TP UP-SH II
Thermal Line Printer

User's Manual

June 2002
Rev. alpha (draft)

Attention

1. No warranty will be provided for bad printing quality, even print head damage caused by the use of the paper not specified.
2. Disassemble or alter any part of the printer is prohibited. No warranty will be provided.
3. The contents of this manual are subject to change without notice.

Contents

Introduction

TPuP-SH is a new series of direct thermal line printer. It is small in size, light in weight, low in noise, good in printing quality and reliability. It suits many applications such as receipts of ECR/POS, transaction receipts printing, data and image printout for various medical instruments or equipment.

Chapter 1 - Features and Specifications

1.1 Printing Features

- Printing Method : direct line thermal
- Printing Paper Width : 57.5 ± 0.5mm
- Density : 8 dot/mm
- Printing Width : 384 dots/mm
- Printing Speed : 9 characters/sec. (at DC 9V/2A)

1.2 Printing Paper

- Thermal Paper Roll with paper width 57.5 ± 0.5mm
- Original thermal paper No. TF50KS-E3C of Jujo Seishi or approved suppliers
- Outer diameter < ϕ50mm
- Paper thickness 65 ± μs

1.3 Printing Characters

- IBM Character set: 12 x 24 dots, 1.50 x 3.00mm (W x H)
- Optional Chinese Characters (GB2312): 24 x 24 dots, 3.00 x 3.00mm (W x H)

1.3 Printer Buffer Size

- 10K

1.5 Printing Commands

- ESC/POS commands
- FS Chinese commands

1.6 Working Modes

- Printing text, graphic, Hexadecimal and Chinese
- Self-test
- Paper-feed

1.7 Printing-Head Energy Compensation Function

- Temperature Adjustment: adjusting printing energy by monitoring the build-in thermal resistor inside the print-head
- Electric Voltage Adjustment: adjusting energy by monitoring the voltage.

1.8 Printing-Head Protection Function

- Paper end warning
- Printing-head over-heat warning
- Lifting-up of printer-head lever warning

1.9 Interface

- Serial Interface (RS-232 compatible)

Baud Rate	:	9600, 4800, 2400, 1200bps selectable
Handshaking	:	RTS/CTS or XON/XOFF protocol
Data	:	7, 8 bits
Parity	:	Odd, Even and None
Connector	:	DB-25 (female)
Signal level	:	EIA

- Parallel Interface (Centronics compatible)

Handshaking	:	BUSY/ACK protocol
Connector	:	DB-25 (male)
Signal Level	:	TTL

1.10 Power Supply

- DC9V/2A (idle current: 100mA; average working current: 1.9A, max. 2.6A)
- Connector : DC jack type, inner diameter 2.0mm

1.11 Overall Dimension

- 104mm x 186mm x 96mm (W x D x H)

1.12 Weight

- 420g without paper roll

1.13 Working Environment

- Working Temperature : 0 - 50°C
- Humidity : 20 - 85% RH

1.14 Models

- UP-SHII32S (Serial Interface)
- UP-SHII32P (Parallel Interface)

Chapter 2 – Installation and Operation

2.1 Unpacking

The appearance of the TP UP-SH is shown in Figure 2.1. Please check whether the model number shown on the label underneath the printer is the same model of your package.

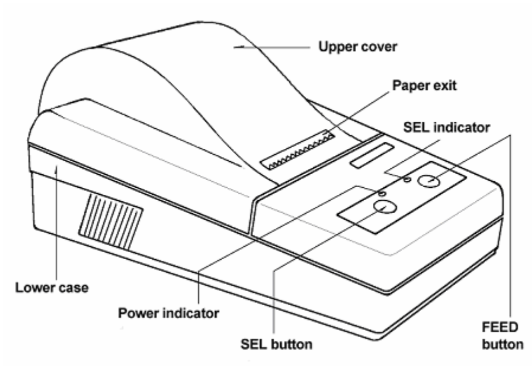


Figure 2.1 The appearance of TP UP-SH

The package included a pre-loaded roll of paper inside the printer, and a user's manual.

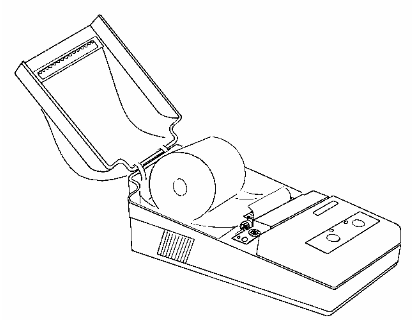


Figure 2.2 Open the upper cover

2.2 Loading Paper

TP UP-SH series printers loaded with a paper roll ex-factory. Before printing, insert the paper end into paper slit first. The step of loading paper is as follows:

(1) Open the cover of the printer (see Figure 2.2)
(2) Cut the end of the paper as following shape shown in Figure 2.3

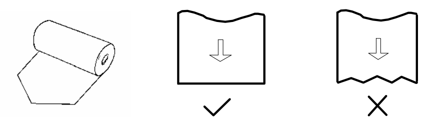


Figure 2.3 Paper end's shape

(3) Lift the print-head lever, insert the paper end into the slit till it pass through the printer head, then release the lever. Switch on the power of the printer, push button "SEL" once. Press the "FEED" button to feed the paper into the slit. The paper will then gradually coming out from the printer mechanism. Release the "Feed" button until the paper is coming out.

> **Caution:** Using incorrect thermal paper may cause poor printing quality and even lead to a permanent damage to the printer. Remove paper while in printing may damage the printer.

Pull the paper end passing through the slot on the cover of printer and close the cover.

2.3 Power Connection

TP UP-SH series printers use with a DC 9V, 2A external power supply. The polarity of the power connector is shown in figure 2.4.

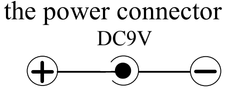


Figure 2.4 Power socket

A proper power supply with a compatible connector can directly connect to the printer.

Caution: Using an incorrect power supply may cause abnormal operation and even lead to permanent damage to the printer.

2.4 Parallel Interface Connection

Parallel model of TP UP-SH series equipped with a centronics compatible DB-25 connector. The connector is compatible with the printer port of IBM PC and is shown in Figure 2.5.

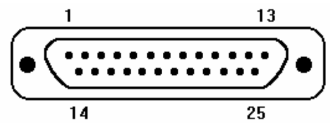


Figure 2.5 Parallel interface

Definition of the pin assignment is shown in Figure 2.6.

Pin No	Signal	I/O	Description
1	/STROBE	In	strobe pulse; normal state is High; when Low, printer accepts data from data lines
2	D0	In	data bit 0
3	D1	In	data bit 1
4	D2	In	data bit 2
5	D3	In	data bit 3
6	D4	In	data bit 4
7	D5	In	data bit 5
8	D6	In	data bit 6
9	D7	In	data bit 7
10	/ACK	Out	acknowledge pulse; normal state is High; when Low, printer accepts data from data lines; pulse ~ 10us
11	BUSY	Out	when HIGH, printer is busy, cannot accepts data from data lines
12	PE	Out	when High, printer has an error (paper out)
13	SLCT	Out	select; pull-up to +5V.
14	----	----	not used
15	/ERROR	Out	Pull-up to +5V
16	/INIT	----	not use
17	----	----	not use
18 ~ 25	GND	----	Ground

Remarks: 1. "In" represents input to printer. "Out" represents output from printer.
2. Signal level is TTL standard.

Figure 2.6 Pin assignment of parallel interface

The signal timing chart of parallel interface is shown in Figure 2.7.

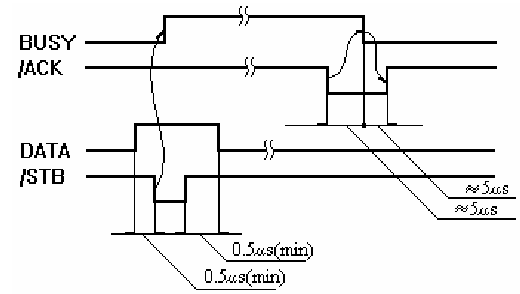


Figure 2.7 The signal timing chart of parallel interface

2.5 Serial Interface Connection

Serial model of TP UP-SH series equipped with a RS-232 compatible D-25 connector. The is compatible with the serial port of IBM PC and is shown in Figure 2-8. The pin assignment is shown in Figure 2.8.

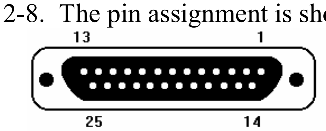


Figure 2.8 Serial interface

Pin No.	Signal	Source	Description
2	TXD	Printer	Printer sends control code XON/XOFF to host when using XON/XOFF handshakingz.
3	RXD	Host	Printer receives data from host.
4	RTS	Printer	Signal sets MARK to state indicates the printer is BUSY and cannot receive data. While in SPACE state indicate the printer is ready to receive data.
20	DTR	Printer	Same as SPACE
7	GND	-----	Signal ground

Remarks: 1. “SOURCE” represents source of signal.
2. Signal level is EIA standard.

Figure 2.9 Pin assignment of serial interface

The data transfer of the serial interface is in asynchronous mode as shown in Figure 2.10. The data format and baud rate can be selected and detailed settings will be illustrated later.

Start Bit	Data bits	Parity Bit	Stop Bit
1 bit	7/8 bits	1 bit	1 bit

Figure 2.10 Asynchronous transmitting format

The signal polarity of serial RS-232 is as follows:

MARK = Logic “1” (EIA low level: -3V~ - 27V)
SPACE = Logic “0” (EIA high level: +3V ~ +27V)

There are two kinds of handshaking modes. One is flag control (RTS/CTS hardware signal control) and the other is XON/XOFF protocol (software control). The illustration of handshaking is showing in Figure 2.11.

Handshaking	**Data Direction**	**Signal of RS-232C Interface**
Flag Control	Can accept data	Line 4 (RTS) in SPACE state
	Can’t accept data	Line 4 (RTS) in Mark state
XON/XOFF	Can accept data	Send XON (11H) to Line 2 (TXD)
	Can’t accept data	Send XOFF (13H) to Line 2 (TXD)

Figure 2.11 Two kinds of Handshaking

The serial interface of TP UP-SH printers (with suffix S) can connect to the standard interface RS-232C. Connection with IBM PC or compatible is shown in Figure 2.12.

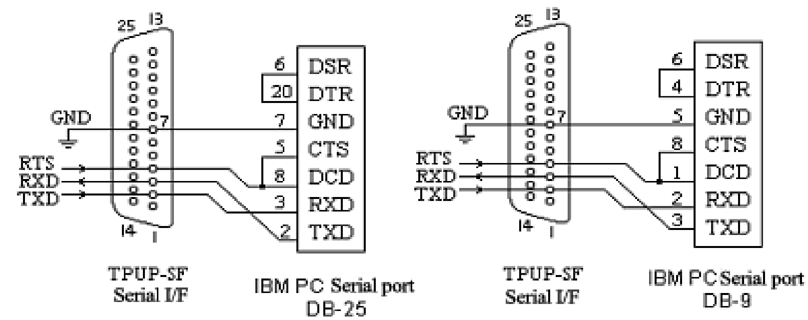


Figure 2.12 Connection between UP-SH and IBM PC (serial)

The operation procedure of serial interface is as follows:

1. Set the parameter of data communication. Skip to the step 2 if no modification is needed.
   a. Hold the FEED button down and power on, then the printer will enter the setting serial parameters mode.
   b. Release the FEED button begin to set the *Baud Rate*. The current *Baud Rate* will be printed at same time.
   c. Push the SEL button one by one to select *Baud Rate*, the value of *Baud Rate* will be printed out in turn as: 1200,2400,4800,9600 bps.
   d. After select the required *Baud Rate*, push the FEED button to confirm your selection. Next to set the *Parity*. Its current value will be printed out.
   e. Push the SEL button to select *Parity*, the value will be printed out in turn as: None, Odd, Even.
   f. Push the FEED button to confirm your selection. Next to set *Data Length* and print out the current parity.
   g. Push the SEL button to set *Data Length*, the value is printed out in turn as: 8 bits, 7 bits.
   h. Push the FEED button to confirm your selection. Printer turns to set the *Baud Rate* setting again.

   i. Push the SEL button again to repeat steps (c) to (h). Or switch off the printer power to quit the parameters setting mode.
2. When the printer buffer is reduced to less than 256 bytes, the printer sets the RTS line to BUSY state (ie. MARK) and send out the XOFF (13H) code. Otherwise, printer sets the RTS line to READY state (ie. SPACE) and send out the XON (11H) code and is ready for receiving data.
3. Host computer will use either the XON/XOFF or RTS/CTS protocol to identify whether the printer is in READY or the BUSY status. Then the host computer can base on the status to send or stop sending data to printer.

2.6 Indicator & Switches Operation

There are two LED indicators and two key buttons located on the panel of TP UP-SH printer. One is Power indicator marked with “P”. Another is On/Off Line indicator marked with “SEL”. “SEL” button is used for On/Off line selection. And “FEED” button is for Paper Feeding function. See Figure 2.13 as follows.

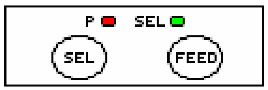


Figure 2.13 Indicators & buttons

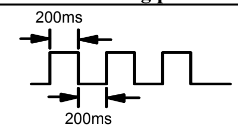
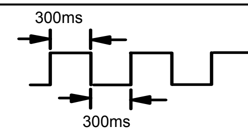
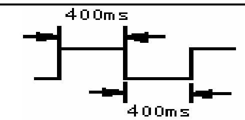
The P indicator lights up when power on. The SEL indicator lights up when printer is in on-line mode and is blinking, there is error such as no paper. With the combination of the SEL and FEED buttons, three kinds of working modes: Self-test, On/Off Line and Paper Feed can be selected.

1. Self-test mode

   Press & hold “SEL” button, turn on the power and then release “SEL” button. Printer enters the Self-Test mode.

2. On/off-line mode

   When power on or exit from Self-test mode, printer enters the On-line status. At same time, the SEL indicator lights up. Push the SEL button once, printer go to off-line status and the SEL indicator goes out. Push the SEL button again it return to on-line status again. The printer cannot receive data from host computer while in off-line status.
   During printer is printing and push the SEL button once, the printing will finish printing the current line & stopped. Push the SEL button again, the printing will resume again.

Error	LED blinking pattern	Description
No Paper		Automatically go to off-line mode
Print-head over-heated or dis-connected		Stop printing until the temperature of print-head decrease to 45°C, then resume automatically
Lifting of print-head lever		Automatically go to off-line mode

3. Paper feed mode

   Hold down FEED button when printer is in off-line mode, printer will feeding the paper until release the FEED button. Push the SEL button, the printer go to on-line mode.

2.7 Self-test

The Self-test checks the condition of printer. If the printer prints out the Self-test receipt correctly, it means the printer is working normally. The printer needs checking & repair if faulty sample is printed out.
The Self-test prints the software version, interface type and ANK, Chinese font characters and finally, the model number.
After completing the self-test, printer go to on-line mode.

Chapter 3 - Printing Commands

3.1 Summary

TP-UP-SH Line thermal printer provides ESC/POS printing commands, FS Chinese characters printing commands. These commands have the following functions:

1. Set format
2. Enlarge and condense characters
3. Printing bit-map graphics
4. Set user-define characters
5. Printing Chinese characters (optional)
6. Others

The format of each printing commands are illustrated below:

Code Sequence		Function
Format : ASCII :	the sequence in standard ASCII characters	
Decimal :	the sequence in decimal numbers	
Hexadecimal :	the sequence in hexadecimal numbers	

Explanation: description of the command.

Here are the commands in different categories.

3.2 Paper Feeding Commands

LF		Print and Feed Paper
Format : ASCII :	LF	
Decimal :	10	
Hexadecimal :	0A	

Explanation:

Print the data in the print buffer and feed one line.

ESC		Print and feed paper ‘n’ dots lines
Format : ASCII :	ESC J n	
Decimal :	27 74 n	
Hexadecimal :	1B 4A n	

Explanation:

Print data in buffer and feed ‘n’ dots lines. n = 0 ~ 255.

ESC 2		Set line spacing to 1/6”
Format : ASCII :	ESC 2	
Decimal :	27 50	
Hexadecimal :	1B 32	

Explanation:

Set the line spacing to 1/6”. That is, 32 dot-lines.

ESC 3		Set line spacing to ‘n’ dot lines
Format : ASCII :	ESC 3 n	
Decimal :	27 51 n	
Hexadecimal :	1B 33 n	

Explanation:

Set the line spacing to n dot-lines. n = 24 ~ 255, default n = 32.

3.3 Character Setting Commands

ESC !		Set character printing mode
Format : ASCII :	ESC ! n	
Decimal :	27 33 n	
Hexadecimal :	1B 21 n	

Explanation:

Set the character print mode using n as follows:

n = 0 ~ 255, default n = 0.

Bit	Function	Value	
		0	1
4	Double High	Disable	Enable
5	Double Width	Disable	Enable
6	Not defined		
7	Not defined		

ESC S0 — Set double width character printing

Format : ASCII : ESC S0
Decimal : 27 14
Hexadecimal : 1B 0E

Explanation:

Set the double width character printing in the same print line.
This command can be cancelled by carriage return or DC4 commands.

ESC DC4 — Cancel double width character printing

Format : ASCII : ESC DC4
Decimal : 27 20
Hexadecimal : 1B 14

Explanation:

Cancel the double width character printing mode set by ESC S0.
The double width printing can be cancelled by carriage return or DC4 commands but not the character enlargement set by ESC !.

3.4 User-defined Character Commands

ESC % — Select user-defined characters

Format : ASCII : ESC % n
Decimal : 27 37 n
Hexadecimal : 1B 25 n

Explanation:

Select/cancel user-defined characters. n = 0 or 1, and only the lowest bit of n is valid. Default n = 0.
When n = 1, user-defined character is selected.
When n = 0, normal character is selected.
* use ESC & to define user-defined characters.

ESC & — Define user-defined characters

Format : ASCII : ESC & s n m [a[p]s x a]m-n+1
Decimal : 27 38 s n m [a[p]s x a]m-n+1
Hexadecimal : 1B 26 s n m [a[p]s x a]m-n+1

Explanation:

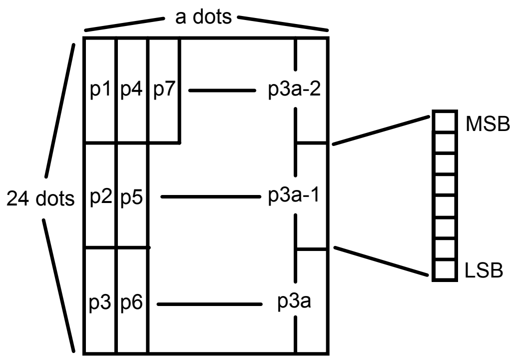
Define user-defined characters. s = 3, 32≤n<m≤126, 0≤a≤12, 0≤p≤ 255.

- s is the number of bytes in vertical direction. s=3.
- n is the starting ASCII code of user-defined character.
- m is the ending ASCII code of user-defined character.

When define only one character, n equal m. The maximum number of user-defined characters is 96.

- a is the number of dots in horizontal direction.
- p is the data of user-defined characters. There are (s x a) bytes in each character, the total no. of user-defined characters is m-n+1.
- user-defined characters are valid until re-defined, reset or power off.

Format of the user-defined characters is shown as follows:



3.5 Graphic Line Printing Commands

ESC * Select bit-map mode printing

Format : ASCII : ESC * m n1 n2 [d]k
Decimal : 27 42 m n1 n2 [d]k
Hexadecimal : 1B 2A m n1 n2 [d]k

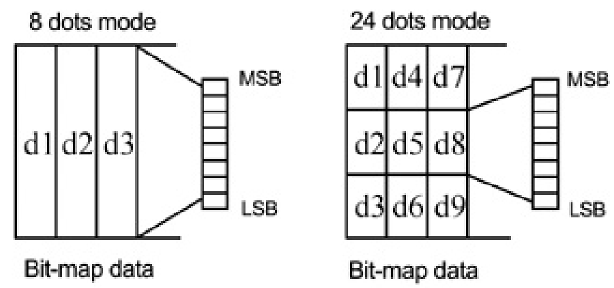
Explanation:

Select bit-map mode printing.
m=0, 1, 32, 33. n1 = 0 ~ 255, n2 = 0 ~ 3. d = 0 ~ 255.
k = n1 + 256 x n2, (m=0,1)
k = (n1 + 256 x n2) x 3, (m=32,33)

- The number of horizontal dots of the graphics is n1 + 256 x n2.
- The width of bit-map should be within the line width, excessive part will be ignored.
- d is the bit-map data and k is the total no. of data.
- m is the selected bit-map mode.

The definition of m is shown as follows:

m	Mode	Vertical		Horizontal	
		Dot	Density	Density	Max. Dots
0	8 dot single density	8	68 dpi	101 dpi	192
1	8 dot double density	8	68 dpi	203 dpi	384
32	24 dot single density	24	203 dpi	101 dpi	192
33	24 dot double density	24	203 dpi	203 dpi	384



GS * Define download bit-map graphic

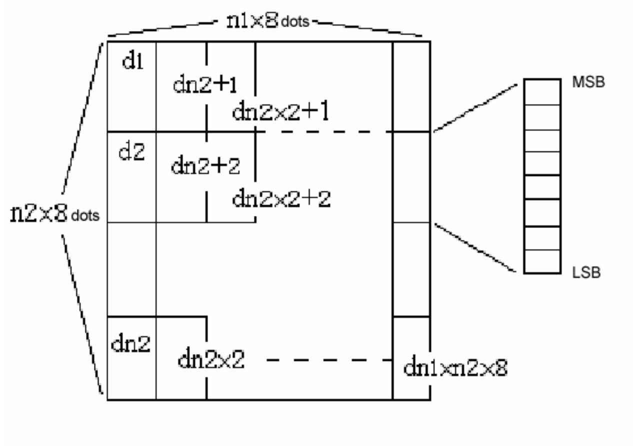
Format : ASCII : GS * n1 n2 [d]k
Decimal : 29 42 n1 n2 [d]k
Hexadecimal : 1D 2A n1 n2 [d]k

Explanation:

Define download bit-map graphic.
n1 = 0 ~ 48, n2 = 1 ~ 255, n1 x n2 < 9600, k = n1 x n2 x 8.

- d is the bit-map data.
- The horizontal size of this graph is n1 x 8 dots and vertical is n2 x 8 dots.
- The down-load bit image data will be lost after re-define, power off or system reset.

Format of the download bit-map data is shown as follows:



GS /	Print download bit-map graphic

Format : ASCII : GS / n
Decimal : 29 47 n
Hexadecimal : 1D 2F n

Explanation:

Print download bit-map graphic. n = 0 ~ 3.

- n is the bit-map mode selection.

n	Bit-map Mode	Vertical Density	Horizontal Density
0	Normal	203 dpi	203 dpi
1	Double Width	203 dpi	101 dpi
2	Double Height	101 dpi	203 dpi
3	Double Width & Height	101 dpi	101 dpi

3.6 Other Commands

ESC @	Initialize printer

Format : ASCII : ESC @
Decimal : 27 64
Hexadecimal : 1B 40

Explanation:

Initialize printer in the following aspects:

- clear data in print buffer
- re-instate printer default value
- clear user-defined characters

CR	Carrier return

Format : ASCII : CR
Decimal : 13
Hexadecimal : 0D

Explanation:

Print all the data in the printer buffer and feed one line. Same as LF command.

FS S0	Set double width Chinese character printing

Format : ASCII : FS S0
Decimal : 28 14
Hexadecimal : 1C 0E

Explanation:

Set double width for Chinese character printing. It will be release when receive FS DC4 commands.

FS DC4 Cancel double width Chinese character printing

Format : ASCII : FS DC4
Decimal : 28 20
Hexadecimal : 1C 14

Explanation:

Cancel double width Chinese character printing.

FS ! Set Chinese character printing mode

Format : ASCII : FS ! n
Decimal : 28 33 n
Hexadecimal : 1C 21 n

Explanation:

Set Chinese character printing mode. n = 0 ~ 255, default n = 0.

Bit	Function	Value	
		0	1
4	double height	prohibit	set
5	double width	prohibit	set
6	not defined		
7	not defined		

ESC c 5 Enable/disable panel buttons

Format : ASCII : ESC c 5 n
Decimal : 27 99 53 n
Hexadecimal : 1B 63 35 n

Explanation:

Enable/disable the panel buttons. n = 0 ~ 255, only the least significant bit (bit 0) is valid.

ESC v Return printer status

Format : ASCII : ESC v
Decimal : 27 118
Hexadecimal : 1B 76

Explanation:

Send the printer current status to host.

Bit	Function	Value	
		0	1
2	paper out	with paper	without paper
4	not defined	fixed to 0	---

Appendix - Index of Printing Command

Dec	Hex.	Command	Eescription	Page
10	0A	LF	Print and line feed	
13	0D	CR	Carriage return	
27 14	1B 0E	ESC SO	Set double-width printing	
27 20	1B 14	ESC DC4	Cancel double-width printing	
27 42	1B 2A	ESC *	Set bit map printing mode	
27 37	1B 25	ESC % n	Select user-defined character	
27 38	1B 26	ESC & s n m [a[p]sxa]m-n+1	Define user-defined character	
27 50	1B 32	ESC 2	Set line spacing to 1/6 inch	
27 51	1B 33	ESC 3	Set line spacing to n dot-lines	
27 74	1B 4A	ESC J n	Print & feed paper n dot-lines	
27 33	1B 21	ESC ! n	Set character printing mode	
27 99	1B 63	ESC c 5	Enable/disable buttons function	
27 118	1B 76	ESC v	Return printer status	
29 42	1D 2A	GS * n1 n2 [d]k	Define download bit-map graphic	
29 47	1D 2F	GS / n	Print download bit-map graphic	
28 14	1C 0E	FS S0	Set double width Chinese character printing	
28 20	1C 14	FS DC4	Cancel double-width Chinese character printing	
28 33	1C 21	FS !	Set Chinese character printing	