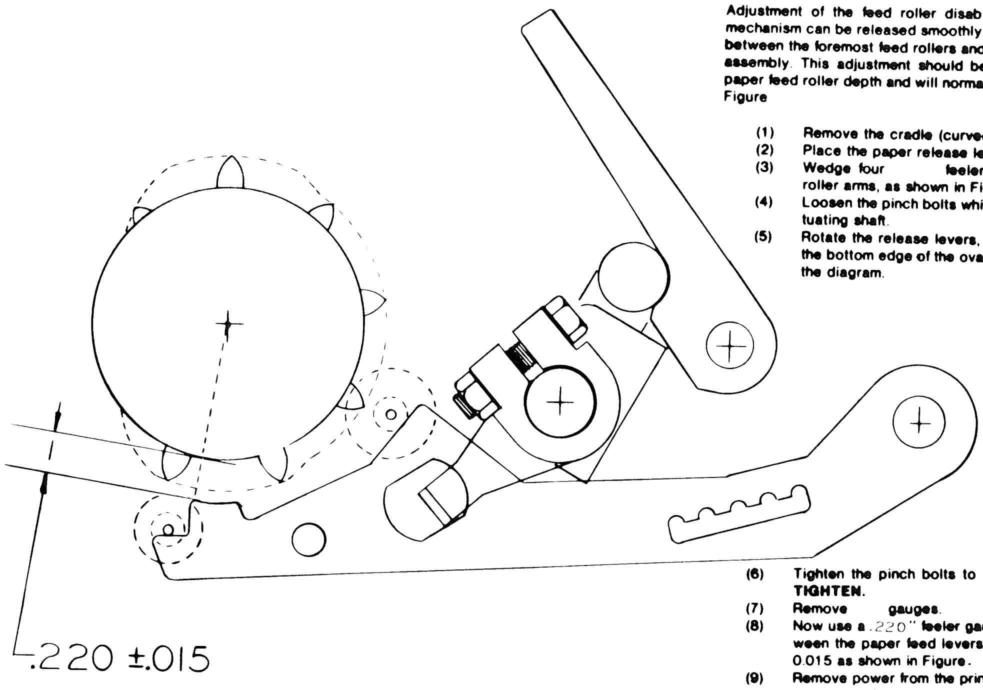
FIGURE 7-9

FEED ROLLER DISABLING LEVER

FEED ROLLER DISABLING LEVER ADJUSTMENT FOR SHORT PIN FEED PLATENS

Adjustment of the feed roller disabling levers insures that paper in the feed mechanism can be released smoothly, and that adequate clearance is established between the foremost feed rollers and the moving parts of the printwheel carriage assembly. This adjustment should be performed following re-adjustment of the paper feed roller depth and will normally be preceded by that adjustment. Refer to Figure

(1) **Remove the cradle (curved paper guide under the platen).**
(2) **Place the paper release lever in its extreme forward position.**
(3) **Wedge four feeler gauges between the platen and the feed roller arms, as shown in Figure.**
(4) **Loosen the pinch bolts which clamp the four release levers to their actuating shaft.**
(5) **Rotate the release levers, until their protruding flanges rest lightly on the bottom edge of the oval cutouts in the** *feed roller arms*, **as shown in the diagram.**



(6) **Tighten the pinch bolts to secure this adjustment. DO NOT OVER-TIGHTEN.**
(7) **Remove gauges.**
(8) **Now use a** .220" **feeler gauge to check the unloaded clearance between the paper feed levers and the platen, which should be** .220 ± **0.015 as shown in Figure.**
(9) **Remove power from the printer, and move the carriage through its entire range of travel. With the paper release lever in its extreme forward position, check to be sure that there is adequate clearance between the paper feed rollers and the printwheel hub.**
This completes the adjustment.

FEED ROLLER DISABLING ADJUSTMENT
FOR SHORT PIN FEED PLATENS -
7-9.1

(6) Tighten the pinch bolts to secure this adjustment. DO NOT OVERTIGHTEN.

(7) Remove .135 gauges.

(8) Now use a 0.110" feeler gauge to check the unloaded clearance between the paper feed levers and the platen, which should be 0.110 ± .015 as shown in Figure 7-9. For a pin feed platen of 12 inches or shorter, the clearance should be .220 ± .015. Refer to Figure 7-9.1.

(9) Remove power from the printer, and move the carriage through its entire range of travel. With the paper release lever in its extreme forward position, check to be sure that there is adequate clearance between the paper feed rollers and the printwheel hub, as shown in the diagram. This completes the adjustment.

7.2.4 CARRIAGE ADJUSTMENTS

Faulty adjustments in the carriage mechanism do not usually result in visible trouble symptoms, and for this reason they are seldom apparent to the untrained eye. Nevertheless, the proper adjustment of the carriage and its associated assemblies is essential to optimum performance and to the long service life of the printer.

CARRIAGE CABLE TENSION ADJUSTMENT

Carriage cable tension should be checked and adjusted whenever carriage, servomotor, or the cables are removed or replaced.

Normal stretch in the cable itself may make re-adjustment necessary after a long period in service.

(1) Refer to Figure 7-10, which shows the tension adjustment. Note that this calls for lengthening or shortening the effective length of the cable, until the shaft of the spring-loaded pulley is centered in the hole of the pulley mounting bracket on the right side of the chassis. When the spring flexure has been installed, refer to Figure 7-10.1 which shows the adjustment using gauge No. 80738. Slide this gauge along the side frame, touching the underside of the pulley. Cable tension is correct when the ball bearing is aligned with the gauge opening.

(2) To make the adjustment, use a pair of pliers to hold the flatted portion of the swaged fitting attached to the end of the drive cable. This precaution must be observed, to avoid imparting any unwanted twist to the drive cable.

(3) Use a 3/16" wrench to turn the adjustment nut Ⓐ shown in the illustration, until the desired adjustment is obtained. This completes the tension adjustment.

LEFT MARGIN PHOTO SENSOR

The position of the optical sensor at the left limit of carriage travel will determine the starting position of the carriage when the printer is initialized. Re-positioning of the sensor will be required following removal or replacement of the carriage or the sensor itself.

(1) With power applied to the printer, initialize the printer by using a test lead to apply a momentary ground to pin #16 of the rear panel interface connector, J2 (refer to Figure 2-2 for connector orientation).

(2) Use a graduated rule to measure the distance between the axis of the printhammer and the left chassis side plate, as shown in Figure 7-11. Visual accuracy is acceptable. The adjustment should be correct within $\pm 0.020"$.

(3) If the dimension observed is not within the specified tolerance, loosen the two retaining screws that hold the sensor unit in place.

(4) Re-position the sensor to correct for the observed error, and tighten the two retaining screws.

(5) Repeat Steps #1 through #4, until the proper geometry is obtained. This completes the adjustment of the optical stop.

CARD GUIDE DEPTH ADJUSTMENT

The card guide depth adjustment establishes the proper operating clearance between the plastic card guide and the surface of the platen. Take care in adjusting the depth to be certain that there is no interference between the card guide and the stationary paper feed rollers (Figure 7-13).

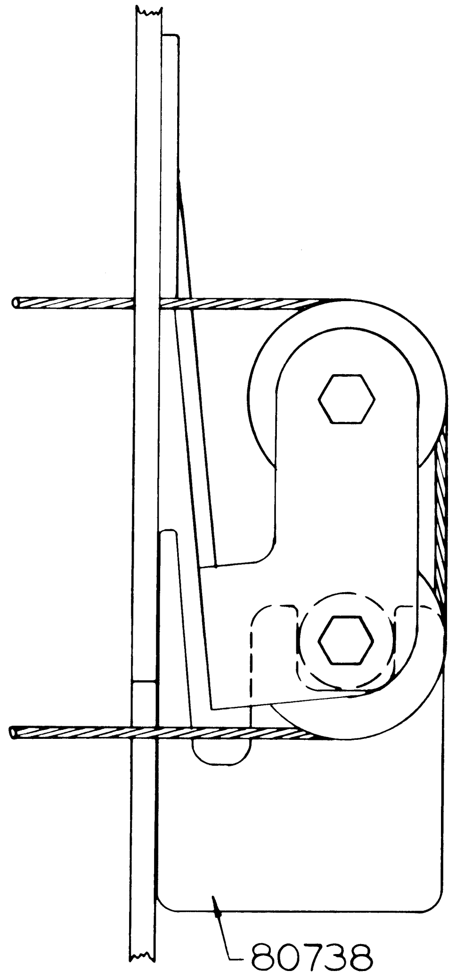


FIG. 7-10.1

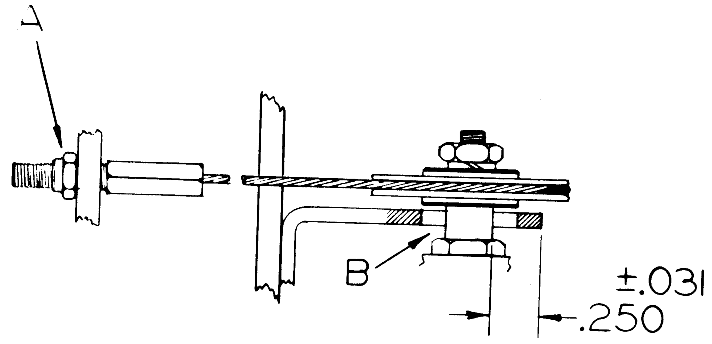


FIGURE 7-10
CARRIAGE CABLE TENSION ADJUSTMENT

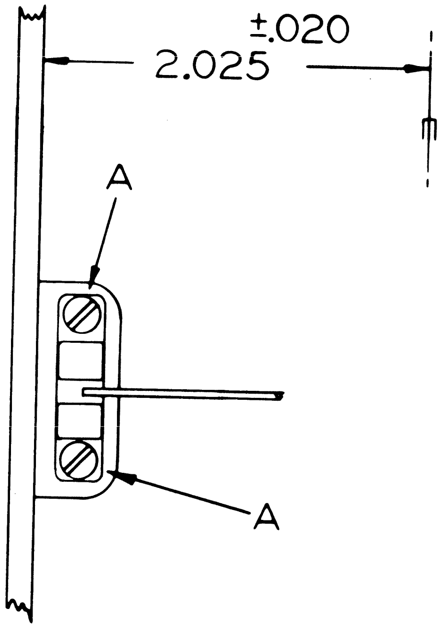


FIGURE 7-11
LEFT LIMIT PHOTOSENSOR

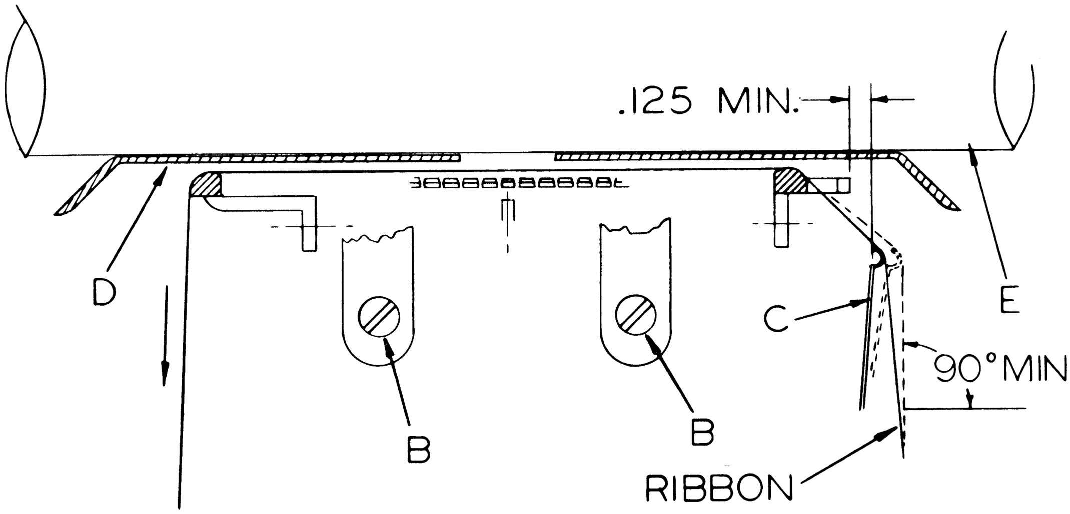


FIGURE 7-12
CARD GUIDE DEPTH ADJUSTMENT

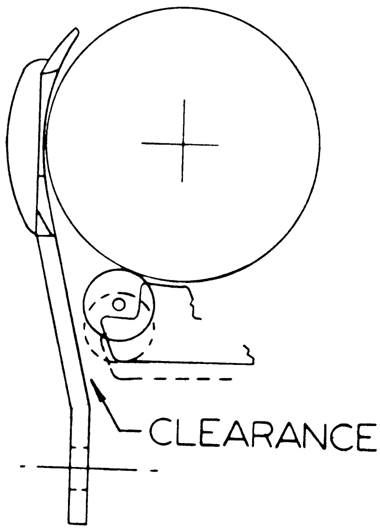


FIGURE 7-13
CRITICAL CLEARANCE

Card guide depth should be checked following any adjustment to the platen or to the paper feed rollers. The printer's top cover section should be removed. A screwdriver is the only tool required.

(1) Remove power from the printer. Place the forms thickness selector lever in its extreme forward position. Remove ribbon cartridge and printwheel.

(2) Refer to Figure 7-12. Loosen the two screws (B) that secure the card guide's support stanchions.

(3) Move the card guide toward the platen, so that it is parallel to the platen's working surface, until the guide just grazes the platen or even contacts the platen under a very slight preload.

(4) Re-tighten the two screws that were loosened in Step #2 above, to secure this adjustment.

(5) Move the forms thickness selector lever to the rear. The tension of the card guide against the platen surface should <u>not</u> be so great that the card guide follows the platen to the rear.

(6) Move the carriage assembly by hand throughout the full range of its travel, and ensure that the card guide slides freely over the platen's working surface. At the same time, observe that there is adequate clearance between the guide and the forward paper feed rollers, as shown in Figure 7-13, when the paper release lever is in its extreme forward position (released). If necessary, repeat Steps #2 through #5. This completes the adjustment.

CARD GUIDE REGISTRATION ADJUSTMENT

The reference marks inscribed on the card guide should appear as in Figure 7-14. Registration should be re-checked following adjustment of the card guide depth, or any time that it is sufficiently imperfect to inconvenience the operator.

The easiest way to check registration is to print two consecutive lines of capital "I", at a standard spacing of six lines per inch. If the reference marks are in error, it will be necessary to adjust the card guide.

Adjustment may be made with the top cover of the printer removed. An offset screwdriver will be helpful in adjusting some printers. Later versions of the printer use socket head screws or hex head screws and require an Allen wrench or open-end wrench for the adjustment.

(1) First adjust the vertical alignment, by disabling the CARR test switch on the #1 printed circuits board, and moving the carriage to the center of the line.

(2) Loosen the two retaining screws (A) shown in Figure 7-14.

(3) Position the card guide to obtain the best alignment of the horizontal registration marks and the printed line, as shown in the diagram.

(4) Secure the card guide by re-tightening the two retaining screws.

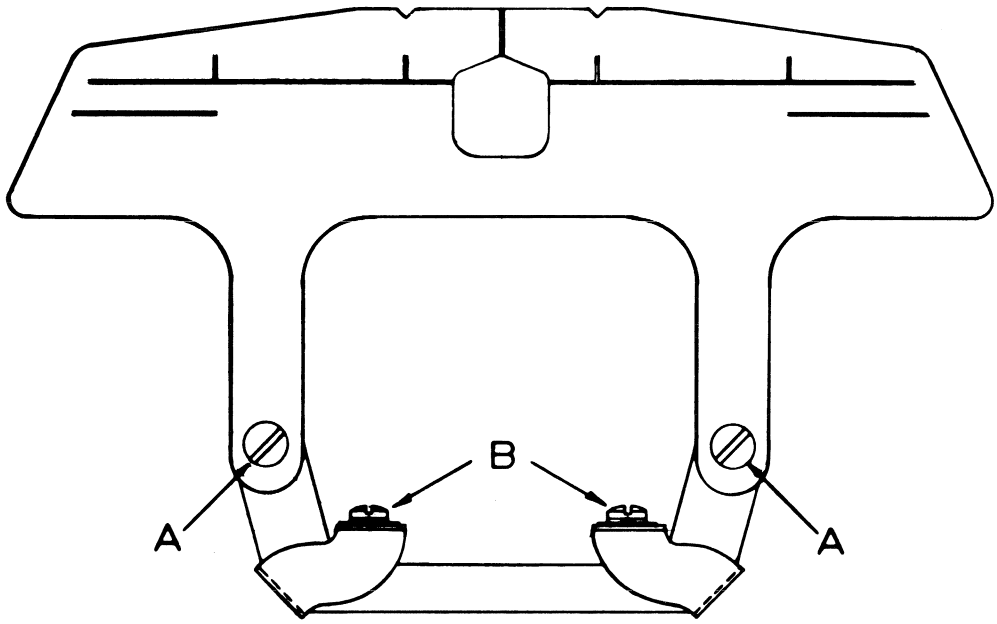


FIGURE 7-14

CARD GUIDE REGISTRATION

(5) Next adjust the lateral alignment of the guide. Move the carriage to the approximate center of the page, return the CARR test switch to its normal operating position, and print a single capital "I" for reference.

(6) If the vertical registration mark does not bisect the printed character, loosen the two retaining screws (B) shown in Figure 7-14.

(7) Position the card guide to obtain the best adjustment and secure it in place by re-tightening the two retaining screws.

(8) Again check the vertical alignment and re-adjust as necessary. This completes the registration adjustment.

7.2.5 RIBBON ADJUSTMENT

The only ribbon adjustment that requires attention in normal service is the ribbon lift height adjustment. This adjustment should be performed following replacement of the ribbon lift solenoid and following repair of replacement of damaged components. Occasionally it will be found that operator error has resulted in bending and misalignment of parts in the ribbon lift mechanism. The height adjustment should be re-checked at the time such a condition is corrected.

RIBBON LIFT HEIGHT ADJUSTMENT

The ribbon lift height adjustment should be checked by connecting the test exerciser to the printer and printing alternately the apostrophe (') and the underline (_). These two symbols represent the highest and lowest characters and should be the same distance from the top and bottom edge of the ribbon. Examine the ribbon, which should appear as in Figure 7-15, to determine whether the adjustment is necessary. If the symbols do not strike the ribbon as shown, proceed as follows:

(1) Use a screwdriver to loosen the two solenoid retaining screws (A) shown in the diagram.

(2) With the ribbon raised, position the solenoid to obtain a more favorable point of impact.

(3) Clamp the solenoid in place, by tightening the two retaining screws.

(4) Re-check the printing height, and repeat the preceding steps if necessary. This completes the height adjustment.

RIBBON DRIVE GEAR ADJUSTMENT

The drive gear on the ribbon motor must rotate freely with the large gear on the ribbon clutch and must be adjusted for minimum blacklash. Refer to 7-16.

(1) To adjust, loosen screws (B) and adjust location of motor. Tighten (B) .

(2) If insufficient adjustment is available by moving motor (Step #1) loosen fasteners (A) and adjust location of plate. Tighten fasteners (A) .

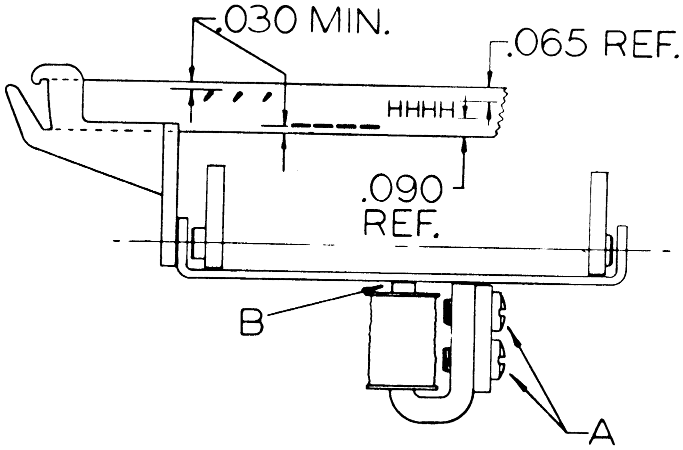


FIGURE 7-15
RIBBON HEIGHT ADJUSTMENT

7.2.6 CHASSIS

The only chassis adjustment that requires attention in normal service is the mother board alignment.

MOTHER BOARD ALIGNMENT

The mother board is aligned at the factory during assembly of the printer. It will seldom require further attention, but there may be some occasional difficulty in inserting and removing the power and interface connectors at the rear of the printer. Re-alignment is necessary in order to center the mother board's two connector tongues in the cutouts on the rear chassis panel. Proceed as follows:

(1) Remove power from the printer, and disconnect the interface and power plugs.

(2) Remove the top and middle cover sections from the printer, and withdraw the three printed circuit boards.

(3) Locate and loosen the eight pan-head screws that secure the mother board to standoffs on the printer's chassis.

(4) Re-insert the power and interface connectors in their respective positions, and tighten down the jackscrews that hold these connectors in place.

(5) Now re-tighten the eight retaining screws that secure the mother board to its standoffs. This completes the adjustment.

DUAL CARRIAGE BEARING CARRIER ALIGNMENT

The model S3-55 and the Widetrack printers are equipped with a dual carriage bearing carrier. This alignment procedure is necessary only when the carriage or bearing carrier are replaced.

To align the bearing carrier, proceed as follows:

(1) Prior to installing carriage in printer, install 1/2" carriage shaft under dual bearing carrier.

(2) Install tensioner spring loading dual bearing carrier against shaft.

(3) The centerline of the dual bearing carrier must be in line with the centerline of the carriage shaft.

(4) Move the shaft back and forth. The bearing carrier must not tilt or rock in any way. If so, bearings are not aligned properly.

(5) If alignment is necessary, grasp link with pliers at point A refer to Figure 7-17 and twist carefully until carrier is aligned properly. Repeat steps 4 and 5 until alignment is correct.

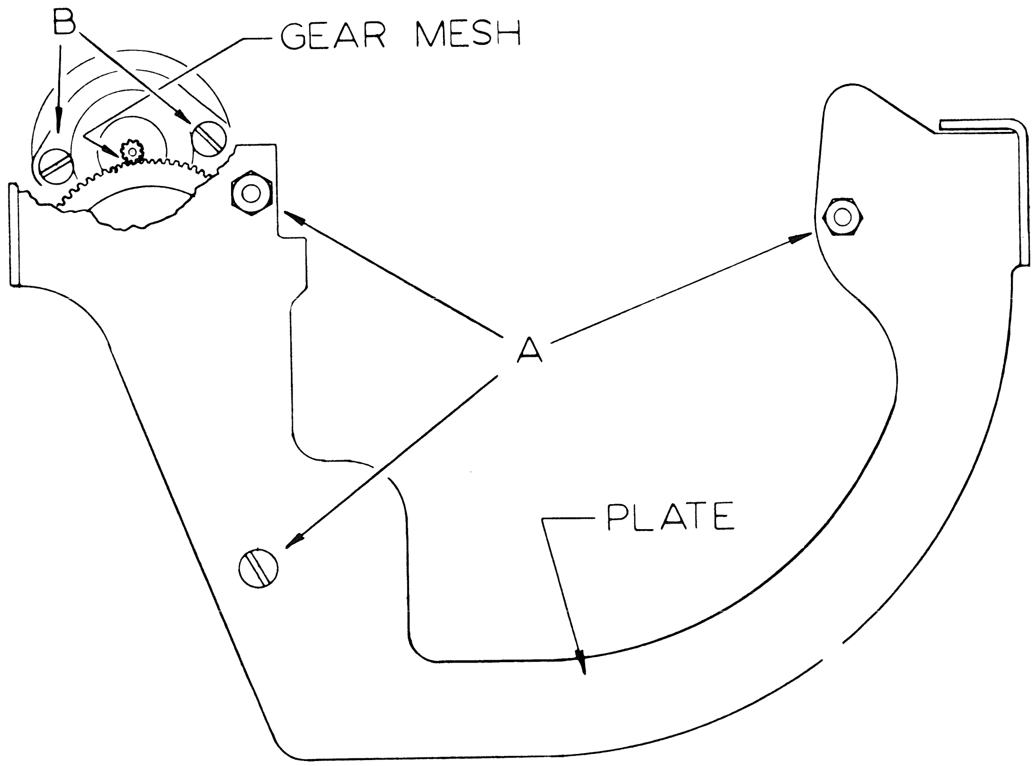


FIGURE 7-16
RIBBON DRIVE GEAR ADJUSTMENT

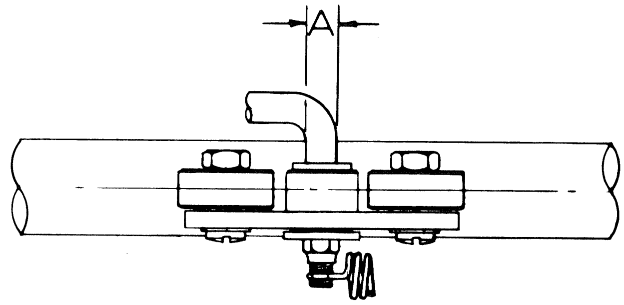


FIGURE 7-17
DUAL CARRIAGE BEARING CARRIER ALIGNMENT

CHAPTER VIII
ILLUSTRATED PARTS LIST

The following drawings show how the printer is put together. They will be a useful reference during maintenance, and will help you identify broken or missing parts. When replacing parts, always refer to the alignment instruction in Chapter VII, to be sure that you have correctly observed all the necessary adjustments.

Note that the printer mechanism has been divided into four sub-assemblies:

(a) structure (chassis)
(b) platen carrier
(c) upper carriage
(d) lower carriage

Each of these basic sub-assemblies is identified by an outline drawing in the upper righthand corner of the corresponding exploded view. The shaded portion identifies the sub-assembly and shows its relationship to the printer as a whole.

In the exploded view drawings, each part is identified by an index number, relating it to a description and to a Qume part number in the cross-reference listing. Refer to this part number and to the serial number of your machine when communicating with our customer service department.

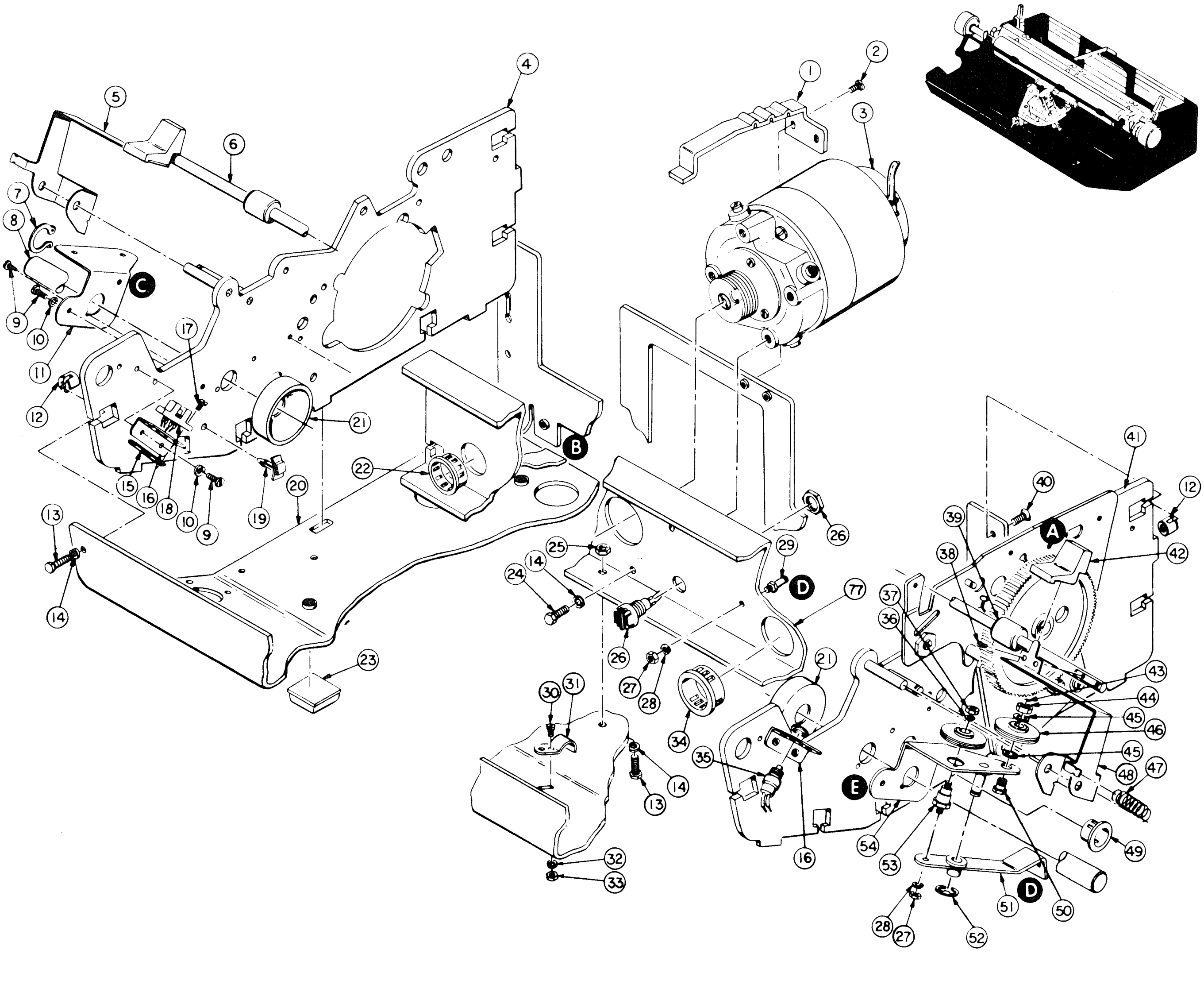


Figure 8-1. STRUCTURE ASSEMBLY

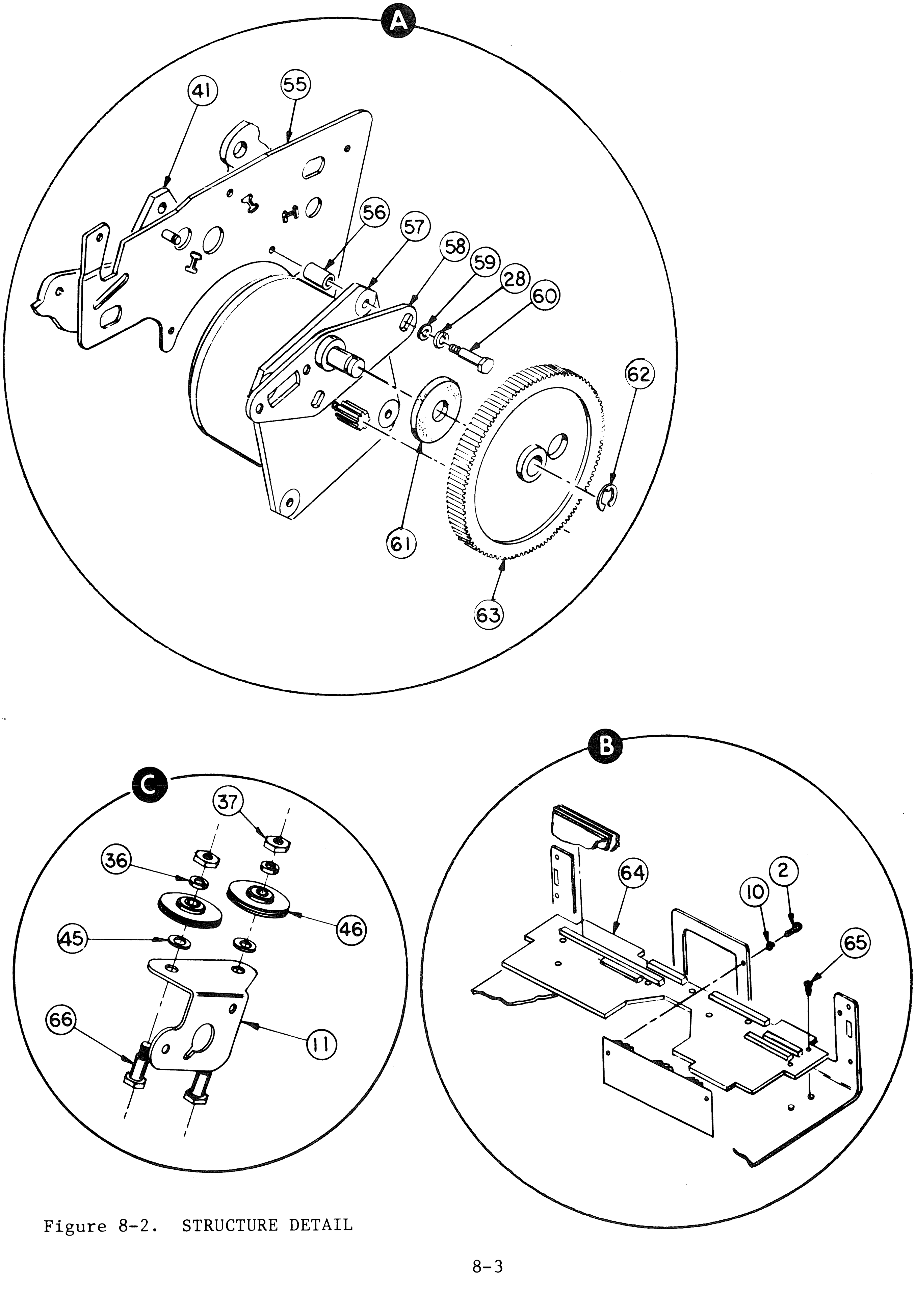
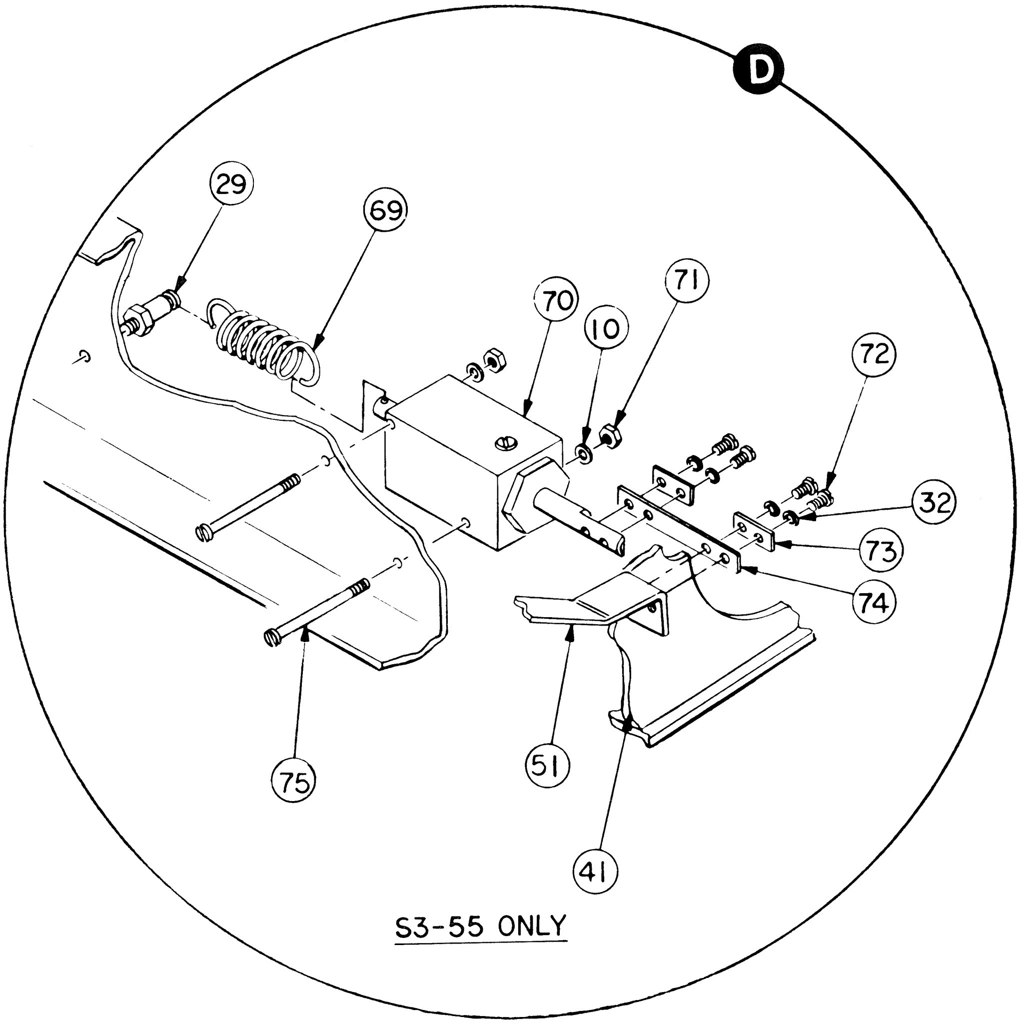


Figure 8-2. STRUCTURE DETAIL



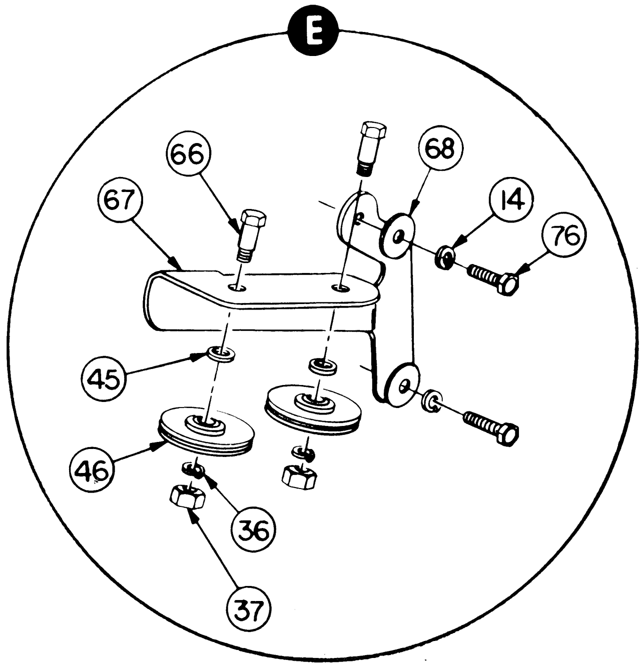


Figure 8-3. STRUCTURE DETAIL

STRUCTURE ASSEMBLY

ITEM	P/N	DESCRIPTION	QTY.
1	80408	Clamp-P.C.B.	1
2	85006-05	Screw 6-32 x .312 Pan Head	4
3	80023	Carriage Drive Motor	1
4	80048	Frame Asy Left Side	1
5	80257-01	Arm Bail Roller-Left	1
6	80259	Shaft-Bail Roller	1
7	85129-50	Grip Ring	4
8	80116	Shaft-Carriage Guide	2
9	85006-04	Screw 6-32 x .250 Pan Head	10
10	85124-06	Washer #6-32 Helical-Lock	12
11	80106-02	Bracket Pulley-Left	1
12	80220	Retainer Nut	16
13	85058-10	Screw 10-32 x .625 Hex Head	15
14	85124-10	Washer #10 Helical-Lock	19
15	80405	Bar Nut-Photo Sensor	1
16	80404	Bracket-Ribbon Advance	2
17	85004-04	Screw 4-40 x .250 Pan Head	6
18	80368	Photon Module	1
19	85159	Snap Grip-Wire Fastening	2
20	80049	Pan Asy-Bottom	1
21	80719	Bumper-Carriage Deceleration	2
22	85157-02	Snap Bushing	1
23	85152-01	Foot SJ5123 Grey	4
24	85058-08	SCREW 10-32 x .5 Hex Head	4
25	85122-10	Nut 10-32	3
26	80610	Resistor Asy-Hammer 5 OHM 20W	1
27	85122-08	Nut 8-32	1
28	85124-08	Washer #8 Helical-Lock	2
29	80666	Screw Stud Platen Spring	1
30	85004-06	Screw 4-40 x .375 Pan Head	2
31	80246	Clamp-Cable	1
32	85124-04	Washer Helical-Lock #4	6
33	85122-04	Nut 4-40	2
34	85157-03	Snap Bushing	1
35	94038	Pushbutton Switch Ribbon Feed	1
36	85124-05	Washer # 5- Helical-Lock	4
37	85122-05	Nut 5-40	4
38	85074-04	Screw 4-40 X .250 Flat Head	4
39	80329	Sleeve Bail Roller	3
40	85068-10	Screw 10-32 X .625 Flat Head	4
41	80050	Frame Asy-Right Side	1
42	80320-01	Lever - Platen Bail Chrome	2*

STRUCTURE ASSEMBLY

ITEM	P/N	DESCRIPTION	QTY.
42A	80320-02	Lever-Platen Bail Charcoal Gray	2*
42B	80320-03	Lever-Platen Bail Cordovan Brown	2*
43	85138-12	Clip 5103-12	1
44	85122-10	Nut 10-32	1
45	80109	Washer R.R Pulley	4
46	80037	Pulley Asy-Idler	4
47	80237	Spring-Extension	2
48	80257-02	Arm Bail Roller-Right	1
49	85157-04	Snap Bushing	1
50	80108	Bushing R.R Pulley	1
51	80673	Link Asy S3-55	1
52	85128-25	"E" Ring	2
53	80107	Stud	1
54	80106	Bracket Asy-Pulley Right	1
55	80040	Frame Asy-Platen	1
56	80197-01	Spacer Motor Mount	3
56A	80197-02	Spacer Phillips Motor Mount	3
57	80046-01	Motor Asy-Paper Feed Low Current	1
57A	80046-02	Motor Asy-Paper Feed	1
58	80339	Plate Asy-Idler Gear	1
59	85125-08	Washer 8-32 Narrow Plain	3
60	85057-14	Screw 8-32 X .875 Hex Head	3
61	80398	Felt Washer	1
62	85128-31	E-Ring X5133-31	1
63	80202	Gear-Idler	1
64	90602	Printer Motherboard	1
65	85008-08	Screw 10-32 X .5 Pan Head	8
66	80523	Screw-Left Cable Pulley	4
67	80685	Bracket Pulley Right	1
68	85126-10	Washer #10 Plain	2
69	80664	Spring S3-55	1
70	80674	Dash Pot S3-55	1
71	85122-06	Nut 6-32 S3-55	2
72	85004-04	Screw 4-40 X .250 S3-55	4
73	80671	Plate S3-55	2
74	80665	Link S3-55	1
75	85006-20	Screw 6-32 1.250 Pan Head S3-55	2
76	85058-12	Screw 10-32 X .750 Hex Head	2
77	80223	Brace Carriage Motor Mount	1

* Optional

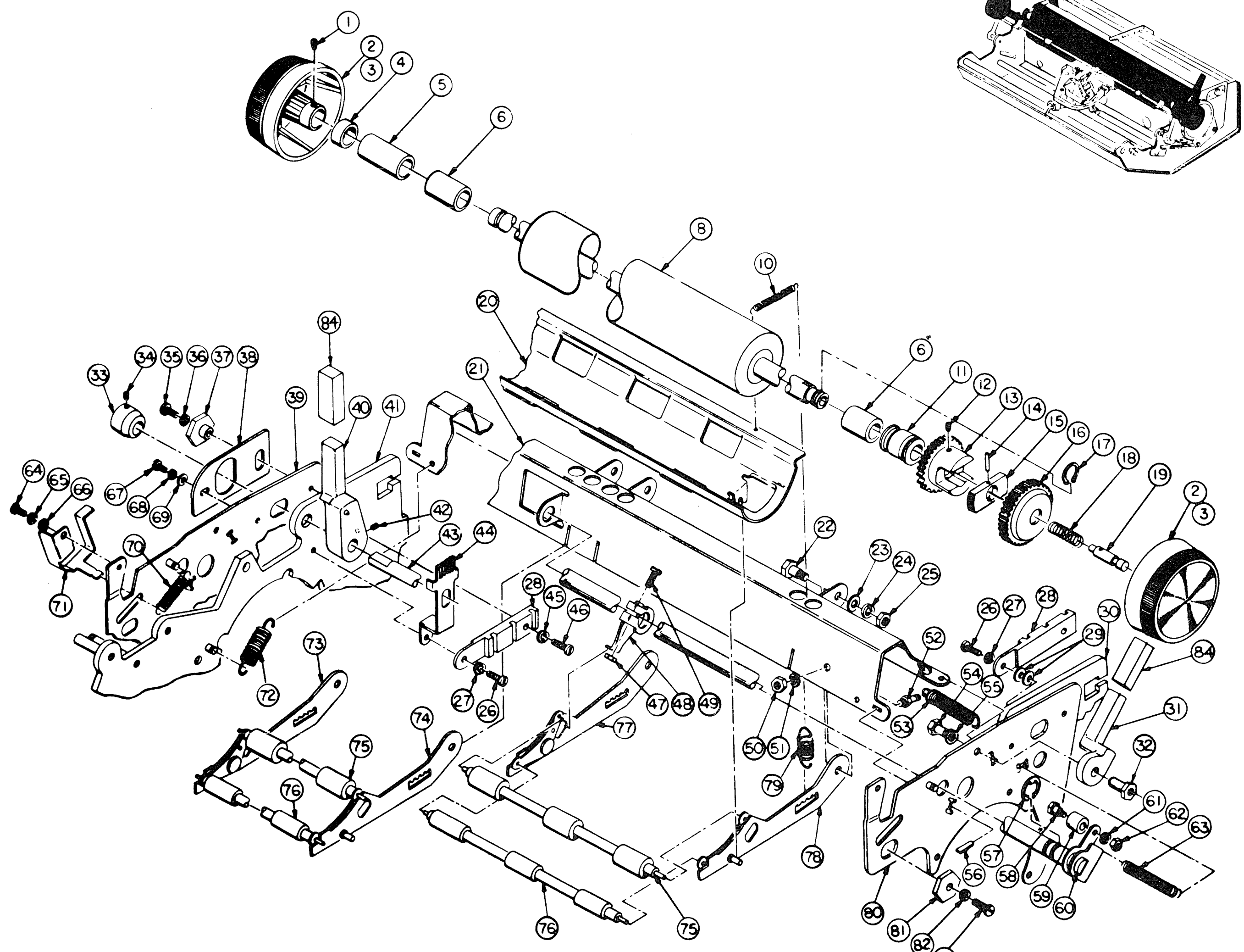


Figure 8-4. PLATEN CARRIER ASSEMBLY

PLATEN CARRIER ASSEMBLY

ITEM	P/N	DESCRIPTION	QTY.
1	85207-02	Screw 8-32 x 1/8 Splined Socket	2
2	80045-01	Knob Asy Platen Charcoal Grey	2
3	80045-02	Knob Asy Platen Cordovan Brown	2*
4	80513-02	Spacer-Platen	1
5	80515	Spacer-Platen	1
6	80513-01	Spacer-Platen	2
7		Deleted	
8	80022-01	Platen, Rubber	1
9		Deleted	
10	80334	Spring, Cradle	2
11	80514	Spacer-Platen	1
12	85206-04	Screw 6-32 x 1/4 Splined Socket	2
13	80175	Gear - Tractor Drive	1
14	85237-04	Groove Pin .062 x .500	1
15	80176	Driver - Plain	1
16	80177	Gear - Platen	1
17	85129-31	Grip Ring 5555-31	1
18	80198	Spring - Compression	1
19	80594	Push Shaft - Platen	1
20	80032	Cradle Asy	1
21	80130	Brace - Platen	1
22	80159	Screw - Shoulder Feed Arm	4
23	85125-08	Washer #8 Narrow - Plain	4
24	85124-08	Washer #8 Helical - Lock	4
25	85122-08	Nut 8-32	4
26	85006-05	Screw 6-32 x .312 Pan Head	2
27	85124-06	Washer #6 Helical-Lock	2
28	80306	Guide-P.C. Board Mounting	2
29	85125-06	Washer	2
30	80050	Frame Asy Right Side	1
31	80160-01	Lever Casting - Feed Roller	1
32	80620	Shoulder Nut	1
33	80184	Eccentric - Impression Control	2
34	85206-03	Screw 6-32 x 3/16 Splined Socket	2
35	85007-06	Screw 8-32 x .375 Pan Head	2
36	85124-08	Washer #8 Helical-Lock	2
37	80181	Eccentric-Platen-Rear	2
38	80183	Platen-Impression Control	2
39	80040	Frame Asy-Platen	1
40	80186-01	Lever-Impression Control (FIN. OPS.)	1
41	80048	Frame Asy-Left Side	1
42	85207-04	Screw 8-32 x .250 Splined Socket	1
43	80185	Shaft	1
44	80187	Detent - Impression Control	1

PLATEN CARRIER ASSEMBLY

ITEM	P/N	DESCRIPTION	QTY.
45	85124-06	Washer #6 Helical-Lock	2
46	85006-08	Screw 6-32 X.5 Pan Hd	2
47	85122-66	Nut 6-32 x 5/16	4
48	80142	Bail-Feed Roller	4
49	85056-10	Screw 6-32 x .312 Hex Head	4
50	85122-08	Nut 8-32	1
51	85124-08	Washer #8 Helical-Lock	1
52	80172	Screw Stud-Platen Spring	1
53	80236	Spring Extension	1
54	85056-07	Screw 6-32 x 7/16	1
55	85124-06	Washer #6 Helical-Lock	1
56	80132	Wedge	4
57	85128-37	E-Ring 5133-37	2
58	80149	Screw-Shoulder-Cam Foller	1
59	80150	Roller-Cam Foller	1
60	80036	Shaft Asy-Feed Roll Disabling	1
61	85124-06	Washer #6 Helical-Lock	1
62	85122-66	Nut 6-32	1
63	80333	Spring-Cam Follower	1
64	85006-05	Screw 6-32x .312 Pan Head	2
65	85124-06	Washer #6 Helical-Lock	2
66	80156	Eccentric-Platen Latch	2
67	85007-05	Screw 8-32 x .312 Pan Head	2
68	85124-08	Washer #8 Helical-Lock	2
69	85125-08	Washer #8 Narrow-Plain	2
70	80234	Spring	2
71	80141	Latch-Platen	2
72	80237	Spring-Extension	2
73	80041	Arm Asy Feed Roller Left-Out	1
74	80042	Arm Asy Feed Roller Left-In	1
75	80154	Shaft-Rear Feed Roller	2
76	80153	Shaft-Front Feed Roller	2
77	80044	Arm Asy-Feed Roller Right-In	1
78	80043	Arm Asy-Feed Roller Right-Out	1
79	80598	Spring Extension-Feed Roller	4
80	80040	Frame Asy-Platen	1
81	80182	Eccentric-Platen, Front	2
82	85124-08	Washer #8 Helical-Lock	2
83	85007-08	Screw 10-32 x .500 Pan Head	2
84	80707-01	Plastic Cap Charcoal Grey	2*
84A	80707-02	Plastic Cap Cordovan Brown	2*

*OPTIONAL

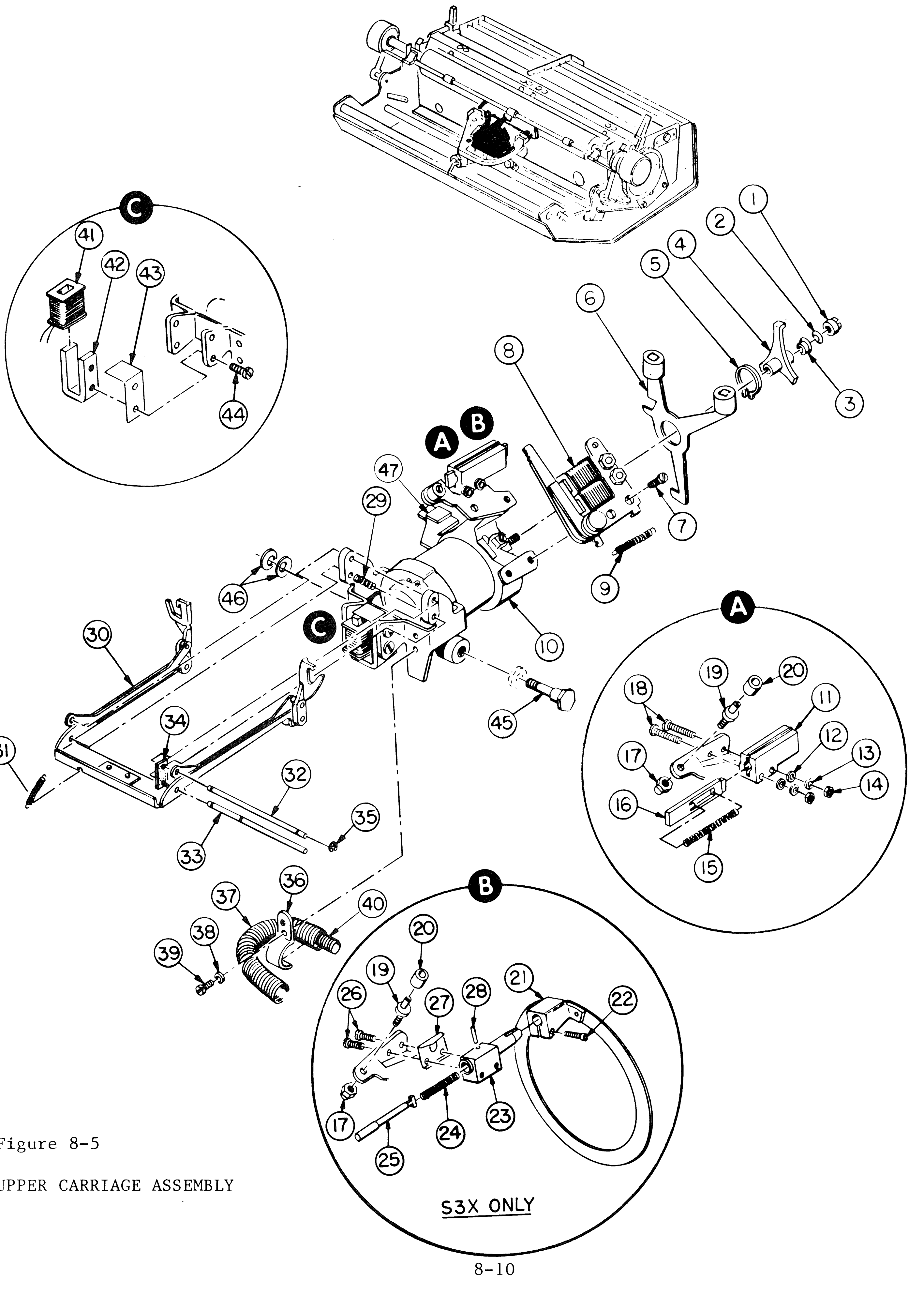


Figure 8-5

UPPER CARRIAGE ASSEMBLY

UPPER CARRIAGE ASSEMBLY

ITEM	P/N	DESCRIPTION	QTY
1	80256	Pilot-Print Wheel	1
2	85140-10	Belleville Washer AD 18.18	1
3	80407	Collet-Print Disk	1
4	80376	Hub-Printwheel Disk	1
5	85145-50	Retainer 5100-50	1
6	80375	Latch Asy-Print Motor	1
7	85004-04	Screw 4-40 X .250 Pan Head	3
8	80369-02	Armature Asy Hammer	1
9	80387	Spring Hammer Arm	1
10	80336-01	Motor/Encoder Asy Round S3-55	1
10A	80336-02	Motor/Encoder Asy Square	1
11	80687	Hammer Guide	1
12	85125-03	Flat Washer #3	2
13	85124-03	Washer #3 Helical Lock	2
14	85122-03	Nut 3-48	2
15	80713	Spring Hammer	1
16	80686	Hammer, Character	1
17	85137-05	Nut 5-40 Self Locking	2
18	85003-10	Screw 3-48	2
19	80135	Eccentric-Hammer Arm	2
20	80136	Bumper-Hammer	2
21	80729	Print Wheel Dampner S3X	1
22	85084-06	Screw S3X	1
23	80716	Hammer Guide S3X	1
24	80728	Spring S3X	1
25	85179-04	Hammer S3X	1
26	85003-05	Screw 3-48 X .312 S3X	2
27	80718	Retainer S3X	1
28	85000-01	Needle Roll .0625 X .375 S3X	1
29	80343	Spring Compression	1
30	80380	Bail Asy-Ribbon Lift	1
31	80476	Spring	1
32	80155	Shaft-Ribbon Link	1
33	80158	Shaft-Ribbon Bail	1
34	80403	Felt Pad-Ribbon Lift	2
35	85128-06	E-Ring Y5133-6	4
36	80246	Clamp Cable	1
37	80614	Spring Carriage Conductors	1
38	85124-04	Washer #4 Helical Lock	2
39	85004-04	Screw 4-40 X .250 Pan Head	2
40	80613	Spring-Inner Carriage Conductors	1
41	80379	Coil-Ribbon Lift	1
42	80147	Ribbon Magnet Core-Finished	1
43	80401	Shim-Ribbon Magnet	1
44	85004-04	Screw 4-40 X .250 Pan Head	4
45	80248	Pivot Print Motor Housing	2
46	85140-01	Belleville Washer	2
47	80374-02	Ribbon Bail Pad	1

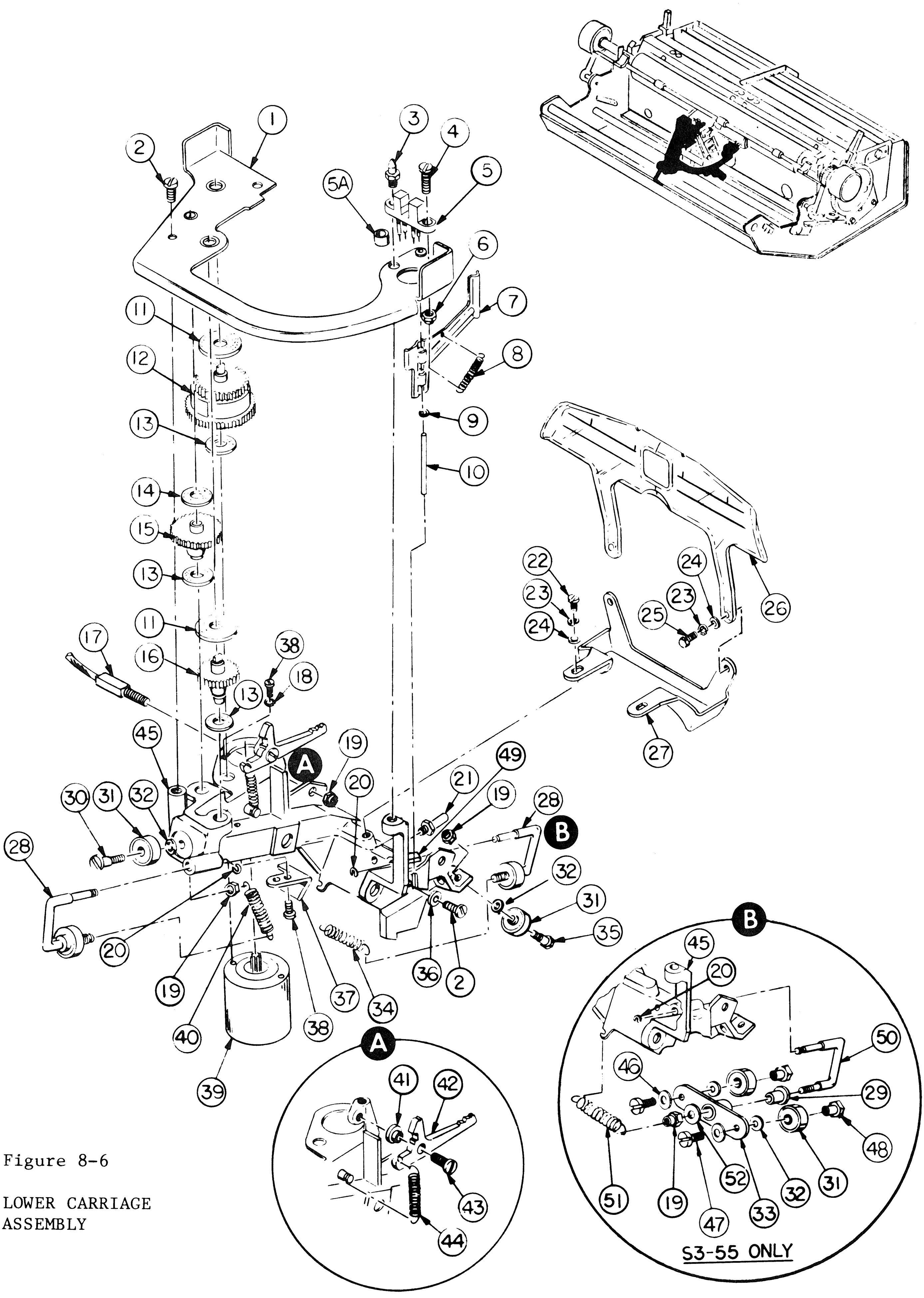


Figure 8-6

LOWER CARRIAGE ASSEMBLY

LOWER CARRIAGE ASSEMBLY

ITEM	P/N	DESCRIPTION	QTY.
1	80058	Plate Asy-Ribbon Drive	1
2	85004-04	Screw 4-40 x .250 Pan Head	2
3	80296	Screw Stud	2
4	85004-06	Screw 4-40 x .375 Pan Head	1
5	80368	Photon Module	1
5A	80465	Spacer	2
6	85137-04	Nut 4-40 Self-Locking	1
7	80315	Tension Arm Ribbon Drive	1
8	80387	Spring Ribbon Tension Arm	1
9	80386	Washer	1
10	80316	Shaft Ribbon Tension Arm	1
11	80383	Felt Washer	2
12	80057	Clutch And Magnet Asy	1
13	80385	Felt Washer	3
14	80384	Felt Washer	1
15	80218	Idler Gear-44T-Ribbon Drive	1
16	80367	Gear Asy-36 Teeth	1
17	85127	Cable Carriage Drive	2
18	85124-04	Washer #4 Helical-Lock	2
19	85137-05	Nut 5-40 Self-Locking	6
20	85138-12	Clip 5103-12	2
21	80253	Stud-Print Motor Latch	1
22	85003-04	Screw 3-48 x .250 Pan Head	2
23	85124-03	Washer #3 Helical-Lock	4
24	85125-03	Washer #3 Narrow-Plain	4
25	85053-04	Screw 3-48 x .250 Hex Head	2
26	80312	Card Guide	1
27	80357	Bracket Asy	1
28	80358	Link Asy-Guide Bearing	2
29	80657	Bushing	1
30	80104	Screw Front Guide Bearing	1
31	85144-01	Bearing	7
32	80105	Washer-Guide Roller	5
33	80655	Bearing Plate Asy	1
34	80601	Spring-Extension	1
35	80103	Screw-Guide Bearing	4
36	85125-04	Washer #4 Narrow-Plain	1
37	80406	Shutter-Photo Sensor	1
38	85004-03	Screw 4-40 x .187 Pan Head	4
39	80207	Stepper-Motor Ribbon Drive	1
40	80119	Spring-Ext Front Carriage	1
41	80217	Bearing	1
42	80219	Latch	1
43	85004-05	Screw 4-40 x .312 PAN HEAD	1
44	80304	Spring	1
45	80356	Casting	1
46	85140-10	Belleville Washer	2
47	85004-05	Screw 4-40 X .312	2
48	80114	Shoulder Nut	2
49	80374-01	Pad Print Wheel Motor	1
50	80102	Link Asy S3-55	1
51	80681	Spring S3-55	1
52	85126-05	Washer #5 S3-55	1

CHAPTER IX

SCHEMATICS AND DRAWINGS

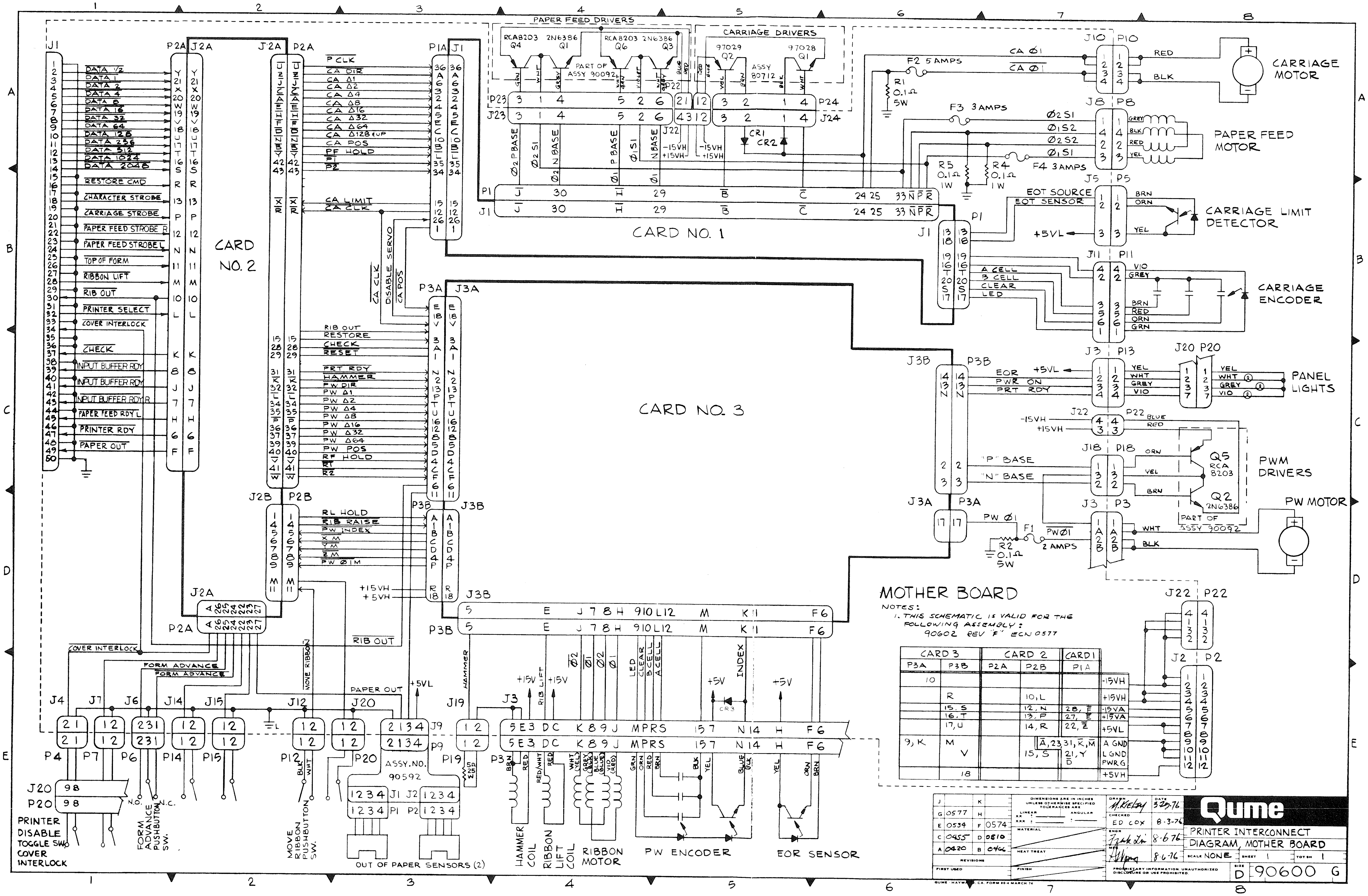


Figure 9-1 MOTHER BOARD SCHEMATIC

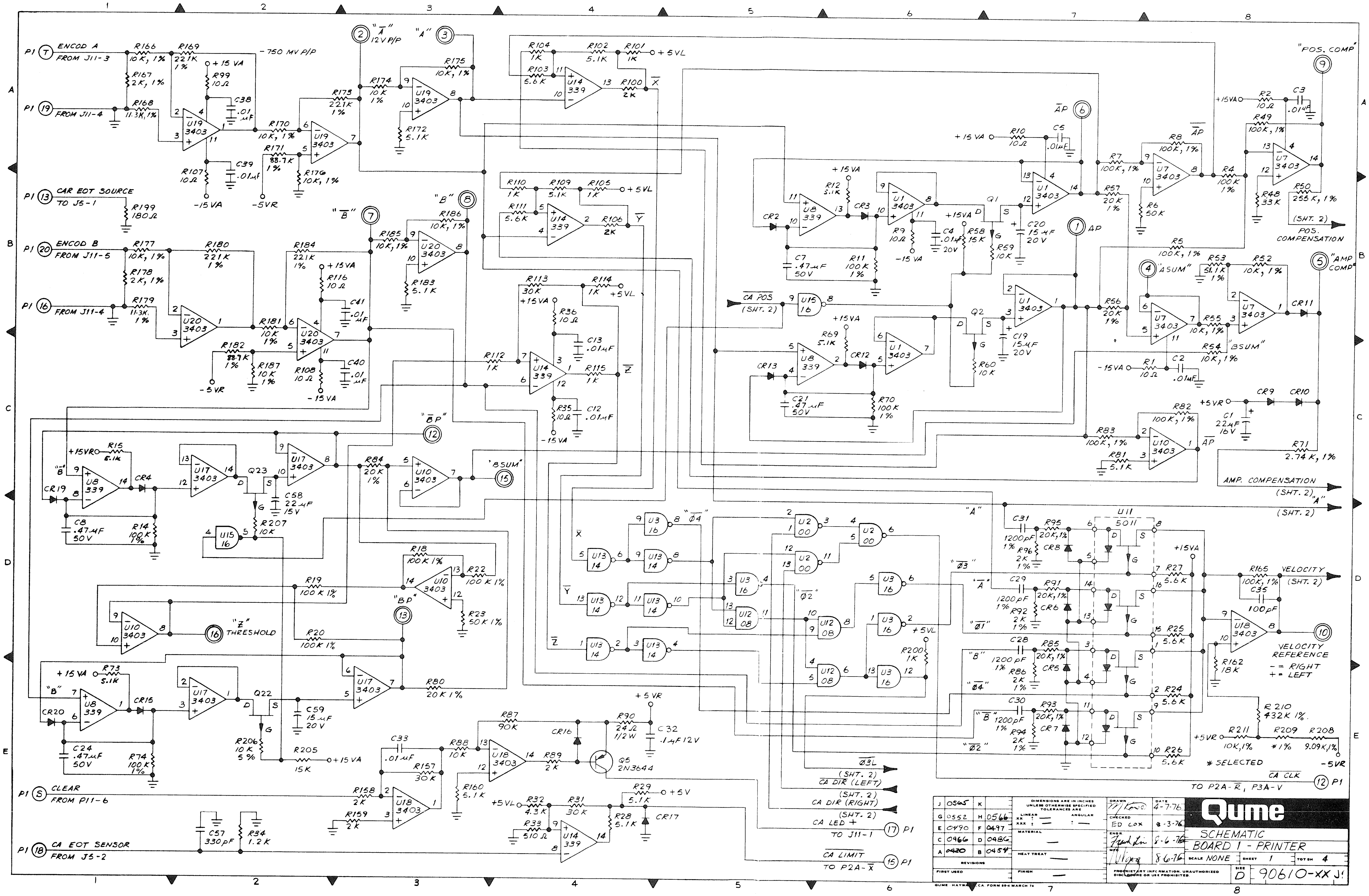


Figure 9-2 PC BOARD #1 SCHEMATIC (1 OF 4)

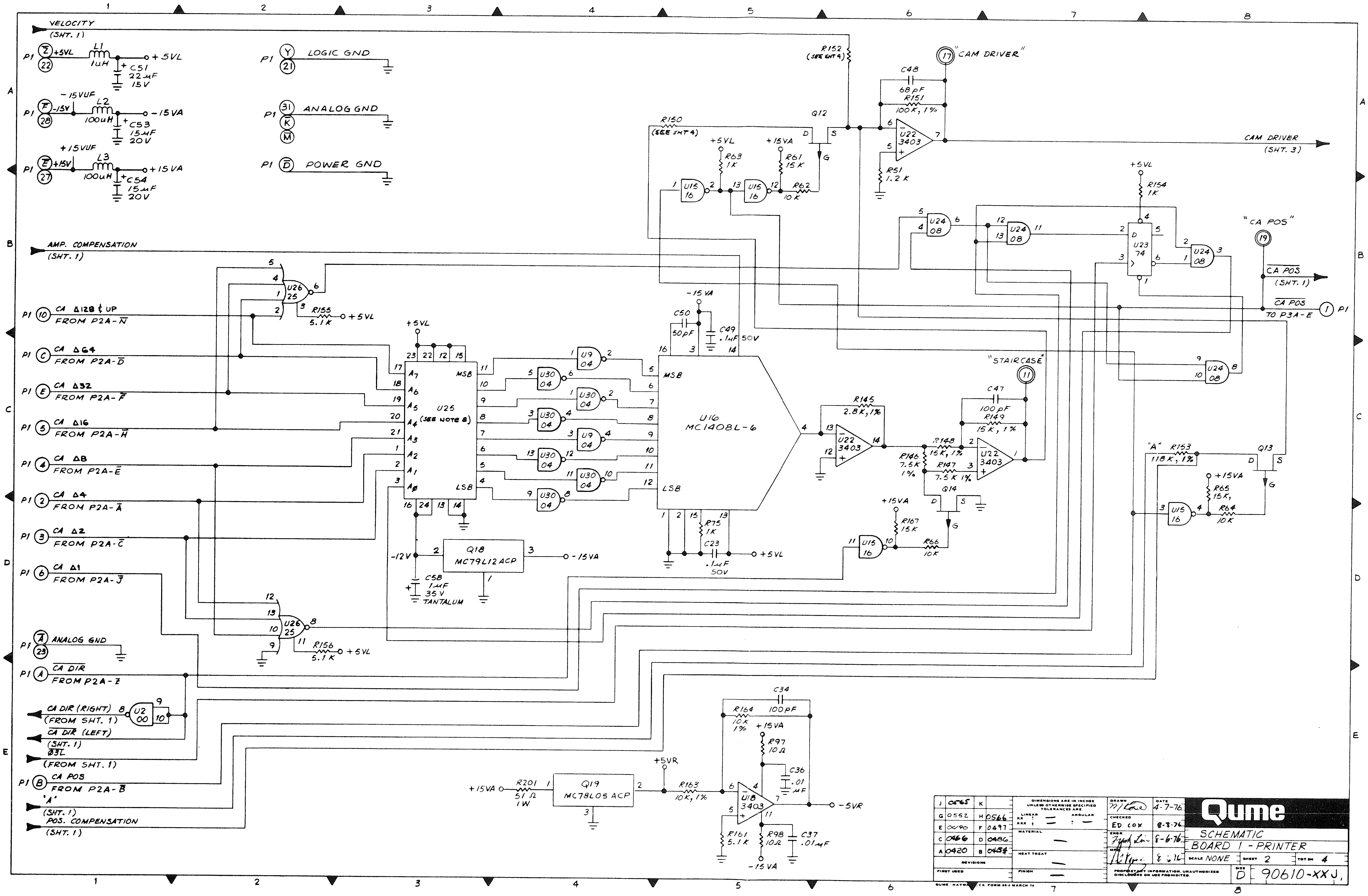


Figure 9-3 PC BOARD #1 SCHEMATIC (2 OF 4)

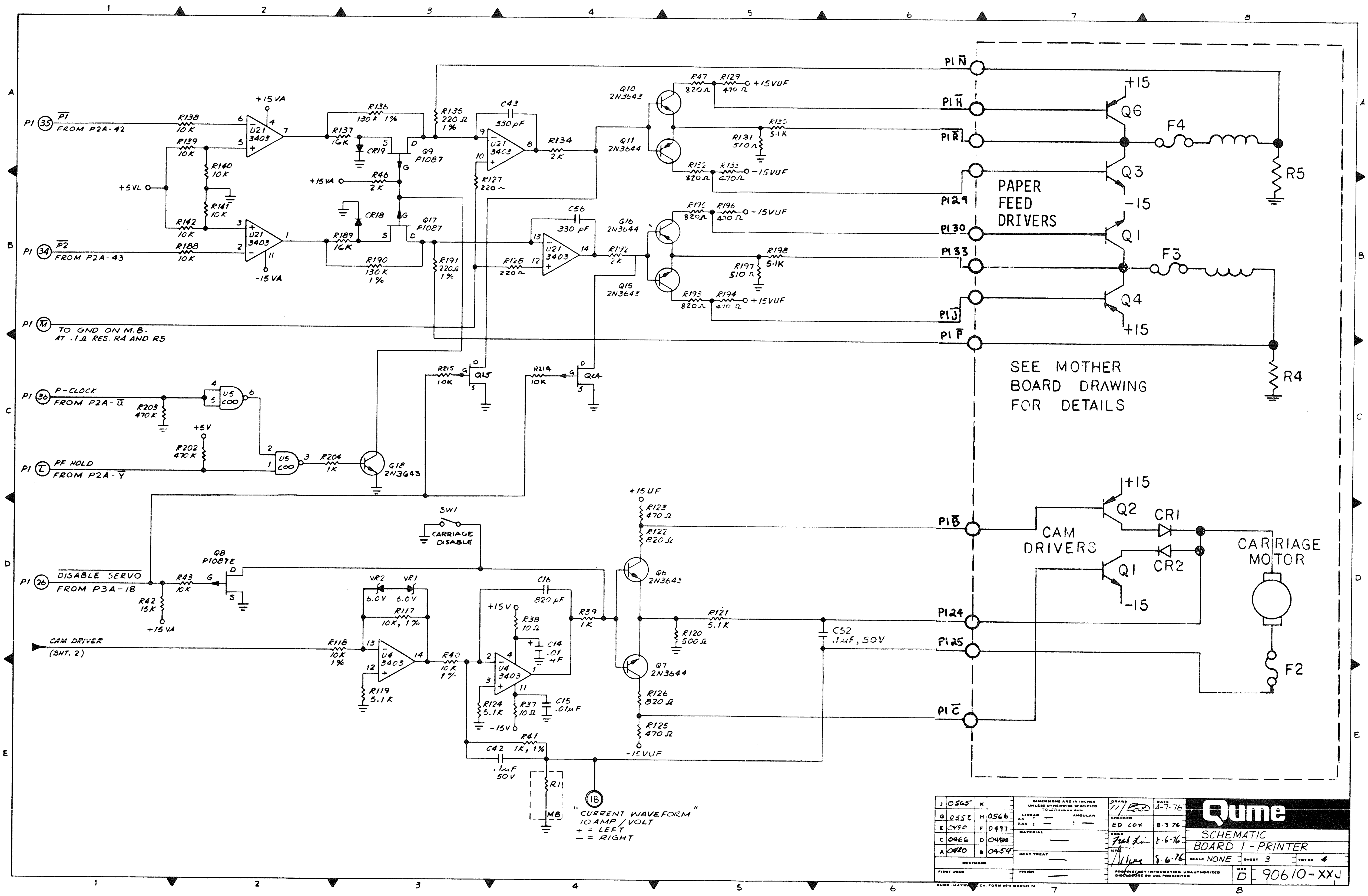
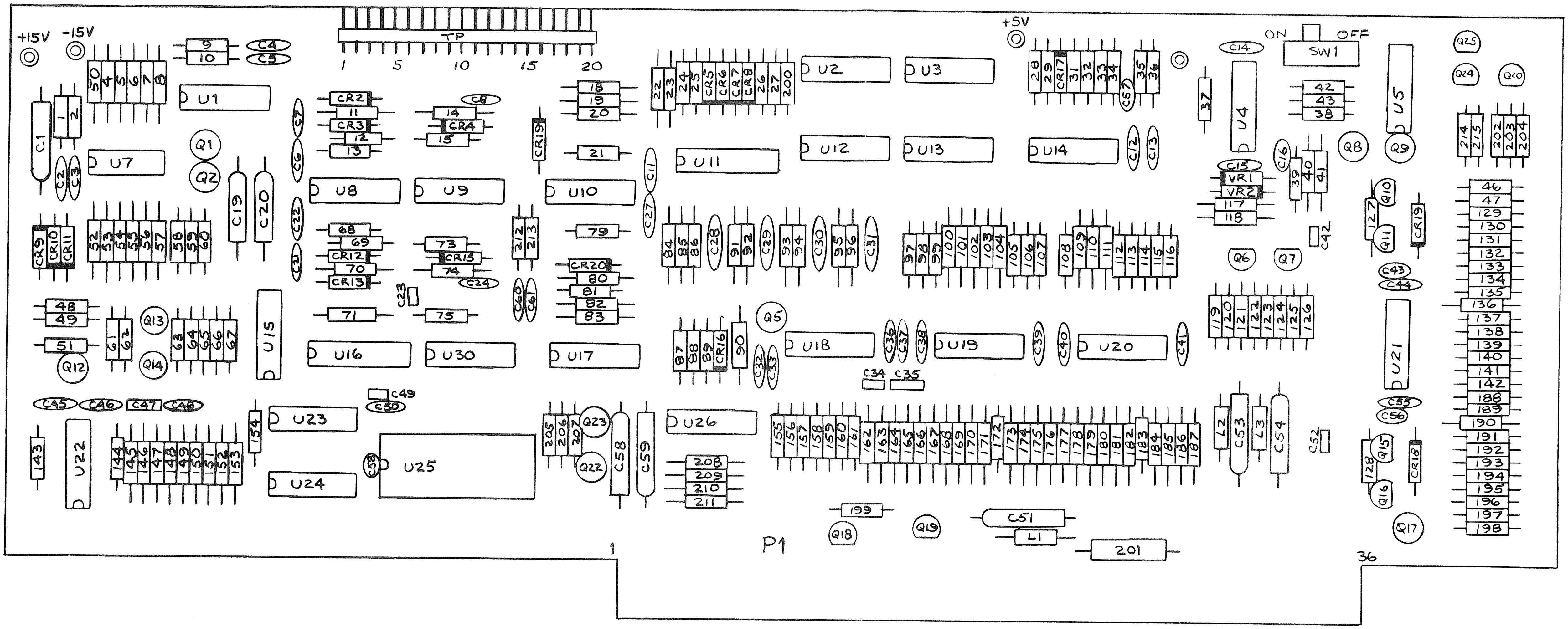


Figure 9-4 PC BOARD #1 SCHEMATIC (3 OF 4)



RESISTOR CHART				
RESISTOR	S3/35-00	S3/45-01	S3/55-02	WT40-05
R150	4.12K, 1%	4.12K, 1%	4.32K, 1%	4.32K, 1%
R152	1.33K, 1%	1.74K, 1%	1.65K, 1%	1.22K, 1%

NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL .01μF CAPACITORS ARE 25V
2. ALL RESISTORS ARE 5% 1/4W
3. ALL 1% RESISTORS ARE 1/8W
4. ALL DIODES ARE IN4154
5. ALL GROUNDS ARE ANALOG
6. ALL FETS ARE P1087E
7. THIS SCHEMATIC IS VALID FOR THE FOLLOWING ASSEMBLY:
   - S3/35 - 00 "J" ECN 0565
   - S3/45 - 01 "J" ECN 0565
   - S3/55 - 02 "J" ECN 0565
   - WT40 - 05 "J" ECN 0565
8. U25 ROM USE 95819 FOR S3/35(90612-00), S3/45 (90612-01) & WT-40 (90612-05). FOR S3/55 (90612-02) USE 95818

REVISIONS			
J	0565	K	
G	0552	H	
E	0490	F	0497
C	0466	D	0486
A	0420	B	0454

FIRST USED

DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED TOLERANCES ARE
LINEAR XX ± — XXX ± — ANGULAR ± —
MATERIAL —
HEAT TREAT —
FINISH —

DRAWN	F.NABONNE	7-19-76
CHECKED	ED COX	8-3-76
ENGR	[signature]	8-6-76
MFG	[signature]	8-6-76

Qume

SCHEMATIC
BOARD 1 - PRINTER

SCALE NONE SHEET 4 TOT SH 4

SIZE D 90610-XXJ

PROPRIETARY INFORMATION UNAUTHORIZED DISCLOSURE OR USE PROHIBITED

QUME · HAYWARD, CA. FORM 80-4 MARCH 74

Figure 9-5 PC BOARD #1 ASSEMBLY DRAWING (4 OF 4)

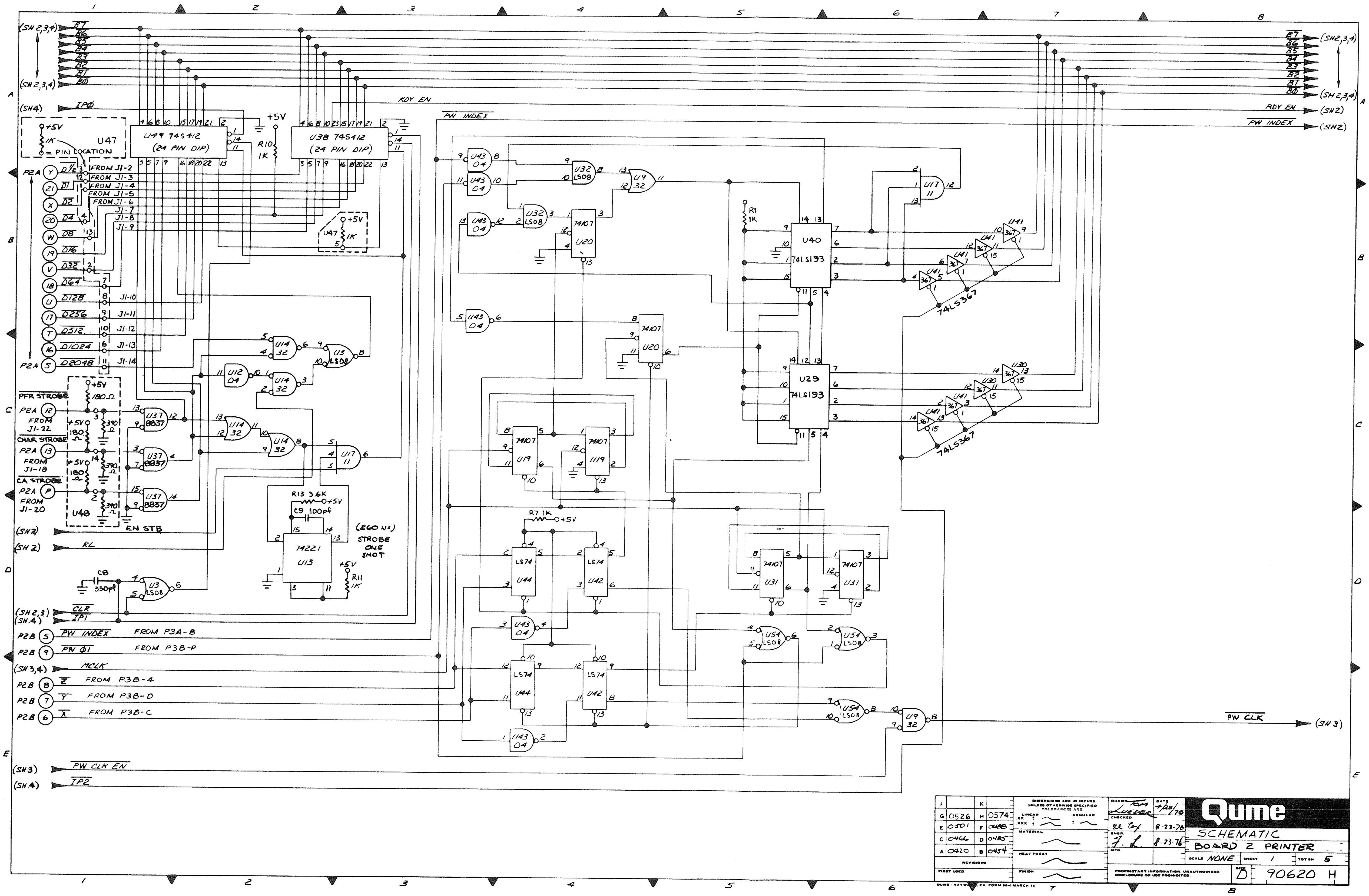


Figure 9-6 PC BOARD #2 SCHEMATIC (1 OF 5)

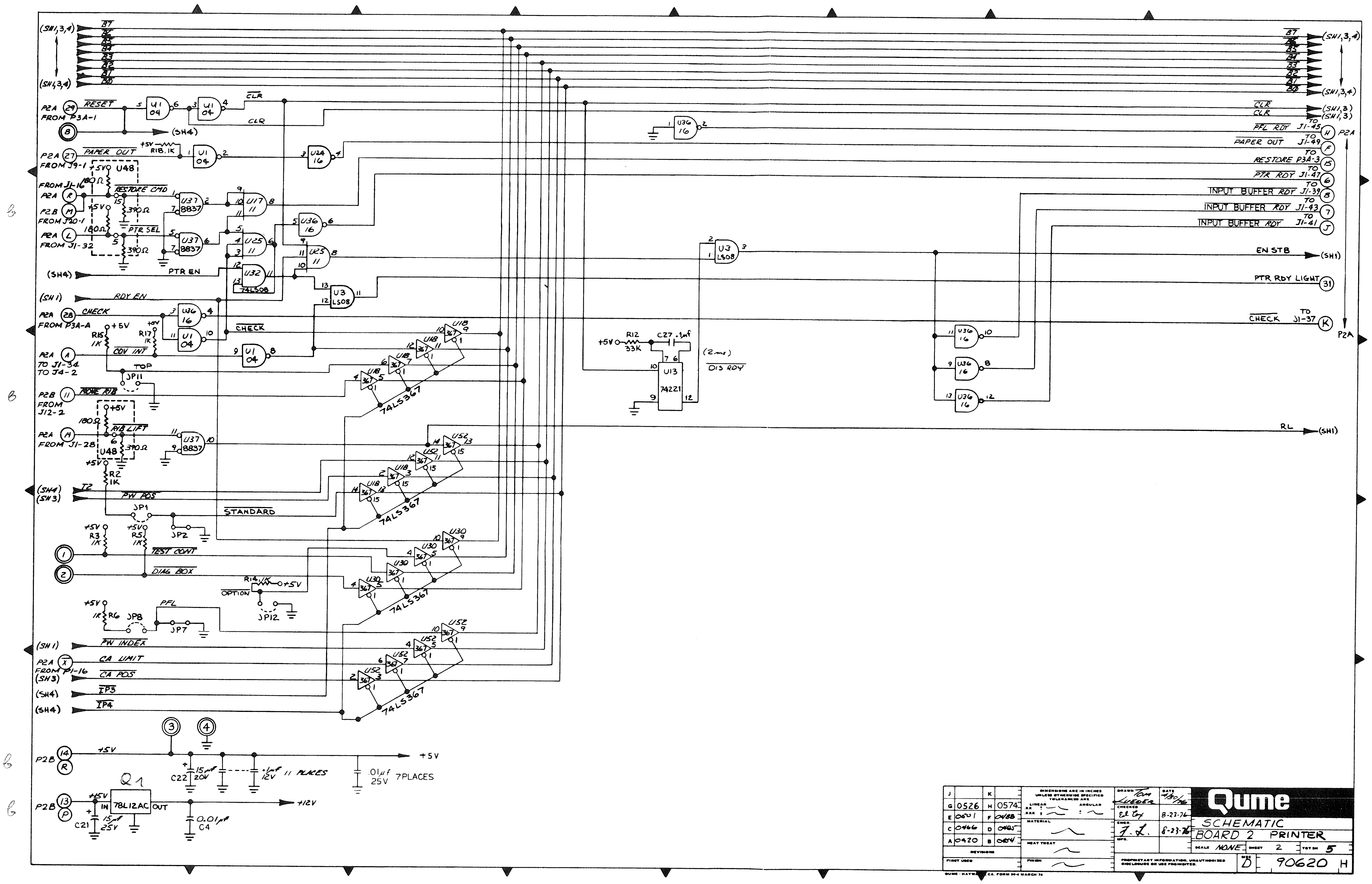


Figure 9-7 PC BOARD #2 SCHEMATIC (2 OF 5)

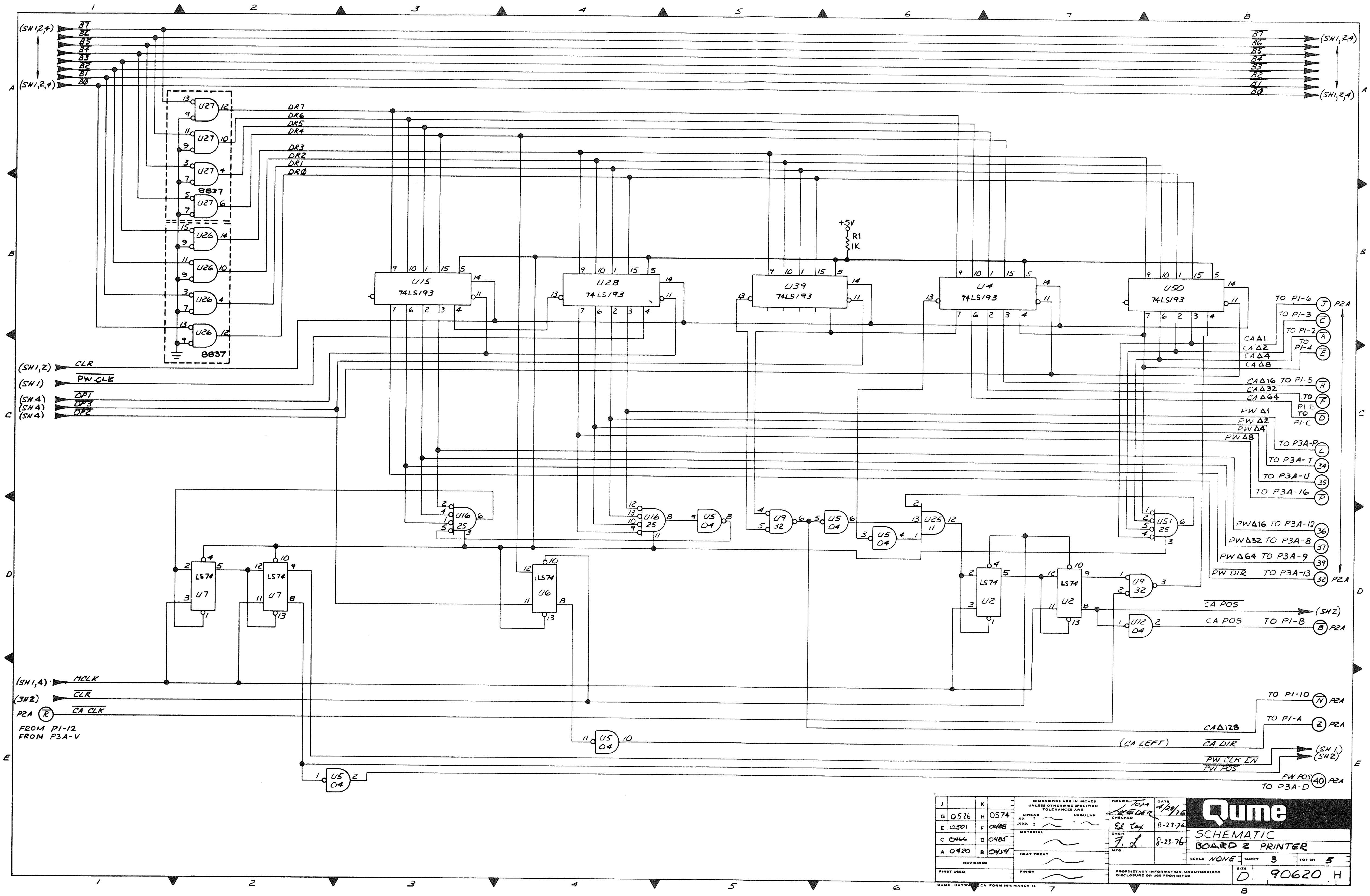


Figure 9-8 PC BOARD #2 SCHEMATIC (3 OF 5)

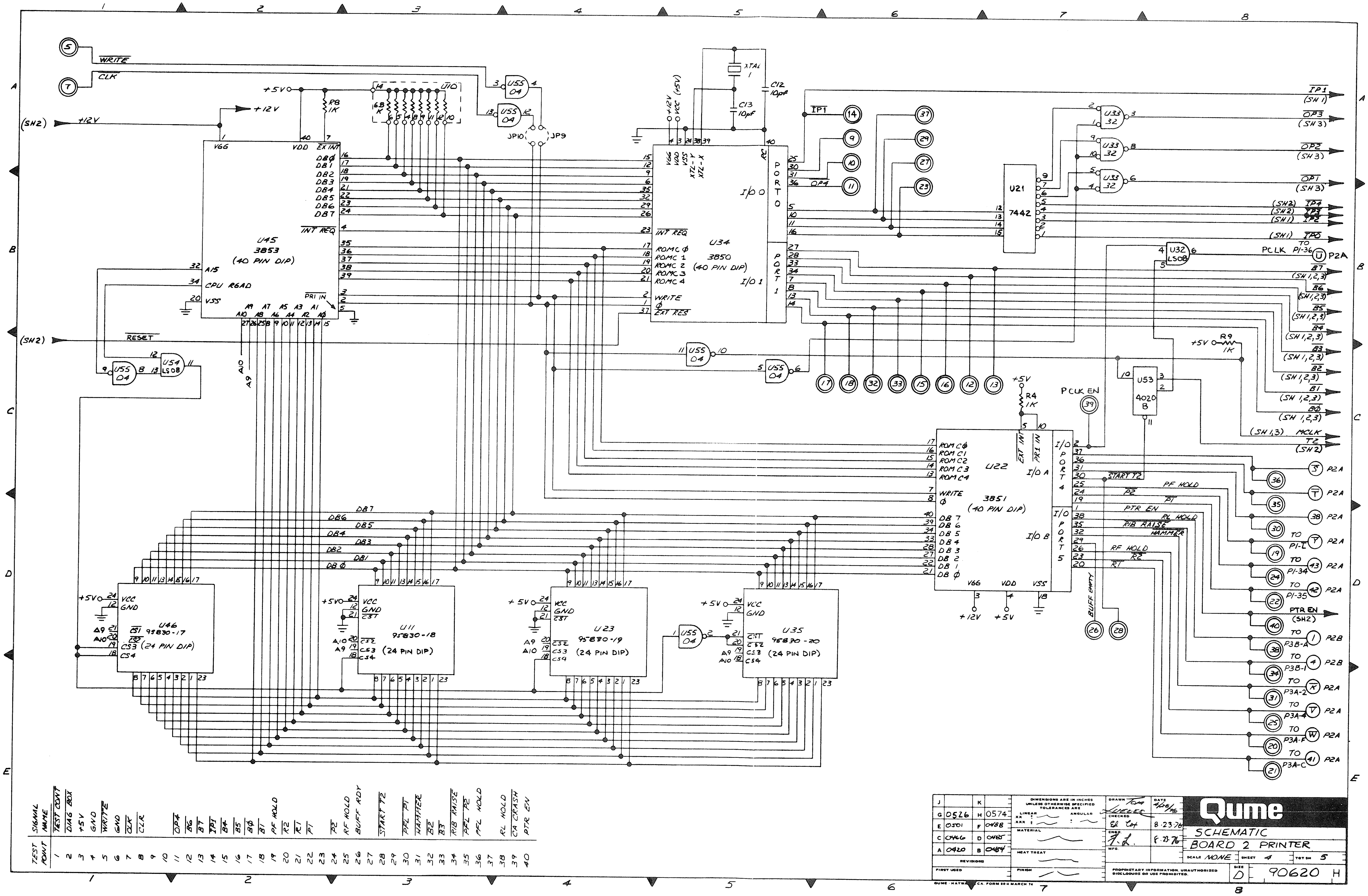
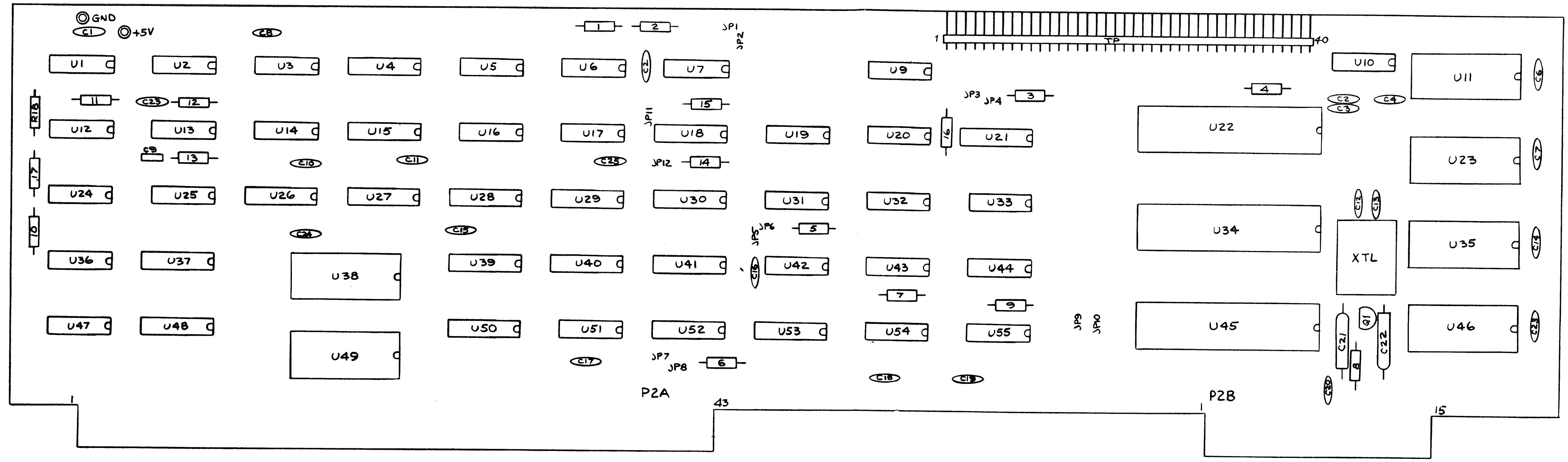


Figure 9-9 PC BOARD #2 SCHEMATIC (4 OF 5)



NOTES:

UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTOR ARE 1/4W 5%.
2. ALL DIODES ARE IN4154.
3. ALL FILTER CAPS. .1μF, 12V.
4. THIS SCHEMATIC IS VALID FOR FOLLOWING ASSEMBLY REV "G" ECN 0526

J		K	
G	0526	H	0574
E	0501	F	0488
C	0466	D	0485
A	0420	B	0454
REVISIONS			
FIRST USED			

DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED TOLERANCES ARE
LINEAR XX ± — XXX ± — ANGULAR ± —
MATERIAL —
HEAT TREAT —
FINISH

DRAWN	F. NABONNE	DATE 7-19-76
CHECKED	[signature]	7-21-76
ENGR	[signature]	8-23-76
MFG		

Qume

SCHEMATIC
BOARD 2 PRINTER

SCALE NONE SHEET 5 TOT SH 5

PROPRIETARY INFORMATION. UNAUTHORIZED DISCLOSURE OR USE PROHIBITED.

SIZE D 90620 H

QUME · HAYWARD, CA · FORM 80-4 MARCH 74

Figure 9-10 PC BOARD #2 ASSEMBLY DRAWING (5 OF 5)

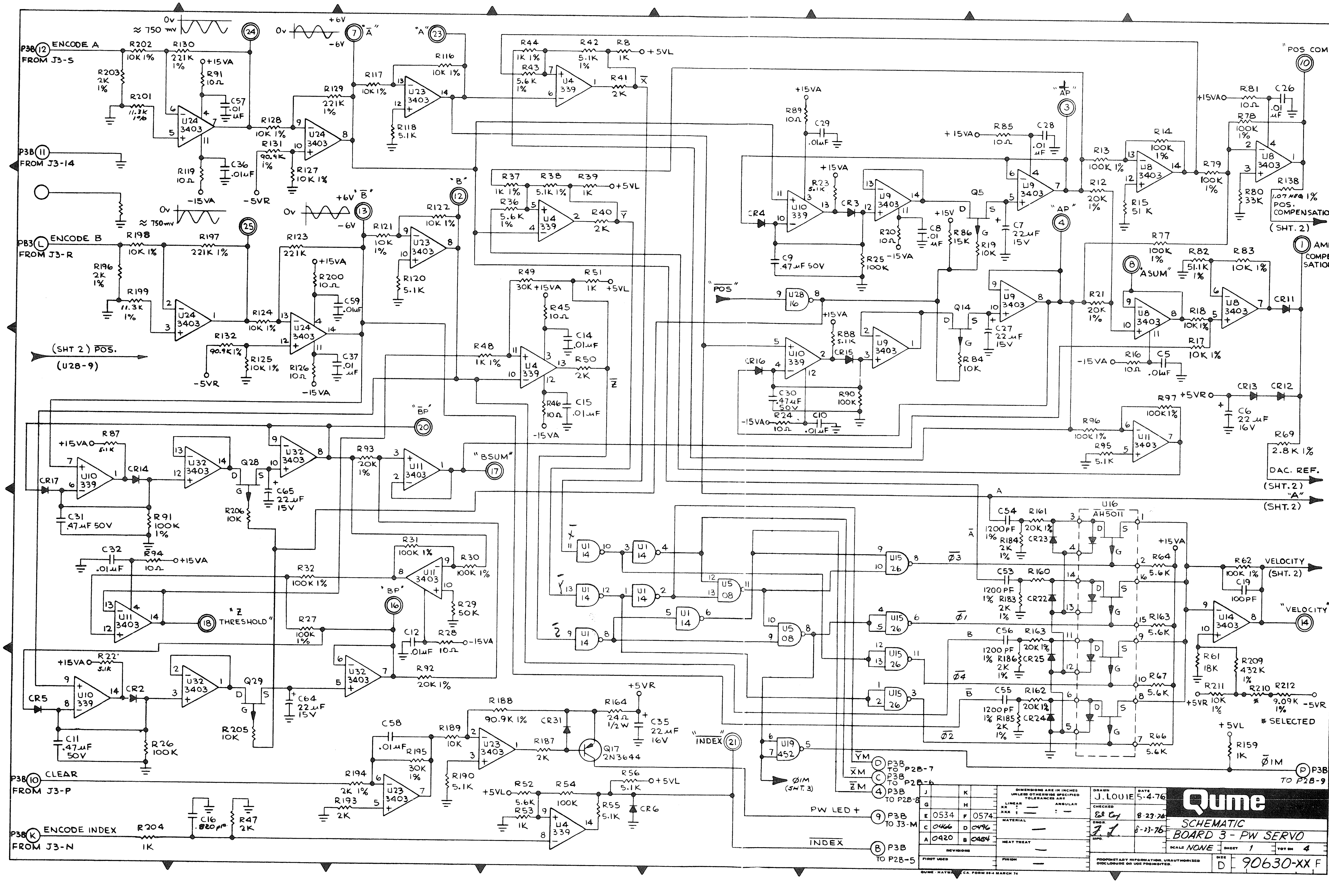


Figure 9-11 PC BOARD #3 SCHEMATIC (1 OF 4)

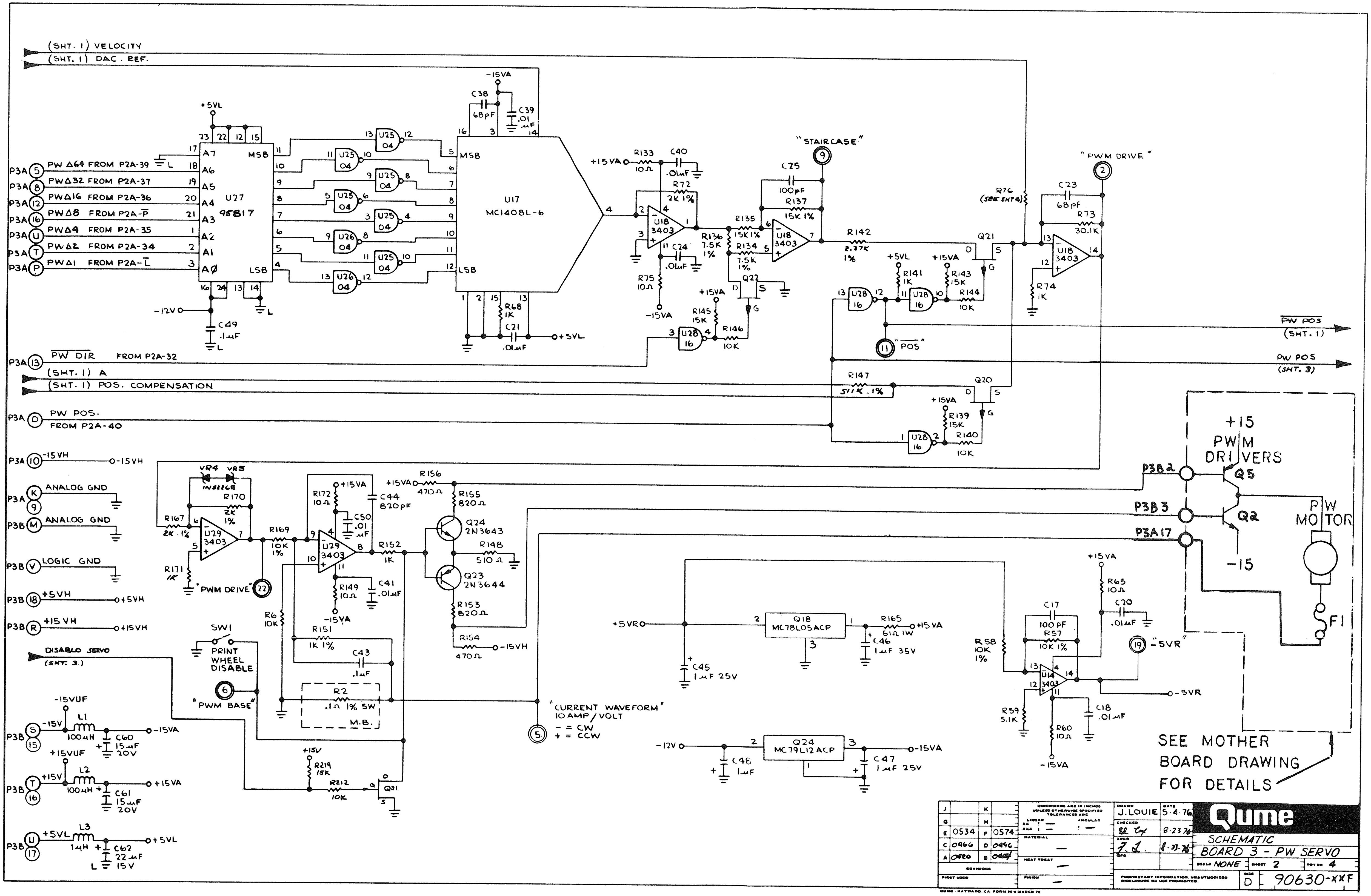


Figure 9-12 PC BOARD #3 SCHEMATIC (2 OF 4)

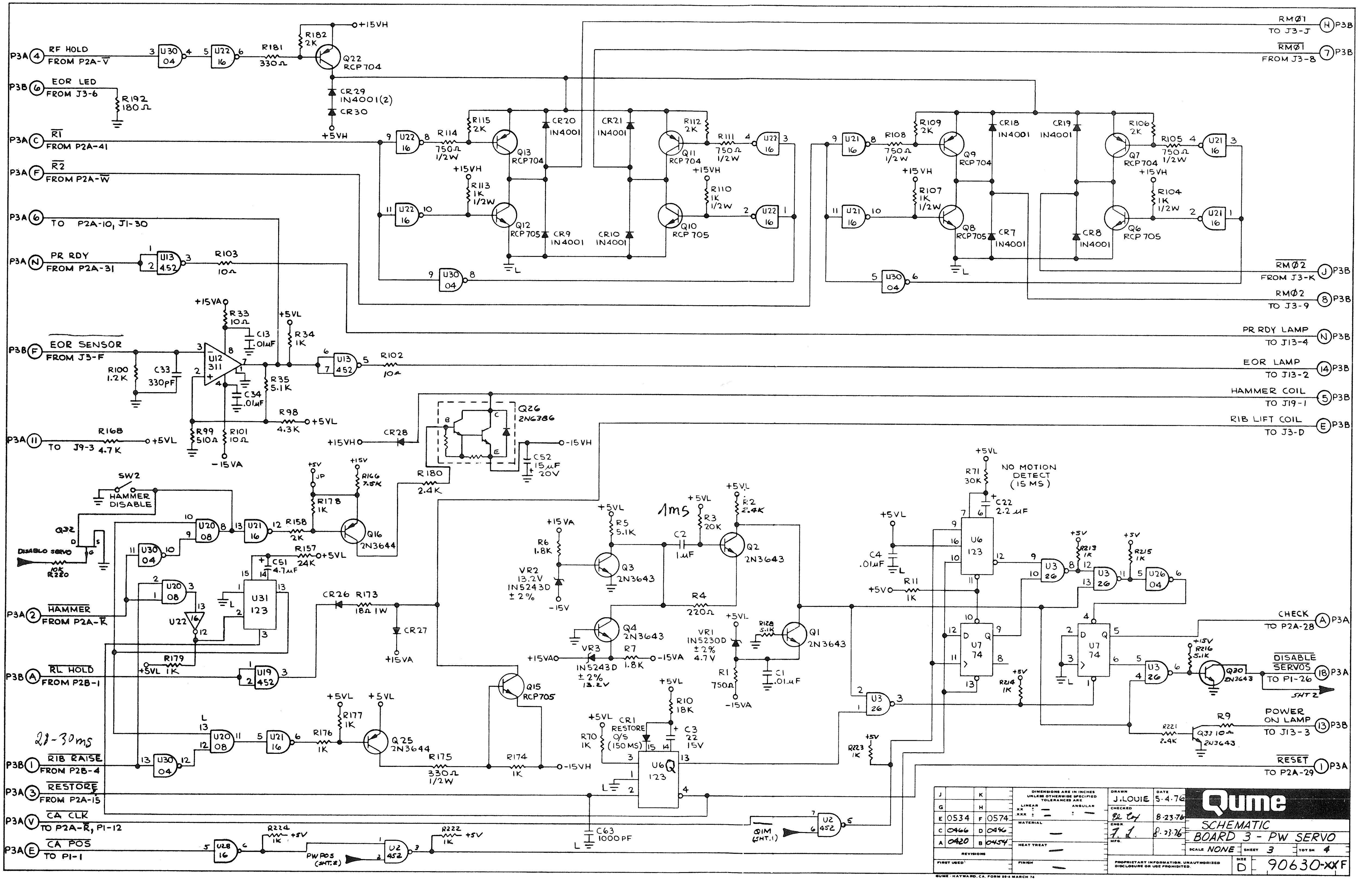
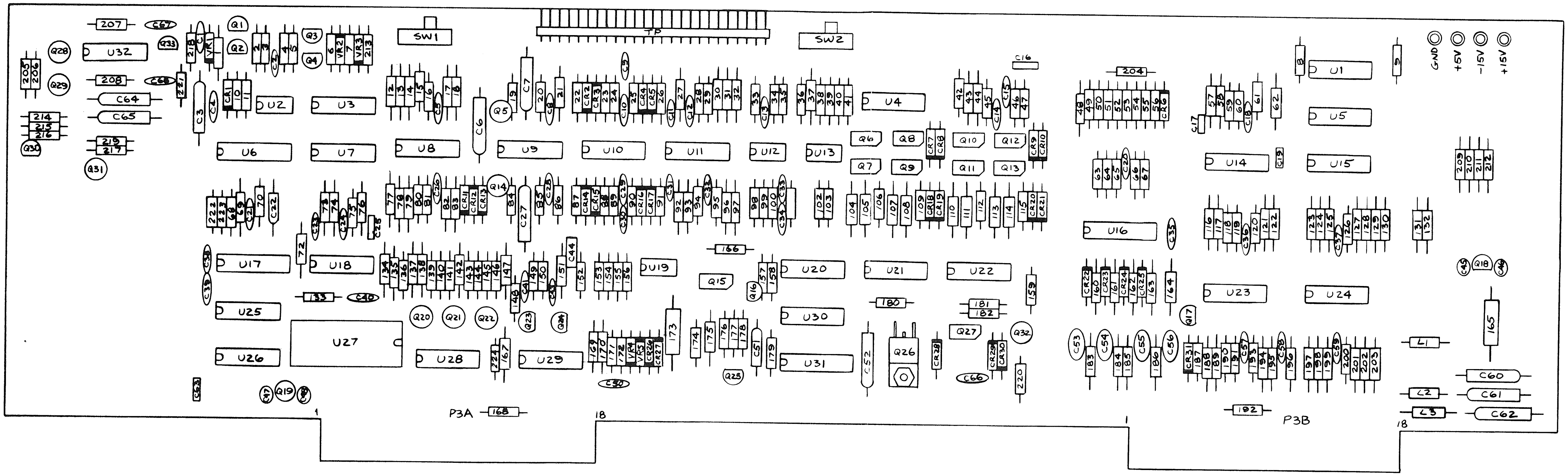


Figure 9-13 PC BOARD #3 SCHEMATIC (3 OF 4)



RESISTOR CHART	
UNIT	RESISTOR
53/35 -00	R76, 1.70K, 1%
53/45 -01	R76, 1.40K, 1%
53/55 -02	R76, 1.58K, 1%
53/X30 -03	R76 —
53/X40 -04	R76 —
WT40 -02	R76, 1.58K, 1%

MODIFICATIONS:
CUT TRACE FROM L1 TO Q26 EMITTER ADD JUMPER FROM P3A-10 TO R154 TOP SIDE OF BOARD.

NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL RESISTOR IN OHM'S, 1/4W, 5%.
2. ALL DIODES ARE IN4154.
3. ALL .01µF CAPACITORS ARE 25V.
4. ALL 1% RESISTORS ARE 1/8W.
5. ALL GROUNDS ARE ANALOG.
6. ALL FETS ARE P1087E.

7. THIS SCHEMATIC IS VALID FOR THE FOLLOWING ASSEMBLYS.
53/35 -00 "E" ECN 0496
53/45 -01 "E" ECN 0496
53/55 -02 "E" ECN 0496
53/X30 -03
53/X40 -04
WT 40 -02 "E" ECN 0496

J		K	
G		H	
E	0534	F	0574
C	0466	D	0496
A	0420	B	0454

REVISIONS
FIRST USED

DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED TOLERANCES ARE
LINEAR .XX ± — .XXX ± — ANGULAR ± —
MATERIAL —
HEAT TREAT —
FINISH —

DRAWN F. NABONNE DATE 7-19-76
CHECKED El Coy 8-23-76
ENGR. 7. L. 8-23-76
MFG.

PROPRIETARY INFORMATION. UNAUTHORIZED DISCLOSURE OR USE PROHIBITED.

Qume
SCHEMATIC
BOARD 3 - PW SERVO
SCALE NONE SHEET 4 TOT SH 4
SIZE D 90630-XX F

QUME · HAYWARD, CA. FORM 80-4 MARCH 74

Figure 9-14 PC BOARD #3 ASSEMBLY DRAWING (4 OF 4)