

INTRODUCTION

The following notes give guidance to the user on the selection of printers for use with GEM 80 systems. With present GEM 80 systems, there are some differences in the requirements for different applications, which are:

- Processor printer port
- Video printer port
- Programmer printer port

The notes that follow are written around the requirements for printers coupled to the processor printer port. Exceptions applying to the other two applications are pointed out as they arise in the text.

There are many types of printer available on the market, offering a variety of facilities at a variety of prices. Since new models are being introduced all the time, any recommendation would quickly become out of date. The notes below therefore highlight the factors which should be considered when selecting a printer.

ESSENTIAL FEATURES

1. Signal Levels

The printer must be able to accept a 20mA current loop serial input.

For printers which can accept RS232C signal levels only, a separate conversion unit will be required to provide the necessary interface, except when driven by an 8922 system programmer, which can provide RS232C signals direct.

With the 8920 portable programmer, a conversion is possible to provide RS232C signal levels as a special option.

2. Signalling Code

The printer must be able to accept ASCII (American Standard Code for Information Interchange) or other national variants of ISO-7. ASCII is detailed in Table 1.

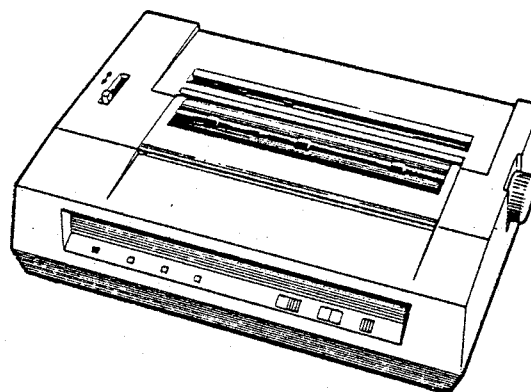
3. Signalling Rate

The printer must be able to receive signals transmitted at one of the following rates: 110, 300, 600, 1200, 2400, 4800 or 9600 bits/second.

Note....

The term "baud", frequently found in manufacturers' data, is the modulation rate. For signals which have two possible levels only, "baud" is numerically equal to "bit/s".

Printers



The Video printer port provides a 300 bit/s output only.

The 8920 portable programmer provides an output at 110, 300, 600 or 1200 bit/s only.

As is to be expected, the faster the printer, the higher the price in general.

Note....

The user is warned that average printing rates of different printers are not related directly to the signalling rate; two different printers both operating at 600 bit/s may give noticeably different average printing rates. This is because some printers take a time equivalent to the printing of several characters for the line feed/carriage return operations. The difference in average speed is more noticeable where the information to be printed is generally in short lines. If, on a printer with pre-settable signalling rate, the signalling rate is increased, a pro rata increase in printing rate will not be obtained as a larger fraction of the printer's time will be lost in the line feed/carriage return operations. The user should therefore check the manufacturer's spec. carefully, differentiating between maximum and average printing rates at different signalling rates.

When driven from a GEM 80 system, the maximum printing rate at which a printer will be driven is the signalling rate divided by 11.

4. Handshake

Some types of printer require that the device sending messages can accept a signal coming back from the printer, telling the transmitter when messages may be sent. Any messages sent by the transmitter when the printer is not ready are ignored by the printer. Such printers are said to operate "with a handshake".

GEM 80 printer ports are not designed to accept handshake signals. Where printers need a handshake, then such additional signals need to be connected to the GEM 80 processor via basic I/O modules or units.

The 8920 and 8922 programmers are designed to accept handshake signals.

Handshake signals are generally encountered only with printers operating at high signalling rates (1200 bit/s upwards).

5. Character Bit Format

The printer must be able to accept characters sent as 11 bits each, comprising 1 start bit, 7 code bits in ASCII, 1 even parity bit, and 2 stop bits.

Many printers have it stated that they will accept the format generally as above, but with only 1 stop bit or 1½ stop bits. Such printers will generally work perfectly well when provided with 2 stop bits (which effectively means a double length stop bit), but at the penalty of slightly lower character/second printing speed.

Most printers ignore the parity bit, and take no action on parity error. A few printers print a special character when a parity error is detected, indicating a suspect character in the transmission.

Even parity means that the GEM 80 sets the parity bit to be a 0 or a 1 such that the total quantity of 1's in the 8 bits made up of the 7 code bits + the parity bit itself is always an even number. A parity error means that the signal reaching the printer did not contain an even number of 1's, the cause normally being noise or signal distortion (e.g. if the signal line is too long for the given signalling rate or contains too much capacitance).

6. Minimum Line Length

The line length for printers on a GEM 80 processor printer port is open to choice - see Optional Factors below.

However, for both Video printer ports (for screen prints) and the 8920 and 8922 programmers (for printing ladder diagrams), the line length of the printer must be at least 80 characters.

OPTIONAL FEATURES

1. Printing Character Set

Most printers can print all of the 96 printing characters available in ASCII (codes @20 to @7F; see Table 1).

Some cheaper printers can print only the first 64 of these characters (@20 to @5F), i.e. they can print only upper case (capital letters) but not lower case (small letters). Such printers are usually designed so that, if they receive the code for a lower case letter, they print the corresponding upper case letter, or the symbol corresponding to @20 less than the code received.

Many printer manufacturers offer alternative symbols (e.g. for currency signs) where there are national variants at little or no extra cost.

2. Typeface

Characters may be printed whole or made up from a matrix of dots. Whole character printers generally give a clearer print-out but tend to be more expensive, and slower.

The clarity of print-out from dot-matrix printers depends mainly on the number of dots used.

Some printers do not print lower case letters having descenders (g, j, p, q and y) very well. More important, there may be difficulty in distinguishing between certain pairs of characters, such as B and 8, S and 5, D and 0, letter O and figure 0, etc. The user should beware of purchasing a dot-matrix printer without having seen a sample of its output.

Some dot-matrix printers allow characters to be printed at different pitches presettable by a switch on the printer. Normal printing is generally at 10 characters/inch, but condense styles may provide 16 or more characters/inch. This facility may also be controlled remotely on some printers by transmitting appropriate control (non-printing) codes.

Some dot-matrix printers allow characters to be printed either in Roman or Italic style. Whether this facility can be utilised when the printer is driven from a GEM 80 printer port depends on how the typeface style is controlled. Some printers make use of the 8th bit which is used by GEM 80 signals for the parity bit to determine whether Roman or Italic characters are printed, so that, unless the facility can be switched out by a preset switch on the printer, any print out will contain a seemingly random mixture of Roman and Italic characters. For alternative character styles to be usable by a GEM 80 system, these styles must be selectable by control codes, e.g. @0F and @0E (SI = shift in, and S0 = shift out).

TABLE 1 ASCII CODE TABLE			
Decimal	Hex.	Binary	Character Name
0	@00	0000000	NUL(null)
1	@01	0000001	SOH(start of heading)
2	@02	0000010	STX(start of text)
3	@03	0000011	ETX(end of text)
4	@04	0000100	EOT(end of trans- mission)
5	@05	0000101	ENQ (enquiry)
6	@06	0000110	ACK (acknowledge)
7	@07	0000111	BEL (bell)
8	@08	0001000	BS (backspace)
9	@09	0001001	HT (horizontal tab)
10	@0A	0001010	LF (line feed)
11	@0B	0001011	VT (vertical tab)
12	@0C	0001100	FF (form feed)
13	@0D	0001101	CR (carriage return)
14	@0E	0001110	SO (shift-out)
15	@0F	0001111	SI (shift-in)
16	@10	0010000	DLE (data link escape)
17	@11	0010001	DC1 (device control 1)
18	@12	0010010	DC2 (device control 2)
19	@13	0010011	DC3 (device control 3)
20	@14	0010100	DC4 (device control 4)
21	@15	0010101	NAK (negative acknowledge)
22	@16	0010110	SYN (synchronous idle)
23	@17	0010111	ETB (end of trans- mission block)
24	@18	0011000	CAN (cancel)
25	@19	0011001	EM (end of medium)
26	@1A	0011010	SUB (substitute)
27	@1B	0011011	ESC (escape)
28	@1C	0011100	FS (file separator)
29	@1D	0011101	GS (group separator)
30	@1E	0011110	RS (record separator)
31	@1F	0011111	US (unit separator)

Variants

The following hex. codes are subject to variation.

@23 : May be replaced by £ symbol
 @24 : May be replaced by ₤ currency symbol

@5B :
 @5C : } Subject to national use variation
 @5D : }

@5E : May be replaced by upward arrow

@7B :
 @7C : } Subject to national use variation
 @7D : }

ASCII CODE TABLE - Continued			
Decimal	Hex.	Binary	Character Name
32	@20	0100000	SP (space)
33	@21	0100001	! (exclamation mark)
34	@22	0100010	" (quotation mark)
35	@23	0100011	#
36	@24	0100100	\$
37	@25	0100101	%
38	@26	0100110	&
39	@27	0100111	' (apostrophe)
40	@28	0100100	(
41	@29	0100101	)
42	@2A	0101010	*
43	@2B	0101011	+
44	@2C	0101100	, (comma)
45	@2D	0101101	- (hyphen, minus sign)
46	@2E	0101110	. (period)
47	@2F	0101111	/
48	@30	0110000	0
49	@31	0110001	1
50	@32	0110010	2
51	@33	0110011	3
52	@34	0110100	4
53	@35	0110101	5
54	@36	0110110	6
55	@37	0110111	7
56	@38	0111000	8
57	@39	0111001	9
58	@3A	0111010	:
59	@3B	0111011	;
60	@3C	0111100	<
61	@3D	0111101	=
62	@3C	0111110	>
63	@3D	0111111	?

@7E : May be replaced by ¯ overline

@60 : Subject to national use variation

ASCII CODE TABLE - Continued

Decimal	Hex.	Binary	Character Name
64	@40	1000000	@
65	@41	1000001	A
66	@42	1000010	B
67	@43	1000011	C
68	@44	1000100	D
69	@45	1000101	E
70	@46	1000110	F
71	@47	1000111	G
72	@48	1001000	H
73	@49	1001001	I
74	@4A	1001010	J
75	@4B	1001011	K
76	@4C	1001100	L
77	@4D	1001101	M
78	@4E	1001110	N
79	@4F	1001111	O
80	@50	1010000	P
81	@51	1010001	Q
82	@52	1010010	R
83	@53	1010011	S
84	@54	1010100	T
85	@55	1010101	U
86	@56	1010110	V
87	@57	1010111	W
88	@58	1011000	X
89	@59	1011001	Y
90	@5A	1011010	Z
91	@5B	1011011	[
92	@5C	1011100	\
93	@5D	1011101	]
94	@5E	1011110	^ (circumflex)
95	@5F	1011111	_ (underline)

Foreign Accents

The following hex. codes may be used for accents if transmitted preceded by a BS backspace but only with printers which respond to BS by moving the printing head back one space. When intended for this purpose, the symbols may be modified in typeface style (e.g. the apostrophe may slant).

@22 quotation mark : Diaeresis or umlaut
 @27 apostrophe : Acute accent
 @2C comma : Cedilla
 @5E : Circumflex
 @60 : Grave accent
 @7E : Tilde

ASCII CODE TABLE - Continued

Decimal	Hex.	Binary	Character Name
96	@60	1100000	` (grave accent)
97	@61	1100001	a
98	@62	1100010	b
99	@63	1100011	c
100	@64	1100100	d
101	@65	1100101	e
102	@66	1100110	f
103	@67	1100111	g
104	@68	1101000	h
105	@69	1101001	i
106	@6A	1101010	j
107	@6B	1101011	k
108	@6C	1101100	l
109	@6D	1101101	m
110	@6E	1101110	n
111	@6F	1101111	o
112	@70	1110000	p
113	@71	1110001	q
114	@72	1110010	r
115	@73	1110011	s
116	@74	1110100	t
117	@75	1110101	u
118	@76	1110110	v
119	@77	1110111	w
120	@78	1111000	x
121	@79	1111001	y
122	@7A	1111010	z
123	@7B	1111011	{
124	@7C	1111100	(vertical line)
125	@7D	1111101	}
126	@7E	1111110	~ (tilde)
127	@7F	1111111	DEL (delete or rub out)

3. Style of Paper

Cheaper printers are designed for "Teletype Rolls", i.e. a continuous roll of paper 8 1/2" (216mm) wide with no perforations. The paper is fed through by "friction feed", i.e. by the surface of the platen with auxiliary pressure rollers. The line length is generally 80 characters at normal character spacing, more with condensed characters. Old styles of printer may have a line length less than 80 characters.

Other printers require paper with sprocket holes down the edge. These have either a special platen with sprocket pins or else a tractor mechanism mounted above the platen. Such printers will take fan-fold paper, and most of them can print carbon copies with multi-part stationery. With friction feed printers, generally no more than 2-part stationery can be used.

Some printers with tractor-feed can accept paper of different widths.

4. Line Length

The output from GEM 80 controller printer ports is suitable for line lengths up to 125 characters. If the printer gives a longer line length than this, it may not be possible to make full use of it. This, however, depends on the type of printer and how signals are buffered.

5. Forms Control

Some printers taking sprocket-feed fan-fold paper respond to code @0C (FF = form feed) by throwing up the paper so that further printing starts on a new page. This facility allows print-outs to be in a state suitable for filing rather than being in a continuous strip with the perforations coming at inconvenient places in the middle.

6. Horizontal Tabulation

Some printers respond to @09 (HT = horizontal tabulation) by making the printing head or printing position jump to the next preset column position, instead of having to space across one character at a time till it gets there. This facility can speed up the printing of tabular information. Usually, the column positions can be programmed remotely and could therefore be set up by the GEM 80 controller program.

7. Two-colour Printing

A few printers have two-colour ribbons, and respond to the codes @0F and @0E (SI = shift in, and SO = shift out) to move the ribbon, from one colour to the other, and back again, respectively.

8. Acoustic Noise

Some types of printer produce more noise than is generally acceptable in an office environment, and could need acoustic covers to reduce the noise level.

9. Ribbons/Thermal Paper

When selecting a printer, make sure that whatever type of ribbon spool or cassette is used is readily available. Some cassettes are peculiar to one type of printer only, and expensive or on long delivery as a result.

If, on the other hand, you select a thermal printer, check on the availability and cost of thermal paper, and also on its life. Some types of thermal paper discolour with age.

OPERATION NOTES

1. Printer Buffering

On most printers, characters received from the GEM 80 controller are not printed immediately they are received, but are stored in a buffer memory and printed after a small delay. This is because certain actions of the printer, notably carriage return and line feed, take much longer than it takes to print a character. At the start of a new line, the printer then has to print characters at a faster rate than they are being received to make up for lost time, taking these characters out of the buffer memory.

However, not all printers are like this. Some require that the signal transmitted includes sufficient NUL characters following carriage return and line feed to allow for the mechanical delays. NUL characters may also be required following FF on printers with forms control, and following SI or SO on printers with two-colour ribbons. The user should find out from the manufacturer how many NUL's, if any, are needed for these operations, as they would have to be included in the messages transmitted by the GEM 80 controller.

2. Line Buffering

Some printers only commence printing when they have received a complete line of characters, whereas other types of printer print characters more or less as they are received. This fact should be borne in mind when designing print-out formats.

Note that some types of printer are presettable by a switch in the printer to either print all lines starting from the left hand margin, or printing alternate lines left-to-right and right-to-left. The user should check the manufacturer's data as to whether this influences line buffering.

3. Auto Line Feed

When they receive a carriage return code, some printers automatically provide a line feed themselves, without a line feed code needing to be sent to them.

However, GEM 80 printing functions (for both ladder diagram and BASIC language controllers) generally transmit both CR and LF at the end of a line, and the LF will cause print-outs to be double line spaced if the printer has auto line feed. If this auto line feed feature cannot be switched out on the printer preset switches, then GEM80 messages must be programmed slightly differently from standard practice.

MAINTENANCE

Because printers, unlike GEM 80 controllers, have moving parts, they need regular maintenance if they are to perform reliably. The user should consider entering into a contract for the regular maintenance of his printer with the supplier. Printers which get out of adjustment may fail to line feed correctly, truncate the print line, fail to print all the dots which form the characters on a dot-matrix printer, etc. Where printed reports are essential to the smooth operation of a plant, the user should also consider purchasing a second printer as a standby.

Note The Company's policy is one of continuous development and improvement and therefore the right is reserved to supply products which may differ in detail from those described and illustrated in this publication. All our products and materials are sold subject to Conditions of Sale available from us on request

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