SII

DPU-S445 SERIES
THERMAL PRINTER
TECHNICAL REFERENCE

U00110811305

Seiko Instruments Inc.

DPU-S445 SERIES THERMAL PRINTER TECHNICAL REFERENCE

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CHAPTER 1
TERMS USED IN THIS MANUAL

This chapter describes the terms used in this manual.

- **INPUT BUFFER AND LINE BUFFER**

  When the DPU-S445 (hereinafter it is referred to as “printer”) receives data (character codes and commands) from the host devices, it stores the data in the printer input buffer. The input buffer has a capacity of 4K bytes (4096 bytes). Then, the printer retrieves data from the input buffer. If data is character code, data is stored into the line buffer. If data is command, data is executed as command immediately.

  The printer inputs character codes to the line buffer until the amount of character codes reaches the amount to be printed on one line, then prints the characters. The printer repeats this operation to print all the character data.

  The relationship between the input buffer and line buffer is illustrated in Figure 1-1.

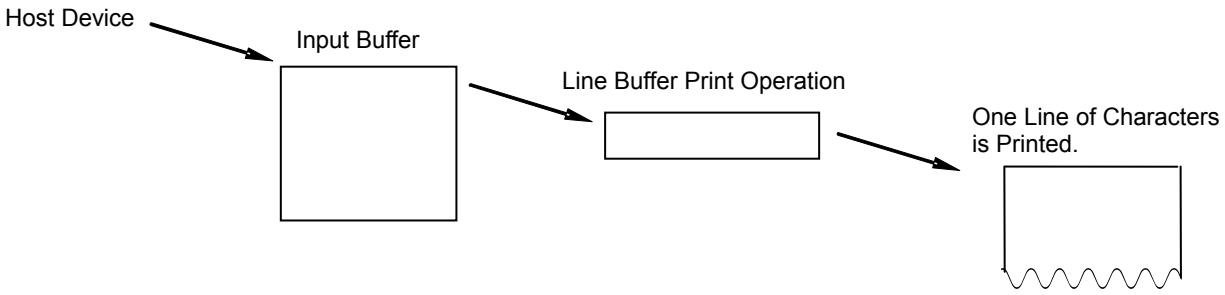


Figure 1-1 Relationship between Input Buffer and Line Buffer

- **1-byte characters and 2-byte characters**

  The printer can print two-size characters; 1-byte characters and 2-byte characters.
  Table 1-1 lists the character types which can be printed by 1-byte and 2-byte characters.

Table 1-1 Character Types and Relationship between 1-byte and 2-byte Characters

	Character Types
1-byte characters	Katakana character (ANK) Extended graphics character (IBM Compatible) Codepage 1252
2-byte characters	Kanji, User-defined characters

*1 The size of a character to be printed differs depending on the font specified. (See 2.1 Printer Specifications.)

- **Line Spacing**

  Line spacing is the space between the lines of printed characters (See Figure 1-2).

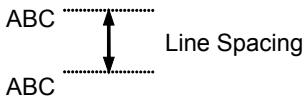


Figure 1-2 Line Spacing

This printer use a line thermal print mechanism, therefore, a paper feed step is necessary before printing characters or bit images.

The line feed command with printing feeds the paper for height of characters or bit images. Therefore, a paper feed amount which is smaller than character or bit image height is ignored. Printing with underline feeds the paper 4 dot lines in addition to the character height. Line feeding without printing feeds the paper for specified line feed amount.

- **Character Spacing**

  Character spacing is the space between each character in the horizontal direction (See Figure 1-3).

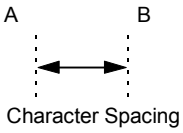


Figure 1-3 Character Spacing

- **Line**

  The word “line” in this manual indicates a line of characters. For example, the sentence “the printer feeds paper one line” indicates that the printer feeds paper a line of characters.

- **Dot Line**

  The words “dot line” in this manual indicate a line of dots in the vertical direction. For example, the sentence “the printer feeds paper by one dot line” indicates that the printer feeds paper by the space of 1 dot.

- **Paper Auto-loading**

  The paper auto−loading function which can loads the cut paper from the paper slot automatically by using the paper feed motor.

- **Notation in the Technical Reference**

  - Hexadecimal

  Hexadecimal is showing as follows;
  Example: 0AH (a hexadecimal unit 'H' is added behind a hexadecimal number.)

  - Character string

  A character string is showing as follows;
  Example: 'G' (a character string 'G' is enclosed with a single quotation mark.)

CHAPTER 2
SPECIFICATIONS

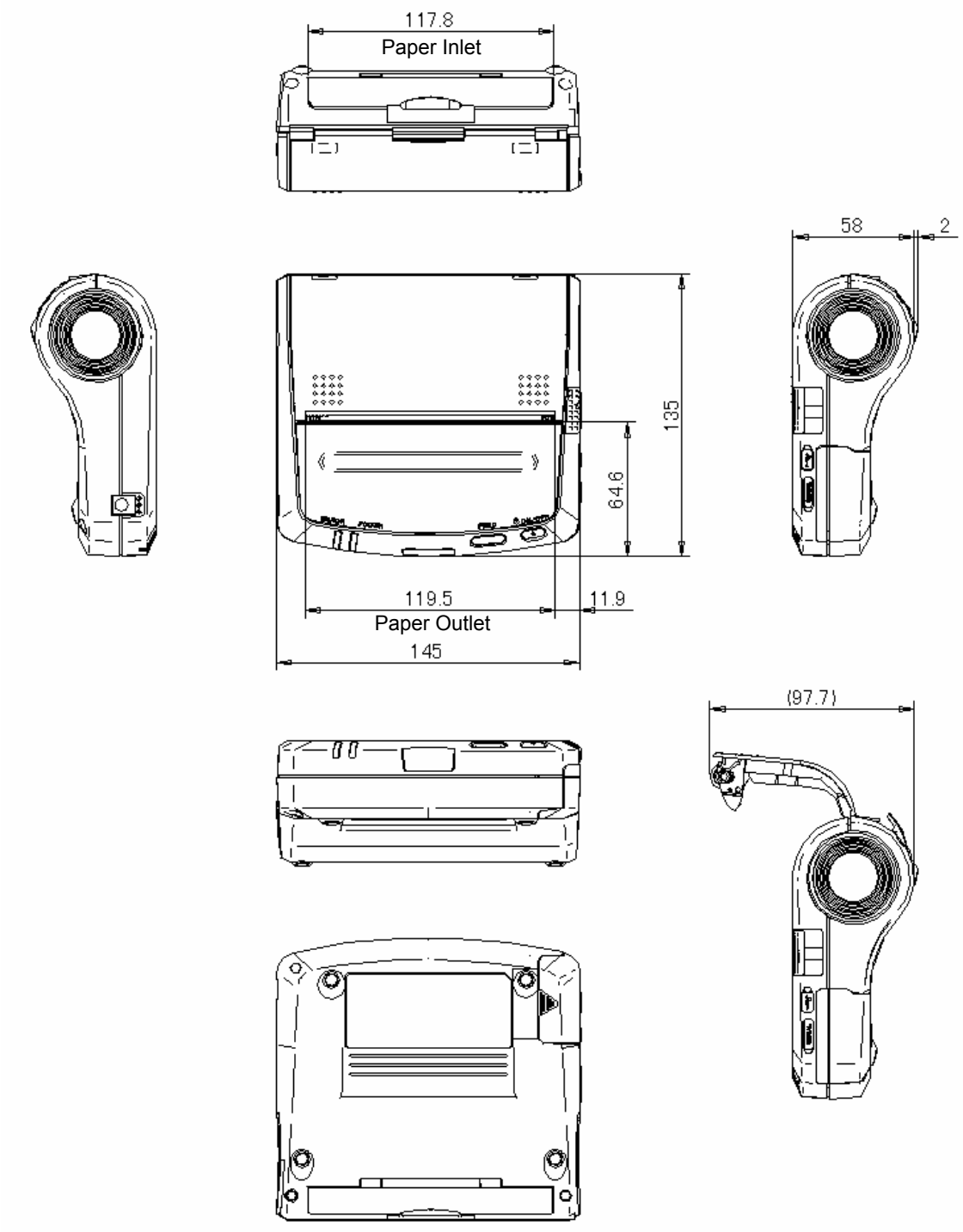
2.1 PRINTER SPECIFICATIONS

Table 2-1 General Specifications

Item		Specification
Total number of dots		832 dots/line
Effective dot number		832 dots/line
Resolution		W 8 dots/mm x H 8 dots/mm
Printing width / paper width		104 / 112 mm
Printing speed		90 mm/s max. *1
Number of character per line		24 dots 1-byte characters: 52 characters (right character space is 4 dots) 24 dots 2-byte characters: 26 characters (left character space is 0 dot, right character space is 8 dots)
Character size (H x W)		24 dots 1-byte characters: 24 x 12 dots 16 dots 1-byte characters: 16 x 8 dots 24 dots 2-byte characters: 24 x 24 dots 16 dots 2-byte characters: 16 x 16 dots
Character set		Katakana character set *2 Extended graphics character set Codepage 1252 character set JIS 1st and 2nd level of Kanji *2
Interface		Serial (RS-232C conformity) USB (Ver.2.0 conformity) Infrared (IrDA Ver.1.2 / BHT-Ir protocol conformity) Bluetooth (Ver.2.0+EDR conformity) *3
Input buffer size		4K bytes
Dimensions (W x D x H)		145 mm x 135mm x 8mm
Mass		Approx. 490 g (including the battery pack, excluding paper)
Operating temperature and humidity range		Temperature: 0 to 50°C Humidity: 30%RH to 80%RH (Non condensing)
Storage temperature and humidity range		Temperature: -25 to 60°C Humidity: 5%RH to 90%RH (Non condensing)
Regulations	EMC	VCCI Class B, FCC Class B, Industry Canada Class B, CE (EMC), CCC, KC, BSMI
	The wireless telegraph law regulation conformity	FCC, IC, CE (R&TTE), Radio Law of Japan, SRRC, ANATEL
	Safety	CB, CE (LVD), CCC, BSMI
Countries under the regulations		Japan, USA, Canada, EU, EFTA, Australia, New Zealand, China, Korea, Taiwan, Brazil

*1: Using AC adapter, printing ratio is 7.5% or lower, thermal head temperature is 25°C.
*2: SII Japanese font set installed (at shipping).
*3: Only for Bluetooth-supporting model.

- **Dimensions**



Unit : mm

Figure 2-1 Dimensions

2.2 SPECIFIED THERMAL PAPER SPECIFICATIONS

Table 2-2 Thermal Paper Provided by SII

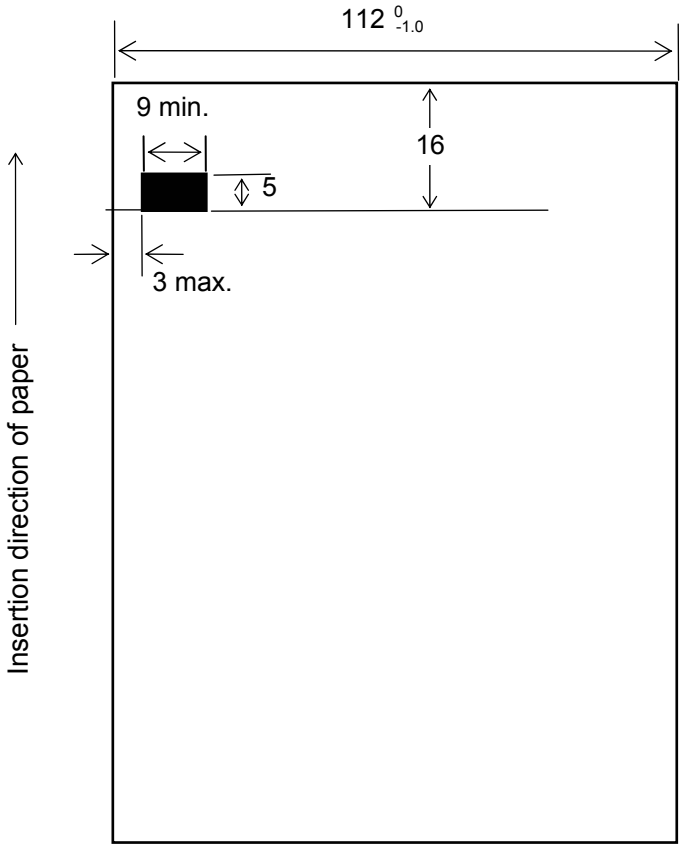
Item	Specifications
Model	TP-341L-1
Type	Normal paper roll
Paper width	112 $^{0}_{-1.0}$ mm
Outside diameter	48mm max.
Paper thickness	59 ±5 μm
Printing surface of Paper roll	Outside

Table 2-3 Specified Thermal Paper Specifications

Item		Specifications	
Paper mode *1	Paper roll	PD160R-N	Oji Paper Co., Ltd.
		TF50KS-E2D	Nippon Paper Industries Co.
		P350	Kanzaki Specialty Papers
		KT55F20	Papierfabrik August Koehler AG
	Cut paper	TC98KS-LH	Nippon Paper Industries Co.
		TF8067	Mitsubishi Hi-Tech Paper
	Label paper	TL69KS-HW76B	Nippon Paper Industries Co.
Paper width		112 $^{0}_{-1.0}$ mm	
Outside diameter		50 mm max.	
Inside diameter		8 mm min. (Label paper: Outside diameter of paper core should be 25.4 mm min.)	
Spectral reflectivity		Black, near-infrared reflectance should be 6% and below.	
Printing surface of Paper roll		Outside	

*1 Use each specified thermal paper in an applicable thermal paper mode.

2.2.1 Timing Mark for the Cut Paper Dimensions



Unit : mm

Figure 2-2 Timing Mark for the Cut Paper (back surface)

(1) Example of use of the cut paper

An example of use of the cut paper is shown Figure 2-2.

(a) Set the function setting of Paper Mode to “Cut paper”.

(b) Set the paper length as page length.

(c) Insert the cut paper.

(d) Print data within the printable area shown in Figure 2-3. (The position of print end must be at the position of 15mm or longer from the bottom edge of the paper.)

(e) The cut paper is ejected by sending Form Feed command at the end of printing.

Repeat steps (c) to (e).

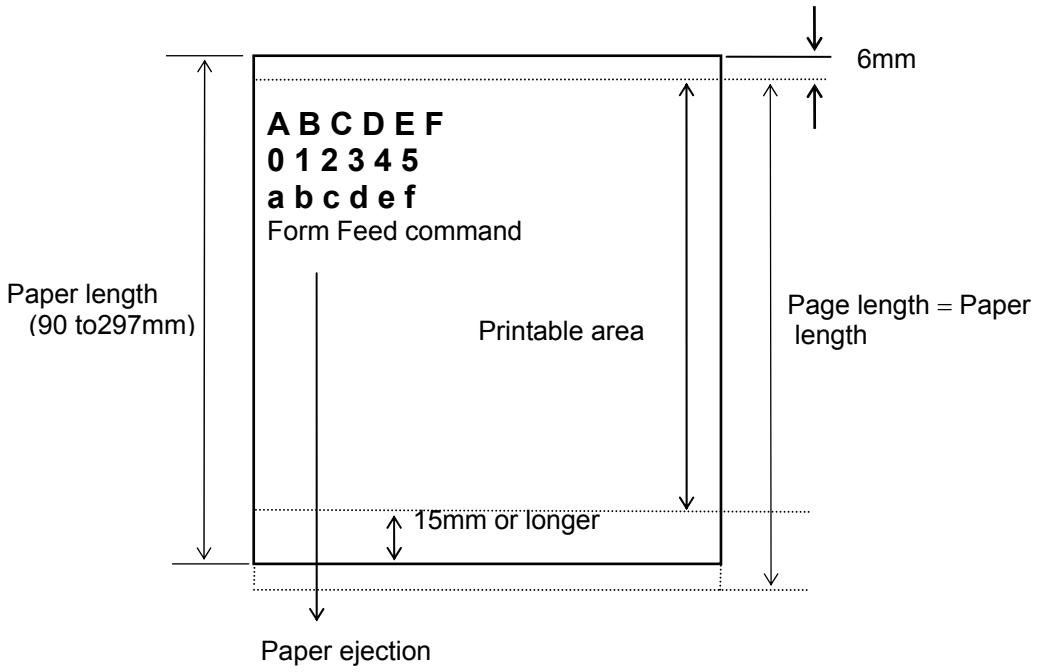
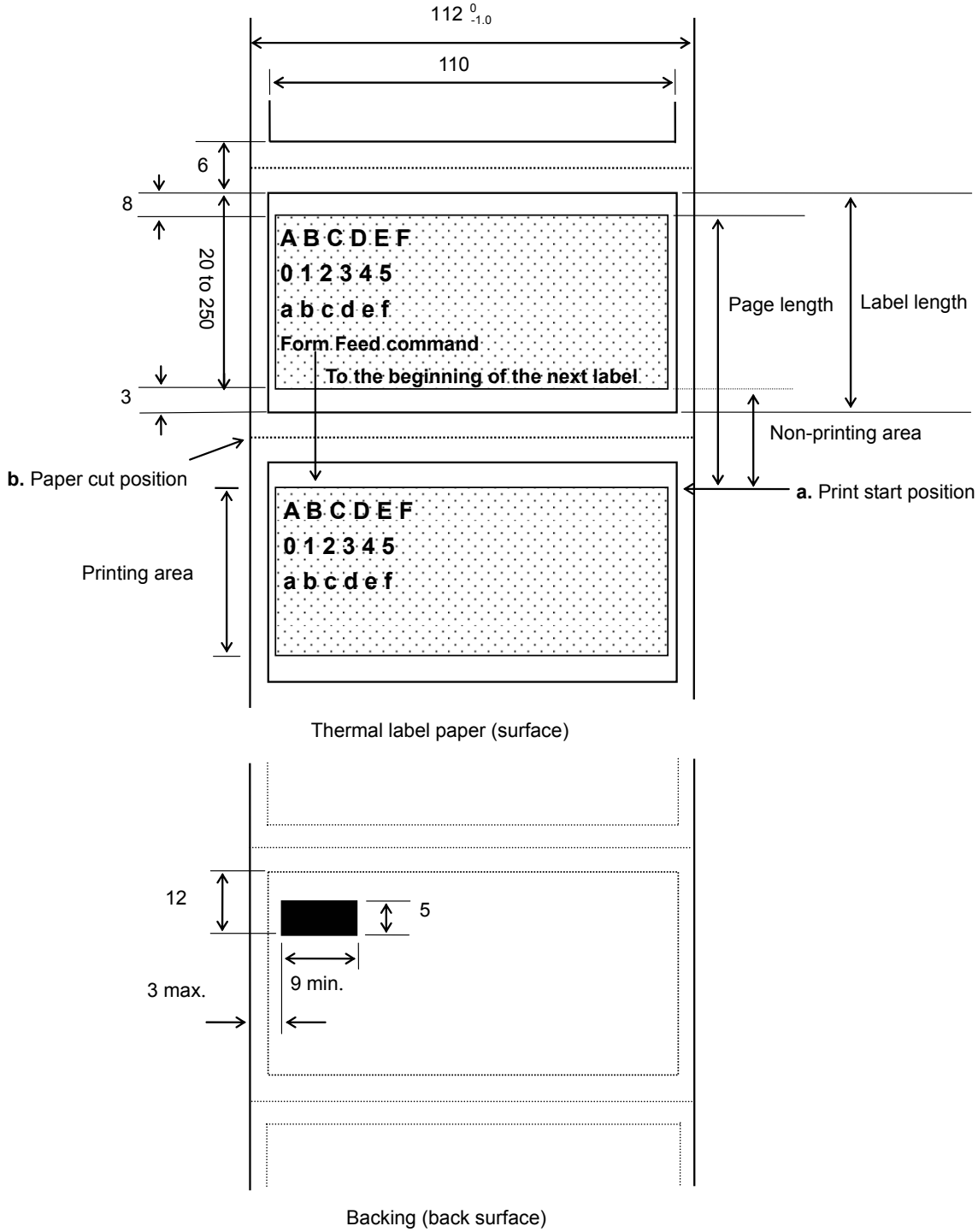


Figure 2-3 Example for the Cut Paper

2.2.2 Thermal Label Paper Dimensions



Unit : mm

Figure 2-4 Example for Thermal Label Paper Dimensions

(1) Example of use of thermal label paper

An example of use of the thermal label paper is shown Figure 2-4.

(a) Set the function setting of Paper Mode to “Mark Roll Paper”.

(b) Insert the thermal label paper.

(c) Set the page length as the length from the beginning of the current label to the beginning of the next label.

(d) Set the skip amount (non-printing area) between labels.

(e) Print data within the printable area.

(f) Use Form Feed command to find the beginning of the next label. The mark on the next label is detected and the beginning of the next label is located by sending Form Feed command.
The print start position after the beginning of the next label is placed at position 'a', and the paper cut position is 'b' as shown in Figure 2-4.

Repeat steps (e) to (f).

(NOTE)	**When Mark Position Correct of SWDIP 4-5 is set as Enable, the printer operates paper feeding to backward 5 mm just before printing process after placing print start position.** **If this function set as Enable, use the thermal label paper 40mm or longer length to prevent paper jamming from feeding paper backward.**

2.3 SPECIFIED BATTERY PACK SPECIFICATIONS

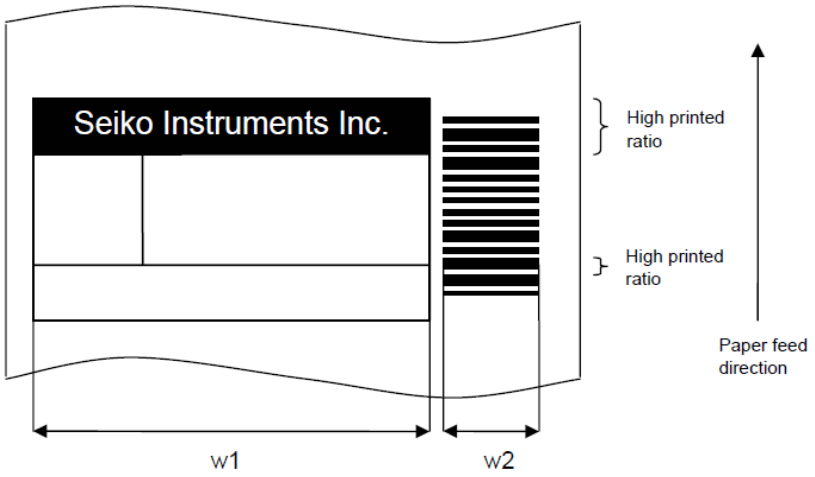
Item	Specification
Model	BP-L0720-A1-E
Available printing lines *1	10000 lines min.
Battery Cycle Life *2	300 cycles

*1: 25°C, character spacing is 4 dots, line spacing is 34 dots, TF50KS-E2D selection, print density is 100%, continuous printing with 'H' 1-byte characters, serial communication, fully charged with 8.4 V by specified battery charger.

2: 25°C, charged in the printer with specified AC adapter, print ratio is 12.5%, charged with 70% or more of fully charged.
* The rate in environment of 0 to 50°C becomes 40% or more.

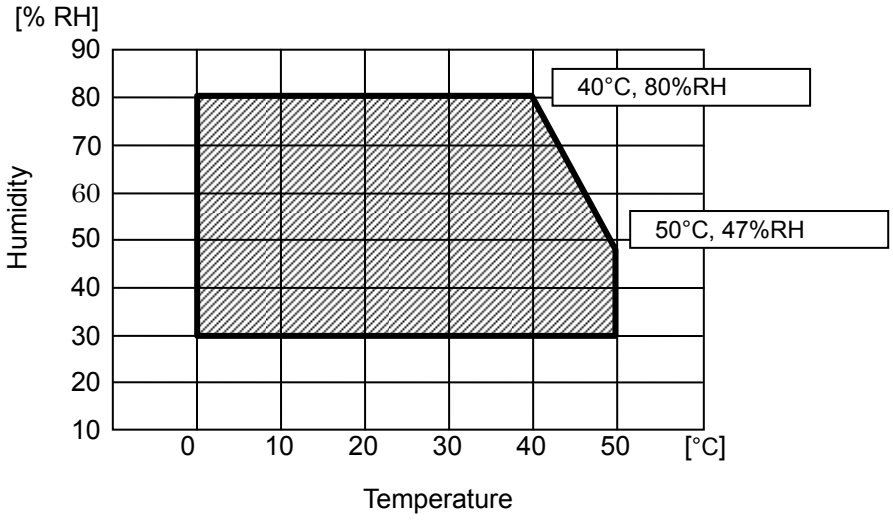
2.4 PRECAUTIONS FOR USE

- Always print the two-dimensional bar code and ladder bar code (its bar is to be printed verticality to the printer) within 0 to 40°C to ensure the bar code's reading accuracy.
- The two-dimensional bar code and ladder bar code printing always requires the low speed mode to ensure its reading accuracy. Set the print speed to the low speed mode by using Motor Speed Select (GS 'E') command.
- The height of the ladder bar code requires over 10 mm to ensure its reading accuracy.
- To print data at a temperature of 15°C or lower, be sure to set data for black printing to 78 mm or less (see figure below).



At a low temperature, the total number of black printing areas (w1 + w2 in the figure above, for example) should not exceed 78mm for parts having high printed ratios* (including the ladder bar code part).
Be aware, in particular, that reverse printing and ruled line tend to increase the ratio.
* Parts where many black dots are used when viewed in the direction vertical to the paper feed direction.

- Use of the battery pack at low temperature will run out of power in a shorter time.
- When printing ruled lines, a 2-dot configuration is needed. In case of a 1-dot configuration, the printed lines may be invisible.
- Always use the printer within the shadowed range depicted in figure below Relationship between Temperature and Humidity.



- When using a Bluetooth interface, the radio environment around the printer may cause a failure in communications. This is due to the specifications of Bluetooth, which is a radio communications standard.

- When handling this product, be aware of static electricity. If the static electricity is discharged, this could case communication failure. When this problem occurs, disconnect the USB connector that is connected to the host device and wait few seconds before connect it again.

- When the printer is left unused for a long period of time, a white powder appears to the surface of platen. (This is the powder by which an ingredient of a thermal paper was recrystallized.)
  If the powder appears to the platen, wipe the platen with ethanol and use the printer after ethanol has dried completely.
  Also, make sure not to adhere ethanol except the platen area. If ethanol adheres except the platen area, wipe it off immediately.

(NOTE)	**Refer to "SAFETY PRECAUTIONS" and "OPERATING PRECAUTIONS" on DPU-S445 SERIES USER'S GUIDE which be included with the printer for other precautions.**

CHAPTER 3
INTERFACE

This chapter describes 4 types of the interface specifications which are required to connect the host device with the printer.

Irrespective of the interface used, amount of the input buffer in the printer is 4k bytes, and transmission buffer is 768 bytes. If the transmission buffer becomes the condition of the buffer full, the printer waits data processing until the buffer can be received data. Be aware that printing process does not performed in that meantime.

3.1 SERIAL INTERFACE SPECIFICATIONS (RS-232C CONFORMITY)

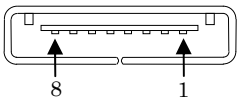
(1) General specifications

Item	Specification
Synchronization	Asynchronous
Signal level	MARK = –3.0 to –15.0 V: Logic '1' SPACE= +3.0 to +15.0 V: Logic '0'
Baud rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 bps
Data bit length	7 bits or 8 bits
Stop bit length	1 bit or 2 bits
Parity	None, odd or even
Reset	Break signal input to RxD (20ms or longer)

(2) Pin assignment

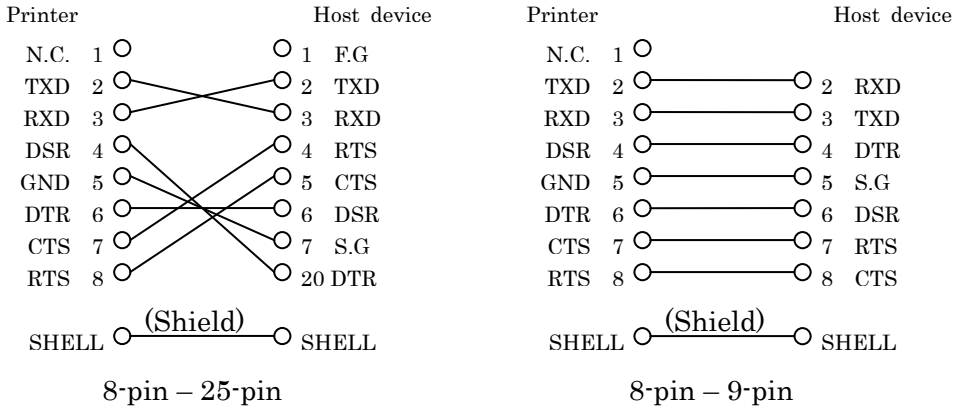
Pin No.	Name	I/O	Function
1	N.C.	-	No connection
2	TxD	O	Sends data from the printer to the host device.
3	RxD	I	Receives data from the host device. Break signal input (SPACE) resets the printer.
4	-	-	Internally connected with pin No.6.
5	GND	-	Signal ground
6	-	-	Internally connected with pin No.4.
7	CTS	I	Outputs SPACE when the host device can receive data.
8	RTS	O	Outputs SPACE when the printer can receive data.

(3) Connector



3260-8S3: HIROSE ELECTRIC CO., LTD. or equivalent

(4) Examples of connection with the host device (a standard personal computer)



(5) Data reception

- **Busy control**

  In Busy Control, RTS outputs MARK until the printer is ready to receive data after power ON. After the printer is ready, RTS outputs SPACE and the received data is input to the input buffer. When there are 33 bytes or less remaining in the input buffer, RTS outputs MARK. The host device does not transmit data during RTS outputs MARK. When the input buffer is ready to receive data (there are 65 bytes or more in the input buffer) after stopping data reception, RTS once again outputs SPACE. If an error occurs in the printer, RTS outputs MARK and inhibits data entry until the error is cleared. If an error is cleared, RTS outputs SPACE again.
  For RTS output when an error occurs, the setting is changed by Busy Output When Error Occurs at function setting.

- **Xon/Xoff control**

  In Xon/Xoff control, TXD outputs Xon code (11H) from power ON until the printer is ready to receive data. Received data is input to the input buffer. When there are 65 bytes or less remaining in the input buffer, TXD outputs Xoff code (13H). The host device does not transmit data while Xoff code is received. When the input buffer is ready to receive data (there are 129 bytes or more in the input buffer) after stopping data reception, TXD once again outputs Xon code. When this control method is selected, the RTS signal always outputs SPACE. If an error occurs in the printer, TXD outputs Xoff code and inhibits data entry until the error is cleared. When the error is cleared, TXD outputs Xon code again.
  For Xoff code transmission when an error occurs, the setting is changed by Busy Output When Error Occurs at function setting.

- **Data reception error in serial communication**

  When Parity is selected as Yes by the function setting, a '!' is printed next to data in which a parity error occurred and a '?' is printed next to data in which any other error (framing error, etc.) occurred. If a serial data reception error occurs, no error indication other than the printing of '!' and '?' is performed (for example, the ERROR lamp does not light).

(6) Data transmission

- **Busy control**

  In Busy Control, the conditions which transmit status information to the host device from the printer are as follows;
  When CTS Control of function setting sets to Enable, the printer sends data from TXD after confirming CTS status as SPACE.
  When CTS Control of function setting sets to Disable, the printer sends data from TXD regardless of the condition of the host device.

- **Xon/Xoff control**

  In Xon/Xoff control, the conditions which transmit status information to the host device from the printer is that the printer sends data from TXD regardless of the condition of the host device.

(NOTE)	**Be aware that if the transmission buffer becomes full, the printer does not print until the buffer is available.**

3.2 USB INTERFACE SPECIFICATIONS

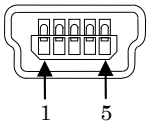
(1) General specifications

Item	Specification
USB Version	Ver 2.0 conformity
USB Printing class specification	1.1
Communication speed	Full speed（12 Mbps）
Communication protocol	Bulk transfer

(2) Pin assignment

Pin No.	Name	I/O	Function
1	Vbus	-	USB power supply
2	D-	I/O	USB data signal
3	D+	I/O	USB data signal
4	N.C.	-	No connection
5	GND	-	GND

(3) Connector



Mini B type

(4) Data reception

USB data reception uses a bulk-out transfer method.
The data are received even during the printing operation, and when the data accumulate in the input buffer by the amount of input buffer + 2 packets, the NAK response continues until amount of the input buffer becomes 129 bytes or more.
The number of bytes that can be received with one packet is maximum 64 bytes. When an error occurs, the NAK response continues until the error is cleared after receiving data of 2 packets.
For the operation when an error occurs, the setting is changed by Busy Output When Error Occurs at function setting.

(5) Data transmission

USB data transmission uses a bulk-in transfer method.
The response data are stored temporarily in the transmission buffer, and a response is made to the bulk-in packet request from the host device. If no transmission data exist, the zero length data is returned when the bulk-in request is received. The number of bytes that can be transmitted with one packet is maximum 64 bytes.

(NOTE) Be aware that if the transmission buffer becomes full, the printer does not print until the buffer is available.

3.3 INFRARED INTERFACE SPECIFICATIONS

The printer can communicate with the host device through the infrared interface.
The infrared interface used in the printer conforms to the physical layer standard (Ver 1.2) specified by the Infrared Data Association (IrDA).
The printer supports the minimum infrared transmission functions as the second station specified by IrDA and BHT-Ir protocol specified by DENSO CORPORATION.

3.3.1 Physical Specifications

Item	Specification
Transmission distance	0.2m max.
Transmission range	±15°
Infrared transmission pulse width	Typ. 1.63 μs

3.3.2 IrDA Specifications

The printer conforms to IrDA Ver.1.2 and supports only the minimum infrared transmission functions as the second station.

(1) Transmission specifications

Item	Specification
Baud Rate	9600 to 115200 bps
Data Size	64 to 512 bytes
Window Size	1
Additional BOFs	0 to 48
Maximum Turn Around Time	500ms
Minimum Turn Around Time	10ms
Link Disconnect/Threshold Time	3 to 40 s

(2) Services supported by IrLAP

1. Connect service
2. Data service
3. Disconnect service

IrLAP does not support a transfer for non-number and sniffing services.
The printer does not initiate connections.

Service Hint	Printer, IrCOMM
Device Nickname	DPU-S445

(3) Services supported by IrLMP

1. Connect service
2. Disconnect service
3. Data service

A single LSAP address does not support multiple connections. furthermore, LSAP address 7 and 9 can not share the connection state. If multiple connections are requested, a disconnect request is transmitted and the printer waits until it receives a disconnect command.

IAS server: LSAP address 0
IAS client: Not supported
Printer application: LSAP address 7 (3-wireraw/IrLPT) and address 9 (3-wire/9-wire)

(4) IAS service

IAS service is supported by 'GetValueByClass' only.
Return values for GetValueByClass inquiries are listed below.

1.

Inquiry	
Class	Device
Attribute	Device Name
Return value	
Device Name	SII Thermal Printer

2.

Inquiry	
Class	IrDA:IrCOMM
Attribute	Parameters
Return value	
Service type	3-Wireraw
Port type	Serial

3

Inquiry	
Class	IrDA:IrCOMM
Attribute	IrDA:IrLMP:LsapSel
Return value	
Lsap address	7

4.

Inquiry	
Class	IrLPT
Attribute	IrDA:IrLMP:LsapSel
Return value	
Lsap address	7

5.

Class	IrDA:IrLMP
Attribute	IrDA:IrLMP:LsapSel
Return value	
Lsap address	7

6.

Inquiry	
Class	IrDA:IrCOMM
Attribute	IrDA:TinyTP:LsapSel
Return value	
Lsap address	9

(5) TinyTP

Flow control is performed by this layer when connecting with 3-Wire or 9-Wire.
'5' is transferred to the primary station as the initial credit when connecting the LMP layer.

(6) IrCOMM

Supports 3-Wireraw, IrLPT, 3-Wire and 9-Wire.

Flow control is performed only by the IrLAP layer when connecting with 3-Wireraw or LrLPT.

Flow control is performed by the TinyTP layer when connecting with 3-Wire or 9-Wire.
Xon/off control and line status control are not supported.

(7) Command response processing during IrDA transmission

If the printer receives a command that requires transmission of data from the remote station during IrDA transmission, and then stores the data in the transmission buffer and transfers them at transmit timing to the remote station.

The printer clears a response data in the transmission buffer when transmission to the remote station is disconnected for busy state. When the remote station is in disconnection, the printer does not store the data in the transmission buffer and the data is cleared.

However the printer transfers the status regardless of the remote station state when initial automatic status transmission is enabled.
The printer transfers status when the remote station is connected again if automatic status transmission has not deactivated by power off.

(NOTE) Be aware that if the transmission buffer becomes full, the printer does not print until the buffer is available.

3.3.3 BHT-Ir Specifications

The printer also supports BHT-Ir communication specified by DENSO CORPORATION.

The printer can receive data from the 'BHT-6500' made by DENSO CORPORATION when Data Input Mode SWDIP2-1 and SWDIP2-2 is selected to BHT-Ir.
The inherent processing of the printer for BHT-Ir communication is shown below:
See BHT-Ir protocol specification for details of the protocol.

(1) ID

Printer ID: 3445H (fixed)

(2) Text format

Only text is valid.
Files with 'PD3', 'FN3' or 'EX3' extension can not be processed.

(3) Input buffer full processing when receiving header.

Upon receiving the header, the printer inhibits connection with the host device when the remaining amount of the input buffer becomes 512 bytes or less after subtracting the field number of the data text indicated in heading text.

(4) Input buffer full processing when receiving data

Upon receiving data, the printer sends WACK supervisory sequence to a host device for requiring temporarily delay of the data output from the host device as the input buffer full state when the remaining amount of the input buffer is 255 bytes or less.
Then, the printer sends the ACK supervisory sequence to the host device to restart data transmission when the remaining amount of the input buffer is 512 bytes or more.
The printer transfers the EOT supervisory sequence and stops when the input buffer full status continues more than 1 minute.

(5) Command response processing during BHT-Ir transmission

No response command is transferred in BHT-Ir transmission mode.
Although response data is generated, it is discarded.

3.4 BLUETOOTH INTERFACE SPECIFICATIONS

Bluetooth-supporting model can perform wireless communication by Bluetooth communication function. When Data Input Mode of the function setting is set to Bluetooth/USB, internal Bluetooth module of the printer operates regardless of its communication.
When using the printer at the place with radio limitations like a hospital or an airplane, set Data Input Mode of the function setting as Serial/USB or IrDA/USB to stop Bluetooth communication.

(1) General specifications

Item	Specification
Bluetooth version	2.0+EDR conformity
Transmitted electric power class	Class 2
Connection mode	Peer-to-peer
Profile	SPP
PIN code *1	None (default)
Device name *1	DPU-S445 (default)

*1: This specification can be changed by the command.

(2) Security

The printer does not set with PIN code or the Link Key in default. Bluetooth device uses security mode 1, so no encryption is used.
Bluetooth device becomes security mode 3 if PIN code is set by Set default/Set test print header command or Bluetooth Link Key selection of the function setting is set to Enable, and encryption is used.
When the setting of Bluetooth Link Key is Disable and selection of PIN code is canceled, Bluetooth device becomes security mode 1 again, and no encryption is used.

(3) Input buffer

Capacity of input buffer for internal Bluetooth module is 3Kbytes. Received data is stored in the input buffer of Bluetooth module, and then these data is to be processed after data transfer to input buffer of the printer.
If an error occurs, the printer stops receiving data after data that stored into input buffer of Bluetooth until the error is cleared.
For the operation when an error occurs, the setting is changed by Busy Output When Error Occurs at function setting.

(NOTE) Be aware that if the transmission buffer becomes full, the printer does not print until the buffer is available.

(4) Link key saving

If the Bluetooth Link Key selection of the function setting is set to Enable, the printer saves the link key to connect with the host device in the pairing process.
The host devices can be saved up to 10. When requiring to save the 11th host device, perform the pairing after clearing the saved host devices in the printer.
To clear the all of saved host device data, set the Bluetooth Link Key selection of the function setting as Disable after setting Data Input Mode of the function setting as Bluetooth. The printer clears the stored host device data after the above process.

CHAPTER 4
FUNCTION SETTINGS

4.1 FUNCTION SETTING

The communication method, a paper types, and so on can be preset in this printer.
Preset these functions before using the printer.

The function settings of the printer are stored in FLASH memory. Once these are set, these are stored until changing again.

The function settings are specified through the software DIP switch (hereinafter referred to as SWDIP switch), SWDIP1 to 4.
Details for settings of SWDIP 1 to 4 are described below. The value that is indicated by boldface and shaded cell shows a default setting value. The words in parentheses in the table are indicated in test print.

4.1.1 Function Settings(SWDIP1)

Table 4-1 Function Settings (SWDIP1)

SWDIP	Function	Value	
		0	**1**
1-8	Data Control	Xon/Xoff	**Busy**
1-7	Stop Bit	2 bits	**1 bit**
1-6	Parity	See table below	
1-5			
1-4	Bit Length	7 bits	**8 bits**
1-3	Baud Rate	See table below	
1-2			
1-1			

- **Data Control selection**

  Select flow control in serial communication as BUSY (hardware) control or Xon/Xoff control.
  In BUSY control, flow control is performed using RTS signal in the printer.
  In Xon/Xoff control, flow control is performed using codes of Xon(11H) or Xoff(13H) from the printer.

- **Stop Bit selection**

  Select Stop Bit in serial communication as 1 bit or 2 bits.

- **Parity selection**

  Select Parity in serial communication as Even, Odd or None.

Parity	SWDIP1-6	SWDIP1-5
None	**0**	**0**
Odd	0	1
None	1	0
Even	1	1

- **Bit Length selection**

  Select Bit Length in serial communication as 8 or 7 bits.

- **Baud Rate selection**

  Select Baud Rate of communications as Serial and BHT-Ir.

Baud Rate	SWDIP1-3	SWDIP1-2	SWDIP1-1
1200 *1	0	0	0
2400	0	0	1
4800 *1	0	1	0
9600	0	1	1
19200	1	0	0
38400	1	0	1
57600	1	1	0
115200	**1**	**1**	**1**

*1 This setting is enabled only when Serial is selected as the communication mode.
When BHT-Ir is selected as the communication mode, the baud rate is set to 2400 bps automatically.

4.1.2 Function Settings(SWDIP2)

Table 4-2 Function Settings (SWDIP2)

SWDIP	Function	Value	
		0	**1**
2-8	Auto Status Output	Enable	**Disable**
2-7	Kanji Code	Shift-JIS Code	**JIS Code**
2-6	Font Size	16 dots	**24 dots**
2-5	Auto Power Off	Enable	**Disable**
2-4	Character Set	IBM Compatible	**ANK**
2-3	Auto Loading	Disable	**Enable**
2-2	Data Input Mode	See below	
2-1			

- **Auto Status Output selection**

  When Auto Status Output selection sets to Enable, the printer sends printer status to the host device every one second.
  Refer to the descriptions of Automatic Status Response (DC2 'e') command for the code to be sent. Moreover, refer to 6.7 INITIAL AUTOMATIC STATUS TRANSMISSION for more details.

(NOTE) When this function set to Enable, the printer keeps on storing data into the transmission buffer if the printer status is not received.
The condition of the transmission buffer as buffer full may not work because status data can not be created. Note that the printer does not perform printing processing until the transmission buffer full is cleared.

- **Kanji Code selection**

  Select Kanji Code in default as JIS Code or Shift-JIS Code. This setting can be changed by Select Kanji Code System (FS 'C') command (6.5.11 Kanji Character Set Selection commands).

- **Font Size selection**

  Select Font Size in default as 16 or 24 dots. This setting can be changed by Select Character Font Size (DC2 'F') command (6.5.24 Character Set Command).

- **Auto Power Off selection**

  When Auto Power Off selection sets to Enable, the printer turns itself off after passing a set time. This setting can be changed by Set default/Set test print header (DC2 'i') command (6.5.25 Auxiliary Function Commands). The default value is 30 minutes.

- **Character Set selection**

  Select Character Set as IBM compatible or ANK. This setting can be changed by Select character code table (ESC 't') command. See Appendix A CHARACTER CODE for character code.

- **Auto Loading selection**

  When Auto Loading selection sets to Enable, the printer detects the thermal paper inserted from the paper slot and loads that automatically.

- **Data Input Mode selection**

  Select the communication method. Refer to CHAPTER 3 INTERFACE for more detail.

Data Input Mode	SWDIP2-2	SWDIP2-1
BHT-Ir/USB	0	0
Serial/USB	**0**	**1**
IrDA/USB	1	0
Bluetooth/USB *1	1	1

*1 This setting is enabled for Bluetooth-supporting model only.
Bluetooth-supporting model is shipped with this setting value (Bluetooth/USB).

4.1.3 Function Settings(SWDIP3)

Table 4-3 Function Settings (SWDIP3)

SWDIP	Function	Value	
		0	**1**
3-8	Reserved	Fix to 1	
3-7	Print Density	See table below	
3-6			
3-5	Paper Select	See table below	
3-4			
3-3			
3-2	Paper Mode	See table below	
3-1			

- **Print Density selection**

  Normally, select the print density as 100%.

Print Density	SWDIP3-7	SWDIP3-6
95%	0	0
100%	**0**	**1**
105%	1	0
110%	1	1

(NOTE) If too much energy is applied to the thermal head, it would shorten its life span and cause the paper feed problem. Set an accurate thermal paper selection and print density.
If selecting the thermal paper that is different from the one specified in the thermal paper selection or in case of not setting the print density in 100%, verify the performance with your actual device before printing.

- **Thermal Paper selection**

  Select the thermal paper by Paper Select.

Paper Select	SWDIP3-5	SWDIP3-4	SWDIP3-3
PD160R-N	0	0	0
TC98KS-LH	0	0	1
P350	0	1	0
Reserved	0	1	1
KT55F20	1	0	0
TF8067	1	0	1
TL69KS-HW76B	1	1	0
TF50KS-E2D (TP-341L-1)	**1**	**1**	**1**

- **Paper Mode selection**

  Select Paper Mode as the thermal paper in use.

Paper Mode	SWDIP3-2	SWDIP3-1
Cut Paper	0	0
Roll Paper	**0**	**1**
Mark Roll Paper	1	0
Reserved	1	1

(1) Cut Paper mode

This mode assumes that to print the thermal paper which be cut by a certain fixed length. The paper should be printed the mark on back side to detect paper position when loading the paper automatically. Refer to 2.2 SPECIFIED THERMAL PAPER SPECIFICATION for the paper dimensions.

(a) Auto loading operation

In this mode, the printer feeds the thermal paper to the set value by detecting the paper mark after loading the thermal paper from the paper slot, and then becomes print-ready status.
When the mark for detection is not printed on the back side, the printer stops as an error status after feeding the thermal paper up to paper length which is set. At this time, the printer is in the state waiting for error release by pressing the FEED switch. When the FEED switch is pressed, the thermal paper is fed one dot line and the printer goes print-ready status.
Amount of paper feed can be set by Set Default/Set Test Print Header (DC2 'i') command. The default is 50 mm.

(b) Process of out-of-paper detection

The printer processes the error operation by lighting the lamp if out-of-paper error detected.

(2) Roll Paper mode

This mode assumes that to print the thermal paper roll.

(a) Process of out-of-paper detection

The printer processes the error operation by lighting the lamp if out-of-paper error detected.

(3) Mark Roll Paper mode

This mode assumes that to print the thermal paper roll with the printed mark at regular intervals on the back side which to detect paper position. Refer to 2.2 SPECIFIED THERMAL PAPER SPECIFICATION for the paper roll dimensions.

(a) Operation of paper detection

In this mode, the printer determines the status as the out-of-paper error by feeding the thermal paper 10mm or longer, if it is less than 10mm, the printer determines the status as the mark and does not detect the out-of-paper error.

4.1.4 Function Settings(SWDIP4)

Table 4-4 Function Settings (SWDIP4)

SWDIP	Function	Value	
		0	**1**
4-8	Bluetooth Link Key Selection (Bluetooth Link Key)	Enable	**Disable**
4-7	Reserved	Fix to 1	
4-6	Busy Output When Error Occurs (Error)	Unbusy	**Busy**
4-5	Mark Position Correct	Enable	**Disable**
4-4	Bluetooth Baud Rate	See below	
4-3			
4-2	CTS Control	**Enable**	Disable
4-1	Auto Activation by AC	**Enable**	Disable

- **Bluetooth Link Key Selection**

  This function is set to Enable, the printer saves the link key from the host device to connect in the pairing process. When once a pairing is performed for the host device, the printer can connect to the host device using the link key from the next time without a pairing.
  If this function is set to Enable and PIN code is not specified in advance, the printer processes PIN code as '0000'.

- **Busy Output When Error Occurs**

  This function can select whether data reception becomes busy status or not when an error occurs. If this function is disabled, data reception does not become busy status while an error occurs and data reception is available.
  However, regardless of this setting if receiving buffer becomes full, data reception turns to busy status.

- **Mark Position Correct selection**

  When Mark Position Correct selection sets to Enable and Paper Mode SWDIP3-1 to 3-2 is selected to Mark Roll Paper, the printer feeds the paper roll in backward as following conditions:

  - Beginning of a printing right after power-on or resetting.
  - Beginning of a printing right after performance paper home feed by FEED switch or page feed execution.

  To use this function, there are several restrictions. Refer to 2.2 SPECIFIED THERMAL PAPER SPECIFICATION.

- **Bluetooth Baud Rate selection**

  Select Bluetooth Baud Rate in Bluetooth communication. Usually, select Bluetooth baud rate to 230400bps.

Bluetooth Baud Rate	SWDIP4-4	SWDIP4-3
230400 bps	0	0
57600 bps	0	1
115200 bps	1	0
230400 bps	**1**	**1**

- **CTS Control selection**

  When CTS Control selection sets to Enable and Data Control SWDIP1-8 is selected to Busy, the printer transmits data after identifying CTS of the host device as SPACE.
  When CTS Control selection sets to Disable or selecting serial communication as Xon/Xoff control, the printer transmits data regardless of status of the host device.

- **Auto Activation by AC selection**

  When Auto Activation by AC selection sets to Enable, the printer turns the power on after plugging specified AC adapter to the outlet.

4.1.5 Function Settings by Switch Operation

A function setting can be performed by switch operation.
Use the function settings by switch operation in the function settings mode of the printer.
Operate the following procedures to enter the printer to the function settings mode.

(a) Be sure that the thermal paper is set to the printer and the printer is turned off. If the thermal paper is not set, set the thermal paper to the printer.

- **Hint**
    - When an error occurs during the function settings mode, the printer exits the function setting mode and returns to the power off after blinking the POWER and ERROR lamps. Therefore, the function setting mode exits the function setting mode if out-of-paper error occurs in settings. So set the thermal paper of length enough to prevent from occurring an error.

(b) Press the POWER switch and the FEED switch on the printer at the same time until the POWER lamp and ERROR lamp light.
Keep on pressing the POWER and FEED switches until two lamps blink in six seconds, and then release the POWER and FEED switches immediately.

(c) When the following message is printed, press the FEED switch.

Select Function Setting Mode: Feed SW / HEX Dump Mode: Power SW

- **Hint**
    - When the POWER switch is pressed at this time, the printer becomes in HEX dump mode.
    - If you do not press any switch within 30 seconds after a message is printed, the printer turns off.
    - When the POWER and ERROR lamps start to blink, release your finger from the POWER and ERROR switches within 5 seconds. If it is ongoing, the printer exits function setting mode. In such a case, turn the power off and try the procedure from (1) again.

(d) When the following message is printed, press the FEED switch.

[SETTING MODE] Yes: Feed SW / No: Power SW

- **Hint**
    - If the POWER switch pressed, the printer exits the function setting mode and turns the power off.
    - If you do not press any switch within 30 seconds after a message is printed, the printer turns off.

The printer becomes in the function settings mode and becomes in the state of waiting for switch operation.

In the function setting mode, you can initialize or modify settings. To set the settings to defaults, perform operation (1). To change settings, perform operation (2).

(1) Initializing SWDIP switch settings

(a) When the following message is printed in the function setting mode, press the FEED switch.

```
Load Default Setting? Yes: Feed SW / No: Power SW
```

(b) When the following message is printed, the printer turns off.
The settings are set to defaults. Initialization is complete.

```
Default Setting Saved.
Setting Mode Finished.
```

(2) Changing SWDIP switch settings

(a) When the following message is printed in the function setting mode, press the POWER switch.

```
Load Default Setting? Yes: Feed SW / No: Power SW
```

- **Hint**
  - There are SWDIP switches from 1 to 4 in the printer, so set 8 bits within SWDIP switches respectively.
  - In function setting mode, the POWER lamp blinks once by pressing either the POWER switch or the FEED switch. Be sure to confirm the POWER lamp blinking in order to ensure proper operation.

Operation 1: SWDIP switch selection

(a) If pressing the FEED switch after printing the message shown below, the function setting shifts (operation 2).
If pressing the POWER switch instead of the FEED switch, the details of the printed SWDIP switch (SWDIP switch 1) are not changed, and the next SWDIP switch is selected (operation 1).

DIP Switch setting mode. DIP SW-1=******** Change Setting? Yes: Feed SW / No: Power SW

- **Hint**
  - "********" in the message indicates the setting of the SWDIP switch. The leftmost bit is the most significant bit (SWDIP*-8) and the rightmost bit is the least significant bit (SWDIP*-1).
  - If SWDIP switches 1 to 4 are skipped, the function setting mode can be terminated (operation 3).

Operation 2: SWDIP switch setting

(a) When the message shown at the following is printed, set the bits from the most significant bit (SWDIP*-8) to the least significant bit (SWDIP*-1).

Input 8 bits. 1: Feed SW / 0: Power SW

To set 1: Press the FEED switch.
To set 0: Press the POWER switch.
For example, to set 10101110, press the switches in the following sequence:
FEED, POWER, FEED, POWER, FEED, FEED, FEED, FEED, POWER.

(b) When the switches are pressed eight times (for eight bits), the following message is printed.

DIP SW-1=********” Save Setting? Yes: Feed SW / No: Power SW

When the FEED switch is pressed, the message shown at the following is printed, and the setting is saved.

DIP SW-1=******** Saved.

When pressing the POWER switch instead of the FEED switch, the message shown at the following is printed and the setting is not changed.

DIP SW-1 Not Changed.

After this operation, the function setting shifts next SWDIP switch (operation 1). After setting SWDIP switch 4, the setting function exits setting mode (operation 3).

Operation 3: Exiting function setting mode

(a) If pressing the FEED switch after printing the message shown below, the function setting shifts (operation 1).

DIP Switch setting mode. Continue: Feed SW / Quit: Power SW

If pressing the POWER switch after printing the message shown below, the printer exits the function setting mode and turns off. The function setting is now complete.

Setting Mode Finished.

4.1.6 Function Settings by Commands

The command is transmitted to the printer by selected communication.

For details of commands, refer to Function Settings (DC2 ‘k’) command (“6.5.25 Auxiliary Function Commands”).

4.2 TEST PRINT

The printer has a test print function that prints the contents of Function Settings and character strings for test.

(a) Be sure that the thermal paper is set to the printer and the printer is turned off. If the thermal paper is not set, set the thermal paper to the printer.

(b) Press the POWER switch and the FEED switch on the printer at the same time until the POWER lamp lights, release the POWER switch first and then the FEED switch second.

(c) The test print is performed.

(d) The printer goes to print-ready status after test printing is completed.

4.3 HEX DUMP MODE

This function can be used to check whether the host device transmits data to the printer correctly. Perform the following steps.

(a) Be sure that the thermal paper is installed to the printer and the printer is turned off.

(b) Keep on pressing the POWER and FEED switches in six seconds.

(c) Release the POWER and FEED switches after blinking the POWER and ERROR lamps.

(d) Press the POWER switch after printing the message below.

```
Select Function
Setting Mode: Feed SW / HEX Dump Mode: Power SW
```

(e) After printing the message below, the printer enters a HEX dump mode.

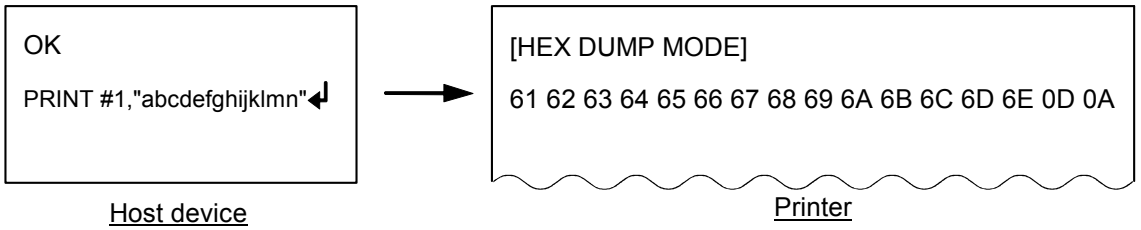
```
[HEX DUMP MODE]
```

The example of printing using BASIC is shown below:

Input data from host computer. The data input through the printer interface is printed as hexadecimal code, 16 bytes at a time. If the input buffer contains less than 16 bytes of data, it is printed when the FEED switch is pressed.

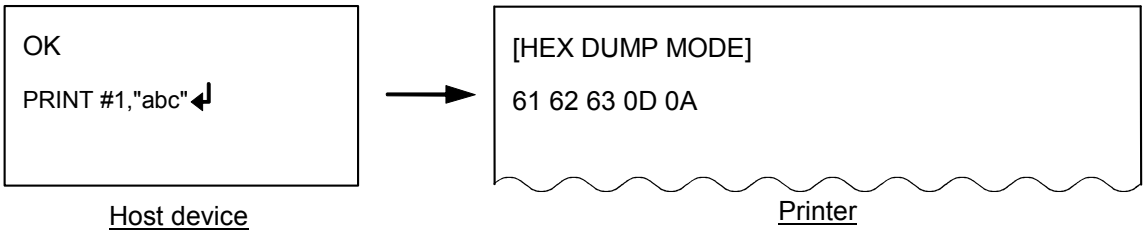
16 bytes

Input PRINT#1,"abcdefghijklmn" to the host computer and press the Return key.
The printer prints 'abcdefghijklmn' in hexadecimal number and two control codes (0DH and 0AH).



Less than 16 bytes

Input PRINT#1,"abc" to the host computer, press the Return key, and then press the FEED switch.
The printer prints 'abc' in hexadecimal number and two control codes (0DH and 0AH).



(f) Press the POWER switch to exit the HEX dump printing.

- **Hint**
  - Some BASIC use a PR# statement instead of PRINT#. Refer to the computer manual for details on BASIC.

CHAPTER 5
LAMP DISPLAY AND SWITCH FUNCTION

This chapter explains printer status by lamp display and functions of switches.

5.1 PRINTER STATE LAMP DISPLAY

Table 5-1 lists states of the printer, display that by two lamps (POWER and ERROR lamps).

Table 5-1 Printer Status Signals

Printer status	Error	Display	
		POWER	ERROR
Power OFF	—	Off	Off
Power ON (Print-ready)	—	On	Off
Initializing	—	On	On
Out-of-paper error	Thermal paper is not inserted	On	Blink
Paper cover open error	Paper cover is opened	On	Blink twice
Battery low, power failure	Power supply voltage is out of the stipulated range *1	Blink	On
Thermal head temperature error	Thermal head temperature is out of the stipulated range *2	Blink twice	On
Recharging	Battery pack is recharging	Blink	Off
Function setting mode	Mode where function settings can be set	Off	On
Function setting mode shifting	—	Blink	Blink
FLASH memory accessing	FLASH memory is operating	Short blink	Short blink
Hardware error	Error occurs in hardware	Off	Blink

*1: Range of stipulated power supply voltage is 6.5V≦power supply voltage ≦9.7V
*2: Range of stipulated temperature is -10°C≦ head temperature ≦80°C

Display Pattern ○: On, —: Off

Items	Pattern
Blink	— ○ — ○ — ○ — .....
Short blink	○—○—○—○—○—○—○—○—○—○—○.....
Blink twice	○—○ — ○—○ — ○—○ — .....

5.2 ERROR RECOVERY PROCEDURE

When an error occurs, the printer stops printing operation. Moreover, when Busy Output When Error Occurs is enabled in the Function Settings, the status of data reception becomes busy.
However, Some errors can be recovered to a status just before a printing stop after clearing errors.
Error recovery procedure is shown below.
In this case, the printer resumes the printing from next line or next dot line a print stopped.

Table 5-2 Error Recovery Procedure

Item	Recovery Procedure
Out-of-paper	Cut Paper mode: Insert the thermal paper from the paper slot, the printer loads the thermal paper automatically and returns to print-ready status if the mark is detected. When the mark is not detected, press the FEED switch to recover to print-ready status [*1]. Roll Paper / Mark Roll Paper mode: Open the paper cover and replace the thermal paper. Close the paper cover, so the printer returns to print-ready status automatically one second later.
Paper cover open	Close the paper cover, so the printer returns to print-ready status automatically one second later.
Thermal head temperature error	The printer returns to print-ready status automatically if thermal head temperature becomes within the stipulated range. [*2]
Power failure	Return the power supply voltage to the stipulated range, and then press the FEED switch. [*1] [*3]
Hardware error	Non-recoverable error

*1: In this case, paper feed operation is performed.
*2: Range of stipulated temperature is -5°C≦ head temperature ≦75°C
*3: Range of stipulated power supply voltage is 6.5V≦power supply voltage ≦9.7V

5.3 POWER SWITCH

Turning ON / OFF the printer and changing the mode to the print-ready can be performed by the POWER switch.

(NOTE)	**Always use the POWER switch to turn off the printer. Do not power off the printer by removing the AC adapter or the battery pack. If doing so, the memory may be damaged.**

5.4 FEED SWITCH

The paper can be fed by the FEED switch.
The action differs depending upon SWDIP3-1 to 3-2 of the function settings.

- **Cut Paper / Roll Paper mode**

  The printer feeds a small amount of thermal paper by pressing this switch once and the switch is held down, the thermal paper is fed continuously.

- **Mark Roll Paper mode**

  The printer feeds the paper until paper mark detection by pressing this switch once.
  The printer stops its operation if the printer does not detect the mark after feeding the thermal paper up to paper length which is set.
  The amount of maximum paper length to mark detection can be set by Set default/Set test print header (DC2 'i') command (6.5.25 Auxiliary Function Commands). The default value is 300 mm.

The printer does not feed the thermal paper if pressing FEED switch in the following case.

- When the paper cover opens
- When power supply voltage is larger than 9.7V.
- When the printer is in the download mode. (For the download mode, refer to 6.5.26 Download Mode)

CHAPTER 6
COMMAND DESCRIPTIONS

This chapter describes the functions of the commands supported by the printer.

6.1 THE SUMMARY OF COMMAND FUNCTION

The printer supports the ESC/P based commands.

Table 6-1 Command Summary (1/4)

Command	Function	Page
ESC 'C'	Set Page Length at n Lines	6-19
ESC 'C' 0	Set Page Length at n Inches	6-19
ESC 'N'	Set Bottom Margin	6-19
ESC 'O'	Cancel Bottom Margin	6-20
ESC 'Q'	Set Right Margin	6-20
ESC 'l'	Set Left Margin	6-21
ESC '0'	Set 1/8-inch Line Spacing	6-23
ESC '2'	Set 1/6-inch Line Spacing	6-23
ESC '3'	Set n-dot-line Line Spacing	6-23
ESC 'B'	Set Vertical Tab Positions	6-25
ESC 'D'	Set Horizontal Tab Positions	6-26
CR	Print and Carriage Return	6-27
LF	Print and Line Feed	6-27
FF	Page Feed (Form Feed)	6-27
ESC 'J'	Print and Feed Paper	6-28
GS '<'	Marked Paper Form Feed	6-28
HT	Execute Horizontal Tab	6-29
VT	Execute Vertical Tab	6-29
ESC '$'	Set Absolute Position	6-29
ESC '\'	Set Relative Position	6-29

Table 6-1 Command Summary (2/4)

Command	Function	Page
ESC 'R'	Select International Character	6-31
ESC 't'	Select Character Code Table	6-31
DC2 'y'	Euro Character Specify	6-32
ESC '%'	Set/Cancel Download Character Set	6-34
ESC '&'	Define Download Characters	6-34
DC2 'D'	Download Characters Area Operation	6-35
SO	Select Expanded Character Mode with Automatic Cancellation	6-36
DC4	Cancel Expanded Character Mode with Automatic Cancellation	6-36
ESC 'W'	Select/Cancel Expanded Character Mode	6-36
ESC 'w'	Select/Cancel Double Height Mode	6-36
ESC 'E'	Select Emphasized Print Mode	6-36
ESC 'F'	Cancel Emphasized Print Mode	6-37
ESC 'G'	Select Double Print Mode	6-37
ESC 'H'	Cancel Double Print Mode	6-37
ESC '-'	Select/Cancel Underline Mode	6-37
ESC '!'	Set Print Mode	6-38
DC2 'Y'	Character Rotation	6-39
ESC SP	Set Character Spacing	6-40
FS '&'	Select Kanji Mode	6-43
FS '.'	Cancel Kanji Mode	6-43
FS 'C'	Select Kanji Code System	6-43
FS 'r'	Select Kanji Quarter Size Character Mode	6-44
FS DC2	Cancel Kanji Quarter Size Character Mode	6-44
FS '2'	Define User-defined Character	6-45
DC2 'G'	User-defined Character Area Operation	6-46
FS 'J'	Select Vertical Writing	6-47
FS 'K'	Select Horizontal Writing	6-47
FS 'W'	Select/Cancel Quadruple-size Kanji Character	6-47
FS '-'	Select/Cancel Kanji Underline Mode	6-48
FS '!'	Set Kanji Print Mode	6-49
FS 'S'	Set Kanji Left- and Right-side Spacing	6-50
ESC '*'	Set Bit Image Mode	6-53
GS 'v' '0'	Raster Bit Image Print	6-55
DC2 'T'	Stamp Define	6-58
DC2 'S'	Stamp Select	6-59
DC2 'V'	Stamp Print Out	6-59
DC2 'W'	Stamp Abort	6-59
DC2 'U'	Stamp Clear	6-59
CAN	Cancel Print Data in Buffer	6-61

Table 6-1 Command Summary (3/4)

Command	Function	Page
DC3 '+	Ruler Line ON	6-62
DC3 '-'	Ruler Line OFF	6-62
DC3 'A'	Ruler Line Buffer A	6-62
DC3 'B'	Ruler Line Buffer B	6-62
DC3 'C'	Ruler Line Buffer Clear	6-63
DC3 'D'	Define Ruler Line by Dot	6-63
DC3 'F'	Define Ruler Line with Repeating Patterns	6-63
DC3 'L'	Define Ruler Line by Line	6-63
DC3 'V'	Ruler Line LSB/MSB Image	6-64
DC3 'P'	Print One dot Line after Printing Line Buffer Data	6-64
DC3 '('	Continuous Ruler Line Command Input	6-64
DC2 'P'	Define Optional Font	6-66
DC2 'O'	Select Optional Font	6-67
DC2 'Q'	Erase Optional Font	6-67
GS 'H'	Select HRI Character Print Position	6-69
GS 'f'	Select HRI Character Font	6-69
GS 'h'	Set Bar Code Height	6-69
GS 'k'	Print Bar Code	6-70
GS 'w'	Set Width of Bar Code	6-72
GS 'P'	Set Bar Code Print Position	6-72
GS 'n'	Nominal Fine Element Width	6-72
GS 'o'	PDF Row Height	6-73
GS 'p' 0	PDF417 Print	6-73
DC2 ';'	QR Code and Data Matrix Module Sizes	6-74
GS 'p' 1	QR Code Print	6-74
GS 'p' 2	Data Matrix Print	6-75
GS 'p' 3	Maxi Code Print	6-76
DC2 'E' 0	Set Routine Format	6-83
DC2 'E' 1	Set Routine Parameter Data	6-85
DC2 'E' 2	Execute Routine Format	6-86
DC2 'E' 3	Delete All Routine Data	6-86
DC2 'z' 0	Page Mode Select	6-88
DC2 'z' 1	Page Mode Print	6-89
DC2 'z' 2	Page Mode Vertical Position Specify	6-89
DC2 'z' 4	Page Mode Data Registration	6-89
DC2 'z' 5	Page Mode Data Calling	6-89

Table 6-1 Command Summary (4/4)

Command	Function	Page
DC2 '$' '1'	Rectangle Print	6-90
DC2 '$' '2'	Line Type Property	6-91
DC2 '$' '3'	Line Width Property	6-91
DC2 '$' '4'	Fill Property	6-91
DC2 'e'	Enable/Disable Automatic Status Transmission	6-93
DC2 'r'	Send Remaining Memory Capacity	6-93
DC2 'v'	Send V_P Voltage	6-94
DC2 'q'	Send External RAM Checksum	6-94
DC2 'l'	Send SWDIP Switch Settings	6-94
DC2 'j'	Execute Response Request	6-95
DC2 'F'	Select Character Font Size	6-97
DC2 '!'	Select Paper	6-99
DC2 '~'	Select Print Density	6-99
GS 'E'	Motor Speed Select	6-100
DC2 'a'	Set Automatic Power-off Time	6-100
DC2 '#'	Select Overlap Mode	6-100
DC2 '='	Select Image LSB/MSB	6-101
GS 'g' '0'	Maintenance Counter Initialization	6-102
GS 'g' '1'	Maintenance Counter Preservation	6-102
GS 'g' '2'	Maintenance Counter Transmission	6-103
DC2 '{'	User Area Data Registration/Clears	6-104
DC2 '*' '1'	User Area Defragment	6-104
DC2 '*' '2'	Remaining User Area Response	6-104
DC2 'R'	User Area Initialization	6-105
ESC '@'	Initialize Printer	6-105
DC2 's' 't' 'p'	Power Off	6-105
DC2 'k'	Function Settings	6-107
DC2 'i'	Set Default/Set Test Print Header	6-108
DC2 DC2	Download Mode Selection	6-111
'@'	Hardware Reset	6-111
','	Area of 2-byte Character Download	6-111
'{'	Data Structure of a 2-byte Character	6-115

6.2 FUNCTION CODES

One of the following control codes is attached to the beginning of each command. These control codes are also called function codes.

HT(09H), LF(0AH), VT(0BH), FF(0CH), CR(0DH), SO(0EH), DC2(12H), DC3(13H), DC4(14H), CAN(18H), ESC(1BH), FS(1CH), GS(1DH)

Function codes may or may not have parameters or image data.

The number of bytes per command differs based on the type of command. Some commands are only 1 byte long, while some are up to several hundred bytes in length.

6.3 CHARACTER CODES

This section describes character codes.

The character code range and User-defined character codes are different depending on JIS code system or Shift JIS code system which is selected with the Kanji Code System Select command (FS 'C').

6.3.1 JIS Code System

When the JIS Code System is selected with the Kanji Code System Select command (FS ‘C’), Kanji characters can be printed using 2-byte character codes after Kanji mode is selected with the Kanji Mode Specify command (FS '&').

The command functions as 1-byte character code or the first or second byte of 2-byte character code.
If a command is input in 2-byte character codes, the next data is always processed as the first byte. However, the next data is 1-byte character code for Cancel Kanji Mode, FS '.'.
If a command is input as the second byte of 2-byte character code, the first byte is ignored.

(1) 1-byte character codes

00H - 1FH:	Commands are processed as commands.
20H - 7EH:	The codes are processed as 1-byte character code.
7FH:	Ignored (except that when 7FH is defined as downloaded character and download character operation is effective).
80H - FEH:	The codes are processed as 1-byte character code.
FFH:	It differs from each character set. If the extended graphics character set or the katakana character set are selected, they are ignored. If the Codepage 1252 is selected, it is processed as the character code.

(2) 2-byte character codes
2-byte character codes specify Kanji characters, Kanji quarter size characters or User-defined characters.

- First byte

00H:	1-byte character area in Kanji ROM. Specify the 1-byte character in the Kanji ROM with the next data of 00H.
21H - 76H:	2-byte character area.
77H:	User-defined character area.
78H - 7EH:	2-byte character area.

If the codes other than the above are not commands, these codes are ignored.
The next data to be received is processed as the first byte.

- Second byte

(If the first byte is 00H)

20H - 7EH:	The codes are processed as 1-byte character in the Kanji ROM.
80H - FEH:	The codes are processed as 1-byte character in the Kanji ROM.
FFH:	It differs from each character set. If the extended graphics character set or the katakana character set are selected, they are ignored with the first byte. If the Codepage 1252 is selected, it is processed as the character code.

(If the first byte is not 00H)

21H - 7EH:	The codes are processed as the second byte of Kanji characters or user-defined characters.

If the codes other than the above are not commands, these codes are ignored with the first byte. The next data to be received is processed as the first byte.
The codes not defined as JIS or special characters in the 2-byte character area are processed as 2-byte character spaces.

Printed 2-byte character code conforms to JIS X 0208-1997.

(3) 2-byte character codes when mounting Korean character

2-byte character codes specify Korean or User-defined characters.

- First byte

00H:	1-byte character area. Specify the 1-byte character with the next data of 00H.
77H:	User-defined character area.
A1H - FDH:	Korean character area.

The other codes are ignored unless they are commands.
The next data to be received is processed as the first byte.

- Second byte

(If the first byte is 00H)

20H - 7EH:	The codes are processed as 1-byte character.
80H - FEH:	The codes are processed as 1-byte character.
FFH:	It differs from each character set. If the extended graphics character set or the katakana character set are selected, they are ignored with the first byte. If the Codepage 1252 is selected, it is processed as the character code.

(If the first byte is 77H)

21H - 7EH:	The codes are processed as the second byte of user-defined characters.

(If the first byte is A1H to FDH)

A1H - FEH: The codes are processed as the second byte of Korean.

The other codes are ignored unless they are commands.
The next data to be received is processed as the first byte.

6.3.2 Shift JIS Code System

If the Shift JIS Code System is selected with the Kanji Code System Select command, Kanji characters can be printed with 2-byte character codes without entering the Kanji Mode Specify command.
The command functions as 1-byte character code or the second byte of 2-byte character code.
If a command is input for the second byte of 2-byte character code, the first byte is ignored.

(1) 1-byte character codes

00H - 1FH:	Commands are processed as commands.
20H - 7EH:	The codes are processed as 1-byte character code.
7FH:	Ignored (except that when 7FH is defined as downloaded character and download character operation is effective).
80H - FEH:	See (2).
FFH:	It differs from each character set. If the extended graphics character set or the katakana character set are selected, they are ignored with the first byte. If the Codepage 1252 is selected, it is processed as the character code.

(2) 2-byte character codes

2-byte character codes specify Kanji and User-defined characters.

- First byte

81H - 9FH:	2-byte character area.
E0H - EBH:	2-byte character area.
ECH:	User-defined character area.
EDH - EFH:	2-byte character area.

The other codes 80H - FEH are processed as 1 byte characters.

- Second byte

40H - 7EH:	The codes are processed as the second byte of Shift JIS code or user defined character.
80H - FCH:	The codes are processed as the second byte of Shift JIS code or user defined character.

If the codes other than the above are not commands, these codes are ignored with the first byte.

The codes not defined as Shift JIS or special characters in the 2-byte character area are processed as 2-byte character spaces.

(3) 2-byte character codes when mounting Korean character

2-byte character codes specify Korean or User-defined characters.

- First byte

A0H: User-defined character area.
A1H - FDH: Korean characters area when selecting Korean.

The other codes are ignored unless they are commands.
The next data to be received is processed as the first byte.

- Second byte
(If the first byte is A0H)

A1H - FEH: The codes are processed as the second byte of user-defined characters.

(If the first byte is A1H-FDH)

A1H - FEH: The codes are processed as the second byte of Korean.

The other codes are ignored unless they are commands.
The next data to be received is processed as the first byte.

6.4 MEMORY

Check remaining memory size when using optional fonts, routine command or stamp. Refer to this section to use those functions.

6.4.1 Extended RAM Memory

(1) Memory area

The printer has 232280 bytes of memory for User-defined characters, downloaded characters, optional fonts, routine command and stamp.
Set or clear memory area for each function.
Setting of the memory area means to create a partition for certain function exclusively.
Clearing the memory area means to remove a partition for a certain function.

Usually users do not need to check it, however, make sure that the required memory does not exceed the remaining memory size when using optional fonts, routine command, and stamp.
The following memory sizes shown in Table 6-2 are set right after initialization.

Table 6-2 Memory Sizes Right After Initialization

Uses	Memory size (bytes)	Availability of clear
User-defined characters	9784	Available
Download characters	6248	Available
Optional fonts	0	Available
Routine command (DC2 'E')	0	Available
Stamp	0	Available

Memory area of User-defined characters and downloaded characters are set in initialization.
Memory area can be cleared by a command and can be increased for optional fonts, routine command or stamp.
When registering optional fonts, routine command or stamp, always check the remaining memory size.
Registering data that exceeds the remaining memory size is ignored.
When setting optional fonts, fixed size format or fixed size parameters, memory area is set automatically by command input.

When setting memory area, memory control information is always added to the head of the memory area.
Number of bytes for memory control information differs according to each function. The number of bytes for used for memory control information is shown in Table 6-3.

Table 6-3 Number of Bytes for Memory Control Information

Uses	Number of bytes
User-defined characters	8
Downloaded characters	8
Optional fonts	12
Routine command (DC2 'E')	10
Stamp	11

(2) Capacity of memory size

Allocated memory size depend on used function. User-defined character and downloaded character is allocated size of 9784 and 6248 bytes respectively. Optional fonts, routine function or stamp is allocated size of (number of data + Memory control Information). Moreover, registration of routine function and stamp requires the above-mentioned size per registration data.

(3) Precautions for stamp function

Do not use the commands such as which to be allocated or freed as listed below during stamp operation.

Table 6-4 Commands for Allocating or Freeing Memory Area

Command	Command name
DC2 'T'	Stamp Define
DC2 'U'	Stamp Clear
DC2 'P'	Define optional font
DC2 'Q'	Erase optional font
DC2 'E' 0	Set routine format
DC2 'E' 1	Set routine parameter data
DC2 'E' 3	Delete all routine data
DC2 'z' 0	Page Mode Select
DC2 'D'	Download characters area operation
DC2 'G'	User-defined character area operation
DC2 'R'	User Area Initialization

If the commands listed in Table 6-4 are input during selection of the stamp, the stamp selection is canceled.

(4) Initialization of memory

The printer does not erase the content of the memory using the AC adapter or the battery pack with active voltage even if Reset command or Power off command is input or the printer is turned the power off. However, the printer initializes the memory during its next start-up when disconnecting the power supply or executing the User Area Initialization command.

(5) Memory usage at two-dimensional bar code function

At two-dimensional bar code print, empty area of the external RAM is used temporarily at bar code print. The two-dimensional bar code printing performs depending on their parameter, available memory capacity and settable data size as described below:

- When the parameter of the command is outside the range:
  CPU ignores the part outside and processes the remaining data as character codes.

- When the available memory capacity is short:
  All of data is processed as normal code.

- When the command is normal and memory area has been allocated but the data more than maximum data size is specified:
  All of the data is discarded. Since settable data size varies depending on the type of two-dimensional bar codes, refer to each explanation of two-dimensional bar code commands. Moreover, note that settable data size changes in accordance with the value of specified parameter.

- When the command is normal and memory area has been allocated, but the bar code cannot be printed within printable area:
  The command is ignored.

- When the command is normal, memory area has been allocated and the bar code can be printed within printable area:
  The two-dimensional bar code is printed.

The necessary empty capacity differs according to types and sizes of bar codes.

(a) Used Memory Capacity of PDF417

The total empty area of area 1 to 4 shown in Table 6-5 is necessary for PDF417 print.
For an example, when number of bar code data byte =15, error correction level=3, number of column number=8, and number of row=20;

Area1 = 15+1 = 16 bytes
Area2 = 2048 bytes
Area3 = $2^{(3+2)}$ = 32 bytes
Area4 = (8+7) ×20×2 = 600 bytes
Total = 2696 bytes
(Empty area size: Even number of bytes)

Table 6-5 GS 'p' 0 Used Memory Capacity of PDF417 Print Command

Area	Memory Usage
Area1	N+1 bytes *1
Area2	2048 bytes
Area3	$2^{(L+2)}$ bytes *2
Area4	(C+7)×R×2 bytes *3

*1: N: Number of bar code data byte
When empty capacity of the external RAM is an odd number, one more byte is necessary.
When N+1 is an odd number, one more byte is necessary.
*2: L: Error correction level
*3: C: Number of column, R: Number of row

(b) Used Memory Capacity of QR Code

The total empty area of area1 to 3 shown in Table 6-6 is necessary for QR Code print.
For an example, when number of bar code data byte=30, model=2, and version=4;

Area1 = 30×2+560 = 620 bytes
Area2 = 8006 bytes

$$\text{Area3} = 33 \times \text{int}\left\lfloor \frac{33+7}{8} \right\rfloor \times 3+1 = 496 \text{ bytes}$$

Total = 9122 bytes

(Empty area size is even number of bytes)

Table 6-6 GS 'p' 1 Used Memory Capacity of QR Code Print Command

Area	Memory usage
Area1	N×2+560 bytes *1
Area 2	8006 bytes
Area 3	$M \times \text{int}\left[\frac{M+7}{8}\right] \times 3$ bytes *2 M=17+V×4

*1: N: Number of bar code data
When empty capacity of the external RAM is an odd number, one more byte is necessary.
When number of bar code data byte is an odd number, one more byte is necessary.

*2: M: Number of modules for one side of the QR Code.
V: Version
The int () means that less than a decimal point will be omitted.
When area 3 becomes an odd number, one more byte is necessary.

(c) Used Memory Capacity of Data Matrix

The total empty area of area1 to 4 shown in Table 6-7 is necessary for Data Matrix print.
For an example, when number of bar code data byte =20 and symbol size=22 (vertical) ×22 (horizontal);

Area1 = 20 bytes
Area2 = 2230 bytes
Area3 = (30+20+1) × 2 = 102 bytes
Area4-A = 1 × (30+68) × 2 = 196 bytes

$$\text{Area4-B} = 33 \times \{\text{int}[\ \frac{20+15}{16}\ ] \times 20 + \text{int}[\ \frac{22+15}{16}\ ]\}22 \times 2 = 168 \text{ bytes}$$

Total = 2548 bytes (Area4 uses a value of Area4-A.)
(Empty area size is an even byte number.)

Table 6-7 GS 'p' 2 Used Memory Capacity of Data Matrix Print

Area	Memory usage
Area1	N bytes *1
Area2	2230 bytes
Area3	(D+E+1)×2 bytes *2
Area4-A	I×(B+68) ×2 bytes *3 *4
Area4-B	$\{\text{int}[\ \frac{Xm+15}{16}\ ] \times Ym + \text{int}[\ \frac{X+15}{16}\ ]\}Y \times 2$ bytes *3 *5

*1: N: Number of bar code data
When empty capacity of the external RAM is an odd number, one more byte is necessary
When number of bar code data byte is an odd number, one more byte is necessary
*2: D: Number of data code word.
E: Number of error correction code word.
These value are decided from symbol sizes. See Table 6-8
*3: Area 4-A and area 4-B are used commonly. The larger number will be used
*4: The I will be calculated as follows:
・When E is 68 or less, I=1
・When E exceeds 68,

$$I = \text{int}\left(\frac{E+67}{68}\right)$$

When the above value is an odd number, plus 1 to the value.
B will be calculated as follows:

$$B = \text{int}\left(\frac{D+I-1}{I}\right)$$

*5: X: Horizontal size of the symbol
Y: Vertical size of the symbol
Xm: Horizontal size of the map matrix
Ym: Vertical size of the map matrix
See Table 6-8 for sizes of the map matrixes.
The int () means that less than a decimal point will be omitted.

Table 6-8 Data Matrix Symbol Sizes

Symbol size		Map matrix size		Number of the Code Word	
Vertical	Horizontal	Vertical	Horizontal	Data	Error correction
10	10	8	8	3	5
12	12	10	10	5	7
14	14	12	12	8	10
16	16	14	14	12	12
18	18	16	16	18	14
20	20	18	18	22	18
22	22	20	20	30	20
24	24	22	22	36	24
26	26	24	24	44	28
32	32	28	28	62	36
36	36	32	32	86	42
40	40	36	36	114	48
44	44	40	40	144	56
48	48	44	44	174	68
52	52	48	48	204	84
64	64	56	56	280	112
72	72	64	64	368	144
80	80	72	72	456	192
88	88	80	80	576	224
96	96	88	88	696	272
104	104	96	96	816	336
120	120	108	108	1050	408
132	132	120	120	1304	496
144	144	132	132	1558	620
8	18	6	16	5	7
8	32	6	28	10	11
12	26	10	24	16	14
12	36	10	32	22	18
16	36	14	32	32	24
16	48	14	44	49	28

(d) Used Memory Capacity of MaxiCode

The total empty area of area1 to 2 shown in Table 6-9 is necessary for MaxiCode print.
For an example, when number of bar code data byte=33;

Area 1 = 33+1 = 34 bytes
Area 2 = 7684 bytes
Total = 7718 bytes
(Empty area size is an even byte number.)

Table 6-9 GS 'p' 3 Used Memory Capacity of MaxiCode Print

Area	Memory Usage
Area 1	N bytes *1
Area 2	7684 bytes

*1:N: Number of bar code data
When empty capacity of the extended RAM is an odd number, one more byte is necessary.
When number of bar code data byte is an odd number, one more byte is necessary.

6.4.2 FLASH Memory

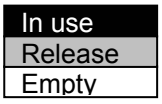
The printer stores data such as User-defined character, downloaded character, optional font, routine function, stamp and template data into FLASH memory. Of these data, User-defined character, downloaded character, optional font and template data can be used dedicated memory area. Moreover, FLASH memory has shared memory area as 256K byte user area for routine function and stamp.

Data except template data stored into FLASH memory is used when that is not present into extended RAM. If data is present in both of FLASH memory and extended RAM, the printer treats data in extended RAM as priority.
When allocating memory area for User-defined character or downloaded character in extended RAM, the printer copies data of User-defined character or downloaded character if those data are present in FLASH memory.

(1) User area in FLASH memory management

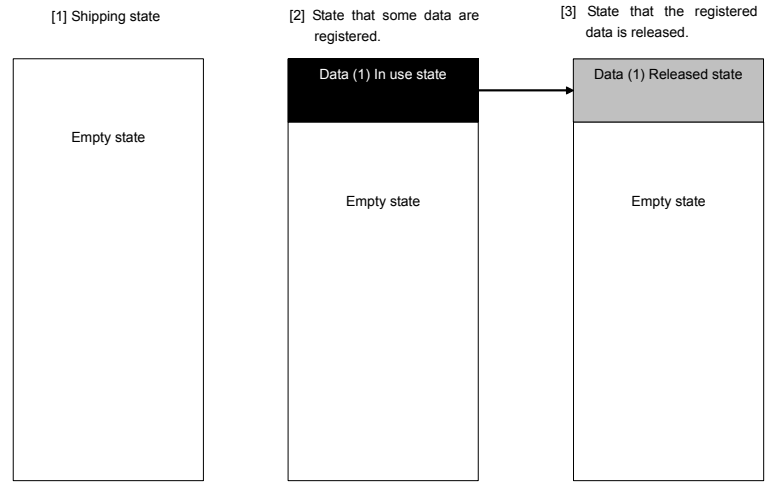
Memory in the user area has the following conditions:

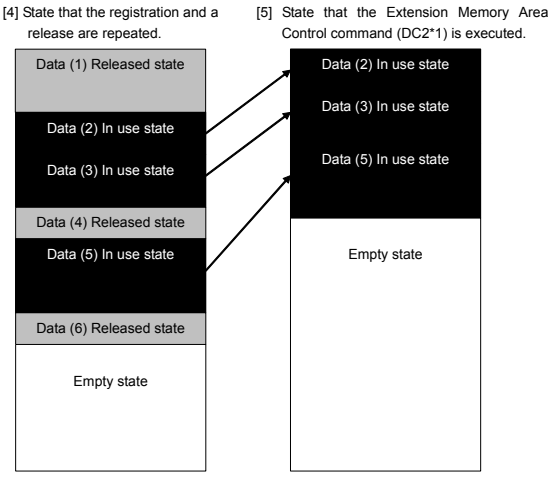
- In use state (storage state)
- Release state (Erasable state)
- Empty state



All Extension memories are in “Empty state” at shipping.

When some data is saved in the memory, the memory turns to “In use state”.
When the data is in use condition is released, the memory turns to “Released state (Erasable state).” This area cannot be used again in this state.





When data storage and release are repeated, the memory state turns to the [4] state.
To use the “Released state (Erasable state)” area again, execute the User Area Defragment (DC2 '*' '1') command.
The [5] shows the memory state after the command is executed.

Executing Remaining User Area Response (DC2'*' '2') command to check the current remaining area. Remaining Memory Response command in user area responds the current available amount of FLASH memory.

(2) Precautions on data in FLASH memory when rewriting, freeing and allocating

The maximum rewritable number of the FLASH memory is approximately 100000 times. Execute the User Area Defragment command after getting low memory for restraining the numbers of the memory rewriting.

Do not turn the power off during FLASH memory writing/erasing. If doing so may cause FLASH memory damage and it may not work. To confirm the FLASH memory writing/erasing, send Execute Response Request (DC2 ‘j’) command (6.5.23 Status Commands) behind the command as the above-mentioned and check response code.

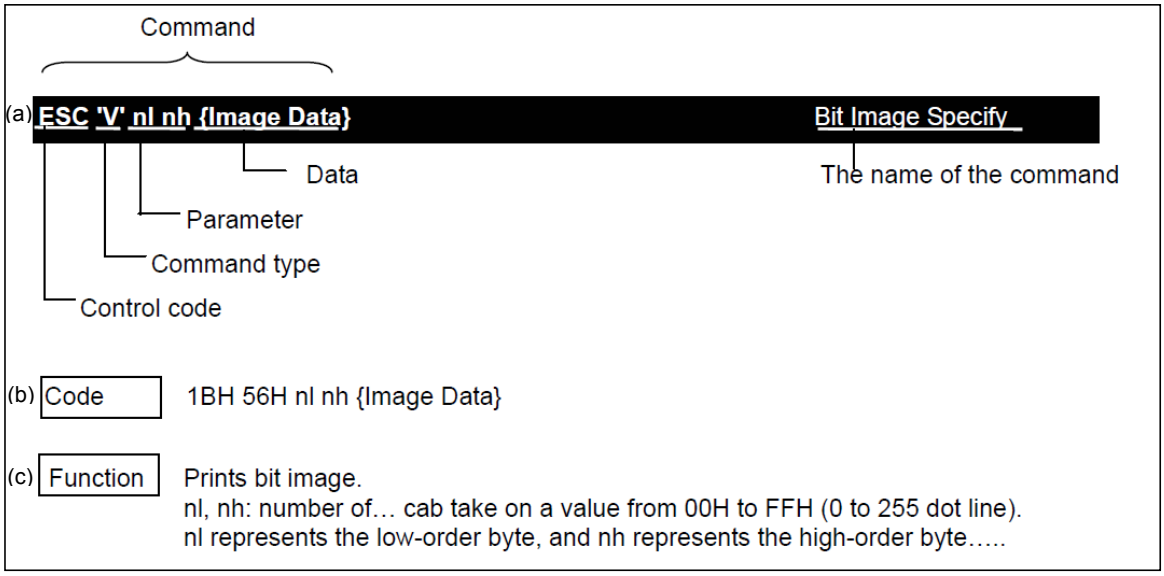
6.5 COMMAND DESCRIPTION

Each command for the printer is described respectively.

This section explains each command.

6.5.1 Command Format

Each command is described in the following format.



(a) Indicates the name of the command.
(b) Indicates hexadecimal codes.
nhnl of the parameter behind the control code an command type is indicated as follows:
nh: nhigh = high-order byte
nl: nlow = low-order byte
(c) Indicates the functions of the commands.

6.5.2 Formatting Commands

ESC 'C' n — Set page Length at n Lines

Code 1BH 43H n
1≤n≤127

Function Set page length at n lines.

The page length is (current line spacing x n) dot lines.
If the line spacing is zero, this command is ignored.
The current position becomes the beginning of the page.
The bottom margin set by ESC 'N' is canceled.
If n = 0, the page length is set at n inches.
This setting is canceled by Page Mode Select (DC2 'z' 0) command.
Moreover, this command is ignored in the page mode.

Default
Cut paper mode : 38 lines (line spacing 34 dots lines)
Roll paper mode : No page length setting
Mark roll paper mode : 38 lines (line spacing 34 dots lines)

ESC 'C' 0 n — Set Page Length at n Inches

Code 1BH 43H 00H n
1≤n≤22

Function Sets the page length at n inches.

The current position becomes the beginning of the page.
The page length is n x 203 dot lines.
The bottom margin set by ESC 'N' is canceled.
If n = 0 or n≥23, this command is ignored.
This setting is canceled by Page Mode Select (DC2 'z' 0) command.
Moreover, this command is ignored in the page mode.

Default
Cut paper mode : 6.4 inches (1292 dots lines)
Roll paper mode : No page length setting
Mark roll paper mode : 6.4 inches (1292 dots lines)

ESC 'N' n — Set Bottom Margin

Code 1BH 4EH n
1≤n≤127

Function Sets the bottom margin at n lines.

The last dot (n x current line spacing) of the page is the skip amount (non-printable area).
The skip amount does not change even if the line spacing is set after setting the bottom margin.
The bottom margin is canceled when the page length is modified.
If the bottom margin exceeds the page length, this command is ignored.
If the page length is not specified in the initial state in the roll paper mode, this command is ignored.
This setting is canceled by Page Mode Select (DC2 'z' 0) command.
Moreover, this command is ignored in the page mode.

Default The bottom margin is not defined.

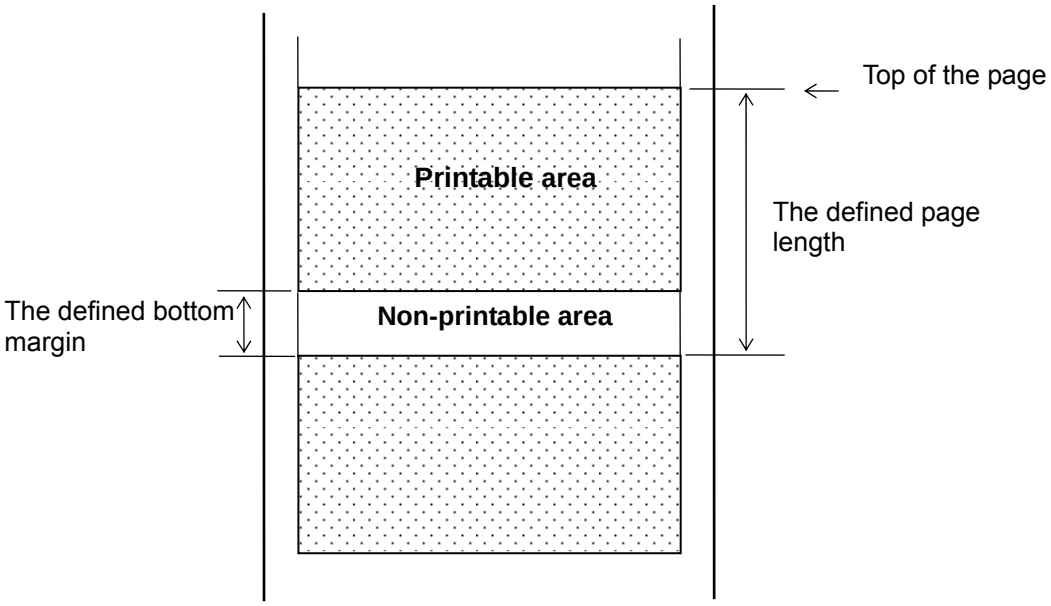
ESC 'O' Cancel Bottom Margin

Code 1BH 4FH

Function Cancels bottom margin.

If the page length is not specified in the initial state in the roll paper mode, this command is ignored.

Default The bottom margin is canceled.



ESC 'Q' n Set Right Margin

Code 1BH 51H n
1≤n≤255

Function Sets the right margin at n columns from the left edge (first column).

Column n (current character pitch x n) from the left edge becomes the right margin.
The character width includes character spacing. The character width is also doubled in double-width setting. The character width is not calculated by double when Select expanded character mode with automatic cancellation (SO) command is selecting.
The line buffer data is cleared and the next print position becomes the left margin.
The right margin does not move if the character pitch is changed later.
When n is smaller than the left margin columns, the command is ignored.
If the printable area is one character or less, one character is printed.
This command is ignored in the page mode.

Default Maximum number of digits for printing. (at shipping)
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i') command.

ESC 'l' n — Set Left Margin

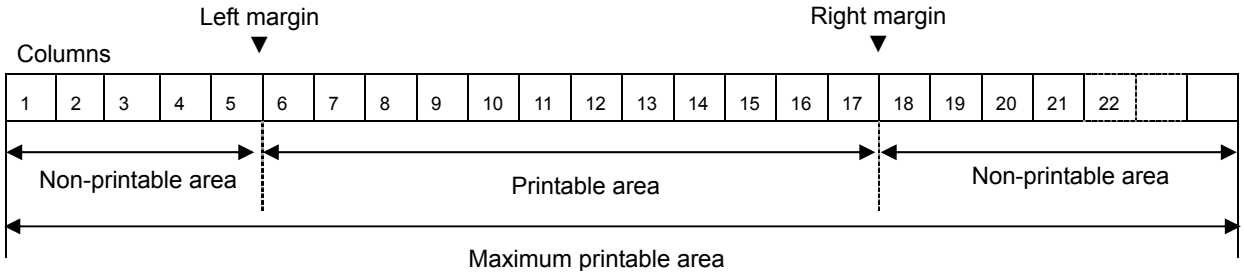
Code 1BH 6CH n
0≤n≤255

Function Sets the left margin at n columns from the left edge (first column).

Column n (current character pitch x n) from the left edge becomes the left margin.
The character width includes character spacing. The character width is also doubled in double-width setting. The character width is not calculated by double when Select expanded character mode with automatic cancellation (SO) command is selecting.
The line buffer data is cleared and the next print position becomes the left margin.
The left margin does not move if the character pitch is changed later.
When n is larger than the right margin columns, the command is ignored.
If the printable area is one character or less, one character is printed.
This command is ignored in the page mode.

Default n=0 (at shipping)
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i') command.

When the left margin is set at fifth column and the right margin is set at 17th column, the printable area is as follows:



```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 PRINT #1,"Page Length : 5 line"
120 PRINT #1,"Skip Length : 2 line"
130 PRINT #1,"Right Margin : 34 char"
140 PRINT #1,"Left Margin : 17 char"
150 PRINT #1,CHR$(&H0D);
160 PRINT #1,CHR$(&H1B);"C";CHR$(5);                'Page Length : 5 line
170 PRINT #1,CHR$(&H1B);"N";CHR$(2);                'Skip Length : 2 line
180 PRINT #1,CHR$(&H1B);"Q";CHR$(34);               'Right Margin : 34 char
190 PRINT #1,CHR$(&H1B);"l";CHR$(17);               'Left Margin : 17 char
200 FOR I=&H20 TO &HFE
210   PRINT #1,CHR$(I);
220 NEXT I
230 PRINT #1,CHR$(&H0D);
240 CLOSE #1
250 END
```

Figure 6-1 Program Sample 1

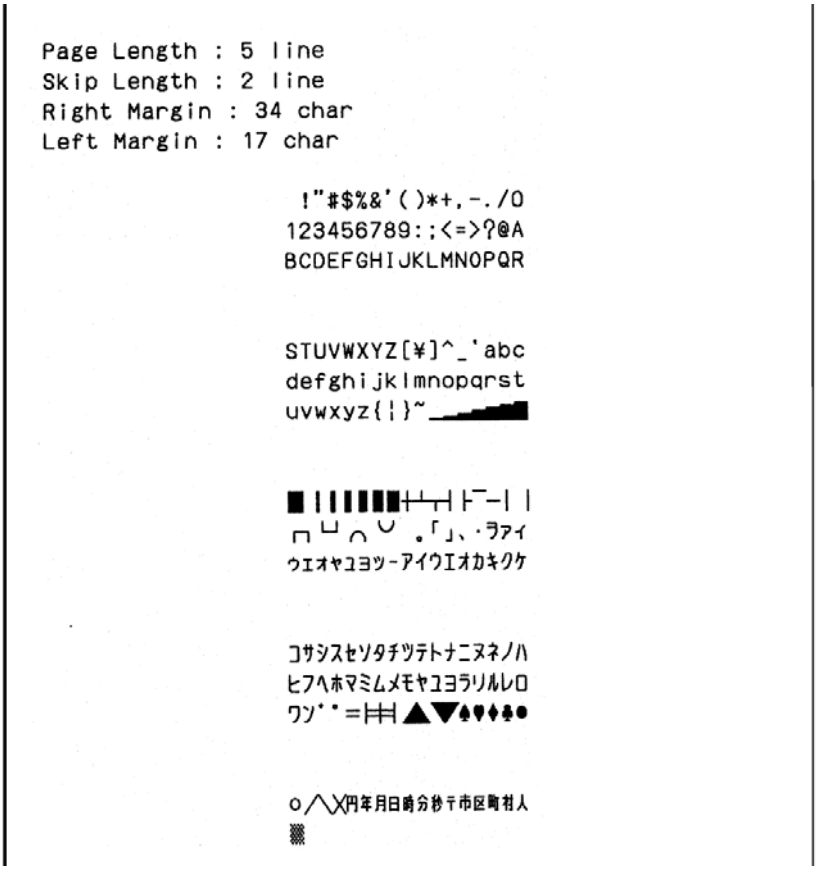


Figure 6-2 Print Sample 1

6.5.3 Line Spacing Commands

ESC '0' Set 1/8-inch Line Spacing

Code 1BH 30H

Function Sets the line spacing amount to 1/8 of an inch (26 dots lines).

If the line buffer contains data and the line spacing amount is smaller than the character height, the data in the buffer is printed and line feeding is performed by the character height.

Default 34 dots lines
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i')command.

ESC '2' Set 1/6-inch Line Spacing

Code 1BH 32H

Function Sets the line spacing to 1/6 of an inch (34 dots lines).

If the line buffer contains data and the line spacing amount is smaller than the character height, the data in the buffer is printed and line feeding is performed by the character height.

Default 34 dots lines
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i') command.

ESC '3' n Set n-dot-line Line Spacing

Code 1BH 33H n
$0 \le n \le 255$

Function Sets line spacing.

The line spacing is set to n dot lines.
If the line buffer contains data and the line spacing amount is smaller than the character height, the data in the buffer is printed and line feeding is performed by the character height.

Default 34 dots lines
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i') command.

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 PRINT #1,CHR$(&H1B);"0";
120 PRINT #1,"ESC+0   ----- 1/8 inch line space"
130 PRINT #1,CHR$(&H1B);"2";
140 PRINT #1,"ESC+2   ----- 1/6 inch line space"
150 FOR I=0 TO 96 STEP 24
160   PRINT #1,CHR$(&H1B);"3";CHR$(I);
170   PRINT #1,"ESC+3+n -----";I;"dot-line line space"
180 NEXT I
190 PRINT #1,"---------------------------------------"
200 CLOSE #1
210 END
```

Figure 6-3 Program Sample 2

```
ESC+0    ----- 1/8 inch line space
ESC+2    ----- 1/6 inch line space
ESC+3+n ----- 0 dot-line line space
ESC+3+n ----- 24 dot-line line space
ESC+3+n ----- 48 dot-line line space

ESC+3+n ----- 72 dot-line line space


ESC+3+n ----- 96 dot-line line space


---------------------------------------
```

Figure 6-4 Print Sample 2

6.5.4 Tab Setting Commands

ESC 'B' {DATA} NUL — Set Vertical Tab Positions

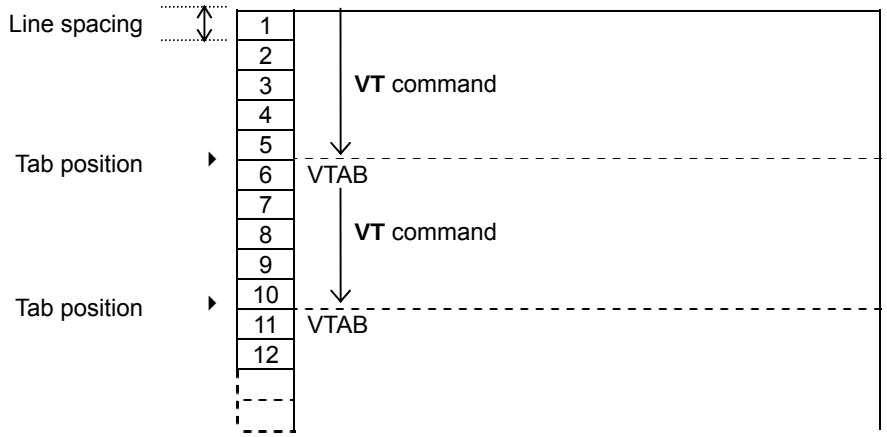
Code 1BH 42H {p1 p2••• pk} 00H
1≤p≤255
0≤k≤16

Function Sets the vertical tab position.

The tab position is the (current line spacing × p lines) dot position with respect to the page starting position.
If the line spacing is zero, ESC 'B' is ignored and the subsequent data is processed as normal data.
The positions, p, are input in ascending order and the command ends with 00H (NUL). The value of p is equal to or less than the value of the preceding p, the vertical tab position setting ends, and the following data is processed as normal data.
Preset vertical tabs are cleared.
A maximum of 16 vertical tab positions k can be set. If more tab positions are specified, they are ignored until the value becomes 00H or the preceding value.
ESC 'B' NUL clears all vertical tab positions.
If p exceeds the page length, the tab position is invalid. The following data is processed as normal data.
Even if the line spacing is changed after setting vertical tab positions, the tab positions are not changed.
If the page length is not specified in the initial state in the roll paper mode, this command is ignored.

Default No definition.

When the vertical tab is set at every fifth line and the vertical tab execution (VT command) and 'VTAB' are sent alternately, the print operation is as follows.



ESC 'D' {DATA} NUL — Set Horizontal Tab Positions

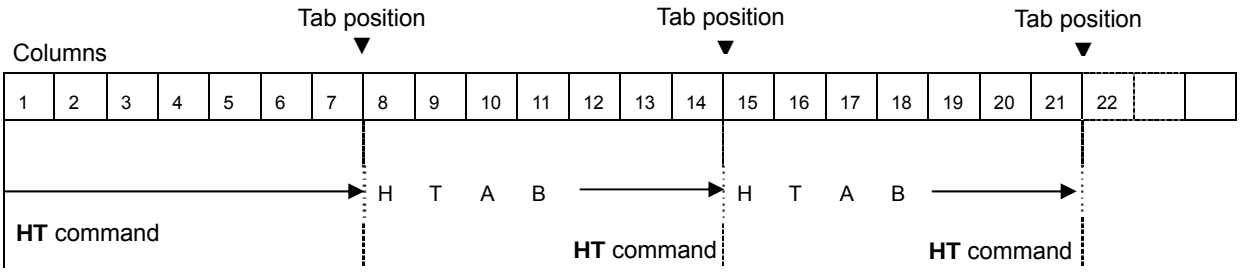
Code 1BH 44H {p1 p2•••pk} 00H
1≤p≤255
1≤k≤32

Function Sets horizontal tab positions.

The tab position is the (current character with × p columns) position with respect to the left margin.
The character width includes the character spacing. The character width is also doubled in double-width mode. The character width is not calculated by double when Select expanded character mode with automatic cancellation (SO) command is selecting.
The positions, p, are input in ascending order and the command ends with 00H (NUL). The value of p is equal to, or less than the value of the preceding p, the horizontal tab position setting ends. The following data is processed as normal data.
Tab positions exceeding the right margin are invalid. They become valid when the right margin is changed so that they are included in the printable area.
Preset horizontal tabs are cleared.
Up to 32 tab positions k can be set. Data which exceeds 32 tab positions will be ignored until the value becomes 00H or the preceding value.
ESC 'D' NULL clears all horizontal tab positions.

Default Every eight Katakana characters in 24-dot fonts.

When the horizontal tab is set at every seventh column, the horizontal tab execution (HT command) and 'HTAB' are sent alternately, the printing operation is as follows.



6.5.5 Print and Paper Feed Commands

CR — Print and Carriage Return

Code 0DH

Function Functions the same as an LF command.

If the line buffer contains data and the line spacing amount is smaller than the character height, the data in the buffer is printed and line feeding is performed by the character height.

LF — Print and Line Feed

Code 0AH

Function After data in the line buffer is printed out, the printer feeds one line.

The next print starting position becomes the beginning of the next line (left margin).
If the line buffer contains data and the line spacing is smaller than the character height, the data in the line buffer is printed and one line is fed by the character height.
If the line buffer does not contain data before this code is received, the printer only feeds one line.
The select expanded character mode with automatic cancellation selected by SO is canceled.
The LF command that follows CR is ignored.

FF — Page Feed (Form Feed)

Code 0CH

Function When page length is specified, the printer performs page feed up to specified page length after data in the line buffer is printed out.
When page length is not specified, the printer performs page feed up to mark by specified value with Set default/Set test print header (DC2 'i')command after data in the line buffer is printed out.
The next print starting position becomes the beginning of the next line (left margin).

The select expanded character mode with automatic cancellation selected by SO is canceled.

In the cut paper mode:
If an out-of-paper error occurs during page feeding, the page feed ends at the time. Then, the paper is fed at low speed. When new paper is loaded, it is not fed, and the page insertion position is regarded as the beginning of the page.

In the roll paper mode:
When page length is not specified, this command is ignored. When page length is specified, if an out-of-paper error occurs during page feeding, the page feed ends at the time. When new paper is loaded, it is not fed, and the page insertion position is regarded as the beginning of the page.

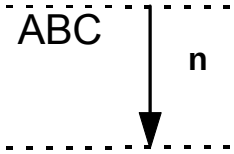
In the mark roll paper mode:
The paper mark is detected by this command and paper form feed is executed. If an out-of-paper error occurs, the printer operation is same as in the roll paper mode.

ESC 'J' n — Print and Feed Paper

Code: 1BH 4AH n
0≤n≤255

Function: Prints the data in the print buffer and feeds the paper one dot line.

If the line buffer contains data and n is smaller than the character height, the data in the line buffer is printed and one line is fed by the character height.
If the line buffer contains data, the select expanded character mode with automatic cancellation selected by SO is canceled.
If the line buffer does not contain data before this code is received, the printer only feeds n dot lines.
The predetermined line spacing remains unchanged.



GS '<' — Marked Paper Form Feed

Code: 1DH 3CH

Function: Performs the marked paper form feed.

This command is effective only when marked paper is selected.

In the Mark Roll Paper mode or Cut Paper mode, the printer performs its operation as same as Page feed (FF) command.

In the Mark Roll Paper mode, the printer executes the paper form feed to the cutting position. If data is remaining in the line buffer, the printer executes paper feed after printing data in the line buffer.

The select expanded character mode with automatic cancellation selected by SO is canceled.

6.5.6 Print Position Commands

HT — Execute Horizontal Tab

Code 09H

Function Moves the print position to the next horizontal tab position.

This command is ignored if the next horizontal tab position is not set.
This command is ignored if the next horizontal tab position exceeds the right margin.
The horizontal tab position is set using the ESC 'D' command.

Default The default tab positions are at intervals of 8 characters.

VT — Execute Vertical Tab

Code 0BH

Function Feeds the paper to the next vertical position.

If the line buffer contains data, it is printed and the print position moves to the next tab position.
When a VT command is input after the last vertical tab position, the command functions in the same way as the FF command.
If the next vertical tab position is not set, the command functions in the same way as the LF command.
If the print position enters the perforated line skip area when a VT command is executed, the paper is fed to the beginning of the next page.
The vertical tab position is set using the ESC 'B' command.
The select expanded character mode with automatic cancellation selected by SO is canceled.
If the page length is not specified in the initial state in the roll paper mode, the command functions in the same way as the LF command.

Default No definition.

ESC '$' nl nh — Set Absolute Position

Code 1BH 24H nl nh
$0 \leq nh \times 256 + nl \leq 2399$

Function Sets the print starting position at the specified number of dots (nhnl) in the right direction from the left margin.

Any print start position specification exceeding the right margin is ignored.

ESC '\' nl nh — Set Relative Position

Code 1BH 5CH nl nh
$-2399 \leq nh \times 256 + nl \leq 2399$

Function Sets the print starting position at the specified number (nhnl) of dots from the current position to the right or left.

Any specification exceeding the printable area is ignored.
Negative numbers are specified using the 2's complement with the number of dots.
Example: Move N dots to the left.
nhnl=65536-N

Default nl=0, nh=0

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 PRINT #1,CHR$(&H1B);"2";
120 PRINT #1,CHR$(&H1B);"C";CHR$(25);
130 PRINT #1,CHR$(&H1B);"B";CHR$(3);CHR$(6);CHR$(9);CHR$(12);CHR$(0);
140 PRINT #1,CHR$(&H1B);"D";CHR$(10);CHR$(20);CHR$(30);CHR$(0);
150 PRINT #1,"---------- Page top ----------"
160 PRINT #1,"Carrige Return + CR";CHR$(&H0D);
170 PRINT #1,"Line Feed + LF";CHR$(&H0A);
180 PRINT #1,"100 dot-line feed + ESC+J";CHR$(&H1B);"J";CHR$(100);
190 PRINT #1,"Vertical Tab + VT";CHR$(&H0B);
200 PRINT #1,"Vertical Tab + VT";CHR$(&H0B);
210 PRINT #1,CHR$(&H09);"HTAB";CHR$(&H09);"HTAB";CHR$(&H09);"HTAB"
220 PRINT #1,CHR$(&H1B);"$";CHR$(&HFA);CHR$(&H0);          '250 dots
230 PRINT #1,"Absolute Position";
240 PRINT #1,CHR$(&H1B); "\";CHR$(&HF0);CHR$(&HFE);
250 PRINT #1,"==========Relative Position"
260 PRINT #1,"Form Feed + FF";CHR$(&H0C);
270 PRINT #1,"---------- Next page top ----------"
280 CLOSE #1
290 END
```

Figure 6-5 Program Sample 3

```
---------- Page top ----------
Carrige Return + CR
Line Feed + LF
100 dot-line feed + ESC+J


Vertical Tab + VT


Vertical Tab + VT


          HTAB      HTAB      HTAB
               Absolute Position Relative Position
Form Feed + FF









---------- Next page top ----------
```

Figure 6-6 Print Sample 3

6.5.7 1-byte Character Set Selection Commands

ESC 'R' n — Select International Character

Code: 1BH 52H n
0≤n≤12

Function: n selects an international character set from the following table.

n	Country
0	U.S.A.
1	France
2	Germany
3	U.K.
4	Denmark I
5	Sweden
6	Italy
7	Spain
8	Japan
9	Norway
10	Denmark II
11	Spain II
12	Latin America

The download characters and optional fonts are not affected by the international character sets. If n is selected out of range, this command is ignored.

Default: n=8 (Japan)
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i')command.

ESC 't' n — Select Character Code Table

Code: 1BH 74H n

Function: Selects a character code table.

Only two low-order bits are valid.
n = 0: Extended graphics character set (IBM Compatible)
n = 1: Katakana character set (ANK)
n = 2: Codepage 1252 character set
n = 3: Ignored
00H to 1FH are treated as control codes and no characters are printed regardless of the selected code table. 7FH is ignored.
For character font, see the Appendix A.1 Character Code Table.

Default: Depends on the setting of bit 4 of SWDIP switch 2.

DC2 'y' n — Euro Character Specify

Code

12H 79H n
n=0, 32≤n≤254 (except 127)

Function

Exchanges the font of character code n of the one-byte system to Euro characters.

When n is 0, the exchange to the Euro characters is released and the font returns before selection.
Only one character code to be exchanged to Euro characters is available.
When an exchange to Euro characters for other character code is performed, the last change to Euro characters for character code is released.

Default

n=0 (not selected)

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 PRINT #1,CHR$(&H1B);"$";CHR$(&HD8);CHR$(0);"23 24 40 5B 5C 5D 5E 60 7B 7C 7D 7E"
120 FOR I=0 TO 12
130  RESTORE 310
140  FOR J=0 TO I
150    READ CNTRY$
160  NEXT J
170  PRINT #1,CNTRY$;CHR$(&H1B);"$";CHR$(&HA8);CHR$(0);:GOSUB 250
180 NEXT I
190 FOR I=0 TO 1
200   PRINT #1,CHR$(&H1B);"t";CHR$(I);
210   PRINT #1,"#$%&01234567ABCDEFGabcdefg ｱｲｳｴｵ"
220 NEXT I
230 CLOSE #1
240 END
250 PRINT #1,CHR$(&H1B);"R";CHR$(I);" ";
260 PRINT #1,CHR$(&H23);"  ";CHR$(&H24);"  ";CHR$(&H40);"  ";
270 PRINT #1,CHR$(&H5B);"  ";CHR$(&H5C);"  ";CHR$(&H5D);"  ";
280 PRINT #1,CHR$(&H5E);"  ";CHR$(&H60);"  ";CHR$(&H7B);"  ";
290 PRINT #1,CHR$(&H7C);"  ";CHR$(&H7D);"  ";CHR$(&H7E)
300 RETURN
310 'COUNTRY NAME
320 DATA USA,FRANCE,GERMANY,ENGLAND,ENGLAND,DENMARK 1,SWEDEN
330 DATA ITALY,SPAIN,JAPAN,DENMARK 2,SPAIN 2,LATIN AMERICA
```

Figure 6-7 Program Sample 4

	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
USA	#	$	@	[	\	]	^	`	{	¦	}	~
FRANCE	#	$	à	°	Ç	§	^	`	é	ù	è	¨
GERMANY	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
ENGLAND	£	$	@	[	\	]	^	`	{	¦	}	~
DENMARK 1	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
SWEDEN	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
ITALY	#	$	@	°	\	é	^	ù	à	ò	è	ì
SPAIN	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
JAPAN	#	$	@	[	¥	]	^	`	{	¦	}	~
NORWAY	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
DENMARK 2	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
SPAIN 2	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
LATIN AMERICA	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú

#$%&01234567ABCDEFGabcdefg

#$%&01234567ABCDEFGabcdefgｱｲｳｴｵ

Figure 6-8 Print Sample 4

6.5.8 1-byte Characters Definition Commands

ESC '%' n — Set/Cancel Download Character Set

Code 1BH 25H n

Function Sets or cancels the download character set.

Only the least significant bit of n is valid.
n = 0: Cancel the download character set.
n = 1: Set the download character set.
When the download character set is set, it can be printed.
When the download character set is input with undefined character code, the optional font or the selected internal character set is printed. However, the 7FH character code is ignored.
If the download character set and optional font are defined in the same character code and both are selected, the download character set is given priority.

Default n=0 (Cancel)

ESC '&' s n m {DATA} — Define Download Characters

Code 1BH 26H s n m {d1 d2•••dk}
s=0
20H≤n≤m≤7FH

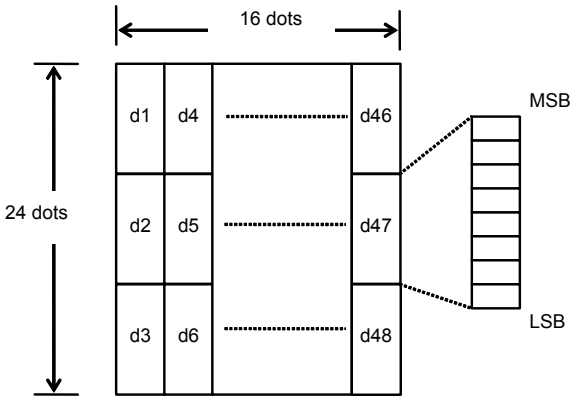
Function Defines 1-byte characters in the download character set.

s indicates the character set number of the download character.

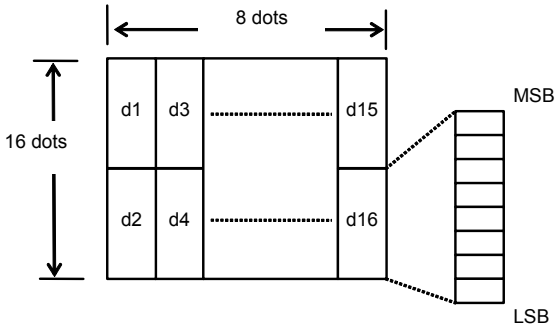
n is the beginning of the definition of download characters and m is the end of the definition of download characters. If either n or m is defined, n must be equal to m.
If n or m is out of range, the data out of range is ignored and the following data will be processed as normal data.
The font size of the download character registered is decided by current selected font size.
The download characters for 24- or 16-dot fonts are defined simultaneously because both are registered in separate areas.

d indicates the defining data. The bit corresponding to the dot to be printed is set to 1, and the bit corresponding to the dot not to be printed is set to 0.
Multiple character codes can be defined at the same time.
If the previously defined character code is defined again, it is overwritten.
The size of data per character for a selected font is as follows:
24-dot font: 48 bytes/character
16-dots font: 16 bytes/character
The total number of character patterns (k) is as follows:
24-dot font: k=48×(m-n+1)
16-dot font: k=16×(m-n+1)
Enter font data by using eight vertical dots as one byte.
If the download character area is freed up, ESC '&' is ignored and the following data will be processed as normal data.
For 24-dot fonts, a character is defined as 24 x 16 dots. The following restrictions apply to the actual printing. If the right space + character width is 16 dots or more, the character can be printed as 24 x 16 dots. If it is 16 dots or less, only the (character width + character right-side spacing) dots are printed. To print the whole character regardless of the character right-side spacing, the font must be defined as 12 dots (horizontal) or less.

•24-dot font



•16-dot font



DC2 'D' n — Download Characters Area Operation

Code: 12H 44H n

Function: Allocates or frees up the download character area.

Only the least significant bit (LSB) of n is valid.
n = 0: Frees up the download character area.
n = 1: Allocates the download character area.
When the download area is freed up, the download character is erased and the download character set specification is freed up. The following commands are ignored.
ESC '&' Define download character
ESC '%' Select/cancel download character set
The download character area after memory initialization is 6248 bytes long. If the download character area is freed up, the remaining memory capacity increases by 6248 bytes.
The remaining memory capacity must be at least 6248 bytes to reallocate the download character area. If the remaining memory capacity is insufficient, the download character area is not allocated and DC2 'D' 1 is ignored.

Default: n=1 (Allocate the download character area)

6.5.9 Character Decoration Commands

SO — Select Expanded Character Mode with Automatic Cancellation

Code: 0EH

Function: Prints 1-byte characters and 2-byte characters following this code in double-width characters.

This mode is canceled by DC4, LF, VT, FF, ESC 'W', GS '<' or CR, or by buffer-full printing. When the line buffer is cleared, the expanded character mode is canceled.

DC4 — Cancel Expanded Character Mode with Automatic Cancellation

Code: 14H

Function: Cancels expanded character mode set by SO code for 1-byte characters and 2-byte characters.

The expanded character mode set by ESC 'W' 1 is not canceled.

ESC 'W' n — Select/Cancel Expanded Character Mode

Code: 1BH 57H n

Function: Selects or cancels the expanded character mode for 1-byte characters and 2-byte characters.

Only the least significant bit (LSB) of n is valid.
n = 1: Select the expanded character mode.
n = 0: Cancel the expanded character mode.
ESC 'W' 0 frees up the expanded character mode selected by SO.

Default: n=0 (Cancel the expanded character mode)

ESC 'w' n — Select/Cancel Double Height Mode

Code: 1BH 77H n

Function: Selects or cancels the double height mode for 1-byte characters.

Only the least significant bit (LSB) of n is valid.
n = 1: Select the double height mode.
n = 0: Cancel the double height mode.

Default: n=0 (Cancel the double height mode)

ESC 'E' — Select Emphasized Print Mode

Code: 1BH 45H

Function: Selects emphasized print mode for 1-byte characters and 2-byte characters.

The emphasized print mode can also be selected or canceled with ESC '!', but the most recently processed command is effective.

ESC 'F' Cancel Emphasized Print Mode

Code 1BH 46H

Function Cancels the emphasized print mode for 1-byte characters and 2-byte characters.

The emphasized print mode can also be selected or canceled with ESC '!', but the most recently processed command is effective.
The double print mode is also canceled.

ESC 'G' Select Double Print Mode

Code 1BH 47H

Function Selects the double print mode for 1-byte characters and 2-byte characters.

Same as in emphasized print mode.

ESC 'H' Cancel Double Print Mode

Code 1BH 48H

Function Cancels the double print mode for 1-byte characters and 2-byte characters.

The emphasized print mode is also canceled.

ESC '-' n Select/Cancel Underline Mode

Code 1BH 2DH n

Function Selects or cancels underline mode for 1-byte characters.

Only the least significant bit (LSB) of n is valid.
n = 1: Select the underline mode.
n = 0: Cancel the underline mode.
The underline is attached to all printing characters, including character right-side spacing. The underline, however, is not attached when skipped by Horizontal Tab (HT), Set Absolute Position (ESC '$'), or Set Relative Position (ESC '\') command.
This command is not valid for 2-byte characters.
The underline width can also be modified with FS '-'. When the underline width is not specified by FS '-', default width is set as 1-dot underline.
If the underline is canceled by n=0, the subsequent 1-byte characters are not underlined.
The underline mode can also be selected or canceled with ESC '!', but the most recently processed command is effective.

Default n=0 (Cancel underline mode)

ESC '!' n — Set Print Mode

Code: 1BH 21H n

Function: Sets a print mode for 1-byte characters.

Each bit of n is used as follows:

Bit	Function	n=0	n=1
0	Undefined	-	-
1	Undefined	-	-
2	Undefined	-	-
3	Emphasized printing	Canceled	Set
4	Double printing	Canceled	Set
5	Double-width	Canceled	Set
6	Undefined	-	-
7	Underline	Canceled	Set

The underline is attached to all character widths, including character right-side spacing. However, it is not attached when skipped by HT or other commands.
The underline width can also be modified with FS '-'. When the underline width is not specified by FS '-', default width is set as 1-dot underline.
This command is valid for 2-byte characters, except underlines.
If emphasized printing is canceled, double printing is canceled. If double printing is canceled, emphasized printing is canceled.
The underline mode can also be selected or canceled by other commands, but the most recently processed command is effective.

Default: n=0 (Cancel emphasized printing mode/double printing mode/double-width printing mode/underline mode)

DC2 'Y' n — Character Rotation

Code 12H 59H n

Function Selects the direction of rotation of 1-byte and 2-byte characters.

Only two low-order bits are valid.
- n = 0: Cancel character rotation.
- n = 1: Rotate the character 90° clockwise.
- n = 2: Rotate the character 90° counterclockwise.
- n = 3: Ignore the command.

If the character is decorated, the decorated character is rotated.
Character decoration applies to a line. If the character rotation is doubled vertically, it is doubled in the Y direction (character widths are doubled). If the width is doubled, the character is doubled in the X direction (characters are doubled vertically).
Character rotation cannot be underlined.
The following characters can be rotated:
- Extended graphics characters
- Katakana characters
- Codepage 1252
- Download characters
- Kanji
- Kanji quarter size characters
- User-defined characters

Optional fonts cannot be rotated.
The four rightmost dots of 24 × 16 dots fonts of extended graphics characters and Katakana characters are not printed.
When download characters are in 24-dot fonts, they are printed as 24 × 12 dots. Therefore, the fonts must be 12 dots or less.
If character rotation and vertical writing are specified in Kanji mode, vertical writing is given priority.

Default n=0 (Cancel character rotation)

6.5.10 Character Pitch Adjustment Command

ESC SP n	Set Character Spacing

Code 1BH 20H n
0≤n≤127

Function Sets the character right-side spacing for 1-byte characters in dot units (n).
If a character code is input after this command, it is printed with (character width + set character spacing).
The character left-side spacing will be 0 dot.
Only the seven significant bits of n are valid. n must be 0 to 127 dots.
The character right-side spacing for double-width mode is twice the value set by this command. It can be expanded to up to 254 dots.
This command does not change the spacing of 2-byte characters. This also does not change the spacing of 1-byte characters in the Kanji ROM. (See FS 'S' for details on the spacing of 2-byte characters.)

Default n=4 (at shipping)
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i') command.

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 PRINT #1,CHR$(&H12);"F0";                    '16 dots font
120 PRINT #1,CHR$(&H1B);"&";CHR$(0);"DD";        'D
130 RESTORE 460 : N=16 : GOSUB 430
140 PRINT #1,CHR$(&H12);"F1";                    '24 dots font
150 PRINT #1,CHR$(&H1B);"&";CHR$(0);"oo";        'o
160 RESTORE 480 : N=48 : GOSUB 430
170 PRINT #1,CHR$(&H1B);"%1";                    'Down Load Select
180 PRINT #1,CHR$(&H12);"F0";"16 dots Down Load Select"
190 PRINT #1,CHR$(&H12);"F1";"24 dots Down Load Select"
200 PRINT #1,CHR$(&HE);"DoubleWidth by SO"
210 PRINT #1,"Normal print"
220 PRINT #1,"Normal";
230 PRINT #1,CHR$(&H1B);"-1";"+UnderLine";
240 PRINT #1,CHR$(&H1B);"W1";"+DoubleWidth";
250 PRINT #1,CHR$(&H1B);"w1";"+DoubleHeight";
260 PRINT #1,CHR$(&H1B);"E";"+Emphasize";
270 PRINT #1,CHR$(&H1B);"-0";"-UnderLine";
280 PRINT #1,CHR$(&H1B);"W0";"-DoubleWidth";
290 PRINT #1,CHR$(&H1B);"w0";"-DoubleHeight";
300 PRINT #1,CHR$(&H1B);"F";"-Emphasize";
310 PRINT #1,CHR$(&H1B);"!";CHR$(&HB8);"+CollectivelySet";
320 PRINT #1,CHR$(&H1B);"!";CHR$(&H00);"-CollectivelyClear"
330 PRINT #1,CHR$(&H12);"Y2";"Rotation Left"
340 PRINT #1,CHR$(&H12);"Y1";"Rotation Right"
350 PRINT #1,CHR$(&H12);"Y0";"Rotation Off";CHR$(&H0D);CHR$(&H0D);
360 PRINT #1,"Character space"
370 FOR I=0 TO 25
380   PRINT #1,CHR$(&H1B);" ";CHR$(I);
390   PRINT #1,CHR$(&H41+I);
400 NEXT I : PRINT #1,CHR$(&H0D);
410 CLOSE #1
420 END
430 FOR I=0 TO N-1
440   READ D$ : PRINT #1,CHR$(VAL("&h"+D$));
450 NEXT I : RETURN
460 '16x8 Font
470 DATA 80,80,C0,C0,E0,E0,F0,F0,F8,F8,FC,FC,FE,FE,FF,FF
480 '24x12 Font
490 DATA 80,80,80,C0,C0,C0,E0,E0,E0,F0,F0,F0,F8,F8,F8,FC
500 DATA FC,FC,FE,FE,FE,FF,FF,FF,00,00,00,00,00,00,00,00
510 DATA 00,00,00,00,00,00,00,00,00,00,00,00,00,00,00,00
```

Figure 6-9 Program Sample 5

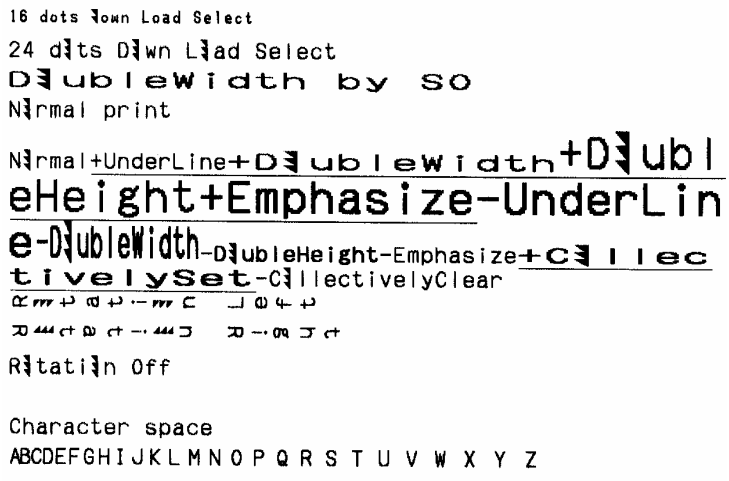


Figure 6-10 Print Sample 5

6.5.11 Kanji Character Set Selection Commands

FS '&' Select Kanji Mode

Code 1CH 26H

Function Selects Kanji mode.

In Kanji mode, only 2-byte character codes are accepted.
1-byte character in SII Japanese font set (at shipping) can be printed by entering 00H + 1-byte code.
This command is ignored when Shift-JIS is selected as the Kanji code system.

Default Cancel Kanji mode.

FS '.' Cancel Kanji Mode

Code 1CH 2EH

Function Cancels Kanji mode.

This command is ignored when Shift-JIS is selected as the Kanji code system.

Default Cancel Kanji mode.

FS 'C' n Select Kanji Code System

Code 1CH 43H n

Function Selects Kanji code system.

Only the least significant bit of n is valid.
n = 0: JIS code system.
n = 1: Shift-JIS code system.
The Kanji mode is canceled and the Shift-JIS is set to the Kanji code system when Shift-JIS is selected as the Kanji code system by this command.

Refer to 6.3 CHARACTER CODES for character code system or applicable Kanji code correspond.

Default Depends on the setting of SWDIP2-7.

FS 'r' n — Select Kanji Quarter Size Character Mode

Code 1CH 72H n

Function Selects Kanji quarter size character mode.

Only the least significant bit of n is valid.
n = 0: Superscript
n = 1: Subscript
Only the least significant bit of n is valid, and it can be set only in Kanji mode. When Kanji mode is ineffective, FS 'r' is ignored.
If one of the following Kanji codes is input, a Kanji quarter size character is printed.
2321H to 237EH: Alphanumeric
2421H to 247EH: Hiragana
2521H to 257EH: Katakana
The other Kanji codes are printed as normal 2-bytes characters, User-defined characters, or 1-byte characters in Kanji ROM.
Only 2330H to 2339H ('0' to '9') can be printed as 16-dot Kanji quarter size characters.
The other alphanumeric, Hiragana, and Katakana have horizontal 8-dot spacing.
The Kanji quarter size character mode can be canceled with the Cancel Kanji Mode (FS '.') command.
For character font, see the Appendix A.4 Kanji quarter size character set.

This command is valid for SII Japanese font set (at shipping) mounted.

Default Cancel Kanji Quarter Size Character Mode.

FS DC2 — Cancel Kanji Quarter Size Character Mode

Code 1CH 12H

Function Cancels Kanji Quarter Size Character Mode.

Kanji Quarter Size Character Mode is canceled and the following characters are printed in Kanji character mode.

Default Cancel Kanji Quarter Size Character Mode.

6.5.12 Kanji Character Definition Commands

FS '2' c1 c2 {DATA} Define User-defined Character

Code 1CH 32H c1 c2 {d1 d2•••dk}

Function Defines a Kanji User-defined character pattern for the character code specified by c1 and c2.

c1 and c2 indicate a Kanji code for the User-defined character to be defined.
c1 indicates the first byte, and c2, the second byte.
c1 and c2 depend on selected kanji code system or mounted font set, refer to 6.3 CHARACTER CODES for details.

If c1 or c2 is out of range, the range is ignored and the following data will be processed as normal data.

Since 24-dot User-defined characters and 16-dot User-defined characters are registered in different areas, up to 94 characters of each type can be defined at the same time.

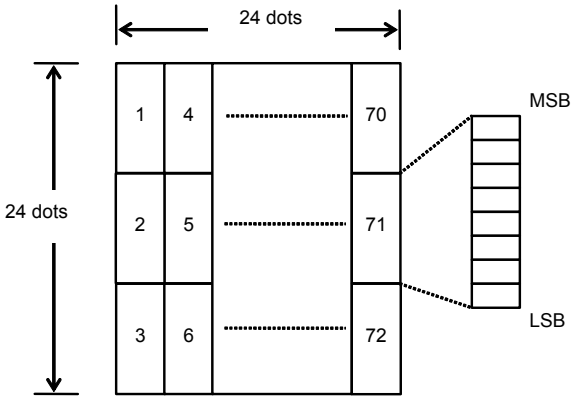
Whether a 24-dot or 16-dot User-defined character is registered according to the font selected when this command is input.

The number of bytes (k) of the pattern is as follows:
24-dot: k = 3 × 24 = 72 bytes
16-dot: k = 2 × 16 = 32 bytes

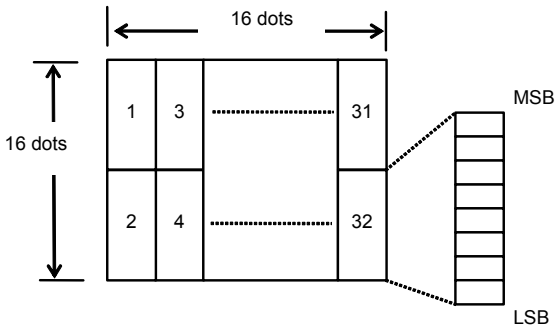
d indicates font data. 8 vertical dots of font data must be input as 1 byte.

Default Undefined

•24-dot font



•16-dot font



DC2 'G' n — User-defined Character Area Operation

Code 12H 47H n

Function Allocates or frees up the User-defined character area.

Only the least significant bit (LSB) of n is valid.
n = 0: Frees up the User-defined character area.
n = 1: Allocates the User-defined character area.

When the User-defined character area is freed up, the User-defined character is erased and the User-defined character definition commands are ignored.

The User-defined character area after memory initialization is 9784 bytes. If the User-defined character area is freed up, the remaining memory capacity increases 9784 bytes.

The remaining memory capacity must be at least 9784 bytes to reallocate the User-defined character area. If the remaining memory capacity is insufficient, the User-defined character area is not allocated and DC2 'G' 1 is ignored.

Default n=1 (Allocate the User-defined character area.)

6.5.13 Kanji Character Decoration Commands

FS 'J' Select Vertical Writing

Code 1CH 4AH

Function Selects vertical writing.

Valid in Kanji mode only.

Character decoration applies to a line. If the vertically written character is doubled vertically, it is doubled in the Y direction (character widths are doubled). If the width is doubled, the character is doubled in the X direction (characters are doubled vertically).

Default Horizontal writing.

FS 'K' Select Horizontal Writing

Code 1CH 4BH

Function Selects horizontal writing.

Valid in Kanji mode only.

Default Horizontal writing.

FS 'W' n Select/Cancel Quadruple-size Kanji Character

Code 1CH 57H n

Function Selects or cancels quadruple-size Kanji character.

Only the least significant bit of n is valid.
n = 1: Select quadruple-size Kanji character.
n = 0: Cancel quadruple-size Kanji character.

A quadruple-size character is generated by specifying double height and double width. When a quadruple-size Kanji character is canceled, it becomes a normal character.

Default n=0 (Canceled quadruple-size Kanji character)

FS '-' n — Select/Cancel Kanji Underline Mode

Code 1CH 2DH n

Function Select or cancel underline mode.

Only the low two bits of n is valid.
- n = 0: Cancel underline mode.
- n = 1: Select 1-dot underline mode.
- n = 2: Select 2-dot underline mode.
- n = 3: Ignore the command.

The underline is attached to all printing characters, including character right-side spacing. However, the underline is not attached when skipped by HT or other commands.

This command is not valid for 1-byte characters, however underline setting is valid for 1-byte characters.

If the underline is canceled by n=0, the subsequent 2-byte characters are not underlined.

The underline mode can also be selected or canceled with FS '!', but the most recently processed command is effective.

Default n=0 (Cancel underline mode.)

FS '!' n — Set Kanji Print Mode

Code: 1CH 21H n

Function: Sets a print mode for 2-byte characters.

Each bit of n is used as follows:

Bit	Function	n=0	n=1
0	Printing direction selection	Horizontal writing	Vertical writing
1	Undefined	-	-
2	Double-width	Canceled	Set
3	Double height	Canceled	Set
4	Kanji quarter size character	Canceled	Set
5	Kanji quarter size character position	Subscript	Superscript
6	Undefined	-	-
7	Under line	Canceled	Set

The underline is attached to all character widths, including right- and left-side character spacing. However, it is not attached to the characters skipped by HT or other commands, or the characters rotated by 90°.

The underline width is specified by FS '-' regardless of the character size. When the underline width is not specified by FS '-', default width is set as 1-dot underline.

This command does not affect 1-byte character, however the only double-width mode is valid for 1-byte characters.

If the print mode can also be selected or canceled by another command, the most recently processed command is effective.

The Kanji quarter size character can be selected or canceled in Kanji mode only. Bit 4 is ignored in non-Kanji mode.

Default: n=0

6.5.14 Kanji Character Pitch Adjustment Command

FS 'S' nl nr	Set Kanji Left- and Right-side Spacing

Code 1CH 53H nl nr
0≤nl≤127
0≤nr≤127

Function Sets the left-side spacing nl and the right-side spacing nr of 2-byte characters.

Only the seven least significant bits of nl and nr are valid. Up to 127 dots can be set.

The character spacing specified by this command does not apply to 1-byte characters.

The character spacing for double-width mode is twice the value set by this command. It can be expanded to up to 254 dots.

Default nl=0, nr=8 (at shipping)
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i') command.

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 GJ$=CHR$(&H77)+CHR$(&H21)
120 PRINT #1,CHR$(&H12);"F0";                    '16 dots font
130 PRINT #1,CHR$(&H1C);"2";GJ$;                 '7721H
140 RESTORE 570 : N=32 : GOSUB 540
150 PRINT #1,CHR$(&H12);"F1";                    '24 dots font
160 PRINT #1,CHR$(&H1C);"2";GJ$;                 '7721H
170 RESTORE 600 : N=72 : GOSUB 540
180 FOR I=&H30 TO &H33                           '2330~2333
190   K$=K$+CHR$(&H23)+CHR$(I)
200 NEXT I
210 FOR I=&H41 TO &H44                           '2341~2444
220   K$=K$+CHR$(&H23)+CHR$(I)
230 NEXT I
240 FOR I=&H21 TO &H23                           '3021~3024
250   K$=K$+CHR$(&H30)+CHR$(I)
260 NEXT I : K$=K$+GJ$
270 PRINT #1,CHR$(&H1C);"&";
280 FOR J=0 TO 1
290   PRINT #1,CHR$(&H12);"F";CHR$(J);
300   FOR I=0 TO 1
310     PRINT #1,CHR$(&H1C);"W";CHR$(I);
320     PRINT #1,CHR$(&H1C);"r";CHR$(I);K$
330   NEXT I : NEXT J
340 PRINT #1,CHR$(&H1C);"W0";
350 PRINT #1,CHR$(&H1C);"J";
360 FOR I=2 TO 0 STEP -1
370   PRINT #1,CHR$(&H1C);"-";CHR$(I);K$
380 NEXT I
390 PRINT #1,CHR$(&H1C);"K";
400 FOR I=2 TO 0 STEP -1
410   PRINT #1,CHR$(&H1C);"-";CHR$(I);K$
420 NEXT I
430 FOR I=2 TO 0 STEP -1
440   PRINT #1,CHR$(&H12);"Y";CHR$(I);K$         'Rotation
450 NEXT I
460 PRINT #1,CHR$(&H1C);"!";CHR$(&HBD);K$
470 PRINT #1,CHR$(&H1C);"!";CHR$(&H0);K$
480 FOR I=0 TO 18
490   PRINT #1,CHR$(&H1C);"S";CHR$(I);CHR$(I);   'Kanji space
500   PRINT #1,CHR$(&H30);CHR$(&H21+I);
510 NEXT I : PRINT #1,CHR$(&H0D);CHR$(&H1C);".";
520 CLOSE #1
530 END
540 FOR I=0 TO N-1
550   READ D$ : PRINT #1,CHR$(VAL("&h"+D$));
560 NEXT I : RETURN
570 '16x16 Font
580 DATA 80,80,C0,C0,E0,E0,F0,F0,F8,F8,FC,FC,FE,FE,FF,FF
590 DATA 80,80,C0,C0,E0,E0,F0,F0,F8,F8,FC,FC,FE,FE,FF,FF
600 '24x24 Font
610 DATA 80,80,80,C0,C0,C0,E0,E0,E0,F0,F0,F0,F8,F8,F8,FC
620 DATA FC,FC,FE,FE,FE,FF,FF,FF,80,80,80,C0,C0,C0,E0,E0
630 DATA E0,F0,F0,F0,F8,F8,F8,FC,FC,FC,FE,FE,FE,FF,FF,FF
640 DATA 80,80,80,C0,C0,C0,E0,E0,E0,F0,F0,F0,F8,F8,F8,FC
650 DATA FC,FC,FE,FE,FE,FF,FF,FF
```

Figure 6-11 Program Sample 6

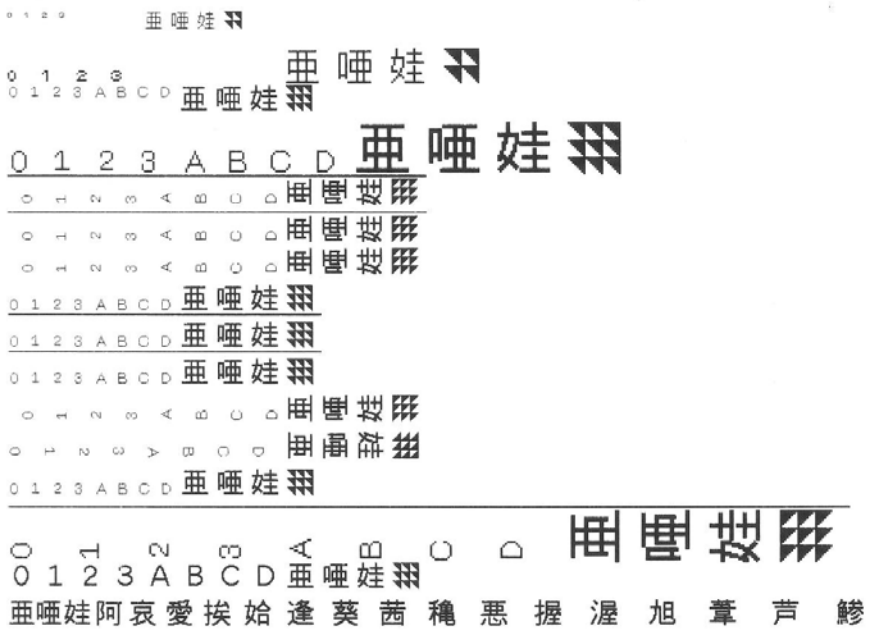


Figure 6-12 Print Sample 6

6.5.15 Image Command

ESC '*' m nl nh {DATA} Set Bit Image Mode

Code 1BH 2AH m nl nh {d1 d2•••dk}
m: 0,1,32,33 (mode setting)
0≤nh×256＋nl≤4095

Function Sets the bit image mode and prints bit image.

m indicates the bit image mode.
The bit image modes are related to the set bit images as shown below when the horizontal image width is 104mm (832 dots).

m	Mode	Vertical		Horizontal	
		Dots	Resolution	Dots	Resolution
0	8-dot single-density	8	2.7 dots/mm	416	4 dots/mm
1	8-dot double-density	8	2.7 dots/mm	832	8 dots/mm
32	24-dot single-density	24	8 dots/mm	416	4 dots/mm
33	24-dot double-density	24	8 dots/mm	832	8 dots/mm

If m is not one of the values listed above, ESC '*' m is ignored and the subsequent data will be processed as normal data.

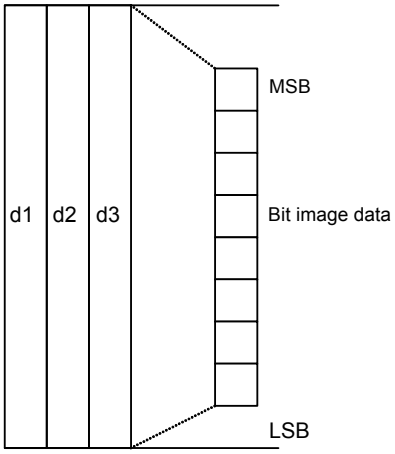
Number of dots in the horizontal direction = nhx256+nl

If nl = nh = 0, the data before nh is ignored, and the following data will be processed as normal data.

d indicates bit image data. The image data k is as follows:
8-dot bit image: k = (nh×256+nl) bytes
24-dot bit image: k = (nh×256+nl) × 3 bytes

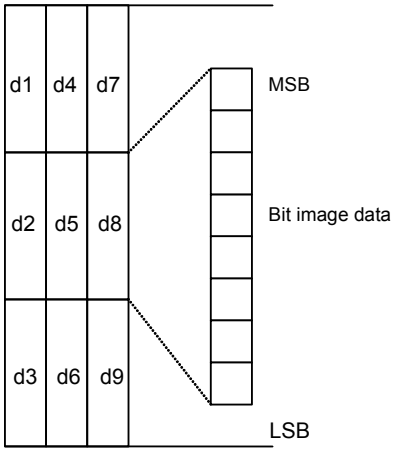
If the number of dots in the horizontal direction exceeds the printable area, the excess data is ignored.

•8-dot mode



Print data

•24-dot mode



Print data

GS 'v' '0' m xl xh yl yh {DATA} — Raster Bit Image Print

Code

1DH 76H 30H m xl xh yl yh {d1 d2•••dk}
0=0 or 48
0≤xh x 256 + xl ≤ 65535
0≤yh x 256 + yl ≤ 65535

Function

Prints raster format dot images.

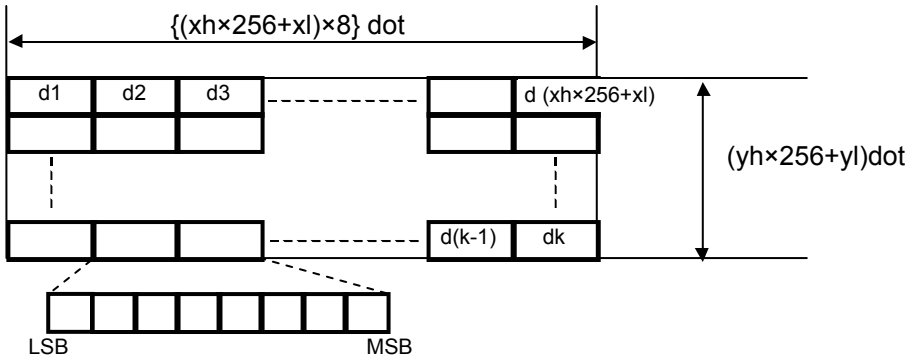
xh, xl: specify the horizontal data by count of bytes.
yh, yl: specify the vertical data by count of dots.

The printer does not print data which exceeds right margin.

Ignores this command when xhxl or yhyl is 0.
Ignores the setting of page length or bottom margin.

If there is any data in the line buffer, the printer prints the raster bit image after data in the line buffer is printed.

The correspondence between the bits of image data can be selected by the Select image LSB/MSB (DC2 '='). The LSB initially corresponds to the leftmost dot.



```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 D=408:N=D
120 PRINT #1,"8 dots Single-density
130 PRINT #1,CHR$(&H1B);"*";CHR$(0);CHR$(D MOD 256);CHR$(D\256);
140 GOSUB 260
150 N=D : PRINT #1,"8 dots Double-density
160 PRINT #1,CHR$(&H1B);"*";CHR$(1);CHR$(D MOD 256);CHR$(D\256);
170 GOSUB 260
180 N=D*3 : PRINT #1,"24 dots Single-density
190 PRINT #1,CHR$(&H1B);"*";CHR$(32);CHR$(D MOD 256);CHR$(D\256);
200 GOSUB 260
210 N=D*3 : PRINT #1,"24 dots Double-density
220 PRINT #1,CHR$(&H1B);"*";CHR$(33);CHR$(D MOD 256);CHR$(D\256);
230 GOSUB 260
240 CLOSE #1
250 END
260 FOR I=1 TO N/12
270  PRINT #1,CHR$(&H33);CHR$(&H33);CHR$(&H33);
280  PRINT #1,CHR$(&H33);CHR$(&H33);CHR$(&H33);
290  PRINT #1,CHR$(&HCC);CHR$(&HCC);CHR$(&HCC);
300  PRINT #1,CHR$(&HCC);CHR$(&HCC);CHR$(&HCC);
310 NEXT I:PRINT #1,CHR$(&HD);
320 RETURN
```

Figure 6-13 Program Sample 7

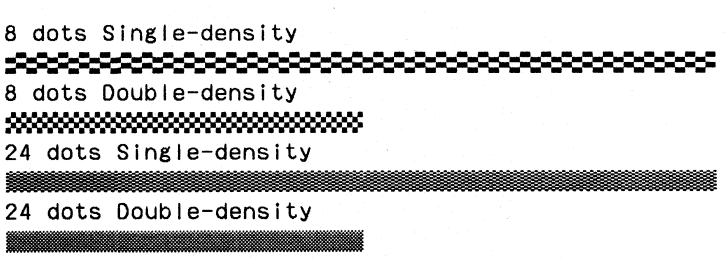


Figure 6-14 Print Sample 7

6.5.16 Stamp

Stamp function does overlap characters with predefined bit images and to print out them simultaneously.

Since the memory stores the defined stamps unless initializing the user area of the memory or clearing the stamp, repeating print of the same stamp is possible without entering a large amount of data repeatedly. Create bit image in the rectangular area which is specified by a number of bytes in the horizontal direction and a number of dot lines in the vertical direction. Up to 127 bytes (1016 dots) in the horizontal direction and up to 2047 dot lines in the vertical direction can be specified. Up to 128 stamps can be registered and the stamps with the stamp select function code can be printed out.

Stamp selection does specify the registered stamp number and printing position and to print out the stamps overlapped with printed character or character spaces. Specify the printing position in the horizontal direction by 8 dots. Stamp print function code prints stamps without overlapping.
More than one stamp cannot be printed out simultaneously.
The stamp overlapping mode can be set to OR or XOR by the Select overlap mode command (DC2 '#' n).

If a stamp is selected when ruler line printing is on, ruler line printing stops and stamps are printed out. When print out of stamps has been completed, printout of ruler lines restarts. Note that the stamps can be printed out without turning on ruler line.

While the selected stamp is being printed, the function codes such as setting memory area active or inactive should not be entered (Table 6-4).
If such codes are included, printout of the stamps is aborted. For more information, see 6.4MEMORY.

DC2 'T' n x yl yh {Image Data} Stamp Define

Code

12H 54H n x yl yh {d1 d2•••dk}
0≤n≤127
1≤x≤127
1≤yhx256+yl≤2047

Function

Specify the stamp images.

Specify the stamp number between 00H and 7FH (0 to 127) to n. The stamp number is any number. Stamps are selected with this number.
If the defined stamp number is specified, the predefined stamp is cleared and the memory area of the predefined stamp is freed up, then the new stamp is defined.

x specifies the number of bytes of stamp image in the horizontal direction. The least significant 7bits of x are valid and the values between 01H and 7FH (1 to 127) are specified. Thus specify up to 127 × 8=1016 dots by 8 dots to the horizontal direction.

yl and yh specify the number of dot lines of stamp image in the vertical direction. yl represents least significant byte and yh represents most significant byte. The least significant 3 bits of yh are valid. Specify up to 07FFH (2047) dot lines with yl and yh.

If an invalid value beyond the range is specified for x, yl, or yh, the command data is ignored up to that specification and the following data is processed as character codes.

Enter the stamp data in the horizontal direction by 8 dots as follows:

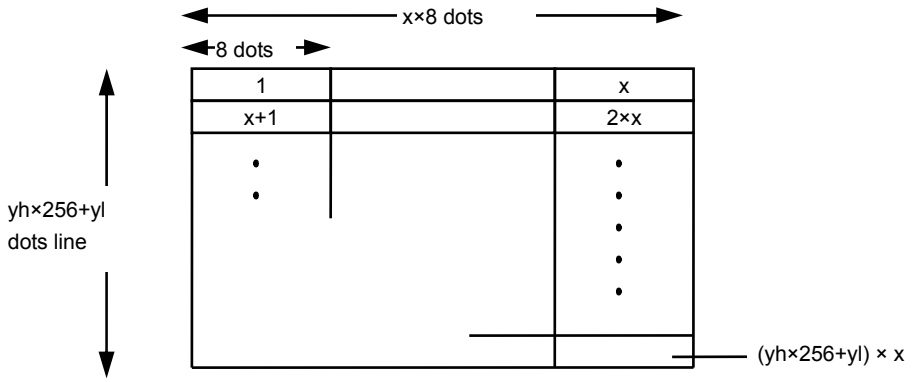


Image data input order

Total stamp data is expressed by the following equation.
Total stamp data=x × (yh × 256+yl) bytes

Since 11 bytes of memory control data is added to stamp data, total stamp data plus 11 bytes memory is used.
Specify total stamp data plus 11 must be 65535 bytes or less.
If registered data exceeds more than 65535, the image data is processed as character codes.

The correspondence between the bits of image data can be selected by the Select image LSB/MSB (DC2 '='). The LSB initially corresponds to the leftmost dot.

DC2 'S' n x — Stamp Select

Code: 12H 53H n x
0≤n≤127
0≤x≤255

Function: Selects stamp and specifies the printing position to the horizontal direction.

n: Stamp number (00H to 7FH)
x: Printing position in the horizontal direction (by 8 dots) (00H to FFH)

x specifies the printing position to the horizontal direction. The printing position can be specified by 8 dots. The stamp is printed at the x × 8th dot position from the left edge of the printable area.

If stamp is too large or the printing position x are out of the print area, those parts are not printed out.
If stamp has not been specified, the data until n is ignored and x is processed as a character.

More than one stamp cannot be printed out simultaneously.
When the selected stamp is printed out until the last dot line, its stamp selection is automatically canceled.

If this function code is entered before the printing of the selected stamp is completed, the stamp selection is canceled and the newly specified stamp is selected.

While the selected stamp is being printed, do not enter the function codes listed in Table 6-4. If function codes are entered at this time, stamp printing will be aborted.

DC2 'V' — Stamp Print Out

Code: 12H 56H

Function: Prints out all the selected stamps.

If stamp is not selected, this function code is ignored.
If stamp is being selected, the stamp is printed out to the bottom edge.
If stamp length is larger than page length, the printer ignores this command.

When the position of the stamp end does not placed within the page length, the printer prints the stamp after executing Form Feed.

DC2 'W' — Stamp Abort

Code: 12H 57H

Function: Aborts the printout of the selected stamp.

If stamp is not selected, this function code is ignored.
If stamp is being selected, stamp printing is aborted.

DC2 'U' n — Stamp Clear

Code: 12H 55H n
0≤n≤127

Function: Clears the stamp specified with n (stamp number) and frees up the memory area.

The remaining memory area increases by the memory area freed up.
If stamp is selected, the selected stamp is cleared automatically.

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 S$=STRING$(20,CHR$(&HFF))+STRING$(6,CHR$(0))+STRING$(20,CHR$(&H55))
120 PRINT #1,CHR$(&H12);"T";CHR$(10);CHR$(20);CHR$(160);CHR$(0);
130 FOR I=1 TO 20 : FOR J=0 TO 7
140  PRINT #1,MID$(S$,I+J,20);
150 NEXT J,I
160 PRINT #1,CHR$(&H12);"S";CHR$(10);CHR$(0);
170 GOSUB 290
180 PRINT #1,CHR$(&H12);"S";CHR$(10);CHR$(50);
190 GOSUB 290
200 PRINT #1,CHR$(&H12);"S";CHR$(10);CHR$(1);
210 PRINT #1,"      STAMP PRINT"
220 PRINT #1,CHR$(&H12);"W";
230 PRINT #1,"      STOP STAMP"
240 PRINT #1,CHR$(&H12);"U";CHR$(10);
250 PRINT #1,"STAMP DELETED"
260 PRINT #1,CHR$(&H12);"S";CHR$(10);CHR$(0);
270 PRINT #1,CHR$(&H12);"V"
280 CLOSE #1
290 END
300 ' WELCOME
310 PRINT #1,"           WELCOME to"
320 PRINT #1,CHR$(&H1B);"w1";CHR$(&HE);"      STAMP"
330 PRINT #1,CHR$(&H1B);"w0";CHR$(&HE);"      World"
340 PRINT #1,CHR$(&H12);"V";
350 RETURN
```

Figure 6-15 Program Sample 8

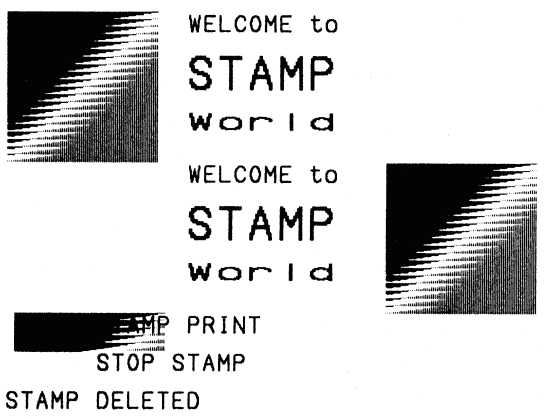


Figure 6-16 Print Sample 8

6.5.17 Other Commands

CAN	Cancel Print Data in Buffer

Code 18H

Function Clears the data in the line buffer.

The next print starting position is the beginning of the line (left margin).

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 PRINT #1,CHR$(&H1B);"Q";CHR$(40);      'Right Margin 40 char
120 PRINT #1,CHR$(&H1B);"l";CHR$(10);      'Left Margin 10 char
130 PRINT #1,CHR$(&H12);"F0";              '16 dots Font
140 PRINT #1,CHR$(&H1B);"W1";              'Double Width
150 PRINT #1,CHR$(&H1B);"w1";              'Double Height
160 PRINT #1,CHR$(&H1B);" ";CHR$(10);      'Char Space
170 PRINT #1,CHR$(&H12);"Y1";              'Right Rotation
180 PRINT #1,"RESET COMMAND TEST"
190 PRINT #1,"ABCDEFG";
200 PRINT #1,CHR$(&H1B);"@";               'Reset!
210 FOR I=0 TO 999:NEXT I
220 PRINT #1,"RESET COMMAND TEST"
230 PRINT #1,"ABCDEFG";
240 PRINT #1,CHR$(&H18);"CANCELED"
250 CLOSE #1
260 END
```

Figure 6-17 Program Sample 9

Figure 6-18 Print Sample 9

6.5.18 Ruler Line Commands

DC3 '+' Ruler Line ON

Code 13H 2BH

Function Turns on ruler line printing.

After this command is input, the printer prints the contents of the ruler line buffer with a character print or paper feed command until the DC3 '-' command or DC3 'C' command is input.

When characters are printed, characters and ruler lines are overlapped with each other in the mode specified by DC2 '#'.

The ruler lines are not affected by the print area or print position setting.

Default Ruler line OFF

DC3 '-' Ruler Line OFF

Code 13H 2DH

Function Turns off ruler line printing.

After this command, the printer prints no ruler lines even when a character print or paper feed command is input.

Default Ruler line OFF

DC3 'A' Ruler Line Buffer A

Code 13H 41H

Function Selects ruler line buffer A.

There are two ruler line buffers, A and B. This command selects ruler line buffer A.

Subsequently, the printer writes ruler line data into ruler line buffer A and prints the image from ruler line buffer A when ruler line printing is turned on.

Default Ruler line buffer A selection.

DC3 'B' Ruler Line Buffer B

Code 13H 42H

Function Selects ruler line buffer B.

There are two ruler line buffers, A and B. This command selects ruler line buffer B.

Subsequently, the printer writes ruler line data into ruler line buffer B and prints the image from ruler line buffer B when ruler line printing is turned on.

Default Ruler line buffer A selection.

DC3 'C' Ruler Line Buffer Clear

Code 13H 43H

Function Clears all bits in the selected line buffer to zero.

If all bits in the selected line buffer are set to zero, the data is not printed even when the ruler line printing is turned on.

Default Both ruler line buffers A and B are clear.

DC3 'D' nl nh Define Ruler Line by Dot

Code 13H 44H nl nh
0≤nh×256＋nl≤4095

Function Sets to 1 the specified dot in the selected ruler line buffer.

nl and nh specify the dot position. The leftmost position corresponds to dot 0 and the dot position is specified at the (nh×256+nl) position.

Only the 4 least significant bits of nh are valid.

DC3 'F' nl nh Define Ruler Line with Repeating Patterns

Code 13H 46H nl nh
0≤nl≤255
0≤nh≤255

Function Fills the selected ruler line buffer with the bit image data (two bytes) of the specified code.

nl indicates 8 dots in the left side and nh indicates 8 dots in the right side.

The correspondence between the bits of nl and nh and dots can be selected by the Select image LSB/MSB (DC2 '='). The LSB initially corresponds to the leftmost dot.

DC3 'L' sl sh el eh Define Ruler Line by Line

Code 13H 4CH sl sh el eh
0≤sh×256+sl≤4095
0≤eh×256+el≤4095

Function Sets to 1 a line of dots from the specified start point to the end point of the selected ruler line buffer.

sl and sh specify the start position, and el and eh specify the end position. The start and end positions are (sh×256+sl) and (eh×256+el), respectively, assuming that the leftmost end of the ruler line buffer corresponds to dot 0.

Only the 4 least significant bits of sh and eh are valid.

DC3 'V' {DATA} Ruler Line LSB/MSB Image

Code: 13H 56H {d1 d2••• dk}
0≤d≤255

Function: Writes one dot line of the image data into the selected ruler line buffer.

The image data k corresponds to the line of dots in a ruler line buffer.
When the page mode is not selected, number of image data is 104 bytes.
In page mode, number of image data depends on its printing mode and page size.
Normal printing mode : number of bytes by horizontal
Rotated 90° clockwise mode : INT ((number of dots by paper feed direction + 7) / 8) bytes

The correspondence between the bits of image data and dots can be selected by the Select image LSB/MSB (DC2 '='). The LSB initially corresponds to the leftmost dot.

DC3 'P' Print One dot Line after Printing Line Buffer Data

Code: 13H 50H

Function: If ruler line printing is ON, this prints one dot line from the selected ruler line buffer after printing data in the line buffer.

If there is any data in the line buffer, it is printed, then one dot line is printed.
If ruler line printing is off, the printer only feeds one dot line.

DC3 '(' Continuous Ruler Line Command Input

Code: 13H + 28H

Function: After this code is received, the printer accepts all ruler line control commands without a leading DC3 code until a ')' code is received.

Commands other than ruler line control commands are ignored.
For example, the sequence of commands to select ruler line A, turn ruler line ON, select one dot print, and turn ruler line OFF is as follows:
DC3 '(A+P-)'

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 PRINT #1,CHR$(&H13);"A";
120 PRINT #1,CHR$(&H13);"V";
130 PRINT #1,STRING$(52,CHR$(&H88));
140 FOR I=1 TO 52 : PRINT #1,CHR$(I); : NEXT I
150 PRINT #1,CHR$(&H13);"+";
160 PRINT #1,"RULED LINE OR"
170 PRINT #1,CHR$(&H12);"#1";
180 PRINT #1,"RULED LINE XOR"
190 PRINT #1,CHR$(&H13);"(";
200 FOR I=0 TO 200
210   X=INT(SQR(40000!-I^2)):X1=415-X:X2=415+X
220   PRINT #1,"C";
230   PRINT #1,"L";CHR$(X1 MOD 256);CHR$(X1\256);CHR$(160);CHR$(1);
240   PRINT #1,"D";CHR$(X2 MOD 256);CHR$(X2\256);
250   PRINT #1,"P";
260 NEXT I
270 PRINT #1,"ACF";CHR$(&HFF);CHR$(&HFF);
280 PRINT #1,"BCL";CHR$(0);CHR$(0);CHR$(3);CHR$(0);
290 PRINT #1,"L";CHR$(60);CHR$(3);CHR$(63);CHR$(3);
300 PRINT #1,"D";CHR$(94);CHR$(0);
310 PRINT #1,"D";CHR$(158);CHR$(0);"-)"
320 PRINT #1,CHR$(&H13);"(+APPPPB)";
330 PRINT #1," RULEDLINEPRINT"
340 PRINT #1,CHR$(&H13);"(APPB)";
350 PRINT #1,CHR$(&HE);"ABCDEFGHIJ"
360 PRINT #1,CHR$(&H13);"(APPPP-)";
365 CLOSE #1
370 END
```

Figure 6-19 Program Sample 10

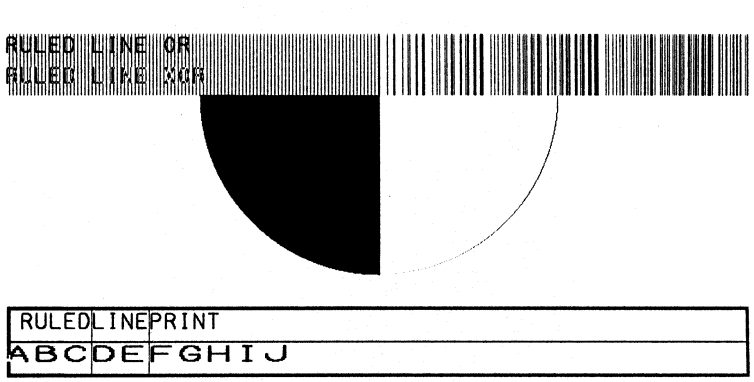


Figure 6-20 Print Sample 10

6.5.19 Optional Font Commands

DC2 'P' s e x y {DATA} — Define Optional Font

Code

12H 50H s e x y {d1 d2•••dk}
20H≤s≤e≤FEH
s≠7FH, e≠7FH
8≤x≤127
1≤y≤48
0≤d≤255

Function

Defines an optional font.

s and e specify a definition start character code and a definition end character code of the optional font. If only one character is input, s=e.
If the area from s to e contains 7FH, the 00H for one character of data must be input for 7FH.

x and y indicate the number of dots of the optional font in the horizontal direction and the number of dots in the vertical direction.

If s, e, x, or y is out of range, the excess part is ignored and the following data will be processed as normal data.

The optional font can be defined only in the continuous character area specified by s to e. If any optional font is already registered, it is erased and the area is freed up, and the new optional font is registered.

d indicates font data.

Create font as follows:
The number of bytes of data required for one character in the horizontal direction is obtained by dividing x by 8 and rounding off decimals to the next whole number.
There are y dot lines in the vertical direction. The amount of data of one character is calculated by the following formula:
Amount of data of one character = INT((x+7)/8) × y bytes
If x is not a multiple of 8, the excess rightmost bits are ignored.

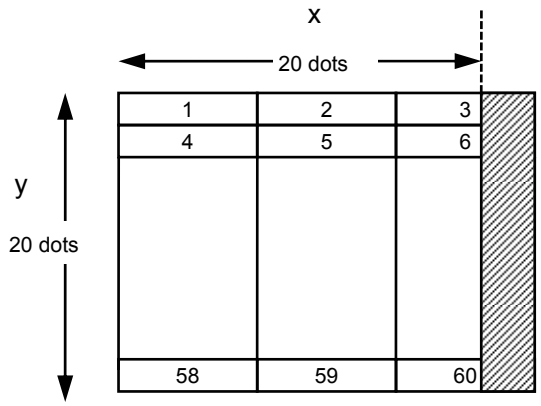
The total quantity of font data (k) is obtained by the following equation:
k = (Amount of data of one character) x (e-s+1) bytes

The 12-byte memory control data is attached to the optional font, (total amount of font data + 12) bytes of memory are used.

If the remaining amount of memory is less than (total amount of font data + 12) bytes, (total amount of font data + 12) must be 65535 bytes or less. The data exceeding 65535 bytes will be treated as normal data.

If the remaining amount of memory is less than (total amount of font data + 12) bytes or if 65536 bytes or more of data are input, the previously defined data is erased.

The correspondence between the bits of image data can be selected by the Select image LSB/MSB (DC2 '='). The LSB initially corresponds to the leftmost dot.



Order of Optionnal font data input (x=20、y=20)

Default No definition.

DC2 'O' n — Select Optional Font

Code 12H 4FH n

Function Selects an optional font.

Only the least significant bit of n is valid.
n = 0: Cancel the optional font.
n = 1: Select the optional font.

If the optional font is selected, the character codes for which the optional font was defined are printed with the font. Undefined character codes are printed with internal fonts.
If the download character set and optional font are defined in the same character code and both character sets are selected, the download character set is given priority.

The optional fonts cannot be rotated by 90°.

Default n=0 (Cancel)

DC2 'Q' — Erase Optional Font

Code 12H 51H

Function Erases the optional font and frees up the memory area allocated to the optional font.

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 SCD=&H41:ECD=&H45
120 PRINT #1,CHR$(&H12);"P";CHR$(SCD);CHR$(ECD);CHR$(16);CHR$(8);          'A~E
130 FOR I=0 TO ECD-SCD
140   RESTORE 280 : N=16 : GOSUB 250
150 NEXT I
160 FOR I=0 TO 1
170   PRINT #1,CHR$(&H12);"O";CHR$(I);
180   FOR J=0 TO 1
190    PRINT #1,CHR$(&H1B);"W";CHR$(J);
200    PRINT #1,CHR$(&H1B);"w";CHR$(J);
210    PRINT #1,"ABCDEFGHIJ"
220   NEXT J : NEXT I
230 CLOSE #1
240 END
250 FOR J=0 TO N-1
260   READ D$ : PRINT #1,CHR$(VAL("&h"+D$));
270 NEXT J : RETURN
280 '8×16 Font
290 DATA 80,80,C0,C0,E0,E0,F0,F0,F8,F8,FC,FC,FE,FE,FF,FF
```

Figure 6-21 Program Sample 11

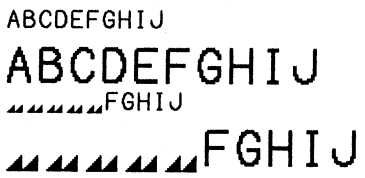


Figure 6-22 Print Sample 11

6.5.20 Bar Code Commands

GS 'H' n — Select HRI Character Print Position

Code 1DH 48H n

Function Selects the print position of the HRI character when printing a bar code.

Only the two low-order bits of n are valid.
- n = 0: Does not print
- n = 1: Above the bar code
- n = 2: Below the bar code
- n = 3: Above and below the bar code

HRI characters are printed with the font selected by GS 'f'.

Default n=0 (Does not print)

GS 'f' n — Select HRI Character Font

Code 1DH 66H n

Function Selects the HRI character font used when printing a bar code.

Only the least significant bit (LSB) of n is valid.
- n = 0: 24 × 12 dots font
- n = 1: 16 × 8 dots font

Default n=0 (24 × 12 dot font)

GS 'h' n — Set Bar Code Height

Code 1DH 68H n
$1 \le n \le 255$

Function Sets the bar code height.

The bar code height is n dot lines.
If n = 0, this command is ignored.

Default n=162

GS 'k' n {DATA} Print Bar Code

Code

1DH 6BH n {d1 d2•••dk}
0≤n≤255

Function

Selects a bar code system and prints a bar code.

n: Bar code system

n	Function
0	UPC-A
1	UPC-E
2	JAN13(EAN)
3	JAN8
4	CODE39
5	ITF
6	CODABAR
7	CODE128

Each bar code data is input as follows:
UPC-A :Input one of '0' to '9' 11 times, then input 00H.
UPC-E :Input one of '0' to '9' 11 times, then input 00H.
JAN13 :Input one of '0' to '9' 12 times, then input 00H.
JAN8 :Input one of '0' to '9' 7 times, then input 00H.
CODE39 :Input one of ' ' , '$', '%', '+', '-', '.', '/', '0' to '9', 'A' to 'Z' a given number of times, then input 00H.
ITF :Input one of '0' to '9' a given even-number of times, then input 00H.
CODABAR :Input a start character 'A' to 'D', one of '0' to '9', '+', '.', '/', ':', '$', '-', a given number of times, a stop character 'A' to 'D', then input 00H.
CODE128 :Input a start code as 103 to 105, and input arbitrary number as 0 to 102, then input a stop code as 103 or larger.

If the line buffer contains data, it is printed, and then the bar code is printed.
Paper is fed at the bar code height (including the HRI character height when printing HRI characters) regardless of the line feed set with ESC '2' and ESC '3' n.

If input data does not meet the code system, it is ignored and the subsequent data is accepted as a character code. Therefore, no bar code is printed.

If the bar code length specified in input data exceeds the printable area, no bar code is printed. The data is ignored.

Normal character printing settings, such as character decoration, are not reflected in barcode printing.

Bar codes, including HRI characters, cannot be overwritten with ruled lines.

See the document for each bar code system for details on its specifications.

Note

A ladder bar code is that to be printed horizontally against paper feed direction by specifying Page Mode Select (DC2 'z' 0) command n as 1.
When printing the ladder bar code, specify bar code height should be 10 mm or longer and print that under the temperature of 0 to 40°C.
Moreover, specify printing motor speed as low speed by Motor Speed Select (GS 'E') command.
If ladder bar code is printed with the condition except above, may cause loss of reading accuracy.

GS 'w' n1 n2 — Set Width of Bar Code

Code 1DH 77H n1 n2
0≤n1≤255
0≤n2≤255

Function Specifies the bar code narrow width and wide width in dots.

The two low-order bits of n1 and n2 are valid. They are set as follows:

Narrow width

n1	Dots
0	2
1	3
2	4

Wide width

n1	n2			
	0	**1**	**2**	**3**
0	5	6	6	6
1	7	8	9	9
2	9	10	11	12

If the two low-order bits of n1 are 3, it is ignored to n1, and n2 will be processed as normal data.

Note Specify n1 and n2 to 1 and 2 or larger when printing ladder bar code (its bar is to be printed horizontally against paper feed direction). If doing so may cause loss of reading accuracy.

Default n1=1 (narrow width: 3 dots), n2=2 (wide width: 9 dots)

GS 'P' n — Set Bar Code Print Position

Code 1DH 50H n

Function Sets the bar code print position.

Only the two low-order bits of n are valid.
n = 0: Print a bar code at the left.
n = 1: Print a bar code at the center.
n = 2: Print a bar code at the right.
n = 3: Ignored

Default n=0 (Print a bar code at the left.)

GS 'n' n — Nominal Fine Element Width

Code 1DH 6EH n
2≤n≤8

Function Sets a norminal fine element width by dot.
n:Norminal fine element width in a dot number.

Sets the norminal fine element width of PDF417 n dots.

Default n=2

GS 'o' n — PDF Row Height

Code

1DH 6FH n
2≤n≤85

Function

Sets a PDF row height by dot.
n:PDF417 row height in a dot number.

Sets PDF417 row height n dots.

When a small value is set as the row height, some bar code reader may not read.
Normally, set 3 dots or more.

Default

n=7

GS 'p' 0 m2 e r c nl nh {DATA} — PDF417 Print

Code

1DH 70H 00H m2 e r c nl nh {d1 d2•••dk}
0≤m2≤1
0≤e≤8
0, 3≤r≤90
0, 1≤c≤30
0≤ nh ×256+ nl ≤1023

Function

Prints PDF417 based on the designated contents.

m2	:Print mode 0:Normal mode, 1:Simple mode (Micro PDF is not supported)
e	:Error correction level
r	:Number of row (0: Automatic setting)
c	:Number of column in data area (0: Automatic setting)
nl, nh	:Number of data

When out of range value is designated, this command is ignored and the subsequent data is processed as normal data.

When setting more than data of 1024 bytes, the printer processes the subsequent data as normal data.
However, maximum value of data should be less than 1023 depending on the contents of data or error correction level, so the printer discards data which is exceeding maximum value.

When there is the data in line buffer, printing starts after the data is output.

When horizontal width of PDF417 (including quiet zone) exceed the print area, this command is ignored.

The right and left margin is invalid.

When the position of PDF417 end is not placed within the page length and exceeds the print area set by bottom margin setting, the printer prints PDF417 after executing Form Feed.

The bar code print position setting is valid.

The quiet zone width is fixed to two nominal fine element width.

DC2 ';' n — QR Code and Data Matrix Module Sizes

Code 12H 3BH n
2≤n≤11

Function Sets QR Code and Data Matrix module sizes by dot.
n: Number of dots on one side of the module.

Sets module sizes of QR Code and Data Matrix to n dots.
When a small value is set as the module size, some bar code readers may not read.
Set the module size to 4 dots or more for normal operation.

Default n=4

GS 'p' 1 model e v mode nl nh {DATA} — QR Code Print

Code 1DH 70H 01H model e v mode nl nh {d1 d2•••dk}
1≤model≤2
e= 48H, 4CH, 4DH, 51H
0, 1≤v≤40
mode= 41H, 42H, 4BH, 4DH, 4EH
1≤nh x 256 + nl≤7089

Function Prints QR Code data based on the designated contents.
model :Designates a model.
e :Selects an error correction level.
'L' (4CH), 'M' (4DH), 'Q' (51H), 'H' (48H)
v :=0 Automatic selection (Selects a version according to input data number.)
1 ≤ v ≤ 40 Fixed version (model 1: up to 14)
mode :Designates a data mode

Mode	Value	Mode Name
'N'	4EH	Numerical mode
'A'	41H	Alphanumeric mode
'B'	42H	8-bits byte mode
'K'	4BH	Kanji mode
'M'	4DH	Mixed mode

nl, nh : Designates data number.
d :QR Code data. Set Kanji data in Shift JIS codes.

When out-of-range value is designated, this command is ignored and the subsequent data are processed as normal data.

When a value of 7090 bytes or more is set, the subsequent data are processed as normal data. The maximum value becomes less than 7089 bytes according to models, modes, and error correction levels.
When data are designated more than the maximum value, the data are read and ignored.

If data is remaining in the line buffer, the printer prints bar code after sending data

When horizontal width of QR code (including quiet zone) exceed the print area, this command is ignored.

The right and left margin is invalid.

When the position of bar code end is not placed within the page length and exceeds the print area set by bottom margin setting, the printer prints bar code after executing Form Feed.

The bar code print position setting is valid.

The quiet zone width is fixed to four modules.

GS 'p' 2 ecc row col nL nH {DATA} Data Matrix Print

Code

1DH 70H 02H ecc row col nL nH {d1 d2•••dk}
ecc=00H
8≤row≤144
10≤col≤144
1≤nH×256+nL≤3116

Function

Prints the Data Matrix code base on the specified contents.

ecc:	00H (ECC 200) (for future extensional function)
row:	Specifies the number of the modules for the vertical direction. When '0' is specified, this is defined automatically.
col:	Specifies the number of the modules for the horizontal direction. When '0' is specified, this is defined automatically.
nL, nH:	Specifies the number of the data. The maximum number of the data is 3116 bytes.

When specifying any value other than the number of the modules for horizontal and vertical directions in ECC 200, this command is ignored.

When specifying any value exceeding 3116 bytes, the subsequent data is processed as the normal print data.

The maximum value varies depending on the number of the modules for horizontal and vertical directions and storage data. When specifying any data exceeding the maximum value, it is discarded.

If data is remaining in the line buffer, the printer prints bar code after sending data.

When the barcode size (includes a quiet zone) exceeds the print area, this command is ignored.

The right and left margin is invalid.

When the position of bar code end is not placed within the page length and exceeds the print area set by bottom margin setting, the printer prints bar code after executing Form Feed.

The bar code print position setting is valid.

The width of the quiet zone is fixed to 1 value.

The Structured Append is not supported.

Only the following combinations between horizontal line (row) and vertical line (column) are enable.
Squares (Row × Column)
10×10, 12×12, 14×14, 16×16, 18×18, 20×20, 22×22, 24×24, 26×26, 32×32, 36×36, 40×40, 44×44, 48×48, 52×52, 64×64, 72×72, 80×80, 88×88, 96×96, 104×104, 120×120, 132×132, 144×144

Rectangles (Row × Column)
8×18, 8×32, 12×26, 12×36, 16×36, 16×48

GS 'p' 3 mode ….n {DATA} Maxi Code Print

Code

1DH 70H 03H 02H sc cc pc n {d1 d2•••dk} (mode2)
1DH 70H 03H 03H sc cc pc n {d1 d2•••dk} (mode3)
1DH 70H 03H 04H n {d1 d2•••dk} (mode4)
1DH 70H 03H 05H n {d1 d2•••dk} (mode5)

Function

Prints the MaxiCode data based on the specified contents.

sc: Specifies a service class.
In mode 2, and mode 3, sc should be 3-digit numerals.

cc: Specifies a country code.
In mode 2, and mode 3, cc should be 3-digit numerals.

pc: Specifies a postal code.
In mode 2, the postal code should be specified in 9-digit numerals.
If less than 9-digit numerals is desired, specify data except numerals for the remainder.
In mode 3, the postal code should be specified in 6 alpha numerals

n: Specifies the number of the data. 1≤n≤138

When specifying any value of 139 or more bytes, the subsequent data is processed as the normal print data.

The maximum data value will be 138 or less bytes depending on the mode. When specifying any data exceeding the maximum value, it is discarded.

If data is remaining in the line buffer, the printer prints bar code after sending data

When the barcode size (includes a quiet zone) exceeds the print area, this command is ignored.

The right and left margin is invalid.

When the position of bar code end is not placed within the page length and exceeds the print area set by bottom margin setting, the printer prints bar code after executing Form Feed.

The bar code print position setting is valid.

The print size of the barcode is fixed to vertical 213 dots × horizontal 225 dots.

The right and left width of the quiet zone is 8 dots.
The bottom and top width of the quiet zone is 7 dots.

The Structured Append is not supported.

```
110 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
120 PRINT #1,"****** BARCODE TEST ******"
130 FOR I=0 TO 7
140  RESTORE 380
150  FOR J=0 TO I
160    READ CODE$          'Get Code Name
170  NEXT J
180  RESTORE 400
190  FOR J=0 TO I
200    READ DAT$ 'Get Bar Data
210  NEXT J
220  PRINT #1,CHR$(&H1D);"w";CHR$(I MOD 3);CHR$(I MOD 4);            'Narrow/Wide
230  PRINT #1,CHR$(&H1D);"P";CHR$(I MOD 3);          'Bar Position
240  PRINT #1,CHR$(&H1D);"h";CHR$(I*10+100);         'Bar Height
250  PRINT #1,CHR$(&H1D);"H";CHR$(I MOD 4);          'Strings position
260  PRINT #1,CHR$(&H1D);"f";CHR$(I MOD 2);          'Storings Font Size
270  PRINT #1,"*****";CODE$;"*****"
280  IF I=7 THEN GOTO 300
290  PRINT #1,CHR$(&H1D);"k";CHR$(I);DAT$;CHR$(0);:GOTO 320'Barcode Print
300  PRINT #1,CHR$(&H1D);"k";CHR$(I);                    'CODE128 print
310  PRINT #1,CHR$(104);                         'Start Code
320  PRINT #1,CHR$(32);CHR$(33);CHR$(34);CHR$(35);CHR$(36);
330  PRINT #1,CHR$(106);                         'Stop Code
340  PRINT #1,CHR$(&H0D);
350 NEXT I
360 CLOSE #1
370 END
380 'BARCODE TYPE
390 DATA UPC_A,UPC_E,JAN_13,JAN_8,CODE39,ITF,CODABAR,CODE128
400 'BARCODE DATA
410 DATA 12345678901,01245000002,490130101188,4940125,ABC,123456, A12345B,DUMY
```

Figure 6-23 Program Sample 12

****** BARCODE TEST ******

*****UPC_A*****

*****UPC_E*****

*****JAN_13*****

*****JAN_8*****

*****CODE39*****

*****ITF*****

*****CODABAR*****

*****CODE128*****

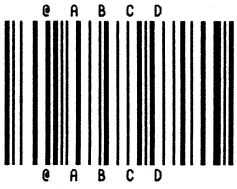


Figure 6-24 Print Sample 12

```
100 OPEN “COM1:9600,N,8,1” FOR OUTPUT AS #1
110 PRINT #1, "*****PDF417*****"
120 PRINT #1, CHR$(&H1D);"n";CHR$(3);          'Nominal narrow element width setting
130 PRINT #1, CHR$(&H1D);"o";CHR$(6);          'PDF step height setting
140 PRINT #1, CHR$(&H1D);"P";CHR$(0);          'Barcode print position setting (left end)
150 PRINT #1, CHR$(&H1D);"p";CHR$(0);          'Print of PDF417
160 PRINT #1, CHR$(0);CHR$(2);CHR$(0);CHR$(0);CHR$(50);CHR$(0);
170 FOR I=1 TO 5
180  READ DAT$
190  PRINT #1, DAT$;
200 NEXT I
210 PRINT #1, CHR$(&H0A);"*****QR Code*****"
220 PRINT #1, CHR$(&H1D);";";CHR$(3);          'Module size setting
230 PRINT #1, CHR$(&H1D);"P";CHR$(1);          'Barcode print position setting (center)
240 PRINT #1, CHR$(&H1D);"p";CHR$(1);          'Print of QR codes
250 PRINT #1, CHR$(2);"M";CHR$(0);"M";CHR$(100);CHR$(0);
260 FOR I=1 TO 10
270  READ DAT$
280  PRINT #1, DAT$;
290 NEXT I
300 PRINT #1, CHR$(&H0A);"*****Data Matrix*****"
310 PRINT #1, CHR$(&H1D);"P";CHR$(2);          'Barcode print position setting (left end)
320 PRINT #1, CHR$(&H1D);"p";CHR$(2);          'Print of DataMatrix
330 PRINT #1, CHR$(&H00);CHR$(0);CHR$(0);CHR$(100);CHR$(0);
340 FOR I=1 TO 10
350  READ DAT$
360  PRINT #1, DAT$;
370 NEXT I
380 CLOSE #1
390 END
400 '    2 Dimensional Code Data
410 DATA "PDF417****","0123456789","ABCDEFGHIJ","KLMNOPQRST","abcdefghij"
420 DATA "QR_Code***","0123456789","ABCDEFGHIJ","KLMNOPQRST","abcdefghij"
430 DATA "0123456789","ABCDEFGHIJ","KLMNOPQRST","abcdefghij","klmnopqrst"
440 DATA "DataMatrix","0123456789","ABCDEFGHIJ","KLMNOPQRST","abcdefghij"
450 DATA "0123456789","ABCDEFGHIJ","KLMNOPQRST","abcdefghij","klmnopqrst"
```

Figure 6-25 Program Sample 13

*****PDF417*****

*****QR Code*****

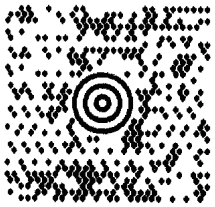
*****Data Matrix*****

Figure 6-26 Print Sample 13

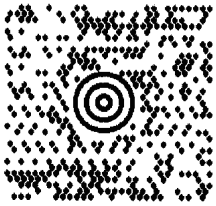
```
100 OPEN “COM1:9600,N,8,1” FOR OUTPUT AS #1
110 FOR I=2 TO 3
120  READ MODE$,SERVICE$,COUNTRY$,POSTAL$
130  PRINT #1, "*****MaxiCode ";MODE$;"******"
140  PRINT #1, CHR$(&H1D);"P";CHR$(I MOD 2);       'Barcode print position setting
150  PRINT #1, CHR$(&H1D);"p";CHR$(3);             'Print of MaxiCode (modes 2 & 3)
160  PRINT #1, CHR$(I);SERVICE$;COUNTRY$;POSTAL$;CHR$(50);
170  FOR J=1 TO 5
180   READ DAT$
190   PRINT #1, DAT$;
200  NEXT J
210  PRINT #1, CHR$(&H0A);
220 NEXT I
230 FOR I=4 TO 5
240  READ MODE$
250  PRINT #1, "*****MaxiCode ";MODE$;"******"
260  PRINT #1, CHR$(&H1D);"P";CHR$((I-2) MOD 3);   'Barcode print position setting
270  PRINT #1, CHR$(&H1D);"p";CHR$(3);             'Print of MaxiCode (modes 4 & 5)
280  PRINT #1, CHR$(I);CHR$(50);
290  FOR J=1 TO 5
300   READ DAT$
310   PRINT #1, DAT$;
320  NEXT J
330  PRINT #1, CHR$(&H0A);
340 NEXT I
350 CLOSE #1
360 END
370 '    2 Dimensional Code Data
380 DATA "Mode2",  "123",  "456",  "7890123**"     '"*" is used for matching numbers of columns.
390 DATA "MaxiCode*2",  "0123456789",  "ABCDEFGHIJ",  "KLMNOPQRST",  "abcdefghij"
400 DATA "Mode3",  "321",  "654",  "ABC987"
410 DATA "MaxiCode*3",  "0123456789",  "ABCDEFGHIJ",  "KLMNOPQRST",  "abcdefghij"
420 DATA "Mode4"
430 DATA "MaxiCode*4",  "0123456789",  "ABCDEFGHIJ",  "KLMNOPQRST",  "abcdefghij"
440 DATA "Mode5"
450 DATA "MaxiCode*5",  "0123456789",  "ABCDEFGHIJ",  "KLMNOPQRST",  "abcdefghij"
```

Figure 6-27 Program Sample 14

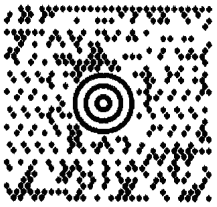
*****MaxiCode Mode2*****



*****MaxiCode Mode3*****



*****MaxiCode Mode4*****



*****MaxiCode Mode5*****

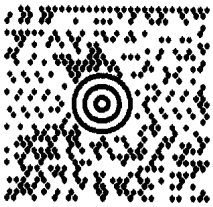


Figure 6-28 Print Sample 14

6.5.21 Routine Commands

The routine commands put character strings and commands in memory and prints data in routine formats. They are a type of macro processes.

The routine commands begin with DC2 'E' m and are divided into four types according to the value of m.

Only the two low-order bits of m are valid.

m = 0: Set routine format.
m = 1: Set routine parameter data.
m = 2: Execute routine format.
m = 3: Delete all routine data.

DC2 'E' 0 n dl dh {DATA} — Set Routine Format

Code

12H 45H 00H n dl dh {d1 d2•••dk}
0≤n≤127
0≤dhX256+dl≤65525

Function

Creates and registers a print format combining ruled lines and character print position.

n is a routine format number. 128 types can be registered (00H to 7FH). If n is not in the above range, DC2 'E' 0 n is ignored and the subsequent data is processed as normal data.

dl and dh indicate the number of bytes of the routine format data.

d indicates routine format data, and dhX256+dl bytes of command data are sent.

Only the following commands can be set in routine formats. If commands other than those listed below are registered, they are ignored when executing the routine format.

'A'
NAME : Selects ruled line A.
FUNCTION : Selects ruled line buffer A. (Same function as DC3 'A')

'B'
NAME : Selects ruled line B.
FUNCTION : Selects ruled line buffer B. (Same function as DC3 'B')

'C'
NAME : Clears ruled line.
FUNCTION : Clears the currently selected ruled line buffer. (Same function as DC3 'C')

'L' ml mh nl nh
NAME : Sets routine line.
FUNCTION : Sets the dot from the start point to the end point of the selected buffer to 1.
(Same function as DC3 'L' sl sh el eh)
(mhX256+ml)= Line start point
(nhX256+nl) = Line end point

'D' nl nh
NAME : Sets routine dot (Same function as DC3 'D' nl nh).
FUNCTION : Sets the specified dot of the selected ruled line buffer to 1.
(nhX256+nl)=dot position

'F' n1 n2
NAME : Sets routine pattern (Same function as DC3 'F' nl nh).
n1, n2: Repetitive pattern data
FUNCTION : Places a repetitive pattern of bit images (2-byte data) of the specified code in the selected ruled line buffer.

'V' {d1 d2 ••• dk}
NAME : Sets routine image (Same function as DC3 'V' {DATA})
FUNCTION : Stores image data in the selected ruled line buffer.

'P' n
NAME : Prints routine dot line (parameter print)
n=Repetitive dot lines (0≤n≤255)
FUNCTION : Prints data in the line buffer. After printing data in the line buffer, it prints n dot lines of the selected ruled line. If n=0, data in the line buffer only is printed.

'$' nl nh
NAME : Sets parameter absolute position (Same function as ESC '$' nl nh)
(nhX256+nl) =Print start point of parameter data
FUNCTION : Sets the print start point to a position nhnl dots to the right from the left margin.

'S' n
NAME : Sets parameter
n=Parameter data number
FUNCTION : Outputs parameter data with the parameter number specified by n to the line buffer.

If a registered routine format number is specified, the old routine format is deleted, the area is released, and a new routine format is registered.

10 bytes of memory control data is added to each routine data. Therefore, (all routine format data amount + 10) bytes of memory are used.

If the remaining memory capacity is less than (all routine format data amount + 10) bytes, all data is ignored. (all routine format data amount + 10) bytes must be 65535 bytes or less. Data exceeding 65535 bytes is processed as normal data.

Specify dh=dl=0 to erase a routine format from memory.
Data with the routine format number specified by n is deleted.

DC2 'E' 1 n dl dh {DATA} Set Routine Parameter Data

Code

12H 45H 01H n dl dh {d1 d2•••dk}
0≤n≤127
0≤dhdl≤65525

Function

Sets character data to be printed in a routine format.

n is a routine parameter number. 128 types can be registered (00H to 7FH). If n is not in the above range, DC2 'E' 1 n is ignored and the subsequent data is processed as normal data.

dl and dh indicate the number of bytes of the routine parameter data.

d indicates parameter data, and dl,dh bytes of character data and the following commands can be registered. The commands not listed below are ignored when executing a routine format.

The commands function in the same way as normal commands. See the description of each command.

ESC 'R' n	: Select international character
ESC 't' n	: Select character code table
ESC '%' n	: Set/cancel download character set
ESC 'w' n	: Select/cancel expanded character mode
ESC '-' n	: Select/cancel underline mode
ESC '!' n	: Set print mode
ESC ' SP' n	: Set character spacing
ESC '*' m nl nh	: Set bit image mode
FS '&' n	: Select Kanji mode
FS '.' n	: Cancel Kanji mode
FS '-' n	: Select/cancel Kanji underline mode
FS '!' n	: Set Kanji print mode
FS 'S' nl nr	: Set Kanji left- and right-side spacing
DC2 'Y' n	: Character Rotation
DC2 'F' n	: Select character font size
DC2 'O' n	: Select optional font

Character decoration is cleared and Kanji mode is canceled at the beginning of parameter data.

If a registered routine parameter number is specified, the old routine parameter is deleted, the area is released, and a new routine parameter is registered.

10 bytes of memory control data is added to each routine data. Therefore, (all routine parameter data amount + 10) bytes of memory is used.

If the remaining memory capacity is less than (all routine parameter data amount + 10) bytes, all data is ignored. (all routine parameter data amount + 10) bytes must be 65535 bytes or less. Data exceeding 65535 bytes is processed as normal data.

Specify dh=dl=0 to erase a routine parameter from memory.
Data with the routine parameter number specified by n is deleted.

DC2 'E' 2 n — Execute Routine Format

Code 12H 45H 02H n
0≤n≤127

Function Executes a routine format.

n is the number of a routine format to be executed. If n is not in the above range, the command is ignored.

If format data is not registered with the format number specified by n, the command is ignored.

If the parameter data is not set, paper is fed in 24 dots lines.

If parameter data exceeds a printable line, it is not printed.

The height of a line, including characters, depends on the maximum character height.

Ruled lines, characters, and images are combined with routine format settings in the mode specified before executing the routine format.

This command cancels character decoration as follows:

Line buffer	: Cleared
Ruled line buffer A	: Cleared
Ruled line buffer B	: Cleared
Ruled line	: Off
Left margin	: Cleared
Right margin	: Cleared
Line feed	: 34 dots
Character spaces	: 4 dots
Kanji character space	: Left: 0; Right: 8 dots
International language	: Japanese
Kanji mode	: Canceled
Font size	: 24 dots
Underline	: Canceled by a dot line
Character rotation	: Canceled

DC2 'E' 3 — Delete All Routine Data

Code 12H 45H 03H

Function Deletes all routine formats and routine parameters.

Frees up the memory area used for routine formats and routine parameters.

The remaining memory capacity increases by the size of the freed up area.

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 'Format Set
120 PRINT #1,CHR$(&H12);"E0";CHR$(0);CHR$(7);CHR$(0);       'Format No.0
130 PRINT #1,"ACF";CHR$(&HFF);CHR$(&HFF);"P";CHR$(2);
140 FOR I=1 TO 3
150   PRINT #1,CHR$(&H12);"E0";CHR$(I);CHR$(29);CHR$(0);    'Format No.1
160   PRINT #1,"BCL";CHR$(0);CHR$(0);CHR$(1);CHR$(0);
170   PRINT #1,"L";CHR$(21);CHR$(1);CHR$(22);CHR$(1);
180   PRINT #1,"L";CHR$(42);CHR$(2);CHR$(43);CHR$(2);
190   PRINT #1,"L";CHR$(62);CHR$(3);CHR$(63);CHR$(3);
200   PRINT #1,"$";CHR$((I-1)*277 MOD 256);CHR$((I-1)*277 \ 256);
210   PRINT #1,"S";CHR$(I-1);"P";CHR$(0);
220 NEXT I
230 'Parameter Data Set
240 PRINT #1,CHR$(&H12);"E1";CHR$(0);CHR$(14);CHR$(0);     'Parameter No.0
250 PRINT #1,CHR$(&H12);"F0";" Parameter0";
260 PRINT #1,CHR$(&H12);"E1";CHR$(1);CHR$(17);CHR$(0);     'Parameter No.1
270 PRINT #1,CHR$(&H12);"F1";CHR$(&H1B);"w1";" Parameter1";
280 PRINT #1,CHR$(&H12);"E1";CHR$(2);CHR$(22);CHR$(0);     'Parameter No.2
290 PRINT #1,CHR$(&H12);"F1";" ";CHR$(&H1C);"&";
300 PRINT #1,CHR$(&H44);CHR$(&H6A);CHR$(&H37);CHR$(&H3F);
310 PRINT #1,CHR$(&H25);CHR$(&H51);CHR$(&H25);CHR$(&H69);
320 PRINT #1,CHR$(&H25);CHR$(&H61);CHR$(&H21);CHR$(&H3C);
330 PRINT #1,CHR$(&H25);CHR$(&H3F);CHR$(&H23);CHR$(&H33);
340 'Format Execute
350 PRINT #1,CHR$(&H12);"E2";CHR$(0);       'Format No.0 Execute
360 PRINT #1,CHR$(&H12);"E2";CHR$(1);       'Format No.1 Execute
370 PRINT #1,CHR$(&H12);"E2";CHR$(0);       'Format No.0 Execute
380 PRINT #1,CHR$(&H12);"E2";CHR$(2);       'Format No.2 Execute
390 PRINT #1,CHR$(&H12);"E2";CHR$(0);       'Format No.0 Execute
400 PRINT #1,CHR$(&H12);"E2";CHR$(3);       'Format No.3 Execute
410 PRINT #1,CHR$(&H12);"E2";CHR$(0);       'Format No.0 Execute
420 CLOSE #1
430 END
```

Figure 6-29 Program Sample 15

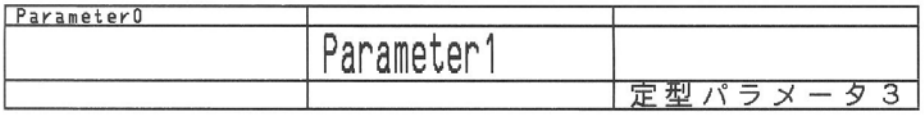


Figure 6-30 Print Sample 15

6.5.22 Page Mode

The page mode function maintains a rectangular area with an arbitrary size, deploys the printed data there, and prints characters in the normal direction or rotated 90° clockwise. The page mode function allows the user to layout printing material more freely thanks to the above features.

DC2 'z' 0 n x yl yh — Page Mode Select

Code 12H 7AH 00H n x yl yh
0≤n≤1
0≤x≤104
0≤yh × 256 + yl≤2400

Function Specifies the page mode.

Specify the page size with x, yh and yl.
x : Horizontal length (by byte)
yhX256+yl : Vertical length (by dot)

Specify the print direction of data with n
0: Normal direction
1: Rotated 90° clockwise

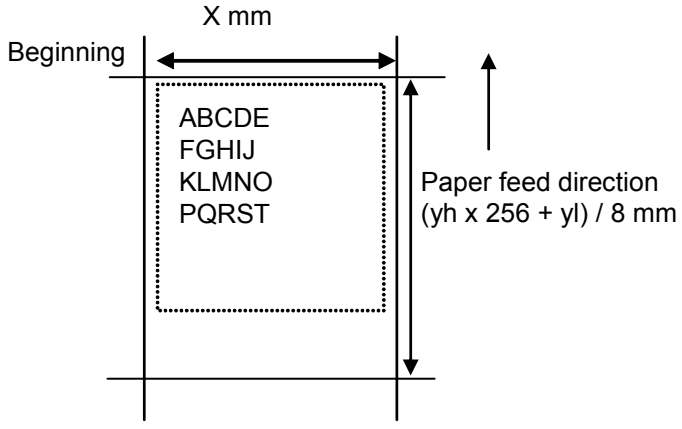
Page length in normal direction is specified by yh and yl.
Page length in rotated 90° clockwise is specified by x.

When x, yh and yl is out of range, this command is ignored.

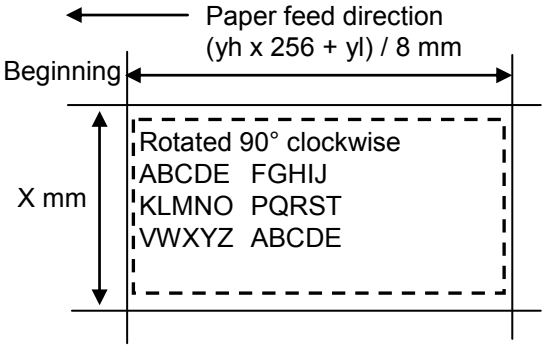
Ignores the Set page length at lines (ESC 'C') or Set bottom margin (ESC 'N').
Ignores the setting of left margin and right margin.
Cancels the Stamp Select.
Clears data in the line buffer.

Default Not selected

Normal direction



Rotated 90° clockwise



DC2 'z' 1 Page Mode Print

Code 12H 7AH 01H

Function Prints the contents of the page area.

The printer returns to the standard mode after processing the page mode print.
Printing deploys in direction according to Page Mode Select (DC2 'z' 0) command.

If the printer is not in the page mode, this command is ignored.

DC2 'z' 2 yl yh Page Mode Vertical Position Specify

Code 12H 7AH 02H yl yh
$0 \leq yh \times 256 + yl \leq 2400$

Function Specifies the position in the vertical direction from the top edge of the page area.
Use (yh × 256 + yl) dot to specify the number of dot lines from the top edge of the page area.

If the printer is not in the page mode, this command is ignored.

Default Undefined

DC2 'z' 4 n Page Mode Data Registration

Code 12H 7AH 04H n
$0 \leq n \leq 1$

Function Registers page image as template data in the FLASH memory.
Specify the area of FLASH memory as n.

If image data already has been registered, the printer deletes registered image and registers new one.

If the printer is not in the page mode, this command is ignored.

DC2 'z' 5 n Page Mode Data Calling

Code 12H 7AH 05H n
$0 \leq n \leq 1$

Function Calls registered template data in the FLASH memory to page area.
The printer clears data in the line buffer and shifts the page mode after executing this command.

Size of page area and the deployment direction of printing depend on the registered data.

In the page mode, this command execution calls registered data in the FLASH memory after clearing current page setting and page data.

If the template data is not registered in the FLASH memory, this command is ignored.

DC2 '$' '1' xsL xsH ysL ysH xeL xeH yeL yeH mode — Rectangle Print

Code: 12H 24H 31H xsL xsH ysL ysH xeL xeH yeL yeH mode
0≤xsH×256+xsL≤65535
0≤ysH×256+ysL≤65535
0≤xeH×256+xeL≤65535
0≤yeH×256+yeL≤65535
0≤mode≤255

Function: Specifies diagonal coordinates of the drawing (line, frame, fill).
Horizontal start point = xsH×256 + xsL
Vertical start point = ysH×256 + ysL
Horizontal end point = xeH×256 + xeL
Vertical end point = yeH×256 + yeL

mode: Print type

Bit No.	Function	Value	
		0	1
0	Line	Release	Specification
1	Frame	Release	Specification
2	Fill	Release	Specification
3	Undefined	-	-
4	Undefined	-	-
5	Undefined	-	-
6	Undefined	-	-
7	Undefined	-	-

Line, frame, and fill can be specified at the same time.
Rectangle print is enabled only in the page mode. Rectangle print is ignored in the standard mode.

When the coordinates out of the print area are specified, this command is ignored.

When the line or frame other than solid line is specified, print of the corner cannot be guaranteed.
When overlapped print exists, the printer overwrites.
Even the frame with no height is specified, the printer prints.
When all are specified to release, the printer does not print.

This command ignores the setting of left and right margins.

DC2 '$' '2' n — Line Type Property

Code: 12H 24H 32H n
0≤n≤2

Function: Specifies a line type property.

n	Line type
0	Solid line
1	Long dashed line
2	Short dashed line

Default: n=0

DC2 '$' '3' n — Line Width Property

Code: 12H 24H 33H n
0<n≤255

Function: Specifies a line width property of lines and rectangles.
n: Line width (dot)

The line width is thickened at the center of the specified coordinates.
When any even number of dots is specified, the line width is increased by 1 dot and equalized for upper and lower specified coordinates.
When the line is aslant, line width may become thin.

Default: n=1

DC2 '$' '4' n — Fill Property

Code: 12H 24H 34H n
0≤n≤2

Function: Specifies a paint type of the rectangles.

n	Paint type
0	None
1	50 %
2	100 %

Default: n=0

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 S$=”ABCDEFGHIJKLMN”
120 PRINT #1,CHR$(&H12);"z";CHR$(0);CHR$(1);CHR$(80);CHR$(0);CHR$(3);
130 PRINT #1,S$
140 PRINT #1,CHR$(&H1B);"W1";S$
150 PRINT #1,CHR$(&H1B);"w1";S$
160 PRINT #1,CHR$(&H12);"z";CHR$(2);CHR$(0);CHR$(1);
170 PRINT #1,CHR$(&H1D);"P";CHR$(2);
180 PRINT #1,CHR$(&H1D);"H";CHR$(2);
190 PRINT #1,CHR$(&H1D);"h";CHR$(80);
200 PRINT #1,CHR$(&H1D);"k";CHR$(0);”12345678901”;CHR$(0);
210 PRINT #1,CHR$(&H12);"$2";CHR$(1);
220 PRINT #1,CHR$(&H12);"$3";CHR$(2);
230 PRINT #1,CHR$(&H12);"$1";
240 PRINT #1,CHR$(1);CHR$(0);CHR$(200);CHR$(0);CHR$(160);CHR$(0);CHR$(0);CHR$(2);CHR$(2);
250 PRINT #1,CHR$(&H1D);"E";CHR$($H10);
260 PRINT #1,CHR$(&H12);"z";CHR$(1);
270 CLOSE #1
280 END
```

Figure 6-31 Program Sample 16

Figure 6-32 Print Sample 16

6.5.23 Status Commands

DC2 'e' n — Enable/Disable Automatic Status Transmission

Code: 12H 65H n

Function: Select whether to send an error status if an error occurs.

Only the least significant bit of n is valid.
n = 0: Do not send an error status.
n = 1: Send an error status.

If error status transmission is specified (n=1), the error status (one byte) is output. If an error occurs or error status changes, a single-byte error code indicating the cause of the error is automatically output.
However, an error status is not sent automatically if the battery voltage state changes.

The initial automatic status transmission is stopped when issued the command.

The bits of the error status indicate the following error states:

Bit	Function	Value	
		0	1
0	Paper out	OK	Error
1	Head up	OK	Error
2	Vp voltage error	OK	Error
3	Head temperature error	OK	Error
4	DIP switch setting error	OK	Error
5	Battery voltage state	See the list below.	See the list below.
6	Battery voltage state	See the list below.	See the list below.
7	Reserved	-	Fixed

Battery voltage state	Bit6	Bit5
8.0 V or higher	0	0
7.5 to 8.0 V	0	1
7.0 to 7.5 V	1	0
Lower than 7.0 V	1	1

Default: n=0 (Does not send an error status.)

DC2 'r' — Send Remaining Memory Capacity

Code: 12H 72H

Function: Outputs the signal that indicates the remaining memory (RAM) capacity. The number of bytes of the unused memory area is transmitted as a 6-byte hexadecimal number.

If the remaining memory capacity is 6736 (1A50H) bytes, '001A50' is transmitted.

DC2 'v' Send V_P Voltage

Code 12H 76H

Function Measures the V_P voltage (head and motor operating voltage) in the printer and sends it.

The voltage is transmitted as a 3-bytes code consisting of a 1-digit integer part, a decimal point, and a 1-digit decimal.
Example: 7.2 V -> 37H 2EH 32H
6.5 V -> 36H 2EH 35H

If the voltage is out of the V_P voltage permissible range (6.50 to 9.75 V), an error status is generated, and no commands or data can be input. If the voltage becomes 9.75 V or higher, feeding with the switch is inhibited.

If the printer is powered by a battery, the print density may become low or a voltage error may occur due to a drop in battery voltage. This command can be used for the host to detect the V_P voltage and issue a warning.

DC2 'q' Send External RAM Checksum

Code 12H 71H

Function Outputs the external RAM checksum.

The memory checksum is calculated and a 4-bytes hexadecimal number is transmitted.

DC2 'l' Send SWDIP Switch Settings

Code 12H 6CH

Function Sends the states of the SWDIP switches 1 to 4.

8 bytes of '1'(31H) or '0'(30H) are sent as a SWDIP switch setting status.

The data is sent from the most significant bit of SWDIP switch 1 to the least significant bit of SWDIP switch 4.

','(2CH) is placed between the states of SWDIP switches 1 and 2 and SWDIP switches 2 and 3 and DIP switches 3 and 4. Therefore, a total of 35 bytes are transmitted.
Example: SWDIP switch 1: 11001011
SWDIP switch 2: 01111111
SWDIP switch 3: 00000001
SWDIP switch 4: 00111111

If the states of the SWDIP switches are as shown above, the following character codes are sent.
31H 31H 30H 30H 31H 30H 31H 31H 2CH
30H 31H 31H 31H 31H 31H 31H 31H 2CH
30H 30H 30H 30H 30H 30H 30H 31H 2CH
30H 30H 31H 31H 31H 31H 31H 31H

DC2 'j' n — Execute Response Request

Code 12H 6AH n

Function Sends the execute response code as n if this command is executed.
n: response code (low order 4 bits are valid)

This interface has 4K bytes reception buffer and does not handle several operations such as the commands, data input or execution or printing at the same time. Therefore, command or printing termination can not be confirmed from outside.
By inserting this command the end of a command and/or print sequence and checking the execute response code by this command, however, it is possible to confirm which commands have been executed if the execute response code is responded.

Specify the execute response code as n. The code to be sent is the logical sum of the low order 4 bits of the specified n and the 50H and it will be the code of 50H to 5FH.

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 PRINT #1,CHR$(&H12);"v";
120 PRINT #1,"Vp voltage : ";INPUT$(3,#1);" V"
130 PRINT #1,CHR$(&H12);"r";
140 PRINT #1,"Rest Memory : ";INPUT$(6,#1);"H Byte"
150 PRINT #1,CHR$(&H12);"q";
160 PRINT #1,"Extend Check Sum :";INPUT$(4,#1);"H"
170 PRINT #1,CHR$(&H12);"l";
180 PRINT #1,"DIP_SW:";INPUT$(35,#1)
190 PRINT #1,CHR$(&H12);"e1";
200 PRINT "Indicate error when an error occurs."
210 PRINT "When you want to stop program, press Ctrl+Break key."
220 ' LOOP
230 E=ASC(INPUT$(1,#1))
240 IF (E AND 1)<>0 THEN PRINT "Paper empty error!"
250 IF (E AND 2)<>0 THEN PRINT "Head Up error!"
260 IF (E AND 4)<>0 THEN PRINT "Vp voltage error!"
270 IF (E AND 8)<>0 THEN PRINT "Head temperature error!"
280 IF (E AND 16)<>0 THEN PRINT "DIP_SW Setting write error!"
290 GOTO 220
```

Figure 6-33 Program Sample 17

```
Vp Voltage : 9.1 V
Rest Memory : 034CB8 Byte
Extend Check Sum : 1DA9H
DIP_SW:11001111,11111101,10111101,11111100
```

Figure 6-34 Print Sample 17

6.5.24 Character Set Command

DC2 'F' n	Select Character Font Size

Code 12H 46H n

Function Sets the character font size to 16 dots or 24 dots.

Only the least significant bit of n is valid.
n = 0: 16 dots
n = 1: 24 dots

The character size specified here is applied to 1-byte characters, and 2-byte characters.

Default Depends on the setting of SWDIP 2-6.

```
100 OPEN "COM1:9600,N,8,1" FOR OUTPUT AS #1
110 FOR I=0 TO 1
120   PRINT #1,CHR$(&H12);"F";CHR$(I);
130   IF I=0 THEN PRINT #1,"16"; ELSE PRINT #1,"24";
140   PRINT #1," DOT FONT"
150   FOR J=&H41 TO &H5A
160    PRINT #1,CHR$(J);
170   NEXT J:PRINT #1,CHR$(&H0D);
180   PRINT #1,CHR$(&H1C);"&";
190   FOR J=&H21 TO &H30
200    PRINT #1,CHR$(&H30);CHR$(J);
210   NEXT J:PRINT #1,CHR$(&H0D);
220   PRINT #1,CHR$(&H1C);"r";CHR$(0);
230   FOR J=&H30 TO &H39
240    PRINT #1,CHR$(&H23);CHR$(J);
250   NEXT J:PRINT #1,CHR$(&H0D);
260   PRINT #1,CHR$(&H0D);CHR$(&H1C);".";
270 NEXT I:PRINT #1,CHR$(&H0D);
280 CLOSE #1
290 END
```

Figure 6-35 Program Sample 18

Figure 6-36 Print Sample 18

6.5.25 Auxiliary Function Commands

DC2 '!' n — Select Paper

Code: 12H 21H n

Function: Specifies paper to be used.

The three low-order bits of n are valid.
- n = 0: PD160R-N
- n = 1: TC98KS-LH
- n = 2: P350
- n = 3: reserved
- n = 4: KT55F20
- n = 5: TF8067
- n = 6: TL69KS-HW76B
- n = 7: TF50KS-E2D

Default: Depends on the setting of SWDIP 2-3 to 2-5.

(NOTE) If too much energy is applied to the thermal head, it would shorten its life span and cause the paper feed problem. Set an accurate thermal paper selection and print density.
If selecting the thermal paper that is different from the one specified in the thermal paper selection or in case of not setting the print density in 100%, verify the performance with your actual device before printing.

DC2 '~' n — Select Print Density

Code: 12H 7EH n
$65 \leq n \leq 135$

Function: Sets the print density.

n must be in the range 65 to 135, which will set the print density to 65%(-35%) to 135% (+35%) of the rated energy.

If n is out of range, the command is ignored.

Default: Depends on the setting of SWDIP 3-6 and 3-7.

(NOTE) If too much energy is applied to the thermal head, it would shorten its life span and cause the paper feed problem. Set an accurate thermal paper selection and print density.
If selecting the thermal paper that is different from the one specified in the thermal paper selection or in case of not setting the print density in 100%, verify the performance with your actual device before printing.

DC2 'E' n — Motor Speed Select

Code: 1DH 45H n
0≤n≤255

Function: Sets the motor speed high or low.

Bit No.	Function	Value	
		0	1
0	Undefined	-	-
1	Undefined	-	-
2	Undefined	-	-
3	Undefined	-	-
4	Motor speed	High speed	Low speed
5	Undefined	-	-
6	Undefined	-	-
7	Undefined	-	-

Default: n=0 (High speed)

DC2 'a' n — Set Automatic Power-off Time

Code: 12H 61H n
0≤n≤255

Function: Enables the automatic power-off function and sets the automatic power-off time.

n must be in the range 1 to 255 (minutes).
If n = 0, the automatic power-off function is off.

The initial status after power-up can be set by SWDIP 2-5.

Default: n=30 (30 minutes)
Printer initial state after power-on can be changed by Set default/Set test print header (DC2 'i') command.

DC2 '#' n — Select Overlap Mode

Code: 12H 23H n

Function: Sets the overlap mode for ruler lines and characters to either OR or XOR.

Only the least significant bit of n is valid.
n = 0: OR overlap
n = 1: XOR overlap

When OR overlap mode is selected, dots part in the image or character is printed in black.

XOR means exclusive OR. When XOR overlap mode is selected, the part where the image and character are overlapped is printed in white and the part where the image or character has a dot is printed in black.

Default: n=0 (OR overlap)

DC2 '=' n — Select Image LSB/MSB

Code 12H 3DH n

Function Sets whether the leftmost bit is set to the LSB (least significant bit) or MSB (most significant bit) for the data.

Only the least significant bit of n is valid.
- n = 0: The leftmost bit is LSB.
- n = 1: The leftmost bit is MSB.

This command is valid for the followings:
- Define Optional Font
- Define Ruler Line with Repeating Patterns
- Ruler Line LSB/MSB image
- Raster Bit Image Print
- Stamp Define

Default n=0 (The leftmost bit is LSB.)

GS 'g' '0' m nl nh — Maintenance Counter Initialization

Code 1DH 67H 30H m nl nh
m=0
(nh×256+nl)=20, 21, 70

Function Sets the values of the specified maintenance counter and the maintenance counter saved in the system area to 0. nh and nh show maintenance number (nh×256+nl).

nh×256+nl		Counter type
Hexadecimal	**Decimal**	
14	20	Line number of paper feed (in 100-dot line)
15	21	Number of head activation times (in 100-dot line)
46	70	Drive time of printer unit (in minutes)

Note Using much of this command may cause the FLASH memory damage. It is recommended that this command be used 10 times/day.

The printer turns BUSY status during writing data to the system area for this command. Do not transmit data (including real time commands) from the host computer while the printer is in BUSY status. The printer stops data receiving.

GS 'g' '1' m — Maintenance Counter Preservation

Code 1DH 67H 31H m
m=0

Function Saves all maintenance counter values in the system area of the FLASH memory.

The paper feed line number and head activation count are returned in 1/100 unit.

Note Timing of saving maintenance counter except this command execution is as follows:
1. Turn the power off (except that unplug AC adapter or remove the battery pack forcibly)
2. During Function Setting command execution
3. During Hardware Reset command in the download mode execution
4. During bus resetting of USB or serial communication

Using much of this command may cause the FLASH memory damage. Saving maintenance counter should be 400 times or less in the condition of command execution and preservation in the above.

The printer turns BUSY status during writing data to the system area for this command. Do not transmit data (including real time commands) from the host computer while the printer is in BUSY status. The printer stops data receiving.

Code 1DH 67H 32H m nl nh
m=0
(nh×256+nl)=20, 21, 70, 148, 149,198

Function Transmits the maintenance counter value.

Transmits the maintenance counter value. The initial value of the maintenance counter becomes the value saved in the system area. Specifies the maintenance number as (nh×256+nl).

nh×256+nl		Counter type
Hexadecimal	**Decimal**	
14	20	Line number of paper feed (in 100-dot line)
15	21	Number of head activation times (in 100-dot line)
46	70	Drive time of printer unit (in minutes)
94	148	Line number of paper feed (every 100-dot line) *1
95	149	Number of head activation times (every 100-dot line) *1
C6	198	Drive time of printer unit (in minutes) *1

*1:The value is accumulated without being reset.

Configuration of the maintenance counter data

	Hexadecimal	Decimal	Number of data
Data	30H to 39H	48 to 57	10 bytes

DC2 '{' a n m — User Area Data Registration/Clears

Code 12H 7BH a n m

Function Registers/Clears data in the external RAM to the FLASH memory.
a = Data types (00H to 05H)
n = Data ID
m = Registers/Clears data (*******1B: registers, *******0B: clears)

When the least significant bit of m is set as 1, the printer registers data in the external RAM to the FLASH memory. If selected data by a already has been registered into the FLASH memory, the printer deletes registered data and registers new one.
When the least significant bit of m is set as 0, the printer clears selected data by a in the FLASH memory.

Specify data types as a.
a=0: Downloaded characters
a=1: User-defined characters
a=2: Optional fonts
a=3: Stamp
a=4: Routine format
a=5: Routine parameter

Specify data ID as n.
a=3 selected: Stamp number
a=4 selected: Routine format number
a=5 selected: Routine parameter number
When selecting a as 0 to 2, the value of n is ignored.
The FLASH memory life is shortened if this command is used many times. The FLASH memory life: Approx.100000 times.

DC2 '*' '1' — User Area Defragment

Code 12H 2AH 31H

Function The printer performs the FLASH memory allocation again and keeps memory area.

Note The FLASH memory capacity cannot be increased by area control related commands.
The released memory by area control can be used again by this command.

The FLASH memory life is shortened if this command is used many times. The FLASH memory life: Approx.100000 times.

DC2 '*' '2' — Remaining User Area Response

Code 12H 2AH 32H

Function Checks the remaining memory capacity of the FLASH memory. The remaining memory capacity in the FLASH memory is responded with 6-byte by hexadecimal number.

Note The remaining capacity in the FLASH memory cannot be increased by commands related to registration and release of the registered area.
Executing User Area Defragment (DC2 * '1') command can increase the remaining FLASH memory capacity.

DC2 'R' n — User Area Initialization

Code: 12H 52H n
0≤n≤1

Function: Initializes memory in the user area.

Specify n as memory the external RAM or FLASH memory.
n = 0: Use area in the external RAM
n = 1: Use area in the FLASH memory

The printer clears data in line buffer, page mode, all User-defined characters, downloaded characters, optional fonts, stamps, template and initializes memory in the user area.

When selecting n = 0 (external RAM):
After initialization, memory areas indicated in Table 6-2 are allocated.
If downloaded characters or User-defined character is registered in the FLASH memory, the data of downloaded characters or User-defined characters are copied into the external RAM after initialization immediately. See 6.4.2 FLASH Memory.

When selecting n = 1 (FLASH memory):
Clears data in page mode, all User-defined characters, downloaded characters, optional fonts, stamps, template. The function settings, default and test print header setting and maintenance counter are not initialized.
The FLASH memory life is shortened if this command is used many times. The FLASH memory life: Approx.100000 times.

ESC '@' — Initialize Printer

Code: 1BH 40H

Function: Initializes the printer to the initial status at power on.

The contents of the line buffers are cleared.
The registered User-defined characters, download characters, optional fonts, and routine data are not cleared.

DC2 's' 't' 'p' — Power Off

Code: 12H 73H 74H 70H

Function: Turns the printer power switch off.

The data obtained before this command is received is processed, then the power is turned off. If the line buffer contains data, it is printed, then the power is turned off.

When IrDA is selected, the power is turned off after the following two conditions are satisfied:
The data obtained before this command is received is processed (character data is printed).
An IrDA disconnect request is output and disconnection is complete.

Note: When this command is sent, please note that communication is disconnected regardless of existence of non-transmitted response data.

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 PRINT #1,CHR$(&H12);"=0";
120 PRINT #1,CHR$(&H13);"(AF";CHR$(&H3);CHR$(&HC0);")";
130 PRINT #1,CHR$(&H12);"=1";
140 PRINT #1,CHR$(&H13);"(BF";CHR$(&H3);CHR$(&HC0);")";
150 PRINT #1,CHR$(&H13);"+";
160 PRINT #1,CHR$(&H13);"A";
170 PRINT #1,CHR$(&H12);"#0";"Left=LSB, Overlap print with OR."
180 PRINT #1,CHR$(&H13);"B";
190 PRINT #1,CHR$(&H12);"#1";"Left=MSB, Overlap print with XOR."
200 PRINT #1,CHR$(&H13);"-";
210 PRINT #1,CHR$(&H0D);
220 FOR I=70 TO 130 STEP 10
230  PRINT #1,CHR$(&H12);"~";CHR$(I);"Print Density";I;"%"
240 NEXT I : PRINT #1,CHR$(&H0D);
250 PRINT #1,CHR$(&H12);"~";CHR$(100);
260 PRINT #1,"DPU-S445 Power Off"
270 PRINT #1,CHR$(&H12);"stp";                    'Power Off
280 CLOSE #1
290 END
```

Figure 6-37 Program Sample 19

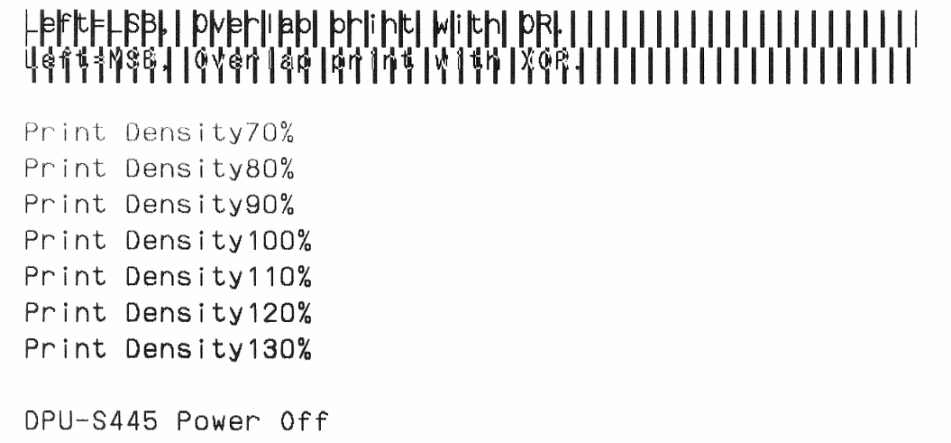


Figure 6-38 Print Sample 19

Code 12H 6BH n1 n2 n3 n4
0≤n1≤255, 0≤n2≤255, 0≤n3≤255, 0≤n4≤255

Function Changes the printer SWDIP switch setting.

The contents of n1, n2, n3 and n4 are as follows:
The underline is the status after setting is initialized with switches.

n1 (SWDIP switch 1)

bit										
8	7	6	5	4	3	2	1			
								1 Baud Rate	000: 1200*1	001: 2400	010: 4800*1
								2 (bps)	011: 9600	100: 19200	101: 38400
								3	110: 57600	111: 115200	
								4 Bit length	1: 8 bits	0: 7 bits	
								5 Parity	1: Yes(Even or Odd)	0: None	
								6 Parity	1: Even	0: Odd	
								7 Stop Bit	1: 1 bit	0: 2 bits	
								8 Data control	1: Busy control	0: Xon-off	

*1 Valid only when Serial is selected. 2400 bps is set automatically when BHT-Ir is selected.

n2 (SWDIP switch 2)

bit										
8	7	6	5	4	3	2	1			
								1 Data Input Mode	00: BHT-Ir/USB	01: Serial/USB
								2 ↑	10: IrDA/USB	11: Bluetooth/USB
								3 Auto Loading	1: Enable	0: Disable
								4 Character set	1: ANK	0: IBM Compatible
								5 Auto Power Off	1: Disable	0: Enable
								6 Font size:	1: 24 dots	0: 16 dots
								7 Kanji Code:	1: JIS code	0: Shift-JIS code
								8 Auto Status Output:	1: Disable	0: Enable

n3 (SWDIP switch 3)

bit										
8	7	6	5	4	3	2	1			
								1 Paper Mode	00: Cut paper	01:Roll paper
								2 ↑	10: Mark roll paper	11: Reserved
								3 Paper Select	000: PD160R-N	001: TC98KS-LH
									010: P350	011: Reserved
								4 ↑	100: KT55F20	101: TF8067
								5 ↑	110: TL69KS-HW76B	111: TF50KS-E2D
								6 Print Density	00: 95%	01: 100%	10: 105%	11: 110%
								7 ↑				
								8 Fixed to 1				

n4 (SWDIP switch 4)

bit										
8	7	6	5	4	3	2	1			
								1 Auto Activation by AC	1 : Disable	0: Enable
								2 CTS Control	1: Disable	0: Enable
								3 Bluetooth Baud	00: 230400 bps	01: 57600 bps
								4 Rate (bps)	10: 115200 bps	11: 230400 bps
								5 Mark Position Correct	1: Disable	0: Enable
								6 Busy Output When Error Occurs (Error)	1: Busy	0: Unbusy
								7 Fixed to 1		
								8 Bluetooth Link Key selection	1: Disable	0: Enable

After executing this command, the printer resets (same as power OFF and ON) itself.

Refer to the DPU-S445 SERIES USER'S GUIDE for the setting of SWDIP switch from the function setting mode.

Note Using much of this command may cause the FLASH memory damage. It is recommended that this command be used 10 times/day.

DC2 'i' m {DATA} Set Default/Set Test Print Header

Code 12H 69H m {Data}

Function Set default and test print header. Moreover, can be set various settings for Bluetooth.

m	Function	Data
30H	Initializing of the test print header	None
31H	Reading test print header	None
32H	Writing test print header	0≤data<96 bytes+NULL
33H	Initializing Bluetooth device name	None
34H	Reading Bluetooth device name	None
35H	Writing Bluetooth device name	2≤data<32 bytes+NULL
36H	Canceling Bluetooth PIN code	None
38H	Writing Bluetooth PIN code	4≤data<16 bytes+NULL
40H	Initializing default value	None
41H	Reading default value	None
42H	Line spacing	1 byte (00H≤data≤FFH)
43H	Character spacing	1 byte (00H≤data≤7FH)
44H	Kanji left-side spacing	1 byte (00H≤data≤7FH)
45H	Kanji right-side spacing	1 byte (00H≤data≤7FH)
46H	International character	1 byte (00H≤data≤0CH)
47H	Left margin	1 byte (00H≤data≤FFH)
48H	Right margin	1 byte (00H≤data≤FFH)
49H	Automatic power-off time	1 byte (00H≤data≤FFH)
4AH	Paper length to mark	2 bytes (00H≤data≤03E8H)
4BH	Paper length of autoloading	1 byte (00H≤data≤FFH)
60H	Reading each default values	1 byte (42H≤data≤4BH)

Up to 96 bytes character strings can be set for the test print header.

Writing test print header is completed when data exceeds 96 bytes or the NULL character is detected. When data exceeds 96 bytes, the printer uses 97th as NULL check code and processes the following data as the command or 1 byte data.

Only LF(0AH) and CR(0DH) control codes can be used.
Control codes under 1FH except LF and CR are ignored and are not counted as data.
All 20H to FFH codes are processed as 1 byte code. 24-dot fonts are used for printing.

(Example)

Data: 'Portable Pinter' + 0DH

Print:

```
Portable Pinter
**********************
*DIP SWITCH 1*
          .
          .
```

Reading test print header transfers head data to the computer from top to bottom. Transfer NULL character to complete the data transmission.

Initializing of the test print header clears set header and returns to default test print header at shipping.

Set Writing Bluetooth device name as character string within 2 to 32 bytes.
Bluetooth device name is completed when data exceeds 32 bytes or the NULL character is detected. When data exceeds 32 bytes, the printer uses 33th as NULL check code and processes the following data as the command or 1 byte code. If specified data is less than 2 bytes, this command is ignored.

Reading Bluetooth device name transfers the Bluetooth device name to the host device from the beginning code. Indicates data completed by transferring NULL character.

Initializing Bluetooth device name function can initialize Bluetooth device name to the default.

Set Writing Bluetooth PIN code as character string within 4 to 16 bytes.
Bluetooth PIN code is completed when data exceeds 16 bytes or the NULL character is detected. When data exceeds 16 bytes, the printer uses 17th as NULL check code and processes the following data as the command or 1 byte code. If specified data is less than 4 bytes, this command is ignored.

Bluetooth device name and Bluetooth PIN code require the characters below:
'0' to '9', 'a' to 'z', 'A' to 'Z', '+', '-', '_', '#', '*', ' '(SPACE:20H)

Perform the POWER-OFF and ON or communication break after setting Writing Bluetooth device name or Writing Bluetooth PIN code.

Each default value for 42H to 4BH can be set one by one manually.
If an invalid value is set, the value is ignored and the default is set instead of that.

If the right margin setting is set as ‘0’, the right margin becomes the maximum number of digits for printing.

Paper length to mark sets maximum paper length to detect the paper mark or tip of thermal paper within 0 to 1000 mm in the mark roll paper mode or cut paper mode.
This setting is valid for:
paper feeding by pressing the FEED switch in the mark roll paper mode.
page feeding without page length specified in the roll paper mode and the cut paper mode.

Paper length of auto-loading sets maximum paper length of auto-loading by mm.

Initializing default value sets default value for 42H to 4BH.

The reading of the default transfers default data for 42H to 49H to the host device in 2 digits of hexadecimal in order.

Each value transferred is separated by ','(2CH).
(Example)

Line feed	: 34
Character spacing	: 4
Kanji left-side spacing	: 0
Kanji right-side spacing	: 8
International character	: 8
Left margin	: 0
Right margin	: 0
Automatic power-off time	: 30

The printer sends the code of 23 bytes as 32H, 32H, 2CH, 30H, 34H, 2CH, 30H, 30H, 2CH, 30H, 38H, 2CH, 30H, 38H, 2CH, 30H, 30H, 2CH, 30H, 30H, 2CH, 31H, 45H.

Reading each default values is transferred data that correspond of m by the hexadecimal of 2 or 4 digits to the host device.

Reboot or execute reset command after turning off the POWER switch to set the default settings.

After executing Execute Routine Format command (DC2 'E' 2 n), the printer cancels setting of 42H to 48H as follows:

Line feed	: 34 dots
Character spaces	: 4 dots
Line buffer	: Cleared
Kanji character space	: Left: 0; Right: 8 dots
International language	: Japanese
Left margin	: Cleared
Right margin	: Cleared

Note

Using much of this command may cause the FLASH memory damage. It is recommended that this command be used 10 times/day.

6.5.26 Download Mode

DC2 DC2 Download Mode Selection

Code 12H 12H

Function Switches to the download mode.

This function performs a hardware reset in order to return from the download mode to the printing mode. (Execute hardware reset by turning on the power again or using '@' command.)

In the download mode, only the commands described in Table [Download mode] become valid.

Table [Download Mode]

Command	Function
'@'	Hardware Reset
','	Area of 2-Byte Character Download
'{'	Data Structure Selection of 2-Byte Character

'@' Hardware Reset

Code 40H

Function Performs hardware reset.

This command is valid for download mode.

',' m {Font Data} Area of 2-Byte Character Download

Code 2CH m {Font Data}
0 ≤m≤1

Function Downloads font set in the area of 2-byte character.

m	Download CG
0	Japanese CG
1	Korean CG

Number of font data required are 1048576 bytes.

Font is set as SII Japanese font set at shipping.

The printer deletes registered font set and replaces the font set with newly font set by this command.

Note If executing this command, the printer deletes SII Japanese font set which is set at shipping. Make sure this execution cannot undo.

To print the following characters, SII Japanese font set is required.
・Katakana character set

Japanese font set uses JIS X 0208-1997.
Korean font set uses KS C 5601-1989.

If the m differs from the data structure which specified by Data Structure of a 2-Byte Character ('{' n) command, the printer discards data of 1048576 bytes from next byte.

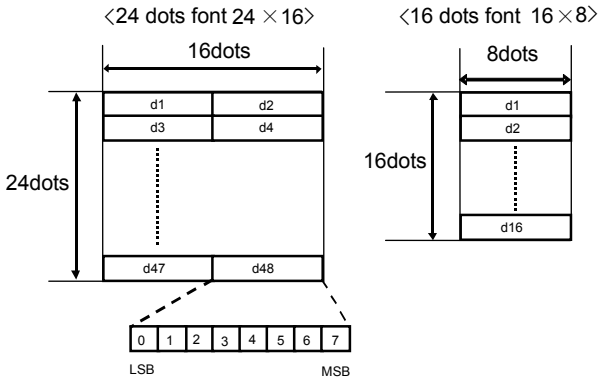
This command is valid for download mode.

Do not turn the printer off or input communication break during executing the command.

To print Japanese Kanji or Korean, following the format below and creates font data.

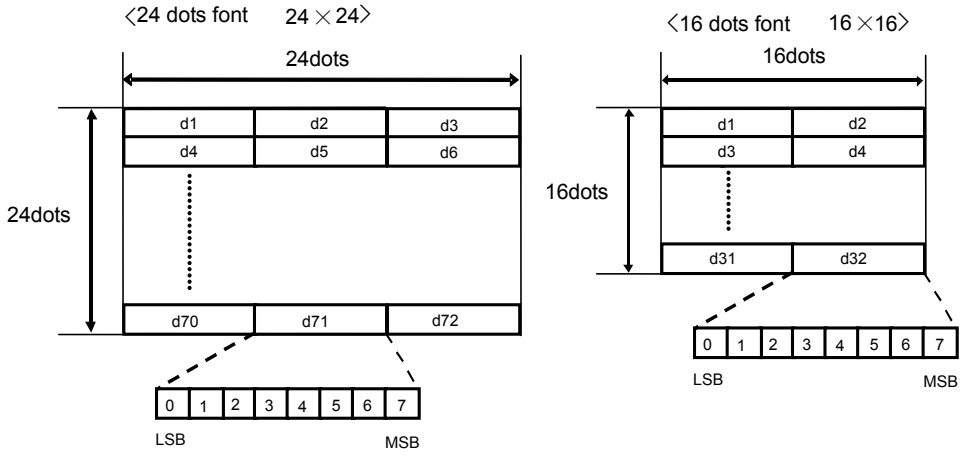
- **Format for font data**

  <1-byte download>



- **Format for font data**

  <2-byte download>

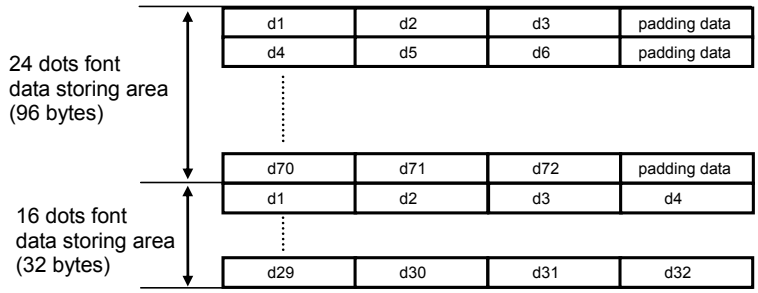


- **Address Structure for font data**

  Structure of Japanese

  <2-byte download>

  Font data for 1 character is configured as the figure below.
  Padding data of 1 byte is added to 24 dots font data every 3 bytes.
  Therefore, 1 character font data requires 96 + 32 = 128 bytes.



  Character code (JIS) correspond to initial address of font data as shown below. The table shows initial address in 20 bits as A19 to A0.
  Character code (JIS) are indicated by upper byte in b7 to b0 and lower byte in a7 to a0.

Area	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
Unregistered area（2121H～2840H）	0	a6	a5	b2	b1	b0	0	0	a4	a3	a2	a1	a0	0	0	0	0	0	0	0
JIS 1st level （3021H～4F53H）	0	b6	b3	b2	b1	b0	a6	a5	a4	a3	a2	a1	a0	0	0	0	0	0	0	0
JIS 2nd level （5021H～6F7EH）	1	b5	b3	b2	b1	b0	a6	a5	a4	a3	a2	a1	a0	0	0	0	0	0	0	0
JIS 2nd level （7021H～7426H）	1	a6	a5	b2	b1	b0	0	0	a4	a3	a2	a1	a0	0	0	0	0	0	0	0

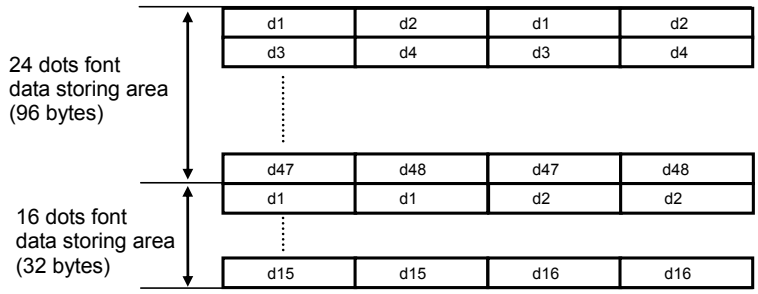
  Example: Obtaining for registration address of ”亜” (JIS code:3021H)

	b7	b6	b5	b4	b3	b2	b1	b0												
Upper byte: 30H	0	0	1	1	0	0	0	0	B											
	a7	a6	a5	a4	a3	a2	a1	a0												
Lower byte: 21H	0	0	1	0	0	0	0	1	B											
	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
Initial address：	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0 B

  Address：Register font data of 128 bytes from the address of 01080H

  <1-byte download>

  Font data for 1 character is configured as the figure below.
  24 dots font data is registered by repeating data of 2 bytes every 2 times.
  16 dots font data is registered by repeating data of 1 byte every 2 times.
  Therefore, 1 character font data requires 96 + 32 = 128 bytes.



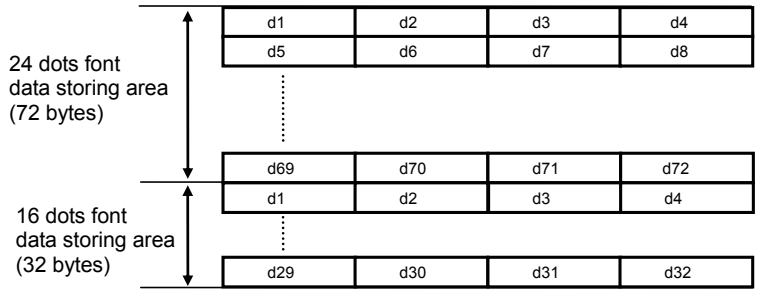
  Character code (JIS) correspond to initial address of font data as shown below. The table shows initial address in 20 bits as A19 to A0.

Area	A19	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1	A0
Single-byte area （20H～FEH）	1	0	0	b7	b6	b5	0	0	b4	b3	b2	b1	b0	0	0	0	0	0	0	0

Structure of Korean

<2-byte download>

Font data for 1 character is configured as the figure below.
1 character font data requires 72 + 32 = 104 bytes.



All characters are registered into the section of 1 to 93 and assigning 94 characters in each section

Section1: A1A1H to A1FEH
Section2: A2A1H to A2FEH

:
Section93: FDA1H to FDFEH

Initial address of font data can be calculated by the formula below when representing first byte and second byte of character code as K1 and K2 respectively.

Initial address = （（K1 - A1H） × 94 + （K2 - A1H））× 104

Example: Obtaining for initial address B5A4H
（（B5H - A1H） × 94 + （A4 - A1H））× 104
= （14H × 94 + 3H） × 104
= 2FCF8H

Address: Font data of 104 bytes from the address of 2FCF8H are registered

- **ROM information**

Font information is registered in appropriate address:

Language:(Address: FFFC0H)
Japanese: 'JAPANESE', 00H (Total of 9 bytes)
Korean: 'KOREAN', 00H (Total of 7 bytes)

Language ID:(Address: FFFFFH)
Japanese: 00H
Korean: 02H

'{' n Data Structure of a 2-Byte Character

Code 7BH n
0 ≤n≤1

Function Selects the data structure of a 2-byte character.

n	Function
0	Japanese
1	Korean

Code This command is valid for download mode.

6.6 DEFAULTS

The defaults of the items are listed below.

Table 6-10 Default Settings(1/2)

Item	Default
Line buffer	Cleared
Page length	38 lines (1292 dots line)
Bottom margin	Canceled
Page mode	Canceled
Right margin *1	Maximum number of digits for printing (at shipping)
Left margin *1	0 digit (at shipping)
Line feed *1	34 dots lines (at shipping)
Horizontal tab position	Every eight 24-dot 1-byte characters
Vertical tab position	Not set
Font size	Depend on the SWDIP switch setting
International character selection *1	Japanese (at shipping)
Character code table	Depend on the SWDIP switch setting
Euro character	Canceled
Character space *1	4 dots (at shipping)
Character decoration	Canceled
Download character selection	Canceled
Kanji code system	Depend on the SWDIP switch setting
Kanji mode	Canceled
Vertical/horizontal writing	Horizontal writing
2-bytes character right- and left-side spaces *1	Left space: 0; Right space: 8 dots (at shipping)
Kanji character decoration	Canceled
Ruler line	OFF
Ruler line buffer	Cleared
HRI character print position	Not printed
HRI character font	24 × 12 dots font
Bar code height	162 dots lines
Bar code width	Narrow width: 3 dots; Wide width: 9 dots
Bar code print position	Left
PDF417 nominal fine element width	2 dots
PDF417 row height	7 dots
QR Code, Data Matrix module size	4 dots

Table 6-10 Default Settings(2/2)

Item	Default
Initial automatic status transmission	Depend on the SWDIP switch setting
Automatic status transmission	Not respond
Paper selection	Depend on the SWDIP switch setting
Print density selection	Depend on the SWDIP switch setting
Auto power off	Depend on the SWDIP switch setting
Auto power off time *1	30 minutes (at shipping)
Overlap mode selection	OR overlap
Select Image LSB/MSB	The leftmost bit is LSB
Maximum paper feed length to mark detection *1	300 mm
Amount of paper length by auto-loading *1	50 mm
Bluetooth PIN code *1	Not registered
Bluetooth device name *1	DPU-S445

*1: The value can be changed by Set default/Set test print header (DC2 'i') command.

6.7 INITIAL AUTOMATIC STATUS TRANSMISSION

The printer can transfer 1 byte of data containing status information at one second intervals automatically regardless of the existence of an error when bit 8 of SWDIP switch 2 is set to 0.

The contents of status information is the same as the description shown in DC2 'e' n.
The initial automatic status transmission for each communication mode is explained below:

- **When Serial or USB is selected:**

  Start initial automatic status transmission in one second interval from one second after of completion of initialization.

- **When IrDA or Bluetooth selected:**

  Start initial automatic status transmission after establishment of the connection between the printer and computer.
  When connection is not established, the initial status is cleared as untransmitable data.

- **When BHT-Ir selected:**

  The initial automatic status transmission is not performed.

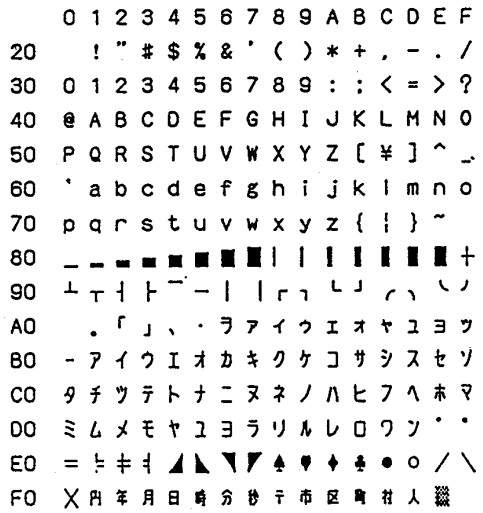
Execute automatic status transmission command to stop the initial automatic status transmission.
When the automatic status transmission is set to disable (DC2 'e' 00H), status transmission is stopped.
When the automatic status transmission is set to enable (DC2 'e' 01H), the status transmission in one second interval is stopped and printer status is sent only when an error occurs.

6.8 COMMAND INDEX

APPENDIX A
CHARACTER SETS (CHARACTER CODE TABLE)

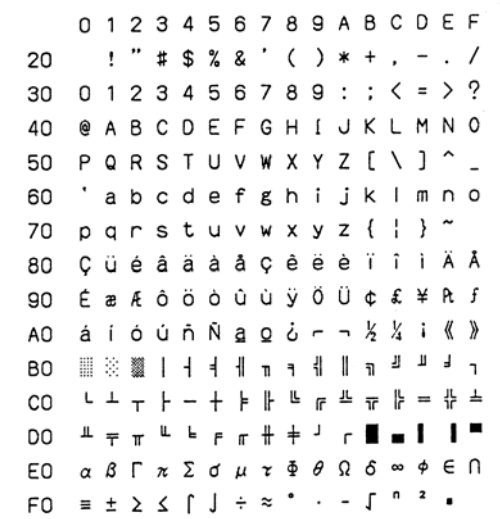
A.1 CHARACTER CODE TABLE

- ANK (Katakana character set: if Japanese is selected as an international character set)



* 20H and A0H indicate a space. 7FH and FFH are ignored.

- IBM Compatible (Extended graphics character set: if Japanese is selected as an international character set)



* 20H indicates a space. 7FH and FFH are ignored.

- Codepage 1252 character set: if Japanese is selected as an international character set

* 20H indicates a space. 7FH is ignored.

A.2 INTERNATIONAL CHARACTER SETS

The following codes differ depending on the international character set selected.

	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
USA	#	$	@	[	\	]	^	`	{	¦	}	~
FRANCE	#	$	à	°	Ç	§	^	`	é	ù	è	¨
GERMANY	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
ENGLAND	£	$	@	[	\	]	^	`	{	¦	}	~
DENMARK 1	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
SWEDEN	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
ITALY	#	$	@	°	\	é	^	ù	à	ò	è	ì
SPAIN	₧	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
JAPAN	#	$	@	[	¥	]	^	`	{	¦	}	~
NORWAY	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
DENMARK 2	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
SPAIN 2	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
LATIN AMERICA	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú

A.3 KANJI CODE TABLE

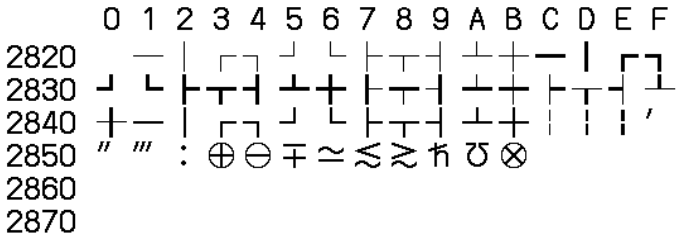
Kanji characters of 1997 JIS levels 1 and 2 are supported. The following special characters and character codes for vertical writing, which are not listed in the table, are also supported.

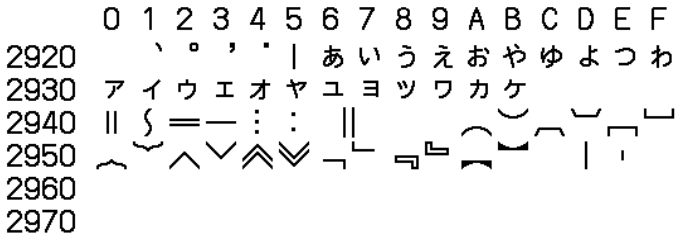
- Special character codes

  2821H to 285BH
  2D21H to 2D7EH

- Character codes for vertical writing

  2921H to 295EH





A.4 KANJI QUARTER SIZE CHARACTER SET