

OKI

OKIPOS 425S/D

(OKI Standard Version)

POS-PRINTER

Product Specifications
(Software edition)

2001-05-10 Rev.3

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1. OVERVIEW

This specification defines the following that are realized by the firmware, for the OKIPOS 425S/D (POS Printer) OKI Standard Version.

- OKIPOS 425S : OKI Single Standard Version
- OKIPOS 425D : OKI Dual Standard Version

<Conventions in this specification document>

This printer comes in two models, 1-Roll Model and 2-Roll Model. The 2-Roll Model printer has three roll paper modes, Receipt, Journal, and Receipt+Journal. The 1-Roll Mode printer has only the Roll paper mode.

In this specification document, if the 1-Roll Model is not specifically mentioned when the 1-Roll Model is involved, for "Receipt (mode)", read "Roll Paper (mode)", and ignore the descriptions for "Journal (mode)" or "Receipt+Journal (mode)".

<Definitions of Off-line>

This printer is not equipped with the On-line/Off-line switch. It becomes Off-line under the following conditions:

- (1) During the period from POW ON or initialization of the mechanism prompted by the reset from the interface, to the time communications become available.
- (2) During execution of local test.
- (3) When the cover is opened ("Cover Open Alarm" on the menu is set to "Yes")
- (4) During paper feed by the switch.
- (5) Printing has stopped due to Paper End.
(Paper End of Receipt, Journal, or Receipt+Journal selected by ESC c4.)
- (6) Recoverable Error has occurred.
(Except Head Thermal Alarm, SP Thermal Alarm or LF Thermal Alarm)
- (7) Unrecoverable Error has occurred.

At Off-line, an On-line/Off-line status that is sent by GS a n, ESC DLE a Pno n, GS ENQ, DLE EOT n, and ESC DLE r Pno n becomes off-line, and the I/F becomes Busy. In the case of (3) through (6), the I/F becomes Busy only if "Off-line Busy Control" on the menu is set to "Yes"

* Each I/F becomes Busy in the following manner.

- With the Parallel model (Centronics I/F), the Busy signal becomes High at Off-line.
- With the Serial model (RS232C I/F), the following Busy control is performed at Off-line.
If handshake is DTR/DSR, the DTR signal will change to MARK.
If handshake is XON/XOFF, DC3 will be sent.

2. OPERATOR CONTROL

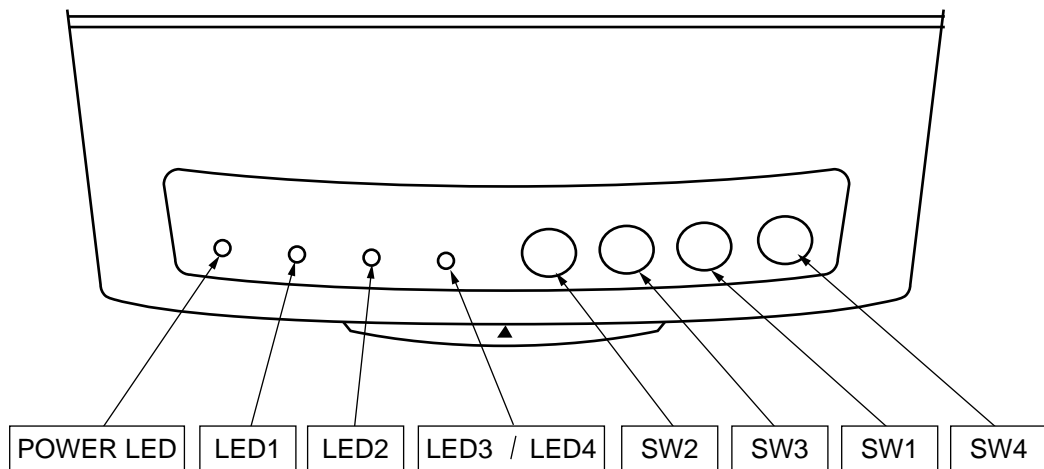
This specification document describes the details of the operator panel and the local functions that are realized by the firmware.

2.1 Operator Panel Functions

This chapter describes the operator panel functions.

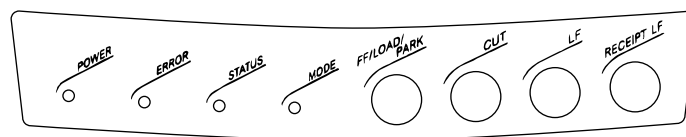
2.1.1 Operator Panel Specifications

(Operator Panel layout)



* The SW names in the above layout are tentative. They have been assigned to make their explanations easy.

<Panel sheet design>



(Switch functions)

No.	Switch	Function in Modes other than Tractor Mode	Function in Tractor Mode
1	SW2 (FF/LOAD/ PARK)	In Receipt mode: Line-feeds receipts for a fixed amount (10/6") In Receipt+Journal mode: Same as above. In Journal mode: Invalid. In Slip mode: Ejects when paper is already set. In Validation mode: Invalid * Does not cause printing to start.	Paper not loaded: Auto Load Paper already loaded: Auto Park * When No Paper is sensed by Slip Sensor, Auto Park is invalid.
2	SW3 (CUT)	Auto Cut (partial cut) Note 1) * Valid regardless of print sheet mode or print sheet status.	Cut position: Reverse-feeds to print position. Print position: Feeds to cut position. Paper not loaded: Above does not occur when pressed.
3	SW1 (LF)	In Slip mode: Line-feeds the slip already set by 1-line . In Receipt mode: Line-feeds a journal by 1 line. Note 2) In Validation mode: Invalid. In Journal mode: Line-feeds a journal by 1-line. In Receipt+Journal mode: Line-feeds a journal by 1-line. * None of the above cause printing to start.	Single Press: Feeds Sprocket paper by 1-line. Continuous Press: Form-feeds. * Line-feeds 1-line immediately after the SW is pressed. Form-feeds after the SW is held down continuously at least for 500ms. * Does not cause printing to start.
4	SW4 (RECEIPT LF)	Line-feeds a receipt by 1-line. * Valid regardless of the print sheet mode or print sheet status.	

Note 1) Invalid when "Auto Cutter Unit = No" is set in the menu.

In the 1-Roll Model, Auto Cut function is invalid since this model does not have the auto cutter unit.

Note 2) In the 1-Roll Model, a receipt is line-fed by 1-line.

* When panel SW is set to invalid by Panel SW enable/disable command (ESC c5), the SW is invalid.

* During the time between MICR read start and check paper eject, SW is invalid.

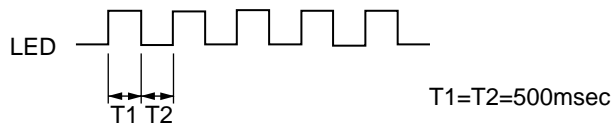
(LED display)

No.	LED		ON	OFF	BLINK	
1	POWER	Green	Powered on	Powered off	—	
2	LED1 (ERROR)	Red	Recoverable alarms <ul style="list-style-type: none"> • Slip Load/Eject Alarm • Auto loading Alarm • Auto parking Alarm • Media Does Not Match Alarm (1) • Media Does Not Match Alarm (2) • Cover Open Alarm Note 1) 	Normal state	<ul style="list-style-type: none"> • Fatal alarms (Alarm type is differentiated by the number of times the light blinks) * Refer to the table on next page. • SP thermal alarm (Blinks simultaneously with LED2.) • LF thermal alarm 	
3	LED2 (STATUS)	Orange	Paper not loaded (waiting for paper to be loaded) state	Paper loaded (ready for print) state	<ul style="list-style-type: none"> • Waiting for removal • SP thermal alarm (Blinks simultaneously with LED1.) 	
4	LED3/ LED4 (MODE)	Orange	Slip Mode	Tractor Mode	Validation mode * Fast blinking	MICR mode * Slow blinking
		Green	Receipt+Journal Mode Roll Paper Mode (1-Roll Model)		Receipt mode * Fast blinking	Journal mode * Slow blinking

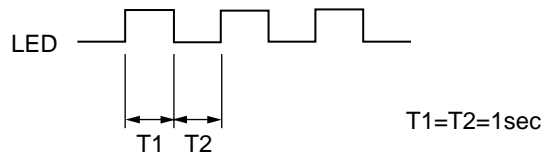
Note 1) When “Cover Open Alarm” is set to No in Menu, Cover Open Alarm does not happen (Printing does not stop.)

* Media Does Not Match Alarm (1) is detected by monitoring the lever of the option tractor. Media Does Not Match Alarm (2) is detected by the Validation sensor monitoring (media manually inserted to the validation opening).

(Timing charts for LED1 and LED2 display for Waiting for removal and SP/LF thermal alarm state and LED3 display for Validation mode and Receipt mode.)



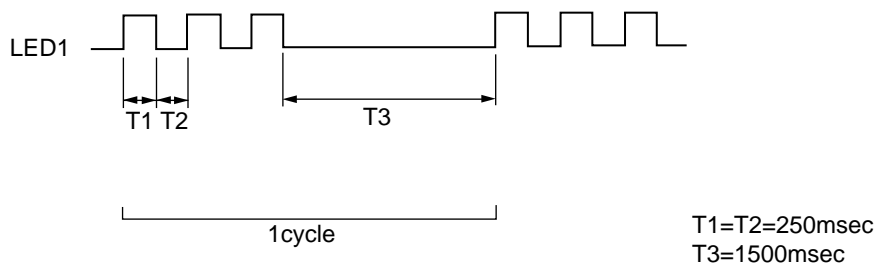
(LED3 display timing chart for MICR mode and Journal mode)



(Number of times LED1 blinks when fatal alarms have occurred)

Number of times	Fatal alarm
1	Program ROM
2	EEPROM
3	Internal RAM
4	External RAM
5	Homing
6	Spacing
7	Auto Cutter
8	Platen Switch
9	Head A/D Error
10	WDT (F/W Control)
11	NMI (F/W Control)
12	BRK command (F/W Control)
13	MICR Unit Error
14	I/F board

(LED1 display timing chart when a fatal alarm has occurred)

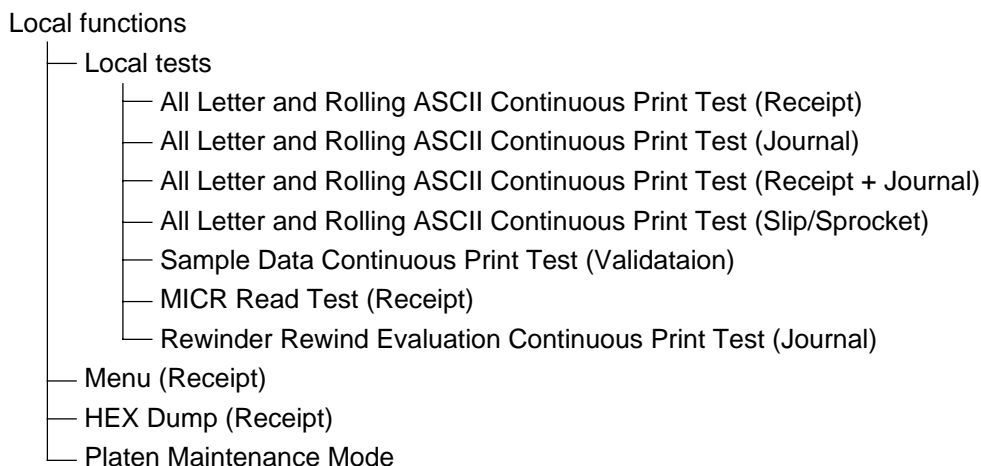


2.2 LOCAL FUNCTIONS

The local and maintenance functions are described next.

2.2.1 Kinds of Local Functions and How to Start

(1) Kinds



(2) How to start

NO.	Local Functions	SW 2	SW 3	SW 1	SW 4
1	All Letter & Rolling ASCII Continuous Print Test (Receipt)	×	×	○	×
2	All Letter & Rolling ASCII Continuous Print Test (Journal)	×	×	×	○
3	All Letter & Rolling ASCII Continuous Print Test (Receipt+Journal)	×	×	○	○
4	All Letter & Rolling ASCII Continuous Print Test (Slip)/(Sprocket)	○	×	×	×
5	Sample Data Continuous Print Test (Validation)	×	○	×	×
6	Menu (Receipt)	○	×	○	×
7	HEX Dump (Receipt)	×	○	○	×
8	MICR Read Test (Receipt)	○	○	×	×
9	Platen Maintenance Mode	○	○	○	×
10	Rewinder Rewind Evaluation Continuous Print Test (Journal)	×	○	○	○

Note 1 To enter the above modes, turn the power on while holding down the switches marked with a circle (○).

Note 2 In No.4, if the lever is on the tractor side, the Sprocket Print Test becomes effective. If the lever is not on the tractor side, the Slip Print Test becomes effective.

Note 3 In Nos. 5, 8 and 10, if the lever is on the tractor side, these local functions become invalid, and the printer starts in normal mode.

Nos.1 ~ 3, 6, 7 and 9 become effective regardless of the lever state.

Note 4 In Nos.1~ 3, the print widths will be those set in the menu "Width of Roll Paper".

Note 5 In Nos.1 ~ 4 and 10, if SW1 is pressed, printing suspends. When the SW1 is pressed again, the printing resumes.

Note 6 In No.1 ~ 5, 8 and 10, if the cover is opened, printing suspends. When the cover is closed, printing resumes.

(This is limited to only with the setting of Menu "Cover Open Alarm = YES", suspend in the cases of No.6 and 7.)

Note 7 In each local function, if the tractor lever is switched, Media Does Not Match Alarm (1) will result. When the tractor is returned to the original position, the alarm is cleared and test printing resumes.

2.3 LOCAL TEST

This function creates test data internally as if the printer received the data from the host, and prints the test pattern.

2.3.1 Printer Status in Local Test Mode

When the local test begins, the printer cannot receive data (*1).

Even when a recoverable alarm occurs, the test mode is not cleared, and the test print resumes when the alarm element is cleared.

The condition to end the local test is to turn the power off, but the local test is terminated when $\overline{I-PRIME}$ signal (Parallel model) /Reset signal (Serial model) is received or a fatal alarm occurs.

(*1) When the printer cannot receive data, each I/F presents Busy as follows.

- * Parallel model (Centronics interface): Busy signal → High
- * Serial model (RS232C I/F): Busy control as follows.
 - When handshake is DTR/DSR: DTR signal → MARK status
 - When handshake is XON/XOFF: Sends DC3

2.3.2 Details of Local Test Prints

2.3.2.1 All Letter and Rolling ASCII Continuous Print Test (Receipt)

This function performs All Letter Print and Rolling ASCII Continuous Print in Receive mode.

It can test Auto Cutter Unit as well, and executes Auto Cut operations. It executes Auto Cut operation only when "Auto Cutter Unit = Yes" is sent in the menu, however.

* In case of 1-Roll Model, since this model does not come with Auto Cutter Unit, the Auto Cut function is invalid.

- (1) How to start
 - Turn the power on while holding down the SW1.
- (2) How to exit this mode
 - Turn the power off.
 - * During test printing, if you press SW1, printing suspends. If you press the SW1 again, printing resumes.
- (3) Printed contents and operations
 - (a) Auto Cut (Full Cut) operation
 - (b) Horizontal line (bit image print) printing
 - (c) Pattern ("X") printing to check breakage of the head pins
 - (d) Local test header printing
 - (e) UTL and HSD characters (20H~FFH) All Letter Print
 - (f) Auto Cut (Partial Cut) operation
 - (g) UTL characters (20H~7EH) Rolling ASCII Continuous Print

2.3.2.2 All Letter and Rolling ASCII Continuous Print Test (Journal)

This function performs All Letter Print and Rolling ASCII Continuous Print in Journal mode.

* In case of 1-Roll Model, this function is invalid.

(1) How to start

Turn the power on while holding down the SW4.

(2) How to exit this mode

Turn the power off.

* During test printing, if you press SW1, printing suspends. If you press the SW1 again, printing resumes.

(3) Printed contents

- (a) Horizontal lines (bit image print) printing
- (b) Pattern (“X”) printing to check breakage of the head pins
- (c) Local test header printing
- (d) UTL and HSD characters (20H~FFH) All Letter Print
- (e) UTL characters (20H~7EH) Rolling ASCII Continuous Print

2.3.2.3 All Letter and Rolling ASCII Continuous Print Test (Receipt + Journal)

This function performs All Letter Print and Rolling ASCII Continuous Print in the Receipt+Journal mode.

Prints the same data on both receipt and journal.

This function can test the auto cutter unit as well, and executes Auto Cut operation of receipts only when “Auto Cutter Unit = Yes” is set in the menu, however.

* In case of 1-Roll Model, this function is invalid.

(1) How to start

Turn the power on while holding down SW1 + SW4.

(2) How to exit this mode

Turn the power off.

* During test printing, if you press SW1, printing suspends. If you press the SW1 again, printing resumes.

(3) Print contents and operations

- (a) Auto Cut (Full Cut) operation
- (b) Horizontal line (bit image print) printing
- (c) Pattern (“X”) printing to check breakage of the head pins
- (d) Local test header printing
- (e) UTL and HSD characters (20H~FFH) All Letter Print
- (f) Auto Cut (Partial Cut) operation
- (g) UTL characters (20H~7EH) Rolling ASCII Continuous Print

2.3.2.4 All Letter and Rolling ASCII Continuous Print Test (Slip/Sprocket)

This function performs Rolling ASCII Continuous Print after All Letter Print.

(1) How to start

Turn the power on while holding down the SW2. If the lever is on the tractor side, the Sprocket paper print test takes place. Otherwise, Slip paper print test takes place.

(2) How to exit

Turn the power off.

* During test printing, if you press SW1, printing suspends. If you press the SW1 again, printing resumes.

(3) Print contents

- (a) Horizontal line (bit image print) printing
- (b) Pattern ("X") printing to check breakage of the head pins
- (c) Local test header printing
- (d) UTL and HSD characters (20H~FFH) All Letter Print
- (e) UTL and HSD characters (20H~FFH) All Letter Print in Compressed Mode.
- (f) UTL characters (20H~7EH) Rolling ASCII Continuous Print

2.3.2.5 Sample Data Continuous Print Test (Validation)

This function performs the test print on the Validation paper.

(1) How to start

Turn the power on while holding down the SW3.

(2) How to exit

Turn the power off.

(3) Print contents

- (a) UTL character (20H~86H) printing (prints only one-line)

* Prints one-line when Validation is inserted, then enters Waiting for Removal state. After the validation is removed, the printer enters the Waiting for Insertion state. Repeat the sequence : Set paper → Print → Remove.

2.3.2.6 MICR Read Test (Receipt)

This function performs MICR read and prints that result on the receipt paper.

Effective only when the MICR unit is installed and "MICR Unit = Yes(CMC-7)" or "MICR Unit = Yes(E-13B)" is set in the menu.

- (1) How to start
Turn the power on while holding down SW2 + SW3.
- (2) How to exit
Turn the power off.
- (3) Contents of the test
 - (a) When this mode is started, the printer enters Wait for MICR Insertion state.
 - (b) Insert MICR card and perform MICR read.
 - (c) The printer prints MICR read results on the Receipt paper, and enters Wait for MICR Insertion state.
(b) and (c) above are repeated.
- (4) Contents printed
<When Read is OK:>
 - (a) Prints "Read OK".
 - (b) Prints the MICR read results in HEX dump.
("XX XX XX" + ASCII: 1 line contains 8 byte information)

<When Read is NG:>

- (a) Prints "Read NG".
- (b) Prints the MICR read results (Return Code (1 byte) and read data) in HEX dump.
("XX XX XX" + ASCII: 1 line contains 8 byte information)
 - * Regarding MICR Read result, Return Code (1 byte) and Read Data are printed.
When the Return Code is 30H ("No errors"), it is assumed as "Read OK" Otherwise, it is assumed as "Read NG"
 - * Return codes are shown below:

Return code	Status
30H (0)	No errors.
33H (3)	Error: Read/Decode error.
34H (4)	Error: No magnetic ink detected.
36H (6)	Error: Document jam or document is too long.

* When character set is CMC-7, the below codes are returned.

1 2 3 4 5 6 7 8 9 0

Co transit L dash

Se On-U\$ Et amount

 G comma

A: dash symbol
 B: amount symbol
 C: transit symbol
 D: On-U\$ symbol
 E: comma symbol

Character	Code	Character	Code	Character	Code	Character	Code
1	31H	2	32H	3	33H	4	34H
5	35H	6	36H	7	37H	8	38H
9	39H	0	30H	(space)	20H	A	41H
B	42H	C	43H	D	44H	E	45H

* Unknown:3FH(?)

* When character set is E-13B, the below codes are returned.

0 1 2 3 4 5 6 7 8 9

dash symbol On-U\$ symbol

amount symbol transit symbol

A: dash symbol
 B: amount symbol
 C: transit symbol
 D: On-U\$ symbol

Character	Code	Character	Code	Character	Code	Character	Code
1	31H	2	32H	3	33H	4	34H
5	35H	6	36H	7	37H	8	38H
9	39H	0	30H	(space)	20H	-	-
A	41H	B	42H	C	43H	D	44H

* Unknown:3FH(?)

(Note) In both cases of CMC-7 and E-13B, special character codes are different from those sent to host by a check paper read command.

2.3.2.7 Rewinder Winding Evaluation Continuous Print Test (Journal)

This function performs print/platen switch continuous test to evaluate the rewinder winding performance.

* In case of 1-Roll Model, this function will be in Roll Paper mode.

- (1) How to start
Turn the power on while holding down SW3 + SW1 + SW4.
- (2) How to exit
Turn the power off.
* During test printing, if you press the SW1, printing suspends. If you press the SW1 again, printing resumes.
- (3) Contents printed
 - (a) Prints "HHH"+ Space + "HHH" (UTL characters)
 - (b) Print Sheet Mode switching (Journal → Slip → Journal)

2.3.3 Local Test Header

Prints Model Name, Design Drawing Number, Version and F/W Revision.

OKIPOS 425D 41783801YR *1
VER 01 F/W REV 01.00

*1 1-Roll model: OKIPOS 425S 41783701YR
2-Roll model: OKIPOS 425D 41783801YR

The device names are not finalized yet.

The above names are tentative.

2.4 MENU FUNCTION (Receipt)

2.4.1 Overview

The menu function is the local function that sets each mode to control the printer and adjusts it. This mode has the following items, saved in the E²P-ROM. This information is printed only when the menu mode is activated at Power On, and the information can be written over from the operator panel.

Menu Print is printed in Receipt Mode.

For the printer's initialization state, each mode is set according to the information of this area.

2.4.2 Menu Items

- (1) Auto Cutter Unit
- (2) MICR Unit
- (3) Print Registration
- (4) Top Adjust
- (5) Cut Adjust
- (6) Auto LF (Auto line feed)
- (7) Receive Buffer Size
- (8) Print Mode
- (9) Off-line Busy Control
- (10) Cover Open Alarm
- (11) Width of Roll Paper
- (12) Zero Character
- (13) Page Lengths
- (14) Page End Signal

NO.	Item	Function	Sets
1	Auto Cutter Unit	Selects Auto Cutter Unit Installed/Not Installed.	○ Yes No *Default of 1-Roll Model is No.
2	MICR Unit	Selects MICR Unit Installed/Not Installed.	Yes(CMC-7) Yes(E-13B) ○ No
3	Print Registration	Adjusts the print position if it shifts in Forward printing and Reverse printing.	0.25mm Right 0.20mm Right 0.15mm Right 0.10mm Right 0.05mm Right ○ 0 0.05mm Left 0.10mm Left 0.15mm Left 0.20mm Left 0.25mm Left
4	Top Adjust	Adjusts Top Of Form position when Slip/Sprocket are used.	-1.75mm ~ +1.75mm * Can be set in the 0.35mm unit. * Default value : 0 mm
5	Cut Adjust	Adjusts Cut Position when cutting Sprocket paper.	-1.75mm ~ +1.75mm * Can be set in the 0.35mm unit. * Default value : 0 mm
6	Auto LF (Auto line feed)	Selects auto line feed. (Selects auto line feed by CR Code)	Yes ○ No
7	Receive Buffer Size	Selects Receive Buffer Size	2K ○ 16K
8	Print Mode	Selects font	○ Utility HSD
9	Off-line Busy Control	Selects conditions of BUSY	○ Yes * Off-line or Receive buffer-full No * Receive buffer-full
10	Cover Open Alarm	Selects enable/disable of print stop in Cover Open	○ Yes No
11	Width of Roll Paper	Selects the paper width of Roll paper (Changes the print area.)	○ 76.2mm 69.5mm
12	Zero Character	Selects a zero font	Slashed ○ Unslashed
13	Page Length	Selects the paper length of Sprocket paper.	88.9mm 139.7mm 215.9mm ○ 279.4mm 304.8mm
14	Paper End Signal	Selects the paper sensor that enables Paper End signal. * RNE : Receipt/Journal Near End Sensor * RE : Receipt/Journal End Sensor	○ Yes (RNE or RE) Yes (RE) No

Note 1) In the 1-Roll Model, an auto cutter unit cannot be installed.

Note 2) I/F control information (baud rate and etc.) and customer display connection/disconnection of serial model are set by DIP-SW of the I/F board.

Note 3) MICR Unit selection has the following two types for MICR Read test (Refer to Section 2.3.2.6.): "Yes (CMC-7)," and "Yes (E-13B)" Normally, either selection is recognized as an actual installation status of MICR Unit, and MICR type is selected by designation of the command.

2.4.3 How to Operate

2.4.3.1 Start

To start the Menu Mode, turn the printer on while holding down SW2 + SW1. When the printer's initialization ends correctly, the printer prints the title "Menu Print" and all the menu items and set values. Then, the printer line-feeds until the print result goes beyond the Manual Cutter position, prints the item/set value immediately after "Menu Print", then, waits for a switch to be pressed.

2.4.3.2 Operation

The switch functions during the menu mode are as follows:

Switch	Function
SW2	Advances the set values of the Menu Item, one at a time. From the last set value, returns to the first set value.
SW3	Ends Menu Mode. Registers the set values in EEPROM, then, prints the end message "Menu End" and returns to the same initialized state as at power on.
SW1	Advances the Menu Items, one at a time. From the last Menu Item, returns to the first Menu Item.
SW4	Feeds the receipt, by one line.

2.5 HEX DUMP FUNCTION (Receipt)

This function converts received data, as it is, to character codes, and prints it in the Receipt mode. The printed contents are as follows: Upon receiving one byte, the printer divides it into three characters, High-nibble, Low-nibble and a space. Regarding these as 1 block, the printer prints 8 blocks in one line, then, prints the same data in the character format.

Upon entering the HEX dump mode, the printer prints "Hex Data Dump". (Title printing)

2.5.1 Print Format

Hex Data Dump

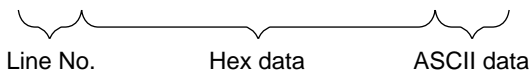
0000 XX XX XX XX XX XX XX XX :
0008 XX XX XX XX XX XX XX XX :

.
. .
. .
. .

FFF8 XX XX XX XX XX XX XX XX :

0000 XX XX XX XX XX XX XX XX :

.
. .
. .
. .



2.5.2 How to Print

- (1) If it does not receive data after 150ms have passed since receiving last data, the printer starts printing (CR) if it has some data.
(If there is not enough data to form 8 blocks, spaces will be used.)
If it subsequently receives data, the printer prints from a position next to the position at which the printing started.
- (2) If it receives the $\overline{\text{I-PRIME}}$ signal (Parallel model)/Reset signal (Serial model), the printer starts printing if it has some data, then, feeds one line. Then, the printer is initialized. (If it does not have any data, the printer feeds one line and then, is initialized.) After the initialization, the printer starts up in dump mode again and prints. The line number is reset, however, and counting begins from "0000".
 - * When I-PRIME signal (Parallel model)/Reset signal (Serial model) is hard reset (setting by Short Plug with Parallel I/F board and by DIP SW with Serial I/F board), it immediately starts initialization and does not continue hex dump.
- (3) One line-feed is added for every 16 lines.
- (4) The count begins from "0000" when the line number exceeds "FFF8".

2.6 PLATEN MAINTENANCE MODE

This function is for switching the platen position when the print head gap is adjusted in the production line.

(1) How to start the mode

Turn the power on while holding down SW2 + SW3 + SW1.

*1 This mode can be executed even when the print head is not installed.

*2 When this mode is being started, the initial platen position should be on the Receipt side.

If the paper is already loaded in the Tractor mode, the platen should be on the Slip side.

(2) How to operate

Switch	Function
SW2	Moves the platen to the Receipt side.
SW3	Moves the platen to the Slip side.
SW1	Invalid
SW4	

(3) How to exit the maintenance mode

Turn the power off.

3. COMMAND DESCRIPTION

The intent of this document is to describe the details of the command functions that are effectuated by the firmware.

3.1 Control Code

3.1.1 Control Code List

3.1.1.1 Function Code

(1) List of Function Codes

No.	HEX	DEC	CODE	Remarks	Section	Print Start
1	0A	10	LF	Print/line feed	3.2.3.1	○
2	0C	12	FF	Eject Cut Sheet paper or form-feed sprocket paper	3.2.3.7	○
3	0D	13	CR	Print/carriage return	3.2.1.1	○
4	0F	15	SI	Condense Designate	3.2.5.10	×
5	12	18	DC2	Condense Clear	3.2.5.12	×
6	18	24	CAN	Cancel print data	3.2.8.4	×
7	10	16	DLE	Start DLE sequence	3.1.1.2	–
8	1B	27	ESC	Start ESC sequence	3.1.1.3	–
9	1C	28	FS	Start FS sequence	3.1.1.4	–
10	1D	29	GS	Start GS sequence	3.1.1.5	–
11	1E	30	RS	Journal Tab	3.2.2.5	×

* Print Start Column

○ : Command that invokes print start

× : Command that does not invoke print start

△ : Command that sometimes invokes print start

(This applies hereafter.)

3.1.1.2 DLE Sequence

(1) Command recognition

A code that follows a DLE code is treated as a 7-bit code. (MSB=0)

For the parameters, which vary among the commands, see each command's functions.

If a function code follows a DLE code, it is treated as a stand-alone function code.

If DLE codes come in succession, they are treated as a DLE code.

Example: DLE DLE EOT n is treated as command DLE EOT n.

(2) DLE sequences

No.	HEX	Command Sequence	Functions	Section	Print Start
1	10 04	DLE EOT n	Real-time status sending	3.2.8.16	×
2	10 04 08	DLE EOT BS n	Real-time MICR status sending	3.2.8.18	×
3	10 05	DLE ENQ n	Real-time request to Printer	3.2.8.17	×

3.1.1.3 ESC Sequence

(1) Command recognition

For the handling of codes that follow the ESC Code, when the ESC codes come in succession, and their relationship with the functional codes, the way the DLE sequence is handled applies.

(2) ESC sequence list

No.	HEX	Command Sequence	Functions	Section	Print Start
1	1B 0F	ESC SI	Condense Designate	3.2.5.11	×
2	1B 10 44	ESC DLE D Pno Pa1 Pb1...Pan Pbn	Sets up menu items	3.2.8.9	○
3	1B 10 61	ESC DLE a Pno n	Enables/disables auto status send	3.2.8.24	×
4	1B 10 63	ESC DLE c Pno 0 n	Selects print sheet	3.2.7.9	×
5	1B 10 63	ESC DLE c Pno 1 n	Selects set sheet	3.2.7.10	×
6	1B 10 6C	ESC DLE l Pno n1 n2	Sets Left Margin	3.2.2.1	×
7	1B 10 72	ESC DLE r Pno n	Real-time status sending	3.2.8.25	×
8	1B 10 76	ESC DLE v Pno n	Selects Validation insert position	3.2.8.23	×
9	1B 20	ESC SP n	Sets chracter right-side space	3.2.5.1	×
10	1B 21	ESC ! n	Designates Print Mode all at once	3.2.5.9	×
11	1B 24	ESC \$ n1 n2	Designates absolute position	3.2.2.2	△
12	1B 25 35	ESC % 5 n	Feeds paper in inrements of n/144"	3.2.3.13	○
13	1B 25 39	ESC % 9 n	Sets n/144" line feed	3.2.3.14	×
14	1B 2A	ESC * m n1 n2 data	Designates Bit Image Mode	3.2.6.1	△
15	1B 2D	ESC - n	Designates/clears Underline	3.2.5.2	×
16	1B 30	ESC 0	Sets 1/8" line feed	3.2.3.2	×
17	1B 31	ESC 1	Sets 7/72" line feed	3.2.3.3	×
18	1B 32	ESC 2	Sets 1/6" line feed	3.2.3.4	×
19	1B 33	ESC 3 n	Sets n/144" line feed	3.2.3.5	×
20	1B 34	ESC 4	Sets Italic Mode	3.2.5.5	×
21	1B 35	ESC 5	Resets Italic Mode	3.2.5.6	×
22	1B 3C	ESC <	Designates one-line uni-directional print	3.2.8.7	×
23	1B 3D	ESC = n	Selects peripheral device	3.2.8.1	×
24	1B 40	ESC @	Initializes printer	3.2.8.5	×
25	1B 41	ESC A n	Sets n/72" line feed pitch	3.2.3.6	×
26	1B 43	ESC C n	Sets page length for Sprocket paper	3.2.3.8	×
27	1B 45	ESC E n	Designates/cancels Emphaize print	3.2.5.7	×
28	1B 47	ESC G n	Designates/cancels Double Strike print	3.2.5.8	×
29	1B 4A	ESC J n	Feeds paper in increments of n/144"	3.2.3.11	○
30	1B 4E	ESC N n	Sets Sprocket paper perforation skip	3.2.3.9	×
31	1B 4F	ESC O	Resets Sprocket paper perforation skip	3.2.3.10	×
32	1B 52	ESC R n	Selects international character set	3.2.4.1	×
33	1B 55	ESC U n	Designates/cancels uni-directional print	3.2.8.6	×

No.	HEX	Command Sequence	Functions	Section	Print Start
34	1B 57	ESC w n	Designates/cancels double width print	3.2.5.4	×
35	1B 5C	ESC \ n1 n2	Designates relative position	3.2.2.3	△
36	1B 5E	ESC ^ m n1 n2	Designates 9-pin Bit Image Mode	3.2.6.2	×
37	1B 61	ESC a n	Aligns positions	3.2.2.4	×
38	1B 63 30	ESC c 0 n	Selects print sheet	3.2.7.1	×
39	1B 63 31	ESC c 1 n	Selects set sheet	3.2.7.2	×
40	1B 63 32	ESC c 3 n	Selects paper sensor that enables the paper end signal; valid only with Parallel I/F	3.2.7.3	×
41	1B 63 34	ESC c 4 n	Selects print stop sensor	3.2.7.4	×
42	1B 63 35	ESC c 5 n	Enables/disables panel switch	3.2.8.3	×
43	1B 64	ESC d n	Feeds paper for n lines	3.2.3.12	○
44	1B 66	ESC f t1 t2	Sets Cut paper wait time	3.2.7.5	×
45	1B 69	ESC i	Full cut	3.2.7.6	×
46	1B 6D	ESC m	Partial cut (keeping one point uncut)	3.2.7.7	×
47	1B 70	ESC p m t1 t2	Generates designated pulse (Open Cash Drawer)	3.2.8.11	×
48	1B 74	ESC t n	Selects character code table	3.2.4.2	×
49	1B 75	ESC u n	Sends peripheral device status	3.2.8.2	×
50	1B 76	ESC v	Sends paper sensor status	3.2.8.8	×
51	1B 77	ESC w n	Sets/resets Double Height print	3.2.5.3	×
52	1B 7A	ESC z n	Designates/cancels Receipt+Journal same data print	3.2.7.8	×
53	1B 10 41	ESC DLE A Pno N1...N8	Selects and sets the barcode type and size	3.2.9.1	×
54	1B 10 42	ESC DLE B Pno Pm DATA	Prints barcode data	3.2.9.2	△

* The ESC DLE sequence other than No. 2~8, 53, 54 will be ignored by the sequence.
(The data that follows "Pno" will be ignored as many bytes as set by Pno.)

3.1.1.4 FS Sequence

(1) Command recognition

For the handling of subsequent codes that follow the FS code, when the FS codes come in succession, and their relationship with the functional codes, the way the DLE sequence is handled applies.

(2) FS Sequence table

No.	HEX	Command Sequence	Functions	Section	Print Start
1	1C 61 30	FS a 0 n	Reads Check paper	3.2.8.19	×
2	1C 61 31	FS a 1	Loads Check paper to the print start position	3.2.8.20	×
3	1C 61 32	FS a 2	Ejects Check paper	3.2.8.21	×
4	1C 62	FS b	Requests for resending a result of reading Check paper	3.2.8.22	×

3.1.1.5 GS Sequence

(1) Command recognition

For the handling of subsequent codes that follow the GS code, when the GS codes come in succession, and their relationship with the functional codes, the way the DLE sequence is handled applies.

(2) GS Sequence table

No.	HEX	Command Sequence	Functions	Section	Print Start
1	1D 05	GS ENQ	Sends a status of the printer status real-time	3.2.8.13	×
2	1D 45	GS E n	Selects print speed and printhead current flow time	3.2.8.10	×
3	1D 49	GS I n	Sends a printer ID	3.2.8.14	×
4	1D 61	GS a n	Enables/disables auto status send	3.2.8.12	×
5	1D 72	GS r n	Sends a status	3.2.8.15	×

3.2 Control Operations

The control functions are described in the subsequent sections.

3.2.1 Print Operation Control

This section describes the print operation control functions.

3.2.1.1 Print/Carriage Return

CR

Name:	Print/Carriage Return	
Code	HEX:	0DH
	DEC:	13

Functions:

- (1) To start printing received data and set the position to start receiving the next line's data at the left margin position (start of that line) after printing.
- (2) To perform Carriage Return and Line Feed if Auto LF is set to Enabled on the menu.
- (3) To perform Carriage Return to the start position of the line on Receipt side in Receipt+Journal mode.
- (4) To prompt the mode to shift Receipt+Journal in Validation Mode if Auto LF is set to Enabled on the menu.

3.2.2 Space Control

The space control functions are described in the subsequent sections.

3.2.2.1 Left Margin Set

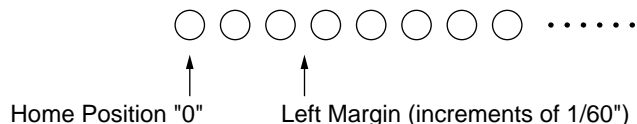
ESC DLE I Pno n1 n2

Name:	Setting Left Margin	
Code	HEX:	1BH 10H 6CH Pno n1 n2
	DEC:	27 16 108 Pno n1 n2

Function:

- (1) To set Left Margin in increments of 1/60" from the home position.
n1= low-order bytes and n2=high-order bytes
- (2) The DEL in the command sequence disables MSB. ("90H" is effective as well.)
- (3) Valid range and definitions of parameters
 - (a) Pno: To designate the number of bytes (number of parameters) following ESC DLE I Pno MSB is invalid.
Range: 00H ≤ Pno ≤ FFH
With this command, Pno=2.
 - (b) To designate the print position by n1 n2 on the basis of the home position.
Example) In case of ESC DLE I 02H 02H 00H:
n1=02H
n2=00H

The print position would be:



In this case, Left Margin is 2/60" from the home position.

- (4) Range and definitions of n1,n2
 $0(00H) \leq n1 \leq 255 (FFH)$
 $0(00H) \leq n2 \leq 255 (FFH)$
 If a value exceeding the value below is set, this command will be ignored and the previous setting will remain valid.
 The maximum value of n1, n2 would be one that does not fall below 1.25" in the distance to the right margin.

Selected print sheet	Range of n1, n2	Right Margin (")
Receipt/Journal/Receipt+Journal(76.2mm)	$0 \leq n2 \leq n1 \leq 93$	2.8
Receipt/Journal/Receipt+Journal(69.5mm)	$0 \leq n2 \leq n1 \leq 77$	2.53
Slip(/MICR Read)/Sprocket paper (option)	$0 \leq n2 \leq n1 \leq 303$	6.3

- (5) Received within the line, this command will be ignored.
- (6) If setting is made by this command in Receipt/Journal/Receipt+Journal Mode, that setting will be valid for both Receipt and Journal.
It will not affect Slip/Validation/Sprocket.
- (7) If setting is made by this command in Slip/Validation/Sprocket Mode, that setting will be valid for all of Slip/Validation/Sprocket.
It will not affect Receipt or Journal.
- (8) Neither the left margin position that is set in Receipt/Journal/Receipt+Journal Mode nor the left margin position set in Slip/Validation/Sprocket Mode will change when the mode is switched.

Name:	Absolute Position Designate	
Code	HEX:	1BH 24H n1 n2
	DEC:	27 36 n1 n2

Function:

- (1) To move a next printing position from the start position in the line to the one designated by n1 n2 in increments of 1/180" or 1/240".

Default unit of measurement is 1/180", but 1/240" if Condense is set.

n1 = low-order byte, n2 = high-order byte

- (2) To designate the print position according to n1 n2, based on the left margin position (start position of the line).

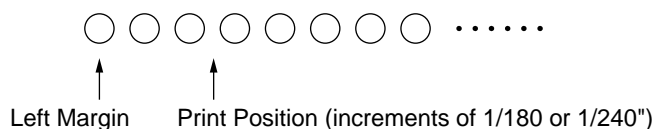
The left margin changes, the print start position, too, changes even if the setting is the same.

e.g.) ESC \$ 02H 00H

n1 = 02H

n2 = 00H

The print position would be:



In this case, subsequent data will be printed 2/180" or 2/240" from the left margin.

- (3) Valid range and definitions of n1,n2
 $0(00H) \leq n1 \leq 255(FFH)$
 $0(00H) \leq n2 \leq 255(FFH)$
- (4) Range of n1 n2 (If any value outside the range is designated, the command will be ignored in its entirety.)

The range in the table below assumes the left margin position being 0.

If Left Margin + Absolute Position exceeds the right margin (inches) in the table below, the command will be ignored in its entirety.

Selected print sheet	Range of n1 n2	Margin	Right Margin (")
Receipt/Journal/Receipt+Journal (76.2mm)	$0 \leq n2 \ n1 \leq 504 \ (1/180")$ $0 \leq n2 \ n1 \leq 672 \ (2/240")$	504/180" 672/240"	2.8
Receipt/Journal/Receipt+Journal (69.5mm)	$0 \leq n2 \ n1 \leq 456 \ (1/180")$ $0 \leq n2 \ n1 \leq 608 \ (2/240")$	456/180" 608/240"	2.53
Slip/Validation	$0 \leq n2 \ n1 \leq 1134 \ (1/180")$ $0 \leq n2 \ n1 \leq 1512 \ (2/240")$	1134/180" 1512/240"	6.3
Sprocket (option)	$0 \leq n2 \ n1 \leq 1134 \ (1/180")$ $0 \leq n2 \ n1 \leq 1512 \ (2/240")$	1134/180" 1512/240"	6.3

- (5) The amount of movement is calculated according to the following formula.
 Movement (Distance from left margin) = $\{n1+(n2 \text{ AND } 03H) \times 256\}/180$ (inch) or
 $= \{n1+(n2 \text{ AND } 03H) \times 256\}/240$ (inch)
 $0 \leq \text{movement} < 6.3$ (inch)
- (6) If the parameter (n1 n2), which would set the print position to the left of the present print position, is designated, print start is prompted.
- (7) No underline is added to the movement made by this command.
- (8) When Same Data Print is reset with Receipt+Journal, if the present position is located on the Receipt side, the setting within the Receipt print position is valid, and if the present position is located on the Journal side, the setting within the Journal print range is valid.
 (On the Journal side, the left edge of the Journal print area is set as a start position of the print line.)

3.2.2.3 Relative Position Designate

ESC \ n1 n2

Name:	Relative Position Designate	
Code	HEX:	1BH 5CH n1 n2
	DEC:	27 92 n1 n2

Function:

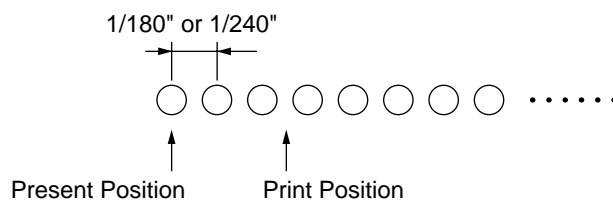
- (1) To move a next print position to the right or to the left, relative to the present position.
To move the print position to the position designated by n1 n2 in increments of 1/180" or 1/240".
Default unit is 1/180" but 1/240" if Condense is set.
n1 = low-order byte, n2 = high-order byte
- (2) To designate the print position to left/right by the dots as designated by n1 n2, on the basis of the present position being "0."

Ex.) In case ESC \ 02H 00H is received:

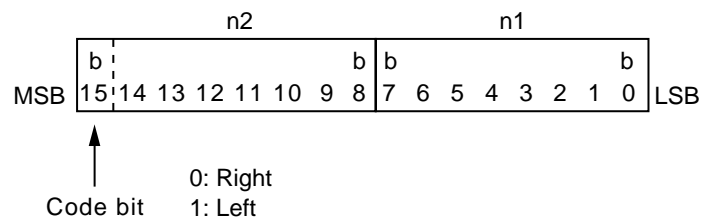
n1=02H

n2=00H

Thus, the print position would be



- (3) A pair of n1 n2 consists of 2 bytes making up a 16-bit numerical value.
Its 16th bit indicates a code. {positive = right, negative (Two's complement)=left}



(4) Range of move

Direction	Selected Print Sheet	Range of n1 n2	Right Margin	Right Margin (")
Forward	Receipt/Journal (76.2mm)	0H ≤ n2 n1 ≤ 504-(present Position) (1/180") 0H ≤ n2 n1 ≤ 672-(present Position) (1/240")	504/180" 672/240"	2.8
	Receipt/Journal (69.5mm)	0H ≤ n2 n1 ≤ 456-(present position) (1/180") 0H ≤ n2 n1 ≤ 608-(present position) (1/240")	456/180" 608/240"	2.53
	Slip/Validation	0 ≤ n2 n1 ≤ 1134-(present position) (1/180") 0 ≤ n2 n1 ≤ 1512-(present position) (1/240")	1134/180" 1512/240"	6.3
	Sprocket (option)	0 ≤ n2 n1 ≤ 1134-(present position) (1/180") 0 ≤ n2 n1 ≤ 1512-(present position) (1/240")	1134/180" 1512/240"	6.3
Reverse	Receipt/Journal (76.2mm)	-(present position) ≤ n2 n1 < 0 (1/180") -(present position) ≤ n2 n1 < 0 (1/240")	504/180" 672/240"	2.8
	Receipt/Journal (69.5mm)	-(present position) ≤ n2 n1 < 0 (1/180") -(present position) ≤ n2 n1 < 0 (1/240")	456/180" 608/240"	2.53
	Slip/Validation	-(present position) ≤ n2 n1 < 0 (1/180") -(present position) ≤ n2 n1 < 0 (1/240")	1134/180" 1512/240"	6.3
	Sprocket (option)	-(present position) ≤ n2 n1 < 0 (1/180") -(present position) ≤ n2 n1 < 0 (1/240")	1134/180" 1512/240"	6.3

(5) Maximum value of n2 n1

Selected Print Sheet	Maximum value for Forward	Maximum value for Reverse
Receipt/Journal (76.2mm)	504/180" 672/240"	-504/180" -672/240"
Receipt/Journal (69.5mm)	456/180" 608/240"	-456/180" -608/240"
Slip/Validation	1134/180" 1512/240"	-1134/180" -1512/240"
Sprocket(option)	1134/180" 1512/240"	-1134/180" -1512/240"

- (6) A move in Reverse will prompt print start.
- (7) If a move outside the printable range is designated, the command is ignored in its entire sequence.
- (8) If Underline is designated with the move made by this command, no underline will be applied to the skipped spaces.
- (9) When Same Data Print is reset with Receipt+Journal, if the present position is located on the Receipt side, the setting within the Receipt print position is valid, and if the present position is located on the Journal side, the setting within the Journal print range is valid. (On the Journal side, the left edge of the Journal print area is set as a start position of the line.)
- (10) In Validation Mode, if this command is received when the present position is already beyond the right margin, the command will be ignored in its entire sequence. (See 3.4.3 Right Margin Process.)

3.2.2.4 Position Align

ESC a n

Name:	Position Align	
Code	HEX:	1BH 61H n
	DEC:	27 97 n

Function:

- (1) To align the print position
- (2) Valid range and definitions of n

Mode	Value of n	Definition
0	00H, 30H	Left alignment (Default)
1	01H, 31H	Center alignment
2	02H, 32H	Right alignment

- (a) If n is any other value than the above, this command is ignored and the previously set mode remains effective.
- (b) This command is valid only when received at the start of the line. Received some-way into the line, the command will be ignored.
- (3) Mode 0 (Left alignment)
To align the print start position relative to the left margin.
- (4) Mode 1 (Center alignment)
 - (a) Those characters that would go beyond the right margin will be aligned relative to the center of a next line. (This includes spaces at the start and end of the line.)
 - (b) Even if character pitch is changed in the middle of the line (Normal, Enlarge, and Character right-side space), an entire text will be spread over evenly.
- (5) Mode 2 (Right alignment)
To align the printer end position relative to the right margin.
- (6) To align image as well.
- (7) To align absolute skip and relative slip as well.

3.2.2.5 Journal Tab

RS

Name:	Journal Tab	
Code	HEX:	1EH
	DEC:	30

Function:

- (1) To move the print position to the top of Journal.
- (2) Valid only in Receipt+Journal Mode and if Same Data Print to Receipt/Journal has been reset. (Invalid if the present horizontal position is on the Journal side.)

3.2.3 Line Feed Control

The line feed control functions are described in the subsequent sections.

3.2.3.1 Print/Line Feed

LF

Name:	Print/Line Feed	
Code	HEX:	0AH
	DEC:	10

Functions:

- (1) To complete receiving data for a line and start printing. To perform one line-feed after printing has ended, according to the amount of line feed set for each type of print sheet (Receipt, Journal, Slip, or Sprocket paper (option)).
(To perform line feed for the amount in accordance with each set value in the Receipt+Journal mode.)
- (2) To perform carriage return after printing by this command has started. The position following carriage return is at the left margin (start of the line).
(The position is at the left margin on the Receipt side with the Same Data Print is reset in Receipt+Journal Mode.)
- (3) To perform perforation skip to the next TOF position when the selected print sheet is Sprocket (option) if the position following line feed is within the perforation skip area.
- (4) To set the line feed pitch for each type of print sheet in a combination of designation by ESC 0, ESC 1, ESC 2, ESC 3 n, ESC A n, or ESC % 9 n and Sheet selection by ESC c 1 n, ESC DLE c Pno 1 n.
- (5) Default line feed is one sixth of an inch (1/6") for all types of print sheet.
- (6) To perform only carriage return following print start if the line feed pitch is "0." (No line feed is performed.)
- (7) To perform only carriage return following print start in the Validation mode and prompt the mode to shift to the Receipt+Journal mode when Validation media is removed.

3.2.3.2 1/8-inch Line Feed Set

ESC 0

Name:	1/8-inch Line Feed Set	
Code	HEX:	1BH 30H
	DEC:	27 48

Function:

- (1) To set the line feed pitch for the print sheet selected by the Set Sheet Select command (ESC c 1 n, ESC DLE c Pno 1 n) to one eighth of an inch (1/8").
- (2) To perform 1/8-inch line feed upon receiving the LF code with the type of print sheet set after this command has been designated.
- (3) For line feed by Right Margin Over and Switch, too, the 1/8-inch line feed pitch set by this command applies.
- (4) Default line feed is one sixth of an inch (1/6") for all types of print sheet.
- (5) This command is effective at any point in the line.
Except in the middle of image data or a function sequence.
- (6) The commands that execute line feed by the line feed pitch set by this command are LF and CR (with Auto LF enabled).
- (7) This command does not set TOF.
- (8) The line feed pitch set by this command applies to the following commands.
 - (a) ESC d n (Printing, then feeding paper for an "n" number of lines)
 - (b) ESC C n (Setting the eject length for cut sheet paper and the page length for sprocket paper)
 - (c) ESC N n (Setting perforation skip for sprocket paper)

3.2.3.3 7/72-inch Line Feed Set

ESC 1

Name:	7/72-inch Line Feed Set	
Code	HEX:	1BH 31H
	DEC:	27 49

Function:

- (1) To set the line feed pitch for the print sheet selected by the Set Sheet Select command (ESC c 1 n, ESC DLE c Pno 1 n) to seven seventy-seconds of an inch (7/72").
- (2) To perform 7/72-inch line feed upon receiving the LF code with the type of print sheet set after this command has been designated.
- (3) For line feed by Right Margin Over and Switch, too, the 7/72-inch line feed pitch set by this command applies.
- (4) Default line feed is one sixth of an inch (1/6") for all types of print sheet.
- (5) This command is effective at any point in the line.
Except in the middle of image data or a function sequence.
- (6) The commands that execute line feed by the line feed pitch set by this command are LF and CR (with Auto LF enabled).
- (7) This command does not set TOF.
- (8) The line feed pitch set by this command applies to the following commands.
 - (a) ESC d n (Printing, then feeding paper for an "n" number of lines)
 - (b) ESC C n (Setting the eject length for cut sheet paper and the page length for sprocket paper)
 - (c) ESC N n (Setting perforation skip for sprocket paper)

3.2.3.4 1/6-inch Line Feed Set

ESC 2

Name:	1/6-inch Line Feed Set	
Code	HEX:	1BH 32H
	DEC:	27 50

Function:

- (1) To set the line feed pitch for the print sheet selected by the Set Sheet Select command (ESC c 1 n, ESC DLE c Pno 1 n) to one sixth of an inch (1/6").
- (2) To perform 1/6-inch line feed upon receiving the LF code with the type of print sheet set after this command has been designated.
- (3) For line feed by Right Margin Over and the switch, too, the 1/6-inch line feed pitch set by this command applies.
- (4) Default line feed is one sixth of an inch (1/6") for all types of print sheet.
- (5) This command is effective at any point in the line.
Except in the middle of image data or a function sequence.
- (6) The commands that execute line feed by the line feed pitch set by this command are LF and CR (with Auto LF enabled).
- (7) This command does not set TOF.
- (8) The line feed pitch set by this command applies to the following commands.
 - (a) ESC d n (Printing, then feeding paper for an "n" number of lines)
 - (b) ESC C n (Setting the eject length for cut sheet paper and the page length for sprocket paper)
 - (c) ESC N n (Setting perforation skip for sprocket paper)

3.2.3.5 n/144-inch Line Feed Pitch Set

ESC 3 n

Name:	n/144-inch Line Feed Pitch Set	
Code	HEX:	1BH 33H n
	DEC:	27 51 n

Function:

- (1) To set the line feed pitch for the print sheet selected by the Set Sheet Select command (ESC c 1 n, ESC DLE c Pno 1 n) to n hundred forty-fourth of an inch (n/144").
- (2) To perform n/144-inch line feed upon receiving the LF code with the type of print sheet set after this command has been designated.
- (3) For line feed by Right Margin Over and Switch, too, the n/144-inch line feed pitch set by this command applies.
- (4) Default line feed is one sixth of an inch (1/6") for all types of print sheet.
- (5) This command is effective at any point in the line.
Except in the middle of image data or a function sequence.
- (6) The commands that execute line feed by the line feed pitch set by this command are LF and CR (with Auto LF enabled).
- (7) Range of n
 $0 \leq n \leq 255$
- (8) This command does not set TOF.
- (9) The line feed pitch set by this command applies to the following commands.
 - (a) ESC d n (Printing, then feeding paper for an "n" number of lines)
 - (b) ESC C n (Setting the eject length for cut sheet paper and the page length for sprocket paper)
 - (c) ESC N n (Setting perforation skip for sprocket paper)

3.2.3.6 n/72-inch Line Feed Pitch Set

ESC A n

Name:	n/72-inch Line Feed Pitch Set	
Code	HEX:	1BH 41H n
	DEC:	27 65 n

Function:

- (1) To set the line feed pitch for the print sheet selected by the Set Sheet Select command (ESC c 1 n, ESC DLE c Pno 1 n) to n seventy-seconds of an inch (n/72").
- (2) To perform n/72-inch line feed upon receiving the LF code with the type of print sheet set after this command has been designated.
- (3) For line feed by Right Margin Over and Switch, too, the n/72-inch line feed pitch set by this command applies.
- (4) Default line feed is one sixth of an inch (1/6") for all types of print sheet.
- (5) This command is effective at any point in the line.
Except in the middle of image data or a function sequence.
- (6) The commands that execute line feed by the line feed pitch set by this command are LF and CR (with Auto LF enabled).
- (7) Range of n
 $0(00H) \leq n \leq 85(55H)$
 $128(80H) \leq n \leq 213(D5H)$
 MSB will be ignored.
 If an n value is other than the above, this command is invalid and the previously set mode remains valid.
- (8) This command does not set TOF.
- (9) The line feed pitch set by this command applies to the following commands.
 - (a) ESC d n (Printing, then feeding paper for an "n" number of lines)
 - (b) ESC C n (Setting the eject length for cut sheet paper and the page length for sprocket paper)
 - (c) ESC N n (Setting perforation skip for sprocket paper)

3.2.3.7 Cut Sheet Paper Print and Eject or Sprocket Paper Form Feed

FF

Name:	Cut Sheet Paper Print and Eject or Sprocket Paper Form Feed	
Code	HEX:	0CH
	DEC:	12

Functions:

- (1) This command is ignored if the selected print sheet is Receipt/Journal/Receipt+Journal Paper.
- (2) The selected print sheet is Slip:
 - To print the data in the print buffer and perform CR, then prompt the sensor to monitor the bottom of paper, eject a sheet of cut sheet paper and switch the selected print sheet to Receipt+Journal.
 - If the bottom is not detected after a pre-set amount has been fed, Eject Error occurs.
 - The command is not affected by the setting by Print Stop Sensor Select (ESC c 4 n).
- (3) To print data in the print buffer and perform carriage return, then feed paper to the next TOF position if the print sheet is Sprocket paper (with the option tractor installed.)
- (4) To perform only carriage return following print start if the selected print sheet is Validation, prompting the mode to switch to Receipt+Journal upon removal of Validation
 * Valid even at the heading position or the TOF position in Step (2) and (3) above.

Name:	Sprocket Paper Page Length Set	
Code	HEX:	1BH 43H n
	DEC:	27 67 n

Functions:

- (1) To set the page length for sprocket paper by lines, based on the selection by the Set Sheet Select command (ESC c 1 n, ESC DLE c Pno 1 n).

Only the lower seven bits of n are valid.

- (a) Sprocket Paper selected by Set Sheet Select is valid:

- The page length set by this command becomes valid only if the print sheet is Sprocket paper (with the option tractor installed).
- To initialize the page length to default (Setting made on Menu "Page Length") if n = 00H.
- To set "n x LF pitch" as the page length if n ≠ 00H.
- If the line feed pitch is 0, the same setting takes place as n=00H.
- The maximum length that can be set is 40 inches and if any length that goes over this limit will be set to 40 inches.
- To set the page length based on the line feed pitch for Sprocket paper as a unit of measurement.
(The line feed pitch set by ESC 0, ESC 1, ESC 2, ESC 3 n, ESC A n, or ESC % 9 n with Sprocket paper selected by Set Sheet Select.)
- Once set, the page length is not affected even if the line feed pitch is changed.
- To clear Perforation Skip for Sprocket paper.
- When the print sheet is Sprocket paper (with the option tractor installed), the position where this command is received becomes the TOF position.
- Default page length is the setting made on Menu "Page Length".

Name:	Sprocket Paper Perforation Skip Set	
Code	HEX:	1BH 4EH n
	DEC:	27 78 n

Function:

- (1) To set the perforation skip area for an “n” number of lines, based on the line feed pitch for Sprocket paper if Sprocket paper selected by Set Sheet Select is valid.
The perforation skip area set by this command becomes valid only if the print sheet is Sprocket paper (with the option tractor installed).
- (2) To set the perforation skip area based on the line feed pitch set by ESC 0, ESC 1, ESC 2, ESC 3 n, ESC A n, or ESC % 9 n if Sprocket paper is selected by Set Sheet Select.
Example: 1 line = 1/6" and n = 12
Perforation Skip Area = 1/6 × 12 = 2 (inches)
- (3) Range of n

Command	Valid range	Remarks
ESC N n	$0 \leq n \leq 255$	Only the lower 7 bits of n are valid; thus, $0 \leq n \leq 127$. If n=0, the entire command is ignored.

- (4) Perforation Skip set by this command is cleared when the page length is set for sprocket paper.
- (5) Once set, the Perforation Skip area is not affected even if the line feed pitch is changed.
- (6) To perform Perforation Skip, when a line feed by LF/CR (with Auto Line Feed enabled), ESC J n, ESC d n, or ESC % 5 n brings the position into the perforation skip area, then to feed paper to the next TOF position.
- (7) If the setting is set as “Page Length ≤ Perforation Skip Area, that perforation skip setting becomes invalid, and previous perforation skip setting remains effective.
- (8) Difference between ESC O and ESC N 00H:
The command ESC O clears Perforation Skip while ESC N 00H is ignored. (In other words, the previous setting remains effective.)
- (9) When the print sheet is Sprocket paper (with the option tractor installed), if setting a perforation skip area brings the present vertical position into the perforation skip area, the printer can still print one line even if the position is in the perforation skip area. Execution of the next forward line feed command feed paper to the next page’s TOF position.
- (10) When the print sheet is Sprocket paper (with the option tractor installed) and the line feed pitch larger than the perforation skip area is set, if the line feed command that would prompt a jump over the perforation skip area is received, paper is fed as much as the designated amount of line feed.
- (11) When the line feed pitch is set to 0, if n > 0. the perforation skip set command sets the amount of skip to “0”. (This clears Perforation Skip.)
- (12) When the print sheet is Sprocket paper (with the option tractor installed) and the perforation skip area is set by this command, the setting becomes immediately effective within the current page.
- (13) The default perforation skip area is now cleared.

3.2.3.10 Sprocket Paper Perforation Skip Reset

ESC O

Name:	Sprocket Paper Perforation Skip Reset	
Code	HEX:	1BH 4FH
	DEC:	27 79

Functions:

- (1) To reset the perforation skip setting if the sprocket paper selected by Set Sheet Select is valid.
- (2) Perforation Skip is also reset when the page length is set for Sprocket paper by ESC C n.
(This applies only when Sprocket by Print Sheet Select is valid.)

3.2.3.11 n/144-inch Paper Feed

ESC J n

Name:	n/144-inch Paper Feed	
Code	HEX:	1BH 4AH n
	DEC:	27 74 n

Function:

- (1) To print data in the print buffer and perform n/144-inch line feed.
- (2) To perform carriage return as this command is executed.
- (3) Range of n

Valid range	Remarks
$0 \leq n \leq 255$	No line feed is performed if n=0, but printing starts.

- (4) To perform Perforation Skip to the next TOF position if n/144-inch paper feed results in the position being within the perforation skip area when the print sheet is Sprocket paper (with the option tractor installed).
- (5) To perform only carriage return following print start in the Validation mode, prompting the mode to switch to Receipt+Journal upon removal of Validation media.
- (6) To perform line feed for as much as each setting in the Receipt+Journal mode. The carriage return position is at the left margin on the Receipt side upon cancellation of Same Data Print.

3.2.3.12 n-line Paper Feed

ESC d n

Name:	n-line Paper Feed	
Code	HEX:	1BH 64H n
	DEC:	27 100 n

Function:

- (1) To print data in the print buffer and perform line feed for an “n” number of lines based on the line feed pitch set for each type of print sheet.
- (2) This command is accompanied by carriage return.
- (3) Range of n

Valid range	Remarks
$0 \leq n \leq 255$	Line feed is not performed if n=0, but print start is prompted.

- (4) The maximum paper feed amount that can be designated is 40 inches, and if “n x line feed pitch” results in more than 40 inches, line feed is performed just for 40 inches.
- (5) To perform Perforation Skip to the next TOF position if paper feed for an “n” number of lines results in the position being within the perforation skip area when the print sheet is Sprocket paper (with the option tractor installed).
- (6) To perform only carriage return following print start in the Validation mode, prompting the mode to switch to Receipt+Journal when Validation media is removed.
- (7) To perform line feed as much as each setting in the Receipt+Journal mode. The carriage return position is at the left margin on the Receipt side upon cancellation of Same Data Print.

3.2.3.13 n/144-inch Paper Feed

ESC % 5 n

Name:	n/144-inch Paper Feed	
Code	HEX:	1BH 25H 35H n
	DEC:	27 37 53 n

Functions:

- (1) To print data in the print buffer and perform n/144-inch line feed.
- (2) This command is accompanied by carriage return.
- (3) Range of n

Valid range	Remarks
$0 \leq n \leq 255$	No line feed is performed if n=0, but print start is prompted.

- (4) To perform Perforation Skip to the next TOF position if forward paper feed for n/144" results in the position being within the perforation skip area when the print sheet is Sprocket paper (with the option tractor installed).
- (5) To perform only carriage return following print start in the Validation mode, prompting the mode to switch to Receipt+Journal upon removal of Validation media.
- (6) To perform line feed for the amount designated for both Receipt and Journal in the Receipt+Journal mode. The carriage return position is at the left margin on the Receipt side upon cancellation of Same Data Print.

3.2.3.14 n/144-inch Line Feed Pitch Set

ESC % 9 n

Name:	n/144-inch Line Feed Pitch Set	
Code	HEX:	1BH 25H 35H n
	DEC:	27 37 53 n

Function:

- (1) To set the line feed pitch for the print sheet selected by the Set Sheet Select command (ESC c 1 n, ESC DLE c Pno 1 n) to n hundred forty-fourth of an inch (n/144").
- (2) To perform n/144-inch line feed upon receiving the LF code with the type of print sheet set after this command has been designated.
- (3) For line feed by Right Margin Over and Switch, too, the n/144-inch line feed pitch set by this command applies.
- (4) Default line feed is one sixth of an inch (1/6") for all types of print sheet.
- (5) This command is effective at any point in the line.
Except in the middle of image data or a function sequence.
- (6) The commands that execute line feed by the line feed pitch set by this command are LF and CR (if Auto LF enabled).
- (7) Range of n
 $0 \leq n \leq 255$
- (8) This command does not set TOF.
- (9) The line feed pitch set by this command applies to the following commands.
 - (a) ESC d n (Printing, then feeding paper for an "n" number of lines)
 - (b) ESC C n (Setting the eject length for cut sheet paper and the page length for sprocket paper)
 - (c) ESC N n (Setting perforation skip for sprocket paper)

3.2.4 Character Control

The character control functions are described in the subsequent sections.

3.2.4.1 International Character Set Select

ESC R n

Name:	International Character Set Select		
Code	HEX:	1BH 52H n	
	DEC:	27 82 n	

Function:

- (1) To set a character set for each language as designated by n.
- (2) Range of n

If the value of n is other than those listed in the table, this command will be ignored in its entirety and the previously selected Set remains effective.

n value	Character set	n value	Character set
00H	American	08H	Japanese
01H	French	09H	Norwegian
02H	German	0AH	Danish II
03H	British	0BH	Spanish II
04H	Danish I	0CH	Latin American
05H	Swedish	0DH	French Canadian
06H	Italian	0EH	Dutch
07H	Spanish I	40H	Publisher

- (3) Default is American (n=00H).
- (4) For the International Character Set table, see Section 3.3.1.

Name:	Character Code Table Select	
Code	HEX:	1BH 74H n
	DEC:	27 116 n

Function:

- (1) To select a character code table.
(For the Character Code tables, see Section 3.3.1.)
- (2) Values of n:

Value of n	Code Page
00H	USA
02H	Multilingual
03H	Portugal
04H	Canada French
05H	Norway
50H	BRASCII
51H	Abicomp
52H	ISO 8859/15
53H	Multilingual 858

If the value of n is other than the above, the entire command is ignored and the previously set Code Page remains effective.

- (3) Default is USA (n=00H).

3.2.5 Print Mode Control

This section describes the print mode control functions.

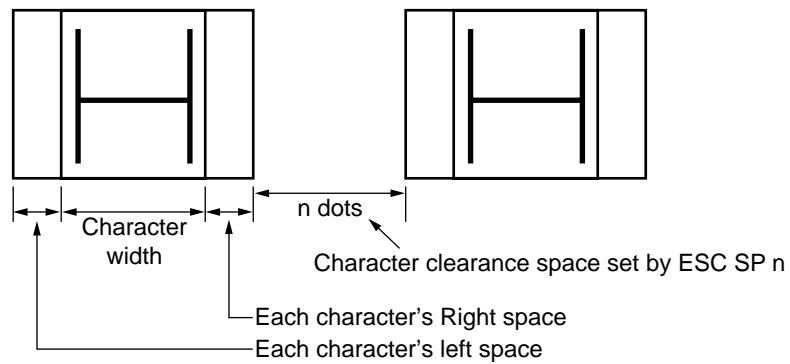
3.2.5.1 Character Right-side Space Set

ESC SP n

Name:	Character Right-side Space Set	
Code	HEX:	1BH 20H n
	DEC:	27 32 n

Function:

- (1) To set the amount of space on the right side of a character in increments of $n/180$ ". It is set in increments of $n/240$ ", however, for Condense Print.



Note 1) At default, $n=0$.

Note 2) This printer's character left-side space is "0."

- (2) Values of n :
 $0 \leq n \leq 32$
 If n is other than the above the command is ignored in its entirety.
- (3) The character clearance is also doubled if Double Width Print is set.

3.2.5.2 Underline Designate/Clear

ESC - n

Name:	Underline Designate/Clear	
Code	HEX:	1BH 2DH n
	DEC:	27 45 n

Function:

- (1) To set or clear Underline Print.
- (2) Values of n

Values of n	Meaning
01H, 31H	Sets underline mode.
00H, 30H	Clears underline mode.

If n is other than the above, the entire command is ignored.

- (3) Underlines are not applied to bit image. (Refer to Section 3.4.4.)
- (4) Underlines are applied to graphic characters.
- (5) Underlines are applied to the spaces (20H, 7FH or FFH).
- (6) This command does not prompt print start.
- (7) For the print position of underline, refer to Section 3.4.5.
- (8) Underlines are printed in the same pass as for the characters.
- (9) Double Strike Print is not applied to underlines even if the mode is specified.
- (10) Emphasized Print is not applied to underlines even if the mode is specified.
- (11) Underlines are not applied to the move made by the Absolute Position Designate command (ESC \$ n1 n2).
- (12) Underlines are not applied to the move prompted by the Relative Position Designate command (ESC \ n1 n2).

3.2.5.3 Double Height Print Set/Reset

ESC w n

Name:	Double Height Print Set/Reset	
Code	HEX:	1BH 77H n
	DEC:	27 119 n

Function:

- (1) Sets/Clears Double Height Print.
To print characters received subsequent to this command in double height.
- (2) Values of n

Values of n	Meaning
01H, 31H	Sets Double Height Print
00H, 30H	Resets Double Height Print

If n is other than the above, the entire command is ignored.

- (3) In Validation Mode, the above setting is valid but printing will be the same as when Double Height Mode is reset.

3.2.5.4 Double Width Print Set/Reset

ESC W n

Name:	Double Width Print Set/Reset	
Code	HEX:	1BH 57H n
	DEC:	27 87 n

Function:

- (1) To set/reset Double Width Print.
To enlarge the characters received after this command double in width, then print.
- (2) Values of n

Values of n	Meaning
01H, 31H	Sets Double Width Print
00H, 30H	Clears Double Width Print

If the value of n is other than the above, the entire command is ignored.

- (3) For how to enlarge characters refer to Section 3.3.3.
- (4) The table below shows the character sizes in Double Width Print for each font selected.

Font type	Normal size		Double Wide size	
	180DPI	240DPI	180DPI	240DPI
HSD	20cpi	26.7cpi	10cpi	13.3cpi
Utility	16.4cpi	21.8cpi	8.2cpi	10.9cpi

3.2.5.5 Italic Mode Set

ESC 4

Name:	Italic Mode Set	
Code	HEX:	1BH 34H
	DEC:	27 52

Function:

- (1) To set Italic Print.
To print characters received subsequently to this command in Italic.
- (2) This command is valid even if received in the middle of the line and takes effect immediately.
- (3) Graphics characters are not printed in Italic. (See 3.4.4.)
- (4) Characters in Italic are printed in slant on the basis of the lowest dot (9th dot) in the normal character patterns. For how characters are slanted, see 3.3.3.

3.2.5.6 Italic Mode Reset

ESC 5

Name:	Italic Mode Reset	
Code	HEX:	1BH 35H
	DEC:	27 53

Function:

- (1) To reset Italic Print Mode.
- (2) This command is valid even if received in the middle of the line and takes effect immediately.
- (3) If characters overlap as a result of setting/resetting of Italic characters, OR takes place for printing.

3.2.5.7 Emphasized Print Designate/Clear

ESC E n

Name:	Emphasized Print Designate/Clear	
Code	HEX:	1BH 45H n
	DEC:	27 69 n

Function:

- (1) To designate or clear Emphasized Print Mode.
To print characters that are received after this command emphasized in the horizontal direction. Characters in Emphasized Print are heavier in the horizontal direction than normal character pattern. (Horizontally emphasized print)
- (2) Values of n

Values of n	Meaning
01H	Designated Emphasized Print.
00H	Clears Emphasized Print.

The upper seven bits of n are ignored.

- (3) For more about Emphasized Print, refer to Section 4.3.
- (4) Emphasized Print applies to line graphics as well.
- (5) Emphasize Print does not apply to bit images.

3.2.5.8 Double Strike Print Designate/Clear

ESC G n

Name:	Double Strike Print Designate/Clear	
Code	HEX:	1BH 47H n
	DEC:	27 71 n

Function:

- (1) To designate or clear Double Strike Print Mode.
To print again over the characters that are received after this command.
- (2) Values of n

Values of n	Meaning
01H	Designates Double Strike Print Mode.
00H	Clears Double Strike Print Mode.

The upper seven bits of n are ignored.

- (3) To print over the same characters in 2 passes.
- (4) Double Strike Print applies to line graphics as well.
- (5) This command does not prompt print start.
- (6) In Validation Mode, the above setting is valid but printing will be the same as when Double Strike Mode is "cleared."

3.2.5.9 Blanket Print Mode Designate

ESC ! n

Name:	Blanket Print Mode Designate	
Code	HEX:	1BH 21H n
	DEC:	27 33 n

Function:

- (1) To designate printer modes all at once.
- (2) The n is a parameter that designates print modes by each bit, and the correspondence between Print Modes and bits are as follows:

		MSB								LSB		
		b								b		
		7	6	5	4	3	2	1	0			
LSB	0	Print Font	HSD	–	Utility	–						
	1	(Undefined)	–	–	–	–						
	2	(Undefined)	–	–	–	–						
	3	Emphasized Print (Horizontally)	Designate	ESC E 1	Clear	ESC E 0						
	4	Double Height Print	Designate	ESC w 1	Clear	ESC w 0						
	5	Double Width Print	Designate	ESC W 1	Clear	ESC W 0						
	6	(Undefined)	–	–	–	–						
MSB	7	Underline	Designate	ESC-1	Clear	ESC-0						

- (3) Designations by this command have the same effects as by the above individual corresponding commands.

3.2.5.10 Condense Designate

SI

Name:	Condense Designate	
Code	HEX:	0FH
	DEC:	15

Function:

- (1) To designate Condense Print.
To print characters and bit images at 240DPI.
(A printing area does not change; thus, the number of printable columns changes.)
- (2) This command is valid only when received at the start of the line
(If Condense Print Designate and Condense Print Clear are both present in the same line, printing cannot take place.)
- (3) This is valid in all modes of Journal, Receipt, Receipt+Journal, Validation, Slip and Sprocket, and printing is performed at 180DPI if Condense is cleared and at 240DPI if Condense is designated.
- (4) At default, Condense mode is reset.

3.2.5.11 Condense Designate

ESC SI

Name:	Condense Designate	
Code	HEX:	1BH 0FH
	DEC:	27 15

Function:

- (1) To designate Condense Print.
(This is the same function as 3.2.5.10 SI.)

3.2.5.12 Condense Clear

DC2

Name:	Condense Clear	
Code	HEX:	12H
	DEC:	18

Function:

- (1) To clear Condense Print.
To clear Condense Print that has been set by the Condense Designate commands (SI, ESC SI).
- (2) This command is valid only when received at the start of the line.
(If Condense Print Designate and Condense Print Clear are present in the same line, printing cannot take place.)
- (3) At default Condense mode is cleared.
- (4) This command is valid in all print sheet modes, and printing is performed at 180DPI if Condense is cleared and at 240DPI if Condense is designated.

3.2.6 Image Control

This section describes Image Control Function.

3.2.6.1 Bit Image Mode Designate

ESC * m n1 n2

Name:	Bit Image Mode Designate		
Code	HEX:	1BH 2AH m n1n2 data	
	DEC:	27 42 m n1n2 data	

Function:

- (1) Prints in bit image mode set by m.
- (2) Types of bit images set by m:

Parameters		Details			
m		00H (Single density)		01H (Double density)	
Dots in vertical direction		8		8	
Dots per inch (DPI)		90 Full	120 Full (Condense designated)	180 Quasi	240 Quasi (Condense designated)
Max. print dot columns (Number of dots)	Receipt / Journal (Receipt + Journal Same Data Print designated)	252 228 *1	336 304 *1	504 456 *1	672 608 *1
	Receipt + Journal Same Data Print cleared	504(252+252) 456(228+228) *1	672(336+336) 608(304+304) *1	1008(504+504) 912(456+456) *1	1344(672+672) 1216(608+608) *1
	Slip / Validation	567	756	1134	1512
	Sprocket (option)	567	756	1134	1512

*1 The upper value is the number of dots when the width is 76.2mm while the lower values is the number of dots when the width is 69.5mm.

Note) In Double Density, when two or more columns continue horizontally next to each other, adjacent even-number positioned dots cannot be printed.

For details, refer to (9).

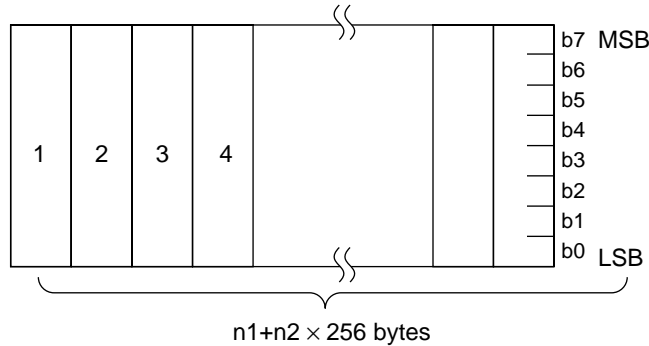
When an m value other than the above is received, the "ESC * m" part of the command will be ignored, and n1 and thereafter will be processed as print data or a function code.

- (3) Definitions and range of n1 and n2
 - (a) Definitions

To specify the number of columns according to the following formula:
Number of columns = $n1+n2 \times 256$
 - (b) Range
 - $0 \leq n1 \leq 255$
 - $0 \leq n2 \leq 255$
 - If $n1=n2=0$, the entire command of ESC* m n1 n2 will be ignored.
- (4) The number of data will be determined based on the number of columns set by n1 and n2.
 - (a) Number of data = $n1+n2 \times 256$ (bytes)
- (5) When a setting exceeding the right margin is made, data up to the right margin will be valid, and data exceeding the right margin will be ignored.

- (6) With Same Data Print cleared in Receipt+Journal Mode, if the position to start receiving data is on the Receipt side, yet goes beyond the Receipt's right margin, the data that goes beyond the right margin will be printed from the Journal's left margin (start of the line). If it goes beyond the Journal's right margin, the data only up to the Journal's right margin will be valid. (See Section 3.4.3.)

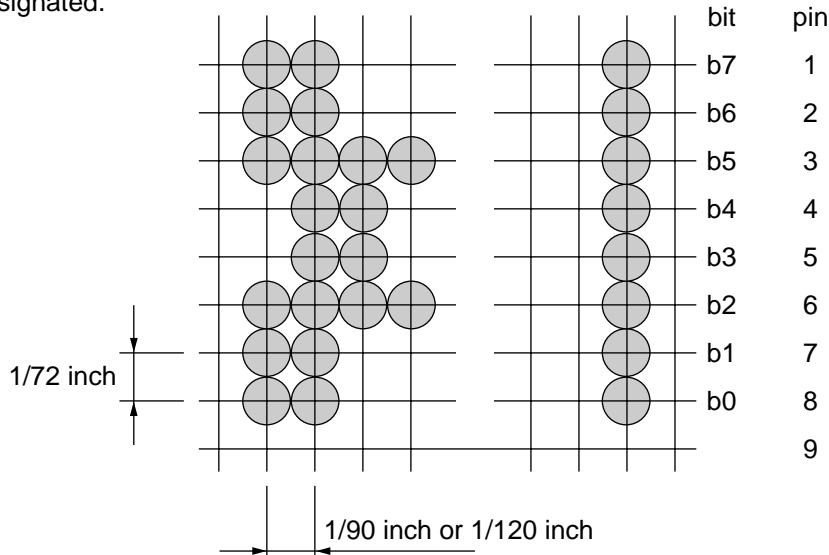
(7) Data Format



Data is written in the above sequence.

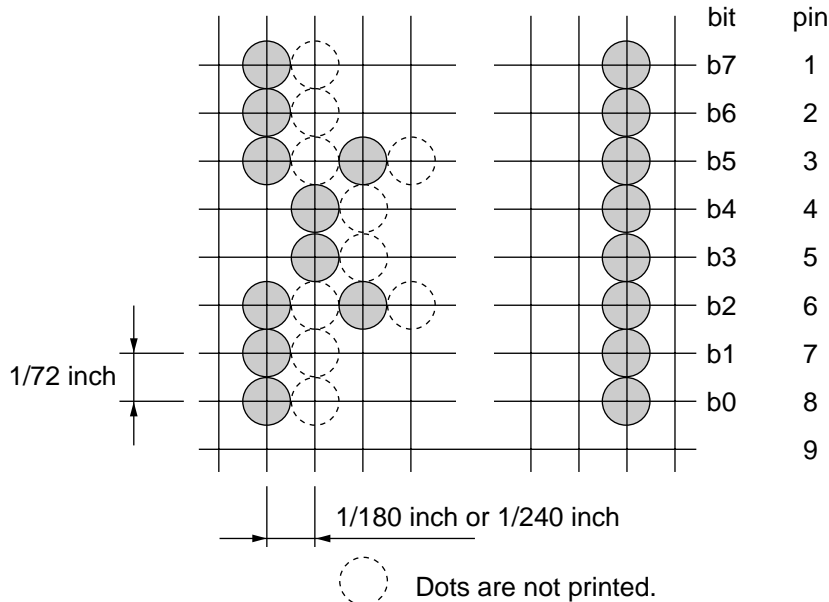
(8) Relationship between data and print head pins (Single density images)

Dot clearance is 1/90" horizontally and 1/72" vertically. It is 1/120" horizontally if Condense is designated.



(9) Relationship between data and print head pins (Double density images)

Dot spacing is 1/180 inch horizontally and 1/72 inch vertically. Dot spacing is 1/240 inch horizontally if Condense is designated.



Name:	9-Pin Bit Image Mode Designate	
Code	HEX:	1BH 5EH m n1n2 data
	DEC:	27 94 m n1n2 data

Function:

- (1) To print according to the bit image set by m.
- (2) Types of bit images that are set by m are as follows:

Parameters		Details			
m		00H (Single density)		01H (Double density)	
Dots in vertical direction		9		9	
Dots per inch (DPI)		90 Full	120 Full (Condense designated)	180 Quasi	240 Quasi (Condense designated)
Max. print dot columns (Dots)	Receipt / Journal (Receipt + Journal Same Data Print designated)	252 228 *1	336 304 *1	504 456 *1	672 608 *1
	Receipt + Journal Same Data Print cleared	504(252+252) 456(228+228) *1	672(336+336) 608(304+304) *1	1008(504+504) 912(456+456) *1	1344(672+672) 1216(608+608) *1
	Slip / Validation	567	756	1134	1512
	Sprocket (option)	567	756	1134	1512

*1 The upper value is the number of dots when the width is 76.2mm while the lower values is the number of dots when the width is 69.5mm.

Note) In Double Density, when two or more columns continue horizontally next to each other, adjacent even-number positioned dots cannot be printed.

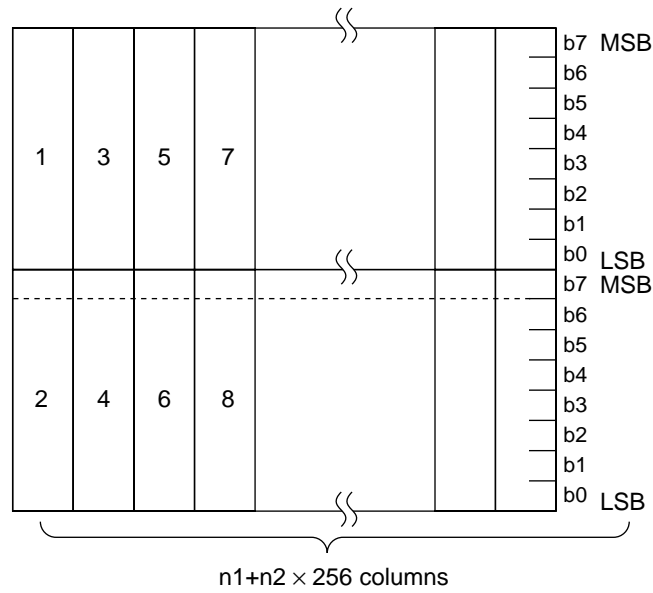
For details, refer to (9).

When an m value other than the above is received, the ESC ^ m part of the command will be ignored, and n1 and thereafter will be processed as print data or a function code.

- (3) Definitions and range of n1 and n2
 - (a) Definitions

To specify the number of columns according to the following formula:
Number of columns = $n1+n2 \times 256$
 - (b) Range
 - $0 \leq n1 \leq 255$
 - $0 \leq n2 \leq 255$
 - If $n1=n2=0$, the entire command of ESC ^ m n1 n2 will be ignored.
- (4) The number of data will be determined by doubling the columns based on the number of columns set by n1 and n2.
 - (a) Number of data = $n1+n2 \times 256 \times 2$ (bytes)
- (5) When a setting exceeding the right margin is made, data up to the right margin will be valid, but data exceeding the right margin will be ignored.
- (6) With Same Data Print cleared in Receipt+Journal Mode, if the position to start receiving data is on the Receipt side, yet goes beyond the Receipt's right margin, the data that goes beyond the right margin will be printed from the Journal's left margin (start of the line). If it goes beyond the Journal's right margin, the data only up to the Journal's right margin will be valid. (See Section 3.4.3.)

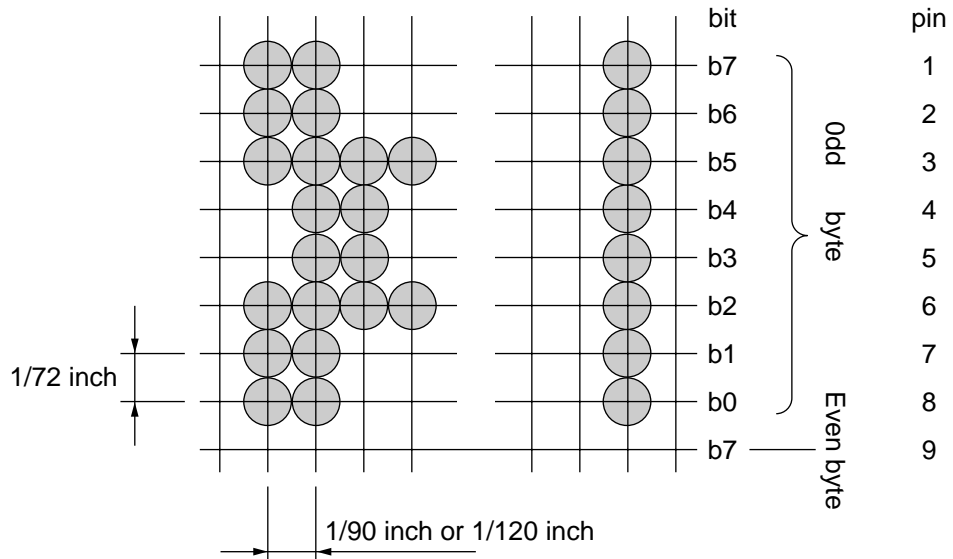
(7) Data format



Data is written in the above sequence. The number of data is twice that of columns.
 Bit 7 of even bytes will form a 9-pin image.

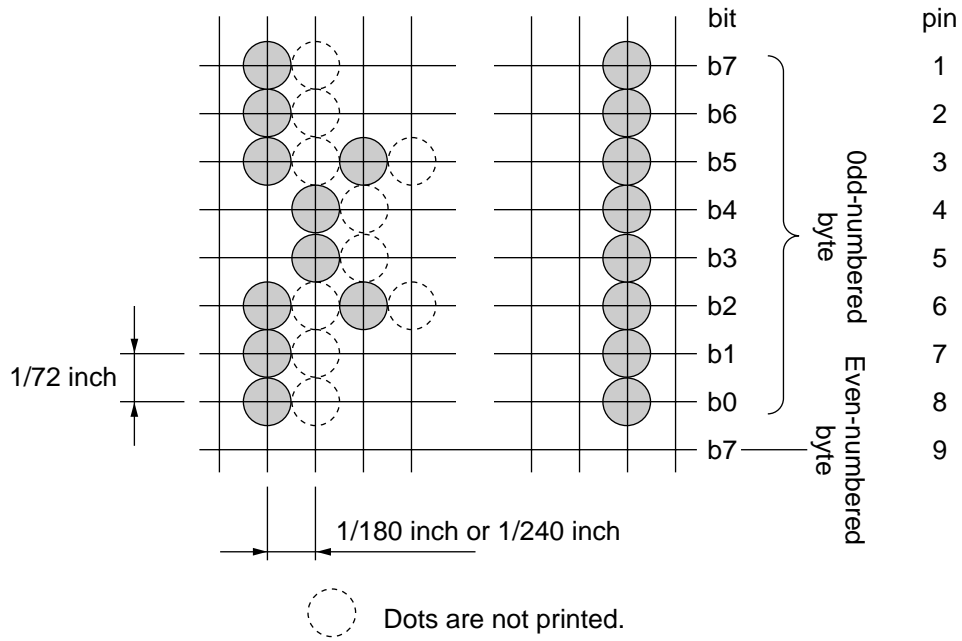
(8) Relationship between data and print head pins (Single density images)

Dot clearance is 1/90" horizontally and 1/72" vertically. It is 1/120" horizontally if Condense is designated.



(9) Relationship between data and print head pins (Double density images)

Dot clearance is 1/180 inch horizontally and 1/72 inch vertically. Dot clearance is 1/240 inch horizontally if Condense is designated.



3.2.7 Print Sheet Control

This section describes the print sheet control functions.

3.2.7.1 Print Sheet Select

ESC c 0 n

Name:	Print Sheet Select	
Code	HEX:	1BH 63H 30H n
	DEC:	27 99 48 n

Function:

- (1) To select print sheet subject to printing.
- (2) The n is a parameter that designates print sheet by the bit, and the correspondence between print sheet and bit is as follows:

		MSB		LSB		
		b	|	b		
		7	|	0		
		6	|	1		
		5	|	2		
		4	|	3		
		3	|	4		
		2	|	5		
		1	|	6		
		0	|	7		
		7	|	0		
		6	|	1		
		5	|	2		
		4	|	3		
		3	|	4		
		2	|	5		
		1	|	6		
		0	|	7		
LSB	0	Journal *1	bit value=1	Valid	bit value=0	Invalid
	1	Receipt *1	Valid	Invalid		
	2	Slip	Valid	Invalid		
	3	Validation	Valid	Invalid		
	4	(Undefined)	–	–		
	5	(Undefined)	–	–		
	6	(Undefined)	–	–		
MSB	7	(Undefined)	–	–		

- Undefined bits will be masked; therefore, either 0 or 1 can be set.
 - Only the combination of Receipt+Journal is valid; other types of print sheet are valid only if they are individually selected. If any other combinations than Receipt+Journal are set, the entire command will be ignored.
 - If all types of print sheets are invalid, the entire command is ignored.
- *1 With the 1 Roll Model, if either Journal (bit0) or Receipt (bit1) is valid, Roll paper becomes valid.
- (3) When this command is received while a line is being received, the entire command will be ignored.
 - (4) To perform Eject when the following print sheet switch takes place, in the same way as when the FF command is received:
 - (a) Switch from Slip to Receipt/Journal/Receipt+Journal.
 - (b) Switch from Slip to Validation.
 - (5) To set Print Sheet to Receipt+Journal regardless of the setting by this command when the option tractor is installed and the lever is switched.
 - (6) With the optional tractor installed, if this command is received when the lever is set to Tractor, the setting of Receipt/Journal/Receipt+Journal is valid. (Any other print sheet settings are invalid.)
 - (7) Line feed pitch can be set separately for each print sheet in a combination of the set sheet selection and the Line Feed Pitch Set command.

(In Receipt+Journal Mode, line feed is performed according to each set line-feed pitch at the execution of LF.)
 - (8) Whether to or not to stop printing at Paper Out can be set separately for each print sheet by the Stop Print Sensor Select.
 - (9) The default print sheet is Receipt+Journal.

When the option tractor is installed and the lever is set to the Tractor side, if the sprocket paper has been fed, the default print sheet will be Sprocket.

Name:	Set Sheet Select	
Code	HEX:	1BH 63H 31H n
	DEC:	27 99 49 n

Function:

- (1) To select a sheet subject to setting the line feed pitch.
- (2) The n is a parameter that designates a sheet (s) that becomes subject to setting by the bits. Correspondence between print sheet and bit is as follows:

MSB	LSB
b	b
7	0
6	1
5	2
4	3
3	4
2	5
1	6
0	7

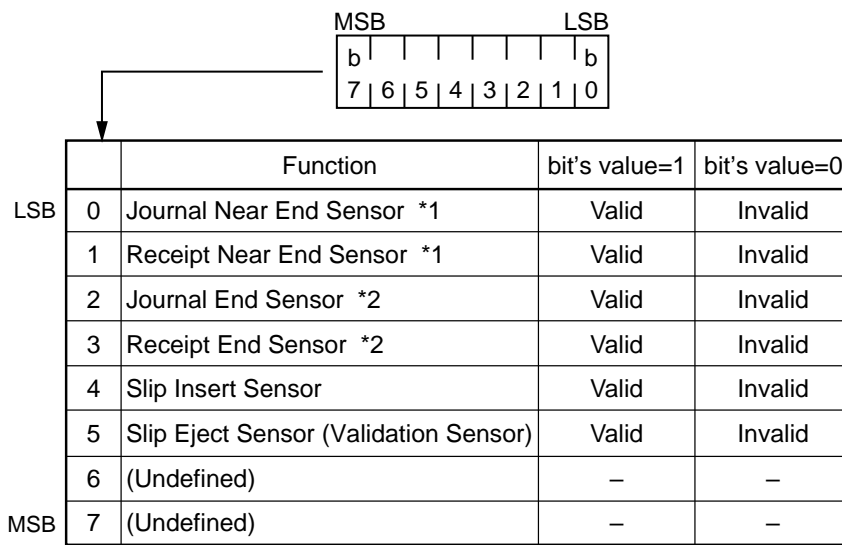
	Function	bit's value=1	bit's value=0
LSB	0 Journal *1	Valid	Invalid
	1 Receipt *1	Valid	Invalid
	2 Slip	Valid	Invalid
	3 (Validation)	Valid	Invalid
	4 (Undefined)	–	–
	5 (Undefined)	–	–
	6 (Undefined)	–	–
MSB	7 (Undefined)	–	–

- Undefined bits will be masked. Therefore either 0 or 1 setting is permitted.
 - Multiple sheets can be selected simultaneously and in that case all the selected sheets will be subject to selection.
 - If all types of print sheets are invalid, the LF Pitch Set command is ignored in its entirety.
- *1 With the 1 Roll Model, if either Journal (bit0) or Receipt (bit1) is valid, Roll paper becomes valid.
- (3) The settings by this command are applied when the following setting commands are received:
 - Line Feed Pitch Set command: ESC 0, ESC 1, ESC 2, ESC 3 n, ESC A n, ESC % 9 n
 - (4) At default, all types of print sheet are subject to this command. (Valid with all.)
 - (5) Even if Validation is made valid, there are no other items to actually set.
 - (6) To disable Set Sheet selection of Sprocket, which can be set by ESC DLE c Pno 1 n.

Name:	Paper Sensor Select Enabling Paper End Signal	
Code	HEX:	1BH 63H 33H n
	DEC:	27 99 51 n

Function:

- (1) To select a paper sensor that enables the Paper End Signal.
- (2) Range of n
00H ≤ n ≤ FFH
- (3) To select a status of the sensor to enable the paper end signal.
- (4) The n is a parameter that designates the sensor by the bit, and the correspondence between the sensor and each bit is as follows:



- Undefined bits will be masked. Therefore either 0 or 1 setting is permitted.
 - Multiple sheets can be selected simultaneously and in that case all the selected sheets will be subject to selection.
- *1 With the 1 Roll Model, if either Journal Near End sensor (bit0) or Receipt Near End sensor (bit1) is valid, the Roll Paper Near End sensor will become valid.
 - *2 With the 1 Roll Model, if either Journal Near End sensor (bit2) or Receipt Near End sensor (bit3) is valid, the Roll Paper Near End sensor will become valid.
- (5) If multiple sensors are designated to Enable, when one of the sensors has detected paper end, the paper end signal will be enabled.
 - (6) This command becomes valid only with the parallel interface; it is received and ignored until ESC c 3 n with the serial interface.
 - (7) The initial state of this command conforms to the settings of the menu "Paper End Signal".
 "Yes (RNE or RE)" : n = 0FH (Receipt/Journal Near End Sensor and End Sensor enabled)
 "Yes (RE)" : n = 0CH (Receipt/Journal End Sensor enabled)
 "No" : n = 00H (all the sensors disabled)
 - (8) If the sensor that has been set valid by this command detects Paper End without regard to the selected, the paper end signal will be enabled.
 (Example) When bit4 (Slip Insert sensor) of ESC c 3 n is valid, even if the selected print sheet is Receipt, the Paper End signal will be enabled in the Slip paper end status.
 - (9) To enable/disable the Paper End signal solely based on the sensor status.
 (Example) The Paper End signal is enabled/disabled according to a status of the Slip Insert sensor and Slip Eject sensor, even if Slip paper has been already fed.
 - (10) The Fault signal, too, will change together with the Paper End signal.
 The Busy signal will not change.
 - (11) The setting of Paper End signal enable/disable by this command will not affect the status of the LED (ON, OFF, Blink) influenced by the status of each paper sensor.

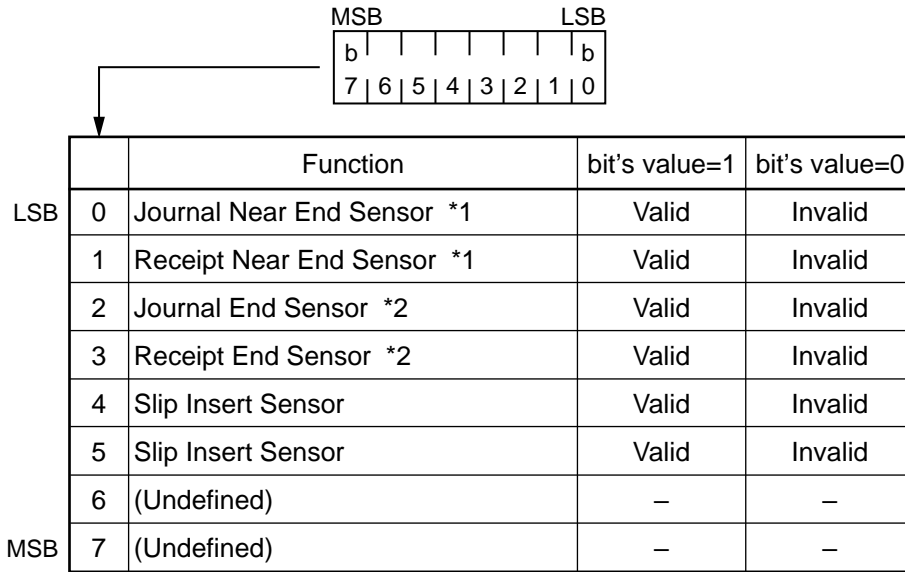
3.2.7.4 Print Stop Sensor Select

ESC c 4 n

Name:	Stop Print Sensor Select	
Code	HEX:	1BH 63H 34H n
	DEC:	27 99 52 n

Function:

- (1) To select in which sensor status printing should be stopped.
- (2) The n is a parameter that designates a sensor(s) by the bit. The correspondence between sensor and bit is as follows:



- Undefined bits will be masked. Therefore, setting either 0 or 1 is permitted.
- Multiple sensors can be selected simultaneously and in that case, all the selected sensors become subject to this command.
- If either bit 4 or bit 5 is "1," the Slip Insert sensor takes effect.

*1 With the 1 Roll Model, if either Journal Near End sensor (bit0) or Receipt Near End sensor (bit1) is valid, Roll paper Near End sensor will become valid.

*2 With the 1 Roll Model, if either Journal Near End sensor (bit2) or Receipt Near End sensor (bit3) is valid, the Roll paper Near End sensor will become valid.

- (3) The initial state of this command is as follows:
n = 0CH
Only the Journal End sensor and Receipt End sensor are valid; any other sensors are invalid.
- (4) The sensors that determine the validity of setting by this command vary, depending on the selection of print sheet.
 - If print sheet is Receipt, the setting by bit 1 and bit 3 takes effect.
 - If print sheet is Journal, the setting by bit 0 and bit 2 takes effect.
 - If print sheet is Receipt+Journal, the setting by bit 0,bit 1, bit 2 and bit 3 takes effect.
 - If print sheet is Slip, the setting by bit 4 and bit 5 takes effect.
 - If print sheet is Validation, Print Stop Sensor Select is disabled, and printing will stop as with the Slip Eject sensor (Validation sensor) at paper end. (Valid Print Stop Sensor is fixed.)
 - If print sheet is Sprocket, Print Stop Sensor Select is disabled, and the bottom edge of paper is monitored by the Slip Insert sensor, and when it goes beyond the printable area, printing will stop. (Valid Print Stop sensor is fixed.)

Name:	Cut Form Wait Time Set	
Code	HEX:	1BH 66H t1 t2
	DEC:	27 102 t1 t2

Function:

- (1) To set a time for the printer to wait for Slip and Validation to be inserted and a time till an operation begins after either is inserted. (Feeding Slip or printing Validation.)
- (2) Definition and range of t1
 - (a) Definition
t1 specifies a time to wait for Slip or Validation to be inserted in increments of a minute.
 - (b) Range $00H(0D) \leq t1 \leq 0FH(15D)$
When the value of t1 is other than the above, the entire command is ignored.
 - (c) When t1=0, a wait time for paper to be inserted is infinite.
 - (d) If paper insertion is not detected even after the time specified by t1 has elapsed, Slip or Validation Print Sheet Mode will automatically be cancelled, and Receipt+Journal Print Sheet mode becomes effective.
 - (e) If Slip is ejected because the switch is pressed while receiving data for the line and the printer waits for insertion, a wait time will be infinite regardless of the setting by this command.
The printer waits for insertion after paper eject has been made by the switch, only when the Slip Print Stop Sensor is effective (bit5=1 of ESC c 4 n).
 - (f) Default setting is limitless. (t1=0)
- (3) Meaning and range of t2
 - (a) Meaning
t2 specifies a time to start of operation following insertion, in increments of 0.1 second.
Start of operation following insertion means an operation of starting feeding paper if Slip is selected and printing if Validation is selected.
 - (b) Range $00H(0D) \leq t2 \leq 40H(64D)$
If the value of t2 is other than above the entire command will be ignored.
 - (c) Default setting is 1 second (t2=10)
- (4) This command becomes valid regardless of the selected Print Sheet(s), but the setting itself becomes effective in the Slip or Validation Print Sheet Mode.
- (5) This setting cannot be made separately for Slip and Validation Print Sheet.
(The same setting is used for Slip and Validation.)
- (6) The same time value(s) will be used in MICR Read Mode as well.

3.2.7.6 Full Cut

ESC i

Name:	Full Cut	
Code	HEX:	1BH 69H
	DEC:	27 105

Function:

- (1) To cut the entire Receipt when "Auto Cutter Yes" is set in "Auto Cutter YES/NO" on the menu. (If an Auto Cutter is not installed, however, Auto Cutter Alarm will occur.)
- (2) If "Auto Cutter No" is set in "Auto Cutter YES/NO" on the menu, the entire command will be ignored (regardless of Auto Cutter being installed or not).
- (3) To operate without regard to the print sheet mode or the print sheet status.

3.2.7.7 Partial Cut (one point left intact)

ESC m

Name:	Partial Cut (1 point left intact)	
Code	HEX:	1BH 6DH
	DEC:	27 109

Function:

- (1) To cut Receipts leaving 1 point intact when "Auto Cutter Yes" is set in "Auto Cutter YES/NO" on the menu. (If an Auto Cutter is not installed, however, Auto Cutter Alarm occurs.)
- (2) If "Auto Cutter No" is set in "Auto Cutter YES/NO" on the menu (regardless of Auto Cutter being installed or not), the entire command will be ignored.
- (3) To operate without regard to the print sheet mode or the print sheet status.

3.2.7.8 Receipt+Journal Same Data Print Designate/Clear

ESC z n

Name:	Receipt+Journal Same Data Print Designate/Clear	
Code	HEX:	1BH 7AH n
	DEC:	27 122 n

Function:

- (1) To designate or clear Same Data Print with Receipt+Journal.
- (2) Value of n

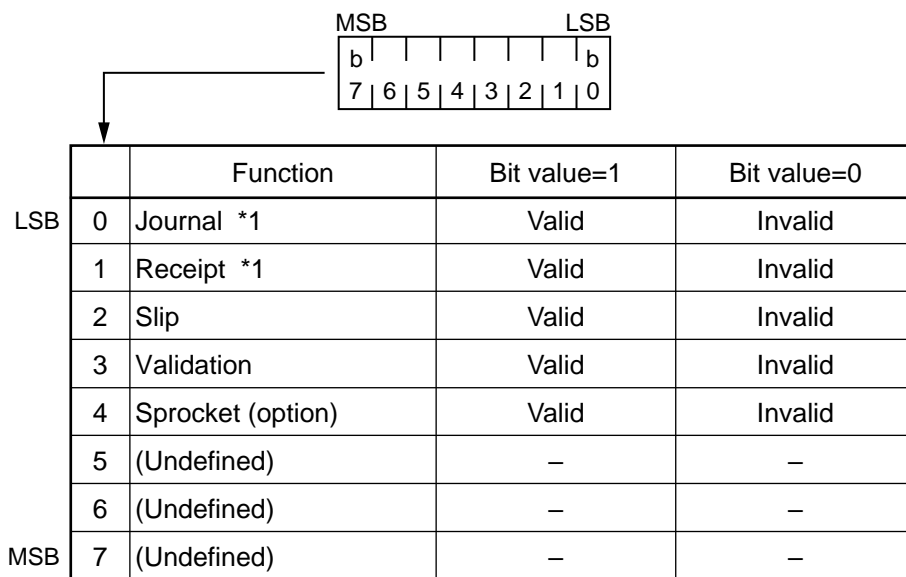
Mn	Definition
01H	Designates Same Data Print
00H	Clears Same Data Print

- Upper 7 bits of n are ignored.
- (3) Default value: n=00H (Same Data Print Clear)
 - (4) This is valid only when received at the start of the line.
 - (5) The Setting (designate or clear) is valid even in other modes than Receipt+Journal.
 - (6) If Same Data Print is designated, the same data is printed to both Receipt and Journal. Line feed, however, will be performed according to the line feed pitch set for each.
 - (7) If Same Data Print is cleared, the line will be treated as with the line that includes a skip area in the printing area.

Name:	Print Sheet Select	
Code	HEX:	1BH 10H 63H Pno 30H n
	DEC:	27 16 99 Pno 48 n

Function:

- (1) To select a sheet subject to printing.
- (2) The MSB of DLE (10H) in the command sequence will be ignored. ("90H" is effective as well.)
- (3) Valid range and definition of parameter
 - (a) Pn0: To designate the bytes (parameters) following ESC DLE c Pno. Its MSB will be ignored.
Range: 00H ≤ Pno ≤ FFH
With this command, Pno=2.
 - (b) n: A parameter that designates a print sheet by the bit, and the correspondence between print sheet and bit is shown below.



- Undefined bits will be masked; therefore, either 0 or 1 can be set.
- Only the combination of Receipt+Journal is valid; other types of print sheet are valid only if they are individually selected. If any other combinations than Receipt+Journal are set, they will be ignored in their entirety.
- If all types of print sheets are invalid, the command is ignored in its entirety.

*1 With the 1 Roll Model, if either Journal(bit0) or Receipt(bit1) is valid, Roll paper will be valid.

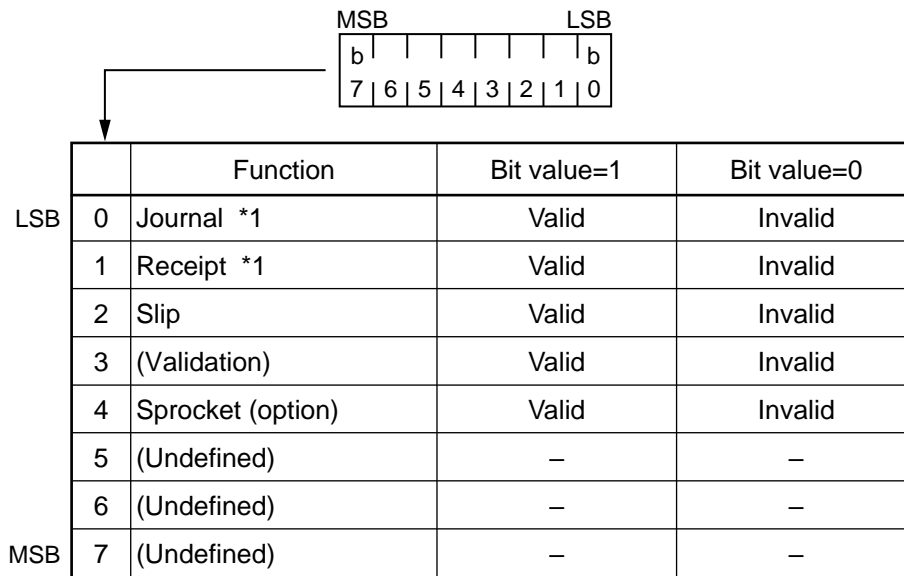
- (4) When this command is received while a line is being received, the entire command will be ignored.
- (5) To perform Eject when the following print sheet switch takes place, in the same way as when the FF command is received:
 - (a) Switch from Slip to Receipt/Journal/Receipt+Journal.
 - (b) Switch from Slip to Validation.
- (6) To set Print Sheet to Receipt+Journal when the option tractor is installed and the lever is switched to either side (Tractor side or Slip side) regardless of the setting by this command.
- (7) With the optional tractor installed and the lever set to the Tractor side, only the setting of Receipt/Journal/Receipt+Journal/Sprocket is valid when this command is received. (Any other print sheet setting is invalid.)

- (8) Line feed pitch can be set separately for each print sheet by the combination of the Set Sheet Select and the Line Feed Pitch Set commands.
(In Receipt+Journal Mode, line feed is performed according to each set line-feed pitch at the execution of LF.)
- (9) Whether to or not to stop printing at Paper End can be set separately for each print sheet by the Stop Print Sensor Select.
- (10) The default print sheet is Receipt+Journal.
With the option tractor installed, the lever set to Tractor, and the sprocket paper loaded, the default print sheet is Sprocket.
- (11) When the optional tractor is not installed, or when the optional tractor is installed but the lever is not set to Tractor, the selection of Sprocket will be invalid.
- (12) This command is exactly the same as ESC c 0 n except for Sprocket being added to bit 4 relative to the parameter n.

Name:	Set Sheet Select	
Code	HEX:	1BH 10H 63H Pno 31H n
	DEC:	27 16 99 Pno 49 n

Function:

- (1) To select a sheet subject to line feed pitch setting and page length setting.
- (2) The MSB of DLE (10H) in the command sequence will be ignored. ("90H" is effective as well.)
- (3) Valid range and definition of n
 - (a) Pn0: To designate the number of bytes (parameters) following ESC DLE c Pno. Its MSB will be ignored.
Range: 00H ≤ Pno ≤ FFH
With this command, Pno=2.
 - (b) n: A parameter that designates a sheet subject to setting by the bit, and the correspondence between sheet and bit is shown below.



- Undefined bits will be masked; therefore, either 0 or 1 can be set.
- Multiple sheets can be selected at the same time, and in that case all sheets are subject to setting.
- If all types of print sheets are invalid, the Line Feed Pitch and Page Length Set commands will be ignored in their entirety.

- *1 With the 1 Roll Model, if either Journal (bit0) or Receipt(bit1) is valid, Roll paper will be valid.
- (4) The settings by this command are applied when the following setting commands are received:
 - Line Feed Pitch Set command : ESC 0, ESC 1, ESC 2, ESC 3 n,
 ESC A n, ESC % 9 n
 - Page Length Set command : ESC C n
 - Perforation Skip Set/Reset command : ESC N n, ESC O

* Even if Validation is valid (bit3=1), it will not affect the settings by the above commands.
 - (5) At default, all types of print sheet are subject to this command. (All sheets are valid.)
 - (6) This command is exactly the same as ESC c 1 n except for addition of Sprocket to bit 4 relative to the parameter n. Upon reception of ESC c 1 n, however, Set Sheet Select for Sprocket will be become invalid.

3.2.8 Printer Hardware Control

This section describes the printer hardware control functions.

3.2.8.1 Peripheral Device Select

ESC = n

Name:	Peripheral Device Select		
Code	HEX:	1BH 3DH n	
	DEC:	27 61 n	

Function:

- (1) To select a peripheral device, with which data input from the host PC becomes valid.
- (2) Definition of bits in n:

Bit	Device	Value	
		0	1
0	Printer	Deselected	Selected
1	Customer Display	Deselected	Selected
2	(Undefined)	–	–
3	(Undefined)	–	–
4	(Undefined)	–	–
5	(Undefined)	–	–
6	(Undefined)	–	–
7	(Undefined)	–	–

If the value of n is other than the above, the command will be ignored in its entirety.

- Printer and Customer Display can be simultaneously selected or deselected.
- (3) Presence of any data that has not yet been printed before reception of data command will not invoke print start.
 - (4) With the setting of Printer Deselected, this printer will ignore all data it receives (except for DLE ENQ 02H) until selected by this command.
 - (5) If there is any data not printed as yet before Printer Deselected takes effect, that data will be printed when print start is prompted after Printer Selected takes placed.
 - (6) Even if Printer Deselected is in effect, the printer sometimes goes Off-line through some printer operations (the cover is opened or SW on the Operator Panel is pressed).

(7) Default

(a) At POW ON, reception of I-PRIME signal (Parallel model)/Reset signal (Serial model)

n	Customer Display connected or disconnected
02H	DIP-SW 1-8 setting on the Serial I/F board is Customer Display connect *1
01H	DIP-SW 1-8 setting on the Serial I/F board is Customer Display disconnect *1

(b) Execution of ESC@

Default setting by ESC@ is determined according to the value designated by ESC = and the menu setting immediately prior to the process of ESC@, as shown in the table below.

Preceding setting (n)		01H	02H	03H
After ESC @ Process	DIP-SW 1-8 setting on the Serial I/F board is Customer Display connect *1	01H	02H *2	02H
	DIP-SW 1-8 setting on the Serial I/F board is Customer Display disconnect *1	01H	02H *2	01H

*1 Fixed to Disconnect with Parallel models.

*2 In the Printer Deselected state, the printer will not process ESC @; thus, the value set in ESC = will not change.

Customer Display is optional and can be connected only with the Serial models.

The command itself is valid, however, even with the Parallel models.

Name:	Peripheral Device Status Send	
Code	HEX:	1BH 75H n
	DEC:	27 117 n

Function:

- (1) To create(send) a status of the connector pin “n” at execution of the command.
- (2) Types of n:

n	Connector Pin
00H 30H	Drawer Kick Connector Pin #3

(Notes)

(Notes common to Parallel/Serial)

- (a) Bit 0 is always “1” if nothing is connected to the connector.
- (b) If ASB by the command GS a or ESC DLE a is valid, it becomes necessary to distinguish a status by this command from a status by ASB.
- (c) If the value of n is other than the defined range, the command will be ignored in its entirety.
- (d) If the printer holds one status by ASB and another by this command, it sends the one by ABS first.

(Notes specific to Parallel Mode)

- (a) This command is executed as incoming data is processed in the receive buffer and a one-byte status is created. This status is sent at the request from the host PC for reverse data transfer.
- (b) There may be some delay incurred between command reception and status creation, depending on the status of the receive buffer.
- (c) If the host PC does not request reverse data transfer after reception of this command, data will be held to the maximum of 100bytes (except a status by ASB). If the size of data held exceeds 100 bytes, reception of this command will not prompt creating data to be sent to the host PC.

(Notes specific to Serial Mode)

- (a) This command is executed as incoming information is processed in the receive buffer, and a one-byte status is sent.
- (b) With DTR/DSR Control selected, the printer sends one byte after confirming that the host PC is enable to receive (DSR Signal is in SPACE). If the host PC is not enable to receive (DSR Signal is in MARK), the printer keeps waiting until the host becomes enabled to receive. With XON/XOFF Control selected, the printer sends one byte without confirming the status of the DSR signal.
- (c) This command is executed as incoming data is processed in the receive buffer; thus, there may be some delay incurred between command reception and status creation, depending on the status of the receive buffer.

Statuses to be sent:

	Functions	Bit value= 0	Bit value= 1
LSB	0 Drawer Kick Connector Level of Pin #3	"L"	"H"
	1 (Undefined)	–	–
	2 (Undefined)	–	–
	3 (Undefined)	–	–
	4 (Fixed)	Fixed at 0.	Fixed at 0.
	5 (Undefined)	–	–
	6 (Undefined)	–	–
MSB	7 (Fixed)	Fixed at 0.	Fixed at 0.

- For any undefined bits, 0 will be sent.

3.2.8.3 Panel Switch Enable/Disable

ESC c 5 n

Name:	Panel Switch Enable/Disable	
Code	HEX:	1BH 63H 35H n
	DEC:	27 99 53 n

Function:

- (1) To switch Enable/Disable for all the panel switches.
To enable the panel switch if n has bit0=0.
To disable the panel switch if n has bit0=1.
- (2) Range of n
 - 00H ≤ n ≤ FFH
 - Only the LSB of n is valid.
- (3) If any of the panel switches is disabled by this command, all panel switches will be disabled. (Except for Cover Open)
- (4) Reception of this command will not invoke printing of data that has not yet been printed.

3.2.8.4 Print Data Cancel

CAN

Name:	Cancel Print Data	
Code	HEX:	18H
	DEC:	24

Function:

- (1) To clear the contents of the print buffer for the line, at which this command was received and shift the next print start position to the Left Margin position.
The data for which print start has already been prompted cannot be cleared, however.
To clear the contents of the print buffer for Receipt and Journal within the same line if Same Data Print Clear is in effect while in the Receipt+Journal mode.
- (2) Only data that is canceled is the print data (including spaces, etc.) within the line, at which this command was received.
Therefore, print modes such as Double Width are not canceled.

3.2.8.5 Printer Initialize

ESC @

Name:	Printer Initialize	
Code	HEX:	1BH 40H
	DEC:	27 64

Functions:

- (1) To initialize printer settings.
- (2) To clear all printing data in the print buffer and initialize each setting.
The data in the line that has already been received and for which print start has already been invoked prior to reception of this command cannot be cleared. The receive buffer is not cleared either.
- (3) Refer to 3.4.1 for defaults.
- (4) Default print sheet is Receipt+Journal.
If the optional tractor is installed, the lever is set to Tractor, and Sprocket paper is loaded, then default print sheet is Sprocket paper.
- (5) To eject paper according to the sensor monitoring if Slip is already loaded, and start initializing after removal of paper.
(This is the same ejecting action as reception of the FF command without Eject Length set.)
- (6) With the optional tractor installed, the lever set to Tractor and Sprocket paper loaded the position where this command is received is the TOF position for Sprocket paper.
(If it happens to be in the cut position, then the cut position remains effective.)
- (7) When Sprocket paper (with optional tractor installed) is set for print sheet, even if the print sheet is not present at the Slip sensor at the time of reception of this command, the paper loaded status will remain effective.
- (8) For Validation (already loaded), initialization starts after removal of paper.
- (9) This command becomes invalid if Printer is not selected by the command ESC = (Peripheral Device Select).

3.2.8.6 Unidirectional Print Designate/Clear

ESC U n

Name:	Unidirectional Print Designate/Clear	
Code	HEX:	1BH 55H n
	DEC:	27 85 n

Functions:

- (1) To designate/clear Unidirectional Print (printing from left to right).
- (2) Value and definitions of n

Value of n	Designation
01H	Unidirectional Print Designate
00H	Unidirectional Print Clear (Bidirectional)

The upper seven bits of n are ignored.

- (3) To print in a single direction starting with the line at which the Unidirectional Print Designate command was received.
- (4) To print in two directions starting with the line at which the Unidirectional Print Clear command was received.
- (5) If both Designate and Clear are present in the same line, whichever print direction is set last will take effect.
- (6) Default is Bi-directional Print.

3.2.8.7 One Line Unidirectional Print

ESC <

Name:	One Line Unidirectional Print	
Code	HEX:	1BH 3CH
	DEC:	27 60

Functions:

- (1) To print from left to right the line at which this command was received.
(To move the head to the home position. As a result, Unidirectional printing takes place.)
- (2) This command is not continual.
- (3) This command does not invoke printing.
- (4) This can be set effectively anywhere in the line.

Name:	Paper Sensor Status Send	
Code	HEX:	1BH 76H
	DEC:	27 118

Functions:

- (1) To create(send) a status of the paper sensor at the time of command execution.

Notes)

(Items common to both Parallel and Serial Models)

- (a) If ASB by the command GS a or ESC DLE a is effective, it is necessary to distinguish a status by this command from one by ASB.
- (b) Statuses of all the sensors are monitored regardless of the selected paper mode. (With the sensor for other than the selected paper mode, its status to be created(sent), too, will change if its state changes.)
- (c) Presence of print data not printed as yet at the time of reception of this command will not prompt printing.
- (d) If the printer holds one status by ASB and another by this command, it sends the one by ASB first.

(Notes specific to Parallel Mode)

- (a) This command is executed as incoming data is processed in the receive buffer and a one-byte status is created after printing and paper feeding has completely stopped. (Its status create timing is different from ESC u, GSI, or GS r 2.) This status is sent at the request from the host PC for reverse data transfer.
- (b) There may be some delay incurred between command reception and status creation, depending on the status of the receive buffer.
- (c) If the host PC does not request reverse data transfer after reception of this command, data will be held to the maximum of 100bytes (except a status by ASB). If the size of data held exceeds 100 bytes, reception of this command will not prompt creating data to be sent to the host PC.

(Notes specific to Serial Mode)

- (a) This command is executed as incoming information is processed in the receive buffer, and a one-byte status is created and sent after printing and paper feeding has completely stopped.
(Its status create timing is defferent from ESC u, GS I, or GS r 2.)
- (b) With DTR/DSR Control selected, the printer sends one byte after confirming that the host PC is enable to receive (DSR Signal is in SPACE). If the host PC is not enable to receive (DSR Signal is in MARK), the printer keeps waiting until the host becomes enabled to receive.
With XON/XOFF selected, the printer sends one byte without confirming the status of the DSR signal.
- (c) There may be some delay incurred between command reception and status creation, depending on the status of the receive buffer.

	Functions	Bit value= 0	Bit value= 1	
LSB	0	Journal Near End Sensor	Paper present	Paper End
	1	Receipt Near End Sensor	Paper present	Paper End
	2	Journal Paper Sensor	Paper present	Paper End
	3	Receipt Paper Sensor	Paper present	Paper End
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	Slip Insert Sensor (Sprocket Insert Sensor)	Paper present	Paper End
MSB	6	Slip Exit Sensor (Validation sensor)	Paper present	Paper End
	7	(Fixed value)	Fixed at 0	Fixed at 0

Bit 0, 1: With 1-Roll model, the Roll paper Near End Sensor status takes effect.

Bit 2, 3: With 1-Roll model, the Roll paper End Sensor status takes effect.

Name:	Menu Item Set	
Code	HEX:	1BH 10H 44H Pno Pa1 Pb1 ... Pan Pbn
	DEC:	27 16 68 Pno Pa1 Pb1 ... Pan Pbn

Functions:

- (1) To set Menu.
- (2) MSB of DLE (10H) in the command sequence is invalid. ("90H" is effective as well.)
- (3) Valid range and meaning of parameters
 - (a) Pno: Designates the number of bytes (parameters) following ESC DLE D Pno.
MSB is invalid.
Range $00H \leq Pno \leq FFH$
If Pno=00H or 01H, the menu settings do not change, but initialization takes place.
If Pno=01H, whatever follows, up to one byte, is the sequence.
 - (b) Pa: Sets the Menu item number.
If Bit6=1, then it is recognized as a Pa parameter.
MSB is invalid.
Range $40H \leq Pa \leq 7F, 0H \leq Pa \leq FFH$
 - (c) Pb: Sets Menu set values.
If Bit6=0, it is recognized as a Pb parameter.
MSB is invalid.
Range $00H \leq Pb \leq 3F, 80H \leq Pb \leq BFH$
- (4) Printing is activated when ESC DLE D is received.
- (5) After the settings by this command are completed, each mode is set to default.
(For the initial state, refer to Section 3.4.1.)
- (6) EEPROM contents are rewritten by this command setting.
However, it does not write in EEPROM, when the setting items by this command are the same as the Menu settings.
- (7) The following shows examples of command sequences.

No.	Command sequences	Designation
1	ESC DLE D 04H Pa1 Pb1 Pa2 Pb2	Sets Pa1 item at Pb1 and Pa2 item at Pb2.
2	ESC DLE D 03H Pa1 Pb1 Pa2	Sets Pa1 item at Pb1 and ignores Pa2.
3	ESC DLE D 03H Pa1 Pa2 Pb2	Sets Pa2 item at Pb2 and ignores Pa1.
4	ESC DLE D 03H Pb1 Pb2 Pb3	Ignores Pb1 Pb2 Pb3 entirely.
5	ESC DLE D 03H Pa1 Pb1 Pb2	Sets Pa1 item at Pb2 and ignores Pb1.
6	ESC DLE D 03H Pa1 Pa2 Pb2	Ignores Pa2 when Pa2 is out of the range (undefined value) invalidates Pa1. Thus, settings do not change. The same applies when Pb2 is out of the range.

(8) The following shows Pa and Pb setting values.

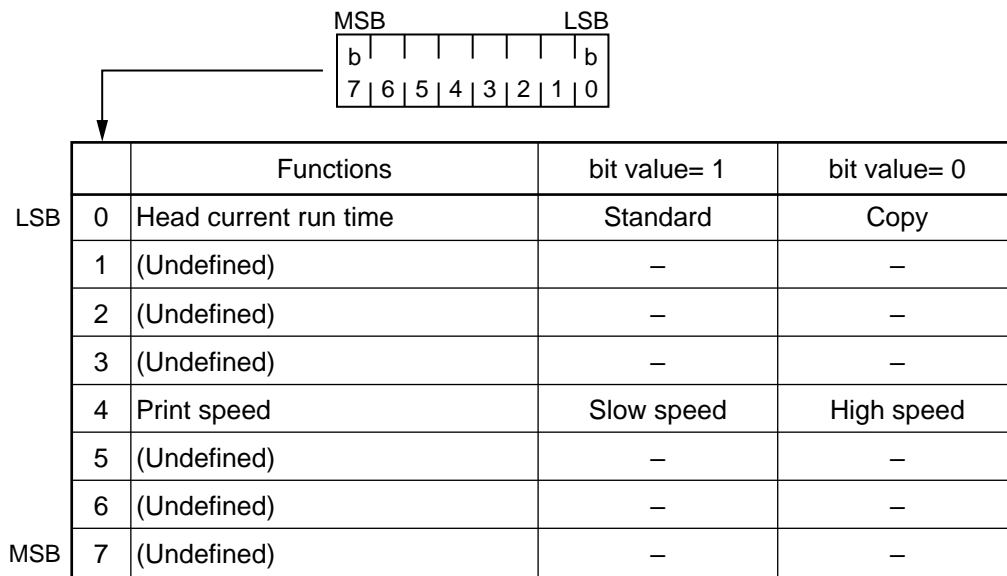
No.	Pa		Menu items	Pa		Menu items
	b7	b0		b7	b0	
1	x100	0000	Auto cutter Unit	x000 0000 x000 0001	No <input type="radio"/> Yes * Default of 1 Roll Model is No.	
2	x100	0001	MICR Unit	x000 0000 x000 0001 x000 0010	<input type="radio"/> No Yes (CMC-7) Yes (E-13B)	
3	x101	0000	Print Registration	x011 1011 x011 1100 x011 1101 x011 1110 x011 1111 x000 0000 x000 0001 x000 0010 x000 0011 x000 0100 x000 0101	0.25mm Right 0.20mm Right 0.15mm Right 0.10mm Right 0.05mm Right <input type="radio"/> 0mm 0.05mm Left 0.10mm Left 0.15mm Left 0.20mm Left 0.25mm Left	
4	x101	0001	Top Adjust	x011 1011 x011 1100 x011 1101 x011 1110 x011 1111 x000 0000 x000 0001 x000 0010 x000 0011 x000 0100 x000 0101	-1.75mm -1.40mm -1.05mm -0.70mm -0.35mm <input type="radio"/> 0mm +0.35mm +0.70mm +1.05mm +1.40mm +1.75mm	
5	x101	0010	Cut Adjust	x011 1011 x011 1100 x011 1101 x011 1110 x011 1111 x000 0000 x000 0001 x000 0010 x000 0011 x000 0100 x000 0101	-1.75mm -1.40mm -1.05mm -0.70mm -0.35mm <input type="radio"/> 0mm +0.35mm +0.70mm +1.05mm +1.40mm +1.75mm	
6	x110	0000	Auto LF (Auto line feed)	x000 0000 x000 0001	<input type="radio"/> No Yes	
7	x110	0001	Receive Buffer Size	x000 0000 x000 0001	2K <input type="radio"/> 16K	
8	x110	0010	Print Mode	x000 0000 x000 0001	<input type="radio"/> Utility HSD	
9	x110	0011	Off-line Busy Control	x000 0000 x000 0001	No <input type="radio"/> Yes	
10	x110	0100	Cover Open Alarm	x000 0000 x000 0001	No <input type="radio"/> Yes	
11	x110	0101	Width of Roll Paper	x000 0000 x000 0001	<input type="radio"/> 76.2mm 69.5mm	
12	x110	0110	Zero Character	x000 0000 x000 0001	Slashed Unslashed	
13	x110	0111	Page Length	x000 0000 x000 0001 x000 0010 x000 0011 x000 0100	88.9mm 139.7mm 215.9mm <input type="radio"/> 279.4mm 304.8mm	
14	x110	1000	Paper End Signal	x000 0000 x000 0001 x000 0010	No <input type="radio"/> Yes (RNE or RE) Yes (RE)	

* The setting with is default.

Name:	Print Speed and Head Current Run Time Set	
Code	HEX:	1DH 45H n
	DEC:	29 69 n

Functions:

- (1) Selects print speed and head current run time (printing operation mode)
(Effective in with selected sheet.)
- (2) n: A parameter that specifies print speed and head current run time by each bit. The following shows how each bit works.



- Undefined bits are masked; thus, either 0 or 1 can be set.
- If bit4=0, Standard Mode applies regardless of 0 or 1 for bit0.

Therefore, there are the following three types of printing modes.

n	Print speed	Head current run time	Print operation mode
bit7 bit0			
00	High speed (100%)	Standard 1 (Short)	Standard mode
01			
10	Low speed 2 (80%)	Copy (Long)	Copy mode
11	Low speed 1 (85%)	Standard 2 (Medium)	Low speed mode

- (3) This print operation mode can be set separately for the following print sheets. It is set when a print sheet is selected this command is received.

No.	Print sheet	Default
1	Receipt/Journal/Receipt+Journal *1	Standard mode
2	Slip	Low speed mode
3	Validation	Standard mode
4	Sprocket paper (optional)	Low speed mode

*1 The setting for Receipt/Journal/Receipt+Journal is shared among them.
If the setting for Receipt is different from that for Journal, the setting made last is effective in all modes.

- (4) If the command is received while a line is being received, the command becomes valid in that line onward.

3.2.8.11 Designated Pulse Generate (Open Cash Drawer)

ESC p m t1 t2

Name:	Designated Pulse Generate (Open Cash Drawer)	
Code	HEX:	1BH 70H m t1 t2
	DEC:	27 112 m t1 t2

Functions:

- (1) Outputs the signals designated by t1 and t2 to Connector Pin m.
- (2) Values and definitions of m

Value of m	Content of designation
00H, 30H	Drawer Kick Connector Pin 2
01H, 31H	Drawer Kick Connector Pin 5

If the value of m is other than the above, the command is ignored to ESC p m, and t1 and thereafter are processed as either print data or a function code.

- (3) Range and definitions of t1 and t2
 - t1: ON time in increments of 10ms
 - t2: OFF time in increments of 10ms
 - Range
00H ≤ t1 ≤ FFH, 00H ≤ t2 ≤ FFH
 - If t1>t2, the value of t2 is processed as if t1=t2.

Name:	Auto Status Send Enable/Disable	
Code	HEX:	1DH 61H n
	DEC:	29 97 n

Functions:

- (1) Selects which status is subject to Auto Status Send (ASB: Automatic Status Back).
- (2) Range: $00H \leq n \leq FFH$
- (3) Default value

If Menu Off-line Busy Control is

Yes n=0

No n=2

Definitions of each bit of n

		Functions	bit value= 1	bit value= 0	Supported status
LSB	0	Level of Drawer Kick Connector Pin 3	Invalid	Valid	Byte 1 – Bit 2
	1	Status of On-line/Off-line	Invalid	Valid	Byte 1 – Bit 3,5,6
	2	Error status	Invalid	Valid	Byte 2 – Bit 2,3,5,6
	3	Roll Paper Sensor	Invalid	Valid	Byte 3 – Bit 0,1,2,3
	4	(Undefined)	–	–	–
	5	Cut Paper Sensor and Cut Paper Status	Invalid	Valid	Byte 3 – Bit 5,6 Byte 4 – Bit 0,1,2,3
MSB	6	(Undefined)	–	–	–
	7	(Undefined)	–	–	–

(Notes)

(Notes common to Parallel/Serial)

- (a) Setting and creating(sending) status by this command is performed when the receive buffer is expanded.
- (b) When none of the statuses is selected, ASB function becomes invalid. (No status will be created or sent.)
- (c) For statuses to be sent refer to the tables on the subsequent pages.
- (d) This command is disabled in Printer Deselected set by the Peripheral Device Select (ESC =), but the ASB functions, once set, are valid.
- (e) In using ESC u, ESC v, GS I, GS r, DLE EOT, GS ENQ, or ESC DLE r, it becomes necessary to distinguish a status by this command or the ASB function from one by each command.
- (f) For the undefined bits, 0 is sent instead. (For the undefined bit of Byte 4, 1 is sent instead.)
- (g) If Menu "Off-line Busy Control" is set to "No," the ASB status is created (sent) immediately after POW ON, reception of I-PRIME signal (Parallel model)/Reset signal (Serial model), reception of ESC @, or initialization by Menu setting command reception.

(Notes specific to Parallel Model)

- (a) If any of statuses is selected valid, the ASB function becomes enabled, and the printer uses the change to the status selected valid as a trigger, and creates a 4-byte status as send data to the host PC. (Even for statuses selected invalid, the printer still creates a current status.)
- (b) If any of statuses is selected valid, the printer creates a status as data to be sent to the host PC as subsequent data is processed in the receive buffer. There may be some delay incurred between reception of this command and creation of status data. (You must be aware that when a status change occurs before the entire command is processed, the printer creates a new status.)
- (c) The created send data to the host PC is sent at a request for reverse transfer from the host PC.
- (d) If the selected status changes several times without data being read due to the reverse data transfer requests from the host PC, the printer will hold up to two sets of the latest status (8bytes).
- (e) If any ASB statuses by the ESC DLE a Pno n command that has not been sent is held, they will be cleared upon reception of this command.
- (f) If an unrecoverable error occurs, the same status will be sent whenever host requests a reverse transfer when any of the statuses is subject to auto status send. Regarding information of other than unrecoverable errors, the information available at the time of an unrecoverable error occurrence will be continuously sent.

(Special notes for Serial Model)

- (a) If any of statuses is selected valid, the ASB functions become valid, and the printer uses the change to the status selected valid as a trigger, and creates a 4-byte status as send data to the host PC. (Even for statuses selected invalid the printer still creates the current status.)
- (b) If any of statuses is selected valid, the printer creates a status as data to be sent to the host PC as subsequent data is processed in the receive buffer. There may be some delay incurred between reception of this command and creation of status data. (You must be aware that when a status change occurs before the entire command is processed, the printer creates a new status.)
- (c) The printer sends four bytes of status without checking the DSR signal status.
- (d) A status of four bytes must be sent except for the XOFF code.
- (e) If an unrecoverable error occurs, the information available at the time of an unrecoverable error occurrence will be continuously sent when any of the statuses is subject to auto status send. After this, even though a status being selected valid changes, the status data will not be sent to host.

Byte 1 (Printer information)

	Functions	Bit value = 0	Bit value = 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 0	Fixed at 0
	2 Level of Drawer Kick Connector Pin 3	"L"	"H"
	3 On-line/Off-line status	On-line	Off-line
	4 (Fixed value)	Fixed at 1	Fixed at 1
MSB	5 Cover status	Cover Close	Cover Open
	6 Paper feed by switch	Not feeding paper	Feeding paper
	7 (Fixed value)	Fixed at 0	Fixed at 0

Bit 3: Indicates printer's On-line/Off-line status.

<Parallel Model>

A status is sent at the reverse data transfer request from the host PC regardless of printer's On-line/Off-line status.

<Serial Model>

A status is sent when a printer status change is recognized regardless of printer's On-line/Off-line status.

Bit 5/6: <Parallel Model>

The Off-line status takes effect during Cover Open (With Cover Open Alarm set to Yes) and Feeding Paper by the switch; hence, the printer creates status information as "Off-line/Cover Open" or "Off-line/Feeding paper by Switch" and sends at the reverse data transfer request from the host PC.

<Serial Model>

The Off-line status takes effect during Cover Open (with Cover Open Alarm set to Yes) and Feeding Paper by the switch; hence, the printer sends a status as "Off-line/Cover Open" or "Off-line/Feeding paper by Switch."

Byte 2 (Error occurrence information)

		Functions	Bit value = 0	Bit value = 1
LSB	0	(Undefined)	–	–
	1	(Undefined)	–	–
	2	Mechanical error	No error	Error has occurred
	3	Auto Cutter Error	No error	Error has occurred
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	Unrecoverable error	No error	Error has occurred
MSB	6	Temperature error	No error	Error has occurred
	7	(Fixed value)	Fixed at 0	Fixed at 0

Bit 2: When the following condition has arose, a status is sent as mechanical error.

- Slip paper feed/Exit Alarm
- Auto Loading/Auto Parking Alarm
- Media Mismatch Alarm (1)/(2)
- Spacing Error (*1)
- Platen Switch Error (*1)

*1: Unrecoverable, prompting Bit 5 to turn “1.”

Bit 5: When the following conditions have arose, a status is sent as unrecoverable error.

- Head A/D error
- MICR Unit error
- Spacing error (*1)
- Platen Switch error (*1) (*3)
- Auto Cutter error (*2) (*3)

*1: Mechanical error, prompting Bit 2 to turn “1.”

*2: Auto Cutter Error is unrecoverable, prompting this bit to turn “1.”

*3: If this error occurs during POW ON Initialization, none of these statuses will be sent.

Bit 6: If the temperature of the print head, SP motor, or LF motor rises, the printer stops printing (*1), during which time this bit is “1.” This error automatically recovers. On-line status remains effective.

*1: Print stop time: 3 seconds for SP Motor and 5 seconds for LF Motor, until the temperature of the print head goes down.

Byte 3 (Paper Sensor Information)

	Functions	Bit value= 0	Bit value= 1	
LSB	0	Journal Near End Sensor	Paper present	Paper End
	1	Receipt Near End Sensor	Paper present	Paper End
	2	Journal Paper Sensor	Paper present	Paper End
	3	Receipt Paper Sensor	Paper present	Paper End
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	Slip Insert Sensor (Sprocket Insert Sensor)	Paper present	Paper End
MSB	6	Slip Exit Sensor (Validation sensor)	Paper present	Paper End
	7	(Fixed value)	Fixed at 0	Fixed at 0

If only the Roller Paper sensor is selected, the printer does not use the change to the Slip Insert sensor or the Exit sensor as a trigger for creating(sending) a status. If only Cut Paper Sensor and Cut Paper Status are selected, the printer does not use the change to the Journal sensor or Receipt sensor as a trigger for creating(sending) a status.

Bit 0,1: With 1-Roll model, the Roll paper Near End Sensor status takes effect.

Bit 2,3: With 1-Roll model, the Roll paper End Sensor status takes effect.

Byte 4 (Cut Paper Information)

	Functions	Bit value= 0	Bit value= 1	
LSB	0	Slip Select	Selected	Deselected
	1	Slip Status	Printable	Not printable
	2	Validation Select	Selected	Deselected
	3	Validation Status	Printable	Not printable
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	(Underfined)	–	–
MSB	6	(Underfined)	–	–
	7	(Fixed value)	Fixed at 0	Fixed at 0

Bit 1: Slip status turns 0 (printable) at end of loading and 1 (not printable) at start of ejection.

- Even if Bit 3 of Byte 1 (On-line/Off-line) is Off-line, Slip status does not change to 1 (not printable).
- When Slip is selected and its insertion is awaited:
Of Byte 3, Bit 5 and Bit 6 turn 1 (Paper End).
Of Byte 4, Bit 0 turns 0 (selected) and Bit 1 turns 1 (not printable).
- When Slip is selected and its removal is awaited:
Of Byte 3, Bit 5 turns 1 (Paper End) and Bit 6 turns 0 (paper present).
Of Byte 4, Bit 0 turns 0 (selected) and Bit 1 turns 1 (not printable).
- When there is no Slip paper and Print Stop (ESC c 4) is disabled, even if there is no more printable area in the Slip paper, Slip status does not turn 1 (unprintable). Whether or not there is still a printable area in the Slip paper must be checked by using the Status Send command (GS r 3).

Name:	Printer Status Real-time Send	
Code	HEX:	1DH 05H
	DEC:	29 05

Functions:

- (1) Creates(sends) a status of the printer upon reception of this command.
- (2) Contents of statuses to be sent are found in the table on the next page.
- (3) It must be noted that printer status is created(sent), too, when a string of data by 1DH 05H is received, in addition to by this command.

(Example)

ESC *m n1 n2

- (4) This command may not be used in the middle of a code sequence of other commands made of more than two bytes.

(Example)

In sensing ESC 3 n from the host PC, if GS ENQ is sent at the point past ESC 3, these commands are processed as ESC 3 n = 1DH instead. This must be kept in mind.

- (5) If ASB is enabled by GS a or ESC DLE a, a status sent by this command must be distinguished from one by ASB.

(Limitation with Parallel Models)

- (6) A status is sent at a request from the host PC for Reverse Transfer.
- (7) If the Busy signal is at High, reception of this command is disabled. The Busy signal becomes High either when the receive buffer is full or the Off-line state is effective. (See Section 1 "Definitions of Off-line>.)
- (8) If the printer holds one status sent by ASB and another by this command, it sends the one by ASB first.
- (9) If there is not a request from the host PC for Reverse Transfer following the reception of this command, the printer holds data up to 100bytes (except the status data by ASB). Once the data it holds goes over 100bytes, the printer does not generate data to send to the host upon reception of this command.

(Limitation with Serial Models)

- (10) The printer sends only one byte without checking the status of the DSR signal.
- (11) This command is executed in the Off-line mode and Receive Buffer Full state.
This process is not performed if an unrecoverable error has occurred.
- (12) It is desirable not to use this command if the communication data length is 7 bits and handshake is done in the XON/XOFF control. Neither any of statuses sent by this nor the XON/XOFF code can be recognized.

	Functions	Bit value= 0	Bit value= 1	
LSB	0	Journal Near End Sensor	Paper present	Paper End
	1	Receipt Near End Sensor	Paper present	Paper End
	2	Cover status	Cover Close	Cover Open
	3	On-line/Off-line status	On-line	Off-line
	4	Status of Drawer Kick Connector Pin 3	"L"	"H"
	5	Slip Insert Sensor (Sprocket Insert Sensor)	Paper present	Paper End
MSB	6	Error	No error	Error has occurred
	7	(Fixed value)	Fixed at 1	Fixed at 1

Bit 0,1: With 1-Roll model, the Roller paper Near End Sensor status takes effect.

Bit 3: Turns "1" if the printer is Off-line because of print stop due to Paper End, Cover Open (with "Cover Open Alarm" set to "Yes" on the menu), and so forth.

Bit 6: Turns "1" if error has occurred due to the following causes. Cover Open is not considered error.

- Slip Paper Feed/Exit Alarm
- Auto Loading/Auto Parking Alarm
- Media Mismatch Alarm (1), (2)
- Head Thermal Alarm (*1)
- SP Thermal Alarm (*1)
- LF Thermal Alarm (*1)

*1: These errors automatically recover. On-line remains effective for On-line/Off-line status.

Print stop time: Until the temperature goes down for Print Head, 3 seconds for SP Motor, and 5 seconds for LF Motor.

Name:	Printer ID Send	
Code	HEX:	1DH 49H n
	DEC:	29 73 n

Functions:

- (1) Creates(sends) a printer ID according to the designation by n.

n	Printer ID	Spec	ID (Hexadecimal)
01H 31H	Model ID		00
02H 32H	Type ID	See the table on the next page.	–
03H 33H	ROM Version ID	According to the ROM Version	01 (Version 1)

- (2) Range of n
 $01H \leq n \leq 03H$
 $31H \leq n \leq 33H$

(Notes)

(Notes common to Parallel/Serial)

- The ROM version ID is variable.
- IF the ASB is enabled by GS a or ESC DLE a, a status sent by this command and one by ASB must be distinguished,
- If the value of n is outside the above range, this command is ignored.
(If n is 04H 34H, 00H ID is created(sent).)
- If the printer holds one status by ASB and another by this command, it sends the one by ABS first.

(Notes specific to Parallel Models)

- This command is executed as incoming data is processed in the receive buffer and a one-byte status is created. This status is sent at the request from the host PC for reverse data transfer.
- If the host PC does not request reverse data transfer after reception of this command, data will be held to the maximum of 100bytes (except a status by ASB). If the size of data held exceeds 100 bytes, reception of this command will not prompt creating data to be sent to the host PC.
- There may be some delay incurred between command reception and status creation, depending on the status of the receive buffer.

(Notes specific to Serial Models)

- This command is executed as incoming information is processed in the receive buffer, and a one-byte status is sent.
- With DTR/DSR Control selected, the printer sends one byte after confirming that the host PC is enable to receive (DSR Signal is in SPACE). If the host PC is not enable to receive (DSR Signal is in MARK), the printer keeps waiting until the host becomes enabled to receive. With XON/XOFF selected, the printer sends one byte without confirming the status of the DSR signal.
- There may be some delay incurred between command reception and status creation, depending on the status of the receive buffer

n=2 Type ID

	Functions	Bit value= 0	Bit value= 1	
LSB	0	2-byte code (Kanji) support	Unsupported	Supported
	1	Auto Cutter Available/Not available	Not available	Available
	2	Customer Display connect/disconnect Setting	OFF	ON
	3	MICR Mode Enabled/Disabled	Disabled	Enabled
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	(Undefined)	–	–
MSB	6	(Undefined)	–	–
	7	(Fixed value)	Fixed at 0	Fixed at 0

Bit 0: Fixed at 0 (Kanji unsupported)

Bit 1/3: By Menu setting

Bit 2: By the DIP-SW setting on the Serial I/F board for Serial Models while fixed at 0 (OFF) for Parallel Models.

- For the undefined bits, 0 is sent instead.

Name:	Status Send	
Code	HEX:	1DH 72H n
	DEC:	27 114 n

Functions:

- (1) Creates(sends) a status according to n.

N	Functions
01H 31H	Sends a status of Paper Sensor. (Same as ESC v.)
02H 32H	Sends a status of Drawer Kick Connector. (Same as ESC u 0.)
03H 33H	Sends a status of Slip paper.

(Notes)

(Notes common to Parallel/Serial Models)

- For statuses to be sent refer to the tables on the subsequent pages.
- If ASB is enabled by GS a or ESC DLE a, a status sent by this command must be distinguished from one by ASB.
- If the value of n is outside the above range, this command is ignored.
- If the printer holds one status sent by ASB and another by this command, it sends the one by ASB first.

(Notes specific to Parallel Models)

- This command is executed as incoming data is processed in the receive buffer and a one-byte status is created (excluding GS r 1, GS r 3). This status is sent at the request from the host PC for reverse data transfer.
- If the Busy signal is at High, reception of this command is disabled. The Busy signal becomes High either when the receive buffer is full or in the Off-line state. (See Section 1 "Definitions of Off-line".)
- With GS r 3 (Slip Mode only) and GS r 1, a one-byte status is created after printing and paper feeding has completely stopped. (Its status create timing is different from ESC u, GS l, or GS r 2.)
- There may be some delay incurred between command reception and status creation, depending on the status of the receive buffer.
- Status information is not generated during a wait for Slip paper or for removal of Slip paper.
- If there is not a request from the host PC for Reverse Transfer following the reception of this command, the printer holds data up to 100bytes (except the status data by ASB). Once the data it holds goes over 100bytes, the printer does not generate data to send to the host upon reception of this command.
- In checking paper present/paper end by using this command in Receipt, Journal, or Receipt+Journal mode, if the sensor, for which Print Stop Enable has been set by ESC c 4n, has no paper, the printer mode turns Off-line. Thus, a status is not sent until this off-line state is reset. In other words, no status will be sent as long as the sensor for which Print Stop Valid is set is in paper empty state. (The default value of ESC c 4n is, the Receipt and Journal Paper End Sensors are Valid.)

(Notes specific to Serial Modes)

- (a) This command is executed as incoming information is processed in the receive buffer, and a one-byte status is sent (excluding GS r 1, GS r 3).
- (b) With DTR/DSR Control selected, the printer sends one byte after confirming that the host PC is enable to receive (DSR Signal is in SPACE). If the host PC is not enable to receive (DSR Signal is in MARK), the printer waits until it becomes enabled to receive. With XON/XOFF selected, the printer sends one byte without confirming the status of the DSR signal.
- (c) With GS r 3 (Slip Mode only) and GS r 1, a one-byte status is created after printing and paper feeding has completely stopped. (Its status create timing is different from ESC u, GS l, or GS r 2.)
- (d) There may be some delay incurred between command reception and status creation, depending on the status of the receive buffer.
- (e) During Slip paper wait and Slip paper ejection wait, none of statuses is sent.
- (f) In checking paper present/paper end by using this command in Receipt, Journal, or Receipt-Journal mode, if the sensor, for which Print Stop Enable has been set by ESC c 4n, has no paper, the printer mode turns Off-line. Thus, a status is not sent until this off-line state is reset. In other words, no status will be sent as long as the sensor for which Print Stop valid is set is in paper empty state. (The default value of ESC c 4 n is, the Receipt and Journal Paper End Sensors are Valid.)

n= 1: Paper Sensor Status

		Functions	Bit value= 0	Bit value= 1
LSB	0	Journal Near End Sensor	Paper present	Paper End
	1	Receipt Near End Sensor	Paper present	Paper End
	2	Journal Paper Sensor	Paper present	Paper End
	3	Receipt Paper Sensor	Paper present	Paper End
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	Slip Insert Sensor (Sprocket Insert Sensor)	Paper present	Paper End
MSB	6	Slip Eject Sensor (Validation sensor)	Paper present	Paper End
	7	(Fixed value)	Fixed at 0	Fixed at 0

Bit 0,1: With 1-Roll model, the Roll paper Near End Sensor status takes effect.

Bit 2,3: With 1-Roll mode, the Roll paper End Sensor status takes effect.

n = 2: Status of Drawer Kick Connector

		Functions	Bit value = 0	Bit value = 1
LSB	0	Level of Pin 3	"L"	"L"
	1	(Undefined)	–	–
	2	(Undefined)	–	–
	3	(Undefined)	–	–
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	(Undefined)	–	–
MSB	6	(Undefined)	–	–
	7	(Fixed value)	Fixed at 0	Fixed at 0

- For undefined bits, 0 is sent instead.

n=3: Status of Slip paper

	Current status of Slip paper
0 0 0 0 0 0 0 B	No printable area or Slip paper not selected
0 0 0 0 0 0 1 B	One line with no double-height characters printable
0 0 0 0 0 1 0 B	One line with no double-height characters printable
0 0 0 0 0 1 1 B	Multiple lines printable at the currently set line feed pitch

(Remarks) Whether or not the Slip paper still has a printable area can be found by GS r 3.

- Sends 03H if several more lines can be printed at the currently set line feed pitch.
- Sends 02H if only one line including double-height characters can be printed.
- Sends 01H if only one line excluding double-height characters can be printed.
- Sends 00H if no printing can be made to the current paper.

Name:	Status Real-time Send	
Code	HEX:	10H 04H n
	DEC:	16 04 n

Functions:

- (1) Creates(sends) a status of n real-time.

Hn	Function
01H	Sends printer status
02H	Sends Off-line cause status
03H	Sends Error cause status
04H	Sends Roll Paper Sensor status
05H	Sends Slip paper status
06H	Sends Validation status

- (2) Range of n
 $01H \leq n \leq 06H$

(Notes)

(Notes common to Parallel/Serial Models)

- For statuses to be sent refer to the tables on the subsequent pages.
- This command is executed as data is received.
- Be aware that in addition to this command, reception of a data sequence of 10H 04H n ($01H \leq n \leq 05H$) prompts the same operation as this command does.
 (Example) ESC * m n1 n2
- This command may not be used in the middle of a code sequence of other commands of more than two bytes.
 (Example) It must be made aware that when the host has sent ESC 3 in sending ESC 3 n, if DLE EOT 4 is sent, ESC 3 n will be processed as ESC 3 n=10H.
- This command is disabled in the Printer Deselected state set by the Peripheral Device Select (ESC =).
- If the ASB function is enabled by GS a or ESC DLE a, a status sent by this command and one by ASB must be distinguished,
- If the value of n is outside the above range, this command is ignored.

(Notes specific to Parallel Models)

- Sends a status at a request from the host PC for Reverse Transfer.
- If the Busy signal is at High, reception of this command is disabled. The Busy signal becomes High either when the receive buffer is full or in the Off-line state. (See Section 1 "Definitions of Off-line".)
 (Hence, when an unrecoverable error has occurred, this command cannot be received.)
- If the printer holds a status sent by ASB and one by this command, it sends the one by ASB first.
- If there is not a request from the host PC for Reverse Transfer following the reception of this command, the printer holds data up to 100bytes (except the status data by ASB). Once the data it holds goes over 100bytes, reception of this command does not prompt the printer to generate data to send to the host.

(Notes specific to Serial Models)

- Sends only one byte without checking the status of the DSR signal in sending a status.
- Processes while Off-line or in the Receive Buffer Full state.
 This process is not performed if an unrecoverable error has occurred.

n= 1: Printer status

	Functions	Bit value= 0	Bit value= 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 1	Fixed at 1
	2 Level of Drawer Kick Connector Pin 3	"L"	"H"
	3 On-line/Off-line status	On-line	Off-line
	4 (Fixed value)	Fixed at 1	Fixed at 1
	5 (Underfined)	–	–
MSB	6 (Underfined)	–	–
	7 (Fixed value)	Fixed at 0	Fixed at 0

- For undefined bits, 0 is sent instead.

n= 2: Status of Off-line causes

	Functions	Bit value= 0	Bit value= 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 1	Fixed at 1
	2 Cover Status	Cover Close	Cover Open
	3 Paper feed by switch	Not feeding paper	Feeding paper
	4 (Fixed value)	Fixed at 1	Fixed at 1
	5 Roll Paper status	Printable	Not printable
MSB	6 Error status	No error	Error has occurred
	7 (Fixed value)	Fixed at 0	Fixed at 0

Bit 5: Turns 1 (Printing has stopped) if printing has stopped based on the ESC c 4 setting while in the Receipt, Journal, and Receipt+Journal modes.(It turns 0 (Printable) otherwise.)

Bit 6: Turns "1" if error has occurred due to the following causes. Cover Open is not considered error.

- Slip Paper Feed/Exit Alarm
- Auto Loading/Auto Parking Alarm
- Media Mismatch Alarm (1), (2)
- Head Thermal Alarm (*1)
- SP Thermal Alarm (*1)
- LF Thermal Alarm (*1)
- Spacing Alarm
- Auto Cutter Alarm
- Platen Switch Alarm
- Head A/D Error
- MICR Unit Error

*1: These errors automatically recover. On-line remains effective for On-line/Off-line status.

Print stop time: Until the temperature goes down for Print Head, 3 seconds for SP Motor, and 5 seconds for LF Motor.

n = 3: Status or Error Causes

	Functions	Bit value= 0	Bit value= 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 1	Fixed at 1
	2 Mechanical error	No error	Error has occurred
	3 Auto Cutter Error	No error	Error has occurred
	4 (Fixed value)	Fixed at 1	Fixed at 1
	5 Unrecoverable error	No error	Error has occurred
MSB	6 Thermal error	No error	Error has occurred
	7 (Fixed value)	Fixed at 0	Fixed at 0

Bit 2: Sends Mechanical error as a status instead if one of the following conditions has occurred.

- Slip Paper Feed/Exit Alarm
- Auto Loading/Auto Parking Alarm
- Media Mismatch Alarm (1), (2)

Bit 5: 0 (No error).

This is because this command cannot be processed when any unrecoverable error occurs.

Bit 6: Printing stops (*1) when the temperature has gone up with the print head, SP motor, and LF motor. The bit value changes to “1” during this time. This error automatically recovers. On-line remains effective for On-line/Off-line status.

*1 Print stop time: Until the temperature goes down for Print Head, 3 seconds for SP Motor, and 5 seconds for LF Motor.

n=4: Roll Paper Sensor Status

	Functions	Bit value= 0	Bit value= 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 1	Fixed at 1
	2 Journal Near End Sensor	Paper present	Paper end
	3 Receipt Near End Sensor	Paper present	Paper end
	4 (Fixed value)	Fixed at 1	Fixed at 1
	5 Journal Paper Sensor	Paper present	Paper end
MSB	6 Receipt Paper Sensor	Paper present	Paper end
	7 (Fixed value)	Fixed at 0	Fixed at 0

Bit 2,3: With 1-Roll model, the Roll paper Near End Sensor status takes effect.

Bit 5,6: With 1-Roll model, the Roll paper End Sensor status takes effect.

n=5: Slip status

	Functions	Bit value= 0	Bit value= 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 1	Fixed at 1
	2 Slip Select	Selected	Deselected
	3 Slip Insert Wait	Not waiting	Waiting
	4 (Fixed value)	Fixed at 1	Fixed at 1
MSB	5 Slip Insert Sensor	Paper present	Paper end
	6 Slip Eject Sensor	Paper present	Paper end
	7 (Fixed value)	Fixed at 0	Fixed at 0

Bit 2: There may be some delay incurred between reception of ESC c 0 and actual selection of Slip. During this delay, the status is 1 (non-select).

After the Slip paper has been ejected and before it is removed, the status is 0 (Deselected).

Bit 3: The status turns 0(Not waiting) as loading starts, following detection of Slip paper.

Bit 5,6: Sends a status of the Slip sensor.

n=6: Validation status

	Functions	Bit value= 0	Bit value= 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 1	Fixed at 1
	2 Validation select	Selected	Deselected
	3 Validation Insert wait	Not waiting for insertion	Waiting for insertion
	4 (Fixed value)	Fixed at 1	Fixed at 1
MSB	5 Slip Eject sensor (Validation Sensor)	Paper present	Paper end
	6 Slip Eject sensor (Validation Sensor)	Paper present	Paper end
	7 (Fixed value)	Fixed at 0	Fixed at 0

Bit 2: There may be some delay between reception of ESC c 0 and actual selection of Validation. During this delay, the status is 1 (Non-select).

The status is 0 (Select) while removal of Validation is awaited and until it is actually removed.

Bit 3: The status turns 0 (not waiting for insertion) when the printer goes into the state where the paper is actually loaded, after the Slip Eject sensor (Validation sensor) has detected the paper and the time between paper insertion and operation start has elapsed.

Bit 5/6: Sends the current status of Slip Eject Sensor (Validation sensor).

Name:	Real-time Request to Printer	
Code	HEX:	10H 05H n
	DEC:	16 05 n

Functions

- (1) Responds to the request from the host based on the designation of n. The operations based on n are explained in the table below.

N	Function
02H	If this command is received in the recoverable error state (*1), clearing of the receive buffer and print buffer, and clearing the cause of error prompt setting the print sheet to Receipt+Journal. (*2) (This command is ignored with any other error than recoverable error.)
03H	If this command is received in the state (*3) waiting for Slip, Validation or Check (MICR Mode), or when there is no Sprocket paper, the receive buffer and print buffer are cleared; then the print sheet is set to Receipt+Journal. (*2) (This command is ignored in any other states than Waiting.)

*1 Recoverable errors (Not including Cover Open Error).

- Slip Paper Feed/Eject Alarm
- Auto Loading/Auto Parking Alarm
- Media Mismatch Alarm (1)/(2)

*2 Nothing other than Receive Buffer, Print Buffer, and Print Sheet Mode will be initialized. When the Option tractor is installed and the lever is set to Tractor, if Paper Mode is Sprocket, the Sprocket Mode remains effective if the status is Paper present.

*3 This is the state effective before an operation starts at insertion of paper.

- (2) Range of n: $02H \leq n \leq 03H$

(Notes)

(a) This command is processed at reception.

(b) (Parallel Models)

Reception is disabled in the Off-line (Menu, "Off-line Busy Control" is "Yes"), Receive Buffer Full and an unrecoverable error state; hence, this command cannot be processed.

(Serial Models)

The command is processed even in the Off-line and Receive Buffer Full state.

It is not processed in an unrecoverable error.

(c) It must be noted that reception of a string of data as 10H 05H n ($02H \leq n \leq 03H$), in addition to this command, also prompts an operation by this command.

Example)

ESC * m n1 n2

(d) This command may not be used in the middle of a code sequence of other commands made of more than two bytes.

(Example)

It must be made aware that when the host has sent ESC 3 in sending ESC 3 n, if DLE ENQ 02H is sent, ESC 3 n will be processed as ESC 3 n=10H.

(e) If DLE ENQ 02H is received in the recoverable error state, clearing the cause of error prompts clearing of the receive buffer and print buffer, then setting the print sheet to Receipt+Journal. For various settings by ESC !, ESC 3, and so forth, the printer retains the status effective at the time of error occurrence. This command and ESC @ can completely initialize the printer. Furthermore, this command is valid only if the errors are recoverable except for Thermal Error.

- (f) DLE ENQ 03H is valid only during Slip Insert Wait or Validation Insert Wait. Hence, it must be confirmed prior to execution of DLE ENQ 03H that Slip or Validation has been selected by DLE EOT 05H or 06H, and insertion of either print sheet is being awaited. The print sheet will be Receipt+Journal once Slip Insert Wait or Validation Insert Wait is reset.
- (g) In the Printer Deselected states set by Peripheral Device Select (ESC=), the error recovery function (DLE ENQ 02H) is enabled while the insert wait cancel (DLE ENGQ 03H) function becomes disabled.
- (h) When the print sheet selected is Slip, if error recovery has been made after reception of DLE ENQ 02H, the print sheet will be Receipt+Journal. Hence, the Slip mode needs to be selected again by ESC c 0 04H in order to print Slip paper again.
- (i) If the value of n is outside the specified range, this command is ignored.
- (j) Reception of this command will not clear a status that has not yet been sent.

[In the Serial mode, if the DTR signal is MARK, sending of a status prompted by Non-Real-time command (such as ESC u n) is awaited until the DTR signal changes to SPACE and no other commands or data are processed during this wait. In other words, there cannot be any occurrence of state (such as Recoverable Error and Paper Insert Wait) that would allow this command to become effective while there is still an unsent status.]

(Notes) In case of MICR Mode:

- (a) When MICR Mode is selected by FS a 0, if error recovery has been made after reception of DLE ENQ 02H, the printer clears the contents of the receive buffer and print buffer, prompting Receipt+Journal. Hence, the MICR mode needs to be selected again by FS a 0 in order to print Check paper.
- (b) DLE ENQ 03H can reset the Check Insert Wait status in Check Paper Insert Wait state. Prior to resetting, it is necessary to check that the MICR mode is selected by DLE EOT BS 01H, and also the Check Insert Wait state. Once Insert Wait is cleared, the print sheet is set to Receipt+Journal.
- (c) Canceling Insert Wait by DLE ENQ 03H prompts clearing the receive buffer and print buffer.
- (d) This command is invalid during reading of MICR data.

Name:	Real-time MICR Status Send	
Code	HEX:	10H 04H 08H n
	DEC:	17 04 08 n

Functions

- (1) Creates(sends) real-time a 1-byte status of MICR if n=01H.
- (2) This command functions only if the menu item "MICR Unit" is set to "Yes."
If the setting of Menu "MICR Unit" is "No," the command is ignored to DLE EOT BS.
If the MICR option is not installed and the setting of MICR Unit is "Yes," the status is MICR Mode Deselected, prompting sending of this status.
- (3) This command is ignored during reading of Check paper.
- (4) It must be noted that reception of a data queue as 1DH 61H n (00H ≤ n ≤ FFH), in addition to this command, also prompts an operation by this command.
Example)
ESC * m n1 n2
- (5) This command may not be used in the middle of a code sequence of other commands made of more than two bytes.
Example)
In sensing ESC 3 n from the host PC, if you send DLE EOT BS 01H past ESC 3, these commands are processed as ESC 3 n = 1DH instead. This must be kept in mind.

(Notes specific to Parallel Models)

- (6) Sends a status when the host PC requests for Reverse Data Transfer.
- (7) If the Busy signal is at High, reception of this command is disabled. The Busy signal becomes "High" at Receive Buffer Full or at Off-line. (See Section 1 "Definitions of Off-line.")
- (8) If the printer holds a status sent by ASB and another by this command, it sends the one by ASB first.
- (9) If there is not a request from the host PC for Reverse Transfer following the reception of this command, the printer holds data up to 100bytes (except the status data by ASB). Once the data it holds goes over 100bytes, reception of this command does not prompt the printer to generate data to send to the host.

(Notes specific to Serial Models)

- (10) Sends one byte without checking the status of the DSR signal in sending a status.
- (11) Processes while at Off-line or in the Receive Buffer Full state.
This process is not performed when an unrecoverable error has occurred.
- (12) MICR status is sent as follows:

- MICR status (n=1)

		Functions	Bit value= 0	Bit value= 1
LSB	0	(Fixed value)	Fixed at 0	Fixed at 0
	1	(Fixed value)	Fixed at 1	Fixed at 1
	2	MICR Mode Select/Deselect	MICR Mode Selected	MICR Mode deselected
	3	Check Insert wait	Not waiting	Waiting
	4	(Fixed value)	Fixed at 1	Fixed at 1
	5	Slip Insert Sensor	Paper present	Paper end
MSB	6	Slip Exit Sensor	Paper present	Paper end
	7	(Fixed value)	Fixed at 0	Fixed at 0

3.2.8.19 Check Paper Read (MICR Mode Select)

FS a 0 n

Name:	Check Paper Read (MICR Mode Select)	
Code	HEX:	1CH 61H 30H n
	DEC:	28 97 48 n

Functions

- (1) Selects MICR Mode and reads Check paper.
- (2) Range and definitions of n

		Functions	Bit value= 0	Bit value= 1
LSB	0	Font recognition	(See the table below.)	
	1			
MSB	2	(Fixed value)	Fixed at 0	
	3			
	4			
	5			
	6			
	7			

Font recognition:

Bit1	bit0	Font
0	0	E13B
0	1	CMC7
1	0	(Undefined)
1	1	(Undefined)

- If an undefined font is selected, this command is entirely ignored.

Character Codes

If the character code is E-13B, the following codes are returned.

0	1	2	3	4	5	6	7	8	9
dash symbol	amount symbol	On-U's symbol	transit symbol						

D: dash symbol
 A: amount symbol
 O: On-U's symbol
 T: transit symbol

Chrs	Code	Chrs	Code	Chrs	Code	Chrs	Code
1	31H	2	32H	3	33H	4	34H
5	35H	6	36H	7	37H	8	38H
9	39H	0	30H	(space)	20H	-	-
T	54H	A	41H	O	4FH	D	44H

* For any unrecognizable characters, "?"(3FH) is returned.

If the character set is CMC-7, the following codes are returned.

1	2	3	4	5	6	7	8	9	0
transit	dash	On-U's	amount						
			comma						

/: transit symbol
 #: On-U's symbol
 =: dash symbol
 >: amount symbol
 ^: comma symbol

Chrs	Code	Chrs	Code	Chrs	Code	Chrs	Code
1	31H	2	32H	3	33H	4	34H
5	35H	6	36H	7	37H	8	38H
9	39H	0	30H	(space)	20H	/	2FH
#	23H	=	3DH	>	3EH	^	5EH

* For any unrecognizable characters, "?"(3FH) is returned.

- (3) This command functions only if Menu Item "MICR Unit" is set to "Yes."
 If Menu Item "MICR Unit" is set to "No," the command is partially ignored, to FS a.
 When the MICR option is not installed and Menu Item "MICR Unit" is set to "Yes," reception of this command will result in MICR Unit error (unrecoverable error).
- (4) This command is valid only if designated at the start of the line.
 Designated in the middle of the line, the command is ignored in its entirety.
- (5) Upon reception of this command, the printer enters the MICR mode and waits for insertion of Check paper.
 The printer waits for insertion of Check paper until DLE ENQ 03H is received, the Insert Wait time (t1) set by ESC f has lapsed, the printer is reset, or the power supply is shut off.
 Whether the status is MICR Mode Selected or Deselected can be checked by DLE EOT BS.
- (6) The printer only processes the real-time commands (DLE EOT n, DLE EOT BS n, DLE ENQ n, ESC DLE r Pno n, or GS ENQ) while waiting for the Check paper to be inserted or reading the Check paper.
- (7) The Check paper insert wait status can be cancelled by DLE ENQ 03H.
 In this case, the data in the print and receive buffers are cleared.
 The Check paper insert wait status can be checked by DLE EOT BS.
- (8) Reading the Check paper, the printer creates (sends) a result to the host PC.
- The printer read normally.
 "① Header + ② Read status (Normal end) + ③ Date + ④ NUL"
 - The printer did not read normally.
 "① Header + ② Read status (Anomalous end) + ④ NUL" (Data is not sent)
- ① Header: 5FH
 ② Read status:

	Functions	Bit value= 0	Bit value= 1
LSB	0	(See the table below.)	(See the table below.)
	1		
	2 (Fixed value)	Fixed at 0	Fixed at 0
	3 (Fixed value)	Fixed at 0	Fixed at 0
	4 Re-read operation Enable/Disable	Re-read operation enabled	Re-read operation disabled
	5 Read result	Read normal end	Read anomalous end
	6 (Fixed value)	Fixed at 1	Fixed at 1
MSB	7 (Fixed value)	Fixed at 0	Fixed at 0

- For the undefined bit, 0 is returned.
- This printer has the setting constant at Re-read operation (reading from the normal read end position) disable; hence, bit 4 is always 1.
- Read status is constant at 70H in case of anomalous end.

Font Recognition

Bit1	bit0	Font
0	0	E13B
0	1	CMC7
1	0	(Undefined)
1	1	(Undefined)

- ③ Data: Recognized character strings (ASCII Codes)
 - ④ NUL: 00H
- (9) Bit 0 and Bit 1 of read status indicate the recognized character fonts.
If reading did not end normally neither Bit 0 nor Bit 1 carries any meaning.
- (10) In the following cases, the status is read anomalous end (Bit 5=1).
- Check Insert Wait has been cleared by DLE ENQ 03H.
 - The Insert Wait Time (t1) set by ESC f has elapsed.
 - Characters to be read could not be found.
 - Less than five characters are recognizable.
 - More than three characters are unrecognizable.
 - The character font is not what is designated.
 - The printer is waiting for Check paper to be inserted and the lever is switched to Tractor.
- (11) In the case of Check Read anomalous end (Read status bit5=0), the printer sends "Header~NUL" to the host PC but does not eject the Check paper. If any command other than FS a 0, FS a 1, FS a 2, FS b, and real-time commands (DLE EOT n, DLE EOT BS n, DLE ENQ n, ESC DLE r Pno n) has been processed, the printer ejects Check paper and goes into Receipt+Journal Mode.
(The real-time commands "GS ENQ" prompt ejection of Check paper as "GS" is processed in the receive buffer.)
- (12) In the case of Check Read anomalous end (Read status bit5=1), the printer ejects Check paper to set MICR Mode to Deselected. It moves to Receipt+Journal Mode.
- (13) If Check Read action results in JAM, paper feed alarm occurs.
When the alarm condition is cleared, the status is Check Insert Wait.
- (14) When paper feed alarm has occurred, if DLE ENQ 02H is received, the alarm status is cleared and MICR Mode is deselected; then the printer goes into Receipt+Journal mode.
- (15) The printer ignores the Real-time command while sending "Header~NUL."
- (16) Even if the ASB function is selected, the printer does not send ASB status while reading, and sending "Header~NUL."
In the case of Parallel Mode, the printer sends "Header~NUL" at the request from the Host PC for Reverse Data Transfer, then sends ASB status at a next Reverse Data Transfer request.
- (17) Read status will be hold until reception of either ESC @, FS a 0 n, Menu setting command, I-PRIME signal (Parallel model), or Reset signal (Serial Model). (DLE ENQ n does not initialize Read status.)
- (18) All switches are invalid between the start of MICR read and ejection of Check paper.
- (19) In the case of Check Read Normal End (Read status bit5=0), reception of this command prompts the printer to eject Check paper and go into the Check Insert Wait state again.
- (20) With the option tractor installed and the lever set to the tractor, reception of this command will be ignored.
- (21) If MICR Reader Unit communication error has occurred, MICR Unit error (unrecoverable error) occurs.

(Notes specific to Serial models)

- (a) With DTR/DSR Control selected, the printer sends a result of reading Check paper after confirming that the host PC is enable to receive (DSR Signal is in SPACE).
If the host PC is not enable to receive (DSR Signal is in MARK), the printer waits until it becomes enabled to receive.
With XON/XOFF selected, the printer sends a result of reading Check paper irrespective of the status of the DSR signal.
- (b) While the printer sends status data read, if the host PC becomes unable to receive (DSR signal is in MARK), it keeps sending status data.
- (c) While waiting for Check paper to be inserted according to this command, if the printer receives the real-time status request command, it sends response data in reply to the real-time request command.
- (d) While waiting for Check paper to be inserted according to this command, if the printer receives the non-real-time status request command, it does not send response data in reply to the non-real-time request command.
The printer sends response data in reply to the non-real-time request command after having finished sending status data as a result of reading Check paper.

3.2.8.20 Paper Load to Print Start Position

FS a 1

Name:	Paper Load to Print Start Position	
Code	HEX:	1CH 61H 31H
	DEC:	28 97 49

Functions

- (1) Loads Check paper to the print start position.
- (2) This command functions only when MICR Mode is selected by FS a 0.
If MICR Mode is not selected, the command is ignored in its entirety.
- (3) If Menu "MICR Unit" is set to "No," this command is ignored to FS a.
- (4) If Check read has ended normally (Read status Bit5=0), this command is executed.
- (5) Resets MICR Mode after loading Check paper and enters Slip Mode.
- (6) If JAM has occurred, paper feed alarm occurs. When the alarm condition is cleared, the printer goes into Slip Mode.

3.2.8.21 Check Paper Eject

FS a 2

Name:	Check Paper Eject	
Code	HEX:	1CH 61H 32H
	DEC:	28 97 50

Functions:

- (1) Ejects Check paper.
- (2) Switches Print sheet Mode to default (Receipt+Journal) after Check paper has been loaded.
- (3) This command functions only when MICR Mode is selected by FS a 0.
If MICR Mode is not selected, the command is ignored in its entirety.
- (4) If Menu "MICR Unit" is set to "No," this command is ignored to FS a.
- (5) In the case of Check Read Normal End, the printer ejects the Check paper as at reception of this command.

Name:	Check Paper Read Result Re-send Request	
Code	HEX:	1CH 62H
	DEC:	28 98

Functions:

- (1) Re-sends a result of Check Paper Read.
 - (2) If Check Paper Read has not yet been executed (FS a 0 not received yet), reception of this command prompts creating(sending) the following.
 - ① Header: 5FH
 - ② Read status: 70H (Anomalous end)
 - ③ NUL: 00H
 - (3) This command functions only when MENU "MICR Unit" is set to "Yes."
If Menu "MICR Unit" is set to "No," the command is ignored in its entirety.
With the MICR option unit uninstalled and Menu "MICR Unit" set to "Yes," reception of this command prompts sending of the same status as in (2). (Same status as Check read is disabled and Read has not been executed.)
 - (4) The information sent is the same as by FS a 0.
 - (5) A result of Read is retained until reception of ESC @, FS a 0 n, Menu Set command, I-PRIME signal (Parallel Models) or Reset signal (Serial Models). (Initialization results in (2) above.)
DLE ENQ n does not prompt initialization of read results.
- (Notes specific to Serial models)
- (a) With DTR/DSR Control selected, the printer re-sends a result of reading Check paper after confirming that the host PC is enable to receive (DSR Signal is in SPACE).
If the host PC is not enable to receive (DSR Signal is in MARK), the printer waits until it becomes enabled to receive.
With XON/XOFF selected, the printer re-sends a result of reading Check paper irrespective of the status of the DSR signal.
 - (b) While the printer re-sends a result of reading Check paper, if the host PC becomes disabled to receive (DSR Signal is in MARK), the printer still keeps sending status data.

Name:	Validation Insert Position Select	
Code	HEX:	1BH 10H 76H Pno n
	DEC:	27 16 118 Pno n

Functions:

- (1) Selects the position to insert Validation.
- (2) MSB of DLE (10H) in the command sequence is invalid. ("90H" is effective as well.)
- (3) Valid range and definitions of parameters:
 - (a) Pno: Designates the number of bytes (number of parameters) following ESC DLE c Pno. MSB is invalid.
Range: $00H \leq n \leq FFH$
With this command, Pno=1 is designated.
 - (b) Value and definitions of n:

Value of n	Designation
01H	Inserts at the left sensor position
00H	Inserts at the right sensor position

The upper 7 bits of n are ignored.

- (4) "Insert at the right sensor position" takes effect at default.
- (5) This selection changes only the head's centering position when Print Sheet Select is set to Validation. (It does not affect the Validation's printing area, etc.)

Name:	Auto Status Send Enable/Disable	
Code	HEX:	1BH 10H 61H Pno n
	DEC:	27 16 97 Pno n

Functions:

- (1) Selects which status is subject to Auto Status Send (ASB: Automatic Status Back). It is practically the same spec as Auto Status Send Enable/Disable by the command GS except that Byte 5 is added. Hence, only the differences are described herein.
- (2) MSB of DLE (10H) in the command sequence is ignored. ("90H" is effective as well.)
- (3) Valid range and definitions of parameters
 - (a) Pno: Designates the number of bytes (number of parameters) following ESC DLE a Pno. MSB is invalid.
Range: $00H \leq Pno \leq FFH$
With this command, Pno=1 is designated.
 - (b) n:
Range: $00H \leq n \leq FFH$
Default: n=0

Definitions of bit:

	Functions	Bit value= 0	Bit value= 1	Supported status	
LSB	0	Level of Drawer Kick Connector Pin 3	Invalid	Valid	Byte 1 – Bit 2
	1	On-line/Off-line status	Invalid	Valid	Byte 1 – Bit 3,5,6
	2	Error status	Invalid	Valid	Byte 2 – Bit 2,3,5,6
	3	Roll Paper Sensor	Invalid	Valid	Byte 3 – Bit 0,1,2,3
	4	(Undefined)	–	–	–
	5	Cut Paper Sensor and Cut Paper Status	Invalid	Valid	Byte 3 – Bit 5,6 Byte 4 – Bit 0,1,2,3
MSB	6	Sprocket Paper status	Invalid	Valid	–
	7	(Undefined)	–	–	–

Byte 5 (Information on Sprocket paper)

		Functions	Bit value = 0	Bit value = 1
LSB	0	Sprocket select	Selected	Deselected
	1	Sprocket paper status	Printable	Unprintable
	2	Lever status	Tractor	Slip
	3	(Undefined)	–	–
	4	(Fixed value)	Fixed at 0	Fixed at 0
	5	(Undefined)	–	–
MSB	6	(Undefined)	–	–
	7	(Fixed value)	Fixed at 0	Fixed at 0

- Bit 1: Sprocket paper status is 0 (Printable) at end of auto loading and 1 (Unprintable) at Auto Park, or Paper End due to bottom detection.
- Even if Bit 3 of Byte 1 (On-line/Off-line status) is Off-line, Sprocket paper status does not turn 1 (Unprintable).
 - If Sprocket paper is selected and there is no paper, the status is:
Of Byte 3, Bit 5 and Bit 6 are 1 (Paper End).
Of Byte 5, Bit 0 is 0 (Selected) and Bit 1 is 1 (Unprintable).
 - For the undefined bits, 1 is sent.
- (4) If an unsent ASB status by the command GS a n is still retained, reception of this command will clear it. (Applicable to only Parallel Models.)

Name:	Status Real-time Send	
Code	HEX:	1BH 10H 72H Pno n
	DEC:	27 16 114 Pno n

Functions:

- (1) Sends real-time a status of "n"
This is the same spec as the DLE EOT n Status Real-time Send command except the addition of Parameter 07H (Sprocket Paper Status Send); hence, only the differences are described herein.
- (2) The DEL in the command sequence disables MSB. ("90H" is effective as well.)
- (3) Valid range and definitions of parameters
 - (a) Pno : Designates the number of bytes (number of parameters) following ESC DLE r Pno.
Invalidates MSB.
Range : 00H ≤ Pno ≤ FFH
With this command, Pno=1 is designated.
 - (b) n :
Range : 01H ≤ n ≤ 07H

n	Function
01H	Sends printer status
02H	Sends Off-line Cause status
03H	Sends Error cause status
04H	Sends Roller Paper Sensor status
05H	Sends Slip paper status
06H	Sends Validation status
07H	Sends Sprocket paper status

N=7: Sprocket Paper status

	Functions	Bit value = 0	Bit value = 1
LSB	0 (Fixed value)	Fixed at 0	Fixed at 0
	1 (Fixed value)	Fixed at 1	Fixed at 1
	2 Sprocket Paper Select	Selected	Deselected
	3 Status of Lever	Tractor	Slip
	4 (Fixed value)	Fixed at 1	Fixed at 1
	5 Slip Insert Sensor (Sprocket Insert Sensor)	Paper present	Paper end
MSB	6 Slip Eject Sensor (Validation Sensor)	Paper present	Paper end
	7 (Fixed value)	Fixed at 0	Fixed at 0

Bit 2: There may be some delay between reception of ESC DLE c Pno 0 n and actual selection of Sprocket paper. During this delay, the status is 1 (Deselected).

Bit 3: Sends a status of the lever at the present time.

Bit 5/6: Sends a status of Slip Sensor (Sprocket Insert Sensor and Validation Sensor) at the present time.

3.2.9 Bar Code Control

This section describes the bar code control features.

3.2.9.1 Bar Code Style Select and Size Set

ESC DLE A Pno N1...N8

Name:	Bar Code Type and Size Select and Set	
Code	HEX:	1BH 10H 41H Pno N1 N2 N3 N4 N5 N6 N7 N8
	DEC:	27 16 65 Pno N1 N2 N3 N4 N5 N6 N7 N8

Functions:

- (1) This command selects and set the bar code type and size.
- (2) Functions of individual parameters

Table 0 Parameter listing

No	Parameter	Description	Remarks
1	Pno	The number of bytes following Pno (the number of parameters)	Refer to (a).
2	N1N2	Bar code type	Refer to (b).
3	N3N4	Vertical length of the bar	Refer to (c).
4	N5	Bar width (magnification of module width) or Narrow Element's black bar width (magnification)	Refer to (d).
5	N6	Narrow Element's space width (magnification)	Refer to (e).
6	N7	Wide Element and Narrow Element ratio	Refer to (f).
7	N8	Human Readable Character Present/Not Present	Refer to (g).

- (a) Pno specifies the number of bytes (the number of parameters) following ESC DLE A Pno. (MSB: Invalid)

Pno=0,1,3: This command becomes invalid, and the entire command is ignored.

Pno=2,4,5,6,7,8: This command becomes valid.

Pno≥9: N1 to N8 become valid and data from N9 is ignored.

- (b) N1N2 selects barcode type. (N1N2: High order 4 bits are invalid.)

N1 N2

0 1 EAN8

0 2 EAN13

1 0 UPC-A

1 4 UPC-E

2 0 CODE 39

3 0 Interleaved 2 of 5 (ITF)

4 0 CODE 128

5 0 CODABAR (NW-7)

Only the above values in the N1N2 combinations are valid parameters.

If an invalid parameter is received, the entire command is ignored.

- (c) N3N4 sets the vertical length of the bar. (N3N4: High order 4 bits are invalid.)

The unit is 6/72 inch.

The height of the bar is $(N3 \times 10 + N4) \times (6/72 \text{ inch})$.

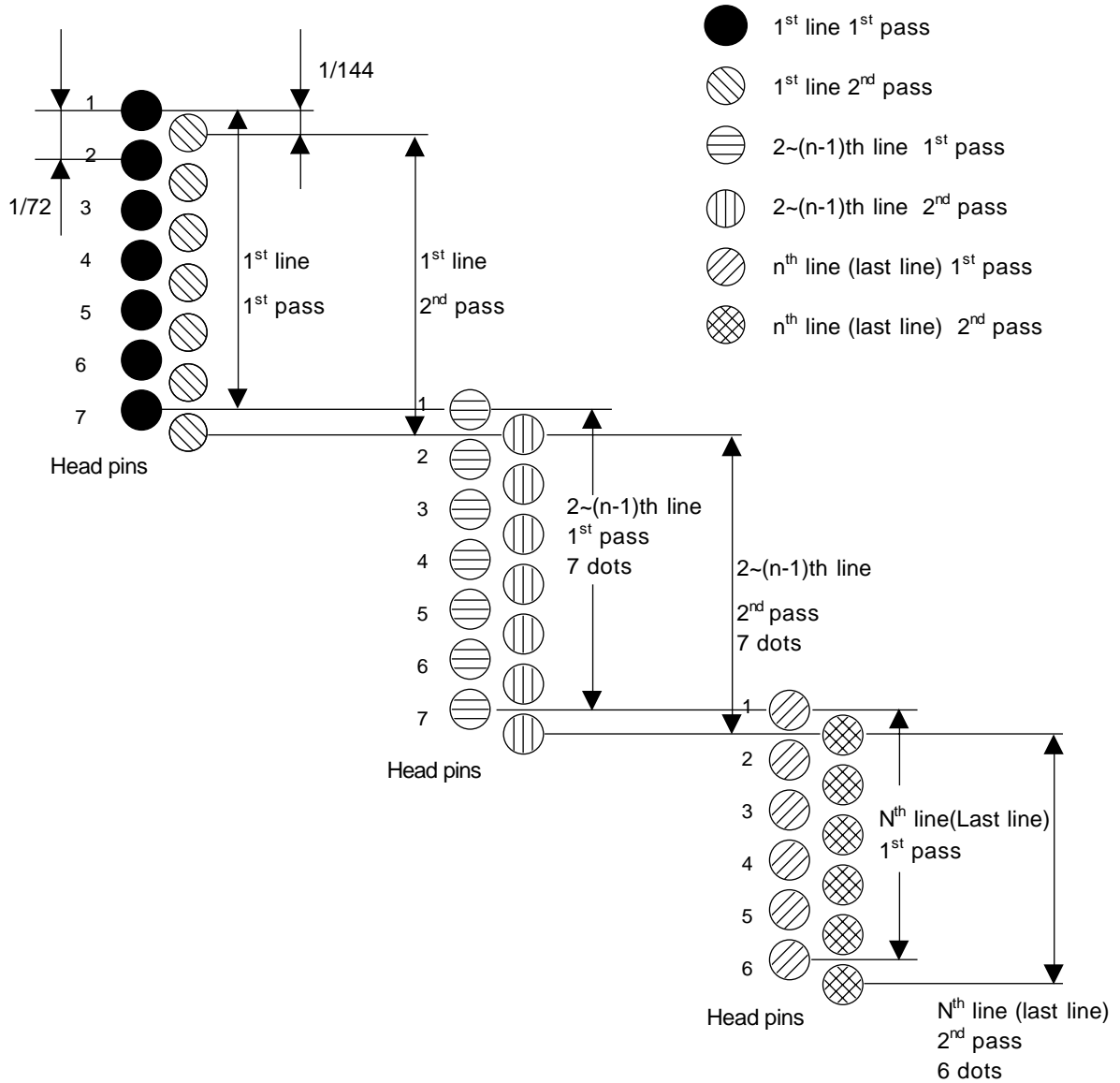
N3=N4=0: The previous setting remains effective.

N3>9 or N4>9: The previous setting remains effective.

$N3 \times 10 + N4 \geq 25$: It is set as $N3 \times 10 + N4 = 24$.

The bar code consists of 6 dots vertically and prints with 1/144-inch line feed in two passes. When printing a bar code over multiple lines ($N \geq 4$), the printer prints it in 7 vertical dots except for the last line, in order to overlap the lowest dot of the 1st pass of the line printed the previous time and the highest dot of the 1st pass of the line to be printed this time. (This is to prevent a white line.)

In line feed in bar code printing, the base line that becomes the reference to the vertical current position moves, too.



- (d) N5 sets the width of the bar (module width) when EAN8 / EAN13 / UPC-A / UPC-E / CODE128 are selected, and sets the width of black bar of Narrow Element when CODE39 / Interleaved 2 of 5 / CODABAR are selected.
- N5's high order 4 bits are invalid.
 - N5=0: The previous setting remains valid.
 - N5≥8: N5 is set as N5=7.

(EAN8 / EAN13 / UPC-A / UPC-E / CODE128)

- The minimum width of the black bar and a space is 1 / 72-inch.
- N5 sets the magnification of the bar width. (N6 and N7 settings are ignored.)
- The number of columns (144DPI) of the four-value level (bar widths of four types) is shown below (Table 1):

Table 1 EAN8 / EAN13 / UPC-A / UPC-E / CODE128 module width

N5	Magnification	Upper column: Black bar; Lower column: Space			
		1 module	2 modules	3 modules	4 modules
1	1	1	4	6	9
		4	7	9	12
2	1.5	2	6	9	13
		5	9	12	16
3	2	3	8	12	17
		6	11	15	20
4	2.5	4	10	15	21
		7	13	18	24
5	3	5	12	18	25
		8	15	21	28
6	3.5	6	14	21	29
		9	17	24	32
7	4	7	16	24	33
		10	19	27	36

(CODE39 / Interleaved 2 of 5 / CODABAR)

- The minimum width of a black bar shall be 1 / 72-inch.
- Relation of N5 and magnification is shown below (Table 2):
- The printer prints in the number of columns shown below (144DPI):

Table 2 CODE39/Interleaved 2 of 5/CODABAR Narrow Element's Black Bar Width

N5	1	2	3	4	5	6	7
Magnification	1	1.5	2	2.5	3	3.5	4
Number of columns	1	2	3	4	5	6	7

- (e) N6 sets the space width of the Narrow Element when CODE39 / Interleaved 2 of 5 / CODABAR are selected, and when EAN8 / EAN13 / UPC-A / UPC-E / CODE128 are selected, all it takes place is setting, and it is ignored.
- The minimum width of the space is 1 / 72-inch.
 - N6's high order 4 bits are invalid.
 - N6=0: The previous setting remains valid.
 - N6≥8: N6 is set as N6=7.
 - The N6 and magnification relation is shown below (Table 3).
 - The printer prints in the number of columns shown below (144DPI).

Table 3 CODE39/Interleaved 2 of 5/CODABAR Space width of Narrow Element

N6	1	2	3	4	5	6	7
Magnification	1	1.5	2	2.5	3	3.5	4
Number of columns	4	5	6	7	8	9	10

- (f) N7 sets the ratio of the Wide Element and the Narrow Element when CODE39 / Interleaved 2 of 5 / CODABAR are selected, and when EAN8 / EAN13 / UPC-A / UPC-E / CODE128 are selected, all it takes place is setting and it is ignored.
- N7's high order 4 bits are invalid.
 - N7=0: The previous setting remains effective.
 - N7≥8: N7 is set as N7=7.
 - The N7 and ratio relation is shown below (Table 4).

Table 4 CODE39/Interleaved 2 of 5/CODABAR Wide Element and Narrow Element ratio

N7	1	2	3	4	5	6	7
Ratio	2:1	2.5:1	3:1	3.5:1	4:1	4.5:1	5:1

The table below shows the Narrow Element and Wide Element relation of black bars of the CODE39 / Interleaved 2 of 5 / CODABAR (Table 5). (Relation of N5 and N7)

Table 5 CODE39 / Interleaved 2 of 5 / CODABAR Black Bar Symbol table

Type		N5		1	2	3	4	5	6	7
		Magnification	1	1.5	2	2.5	3	3.5	4	
Narrow Elements		1	1	1	2	3	4	5	6	7
Wide Elements	N7=1	2	4	6	8	10	12	14	16	
	N7=2	2.5	5	7	10	12	15	17	20	
	N7=3	3	6	9	12	15	18	21	24	
	N7=4	3.5	7	11	14	18	21	25	28	
	N7=5	4	9	13	17	21	25	29	33	
	N7=6	4.5	10	14	19	23	28	32	37	
	N7=7	5	11	16	21	26	31	39	41	

Number of columns (144DPI)

Table 6 shows the Narrow Element and Wide Element relation of CODE39 / Interleaved 2 of 5 / CODABAR spaces. (Relation of N6 and N7)

Table 6 CODE39 / Interleaved 2 of 5 / CODABAR Space Symbol List

Type		N6	1	2	3	4	5	6	7
		Magnification	1	1.5	2	2.5	3	3.5	4
Narrow Elements		1	4	5	6	7	8	9	10
Wide Elements	N7=1	2	7	9	11	13	15	17	19
	N7=2	2.5	8	10	13	15	18	20	23
	N7=3	3	9	12	15	18	21	24	27
	N7=4	3.5	10	14	17	21	24	28	31
	N7=5	4	12	16	20	24	28	32	36
	N7=6	4.5	13	18	22	27	31	36	40
	N7=7	5	14	19	24	29	34	39	44

Number of columns (144DPI)

- (g) N8 sets the Human Readable Character Present/Not-present.
- N8's high order 4 bits are invalid.
 - Table 7 shows the relation of N8 and Human Readable Character Present/Not-present:

Table 7

N8	Meaning
0	Do not add human readable character(s).
Value other than 0	Add human readable character(s). (Print font: Utility)

- *1 Human readable characters are printed according to each bar width, in 144DPI.
(Spaces are added to the left and the right of the font.)
For the bar code and human readable character positional relation, refer to the bar code print command (ESC DLE B).

(3) This section shows how to calculate the print width of each bar code.

Use the maximum width of the bar code for the calculation to obtain the print width because the bar code width varies with barcode data. If the actual bar code width is smaller than the calculated width, add spaces to make up for the deficiency to the right of the barcode.

(a) EAN8 / EAN13 / UPC-A / UPC-E / CODE128

Obtain the barcode print width by adding the number of columns shown below, according to the parameter N5 (magnification of bar width).

Table 8 EAN8/EAN13/UPC-A/UPC-E/CODE128 structure and the number of columns (1/2)

No	Bar code type	Bar code structure	Number of columns(144DPI)							Remarks	
			N5	1	2	3	4	5	6		7
			Magnification	1	1.5	2	2.5	3	3.5		4
1	EAN8	Start Bar	6	9	12	15	18	21	24		
		Data Characters (4 characters, fixed)	19	26	33	40	47	54	61		
		Center Bar	14	19	24	29	34	39	44		
		Data Characters (3 characters, fixed)	19	26	33	40	47	54	61		
		Check Digit (1 character, fixed)	19	26	33	40	47	54	61		
		End Bar	6	9	12	15	18	21	24		
2	EAN13	Left Margin (HRC: Flag Character)	24, fixed.								
		Start Bar	6	9	12	15	18	21	24		
		Data Characters (6 characters, fixed)	19	26	33	40	47	54	61		
		Center Bar	14	19	24	29	34	39	44		
		Data Characters (5 characters, fixed)	19	26	33	40	47	54	61		
		Check Digit (1 character, fixed)	19	26	33	40	47	54	61		
		End Bar	6	9	12	15	18	21	24		

*1 HRC is an acronym for Human Readable Character, and when Attach HRC is specified, /HRC is printed.

*2 EAN13's Flag Character is used for judging the parity when a bar pattern is being created, and the barcode is not printed.

Table 8 EAN8/EAN13/UPC-A/UPC-E/CODE128 structure and the number of columns (2/2)

No	Bar code type	Bar code structure	Number of columns(144DPI)							Remarks	
			N5	1	2	3	4	5	6		7
			Magnification	1	1.5	2	2.5	3	3.5		4
3	UPC-A	Left Margin (HRC: Number System Character)	24, fixed.								
		Start Bar	6	9	12	15	18	21	24		
		Number System Character (1 character, fixed)	19	26	33	40	47	54	61		
		Data Characters (5 characters, fixed)	19	26	33	40	47	54	61		
		Center Bar	14	19	24	29	34	39	44		
		Data Characters (5 characters, fixed)	19	26	33	40	47	54	61		
		Check Digit (1 character, fixed)	19	26	33	40	47	54	61		
		End Bar	6	9	12	15	18	21	24		
		Right Margin (HRC: Check Digit)	24, fixed.								
4	UPC-E	Left Margin (HRC: Number System Character)	24, fixed.								
		Start Bar	6	9	12	15	18	21	24		
		Data Characters (6 characters, fixed)	19	26	33	40	47	54	61		
		End Bar	15	21	27	33	39	45	51		
		Right Margin (HRC: Check Digit)	24, fixed.								
5	CODE128	Start Character	30	41	52	63	74	85	96		
		Data Characters (50 characters, max)	30	41	52	63	74	85	96	(*1) (*2)	
		Stop Character	32	45	58	71	84	97	110		

- *1 The last character shall be the Check digit.
- *2 For CODE128(CODE C), calculate with the number of characters x 1/2.
(If the number of characters is an odd-number, use (the number of characters +1) x 1/2.)
- *3 HRC is an acronym for Human Readable Character, and when Attach HRC is specified, HRC is printed.
- *4 The UPC-E's Number System Character is fixed to the "0" character, and the bar code is not printed. The Check Digit is used for judging the parity when a bar pattern is being created, and the barcode is not printed.

Table 9 shows the parameter N5 or the maximum value of the number of characters for each media:

Table 9

No	Bar code type	Number of characters	Receipt, Journal		Slip, Sprocket	
			76.2mm	69.5mm		
1	EAN8	8 characters, fixed.	N5=4	N5=3	N5=7	
2	EAN13	13 characters, fixed.	N5=2	N5=1	N5=7	
3	UPC-A	12 characters, fixed.	N5=2	N5=1	N5=7	
4	UPC-E	6 characters, fixed.	N5=5	N5=4	N5=7	
5	CODE 128(*1)	Max 50 characters (Upper row: CODE A & B Lower row:BCODE C)	N5=1	11 characters	10 characters	28 characters
				22 characters	20 characters	50 characters
			N5=2	7 characters	6 characters	20 characters
				14 characters	12 characters	40 characters
			N5=3	5 characters	4 characters	15 characters
				10 characters	8 characters	30 characters
			N5=4	4 characters	3 characters	12 characters
				8 characters	6 characters	24 characters
			N5=5	3 characters	2 characters	10 characters
				6 characters	4 characters	20 characters
			N5=6	2 characters	2 characters	8 characters
				4 characters	4 characters	16 characters
			N5=7	2 characters	1 characters	7 characters
				4 characters	2 characters	14 characters

*1 Indicates the number of characters without CODE A/B/C mode switch.

(b) CODE39 / Interleaved 2 of 5 / CODABAR

Obtain the bar code print width by the formulas shown in Table 10, using the parameter N5 (the magnification of Narrow Element's black bar width), N6 (the magnification of Narrow Element space width), N7 (Wide Element and Narrow Element ratio), Table 5 and Table 6.

NB = Narrow Element's black bar; WB = Wide Element's black bar

NS = Narrow Element's space; WS = Wide Element's space

Table 10 CODE39/Interleaved 2 of 5/CODABAR structure and the number of columns

No	Bar code type	Bar code structure	Calculation of the number of columns (144DPI)
1	CODE39	Start Character	$N5 \leq N6: NBx5 + NSx1 + WSx3$ $N5 > N6: NBx3 + NSx3 + WBx2 + WSx1$
		Gap between characters	NS
		Data Characters (*2) (Max 50 characters)	$N5 \leq N6: NBx5 + NSx1 + WSx3$ $N5 > N6: NBx3 + NSx3 + WBx2 + WSx1$
		Gap between characters(*1)	NS
		Stop Character	$N5 \leq N6: NBx5 + NSx1 + WSx3$ $N5 > N6: NBx3 + NSx3 + WBx2 + WSx1$
2	Interleaved 2 of 5	Start Character	$NBx2 + NSx2$
		Data Characters (*2,*3) (Max 50 characters)	$NBx3 + NSx3 + WBx2 + WSx2$
		Stop Character	$WB + NS + NB$
3	CODABAR (*4)	Start Character (1 character)	$N5 \leq N6: NBx3 + NSx1 + WBx1 + WSx2$ $N5 > N6: NBx1 + NSx3 + WBx3$
		Gap between characters	NS
		Data Characters (*2) (Max 48 characters)	$N5 \leq N6: NBx3 + NSx1 + WBx1 + WSx2$ $N5 > N6: NBx1 + NSx3 + WBx3$
		Gap between characters(*1)	NS
		Stop Character (1 character)	$N5 \leq N6: NBx3 + NSx1 + WBx1 + WSx2$ $N5 > N6: NBx1 + NSx3 + WBx3$

*1 Gap between characters is added for every 1 character.

*2 The last character shall be the Check Digit.

*3 For Interleaved 2 of 5, calculate with the number of characters x 1/2.

(If the number of characters is an odd-number, use (the number of characters +1) x 1/2.)

*4 Since Start/Stop Characters of CODABAR vary, they are included in data string (ESC DLE B's DATA). The printer expands the data without being conscious of the Start/Stop Characters, and adds the gap between characters when there are multiple characters. (Consequently, even when the number of characters is 1 or 2, printing is possible.)

Table 11 shows the maximum value of the number of characters for each media by the parameters N5, N6 and N7:

Table 11

No	Bar code type	Parameter			Receipt, Journal		Slip, Sprocket
		N5	N6	N7	76.2mm	69.5mm	
1	CODE39	1	1	1	9 characters	8 characters	24 characters
		2	2	2	6 characters	5 characters	16 characters
		3	3	3	3 characters	3 characters	10 characters
		4	4	4	2 characters	1 character	7 characters
		5	5	5	1 character		5 characters
		6	6	6			3 characters
		7	7	7			2 characters
2	Interleaved 2 of 5	1	1	1	20 characters	18 characters	48 characters
		2	2	2	12 characters	12 characters	30 characters
		3	3	3	8 characters	8 characters	20 characters
		4	4	4	6 characters	4 characters	14 characters
		5	5	5	4 characters	4 characters	10 characters
		6	6	6	2 characters	2 characters	8 characters
		7	7	7	2 characters	2 characters	6 characters
3	CODABAR	1	1	1	14 characters	12 characters	31 characters
		2	2	2	9 characters	8 characters	21 characters
		3	3	3	6 characters	5 characters	14 characters
		4	4	4	4 characters	4 characters	10 characters
		5	5	5	3 characters	3 characters	8 characters
		6	6	6	2 characters	2 characters	6 characters
		7	7	7	2 characters	2 characters	5 characters

*1 CODABAR shows the number of characters that includes Start/Stop Characters.

- (4) This command does not cause printing to start.
- (5) The defaults of these parameters are as follows:
 - NIN2 = 10 (UPC-A)
 - N3N4 = 09 (3/4 inch)
 - N5 = 1 (1/72 inch)
 - N6 = 1 (1/72 inch)
 - N7 = 2 (2.5:1)
 - N8 = 1 (Human readable character present)
- (6) When any of the following events takes place, the default bar code settings become effective:
 - (a) When the Initialize command (ESC @) is received.
 - (b) When the I-PRIME signal (Parallel model)/Reset signal is received.
 - (c) When the printer is turned on.
 - (d) When the Menu Set command (ESC DLE D) is received.

Name:	Print Bar Code Data	
Code	HEX:	1BH 10H 42H Pno Pm DATA
	DEC:	27 16 66 Pno Pm DATA

Functions:

- (1) Prints bar code data.
 - (a) The conditions that cause the printer to print bar code data:
 For horizontal direction print density, use 144DPI FULL.
 1 / 144 inch line feed 2-pass print. (Vertical direction: 144DPI)
 Uni-direction printing takes place regardless of the Uni-direction Print command (ESC U) settings.
- (2) Pno specifies the number of bytes following ESC DLE B Pno. (MSB: Invalid)
- (3) Pm selects the CODE128 Modes A, B or C.
 Valid only when the CODE128 is selected, and when anything other than CODE128 is selected, the command sequence becomes ESC DLE B Pno DATA.

41H: CODE128(Set A)	Start Code is START CODE A. (Starts in the CODE A Mode.)
42H: CODE128(Set B)	Start Code is START CODE B. (Starts in the CODE B Mode.)
43H: CODE128(Set C)	Start Code is START CODE C. (Starts in the CODE C Mode.)

 For any other value, the entire command is ignored.
- (4) DATA indicates bar code data and MSB is invalid.
 Since Start/Stop Characters of CODABAR vary, however, they are included in the DATA.
 For the number of characters (number of data) that become effective by this command, refer to (11).
 For the range that can be actually printed, refer to the Bar Code Style Select and Size Set command (ESC DLE A).

(5) Block change conditions that trigger printing:

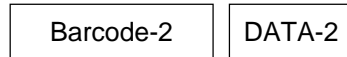
(a) Condition proceeding valid print bar code that triggers printing



If a block of bar code data (barcode-1) follows a block of characters (including spaces) or bit image graphics (above DATA-1), the block change triggers the "data-1" to print. The only case this is not applicable is when the DATA-1 is SKIP.

SKIP, too, however, triggers printing if the 144DPI calculation results in a fraction.

(b) Block change condition that triggers valid print bar code to print



If a block of bar code data (barcode-2) proceeds a block of data (above DATA-2) that is a print start command, or characters (including spaces) or bit image graphics, the block change triggers the "barcode-2" data to print.

(c) Block change condition that triggers printing when valid print bar codes continue



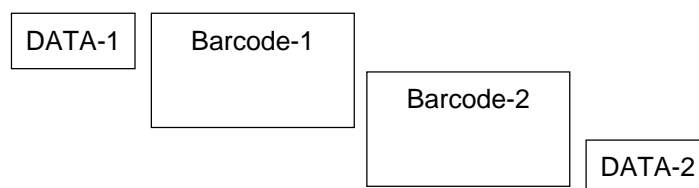
If a different bar code mode is set after (or before) the above barcode-3 and then this command is received, the block change triggers the barcode-3 data to print.

A different bar code mode here means a change(s) in the following settings:

- Bar code type
- Height
- Black bar, space width
- Narrow/Wide ratio
- Whether human readable characters Present/Not-present

(6) The vertical current position after bar code printing shall be the print end position.

When the block change triggers printing according to the conditions described in (5), the baseline that becomes the reference for the current vertical position shifts by the line feed that accompanies the bar code printing. As a result, the print position will become as follows:



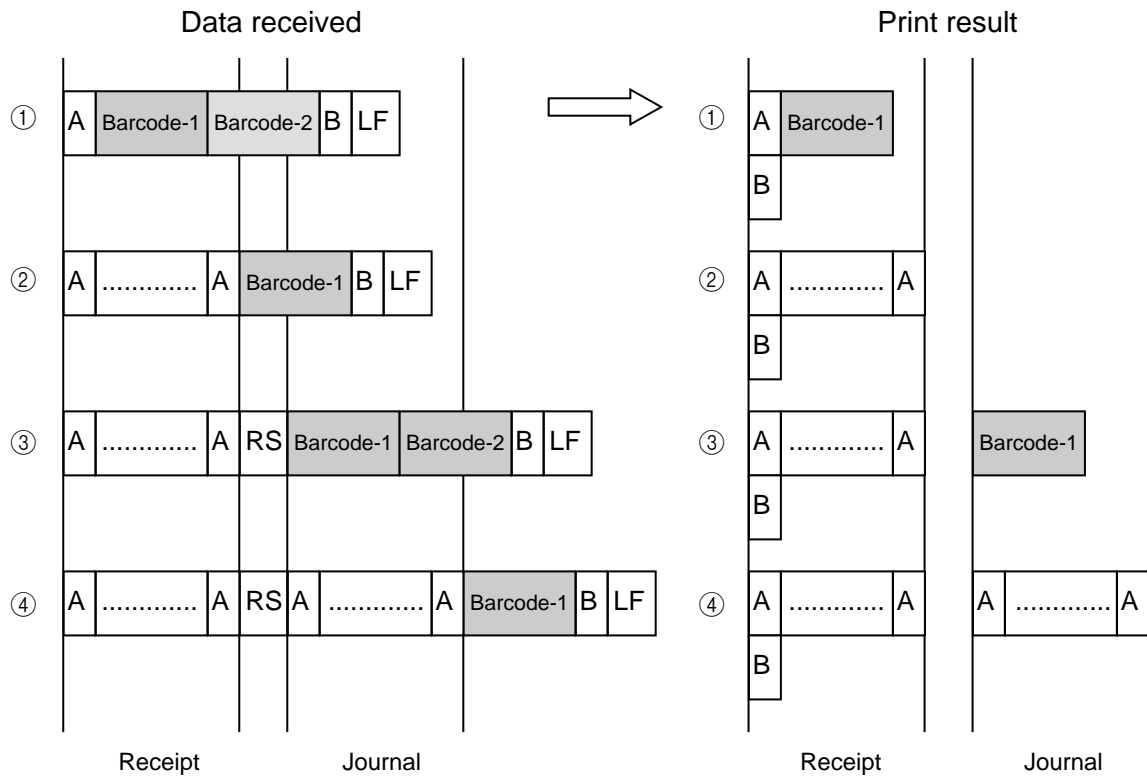
(7) When bar code data exceeding the right margin is received, the entire command is ignored, and next print start position (horizontal current position) shall become the right margin position.

When the Identical Data Print is cleared in Receipt+Journal mode, if the print start position exceeds Receipt's right margin on the Receipt side or Journal's right margin on Journal side, the entire command is ignored, and next print start position will become Journal's right margin position, whether the print start position is on Receipt side or Journal side.

(Since Block Change Check is performed before Right Margin Check, however, even when the right margin is exceeded, if the block change conditions that trigger printing are met, the block change triggers applicable data to print.)

For how to calculate the bar code width, refer to the Bar Code Style Select and Size Set command (ESC DLE A).

Print example when bar code exceeding right margin is received after Identical Data Print is cleared in the Receipt+Journal mode:



- *1 Bar code settings of Barcode-1 and Barcode-2 are identical.
- *2 With the reception of Barcode-1, the block change triggers the character "A" to print.
- *3 With the reception of the character "B" before LF, printing, then, carriage return and line feed take place.

Note 1) The print result in the above figure is for the bar code height of 7/72 inch and no human readable character present.

- (8) When this command is received in the Validation mode, the entire command is ignored.
- (9) The bar code print line is Left Align, regardless of the setting of the Position Align command (ESC a).
The same applies to the line that is printed triggered by the block change with the reception of this command.
- (10) In Slip mode and Sprocket mode, if the bar code exceeds the printable area in the vertical direction while it is being printed over multiple lines, it is printed overlapping.

(11) The number of characters that become valid in this command is as follows (Check Digit code is counted as 1 character):

- (a) EAN8 8 characters (fixed)
- (b) EAN13 13 characters (fixed)
- (c) UPC-A 12 characters (fixed)
- (d) UPC-E 6 characters (fixed)
- (e) CODE39 50 characters (maximum number of characters)
- (f) Interleaved 2 of 5 50 characters (maximum number of characters)
- (g) CODE128(Set A,B,C) 50 characters (maximum number of characters)
- (h) CODABAR 50 characters (maximum number of characters)

- For (a) through (d), the number of characters is fixed to the above.

When the Pno value is not the fixed number of characters, the entire command is ignored.

- For (e) through (h), they are valid as long as they do not exceed the maximum number of characters.

If the Pno value ((g): Pno - 1 value) exceeds the maximum number of characters, the entire command is ignored.

- In the Interleaved 2 of 5, if the number of characters is an odd number, add the character "0" in front of the data. (Ex. 123 → 0123)
- In the CODE128's CODE C, if the number of characters excluding the Check Digit Character and 3AH~3CH is an odd number, add the character "0" in front of the data. (Ex. 123 → 0123)
- For CODABAR, Start/Stop Characters are included in the number of characters.

(12) By sending the Check Digit Character at the end of DATA, the Check Digit can be automatically generated. This is not applicable to UPC-E or CODABAR, however.

If the Check Digit Character is not at the end of DATA, it is handled as an invalid code, and for EAN8, EAN13 and UPC-A, the entire command is ignored. For CODE39, Interleaved 2 of 5 and CODE128, only the Check Digit Character is ignored.

(13) Bar code types and valid characters

- (a) EAN8 0(30H) =<Valid characters =<9(39H)
- (b) EAN13 0(30H) =<Valid characters =<9(39H)
- (c) UPC-A 0(30H) =<Valid characters =<9(39H)
- (d) UPC-E 0(30H) =<Valid characters =<9(39H)
- (e) CODE39 43 characters SP(20H), \$(24H), %(25H), +(2BH), -(2DH), .(2EH), / (2FH), 0(30H)~9(39H), A(41H)~Z(5AH), are valid.
- (f) Interleaved 2 of 5 0(30H) =<Valid characters =<9(39H)
- (g) CODE128(SetA) 00H =<Valid characters =<66H
- (h) CODE128(SetB) 19H =<Valid characters =<7FH
- (i) CODE128(SetC) 30H =<Valid characters =<3CH
- (j) CODABAR 20 characters \$(24H), +(2BH), -(2DH), .(2EH), / (2FH), :(3AH), 0(30H)~9(39H), A(41H)~D(44H) are valid.

When it receives a character other than the above (excluding Check Digit Character), for (a)~(d), the printer ignores the entire command, and for (e)~(j), ignores only that character, but count the number of bytes of Pno.

(For (d) and (j), there is no Check Digit Character.)

(14) Bar code type and Check Digit Character

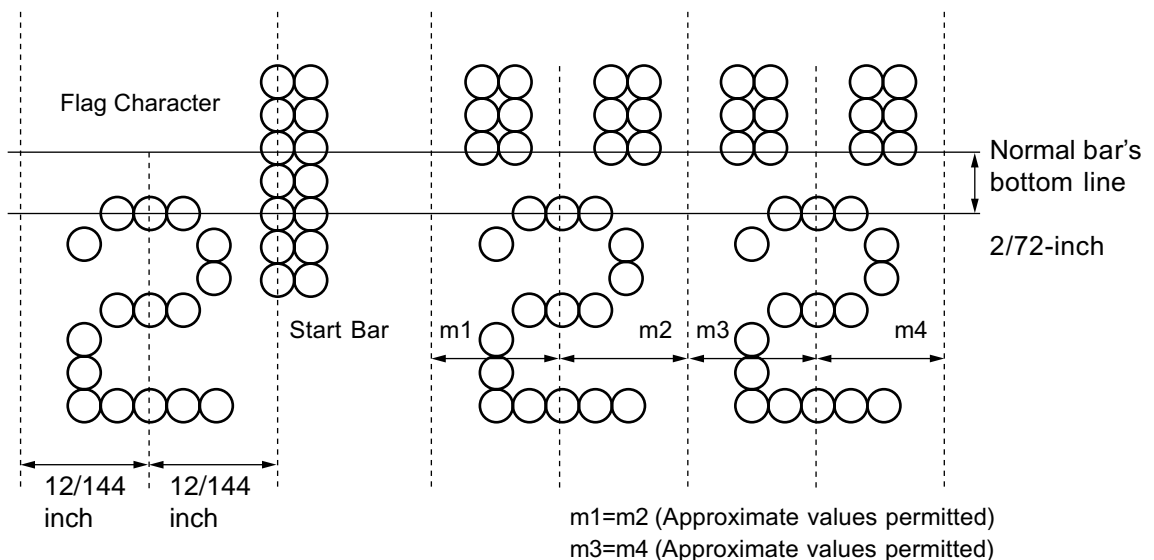
- (a) EAN8 "@"(40H)
- (b) EAN13 "@"(40H)
- (c) UPC-A "@"(40H)
- (d) UPC-E Cannot be specified. (Check Digit Auto Generation Enable, fixed.)
- (e) CODE39 "@"(40H)
- (f) Interleaved 2 of 5 "@"(40H)
- (g) CODE128(SetA) "@"(67H)
- (h) CODE128(SetB) 18H
- (i) CODE128(SetC) "@"(40H)
- (j) CODABAR Cannot be specified. (Check Digit Auto Generation Disabled, fixed.)

UPC-E Check Digit prints only human readable characters, and does not print bar code(s).
 CODE128 Check Digit prints only bar codes, and does not print human readable characters.

(15) The position to print a human readable character

In this printer, human readable characters are added to underneath the bar codes.
 (Cannot be added above the bar codes.)

- (a) In vertical direction, the printer prints top dots (for ascender) of a human readable character at a position 2/72-inch away from the normal bar's bottom line (last dot of 1st pass of the last line).
- (b) In horizontal direction, the printer prints them at the center of a bar equivalent to 1 character.
- (c) Flag Character (valid only for EAN13) is added with Human Readable Character Present designation. (Does not print Flag Character's bar code, however.)



- (d) When Human Readable Characters are added, Start, Center, End Bar and UPC-A's Number System Character and Check Digit are printed up to four dots below the normal bar's bottom line. (This bar that sticks out is printed in 1/144-inch line feed and 2-pass, too.)
- (e) Number Character of UPC-A and UPC-E is added in the same manner as the EAN13 Flag Character when the Human Readable Character Present is designated. (For UPC-E, Number System Character's bar code is not printed.)
- (f) Human Readable Characters disable all the print modes, but enable the International Character Setting.

(16) Start, Center and End Bars are added only in the following types:

- (a) EAN8
- (b) EAN13
- (c) UPC-A
- (d) UPC-E (no Center Bar)

(17) If it receives an invalid code in DATA, for EAN8, EAN13, UPC-A, and UPC-E, the printer ignores the entire command, but for CODE39, Interleaved 2 of 5, CODE128 and CODABAR, ignores only the invalid codes.

- (a) The following cases constitute invalid codes:
 - Received an invalid character;
 - Received Check Digit Character somewhere other than the end of DATA.

(18) Check Digit auto generation is as follows:

(Check Digit is a numerical value that is calculated to check if there is an error in bar code reading.)

- (a) If the last bar code data is the Check Digit Character, Check Digit is calculated, and the Check Digit replaces the Check Digit Character.
 UPC-E is fixed to Check Digit Auto Generation Enable, however, and as a result, Check Digit Character cannot be designated. CODABAR is fixed to Check Digit Auto Generation Disable, Check Digit Character cannot be designated.

(b) Table 1 shows bar code type and Check Digit calculation method:

Table 1 Bar code type and Check Digit calculation method

No	Bar code type	Kind of Check Digit calculation method (auto generation)	Remarks
1	EAN8	Modulus10 / Weight3	
2	EAN13	Modulus10 / Weight3	
3	UPC-A	Modulus10 / Weight3	
4	UPC-E	Modulus10 / Weight3	6 characters are expanded to 11 characters, then, Check Digit is calculated.
5	CODE39	Modulus43	
6	Interleaved 2 of 5	Modulus10 / Weight3	If the number of data is an odd number, the character 0 is added at the top of the data, then, the Check Digit is calculated.
7	CODE128	Modulus103	For CODE C, if the number of data is an odd number, the character 0 is added at the top of the data, then, the Check Digit is calculated.
8	CODABAR	(No Auto Generation)	As Check Digit calculation methods, the following are available: Modulus10/Weight3, Modulus16, Modulus11, Modulus10/Weight2, 7check DR, Weighted Modulus11, and Runes To be added by the host according to the need.

Modulus10/Weight3 calculation method (EAN8, EAN13, UPC-A, UPC-E, Interleaved 2 of 5)

- (1) Assign numbers from the right digit of the bar code data to left in order, excluding Start/Stop Characters and Check Digit Character.
- (2) Multiply the odd-number digits by 3 and the even-number digits by 1, and obtain their sum.
- (3) Divide the above sum by 10 and obtain the remainder.
- (4) The value obtained by subtracting the above remainder from 10 is the Check Digit.
When the value obtained in the above manner is 10, however, 0 becomes the Check Digit.
(Ex.) EAN8 bar code data 1234567@ (@ becomes Check Digit)

Number	7	6	5	4	3	2	1	
Data	1	2	3	4	5	6	7	
	x	x	x	x	x	x	x	
Weight	3	1	3	1	3	1	3	
	↓	↓	↓	↓	↓	↓	↓	
	3	+	2	+	9	+	4	+
					15	+	6	+
							21	=60

60 ÷ 10 = 6 Remainder 0
 10 - 0 = 10 Check Digit 0

- Note 1) In Interleaved 2 of 5, if the number of data is an odd number, 0 (zero) is added at the top of the data, then, the above Check Digit calculation is made. (Ex. 123 → 0123)
- Note 2) In UPC-E, the Check Digit is calculated after 6 characters are expanded to 11 characters, according to the following method:

6-character control method (depending on the 6th value, the expansion method varies.)

- M1 M2 I3 I4 I5 M3 (M3=0,1,2)
 0 M1 M2 M3 0 0 0 0 I3 I4 I5 I3 I4 I5=000~999
- M1 M2 M3 I4 I5 3
 0 M1 M2 M3 0 0 0 0 0 I4 I5 I4 I5=00~99
- M1 M2 M3 M4 I5 4
 0 M1 M2 M3 M4 0 0 0 0 0 I5 I5=0~9
- M1 M2 M3 M4 M5 I5 (I5=5~9)
 0 M1 M2 M3 M4 M5 0 0 0 0 I5 I5=5~9

M: Maker Code I: Product Code

(Ex.) Bar code data 123451 → Expand to 01210000345.

Modulus43 calculation method (CODE39)

- (1) Convert bar code data into numerical values excluding Start/Stop Characters and Check Digit Character, according to the table below (Table 2):
- (2) Obtain the sum of the above numerical values.
- (3) Divide that sum by 43, and obtain the remainder.
- (4) Return the value of the remainder back to the character according to the table below (Table 2). This becomes the Check Digit.

Table 2 CODE39 Character/numerical value conversion table

Character	Value	Character	Value	Character	Value
0	0	F	15	T	29
1	1	G	16	U	30
2	2	H	17	V	31
3	3	I	18	W	32
4	4	J	19	X	33
5	5	K	20	Y	34
6	6	L	21	Z	35
7	7	M	22	-	36
8	8	N	23	.	37
9	9	O	24	Space	38
A	10	P	25	\$	39
B	11	Q	26	/	40
C	12	R	27	+	41
D	13	S	28	%	42
E	14				

(Ex.) Bar code data ABCD1234+ @ (@becomes Check Digit)

Data	A	B	C	D	1	2	3	4	+									
	↓	↓	↓	↓	↓	↓	↓	↓										
Converted into numeral	10	+	11	+	12	+	13	+	1	+	2	+	3	+	4	+	41	=97

Character conversion
 $97 \div 43 = 2$ Remainder 11
 11 → Check Digit B

Table 3 CODE39 External code table

H L	0	1	2	3	4	5	6	7
0			SP	0	CHECK DIGIT	P		
1				1	A	Q		
2				2	B	R		
3				3	C	S		
4			\$	4	D	T		
5			%	5	E	U		
6				6	F	V		
7				7	G	W		
8				8	H	W		
9				9	I	Y		
A					J	Z		
B			+		K			
C					L			
D			-		M			
E			.		N			
F			/		O			

Note 1) Unshaded areas: Valid characters.

Modulus103 calculation method (CODE128)

- (1) Convert bar code data into numerical values excluding Stop Characters and Check Digit Character, according to the table on next page (Table 4):
- (2) Multiply Start Code by 1, weight the data starting from next data, by multiplying by 1, 2, 3, 4... in order, and obtain their sum.
- (3) Divide that sum by 103 and obtain the remainder.
- (4) Return the value of that remainder back to the character according to the table on the next page (Table 4). This character becomes the Check Digit.

(Ex.) Bar code data [Start Code A] 3 8 A 6 g (g becomes Check Digit)

Data	START	3	8	A	6	
	CODE A					
	↓	↓	↓	↓	↓	
Conversion to numeral	103	19	24	33	22	
	x	x	x	x	x	
Weight	1	1	2	3	4	
	↓		↓	↓	↓	
	103	+ 19	+ 48	+ 99	+ 88	=357

$$357 \div 103 = 3 \quad \text{Remainder } 48$$

Character conversion 48 → Check Digit P

Note) In CODE128's CODE C, if the number of data becomes an odd number, 0(zero) is added at the top of the data, then, the above Check Digit calculation is made. (Ex. 123 → 0123)

Table 4 CODE128 numerical value/character conversion table

Value	CODE A	CODE B	CODE C	Value	CODE A	CODE B	CODE C	Value	CODE A	CODE B	CODE C
0	SP	SP	00	36	D	D	36	72	BS	h	72
1	!	!	01	37	E	E	37	73	HT	i	73
2	"	"	02	38	F	F	38	74	VF	j	74
3	#	#	03	39	G	G	39	75	VT	k	75
4	\$	\$	04	40	H	H	40	76	FF	l	76
5	%	%	05	41	I	I	41	77	CR	m	77
6	&	&	06	42	J	J	42	78	SO	n	78
7	'	'	07	43	K	K	43	79	SI	o	79
8	(	(	08	44	L	L	44	80	DLE	p	80
9	)	)	09	45	M	M	45	81	DC1	q	81
10	*	*	10	46	N	N	46	82	DC2	r	82
11	+	+	11	47	O	O	47	83	DC3	s	83
12	,	,	12	48	P	P	48	84	DC4	t	84
13	-	-	13	49	Q	Q	49	85	MAL	u	85
14	.	.	14	50	R	R	50	86	SYN	v	86
15	/	/	15	51	S	S	51	87	ETB	w	87
16	0	0	16	52	T	T	52	88	CAN	x	88
17	1	1	17	53	U	U	53	89	EM	y	89
18	2	2	18	54	V	V	54	90	SUB	z	90
19	3	3	19	55	W	W	55	91	ESC	{	91
20	4	4	20	56	X	X	56	92	FS	|	92
21	5	5	21	57	Y	Y	57	93	GS	}	93
22	6	6	22	58	Z	Z	58	94	RS	-	94
23	7	7	23	59	[	[	59	95	US	DEL	95
24	8	8	24	60	¥	¥	60	96	FNC 3	FNC 3	96
25	9	9	25	61	]	]	61	97	FNC 2	FNC 2	97
26	:	:	26	62	^	^	62	98	SHIFT	SHIFT	98
27	;	;	27	63	-	-	63	99	CODE C	CODE C	99
28	<	<	28	64	NUL	`	64	100	CODE B	CODE B	CODE B
29	=	=	29	65	SOH	a	65	101	FNC 4	FNC 4	CODE A
30	>	>	30	66	STX	b	66	102	FNC 1	FNC 1	FNC 1
31	?	?	31	67	ETX	c	67				
32	@	@	32	68	EOT	d	68				
33	A	A	33	69	ENQ	e	69	103	START (CODE A)		
34	B	B	34	70	ACK	f	70	104	START (CODE B)		
35	C	C	35	71	BEL	g	71	105	START (CODE C)		

Table 5 CODE128 (CODE A) External code table

L ^H	0	1	2	3	4	5	6	7
0	NUL	DEL	SP	0	@	P	FNC3	
1	SOH	DC1	!	1	A	Q	FNC2	
2	STX	DC2	"	2	B	R	SHIFT	
3	ETX	DC3	#	3	C	S	CODE C	
4	EOT	DC4	\$	4	D	T	CODE B	
5	ENQ	NAK	%	5	E	U	FNC4	
6	ACK	SYN	&	6	F	V	FNC1	
7	BEL	ETB	'	7	G	W	CHECK DIGIT	
8	BS	CAN	(	8	H	W		
9	HT	EM	)	9	I	Y		
A	LF	SUB	*	:	J	Z		
B	VT	ESC	+	;	K	[
C	FF	FS	,	<	L	\		
D	CR	GS	-	=	M]		
E	SO	RS	.	>	N	^		
F	SI	US	/	?	O	_		

Table 6 CODE128 (CODE B) External code table

L ^H	0	1	2	3	4	5	6	7
0			SP	0	@	P	`	p
1			!	1	A	Q	a	q
2			"	2	B	R	b	r
3			#	3	C	S	c	s
4			\$	4	D	T	d	t
5			%	5	E	U	e	u
6			&	6	F	V	f	v
7			'	7	G	W	g	w
8		CHECK DIGIT	(	8	H	W	h	x
9		FNC3	)	9	I	Y	i	y
A		FNC2	*	:	J	Z	j	z
B		SHIFT	+	;	K	[	k	{
C		CODE C	,	<	L	\	l	|
D		FNC4	-	=	M	]	m	}
E		CODE A	.	>	N	^	n	~
F		FNC1	/	?	O	_	o	DEL

Table 7 CODE128 (CODE C) External code table

L ^H	0	1	2	3	4	5	6	7
0				0	CHECK DIGIT			
1				1				
2				2				
3				3				
4				4				
5				5				
6				6				
7				7				
8				8				
9				9				
A				CODE B				
B				CODE A				
C				FNC1				
D								
E								
F								

Note 1) With the reception of an external code of CODE A, CODE B or CODE C, the mode switches.

When the SHIFT code is received, only next one character is handled as the data of the next mode (CODE A → CODE B → CODE A).

Note 2) Unshaded areas: Valid characters.

Note 3) 00H~1FH and 60H~ 66H codes of the CODE A do not print human readable characters.

Note 4) 19H~1FH and 7FH codes of the CODE B do not print human readable characters.

Note 5) 3AH~3CH codes of the CODE C do not print human readable characters.

Table 8 CODABAR External code table

L ^H	0	1	2	3	4	5	6	7
0				0				
1				1	A			
2				2	B			
3				3	C			
4			\$	4	D			
5				5				
6				6				
7				7				
8				8				
9				9				
A				:				
B			+					
C								
D			-					
E			.					
F			/					

Note 1) Unshaded areas: Valid characters.

3.3 Character set

3.3.1 Code table

The character code tables follow.

3.3.1.1 USA

B ₇ B ₆ B ₅ B ₄	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
B ₃ B ₂ B ₁ B ₀	(2xH)	(3xH)	(4xH)	(5xH)	(6xH)	(7xH)	(8xH)	(9xH)	(AxH)	(BxH)	(CxH)	(DxH)	(ExH)	(FxH)
0000 (x0H)		0	@	P	`	p	Ç	É	á	■	L	⊥	α	≡
0001 (x1H)	!	1	A	Q	a	q	ü	æ	í	■	⊥	⊥	β	±
0010 (x2H)	"	2	B	R	b	r	é	Æ	ó	■	⊥	⊥	Γ	≥
0011 (x3H)	#	3	C	S	c	s	â	ô	ú	|	⊥	⊥	Π	≤
0100 (x4H)	\$	4	D	T	d	t	ä	ö	ñ	⊥	—	⊥	Σ	⊥
0101 (x5H)	%	5	E	U	e	u	à	ò	Ñ	⊥	+	⊥	σ	⊥
0110 (x6H)	&	6	F	V	f	v	å	û	ä	⊥	⊥	⊥	μ	÷
0111 (x7H)	'	7	G	W	g	w	ç	ù	º	⊥	⊥	⊥	τ	≈
1000 (x8H)	(	8	H	X	h	x	ê	ÿ	¿	⊥	⊥	⊥	Φ	°
1001 (x9H)	)	9	I	Y	i	y	ë	Ö	⊥	⊥	⊥	⊥	Θ	•
1010 (xAH)	*	:	J	Z	j	z	è	Ü	⊥	⊥	⊥	⊥	Ω	•
1011 (xBH)	+	;	K	[	k	{	ï	ç	½	⊥	⊥	■	δ	√
1100 (xCH)	,	<	L	\	l	|	î	£	¼	⊥	⊥	■	∞	n
1101 (xDH)	-	=	M	]	m	}	ì	¥	ı	⊥	=	■	∅	²
1110 (xEH)	.	>	N	^	n	~	Ä	℞	«	⊥	⊥	■	ε	■
1111 (xFH)	/	?	O	_	o		Å	f	»	⊥	⊥	■	∩	

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, FFH) indicates a space code.

3.3.1.2 Canada-French

B ₇ B ₆ B ₅ B ₄	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
B ₃ B ₂ B ₁ B ₀	(2xH)	(3xH)	(4xH)	(5xH)	(6xH)	(7xH)	(8xH)	(9xH)	(AxH)	(BxH)	(CxH)	(DxH)	(ExH)	(FxH)
0000 (x0H)		0	@	P	`	p	Ç	É	|	▒	L	⌌	α	≡
0001 (x1H)	!	1	A	Q	a	q	ü	È	'	▒	⌋	⌌	β	±
0010 (x2H)	"	2	B	R	b	r	é	Ê	ó	▒	⌋	⌌	Γ	≥
0011 (x3H)	#	3	C	S	c	s	â	ô	ú	|	⌋	⌌	Π	≤
0100 (x4H)	\$	4	D	T	d	t	Â	Ë	..	⌋	—	⌌	Σ	∫
0101 (x5H)	%	5	E	U	e	u	à	Ï	,	⌋	⌋	⌌	σ	|
0110 (x6H)	&	6	F	V	f	v	Œ	û	³	⌌	⌋	⌌	μ	÷
0111 (x7H)	'	7	G	W	g	w	ç	ù	—	⌌	⌋	⌌	τ	≈
1000 (x8H)	(	8	H	X	h	x	ê	α	î	⌋	⌌	⌋	Φ	°
1001 (x9H)	)	9	I	Y	i	y	ë	ô	⌋	⌌	⌋	⌌	Θ	•
1010 (xAH)	*	:	J	Z	j	z	è	Û	⌋	⌌	⌌	⌋	Ω	•
1011 (xBH)	+	;	K	[	k	{	ï	ç	½	⌋	⌌	▒	δ	√
1100 (xCH)	,	<	L	\	l	|	î	£	¼	⌌	⌋	▒	∞	n
1101 (xDH)	-	=	M	]	m	}	—	Û	¾	⌌	=	▒	∅	²
1110 (xEH)	.	>	N	^	n	~	À	Û	«	⌋	⌌	▒	ε	■
1111 (xFH)	/	?	O	_	o		§	f	»	⌋	⌌	▒	∩	

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, FFH) indicates a space code.

3.3.1.3 Multilingual

B ₇ B ₆ B ₅ B ₄	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
B ₃ B ₂ B ₁ B ₀	(2xH)	(3xH)	(4xH)	(5xH)	(6xH)	(7xH)	(8xH)	(9xH)	(AxH)	(BxH)	(CxH)	(DxH)	(ExH)	(FxH)
0000 (x0H)		0	@	P	`	p	Ç	É	á	☐	Ł	õ	Ó	—
0001 (x1H)	!	1	A	Q	a	q	ü	æ	í	☐	⊥	Ð	ß	±
0010 (x2H)	"	2	B	R	b	r	é	Æ	ó	☐	⊥	Ê	Ô	=
0011 (x3H)	#	3	C	S	c	s	â	ô	ú	|	⊥	Ë	Ò	¾
0100 (x4H)	\$	4	D	T	d	t	ä	ö	ñ	⊥	—	È	õ	¶
0101 (x5H)	%	5	E	U	e	u	à	ò	Ñ	Á	⊥	ı	Õ	§
0110 (x6H)	&	6	F	V	f	v	å	û	ª	Â	ã	Í	μ	÷
0111 (x7H)	'	7	G	W	g	w	ç	ù	º	À	Ã	Î	þ	¸
1000 (x8H)	(	8	H	X	h	x	ê	ÿ	¿	©	Ł	İ	Ɔ	°
1001 (x9H)	)	9	I	Y	i	y	ë	ö	®	¶	ŕ	Ј	Ú	¨
1010 (xAH)	*	:	J	Z	j	z	è	Û	¬	¶	⊥	ŕ	Û	•
1011 (xBH)	+	;	K	[	k	{	ï	ø	½	¶	¶	■	Ü	¹
1100 (xCH)	,	<	L	\	l	|	î	£	¼	¶	¶	■	Ý	³
1101 (xDH)	-	=	M	]	m	}	ì	Ø	ı	¢	=	|	Ÿ	²
1110 (xEH)	.	>	N	^	n	~	Ä	×	«	¥	¶	İ	—	■
1111 (xFH)	/	?	O	_	o	Ⓟ	Å	f	»	ŕ	☼	■	'	

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, FFH) indicates a space code.

3.3.1.4 Portugal

B ₇ B ₆ B ₅ B ₄	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
B ₃ B ₂ B ₁ B ₀	(2xH)	(3xH)	(4xH)	(5xH)	(6xH)	(7xH)	(8xH)	(9xH)	(AxH)	(BxH)	(CxH)	(DxH)	(ExH)	(FxH)
0000 (x0H)		0	@	P	`	p	Ç	É	á	☐	⊥	⊥	α	≡
0001 (x1H)	!	1	A	Q	a	q	ü	À	í	☐	⊥	⊥	β	±
0010 (x2H)	"	2	B	R	b	r	é	È	ó	☐	⊥	⊥	Γ	≥
0011 (x3H)	#	3	C	S	c	s	â	ô	ú	|	⊥	⊥	Π	≤
0100 (x4H)	\$	4	D	T	d	t	ã	õ	ñ	⊥	-	⊥	Σ	|
0101 (x5H)	%	5	E	U	e	u	à	ò	Ñ	⊥	⊥	⊥	σ	J
0110 (x6H)	&	6	F	V	f	v	Á	Ú	ª	⊥	⊥	⊥	μ	÷
0111 (x7H)	'	7	G	W	g	w	ç	ù	º	⊥	⊥	⊥	τ	≈
1000 (x8H)	(	8	H	X	h	x	ê	ì	¿	⊥	⊥	⊥	Φ	°
1001 (x9H)	)	9	I	Y	i	y	Ê	Ï	Ò	⊥	⊥	⊥	Θ	•
1010 (xAH)	*	:	J	Z	j	z	è	Û	¬	⊥	⊥	⊥	Ω	•
1011 (xBH)	+	;	K	[	k	{	Í	ç	½	⊥	⊥	■	δ	√
1100 (xCH)	,	<	L	\	l	|	Ô	£	¼	⊥	⊥	■	∞	n
1101 (xDH)	-	=	M	]	m	}	ì	Ü	í	⊥	=	■	∅	²
1110 (xEH)	.	>	N	^	n	~	Ã	₣	«	⊥	⊥	■	ε	■
1111 (xFH)	/	?	O	_	o	Ⓟ	Â	Ó	»	⊥	⊥	■	∩	

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, FFH) indicates a space code.

3.3.1.5 Norway

B ₇ B ₆ B ₅ B ₄	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
B ₃ B ₂ B ₁ B ₀	(2xH)	(3xH)	(4xH)	(5xH)	(6xH)	(7xH)	(8xH)	(9xH)	(AxH)	(BxH)	(CxH)	(DxH)	(ExH)	(FxH)
0000 (x0H)		0	@	P	`	p	Ç	É	á	☒	L	⌌	α	≡
0001 (x1H)	!	1	A	Q	a	q	ü	æ	í	☒	⌋	⌌	β	±
0010 (x2H)	"	2	B	R	b	r	é	Æ	ó	■	⌋	⌌	Γ	≥
0011 (x3H)	#	3	C	S	c	s	â	ô	ú	|	⌋	⌌	Π	≤
0100 (x4H)	\$	4	D	T	d	t	ä	ö	ñ	⌋	—	⌌	Σ	∫
0101 (x5H)	%	5	E	U	e	u	à	ò	Ñ	⌋	+	⌌	σ	|
0110 (x6H)	&	6	F	V	f	v	å	û	ä	⌋	⌋	⌌	μ	÷
0111 (x7H)	'	7	G	W	g	w	ç	ù	ø	⌋	⌋	⌌	τ	≈
1000 (x8H)	(	8	H	X	h	x	ê	ÿ	¿	⌋	⌌	⌋	Φ	°
1001 (x9H)	)	9	I	Y	i	y	ë	Ö	⌋	⌋	⌌	⌋	Θ	•
1010 (xAH)	*	:	J	Z	j	z	è	Ü	⌋	⌌	⌌	⌋	Ω	•
1011 (xBH)	+	;	K	[	k	{	ï	ø	½	⌋	⌌	■	δ	√
1100 (xCH)	,	<	L	\	l	|	î	£	¼	⌋	⌋	■	∞	n
1101 (xDH)	-	=	M	]	m	}	ì	Ø	ı	⌋	=	■	∅	²
1110 (xEH)	.	>	N	^	n	~	Ä	Pt	«	⌋	⌋	■	ε	■
1111 (xFH)	/	?	O	_	o		Å	f	α	⌋	⌌	■	∩	

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, FFH) indicates a space code.

3.3.1.6 BRASCI I

B ₇ B ₆ B ₅ B ₄ B ₃ B ₂ B ₁ B ₀	0010 (2xH)	0011 (3xH)	0100 (4xH)	0101 (5xH)	0110 (6xH)	0111 (7xH)	1000 (8xH)	1001 (9xH)	1010 (AxH)	1011 (BxH)	1100 (CxH)	1101 (DxH)	1110 (ExH)	1111 (FxH)
0000 (x0H)		0	@	P	'	p				°	À	Ð	à	ǒ
0001 (x1H)	!	1	A	Q	a	q			i	±	Á	Ñ	á	ñ
0010 (x2H)	"	2	B	R	b	r			ç	²	Â	Ò	â	ò
0011 (x3H)	#	3	C	S	c	s			£	³	Ã	Ó	ã	ó
0100 (x4H)	\$	4	D	T	d	t			¤	'	Ä	Ô	ä	ô
0101 (x5H)	%	5	E	U	e	u			¥	µ	Å	Õ	å	õ
0110 (x6H)	&	6	F	V	f	v			|	¶	Æ	Ö	æ	ö
0111 (x7H)	'	7	G	W	g	w			§	•	Ç	Ɔ	ç	œ
1000 (x8H)	(	8	H	X	h	x			¨	,	È	Ø	è	ø
1001 (x9H)	)	9	I	Y	i	y			©	¹	É	Ù	é	ù
1010 (xAH)	*	:	J	Z	j	z			ª	º	Ê	Ú	ê	ú
1011 (xBH)	+	;	K	[	k	{			«	»	Ë	Û	ë	û
1100 (xCH)	,	<	L	\	l	|			¬	¼	Ì	Ü	ì	ü
1101 (xDH)	-	=	M	]	m	}			-	½	Í	Ý	í	ý
1110 (xEH)	.	>	N	^	n	~			®	¾	Î	Þ	î	þ
1111 (xFH)	/	?	O	_	o				-	¿	Ï	ß	ï	ÿ

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, A0H) indicates a space code.
- ⑤ 8xH and 9xH is ignored even if it is received. (Shaded areas)

3.3.1.7 Abicomp

B ₇ B ₆ B ₅ B ₄	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
B ₃ B ₂ B ₁ B ₀	(2xH)	(3xH)	(4xH)	(5xH)	(6xH)	(7xH)	(8xH)	(9xH)	(AxH)	(BxH)	(CxH)	(DxH)	(ExH)	(FxH)
0000 (x0H)		0	@	P	'	p				Ò	ì	ò		
0001 (x1H)	!	1	A	Q	a	q			À	Ó	à	ó		
0010 (x2H)	"	2	B	R	b	r			Á	Ô	á	ô		
0011 (x3H)	#	3	C	S	c	s			Â	Õ	â	õ		
0100 (x4H)	\$	4	D	T	d	t			Ã	Ö	ã	ö		
0101 (x5H)	%	5	E	U	e	u			Ä	Œ	ä	œ		
0110 (x6H)	&	6	F	V	f	v			Ç	Ù	ç	ù		
0111 (x7H)	'	7	G	W	g	w			È	Ú	è	ú		
1000 (x8H)	(	8	H	X	h	x			É	Û	é	û		
1001 (x9H)	)	9	I	Y	i	y			Ê	Ü	ê	ü		
1010 (xAH)	*	:	J	Z	j	z			Ë	ÿ	ë	ÿ		
1011 (xBH)	+	;	K	[	k	{			Ì	·	ì	ß		
1100 (xCH)	,	<	L	\	l	|			Í	£	í			
1101 (xDH)	-	=	M	]	m	}			Î	•	î			
1110 (xEH)	.	>	N	^	n	~			Ï		ï			
1111 (xFH)	/	?	O	_	o				Ñ		ñ			

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, A0H) indicates a space code.
- ⑤ 8xH, 9xH, ExH, and FxH are ignored even if they are received. (Shaded areas)

3.3.1.8 Multilingual 858

B ₇ B ₆ B ₅ B ₄	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
B ₃ B ₂ B ₁ B ₀	(2xH)	(3xH)	(4xH)	(5xH)	(6xH)	(7xH)	(8xH)	(9xH)	(AxH)	(BxH)	(CxH)	(DxH)	(ExH)	(FxH)
0000 (x0H)		0	@	P	`	p	Ç	É	á	■	L	ø	Ó	—
0001 (x1H)	!	1	A	Q	a	q	ü	æ	í	■	⊥	Ð	ß	±
0010 (x2H)	"	2	B	R	b	r	é	Æ	ó	■	⊥	Ê	Ô	=
0011 (x3H)	#	3	C	S	c	s	â	ô	ú	|	⊥	Ë	Ò	¾
0100 (x4H)	\$	4	D	T	d	t	ä	ö	ñ	⊥	—	È	õ	¶
0101 (x5H)	%	5	E	U	e	u	à	ò	Ñ	Á	⊥	□	Õ	§
0110 (x6H)	&	6	F	V	f	v	å	û	ä	Â	ã	Í	μ	÷
0111 (x7H)	'	7	G	W	g	w	ç	ù	ó	À	Ã	Î	þ	,
1000 (x8H)	(	8	H	X	h	x	ê	ÿ	¿	©	ℒ	Ï	Ɔ	°
1001 (x9H)	)	9	I	Y	i	y	ë	ö	®	¶	¶	⊥	Ú	..
1010 (xAH)	*	:	J	Z	j	z	è	ü	¬	||	⊥	⊥	Û	.
1011 (xBH)	+	;	K	[	k	{	ï	ø	½	¶	¶	■	Ü	1
1100 (xCH)	,	<	L	\	l	|	î	£	¼	¶	¶	■	Ý	3
1101 (xDH)	-	=	M	]	m	}	ì	ø	ı	ç	=	ı	Ÿ	2
1110 (xEH)	.	>	N	^	n	~	Ä	×	«	¥	¶	Ï	—	■
1111 (xFH)	/	?	O	_	o		Å	f	»	⊥	α	■	'	

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, FFH) indicates a space code.

3.3.1.9 ISO 8859/15

B ₇ B ₆ B ₅ B ₄ B ₃ B ₂ B ₁ B ₀	0010 (2xH)	0011 (3xH)	0100 (4xH)	0101 (5xH)	0110 (6xH)	0111 (7xH)	1000 (8xH)	1001 (9xH)	1010 (AxH)	1011 (BxH)	1100 (CxH)	1101 (DxH)	1110 (ExH)	1111 (FxH)
0000 (x0H)		0	@	P	'	p				°	À	Ð	à	ǎ
0001 (x1H)	!	1	A	Q	a	q			i	±	Á	Ñ	á	ñ
0010 (x2H)	"	2	B	R	b	r			ç	²	Â	Ò	â	ò
0011 (x3H)	#	3	C	S	c	s			£	³	Ã	Ó	ã	ó
0100 (x4H)	\$	4	D	T	d	t			?	Z	Ä	Ô	ä	ô
0101 (x5H)	%	5	E	U	e	u			¥	µ	Å	Õ	å	õ
0110 (x6H)	&	6	F	V	f	v			Š	¶	Æ	Ö	æ	ö
0111 (x7H)	'	7	G	W	g	w			§	•	Ç	×	ç	÷
1000 (x8H)	(	8	H	X	h	x			š	z	È	Ø	è	ø
1001 (x9H)	)	9	I	Y	i	y			©	¹	É	Ù	é	ù
1010 (xAH)	*	:	J	Z	j	z			ª	º	Ê	Ú	ê	ú
1011 (xBH)	+	;	K	[	k	{			«	»	Ë	Û	ë	û
1100 (xCH)	,	<	L	\	l	|			¬	œ	Ì	Ü	ì	ü
1101 (xDH)	-	=	M	]	m	}			-	œ	Í	Ý	í	ý
1110 (xEH)	.	>	N	^	n	~			®	ÿ	Î	Þ	î	þ
1111 (xFH)	/	?	O	_	o				-	ı	Ï	ß	ï	ÿ

- ① 0xH and 1xH are Control Code areas.
- ② If a code received is other than a control code in 0xH and 1xH, it is ignored.
- ③ The above table assumes international character set is set to "American."
- ④ The blank space (20H, 7FH, A0H) indicates a space code.
- ⑤ 8xH and 9xH are ignored even if they are received. (Shaded areas)

3.3.1.10 International character set table

ESC·R·n	Country	23	24	26	40	4F	5B	5C	5D	5E	5F	60	7B	7C	7D	7E
0 (00)H	American	#	\$	&	@	O	[	\	\]	^	_	`	{	|	}	~
1 (01)H	French	#	\$	&	à	O	°	ç	§	^	_	`	é	ù	è	¨
2 (02)H	German	#	\$	&	§	O	Ä	Ö	Ü	^	_	`	ä	ö	ü	ß
3 (03)H	British	£	\$	&	@	O	[	\	\]	^	_	`	{	|	}	~
4 (04)H	Danish I	#	\$	&	@	O	Æ	Ø	Å	^	_	`	æ	ø	å	~
5 (05)H	Swedish	#	α	&	É	O	Ä	Ö	Å	Ü	_	é	ä	ö	å	ü
6 (06)H	Italian	#	\$	&	@	O	°	\	é	^	_	ù	à	ò	è	ì
7 (07)H	Spanish I	Pt	\$	&	@	O	i	Ñ	¿	^	_	`	¨	ñ	}	~
8 (08)H	Japanese	#	\$	&	@	O	[	¥	]	^	_	`	{	|	}	~
9 (09)H	Norwegian	#	α	&	É	O	Æ	Ø	Å	Ü	_	é	æ	ø	å	ü
10 (0A)H	Danish II	#	\$	&	É	O	Æ	Ø	Å	Ü	_	é	æ	ø	å	ü
11 (0B)H	Spanish II	#	\$	&	á	O	i	Ñ	¿	é	_	`	í	ñ	ó	ú
12 (0C)H	Latin American	#	\$	&	á	O	i	Ñ	¿	é	_	ü	í	ñ	ó	ú
13 (0D)H	French Canadian	ü	\$	è	à	Ø	â	ç	ê	î	ï	ô	é	ù	è	û
14 (0E)H	Dutch	£	\$	&	@	O	[	U	]	^	_	`	{	ij	}	~
64 (40)H	Publisher	#	\$	&	§	O	°	'	"	¶	_	`	©	®	†	™

3.3.2 Spec

DPI (dot per inch)	180DPI	240DPI	Comments
Character configuration w × h () Clearance	7(+2)×7(+2) (HSD) 9(+2)×7(+2) (UTY)	7(+2)×7(+2) (HSD) 9(+2)×7(+2) (UTY)	Vertical 72DPI
CPI (Normal size) (Character per inch) *1	20.0 CPI 16.4 CPI	26.7 CPI 21.8 CPI	
CPI (Double width size) (Character per inch) *1	10.0 CPI 8.2 CPI	13.3 CPI 10.9 CPI	
IPS Roll/Slip (Inch per second)	19.3 IPS/16.4 IPS	14.5 IPS/12.3 IPS	
CPS Roll/Slip (Character per second)	387CPS/329CPS 317CPS/269CPS	← ←	
Print Area Upper: Roll/Lower: Slip	71.1mm (504 dots) (64.4mm 456 dots) 160.0mm (1134 dots)	71.1mm (672 dots) (64.4mm 608 dots) 160.0mm (1512 dots)	← 76.2mm-wide paper ← 69.5mm-wide paper
CPL Roll/Slip (characters per line)	56(50)CPL/126CPL 45(41)CPL/103CPL	74(67)CPL/168CPL 61(55)CPL/137CPL	← () 69.5mm-wide paper

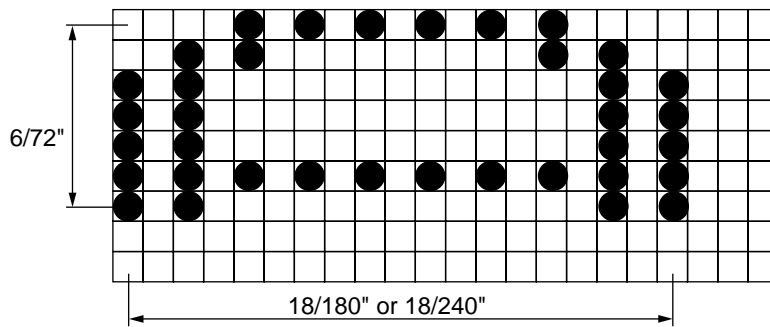
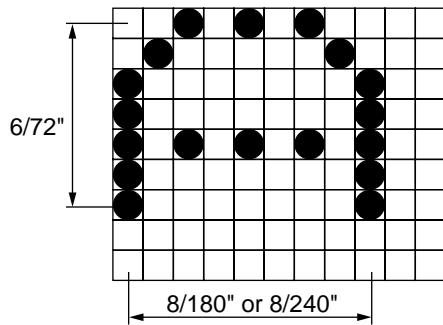
*1 The character width in the table applies if Character Space = 0, and if it is other than 0, it is included in the character width.

3.3.3 Character development

The following are font attributes.

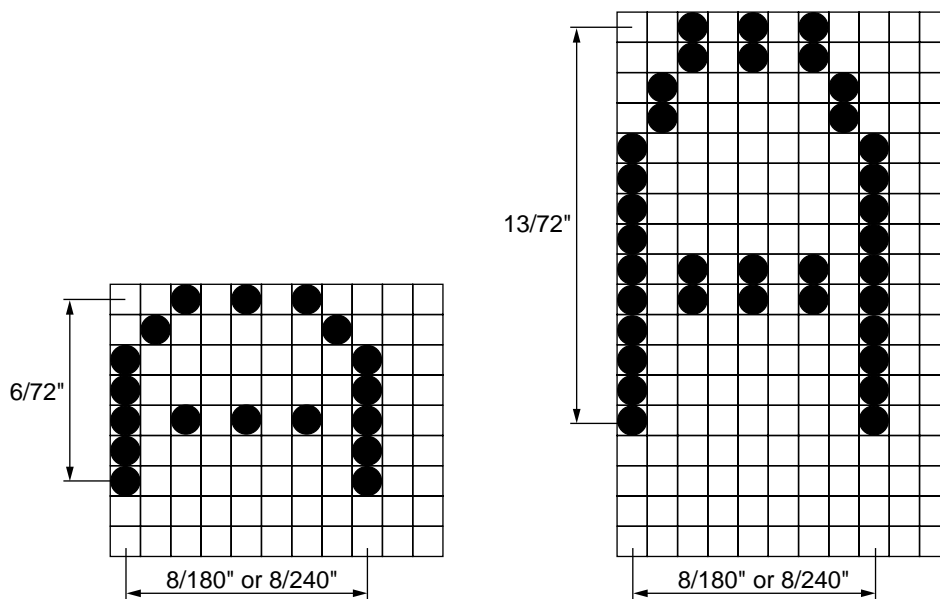
(1) Enlargement

① Double width



* 240 DPI in Condensed Print.

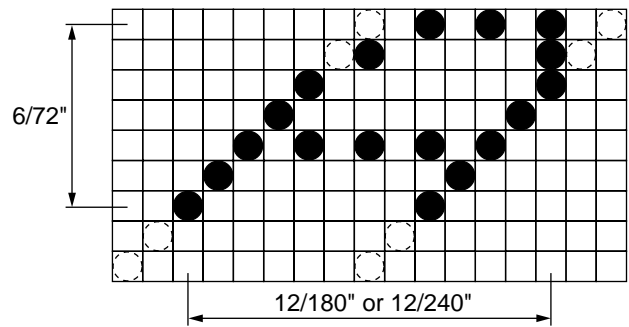
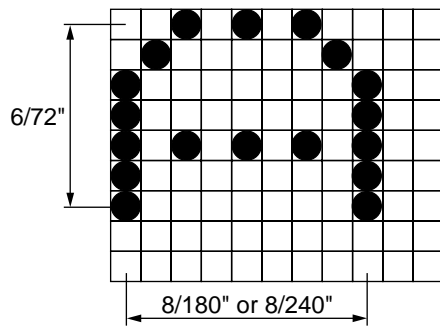
② Double height



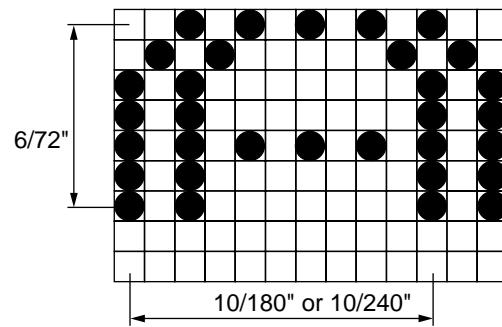
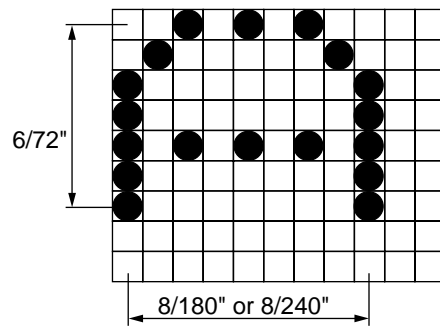
* 240 DPI in Condensed Print.

(2) Modification

① Italics



② Emphasize



③ Double Strike

Characters are printed over in two passes.

3.4 Operation

3.4.1 Default

Initialization to defaults takes place under the following conditions: at POW-ON, or reception of I-PRIME signal (Parallel model)/Reset signal (Serial Model), software reset commands, or Menu Item set command, or end of Menu operation.

(With this printer, end of local test will not prompt default initialization on any setting.)

The following pages describe the statuses in detail.

<<Cautionary notes at reception of I-PRIME signal (Parallel model)/Reset signal(Serial model)>>

- (1) If data still remains in the receive buffer or the print buffer at reception of I-PRIME signal (Parallel model)/Reset signal (Serial model), initialization starts after the printer completes printing all the passes of the line that it is printing, and clears the data that remains in the buffer. (This is the spec similar to hardware reset.)
Presence of unprocessed data does prompt print start.
- (2) Reception of I-PRIME signal (Parallel model)/Reset signal (Serial model) in Dump Mode prompts printer initialization, but Dump Mode continues.
- (3) Initialization prompted by reception of I-PRIME signal (Parallel model)/Reset signal (Serial model) does not prompt local test or menu startup; in other words, the press of the switch is all disabled during initialization.
- (4) If Slip is already loaded, paper eject is performed according to the sensor monitoring, and initialization starts after removal of paper.
- (5) During recoverable alarm (including the state in which removal of paper is awaited), initialization is put on hold. After alarm has been cleared (or after removal of paper), initialization starts. While initialization is put on hold, the Parallel model is disabled to receive (because Busy signal is at High), but the Serial model reads data into receive buffer and executes only DLE EOT n, GS ENQ, DLE EOT BS n, ESC DLE r Pno n. (Data read into the receive buffer is cleared in the initialization process.)
- (6) If Validation is already loaded, initialization starts after removal of paper.
- (7) With the option tractor installed and the lever set to Tractor, when the status is Slip Sensor Paper End and Validation Sensor Paper present, even if Sprocket paper has been loaded, Media Mismatch alarm in Receipt+Journal Mode occurs.
- (8) If the data to be sent to the host PC still remains without being reverse-transferred, that data will be cleared. If the Software Reset command or the Menu Item Set command is received, however, ASB status and Check Paper Read result data (including Re-send Request) is cleared, but status data other than that is kept.

(Note) With the hard reset (setting by Short Plug with Parallel I/F board and by DIP SW with Serial I/F board), the same operation as at POW-ON is performed.

<<Cautionary notes at reception of Menu Item Set command>>

- (1) The receive buffer is not cleared.
Print data in the print buffer is cleared, prompting initialization of each setting.
If receiving lines of data has been completed prior to reception of this command and print start has been already initiated, that data cannot be cleared.
- (2) If the size of the receive buffer has been changed by the Menu Item Set command, it cannot be changed again until a power cycle takes place or I-PRIME signal (Parallel model)/Reset signal (Serial model) is received.

No.	Items	Settings
1	Print head position	Centering position (At Power On: Homing, then centering)
2	Horizontal direction print position (Left margin position)	The first dot position (Column 0)
3	Print position alignment set	Left alignment
4	Line feed pitch	6LPI(all print sheets)
5	International character set	American
6	Character code table	USA
7	Print font	By Menu settings
8	Character right-side space	0 dot
9	Underline designate	Reset
10	Double height set	Reset
11	Double width set	Reset
12	Italic mode	Reset
13	Emphasized designate	Reset
14	Double strike print designate	Reset
15	Print sheet	Receipt+Journal (Sprocket paper if print sheet is present and the lever is set to Tractor when the option tractor is installed.)
16	Set sheet	All sheets are valid.
17	Print stop sensor select	Receipt End Sensor and Journal End Sensor are valid. (See 3.2.7.4)
18	Cut-sheet wait time	Insert wait time: unlimited Operation start time: one second
19	Uni-directional print	Reset
20	Auto LF valid/invalid	By Menu setting
21	Print speed and head current run time	Receipt/Journal: Standard mode Slip paper: Low speed mode Validation paper: Standard mode Sprocket paper: Low speed mode
22	Receive Buffer size	By the Menu setting Note 1)
23	BUSY Process	By the Menu setting
24	Sprocket paper page length	By the Menu setting
25	Sprocket paper vertical position	The current print position is TOF position.
26	Perforation skip length	0(Reset)
27	Cut position	Reception of I-PRIME signal (Parallel model)/Reset signal (Serial model): Feeding to a print position Reception of Software Reset/Menu Item Set commands: Keeping the cut position POW ON: The current position becomes a print position.
28	Pass position	POW ON: The current position becomes a normal pass position. Other than POW ON: The pass position prior to initialization remains as is.

No.	Items	Settings
29	Receipt+Journal Same Data Print Designate	Reset
30	Condense Designate	Reset
31	Basic pitch	Horizontal: 1/180", vertical: 1/144"
32	Peripheral Device select	Parallel model (Customer display unconnectable) Printer select Serial model (Customer display connectable) By the DIP SW 1-8 on the Serial I/F board
33	Paper Sensor select, enabling Paper End signal (valid with only Parallel I/F)	By the menu setting
34	ASB (Automatic Status Back)	If Menu Off-line Busy Control is set to: No → Only On-line/Off-line status is valid. Yes → All statuses are invalid.
35	Panel Switch	Valid
36	Print stop by Cover Open	By the menu setting
37	Roll Paper width	By the menu setting

Note 1) Size of the receive buffer is changed according to the Menu setting only at POW ON or when the I-PRIME signal (Parallel model)/Reset signal (Serial model) is received, and then initialization takes place.

3.4.2 Print Start

3.4.2.1 Conditions for Print Start

This printer starts printing in the following cases.

- (1) Upon receiving the following function code strings, the printer partitions the data block at that point, starts printing, and performs the process designated after it finishes printing.

○ : Performed × : Not performed → : Refer to comment

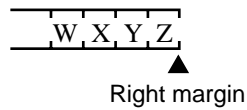
Items	CR	LF	Comment
CR	○	→	LF performed if Auto Line Feed is enabled.
LF	○	○	
FF	○	○	
ESC J n (n/144" paper feed)	○	○	
ESC d n (n-line paper feed)	○	○	
ESC % 5 n (n/144" paper feed)	○	○	
ESC DLE D (Menu setting)	○	×	
ESC \$ n1 n2 (Absolute Position designate)	×	×	Left of the present position
ESC \ n1 n2 (Relative Position designate)	×	×	Left of the present position

- (2) When the printer has received data for 16 characters or after 0.2 second timeout, in Hexadecimal Dump mode.
- (3) Right margin over has occurred. (Right margin just is not included.)
(Refer to 3.4.3 Right Margin Process.)
- (4) When the number of print blocks within a line is 352 or more.

3.4.3 Right Margin Process

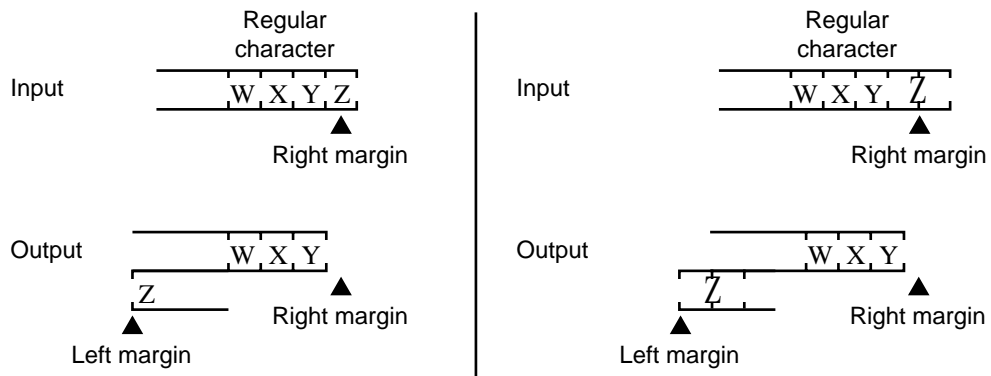
(1) Character

(a) Right margin just



- Printing does not start even though input data comes to the right margin just.

(b) Right margin over

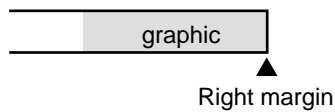


- The data up to the right margin is printed, Auto CR/LF is performed, and the characters that go beyond the right margin are printed in the next line.
- In the case of Validation, data is ignored until print start is invoked.
- In the Receipt+Journal mode with Same Data Print cleared, if the receive start position is on the Receipt side, characters that go beyond the Receipt's right margin are printed from the Journal's left margin. Characters that go beyond the Journal's right margin are printed in the next line (at the Receipt's left margin.) (See (3).)

* Refer to below (c) regarding reception at the right margin just.

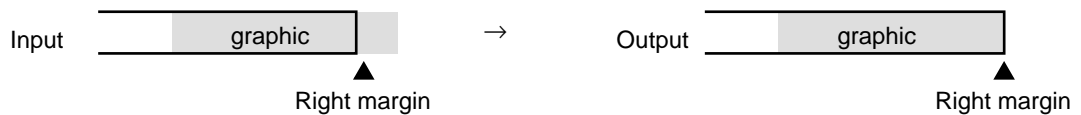
(2) Bit image graphics

(a) Right margin just

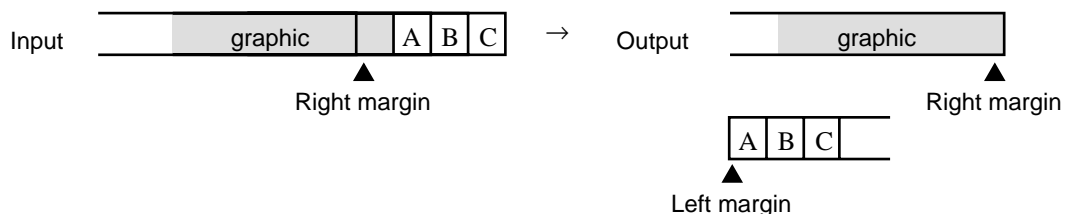


- Even if input data comes to the right margin just, printing does not start.
- When new print data is input, the printer performs CR/LF and prints that data in the next line.
- With Validation, data is ignored until prompting of print start.
- In the Receipt+Journal mode with Same Data Print cleared, if the data his at Receipt's right margin just and new print data is input, that data is printed from the Journal's left margin. If the data is at Journal's right margin just and new print data is input, that data is printed in the next line (at the Receipt's left margin).

(b) Right margin over



- When the input data exceeds the right margin, the data up to the right margin is retained while the data exceeding is ignored. Printing does not start. Neither CR nor LF is performed.
- When print data is input next, CR/LF is performed, then the data is printed in the next line.
- With Validation, the data is ignored until print start is invoked.
- In the Receipt+Journal mode with Same Data Print cleared, if the receive start position is on the Receipt side and the data goes beyond the Receipt's right margin, that portion is printed from the Journal's left margin. If the data goes beyond the Journal's right margin, the data to the Journal's right margin is retained awhile the data exceeding is ignored. Printing does not start. (See (3).)



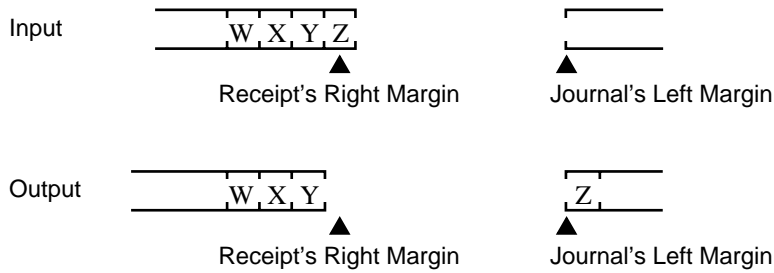
(c) Receiving at the right margin just

- If image data is input when the current position is at the right margin just, CR/LF is performed, then that input data is printed from the position resulted from CR.
- If the input data exceeds the range from the CR position to the right margin, it is processed the same way as the right margin over. (above (b))
- If a character is input when the current position is at the right margin just, CR/LF is performed, then that input data is printed from the position resulted from CR.
- With Validation, the data is ignored until print start is invoked.
- In the Receipt+Journal mode with Same Data Print cleared, if image data is input when the position is at the Receipt's right margin just, that data is printed from the Journal's left margin. If image data is input when the position is at the Journal's right margin just, that data is printed in the next line (Receipt's left margin).



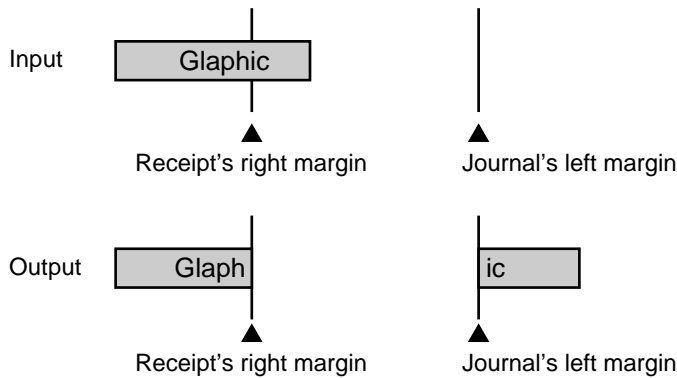
(3) Receipt+Journal Mode with Same Data Print cleared

① With a character running into Receipt' Right Margin Over



- Even in the above case, print start is not invoked.
- If Journal's Right Margin Over has occurred, the printer performs Auto CR/LF as said earlier, and prints those characters that go beyond the right margin in the next line (at the Receipt's left margin position).

② Data input as image has gone beyond the Receipt's right margin



- Even in the above case, print start is not invoked.
- If Journal's Right Margin Over has occurred, the data that goes beyond is ignored as said earlier and printing does not start.

3.4.4 Combination of print mode

None of the received commands will be ignored as long as they are received properly. Even in the combinations of modes in which printing is not allowed, the command received properly will set or reset the status in the printer.

A prohibited print mode becomes valid again when the condition(s) of the prohibited print mode is reset.

(1) Combinations of print mode

No.		1	2	3	4	5	6	7	8
	Print Mode setup	Double Width	Double Height	Italics	Emphasized (horizontal)	Double Strike	Underline	Character Right-side Space	Condense
1	Double Width		○	○	○	○	○	○	○
2	Double Height	○		○	○	○	○	○	○
3	Italics	○	○		○	○	○	○	○
4	Emphasized (horizontal)	○	○	○		○	○	○	○
5	Double Strike	○	○	○	○		○	○	○
6	Underline	○	○	○	○	○		○	○
7	Character Right-side Space	○	○	○	○	○	○		○
8	Condense	○	○	○	○	○	○	○	

○ : Combination setting (print) enabled × : Combination setting (print) disabled

(2) Combinations of print data and print mode

No.			1	2	3	4	5	6	7	8	
Print data			Print mode								
			Double Width	Double Height	Italics	Emphasized (Horizontal)	Double strike	Underline	Character right-side spec	Condensed	
1	Print font	Utility	STD Chrs.	○	○	○	○	○	○	○	○
			Graphic Chrs.	○	○	×	○	○	○	○	○
	HSD	STD Chrs.	○	○	○	○	○	○	○	○	
		Graphic Chrs.	○	○	×	○	○	○	○	○	
2	Bit Image data		×	×	×	×	×	×	×	○	
3	Absolute skip (Left-right move)		×	×	×	×	×	×	×	○	
4	Relative skip (Rightward move)		×	×	×	×	×	×	×	○	
	(Leftward move)		×	×	×	×	×	×	×	○	

○: Combination print enabled ×: Combination print disabled

* In Validation mode, setting of the following print modes is valid but printing is the same as they are reset.

- Double Strike
- Double Height

* Standard/graphics characters indicate the following.

Code page	Standard character code	Graphics character code
USA	20H ~ FFH except the code listed to the right	B0H ~ DFH, F4H, F5H
Canada-French	20H ~ FFH except the code listed to the right	B0H ~ DFH, F4H, F5H
Multilingual	20H ~ FFH except the code listed to the right	B0H ~ B4H, B9H ~ BCH, BFH ~ C5H, C8H ~ CEH, D9H ~ DCH, DFH
Portugal	20H ~ FFH except the code listed to the right	B0H ~ DFH, F4H, F5H
Norway	20H ~ FFH except the code listed to the right	B0H ~ DFH, F4H, F5H
BRASCII	20H ~ FFH (80H~9FH are ignored even if received.)	None
Abicomp	20H ~ FFH (80H~9FH are ignored even if received.)	None
Multilingual 858	20H ~ FFH except the code listed to the right	B0H ~ B4H, B9H ~ BCH, BFH ~ C5H, C8H ~ CEH, D9H ~ DCH, DFH
ISO 8859/15	20H ~ FFH (80H~9FH are ignored even if received.)	None

3.4.5 Print Pass Position Control

- (1) For the data that contains Double Height, the printer performs line feed to the specified print position at the start of printing lower pass after printing upper pass. As this happens, the baseline, on which the present vertical position is based, moves.

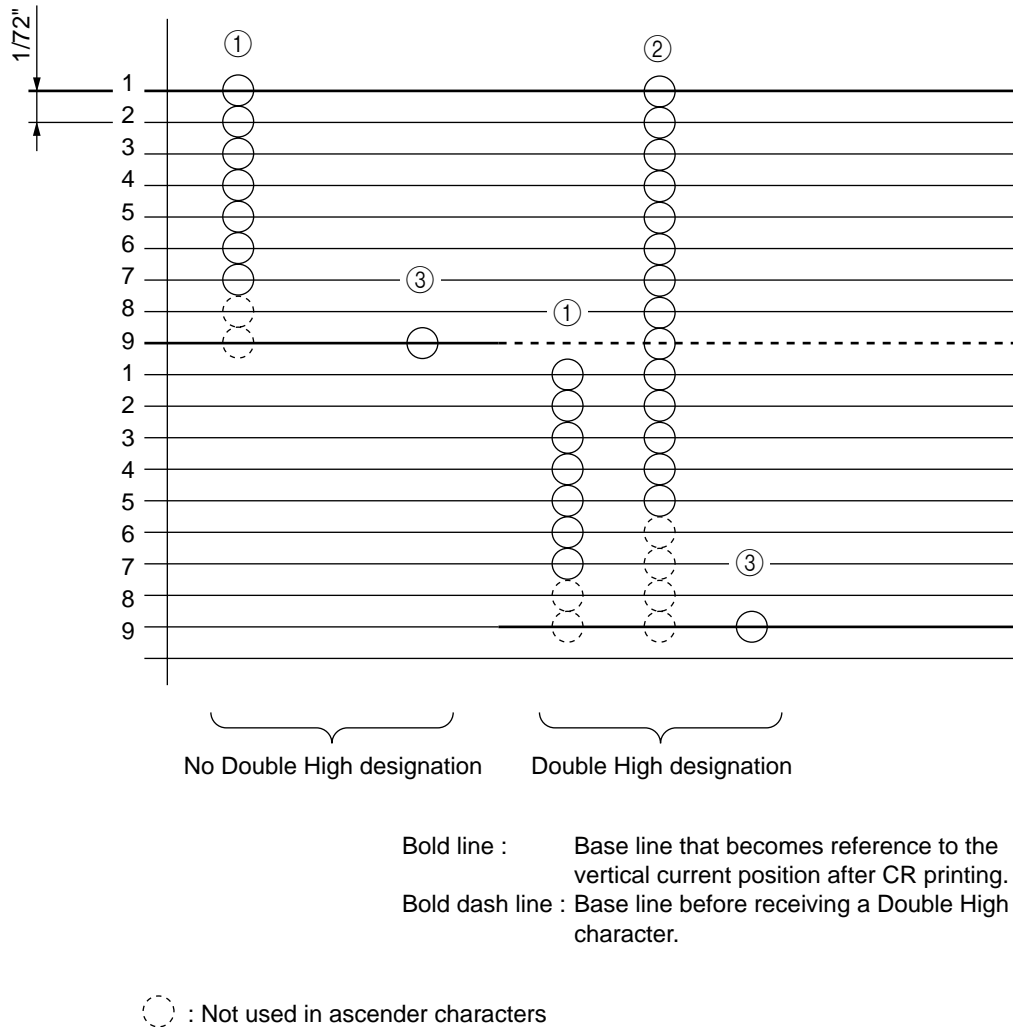


Figure 3.4.5 Print Pass Position

- ① Normal Character
- * Ascender characters (normal ANK) are printed with pins 1~7, while descender characters (certain ANK (“g, p”, etc) are printed with pins 3~9 and graphics characters and certain ANK (“j”, etc) with pins 1~9.
- ② Double Height Character
- * Ascender characters (normal ANK) are printed with the upper pass with pins 1~9 and the lower pass with pins 1~5 while descender characters (certain ANK (“g, p”, etc) are printed with the upper pass with pins 5~9 and the lower pass with pins 1~9. Graphics characters and certain ANK (“j”, etc) are printed with the upper pass with pins 1~9 and the lower pass with pins 1~9.
- ③ Underline

4. IEEE1284 SPECIFICATIONS

This Specification describes the specifications of the IEEE1284 bi-directional Centronics interface that is the interface between the host and the printer.

4.1 Terminology

<Sensor >

- RP sensor: Receipt Paper End sensor
(Monitors paper-feed-starting position and bottom position of Roll paper)
- RN sensor: Receipt Near End sensor
(Monitors Near End bottom position of Roll paper)
- JP sensor: Journal Paper End sensor
(Monitors paper-feed-starting position and bottom position of Roll paper)
- JN sensor: Journal Near End sensor
(Monitors Near End bottom position of Roll paper)
- S sensor: Slip sensor
(Monitors paper-feed-starting, ejecting position of Slip, and bottom position of Slip/Tractor.)
- V sensor: Validation sensor (Installed in the 2 positions, left side and right side, controlled by the same board)
(Monitors paper-feed-starting position of Slip/Tractor, inserting/removing position of Validation and removal-waiting status of Slip/Validation/Tractor)

<Paper mode>

Roll mode: Mode in which Roll paper is used (Receipt, journal, Receipt + Journal)

<Others>

ASB: Automatic Status Back

Depending on the printer status change, a status is automatically notified to the host.

There are two ASB status: 4 byte 1 set (GS a) and 5 byte 1 set (ESC DLE a)

Description in this document is based on "4 byte 1 set (GS a)."

4.2 IEEE1284

The IEEE1284 defines the following signaling methods:

- (1) Compatible mode (Compatibility mode)
- (2) Nibble mode
- (3) Byte mode
- (4) ECP mode
- (5) EPP mode

This printer supports IEEE1284 compliant bi-directional Centronics interfaces. Of these five modes, this printer supports “Compatible mode” and “Nibble mode”.

(1) Compatible mode

This mode is compatible with standard Centronics interface (36pin parallel I/F).

Data goes from the host to the printer unidirectional.

This mode will be the default mode of the IEEE1284.

(2) Nibble mode

This mode makes the data transfer from the printer to the host possible when the host requests it.

When the printer sends data to the host, it uses the status line from the printer to the host, and sends 1byte data to the host by transferring 4bit data per transfer, twice.

Next several chapters describe details of the interface including each of the above modes.

4.3 Compatible Mode

Compatible mode transfers data in parallel using the 8-bit data lines.

As described earlier, this mode is the default mode in the IEEE1284 interface, and after the power to the printer is turned on and the printer is initialized by the nInIt (I-PRIME) signal, the printer will always be in this mode.

In the compatible mode, the host can select from the following operations:

- (1) Forward transfer (host → printer) by parallel interface in the compatible mode
- (2) Starting negotiation phase to shift to the mode that enables reverse transfer (printer → host), from the compatible mode.

The following table shows the names and the functions of the signals used in this mode:

Pin No.	Names		Direction	Function
	Traditional	Compatible mode		
1	STROBE	nStrobe	From Host	Data strobe
2~9	DATA bit1~8	Data bit1~8	From Host	Data from host
10	ACKNLG	nAck	To Host	Data reception ends
11	BUSY	Busy	To Host	Cannot receive data
12	PAPER END	PError	To Host	No paper
13	SELECT	Select	To Host	Online
14	AUTOFEED XT	nAutoFd	From Host	1284 mode transition request
15	–	–	–	Unused
16	GND	Grand	–	Signal ground
17	FG	Frame Grand	–	Frame ground
18	+5V	+5V	To Host	+5V
19~30	GND	Grand	–	Signal ground
31	I-PRIME	nInIt	From Host	Initialization
32	FAULT	nFault	To Host	Error has occurred, offline
33	GND	Grand	–	Signal ground
34	DK_STATUS	DK_STATUS	To Host	Drawer open/close status
35	+5V	+5V	To Host	+5V
36	SELECT IN	nSelectIn	From Host	1284 mode transition request

* In the above table, the shaded areas are those not controlled in this mode. For details, refer to the circuit materials.

4.3.1 Compatible Mode Handshake

The handshake in the compatible mode has the following two phases:

(1) Forward data transfer phase

This phase is the forward transfer phase that begins when the host outputs nStrobe signal "Low" pulse.

The host can begin this phase any time from the forward idle phase status.

The forward data transfer takes place in the following manner:

1.	(Host)	Outputs data to transfer to the printer on the 8-bit parallel line(s).
2.	(Host)	Indicates that that data is valid by setting nStrobe signal "Low".
3.	(Printer)	Latches the data and sets the Busy signal "High".
4.	(Printer)	Decodes the received data and prepares to receive next data.
5.	(Printer)	Sets Busy signal "Low", returns nAck signal to the host and informs the host that it can receive next data.
6.		Shifts to the forward idle phase.

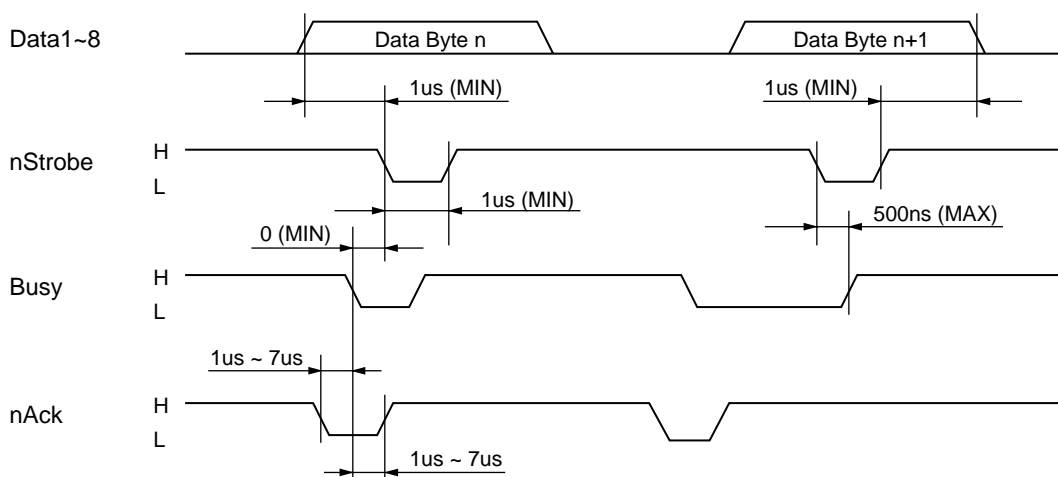
(2) Forward idle phase

This phase indicates that data transfer is not taking place in the compatible mode, and the host can begin the forward data transfer phase or the negotiation phase to request the shift to other mode.

In this phase, the printer can set Busy signal "High" at an arbitrary timing, and inhibit the forward data transfer phase.

4.3.1.1 Compatible mode handshake timing chart

4.3.1.1.1 Data receive (forward data transfer phase)



Note) The above timing chart shows the specifications of this printer, and slightly different from the timing chart defined in the IEEE1284.

(In the IEEE1284, Busy is set low after nAck is set high.)

4.3.1.1.2 Initialization by POWER ON

* Refer to Chapter 4.9.1 (1)

4.3.1.1.3 Initialization by I-PRIME (nInit) signal

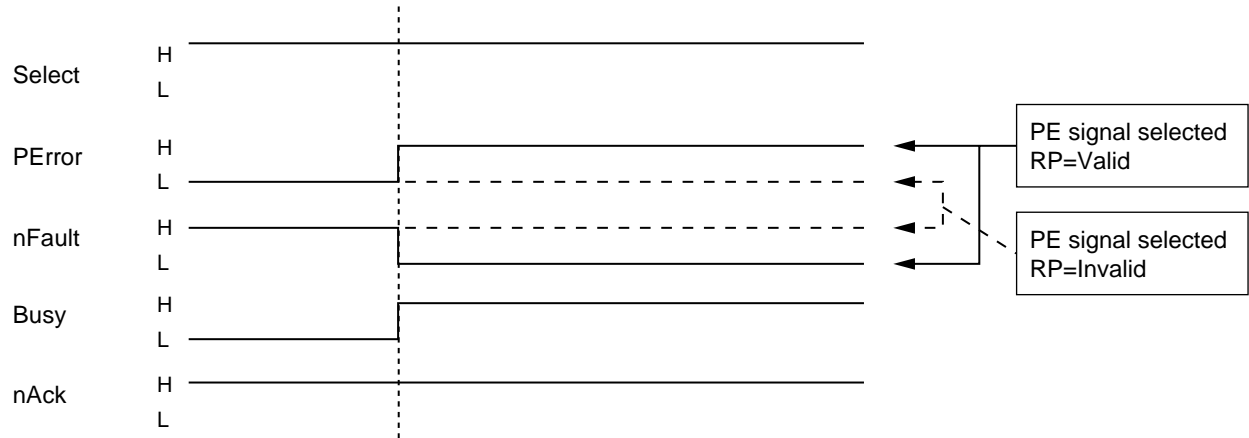
* Refer to Chapter 4.9.1 (2)

4.3.1.1.4 Paper end

(1) Roll mode

- * When RP sensor is set to valid by print stop sensor select command (When "Off-line Busy Control = Yes" is set in MENU)
- * When Menu is set to "Off-line Busy Control = No," Busy signal does not change.

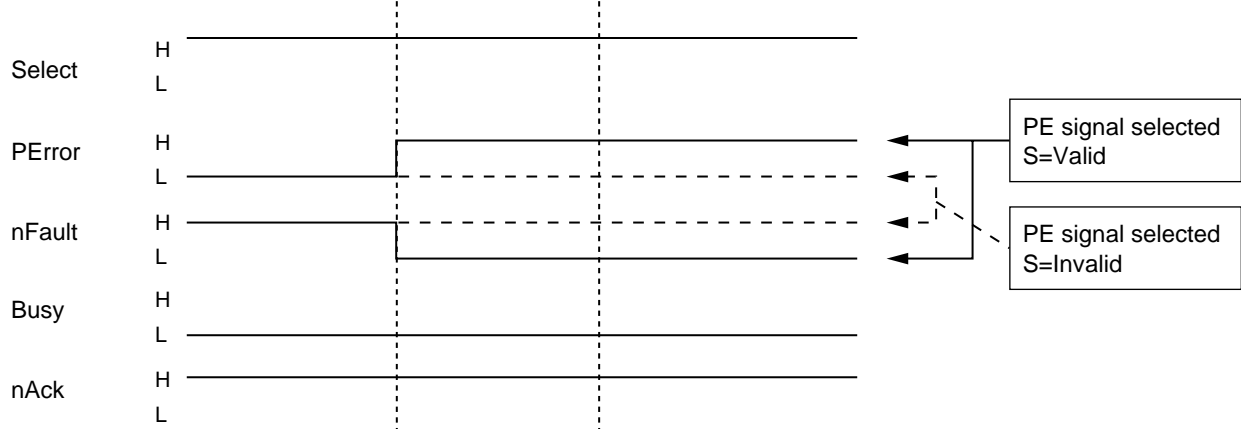
PE Occur (RP sensor with paper → no paper)



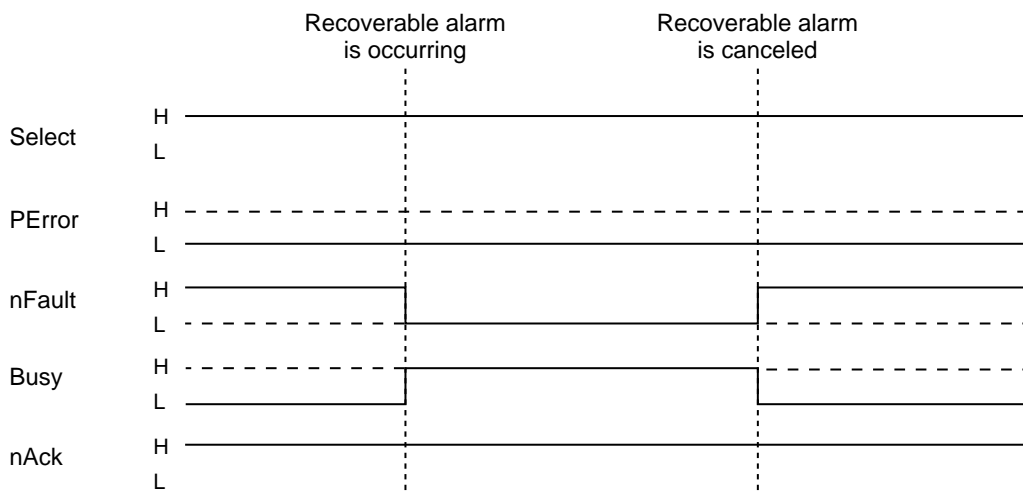
(2) Slip mode

- * When S sensor (Slip insert sensor) is set to Valid by print stop sensor select command

S sensor With paper → No paper PE Occur (bottom over)

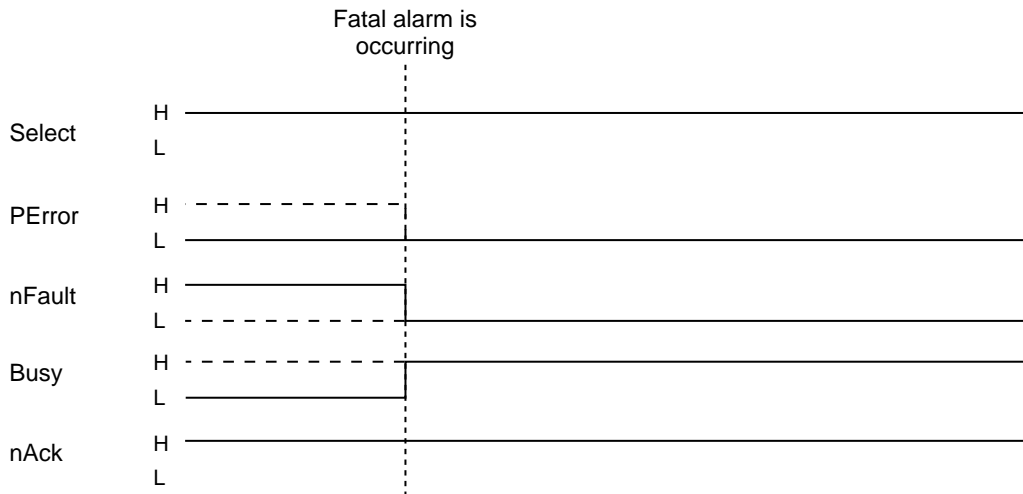


4.3.1.1.5 Recoverable alarm



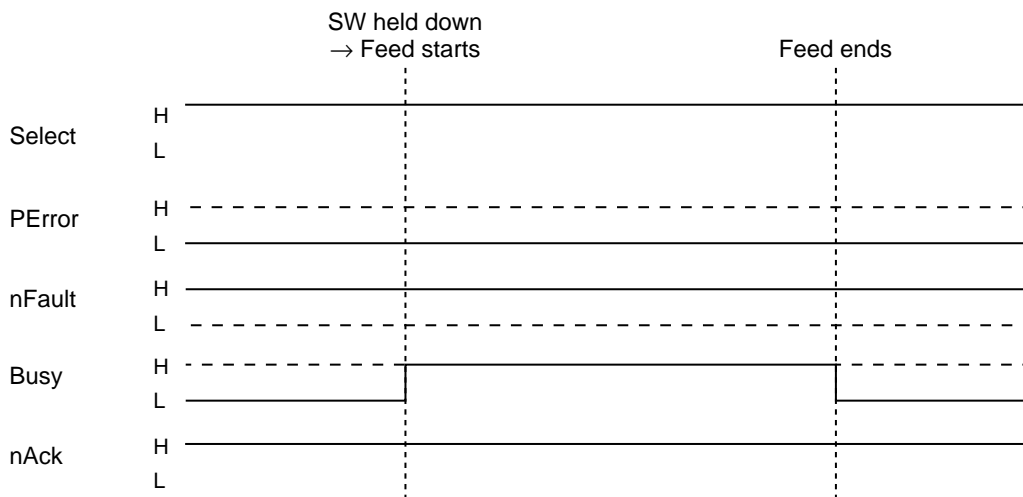
- * The above is the example when Menu is set to "Off-line Busy Control = Yes." When Menu is set to "Off-line Busy Control = No," Busy signal does not change.

4.3.1.1.6 Fatal alarm



4.3.1.1.7 Feed SW hold down

(1) When the SW is held down



* The above is the example when Menu is set to "Off-line Busy Control = Yes," and when Menu is set to "Off-line Busy Control = No," Busy signal does not change.

4.3.1.2 Negotiation phase start

Next chapter (Chapter 4.4) describes how the negotiation phase can be started, its method and details.

4.4 Negotiation

When it requests information such as the device ID from the printer, the host tries to switch the mode to the one which can transfer data in reverse (printer → host), from the compatible mode.

Here, the phase to select the most appropriate mode out of the transfer modes supported by both the host and the printer and switch to that mode is called Negotiation Phase.

4.4.1 Details of Negotiation

This section describes the details of the negotiation when the host requests to shift to other mode from the compatible mode.

The table below shows the names and the functions of the signals used in the negotiation phase:

Pin No.	Names		Direction	Function
	Traditional	Compatible mode		
1	STROBE	HostClk	From Host	Host sets "Low" when it sends an extensibility request value.
2~9	DATA bit1~8	Data bit1~8	From Host	The extensibility request value from the host
10	ACKNLG	PtrClk	To Host	Sets "Low" in concert with 1284 Active. Sets "High" after setting Xflag to its appropriate value.
11	BUSY	PtrBusy	To Host	Outputs the forward channel status.
12	PAPER END	AckDataReq	To Host	Sets "High" responding to the extensibility request value. Sets "Low" coincident with Xflag.
13	SELECT	XFlag	To Host	Sets "High" responding to the extensibility request value. Sets "Low" when the mode has been established.
14	AUTOFEED XT	HostBusy	From Host	1284 mode shift request from the host
15	–	–	–	Not used
16	GND	Grand	–	Signal ground
17	FG	Frame Grand	–	Frame Grand
18	+5V	+5V	To Host	+5V
19~30	GND	Grand	–	Signal ground
31	I-PRIME	nInit	From Host	Initialization
32	FAULT	nDataAvail	To Host	Sets "High" responding to the extensibility request value. Sets "Low" coincident with Xflag.
33	GND	Grand	–	Signal Ground
34	DK_STATUS	DK_STATUS	To Host	Drawer open/close status
35	+5V	+5V	To Host	+5V
36	SELECT IN	1284 Active	From Host	1284 mode shift request from the host

* As with the compatible mode, in the above table, the shaded areas are not controlled by this mode. For details, refer to the circuit materials.

4.4.1.1 Negotiation and handshake

(1) 1284 mode switch request

When it requests the reverse transfer from the printer, the host places the 1 byte extensibility request value on the data line as the request to switch to the reverse transfer possible mode from the compatible mode, sets the 1284 Active signal “High” at the same time setting HostBusy signal “Low”.

(2) Response status set

For the 1284 mode switch request, if it supports the requested mode, the printer sets the response status that includes AckDataReq signal and nDataAvail signal “High” settings, to indicate that it is IEEE1284 compliant.

When there is no response (the printer is not IEEE 1284 compliant), the host withdraws the 1284 mode switch request and returns to the compatible mode and forward idle phase.

(3) Switch Mode provision

With the above response status returned, the host acknowledges the support of the IEEE1284 by the printer and shows the extensibility request value (shown below) to the printer by setting HostClk signal “Low”.

Table 4-1 Extensibility request values

Definition	Value (binary)	Xflag affirmative response	Support/nonsupport (Xflag)
Extensibility Link Request	1000 0000	High	× (Low)
EPP Mode Request	0100 0000	High	× (Low)
ECP Mode Request (with Run Length Encode)	0011 0000	High	× (Low)
ECP Mode Request (without Run Length Encode)	0001 0000	High	× (Low)
Unused (reserved)	0000 1000	High	× (Low)
Device ID Transfer Request			
ECP Mode (with Run Length Encode)	0011 0100	High	× (Low)
ECP mode (without Run Length Encode)	0001 0100	High	× (Low)
Byte Move	0000 0101	High	× (Low)
Nibble Mode	0000 0100	High	○ (High)
Unused (reserved)	0000 0010	High	× (Low)
Byte Mode Reverse Channel Transfer Request	0000 0001	High	× (Low)
Nibble Mode Reverse Channel Transfer Request	0000 0000	Low	○ (Low)

Note) In the above table, “Xflag affirmative response” denotes the level of the Xflag signal that the host expects to see, as an indication of a positive response, when it provides the specified Extensibility Request byte to the printer during the negotiation phase.

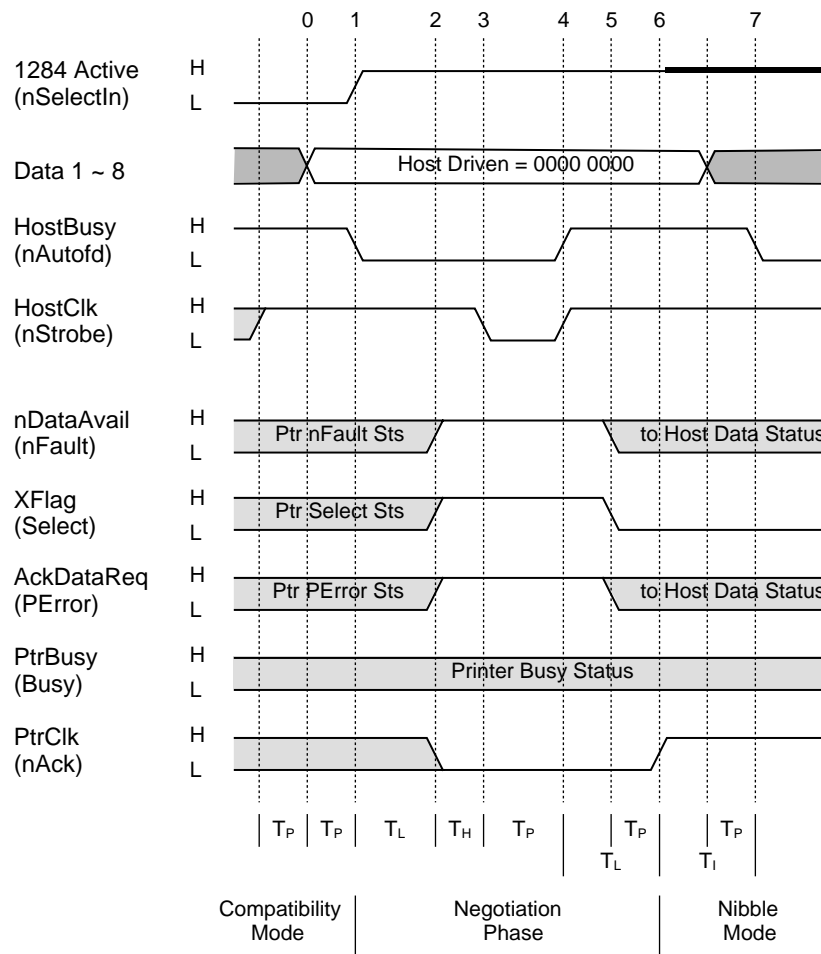
(4) Mode switch end (negotiation ends)

For the Extensibility Request Value, the printer sets nDataAvail signal “Low”, and denotes a positive response in Xflag signal if it can meet the request, and begins the reverse transfer. If it cannot meet the request, the printer sets Xflag signal to the opposite level of the positive response, waits for the 1284 signal to become “Low” and returns to Compatible Mode.

(Affirmative response to “Nibble Mode Device ID Transfer Request” and “Nibble Mode Reverse Channel Transfer Request” only)

4.4.1.2 Negotiation timing chart

(1) Negotiation from Compatible Mode to Nibble Mode

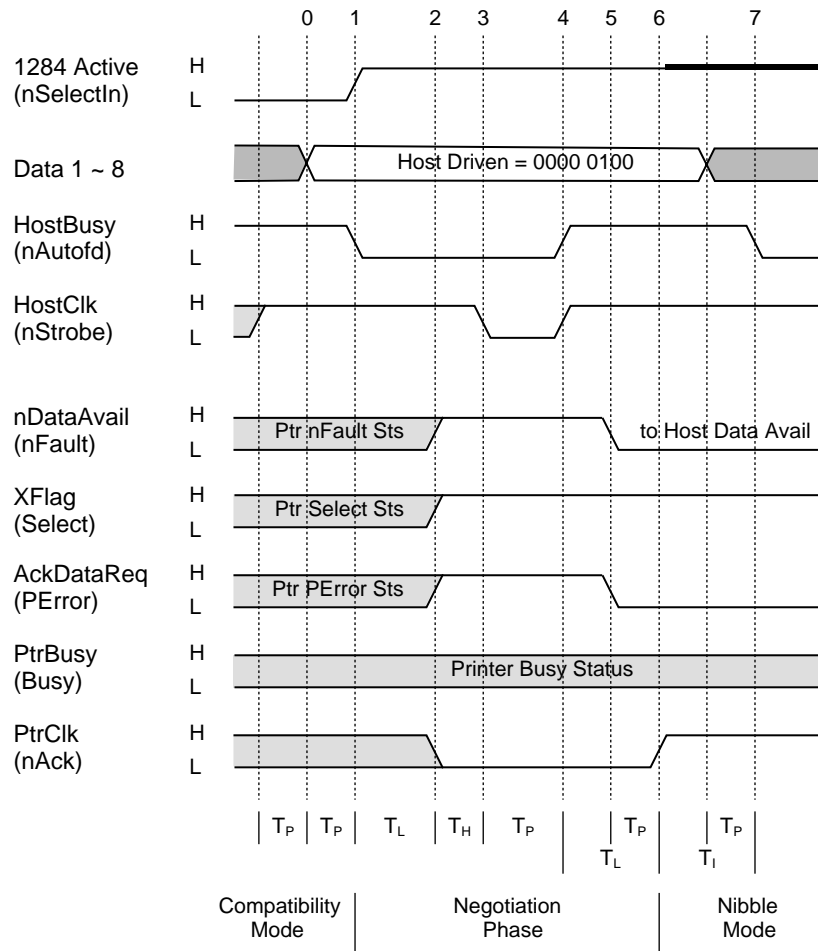


<Explanation of events>

0. (Host) Places Extensibility Request Value (Nibble Mode Reverse Channel Transfer) on the data bus.
1. (Host) Requests the switch to the 1284 Mode by setting 1284 Active "High" and HostBusy "Low".
2. (Printer) Sets AckDataReq, Xflag and nDataAvail "High" and PtrClk "Low" and denotes that it is IEEE1284 compliant.
3. (Host) Sets HostClk "Low" and provides the printer with the Extensibility Request Value.
4. (Host) Acknowledges that the printer is IEEE1284 compliant and sets HostClk and HostBusy "High".
5. (Printer) Sets Xflag "Low" and indicates that it supports the transfer mode (Nibble Mode) specified by the Extensibility Request Value.
Maintains nDataAvail and AckDataReq "Low" if there is data to transfer, and "High" if there is no data to transfer.
6. (Printer) Sets PtrClk "High" to indicate that the transfer preparation is complete.
7. (Host) Sets HostBusy "Low" to indicate that receiving preparation is complete.

—	: Valid state (host can start termination phase)
T_H	: 0 ~ 1.0sec Host response time
T_L	: 0 ~ 35ms Printer response time
T_P	: 0.5us Minimum setup time or minimum signal pulse width
T_I	: 0 ~ Infinite Maximun setup time

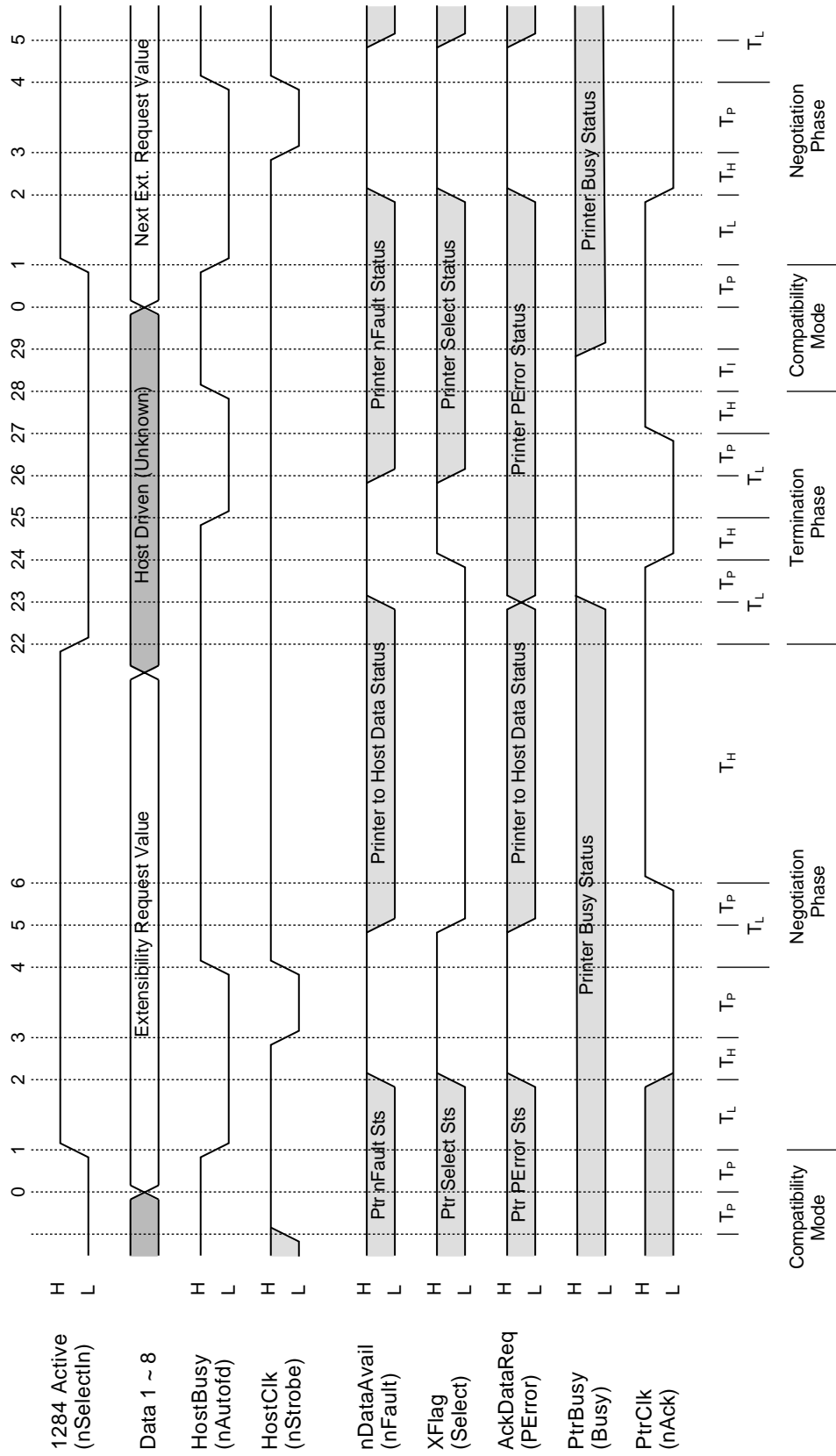
(2) Negotiation for Device ID Transfer Request from Compatible Mode



<Explanation of events>

0. (Host) Places Extensibility Request Value (Device ID Request) on the data bus.
1. (Host) Sets 1284 Active "High" and HostBusy "Low" and requests the switch to 1284 mode.
2. (Printer) Sets AckDataReq, Xflag and nDataAvail "High" and PtrClk "Low" to indicate that it is IEEE1284 compliant.
3. (Host) Sets HostClk "Low" and provides Extensibility Request Value to the printer.
4. (Host) Acknowledges that the printer is IEEE1284 compliant and sets HostClk and HostBusy "High".
5. (Printer) Maintains Xflag "High" and indicates that it has data to transfer by setting nDataAvail and AckDataReq "Low" that indicate that the printer can transfer device ID in the specified mode.
6. (Printer) Sets PtrClk "High" to indicate that the transfer preparation is complete. (Xflag becomes "High" that indicates that ID return is possible.)
7. (Host) Sets HostBusy "Low" to indicate that the receiving preparation is complete.

(3) Unsuccessful negotiation (requested mode not supported) and re-negotiation (reference)



<Explanations of events>

0. (Host) Places Extensibility Request Value on the data bus.
1. (Host) Sets 1284 Active "High" and HostBusy "Low", and requests the switch to the IEEE 1284 mode.
2. (Printer) Sets AckDataReq, Xflag and nDataAvail "High" and PtrClk "Low" to indicate that it is IEEE1284 compliant.
3. (Host) Sets HostClk "Low" and provides the printer with the Extensibility Request Value.
4. (Host) Acknowledge that the printer is IEEE1284 compliant and sets HostClk and HostBusy "High".
5. (Printer) Sets Xflag "Low" to indicate that it does not support transfer mode (Byte Mode) specified by Extensibility Request Value.
(When there is data to transfer to the host, the printer sets nDataAvail and AckDataReq "Low".)
6. (Printer) Sets PtrClk "High" to indicate that the transfer preparation is complete.
22. (Host) Sets 1284 Active "Low" to request the negotiation to terminate.
23. (Printer) Upon receiving 1284 Active "Low", printer sets PtrBusy and nDataAvail "High" and returns AckDataReq to Compatible Mode state.
24. (Printer) Following the above signal changes, printer sets Xflag "High" and PtrClk "Low".
25. (Host) In response to PtrClk "Low", host sets HostBusy "Low".
26. (Printer) Returns nDataAvail and Xflag to the Compatible Mode state.
27. (Printer) Sets PtrClk "High" to indicate that each signal status setting has been completed.
28. (Host) Sets HostBusy "High" and terminates the negotiation.
29. (Printer) Returns PtrBusy to Compatible Mode state.

4.5 Nibble Mode

Nibble Mode is the mode for the printer to transfer the information such as Device ID that the printer has to the host (reverse transfer), in response to the request from the host.

This mode is started by the negotiation from the Compatible Mode, and after Power On and the initialization by nInit (I-PRIME) signal, the printer never starts in this mode.

In the Nibble Mode, the host can select from the following operations:

- (1) Asynchronous reverse (printer R host) transfer in the Nibble Mode
- (2) Starting the termination phase to return to the Compatible Mode from the Nibble Mode

The table below shows the names and the functions of the signals used in this mode:

Pin No.	Name		Direction	Function
	Traditional	Nibble mode		
1	STROBE	HostClk	From Host	"High", fixed.
2~9	DATA bit1~8	Data bit1~8	From Host	Host can drive (unused)
10	ACKNLG	PtrClk	To Host	Sets "Low" to notify the host that Nibble data is valid, and returns this signal to "High" in response to the Host-Busy "High".
11	BUSY	PtrBusy	To Host	Indicates bit3 or bit7 of Nibble data. Outputs Forward Channel status when in idle state.
12	PAPER END	AckDataReq	To Host	Indicates bit2 or bit6 of Nibble data. Outputs transfer data presence or not presence when in idle state.
13	SELECT	XFlag	To Host	Indicates bit1 or bit5 of Nibble data. Outputs Xflag Affirmative Response level when in idle state.
14	AUTOFEED XT	HostBusy	From Host	Indicates the host's data receiving preparation state.
15	–	–	–	Unused.
16	GND	Grand	–	Signal ground
17	FG	Frame Grand	–	Frame ground
18	+5V	+5V	To Host	+5V
19~30	GND	Grand	–	Signal ground
31	I-PRIME	nInit	From Host	Initialization
32	FAULT	nDataAvail	To Host	Indicates bit0 or bit4 of Nibble data. Outputs transfer data presence or not presence when in idle state.
33	GND	Grand	–	Signal ground
34	DK_STATUS	DK_STATUS	To Host	Drawer open/close status
35	+5V	+5V	To Host	+5V
36	SELECT IN	1284 Active	From Host	1284 mode termination request from the host.

* The signal names and pin assignments, etc., are the same as the Negotiation Phase (Section 4.4.1). In the above table, the shaded areas are not controlled by this mode. For details, refer to the circuit materials.

4.5.1 Nibble Mode Handshake

Handshake in the Nibble Mode has the following phases:

(1) Host busy data available phase

When the printer has data to send to the host after the negotiation to the Nibble Mode has ended or 1byte data was sent, the transition to this phase takes place. In this phase, the transition to the reverse data transfer phase takes place when HostBusy signal becomes “Low”.

(2) Host busy data not available phase

Shifts to this phase when there is no data to send from printer to host after the negotiation to the Nibble Mode ends or 1-byte data is sent

If data to send becomes available in this phase, the phase shifts to Nibble mode host busy data available phase.

(3) Reverse data transfer phase

This phase performs asynchronous reverse data transfer that is activated when HostBusy signal becomes “Low”, from the host busy data available phase.

Data transfer is done in the following manner:

1.		Nibble mode/host busy data available phase
2.	(Host)	Sets HostBusy signal “Low” to indicate that it can accept low order nibble data. (Nibble Mode reverse data transfer begins.)
3.	(Printer)	Places bit0 ~ bit3 of the transfer data on nDataAvail, Xflag, AckDataReq & PtrBusy signals.
4.	(Printer)	Sets PtrClk signal “Low” to indicate that data is valid.
5.	(Host)	Latches data and sets HostBusy signal “High”.
6.	(Printer)	Acknowledges HostBusy signal “High” and sets PtrClk signal “High”.
7.	(Host)	Sets HostBusy signal “Low” to indicate that it can accept high order nibble data.
8.	(Printer)	Places bit4 ~ bit7 of the transfer data on nDataAvail, Xflag, AckDataReq & PtrBusy signals.
9.	(Printer)	Sets PtrClk signal “Low” to show host that data is valid.
10.	(Host)	Latches data and sets HostBusy signal “High”.
11.	(Printer)	Acknowledges HostBusy signal “High” and sets PtrClk signal “High”.
12.		Shifts to host busy data available phase or host busy data not available phase.

(4) Reverse idle phase

This phase means: No reverse data transfer is in progress, there is no reverse transfer data, either, and HostBusy signal is “Low” (host can start receiving reverse data).

If transfer data becomes available in this phase, the phase shifts to host busy data available phase.

(5) Interrupt phase

This is a phase that provides the mechanism for the printer to alert the host that it has data to transfer, in the reverse idle phase.

Printer shows host that it has data to transfer by setting nDataAvail signal “Low” and outputting PtrClk signal “Low” pulse, and prompts host to get ready to receive the data.

Phase shifts to host busy data available phase via this phase.

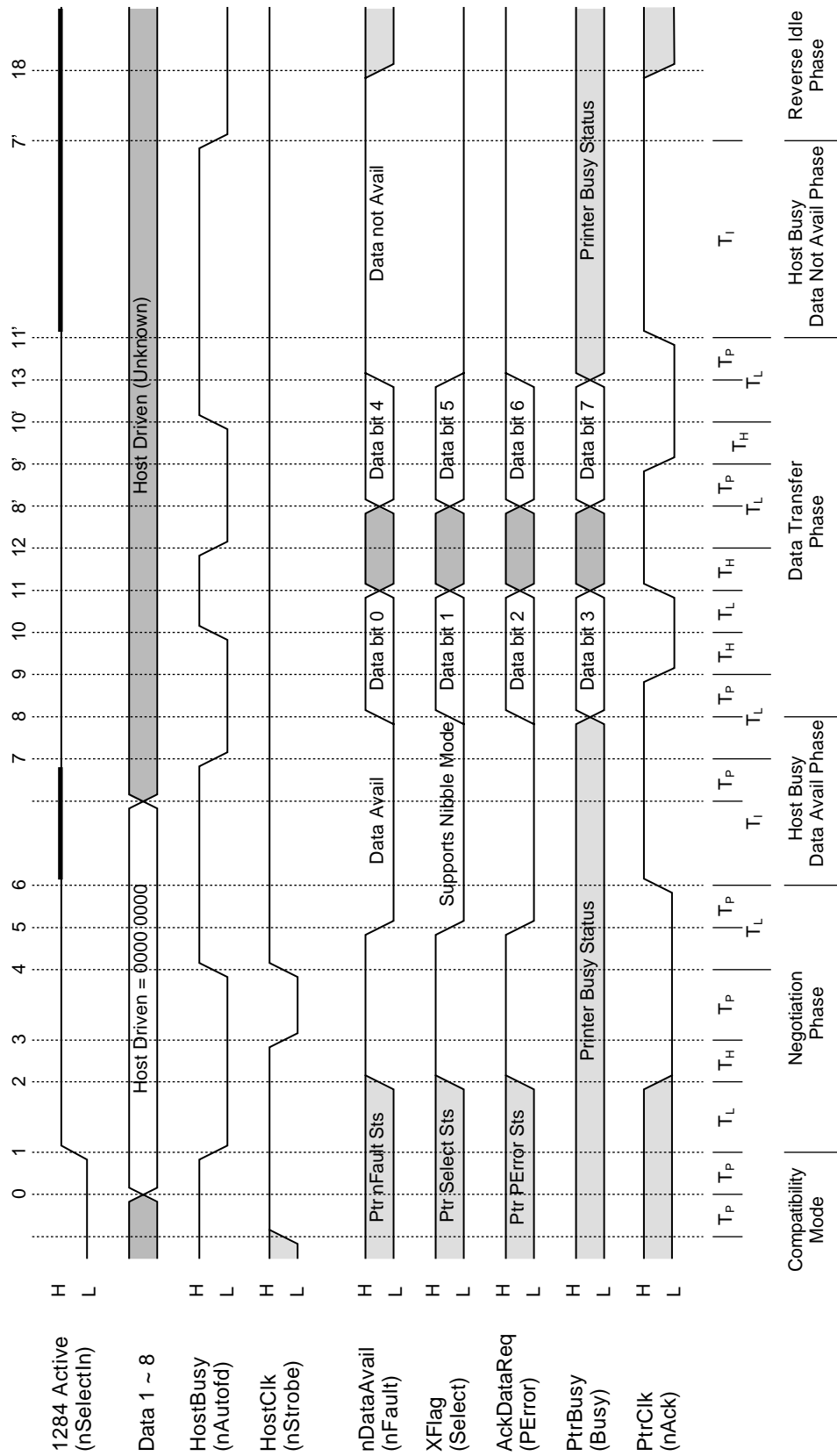
(6) Nibble mode termination phase

Termination phase is a phase to return to Compatible Mode from the Nibble Mode by the host’s reverse transfer termination (Nibble Mode) request.

This phase is activated when 1284 Active signal becomes “Low” and HostBusy signal becomes “High” from the valid state.

4.5.1.1 Nibble mode handshake timing charts

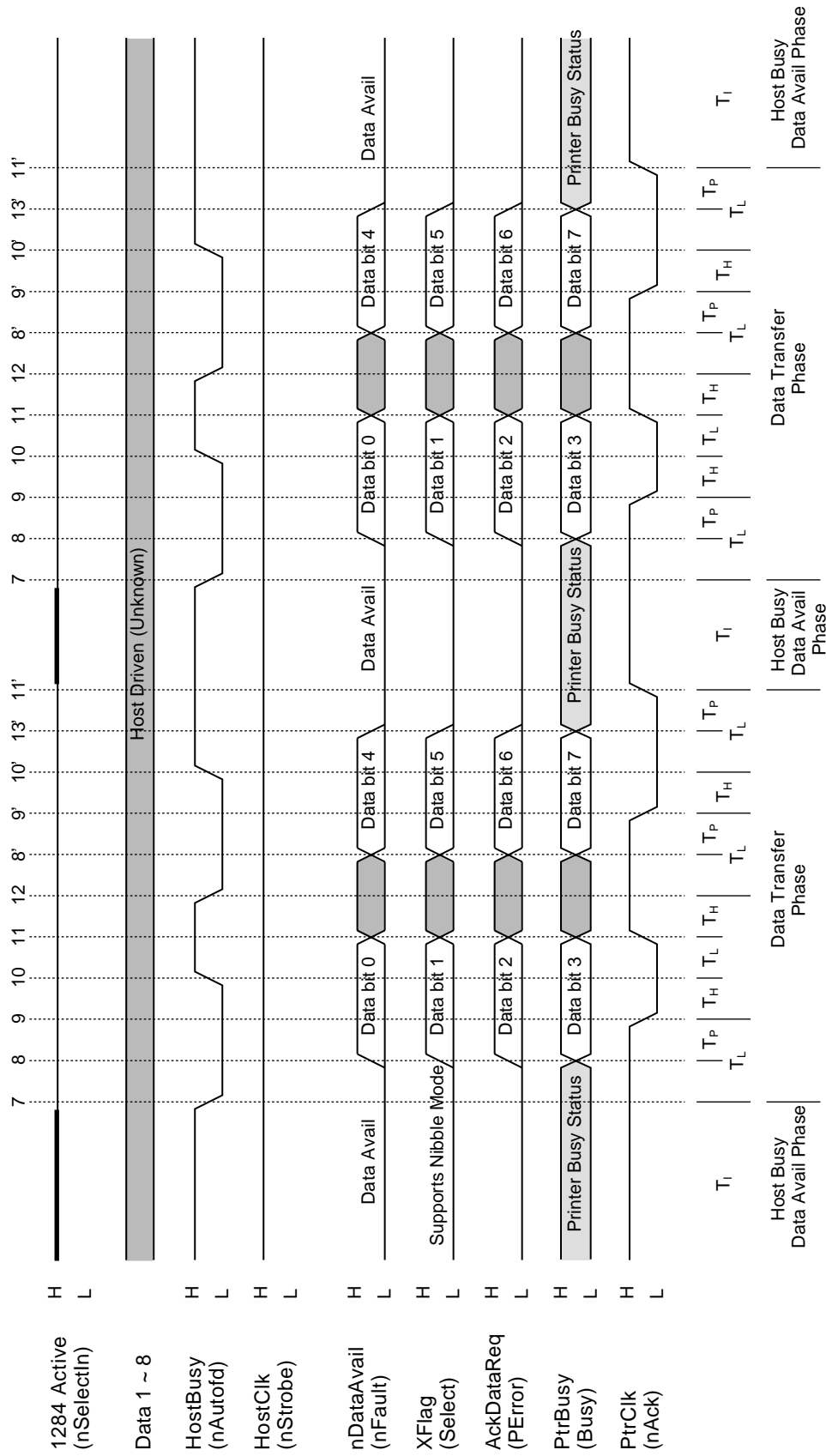
(1) 1byte reverse transfer from negotiation



<Explanation of events>

- 0 ~ 6. From negotiation to host busy data available phase. (Refer to Chapter 4.4.)
- 7. (Host) Sets HostBusy "Low" to indicate that it can accept low order nibble data.
- 8. (Printer) Places low order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
- 9. (Printer) Sets PtrClk signal "Low" to indicate that low order nibble data is valid.
- 10. (Host) Receives the low order nibble data and sets HostBusy "High".
- 11. (Printer) Acknowledges HostBusy "High" and sets PtrClk signal "High".
- 12. (Host) Sets HostBusy "Low" when it is ready to accept the high order nibble data.
- 8'. (Printer) Places the high order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
- 9'. (Printer) Sets PtrClk "Low" to indicate that high order nibble data is valid.
- 10'. (Host) Receives the high order nibble data and sets HostBusy "High".
- 13. (Printer) Acknowledges HostBusy "High" and sets nDataAvail and AckDataReq "High"(indicating there is no more data) and Xflag "Low"(the same level as affirmative response) and PtrBusy to indicate the forward channel status.
- 11'. (Printer) Sets PtrClk "High" to indicate that there is no more data.
- 7'. (Host) Sets HostBusy "Low" to indicate that it is ready to accept next data.
- 18. (Printer) When valid data becomes available for the host, the printer sets PtrClk and nDataAvail "Low" to indicate it.

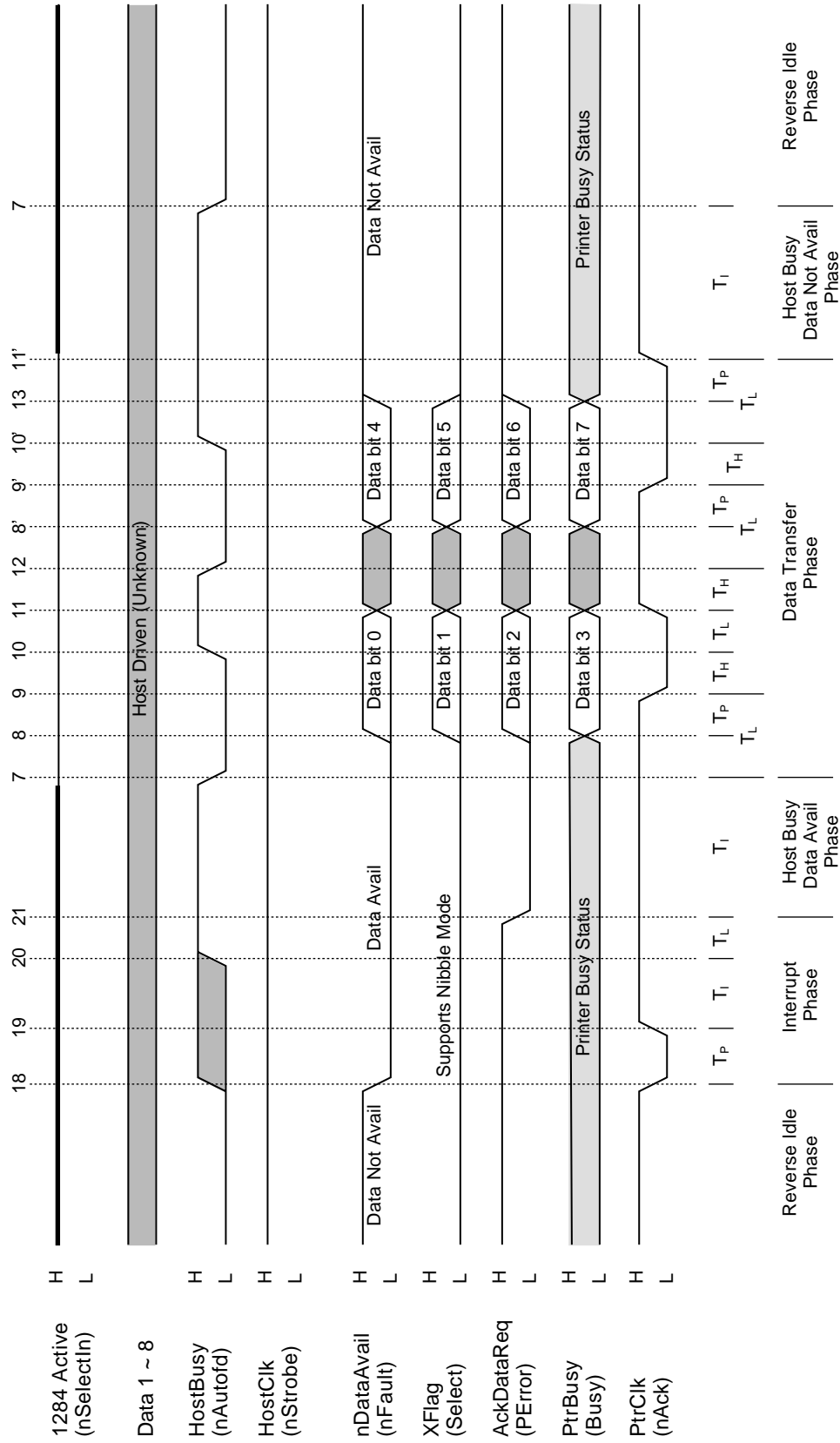
(2) Multiple byte reverse transfer



<Explanation of events>

7. (Host) Sets HostBusy "Low" to indicate that it is ready to accept low order nibble data.
8. (Printer) Places the low order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
9. (Printer) Sets PtrClk "Low" to indicate that the low order nibble data is valid.
10. (Host) Receives the low order nibble data and sets HostBusy "High".
11. (Printer) Acknowledges HostBusy "High" and sets PtrClk "High".
12. (Host) Sets HostBusy "Low" when it is ready to receive the high order nibble.
- 8'. (Printer) Places the high order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
- 9'. (Printer) Sets PtrClk "Low" to indicate that the high order nibble data is valid.
- 10'. (Host) Receives the high order nibble data and sets HostBusy "High".
- 13'. (Printer) Acknowledges HostBusy "High" and sets nDataAvail and AckDataReq "Low"(indicating there is more data), Xflag "Low"(the same level as the affirmative response), and PtrBusy to indicate the forward channel status.
- 11'. (Printer) Sets PtrClk "High" to indicate that there is more data.

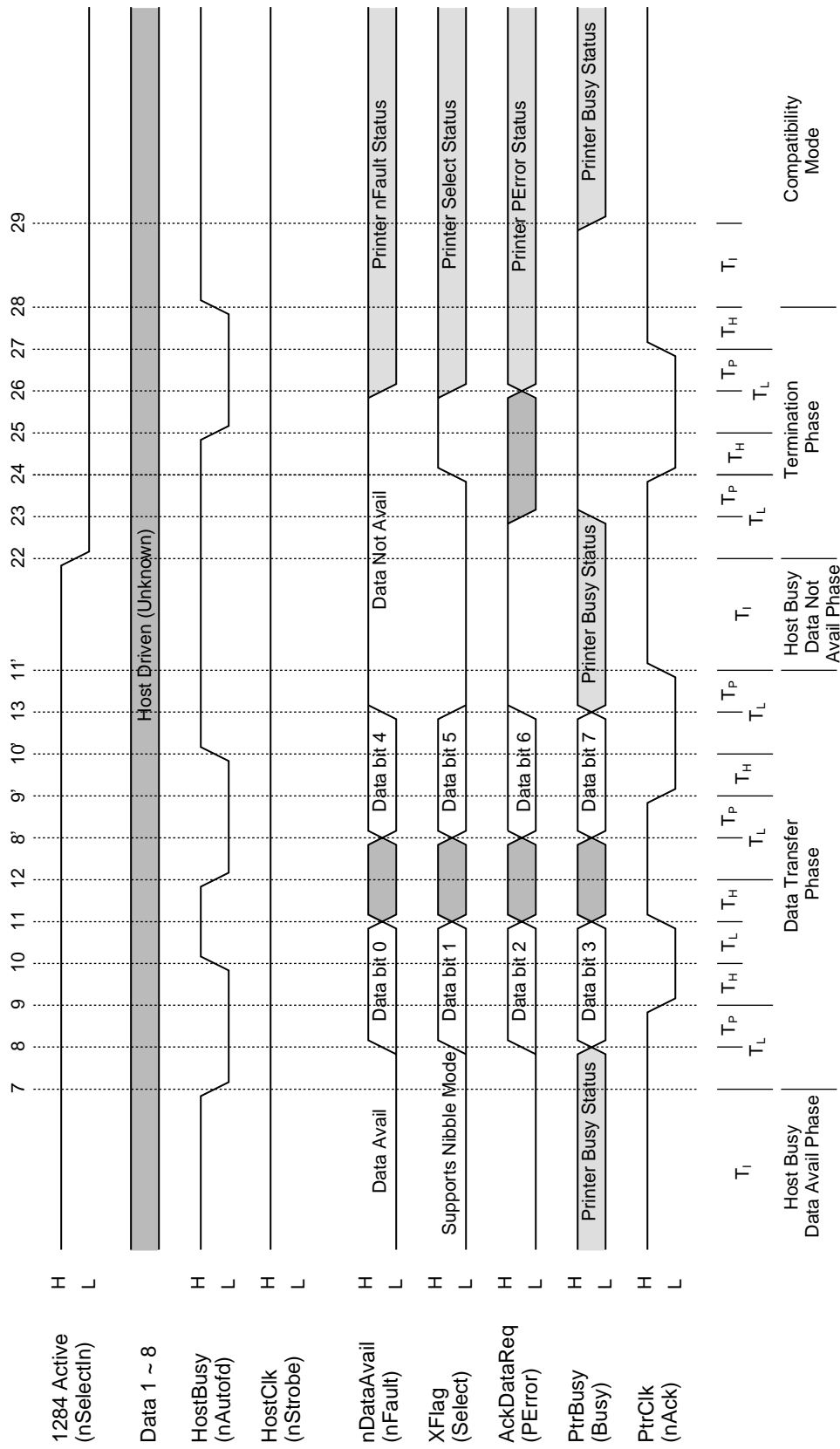
(3) Reverse transfer from the reverse idle phase



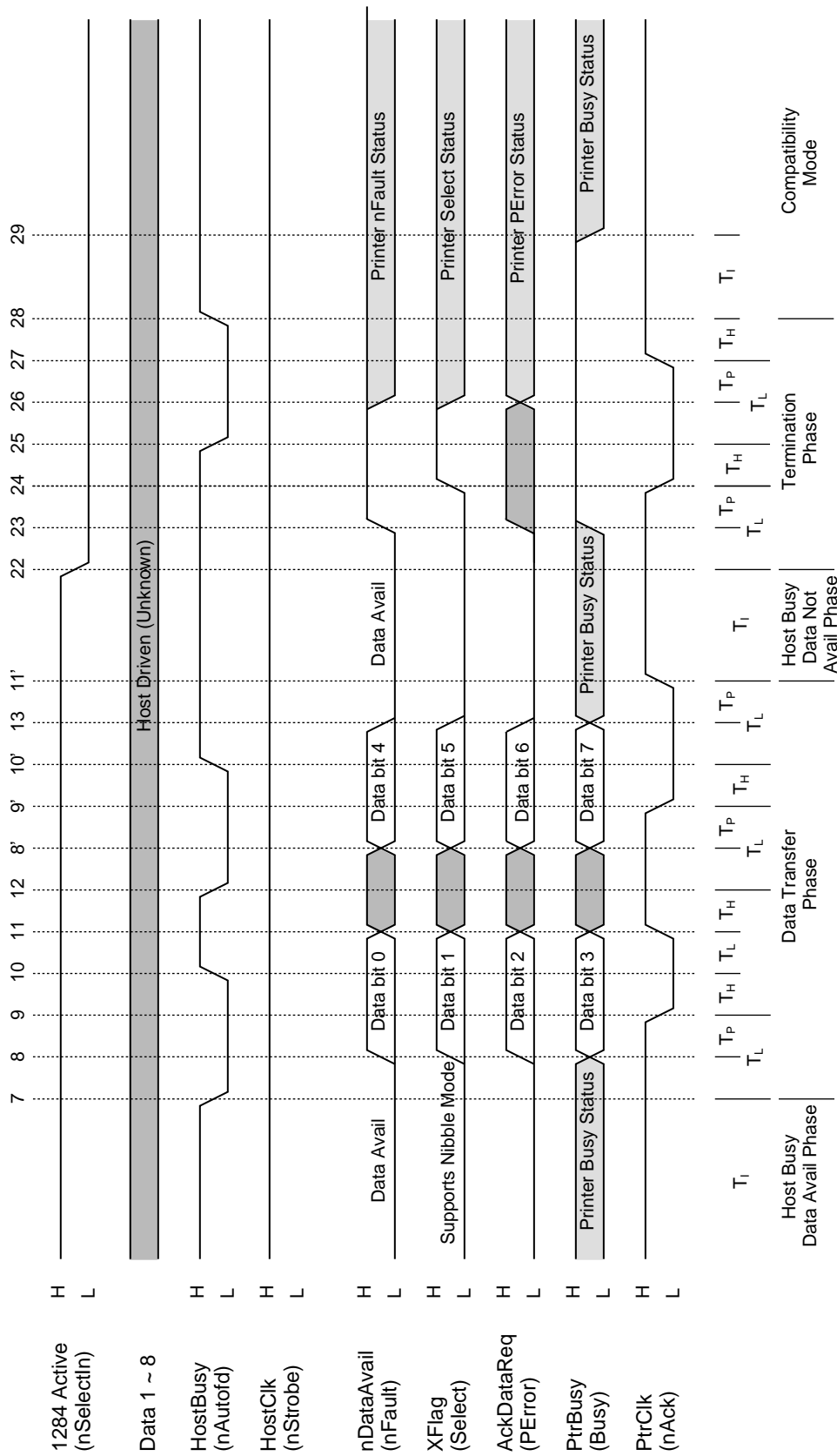
<Explanation of events>

18. (Printer) Because data to transfer to host becomes available, the printer sets nDataAvail and PtrClk "Low" to alert the host.
19. (Printer) After waiting for the minimum pulse width, printer sets PtrClk "High".
20. (Host) Sets HostBusy "High" from the PtrClk "Low" pulse, and gets ready to receive the data.
21. (Printer) Acknowledges HostBusy "High" and sets AckDataReq "Low".
7. (Host) Sets HostBusy "Low" to indicate that it is ready to receive.
8. (Printer) Places low order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
9. (Printer) Sets PtrClk "Low" to indicate that the low order nibble data is valid.
10. (Host) Receives the low order nibble data and sets HostBusy "High".
11. (Printer) Acknowledges HostBusy "High" and sets PtrClk "High".
12. (Host) Sets HostBusy "Low" when it is ready to receive the high order nibble data.
- 8'. (Printer) Places the high order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
- 9'. (Printer) Sets PtrClk "Low" to indicate that the high order nibble data is valid.
- 10'. (Host) Receives the high order nibble data and sets HostBusy "High".
13. (Printer) Acknowledges HostBusy "High" and sets nDataAvail and AckDataReq "High"(indicating that there is no more data), and Xflag "Low"(same level as the affirmative response) and PtrBusy to indicate the forward channel status.
- 11'. (Printer) Sets PtrClk "High" to indicate that there is no more data.
7. (Host) Sets HostBusy "Low" to indicate that it is ready to receive next data.

(4) Termination from host busy data not available phase, after reverse transfer



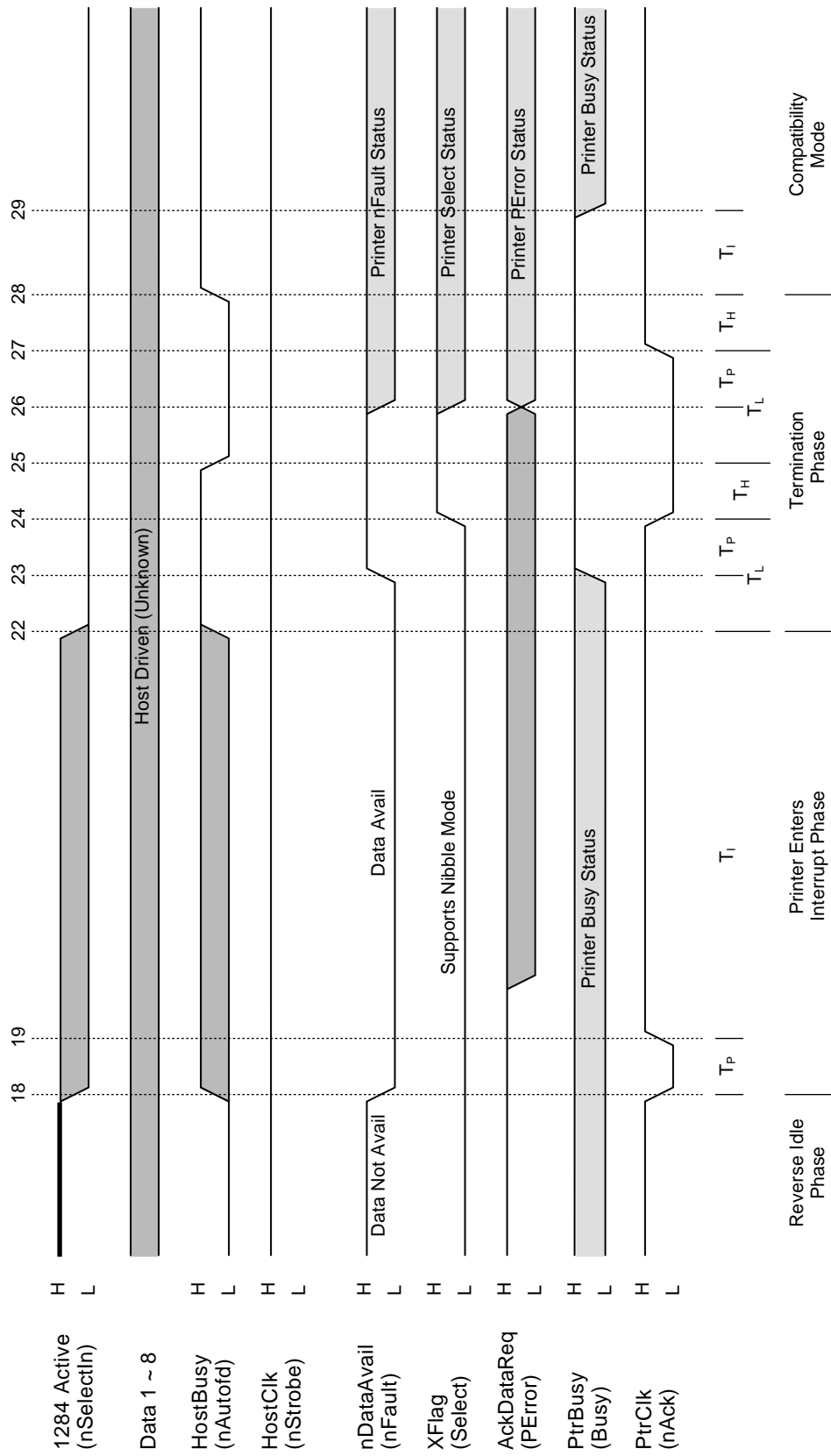
(5) Termination from host busy data available phase after reverse transfer (reference)



<Explanation of events>

7. ~ 10'. Reverse data transfer. Refer to (2).
13. (Printer) Sets information on data to transfer next.
When there is no more data to transfer: → (4)
Acknowledges HostBusy "High" and sets nDataAvail and AckDataReq "High"(indicating that there is no data) and Xflag "Low"(same level as the affirmative response) and PtrBusy to the forward channel status.
When there is more data: → (5)
Acknowledges HostBusy "High", and sets nDataAvail and AckDataReq "Low"(indicating that there is more data) and Xflag "Low"(same level as the affirmative response), and PtrBusy to the forward channel status.
- 11'. (Printer) Sets PtrClk "High" to show host if there is more data or not.
22. (Host) Sets 1284 Active "Low" to request the termination of Nibble Mode.
23. (Printer) Sets PtrBusy and nDataAvail "High".
24. (Printer) Sets Xflag to its opposite sense of the affirmative response ("Low" for the device ID transfer request) and PtrClk "Low".
25. (Host) Sets HostBusy "Low".
26. (Printer) Acknowledges HostBusy "Low" and sets nDataAvail, Xflag and AckDataReq in the forward channel status.
27. (Printer) After signals become stable, printer sets PtrClk "High" to indicate that each signal has been returned to the Compatible Mode.
28. (Host) Ends the termination phase by setting HostBusy "High" and switches to the Compatible Mode/forward idle phase.
29. (Printer) Sets Busy "Low" when the preparation to receive forward data has been completed.

(6) Reverse transfer and termination phase collision



<Explanation of events>

18. (Printer) Because data to transfer to the host becomes available, the printer sets nDataAvail and PtrClk "Low" to alert the host.
19. (Printer) After waiting the minimum signal pulse width, printer sets PtrClk "High".
22. (Host) Nibble mode termination request status, 1284 Active="Low" and HostBusy="High" are established.
23. (Printer) Sets PtrBusy and nDataAvail "High".
24. (Printer) Sets Xflag to the opposite sense of the affirmative response and PtrClk "Low".
25. (Host) Sets HostBusy "Low".
26. (Printer) Acknowledges HostBusy "Low" and sets nDataAvail, Xflag and AckDataReq in the forward channel status.
27. (Printer) After signals become stable, printer sets PtrClk "High" to indicate that each signal has been returned to the Compatible Mode.
28. (Host) Ends the termination phase by setting HostBusy "High" and switches to the Compatible Mode/forward idle phase.
29. (Printer) Sets Busy "Low" when the preparation to receive forward data has been completed.

4.6 Interface Errors

Abnormal status, abnormal signal transition and timeout during the 1284 mode shall be handled as interface errors.

When an interface error occurs, the current mode shall be aborted immediately and the system shall return to the Compatible Mode, without going through the termination phase. This is to protect the host and the printer.

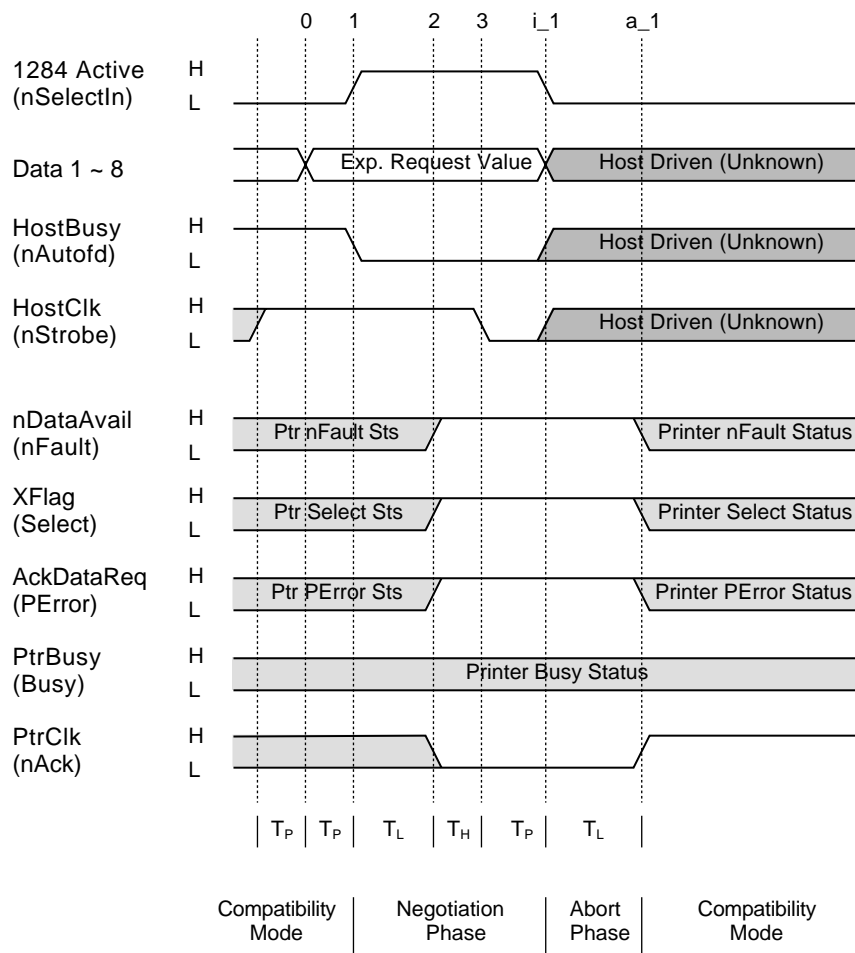
The following are examples of interface errors:

- ① When 1284 Active signal becomes "Low" in states other than valid states.
- ② When nlnit signal becomes "Low" during 1284 mode.
- ③ When there has been a signal transition different from the Standard
- ④ When there is no response from the host (timeout occurred).

When any of the above phenomena has occurred, the system shall terminate the 1284 mode and return to Compatible Mode, regardless of the current phase or status.

4.6.1 Interface Error Timing Charts

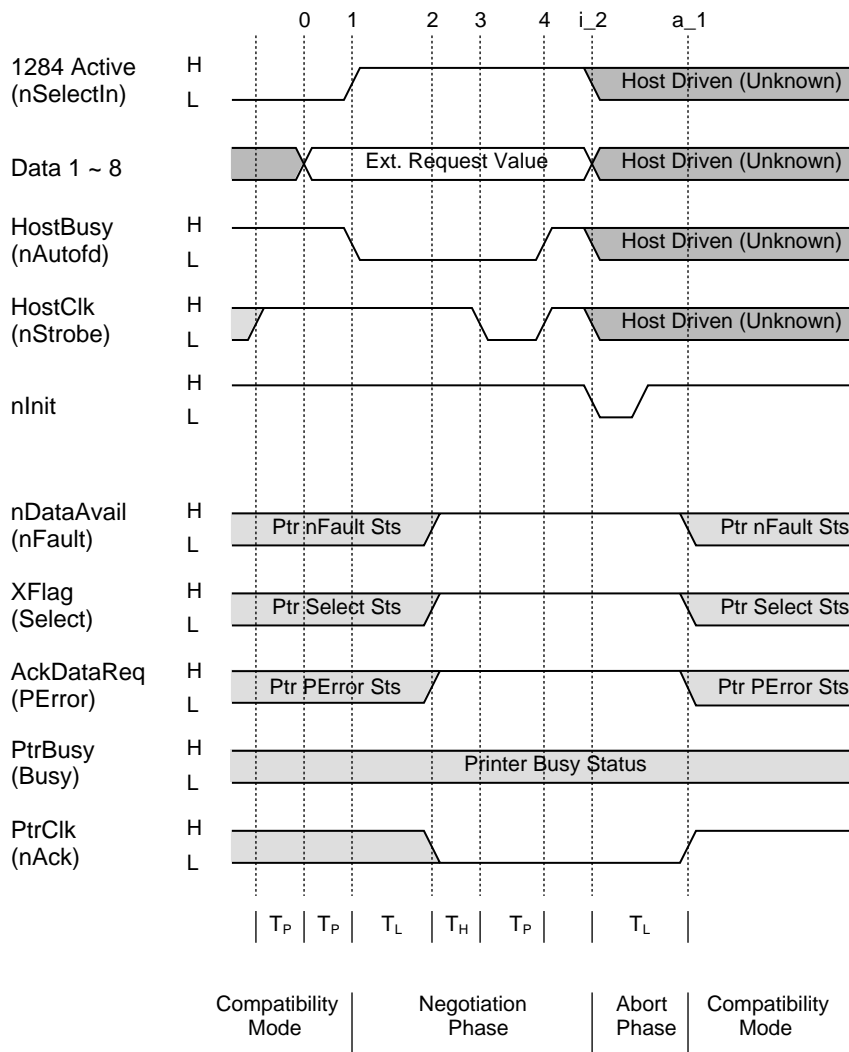
(1) Abnormal status detection during negotiation (Part 1)



<Explanation of events>

0. (Host) Places Extensibility Request Value (nibble mode reverse channel transfer) on data bus.
1. (Host) Sets 1284 Active "High" and HostBusy "Low" to request the switch to 1284 mode.
2. (Printer) Sets AckDataReq, Xflag and nDataAvail "High" and PtrClk "Low" to indicate 1284 support.
3. (Host) Shows printer Extensibility Request Value by setting HostClk "Low".
- i_1. (Host) For some reason, 1284 Active indicates "Low".
(Abnormal status has occurred.)
- a_1. (Printer) Aborts 1284 mode and returns to Compatible Mode.

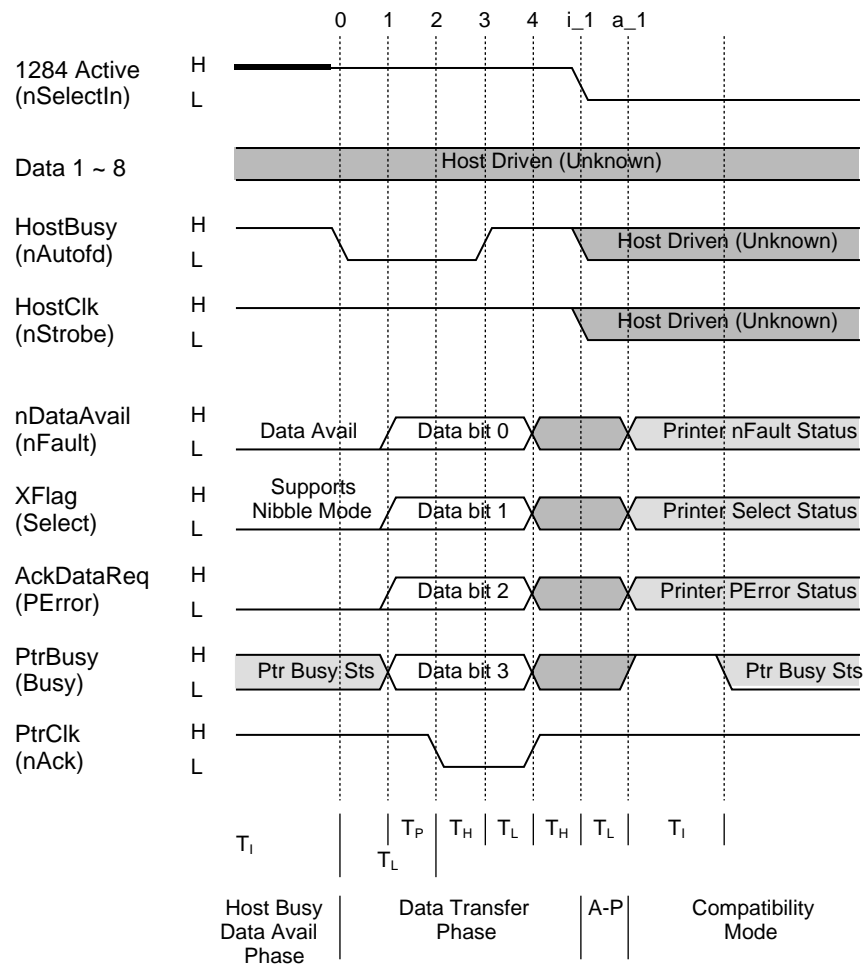
(2) Abnormal status detection during negotiation (Part 2)



<Explanation of events>

- 0. (Host) Places extensibility request value on data bus.
- 1. (Host) Request switch to IEEE1284 mode by setting 1284 Active “High” and HostBusy “Low”.
- 2. (Printer) Sets AckDataReq, Xflag and nDataAvail “High” and PtrClk “Low” to indicate 1284 support.
- 3. (Host) Sets HostClk “Low” to show printer extensibility request value.
- 4. (Host) Acknowledges the support of 1284 by the printer and sets HostClk and HostBusy “High”.
- i_2. (Host) For some reason, nInit becomes “Low”.
(Abnormal status has occurred.)
- a_1.(Printer) Aborts 1284 mode and returns to Compatibility Mode.

(3) Abnormal status detection during reverse transfer (Part 1)

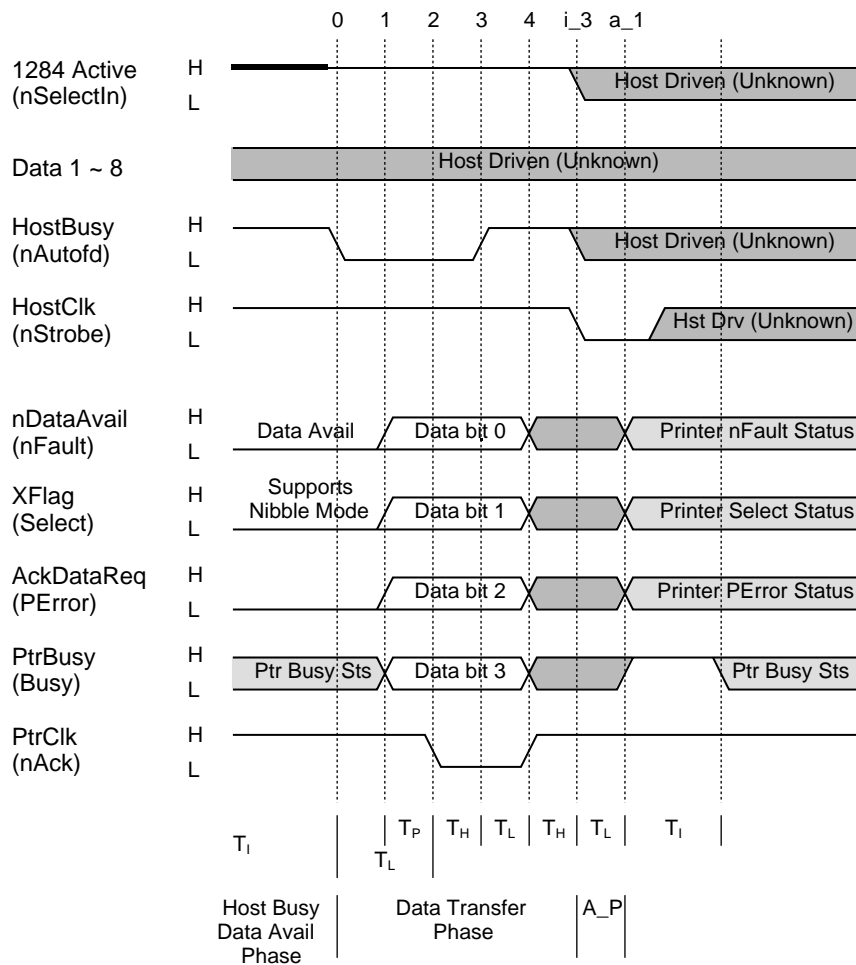


<Explanation of events>

0. (Host) Indicates that it is ready to receive low order nibble data by setting HostBusy "Low" from host busy data available state.
1. (Printer) Places low order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
2. (Printer) Indicates that low order nibble data is valid by setting PtrClk "Low".
3. (Host) Receives low order nibble data and sets HostBusy "High".
4. (Printer) Acknowledges HostBusy "High" and sets PtrClk "High".
- i_1. (Host) For some reason, 1284 Active becomes "Low".
(Abnormal status has occurred.)
- a_1.(Printer) Aborts Nibble Mode and returns to Compatibility Mode.

* According to the Standard, data that is being transferred when Nibble Mode is aborted shall be resent at next data transfer, but in this printer, data resend does not take place from data that was being transferred. (For details about resending, refer to Chapter 4.7.3 and 4.8.2.)

(4) Abnormal status detection during reverse transfer (Part 2)

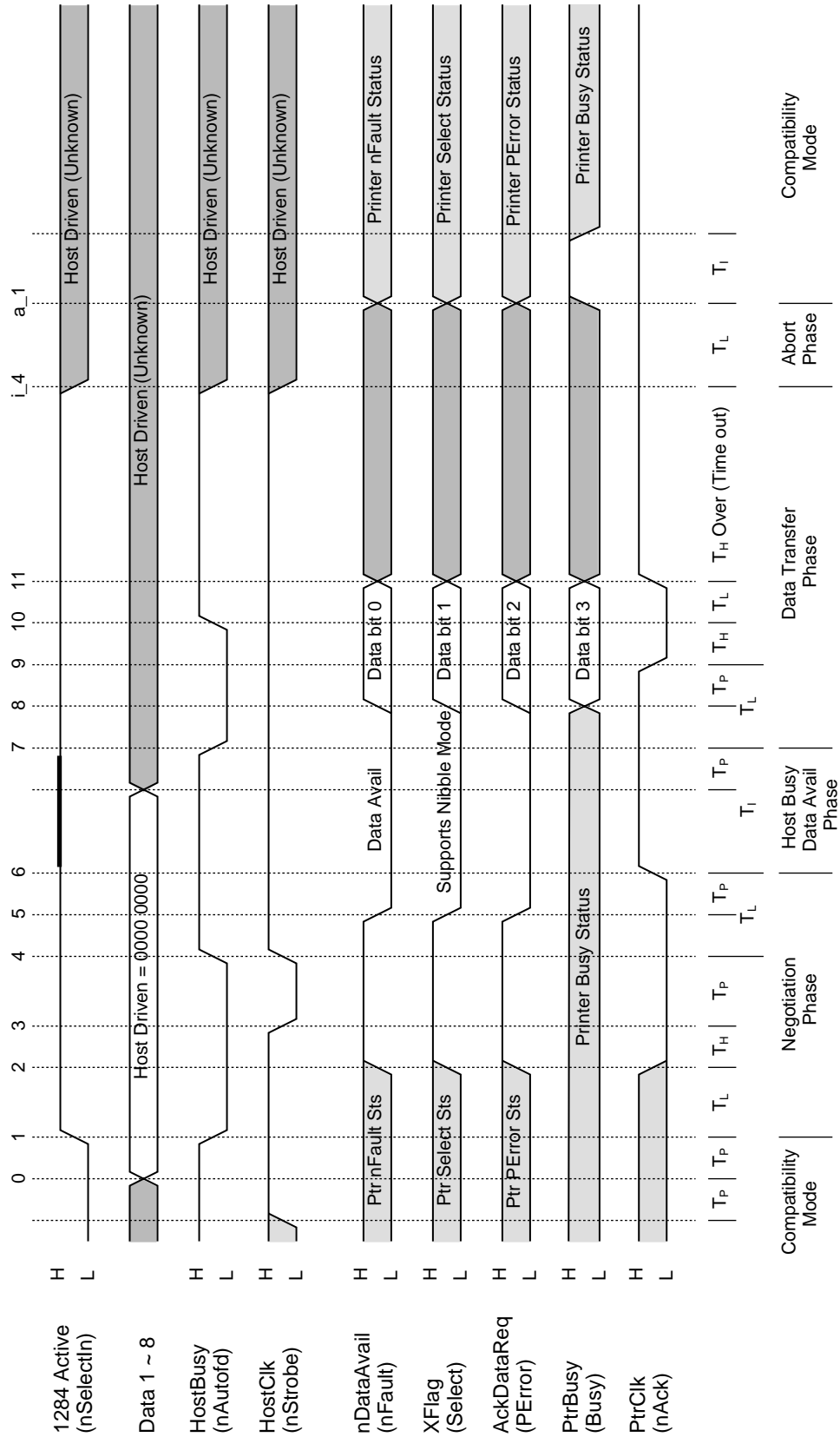


<Explanation of events>

- 0. (Host) Indicates that it is ready to accept low order nibble data by setting HostBusy "Low" from host busy data available status.
- 1. (Printer) Places low order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
- 2. (Printer) Indicates that low order nibble data is valid by setting PtrClk "Low".
- 3. (Host) Receives low order nibble data and sets HostBusy "High".
- 4. (Printer) Acknowledges HostBusy "High" and sets PtrClk "High".
- i_3. (Host) For some reason, HostClk becomes "Low".
(Abnormal status has occurred.)
- a_1. (Printer) Aborts Nibble Mode and returns to Compatible Mode.

* According to the Standard, data that is being transferred when Nibble Mode is aborted shall be resent at next data transfer, but in this printer, data resend does not take place from data that was being transferred. (For details about resending, refer to Chapter 4.7.3 and 4.8.2.)

(5) Host response timeout during reverse transfer



<Explanation of events>

- 0. ~ 6. From negotiation to host busy data available phase. (Refer to Chapter 4.5.)
- 7. (Host) Indicates that it is ready to accept low order nibble data by setting HostBusy "Low".
- 8. (Printer) Places low order nibble data on nDataAvail, Xflag, AckDataReq and PtrBusy.
- 9. (Printer) Indicates that low order nibble data is valid by setting PtrClk "Low".
- 10. (Host) Receives the low order nibble data and sets HostBusy "High".
- 11. (Printer) Acknowledges HostBusy "High" and sets PtrClk "High".
- i_4. (Host) There is no response even after 1.0Sec or more have passed after PtrClk became "High".
- a_1.(Printer) Aborts Nibble Mode and returns to Compatible Mode.

* According to the Standard, data that is being transferred when Nibble Mode is aborted shall be resent at next data transfer, but in this printer, data resend does not take place from data that was being transferred. (For details about resending, refer to Chapter 4.7.3 and 4.8.2.)

4.7 DEVICE ID

Host can request the device ID at an arbitrary timing from Compatible Mode/forward idle phase. This printer returns the device ID in Nibble Mode.

4.7.1 Device ID Format

The device ID is composed of 2 bytes that indicate the data length of the ID data and key and value combination shown below.

key:value{,value};

As seen above, one key takes more than one value. The minimum required keys are MANUFACTURER(MFG), COMMAND SET(CMD) and MODEL(MDL). You can set a key(s) other than these three.

Keys and values are character strings and you can use characters other than a colon (:), a comma(,), semi colon (;). Space (20H), tab(08H), vertical tab (0BH), carriage return(0DH), line feed(0AH) and form feed(0CH) are included in the character length, but host ignores them (does not recognize).

(1) Device ID byte length

The first 2 bytes of the device ID indicate the length of the device ID string that includes these 2 bytes (Byte 1 is high order byte while Byte2 is low order byte).

Host returns to the Compatible Mode regardless of whether additional data to transfer is available or not when it receives all the data of the device ID byte length shown here.

If the host returns to Compatible Mode before it receives all the data, the printer discards the data that has not been sent, and sends from the Byte1 of the device ID if the data is to be resent.

(2) MANUFACTURER

Indicates the name of the manufacturer.

(3) COMMAND SET

Indicates command(s) that can be used.

(4) MODEL

Indicates the device model.

(5) Others

Indicates comments or emulation that is currently in use.

← In this printer, ROM revision and factory option are added as a comment.

4.7.2 Device ID Data

The table below shows the device ID of this printer :

Item	Key	Value
Device ID byte length	–	(00H, 69H)
MANUFACTURER	MFG	OKI DATA CORP
COMMAND SET	CMD	OKIPOS
MODEL	MDL	(1 Roll) OKIPOS 425S (2 Roll) OKIPOS 425D
CLASS	CLS	PRINTER
DESCRIPTION	DES	(1 Roll) OKI DATA CORP OKIPOS 425S (2 Roll) OKI DATA CORP OKIPOS 425D
COMMENT (ROM Rev./Option)	COMMENT	0100-11 *1

*1 Comment's values are as follows:

- ROM Rev.: Value's byte1 ~ byte4 ← In the above example, it means ROM Rev. 01.00
- Auto Cutter: Value's byte6 ("1" means Auto Cutter present; "0" means Auto Cutter not present.) ← In the above example, Auto Cutter present
- MICR read unit: Value's byte7 ("1" means MICR read unit present; "0" means MICR read unit not present. ← In the above example, MICR read unit present

4.7.3 Error control during device ID data transfer

If transfer is interrupted (aborted, terminated) due to an error during device ID data transfer, the beginning of the device ID (device ID byte number) starts to be transferred when the next device ID transfer request is made. In other words, no re-send control is performed.

4.8 NIBBLE MODE REVERSE CHANNEL TRANSFER

4.8.1 Reverse channel transfer data

In response to the aforementioned “Nibble mode reverse channel transfer request”, this printer notifies host of the following information:

- ① Printer status (ASB, status request command, ID request command)
- ② MICR read data

* ASB : Automatic Status Back

Depending on the printer’s status change, this function automatically notifies host of the status. There are two ASB status: 4 byte 1 set (GS a) and 5 byte 1 set (ESC DLE a)

Description in this document is based on “4 byte 1 set (GS a).”

4.8.1.1 Transfer priority of reverse channel transfer data

Reverse channel transfer data is given priority depending on its data type, and transferred. The following shows priorities of each transfer data.

High ← Priority → Low
MICR read data > ASB > Real time commands/non-real time commands

- * Real time commands: Commands processed at receive (When stored in receive buffer)(DLE EOT etc.)
- Non-real time commands: Commands processed at decode (When receive buffer is read)(ESC v etc.)

(Example) When a response by status request command and ASB data coexist as follows,

- (1) Status request command 1 (GS r and etc.) → Response is S1 (1 byte).
- (2) ASB applied status change 1 (S sensor change and etc.) → Response is ASB1-1 - 1-4 (4 bytes).
- (3) Status request command 2 (GS r and etc.) → Response is S2 (1 byte).

If no reverse transfer is performed during (1) - (3), reverse transfer data will be as follows. (According to the above priorities)

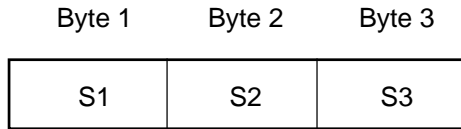
Byte 1	Byte2	Byte 3	Byte 4	Byte 5	Byte6
ASB 1-1	ASB 1-2	ASB 1-3	ASB 1-4	S1	S2

4.8.2 Error control while reverse channel transfer data is being transferred

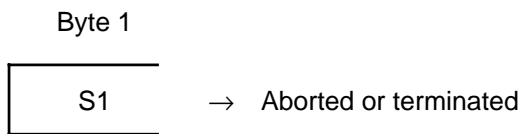
The following shows an error control depending on the transfer data type, while reverse channel transfer is being transferred.

4.8.2.1 Control when status other than ASB is being transferred

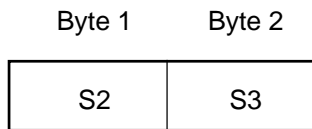
When there are 3 sets (3 bytes) of status data as below,



When transfer is interrupted (aborted, terminated) while Byte 1 is transferred.



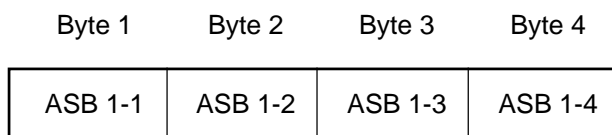
(When reverse transfer is re-started)



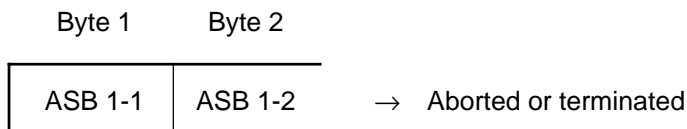
- * Data that was interrupted during transfer is not re-sent.
(If the data is aborted after the lower nibble is transferred (case in Chapter 4.6.1(3) - (5)), the data is not re-sent and discarded.)

4.8.2.2 Control when ASB is being transferred

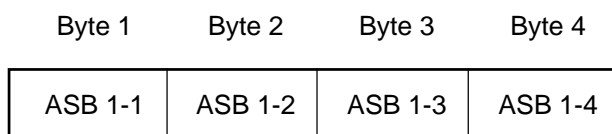
When there is a set of ASB data (4 byte) as below shows,



(When transfer is interrupted (aborted, terminated) while Byte 2 is being transferred)



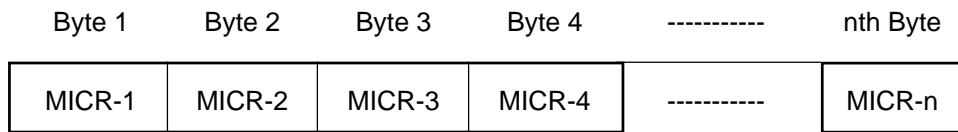
(When reverse transfer is re-started)



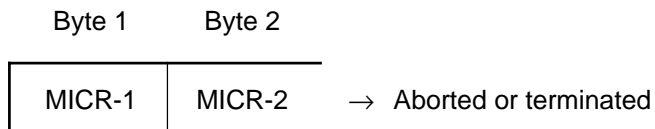
- * Re-sending starts at the Byte 1 of the ASB data string (4 bytes, 1 set) whose transfer was interrupted.

4.8.2.3 Control while MICR read data is being transferred

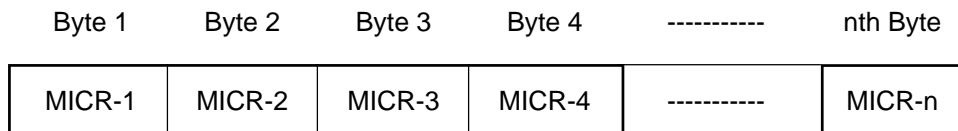
When there is 1 set (n byte) of MICR read data (transfer sequence)



(When transfer is interrupted (aborted, terminated) when Byte 2 is being transferred)



(When reverse-transfer is restarted)



* Re-sending starts at Byte 1 of the MICR read data (transfer sequence) whose transfer is interrupted.

4.8.2.4 Control while ASB/non-ASB mixed data is being transferred

When response by status request command (S1, S2) and ASB data coexist as the below shows,

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ASB 1-1	ASB 1-2	ASB 1-3	ASB 1-4	S1	S2

If the following status change occurs after the transfer is interrupted while the above status is being transferred,

- ASB applied status change (S sensor change or etc.) → Response is ASB2-1 ~ 2-4 (4 bytes) the transfer data responding to the next reverse data transfer request will be as follows depending on the data type of the interrupted data.

(a) When interrupted while ASB1-1 ~ ASB1-4 is being transferred,

Byte 1	Byte 2
ASB 1-1	ASB 1-2

→ Aborted or terminated

(When reverse transfer is re-started)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
ASB 1-1	ASB 1-2	ASB 1-3	ASB 1-4	S1	S2

→ No Data Phase
→ To Reverse Idle or Termination Phase
*By Host Control

	Byte 1	Byte 2	Byte 3	Byte 4
Interrupt Phase or Negotiation Phase *By Host Control	ASB 2-1	ASB 2-2	ASB 2-3	ASB 2-4

- * When non-ASB data transfer is completed, no data status comes instead of continuous ASB data transfer.

(b) When transfer is interrupted while S1 - S2 is being transferred,

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
ASB 1-1	ASB 1-2	ASB 1-3	ASB 1-4	S1

→ Aborted or terminated

(When reverse transfer is re-started)

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
ASB 2-1	ASB 2-2	ASB 2-3	ASB 2-4	S2

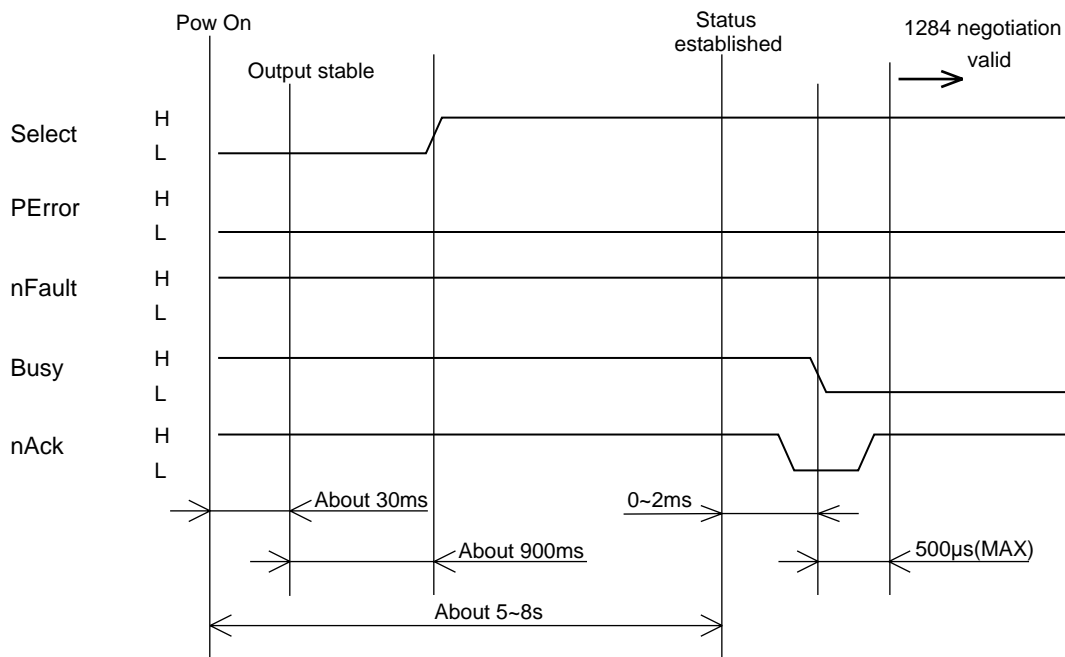
4.9 Interface Initialization

This printer is initialized at Power On and when the nInit signal “Low” level is received. This chapter describes the interface initialization that accompanies the above initialization and the start of handshake that includes the negotiation after the initialization ends.

4.9.1 I/F Signals During Initialization

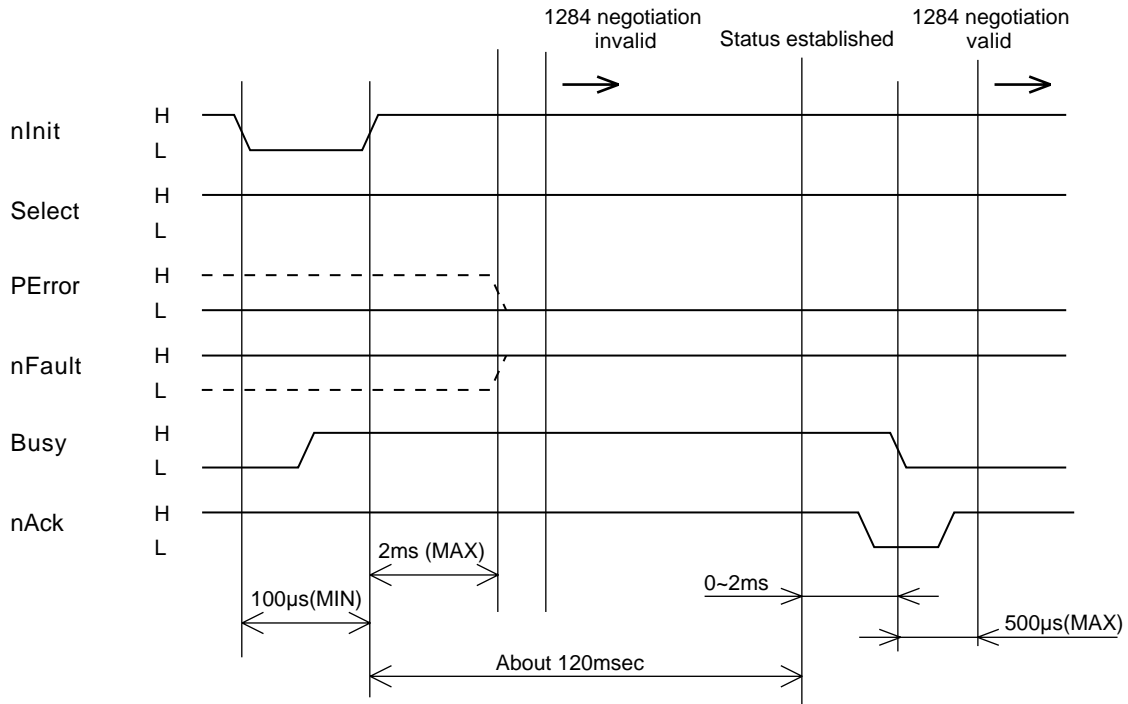
The I/F signals' statuses during this printer's initialization operation and the timing chart for the 1284 mode negotiation to become valid are shown in the diagram below:

(1) Initialization by Power On



- * The above diagram shows the timing chart at Power On in the normal state.
- * The signal statuses and the timing chart may change depending on the circuit and the process.
- * The time from Power On to the establishment of the status varies with the position of the head and the platen and other factors at the time of Power On.

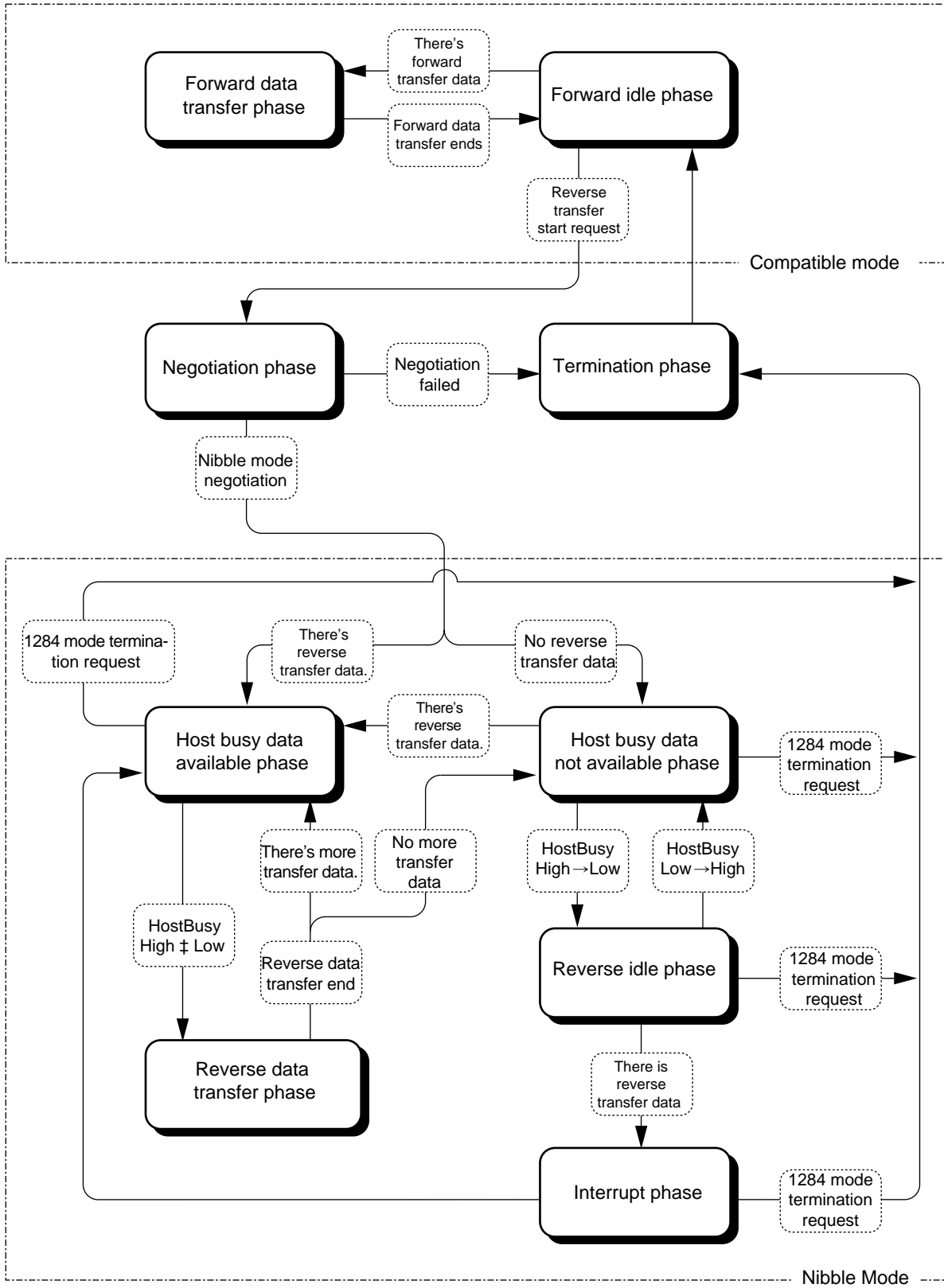
(2) Initialization by nInit signal



- * The above diagram shows the initialization timing chart by the nInit signal in the normal state.
- * When nInit signal is hard- reset (setting by short plug), it is the same as initialization by Power ON.
- * With this initialization, FAULT High, PE Low, BUSY High state continues until Wait-for Paper-Removal, Paper Jam, etc., are cleared when they occur.
- * For initialization by ESC @, ESC DLE D, DLE ENQ 02H and DLE ENQ 03H, 1284 negotiation becomes invalid during initialization process is being executed.

4.10 Status Transition Diagram

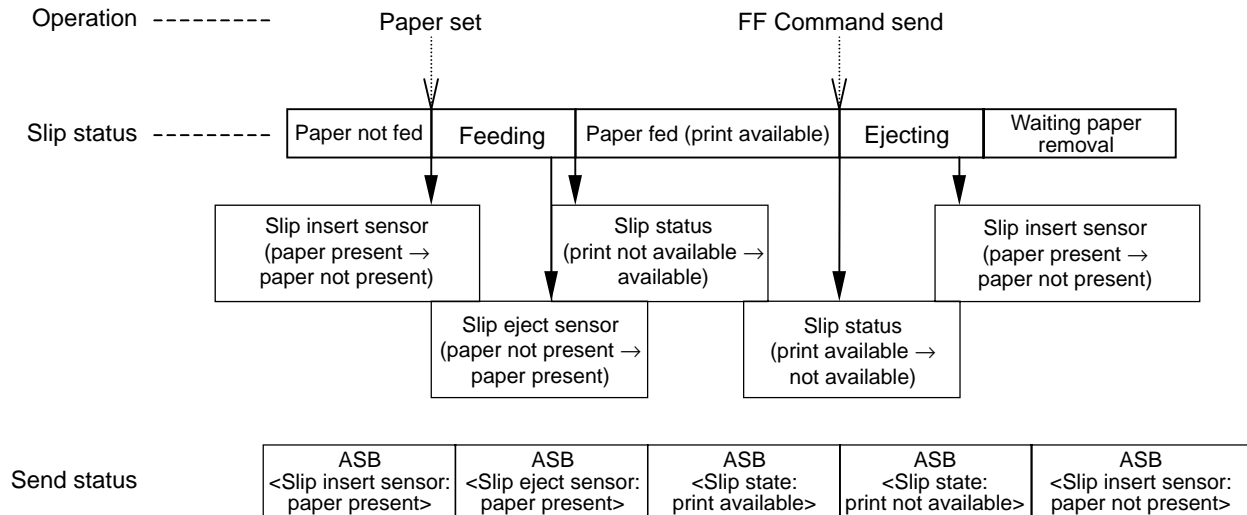
The following diagram shows negotiation from Compatible Mode, termination from Nibble Mode and transitions between individual phases.



4.11 ASB performance

When a status according to the type selected by a setting command changes, this function automatically notifies the host of the status.

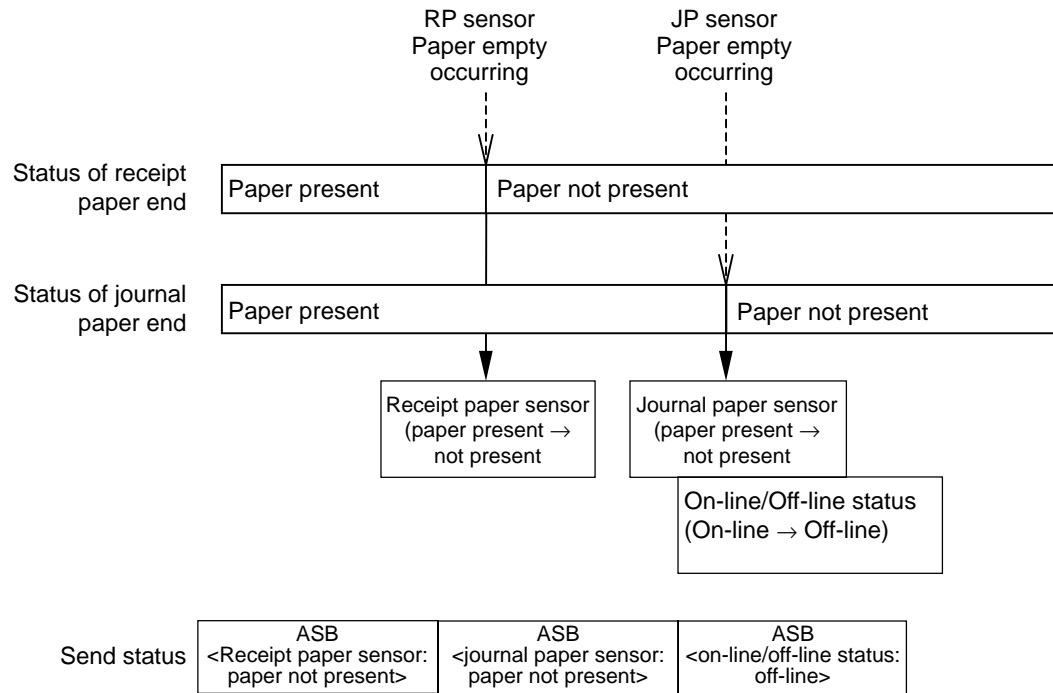
(An example of normal behavior of Slip mode feed/eject)



- *1 The Slip insert sensor status may differ from the above depending on the situation of the media.
- *2 Only send statuses that have status changes are described.
- *3 One set of ASB data may include multiple status changes depending on the timing of status changes such as sensor change, or the host's status read timing.

(An example of Receipt + Journal mode)

* When only JP sensor is valid by print stop sensor select



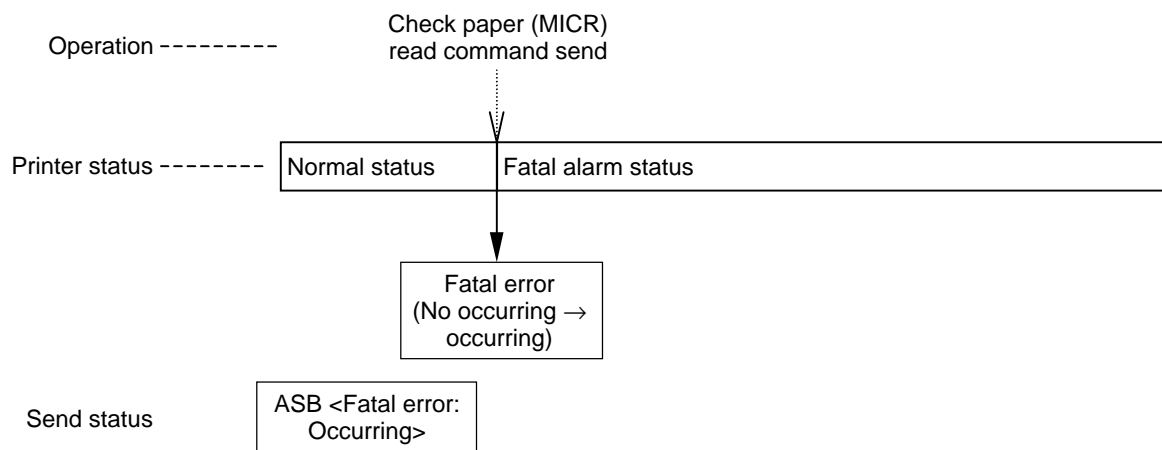
*1 Only send statuses that have status change are described.

*2 A set of ASB data may have multiple status changes depending on timing of status change such as sensor change or timing of host's status read.

(Example when a fatal alarm occurs)

* When a MICR unit error occurs

(MICR unit is not installed, but Menu is set to valid, and check paper (MICR) read command is received)



*1 Only send statuses that have status change are described.

*2 A set of ASB data may have multiple status changes depending on timing of status change such as sensor change or timing of host's status read.

5. RS-232C SPECIFICATIONS

This specification document describes the detailed specifications of RS-232C serial interface reception that is realized by the firmware.

5.1 Receive Buffer

5.1.1 Receive Buffer Size

There are two sizes for the receive buffer that can be selected in the printer's menu setting item "Receive Buffer Size", as shown below:

- (1) 2Kbyte
- (2) 16Kbyte

5.1.2 Receive buffer structure

In the receive buffer, "Receive Buffer Near Full Area" and "Receive Buffer Full Area" are set, and each area is 256byte.

The Receive Buffer Near Full Area is the area that indicates that the number of data bytes that can be stored in the receive buffer is 256byte or more, but less than 512byte. And if data enters this Near Full Area, the control shifts to receive data for every 700ms.

The Receive Full Areas is the area that indicates that the number of data bytes that can be stored in the receive buffer is down to less than 256byte.

When data enters Buffer Full Area, the Receive Buffer Busy state is maintained, and sending data from the host machine is prohibited.

For the details of the Receive Buffer Busy control that is executed when storing receive data, refer to Section 4.5, "Protocol".

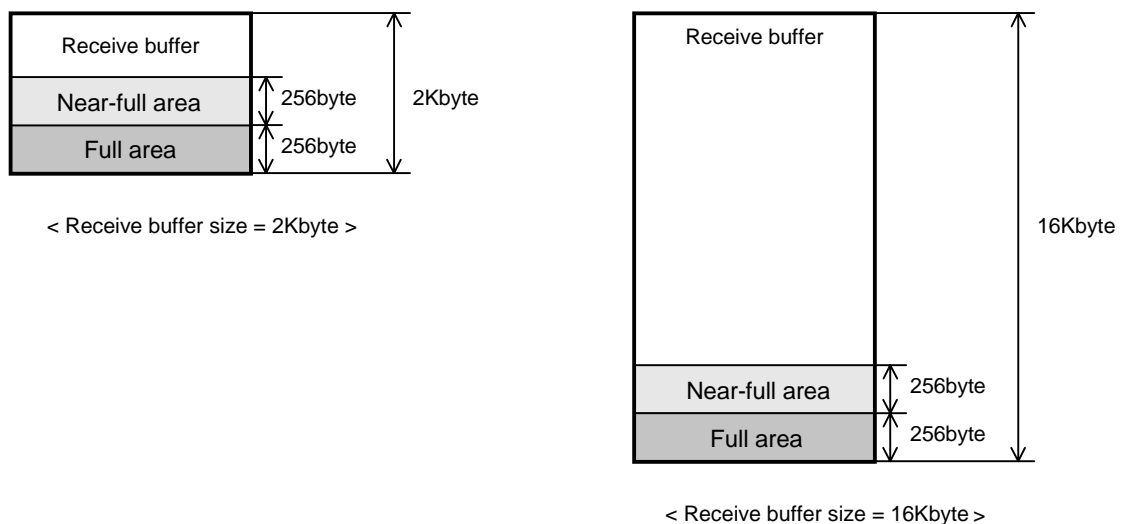


Figure 5.1 Receive buffer structure

5.2 Serial Interface

5.2.1 Explanation of Interface Signal and Pins

Table 5-1 RS-232C interface signals and printer side pin numbers

PIN No.	Signal name	Acronym	Direction	Explanation
1	Protective Ground	FG	–	Connects to the printer frame. (Frame ground)
2	Transmitted Data	TXD	From Printer	Serial data send signal from printer
3	Receive Data	RXD	To Printer	Serial data receive signal to printer
4	Request To Send	RTS	From Printer	Signal that notifies Receive Not Possible State in the printer and customer display in Ready / Busy protocol.
5	Clear To Send	CTS	To Printer	Not used.
6	Data Set Ready	DSR	To Printer	Signal that notifies printer that data can be sent.
7	Signal Ground	SG	–	Ground for signal
8	Carrier Detect	CD	To Printer	Not used.
9~19	–	–	–	Not used.
20	Data Terminal Ready	DTR	From Printer	Signals that notifies Receive Not Possible status in the printer in Ready/Busy protocol.
21~24	–	–	–	Not used.
25	Initial	INIT	To Printer	Printer Initial request signal from the sending side

(Note) PIN NO. in the above table is the pin no. of the connector on the printer side.

5.2.2 Interface Cable Wiring Diagram

The diagrams below show the basic wiring of the interface cable that connects this printer and the host.

5.2.2.1 Wiring diagram when the host side serial board connector is D-SUB 9-pin

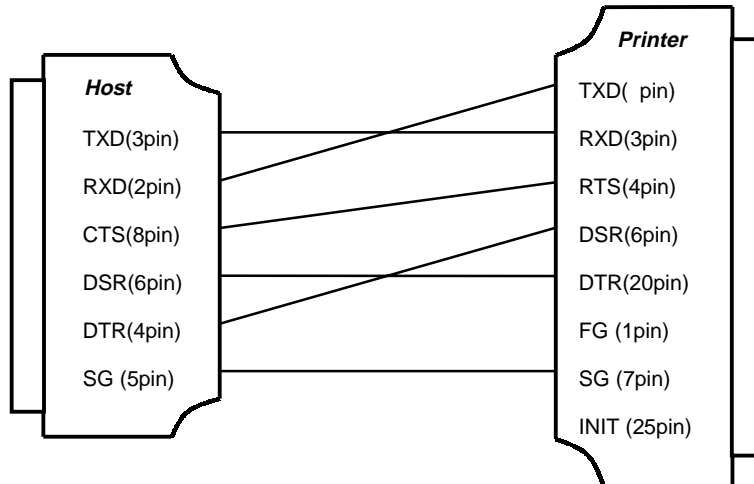


Figure 5.2 Interface cable wiring diagram (D-SUB 9pin)

5.2.2.2 Wiring diagram when the host side serial board connector is D-SUB 25-pin

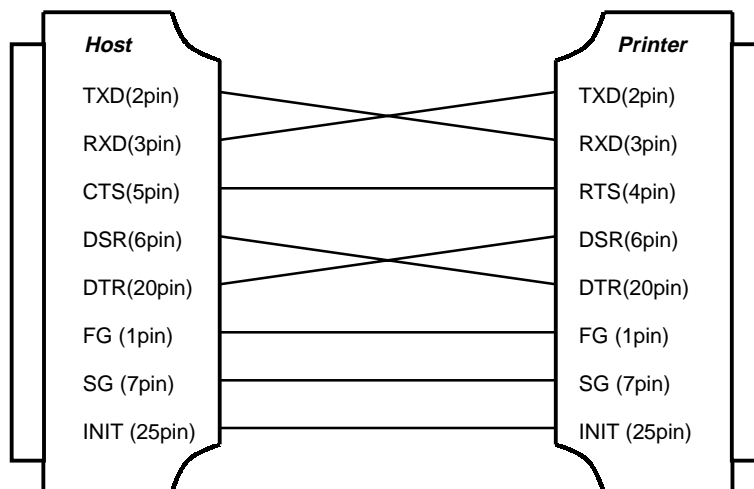


Figure 5.3 Interface cable wiring diagram (D-SUB 25pin)

As the serial interface cable that connects to this printer, a general-purpose cross cable can handle printing and Busy control without problem except support of reset function of #25pin.

5.2.3 Overview

The below shows the overview of RS-232C Interface specifications.

Start bit :	1 bit
Data bit :	7 bit or 8 bit * Note1
Parity bit :	Even number/odd number parity, or no parity * note 1
Stop bit :	1 bit or more
Baud rate :	1200,2400,4800,9600,19200 BPS * Note 1
Protocol :	Ready / Busy or X-ON / X-OFF * Note1
Busy Line :	DTR , RTS * Note 2
Minimum Busy on time :	200 ms
Parity error control :	When even number/odd number parity is selected, converts into 40H (“@”) code by receive parity error recognition, and prints. *Note 3
Framing error control :	When stop bit of receive data was not recognized, converts into 3FH(“?”) code, and prints. * Note 3
Overrun error control :	When overflow of receive FIFO occurs because received data could not be processed due to some problem, converts into 21H (“!”) code, and prints. *Note 3 A character just before and after an overrun error is not guaranteed.
Printer initialization by DSR signal :	Enable/Disable of printer initialization in DSR signal (6pin) status * Note1 A printer is initialized when you enter reset pulse into DSR signal.
Printer initialization by INIT signal :	Enable/Disable of printer initialization in INIT signal status (25pin) *Note 1 A printer is initialized when you enter reset pulse into INIT signal.

***Note 1:** You can select these settings by DIP switch.

***Note 2:** A printer’s Busy Line is DTR signal.

RTS signal is used for checking Busy status of customer display.

For details, refer to Chapter 4.8 Customer display.

***Note 3:** You can select receive error check by DIP switch.

When receive error check is enabled by DIP switch, all the checks, parity error, framing error and FIFO overrun error become valid.

5.2.4 RS-232C Interface

5.2.4.1 Signal level

The below shows signal level of RS-232C interface part.

-15V ~ -3V : MARK = ON = "1" by logic
+15V ~ +3V : SPACE = OFF = "0" by logic

5.2.4.2 Character structure on transmission circuit

The below shows the character structure in this interface.

(1) Start bit

Start bit: Signal that keeps SPACE status ("0") for 1 bit length

(Unit time of 1 bit of Start bit varies depending on transmission speed.)

(2) Transfer order of data bit

Transfer order of data bit: LSB bit → MSB bit

(3) Parity bit

Parity bit is added to each character only when parity bit is selected by DIP switch 1-2.

(4) Stop bit

Stop bit: Signal that keeps MARK status ("1") for 1 bit length or longer.

(Unit time of Start bit varies depending on transmission speed.)

(5) Character interval

The interval between an end of character stop bit and a beginning of next character start bit is arbitrary.

Polarity of signal in the character interval: Polarity of MARK status ("1").

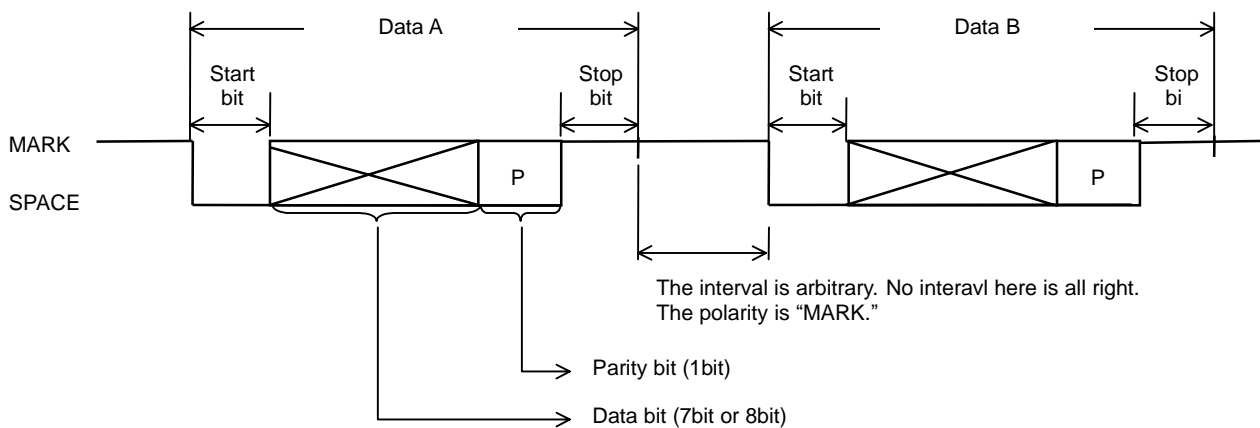


Figure 5.4 Character interval

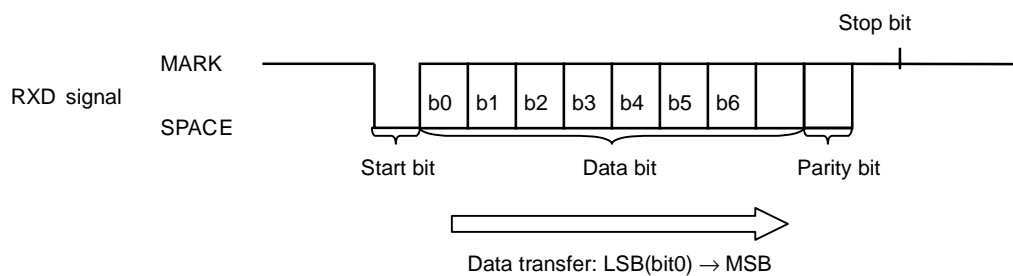


Figure 5.5 Transfer order of data bit

5.2.4.3 BUSY signal timing chart

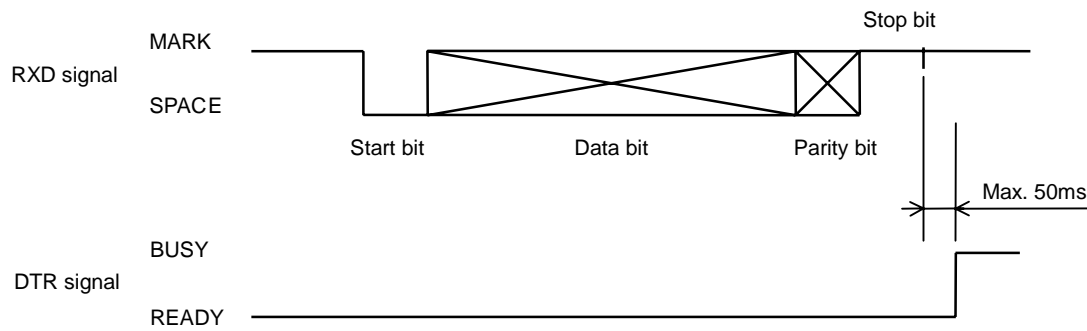


Figure 5.6 ON timing of Busy signal

5.2.5 Receiving Margin

Receiving margin should be 37% or more.

5.3 Selecting a Function

You can select various functions by DIP switch installed on the RS-232C interface board.

When you change a setting by DIP switch, turn off the printer, change the setting and then turn on the printer again.

5.3.1 DIP switch structure

You can set RS-232C serial interface related settings by DIP switches installed on the RS-232C interface board.

The below describes the structure of DIP switches installed on the RS-232C serial interface board.

Table 5-2 DIP switch allocation

DIP SW		Function
DIP SW 1	SW1	Selects data bit length
	SW2	Parity bit exist/not exist
	SW3	Parity
	SW4	Selects protocol
	SW5	Selects communication speed
	SW6	Selects communication speed
	SW7	Selects communication speed
	SW8	Selects customer display
DIP SW 2	SW1	Selects reset signal of #6 pin
	SW2	Selects reset signal of #25 pin
	SW3	Selects receive error display
	SW4	Selects circuit test mode
	SW5	Selects hardware reset
	SW6	Selects software reset
	SW7	Reserved
	SW8	Reserved

5.3.1.1 Details of DIP switch functions

Table 5-3 DIP switch details

DIP SW		Function	Switch setting				
			ON			OFF	
DIP SW 1	SW1	Data bit length	7 bit			8 bit	
	SW2	Parity bit exist/not exist	Exist			Not exist	
	SW3	Select parity	Even party			Odd party	
	SW4	Protocol	XON / OFF			Ready / Busy	
	SW5	Communication speed	SW5	SW6	SW7	Communication speed (BPS)	
	SW7		OFF	OFF	OFF		1200
			OFF	OFF	ON		2400
			OFF	ON	OFF		4800
			OFF	ON	ON		9600
			ON	OFF	OFF		19200
ON			OFF	ON	Reserved		
ON			ON	OFF	Reserved		
ON	ON	ON	Reserved				
SW8	Selects customer display	Connected			Not connected		
DIP SW 2	SW1	#6 pin reset signal	used			Not used	
	SW2	#6 pin reset signal	used			Not used	
	SW3	Receive data error display *Note1	Ignored (No error conversion)			Convert into receive error character.	
	SW4	Circuit test mode *Note3	Yes			No	
	SW5	Select hardware reset *Note2	Selects #6 & #25 pins reset function for hardware reset.			Does not select #6 & #25 pins reset function for hardware reset.	
	SW6	Select software reset *Note2	Selects #6 & #25 pins reset function for software reset.			Does not select #6 & #25 pins reset function for software reset.	
	SW7	Reserved	-			-	
	SW8	Reserved	-			-	

***Note1:** There are 3 kinds of receive errors: "Parity error," "Framing error," and "Overrun error."

***Note2:** The switch to select the initial operation by the reset signal input of the #6pin and #25pin. Both the DIPSW2-5 and the DIPSW2-6 must not be set to ON (both selected) at the same time.

Similarly, both switches must not be set to OFF (neither selected).

These combinations are prohibited.

***Note3:** To execute the Circuit Test Mode, you must first set both #6 pin Reset signal (DIP SW 2-1) and #25 pin Reset signal (DIP SW 2-2) to OFF (not to be used).

The combination of DIP SW 2-1 or DIP SW 2-2 ON and Circuit Test Mode (DIP SW 2-4) ON is prohibited.

5.3.2 Factory default

The below shows the factory default of DIP switch.

Table 5-4 Factory default of DIP switch

DIP SW		Function			Switch setting
DIP SW 1	SW1	OFF			Data bit length 8 bits
	SW2	OFF			No parity bit
	SW3	OFF			Odd parity
	SW4	OFF			Ready / Busy protocol
	SW5 ⋮ SW7	OFF	ON	ON	Communication speed: 9600BPS
	SW8	OFF			Customer display not connected.
	DIP SW 2	SW1	OFF			#6 pin reset signal not used.
SW2		OFF			#25 pin reset signal not used.
SW3		OFF			An error display appears when a receive data error occurs.
SW4		OFF			Circuit test mode not selected.
SW5		OFF			Hardware reset not used.
SW6		ON			Software reset used.
SW7		OFF			Reserved.
SW8		OFF			Reserved.

5.3.3 Receive data error check

The below three receive data errors are checked.

Receive data error check is performed only when DIP switch 2-3 setting is set to "OFF." When DIP 2-3 switch is set to "ON," receive error is not checked. (Data is output as it is received.)

5.3.3.1 Parity check

This is a function that calculates the total of "1" (MARK) of each bit of the received data (including Parity bit), and checks whether the status of even number/odd number agrees with the Parity mode selected by DIP switch 1-3.

When DIP switch 1-2 is set to OFF, parity check is not performed.

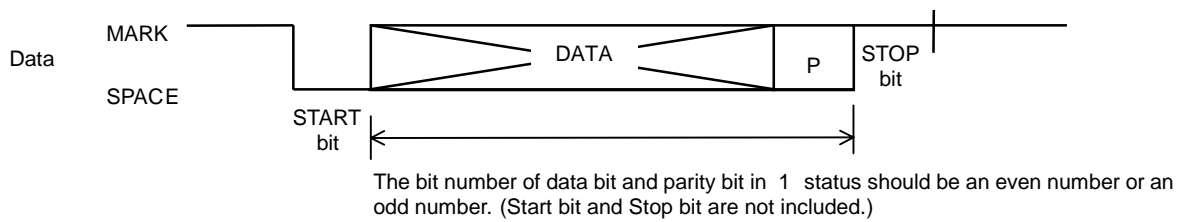


Figure 5.7 Parity check structure

(1) Error display when a parity error is recognized

When a parity error is recognized as a result of parity check, the received data is invalid and 40H ("@") code is printed.

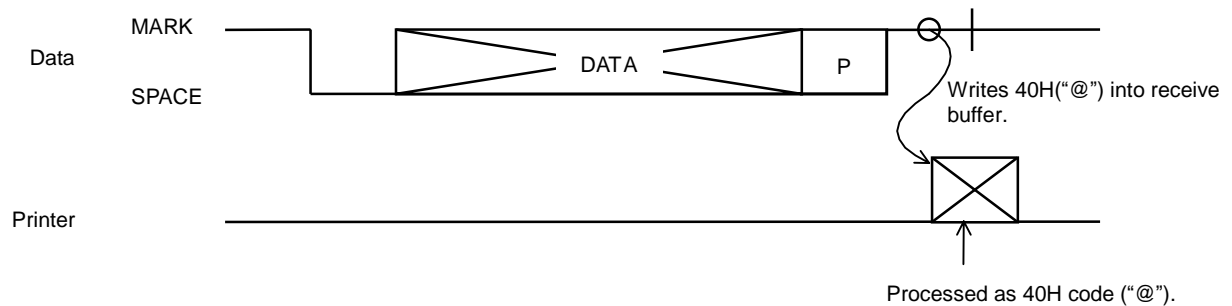
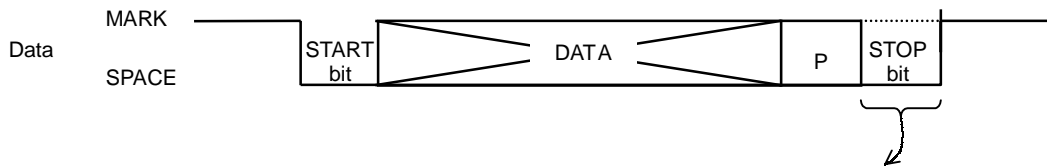


Figure 5.8 Parity error display

5.3.3.2 Framing error check

This function checks the status of Stop bit of the received data.
Checks if the stop bit of the received data is in MARK status ("1").



The Stop bit status of the received data should be in MARK status.
(1).

Figure 5.9 Framing error check structure

(1) Error display when a framing error is recognized

When a framing error is recognized as a result of framing error check, the received data is invalid and 3FH("?") code is printed.

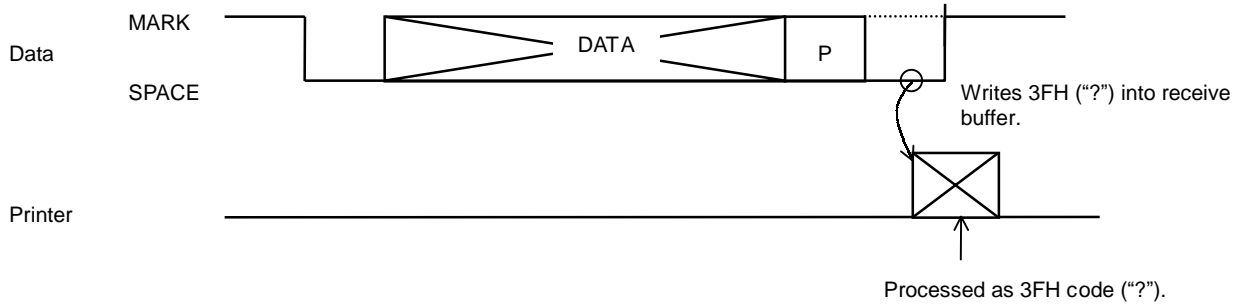


Figure 5.10 Framing error display

5.3.3.3 Overrun error check

This function generates an overrun error when a character currently being received cannot be stored in receive FIFO because received data cannot be processed for some reason and the receive FIFO is full.

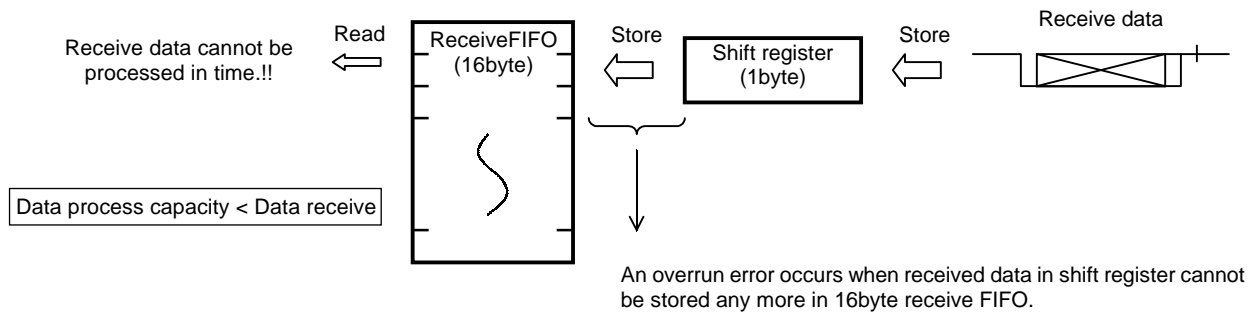


Figure 5.11 Overrun error check structure

- (1) Error display when an overrun error is recognized
When an overrun error occurs, 21H(" ! ") code is printed.

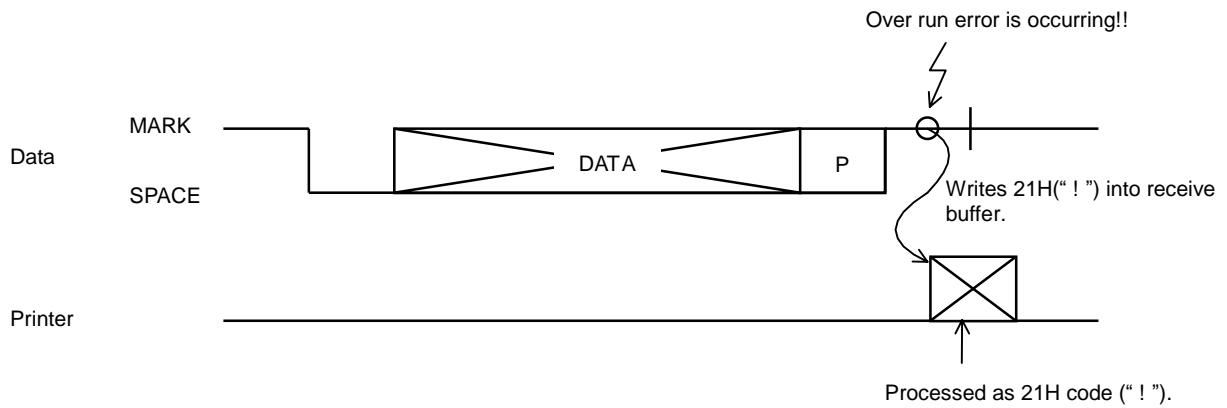


Figure 5.12 Overrun error display

5.3.4 DSR signal control

5.3.4.1 DSR signal when data is being received

Printer does not control receive data valid/invalid according to the status of DSR signal when receive data is received. It receives the sent data regardless of the status of DSR signal.

Even though protocol is set either XON or XOFF, the received data is valid regardless of the status of DSR signal.

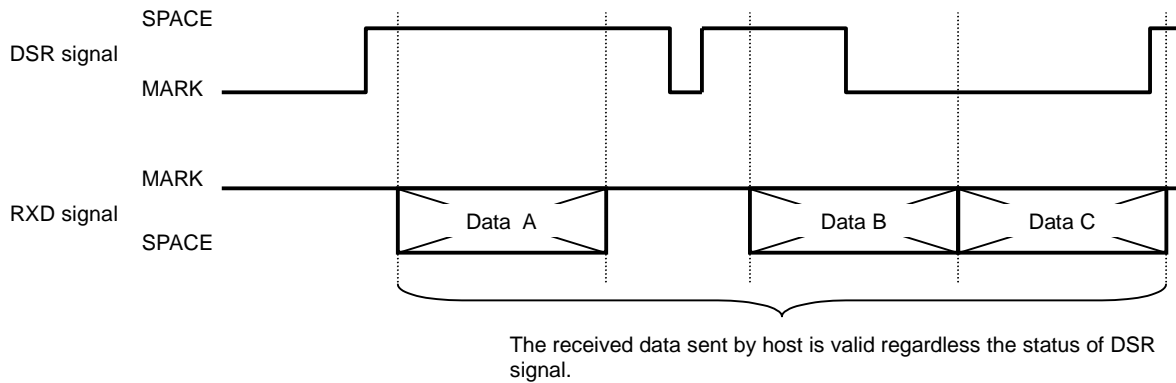


Figure 5.13 DSR signal and receive data

5.3.4.2 DSR signal when data is being sent

When host machine returns a response to printer's status read command, the status of DSR signal is monitored only in the case of the commands described in Chapter 5.3.4.3. When DSR signal is in MARK status ("1"), a printer does not send a response data to host machine.

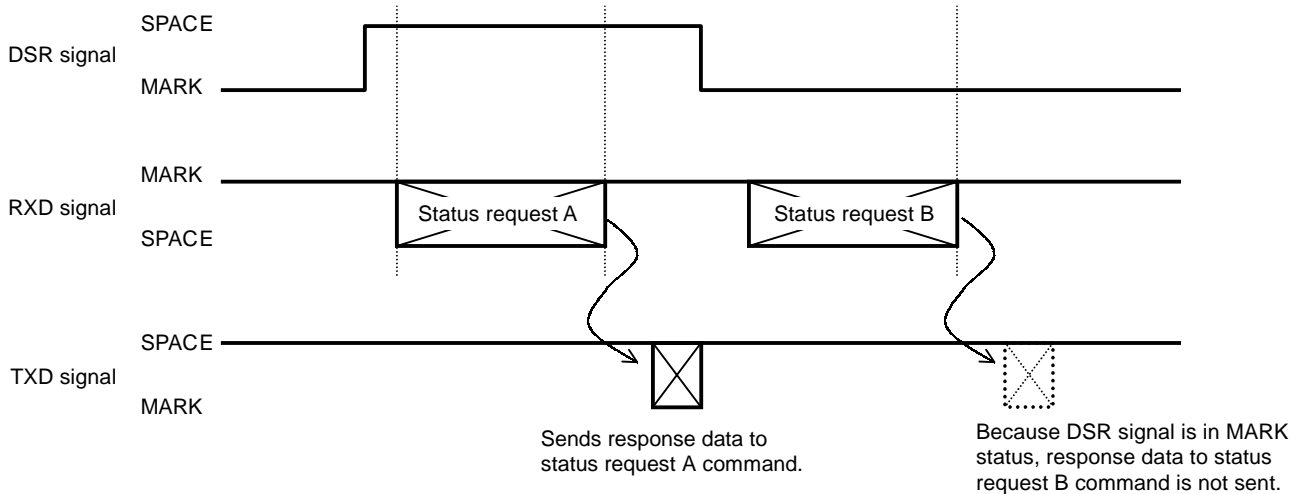


Figure 5.14 DSR signal and printer status response data

5.3.4.3 Printer status request command that monitors status of DSR signal

As described above, the below commands check DSR signal when response data to printer status request command is being sent.

If DSR signal is in MARK status when response data is being sent, response data is not sent.

Table 5-5 Printer status request commands that monitor DSR signal

No.	Command	Function
1	ESC u n	Sends peripheral device status
2	ESC v	Sends paper detector status
3	GS l n	Sends printer ID
4	GS r n	Sends status

Response data is sent regardless of DSR signal status when response data such as real time request command, ASB request command, MICR read command, and check paper read command is sent.

Table 5-6 Printer status request commands that do not monitor DSR signal

No.	Command	Function
1	GS a n	Enable/Disable of auto status send
2	GS ENQ	Real time send of printer status
3	DLE EOT n	Real time send of status
4	DLE EOT BS n	Real time MICR status send
5	FS a 0 n	Check paper read (when MICR mode is selected)
6	FS b	Re-send request of check paper read result
7	ESC DLE a Pno n	Enable/Disable of auto status send
8	ESC DLE r Pno n	Real time send of status

5.3.4.4 Printer status request command when DSR signal is in MARK status

Printer status request command that could not be sent because DSR signal was in MARK status is not discarded. When DSR signal shifts to SPACE status, response data is sent to host machine. A printer status request command can store response data that can be stored in receive buffer at maximum.

When printer status request command that cannot be stored in receive buffer is received, the printer status request command is received, but ignored.

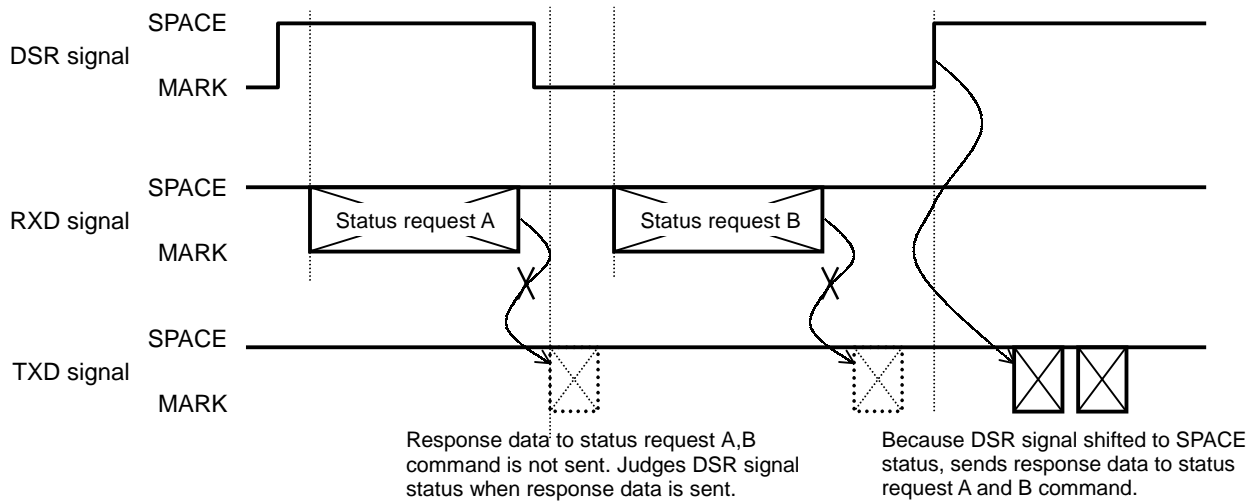
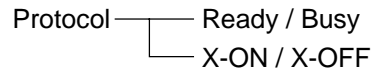


Figure 5.15 Printer status request command and status response when DSR signal is in MARK status

5.3.5 Protocol

You can select two types of protocols by switching DIP switch 1-4.



5.3.5.1 Ready / Busy protocols

Ready / Busy protocol notifies printer's Busy/Ready status to host computer by DTR signal cable (20pin).

(1) Busy control

This control checks remaining receive buffer and makes sure that all the data is received by controlling data receive available/not available, using DTR signal cable.

(2) Busy status display

When remaining receive buffer becomes 512 byte or less, Busy control signal shows Busy status, and requests host to stop data sending.

The timing when buffer remaining recovers to 512byte or more is within 200ms after Busy ON, Busy control signal becomes Ready status in 200ms. If it is not within 200ms, Busy control signal becomes Ready status when the buffer recovers to 512byte or more.

* The minimum Busy On time, 200ms is program's fixed value.

(3) Timing chart

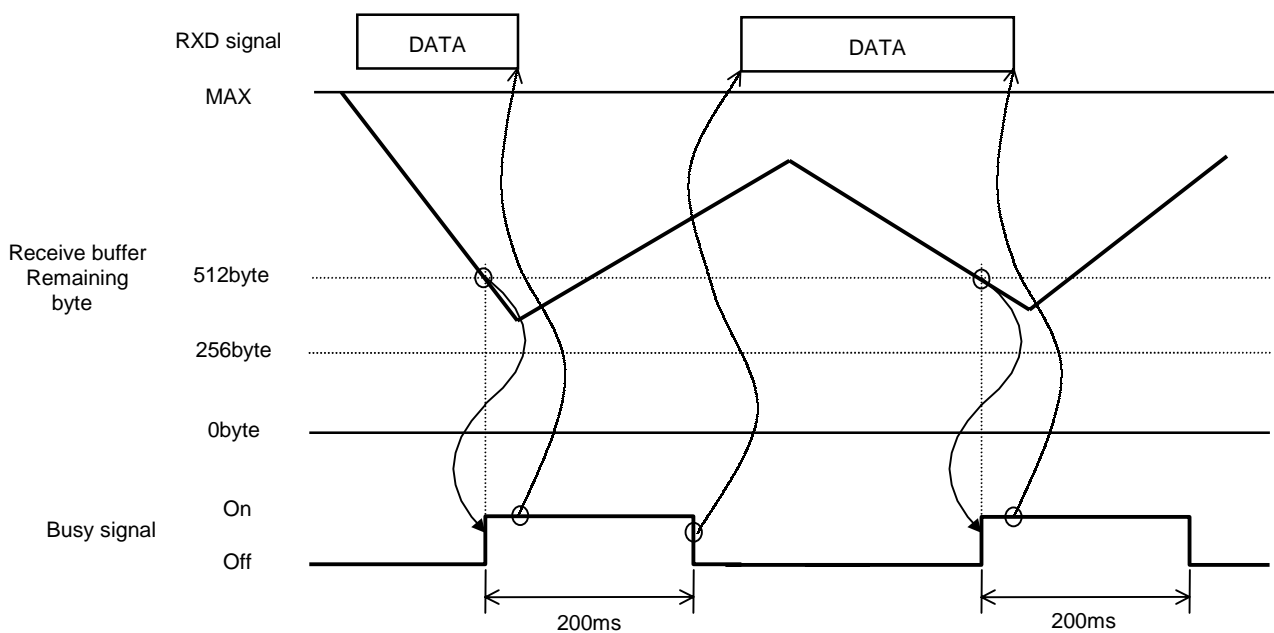


Figure 5.16 Busy control timing chart (Ready / Busy)

5.3.5.2 X-ON / X-OFF protocol

This protocol sends printer's Busy / Ready status using the below function codes and notifies host computer.

The following is the function codes that can notify Busy / Ready status.

Command	Hex	Function
DC1	11	Sends when printer shifts Busy → Ready status.
DC3	13	Sends when printer shifts Ready → Busy status.

(1) Busy control

This control checks remaining buffer, controls data receive available/not available using the above function codes, and receives data without ignoring it.

(2) Busy status display

When receive buffer remaining becomes 512byte or less, returns DC3 code, and notifies the sender that receiving is not possible.

If receive buffer remaining recovers to 512byte or more within 200ms after DC3 code return, returns DC1 code in 200 ms, and notifies the sender that receiving is possible.

If receive buffer remaining recovers to 512 byte or more after 200ms of DC3 code return, returns DC1 code when the buffer recovers to 512 byte or more.

(3) DTR signal when X-ON/X-OFF protocol is selected

DTR signal when X-ON/X-OFF protocol is selected always should keep Ready status (SPACE).

However, a printer experiences an irrecoverable alarm for some reason, DTR signal should be in Busy status (MARK).

(4) Timing chart

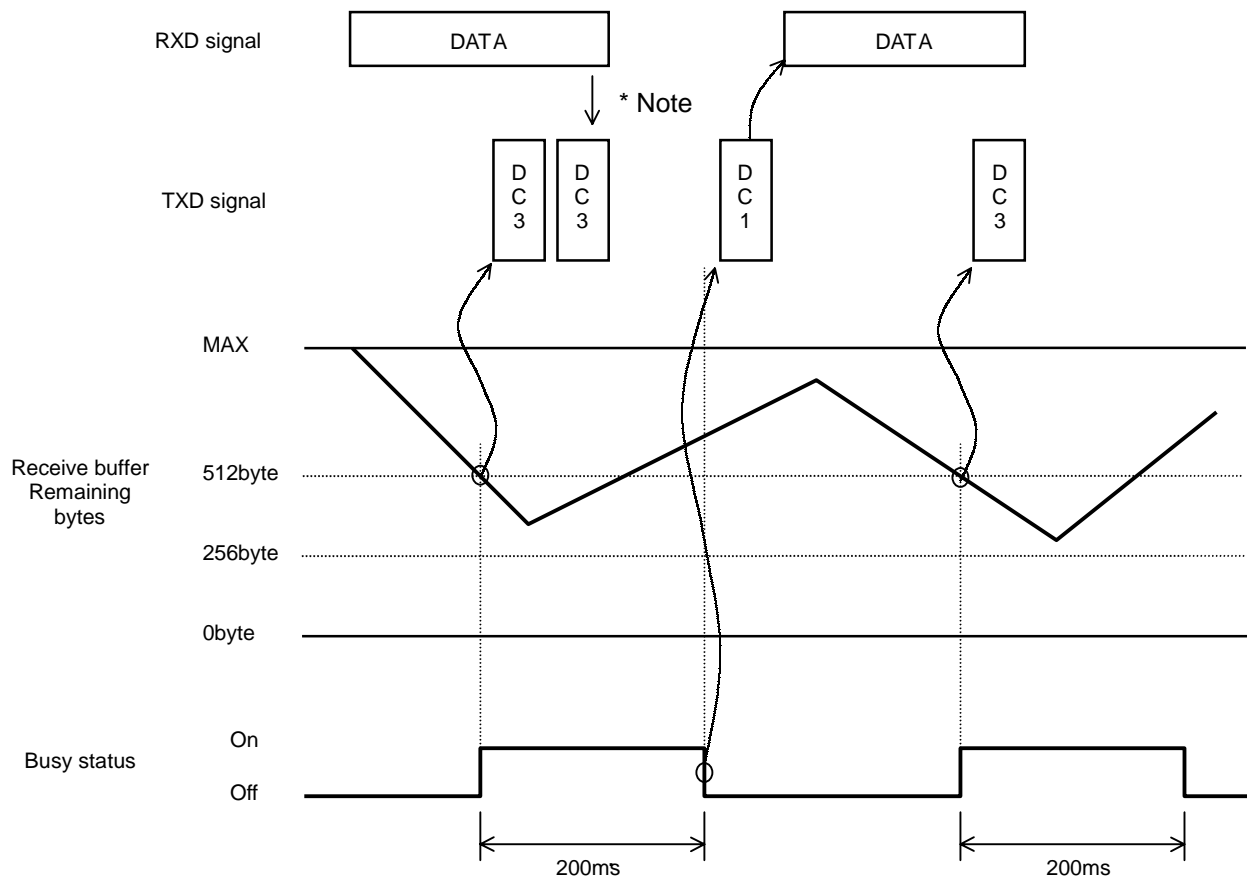


Figure 5.17 Busy control timing chart (X-ON / X-OFF)

***Note:** When data is received in Busy status, DC3 code is returned every time data is received. The minimum Busy On time is fixed to 200ms.

5.3.6 Busy On timeout receive control

Due to Busy On timeout control, host computer may become send timeout when Busy status continues for a long time of period without being canceled.

To avoid timeout, this function regularly (every 700ms) cancels Busy status and receives 1 byte data even though receive buffer is in near-full status.

5.3.6.1 Behavior

This Busy On timeout receive is controlled by Busy ON timer (200ms) and 700ms timer.

The following shows behaviors of each timer at the time of timeout.

Busy timeout condition	Receive buffer remaining	Function
Only 200ms timeout occurs	512Byte or more	Cancels Busy
	511 ~ 256Byte	Keeps Busy status
	255Byte or less	Keeps Busy status
200ms timeout and 700ms time out occur	512Byte or more	Cancels Busy
	511 ~ 256Byte	1Byte receive
	255Byte or less	Keeps Busy status

When receive buffer size that can store data becomes 511(256byte, cancels Busy status in every 700ms, and receives 1 byte data.

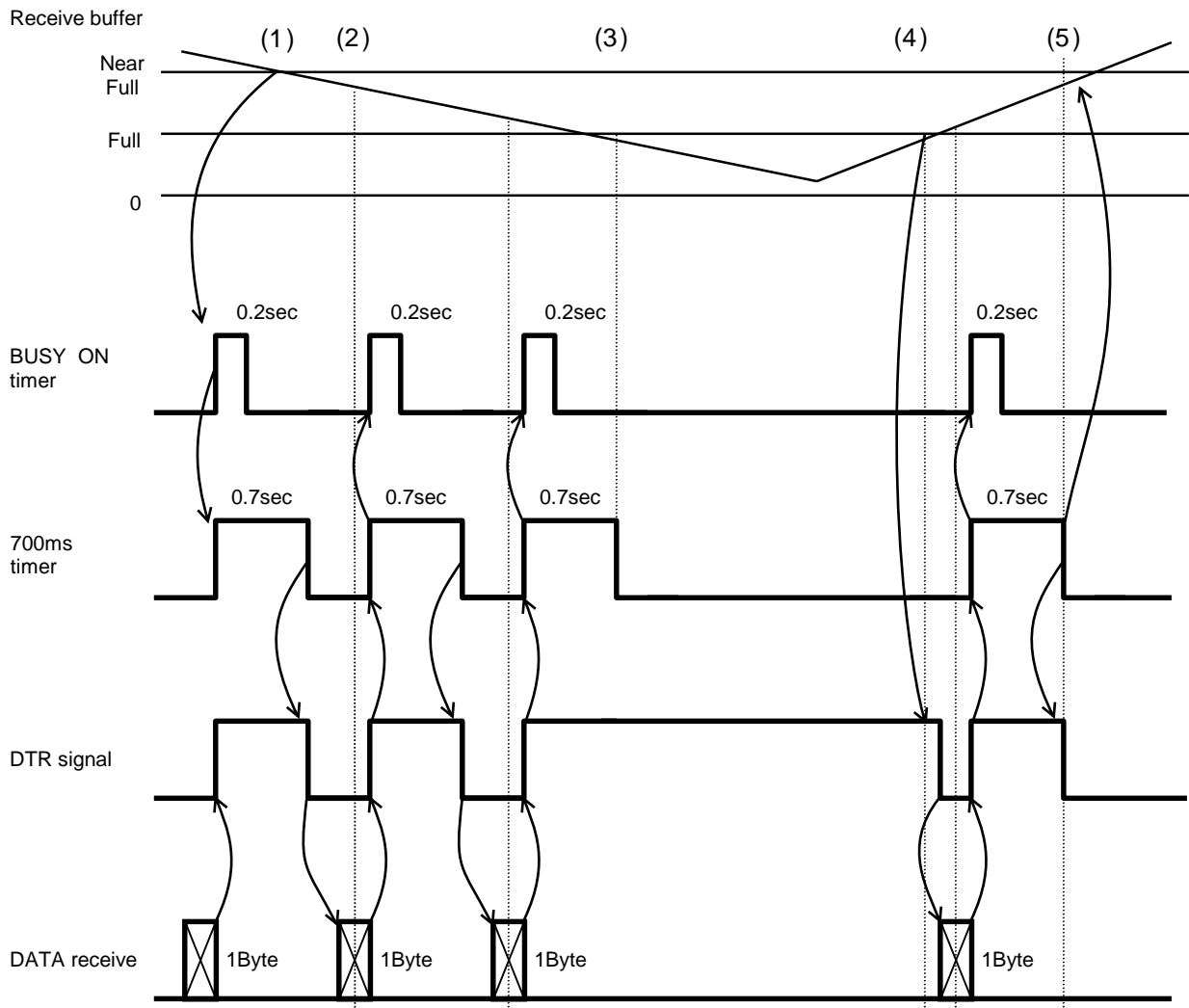
When 1 byte data is received, immediately resumes Busy status, and requests data sending stop.

When receive buffer size that can store data becomes less than 256byte, stops data receive in every 700ms.

Resumes data receive, when buffer remaining becomes 256byte or more.

5.3.6.2 BUSY ON timeout receive time chart

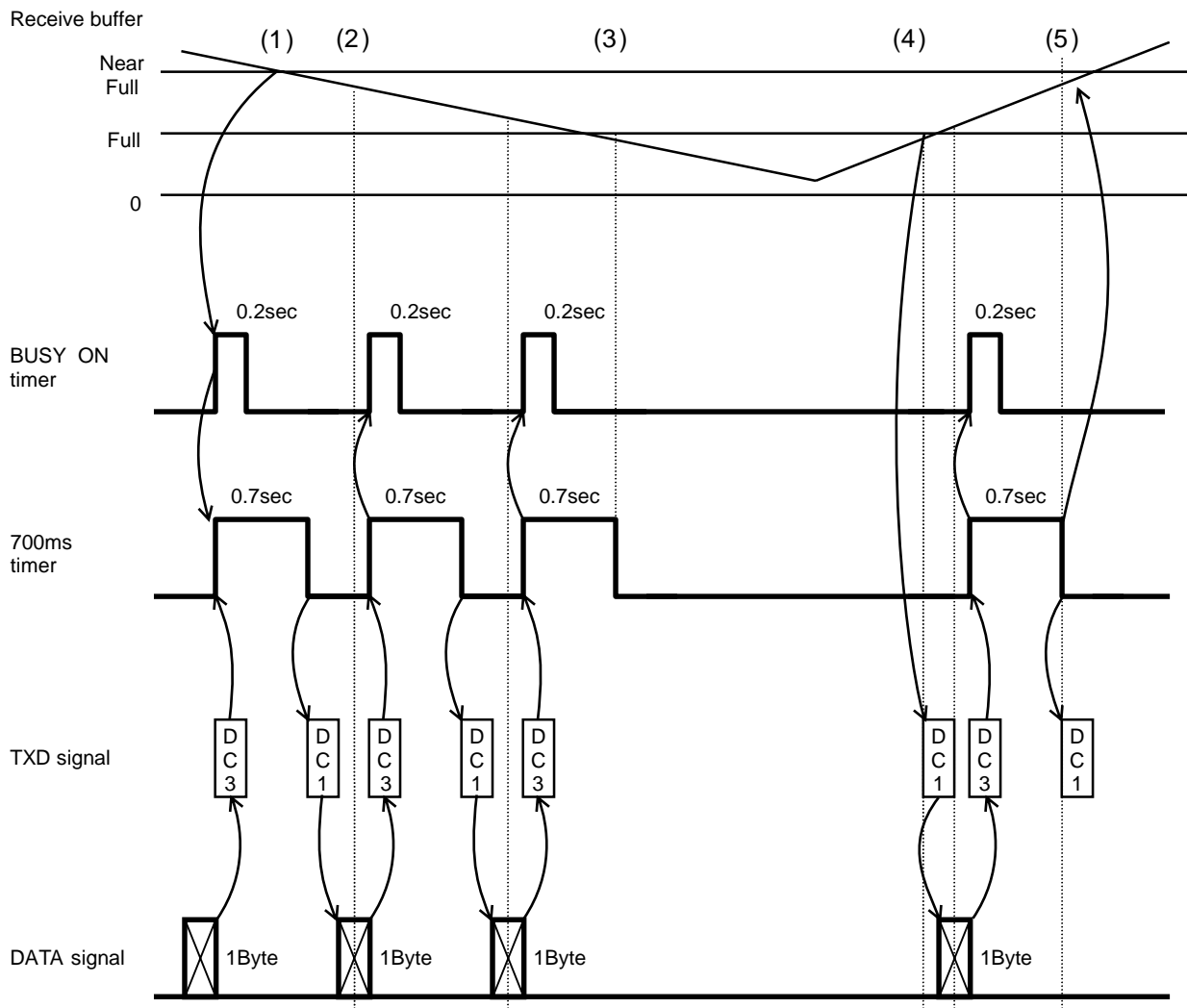
(1) When protocol Ready / Busy is selected



- (1) : BUSY ON start due to receive buffer near full
- (2) : Receive due to 700ms timeout and BUSY ON re-start due to receive buffer near full
- (3) : Timeout receive invalid due to receive buffer full
- (4) : 1 Byte receive due to receive buffer full cancel and BUSY ON re-start due to receive buffer near full
- (5) : Busy cancel due to receive buffer near full cancel

Figure 5.18 Busy On control in Ready/Busy protocol setting

(2) When protocol X-ON/X-OFF is selected



- (1) : BUSY ON start due to receive buffer near full and outputs DC3 code.
- (2) : Due to 200ms and 700ms timeout, outputs DC1 code.
Outputs DC 3 code due to BUSY ON re-start because of data receive and receive buffer near-full
- (3): Timeout receive invalid due to receive buffer full
- (4): Outputs DC1 code due to receive buffer cancel
Outputs DC3 code due to BUSY ON re-start because of data 1 Byte receive and receive buffer near full
- (5): BUSY cancel due to receive buffer near full cancel, and outputs DC1 code.

Figure 5.19 Busy On control when X-ON/X-OFF protocol is set

5.3.7 Local test function

5.3.7.1 Circuit test mode

When you select "Circuit test mode" by DIP switch 2-4, this test mode checks interface driver, receiver circuit, and receive/send functions.

The circuit test mode does not check receive buffer.

(1) Test connector

Using the test connector shown below, execute the circuit test mode.

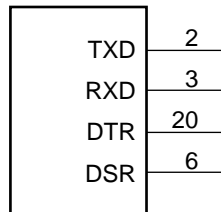


Figure 5.20 Test connector wiring diagram

(2) Printing of DIP switch setting

The serial interface setting status by DIP switch read at POWER ON is printed.

The DIP switch setting status are printed as below.

DIP switch item	Set value data to be printed	Remark
Data bits	7bits / 8bits	
Parity	None / Odd / Even	
Protocol	Ready/Busy / XON/XOFF	
Baud rate	1200BPS / 2400BPS / 4800BPS / 9600BPS / 19200BPS	
Receive error	Checked / Not Checked	
Customer Display	Connected / Not Connected	

Note: The DIP switch setting status for the reset signal select function by #6 pin and #25 pin that you specify with DIP switches 2-1 and 2-2 and the H/W reset/F/W reset selection that you specify with DIP switches 2-5 and 2-6 is not displayed.

This is because DIP switch status cannot be read due to the H/W structure.

- (3) Interface signal cable check and PC-16550D chip check
 Check the behavior of receiver/transmitter of RS-232C interface board and PC-16550D chip, and print the result of the check.
- (a) Checking PC-16550D
 Using "loop back function" that PC-16550D supports, check the behavior of the receiver/transmitter of PC16550D.
 Set loop back function mode. Change DTR, RTS, OUT1, and OUT2 signals to SPACE status and MARK status, and check whether the changed signal cable status is input in each DSR, CTS, RI, and CD signal cable.
- Regarding send/receive behavior check, send check data and check whether the received data matches the sent data.
 If normal behaviors are not observed in these checks, "I/F=BAD(PC16550D)" display appears.
- (b) Checking receiver/transmitter
 Check receiver/transmitter as follows. Similarly as loop back function, change DTR signal to SPACE status and MARK status, and check whether the modification is input in the DSR signal cable.
 If normal behaviors are not observed in these checks, "I/F=BAD(DRIVER OR TEST CONNECTOR)" display appears.
- (4) Loop test print pattern (when I/F check is normal)

```

<LF>
<LF>
Serial Interface
  Data Bits :      7 bits
  Party :         Even
  Protocol :      Ready / Busy
  Baud rate :     9600BPS
  Receive error : Checked
Customer Display : Not Connected
<LF>
<LF>
Serial I/F
LOOP TEST
<LF>
I/F=GOOD
!"#$%&'+,.-/123456789:;<=>?@ABCDEFGHIJKLMN
OPQRSTUVWXYZ...
pqrstuvwxyz[{}~
  
```



Figure 5.21 Circuit test print pattern (in normal)

(5) Loop test printer pattern (When an error occurs in I/F check)

```
<LF>
<LF>
Serial Interface
  Data Bits :      7 bits
  Parity :        Even
  Protocol :      Ready / Busy
  Baud rate :     9600BPS
  Receive error : Checked
Customer Display : Not Connected
<LF>
<LF>
Serial I/F
LOOP TEST
<LF>
I/F=BAD (PC16550D)
```



Figure 5.22 Circuit test print pattern (in error)

Remark 20H (7EH, which is a part of TEST message, is processed in the same way as regular ON-LINE by TXD's and RXD's loop sending/receiving of serial data.

Print paper mode by circuit test mode is receipt mode.

Print mode by circuit test mode follows the print mode that is currently set in printer menu.

(6) Ending circuit test mode

Circuit test mode ends when the printer power is turned off.

(7) Restrictions for executing Circuit Test Mode

To execute Circuit Test Mode, you must first set Reset function of both DIP switch #6 pin and #25 pin to OFF (DIP SW 2-1 = OFF, DIP SW 2-2 = OFF).

5.3.8 Customer display

This printer is ready for connection of customer display. Customer display connection becomes available when DIP switch 1-8 is set to ON.

RS-232C interface control enables host machine to sense Busy status of customer display. Thus, H/W executes output control of the status by using RTS signal cable.

5.3.8.1 Customer display connection and RTS signal

RTS signal that a printer outputs OR status of the printer DTR signal and customer display DTR signal instead of outputting DTR status of customer display as it is. (See the below diagram.)

When DIP switch 1-8 is set to OFF, printer's DTR signal is output to RTS signal as is.

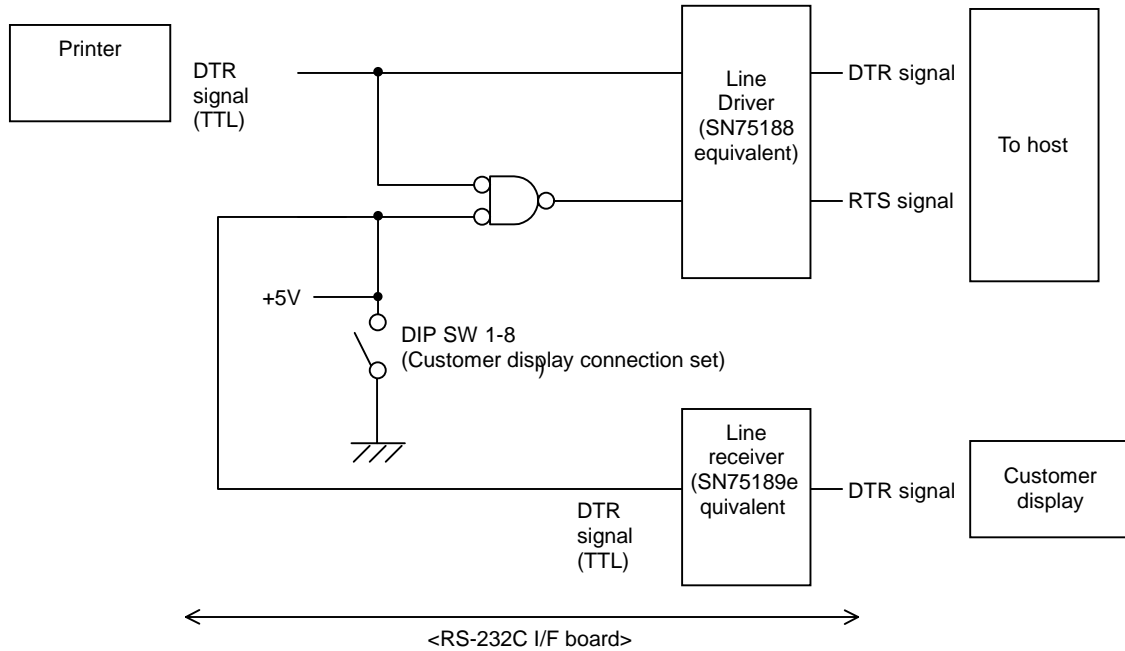


Figure 5.23 Outline circuit of 4-17 RTS signal

5.3.8.2 Customer display connection/non-connection and RTS signal status

The below table shows RTS signal status output by the circuit described above.

DIP SW1-8	Printer DTR signal status	Customer display DTR signal status	RTS signal output status
OFF	Busy status (MARK)		Busy status (MARK)
	Ready status (SPACE)		Ready status (SPACE)
ON	Busy status (MARK)	Busy status (MARK)	Busy status (MARK)
	Ready status (SPACE)	Busy status (MARK)	Busy status (MARK)
	Busy status (MARK)	Ready status (SPACE)	Busy status (MARK)
	Ready status (SPACE)	Ready status (SPACE)	Ready status (SPACE)

5.3.9 Printer reset signal

This printer has reset signal so that host machine can initialize the printer even though RS-232C interface is in use.

There are two lines of reset signals, DSR signal (6 pin) and INIT signal (25 pin). You can select valid/invalid by DIP switch 2 -1 and 2-2.

When the reset signal is set to valid by DIP switch 2-1 and 2-2, you can initialize the printer by inputting reset pulse over 100 μ s from host.

There are two printer initializations.

- (1) H/W reset (Same as POWER ON)
- (2) F/W reset

You can select either by DIP switch. (Factory shipment setting is F/W reset.)

When F/W reset is selected, H/W inputs reset pulse signal to I-PRIME signal of Centronics interface. Thus, the same initialization as the I-PRIME signal of Centronics interface is performed.

5.3.9.1 Printer Busy control when reset signal is received

Printer becomes OFF-LINE when reset signal is input, and DTR signal and RTS signal shift to Busy status (MARK).

Even though protocol is set to X-ON/X-OFF, DTR signal and RTS signal shift to Busy status by reset signal input.

The printer does not start initialization until the reset signal is canceled.

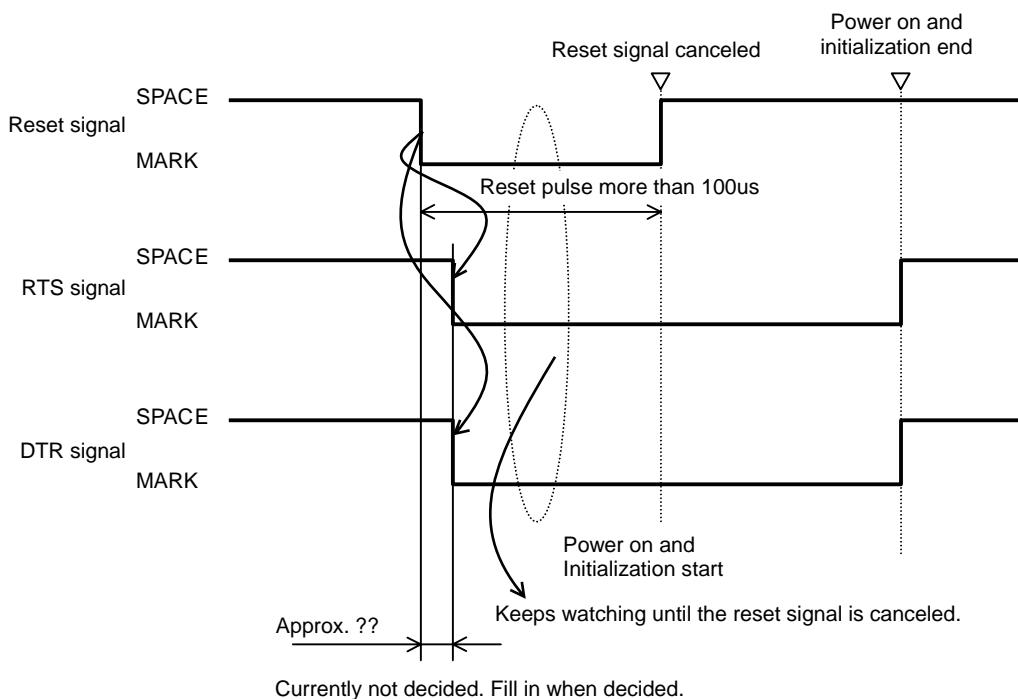


Figure 5.24 Busy signal when reset signal is input

5.3.9.2 Busy control in X-ON/X-OFF protocol

If reset signal is input when protocol is set to X-ON/X-OFF, Busy control in H/W reset and Busy control in F/W reset are different.

5.3.9.2.1 H/W reset

In case of H/W reset, DC3 code is not output immediately even though reset signal is input as the below shows.

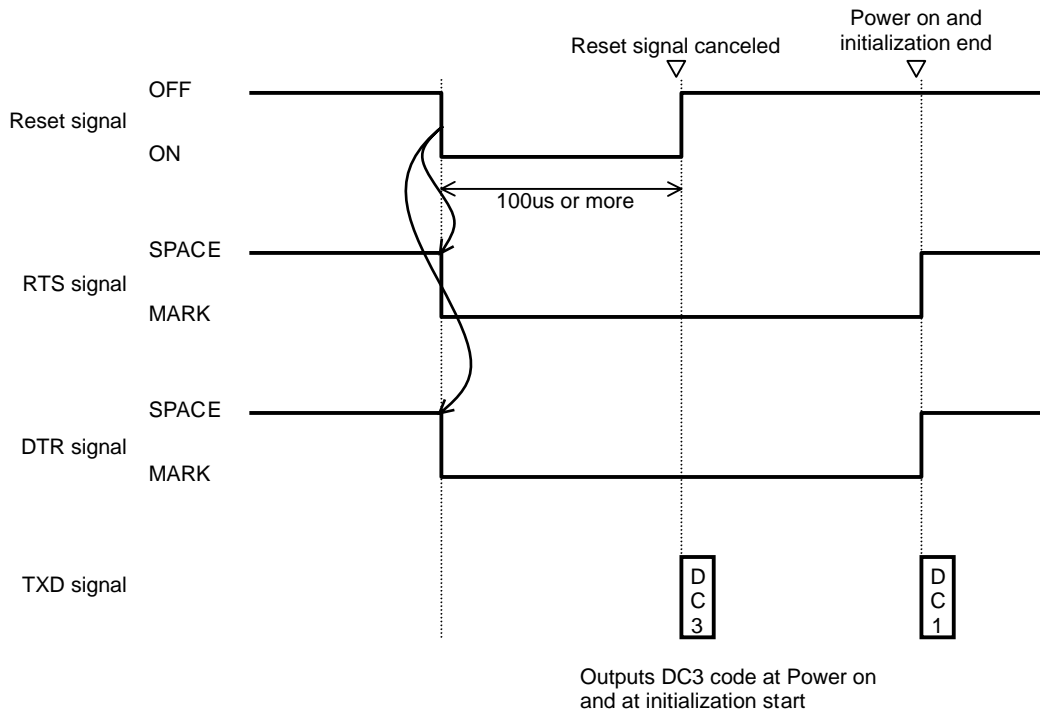


Figure 5.25 X-ON/X-OFF control in H/W reset >

DC3 code is output when reset signal is canceled and initialization starts.

The time between reset signal ON and RTS/DTR signal shift to MARK status (Busy status) is not decided yet. When decided, will be clearly described.

5.3.9.2.2 F/W reset

In case of F/W reset, the program recognizes reset signal input and executes reset. Busy control data (DC3) is output at the time when reset signal is input, which is different from the case of H/W reset.

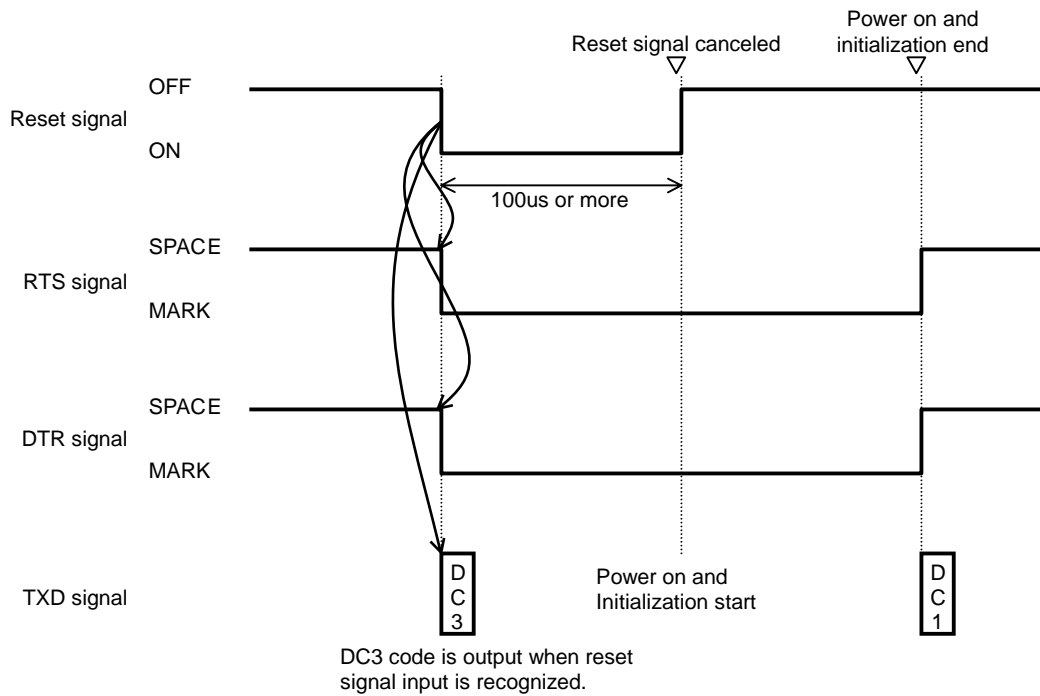


Figure 5.25 X-ON/X-OFF control in F/W reset

The time between reset signal ON and RTS/DTR signal shift to MARK status (Busy status) is not decided yet. When decided, will be clearly described.