

**HP 9871A
Printer**

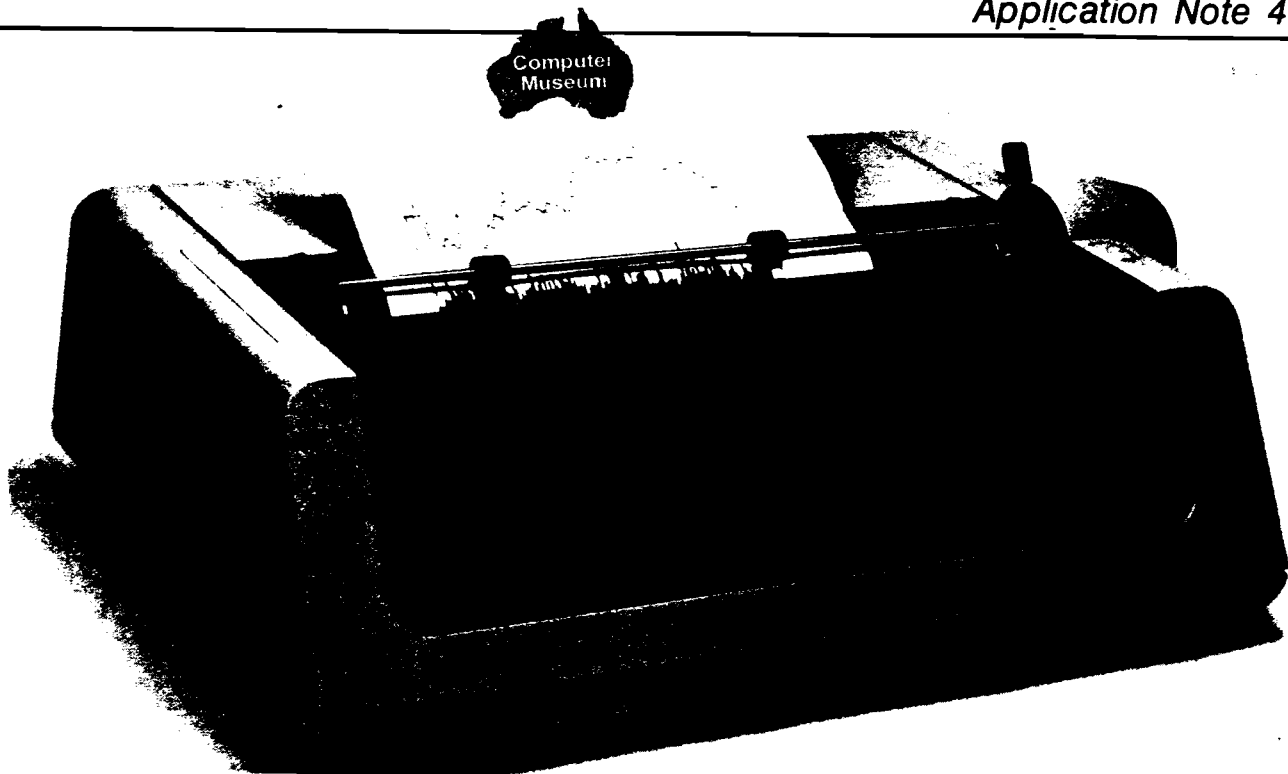


**HP 1000
Computer**

HEWLETT  PACKARD

Programming Guide

Application Note 401-20



Device Introduction

The HP 9871A is a character-serial, impact printer capable of performing all normal typewriter and printer functions, as well as typewriter plotting.¹ All printer operations are remotely controlled. The print intensity is the only manual printer adjustment.

Besides the normal typewriter and printer functions, the 9871A provides the following:

- A variable "view" feature which allows you to see the last line that was printed. When enabled, the paper automatically advances when printing stops, and returns to the proper position when printing resumes.
- Reverse line feed.
- A character replacement command which allows any ASCII character to be replaced by a desired string of characters.
- Horizontal and vertical tabulation which allows you to tab forward, backward, up and down.

¹This note should be used in conjunction with the 9871A Operating and Service Manual (09871-90030) and with Application Note 401-1 (5953-2800).

- Horizontal and vertical spacing commands which cause the spacing between characters and the spacing between linefeeds to be altered.

Addressing

The HP-IB address switches are located behind a panel at the rear of the printer. To set these switches,

1. Remove the screw that holds the switch access door closed (see figure 20-1).

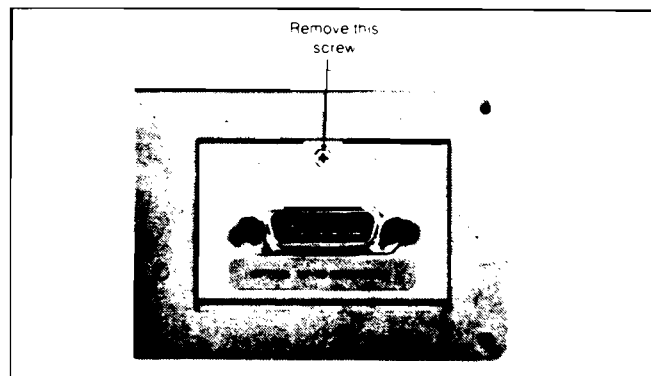


Figure 20-1. Access Door Removal

- Pull the top of the door out and down to access the switches (see figure 20-2).

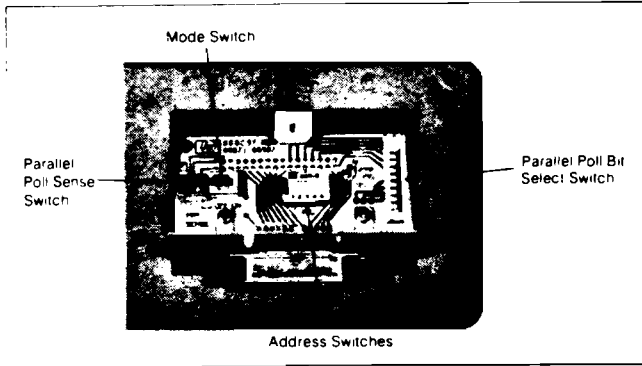
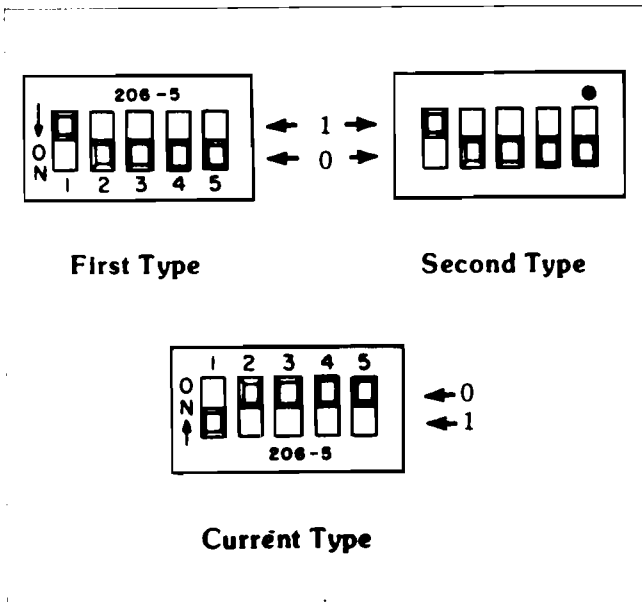


Figure 20-2. Option 001 Configuration Switches

- Set the Mode Switch (figure 20-2) to the addressable mode (switch to the right). In this mode, the printer must be addressed to "listen" before it will accept and print data. This mode is used in systems where the HP 1000 is used as the controller.
- Select an HP-IB address for the 9871A. The following diagrams show three different types of address switches used in the 9871A Printer. All switches are preset to "A" (00001) at the factory.



- Set the Parallel Poll Bit Select (PPMS) switch (figure 20-2). A parallel poll enables the printer to present one bit of status to the controller without being previously addressed to talk. The status bit (when true) indicates that the option 001 assembly is ready to accept data. The PPMS switch selects which data line (DI01 to DI08) will be used by this status bit. PPMS switch settings 0 and 9 are used to disconnect the parallel poll function.
- Set the Parallel Poll Sense switch for positive or negative sensing. With the sense switch set positive, the PPMS bit (previously set) will indicate a 0 when the option 001 assembly is busy and 1 when it is ready for data. With the sense switch set negative, the PPMS bit will indicate a 1 for busy and 0 for ready. The user should determine whether a positive or a negative condition should be sensed by the controller.
- Close the switch access door and secure it with the screw that was previously removed. Connect the printer into the system with an HP-IB cable.

System Preparation

LU Assignment

Once the physical address of the 9871A has been set, an LU can be assigned to it. The File Manager command:

```
:SYLU,20,11,1B
```

would assign LU 20 to equipment table 11. The device address associated with LU 20 would be 1 octal.

Buffering

Buffering may be used on output from the HP 1000 to the 9871A. This is a useful feature to improve throughput when large amounts of data are to be printed. However, make sure that the 9871A is operating before allocating buffering. To unbuffer the 9871A for checkout, enter the File Manager command:

```
:SYEQ,11,UN
```

if the 9871A is on EQT 11.

Once operation of the 9871A has been verified, the 9871's EQT can be buffered with the File Manager command:

```
:SYEQ,11,BU
```

Remember, buffering affects all HP-IB devices on the same EQT. Also, buffering must be disabled if the user program performs its own error checking.

Time-out

A time-out condition for the 9871A indicates a hardware problem requiring operator intervention, and loss of printed information. For these reasons, the operating system should be allowed to handle the time-out. This is the default course of action.

When selecting a time-out value, consideration should be given to all devices on the same EQT as the 9871A. Remember that the time-out value will affect all devices on the same EQT, and should encompass the needs of all these devices.

From File Manager, a system request may be used to set the time-out value.

```
:SYTO,11,100
```

will set the time-out for EQT 11 to one second.

Decimal Code	Spoke Number	Standard Characters	Decimal Code	Spoke Number	Standard Characters	Decimal Code	Spoke Number	Standard Characters
33	48	!	76	55	L	119	88	w
34	61	..	77	37	M	120	70	x
35	23	#	78	49	N	121	67	y
36	24	\$	79	51	O	122	68	z
37	5	%	80	56	P	123	4	π
38	9	&	81	65	Q	124	64	
39	2	'	82	43	R	125	94	→
39 (SO)	89	.	83	44	S	126	96	~
40	38	(84	46	T	Here are the unique characters found on the ASCII character disk		
41	36)	85	60	U			
42	26	*	86	62	V	Decimal Code	Spoke Number	ASCII Character
43	25	+	87	32	W	92	3	\
44	6	,	88	28	X	123	4	{
45	27	-	89	35	Y	125	94	}
46	33	_	90	63	Z	Here are the unique characters found on the European character disk		
47	31	`	91	42	[
48	18	0	92	3	√	Decimal Code	Spoke Number	European Character
49	17	1	93	40]	35	23	£
50	19	2	94	1	.	39 (SO)	89	¢
51	16	3	94 (SO)	8	†	92	3	¿
52	20	4	95	11	—	94 (SO)	8	•
53	15	5	96	95	\	123	4	" (U C)
54	21	6	97	85	a	125	94	" (L C)
55	14	7	98	93	b			
56	22	8	99	75	c			
57	13	9	100	86	d			
58	52	:	101	82	e			
59	59	;	102	74	f			
60	10	<	103	73	g			
61	29	=	104	81	h			
62	12	>	105	79	i			
63	54	?	106	91	j			
64	7	@	107	72	k			
65	47	A	108	87	l			
66	58	B	109	90	m			
67	39	C	110	78	n			
68	53	D	111	77	o			
69	45	E	112	92	p			
70	57	F	113	69	q			
71	34	G	114	83	r			
72	41	H	115	84	s			
73	50	I	116	80	t			
74	66	J	117	76	u			
75	30	K	118	71	v			

The character spokes are numbered clockwise, 1 to 96, beginning with the circumflex (ˆ) character. Hold the character disk with the characters facing you and the locating tab up. The circumflex character (spoke 1) will be on top.

Figure 20-3. 9871A Character Set

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Configuration

The device configuration word for the 9871A defaults to the required value for end-of-record requirements, system error checking, and SRQ handling. Generally, system operation is more efficient when DMA is not allocated to the 9871A. This is also a default condition.

Remote

The 9871A does not need to be configured into remote for programming.

Programming

Programming the 9871A simply consists of sending ASCII strings. For example, the statement:

```
WRITE (20, 101)
101 FORMAT ("ABC")
```

would cause the 9871A printer on LU 20 to print:

```
ABC
```

The character set available on the print wheel is shown in figure 20-3.

In normal 9871A operation, there are certain print parameters which can be altered. These include: top of form, form length, left margin, text length, and text width. Figure 20-4 shows how the parameters relate to each other. At start-up, (or when the printer is reset), the following states are set:

1. The carrier moves to the extreme left and rotates into a mechanical stop. This synchronizes the internal logic with mechanical position. The carrier then moves to column 1.
2. All tabs are cleared.
3. Horizontal spacing is set to 10 characters per inch. Variable horizontal spacing is disabled.
4. Vertical spacing is set to 6 lines per inch.
5. The view-delay function is disabled.
6. Top of form is assumed at the current platen position.
7. Left margin is assumed at column 1.
8. Text length is assumed to be 11 inches.
9. Form length is assumed to be 11 inches.
10. The standard "shift-in" character-set is assumed.
11. Text width is assumed to be 13.2 inches.
12. The origin for absolute plotting is set at the left margin and lower margin.
13. Character fill parameters are set to: decimal point, spacing = 3, vertical offset = +5.
14. All character replacements are cleared.
15. A ROM and RAM check is made.

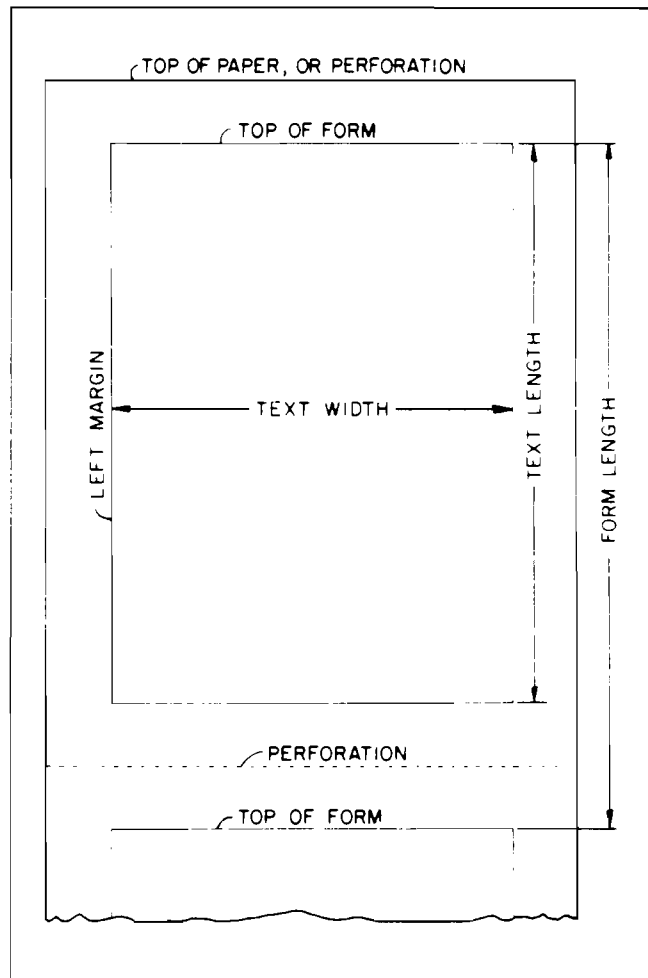


Figure 20-4. Form and Margin Parameters

Tabulation, form size, and margin control can be altered by sending the appropriate ASCII characters. Many of them are non-printing characters or escape sequences. Figure 20-5 illustrates the various functions for the printer, and the ASCII strings required to set them. For example, the left margin can be set by sending the desired number of spaces to position the printer at the desired spot and sending ESC,M.

The parameter for many of the 9871A functions are based on 7-bit ASCII characters. Therefore, the value for a parameter must be sent as two bytes. The first byte is the integer

quotient of the parameter divided by 64. The second byte is the remainder of the parameter divided by 64. For vertical spacing, there are 96 segments per inch (i.e., 11 inches is 1056 segments). For horizontal spacing, there are 120 segments per inch. Normal spacing of 10 characters per inch requires 12 segments per letter.

To alleviate the exercise in bit manipulation, a utility program is provided to set up all the form controls on the 9871A (see figure 20-6). After the program is run, the 9871A will retain its settings until reset or until power is shut off.

COMMAND	COMMAND CODE		
	ASCII CHARACTER	DECIMAL CODE	DECIMAL PARAMETER
GENERAL			
• Bell	BELL	7	
• Backspace	BS	8	
• Linefeed	LF	10	
• Carrier Return	CR	13	
• Shift Out	SO	14	
• Shift In	SI	15	
• View Delay	ESC. D	27. 68.	INT(N/64) INT N
• Reverse Line Feed	ESC. LF	27. 10	
• Character Replacement	ESC. C	27. 67	"CHAR", N, "LIST"
• Reset	ESC. E	27. 69	
• Self Test	ESC. R	27. 122	
HORIZONTAL TABULATION			
• Set Horizontal Tab	ESC. 1	27. 49	
• Clear Horizontal Tab	ESC. 2	27. 50	
• Clear All Horizontal Tabs	ESC. 3	27. 51	
• Horizontal Tab Right	H _{TAB}	9	
• Horizontal Tab Left	ESC. 4	27. 52	
VERTICAL TABULATION			
• Set Vertical Tab	ESC. 5	27. 53	
• Clear Vertical Tab	ESC. 6	27. 54	
• Clear All Vertical Tabs	ESC. 7	27. 55	
• Vertical Tab Up	ESC. 8	27. 56	
• Vertical Tab Down	V _{TAB}	11	
FORM AND MARGIN CONTROL			
• Set Top of Form	ESC. T	27. 84	
• Form Length	ESC. F	27. 70	INT(N/64), INT N
• Text Length	ESC. L	27. 76	INT(N/64), INT N
• Form Feed	FF	12	
• Set Left Margin	ESC. M	27. 77	
• Text Width	ESC. W	27. 87	INT(N/64), INT N
SPACING CONTROL			
• Horizontal Spacing	ESC. H	27. 72	INT(N/64), INT N
• Vertical Spacing	ESC. V	27. 86	INT(N/64), INT N
• Variable Spacing	ESC. S	27. 83	
PLOTTING CONTROL			
• Absolute Plot	ESC. A	27. 65	INT(X/64), INT X, INT(Y/64), INT Y
• Relative Plot	ESC. R	27. 82	INT(X/64), INT X, INT(Y/64), INT Y
• Character Fill Setup	ESC. .	27. 46	P1, INT(P2/64), INT P2, P3
• Absolute Plot With Fill	ESC. a	27. 97	INT(X/64), INT X, INT(Y/64), INT Y
• Relative Plot With Fill	ESC. r	27. 114	INT(X/64), INT X, INT(Y/64), INT Y
• Plot Origin	ESC. O	27. 79	INT(X/64), INT X, INT(Y/64), INT Y

Figure 20-5. 9871A Function Codes

```

0001  FTN4,L
0002      PROGRAM LPSP
0003      INTEGER IP(5),IFLEN(2),ITLEN(2),IMRG(50),LMAR
0004      CALL RMPAR(IP)
0005      ITLU=IP
0006      IF(IP.EQ.0) ITLU=1
0007      IDLU=IP(2)
0008      IF(IDLU.NE.0) GO TO 44
0009      WRITE(ITLU,101)
0010  101  FORMAT("ENTER PRINTER LU")
0011      READ(ITLU,*) IDLU
0012  44   WRITE(ITLU,102)
0013  102  FORMAT("ENTER FORM LENGTH IN INCHES (DEFAULT IS 11.0)")
0014      READ(ITLU,*) TEMP
0015      IF(TEMP.LE.0.0) TEMP=11.0
0016      IFLEN(1)=IFIX(TEMP*96.0)
0017      WRITE(ITLU,103)
0018  103  FORMAT("ENTER TEXT LENGTH IN INCHES (DEFAULT IS 11.0)")
0019      READ(ITLU,*) TEMP
0020      IF(TEMP.LE.0.0) TEMP=11.0
0021      ITLEN(1)=IFIX(TEMP*96.0)
0022      WRITE(ITLU,104)
0023  104  FORMAT("ENTER LEFT MARGIN IN SPACES (DEFAULT IS 1)")
0024      READ(ITLU,*) LMAR
0025      C      SEND RESET
0026      IRSET=27*256+69
0027      CALL EXEC(2,IDLU,IRSET,-2)
0028      C      COMPUTE IFLEN AND ITLEN
0029      IT1=IFLEN(1)/64
0030      IT2=IAND(IFLEN(1),77B)
0031      IFLEN(2)=IT1*256+IT2
0032      IFLEN(1)=27*256+70
0033      IT1=ITLEN(1)/64
0034      IT2=IAND(ITLEN(1),77B)
0035      ITLEN(2)=IT1*256+IT2
0036      ITLEN(1)=27*256+76
0037      CALL EXEC(2,IDLU,IFLEN,-8)
0038      C      SET MARGIN
0039      IF (LMAR.EQ.1) GO TO 56
0040      DO 55 I=1,LMAR
0041  55   IMRG(I)=1H
0042      LMAR=LMAR+1
0043      IMRG(LMAR)=1H
0044      WRITE(IDLU,105) (IMRG(I),I=1,LMAR)
0045  105  FORMAT(50A1)
0046      IMGN=27*256+77
0047      CALL EXEC(2,IDLU,IMGN,-2)
0048      C      DO FORMFEED
0049  56   IFF=12
0050      CALL EXEC(2,IDLU,IFF,-2)
0051      C      ALL DONE
0052      STOP
0053      END
0054  END$

```

Figure 20-6. Form Control Program



The program is totally interactive. To run the program, position the paper at the top of form, and answer the questions the program asks. It will compute and output the necessary control parameters, and then advance one form. If a value is not given for a question, the respective parameter will default to the standard value.

The 9871A responds to both serial and parallel poll. Figure 20-7 illustrates the status byte for the serial poll. During the parallel poll, the 9871A returns a bit indicating if it is ready to accept data. The address section of this note describes how this bit will be presented.

SRQ and Status

The 9871A printer only asserts SRQ when its cover has been removed. Since this event requires operator intervention, SRQ scheduling is not necessary. Removing the cover will stop the printer, and the program will stop because of a time-out, or a buffer limit being exceeded.

Performance

The 9871A has an internal 156-character buffer. By utilizing output buffering in the HP 1000, and the internal buffering in the 9871A, thirty characters per second will be printed. The actual throughput is difficult to characterize, however, because the 9871A will accept data into its internal buffer while printing. When the buffer is full, data transmission will wait until the printer has caught up. Then the buffer will refill. This process continues until printing has been completed.

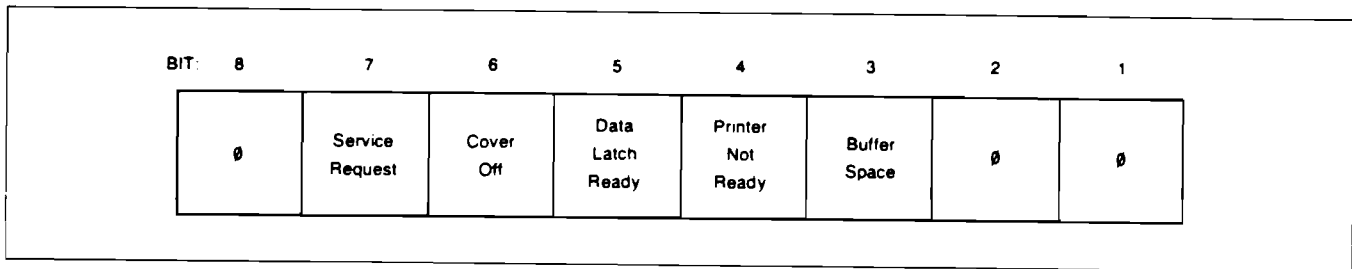


Figure 20-7. Serial Poll Status Byte



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