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micro dot printer

M - 190

Specification

STANDARD	
REV. No.	REV. A
Created or updated date	Jun.26,1991
Notes	

EPSON

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SUMMARY

The M-190 is a mechanical dot printer with a print head consisting of 8 print solenoids arranged in a horizontal line. The print head moves horizontally to print each dot line.

The print head which moves horizontally and performs uni-directional printing as each print solenoid is energized in order.

Paper is automatically fed one pitch when the print head returns. The desired print format is obtained by repeating this operation.

The M-190 has the following features:

1. Clear print quality from the impact dot printing system.
2. Ultra compact (height: 15.8 mm), light weight (100 g), and high reliability (MCBF: 1,500,000 lines).
3. Can be driven using Ni-Cd batteries.
4. Low running cost is obtained by using normal paper and a long-life ribbon (ERC-22).
5. Copies are possible (one original + one copy)
6. Fast paper feed and paper release mechanism.
7. Graphic characters can be printed.
8. An exclusive LSI chip can be used.
9. Various options are available (see below).

Options

Item	Specifications	Note
Ribbon cassette	ERC-09 (purple)	Life: Approx. 250,000 characters
	ERC-09 (black)	Life: Approx. 200,000 characters
	ERC-22 (purple)	Life: Approx. 1,000,000 characters
	ERC-22 (black)	Life: Approx. 600,000 characters
Manual feed knob	Horizontal type	Outside diameter: ø 20 mm
	Vertical type	Outside diameter: ø 22 mm

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1. GENERAL SPECIFICATIONS

1.1 Print Method

Impact dot matrix printer (8 print solenoids)

1.2 Print Format

1) Total number of dots: Maximum 144 dots/dot line

2) Number of columns: Maximum 24 (5 × 7 dot matrix and 1 dot column space)
(3 columns/print solenoid × 8)

1.3 Printing Speed

1) 1 dot line: Typ. 50 ms (at 4.8 VDC, 25°C, continuous printing)

2) 5 × 7 dot matrix (3-dot line spacing):
2.5 lines/sec ± 15% (at 4.8 VDC, 25°C, continuous printing)

1.4 Character Size

1) Dot pitch: Horizontal; 0.33 mm, Vertical; 0.37 mm

2) 5 × 7 dot matrix: 1.7 mm (W) × 2.6 mm (H)

1.5 Coping Capability

1 original + 1 copy

1.6 Paper

Normal paper or the specified pressure sensitive paper of 57.5 mm wide.

1.7 Paper Feed

Paper is automatically fed every dot line.

Fast paper feeding is possible (6.0 lines/sec ± 15% (at 4.8 VDC, 25°C, continuous printing))

With paper release mechanism.

1.8 Inking

Ribbon cassette (ERC-09 or ERC-22)

Ribbon is automatically fed while motor is rotating.

1.9 Motor

1) Terminal voltage: $4.8 \pm {}^{0.7}_{1.0}$ VDC (Ni-Cd battery, nominal voltage 4.8 V)

$4.8 \pm {}^{0.4}_{1.0}$ VDC (when stabilized power supply is used)

2) Mean current: Typ. 0.35 A (4.8 VDC, at 25°C, as measured with an ammeter)

1.10 Timing Detector

Tachometer-generator (connected directly to the motor)

1.11 Reset Detector

Reed switch

1.12 Print Solenoid

1) Terminal voltage $4.8 \pm {}^{0.7}_{1.5}$ VDC (Ni-Cd battery, nominal voltage 4.8 V)

$4.8 \pm {}^{0.4}_{1.5}$ VDC (when stabilized power supply is used)

(However, the print solenoid terminal voltage and motor terminal voltage should satisfy the voltage relationship shown in Section 2.8.1)).

2) DC resistance: 1.3 Ω ± 10% (at 25 °C)

1.13 Fast Paper Feed Trigger Solenoid

1) Terminal voltage $4.8 \pm {}^{0.7}_{1.0}$ VDC (Ni-Cd battery, nominal voltage 4.8 V)

$4.8 \pm {}^{0.4}_{1.0}$ VDC (when stabilized power supply is used)

(Use the same power supply as that for the motor so that the terminal voltages match.)

2) DC resistance: 20 Ω ± 10% (at 25 °C)

1.14 Connection

1) Printer side: P.C.B. fixed to the frame (with 2.5 mm pitch copper pattern)

2) Circuit side: Flat cables or lead wires

1.15 Operating Ambient Temperature

0 to 50°C

1.16 Reliability

M.C.B.F.: 1,500,000 lines

Printer life: 2,250,000 lines

Provided that during the M.C.B.F. and Life time, Print Example in Attached Figure 1 is printed.

Also, when one of the following parts or units fails, the printer is considered to have reached the end of its life.

(Head unit, head cam unit, motor)

Reference:

Reliable Period: 1,500,000 lines

Cumulative failure rate during the Reliable Period

F(t) = 30%/1,500,000 lines

1.17 Overall Dimensions

91 mm (W) × 46.9 mm (D) × 15.8 mm (H) (excluding manual feed knob)

1.18 Weight

Approx. 100 g

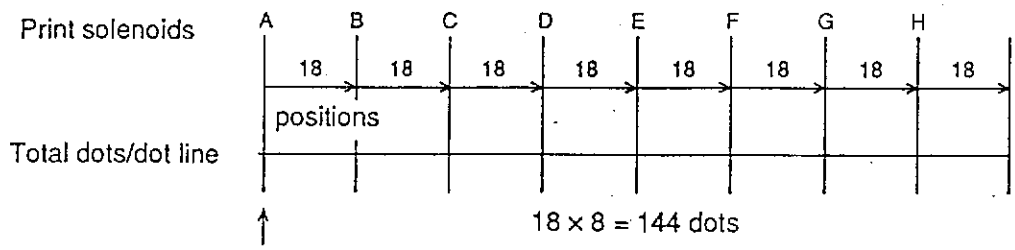
NOTE: Terminal voltage is the voltage at the printer board terminal, and it is the voltage which should be ensured after the voltage on the drive circuit side drops due to energizing.

2. DETAILED SPECIFICATIONS

2.1 Print Format

The print head consists of 8 print solenoids (A, B, C, D, E, F, G and H) arranged in a horizontal line.

The print head moves from the left (from the standby position) to the right, printing at 18 positions as each print solenoid is energized, so that one dot line is formed. The total number of dots per dot line is 144 (18 positions × 8 solenoids).

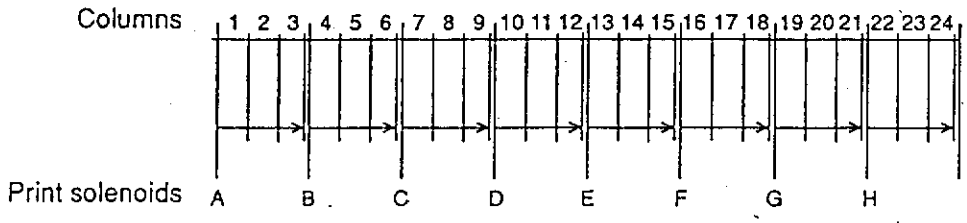


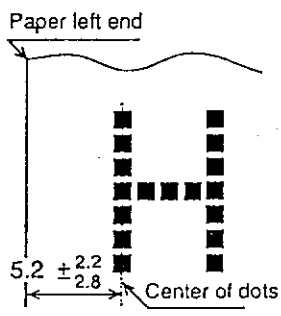
Indicates the standard dot position

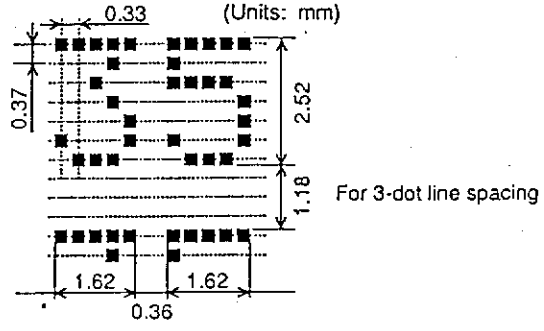
5 × 7 Dot matrix:

Divide 18 positions by three. Out of 6 dots, use 5 dots for printing and 1 dot for column space. By repeating this 7 times in the vertical direction (paper feed direction), a 5 × 7 dot matrix of 24 columns (3 columns × 8 solenoids) can be obtained.

(5 + 1) × 24 = 144 dots/dot line







<Terms> Room temperature and normal humidity
When paper is fed under normal conditions, the paper edge should not fold.

NOTE: The values above are design values. Therefore the dot blur is not being considered.

For 1-dot column spacing

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2.2 Paper Feeding

1) When printing: Paper is automatically fed one pitch (0.37 mm) when the print head returns.

2) Space feed

(a) One pitch feeding: Same as when printing

(b) Fast feeding: Paper is fed three pitches when the print head goes back and forth by driving the fast paper feed trigger solenoid.

3) Paper release mechanism: Paper can be pulled out (straight forward or backward) by stopping the motor quickly while satisfying the requirements given in Section 2.7.1), because the paper release mechanism operates.

NOTE: 1. When the motor halts without satisfying the requirements given in Section 2.7.1), the paper release mechanism won't operate.

4) Manual feed knob: Paper can be fed forward or backward by rotating the manual feed knob when the printer is halted and the paper released.

NOTES: 1. If the paper release mechanism does not operate, paper cannot be fed backward with the manual feed knob.

2. Nothing shall touch (so as to resist rotation) the manual feed knob during printer operation.

2.3 Ribbon Cassette

Two types of ribbon cassettes (ERC-09 and ERC-22) can be used with the M-190.

Refer to Section 5 (RIBBON CASSETTE SPECIFICATIONS) for more detailed specifications.

2.4 Paper

1) Type: Normal or specified pressure sensitive paper
(For specified pressure sensitive paper, refer to Section 3 (PRESSURE SENSITIVE PAPER SPECIFICATIONS.))

2) Form (normal paper): 57.5 ± 0.5 mm (width) × ø 83 + 0 mm (outside diameter)
× ø 10 - 0 mm (inside diameter)

NOTE: Inside end of paper roll should meet the following conditions:

1. No fold is allowed. The paper must be wound so that the paper edge goes along the internal circumference. (Refer to Figure A below.)
2. No folding back is allowed.
3. Inside end must not be glued to the core. (when a core exists).

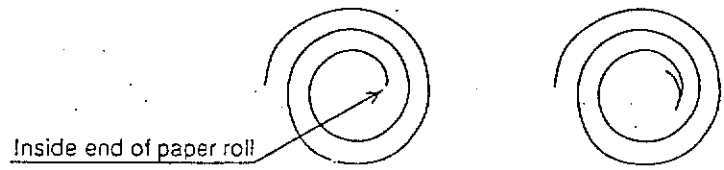


Figure A Incorrect

3) Paper supply load: The paper supply load at the paper entrance should be 30 g or less.

4) Paper thickness (normal paper):
0.06 to 0.085 mm

5) Weight (normal paper): 52.3 to 64g/m² (45 to 55 Kg/1000 sheets/1091 mm × 788 mm)

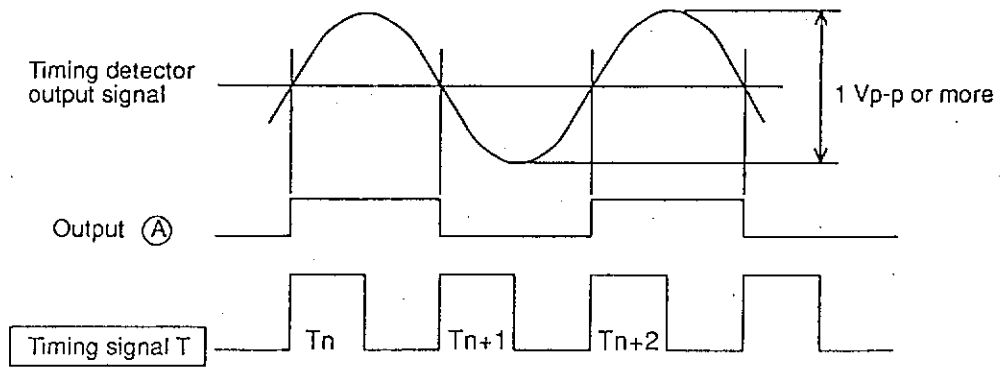
6) Others: No gluing at either side of roll paper.

2.5 Timing Detector

The timing detector is a tachometer-generator that is connected directly to the motor. It generates 90 output pulses per 1 dot line; 54 pulses correspond to the printing area and 36 correspond to the print head return. The pulses are used to control print head energizing, and are to be wave-shaped on the user side. The pulses constitute timing signal T.

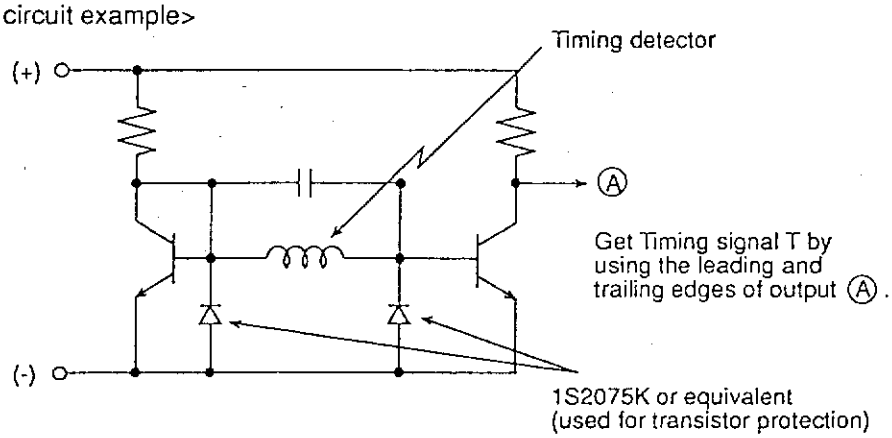
1) Timing pulses: Timing signal T should be obtained using a threshold level of 0 ±0.1 V on the timing detector output signal.

2) Output waveform:



Signals in ☐ should be provided from the user side.

<Waveform shaping circuit example>



NOTE: Be sure to use a diode for protection (in case the output voltage becomes 10 Vp-p or more).

2.6 Reset Detector

This detector is a reed switch that closes once for each dot line. The reset detector output signal (reset signal R) is used to reset the counting of timing signal T for each printing cycle of either characters or graphics.

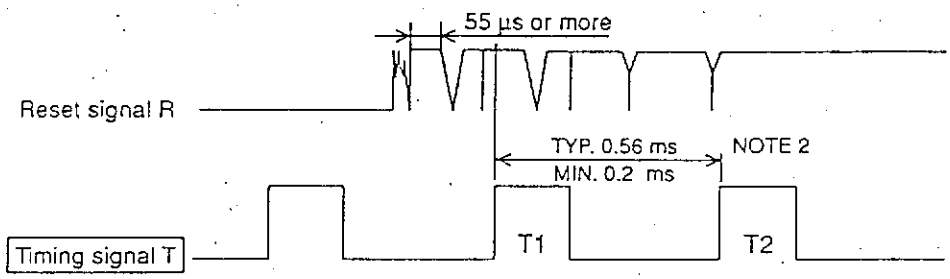
※ For printing one character line (ex. 5 × 7 dot matrix), reset signal R is detected only when timing signal T1 is detected, and printing is controlled by the count of timing signal T until one character line is completed.

(Refer to Section 2.13.)

1) Reset signal R: The reset detector output signal is confirmed when the reed switch closes for 55 μ s or more, and is denoted as reset signal R.

2) Rating:
Rated voltage: 2.85 to 10 VDC
Rated current: 20 to 1000 μA
Instantaneous power (Maximum value of open/close capacity):
5 mW (resistive load)

3) Waveform phase:



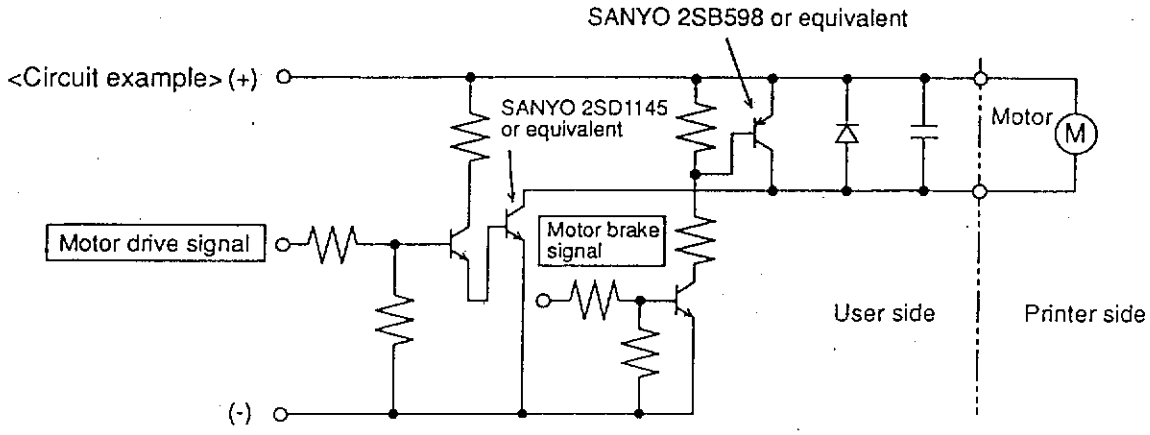
NOTES: 1. Signals in ▭ should be provided from the user side.
2. During constant motor speed (except for the period from motor start-up to generation of reset signal R1)

2.7 Motor

1) Driving and braking:

Energize the motor driving signal to start a stopped motor.

Shut off the motor drive signal within 0.5 ms from the leading edge of reset signal Rn (Rn is R10 for the 5 × 7 dot matrix and 3-dot line spacing), short circuit the motor terminals with a transistor by energizing the motor braking signal (100 ms or more), to quickly stop the motor. If the motor is not stopped quickly, the paper release mechanism will not work.



NOTES: 1. Signals in ☐ should be provided from the user side.
2. Use a low-saturation transistor for motor driving/braking.

2) Stopping due to an abnormality:

Refer to Sections 2.10 and 2.11.

3) Terminal voltage:

$4.8 \pm {}^{0.7}_{1.0}$ VDC (Ni-Cd battery, nominal voltage 4.8 V)

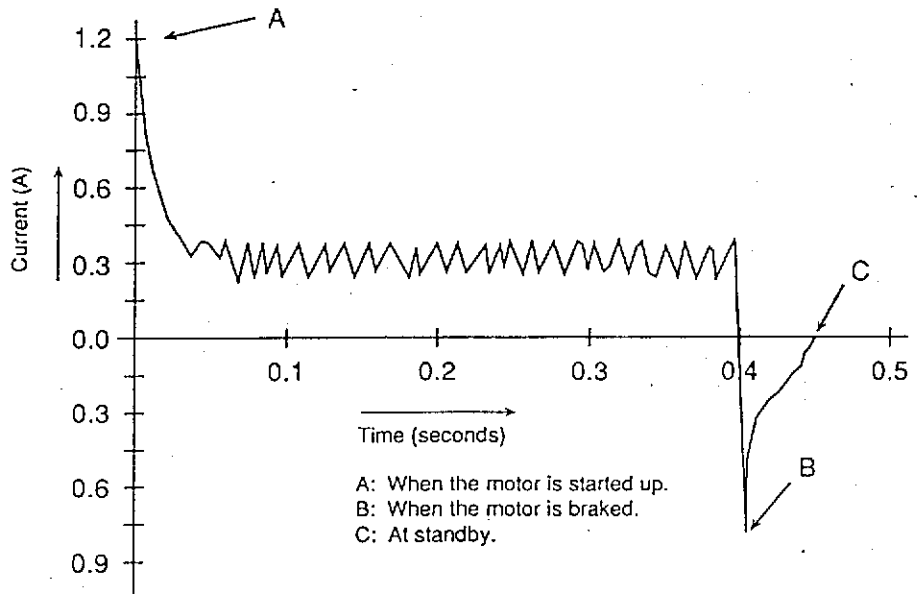
$4.8 \pm {}^{0.4}_{1.0}$ VDC (when stabilized power supply is used.)

4) Current:

(a) Peak current: Typ. 1.2 A (4.8 VDC, 25°C)
(Worst case: 1.8 A or less)

(b) Mean current: Typ. 0.35 A (4.8 VDC, 25°C, as measured with an ammeter)

(c) Current waveform: Refer to Figure below. (4.8 VDC, 25°C)



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2.8 Print Solenoids

Dot printing is performed by energizing the print solenoids.

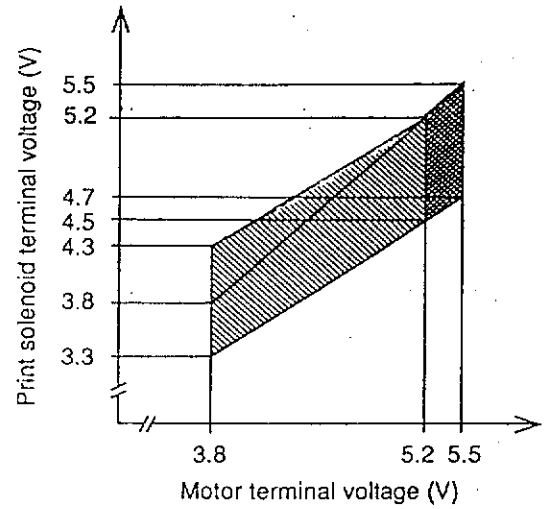
1) Terminal voltage: $4.8 \pm {}^{0.7}_{1.5}$ VDC (Ni-Cd battery, nominal voltage 4.8 V)

$4.8 \pm {}^{0.4}_{1.5}$ VDC (when stabilized power supply is used.)

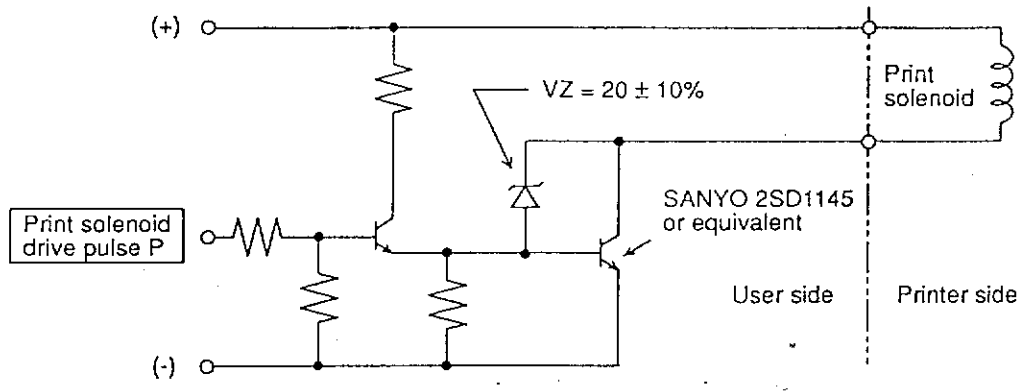
The print solenoid terminal voltage and motor terminal voltage should satisfy the voltage relationship shown by ▨ in the following figure.

Refer to Section 3 when using the specified pressure sensitive paper.

The shaded area shown by ▨ is available only when using Ni-Cd battery.



<Circuit Example>



NOTES:
1. Use a low-saturation transistor for driving the print solenoids.
2. The Zener diode for current suppression should be able to handle the maximum collecter-emittor rating of the print solenoid drive transistor.
3. Print solenoid drive pulse P should not shut off due to noise.
4. Up to 3 print solenoids may sometimes be energized at the same time. Therefore, when using transistor arrays, it is better not to connect A, D and G to the same array. (The same holds for B, E and H, and C and F.)

2) DC resistance: 1.3 Ω ± 10% (25°C)

3) Peak current: Typ. 2.5 A/solenoid (4.8 VDC, 25°C)

Max. 3.6 A/solenoid (5.5 VDC, 0°C)

4) Pulse width: From the leading edge of timing signal Tn to the leading edge of timing signal Tn+1 (see following Figure).

5) Power consumption: Typ. 4.5 mJ/dot (4.8 VDC, 25 °C)

Max. 9.1 mJ/dot (5.5 VDC, 0 °C)

6) Energizing duty: 1/3

7) Number of solenoids energized at the same time:

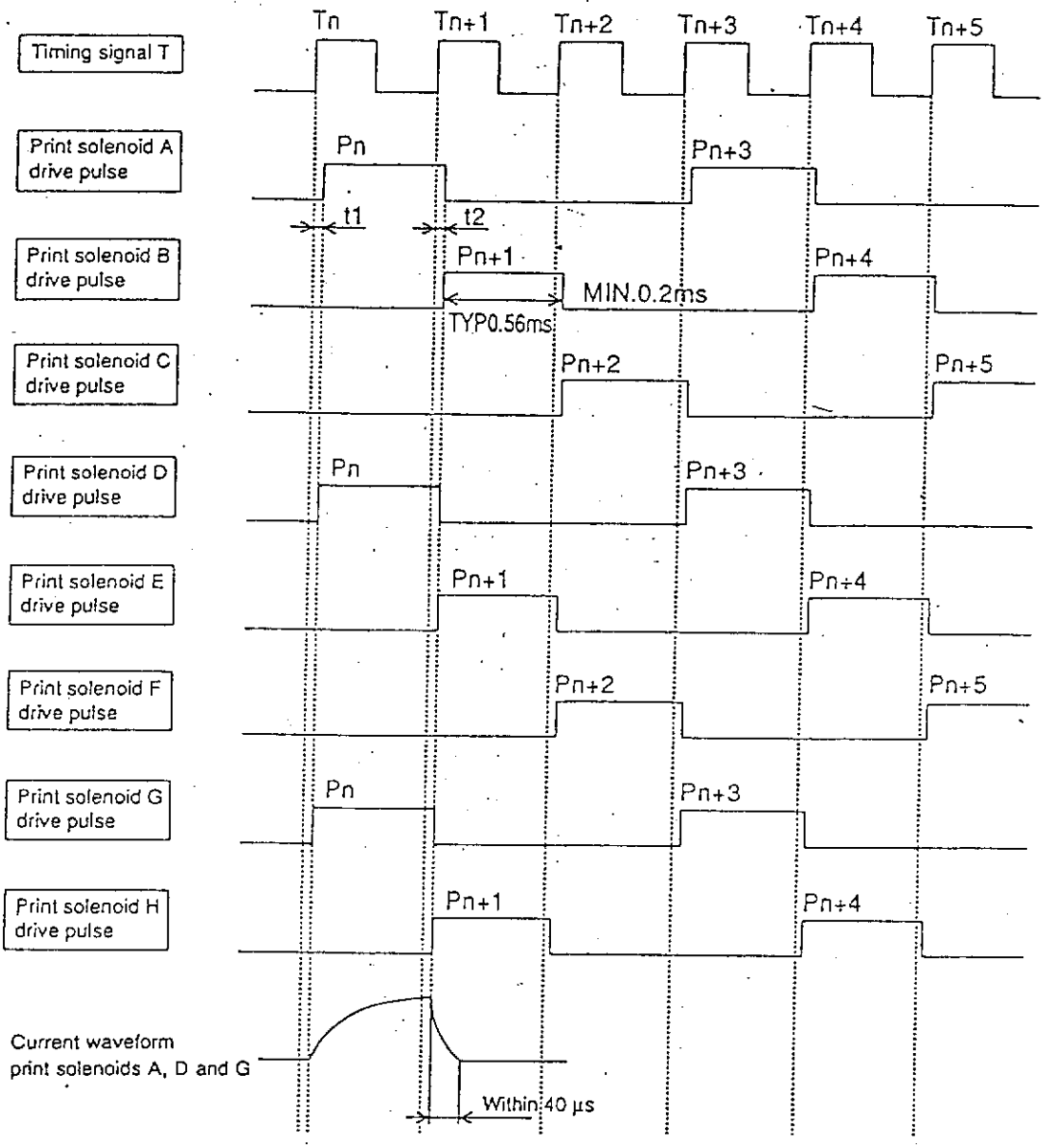
Max. 3

8) Continuous energizing: One print solenoid can be energized continuously up to 400 dot lines (6× 3× 400 = 7200 dots). However, the non-energized time should always be twice as long as the continuous energized time.

9) Current suppressor: Should be prepared on the user side.

10) Solenoid protection for abnormal conditions:

Refer to Sections 2.10 and 2.11.



Signals in ☐ should be provided from the user side.

NOTES: 1. t1 = t2 ≤ 50 µs

2. For printing, print solenoids A, D and G are energized with drive pulse Pn which has the pulse width of timing signal Tn to Tn+1. Next, print solenoids B, E and H are energized with drive pulse Pn+1 which has a pulse width equal to timing signal Tn+1 to Tn+2. In the same way, print solenoids C and F are energized with drive pulse Pn+2, and then print solenoids A, D and G are energized with drive pulse Pn+3. The 8 solenoids should be driven in the order (A, D, G) - (B, E, H) - (C, F).

2.9 Fast Paper Feed Trigger Solenoid

Paper is fed at high-speed (three pitches when print head returns) by energizing the fast paper feed trigger solenoid during the period of time from the leading edge of timing pulse Tf1, which is generated first after reset pulse R, to the leading edge of timing pulse Tf6 which is the 5th pulse from Tf1.

The same paper feed operation can be performed in the 5 × 7 dot matrix (line space: 3 dots) printing mode by driving the fast paper feed trigger solenoid during the period from the leading edge of T631 to the leading edge of T636.

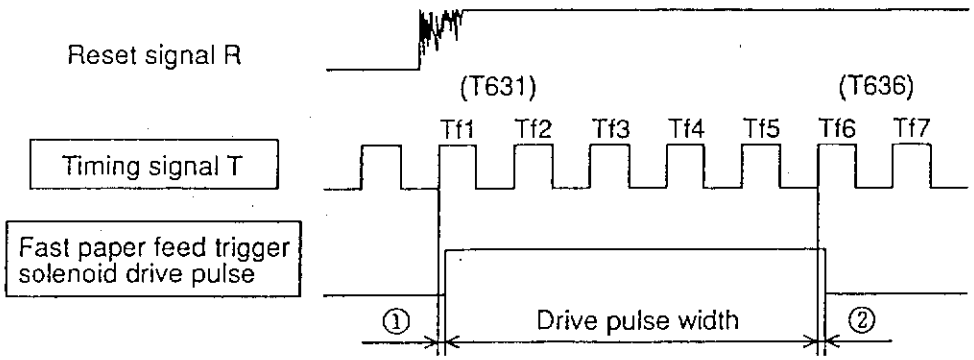
1) Terminal voltage: $4.8 \pm {}^{0.7}_{1.0}$ VDC (Ni-Cd battery, nominal voltage 4.8 V)

$4.8 \pm {}^{0.4}_{1.0}$ VDC (when stabilized power supply is used.)

(Use the same power supply as that for the motor so that the terminal voltages match.)

2) DC resistance: 20 Ω ± 10% (at 25 °C)

3) Drive pulse width:



Signals in ▭ should be provided from the user side.

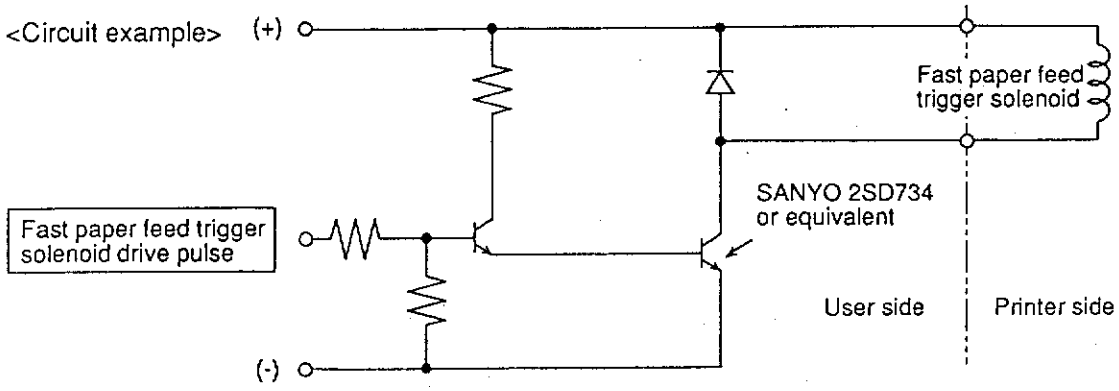
Numbers in ( ) denote timing pulses when fast paper feed is performed in 5 × 7 dot matrix with 3-dot line spacing mode.

① Delay in starting drive pulse: 0.1 ms or less

② Delay in stopping drive pulse: 0.1 ms or less

4) Drive circuit: A diode is used as a current suppressor and it should be prepared on the user side.
(1S2075K or equivalent)

<Circuit example>



NOTES: 1. The fast paper feed trigger solenoid should not be disturbed or stopped by noise.
2. Use a low-saturation transistor to drive the fast paper feed trigger solenoid.

5) Protection of fast paper feed trigger solenoid against abnormalities:

Refer to Sections 2.10 and 2.11.

2.10 Detection of Abnormal Printer Conditions

1) Detection of abnormal conditions:

Abnormal printer conditions are detected by monitoring the period of timing signal T. When the period is more than 2.8 ms, the printer is considered to be in an abnormal condition.

However, for a period of 100 ms after energizing the motor drive signal or after energizing the motor brake signal, the monitoring of timing signal T should be suspended.

2) Handling abnormal conditions:

Whenever an abnormal condition is detected, the motor, print solenoid, and fast paper feed trigger solenoid drive signals should be immediately shut off.

Allowable delay until shut off:

Motor:	1 sec. or less
Print solenoid:	Refer to Section 2.11.
Fast paper feed trigger solenoid:	Refer to Section 2.11.

3) Procedure after abnormal conditions:

Check whether or not a paper jam has occurred or if a foreign object has fallen into the printer. If a paper jam or foreign object is present, remove it and restart the printer.

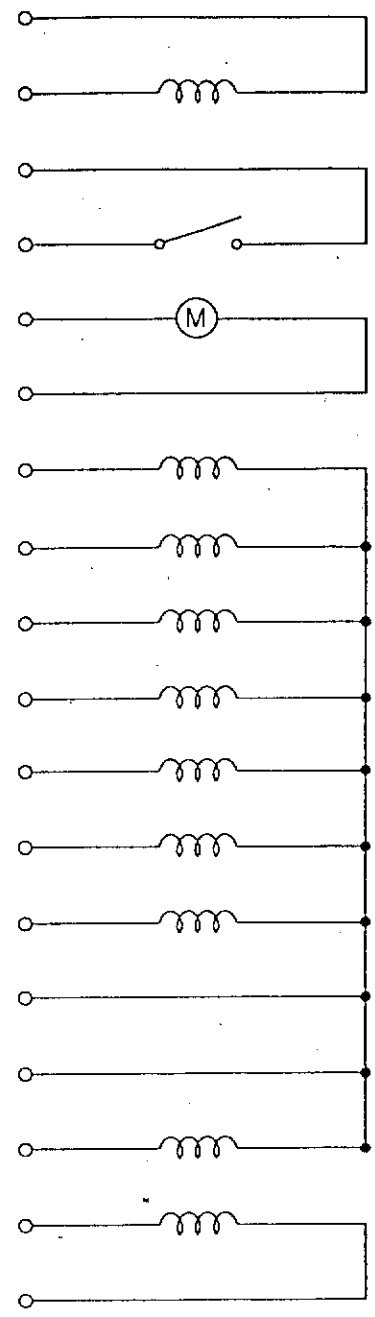
2.11 Maximum Allowable Continuous Energizing Time

The continuous energizing time (including the abnormal condition of Section 2.10) should never exceed the time shown below.

Print solenoid:	1 sec.
Fast paper feed trigger solenoid:	5 sec.

2.12 Terminal Assignment

Connection	Terminal No.
Fast paper feed trigger solenoid	1
Fast paper feed trigger solenoid	2
Reset detector	3
Reset detector	4
Motor (+)	5
Motor (-)	6
Print solenoid (B)	7
Print solenoid (C)	8
Print solenoid (D)	9
Print solenoid (E)	10
Print solenoid (F)	11
Print solenoid (G)	12
Print solenoid (H)	13
Common for print solenoids	14
Common for print solenoids	15
Print solenoid (A)	16
Timing detector	17
Timing detector	18



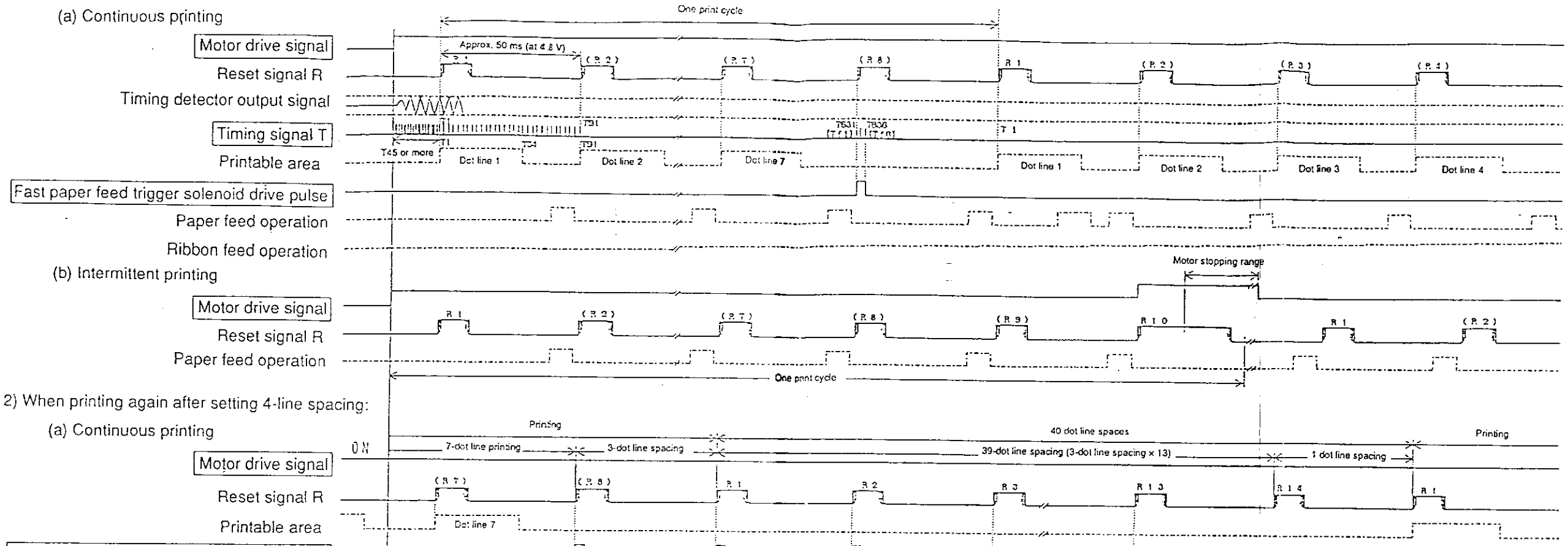
NOTE: 1. Terminals are numbered 1, 2, ... 18 from the left side of the edge-connector pattern on the board.

2.13 Timing Chart

2.13.1 Timing chart diagram (5 × 7 dot matrix)

1) For 3-dot line spacing:

(a) Continuous printing

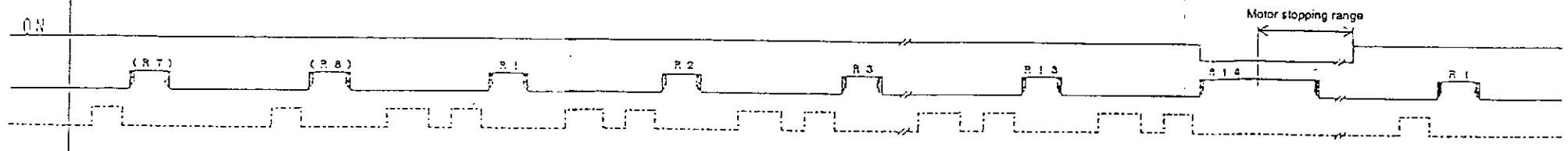


(b) Intermittent printing

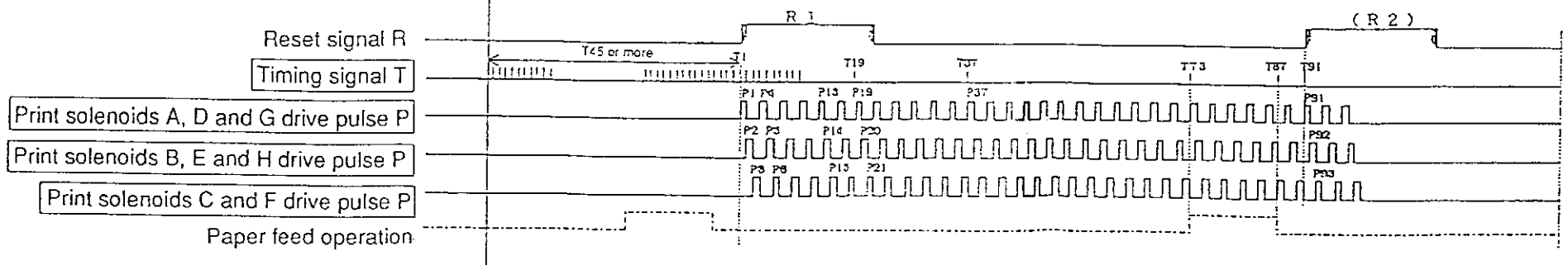
2) When printing again after setting 4-line spacing:

(a) Continuous printing

(b) Intermittent printing



3) Expanded scale



NOTES:
1. ( ) are not necessary under normal conditions.
2. Numeric values in [ ] denote the timing pulse when reset pulse R8 is detected.
3. Signals in ▭ should be provided from the user side.

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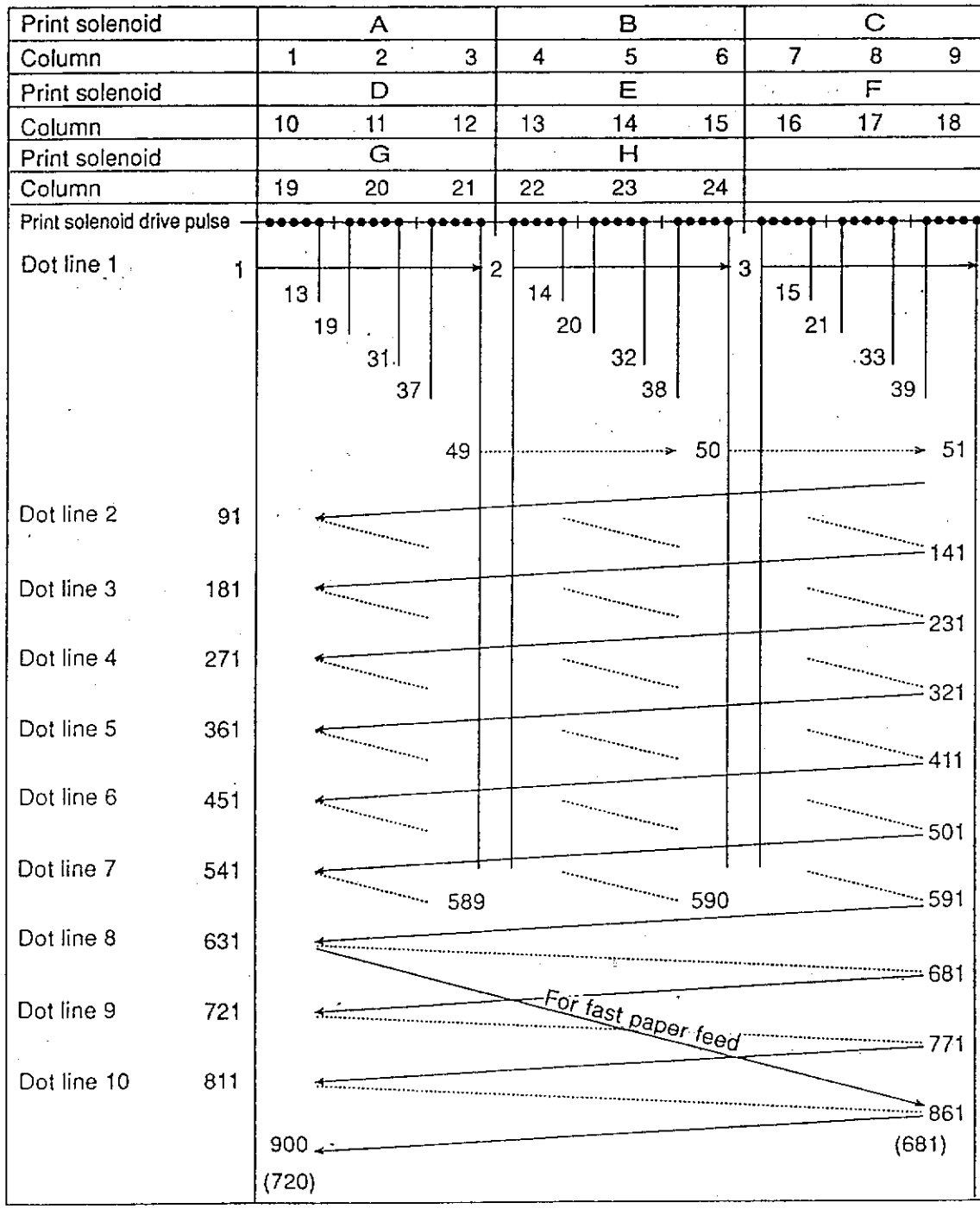
2.13.2 Detailed timing signal T distribution (5 × 7 dot matrix, 3-dot line spacing)

NOTE: ( ) in the figure denote the number of timing pulse T in the case of fast paper feed by energizing the fast paper feed trigger solenoid at dot line 8.



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2.13.3 Description of operation (5 × 7 dot matrix)

1) In case of 3-dot line spacing:

(a) Continuous printing

① Count the number of timing pulses after starting up the motor. Check whether or not reset signal R is generated during the period from the leading edge of timing signal 44 to the leading edge of timing signal 45. Then, follow a) or b) below.

a) When reset signal R isn't generated:

Hereafter, the first reset signal R is taken to be R1, and the first timing pulse after R1 is T1.

b) When reset signal R is generated:

Start counting the timing pulses from the next one. The reset signal R arising after the number of timing pulses reaches 45 is R1, and the first timing signal after the rising edge of R1 is T1.

② The left-most upper dot of the 1st, 10th and 19th columns is printed by applying drive pulse P1 of T1 to T2 to print solenoids A, D and G.

③ The left-most upper dot of the 4th, 13th and 22nd columns is printed by applying drive pulse P2 of T2 to T3 to print solenoids B, E and H.

④ The left-most upper dot of the 7th and 16th columns is printed by applying drive pulse P3 of T3 to T4 to print solenoids C and F.

⑤ The above procedure is repeated, and when drive pulse P51 of T51 to T52 is applied to print solenoids C and F, the upper-right dot of the 9th and 18th columns is printed.

⑥ One dot of character space is obtained for the right-most column <(3, 12, 21), (6, 15, 24), (9, 18)> of each print solenoid. Paper is automatically fed one dot when the print head returns during the time from T55 to T90, and this completes the printing of one dot line.

⑦ Afterward, counting of timing pulses is continued (T91, T92, ...), and printing is carried out up to dot line 7. The right-most lower dot of columns 9 and 18 is printed by applying drive pulse P591 (from T591 to T592) to print solenoids C and F. This completes the printing of the 5 × 7 dot matrix.

⑧ Continue to count the timing pulses, and drive the fast paper feed trigger solenoid for the period from the leading edge of timing pulse T631 in dot line 8 to the leading edge of T636 which is the 5th pulse from T631. Fast paper feed is performed (3 pitches while print head moves back and forth) and thus 3-dot line spacing is obtained.

⑨ Printing of the next line is started with R1, which is the next reset signal generated after timing pulse T664 in dot line 8.

※ From ⑧ on, the fast paper feed trigger solenoid can be energized using reset pulse R as a reference.

⑧' The reset pulse generated after timing pulse T574 of dot line 7 is detected. After this detection, the first timing pulse is Tf1, and fast paper feed is performed by driving the fast feed trigger solenoid during the period from the leading edge of Tf1 to that of Tf6.

⑨' The timing pulses used for driving the fast feed trigger solenoid are counted continuously, and the reset pulse after Tf34 is taken as R1, after which printing is started.

(b) Intermittent printing

① Same as Step ① to ⑦ of 2.13.3 1) (a).

② In dot lines 8 and 9, the fast feed trigger solenoid is not driven, and the paper is fed automatically. The reset pulse generated after timing pulse T754 is R10, and the motor is stopped quickly after this reset pulse.

③ Repeat Steps ① and ②.

2) When printing again after setting n-line spacing:

(a) Continuous printing

① Same as Step ① to ⑧ of 2.13.3 1) (a).

② Printing of the next line started with the next reset pulse (R1) generated after timing pulse T664 (or Tf34) in dot line 8. The paper is fed at fast-speed (in the same manner as 2.13.3 1), (a)-⑧ m times units Rm. (m is obtained from formula 1.)

③ The fast paper feed trigger solenoid is not energized, and paper is fed automatically until R(m+a+1) while counting reset pulses.

④ Printing of the next line is started with R(m+a+1) as R1.
$(10 \times n)/3 = m$, remainder a -- (formula 1)
where n: number of space lines
m, a: integer values

(Example)

To feed paper for 4 lines (40 dot lines)
$n = 4 \rightarrow m = 13 \Rightarrow Rm = R13 \Rightarrow$ Fast paper feed 13 times
$a = 1$ R(m+a+1) = R15 = The R1 pulse for the next line

(b) Intermittent printing

① Same as Step ① to ⑧ of 2.13.3 1) (a).

② Printing of the next column is started with the next reset pulse as R1 that is generated after timing pulse T664 (or Tf34) in dot line 8. The paper is fed at fast-speed (in the same manner as 2.13.3 1) (a), Step ⑧) m times until Rm. (m is obtained from formula 2 below.)

③ The fast paper feed trigger solenoid is not energized, and paper is fed automatically until R(m+a+1) is generated while counting reset pulses. After R(m+a+1) is generated, the motor is stopped quickly.

④ Start printing in the same manner as Steps ① to ⑦ of 2.13.3 1) (a).
(10 × n-1)/3 = m, remainder a – – (formula 2)
where n: number of space lines
m, a: integer values

(Example)

To feed paper for 4 lines (40 dot lines)
n = 4 → m = 13 ⇒ Rm = R13 ⇒ Fast paper feed 13 times
a = 0 R(m+a+1) = R14 ⇒ Reset signal R used to stop the motor quickly.

2.13.4 Bit image printing

When bit image printing is activated, T1 is detected according to the procedure described in 2.13.3 1) (a) Step ① , after which printing is carried out while counting timing pulses until the bit image printing is finished.

※ For the continuous energizing time for the print solenoid, refer to Section 2.8.8).

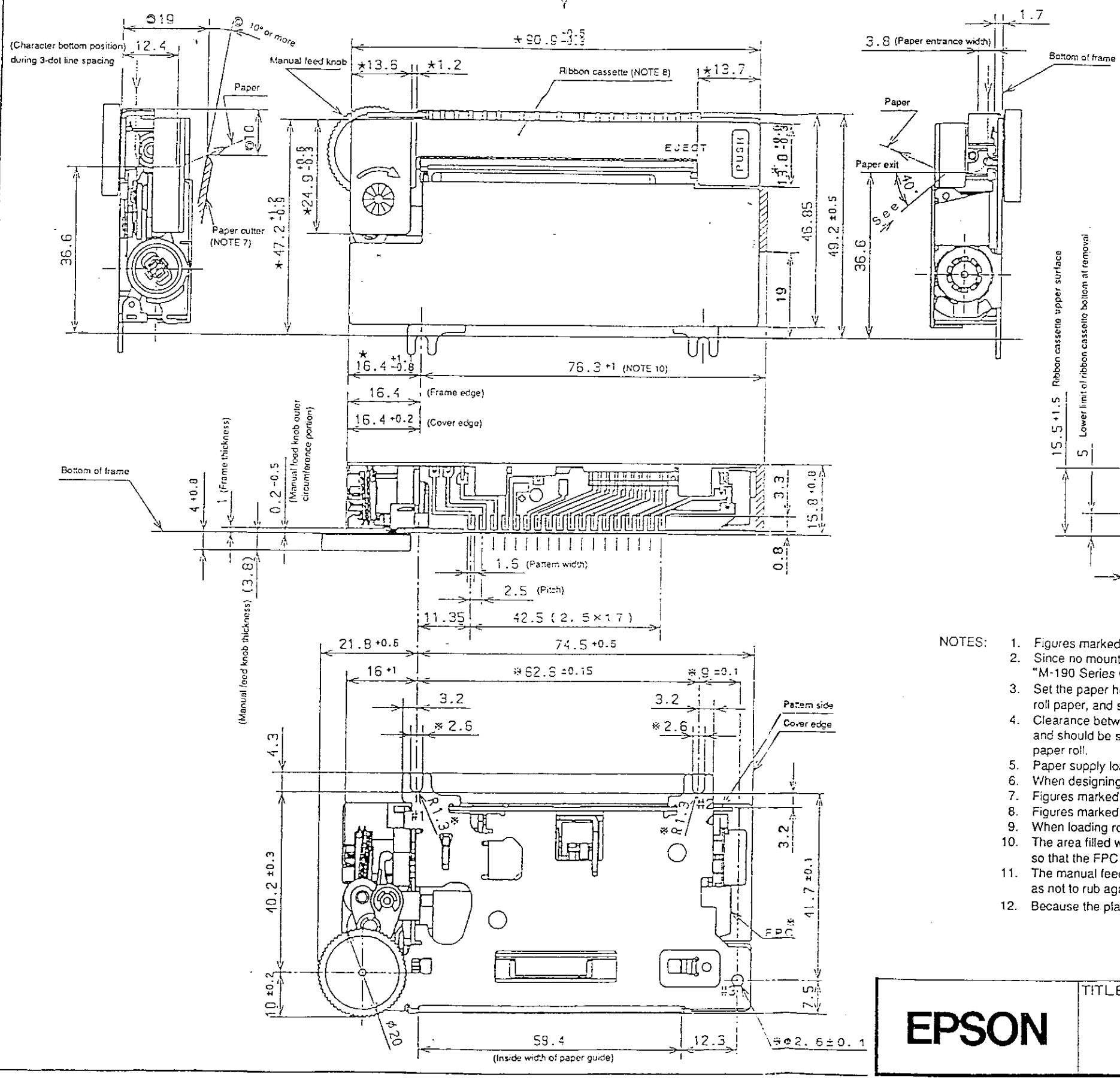
2.13.5 Reset signal R

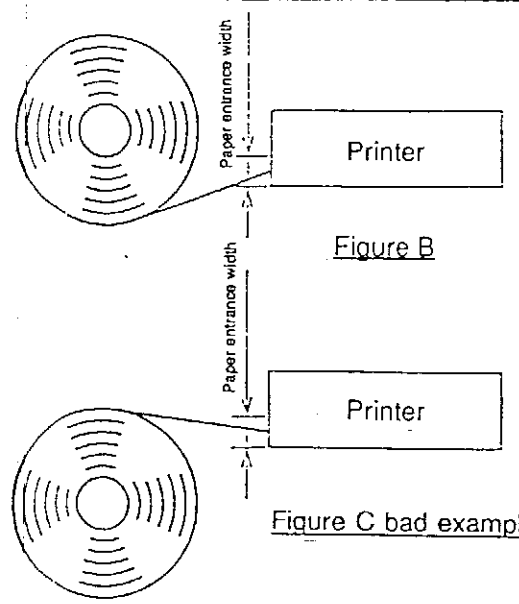
1) After detecting reset pulse R1, reset pulse R which is generated after timing pulse T (90 × (n-2) + 34) is taken as Rn.
2) The initialization procedure for verifying that the print head is in the standby mode is completed automatically by detecting the above R1 pulse. Timing pulse T1, which indicates the standard dot position for each character print cycle, is determined by detecting R1.
3) In standby mode, the reset signal reed switch may be open or closed.

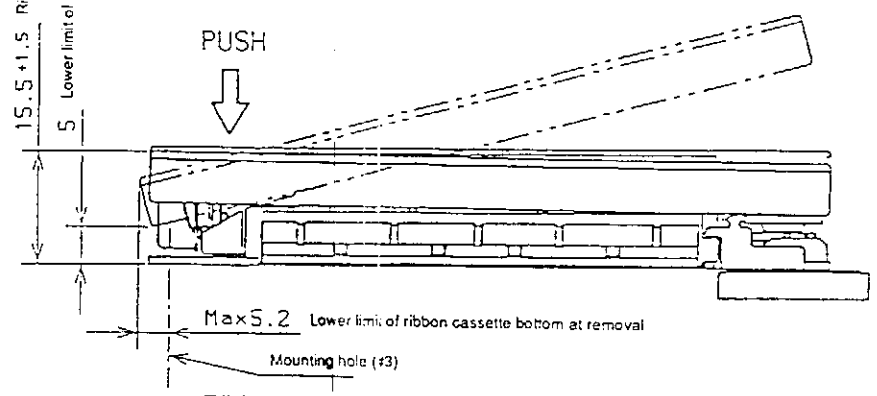
NOTES: 1. Periods when print solenoid must not be energized:
1) From motor start-up to the leading edge of reset pulse R1 (from motor start-up to steady driving)
2) From T55+90n to T90+90n (while print head returns)
(n = 0 to 10, 5 × 7 dot matrix, 3-dot line spacing)
3) From the moment when the fast paper feed trigger solenoid is energized to the next reset pulse.

2. The print solenoid drive pulses should not be activated or stopped by noise.
3. The fast paper feed trigger solenoid drive pulse should not be activated or stopped by noise.
4. The fast paper feed trigger solenoid should not be energized by the reset pulse which turns off the motor drive signal.

2.14 Overall Dimensions 2.14.1 When ERC-09 is mounted







Ribbon cassette removal (as seen from the direction of arrow "A")

NOTES:
1. Figures marked ※ indicate mounting holes.
2. Since no mounting hole is available around the paper feed knob, for printer frame attachment refer to "M-190 Series Outer Case Design Guide".
3. Set the paper holder so that the center of the paper guide inside width is aligned with the center of the roll paper, and so that paper that is 57.5 ± 0.5 mm wide can be guided.
4. Clearance between the paper holder on the case side and the roll paper width must be 2.0 mm or less and should be sufficient so as to prevent the holder from pressing or rubbing against both sides of the paper roll.
5. Paper supply load at Paper Entrance position should be 30g or less.
6. When designing the case, paper cutter position and roll-in protection should be considered.
7. Figures marked "◎" indicate the reference position for adjusting the paper cutter.
8. Figures marked with "★" describe the ribbon cassette (ERC-09).
9. When loading roll paper, use normal curl (see Figure B), not reverse curl (see Figure C).
10. The area filled with oblique lines is where the FPC moves back and forth. The case should be designed so that the FPC does not touch the case.
11. The manual feed knob rotates while the printer is operating. Therefore, the knob should be adjusted so as not to rub against the case or project outside the case. The knob should be protected.
12. Because the plated steel plate is used in this unit, the cut edges may get rusty.

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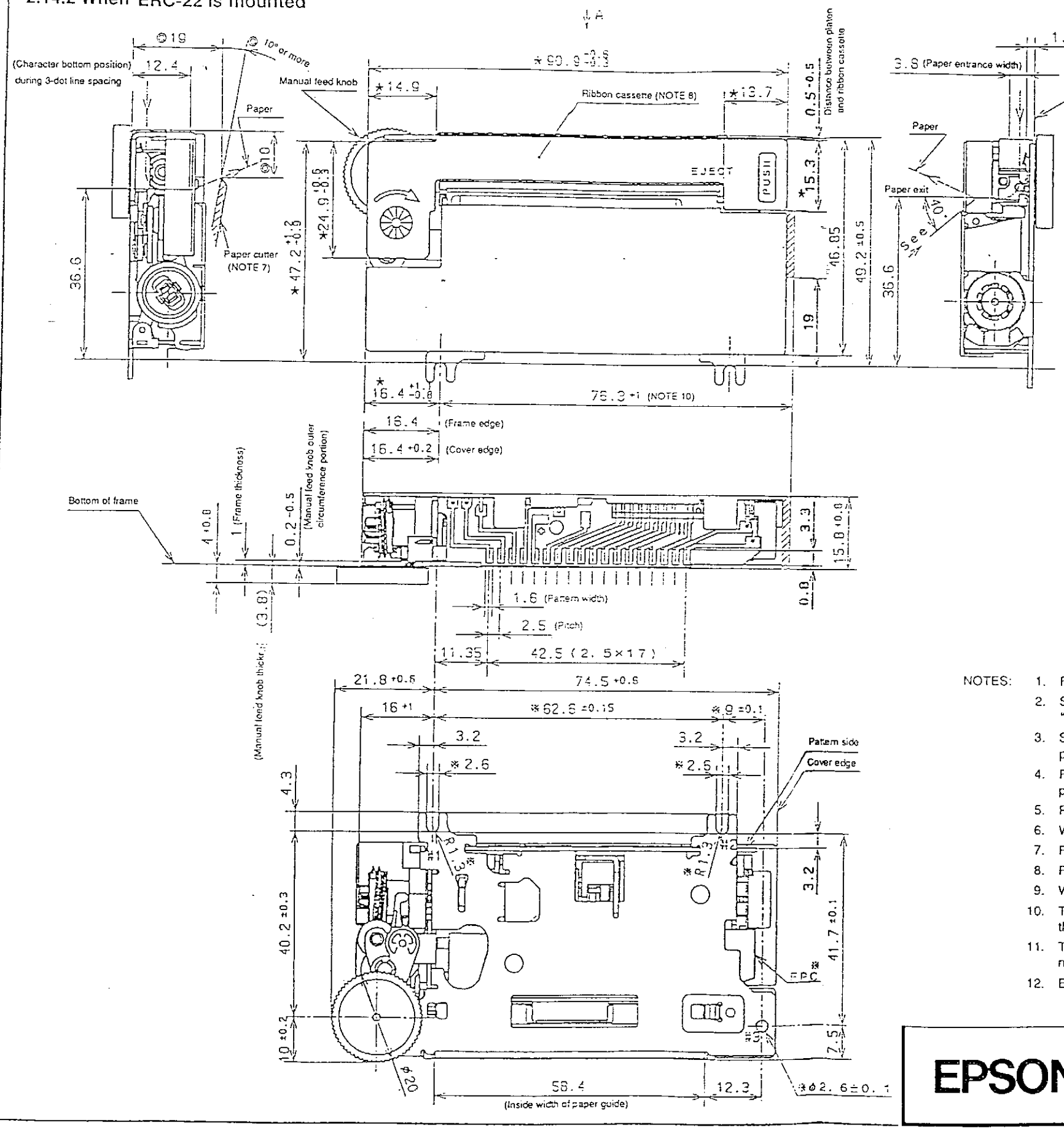
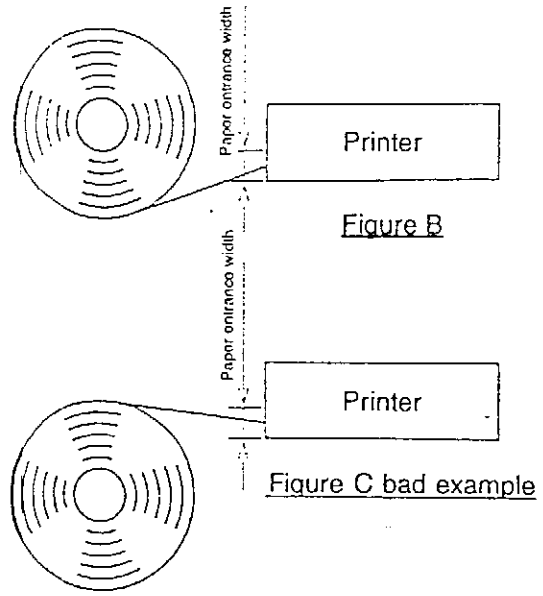
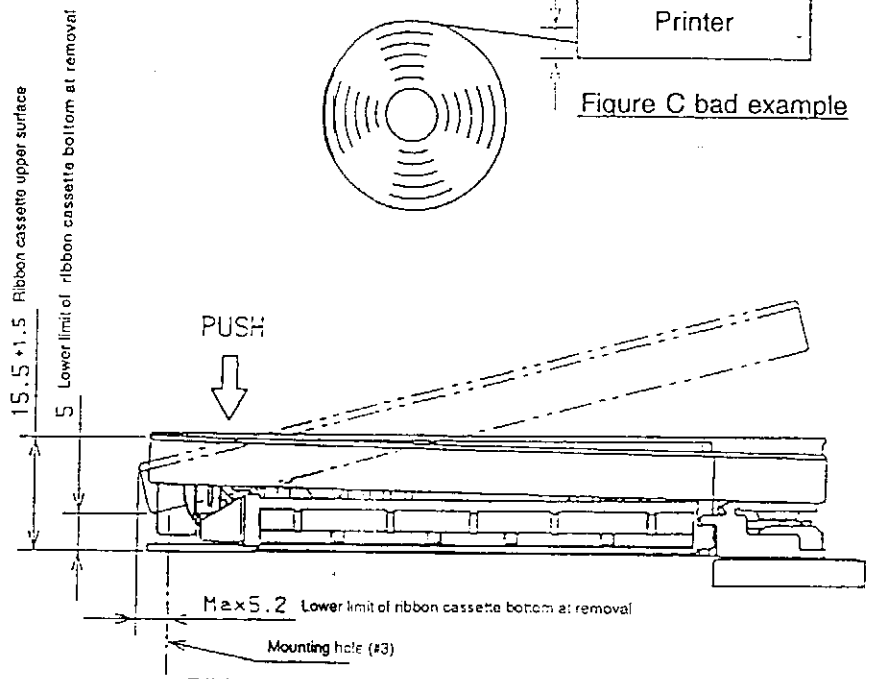
2.14.2 When ERC-22 is mounted







Ribbon cassette removal (as seen from direction of the arrow "A")

NOTES:

1. Figures marked with ※ describe mounting holes.
2. Since no mounting hole is available around the paper feed knob, for printer frame attachment refer to "M-190 Series Outer Case Design Guide".
3. Set the paper holder so that the center of the paper guide inside width is aligned with the center of the roll paper, and so that paper that is 57.5 ± 0.5 mm wide can be guided.
4. Paper holder inside width should not exceed "paper width plus 2.0 mm", but should be sufficient so as t prevent the holder from pressing or rubbing against both sides of the paper roll.
5. Paper supply load at Paper Entrance position should be 30 g or less.
6. When designing the case, the paper cutter position and roll-in protection should be considered.
7. Figures marked "©" indicate the reference position for adjusting the paper cutter.
8. Figures marked "★" describe the ribbon cassette (ERC-22).
9. When loading roll paper, use normal curl (see Figure B), not reverse curl (see Figure C).
10. The area filled with oblique lines is where the FPC moves back and forth. The case should be designed so that the FPC does not touch the case.
11. The paper feed knob rotates while the printer is operating. Therefore, the knob should be adjusted so as not to rub against the case or project outside the case. The knob should be protected.
12. Because the plated steel plate is used in this unit, the cut edges may get rusty.

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3. PRESSURE SENSITIVE PAPER SPECIFICATIONS

3.1 Applied Model

M-190

3.2 Characteristic Items and Tolerances

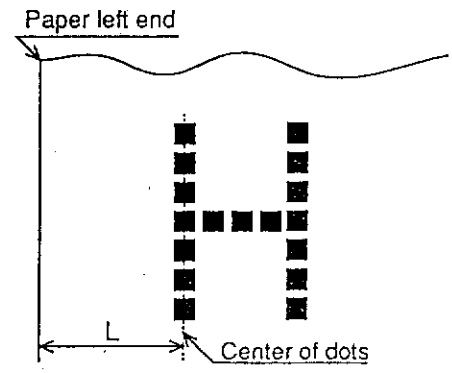
1) Paper feed pitch: 0.37 mm ± 15% per 1-dot line

2) Print starting position: $L = 5.2 \pm^{2.2}_{2.8}$ mm from the left end of the paper

<Conditions>

Room temperature and normal humidity

On condition that paper without any folded edges is fed in the normal operating environment.

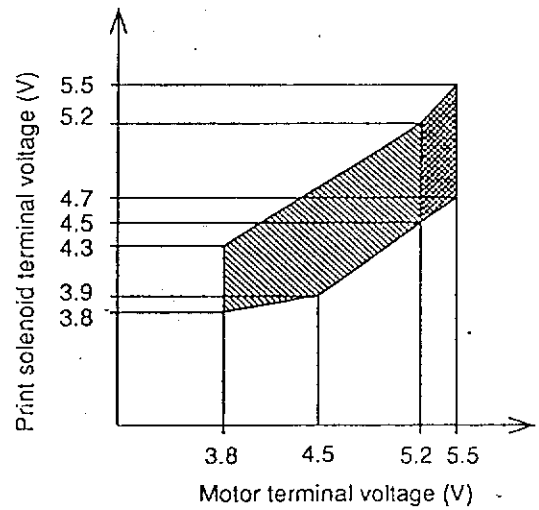


<Figure 1>

3.3 Terminal Voltages of Print Solenoid and Motor

Both terminal voltages should match and fall within the voltage range shown by ▨ in <Figure 2>.

The shaded area shown by ▨ is available only when using Ni-Cd battery.



<Figure 2>

3.4 Print Method

1) Upper sheet (original): Printed by the ribbon

2) Lower sheet (copy): Printed by pressure sensitive copying (Only one copy is available.)

3.5 Paper

Cut sheet and roll paper

1) Cut sheet:

(a) Type: No-carbon paper (by MITSUBISHI SEISHI)
N40 upper sheet Hi + lower sheet, blue color
Paper thickness: upper sheet 0.066 mm weight: 47.0g/m²
lower sheet 0.058 mm weight: 47.0g/m²

(b) Size: Cut sheet; 57.5 ± 0.5 mm (W) × Max. 300 mm (L)

(c) Glue conditions

① Glued portion (see Figure 3)

② NOTES:
1. No past can ooze outside the portion beyond the wavy line in the figure.
2. Paper should be pasted evenly.
3. Glued portion must not harden.
4. Whether the printer is under operating or storage condition, glued sheets should not peel off and paste must not run out (ooze out).

(d) Filing hole position: See <Figure 3>

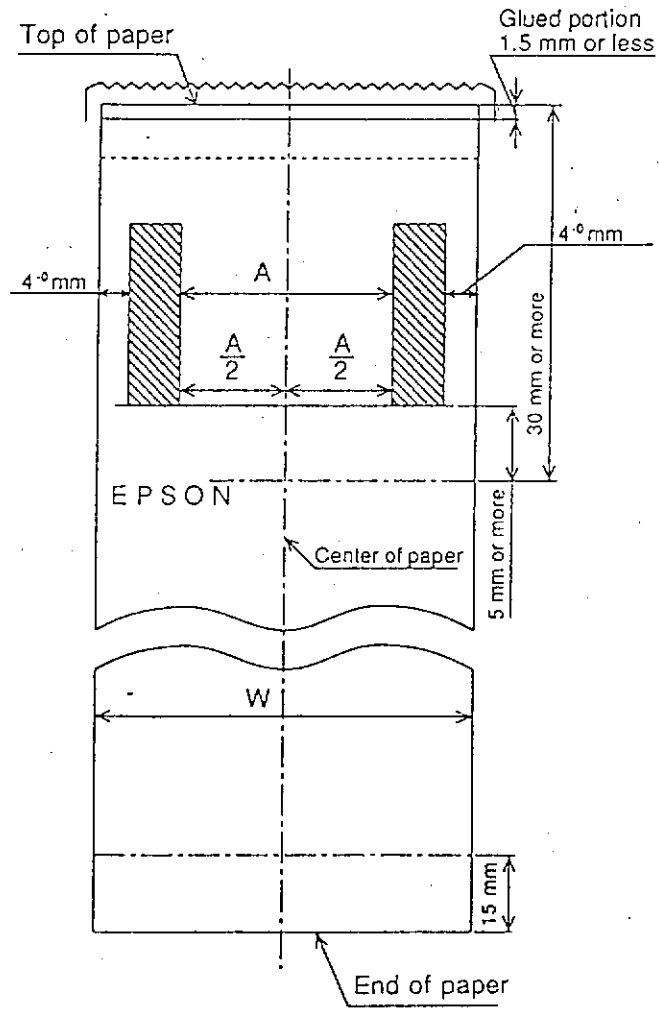
① Dimensions

Model	Paper width (W)	Dimension A
M-190	57.5 ± 0.5 mm	30 mm or more

② A filing hole can be placed within the area filled with oblique lines in the figure.

③ The first line must be printed 5 mm or more below the hole and 30 mm or more below the top of the paper.

④ Nothing shall be printed within 15 mm from the end of the paper.



<Figure 3>

2) Roll paper:

(a) Type: No-carbon paper (by MITSUBISHI SEISHI)
N40 upper sheet Hi + Lower sheet, blue color
Paper thickness: upper sheet 0.066 mm weight: 47.0g/m²
lower sheet 0.058 mm weight: 47.0g/m²

(b) Size and product number
① When paper roll with outside diameter of ø 30 mm or less is used:

Units: mm

Model	Paper size	Product Number
M-190	57.5 ± 0.5 mm (W) × ø 30+0 mm (outside diameter) × ø 10-0 mm (inside diameter)	ESP-01 by Kobayashi Kirokushi

NOTE: The above listed paper is recommended in order to avoid paper jams due to inappropriate roll end conditions found on other roll papers.

② When roll paper with an outside diameter of more than ø 30 mm is used:

Units: mm

Model	Paper size
M-190	57.5 ± 0.5 mm (W) × max. ø 80 mm (outside diameter) × max. ø 10 mm (inside diameter)

NOTE: We do not have any recommendable paper roll with an outside diameter of greater than ø30 mm. Therefore, for larger diameters, discuss the details with the paper manufacture while referring to above Section 1), 2)-(b), and Section 3).

(c) Notes on using paper rolls with an outside diameter of more than ø 30 mm:

① Conditions on inside end of roll paper (with or without a core)

1. No fold is allowed. The paper must be wound so that the paper edge goes along the internal circumference. (Refer to Figure A below.)
2. No folding back is allowed.
3. Inside end must not be glued to the core (when a core exists).
4. Upper and lower papers must not be glued to each other.

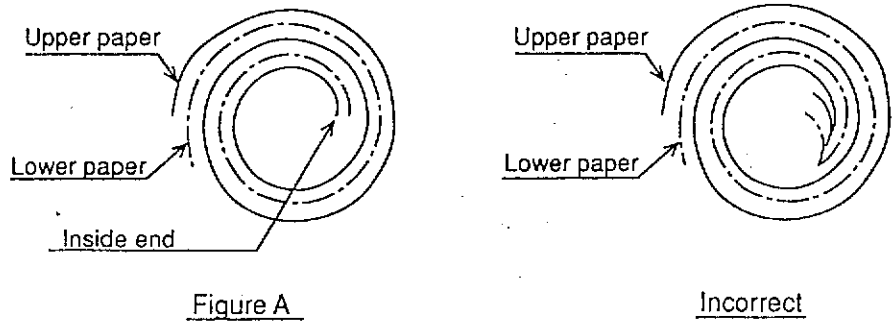
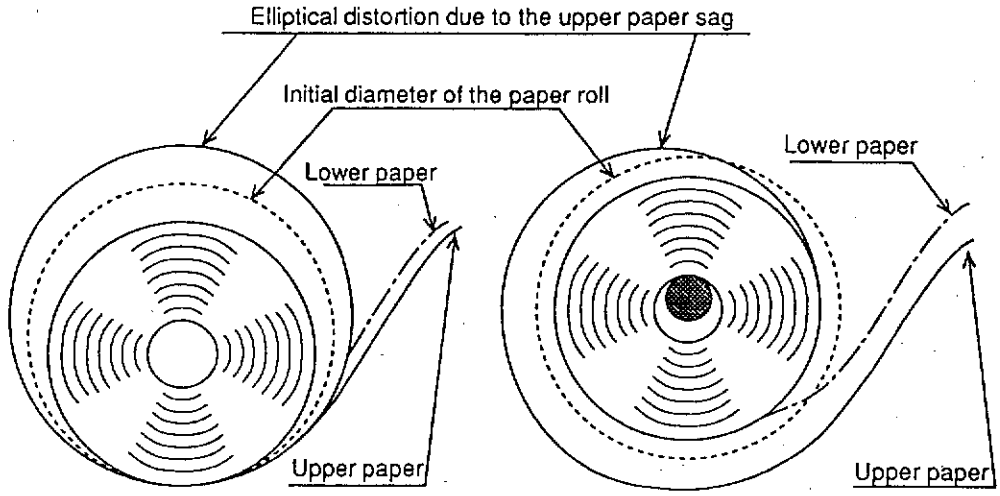


Figure A Incorrect

<Figure 4>

② Paper supply load
The case should be designed so that the paper supply load at the paper entrance is 30g or less.

③ Roll paper sag
When pressure sensitive roll paper is used, the difference in diameter between the upper and lower papers generates an upper paper sag and, as seen from the side, the initial circular shape of the paper roll is distorted to form an ellipse. The diameter of the ellipse eventually becomes larger than the initial diameter of the roll. (See <Figure 5>.)
The shape of the case around the roll paper holder should be designed so that it allows some sag of the upper paper.
Besides this, when a paper take-up device is employed, be careful of its position to prevent the upper paper sag from being taken up by the device.



(a) Drop-in type (b) Shaft-holding type

<Figure 5>

3) Others (common to cut sheet and roll paper):

(a) Other characteristics

Impact, friction, temperature, humidity, light, and oil contamination do affect the color and life of no-carbon paper. This means that all these factors should be taken into account when handling this type of paper. Discuss the details with the paper manufacturers.

(b) Other notes

① Paper with folds, wrinkles, or tears should not be used.

② Neither perforations nor holes can be positioned within the printable area.

③ Paper should be pulled out slowly and straight-forwardly.

④ When printing is stopped in the middle of a print job and the paper is reset after being pulled out or moved, printing position and pitch cannot be guaranteed for subsequent printing.

⑤ When loading the paper, be sure the upper and lower paper fit correctly.

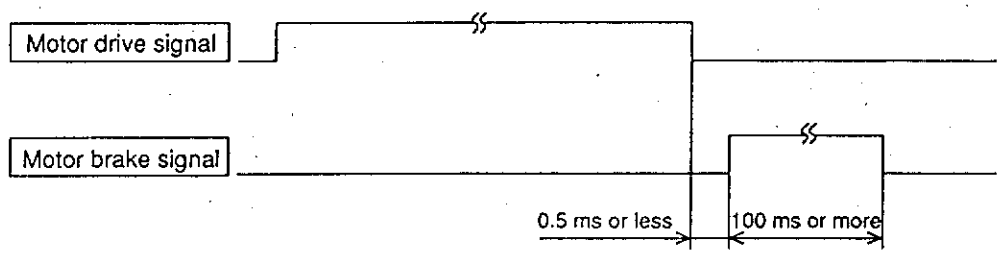
(c) Storage

Unused paper should be stored so as to avoid impact, friction, light, and oil, and should be kept under adequate temperature and humidity conditions.

4. OUTER CASE DESIGN GUIDE

4.1 Motor Drive Signal and Motor Brake Signal

1) Phasing: The leading edge of the motor brake signal must be within 0.5 ms from the trailing edge of the motor drive signal.



2) Motor brake signal: The motor brake signal must be applied for 100 ms or more. If the power consumption required for braking the motor is disregarded, this duration can be prolonged up to the leading edge of the subsequent signal.

4.2 Connections

A copper foil edge connector with a 2.5 mm pitch is fixed to the printer frame. The printer can be connected to external circuits by soldering flat cables or lead wires to the copper foil pattern. When selecting and using cables and wires, the current capacity must be taken into account for each of the print solenoid signals, i.e. the common, A, B, C, D, E, F, G and H. Be sure that the soldered portions are not placed under mechanical stress. (For the detailed dimensions, refer to the figures illustrating the terminal assignment and the overall dimensions.)

4.3 Ribbon Cassette Handling

1) It is desirable to mount the ribbon cassette after removing the paper.

2) Before mounting the cassette, the ribbon should be tightened by rotating the ribbon feed roller in the direction shown by the arrow. Then place the cassette so as to insert the ribbon between the gap by matching the cutouts on the left and right sides of the printer frame. The cassette can be easily installed by pushing it down gently. Be careful not to lock the ribbon feed roller. (See Figures 1 and 2 below.)

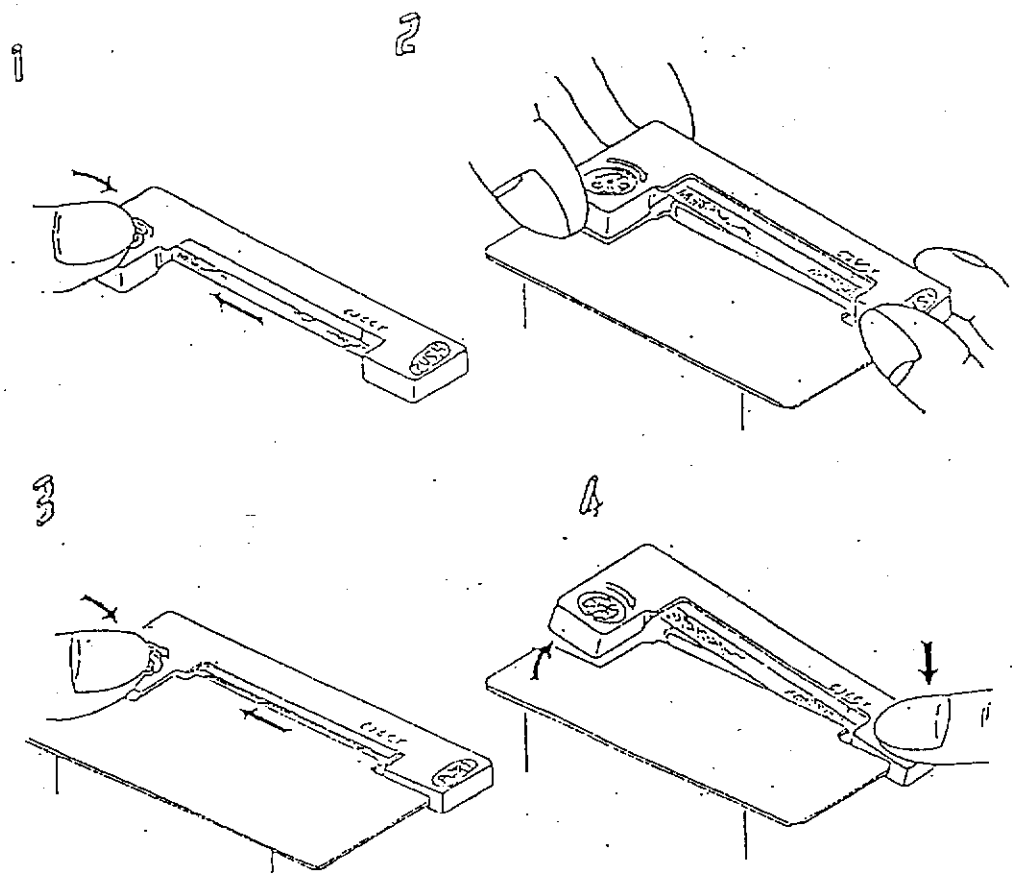
   (It will be easier to install if the cassette is pressed down while rotating the ribbon feed roller in the direction of the arrow.)

   Even if the ribbon is tucked up or sags while mounting, it can be tightened and fixed to its proper position by rotating the roller after inserting the cassette frame. (See Figure 3 below.)

3) To remove the ribbon cassette, push the portion marked PUSH with a finger. The other side of the cassette will go up. Then rotate and remove the cassette using the PUSH mark as the center of rotation. When designing the case, be sure to provide the necessary space which allows the rotation. (See Figure 4 below.)

   (For the detailed dimensions, see the overall dimension figures.)

NOTE: In order to assure good print quality, use a standard ribbon cassette (ERC-09 or ERC-22).



4.4 Paper Entrance and Paper Holder Design

1) The center of the paper holder on the case side must be aligned with the center of the paper entrance width on the printer side. The paper guide must be able to guide paper which is 57.5 ± 0.5 mm wide.

2) Clearance between the paper holder on the case side and the roll paper width must be 2.0 mm or less. However, the clearance must be sufficient to prevent the holder from pressing or rubbing against both sides of the paper roll.

   (See the overall dimensions figure for the dimensions of the paper entrance.)

3) Paper supply load at the paper entrance should be 30 g or less.

4.5 Paper Cutter Design

When designing the paper cutter, the followings should be taken into account:

1) The more the paper near the Paper Exit (i.e. paper cutter mounting position) approaches the vertical, the more the paper resonates, making printing noise greater.

2) On the other hand, the more the paper approaches the horizontal, the more the paper feed load increases. This may cause paper feeding problems.

3) The figure in Section 2.14 (Overall Dimensions) gives a reference position for mounting the paper cutter.

4.6 Case Design around the Paper Feed Knob

Because the Paper Feed Knob rotates while the printer is operating, the following items should be considered:

1) The paper feed knob must not touch the case.

2) The knob must not project outside the case. The knob should be protected.

4.7 Paper Roll-in Protection

When designing the case, be sure to prevent printed paper from being taken up again.

4.8 External Interference Protection

Since a reed switch is employed as the reset detector, be sure to protect the printer from external magnetic fields. In particular the upper surface of the cover should be kept away from magnetic fields.

4.9 Other Notes on Designing the Outer Case

The openings in the case, such as the paper entrance and paper cut position (i.e. Paper Exit) should be as small as possible in order to minimize noise.

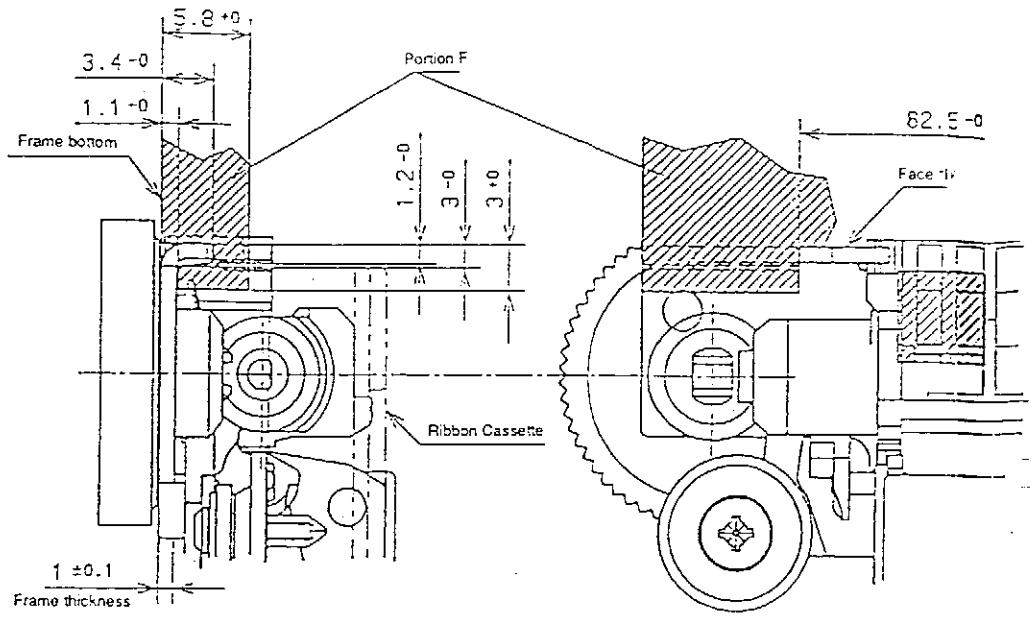
4.10 Notes on Printer Handling

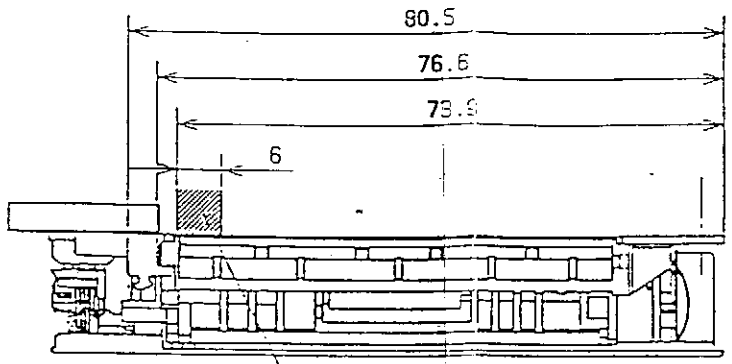
1) Printing without paper or ribbon is prohibited to avoid damaging the printer.

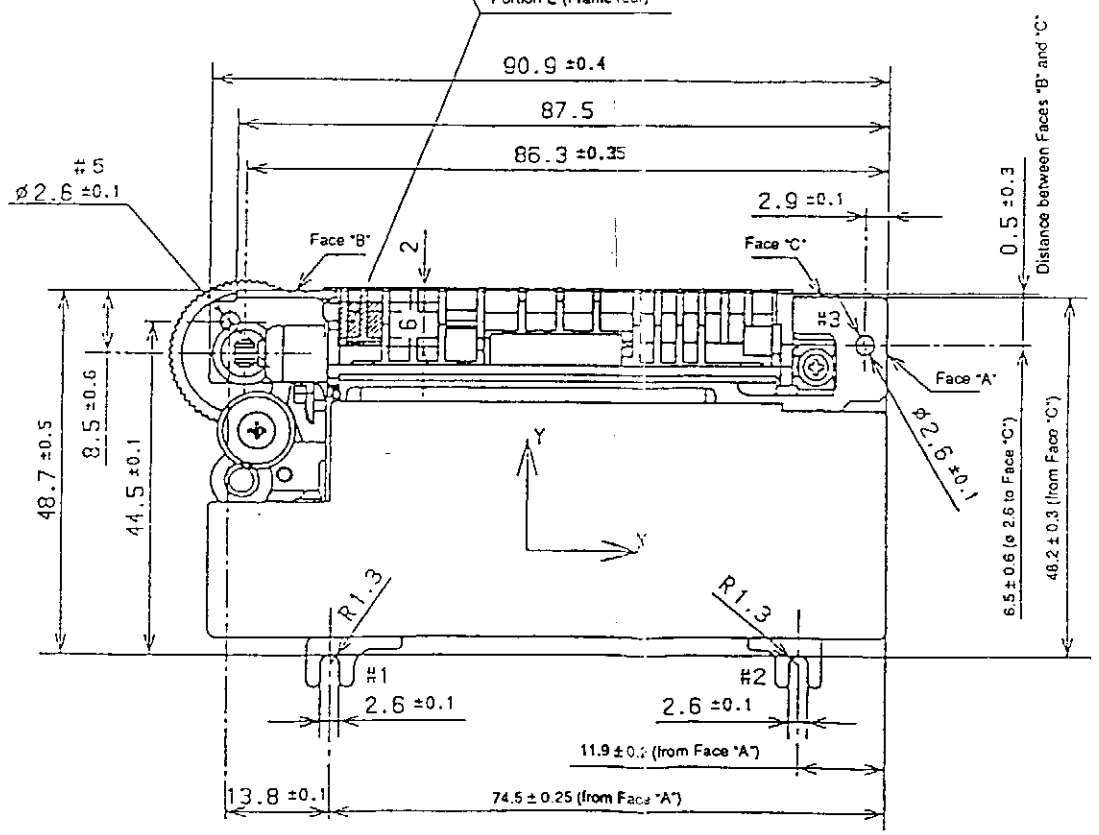
2) Because plated steel plate is used in this unit, the cut edges may get rusty.

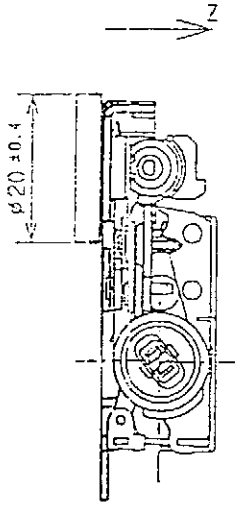
4.11 Printer Installation

Refer to Pages 36 and 37.









4.11.1 An example installation procedure for a printer with a horizontal paper feed knob, or without a knob

① For the X direction, position the printer by attaching the frame face "A" to the case.
② For the Y direction, position the printer by attaching the frame faces "B" and "C" to the case.
③ Insert screws into mounting holes #1 to #3, and tighten them.

※ How to fix the case around the paper feed knob:

1) For a printer with a horizontal paper feed knob, the case cannot be fixed with screws around that portion. Therefore, the frame should be guided at portions E and F (marked with oblique lines in the figure) so as to suppress frame shaking in the Z direction as much as possible.
2) For a printer without a paper feed knob, insert a screw into hole #5 (ø 2.6 ± 0.1) or the paper feed knob mounting hole (ø 4), and tighten it.

NOTES:
1. The figure shows a printer with a horizontal knob, without a ribbon cassette mounted.
2. The case should not touch the printer bottom except near the mounting holes.
3. The shapes of portions E and F must be as shown in the figure.
4. Even though the frame near the knob is guided at portions E and F, frame shaking in the Z direction cannot be eliminated completely. Therefore, the case must be designed so that the paper feed knob does not touch the case when the frame shakes up and down.

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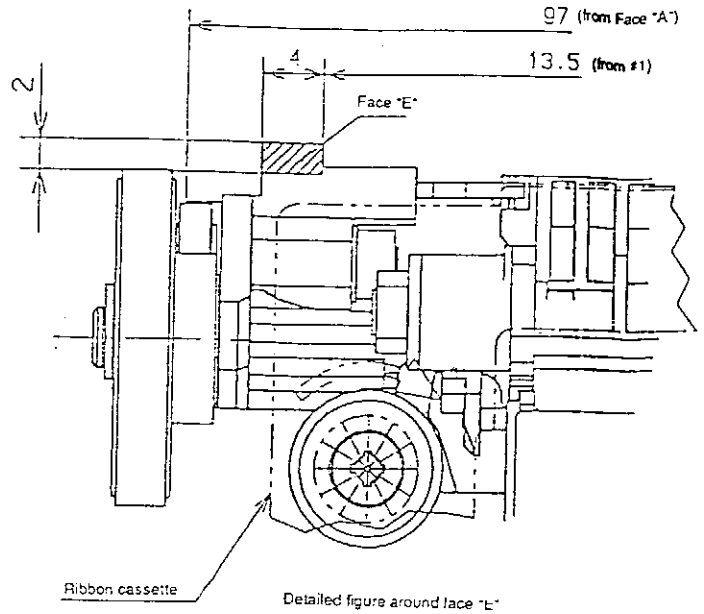
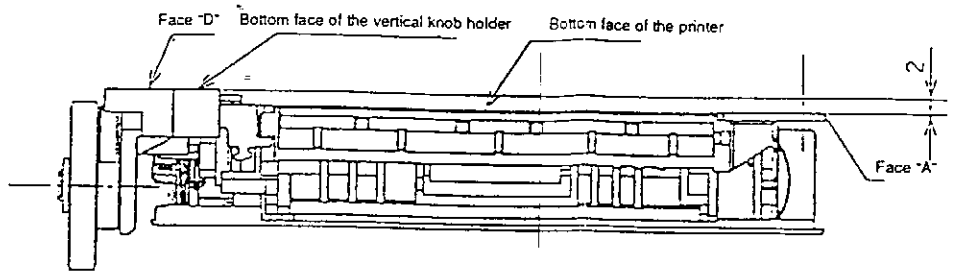
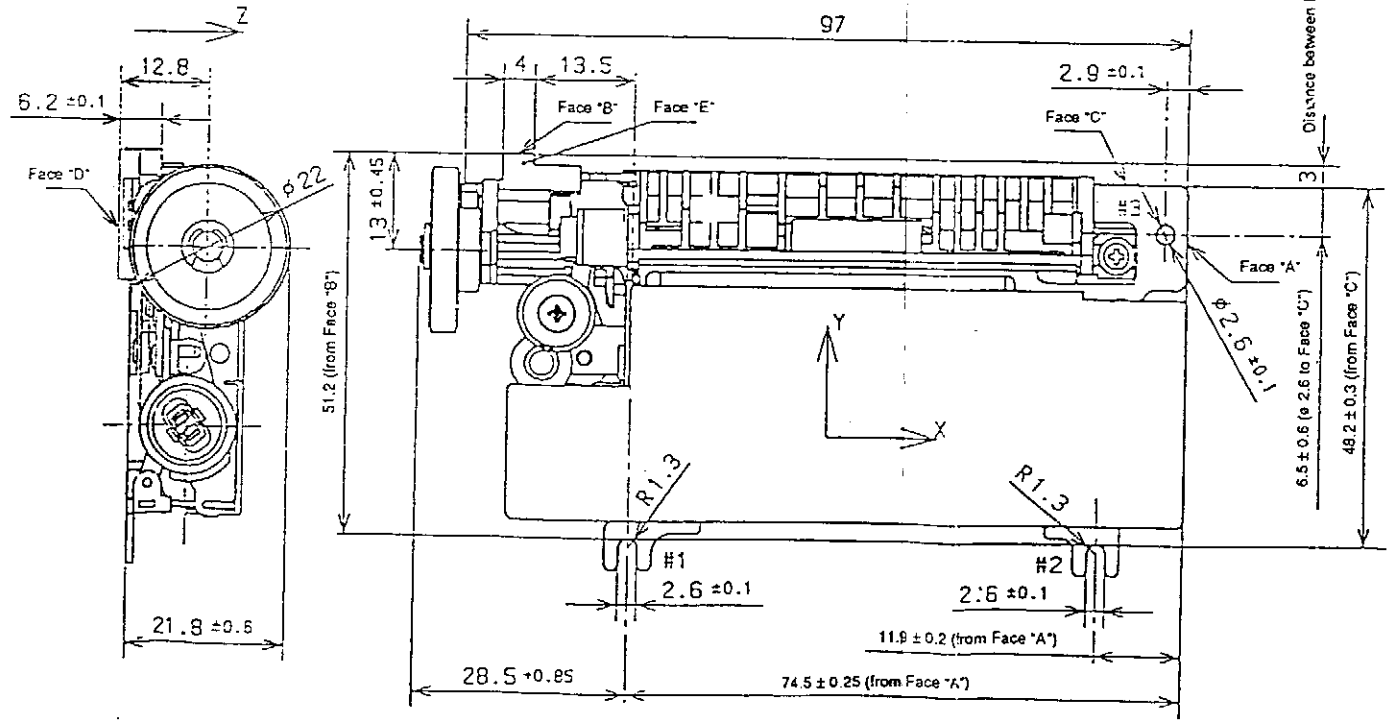


Detailed figure around face "E"





4.11.2 An example installation procedure for a printer with a vertical paper feed knob

① For the X direction, position the printer by attaching the frame face "A" to the case.
② For the Y direction, position the printer by attaching the frame faces "B" and "C" to the case.
③ Insert screws into mounting holes #1 to #3, and tighten them.

※ How to fix the case around the paper feed knob:
For a printer with a paper feed knob, the case cannot be fixed with screws around that portion. Therefore, the frame should be attached to the case at face "D" and face "E" of the portion marked with oblique lines in the figure so as to suppress frame shaking in the Z direction as much as possible.

NOTES: 1. The figure shows a printer with a vertical knob, without a ribbon cassette mounted.
2. The case should not touch the printer bottom except near the mounting holes and face "D".

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5. RIBBON CASSETTE SPECIFICATIONS

5.1 Ribbon Cassette Specifications

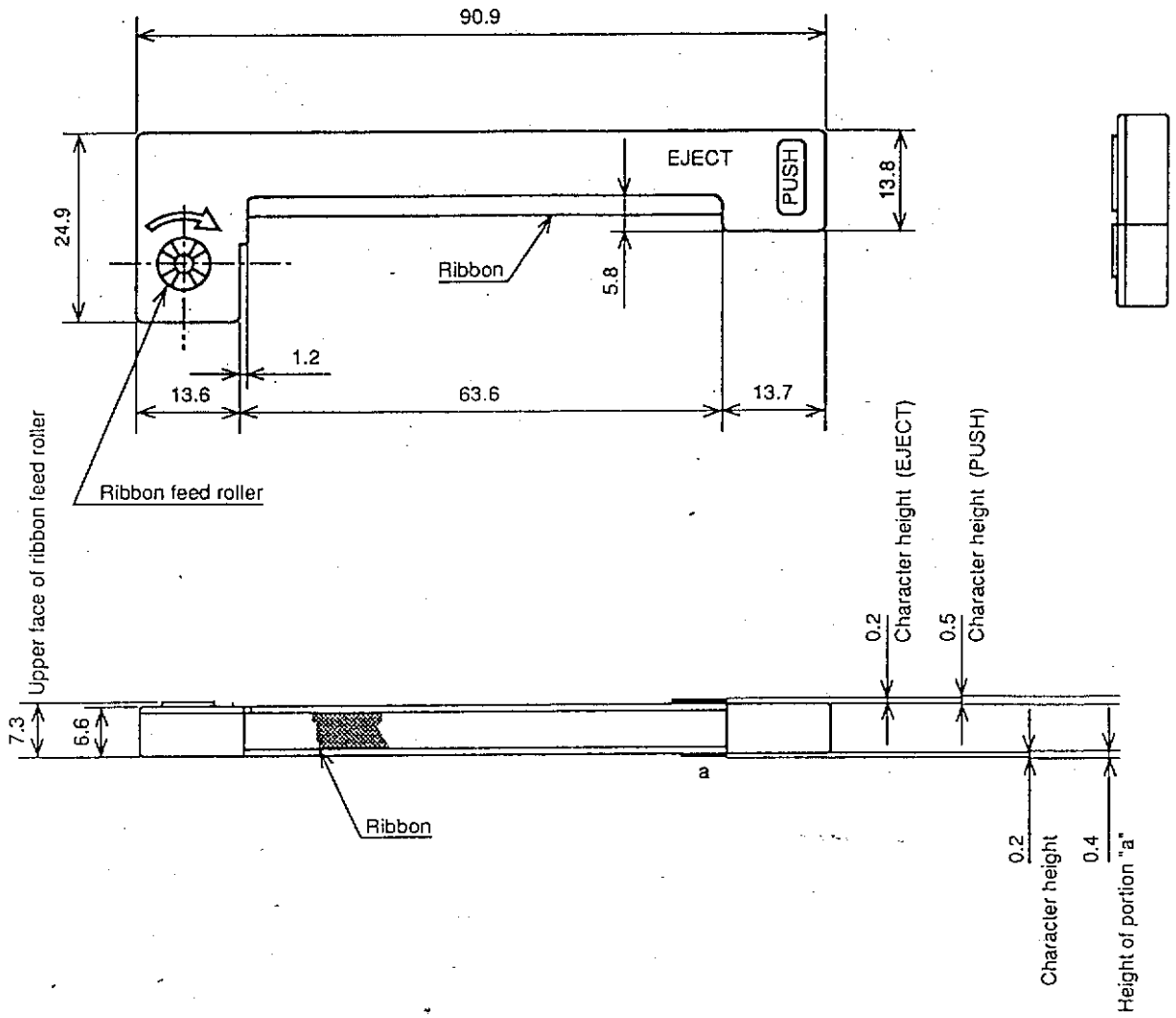
Two types of ribbon cassette (ERC-09 and ERC-22) can be used with this model. The table below gives the detailed specifications.

Product Number	ERC-09	ERC-22
Size (mm)	90.9 (W) × 24.9 (D) × 7.0 (H)	90.9 (W) × 26.4 (D) × 6.3 (H)
Weight	Approx. 3.5 g	Approx. 4.0 g
Life	Purple: Approx. 250,000 characters Black: Approx. 200,000 characters (At 4.8 VDC, 25°C, continuous printing) (Print mode is as shown in Attached Table 1.)	Purple: Approx. 1 million characters Black: Approx. 600,000 characters
Color	Purple or Black	
Humidity during operation	40°C × 80%RH	

※ Refer to the Ribbon Cassette Specifications for details.

5.2 ERC-09 Overall Dimensions

Units: mm	Scale: 1/1



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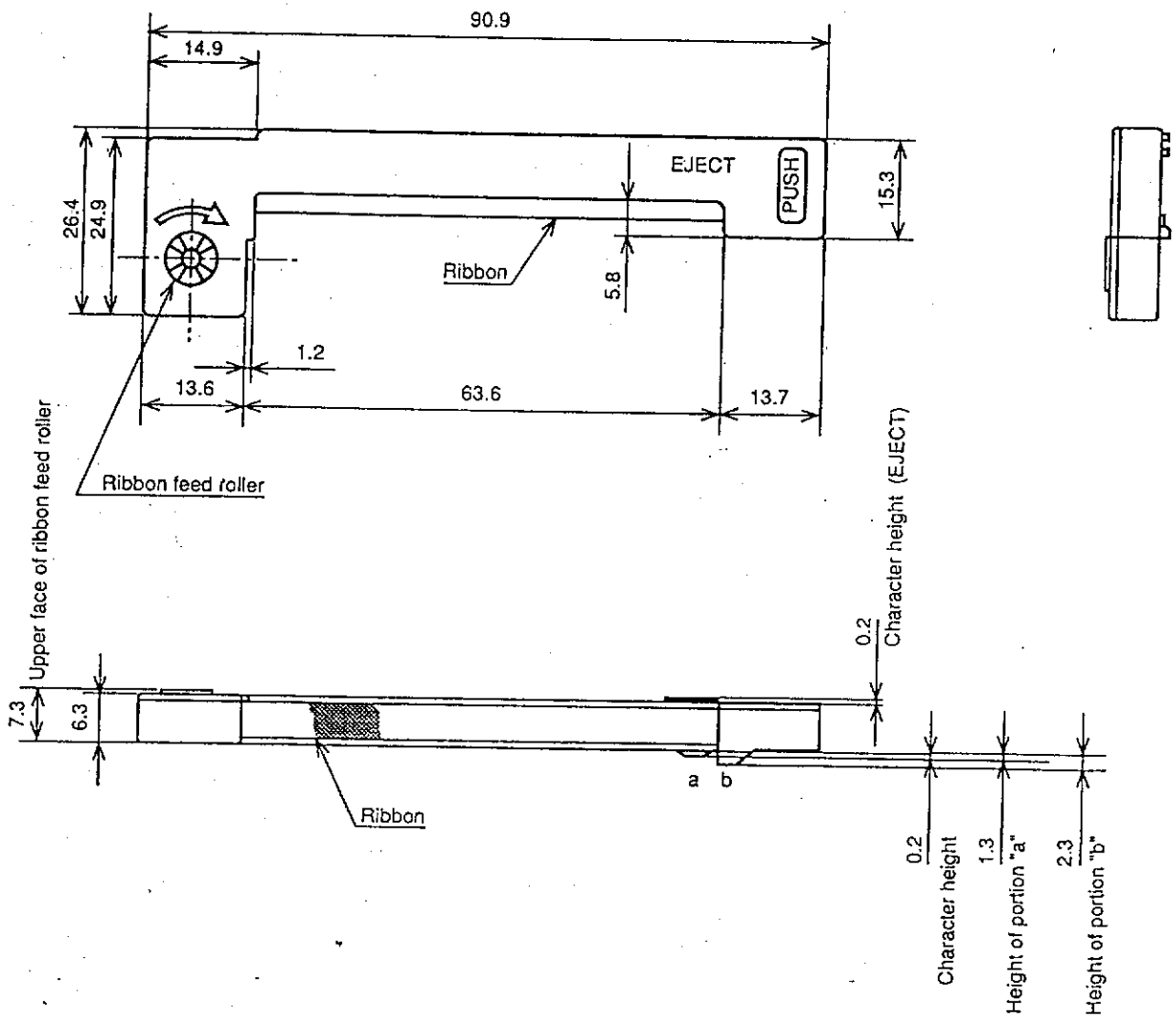
5.3 ERC-22 Overall Dimensions

Units: mm	Scale: 1/1



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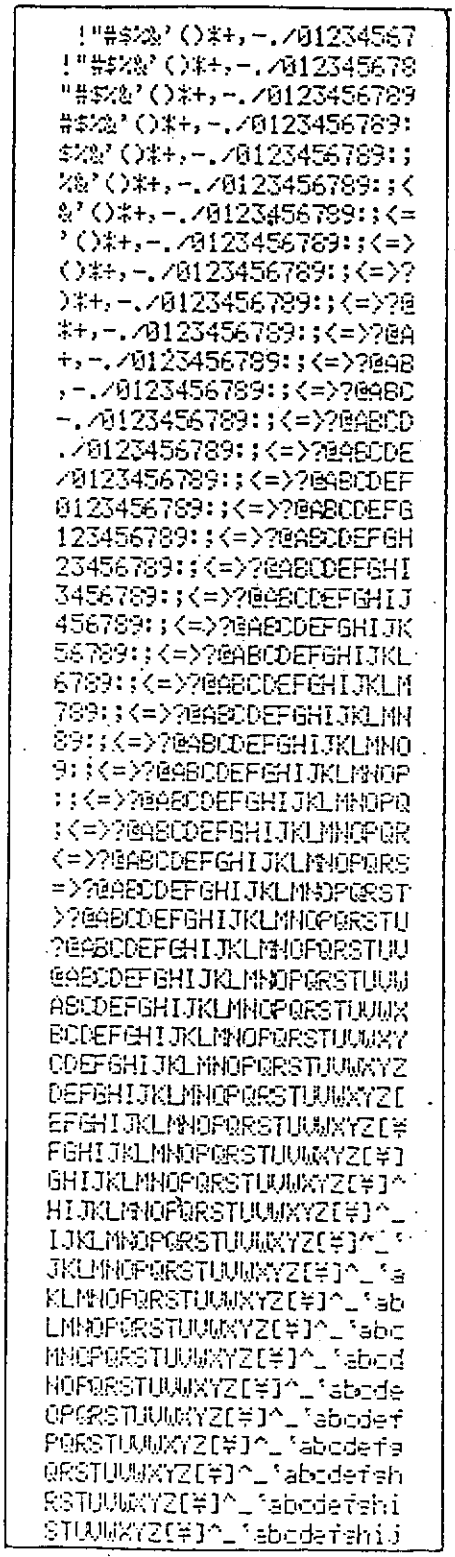
Attached Table 1. Print Sample



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REVISION SHEET

Be sure to check the contents before utilizing the specification because this specification has the history as shown below.

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REV.	DOCUMENT	DATE	SHEET	REV.	SHEET	REV.	SHEET	REV.	SHEET	REV.
A	ENACTMENT	Jun.26,1991	1	A	18	A	35	A		
			2	A	19	A	36	A		
			3	A	20	A	37	A		
			4	A	21	A	38	A		
			5	A	22	A	39	A		
			6	A	23	A	40	A		
			7	A	24	A	App. 1	A		
			8	A	25	A				
			9	A	26	A				
			10	A	27	A				
			11	A	28	A				
			12	A	29	A				
			13	A	30	A				
			14	A	31	A				
			15	A	32	A				
			16	A	33	A				
			17	A	34	A				

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