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EPSON

TM-H6000II

Specification

STANDARD	
Rev. No.	B
Notes	

Copied Date	, ,
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SEIKO EPSON CORPORATION

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REVISION SHEET

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Revisions		Design Section			Sheet Rev.No.					
Rev.	Document	WRT	CHK	APL	Sheet	Rev.	Sheet	Rev.	Sheet	Rev.
A	Enactment	Nebashi	Asai	Omura	I	A	16	A	40	A
B	Change				II	A	17	B	41	A
					III	A	18	A	42	A
					IV	A	19	A	43	A
					V	A	20	A	44	A
					VI	A	21	A	45	A
					VII	A	22	A	46	A
							23	A	47	A
							24	A	48	A
					1	A	25	A	49	A
					2	A	26	A	50	A
					3	A	27	A	51	A
					4	A	28	A	52	A
					5	A	29	A	53	A
					6	A	30	A	54	A
					7	A	31	A	55	A
					8	A	32	A	56	A
					9	A	33	A	57	A
					10	A	34	A	58	A
					11	A	35	A	59	A
					12	A	36	A	60	A
					13	A	37	A	61	A
					14	A	38	A	62	A
					15	A	39	A	63	A

TITLE

TM-H6000II
Specification
(STANDARD)

Front part							
Cover	Rev. Sheet	Scope	General Descriptions	Table of Contents	Contents	Appendix	Total
1	4	--	2	5	172	17	201

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B	Change				65	A	89	A	113	A
					66	A	90	A	114	A
					67	A	91	A	115	A
					68	A	92	A	116	A
					69	A	93	A	117	A
					70	A	94	A	118	A
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					72	A	96	A	120	A
					73	A	97	A	121	A
					74	A	98	A	122	A
					75	A	99	A	123	A
					76	A	100	A	124	A
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B	Change				137	A	161	A	App.2	A
					138	A	162	A	App.3	A
					139	A	163	A	App.4	A
					140	A	164	A	App.5	A
					141	A	165	A	App.6	A
					142	A	166	A	App.7	A
					143	A	167	A	App.8	A
					144	A	168	A	App.9	A
					145	A	169	A	App.10	A
					146	A	170	A	App.11	A
					147	A	171	A	App.12	A
					148	A	172	A	App.13	A
					149	A			App.14	A
					150	A			App.15	A
					151	A			App.16	A
					152	A			App.17	A
					153	A				
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					156	A				
					157	A				
					158	A				
					159	A				

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REV.	SHEET	CHANGED CONTENTS
B	17	Condition of Acceptability (added)

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GENERAL FEATURES

1) This specification applies to the following models of the TM-H6000II series printer:

TM-H6000II (with serial interface)
TM-H6000II (with parallel interface)

2) Features

This printer is a high-end POS printer that can print both receipts and slips.

<Slip section>

- An optional Magnetic Ink Character Recognition (MICR) reader that enables the printer to perform consecutive reading and processing of MICR characters and an optional endorsement printer (E/P) that enables single-pass high speed printing of endorsements can be installed.
- Single-pass processing for checks eliminates the need to reverse the check paper for printing an endorsement.
- High throughput using bidirectional minimum distance printing.
- A mechanical form stopper gives a slip stability.
- Page mode is a flexible printing format.

<Receipt section>

- Highest speed printing in the POS business world with batch processing printing.
- High speed graphic printing.
- Standard autocutter provides easy user operation.
- Drop-in paper loading provides easy user operation.
- PDF417 symbols (2-dimensional code) print is possible.
- Two-color printing is possible with two-color paper.

<Common to both receipt and slip>

- Small footprint and simple design.
- EPSON customer display series connection (DM-***). (Available only for serial interface model).
- Command protocol based on the ESC/POS® standard.
- Automatic Status Back (ASB) function that automatically transmits changes in the printer status.
- Selectable receive buffer size (45 bytes or 4 KB).
- Available NV (non-volatile) bit image buffer size (384 KB). (*1)
- User NV (non-volatile) memory size (1 KB). (*1)
- Counter function that enables the printer to be checked by remote maintenance.
- Several interface models (RS-232/bidirectional parallel) are supported.

NOTE: *1 The memory size can be set by a user-defined command.

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1. GENERAL SPECIFICATIONS

1.1 Slip Printer Section

1.1.1 Printing Specifications

1) Printing method: Serial impact dot matrix

2) Head wire configuration: 9-pin vertical line, wire pitch approximately 0.353 mm {1/72"}

3) Printing direction: Bidirectional, minimum distance printing

4) Printing speed: Approximately 5.14 lps (printing 40 columns per line with 17.8 cpi when the head energizing time is set to normal mode.)
[lps: lines per second]
[cpi: characters per inch (number of characters per 25.4 mm)]

5) Characters per line: Refer to Table 1.1.1.

6) Characters per inch: Refer to Table 1.1.1.

1.1.2 Character Specifications

1) Number of characters:
Alphanumeric characters: 95 character types
Extended graphics: 128 characters × 12 pages (including two space pages)
International characters: 37 character types

2) Character structure:
Font A: 5 × 9 (total 270 dots horizontally)
Font B: 7 × 9 (total 540 half dots horizontally)

3) Character size: Refer to Table 1.1.1.

Table 1.1.1 Character Size, Characters Per Line, Characters Per Inch

	Character structure Horizontal dots × Vertical dots	Character Size (mm) Width × Height	Character Dot Spacing	Characters Per Line (cpl)	Characters Per Inch (cpi)
Font A	5 × 9	1.56 × 3.1	1 dot	45	13.3
Font B	7 × 9	1.24 × 3.1	2 half dots	60	17.8

Character structure in the default setting is Font A

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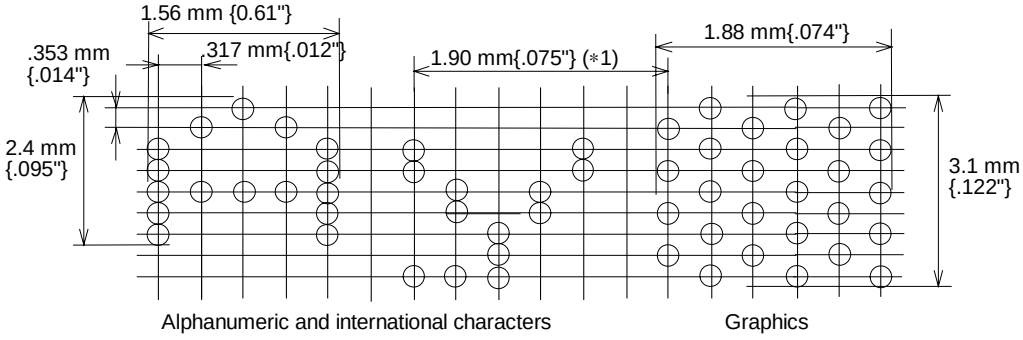
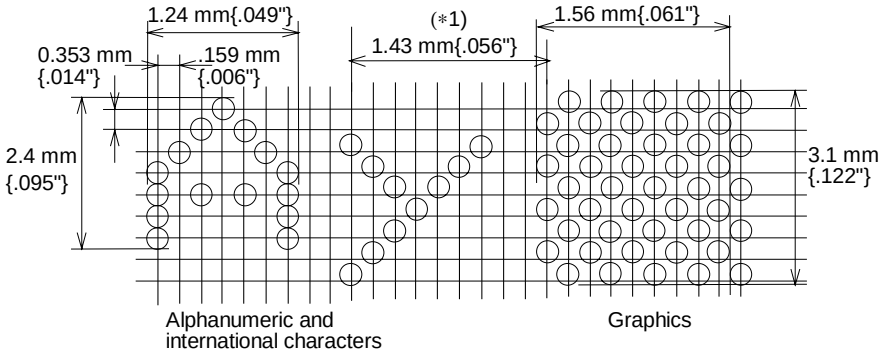
Character structure in the default setting is Font A

5 × 9 Font Sample (Font A)



∗1: Character pitch

7 × 9 Font Sample (Font B)



∗1: Character pitch

Figure 1.1.1 Character Structure

1.1.3 Paper Specifications

1) Cut sheet

Paper types: Normal paper, pressure-sensitive paper, carbon copy paper

Paper sizes: 68 – 230 mm (W) × 68 – 297 mm (L) {2.7 – 11.8"(W) × 2.7 – 11.7"(L)}

NOTE: The minimum paper size is 68 × 152 mm {2.7 – 6.0"}

Copy capability and paper thickness:

① Normal paper (single-ply): 0.09 to 0.2 mm {0.0035 to 0.0079"}

② Carbonless copy paper combination: 4 sheets maximum

- Backing paper: 0.07 to 0.12 mm {0.0028 to 0.0047"}
- Copy and original: 0.04 to 0.07 mm {0.0016 to 0.0028"}
- Carbonless paper: Approximately 0.035 mm {0.0014"}
- Total thickness: 0.09 to 0.31 mm {0.0035 to 0.0122"}

example: one original + 2 copies,

Original paper	0.04 mm
Carbonless paper	0.07 mm (0.035 mm × 2 sheets)
Copy paper	0.04 mm
Backing paper	0.07 mm
Total thickness	0.22 mm

Ambient temperature and copy capability:

Copy capability is greatly influenced by the ambient temperature, so printing must be performed under the conditions described in Table 1.1.2.

Table 1.1.2 Relationship between Ambient Temperature and Number of Copies

Number of copies	Ambient temperature
Original + 3 copies	10 to 40°C {50 to 104°F}
Original + 1 copy	5 to 45°C {41 to 113°F}

2) Notes on slip paper

- The slip paper must be flat, without curls or wrinkles, especially at the top edges. Otherwise, the paper may rub against the ribbon and become dirty.
- There must be no glue on the bottom edge of slip paper. Choose slip paper carefully when the glue is on the right or top edge, since paper feeding and insertion are affected by gluing conditions (e.g., glue quality, method, and length) and glue location (refer to Figure 1.1.2). Be especially careful when slip paper is wide and has the glue on the left edge, since drifting may occur.
- Since the slip BOF sensor uses a photo sensor, do not use paper that has holes at the sensor position, or is translucent.
- Since the slip TOF sensor uses a reflective photo sensor and it detects from the back of slip paper, do not use paper that has holes or dark portions with low reflection (less than 40% reflection) at the sensor position.

- Since the slip paper ejection sensor uses a reflective photo sensor and it detects from the face of the paper, do not use paper that has holes or dark portions with low reflection (less than 40% reflection) at the sensor position.
- Use thinner paper (N30 or equivalent) between the top and bottom sheets of multi-ply paper. If thick paper is used, the copy capability is lowered.

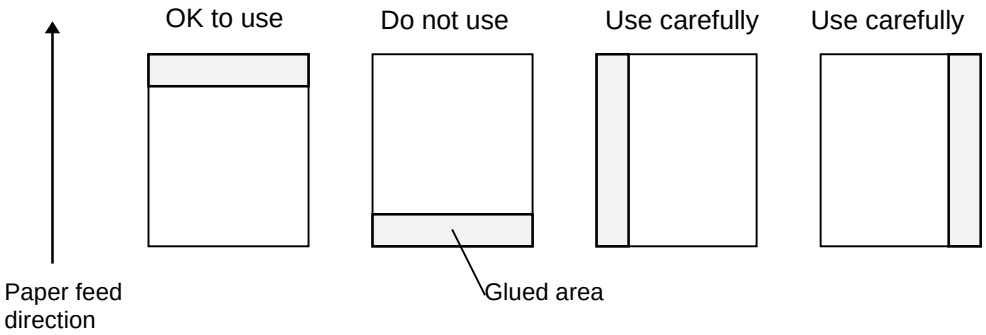


Figure 1.1.2 Slip Paper Glued Area

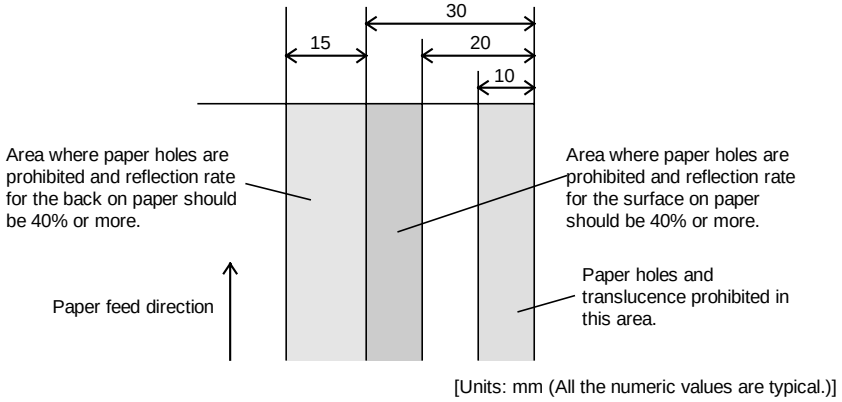
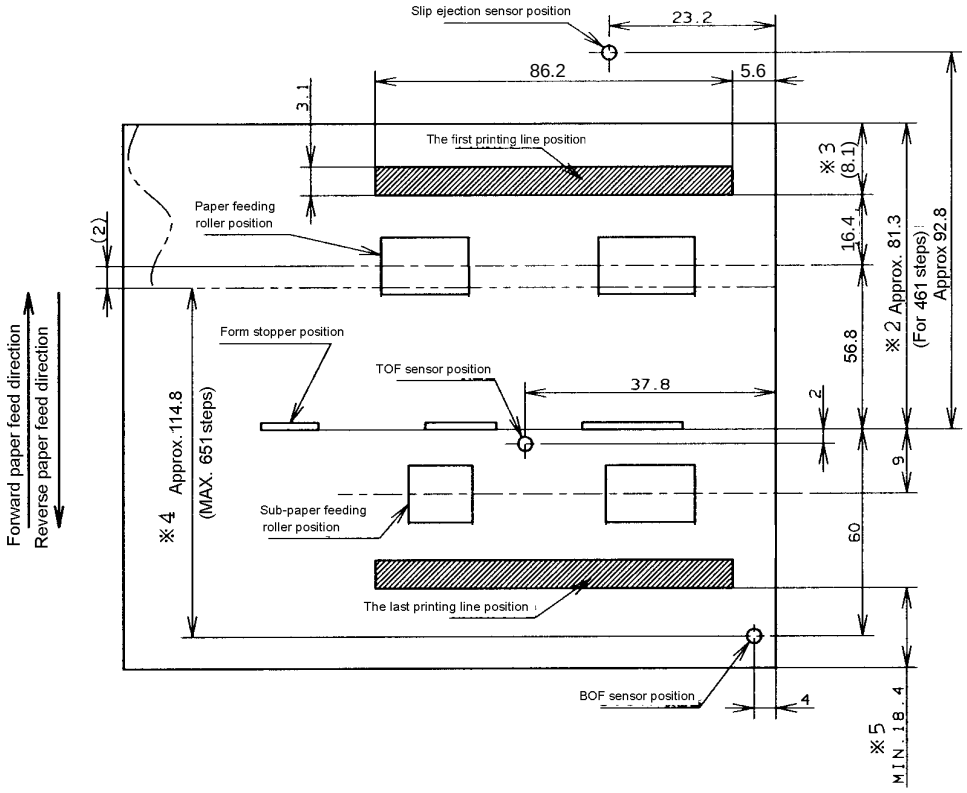


Figure 1.1.3 Area with No Paper Holes and Low Reflection

1.1.4 Printable Area

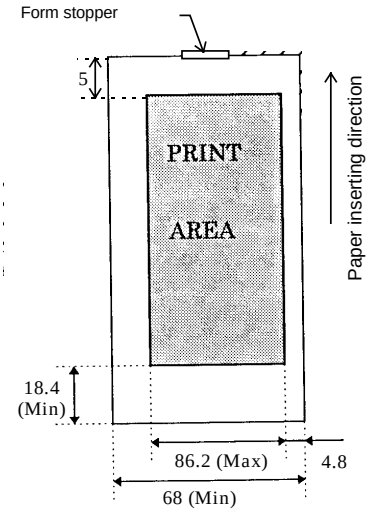


*2 The length from the form stopper to the tip of the paper.

*3 The length from the tip of the paper to the first printing line position.

*4 The printable area after the slip BOF sensor detects the end of the paper. (The bottom margin must be considered for a real printable area.)

*5 Bottom margin (calculated value).



[Units: mm]

Figure 1.1.4 Printable Area for Slip Paper

NOTE: The values shown in Figure 1.1.4 are calculated ones. Consider this for the user design for the print starting position in the paper feeding direction.

1.1.5 Ribbon Cassette

Exclusive ribbon cassette for slip

Type No.	ERC-32(P)	ERC-32(B)
Ribbon color	Purple	Black
Ribbon life	6,000,000 characters (at 25°C {77°F} with continuous printing)	4,000,000 characters (at 25°C {77°F} with continuous printing)

1.2 E/P Endorsement Printer Section (Factory-Installed Option)

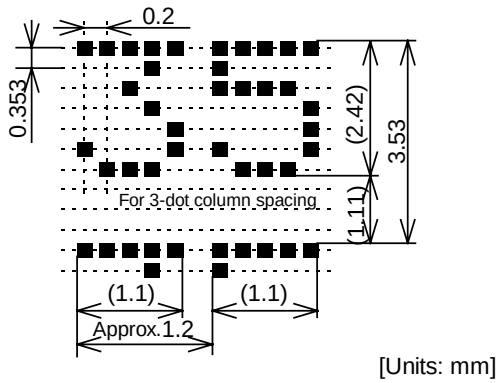
The endorsement printer enables printing of endorsements as part of a sequence that is automatically processed: MICR reading, printing an endorsement on the back side of the personal check, and printing on the surface of it.

1.2.1 Printing Specifications

1) Printing method:	Shuttle impact dot matrix
2) Head wire configuration:	8 print solenoids in a horizontal line
3) Printing speed:	Approximately 1.9 lps (lps: lines per second)
4) Characters per line:	40 columns
5) Characters per inch:	Refer to Figure 1.2.1.

1.2.2 Character Specifications

1) Number of characters:	Alphanumeric characters:	95 character types
	Extended graphics:	128 characters × 11 pages (including a space page)
	International characters:	37 character types
2) Character structure:	5 × 7 (total 240 dots horizontally)	
3) Character size:	Refer to Figure 1.2.1	



For 1-dot column spacing

Figure 1.2.1 Character Structure

NOTE: Character dot spacing can be changed by the **ESC SP** command.

1.2.3 Paper Specifications

1) Cut sheets

Paper type: Normal paper

Paper size: 68 – 230 mm (W) × 68 – 297 mm (L) {2.7 – 8.8"(W) × 2.7 – 11.7"(L)}

NOTE: The minimum paper size is 68 × 152 mm {2.7 – 6.0"}

Paper thickness: Single-ply (copy paper cannot be used)
0.09 mm – 0.2 mm {0.0035 – 0.0079"}

1.2.4 Printable Area

The print head consists of 8 print solenoids (A, B, C, D, E, F, G, and H) arranged in a horizontal line. The print head moves from the left (from the standby position) to the right, printing at 30 positions as each print solenoid is energized, so that one dot line is formed. The total number of dots per dot line is 240 (30 positions × 8 solenoids).

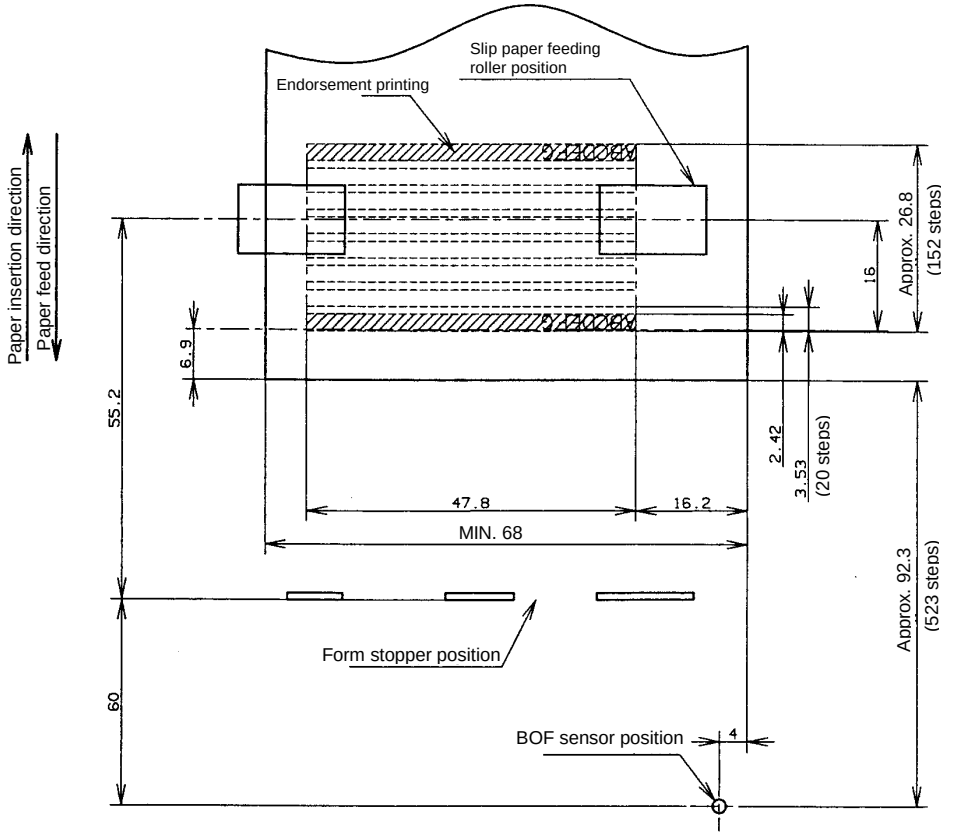


Figure 1.2.2 E/P Printable Area (for Endorsement Printing)

1.2.5 Ribbon Cassette

Exclusive ribbon cassette for E/P

Type No.	ERC-41(P)	ERC-41(B)
Ribbon color	Purple	Black
Ribbon life	1,000,000 characters (at 25°C {77°F} with continuous printing)	800,000 characters (at 25°C {77°F} with continuous printing)

1.2.6 Notes on Using the Endorsement Printer

- The endorsement printer (abbreviated to E/P) enables printing of endorsements as part of sequence that is automatically processed: MICR reading, printing an endorsement on the back side of a personal check, and printing on the surface of it. Once the end of the paper exceeds the print head position of the E/P, reverse paper feeding to the front side is not possible.
- When the endorsement printing is executed after a MICR reading, the printer feeds the paper forward automatically after receiving a command to print the endorsement; then the printer starts printing up to approximately 7.0 mm {0.28"} from the end of the check paper by using reverse paper feeding.
- Since the E/P printing format is assumed to print an endorsement on a US personal check, the print begins the back side of the paper. (As viewed from the front of the printer, the endorsement printing characters are upside down.)
- The printing sequence for slip paper is different, depending on whether an endorsement printer is installed. That is, when the E/P is installed, once the printing exceeds the E/P printable area and the slip paper is fed forward, reverse paper feeding must be prohibited. Consider this when developing application programs.
- The E/P printing must be not performed on copy paper. Otherwise, a paper jam may occur or the E/P may be broken. Because E/P printing feeds the paper in a reverse paper feed direction, the paper may be wrinkled.
- In some case paper feeding may not be accurate when E/P printing is performed on check paper. This may depend on the width of the check paper. Therefore, it is recommended for the user to check in advance whether the check paper will print correctly or not.

1.3 Receipt Section

1.3.1 Printing Specifications

1) Printing method: Thermal line printing

2) Dot density: 180 dpi × 180 dpi
[dpi: dots per inch (number of dots per 25.4 mm {1"})]

3) Printing direction: Unidirectional with friction feed

4) Printing width: 72 mm {2.83"}, 512 dot positions

5) Characters per line (default): Font A: 42
Font B: 56

6) Character spacing (default): Font A: 0.28 mm {.01"} (2 dots)
Font B: 0.28 mm {.01"} (2 dots)
Programmable by control command.

7) Printing speed: For ANK/Multilingual model:

Normal: 54 lps maximum (computed value for 1/8" feed)
170 mm/s maximum {Approximately 6.7"/s}
(at 24V, density level 2)

Ladder barcode/2-dimensional code printing:
114 mm/s maximum

Two-color print mode:
56.4 mm/s maximum

For Japanese Kanji model (with paper width 58 mm):

Normal: 150 mm/s maximum

Ladder barcode/2-dimensional code printing:
114 mm/s maximum

Two-color print mode:
56.4 mm/s maximum

8) Paper feed speed: Approximately 170 mm/s
(approximately 6.7"/s) (continuous paper feeding)

9) Line spacing: 4.23 mm {1/6"} (default)
Programmable by control command.

1.3.2 Character Specifications

1) Number of characters:
- Alphanumeric characters: 95 characters
- Extended graphics: 128 characters × 11 pages (including a space page)
- International characters: 37 characters

2) Character structure:
- Font A: 12 × 24 (including 2-dot spacing horizontally)
- Font B: 9 × 17 (including 2-dot spacing horizontally)

3) Character size: Refer to Table 1.3.1.

Table 1.3.1 Character Sizes

	Standard		Double-height		Double-width		Double-width/ Double-height	
	W×H (mm)	cpl	W×H (mm)	cpl	W×H (mm)	cpl	W×H (mm)	cpl
Font A 12×24	1.41×3.39	42	1.41×6.77	42	2.82×3.39	21	2.82×6.77	21
Font B 9×17	0.99×2.40	56	0.99×4.80	56	1.98×2.40	28	1.98×4.80	28

- Space between characters is not included.
- Characters can be scaled up to 64 times the standard sizes.
- When using Font B with a font style such as emphasized, some words may be hard to read. Check the font style in advance when using Font B.

(cpl = characters per line)

1.3.3 Autocutter

Partial cut: Cutting with one point left uncut

NOTES:
- To prevent dot displacement, after cutting, feed paper approximately 1 mm {14/360"} or more before printing.
- Paper must be fed over 40 mm {1.57"} before cutting if the printer is stopped.

1.3.4 Paper Roll Supply Device Section

1) Supply method: Drop-in paper roll

2) Near-end sensor

a) Detection method: Microswitch

b) Paper roll spool diameter: Inside: 12 mm {.47"}
Outside: 18 mm {.71"}

c) Near-end adjustment: Adjusting screw

d) Remaining amount: Fixed position #1 approximately 23 mm {0.9"}
#2 approximately 27 mm {1.06"}
(The adjusting screw has two positions.)
Refer to Appendix D.

3) Paper roll end detection

a) Detection method: Reflective photo sensor

NOTE: You can use the **ESC c 4** command to stop printing upon detection of a paper near-end.

1.3.5 Paper Specifications

1) Paper type: Specified thermal paper

2) Form: Paper roll

3) Paper width: 79.5 ± 0.5 mm {3.13 ± 0.02"}

4) Paper roll size: Roll diameter: Maximum 83 mm {3.27"}
Take-up paper roll width: 80+0.5/–1.0 mm {3.15+0.02/–0.04"}

5) Specified paper: Specified thermal roll paper, NTP080-80
In Japan: Nakagawa Mfg. Co.,Ltd.
In U.S.A.: Nakagawa Mfg. (USA) Inc.
In Europe: Nakagawa Mfg. (Europe) GmbH
In Southeast Asia: N.A.K. Mfg. (Malaysia) SDN BHD
[Original paper: TF50KS-E Nippon Paper Industries Co.,Ltd.]
The following paper can be used instead of the specified paper above:
Original paper: PD 160R (Oji Paper Mfg. Co. Ltd.)
Original paper: AF50KS-E (Jujo Thermal Oy (Finland))
Original paper: P350(F380), P310, P300
(Kanzaki Specialty Papers, Inc. (U.S.A.))

NOTE: When paper other than that specified is used, the thermal print head may wear out more quickly. Be sure to use the specified paper.

Depending on each paper specification, it is recommended to set the DIP switches as shown in Table below:

Original paper type	DIP SW2		Print density level
	3	4	
P350 (F380)	ON	ON	1
PD160R, AF50KS-E, P310, P300	OFF	OFF	2 (default)

6) Recommended two-color thermal paper

The following paper is recommended to use when the two-color print mode is selected:

Original paper: PD750R (paper thickness: 75 μm) (Oji Paper Mfg. Co. Ltd.)

NOTES:
- With some printing patterns, the previous print color may not be cleared.
- The printer's reliability when two-color thermal paper is used differs from the reliability when monochrome paper is used.

7) Paper roll spool diameter: Inside: 12 mm {.47"}
Outside: 18 mm {.71")

NOTE: Paper must not be pasted to the paper roll spool.

1.3.6 Printable Area

1) Paper roll

The printable area of a paper roll with a width of 79.5 ± 0.5 mm {3.13" ± 0.02"} is 72.2 ± 0.2 mm {2.84" ± 0.008"} (512 dots), and the space on the right and left sides are approximately 3.7 ±2 mm {0.15" ± 0.079"}.

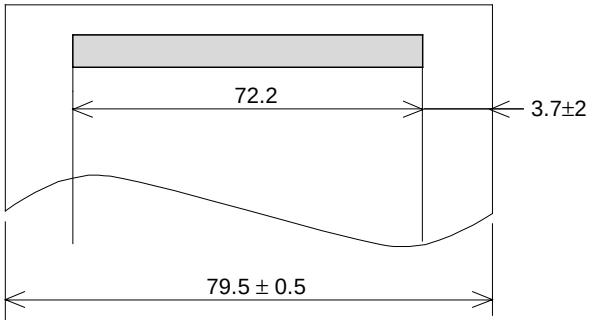


Figure 1.3.1 Printable Area for Paper Roll

NOTE: The print position within the printable area of the thermal elements for dots 257 to 512 is shifted approximately 0.07 mm {.003"} in the paper feed direction from the position for dots 1 to 256. Be sure not to print a ladder barcode across both printable areas, as this can cause variations in printing which are difficult to read.

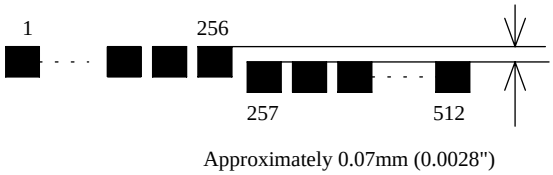
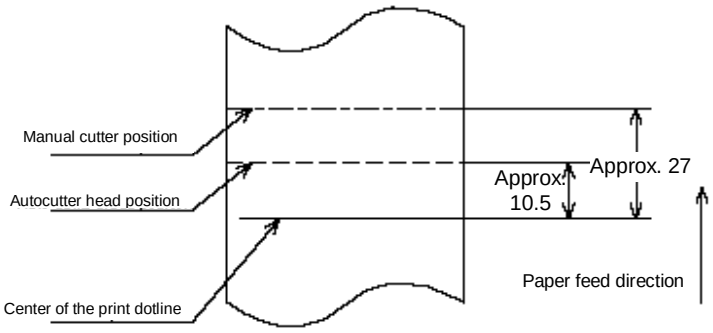


Figure 1.3.2 Shifting of the Print Position

1.3.7 Printing and Cutting Posiitions



[Units: mm (All the numerical values are typical.)]

Figure 1.3.3 Printing and Cutting Positions

NOTE: Numeric values used here are typical values; the values may vary slightly as a result of paper slack or variations in the paper. Take this into account when setting the cutting position of the autocutter.

1.4 MICR Reader (when the Printer is Used with a MICR Reader)

1.4.1 Reading method

Magnetic bias

1.4.2 Recognition rating

98% or more at 25°C {77°F}

Recognition rating is defined as follows

$$\text{Recognition rating (\%)} = \frac{\text{Total number of checks} - \text{(number of sheets misread or not identified.)}}{\text{Total number of checks}} \times 100$$

- Check paper used for test is EPSON standard check paper.
- Checks must be flat, without curls, folds, or wrinkles.

1.4.3 Inserting Direction and Endorsement Printing

- Insert the check with the surface printed with the magnetic ink facing upward, following the slip side guide.
- The printer can perform endorsement printing.

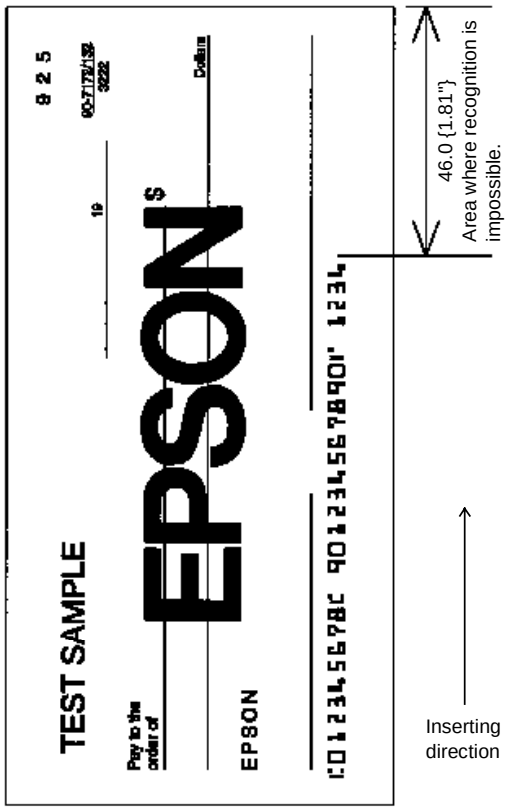
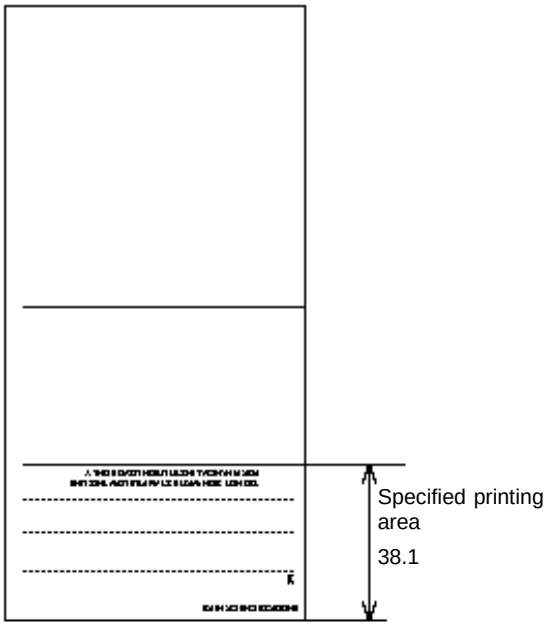


Figure 1.4.1 Area of Personal Check Where MICR Character Recognition is Impossible

- To print endorsements in the specified area (within 38.1 mm {1.5"} from the top), set the print position for the last line so that it is printed at least 3 mm {0.118"} above the bottom of the printable area. (Especially when the printer is used near the display device, the user is required to check the recognition rate of the MICR.)

NOTES: 1. Do not install the printer near any magnetic fields, because this may cause MICR reading errors. (Especially when the printer is used near the display device, the user is required to check the recognition rate of the MICR.)

2. The MICR characters may not be recognized when impact or vibration is applied to the printer.



[Units: mm (All numeric values are typical.)]

Figure 1.4.2 Endorsement Printing

1.4.4 Notes on Using the MICR Reader (only When the Printer is Used with MICR)

- The personal checks must be flat, without curls, folds, or wrinkles (especially at the edges). Otherwise, the check may rub against the ribbon and become ink-stained.
- Do not insert checks that have clips or staples. This may cause paper jams, MICR reading errors, and damage to the MICR head.
- Let go of the check immediately as soon as the printer starts feeding it. Otherwise, the paper is not fed straight, causing paper jams and MICR reading errors.

1.5 General Section

1.5.1 Internal Buffer

1) Receive buffer selectable as 45 bytes or 4 KB using the DIP switch.

2) User-defined buffer (both for user-defined characters and user-defined bit images)
Receipt : 12 KB Slip: 3 KB

3) Macro buffer 2KB

4) NV (non-volatile) bit image buffer 384 KB (default), 256 KB for model with multilingual support (default)

5) User NV (non-volatile) memory 1 KB

1.5.2 Electrical Characteristics

1) Supply voltage: +24 VDC ± 10%
(optional power supply: EPSON PS-170, PS-180)

Ripple voltage: 300 mVpp or less
(only when the printer is used with the MICR reader)

2) Current consumption (at 24V except for drawer kickout driving)

Slip:	Operating:	Mean:	Approximately 1.7A (Character font A α-N, all columns printing)
		Peak:	Approximately 5.5A
Receipt:	Operating:	Mean:	Approximately 1.8A (Character font A α-N, all columns printing)
		Peak:	Approximately 7.7A
Standby:		Mean:	Approximately 0.2A

1.5.3 EMI and Safety Standards Applied (EMC is Tested Using the EPSON PS-170, PS-180 Power Supply)

1) Europe: CE Marking
Directive 89/336/EEC
EN55022 Class B
EN55024
IEC 61000-4-2
IEC 61000-4-3
IEC 61000-4-4
IEC 61000-4-5
IEC 61000-4-6
IEC 61000-4-8
IEC 61000-4-11
Safety Standard:
EN 60950

2) North America:
EMI: FCC Class A
Safety Standards: UL1950
CSA C22.2 No.950

3) Japan: EMI: VCCI Class A

4) Oceania: EMI: AS/NZS 3548 class B

Condition of Acceptability (for UL)

1. This component has been judged on the basis of the required spacings in the Standard for Safety of Information Technology Equipment, Including Electrical Business Equipment, CAN/CSA C22.2 NO. 950-951, UL 1950 which would cover the component itself if submitted for Listing.
2. This unit is intended to be supplied by a SELV source only.
3. Interface connectors (DK, DM-D) are not intended for TNV connection.

1.5.4 Reliability

Slip printer section:

1) Life (when printing alphanumeric characters)
   When the printer is used with the MICR and performs both-sided printing:
   7,500,000 lines
   When the printer performs a surface side printing only:
   12,000,000 lines
   The printer is each defined to have reached the end of its life when it reaches the beginning of the Wearout Period.
2) MTBF 180,000 hours
   Failure is defined as a Random Failure occurring during the Random Failure Period.
3) MCBF
   When the printer is used with the MICR and performs both-sided printing:
   18,000,000 lines
   When the printer performs a surface side printing only:
   29,000,000 lines
   This is an average failure interval based on failures relating to Wearout and Random Failures up to the life of 7.5 million or 29 million lines.
4) Print head life: 200 million characters (when printed with Font B only)
   NOTE: Printing pattern: Average 2 dots / wire per character
   This printer has nine wire (dots) vertically and prints characters moving horizontally. If one wire prints repeatedly, the problem may occur. Consider this when you use the printer.
   Example:
   If the characters which consists of the horizontally adjacent dots such as "H", "L", "-", or " A" are repeatedly printed, the number of the printed lines should be ten or less. If more than ten such lines need to be printed, the printer should pause for a time longer the total printing time for each 10 lines.
5) MICR reader mechanism (only when the printer is used with the MICR reader):
   240,000 passes (when used with US personal checks)

Endorsement printer section (factory-installed option):

1) Life
   Mechanism: 1,350,000 lines
   The printer is defined to have reached the end of its life when it reaches the beginning of the Wearout Period.
2) MTBF 180,000 hours
   Failure is defined as a Random Failure occurring at the time of the Random Failure Period.
3) MCBF 3,300,000 lines
   This is an average failure interval based on failures relating to Wearout and Random Failures up to the life of 1.35 million lines.

Receipt printer section:

1) Life
   Mechanism: 15,000,000 lines (when using monochrome thermal paper)
   7,500,000 lines (when using two-color thermal paper)
   The printer is defined to have reached the end of its life when it reaches the beginning of the Wearout Period.
2) MTBF 360,000 hours
   In the printer's life of 15 million lines (in monochrome printing) or 7.5 million lines (in two-color printing), failure is defined as a Random Failure occurring at the time of the Random Failure Period.
3) MCBF 52,000,000 lines
   This is an average failure interval based on failures relating to Wearout and Random Failures up to the life of 15 million lines (in monochrome printing) or 7.5 million lines (in two-color printing).
4) Thermal head life: 100 million pulses,
   100 km (when using monochrome thermal paper)
   50 km (when using two-color thermal paper)
5) Autocutter life: 1,500,000 cuts

1.5.5 Environmental Conditions

1) Temperature: Operating: 5 to 45°C {41 to 113°F}
Storage: -10 to 50°C {14 to 122°F} (except for paper and ribbon)

2) Humidity: Operating: 10 to 90% RH (refer to Figure 1.5.1)
Storage: 10 to 90% RH (except for paper and ribbon)

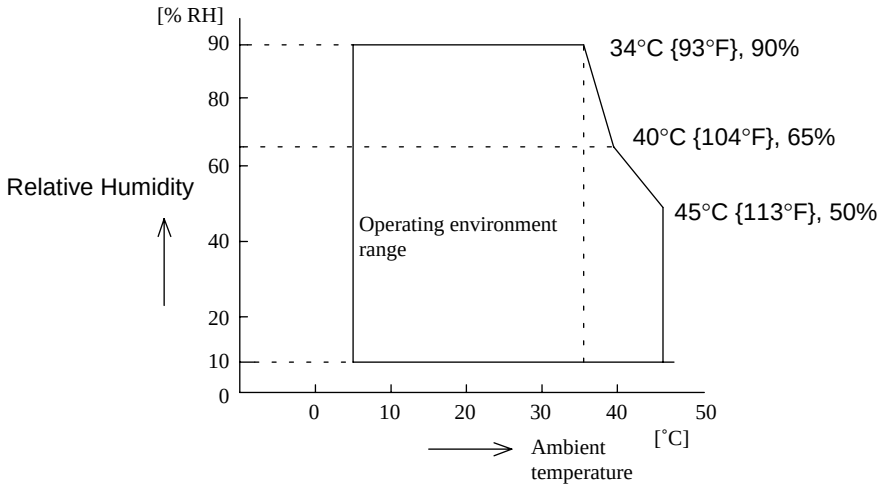


Figure 1.5.1 Operating Temperature and Humidity Range

3) Vibration resistance: When Packed:
Frequency: 5 to 55 Hz
Acceleration: Approximately 19.6 m/s^2 {2 G}
Sweep: 10 minutes (half cycle)
Duration: 1 hour
Directions: x, y, and z

No external or internal damage should be found after the vibration test, and the unit should operate normally.

4) Impact resistance: When Packed:
Package: EPSON standard package
Height: 50 cm {19.69"}
Directions: 1 corner, 3 edges, and 6 surfaces

No external or internal damage should be found after the drop test, and the unit should operate normally.

When unpacked:
Height: 5 cm {1.97"}
Directions: Lift one edge and release it (for all 4 edges).

When the printer is not printing, no external or internal damage should be found after the drop test.

5) Acoustic noise(Operating):

Receipt: When using autocutter:
Approximately 52 dB (Bystander position)
When not using autocutter:
Approximately 45 dB (Bystander position)

1.5.6 Installation

The printer must be installed horizontally.

2. CONFIGURATION

2.1 Interface

2.1.1 RS-232 Serial Interface

2.1.1.1 Specifications

Data transmission:	Serial
Synchronization:	Asynchronous
Handshaking:	DTR/DSR or XON/XOFF control
Signal levels:	MARK = -3 to -15 V: Logic "1"
	SPACE = +3 to +15 V: Logic "0"
Baud rates:	4800, 9600, 19200, 38400 bps (bps: bits per second)
Stop bits:	1 bit (fixed)
Connector (printer side):	Female DSUB-25 pin connector

The data word length, baud rate, and parity depend on the DIP switch settings. (Refer to Section 3.3.3.) The stop bit for the printer side is fixed to 1.

2.1.1.2 Switching between online and offline

The printer does not have an online/offline button. The printer goes offline:

1) Between when the power is turned on (including reset using the interface) and when the printer is ready to receive data.
2) During the self-test.
3) When the cover is open.
4) During paper feeding using the paper FEED button.
5) When the printer stops printing due to a paper-end (only when the paper roll is not present).
6) When an error has occurred.

2.1.1.3 Interface connector terminal assignments and signal functions

Interface connector terminal assignments and signal functions are described in Table 2.1.1.

Table 2.1.1 Printer Status and Signals

<table>
<tr><th>Pin No.</th><th>Signal name</th><th>Signal direction</th><th>Function</th></tr>
<tr><td>1</td><td>FG</td><td>—</td><td>Frame ground</td></tr>
<tr><td>2</td><td>TXD</td><td>Output</td><td>Transmit data</td></tr>
<tr><td>3</td><td>RXD</td><td>Input</td><td>Receive data</td></tr>
<tr><td>4</td><td>RTS</td><td>Output</td><td>DIP SW 2-2 OFF: Same as DTR signal (pin 20)
DIP SW 2-2 ON: Logical product of DTR signals of DM-D and TM (If both are SPACE, the printer can receive data (SPACE).)</td></tr>
<tr><td>6</td><td>DSR</td><td>Input</td><td>This signal indicates whether the host computer can receive data.
SPACE indicates that the host computer can receive data, and MARK indicates that the host computer cannot receive data.
When DTR/DSR control is selected, the printer transmits data after confirming this signal (except when transmitting data by DLE EOT, GS a, or FS (e).
When XON/XOFF control is selected, the printer does not check this signal.
Changing the DIP switch setting enables this signal to be used as a reset signal for the printer (refer to Section 3.3.3).
The printer is reset when the signal remains MARK for 1 ms or more.</td></tr>
<tr><td>7</td><td>SG</td><td>—</td><td>Signal ground</td></tr>
<tr><td>20</td><td>DTR</td><td>Output</td><td>1) When DTR/DSR control is selected, this signal indicates whether the printer is busy. SPACE indicates that the printer is ready to receive data, and MARK indicates that the printer is busy. The busy condition can be changed by using DIP SW 2-1 as follows (refer to Section 3.3.3):
<table>
<tr><th></th><th>Printer status</th><th>DIP SW 2-1 status
ON</th><th>OFF</th></tr>
<tr><td rowspan="8">Offline</td><td>1. During the period from when the power is turned on (including resetting using the interface) to when the printer is ready to receive data.</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>2. During the self-test.</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td>3. When the cover is open.</td><td>—</td><td>BUSY</td></tr>
<tr><td>4. During paper feeding using the paper FEED button.</td><td>—</td><td>BUSY</td></tr>
<tr><td>5. When the printer stops printing due to a paper-end (only when the paper roll is not present).</td><td>—</td><td>BUSY</td></tr>
<tr><td>6. During macro executing standby states.</td><td>—</td><td>BUSY</td></tr>
<tr><td>7. When an error has occurred.</td><td>—</td><td>BUSY</td></tr>
<tr><td>8. When the receive buffer becomes full.(*1)</td><td>BUSY</td><td>BUSY</td></tr>
</table></td></tr>
</table>

Table 2.1.1 Printer Status and Signals (Continued)

Pin number	Signal name	Signal direction	Function
			2) When XON/XOFF control is selected: The signal indicates whether the printer is correctly connected and is ready to receive data. SPACE indicates that the printer is ready to receive data. The signal is always SPACE except in the following cases: • During the period from when the power is turned on to when the printer is ready to receive data. • During the self-test.
25	INIT	Input	Changing the DIP switch setting enables this signal to be used as a reset signal for the printer. The printer is reset when the signal remains SPACE for 1 ms or more.

*1:
- When the receive buffer capacity is specified to 45 bytes:
  When the remaining space in the receive buffer drops to 16 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 26 bytes.
- When the receive buffer capacity is specified to 4 KB:
  When the remaining space in the receive buffer drops to 128 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 256 bytes.
- The printer ignores the data received when the remaining space in the receive buffer is 0 bytes.

2.1.1.4 XON/XOFF transmission timing

When XON/XOFF control is selected, the printer transmits XON or XOFF signals as follows. Transmission timing differs depending on the DIP SW2-1 setting.

Table 2.1.2 XON/XOFF Transmission Timing

	Printer status	DIP SW 2-1 status	
		ON	OFF
XON transmission	① When the printer goes online after turning on the power or reset using interface	Transmit	Transmit
	② When the receive buffer is released from the buffer full state	Transmit	Transmit
	③ When the printer switches from offline to online	—	Transmit
	④ When the printer recovers from an error using the **DLE ENQ 1** or **DLE ENQ 2** commands	—	Transmit
XOFF Transmission	⑤ When the receive buffer becomes full	Transmit	Transmit
	⑥ When the printer switches from online to offline	—	Transmit

NOTES:
- The XON code is <11>H and the XOFF code is <13>H.
- In case ③, XON is not transmitted when the receive buffer is full.
- In case ⑥, XOFF is not transmitted when the receive buffer is full.
- When the DIP SW 2-1 is set to OFF, XON is not transmitted if the printer is in offline state in case ②.

2.1.1.5 Notes on setting DIP switch 2-1 to ON

1) The printer mechanism stops but does not become busy when: an error has occurred, the cover is open, printing stops due to a paper-end, or paper is fed using the paper FEED button.
2) When setting DIP switch 2-1 to ON to enable handshaking with the printer, be sure to check the printer status using the **GS a** command and the ASB function. In this setting, the default value of *n* for **GS a** is 2. The printer automatically transmits the printer status, depending on online/offline changes.
3) When using **DLE EOT**, **DLE ENQ**, and **DLE DC4** be sure that the receive buffer does not become full.
   - When using a host that cannot transmit data when the printer is busy:
     If an error has occurred, **DLE EOT**, **DLE ENQ,** and **DLE DC4** cannot be used when the printer is busy due to a receive buffer-full state.
   - When using a host that can transmit data when the printer is busy:
     When the receive buffer becomes full while transmitting bit-image data, **DLE EOT** or **DLE ENQ,** and **DLE DC4** used while sending the bit-image data is processed as bit-image data. The data transmitted when the receive buffer is full may be lost.

     Example: Check the printer status using **GS I** or **GS r** after transmitting each line of data and use the 4 KB receive buffer. Transmit one line of data so that the receive buffer does not become full.

2.1.1.6 Notes on resetting the printer using the interface

The printer can be reset using interface pins 6 and 25 by changing the DIP switch setting (refer to Section 3.3.3, DIP switch 2).

Table 2.1.3 Reset Switching

Signal Line	DIP Switch	Reset Condition
Pin 6 (DSR)	DSW 2-7: ON	MARK level input
Pin 25 (INIT)	DSW 2-8: ON	SPACE or TTL-HIGH level input

To reset the printer, the following requirements must be satisfied.

- DC characteristics:

Table 2.1.4 Reset DC Characteristics

		Pin 6 (DSR)	Pin 25 (INIT)
Input HIGH voltage	V_{IH}	+3 to +15 V	+2 to +15 V
Input LOW voltage	V_{IL}	-15 to -3 V	-15 to + 0.8 V
Input HIGH current:	I_{IH}	5 mA (maximum)	1 mA (maximum)
Input LOW current:	I_{IL}	-5.3 mA (maximum)	-2 mA (maximum)
Input impedance:	R_{IN}	3 kΩ (minimum)	

- AC characteristics:

  Minimum reset pulse width: TRS 1 ms (minimum)

  When using pin 6 (DSR) (DIP switch 2-7 is ON):

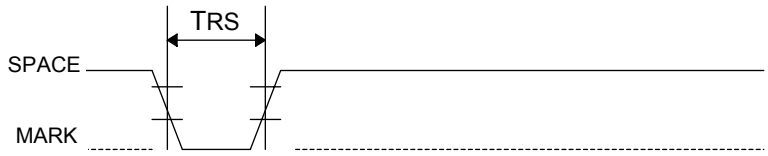


Figure 2.1.1 Minimum Reset Pulse Width (Pin 6)

When using pin 25 (INIT) (DIP switch 2-8 is ON):

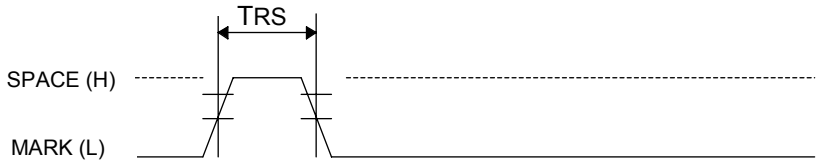


Figure 2.1.2 Minimum Reset Pulse Width (Pin 25)

NOTES:
- When a signal that does not satisfy the requirements above is input, printer operation is not guaranteed. When a signal is input to pin 25 (INIT) at the TTL level, the requirements above must also be satisfied. Although a signal is input to pin 6 (DSR) at the TTL level, according to the DC characteristics described above, the operation is not guaranteed and pin 6 cannot be controlled.
- When pin 6 (DSR) and pin 25 (INIT) are open, the printer is operating.

2.1.2 IEEE 1284 Bidirectional Parallel Interface (Parallel Interface Specifications)

2.1.2.1 Compatibility Mode (Data Transmission from Host to Printer: Centronics Compatible)

(1) Outline

Compatibility mode supports the compatibility with Centronics parallel interface.

(2) Specifications

Data transmission:	8-bit Parallel
Synchronization:	Externally supplied nStrobe signals
Handshaking:	nAck and Busy signals
Signal levels:	TTL compatible
Connector:	ADS-B36BLFDR176 (HONDA) or equivalent (IEEE 1284 Type B)

(3) Switching between online and offline

The printer is not equipped with any online/offline switch. The printer is placed into offline status in any of the following conditions:

1) When the power is turned on or until the printer becomes ready for data transmission after it is initialized by the reset signal (nInit) from the interface.
2) During the self-test.
3) When the cover is open.
4) During paper feeding using the FEED button.
5) When the printer stops printing due to a paper-end (only when the paper roll is not present).
6) During macro executing standby status.
7) When a temporary abnormality occurs in the power supply voltage.
8) When an error has occurred.

2.1.2.2 Reverse Mode (Data Transmission from Printer to Host)

The STATUS data transmission from the printer to the host proceeds in the Nibble or Byte mode.

- Description

  This mode allows data transmission from the asynchronous printer under the control of the host.

  Data transmissions in the Nibble Mode are made via the existing control lines in units of four bits (a Nibble). In the Byte Mode, data transmissions proceed by making the eight-bit data lines bidirectional.

  Both modes fail to proceed concurrently in the Compatibility Mode, causing half duplex transmission.

NOTE: The letter “n” before a signal name indicates an active LOW signal.

2.1.2.3 Interface Pin Assignments for Each Mode

Pin	Source	Compatibility Mode	Nibble Mode	Byte Mode
1	Host	nStrobe	HostClk	HostClk
2	Host/Ptr	Data0(LSB)	Data0(LSB)	Data0(LSB)
3	Host/Ptr	Data1	Data1	Data1
4	Host/Ptr	Data2	Data2	Data2
5	Host/Ptr	Data3	Data3	Data3
6	Host/Ptr	Data4	Data4	Data4
7	Host/Ptr	Data5	Data5	Data5
8	Host/Ptr	Data6	Data6	Data6
9	Host/Ptr	Data7(MSB)	Data7(MSB)	Data7(MSB)
10	Printer	nAck	PtrClk	PtrClk
11	Printer	Busy	PtrBusy/Data3, 7	PtrBusy
12	Printer	PError	AckDataReq/Data2, 6	AckDataReq
13	Printer	Select	Xflag/Data1, 5	Xflag
14	Host	nAutoFd	HostBusy	HostBusy
15		NC	ND	ND
16		GND	GND	GND
17		FG	FG	FG
18	Printer	Logic-H	Logic-H	Logic-H
19		GND	GND	GND
20		GND	GND	GND
21		GND	GND	GND
22		GND	GND	GND
23		GND	GND	GND
24		GND	GND	GND
25		GND	GND	GND
26		GND	GND	GND
27		GND	GND	GND
28		GND	GND	GND
29		GND	GND	GND
30		GND	GND	GND
31	Host	nInit	nInit	nInit
32	Printer	nFault	nDataAvail/Data0, 4	nDataAvail
33		GND	ND	ND
34	Printer	DK_STATUS	ND	ND
35	Printer	+5V	ND	ND
36	Host	nSelectIn	1284-Active	1284-Active

* NC: Not connected
ND: Not defined

NOTES: 1. A prefix “n” to signal names indicates active LOW signals. To the host not provided with the signal lines listed above, both-way communication fails.

2. For interfacing, signal lines shall use twisted pair cables with the return sides connected to signal ground level.

3. Interfacing conditions all shall be based on the TTL level to meet the characteristics described below. In addition, both rise time and fall time of each signal shall be 0.5 μs or less.

4. Data transmission shall not ignore the signal nAck or Busy. An attempt to transmit data with either signal, nAck or Busy, ignored can cause lost data. (Data transmissions to the printer shall be made after verifying the nAck signal or while the Busy signal is at the LOW level.)

5. Interface cables shall be the minimum length required and as short in length as possible.

6. When the DTR/DSR control is selected, the printer enters the BUSY state under the following conditions.

	Printer status	DIP SW 2-1 status	
		ON	OFF
Offline	1. During the period from when the power is turned on (including resetting using the interface) to when the printer is ready to receive data.	BUSY	BUSY
	2. During the self-test.	BUSY	BUSY
	3. When the cover is open.	—	BUSY
	4. During paper feeding using the paper FEED button.	—	BUSY
	5. When the printer stops printing due to a paper-end (only when the paper roll is not present).	—	BUSY
	6. During macro executing standby status.	—	BUSY
	7. When an error has occurred.		BUSY
	8. When the receive buffer becomes full. (*1)	BUSY	BUSY

*1:
- When the receive buffer capacity is specified to 45 bytes:
  When the remaining space in the receive buffer drops to 16 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 26 bytes.
- When the receive buffer capacity is specified to 4 KB:
  When the remaining space in the receive buffer drops to 128 bytes, the printer status becomes "buffer full" and it remains "buffer full" until the space in the receive buffer increases to 256 bytes.
- The printer ignores the data received when the remaining space in the receive buffer is 0 bytes.

2.1.2.4 Electrical Characteristics

DC Characteristics (Except Logic-H, +5 V Signals)

Characteristics	Symbol	Specifications		Conditions
		Min	Max	
Output HIGH voltage	V_{OH}	*2.4 V	5.5 V	*I_{OH}=0.32 mA
Output LOW voltage	V_{OL}	-0.5 V	*0.4 V	*I_{OL}=-12 mA
Output HIGH current	I_{OH}	0.32 mA	-	V_{OH}=2.4 V
Output LOW current	I_{OL}	-12 mA	-	V_{OL}=0.4 V
Input HIGH voltage	V_{IH}	2.0 V	-	
Input LOW voltage	V_{IL}	-	0.8 V	
Input HIGH current	I_{IH}	-	-0.32 mA	V_{IH}=2.0 V
Input LOW current	I_{IL}	-	12 mA	V_{IL}=0.8 V

Logic-H Signal Sender Characteristics

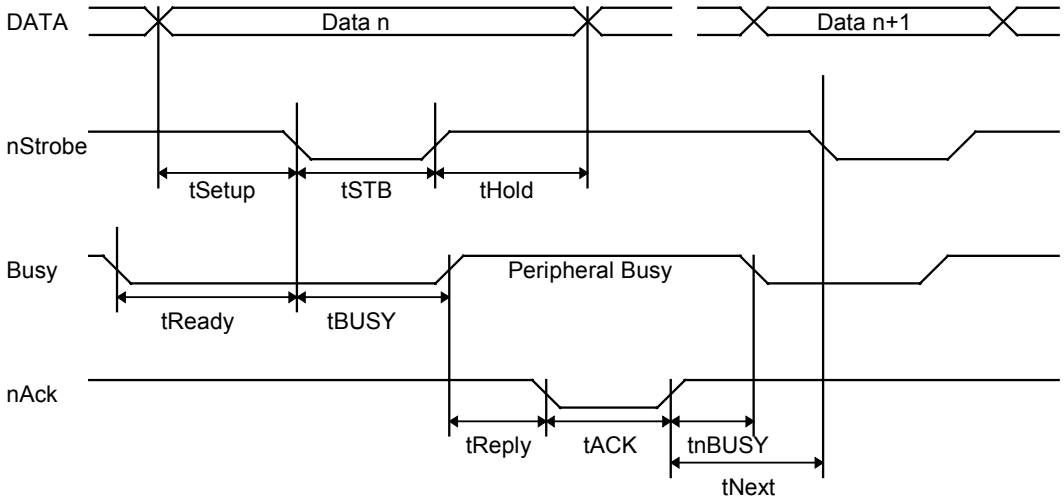
Characteristics	Symbol	Specifications		Conditions
		Min	Max	
Output HIGH voltage	V_{OH}	3.0 V	5.5 V	
Output LOW voltage	V_{OL}	-	2.0 V	While the power is OFF

+5 V Signal Sender Characteristics

Characteristics	Symbol	Specifications		Conditions
		Min	Max	
Output HIGH voltage	V_{OH}	*2.4 V	5.5 V	*I_{OH}=0.32 mA
Output LOW voltage	V_{OL}	-	- **	While the power is OFF
Output HIGH current	I_{OH}	-	0.32 mA	V_{OH}=2.4 V
Output LOW current	I_{OL}	- **	-	While the power is OFF

** No guarantee is offered to V_{OL} and I_{OL} while the power is OFF.

2.1.2.5 Data Receiving Timing (Compatibility Mode)



Characteristics	Symbol	Specifications	
		Min [ns]	Max [ns]
Data Hold Time	tHold	750	--
Data Setup Time	tSetup	750	--
STROBE Pulse Width	tSTB	750	--
READY Cycle Idle Time	tReady	--	--
BUSY Output Delay Time	tBUSY	0	500
Data Processing Time	tReply	0	∞
ACKNLG Pulse Width	tACK	500	10 µs
BUSY Release Time	tnBUSY	0	∞
ACK Cycle Idle Time	tNEXT	0	--

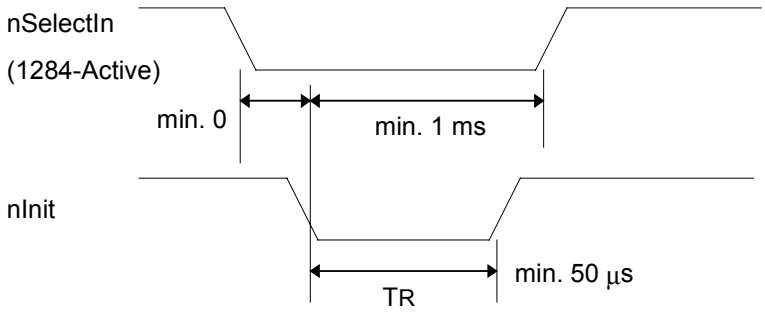
*The printer latches data at the nStrobe ↓ timing

2.1.2.6 Notes on resetting the printer through the interface

To enable the printer reset in compatibility mode, the following signal timing shall be satisfied. However, the printer reset is ignored when the signal nSelectIn (#36 pin, 1284-Actie high) is active in reverse mode.

DC characteristics: TTL level

AC characteristics: Minimum reset pulse width TR: 50 μs (min)



NOTE: The letter “n” before a signal name indicates an active LOW signal.

2.1.2.7 Reception of status from the printer through the bidirectional parallel interface

In the bidirectional parallel interface specifications, printer status transmission is available by using the both-way communication facility in the Nibble/Byte Modes in accordance with IEEE 1284 specifications.

In this case, as opposed to the RS-232 serial interface specifications, the real-time interruptions from the printer to the host are disabled and thus precautions must be taken for the following:

1) The allowable capacity of the printer internal buffer is 99 bytes (except for ASB status). The status signals exceeding this capacity will be discarded. To prevent possible loss of status, the host shall be ready for data acceptance (Reverse Mode).
2) When ASB is used, the host is preferably in the wait state for data acceptance (Reverse Idle Mode). When this state is not available, the host shall enter the Reverse Mode to constantly monitor the presence of data.
3) When ASB is used, preference shall be given to the ASB status for transmission over the other status signals. Any accumulated ASB status signals left for transmission from the last to the newest ASB status transmission shall be transmitted together at a time as one ASB status showing the presence of change, followed by the latest ASB status.

Example: In the normal (wait) state, the ASB status is configured as follows:

First Status	Second Status	Third Status	Fourth Status
0001 0000	0000 0000	0110 0000	0000 1111

When the following sequence of operations proceed - the near end is detected the printer cover is opened, and then the printer cover is closed - the following pieces of data are accumulated.

	First Status	Second Status	Third Status	Fourth Status	
①	0001 0000	0000 0000	0110 0011	0000 1111	Near end detection
②	0011 1000	0000 0000	0110 0011	0000 1111	The printer cover is opened.
③	0001 0000	0000 0000	0110 0011	0000 1111	The printer cover is closed.

When the ASB status is received following this, a total of eight (8) bytes of ASB will be transmitted as follows.

Accumulated ASB (①+②+③)

	First Status	Second Status	Third Status	Fourth Status
Accumulated ASB(①+②+③)	0011 1000	0000 0000	0110 0011	0000 1111
+	First Status	Second Status	Third Status	Fourth Status
The latest ASB (③)	0001 0000	0000 0000	0110 0011	0000 1111
Fourth Status				

2.1.2.8 Notes on setting DIP switch 2-1 to ON

1) The printer mechanism stops but does not become busy when: an error has occurred, the cover is open, printing stops due to a paper-end, or paper is fed using the paper FEED button.
2) When setting DIP switch 2-1 to ON to enable handshaking with the printer, be sure to check the printer status using the **GS a** command and the ASB function. In this setting, the default value of *n* for **GS a** is 2. The printer automatically transmits the printer status, depending on online/offline changes.
3) When using **DLE EOT**, **DLE ENQ**, or **DLE DC4** be sure that the receive buffer does not become full.
   - When using a host that cannot transmit data when the printer is busy:
     If an error has occurred, **DLE EOT**, **DLE ENQ,** or **DLE DC4** cannot be used when the printer is busy due to a receive buffer-full state.
   - When using a host that can transmit data when the printer is busy:
     When the receive buffer becomes full while transmitting bit-image data, **DLE EOT**, **DLE ENQ,** or **DLE DC4** used while sending the bit-image, this data is processed as bit-image data. The data transmitted when the receive buffer is full may be lost.

     Example: Check the printer status using **GS I** or **GS r** after transmitting each line of data and use the 4 KB receive buffer. Transmit one line of data so that the receive buffer does not become full.

2.2 Connectors

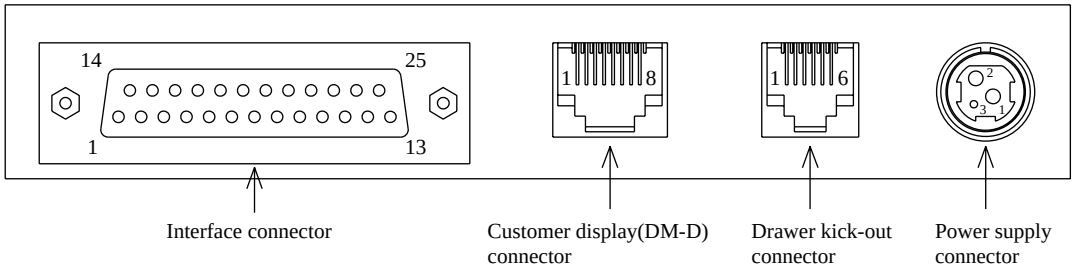


Figure 2.2.1 Serial Interface Connector Panel External Appearance

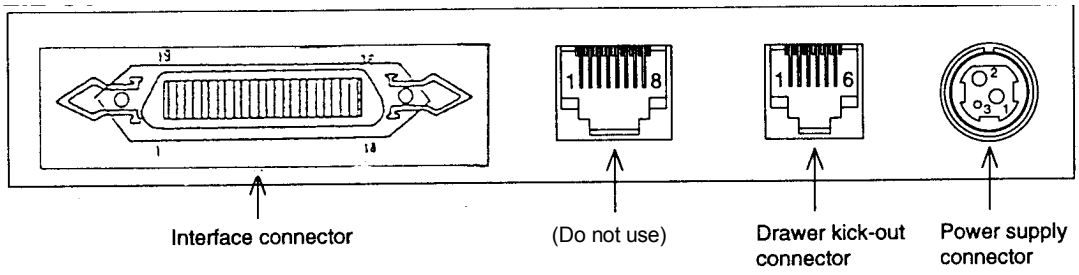


Figure 2.2.2 Parallel Interface Connector Panel External Appearance

2.2.1 Interface Connectors

Refer to Section 2.1, Interface.

2.2.2 Power Supply Connector

This connector is used to connect the printer to an external power source.

1) Pin assignments: Refer to Table 2.2.1.
2) Model: Printer side: Hoshiden TCS7960-532010 or equivalent

Table 2.2.1 Power Supply Connector Pin Assignments

Pin Number	Signal Name
1	+24 V
2	GND
3	NC
Shell	Frame GND

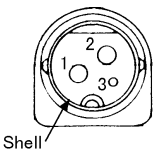


Figure 2.2.3 Power Supply Connector

2.2.3 Drawer Kick-out Connector (Modular Connector)

The pulse specified by **ESC p** or **DLE DC4** is output to this connector. The host can confirm the status of the input signal by using the **DLE EOT**, **GS r**, or **GS a** (ASB) commands.

1) Pin assignments: Refer to Table 2.2.2

2) Connector model: Printer side: MOLEX 52065-6615 or equivalent
User side: 6-position 6-contact (RJ-12 telephone jack)

Table 2.2.2 Drawer Kick-out Connector Pin Assignments

Pin Number	Signal Name	Direction
1	Frame GND	—
2	Drawer kick-out drive signal 1	Output
3	Drawer open/close signal	Input
4	+24 V	—
5	Drawer kick-out drive signal 2	Output
6	Signal GND	—

+24 V is output through pin 4 when the power is turned on. However, pin 4 must be used only for the drawer.

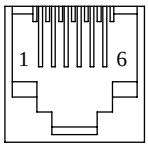


Figure 2.2.4 Drawer Kick-out Connector

3) Drawer kick-out drive signal

Output signal: Output voltage: Approximately 24 V
Output current: 1 A or less

CAUTION: To avoid an overcurrent, the resistance of the drawer kick-out solenoid must be 24 Ω or more.

Output waveform: Outputs the waveforms in Figure 2.2.5 to the points A and B in Figure 2.2.6.

t1 (ON time) and *t2* (OFF time) are specified by **ESC p** or **DLE DC4**.

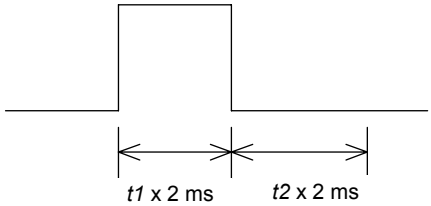


Figure 2.2.5 Drawer Kick-out Drive Signal Output Waveform

4) Drawer open/close signal

Input signal level (connector pin 3): "L" = 0 to 0.8 V
"H" = 2 to 5 V

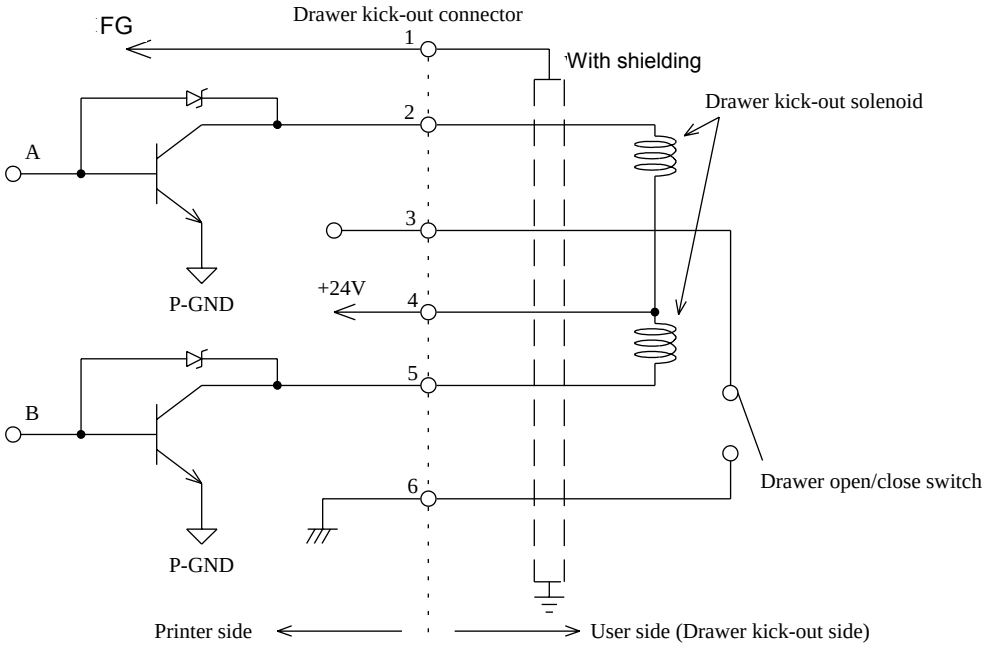


Figure 2.2.6 Drawer Circuitry

NOTES:
1. Two driver transistors cannot be energized simultaneously.
2. The driver must not be energized continuously.
3. Be sure to use the printer power supply (connector pin 4) for the drawer power source.
4. The resistance of the drawer kick-out solenoid must not be less than the specified resistance. Otherwise, an overcurrent could damage the solenoid.
5. The drawer kick-out power (+24 V) is supplied only when the drawer is driven.

2.2.4 Customer Display Connector (Available only for serial interface model)

1) Model:

Receptacle: MOLEX 52065-8845 or equivalent

2) Pin assignments:

Table 2.2.3 Customer Display Connector Pin Assignments

Pin Number	Signal Name	Direction
1	FG	—
2	NC	—
3	TXD	Output
4	DTR	Output
5	DSR	Input
6	SG	—
7	+24 V	—
8	PG	—

NC = Not Connected

+24 V is always output through pin 7. The driving capability is 350 mA or less. Be sure not to use customer displays other than Seiko Epson DM-D series.

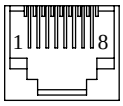


Figure 2.2.7 DM-D Connector

3. FUNCTIONS

3.1 Commands List

Command	Name
HT	Horizontal tab
LF	Print and line feed
FF	Print and eject cut sheet (in standard mode)
	Print and return to standard mode (in page mode)
CR	Print and carriage return
CAN	Cancel print data in page mode
DLE EOT	Real-time status transmission
DLE EOT NUL	Real-time status transmission
DLE ENQ	Real-time request to printer
DLE DC4	*fn* = 1: Generate pulse in real-time
	fn = 2: Execute power-off sequence
	fn = 8: Clear buffer(s)
ESC FF	Print data in page mode
ESC SP	Set right-side character spacing
ESC !	Select print mode(s)
ESC $	Set absolute print position
ESC %	Select/cancel user-defined character set
ESC &	Define user-defined characters
ESC ∗	Select bit-image mode
ESC –	Turn underline mode on/off
ESC 2	Select default line spacing
ESC 3	Set line spacing
ESC <	Return home
ESC =	Select peripheral device
ESC ?	Cancel user-defined characters
ESC @	Initialize printer
ESC D	Set horizontal tab positions
ESC E	Turn emphasized mode on/off
ESC F	Set/cancel cut sheet reverse eject
ESC G	Turn double-strike mode on/off
ESC J	Print and feed paper
ESC K	Print and reverse feed
ESC L	Select page mode
ESC M	Select character font
ESC R	Select an international character set
ESC S	Select standard mode
ESC T	Select print direction in page mode
ESC U	Turn unidirectional printing mode on/off

Command	Name
ESC V	Turn 90° clockwise rotation mode on/off
ESC W	Set printing area in page mode
**ESC **	Set relative print position
ESC a	Select justification
ESC c 0	Select paper type(s) for printing
ESC c 1	Select paper type(s) for command settings
ESC c 3	Select paper sensor(s) to output paper-end signals
ESC c 4	Select paper sensor(s) to stop printing
ESC c 5	Enable/disable panel buttons
ESC d	Print and feed *n* lines
ESC e	Print and reverse feed *n* lines
ESC f	Set cut sheet wait time
ESC p	General pulse
ESC q	Paper release
ESC t	Select character code table
ESC {	Turn upside-down printing mode on/off
FS (e	Enable/disable Automatic Status Back (ASB) for optional functions
FS L	Select double-density page mode
FS p	Print NV bit image
FS q	Define NV bit image
GS !	Select character size
GS $	Set absolute vertical print position in page mode
GS (A	Execute test print
GS (B	Customize ASB-status bits
GS (C	Edit user NV memory
GS (D	Enable/disable real-time command
GS (E	User setup commands
GS (G	Select cut sheet control functions
GS 8 L **GS (L**	Set graphics data
GS (M	Customize printer control value(s)
GS (N	Select character style(s)
GS (k	Setup and print symbol
GS *	Define downloaded bit image
GS /	Print downloaded bit image
GS :	Start/end macro definition
GS B	Turn white/black reverse printing mode on/off
GS E	Select head control method
GS H	Select printing position of HRI characters

Command	Name
GS I	Transmit printer ID
GS L	Set left margin
GS P	Set horizontal and vertical motion units
GS T	Set print position to the beginning of print line
GS V	Select cut mode and cut paper
GS W	Set printing area width
**GS **	Set relative vertical print position in page mode
GS ^	Execute macro
GS a	Enable/disable Automatic Status Back (ASB)
GS b	Turn smoothing mode on/off
GS f	Select font for HRI characters
GS g 0	Initialize maintenance counter
GS g 2	Transmit maintenance counter
GS h	Set barcode height
GS k	Print barcode
GS r	Transmit status
GS v 0	Print raster bit image
GS w	Set barcode width

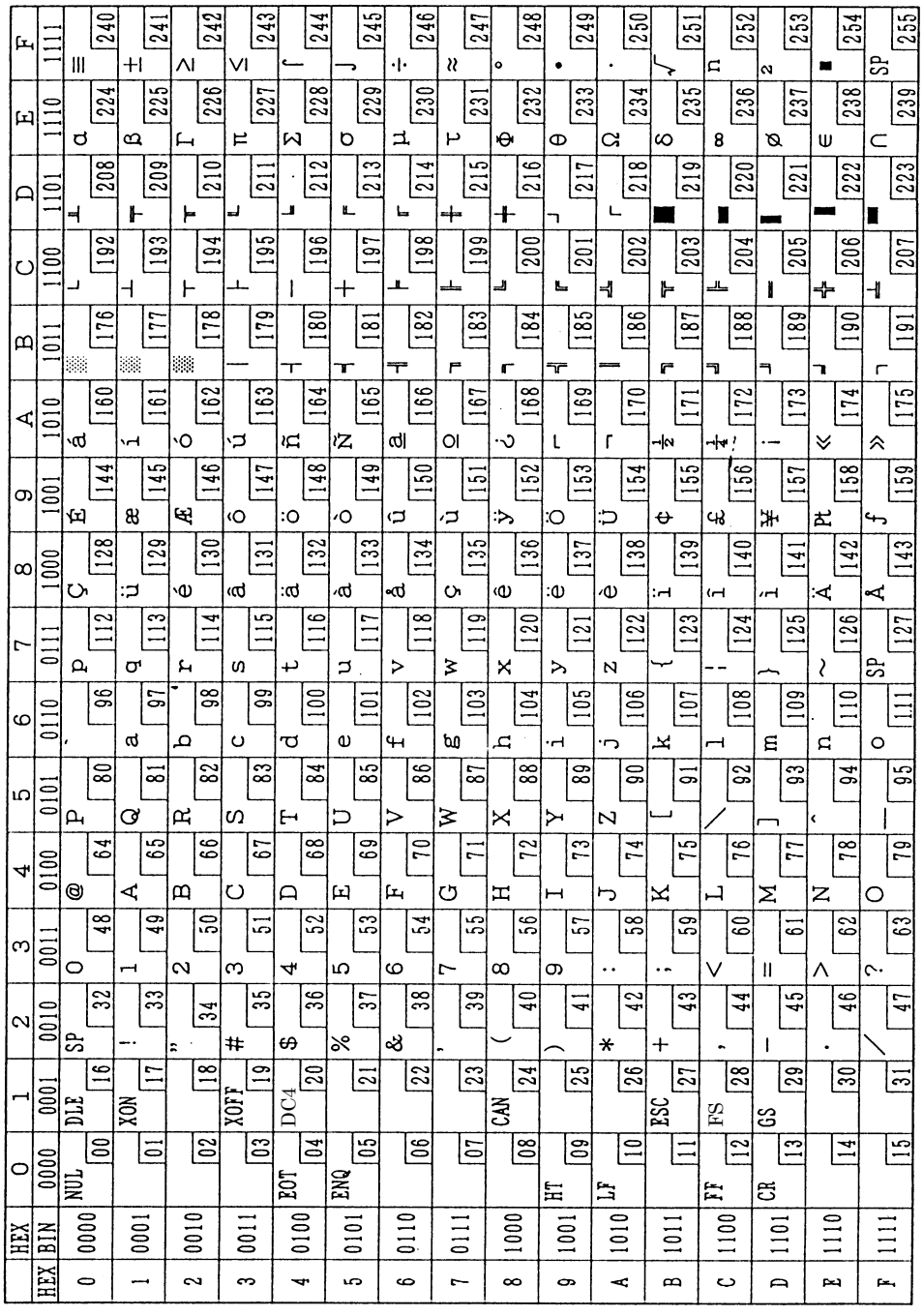
MICR commands list (when the printer is used with the MICR reader)

Command	Name
DLE EOT BS	Real-time MICR status transmission
FS (f	Select MICR data handling
FS a 0	Read check paper
FS a 1	Load check paper to print starting position
FS a 2	Eject check paper
FS b	Request retransmission of check paper reading result
FS c	MICR mechanism cleaning

NOTE: NV = non-volatile

3.2 Character Code Tables

3.2.1 Page 0 (PC437: USA, Standard Europe) (International Character Set: U.S.A.)



HEX	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
HEX BIN	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0 0000	NUL 00	DLE 16	SP 32	0 48	@ 64	P 80	` 96	p 112	Ç 128	É 144	á 160	▒ 176	└ 192	┴ 208	α 224	≡ 240
1 0001	01	XON 17	! 33	1 49	A 65	Q 81	a 97	q 113	ü 129	æ 145	í 161	▒ 177	┴ 193	┬ 209	ß 225	± 241
2 0010	02	18	" 34	2 50	B 66	R 82	b 98	r 114	é 130	Æ 146	ó 162	▒ 178	┬ 194	┬ 210	Γ 226	≥ 242
3 0011	03	XOFF 19	# 35	3 51	C 67	S 83	c 99	s 115	â 131	ô 147	ú 163	│ 179	├ 195	└ 211	π 227	≤ 243
4 0100	EOT 04	DC4 20	$ 36	4 52	D 68	T 84	d 100	t 116	ä 132	ö 148	ñ 164	┤ 180	─ 196	┘ 212	Σ 228	⌠ 244
5 0101	ENQ 05	21	% 37	5 53	E 69	U 85	e 101	u 117	à 133	ò 149	Ñ 165	╡ 181	┼ 197	┌ 213	σ 229	⌡ 245
6 0110	06	22	& 38	6 54	F 70	V 86	f 102	v 118	å 134	û 150	ª 166	╢ 182	├ 198	┌ 214	µ 230	÷ 246
7 0111	07	23	' 39	7 55	G 71	W 87	g 103	w 119	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8 1000	08	CAN 24	(40	8 56	H 72	X 88	h 104	x 120	ê 136	ÿ 152	¿ 168	╕ 184	└ 200	╪ 216	Φ 232	° 248
9 1001	HT 09	25	) 41	9 57	I 73	Y 89	i 105	y 121	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249
A 1010	LF 10	26	* 42	: 58	J 74	Z 90	j 106	z 122	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B 1011	11	ESC 27	+ 43	; 59	K 75	[91	k 107	{ 123	ï 139	¢ 155	½ 171	╗ 187	╦ 203	▒ 219	δ 235	√ 251
C 1100	FF 12	FS 28	, 44	< 60	L 76	\ 92	l 108	¦ 124	î 140	£ 156	¼ 172	╝ 188	╠ 204	▒ 220	∞ 236	n 252
D 1101	CR 13	GS 29	- 45	= 61	M 77	] 93	m 109	} 125	ì 141	¥ 157	¡ 173	╜ 189	═ 205	▒ 221	ø 237	2 253
E 1110	14	30	. 46	> 62	N 78	^ 94	n 110	~ 126	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▒ 222	∈ 238	■ 254
F 1111	15	31	/ 47	? 63	O 79	_ 95	o 111	SP 127	Å 143	ƒ 159	» 175	┐ 191	╧ 207	▒ 223	∩ 239	SP 255

NOTE: The character code tables show only character configurations. They do not show the actual print pattern.

3.2.2 Page 1 (Katakana)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	ー 128	ㅗ 144	SP 160	ー 176	タ 192	ミ 208	三 224	× 240
1	0001	▬ 129	ㅜ 145	。 161	ア 177	チ 193	ム 209	ㅏ 225	円 241
2	0010	▬ 130	ㅓ 146	「 162	イ 178	ツ 194	メ 210	ㅓ 226	年 242
3	0011	▬ 131	ㅏ 147	」 163	ウ 179	テ 195	モ 211	ㅕ 227	月 243
4	0100	■ 132	ㅡ 148	、 164	エ 180	ト 196	ヤ 212	◢ 228	日 244
5	0101	■ 133	ㅡ 149	・ 165	オ 181	ナ 197	ユ 213	◣ 229	時 245
6	0110	■ 134	ㅣ 150	ヲ 166	カ 182	ニ 198	ヨ 214	◥ 230	分 246
7	0111	■ 135	ㅣ 151	ァ 167	キ 183	ヌ 199	ラ 215	◤ 231	秒 247
8	1000	▏ 136	ㄱ 152	ィ 168	ク 184	ネ 200	リ 216	♠ 232	〒 248
9	1001	▏ 137	ㄱ 153	ゥ 169	ケ 185	ノ 201	ル 217	♥ 233	市 249
A	1010	▏ 138	ㄴ 154	ェ 170	コ 186	ハ 202	レ 218	✦ 234	区 250
B	1011	▏ 139	ㄴ 155	ォ 171	サ 187	ヒ 203	ロ 219	♣ 235	町 251
C	1100	▏ 140	ㄱ 156	ャ 172	シ 188	フ 204	ワ 220	● 236	村 252
D	1101	▏ 141	ㄱ 157	ュ 173	ス 189	ヘ 205	ン 221	○ 237	人 253
E	1110	▏ 142	ㄱ 158	ョ 174	セ 190	ホ 206	゛ 222	／ 238	▒ 254
F	1111	┼ 143	ノ 159	ッ 175	ソ 191	マ 207	゜ 223	＼ 239	SP 255

3.2.3 Page 2 (PC850: Multilingual)

HEX	BIN	8	9	A	B	C	D	E	F
		1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	▒ 176	└ 192	ð 208	Ó 224	— 240
1	0001	ü 129	æ 145	í 161	▒ 177	┴ 193	Ð 209	ß 225	± 241
2	0010	é 130	Æ 146	ó 162	▒ 178	┬ 194	Ê 210	Ô 226	‗ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ò 227	¾ 243
4	0100	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	à 133	ò 149	Ñ 165	Á 181	┼ 197	ı 213	Õ 229	§ 245
6	0110	å 134	û 150	ª 166	Â 182	ã 198	Í 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	À 183	Ã 199	Î 215	þ 231	¸ 247
8	1000	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Ï 216	Þ 232	° 248
9	1001	ë 137	Ö 153	® 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250
B	1011	ï 139	ø 155	½ 171	╗ 187	╦ 203	█ 219	Ù 235	¹ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	ý 236	³ 252
D	1101	ì 141	Ø 157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	Ä 142	× 158	« 174	¥ 190	╬ 206	Ì 222	¯ 238	■ 254
F	1111	Å 143	ƒ 159	» 175	┐ 191	¤ 207	▀ 223	´ 239	SP 255

3.2.4 Page 3 (PC860: Portuguese)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	▒ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	ü 129	À 145	í 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	é 130	È 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	ã 132	õ 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	Á 134	Ú 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	ê 136	Ì 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	Ê 137	Õ 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	Í 139	¢ 155	½ 171	╗ 187	╦ 203	■ 219	δ 235	√ 251
C	1100	Ô 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D	1101	ì 141	Ù 157	¡ 173	╜ 189	═ 205	▌ 221	ø 237	² 253
E	1110	Ã 142	Pt 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	1111	Â 143	Ó 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

3.2.5 Page 4 (PC863: Canadian-French)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	¦ 160	▒ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	ü 129	È 145	´ 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	é 130	Ê 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	Â 132	Ë 148	¨ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	à 133	Ï 149	¸ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	¶ 134	û 150	³ 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	ç 135	ù 151	— 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	0100	ê 136	¤ 152	Î 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	ë 137	Ô 153	⌐ 169	╣ 185	╔ 201	┘ 217	θ 233	• 249
A	1010	è 138	Ù 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	ï 139	¢ 155	½ 171	╗ 187	╦ 203	■ 219	δ 235	√ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D	1101	‗ 141	Ù 157	¾ 173	╜ 189	═ 205	▌ 221	ø 237	² 253
E	1110	À 142	Û 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	1111	§ 143	ƒ 159	» 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

3.2.6 Page 5 (PC865: Nordic)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	▒ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	ü 129	æ 145	í 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	é 130	Æ 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	ä 132	ö 148	ñ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	à 133	ò 149	Ñ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	å 134	û 150	ª 166	╢ 182	╞ 198	╓ 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	╖ 183	╟ 199	╫ 215	τ 231	≈ 247
8	1000	ê 136	ÿ 152	¿ 168	╕ 184	╚ 200	╪ 216	Φ 232	° 248
9	1001	ë 137	Ö 153	⌐ 169	╣ 185	╔ 201	┘ 217	Θ 233	• 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Ω 234	· 250
B	1011	ï 139	ø 155	½ 171	╗ 187	╦ 203	■ 219	δ 235	√ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	∞ 236	n 252
D	1101	ì 141	Ø 157	¡ 173	╜ 189	═ 205	▌ 221	ø 237	² 253
E	1110	Ä 142	₧ 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	1111	Å 143	ƒ 159	¤ 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

3.2.7 Page 16 (WPC1252)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	€ 128	SP 144	SP 160	° 176	À 192	Đ 208	à 224	ð 240
1	0001	SP 129	‘ 145	¡ 161	± 177	Á 193	Ñ 209	á 225	ñ 241
2	0010	’ 130	’ 146	¢ 162	² 178	Â 194	Ò 210	â 226	ò 242
3	0011	ƒ 131	“ 147	£ 163	³ 179	Ã 195	Ó 211	ã 227	ó 243
4	0100	” 132	” 148	¤ 164	´ 180	Ä 196	Ô 212	ä 228	ô 244
5	0101	… 133	• 149	¥ 165	µ 181	Å 197	Õ 213	å 229	õ 245
6	0110	† 134	– 150	¦ 166	¶ 182	Æ 198	Ö 214	æ 230	ö 246
7	0111	‡ 135	— 151	§ 167	· 183	Ç 199	× 215	ç 231	÷ 247
8	1000	ˆ 136	˜ 152	¨ 168	¸ 184	È 200	Ø 216	è 232	ø 248
9	1001	‰ 137	™ 153	© 169	¹ 185	É 201	Ù 217	é 233	ù 249
A	1010	Š 138	š 154	ª 170	º 186	Ê 202	Ú 218	ê 234	ú 250
B	1011	‹ 139	› 155	« 171	» 187	Ë 203	Û 219	ë 235	û 251
C	1100	Œ 140	œ 156	¬ 172	¼ 188	Ì 204	Ü 220	ì 236	ü 252
D	1101	SP 141	SP 157	- 173	½ 189	Í 205	Ý 221	í 237	ý 253
E	1110	Ž 142	ž 158	® 174	¾ 190	Î 206	Þ 222	î 238	þ 254
F	1111	SP 143	Ÿ 159	¯ 175	¿ 191	Ï 207	ß 223	ï 239	ÿ 255

3.2.8 Page 17 (PC866: Cyrillic #2)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	А 128	Р 144	а 160	176	192	208	р 224	Ё 240
1	0001	Б 129	С 145	б 161	177	193	209	с 225	ё 241
2	0010	В 130	Т 146	в 162	178	194	210	т 226	Є 242
3	0011	Г 131	У 147	г 163	179	195	211	у 227	є 243
4	0100	Д 132	Ф 148	д 164	180	196	212	ф 228	Ї 244
5	0101	Е 133	Х 149	е 165	181	197	213	х 229	ї 245
6	0110	Ж 134	Ц 150	ж 166	182	198	214	ц 230	Ў 246
7	0111	З 135	Ч 151	з 167	183	199	215	ч 231	ў 247
8	1000	И 136	Ш 152	и 168	184	200	216	ш 232	° 248
9	1001	Й 137	Щ 153	й 169	185	201	217	щ 233	∙ 249
A	1010	К 138	Ъ 154	к 170	186	202	218	ъ 234	· 250
B	1011	Л 139	Ы 155	л 171	187	203	219	ы 235	√ 251
C	1100	М 140	Ь 156	м 172	188	204	220	ь 236	№ 252
D	1101	Н 141	Э 157	н 173	189	205	221	э 237	¤ 253
E	1110	О 142	Ю 158	о 174	190	206	222	ю 238	■ 254
F	1111	П 143	Я 159	п 175	191	207	223	я 239	SP 255

3.2.9 Page 18 (PC852: Latin2)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	176	192	đ 208	Ó 224	240
1	0001	ü 129	Ĺ 145	í 161	177	193	Đ 209	ß 225	˝ 241
2	0010	é 130	Í 146	ó 162	178	194	Ď 210	Ô 226	˛ 242
3	0011	â 131	ô 147	ú 163	179	195	Ë 211	Ń 227	ˇ 243
4	0100	ä 132	ö 148	Ą 164	180	196	ď 212	ń 228	˘ 244
5	0101	ů 133	Ľ 149	ą 165	Á 181	197	Ň 213	ň 229	§ 245
6	0110	ć 134	ľ 150	Ž 166	Â 182	Ă 198	Í 214	Š 230	÷ 246
7	0111	ç 135	Ś 151	ž 167	Ě 183	ă 199	Î 215	š 231	¸ 247
8	1000	ł 136	ś 152	Ę 168	Ş 184	200	ě 216	Ř 232	° 248
9	1001	ë 137	Ö 153	ę 169	185	201	217	Ú 233	¨ 249
A	1010	Ő 138	Ü 154	170	186	202	218	ŕ 234	˙ 250
B	1011	ő 139	Ť 155	ź 171	187	203	219	Ũ 235	ű 251
C	1100	î 140	ť 156	Č 172	188	204	220	ý 236	Ř 252
D	1101	Ź 141	Ł 157	ş 173	Ż 189	205	Ţ 221	Ý 237	ř 253
E	1110	Ä 142	× 158	« 174	ż 190	206	Ů 222	ţ 238	254
F	1111	Ć 143	č 159	» 175	191	¤ 207	223	´ 239	SP 255

3.2.10 Page 19 (PC858: Euro)

HEX	BIN	8	9	A	B	C	D	E	F
		1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	▒ 176	└ 192	ð 208	Ó 224	— 240
1	0001	ü 129	æ 145	í 161	▒ 177	┴ 193	Ð 209	ß 225	± 241
2	0010	é 130	Æ 146	ó 162	▒ 178	┬ 194	Ê 210	Ô 226	‗ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	Ë 211	Ò 227	¾ 243
4	0100	ä 132	ö 148	ñ 164	┤ 180	─ 196	È 212	õ 228	¶ 244
5	0101	à 133	ò 149	Ñ 165	Á 181	┼ 197	€ 213	Õ 229	§ 245
6	0110	å 134	û 150	ª 166	Â 182	ã 198	Í 214	µ 230	÷ 246
7	0111	ç 135	ù 151	º 167	À 183	Ã 199	Î 215	þ 231	¸ 247
8	1000	ê 136	ÿ 152	¿ 168	© 184	╚ 200	Ï 216	Þ 232	° 248
9	1001	ë 137	Ö 153	® 169	╣ 185	╔ 201	┘ 217	Ú 233	¨ 249
A	1010	è 138	Ü 154	¬ 170	║ 186	╩ 202	┌ 218	Û 234	· 250
B	1011	ï 139	ø 155	½ 171	╗ 187	╦ 203	■ 219	Ù 235	¹ 251
C	1100	î 140	£ 156	¼ 172	╝ 188	╠ 204	▄ 220	ý 236	³ 252
D	1101	ì 141	Ø 157	¡ 173	¢ 189	═ 205	¦ 221	Ý 237	² 253
E	1110	Ä 142	× 158	« 174	¥ 190	╬ 206	Ì 222	¯ 238	■ 254
F	1111	Å 143	ƒ 159	» 175	┐ 191	¤ 207	▀ 223	´ 239	SP 255

3.2.11 Page 254 (Space Page)

Page 254 is supported only when printing on the face of a slip. When font A is selected, character codes 80H to FFH are all spaces. When font B is selected, the following font is defined as the default.

Character structure: 7 × 7

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	SP 128	ð 144	SP 160	0 176	@ 192	P 208	. 224	p 240
1	0001	δ 129	µ 145	! 161	1 177	A 193	Q 209	a 225	q 241
2	0010	Ð 130	þ 146	" 162	2 178	B 194	R 210	b 226	r 242
3	0011	Ê 131	Þ 147	# 163	3 179	C 195	S 211	c 227	s 243
4	0100	Ë 132	Ú 148	$ 164	4 180	D 196	T 212	d 228	t 244
5	0101	È 133	Û 149	% 165	5 181	E 197	U 213	e 229	u 245
6	0110	Í 134	Ù 150	& 166	6 182	F 198	V 214	f 230	v 246
7	0111	Î 135	ý 151	' 167	7 183	G 199	W 215	g 231	w 247
8	1000	Ï 136	Ý 152	(168	8 184	H 200	X 216	h 232	x 248
9	1001	Ì 137	± 153	) 169	9 185	I 201	Y 217	i 233	y 249
A	1010	Ó 138	÷ 154	* 170	: 186	J 202	Z 218	j 234	z 250
B	1011	ß 139	· 155	+ 171	; 187	K 203	[219	k 235	{ 251
C	1100	Ô 140	SP 156	, 172	< 188	L 204	\ 220	l 236	| 252
D	1101	Ò 141	SP 157	− 173	= 189	M 205	] 221	m 237	} 253
E	1110	SP 142	SP 158	. 174	> 190	N 206	^ 222	n 238	~ 254
F	1111	õ 143	SP 159	/ 175	? 191	O 207	_ 223	o 239	. 255

3.2.12 Page 255 (Space Page)

In printing on the face of a slip with page 255, the font is selected as follows, when font A is selected, character codes 80H to FFH are all spaces, when font B is selected, the following font is defined as the default. In printing on the paper roll or the back side of a slip, character codes 80H to FFH are all spaces.

Character structure: 7 × 7

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	á 160	. 176	. 192	H 208	SP 224	SP 240
1	0001	ü 129	æ 145	í 161	. 177	. 193	I 209	SP 225	SP 241
2	0010	é 130	Æ 146	ó 162	. 178	. 194	SP 210	SP 226	SP 242
3	0011	â 131	ô 147	ú 163	. 179	. 195	SP 211	SP 227	SP 243
4	0100	ä 132	ö 148	ñ 164	. 180	. 196	SP 212	SP 228	SP 244
5	0101	à 133	ò 149	Ñ 165	Á 181	. 197	SP 213	SP 229	SP 245
6	0110	å 134	û 150	Ğ 166	Â 182	â 198	. 214	SP 230	SP 246
7	0111	ç 135	ù 151	ğ 167	À 183	Ä 199	. 215	SP 231	SP 247
8	1000	ê 136	ÿ 152	¿ 168	ı 184	╚ 200	SP 216	SP 232	SP 248
9	1001	ë 137	Ö 153	. 169	╣ 185	╔ 201	SP 217	SP 233	SP 249
A	1010	è 138	Ü 154	. 170	║ 186	╩ 202	SP 218	SP 234	SP 250
B	1011	ï 139	ø 155	. 171	╗ 187	╦ 203	SP 219	SP 235	SP 251
C	1100	î 140	£ 156	. 172	╝ 188	╠ 204	SP 220	SP 236	SP 252
D	1101	ì 141	Ø 157	¡ 173	¢ 189	═ 205	SP 221	SP 237	SP 253
E	1110	Ä 142	Ş 158	. 174	. 190	╬ 206	SP 222	SP 238	SP 254
F	1111	Å 143	s 159	¤ 175	. 191	. 207	SP 223	SP 239	SP 255

3.2.13 International Character Sets

Country	ASCII code (Hex)											
	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
U.S.A.	#	$	@	[	\	]	^	`	{	|	}	~
France	#	$	à	°	ç	§	^	`	é	ù	è	¨
Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
U.K.	£	$	@	[	\	]	^	`	{	|	}	~
Denmark I	#	$	@	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 I	Pt	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
Japan	#	$	@	[	¥	]	^	`	{	|	}	~
Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
Spain II	#	$	á	¡	Ñ	¿	é	`	í	ñ	ó	ú
Latin America	#	$	á	¡	Ñ	¿	é	ü	í	ñ	ó	ú
Korea	#	$	@	[	~~₩~~	]	^	`	{	|	}	~

3.3 Switches and Buttons

3.3.1 Power Button

The power button (a rocker switch) located on the lower right front of the printer turns the power on or off.

Using the power button cover, which is packed with the printer, you can prevent accidental turning off of the power button.

NOTE: Turn on the power only after connecting the power supply.

3.3.2 Panel Buttons

The panel buttons are located above of the slip paper entrance. The **ESC c 5** command enables or disables the panel buttons. When disabled, none of the buttons function. Refer to NOTES below for more details.

1) RELEASE button

[Type] Non-locking push button

[Function] Releases the paper clamp.

NOTES:
- When the front cover, the receipt unit cover, or the receipt unit is open, this button is enabled regardless of the **ESC c 5** setting.
- When changing the ribbon cassette is required during printing, open the printer cover and press this button to release the paper clamp.
- If the paper clamp is released by this button while printing on a cut sheet, the print position may shift, and the status information transmitted by the **GS r 3** command may be incorrect.

2) FEED button

[Type] Non-locking push button

[Function] Feeds paper based upon the line feed amount set by the **ESC 2** and **ESC 3** commands.

NOTES:
- When the paper roll is selected as a paper source, and the front cover, the receipt unit cover, or the receipt unit is open, this switch is disabled regardless of the **ESC c 5** setting.
- When the paper roll is selected as a paper source, and the front cover is open, or when the cut sheet is selected as a paper source, and the receipt cover is open, this switch operates based on the **ESC c 5** setting.
- When the cut sheet is selected as a paper source, and the front cover is open, or the receipt unit is open, this switch is enabled regardless of the **ESC c 5** setting.

3.3.3 DIP Switches

3.3.3.1 Serial interface specifications

1) DIP switch 1: 8 switches

Table 3.3.1 DIP Switch 1

SW 1	Function	ON	OFF
1	Data reception error	Ignored	Prints '?'
2	Receive buffer capacity	45 bytes	4 KB
3	Handshaking	XON/XOFF	DTR/DSR
4	Word length	7 bits	8 bits
5	Parity check	Yes	No
6	Parity selection	Even	Odd
7	Transmission speed selection	Refer to Table 3.3.2	
8			

Table 3.3.2 Transmission Speed

Transmission Speed (bps)	SW 1-7	SW 1-8
4800	ON	ON
9600	OFF	ON
19200	ON	OFF
38400	OFF	OFF

bps: bits per second

2) DIP switch 2: 8 switches

Table 3.3.3 DIP Switch 2

SW 2	Function	ON	OFF
1	Handshaking (BUSY condition)	Receive buffer full	Offline or receive buffer full
2	Customer display (DM-D) connection	Connected	Not connected
3	Selects print density	Refer to Table 3.3.4	
4			
5	Internal use	Fixed to Off	
6	Internal use	Fixed to Off	
7	I/F pin 6 reset signal	Enabled	Disabled
8	IF pin 25 reset signal	Enabled	Disabled

Table 3.3.4 DIP Switches 2-3 and 2-4

Level	Function	SW 2-3	SW 2-4
1	Print density (Light)	ON	ON
2	↕	OFF	OFF
3	↕	ON	OFF
4	Print density (Dark)	OFF	ON

NOTES:
- When pin 6 of the interface connector is used for the reset signal, the printer is reset at MARK on the RS-232 level.
- When pin 25 of the interface connector is used for the reset signal, the printer is reset at SPACE on the RS-232 level or at HIGH on the TTL level.
- Changes in DIP switch settings (excluding switches 2-7 and 2-8 interface reset signals) are recognized only when the printer power is turned on or when the printer is reset by using the interface. If the DIP switch setting is changed after the printer power is turned on, the change does not take effect until the printer is turned on again or is reset.
- If you turn on DIP switch 2-7 or 2-8 while the printer power is turned on, the printer may be reset, depending on the signal state. DIP switches should not be changed while the printer power is on.
- If the print density is set to level 3 or 4, printing speed is usually reduced.

3.3.3.2 Parallel interface specifications

Table 3.3.5 DIP Switch 1

SW	Function	ON	OFF
1	Auto line feed	Always enabled	Always disabled
2	Receive buffer capacity	45 bytes	4 KB
3–8	Reserved	Fixed to Off	

Table 3.3.6 DIP Switch 2

SW	Function	ON	OFF
1	Handshaking (BUSY condition)	Receive buffer full	Offline or receive buffer full
2	Internal use (do not change settings)	Fixed to Off	
3	Selects print density	Refer to Table 3.3.7	
4			
5	Internal use	Fixed to Off	
6	Internal use	Fixed to Off	
7	Reserved (for serial interface)	Fixed to Off	
8	I/F pin 31 reset signal (do not change setting)	Fixed to On	

Table 3.3.7 DIP Switch 2-3 and 2-4

Level	Function	SW 2-3	SW 2-4
1	Print density (Light)	ON	ON
2	↕	OFF	OFF
3		ON	OFF
4	Print density (Dark)	OFF	ON

NOTES:
- Changes in DIP switch settings (excluding switch 2-8, interface reset signal) are recognized only when the printer power is turned on or when the printer is reset by using the interface. If the DIP switch setting is changed after the printer power is turned on, the change does not take effect until the printer is turned on again or is reset.
- If the DIP switch 2-8 is turned on while the printer power is turned on, the printer may be reset, depending on the signal state. DIP switches should not be changed while the printer power is on.
- If the print density is set to level 3 or 4, printing speed is usually reduced.

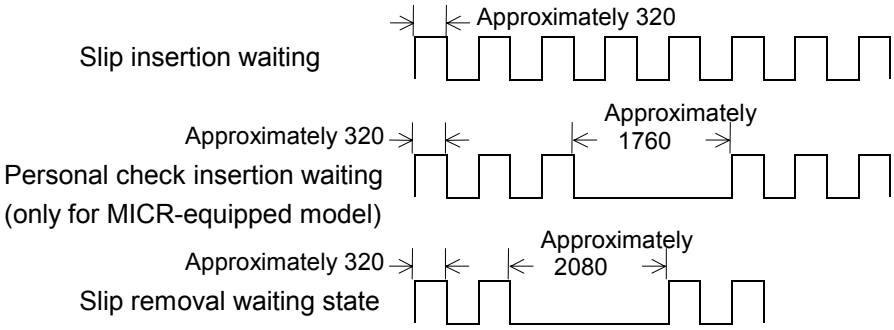
3.4 Panel LED Indicators

3.4.1 Panel LEDs

1) Power supply (POWER) LED: Green
   On: Power is stable.
   Off: Power is not stable.

2) Paper roll end (PAPER OUT) LED: Red
   On: The paper roll near end or paper end of the receipt paper supply is detected.
   Off: Paper is loaded (normal condition).
   Blinking: Self-test standby state (refer to Section 3.5.3) or macro standby state when the macro execution command is used.

3) SLIP LED: Green
   On: During printing on slip paper.
   Off: When slip paper is not selected. (Receipt is selected.)
   Blinking: Slip insertion/removal waiting state (refer to Figure 3.4.1).



[Units: ms]

Figure 3.4.1 Slip LED Blinking Pattern

NOTE: If the slip paper is removed during in the slip removal waiting state, the printer enters the paper roll mode two seconds later. The SLIP LED light is on during this time.

4) Error (ERROR) LED: Red
   On: Offline (except during paper feeding using the FEED button and during test printing).
   Off: Normal condition.
   Blinking: Error (refer to Section 3.7, Error Processing).

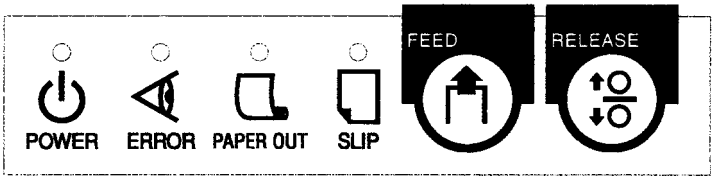


Figure 3.4.2 Panel Switches and Indicators

3.5 Self-test

1) The printer has a self-test function that checks the following:
   - Control circuit functions
   - Printer mechanisms
   - Print quality
   - Control software version
   - DIP switch settings

2) Starting the self-test

   a) Self-test on paper roll

   To start the self-test on a paper roll, hold down the FEED button while turning on the printer with the cover closed.

   b) Self-test on slip paper

   To start the self-test on slip paper, hold down the RELEASE button while turning on the printer with the cover closed. The printer enters the paper waiting state. Insert slip paper to begin printing the printer status.

3) Self-test standby state

   a) Self-test on paper roll

   After printing the current printer status, the printer prints the message "If you want to continue SELF-TEST printing, please press FEED button." The PAPER OUT LED indicator blinks and the printer enters the test printing standby state. Press the FEED button to start test printing.

   b) Self-test on slip paper

   After printing the current printer status, the printer ejects the slip and waits for the next sheet of slip paper to be inserted. If the printer is equipped with an endorsement printer, the test print on the endorsement is performed when the paper is inserted at the second time.

4) Ending the self-test

   After a number of lines are printed, the printer indicates the end of the self-test by printing "*** completed ***," initializes, and goes into the normal mode.

   The printer then enters the normal print mode.

3.6 Hexadecimal Dumping

1) Hexadecimal dumping function

This function prints the data transmitted from the host computer in hexadecimal numbers and their corresponding characters.

2) Starting hexadecimal dumping

Open the cover and turn the power on while pressing the FEED button or executing the **GS (A** command; then close the cover. The printer first prints "Hexadecimal Dump" on the paper roll and prints the received print data in hexadecimal numbers and their corresponding characters.

NOTES: 1. If no characters correspond to the data received, the printer prints "."

2. During hexadecimal dumping, any commands other than **DLE EOT**, **DLE ENQ**, and **DLE DC4** do not function.

3. Insufficient print data to fill the last line can be printed by setting the printer offline.

3) Ending hexadecimal dumping

Hexadecimal dumping ends when the power is turned off or when the cover is closed, the FEED button is pressed three times, or the printer is reset after printing has finished.

<Printing example>

```
Hexadecimal Dump

To terminate hexadecimal dump,
press FEED button three times.




1B 21 00 1B 26 02 40 40 1B 69        . ! . . & . @@ . i
1B 25 01 1B 63 34 00 1B 30 31        . % . . c 4 . . 0 1
41 42 43 44 45 46 47 48 49 4A        A B C D E F G H I J

                        *** completed ***
```

3.7 Error Processing

3.7.1 Error Types

1) Errors that automatically recover

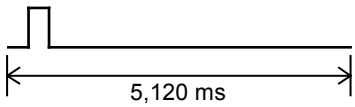
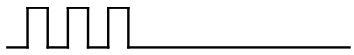
Table 3.7.1 Errors That Automatically Recover

Error	Description	ERROR LED Blinking Pattern Approximately 320 ms	Recovery
Print head temperature error	The temperature of the print head is extremely high.		Recovers automatically when the print head cools.

NOTE: Print head temperature error is not an abnormality.

2) Errors that have the possibility of recovery

Table 3.7.2 Errors That Can Possibly Recover

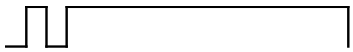
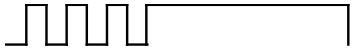
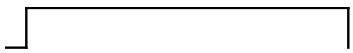
Error	Description	ERROR LED Blinking Pattern Approximately 320 ms	Recovery
Autocutter error	The autocutter does not work correctly.		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.
Home position detection error	The home position cannot be detected due to a paper jam.		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.
Carriage detection error	The carriage is malfunctioning due to a paper jam, etc.		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.
Receipt cover open error	Printing on the paper roll is not performed correctly due to a receipt-cover or an unit cover open.		Recovers by **DLE ENQ 1** or **DLE ENQ 2** with the cover closed.
Slip ejection error	The slip is not ejected when the printer feeds a specified amount of paper.		Recovers by **DLE ENQ 1** or **DLE ENQ 2** with the cover closed.
Receipt unit open error	Printing on the paper roll on the slip is not performed correctly due to a receipt unit open		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.

NOTES: 1. Errors that have the possibility of recovery are recovered by **DLE ENQ 1** or **DLE ENQ 2**.

2. When the printer recovers from an error using **DLE ENQ 1** while slip paper is selected, the printer first ejects the slip, then loads paper. However, when the printer recovers from a slip ejection error, the printer only ejects the slip and does not load paper.
3. When the printer recovers from an error using **DLE ENQ 2** while slip paper is selected, the printer ejects the slip.
4. The receipt unit open error will be occurred if the memory switch that is controlled with the **GS (E** [MSW8-8] is On.

3) Errors that are impossible to recover

Table 3.7.3 Unrecoverable Errors

Error	Description	ERROR LED Blinking Pattern Approximately 320 ms	Recovery
R/W error in memory or gate array	After R/W checking, the printer does not work correctly.		Impossible to recover.
High voltage error	The power supply voltage is extremely high. (*1)		Impossible to recover.
Low voltage error	The power supply voltage is extremely low. (*1)		Impossible to recover.
CPU execution error	The CPU executes an incorrect address or I/F board is not connected.		Impossible to recover.
Control circuit board error	There is an abnormality in the print head temperature, thermistor is detected in-correctly, or thermistor wiring is not connected or the endorsement printer is broken, or the lever driving motor is broken.		Impossible to recover.

(*1) Refer to Appendix A.

NOTE: When any error shown above occurs, turn off the power as soon as possible.

3.7.2 Printer Operation When an Error Occurs

The printer executes the following operations when detecting an error.

- Stops all printer operations for the selected paper section.
- Goes offline.
- Blinks the ERROR LED.

3.7.3 Data Receive Error

If one of the following errors occurs during serial interface communication, the printer prints "?" or ignores the data, depending on the setting of DIP switch 1-1.

- Parity error
- Framing error
- Overrun error

3.8 Paper Sensors

The printer has 5 paper sensors as follows:

Slip:

- TOF (Top of Form) sensor
- BOF (Bottom of Form) sensor
- Slip eject sensor

Receipt:

- Paper roll near-end sensor
- Paper roll end sensor

3.8.1 Sensors and LED Indicators

1) TOF sensor
The slip TOF sensor is located in the slip paper path and detects the presence of slip paper in the paper path. The SLIP LED indicator lights accordingly.

2) BOF sensor
The slip BOF sensor is located in the slip entrance and detects whether the paper is inserted correctly and whether it is removed or not. The printer does not proceed to the next operation until the paper has been removed. (The SLIP LED indicator continues blinking.)

3) Slip eject sensor
The slip eject sensor is located in the slip paper exit and detects whether the paper is set correctly or not. The printer does not proceed to the next operation until the paper has been set correctly.

4) Paper roll near-end sensor
The near-end sensor is located on the roll paper supply device on the receipt side. It detects the near-end of the paper roll by detecting the paper roll diameter.

5) Paper roll end sensor
The paper sensor is located in the paper path on the receipt side. It detects the presence of paper from the paper roll in the paper path of the printer mechanism.
When there is no paper in the paper path (paper end status), the PAPER OUT LED indicator lights.

3.8.2 Sensors and Printing

When the printer detects a paper near-end, it either stops or continues printing, depending on the **ESC c 4** setting. The corresponding sensors are as follows:

- Paper roll near-end sensor
- Slip BOF sensor

The paper roll near-end sensor is enabled only when paper roll is selected as the paper source, and the slip BOF is enabled only when slip is selected as the paper source. However, since the paper roll end sensor is used for paper-end detection, the printer stops printing. Use the paper roll near-end sensor for detecting a roll paper end, and also use the paper roll end sensor, if necessary.

The printer behaves as follows in the paper-end state:

1) When slip is selected
   When the slip BOF sensor is selected to stop printing, the slip BOF sensor detects a paper-end and the printer prints data up to the end of the printable area, ejects the slip when all the next print data is transmitted, and then waits for the slip to be removed. After the slip is removed, the printer enters the paper insertion waiting state.

2) When receipt is selected
   When a printing stop is enabled, the paper roll near-end sensor detects a paper near end and the printer automatically goes offline after printing the line being printed when the paper near end is detected. To restart printing, load the paper and set the printer back online by closing the printer cover. The printer starts initializing and continues printing data stored in the print buffer.

3.9 Printer Cover Sensors

3.9.1 Cover Open Sensor in the Slip Section

The sensor detects opening/closing of the front cover. When the cover open is detected, the printer prints data for the line during which the cover open is detected; then the printer stops the carriage movement. The printer goes offline automatically.

The printer goes online when the front cover is closed. If the printer continues printing, it starts printing the beginning of the line it was printing when the front cover was opened. In this case, the printing position may shift; therefore, it is recommended to initialize the printer and resend the print data.

3.9.2 Opening/Closing the Cover in the Slip Section

The cover can be opened by lifting the two tabs of the cover toward the front. When you close the cover, push the cover backward until it clicks.

3.9.3 Cover Open Sensor for the Receipt Section

The cover-open sensor monitors the receipt unit cover. When the sensor detects a cover open, the printer automatically goes offline, stops printing, and blinks the ERROR LED (automatic recovery error). Even if the receipt unit cover is closed, the ERROR LED blinks. The printer goes online when the receipt unit cover is closed. However, the ERROR LED still blinks if the receipt unit cover is closed. In this case, the printer can recover by being sent an error recovery command. If the printer continues printing, it starts printing the beginning of the line it was printing when the receipt unit cover was opened.

NOTE: Whether the cover is open or not does not affect the status reported by the paper roll end sensor.

3.9.4 Opening/Closing the Receipt Section Cover

- The cover can be opened by lifting the two tabs of the cover toward the front. When you close the cover, push the cover backward.

NOTES: Because the printer mechanism is reinitialized after the printer cover is opened and closed when the printer is in a waiting state, the cover must not be opened during printing or the error (automatic recovery error) may be caused. Opening the cover during the autocutter operation may damage the printer.

3.9.5 Unit Open Sensor for the Receipt Section

The unit open sensor monitors the receipt unit. When the sensor detects a unit cover open, the printer operates as the same with the receipt cover open sensor.

3.9.6 Opening/Closing the Receipt Unit Cover

- Opening the receipt is necessary when exchanging the E/P printer ribbon cassette or when paper is jammed.
- The receipt unit cover can be opened by lifting the two tabs of the receipt unit.

3.10 Print Buffer-full Printing

When subsequent data is received after the printer processes one line of data in the print buffer, the printer automatically prints the processed line and feeds the paper by one line.

3.11 Paper Jam Removal

3.11.1 Slip

To remove jammed paper from the print head area, open the receipt unit cover and operate the lever of the platen in the slip section.

NOTES:
- Since the print head becomes very hot just after printing, remove jammed paper only after the print head cools sufficiently.
- The carriage moves to the specified position after the printer is reset. Do not touch the carriage.

3.11.2 Receipt

To remove jammed paper from the print head area and autocutter, open the paper roll cover.

3.12 Reading MICR Characters and Printing Endorsements

(when the printer is used with the MICR reader)

Use the following procedure to read MICR characters.

	User Operation	Printer Operation
1	Transmit **FS a 0 <*n*>**.	Mechanically switches to MICR mode and waits for a personal check to be loaded. The SLIP LED blinks.
2	Insert a check.	Detects the check, lights the SLIP LED, and reads MICR characters. After reading, transmits the reading results.
3	Transmit **GS (G 2 0 48 68**	Select the back side of the check.
4	Transmit **GS (G 2 0 84 1**	Select the print starting position on the back side of the check.
5	Transmit endorsement printing data.	Prints data and feeds paper.
6	Transmit **FF**.	After printing, ejects paper. The slip LED blinks until the check is removed.
7	Eject the check paper.	The slip LED is off.

NOTES:
1. The check insertion waiting state is canceled using **DLE ENQ 3**.
2. After the personal check is ejected, the SLIP LED indicator lights, and the printer does not proceed to the next operation until the check is removed.
3. Insert personal checks correctly by matching the right side with the right side of the paper insert portion and inserting it until it is stopped by the from stopper.
4. The check waiting time and the interval from when a check is inserted to when the operation starts can be set using **ESC f**.
5. To check the MICR function status exactly, use **DLE EOT BS 1**.

3.13 Cleaning the MICR Mechanism

(when the printer is used with a MICR reader)

Foreign matter on the MICR mechanism can cause MICR reading errors. To clean the MICR mechanism, execute the cleaning command (**FS c**). Then insert cleaning paper the same way you insert check paper to clean the MICR head, roller, and the paper path.

Cleaning interval:	Once per 12 months or every 72,000 passes
Example cleaning paper:	KIC Products PRESAT brand check reader cleaning card or equivalent
Cleaning paper size:	63 mm {2.48"} (W) × 152 mm {5.98"} (H)

4. CASE SPECIFICATIONS

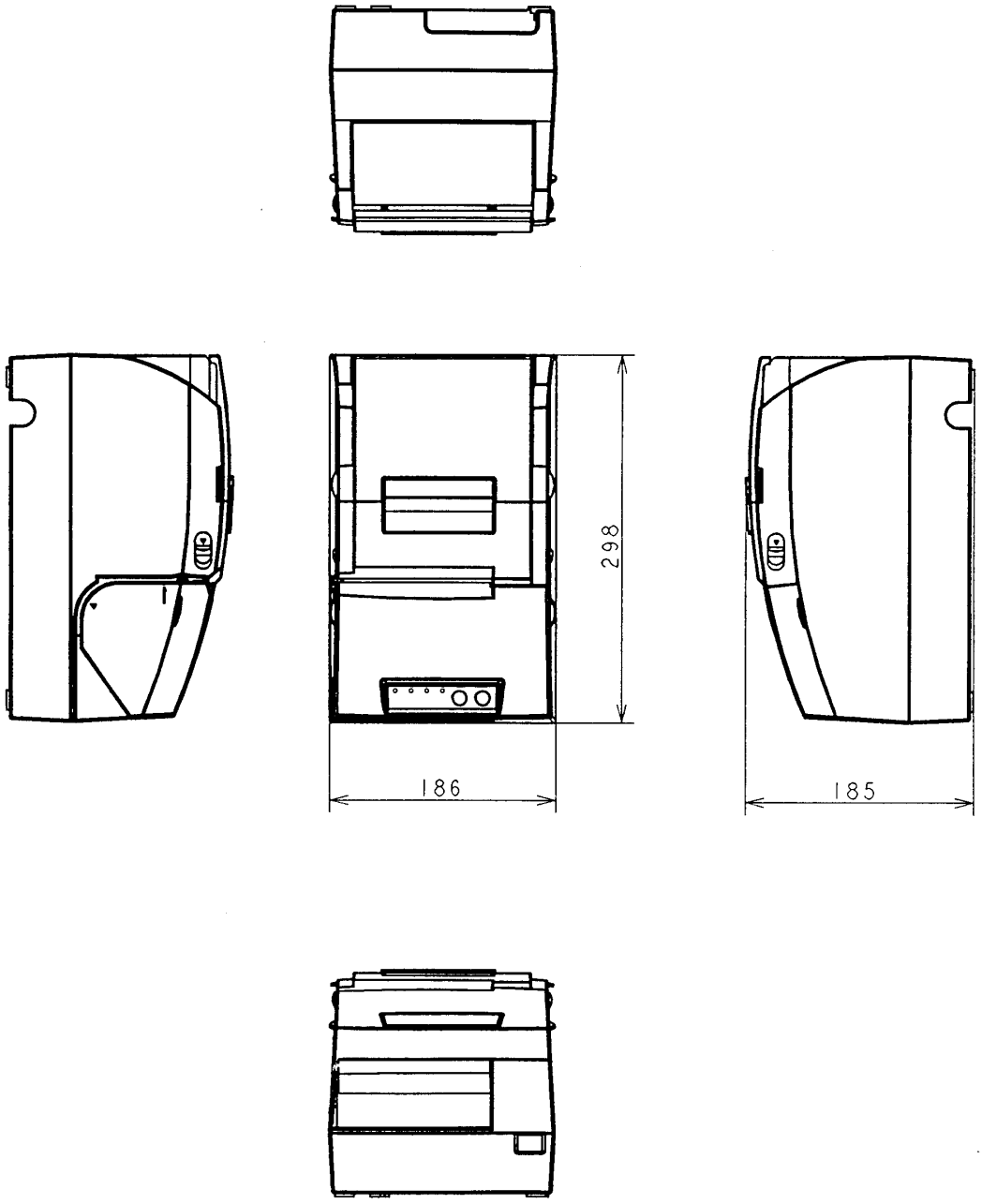
4.1 External Dimensions and Mass

Height: 185 mm {7.28"}
Width: 186 mm {7.32"}
Depth: 298 mm {11.73"} (except for the protrusion)
Mass: Approximately 5.8 kg {12.8 lb}
(All the numeric values are typical.)

4.2 Color

EPSON standard color (ECW, EDG)

4.3 External Appearance



[Units: mm]

Figure 4.3.1 External Appearance

5. OPTIONS AND CONSUMABLES

5.1 Standard Accessories

- Paper roll (diameter 40 mm {1.57"}) × 1 roll
- Exclusive ribbon cassette ERC-32(P)
- User's Manual
- I/F fixing screws (hexagonal millimeter screws)
- Power switch cover

5.2 Options

- External power supply PS-170, PS-180
- MICR reader (factory-installed option) (available only for serial interface model).
- Endorsement printer (factory-installed option) (Can only be used with MICR).
- Direct connection customer display DM-D105/D205 or DM-D106/DM-D206 (available only for serial interface model).
- Paper-width variable plate for 58 mm or 60 mm {2.3 or 2.4"} PG-58
- Special tray for TM-H6000 / H6000II (PT-6000, DPR-6000, TA-6000)

5.3 Consumables

- Specified paper:
  Thermal roll paper: NTP080-80
  In Japan: Nakagawa Mfg. Co., Ltd.
  In U.S.A.: Nakagawa Mfg. (USA) Inc.
  In Europe: Nakagawa Mfg. (Europe) GmbH
  In Southeast Asia: N.A.K. Mfg. (Malaysia) SDN BHD
  [Original paper: TF50KS-E Nippon Paper Industries Co., Ltd.]
  The following paper can be used instead of the specified paper above:
  Original paper: PD160R Oji Paper Mfg. Co., Ltd.
  AF50KS-E Jujo Thermal Oy (Finland)
  P350 (F380), P310, P300 Kanzaki Specialty Papers, Inc. (U.S.A.)

- Ribbon Cassette
  ERC-32(P) (Life: 6,000,000 characters)
  ERC-32(B) (Life: 4,000,000 characters)
  In Japan: EPSON HANBAI Co., Ltd.
  In U.S.A.: EPSON America, Inc.
  In Europe: EPSON Europe B.V.
  ERC-41(P) (Life: 1,000,000 characters) for E/P
  ERC-41(B) (Life: 800,000 characters) for E/P

6. COMMANDS

6.1 Command Notation

XXXX

[Name] The name of the command.

[Format] The code sequence.
The numbers denoted by < >H are hexadecimal.
[ ]*k* indicates the contents of the [ ] should be repeated *k* times.

[Range] Gives the allowable ranges, if any, for the arguments.

[Default] Gives the default values, if any, for the command parameters.

[Description] Describes the function of the command.

[Notes] Provides important information on setting and using the printer command, if necessary.

6.2 Explanation of Terms

1) Real-time command

The real-time commands are identified with a **DLE** extension. The printer executes this command upon receiving it. The real-time commands are stored in the print buffer after executing, and print data transmitted after that is ignored.

2) Ignore a command

The state in which all codes, including parameters, are read in and discarded, and nothing happens.

3) Printing area

Printing range is set by command. The printing area must be ≤ printable area.

4) Maximum printable area

The maximum printable area of this printer is as follows:

Paper Source	Standard Mode (Horizontal direction)	Page Mode	
		Horizontal direction	Vertical direction
Paper roll	Approximately 72.25 mm {512/180"}	Approximately 72.25 mm {512/180"}	Approximately 117.26 mm {1662/360"}
Slip paper (face)	Approximately 85.72 mm {540/160"}	Approximately 85.72 mm {540/160"}	Approximately 248.36 mm {1408/144"}
Slip paper (back)	Approximately 48 mm {240/127"}	Not supported	

5) Face / Back of slip

The face of the slip is the side printed by the serial impact dot matrix printer. The back of the slip is the side printed by the shuttle printer as an endorsement printer.

6) Inch

A unit of length. One inch is 25.4 mm.

7) dpi

dpi (dots per inch) is the number of dots per 25.4 mm.

6.3 Control Commands

HT

[Name] Horizontal tab

[Format]

ASCII	HT
Hex	09
Decimal	9

[Description]
- Moves the print position to the next horizontal tab position.

LF

[Name] Print and line feed

[Format]

ASCII	LF
Hex	0A
Decimal	10

[Description]
- Prints the data in the print buffer and feeds one line based on the current line spacing.
- When the back of a slip is selected as a paper source, the paper feeding pitch is set to approximately 3.18 mm {1/8"}.
- When the slip is set as a paper source but no paper is in the position, the printer waits for the paper insertion after the current paper is ejected (including the slip removal waiting state). The paper ejection direction is set to forward regardless of the setting with **ESC F**.

FF

[Name] ①Print and eject cut sheet (in standard mode)
②Print and return to standard mode (in page mode)

[Format]

ASCII	FF
Hex	0C
Decimal	12

[Description] For ①
- When slip paper is selected, prints the data in print buffer and ejects the slip paper.
- After the slip is ejected, the printer selects the paper roll.
- When this command is executed in the state below, the printer waits for paper insertion after the current paper is ejected (including the slip removal waiting state).
  E/P is installed:
  The state when the paper is fed for approximately 92 mm {523/144"} or more after paper empty is detected by the BOF sensor.
  E/P is not installed:
  The state when the paper is fed for approximately 75 mm {425/144"} or more after paper empty is detected by the BOF sensor.

For ②
- In page mode, prints the data in the print buffer collectively and returns to standard mode.

CR

[Name] Print and carriage return

[Format]

ASCII	CR
Hex	0D
Decimal	13

[Description]

- Executes automatic line feed as follows:

Paper	Automatic line feed enabled	Automatic line feed disabled
Paper roll Slip paper (back)	Functions the same as **LF**	Ignored
Slip paper (face)	Functions the same as **LF**	Prints the data in the print buffer and does not feed the paper.

- The automatic line feed is ignored with a serial interface model.

CAN

[Name] Cancel print data in page mode

[Format]

ASCII	CAN
Hex	18
Decimal	24

[Description] In page mode, deletes all the print data in the current printable area.

DLE EOT *n*

[Name] Real-time status transmission

[Format]

ASCII	DLE	EOT	*n*
Hex	10	04	*n*
Decimal	16	4	*n*

[Range] $1 \le n \le 5$

[Description] Transmits the selected printer status specified by *n* in real time, according to the following parameters:

n	Function
1	Specifies printer status
2	Specifies offline status
3	Specifies error status
4	Specifies paper roll sensor status
5	Specifies slip paper status

This printer transmits the following status in real time.

n = 1: Printer status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Fixed.
1	On	02	2	Fixed.
2	Off	00	0	Drawer open/close signal is LOW (connector pin 3).
	On	04	4	Drawer open/close signal is HIGH (connector pin 3).
3	Off	00	0	Online.
	On	08	8	Offline.
4	On	10	16	Fixed.
5	Off	00	0	Not in online waiting status.
	On	20	32	During online waiting status.
6	Off	00	0	Paper FEED button is turned Off.
	On	40	64	Paper FEED button is turned On.
7	Off	00	0	Fixed.

n =2: Offline status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Fixed.
1	On	02	2	Fixed.
2	Off	00	0	Cover is closed.
	On	04	4	Cover is open.
3	Off	00	0	Paper is not being fed by using the paper FEED button.
	On	08	8	Paper is being fed by the paper FEED button.
4	On	10	16	Fixed.
5	Off	00	0	No paper-end stop.
	On	20	32	Printing is being stopped.
6	Off	00	0	No error.
	On	40	64	Error has occurred.
7	Off	00	0	Fixed.

n = 3: Error status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Fixed.
1	On	02	2	Fixed.
2	Off	00	0	No mechanical error.
	On	04	4	Mechanical error has occurred.
3	Off	00	0	No autocutter error.
	On	08	8	Autocutter error has occurred.
4	On	10	16	Fixed.
5	Off	00	0	No unrecoverable error.
	On	20	32	Unrecoverable error has occurred.
6	Off	00	0	No auto-recoverable error.
	On	40	64	Auto recoverable error has occurred.
7	Off	00	00	Fixed.

n = 4: Continuous paper sensor status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Fixed.
1	On	02	2	Fixed.
2, 3	Off	00	0	Paper roll near-end sensor: Paper adequate.
	On	0C	12	Paper near-end is detected by the paper roll near-end sensor.
4	On	10	16	Fixed.
5, 6	Off	00	0	Paper roll sensor: Paper present.
	On	60	96	Paper roll end detected by paper roll sensor.
7	Off	00	0	Fixed.

n = 5: Slip paper status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Fixed.
1	On	02	2	Fixed.
2	Off	00	0	Slip paper selected.
	On	04	4	Slip paper not selected.
3	Off	00	0	Does not wait for slip paper insertion.
	On	08	8	Waits for slip paper insertion.
4	On	10	16	Fixed.
5	Off	00	0	TOF sensor: paper present.
	On	20	32	TOF sensor: paper not present.
6	Off	00	0	BOF sensor: paper present.
	On	40	64	BOF sensor: paper not present.
7	Off	00	0	Fixed.

[Notes]

- If print data includes a character string with this command, the printer performs this command. Users must consider this.

  For example: Bit image data accidentally might include a data string with this command.
- Do not embed this command within another command.

  For example: Bit image data might include this command.
- This command is ignored when block data is transmitted.

DLE EOT NUL *n*

[Name] Real-time status transmission

[Format]

ASCII	DLE	EOT	NUL	*n*
Hex	10	04	00	*n*
Decimal	16	4	00	*n*

[Range] *n* = 1

[Description] Transmits the selected printer status specified by *n* in real time, according to the following parameters:

n	Function
1	Specifies cut sheet status

This printer transmits the following status in real time.

n = 1: Cut sheet status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Fixed.
1	On	02	2	Fixed.
2	Off	00	0	Reserved.
3	Off	00	0	Slip paper ejection sensor detects the presence of paper.
	On	08	8	Slip paper ejection sensor does not detect the presence of paper.
4	On	10	16	Not used. Fixed to On.
5	Off	00	0	Face of slip is selected.
	On	20	32	Back of slip is selected.
6	Off	00	0	Reserved.
7	Off	00	0	Fixed.

[Notes]

- If print data includes a character string with this command, the printer performs this command. Users must consider this.

  For example: Bit image data accidentally might include a data string with this command.
- Do not embed this command within another command.

  For example: Bit image data might include this command.
- This command is ignored when block data is transmitted.

DLE ENQ *n*

[Name] Real-time request to printer

[Format]

ASCII	DLE	ENQ	*n*
Hex	10	05	*n*
Decimal	16	5	*n*

[Range] $0 \leq n \leq 3$

[Description] Responds to a request from the host computer.

- *n* specifies the requests as follows:

n	Request
0	Works the same as when the paper FEED button is pressed once during a waiting status during the operation of the **GS ^** command.
1	Recovers from an error and restarts printing from the line where the error occurred
2	Recovers from an error after clearing the receive and print buffers
3	Cancels the slip waiting status after clearing the receive and print buffers

[Notes]

- Specify *n* = 1 or 2 after removing the cause of the error.
- If print data includes a character string with this command, the printer performs the command. The users must consider this.

  For example: Bit image data accidentally might include a data string with this command.
- Do not embed this command within another command.
- This command is ignored when block data is transmitted.

DLE DC4 *fn m t* (when *fn* = 1)

[Name] Generate pulse in real-time

[Format]

ASCII	DLE	DC4	*fn*	*m*	*t*
Hex	10	14	*fn*	*m*	*t*
Decimal	16	20	*fn*	*m*	*t*

[Range] *fn* = 1
m = 0, 1
$1 \le t \le 8$

[Description] Outputs the pulse specified by *t* in real-time to the connector pin specified by *m* as follows:

m	Connector pin
0	Drawer kick-out connector pin 2.
1	Drawer kick-out connector pin 5.

The pulse ON time or OFF time is set to [$t \times 100$ ms].

[Notes]
- If print data includes a character string containing this command, the printer performs the command. Users must consider this.

  For example: A bit image accidentally might include the same data string as this command.
- Do not embed this command within another command.
- This command is ignored in the following states.
  - During transmission of block data
  - During driving of drawer kick-out
  - When an error has occurred.

DLE DC4 *fn a b* (when *fn* = 2)

[Name] Execute power-off sequence

[Format]

ASCII	DLE	DC4	*fn*	*a*	*b*
Hex	10	14	*fn*	*a*	*b*
Decimal	16	20	*fn*	*a*	*b*

[Range] *fn* = 2
a = 1
b = 8

[Description]
- Stores the values of the maintenance counter.
- Sets the interface to BUSY (DTR MARK, XOFF transmission, BUSY output, etc.)
- Transmits the following data block to the host.
  Header: Hexadecimal = 3BH / Decimal = 59 (1 byte)
  Status: Hexadecimal = 30H / Decimal = 48 (1 byte)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)
- Executes the printer power-off sequence.

[Notes]
- If this command is encountered, the printer will not continue to process anything. To recover the printer to print again, it is necessary to turn the power on again or execute a hardware reset.
- If print data includes a character string with this command, the printer performs the command. Users must consider this.

  For example: Bit image data accidentally might include a data string with this command.
- Do not embed this command within another command.

  For example: Bit image data might include this command.
- This command is ignored when block data is transmitted.

DLE DC4 *fn d1...d7* (when *fn* = 8)

[Name] Clear buffer(s)

[Format]

ASCII	DLE	DC4	*fn*	*d1...d7*
Hex	10	14	*fn*	*d1...d7*
Decimal	16	20	*fn*	*d1...d7*

[Range] *fn* = 8
d1 = 1, *d2* = 3, *d3* = 20, *d4* = 1, *d5* = 6, *d6* = 2, *d7* = 8

[Description]
- Clear all data stored in the receive buffer and the print buffer.
- Transmits the following data block to the host.
  Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
  Status: Hexadecimal = 25H / Decimal = 37 (1 byte)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)
- After this command is executed, the printer selects the paper roll as a paper source and enters the standard mode.

[Notes]
- This command must be inhibited for use in a system using this printer and the EPSON OPOS driver.
- If print data includes a character string with this command, the printer performs the command. Users must consider this.

  For example: Bit image data accidentally might include a data string with this command.
- Do not embed this command within another command.

  For example: Bit image data might include this command.
- This command is ignored when block data is transmitted.

ESC FF

[Name] Print data in page mode

[Format]

ASCII	ESC	FF
Hex	1B	0C
Decimal	27	12

[Description] In page mode, prints all buffered data in the printing area collectively.

ESC SP *n*

[Name] Set right-side character spacing

[Format]

ASCII	ESC	SP	*n*
Hex	1B	20	*n*
Decimal	27	32	*n*

[Range] $0 \leq n \leq 255$

[Default] $n = 0$

[Description]

- Sets the character spacing for the right side of the character to [$n \times$ horizontal motion unit].
- On the back of slip, sets the character spacing for the right side of the character to [horizontal motion unit = 0.2 mm {1/127"}].
- The maximum right-side spacing is as follows:
  - Paper roll: 35.983 mm {255/180"}
  - Slip paper (face): 40.481 mm {255/160"}
  - Slip paper (back): 51 mm {255/127"}

ESC ! *n*

[Name] Select print mode(s)

[Format]

ASCII	ESC	!	*n*
Hex	1B	21	*n*
Decimal	27	33	*n*

[Range] $0 \le n \le 255$

[Default] $n = 0$

[Description] Specifies or cancels the selection of font, emphasized, double-height or double-width size.

- *n* specifies the print mode(s) in the table below:

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Character font A selected.
	On	01	1	Character font B selected.
1	Off	00	0	Reserved.
2	Off	00	0	Reserved.
3	Off	00	0	Emphasized mode not selected.
	On	08	8	Emphasized mode selected.
4	Off	00	0	Double-height mode not selected.
	On	10	16	Double-height mode selected.
5	Off	00	0	Double-width mode not selected.
	On	20	32	Double-width mode selected.
6	Off	00	0	Reserved.
7	Off	00	0	Underline mode not selected.
	On	80	128	Underline mode selected.

- This command affects only printing on a paper roll and the face of a slip.

ESC $ *nL nH*

[Name] Set absolute print position

[Format]

ASCII	ESC	$	*nL*	*nH*
Hex	1B	24	*nL*	*nH*
Decimal	27	36	*nL*	*nH*

[Range] $0 \le (nL + nH \times 256) \le 65535$ ($0 \le nL \le 255$, $0 \le nH \le 255$)

[Description]
- The distance from the beginning of the line to the print position is set to [(*nL* + *nH* × 256) × (vertical or horizontal motion units)].
- When the back of a slip is selected as a paper source, the print position is calculated as [vertical or horizontal motion units = approximately 0.2 mm {1/127"}].

ESC % *n*

[Name] Select/cancel user-defined character set

[Format]

ASCII	ESC	%	*n*
Hex	1B	25	*n*
Decimal	27	37	*n*

[Range] $0 \le n \le 255$

[Default] *n* = 0

[Description] Selects or cancels the user-defined character set.
- When the LSB of *n* is 0, the user-defined character set is canceled.
- When the LSB of *n* is 1, the user-defined character set is selected.
- This command affects only printing on a paper roll and the face of a slip.

ESC & *y c1 c2 [x1 d1...d(y × x1)]...[xk d1...d(y × xk)]*

[Name] Define user-defined characters

[Format]

ASCII	ESC	&	*y*	*c1*	*c2 [x1 d1...d(y × x1)]...[xk d1...d(y × xk)]*
Hex	1B	26	*y*	*c1*	*c2 [x1 d1...d(y × x1)]...[xk d1...d(y × xk)]*
Decimal	27	38	*y*	*c1*	*c2 [x1 d1...d(y × x1)]...[xk d1...d(y × xk)]*

[Range]

- When paper roll is selected:
  $y = 3$
  $32 \le c1 \le c2 \le 126$
  $0 \le x \le 12$ (Font A)
  $0 \le x \le 9$ (Font B)
  $0 \le d \le 255$
  $k = c2 - c1 + 1$
- When slip paper is selected:
  $y = 2$
  $32 \le c1 \le c2 \le 126$
  $0 \le x \le 6$ (Font A)
  $0 \le x \le 9$ (Font B)
  $0 \le d \le 255$
  $k = c2 - c1 + 1$

[Description] Assigns user-defined characters for the character codes specified.

- *y* specifies the number of bytes in the vertical direction.
- *c1* specifies the beginning character code for the definition, and *c2* specifies the final code.
- *x* specifies the number of dots in the horizontal direction.
- *d* specifies the dot data for the characters.

[Notes]

- User-defined characters and a downloaded bit image cannot be defined simultaneously.
- User-defined characters on a slip affect printing on the face of the slip.

ESC ∗ *m nL nH d1 ... dk*

[Name] Select bit image mode

[Format]

ASCII	ESC	∗	*m*	*nL*	*nH*	*d1 ... dk*
Hex	1B	2A	*m*	*nL*	*nH*	*d1 ... dk*
Decimal	27	42	*m*	*nL*	*nH*	*d1 ... dk*

[Range]

- When paper roll is selected:
  m = 0, 1, 32, 33
  $1 \le (nL+nH\times256) \le 1023$ ($0 \le nL \le 255$, $0 \le nH \le 3$)
  $0 \le d \le 255$
  $k = nL + nH \times 256$ (when *m* = 0, 1)
  $k = (nL + nH \times 256) \times 3$ (when *m* = 32, 33)
- When the face of a slip is selected:
  m = 0, 1 (when the standard mode is selected)
  m = 0 (when the page mode is selected)
  $1 \le (nL+nH\times256) \le 1023$ ($0 \le nL \le 255$, $0 \le nH \le 3$)
  $0 \le d \le 255$
  $k = nL + nH \times 256$
- When the back of a slip is selected:
  m = 0
  $1 \le (nL+nH\times256) \le 1023$ ($0 \le nL \le 255$, $0 \le nH \le 3$)
  $0 \le d \le 255$
  $k = nL + nH \times 256$

[Description]

- Stores the bit image data in the print buffer.
- *m* specifies a bit image mode in the table below.

When paper roll is selected:

m	Mode	Vertical Direction		Horizontal Direction Dot Density
		Number of Bytes	Dot Density	
0	8-dot single-density	1 byte	60 dpi	90 dpi
1	8-dot double-density	1 byte	60 dpi	180 dpi
32	24-dot single-density	3 bytes	180 dpi	90 dpi
33	24-dot double-density	3 bytes	180 dpi	180 dpi

When the face of a slip is selected:

m	Mode	Vertical Direction		Horizontal Direction Dot Density
		Number of Bytes	Dot Density	
0	8-dot single-density	1 byte	72 dpi	80 dpi
1	8-dot double-density	1 byte	72 dpi	160 dpi

When the back of a slip is selected:

m	Mode	Vertical Direction		Horizontal Direction Dot Density
		Number of Bytes	Dot Density	
0	8-dot single-density	1 byte	72 dpi	127 dpi

- The *nL* and *nH* specify the number of dots of the bit image in the horizontal direction. The number of dots is calculated by (*nL* + *nH* × 256).
- *d* specifies the bit image data.

[dpi: dots per inch (number of dots per 25.4 mm)]

ESC – *n*

[Name] Turn underline mode on/off

[Format]

ASCII	ESC	–	*n*
Hex	1B	2D	*n*
Decimal	27	45	*n*

[Range] $0 \le n \le 2, 48 \le n \le 50$

[Default] $n = 0$

[Description]
- Turns underline mode on or off, based on the following values of *n*:
- When paper roll is selected:

n	Function
0, 48	Turns off underline mode
1, 49	Turns on 1-dot width underline mode
2, 50	Turns on 2-dot width underline mode

- When slip paper is selected:

n	Function
0, 48	Turns off underline mode
1, 49 2, 50	Turns on 1-dot width underline mode

- This command affects only printing on a paper roll and the face of a slip.

ESC 2

[Name] Select default line spacing

[Format]

ASCII	ESC	2
Hex	1B	32
Decimal	27	50

[Description]
- Sets the current line spacing to approximately 4.23 mm {1/6"}.
- This command affects only printing on a paper roll and the face of a slip.

ESC 3 *n*

[Name] Set line spacing

[Format]

ASCII	ESC	3	*n*
Hex	1B	33	*n*
Decimal	27	51	*n*

[Range] $0 \leq n \leq 255$

[Default] Equivalent to approximately 4.23 mm {1/6"}.

[Description]
- Sets the line spacing to [*n* × vertical or horizontal motion units] inches.
- The maximum paper feed amount is 1016 mm {40"}.
- This command affects only printing on a paper roll and the face of a slip.

ESC <

[Name] Return home

[Format]

ASCII	ESC	<
Hex	1B	3C
Decimal	27	60

[Description]
- Moves the print head for the face of the slip paper to the standby position.

ESC = *n*

[Name] Select peripheral device

[Format]

ASCII	ESC	=	*n*
Hex	1B	3D	*n*
Decimal	27	61	*n*

[Range] $1 \leq n \leq 3$

[Default] Serial interface specification:

- When turning on the printer:

DIP switch SW2-2 status	*n*
OFF	1
ON	2

- When executing **ESC @**:

Peripheral device status Default value to be set		*n*		
		1	2	3
After **ESC @** Processing	DIP switch SW2-2 is set to OFF	1	2	1
	DIP switch SW2-2 is set to ON	1	2	2

Parallel interface specification: *n* = 1

[Description] Selects device to which host computer sends data, using *n* as follows:

n	Function
1	Specifies printer only.
2	Specifies customer display only.
3	Specifies printer and customer display.

- When the customer display only is selected, specified by *n* =2, all data except this command and the real-time commands are ignored.

ESC ? *n*

[Name] Cancel user-defined characters

[Format]

ASCII	ESC	?	*n*
Hex	1B	3F	*n*
Decimal	27	63	*n*

[Range] $32 \le n \le 126$

[Description] Cancels user-defined characters, specified with character codes on a selected sheet.

- *n* specifies the character code for which the pattern defined is to be canceled.
- User-defined characters on slip affects printing on the face of the slip.

ESC @

[Name] Initialize printer

[Format]

ASCII	ESC	@
Hex	1B	40
Decimal	27	64

[Description] Clears the data in the print buffer and resets the printer modes to the mode that were in effect when the power was turned on. Keeps the following data:

- Customized ASB-status bits
- Macro definition
- Contents stored in the user NV memory
- Contents defined for the NV bit image
- Values in the maintenance counter

ESC D *n1 ... nk NUL*

[Name] Set horizontal tab positions

[Format]

ASCII	ESC	D	*n1 ... nk*	*NUL*
Hex	1B	44	*n1 ... nk*	*00*
Decimal	27	68	*n1 ... nk*	*0*

[Range] $1 \le n1 \le n2 \le ..... \le nk \le 255$
$0 \le k \le 32$

[Default] *n* = 8, 16, 24, 32, 40, ..., 232, 240, 248
(for font A in a standard character size width)

[Description] Sets horizontal tab positions from the left margin to [*n* × (the current setting character width)].

ESC E *n*

[Name] Turn emphasized mode on/off

[Format]

ASCII	ESC	E	*n*
Hex	1B	45	*n*
Decimal	27	69	*n*

[Range] $0 \le n \le 255$

[Default] $n = 0$

[Description] Turns emphasized mode on or off.

- When the LSB of *n* is 0, emphasized mode is turned off.
- When the LSB of *n* is 1, emphasized mode is turned on.
- This command affects only printing on a paper roll and the face of a slip.

ESC F *n*

[Name] Set/cancel cut sheet reverse eject

[Format]

ASCII	ESC	F	*n*
Hex	1B	46	*n*
Decimal	27	70	*n*

[Range] $0 \le n \le 255$

[Description] Sets or cancels the cut sheet reverse eject.

- When the LSB of *n* is 0, cancels the cut sheet reverse eject.
- When the LSB of *n* is 1, sets the cut sheet reverse eject.
- This command affects printing on the face or the back of the slip.

ESC G *n*

[Name] Turn double-strike mode on/off

[Format]

ASCII	ESC	G	*n*
Hex	1B	47	*n*
Decimal	27	71	*n*

[Range] $0 \le n \le 255$

[Default] $n = 0$

[Description] Turns double-strike mode on or off.

- When the LSB of *n* is 0, double-strike mode is turned off.
- When the LSB of *n* is 1, double-strike mode is turned on.
- This command affects only printing on a paper roll and the face of a slip.

ESC J *n*

[Name] Print and feed paper

[Format]

ASCII	ESC	J	*n*
Hex	1B	4A	*n*
Decimal	27	74	*n*

[Range] $0 \le n \le 255$

[Description] Prints the data in the print buffer and feeds the paper [*n* × vertical motion unit] inches.

- On the back of slip, sets the paper feed amount to [horizontal motion unit = 0.176 mm {1/144"}].
- The maximum paper feed amount is 1016 mm {40"}.
- When the slip is set as a paper source but no paper is in the position, the printer waits for the paper insertion after the current paper is ejected (including the slip removal waiting state). The paper ejection direction is set to forward regardless of the setting with **ESC F**.

ESC K *n*

[Name] Print and reverse feed

[Format]

ASCII	ESC	K	*n*
Hex	1B	4B	*n*
Decimal	27	75	*n*

[Range] $0 \le n \le 255$

[Description] Prints the data in the print buffer and feeds the paper [*n* × vertical motion unit] inches in the reverse direction.

- When the back of the slip is selected as a paper source and the print data is stored in the print buffer, the printer prints the data in the print buffer and feeds to the forward direction for the height corresponding to the print data.
- On the back of slip, sets the paper feed amount to [horizontal motion unit = 0.176 mm {1/144"}].
- When the slip is set as a paper source but no paper is in the position, the printer waits for the paper insertion after the current paper is ejected (including the slip removal waiting state). The paper ejection direction is set to forward regardless of the setting with the **ESC F**.
- The maximum paper feed amount is 1016 mm {40"}.
- This command controls printing on the face or the back of the slip.
- When this command is executed in the state below, the printer executes printing only and does not feed if the face of the slip is selected as a paper source.

  E/P is installed:
  The state when the paper is fed for approximately 92 mm {523/144"} or more after paper empty is detected by the BOF sensor.

  E/P is not installed:
  The state when the paper is fed for approximately 75 mm {425/144"} or more after paper empty is detected by the BOF sensor.

ESC L

[Name] Select page mode

[Format]

ASCII	ESC	L
Hex	1B	4C
Decimal	27	76

[Description] Switches from standard mode to page mode.

- If the back of a slip is selected as a paper source, this command is ignored.
- When the printer prints on the face of a slip in a page mode, the following cannot be printed; emphasized, or double strike, the font B printing, Kanji printing.
- If the double-density page mode is selected, this command is ignored

ESC M *n*

[Name] Select character font

[Format]

ASCII	ESC	M	*n*
Hex	1B	4D	*n*
Decimal	27	77	*n*

[Range] *n* = 0, 1, 48, 49

[Default] *n* = 0

[Description] Selects character fonts.

n	Function
0, 48	Character font A selected.
1, 49	Character font B selected.

- This command affects only printing on a paper roll and the face of a slip.

ESC R *n*

[Name] Select an international character set

[Format]

ASCII	ESC	R	*n*
Hex	1B	52	*n*
Decimal	27	82	*n*

[Range] $0 \le n \le 13$

[Default] $n = 0$

[Description] Selects international character set *n* from the following table:

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

ESC S

[Name] Select standard mode

[Format]

ASCII	ESC	S
Hex	1B	53
Decimal	27	83

[Description] Switches from page mode to standard mode.

ESC T *n*

[Name] Select print direction in page mode

[Format]

ASCII	ESC	T	*n*
Hex	1B	54	*n*
Decimal	27	84	*n*

[Range] $0 \le n \le 3$
$48 \le n \le 51$

[Default] $n = 0$

[Description] Selects the print direction and starting position in page mode.
n specifies the print direction and starting position as follows:

n	Print Direction	Starting Position
0, 48	Left to right	Upper left
1, 49	Bottom to top	Lower left
2, 50	Right to left	Lower right
3, 51	Top to bottom	Upper right

ESC U *n*

[Name] Turn unidirectional printing mode on/off

[Format]

ASCII	ESC	U	*n*
Hex	1B	55	*n*
Decimal	27	85	*n*

[Range] $0 \le n \le 255$

[Default] Standard mode: $n = 0$
Page mode: $n = 1$

[Description] Turns unidirectional printing mode on or off.

- When the LSB of *n* is 0, turns on unidirectional printing mode.
- When the LSB of *n* is 1, turns off unidirectional printing mode.
- This command affects only printing on the face of the slip.

ESC V *n*

[Name] Turn 90° clockwise rotation mode on/off

[Format]

ASCII	ESC	V	*n*
Hex	1B	56	*n*
Decimal	27	86	*n*

[Range] $0 \le n \le 1, 48 \le n \le 50$

[Default] $n = 0$

[Description] Turns 90° clockwise rotation mode on/off in standard mode

n is used as follows:

- When paper roll is selected:

n	Function
0, 48	Turns off 90° clockwise rotation mode
1, 49	Turns on 90° clockwise rotation mode

- When the face of the slip paper is selected:

n	Function
0, 48	Turns off 90° clockwise rotation mode
1, 49	Turns on 90° clockwise rotation mode with 1-dot horizontal spacing
2, 50	Turns on 90° clockwise rotation mode with 1.5-dot horizontal spacing

- This command affects only printing with font A and Kanji on a paper roll and the face of a slip.

ESC W *xL xH yL yH dxL dxH dyL dyH*

[Name] Set printing area in page mode

[Format]

ASCII	ESC	W	*xL*	*xH*	*yL*	*yH*	*dxL*	*dxH*	*dyL*	*dyH*
Hex	1B	57	*xL*	*xH*	*yL*	*yH*	*dxL*	*dxH*	*dyL*	*dyH*
Decimal	27	87	*xL*	*xH*	*yL*	*yH*	*dxL*	*dxH*	*dyL*	*dyH*

[Range]
$0 \le xL + xH \times 256 \le 65535$ ($0 \le xL \le 255$, $0 \le xH \le 255$)
$0 \le yL + yH \times 256 \le 65535$ ($0 \le yL \le 255$, $0 \le yH \le 255$)
$0 \le dxL + dxH \times 256 \le 65535$ ($0 \le dxL \le 255$, $0 \le dxH \le 255$)
$0 \le dyL + dyH \times 256 \le 65535$ ($0 \le dyL \le 255$, $0 \le dyH \le 255$)

[Default]
For paper roll: $(xL + xH \times 256) = 0$ ($xL = 0$, $xH = 0$)
$(yL + yH \times 256) = 0$ ($yL = 0$, $xH = 0$)
$(dxL + dxH \times 256) = 512$ ($dxL = 0$, $dxH = 2$)
$(dyL + dyH \times 256) = 1662$ ($dyL = 126$, $dyH = 6$: monochrome)
$(dyL + dyH \times 256) = 830$ ($dyL = 62$, $dyH = 3$: two-color)

For the face of slip paper:
$(xL + xH \times 256) = 0$ ($xL = 0$, $xH = 0$)
$(yL + yH \times 256) = 0$ ($yL = 0$, $xH = 0$)
$(dxL + dxH \times 256) = 540$ ($dxL = 28$, $dxH = 2$)
$(dyL + dyH \times 256) = 1408$ ($dyL = 128$, $dyH = 5$)

When the double-density page mode is selected:
$(xL + xH \times 256) = 0$ ($xL = 0$, $xH = 0$)
$(yL + yH \times 256) = 0$ ($yL = 0$, $xH = 0$)
$(dxL + dxH \times 256) = 540$ ($dxL = 28$, $dxH = 2$)
$(dyL + dyH \times 256) = 704$ ($dyL = 192$, $dyH = 2$)

[Description]
- This command sets the horizontal and vertical starting position (top of the left corner in printing area) and the size of the printing area.
- *xL, xH* specify the horizontal starting position with [$(xL + xH \times 256) \times$ (horizontal motion units)].
- *yL, yH* specify the vertical starting position with [$(yL + yH \times 256) \times$ (vertical motion units)].
- *dxL, dxH* specify the horizontal printing area width with [$(dxL + dxH \times 256) \times$ (horizontal motion units)].
- *dyL, dyH* specify the vertical printing area height with [$(dyL + dyH \times 256) \times$ (vertical motion units)].

ESC \ *nL nH*

[Name] Set relative print position

[Format]

ASCII	ESC	\	*nL*	*nH*
Hex	1B	5C	*nL*	*nH*
Decimal	27	92	*nL*	*nH*

[Range] $-32768 \le (nL + nH \times 256) \le 32767$ $(0 \le nL \le 255, 0 \le nH \le 255)$

[Description] Sets the print starting position based on the current position to [$(nL + nH \times 256) \times$ horizontal or vertical motion units].

- When ($nL + nH \times 256$) is positive number, the print starting position is specified to the right based on the current position.
- When ($nL + nH \times 256$) is negative number, the print starting position is specified to the left based on the current position.
- When the back of a slip is selected as a paper source, the print position is calculated as [vertical or horizontal motion units = approximately 0.2 mm{1/127"}].

ESC a *n*

[Name] Select justification

[Format]

ASCII	ESC	a	*n*
Hex	1B	61	*n*
Decimal	27	97	*n*

[Range] $0 \le n \le 2, 48 \le n \le 50$

[Default] $n = 0$

[Description]

- In standard mode, aligns all the data in one line to the position specified by *n* as follows:

n	Justification
0, 48	Left justification
1, 49	Centering
2, 50	Right justification

- This command affects only printing on a paper roll and the face of a slip.

ESC c 0 *n*

[Name] Select paper type(s) for printing

[Format]

ASCII	ESC	c	0	*n*
Hex	1B	63	30	*n*
Decimal	27	99	48	*n*

[Range] $1 \le n \le 4$

[Default] $n = 3$

[Description] Selects the type of paper for printing, using *n* as follows:

n	Function
1, 2, 3	Specifies paper roll.
4	Specifies the face of the slip paper.

- If paper roll was previously selected, and then the face of a slip paper is selected, the printer waits for the slip paper to be loaded.
- If paper roll is selected, a previously selected slip paper is canceled out and ejected.

ESC c 1 *n*

[Name] Select paper type(s) for command settings

[Format]

ASCII	ESC	c	1	*n*
Hex	1B	63	31	*n*
Decimal	27	99	49	*n*

[Range] $1 \le n \le 4$

[Default] $n = 3$

[Description] Selects the paper type(s), using *n* as follows:

n	Function
1, 2, 3	Specifies paper roll.
4	Specifies the face of slip paper.

This command affects the **ESC 2**, **ESC 3**, **ESC &**, **ESC ?**, **GS ***, **GS L**, **GS P**, and **GS W** commands.

ESC c 3 *n*

[Name] Select paper sensor(s) to output paper-end signals

[Format]

ASCII	ESC	c	3	*n*
Hex	1B	63	33	*n*
Decimal	27	99	51	*n*

[Range] $0 \le n \le 255$

[Default] $n = 0$

[Description] Selects the paper sensor(s) to output paper end signals when the specified sensor(s) detect(s) the paper end.

- Each bit of *n* specifies the paper sensor(s) as follows:

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Paper roll near-end sensor disabled.
	On	01	1	Paper roll near-end sensor enabled.
1	Off	00	0	Paper roll near-end sensor disabled.
	On	02	2	Paper roll near-end sensor enabled.
2	Off	00	0	Paper roll end sensor disabled.
	On	04	4	Paper roll end sensor enabled.
3	Off	00	0	Paper roll end sensor disabled.
	On	08	8	Paper roll end sensor enabled.
4	Off	00	0	TOF sensor disabled.
	On	10	16	TOF sensor enabled.
5	Off	00	0	BOF sensor disabled.
	On	20	32	BOF sensor enabled.
6, 7	---	--	-	Reserved.

[Notes]

- This command is ignored with a serial interface model.

ESC c 4 *n*

[Name] Select paper sensor(s) to stop printing

[Format]

ASCII	ESC	c	4	*n*
Hex	1B	63	34	*n*
Decimal	27	99	52	*n*

[Range] $0 \le n \le 255$

[Default] $n = 32$

[Description] Selects the paper sensor(s) to use to stop printing when a paper end is detected.

- *n* specifies the paper sensor(s) as follows:

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Paper roll near end sensor disabled.
	On	01	1	Paper roll near end sensor enabled.
1	Off	00	0	Paper roll near end sensor disabled.
	On	02	2	Paper roll near end sensor enabled.
2, 3, 4	---	--	-	Reserved.
5	Off	00	0	BOF sensor disabled.
	On	20	32	BOF sensor enabled.
6, 7	---	--	-	Reserved.

ESC c 5 *n*

[Name] Enable/disable panel buttons

[Format]

ASCII	ESC	c	5	*n*
Hex	1B	63	35	*n*
Decimal	27	99	53	*n*

[Range] $0 \le n \le 255$

[Default] $n = 0$

[Description] Enables or disables the panel buttons.

- When the LSB of *n* is 0, the panel buttons are enabled.
- When the LSB of *n* is 1, the panel buttons are disabled.

ESC d *n*

[Name] Print and feed *n* lines

[Format]

ASCII	ESC	d	*n*
Hex	1B	64	*n*
Decimal	27	100	*n*

[Range] $0 \le n \le 255$

[Description] Prints the data in the print buffer and feeds *n* lines for [$n \times$ current line spacing amount].

- The maximum paper feed amount is 1016 mm {40"}.
- When the back of a slip is selected as a paper source, the paper feeding pitch is set to approximately 3.18 mm {1/8"}.
- When the slip is set as a paper source but no paper is in the position, the printer waits for the paper insertion after the current paper is ejected (including the slip removal waiting state). The paper ejection direction is set to forward regardless of the setting with **ESC F**.

ESC e *n*

[Name] Print and reverse feed *n* lines

[Format]

ASCII	ESC	e	*n*
Hex	1B	65	*n*
Decimal	27	101	*n*

[Range] $0 \le n \le 255$

[Description] Prints the data in the print buffer and feeds the paper [$n \times$ vertical motion unit] inches in the reverse direction.

- When the back of the slip is selected as a paper source and the print data is stored in the print buffer, the printer prints the data in the print buffer and feeds to the forward direction for the height corresponding to the print data.
- On the back of slip, sets the paper feed amount to [horizontal motion unit = 3.18 mm {1/8"}].
- The maximum paper feed amount is 1016 mm {40"}.
- This command controls printing on the face or the back of the slip.
- When this command is executed in the state below, the printer executes printing only and does not feed if the face of the slip is selected as a paper source.

  E/P is installed:
  The state when the paper is fed for approximately 92 mm {523/144"} or more after paper empty is detected by the BOF sensor.

  E/P is not installed:
  The state when the paper is fed for approximately 75 mm {425/144"} or more after paper empty is detected by the BOF sensor.

ESC f *t1 t2*

[Name] Set cut sheet wait time

[Format]

ASCII	ESC	f	*t1*	*t2*
Hex	1B	66	*t1*	*t2*
Decimal	27	102	*t1*	*t2*

[Range] $0 \le t1 \le 15$
$0 \le t2 \le 64$

[Default] *t1* = 0, *t2* = 10

[Description] Sets the time that the printer waits for slip paper to be inserted and the time from insertion of the slip to the start of printing.

- *t1* specifies the wait time for slip paper to be inserted as [$t1 \times 1$] minutes. When *t1* is set to 0, the printer cancels the setting of the wait time.
- *t2* specifies time from insertion of the slip to the start of printing as [$t2 \times 0.1$] seconds.

ESC p *m t1 t2*

[Name] Generate pulse

[Format]

ASCII	ESC	p	*m*	*t1*	*t2*
Hex	1B	70	*m*	*t1*	*t2*
Decimal	27	112	*m*	*t1*	*t2*

[Range] $m = 0, 1, 48, 49$
$0 \le t1 \le 255$
$0 \le t2 \le 255$

[Description] Outputs the pulse specified by *t1* and *t2* to connector pin *m,* as follows:

m	Function
0, 48	Drawer kick-out connector pin 2.
1, 49	Drawer kick-out connector pin 5.

- *t1* specifies the pulse ON time as [*t1* × 2 ms].
- *t2* specifies the pulse OFF time as [*t2* × 2 ms].

[Note]
- OFF time must be longer than ON time (*t1* < *t2*).

ESC q

[Name] Release

[Format]

ASCII	ESC	q
Hex	1B	71
Decimal	27	113

[Description] Releases the slip paper.

ESC t *n*

[Name] Select character code table

[Format]

ASCII	ESC	t	*n*
Hex	1B	74	*n*
Decimal	27	116	*n*

[Range]

For paper roll:	$0 \le n \le 5$, $16 \le n \le 19$, $n = 255$
For slip (face):	$0 \le n \le 5$, $16 \le n \le 19$, $n = 254, 255$
For slip (back):	$0 \le n \le 5$, $16 \le n \le 19$, $n = 255$

[Default] *n* = 0

[Description] Selects a page *n* from the character code table.

n	Selected Character Code
0	PC437 (U.S.A., Standard Europe)
1	Katakana
2	PC850 (Multilingual)
3	PC860 (Portuguese)
4	PC863 (Canadian-French)
5	PC865 (Nordic)
16	WPC1252
17	PC866 (Cyrillic#2)
18	PC852 (Latin2)
19	PC858 (Euro)
254	For Font A for the face of a slip: Space For Font B for the face of a slip: Characters code 80H – FFH
255	For paper roll: Space For Font A for the face of a slip: Space For Font B for the face of a slip: Characters code 80H – FFH For the back of a slip: Space

[Default] *n* = 0

[Reference] Appendix E, 3.2 *Character Code Tables*

ESC { *n*

[Name] Turn upside-down printing mode on/off

[Format]

ASCII	ESC	{	*n*
Hex	1B	7B	*n*
Decimal	27	123	*n*

[Range] $0 \le n \le 255$

[Default] $n = 0$

[Description] Turns upside-down printing mode on or off.

- When the LSB of *n* is 0, upside-down printing mode is turned off.
- When the LSB of *n* is 1, upside-down printing mode is turned on.

FS (e *pL pH m n*

[Name] Enable/disable Automatic Status Back (ASB) for optional functions

[Format]

ASCII	FS	(	e	*pL*	*pH*	*m*	*n*
Hex	1C	28	65	*pL*	*pH*	*m*	*n*
Decimal	28	40	101	*pL*	*pH*	*m*	*n*

[Range] $(pL + pH \times 256) = 2$ ($pL = 2$, $pH = 0$)
$m = 51$
$0 \le n \le 255$

[Default] $n = 0$

[Description] Enables or disables Automatic Status Back (ASB) for optional functions.

- *n* specifies enabling or disabling of the status bit of the ASB as follows:

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Disables the status bit for MICR.
	On	01	1	Enables the status bit for MICR.
1	Off	00	0	Disables the status bit for printing on slip face.
	On	02	2	Enables the status bit for printing on slip face.
2	Off	00	0	Reserved.
3	Off	00	0	Reserved.
4	Off	00	0	Reserved.
5	Off	00	0	Reserved.
6	Off	00	0	Reserved.
7	Off	00	0	Reserved.

- The ASB status that is transmitted consists of the following four bytes.
  - The first byte (Header): 57 (39H)
  - The second byte (status A)

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	MICR function is selected.
	On	01	1	MICR function is not selected.
1 - 4	Off	00	0	Reserved.
5	Off	00	0	Face of slip is selected.
	On	20	32	Back of slip is selected.
6	On	40	64	Fixed.
7	Off	00	0	Fixed.

  - The third byte (status B): 640 (40H)
  - The fourth byte (NUL): 0 (00H)
- If any bits of *n* are effective, the printer transmits four bytes of ASB status that give the current status whenever the command is executed.
- Whenever a status change occurs for an effective bit, the printer transmits four bytes of ASB status.

[Note]
- The printer transmits the status without confirming whether the computer can receive data.

FS L

[Name] Select double-density page mode

[Format]

ASCII	FS	L
Hex	1C	4C
Decimal	28	76

[Description] Switches from standard mode to double-density page mode.
- If the back of a slip is selected as a paper source, this command is ignored.
- When the printer prints on the face of a slip in a page mode, the following cannot be printed; emphasized, or double strike.
- If the page mode is selected, this command is ignored.

FS p *n m*

[Name] Print NV bit image

[Format]

ASCII	FS	p	*n*	*m*
Hex	1C	70	*n*	*m*
Decimal	28	112	*n*	*m*

[Range] <When the paper roll is selected>
$1 \le n \le 255$
$0 \le m \le 3, 48 \le m \le 51$

<When the face of a slip is selected>
$1 \le n \le 255$
m = 0, 1, 48, 49 (when the standard mode is selected)
m = 1, 49 (when the page mode is selected)

[Description] Prints an NV bit image on the currently selected paper source.

- *n* specifies the number of the NV bit image.
- *m* specifies a bit image mode.

When the paper roll is selected:

m	Mode	Vertical Dot Density	Horizontal Dot Density
0, 48	Normal	180 dpi	180 dpi
1, 49	Double-width	180 dpi	90 dpi
2, 50	Double-height	90 dpi	180 dpi
3, 51	Quadruple	90 dpi	90 dpi

When the face of slip paper is selected:

m	Mode	Vertical Dot Density	Horizontal Dot Density
0, 48	Normal	72 dpi	160 dpi
1, 49	Double-width	72 dpi	80 dpi

[dpi: dots per inch (number of dots per 25.4 mm)]

FS q *n [xL xH yL yH d1...dk]1...[xL xH yL yH d1...dk]n*

[Name] Define NV bit image

[Format]

ASCII	FS	q	*n*	*[xL xH yL yH d1...dk]1...[xL xH yL yH d1...dk]n*
Hex	1C	71	*n*	*[xL xH yL yH d1...dk]1...[xL xH yL yH d1...dk]n*
Decimal	28	113	*n*	*[xL xH yL yH d1...dk]1...[xL xH yL yH d1...dk]n*

[Range]
$1 \le n \le 255$
$1 \le (xL + xH \times 256) \le 1023$ ($0 \le xL \le 255$, $0 \le xH \le 3$)
$1 \le (yL + yH \times 256) \le 288$ ($0 \le yL \le 255$, $yL = 0, 1$)
$0 \le d \le 255$
$k = (xL + xH \times 256) \times (yL + yH \times 256) \times 8$
Total defined data area = 0, 64K, 128K, 192K, 256K, 320K, 384K bytes
(Total defined data area can be selected with **GS (E** command)
(default: 384K bytes for the model without multilingual support, 256K bytes for the model with multilingual support)

[Description] Defines the NV bit image on the currently selected paper roll specified in the non-volatile memory.

- *n* specifies the number of the NV bit image you are defining.
- *xL*, *xH* specifies ($xL + xH \times 256$) bytes in the horizontal direction for the NV bit image.
- *yL*, *yH* specifies ($yL + yH \times 256$) bytes in the vertical direction for the NV bit image.
- *d* is data for the NV bit image.
- The printer executes a hardware reset after the command to place the image into the non-volatile memory. The printer clears the receive and print buffers and then resets the mode to the mode that was in effect at power on.

[Notes]

- Frequent write command executions by an NV memory write command (**GS (C**, **GS (E**, **FS q**, or **GS g 0**)may damage to the NV memory. Therefore, it is recommended to write to the NV memory 10 times or less a day.
- During processing of this command, the printer is BUSY while writing the data to the NV user memory and stops receiving data. Therefore, it is prohibited to transmit data, including real-time commands, during the execution of this command.

GS ! *n*

[Name] Select character size

[Format]

ASCII	GS	!	*n*
Hex	1D	21	*n*
Decimal	29	33	*n*

[Range] $0 \le n \le 7$, $16 \le n \le 23$, $32 \le n \le 39$, $48 \le n \le 55$, $64 \le n \le 71$, $80 \le n \le 87$, $96 \le n \le 103$, $112 \le n \le 119$

[Default] $n = 0$

[Description] Selects character size, using *n*:

Bit	Function	Hex	Decimal
0 to 3	Specifies the times enlarged in the vertical direction	Refer to Table 2	
4 to 7	Specifies the times enlarged in the horizontal direction	Refer to Table 1	

Table 1 [Enlarged in horizontal direction]

Paper roll	Slip	Hex	Decimal
1 time	1 time	00	0
2 times	2 times	10	16
3 times		20	32
4 times		30	48
5 times		40	64
6 times		50	80
7 times		60	96
8 times		70	112

Table 2 [Enlarged in vertical direction]

Paper roll	Slip	Hex	Decimal
1 time	1 time	00	0
2 times	2 times	01	1
3 times		02	2
4 times		03	3
5 times		04	4
6 times		05	5
7 times		06	6
8 times		07	7

- This command affects only printing on a paper roll and the face of a slip.

GS $ *nL nH*

[Name] Set absolute vertical print position in page mode

[Format]

ASCII	GS	$	*nL*	*nH*
Hex	1D	24	*nL*	*nH*
Decimal	29	36	*nL*	*nH*

[Range] $0 \le (nL + nH \times 256) \le 65535$ ($0 \le nL \le 255$, $0 \le nH \le 255$)

[Description]
- Sets the absolute vertical print starting position for buffered character data in page mode.
- This command sets the absolute print position to [$(nL + nH \times 256) \times$ (vertical or horizontal motion units)].

GS (A *pL pH n m*

[Name] Execute test print

[Format]

ASCII	GS	(	A	*pL*	*pH*	*n*	*m*
Hex	1D	28	41	*pL*	*pH*	*n*	*m*
Decimal	29	40	65	*pL*	*pH*	*n*	*m*

[Range] $(pL + pH \times 256) = 2$ ($pL = 2$, $pH = 0$)
$0 \le n \le 4$, $48 \le n \le 52$
$1 \le m \le 3$, $49 \le m \le 51$

[Description]

- Executes a test print with a specified test pattern on a specified paper type (roll or slip).

  n specifies the paper type to be tested:

n	Paper type
0, 48	Basic sheet (paper roll)
1, 49 2, 50	Paper roll
3, 51 4, 52	Slip paper (face)

  m specifies a test pattern:

m	Test pattern
1, 49	Hexadecimal dump
2, 50	Printer status print
3, 51	Rolling pattern print

- The printer executes a hardware reset after the procedure to place the image into the non-volatile memory. The printer clears the receive and print buffers, and resets all settings (user-defined characters, macros, and the character style) to the mode that was in effect at power on.

GS (B *pL pH m [a1 b1]...[ak bk]*

[Name] Customize ASB status bits

[Format]

ASCII	GS	(	B	*pL*	*pH*	*m*	*[a1 b1]...[ak bk]*
Hex	1D	28	42	*pL*	*pH*	*m*	*[a1 b1]...[ak bk]*
Decimal	29	40	66	*pL*	*pH*	*m*	*[a1 b1]...[ak bk]*

[Range] (*pL* + *pH* × 256) = 2, 3, 5, 7 (*pL* = 2, 3, 5, 7 *pH* =0)
m = 97
a = 0, 49, 51, 70
b = 44 (when *a* = 49), 45 (when *a* = 51), 55 (when *a* = 70)

[Description] Changes the bit assignments of the ASB status bit specified with **GS a** command (bit customization).

- The combinations of *a* and *b* that can be set are as follows:

a	*b*	Bit of ASB status	ASB status to be assigned
0	--	Cancels the setting of bit assignment	---
49	44	Bit 1 of the third byte	Slip insertion waiting status
51	45	Bit 3 of the third byte	Slip paper width sensor status
70	55	Bit 6 of the fourth byte	Slip paper ejection sensor status

- *pL, pH* specifies (*pL* + (*pH* × 256)) for the number of bytes after *pH* (*m*, *[a1 b1]...[ak bk]*).
- *a* specifies the bit of the ASB to be customized.
- *b* specifies the ASB status.

GS (C *pL pH m fn b [c1 c2][d1...dk]*

[Name] Edit NV user memory

[Description] Deletes, stores, and transmits data in the NV user memory based on the functions in the table below. Also sends status information for the amount of space used in NV RAM, the amount of space still available, and the list of key codes identifying the data records.

a	Format	Function	
0, 48	**GS (C *pL pH m fn b c1 c2***	0	Deletes the specified record.
1, 49	**GS (C *pL pH m fn b c1 c2 d1...dk***	1	Stores data in the specified record.
2, 50	**GS (C *pL pH m fn b c1 c2***	2	Sends the data in the specified record.
3, 51	**GS (C *pL pH m fn b***	3	Sends the number of bytes being used in NV user memory.
4, 52	**GS (C *pL pH m fn b***	4	Sends the remaining space available in NV user memory.
5, 53	**GS (C *pL pH m fn b***	5	Transmits the key code list identifying the stored data.
6, 54	**GS (C *pL pH m fn b d1 d2 d3***	6	Deletes all data in the NV user memory.

- *pL pH* specifies (*pL* + (*pH* × 256)) for the number of bytes after *pH* (*m, fn, b, [c1 c2, [d1...dk]*].
- *fn* specifies the function.
- *c1, c2* specifies the key code (which identifies the record).
- *d1...dk* specifies the customized values (contents of the record).
- The capacity of the user NV memory can be selected as 1K, 64K, 128K or 192K with **GS (E** command. Default value is 1 KB.

[Notes]
- Frequent write command executions by an NV memory write command (**FS q, GS (C, GS (E,** or **GS g 0**) may damage the NV memory. Therefore, it is recommended to write to the NV memory 10 times or less day.
- While processing this command, the printer is BUSY while writing data to the NV user memory and stops receiving data. Therefore it is prohibited to transmit data including the real-time commands during the execution of this command.

GS (C *pL pH m fn b c1 c2* (when *a* = 0, 48) <Function 0>

[Format]	ASCII	GS	(	C	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*
	Hex	1D	28	43	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*
	Decimal	29	40	67	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*

[Range] $(pL + pH \times 256) = 5$ (pL = 5, pH = 0)
m = 0
fn = 0, 48
b = 0
$32 \le c1 \le 126$
$32 \le c2 \le 126$

[Description] Deletes the record specified by *c1, c2* in the NV user memory.

<Function 1> **GS (C *pL pH m fn b c1 c2 d1...dk*** (when *fn* = 1, 49)

[Format]	ASCII	GS	(	C	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*	*d1...dk*
	Hex	1D	28	43	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*	*d1...dk*
	Decimal	29	40	67	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*	*d1...dk*

[Range] $6 \le (pL + pH \times 256) \le 65535$ ($0 \le pL \le 255$, $0 \le pH \le 255$)
m = 0
fn = 1, 49
b = 0
$32 \le c1 \le 126$
$32 \le c2 \le 126$
$32 \le d \le 254$
$k = (pL + pH \times 256) - 5$

[Description]
- Stores the data to the record specified by *c1, c2.*
- The new data overwrites the data already stored, if there is data already stored.

<Function 2> **GS (C *pL pH m fn b c1 c2*** (when *fn* = 2, 50)

[Format]

ASCII	GS	(	C	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*
Hex	1D	28	43	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*
Decimal	29	40	67	*pL*	*pH*	*m*	*fn*	*b*	*c1*	*c2*

[Range] $(pL + pH \times 256) = 5$ (pL = 5, pH = 0)
m = 0
fn = 2, 50
b = 0
$32 \leq c1 \leq 126$
$32 \leq c2 \leq 126$

[Description]

- Transmits data for the record specified by *c1, c2* in the NV user memory.

  Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
  Flag: Hexadecimal = 70H / Decimal = 112 (1 byte)
  Status: Hexadecimal = 40H or 41H / Decimal = 64 or 65 (1 byte)
  Data: Hexadecimal = 20-FEH / Decimal = 32-254 (0 - 80 bytes)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- If the specified record cannot be detected, the following data is transmitted:

  Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
  Flag: Hexadecimal = 70H / Decimal = 112 (1 byte)
  Status: Hexadecimal = 40H / Decimal = 64 (1 byte)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- After the [Header - NUL] is transmitted, the printer receives a response from the host; then it performs the process defined in the response. See the tables below.

When the status (existence of the next data block) is Hexadecimal = 41H/Decimal = 65.

Response		Process performed
ASCII	Decimal	
ACK	6	Transmits the next data
NAK	21	Transmits the last data again
CAN	24	Ends the process

When the status (for the last data block) is Hexadecimal = 40H/Decimal = 64,

Response		Process performed
ASCII	Decimal	
ACK	6	Ends the process
NAK	21	Transmits the last data again
CAN	24	Cancels the process

<Function 3> **GS (C *pL pH m fn b*** (when *fn* = 3, 51)

[Format]

ASCII	GS	(	C	*pL*	*pH*	*m*	*fn*	*b*
Hex	1D	28	43	*pL*	*pH*	*m*	*fn*	*b*
Decimal	29	40	67	*pL*	*pH*	*m*	*fn*	*b*

[Range] (*pL* + *pH* × 256) = 3 (*pL* = 3, *pH* = 0)
m = 0
fn = 3, 51
b = 0

[Description] Transmits the number of bytes of memory used in the NV user memory.

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 28H / Decimal = 40 (1 byte)
Occupied memory size:
Hexadecimal = 30-39H / Decimal =48-57 (1 to 6 bytes)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

<Function 4> **GS (C *pL pH m fn b*** (when *fn* = 4, 52)

[Format]

ASCII	GS	(	C	*pL*	*pH*	*m*	*fn*	*b*
Hex	1D	28	43	*pL*	*pH*	*m*	*fn*	*b*
Decimal	29	40	67	*pL*	*pH*	*m*	*fn*	*b*

[Range] (*pL* + *pH* × 256) = 3 (*pL* = 3, *pH* = 0)
m = 0
fn = 4, 52
b = 0

[Description] Transmits the number of bytes of remaining memory (unused area) in the NV user memory.

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 29H / Decimal = 41 (1 byte)
Remaining memory size:
Hexadecimal = 30-39H / Decimal = 48-57 (1 to 6 bytes)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

<Function 5> **GS (C *pL pH m fn b*** (when *fn* = 5, 53)

[Format]

ASCII	GS	(	C	*pL*	*pH*	*m*	*fn*	*b*
Hex	1D	28	43	*pL*	*pH*	*m*	*fn*	*b*
Decimal	29	40	67	*pL*	*pH*	*m*	*fn*	*b*

[Range] (*pL* + *pH* × 256) = 3 (*pL* = 3, *pH* = 0)
m = 0
fn = 5, 53
b = 0

[Description]

- Transmits the key code ID list for the stored data.

  Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
  Flag: Hexadecimal = 71H / Decimal = 113 (1 byte)
  Status: Hexadecimal = 40H or 41H / Decimal = 64 or 65 (1 byte)
  Data: Hexadecimal = 20-FEH / Decimal = 32-254 (2 - 80 bytes)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- Data consists of the data groups identified with key codes.
- If the specified record cannot be detected, the contents of the transmitted data are as follows:

  Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
  Flag: Hexadecimal = 71H / Decimal = 113 (1 byte)
  Status: Hexadecimal = 40H / Decimal = 64 (1 byte)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- After the [Header - NUL] is transmitted, the printer receives a response from the host; then it performs the process defined by the response. (See the tables below.).

When the status (existence of the next data block) is Hexadecimal = 41H/Decimal = 65.

Response		Process performed
ASCII	Decimal	
ACK	6	Transmits the next data
NAK	21	Transmits the last data again
CAN	24	Ends the process

When the status (for the last data block) is Hexadecimal = 40H/Decimal = 64,

Response		Process performed
ASCII	Decimal	
ACK	6	Ends the process
NAK	21	Transmits the last data again
CAN	24	Cancels the process

<Function 6> **GS (C *pL pH m fn b d1 d2 d3*** (when *fn* = 6, 54)

[Format]

ASCII	GS	(	C	*pL*	*pH*	*m*	*fn*	*b*	*d1*	*d2*	*d3*
Hex	1D	28	43	*pL*	*pH*	*m*	*fn*	*b*	*d1*	*d2*	*d3*
Decimal	29	40	67	*pL*	*pH*	*m*	*fn*	*b*	*d1*	*d2*	*d3*

[Range] (*pL* + *pH* × 256) = 6 (*pL* = 6, *pH* = 0)
m = 0
fn = 6, 54
b = 0
d1 = 67
d2 = 76
d3 = 82

[Description] Deletes all data in the NV user memory.

GS (D *pL pH m [a1 b1]...[ak...bk]*

[Name] Enable/disable real-time command

[Format]

ASCII	GS	(	D	*pL*	*pH*	*m*	*[a1 b1]...[ak bk]*
Hex	1D	28	44	*pL*	*pH*	*m*	*[a1 b1]...[ak bk]*
Decimal	29	40	68	*pL*	*pH*	*m*	*[a1 b1]...[ak bk]*

[Range] 3 ≤ (*pL* + *pH* × 256) ≤ 65535 (0 ≤ *pL* ≤255, 0 ≤ *pH* ≤ 255)
m = 20
a = 1, 2
b = 0, 1, 48, 49

[Default]

a	Type(s) of real-time commands	Default
1	**DLE DC4 *fn m t*** (*fn* = 1): Generate pulse in real-time	Enabled (*b* = 1)
2	**DLE DC4 *fn a b*** (*fn* = 2): Execute power-off sequence	Disabled (*b* = 0)

[Description] Enables or disables the following real-time commands.

a	*b*	Function
1	0, 48	**DLE DC4 *fn m t*** (*fn* = 1): Not processed (disabled)
	1, 49	**DLE DC4 *fn m t*** (*fn* = 1): Processed (enabled)
2	0, 48	**DLE DC4 *fn a b*** (*fn* = 2): Not processed (disabled)
	1, 49	**DLE DC4 *fn a b*** (*fn* = 2): Processed (enabled)

- *pL*, *pH* specifies (*pL*+ (*pH* × 256)) as the number of bytes after *pH* (*m* and *[a1 b1]...[ak bk]*).
- *a* specifies the type of real-time command.
- *b* specifies enable or disable.

[Note]
- If bit image data accidentally includes a character string with this command, it is recommended to use this command in advance to disable the real-time command.

GS (E *pL pH fn [parameter]*

[Name] Customize NV memory area

[Description] Customizes the NV user memory area. The table below explains the functions available in this command. The value of *fn* specifies the function.

m	Format	Function	
1	**GS (E *pL pH fn d1 d2***	1	Changes into the user setting mode
2	**GS (E *pL pH fn d1 d2 d3***	2	Ends the user setting mode session. (Performs a soft reset.)
3	**GS (E *pL pH fn [a1 b18...b11]*.. ..*[ak bk8....bk1]***	3	Sets value(s) for the memory switch.
4	**GS (E *pL pH fn a***	4	Transmits the settings of the memory switch to the host.
5	**GS (E *pL pH fn [a1 n1L n1H]...[ak nkL nkH]***	5	Lets you change the size of the NV user memory and the NV bit image memory. (Increasing NV user RAM decreases the NV bit image memory.)
6	**GS (E *pL pH fn a***	6	Reads back the customized value settings.

- *pL, pH* specifies (*pL* + (*pH* ×256)) as the number of bytes after *pH* (*fn and [parameter]*).
- *fn* specifies the function (1 through 6). Command operation differs depending on the function.
- *d1, d2, d3* vary, depending on the mode.
- *a* specifies the type of customized values.
- *b8...b1* specifies the setting values for the memory switch.
- *nL, nH* specifies the values to be set for the customized values specified by *a.*
- If the printer is not in the user setting mode, only Function 1, Function 4 or Function 6 is effective.
- While the printer is in the user setting mode, Function 2 though Function 6 are effective.
- The printer must be in the user setting mode before this command can change values in the NV user memory.
- In Function 2, the printer performs software reset. Therefore, the printer clears the receive and print buffers, and resets all settings (user-defined characters, macros, and the character style) to the mode that was in effect at power on.

[Notes]
- Frequent write commands to NV memory, (**FS q, GS (C, GS (E,** or **GS g 0**), may damage the NV memory. Therefore, it is recommended to write to NV memory 10 times or less a day.
- In processing this command, the printer is BUSY while writing data to the NV user memory and stops receiving data. Therefore it is prohibited to transmit data, including the real-time commands, during the execution of this command.

<Function 1> **GS (E *pL pH fn d1 d2*** (when *fn* = 1)

[Format]	ASCII	GS	(	E	*pL*	*pH*	*fn*	*d1*	*d2*
	Hex	1D	28	45	*pL*	*pH*	*fn*	*d1*	*d2*
	Decimal	29	40	69	*pL*	*pH*	*fn*	*d1*	*d2*

[Range] (*pL* + *pH* × 256) = 3 (*pL* = 3, *pH* = 0)
m = 1
d1 = 73
d2 = 78

[Description] Enters to the user setting mode and transmits the following data:

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 20H / Decimal = 32 (1 byte)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

<Function 2> **GS (E *pL pH fn d1 d2 d3*** (when *fn* = 2)

[Format]	ASCII	GS	(	E	*pL*	*pH*	*fn*	*d1*	*d2*	*d3*
	Hex	1D	28	45	*pL*	*pH*	*fn*	*d1*	*d2*	*d3*
	Decimal	29	40	69	*pL*	*pH*	*fn*	*d1*	*d2*	*d3*

[Range] (*pL* + *pH* × 256) = 4 (*pL* = 4, *pH* = 0)
m = 2
d1 = 79
d2 = 85
d3 = 84

[Description] Ends the user setting mode and performs a software reset. Therefore, the printer clears the receive and print buffers, and resets all settings (user-defined characters, downloaded bit images, macros, and the print mode) to the mode that was in effect at power on.

<Function 3> **GS (E *pL pH fn [a1 b18 n11]...[ak bk8 8k1]*** (when *fn* = 3)

[Format]

ASCII	GS	(	E	*pL*	*pH*	*fn*	*[a1 b18 n11]...[ak bk8 8k1]*
Hex	1D	28	45	*pL*	*pH*	*fn*	*[a1 b18 n11]...[ak bk8 8k1]*
Decimal	29	40	69	*pL*	*pH*	*fn*	*[a1 b18 n11]...[ak bk8 8k1]*

[Range] $10 \le (pL + pH \times 256) \le 65533$ $(0 \le pL \le 255, 0 \le pH \le 255)$
fn = 3
a = 1, 8
b = 48, 49, 50

[Description] Changes the memory switch specified by *a* to the values specified with *b*.

- When *b* = 48, the applicable bit is turned to Off.
- When *b* = 49, the applicable bit is turned to On.
- When *b* = 50, the applicable bit is not changed.

- When ***a*** =1, the memory switch 1 is set as follows:

Bit	Function	Setting value
1	Does not transmit the power ON information.	48
	Transmits the power ON information	49
2	Reserved	50
3	Reserved	50
4	Reserved	50
5	Reserved	50
6	Reserved	50
7	Reserved	50
8	Reserved	50

- Set *b* = 50 for the reserved bit(s).

- The power ON information consists of the data as follows:
  Header: Hexadecimal = 3BH / Decimal = 59 (1 byte)
  Flag: Hexadecimal = 31H / Decimal = 49 (1 byte)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- When *a* =8, memory switch 8 is set as follows:

Msw	Function	Setting value
8-1	Reserved	50
8-2	Reserved	50
8-3	Uses an 80 mm width roll paper	48
	Uses a 58 mm width roll paper	49
8-4	Uses a monochrome roll paper	48
	Uses a two-color roll paper	49
8-5	Reserved	50
8-6	Reserved	50
8-7	Slip paper jam detection: Enabled	48
	Slip paper jam detection: Disabled	49
8-8	Becomes offline if the unit is opened during printing.	48
	Becomes recoverable error even if the unit is opened during printing.	49

- Set *b* = 50 for the reserved bit(s).

<Function 4> **GS (E *pL pH fn a*** (when *fn* = 4)

[Format]

ASCII	GS	(	E	*pL*	*pH*	*fn*	*a*
Hex	1D	28	45	*pL*	*pH*	*fn*	*a*
Decimal	29	40	69	*pL*	*pH*	*fn*	*a*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2, *pH* = 0)
m = 4
a = 1, 8

[Description: Transmits the setting value(s) of the memory switch specified by ***a***.

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 21H / Decimal = 33 (1 byte)
Data: Hexadecimal = 30H or 31H / Decimal 48 or 49 (8 bytes)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- Data for the setting is transmitted as 8 bytes or a data string in the order from bit 8 to bit 1, as follows:

Off: Hexadecimal = 30H / Decimal = 48
On: Hexadecimal = 31H / Decimal = 49

<Function 5> **GS (E *pL pH fn [a1 n1L n1H]...[ak nkL nkH]*** (when *fn* = 5)

[Format]

ASCII	GS	(	E	*pL*	*pH*	*fn*	*[a1 n1L n1H]...[ak nkL nkH]*
Hex	1D	28	45	*pL*	*pH*	*fn*	*[a1 n1L n1H]...[ak nkL nkH]*
Decimal	29	40	69	*pL*	*pH*	*fn*	*[a1 n1L n1H]...[ak nkL nkH]*

[Range] $4 \le (pL + pH \times 256) \le 65533$ $(0 \le pL \le 255, 0 \le pH \le 255)$
$fn = 5$
$a = 1, 2$
$1 \le (nL + nH \times 256) \le 7$ $(1 \le nL \le 7, nH = 0)$

[Default] NV user memory capacity (a =1): 1K byte ($(nL + nH \times 256) = 1$)
NV bit image memory capacity (a =2):
For model without multilingual support:
384 KB ($(nL + nH \times 256) = 7$)
For model with multilingual support:
256 KB ($(nL + nH \times 256) = 5$)

[Description] Changes the NV memory area specified by a to the size specified with $(nL + nH \times 256)$.
When a = 1, the NV user memory size is selected as follows:

Value of $(nL + nH \times 256)$	Memory size
1	1 KB
2	64 KB
3	128 KB
4	192 KB

When a = 2, the NV user memory size is selected as follows:

Value of $(nL + nH \times 256)$	Memory size
1	None
2	64 KB
3	128 KB
4	192 KB
5	256 KB
6	320 KB
7	384 KB

- The combination that can be specified between the NV user memory capacity and the NV bit image capacity is as shown in the table below.
  Even if the printer receives an impossible combination, the printer automatically sets possible combinations for each memory size.

<For model without multilingual support>

Memory size of NV user memory	Memory size of NV bit image memory
1 KB	384 KB or less
64 KB	256 KB or less
128 KB	128 KB or less
192 KB	0

- The values set by this command become effective when the following events occur:
  - The printer executes the Function 2 of this command (recommended operation)
  - The user turns the power on again
  - The printer executes the hardware reset from the reset terminal.
- If the setting value is changed, the values in both areas (the NV user memory and the NV bit image memory) to be used are also cleared.

<Function 6> **GS (E *pL pH fn a*** (when *fn* = 6)

[Format]

ASCII	GS	(	E	*pL*	*pH*	*fn*	*a*
Hex	1D	28	45	*pL*	*pH*	*fn*	*a*
Decimal	29	40	69	*pL*	*pH*	*fn*	*a*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2, *pH* = 0)
fn = 6
a = 1, 2

[Description]
- Transmits the memory capacity of the NV memory specified by *a.*

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 27H / Decimal = 39 (1 byte)
Data: See Table below (3 bytes)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

Data (3 bytes) is formatted as follows:

When a user NV memory is specified (*a* = 1);

Setting status		Transmit data		
Value stored	Memory capacity	1st byte	2nd byte	3rd byte
1	1 KB	49	31	49
2	64 KB	49	31	50
3	128 KB	49	31	51
4 (*)	192 KB	49	31	52

When a NV bit image is specified (*a* = 2);

Setting status		Transmit data		
Value stored	Memory capacity	1st byte	2nd byte	3rd byte
1	None	50	31	49
2	64 KB	50	31	50
3	128 KB	50	31	51
4	192 KB	50	31	52
5	256 KB	50	31	53
6 (*)	320 KB	50	31	54
7 (*)	384 KB	50	31	55

(*) Effective in the model with multilingual support.

GS (G *pL pH fn m*

[Name] Select cut sheet control function

[Description] Selects the side of slip to print or feeds to the print starting position for the slip.

fn	Function	
48	1	Specifies the slip (face or back) to be printed.
84	2	Feeds to the print starting position for the slip.

- *pL*, *pH* specifies (*pL* + (*pH* × 256)) as the number of bytes after *pH* (*fn* and *m*).
- *fn* specifies the function.
- *m* specifies the command operation of each function.

<Function 1> **GS (G *pL pH fn m*** (when *fn* = 48)

[Format]

ASCII	GS	(	G	*pL*	*pH*	*fn*	*m*
Hex	1D	28	47	*pL*	*pH*	*fn*	*m*
Decimal	29	40	71	*pL*	*pH*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2, *pH* = 0)
fn = 48
m = 4, 68

[Description] Selects the paper source and the side of the slip to be printed.

- *m* specifies the side for printing as follows:

m	Function
4	Specifies the face of the slip.
68	Specifies the back of the slip.

- If the printer executes this command when the paper roll is selected, the printer enters the waiting state for inserting the slip.
- If the printer executes this command when the MICR function is selected, the MICR function becomes deselected.

<Function 2> **GS (G *pL pH fn m*** (when *fn* = 84)

[Format]	ASCII	GS	(	G	*pL*	*pH*	*fn*	*m*
	Hex	1D	28	47	*pL*	*pH*	*fn*	*m*
	Decimal	29	40	71	*pL*	*pH*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 2 (*pL* =2, *pH* = 0)
fn = 84
m = 1

[Description] Feeds to the print starting position on the currently selected paper side when slip is selected.

- When this command is executed in the state below, the printer waits for paper insertion after the current paper is ejected (including the slip removal waiting state).

  E/P is installed:
  The state when the paper is fed for approximately 92 mm {523/144"} or more after paper empty is detected by the BOF sensor.

  E/P is not installed:
  The state when the paper is fed for approximately 75 mm {425/144"} or more after paper empty is detected by the BOF sensor.

GS (L *pL pH m fn [parameter]*
GS 8 L *p1 p2 p3 p4 m fn [parameter]*

[Name] Select graphics data

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*	*[parameter]*		
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*	*[parameter]*		
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*	*[parameter]*		
ASCII	GS	8	L	*p1*	*p2*	*p3*	*p4*	*m*	*fn*	*[parameter]*
Hex	1D	38	4C	*p1*	*p2*	*p3*	*p4*	*m*	*fn*	*[parameter]*
Decimal	29	56	76	*p1*	*p2*	*p3*	*p4*	*m*	*fn*	*[parameter]*

* In the description below **GS (L** is used for the explanation.

- Note that **GS (L** and **GS 8 L** have the same Function.
- If the *[parameter]* of each format exceeds 65533 bytes use **GS 8 L**.

[Description]
- Processes graphics data according to the function code *fn*.

fn	Format	Function No.	Function
0, 48	**GS (L *pL pH m fn***	Function 48	Transmits the NV graphics memory capacity.
2, 50	**GS (L *pL pH m fn***	Function 50	Prints the graphics data in the print buffer.
3, 51	**GS (L *pL pH m fn***	Function 51	Transmits the remaining capacity of the NV graphics memory.
64	**GS (L *pL pH m fn d1 d2***	Function 64	Transmits the defined NV graphics key code list.
65	**GS (L *pL pH m fn d1 d2 d3***	Function 65	Deletes all NV graphics data.
66	**GS (L *pL pH m fn kc1 kc2***	Function 66	Deletes the specified NV graphics data.
67	**GS (L *pL pH m fn a kc1 kc2 b xL xH yL yH [c d1...dk]1...[c d1...dk]b***	Function 67	Defines the raster graphics data in the non-volatile memory.
69	**GS (L *pL pH m fn kc1 kc2 x y***	Function 69	Prints the specified NV graphics data.
112	**GS (L *pL pH m fn a bx by c xL xH yL yH d1...dk***	Function 112	Stores the raster graphics data in the print buffer memory.

- *pL*, *pH* specifies (*pL* + *pH* × 256) as the number of bytes after *pH* (*m*, *fn*, and *[parameter]*).

[Notes]
- Frequent write command executions by this command may damage the NV memory. Therefore, it is recommended to write to the NV memory no more than 10 times a day.
- While processing this command, the printer is BUSY while writing data to the NV graphics memory and stops receiving data. Therefore it is prohibited to transmit data including the real-time commands during the execution of this command.

<Function 48> **GS (L *pL pH m fn*** (*fn* = 0, 48)

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2 , *pH* = 0)
m = 48
fn = 0, 48

[Description]
- Transmits the total capacity of the NV bit-image memory (number of bytes in the memory area).

	Hexadecimal	Decimal	Amount of data
Header	37H	55	1 byte
Flag	30H	48	1 byte
Data	30H – 39H	48 – 57	1 – 8 bytes
NUL	00H	0	1 byte

- The total capacity data is converted to character codes corresponding to decimal data, then transmitted from the MSB.
- The data length is variable.
- The total capacity of the UV user memory is selectable as any one of [0, 64K, 128K, 192K, 256K, 320K, 384K] bytes with **GS (E**. The default value is 384KB.

<Function 50> **GS (L *pL pH m fn*** (*fn* = 2, 50)

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2, *pH* = 0)
m = 48
fn = 2, 50

[Description]
- This command is effective only when the paper roll is selected as a paper source.
- Prints the buffered graphics which is stored by the process of <Function 112>.
- Feeds paper by the amount corresponding to the number of dots in the *y* direction of the buffered graphics.

<Function 51> **GS (L *pL pH m fn*** (*fn* = 3, 51)

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2, *pH* = 0)
m = 48
fn = 3, 51

[Description]
- Transmits the number of bytes of remaining memory (unused area) in the NV user memory.

	Hexadecimal	Decimal	Amount of data
Header	37H	55	1 byte
Flag	31H	49	1 byte
Data	30H – 39H	48 – 57	1 – 8 bytes
NUL	00H	0	1 byte

- The number of bytes of remaining memory is converted to character codes corresponding to decimal data, then transmitted from the MSB.
- The data length is variable.

<Function 64> **GS (L *pL pH m fn d1 d2*** (*fn* = 64)

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*	*d1*	*d2*
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*	*d1*	*d2*
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*	*d1*	*d2*

[Range] (*pL* + *pH* × 256) = 4 (*pL* = 4, *pH* = 0)
m = 48
fn = 64
d1 = 75
d2 = 67

[Description]
- Transmits the defined NV graphics key code list.
  - When the key code is present:

	Hexadecimal	Decimal	Amount of data
Header	37H	55	1 byte
Flag	72H	114	1 byte
Status	40H or 41H	64 or 65	1 byte
Data	30H – 39H	48 – 57	2 – 80 bytes
NUL	00H	0	1 byte

  - When the key code is not present:

	Hexadecimal	Decimal	Amount of data
Header	37H	55	1 byte
Flag	72H	114	1 byte
Status	40H	64	1 byte
NUL	00H	0	1 byte

- If the number of the key code exceeds 40, the key code is transmitted dividing up to 40.
  - The status if the continuous transmission data block is present is 41H.
  - The status if the continuous transmission data block is not present is 40H.

- After the [Header – NUL] is transmitted, the printer receives a response from the host; then it performs the process defined by the response. (See the tables below.)

  When the status (existence of the next data block) is
  Hexadecimal = 41H / Decimal = 65

Response		Process performed
ASCII	Decimal	
ACK	6	Transmits the next data
NAK	21	Transmits the last data again
CAN	24	Ends the process

  When the status (for the last data block) is
  Hexadecimal = 40H / Decimal = 64

Response		Process performed
ASCII	Decimal	
ACK	6	Ends the process
NAK	21	Transmits the last data again
CAN	24	Cancels the process

<Function 65> **GS (L *pL pH m fn d1 d2 d3*** (*fn* = 65)

[Format]	ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*	*d1*	*d2*	*d3*
	Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*	*d1*	*d2*	*d3*
	Decimal	29	40	76	*pL*	*pH*	*m*	*fn*	*d1*	*d2*	*d3*

[Range] (*pL* + *pH* × 256) = 5 (*pL* = 5, *pH* = 0)
m = 48
fn = 65
d1 = 67
d2 = 76
d3 = 82

[Description] • Deletes all defined NV graphics data.

<Function 66> **GS (L *pL pH m fn kc1 kc2*** (*fn* = 66)

[Format]	ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*	*kc1*	*kc2*
	Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*	*kc1*	*kc2*
	Decimal	29	40	76	*pL*	*pH*	*m*	*fn*	*kc1*	*kc2*

[Range] (*pL* + *pH* × 256) = 4 (*pL* = 4, *pH* = 0)
m = 48
fn = 66
32 ≤ *kc1* ≤ 126
32 ≤ *kc2* ≤ 126

[Description] Deletes the NV graphics data defined by the key codes *kc1* and *kc2*.

<Function 67> **GS (L** ***pL pH m fn a kc1 kc2 b xL xH yL yH [c d1....dk]1… [c d1....dk]b***
(*fn* = 67)

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*	*a*	*kc1*	*kc2*	*b*
	xL	*xH*	*yL*	*yH [c d1...dk]1... [c d1...dk]b*							
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*	*a*	*kc1*	*kc2*	*b*
	xL	*xH*	*yL*	*yH [c d1...dk]1... [c d1...dk]b*							
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*	*a*	*kc1*	*kc2*	*b*
	xL	*xH*	*yL*	*yH [c d1...dk]1... [c d1...dk]b*							

[Range]

- **GS (L** parameter
  $3 \le (pL + pH \times 256) \le 65535$ ($0 \le pL \le 255$, $0 \le pH \le 255$)
- **GS 8 L** parameter
  $3 \le (p1 + p2 \times 256 + p3 \times 65536 + p4 \times 16777216) \le 4294967295$
  ($0 \le p1 \le 255$, $0 \le p2 \le 255$, $0 \le p3 \le 255$, $0 \le p4 \le 255$)
- Common parameter for **GS 8 L** / **GS (L**
  $m = 48$
  $fn = 67$
  $a = 48$
  $32 \le kc1 \le 126$
  $32 \le kc2 \le 126$
  $b = 1, 2$
  $1 \le (xL + xH \times 256) \le 8192$
  $1 \le (yL + yH \times 256) \le 2304$
  $c = 49$ (when the monochrome paper is selected)
  $c = 50$ (when the two-color paper is selected with **GS (E**)
  $0 \le d \le 255$
  $k = (\text{int}((xL + xH \times 256) + 7) /8) \times (yL + yH \times 256)$
- The total capacity of the UV user memory is selectable as any one of [0, 64K, 128K, 192K, 256K, 320K, 384K] bytes with **GS (E**. The default value is 384KB.

[Description]

- Defines the raster graphics data in the NV graphics area.
  - *b* specifies the number of the color of the defined data.
  - *xL*, *xH* specifies the defined data in the horizontal direction to ($xL + xH \times 256$) dots.
  - *yL*, *yH* specifies the defined data in the vertical direction to ($yL + yH \times 256$) dots.
  - *c* specifies the color of the defined data.

c	Defined data color
49	Color 1
50	Color 2

  - Color 1 means black (high level of energy) in the specified two-color thermal paper.
  - Color 2 means red (low level of energy) in the specified two-color thermal paper.

[Notes]
- If the color is specified with *b* and a single color also is specified with *c*, the printer stops processing the command, and regards the defined data as effective up to the time when the printer stops processing, then disregards the remaining data after it.
- When this command is processed while NV bit image data is defined with **FS q**, the printer deletes all NV bit image data, then defines data with this command.

<Function 69> **GS (L *pL pH m fn kc1 kc2 b x y*** (*fn* = 69)

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*	*kc1*	*kc2*	*x*	*y*
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*	*kc1*	*kc2*	*x*	*y*
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*	*kc1*	*kc2*	*x*	*y*

[Range]
$(pL + pH \times 256) = 6$ ($pL = 6$, $pH = 0$)
$m = 48$
$fn = 69$
$32 \leq kc1 \leq 126$
$32 \leq kc2 \leq 126$
$x = 1, 2$
$y = 1, 2$

[Description]
- Prints the NV graphics data defined by the key codes *kc1* and *kc2*. The graphics data is enlarged by *x* and *y* in the horizontal and vertical directions.

<Function 112> **GS (L *pL pH m fn a bx by c xL xH yL yH d1...dk*** (*fn* = 112)

[Format]

ASCII	GS	(	L	*pL*	*pH*	*m*	*fn*	*a*	*bx*	*by*	*c*	*xL*	*xH*	*yL*	*yH* *d1...dk*
Hex	1D	28	4C	*pL*	*pH*	*m*	*fn*	*a*	*bx*	*by*	*c*	*xL*	*xH*	*yL*	*yH* *d1...dk*
Decimal	29	40	76	*pL*	*pH*	*m*	*fn*	*a*	*bx*	*by*	*c*	*xL*	*xH*	*yL*	*yH* *d1...dk*

[Range]

- **GS (L** parameter
  $11 \le (pL + pH \times 256) \le 65535 \quad (0 \le pL \le 255, 0 \le pH \le 255)$
- **GS 8 L** parameter
  $11 \le (p1 + p2 \times 256 + p3 \times 65536 + p4 \times 16777216) \le 4294967295$
  $(0 \le p1 \le 255, 0 \le p2 \le 255, 0 \le p3 \le 255, 0 \le p4 \le 255)$
- Common parameters for **GS 8 L** / **GS (L**
  $m = 48$
  $fn = 112$
  $a = 48$
  $bx = 1, 2$
  $by = 1, 2$
  $c = 49$ (when the monochrome paper is selected)
  $c = 49, 50$ (when the two-color paper is selected with **GS (E**)
  $1 \le (xL + xH \times 256) \le 1024$

  When single-color paper is specified:
  $1 \le (yL + yH \times 256) \le 831$ (when $by = 1$)
  $1 \le (yL + yH \times 256) \le 415$ (when $by = 2$)

  When two-color paper is specified:
  $1 \le (yL + yH \times 256) \le 415$ (when $by = 1$)
  $1 \le (yL + yH \times 256) \le 207$ (when $by = 2$)

  $0 \le d \le 255$

  $k = (\text{int}((xL + xH \times 256) + 7) / 8) \times (yL + yH \times 256)$

[Description]

- Stores the raster graphics data, enlarged by *bx* and *by* in the horizontal and vertical directions to the print buffer.
  - *xL*, *xH* specifies the raster graphics data in the horizontal direction as $(xL + xH \times 256)$ dots.
  - *yL*, *yH* specifies the raster graphics data in the vertical direction as $(yL + yH \times 256)$ dots.
  - *c* specifies the color of the defined data.

c	Printing color
49	Color 1
50	Color 2

  - Color 1 means black (high level of energy) in the specified two-color thermal paper.
  - Color 2 means red (low level of energy) in the specified two-color thermal paper.
- This command is effective only when the paper roll is selected as a paper source.

[Note] • In standard mode, when the multiple graphics data are stored, the size and multiple number of each data must be equal.

GS (M *pL pH fn m*

[Name] Customize printer control value(s)

[Description] Executes the functions shown in table below, using the function code defined by *fn*.

Fn	Function No.	Function
1, 49	Function 1	Saves the setting values in the work area to the archive area.
2, 50	Function 2	Loads the setting values stored in the archive area to the work area.
3, 51	Function 3	Specifies the setting values for the work area after the initialization process.

- *pL*, *pH* specifies (*pL* + (*pH* × 256)) for the number of bytes after *pH* (*fn* and *m*).
- *fn* specifies the function.
- *m* specifies the process of each function.
- Data stored in the work area is erased by power off or reset because volatile RAM is used. On the other hand, data stored in the archive area is kept, even if the power is turned off or reset is executed, because non-volatile RAM is used. “Setting values” are the values specified or defined by commands.

Setting values	Commands to be controlled with **GS (M**
Related to printer status	**ESC c 3, FS (e, GS (B, GS a**
Macro data	**GS :**
Font type	**ESC M, ESC R, ESC t**
Font style	**ESC !, ESC –, ESC E, ESC G, ESC V, ESC {, GS !, GS B, GS b**
Bar code	**GS H, GS f, GS h, GS w**
Print position	**ESC SP, ESC 2, ESC 3, ESC D, ESC T, ESC a, GS L, GS W**
Cut sheet operation	**ESC F, ESC f**
Kanji printing	**FS !, FS &, FS ., FS 2, FS –, FS C, FS S, FS W**
MICR function	**FS (f**
2-dimensional code	**GS (k** <Function 65> through <Function 70>
Others	**ESC U, ESC c 4, ESC c 5, GS (D, GS E, GS P**

<Function 1> **GS (M *pL pH fn m*** (when *fn* = 1, 49)

[Format]	ASCII	GS	(	M	*pL*	*pH*	*fn*	*m*
	Hex	1D	28	4D	*pL*	*pH*	*fn*	*m*
	Decimal	29	40	77	*pL*	*pH*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 2, (*pL* = 2, *pH* = 0)
fn = 1, 49
m = 1, 49

[Description] Saves the setting values of commands listed in the table below and stored in the work area to the archive area.

[Note]
- Excessive use of this function may destroy the non-volatile memory. As a guideline, do not use any combination of the following commands more than 10 times paer day for writing data in the non-volatile memory: **FS q, GS (C, GS (E, GS g 0,** or **GS (M**.
- The printer may go BUSY while processing this command. The printer does not process any received data while it is BUSY. Therefore, under no circumstances should the host send data at this time.

<Function 2> **GS (M *pL pH fn m*** (when *fn* = 2, 50)

[Format]	ASCII	GS	(	M	*pL*	*pH*	*fn*	*m*
	Hex	1D	28	4D	*pL*	*pH*	*fn*	*m*
	Decimal	29	40	77	*pL*	*pH*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 2, (*pL* = 2, *pH* = 0)
fn = 2, 50
m = 0, 1, 48, 49

[Description]
- Loads the values specified with *m* as the current command settings in the work area. When *m* = 0 or 48, the default values described in this specification are applied. When *m* = 1 or 49, this command loads the setting values stored in the archive area.
- Data not listed among the above commands or data stored in the receive buffer is not affected.

<Function 3> **GS (M *pL pH fn m*** (when *fn* = 3, 51)

[Format]

ASCII	GS	(	M	*pL*	*pH*	*fn*	*m*
Hex	1D	28	4D	*pL*	*pH*	*fn*	*m*
Decimal	29	40	77	*pL*	*pH*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2, *pH* = 0)
fn = 3, 51
m = 0, 1, 48, 49

[Default] *m* = 0

[Description]
- Loads the values specified by *m* as the current command settings in the work area after the printer performs the initialization process.
  When *m* = 0 or 48, the default values described in this specification are applied.
  When *m* = 1 or 49, this command loads the setting values stored in the archive area.
- For values not listed among the above commands the default values described in this specification are applied.
- "Initialization process" is when the printer performs the following operations:
  - Power is turned on with the switch or hardware reset is performed.
  - Software reset is performed.
  - **ESC @** is executed.

GS (N *pL pH fn [parameter]*

[Name] Select character style

[Description]
- Executes commands for the character style as specified by the function code *fn*.

fn	Format	Function No.	Description
48	**GS (N *pL pH fn m***	Function 48	Selects character color.

<Function 48> GS (N *pL pH fn m* (*fn* = 48)

[Format]

ASCII	GS	(	N	*pL*	*pH*	*fn*	*m*
Hex	1D	28	4E	*pL*	*pH*	*fn*	*m*
Decimal	29	40	78	*pL*	*pH*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 2 (*pL* = 2, *pH* = 0)
fn = 48
m = 49 (when the monochrome paper is selected)
m = 50 (when the two-color paper is selected with **GS (E**)

[Default] *m* = 49

[Description]
- Prints characters in the color specified by *m*. (only for paper roll)

m	Color
49	Color 1
50	Color 2

  - Color 1 means black (high level of energy) in the specified two-color thermal paper.
  - Color 2 means red (low level of energy) in the specified two-color thermal paper.

GS (k *pL pH cn fn [parameter]*

[Name] Setup and print symbol

[Description]
- Various processes are performed according to the function code (*fn*).

cn	Type of Symbol
48	PDF417 (2-dimensional code)

fn	Code	Function	Description
65	**GS (k *pL pH cn fn n***	065	Sets the number of columns of one per (step size) of the PDF417
66	**GS (k *pL pH cn fn n***	066	Specifies PDF417 step number
67	**GS (k *pL pH cn fn n***	067	Sets PDF417 module width
68	**GS (k *pL pH cn fn n***	068	Sets PDF417 step height
69	**GS (k *pL pH cn fn m n***	069	Sets PDF417 error correction level
70	**GS (k *pL pH cn fn m***	070	Specifies PDF417 options
80	**GS (k *pL pH cn fn m d1...dk***	080	Receives and stores data (*d1...dk*) in the symbol storage area
81	**GS (k *pL pH cn fn m***	081	Prints symbol data in the symbol storage area
82	**GS (k *pL pH cn fn m***	082	Transmits the size information of the symbol data in the symbol storage area

- *pL*, *pH* specifies (*pL* + (*pH* × 256)) as the number of bytes after *pH* (*cn*, *fn*, *[parameter]*).
- *fn* specifies the function.
- "Symbol data" refers to the data received with Function 080 before encoding.
- "Symbol storage area" refers to the range for storing data received with Function 080 before encoding.

<Function 065> **GS (k *pL pH cn fn n*** (when *fn* = 65)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*n*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*n*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*n*

[Range] $(pL + pH \times 256) = 3$ $(pL = 3, pH = 0)$
$cn = 48$
$fn = 65$
$0 \leq n \leq 30$

[Default] $n = 0$

[Description] Sets the number of digits (step size) of the data area for PDF417 symbols.

- When $n = 0$, specifies automatic processing
- When $n \neq 0$, sets the number of digits of the data area to *n* codewords.
- When the automatic processing ($n = 0$) is specified, the number of columns per row is calculated with the number of codewords or the range of printable area.

[Notes] The following data is not included in the line number.

- Start and stop patterns
- Left and right indicator codewords

[Reference] Appendix J

<Function 066> **GS (k *pL pH cn fn n*** (when *fn* = 66)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*n*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*n*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*n*

[Range] $(pL + pH \times 256) = 3$ $(pL = 3, pH = 0)$
$cn = 48$
$fn = 66$
$n = 0, 3 \leq n \leq 90$

[Default] $n = 0$

[Description] Sets the step size of PDF417 symbols

- When $n = 0$, specifies automatic processing
- When $n \neq 0$, sets the height of the symbol steps to *n*.
- When the automatic processing ($n = 0$) is specified, the number of columns per row is calculated with the number of codewords or the range of printable area.

<Function 067> **GS (k *pL pH cn fn n*** (when *fn* = 67)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*n*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*n*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*n*

[Range] ($pL + pH \times 256$) = 3 (pL = 3, pH = 0)
cn = 48
fn = 67
$2 \le n \le 8$

[Default] *n* =3

[Description] Sets the dot width of one PDF417 symbol module to *n* dots.

<Function 068> **GS (k *pL pH cn fn n*** (when *fn* = 68)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*n*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*n*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*n*

[Range] ($pL + pH \times 256$) = 3 (pL = 3, pH = 0)
cn = 48
fn = 68
$2 \le n \le 8$

[Default] *n* = 3

[Description] Sets the height of one PDF417 symbol step to *n* times the module width.

- The module width is set with the Function 067 of this command.

<Function 069> **GS (k *pL pH cn fn n*** (when *fn* = 69)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*m*	*n*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*m*	*n*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*m*	*n*

[Range] ($pL + pH \times 256$) = 3 (pL = 3, pH = 0)
cn = 48
fn = 69
m = 48, 49
$48 \le n \le 56$ [when *m* = 48 is specified]
$1 \le n \le 40$ [when *m* = 49 is specified]

[Default] *m* = 49, *n* = 1 (Set to 10%)

[Description] Sets the error correction level for PDF417 symbols.

- When *m* = 48, the error correction level is set by the “Level Setting” error correction codeword.

n	Function	Error Correction Codeword
48	Select error correction level 0	2
49	Select error correction level 1	4
50	Select error correction level 2	8
51	Select error correction level 3	16
52	Select error correction level 4	32
53	Select error correction level 5	64
54	Select error correction level 6	128
55	Select error correction level 7	256
56	Select error correction level 8	512

- The value set by “Set with (*m* = 49)” is cancelled.

When *m* = 49, the error correction level is set to the level indicated by the data codeword value.

- The rate is set to [*n* × 10%].
- The value set by “Set with (*m* = 48)” is destroyed.

The error correction levels in the following table are determined by the calculation [Data codeword × *n* × 0.1 = (A)]. (round up fractions of 0.5 and over and truncate others.)

Result (A)	Error Correction Level	Error Correction Codeword
0 - 3	1	4
4 - 10	2	8
11 - 20	3	16
21 - 45	4	32
46 - 100	5	64
101 - 200	6	128
201 - 400	7	256
401 or more	8	512

<Function 070> **GS (k *pL pH cn fn m*** (when *fn* = 70)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*m*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*m*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 3 (*pL* = 3, *pH* = 0)
cn = 48
fn = 70
m = 0, 1

[Default] *m* = 0

[Description] Specify or cancel various PDF417 symbol options

- When *m* = 0, the simple PDF417 symbol processing is cancelled and the standard PDF417 symbol processing is specified.
- When *m* = 1, the simple PDF417 symbol processing is specified.

<Function 080> **GS (k *pL pH cn fn m d1…dk*** (when *fn* = 80)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*m*	*d1…dk*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*m*	*d1…dk*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*m*	*d1…dk*

[Range] 4 ≤ (*pL* + (*pH* × 256)) ≤ 65535 (0 ≤ *pL* ≤ 255, 0 ≤ *pH* ≤ 255)
cn = 48
fn = 80
m = 48
0 ≤ *d* ≤ 255
k = (*pL* + (*pH* × 256)) – 3

[Description] Writes symbol data (*d1...dk*) in the PDF417 symbol storage area.

- Bytes of ((*pL* + (*pH* × 256)) – 3) after d1 are processed as symbol data. Received symbol data is stored raw in the symbol storage area (unencoded).

<Function 081> **GS (k *pL pH cn fn m*** (when *fn* = 81)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*m*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*30*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*48*

[Range] (*pL* + *pH* × 256) = 3 (*pL* = 3, *pH* = 0)
cn = 48
fn = 81
m = 48

[Description] Encodes and prints symbol data in the symbol storage area.

If the printer is in either of the following conditions during processing this command, the symbol printing cannot be performed and the printer does not work:

- No symbol data in symbol storage area
- In standard mode, when this command is executed while the data is still remaining in the print buffer.
- Number of codewords in the data area exceeds 928.
- When the number of columns and rows is not automatically processed, that is, (number of columns × number of rows) < number of codewords.
- When the number of columns is automatically processed, the data in the data area cannot be printed because of lack of the print area.

If the symbol size is larger than the printable area, the printer processes the followings without printing.

Status	Standard mode	Page mode
Print area	Horizontal direction: Specified with the setting values and printing position by **GS L** and **GS W**. Vertical direction: 831 dots	Horizontal direction: Specified with the setting values and printing position by **ESC W**. Vertical direction: Specified with the setting values and printing position by **ESC W**.
Operation	Paper feeds for 3 rows spacing of the symbol	Printing position moves to the buffer-full position.

- This command is ignored when the slip is selected as a paper source.
- User must consider that the quiet zone of the PDF417 symbols (Upward and downward spaces and left and right spaces of the PDF417 symbols which are specified with the specifications of the PDF417 symbols.)

<Function 082> **GS (k *pL pH cn fn m*** (when *fn* = 82)

[Format]

ASCII	GS	(	k	*pL*	*pH*	*cn*	*fn*	*m*
Hex	1D	28	6B	*pL*	*pH*	*cn*	*fn*	*m*
Decimal	29	40	107	*pL*	*pH*	*cn*	*fn*	*m*

[Range] (*pL* + *pH* × 256) = 3 (*pL* = 3, *pH* = 0)
cn = 48
fn = 82
m = 48

[Description] Sends the size of the encoded symbol data in the symbol storage area.
The basic types of symbol size information are as follows:

Sent data	Hex	Decimal	Data Size
① Header	37H	55	1 byte
② Flag	2FH	47	1 byte
③ Width	30H - 39H	48 - 57	1 - 5 bytes
④ Separator	1FH	31	1 byte
⑤ Height	30H - 39H	48 - 57	1 - 5 bytes
⑥ Separator	1FH	31	1 byte
⑦ Fixed Value	31H	49	1 byte
⑧ Separator	1FH	31	1 byte
⑨ Other Information	30H or 31H	48 or 49	1 byte
⑩ NUL	00H	0	1 byte

Description of ③ Width and ⑤ Height sending data:

- The height and width values of the symbol data are in dot units.

Description of ⑨ Other Information sending data:

[30H (48)] indicates that the data is printable.
[31H (49)] indicates that the data is not printable.

The relationship between the processing of this function and symbol size information is as follows.

Cause of the impossible to print	Width/Height size information
No symbol data in symbol storage area	Both (Width/Height) 0
In standard mode, when this command is executed while the data is still remaining in the print buffer.	Both (Width/Height) 0
Number of codewords in the data area exceeds 928.	Both (Width/Height) 0
When the number of columns and rows is automatically processed. ((number of columns × number of rows) < number of codewords.)	Both (Width/Height) 0
When the number of columns is automatically processed, the data in the data area cannot be printed, because of lack of the print area.	Both (Width/Height) 0
When the symbol size exceeds the print area.	Symbol size

[Notes]
- This command is ignored when the slip is selected as a paper source.
- User must consider that the quiet zone of the PDF417 symbols (Upward and downward spaces and left and right spaces of the PDF417 symbols which are specified with the specifications of the PDF417 symbols.)

GS ∗ *x y d1...dk*

[Name] Define downloaded bit image

[Format]

ASCII	GS	∗	*x*	*y*	*d1...dk*
Hex	1D	2A	*x*	*y*	*d1...dk*
Decimal	29	42	*x*	*y*	*d1...dk*

[Range]
$1 \le x \le 255$
$1 \le y \le 48$, where $1 \le x \times y \le 1536$ (for paper roll)
$1 \le y \le 255$, where $1 \le x \times y \le 512$ (for slip paper (face))
$0 \le d \le 255$
$k = x \times y \times 8$

[Description] Defines the downloaded bit image using the number of dots specified by *x* and *y* for the currently selected paper source.
- *x* specifies the number of dots in the horizontal direction as *x* byte(s).
- *y* specifies the number of dots in the vertical direction as *y* byte(s).
- *d* specifies the bit image data.

[Notes]
- A downloaded bit image and user-defined characters cannot be defined simultaneously.
- Downloaded bit image on slip affects printing on the face of the slip.

GS / *m*

[Name] Print downloaded bit image

[Format]

ASCII	GS	/	*m*
Hex	1D	2F	*m*
Decimal	29	47	*m*

[Range] <When the paper roll is selected>
$0 \le m \le 3, 48 \le m \le 51$

<When the face of a slip is selected>
m = 0, 1, 48, 49 (when standard mode is selected)
m = 1, 49 (when page mode is selected)

[Description] Prints a downloaded bit image on the currently selected paper source.

- *m* specifies bit image mode.

When the paper roll is selected:

m	Mode	Vertical Dot Density	Horizontal Dot Density
0, 48	Normal	180 dpi	180 dpi
1, 49	Double-width	180 dpi	90 dpi
2, 50	Double-height	90 dpi	180 dpi
3, 51	Quadruple	90 dpi	90 dpi

When the face of slip paper is selected:

m	Mode	Vertical Dot Density	Horizontal Dot Density
0, 48	Normal	72 dpi	160 dpi
1, 49	Double-width	72 dpi	80 dpi

[dpi: dots per inch {number of dots per 25.4 mm}]

GS :

[Name] Start/end macro definition

[Format]

ASCII	GS	:
Hex	1D	3A
Decimal	29	58

[Description] Starts or ends macro definition.

- The contents of the macro can be defined up to 2048 bytes.

GS B *n*

[Name] Turn white/black reverse printing mode on/off

[Format]

ASCII	GS	B	*n*
Hex	1D	42	*n*
Decimal	29	66	*n*

[Range] $0 \le n \le 255$

[Default] $n = 0$

[Description] Turns white/black reverse printing mode on or off on the paper roll.

- When the LSB of *n* is 0, white/black reverse mode is turned off.
- When the LSB of *n* is 1, white/black reverse mode is turned on.

GS E *n*

[Name] Select head control method

[Format]

ASCII	GS	E	*n*
Hex	1D	45	*n*
Decimal	29	69	*n*

[Range] $0 \le n \le 255$

[Default] $n = 1$

[Description] Selects head control method for the face of a slip.

- *n* specifies the head control method as follows:

LSB of *n*	Head Control Method
0	Head energizing time: Copy
1	Head energizing time: Normal

GS H *n*

[Name] Select printing position for HRI characters

[Format]

ASCII	GS	H	*n*
Hex	1D	48	*n*
Decimal	29	72	*n*

[Range] $0 \le n \le 3, 48 \le n \le 51$

[Default] $n = 0$

[Description] Selects the printing position of HRI (Human Readable Interpretation) characters when printing a barcode.

- *n* selects the execution of printing and the printing position as follows:

n	Printing position
0, 48	Not printed
1, 49	Above the barcode
2, 50	Below the barcode
3, 51	Both above and below the barcode

GS I *n*

[Name] Transmit printer ID

[Format]

ASCII	GS	I	*n*
Hex	1D	49	*n*
Decimal	29	73	*n*

[Range] $1 \le n \le 3, 49 \le n \le 51, 65 \le n \le 69, n = 112$

[Description] Transmits the printer ID specified.

- *n* specifies the types of the printer ID.

n	Printer ID type	ID
1, 49	Printer model ID	Hexadecimal: 24H Decimal: 36
2, 50	Type ID	See table below.
3, 51	Firmware version ID	Depends on firmware version.

- *n* specifies the printer information.

n	Printer ID type	ID
65	Firmware version	Depends on firmware version
66	Manufacturer	EPSON
67	Printer name	TM-H6000II
68	Product ID	Serial number
69	Supporting multilingual	Japanese kanji model: KANJI JAPANESE Chinese kanji model: CHINA GB2312 Taiwanese kanji model: TAIWAN BIG-5 Korean kanji model: KOREA C-5601C Thai character model: THAI 3 PASS
112	Status of DIP switches	See 'DIP switch status information' on the next sheets

[Type ID]

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Two-byte code character (kanji) not supported.
	On	01	1	Two-byte code character (kanji) supported.
1	On	02	2	Autocutter installed.
2	Off	00	0	DIP switch 2-2 is set to Off.
	On	04	4	DIP switch 2-2 is set to On.
3	Off	00	0	MICR reader not installed.
	On	08	8	MICR reader installed.
4	Off	00	0	Fixed.
5	Off	00	0	Reserved.
6	Off	00	0	Endorsement printer not installed.
	On	40	64	Endorsement printer installed.
7	Off	00	0	Fixed.

- When the printer ID transmission is specified by ($1 \leq n \leq 3$) or ($49 \leq n \leq 51$), a one-byte code is transmitted.
- When the printer information is specified by ($65 \leq n \leq 69$), the following are transmitted:

  Header: Hexadecimal = 5FH / Decimal = 95 (1 byte)
  Data: Printer information
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)
- The DIP switch status information consists of four bytes and is transmitted to the host computer.

1st byte of DIP switch status information

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	DIP SW 1-1: Off
	On	01	1	DIP SW 1-1: On
1	Off	00	0	DIP SW 1-2: Off
	On	02	2	DIP SW 1-2: On
2	Off	00	0	DIP SW 1-3: Off
	On	04	4	DIP SW 1-3: On
3	Off	00	0	DIP SW 1-4: Off
	On	08	8	DIP SW 1-4: On
4	Off	00	0	Reserved.
5	Off	00	0	Reserved.
6	On	40	64	Fixed.
7	Off	00	0	Reserved.

2nd byte of DIP switch status information

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	DIP SW 1-5: Off
	On	01	1	DIP SW 1-5: On
1	Off	00	0	DIP SW 1-6: Off
	On	02	2	DIP SW 1-6: On
2	Off	00	0	DIP SW 1-7: Off
	On	04	4	DIP SW 1-7: On
3	Off	00	0	DIP SW 1-8: Off
	On	08	8	DIP SW 1-8: On
4	Off	00	0	Reserved.
5	Off	00	0	Reserved.
6	On	40	64	Fixed.
7	Off	00	0	Fixed.

3rd byte of DIP switch status information

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	DIP SW 2-1: Off
	On	01	1	DIP SW 2-1: On
1	Off	00	0	DIP SW 2-2: Off
	On	02	2	DIP SW 2-2: On
2	Off	00	0	DIP SW 2-3: Off
	On	04	4	DIP SW 2-3: On
3	Off	00	0	DIP SW 2-4: Off
	On	08	8	DIP SW 2-4: On
4	Off	00	0	Reserved.
5	Off	00	0	Reserved.
6	On	40	64	Fixed.
7	Off	00	0	Fixed.

4th byte of DIP switch status information

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	DIP SW 2-5: Off
	On	01	1	DIP SW 2-5: On
1	Off	00	0	Reserved.
2	Off	00	0	Reserved.
3	Off	40	0	Reserved
4	Off	00	0	Reserved.
5	Off	00	0	Reserved.
6	On	40	64	Fixed.
7	Off	00	0	Fixed.

[Notes]

- The printer transmits [Header + Data + NUL] collectively without confirming whether the host is ready to receive data. To receive all data results correctly, the host needs on adequate capacity in the receive buffer.
- During data transmission, the printer ignores real-time commands. Also, the printer does not transmit ASB even when the ASB is enabled. Therefore, the user cannot confirm changes in the printer status during these periods.

GS L *nL nH*

[Name] Set left margin

[Format]

ASCII	GS	L	*nL*	*nH*
Hex	1D	4C	*nL*	*nH*
Decimal	29	76	*nL*	*nH*

[Range] $0 \le (nL + nH \times 256) \le 65535$ $(0 \le nL \le 255, 0 \le nH \le 255)$ (default)
$(nL + nH \times 256) = 0$ $(nL = 0, nH = 0)$

[Description] Sets the left margin to [$(nL + nH \times 256) \times$ horizontal motion units)] inches.

- This command only affects printing on a paper roll and the face of a slip.

GS P *x y*

[Name] Set horizontal and vertical motion units

[Format]

ASCII	GS	P	*x*	*y*
Hex	1D	50	*x*	*y*
Decimal	29	80	*x*	*y*

[Range] $0 \le x \le 255$
$0 \le y \le 255$

[Default] For paper roll: $x = 180, y = 360$
For the face of slip paper: $x = 160, y = 144$

[Description] Sets the horizontal and vertical motion units to approximately 25.4/*x* mm {1/*x* inches} and approximately 25.4/*y* mm {1/*y* inches}, respectively.

- This command affects only printing on a paper roll and the face of a slip.
- When *x* and *y* are set to 0, the default setting of each value is used.

GS T *n*

[Name] Set print position to the beginning of print line

[Format]

ASCII	GS	T	*n*
Hex	1D	54	*n*
Decimal	29	84	*n*

[Range] *n* = 0, 1, 48, 49

[Description] Sets the print position to the beginning of the print line.

- *n* specifies how data in the print buffer is processed when this command is executed.

n	Function
0, 48	Sets the print position after the data in the print buffer is deleted.
1, 49	Sets the print position after the data in the print buffer is printed.

① GS V *m* ② GS V *m n*

[Name] Select cut mode and cut paper

[Format]

①	ASCII	GS	V	*m*	
	Hex	1D	56	*m*	
	Decimal	29	86	*m*	
②	ASCII	GS	V	*m*	*n*
	Hex	1D	56	*m*	*n*
	Decimal	29	86	*m*	*n*

[Range] ① *m* = 0, 1, 48, 49
② *m* = 65, 66, 0 ≤ *n* ≤ 255

[Description] ① Cuts the paper completely.

② Feeds paper (cutting position + [*n* × vertical motion units]), and cuts the paper completely.

- *n* specifies the paper feeding amount.

GS W *nL nH*

[Name] Set printing area width

[Format]

ASCII	GS	W	*nL*	*nH*
Hex	1D	57	*nL*	*nH*
Decimal	29	87	*nL*	*nH*

[Range] $0 \le (nL + nH \times 256) \le 65535$ $(0 \le nL \le 255, 0 \le nH \le 255)$

[Default] For paper roll: $(nL + nH \times 256) = 512$ $(nL = 0, nH = 2)$
For the face of slip paper: $(nL + nH \times 256) = 540$ $(nL = 28, nH = 2)$

[Description] Sets the current printing area width to [$(nL + nH \times 256) \times$ horizontal motion units]].

- This command affects only printing on a paper roll and the face of a slip.

GS \ *nL nH*

[Name] Set relative vertical print position in page mode

[Format]

ASCII	GS	\	*nL*	*nH*
Hex	1D	5C	*nL*	*nH*
Decimal	29	92	*nL*	*nH*

[Range] $-32768 \le (nL + nH \times 256) \le 32767$ $(0 \le nL \le 255, -128 \le nH \le 127)$

[Description] Sets the relative vertical print starting position from the current position in page mode.

- This command sets the distance from the current position to [$(nL + nH \times 256) \times$ vertical or horizontal motion units] inches.
- When $(nL + nH \times 256)$ is positive number, the print movement is specified for the downward.
- When $(nL + nH \times 256)$ is negative number, the print movement is specified for the upward.

GS ^ *r t m*

[Name] Execute macro

[Format]

ASCII	GS	^	*r*	*t*	*m*
Hex	1D	5E	*r*	*t*	*m*
Decimal	29	94	*r*	*t*	*m*

[Range] $0 \le r \le 255$
$0 \le t \le 255$
$m = 0, 1$

[Description] Executes a macro.

- *r* specifies the number of times to execute the macro.
- *t* specifies the waiting time for executing the macro.
- *m* specifies macro executing mode from the table below.

m	Function
0	Executes the macro *r* times continuously at an interval of [$t \times 100$ ms].
1	After waiting for [$t \times 100$ ms], blinks the LED indicator and waits for the FEED button to be pressed. After the button is pressed, executes the macro once. Then it repeats the operation *r* times.

- Processing is in a waiting state when *m* =1 is set for this command; it is equivalent to the process when the FEED button is pressed once when the **DLE ENQ** command is sent during macro execution.

GS a *n*

[Name] Enable/Disable Automatic Status Back (ASB)

[Format]

ASCII	GS	a	*n*
Hex	1D	61	*n*
Decimal	29	97	*n*

[Range] $0 \le n \le 255$

[Default] *n* = 0 when DIP SW 2-1 is Off, *n* = 2 when DIP SW 2-1 is On.

[Description] Enables or disables ASB (Automatic Status Back) and specifies the status items to include.

- *n* specifies the status for ASB.

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Drawer kick-out connector status disabled.
	On	01	1	Drawer kick-out connector status enabled.
1	Off	00	0	Online/offline status disabled.
	On	02	2	Online/offline status enabled.
2	Off	00	0	Error status disabled.
	On	04	4	Error status enabled.
3	Off	00	0	Paper roll sensor status disabled.
	On	08	8	Paper roll sensor status enabled.
4	Off	00	0	Reserved.
5	Off	00	0	Slip paper sensor status disabled.
	On	20	32	Slip paper sensor status enabled.
6	Off	00	0	Panel button status disabled.
	On	40	64	Panel button status enabled.
7	Off	00	0	Reserved.

- The status to be transmitted is the four bytes that follow:

First byte (printer information)

Bit	Off/On	Hex	Decimal	Function
0, 1	Off	00	0	Fixed.
2	Off	00	0	Drawer kick-out connector pin 3 is LOW.
	On	04	4	Drawer kick-out connector pin 3 is HIGH.
3	Off	00	0	Online.
	On	08	8	Offline.
4	On	10	16	Fixed.
5	Off	00	0	Cover is closed.
	On	20	32	Cover is open.
6	Off	00	0	Paper is not being fed by using the paper FEED button.
	On	40	64	Paper is being fed by using the paper FEED button.
7	Off	00	0	Fixed.

Second byte (printer information)

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Not in online waiting status.
	On	01	1	During online waiting status.
1	Off	00	0	Paper FEED button is turned Off.
	On	02	2	Paper FEED button is turned On.
2	Off	00	0	No mechanical error.
	On	04	4	Mechanical error has occurred.
3	Off	00	0	No autocutter error.
	On	08	8	Autocutter error occurred.
4	Off	00	0	Fixed.
5	Off	00	0	No unrecoverable error.
	On	20	32	Unrecoverable error has occurred.
6	Off	00	0	No automatically recoverable error.
	On	40	64	Automatically recoverable error has occurred.
7	Off	00	0	Fixed.

Third byte (paper sensor information)

Bit	Off/On	Hex	Decimal	Function
0, 1	Off	00	0	Paper roll near-end sensor: paper adequate.
	On	01	1	Paper roll near-end sensor: paper near end.
2, 3	Off	00	0	Paper roll end sensor: paper present.
	On	04	4	Paper roll end sensor: paper not present.
4	Off	00	0	Fixed.
5	Off	00	0	TOF sensor: paper present.
	On	20	32	TOF sensor: paper not present.
6	Off	00	0	BOF sensor: paper present.
	On	40	64	BOF sensor: paper not present.
7	Off	00	0	Fixed.

Fourth byte (paper sensor information)

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Slip is selected.
	On	01	1	Slip is not selected.
1	Off	00	0	Can print on slip.
	On	02	2	Cannot print on slip.
2, 3	-	-	-	Reserved.
4	Off	00	0	Fixed.
5, 6	-	-	-	Reserved.
7	Off	00	0	Fixed.

[Description]
- If any of the status items in the table above are enabled, the printer transmits four bytes of the status when this command is executed.
- The printer automatically transmits the status whenever the enabled status item changes.

[Note] The ASB is transmitted without confirming whether the host is ready to receive data.

GS b *n*

[Name] Turns smoothing mode on/off

[Format]

ASCII	GS	b	*n*
Hex	1D	62	*n*
Decimal	29	98	*n*

[Range] $0 \le n \le 255$

[Default] *n* = 0

[Description] Turns smoothing mode on or off for the quadruple or larger sizes of the characters on the paper roll.

When the LSB of *n* is 0, smoothing mode is turned off.

When the LSB of *n* is 1, smoothing mode is turned on.

GS f *n*

[Name] Select font for HRI characters

[Format]

ASCII	GS	f	*n*
Hex	1D	66	*n*
Decimal	29	102	*n*

[Range] *n* = 0, 1, 48, 49

[Default] *n* =0

[Description] Selects a font for the HRI (Human Readable Interpretation) characters used when printing a barcode.

- *n* specifies the font of the HRI characters as follows:

n	Font
0, 48	Font A
1, 49	Font B

GS g 0 *m nL nH*

[Name] Initialize maintenance counter

[Format]

ASCII	GS	g	0	*m*	*nL*	*nH*
Hex	1D	67	30	*m*	*nL*	*nH*
Decimal	29	103	48	*m*	*nL*	*nH*

[Range] $m = 0$

$10 \le (nL + nH \times 256) \le 70 \quad (10 \le nL \le 70, nH = 0)$

[Description] Set the specified resettable maintenance counter to 0.

- *m* is always set to 0.
- *nL*, *nH* set the maintenance counter number to (*nL*+(*nH*×256)).

Counter number		Counter
Hex	Decimal	
0A	10	Number of line feeds (for slip).
0B	11	Number of printed characters (for the face of slip).
14	20	Number of feeding lines (for paper roll).
15	21	Number of energizing head (for paper roll).
28	40	Number of coming and going head (for the back of slip).
29	41	Number of printed characters (for the back of slip).
32	50	Number of autocutter operations.
3C	60	Number of MICR reads.
46	70	Period of printer operation.

[Note]

- Frequent write commands by NV memory write commands (**FS q, GS (C, GS (E,** or **GS g 0**) may damage the NV memory. Therefore, it is recommended to write to the NV memory 10 times or less a day.

GS g 2 *m nL nH*

[Name] Transmit maintenance counter value

[Format]

ASCII	GS	g	2	*m*	*nL*	*nH*
Hex	1D	67	32	*m*	*nL*	*nH*
Decimal	29	103	50	*m*	*nL*	*nH*

[Range] $m = 0$

$10 \le (nL + nH \times 256) \le 198 \quad (10 \le nL \le 198, nH = 0)$

[Description] Transmits the value of the specified maintenance counter.

- *nL*, *nH* specify the maintenance counter number as (*nL*+(*nH*×256)).

Counter number		Counter	Type of maintenance counter
Hex	Decimal		
0A	10	Number of line feeds (for slip).	Resettable
0B	11	Number of printed characters (for the face of slip).	Resettable
14	20	Number of feeding lines (for paper roll).	Resettable
15	21	Number of times energizing head (for paper roll).	Resettable
28	40	Number of coming and going head (for the back of slip).	Resettable
29	41	Number of printed characters (for the back of slip).	Resettable
32	50	Number of autocutter operations.	Resettable
3C	60	Number of MICR reads.	Resettable
46	70	Period of printer operation	Resettable
8A	138	Number of feeding lines (for slip).	Non-resettable
8B	139	Number of printed characters (for the face of slip).	Non-resettable
94	148	Number of times feeding lines (for paper roll).	Non-resettable
95	149	Number of energizing head (for paper roll).	Non-resettable
A8	168	Number of coming and going head (for the back of slip).	Non-resettable
A9	169	Number of printed characters (for the back of slip).	Non-resettable
B2	178	Number of autocutter operations.	Non-resettable
BC	188	Number of MICR reads.	Non-resettable
C6	198	Period of printer operation.	Non-resettable

- The contents of [Header + DATA + NUL] are as follows:
  Header: Hexadecimal = 5FH / Decimal = 95 (1 byte)
  Data: Value of counters
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

[Notes]

- The printer transmits [Header + Data + NUL] collectively without confirming whether the host is ready to receive data. To receive all data correctly, adequate capacity is required in the receive buffer of the host.
- During data transmission, the printer ignores the real-time commands. Also, the printer does not transmit ASB even when the ASB is enabled. Therefore, the user cannot confirm changes in the printer status during these periods.
- The counter values may be different from actual counting depending on the time difference or the error occuring.

GS h *n*

[Name]	Select barcode height			
[Format]	ASCII	GS	h	*n*
	Hex	1D	68	*n*
	Decimal	29	104	*n*
[Range]	$1 \leq n \leq 255$			
[Default]	$n = 162$			
[Description]	Selects the height of the barcode as *n* dots.			

① GS k *m d1...dk NUL* ② GS k *m n d1...dn*

[Name] Print barcode

[Format]

①	ASCII	GS	k	*m*	*d1...dk*	*NUL*
	Hex	1D	6B	*m*	*d1...dk*	*00*
	Decimal	29	107	*m*	*d1...dk*	*0*
②	ASCII	GS	k	*m*	*n*	*d1...dn*
	Hex	1D	6B	*m*	*n*	*d1...dn*
	Decimal	29	107	*m*	*n*	*d1...dn*

[Range] ① $0 \le m \le 6$ (*k* and *d* depend on the barcode system used)

② $65 \le m \le 73$ (*n* and *d* depend on the barcode system used)

[Description] Selects a barcode system and prints the barcode.

m		Bar Code System	Number of Characters	Remarks
①	0	UPC-A	$11 \le k \le 12$	$48 \le d \le 57$
	1	UPC-E	$11 \le k \le 12$	$48 \le d \le 57$
	2	JAN13 (EAN13)	$12 \le k \le 13$	$48 \le d \le 57$
	3	JAN 8 (EAN8)	$7 \le k \le 8$	$48 \le d \le 57$
	4	CODE39	$1 \le k$	$48 \le d \le 57$, $65 \le d \le 90$ *d* = 32,36,37,42,43,45,46,47
	5	ITF	$1 \le k$ (even number)	$48 \le d \le 57$
	6	CODABAR (NW7)	$1 \le k$	$48 \le d \le 57$, $65 \le d \le 68$ *d* = 36,43,45,46,47,58
②	65	UPC-A	$11 \le n \le 12$	$48 \le d \le 57$
	66	UPC-E	$11 \le n \le 12$	$48 \le d \le 57$
	67	JAN13 (EAN13)	$12 \le n \le 13$	$48 \le d \le 57$
	68	JAN 8 (EAN8)	$7 \le n \le 8$	$48 \le d \le 57$
	69	CODE39	$1 \le n \le 255$	$48 \le d \le 57$, $65 \le d \le 90$ *d* = 32,36,37,42,43,45,46,47
	70	ITF	$2 \le n \le 255$ (even number)	$48 \le d \le 57$
	71	CODABAR (NW7)	$1 \le n \le 255$	$48 \le d \le 57$, $65 \le d \le 68$ *d* = 36,43,45,46,47,58
	72	CODE93	$1 \le n \le 255$	$0 \le d \le 127$
	73	CODE128	$2 \le n \le 255$	$0 \le d \le 127$

- *m* selects a barcode system.
- *n* specifies the amount of barcode data to be printed.
- *d* specifies the barcode data.

[Notes]
- This command is ignored when the slip paper is selected as a paper source.
- This command is ignored if the page mode is specified when the face of the slip is selected as a paper source.
- Consider that a quiet zone (left or right side space area according to barcode specifications) must be ensured for a barcode printing.

[Reference] Appendix I

GS r *n*

[Name] Transmit status

[Format]

ASCII	GS	r	*n*
Hex	1D	72	*n*
Decimal	29	114	*n*

[Range] $1 \le n \le 3$, $49 \le n \le 51$, $n = 80$

[Description] Transmits the status specified by *n* as follows:

n	Function
1, 49	Transmits paper sensor status. See table below.
2, 50	Transmits drawer kick-out connector status.
3, 51	Transmits slip status.
80	Transmits the remaining print area on a slip in dots.

- The status types to be transmitted are shown in the tables below:

Paper sensor status (*n* = 1, 49):

Bit	Off/On	Hex	Decimal	Function
0, 1	Off	00	0	Paper roll near-end sensor: paper adequate.
	On	01	1	Paper roll near-end sensor: paper near end.
2, 3	Off	00	0	Paper roll end sensor: paper adequate.
	On	04	4	Paper roll end sensor: paper near end.
4	Off	00	0	Fixed.
5	Off	00	0	TOF sensor: paper present.
	On	20	32	TOF sensor: paper not present.
6	Off	00	0	BOF sensor: paper present.
	On	40	64	BOF sensor: paper not present.
7	Off	00	0	Fixed.

Drawer kick-out connector status (*n* = 2, 50):

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Drawer kick-out connector pin 3 is LOW.
	On	01	1	Drawer kick-out connector pin 3 is HIGH.
1-3	Off	00	0	Reserved.
4	Off	00	0	Fixed.
5, 6	Off	00	0	Reserved.
7	Off	00	0	Fixed.

Slip Status (*n* = 3, 51)

The remaining print area (the number of dots in the vertical direction for one character) is transmitted using values from the table below:

<When the face of a slip is selected>

The number of remaining dots	Slip status	
	Hex	Decimal
Impossible to print on the slip or 0 - 8	00	0
9 - 17	01	1
18 - 26	02	2
27 - 35	03	3
36 - 44	04	4
45 - 53	05	5
⋮	⋮	⋮
135 or more	0F	15

When slip is not selected, the status becomes 00H.

<When the back of a slip is selected>

The number of remaining dots	Slip status	
	Hex	Decimal
Impossible to print on the slip or 0 - 6	00	0
7 - 13	01	1
14 - 20	02	2
21- 27	03	3
⋮	⋮	⋮
105 or more	0F	15

Slip dot status (*n* = 80)

The remaining print area in slip printing is transmitted as a number of dots based on the normal dot pitch.

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 2BH / Decimal = 43 (1byte)
Number of dots: Hexadecimal = 30H–39H / Decimal = 48–57 (1~4 bytes)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

If slip is not selected or printing is not enabled, the number of dots is set to 0.

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 2BH / Decimal = 43 (1byte)
Number of dots: Hexadecimal = 30H / Decimal = 48 (1 byte)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

If paper is detected by the BOF sensor when the face of a slip is selected, the number of dots is set to 9999.

Header: Hexadecimal = 37H / Decimal = 55 (1 byte)
Flag: Hexadecimal = 2BH / Decimal = 43 (1byte)
Numbers of dots: Hexadecimal = 39H, 39H, 39H, 39H,
Decimal = 57, 57, 57, 57 (4 bytes)
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

GS v 0 *m xL xH yL yH d1....dk*

[Name] Print raster bit image

[Format]

ASCII	GS	v	0	*m*	*xL*	*xH*	*yL*	*yH*	*d1...dk*
Hex	1D	76	30	*m*	*xL*	*xH*	*yL*	*yH*	*d1...dk*
Decimal	29	118	48	*m*	*xL*	*xH*	*yL*	*yH*	*d1...dk*

[Range] $0 \le m \le 3, 48 \le m \le 51$ (when the paper roll is selected)
$m = 0, 1, 48, 49$ (when the slip paper (face) is selected in the standard mode)
$m = 1, 49$ (when the slip paper (back) is selected in the page mode)
$1 \le (xL + xH \times 256) \le 128 \quad (1 \le xL \le 128, xH = 0)$
$1 \le (yL + yH \times 256) \le 4095 \quad (0 \le yL \le 255, 0 \le yH \le 15)$
$0 \le d \le 255$
$k = (xL + xH \times 256) \times (yL + yH \times 256)$

[Description] Selects a raster bit image mode for printing on a paper roll or the face of a slip.

- *m* specifies a bit image mode.

When the paper roll is selected:

m	Mode	Vertical Dot Density	Horizontal Dot Density
0, 48	Normal	180 dpi	180 dpi
1, 49	Double-width	180 dpi	90 dpi
2, 50	Double-height	90 dpi	180 dpi
3, 51	Quadruple	90 dpi	90 dpi

When the face of slip paper is selected:

m	Mode	Vertical Dot Density	Horizontal Dot Density
0, 48	Normal	72 dpi	160 dpi
1, 49	Double-width	72 dpi	80 dpi

[dpi: dots per inch (number of dots per 25.4 mm)]

- *xL*, *xH* specifies $(xL + xH \times 256)$ byte(s) in the horizontal direction for the bit image.
- *yL*, *yH* specifies $(yL + yH \times 256)$ dot(s) in the vertical direction for the bit image.
- *d* specifies the definition data of the bit image.

GS w *n*

[Name] Set barcode width

[Format]

ASCII	GS	w	*n*
Hex	1D	77	*n*
Decimal	29	119	*n*

[Range] $2 \leq n \leq 6$

[Default] $n = 3$

[Description] Set the horizontal size of the barcode, using *n* as follows:

When the paper roll is selected as a paper source:

n	Multi-level Bar Code	Binary-level Bar Code	
	Module Width (mm)	Thin element width (mm)	Thick element width (mm)
2	0.282	0.282	0.706
3	0.423	0.423	1.129
4	0.564	0.564	1.411
5	0.706	0.706	1.834
6	0.847	0.847	2.258

When the face of slip is selected as a paper source:

n	Multi-level Bar Code	Binary-level Bar Code	
	Module Width (mm)	Thin element width (mm)	Thick element width (mm)
2	0.635	0.635	1.588
3	0.953	0.953	2.540
4	1.270	1.270	3.175
5	1.588	1.588	4.128
6	1.905	1.905	5.080

[Notes]

- Multi-level barcodes are as follows:
  UPC-A, UPC-E, JAN13 (EAN13), JAN8 (EAN8), CODE93, CODE128
- Binary-level barcodes are as follows:
  CODE39, ITF, CODABAR

6.4 MICR Control Commands (only for printers with MICR)

DLE EOT BS *n*

[Name] Transmit real-time MICR status

[Format]

ASCII	DLE	EOT	BS	*n*
Hex	10	04	08	*n*
Decimal	16	4	8	*n*

[Range] *n* = 1

[Description] Transmits the selected MICR status specified by *n* in real time as follows:

n	Function
1	Transmit MICR status

- The status information to be transmitted is shown in the following table.

n = 1: MICR status

Bit	Off/On	Hex	Decimal	Status
0	Off	-	-	Fixed.
1	On	-	-	Fixed.
2	Off	00	0	MICR function selected.
	On	04	4	MICR function not selected.
3	Off	00	0	Does not wait for check paper or cleaning sheet to be inserted.
	On	08	8	Waits for check paper or cleaning sheet to be inserted.
4	On	10	16	Fixed.
5	Off	00	0	TOF sensor: paper present.
	On	20	32	TOF sensor: paper not present.
6	Off	00	0	BOF sensor: paper present.
	On	40	64	BOF sensor: paper not present.
7	Off	00	0	Fixed.

[Notes]

- If print data includes a character string with this command, the printer performs the command. Users must consider this.

  For example: Bit image data accidentally might include a data string with this command.
- Do not embed this command within another command.

  For example: Bit image data might include this command.
- This command is ignored when block data is transmitted.

FS (f *pL pH [n m]1...[n m]k*

[Name] Select MICR data handling

[Format]

ASCII	FS	(	f	*pL*	*pH*	*[n m]1...[n m]k*
Hex	1C	28	66	*pL*	*pH*	*[n m]1...[n m]k*
Decimal	28	40	102	*pL*	*pH*	*[n m]1...[n m]k*

[Range] $2 \le (pL + pH \times 256) \le 65535$ $(0 \le pL \le 255, 0 \le pH \le 255)$
$0 \le n \le 3, 48 \le n < 51$
$0 \le m \le 255$

[Default] Always $m = 0$ for each n

[Description] Selects the MICR reading operations as follows:

n	Function
0, 48	Specifies to process for character which cannot be recognized.
1, 49	Specifies to add detailed information for the reading result
2, 50	Specifies the condition to disable/enable the MICR function when reading error has occurred
3, 51	Specifies the header of the transmitted data

- When $n = 0$ or 48, the command specifies to process for the character which cannot be recognized.
- When $m = 0$, the recognition process is aborted when the character which cannot be recognized is aborted when the character which cannot be recognized is detected.
  The reading result in this case does not have the data.
- When $m \neq 0$, the recognition process is continued and the character which cannot be recognized is replaced with the character '?'. If the number of the characters which are replaced with '?' is less than *m*, the data is added to the reading result.
- When the printer processes the characters which cannot be recognized even though those characters are replaced with '?', the status of the reading result becomes 'Error ending'.
- When $n = 1$ or 49, the command specifies whether the detailed information for the reading result is added or not.

Bit	Off/On	Hex	Decimal	Status
1	Off	00	0	Adds detailed information
	On	01	1	Does not add detailed information
2	Off	00	0	Reserved.
3	Off	00	0	Reserved.
4	Off	00	0	Reserved.
5	Off	00	0	Reserved.
6	Off	00	0	Reserved.
7	Off	00	0	Reserved.

Set Hex = 00 / Decimal = 0 for the reserved bit(s).

<Detailed information when an error occurs>

Information	Hex	Decimal
No error has occurred.	40	64
FS a 0 command is not executed yet.	41	65
The check insertion waiting state has been canceled with the command.	42	66
The check insertion waiting state has been canceled because the time which is set with **ESC f** command has passed.	43	67
A check whose size is out of the specified range is inserted.	44	68
A magnetic waveform cannot be detected.	45	69
A character cannot be recognized.	46	70
An error has occurred during the processing of **FS a 0** command.	47	71
An error has detected when the noise is observed.	48	72
The process of **FS a 0** command is aborted due to the cover open.	49	73
Paper has been jammed during a MICR reading.	4A	74

- When *n* = 2 or 50, the command specifies whether the MICR function is disabled or not if an error has occurred.

n	Function
0, 48	The MICR function is disabled if an error has occurred under the condition that the MICR function is set to disable if an error has occurred without addition of the reading data.
1, 49	The MICR function is continuously enabled after the reading result has been transmitted under the condition that the MICR function is set to disable due to the following causes. • The check whose size is out of the specified range is inserted. • The magnetic waveform cannot be detected. • A character cannot be recognized. • An error has detected when the noise is observed.

- The MICR function is continuously enabled when the MICR is processed normally or the reading result is added even if an error has occurred.
- When *n* = 3 or 51, the command specifies the header of the transmitted data.

m	Function
0, 48	The header is set as follows: Hexadecimal = 5FH Decimal = 95
1, 49	The header (one byte) is added with a flag (one byte) as follows: 1st byte: Hexadecimal = 37H / Decimal = 55 2nd byte: Hexadecimal = 2AH / Decimal = 42

[Note]
- This command does not execute to read the check, and affects the process of the **FS a 0** or **FS b** commands.

FS a 0 *n*

[Name] Read check paper

[Format]

ASCII	FS	a	0	*n*
Hex	1C	61	30	*n*
Decimal	28	97	48	*n*

[Range] $0 \le n \le 255$

[Description] Selects MICR function and reads MICR characters specified by *n* as follows:

Bit	Off/On	Hex	Decimal	Function
0	Readable fonts. See the table below.			
1				
2 - 7	Off	00	0	Reserved.

Readable Fonts

Hex	Decimal	Font
00	0	E13B
01	1	CMC7
02	2	Reserved.
03	3	Reserved.

[Notes]

- When this command is executed, the printer waits for slip paper insertion.
- When the printer ends reading and recognizing the MICR characters normally, it transmits “header + reading status + data + NUL” to the host computer as follows:
  - Header: Hexadecimal = 5FH / Decimal = 95 (1 byte) or
    Hexadecimal = 37H, 2AH / Decimal = 55, 42 (2 bytes)
  - Status: Reading status (1 byte)
  - Data: Recognized character strings
  - NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- The reading status is as follows:

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Readable font: E13B
	On	01	1	Readable font: CMC7
1, 2	Off	00	0	Reserved.
3	Off	00	0	Detailed information: not added
	On	08	1	Detailed information: added
4	On	10	16	Rereading not possible. Fixed to On.
5	Off	00	0	Reading normal.
	On	20	32	Reading not normal.
6	On	40	64	Fixed.
7	Off	00	0	Fixed.

[Notes]

- The printer transmits [Header + Data + NUL] collectively without confirming whether the host is ready to receive data. To receive all data correctly, adequate capacity is required in the receive buffer of the host.
- During data transmission, the printer ignores real-time commands. Also, the printer does not transmit ASB even when the ABS is enabled. Therefore, the user cannot confirm changes in the printer status during these periods.
- Under the following conditions, the printer sets bit 5=1 (abnormal end).
  ① If the personal check waiting is canceled.
  ② If the waiting time (*t1*) set by **ESC f** elapses during personal check waiting.
  ③ When character waveforms are not detected.
  ④ If character waveforms detected during reading are not identified as the specified character font.
  ⑤ If between the start of processing this command and the start of transmitting the header, an error occurs.
  ⑥ When **ESC @** is executed, the printer is reset, and printer power is on, but the printer doesn't execute.
- The readable characters with CMC7 are numeric (0 – 9) and five kinds of special characters only.

- The identified characters consist of the following:

① E13B

MICR	Character	Hex	Decimal	MICR	Character	Hex	Decimal
	NULL	0 0	0		0	3 0	4 8
	SP	2 0	3 2		1	3 1	4 9
	?	3 F	6 3		2	3 2	5 0
					3	3 3	5 1
	T	5 4	8 4		4	3 4	5 2
	A	4 1	6 5		5	3 5	5 3
	O	4 F	7 9		6	3 6	5 4
	D	4 4	6 8		7	3 7	5 5
					8	3 8	5 6
					9	3 9	5 7

② CMC7

MICR	Character	Hex	Decimal	MICR	Character	Hex	Decimal
	NULL	0 0	0		0	3 0	4 8
	SP	2 0	3 2		1	3 1	4 9
	?	3 F	6 3		2	3 2	5 0
					3	3 3	5 1
	/	2 F	4 7		4	3 4	5 2
	#	2 3	3 5		5	3 5	5 3
	=	3 D	6 1		6	3 6	5 4
	>	3 E	6 2		7	3 7	5 5
	^	5 E	9 4		8	3 8	5 6
					9	3 9	5 7

FS a 1

[Name] Load check paper to print starting position

[Format]				
ASCII	FS	a	1	*n*
Hex	1C	61	31	*n*
Decimal	28	97	49	*n*

[Description] Loads check paper to the print starting position in MICR mode.

- After loading check paper to the print starting position, the printer cancels the MICR function and selects slip paper automatically.

FS a 2

[Name] Eject check paper

[Format]

ASCII	FS	a	2
Hex	1C	61	32
Decimal	28	97	50

[Description] Ejects check paper in MICR mode.

- After ejecting check paper, the printer cancels MICR function and selects the paper roll.

FS b

[Name] Request retransmission of check paper reading results

[Format]

ASCII	FS	b
Hex	1C	62
Decimal	28	98

[Description] Retransmits the previous check (MICR character) reading results.

Header: Hexadecimal = 5FH / Decimal = 95 (1 byte)
Status: Reading status (1 byte)
Data: Recognized character strings
NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

- When the **FS a 0** command is not executed, the following data bytes are transmitted:

  Header: Hexadecimal = 5FA / Decimal = 95 (1 byte)
  Status: Reading status: Ends abnormally (1 byte)
  NUL: Hexadecimal = 00H / Decimal = 0 (1 byte)

[Notes]

- The printer transmits all data collectively without confirming whether the host computer is ready to receive data after transmitting the header. To receive all data correctly, adequate capacity is required in the receive buffer.
- During identification results transmission, the printer ignores real-time commands. Also, the printer does not transmit ASB even when the ASB is enabled. Therefore, the user cannot confirm changes in the printer status during these periods.

FS c

[Name] MICR mechanism cleaning

[Format]

ASCII	FS	c
Hex	1C	63
Decimal	28	99

[Description] Cleans the MICR mechanism.

- When this command is executed, the printer enters the cleaning sheet wait status.
- If the cleaning is ended, the printer ejects the cleaning sheet, and selects the paper roll.

APPENDIX A: MISCELLANEOUS NOTES

A.1 Notes on Printing and Paper Feeding

1) Print duty

- When printing exceeds the allowable print duty cycle, the printer automatically senses the status and controls printing (both for receipt and slip). In this case, the printing speed may slow temporarily. When print duty is lowered to normal, the printing speed also returns to normal.
- If printing stops due to excessive print duty, the ERROR LED indicator blinks, as shown in Table 3.7.1.

2) Inserting slip paper

Insert slip paper correctly by matching the right side with the right side of the paper insert portion and inserting until it is stopped by the from stopper.

If the paper is not straight, the sensors (TOF and BOF sensors) cannot detect it. The paper cannot be clamped.

As soon as the paper is engaged by the paper feed roller and the print head, immediately let go of it.

3) Printing on slip paper

- Insert slip paper correctly by matching the right side with the right side of the paper insert portion and inserting until it is stopped by the from stopper.
- The slip waiting time and the interval from when slip is inserted to when the operation starts can be set using **ESC f**.
- The slip waiting state is canceled using **DLE ENQ 3**.
- After the slip is ejected, the SLIP LED indicator lights and the printer does not proceed to the next operation until the slip paper is removed.
- The remaining printing space for printing the following data on slip can be checked using **GS r 3**.

4) Because the receipt section of the printer is a line printer, it automatically feeds paper after printing the data.

   Therefore, when the line spacing for one line is set to a smaller value than the print data, paper may be fed more than the set amount just to print the data.

   For example, when the line spacing for one line is set to 10 dots (10/180 inches) and only paper feeding is executed, paper is fed for 10 dots; however, if bit-image characters are printed, paper is fed for 24 dots. (Refer to Table A.1.)

   When only rotated characters are printed on one line, paper feeding is executed as shown in Table A.1.

Table A.1 Paper Feeding Amount

		Required Paper Feeding Amount (dots)
Normal Characters	Font A	24 × number of times enlarged vertically
	Font B	17 × number of times enlarged vertically
Rotated Characters	Font A	12 × number of times enlarged vertically
	Font B	9 × number of times enlarged vertically
Bit image		24

5) When the printer goes to the standby (data-waiting) state during printing, it temporarily stops printing and feeding paper. When data is transmitted and printing is executed, paper may shift 1 to 3 dots from the print starting position, which especially affects bit-image printing.

6) Interval of autocutting operation in the receipt section

   For driving the auto cutter of the receipt section, take the interval as a minimum of 10 lines of printing or paper feeding (to prevent small pieces of cut paper from dropping into the auto cutter).

A.2 Notes on Printer Installation

- When transporting the printer, there are dampers in the paper path in the slip section. Therefore, remove the dampers before using the printer.
- Connect the external power supply to the power supply connector of the printer. Then plug in the external power supply and turn it on if necessary. Be sure not to connect an external power supply with the wrong polarity. If it is connected incorrectly, the internal circuit fuse of the printer may be blown or the external power supply may be damaged.
- The power supply voltage is within the range of 24 V ± 10% (21.6 ~ 26.4V)
  If the power supply voltage drops outside this range during printing, the printer stops printing and waits until the voltage returns to normal and then automatically begins printing again. Therefore, printing speed may slow, the print pitch may not be correct, and some dots in some characters may not be printed.
- If the power voltage exceeds 26.4 V for some constant period succeedingly, it causes a high voltage error. If the power voltage drops 21.6 V below for some constant period succeedingly, it causes a low voltage error.
- Both high and low voltage errors are shown in Table 3.7.3. The blinking patterns are shown in the table.
- When either a high or low voltage error occurs, turn off the power as soon as possible.

A.3 Other Notes

1) Printer mechanism handling on the receipt side

- Because the thermal elements of the print head and driver IC are easy to break, do not touch them with any metal objects.
- Since the areas around the print head become very hot during and just after printing, do not touch them.
- Do not touch the surface of the print head because dust and dirt can stick to the surface and damage the elements.
- Thermal paper containing Na^-, K^-, and Cl^- ions can harm the print head thermal elements. Therefore, be sure to use only the specified paper.
- Label paper cannot be used.

2) Thermal paper handling

① Notes on using thermal paper

Chemicals and oil on thermal paper may cause discoloration and faded printing. Therefore, pay attention to the following:

a) Use water paste, starch paste, polyvinyl paste, or CMC paste when gluing thermal paper.

b) Volatile organic solvents such as alcohol, ester, and ketone can cause discoloration.

c) Some adhesive tapes may cause discoloration or faded printing.

d) If thermal paper touches anything that includes phthalic acid ester plasticizer for a long time, it can reduce the image-formation ability of the paper and can cause the printed image to fade. Therefore, when storing thermal paper in a card case or sample notebook, be sure to use only products made from polyethylene, polypropylene, or polyester.

e) If thermal paper touches diazo copy paper immediately after copying, the printed surface may be discolored.

f) Thermal paper must not be stored with the printed surfaces against each other because the printing may be transferred between the surfaces.

g) If the surface of thermal paper is scratched with a hard metal object such as a nail, the paper may become discolored.

② Notes on thermal paper storage

Since color development begins at 70°C {158°F}, thermal paper should be protected from high temperature, humidity, and light, both before and after printing.

a) Store paper away from high temperatures and humidity.

Do not store thermal paper near a heater or in enclosed places exposed to direct sunlight.

b) Avoid direct light.

Extended exposure to direct light may cause discoloration or faded printing.

3) Others

- Because this printer uses plated steel, the cutting edges may be subject to rust. However, this does not affect the printer performance.
- When you move the printer, put your hand under the printer so that you do not apply excessive pressure to the printer case.
- Do not set any liquids or drinks such as coffee on the printer case.

APPENDIX B: PAPER ROLL SETUP

B.1 Replacing the Ribbon Cassette in the Slip Section

1) Turn off the power.
2) Open the front cover.
3) Remove the ribbon cassette.
4) Make sure that the print head is on the right side and turn the feed knob to take up any slack in the ribbon. Then insert the new ribbon cassette.

   (Note that if the ribbon is not correctly placed in the ribbon guide when you insert slip paper, it may catch on the ribbon or become stained with ink from the ribbon.)
5) Push the front cover down and back.

B.2 Replacing the Paper Roll in the Receipt Section

1) Turn on the printer power.
2) Open the paper roll cover pulling the tabs up.
3) Remove the spool for the used paper roll from the paper holder and load the new paper roll. (Note the paper roll winding direction.)
4) Pull out some of the paper from the paper roll and close the printer cover.

APPENDIX C: RECOVERY FROM AN AUTOCUTTER ERROR

If a foreign object such as a push pin or paper clip drops in the autocutter and causes the autocutter to lock up, the printer enters an error state and begins the recovery operation automatically. (The ERROR LED blinks continuously, but it is possible for the error to be corrected automatically.)

If the problem is not serious, the autocutter returns to its normal position without any intervention by the user.

If the autocutter does not return to its normal position by itself, follow the steps below to correct the problem:

1) Open the receipt unit so that you can rotate the cutter blade knob.
2) Rotate the cutter blade knob.
3) Following the instructions on the caution label, rotate the knob until the ▼indicator appears in the hole.

If the cutter blade knob cannot be rotated, rotate it in the reverse direction to loosen it; then send the **DLE ENQ *n*** command. Next, check the ERROR LED. If the ERROR LED is not off, repeat the same procedure and confirm that the ERROR LED is off. When the ERROR LED is off, the autocutter blade has returned to its normal position and the paper roll cover can be opened. Open the paper roll cover, remove the jammed paper, and reinstall the paper roll. Then close the paper roll cover.

APPENDIX D: ADJUSTING THE PAPER ROLL NEAR-END SENSOR LOCATION

The remaining detectable amount of paper on the paper roll varies with the inside and outside diameters of the paper core. The minimum detectable amount of paper on the paper roll can be set using the following method:

1) The inside diameter of the paper spool should be 12 mm {.47"} and the outside diameter of the paper spool should be 18 mm {.71"}. Specified thermal paper should be used.
2) Loosen the adjusting screw that holds the paper near-end sensor and set the top of the positioning plate to the appropriate adjustment value and tighten the adjusting screw.

   Adjust the positioning plate to #1 if the outside diameter of a paper roll to be used is 18 mm.

   Adjust the positioning plate to #2 if the outside diameter of a paper roll to be used is more than 18 mm.

Table D.1 Adjustment Positions

Adjustment Position Number	Specified Thermal Paper Dimension of A
#1	Approximately 23 mm {0.97"}
#2	Approximately 27 mm {1.06"}

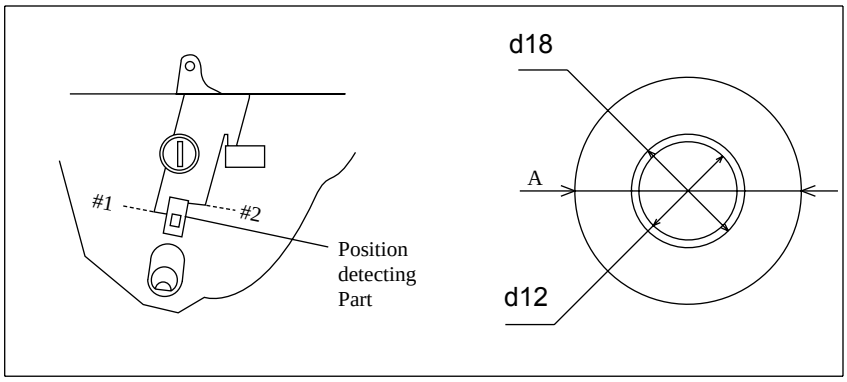


Figure D.1 Near-end Adjusting Position

NOTES:

1) Since dimension A in the table is a calculated value, there may be some variations depending on the printer.
2) Be sure that the adjustable slider operates smoothly after you finish the adjustment.

APPENDIX E: CONFIGURING THE SPACE PAGE

E.1 Slip Section (for printing the face of a slip)

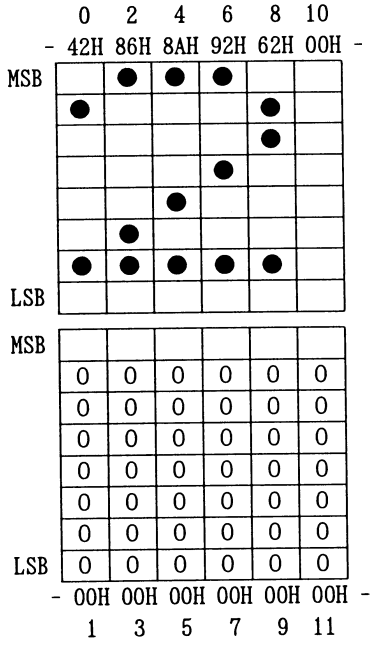
The space page is a character code table in which character codes 80H to FFH are all undefined. This character code table is selected when *n* is set to 254, 255 using the character code table selection command **ESC t *n***.

1) Space page top address

Character Table	Space page top address	
	Font A (5 × 9)	Font B (7 × 9)
Space page (254)	FC1DECH	FC29ECH
Space page (255)	FC23ECH	FC33ECH

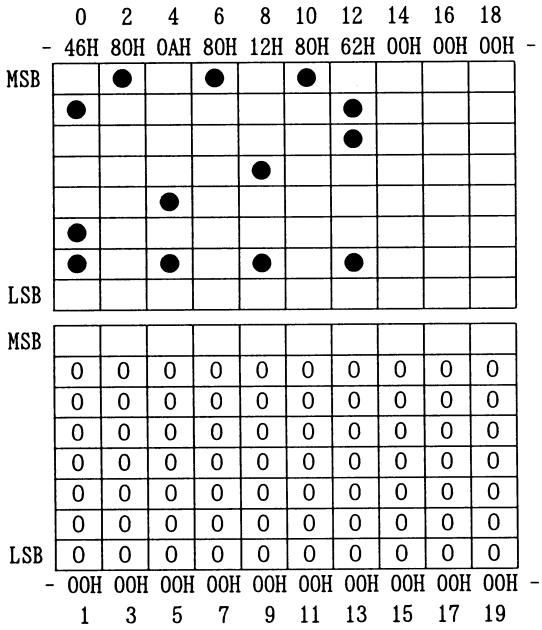
2) Example configuring the font data

- Font A (5 × 9)



	Data		Data
0:	42H	1:	00H
2:	86H	3:	00H
4:	8AH	5:	00H
6:	92H	7:	00H
8:	62H	9:	00H
10:	00H	11:	00H

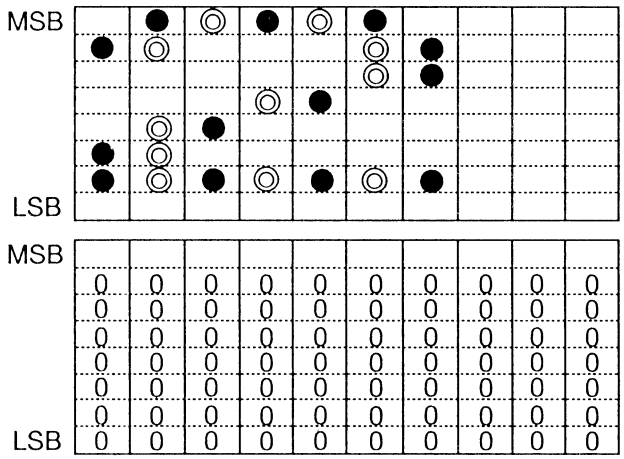
- Font B (7 × 9)



	Data		Data
0:	46H	1:	00H
2:	80H	3:	00H
4:	0AH	5:	00H
6:	80H	7:	00H
8:	12H	9:	00H
10:	80H	11:	00H
12:	62H	13:	00H
14:	00H	15:	00H
16:	00H	17:	00H
18:	00H	19:	00H

3) Notes

Horizontally adjacent continuous character patterns must not be defined for Font B (7 × 9).



The pattern shown above, in which ● and ◎ adjoin horizontally, is prohibited.

E.2 Slip Section (for printing the back of a slip)

The space page is a character code table in which character codes 80H to FFH are all undefined. This character code table is selected when *n* is set to 254, 255 using the character code table selection command **ESC t *n***.

1) Space page top address

Character Table	Space page top address
	Font A(5 × 7)
Space page (254)	FC4AD0H
Space page (255)	FC4DD0H

E.3 Receipt Section

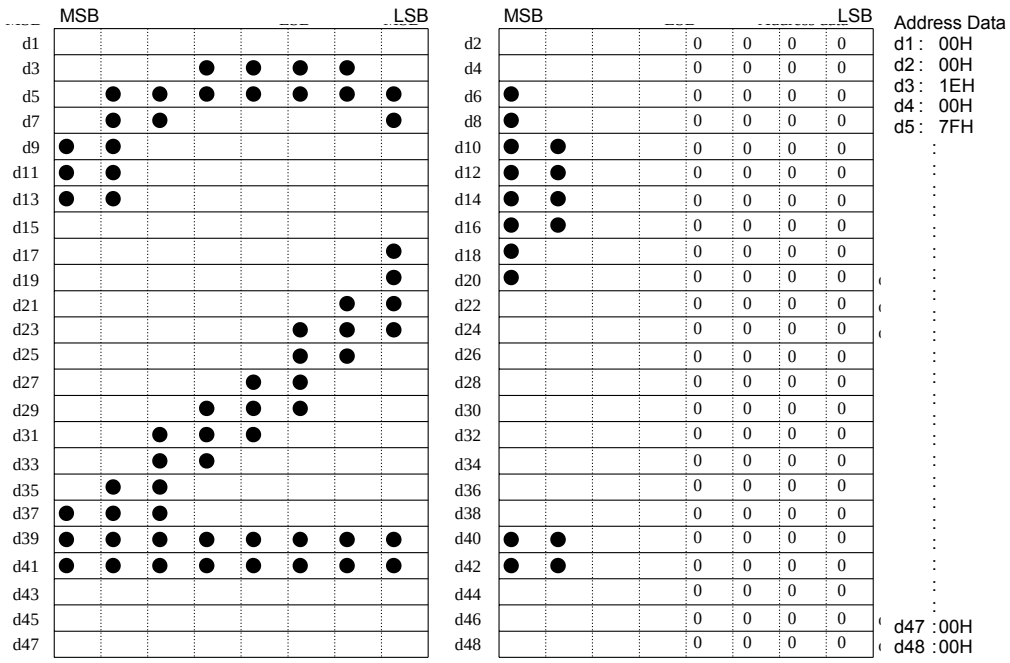
The space page is a character code table in which character codes 80H to FFH are all spaces. This character code table is selected when *n* is set to 255 using the character code table selection command **ESC t *n***.

1) Space page top address

Character Table	Space page top address	
	Font A (12 × 24)	Font B (9 × 17)
Space page (255)	FBB02CH	FBC82CH

2) Example configuring the font data

- Font A (12 × 24)



- Font B (9 × 17)

	MSB							LSB
d1								
d3			●	●	●			
d5		●	●	●	●	●		
d7		●	●		●	●	●	
d9	●	●				●	●	
d11	●	●				●	●	
d13	●	●				●	●	
d15						●	●	
d17						●	●	
d19					●	●		
d21				●	●	●		
d23			●	●	●			
d25		●	●	●				
d27	●	●	●					
d29	●	●	●	●	●	●	●	
d31	●	●	●	●	●	●	●	
d33								

	MSB							LSB	Data
d2		0	0	0	0	0	0	0	d1: 00H
d4		0	0	0	0	0	0	0	d2: 00H
d6		0	0	0	0	0	0	0	d3: 38H
d8		0	0	0	0	0	0	0	d4: 00H
d10		0	0	0	0	0	0	0	d5: 7CH
d12		0	0	0	0	0	0	0	:
d14		0	0	0	0	0	0	0	:
d16		0	0	0	0	0	0	0	:
d18		0	0	0	0	0	0	0	:
d20		0	0	0	0	0	0	0	d19: 0CH
d22		0	0	0	0	0	0	0	d20: 00H
d24		0	0	0	0	0	0	0	d21: 1CH
d26		0	0	0	0	0	0	0	:
d28		0	0	0	0	0	0	0	:
d30		0	0	0	0	0	0	0	:
d32		0	0	0	0	0	0	0	d33: 00H
d34		0	0	0	0	0	0	0	d34: 00H

APPENDIX F: DESCRIPTION OF THE MAINTENANCE COUNTER

The printer has maintenance counters supported by software,

Counter	Type of maintenance counter	Value of maintenance counter		Counter number	
		Readability	Initialization	Hex	Decimal
Number of line feeds (for slip)	Resettable	Possible	Possible	0A	10
Number of printed characters (for the face of slip)	Resettable	Possible	Possible	0B	11
Number of line feeds (for paper roll)	Resettable	Possible	Possible	14	20
Number of times head is energized (for paper roll)	Resettable	Possible	Possible	15	21
Number of coming and going of head (for the back of slip)	Resettable	Possible	Possible	28	40
Number of printed characters (for the back of slip)	Resettable	Possible	Possible	29	41
Number of autocutter operations	Resettable	Possible	Possible	32	50
Number of MICR readings	Resettable	Possible	Possible	3C	60
Period of printer operation	Resettable	Possible	Possible	46	70
Number of line feeds (for slip)	Non-resettable	Possible	Impossible	8A	138
Number of printed characters (for the face of slip)	Non-resettable	Possible	Impossible	8B	139
Number of line feeds (for paper roll)	Non-resettable	Possible	Impossible	94	148
Number of energizing head (for paper roll)	Non-resettable	Possible	Impossible	95	149
Number of coming and going of head (for the back of slip)	Non-resettable	Possible	Impossible	A8	168
Number of printed characters (for the back of slip)	Non-resettable	Possible	Impossible	A9	169
Number of autocutter operations	Non-resettable	Possible	Impossible	B2	178
Number of MICR readings	Non-resettable	Possible	Impossible	BC	188
Period of printer operation	Non-resettable	Possible	Impossible	C6	198

- Values of all maintenance counters are transmitted to the host by the **GS g 2** command.
- The resettable counter can be initialized (cleared to “0”) by the **GS g 0** command.

- Values of all maintenance counters are counted up one by one. When the value of the counter reaches the maximum, it becomes 0 at the next counting.

Counter	Unit	Counting method	Maximum value
Number of line feeds (for slip)	lines	Counts when 4.23 mm {24/144"} line feed on the serial impact dot matrix printer is executed.	178, 956, 970
Number of characters printed (for the face of slip)	characters	Counts each 6 times of energizing head for one character.	715, 827, 882
Number of line feeds (for paper roll)	lines	Counts when 4.23 mm {24/144"} line feed is executed.	143, 165, 576
Number of times head is energized (for paper roll)	times	Counts each time the thermal head is energized when printing on the paper roll.	4, 294, 967, 295
Number of coming and going head (for the back of slip)	times	Counts the number of dot lines which the shuttle printer (E/P) performs.	4, 294, 967, 295
Number of printed characters (for the back of slip)	characters	Counts the number of printed characters which the shuttle printer (E/P) performs.	4, 294, 967, 295
Number of autocutter operations	times	Counts each time when the autocutter executes a cutting operation	4, 294, 967, 295
Number of MICR reads	times	Counts each time the check paper is read.	4, 297, 967, 295
Period of printer operation	hours	Counts the operating hours after power on.	71, 582, 788

APPENDIX G: THERMAL PRINT HEAD CLEANING (Receipt printer section)

Paper dust on the heating elements may lower the print quality. Paper dust, paper chips, and thermal chemicals attached to the heat elements of the print head may reduce print quality. It is especially remarkable when the print density level is set to dark, so the print density level should be set to be appropriate with DIP switch 2. It is also recommended to clean the print head at least every 3 months to keep good print quality. As for the cleaning procedure of the print head, follow the steps below:

1) Open the printer cover.

2) Clean the thermal elements of the print head using a cotton swab moistened with alcohol solvent (ethanol, methanol, IPA).

   NOTES:
   - Do not touch the print head thermal elements.
   - Do not scratch the print head.

3) Insert a paper roll and close the print head.

   NOTE: The print head becomes very hot just after printing and is very dangerous. Be sure to allow the print head to cool down (after printing) before cleaning it. Also, be sure to turn off the printer power before cleaning the print head.

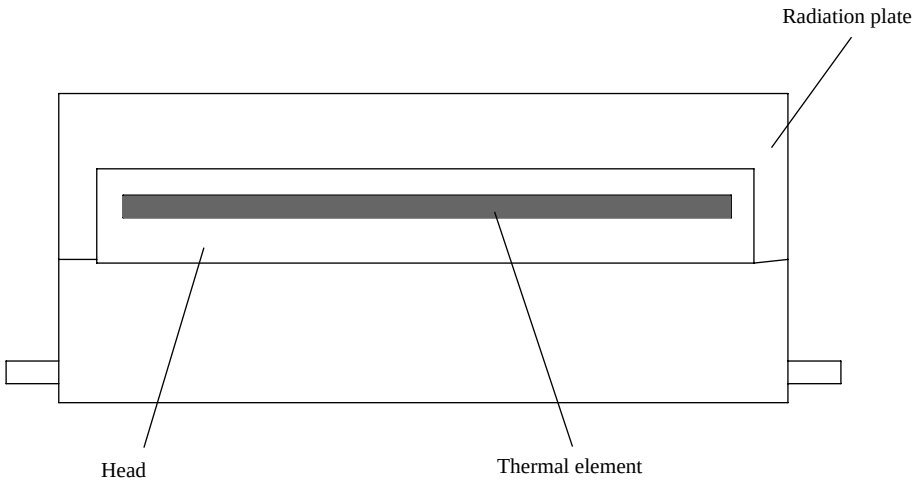


Figure G.1 Print Head Thermal Elements

(*) Depending on the paper roll used, paper dust may stick to the platen roller and paper roll end sensor. To remove the paper dust, clean the platen roller and paper roll end sensor with a cotton swab moistened with water.

APPENDIX H: NOTES ON USING THE DRAWER KICK-OUT CONNECTOR

1) Drawer kick-out connector use conditions (refer to Section 2.2.3, Drawer kick-out connector)

Because drawer specifications differ depending on the manufacturer and the part number, make sure that the specifications of the drawer to be used meet the following conditions before connecting it to the drawer kick-out connector. These conditions also apply to any other devices that use the drawer kick-out connector.

Any devices that do not satisfy all the following conditions must not be used.

[Conditions]

- A load must be provided between drawer kick-out connector pins 4 and 2 or between pins 4 and 5. (Operating the printer with incorrectly installed devices voids the warranty.)
- When the drawer open/close signal is used, a switch must be provided between drawer kick-out connector pins 3 and 6. (Connecting devices other than the drawer open/close switch voids the warranty.)
- The resistance of the load must be 24 Ω or more, or the input current must be 1 A or less. (If a device with a resistance of less than 24 Ω or an input current of over 1 A is used, the resulting overcurrent may damage the printer and the device.)
- Be sure to use drawer kick-out connector pin 4 (24 V power output) to drive the device. Never connect any other power supply to the drawer kick-out connector. (Connecting a power supply other than that specified voids the warranty.)

  The peak current is 1 A. When energizing the drawer kick-out drive signal, follow the conditions described in 3) of Section 2.2.3, *Drawer kick-out drive signal*.

APPENDIX Ⅰ: NOTES ON BAR CODE PRINTING

This printer supports the bar code printing on the paper roll and the face of a slip. Note the following when the bar code is printed on the face of a slip.

- Ladder bar code is not supported.
- HRI character must be added.
- Use the ERC-32(B) black ink ribbon cassette that is sold separately.

APPENDIX J: NOTES ON PRINTING 2-DIMENSIONAL CODE

The TM-H6000 can support 2-dimensional code printing.

Be sure to follow the Notes below when printing 2-dimensional code.

1) When printing PDF417 (2-dimensional code), it is recommended to set the height of one step of the symbol to three to five times the width of one module, also making sure that the total height is almost 5 mm or more.
2) The recognition rate of the 2-dimensional code may be affected by such items as different widths of the modules, print density environmental temperature, type of the thermal paper, and characteristics of the reader. Therefore, the user should check the recognition rate in advance so that the limitation of the reader can be considered.