Digitronics Model 200 Printer and Controller

The printer we are getting will print 132 columns on 14-7/8" paper. Data is input as 7 bit ANSCII codes, with a byte transferred every 850 ns while filling the line buffer, or 1.7 μ sec per word, ignoring the extra delay caused by using a longer cable. Since the buffer can use almost every other Hp memory cycle when filling a new line the controller is designed to be served by DMA whenever one of the two DMA channels is free. [illegible] interleaving of [illegible]

The complete sequence for printing a line is as follows. A line of data is received, character-by-character from the Hp, and stored in the line memory. When the line transfer is complete, the Hp transfers a paperfeed instruction control and printing commences. As comparisons are found between the characters stored in memory and characters being presented at corresponding column positions by the point belt, the hammers are released and printing occurs. When printing of the current line is complete, the paperfeed system executes the paperfeed instruction previously transferred from the Hp, and the next line of data can be transmitted. The typefont belts are operator changeable. The multi-font buffer automatically detects which font is being used (font) currently. This information is fed back to the Hp as a coded three bit data field. in the status word. The line buffers should be set up as follows: The first

Table 1. Printing Speed (LPM)/Number of Columns

	Full Font		Alpha/Numeric		Numerics	
Font Size	lpm	columns	lpm	columns	lpm	columns
16	526	132	–	–	526	132
48	254	132	254	132	324	22
64	202	132	244	7	244	39
96	142	132	162	38	162	70
128	110	132	122	70	122	102

Table 2. Paper Feed Instructions

ID Bits				
4	3	2	1	Action Performed
0	0	0	0	No paper feed
0	0	1	0	Double line space
0	0	0	1	Single line space
1	0	0	1	Slew to channel 1 (top of form channel)
1	0	1	0	Slew to channel 2
1	0	1	1	Slew to channel 3
1	1	0	0	Slew to channel 4
1	1	0	1	Slew to channel 5
1	1	1	0	Slew to channel 6
1	1	1	1	Slew to channel 7
1	0	0	0	Slew to channel 8

how different from 1403?

3 77

[illegible]

Table 4. Character Code Assignments

				ID7	0	0	0	0	1	1	1	1
				ID6	0	0	1	1	0	0	1	1
				ID5	0	1	0	1	0	1	0	1
ID4	ID3	ID2	ID1									
0	0	0	0				SP	0				
0	0	0	1					1				
0	0	1	0					2				
0	0	1	1					3				
0	1	0	0				$	4				
0	1	0	1					5				
0	1	1	0					6				
0	1	1	1					7				
1	0	0	0					8				
1	0	0	1					9				
1	0	1	0				*					
1	0	1	1									
1	1	0	0				,					
1	1	0	1				-					
1	1	1	0				.					
1	1	1	1									

16 Character Font Set And Codes

FONT CODE: ØØØ

				ID7	0	0	0	0	1	1	1	1
				ID6	0	0	1	1	0	0	1	1
				ID5	0	1	0	1	0	1	0	1
ID4	ID3	ID2	ID1									
0	0	0	0				SP	0	@	P		
0	0	0	1					1	A	Q		
0	0	1	0					2	B	R		
0	0	1	1				#	3	C	S		
0	1	0	0				$	4	D	T		
0	1	0	1				%	5	E	U		
0	1	1	0				&	6	F	V		
0	1	1	1					7	G	W		
1	0	0	0					8	H	X		
1	0	0	1					9	I	Y		
1	0	1	0				*		J	Z		
1	0	1	1				+		K			
1	1	0	0				,		L			
1	1	0	1				-		M			
1	1	1	0				.		N			
1	1	1	1				/		O			

48 Character Font Set And Codes

FONT CODE: 1ØØ

				ID7	0	0	0	0	1	1	1	1
				ID6	0	0	1	1	0	0	1	1
				ID5	0	1	0	1	0	1	0	1
ID4	ID3	ID2	ID1									
0	0	0	0				SP	0	@	P		
0	0	0	1				!	1	A	Q		
0	0	1	0				"	2	B	R		
0	0	1	1				#	3	C	S		
0	1	0	0				$	4	D	T		
0	1	0	1				%	5	E	U		
0	1	1	0				&	6	F	V		
0	1	1	1				'	7	G	W		
1	0	0	0				(	8	H	X		
1	0	0	1				)	9	I	Y		
1	0	1	0				*	:	J	Z		
1	0	1	1				+	;	K	[		
1	1	0	0				,	<	L	\		
1	1	0	1				-	=	M	]		
1	1	1	0				.	>	N	↑		
1	1	1	1				/	?	O	_		

64 Character Font Set And Codes

FONT CODE: Ø1Ø

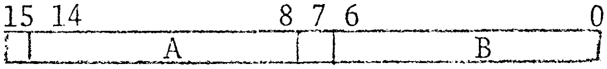
LF, CR
etc not part
of ANSC [illegible]
part of A[illegible]
[illegible]

				ID7	0	0	0	0	1	1	1	1
				ID6	0	0	1	1	0	0	1	1
				ID5	0	1	0	1	0	1	0	1
ID4	ID3	ID2	ID1									
0	0	0	0				SP	0	@	P	°	p
0	0	0	1				!	1	A	Q	a	q
0	0	1	0				"	2	B	R	b	r
0	0	1	1				#	3	C	S	c	s
0	1	0	0				$	4	D	T	d	t
0	1	0	1				%	5	E	U	e	u
0	1	1	0				&	6	F	V	f	v
0	1	1	1				'	7	G	W	g	w
1	0	0	0				(	8	H	X	h	x
1	0	0	1				)	9	I	Y	i	y
1	0	1	0				*	:	J	Z	j	z
1	0	1	1				+	;	K	[	k	¢
1	1	0	0				,	<	L	\	l	½
1	1	0	1				-	=	M	]	m	≠
1	1	1	0				.	>	N	↑	n	¼
1	1	1	1				/	?	O	_	o	←

96 Character Font Set And Codes

FONT CODE: 11Ø

byte should be left justified. That is, unless the only byte to be output is just a paperfeed command, the buffer must be packed, two characters to a word, as



Where the A is printed and then the B field.

or

	T		E
	X		T

note that the code is a 7 bit ANSII code, bits 7 and 15 are therefore available for other uses. In particular if 7 or 15 is set the controller can interpret it to mean that it is the last byte of the line; and that it is a 4 bit paperfeed command word instead of a printing byte. Thus

	T		E
	X		T
1	0001		

	T		E
	X		T
	S	1	0000

What if fed with something here too

print out the lines:

TEXT crlf TEXTS cr

It is not clear from the printer documentation on hand, how the printer handles codes which are outside the character set on the current font. Note that the controller requirement that text characters be left justified implies that when setting up a text buffer to output several lines under DMA that the Buffer may need holes put in it as: $\frac{\text{AN}}{\text{OX}}$

	A	N
1	ϕ	*
	-	-
1	1	*
	0	X
1	1	*

The 3 locations marked with the *'s cannot be printed out by the controller. Actually there are several "unprintable" combinations. With p standing for paperfeed command, c for printing-character and ϕ for random garbage not to be printed we have:

random garbage causes software problems deciding how to avoid it

cc pp cp pϕ	Handled correctly
pc	second byte not sent to printer
ϕc ϕp cϕ	printing attempted for the ϕ
ϕϕ	Who cares?

can we fix this? would be very good!

Packing two bytes to the word has left only two control bits, bits 7 and 15. If either is set to a one the associated byte is taken to be a paperfeed command. This allows very efficient packing(from the hardware point of view anyway) of the four cases which hopefully are the only useful ones needed. If it is necessary to be able to handle the other cases there are two alter-

Need null char to do nothing to pad.

natives: 1) take the paperfeed commands out of the text buffer altogether and sent them out over a different 1/0 path by-passing the DMA channel. or 2) noting that the paperfeed commands could not be printing characters with any of the character sets, the controller could call a paperfeed command anything with the high order bits equal to zero. This is nice; but now any garbage bytes might be taken as commands or type characters.

sending of paperfeed bit from KDF, any problems? KDF should put in this stuff

Pushing on, the hardware interface is simple enough that we can get controllers for two printers on one Hp interface card. If it is intended to program for DMA operation, the printer should have higher priority than the link to the 500. So the reshuffled 1/0 addresses could be:

10	Daconics Data channel
11	Daconics Command channel
12	Printer one channel
13	Printer two channel
14	link ZM interrupt address
15	link command address
16	TTY

if another tape unit, then what?

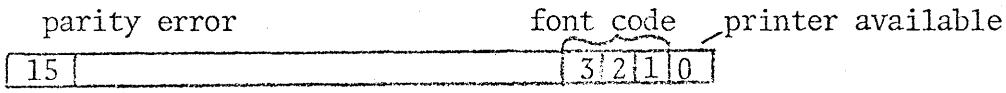
inserted in one

well, can be done.

This is the best scheme if the Hp operating programs can be recompiled- else the printer could be stuck into an unused slot, ugh.

To make two devices on one card accessable to DMA control, an extra SRQ, service request line must be wire-wrapped in for the higher address device. It is proposed that we use pin 62 which is presently unused to provide the SRQ line from the next card to the left, that is the next higher SRQ address.

The printer status bits that can be read with a Load into A or B are: Printer available, 3 bit font code, and parity error on the last byte received by the printer. These bits can be wired anywhere on the bus, the following layout is suggested:



When the interface is ready for a new word to be unpacked and sent to the printer it will set the Interrupt Request Flag. This may be tested with Skip on Flag Set/Clear instructions; give an interrupt if enable etc. or grab a DMA cycle if the DMA is set up.

1) command to reset printer?

UNIVERSITY OF HAWAII

THE ALOHA SYSTEM

MEMORANDUM

TO: Roger Bissonnette

FROM: Wrenwick Lee

SUBJECT: HP Printer Interface (Notes)

DATE: April 17, 1973

1. Channel Allocations

Old		New	
10	Daconics Data	10	Daconics Data (9TRK)
11	Daconics Command	11	Daconics Command (9TRK)
12	link ZM	12	save for 7TRK
13	link command	13	save for 7TRK
14	TTY	14	printer one
15		15	printer two
16		16	link ZM
		17	link command
		20	TTY

The above implies changing of variables that specify link ZM and link command and TTY.
Also initialization code must now be adjusted. Watch out for possible missing case where channel assignment was direct.

2. KDF must now output ASCII without parity.
   KDF must put a 1 in the high order bit for skew* characters.
   KDF must have a new mapping of skew characters to change from IBM to Digitronics. See Table 1.

3. Data will be sent across the link as with a write. Thus the normal sequence of SHIPIT, etc. will be done.

4. Print Routine should be put into dispatcher.

5. Use the tape buffer for now so that one can employ the use of ~~PDT~~ DDT.

6. Restarting the HP should also involve some form of insuring that the printer is restarted, too.

7. DMA Channel 7 should be used for the printer.
   Line by line should be sent.
   Keep the command sending logic, etc., separate from tapes so that can interleave the both later.

*skew: printer carriage control

8. Odd byte problem. A special null character 177B is sent to indicate null. This is necessary so that when the text starts in the middle of an HP word, a null is sent in the first half of the word. The odd byte problem at the end of text does not occur because the last character is a skew character. If the skew character occurs in the first half of the word, the second half is ignored.

9. Don't forget to send back PFIN when finished.

10. A little fancy footwork is needed to keep track of where one is in the text and when one is finished. Also, where a line begins and whether it begins in an odd byte must be provided for.

11. Text is in the format show in Table II.

12. The skew is done <u>after</u> the line is printed when it is sent with the line.

13. Try to keep code below 1300B.

14. Don't forget to check print status.

Possible problem areas:
1. printing stopping in a bad state requiring manual intervention
2. implementation of null character (hardware)
3. mappings not 1-1 from IBM to DIGITRONICS
4. Characters that printer doesn't recognize

Bissonnette
4/17/73
pg. 3

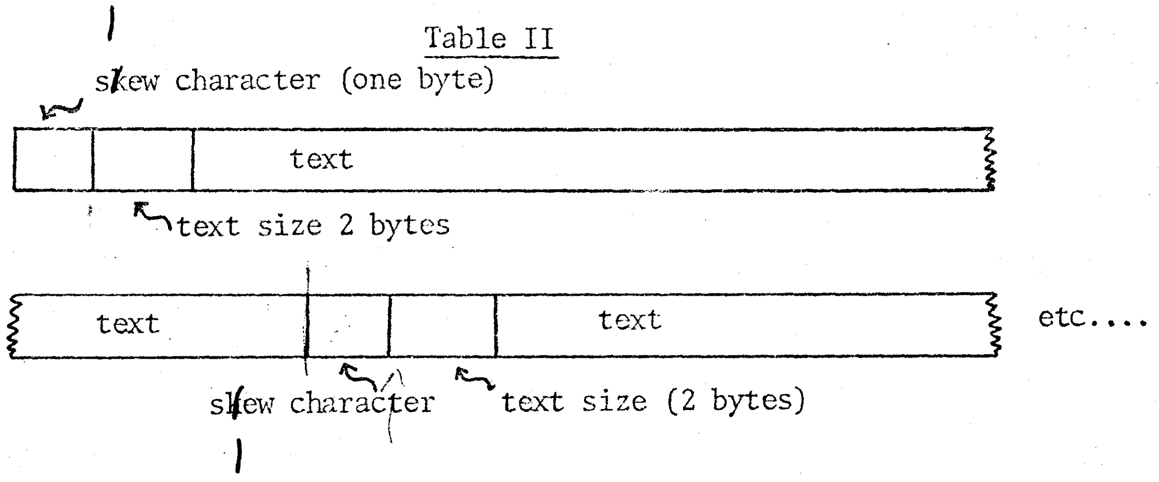
Table I

make to one of channels

	IBM	DIGITRONICS		
	'00001011'	✓ '10000001'	Single-line	
	00010011	✓ 10000010	Double-line	
	00011011	~~none~~	Triple-line	
eject →	10001011	10001001	Channel 1	Eject
	10010011	10001010	2	
	10011011	10001011	3	skip 3
	10100011	10001100	4	
	10101011	10001101	5	
	10110011	10001110	6	
	10111011	10001111	7	
	11000011	10001000	8	
	11001011	none	9	
	11010011	none	10	
	11011011	none	11	
	11100011	none	12	
	00000011	10000000	NO-OP	

Mapping should be done in KDF.
What to do about non-mappings should also be wirried about.

Table II


l
s~~k~~ew character (one byte)
text
text size 2 bytes
text
text
etc....
s~~k~~ew character
l
text size (2 bytes)