CHAPTER 8

CARING FOR YOUR PRINTER

Subjects covered in Chapter 8 include —
- **Cleaning the printer**
- **Replacing the ribbon**
- **Replacing the print head**

Dust and heat will make any mechanism wear more quickly. The best maintenance is preventative, so the first step in any maintenance program is correct location of the printer. This is covered in greater detail in Chapter 1, but in general a normal comfortable office environment is best for both the computer and the printer.

CLEANING THE PRINTER

Cleaning the printer regularly will prolong its service life. Use a damp cloth on the exterior every week or so. For stubborn dirt, you may moisten the cloth with alcohol or water containing a mild detergent, but be careful not to spill any liquid into the interior of the printer or onto the print mechanism.

Use a soft brush to remove paper dust and lint from the interior. A small vacuum cleaner can also make this task easier — but be very careful not to bend or injure any electronic parts or wiring. The printer contains delicate electronic parts, so only clean those places where you have easy access.

REPLACING THE RIBBON

The printer uses an endless-type ribbon cartridge, meaning that the ribbon is recycled automatically. In time however,

when the print becomes to faint to read clearly, you will need to change either the whole cartridge or the ribbon inside it.

Changing the whole cartridge is the simplest method, and because you don't need to touch the ribbon itself, it is the cleanest way too. To remove the old cartridge, remove the printer cover, grasp the ribbon cartridge with both hands, and pull straight up gently until the holder springs release. To fit the new cartridge, refer to Chapter 1, Installing the ribbon cartridge.

A more economical method is to only replace the ribbon itself. First, obtain the correct type of replacement sub-cassette from your dealer. Use the following procedure to change the ribbon:

1. Place the cartridge on a flat surface, and use a flat-bladed screwdriver to unhook the tabs holding the two sections of the cartridge together. See Figure 8-1.
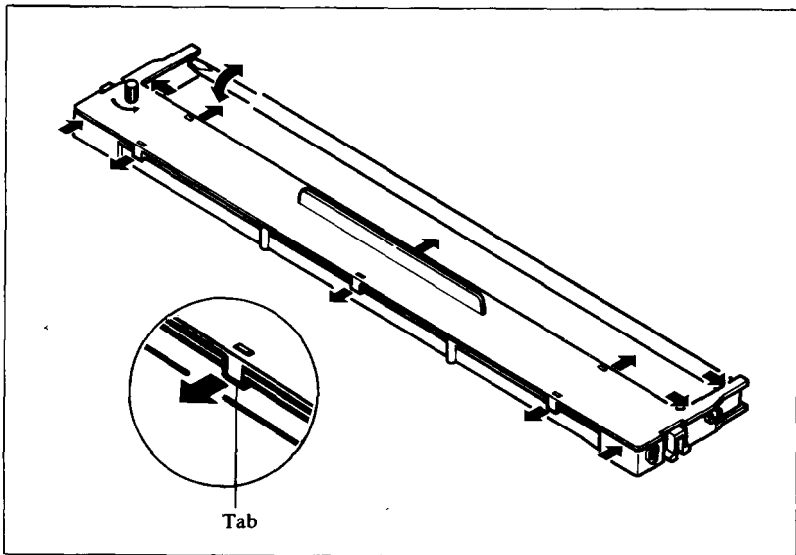

Tab

Figure 8-1. Unhook tabs to open the cartridge.

2. After opening the cartridge, take a moment to notice how the ribbon is threaded. Then press a finger against the idler gear holder (it is held in position by spring pressure), and make enough space to remove the ribbon from between the two gears. See Figure 8-2.
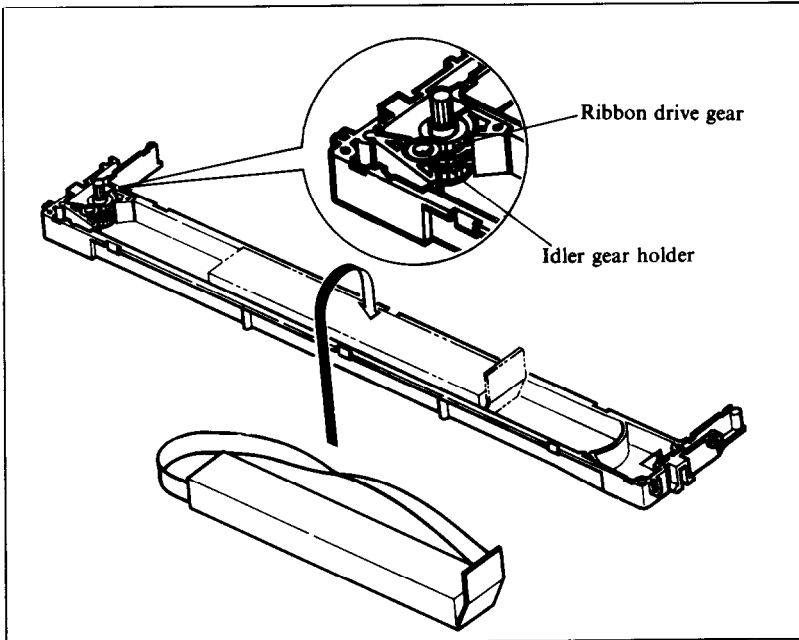
Figure 8-2. Replace the ribbon sub-cassette.

3. Clean the inside of the cartridge, especially around the vicinity of the two gears.

4. Take the new ribbon and holder out of the wrapper, remove the adhesive tape on the joint on the holder, and place it into the cassette as shown in Figure 8-2.

5. Pull sufficient ribbon out of the holder, and thread it as shown in Figure 8-3. Be careful that the half-twist in the ribbon is positioned in the right-hand section of the ribbon cartridge, between the two guide posts. Make sure that no twists occur anywhere else.

6. Again press on the idler gear holder and thread the ribbon between both gears.

7. Remove the top and bottom of the ribbon holder, and replace the cartridge top cover. Snap all tabs back into place.

8. When you've completed the installation, remount the cartridge to the printer.
Note: You should replace the whole cartridge after replacing the ribbon five times.
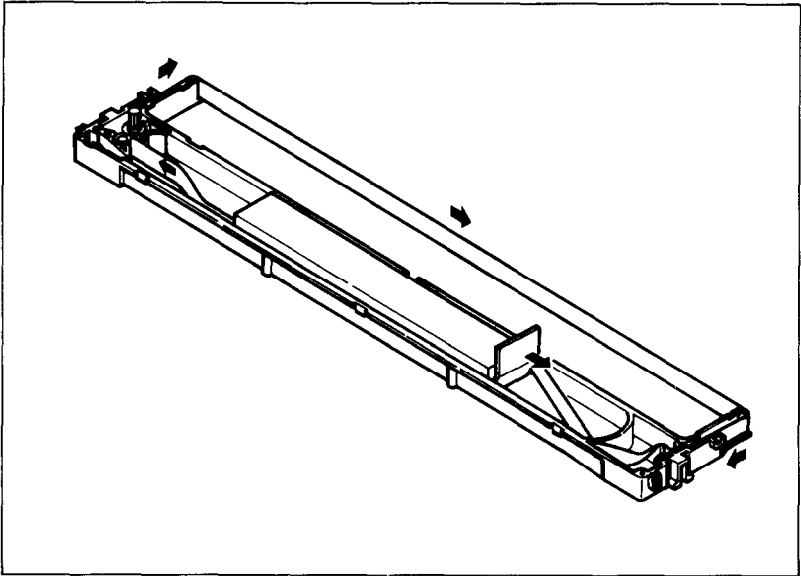
Figure 8-3. Make sure that the ribbon is not twisted when you thread it through its path.

REPLACING THE PRINT HEAD

The dot matrix print head has an extremely long life, around 100,000,000 characters, or years of normal use. However, when printing is too light even after replacing the ribbon, you'll know that the print head has reached the end of its service life.

Turn off the power, unplug the power cord, and use the following procedure to replace the print head:

Warning: The print head becomes hot during operation. If you have been using the printer, let it stand for a while so that the print head can cool off. ·

1. Remove the printer cover and ribbon cartridge.
2. Move the print head left along the carriage, until you can see the connector cover. Remove the cover from the printer frame; for details, see Figure 8-4. Unplug the print head cable from the head cable board.
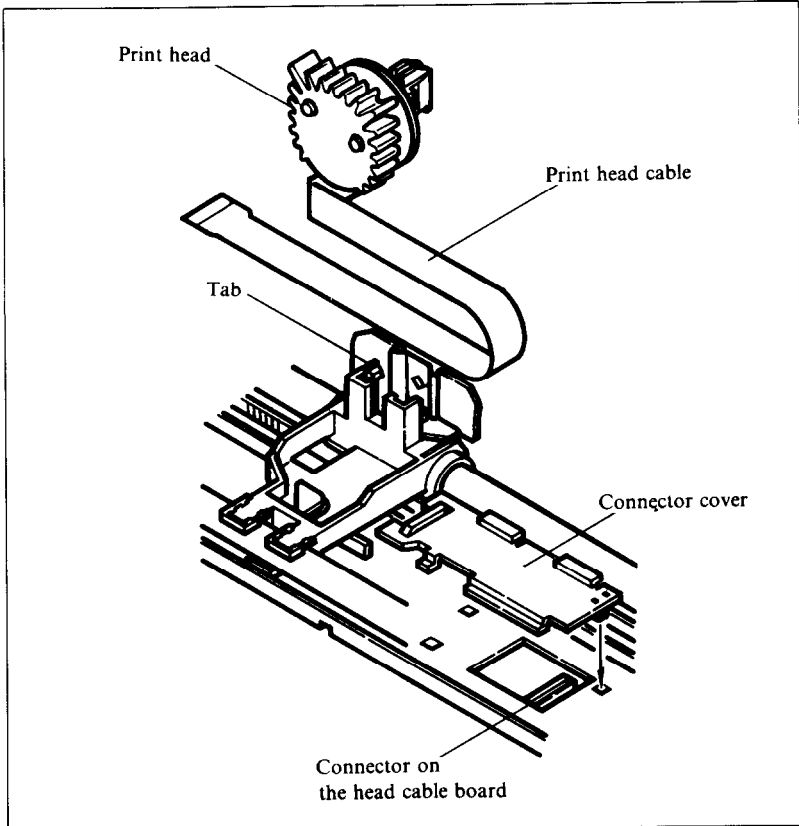
Figure 8-4. Replacement of the print head

   3. Hold back the tab that locks the print head into place, and remove the print head.

   4. Making sure that the new print head is facing the correct direction, carefully plug the cable into the connector on the head cable board. Make sure that this connection is secure, and that the cable is inserted far enough into the connector.

   5. Replace the connector cover, and feed the cable under the support tab on the top of the cover.

   6. Fit the new print head into its support, while holding the tab back. Make sure that the print head is inserted into its guides as far as it can go, and that the tab locks the print head into place.

MEMO

DIP SWITCH SETTINGS

The DIP (Dual In-line Package) switches control many of the functions of the printer. A DIP switch contains a number of small switches, and in this printer, each of the two DIP switches has eight individual switches.

Both DIP switches are easily accessible from the top of the printer. Remove the ribbon cartridge, and you will see the two DIP switches underneath a sheet of black protective plastic film, which you fold back for access.

DIP switch 1 is the one on the right as you look at the printer from the front. The individual switches of DIP switch 1 are named (left to right) from 1-1 to 1-8; similarly, the switches of DIP switch 2 are 2-1 to 2-8.

To change a setting, turn the power OFF, and use a ball-point pen or similar to move any of the small white switches to the front or back of the printer. The "on" position for all switches is towards the back of the printer, and "off" is to the front. Figure A-1 shows the location of the printer's DIP switches. DIP switch settings stay in effect until changed. A new setting becomes the new default or standard setting.

Table A-1 shows a summary of DIP switch functions.

Caution: Never change the setting of any of the DIP switches when the power is on. The printer only reads the DIP switch settings at the moment the power is turned on. Turn off power to both the computer and the printer when changing settings, and turn the power on again to use the new settings.
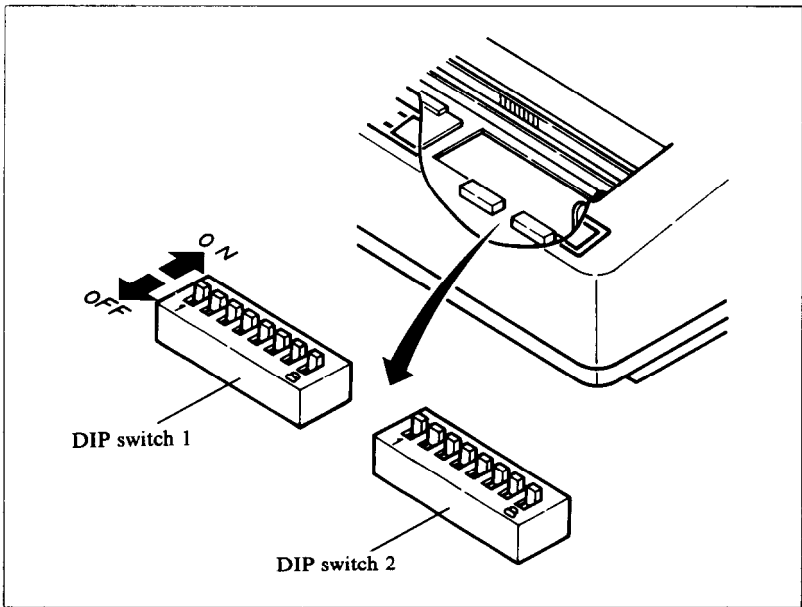
Figure A-1. The DIP switches are located under the printer cover.

Table A-1
DIP switch settings

Switch	ON	OFF
	Switch 1	
1-1	Paper-out detected	Paper-out not detected
1-2	Set SELECT IN signal to LOW	Not fixed
1-3	Ignore download characters	Enable download characters
1-4	1/6 inch line feed	1/8 inch line feed
1-5	LF from host	Auto LF with CR
1-6	No bottom margin	Set bottom margin to 1 inch
1-7	10 CPI (pica pitch)	17 CPI (condensed pitch)
1-8	Print "normal zero"	Print "slash zero"
	Switch 2	
2-1	Draft character set	NLQ character set
2-2	Set Standard mode	Set IBM mode
2-3	Set IBM-P mode	Set IBM-G mode
2-4	Set 1/216 inch or character set #1	Set 1/144 inch or character set #2
2-5	Auto CR with line feed	CR from host
2-6		
2-7	International character set selection — see Table A-2.	
2-8		

SWITCH FUNCTIONS

Switch   **Function**

1-1   This switch disables the paper-out detector. If the switch is on, the printer will signal the computer when it runs out of paper and printing will stop. If the switch is off, the printer will ignore the paper-out detector and will continue printing. This switch is set on at the factory.

1-2   This switch controls the status of the SELECT IN signal of the parallel interface. If this switch is on, this signal is held LOW. If this switch is off, the signal goes HIGH when the printer cannot get data. This switch is set on at the factory.

1-3   This switch controls the RAM. When this switch is on, the download character definitions are ignored and the RAM is used as a print buffer. When this switch is off, the download character definitions are enabled and the print buffer is set to a one line buffer. This switch is set on at the factory.

1-4   This switch sets the default line spacing. When this switch is on the default line spacing is set to 1/6 inch. This means that the printer will advance the paper 1/6 inch each time it receives a line feed. When this switch is off the default line spacing is 1/8 inch. This switch is set on at the factory.

1-5   When this switch is on, the computer must send a line feed command each time to advance the paper. When this switch is off, the printer will automatically advance the paper one line every time it receives a carriage return. (For example, most BASIC's send a line feed with every carriage return; in this case, this switch should be on.) This switch is set on at the factory.

1-6   This switch determines the default bottom margin. When this switch is on, the bottom margin is not set at power-on. When this switch is off, the bottom margin is automatically set to 1 inch. This switch is set on at the factory.

1-7   This switch selects the default character pitch. If this switch is on, the default pitch is normal pica pitch (10 CPI). If this switch is off, the default

pitch is condensed pica pitch (17 CPI). This switch is set on at the factory.

1-8   This switch selects the print style of zeroes. If this switch is on, normal zeroes are printed. If this switch is off, slashed zeroes are printed. This switch is set on at the factory.

2-1   This switch selects the default character style. If this switch is on, the default character style is normal draft characters. If this switch is off, near letter quality (NLQ) characters become the default characters. This switch is set on at the factory.

2-2   This switch selects the active control codes. Turn this switch on to use the "Standard" mode, which emulates the Epson FX-85 printer. Turn this switch off to use the "IBM" compatible mode. This switch is set on at the factory.

2-3   This switch selects emulation between the IBM printers when DIP switch 2-2 is set off.
Turn this switch on to use the "IBM-P" mode, which emulates the IBM Proprinter. Turn this switch off to use the "IBM-G" mode, which emulates the IBM Graphics printer.

2-4   This switch sets two different functions depending on the setting of DIP switch 2-2.
When DIP switch 2-2 is set on and this switch is set on, the minimum line feed value is set to $1/216$ inch. When this switch is set off while DIP switch 2-2 is set on, the minimum line feed value is set to $1/144$ inch. When DIP switch 2-2 is set off, character set #1 is set when this switch is on, and the character set #2 is set when this switch is off. This switch is set on at the factory.

2-5   This switch sets the status of the print head after the paper is advanced. When this switch is on, the print head returns to the left margin after the paper is advanced. When this switch is off, the print head does not return to the left margin after the paper is advanced. This switch is set on at the factory.

2-6 to 2-8   These switches determine the default international character set, as shown in Table A-2. These switches are all set on at the factory.

Table A-2
International character sets

Switch	USA	France	Germany	England	Denmark	Sweden	Italy	Spain
2-6	ON	OFF	ON	OFF	ON	OFF	ON	OFF
2-7	ON	ON	OFF	OFF	ON	ON	OFF	OFF
2-8	ON	ON	ON	ON	OFF	OFF	OFF	OFF

MEMO

APPENDIX B

ASCII CODES AND CONVERSION CHART

The purpose of this Appendix is to provide a quick reference for the relationship between the characters available on this printer and the decimal or hexadecimal values.

For example, when you refer the character "A", it sits in the "4" column and the "1" row. So its hexadecimal value is "41". Similarly, it is written "65" close to the character, which shows the decimal value.

When you refer the table, there are many control codes, which are written inside broken brackets.

[Sample]

Hexa-decimal	0	1	2	3	4	5	6	7
0	⟨NUL⟩ 0	16	SP 32	0 48	@ 64	P 80	` 96	p 112
1	1	⟨DC1⟩ 17	! 33	1 49	A 65	Q 81	a 97	q 113
2	2	⟨DC2⟩ 18	" 34	2 50	B 66	R 82	b 98	r 114
3	3	⟨DC3⟩	#	3 51	C 67	S		

Character — Hexadecimal value (high order)

Control code — Decimal value

Hexadecimal value (low order)

STANDARD MODE CHARACTERS

Hexa-decimal	0	1	2	3	4	5	6	7
0	〈NUL〉 0	16	32	0 48	@ 64	P 80	` 96	p 112
1	1	〈DC1〉 17	! 33	1 49	A 65	Q 81	a 97	q 113
2	2	〈DC2〉 18	'' 34	2 50	B 66	R 82	b 98	r 114
3	3	〈DC3〉 19	# 35	3 51	C 67	S 83	c 99	s 115
4	4	〈DC4〉 20	$ 36	4 52	D 68	T 84	d 100	t 116
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118
7	〈BEL〉 7	23	' 39	7 55	G 71	W 87	g 103	w 119
8	〈BS〉 8	〈CAN〉 24	(40	8 56	H 72	X 88	h 104	x 120
9	〈HT〉 9	25	) 41	9 57	I 73	Y 89	i 105	y 121
A	〈LF〉 10	26	* 42	: 58	J 74	Z 90	j 106	z 122
B	〈VT〉 11	〈ESC〉 27	+ 43	; 59	K 75	[91	k 107	{ 123
C	〈FF〉 12	28	, 44	< 60	L 76	\ 92	l 108	¦ 124
D	〈CR〉 13	29	— 45	= 61	M 77	] 93	m 109	} 125
E	〈SO〉 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126
F	〈SI〉 15	31	/ 47	? 63	O 79	_ 95	o 111	〈DEL〉 127

Hexa-decimal	8	9	A	B	C	D	E	F
0	⟨NUL⟩ 128	144	160	O 176	@ 192	P 208	` 224	p 240
1	129	⟨DC1⟩ 145	! 161	1 177	A 193	Q 209	a 225	q 241
2	130	⟨DC2⟩ 146	'' 162	2 178	B 194	R 210	b 226	r 242
3	131	⟨DC3⟩ 147	# 163	3 179	C 195	S 211	c 227	s 243
4	132	⟨DC4⟩ 148	$ 164	4 180	D 196	T 212	d 228	t 244
5	133	149	% 165	5 181	E 197	U 213	e 229	u 245
6	134	150	& 166	6 182	F 198	V 214	f 230	v 246
7	⟨BEL⟩ 135	151	' 167	7 183	G 199	W 215	g 231	w 247
8	⟨BS⟩ 136	⟨CAN⟩ 152	(168	8 184	H 200	X 216	h 232	x 248
9	⟨HT⟩ 137	153	) 169	9 185	I 201	Y 217	i 233	y 249
A	⟨LF⟩ 138	154	* 170	: 186	J 202	Z 218	j 234	z 250
B	⟨VT⟩ 139	⟨ESC⟩ 155	+ 171	; 187	K 203	[219	k 235	{ 251
C	⟨FF⟩ 140	156	, 172	< 188	L 204	\ 220	l 236	¦ 252
D	⟨CR⟩ 141	157	- 173	= 189	M 205	] 221	m 237	} 253
E	⟨SO⟩ 142	158	. 174	> 190	N 206	^ 222	n 238	~ 254
F	⟨SI⟩ 143	159	/ 175	? 191	O 207	_ 223	o 239	⟨DEL⟩ 255

IBM MODE CHARACTERS

■ Character set #1

Hexa-decimal	0	1	2	3	4	5	6	7
0	⟨NUL⟩ 0	16	32	0 48	@ 64	P 80	` 96	p 112
1	1	⟨DC1⟩ 17	! 33	1 49	A 65	Q 81	a 97	q 113
2	2	⟨DC2⟩ 18	'' 34	2 50	B 66	R 82	b 98	r 114
3	3	⟨DC3⟩ 19	# 35	3 51	C 67	S 83	c 99	s 115
4	4	⟨DC4⟩ 20	$ 36	4 52	D 68	T 84	d 100	t 116
5	5	21	% 37	5 53	E 69	U 85	e 101	u 117
6	6	22	& 38	6 54	F 70	V 86	f 102	v 118
7	⟨BEL⟩ 7	23	' 39	7 55	G 71	W 87	g 103	w 119
8	⟨BS⟩ 8	⟨CAN⟩ 24	(40	8 56	H 72	X 88	h 104	x 120
9	⟨HT⟩ 9	25	) 41	9 57	I 73	Y 89	i 105	y 121
A	⟨LF⟩ 10	26	* 42	: 58	J 74	Z 90	j 106	z 122
B	⟨VT⟩ 11	⟨ESC⟩ 27	+ 43	; 59	K 75	[91	k 107	{ 123
C	⟨FF⟩ 12	⟨FS⟩ 28	, 44	< 60	L 76	\ 92	l 108	¦ 124
D	⟨CR⟩ 13	29	— 45	= 61	M 77	] 93	m 109	} 125
E	⟨SO⟩ 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126
F	⟨SI⟩ 15	31	/ 47	? 63	O 79	_ 95	o 111	⟨DEL⟩ 127

Hexa-decimal	8	9	A	B	C	D	E	F
0	⟨NUL⟩ 128	144	á 160	⫴ 176	└ 192	╨ 208	α 224	≡ 240
1	129	⟨DC1⟩ 145	í 161	▓ 177	┴ 193	╤ 209	β 225	± 241
2	130	⟨DC2⟩ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	131	⟨DC3⟩ 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	⟨DC4⟩ 132	148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	133	149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	134	150	ª 166	╢ 182	╞ 198	╓ 214	μ 230	÷ 246
7	⟨BEL⟩ 135	151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	⟨BS⟩ 136	⟨CAN⟩ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	⟨HT⟩ 137	153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	∙ 249
A	⟨LF⟩ 138	154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	− 250
B	⟨VT⟩ 139	⟨ESC⟩ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	⟨FF⟩ 140	⟨FS⟩ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	∩ 252
D	⟨CR⟩ 141	157	¡ 173	╜ 189	═ 205	▌ 221	φ 237	² 253
E	⟨SO⟩ 142	158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	⟨SI⟩ 143	159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	255

■ Character set #2

Hexa-decimal	0	1	2	3	4	5	6	7
0	⟨NUL⟩ 0	16	32	0 48	@ 64	P 80	` 96	p 112
1	1	⟨DC1⟩ 17	! 33	1 49	A 65	Q 81	a 97	q 113
2	2	⟨DC2⟩ 18	'' 34	2 50	B 66	R 82	b 98	r 114
3	♥ 3	⟨DC3⟩ 19	# 35	3 51	C 67	S 83	c 99	s 115
4	♦ 4	⟨DC4⟩ 20	$ 36	4 52	D 68	T 84	d 100	t 116
5	♣ 5	§ 21	% 37	5 53	E 69	U 85	e 101	u 117
6	♠ 6	22	& 38	6 54	F 70	V 86	f 102	v 118
7	⟨BEL⟩ 7	23	' 39	7 55	G 71	W 87	g 103	w 119
8	⟨BS⟩ 8	⟨CAN⟩ 24	(40	8 56	H 72	X 88	h 104	x 120
9	⟨HT⟩ 9	25	) 41	9 57	I 73	Y 89	i 105	y 121
A	⟨LF⟩ 10	26	* 42	: 58	J 74	Z 90	j 106	z 122
B	⟨VT⟩ 11	⟨ESC⟩ 27	+ 43	; 59	K 75	[91	k 107	{ 123
C	⟨FF⟩ 12	⟨FS⟩ 28	, 44	< 60	L 76	\ 92	l 108	¦ 124
D	⟨CR⟩ 13	29	— 45	= 61	M 77	] 93	m 109	} 125
E	⟨SO⟩ 14	30	. 46	> 62	N 78	^ 94	n 110	~ 126
F	⟨SI⟩ 15	31	/ 47	? 63	O 79	_ 95	o 111	⟨DEL⟩ 127

Hexa-decimal	8	9	A	B	C	D	E	F
0	Ç 128	É 144	á 160	▦ 176	└ 192	╨ 208	α 224	≡ 240
1	ü 129	æ 145	í 161	▓ 177	┴ 193	╤ 209	β 225	± 241
2	é 130	Æ 146	ó 162	▓ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	μ 230	÷ 246
7	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	∙ 249
A	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	ⁿ 252
D	ì 141	¥ 157	¡ 173	╜ 189	= 205	▌ 221	ø 237	² 253
E	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	Å 143	ƒ 159	» 175	┐ 191	⊥ 207	▀ 223	∩ 239	255

■ All character set (IBM-P mode only)

Hexa-decimal	0	1	2	3	4	5	6	7
0	(0)	(16)	(32)	0 (48)	@ (64)	P (80)	` (96)	p (112)
1	(1)	(17)	! (33)	1 (49)	A (65)	Q (81)	a (97)	q (113)
2	(2)	(18)	" (34)	2 (50)	B (66)	R (82)	b (98)	r (114)
3	♥ (3)	(19)	# (35)	3 (51)	C (67)	S (83)	c (99)	s (115)
4	♦ (4)	¶ (20)	$ (36)	4 (52)	D (68)	T (84)	d (100)	t (116)
5	♣ (5)	§ (21)	% (37)	5 (53)	E (69)	U (85)	e (101)	u (117)
6	♠ (6)	(22)	& (38)	6 (54)	F (70)	V (86)	f (102)	v (118)
7	(7)	(23)	' (39)	7 (55)	G (71)	W (87)	g (103)	w (119)
8	(8)	(24)	((40)	8 (56)	H (72)	X (88)	h (104)	x (120)
9	(9)	(25)	) (41)	9 (57)	I (73)	Y (89)	i (105)	y (121)
A	(10)	→ (26)	* (42)	: (58)	J (74)	Z (90)	j (106)	z (122)
B	(11)	← (27)	+ (43)	; (59)	K (75)	[(91)	k (107)	{ (123)
C	(12)	(28)	, (44)	< (60)	L (76)	\ (92)	l (108)	¦ (124)
D	(13)	(29)	- (45)	= (61)	M (77)	] (93)	m (109)	} (125)
E	(14)	(30)	. (46)	> (62)	N (78)	^ (94)	n (110)	~ (126)
F	(15)	∅ (31)	/ (47)	? (63)	O (79)	_ (95)	o (111)	(127)

Hexa-decimal	8	9	A	B	C	D	E	F
0	Ç 128	É 144	á 160	▓ 176	└ 192	╨ 208	α 224	≡ 240
1	ü 129	æ 145	í 161	▒ 177	┴ 193	╤ 209	β 225	± 241
2	é 130	Æ 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	μ 230	÷ 246
7	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	∙ 249
A	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	ï 139	¢ 155	½ 171	╗ 187	╦ 203	█ 219	δ 235	√ 251
C	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	ⁿ 252
D	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▌ 221	φ 237	² 253
E	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	255

Decimal	Binary	Hexa-decimal	Decimal	Binary	Hexa-decimal	Decimal	Bianry	Hexa-decimal
0	00000000	00	59	00111011	3B	118	01110110	76
1	00000001	01	60	00111100	3C	119	01110111	77
2	00000010	02	61	00111101	3D	120	01111000	78
3	00000011	03	62	00111110	3E	121	01111001	79
4	00000100	04	63	00111111	3F	122	01111010	7A
5	00000101	05	64	01000000	40	123	01111011	7B
6	00000110	06	65	01000001	41	124	01111100	7C
7	00000111	07	66	01000010	42	125	01111101	7D
8	00001000	08	67	01000011	43	126	01111110	7E
9	00001001	09	68	01000100	44	127	01111111	7F
10	00001010	0A	69	01000101	45	128	10000000	80
11	00001011	0B	70	01000110	46	129	10000001	81
12	00001100	0C	71	01000111	47	130	10000010	82
13	00001101	0D	72	01001000	48	131	10000011	83
14	00001110	0E	73	01001001	49	132	10000100	84
15	00001111	0F	74	01001010	4A	133	10000101	85
16	00010000	10	75	01001011	4B	134	10000110	86
17	00010001	11	76	01001100	4C	135	10000111	87
18	00010010	12	77	01001101	4D	136	10001000	88
19	00010011	13	78	01001110	4E	137	10001001	89
20	00010100	14	79	01001111	4F	138	10001010	8A
21	00010101	15	80	01010000	50	139	10001011	8B
22	00010110	16	81	01010001	51	140	10001100	8C
23	00010111	17	82	01010010	52	141	10001101	8D
24	00011000	18	83	01010011	53	142	10001110	8E
25	00011001	19	84	01010100	54	143	10001111	8F
26	00011010	1A	85	01010101	55	144	10010000	90
27	00011011	1B	86	01010110	56	145	10010001	91
28	00011100	1C	87	01010111	57	146	10010010	92
29	00011101	1D	88	01011000	58	147	10010011	93
30	00011110	1E	89	01011001	59	148	10010100	94
31	00011111	1F	90	01011010	5A	149	10010101	95
32	00100000	20	91	01011011	5B	150	10010110	96
33	00100001	21	92	01011100	5C	151	10010111	97
34	00100010	22	93	01011101	5D	152	10011000	98
35	00100011	23	94	01011110	5E	153	10011001	99
36	00100100	24	95	01011111	5F	154	10011010	9A
37	00100101	25	96	01100000	60	155	10011011	9B
38	00100110	26	97	01100001	61	156	10011100	9C
39	00100111	27	98	01100010	62	157	10011101	9D
40	00101000	28	99	01100011	63	158	10011110	9E
41	00101001	29	100	01100100	64	159	10011111	9F
42	00101010	2A	101	01100101	65	160	10100000	A0
43	00101011	2B	102	01100110	66	161	10100001	A1
44	00101100	2C	103	01100111	67	162	10100010	A2
45	00101101	2D	104	01101000	68	163	10100011	A3
46	00101110	2E	105	01101001	69	164	10100100	A4
47	00101111	2F	106	01101010	6A	165	10100101	A5
48	00110000	30	107	01101011	6B	166	10100110	A6
49	00110001	31	108	01101100	6C	167	10100111	A7
50	00110010	32	109	01101101	6D	168	10101000	A8
51	00110011	33	110	01101110	6E	169	10101001	A9
52	00110100	34	111	01101111	6F	170	10101010	AA
53	00110101	35	112	01110000	70	171	10101011	AB
54	00110110	36	113	01110001	71	172	10101100	AC
55	00110111	37	114	01110010	72	173	10101101	AD
56	00111000	38	115	01110011	73	174	10101110	AE
57	00111001	39	116	01110100	74	175	10101111	AF
58	00111010	3A	117	01110101	75	176	10110000	B0

Decimal	Binary	Hexa-decimal	Decimal	Binary	Hexa-decimal	Decimal	Bianry	Hexa-decimal
177	10110001	B1	204	11001100	CC	231	11100111	E7
178	10110010	B2	205	11001101	CD	232	11101000	E8
179	10110011	B3	206	11001110	CE	233	11101001	E9
180	10110100	B4	207	11001111	CF	234	11101010	EA
181	10110101	B5	208	11010000	D0	235	11101011	EB
182	10110110	B6	209	11010001	D1	236	11101100	EC
183	10110111	B7	210	11010010	D2	237	11101101	ED
184	10111000	B8	211	11010011	D3	238	11101110	EE
185	10111001	B9	212	11010100	D4	239	11101111	EF
186	10111010	BA	213	11010101	D5	240	11110000	F0
187	10111011	BB	214	11010110	D6	241	11110001	F1
188	10111100	BC	215	11010111	D7	242	11110010	F2
189	10111101	BD	216	11011000	D8	243	11110011	F3
190	10111110	BE	217	11011001	D9	244	11110100	F4
191	10111111	BF	218	11011010	DA	245	11110101	F5
192	11000000	C0	219	11011011	DB	246	11110110	F6
193	11000001	C1	220	11011100	DC	247	11110111	F7
194	11000010	C2	221	11011101	DD	248	11111000	F8
195	11000011	C3	222	11011110	DF	249	11111001	F9
196	11000100	C4	223	11011111	DF	250	11111010	FA
197	11000101	C5	224	11100000	E0	251	11111011	FB
198	11000110	C6	225	11100001	E1	252	11111100	FC
199	11000111	C7	226	11100010	E2	253	11111101	FD
200	11001000	C8	227	11100011	E3	254	11111110	FE
201	11001001	C9	228	11100100	E4	255	11111111	FF
202	11001010	CA	229	11100101	E5			
203	11001011	CB	230	11100110	E6			

MEMO

APPENDIX C

FUNCTION CODES

The purpose of this Appendix is to provide a quick reference for the various functions available on this printer. Codes are described in the following format.

PURPOSE   **Tells what the function code does.**

MODE   Indicates the valid emulation mode.
CODE   Control code mnemonic
(decimal ASCII) ASCII decimal equivalent
(hex ASCII)   Hexadecimal equivalent

REMARKS   Briefly describes how the command is used.

SEE   Tells where any additional details of the command may be found.

Several commands require you to specify a value or values. In these cases, we have used an "*n*" or "*m*" to indicate a variable. You should insert the ASCII code for the proper value here.

COMMANDS TO CONTROL PRINT STYLE

These commands are used to control the font style, the print pitch, and special effects.

■ Font style controls

PURPOSE	**Selects italic characters.**	
MODE	Standard, IBM-G	
CODE	< ESC >	"4"
(decimal ASCII)	27	52
(hex ASCII)	1B	34
MODE	**IBM-P**	
CODE	< FS >	"4"
(decimal ASCII)	28	52
(hex ASCII)	IC	34

REMARKS   This command causes all subsequent characters to be printed in italics until italic printing is cancelled.

SEE   Chapter 4

PURPOSE	**Cancels italic characters.**	
MODE	Standard, IBM-G	
CODE	< ESC >	"5"
(decimal ASCII)	27	53
(hex ASCII)	IB	35
MODE	**IBM-P**	
CODE	< FS >	"5"
(decimal ASCII)	28	53
(hex ASCII)	IC	35

REMARKS   This command causes the printer to cancel italic printing and selects the standard roman characters. This command is ignored when the Italic Panel mode is selected at power-on.

SEE   Chapter 4

PURPOSE | **Selects an international character set.**

MODE | Standard, IBM-G
CODE | < ESC > "R" *n*
(decimal ASCII) | 27 82 *n*
(hex ASCII) | 1B 52 *n*

MODE | **IBM-P**
CODE | < FS > "R" *n*
(decimal ASCII) | 28 82 *n*
(hex ASCII) | 1C 52 *n*

REMARKS | This command selects the international character set according to the value of *n* as shown in the table below:

n	Character set	*n*	Character set
0	U.S.A	6	Italy
1	France	7	Spain
2	Germany	8	Japan
3	England	9	Norway
4	Denmark I	10	Denmark II
5	Sweden		

You can select a specific international character set (except Japan, Norway, and Denmark type II), as a power-on default by adjusting the settings of DIP switches 2-6, 2-7, and 2-8.

SEE | Chapter 6

PURPOSE | **Selects character set #2**

MODE | IBM-P, IBM-G
CODE | < ESC > "6"
(decimal ASCII) | 27 . 54
(hex ASCII) | 1B 36

REMARKS | This command selects character set #2 when the DIP switch 2-2 is set off. You can select character set #2 as the power-on default by turning DIP switch 2-4 off.

SEE | Chapter 6

PURPOSE	**Selects character set #1.**
MODE	IBM-P, IBM-G
CODE	< ESC > "7"
(decimal ASCII)	27 55
(hex ASCII)	1B 37
REMARKS	This command cancels character set #2 and selects character set #1 when the DIP switch 2-2 is set off. You can select character set #1 as the power-on default by turning DIP switch 2-4 on.
SEE	Chapter 6

PURPOSE	**Selects NLQ characters.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "x" 1
(decimal ASCII)	27 120 1
(hex ASCII)	1B 78 01
REMARKS	This command causes the printer to print near letter quality (NLQ) characters until the NLQ mode is cancelled. You can select NLQ characters as the power-on default by turning DIP switch 2-1 off. This command is ignored when the "Panel" mode is selected at power-on. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.
SEE	Chapter 4

PURPOSE	**Cancels NLQ characters.**		
MODE	Standard, IBM-P, IBM-G		
CODE	< ESC >	"x"	0
(decimal ASCII)	27	120	0
(hex ASCII)	1B	78	00

REMARKS   This command cancels NLQ printing and returns the printer to the draft mode. You can select draft characters as the power-on default by turning DIP switch 2-1 on. This command is ignored when the "Panel" mode is selected at power-on.
Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE   Chapter 4

PURPOSE	**Selects NLQ characters.**		
MODE	IBM-P		
CODE	< ESC >	"I"	2
(decimal ASCII)	27	73	2
(hex ASCII)	1B	49	02

REMARKS   This command causes the printer to print near letter quality (NLQ) characters until NLQ mode is cancelled. You can select NLQ characters as the power-on default by turning DIP switch 2-1 off. This command is ignored when the "Panel" mode is selected at power-on.
Note: The character "2" (decimal code 50, hexadecimal code 32) can be used instead of ASCII 2.

SEE   Chapter 4

PURPOSE	**Selects draft characters.**

MODE	**IBM-P**		
CODE	< ESC >	"I"	0
(decimal ASCII)	27	73	0
(hex ASCII)	1B	49	00

REMARKS
This command cancels NLQ printing and returns the printer to the draft mode. You can select draft characters as the power-on default by turning DIP switch 2-1 on. This command is ignored when the "Panel" mode is selected at power-on.
Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE   Chapter 4

■ Print pitch controls

PURPOSE	**Sets the print pitch to pica.**

MODE	Standard, IBM-P, IBM-G	
CODE	< ESC >	"P"
(decimal ASCII)	27	80
(hex ASCII)	1B	50

REMARKS
This command causes printing to be done in pica pitch, with 80 characters per line on the 10-inch type and 136 characters per line on the 15-inch type. You can select pica pitch as the power-on default by turning DIP switch 1-7 on. This command is ignored when the "Panel" mode is selected at power-on.

SEE   Chapter 4

PURPOSE   **Sets the print pitch to elite.**

MODE   Standard, IBM-P, IBM-G

CODE   < ESC > "M"

(decimal ASCII)   27   77

(hex ASCII)   1B   4D

REMARKS   This command causes printing to be done in elite pitch, with 96 characters per line on the 10-inch type and 163 characters per line on the 15-inch type. This command is ignored when the "Panel" mode is selected at power-on.

SEE   Chapter 4

PURPOSE   **Sets the print pitch to elite.**

MODE   IBM-P

CODE   < ESC > ":"

(decimal ASCII)   27   58

(hex ASCII)   1B   3A

REMARKS   This command causes printing to be done in elite pitch, with 96 characters per line on the 10-inch type and 163 characters per line on the 15-inch type. This command is ignored when the "Panel" mode is selected at power-on.

SEE   Chapter 4

PURPOSE	**Sets the printer to condensed print.**
MODE	Standard, IBM-P, IBM-G
CODE	< SI >
(decimal ASCII)	15
(hex ASCII)	0F

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > < SI >
(decimal ASCII)	27 15
(hex ASCII)	1B 0F

REMARKS	This command causes printing to be done in condensed pitch, with 233 characters per line for pica condensed, and 272 characters per line for elite condensed (NLQ characters are not printed in condensed pitch). You can select the pica condensed pitch with the control panel, but you cannot select the elite condensed pitch manually This command is ignored when the "Panel" mode is selected at power-on. **Note:** Only with the IBM-P mode this command sets the printer to pica condensed print.
SEE	Chapter 4

PURPOSE	**Cancels condensed print**
MODE	Standard, IBM-G
CODE	< DC2 >
(decimal ASCII)	18
(hex ASCII)	12

REMARKS	This command cancels condensed printing and returns the printer to the normal print pitch. This command is ignored when the "Panel" mode is selected at power-on.
SEE	Chapter 4

PURPOSE	**Sets the print pitch to pica.**
MODE	IBM-P
CODE	< DC2 >
(decimal ASCII)	18
(hex ASCII)	12
REMARKS	This command cancels condensed printing and returns the printer to the normal pica pitch. This commands is ignored when the "Panel" mode is selected at power-on.
SEE	Chapter 4

PURPOSE	**Sets the printer to proportional print.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "p" 1
(decimal ASCII)	27 112 1
(hex ASCII)	1B 70 01
REMARKS	This command causes all subsequent characters to be printed with proportional spacing until proportional printing is cancelled. This command is ignored when the "Panel" mode is selected at the power-on. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.
SEE	Chapter 4

PURPOSE   **Cancels proportional print.**

MODE   Standard, IBM-P, IBM-G
CODE   < ESC >   "p"   0
(decimal ASCII)   27   112   0
(hex ASCII)   1B   70   00

REMARKS   This command cancels proportional print-
                 ing and returns to "fixed pitch" printing.
                 This command is ignored when the "Panel"
                 mode is selected at the power-on.
                 Note: The character "0" (decimal code 48,
                 hexadecimal code 30) can be used instead
                 of ASCII 0.

SEE   Chapter 4

PURPOSE   **Sets the printer to expanded print.**

MODE   Standard, IBM-P, IBM-G
CODE   < ESC >   "W"   1
(decimal ASCII)   27   87   1
(hex ASCII)   1B   57   01

REMARKS   This command causes characters to be
                 printed twice as wide as normal (half the
                 current pitch) until expanded printing is
                 cancelled.
                 Note: The character "1" (decimal code 49,
                 hexadecimal code 31) can be used instead
                 of ASCII 1.

SEE   Chapter 4

PURPOSE	**Cancels expanded print.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "W" 0
(decimal ASCII)	27 87 0
(hex ASCII)	1B 57 00

REMARKS
This command resets the character pitch to what it was before expanded printing was set.
Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE   Chapter 4

PURPOSE	**Sets the printer to expanded print for the remainder of the current line.**
MODE	Standard, IBM-P, IBM-G
CODE	< SO >
(decimal ASCII)	14
(hex ASCII)	0E
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > < SO >
(decimal ASCII)	27 14
(hex ASCII)	1B 0E

REMARKS
This command causes characters to be printed twice as wide as normally until a carriage return is sent. It can also be cancelled with < DC4 > .

SEE   Chapter 4

PURPOSE	**Cancels one line expanded print.**
MODE	Standard, IBM-P, IBM-G
CODE	< DC4 >
(decimal ASCII)	20
(hex ASCII)	·14

REMARKS
This command cancels one line expanded print set with < SO > or < ESC > < SO > .

SEE   Chapter 4

■ Special print modes

PURPOSE	**Sets the master print mode.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "!" n
(decimal ASCII)	27 33 n
(hex ASCII)	1B 21 n

REMARKS	This is a powerful command that allows the user to set several printing characteristics at one time: print pitch, condensed print, expanded print, emphasizing, boldface, italics, underlining, or any combination of these, as determined by n, a number from 0 to 255. (See Table 4-10 for details.)

SEE	Chapter 4

PURPOSE	**Selects emphasized printing.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "E"
(decimal ASCII)	27 69
(hex ASCII)	1B 45

REMARKS	This command causes characters to be emphasized until is cancelled.

SEE	Chapter 4

PURPOSE	**Cancels emphasized printing.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "F"
(decimal ASCII)	27 ·70
(hex ASCII)	1B 46

REMARKS	This command cancels emphasized printing.

SEE	Chapter 4

PURPOSE	**Selects boldface printing.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "G"
(decimal ASCII)	27 71
(hex ASCII)	1B 47

REMARKS	This command causes characters to be printed in boldface until cancelled. Boldface cannot be used with superscripts or subscripts.
SEE	Chapter 4

PURPOSE	**Cancels boldface printing.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "H"
(decimal ASCII)	27 72
(hex ASCII)	1B 48

REMARKS	This command turns off boldface printing and returns the printer to normal printing.
SEE	Chapter 4

PURPOSE	**Selects underlining.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "—" 1
(decimal ASCII)	27 45 1
(hex ASCII)	1B 2D 01

REMARKS	This command underlines the following characters until cancelled. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.
SEE	Chapter 4

PURPOSE	**Cancels underlining.**		
MODE	Standard, IBM-P, IBM-G		
CODE	< ESC >	"—"	0
(decimal ASCII)	27	45	0
(hex ASCII)	1B	2D	00

REMARKS   This command stops underlining.
Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE   Chapter 4

PURPOSE	**Selects overlining.**		
MODE	Standard, IBM-P, IBM-G		
CODE	< ESC >	"—"	1
(decimal ASCII)	27	95	1
(hex ASCII)	1B	5F	01

REMARKS   This command prints a line above the following characters until cancelled.
Note: The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.

SEE   Chapter 4

PURPOSE	**Cancels overlining.**		
MODE	Standard, IBM-P, IBM-G		
CODE	< ESC >	"—"	0
(decimal ASCII)	27	95	0
(hex ASCII)	1B	5F	00

REMARKS   This command stops overlining.
Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE   Chapter 4

PURPOSE	**Selects superscripts.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "S" 0
(decimal ASCII)	27 83 0
(hex ASCII)	1B 53 00

REMARKS	This command raises the following characters and prints them as superscripts until cancelled. Superscripts are printed from left to right only and in boldface. **Note:** The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE	Chapter 4

PURPOSE	**Selects subscripts.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "S" 1
(decimal ASCII)	27 83 1
(hex ASCII)	1B 53 01

REMARKS	This command lowers the following characters and prints them as subscripts until cancelled. All conditions applicable to superscripts also apply to subscripts. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.

SEE	Chapter 4

PURPOSE	**Cancels a superscript or subscript.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "T"
(decimal ASCII)	27 84
(hex ASCII)	1B 54

REMARKS	This command stops printing of superscripts or subscripts and sets normal printing. It also cancels uni-directional printing and boldface, which are set automatically for superscripts and subscripts.

SEE	Chapter 4

CONTROLLING THE VERTICAL PRINT POSITION

These commands are used to move the paper relative to the print head. By moving the paper up or down, the print head, in effect, moves the opposite direction (down or up) on the page.

■ Line feed and reverse line feed

PURPOSE	**Advances the paper one line (line feed).**
MODE	Standard, IBM-P, IBM-G
CODE	< LF >
(decimal ASCII)	10
(hex ASCII)	0A
REMARKS	The actual distance of the line feed is set through various codes (see below). When DIP switch 1-5 is "off" a line feed is automatically generated whenever the printer receives a carriage return.
SEE	Chapter 5

PURPOSE	**Reverses the paper one line.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > < LF >
(decimal ASCII)	27 10
(hex ASCII)	1B 0A
REMARKS	This command causes the printer to reverse the paper (in effect moving the print head up on the sheet) one line. The actual distance travelled is set through various codes (see below). **Note:** You cannot reverse the paper more than one inch when the optional automatic sheet feeder is installed.
SEE	Chapter 5

PURPOSE | **Sets line spacing to 1/8 inch.**

MODE Standard, IBM-P, IBM-G
CODE < ESC > "0"
decimal ASCII) 27 48
hex ASCII) 1B 30

REMARKS This command sets the actual distance the
paper advances or reverses during all
subsequent line feeds to 1/8 inch.
You can select 1/8 inch line spacing as the
power-on default by turning DIP switch
1-4 off.

SEE Chapter 5

PURPOSE | **Sets line spacing to 1/6 inch.**

MODE Standard
CODE < ESC > "2"
decimal ASCII) 27 50
hex ASCII) 1B 32

REMARKS This command sets the actual distance the
paper advances or reverses during all
subsequent line feeds to 1/6 inch.
You can select 1/6 inch line spacing as the
power-on default by turning DIP switch
1-4 on.

·SEE Chapater 5

PURPOSE | **Sets line spacing to 7/72 inch.**

MODE Standard, IBM-P, IBM-G
CODE < ESC > "1"
decimal ASCII) 27 49
hex ASCII) 1B 31

REMARKS This command sets the actual distance the
paper advances or reverses during all
subsequent line feeds to 7/72 inch.

SEE Chapter 5

PURPOSE	**Sets line spacing to n/216 inch.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "3" n
(decimal ASCII)	27 51 n
(hex ASCII)	1B 33 n

REMARKS This command sets the actual distance the paper advances or reverses during all subsequent line feeds to n/216 inch (n/144 inch when DIP switch 2-4 is set off with the Standard mode). The value of n must be between 0 and 255.

SEE Chapter 5

PURPOSE	**Sets line spacing to n/72 inch.**
MODE	Standard
CODE	< ESC > "A" n
(decimal ASCII)	27 65 n
(hex ASCII)	1B 41 n

REMARKS This command sets the actual distance the paper advances or reverses during all subsequent line feeds to n/72 inch. The value of n must be between 0 and 85.

SEE Chapter 5

PURPOSE	**Defines line spacing to n/72 inch.**
MODE	IBM-P, IBM-G
CODE	< ESC > "A" n
(decimal ASCII)	27 65 n
(hex ASCII)	1B 41 n

REMARKS This command defines the actual distance the paper advances or reverses during all subsequent line feeds to n/72 inch. The value of n must be between 0 and 255. This command must be used in conjunction with < ESC > "2" which activates the < ESC > "A" definition.

SEE Chapter 5

PURPOSE   **Uses < ESC > "A" definition.**

MODE   IBM-P, IBM-G
CODE   < ESC >   "2"
(decimal ASCII)   27   50
(hex ASCII)   1B   32

REMARKS   This command activates the line spacing
               defined in the < ESC > "A" command.
               If the < ESC > "A" command has not been
               defined, the line spacing is changed to 1/6
               inch.

SEE   Chapter 5

PURPOSE   **Sends a one-time paper feed of n/216 inch.**

MODE   Standard, IBM-P, IBM-G
CODE   < ESC >   "J" n
(decimal ASCII)   27   74 n
(hex ASCII)   1B   4A n

REMARKS   This command causes the printer to ad-
               vance the paper n/216 inch (n/144 inch
               when DIP switch 2-4 is set off with the
               Standard mode). It does not change the
               current value of line spacing and it does
               not cause a carriage return. The value of
               n must be between 0 and 255.

SEE   Chapter 5

PURPOSE   **Sends a one-time reverse feed of n/216 inch.**

MODE   Standard, IBM-P, IBM-G
CODE   < ESC >   "j" n
(decimal ASCII)   27   106 n
(hex ASCII)   1B   6A n

REMARKS   This command causes the printer to reverse
               the paper n/216 inch (n/144 inch when
               DIP switch 2-4 is set off with the Standard
               mode). It does not change the current value
               of line spacing and it does not cause a
               carriage return. The value of n must be
               between 0 and 255.

SEE   Chapter 5

PURPOSE	**Sets print position to *n* lines.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "f" 1 *n*
(decimal ASCII)	27 102 1 *n*
(hex ASCII)	1B 66 01 *n*

REMARKS   This command sets the next print position to the *n*th line from the top of the current page.

Note: The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.

SEE   Chapter 5

■ Form feed and related commands

PURPOSE	**Advances the paper to the top of the next page (form feed).**
MODE	Standard, IBM-P, IBM-G
CODE	< FF >
(decimal ASCII)	12
(hex ASCII)	0C

REMARKS   The actual length of a page ejected by a form feed is set either by the switch on the control panel or through various codes (see below). This command works as the paper eject command when the optional automatic sheet feeder is installed.

SEE   Chapter 5

PURPOSE	**Reverses the paper to the top of the current page.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > < FF >
(decimal ASCII)	27 12
(hex ASCII)	1B 0C
REMARKS	This command causes the printer to reverse the paper to the top of the current printing page (or form). This command is ignored when the optional automatic sheet feeder is installed.
SEE	Chapter 5

PURPOSE	**Sets page length to *n* inches.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "C" 0 *n*
(decimal ASCII)	27 67 0 *n*
(hex ASCII)	1B 43 00 *n*
REMARKS	This command sets the length of all subsequent pages to *n* inches. The value of *n* must be between 1 and 22 (127 for IBM modes). You can select a power-on default form length by the switch on the control panel. This command is ignored when the optional automatic sheet feeder is installed.
SEE	Chapter 5

PURPOSE	**Sets page length to *n* lines.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "C" *n*
(decimal ASCII)	27 67 *n*
(hex ASCII)	1B 43 *n*
REMARKS	This command sets the length of all subsequent pages to *n* lines. The value of *n* must be between 1 and 255. This command is ignored when the optional automatic sheet feeder is installed.
SEE	Chapter 5

PURPOSE	**Sets the top of form to the current position.**

MODE	IBM-P
CODE	< ESC > "4"
(decimal ASCII)	27 52
(hex ASCII)	1B 34

REMARKS	This command sets the top of form to the current position.
SEE	Chapter 5

PURPOSE	**Sets the print position to *n* characters.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "f" 0 *n*
(decimal ASCII)	27 102 0 *n*
(hex ASCII)	1B 66 00 *n*

REMARKS	This command sets the next print position to *n* columns from the left margin. The value of *n* must be between 0 and 127. **Note:** The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.
SEE	Chapter 5

■ Top/bottom margins and vertical tabs.

PURPOSE	**Sets the top margin.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "r" *n*
(decimal ASCII)	27 114 *n*
(hex ASCII)	1B 72 *n*

REMARKS	This command sets the top margin to *n* lines. Printing begins on the (*n* + 1)th line on the page. This command is ignored when the optional automatic sheet feeder is installed.
SEE	Chapter 5

PURPOSE	**Sets the bottom margin.**

MODE   Standard, IBM-P, IBM-G
CODE   < ESC >   "N" n
(decimal ASCII)   27   78 n
(hex ASCII)   1B   4E n

REMARKS   This command sets the bottom margin to
               n lines. The printer will generate a form
               feed whenever there are n lines left on the
               page. This command is ignored when the
               optional automatic sheet feeder is installed.
               The value of n must be between 1 and 255.

SEE   Chapter 5

PURPOSE   **Cancels top and bottom margins.**

MODE   Standard, IBM-P, IBM-G
CODE   < ESC >   "O"
(decimal ASCII)   27   79
(hex ASCII)   1B   4F

REMARKS   This command cancels both the top margin
               and the bottom margin.

SEE   Chapter 5

PURPOSE   **Advances paper to the next vertical tab
               position.**

MODE   Standard, IBM-P, IBM-G
CODE   < VT >
(decimal ASCII)   11
(hex ASCII)   0B

REMARKS   This command causes the paper to be
               advanced to the next vertical tab position,
               or the top of the next page, whichever is
               first. If the vertical tab positions are not
               set, this command works as a line feed
               command.

SEE   Chapter 5

PURPOSE	**Sets vertical tab positions.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "B" *n1 n2 n3* ... 0
(decimal ASCII)	27 66 *n1 n2 n3* ... 0
(hex ASCII)	1B 42 *n1 n2 n3* ... 00

REMARKS   This command cancels all current vertical tab positions and sets those defined at lines *n1*, *n2*, *n3* etc. The maximum number of vertical tab positions allowed is 16. The ASCII 0 character is used as a command terminator. Each vertical tab position must be specified in ascending order.

SEE   Chapter 5

PURPOSE	**Selects vertical channels.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "/" *n0*
(decimal ASCII)	27 47 *n0*
(hex ASCII)	1B 2F *n0*

REMARKS   This command selects one of the multiple vertical channels determined by the value of *n0*. The value of *n0* must be between 0 and 7.

SEE   Chapter 5

PURPOSE	**Sets vertical tab positions in a channel.**

MODE   Standard, IBM-P, IBM-G

CODE	< ESC >	"b"	$n0\ n1\ n2\ n3$ ... 0
(decimal ASCII)	27	98	$n0\ n1\ n2\ n3$ ... 0
(hex ASCII)	1B	62	$n0\ n1\ n2\ n3$ ... 00

REMARKS   This command cancels all current vertical tab positions in channel $n0$ and sets those defined at lines $n1$, $n2$, $n3$, etc. The maximum number of vertical tab positions for each channel allowed is 16. The ASCII 0 character is used as a command terminator. Each vertical tab position must be specified in ascending order. The vertical channel $n0$ must be between 0 and 7.

SEE   Chapter 5

PURPOSE	**Sets vertical tab position every _n_ lines.**

MODE   Standard, IBM-P, IBM-G

CODE	< ESC >	"e"	1	n
(decimal ASCII)	27	101	1	n
(hex ASCII)	1B	65	01	n

REMARKS   This command cancels all current vertical tab positions and sets those every n lines. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.

SEE   Chapter 5

PURPOSE	**Cancels vertical tab positions.**

MODE   IBM-P

CODE	< ESC >	"R"
(decimal ASCII)	27	82
(hex ASCII)	1B	52

REMARKS   This command cancels the vertical tab positions. This command also sets the horizontal tab positions every 8 characters.

SEE   Chapter 5

CONTROLLING THE HORIZONTAL PRINT POSITION

This section described commands that move the print head and restrict its printing range (such as setting margins and tabs).

PURPOSE	**Returns print head to the left margin (carriage return).**
MODE	Standard, IBM-P, IBM-G
CODE	< CR >
(decimal ASCII)	13
(hex ASCII)	0D
REMARKS	This command returns the print head to the left margin. If DIP switch 1-5 has been set off, this command will also cause a line feed character to be generated after the carriage return, thereby advancing to the beginning of the next print line automatically.
SEE	Chapter 5

PURPOSE	**Sets carriage return function with a line feed.**		
MODE	IBM-P		
CODE	< ESC >	"5"	1
(decimal ASCII)	27	53	1
(hex ASCII)	1B	35	01
REMARKS	This command sets the carriage return function with a line feed. When the < CR > command is sent to the printer after this command has been sent, the printer automatically advances the paper one line. This command overrides the setting of DIP switch 1-5. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.		
SEE	Chapter 5		

PURPOSE	**Sets carriage return function without a line feed.**

MODE	IBM-P		
CODE	< ESC >	"5"	0
(decimal ASCII)	27	53	0
(hex ASCII)	1B	35	00

REMARKS	This command sets the carriage return function without a line feed. After this command has been sent to the printer, the print head returns to the left margin of the current line every time it receives a carriage return. This command overrides the setting of DIP switch 1-5.
	Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE	Chapter 5

PURPOSE	**Sets the left margin.**

MODE	Standard, IBM-P, IBM-G		
CODE	< ESC >	"l"	*n*
(decimal ASCII)	27	108	*n*
(hex ASCII)	1B	6C	*n*

REMARKS	This command sets the left margin to *n* characters. Each line will begin in the (*n* + 1)th character position from the left edge. The value of *n* must be between 0 and 255. You can set the left margin manually on the control panel.
	Note: Changing the print pitch after the left margin has been set does not change the margin — it stays in exactly the same place on the page.

SEE	Chapter 5

PURPOSE	**Sets the right margin.**		
MODE	Standard, IBM-G		
CODE	< ESC >	"Q"	n
(decimal ASCII)	27	81	n
(hex ASCII)	1B	51	n

MODE	IBM-P		
CODE	< FS >	"Q"	n
(decimal ASCII)	28	81	n
(hex ASCII)	IC	51	n

REMARKS
This command sets the right margin to *n*, which is the last character position that will be printed in a line. After execution of this command, any attempt to print beyond print position *n* will cause the printer to automatically generate a carriage return and a line feed before printing the remainder of the line. The values of *n* must be between 1 and 255. You can set the right margin manually on the control panel.
Note: Changing the print pitch after the right margin has been set does not change the margin — it stays in exactly the same position on the page.

SEE
Chapter 5

PURPOSE	**Sets the left and right margins.**			
MODE	Standard, IBM-P, IBM-G			
CODE	< ESC >	"X"	n1	n2
(decimal ASCII)	27	88	n1	n2
(hex ASCII)	1B	58	n1	n2

REMARKS
This command sets the left margin to *n1* characters and the right margin to *n2*. The values of *n1* and *n2* must between 1 and 255, and *n2* should be greater than *n1*. You can set the left and right margins manually on the control panel.
Note: Changing the print pitch after the margins have been set does not change the margins — they stay in exactly the same positions on the page.

SEE
Chapter 5

PURPOSE	**Moves the print head to the next horizontal tab position.**
MODE	Standard, IBM-P, IBM-G
CODE	< HT >
(decimal ASCII)	9
(hex ASCII)	09

REMARKS   This command causes the print head to advance to the next horizontal tab position. The horizontal tab positions are set at power-on to print positions 8, 16, 24, etc., (to the maximum print position).

SEE   Chapter 5

PURPOSE	**Sets horizontal tab positions.**

MODE	Standard, IBM-P, IBM-C		
CODE	< ESC >	"D"	*n1 n2 n3* ... 0
(decimal ASCII)	27	68	*n1 n2 n3* ... 0
(hex ASCII)	1B	44	*n1 n2 n3* ... 00

REMARKS   This command cancels all current horizontal tab positions and sets those defined at print positions, *n1*, *n2*, *n3*, etc. The maximum number of horizontal tab positions allowed is 28. The ASCII 0 character is used as a command terminator. Each horizontal tab position must be specified in ascending order.

SEE   Chapter 5

PURPOSE	**Sets horizontal tab position every *n* characters.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "e" 0 *n*
(decimal ASCII)	27 101 0 *n*
(hex ASCII)	1B 65 00 *n*

REMARKS	This command cancels all current horizontal tab positions and sets those every *n* characters.
	Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE	Chapter 5

PURPOSE	**Sets horizontal tab positions every 8 characters.**

MODE	IBM-P
CODE	< ESC > "R"
(decimal ASCII)	27 82
(hex ASCII)	1B 52

REMARKS	This command cancels all current horizontal tab positions and sets those every 8 characters. This command also cancels the vertical tab positions.

SEE	Chapter 5

PURPOSE	**Moves the print head to an absolute horizontal position.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "$" *n1* *n2*
(decimal ASCII)	27 36 *n1* *n2*
(hex ASCII)	1B 24 *n1* *n2*

REMARKS	This command causes the printer to move the print head to an absolute horizontal position. The position, in inches, is determined by the formula $(n1 + n2 \times 256)/60$.

SEE	Chapter 5

PURPOSE	**Moves the print head to a specified horizontal position.**

MODE   Standard, IBM-G

CODE	< ESC >	"\"	*n1*	*n2*
(decimal ASCII)	27	92	*n1*	*n2*
(hex ASCII)	1B	5C	*n1*	*n2*

REMARKS   This command causes the printer to move the print head to a specified horizontal position. It can move the print head either left or right. The distance, in inches, is determined by the formula ($n1$ + $n2$ × 256)/120.
To move to the left, add 64 to the calculated value of $n2$. The maximum distance is 13.6 inches. The command will be ignored if you try to move to a position outside the current margins.

SEE   Chapter 5

PURPOSE	**Adds *n* dot spaces between characters.**

MODE   Standard

CODE	< ESC >	*"space"*	*n*
(decimal ASCII)	27	32	*n*
(hex ASCII)	1B	20	*n*

REMARKS   This command increases the space between NLQ characters by *n* dots. The value of *n* must be between 0 and 127.

SEE   Chapter 6

PURPOSE	**Moves the print head back one print position (backspace).**
MODE	Standard, IBM-P, IBM-G
CODE	< BS >
(decimal ASCII)	8
(hex ASCII)	08
REMARKS	This command shifts the print head one column to the left. If the print head is at the left margin, the command is ignored. This command can be used to overstrike or combine characters.
SEE	Chapter 6

PURPOSE	**Sets alignment, or centering.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "a" n
(decimal ASCII)	27 97 n
(hex ASCII)	1B 61 n
REMARKS	This command causes the printer to format text as follows:

n	Text formatting
0	Left justified (ragged right margin)
1	Centered
2	Right justified
3	Right and left justified

| SEE | Chapter 5 |

DOWNLOAD CHARACTER COMMANDS

PURPOSE | **Defines download characters into RAM.**

MODE | Standard, IBM-P, IBM-G

CODE | < ESC > "&" 0 *n1 n2 m0 m1 ... m11*
[m12 ... m46]

(decimal ASCII) | 27 38 0 *n1 n2 m0 m1 ... m11*
[m12 ... m46]

(hex ASCII) | 1B 26 00 *n1 n2 m0 m1 ... m11*
[m12 ... m46]

REMARKS | This command is used to define one or more user-defined characters and to store them into RAM for later use. RAM is cleared when the power is turned off. The values of *n1* and *n2* specify the range of positions in RAM that the characters are to occupy. Valid character positions are any number between 0 and 255 (except the area of block graphics characters with the IBM modes). Following *n2* the printer expects character data bytes for each character to be defined. The first byte, *m0*, is the attribute byte, for it specifies whether the character is a descender (if the first bit is 0), and the proportional width of the draft character (starting and ending dot columns are defined by the low order seven bits). *m1* through *m11* determine which dots form the draft character. In case of NLQ download characters, *m1* through *m46* determine which dots form the character.

Note: This command is ignored when the DIP switch 1-3 is set on.

SEE | Chapter 7

PURPOSE	**Defines download characters into RAM.**
MODE	IBM-P

CODE

(Decimal ASCII)

(hex ASCII)

	<ESC>	"="	$n1$ $n2$	<DC4>	$n3$	$m0$	0	$m1$ $m2$ ... $m11$
	27	61	$n1$ $n2$	20	$n3$	$m0$	0	$m1$ $m2$ ... $m11$
	1B	3D	$n1$ $n2$	14	$n3$	$m0$	00	$m1$ $m2$ ... $m11$

REMARKS   This command is used to set up one or more user-defined characters and to store them into RAM for later use. RAM is cleared when the power is turned off. The values of $n1$ and $n2$ indicate how many bytes will follow this command. The value of $n3$ specifies the start range of positions in RAM that the characters are to occupy. Following $n3$ the printer expects character data bytes for each character to be defined. The first byte, $m0$, specifies the attribute data. The attribute describ whether the character is ascending or descending. If $m0 = 1$, the character prints with the bottom eight pins of the print head (descending character). If $m0 = 0$, the character prints with the top eight pins of the print head (ascending character). $m1$ through $m11$ determine which dots form the character.

Note: This command is ignored when the DIP switch 1-3 is set on.

SEE ·   Chapter 7

PURPOSE	**Copies standard character ROM font into RAM.**				
MODE	Standard, IBM-G				
CODE	<ESC>	":"	0	0	0
(decimal ASCII)	27	58	0	0	0
(hex ASCII)	IB	3A	00	00	00
MODE	**IBM-P**				
CODE	<FS>	":"	0	0	0
(decimal ASCII)	28	58	0	0	0
(hex ASCII)	IC	3A	00	00	00

REMARKS
This command copies all the standard characters to the corresponding download character RAM area. This destroys any existing user-defined characters in that range.
Note: This command is ignored when the DIP switch 1-3 is set on.

SEE Chapter 7

PURPOSE	**Selects draft download character set.**		
MODE	Standard, IBM-P, IBM-G		
CODE	<ESC>	"%"	1
(decimal ASCII)	27	37	1
(hex ASCII)	IB	25	01

·REMARKS
This command causes the printer to select the draft download character set.
Note: The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.

SEE Chapter 7

PURPOSE	**Selects draft download character set.**
MODE	IBM-P
CODE	< ESC > "I" 4
(decimal ASCII)	27 73 4
(hex ASCII)	1B 49 04

REMARKS   This command causes the printer to select the draft download character set.
Note: The character "4" (decimal code 52, hexadecimal code 34) can be used instead of ASCII 4.

SEE   Chapter 7

PURPOSE	**Selects NLQ download character set.**
MODE	IBM-P
CODE	< ESC > "I" 6
(decimal ASCII)	27 73 6
(hex ASCII)	1B 49 06

REMARKS   This command causes the prir ter to select the NLQ download character set.
Note: The character "6" (decimal code 54, hexadecimal code 36) can be used insteasd of ASCII 6.

SEE   Chapter 7

PURPOSE	**Cancels download character set.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "%" 0
(decimal ASCII)	27 37 0
(hex ASCII)	1B 25 00

REMARKS   This command cancels the download character set and selects the previous character set.
Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

SEE   Chapter 7

DOT GRAPHICS COMMANDS

PURPOSE	**Prints normal-density graphics.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "K" *n1 n2 m1 m2* ....
(decimal ASCII)	27 75 *n1 n2 m1 m2* ....
(hex ASCII)	1B 4B *n1 n2 m1 m2* ....

REMARKS — This command selects 60 dots-per-inch, column-scan, bit-image graphics mode. The values of *n1* and *n2* represent the number of graphics characters to be printed, where the total number of characters = *n2* times 256 + *n1*. The correct number of graphics data bytes (*m1*, *m2*, etc.) must follow *n2*. The ASCII values of these bytes determine which pins are fired for each character.

SEE — Chapter 7

PURPOSE	**Prints double-density graphics.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "L" *n1 n2 m1 m2* ....
(decimal ASCII)	27 76 *n1 n2 m1 m2* ....
(hex ASCII)	1B 4C *n1 n2 m1 m2* ....

REMARKS — This command selects 120 dots-per-inch, column-scan, bit-image graphics mode. The values of *n1* and *n2* are the same as in normal-density graphics. The correct number of graphics data bytes (*m1*, *m2*, etc.) must follow *n2*. The ASCII values of these bytes determine which pins are fired for each character.

SEE — Chapter 7

PURPOSE	**Prints double-density graphics at double-speed.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "Y" *n1 n2 m1 m2* ....
(decimal ASCII)	27 89 *n1 n2 m1 m2* ....
(hex ASCII)	1B 59 *n1 n2 m1 m2* ....

REMARKS   This command selects 120 dots-per-inch, column-scan, bit-image graphics mode at double-speed. The values of *n1* and *n2* are the same as in normal-density graphics. The correct number of graphics data bytes (*m1, m2*, etc.) must follow *n2*. The ASCII values of these bytes determine which pins are fired for each character.

SEE   Chapter 7

PURPOSE	**Prints quadruple-density graphics.**

MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "Z" *n1 n2 m1 m2* ....
(decimal ASCII)	27 90 *n1 n2 m1 m2* ....
(hex ASCII)	1B 5A *n1 n2 m1 m2* ....

REMARKS   This command selects 240 dots-per-inch, column-scan, bit-image graphics mode. The values of *n1* and *n2* are the same as in normal-density graphics. The correct number of graphics data bytes (*m1, m2*, etc.) must follow *n2*. The ASCII values of these bytes determine which pins are fired for each character.

SEE   Chapter 7

PURPOSE	**Selects graphics modes.**

MODE   Standard, IBM-P, IBM-G

CODE	< ESC >	"*"	$n0$ $n1$ $n2$ $m1$ $m2$ ....
(decimal ASCII)	27	42	$n0$ $n1$ $n2$ $m1$ $m2$ ....
(hex ASCII)	1B	2A	$n0$ $n1$ $n2$ $m1$ $m2$ ....

REMARKS   This command selects one of seven possible
graphics modes, depending on the value
of $n0$. The values of $n1$ and $n2$ are the same
as normal-density graphics mode. The
correct number of graphics data bytes
($m1$, $m2$, etc.) must follow $n2$. The ASCII
values of these bytes determine which pins
are fired for each character. The value of
$n0$ must be between 0 and 6 as shown
below.

n	Graphics mode
0	Normal-density
1	Double-density
2	Double-density at double-speed
3	Quadruple-density
4	CRT graphics
5	Plotter graphics
6	CRT graphics type II

SEE   Chapter 7

PURPOSE	**Prints 9-pin graphics.**

MODE   Standard, IBM-G

CODE	< ESC >	"^"	$n0$ $n1$ $n2$ $m1$ $m2$ ....
(decimal ASCII)	27	94	$n0$ $n1$ $n2$ $m1$ $m2$ ....
(hex ASCII)	1B	5E	$n0$ $n1$ $n2$ $m1$ $m2$ ....

REMARKS   This command selects, column-scan, 9-pin
bit-image graphics mode. The value of $n0$
determines the print density. The values
of $n1$ and $n2$ are the same as in normal-
density graphics. The correct number of
graphics data bytes ($m1$, $m2$, etc.) must
follow $n2$. The ASCII values of these two
bytes determine which pins are fired for
each character.

SEE   Chapter 7

PURPOSE	Redefines the graphics mode.
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "?" *n0* *n1*
(decimal ASCII)	27 63 *n0* *n1*
(hex ASCII)	1B 3F *n0* *n1*
REMARKS	This command redefines one of the 4 alternate graphics codes — < ESC > "K", < ESC > "L", < ESC > "Y", or < ESC > "Z" — as one of the seven graphics density numbers with the < ESC > "*" command, where *n0* is "K", "L", "Y", or "Z" and *n1* is between 0 and 6.
SEE	Chapter 7

MACRO INSTRUCTION COMMANDS

PURPOSE	Defines macro instruction.
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "+" ..... < RS >
(decimal ASCII)	27 43 30
(hex ASCII)	1B 2B 1E
REMARKS	This command cancels any existing macro instructions, and replaces it with the defined instruction. The maximum number of characters allowed in the macro instruction is 16. The < RS > character marks the end of the macro definition.
SEE	Chapter 6

PURPOSE	Executes macro instruction.
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "+" 1
(decimal ASCII)	27 43 1
(hex ASCII)	1B 2B 01
REMARKS	This command executes a previously defined macro instruction.
SEE	Chapter 6

OTHER COMMANDS

PURPOSE	**Sets the value of the eighth data bit to logical 1.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > " > "
(decimal ASCII)	27 62
(hex ASCII)	1B 3E
REMARKS	This command forces the eighth data bit of each subsequent character sent to the printer to logical 1. This code allows users with a 7-bit interface to access those characters whose ASCII code is greater than 127. This code should not be used to transmit printer control codes.
SEE	Chapter 6

PURPOSE	**Sets the value of the eighth data bit to logical 0.**
MODE	Standard, IBM-G
CODE	< ESC > " = "
(decimal ASCII)	27 61
(hex ASCII)	1B 3D
MODE	IBM-P
CODE	< FS > " = "
(decimal ASCII)	28 61
(hex ASCII)	IC 3D
REMARKS	This command forces the eighth data bit of each subsequent character sent to the printer to logical 0. This code should not be used to transmit printer control codes.
SEE	Chapter 6

PURPOSE	Accepts the value of the eighth data bit as is.
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "#"
(decimal ASCII)	27 35
(hex ASCII)	1B 23
REMARKS	This command cancels either setting of the eighth data bit. The printer will use the value of the eighth data bit that is sent from the computer. This code allows users with a 7-bit interface to resume normal functions after accessing those characters whose ASCII code is greater than 127.
SEE	Chapter 6

PURPOSE	Prints "slash zero".
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "~" 1
(decimal ASCII)	27 126 1
(hex ASCII)	1B 7E 01
REMARKS	This command causes to print the zero character with a slash. Note: The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.
SEE	Chapter 6

PURPOSE	Prints "normal zero".
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "~" 0
(decimal ASCII)	27 126 0
(hex ASCII)	1B 7E 00
REMARKS	This command cancels printing the slash zero and returns printing to the normal zero character. Note: The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.
SEE	Chapter 6

PURPOSE   **Deletes the last character sent.**

MODE   Standard, IBM-P, IBM-G
CODE   < DEL >
(decimal ASCII)   127
(hex ASCII)   7F

REMARKS   This command deletes the last character
                 received. This command is ignored if the
                 last character received has already been
                 printed, or if the last character received
                 was all or part of a function code.

SEE   Chapter 6

PURPOSE   **Cancels a line.**

MODE   Standard, IBM-P, IBM-G
CODE   < CAN >
(decimal ASCII)   24
(hex ASCII)   18

REMARKS   This command deletes the last line in the
                 print buffer at the time the command is
                 used.

SEE   Chapter 6

PURPOSE   **Sets printer off line.**

MODE   Standard, IBM-G
CODE   < DC3 >
(decimal ASCII)   19
(hex ASCII)   13

MODE   IBM-P
CODE   < ESC >   Q   3
(decimal ASCII)   27   81   3
(hex ASCII)   1B   51   03

REMARKS   This command causes the printer to go
                 off line, disregarding all subsequent char-
                 acters and function codes, with the ex-
                 ception of < DC1 >, which will return the
                 printer to the on line state. This is not the
                 same as pushing the On Line key. When
                 the On Line lamp is not lit, the printer
                 will not respond to < DC1 >.

SEE   Chapter 6

PURPOSE	**Sets printer on line.**
MODE	Standard, IBM-P, IBM-G
CODE	< DC1 >
(decimal ASCII)	17
(hex ASCII)	11

REMARKS   This command resets the printer to the on line state, allowing it to receive and process all subsequent characters and function codes. This is not the same as pushing the One Line key. When the On Line lamp is not lit, the printer will not respond to < DC1 >.

SEE   Chapter 6

PURPOSE	**Sounds the printer bell.**
MODE	Standard, IBM-P, IBM-G
CODE	< BEL >
(decimal ASCII)	7
(hex ASCII)	07

REMARKS   This command causes the buzzer to sound for about a quarter of a second.

SEE   Chapter 6

PURPOSE	**Disables paper-out detector.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "8"
(decimal ASCII)	27 56
(hex ASCII)	1B 38

REMARKS   This command causes the printer to disregard the signal sent by the paper-out detector. The paper-out signal normally sounds the printer bell and stops printing until paper is inserted and the printer is reset. DIP switch 1-1 can also be set to disable the paper-out detector.

SEE   Chapter 6

PURPOSE	**Enables paper-out detector.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "9"
(decimal ASCII)	27 57
(hex ASCII)	1B 39
REMARKS	This command restores the function of the paper-out detector.
SEE	Chapter 6

PURPOSE	**Selects uni-directional printing.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "U" 1
(decimal ASCII)	27 85 1
(hex ASCII)	1B 55 01
REMARKS	This command causes all subsequent printing to be done in uni-directional printing. Uni-directional printing is useful in printing tables or charts, since it ensures that vertical columns of characters will be aligned. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.
SEE	Chapter 6

PURPOSE	**Cancels uni-directional printing.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "U" 0
(decimal ASCII)	27 85 0
(hex ASCII)	1B 55 00
REMARKS	This command cancels uni-directional printing and returns to the standard bi-directional printing, which is considerably faster. **Note:** The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.
SEE	Chapter 6

PURPOSE	**Selects one-line uni-directional printing.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > " < "
(decimal ASCII)	27 60
(hex ASCII)	1B 3C
REMARKS	This command immediately returns the print head to the left margin. The remainder of the line is printed from left to right. Normal (bi-directional) printing resumes following a carriage return.
SEE	Chapter 6

PURPOSE	**Enlarges characters in whole or in part; cancels same.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "h" n
(decimal ASCII)	27 104 n
(hex ASCII)	1B 68 n
REMARKS	This special command enlarges characters following the command until the enlargement is cancelled. The values of n have the following effects.

n	Effect
0	Cancels enlargement
1	Double-high, double-wide
2	Quadruple-high, quadruple-wide
3	Double-high, double-wide (Lower half only)
4	Double-high, double-wide (Upper half only)
5	Quadruple-high, quadruple-wide (Lower half only)
6	Quadruple-high, quadruple-wide (Upper half only)

SEE	Chapter 6

PURPOSE	**Expands the printable area.**

MODE	Standard	
CODE	< ESC >	"6"
(decimal ASCII)	27	54
(hex ASCII)	1B	36

REMARKS   This command causes the printer to use the high-order control code area as a printable character area.

SEE   Chapter 6

PURPOSE	**Cancels the expansion of printable area.**

MODE	Standard	
CODE	< ESC >	"7"
(decimal ASCII)	27	55
(hex ASCII)	1B	37

REMARKS   This command cancels the expansion of the printable character area and restores the high-order control code area.

SEE   Chapter 6

PURPOSE	**Prints characters in the undefined control code area.**

MODE	Standard, IBM-G		
CODE	< ESC >	"I"	1
(decimal ASCII)	27	73	1
(hex ASCII)	1B	49	01

REMARKS   This command causes the printer to print the characters in the undefined control code area.
Note: The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.

SEE   Chapter 6

PURPOSE   **Selects undefined codes as control codes.**

MODE   Standard, IBM-G

CODE   < ESC >   "I"   0

(decimal ASCII)   27   73   0

(hex ASCII)   1B   49   00

REMARKS   This command cancels printing the char-
              acters in the undefined control codes and
              restores them as control codes.
              Note: The character "0" (decimal code 48,
              hexadecimal code 30) can be used instead
              of ASCII 0.

SEE   Chapter 6

PURPOSE   **Prints characters from all character sets.**

MODE   **IBM-P**

CODE   < ESC >   "\"   *n1*   *n2*

(decimal ASCII)   27   92   *n1*   *n2*

(hex ASCII)   1B   5C   *n1*   *n2*

REMARKS   This command allows the printing of all
              characters, including characters with an
              ASCII value below decimal 32. The printer
              normally recognizes the ASCII values less
              than decimal value 32 as control codes.
              This command allows the printer to print
              the special characters assigned to the
              ASCII control codes. If the printer receives
              a code value for an unassigned character,
              a space character prints.
              The total number of characters is equal
              to $n1 + (n2 \times 256)$.

SEE   Chapter 6

PURPOSE	**Prints a character from all character sets.**
MODE	**IBM-P**
CODE	< ESC > " ∧ " n
(decimal ASCII)	27 94 n
(hex ASCII)	1B 5E n
REMARKS	This command prints one character defined with the value of n from the whole character sets. You can use this command to print codes the printer normally recognizes as control codes.
SEE	Chapter 6

PURPOSE	**Sets immediate print mode.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "i" 1
(decimal ASCII)	27 105 1
(hex ASCII)	1B 69 01
REMARKS	This command selects the immediate print mode. In the immediate print mode the print head prints one character at a time, as you send it. The printer also moves the paper up so that you can see the current line and then down to continue printing. This kind of instant feedback can be especially helpful in telecommunications. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.
SEE	Chapter 6

PURPOSE	Cancels immediate print mode.
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "i" 0
(decimal ASCII)	27 105 0
(hex ASCII)	1B 69 00
REMARKS	This command cancels the immediate print mode and returns the normal print mode. **Note:** The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.
SEE	Chapter 6

PURPOSE	Selects half-speed printing.
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "s" 1
(decimal ASCII)	27 115 1
(hex ASCII)	1B 73 01
REMARKS	This command causes the printer to select half-speed printing. Half-speed printing reduces the noise of printing. **Note:** The character "1" (decimal code 49, hexadecimal code 31) can be used instead of ASCII 1.

PURPOSE	Cancels half-speed printing.
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > "s" 0
(decimal ASCII)	27 115 0
(hex ASCII)	1B 73 00
REMARKS	This command cancels half-speed printing mode, and restores normal printing. **Note:** The character "0" (decimal code 48, hexadecimal code 30) can be used instead of ASCII 0.

PURPOSE	**Resets the printer**		
MODE	Standard, IBM-P, IBM-G		
CODE	< ESC > "@"		
(decimal ASCII)	27	64	
(hex ASCII)	1B	40	

REMARKS This command reinitializes the printer. The print buffer is cleared, and the form length, bottom margin, and international character set are all reset to the values defined by their respective DIP switches. The main difference between the < ESC > "@" command and turning the printer off and back on again is that download characters and macro instructions are preserved with this command.

SEE Chapter 6

PURPOSE	**Selects auto feed mode.**				
MODE	Standard, IBM-P, IBM-G				
CODE	< ESC > < EM >		4		
(decimal ASCII)	27	25	4		
(hex ASCII)	1B	19	04		
MODE	Standard, IBM-P, IBM-G				
CODE	"("	"("	"4"	")"	")"
(decimal ASCII)	40	40	52	41	41
(hex ASCII)	28	28	34	29	29

REMARKS This command causes the printer to select the auto sheet feeding mode. This command is ignored when the optional automatic sheet feeder is not mounted.

SEE Chapter 6

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PURPOSE	**Cancels auto feed mode.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > < EM > 0
(decimal ASCII)	27 25 0
(hex ASCII)	1B 19 00
MODE	Standard, IBM-P, IBM-G
CODE	"(" "(" "0" ")" ")"
(decimal ASCII)	40 40 48 41 41
(hex ASCII)	28 28 30 29 29
REMARKS	This command causes the printer to cancel the auto sheet feeding mode. This command is ignored when the optional automatic sheet feeder is not mounted.
SEE	Chapter 6

PURPOSE	**Supplies paper.**
MODE	Standard, IBM-P, IBM-G
CODE	< ESC > < EM > 1
(decimal ASCII)	27 25 1
(hex ASCII)	1B 19 01
MODE	Standard, IBM-P, IBM-G
CODE	"(" "(" "1" ")" ")"
(decimal ASCII)	40 40 49 41 41
(hex ASCII)	28 28 31 29 29
REMARKS	This command causes the printer to supply paper under non-auto sheet feeding mode. This command is ignored when the optional automatic sheet feeder is not mounted.
SEE	Chapter 6

PURPOSE	**Ejects paper.**				
MODE	Standard, IBM-P, IBM-G				
CODE	< ESC > < EM > "R"				
(decimal ASCII)	27	25	82		
(hex ASCII)	1B	19	52		
MODE	Standard, IBM-P, IBM-G				
CODE	"("	"("	"R"	")"	")"
(decimal ASCII)	40	40	82	41	41
(hex ASCII)	28	28	52	29	29

REMARKS   This command causes the printer to eject paper. This command is ignored when the optional automatic sheet feeder is not mounted.

SEE   Chapter 6

MEMO

APPENDIX D
COMMAND SUMMARY IN NUMERIC ORDER

The purpose of this Appendix is to provide a quick reference of each mode for the various function codes in numeric order.

■ Standard mode

The following functions take effect under the Standard mode, which emulates the Epson FX-85 printer.

Control code	Function
CHR$(7)	Sounds the printer bell
CHR$(8)	Moves the print head back one print position (backspace)
CHR$(9)	Moves the print head to the next horizontal tab position
CHR$(10)	Advances the paper one line (line feed)
CHR$(11)	Advances paper to the next vertical tab position
CHR$(12)	Advances the paper to the top of the next page (form feed)
CHR$(13)	Returns print head to the left margin (carriage return)
CHR$(14)	Sets the printer to expanded print for the remainder of the current line
CHR$(15)	Sets the printer to condensed print
CHR$(17)	Sets printer on line
CHR$(18)	Cancels condensed print
CHR$(19)	Sets printer off line
CHR$(20)	Cancels one line expanded print
CHR$(24)	Cancels a line
CHR$(127)	Deletes the last character sent
< ESC > CHR$(10)	Reverses the paper one line

< ESC > CHR$(12)	Reverses the paper to the top of the current page
< ESC > CHR$(14)	Sets the printer to expanded print for the remainder of the current line
< ESC > CHR$(15)	Sets the printer to condensed print
< ESC > CHR$(25) 0	Cancels auto feed mode
< ESC > CHR$(25) 1	Supplies paper
< ESC > CHR$(25) 4	Selects auto feed mode
< ESC > CHR$(25) "R"	Ejects paper
< ESC > CHR$(32) *n*	Adds *n* dot spaces between characters
< ESC > "!" *n*	Sets the master print mode
< ESC > "#"	Accepts the value of the eighth data bit as is
< ESC > "$" *n1 n2*	Moves the print head to an absolute horizontal position
< ESC > "%" 0	Cancels download character set
< ESC > "%" 1	Selects download character set
< ESC > "&" CHR$(0) *n1 n2 m0 m1 ...*	Defines download characters into **RAM**
< ESC > "*" *n0 n1 n2 m1 m2 ...*	Selects graphics modes
< ESC > " + " ... CHR$(30)	Defines macro instruction
< ESC > " + " 1	Executes macro instruction
< ESC > " − " 0	Cancels underlining
< ESC > " − " 1	Selects underlining
< ESC > "/" *n0*	Selects vertical channels
< ESC > "0"	Sets line spacing to 1/8 inch
< ESC > "1"	Sets line spacing to 7/72 inch
< ESC > "2"	Sets line spacing to 1/6 inch
< ESC > "3" *n*	Sets line spacing to $n/216$ inch
< ESC > "4"	Selects italic characters
< ESC > "5"	Cancels italic characters
< ESC > "6"	Expands the printable area
< ESC > "7"	Cancels the expansion of printable area
< ESC > "8"	Disables paper-out detector
< ESC > "9"	Enables paper-out detector

< ESC > ":" CHR$(0) CHR$(0) CHR$(0)	
	Copies standard character ROM font into RAM
< ESC > " < "	Selects one-line uni-directional printing
< ESC > " = "	Sets the value of the eighth data bit to logical 0
< ESC > " > "	Sets the value of the eighth data bit to logical 1
< ESC > "?" *n0 n1*	Redefines the graphics mode
< ESC > "@"	Resets the printer
< ESC > "A" *n*	Sets line spacing to *n*/72 inch
< ESC > "B" *n1 n2 n3 ...* CHR$(0)	
	Sets vertical tab positions
< ESC > "C"CHR$(0) *n*	Sets page length to *n* inches
< ESC > "C" *n*	Sets page length to *n* lines
< ESC > "D" *n1 n2 n3 ...* CHR$(0)	
	Sets horizontal tab positions
< ESC > "E"	Selects emphasized printing
< ESC > "F"	Cancels emphasized printing
< ESC > "G"	Selects boldface printing
< ESC > "H"	Cancels boldface printing
< ESC > "I" 0	Selects undefined codes as control codes
< ESC > "I" 1	Prints characters in the undefined control code area
< ESC > "J" *n*	Sends a one-time paper feed of *n*/216 inch
< ESC > "K" *n1 n2 m1 m2 ...*	
	Prints normal-density graphics
< ESC > "L" *n1 n2 m1 m2 ...*	
	Prints double-density graphics
< ESC > "M"	Sets the print pitch to elite
< ESC > "N" *n*	Sets the bottom margin
< ESC > "O"	Cancels top and bottom margins
< ESC > "P"	Sets the print pitch to pica
< ESC > "Q" *n*	Sets the right margin
< ESC > "R" *n*	Selects an international character set
< ESC > "S" 0	Selects superscripts

< ESC > "S" 1	Selects subscripts
< ESC > "T"	Cancels a superscript or subscript
< ESC > "U" 0	Cancels uni-directional printing
< ESC > "U" 1	Selects uni-directional printing
< ESC > "W" 0	Cancels expanded print
< ESC > "W" 1	Sets the printer to expanded print
< ESC > "X" *n1 n2*	Sets the left and right margins
< ESC > "Y" *n1 n2 m1 m2* ...	Prints double-density graphics at double-speed
< ESC > "Z" *n1 n2 m1 m2* ...	Prints quadruple-density graphics
< ESC > "\" *n1 n2*	Moves the print head to a specified horizontal position
< ESC > "^" *n0 n1 n2 m1 m2* ...	Prints 9-pin graphics
< ESC > "_" 0	Cancels overlining
< ESC > "_" 1	Selects overlining
< ESC > "a" *n*	Sets alignment, or centering
< ESC > "b" *n0 n1 n2 n3* ... CHR$(0)	Sets vertical tab positions in a channel
< ESC > "e" 0 *n*	Sets horizontal tab positions every *n* characters
< ESC > "e" 1 *n*	Sets vertical tab positions every *n* lines
< ESC > "f" 0 *n*	Sets the print postion to *n* characters
< ESC > "f" 1 *n*	Sets print position to *n* lines
< ESC > "h" *n*	Enlarges characters in whole or in part; cancels same
< ESC > "i" 0	Cancels immediate print mode
< ESC > "i" 0	Sets immediate print mode
< ESC > "j" *n*	Sends a one-time reverse feed of $n/216$ inch
< ESC > "l" *n*	Sets the left margin
< ESC > "p" 0	Cancels proportional print
< ESC > "p" 1	Sets the printer to proportional print
< ESC > "r" *n*	Sets the top margin
< ESC > "s" 0	Cancels half-speed printing

< ESC > "s" 1	Selects half-speed printing
< ESC > "x" 0	Cancels NLQ characters
< ESC > "x" 1	Selects NLQ characters
< ESC > "~" 0	Prints "normal zero"
< ESC > "~" 1	Prints "slash zero"
"(0)"	Cancels auto feed mode
"(1)"	Supplies paper
"(4)"	Selects auto feed mode
"(R)"	Ejects paper

■ IBM-P mode

The following functions take effect under the IBM-P mode, which emulates the IBM Proprinter.

Control code	Function
CHR$(7)	Sounds the printer bell
CHR$(8)	Moves the print head back one print position (backspace)
CHR$(9)	Moves the print head to the next horizontal tab position
CHR$(10)	Advances the paper one line (line feed)
CHR$(11)	Advances paper to the next vertical tab position
CHR$(12)	Advances the paper to the top of the next page (form feed)
CHR$(13)	Returns print head to the left margin (carriage return)
CHR$(14)	Sets the printer to expanded print for the remainder of the current line
CHR$(15)	Sets the printer to condensed print
CHR$(17)	Sets printer on line
CHR$(18)	Sets the print pitch to pica
CHR$(20)	Cancels one line expanded print
CHR$(24)	Cancels a line
CHR$(127)	Deletes the last character sent
< ESC > CHR$(10)	Reverses the paper one line
< ESC > CHR$(12)	Reverses the paper to the top of the current page

< ESC > CHR$(14)	Sets the printer to expanded print for the remainder of the current line
< ESC > CHR$(15)	Sets the printer to condensed print
< ESC > CHR$(25) 0	Cancels auto feed mode
< ESC > CHR$(25) 1	Supplies paper
< ESC > CHR$(25) 4	Selects auto feed mode
< ESC > CHR$(25) "R"	Ejects paper
< ESC > "!" *n*	Sets the master print mode
< ESC > "#"	Accepts the value of the eighth data bit as is
< ESC > "$" *n1 n2*	Moves the print head to an absolute horizontal position
< ESC > "%" 0	Cancels download character set
< ESC > "%" 1	Selects download character set
< ESC > "&" CHR$(0) *n1 n2 m0 m1* ...	Defines download characters into RAM
< ESC > "*" *n0 n1 n2 m1 m2* ...	Selects graphics modes
< ESC > " + " ... CHR$(30)	Defines macro instruction
< ESC > " + " 1	Executes macro instruction
< ESC > " − " 0	Cancels underlining
< ESC > " − " 1	Selects underlining
< ESC > "/" *n0*	Selects vertical channels
< ESC > "0"	Sets line spacing to 1/8 inch
< ESC > "1"	Sets line spacing to 7/72 inch
< ESC > "2"	Uses < ESC > "A" definition
< ESC > "3" *n*	Sets line spacing to *n*/216 inch
< ESC > "4"	Sets the top of form to the current position
< ESC > "5" 0	Sets carriage return function without a line feed
< ESC > "5" 1	Sets carriage return function with a line feed
< ESC > "6"	Selects character set #2
< ESC > "7"	Selects character set #1
< ESC > "8"	Disables paper-out detector
< ESC > "9"	Enables paper-out detector
< ESC > ":"	Sets the print pitch to elite

< ESC > " < "	Selects one-line uni-directional printing
< ESC > " = " *n1 n2* CHR$(20) *n3 m0* CHR$(0) *m1 m2* ...	Defines download characters into RAM
< ESC > " > "	Sets the value of the eighth data bit to logical 1
< ESC > "?" *n0 n1*	Redefines the graphics mode
< ESC > "@"	Resets the printer
< ESC > "A" *n*	Defines line spacing to *n*/72 inch
< ESC > "B" *n1 n2 n 3* ... CHR$(0)	Sets vertical tab positions
< ESC > "C"CHR$(0) *n*	Sets page length to *n* inches
< ESC > "C" *n*	Sets page length to *n* lines
< ESC > "D" *n1 n2 n3* ... CHR$(0)	Sets horizontal tab positions
< ESC > "E"	Selects emphasized printing
< ESC > "F"	Cancels emphasized printing
< ESC > "G"	Selects boldface printing
< ESC > "H"	Cancels boldface printing
< ESC > "I" 0	Selects draft characters
< ESC > "I" 2	Selects NLQ characters
< ESC > "I" 4	Selects draft download character set
< ESC > "I" 6	Selects NLQ download character set
< ESC > "J" *n*	Sends a one-time paper feed of *n*/216 inch
< ESC > "K" *n1 n2 m1 m2* ...	Prints normal-density graphics
< ESC > "L" *n1 n2 m1 m2* ...	Prints double-density graphics
< ESC > "M"	Sets the print pitch to elite
< ESC > "N" *n*	Sets the bottom margin
< ESC > "O"	Cancels top and bottom margins
< ESC > "P"	Sets the print pitch to pica
< ESC > "Q" 3	Sets printer off line
< ESC > "R"	Cancels tabs to the default values
< ESC > "S" 0	Selects superscripts
< ESC > "S" 1	Selects subscripts

< ESC > "T"	Cancels a superscript or subscript
< ESC > "U" 0	Cancels uni-directional printing
< ESC > "U" 1	Selects uni-directional printing
< ESC > "W" 0	Cancels expanded print
< ESC > "W" 1	Sets the printer to expanded print
< ESC > "X" *n1 n2*	Sets the left and right margins
< ESC > "Y" *n1 n2 m1 m2 ...*	Prints double-density graphics at double-speed
< ESC > "Z" *n1 n2 m1 m2 ...*	Prints quadruple-density graphics
< ESC > "\" *n1 n2*	Prints characters from all character sets
< ESC > "^" *n*	Prints a character from all character sets
< ESC > "_" 0	Cancels overlining
< ESC > "_" 1	Selects overlining
< ESC > "a" *n*	Sets alignment, or centering
< ESC > "b" *n0 n1 n2 n3 ...* CHR$(0)	Sets vertical tab positions in a channel
< ESC > "e" 0 *n*	Sets horizontal tab positions every *n* characters
< ESC > "e" 1 *n*	Sets vertical tab positions every *n* lines
< ESC > "f" 0 *n*	Sets the print postion to *n* characters
< ESC > "f" 1 *n*	Sets print position to *n* lines
< ESC > "h" *n*	Enlarges characters in whole or in part; cancels same
< ESC > "i" 0	Cancels immediate print mode
< ESC > "i" 0	Sets immediate print mode
< ESC > "j" *n*	Sends a one-time reverse feed of $n/216$ inch
< ESC > "l" *n*	Sets the left margin
< ESC > "p" 0	Cancels proportional print
< ESC > "p" 1	Sets the printer to proportional print
< ESC > "r" *n*	Sets the top margin
< ESC > "s" 0	Cancels half-speed printing
< ESC > "s" 1	Selects half-speed printing

< ESC > "x" 0	Cancels NLQ characters
< ESC > "x" 1	Selects NLQ characters
< ESC > "~" 0	Prints "normal zero"
< ESC > "~" 1	Prints "slash zero"
< FS > "4"	Selects italic characters
< FS > "5"	Cancels italic characters
< FS > ":" CHR$(0) CHR$(0) CHR$(0)	Copies standard character ROM font into RAM
< FS > "="	Sets the value of the eighth data bit to logical 0
< FS > "Q" *n*	Sets the right margin
< FS > "R" *n*	Selects an international character set
"((0))"	Cancels auto feed mode
"((1))"	Supplies paper
"((4))"	Selects auto feed mode
"((R))"	Ejects paper

■ IBM-G mode

The following funtions take effect under the IBM-G mode, which emulates the IBM Graphics printer.

Control code	Function
CHR$(7)	Sounds the printer bell
CHR$(8)	Moves the print head back one print position (backspace)
CHR$(9)	Moves the print head to the next horizontal tab position
CHR$(10)	Advances the paper one line (line feed)
CHR$(11)	Advances paper to the next vertical tab position
CHR$(12)	Advances the paper to the top of the next page (form feed)
CHR$(13)	Returns print head to the left margin (carriage return)
CHR$(14)	Sets the printer to expanded print for the remainder of the current line
CHR$(15)	Sets the printer to condensed print

CHR$(17)	Sets printer on line
CHR$(18)	Cancels condensed print
CHR$(19)	Sets printer off line
CHR$(20)	Cancels one line expanded print
CHR$(24)	Cancels a line
CHR$(127)	Deletes the last character sent
< ESC > CHR$(10)	Reverses the paper one line
< ESC > CHR$(12)	Reverses the paper to the top of the current page
< ESC > CHR$(14)	Sets the printer to expanded print for the remainder of the current line
< ESC > CHR$(15)	Sets the printer to condensed print
< ESC > CHR$(25) 0	Cancels auto feed mode
< ESC > CHR$(25) 1	Supplies paper
< ESC > CHR$(25) 4	Selects auto feed mode
< ESC > CHR$(25) "R"	Ejects paper
< ESC > "!" *n*	Sets the master print mode
< ESC > "#"	Accepts the value of the eighth data bit as is
< ESC > "$" *n1 n2*	Moves the print head to an absolute horizontal position
< ESC > "%" 0	Cancels download character set
< ESC > "%" 1	Selects download character set
< ESC > "&" CHR$(0) *n1 n2 m0 m1 ...*	Defines download characters into RAM
< ESC > "*" *n0 n1 n2 m1 m2 ...*	Selects graphics modes
< ESC > " + " ... CHR$(30)	Defines macro instruction
< ESC > " + " 1	Executes macro instruction
< ESC > " – " 0	Cancels underlining
< ESC > " – " 1	Selects underlining
< ESC > "/" *n0*	Selects vertical channels
< ESC > "0"	Sets line spacing to 1/8 inch
< ESC > "1"	Sets line spacing to 7/72 inch
< ESC > "2"	Uses < ESC > "A" definition
< ESC > "3" *n*	Sets line spacing to $n/216$ inch
< ESC > "4"	Selects italic characters
< ESC > "5"	Cancels italic characters

< ESC > "6"	Selects character set #2
< ESC > "7"	Selects character set #1
< ESC > "8"	Disables paper-out detector
< ESC > "9"	Enables paper-out detector
< ESC > ":" CHR$(0) CHR$(0) CHR$(0)	Copies standard character ROM font into RAM
< ESC > " < "	Selects one-line uni-directional printing
< ESC > " = "	Sets the value of the eighth data bit to logical 0
< ESC > " > "	Sets the value of the eighth data bit to logical 1
< ESC > "?" *n0 n1*	Redefines the graphics mode
< ESC > "@"	Resets the printer
< ESC > "A" *n*	Defines line spacing to $n/72$ inch
< ESC > "B" *n1 n2 n 3 ...* CHR$(0)	Sets vertical tab positions
< ESC > "C"CHR$(0) *n*	Sets page length to *n* inches
< ESC > "C" *n*	Sets page length to *n* lines
< ESC > "D" *n1 n2 n3 ...* CHR$(0)	Sets horizontal tab positions
< ESC > "E"	Selects emphasized printing
< ESC > "F"	Cancels emphasized printing
< ESC > "G"	Selects boldface printing
< ESC > "H"	Cancels boldface printing
< ESC > "I" 0	Selects undefined codes as control codes
< ESC > "I" 1	Prints characters in the undefined control code area
< ESC > "J" *n*	Sends a one-time paper feed of $n/216$ inch
< ESC > "K" *n1 n2 m1 m2 ...*	Prints normal-density graphics
< ESC > "L" *n1 n2 m1 m2 ...*	Prints double-density graphics
< ESC > "M"	Sets the print pitch to elite
< ESC > "N" *n*	Sets the bottom margin
< ESC > "O"	Cancels top and bottom margins
< ESC > "P"	Sets the print pitch to pica

< ESC > "Q" *n*	Sets the right margin
< ESC > "R" *n*	Selects an international character set
< ESC > "S" 0	Selects superscripts
< ESC > "S" 1	Selects subscripts
< ESC > "T"	Cancels a superscript or subscript
< ESC > "U" 0	Cancels uni-directional printing
< ESC > "U" 1	Selects uni-directional printing
< ESC > "W" 0	Cancels expanded print
< ESC > "W" 1	Sets the printer to expanded print
< ESC > "X" *n1 n2*	Sets the left and right margins
< ESC > "Y" *n1 n2 m1 m2* ...	Prints double-density graphics at double-speed
< ESC > "Z" *n1 n2 m1 m2* ...	Prints quadruple-density graphics
< ESC > "\" *n1 n2*	Moves the print head to a specified horizontal position
< ESC > "^" *n0 n1 n2 m1 m2* ...	Prints 9-pin graphics
< ESC > "—" 0	Cancels overlining
< ESC > "—" 1	Selects overlining
< ESC > "a" *n*	Sets alignment, or centering
< ESC > "b" *n0 n1 n2 n3* ... CHR$(0)	Sets vertical tab positions in a channel
< ESC > "e" 0 *n*	Sets horizontal tab positions every *n* characters
< ESC > "e" 1 *n*	Sets vertical tab positions every *n* lines
< ESC > "f" 0 *n*	Sets the print postion to *n* characters
< ESC > "f" 1 *n*	Sets print position to *n* lines
< ESC > "h" *n*	Enlarges characters in whole or in part; cancels same
< ESC > "i" 0	Cancels immediate print mode
< ESC > "i" 0	Sets immediate print mode
< ESC > "j" *n*	Sends a one-time reverse feed of *n*/216 inch
< ESC > "l" *n*	Sets the left margin
< ESC > "p" 0	Cancels proportional print

< ESC > "p" 1	Sets the printer to proportional print
< ESC > "r" *n*	Sets the top margin
< ESC > "s" 0	Cancels half-speed printing
< ESC > "s" 1	Selects half-speed printing
< ESC > "x" 0	Cancels NLQ characters
< ESC > "x" 1	Selects NLQ characters
< ESC > "~" 0	Prints "normal zero"
< ESC > "~" 1	Prints "slash zero"
"((0))"	Cancels auto feed mode
"((1))"	Supplies paper
"((4))"	Selects auto feed mode
"((R))"	Ejects paper

MEMO

TECHNICAL SPECIFICATIONS

Printing

Printing method	Serial impact dot matrix
Printing speed	240 characters per second (in Draft pica)
	60 characters per second (in NLQ mode)
Print buffer	12.6KB
Paper feed	2.7 inches/second (for form feeding)
	Tractor and Friction feed
Printing direction	Bi-directional, logic seeking
	Uni-directional in dot graphics modes
Character set	
Draft characters	96 standard ASCII characters
	33 international characters [11 sets]
	87 IBM special characters
	50 IBM block graphics characters
	96 italic ASCII characters
	33 italic international characters [11 sets]
	87 italic IBM special characters
NLQ characters	96 standard ASCII characters
	33 international characters [11 sets]
	87 IBM special characters
	96 italic ASCII characters
	33 italic international characters [11 sets]
	87 italic IBM special characters
Other characters	255 downloadable characters
Character matrix	
Draft characters	9 dot × 11 dot
NLQ characters	18 dot × 23 dot
Block graphics	12 dot × 11 dot
Dot graphics	8 or 9 dot × 60 dots/inch
	8 or 9 dot × 120 dots/inch

	8 dot × 240 dots/inch	
	8 dot × 72 dots/inch	
	8 dot × 80 dots/inch	
	8 dot × 90 dots/inch	
Line spacing	1/6 inch standard	
	1/8, $n/72$, $n/144$, or $n/216$ inch programmable	

Column width	10-inch type	15-inch type
Normal pica	80	136
Normal elite	96	163
Condensed pica	137	233
Condensed elite	160	272
Expanded pica	40	68
Expanded elite	48	81
Expanded condensed pica	68	116
Expanded condensed elite	80	136
Proportional spacing	Variable	Variable

Special features	
	Near Letter Quality characters
	Automatic single sheet insertion
	Short form tear-off
	Easy access format switches
	Self-test and hex dump
	Downloadable characters
	Ultra hi-resolution bit image graphics
	Vertical and horizontal tabs
	Skip over perforation
	15.5″ carriage (15-inch type only)
	Automatic sheet feeder (option)

Paper

Single sheets	10-inch type	15-inch type
Width	5.5 ~ 8.5 inches	6 ~ 14.5 inches
Thickness	0.07 ~ 0.10 mm	0.07 ~ 0.10 mm
Sprocket-feed paper		
Width	4 ~ 10 inches	4 ~ 15.5 inches
Thickness	0.07 ~ 0.10 mm, one-part form,	
	Max 0.28 mm, 3-part form	

Printer

Dimensions	10-inch type	15-inch type
Height	105 mm	105 mm
	(4.1 inches)	(4.1 inches)
Width	400 mm	542 mm
	(15.7 inches)	(21.3 inches)
Depth	360 mm	360 mm
	(14.1 inches)	(14.1 inches)
Weight	9.0 kg	11.9 kg
	(19.8 pounds)	(26.2 pounds)

Power   120 VAC ± 10%, 60Hz.
                    220 VAC ± 10%, 50/60Hz.
                    240 VAC ± 10%, 50/60Hz.

Environment   Temperature: 5 to 40°C (41 to 104°F)
                       Humidity: 10 to 80%, non condensing

Ribbon   Black cloth ribbon in special cartridge
   Life   2 million draft characters (10-inch type)
                   3 million draft characters (15-inch type)

Print head life   100 million draft characters

Parallel interface

Interface   Centronics-compatible, 7 or 8 bit
Synchronization   By external supplied Strobe pulses
Handshaking   By ACK or BUSY signals
Logic level   TTL
Connector   57-30360 Amphenol

Serial interface (option)

Interface   Asynchronous RS-232C/20mA current
                   loop
Bit rate   150, 300, 600, 1200, 2400, 4800, 9600,
                   19200 baud
Word length   1 start bit
                   7 or 8 data bits
                   Odd, even or no parity
                   1 or 2 stop bits
Handshaking   Serial BUSY, 1 byte mode
                   Serial BUSY, 1 block mode
                   ACK mode
                   XON/XOFF mode

MEMO

THE

PARALLEL INTERFACE

This printer has a parallel interface to communicate with the computer. The operating specifications of the parallel interface are as follows:

Data transfer rate: 1,000 to 6,000 characters per second
Synchronization: Via externally supplied $\overline{\text{STROBE}}$ pulses
Handshaking: $\overline{\text{ACK}}$ and BUSY signals
Logic level: Compatible with TTL level

The parallel interface connects to the computer by a 36 pin connector on the back of the printer. This connector mates with an Amphenol 57-30360 connector. The functions of the various pins are summarized in Table F-1.

Figure F-1. The interface timing diagram.

Signal Name	Circuit Example
DATA 1 - DATA 8 (To Printer)	74LS Compatible 4.7kΩ
$\overline{\text{STROBE}}$ (To Printer)	74LS Compatible 4.7kΩ 100Ω 470pF
BUSY, $\overline{\text{ACK}}$ (From Printer)	74LS Compatible 4.7kΩ

Figure F-2. Typical interface circuit.

Table F-1
Parallel interface pin functions

Pin No.	Signal Name	Direc-tion	Function
1	$\overline{\text{STROBE}}$	IN	Signals when data is ready to be read. Signal goes from HIGH to LOW (for at least 0.5 microseconds) when data is available.
2	DATA1	IN	These signals provide the information of the first to eighth bits of parallel data. Each signal is at HIGH level for a logical 1 and at a LOW level for a logical 0.
3	DATA2	IN	
4	DATA3	IN	
5	DATA4	IN	
6	DATA5	IN	
7	DATA6	IN	
8	DATA7	IN	
9	DATA8	IN	
10	$\overline{\text{ACK}}$	OUT	A 5 microsecond LOW pulse acknowledges receipt of data.
11	BUSY	OUT	When this signal goes LOW the printer is ready to accept data.
12	PAPER OUT	OUT	This signal is normally LOW. It will go HIGH if the printer runs out of paper. This signal can be held LOW permanently by turning DIP switch 1-1 off.
13	SELECTED	OUT	This signal is HIGH when the printer is on-line.
14-15	N/C		Unused

Pin No.	Signal Name	Direc-tion	Function
16	SIGNAL GND		Signal ground.
17	CHASSIS GND		Printer's chassis ground, isolated from logic ground.
18	+ 5VDC	OUT	External supply of + 5VDC.
19-30	GND		Twisted pair return signal ground level.
31	RESET	IN	When this signal goes LOW the printer is reset to its power-on condition.
32	ERROR	OUT	This signal is normally HIGH. This signal goes LOW to signal that the printer cannot print due to an error condition.
33	EXT GND		External ground.
34, 35	N/C		Unused.
36	SELECT IN		Data entry to the printer is possible only when this level is LOW.

■ Functions of the Connector Signals

Communications between the computer and the printer use many of the pins of the connector. To understand how the system of communications works, let's look at the functions of the various signals carried by the pins of the interface connector.

Pin 1 carries the STROBE pulse signal from the computer to the printer. This signal is normally held high by the computer. When the computer has data ready for the printer it sets this signal to a low value for at least 0.5 microseconds. When the printer sees this pulse on the strobe pin, it reads the data that the computer supplies on pins 2 through 9. Each of these lines carries one bit of information. A logical "1" is represented by a high signal level, and a logical "0" is represented by a low signal level. The computer must maintain these signals for a period beginning at least 0.5 microseconds before the strobe pulse starts and continuing for at least 0.5 microseconds after the strobe pulse ends.

When the printer has successfully received the byte of data from the computer it sets pin 10 low for approximately 5 microseconds. This signal acknowledges the receipt of the data and so is called the ACK (for "acknowledge") signal.

Pin 11 reports when the printer is not able to receive data. The signal is called BUSY. When this signal is high, the printer cannot receive data. This signal will be high during data transfer, when the printer is off-line and when an error condition exists.

The printer will report that it has run out of paper by making the PAPER OUT signal on pin 12 high. This pin can be held low by turning DIP switch 1-1 off. When the printer is in the on-line state, pin 13 is held high. This signal (SELECTED) tells the computer that the printer is ready to receive data.

Pins 14, 15, 34 and 35 are not used, while pins 16, 17, 19-30 and 33 are grounded. Pin 18 is connected to the + 5VDC supply in the printer.

Pin 31 can be used to reset the printer. If this signal (RESET) goes low the printer will reinitialize. Pin 32 is used to report error conditions in the printer. This signal (ERROR) is high during normal operation and goes low to report that the printer cannot print due to an error condition.

APPENDIX G

SERIAL INTERFACE SPECIFICATIONS

This printer provides a very flexible RS232C serial interface as an option. It can communicate at rates from 150 to 19,200 baud (bits per second) and supports four different kinds of *handshaking*. This interface can also function as a 20mA current loop interface. The operating specifications of the interface are as follows:

Data transfer rate: 150-19200
Word length: 1 start bit
                      7 or 8 data bits
                      Odd, even or no parity
                      1 or 2 stop bits
Signal levels: Mark or logical 1, -3 to -15 volts or current ON
                      Space or logical 0, $+3$ to $+15$ volts or current OFF
Handshaking: Serial BUSY, 1 byte mode
                      Serial BUSY, 1 block mode
                      ACK mode
                      XON/XOFF mode

Note: 19200 baud can be used only with an RS232C interface; it cannot be used with a 20mA current loop interface.

The optional board has a DB-25 female connector to connect to a computer. The functions of the pins are summarized in Table G-1.

Table G-1
Serial interface pin functions

Pin No	Signal Name	Direc- tion	Function
1	GND	—	Printer's chassis ground.
2	TXD	OUT	This pin carries data from the printer.
3	RXD	IN	This pin carries data to the printer.
4	RTS	OUT	This is ON when the printer is ready to receive data.
5	CTS	IN	This pin is ON when the computer is ready to send data.
6	DSR	IN	This pin is ON when the computer is ready to send data. The printer does not check this pin.
7	GND	—	Signal ground.
8	DCD	IN	This pin is ON when the computer is ready to send data. The printer does not check this pin.
9	TTY TXDR	—	This pin is the return path for data transmitted from the printer on the 20mA current loop.
10	TTY TXD	OUT	This pin carries data from the printer on the 20mA current loop.
11	RCH	OUT	This is the signal line for the serial busy protocols. This pin goes OFF when printer's buffer fills, and ON when the printer is ready to receive data. In the busy protocols this line carries the same signal as pin 20.
12	N/C		Unused.
13	GND	—	Signal ground.
14-16	N/C		Unused.
17	TTY TXDR	—	This pin is the return path for data transmitted from the printer on the 20mA current loop.
18	TTY RXDR	—	This pin is the return path for data transmitted to the printer on the 20mA current loop.
19	TTY RXD	IN	This pin carries data to the printer on the 20mA current loop.
20	DTR	OUT	The printer turns this pin ON when it is ready to receive data.
21-22	N/C		Unused.
23	TTY RXDR	—	This pin is the return path for data transmitted to the printer on the 20mA current loop.
24	TTY TXD	OUT	This pin carries data from the printer on the 20mA current loop.
25	TTY RXD	IN	This pin carries data to the printer on the 20mA current loop.

CONFIGURING THE SERIAL INTERFACE

The DIP switch on the serial interface board controls the configuration of the serial interface. Table G-2 describes the functions of the individual switches in the DIP switch.

Table G-2
DIP switch on serial board

Switch	ON	OFF
1	7 data bits	8 data bits
2	Parity checked	No parity
3	Handshaking protocols—see Table G-3	
4		
5	Odd parity	Even parity
6	Data transfer rate—see Table G-4	
7		
8		

Table G-3
Handshaking protocols

Protocol	Switch 3	Switch 4
Serial busy, 1 byte mode	OFF	OFF
Serial busy 1 block mode	ON	OFF
ACK mode	OFF	ON
XON/XOFF mode	ON	ON

Table G-4
Data transfer rates

Baud rate	Switch 6	Switch 7	Switch 8
150	OFF	OFF	OFF
300	OFF	OFF	ON
600	OFF	ON	OFF
1200	OFF	ON	ON
2400	ON	OFF	OFF
4800	ON	OFF	ON
9600	ON	ON	OFF
19200	ON	ON	ON

THE SERIAL PROTOCOLS

This printer has four serial protocols, selected by DIP switches 3 and 4. Figure G-1 shows a typical byte of serial data and Figure G-2 shows timing charts for the 4 protocols.

■ Serial busy protocols

In the serial busy protocols, this printer uses DTR (pin 20) and RCH (pin 11) to signal to the computer when it is able to accept data. These two pins go ON when the printer is ready to accept data. In the 1 byte mode they go OFF after each character is received. In the 1 block mode they only go OFF when the printer's buffer approaches capacity. In both cases they will stay OFF if the buffer cannot accept more data.

■ XON/XOFF protocol

The XON/XOFF protocol uses the ASCII characters < DC1 > and < DC3 > (sometimes called XON and XOFF, respectively) to communicate with the computer. When the printer's buffer approaches capacity this printer will send a DC3 (ASCII 19) on TXD (pin 2) to tell the computer that it must stop sending data. When the printer is able to receive more data it sends a DC1 (ASCII 17) on TXD. The computer can then send more data until the printer sends another DC3.

■ ACK protocol

In the ACK protocol, this printer sends an ACK (ASCII6) on TXD (pin 2) each time that it is prepared to receive a byte of data.
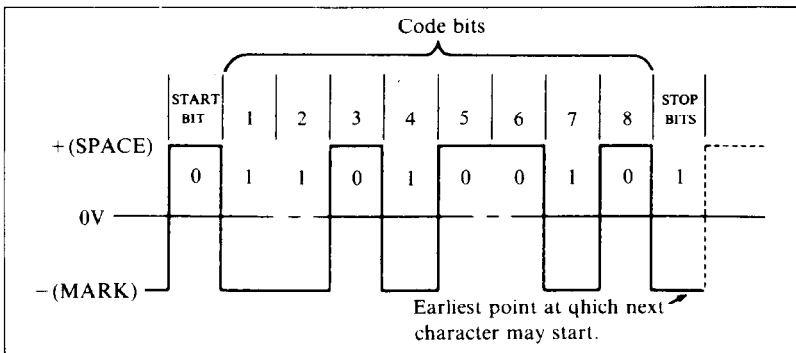
Figure G-1. Typical data byte on the serial interface.

Serial busy protocol (a byte) mode

RXD
Pin 3

DTR
Pin 20

RCH
Pin 11

Buffer full or
Off line

Serial busy protocol (1 block) mode

RXD
Pin 3

DTR
Pin 20

RCH
Pin 11

Buffer full or
Off line

XON/XOFF protocol

RXD
Pin 3

DTR
Pin 20

TXD
Pin 2

XOFF (DC3)   XOFF (DC3)   XON (DC1)

Buffer full or Off line

ACK Protocol

RXD
Pin 3

DTR
Pin 20

TXD
Pin 2

Buffer full or
Off line

DB = Data Byte
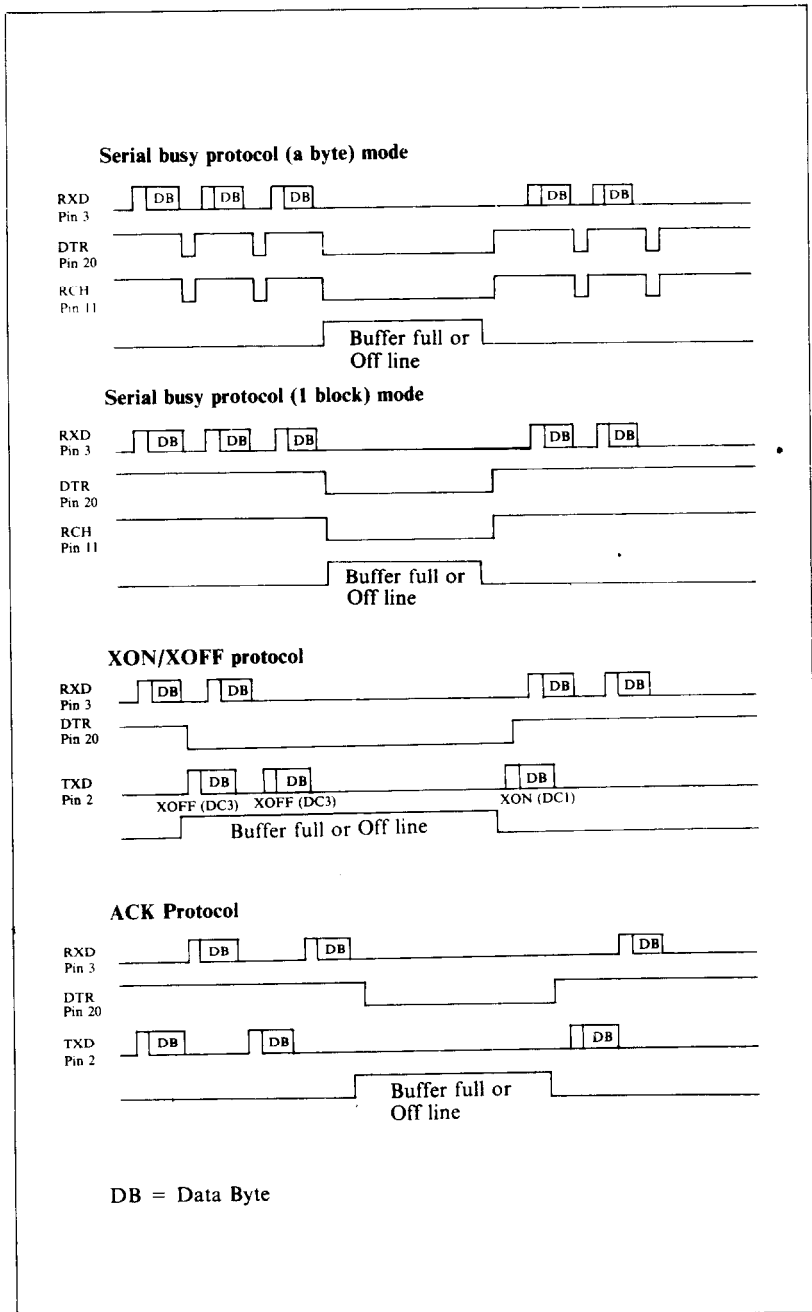
Figure G-2. Serial protocol timing charts.

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