EPSON

receipt, journal, slip printer

TM-U950/U950P

Specification

STANDARD	
REV. NO.	H
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. Fukuda	T. Akiyama	T.Endo	I	D	16	A	34	D
B	CHANGE		E. Takahashi	E. Takahashi	K.Kurose	II	F	17	E	35	A
C	CHANGE		E. Takahashi	E. Takahashi	K.Kurose	III	B	17-1	D	35-1	E
D	CHANGE		K.Ejiri	K. Ebina	Y.Inoda	IV	F	17-2	D	36	B
E	CHANGE		K,Ejiri	K. Ebina	Y.Inoda	V	F	17-3	D	36-1	B
F	CHANGE		E. Takahashi	E. Takahashi	Y.Inoda	VI	D	17-4	E	37	B
G	CHANGE		Y. Matsumoto	--	R.Kanai			17-5	F	38	A
H	CHANGE					1	A	18	D	39	A
						2	A	19	F	40	A
						3	A	20	A	41	A
						4	F	21	D	42	A
						5	A	22	F	43	A
						6	B	23	F	44	A
						6-1	B	23-1	F	44-1	B
						7	A	24	F	44-2	B
						8	C	25	A	45	B
						9	C	26	A	46	B
						10	A	27	A	47	A
						11	B	28	A	48	F
						12	G	29	A	49	E
						12-1	B	30	A	50	A
						13	A	31	A	51	A
						14	A	32	A	52	B
						15	A	33	A	53	F

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A	ENACTMENT					53-1	B	76	A	100	H
B	CHANGE					54	A	77	A	101	B
C	CHANGE					55	A	78	A	102	B
D	CHANGE					56	A	79	A	103	B
E	CHANGE					57	F	80	A	104	B
F	CHANGE					58	A	81	A	App.1	A
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H	CHANGE					60	F	83	A	App.3	A
						61	A	84	F	App.4	A
						62	E	85	A	App.5	A
						63	A	86	A	App.6	A
						64	A	87	F	App.7	A
						65	A	88	F	App.8	A
						66	A	89	A	App.9	A
						67	A	90	A	App.10	B
						68	A	91	F	App.11	B
						69	A	92	A	App.12	D
						70	A	93	A	App.13	D
						70-1	E	94	F	App.14	D
						71	A	95	B	App.15	D
						72	A	96	B	App.16	E
						73	A	97	H	App.17	D
						74	A	98	H	App.18	D
						75	A	99	H	App.19	D

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A	ENACTMENT					App.20	D				
B	CHANGE					App.21	D				
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H	CHANGE					App.27	D				
						App.28	D				
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B	General Description	▫Optional Magnetic Ink Character Recognition (MICR) reader .. [Addition]	
	6	Section 1.8, *Paper* - 4) c) Check paper (only when the printer is used with the MICR reader) [Addition]	
	6-1	Section 1.8, *Paper* - 7) Notes on using the MICR reader [Addition]	
	9	Personal check width: 70mm → 68mm [Correction]	
	11	Section 1.12, *Electrical Characteristics* - 1) Ripple voltage: 300 mVpp or less (only when the printer is used with the MICR reader. [Addition]	
		Section 1.12 -2), b) Printing Operating MICR reader: Mean -approximately 2.3A [Addition]	
		Section 1.13, *Certifications* 1) EMI standards 2) Safety standards → 1.13, *EMI and Safety Standards Applied* 1) Europe 2) North America 3) Japan [Change]	
		Section 1.14, Electrostatic Protection [Deleted] Section numbers are shifted hereafter.(Section 1.15→1.14, 1.16→1.15)	
	12	2) MICR reader mechanism [Addition]	
	12-1	Section 1.16, *MICR Reader* [Addition]	
	23	Description for fundamental calculation pitch is shifted to sheet 23-1.	
	23-1	MICR command lists (**DLE EOT BS, FS a 0, FS a 1, FS a 2, FS b, FS c**) [Addition]	
	24	Section 3.2.1, *Character Code Tables* - page 0 (Note) The BS and FS codes are available only when the printer is used with the MICR reader. [Addition]	
	36	Title of Figure 3.4.1, *Blinking Pattern in Slip Mode (slip insertion waiting state)* is added.	
		Figure 3.4.1, *Blinking Pattern in Slip Mode (slip removal waiting state)* [Addition]	
	36-1	Figure 3.4.3, *Blinking Pattern in MICR Mode* [Addition]	
	37	Section 3.5, *Self-test* - 1) ▫MICR reader circuit function [Addition]	
	44-1	Section 3.14, *Reading MICR Characters and Printing Endorsements* [Addition]	
	44-2	Section 3.15, *Cleaning the MICR Mechanism* [Addition]	
	46	Section 5.1, *Standard Accessories* Slip caution label [Addition]	

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REV.	SHEET	CHANGED CONTENTS	DATE
B	46	Section 5.3, *Customer Display* DM-D202 and DM-D101 → DM-D202II and DM-D101II [Change]	
	52	Bit 3: Bit 3 is not transmitted ... → Becomes 0 ... [Correction]	
	53	DLE ENQ *n* - [Note] ▫ When the printer recovers from ... Therefore, ..., select two-sheet mode again ..." → ▫ When the printer recovers from ... Therefore, ..., select slip mode again ..." [Correction]	
	53-1	[Notes when the printer is used with the MICR reader] [Addition] [Reference when the printer is used with the MICR reader [Addition]	
	95 to 104	Section 6.4, *MICR Control Commands* [Addition] DLE EOT BS *n,* FS a 0 *n,* FS a 1, FS a 2, FS b, FS c	
	App.2	Table: when the printer is used with the MICR reader [Addition]	
	App.10	APPENDIX I: *Example Read Control for MICR Characters*	
	App.11	[Addition]	
C	8	Figure 1.9.2 Slip Paper Printable Area 8.3mm(.33")→8.0mm(.31")	
	9	3) Lengthwise printing ▫Paper fed per step 0.1771mm(.0007")→0.1764mm(.00069") ▫From the top of the slip to the printing position 8.7mm (0.34"=A) → 8.0mm (0.31"=A) Figure 1.9.3 U.S.A. Personal Check Printable Area A=8.7mm(.34") → A=8.00(.31")	
D	I	GENERAL DESCRIPTION	
	17 - 17-4	Section 2.1.2 IEEE-P1284 Bidirectional Parallel Interface [Addition]	
	17-5	Section 2.1.3 Reception of Status from Printer through Bidirectional Parallel Interface [Addition]	
	18	Figure 2.2.2 Schematic View of Parallel Interface Connector Panel [Addition]	
	21	(RS-232 Interface Specifications) [Addition]	
	23	ESC c 3 [Addition]	
	35-1	Description for Parallel Interface Specifications [Addition]	
	70-1	ESC c 3 [Addition]	
	94	Ignored Command ESC c 3 (Available only with Serial Interface) [Addition]	
	App.12-29	APPENDIX J. Bidirectional Parallel Interface [Addition]	

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E	17	2.1.2 IEEE-P1284 ... → IEEE 1284 [Correction] 3) The IEEE P1284... to change. [Deleted]	
	17-4	7) ...by changing ...switch2.) [Deleted] Table 2.1.5 [Deleted]	
	35-1	(*) Effective ... the printer [Deleted] I/F pin25 reset signal → Internal use [Correction] Notes:▫DIP switches excluding switch 2-1 (Auto line feed) and switches 2-7 and 2-8 ... → Notes:▫DIP switches excluding switch 2-8 ... [Correction] ▫If DIP switches 2-7 or 2-8... → ▫If DIP switch 2-8 ... [Correction] ▫When pin 6 ... [Deleted] ▫When pin25... [Deleted]	
	48	CR [Discription] Change to the desctiption both for serial interface model and for parallel interface model [Correction]	
	49	DLE EOT *n* [Notes] Change to the description both for serial interface model and for parallel interface model [Correction]	
	57	ESC & *y c1 c2*... [Discription] ▫After user-defined ..., ESC @ or GS ∗ ... → ▫After user-defined ..., ESC ? or ESC @ ... [Correction]	
	62	ESC = *n* [Default] Change to the description both for serial interface model and for parallel interface model [Correction]	
	70-1	ESC c 3 *n* Bit 6 Validation insertion sensor... → Undefined [Correction] Bit 7 Validation ejection sensor... → Undefined [Correction]	
	87	GS I *n* Bit 3 Undefined ... → MICR [Correction]	
	App.16	J.2.2 Hardware Reset ▫When the printer ... satisfied. [Deleted]	
F	II	2.1.1 RS-232C... → 2.1.1 RS-232... [Correction] 2.1.2 IEEE-P1284... → 2.1.2 IEEE 1284... [Correction]	
	IV	ESC & *y c1 c2 [x[d]y×x]c2-c1+1* → ESC & *y c1 c2 [x1 d1...d(yx×1)]...[xk d1...d(yx×k)]* [Correction] ESC ∗ *m nL nH [d] nL + 256 × nH* → ESC ∗ *m nL nH d1...dk* [Correction]	
	V	GS ∗ *x y[d] x × y × 8* → GS ∗ *x y d1...d(x×y×8)* [Correction]	

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F	4	1.5 Auto Cutter Full cut/partial cut: ... → Partial cut: ... [Correction]	
	17-5	2.1.4 Reception of status from the printer through the bidirectional parallel interface First Status in Example [Correction]	
	19	2.2.3 Drawer kick-out connector (modular connector) The host ... **DLE EOT**, **ESC u**, **GS r** or **GS a** (ASB) commands... → The host ... **DLE EOT**, **ESC u**, **GS ENQ**, **GS r**, or **GS a** (ASB) commands ... [Addition]	
	22	3.1 Command List FF :Print and eject slip paper → Print and eject cut sheet CR :Carrige return → Print and carrige return DLE EOT :Transmit real-time status → Real-time transmission of status ESC – :Turn on/off underline mode → Turn underline mode on/off ESC 2 :Select 1/6-inch line spacing → Select default line spacing ESC = :Set slip paper eject lengh → Set cut sheet eject lengh ESC E :Turn on/off emphasized mode → Turn emphasized mode on/off ESC G :Turn on/off double-strike mode → Turn double-strike mode on/off ESC U :Turn on/off unidirectional printing mode → Turn unidirectional printing mode on/off [Correction]	
	23	ESC c 0 :Select print paper(s) → Paper type(s) for printing ESC c 1 :Select paper(s) for setting → Paper type(s) for command settings ESC c 3 :Select paper sensor(s) to output paper and signals → Select paper sensor(s) to output paper end signals ESC d :Print and feed paper *n* lines → Print and feed *n* lines ESC f :Set slip paper waiting time → Set cut sheet wait time ESC i :Execute full cut → Partial cut (one portion left uncut) ESC m :Execute partial cut → Partial cut (three portions left uncut) [Correction]	

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F	23	ESC z :Turn on/off parallel printing mode for receipt and journal → Turn parallel printing mode on/off for receipt and journal ESC { :Turn on/off upside-down printing mode → Turn upside-down printing mode on/off GS * :Define down-loaded bit-image → Define download bit image GS ♨ :Print down-loaded bit-image → Print downloaded bit image GS E :Select print speed and head energizing time → Select head energizing time GS P :Set fundamental calculation pitch → Set horizontal and vertical motion units GS a :Enable/disable automatic status back → Enable/disable Automatic Status Back [Correction]	
	23-1	DLE EOT BS : Transmit real-time MICR status → Real-time transmission of MICR status [Correction]	
	24	3.2.1 page 0 09 : HT → BS [Correction] 18 : CAN [Deleted] 1C : FS [Addition] 1E : RS [Addition]	
	48	FF [Name] Print and eject slip paper → Print and eject cut sheet [Correction] CR [Name] Carrige return → Print and carrige return [Correction]	
	53	DLE ENQ *n* [Notes] Change to the description both for serial interface model and for parallel interface model [Correction]	
	57	ESC & y c1 c2 [x[d]y×x]c2-c1+1 → ESC & y c1 c2 [x1 d1...d(y×x1)]...[xk d1...d(yx×k)] [Correction] [Format] <1B>H<26>Hy><c1><c2>[<x><d1><d2>...<dy×x>]c2-c1+1→ <1B>H<26>Hy><c1><c2>[x1 d1...d(y×x1)]...[xk d1...d(y×xk)] [Correction]	

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F	59	ESC ∗ *m* n_L n_H *[d]* n_L*+256×*n_H → ESC ∗ *m* n_L n_H *d1...dk* [Correction] [Format] <1B>H<2A>H<*m*><n_L><n_H>*[*<*d*>*]*n_L*+256×*n_H → <1B>H<2A>H<*m*><n_L><n_H>*d1...dk* [Correction] [Range] k = n_L *+* n_H *×* *256* ▫Divide the number...is n_L. Therefore, the...by n_L *+ 256 ×* n_H*.* → ▫Divide the number...is n_L. Therefore, the...by n_L *+* n_H *× 256* [Correction]	
	60	ESC – *n* [Name] Turn on/off underline mode → Turn underline mode on/off [Correction]	
	60	ESC 2 [Name] Select 1/6-Inch line spacing → Select default line spacing [Correction]	
	84	GS ∗ x y [d] x×y×8 → GS ∗ x y d1...d(x×y×8) [Correction] [Name] Define down-loaded bit-image → Define downloaded bit image [Correction]	
	87	GS I *n* [Function] TM-U950 → TM-U950/U950P [Correction]	
	91	When printing...slip. Use **ESC r 3** to...slip. → When printing...slip. Use **GS r 3** to...slip. [Correction]	
	94	6.3 Ignored commands The TM-U950 ignores...commands: → The TM-U950/U950P ignores...commands: [Correction]	
	98	▫When characters are not detected or when an error occurs, ... → ▫When characters are not detected, or when the correct reading waveform is not detected, or when an error occurs,... [Addition]	
G	12	1.14 Reliability 1) Printer mechanism... 2) MICR reader mechanism ↓ 1) Life ... 2) MCBF ... 3) MTBF ... 4) MICR reader mechanism [Change]	

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H	97-100	**FS a 0 *n*** bit 4 and 5 is newly assigned. Descriptions for bit 4 and 5 is added. [Addition]	

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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.
3) No part of this specification shall be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, for any purpose without the express written permission of SEIKO EPSON CORPORATION.

GENERAL FEATURES

The TM-U950 is a high-quality POS printer that can print on slip, journal, and receipt paper.

The printer has the following features:

- Wide slip paper capability (maximum characters per line: 88 with 7 × 9 font).
- Interface connector within the printer's external dimensions.
- High throughput using bidirectional, minimum distance printing.
- Precision paper feeding at 1/144 inch.
- Selectable receive buffer size (32 bytes or 2K bytes).
- Slip ejection sensor.
- Command protocol based on the ESC/POS™ standard.
- Automatic Status Back (ASB) function that automatically transmits changes in the printer status.
- EPSON intelligent module connection (only for serial interface model).
- EPSON customer display series connection (only for serial interface model).
- Optional Magnetic Knk Character Recognition (MICR) reader that enables the printer to perform consecutive reading and processing of MICR characters and printing endorsements.

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3. FUNCTION

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 directions: 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) Print mode:

Table 1.1.1 Print Mode

Print mode	Printing speed	Print head energizing time	Receipt/journal		Slip	
			Default status	Switching *2	Default status	Switching *2
Normal mode	High	Normal	Depends on DIP SW 2-4 setting	Possible	--	Possible
Low speed mode	Low	Normal		Possible	--	Possible
Copy mode	Low	Copy (long)	--	Possible	Selected	Possible

NOTES: 1. The printer automatically goes to low speed mode during bit image printing, regardless of the type of selected paper.

2. Print mode can be changed using the **GS E** command.

1.2 Character Specifications

1) Number of characters: Alphanumeric characters: 95
International characters: 32
Extended graphics: 128 × 8 pages (including space pages)

2) Character structure: 9 × 9 3-dot spacing (in half dot units)
7 × 9 2-dot spacing (in half dot units)
Larger spacing can be set by using **ESC SP**.

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)		Character Size (units: mm) Width × Height
			High speed	Low speed	Roll Paper	Slip Paper	
9 × 9	3 dots	12.5	233	200	30	66	1.6×3.1 (.06"×.12")
7 × 9	2 dots	16.7	311	267	40	88	1.3×3.1 (.05"×.12")

1.3 Ribbon

1) Type: Exclusive cassette ribbon

2) Ribbon cassette specifications:

Part number	ERC-31
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)

(All the numeric values are typical.)

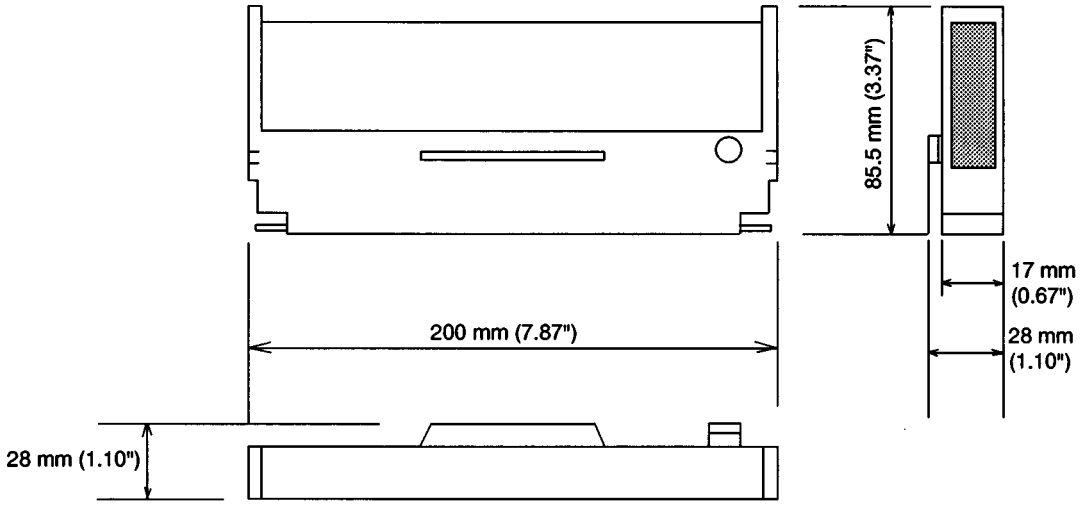


Figure 1.3.1 Ribbon Cassette Overall Dimensions

1.4 Stamp

Receipt side only (controlled by the **ESC o** command)

1) Recommended stamp: FUJI COPIAN CSP-2042C

2) Recommended ink: FUJI COPIAN Super Ink (purple)

3) Printable area dimensions (W × H):
42 mm × 20 mm (1.65" × 0.79")

4) Stamp overall dimensions: Refer to Figure 1.4.1.

NOTE: The stamp mechanism is a factory option. The stamp set should be supplied by the user.

(All the numeric values are typical.)

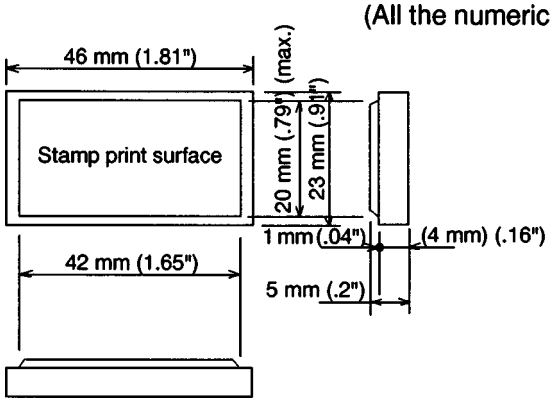


Figure 1.4.1 Stamp Overall Dimensions

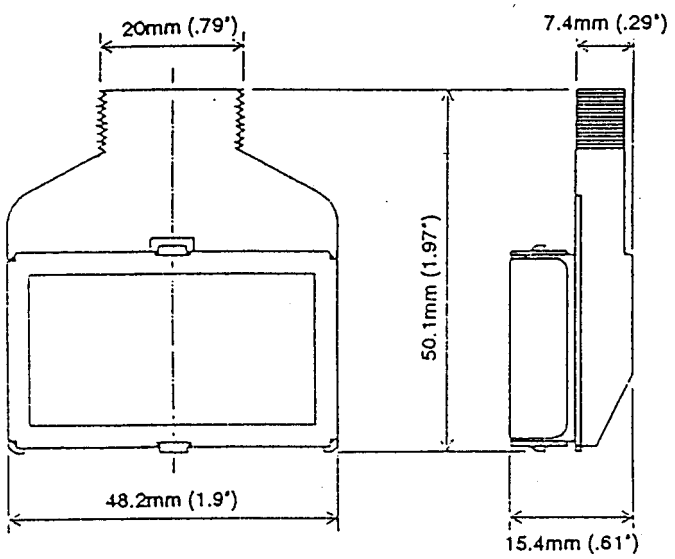


Figure 1.4.2 Stamp Set Overall Dimensions

1.5 Auto Cutter

Full cut/partial cut:	Receipt side only (controlled by **ESC i** and **ESC m**)

1.6 Paper Roll Supply Device

1) Supply method:	Paper roll drop-in loading
2) Near-end sensors:	For journal and receipt
a) Detection method:	Micro switch
b) Paper roll:	Inside diameter of 10 mm (0.39") or more
c) Near-end adjustment:	Adjusting screw (refer to APPENDIX D)

1.7 Journal Paper Take-up Device

The printer is equipped with a take-up device so journal paper is automatically taken up by driving the journal paper feed motor.

1.8 Paper

1) Paper feed method: Friction feed

2) Paper feed pitch: Default 1/6 inch
Can be set in units of 1/144 inch by the **ESC 3** and **ESC J** commands.

3) Paper feed speed: Approximately 60.3 ms/line (1/6 inch feeding)
Approximately 3.4 inches/second (continuous feeding)

4) Paper size:

a) Paper roll (single-ply)

① Quality: High

② Size: Width 69.5 mm ± 0.5 mm (2.74" ± .02")
Maximum outside diameter ∅83 mm (3.27")

③ Thickness: 0.06 to 0.09 mm (.0024 to .0035")

④ Weight: 52.3 to 64.0 g/m2 (13.9 to 17 lbs) (JIS P8124)
(45 to 55 Kg (20.41 to 24.94 lbs)/1000 sheets/788 mm ×1091 mm (31.02" × 42.95"))

⑤ Paper roll inside diameter:
∅10 mm (0.39") or more

b) Slip paper

① Paper type: ▫Normal paper
▫Carbon copy paper
▫Pressure sensitive paper

② Total thickness: 0.09 to 0.36 mm (.0035 to .0141") (Refer to b)-⑤)

③ Size (W × L): 70 mm × 70 mm to 210 mm × 297 mm (A4)
(2.76" × 2.76" to 8.27" × 11.69")

④ 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 2.6.1.

Table 2.6.1 Relationship between Ambient Temperature and Number of Copies

Number of copies	Ambient temperature (print mode)
Original + 4 copies	Approx. 20° to 40°C (68° to 104°F) (copy mode)
Original + 1 to 3 copies	5 to 40°C (41° to 104°F) (copy mode)

⑤ Copy capability and paper thickness:

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

▫Carbon copy paper combination:

5 sheets maximum
(original + 4 copies, at 20° to 40°C (68° to 104°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)

▫Pressure sensitive paper: 5 sheets maximum
(original + 4 copies, at 20° to 40°C (68° to 104°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.

c) Check paper (only when the printer is used with the MICR reader)

① Paper type:	Normal paper
② Total thickness:	0.09 to 0.2 mm (.0035 to .0079")
③ Size:	68 to 102 mm × 152 to 210 mm (2.68 to 4.02" × 2.98 to 8.27")
④ Weight:	70 to 90 kg paper

5) Notes on setting the print operation mode

- The **GS E** command sets print mode (printing speed and print head energizing time).
- When the power is turned on, normal mode is selected as the default. The printer automatically switches from normal mode to copy mode when slip is selected by **ESC c 0**.
- Refer to **ESC c 0** and **GS E**.

6) 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. It is desirable for the glue to be on the top edge. Choose slip paper carefully when the glue is on the right or left edge, since paper feeding and insertion are affected by gluing conditions (e.g., glue quality, method, and length) and glue location (refer to Figure 1.8.1). Be especially careful when slip paper is wide and has the glue on the right or 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 1.8.2).

- Since the slip ejection sensor uses a reflective photo sensor, do not use paper that has holes or dark portions with low reflection (less than 40% reflection) at the sensor position (refer to Figure 1.8.3).
- Be sure to perform slip printing with a paper roll loaded to avoid incorrect paper feeding due to paper jams.
- 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.

7) Notes on using the MICR reader (only when the printer is used with MICR)

- Be sure to perform personal check printing with a paper roll loaded. If MICR reading and/or printing is performed without a paper roll loaded, the check cannot be fed correctly or may be damaged due to paper jams.
- The personal checks must be flat, without curls, folds, or wrinkles (especially at the edges). Otherwise, the check may rub against the ribbon and become ink-stained.
- Do not insert checks with staples. This may cause paper jams, MICR reading errors, and damage to the MICR head.
- Let go off the check immediately as soon as the printer starts feeding it. Otherwise, the paper is not fed straight, causing paper jams and MICR reading errors.

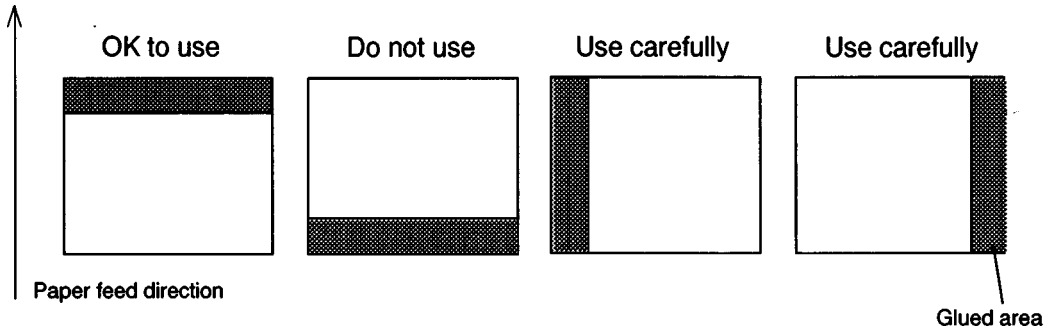


Figure 1.8.1 Slip Paper Glued Area

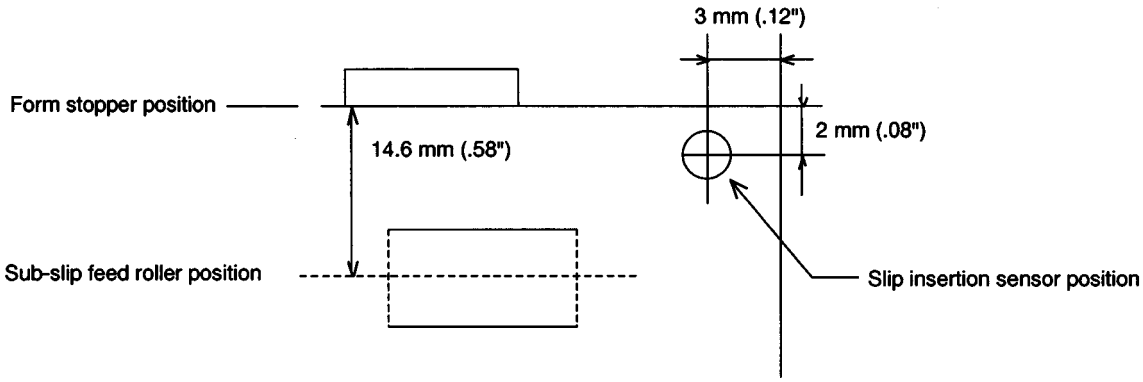


Figure 1.8.2 Slip Insertion Sensor Position

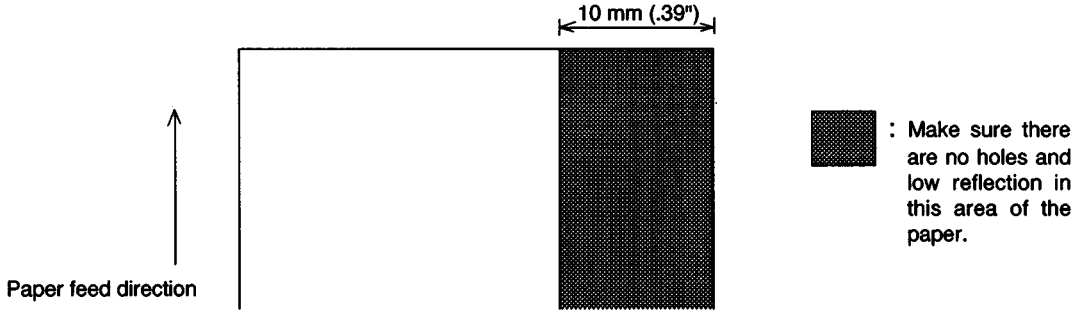


Figure 1.8.3 Paper Holes and Low Reflection Prohibited Area

1.9 Printable Area

1) Paper roll

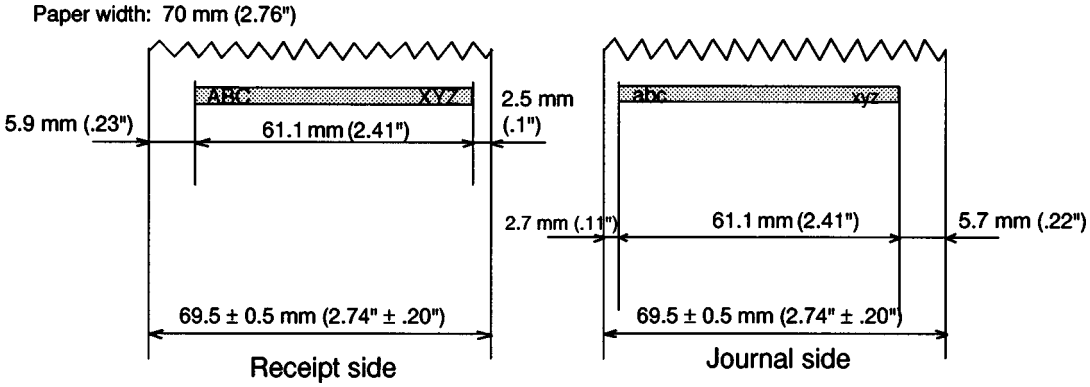


Figure 1.9.1 Paper Roll Printable Area

2) Slip paper

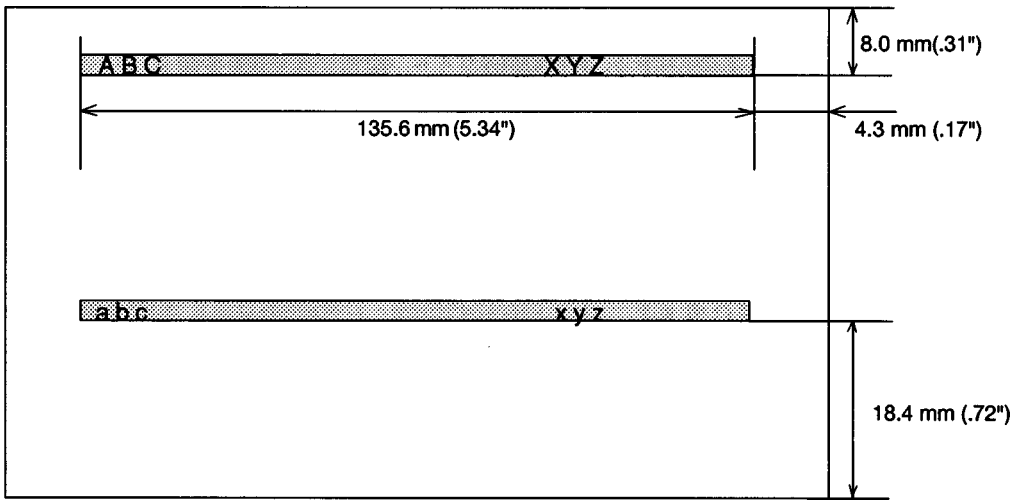


Figure 1.9.2 Slip Paper Printable Area

Printing U.S.A personal checks (lengthwise printing)

1) Width: 68 to 77 mm (2.68 to 3.03”)
2) Thickness: 0.09 to 0.2 mm (.0035 to .0079”)
3) Lengthwise printing (on the back)

Printing within the printable area shown in Figure 2.9.4 is possible, but pay attention to the following points:

① Since only one roller is used, paper fed per step is calculated as 0.1764mm (.00069”). Distance from the top of the slip to the printing position is 8.0 mm (0.31” = A) (calculated value.)

② The printable area is 180 dots (360 positions) from the right-side print starting position.

③ To print endorsements on the back in the specified area (within 1.5 inches from the top), set the print position for the last line so that it is printed at 3 mm above the bottom of the printable area.

(All the numeric values are typical.)

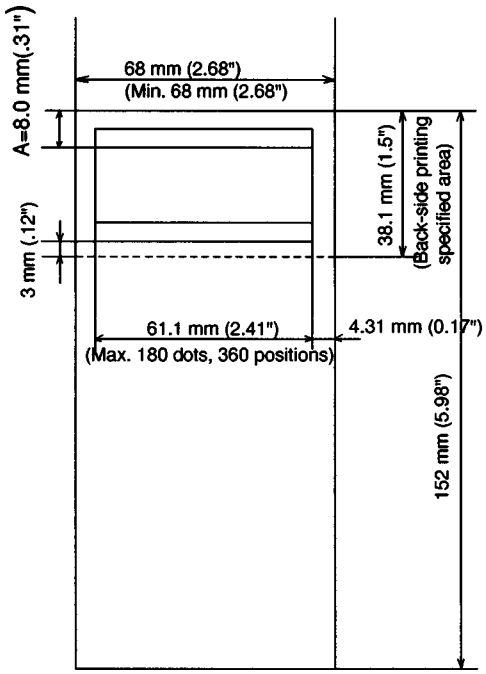
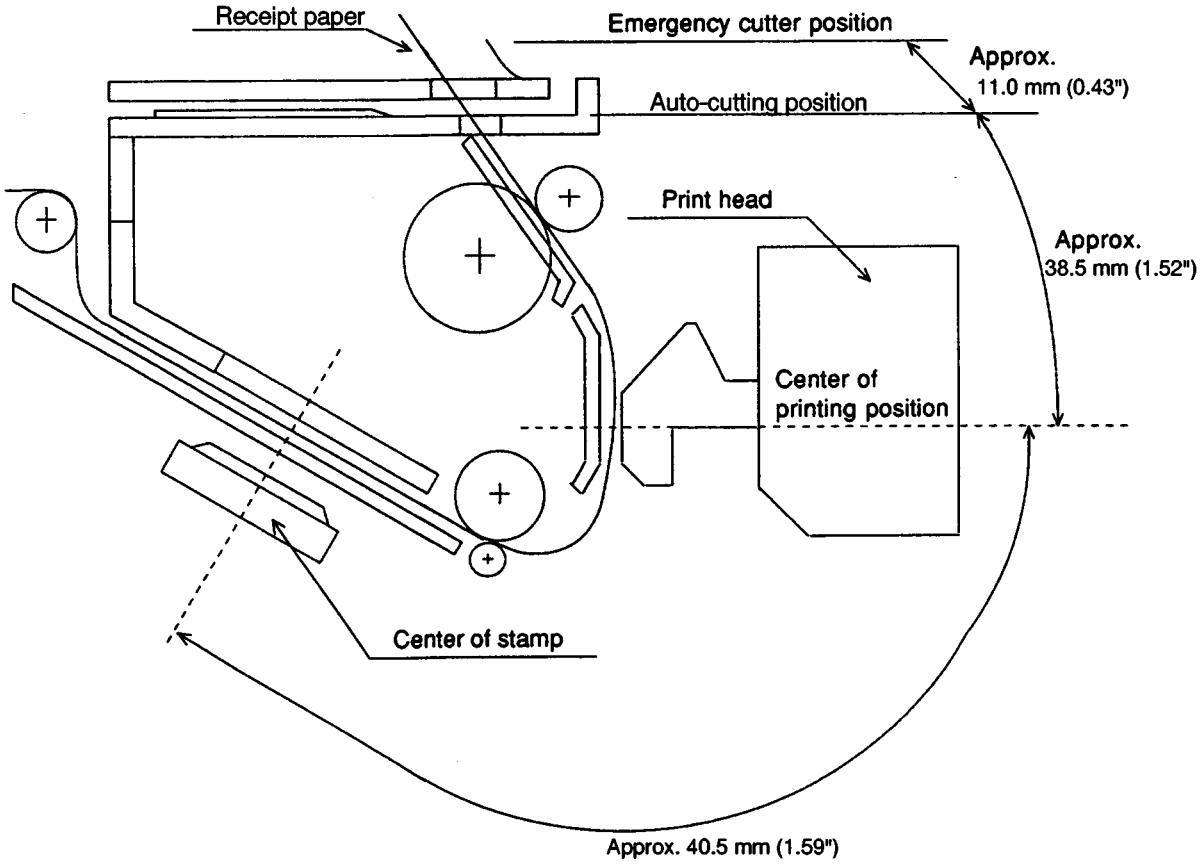


Figure 1.9.3 U.S.A. Personal Check Printable Area

1.10 Printing, Stamp, and Auto Cutter Positions



[All the numeric values are typical.]

Figure 1.10.1 Printing, Stamp, and Auto Cutter Positions

1) Distance from the auto-cutting position to the center of the printing position:
   Approx. 38.5 mm (1.52")
2) Distance from the center of the stamp to the center of the printing position:
   Approx. 40.5 mm (1.59")
3) Distance from the auto-cutting position to the emergency cutter position:
   Approx. 11.0 mm (0.43")

NOTE: The dimensions in Figure 1.10.1 do not allow for paper slack. Therefore, take this into account when using the stamp or cutter.

1.11 Receive Buffer

Selectable as 32 or 2K bytes using the DIP switch

1.12 Electrical Characteristics

1) Supply voltage: +24 VDC ± 10%

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

2) Current consumption: Operating:

a) When feeding slip paper to the print starting position:

Mean - approximately 2.3 A, approx. 1.4 seconds

b) Printing:

Mean - approximately 1.8 A
(when printing alphanumeric characters for 40 columns on each receipt and journal)

Peak - approximately 8.0 A

Standby: Mean - approximately 0.3 A

Operating MICR reader
(when the printer used with the MICR reader)

Mean - approximately 2.3 A
(Approximately 1.4 seconds)

1.13 EMI and Safety Standards Applied

1) Europe: CE marking

EN55022
EN50082-1
EN45501 (except for when connected to IM)

Safety Standard: T✓V

2) North America:

EMI: FCC Class A

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

3) Japan: EMI: VCCI Class 1

1.14 Reliability

1) Life (When printing alphanumeric characters)

Mechanism: 7,500,000 lines

Print head: 150 million characters
(When printing in the average of 2 dots/wire per character)

End of life is defined as the point at which the printer 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 18,000,000 lines

This is an average failure interval based on failures relating to wear up to the life of 7.5 million lines.

4) MICR reader mechanism (only when the printer is used with the MICR reader):

Life: 240,000 passes

(1 pass: from reading characters to printing endorsements on a U.S. personal check (152 mm (5.98") long))

(The MICR reader is defined to have reached the end of its life when it cannot function properly because of wearing out of the main parts (magnetic head, head holding roller, etc).)

1.15 Environmental Conditions

1) Temperature:	Operating:	5° to 40°C (41° to 104°F)	
	Storage:	-10° to 50°C (14° to 122°F) (except for ribbon)	
2) Humidity:	Operating:	30 to 80%RH	
		(at 30°C (86°F) or more, the upper limit condition is 30°C, 80% or equivalent, with no condensation)	
	Storage:	30 to 90%RH	
		(with no condensation, except for ribbon)	
3) Vibration resistance:	When packed:	Frequency:	5 to 55 Hz
		Acceleration:	2 G
		Sweep:	5 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).

Printer that is not currently printing should not be damaged after it is dropped.

5) Acoustic noise: Operating: 63 dB or less (Bystander Position)
(Receipt and journal printing)

1.16 MICR Reader (when the printer is used with the MICR reader)

1) Available fonts: E13B, CMC7

2) Recognition rating: 98 % or more (at 25°C)

Recognition rating is defined as follows:

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

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

3) Notes on installation location

Do not install the printer near any magnetic fields because this may cause MICR reading errors.

2. CONFIGURATION

2.1 Interface

2.1.1 RS-232 serial interface

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.)

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 paper feed switch
- When the printer stops printing due to a paper-end (if enabled by **ESC c 4**)
- When an error has occurred

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

Table 2.1.1 TM-U950/U950P 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 1-6 OFF: Same as DTR signal (Pin 20)
DIP SW 1-6 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 GS ENQ, DLE ENQ, 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 Section3.3.3).
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 2-5 as follows (refer to Section 3.3.3):
<table>
<tr><th colspan="2" rowspan="2">Printer status</th><th colspan="2">DIP SW 2-5 status</th></tr>
<tr><th>ON</th><th>OFF</th></tr>
<tr><td></td><td>1. During the period from when the power is turned on (including reseting using the interface) to when the printer is ready to receive data.</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td></td><td>2. During the self-test.</td><td>BUSY</td><td>BUSY</td></tr>
<tr><td></td><td>3. When the cover is open.</td><td>--</td><td>BUSY</td></tr>
<tr><td></td><td>4. During paper feeding using the paper feed switch.</td><td>--</td><td>BUSY</td></tr>
<tr><td></td><td>5. When the printer stops printing due to a paper-end.</td><td>--</td><td>BUSY</td></tr>
<tr><td></td><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></td><td>BUSY</td></tr>
</table></td></tr>
</table>

(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.

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 SW2-5 setting.

	Printer status	DIP SW 2-5 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 ③, XON is not transmitted when the receive buffer is full.

▫ In case ⑥, XOFF is not transmitted when the receive buffer is full.

5) 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 2.1.1Reset 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:

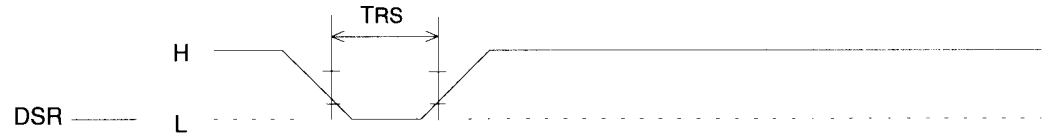
Table 2.1.2 Reset DC Characteristics

		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)	

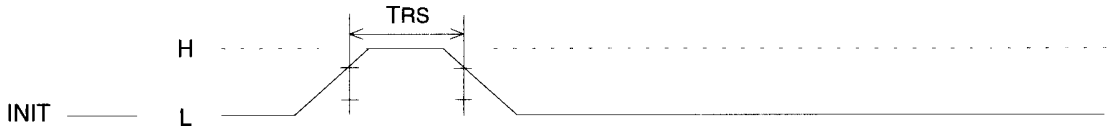
- AC characteristics:

  Minimum reset pulse width: T_{RS} 1 ms (minimum)

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



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



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)

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.
- In the process of self-test.
- While the cover is set open.
- In the process of paper feeding using the paper feed switch
- When the printer runs out of paper, thereby suspending the printing operation in progress (in cases when empty paper supply is detected by either the journal end detector or the journal near end detector with a printing halt feature set enabled due to paper shortage by **ESC c 4**).
- In the process of waiting for a switch for macro execution.
- When an error has occurred.

3) 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.

  For detail description, refer to APPENDIX J.

4) 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 0.5Js 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

5) Electrical Characteristics

DC Characteristics (Except Logic-H, 5 V signals)

Characteristics	Symbol	Specifications		Conditions
		Min	Max	
Output HIGH voltage	VOH	*2.4 V	5.5 V	*IOH=0.32mA
Output LOW voltage	VOL	-0.5 V	*0.4 V	*IOL=-12mA
Output HIGH current	IOH	0.32 V	-	VOH=0.32V
Output LOW current	IOL	-12 V	-	VOL=0.4V
Input HIGH voltage	VIH	2.0 V	-	
Input LOW voltage	VIL	-	0.8 V	
Input HIGH current	VIH	-	-0.32 mA	VIH=2.0V
Input LOW current	VIL	-	12 mA	VIL=0.8V

Logic-H Signal Sender Characteristics

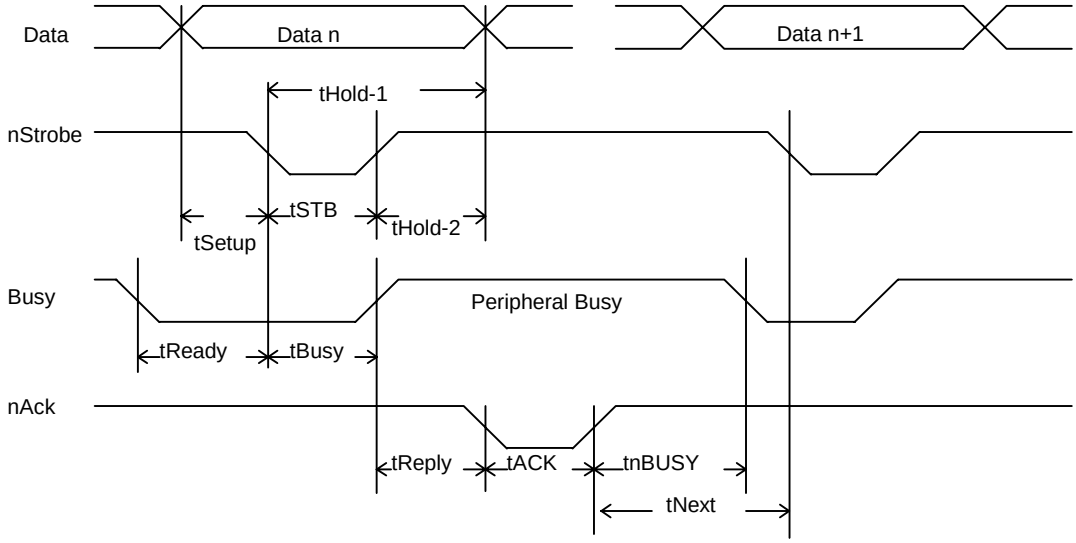
Characteristics	Symbol	Specifications		Conditions
		Min	Max	
Output HIGH voltage	VOH	3.0 V	5.5 V	
Output LOW voltage	VOL	-	2.0 V	While the power is OFF

5 V Signal Sender Characteristics

Characteristics	Symbol	Specifications		Conditions
		Min	Max	
Output HIGH voltage	VOH	*2.4 V	5.5 V	*IOH=0.32mA
Output LOW voltage	VOL	-	- **	While the power is OFF
Output HIGH current	IOH	-	0.32 mA	VOH=2.4V
Output LOW current	IOL	- **	-	While the power is OFF

** No guarantee is offered to VOL and IOL while the power is OFF.

6) Compatibility Mode



Characteristics	Symbol	Specifications	
		Min	Max
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	10ps
BUSY Release Time	tBUSY	0	e
ACK Cycle Idle Time	tNEXT	--	∞

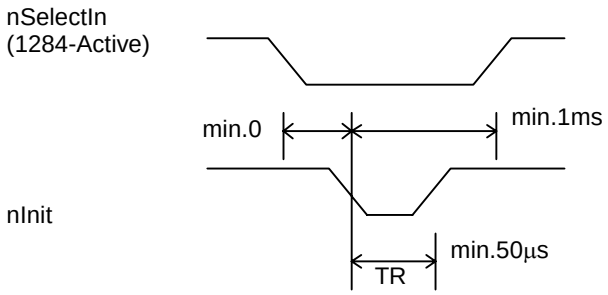
* The printer latches data at a nStrobe ↓timing.

7) Notes on resetting the printer through the interface

The printer reset is available through the interface nInit signal (#31 pin) .

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)



2.1.3 Notes on setting DIP switch 2-5 to ON

1) The printer mechanism stops but does not become busy when: an error has occurred, the cover is open, printing stops due to a paper-end, or paper is fed using the paper feed switch.
2) When setting DIP switch 2-5 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, DLE ENQ,** and **GS 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, DLE ENQ**, and **GS 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**, **DLE ENQ**, or **GS 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: Check the printer status using **ESC v** or **ESC u** after transmitting each line of data and use the 2K byte receive buffer. Transmit one line of data so that the receive buffer does not become full.

2.1.4 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 100 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, the ASB status is configured as follows.

First Status	Second Status	Third Status	Fourth Status
0001 0000	0000 0000	0000 0000	0000 0000

When a sequence of operations are proceeded, near end detection cover open cover closed, the following pieces of data are accumulated.

	First Status	Second Status	Third Status	Fourth Status	
①	0001 0000	0000 0000	0000 0011	0000 0000	Near end detection
②	0011 1000	0000 0000	0000 0011	0000 0000	Cover open
③	0001 0000	0000 0000	0000 0011	0000 0000	Cover closed

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

Accumulated ASB (①+②+③)

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

2.2 Connectors

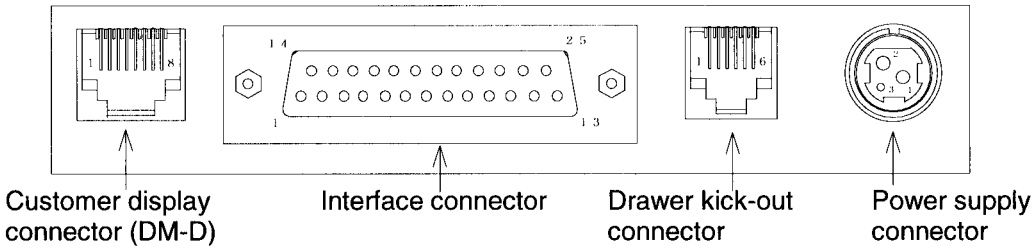


Figure 2.2.1 Serial Interface Connector Panel External Appearance

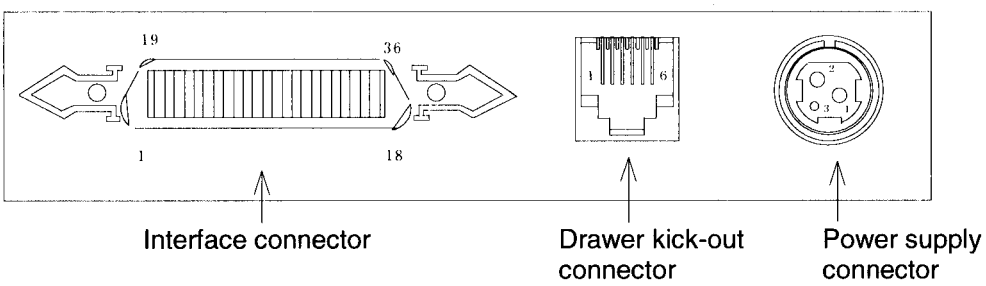


Figure 2.2.2 Parallel Interface Connector Panel External Appearance

2.2.1 Interface connectors

Refer to Section 2.1, Interface

2.2.2 Power supply connector

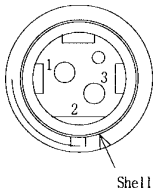
This connector is used to connect the printer to an external power source.

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



2.2.3 Drawer kick-out connector (modular connector)

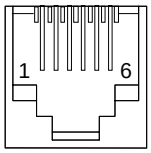
The pulse specified by **ESC p** is output to this connector. The host can confirm the status of the input signal by using the **DLE EOT, ESC u, GS r,** or **GS a** (ASB) commands.

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 driver signal 1	Output
3	Drawer open/close signal	Input
4	+24V	--
5	Drawer kick-out drive signal 2	Output
6	Signal GND	--



3) Drawer Kick-out drive signal

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

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

Output waveform: Outputs the waveforms in Figure 2.2.2 to the points A and B in Figure 2.2.3.

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

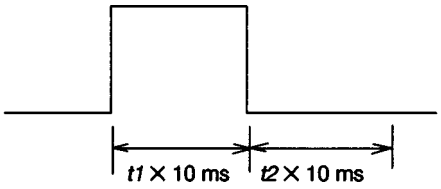


Figure 2.2.2 Drawer Kick-out Drive Signal Output Waveform

4) Drawer open/close signal

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

"H" = 2 to 5 V

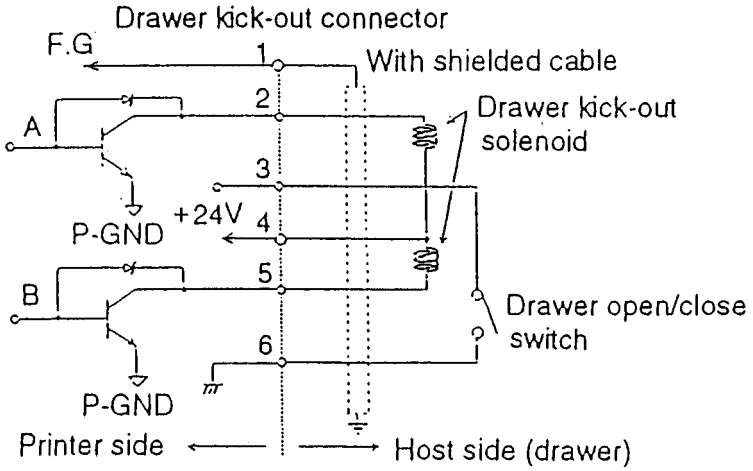


Figure 2.2.3 Drawer Circuitry

NOTES:
1. Use a shielded cable for the drawer connector cable.
2. Two driver transistors cannot be energized simultaneously.
3. The driver must not be energized continuously.
4. Be sure to use the printer power supply (connector pin 4) for the drawer power source.
5. The resistance of the drawer kick-out solenoid must not be less than that specified (24 Ω). Otherwise, an overcurrent could damage the solenoid.

2.2.4 Customer display connector (For RS-232 serial interface)

1) Model:

Receptacle: MOLEX 52065-8845 or equivalent

2) Pin assignments

Pin Number	Signal name	Direction
1	FG	--
2	RXD	--
3	TXD	Output
4	DTR	Output
5	DSR	Input
6	SG	--
7	+24	--
8	PG	--

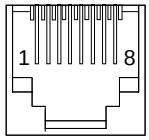


Figure 2.2.4 DM-D Connector

3. FUNCTION

3.1 Command List

Command	Name
LF	Print and line feed
FF	Print and eject cut sheet
CR	Print and carriage return
DLE EOT	Real-time transmission of status
DLE ENQ	Real-time request to printer
RS	Journal tab
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 on/off underline mode
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 cut sheet eject length
ESC E	Turn emphasized mode on/off
ESC G	Turn double-strike mode on/off
ESC J	Print and feed paper
ESC K	Print and reverse feed
ESC R	Select an international character set
ESC U	Turn unidirectional printing mode on/off

Command	Name
**ESC **	Set relative print position
ESC a	Select justification
ESC c 0	Select print paper(s) for printing
ESC c 1	Select paper(s) for command settings
ESC c 3	Select paper sensor(s) to output paper and signals
ESC c 4	Select paper sensor(s) to stop printing
ESC c 5	Enable/disable panel buttons
ESC d	Print and feed paper *n* lines
ESC e	Print and reverse feed *n* lines
ESC f	Set cut sheet wait time
ESC i	Partial cut (one portion left uncut)
ESC m	Partial cut (Three portions left uncut)
ESC o	Stamp
ESC p	Generate pulse
ESC t	Select character code table
ESC u	Transmit peripheral device status
ESC v	Transmit paper sensor status
ESC z	Turn parallel printing mode on/off for receipt and journal
ESC {	Turn upside-down printing mode on/off
GS ENQ	Transmit real-time printer status
GS *	Define downloaded bit image
GS /	Print downloaded bit image
GS E	Select head energizing time
GS I	Transmit printer ID
GS P	Set horizontal and vertical motion unit
GS a	Enable/disable Automatic Status Back
GS r	Transmit status

MICR command lists (when the printer is used with the MICR reader)

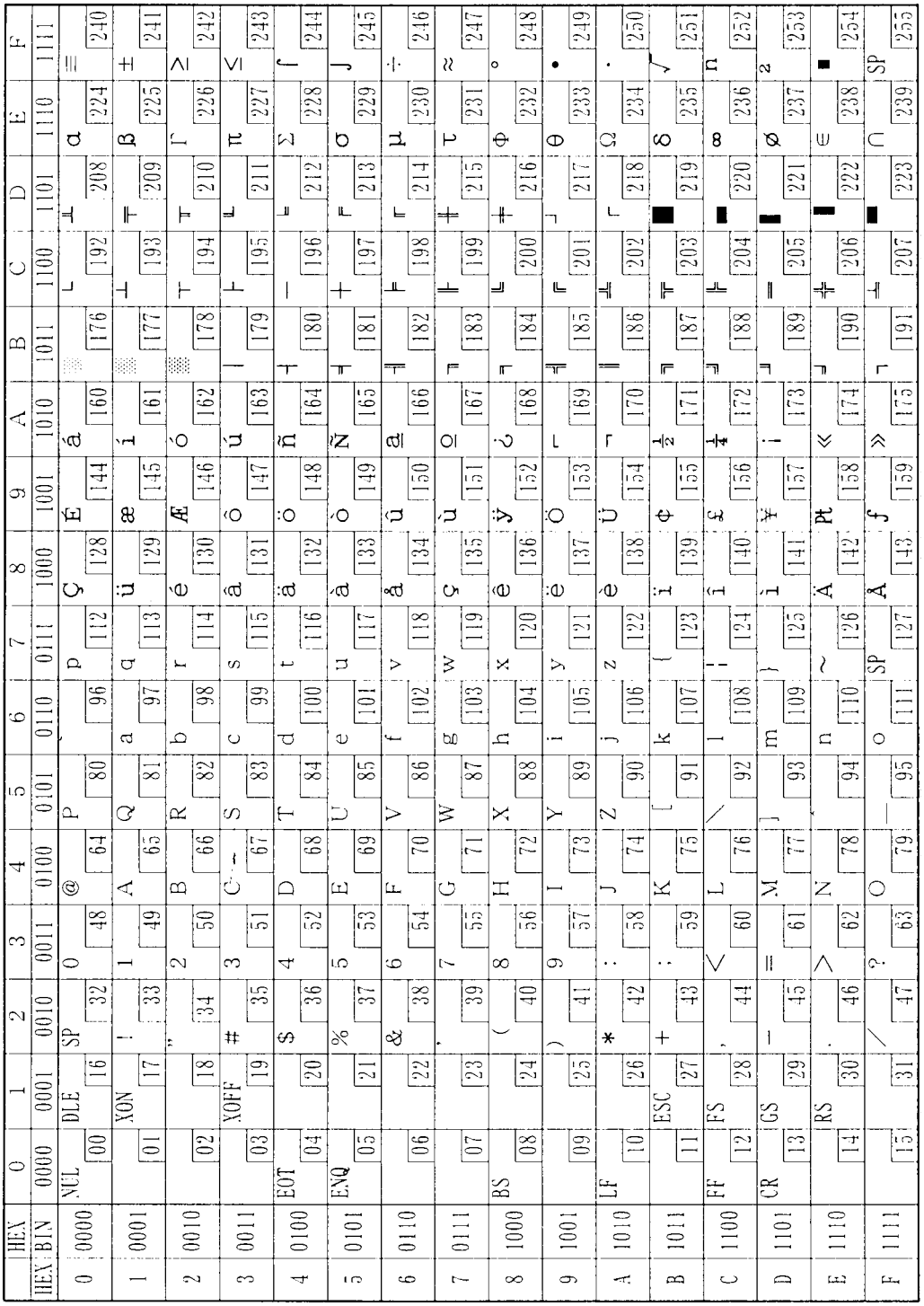
Command	Name
DLE EOT BS	Real-time transmit MICR status
FS a 0	Read check paper
FS a 1	Load check paper to print starting position
FS a 2	Eject check paper
FS b	Request retransmission of check paper reading result
FS c	MICR mechanism cleaning

<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: U.S.A., Standard Europe) (International character set:U.S.A.)



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

Notes:
- The character code tables show only character configurations. They do not show the actual print pattern.
- The BS and FS codes are available only when the printer is used with the MICR reader.

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	144	SP 160	ー 176	タ 192	ミ 208	三 224	× 240
1	0001	▬ 129	ヤ 145	。 161	ア 177	チ 193	ム 209	上 225	円 241
2	0010	▬ 130	ㇵ 146	「 162	イ 178	ツ 194	メ 210	下 226	年 242
3	0011	▬ 131	ト 147	」 163	ウ 179	テ 195	モ 211	丰 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	「 152	ィ 168	ク 184	ネ 200	リ 216	♠ 232	〒 248
9	1001	▌ 137	ㄱ 153	ゥ 169	ケ 185	ノ 201	ル 217	♥ 233	市 249
A	1010	▌ 138	乚 154	ェ 170	コ 186	ハ 202	レ 218	✦ 234	区 250
B	1011	▌ 139	」 155	ォ 171	サ 187	ヒ 203	ロ 219	♣ 235	町 251
C	1100	▌ 140	ㄱ 156	ャ 172	シ 188	フ 204	ワ 220	● 236	村 252
D	1101	▌ 141	ㄱ 157	ュ 173	ス 189	ヘ 205	ン 221	○ 237	人 253
E	1110	▌ 142	ㄴ 158	ョ 174	セ 190	ホ 206	゛ 222	／ 238	▒ 254
F	1111	＋ 143	ノ 159	ッ 175	ソ 191	マ 207	° 223	＼ 239	SP 255

3.2.3 Page 2 (PC850: Multilingual)

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

3.2.4 Page 3 (PC860: Portuguese)

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

3.2.5 Page 4 (PC863: Canadian-French)

	HEX	8	9	A	B	C	D	E	F
HEX	BIN	1000	1001	1010	1011	1100	1101	1110	1111
0	0000	Ç 128	É 144	¦ 160	▒ 176	└ 192	╨ 208	α 224	≡ 240
1	0001	ü 129	È 145	´ 161	▒ 177	┴ 193	╤ 209	ß 225	± 241
2	0010	é 130	Ê 146	ó 162	▒ 178	┬ 194	╥ 210	Γ 226	≥ 242
3	0011	â 131	ô 147	ú 163	│ 179	├ 195	╙ 211	π 227	≤ 243
4	0100	Â 132	Ë 148	¨ 164	┤ 180	─ 196	╘ 212	Σ 228	⌠ 244
5	0101	à 133	Ï 149	¸ 165	╡ 181	┼ 197	╒ 213	σ 229	⌡ 245
6	0110	¶ 134	û 150	ª 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	Pt 158	« 174	╛ 190	╬ 206	▐ 222	∈ 238	■ 254
F	1111	Å 143	ƒ 159	¤ 175	┐ 191	╧ 207	▀ 223	∩ 239	SP 255

3.2.7 Page 254 (Space Page)

In the space page (page 254), 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

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

3.2.9 International character set

	Country Name	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	England		£	$	@	[	\	]	^	`	{	¦	}	~
4	Denmark I		#	$	@	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	Denmark II		#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

3.3 Switches and Buttons

3.3.1 Power switch (locking type)

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

Turn on the power only after connecting the power supply.

3.3.2 Panel buttons

Panel buttons are enabled or disabled by the **ESC c 5** command. These buttons are inactive if they are disabled.

1) Receipt feed button: Non-locking push button

[Function] If this button is pushed once and released, the printer feeds receipt paper for one line based on the line spacing set by **ESC 2** and **ESC 3**. If this button is held down, the printer feeds paper continuously.

The paper is fed after the carriage is moves to the center of the receipt paper roll.

[Note] The switch is enabled when the printer cover is open, regardless of the **ESC c 5** setting.

2) Journal/slip feed button: Non-locking push button

[Function] If this button is pushed once and released, the printer feeds journal paper for one line based on the line spacing set by **ESC 2** and **ESC 3**. If this button is held down, the printer feeds paper continuously.

When this button is pushed in slip mode (the slip LED lights or blinks), the printer feeds slip paper.

In 2-sheet mode, the paper is fed after the carriage is moved to the center of the journal paper roll.

In slip mode, the paper is fed after the carriage is moved to the right edge of the slip paper.

[Note] The switch is enabled when the printer cover is open, regardless of the **ESC c 5** setting.

3.3.3 DIP switches

1) For serial interface model

DIP switch 1: 8 switches

Table 3.3.1 DIP Switch 1

SW1	Function	ON	OFF
1	Data word length	7 bits	8 bits
2	Parity	Enabled	Disabled
3	Parity selection	Even	Odd
4	Transmission speed selection (Refer to Table 3.3.2.)		
5			
6	Connection of customer display (*)	Connected	Not connected
7	Data receive error	Ignored	Prints"?"
8	Handshaking	XON/XOFF	DTR/DSR

(*) Effective when a direct connection customer display is connected to the DM-D connector of the printer.

Table 3.3.2 Transmission Speed

Transmission Speed (BPS)	SW1-5	SW1-4
1200	ON	ON
2400	ON	OFF
4800	OFF	ON
9600	OFF	OFF

DIP switch 2: 8 switches

Table 3.3.3 DIP Switch 2

SW2	Function	ON	OFF
1	Auto line feed	Always enabled	Always disabled
2	Receive buffer	32 bytes	2048 bytes
3	Font selection (default)	9 × 9	7 × 9
4	Carriage moving speed (default for paper roll printing)	Low	High
5	Handshaking (BUSY condition)	Receive buffer-full	Off-line or receive buffer-full
6	Internal use	Fixed	--
7	I/F pin 6 reset signal	Enabled	Disabled
8	I/F pin 25 reset signal	Enabled	Disabled

NOTES: DIP switches excluding switch 2-1 (Auto line feed) and switches 2-7 and 2-8 (I/F reset signal) are effective only while the printer power is turned on. If the DIP switch setting is changed after the printer power is turned on, the change is not effective.

If DIP switches 2-7 or 2-8 is on while the printer power is turned on, the printer may be reset, depending on the signal state. DIP switches should not be operated while the printer power is turned on.

When pin 6 of the interface connector is used for the reset signal, the printer is reset at MARK on the RS-232 level.

When pin 25 of the interface connector is used for the reset signal, the printer is reset at SPACE on the RS-232 level or at HIGH on the TTL level.

2) For parallel interface model

Table 3.3.4 DIP Switch 1

SW1	Function	ON	OFF
1	Undefined	--	--
2	Undefined	--	--
3	Undefined	--	--
4	Undefined	--	--
5	Undefined	--	--
6	Internal use	--	Fixed
7	Undefined	--	--
8	Undefined	--	--

Table 3.3.5 DIP Switch 2

SW2	Function	ON	OFF
1	Auto line feed	Always enabled	Always disabled
2	Receive buffer	32 bytes	2048 bytes
3	Font selection (default)	9 × 9	7 × 9
4	Carriage moving speed (default for paper roll printing)	Low	High
5	Handshaking (BUSY condition)	Receive buffer-full	Off-line or receive buffer-full
6	Internal use	Fixed	--
7	Undefined	--	--
8	Internal use	Fixed	--

NOTES: DIP switches excluding switch 2-8 (I/F reset signal) are effective only while the printer power is turned on. If the DIP switch setting is changed after the printer power is turned on, the change is not effective.

If DIP switch 2-8 is on while the printer power is turned on, the printer may be reset, depending on the signal state. DIP switches should not be operated while the printer power is turned on.

3.4 Panel LED Indicators

3. 4. 1 Panel LED

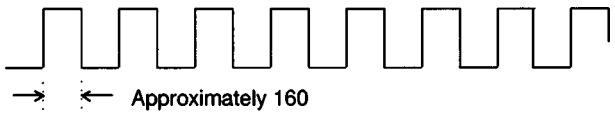
1) Power supply (POWER) LED: Green
   - On: Power is stable.
   - Off: Power is not stable.

2) Receipt near-end (RECEIPT OUT) LED: Red
   - On: The receipt paper roll near-end or end is detected.
   - Off: There is sufficient paper on the receipt side (normal condition).
   - Blinking: Test printing standby state (refer to Section 3.5 - 3))

3) Journal near-end (JOURNAL OUT) LED: Red
   - On: The journal paper roll near-end or end is detected.
   - Off: There is sufficient paper on the journal side (normal condition).
   - Blinking: Test printing standby state (refer to Section 3.5 - 3))

4) Error (ERROR) LED: Red
   - On: Off-line (except during paper feeding using the FEED buttons and during self test printing)
   - Off: Normal condition
   - Blinking: Error (refer to Section 3.8)

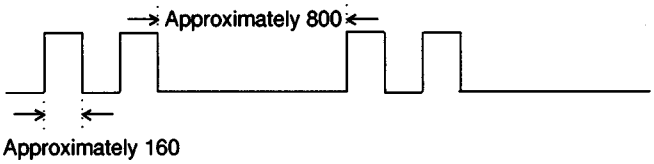
5) Slip LED: Green
   - On: Slip mode
   - Off: 2-sheet mode
   - Blinking: Slip insertion waiting state



[Units: msec]

Figure 3.4.1 Blinking Pattern in Slip Mode (slip insertion waiting state)

Slip removal waiting state



[Units: msec]

Figure 3.4.2 Blinking Pattern in Slip Mode (slip removal waiting state)

Blinking: Personal check waiting state (when the printer is used with the MICR reader)

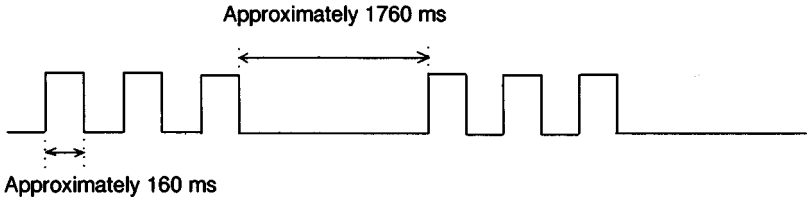


Figure 3.4.3 Blinking Pattern in MICR Mode

3.5 Self-test

1) The printer has a self-test function that checks the following:

Control circuit functions

Printer mechanisms

Print quality

Control ROM version

DIP switch settings

MICR reader circuit function (when the printer is used with the MICR reader)

2) Starting the self-test

a) Self-test on paper roll

To start the self-test on a paper roll, hold down the RECEIPT FEED button and turn on the printer with the cover closed.
The printer then prints the current printer status, which provides the following information:

Control ROM version

DIP switch settings

Setting values for internal uses

Checking results of the MICR reader circuit function (when the printer is used with the MICR reader.

b) Self-test on slip paper

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

3) Self-test standby state

a) Self-test on paper roll

After printing the current printer status, the printer prints the message "Self-test printing. Please press RECEIPT FEED button." The RECEIPT OUT LED and the JOURNAL OUT LED indicators blink alternately, and the printer enters the test printing standby state. Press the RECEIPT FEED button to start test printing.

b) Self-test on slip paper

After printing the current printer status, the printer ejects the slip and waits for the next 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 *** ", performs initialization, and goes to normal mode.

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 RECEIPT FEED button, then close the cover. The printer first prints "Hexadecimal Dump" on roll 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, DLE ENQ**, and **GS ENQ** do not function.

3) Ending hexadecimal dumping

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

<Example printing>

```
Hexadecimal Dump
1B   21   00   1B   26   02   40   40    :   . ! . . & . @ @
1B   25   01   1B   63   34   00   1B    :   . % . . c4 .     .
41   42   43    44   45   46   47   48   :   ABCDEFGH
```

3.7 Printing on Slip Paper

Use the following procedure to print on slip paper.

	User Operation	Printer Operation
1	Transmit **ESC c 0 4**.	Mechanically switches to slip mode and waits for slip paper to be loaded. The slip LED blinks. To cancel the slip waiting state, transmit **DLE ENQ 3**.
2	Insert slip paper.	Detects the slip paper, lights the SLIP LED indicator, and feeds the slip to the print starting position.
3	Transmit data and commands.	Prints data and feeds the slip.
4	Transmit **FF**.	After printing, ejects the slip. The SLIP LED continues blinking until the slip is removed.
5	Remove the slip.	Switches to 2-sheet mode and turns off the SLIP LED indicator.

NOTES:
1. Slip paper is ejected in the forward direction only.
2. Since the paper feed pitch is inaccurate immediately after the paper feed direction is changed, pay attention to the printing that follows and correct as necessary.
3. The mechanical structure allows paper to be fed only when the paper roll is loaded properly. Accordingly, the paper roll must be loaded onto both the receipt and journal sides before selecting slip paper by transmitting **ESC c 0**.
4. 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.
5. The slip waiting time and the interval from when slip is inserted to when the operation starts can be set using **ESC f**.
6. The slip waiting state is canceled using **DLE ENQ 3**.
7. 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.
8. To check the slip status exactly, ASB function should be used.
   (Refer to APPENDIX F, Example Print Control for Slip Paper.)
9. Remove ejected slip paper by pulling it upward. Do not pull out in the horizontal direction.
10. The remaining printing space for printing the following data on slip can be checked using **GS r 3**.

3.8 Error Processing

3.8.1 Error types

1) Errors that automatically recover

Table 3.8.1 Error that automatically recovers

Error	Description	ERROR LED blinking pattern → ← Approx. 160msec	Recovery
Print head temperature error	The temperature of the print head is extremely high.		Recovers automatically by cooling the print head.

NOTE: Print head temperature error is not abnormality.

2) Errors that have the possibility of recovery

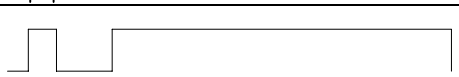
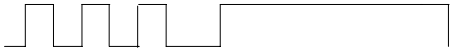
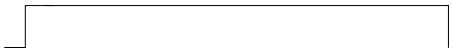
Table 3.8.2 Recoverable Errors

Error	Description	ERROR LED blinking pattern → ← Approx. 160msec	Recovery
Auto cutter error	The auto cutter does not work correctly.		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.
Home position detection error	The home position cannot be detected due to a paper jam.		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.
Carriage detection error	The carriage is malfunctioning due to a paper jam, etc.		Recovers by **DLE ENQ 1** or **DLE ENQ 2**.
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** while slip paper is selected, the printer first ejects the slip, then loads paper. However, when the printer recovers from a slip ejection error, the printer only ejects the slip and does not load paper.
3. When the printer recovers from an error using **DLE ENQ 2** while slip paper is selected, the printer first ejects the slip, then goes to two-sheet mode.

3) Errors that are impossible to recover

Table 3.8.3 Unrecoverable Errors

Error	Description	ERROR LED blinking pattern → ← Approx. 160msec	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.		Impossible to recover.
Drive circuit error	There is an abnormality in a mechanism drive circuit.		Impossible to recover.
Thermistor error	There is an abnormality in the print head themperature.		Impossible to recover.

(*) Refer to Appendix A.

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

3.8.2 Printer operation when an error occurs

The printer executes the following operations when detecting an error:

Stops all printer operations.

Goes off-line.

Blinks the ERROR LED.

3.8.3 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 1-7.

Parity error

Framing error

Overrun error

3.9 Paper Sensors

The printer has 6 paper sensors as follows:

Journal near-end sensor

Receipt near-end sensor

Journal paper sensor

Receipt paper sensor

Slip insertion sensor

Slip ejection sensor

3.9.1 Sensors and LED indicators

1) Near-end sensors

The near-end sensors are located on the roll paper supply device on the receipt and journal sides. They detect the near-end of the paper roll by detecting the paper roll diameter. When the paper roll diameter becomes sufficiently small, the RECEIPT OUT or JOURNAL OUT LED indicator lights.

2) Paper sensors

The paper sensors are located in the paper path on the receipt and journal sides. They detect the presence of paper from the paper roll in the paper path of the printer mechanism, then loads paper from the paper roll. When there is no paper in the paper path (paper end status), the RECEIPT OUT or JOURNAL OUT LED indicator lights.

3) Slip insertion 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.

4) Slip ejection sensor

The slip ejection sensor is located in the slip exit and detects the removal of the slip paper. The printer does not proceed to the next operation until the paper has been removed. (The SLIP LED indicator remains blinking.)

3.9.2 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:

Journal near-end sensor

Receipt near-end sensor

Journal sensor

Receipt sensor

Slip insertion sensor

The journal near-end, receipt near-end, journal, and receipt sensors are enabled only in two-sheet mode and the slip insertion sensor is enabled only in slip mode. However, since the journal and receipt sensors are used for auto-loading and cannot be used for paper-end detection, the end of paper is not detected by them. The user should note that these sensors may not stop printing, even if they are selected by **ESC c 4**. Therefore, use the near-end sensor for detecting a roll paper-end, and also use the paper sensor, if necessary.

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

1) Two-sheet mode

When printing stop is enabled, the printer automatically goes off-line when a paper-end is detected. To restart printing, load the paper and set the printer back on-line by closing the printer cover.

2) Slip mode

When printing stop is enabled, the printer detects a paper-end and prints data up to the end of the printable area, ejects the slip, and then waits for the slip to be removed. After the slip is removed, the printer enters the paper waiting state.

3.10 Printer Cover

3.10.1 Cover open button

When the cover open button (see Section 5.3, External Appearance) is pressed, the printer cover is opened. When the cover is closed, the cover open button is latched.

NOTE: Be sure to use the cover open button located on the front of the printer to open the printer cover.

3.10.2 Cover open sensor

The cover open sensor monitors the printer cover. When the sensor detects a cover-open, the printer automatically goes off-line after printing the current line. After the printer cover is opened, the printer moves the carriage to the home position at a low speed.

To get back on-line, close the printer cover.

NOTE: Because the printer mechanism is reinitialized after the printer cover is opened and closed, the cover must not be opened during printing to prevent an incorrect paper feed pitch.

3.11 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.

3.12 Loading the Paper Roll

If paper from the paper roll is inserted into the paper path with the printer cover open, the paper is detected by the paper sensor, and receipt and journal paper are fed automatically by approximately 180 mm (7.09") and 270 mm (10.63") respectively. If the amount of paper fed automatically is insufficient, the user can feed additional paper by using the FEED button.

3.13 Paper Jam Removal

1) Around the print head

To remove jammed paper from the print head area, loosen the thumb screw on the journal side and remove the print head cover.

CAUTION: 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 or paper is fed. Do not touch the carriage.

2) Near the paper feed roller or cutter

To remove jammed paper from the paper feed roller or cutter, open the cutter unit by pushing it and the lock lever backward.

To close the cutter unit, push the cutter unit lock lever forward to lock it while pushing the cutter unit down gently.

Pull in the cutter blade by rotating the cutter manual-operation gear in the direction of the arrow.

3) If the cutter unit is not completely closed, the printer cover cannot be completely closed.

4) Paper from the paper roll can be removed by pulling the paper out while pushing the release lever.

3.14 Reading MICR Characters and Printing Endorsements

(when the printer is used with the MICR reader)

Use the following procedure to read MICR characters.

	User Operation	Printer Operation
1	Transmit **FS a 0 <00>H**. (Transmit DLE ENQ 3.)	Mechanically switches to MICR mode and waits for a personal check to be loaded. The slip LED blinks. (when the check waiting state is canceled)
2	Insert a check.	Detects the check, lights the slip LED, and reads MICR characters. After reading, transmits the reading results.
3	(Transmit FS a 0 <00>H.)	(Re-reads the check and transmits the reading result.)
4	Transmit **FS a 1**.	Loads the check paper to the print starting position.
5	Transmit endorsement printing data.	Prints data and feeds paper.
6	Transmit **FF**.	After printing, ejects paper. The slip LED blinks until the check is removed.
7	Eject the check paper.	Switches to two sheet mode. The slip LED blinks.

NOTES:
1. Personal check is ejected in the forward direction only.
2. The paper roll must be loaded onto both the receipt and journal sides correctly before selecting MICR function by transmitting **FS a 0**. Otherwise, check paper is not fed properly.
3. The check waiting state is canceled using **DLE ENQ 3**.
4. After the personal check is ejected, the slip LED indicator lights and the printer does not proceed to the next operation until the check is removed.
5. Personal check 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.
6. The check waiting time and the interval from when a check is inserted to when the operation starts can be set using **ESC f**.
7. To check the MICR function status exactly, **DLE EOT BS 1** should be used. (Refer to APPENDIX I, *Example Read Control for MICR Characters*.)
8. Remove the ejected personal check by pulling it upward. Do not pull it out in the horizontal direction.

3.15 Cleaning the MICR Mechanism

(when the printer is used with MICR reader)

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

Cleaning period:	Once per month or every 6000 passes
Example cleaning paper:	KIP Products PRESAT brand check reader cleaning card or equivalent
Cleaning paper size:	63 mm (2.48") (W) x 152 mm (5.98") (H)

4. CASE SPECIFICATIONS

4.1 External Dimensions and Weight

Height: 194.5 mm (7.66")
Width: 251 mm (9.88")
Depth: 298 mm (11.73")
Weight: Approximately 5.6 kg (12.35 lbs)
(All the numeric values are typical.)

4.2 Color

EPSON standard gray

4.3 External Appearance

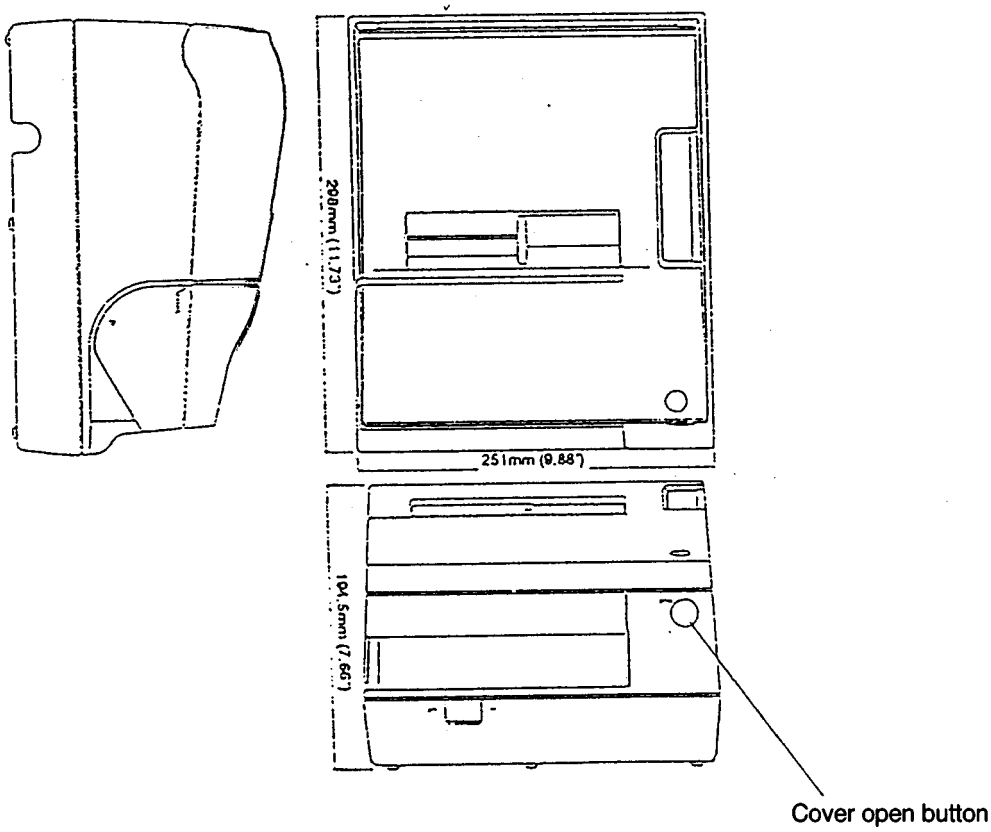


Figure 4.3.1 External Appearance

4.4 Note

Do not apply excessive force to the printer case.

5. OPTIONS

5.1 Standard Accessories

Paper roll (∅60 mm (2.36") 5 2 rolls)
Exclusive ribbon cassette ERC-31
Operator's Manual
Paper roll take-up reel
I/F fixing screw (hexagonal setscrew)
Power switch cover
Slip caution label

5.2 Options

External power supply PS-150
Journal lock with keys: JL-950
Stamp unit (factory-installed option)
MICR reader (factory-installed option)

5.3 Customer Display

(1) Pass-through:
Customer displays DM-D202II and DM-D101II are sold separately from the printer.

(2) Direct connection between the printer and display:
Direct connection customer displays DM-D203, DM-D102 are sold separately from the printer.

6. COMMANDS

6.1 Command Notation

XXXX Command

[Name] The name of the command.

[Format] The code sequence. The numbers denoted by < >H are hexadecimal, by < >B are binary, and by < > denote decimal.
A *k* format indicates the contents of the brackets 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 arguments.

[Reference] Lists related commands.

[Example] Provides examples using the command.

NOTE: Some of the command descriptions include the sentence "This command is enabled only when input at the beginning of a line." The phrase "beginning of a line" assumes that the following conditions have been met:

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

6.2 Control Commands

LF

[Name] Print and line feed

[Format] <0A>H

[Description] Prints the data in the print buffer and feeds one line based on the current line spacing

[Note] Sets the print starting position to the beginning of the line.

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

FF

[Name] Print and eject cut sheet

[Format] <0C>H

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

[Notes] The command is enabled only when slip paper is selected for printing.

Paper ejection continues until the paper is completely ejected. When the slip ejection length has been set by **ESC C**, the specified length is ejected regardless of the slip ejection sensor.

After the slip is ejected, the printer selects paper selected by **ESC c 0** as the default.

The slip is ejected in the forward direction only.

[Reference] **ESC c 0, ESC C**

CR

[Name] Print and carriage return

[Format] <0D>H

[Description] When auto line feed is enabled, this command functions in the same way as **LF**. When auto-line feed is disabled, this command prints the data in the print buffer and does not feed the paper.

The setting to enable/disable auto line feed differs for the serial interface model and the parallel interface model.

Serial interface model

Defined by the position of DIP switch 2-1 when the CR command is executed.

Parallel interface model

Defined by the position of DIP switch 2-1 when the power is turned on or after the unit is reset.

[Reference] **LF**

DLE EOT *n*

[Name] Real-time transmission of status

[Format] <10>H<04>H<*n*>

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

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

n	Function
1	Transmit printer status
2	Transmit off-line factor status
3	Transmit error factor status
4	Transmit paper roll sensor status
5	Transmit slip paper status

[Notes] The status information to be transmitted is shown in the tables on the following pages.

The printer starts processing data upon receiving this command.

When transmitting status, the printer transmits only 1 byte without confirming the condition of the DSR signal.

With the serial interface model, this command is executed even in off-line or receive buffer-full state.

With the parallel interface model, this command is executed even in off-line if the DIP switch 2-5 is set ON.

The status is transmitted whenever the data sequence of <10>H<04>H<*n*> ($1 \leq n \leq 5$) is received.

Example:

In **ESC ✽ *m nL nH d1...dk***, *d1*=<10>H, *d2*=<04>H, *d3*=<1>

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 4** interrupts before *n* is received, the code <10>H for **DLE EOT 4** is processed as the code for **ESC 3** <10>H.

This command is unavailable when using the **ESC =** (Select peripheral device) to select the printer to be disabled.

When Automatic 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 using the table in APPENDIX B.

If the value of *n* is out of the specified range, the printer ignores this command.

n = 1: Printer status

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Drawer kick-out connector pin 3	Low	High
3	On-line/Off-line	On-line	Off-line
4	Not used	Fixed to 1	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

n = 2: Off-line factor status

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Cover status	Closed	Open
3	Paper feeding with paper feed button	Except during paper feeding	During paper feeding
4	Not used	Fixed to 1	
5	Printing stop due to a paper-end	No paper-end stop	Printing stops
6	Error	No error	Error occurs
7	Not used	Fixed to 0	

Bit 5: Is transmitted (printing stops) when printing stops due to paper selected by **ESC c 0** and **ESC c 4** and due to paper sensor conditions.

n = 3: Error factor status

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Mechanical error	No error	Error occurs
3	Auto cutter error	No error	Error occurs
4	Not used	Fixed to 1	
5	Unrecoverable error	No error	Error occurs
6	Print head temperature	No error	Error occurs
7	Not used	Fixed to 0	

Bit 2: Mechanical errors include home position, carriage sensor, and slip ejection errors.

Bit 2 and 3:
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.

Bit 6: If the print head temperature becomes high, bit 6 is transmitted until the print head temperature drops sufficiently. The printer automatically recovers from this error.

n=4: Continuous paper sensor status

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Journal near-end sensor	Paper present	No paper
3	Receipt near-end sensor	Paper present	No paper
4	Not used	Fixed to 1	
5	Journal paper sensor	Paper present	No paper
6	Receipt paper sensor	Paper present	No paper
7	Not used	Fixed to 0	

n = 5: Slip paper status

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Slip paper selection	Selected	Not selected
3	Slip insertion waiting	Not waiting	Waiting
4	Not used	Fixed to 1	
5	Slip insertion sensor	Paper present	No paper
6	Slip ejection sensor	Paper present	No paper
7	Not used	Fixed to 0	

Bit 2: There may be a time lag between receiving the paper selection command (**ESC c 0**) and selecting the slip paper. During this period, bit 2 remains 1.

After the slip is ejected, bit 2 is transmitted (Slip paper is not selected).

Bit 3: Becomes 0 (slip insertion is not waiting) just before loading slip paper, after detecting it.

Bit 5 and 6:

Transmit the current status of the slip sensors.

[Reference] **DLE ENQ**, **ESC u**, **ESC v, GS ENQ, GS a, GS r**, APPENDIX B, *Transmit Status Identification*

DLE ENQ n

[Name] Real-time request to printer

[Format] <10>H<05>H<*n*>

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

[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 after clearing the receive and print buffers
3	Cancel the slip waiting status

[Notes] The printer starts processing data upon receiving this command.

With the serial interface model, this command is executed even in off-line or receive buffer-full state.

With the parallel interface model, this command is executed even in off-line if the DIP switch 2-5 is set ON.

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*=<1>

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 2** interrupts before *n* is received, the code <10>H for **DLE ENQ 2** is processed as the code for **ESC 3** <10>H.

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, except print head temperature error.

When the printer recovers from an error using **DLE ENQ 1**, and slip paper is selected, the printer ejects the slip completely and loads paper. However, the printer only ejects the slip and does not load paper when the printer recovers from a slip ejection error.

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, except for print head temperature error.

When the printer recovers from an error using **DEL ENQ 2** with slip selected, the printer ejects the slip completely and goes to two-sheet mode. Therefore, when printing on slip is to be continued, select slip mode again using **ESC c 0 4** after the slip is ejected.

DLE ENQ 3 is ignored except when the printer is in the slip waiting state. Therefore , be sure to use **DLE EOT 5** to check whether slip paper is selected and the printer is in the slip waiting state before executing **DLE ENQ 3**. After the printer is released from the slip waiting state, receipt and journal papers are selected.

When the slip waiting status is canceled by **DLE ENQ 3**, the receive and print buffers are cleared.

When the printer is disabled with **ESC =** (Select peripheral device), the error recovery functions (**DLE ENQ 1** and **DLE ENQ 2**) are enabled, and the other functions are disabled.

If the value of *n* is out of the specified range, this command is ignored.

[Reference] **DLE EOT**, Appendix B: Transmit Status Identification

[Notes when the printer is used with the MICR reader]

When the printer recovers from an error using **DLE ENQ 1**, and MICR function is selected using **FS a 0**, the printer clears the print buffer, ejects the slip completely, and goes to two-sheet mode. Therefore, when personal check reading is to be continued, select MICR function again using **FS a 0**.

When the printer recovers from an error using **DEL ENQ 2** with the MICR function selected using **FS a 0**, the printer clears the receive and print buffers, ejects the slip completely, and goes to two-sheet mode. Therefore, when check reading is to be continued, select MICR function again using **FS a 0**.

DLE ENQ 3 is ignored, except when the printer is in the slip or personal check waiting state. Therefore , be sure to confirm whether slip paper is selected and the printer is in the slip waiting state using **DLE EOT 5** before executing **DLE ENQ 3**. Or, be sure to confirm whether MICR function is selected and the printer is in the personal check waiting state using **DLE EOT BS 1**. After the printer is released from the slip or personal check waiting state, receipt and journal papers are selected.

When the slip or personal check waiting status is canceled by **DLE ENQ 3**, the receive and print buffers are cleared.

This command is ignored while the printer transmits reading results of MICR.

[Reference when the printer is used with the MICR reader]

DLE EOT BS

RS

[Name] Journal tab

[Format] <1E>H

[Description] Moves the print position to the beginning of the journal paper.

[Note] This command is enabled only when both receipt and journal paper are selected and parallel printing mode on receipt and journal paper is turned off.

[Reference] **ESC c 0 , ESC z**

ESC SP *n*

[Name] Set right-side character spacing

[Format] <1B>H<20>H<*n*>

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

[Description] Sets the right-side character spacing using the fundamental calculation pitch.

The right-side character spacing is [$n \times$ (fundamental calculation pitch)] inches.

[Notes] This command is effective when the right-side character spacing [$n \times$ (fundamental calculation pitch)] is 32/150 inches or less.

The right-side character spacing for double-width mode is twice the normal value.

If the value of *n* is out of the specified range, this command is ignored.

[Default] $n = 0$

[Reference] **GS P**

ESC ! n

[Name] Select print mode(s)

[Format] <1B>H<21>H<*n*>

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

[Description] Selects print mode(s)

Each bit of *n* is used as follows:

Bit	Function	Value	
		0	1
0	Character font	9 × 9 font	7 × 9 font
1	Undefined		
2	Undefined		
3	Emphasized	Canceled	Selected
4	Double-height	Canceled	Selected
5	Double-width	Canceled	Selected
6	Undefined		
7	Underline	Canceled	Selected

[Notes] When both double-height mode and double-width mode are selected, quadruple-size characters are printed.

Bidirectional printing may cause printing position misalignment between the upper and lower halves of the characters during double-height enlarged printing. Therefore, it is better to select unidirectional printing (using **ESC U**) for double-height enlarged printing.

If you select underline mode, some printed characters may be difficult to read, because the underline overlaps the lowest dots in the characters.

[Default] *n* = 0 or 1 depending on the DIP switch setting.

[Reference] **ESC E, ESC –**

ESC $ *nL nH*

[Name] Set absolute print position

[Format] <1B>H<24>H<*nL*><*nH*>

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

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

The distance (inches) from the beginning of the line is calculated by the formula [(*nL* + *nH* × 256) × (fundamental calculation pitch)] inches.

[Note] Any value that falls outside the printable area is ignored.

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

ESC % *n*

[Name] Select/cancel user-defined character set

[Format] <1B>H<25>H<*n*>

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

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

When *n* = <*******0>B, the user-defined character set is canceled and the internal character set is enabled.

When *n* = <*******1>B, the user-defined character set is enabled.

[Notes] The user-defined character and the down-loaded bit image cannot be defined simultaneously.

[Default] *n* = 0

[Reference] **ESC &**

ESC & y *c1 c2 [X1 d1...d(y×1)]...[xk d1...d(y×k)]*

[Name] Define user-defined characters

[Format] <1B>H<26>H<*y*><*c1*><*c2*>[<*x1 d1...d(y×1)]...[xk d1...d(y×k)]*

[Range] *s* = 2
$32 \le c1 \le c2 \le 126$
$0 \le x \le 12$ (9 × 9 font)
$0 \le x \le 9$ (7 × 9 font)
$0 \le d1 \ldots dy \times x \le 255$

[Description] Defines user-defined characters for the specified character code

The *y* specifies the number of bytes in the vertical direction.

The *c1* specifies the beginning ASCII code for the definition, and *c2* specifies the final code. If only one character is defined, *c1* equals *c2*.

The allowable character code range is from ASCII code <20>H to <7E>H. The maximum number of user-defined characters differs depending on the receive buffer capacity as follows: (Refer to DIP switch 2-2 in Table 3.3.3.)

Receive buffer capacity	Maximum number of user-defined characters
2K bytes	23
32 bytes	71

When the maximum number of user-defined characters is defined, it is possible to redefine user-defined characters for the defined ASCII codes, but not for new ASCII codes.

The *x* specifies the number of dots in the horizontal direction.

The *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.

After user-defined characters are defined, they are available until: another definition is made; **ESC ?** or **ESC @** is executed; the printer is reset; or the power is turned off.

[Notes] Horizontally adjacent dots cannot be printed.

Only the top bit in the secondary data bytes in the vertical direction is valid.

If the values of *y, c1 ,c2*, or *x* is out of the specified range, the printer ignores the command and processes the following data as normal data.

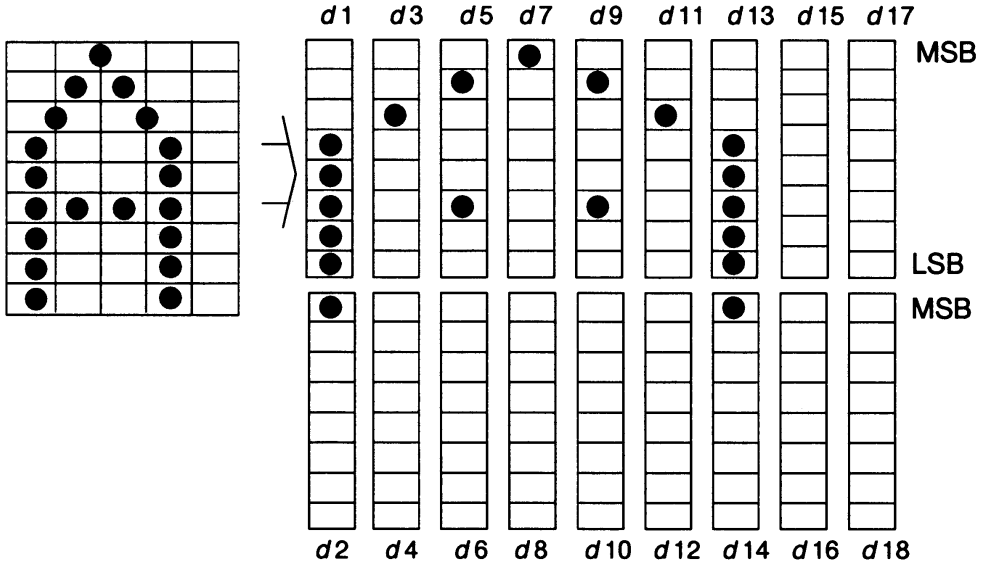
A user-defined character and a down-loaded bit-image cannot be defined simultaneously. When this command is executed, the down-loaded bit image is cleared.

[Default] The internal character set

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

[Example]

7 × 9 font when the dot pattern for code 20H is defined as shown below:



When the dot pattern for code 20H is defined as shown above.

	ESC	&	*y*	*c1*	*c2*	*x*	*d1*	*d2*	*d3*	*d4*	*d5*	*d6*	*d7*	*d8*	*d9*	*d10*	*d11*	*d12*	*d13*	*d14*
Code (Hexadecimal)	1B		26	02	20	20	07	1F	80	20	00	44	00	80	00	44	00	20	00	1F	80

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

ESC * *m nL nH d1...dk*

[Name] Select bit image mode

[Format] <1B>H<2A>H<*m*><*nL*><*nH*>*d1...dk*

[Range] *m* = 0, 1
$0 \le nL \le 255$
$0 \le nH \le 3$
$0 \le d \le 255$
$k = nL + nH \times 256$

[Description] Selects a bit image mode using *m* and the number of dots using *nL* and *nH*.

Divide the number of dots to be printed by 256. The integer answer is *nH* and the remainder is *nL*. Therefore, the number of dots in the horizontal direction is calculated by *nL* + *nH*. × 256

If the bit image data input exceeds the number of dots to be printed on a line, the excess data is ignored. When the first data is transmitted exceeding one line, the printer prints the data from the beginning of the next line.

The *d* indicates the bit image data. Set a corresponding bit to 1 to print a dot or 0 to not print a dot.

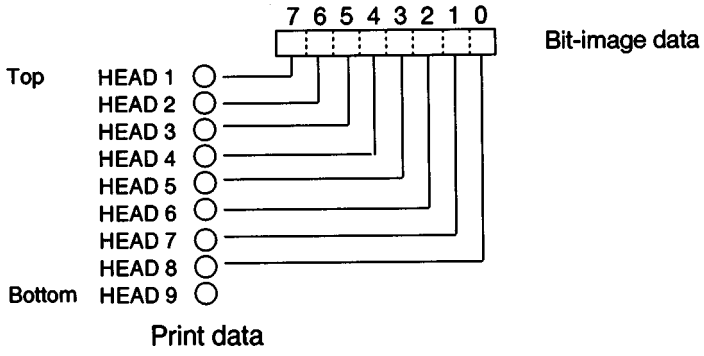
The bit image modes selectable by *m* are as follows:

m	Number of Vertical Dots	Horizontal Direction		Number of Horizontal Dots	
		Dot Density	Horizontally adjacent dot	Paper Roll	Slip
0	8	Single density	Permitted	180	400
1	8	Double density	Prohibited	360	800

[Notes] If the value of *m* is out of the specified range, the data following *nL* (*nL* is included) is processed as normal data.

After printing a bit image, the printer returns to normal data processing mode.

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



ESC – n

[Name] Turn underline mode on/off

[Format] <1B>H<2D>H<*n*>

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

[Description] Turns underline mode on/off.

n = 0 or 48: turns off underline mode.
n = 1 or 49: turns on underline mode.

[Notes] This command and **ESC !** turn underline mode on or off in the same way.

If the value of *n* is out of the specified range, the printer ignores the command.

[Default] *n* = 0

[Reference] **ESC !**

ESC 2

[Name] Select default line spacing

[Format] <1B>H<32>H

[Description] Sets the line spacing to 1/6 of an inch

[Note] The command is enabled only for paper(s) selected by **ESC c 1**.

[Reference] **ESC c 1**

ESC 3 n

[Name] Set line spacing

[Format] <1B>H<33>H<*n*>

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

[Description] Sets the line spacing to [*n* × (fundamental calculation pitch)] inches.

[Note] The command is enabled only for paper(s) selected by **ESC c 1**.

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

[Reference] **ESC c 1, GS P**

ESC <

[Name] Return home

[Format] <1B>H<3C>H

[Description] Moves the carriage to the left-most position, then moves it to the right-most position

[Notes] The left-most end is detected by the home position sensor.

Since the home position is detected when this command is executed, the printing position may shift after this command is executed.

ESC = *n*

[Name] Select peripheral device

[Format] <1B>H<3D>H<*n*>

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

[Description] Selects the device to which the host computer sends data

Each bit of *n* is used as follows:

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

Bit	Function	Value	
		0	1
0	Printer	Disabled	Enabled
1	Customer display	Disabled	Enabled
2	Undefined		
3	Undefined		
4	Undefined		
5	Undefined		
6	Undefined		
7	Undefined		

[Notes] Even if the printer is disabled, it may go off-line due to manual printer operation (refer to Section 2.1.1 - 2)).

[Default]

Serial interface model

When turning on the printer:

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

When executing **ESC @**:

Default value set by **ESC @** are as follows, depending on the value set by **ESC =** just before processing **ESC @** and on the setting of DIP switch 1-6:

Direct Connection Customer Display Status		*n*		
Default Value to be Set		1	2	3
After processing **ESC @**	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 1-6.

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

Parallel interface model *n* = 1

[Reference] Section 3.3.3, DIP switches

ESC ? *n*

[Name] Cancel user-defined characters

[Format] <1B>H<3F>H<*n*>

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

[Description] Cancels the specified user-defined characters

[Notes] This command deletes the defined pattern for the character code specified by *n* in the selected font.

After defined pattern is deleted, the printer prints the same pattern for the internal characters.

The printer ignores this command when the value of *n* is out of the specified range and when the specified character code is not defined.

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

ESC @

[Name] Initialize printer

[Format] <1B>H<40>H

[Description] Clears the data in the print buffer and resets the printer mode to the mode in effect when the power was turned on

[Notes] The DIP switches are not checked again.

The data in the receive buffer remains as is.

When this command is executed in slip mode, the printer ejects the slip and switches from slip mode to 2-sheet mode.

ESC C *n*

[Name] Set cut sheet eject length

[Format] <1B>H<43>H<*n*>

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

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

[Notes] When $n = 0$, the eject length setting for slip paper is canceled.

The specified eject length does not change even if the line spacing changes.

The maximum eject length that can be set is 40 inches. If the specified amount exceeds 40 inches, the eject length is automatically set to 40 inches.

[Default] $n = 0$

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

ESC E *n*

[Name] Turn emphasized mode on/off

[Format] <1B>H<45>H<*n*>

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

[Description] Turns emphasized mode on or off

When *n* = <*******0>B, emphasized mode is turned off.
When *n* = <*******1>B, emphasized mode is turned on.

[Notes] 2-pass printing is slower in emphasized mode.

This command and **ESC !** turn on and off emphasized mode in the same way. Be careful when this command is used with **ESC !**.

Only the lowest bit of *n* is enabled.

[Default] *n* = 0

[Reference] **ESC !**

ESC G *n*

[Name] Turn double-strike mode on/off

[Format] <1B>H<47>H<*n*>

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

[Description] Turns double-strike mode on or off

Only the lowest bit of *n* is enabled.

When *n* = <*******0>B, turns off double-strike mode.
When *n* = <*******1>B, turns on double-strike mode.

[Notes] Only the lowest bit of n is enabled.

Printer output is the same in double-strike mode and in emphasized mode.

[Default] *n* = 0

[Reference] **ESC E**

ESC J *n*

[Name] Print and feed paper

[Format] <1B>H<4A>H<*n*>

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

[Description] Prints the data in the print buffer and feeds the paper [*n* × (fundamental calculation pitch)] inches

[Notes] Sets the print starting position to the beginning of the line.

The maximum paper feed amount is 40 inches. If the specified amount exceeds 40 inches, the paper feed amount is automatically set to 40 inches.

[Reference] **GS P**

ESC K *n*

[Name] Print and reverse feed

[Format] <1B>H<4B>H<*n*>

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

[Description] Prints the data in the print buffer and feeds the paper [*n* × (fundamental calculation pitch)] inches in the reverse direction

[Notes] Sets the print starting position to the beginning of the line.

This command must not be executed continuously more than two times.

If *n* is out of the specified range or if the paper feed amount exceeds 1/6 inch, the printer prints the data and does not feed the paper.

If paper gets out of the slip sensor during slip printing, the printer prints the data and does not feed the paper.

Paper feeding in the reverse direction causes the following problems:

① Paper feed pitch is incorrect.

② Printer noise is louder than normal.

③ The paper may rub against the ribbon and become dirty.

[Reference] **GS P**

ESC R *n*

[Name] Select an international character set

[Format] <1B>H<52>H<*n*>

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

[Description] Selects a country's character set using *n* as follows:

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

[Note] If the value of *n* is out of the specified range, the printer ignores the command.

[Default] *n* = 0

[Reference] Section 3.2, *Character Code Tables*

ESC U *n*

[Name] Turn unidirectional printing mode on/off

[Format] <1B>H<55>H<*n*>

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

[Description] Turns unidirectional printing mode on or off

When *n* = <*******1>B, turn on unidirectional printing mode.
When *n* = <*******0>B, turn off unidirectional printing mode and turn on bidirectional printing mode.

[Notes] 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.

Only the lowest bit of *n* is enabled.

[Default] *n* = 0

ESC \ *nL nH*

[Name] Set relative print position

[Format] <1B>H<5C>H<*nL*><*nH*>

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

[Description] Sets the print starting position based on the current position

[Notes] A positive number specifies movement to the right and a negative number specifies movement to the left.

Use the supplement of *N* for setting *N* pitch movement to the left:

- *N* pitch = 65536 - *N*

The print starting position is [(*nL*+*nH* × 256) × (fundamental calculation pitch)] inches calculated from the current position.

Any value that falls outside the printable area is ignored.

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

ESC a *n*

[Name] Select justification

[Format] <1B>H<61>H<*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 input at the beginning of the line.

This command justifies the space area according to **ESC $** or **ESC ¥**.

If the value of *n* is out of the specified range, the printer ignores the command.

[Default] *n* = 0

[Example]

Left justification	Centering	Right justification
ABC	ABC	ABC
ABCD	ABCD	ABCD
ABCDE	ABCDE	ABCDE

ESC c 0 *n*

[Name] Paper type(s) for printing

[Format] <1B>H<63>H<30>H<*n*>

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

[Description] Selects paper(s) for printing

Each bit of *n* is used as follows:

Bit	Function	Value	
		0	1
0	Journal	Disabled	Enabled
1	Receipt	Disabled	Enabled
2	Slip	Disabled	Enabled
3	Undefined		
4	Undefined		
5	Undefined		
6	Undefined		
7	Undefined		

[Notes] This command is enabled only when input at the beginning of a line.

Slip paper and another paper cannot be selected simultaneously.

When this command is input, the printer executes the following:

① If either receipt or journal paper is selected, a previously selected slip paper is canceled and ejected.

② If a slip was previously selected and is selected again, no operation is executed.

③ If either receipt or journal paper was previously selected, and then slip paper is selected, the printer waits for the slip paper to be loaded.

If the value of *n* is out of the specified range, the printer ignores the command.

[Default] *n* = 3

ESC c 1 *n*

[Name] Select type(s) for command settings

[Format] <1B>H<63>H<31>H<*n*>

[Range] $1 \leq n \leq 7$

[Description] Selects paper(s) for setting the line spacing

Line spacing is set using **ESC 2** and **ESC 3**.

Each bit of *n* is used as follows:

Bit	Function	Value	
		0	1
0	Journal	Disabled	Enabled
1	Receipt	Disabled	Enabled
2	Slip	Disabled	Enabled
3	Undefined		
4	Undefined		
5	Undefined		
6	Undefined		
7	Undefined		

[Note] If the value of *n* is out of the specified range, the printer ignores the command.

[Default] *n* = 7

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

ESC c 3 *n*

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

[Format] <1B>H<63>H<33>H<*n*>

[Range] $1 \leq n \leq 255$

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

Each bit of *n* is used as follows:

Bit	Function	Value	
		0	1
0	Journal near-end sensor	Disabled	Enabled
1	Receipt near-end sensor	Disabled	Enabled
2	Journal end sensor	Disabled	Enabled
3	Receipt end sensor	Disabled	Enabled
4	Slip insertion sensor	Disabled	Enabled
5	Slip ejection sensor	Disabled	Enabled
6	Undefined		
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.

This command is available only with a parallel interface and is ignored with a serial interface.

[Default] *n* = 15

ESC c 4 *n*

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

[Format] <1B>H<63>H<34>H<*n*>

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

[Description] Selects the paper sensor(s) used to stop printing when paper-end is detected

Each bit of *n* is used as follows:

Bit	Function	Value	
		0	1
0	Journal near-end sensor	Disabled	Enabled
1	Receipt near-end sensor	Disabled	Enabled
2	Journal sensor	Disabled	Enabled
3	Receipt sensor	Disabled	Enabled
4	Slip insertion sensor	Disabled	Enabled
5	Slip ejection sensor	Disabled	Enabled
6	Undefined		
7	Undefined		

[Notes] When a paper sensor is enabled with this command, printing is stopped only when the corresponding paper is selected for printing.

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.

Printing is stopped after the current line is completed and the paper is fed.

When a paper-end is detected by the journal or receipt sensor, the printer goes off-line after printing stops.

When the slip insertion sensor detects a paper-end, the printer ejects the paper after printing as much data as possible and enters the paper waiting state.

[Default] *n* = 12

ESC c 5 *n*

[Name] Enable/disable panel buttons

[Format] <1B>H<63>H<35>H<*n*>

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

[Description] Enables or disables all of the panel buttons

When *n* = <*******0>B, the panel buttons are enabled.
When *n* = <*******1>B, the panel buttons are disabled.

[Notes] Only the lowest bit of n is valid.

When the panel buttons are disabled, no buttons on the panel are usable. Therefore, paper can be fed with the panel buttons only when the printer cover is open.

[Default] *n* = 0

ESC d *n*

[Name] Print and feed *n* lines

[Format] <1B>H<64>H<*n*>

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

[Description] Prints the data in the print buffer and feeds *n* lines

[Notes] Sets the print starting position to the beginning of the line.

The maximum paper feed amount is 40 inches. If the specified amount exceeds 40 inches, the paper feed amount is automatically set to 40 inches.

[Default] Not defined

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

ESC e *n*

[Name] Print and reverse feed *n* lines

[Format] <1B>H<65>H<*n*>

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

[Description] Prints the data in the print buffer and feeds *n* lines in the reverse direction

[Notes] Sets the print starting position to the beginning of the line.

This command must not be executed continuously more than two times.

If the value of *n* is out of the specified range or if the *n* line feed amount exceeds 1/6 inch, the printer prints the data and does not feed the paper.

If slip paper gets out of the slip sensor during printing, the printer prints the data and does not feed the paper.

Paper feeding in the reverse direction causes the following problems:

① Paper feed pitch is incorrect.

② Printer noise is louder than normal.

③ The paper may rub against the ribbon and become dirty.

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

ESC f *t1 t2*

[Name] Set cut sheet wait

[Format] <1B>H<66>H<*t1*><*t2*>

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

[Description] Sets the time the printer waits for slip paper to be inserted and the time from when the slip is inserted to when the printer starts operation

The slip waiting time is *t1* × 1 minutes. If slip paper is not inserted within this time, the printer cancels slip mode automatically and selects the default paper in **ESC c 0**.

When *t1* = 0, the printer waits until slip paper is inserted.

The printer starts operation *t2* × 0.1 seconds after detecting a slip.

[Notes] If either *t1* or *t2* is out of the specified range, this command is ignored and the previously set value is not changed.

Using **DLE ENQ 3** cancels the slip waiting state. The data in the receive buffer and the print buffer are cleared in this time.

For the following notes, assume that **ESC c 4** is set to stop printing when the absence of slip paper is detected:

If the printer is in paper-end and enters the slip waiting state by feeding a slip with the FEED button, there is no limit on the slip waiting time if the printer is not at the beginning of a line.

If the printer is in a paper-end and enters the slip waiting state by attempting to print double-height characters on the last line of the slip, there is no limit on the slip waiting time.

When the slip waiting time is set using **ESC f *t1 t2*** and when printing stops because paper-end is enabled using **ESC c 4 *n***, it is desirable to print on the remaining slip paper while checking the slip status using **GS r 3**.

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

ESC i

[Name] Partial cut (one portion left uncut)

[Format] <1B>H<69>H

[Description] Executes a full cut of the receipt paper.

[Notes] The command is enabled only when input at the beginning of a line.

The command is enabled only when receipt paper is selected for printing by using **ESC c 0**.

[Reference] **ESC m**

ESC m

[Name] Partial cut (three portions left uncut)

[Format] <1B>H<6D>H

[Description] Executes a partial cut of the receipt paper.

[Notes] The command is enabled only when input at the beginning of a line.

The command is enabled only when receipt paper is selected for printing by using **ESC c 0**.

[Reference] **ESC i**

ESC o

[Name] Stamp

[Format] <1B>H<6F>H

[Description] Executes stamping of the receipt paper.

[Notes] The command is enabled only when input at the beginning of a line.

The command is enabled only when receipt paper is selected for printing by **ESC c 0**.

ESC p *m t1 t2*

[Name] Generate pulse

[Format] <1B>H<70>H<*m*><*t1*><*t2*>

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

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

The value of *m* determines the output pin as follows:

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

The ON time is *t1* × 10 ms and the OFF time is *t2* × 10 ms.

[Notes] When *t2* < *t1*, the printer processes *t2* as *t1*.

If the value of m is out of the specified range, the printer ignores the command and processes *t1* and *t2* as normal data.

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

ESC t *n*

[Name] Select character code table

[Format] <1B>H<74>H<*n*>

[Range] $0 \le n \le 5$, $254 \le n \le 255$

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

n	Character code table
0	PC437 (U.S.A., Standard Europe)
1	Katakana
2	PC850 (Multilingual)
3	PC860 (Portuguese)
4	PC863 (Canadian-French)
5	PC865 (Nordic)
254	Space page
255	Space page

[Note] If the value of *n* is out of the specified range, the printer ignores the command.

[Default] *n* = 0

[Reference] Section 3.2, *Character Code Tables*
APPENDIX C, *Configuring the Space Page*

ESC u *n*

[Name] Transmit peripheral device status

[Format] <1B>H<75>H<*n*>

[Range] *n* = 0, 48

[Description] Transmits the status of connector pin *n* upon receiving this command

The value of *n* is set as follows:

n	Connector pin
0, 48	Drawer kick-out connector pin 3

[Notes] When the connector is not used, the value of bit 0 is always 1.

When DTR/DSR control is selected, 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 keeps waiting until the host is ready. When XON/XOFF control is selected, the printer transmits only 1 byte without checking the DSR signal.

This command is executed when the data is processed in the receive buffer. Therefore, there may be a time lag between receiving the 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 **ESC u** and the ASB status must be differentiated, using the table in APPENDIX B.

If the value of *n* is out of the specified range, the printer ignores the command.

The status to be transmitted is shown in the table below.

Bit	Function	Value	
		0	1
0	Pin 3 level	LOW	HIGH
1	Undefined		
2	Undefined		
3	Undefined		
4	Not used	Fixed to 0	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

[Reference] **DLE EOT, GS ENQ, GS a, GS r**

Section 2.2.3, *Drawer kick-out connector*

APPENDIX B, *Transmit Status Identification*

ESC v

[Name] Transmit paper sensor status

[Format] <1B>H<76>H

[Description] Transmits the current paper sensor status

[Notes] When DTR/DSR control is selected, 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, the printer transmits only 1 byte without checking the DSR signal.

The 1 byte status data is transmitted after printing and paper feed operation completely stop (transmit timing differs from **ESC u, GS I,** and **GS r**).

This command is executed when the data is processed in the receive buffer. Therefore, there may be a time lag between receiving the 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 **ESC v** and the ASB status must be differentiated, using the table in APPENDIX B.

The status to be transmitted is shown in the table below:

Bit	Function	Value	
		0	1
0	Journal near-end	Paper present	No paper
1	Receipt near-end	Paper present	No paper
2	Journal end	Paper present	No paper
3	Receipt end	Paper present	No paper
4	Not used	Fixed to 0	
5	Slip insertion sensor	Paper present	No paper
6	Slip ejection sensor	Paper present	No paper
7	Not used	Fixed to 0	

[Reference] **DLE EOT, GS ENQ, GS a, GS r**, APPENDIX B, *Transmit Status Identification*

ESC z *n*

[Name] Turn parallel printing mode on/off for receipt and journal

[Format] <1B>H<7A>H<*n*>

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

[Description] Turns parallel printing mode on or off. When parallel printing mode is turned on, the printer prints the same data on both receipt and journal paper

When *n* = <*******0>B, turns off parallel printing mode.
When *n* = <*******1>B, turns on parallel printing mode.

[Notes] Only the lowest bit of n is enabled.

This command is enabled only when input at the beginning of a line.

If neither receipt nor journal paper is not selected by **ESC c 0** in parallel printing mode, parallel printing is not performed.

[Default] *n* = 0

[Reference] **ESC c 0**

ESC { *n*

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

[Format] <1B>H<7B>H<*n*>

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

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

When *n* = <*******0>B, turns off upside-down printing mode
When *n* = <*******1>B, turns on upside-down printing mode

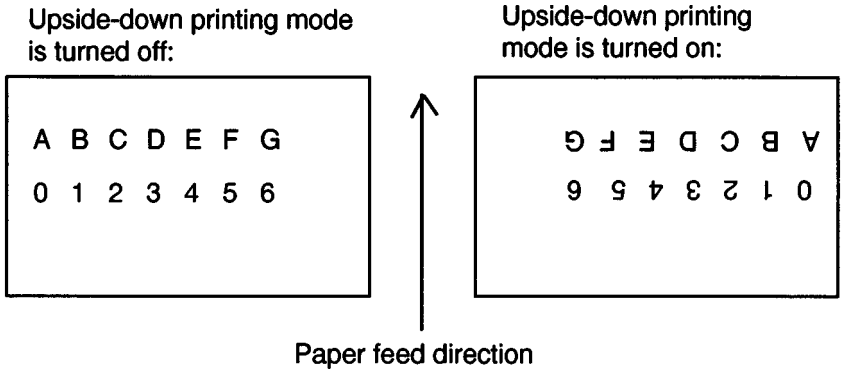
[Notes] Only the lowest bit of n is enabled.

In upside-down printing mode, the printer rotates the line to be printed by 180° and then prints the characters.

This command is enabled only when input at the beginning of a line.

[Default] *n* = 0

[Example]



GS ENQ

[Name] Transmit real-time printer status

[Format] <1D>H<05>H

[Description] Transmits the real-time printer status upon receiving this command

[Notes] The printer transmits only 1 byte without checking the DSR signal.

This command is executed even if the printer is in the off-line state, in the receive buffer full state, or in the mechanical error state.

The printer status is transmitted whenever the data sequence of <1D>H<05>H is received.

Example:

In **ESC p *m t1 t2*:** *t1* = <1D>H, *t2* = <05>H

In **ESC * *m nL nH d1...dk*:** *d1* = <1D>H, *d2* = <05>H

This command should not be used within the data sequence of another command that consists of two or more bytes.

Example:

If you attempt to transmit **ESC 3 *n*** to the printer, be sure to transmit n before transmitting **GS ENQ** regardless of the condition of the DTR signal (DSR for the host computer). If **GS ENQ** interrupts before *n* is received, *n* is processed as <1D>H.

The command should not be used with handshaking of 7-bit data word length and XON/XOFF control. Otherwise, the status transmitted using this command cannot be differentiated from the XON/XOFF codes.

When Auto Status Back (ASB) is enabled using **GS a**, the status transmitted by **GS ENQ** and the ASB status must be differentiated, using the table in APPENDIX B, *Transmit Status Identification*.

Bit	Function	Value	
		0	1
0	Journal near-end sensor	Paper present	No paper
1	Receipt near-end sensor	Paper present	No paper
2	Cover open/close	Close	Open
3	On-line/Off-line	On-line	Off-line
4	Drawer kick-out connector pin 3	LOW	HIGH
5	Slip insertion sensor	Paper present	No paper
6	Error	No error	Error occurs
7	Not used	Fixed to 1	

Bit 3: It becomes 1 when the printer is off-line due to paper-end stop or cover-open.

Bit 6: It becomes 1 when an error has occurred due to auto-cutting, home position detection, carriage detection, slip ejection detection, or print head high temperature error.

[Reference] **DLE EOT, ESC u, ESC v, GS a, GS r**, APPENDIX B, *Transmit Status Identification*

GS * *x y d1...d(x×y×8)*

[Name] Define downloaded bit image

[Format] <1D>H<2A>H<*x*><*y*>*d1...d(x×y×8)*

[Range] $1 \le x \le 255$
$1 \le y \le 255$
$x \times y \le 155$ (when receive buffer is 2K bytes)
$x \times y \le 404$ (when receive buffer is 32 bytes)

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

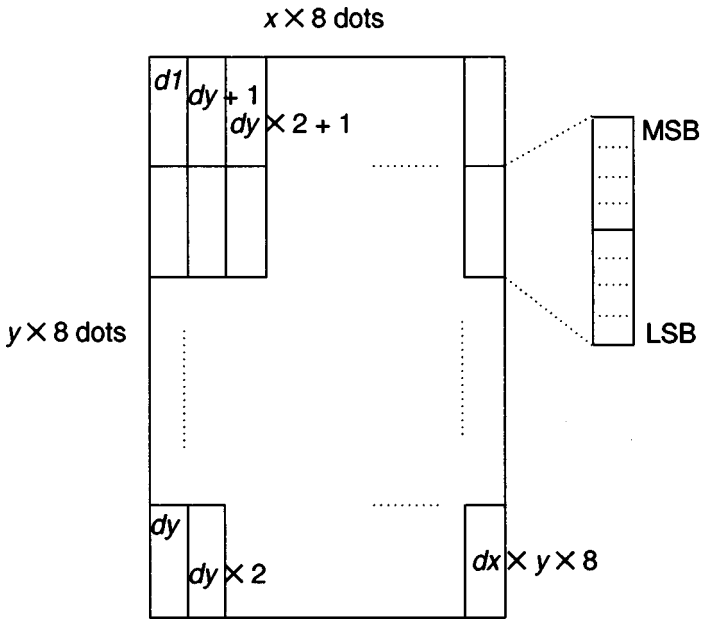
The number of dots in the horizontal direction is $x \times 8$, in the vertical direction it is $y \times 8$.

The *d* indicates bit image data.

After a downloaded bit image is defined, it is available until: another definition is made; **ESC @** or **ESC &** is executed; the printer is reset; or the power is turned off.

[Notes] A user-defined character and a downloaded bit image cannot be defined simultaneously. When this command is executed, the user-defined character is cleared.

The figure below shows the relationship between the bit image data and dots to be defined.



[Reference] **GS /**

GS / *m*

[Name] Print downloaded bit image

[Format] <1D>H<2F>H<*m*>

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

[Description] Prints a downloaded bit image using the mode specified by *m*

m selects a mode from the table below:

m	Horizontal Direction		Number of Horizontal Dots	
	Dot Density	Adjacent dots	Paper Roll	Slip
0, 48	Single density	Permitted	180	400
1, 49	Double density	Prohibited	260	800

[Notes] This command is ignored if data exists in the print buffer.

This command is ignored if a downloaded bit-image has not been defined.

If a downloaded bit-image to be printed exceeds one line, the excess data is not be printed.

A user-defined character and a downloaded bit image cannot be defined for the same character code.

If the value of *m* is out of the specified range, the printer ignores the command.

[Reference] **GS ***

GS E *n*

[Name] Select head energizing time

[Format] <1D>H<45>H<*n*>

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

[Description] Selects the printing speed and the head energizing time (print mode)

Each bit of *n* is used as follows:

Bit	Function	Value	
		0	1
0	Head energizing time	Copy	Normal
1	Undefined		
2	Undefined		
3	Undefined		
4	Printing speed	High	Low
5	Undefined		
6	Undefined		
7	Undefined		

[Notes] This command is enabled only when input at the beginning of the line.

The printer processes *n* = <***0***0>B as *n* = <***0***1>B.

The setting is for paper selected by **ESC c 0**.

n	Speed	Head	Mode	Default value	
				Paper Roll	Slip
1	High	Normal	Normal	Selectable by DIP switch	
16	Low	Copy	Copy		Default
17	Low	Normal	Low	Selectable by DIP switch	

[Default] Paper roll: *n* = 1 or 17, depending on the DIP switch
Slip: *n* = 16

[Reference] **ESC c 0**

GS I *n*

[Name] Transmit printer ID

[Format] <1D>H<49>H<*n*>

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

[Function] Transmits the specified printer ID.

n specifies the printer ID as follows:

n	Printer ID	Specifications	ID (hexadecimal)
1, 49	Model ID	TM-U950/U950P	09H
2, 50	Type ID	Refer to the table below	
3, 51	ROM version ID	ROM version	See the Notes below.

[Notes] When DTR/DSR control is selected, 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, 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.

The ROM version may be changed.

When Auto Status Back (ASB) is enabled using **GS a**, the status transmitted by **GS I** and the ASB status must be differentiated using the table in APPENDIX B.

When *n* is out of the specified range, this command is ignored.

n = 2 Type ID:

Bit	Function	Value	
		0	1
0	Two-byte code characters	Not mounted	Mounted
		Fixed to 0	
1	Auto cutter	Not mounted	Mounted
		Fixed to 1	
2	DIP switch 1-6 setting (DM-D direct connection)	OFF	ON
3	MICR	Not mounted	Mounted
4	Not used	Fixed to 0	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

[Reference] Section 3.3.3, DIP switches, APPENDIX B, *Transmit status identification*

GS P *x y*

[Name] Set horizontal and vertical motion units

[Format] <1D>H<50>H<*x*><*y*>

[Range] $0 \leq x \leq 255$
$0 \leq y \leq 255$

[Description] Sets the units for setting the values in the horizontal direction to 1/*x* inch and in the vertical direction to 1/*y* inch.

When setting *x* = 0 and *y* = 0, the values are reset to the default values.

[Notes] The current settings remain unchanged after this command is executed.

The calculated result when using this command and the line spacing setting command is adjusted with the minimum pitch of the mechanism (horizontal: 1/150", vertical: 1/144"). The remainder is cut off.

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

[Reference] **ESC SP, ESC 3, ESC J, ESC K, ESC $, ESC **

[Example] When setting *n* = 48 in **ESC 3** as a default, the amount of paper feeding is set to 48/144 (1/3 inches). When setting *x* = 0 and *y* = 240 in **GS P** and *n* = 48 in **ESC 3**, the amount of paper feeding is set to 48/240 (1/5 inch).

GS a *n*

[Name] Enable/disable Automatic Status Back

[Format] <1D>H<61>H<*n*>

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

[Function] Selects a status for Automatic Status Back (ASB).

Each bit of *n* is used as follows:

Bit	Function	Value	
		0	1
0	Drawer kick-out connector pin 3	Disabled	Enabled
1	On-line/Off-line	Disabled	Enabled
2	Error	Disabled	Enabled
3	Paper roll sensor	Disabled	Enabled
4	Undefined		
5	Slip paper sensor Slip paper status	Disabled	Enabled
6	Undefined		
7	Undefined		

[Notes] If any status is not selected, ASB becomes disabled.

ASB is enabled if only one status is selected. The printer automatically transmits a status of 4 bytes whenever the status changes.

If ASB is enabled while processing this command, the current status is transmitted with no regulations.

When transmitting a status, the printer transmits only 4 bytes without confirming the condition of the DSR signal.

Four bytes of status data must be consecutive, except for XOFF code.

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 first status, depending on the receive buffer status.

When the printer is disabled by **ESC =** (Select peripheral device), this command is disabled but the ASB which has been set is always enabled.

When using **ESC u, ESC v, GS I, GS r, DLE EOT**, or **GS ENQ**, the status transmitted by this command, the ASB status, and the status transmitted by another commands must be differentiated, according to the procedure in APPENDIX B, *Transmit Status Identification*.

The status to be transmitted are as follows:

First byte (printer information)

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 0	
2	Drawer kick-out connector pin 3	LOW	HIGH
3	On-line/off-line	On-line	Off-line
4	Not used	Fixed to 1	
5	Cover open/close	Close	Open
6	Paper feeding with paper feed switch	Except during paper feed	During paper feed
7	Not used	Fixed to 0	

Second byte (error information)

Bit	Function	Value	
		0	1
0	Undefined		
1	Undefined		
2	Mechanical error	No error	Error occurs
3	Auto cutter error	No error	Error occurs
4	Not used	Fixed to 0	
5	Error impossible to recover	No error	Error occurs
6	Head temperature	No error	Error occurs
7	Not used	Fixed to 0	

Third byte (paper sensor information)

Bit	Function	Value	
		0	1
0	Journal near-end sensor	Paper present	No paper
1	Receipt near-end sensor	Paper present	No paper
2	Journal sensor	Paper present	No paper
3	Receipt sensor	Paper present	No paper
4	Not used	Fixed to 0	
5	Slip insertion sensor	Paper present	No paper
6	Slip ejection sensor	Paper present	No paper
7	Not used	Fixed to 0	

Forth byte (paper sensor information)

Bit	Function	Value	
		0	1
0	Slip selection	Selected	Not selected
1	Slip status	Possible to print	Impossible to print
2	Undefined		
3	Undefined		
4	Not used	Fixed to 0	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

Bit 1: It is 0 (possible to print) when paper loading has finished and is 0 when slip ejection is started or when time out.

When the slip paper is selected and the printer goes to the slip waiting state:

Bits 5 and 6 of the third byte is 1 (no paper)
Bits 0 and 1 of the fourth byte are 0 (selected) and 1 (impossible to print) respectively.

When the printer goes to the slip ejection waiting with slip selected:

Bits 5 and 6 of the third byte are 1 (no paper) and 0 (paper present) respectively
Bits 0 and 1 of the fourth byte are 0 (selected) and 1 (impossible to print) respectively.

When printing stop due to paper-end is disabled using **ESC c 4**, bit 1 of the fourth byte (slip status) does not become 1 (impossible to print) even when there is no remaining printing space on the slip. Use **GS r 3** to check the remaining printing space on the slip.

[Default] *n* = 0 when DIP SW 2-5 is off, *n* = 2 when DIP SW 2-5 is on

[Reference] **DLE EOT, ESC u, ESC v, GS ENQ, GS r**, APPENDIX B, APPENDIX F

GS r *n*

[Name] Transmit status

[Format] <1D>H<72>H<*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 (same as **ESC v**)
2, 50	Transmits drawer kick-out connector status (same as **ESC u 0**)
3, 51	Transmits slip paper status

[Notes] 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 Automatic 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 B.

If the value of *n* is out of the specified range, the printer ignores this command.

The status types to be transmitted are shown below:

n = 1: Paper sensor status

Bit	Function	Value	
		0	1
0	Journal near-end sensor	Paper present	No paper
1	Receipt near-end sensor	Paper present	No paper
2	Journal sensor	Paper present	No paper
3	Receipt sensor	Paper present	No paper
4	Not used	Fixed to 0	
5	Slip insertion sensor	Paper present	No paper
6	Slip ejection sensor	Paper present	No paper
7	Not used	Fixed to 0	

n = 2: Drawer kick-out connector status

Bit	Function	Value	
		0	1
0	Pin 3 level	LOW	HIGH
1	Undefined		
2	Undefined		
3	Undefined		
4	Not used	Fixed to 0	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

n = 3: Slip status

Value	Slip Status
00000000B	There is no printing area on the current slip or slip paper is not selected.
00000001B	It is possible to print one line excluding double-height characters on the current slip.
00000010B	It is possible to print one line including double-height characters on the current slip.
00000011B	It is possible to print one line or more.

∗ The user can confirm whether more printing space is available on the current slip by using **GS r 3**.

When more printing space is available in the current specified line spacing, the printer transmits <03>H.

When only one line including double-height characters is available, the printer transmits <02>H.

When only one line excluding double-height characters is available, the printer transmits <01>H.

If no lines remain on the current slip, the printer transmits <00>H. However, when printing stop by detecting paper-end is enabled, the printer ejects the slip and waits for the next slip to be inserted, but does not transmit <00>H.

[Reference] **DLE EOT, ESC u, ESC v, GS ENQ, GS a**,
APPENDIX B, *Transmit Status Identification*

6.3 Ignored Commands

The TM-U950/U950P ignores the following commands:

ESC c 3 *n* (This command is available only with a parallel interface and is ignored with a serial interface.)

ESC c 6 *n*

6.4 MICR Control Commands (when the printer is used with the MICR reader)

DLE EOT BS *n*

[Name] Transmit real-time MICR status

[Format] <10>H<04>H<08>H<*n*>

[Range] *n* = 1

[Description] Transmits the selected MICR status specified by *n* in real time as follows:

n	Function
1	Transmit MICR status.

[Notes] The status information to be transmitted is shown in the tables on the following pages.

The printer starts MICR status transmission when this command is buffered in the receive buffer.

When transmitting status, the printer transmits only 1 byte without confirming the condition of the DSR signal.

This command is executed even when the printer is in off-line, the receive buffer full, or in an error status.

The status is transmitted whenever the data sequence for **DLE EOT BS *n*** (*n* = 1) is received.

Example:

In **ESC ✽ *m nL nH d1...dk***, *d1*=<10>H, *d2*=<04>H, *d3*=<08>H, *d4* = <01>H

This command should not be contained within another command that consists of 2 or more bytes.

Example:

If you attempt to transmit **ESC 3 *n*** to the printer, and then **DLE EOT BS 1** interrupts before n is received, the code <10>H for **DLE EOT BS 1** is processed as the code for **ESC 3** <10>H.

This command is unavailable when using the **ESC =** (Select Peripheral Device) to select the printer to be disabled.

This command is ignored while the printer transmits reading results of MICR (**FS a 0**, **FS b**).

When Automatic Status Back (ASB) is enabled using the **GS a** command, the status transmitted by the **DLE EOT BS** command and the ASB status must be differentiated using the table in APPENDIX B.

If the value of *n* is out of the specified range, the printer ignores this command.

n = 1: MICR status

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	MICR function Selected	Selected	Not selected
3	Check paper or cleaning sheet insertion waiting	Not waiting	Waiting
4	Not used	Fixed to 1	
5	Check insertion sensor	Paper present	No paper
6	Check ejection sensor	Paper present	No paper
7	Not used	Fixed to 0	

Bit 2: There may be a time lag between receiving the MICR selection command (**FS a 0**) and selecting slip paper. During this period, bit 2 remains 1 (not selected).

Remains 0 (selected) until MICR function completes.

Bit 3: Becomes 0 (not waiting) just before starting MICR reading, or starting MICR head cleaning, after detecting the personal check or cleaning sheet, respectively.

Bits 5 and 6: Transmit the current status of the paper sensors.

[Reference] **DLE ENQ, FS a 0, FS a 1, FS a 2, FS b, FS c**

APPENDIX B: *Transmit Status Identification*

FS a 0 *n*

[Name] Read check paper

[Format] <1C>H<61>H<30>H<*n*>

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

[Description] Selects MICR function and reads MICR characters specified by *n* as follows:

Bit	Off/On	Hex	Decimal	Function
0	Readable fonts. See the table below.			
1				
2,3	-	-	-	Undefined
4	Off	00	0	Unreadable font is detected and terminated.
	On	10	16	Unreadable font is detected and exchanged with '?'.
5	Off	00	0	Terminal symbol is identified.
	On	20	32	Terminal symbol is not identified.
6	-	-	-	Undefined
7	Off	00	0	Not used. Fixed to Off.

Readable Fonts

Hex	Decimal	Font
00	0	E13B
01	1	CMC7
02	2	Undefined
03	3	Undefined

[Notes] This command is available only when input at the beginning of a line.

This command is executed after being buffered in the receive buffer. Therefore, there may be a time lag between receiving this command and starting MICR reading.

When an undefined font is selected, this command is ignored.

If MICR function is not selected when this command is executed, MICR function is selected and the printer enters the personal check waiting status. When slip paper is selected for printing, the printer ejects the current slip, then waits for check paper to be loaded.

When this command is executed with MICR function selected and re-reading possible, the printer re-reads check paper.

The personal check wait time is *t1* × 1 minutes (depending on the **ESC f *t1 t2*** setting), and the printer starts reading *t2* × 0.1 second after detecting insertion of a personal check.

The printer processes only the real-time commands during the paper wait time.

The check waiting status continues until: a check is inserted, the waiting state is canceled, the waiting time *t1* set by **ESC f** elapses, or the power is turned off. When check waiting state is canceled, or when the wait time elapses, the printer ends reading abnormally. The printer starts reading when a personal check is inserted.

When characters are not detected or when the correct reading waveform is not detected, or when an error occurs, the printer ends reading abnormally. Otherwise, the printer ends reading normally.

When (bit 4 of *n* is 0), if character waveforms detected during reading are not identified as the specified character font after analysis, the printer ends this command at the point and transmits “header +reading status (abnormal end) + NULL” to the host computer.

When (bit 4 of *n* is 1), if character waveforms detected during reading are not identified as the specified character font after analysis, the printer converts the data to “?” and continues the process. At this time, the printer transmits “header + reading status (abnormal end) + data (including “?”) + NULL” to the host computer.

Notice that the printer can convert data with up to 3 ”?”s. If a fourth “?” occurs, the printer stops reading the data, ends this command and transmits “header + reading status (abnormal end) + NULL” to the host computer.

When (bit 5 of *n* is 0), the data from the left end to the terminal symbol at the right end in the readable range is available for analysis. Data to the right of the terminal symbol considered are not available for analysis and are not character waveforms are not analyzed. Data to sent to the host computer includes the terminal character.

When (bit 5 of *n* is 0), if the terminal symbol is not detected, printing ends abnormally, and the printer transmits “header + reading status (abnormal end) + NULL” to the host computer.

When (bit 5 of *n* is 1), all data in the readable range is available for analysis.

In Font E13B, the terminal symbol is (‖■), and in Font CMC7, the terminal symbol doesn’t exist. If Font CMC7 and (bit5 of *n* is 0) are selected at the same time, the terminal symbol is not recognized.

When the printer ends reading normally, it transmits “header + reading status (normal end) + data + NULL” to the host computer.

When the printer ends reading abnormally (except for the case that “?”s are three or less), the printer ejects paper, selects the default paper type for **ESC c 0**, and ends MICR function.

When a recoverable error occurs, the printer selects the default paper type for **ESC c 0** automatically and ends MICR function when recovering from the error.

If an error occurs before transmitting the identification result, the printer does not transmit the identified result.

When DTR/DSR control is selected, the printer transmits data consecutively after confirming whether the host computer is ready to receive data. When the host is not ready to receive data, the printer waits until the host is ready.

When XON/XOFF control is selected, the printer transmits all data consecutively without confirming whether the host computer is ready to receive data. The data transmission must be consecutive, except for the XOFF code.

The printer transmits all data collectively without confirming whether the host is ready to receive data. To receive identification result correctly, 67 bytes or more space is required in the receive buffer.

During identification result transmission, the printer ignores **DLE EOT *n***, **DLE EOT BS *n***, and **GS ENQ**. Also, the printer does not transmit ASB during reading and identification result transmission. Therefore, the user cannot confirm changes in the printer status during these periods.

It is possible to differentiate the reading results of MICR, ASB, and real-time status. Refer to Appendix B for data identifying method.

The identification result is not cleared until: the next **FS a 0** is executed, **ESC @** is executed, or the printer power is turned off.

Data transmission (real-time commands and the like) should not be performed during MICR reading, because it affects the reading precision and may lower the recognition rating.

When bit 4 is 0 (re-reading possible) and **FS a 0, FS a 1, FS a 2**, or **FS b** is received, the printer executes each command. When any other code (except for real-time commands) is received, the printer ejects the check paper, ends MICR function, and selects the default paper type for **ESC c 0** automatically.

If the printer receives **FS a 1, FS a 2**, or **FS b** when bit 5 is 0 (normal end) and bit 4 is 1 (re-reading impossible), the printer executes each command. If the printer receives any other code (except for real-time commands), the printer ejects the check, ends MICR function, and selects the default paper type for **ESC c 0** automatically.

Paper feeding with the paper feed button and auto loading cannot be performed during the period from starting MICR character reading to ending check paper ejection. Also, do not change the ink ribbon during this period.

Header: <5F>H
NUL: <00>H

Each bit of *n* is used as follows:

Bit	Off/On	Hex	Decimal	Function
0,1	Readable fonts. See the table below.			
2,3	-	-	-	Undefined
4	Off	00	0	Rereading possible.
	On	10	16	Rereading not possible.
5	Off	00	0	Reading normal.
	On	20	32	Reading not normal.
6	On	40	64	Not used. Fixed to On.
7	Off	00	0	Not used. Fixed to Off.

Readable Fonts

Hex	Decimal	Font
00	0	E13B
01	1	CMC7
02	2	Undefined
03	3	Undefined

Bits 0 and 1: Identified character fonts. When bit 5 is 1 (abnormal end), either bit 0 or 1 has no meaning.

Bit 4: Under the following conditions, the printer sets bit 4=1 (rereading not possible)

①When bit 5=1 (abnormal end). (except for the case that “?”s are three or less)
②If the MICR status is “ Not Selected”.
③When rereading possible number reaches the maximum (maximum is one time).

Bit 5: Under the following conditions, the printer sets bit 5=1 (abnormal end).

① If the personal check waiting is canceled.
② If the waiting time (*t1*) set by **ESC f** elapses during the personal check waiting.
③ When character waveforms are not detected.
④ If character waveforms detected during reading are not identified as the specified character font.
⑤ When (bit5 of *n* is 0), the terminal symbol is not detected.
⑥ If between the start of processing this command and the start of transmitting the header, an error occurs.

The identified characters consist of the following:

① E13B

MICR	Character	Hex	Decimal	MICR	Character	Hex	Decimal
	NULL	0 0	0		0	3 0	4 8
	SP	2 0	3 2		1	3 1	4 9
	?	3 F	6 3		2	3 2	5 0
					3	3 3	5 1
	T	5 4	8 4		4	3 4	5 2
	A	4 1	6 5		5	3 5	5 3
	O	4 F	7 9		6	3 6	5 4
	D	4 4	6 8		7	3 7	5 5
					8	3 8	5 6
					9	3 9	5 7

② CMC7

MICR	Character	Hex	Decimal	MICR	Character	Hex	Decimal
	NULL	0 0	0		0	3 0	4 8
	SP	2 0	3 2		1	3 1	4 9
	?	3 F	6 3		2	3 2	5 0
					3	3 3	5 1
	/	2 F	4 7		4	3 4	5 2
	#	2 3	3 5		5	3 5	5 3
	=	3 D	6 1		6	3 6	5 4
	>	3 E	6 2		7	3 7	5 5
	^	5 E	9 4		8	3 8	5 6
					9	3 9	5 7

MICR	Character	Hex	Decimal	MICR	Character	Hex	Decimal
	A	4 1	6 5		N	4 E	7 8
	B	4 2	6 6		O	4 F	7 9
	C	4 3	6 7		P	5 0	8 0
	D	4 4	6 8		Q	5 1	8 1
	E	4 5	6 9		R	5 2	8 2
	F	4 6	7 0		S	5 3	8 3
	G	4 7	7 1		T	5 4	8 4
	H	4 8	7 2		U	5 5	8 5
	I	4 9	7 3		V	5 6	8 6
	J	4 A	7 4		W	5 7	8 7
	K	4 B	7 5		X	5 8	8 8
	L	4 C	7 6		Y	5 9	8 9
	M	4 D	7 7		Z	5 A	9 0

[Reference] **DLE EOT BS, DLE ENQ, ESC c 0, ESC f, FS a 1, FS a 2, GS ENQ**
Appendix B: *Transmit Status Identification*

FS a 1

[Name] Load check paper to print starting position

[Format] <1C>H<61>H<31>H

[Description] Loads check paper to the print starting position.

[Notes] Since this command is executed after being buffered in the receive buffer, there may be a time lag between receiving this command and starting MICR reading.

This command is ignored unless MICR function is selected.

After loading check paper to the print starting position, the printer cancels MICR function and selects slip paper automatically.

[Reference] **FS a 0**

FS a 2

[Name]	Eject check paper
[Format]	<1C>H<61>H<32>H
[Description]	Ejects check paper.
[Notes]	Since this command is executed after being buffered in the receive buffer, there may be a time lag between command reception and starting paper ejection. This command is ignored unless MICR function is selected. After ejecting check paper, the printer cancels MICR function and selects the default paper for **ESC c 0** automatically.
[Reference]	**ESC c 0, FS a 0**

FS b

[Name] Request retransmission of check paper reading result

[Format] <1C>H<62>H

[Description] Retransmits the previous check paper (MICR character) reading results.

[Notes] This command is executed after being buffered in the receive buffer. Therefore, there may be a time lag between sending this command and starting MICR reading.

When the previous MICR reading results are correct, the printer transmits header + reading status + identified character strings + NULL to the host computer. If it is abnormal, or when **FS a 0** is not executed, the printer transmits header + reading status + NULL to the host.

When DTR/DSR control is selected, the printer transmits data consecutively after confirming whether the host computer is ready to receive data. When the host is not ready to receive data, the printer waits until the host is ready.

When XON/XOFF control is selected, the printer transmits all data consecutively without confirming whether the host computer is ready to receive data. The data transmission must be consecutive, except for the XOFF code.

The printer transmits all data collectively without confirming whether the host computer is ready to receive data after transmitting header. To receive identification result correctly, 67 bytes or more space is required in the receive buffer.

Refer to the **FS a 0** command description for header, reading status, and identified character strings.

During identification result transmission, the printer ignores **DLE EOT *n***, **DLE EOT BS *n***, and **GS ENQ**. Also, the printer does not transmit ASB during reading and identification result transmission. Therefore, the user cannot confirm changes in the printer status during these periods.

It is possible to differentiate the reading results of MICR, ASB, and real-time status. Refer to Appendix B for data identifying method.

[Reference] **DLE EOT BS, DLE EOT, FS a 0, GS ENQ**, APPENDIX B

FS c

[Name] MICR mechanism cleaning

[Format] <1C>H<63>H

[Description] Cleans the MICR mechanism.

[Notes] This command is available only when input at the beginning of the line.

This command is executed after being buffered in the receive buffer. Therefore, there may be a time lag between sending this command and starting head cleaning.

When this command is executed, the printer enters the cleaning sheet wait status.

When this command is executed with slip paper selected, the printer ejects the slip paper and waits for the cleaning sheet to be loaded.

The cleaning sheet waiting time is *t1* × 1 minutes, based on the **ESC f *t1 t2*** setting. The printer starts operation *t2* × 0.1 seconds after detecting a cleaning sheet.

The printer waits for the cleaning sheet until a cleaning sheet is inserted, the cleaning sheet waiting status is canceled, the waiting time is over, or the power is turned off.

During the cleaning sheet waiting period, the printer processes only real-time commands.

The printer starts MICR mechanism cleaning when the cleaning sheet is loaded.

After cleaning the MICR mechanism, the printer ejects the sheet and automatically selects the default paper type for **ESC c 0**.

[Reference] **ESC c 0, ESC f**

APPENDIX A: MISCELLANEOUS NOTES

1) Print duty

When printing exceeds the allowable print duty cycle, the printer automatically senses the status and controls printing. In this case, the printing speed may slow temporarily. When print duty is lowered to normal, the printing speed also returns to normal.

If printing stops due to excessive print duty, the ERROR LED indicator blinks as shown in Table 3.8.1.

2) Power supply

The printer works correctly when power supply voltage is within the range of 24 V ± 10% (21.6 V - 26.4 V). If the power supply voltage goes outside the range of 24 V ± 10% during printing of one line, the printer stops printing. The printer restarts printing after the voltage returns to normal. In this case, the printing speed may be lowered, and the printing pitch may become incorrect. If the power supply voltage goes outside the range of 24 V ± 10% and it continues for one second or more, it is considered a high or low voltage error and printing is not performed.

When a high or low voltage error occurs, the ERROR LED indicator blinks, in the blinking pattern in Table 3.8.3.

When a high or low voltage error occurs, turn the power supply off as soon as possible.

3) Others

Because this printer uses plated steel, the cutting edges may be subject to rust.

APPENDIX B: TRANSMIT STATUS IDENTIFICATION

Because the specified status bits transmitted from the TM-U950/U950P are fixed, the user can confirm the command to which the status belongs, as shown in the following table:

Command & Function	Status Reply
ESC u	<0**0****>B
ESC v	<0**0****>B
GS I	<0**0****>B
GS r	<0**0****>B
XON	<00010001>B
XOFF	<00010011>B
DLE EOT 1 to **5**	<0**1**10>B
ASB (1st byte)	<0**1**00>B
ASB (2nd to 4th bytes)	<0**0****>B
GS ENQ	<1*******>B

(When the printer is used with the MICR reader)

Command & Function	Status Reply
FS a 0, **FS b** (header)	<01011111>B
DLE EOT BS 1	<0**1**10>B

When the printer receives header (<5F>H) transmitted when **FS a 0** or **FS b** is executed, status identifiication must not be perfomed until NUL (<00>H) is recieved.

APPENDIX C: 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 254 or 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
254	Space page	5600H	5F00H
255	Space page	6B00H	7400H

2) Calculating the character data top address

The character data top address is calculated as follows:

7 × 9 font (graphics)

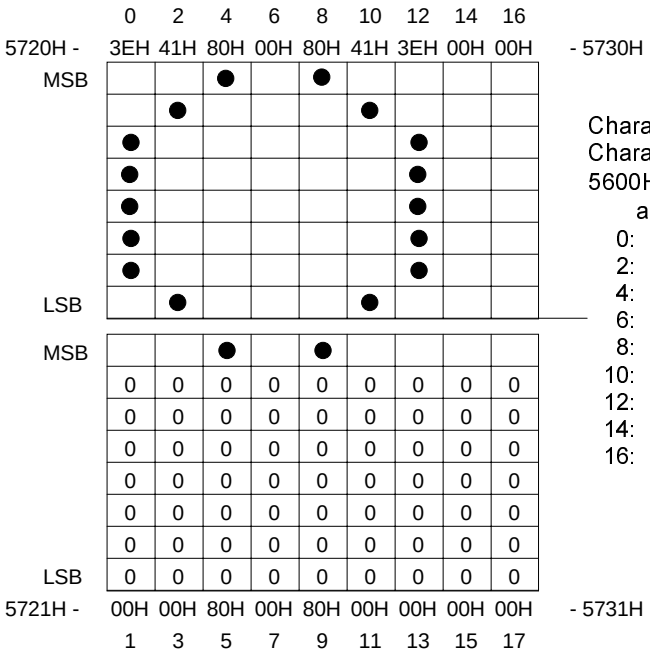
Character data top address = Space page top address + (character code - 80H) × 18

9 × 9 font (graphics)

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

3) Example configuring the font data

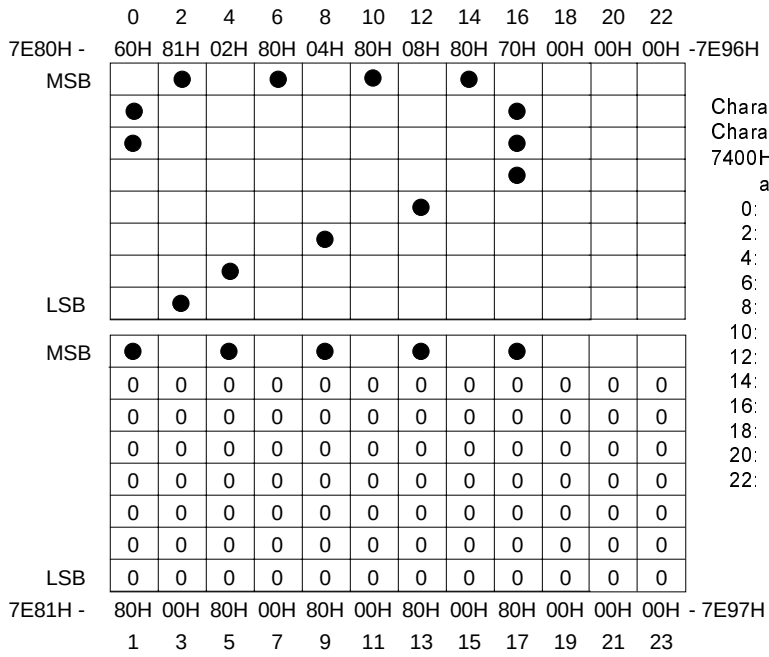
7 × 9 font (in case of character code 90H on page 254)



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

address	data	address	data
0:	5720H 3EH	1:	5721H 00H
2:	5722H 41H	3:	5723H 00H
4:	5724H 80H	5:	5725H 80H
6:	5726H 00H	7:	5727H 00H
8:	5728H 80H	9:	5729H 80H
10:	572AH 41H	11:	572BH 00H
12:	572CH 3EH	13:	572DH 00H
14:	572EH 00H	15:	572FH 00H
16:	F730H 00H	17:	5731H 00H

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

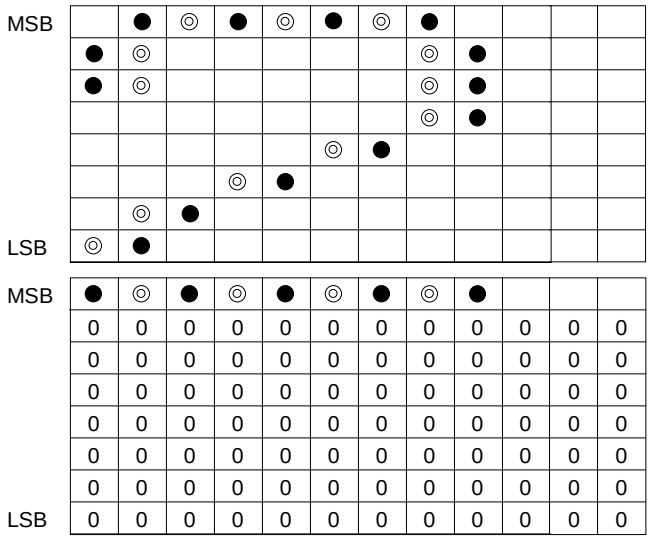


Character code F0H
Character data top address
7400H + (F0H-80H) × 24 = 7E80H

address	data	address	data
0:	7E80H 60H	1:	7E81H 80H
2:	7E82H 81H	3:	7E83H 00H
4:	7E84H 02H	5:	7E85H 80H
6:	7E86H 80H	7:	7E87H 00H
8:	7E88H 04H	9:	7E89H 80H
10:	7E8AH 80H	11:	7E8BH 00H
12:	7E8CH 08H	13:	7E8DH 80H
14:	7E8EH 80H	15:	7E8FH 00H
16:	7E90H 70H	17:	7E91H 80H
18:	7E92H 00H	19:	7E93H 00H
20:	7E94H 00H	21:	7E95H 00H
22:	7E96H 00H	22:	7E97H 00H

4) Notes

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

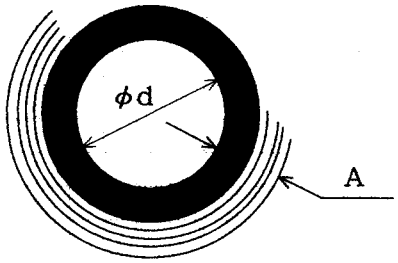


The pattern shown above, in which ◎ and ● adjoin horizontally, is prohibited.

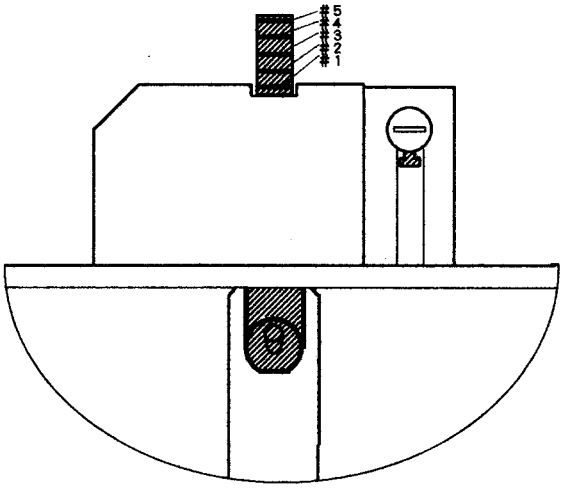
APPENDIX D: ADJUSTING THE PAPER ROLL NEAR-END SENSOR LOCATION

The remaining detectable amount of paper on the paper roll varies with the inside and outside diameters of the paper core . The minimum detectable amount of paper on the paper roll can be set using the following method:

1) The inside diameter (∅d) of the paper spool should be 10mm (.394") or more.
2) Set the paper roll diameter A to obtain the corresponding adjustment position from the table below.



A	Adjustment position
Approx. 10mm (.39”)	#1
Approx. 8mm (.32”)	#2
Approx. 6mm (.24”)	#3
Approx. 4mm (.16”)	#4
Approx. 2mm (.08”)	#5



NOTES:
1. Since diameter A corresponding to the adjustment position in the table is calculated values, there may be some variations depending on the printer.
2. If a paper roll with a red end mark at the paper end is used, the mark may cause the paper to pull up. If this occurs, diameter A differs from the values in the table.
3. Be sure that the adjustable slider operates smoothly after finishing the adjustment.
4. If the paper on the paper roll becomes loose due to the paper quality, the paper roll near-end sensor may operate incorrectly.

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 on the manufacturer and the part number, make sure that the specifications of the drawer to be used meet the following conditions before connecting it to the drawer kick-out connector. These conditions also apply to any other devices that use the drawer kick-out connector.

Any devices that do not satisfy all the following conditions must not be used.

[Conditions]

A load must be provided between drawer kick-out connector pins 4 and 2 or between pins 4 and 5. (*1)

When the drawer open/close signal is used, a switch must be provided between drawer kick-out connector pins 3 and 6. (*2)

The resistance of the load must be 24 Ω or more, or the input current must be 1 A or less. (*3)

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. (*4)

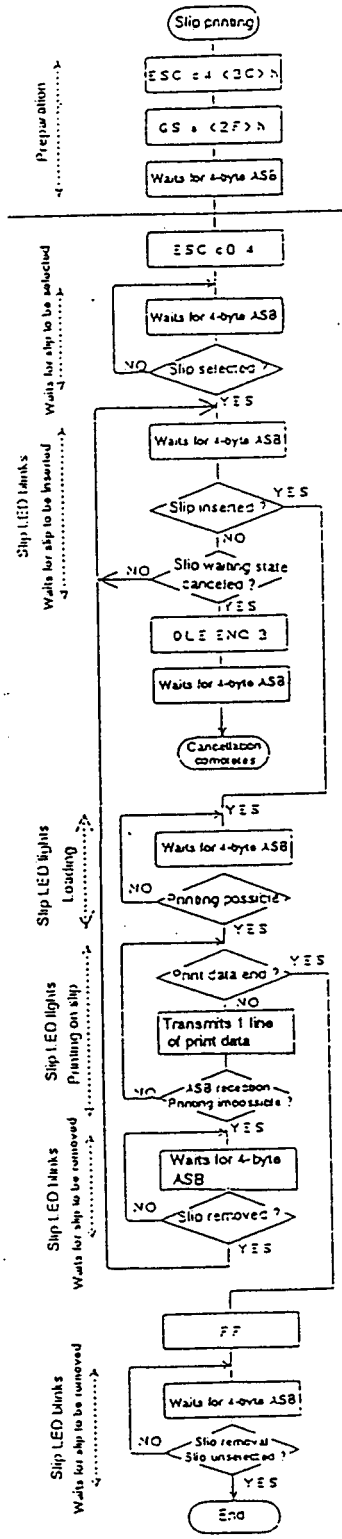
NOTES: (*1) Operating the printer with incorrectly installed devices voids the warranty.

(*2) Connecting devices other than the drawer open/close switch voids the warranty.

(*3) 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 device.

(*4) Connecting power supply other than that specified voids the warranty.

APPENDIX F: EXAMPLE PRINT CONTROL FOR SLIP PAPER



1) Enables printing stop due to slip paper-end

2) Enables ASB for all printer status changes

3) Receives ASB mentioned in 2) above.

4) Selects slip printing.

5) Waits for slip to be selected.
ASB: Waits for ASB4-0 (slip detector) to become 0 (paper present).
*: Bit 0 of the ASB 4th byte (the same rule applies correspondingly to the following)

6) Waits for slip to be inserted.
ASB: Waits for ASB3-5 (slip insertion detection) to become 0 (paper present).

7) If the user cancels the slip waiting state, transmit DLE ENQ 3.
If canceled, the printer switches to 2-sheet mode and transmits 4-byte ASB.
ASB: Waits for ASB4-0 (paper selected) to become 1 (unselected).

8) Waits for the slip to be loaded.
ASB: Waits for ASB4-1 (paper status) to become 0 (possible to print)

9) Transmits one line of data sat until there is no data to be transmitted.
In this case, ASB is transmitted when paper has run out.
ASB: ASB4-1 (slip status) becomes 1 (impossible to print).
After printing is finished, go to step 11).

10) Waits for the slip to be removed.
ASB: Waits for ASB3-5 (slip ejection detector) to become 1 (no paper)

11) Ejects the slip

12) Waits for the slip to be removed.
ASB: ASB3-5 (slip ejection detector) becomes 1 (no paper)
Waits for ASB4-0 (slip selected) to become 1 (unselected).

This page is intentionally deleted.

APPENDIX H: DIFFERENCES BETWEEN THE TM-950 AND THE TM-U950

1) Changes in commands from the TM-950 to the TM-U950 which affect the printing are as follows:

Table H.1

Item	TM-950	TM-U950
1. Processing of commands that function only when received at the beginning of a line.	Ignored except at the beginning of a line (including parameters).	Invalid except at the beginning of a line (parameters are processed as printable data).
	Applicable commands: **ESC z**, **ESC {**, **GS E** TM-950: Commands (other than those above) that are functional only at the beginning of a line do not affect printing, because their parameters are not character codes.	
2. **GS I**	Model ID = 01H Type ID = 02H	Model ID = 09H Type ID = 02H or 06H

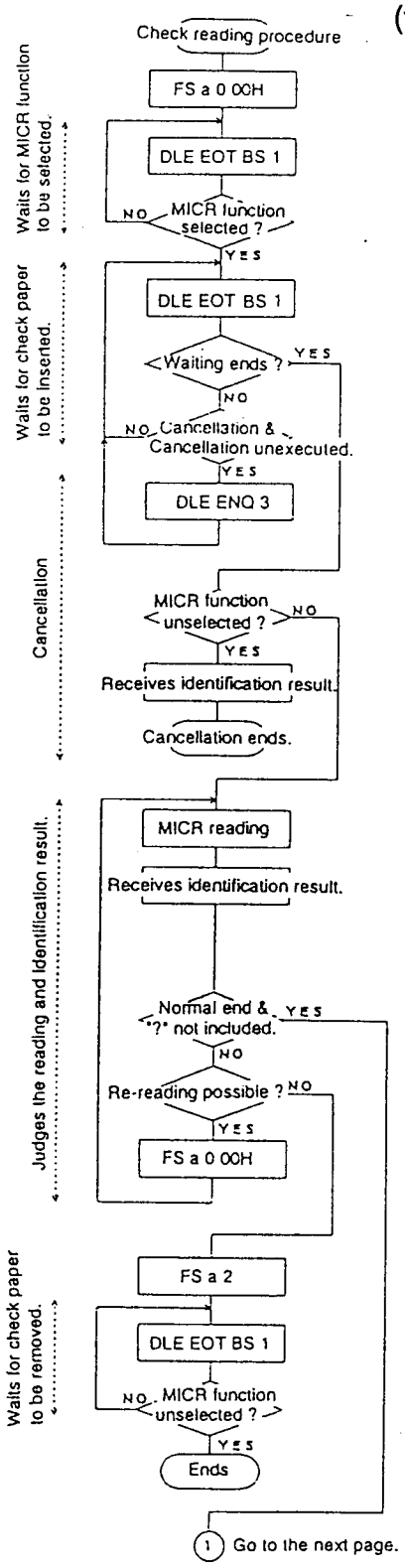
2) Changes in space pages (pages 254 and 255) from the TM-950 to the TM-U950 are as follows:

Table H.2

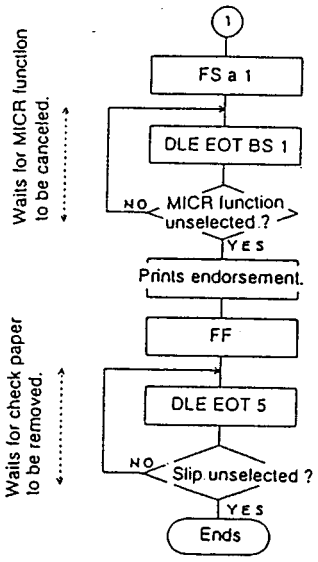
Item	TM-950	TM-U950
Space page	Character codes 80H to FFH are all spaces.	When 7 × 9 font is selected: Characters can be printed. When 9 × 9 font is selected: Character codes are all spaces.

APPENDIX I: EXAMPLE READ CONTROL FOR MICR CHARACTERS

(when the printer is used with the optional MICR reader)



1) Selects MICR function.
2) Waits for MICR function to be selected.
   Waits for bit 2 becomes 0.
3) Waits for check paper to be loaded.
   Waits for bit 3 becomes 0.
4) To cancel the check waiting state, transmit **DLE ENQ 3**.
5) Confirms the MICR function status (bit 2).
   If bit 2 is 0, MICR function is not canceled. Go to item 7).
6) Receives the identification result (header + reading status + NULL) when MICR function is canceled.
   Ends cancellation and goes to two sheet mode.
7) Receives the identification result.
   When reading ends normally: transmits header + reading status + identified character strings + NULL.
   When reading ends abnormally: transmits header + reading status + NULL. *
8) Judges the identification result.
   When the reading ends normally (bit 5 is 0) and the identified character strings does not include "?". Go to item 13).
9) Judges whether the re-reading is possible.
   When re-reading is possible (bit 4 is 0), executes re-reading by using **FS a 0**. Go to item 7).
10) Check paper is disabled.
    Ejects check paper by using **FS a 2**.
    If reading ends abnormally (bit 5 is 1), **FS a 2** is ignored.
11) Waits for the check paper to be removed.
    Waits for MICR function to be canceled (bit 2 is 1).
    Ends check reading procedure and goes to two sheet mode.



12) Loads check paper.
13) Waits for loading to end.
    Waits for MICR function to be canceled (bit 2 becomes 1).
14) Prints endorsement.
15) Ejects check paper.
16) Waits for the check paper to be removed.
    Ends check reading procedure and goes to two sheet mode.

FS a 0 00H Cancellation & Cancellation unexecuted.
DLE ENQ 3 MICR function unselected ? Receives identification result.
MICR function unselected ? MICR function unselected ?
Slip unselected ?
Judges the reading and identification result.

APPENDIX J: Bidirectional Parallel Interface

J.1 Description

The printer interface configured to the parallel interface specifications conforms to the IEEE-1284 Level-1 Devices and it works with those communication modes described in G.1.1 below.

J.1.1 Parallel Interface Communcation Modes

The parallel interface available with this product offers three communication modes as listed below.

When the power is applied to the printer or the printer is reset, the initialization mode is Compatibility Mode.

- Compatibility Mode

  This mode allows byte-by-byte data transmissions from the host to the printer. The normal data acception is proceeded in this mode. All the other modes are accessible through the Compatibility Mode.

- Nibble Mode

  This mode allows data transmission from the printer to the host in units of four bits. Data transmissions from the printer are made via the status signal lines. To transmit one byte data in this mode, four bits data is transmitted twice in succession.

- Byte Mode

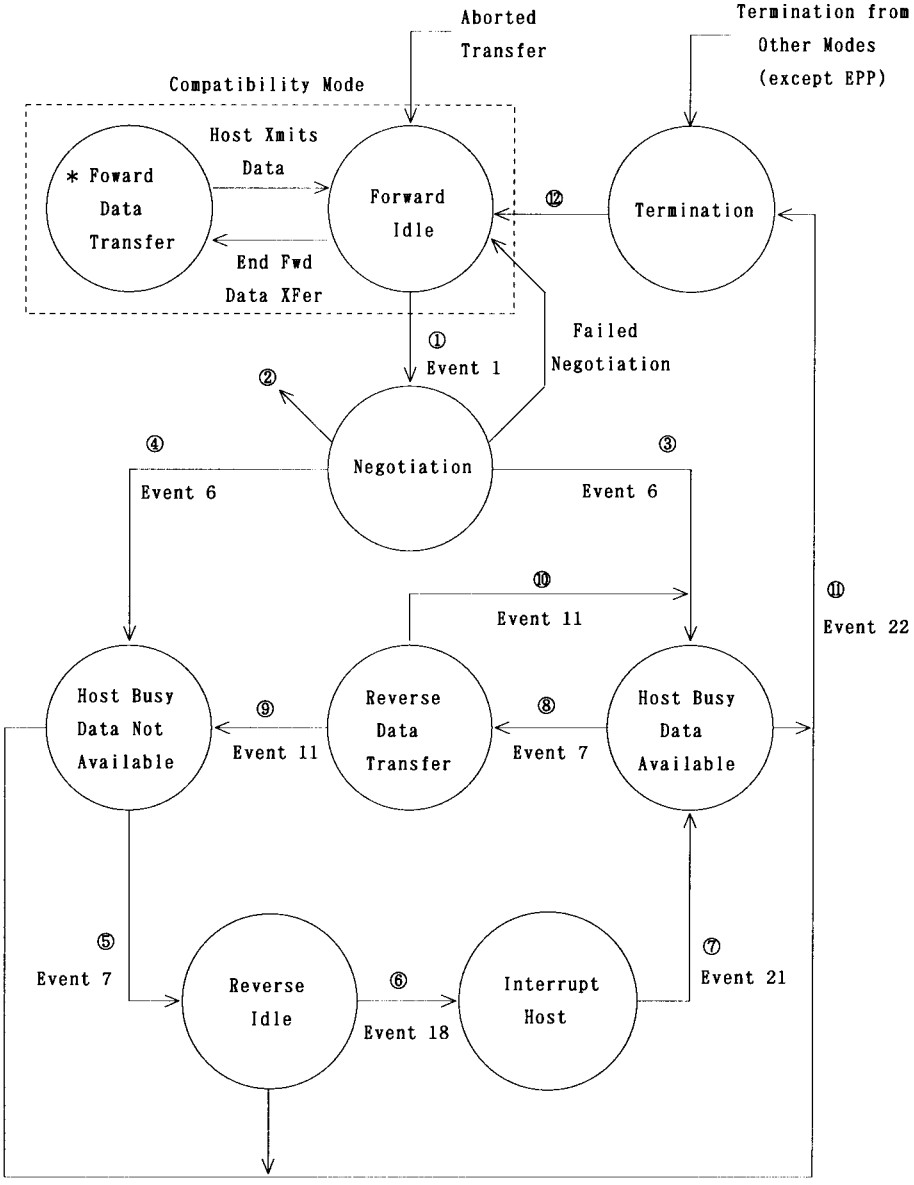
  This mode allows data transmission from the priter to the host in units of byte. Data transmissions from the printer are made via the eight bits data signal lines. To enable the Byte Mode, the host must be capable of switching the direction of signals for the eight bits data signal lines.

The communication direction from the host to the printer is referred to as Forward Mode, while the communication direction from the printer to the host is called Reverse Mode.

J.1.2 Interface Operation Phases

Interface operation is divided into a number of interface phases. Each communication mode consists of one or more phases. Additional phases are defined to cover initialization and transitions between communication modes. The names and interpretations of the interface signals may vary between phases.

Figure J.1.2.1 Interface phase transitions



1) Host Requests Reverse Transfer.
2) Successful Negotiation to Another mode.
3) Peripheral Has Data To Send. nDataAvail = Low
4) Peripheral Has No Data To Send. nDataAvail = High
5) Host Goes To Idle. HostBusy = Low
6) Peripheral Has New Data.
7) Peripheral Has Data Send.
8) Host Requests Data Byte.
9) Host Receives Data Byte.
   Peripheral Has No More Data To Send. nDataAvail = High
10) Host receives Data Byte.
    Peripheral Has More Data. nDataAvail = Low
11) Host requests termination.
12) Interface Returns To The Compatible Mode.

*In states other than in the process of data acception, the interface is set in the Forward Idle phase.

J.1.2.1 Phases in Compatibility Mode

- Compatibility Mode Forward Data Transfer phase:

  This phase allows the printer to accept data from the host. The host and the printer perform handshaking in response to the signals, nStrobe, nAck and Busy. The host shall not initiate any negotiation phase to a new operating mode until the interface successfully returns to the Compatibility Mode Forward Idle phase.

- Compatibility Mode Forward Idle phase:

  The interface is in Compatibility Mode, with no data transfer in progress. The host is allowed to initiate a data transfer in Compatibility Mode, or initiate negotiation phase to a new operating mode.

J.1.2.2 Phases in Nibble Mode and Byte Mode

- Reverse Data Transfer phase:

  Data transfer from the printer to the host.

- Reverse Host Busy Data Available phase:

  The printer has data to transmit to the host.

- Reverse Host Busy Data Not Available phase:

  The printer has no more data to transmit.

- Reverse Idle phase: No data transfer is in progress and the host is waiting for the printer data. When any printer data is available, the printer will cause the interface to go to the Reverse Interrupt phase.

- Reverse Interrupt phase:

  This phase makes the printer report to the host that it has got data to transfer in the Reverse Idle phase. While in this phase, the host may cause the interface to go to the Termination phase.

J.1.2.3 Other phases

Initialization phase:	This phase includes both power-on initialization and host-driven interface reset.
Negotiation phase:	Signal handshaking to change the signaling method from Compatibility Mode to Nibble, Byte or other such modes.
Power-on phase:	This phase includes power-on initialization for both devices.
Termination phase:	A host-initiated transition phase in which the interface is changed from Nibble, Byte or other such Mode to Compatibility Mode.

J.2. Interface Operation

J.2.1 Power-On

In this interface, the printer status after power-on sequence is available by checking Logic-HIGH.
In 500 ms after Logic-HIGH exceeds High level (3.0 V) following the power-on sequence, all signals become active.

J.2.2 Hardware Reset

The printer may be forcedly reset through the nInit signal. However, in either of the following conditions, the forced printer reset becomes inoperative and Low level pulses are ignored.
• When the 1284-active(Select-In) singal is High.

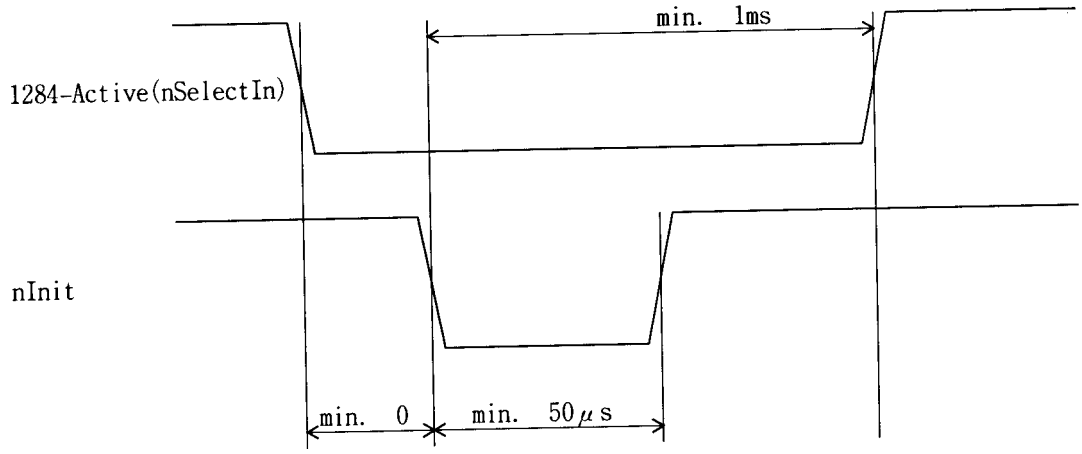


Figure J.2.2.1 nInit signal-driven hardware reset

J.2.3 Compatibility Mode

J.2.3.1 Description

The Compatibility Mode features compatibility with the Centronics interface popular among the existing PCs. This is the initialization mode of the interface following the power-on sequence and also the printer reset. Under normal condition, the printer receives data from the host in this mode.

Data transmissions are proceeded as follows.

- The host checks that the printer has been ready for data acception then sends data and the Strobe signal.
- Upon detection of Strobe signal from the host, the printer responds by setting Busy high to receive transmitted data.
- After completion of data reception, the printer sends the nAck LOW pulse signal and sets the Busy signal low.

J.2.3.2 Handshaking

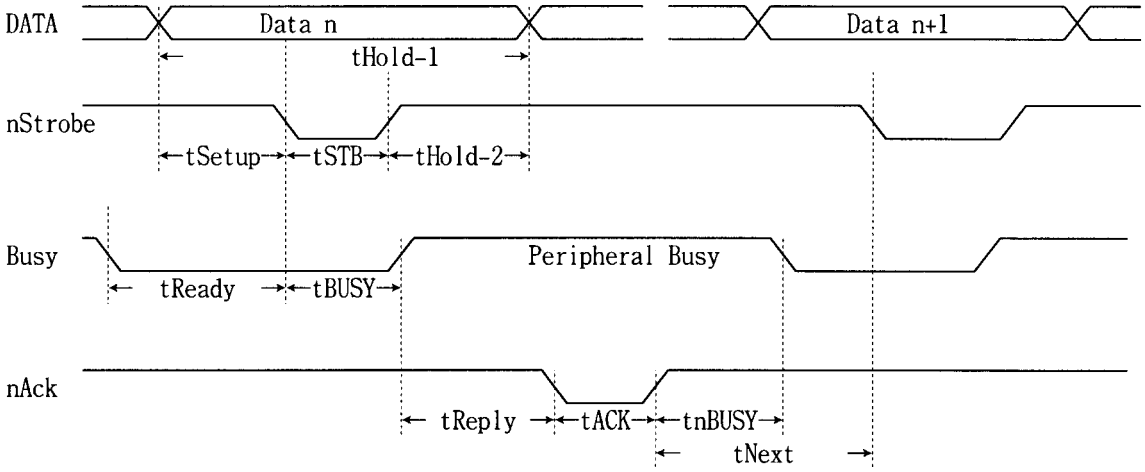


Figure J.2.3.1 Compatibility Mode handshake

Table J.2.3.1 Compatibility Mode handshake timing values

Parameter	Symbol	Request for printer Specifications on the printer		Request for host Specifications on the host	
		Minimum	Maximum	Minimum	Maximum
Data hold time (host)	tHold-1	—	500	—	—
Data hold time (printer)	tHold-2	—	—	750	—
Data setup time	tSetup	—	500	750	—
STROBE pulse width	tSTB	—	500	750	500 s
READY cycle idle time	tReady	—	—	0	
BUSY output delay time	tBUSY	0	500	—	—
Data processing time	tReply	0		—	—
ACKNLG pulse width	tACK	500	10 s	—	—
BUSY release time	tnBUSY	0		—	—
ACK cycle idle time	tNext	—	0	0	—

* The printer latches data at a nStrobe ↓ timing.

J.2.4 Negotiation

J.2.4.1 Description

Normally the printer starts with Compatibility Mode in which it is Centronics interface compliant. In an attempt to transit to Nibble/Byte Mode, the printer proceeds with negotiation in response to the host request. Negotiation is proceeded as follows.

1) The host sets 1284-Active high to allow the interface to go to the Negotiation Phase.
2) The printer reports to the host whether or not it is ready to perform the host-requested mode.
3) The Negotiation Phase is terminated, changing to the communication phase.

J.2.4.2 Negotiation procedures

Negotiation is proceeded as follows.

1) In the 1284 Communication Mode, the default mode for the host and the printer is Compatibility Mode. The Compatibility Mode remains active until the host has successfully verified that it is connected to a 1284 Compatible Device.
2) To begin the negotiation, the host places the communication mode request bit on the data bus (event 0).
3) The host sets 1284-Active(nSelectIn) high and HostBusy(nAutoFd) low (event 1).4)The printer responds by setting PtrClk(nAck) low, nDataAvail(nFault) high, Xflag(Select) high, and AckDataReq(PError) high (event 2).
5) The host sets HostClk(nStrobe) low, allowing the printer to latch the communication request bit data (event 3).
6) The host sets HostClk(nStrobe) and HostBusy(nAutoFd) high (event 4).
7) When the printer has any data to transmit to the host, it sets AckDataReq(PError) low, and nDataAvail(nFault) low then Xflag(Select) to its appropriate value as listed below for the communication mode (event 5).

   Xflag: Low for Nibble Mode
   High for Byte Mode
8) The printer sets PtrClk(nAck) high, indicating that it is ready to accept the other status lines (event 6).
9) When the printer has any data to transmit to host, the host enters the HostBusy Data Available Phase, otherwise it enters the Termination Phase and returns to the Compatibility Mode.
10) When the printer has no data to transmit to the host, the host enters the HostBusy Data Not Available Phase, otherwise it enters the Termination Phase and returns to the Compatibility Mode.
11) If the printer fails to support the communication mode requested by the host, it responds by setting Xflag(Select) as follows.

    For request for Nibble Mode: High
    For request for Byte Mode: Low

J.2.4.3 Notes

1) The start of negotiation phase shall be defined with 1284-Active triggered.
2) The timing to start negotiation in the Compatibility Mode shall be in principle after nAck pulse has been developed following nStrobe.

   Upon detection of 1284-Active before or during the output of nAck after nStrobe , the interface enters the negotiation phase. In this case, when the termination is followed by the Compatibility Mode, nAck pulse is not developed.
3) Negotiation is available from Busy or Error state in the Compatibility Mode. In this case, the termination fails to lead to the original Busy or Error state but to the printer status after termination.
4) If the printer fails to support the communication mode requested by the host, the host shall enter the Termination phase then return to the Compatibility Mode. (Refer to G.2.4.2.)

Table J.2.4.1 1284 Communication Mode Request values-bit assignments

Bit	Definition	Valid		Xflag	Xflag
		Bit values	Hex Code	Values when supported	Valuus on the printer
7	Request Extensibility Link	10000000	80H	High	Low
6	Request EPP Mode	01000000	40H	High	Low
5	Request ECP Mode with RLE	00110000	30H	High	Low
4	Request ECP Mode	00010000	10H	High	Low
3	Reserve	00001000	08H	High	Low
2	Request Device ID; Return Data Using				
	Nibble Mode Rev Channel Transfer	00000100	04H	High	High
	Byte Mode Rev Channel Transfer	00000101	05H	High	High
	ECP Mode Transfer without RLE	00010100	14H	High	Low
	ECP Mode Transfer with RLE	00110100	34H	High	Low
1	Reserve	00000010	High	Low	
0	Byte Mode Reverse Channel Transfer	00000001	01H	High	High
non	Nibble Mode Reverse Channel Transfer	00000000	00H	Low	Low
	Illegal or Contradictory Request	Other than above cases	Other than above cases		Low

* The printer is designed to work with only Nibble/Byte and thus it responds with negative Xflag values for request for the other modes.

J.2.5 Printer to Host Transfer Modes

J.2.5.1 Nibble Mode

Data transmissions from the printer to the host is proceeded as follows. The steps beginning with 1) apply to the transition from the Negotiation phase to the Host Busy Data Available phase. To the transition from the Negotiation phase to the Host Busy Data Not Available phase, the steps shall start with 9).

1) After negotiating to the Nibble Mode, the host will set HostBusy(nAutoFd) low to indicate it is ready to accept data from the printer (event 7).
2) The printer responds by placing the lower four bits on the Reverse channel data lines then sets PtrClk(nAck) low (event 8, event 9).
3) The host latches data in the event 9 then sets HostBusy(nAutoFd) high signaling to the printer that it has received the data (event 10).
4) The printer sets PtrClk(nAck) high completing the first nibble handshake (event 11).
5) The steps 1) through 3) are repeated for the upper four bits transmission, followed by the steps follow.
6) The host sets HostBusy(nAutoFd) high (event 10) to receive data, after which the printer shall set the four status lines as follows (event 13).
   - PtrBusy(Busy): To its current forward channel value.
   - nDataAvail(nFault): Low if another byte is ready to be sent.
   - AckDataReq(PError): To the same value as nDataAvail(nFault).
   - Xflag(Select): To the current mode status or low.
7) The printer sets PtrClk(nAck) high (event 11).
8) Following the event 11, based on the signals set by the printer in the event 13, the host examines the status lines to determine if;

   Another printer to host byte is available,

   and The host to the printer data transmission is possible.
9) At the end of a byte transfer, two nibbles, the host is allowed three options as listed below when the printer has no more data to transmit to the host.
   1. To proceed with termination and return to Compatibility Mode,
   2. To remain in the Host Busy Data Not Available phase, or
   3. To set HostBusy(nAutoFd) low (event 7) then put the interface into the Rev. Idle phase.
10) When the printer has any additional data to transmit to the host, the host is provided with three options as listed below.
   1. To set HostBusy(nAutoFd) low, indicating that the host is ready to accept additional data,
   2. To remain in the Host Busy Data Available phase, or
   3. To proceed with termination and return to Compatibility Mode.
11) When the host sets HostBusy(nAutoFd) low in the Host Busy Data Available phase, the printer repeats the steps starting with 2).

12) Whenever the printer generates data for the host in the Reverse Idle phase, it sets PtrClk low to request an interrupt from the host (event 18).

13) Then, the printer sets PtrClk high (event 19).

14) The host responds to the interrupt requested by the printer by setting HostBusy(nAutoFd) high (event 20).

15) The printer then sets AckDataReq(PError) low to acknowledge the host s response, followed by the transition of the interface to the Host Busy Data Available phase (event 21).

J.2.5.2 Byte Mode

Data transmissions from the printer to the host are proceeded as described below. The steps starting with 1) apply to the transition to the Host Busy Data Available phase in the negotiation. To the transition to the Host Busy Data Not Available phase in the negotiation, the steps shall start from 9).

1) After negotiating to the Byte Mode, the host will place the data line in a high impedance state (event 14) then set HostBusy(nAutoFd) low (event 7) to indicate that it is ready to accept data from the printer.
2) The printer responds by placing the communication data on the data line (event 15).
3) The printer then sets PtrClk(nAck) low (event 9).
4) The host latches data in the event 9 then sets HostBusy(nAutoFd) high, indicating that it is processing the data(event 10).
5) At this point, the printer shall respond by setting the status line as follows (event 13).
   - PtrBusy(Busy): To its current forward channel value
   - nDataAvail(nFault): Low if another byte is ready to be sent
   - AckDataReq(PError): To the same value as nDataAvail(nFault)
   - Xflag(Select): To its value during the last negotiation or low
6) The printer then sets PtrClk(nAck) high, completing the byte handshake (event 11).
7) At this point, the host will pulse HostClk(nStrobe) low (event 16), then high (event 17), signaling that it has received the byte.
8) Note that the events 10 and 16 may occur simultaneously, and the events 7 and 17 may occur simultaneously (in such cases in which HostBusy and HostClk are set equivalent).
9) At the end of a byte transfer, the printer reports to the host whether or not it has additional data to transmit to the host. When the printer has no more data, the host is allowed three options as listed below.
   1. To proceed with termination and return to Compatibility Mode.
   2. To remain in the Host Busy Data Not Available phase.
   3. To set HostBusy(nAutoFd) low then put the interface into the Reverse Idle phase (event 7).

10) When the printer has any additional data, the host is provided with three options as listed below.

1. To set HostBusy(nAutoFd) low, indicating that the host is ready to accept additional data.
2. To remain in the Host Busy Data Available phase.
3. To proceed with termination and return to Compatibility Mode.

The procedures to start data transmissions from the Reverse Idle phase are same as in the Nibble Mode.

J.2.6 Device ID

Device ID is a string of characters to identify a device connected through the interface.

The printer will respond to the request by the host for the Device ID with the following Device ID.

<00>h<31>h
MFG: EPSON;
CMD: ESC/POS;
MDL: TM-P1.00;
CLS: PRINTER;

The first two bytes indicate the length of the entire Device ID including those two bytes.

For request of Device ID, refer to the section under “Negotiation. ”

The host is required to accept a complete string of Device ID having a length indicated by the first two bytes and it is not allowed to terminate the Device ID reception in progress until the entire Device ID is received. If the host terminates the Device ID transfer before all bytes have been transferred, the printer will discard the remainder of the Device ID string. Then, when the host requests Device ID again, the printer sends the ID from the beginning.

Once the host has received a complete string of Device ID having a length indicated by the first two bytes, it shall proceed with termination even if the printer has more data to transmit to the host (Data Available). If the host attempts to accept additional data without termination, the printer status will be sent. J.2.7

J.2.7 Termination

Termination refers to the processing to return to the Compatibility Mode from either Nibble or Byte Mode.

To terminate either the Nibble or Byte Mode, the host must take the following actions.

- To set 1284-Active(nSelectIn) low.
- To set HostBusy(nAutoFd) high (event 22).

Termination is available in two types.

① Handshake between the host and the printer

② Immediate termination

In the case of ①, on the condition that, in the process of transition from Reverse Mode to Compatibility Mode, the event 22 has been completed while the interface is active (with 1284-Active set high);

1) The printer responds to the 1284-Active by setting PtrBusy(Busy) and nDataAvail(nFault) high (event 23).
2) The printer will then reverse Xflag(Select) and set PtrClk(nAck) low (event 24).
3) The host then sets HostBusy(nAutoFd) low (event 25).
4) The printer then sets nDataAvail(nFault), Xflag(Select) and AckDataReq(PError) back to the status in the Compatibility Mode (event 26) and sets PtrClk(nAck) high (event 27).
5) The host completes the termination handshake by setting HostBusy(nAutoFd) high, returning the interface to the Compatibility Mode Idle phase (event 28).
6) The printer then changes PtrBusy(Busy) to be ready to accept data from the host.

In the case of ②, the printer proceeds to immediate termination whenever the interface becomes inactive (with 1284-Active set low) by omitting the event 22. In this termination, data integrity is not guaranteed and the printer will switch the data line from output to input in 1 s.

In the Reverse Idle phase, the printer is allowed to report to the host that it has any data to transmit to the host. This may occur in conjunction with termination because the host changes from the Idle phase to the Compatibility Mode.

The printer will start the Interrupt phase provided in the events 8 and 9 when it has data to transmit to the host. At this point, when 1284-Active(nSelectIn) becomes low before HostBusy(nAutoFd) changes from a high to a low state, the printer will judge that the host has entered the Termination phase and that it proceeds to the normal termination handshake.

J.2.8 Interface Operation Timing Chart

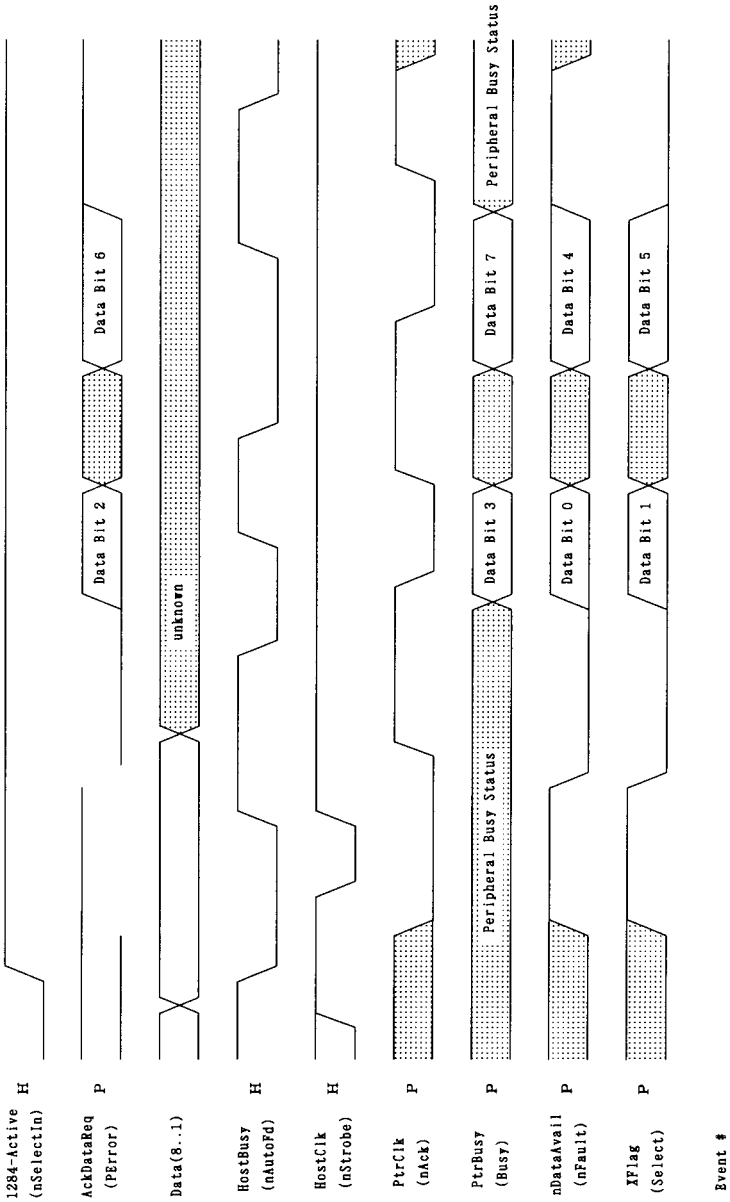


Figure J.2.8.1 Nibble Mode Negotiation and Transfer

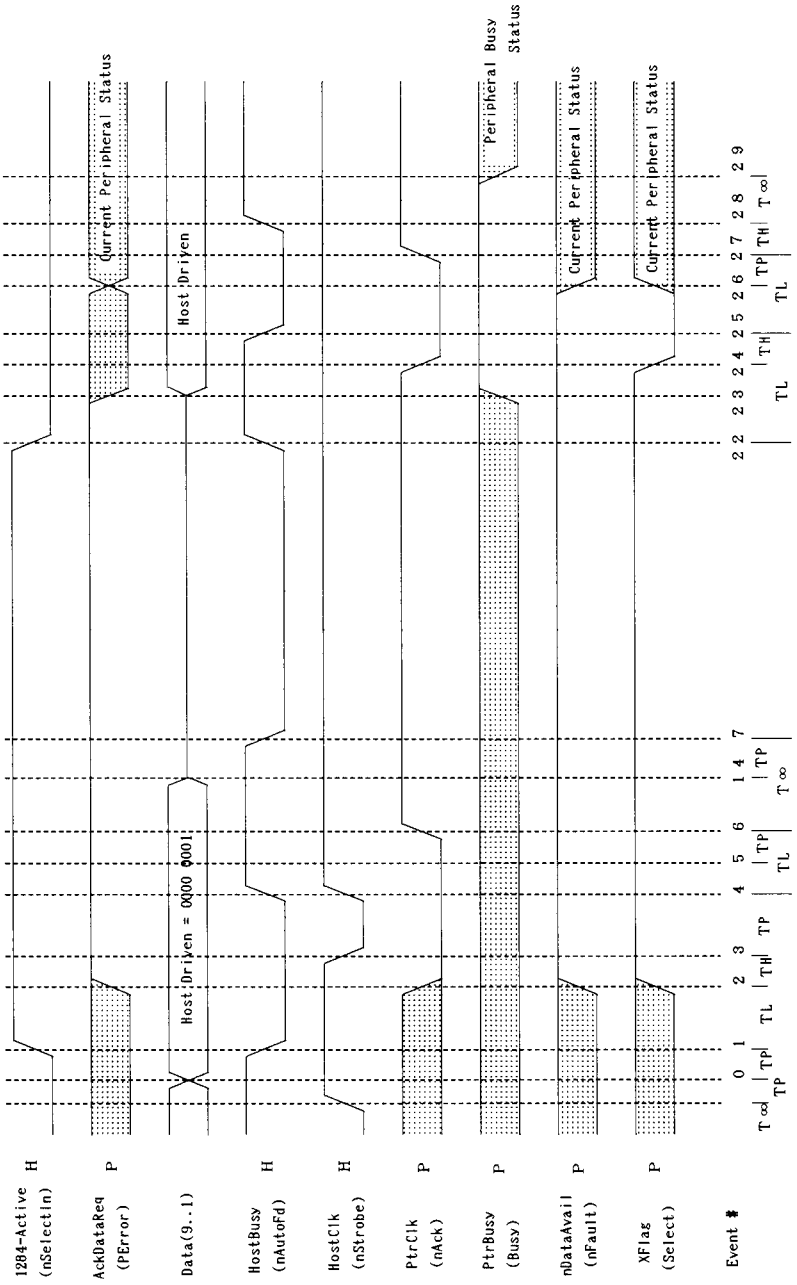


Figure J.2.8.2 Byte Mode Negotiation and Termination

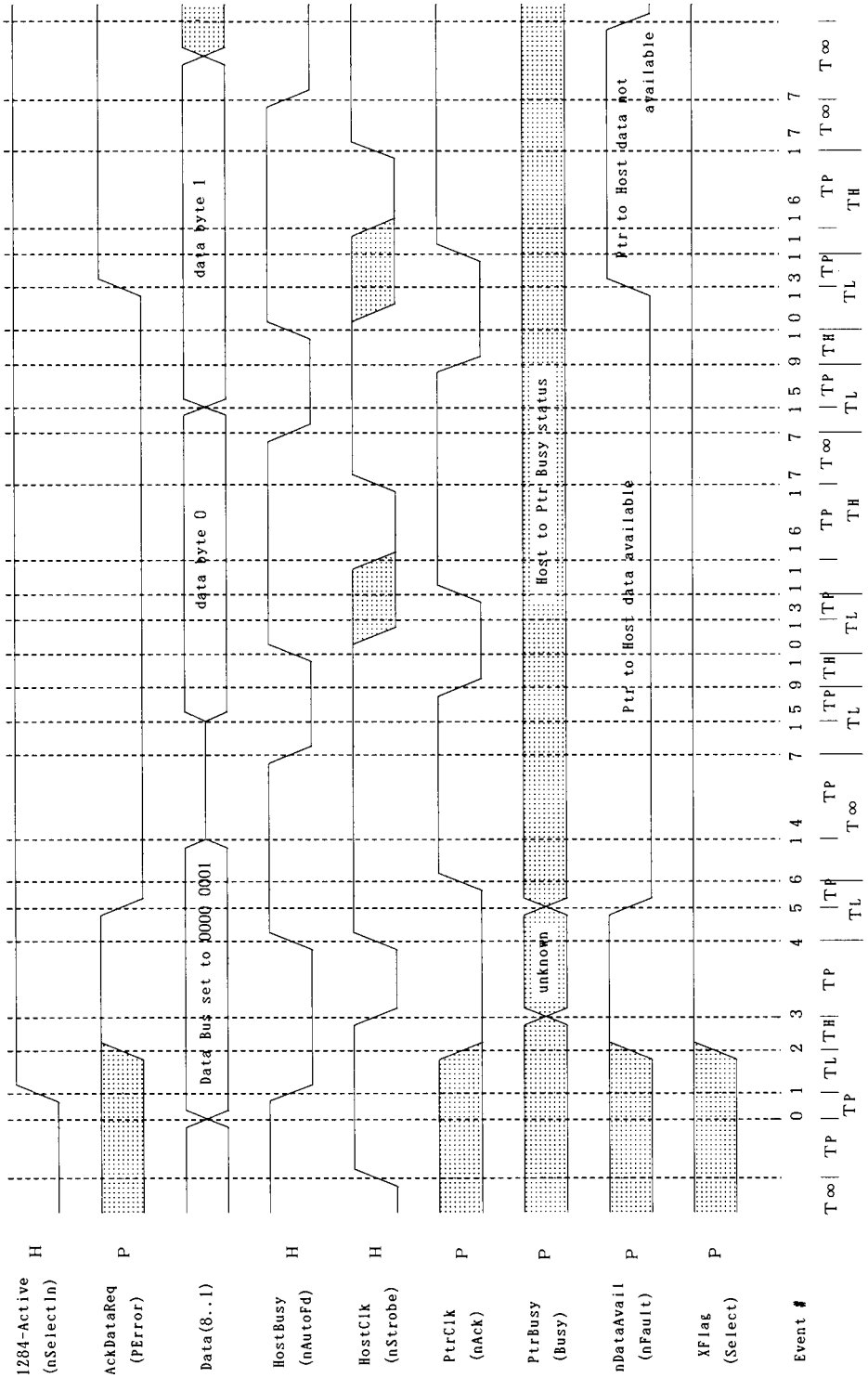


Figure J.2.8.3 Byte Mode Negotiation and Transfer

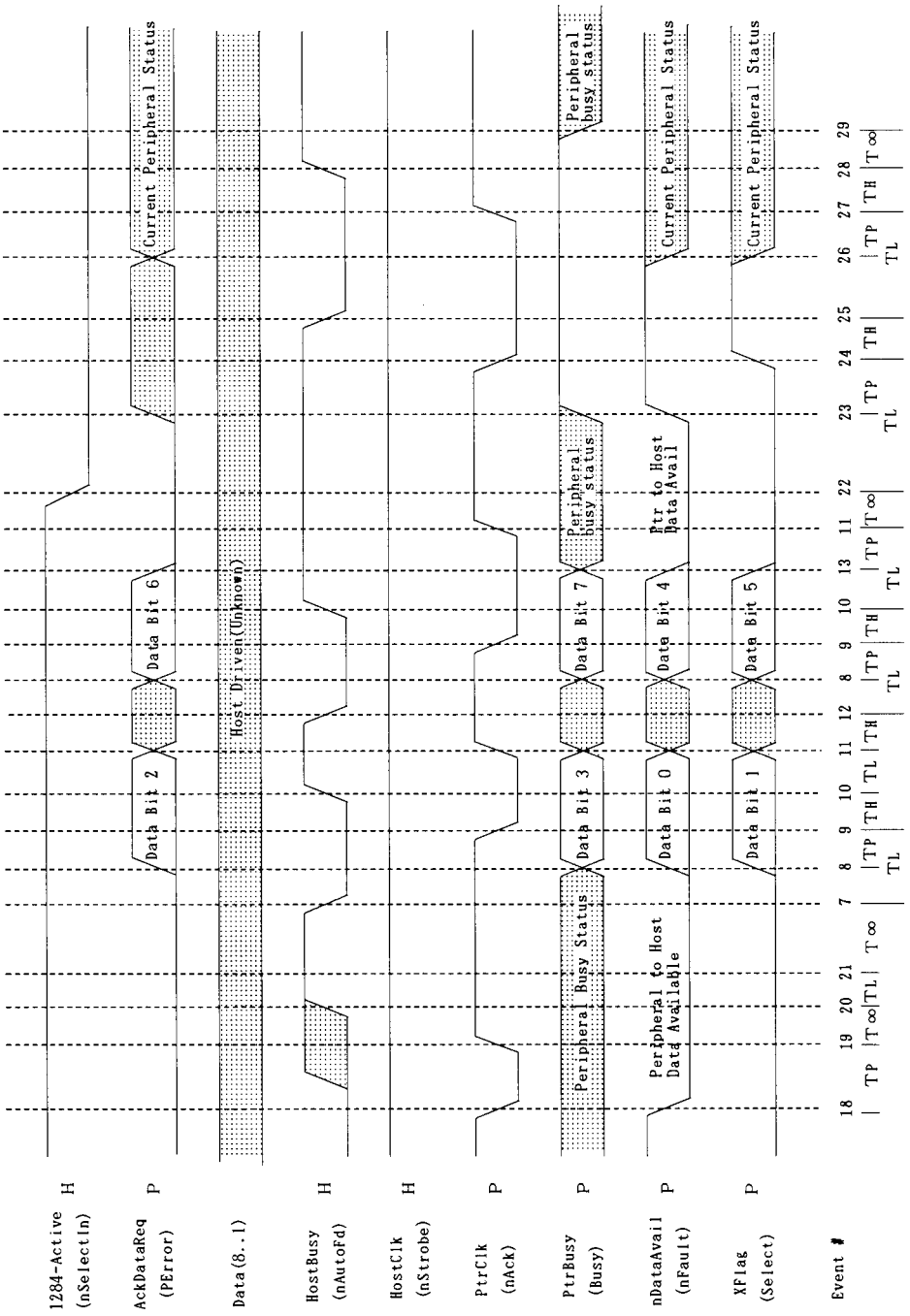


Figure J.2.8.4 Nibble Mode Transfer and Termination

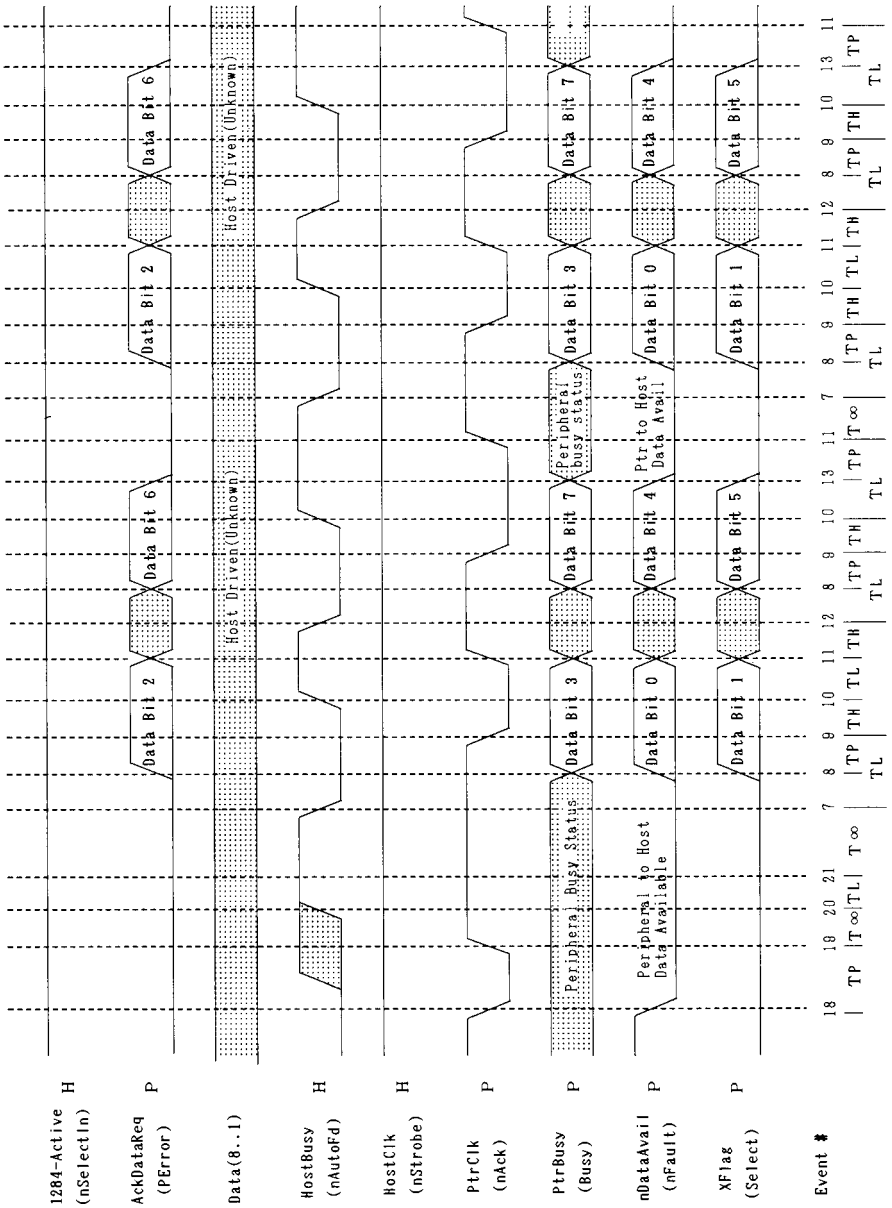


Figure J.2.8.5 Nibble Mode Interrupt and Transfer

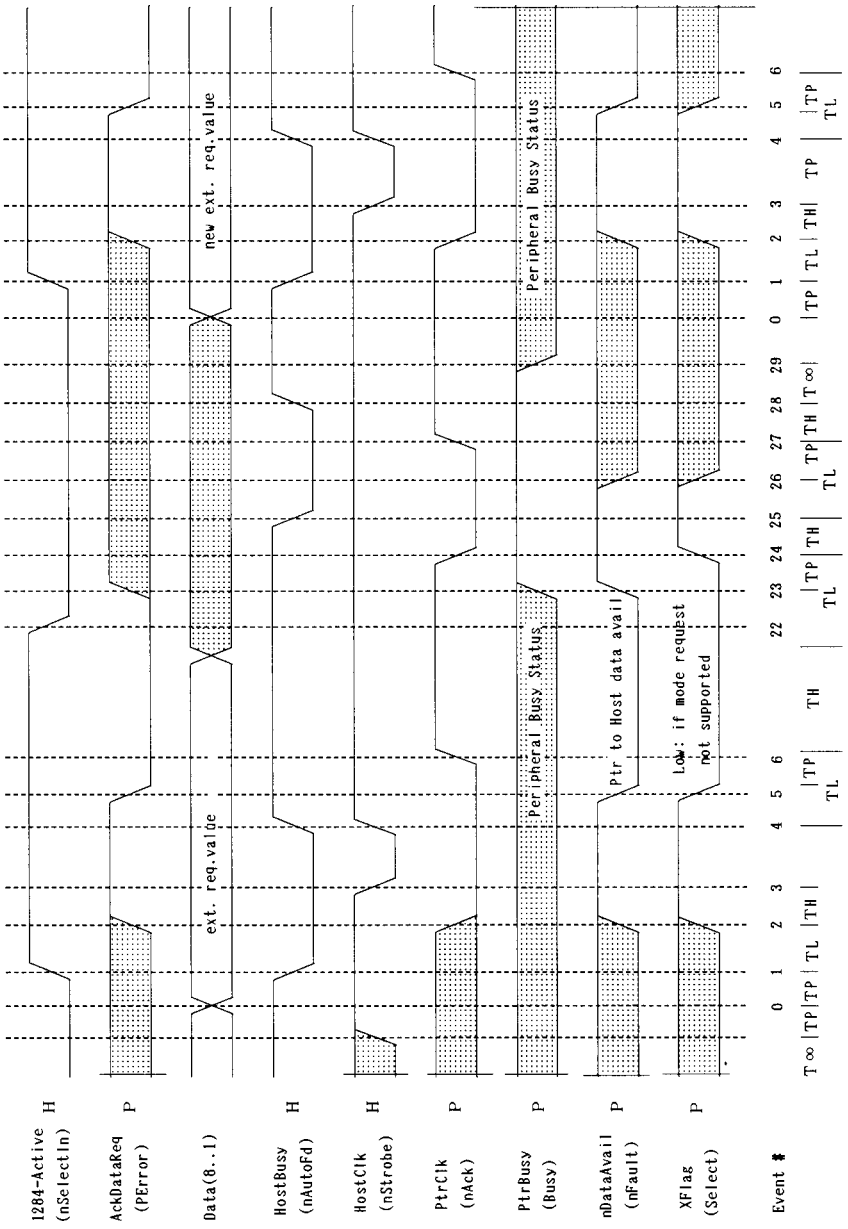


Figure J.2.8.6 Failed Negotiation