HP 9866A/B PRINTER SERVICE MANUAL

HEWLETT PACKARD

9866A/B Printer

SERVICE MANUAL

-hp- Part No. 09866-90031

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Technical Specifications

Printing Speed	–	Print Mode: 240 lines/minute Plot Mode: 900 rows of dots/minute
Print Density	–	Print Mode: 80 characters/line 6 lines/inch (2.4 lines/cm) Plot Mode (9866B): 400 dots/row 60 rows/inch (23.6 rows/cm)
Character Set	–	9866A 64 alphanumeric characters* 9866B 95 alphanumeric characters*
Data Input Format	–	7 line ASCII code, bit-parallel, character-serial fashion
Printer Paper	–	8-¾″ wide (222.3mm wide) thermal sensitive paper, available in 250′ rolls
Buffer	–	1 line of 80 characters
Size	–	17.75″ × 16.1″ × 6.1″ (45.09cm × 40.90cm × 15.49cm)
Weight	–	40 lbs. (18.14 kg)
Power Requirements	–	Nominal voltage ranges - 100, 120, 220, 240V ac; +5% to −10% of each range Frequency range - 48 to 66Hz Power - 250 voltamps, maximum
Temperature Range**	–	0° C to 45° C
Humidity Range**	–	95% relative humidity maximum (non-condensing)

*All characters are not usable with some calculators.
**The printer paper is sensitive to high temperature and high humidity conditions.

Chapter 1
General Information

Introduction

This manual provides the information necessary to service the 9866A or 9866B Printer. The various chapters include theory of operation, troubleshooting, and replaceable parts. This chapter provides general service and installation information. Interfacing information for printers to be used with a controlling device other than a 9800-Series Calculator can also be found in this chapter.

For operating instructions on how to control the printer with a 9800-Series Calculator, see one of the following manuals.

Table 1-1. Calculator/Printer Operating Manuals

Calculator	Printer Manual	Manual Part No.
9810A 9820A 9821A	9866A/B Option 10/20/21/30 Operating Manual	09866-90032
9830A	9866A/B Option 10/20/21/30 Operating Manual	09866-90032
	9830A Operating and Programming Manual	09830-90001
9815A	98134A Opt. 066 Interface Printer Operating Note	98134-90013
9825A	98032A Opt. 066 Interface Printer Operating Note	09825-90043

Service Concept

The printer's chassis, A3 assembly and A5 assembly can be either repaired to a component level or exchanged with a new replacement assembly

The heatsink assembly and the printheads are not repairable and should be replaced with a new assembly.

All other electronic assemblies should be exchanged with the corresponding service kit assembly. The defective assembly should be returned (on the exchange program) to the Calculator Products Division, Loveland or PCE (Europe) for exchange credit.

Service Kit

The 11291C Service Kit is available through CSC (PCE in Europe) to assist in the repair of defective printers. The 11291C Service Kit is used to repair both 9866A and 9866B printers. Here are the items included in the 11291C Service Kit.

Table 1-2. 11291C Service Kit Assemblies

	HP Part No.	Qty.	Description
A1	09866-69501	1	Input Logic Ass'y (9866A)
A2	09866-69502	1	Control Logic Ass'y (9866A)
A3	09866-66503	1	Low Voltage Power Supply
A4	09866-69504	1	High Voltage Power Supply
A5	09866-66505	1	Motor Drive Ass'y
A6	09866-69506	1	Row-Data Storage Ass'y
A7	09866-67908	1	Print Head Ass'y (black)
	09866-67910	1	Print Head Ass'y (green)
A8	09866-60006	1	Heat Sink Ass'y
A91	09866-69591	1	Input Logic Ass'y (9866B)
A92	09866-69592	1	Control Logic Ass'y (9866B)
	09866-90001	1	Peripheral Manual (replaces 09866-90000)
	09866-90031	1	Service Manual (replaces 09866-90030)
	1853-0340	2	Transistor, pwr
	1854-0458	2	Transistor, pwr
	1901-0684	2	Diode, rect
	2110-0381	2	Fuse, 3A SB
	2110-0304	2	Fuse, 1.5A SB
	2110-0454	2	Fuse, Ceramic 7A, for A3 bd.
	2140-0246	2	Lamp, Incandescent
	9320-2943	6	Failure Report
	09866-20001	1	Wrench, shaved, 3/8"
	8710-0864	2	#6 Allen Wrench
	09866-60001	1	Head Drive ET
	8750-0087	1	.004" Spacer, Head Alignment
	2110-0456	5	Fuse 10A, Ceramic - for A4 bd.

Exerciser Programs

9810A	09810-90207
9815A	09815-10004
9820A (PCI)	09820-90202
9820A (PCII)	09820-90204
9821A	09821-90041
9830A	09830-90062

Accessories Supplied

Table 1-3 lists the accessories supplied with the various printer options. Every option receives the Standard accessories.

Table 1-3. Accessories Supplied

Description	Quantity	HP Part No.
Standard Accessories		
Peripheral Manual	1	09866-90001
Service Manual*	1	09866-90031
Interface Cable*	1	09866-61606
Power Cord	1	8120-1378
Spare Fuses:		
1.5A, 250V, Slow-blo	1	2110-0304
3.0A, 250V, Slow-blo	2	2110-0381
Dust Cover	1	4040-0504
Printer Paper (pkg. of 2)	1	9281-0414
Option 10 Accessories		
Option 10/20/21/30 Operating Manual	1	09866-90032
Printer Exerciser Program **	1	09810-90207
(consists of a pre-recorded program card and envelope)		
Interface Cable	1	09866-61610
Select Code Labels	1 pkg.	7120-2940
Option 15 Accessories		
Interface Cable	1	98134-61666
Operating Note	1	98134-90013
Option 20 Accessories		
Option 10/20/21/30 Operating Manual	1	09866-90032
Supplement 'J' (Rev A) for the 9820A Electrical Inspection Booklet **	1	09820-90201
Interface Cable	1	09866-61620
Select Code Labels	1 pkg.	7120-2940
Option 21 Accessories		
Option 10/20/21/30 Operating Manual	1	09866-90032
Interface Cable	1	09866-61620
Select Code Labels	1 pkg.	7120-2940
Option 25 Accessories		
Interface Cable	1	98032-67905
Operating Note	1	09825-90043
Select Code Labels	1 pkg.	7120-4779
Option 30 Accessories		
Option 10/20/21/30 Operating Manual	1	09866-90032
Interface Cable	1	09866-61630
Dust Cover	1	4040-0505
Power Cord, inter-instrument	1	8120-1575

*Standard printer only not supplied with options.
**9866A Only.

Power Requirements

Two line-voltage selector switches (see Figure 1-1) mounted on the rear panel of the printer enable the printer to be operated on a line voltage of l00, 120, 220, or 240 Vac (+5 %, -10 %), as shown in Figure 1-2. The line frequency must be within a range of 48 to 66 Hz inclusive. A maximum power of 250 voltamps is required for normal printer operation.

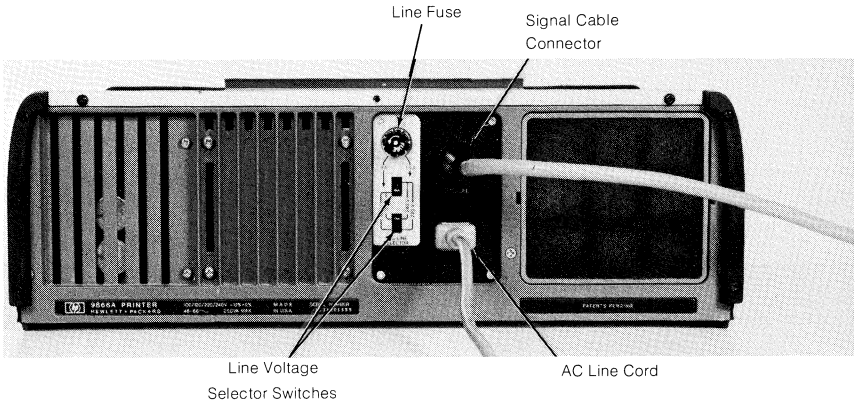


Figure 1-1. The Rear Panel

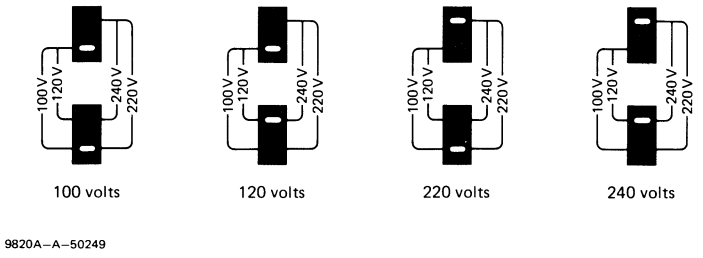


Figure 1-2. Switch Settings for the Various Nominal Powerline Voltages

CAUTION

A DIFFERENT FUSE IS REQUIRED AT EACH OF THE TWO VOLTAGE RANGES OF 100–120 VAC AND 220–240 VAC. SEE "FUSES" FOR FURTHER INFORMATION. THE PRINTER MAY BE DAMAGED IF THE INCORRECT FUSE IS INSTALLED.

Fuses

Table 1-4 shows the fuse that must be installed prior to connecting the printer to the ac power source.

Table 1-4. Powerline Voltages and Fuses

NOMINAL VOLTAGE	OPERATING RANGE (−10%, +5% of nominal)	PRINTER FUSE
100 volts	90 to 105 volts	3 amp (SB)
120 volts	108 to 126 volts	3 amp (SB)
220 volts	198 to 231 volts	1.5 amp (SB)
240 volts	216 to 252 volts	1.5 amp (SB)

WARNING
BEFORE CHANGING A FUSE ENSURE THAT THE PRINTER IS DISCONNECTED FROM ANY AC POWER SOURCE.

Grounding Requirements

To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the printer's cabinet be grounded. The printer is equipped with a three conductor power cable which, when connected to an appropriate power receptacle, grounds the cabinet of the printer.

Interfacing

When the printer is to be used with a 9800-Series Calculator, refer to the 9866A/B Peripheral Manual (HP Part No. 09866-90001) to connect the printer to the calculator.

When the printer is used with a controlling device other than a 9800-Series Calculator, it may be necessary to construct an interface to connect the printer to the controlling device.

Following is a description of the printer's signal lines and signal timing requirements.

Standard Printer Interfaces

The standard 9866A/B Printer is equipped with an unterminated cable. Table 1-5 lists the printer signals and the corresponding cable wire.

The printer requires signals which are negative true (i.e., 0V = 'low' = true; +5V = 'high' = false). The required voltage range of a low signal is 0 V to + 0.8 V; the required voltage range of a high signal is +2.4 V to +5.5 V. The maximum amount of noise on a signal line must be within the specifications prescribed for TTL (Transistor-to-Transistor Logic) circuits.

Table 1-5. Printer Cable Wiring

Signal Mnemonic	Signal Name	Initiator	Function	Color	Printer Connector Pin No.
GND	GROUND	COMMON	SYSTEM GROUND	BLACK	V
DO0	DATA OUTPUT 0	CONTROLLER	DATA BIT 0	GREEN	F
DO1	DATA OUTPUT 1	CONTROLLER	DATA BIT 1	BLUE	E
DO2	DATA OUTPUT 2	CONTROLLER	DATA BIT 2	WHITE-RED	D
DO3	DATA OUTPUT 3	CONTROLLER	DATA BIT 3	WHITE-BROWN	J
DO4	DATA OUTPUT 4	CONTROLLER	DATA BIT 4	GRAY	K
DO5	DATA OUTPUT 5	CONTROLLER	DATA BIT 5	VIOLET	L
DO6	DATA OUTPUT 6	CONTROLLER	DATA BIT 6	RED	C
OTP	OUT OF PAPER	PRINTER	PAPER STATUS	WHITE-BLACK	M
CTL	CONTROL	CONTROLLER	DATA READY	YELLOW	A
FLG	FLAG	PRINTER	PRINTER BUSY	WHITE-ORANGE	HH
CLB	CLEAR LINE BUFFER	CONTROLLER	CLEARS PRINTER	*ORANGE	G
		PRINTER	CABLE SHIELD GND	PINK	S

*Use of this wire is optional.

Figure 1-3 shows the timing for the printer's signals.

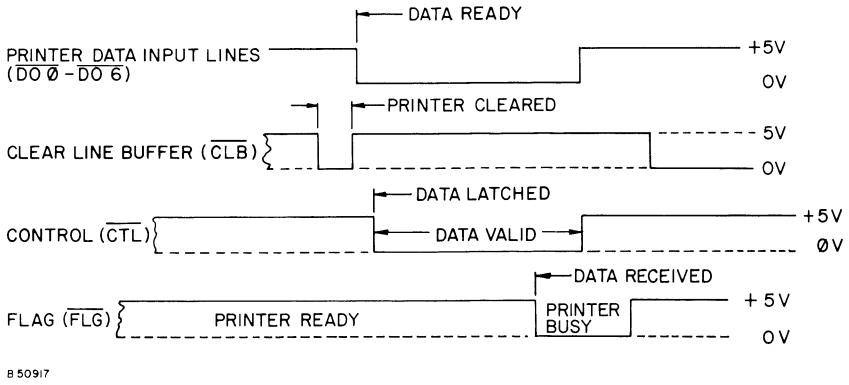


Figure 1-3. 9866 Signal Timing

Here is an explanation of the printer signal requirements.

Data Lines ($\overline{D01}$ - $\overline{D06}$)

A low signal on any of the data lines indicates a data signal on that line. The data is latched into the printer after Control goes low.

Clear Line Buffer ($\overline{CLB}$)

A low CLB causes the printer to ignore any characters after the last line feed. CLB must not be low when Flag is low.

Control ($\overline{CTL}$)

Control must go low to indicate data-ready. Control must remain low (at least 2μs) until Flag goes low. Control goes low again (after flag goes high) to indicate the next data input is ready.

Flag ($\overline{FLG}$)

Flag goes low to indicate data-received and printer-busy (5 μs to 250 ms). Flag goes high to indicate that the printer is ready to accept data. The printer will stay busy for 5 μs to 10 μs as each character of a line is input. The printer is busy for approximately 250 ms while printing a line (65 ms if the plot mode is set).

Out of Paper ($\overline{OTP}$)

The OTP status line indicates to the controlling device that the printer is out of paper. OTP goes low to indicate out of paper.

Recommended Circuits

Printer Output Circuits

Each output from the printer is driven by an open collector, inverting buffer/driver. The current sink of these drivers is 40mA and the breakdown voltage is +30 Vdc.

Vol @ (Iol = 16 mA)	=	+0.4 V maximum
Vol @ (Iol = 40 mA)	=	+0.7 V maximum
Voh (Open Collector)	=	30 V maximum
Iol	=	40 mA maximum
Ioh @ (Voh max.)	=	250 uA

Recommended Interface Receiving Circuit

The preceding text describes the printer output signals. Since each printer output driver has an open collector, the receiving circuits of the interface must have a positive pull-up voltage (not to exceed +30 Vdc), and they must be restricted to less than 40mA printer-driver source current.

The circuit shown below is a recommended interface receiving circuit.

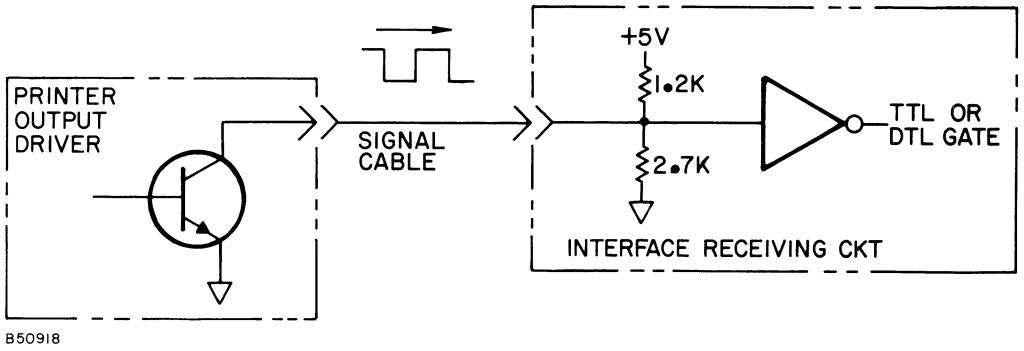


Figure 1-4. Recommended Receiving Circuit

Printer Input Circuits

Each printer input signal line is received by a TTL logic gate with a resistive divider. The resistive divider sets the bias on the CTL and CLB lines to approximately +4 volts on the 9866B and 3.4 volts on the 9866A. The bias on the data lines is +3.4 volts on the 9866B and 3.0 volts on the 9866A. These voltages are present when the input cable is disconnected. The input voltage to these lines must not exceed +5.5 volts dc.

The figure below represents the recommended interface transmitting circuits.

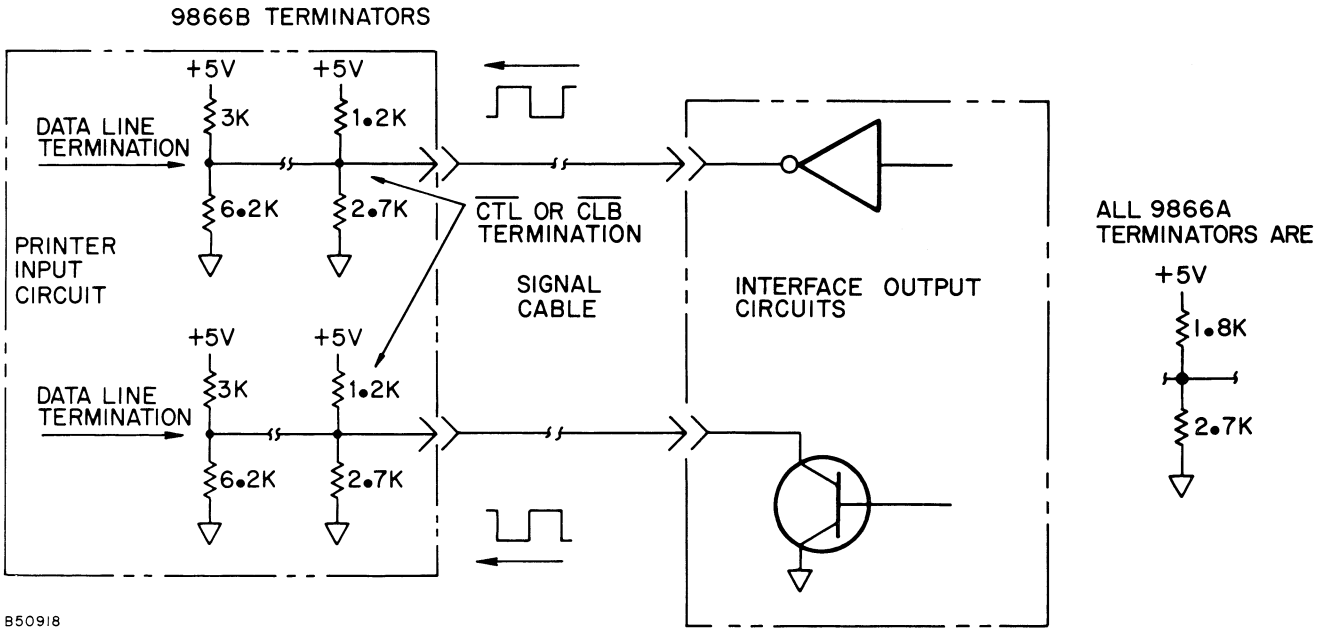


Figure 1-5. Recommended Transmitting Circuits

Printer Characters

Table 1-6 lists the printer's character set and their equivalent forms.

Table 1-6. Printer Characters and Equivalent Forms

9866A/B Char.	EQUIVALENT FORMS		
	Binary	Octal	Dec
LF	00001010	012	10
DC_1	00010001	021	17
space	00100000	040	32
!	00100001	041	33
"	00100010	042	34
#	00100011	043	35
$	00100100	044	36
%	00100101	045	37
&	00100110	046	38
'	00100111	047	39
(	00101000	050	40
)	00101001	051	41
*	00101010	052	42
+	00101011	053	43
,	00101100	054	44
-	00101101	055	45
.	00101110	056	46
/	00101111	057	47
Ø	00110000	060	48
1	00110001	061	49
2	00110010	062	50
3	00110011	063	51
4	00110100	064	52
5	00110101	065	53
6	00110110	066	54
7	00110111	067	55
8	00111000	070	56
9	00111001	071	57
:	00111010	072	58
;	00111011	073	59
<	00111100	074	60
=	00111101	075	61
>	00111110	076	62
?	00111111	077	63

9866A/B Char.	EQUIVALENT FORMS		
	Binary	Octal	Dec
@	01000000	100	64
A	01000001	101	65
B	01000010	102	66
C	01000011	103	67
D	01000100	104	68
E	01000101	105	69
F	01000110	106	70
G	01000111	107	71
H	01001000	110	72
I	01001001	111	73
J	01001010	112	74
K	01001011	113	75
L	01001100	114	76
M	01001101	115	77
N	01001110	116	78
O	01001111	117	79
P	01010000	120	80
Q	01010001	121	81
R	01010010	122	82
S	01010011	123	83
T	01010100	124	84
U	01010101	125	85
V	01010110	126	86
W	01010111	127	87
X	01011000	130	88
Y	01011001	131	89
Z	01011010	132	90
[	01011011	133	91

9866A Char.	9866B Char.	EQUIVALENT FORMS		
		Binary	Octal	Dec[2]
\	√	01011100	134	92
]	]	01011101	135	93
↑	↑	01011110	136	94
—	—	01011111	137	95
@	‘	01100000	140	96
A	a	01100001	141	97
B	b	01100010	142	98
C	c	01100011	143	99
D	d	01100100	144	100
E	e	01100101	145	101
F	f	01100110	146	102
G	g	01100111	147	103
H	h	01101000	150	104
I	i	01101001	151	105
J	j	01101010	152	106
K	k	01101011	153	107
L	l	01101100	154	108
M	m	01101101	155	109
N	n	01101110	156	110
O	o	01101111	157	111
P	p	01110000	160	112
Q	q	01110001	161	113
R	r	01110010	162	114
S	s	01110011	163	115
T	t	01110100	164	116
U	u	01110101	165	117
V	v	01110110	166	118
W	w	01110111	167	119
X	x	01111000	170	120
Y	y	01111001	171	121
Z	z	01111010	172	122
[	π	01111011	173	123
\	|	01111100	174	124
]	→	01111101	175	125
↑	~	01111110	176	126
—		01111111	177	127

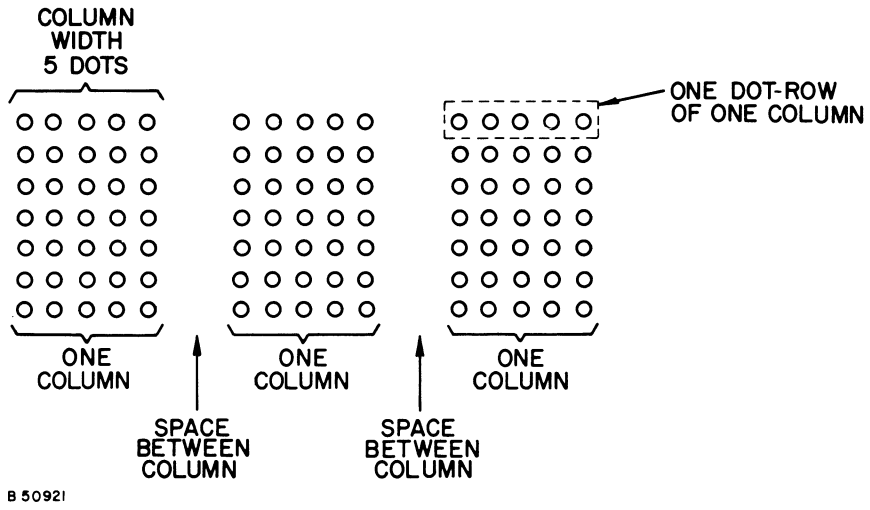
9866B Plot Mode

The 9866B Plot Mode allows you to use your printer as an incremental plotter. Horizontal and vertical bar charts and mathematic function graphs are an example of the plots that can be generated using this mode. Plotting is accomplished by printing a specified dot pattern in a specified column for any one point on the plot.

Printing Dot Patterns

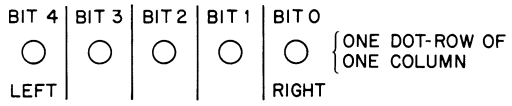
The 9866B plot mode allows any dot pattern listed in Table 1-7 to be printed in any desired column on the printer. The dot patterns are printed one dot-row at a time. After a row is printed in the plot mode, the printer is reset to the normal print mode by a LF. Thus the plot mode must be set before each dot-row is printed. Remember that the printer's line width is 80 columns, and each column is 5 dots wide.

See the figure below.



The ASCII character DC_1 (decimal 17) sets the printer to the plot mode. The plot mode can be set anytime in a line. A line feed command (decimal 10) causes the dot-row to be printed and cancels the plot mode.

When in the plot mode, the printer will interpret each character received as a representation of a five dot pattern as shown below. Only the character's lower 5 bits are used by the printer (Bits 5-7 not used).

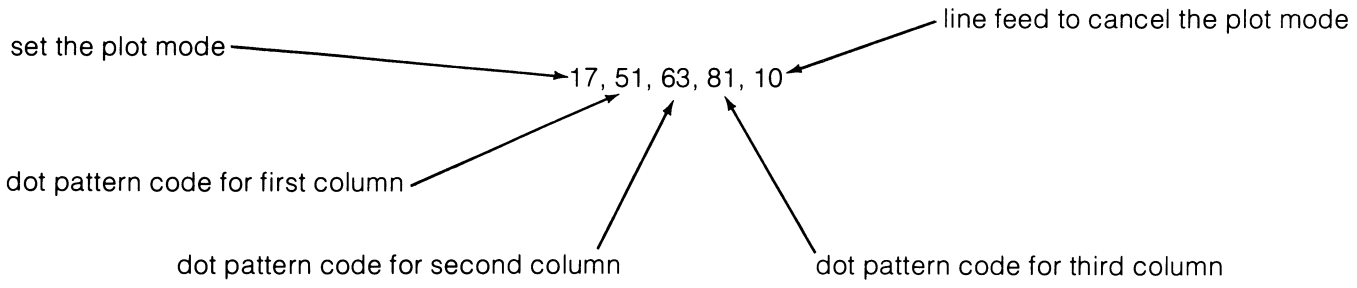


A dot is printed in a dot-row when the corresponding bit is a 1.

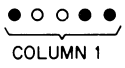
Table 1-7 lists the plot-mode dot-patterns and the characters and codes that will produce them. Note since only the last 5 bits of a character are used to make a pattern, more than one character or code will produce the same pattern.

Here is an example line that prints one dot-row in three columns.

EXAMPLE: Output the following decimal codes to the printer.

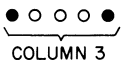


The result will be one dot-row of the first three columns printed with the dot patterns corresponding to the decimal codes.



Dot pattern for decimal 51

Dot pattern for decimal 63



Dot pattern for decimal 81

Note that for any particular dot pattern, any one of the decimal codes or any one of the ASCII characters for that pattern listed in table 1-7 can be used to print that pattern.

Here is how the second dot-row of the preceding example might be printed.

EXAMPLE: Execute this line after the preceding example:

17, 57, 63, 53, 10

Result:

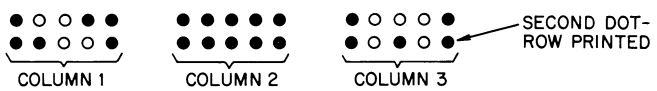


Table 1-7. 9866B Plot Mode Characters

Dot Pattern	Decimal Codes	ASCII Characters
○ ○ ○ ○ ○	32, 64, 96	space @
○ ○ ○ ○ ●	33, 65, 97	! A a
○ ○ ○ ● ○	34, 66, 98	" B b
○ ○ ○ ● ●	35, 67, 99	# C c
○ ○ ● ○ ○	36, 68, 100	$ D d
○ ○ ● ○ ●	37, 69, 101	% E e
○ ○ ● ● ○	38, 70, 102	& F f
○ ○ ● ● ●	39, 71, 103	' G g
○ ● ○ ○ ○	40, 72, 104	(H h
○ ● ○ ○ ●	41, 73, 105	) I i
○ ● ○ ● ○	42, 74, 106	* J j
○ ● ○ ● ●	43, 75, 107	+ K k
○ ● ● ○ ○	44, 76, 108	, L l
○ ● ● ○ ●	45, 77, 109	– M m
○ ● ● ● ○	46, 78, 110	. N n
○ ● ● ● ●	47, 79, 111	/ O o
● ○ ○ ○ ○	48, 80, 112	Ø P p
● ○ ○ ○ ●	49, 81, 113	1 Q q
● ○ ○ ● ○	50, 82, 114	2 R r
● ○ ○ ● ●	51, 83, 115	3 S s
● ○ ● ○ ○	52, 84, 116	4 T t
● ○ ● ○ ●	53, 85, 117	5 U u
● ○ ● ● ○	54, 86, 118	6 V v
● ○ ● ● ●	55, 87, 119	7 W w
● ● ○ ○ ○	56, 88, 120	8 X x
● ● ○ ○ ●	57, 89, 121	9 Y y
● ● ○ ● ○	58, 90, 122	: Z z
● ● ○ ● ●	59, 91, 123	; [π
● ● ● ○ ○	60, 92, 124	< √ '
● ● ● ○ ●	61, 93, 125	=] →
● ● ● ● ○	62, 94, 126	> ↑ ∿
● ● ● ● ●	63, 95	? –
Set Plot Mode	17	DC_1
End of Plot Row	10	LF

Chapter 2
Theory of Operation

Introduction

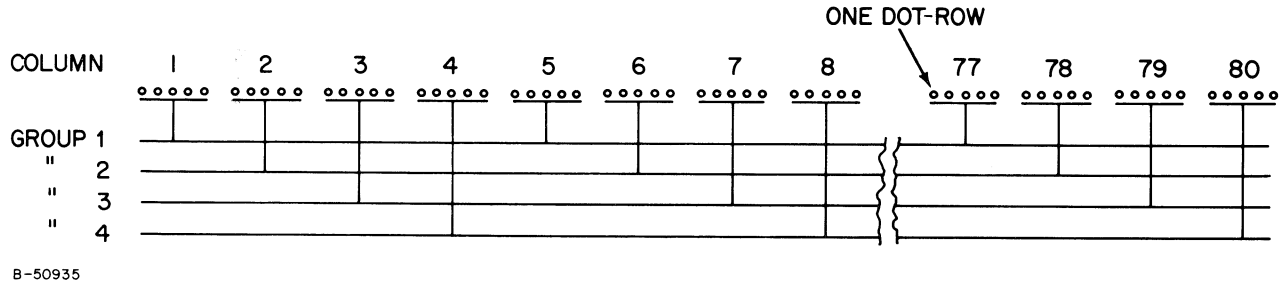
This chapter provides the printer block diagram and printer theory of operation. This chapter applies to both the A and B printers.

General Theory of Operation

The Printing Process

The printer is capable of producing up to eighty characters or columns on a single line. It uses a thermal process that "burns" selected dots onto heat-sensitive paper. The selected dots in each of the eighty columns are printed one dot-row at a time until all the rows of a particular character (7 rows for characters in print mode) or column (any column length for 9866B plot mode) are printed. The width of each column is 5 dots.

To lower the print head's current and cooling requirements, all eighty columns are not printed at the same time. Instead, the dots necessary to print every fourth column (i.e., 20 total characters) in each row are printed. This necessitates the printing of each row, in part, four times to complete that row for all eighty columns. This process is repeated for each row. The printheads are divided into four groups (see figure below). Group 1 prints columns 1, 5, 9, 13,...73, 77. Group 2 prints columns 2, 6, 10, 14,...74, 78. Group 3 prints columns 3, 7, 11, 15,...75, 79. Group 4 prints columns 4, 8, 12, 16,...76, 80. Each group prints once, forming one row of eighty columns.



The Character Grouping

When printing in the print mode, after completion of the seventh row, the paper is automatically advanced three rows, leaving a space of three rows between each printed line. When using the 9866B plot mode, the spacing between each printed line does not occur.

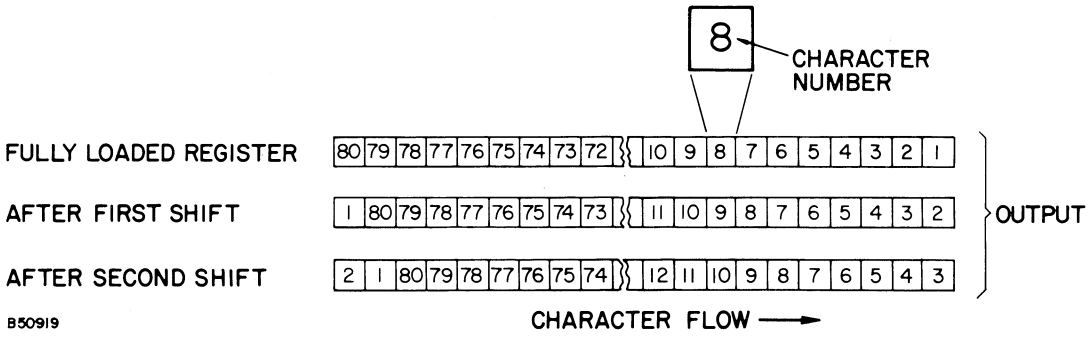
Character Composition

Refer to the 9866 Block Diagram (Figure 2-1). ASCII codes from the controlling device are input to the A1 or A91 Input Logic Assembly. The 7-bit ASCII codes are translated into printer codes. If the input code is not in the printer vocabulary, the input is ignored and a FLAG signal is returned to the calculator. The printer code is then loaded, bit-parallel, character-serial, into the shift registers*; each bit of a code is in a different register.

*These registers are 80-bit static MOS chips. The data in each register is recirculated during each print-mode shift operation, which is the reason for describing them as dynamic rather than static.

80 characters will fill the shift registers; subsequent characters will be ignored. If the calculator does not output 80 characters, the printer fills the remaining characters with spaces. The dynamic registers are always filled from left-to-right as shown below.

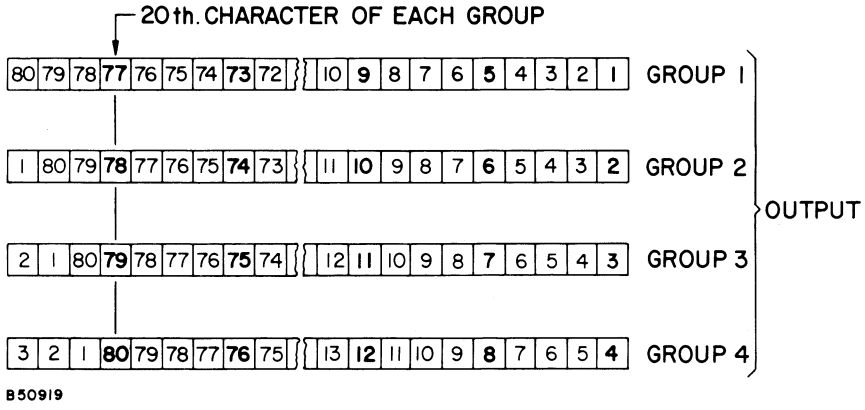
When data is not being input to the dynamic registers, the stored data may be output by shifting data through the register and 'sensing' the output bit (see drawing below). As the register shifts, the previously sensed bit loops back to the input and remains stored in the register. In this manner the data may be sensed as many times as necessary, and is not cleared until new data is input.



Shifting the Register Outputs

Since print head requirements allow only every fourth column to be printed at one time, the dynamic registers must be shifted until the appropriate character can be sensed. This is accomplished by shifting the register four additional times. Every fourth character (20 total) is sensed, encoded into the dot-row pattern required for printing (by the ROM decoder on A1 or A91), then one dot-row is stored in the dot-row storage registers on the A6 assembly. The dynamic registers are then shifted four additional times after which the printing of one group-row occurs (see drawing below).

The process described above has just printed one dot-row in every fourth column position. One 80-column dot row is printed by repeating the process for each print head group as shown below.



The Group Outputs

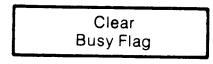
In this manner, 5 × 7 dot matrix characters are printed in the print mode, and columns are printed in the 9866B plot mode.

Printer Operation

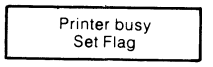
Here is an explanation of the printer's operation from the time data is input to the printer to the actual printing of the data. Refer to the block diagram, Figure 2-1, and the Printer Operation Flowchart, Figure 2-2. The blocks to the left of the text correspond to the blocks in the flowchart.

The A2 or A92 Control Logic Assembly controls and initiates most of the printer's internal operations. The heart of this control is a Read-Only-Memory located on the A2 or A92 Assembly. Inputs to the ROM from the other printer circuits let the ROM know what the printer is doing and what operation the ROM should initiate next.

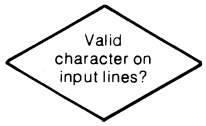
To start, let's assume that the Flag line is high (not busy) allowing new data to be input from the controlling device. Flag is low (5 to 10 μs) following each data input unless printing is occuring.



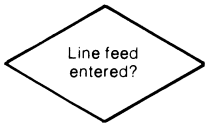
An ASCII code is sent on the input lines (DO0 - DO6). The printer begins processing the new input and sets the Flag line low so no new ASCII inputs can be entered.



The printer ensures that the ASCII-coded character is in its vocabulary.

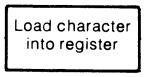


The printer checks to see if the new character is a linefeed. One linefeed causes the row-counter to increment and printing to occur. Two successive linefeeds cause the paper to advance 10 rows or one print line.

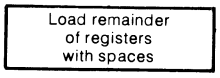


Before attempting to load the A1 or A91 shift registers with the new character, the registers are checked to see if 80 printable characters have been entered since the last line was printed. If the registers are full, the printer ignores all further character entries until a linefeed increments the row-counter and prints the line.

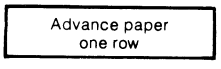
Assuming that the shift registers do not contain 80 characters, the new character is loaded into the registers.



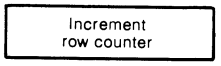
If the line to be printed contains fewer than 80 characters the empty characters are filled with blank spaces.

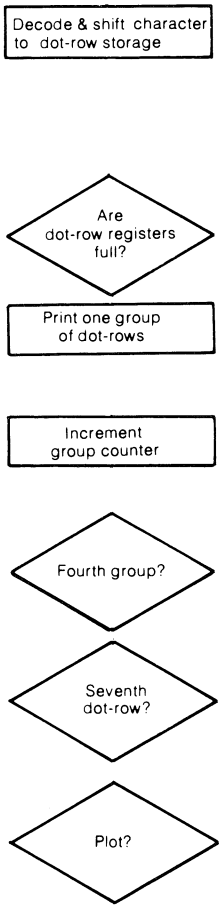


The paper advances one row before printing any dot rows.



The correct ROM row from A1 or A91 is selected for printing of the first row.





The output bit of each shift register (A1 or A91) is decoded by the ROM character decoder and output to the dot-row storage registers (A6). The output of the ROM determines which dots in the (20) dot-row will be printed for each of the 20 (group) columns. The ROM outputs this information one group-row at a time, then increments to the second group. This process continues until all four groups (80 columns) have one row printed.

When the dot-row registers (A6) are full, one group-row is ready for printing.

The A2 or A92 Control Logic Assembly initiates a "start print" signal, causing the first group-row to be printed.

The group counter (A2 or A92) steps from group 1 through group 4. Thus, each group-row is successively printed.

The group counter is checked to ensure that all four groups are printed. The counter is then reset for the next row.

When characters are printed in the print mode, the seventh dot-row completes one line. Then the paper is advanced three dot-rows.

If the 9866B is set in the plot mode, paper advance is inhibited after the first dot-row. The row counter stays at 0 and ignores the increment row count signal from the A92 assembly.

The Control Logic Assembly (A2 or A92) also contains the motor drive circuits. The A5 drive circuits are described later in this chapter.

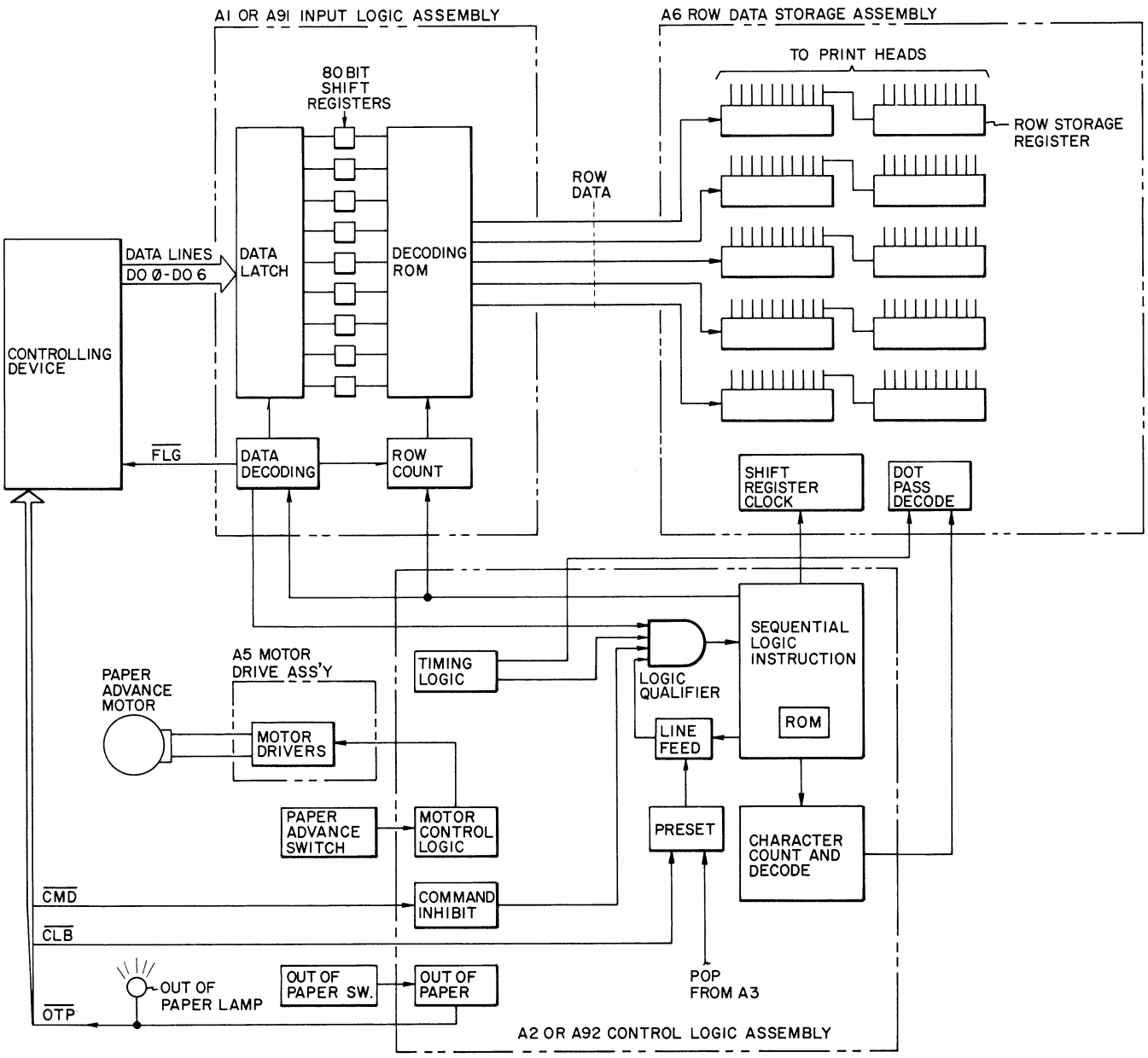


Figure 2-1. 9866 Block Diagram

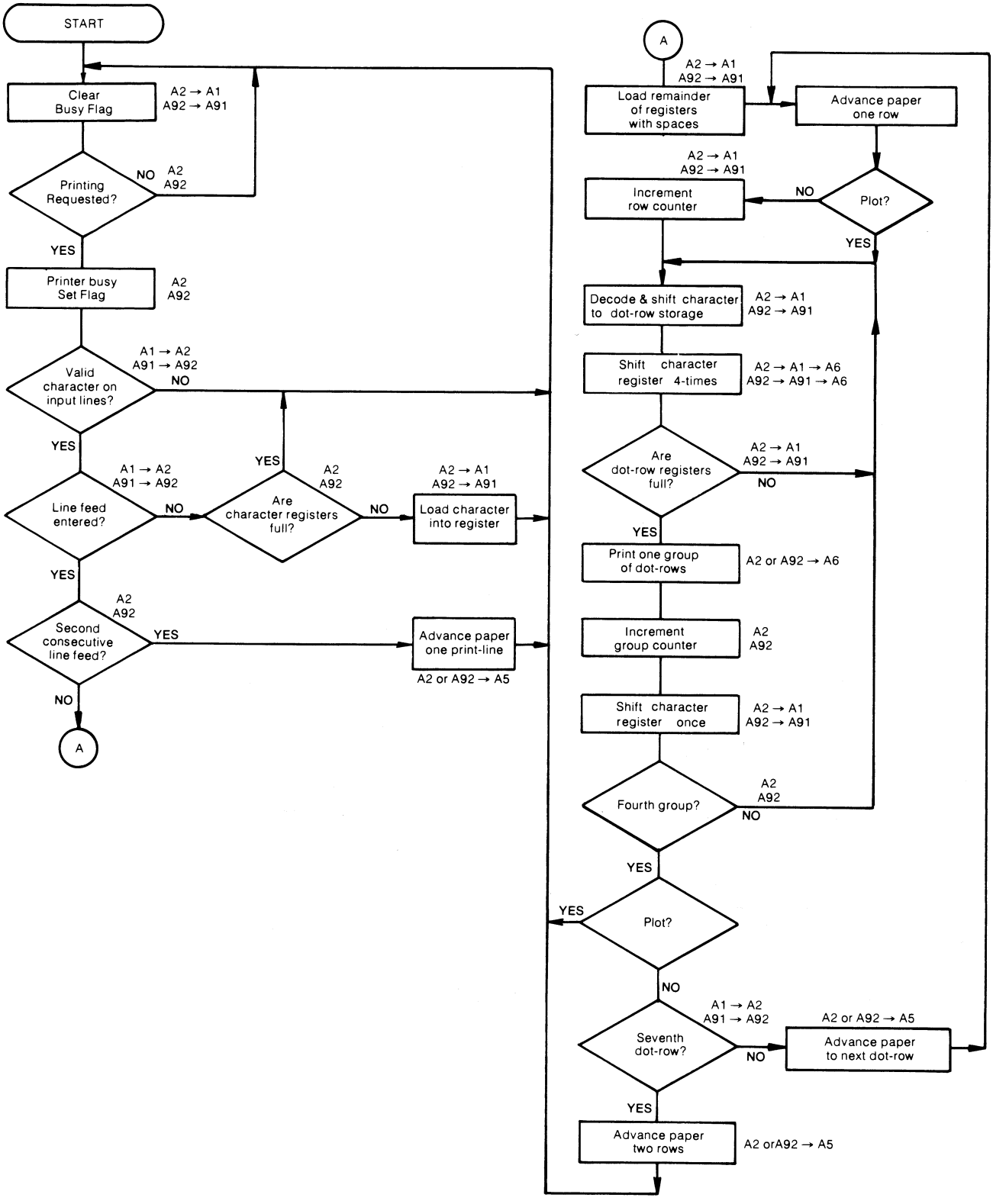
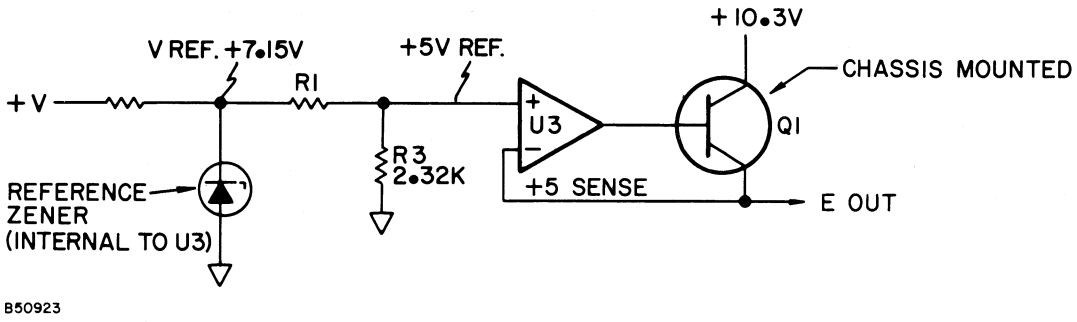


Figure 2-2. Printer Operation Flowchart

Low Voltage Power Supplies (A3)

+5V Power Supply



Simplified +5V Supply

Refer to the +5 V Power Supply Schematic (Figure 3-7) and the Simplified +5 V Supply diagram (above) during the following presentation.

The +5 V power supply regulator (U3) provides the correct amount of base drive-current for Q1 by comparing the reference voltage and +5 V sense voltage. The reference voltage is provided by a temperature compensated reference zener that is contained in the regulator (U3). R1 and R3 reduce the +7.15 V reference zener voltage to the +5 V reference voltage. R1 must be changed to compensate for differences in the reference zener voltage when the regulator is changed.

The 'series-pass' transistor (Q1) is chassis mounted to provide more adequate heat dissipation.

+5V Power Supply Protection

Current limiting is provided by R10 and U4. R10 is in series with the +5 V supply output; thus, the voltage across R10 is proportional to the series-pass transistor's (Q1) output current. U4 senses the voltage across R10 and switches the regulator OFF when the current output of Q1 becomes excessive.

Fuse F1 is a high-speed fuse which protects the printer's circuits, should the series-pass transistor become shorted.

Overvoltage protection is provided by CR12 and SCR Q2. When the supply output exceeds +5 V, CR12 fires Q2 which clamps the +5 V output to ground. When ac power is switched off, Q4 is switched ON to shut down U3.

±12V Power Supplies

Power for the±12 V supplies is provided by two separate full-wave bridge rectifiers. The 12 V supplies utilize self-contained regulators U1 and U2 to provide regulated ±12 V outputs.

Power On Preset (NPOP)

The Power On Preset (POP) circuit provides a low-true output to preset the printer logic when the printer is switched ON. The preset pulse is removed when the charge on C9 reaches the threshold of U5.

Motor Drive Assembly (A5)

Refer to the A5 Motor Drive Assembly Schematic Diagram, Figure 3-8. The Motor Drive Assembly (A5) consists of four darlington amplifiers and their power supply. Each of the amplifiers is switched ON by a 0V input signal (on MDA1, MDA2, MDB1, or MDB2) from the Control Logic Assembly (A2 or A92). Two amplifier outputs are connected to each step motor winding; one amplifier provides positive drive-current and the other amplifier provides negative drive-current. (Only one amplifier per motor winding is on at one time.) The two circuits containing Q1, Q3, Q5 and Q7 provide positive drive current; Q2, Q4, Q6, Q8, Q9, and Q10 provide negative drive current. CR1-CR4 protect the respective amplifiers from flyback current when current through the winding is switched OFF.

Example

When MDA1 is low, Q1 and Q5 are switched ON. (The Control Logic switched Q2 and Q6 OFF.) The positive current through the step motor winding (together with current through the second winding of the motor) causes the motor to step (rotate) a preset amount and stop. The motor will remain at that position until the drive current to at least one of the motor windings is reversed.

Power Supply

Power for the amplifiers is provided by Z1, a full-wave bridge rectifier, which outputs ±17V dc.

Chapter 3
Troubleshooting

Introduction

This chapter provides assembly access, print head alignment and troubleshooting procedures. This chapter, the theory of operation and the schematic diagrams will aid you in the repair of the printer.

Assembly Access

WARNING
DISCONNECT THE AC POWER CORD BEFORE REMOVING ANY PRINTER ASSEMBLY.

Most of the printer assemblies may be accessed by removing the three screws which are located at the back of the top cover, then removing the top cover. The removal of the two PC assembly retainer plates (Figure 3-1) allows the removal of any PC assembly which is contained in the upper portion of the instrument (A1 or A91, A2 or A92, A3, A4 and A5).

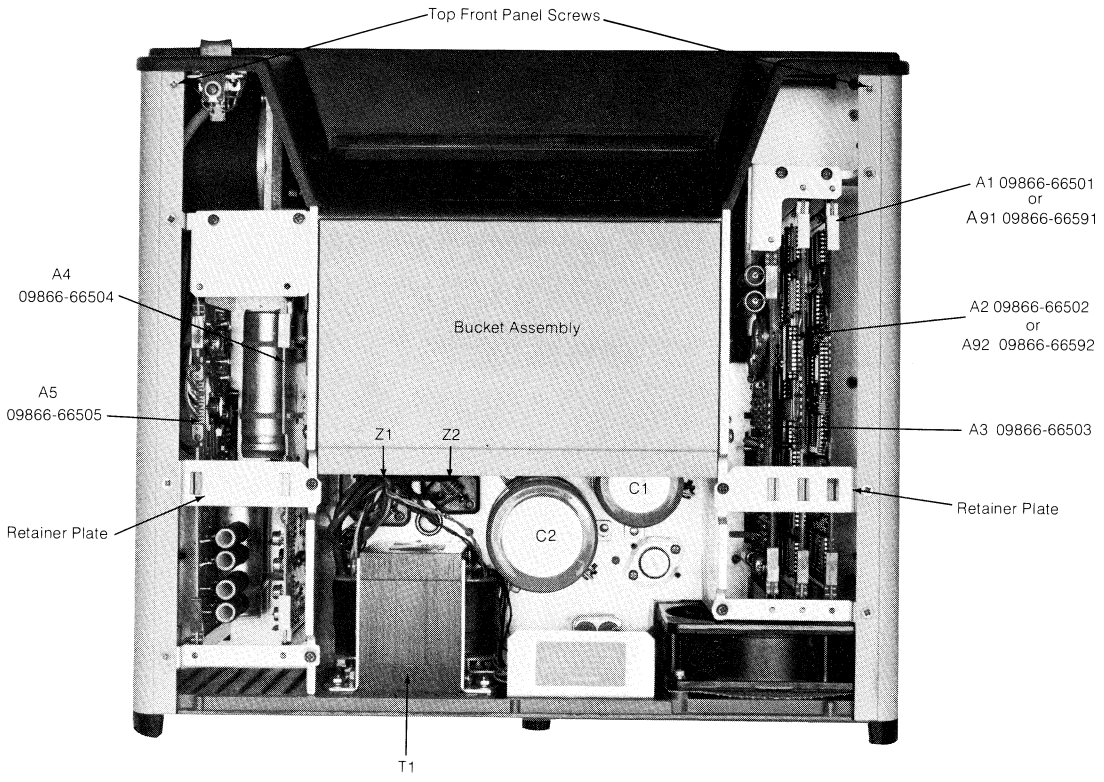
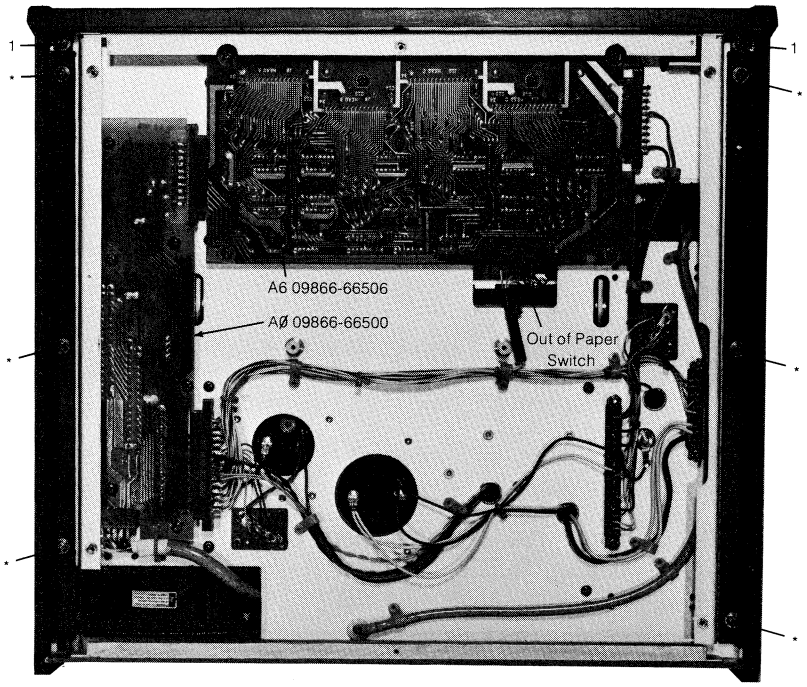


Figure 3-1. Upper Printer Assemblies

Access to the Row-data Storage (A6) and Motherboard (A0) assemblies can be obtained by placing the instrument on its rear panel and removing the six screws in the bottom cover. Once the bottom cover is removed, the A6 assembly (7 screws) or A0 assembly (6 screws) may be removed following the removal of the associated screws. It may be necessary to loosen the three screws (Figure 3-2) which hold the left, bottom foot to the chassis before the A0 assembly can be removed. If these three screws are loosened, they should not be tightened until the bottom cover is replaced and the 6 screws are tight. (This is necessary to provide proper alignment.)



*Feet Screws
1 Bottom Front Panel Screws

Figure 3-2. Printer Bottom Assemblies

Print Head Replacement

The following procedure should be used to replace one or more print heads.

1. Remove the top cover.
2. Loosen the two screws in the top-front and bottom-front of the instrument which attach the front panel to the chassis (see Figures 3-1 and 3-2); then pull the front panel out and to the side of the instrument. This provides access to the print head assembly (Figure 3-3).

CAUTION
CARE SHOULD BE TAKEN TO AVOID BREAKING THE CABLE WHICH CONNECTS THE FRONT PANEL AND THE MAINFRAME.

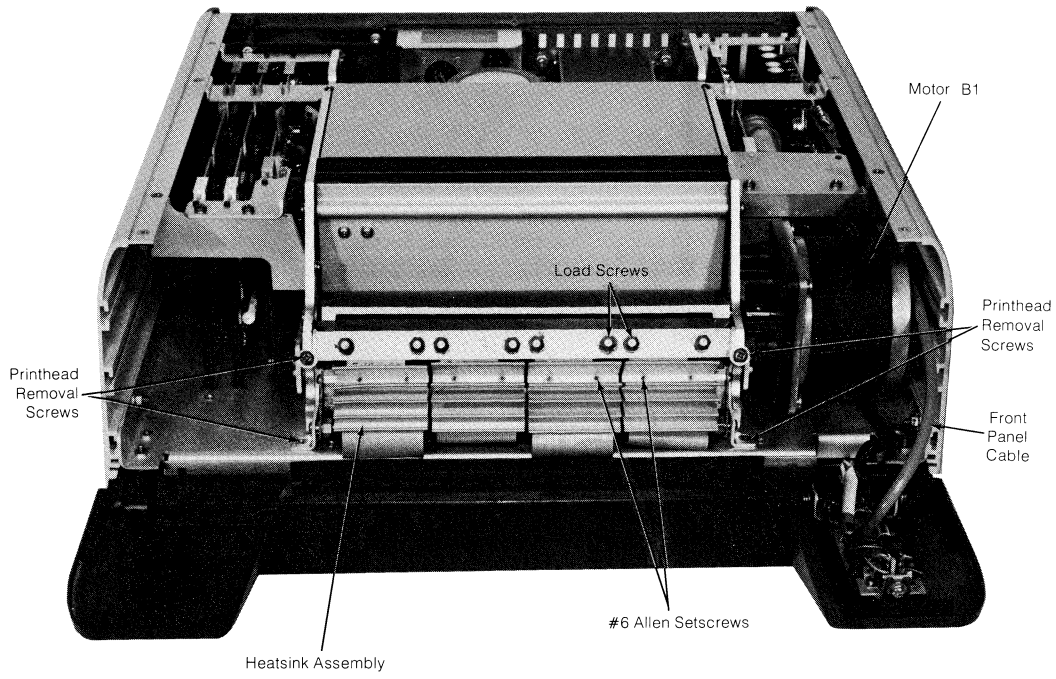


Figure 3-3. Removing the Print Head Assembly

3. Remove the two screws in the bottom-front and top-front of the print head assembly (see Figure 3-3). Then, lift the print head assembly upward until the four print head cables are extended. Use a small screwdriver (e.g., a #1010) to disconnect the four connectors from the A6 assembly. The screwdriver should be inserted into the slot in the front of each connector and gently turned until the connectors are forced apart.
4. Loosen the two load screws which are associated with the defective print head. If the load screws are removed, take care not to lose the spring inside each screw (see Figure 3-4).
5. Loosen the two associated #6 set screws (see Figure 3-3).
6. Remove the defective print head from the print head assembly.

CAUTION
THE PRINT HEADS MAY BE DAMAGED BY THE ABRASIVE ACTION OF THE HEAD AGAINST ANOTHER HEAD OR HARD OBJECT.

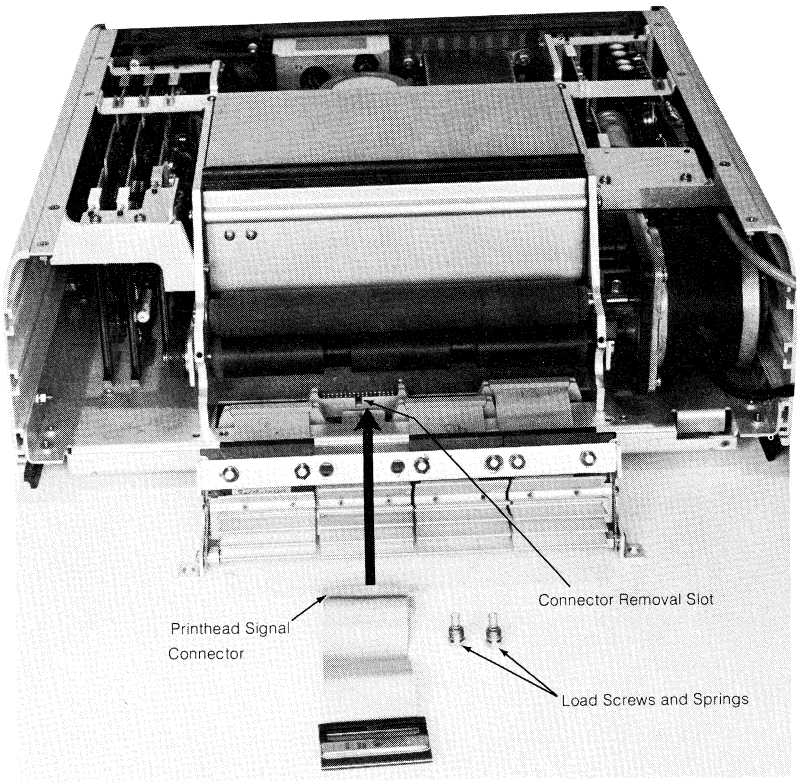


Figure 3-4. Removing a Head

7. Use a brush to clean the reference edge (see Figure 3-5) of the heat sink assembly. Ensure that the reference edge is free from all dirt, grime, or metal burrs (file if necessary). If the reference edge cannot be properly cleaned, replace the heat sink assembly.
8. When the print head(s) is being installed in the print head assembly, be sure that the bottom edge of the head is flush with the reference edge (Figure 3-5).
9. Use the .004 inch spacer to adjust the spacing between each head. Always begin the spacing with one of the two center heads used as a reference and space the adjacent heads .004 inches from it. The remaining head should be spaced in relation to the head next to the reference head. Thus, the two outside heads are spaced last.
10. Check to ensure that all eight #6 allen screws are tight and that each head appears to be properly aligned.

CAUTION

NEVER USE A ROUNDED #6 ALLEN WRENCH TO TIGHTEN THE PRINT HEAD ALLEN SCREWS. THE SCREWS MAY BE DAMAGED BY USING A ROUNDED OR DEFECTIVE WRENCH.

11. Reinstall the print head assembly by reversing steps 3 through 6. Ensure that the print head cables are not jammed between the chassis or the roller and the print head assembly.
12. Perform the 'Print Head Alignment Procedure' found in this chapter.
13. If the print head cannot be properly aligned, recheck steps 7 through 11. If the problem cannot be corrected, use Figure 3-5, the 9866 Bucket Assembly exploded view, to replace the Heat Sink Assembly (A8).

CAUTION
THE HEAT SINK ASSEMBLY ALIGNMENT IS CRITICAL. DO NOT DISASSEMBLE THE HEAT SINK ASSEMBLY.

Print Head Alignment Procedure

1. Switch the printer line switch to the OFF position and remove the ac power cord. Remove the top cover and the front panel.
2. Loosen the eight load screws (see Figure 3-3) approximately three turns.
3. Connect the Head Driver fixture (09866-60001) to the connector on the top of the H.V. Power Supply assembly (A4), and turn the knob on the fixture fully counter clockwise to reduce the voltage on the print resistors (the resistors might be damaged by normal printing currents during the alignment procedure). Connect the ac power cord to the printer and switch the printer ON. Then, connect the printer signal (I/O) cable.
4. Continuously print an 80-character line. If a 9800-Series Calculator is being used, then the 9866 Printer Exerciser may be used. The 9866 Exerciser can be run continuously by performing the following step after the 9866 exerciser has been loaded into the calculator memory.

   9810A PRESS: SET FLAG, END, CONTINUE
   9815A PRESS: SET FLAG 1
   9820A PRESS: SET FLAG 0, RUN PROGRAM
   9821A PRESS: SET FLAG 2, EXECUTE, GOTO 0, EXECUTE, RUN PROGRAM
   9825A PRESS: 0 for the number of times to perform the test.
   9830A PRESS: 0 for the number of times to perform the test.

5. While the printer is printing, turn the knob on the fixture until printing is just visible. Then adjust the two alignment cams (see Figure 3-5) for an optimum printout.
6. Tighten the eight load screws and check the printout. If three heads result in a satisfactory printout but the fourth head appears to be too light on one side, loosen the load screw on the dark side until the printout is even.
7. Turn the knob on the fixture to the clockwise stop and again check the printout. If the printout is satisfactory, disconnect the ac power cord and reassemble the printer. Otherwise, repeat steps 5 through 7 until the printout is satisfactory.
8. If a satisfactory printout cannot be obtained, refer to Step 13 of the Print Head Replacement Procedure.

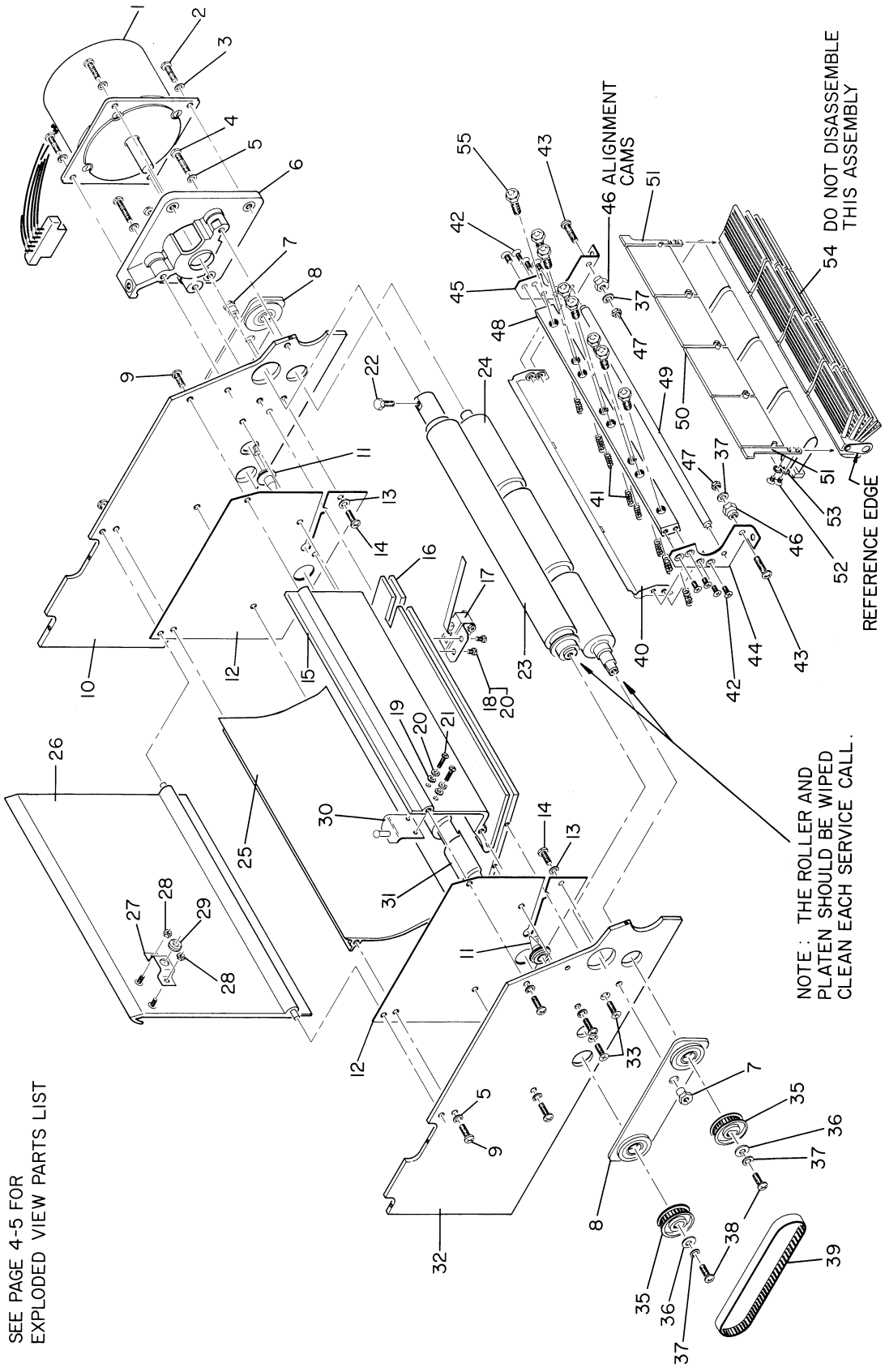


Figure 3-5. 9866 Bucket Assembly

Chassis

WARNING

UNLESS OTHERWISE SPECIFIED, ALL AC POWER MUST BE REMOVED FROM THE 9866 FOR A MINIMUM OF 60 SECONDS PRIOR TO PERFORMING ANY TROUBLESHOOTING ON CHASSIS COMPONENTS. THIS ALLOWS TIME FOR CAPACITOR DISCHARGE. FAILURE TO OBSERVE THIS WARNING MAY RESULT IN ELECTRICAL SHOCK TO SERVICE PERSONNEL.

1. Disconnect the ac power cord and wait at least 60 seconds before proceding with step number 2.
2. Remove the printer top and bottom covers.
3. Visually inspect the chassis for foreign, conductive materials and loose or damaged components. Ensure that the case of Q1 and Q2 is not shorted to the chassis. Make all necessary repairs of any defects which are found during the visual inspection.
4. Remove the A3, A4, and A5 PC assemblies. Then, disconnect the connector to the motherboard (A0). See Figure 3-2.
5. Use an HP 427A Multimeter (or equivalent) to check Q1, Q2, and CR1. (Resistance reverse biased should be 10 times the resistance forward biased.) These components may be easily accessed on J4 and J7 (see the Chassis Wiring Diagram, Figure 3-9). Ensure that C1 and C2 are not shorted.
6. Check the full-wave bridge rectifiers, Z1 and Z2, for shorted or open diodes.
7. The power transformer, T1, may be checked by measuring the voltage on each secondary winding (with A3, A4 and A5 removed). Table 3-1 lists the ac voltage output of each winding. The ac power must be connected and the line switch in the ON position to perform this step.

WARNING

HAZARDOUS PRIMARY (AC) VOLTAGES ARE PRESENT AT VARIOUS POINTS IN THE PRINTER WHEN CHECKING THE POWER TRANSFORMER OUTPUTS.

CAUTION

REMOVE ALL POWER AND ALLOW AT LEAST 60 SECONDS FOR C1 AND C2 TO DISCHARGE BEFORE REINSTALLING ANY OF THE PC ASSEMBLIES.

Table 3-1. Open Circuit Secondary Voltages

TRANSFORMER OUTPUT	VOLTAGE (rms)
Blu-Blu	18.2 Vac
Orn-Orn	18.2 Vac
Grn-Grn	09.6 Vac
Gry-Gry	38.0 Vac
Yel-Yel	27.7 Vac
Yel-Brn	13.8 Vac
Voltage across C1	9.6 Vdc
Voltage across C2	52 Vdc

Low Voltage Power Supplies (A3)

The following procedures assume that the problem has been isolated to the A3 assembly.

Before troubleshooting the A3 assembly, remove the PC board and visually inspect the board for damaged components or foreign, conductive materials. If any defects are found, they should be corrected before proceeding.

±12V Power Supplies

Measure the ±12 V power supply outputs. If either of the supply outputs is not in the required specification (12 V ± 5%), check the output of the full-wave bridge rectifier for 22.0 V (±10%). If the full-wave bridge output does not meet the required voltage specifications, repair the bridge. If the full-wave bridge voltage output is satisfactory, replace the associated regulator (U1 or U2).

+5V Power Supply

To troubleshoot the +5 V power supply, perform the following procedure.

1. Check A3Q1. Replace A3Q1 if it is suspected of being defective.
2. Check, and replace if defective: F1, CR12, and Q2.
3. Replace the voltage regulator, U3. It may be necessary to change R1 to bring the power supply output within the required voltage specifications. To select the proper value for R1, substitute a 2K-ohm pot. for R1. Adjust the pot. for the correct power supply output, measure the resistance to which the pot. is adjusted and use Table 3-2 to select the nearest resistor value.
4. If the power supply is still defective, replace U4.

Table 3-2. R1 Padding List

All resistors are 1% tolerance

Description		Part No.
R-F	750 OHM	0757-0420
R-F	768 OHM	0698-4462
R-F	787 OHM	0698-4014
R-F	806 OHM	0698-3557
R-F	825 OHM	0757-0421
R-F	845 OHM	0698-4463
R-F	866 OHM	0698-3495
R-F	887 OHM	0698-4464
R-F	909 OHM	0757-0422
R-F	931 OHM	0698-4465
R-F	953 OHM	0698-4125
R-F	976 OHM	0698-4466
R-F	1000 OHM	0757-0280
R-F	1020 OHM	0698-4195
R-F	1050 OHM	0698-4467
R-F	1070 OHM	0698-4196
R-F	1100 OHM	0757-0424
R-F	1130 OHM	0698-4468
R-F	1150 OHM	0698-4469
R-F	1180 OHM	0698-3512
R-F	1210 OHM	0757-0274
R-F	1240 OHM	0698-3223

Power On Preset Circuit

1. Check CR8, 10, 13, 14, 15, and 17, and replace if found defective.
2. Check C8, C9, and C10 for shorts.
3. Replace U5.

Motor Drive Assembly (A5)

The following procedure assumes that the problem has been isolated to the A5 assembly.

Visually inspect the A5 assembly for foreign, conductive material and loose or damaged components. If any defects are found, perform any repairs that are necessary.

The following procedure should assist you in the location of defective A5 assembly components.

1. Install the defective A5 assembly into the printer and switch the LINE switch ON.
2. Check for ±17 Vdc output from Z1 (to ground).
3. Use an HP 427A Multimeter (or equivalent) to measure the dc voltage on the collectors of the large, heat sunk transistors (Q1 - Q4) while holding 'PAPER ADVANCE' pressed.

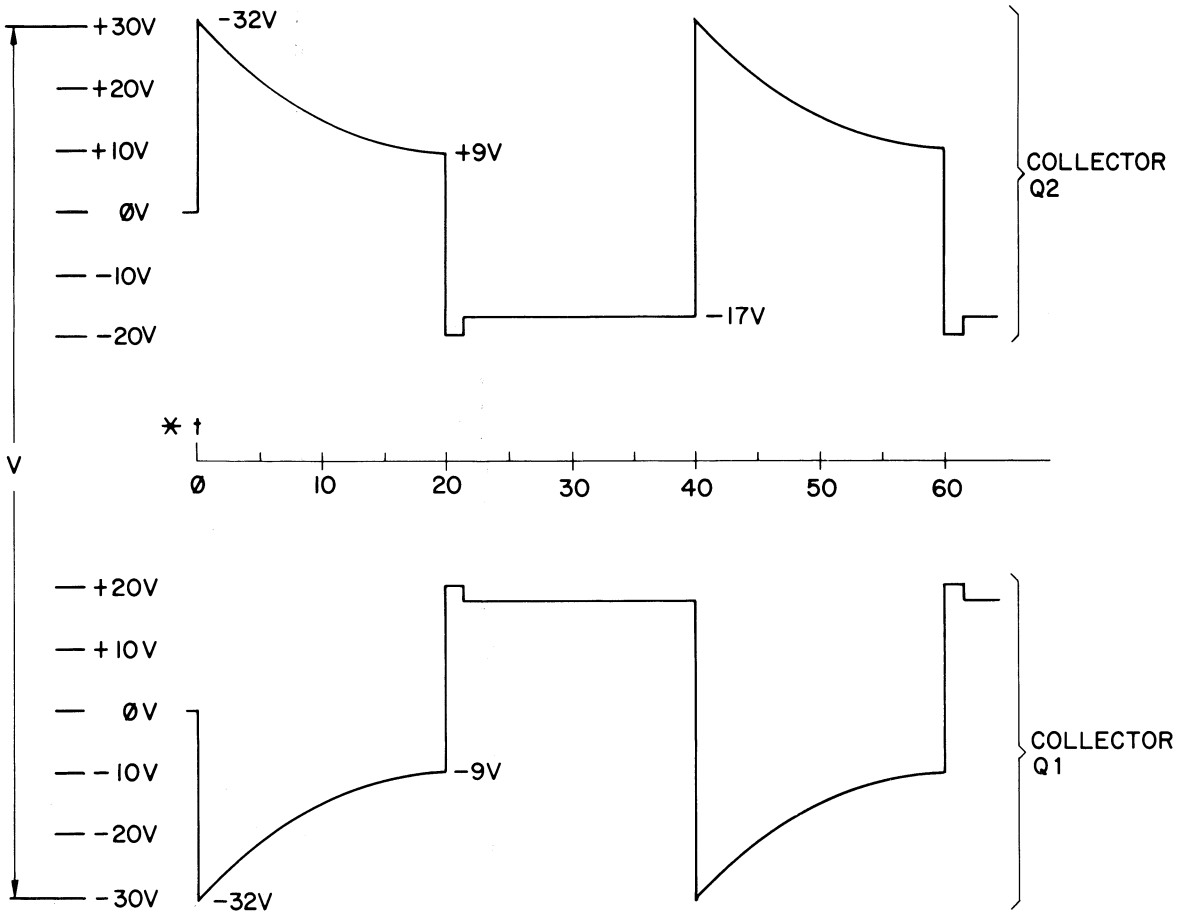
Result:	Button Pressed	Button Released
Q1 and Q3	+2.5 Vdc ±10%	+17 V or −6 Vdc
Q2 and Q4	−2.5 Vdc ±10%	−17 V or +6 Vdc

4. If any of the voltages are incorrect, repair the associated amplifier. The two transistors in each darlington pair should be replaced together; the 'flyback' diodes CR1 through CR4 should be checked while the associated driver is removed.
5. If any doubt exists as to proper amplifier operation, an HP 180A Oscilloscope (or equivalent) may be used to observe the waveform on the collector of Q1 through Q4 (next page) while holding 'PAPER ADVANCE' pressed.

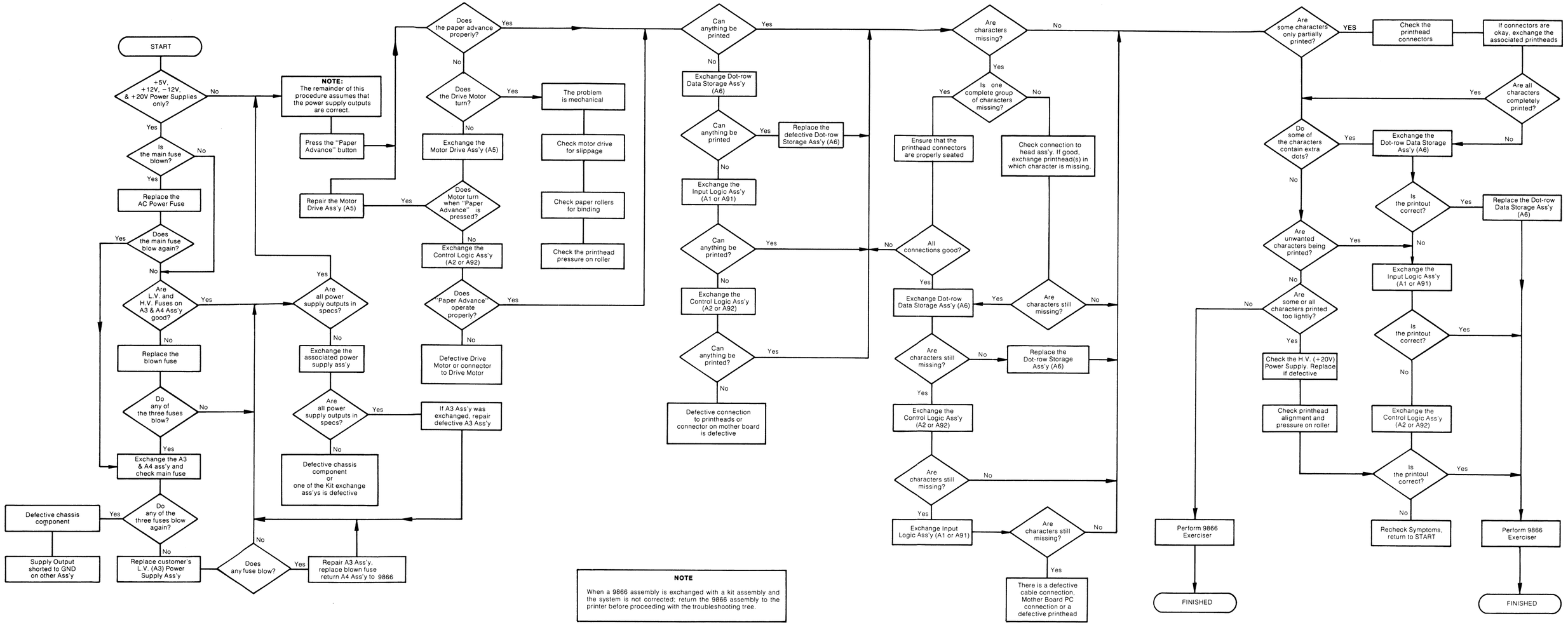
6. If all four amplifiers are inoperative, either Z1, C1, or C2 is defective.

NOTE

The value of A5 R1 - R4 has been changed from 15 ohms (10W) to 10 ohms (20W) to increase the torque developed by the motor. Low motor torque and motor chatter are eliminated with this change.

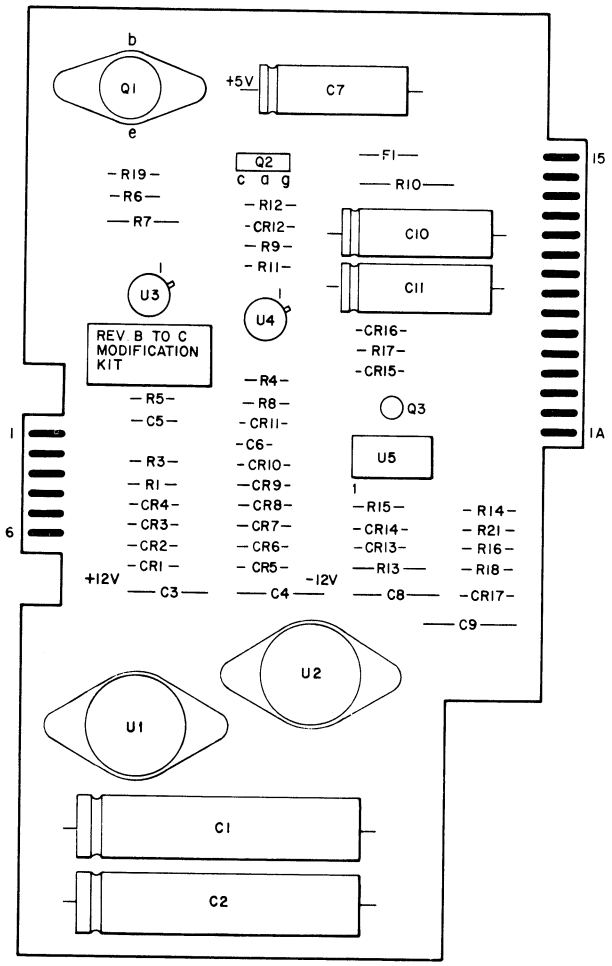


Motor Drive Waveform



D50873

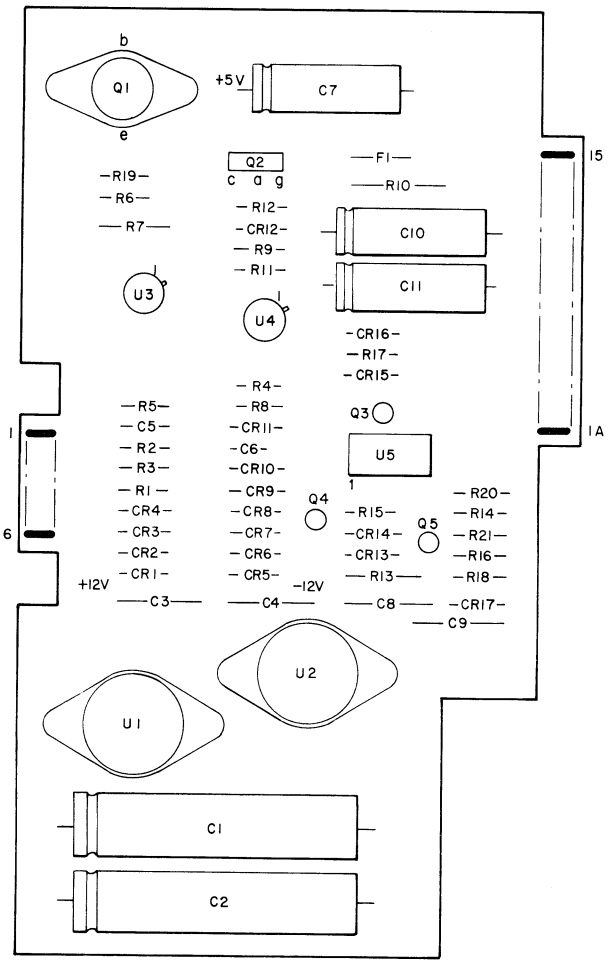
Figure 3-6. 9866 Troubleshooting Tree



COMPONENT SIDE

A3

-hp- Part No. 09866-66503 Rev B



COMPONENT SIDE

A3

-hp- Part No. 09866-66503 Rev C, D

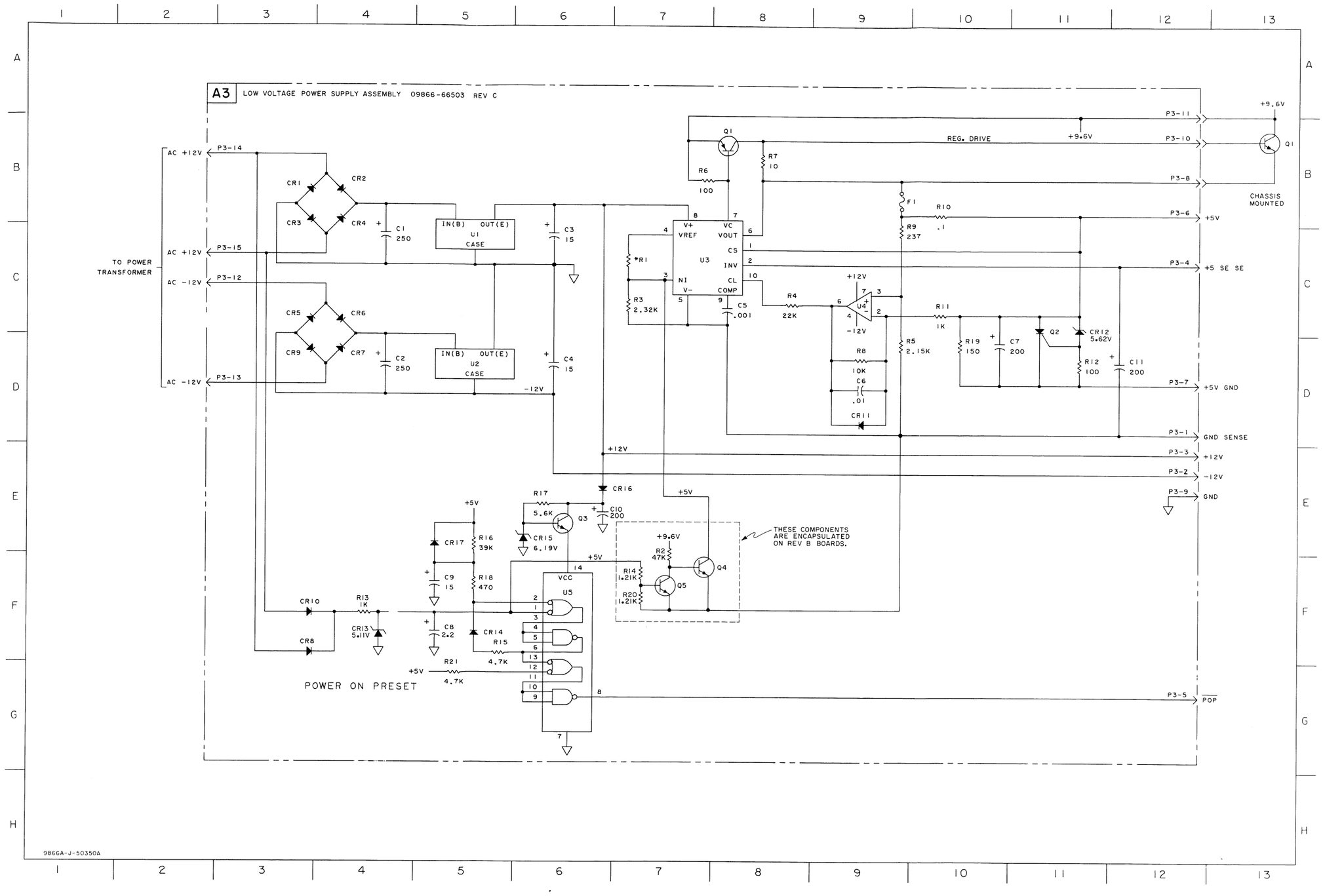
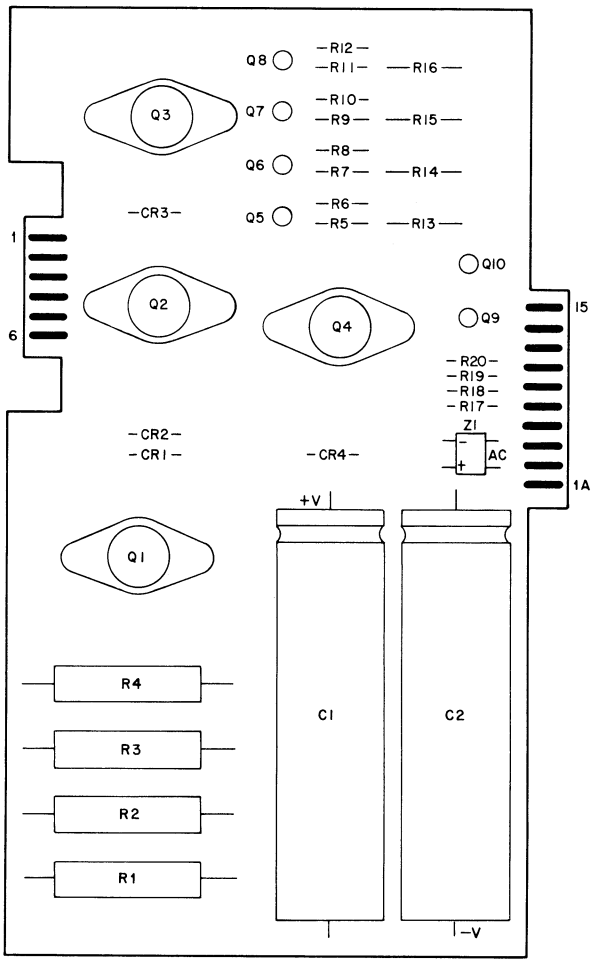


Figure 3-7. Low Voltage Power Supply Schematic Diagram



COMPONENT SIDE

A5

-hp- Part No. 09866-66505 Rev A

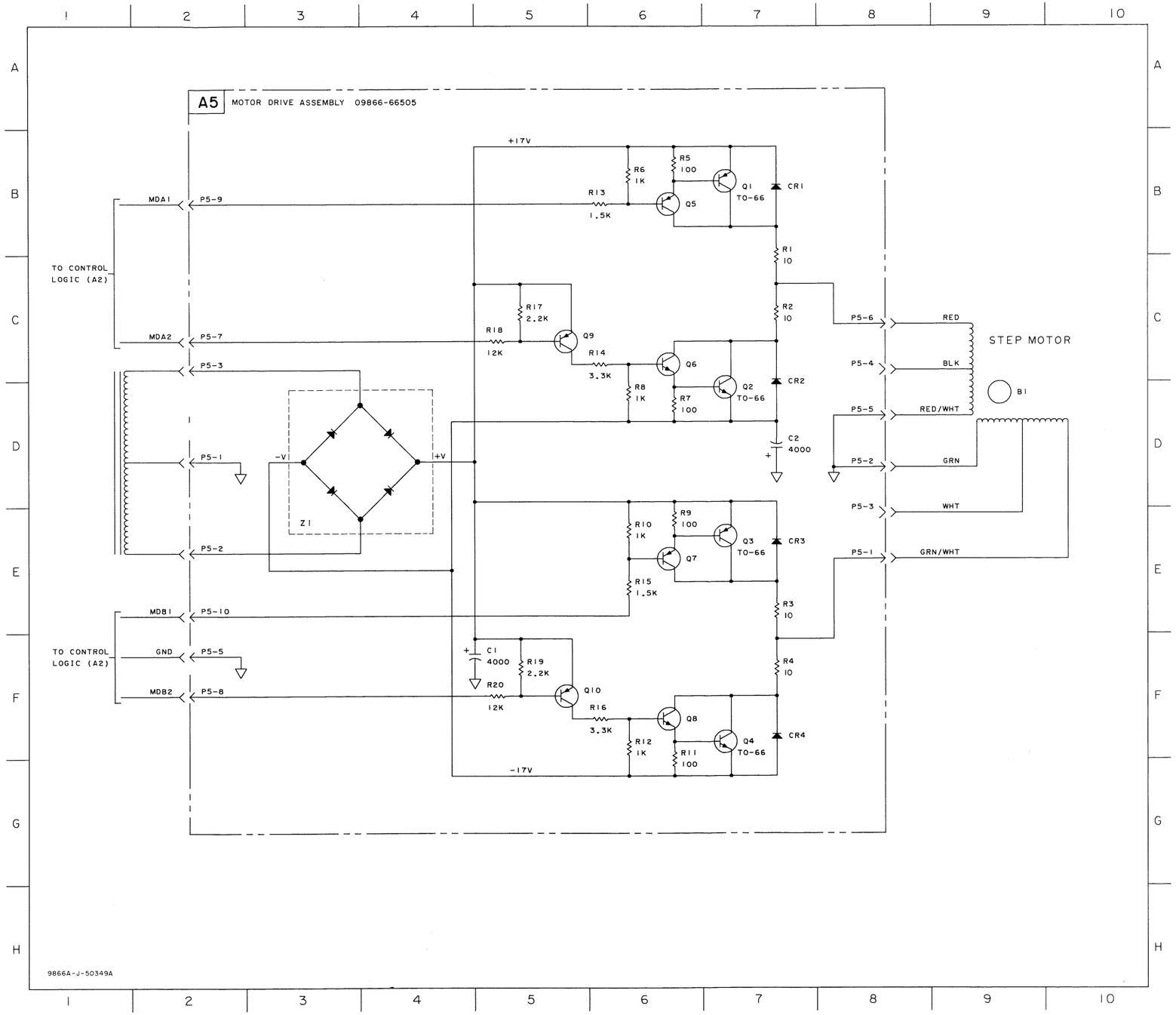


Figure 3-8. Motor Drive Assembly Schematic Diagram

J1
INPUT ASS'Y CONN.

Pin	Signal	Pin	Signal
1	GND	A	GND
2	+5 V	B	+5 V
3	HIRC	C	N/C
4	RST	D	YRC7
5	+12 V	E	RBIT2
6	−12 V	F	RBIT4
7	SCLK	H	RBIT5
8	YRCZ	J	RBIT3
9	OTP	K	RBIT1
10	YNOP	L	OTP
11	RFLG	M	FLG
12	HCFLG	N	BIT 0
13	HIST2	P	BIT 1
14	HSFLG	R	BIT 2
15	YLFE	S	BIT 3
16	GND	T	BIT 4
17	GND	U	BIT 5
18	I/O GND	V	BIT 6

J2
LOGIC ASS'Y CONN.

Pin	Signal	Pin	Signal
1	+5 V	A	+5 V
2	GND	B	GND
3	GND	C	YRC7
4	N/C	D	HIRC
5	YRCZ	E	RST
6	SCLK	F	YNOP
7	PNT	H	RFLG
8	PC 1	J	HCFLG
9	PC 0	K	HIST 2
10	HIST 3	L	YLFE
11	POP	M	OTP
12	LMPD	N	HSFLG
13	MDB 2	P	ROP
14	MDA 1	R	SOP
15	MDA 2	S	SPA
16	MDB 1	T	RPA
17	GND	U	GND
18	CLB	V	CMD

J3
LOW VOLTAGE ASS'Y

Pin	Signal
1	GND SENSE
2	−12 V
3	+12 V
4	+5 SENSE
5	POP
6	+5 V
7	GND
8	+5 V #1
9	GND
10	BASE Q1
11	RAW 5 V
12	AC −12 V
13	AC −12 V
14	AC +12 V
15	AC +12 V

J4
PRINT RESISTOR
D.C. SUPPLY ASS'Y

Pin	Signal
1	COL. Q2
2	GND (PR)
3	GND (PR)
4	+V (PR)
5	+V (PR)
6	RAW DC COM
7	N/C
8	CROW BAR
9	RAW DC
10	FUSE DC
11	N/C
12	N/C
13	BASE Q2
14	N/C
15	GND
16	+5 V
17	+12 V
18	−12 V

J5
MOTOR DRIVE ASS'Y

Pin	Signal
1	AC COM
2	AC
3	AC
4	N/C
5	GND
6	N/C
7	MDA 2
8	MDB 2
9	MDA 1
10	MDB 1

J6
ROW DATA STORAGE ASS'Y

Pin	Signal	Pin	Signal
1	RBIT5	A	RBIT2
2	RBIT4	B	RBIT1
3	RBIT3	C	HIST3
4	PNT	D	PC 1
5	N/C	E	PC 0
6	+5 V	F	+5 V
7	+5 V	H	+5 V
8	GND	J	GND
9	GND	K	GND
10	GND	L	GND

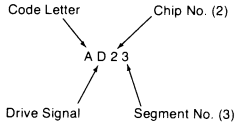
J7
CABLE CONN.

Pin	Signal	Pin	Signal
1	GND	A	GND
2	GND	B	GND
3	GND	C	GND
4	+5 V	D	GND
5	+5 V	E	−12 V
6	+5 V	F	+12 V
7	+5 V #1	H	AC −12 V
8	+5 V #1	J	AC −12 V
9	BASE Q1	K	AC +12 V
10	RAW 5V	L	AC +12 V
11	N/C	M	LMPD
12	RPA	N	MDB 2
13	SPA	P	MDA 1
14	SOP	R	MDA 2
15	ROP	S	MDB 1

J8, 9, 10, 11
HEAD ASS'Y CONN.

Pin	Signal	Pin	Signal
1	+V (PR)	2	GND
3	+5 V	4	AGC1
5	AD55	6	AD54
7	AD53	8	AD52
9	AD51	10	AD45
11	AD44	12	AD43
13	AD42	14	AD41
15	AD35	16	AD34
17	AD33	18	AD32
19	AD31	20	AD25
21	AD24	22	AD23
23	AD22	24	AD21
25	AD15	26	AD14
27	AD13	28	AD12
29	AD11	30	AGC2
31	AGC3	32	AGC4
33	GND	34	+V (PR)

NOTE
Pin assignment on Conn's J8, 9, 10, and11 are all the same except for resistor assembly Code Letter.

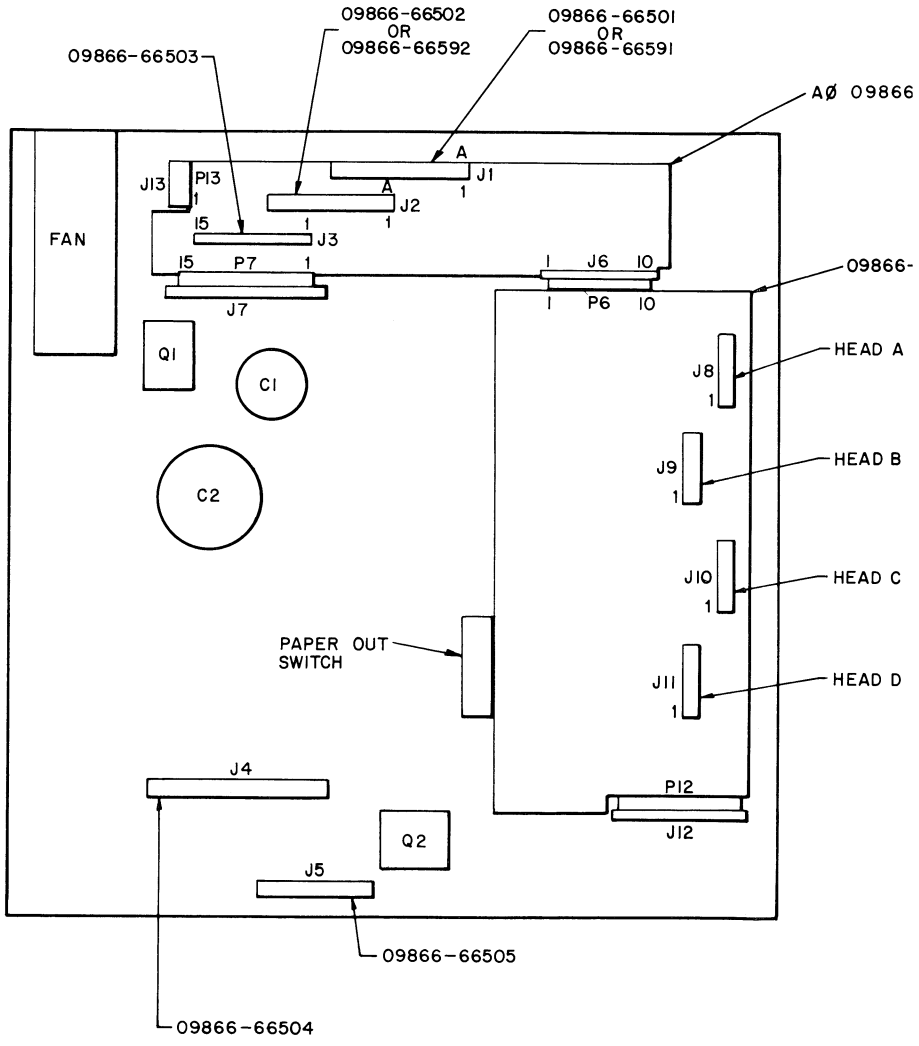


J13
INPUT CONN.

Pin	Signal	Pin	Signal
1	CMD	A	CLB
2	BIT 6	B	I/O GND
3	BIT 1	C	BIT 5
4	BIT 0	D	BIT 4
5	FLG	E	BIT 3
6	OTP	F	BIT 2

J14
REAR INPUT CONN.

Pin	Signal	Pin	Signal
A	CMD	K	BIT 4
B	PIP	L	BIT 5
C	BIT 6	M	OTP
D	BIT 2	N	N/C
E	BIT 1	P	N/C
F	BIT 0	R	N/C
G	CLB	S	N/C
H	FLG	T	N/C
J	BIT 3	U	N/C
		V	GND


09866-66502
OR
09866-66592
09866-66501
OR
09866-66591
09866-66503
AØ 09866
A
J1
1
A
J2
1
J13
P13
1
15
1
J3
FAN
15
P7
1
J7
1
J6
10
1
P6
10
09866-
Q1
C1
C2
J8
1
HEAD A
J9
1
HEAD B
J10
1
HEAD C
PAPER OUT
SWITCH
J11
1
HEAD D
J4
P12
J12
Q2
J5
09866-66505
09866-66504

B50936

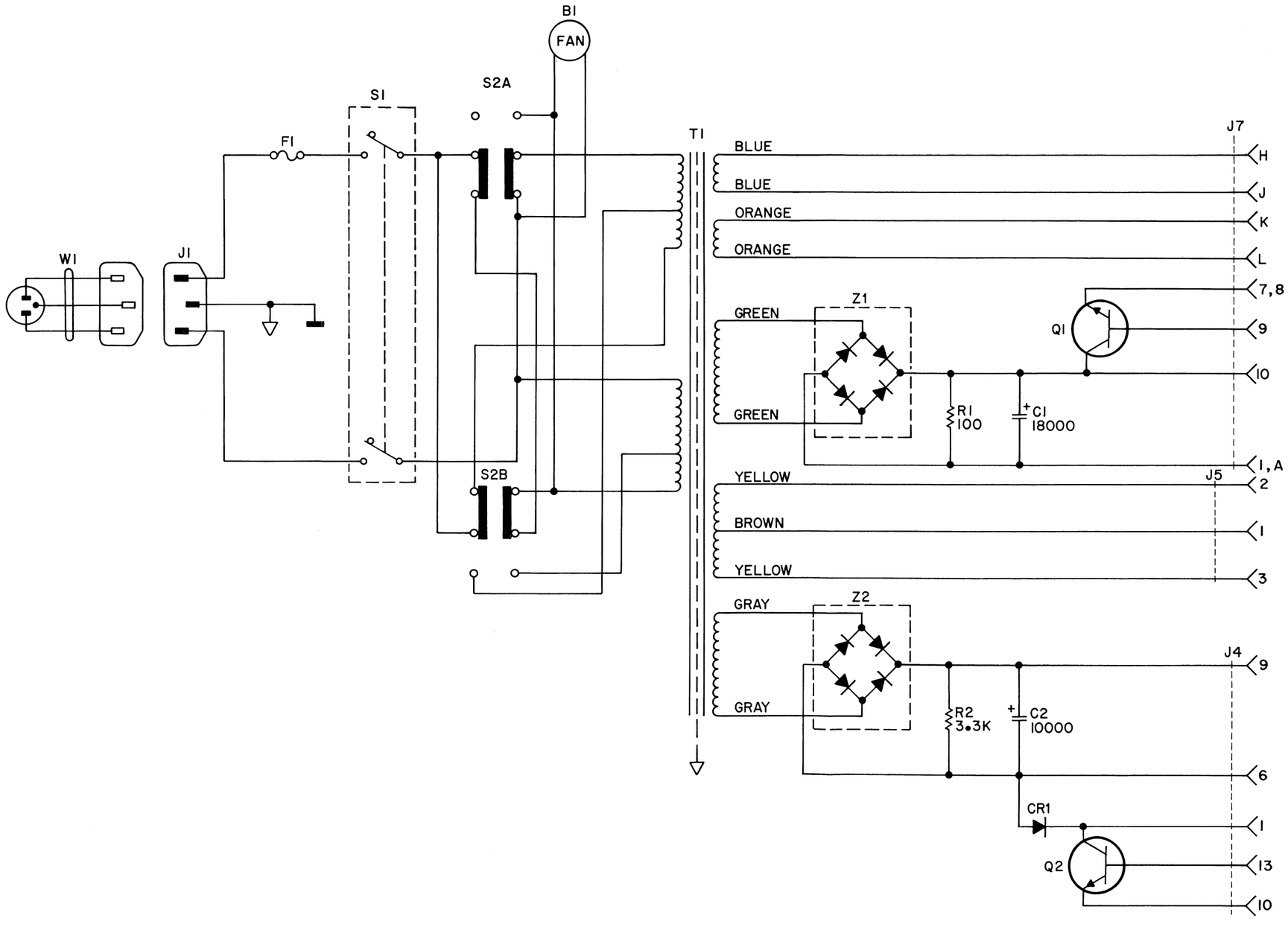


Figure 3-9. Chassis Wiring Schematic Diagram

Chapter 4
Replaceable Parts

Introduction

This chapter lists the printer's replaceable parts. The electrical parts are listed in order of component designators for any particular assembly. Each mechanical part has a reference number. These numbers refer to the numbers on Figure 3-5.

ABBREVIATIONS

Ag .....silver
Al ..... Aluminum
A ..... Ampere(s)
Au ..... gold

C ..... capacitor
cer .....ceramic
coef ..... coefficient
com .....common
comp .....composition
conn .....connection

dep ..... deposited
DPDT ..... double-pole double-throw
DPST ..... double-pole single-throw

elect .....electrolytic
encap .....encapsulated

F .....farad(s)
FET ..... field effect transistor
fxd .....fixed

GaAs ..... gallium arsenide
GHz ..... gigahertz = 10^{+9} hertz
gd ..... guard(ed)
Ge .....germanium
grd .....ground(ed)

H .....henry(ies)
Hz ..... mercury
Hz .....hertz (cycle(s) per second)

ID .....inside diameter
impg .....impregnated
incd .....incandescent
ins .....insulation(ed)

kΩ ..... kilohm(s) = 10^{+3} ohms
kHz ..... kilohertz = 10^{+3} hertz

L .....inductor
lin .....linear taper
log ..... logarithmic taper

mA ... milliampere(s) = 10^{-3} amperes
MHz ..... megahertz = 10^{+6} hertz
MΩ ..... megohm(s) = 10^{+6} ohms
met flm .....metal film
mfr ..... manufacturer
ms .....millisecond
mtg ..... mounting
mV .....millivolt(s) = 10^{-3} volts
μF ..... microfarad(s)
μs ..... microseconds(s)
μV .....microvolt(s) = 10^{-6} volts
my .....Mylar®

nA ....nanoampere(s) = 10^{-9} amperes
NC ..... normally closed
Ne .....neon
NO ..... normally open
NPO .....negative positive zero (zero temperature coefficient)

ns .....nanosecond(s) = 10^{-9} seconds
nsr ..... not separately replaceable

Ω ..... ohm(s)
obd .....order by description
OD .....outside diameter

p .....peak
pA .....picoampere(s)
pc ..... printed circuit
pF .....picofarad(s) = 10^{-12} farads

piv ..... peak inverse voltage
p/o ..... part of
pos .....postion(s)
poly ..... polystyrene
pot .....potiometer
p-p .....peak-to-peak
ppm .....parts per million
prec .....precision (temperature coefficient, long term stability, and/or tolerance)

R .....resistor
Rh .....rhodium
rms ..... root-mean-square
rot .....rotary

Se .....selenium
sect ..... section(s)
Si .....silicon
sl ..... slide

SPDT ..... single-pole double-throw
SPST ..... single-pole single-throw

Ta .....tantalum
TC ..... temperature coefficient
TiO_2 .....titanium dioxide
tog .....toggle
tol ..... tolerance
trim ..... trimmer
TSTR ..... transistor

V .....volt(s)
vacw ..... alternating current working voltage
var .....variable
vdcw ... direct current working voltage

W ..... watt(s)
w/ ..... with
wiv ..... working inverse voltage
w/o ..... without
ww .....wirewound

* ..... optimum value selected at factory, average value shown (part may be omitted)
** .....no standard type number assigned (selected or special type

®Dupont de Nemours

DECIMAL MULTIPLIERS

Prefix	Symbols	Multiplier	Prefix	Symbols	Multiplier
tera	T	10^{12}	centi	c	10^{-2}
giga	G	10^{9}	milli	m	10^{-3}
mega	M or Meg	10^{6}	micro	μ	10^{-6}
kilo	K or k	10^{3}	nano	n	10^{-9}
hecto	h	10^{2}	pico	p	10^{-12}
deka	da	10	femto	f	10^{-15}
deci	d	10^{-1}	atto	a	10^{-18}

DESIGNATORS

A ..... assembly
B ..... motor
BT ..... battery
C ..... capacitor
CR ..... diode
DL ..... delay line
DS ..... lamp
E ..... misc electronic part
F ..... fuse
FL ..... filter
HR ..... heater
J ..... jack
K ..... relay
L ..... inductor
LS ..... speaker, horn
M ..... meter
MP ..... mechanical part
P ..... plug
PU ..... recording head
Q ..... transistor
R ..... resistor
RT ..... thermistor
S ..... switch
T ..... transformer
TB ..... terminal board
TC ..... thermocouple
TP ..... test point
U ..... integrated circuit
V ..... vacuum tube, neon bulb, photocell, etc.
W ..... cable
X ..... socket
XDS ..... lampholder
XF ..... fuseholder
Y ..... crystal
Z ..... network

Rev K

Table 4-1. Replaceable Parts

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
A3	**09866-66503**	**1**	**LOW VOLTAGE POWER SUPPLY**		
C1, C2	0180-2561	2	C-F: 250UF		
C3, C4	0180-1746	3	C-F: 15UF, 20V		
C5	0160-3456	1	C-F: .001, 1KV		
C6	0150-0093	1	C-F: .01UF, 100V		
C7	0180-0104	3	C-F: 200UF, 15V		
C8	0180-0197	1	C-F: 2.2UF, 35V		
C9	0180-1746		C-F: 15UF, 20V		
C10, C11	0180-0104		C-F: 200UF, 15V		
CR1-CR10	1901-0045	12	Diode: Si, .75A, 100V		
CR11	1901-0040	3	Diode: Si, .05A, 30V		
CR12	1902-3104	1	Diode: Bkdn, 5.62V		
CR13	1902-0041	1	Diode: Si, 5.11V		
CR14	1901-0040		Diode: Si, .75A, 100V		
CR15	1902-0049	1	Diode: Bkdn, 6.19V		
CR16	1901-0045		Diode: Si, .05A, 30V		
CR17	1901-0045		Diode: Si, .75A, 100V		
F1	2110-0454	1	Fuse: Ceramic		
Q1	1853-0396	1	XSTR: 2N4899		
Q2	1884-0082	1	Thyristor		
Q3	1854-0019	1	XSTR: Si, NPN		
Q4, Q5	1854-0071	2	XSTR: Si, NPN		
R*1	See Table 3-2	1	R-F: Padded value		
R3	0698-4434	1	R-F: 2320 OHM, 1%		
R4	0684-2221	1	R-F: 2200 OHM, 10%		
R5	0698-0084	1	R-F: 2150 OHM, 1%		
R6	0684-1011	2	R-F: 100 OHM, 10%		
R7	0687-1001	1	R-F: 10 OHM, 10%		
R8	0684-1031	1	R-F: 10K, 10%		
R9	0698-3442	1	R-F: 237 OHM, 1%		
R10	0811-1827	1	R-F: .1 OHM, 3W, 10%		
R11	0684-1021	1	R-F: 1000 OHM, 10%		
R12	0684-1011		R-F: 100 OHM, 10%		
R13	0687-1021	1	R-F: 1000 OHM, 10%		
R14, R20	0757-0274	2	R-F: 1021 OHM, 1%		
R15, R21	0684-4721	2	R-F: 4700 OHM, 10%		
R16	0684-3931	1	R-F: 39K, ¼W 10%		
R17	0684-5621	1	R-F: 5600 OHM, 10%		
R18	0684-4711	1	R-F: 470 OHM, 10%		
R19	0684-1511	1	R-F:150 OHM, 10%		
R22	0684-4721		R-F: 4700 OHM, 10%		
R2	0684-4731	1	R-F: 47K, 10%		
U1, U2	1826-0117	2	IC: Linear		
U3	1820-0196	1	IC: U5R7723393		
U4	1820-0203	1	IC: Opr Ampl		
U5	1820-0583	1	IC: DM74LO0		
	0403-0213	2	Extr: PC Bd, Orn		
A5	**09866-66505**	**1**	**MOTOR DRIVE ASSEMBLY**		
C1, C2	0180-2082	2	C-F: 4000UF, 25V		
CR1 - CR4	1901-0045	4	Diode: Si, .75A, 100V		
Q1	1853-0396	2	XSTR: 2N4899		
Q2	1854-0072	2	XSTR: 2N3054		
Q3	1853-0396		XSTR: 2N4899		
Q4	1854-0072		XSTR: 2N3054		
Q5	1853-0281	4	XSTR: 2N2907A		
Q6	1854-0527	2	XSTR: 2N2895		

Table 4-1. Replaceable Parts (cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
A5	**09866-66505**	**1**	**MOTOR DRIVE ASSEMBLY (cont'd)**		
Q7	1853-0281		XSTR: 2N2907A		
Q8	1854-0527		XSTR: 2N2895		
Q9, Q10	1853-0281		XSTR: N2907A		
R1 - R4	0811-1655	4	R-F: 10 OHM		
R5	0684-1011	4	R-F: 100 OHM		
R6	0684-1021	4	R-F: 1000 OHM		
R7	0684-1011		R-F: 100 OHM		
R8	0684-1021		R-F: 1000 OHM		
R9	0684-1011		R-F: 100 OHM		
R10	0684-1021		R-F: 1000 OHM		
R11	0684-1011		R-F: 100 OHM		
R12	0684-1021		R-F: 1000 OHM		
R13	0687-1521	2	R-F: 1500 OHM		
R14	0687-3321	2	R-F: 3.3K		
R15	0687-1521		R-F: 1500 OHM		
R16	0687-3321		R-F: 3.3K		
R17	0684-2221	2	R-F: 2200 OHM		
R18	0684-1231	2	R-F: 12K		
R19	0684-2221		R-F: 2200 OHM		
R20	0684-1231		R-F: 12K		
Z1	1901-0638	1	Diode Ass'y: Si, 200V		
	0403-0215	2	Extr: PC Bd, Grn		
	09865-26505	1	PC BD: Motor Drive		
	09202-04602	1	Screen, Filter		
	09866-22001	1	Casting, Rear		
	09866-60301	1	Plate, Outer Ass'y		
	09866-60408	1	Connector Rear Ass'y		
	09866-61601	1	Cable I/O Ass'y		
	09866-61602	1	Cable Power Ass'y		
	1400-0084	1	Holder Fuse		
	3150-0223	1	Filter, Foam		
	3160-0262	1	Fan, Tub Axial		
	5040-5833	1	Shoud, Fan		
	9100-3295	1	XFMR Power		
	09866-67904	**1**	**CHASSIS, MAIN ASS'Y**		
C1	0180-2560	1	C-F: 18000UF		
C2	0180-2559	1	C-F: 10000UF		
CR1	1901-0684	1	Diode: Si 100V		
Q1	1854-0458	1	XSTR		
Q2	1853-0340	1	XSTR		
R1	0598-3620	1	R-F: 100 OHM		
R2	0764-0003	1	R-F: 3.3K		
Z1	1901-0261	1	Diode: Si, 100V		
Z2	1906-0008	1	Rect		
	09820-27902	10	Stud, Side Panel		
	09866-00101	1	Deck Main		
	09866-00501	1	Angle Right		
	09866-00502	1	Angle Left		
	09866-23201	2	Mount		
	09866-24102	1	Cover Left Side		
	09866-24103	1	Cover Right Side		
	09866-61603	1	Cable Ass'y Main		

Table 4-1. Replaceable Parts (cont.)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
	09866-67904	**1**	**CHASSIS, MAIN ASS'Y (cont'd)**		
	09866-66500	1	PC Ass'y, Motherboard		
	09866-66503	1	PC Ass'y, Low Voltage		
	09866-69504	1	PC Ass'y, PNT Supply		
	09866-67907	1	Panel Rear Ass'y		
	1200-0043	2	Insul-XSTR: Mtg		
	1200-0080	2	Insulator, Diode		
	3101-1802	1	Switch Ass'y		
	3101-1784	1	Switch, ON-OFF		
	3101-1609	1	Switch, Line Voltage		
	3101-1767	1	Switch, 'Paper Advance'		
	5040-5831	1	Foot, Left Rear		
	5040-5832	1	Foot, Right Rear		
	5040-7037	2	Foot		
	09866-01201	1	Strap-Heat Sink		
	09866-01208	2	Brkt, Rear		
	09866-01209	1	Brkt, Right Front		
	09866-01211	1	Brkt, Right Center		
	09866-01212	1	Brkt, Left Center		
	09866-01213	1	Brkt, Right Rear		
	09866-01214	1	Brkt, Left Rear		
	09866-01215	1	Brkt, Left Front		
	09866-04101	1	Cover, Bottom		
	09866-04102	1	Cover, Top		
	09866-04308	1	Plt Head LH		
	09866-04309	1	Plt Head RH		
	09866-06801	1	Guide Paper, Head		
	09866-08601	2	Arm Pivot		
	09866-21102	1	Heat Sink Right		
	09866-21103	1	Heat Sink Left		
	09866-21104	2	Heat Sink Center		
	09866-21201	1	Bar Load		
	09866-22301	8	Holder Sprg		
	09866-23701	1	Pivot Rod		
	09866-24709	1	Spacer Right		
	09866-24710	1	Spacer Left		
	09866-61606		Cable-External		
	09866-61610	1	Cable Ass'y: 9810A		
	09866-61620	1	Cable Ass'y: 9820A		
	09866-61630	1	Cable Ass'y: 9830A		
	09866-69501	1	PC Ass'y: Input Logic		
	09866-69502	1	PC Ass'y: Control Logic		
	09866-66505	1	PC Ass'y: Motor Drive		
	09866-69506	1	PC Ass'y: Row Data		
	09866-67903	1	Bucket Ass'y		
	09866-67904	1	Chassis Main Ass'y		
	09866-67908	4	Head Ass'y		
	0370-2471	1	Key-Rect, Paper		
	1460-1367	8	Spring Compression		
	1500-0306	2	Cam-Adjusting		
	1600-0347	1	Brk Left Rear		
	2190-0142	2	Washer-Flat		
	3030-0353	8	Set Screw		
	4040-0504	1	Dust Cover		
	4040-0505	1	Dust Cover (9830A)		
	4040-0944	1	Panel-Front (9866A)		
	4040-1058	1	Front Panel (9866B)		
	5040-7044	10	PC Guide		
	7120-2785	1	Plate-Patent		
	7120-2988	1	NPL-Front		
	7120-3027	1	Label-Paper Load		
	7120-3185	1	Label-Caution		
	7120-3315	1	Plate-Serial		
	7120-5016	1	Plate-Serial (9866B)		
	8120-1378	1	Cable-AC Power		
	8120-1575	1	Cable Ass'y		

Table 4-1. Replaceable Parts (cont.)

Exploded View Parts List (See Figure 3-5)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
1	09866-60005	1	Motor-Connector Ass'y		
	1400-0249		Tie-Wrap		
2	2680-0103	4	Screw, #10 Pozidrive		
3	2190-0034	4	Washer, #10 Splitlock		
4	2510-0111	4	Screw, #8 × ¾" pozidrive		
5	2190-0073	4	Washer, #8 Splitlock		
6	5040-7404	1	Block, Motor Mount		
7	09866-27001	2	Pivot, Link		
8	09866-60004	2	Link-Bearing Ass'y		
9	2510-0107	8	Screw, #8 Pozidrive		
10	1530-1719		Plate, Side (RH)		
11	09866-60002	2	Cone-Bearing Ass'y		
12	09866-04701	2	Spacer		
13	2190-0918	2	Washer, #6 Splitlock		
14	2360-0201	2	Screw, #6 Pozidrive		
15	09866-26803	1	Bucket, Front		
16	09866-26801	1	Bucket, Bottom		
17	3101-1802	1	Switch, Out of Paper		
18	2200-0139	2	Screw, #4 × ¼" Pozidrive		
19	3050-0716	2	Washer, #4 Flat		
20	2190-0003	2	Washer, #4, Splitlock		
21	2200-0143	2	Screw, #4 x ⅜" Pozidrive		
22	0624-0297	1	Screw, Tri-oral		
23	09866-60003	1	Platen Ass'y		
24	4320-0263	1	Platen, Lower		
25	09866-26802	1	Bucket, Back		
26	09866-24101	1	Lid Ass'y		
27	09866-01219	1	Bracket, Latch		
28	2260-0003	2	Locknut, #4 Hex		
29	0400-0002	1	Rubber Grommet		
30	09866-69201	1	Pin Ass'y		
31	4320-0262	1	Roller, Paper		
32	1530-1720	1	Plate, Left-Side		
33	2360-0184	2	Screw, #6 Flathead		
35	5060-7437	2	Gear Ass'y		
36	2190-0142	2	Washer, #6 Flat		
37	2190-0918	2	Washer, #6 Splitlock		
38	2360-0197	2	Screw, #6 Pozidrive		
39	1500-0342	2	Belt, Drive		
40	09866-06801	1	Guide, Paper		
41	1460-0565	8	Spring, Load		
42	2360-0316	10	Screw, #6 Flathead		
43	2360-0203	2	Screw, #6 × ⅝" Pozidrive		
44	09866-04309	1	Plate, Head (RH)		
45	09866-04308	1	Plate, Head (LH)		
46	1500-0306	2	Adjusting Cam		
47	0590-0025	2	Hex-Nut, Selflocking		
48	09866-21201	1	Load Bar		
49	09866-23701	1	Pivot Rod		
50	09866-67908	4	Print Head Ass'y (A7)		
51	09866-01208	2	Tear Bracket		
52	2200-0142	2	Screw, #4 × 5/16" Flathead		
53	2190-0724	2	Washer, External Cone		
54	09866-60006	1	Heat Sink Ass'y (A8)		
55	09866-22301	8	Load Screw		

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