

specifications for thermal printer **Model-1221**

February, 1985

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Description of the Model-1221 Printer

This machine is a serial thermal printer with a 9-dot (vertical) thermal head, and prints as the thermal head moves in the left-to-right direction, the column capacity being of 40 columns (in the Normal Density mode or the Text mode).

Performing the specified motor speed control will permit printing in 80 columns at double density (in the Condense mode or the Text mode).

As to paper feeding, selection is possible between 12-dot feed for the Text mode and 8-dot feed for the Graphic mode.

Features

1. Two modes of paper feeding are available: Text mode and Graphic mode.
2. In the Text mode, carriage return ensures higher actual printing speed.
3. The power source can be constituted by four nickel/cadmium cells.

CONTENTS

	<u>Page</u>
1. GENERAL SPECIFICATIONS	1
2. DETAILED SPECIFICATIONS	
2.1 Print Format I	4
2.2 Print Format II	8
2.3 Printing Paper	9
2.4 Head	9
2.5 Motor	12
2.6 Timing Detector	13
2.7 Reset Detector	14
2.8 Printer Control I	15
2.9 Printer Control II	20
2.10 Connectors	23
2.11 Timing Chart (Text Mode)	25
2.12 Timing Chart (Graphic Mode)	26
2.13 Principal Dimensions	27
2.14 Basic Design of Casing	28

1. GENERAL SPECIFICATIONS

- 1.1 Printing System : Thermal serial dot printing.
- 1.2 Printing Direction : Uni-directional (left to right).
- 1.3 Printing Speed (at 25°C. in the Normal Density mode)

Motor terminal voltage	Character speed	Text mode	Graphic mode
5.6 V	Approx. 80 cps	Approx. 0.85 l/s	Approx. 0.8 l/s
5.0 V	Approx. 70 cps	Approx. 0.8 l/s	Approx. 0.75 l/s
4.6 V	Approx. 65 cps	Approx. 0.7 l/s	Approx. 0.65 l/s

1.4 Print Format I (Normal Density mode)

1) Text mode

- Total number of dot rows per line : 240
- Dot row pitch : 0.35mm
- Line pitch : 4.2mm \pm 10% (12-dot feed)
- Print column capacity : 40 columns (in case of printing with 5 x 7 dot matrix and 1-dot intercharacter spacing)
- Column pitch : 2.1mm (in case of printing with 5 x 7 dot matrix and 1-dot intercharacter spacing)
- Character size : 1.7mm (width) x 2.4mm (height) (in case of printing with 5 x 7 dot matrix)

2) Graphic mode

- Total number of dot rows per line : 256
- Dot row pitch : 0.35mm
- Line pitch : 2.8mm \pm 10% (8-dot feed)

1.5 Print Format II (Condense mode)

In the Condense mode, print density is double (but this, only in the column direction).

1) Text mode

Total number of dot rows per line : 480
 Dot row pitch : 0.175mm
 Print column capacity : 80 columns (with 1-dot spacing)
 68 columns (with 2-dot spacing)
 Character size : 0.9mm (width) x 2.4mm (height) (in the case of 5 x 7 dot matrix)

2) Graphic mode

Total number of dot rows per line : 512
 Dot row pitch : 0.175mm

NOTE: The Text and Graphic mode line pitches of Format II are the same as those of Format I, respectively.

Use of Format II requires motor speed reduction.

1.6 Printing Paper

- Type : Thermal paper KF-200 (Kanzaki paper MFG)
 - Width : 112^{+0}_{-1} mm

1.7 Paper Feeding

: 12-dot feed, and 8-dot feed.

Fast feed: Approx. 1.7 lines/s (in the 12-dot feed mode, at 5.0V DC, 25°C)

1.8 Head

- Thermal elements : 9 elements (vertical)
 #1, #3, #4, #6 and #9 precede the others by half-dot.
 - Terminal voltage : 5.4 to 4.2V DC
 - DC resistance : $10\Omega^{+15%}_{-9.5%}$
 - Operating energy : See 2.4 6) (Page 11)

1.9 Motor

- Rotation (normal or reverse) : Normal rotation for printing phase, reverse rotation for resetting phase
- Terminal voltage : 5.6 to 4.4V DC

When using the recommended IC (LB-1630) for motor drive:

- Supply voltage : 5.9 to 4.6V DC
- Mean current : Approx 150mA (at 5.0V DC, 25°C)

1.10 Detectors

- Timing detector : Tachometer generator (generating Timing Signals)
- Reset detector : Mechanical switch (generating Reset Signals)

1.11 Connectors

- Head : Conductors in 2.54mm pitch on the side end of F.P.C. (flexible printed cable)
- Motor and detectors : Conductors in 2.54mm pitch on the side end of jumper lead wire

1.12 Guaranteed Operating Temperature

: 0 to 40°C

1.13 Reliability (MCBF)

: 500,000 lines (except for the print head)

1.14 Overall Dimensions

: 140.4mm (width) x 46.7mm (depth) x 27.0mm (height)
(except the printer mounting brackets, jumper wires and F.P.C.)

1.15 Weight

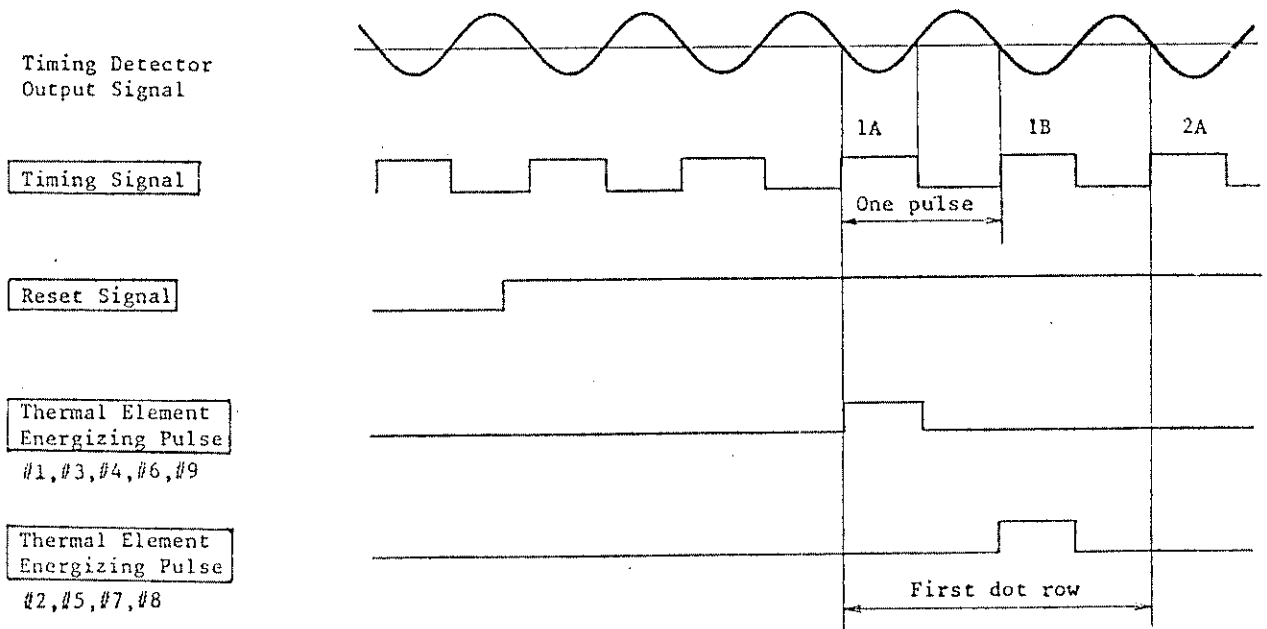
: Approx. 150g

2. DETAILED SPECIFICATIONS

2.1 Print Format I (Normal Density mode)

1) Print Start Position

The 3rd timing pulse appearing after the rising ("making") of reset signal is numbered 1A, and printing can start with this timing pulse.



Thermal elements Nos. #1, #3, #4, #6 and #9 precede thermal elements Nos. #2, #5, #7 and #8 by a half dot; print in the first dot-row can be obtained by energizing thermal elements Nos. #1, #3, #4, #6 and #9 at timing pulse 1A, and energizing thermal elements Nos. #2, #5, #7 and #8 at timing pulse 1B.

NOTE: The signals enclosed in are to be provided by the customer.

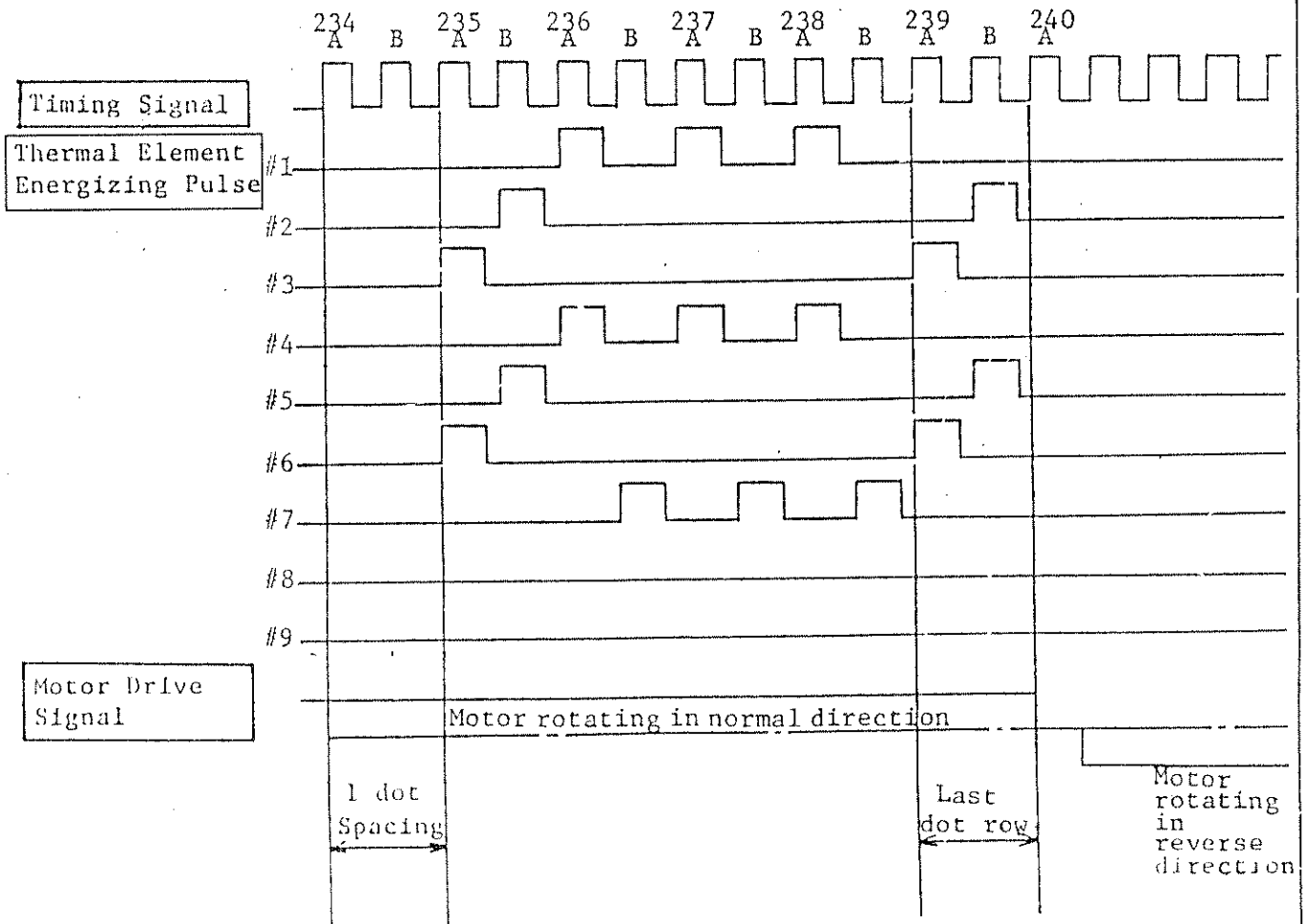
2) Line-to-line Horizontal Gap between Print Start Positions

The horizontal gap between the print start positions for any two adjacent lines will not exceed a half-dot pitch distance.

3) Maximum Printable Number of Dot Rows

The maximum printable number of dot rows is 240 for the Text mode, and 256 for the Graphic mode.

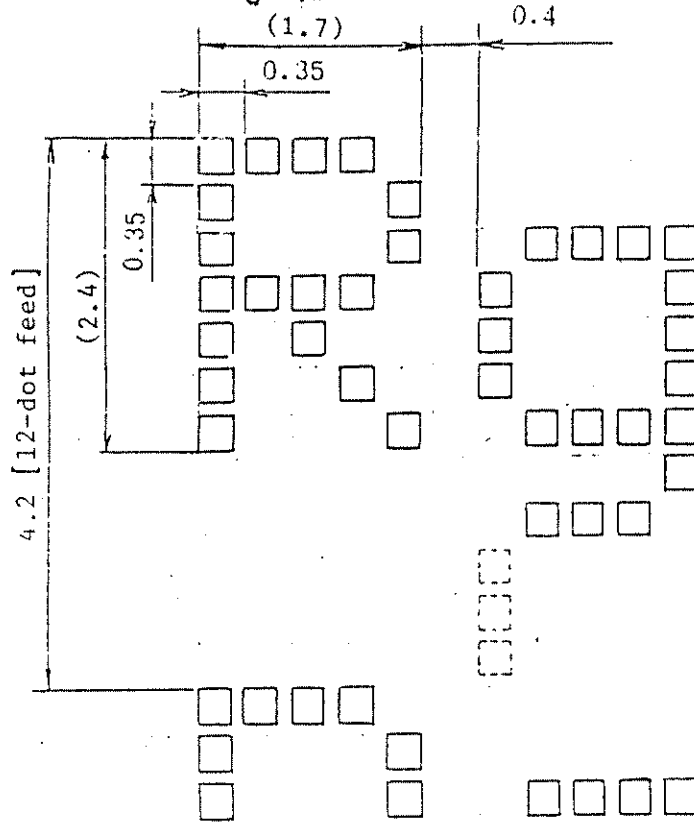
The following is an example of printing with the 40th-column character being "8", using 5 x 7 dot matrix and 1-dot intercharacter spacing.



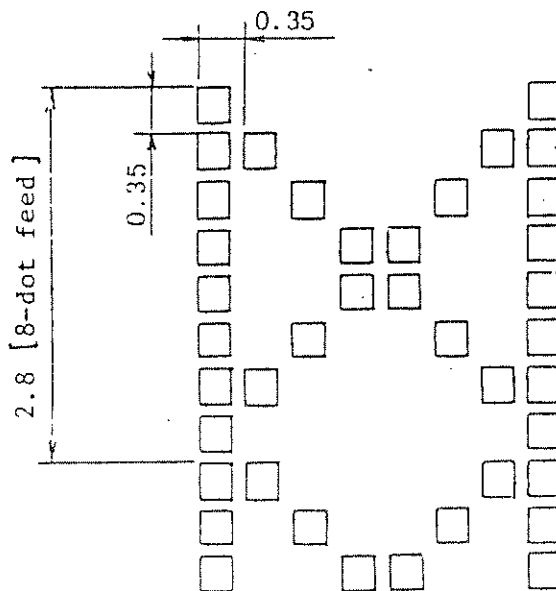
Note: The signals enclosed in are to be provided by the customer.

3) Character size

- ① Text mode (Case of printing with 5x7 dot matrix and 1-dot intercharacter spacing, and small alphabetical letters while using #8, #9 dot).



- ② Graphic mode

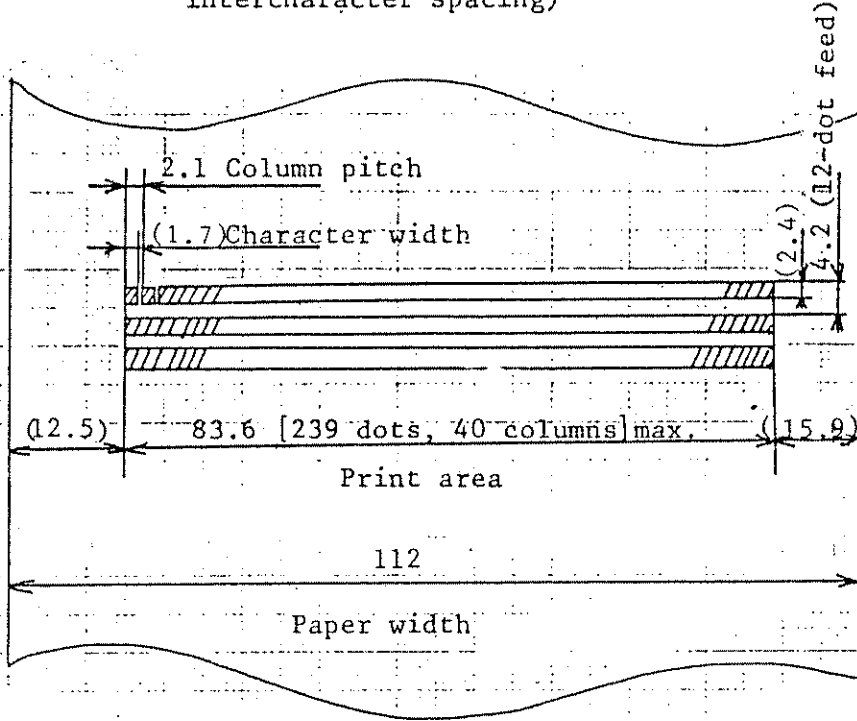


NOTE: - Dimensions in mm.

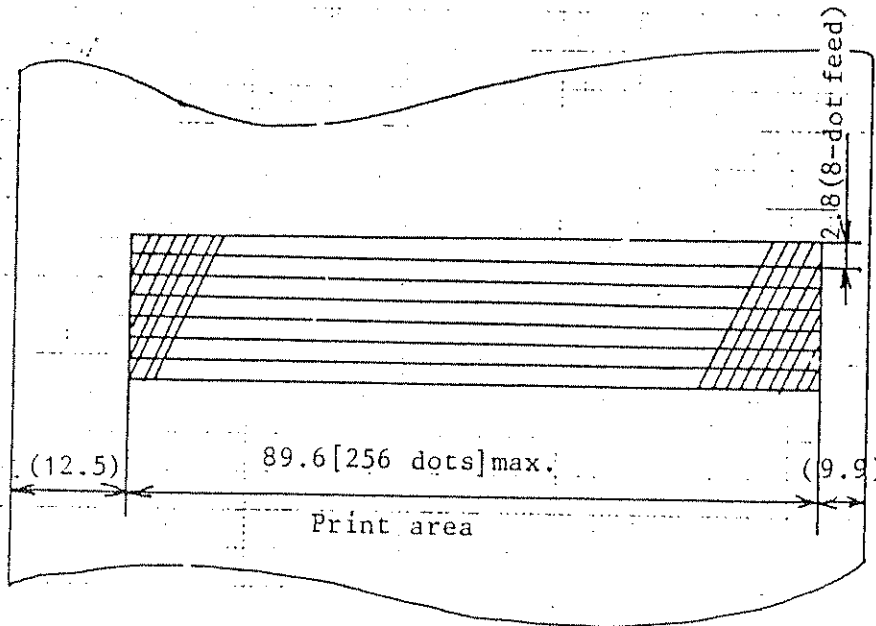
- Parenthesized figures are for approximate dimensions.

4) Print position;

- ① Text mode (Case of printing with 5 x 7 dot matrix and 1-dot intercharacter spacing)



- ② Graphic mode



NOTE: - Dimensions in mm.

- Parenthesized figures are for approximate dimensions.

2.2 Print Format II (Condense mode)

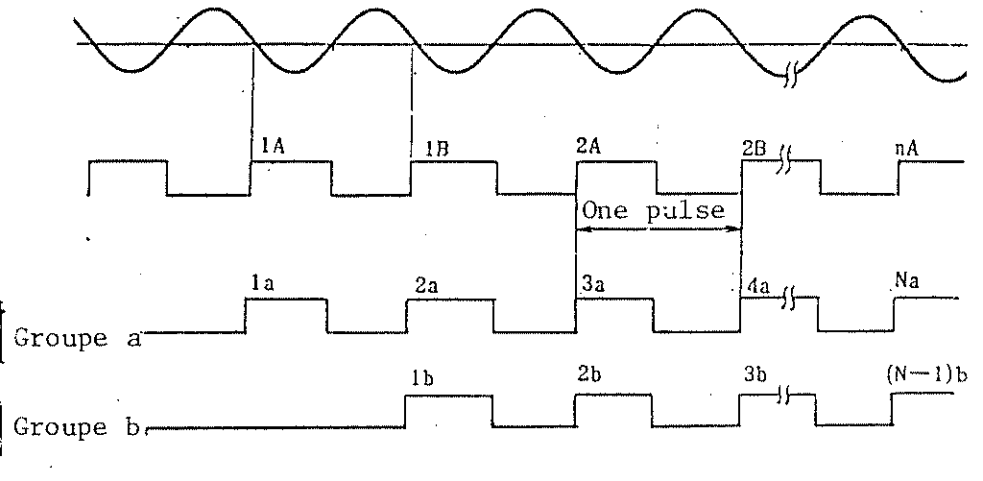
- 1) Print Start Position
Same as with Format I.
- 2) Print Timing

Timing Detector
Output Signal

Timing signal

Thermal Element
Energizing pulse
#1, #3, #4, #6, #9

Thermal Element
Energizing pulse
#2, #5, #7, #8



For the Nth dot row, Group "a" thermal elements shall be energized at timing pulse $N/2B$ if N is an even number, or at timing pulse $[(N+1)/2]A$ if N is an odd number.

For the Nth dot row, Group "b" thermal elements shall be energized at timing pulse $(N/2+1)A$ if N is an even number, or at timing pulse $[(N+1)/2]B$ if N is an odd number.

The maximum value of N is 512.

- 3) Print Start Position Gap

The maximum amount is the same as with Print Format I.

- 4) Character Size

(With 5 x 7 dot matrix)

Same as with Print Format I for line direction.

Dimensions: 0.9mm (width) x 2.4mm (height)

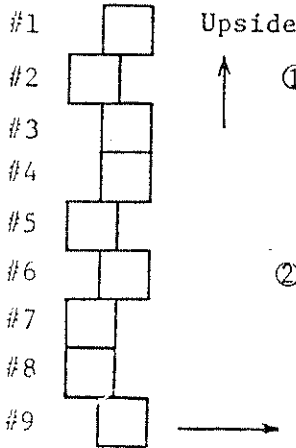
Character pitch: 1.05mm with 1-dot spacing

1.23mm with 2-dot spacing

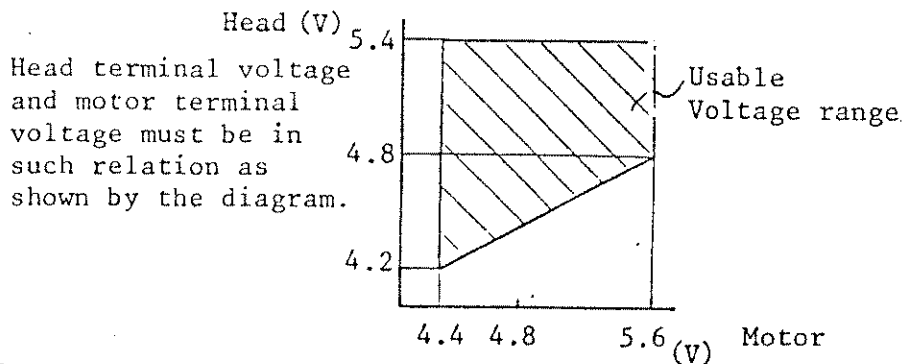
2.3 Printing Paper

- 1) Type : Thermal paper
KF-200 (Kanzaki Paper MFG.)
- 2) Paper width : $112 \begin{matrix} +0 \\ -1 \end{matrix}$ mm
- 3) Roll diameter : 60mm max. (using Roll paper shaft)
30mm max. (non-using Roll paper shaft)
- 4) Paper thickness : $66 \pm 5\mu\text{m}$
- 5) Basic weight : $57 \pm 5\text{g/m}^2$ (49kg/1,000 sheets/1,091 x 788mm)

2.4 Head

- 1) Thermal elements : #1 
 - ① Text mode:
#1 to #7 are used. For lower case letters, #8 and #9 are used in addition.
 - ② Graphic mode:
#1 to #8 are used.

- 2) Terminal voltage : 5.4 to 4.2V DC
Head driving circuit and motor driving circuit must be fed from the same power source.



- 3) DC resistance : $10\Omega \begin{matrix} +15\% \\ -9.5\% \end{matrix}$ (at F.P.C. terminal)
- 4) Rank : B: 11.5 to 9.85 Ω
C: 10.5 to 9.05 Ω

The rank of B or C is stamped on the under side of F.P.C. and the section between terminal No.1 and terminal No.2 is opened for rank B, but not for rank C.

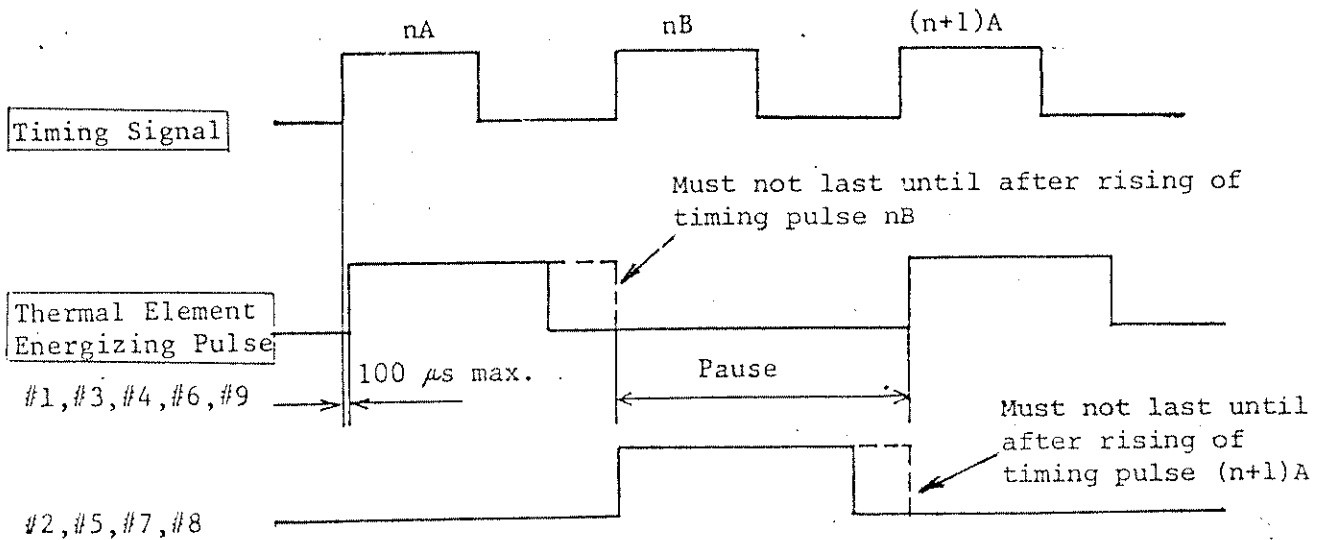
(Refer to Par.2.10 "Connectors" and Par.2.13 "Principal Dimensions".)

5) Energizing

1. Normal Density Mode

The thermal element energizing pulses must rise substantially in time with the rising of timing pulses, and their width must not be greater than the timing pulse width. (Refer to the chart below.)

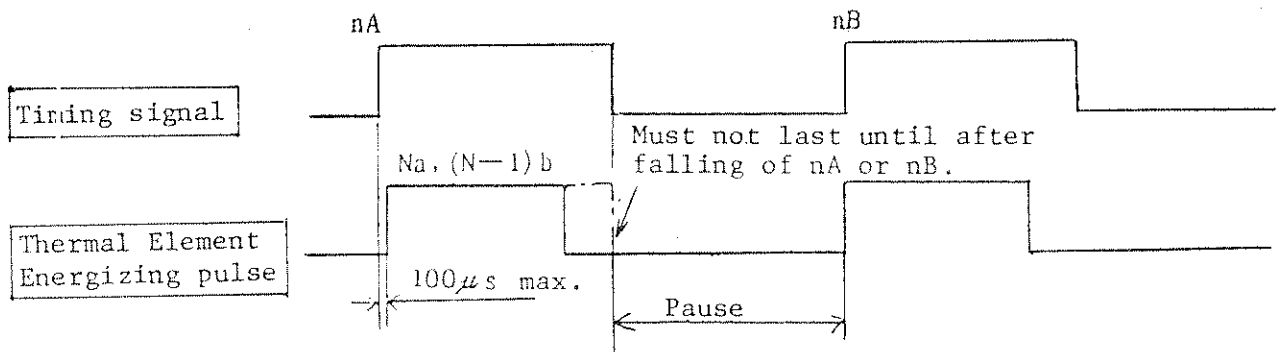
Thermal elements	Timing pulse
#1, #3, #4, #6, #9	nA
#2, #5, #7, #8	nB



2. Condense Mode

Thermal elements

#1, #3, #4, #6, #9 ----- Group "a" N: No. of the dot row
#2, #5, #7, #8 ----- Group "b"



NOTE: The signals enclosed in are to be provided by the customer.
In no case, uninterrupted energizing is permitted.

6) Operating Energy

Operating Energy Range (mj)

Ambient Temp. Terminal voltage (V) (°C)	0	20	40
5.4	1.7 to 2.8	1.6 to 2.2	1.3 to 2.0
4.8	1.9 to 3.0	1.6 to 2.4	1.4 to 2.1
4.2	2.1 to 3.3	1.7 to 2.7	1.4 to 2.3

7) Printing Duty

The printable number of dots per line is not greater than half the total number of dot available per line.

- 8) Life expectancy : 300,000 lines; or
until thermal element resistance exceeds the initial value plus 20% (most heavily changed thermal element)

Testing conditions:

- Printing: Print letters, numerals and symbols in succession.
- Speed : 20 lines/min

2.5 Motor

1) Terminal voltage: 5.6 to 4.4V DC

It is recommended that the LB-1630 be employed as motor drive IC. When this IC is used, the following specification for supply voltage shall be met instead of the above specification for terminal voltage:

2) Supply voltage : 5.9 to 4.6V DC

3) Current:

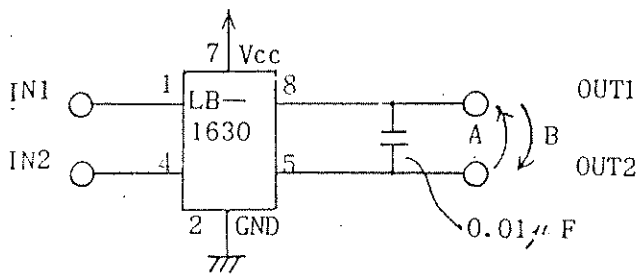
① Peak current: 1.7A max. (at terminal voltage of 5.6V DC and temperature of 0° to 40°C)

② Mean current: Approx. 150mA (at terminal voltage of 5.0V DC and temperature of 25°C)

4) Recommended motor drive circuit:

① Connection:

The recommended motor drive IC (LB-1630) should be connected as shown below.



LB-1630 (DIP 8 pins) fabricated by Tokyo Sanyo Electric

② Usage:

Input level		Direction of Output current
IN 1	IN 2	
H	L	As indicated by arrow B
L	H	As indicated by arrow A
L	L	Stoppage
H	H	Stoppage

2.6 Timing Detector

The timing detector, constituted by a tachometer generator directly coupled to the motor, generates a signal having a cycle time corresponding to a half-dot length of time, by which are determined dot positions in the print area.

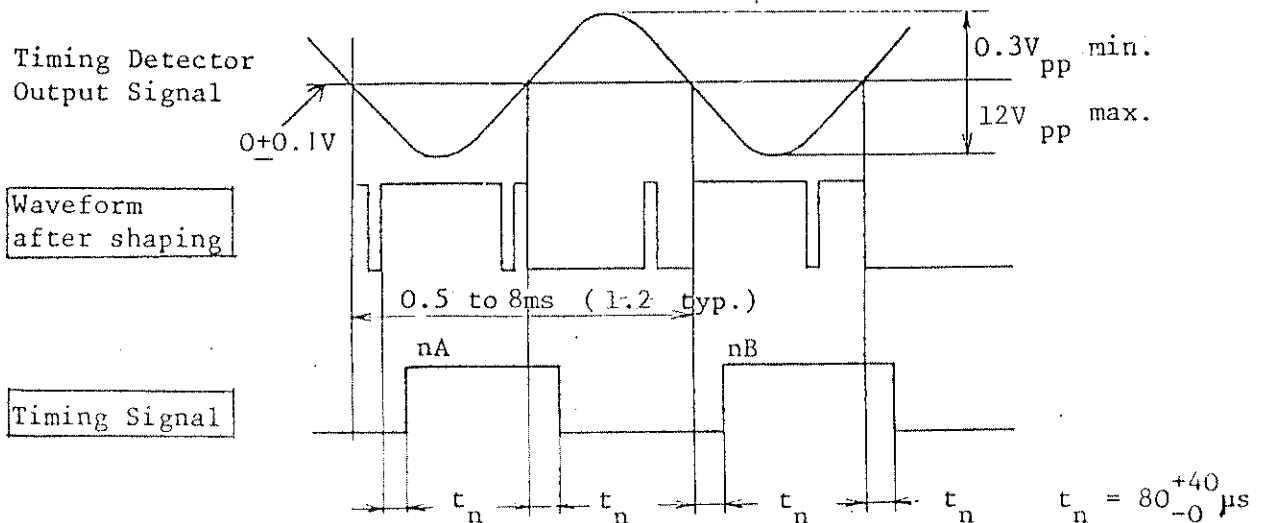
The customer must shape this signal into timing signal.

1) Timing Signal:

- ① Threshold: The timing signal must be within $0 \pm 0.1V$ from the timing detector output signal.
- ② Phase : When timing detector terminal No. 15 is used as the +GND terminal and the output at terminal No. 16 is used as the timing detector output signal, the phase of the timing signal must be reverse to that of the timing detector output signal, as shown in the diagram below. (For terminals Nos. 15 and 16, refer to Par. 2.10.)

2) Noise Prevention

The leading edge of the timing signal must be formed by a continuous high-level section of $80^{+40}_{-0} \mu s$ in the waveform after shaping, and the trailing edge by a continuous low-level section of $80^{+40}_{-0} \mu s$. (Refer to the diagram below.)



Note: The signals enclosed in are to be provided by the customer.

2.7 Reset Detector

The reset detector consists of a mechanical switch which makes once per line.

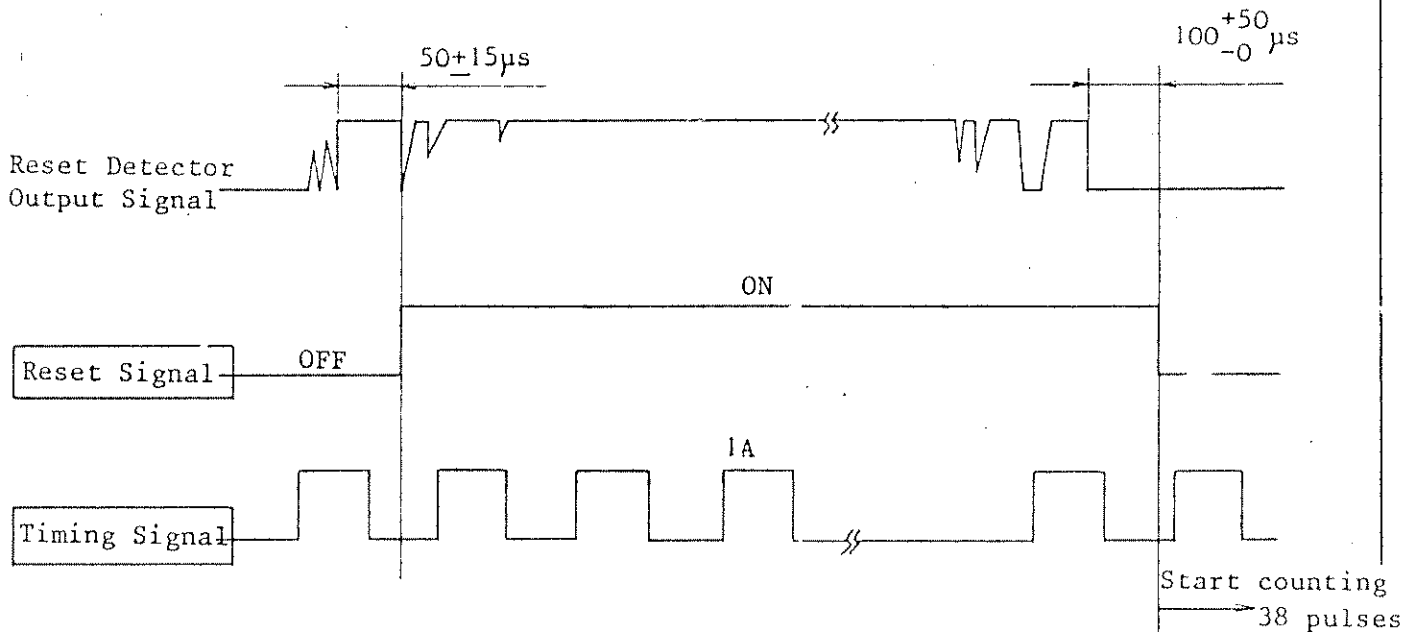
The reset signal is the reference signal for the start of printing and the stop of motor reverse rotation.

1) Contact rating

- ① Rated voltage : 2.85 to 6V DC
- ② Rated current : 20 μ A to 1mA
- ③ Max. make-and-break capacity : 5mW (load resistance)

2) Detection of reset signal

- a) The reset detector's being kept at make for 50_{-15}^{+50} μ s represents the ON state of the reset signal.
- b) The reset detector's being kept at break for 100_{-0}^{+50} μ s represents the OFF state of the reset signal.

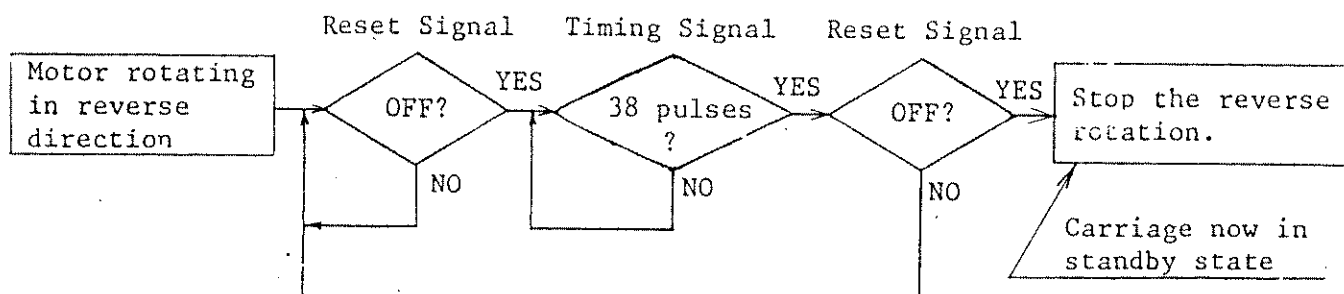


Note: The signals enclosed in are to be provided by the customer.

2.8 Printer Control I (Normal Density mode)

1) Initialization

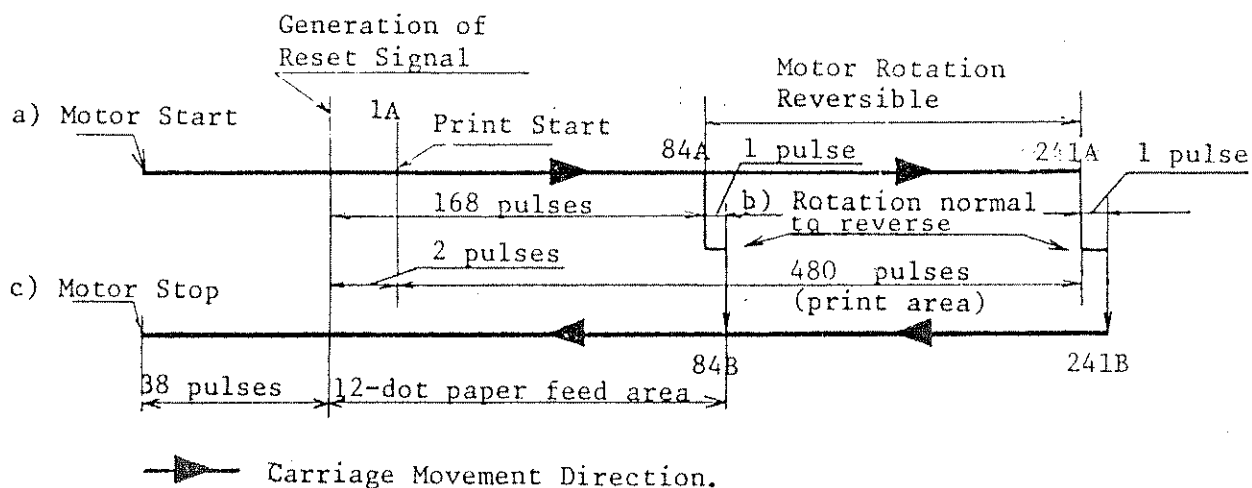
- ① The power circuit being switched on, the carriage must be put in the standby state through the following steps:



- ② Immediately after Power ON, 12-dot paper feed must be carried out five times. (Leaving the paper blank for a long time after set in the printer can result in poor quality of print.)
- ③ Regardless of Power ON or OFF, the carriage must be kept in the standby state when the printer is not operating.

2) Text mode (12-dot feed)

The print cycle for every line develops in three steps: a), b) and c).



1A, 84A, 84B and so on are the Nos. of timing pulses.

a) Motor Start

The motor is put into rotation in the normal direction.

The carriage begins to move; two timing pulses after appearance of the leading edge of the reset signal, the printer becomes ready to print.

b) Rotation Normal to Reverse

After printing, the normal rotation signal is cut off and one pulse later, the reverse rotation signal is applied to return the carriage. (To ensure 12-dot paper feed, the motor must continue to rotate in the normal direction until at least 168 timing pulses have been given after appearance of the leading edge of the reset signal, but not beyond the 482nd pulse.)

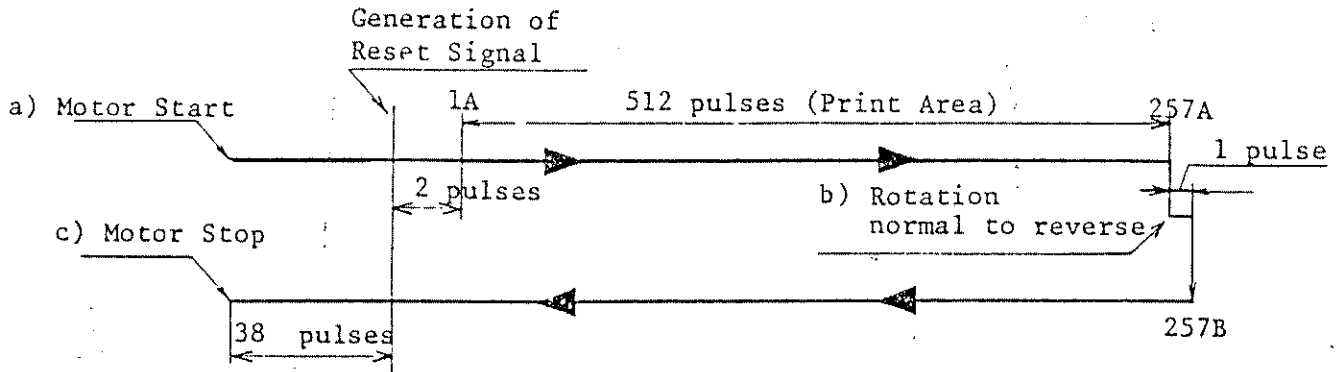
c) Motor Stop

The reverse rotation signal is cut off 38 pulses after appearance of the trailing edge of the reset signal.

Note: When printing in next line without break from the preceding line is desired, it is required that the normal rotation signal be applied again one timing pulse after the reverse rotation signal has been cut off.

3) Graphic mode (8-dot feed)

The print cycle for one line develops in three steps: a), b) and c).



➤ : Carriage Movement Direction.

1A, 257A and so on are the Nos. of timing pulses.

a) Motor Start

The motor is put into rotation in the normal direction.

Two timing pulses after appearance of the leading edge of the reset signal, the printer becomes ready to print.

b) Rotation Normal to Reverse

When the carriage has moved for a 514-pulse period after appearance of the leading edge of the reset signal, the normal rotation signal is cut off and one pulse later, the reverse rotation signal is applied to return the carriage.

c) Motor Stop

38 timing pulses after appearance of the trailing edge of the reset signal, the reverse rotation signal is cut off.

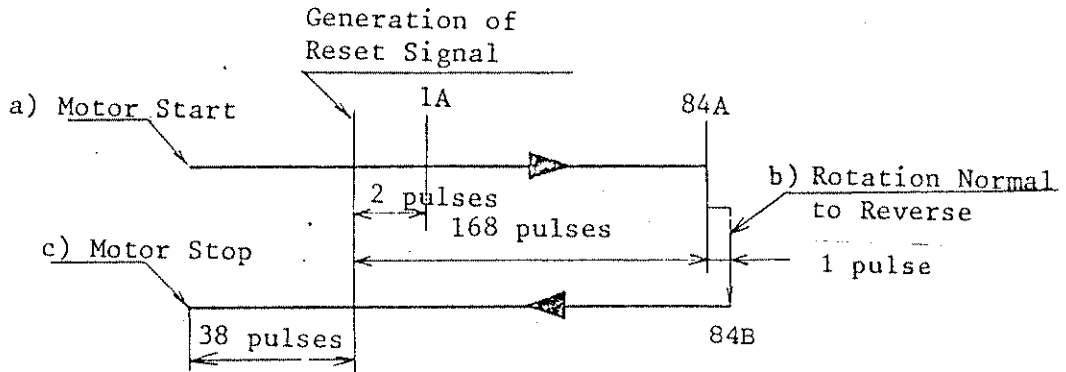
Note: When printing in next line without break from the preceding line is desired, it is required that the normal rotation signal be applied again one timing pulse after the reverse rotation signal has been cut off.

4) Quick feeding of paper

12-dot feed and 8-dot feed are available.

The case of 12-dot feed is explained below.

One quick-feed cycle develops in Steps a), b) and c) in this order.



→ : Carriage Movement Direction.

1A, 84A and so on are the Nos. of timing pulses.

a) Motor Start

The motor is put into rotation in the normal direction.

b) Rotation Normal to Reverse

When the carriage has continued to move for a 168-pulse period after appearance of the leading edge of the reset signal, the normal rotation signal is cut off and one pulse later, the reverse rotation signal is applied to return the carriage.

c) Motor Stop

38 timing pulses after appearance of the trailing edge of the reset signal, the reverse rotation signal is cut off.

5) Manual paper feeding

The thermal paper can be pulled out of the printer in the forward direction.

The printer can be equipped with a knob to permit manual paper feed. For the first line after manual paper feed, the predetermined feed amount is not ensured.

2.9 Printer Control II (Condense mode)

1) Initialization

Same as with Printer Control I. (refer to Par. 2.8)

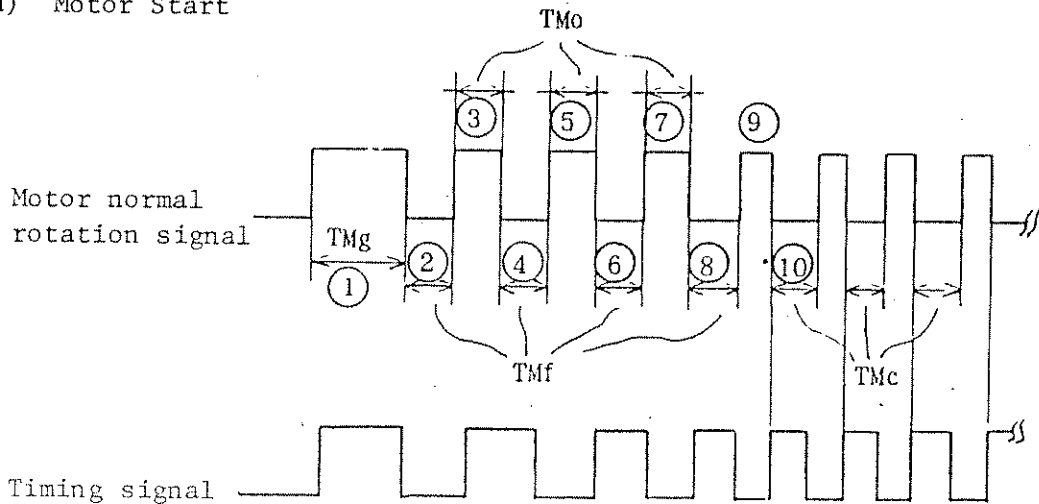
2) Print Cycle

For both Text and Graphic modes, the timing requirements for one-line print cycle are the same as with Printer Control I.

3) Motor Speed Control

The motor speed control mode to be applied when the recommended motor drive IC (LB-1630) is employed shall be as follows:

a) Motor Start



Notation	Designation	Duration	Tolerance
TMg	Motor start trigger time	3 ms	} $\pm 5\%$
TMf	Motor energizing asynchronous off-time	1.5 ms	
TMO	Motor energizing asynchronous on-time	1.5 ms	
TMc	Motor energizing synchronous off-time	1.5 ms	

Motor Start Procedure:

①
Application of TMg (3ms) → ②
TMf (1.5ms) →

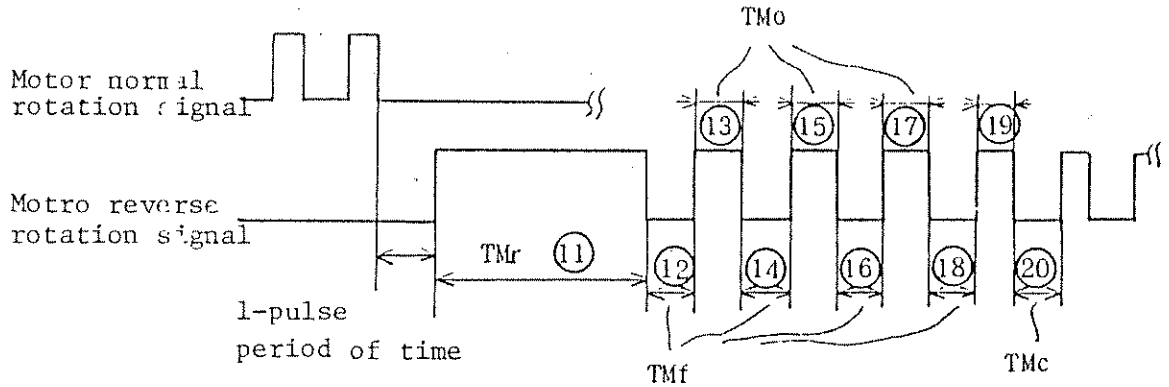
③ ~ ⑧ (3 times)

⑨
TMO (1.5ms) → TMf (1.5ms) → Again, motor energizing →

⑩ ~

Repeated application of TMc (1.5ms) in synchronization with the rising of timing signals.

b) From Normal to Reverse

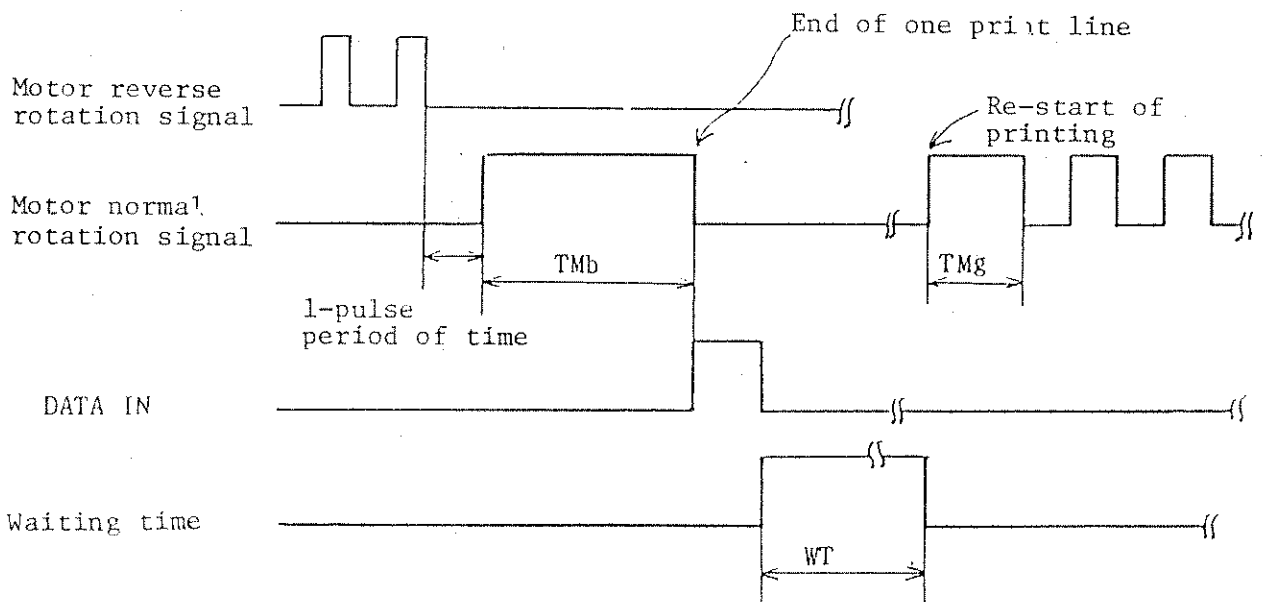


Notation	Designation	Duration	Tolerance
TMr	Motor reverse trigger time	10 ms	} +5%
TMf	Motor energizing asynchronous off-time	1.5 ms	
TMO	Motor energizing asynchronous on-time	1.5 ms	
TMc	Motor energizing synchronous off-time	1.5 ms	

Procedure:

- ⑪ Motor normal rotation stoppage → 1-pulse period of time →
- ⑫ Application of TMr (10ms) → TMf (1.5ms) → TMO (1.5ms) → TMf (1.5ms)
- ⑬ ~ ⑱ Repeated application of TMO (1.5ms) in synchronization with the rising of timing signals.
- ⑲ ~ ⑳ Repeated application of TMc (1.5ms) in synchronization with the rising of timing signals.

c) From Stoppage to Re-start



Notation	Designation	Duration	Tolerance
TMb	Motor reverse braking time	10 ms	+5%
WT	Waiting time	100 ms	<u>+10%</u>

Procedure:

When the Condense mode alone is used or when both Condense and Normal Density modes are used in combination, perform carriage return for the period of TMb. Before proceeding to next print cycle, take in data and then re-start next printing always after providing a waiting time of 100ms (WT) if next print cycle is to be performed in the Condense mode. No waiting time is required if next print cycle is to be performed in the Normal Density mode.

The above procedure is also required after paper feed immediately preceeding to printing.

CAUTION: The motor speed control described above can be applied only when the recommended motor drive IC (LB-1630) is employed.

4) Print Speed

When the motor speed control described above is applied, the timing signal cycle time and the character print speed are as indicated below.

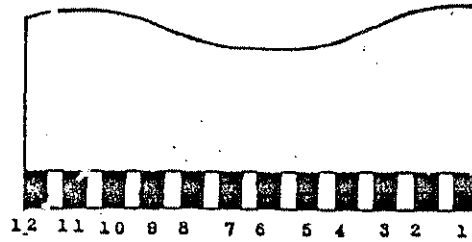
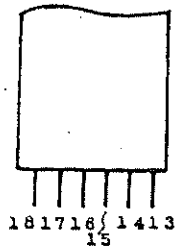
(In the Condense mode, at 25°C)

Supply voltage	Timing signal cycle time	Character print speed
5.8V	Approx. 2.3ms	Approx. 72 cps
5.2V	Approx. 2.4ms	Approx. 70 cps
4.6V	Approx. 2.5ms	Approx. 67 cps

2.10 Connectors

1) Terminal Pin Assignment (F.P.C. and jumper lead wires)

Jumper lead wires (motor, detectors) F.P.C. (head)



	Terminal No.	
Rank selection	1	
Rank selection	2	
Thermal element common wire	3	
Thermal element #9	4	
Thermal element #8	5	
Thermal element #7	6	
Thermal element #6	7	
Thermal element #5	8	
Thermal element #4	9	
Thermal element #3	10	
Thermal element #2	11	
Thermal element #1	12	
Motor power source terminal 1	13	
Motor power source terminal 2	14	
Timing detector (+GND)	15	
Timing detector	16	
Reset detector	17	
Reset detector	18	

Note: 1) The above diagram is for C Rank. (Terminals Nos. 1 and 2 are interconnected. In the case of B Rank, these terminals are not interconnected.)

2) With the motor power source terminal 2 (Terminal No. 14) being plus (+) and the motor power source terminal 1 (Terminal No. 13) being minus (-), the printer enters into the printing phase (the motor rotates in the normal direction).

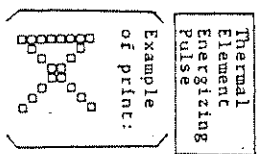
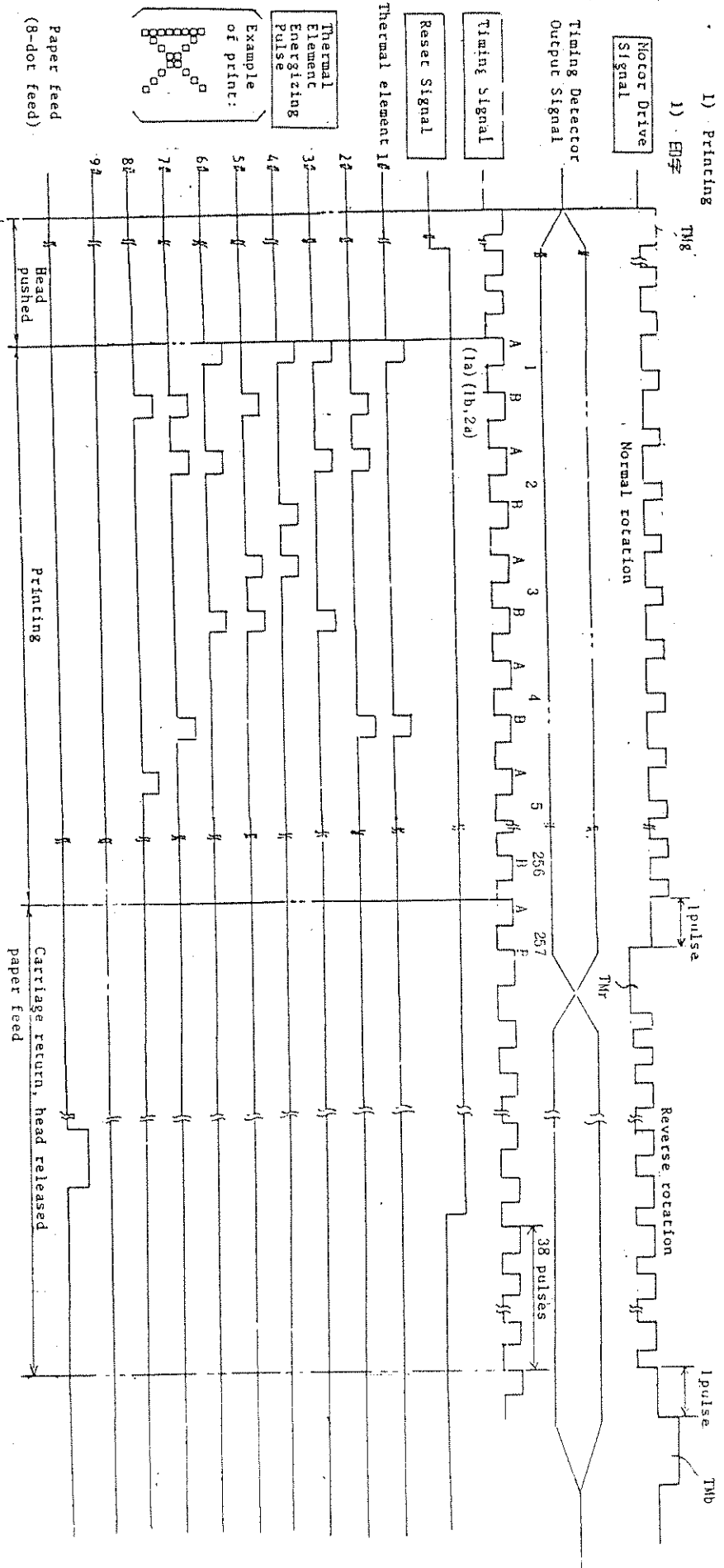
2) Connection

- F.P.C. : F.P.C. is connected directly to the printed circuit board (P.C.B.) or HBLB 12R/S-1J connector is used. (BURNDY JAPAN CO.,LTD.)

- Jumper wires : Jumper wires are connected directly to P.C.B. or either of the following connectors is used:
 - ① HBRB 6R-1J (by BURNDY JAPAN CO., LTD.)
 - ② W-D0606#1 (by Showa Musen Kogyo Co., Ltd.)

2. 12 Timing Chart (Graphic Mode)

1) Printing



Paper feed (8-dot feed)

EPSON
EPSON CORPORATION

TITLE

Model-1221

DWG. NO.

REV
DATE
PAGE: 26

Note: The signals enclosed in are to be provided by the customer.

