EPSON

Slip printer

TM-U590 series

Specification

Standard	
REV. NO.	D
Notes	

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REVISION SHEET

Be sure to check the contents before utilizing the specification. This specification has the history shown below.

Revisions			Design Section			Sheet Rev. No.					
Rev.	**Document**	**Date**	**WRT**	**CHK**	**APL**	**Sheet**	**Rev.**	**Sheet**	**Rev.**	**Sheet**	**Rev.**
A	Enactment		Y.ITO	--	K.ITO	I	D	17	A	41	A
B	Change		Y.ITO	--	K.ITO	II	D	18	A	42	A
C	Change		Y.ITO	--	R.KANAI	III	A	19	A	43	A
D	Change					IV	D	20	A	44	A
						V	A	21	A	45	A
						VI	D	22	A	46	A
								23	D	47	A
								24	A	48	A
						1	A	25	A	49	A
						2	A	26	B	50	D
						3	A	27	A	51	A
						4	A	28	B	52	A
						5	A	29	A	53	D
						6	D	30	A	54	A
						7	D	31	A	55	A
						8	D	32	A	56	A
						9	A	33	D	57	B
						10	D	34	A	58	A
						11	A	35	A	59	A
						12	A	36	D	60	D
						13	A	37	D	61	A
						14	A	38	A	62	D
						15	B	39	A	63	A
						16	B	40	A	64	A

TITLE	Front Part					Contents	Appendix	Total
TM-U590 series Specification (STANDARD)	Cover	Rev. Sheet	Scope	General Features	Table of Contents			
	1	5	-	1	5	127	8	147

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Revisions			Design Section			Sheet Rev. No.					
Rev.	Document	Date	WRT	CHK	APL	Sheet	Rev.	Sheet	Rev.	Sheet	Rev.
A	Enactment					65	A	89	A	113	A
B	Change					66	A	90	A	114	B
C	Change					67	A	91	A	115	A
D	Change					68	A	92	A	116	A
						69	A	93	A	117	A
						70	A	94	C	118	A
						71	D	95	A	119	D
						72	D	96	A	120	D
						73	D	97	A	121	D
						74	A	98	A	122	D
						75	A	99	A	123	D
						76	A	100	A	124	D
						77	A	101	D	125	D
						78	A	102	A	126	D
						79	A	103	A	127	D
						80	A	104	A		
						81	A	105	A	App. 1	A
						82	A	106	A	App. 2	A
						83	A	107	A	App. 3	A
						84	A	108	A	App. 4	D
						85	A	109	D	App. 5	A
						86	A	110	A	App. 6	A
						87	A	111	A	App. 7	A
						88	A	112	A	App. 8	A

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REVISION SHEET

REV.	SHEET	CHANGED CONTENTS	DATE
A		Enactment	
B	10	1.10 Reliability [Change] 1) Life The MICR reader is ..... holding roller, etc.) ↓ The MICR reader is ..... the Wearout Period. 2) MTBF Failure is defined ..... of accidental failure. ↓ Failure is defined ..... the Random Failure Period. 3) MCBF This is an average ..... and accidental failures. ↓ This is an average ..... of 12 million lines.	
	15	2.1.1.4 XON/XOFF transmit timing NOTES: ▫ In case ②, ... off-line state. [Addition]	
	16	2.1.1.5 Notes on setting DIP switch 2-1 to ON 1) ....., printing stops due to a paper-end,... [Deleted]	
	23	Example: ..... (when the TOF/BOF sensor detects that the paper is present), ... [Addition]	
		ASB status bit [Change]	
	26	2.1.3.2 Switching between on-line and off-line ▫When the receive buffer becomes full.(∗1) ↓ ▫During paper feeding using the FORWARD/REVERSE button. [Change]	
		(∗1): 1 When the remaining ..... 2 The printer ignores ..... [Deleted]	
	28	2.1.3.4 XON/XOFF transmit timing ....., refer to Section 3.3.3. ↓ ....., refer to Section 2.1.1.6 [Change]	
	57	Table 3.7.3 Unrecoverable Errors Thermistor error The internal wirings ..... correctly ↓ thermistor is ..... not connected. [Change]	
	114	FS 2 c1 c2 *d[k]* → FS 2 c1 c2 *d1 ... dk* [Change]	

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REV.	SHEET	CHANGED CONTENTS	DATE
C	6	Figure 1.5.2 Values are changed. [Corrected]	
	62	5.3 Consumables ▫Ribbon cassette ERC-31(B) [Addition]	
	94	ESC f *t1 t2* [Default] *t2* = 0 → *t2* = 5 [Corrected]	
	101	GS I *n* Table bit0 On 02 2 → bit0 On 01 1 bit1 On 02 2 Auto cutter equipped. → bit1 Off 00 2 Auto cutter is not equipped [Corrected]	
	102-124	FS a 0 Bit 4 and 5 is newly assigned. Description for bit 4 and 5 is added. [Addition]	
E	I	General Features ▫Optional Magnetic .... [Deleted] ▫..... (Available only for ..... model) [Addition]	
	II	1.6 All descriptions are deleted. [Deleted]	
	IV	3.12 and 3.13 All descriptions are deleted. [Deleted]	
	VI	6.5 All descriptions are deleted. [Deleted]	
	6-8	Figure 1.5.2 MICR nead position is deleted. [Deleted] 1.6 All descriptions are deleted. [Deleted]	
	10	1.10 Reliability MICR reader mechanism [Deleted]	
	23	2.1.2.7 100 bytes → 99 bytes [Corrected]	
	33	2.2.4 Customer display connector (Available only for ..... model) [Addition]	
	36	MICR command lists [Deleted]	
	37	3.2.1 Page 0 BS and CAN codes are deleted. [Deleted]	
	50	Table 3.3.3 Bit 5 is assigned as Internal use. [Addition]	
	53	3.4 Panel LED Indicators Figure 3.4.4 (when ..... reader) [Deleted]	
	60	3.12 and 3.13 All descriptions are deleted. [Deleted]	
	62	5.2 Options ▫MICR reader [Deleted]	

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REV.	SHEET	CHANGED CONTENTS	DATE
E	71	DLE EOT *n* command *n* = 5 : Slip paper status bit 2 On is deleted [Deleted]	
	72, 73	DLE ENQ *n* command *n* = 3 is deleted. [Deleted]	
	101	GS I *n* command *n* = 2, 50 Type ID bit3 On is deleted. [Deleted]	
	109	GS a *n* command Fourth byte bit 0 On is deleted. [Deleted]	
	119 - 127	6.6 All descriptions are deleted. [Deleted]	
	App.4	Appendix C MICR commands are deleted. [Deleted]	

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TM-U590 series

Specification

(STANDARD)

CAUTION

1) This specification shall apply only to the product(s) identified herein.
2) This specification may be modified by SEIKO EPSON CORPORATION without any notice. It is necessary for "the customer" to inquire from SEIKO EPSON CORPORATION for the latest specification.
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GENERAL FEATURES

The TM-U590 is a high-quality POS printer that can print on slip paper. This specification applies the following models of the TM-U590 series printer:

TM-U590	(with serial interface)
TM-U590P	(with parallel interface)
TM-U590M	(supporting print Kanji characters print with serial interface)
TM-U590PM	(supporting print Kanji characters print with parallel interface)

The printer has the following features:

- Wide slip paper capability (maximum characters per line: 88 with 7 x 9 font).
- Copy printing is possible.
- High throughput using bidirectional, minimum distance printing.
- EPSON customer display series connection (DM-D). (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 4K bytes).

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3. FUNCTIONS

1. GENERAL SPECIFICATIONS

1.1 Printing Specifications

1) Printing method: Serial impact dot matrix
2) Head wire configuration: 9-pin vertical line, wire pitch 1/72 inch
3) Head wire diameter: 0.29 mm (.01")
4) Printing direction: Bidirectional, minimum distance printing
5) Printing speed: Refer to Table 1.2.1
6) Characters per line: Refer to Table 1.2.1
7) Characters per inch: Refer to Table 1.2.1
8) Kanji characters print: Unidirectional two-pass printing

1.2 Character Specifications

1) Number of characters:
   - Alphanumeric characters: 95
   - International characters: 32
   - Extended graphics: 128 × 10 pages (including one space page)
   - Kanji characters: JIS Level 1, Level 2 (JIS X0208-1990) (with two-pass printing)
2) Character structure:
   - Font A: 9 × 9 3-dot spacing (in half dot units)
   - Font B: 7 × 9 2-dot spacing (in half dot units)
   - Kanji : 16 × 16 Left 0-dot, Right 2-dot spacing (in half dot units)
   - Larger spacing can be changed by using **ESC SP** or **FS S**.
3) Character size: Refer to Table 1.2.1

Table 1.2.1 Characters Per Inch, Characters Per Second, Characters Per Line, Character Size

Character Structure (Horizontal dots × vertical dots)	**Character Spacing (half dots)**	**Characters Per Inch (CPI)**	**Characters Per Second (CPS) (Carriage moving speed)**	**Characters Per Line (CPL)**	**Characters Size (units: mm) Width × Height**
9 × 9	3 dots	12.5	233	66	1.6 × 3.1 (.06" × .12")
7 × 9	2 dots	16.7	311	88	1.3 × 3.1 (.05" × .12")
16 × 16 (*1)	2 dots	3.06	45	44	2.7 × 2.9 (1.06" × 1.14")

(*1) Kanji character spacing at default setting is 2 half dots. (Kanji character spacing can be changed by **FS S**.)
Pointing speed for Kanji characters shown in table above is the case of full column printing with two-pass printing.

1.3 Ribbon

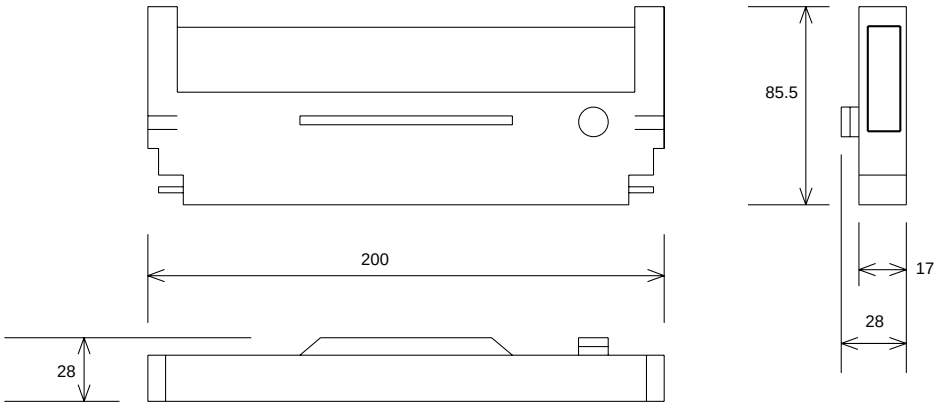
1) Type: Exclusive cassette ribbon

2) Ribbon cassette specifications:

Part number	ERC-31 (P)
Color	Purple
Ribbon life (*)	7,000,000 characters

(*): when one character consists of 18 dots

3) Ribbon cassette overall dimensions (refer to Figure 1.3.1)



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

Figure 1.3.1 Ribbon Cassette Overall Dimensions

NOTE: If you use ribbon cassettes other than those specified, damage may occur. Seiko Epson will not be held responsible for problems arising from the above.

1.4 Paper Feed and Paper Specification

1) Paper feed method:	Friction feed
2) Paper feed pitch:	Default 4.23mm (1/6 inch) Possible to set 0.176mm (1/144 inch) each with a command.
3) Paper feed speed:	Approximately 60.3 msec/line (1/6 inch feeding) Approximately 3.4 inches/second (continuous feeding)

4) Paper size:

a) Paper type:
- Normal paper
- Carbon copy paper
- Pressure sensitive paper

b) Total thickness: 0.09 to 0.36 mm (.0035 to .0141") (Refer to e).)

c) Size (W × L): 70 mm × 70 mm to 210 mm × 297 mm (A4 size)
(2.76" × 2.76" to 8.27" × 11.69")

d) 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 + 4 copies	Approx. 20° to 45°C (68° to 113°F)
Original + 1 to 3 copies	5 to 45°C (41° to 113°F)

e) Copy capability and paper thickness:

① Normal paper (single-ply): 0.09 to 0.2 mm (.0035 to .0079")

② Carbon copy paper combination:

5 sheets maximum
(original + 4 copies, at 20° to 45°C (68° to 113°F))

- Backing paper: 0.06 to 0.15 mm (.0023 to .0059")
- Copy and original: 0.04 to 0.07 mm (.0015 to 0028")
- Carbon paper: Approximately 0.035 mm (.0014")
- Total thickness: 0.30 mm (.0118") or less (for any combination from a single original to an original + 3 copies)
  0.36 mm (.0141") or less (for any combination from a single original to an original + 4 copies)

③ Pressure sensitive paper: 5 sheets maximum
(original + 4 copies, at 20° to 45°C (68° to 113°F))

- Backing paper: 0.06 to 0.15 mm (.0023 to .0059")
- Copy and original: 0.06 to 0.075 mm (.0023 to .003")
- Total thickness: 0.24 mm (.0094") or less (original to original + 3 copies)
  0.30 mm (.0118") or less (original + 4 copies)

NOTE:
- When using multi-ply paper that consists of an original and three copies, be sure to print with a 9 × 9 font. If a 7 × 9 font is used, some characters on some of the copies may not be readable.
- In the same way, when printing kanji characters which consist of many lines, be sure to consider that some of characters may not be readable regardless of number of the copies.

5) 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 1.4.2). Be especially careful when slip paper is wide and has the glue on the left edge, since skew may occur.
- Since the slip insertion sensor uses a photo sensor, do not use paper that has holes at the sensor position, or is translucent (refer to Figure 1.5.2).
- Since the slip ejection 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 (refer to Figure 1.5.3).
- 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.

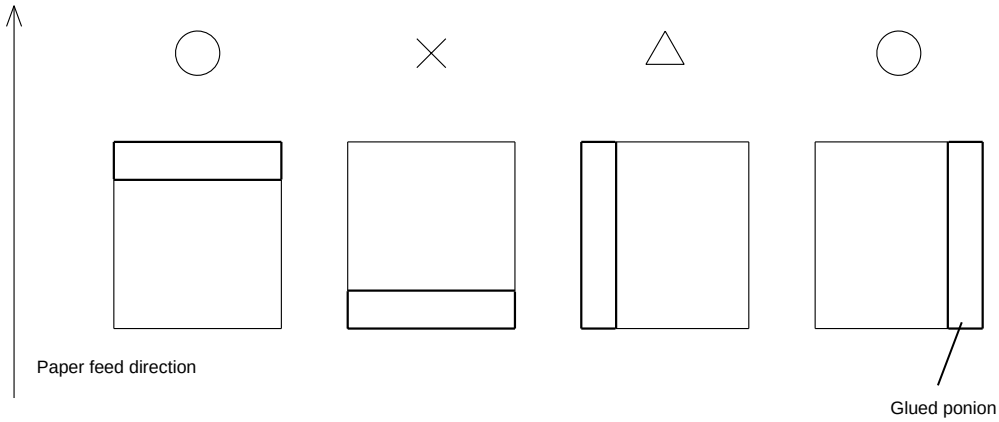
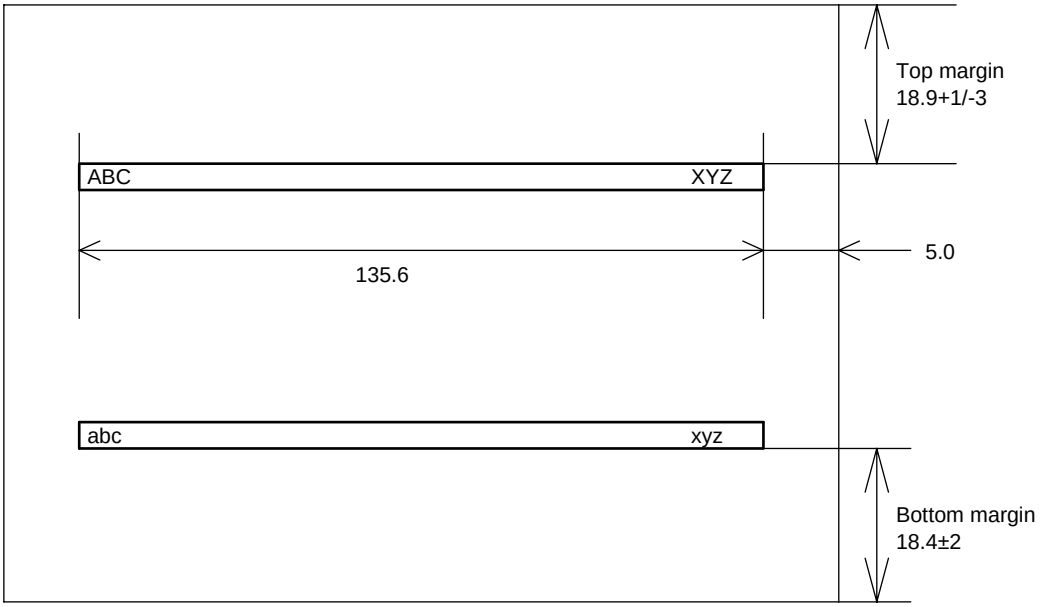


Figure 1.4.1 Slip Paper Glued Area

1.5 Printable Area



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

Figure 1.5.1 Slip Paper Printable Area

The top margin can be set to a minimum of 5 mm (0.19”) by using a command to feed the paper backward.

NOTES:

1. All the numeric values are typical; therefore, there may be variations depending on paper setting and insertion.
2. When inserting slip paper, be sure to use the slip side guide and form stopper. If you insert the slip paper exceeding the form stopper, the slip paper may be ejected.
3. Do not print on the slip paper in the reverse paper feed direction (in the front direction).

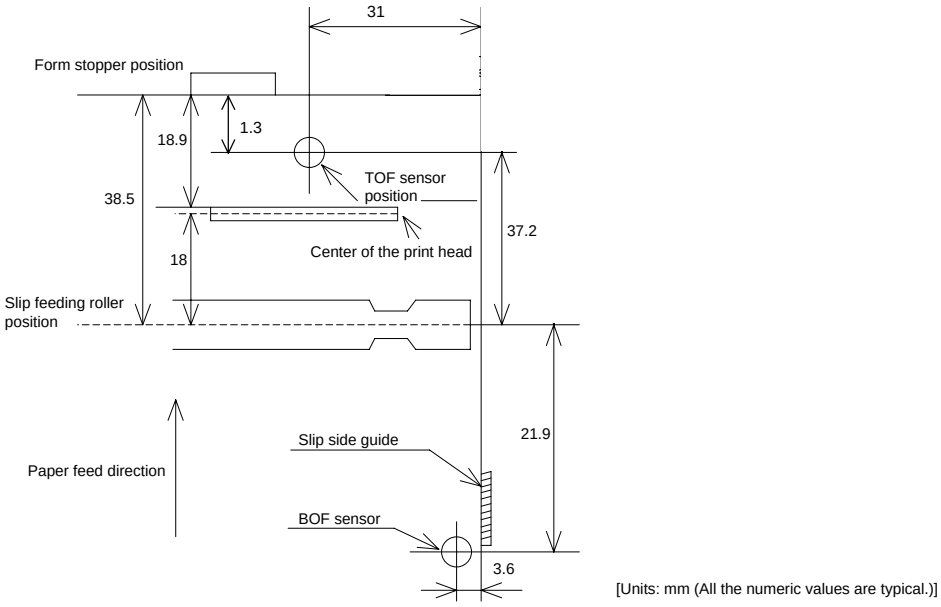


Figure 1.5.2 Slip Sensor Positions

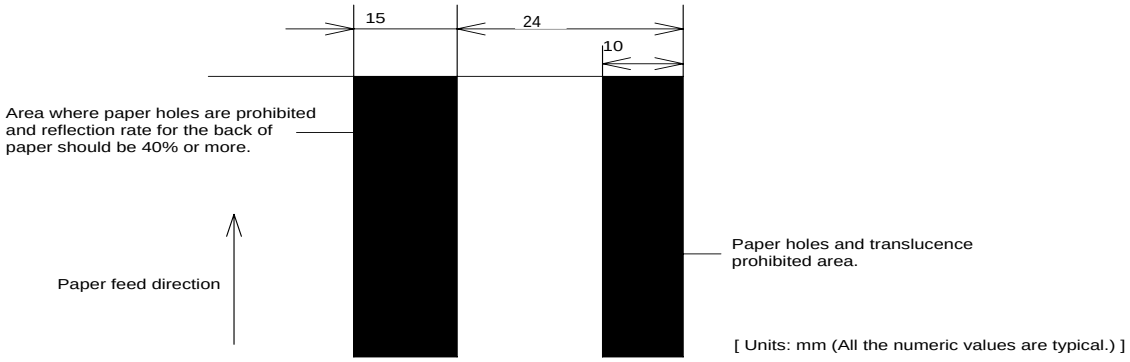


Figure 1.5.3 Paper Holes and Low Reflection Prohibited Area

1.6

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

1.7 Internal Buffer

1) Receive buffer: selectable as 69 or 4K bytes using the DIP switch.

2) User-defined buffer (both for user-defined characters and user-defined bit images):
5K bytes

1.8 Electrical Characteristics

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

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)

Operating:

Mean: Approximately 1.9A
(Character font A α-N all columns printing)

Peak: Approximately 8.0A (20 msec)

When the print platen is released: 2.0A (200 msec)

Standby:

Mean: Approximately 0.3A

1.9 EMI and Safety Standards Applied (EMC is tested using the EPSON PS-170 power supply)

1) Europe: CE marking
EN55022
EN50082-1
EN45501

Safety Standard: TÜV (EN 60950)

2) North America:

EMI: FCC Class A

Safety standards: UL1950-2TH-D3
C-UL

3) Japan: EMI: VCCI Class 1

Conditions of Acceptability

1) This component has been judged on the basis of the required spacing in the Standard for Information Technology equipment, Including Electrical Business Equipment, UL 1950 and CSA22.2 No. 950, Sub-clause 2.9, which would cover the component itself if submitted for Listing.

2) This unit is intended to be supplied by a SELV circuit only.

3) The terminals and connectors have not been evaluated for field wiring.

4) Interface Connectors (DK, DM-D) are not intended for TNV connection.

1.10 Reliability

1) Life (When printing alphanumeric characters)

Mechanism:	12,000,000 lines
Print head:	200 million characters (When printing with font B) End of life 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 Random Failure occurring at the time of the Random Failure Period.
3) MCBF	29,000,000 lines This is an average failure interval based on failures relating to wear up to the life of 12 million lines.

1.11 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)
2) Humidity:	Operating:	10 to 90% RH
	Storage:	10 to 90% RH (except for paper)

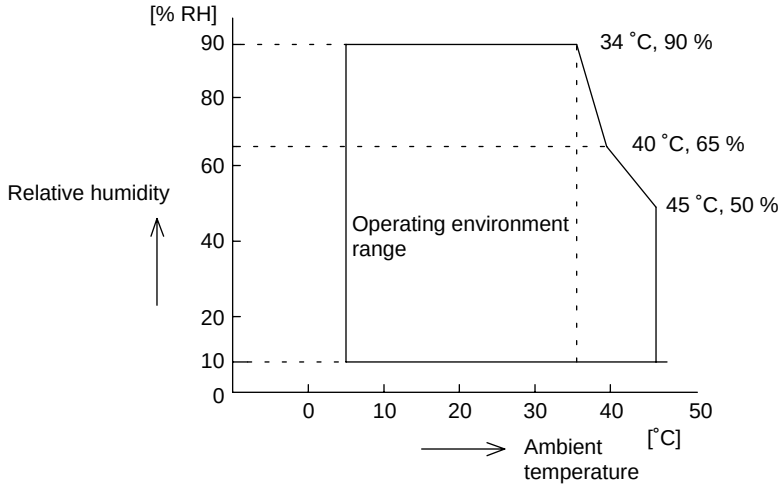


Figure 1.11.1 Operating Temperature and Humidity Range

3) Vibration resistance:	When Packed:	Frequency:	5 to 55 Hz
		Acceleration:	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:	Approximately 65 dB (Bystander position)

1.12 Installation

The TM-U590 series 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"
Stop bits:	1 or more
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 on-line and off-line

The printer does not have an on-line/off-line switch. The printer goes off-line:

- Between when the power is turned on (including reset using the interface) and when the printer is ready to receive data
- During the self-test
- When the cover is open
- During paper feeding using the FORWARD/REVERSE button
- When an error has occurred
- When the power is out of range temporarily.

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 TM-U590 series Printer Status and Signals

<table>
<tr><th>Pin number</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, and GS a).
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>DIP SW 2-1 status
OFF</th></tr>
<tr><td rowspan="5">Off-line</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 FORWARD/REVERSE button.</td><td>—</td><td>BUSY</td></tr>
<tr><td>5. When an error has occurred.</td><td>—</td><td>BUSY</td></tr>
<tr><td></td><td>6. When the receive buffer becomes full.</td><td>BUSY</td><td>BUSY</td></tr>
</table></td></tr>
</table>

Table 2.1.1 TM-U590 series 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.

NOTES: 1. 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.
2. The printer ignores the data received when the remaining space in the receive buffer is 0 bytes.

2.1.1.4 XON/XOFF transmit timing

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

Table 2.1.2 XON/XOFF Transmit Timing

	Printer status	DIP SW 2-1 status	
		ON	OFF
XON transmission	① When the printer goes on-line 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 off-line to on-line	—	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 on-line to off-line	—	Transmit

NOTES:
- The XON code is <11>H and the XOFF code is <13>H.
- In case ②, XON is not transmitted when the
- 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.

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, or paper is fed using the FORWARD/REVERSE 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 on-line/off-line changes.

3) When using **DLE EOT** and **DLE ENQ**, 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** and **DLE ENQ** 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** 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 of use:
  Check the printer status using **GS I** or **GS r** after transmitting each line of data and use the 4K byte 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 msec (minimum)
- When using pin 6 (DSR) (DIP switch 2-7 is ON):

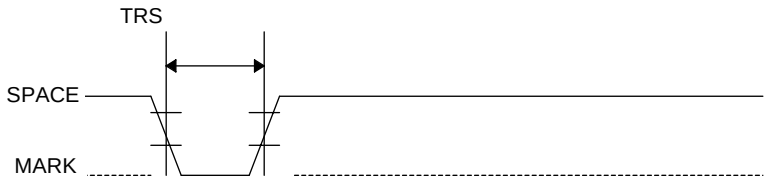


Figure 2.1.1 Minimum Reset Pulse Width (pin 6)

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

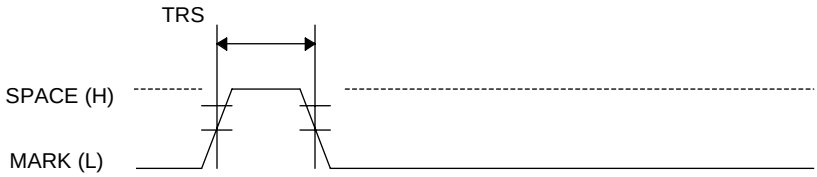


Figure 2.1.2 Minimum Reset Pulse Width (pin 25)

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) Specifications

Data transmission:	8-bit Parallel
Synchronization:	Externally supplied nStrobe signals
Handshaking:	nAck and Busy signals
Signal levels:	TTL compatible
Connector:	57RE-40360-830B (DDK) or equivalent (IEEE 1284 Type B)

Reverse communication (Printer Host): Nibble or Byte Mode

(2) Switching between on-line and off-line

The printer is not equipped with any on-line/off-line switch. The printer is placed into off-line status in either of the followings:

- 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.
- During the self-test.
- When the cover is open.
- During paper feeding using the FORWARD/REVERSE button.
- When the power is out of range temporarily.
- 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 is proceeded 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 (Nibble). In the Byte Mode, data transmissions are proceeded by making the eight-bits data lines bidirectional.

  The both modes fail to be proceeded concurrently with the Compatibility Mode, thereby causing half duplex transmission.

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	Hostr	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

NOTE: 1. A prefix “n” to signal names refers to “L” active signals. To the host provided with none of 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 shall be all based on the TTL level to meet the characteristics described below. In addition, both rise time and fall time of each signal shall be 0.5μs 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 “L” level.)

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

*NC: No Connect
ND: Not Defined

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}=0.32mA
Output LOW voltage	V_{OL}	-0.5 V	*0.4 V	*I_{OL}=-12mA
Output HIGH current	I_{OH}	0.32 V	-	V_{OH}=0.32V
Output LOW current	I_{OL}	-12 V	-	V_{OL}=0.4V
Input HIGH voltage	V_{IH}	2.0 V	-	
Input LOW voltage	V_{IL}	-	0.8 V	
Input HIGH current	V_{IH}	-	-0.32 mA	V_{IH}=2.0V
Input LOW current	V_{IL}	-	12 mA	V_{IL}=0.8V

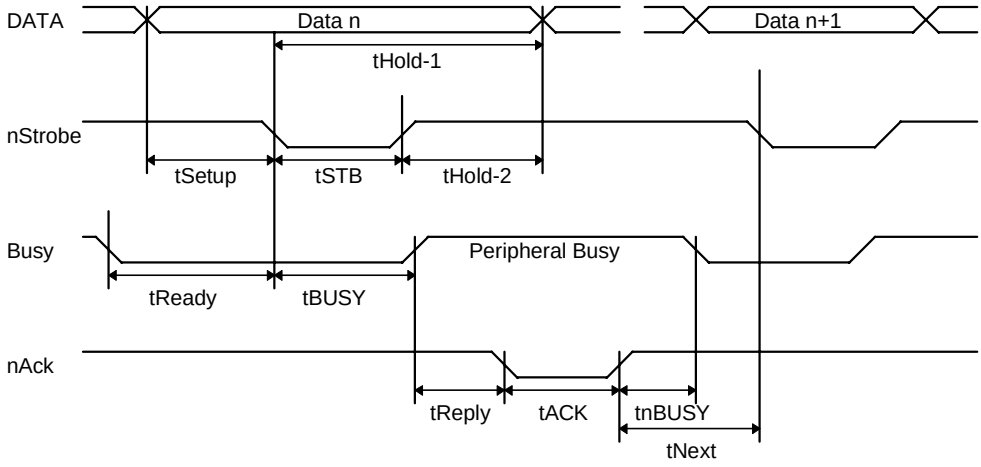
Logic-H Signal Sender Characteristics

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}=0.32mA
Output LOW voltage	V_{OL}	-	- **	While the power is OFF
Output HIGH current	I_{OH}	-	0.32 mA	V_{OH}=2.4V
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 (host)	tHold-1	--	500
Data Hold Time (printer)	tHold-2	--	--
Data Setup Time	tSetup	--	500
STROBE Pulse Width	tSTB	--	500
READY Cycle Idle Time	tReady	--	--
BUSY Output Delay Time	tBUSY	0	500
Data Processing Time	tReply	0	∞
ACKNLG Pulse Width	tACK	500	10μs
BUSY Release Time	tnBUSY	0	∞
ACK Cycle Idle Time	tNEXT	--	0

*The printer latches data at a nStrobe ↓ timing

2.1.2.6 Notes on resetting the printer through the interface

The printer reset is available through the interface nInit signal (#31 pin) by changing the DIP switch setting. (Refer to Table 3.3.5 DIP Switch 2.)

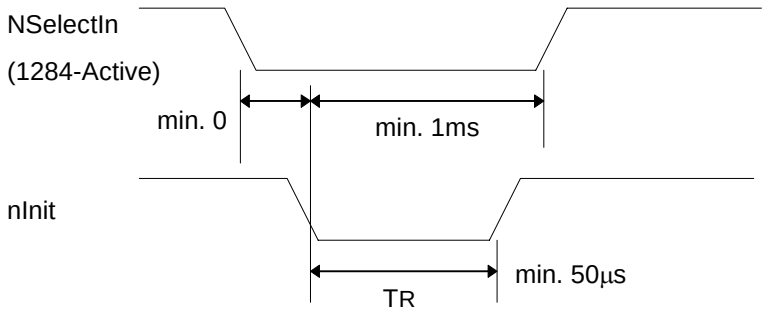
Table 2.1.5 DIP Switch Setting for Printer Reset

Signal Line	DIP Switch	Reset Condition
#31 Pin (nInit)	DSW 2-8: ON	TTL-LOW level input

The printer reset through the nInit signal is only available with the SelectIn(1284-Active) signal at LOW.

To enable the printer reset, the following signal timing shall be satisfied.

Minimum reset pulse width TR: 50μs (min)



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

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

In this case, different from in the RS-232 serial interface specifications, the real-time interruptions from the printer to the host are disabled and thus precautions must be taken to the followings.

1) Allowable capacity of the printer internal buffer is 99 bytes (except ASB status). The status signals exceeding this capacity will be discarded. To prevent possible loss of status, the host shall be ready for data acception (Reverse Mode).
2) When ASB is used, the host is preferably in the wait state for data acception (Reverse Idle Mode). When this state is not available, the host shall enter the Reverse Mode to always 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 (when the TOF/BOF sensor detects that the paper is present), the ASB status is configured as follows.

First Status	Second Status	Third Status	Fourth Status
0000 1000	0000 0000	0000 0000	0000 0000

When a sequence of operations are proceeded, the FORWARD/REVERSE button is pressed and released, the following pieces of data are accumulated.

	First Status	Second Status	Third Status	Fourth Status	
①	0000 1000	0000 0000	0000 0011	0000 0000	Near end detection
②	0010 1000	0000 0000	0000 0011	0000 0000	FORWARD/REVERSE button is pressed
③	0000 1000	0000 0000	0000 0011	0000 0000	FORWARD/REVERSE button is released

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)	0010 1000	0000 0000	0000 0011	0000 0000
+	First Status	Second Status	Third Status	Fourth Status
The latest ASB (③)	0000 1000	0000 0000	0000 0011	0000 0000
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 in the following cases:

- When an error occurs.
- When the cover is open.
- When paper is fed using the FORWARD/REVERSE button.

(2) When handshaking with the printer while using this switch setting, make sure to monitor the printer with the **GS a** command and the ASB function.

With this switch setting, the default value of the **GS a** command n is 2. This automatically transmits the printer status, depending on on-line/off-line changes.

(3) When using the **DLE EOT** or **DLE ENQ** command, make sure that the receive buffer does not become full.

- Notes on using a host that cannot transmit data when the printer is BUSY:

  If an error occurs when the receive buffer is full and the printer is BUSY, the **DLE EOT** and **DLE ENQ** commands cannot be used.

- Notes on using a host that can transmit data when the printer is BUSY:

  If a **DLE EOT** or **DLE ENQ** command is used while sending bit-image data, and the receive buffer-full state is encountered during transmission of the data, the **DLE EOT** or **DLE ENQ** is processed as bit-image data.

  In addition, the data transmitted during the receive buffer-full state may be lost.

  Example of use:

  Set the receive buffer to 4K bytes, and check the status with **GS r** for each line of printing transmitted. Make sure that the data for printing each line does not cause the printer to enter the receive buffer-full state.

2.1.3 RS-485 Serial Interface
(RS-485 serial interface specification is a dealer option.)

2.1.3.1 Specifications (RS-485 compatible)

Data transmission:	Serial
Synchronization:	Asynchronous
Handshaking:	Depend on the DIP switch settings (DTR/DSR or XON/XOFF control)
Signal levels:	2.0 V to 5.0 V: Logic 1 0.0 V to 0.8 V: Logic 0
Baud rates:	2400, 4800, 9600, 19200 bps
Data word lengths:	7 or 8 bits
Parity settings:	None, even, odd
Stop bits:	1 or more
Connector (printer side):	Female D-SUB25 pin connector

Notes: The handshaking data word length, baud rate, and parity depend on the DIP switch (Refer to Section 3.3.3)

Data transmitted from the printer has 1 stop bit (fixed).

DR1 > DR2 CS1 > CS2 indicates that:
Channel 1 is high.
Channel 2 is low.

DR1 < DR2 CS1 < CS2 indicates that:
Channel 2 is high.
Channel 1 is low.

Table 2.1.6 Signal Levels and Communication Control Functions

CS1	CS2	Function
H	L	Communication is available
L	H	Communication is not available

If the electric potential of CS1 is higher than that of CS2, the printer is ready for communication (the host is ready to receive data). If the electric potential of CS1 is lower than that of CS2, the printer is not ready for communication (the host is not ready to receive data).

Table 2.1.7 Signal Levels and Communication Control Functions

DR1	DR2	Function
H	L	Communication is available
L	H	Communication is not available

If the electric potential of DR1 is higher than that of DR2, the printer is ready for communication (the host is ready to receive data). If the electric potential of DR1 is lower than that of DR2, the printer is not ready for communication (the host is not ready to receive data).

2.1.3.2 Switching between on-line and off-line

The printer does not have an on-line/off-line switch.

The printer goes off-line:

- Between when the power is turned on (including reset using the interface) and when the printer is ready to receive data.
- During the self-test.
- When the cover is open.
- When a temporary abnormality occurs in the power supply voltage.
- When an error has occurred.
- During paper feeding using the FORWARD/REVERSE button.

2.1.3.3 Interface pin assignments

Table 2.1.8 TM-U590 series Printer Status and Signals

Pin Number	Signal name	Signal direction	Function
1	FG	--	Frame ground
2	SD1	Output	Transmit data
3	SD2	Output	Transmit data
4	RD1	Input	Receive data
5	RD2	Input	Receive data
7	SG	--	Signal ground

Table 2.1.8 TM-U590 series Printer Status and Signals (Continued)

<table>
<tr><th>Pin Number</th><th>Signal name</th><th>Signal direction</th><th>Function</th></tr>
<tr><td>8</td><td>DR1</td><td>Output</td><td>When DTR/DRS is selected, this signal indicates whether the host computer is BUSY or READY.</td></tr>
<tr><td>9</td><td>DR2</td><td>Output</td><td>1)DR1>DR2 indicates that the printer is READY and DR1<DR2 indicates that the printer is BUSY. The BUSY condition can be changed depending on the off-line conditions set by the DIP switches (refer to Section 3.3.3).
When the DTR/DSR control is selected, the printer becomes the BUSY state (DR1<DR2) under the following concitions.
<table>
<tr><th></th><th>Printer status</th><th>DIP SW 2-1 status
ON</th><th>DIP SW 2-1 status
OFF</th></tr>
<tr><td rowspan="6">Off-line</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 FORWARD/REVERSE button.</td><td>—</td><td>BUSY</td></tr>
<tr><td>5. When a temporary abnormality occurs in the power supply voltage.</td><td></td><td>BUSY</td></tr>
<tr><td>6. When an error has occurred.</td><td></td><td>BUSY</td></tr>
<tr><td></td><td>7. When the receive buffer becomes full.</td><td>BUSY</td><td>BUSY</td></tr>
</table>
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 DR1>DR2 (READY) indicates that the printer is ready to receive data. The signal is always DR1>DR2 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
This signal indicates whether the host computer is BUSY or READY.
CS1>CS2 indicates that the printer is READY and CS1<CS2 indicates that the printer is BUSY.</td></tr>
</table>

Table 2.1.8 TM-U590 series Printer Status and Signals (Continued)

Pin Number	Signal name	Signal direction	Function
10 11	CS1 CS2	Input	1)When DTR>DSR is selected: The signal is checked and data is transmitted only when the host is ready to receive data (READY) (except for transmitted by **DLE EOT** or **GS a**). 2)When XON/XOFF control is selected: Transmits data regardless of the status of this signal.

2.1.3.4 XON/XOFF transmit timing

Refer to Section 2.1.1.4.

For the DIP switch settings of the off-line status, refer to Section 2.1.1.6.

2.1.3.5 Data format when using RS-485

Transmission data (8bits, none parity)

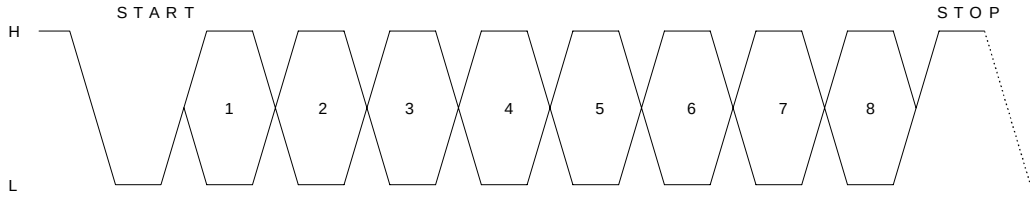


Figure 2.1.5 RS-485 Communication data format

"H" indicates

<Printer transmission data> SD1<SD2

<Printer reception data> RD1<RD2

"L" indicates:

<Printer transmission data> SD1<SD2

<Printer reception data> RD1<RD2

The transmission data is H = 1, L = 0

NOTE: This format is used when the UART for RS-232 is connected to the RS-485 driver.

Table 2.1.11 Printer Reception Data Level

DR1	DR2	Read data
H	L	Receiving data line is low level
L	H	Receiving data line is high level

Table 2.1.12 Printer Transmission Data Level

SD1	SD2	Send data
H	L	Sending data line is low level
L	H	Sending data line is high level

2.2 Connectors

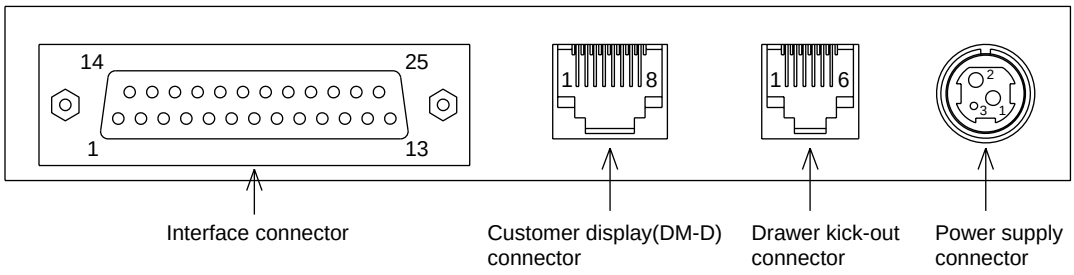


Figure 2.2.1 Serial Interface Connector Panel External Appearance

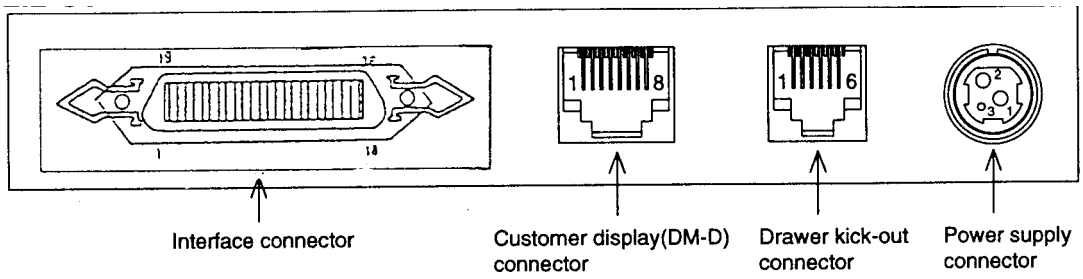


Figure 2.2.2 Parallel Interface Connector Panel External Appearance

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: Hosiden TCS7960-532010 or equivalent

Table 2.2.1 Power Supply Connector Pin Assignments

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

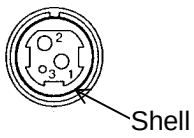


Figure 2.2.3 Power Supply Connector

2.2.3 Drawer Kick-out Connector (Modular Connector)

The pulse specified by **ESC p** 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 (RJ12 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.

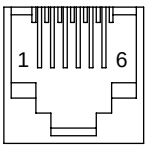


Figure 2.2.4 Drawer Kick-out Connector

3) Drawer kick-out drive signal

Output signal: Output voltage: Approximately 24 V
Output current: 1A 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**.

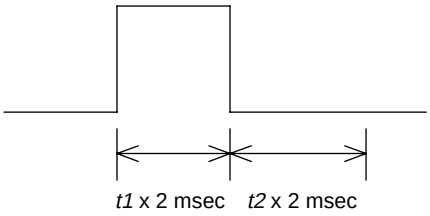


Figure 2.2.5 Drawer Kick-out Drive Signal Output Waveform

4) Drawer open/close signal

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

"H" = 2 to 5 V

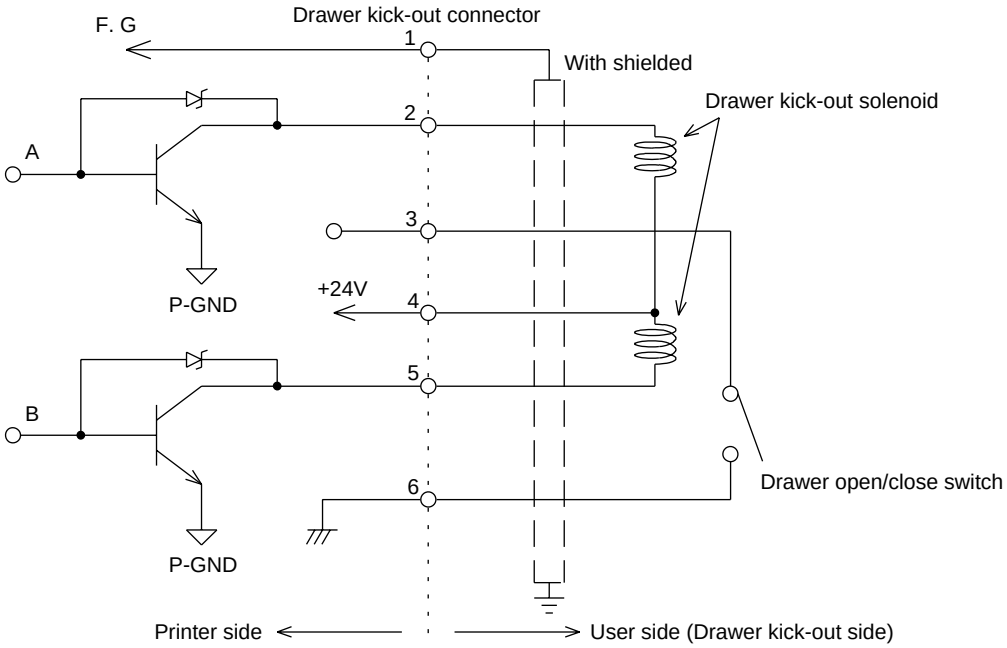


Figure 2.2.6 Drawer Circuitry

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 (24 Ω). Otherwise, an overcurrent could damage the solenoid.

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	N.C.	—
3	TXD	Output
4	DTR	Output
5	DSR	Input
6	SG	—
7	+24	—
8	PG	—

+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.

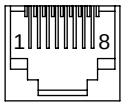


Figure 2.2.7 DM-D Connector

3. FUNCTIONS

3.1 Command List

Command	Name	Command Classification	
		Executing	Setting
HT	Horizontal tab	○	
LF	Print and line feed	○	
FF	Print and eject slip paper	○	
CR	Print and carriage return	○	
DLE EOT	Real-time status transmission	○	
DLE ENQ	Real-time request to printer	○	
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 C	Set slip paper eject length		○
ESC D	Set horizontal tab positions		○
ESC E	Turn emphasized mode on/off		○
ESC F	Set/cancel slip paper reverse eject		○
ESC G	Turn double-strike mode on/off		○
ESC J	Print and feed paper	○	

Command	Name	Command Classification	
		Executing	Setting
ESC K	Print and reverse feed	○	
ESC R	Select an international character set		○
ESC U	Turn unidirectional printing mode on/off		○
**ESC **	Set relative print position	○	
ESC a	Select justification		○
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 slip paper wait time		○
ESC p	General pulse	○	
ESC q	Release	○	
ESC t	Select character code table		○
ESC {	Turn upside-down printing mode on/off		○
GS !	Select character size		○
GS *	Define user-defined bit image		○
GS /	Print user-defined bit image	○	
GS	Transmit printer ID	○	
GS L	Set left margin		○
GS P	Set horizontal and vertical motion units		○
GS W	Set printing area width		○
GS a	Enable/disable Automatic Status Back (ASB)	○	○
GS r	Transmit status	○	

Kanji command list (when the TM-U590M/TM-U590PM is used)

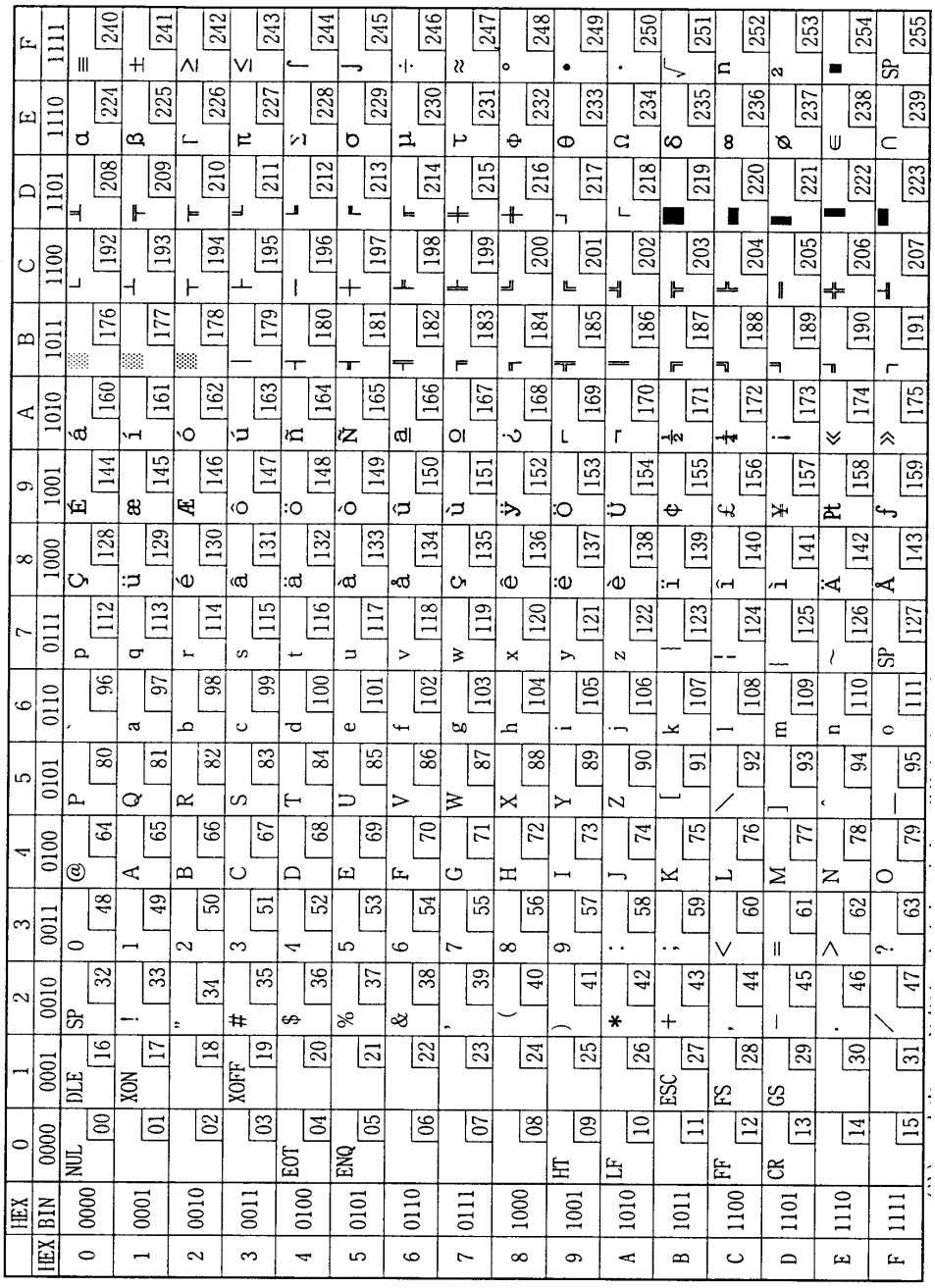
Command	Name	Command Classification	
		Executing	Setting
FS !	Set print mode(s) for Kanji characters		○
FS &	Select Kanji character mode		○
FS -	Turn underline mode on/off for Kanji characters		○
FS .	Cancel Kanji character mode		○
FS 2	Define user-defined Kanji characters		○
FS C	Select Kanji character code system		○
FS S	Set left- and right-side Kanji character spacing		○
FS W	Turn quadruple-size mode on/off for Kanji characters		○

<Fundamental calculation pitch>

The fundamental calculation pitch is used to set the minimum pitch by software instead of by mechanical pitch. Using the fundamental calculation pitch minimizes dependence on the mechanical pitch for setting, e.g., the paper feed amount, and enables the printing position to be set in inches. (Refer to **GS P**.)

3.2 Character Code Tables

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



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	丄 144	SP 160	ー 176	タ 192	ミ 208	二 224	× 240
1	0001	▬ 129	丅 145	。 161	ア 177	チ 193	ム 209	上 225	円 241
2	0010	▬ 130	丬 146	「 162	イ 178	ツ 194	メ 210	丰 226	年 242
3	0011	▬ 131	丨 147	」 163	ウ 179	テ 195	モ 211	刂 227	月 243
4	0100	■ 132	一 148	、 164	エ 180	ト 196	ヤ 212	◢ 228	日 244
5	0101	■ 133	ー 149	・ 165	オ 181	ナ 197	ユ 213	◣ 229	時 245
6	0110	■ 134	丨 150	ヲ 166	カ 182	ニ 198	ヨ 214	◥ 230	分 246
7	0111	■ 135	丨 151	ァ 167	キ 183	ヌ 199	ラ 215	◤ 231	秒 247
8	1000	丨 136	厂 152	ィ 168	ク 184	ネ 200	リ 216	♠ 232	干 248
9	1001	▌ 137	冂 153	ゥ 169	ケ 185	ノ 201	ル 217	♥ 233	市 249
A	1010	▌ 138	乚 154	ェ 170	コ 186	ハ 202	レ 218	✦ 234	区 250
B	1011	▌ 139	亅 155	ォ 171	サ 187	ヒ 203	ロ 219	♣ 235	町 251
C	1100	▌ 140	𠂉 156	ャ 172	シ 188	フ 204	ワ 220	● 236	村 252
D	1101	▌ 141	丶 157	ュ 173	ス 189	ヘ 205	ン 221	○ 237	人 253
E	1110	▌ 142	乀 158	ョ 174	セ 190	ホ 206	゛ 222	／ 238	▒ 254
F	1111	┼ 143	乁 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	₧ 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	1000	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	Ü 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 6 (Hiragana) (Available on TM-U590M/TM-U590PM)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	礎 128	本 144	SP 160	ー 176	た 192	み 208	過 224	換 240
1	0001	129	145	。 161	あ 177	ち 193	む 209	225	241
2	0010	除 130	荷 146	「 162	い 178	つ 194	め 210	足 226	攻 242
3	0011	131	147	」 163	う 179	て 195	も 211	227	243
4	0100	定 132	特 148	、 164	え 180	と 196	や 212	利 228	産 244
5	0101	133	149	・ 165	お 181	な 197	ゆ 213	229	245
6	0110	信 134	越 150	を 166	か 182	に 198	よ 214	用 230	打 246
7	0111	135	151	ぁ 167	き 183	ぬ 199	ら 215	231	247
8	1000	緑 136	他 152	ぃ 168	く 184	ね 200	り 216	移 232	納 248
9	1001	137	153	ぅ 169	け 185	の 201	る 217	233	249
A	1010	科 138	社 154	ぇ 170	こ 186	は 202	れ 218	下 234	変 250
B	1011	139	155	ぉ 171	さ 187	ひ 203	ろ 219	235	251
C	1100	目 140	瓶 156	ゃ 172	し 188	ふ 204	わ 220	加 236	誂 252
D	1101	141	157	ゅ 173	す 189	へ 205	ん 221	237	253
E	1110	々 142	奉 158	ょ 174	せ 190	ほ 206	゛ 222	解 238	件 254
F	1111	143	159	っ 175	そ 191	ま 207	゜ 223	239	255

3.2.8 Page 7 (One-pass printing Kanji characters)
(Available on TM-U590M/TM-U590PM)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	日 128	会 144	水 160	受 176	点 192	課 208	買 224	非 240
1	0001	129	145	161	177	193	209	225	241
2	0010	扱 130	客 146	木 162	前 178	中 194	証 210	号 226	承 242
3	0011	131	147	163	179	195	211	227	243
4	0100	外 132	券 148	土 164	残 180	内 196	組 212	有 228	送 244
5	0101	133	149	165	181	197	213	229	245
6	0110	額 134	回 150	振 166	止 182	部 198	店 214	期 230	― 246
7	0111	135	151	167	183	199	215	231	247
8	1000	割 136	在 152	数 168	純 184	別 200	認 216	限 232	棄 248
9	1001	137	153	169	185	201	217	233	249
A	1010	検 138	算 154	精 170	替 186	戻 202	廃 218	頭 234	累 250
B	1011	139	155	171	187	203	219	235	251
C	1100	高 140	上 156	銭 172	代 188	門 204	両 220	差 236	違 252
D	1101	141	157	173	189	205	221	237	253
E	1110	価 142	火 158	総 174	値 190	料 206	効 222	括 238	番 254
F	1111	143	159	175	191	207	223	239	255

3.2.9 Page 8 (One-pass printing Kanji characters)
(Available on TM-U590M/TM-U590PM)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	訂 128	計 144	払 160	売 176	名 192	次 208	万 224	室 240
1	0001	129	145	161	177	193	209	225	241
2	0010	正 130	小 146	掛 162	取 178	個 194	不 210	責 226	商 242
3	0011	131	147	163	179	195	211	227	243
4	0100	品 132	金 148	入 164	係 180	領 196	枚 212	終 228	人 244
5	0101	133	149	165	181	197	213	229	245
6	0110	円 134	現 150	貸 166	未 182	収 198	誤 214	了 230	大 246
7	0111	135	151	167	183	199	215	231	247
8	1000	種 136	釣 152	出 168	消 184	予 200	休 216	免 232	安 248
9	1001	137	153	169	185	201	217	233	249
A	1010	担 138	預 154	支 170	費 186	約 202	契 218	伝 234	仕 250
B	1011	139	155	171	187	203	219	235	251
C	1100	当 140	税 156	単 172	年 188	込 204	開 220	自 236	控 252
D	1101	141	157	173	189	205	221	237	253
E	1110	合 142	引 158	返 174	月 190	明 206	閉 222	設 238	基 254
F	1111	143	159	175	191	207	223	239	255

3.2.10 Page 255 (Space Page)

In the space page (page 255), the following font is defined as the default.

7 × 7 font (only when font 7 × 9 is selected. When 9 × 9 font is selected, character codes 80H to FFH are all spaces.)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	128	Õ 144	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	156	, 172	< 188	L 204	\ 220	l 236	| 252
D	1101	Ò 141	157	− 173	= 189	M 205	] 221	m 237	} 253
E	1110	142	158	. 174	> 190	N 206	^ 222	n 238	~ 254
F	1111	õ 143	159	/ 175	? 191	O 207	_ 223	o 239	. 255

3.2.11 International Character Set

	Country	ASCII code HEX / DEC	23 35	24 36	40 64	5B 91	5C 92	5D 93	5E 94	60 96	7B 123	7C 124	7D 125	7E 126
0	U.S.A.		#	$	@	[	\	]	^	`	{	¦	}	~
1	France		#	$	à	°	ç	§	^	`	é	ù	è	¨
2	Germany		#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
3	U.K.		£	$	@	[	\	]	^	`	{	¦	}	~
4	DenmarkI		#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
5	Sweden		#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	Italy		#	$	@	°	\	é	^	ù	à	ò	è	ì
7	Spain		Pt	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
8	Japan		#	$	@	[	¥	]	^	`	{	¦	}	~
9	Norway		#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	DenmarkII		#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

3.3 Switches and Buttons

3.3.1 Power Button

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

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

3.3.2 Panel Buttons

All the panel buttons are disabled by **ESC c 5**.

1) RELEASE button (non-locking push button)

[Function] Release paper

2) REVERSE button (non-locking push button)

[Function] Reverse paper feeding for the line spacing set by **ESC 2** and **ESC 3**

3) FORWARD button (non-locking push button)

[Function] Feed paper for the line spacing set by **ESC 2** and **ESC 3**

Paper feed is not executed without paper.

NOTE: When the printer cover is open, the printer will not operate.

3.3.3 DIP Switches

3.3.3.1 Serial interface specification (TM-U590/TM-U590M)

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	69 bytes	4K bytes
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
2400	ON	ON
4800	OFF	ON
9600	ON	OFF
19200	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	Off line or receive buffer full
2	Customer display (DM-D) connection	Connected	Not connected
3	Undefined	--	--
4			
5	Internal use		Fixed to Off
6	Internal use		Fixed to Off
7	I/F pin 6 reset signal (*1)	Enabled	Disabled
8	IF pin 25 reset signal (*2)	Enabled	Disabled

(*1)(*2) with the RS-485 serial interface specification (dealer option), the DIP switches 2-7 and 2-8 are disabled.

NOTES:
- 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.

3.3.3.2 Parallel interface specification (TM-U590P/TM-U590PM)

Table 3.3.4 DIP Switch 1

SW	Function	ON	OFF
1	Automatic line feed	Always enabled	Always disabled
2	Receive buffer capacity	69 bytes	4K bytes
3-8	Undefined	---	---

Table 3.3.5 DIP Switch 2

SW	Function	ON	OFF
1	Handshaking (BUSY condition)	•Receive buffer full •Reading data	•Off-line •Receive buffer full •Reading data
2	Reserved (Do not change settings)		Fixed to Off
3, 4	Undefined	---	
5-7	Reserved (Do not change settings)		Fixed to Off
8	I/F pin 31 reset signal (Do not change settings)	Fixed to 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.
- 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.

3.4 Panel LED Indicators

1) Power supply (POWER) LED: Green

On: Power is stable.

Off: Power is not stable.

2) Error (ERROR) LED: Red

On: Off-line (except during paper feeding using the FORWARD and the REVERSE buttons and during self test printing)

Off: Normal condition

Blinking: Error (refer to Section 3.7)

3) RELEASE LED: Green

On: The print platen and paper feed roller are released.

Off: The print platen and paper feed roller are clamped together. (During printing on slip paper.)

Blinking Waiting for continuous self test printing or macro execution standby state

4) SLIP LED: Green

On: Always On except Off or blinking status.

Off: When ejecting a slip paper.

Blinking: Slip insertion/removal waiting state or personal check insertion/removal waiting state (only when the printer is used with the MICR reader)

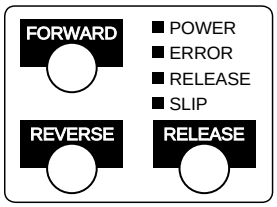


Figure 3.4.1 Panel Switches and Indicators

Blinking: Slip insertion waiting state

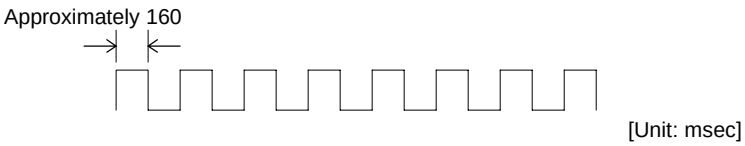


Figure 3.4.2

Blinking: Slip removal waiting state or personal check removal waiting state

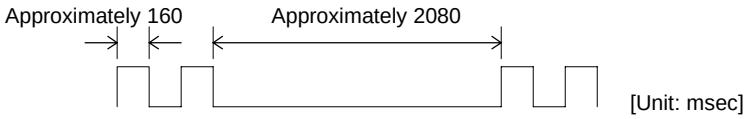


Figure 3.4.3

Blinking: Personal check insertion waiting state

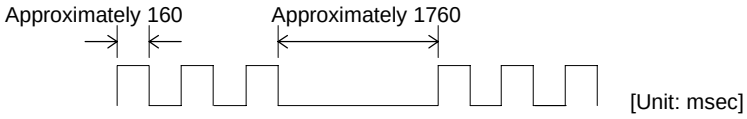


Figure 3.4.4

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

To start the self-test on slip paper, hold down the REVERSE button and turn on the printer with the cover closed. The printer enters the paper insertion waiting state. Insert slip paper to begin printing the printer status.

3) Self-test standby state

After printing the current printer status, the printer ejects the slip and waits for the next slip paper to be inserted.

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 to the normal mode.

The printer then prints the current printer status.

3.6 Hexadecimal Dumping

1) Hexadecimal dumping function

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

2) Starting hexadecimal dumping

Open the cover and turn the power on while pressing the REVERSE button, then close the cover. The printer first prints "Hexadecimal Dump" on a validation paper and prints the received print data in hexadecimal numbers and in its 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** and **DLE ENQ** do not function.

3) Ending hexadecimal dumping

Hexadecimal dumping ends by turning the power off or resetting the printer after printing has finished.

<Printing example>

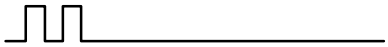
```
Hexadecimal Dump

1B 40 1B 21 00 41 42 43 44 45 46 47 48 49 4A 4B    .@.!.ABCDEFGHIJK
4C 4D 4E 4F 50 51 52 53 54 55 56 57 58 59 5A 0C    LMNOPQRSTUVWXYZ.
```

3.7 Error Processing

3.7.1 Error Types

1) Errors that have the possibility of recovery

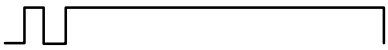
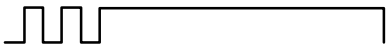
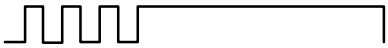
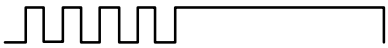
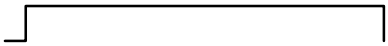
Table 3.7.2 Errors That Can Possibly Recover

Error	Description	ERROR LED Blinking Pattern (160 msec)	Recovery
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**.
Front cover open error	Printing on the slip is not performed correctly due to a 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**.

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** 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** the printer ejects the slip and does not wait the paper insertion.

2) Errors that are impossible to recover

Table 3.7.3 Unrecoverable Errors

Error	Description	ERROR LED Blinking Pattern 160 msec	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. (*)		Impossible to recover.
Low voltage error	The power supply voltage is extremely low. (*)		Impossible to recover.
CPU execution error	• The CPU executes an incorrect address. • I/F board is not connected.		Impossible to recover.
Thermistor error	• There is an abnormality in the print head temperature, thermistor is detected in-correctly, of thermistor wiring is not connected.		Impossible to recover.

(*) 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 off-line.
- 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 two paper sensors as follows:

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

3.8.1 Sensors and LED Indicators

1) TOF sensor

   The slip insertion 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 ejection sensor is located in the slip entrance and detects whether the paper is set 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.)

3.8.2 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:

When the BOF sensor is selected for printing stop, the 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 are transmitted, and then waits for the slip to be removed. After the slip is removed, the printer enters the paper insertion waiting state.

3.9 Printer Cover Sensors

3.9.1 Cover Open Sensor

- The sensor detects opening/closing of the front cover. When the cover open is detected, while printing, the printer releases the print platen immediately and stops the carriage movements. The printer goes off line automatically. The printer is in the recovery error state and the error LED blinks.

  The printer goes on-line by closing the front cover. Even if the front cover is closed, the error LED blinks. The printer can recover by sending an error recovery command. 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, printing position may shift; therefore, it is recommended to initialize the printer and resend the print data.

3.9.2 Opening/Closing the Front Cover

- The cover can be opened by pulling a hook on the left of the cover toward you. When you close the cover, push the cover backward.
- When the cover open is detected by the cover open sensor, while printing, the printer releases the print platen and stops carriage movements. If the front cover is opened during printing, data lines are cut. Be sure not to open the front cover.

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

To remove jammed paper from the print head area, open the front cover.

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.

3.12

(Intentionally blanked)

3.13

(Intentionally blanked)

4. CASE SPECIFICATIONS

4.1 External Dimensions and Weight

Height: 185 mm (7.28”)

Width: 252 mm (9.92”)

Depth: 205 mm (8.07”) (except for the protrusion)

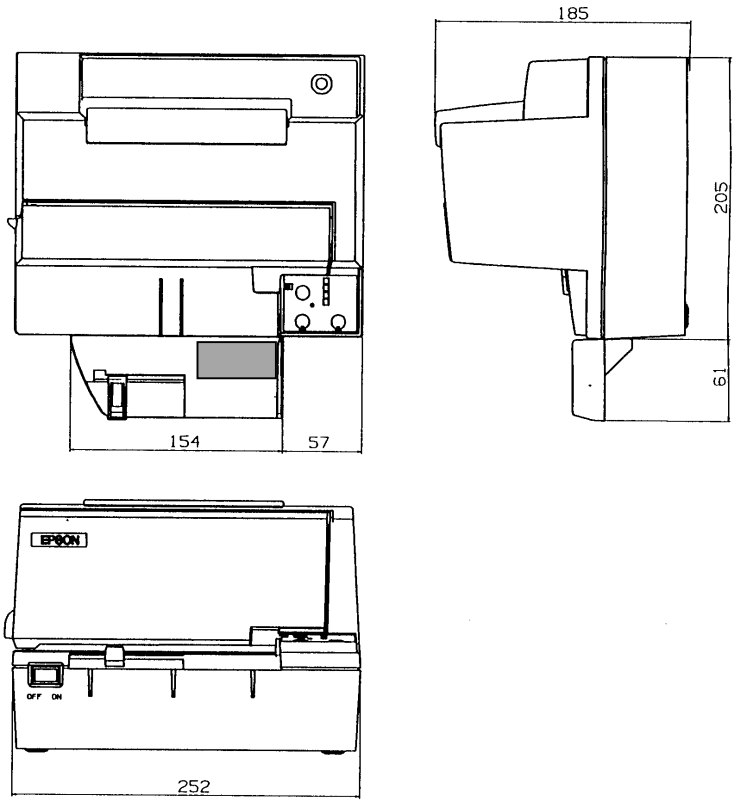
Weight: Approximately 5 kg (11.0 lbs)

(All the numeric values are typical.)

4.2 Color

EPSON standard color (ECW)

4.3 External Appearance



Materials for the external: 94V-0

[Unit : mm]

Figure 4.3.1 External Appearance

5. OPTIONS AND CONSUMABLES

5.1 Standard Accessories

- Exclusive ribbon cassette ERC-31(P)
- Operator's Manual
- I/F fixing screw (hexagonal millimeter screw)
- Power switch cover

5.2 Options

- External power supply PS-170
- Direct connection customer display DM-D series (DM-D102/DM-D203)

5.3 Consumables

- Ribbon Cassette
  ERC-31(P)
  ERC-31(B) (Life: 4,500,000 characters)
  In Japan: EPSON HANBAI Co., LTD.
  In U.S.A.: EPSON America Inc.
  In Europe: EPSON Europe B.V.

6. Commands

6.1 Command Notation

XXXX

[Name] The name of the command.

[Format] The code sequence.

ASCII indicates the ASCII equivalents.

Hex indicates the hexadecimal equivalents.

Decimal indicates the decimal equivalents.

[ ]*k* indicates the contents of the [ ] should be repeated *k* times.

[Range] Gives the allowable ranges for the arguments.

[Description] Describes the function of the command.

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

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

[Reference] Lists related commands.

[Example] Provides examples using the command.

The numbers denoted by < >H are hexadecimal.

The numbers denoted by < >B are binary.

The numbers denoted by < > are decimal.

NOTE: The phrase "beginning of a line" in command descriptions assumes that the following conditions have been met:

1. Print data, including spaces and **HT** command tabs, is not in the current print buffer.
2. The print position is not specified by the **ESC $** or **ESC ** command.

6.2 Explanation of Terms

(1) Reception buffer
The reception buffer is a buffer that stores, as is, the data received from the host (the reception data). The reception data is stored in the reception buffer temporarily, and is then processed sequentially.

(2) Print buffer
The print buffer is a buffer that stores the image data to be printed.

(3) Print buffer full
This is the state where the print buffer is full. If new print data is input while the print buffer is full, the data in the print buffer is printed out and a line feed is executed. This is the same operation as the **LF** operation.

(4) Start of line
The start of line state satisfies the following condition:

- There is no print data (including spaces and portions of data skipped due to **HT**) currently in the print buffer.
- The print position is not specified by the **ESC $** or **ESC ** command.

(5) Printable area
The maximum range within which printing is possible under the printer specifications. The printable area for this printer is as follows:
① The length of the horizontal direction:
approximately 135.467 mm (800/150 inch)

(6) Printing area
Printing range is set by the command. It must be printing area ≤ printable area.

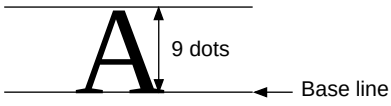
(7) Ignore
The state in which all codes, including parameters, are read in and discarded, and nothing happens.

(8) Inch
A unit of length. One inch is 25.4 mm.

(9) MSB
Most Significant Bit

(10) LSB
Least Significant Bit

(11) Base line
Standard position when character data is stored in the print buffer.



6.3 Exception Processing

6.3.1 Undefined codes

This term refers to the codes ranging from <00>H to <1F>H in the character code table. If a code in this range that is not defined as a command is input, that code (one byte) is read in and discarded, and subsequent data is processed as normal data.

Example: <30>H, <31>H, <03>H, <32>H, <0A>H, <33>H
If the above data string is input, the printer reads in and discards "<03>H" as an undefined code. Note that 0AH is defined as a command (**LF**). As a result, the data string that is actually processed is: <30>H, <31>H, <32>H, <0A>H, <33>H

6.3.2 Undefined commands

If the data following **ESC** (<1B>H) **FS** (<1C>H) or **GS** (<1D>H) is not defined as a command, then the two bytes (**ESC/FS/GS** and the code that follows) are read in and discarded.

Example: <30>H, <1B>H, <22>H, <31>H, <32>H
If the above data string is input, the printer discards the data <1B>H and <22>H as undefined commands. As a result, the data string that is actually processed is: <30>H, <31>H, <32>H.

6.3.3 Settings outside the defined range

If a value outside of the defined range is input for a command that takes parameters, that command is ignored and the previous value for that setting remains unchanged. In the case of a command that takes multiple parameters, command processing is halted the moment that a value outside of the defined range is input and subsequent values are processed as normal data.

Example: <1B>H, <52>H, <15>H
If the above data string is input, <1B>H and <52>H are defined as a command (**ESC R**), but the parameter <15>H is outside of the defined range. As a result, the printer reads in and discards the data string <1B>H, <52>H, <15>H. Accordingly, the previously set international character set is not changed.

6.3.4 Real-time commands

Real-time commands are stored after executing in the print buffer.

6.4 Control Commands

HT

[Name] Horizontal tab

[Format]

ASCII	HT
Hex	09
Decimal	9

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

[Notes]
- Horizontal tab positions are set with **ESC D**.
- If the next horizontal tab position exceeds the printing area, the printer sets the printing position to [Printing area width + 1].
- If this command is received when the printing position is at [printing area width + 1], the printer executes print buffer-full printing of the current line and horizontal tab processing from the beginning of the next line.
- This command is ignored unless the next horizontal tab position has been set.
- The default setting of the horizontal tab position for the slip paper is font A (9 × 9) every 8th character (9th, 17th, 25th, ... column).

[Reference] **ESC D**

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.

[Note] This command sets the print position to the beginning of the line.

[Reference] **ESC 2**, **ESC 3**, Appendix A.1

FF

[Name] Print and eject slip paper

[Format]

ASCII	FF
Hex	0C
Decimal	12

[Description] Prints the data in print buffer and ejects the slip paper.

[Notes]
- When the slip ejection length has been set by **ESC C**, the specified length is ejected, regardless of the TOF and BOF sensors.
- The slip is ejected in the direction specified by **ESC F**.
- This command sets the print starting position to the beginning of the line.

[Reference] **ESC C**, **ESC F**

CR

[Name] Print and carriage return

[Format]

ASCII	CR
Hex	0D
Decimal	13

[Description]

Automatic line feed enabled	Automatic line feed disabled
Functions as same as **LF**	Prints the data in the print buffer and does not feed the paper.

[Notes]
- This command sets the print starting position to the beginning of the line.
- With a serial interface model, this command executes the same operation as when disabling the automatic line feed.
- With a parallel interface model.This command is set according to the DIP switch 1-1 setting.

[Reference] **LF**

DLE EOT *n*

[Name] Real-time status transmission

[Format]

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

[Range] $1 \le n \le 3$, $n = 5$

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

n = 1: Transmit printer status

n = 2: Transmit off-line status

n = 3: Transmit error status

n = 5: Transmit slip paper status

[Notes]

- The printer transmits the status without confirming whether the host computer can receive data.
- The printer executes this command upon receiving it.
- This command is executed even when the printer is off-line, the receive buffer is full, or there is an error status with a serial interface model.
- With a parallel interface model, this command can not be executed when the printer is busy. This command is executed even when the printer is off-line or there is an error status when DIP switch 2-1 is on with a parallel interface model.
- The status is transmitted whenever the data sequence of <10>H<04>H*n* ($1 \le n \le 5$) is received.
  Example:
  In **ESC** * ***m nL nH d1 ... dk***, *d1*=<10>H, *d2*=<04>H, *d3*=<01>H
- This command should not be used within the data sequence of another command that consists of 2 or more bytes.
  Example:
  If you attempt to transmit **ESC 3** ***n*** to the printer, but DTR (DSR for the host computer) goes to MARK before *n* is transmitted and then **DLE EOT 3** interrupts before *n* is received, the code <10>H for **DLE EOT 3** is processed as the code for **ESC 3** <10H>.
- When Auto Status Back (ASB) is enabled using the **GS a** command, the status transmitted by the **DLE EOT** command and the ASB status must be differentiated. Refer to Appendix C, Transmission Status Identification.
- This command is ignored when the printer is deselected by set peripheral device command, **ESC =**.
- The printer transmits the current status. Each status is represented by one-byte data.

n = 1: Printer status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Not used. Fixed to Off.
1	On	02	2	Not used. Fixed to On.
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	On-line.
	On	08	8	Off-line.
4	On	10	16	Not used. Fixed to On.
5,6	-	-	-	Undefined.
7	Off	00	0	Not used. Fixed to Off.

Bit 3:
- The printer enters off-line when the printer cover is open while printing is stopped.
- The printer enters recoverable error status when cover is open during printing.

n = 2: Off-line status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Not used. Fixed to Off.
1	On	02	2	Not used. Fixed to On.
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 FORWARD/REVERSE button.
	On	08	8	Paper is being fed by the FORWARD/REVERSE button.
4	On	10	16	Not used. Fixed to On.
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 occurs.
7	Off	00	0	Not used. Fixed to Off.

Bit 5: The printer does not enter off-line when the printer detects paper end and printing stops.

n = 3: Error status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Not used. Fixed to Off.
1	On	02	2	Not used. Fixed to On.
2	Off	00	0	No mechanical error.
	On	04	4	Mechanical error occurs.
3	--	--	--	Undefined.
4	On	10	16	Not used. Fixed to On.
5	Off	00	0	No unrecoverable error.
	On	20	32	Unrecoverable error occurs.
6	--	--	--	Undefined.
7	Off	00	0	Not used. Fixed to Off.

Bit 2: Mechanical error indicates the home position detection error, carriage detection error, slip paper ejection error, or cover open error during printing.

If these errors occur due to paper jams or the like, it is possible to recover by correcting the cause of the error and executing **DLE ENQ *n*** ($1 \leq n \leq 2$). If an error due to a circuit failure (e.g. wire break) occurs, it is impossible to recover.

n = 5: Slip paper status

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Not used. Fixed to Off.
1	On	02	2	Not used. Fixed to On.
2	Off	00	0	Slip paper selected.
3	Off	00	0	Does not wait for slip paper insertion.
	On	08	8	Waits for slip paper insertion.
4	On	10	16	Not used. Fixed to On.
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	Not used. Fixed to Off.

Bit 3: Becomes 0 (slip insertion is not waiting) just before the platen being closed after detecting it.

Bit 5 and 6: Transmit the current status of the slip sensors.

[Reference] **DLE ENQ**, **GS a**, **GS r**, Appendix C

DLE ENQ *n*

[Name] Real-time request to printer

[Format]

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

[Range] *n* = 1, *n* = 2

[Description] Responds to a request from the host computer. *n* specifies the requests as follows:

n	**Request**
1	Recover from an error and restart printing from the line where the error occurred
2	Recover from an error aft clearing the receive and print buffers

[Notes]

- The printer starts processing data upon receiving this command.
- This command is executed even when the printer is off-line, the receive buffer is full, or there is an error status with a serial interface model.
- With a parallel interface model, this command can not be executed when the printer is busy. This command is executed even when the printer is off-line or there is an error status when DIP switch 2-1 is on with a parallel interface model.
- The status is also transmitted whenever the data sequence of <10>H<05>H*n* ($1 \leq n \leq 3$) is received.
  Example:
  In **ESC** ∗ ***m*** n_L n_H ***d1 ... dk***, *d1*=<10>H, *d2*=<05>H, *d3*=<01>H
- This command should not be contained within another command that consists of two or more bytes.
  Example:
  If you attempt to transmit **ESC 3** ***n*** to the printer, but DTR (DSR for the host computer) goes to MARK before *n* is transmitted, and **DLE ENQ 1** interrupts before *n* is received, the code <10>H for **ESC 3** is processed.
- **DLE ENQ 1** starts printing from the line where an error occurred. This command is available only for errors that have the possibility of recovery.
- When the printer recovers from a recoverable error using **DLE ENQ 1** or **DLE ENQ 2**, and slip paper is selected, the printer ejects the slip completely and is in the slip waiting state.
- **DLE ENQ 2** enables the printer to recover from an error after clearing the data in the receive buffer and the print buffer. The printer retains the settings (by **ESC !**, **ESC 3**, etc.) that were in effect when the error occurred. The printer can be initialized completely by using this command and **ESC** @. This command is enabled only for errors that have the possibility of recovery.

- When the printer is disabled with **ESC =** (Select peripheral device), the error recovery functions are enabled, and the other functions are disabled.

[Reference] **DLE EOT**

ESC SP *n*

[Name] Set right-side character spacing

[Format]

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

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

[Description] Sets the character spacing for the right side of the character to [$n \times$ horizontal or vertical motion units].

[Notes]
- The right-side character spacing for double-width mode is twice the normal value.
- The horizontal and vertical motion unit are specified by **GS P**. Changing the horizontal or vertical motion unit does not affect the current right-side spacing.
- The **GS P** command can change the horizontal (and vertical) motion unit. However, the value cannot be less than the minimum horizontal movement amount, and it must be in even units of the minimum horizontal movement amount.
- The maximum right-side spacing is 43.18mm (255/180 inches) for the slip paper. Any setting exceeding the maximum is converted to the maximum automatically.

[Default] $n = 0$

[Reference] **GS P**

ESC ! *n*

[Name] Select print mode(s)

[Format]

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

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

[Description] Selects print mode(s) using *n* as follows:

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Character font A (9 × 9) for selected.
	On	01	1	Character font B (7 × 9) for selected.
1	-	-	-	Undefined.
2	-	-	-	Undefined.
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	-	-	-	Undefined.
7	Off	00	0	Underline mode not selected.
	On	80	128	Underline mode selected.

[Notes]
- When both double-height and double-width modes are selected, quadruple size characters are printed.
- The printer can underline all characters, but can not underline the space set by **HT**.
- The thickness of the underline is that selected by **ESC -**, regardless of the character size.
- When some characters in a line are double or more height, all the characters on the line are aligned at the baseline.
- **ESC E** can also turn on or off emphasized mode. However, the setting of the last received command is effective.
- **ESC -** can also turn on or off underline mode. However, the setting of the last received command is effective.
- **GS !** can also select character size. However, the setting of the last received command is effective.
- If the underline mode is selected for slip paper, the lowest dot is printed in the same position as the underline. Therefore, some characters may be hard to see.

[Default] *n* = 0

[Reference] **ESC -**, **ESC E**, **GS !**

ESC $ n_L n_H

[Name] Set absolute print position

[Format]

ASCII	ESC	$	n_L	n_H
Hex	1B	24	n_L	n_H
Decimal	27	36	n_L	n_H

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

$0 \le n_H \le 255$

[Description] Sets the distance from the beginning of the line to the position at which subsequent characters are to be printed.

- The distance from the beginning of the line to the print position is $[(n_L + n_H \times 256) \times$ (vertical or horizontal motion unit)] inches.

[Notes]
- Settings outside the specified printable area are ignored.
- The horizontal and vertical motion unit are specified by **GS P**.
- The **GS P** command can change the horizontal (and vertical) motion unit. However, the value cannot be less than the minimum horizontal movement amount, and it must be in even units of the minimum horizontal movement amount.

[Reference] **ESC **, **GS P**

ESC % *n*

[Name] Select/cancel user-defined character set

[Format]

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

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

[Description] Selects or cancels the user-defined character set.

- When the LSB is 0, the user-defined character set is cancelled.
- When the LSB is 1, the user-defined character set is selected.

[Notes]
- *n* is available only for the least significant bit.
- When the user-defined character set is cancelled, the internal character set is automatically selected.

[Default] $n = 0$

[Reference] **ESC &**, **ESC ?**

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] $y = 2$

$32 \le c1 \le c2 \le 126$

$0 \le x \le 12$ (When Font A (9 × 9) is selected.)

$0 \le x \le 9$ (When Font B (7 × 9) is selected.)

$0 \le d \le 255$

[Description] Defines user-defined characters.

- *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.

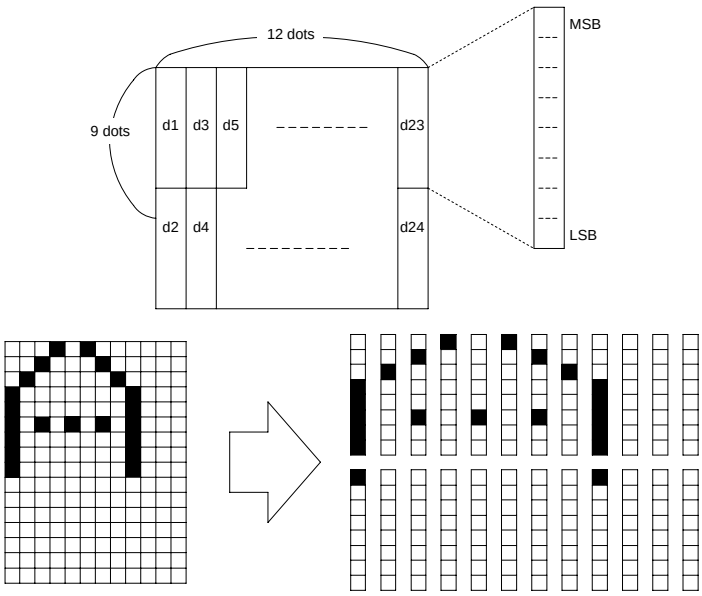
[Notes]

- The allowable character code range is from ASCII code <20>H to <7E>H (95 characters).
- It is possible to define multiple characters for consecutive character codes. If only one character is desired, use *c1 = c2*.
- *d* is the dot data for the characters. The dot pattern is in the horizontal direction from the left side. Any remaining dots on the right side are blank.
- The dots adjoining each other horizontally cannot be printed.
- Only the most upper bit can be printed in the second byte for the vertical direction.
- The data to define a user-defined character is (y × x) bytes.
- Set a corresponding bit to 1 to print a dot or 0 to not print a dot.
- This command can define different user-defined character patterns by each fonts. To select a font, use **ESC !**
- A user-defined character and a downloaded bit image cannot be defined simultaneously. When this command is executed, the downloaded bit image is cleared.
- The user-defined character definition is cleared when:
  ESC @ is executed.
  ESC ? is executed.
  GS * is executed.
  The printer is reset or the power is turned off.

[Default] The internal character set

[Reference] **ESC %**, **ESC ?**

[Example]



d1 = 1FH, d3 = 20H, d5 = 44H, . . .
d2 = 80H, d4 = 00H, d6 = 00H, . . .

ESC ∗ *m* n_L n_H *d1 ... dk*

[Name] Select bit-image mode

[Format]

ASCII	ESC	∗	*m*	n_L	n_H	*d*1 ... *k*	
Hex	1B	2A	*m*	n_L	n_H	*d*1 ... *k*	
Decimal	27	42	*m*	n_L	n_H	*d*1 ... *k*	

[Range] $m = 0, 1$
$0 \le n_L \le 255$
$0 \le n_H \le 3$
$0 \le d \le 255$
$k = n_L + n_H \times 256$

[Description] Selects a bit-image mode using *m* for the number of dots specified by n_L and n_H, as follows:

m	**Mode**	**Vertical Direction**	**Horizontal Direction**	
		Number of Dots	**Dot adjacency**	**Maximum number of dots in horizontal**
0	8-dot single-density	8	Available	400 DPI
1	8-dot double-density	8	Not available	800 DPI

[Notes]

- If the values of *m* is out of the specified range, n_L and data following are processed as normal data.
- The n_L and n_H indicate the number of dots of the bit image in the horizontal direction. The number of dots is calculated by $n_L + n_H \times 256$.
- If the bit-image data input exceeds the number of dots to be printed on a line, the excess data is ignored.
- *d* indicates the bit-image data. Set a corresponding bit to 1 to print a dot or to 0 to not print a dot.
- If the width of the printing area set by **GS L** and **GS W** less than the width required by the data sent with the **ESC ∗** command, the following will be performed on the line in question for each bit of data in single-density mode (*m*=0), the printer prints two dots (two half dot for the slip): for each bit of data in double-density mode (*m*=1), the printer prints one dot (one half dot for the slip):

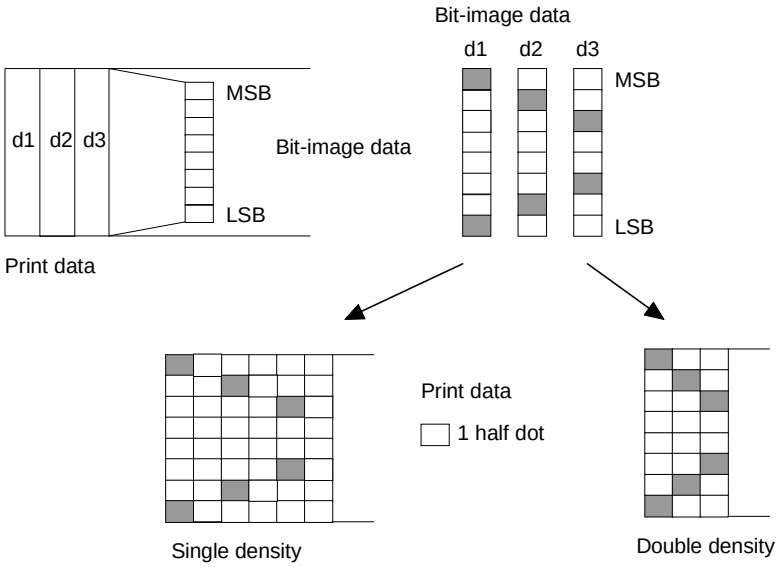
① The width of the printing area is extended to the right to accommodate the amount of data.

② If step ① does not provide sufficient width for the data, the left margin is reduced to accommodate the data.

- After printing a bit image, the printer returns to normal data processing mode.
- This command is not affected by print modes (emphasized, double-strike, underline, or character size), except upside-down printing mode.

- The relationship between the image data and the dots to be printed is as follows:

8-dot bit image



ESC - *n*

[Name] Turn underline mode on/off

[Format]

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

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

[Description] Turns underline mode on or off, based on the following values of *n*:

n	**Function**
0, 48	Turns off underline mode
1, 49	Turns on underline mode (1-dot thick)

[Notes]
- The printer can underline all characters (including right-side character spacing), but cannot underline the space set by **HT.**
- Changing the character size does not affect the current underline thickness.
- Underline mode can also be turned on or off by using **ESC !**. Note, however, that the last received command is effective.

[Default] *n* = 0

[Reference] **ESC !**

ESC 2

[Name]	Select default line spacing		
[Format]	ASCII	ESC	2
	Hex	1B	32
	Decimal	27	50
[Description]	Selects 4.23 mm (1/6-inch) line spacing.		
[Reference]	**ESC 3**		

ESC 3 n

[Name]	Set line spacing			
[Format]	ASCII	ESC	3	*n*
	Hex	1B	33	*n*
	Decimal	27	51	*n*
[Range]	$0 \leq n \leq 255$			
[Description]	Sets the line spacing to [*n* × vertical or horizontal motion unit] inches.			

[Notes]
- The line spacing can be set independently in standard mode and in page mode.
- The horizontal and vertical motion unit are specified by **GS P**. Changing the horizontal or vertical motion unit does not affect the current line spacing.
- The **GS P** command can change the horizontal (and vertical) motion unit. However, the value cannot be less than the minimum vertical movement amount, and it must be in even units of the minimum vertical movement amount.
- The maximum line spacing is 1016 mm (40 inches). When the setting value exceeds the maximum, it is converted to the maximum automatically.

[Default] *n* = 24 (1/6 inches)

[Reference] **ESC 2**, **GS P**

ESC <

[Name]	Return home		
[Format]	ASCII	ESC	<
	Hex	1B	3C
	Decimal	27	60
[Description]	Moves the print head to the standby position.		

[Notes]
- Since the home position is detected when this command is executed, the printing position may shift after this command is executed.
- The standby position is in the left.

ESC = *n*

[Name] Set peripheral device

[Format]

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

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

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

Bit	Off/On	Hex	Decimal	Function
0	Off	00	0	Printer disabled.
	On	01	1	Printer enabled
1	Off	00	0	Customer display disabled.
	On	02	2	Customer display enabled.
2-7	-	-	-	Undefined.

[Notes]

- When the printer is disabled, it ignores all data except for error-recovery commands (**DLE ENQ 1**, **DLE ENQ 2**) until it is enabled by this command.

[Default]

Serial interface specification:

- When turning on the printer:

Direct Connection Customer Display Status	*n*
Customer display is recognized (*1)	2
Customer display is not recognized (*1)	1

- When executing **ESC** @:

  Default values set by **ESC** @ are as follows, depending on the value set by **ESC =** just before processing **ESC** @ and on the setting of DIP switch 2-2:

Direct Connection Customer Display Status Default Value to be Set		*n*		
		1	**2**	**3**
After **ESC** @ Processing	When customer display is connected (*1)	1	2(*2)	2
	When customer display is not connected (*1)	1	2(*2)	1

(*1) Depending on the setting of DIP switch 2-2.

(*2) The printer is disabled and it does not process **ESC** @; therefore, the **ESC =** setting is changed.

Parallel interface specification: *n* = 1

[Reference] **DLE ENQ**

ESC ? *n*

[Name]	Cancel user-defined characters			
[Format]	ASCII	ESC	?	*n*
	Hex	1B	3F	*n*
	Decimal	27	63	*n*
[Range]	$32 \leq n \leq 126$			
[Description]	Cancels user-defined characters.			

[Notes]
- This command cancels the pattern defined for the character code specified by *n*. After the user-defined characters is canceled, the corresponding pattern for the internal character is printed.
- This command deletes the pattern defined for the specified code in the font selected by **ESC !**.
- If a user-defined character has not been defined for the specified character code, the printer ignores this command.

[Reference] **ESC &**, **ESC %**

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 mode to the mode that was in effect when the power was turned on.		

[Notes]
- The DIP switch settings are not checked again.
- The data in the receive buffer is not cleared.
- Printer does not eject and release the slip.

ESC C *n*

[Name] Set slip paper eject length

[Format]

ASCII	ESC	C	*n*
Hex	1B	43	*n*
Decimal	27	67	*n*

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

[Description] Sets the eject length setting for slip paper to *n* lines.

[Notes]

- When *n* = 0, the eject length setting for slip paper is cancelled. The printer continues feeding the paper until the printer gets to the position where the slip can be ejected. The positions are defined as below:

  When reverse ejection is executed:

  If both TOF and BOF sensors detect a paper present status, paper is fed approximately 80 mm (3.15 inches) in the reverse paper feed direction.

  If only TOF sensor detects a paper present status, the printer feeds paper until the BOF sensor detects a paper present status and then the paper is fed approximately 80 mm (3.15 inches) in the reverse paper feed direction. In this case, if the BOF sensor can not detect a paper present status even if the printer feeds paper 450 mm (17.72 inches)or more, it is a slip ejection error.

  If only BOF sensor detects a paper present status, paper is fed approximately 20 mm (0.79 inches) in the reverse paper feed direction.

  When forward ejection is executed:

  Paper is fed until the BOF sensor detects a paper-end and then the paper is fed approximately 20 mm (0.79 inches)in the paper feed direction. In this case, if the BOF sensor can not detect a paper not present status even if the printer feeds paper 450 mm (17.72 inches) or more, it is a slip ejection error.

- Specified eject length doesn't change even if line spacing changes.
- The maximum eject length that can be set is 450 mm (17.72 inches). If the specified amount exceeds 450 mm (17.72 inches), the eject length is automatically set to 450 mm (17.72 inches).

[Default] *n* = 0

[Reference] **FF**, **ESC 2**, **ESC 3**

ESC D *n*1 ... *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] $1 \le n \le 255$

$0 \le k \le 32$

[Description] Sets horizontal tab positions.

- *n* specifies the column number for setting a horizontal tab position from the beginning of the line.
- *k* indicates the total number of horizontal tab positions to be set.

[Notes]
- The horizontal tab position is stored as a value of [*n* × character width] measured from the beginning of the line. The character width includes the right-side character spacing, and double-width characters are set with twice the width of normal characters.
- This command cancels the previous horizontal tab settings.
- When setting *n* = 8, the print position is moved to column 9 by sending **HT**.
- Up to 32 tab positions (*k* = 32) can be set. Data exceeding 32 tab positions is processed as normal data.
- Transmit [*n*]*k* in ascending order and place a NUL code 0 at the end.
- When [*n*]*k* is less than or equal to the preceding value [*n*]*k*-1, tab setting is finished and the following data is processed as normal data.
- **ESC D NUL** cancels all horizontal tab positions.
- The previously specified horizontal tab positions do not change, even if the character width changes.

[Default] *n* = 8, 16, 24, 32... (intervals of 8 characters (columns 9, 17, 25,...) for the font A (9 × 9).)

[Reference] **HT**

ESC E *n*

[Name]	Turn emphasized mode on/off			
[Format]	ASCII	ESC	E	*n*
	Hex	1B	45	*n*
	Decimal	27	69	*n*
[Range]	$0 \le n \le 255$			
[Description]	Turns emphasized mode on or off			
	When the LSB is 0, emphasized mode is turned off.			
	When the LSB is 1, emphasized mode is turned on.			

[Notes]
- Only the least significant bit of *n* is enabled.
- This command and **ESC !** turn on and off emphasized mode in the same way. The command which is executed at latest is effective.
- Emphasized and double-strike printing appear the same.
- Two-pass printing is executed; therefore, printing speed goes slow.

[Default] *n* = 0

[Reference] **ESC !**

ESC F

[Name]	Set/cancel slip paper 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 slip paper reverse eject			
	When the LSB is 0, cancels the slip paper reverse eject.			
	When the LSB is 1, sets the slip paper reverse eject.			

[Notes]
- Only the least significant bit of *n* is enabled.
- The command is enabled only when input at the beginning of the line.

[Default] *n* = 1

[Reference] **FF**

ESC G *n*

[Name] Turn on/off double-strike mode

[Format]

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

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

[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.

[Notes]

- Only the lowest bit of *n* is enabled.
- Printer output is the same in double-strike mode and in emphasized mode.
- Two-pass printing is executed; therefore, printing speed goes slow.

[Default] *n* = 0

[Reference] **ESC E**

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 or horizontal motion unit] inches.

[Notes]

- After printing is completed, this command sets the print starting position to the beginning of the line.
- The paper feed amount set by this command does not affect the values set by **ESC 2** or **ESC 3**.
- The horizontal and vertical motion unit are specified by **GS P**.
- The **GS P** command can change the vertical (and horizontal) motion unit. However, the value cannot be less than the minimum vertical movement amount, and it must be in even units of the minimum vertical movement amount.
- The maximum paper feed amount is 1016 mm(40 inches). Even if a paper feed amount of more than 1016 mm (40 inches) is set, the printer feeds the paper only 1016 mm (40 inches).

[Reference] **GS P**

ESC K *n*

[Name]	Print and reverse feed			
[Format]	ASCII	ESC	K	*n*
	Hex	1B	4B	*n*
	Decimal	27	75	*n*
[Range]	$0 \leq n \leq 255$			
[Description]	Prints the data in the print buffer and feeds the paper [*n* × vertical motion unit] inches in the reverse direction			

[Notes]
- This command set the print position to the beginning of the line.
- The paper feed amount set by this command does not affect the values set by **ESC 2** or **ESC 3**.
- The horizontal and vertical motion units are specified by **GS P**.
- The **GS P** command can change the vertical (and horizontal) motion units. However, the value cannot be less than the minimum vertical movement amount, and it must be in even units of the minimum vertical movement amount.
- The maximum paper feed amount is 1016 mm (40 inches). Even if a paper feed amount of more than 1016 mm (40 inches) is set, the printer feeds the paper only 1016 mm (40 inches).

[Reference] **GS P**

ESC R *n*

[Name] Select an international character set

[Format]

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

[Range] $0 \le n \le 10$

[Description] Selects an 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
8	Japan
9	Norway
10	Denmark II

[Default] *n* = 0

[Reference] 3.2.11 *International Character Set*

ESC U *n*

[Name]	Turn on/off unidirectional printing mode			
[Format]	ASCII	ESC	U	*n*
	Hex	1B	55	*n*
	Decimal	27	85	*n*
[Range]	$0 \le n \le 255$			
[Description]	Turns unidirectional printing mode on or off When the LSB is 0, turns off unidirectional printing mode. When the LSB is 1, turns on unidirectional printing mode.			
[Notes]	• Only the least significant bit of *n* is enabled. • When unidirectional printing mode is turned on, the printer prints from left to right. • To avoid horizontal printing misalignment, unidirectional printing mode should be used.			
[Default]	*n* = 0			

ESC \ *nL nH*

[Name]	Set relative print position				
[Format]	ASCII	ESC	\	*nL*	*nH*
	Hex	1B	5C	*nL*	*nH*
	Decimal	27	92	*nL*	*nH*
[Range]	$0 \le nL \le 255$ $0 \le nH \le 255$				
[Description]	Sets the print starting position based on the current position by using the foundamental motion unit. • This command sets the distance from the current position to [$(nL + nH) \times 256 \times$ foundamental motion unit]				
[Notes]	• Any setting that exceeds the printable area is ignored. • When pitch *N* is specified to the right: $nL + nH \times 256 = N$ When pitch *N* is specified to the left (the negative direction), use the complement of 65536. When pitch *N* is specified to the left: $nL + nH \times 256 = 65536 - N$ • The horizontal and vertical motion unit are specified by **GS P**. • The **GS P** command can change the horizontal (and vertical) motion unit. However, the value cannot be less than the minimum horizontal movement amount, and it must be in even units of the minimum horizontal movement amount.				
[Reference]	**ESC $**, **GS P**				

ESC a *n*

[Name] Select justification

[Format]

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

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

[Description] Aligns all the data in one line to the specified position

n selects the justification as follows:

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

[Notes]
- The command is enabled only when processed at the beginning of the line.
- This command justifies the space area according to **HT**, **ESC $** or **ESC **.

[Default] *n* = 0

[Example]

Left justification

```
ABC
ABCD
ABCDE
```

Centering

```
 ABC
ABCD
ABCDE
```

Right justification

```
  ABC
 ABCD
ABCDE
```

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] $0 \le n \le 255$

[Description] Selects the paper sensor(s) to output paper end signals

- Each bit of n is used as follows:

Bit	Off/On	Hex	Decimal	Function
0	-	-	-	Undefined
1	-	-	-	Undefined
2	-	-	-	Undefined
3	-	-	-	Undefined
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	-	-	-	Undefined

[Notes]

- It is possible to select multiple sensors to output signals. Then, if any of the sensors detects a paper end, the paper end signal is output.
- Sensor is switched when executing this command. The paper end signal switching be delayed depending on the receive buffer state.
- When all the sensors are disabled, the paper end signal always outputs a paper present status.
- The command is available only with a parallel interface and is ignored with a serial interface.

[Default] *n* = 0

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] $0 \le n \le 255$

[Description] Selects the paper sensor(s) used to stop printing when a paper-end is detected, using *n* as follows:

Bit	Off/On	Hex	Decimal	Function
0	-	-	-	Undefined
1	-	-	-	Undefined
2	-	-	-	Undefined
3	-	-	-	Undefined
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	-	-	-	Undefined.
7	-	-	-	Undefined.

[Notes]

- It is possible to select multiple sensors for print control to stop printing. Then if any sensor detects a paper end, the printer stops printing.
- When a paper end is detected, printing is stopped after printing the current line and feeding the paper.
- When the TOF sensor or the BOF sensor is enabled and a paper-end is detected, the printer ejects the paper after printing as much as possible and enters the paper waiting state.
- When a paper-end is detected by the BOF sensor, the printer does not go off-line after printing stops.

[Default] *n* = 0

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] $0 \le n \le 255$

[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.

[Notes]
- Only the lowest bit of *n* is valid.
- When the panel buttons are disabled, none of them are usable.
- In this printer, the panel buttons are the FORWARD, REVERSE, and RELEASE buttons.
- When the cover is open, all panel buttons are disabled regardless of the settings of this command.

[Default] *n* = 0

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.

[Notes]
- This command sets the print starting position to the beginning of the line.
- This command does not affect the line spacing set by **ESC 2** or **ESC 3**.
- The maximum paper feed amount is 1016 mm (40 inches). If the paper feed amount ($n \times$ line spacing) of more than 1016 mm (40 inches) is specified, the printer feeds the paper only 1016 mm (40 inches).

[Reference] **ESC 2**, **ESC 3**

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 *n* lines in the reverse direction.

[Notes]
- This command sets the print starting position to the beginning of the line.
- The paper feed amount set by this command does not affect the values set by **ESC 2** or **ESC 3**.
- Even if the number of ($n \times$ line feed amount) exceeds 1016 mm (40 inches), the printer feeds the paper only 1016 mm (40 inches).

[Reference] **ESC 2**, **ESC 3**

ESC f *t1 t2*

[Name] Set slip paper waiting time

[Format]

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

[Range] *t1* = 0

$0 \le t2 \le 64$

[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.
- *t2* specifies time from insertion of the slip to the start of printing.

[Notes]
- The printer starts operation [$t2 \times 0.1$] seconds after detecting a slip.
- When either *t1* or *t2* is out of the specified range, this command is ignored and the previously set value is not changed.
- When *t1* is out of the specified range, this command is ignored and the following data is executed normally.
- When the cut sheet insert waiting time is set longer than the default setting, there are a few possibility that the paper jams because the user may insert the paper too much. Therefore, the default setting is recommended to avoid this problem.

[Default] *t1* = 0, *t2* = 5

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] $0 \le m \le 1$, $48 \le m \le 49$

$0 \le t1 \le 255$, $0 \le t2 \le 255$

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

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

[Notes]
- The pulse ON time is [*t1* × 2 ms] and the OFF time is [*t2* × 2 ms].
- If *t2* < *t1*, the OFF time is [*t1* × 2 ms]

[Reference] Section 2.2.3, *Drawer kick-out connector*, Appendix E

ESC q

[Name] Release

[Format]

ASCII	ESC	q
Hex	1B	71
Decimal	27	113

[Description] Releases the paper

[Notes]
- The printer waits for the paper to be removed after executing a release

ESC t *n*

[Name] Select character code table

[Format]

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

[Range] $0 \le n \le 8$, $n = 255$

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

n	**Page**
0	0 (PC437 [U.S.A., Standard Europe])
1	1 (Katakana)
2	2 (PC850 [Multilingual])
3	3 (PC860 [Portuguese])
4	4 (PC863 [Canadian-French])
5	5 (PC865 [Nordic])
6	6 (Hiragana)
7	7 (One-pass printing Kanji characters)
8	8 (One-pass printing Kanji characters)
255	Font A: Space page
	Font B: See 3.2.10 Page 255

Page 6 to 8 of the character code table (*n* = 6, 7, 8) are available only on TM-U590M/TM-U590PM.

[Default] *n* = 0

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

ESC { *n*

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

[Format]

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

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

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

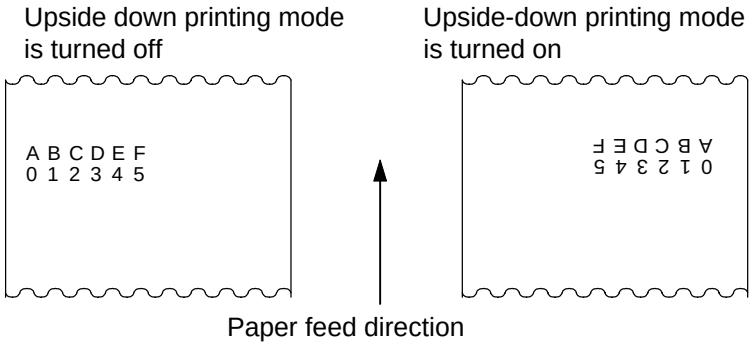
- When the LSB of *n* is 0, upside-down printing mode is turned off.
- When the LSB of *n* is 1, upside-down printing mode is turned on.

[Notes]

- Only the lowest bit of *n* is valid.
- This command is enabled only when processed at the beginning of a line.
- In upside-down printing mode, the printer rotates the line to be printed by 180° and then prints it.

[Default] *n* = 0

[Example]



GS ! *n*

[Name] Select character size

[Format]

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

[Range] *n* = 0, 1, 16, 17

[Description] Selects the character height using bits 0 to 3 and selects the character width using bits 4 to 7, as follows:

Bit	Off/On	Hex	Decimal	Function
0	Character height selection. See Table 2.			
1				
2				
3				
4	Character width selection. See Table 1.			
5				
6				
7				

Table 1 Character Width Selection

Hex	Decimal	Width
00	0	1 (normal)
10	16	2 (double-width)

Table 2 Character Height Selection

Hex	Decimal	Height
00	0	1 (normal)
01	1	2 (double-height)

[Notes]
- When characters are enlarged with different sizes on one line, all the characters on the line are aligned at the baseline.
- The **ESC !** command can also turn double-width and double-height modes on or off. However, the setting of the last received command is effective.

[Default] *n* = 0

[Reference] **ESC !**

GS ∗ *x y d1 ... d(x × y × 8)*

[Name] Define user-defined bit-image

[Format]

ASCII	GS	∗	*x*	*y*	*d1 ... d(x × y × 8)*
Hex	1D	2A	*x*	*y*	*d1 ... d(x × y × 8)*
Decimal	29	42	*x*	*y*	*d1 ... d(x × y × 8)*

[Range] $1 \le x \le 255$

$1 \le y \le 255$

$x \times y \le 404$

$0 \le d \le 255$

[Description] Defines a user-defined bit-image using the number of dots specified by *x* and *y*

- *x* specifies the number of dots in the horizontal direction.
- *y* specifies the number of dots in the vertical direction.

[Notes]

- The number of dots in the horizontal direction is x × 8, in the vertical direction it is y × 8.
- If *x* × *y* is out of the specified range, this command is disabled.
- The *d* indicates bit-image data. Data (*d*) specifies a bit printed to 1 and not printed to 0.
- A user-defined character and a user-defined bit-image cannot be defined simultaneously. When this command is executed, the user-defined character is cleared.
- After a user-defined bit-image is defined, it is available until **ESC** @ or **ESC &** is executed; the printer is reset; or the power is turned off.

[Reference] **ESC &**, **GS *I***

GS / *m*

[Name] Print user-defined bit-image

[Format]

ASCII	GS	/	*m*
Hex	1D	2F	*m*
Decimal	29	47	*m*

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

[Description] Prints a user-defined bit-image using the mode specified by *m*.
m selects a mode from the table below:

m	**Mode**	**Vertical Dot Density (DPI)**	**Maximum Number of Dots in Horizontal**
0, 48	Normal	Not available	800 dots
1, 49	Double-width	Available	400 dots

[Notes]

- This command is ignored if a user-defined bit-image has not been defined.
- This command is effective only when there is no data in the print buffer.
- This command has no effect in the print modes (emphasized, double-strike, underline, character size, white/black reverse printing, or 90° rotated character etc.), except for upside-down printing mode.
- If the printing area width set by **GS L** and **GS W** is less than one line in vertical, the following processing is performed only on the line in question:
  ① The printing area width is extended to the right up to one line in vertical. In this case, printing does not exceed the printable area.
  ② If the printing area width cannot be extended by one line in vertical, the left margin is reduced to accommodate one line in vertical.
  One line in vertical means 1 dot (one half dot for the slip) in normal (*m* = 0, 48) and double-height (2, 50), 2 dots (two half dot for the slip) in double-width (*m* = 1, 49) and quadruple (*m* = 3, 51) modes.
- The user-defined bit-image is printed on the selected paper set by the **ESC c 0** command.
- If a user-defined bit-image to be printed exceeds one line, the excess data is not printed.

[Reference] **GS ***

GS I *n*

[Name] Transmit printer ID

[Format]

ASCII	GS	I	*n*
Hex	1D	49	*n*
Decimal	29	73	*n*

[Range] $1 \le n \le 3$, $49 \le n \le 51$

[Description] Transmits the printer ID specified by *n* as follows:

n	**Printer ID**	**Specification**	**ID (hexadecimal)**
1, 49	Printer model ID	TM-U590/U590P/U590M/U590PM	21H
2, 50	Type ID	See table below.	
3, 51	ROM version ID	Depends on ROM version	

n = 2, 50 Type ID

Bit	**Off/On**	**Hex**	**Decimal**	**Function**
0	Off	00	0	Two-byte character code not supported.
	On	01	1	Two-byte character code supported.
1	Off	00	0	Auto-cutter is not equipped.
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	No MICR reader.
4	Off	00	0	Not used. Fixed to Off.
5	-	-	-	Undefined.
6	-	-	-	Undefined.
7	Off	00	0	Not used. Fixed to Off.

[Notes]

- When DTR/DSR control is selected in the serial interface model, the printer transmits only 1 byte after confirming that the host is ready to receive data (DSR signal is SPACE). If the host computer is not ready to receive data (DSR signal is MARK), the printer waits until the host is ready.
- When XON/XOFF control is selected in the serial interface model, the printer transmits only 1 byte without confirming the condition of the DSR signal.
- The printer ID is transmitted when the data in the receive buffer is developed. Therefore, there may be a time lag between receiving this command and transmitting the status, depending on the receive buffer status.
- When Auto Status Back (ASB) is enabled using **GS a**, the status transmitted by **GS I** and the ASB status must be differentiated.

[Reference] Appendix C

GS L *nL nH*

[Name] Set left margin

[Format]

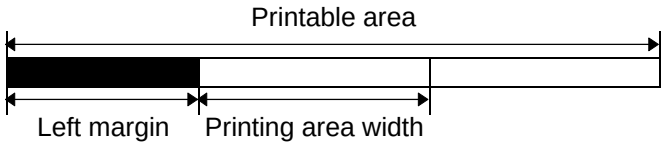
ASCII	GS	L	*nL*	*nH*
Hex	1D	4C	*nL*	*nH*
Decimal	29	76	*nL*	*nH*

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

$0 \le nH \le 255$

[Description] Sets the left margin using *nL* and *nH*.

- The left margin is set to [(*nL* + *nH* × 256) × horizontal motion unit)] inches.



[Notes]

- This command is effective only processed at the beginning of the line.
- If the setting exceeds the printable area, the maximum value of the printable area is used.
- The horizontal and vertical motion units are specified by **GS P**. Changing the horizontal and vertical motion unit does not affect the current left margin.
- The horizontal motion unit (x) is used for calculating the left margin. The calculated result is truncated to the minimum value of the mechanical pitch.

[Default] *nL* = 0, *nH* = 0

[Reference] **GS P**, **GS W**

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] $0 \le x \le 255$

$0 \le y \le 255$

[Description] Sets the horizontal and vertical motion units to 1/*x* inch and 1/*y* inches, respectively.

When *x* and *y* are set to 0, the default setting of each value is used.

[Notes]
- The horizontal direction is perpendicular to the paper feed direction and the vertical direction is the paper feed direction.
- The following commands use *x* or *y*, regardless of character rotation (upside-down or 90° clockwise rotation):
  ① Commands using *x*: **ESC SP**, **ESC $**, **ESC **, **GS L**, **GS W, FS S**
  ② Commands using *y*: **ESC 3**, **ESC J**, **ESC K**
- The command does not affect the previously specified values.
- The calculated result from combining this command with others is truncated to the minimum value of the mechanical pitch.

[Default] *x* = 150, *y* = 144

[Reference] **ESC SP**, **ESC $**, **ESC 3**, **ESC J**, **ESC K**, **ESC **, **FS S**, **GS L**, **GS W**

GS W *nL nH*

[Name] Set printing area width

[Format]

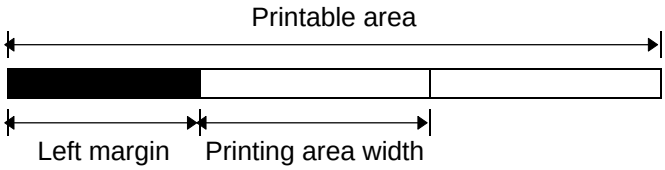
ASCII	GS	W	*nL*	*nH*
Hex	1D	57	*nL*	*nH*
Decimal	29	87	*nL*	*nH*

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

$0 \le n_H \le 255$

[Description] Sets the printing area width to the area specified by *nL* and *nH*.

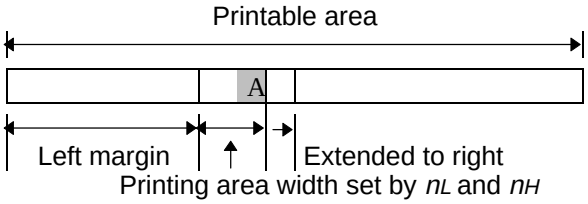
- The printing area width is set to [($n_L + n_H \times 256$) × horizontal motion unit)] inches.



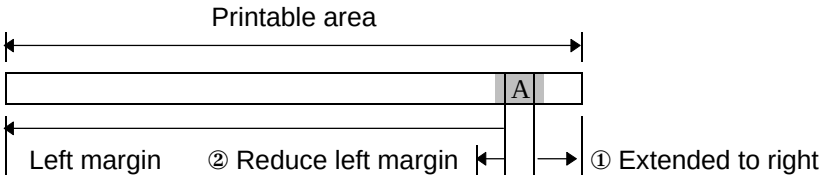
[Notes]

- This command is effective only processed at the beginning of the line.
- If the [left margin + printing area width] exceeds the printable area, [printable area width - left margin) is used.
- The horizontal and vertical motion units are specified by **GS P**. Changing the horizontal and vertical motion units does not affect the current left margin.
- The horizontal motion unit (*x*) is used for calculating the printing area width. The calculated result is truncated to the minimum value of the mechanical pitch.
- If the width set for the printing area is less than the width of one character, when the character data is developed, the following processing is performed:

  ① The printing area width is extended to the right to accommodate one character.



② If the printing area width cannot be extended sufficiently, the left margin is reduced to accommodate one character.



③ If the printing area width cannot be extended sufficiently, the right space is reduced.

- If the width set for the printing area is less than one line in vertical, the following processing is performed only on the line in question when data other than character data (e.g., bit image, user-defined bit image) is developed:

  ① The printing area width is extended to the right to accommodate one line in vertical for the bit image within the printable area.

  ② If the printing area width cannot be extended sufficiently, the left margin is reduced to accommodate one line in vertical.

[Default] n_L = 32, n_H = 3

[Reference] **GS L**, **GS P**

GS a *n*

[Name] Enable/Disable Automatic Status Back (ASB)

[Format]

ASCII	GS	a	*n*
Hex	1D	61	*n*
Decimal	29	97	*n*

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

[Description] Enables or disables ASB and specifies the status items to include, using *n* as follows:

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Drawer kick-out connector pin 3 status disabled.
	On	01	1	Drawer kick-out connector pin 3 status enabled.
1	Off	00	0	On-line/off-line status disabled.
	On	02	2	On-line/off-line status enabled.
2	Off	00	0	Error status disabled.
	On	04	4	Error status enabled.
3	-	-	-	Undefined.
4	-	-	-	Undefined.
5	Off	00	0	Slip paper sensor status disabled.
	On	20	32	Slip paper sensor status enabled.
6	-	-	-	Undefined.
7	-	-	-	Undefined.

[Notes]

- If any of the status items in the table above are enabled, the printer transmits the status when this command is executed. The printer automatically transmits the status whenever the enabled status item changes. The disabled status items may change, in this case, because each status transmission represents the current status.
- If all status items are disabled, the ASB function is also disabled.
- If the ASB is enabled as a default, the printer transmits the status when the printer data reception and transmission is possible at the first time from when the printer is turned on.
- The following four status bytes are transmitted without confirming whether the host is ready to receive data. The four status bytes must be consecutive, except for the XOFF code.
- Since this command is executed after the data is processed in the receive buffer, there may be a time lag between data reception and status transmission.
- When the printer is disabled by **ESC =** (Select peripheral device), the four status bytes are transmitted whenever the status changes.

- When using **DLE EOT**, **GS I**, or **GS r**, the status transmitted by these commands and ASB status must be differentiated, according to the procedure in Appendix C, *Transmission Status Identification*.
- The status to be transmitted are as follows:

First byte (printer information)

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Not used. Fixed to Off.
1	Off	00	0	Not used. Fixed to Off.
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	On-line.
	On	08	8	Off-line.
4	Off	10	16	Not used. Fixed to Off.
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 FORWARD/REVERSE button.
	On	40	64	Paper is being fed by using the FORWARD/REVERSE button.
7	Off	00	0	Not used. Fixed to Off.

Bit5: When the printer cover is open during printing, the printer is in the recoverable error.

Second byte (printer information)

Bit	Off/On	Hex	Decimal	Status for ASB
0	-	-	-	Undefined.
1	-	-	-	Undefined.
2	Off	00	0	No mechanical error.
	On	04	4	Mechanical error occurred.
3	-	-	-	Undefined.
4	Off	00	0	Not used. Fixed to Off.
5	Off	00	0	No unrecoverable error.
	On	20	32	Unrecoverable error occurred.
6	-	-	-	Undefined.
7	Off	00	0	Not used. Fixed to Off.

Bit 2: Mechanical error indicates the home position detection error, carriage detection error, slip paper ejection error, or slip cover open error during printing.

If these errors occur due to paper jams or the like, it is possible to recover by correcting the cause of the error and executing **DLE ENQ *n*** ($1 \leq n \leq 2$). If an error due to a circuit failure (e.g. wire break) occurs, it is impossible to recover.

Third byte (paper sensor information)

Bit	Off/On	Hex	Decimal	Status for ASB
0	-	-	-	Undefined.
1	-	-	-	Undefined.
2	-	-	-	Undefined.
3	-	-	-	Undefined.
4	Off	00	0	Not used. Fixed to Off.
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	Not used. Fixed to Off.

Fourth byte (paper sensor information)

Bit	Off/On	Hex	Decimal	Status for ASB
0	Off	00	0	Slip is selected.
1	Off	00	0	Can print on slip.
	On	02	2	Cannot print on slip.
2, 3	-	-	-	Undefined.
4	Off	00	0	Not used. Fixed to Off.
5, 6	-	-	-	Undefined.
7	Off	00	0	Not used. Fixed to Off.

Bit 1:
- Bit 1 is 0 when the slip is set (can print) and Bit 1 is 1 when the slip ejection starts (cannot print).
- When printing stop due to paper end of a slip is disabled by **ESC c 4**, if there is no printable area on the slip, Bit 1 of fourth byte is not On (cannot print on slip). Check if there is printing area on the slip by using **GS r 3**.

[Default] *n* = 0 when DIP SW 2-1 is off, *n* = 2 when DIP SW 2-1 is on.

[Reference] **DLE EOT**, **ESC c 4**, **GS r**, **FS a**, Appendix C

GS r *n*

[Name] Transmit status

[Format]

ASCII	GS	r	*n*
Hex	1D	72	*n*
Decimal	29	114	*n*

[Range] $1 \le n \le 3, 49 \le n \le 51$

[Description] Transmits the status specified by *n* as follows:

n	Function
1, 49	Transmits paper sensor status
2, 50	Transmits drawer kick-out connector status
3, 51	Transmits slip status

[Notes]

- When using a serial interface
  When DTR/DSR control is selected, the printer transmits only 1 byte after confirming the host is ready to receive data (DSR signal is SPACE). If the host computer is not ready to receive data (DSR signal is MARK), the printer waits until the host is ready.
  When XON/XOFF control is selected, the printer transmits only 1 byte without confirming the condition of the DSR signal.
- This command is executed when the data in the receive buffer is developed. Therefore, there may be a time lag between receiving this command and transmitting the status, depending on the receive buffer status.
- When Auto Status Back (ASB) is enabled using **GS a**, the status transmitted by **GS r** and the ASB status must be differentiated using the table in Appendix C.
- The status types to be transmitted are shown below:

Paper sensor status (*n* = 1, 49):

Bit	Off/On	Hex	Decimal	Status for ASB
0	-	-	-	Undefined.
1	-	-	-	Undefined.
2	-	-	-	Undefined.
3	-	-	-	Undefined.
4	Off	00	0	Not used. Fixed to Off.
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	Not used. Fixed to Off.

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	-	-	-	Undefined.
4	Off	00	0	Not used. Fixed to Off.
5, 6	-	-	-	Undefined.
7	Off	00	0	Not used. Fixed to Off.

Slip Status (*n* = 3, 51)

The remaining print area (times of the number of dots in vertical for one character) is transmitted as values from 00H to 06H.

The number of remaining dots	Slip status
0 - 8	00H
9 - 17	01H
18 - 26	02H
27-35	03H
36 - 44	04H
45 - 53	05H
54 or more	06H

[Reference] **DLE EOT**, **GS a**, Appendix C

6.5 Kanji Control Commands (only for TM-U590M/TM-U590PM)

FS ! n

[Name] Set print mode(s) for Kanji characters

[Format]

ASCII	FS	!	*n*
Hex	1C	21	*n*
Decimal	28	33	*n*

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

[Description] Sets the print mode for Kanji characters, using n as follows:

Bit	Off/On	Hex	Decimal	Function
0	-	-	-	Undefined.
1	-	-	-	Undefined.
2	Off	00	0	Double-width mode is OFF.
	On	04	4	Double-width mode is ON.
3	Off	00	.	Double-height mode is OFF.
	On	08	8	Double-height mode is ON.
4	-	-	-	Undefined.
5	-	-	-	Undefined.
6	-	-	-	Undefined.
7	Off	00	0	Underline mode is OFF.
	On	80	128	Underline mode is ON.

[Notes]
- When both double-width and double-height modes are set (including right- and left-side character spacing), quadruple-size characters are printed.
- The printer can underline all characters (including right- and left-side character spacing), but cannot underline the space set by **HT**.
- The thickness of the underline is that specified by **FS -**, regardless of the character size.
- When some of the characters in a line are double or more height, all the characters on the line are aligned at the baseline.
- It is possible to emphasize the Kanji character using **FS W** or **GS !**, the setting of the last received command is effective.
- It is possible to turn under line mode on or off using **FS -**, and the setting of the last received command is effective.

[Default] *n* = 0

[Reference] **FS -**, **FS W**, **GS !**

FS &

[Name] Select Kanji character mode

[Format]

ASCII	FS	&	
Hex	1C	26	
Decimal	28	38	

[Description] Selects Kanji character mode.

[Notes]
- When the Kanji character code system is SHIFT JIS, the printer performs only internal flag operations. Printing is not affected.
- Kanji character mode is not selected when the power is turned on.
- Kanji codes are processed in the order of the first byte and second byte.

[Reference] **FS .**, **FS C**

FS - n

[Name] Turn underline mode on/off for Kanji characters

[Format]

ASCII	FS	-	*n*
Hex	1C	2D	*n*
Decimal	28	45	*n*

[Range] $0 \le n \le 1$, $48 \le n \le 49$

[Description] Turns underline mode for Kanji characters on or off, based on the following values of n:

n	**Function**
0, 48	Turns off underline mode for Kanji characters
1, 49	Turns on underline mode for Kanji characters (1-dot thick)

[Notes]
- The printer can underline all characters (including right- and left-side character spacing), but cannot underline the space set by **HT**.
- Changing the character size does not affect the current underline thickness.
- It is possible to turn underline mode on or off using **FS !**, and the last received command is effective.

[Default] *n* = 0

[Reference] **FS !**

FS .

[Name] Cancel Kanji character mode

[Format]

ASCII	FS	.
Hex	1C	2E
Decimal	28	46

[Description] Cancels Kanji character mode.

[Notes]
- When the Kanji character code system is SHIFT JIS, the printer performs only internal flag operations. Printing is not affected.
- Kanji character mode is not the default setting.

[Reference] **FS &**, **FS C**

FS 2 *c1 c2 d1...dk*

[Name] Define user-defined Kanji characters

[Format]

ASCII	FS	2	*c1*	*c2*	*d1...dk*
Hex	1C	32	*c1*	*c2*	*d1...dk*
Decimal	28	50	*c1*	*c2*	*d1...dk*

[Range] When the JIS code system is specified:

c1 = <77>H
<21>H ≤ *c2* ≤ <7E>H
0 ≤ *d* ≤ 255
k = 32

When the SHIFT JIS code system is specified:

c1 = <EC>H
<40>H ≤ *c2* ≤ <7E>H and <80>H ≤ *c2* ≤ <9E>H
0 ≤ *d* ≤ 255
k = 32

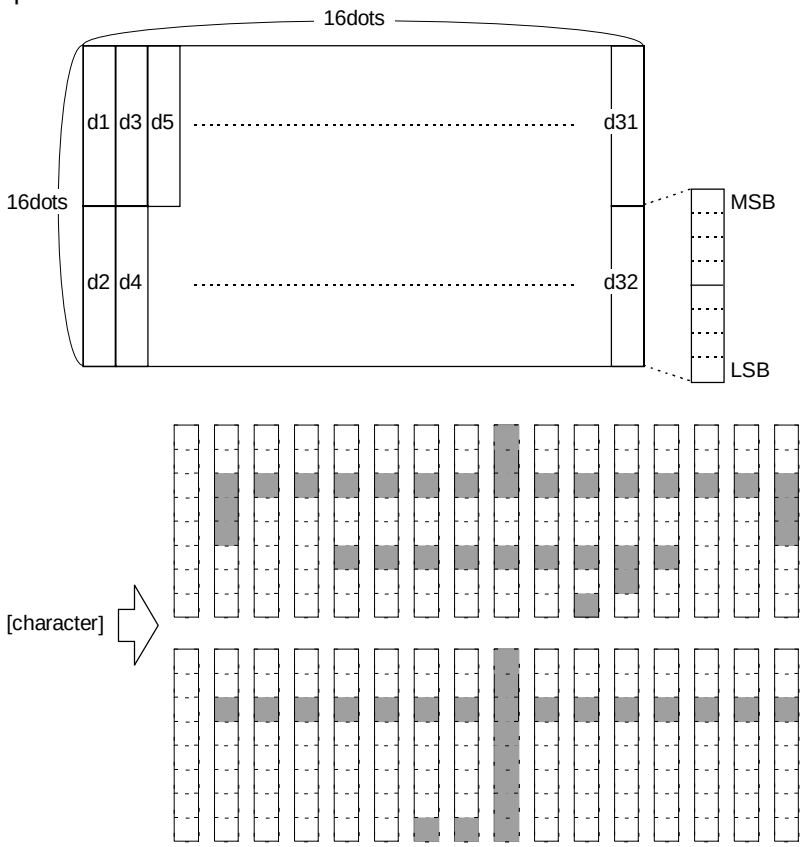
[Description] Defines user-defined Kanji characters for the character codes specified by *c1* and *c2.*

[Notes]
- *c1* and *c2* indicate character codes for the defined characters. The range of values for *c1* and *c2* differ depending on the character code system used.
- *d* indicates the dot data. Set a corresponding bit to 1 to print a dot or to 0 to not print a dot.

[Default] All spaces.

[Reference] **FS C**

<Example>



When the dot pattern for JIS code <7721>H is defined as shown above.

	FS	2	c1	c2	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12
Code (Hex)	IC	32	77	21	00	00	38	20	20	20	20	20	24	20	24	20

d13	d14	d15	d16	d17	d18	d19	d20	d21	d22	d23	d24	d25	d26	d27	d28	d29
24	21	24	21	E4	FF	24	20	25	20	26	20	24	20	20	20	20

d30	d31	d32
20	38	20

The corresponding bit is 1 when printing and 0 when not printing.

FS C *n*

[Name] Select Kanji character code system

[Format]

ASCII	FS	C	*n*
Hex	1C	43	*n*
Decimal	28	67	*n*

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

[Description] Selects a Kanji character code system, based on the following values of *n*:

n	**Kanji System**
0, 48	JIS code
1, 49	SHIFT JIS code

[Notes]
- In the JIS code system, the following codes are available:
  Primary byte: <21>H to <7E>H
  Secondary byte: <21>H to <7E>H
- In the SHIFT JIS code system, the following codes are available:
  Primary byte: <81>H to <9F>H and <E0>H to <EF>H
  Secondary byte: <40>H to <7E>H and <80>H to <FC>H

[Default] *n* = 0

FS S *n1 n2*

[Name] Set left- and right-side Kanji character spacing

[Format]

ASCII	FS	S	*n1*	*n2*
Hex	1C	53	*n1*	*n2*
Decimal	28	83	*n1*	*n2*

[Range] $0 \le n1 \le 255$
$0 \le n2 \le 255$

[Description] Sets left- and right-side Kanji character spacing *n1* and *n2*, respectively.

- When the printer model used supports **GS P**, the left-side character spacing is [*n1* × horizontal or vertical motion units] inches, and the right-side character spacing is [*n2* × horizontal or vertical motion units] inches.

[Notes]

- When double-width mode is set, the left- and right-side character spacing is twice the normal value.
- The horizontal and vertical motion units are set by **GS P**. The previously specified character spacing does not change, even if the horizontal or vertical motion unit is changed using **GS P**.
- The value cannot be less than the minimum horizontal movement amount, and must be in even units of the minimum horizontal movement amount.

[Default] *n1* = 0, *n2* = 0

[Reference] **GS P**

FS W n

[Name] Turn quadruple-size mode on/off for Kanji characters

[Format]

ASCII	FS	W	*n*
Hex	1C	57	*n*
Decimal	28	87	*n*

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

[Description] Turns quadruple-size mode on or off for Kanji characters.

- When LSB of n is 0, quadruple-size mode for Kanji characters is turned off.
- When LSB of n is 1, quadruple-size mode for Kanji characters is turned on.

[Notes]

- Only the lowest bit of *n* is valid.
- In quadruple-size mode, the printer prints the same size characters as when double-width and double-height modes are both turned on.
- When quadruple-size mode is turned off using this command, the following characters are printed in normal size.
- When some of the characters on a line are different in height, all the characters on the line are aligned at the baseline.
- When characters are enlarged in the horizontal direction, they are enlarged to the right, based on the left side of the character.
- **FS !** or **GS !** can also select and cancel quadruple-size mode by selecting double-height and double-width modes, and the setting of the last received command is effective.

[Default] *n* = 0

[Reference] **FS !**, **GS !**

6.6

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

(Intentionally blanked)

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.

2) Inserting slip paper

Slip paper should be inserted correctly by matching the top edge with the form stopper and the right side with the right side of the paper insert portion.

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

- Slip paper can be ejected in both forward (default) and backward directions. However, for small paper, ejecting in the forward direction is recommended.
- Slip paper should be inserted correctly by matching the top edge with the form stopper and the right side with the right side of the paper insert portion.
- The slip waiting time and the interval from when slip is inserted to when the operation starts can be set using **ESC f**.
- 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**.
- Printing with the ejection of the slip paper toward you is prohibited. Doing so may cause paper jams and ink-stained paper.
- Do not execute a mechanical reset with the slip paper inserted. Doing so may cause the paper edge to be caught by the print head carriage.
- Be sure to turn on the power with no slip paper inserted. Otherwise, the paper may be caught by the print head carriage.

ASB function is recommended to check the slip status.

A.2 Notes on Printer Installation

1) When transporting the TM-U590 series printer, the dampers are in the left side of the slip section and in the bottom of the paper roll section. Therefore, remove the dampers before using the printer.

2) 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 the 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 to the outside of the range above 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.

   - When the power supply voltage exceeds 26.4V for a certain time continuously, it is a high voltage error. When the voltage is below 21.6V for a certain time continuously, it is 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

- 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: REPLACING THE RIBBON CASSETTE

1) Turn off the power.

2) Pull the front cover toward you and lift it up.

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.

APPENDIX C: TRANSMISSION STATUS IDENTIFICATION

Because the specified status bits transmitted from the TM-U590 series printer are fixed, the user can confirm the command to which the status belongs, as shown in the following table.

Command & Function	**Status Reply**
GS	<0∗∗0∗∗∗>B
GS r	<0∗∗0∗∗∗>B
XON	<00010001>B
XOFF	<0∗∗1∗∗11>B
DLE EOT 1~5	<0∗∗1∗∗10>B
ASB (1st byte)	<0∗∗1∗∗00>B
ASB (2nd to 4th bytes)	<0∗∗0∗∗∗>B

APPENDIX D: CONFIGURING THE SPACE PAGE

The space page is the character code table where character codes 80H to FFH are all undefined. 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

Page	Character Table	Space page top address	
		7 × 9	9 × 9
255	Space page	FD78F6H	FD6CF6H

2) Calculating the character data top address

The character data top address is calculated as follows:

- 7 × 9 font (graphics)

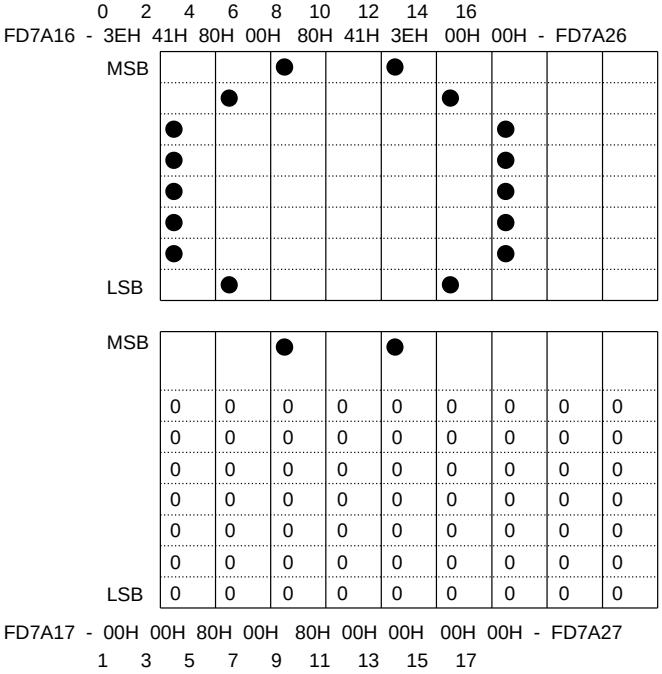
  Character data top address = Space page top address + (character code - 80H) × 18

- 9 × 9 font (graphics)

  Character data top address = Space page top address + (character code - 80H) × 24

3) Example configuring the font data

- 7 × 9 font (in case of character code 90H on page 255)

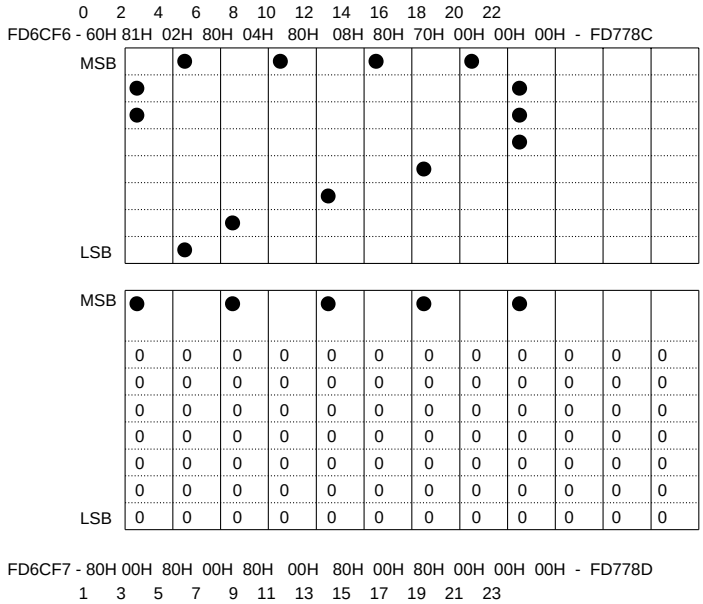


Character code90H
Character data top address
5600H+(90H-80H)×18=5720H

Address data	Address data
0: FD7A16 3EH	1: FD7A17 00H
2: FD7A18 41H	3: FD7A19 00H
4: FD7A1A 80H	5: FD7A1B 80H
6: FD7A1C 00H	7: FD7A1D 00H
8: FD7A1E 80H	9: FD7A1F 80H
10: FD7A20 41H	11: FD7A21 00H
12: FD7A22 3EH	13: FD7A23 00H
14: FD7A24 00H	15: FD7A25 00H
16: FD7A26 00H	17: FD7A27 00H

Figure D.1 7 × 9 font

- 9 × 9 font (in case of character code F0H on page 255)



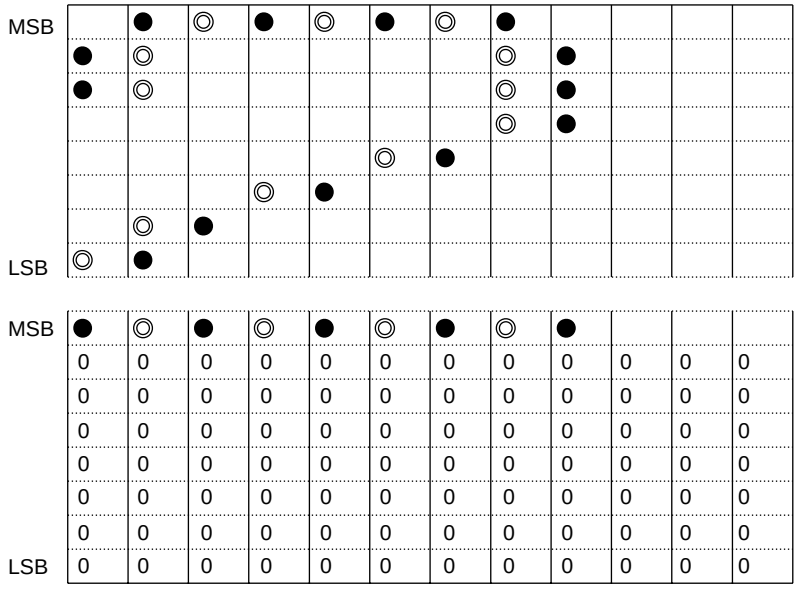
Character code F0H
Character data top address
FD6CF6+(F0H-80H)×24=FD7776

Address data	Address data
0: FD7776 60H	1: FD7777 80H
2: FD7778 81H	3: FD7779 00H
4: FD777A 02H	5: FD777B 80H
6: FD777C 80H	7: FD777D 00H
8: FD777E 04H	9: FD777F 80H
10: FD7780 80H	11: FD7781 00H
12: FD7782 08H	13: FD7783 80H
14: FD7784 80H	15: FD7785 00H
16: FD7786 70H	17: FD7787 80H
18: FD7788 00H	19: FD7789 00H
20: FD778A 00H	20: FD778B 00H
22: FD778C 00H	22: FD778D 00H

Figure D.2 9 × 9 font

4) Notes

Do not use character patterns in which dots are horizontally adjacent.



The pattern shown above, in which ◎ and ● adjoin horizontally, is prohibited.

Figure D.3 Prohibited Dot Patterns

APPENDIX E: 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 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*.