Confidential

technical manual
micro dot printer
Model-180
Model-181
Model-182
Model-183
Model-185

Issued date	, ,
Issued by	

A. JAHNICHEN S.A.
33, RUE DES PEUPLIERS - B.P.809
92008 NANTERRE CEDEX
Tél. 01 47 86 84 40 - Fax 01 47 86 16 01
Capital 5.200 000

EPSON

English

PREFACE

This Technical Manual for this printer contains a description of the mechanisms and instructions on maintenance and repair of the printer.

Major technical modifications or improvements of the printer, if made in future, will be published in SERVICE BULLETINS, which can be used in conjunction with this Manual. The contents of this Manual are subject to change without prior notice.

Should any discrepancy exist between the contents of this Technical Manual and the provisions of "Master Contract" or the Specifications, the latter shall take precedence over the former.

We shall not be responsible for any troubles that might occur from the customer's applying this Manual to machines other than this printer or his applying to said printer a drive circuit or other device which is a third party's industrial property.

If you desire to produce copies of the whole or part of this Manual for the purpose of distributing to a third parties, please notify us in advance.

< Precautions on the Use of This Technical Manual >

- Model-181, 182, and 183 are models based on Model-180 but have an improved deceleration mechanism, altered T pulse processing, and increased carriage width. This Technical Manual, therefore, has also been edited on the basis of Model-180 and, for Model-181, 182, and 183, contains only those sections which differ from Model-180. Please keep this point in mind when using this Technical Manual for Model-181, 182, and 183.
- Furthermore, Model-185 is also based on Model-180 but due to its improved paper feeding platen unit and printing head unit and its altered T pulse processing, it is a model which uses paper of smaller width. This Technical Manual, therefore, contains only those sections which differ from Model-180. Please keep this point in mind when using this Manual for Model-185.

TABLE OF CONTENTS

CHAPTER 1

SPECIFICATIONS AND OPERATING PRINCIPLES

CHAPTER 2

HANDLING, MAINTENANCE, AND REPAIR

CHAPTER 3

DISASSEMBLY AND ASSEMBLY

CHAPTER 1

SPECIFICATIONS AND OPERATING PRINCIPLES

CONTENTS

1.1 SPECIFICATIONS 1-1
1.1.1 Features 1-1
1.1.2 Specifications 1-1
1.1.3 Mechanisms 1-3
1.2 OPERATING PRINCIPLES 1-3
1.2.1 Transmission Mechanism 1-3
1.2.2 Detector Mechanism 1-4
1.2.3 Printing Mechanism 1-5
1.2.4 Paper Feeding Mechanism 1-7
1.2.5 Ribbon Feeding Mechanism 1-9
1.2.6 Print Operation for One Print Cycle 1-10
(Operation of Model-180) 1-10
(Operation of Model-181) 1-12
(Operation of Model-182) 1-14
(Operation of Model-183) 1-16
(Operation of Model-185) 1-18
Fig. 1-19. Model-180 Detail Timing Signal T Distribution 1-20
Fig. 1-20. Model-181 Detail Timing Signal T Distribution 1-21
Fig. 1-21. Model-182 Detail Timing Signal T Distribution 1-22
Fig. 1-22. Model-183 Detail Timing Signal T Distribution 1-23
Fig. 1-23. Model-185 Detail Timing Signal T Distribution 1-24
Fig. 1-24. Model-180 Timing Chart 1-25
Fig. 1-25. Model-181 Timing Chart 1-26
Fig. 1-26. Model-182 Timing Chart 1-27
Fig. 1-27. Model-183 Timing Chart 1-28
Fig. 1-28. Model-185 Timing Chart 1-29

1.1 SPECIFICATIONS

1.1.1 Features

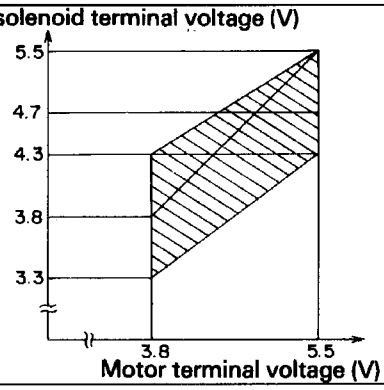
The Micro Dot Printer Model-180/181/182/183/185 was developed and designed mainly for use as a hardcopy device for a wide range of applications, such as data recorders, handheld computers, and functional calculators. It offers the following features:

- Simple and highly-reliable design of mechanisms.
- Ultraslim, compact, and lightweight design.
- Compact and lightweight with precise printing due to its highly-reliable built-in dot head (graphic printing also possible).
- Capable of carbonless duplicating printing [1 original sheet + 1 copy sheet].
- Inking system which uses a ribbon cassette capable of one-touch insertion or removal.
- Capable of battery (nickel cadmium) operation due its energy-saving design.
- Uses ordinary paper.
- Capable of fast-feeding of paper.
- Reduced operational loss during paper insertion (provided with a paper release lever and manual knob).

1.1.2 Specifications

This subsection describes the main specifications. For detailed descriptions of the specifications (as an operating guide), refer to the separate SPECIFICATIONS FOR MODEL-180/181/182/183/185 and GUIDE TO THE CIRCUITRY AND EXTERNAL DESIGN OF MODEL-180/181/182/183/185.

No.		Model-180	Model-181	Model-182	Model-183	Model-185
1	**Print method**					
	Mechanical dot print (6 print solenoids)					(5 print solenoids)
2	**No. of dots** (per dot line)					
	Max. 144 dots		Max. 180 dots	Max. 216 dots	Max. 252 dots	Max. 108 dots
3	**Printed column width** (for 5 × 7 dot matrix and 1-dot line spacing)					
	Max. 24 col.		Max. 30 col	Max. 36 col.	Max. 42 col.	Max. 18 col
4	**Print speed** [Row A: 1-dot line Row B: 5 × 7 dot matrix + 3-dot line spacing				For continuous printing at 4.8 VDC, 25°C	
	A	Approx.75 ms	Approx. 94ms	Approx. 112 ms	Approx. 131 ms	Approx. 75 ms
	B	Approx. 1.7 lps	Approx. 1.3 lps	Approx. 1.1 lps	Approx. 1.0 lps	Approx. 1.7 lps
5	**Paper feeding** (normal feed)					
	Automatic paper feeding after each dot line					
6	**Fast paper feed speed** (for 4.8 VDC, 25°C)					
	Approx. 4.0 lps		Approx. 3.2 lps	Approx. 2.7 lps	Approx. 2.3 lps	Approx. 4.0 lps
7	**Character Size** [Row A: Dot interval (vertical × horizontal) Row B: 5 × 7 dot matrix (W × H)					
	A	0.33mm × 0.37mm	0.26mm × 0.37mm	0.22mm × 0.37mm	0.19mm × 0.37mm	0.33mm × 0.37mm
	B	1.7mm × 2.6mm	1.4mm × 2.6mm	1.2mm × 2.6mm	1.1mm × 2.6mm	1.7mm × 2.6mm
8	**Motor** [Row A: Terminal voltage Row B: Average current (4.8 VDC, 25°C) Row C: Peak voltage (4.8 VDC, 25°C)					
	A	$4.8\ ^{+0.7}_{-1.0}$ VDC				
	B	Approx. 0.2A				
	C	Approx. 1.0A (worst case: less than 1.5 A)				

No.	Model-180	Model-181	Model-182	Model-183	Model-185
9	**Print solenoids** [Row A: Terminal voltage / Row B: D.C. resistance value (25°C)				
	A	$4.8^{+0.7}_{-1.5}$ VDC However, the motor terminal voltage and print solenoid terminal voltage shall satisfy the voltage relationship within the shaded range on the right.  			
	B	Approx. 1.5Ω			
10	**Fast feeding trigger magnet** [Row A: Terminal voltate / Row B: D.C. resistance value (25°C)				
	A	$4.8^{+0.7}_{-1.0}$ VDC (Make sure the voltage variation in the motor terminal is kept within 1.0V.)			
	B	Approx. 20Ω			
11	**Detector** [Row A: Timing detector / Row B: Reset detector				
	A	Tachogenerator (directly coupled to motor)			
	B	Reed switch			
12	**Inking**				
	Ribbon cassette (consecutively fed automatically while the motor is driven)				
13	**Paper** (Supplied by the user)				
	Type	Regular paper			
	Width	57.5 ± 0.5mm			44.5 ± 0.5mm
	Roll dia.	Outer diameter: 83mm + 0 mm Inner diameter: 10 – 0mm			
	Thickness	0.06 ~ 0.085 mm			
	Average weight	47 gm/m² ~ 64 gm/m² (45 ~ 55 kg/1,000 sheets/1091 × 788 mm)			
14	**Ribbon cassette** (Supplied by the user)				
	Color	Purple or black			
	Size		Approx. 91 (W) × 25 (D) × 7 (H) mm		
	Life	Purple: Approx. 250,000 characters Black: Approx. 200,000 characters (for α-N continuous printing at 4.8 VDC, 25°C)			
	Standard	ERC-09			
15	**Connection Method** [Row A: Printer side / Row B: Circuit side (operator side)				
	A	2.54-mm pitch thin film copper pattern P.C.B. fixed onto the frame			
	B	Parallel cable or lead wires			
16	**Guaranteed operating temperature**				
	0°C ~ 50°C				
17	**Reliability** (MCBF value)				
	700,000 lines	Not determined	Not determined	Not determined	700,000 lines
18	**External dimensions**				
	91 (W) × 46.9 (D) × 15.8 (H) mm (excluding manual knob)				
19	**Weight**				
	Approx. 95 gm				

1.1.3 Mechanisms

This printer (Model-180, 181/182/183/185) consists of five mechanisms: the transmission mechanism, detector mechanism, printing mechanism, paper feeding mechanism, and ribbon feeding mechanism.
Fig. 1-1 shows an external view of the Micro Dot Printer Model-180. For details on the operating principles and handling of each mechanisms, see section 1.2, "OPERATING PRINCIPLES," and Chapter 2, "HANDLING, MAINTENANCE, AND REPAIR."

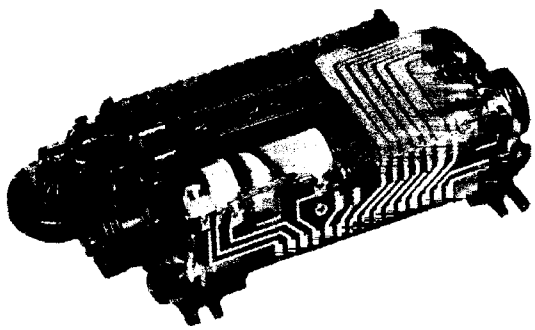


Fig. 1-1 Model-180 Exterior View

1.2 OPERATING PRINCIPLES

1.2.1 Transmission Mechanism

The transmission mechanism consists of the reduction gear series, paper feeding gear series, and ribbon feeding gear series.

Reduction Gear Series
As shown in Fig. 1-2, the reduction gear series consists of the first reduction gear fixed onto the motor shaft, first reduction gear (large, small) within the reduction unit, reduction gears (large, small), and the inner gear built into the cam sub unit.
With the large reduction gear engaged with the first reduction gear, the small reduction gear engaged with the large first reduction gear, and the small first reduction gear engaged with the inner gear of the cam sub unit, their sequential reduction is transmitted to the cam sub unit.

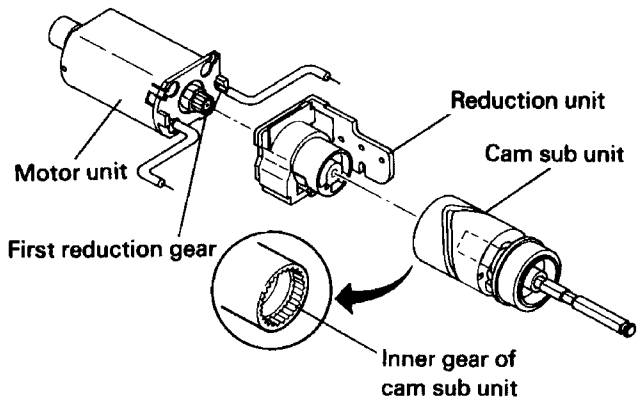


Fig. 1-2 Reduction Gear Series

Paper Feeding Gear Series
As shown in Fig. 1-3, the paper feeding gear series consists of the paper feeding transmission gear that is fixed onto the shaft of the paper feeding roller ass'y and the paper feeding gear that is mounted on that same shaft. Because the paper feeding gear is engaged with the paper feeding lever, the up/down movement (➡ ⓐ or ⓑ arrow directions) of the paper feeding lever causes the paper feeding gear to repeat rotations in the ➡ ⓒ and ⓓ arrow directions. The paper feeding transmission gear becomes engaged with the paper feeding gear only when the latter gear rotates in the ➡ ⓒ arrow direction, then intermittently rotates in the ➡ ⓔ arrow direction for the interval of one or two teeth according to the stroke volume of the paper feeding lever.

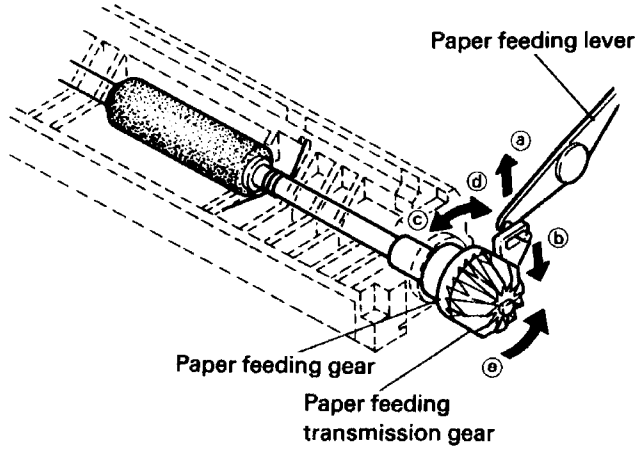


Fig. 1-3 Paper Feeding Gear Series

Ribbon Feeding Gear Series

As shown in Fig. 1-4, the ribbon feeding gear series consists of the ribbon driving gear, the ribbon feeding gear made up of a bevel gear and small gear which form a single unit, and the spool gear ass'y.

When ribbon driving gear rotates in the ➡ ⓐ arrow direction, the bevel gear engaged with the ribbon driving gear rotates in the ➡ ⓑ arrow direction. Because the small gear which is on the same shaft as the bevel gear is engaged with the spool gear ass'y, rotation of the bevel gear causes the spool gear ass'y to rotate in the ➡ ⓒ arrow direction.

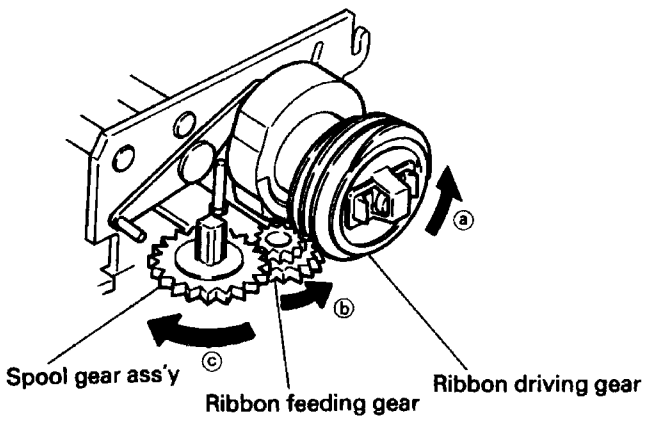


Fig. 1-4. Ribbon Feeding Gear Series

1.2.2 Detector Mechanism

The detector mechanism, consisting of the Timing (T) detector mechanism and Reset (R) detector mechanism, plays an important role in the operating sequences of each section of the printer mechanism.

T detector mechanism

As shown in Fig. 1-5, the timing detector mechanism consists of the timing detector unit and the timing detector magnet within the motor unit, and forms a tachogenerator that is directly coupled to the motor. Consequently, the sine wave Ta (Timing signal) is generated in proportion to the rotation speed of the motor, and the selection of this timing controls the timing for printing and fast feeding operations.

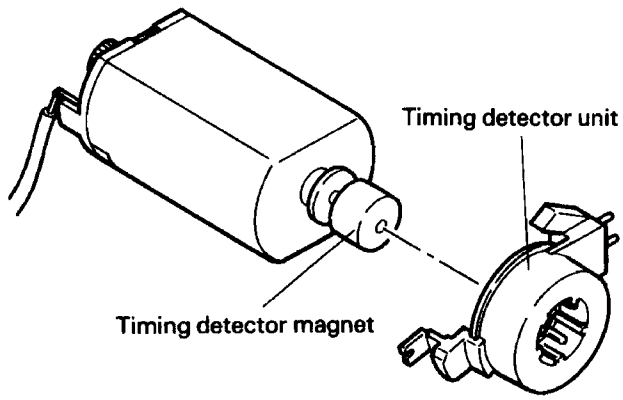


Fig. 1-5. Timing Detector Mechanism

R detector mechanism

As shown in Fig. 1-6, the reset detector mechanism consists of the reed switch (Normal Open) fixed onto the circuit board ass'y and the permanent magnet embedded into the cam sub unit. One rotation (one dot line) of the cam sub unit causes the reed switch to enter MAKE status once, thereby generating a signal.

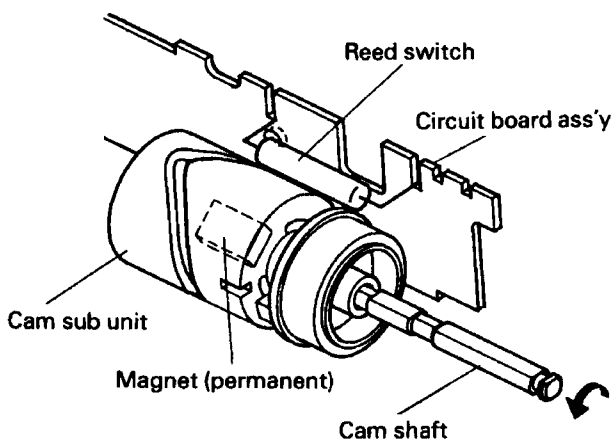


Fig. 1-6. R Detector Mechanism

1.2.3 Printing Mechanism

The printing mechanism consists of a printing head unit with five or six sets of coils in parallel array, head guide shafts (M.P.), return support spring, cam sub unit, and paper feeding platen unit.

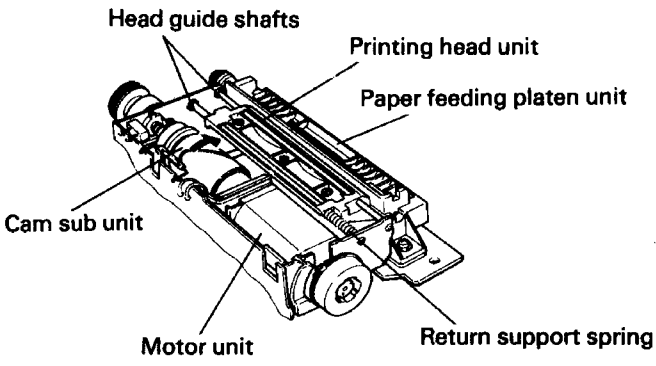


Fig. 1-7 Printing Mechanism

Movement of the printing head unit

As shown in Fig. 1-7, the printing head unit is supported by two head guide shafts. When the cam sub unit rotates in the ➡ arrow direction, because the head oscillating pin (a pin fixed by caulking onto printing head unit) moves in correspondence with the cam groove (endless) embossed around the outer periphery of the cam sub unit, the printing head unit oscillates in parallel with the paper feeding platen unit.

Printing operation of the head (See Fig. 1-8)

- **The operation of the printing lever during the printing of one dot is described as follows:**
  - ① When the coils are charged, the plunger which forms a single unit with the push bar is drawn (➡ ⓐ arrow direction) towards the iron core and presses the back surface of the printing lever.
  - ② Because the lower end of the printing lever is supported by the printing lever shaft, the printing lever with its pressed back surface rotates around the printing lever shaft so that its upper end is projected in the ➡ ⓑ arrow direction towards the paper feeding platen unit (to the status indicated by the two-dot dash line).
  - ③ The projected printing lever strikes the paper feeding platen unit via the ribbon and paper to print one dot.
  - ④ When the charge to the coils is discontinued, the printing lever and plunger are returned to their original positions due to the spring force of the printing lever spring and enter the standby status (indicated by the solid line).

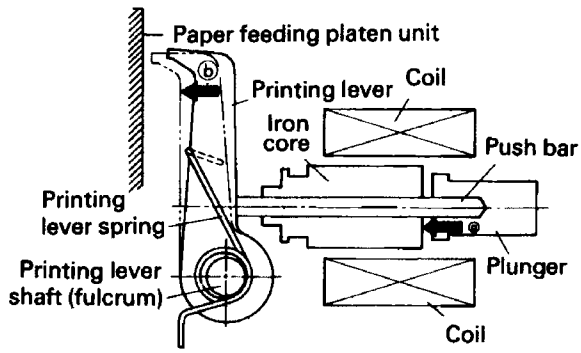


Fig. 1-8 Printing Lever Operation

- **The formation of one dot line** (with a 5 x 7 dot matrix) is described as follows: (For the case of Model-180)
  ① The Charge signal P1, which is formed by Timing signal T1 after detection of Reset signal R, is simultaneously applied to Coils A and D, and P1 is printed.
  ② The Charge signal P2, which is formed by Timing signal T2, is simultaneously applied to Coils B and E, and P2 is printed.
  ③ Charge signal P3, which is formed by Timing signal T3, is simultaneously applied to Coils C and F, and P3 is printed.
  As described above, by repeatedly applying the Charge signals formed according to each Timing signal to each coil in sequence (A/D, B/E, C/F), one dot line is formed.

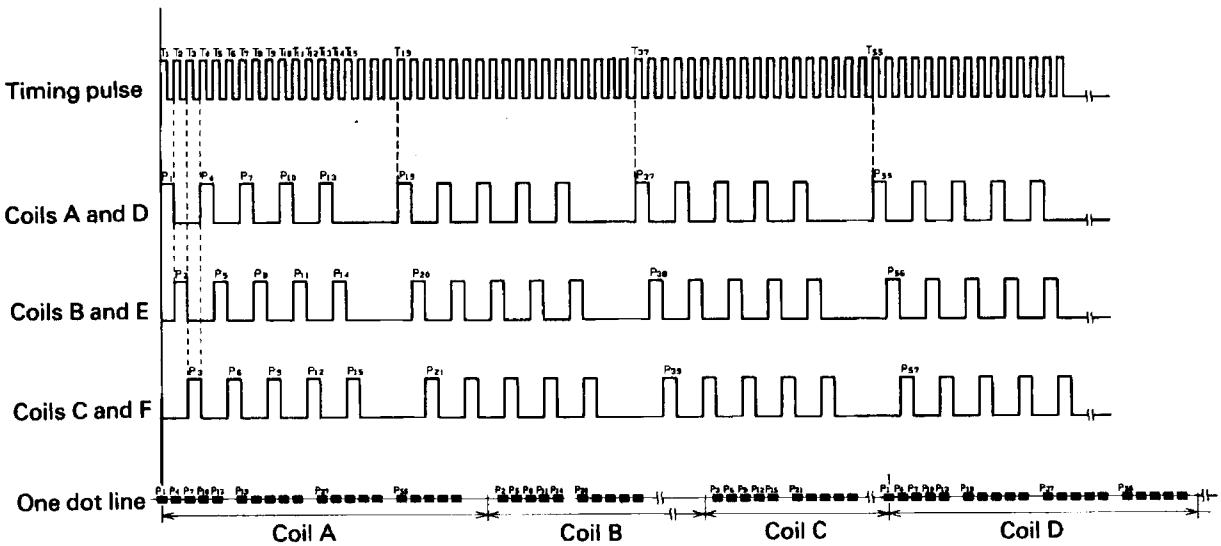


Fig. 1-9 Timing Chart

1.2.4 Paper Feeding Mechanism

As shown in Fig. 1-10, the paper feeding mechanism consists of the paper feeding cam, fast-feeding lever, paper feeding lever, trigger lever, paper feeding platen unit, paper release lever, and so on.

In addition to functions for paper feeding at normal and fast speeds, this printer also has a paper release function which enables the removal of paper by pulling it straight out in the opposite direction from paper feeding.

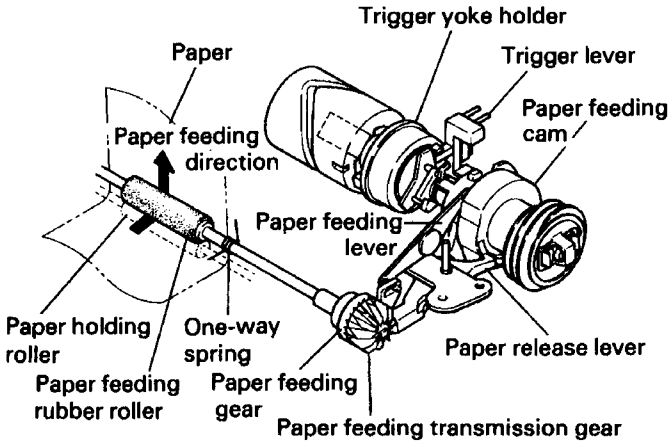


Fig. 1-10 Paper Feeding Mechanism

Operation of Paper Feeding Lever (See Fig. 1-11)

The paper feeding cam has a built-in inner cam. Since the paper feeding lever ("A") is set into this cam groove, when the paper feeding cam rotates in the ➡ ⓐ arrow direction while sliding in the cam shaft direction, the paper driving lever moves along the cam groove. Note that because the paper feeding lever moves around the fulcrum indicated by "B," the movement is amplified by the lever ratio, and "C" moves up and down in the ➡ ⓑ and ⓒ arrow directions.

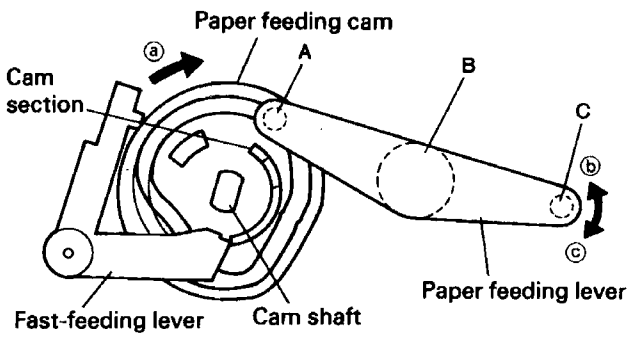
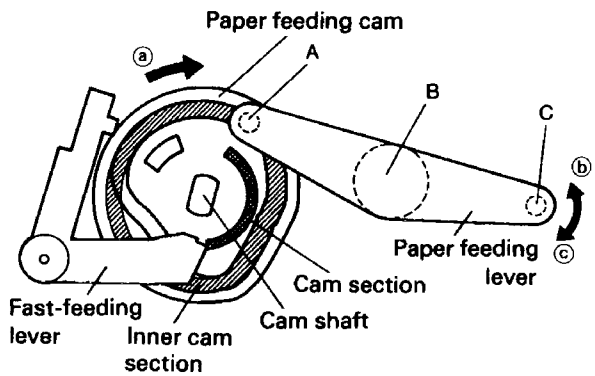


Fig. 1-11 Operation of Paper Feeding Lever

Normal feeding operation (See Fig. 1-12)

When the paper feeding cam rotates in the ➡ ⓐ arrow direction due to the cam shaft, the cam section (crosshatched area) which is set in the center of the paper feeding cam and the fast-feeding lever come into contact, and the paper feeding cam rotates while sliding in the cam shaft direction. When "A" of the paper feeding lever completes one rotation along the inner cam section (shaded area) of the rotating paper feeding cam, "C" of the paper feeding lever moves on pitch up and down in the ⬌ ⓑ and ⓒ arrow directions, thereby feeding the paper.



1-12 Operation of Normal Feeding Lever

Fast-feeding operation (See Figs. 1-13 and 1-14)

When the trigger coil is charged with the prescribed pulse, the trigger plate is drawn and adheres to the trigger yoke holder, then the trigger plate is rotated in the ➡ ⓓ arrow direction of Fig. 1-13. Note that the rotation force is transmitted to the trigger lever which is combined with the trigger plate so that the trigger lever rotates in the ➡ ⓔ arrow direction of Fig. 1-13. Consequently, the engagement between the trigger lever and fast-feeding lever is canceled, and the fast-feeding lever moves in the ➡ ⓕ arrow direction of Figs. 1-13 and 1-14. As shown in Fig. 1-14, the tip of the fast-feeding lever moves out of the locus of the cam sectioin (shaded area) which is set in the center of paper feeding cam. When the paper feeding cam then rotates with its cam section separated from the fast-feeding lever, "A" of the paper feeding lever makes one rotation along the cam groove (shaded area of Fig. 1-14) of the paper feeding cam, thereby feeding the paper three line pitches.

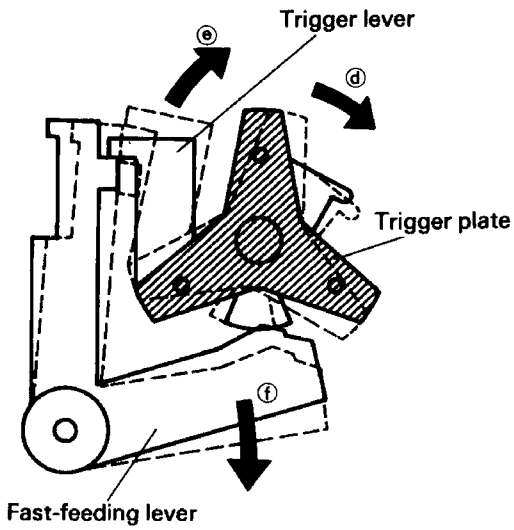


Fig.1-13 Trigger Lever Operation During Paper Feeding

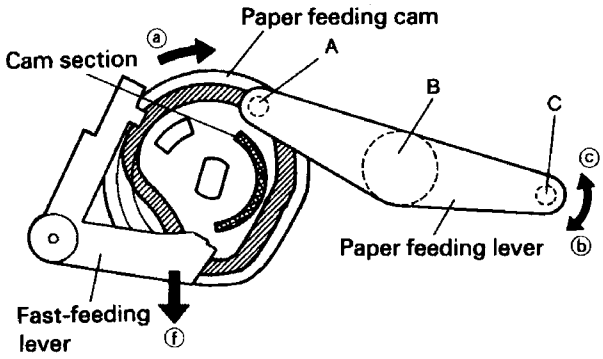


Fig. 1-14. Fast Feeding Operation

Operation of the paper feeding gear and paper feeding transmission gear (See Figs. 1-15 and 1-16)

The paper feeding gear is engaged with the paper feeding lever and performs repetitive rotation linkage according to the up and down movements of the paper feeding lever. The paper feeding transmission gear is engaged with the paper feeding gear during only one direction of its repetitive rotation linkage, and performs intermittent rotation.

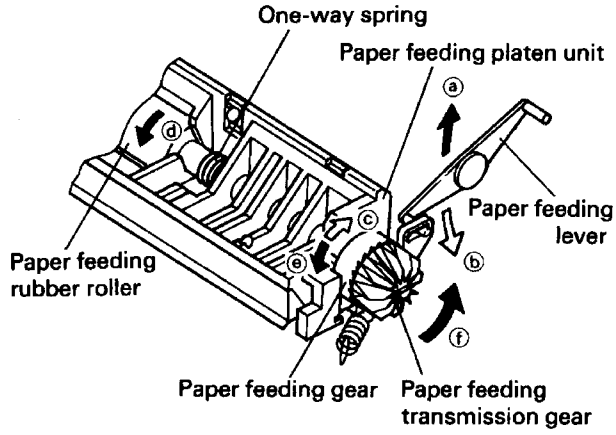


Fig. 1-15 Operation of the Paper Feeding Gear and Paper Feeding Transmission Gear

Paper feeding status (See Fig. 1-15)

When the paper feeding lever moves in the ➡ ⓐ arrow direction due to the inner cam of the paper feeding cam, the paper feeding gear is rotated in the ➡ ⓔ arrow direction and becomes engaged with the paper feeding transmission gear. When the paper feeding transmission gear thus performs intermittent rotation in the ➡ ⓕ arrow direction for a one-tooth or two-teeth interval, the paper feeding rubber roller on the same shaft also rotates in the ➡ ⓓ arrow direction, thereby feeding the paper.

Recovery of paper feeding gear (See Fig. 1-15 and 1-16)

When the paper feeding lever moves in the ⇨ ⓑ arrow direction of Fig. 1-15 due to the inner cam of the paper feeding cam, the paper feeding gear rotates in the ⇨ ⓒ arrow direction of Fig. 1-15. After the paper is fed a one-tooth interval, the return of the paper feeding gear is performed in the Paper Release status (see "Paper release mechanism"). After a two-teeth interval, its return is performed by riding over the teeth of the paper feeding transmission gear. At such time, because the paper feeding transmission gear is prevented from rotating by the one way spring, its engagement with the paper feeding gear is canceled, and only the paper feeding gear reverses rotation for its recovery.

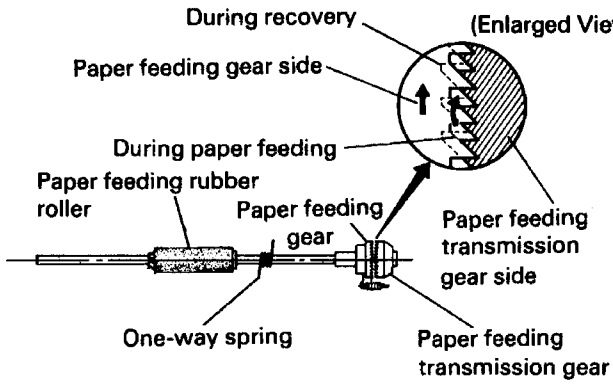


Fig.1-16 Operation of Paper Feeding Gear and Paper Feeding Transmission Gear During Paper Feeding and Recovery

Paper release operation
(See Fig. 1-17)
The paper release lever is moved in the ➡ ⓐ arrow direction by the cam A of the paper feeding cam, the paper feeding gear is slid in the ➡ ⓑ arrow direction, and the engagement between the paper feeding gear and the paper feeding transmission gear is canceled (hereafter referred to as the "Paper Release status").
Even if the paper feeding cam rotates in the ➡ ⓒ arrow direction, the cam A is completed, and cam control becomes impossible, because the Paper Release status is structurally maintained while the inner cam of the paper feeding cam and the fast-feeding lever retain contact, the Paper Release status is ended at the moment that the inner cam of the paper feeding cam and the fast-feeding lever lose contact.
Because this printer is designed to stop in the Paper Release status to facilitate printer use (use in the conditions listed in the specification sheet), the paper can be easily pulled out or fed by manual knob in the direction of or opposite to paper feeding.

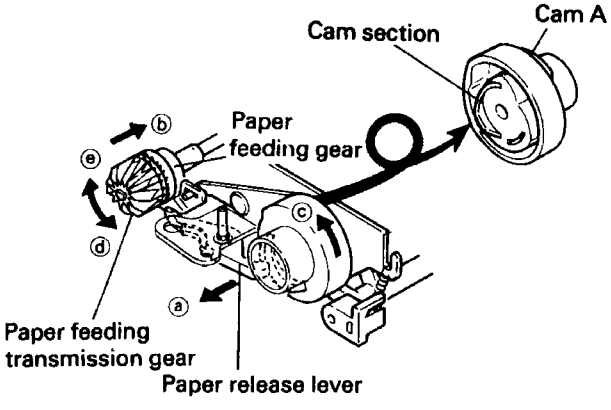


Fig. 1-17. Paper Release Operation

1.2.5 Ribbon Feeding Mechanism

As shown in Fig. 1-18, the ribbon feeding mechanism consists of the ribbon feeding cam, ribbon feeding gear, spool gear ass'y, and a ribbon cassette containing an endless ribbon. The mechanism is constructed so that the ribbon is automatically fed by the rotation of the motor.

Ribbon feeding operation
(See Fig. 1-18)
When the uniquely shaped ribbon feeding cam rotates in the ⇨ ⓐ arrow direction, the ribbon feeding gear consisting of a bevel gear and small gear which form a single unit rotates in the ⇨ ⓑ arrow direction, and the spool gear ass'y which is engaged with the small gear of the ribbon feeding gear rotates in the ⇨ ⓒ arrow direction. Receiving the rotation of the spool gear ass'y, the spool gear shaft which rotates only in one direction becomes engaged with the ribbon feeding roller (an internal part of the ribbon cassette) which rotates to enable ribbon feeding.

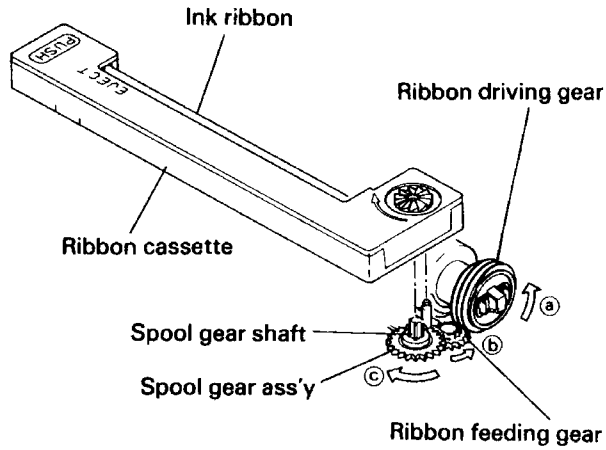


Fig. 1-18. Ribbon Feeding Mechanism

1.2.6 Print Operation for One Print Cycle

Operation of Model-180

1. For Three-Dot Spacing (5 x 7 dot matrix printing)

(a) In case of continuous printing

① The Motor Drive signal is applied, the Timing signal T is counted after motor activation, the presence/absence of the Reset signal R is detected during the period from the front edge of the 44th Timing signal T until the front edge of the 45th Timing signal T, then either (a) or (b) below shall be conformed to.

(a) When no Reset signal R is generated:
The first Reset signal R generated next shall be referred to as R1, and the first Timing signal T generated after R1 generation shall be referred to as T1.

(b) When a Reset signal R is generated:
Beginning the count from next generated Timing signal T, the Reset signal R generated after the 45th Timing signal shall be referred to as R1, and the first Timing signal T generated after R1 generated shall be referred to as T1.

② Due to application of Driving pulse P1 of T1 ~ T2 to print solenoids A and D, the dot which is farthest to the left and in the uppermost row in the characters of the 1st and 13th columns are printed.

③ Dut to application of Driving pulse P2 of T2 ~ T3 to print solenoids B and E, the dot which is farthest to the left and in the uppermost row in the characters of the 5th and 17th columns are printed.

④ Dut to application of Driving pulse P3 of T3 ~ T4 to print solenoids C and F, the dot which is farthest to the left and in the uppermost row in the characters of the 9th and 21st columns are printed.

⑤ After sequential performance of the above control, due to application of Driving pulse P69 of T69 ~ T70 to print solenoids C and F, the dot which is farthest to the right and in the uppermost row of the characters in the 12th and 24th columns are printed.

⑥ One dot is respectively alloted for each character space of the rightmost columns < (4, 16) (8, 20) (12, 24) > which make up the solenoids. At the same time that the printing head performs a return during the period from T73 to T120, a one-dot paper feed is automatically (hereafter referred to as "automatic feed") conducted and the printing of one dot line is completed.

⑦ Due to continuation of the count of Timing signal T (T121, T122...), execution of printing until the 7th dot line, and the application of Driving pulse P789 of T789 ~ T790 to print solenoids C and F, the dot which is farthest to the right and in the lowermost row of the characters in the 12th and 24th columns are printed, and printing of the 5 x 7 dot-matrix character is completed.

⑧ Furthermore, due to the continuation of the count of Timing pulse T and the charging of the fast-feeding trigger magnet during the period from the front edge of Timing signal T841 of the 8th dot line until the front edge of the 5th Timing signal T846, fast-feeding of the paper (the paper is fed three pitches during one printing head cycle) is conducted, and three dot line spacing is gained.

⑨ Furthermore, with the Reset signal R generated after Timing signal T885 of the 8th dot line regarded as R1 of the next line, printing is started.

* Concerning the preceding description, for Steps ⑧ and ⑨, there is a method for charging the fast-feeding trigger magnet with reference to the Reset signal R.

⑧' The Reset signal R generated after Timing signal T765 of the 7th dot line is detected, the first Timing signal T to be generated after detection is regarded as Tf1, then the fast-feeding trigger magnet is driven during the period from the front edge of Tf1 until the front edge of Tf6, and fast-feeding is conducted.

⑨' The count of the Timing pulse T which was used in driving the fast-feeding trigger magnet is continued, the Reset signal R which is generated after Timing signal Tf45 is regarded as R1 of the next line, and printing is started.

(b) In case of intermittent printing

① Identical to Steps ① to ⑦ of the preceding 1. (a).

② For the 8th and 9th dot lines, the fast-feeding trigger magnet is not driven, the paper is fed by automatic feed, the Reset signal R that is generated after Timing signal T1005 is regarded as R10, and the motor is abruptly stopped after R10 generation.

③ Steps ① and ② are repeated.

2. For Recommencing Printing After Setting n-Line Spacing (5 x 7 dot matrix printing)

(a) In case of continuous printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T885 (or Tf45) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 1).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation.

④ R (m + a + 1) is set as R1 of the next line, and printing is started.

(10 × n)/3 = (m remainder) × a — (Equation 1)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 4 → m = 13

a = 1

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R15 = R1 of next line

(b) In case of intermittent printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T885 (or Tf45) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 2).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation, and the motor is abruptly stopped after R (m + a + 1) generation.

④ Printing is started identically to Steps ① to ⑦ of the preceding 1. (a).

(10 × n − 2)/3 = (m remainder) × a — (Equation 2)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 1 → m = 13

a = 0

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R14

Reset signal R used for abruptly stopping the motor

3. For Bit Image Printing

For bit image printing, T1 is detected according to Step ① of 1. (a), and printing is performed according to the Timing pulses T which are continuously counted until the end of the successive bit images.

* Refer to the specification sheet regarding the number of consecutive charges to the print solenoids.

4. Reset Signal R

① In the case of detecting Reset signal Rn — which is the reference for the nth dot line — after detection of Reset signal R1, the Reset signal R that is generated after Timing signal T (120 × (n − 2) + 45) shall be Reset signal Rn.

② The initialization for confirming that the printing head is in Standby status is automatically completed by detecting the above-mentioned R1. The Timing signal T1 which indicates the standard dot position for each print cycle is determined by the detection of R1.

③ The Reset signal R may be in MAKE or BREAK mode in the Standby status.

NOTES:

1. Regions where print solenoid driving is forbidden:
   1) From motor activation until the front edge of Reset signal R1 (from motor activation until constant rotation is achieved)
   2) During the period from (T73 + 120n) to (T120 + 120n) (during return of the printing head)
      (for n = 0 ~ 10, 3-dot line spacing for 5 × 7 dot matrix)
   3) During the period from driving of the fast-feeding trigger magnet until generation of the next Reset signal R
2. Make sure that the Print Solenoid Driving pulse is neither driven nor interrupted by noise.
3. Make sure that the Fast-Feeding Trigger Magnet Driving pulse is neither driven nor interrupted by noise.
4. The fast-feeding trigger magnet must not be driven by the Reset signal R which switches OFF the Motor Driving signal.

Operation of Model-181

1. For Three-Dot Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① The Motor Drive signal is applied, the Timing signal T is counted after motor activation, the presence/absence of the Reset signal R is detected during the period from the front edge of the 56th Timing signal T until the front edge of the 57th Timing signal T, then either (a) or (b) below shall be conformed to.

(a) When no Reset signal R is generated:
The first Reset signal R generated next shall be referred to as R1, and the first Timing signal T generated after R1 generation shall be referred to as T1.

(b) When a Reset signal R is generated:
Beginning the count from next generated Timing signal T, the Reset signal R generated after the 57th Timing signal shall be referred to as R1, and the first Timing signal T generated after R1 generated shall be referred to as T1.

② Due to application of Driving pulse P1 of T1-T2 to print solenoids A and D, the dot which is farthest to the left and in the uppermost row of the characters in the 1st and 16th columns are printed.

③ Due to application of Driving pulse P2 of T2-T3 to print solenoids B and E, the dot which is farthest to the left and in the uppermost row of the characters in the 6th and 21st columns are printed.

④ Due to application of Driving pulse P3 of T3-T4 to print solenoids C and F, the dot which is farthest to the left and in the uppermost row of the characters in the 11th and 26th columns are printed.

⑤ After sequential performance of the above control, due to application of Driving pulse P87 of T87-T88 to print solenoids C and F, the dot which is farthest to the right and in the uppermost row of the characters in the 15th and 30th columns are printed.

⑥ One dot is respectively alloted for each character space of the rightmost columns < (4, 20) (10, 25) (15, 30) > which make up the solenoids. At the same time that the printing head performs a return during the period from T91 to T150, a one-dot paper feed is automatically (hereafter referred to as "automatic feed") conducted and the printing of one dot line is completed.

⑦ Due to continuation of the count of Timing signal T (T151, T152...), execution of printing until the 7th dot line, and the application of Driving pulse P987 of T987-T988 to print solenoids C and F, the dot which is farthest to the right and in the lowermost row of the characters in the 15th and 30th columns are printed, and printing of the 5 × 7 dot-matrix character is completed.

⑧ Furthermore, due to the continuation of the count of Timing pulse T and the charging of the fast-feeding trigger magnet during the period from the front edge of Timing signal T1051 of the 8th dot line until the front edge of the 7th Timing signal T1058, fast-feeding of the paper (the paper is fed three pitches during one printing head cycle) is conducted, and three dot line spacing is gained.

⑨ Furthermore, with the Reset signal R generated after Timing signal T1107 of the 8th dot line regarded as R1 of the next line, printing is started.

* Concerning the preceding description, for Steps ⑧ and ⑨, there is a method for charging the fast-feeding trigger magnet with reference to the Reset signal R.

⑧' The Reset signal R generated after Timing signal T957 of the 7th dot line is detected, the first Timing signal T to be generated after detection is regarded as Tf1, then the fast-feeding trigger magnet is driven during the period from the front edge of Tf1 until the front edge of Tf8, and fast-feeding is conducted.

⑨' The count of the Timing pulse T which was used in driving the fast-feeding trigger magnet is continued, the Reset signal R which is generated after Timing signal Tf57 is regarded as R1 of the next line, and printing is started.

(b) In case of intermittent printing

① Identical to Steps ① to ⑦ of the preceding 1. (a).

② For the 8th and 9th dot lines, the fast-feeding trigger magnet is not driven, the paper is fed by automatic feed, the Reset signal R that is generated after Timing signal T1257 is regarded as R10, the first Timing signal T to be generated after R10 generation is regarded as T1, successive Timing signals T are counted, and the motor is abruptly stopped at the front edge of T11.

③ Steps ① and ② are repeated.

2. For Recommencing Printing After Setting n-Line Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T1107 (or Tf57) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 1).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R(m + a + 1) generation..

④ R (m + a + 1) is set as R1 of the next line, and printing is started.

(10 × n)/3 = (m remainder) × a — (Equation 1)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 4 → m = 13

a = 1

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R15 =R1 of next line

(b) In case of intermittent printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T1107 (or Tf57) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 2).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation, the Timing signals T are counted (T1, T2...), and the motor is abruptly stopped at the front edge of T11.

④ Printing is started identically to Steps ① to ⑦ of the preceding 1. (a).

(10 × n − 1)/3 = (m remainder) × a — (Equation 2)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 1 → m = 13

a = 0

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R14

Reset signal R used as the reference for abruptly stopping the motor

3. For Bit Image Printing

For bit image printing, T1 is detected according to Step ① of 1. (a), and printing is performed according to the Timing pulses T which are continuously counted until the end of the successive bit images.

* Refer to the specification sheet regarding the number of consecutive charges to the print solenoids.

4. Reset Signal R

① In the case of detecting Reset signal Rn — which is the reference for the nth dot line — after detection of Reset signal R1, the Reset signal R that is generated after Timing signal T (150 × (n − 2) + 57) shall be Reset signal Rn.

② The initialization for confirming that the printing head is in Standby status is automatically completed by detecting the above-mentioned R1. The Timing signal T1 which indicates the standard dot position for each print cycle is determined by the detection of R1.

③ The Reset signal R may be in MAKE or BREAK mode in the Standby status.

NOTES:

1. Regions where print solenoid driving is forbidden:
   1) From motor activation until the front edge of Reset signal R1 (from motor activation until constant rotation is achieved)
   2) During the period from (T91 + 150n) to (T150 + 150n) (during return of the printing head)
      (for n = 0 ~ 10, 3-dot line spacing for 5 × 7 dot matrix)
   3) During the period from driving of the fast-feeding trigger magnet until generation of the next Reset signal R
2. Make sure that the Print Solenoid Driving pulse is neither driven nor interrupted by noise.
3. Make sure that the Fast-Feeding Trigger Magnet Driving pulse is neither driven nor interrupted by noise.
4. The fast-feeding trigger magnet must not be driven by the Reset signal R which switches OFF the Motor Driving signal.

Operation of Model-182

1. For Three-Dot Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① The Motor Drive signal is applied, the Timing signal T is counted after motor activation, the presence/absence of the Reset signal R is detected during the period from the front edge of the 67th Timing signal T until the front edge of the 68th Timing signal T, then either (a) or (b) below shall be conformed to.

(a) When no Reset signal R is generated:
The first Reset signal R generated next shall be referred to as R1, and the first Timing signal T generated after R1 generation shall be referred to as T1.

(b) When a Reset signal R is generated:
Beginning the count from next generated Timing signal T, the Reset signal R generated after the 68th Timing signal shall be referred to as R1, and the first Timing signal T generated after R1 generated shall be referred to as T1.

② Due to application of Driving pulse P1 of T1-T2 to print solenoids A and D, the dot which is farthest to the left and in the uppermost row of the characters in the 1st and 19th columns are printed.

③ Due to application of Driving pulse P2 of T2-T3 to print solenoids B and E, the dot which is farthest to the left and in the uppermost row of the characters in the 7th and 25th columns are printed.

④ Due to application of Driving pulse P3 of T3-T4 to print solenoids C and F, the dot which is farthest to the left and in the uppermost row of the characters in the 13th and 31st columns are printed.

⑤ After sequential performance of the above control, due to application of Driving pulse P105 of T105-T106 to print solenoids C and F, the dot which is farthest to the right and in the uppermost row of the characters in the 18th and 36th columns are printed.

⑥ One dot is respectively alloted for each character space of the rightmost columns < (6, 24) (12, 30) (18, 36) > which make up the solenoids. At the same time that the printing head performs a return during the period from T109 to T180, a one-dot paper feed is automatically (hereafter referred to as "automatic feed") conducted and the printing of one dot line is completed.

⑦ Due to continuation of the count of Timing signal T (T181, T182...), execution of printing until the 7th dot line, and the application of Driving pulse P1185 of T1185-T1186 to print solenoids C and F, the dot which is farthest to the right and in the lowermost row of the characters in the 18th and 36th columns are printed, and printing of the 5 × 7 dot-matrix character is completed.

⑧ Furthermore, due to the continuation of the count of Timing pulse T and the charging of the fast-feeding trigger magnet during the period from the front edge of Timing signal T1261 of the 8th dot line until the front edge of the 8th Timing signal T1269, fast-feeding of the paper (the paper is fed three pitches during one printing head cycle) is conducted, and three dot line spacing is gained.

⑨ Furthermore, with the Reset signal R generated after Timing signal T1328 of the 8th dot line regarded as R1 of the next line, printing is started.

* Concerning the preceding description, for Steps ⑧ and ⑨, there is a method for charging the fast-feeding trigger magnet with reference to the Reset signal R.

⑧' The Reset signal R generated after Timing signal T1148 of the 7th dot line is detected, the first Timing signal T to be generated after detection is regarded as Tf1, then the fast-feeding trigger magnet is driven during the period from the front edge of Tf1 until the front edge of Tf9, and fast-feeding is conducted.

⑨' The count of the Timing pulse T which was used in driving the fast-feeding trigger magnet is continued, the Reset signal R which is generated after Timing signal Tf68 is regarded as R1 of the next line, and printing is started.

(b) In case of intermittent printing

① Identical to Steps ① to ⑦ of the preceding 1. (a).

② For the 8th and 9th dot lines, the fast-feeding trigger magnet is not driven, the paper is fed by automatic feed, the Reset signal R that is generated after Timing signal T1508 is regarded as R10, the first Timing signal T to be generated after R10 generation is regarded as T1, successive Timing signals T are counted, and the motor is abruptly stopped at the front edge of T11.

③ Steps ① and ② are repeated.

2. For Recommencing Printing After Setting n-Line Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T1328 (or Tf68) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 1).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation.

④ R (m + a + 1) is set as R1 of the next line, and printing is started.

(10 × n)/3 = (m remainder) × a — (Equation 1)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 4 → m = 13

a = 1

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R15 = R1 of next line

(b) In case of intermittent printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T1328 (or Tf68) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 2).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation, the Timing signals T are counted (T1, T2...), and the motor is abruptly stopped at the front edge of T11.

④ Printing is started identically to Steps ① to ⑦ of the preceding 1. (a).

(10 × n − 1)/3 = (m remainder) × a — (Equation 2)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 1 → m = 13

a = 0

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R14

Reset signal R used as the reference for abruptly stopping the motor

3. For Bit Image Printing

For bit image printing, T1 is detected according to Step ① of 1. (a), and printing is performed according to the Timing pulses T which are continuously counted until the end of the successive bit images.

* Refer to the specification sheet regarding the number of consecutive charges to the print solenoids.

4. Reset Signal R

① In the case of detecting Reset signal Rn — which is the reference for the nth dot line — after detection of Reset signal R1, the Reset signal R that is generated after Timing signal T (180 × (n − 2) + 68) shall be Reset signal Rn.

② The initialization for confirming that the printing head is in Standby status is automatically completed by detecting the above-mentioned R1. The Timing signal T1 which indicates the standard dot position for each print cycle is determined by the detection of R1.

③ The Reset signal R may be in MAKE or BREAK mode in the Standby status.

NOTES:

1. Regions where print solenoid driving is forbidden:
   1) From motor activation until the front edge of Reset signal R1 (from motor activation until constant rotation is achieved)
   2) During the period from (T109 + 180n) to (T180 + 180n) (during return of the printing head)
      (for n = 0 ~ 10, 3-dot line spacing for 5 × 7 dot matrix)
   3) During the period from driving of the fast-feeding trigger magnet until generation of the next Reset signal R
2. Make sure that the Print Solenoid Driving pulse is neither driven nor interrupted by noise.
3. Make sure that the Fast-Feeding Trigger Magnet Driving pulse is neither driven nor interrupted by noise.
4. The fast-feeding trigger magnet must not be driven by the Reset signal R which switches OFF the Motor Driving signal.

Operation of Model-183

1. For Three-Dot Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① The Motor Drive signal is applied, the Timing signal T is counted after motor activation, the presence/absence of the Reset signal R is detected during the period from the front edge of the 78th Timing signal T until the front edge of the 79th Timing signal T, then either (a) or (b) below shall be conformed to.

(a) When no Reset signal R is generated:
The first Reset signal R generated next shall be referred to as R1, and the first Timing signal T generated after R1 generation shall be referred to as T1.

(b) When a Reset signal R is generated:
Beginning the count from next generated Timing signal T, the Reset signal R generated after the 79th Timing signal shall be referred to as R1, and the first Timing signal T generated after R1 generated shall be referred to as T1.

② Due to application of Driving pulse P1 of T1-T2 to print solenoids A and D, the dot which is farthest to the left and in the uppermost row of the characters in the 1st and 22nd columns are printed.

③ Due to application of Driving pulse P2 of T2-T3 to print solenoids B and E, the dot which is farthest to the left and in the uppermost row of the characters in the 8th and 29th columns are printed.

④ Due to application of Driving pulse P3 of T3-T4 to print solenoids C and F, the dot which is farthest to the left and in the uppermost row of the characters in the 15th and 36th columns are printed.

⑤ After sequential performance of the above control, due to application of Driving pulse P123 of T123-T124 to print solenoids C and F, the dot which is farthest to the right and in the uppermost row of the characters in the 21st and 42nd columns are printed.

⑥ One dot is respectively alloted for each character space of the rightmost columns < (7, 28) (14, 35) (21, 42) > which make up the solenoids. At the same time that the printing head performs a return during the period from T127 to T210, a one-dot paper feed is automatically (hereafter referred to as "automatic feed") conducted and the printing of one dot line is completed.

⑦ Due to continuation of the count of Timing signal T (T211, T212...), execution of printing until the 7th dot line, and the application of Driving pulse P1383 of T1383-T1384 to print solenoids C and F, the dot which is farthest to the right and in the lowermost row of the characters in the 21st and 42nd columns are printed, and printing of the 5 × 7 dot-matrix character is completed.

⑧ Furthermore, due to the continuation of the count of Timing pulse T and the charging of the fast-feeding trigger magnet during the period from the front edge of Timing signal T1471 of the 8th dot line until the front edge of the 9th Timing signal T1480, fast-feeding of the paper (the paper is fed three pitches during one printing head cycle) is conducted, and three dot line spacing is gained.

⑨ Furthermore, with the Reset signal R generated after Timing signal T1549 of the 8th dot line regarded as R1 of the next line, printing is started.

* Concerning the preceding description, for Steps ⑧ and ⑨, there is a method for charging the fast-feeding trigger magnet with reference to the Reset signal R.

⑧' The Reset signal R generated after Timing signal T1339 of the 7th dot line is detected, the first Timing signal T to be generated after detection is regarded as Tf1, then the fast-feeding trigger magnet is driven during the period from the front edge of Tf1 until the front edge of Tf10, and fast-feeding is conducted.

⑨' The count of the Timing pulse T which was used in driving the fast-feeding trigger magnet is continued, the Reset signal R which is generated after Timing signal Tf79 is regarded as R1 of the next line, and printing is started.

(b) In case of intermittent printing

① Identical to Steps ① to ⑦ of the preceding 1. (a).

② For the 8th and 9th dot lines, the fast-feeding trigger magnet is not driven, the paper is fed by automatic feed, the Reset signal R that is generated after Timing signal T1759 is regarded as R10, the first Timing signal T to be generated after R10 generation is regarded as T1, successive Timing signals T are counted, and the motor is abruptly stopped at the front edge of T11.

③ Steps ① and ② are repeated.

2. For Recommencing Printing After Setting n-Line Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T1549 (or Tf79) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 1).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation.

④ R (m + a + 1) is set as R1 of the next line, and printing is started.

(10 × n)/3 = (m remainder) × a — (Equation 1)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 4 → m = 13

a = 1

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R15 = R1 of next line

(b) In case of intermittent printing

① Identical to Steps ① to ⑧ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T1549 (or Tf79) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑧) is performed m times to Rm according to (Equation 2).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation, the Timing signals T are counted (T1, T2...), and the motor is abruptly stopped at the front edge of T11.

④ Printing is started identically to Steps 1 to 7 of the preceding 1. (a).

(10 × n − 1)/3 = (m remainder) × a — (Equation 2)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 1 → m = 13

a = 0

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R14

Reset signal R used as the reference for abruptly stopping the motor

3. For Bit Image Printing

For bit image printing, T1 is detected according to Step ① of 1. (a), and printing is performed according to the Timing pulses T which are continuously counted until the end of the successive bit images.

* Refer to the specification sheet regarding the number of consecutive charges to the print solenoids.

4. Reset Signal R

① In the case of detecting Reset signal Rn — which is the reference for the nth dot line — after detection of Reset signal R1, the Reset signal R that is generated after Timing signal T (210 × (n − 2) + 79) shall be Reset signal Rn.

② The initialization for confirming that the printing head is in Standby status is automatically completed by detecting the above-mentioned R1. The Timing signal T1 which indicates the standard dot position for each print cycle is determined by the detection of R1.

③ The Reset signal R may be in MAKE or BREAK mode in the Standby status.

NOTES:

1. Regions where print solenoid driving is forbidden:
   1) From motor activation until the front edge of Reset signal R1 (from motor activation until constant rotation is achieved)
   2) During the period from (T127 + 210n) to (T210 + 210n) (during return of the printing head)
      (for n = 0 ~ 10, 3-dot line spacing for 5 × 7 dot matrix)
   3) During the period from driving of the fast-feeding trigger magnet until generation of the next Reset signal R
2. Make sure that the Print Solenoid Driving pulse is neither driven nor interrupted by noise.
3. Make sure that the Fast-Feeding Trigger Magnet Driving pulse is neither driven nor interrupted by noise.
4. The fast-feeding trigger magnet must not be driven by the Reset signal R which switches OFF the Motor Driving signal.

Operation of Model-185

1. For Three-Dot Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① The Motor Drive signal is applied, the Timing signal T is counted after motor activation, the presence/absence of the Reset signal R is detected during the period from the front edge of the 44th Timing signal T until the front edge of the 45th Timing signal T, then either (a) or (b) below shall be conformed to.

(a) When no Reset signal R is generated:
The first Reset signal R generated next shall be referred to as R1, and the first Timing signal T generated after R1 generation shall be referred to as T1.

(b) When a Reset signal R is generated:
Beginning the count from next generated Timing signal T, the Reset signal R generated after the 45th Timing signal shall be referred to as R1, and the first Timing signal T generated after R1 generated shall be referred to as T1.

② Due to application of Driving pulse P1 of T1-T2 to print solenoids D, the dot which is farthest to the left and in the uppermost row of the character in the 12th column is printed.

③ Due to application of Driving pulse P2 of T2-T3 to print solenoid E, the dot which is farthest to the left and in the uppermost row of the character in the 12th column is printed.

④ Due to application of Driving pulse P3 of T3-T4 to print solenoids C and F, the dot which is farthest to the left and in the uppermost row of the characters in the 4th and 16th columns are printed.

⑤ Due to the application of Driving pulse P20 of T20-T21 to print solenoids B and E, the dot which is farthest to the left and in the uppermost row in the characters in the 1st and 13th columns are printed.

⑥ After sequential performance of the above control, due to application of Driving pulse P69 of T69-T70 to print solenoid C, the dot which is farthest to the right and in the uppermost row of the character in the 7th column.

⑦ One dot is respectively alloted for each character space of the rightmost columns < (11) (3, 15) (21) > which make up the solenoids. At the same time that the printing head performs a return during the period from T73 to T120, a one-dot paper feed is automatically (hereafter referred to as "automatic feed") conducted and the printing of one dot line is completed.

⑧ Due to continuation of the count of Timing signal T (T121, T122...), execution of printing until the 7th dot line, and the application of Driving pulse P789 of T789-T790 to print solenoids C, the dot which is farthest to the right and in the uppermost row of the character in the 7th column is printed, and printing of the 5 × 7 dot-matrix character is completed.

⑨ Furthermore, due to the continuation of the count of Timing pulse T and the charging of the fast-feeding trigger magnet during the period from the front edge of Timing signal T841 of the 8th dot line until the front edge of the 5th Timing signal T8460, fast-feeding of the paper (the paper is fed three pitches during one printing head cycle) is conducted, and three dot line spacing is gained.

⑩ Furthermore, with the Reset signal R generated after Timing signal T885 of the 8th dot line regarded as R1 of the next line, printing is started.

* Concerning the preceding description, for Steps ⑨ and ⑩, there is a method for charging the fast-feeding trigger magnet with reference to the Reset signal R.

⑨' The Reset signal R generated after Timing signal T765 of the 7th dot line is detected, the first Timing signal T to be generated after detection is regarded as Tf1, then the fast-feeding trigger magnet is driven during the period from the front edge of Tf1 until the front edge of Tf6, and fast-feeding is conducted.

⑩' The count of the Timing pulse T which was used in driving the fast-feeding trigger magnet is continued, the Reset signal R which is generated after Timing signal Tf45 is regarded as R1 of the next line, and printing is started.

(b) In case of intermittent printing

① Identical to Steps ① to ⑦ of the preceding 1. (a).

② For the 8th and 9th dot lines, the fast-feeding trigger magnet is not driven, the paper is fed by automatic feed, the Reset signal R that is generated after Timing signal T1005 is regarded as R10, the first Timing signal T to be generated after R10 generation is regarded as T1, successive Timing signals T are counted, and the motor is abruptly stopped at the front edge of T11.

③ Steps ① and ② are repeated.

2. For Recommencing Printing After Setting n-Line Spacing (5 × 7 dot matrix printing)

(a) In case of continuous printing

① Identical to Steps ① to ⑨ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T885 (or Tf45) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑨) is performed m times to Rm according to (Equation 1).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation.

④ R (m + a + 1) is set as R1 of the next line, and printing is started.

(10 × n)/3 = (m remainder) × a — (Equation 1)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 4 → m = 13

a = 1

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R15 = R1 of next line

(b) In case of intermittent printing

① Identical to Steps ① to ⑨ of the preceding 1. (a).

② Regarding the Reset signal R that is generated after Timing signal T885 (or Tf45) of the 8th dot line as R1 of the next line, fast-feeding (identical to 1. (a) ⑨) is performed m times to Rm according to (Equation 2).

③ Next, without driving the fast-feeding trigger magnet, automatic feed of the paper is performed while counting Reset signal R until R (m + a + 1) generation, and the motor is abruptly stopped after R (m + a + 1) generation.

④ Printing is started identically to Steps ① to ⑧ of the preceding 1. (a).

(10 × n − 1)/3 = (m remainder) × a — (Equation 2)

where n equals the no. of lines and (m × a) is an integer.

Example: For feeding 4 lines (40 dot lines)

n = 1 → m = 13

a = 0

⇨ Rm = R13 ⇨ Fast feed 13 times

R (m + a + 1) = R14

Reset signal R used as the reference for abruptly stopping the motor

3. For Bit Image Printing

For bit image printing, T1 is detected according to Step ① of 1. (a), and printing is performed according to the Timing pulses T which are continuously counted until the end of the successive bit images.

* Refer to the specification sheet regarding the number of consecutive charges to the print solenoids.

4. Reset Signal R

① In the case of detecting Reset signal Rn — which is the reference for the nth dot line — after detection of Reset signal R1, the Reset signal R that is generated after Timing signal T (120 × (n − 2) + 45) shall be Reset signal Rn.

② The initialization for confirming that the printing head is in Standby status is automatically completed by detecting the above-mentioned R1. The Timing signal T1 which indicates the standard dot position for each print cycle is determined by the detection of R1.

③ The Reset signal R may be in MAKE or BREAK mode in the Standby status.

NOTES:

1. Regions where print solenoid driving is forbidden:
   1) From motor activation until the front edge of Reset signal R1 (from motor activation until constant rotation is achieved)
   2) During the period from (T73 + 120n) to (T120 + 120n) (during return of the printing head)
      (for n = 0 ~ 10, 3-dot line spacing for 5 × 7 dot matrix)
   3) During the period from driving of the fast-feeding trigger magnet until generation of the next Reset signal R
2. Make sure that the Print Solenoid Driving pulse is neither driven nor interrupted by noise.
3. Make sure that the Fast-Feeding Trigger Magnet Driving pulse is neither driven nor interrupted by noise.
4. The fast-feeding trigger magnet must not be driven by the Reset signal R which switches OFF the Motor Driving signal.

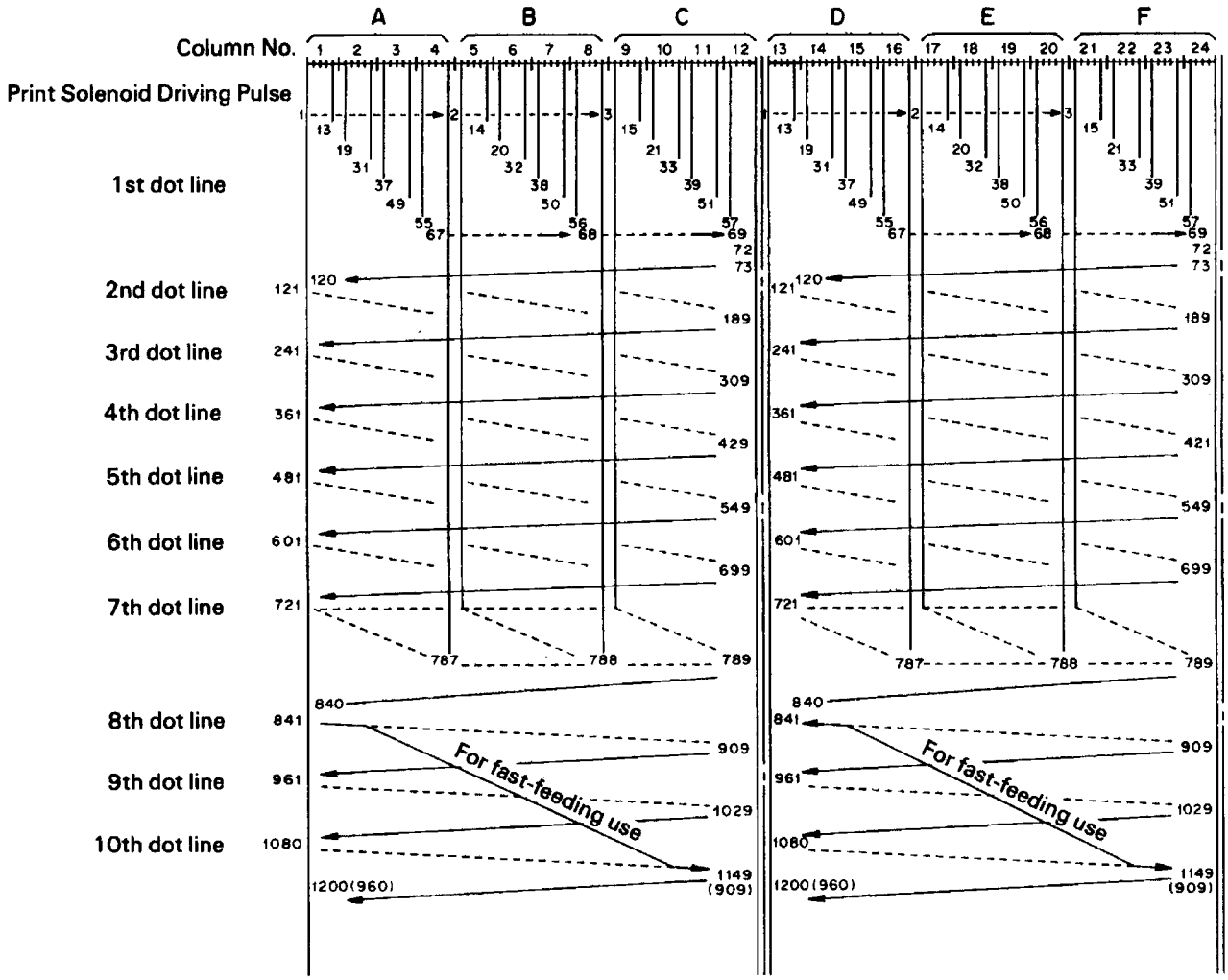


Fig. 1-19. Model-180 Detail Timing Signal T Distribution (5 x 7 Dot Matrix, 3-Dot Line Spacing)

NOTE: Numerals enclosed in parentheses indicate the number of Timing signals T in cases where the fast-feeding trigger magnet is driven at the 8th dot line and fast-feeding is conducted.

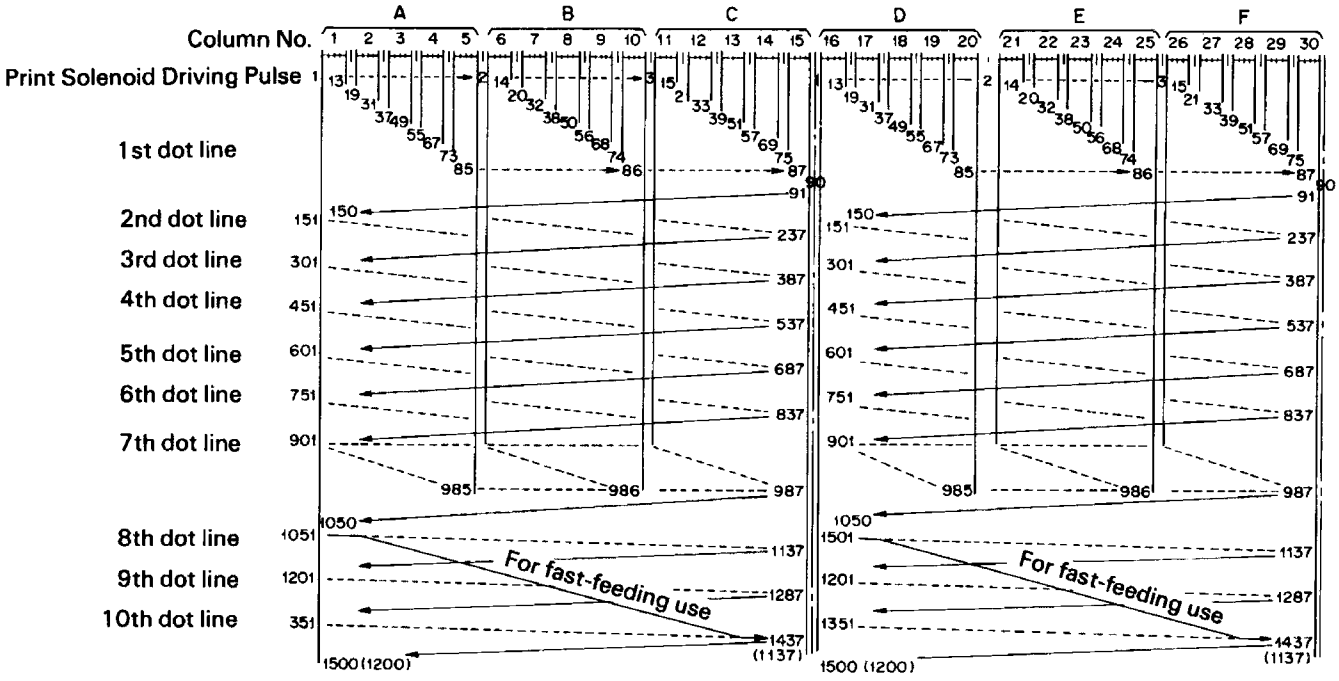


Fig. 1-20. Model-181 Detail Timing Signal T Distribution (5 x 7 Dot Matrix, 3-Dot Line Spacing)

NOTE: Numerals enclosed in parentheses indicate the number of Timing signals T in cases where the fast-feeding trigger magnet is driven at the 8th dot line and fast-feeding is conducted.

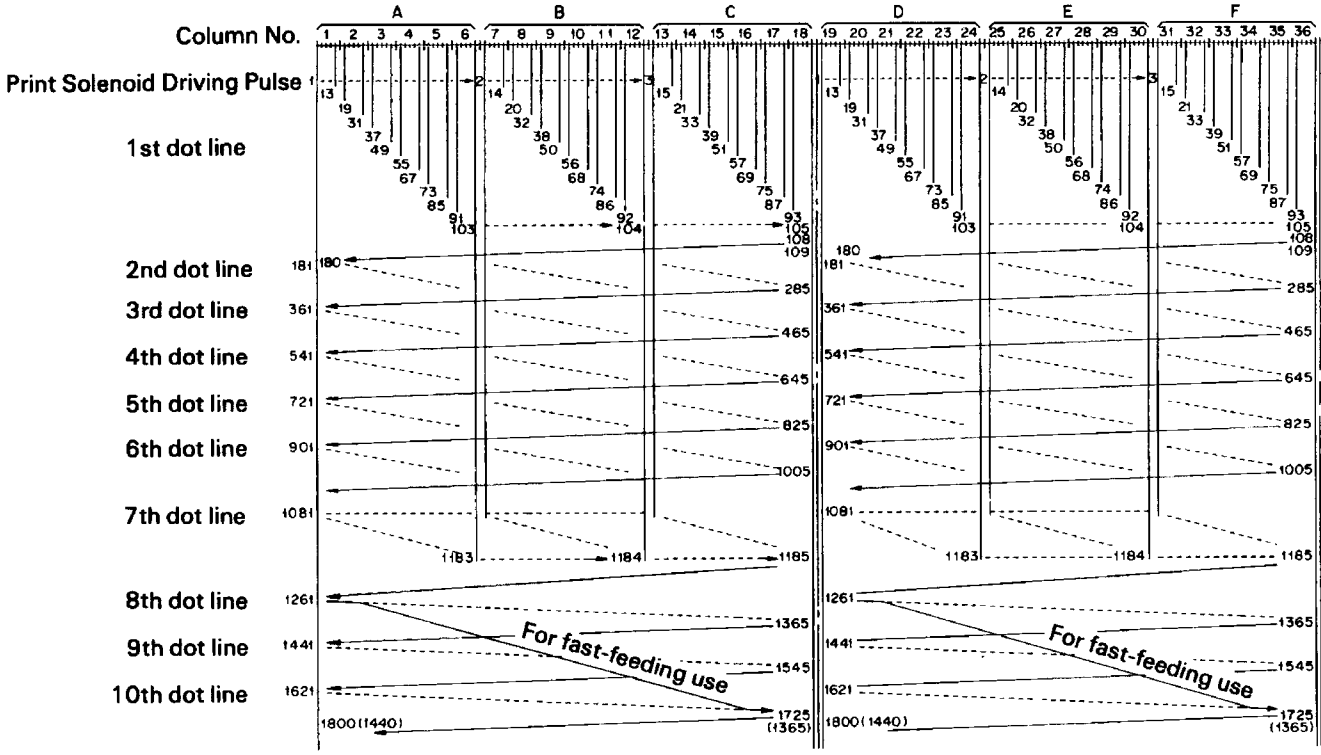


Fig. 1-21. Model-182 Detail Timing Signal T Distribution (5 x 7 Dot Matrix, 3-Dot Line Spacing)

NOTE: Numerals enclosed in parentheses indicate the number of Timing signals T in cases where the fast-feeding trigger magnet is driven at the 8th dot line and fast-feeding is conducted.

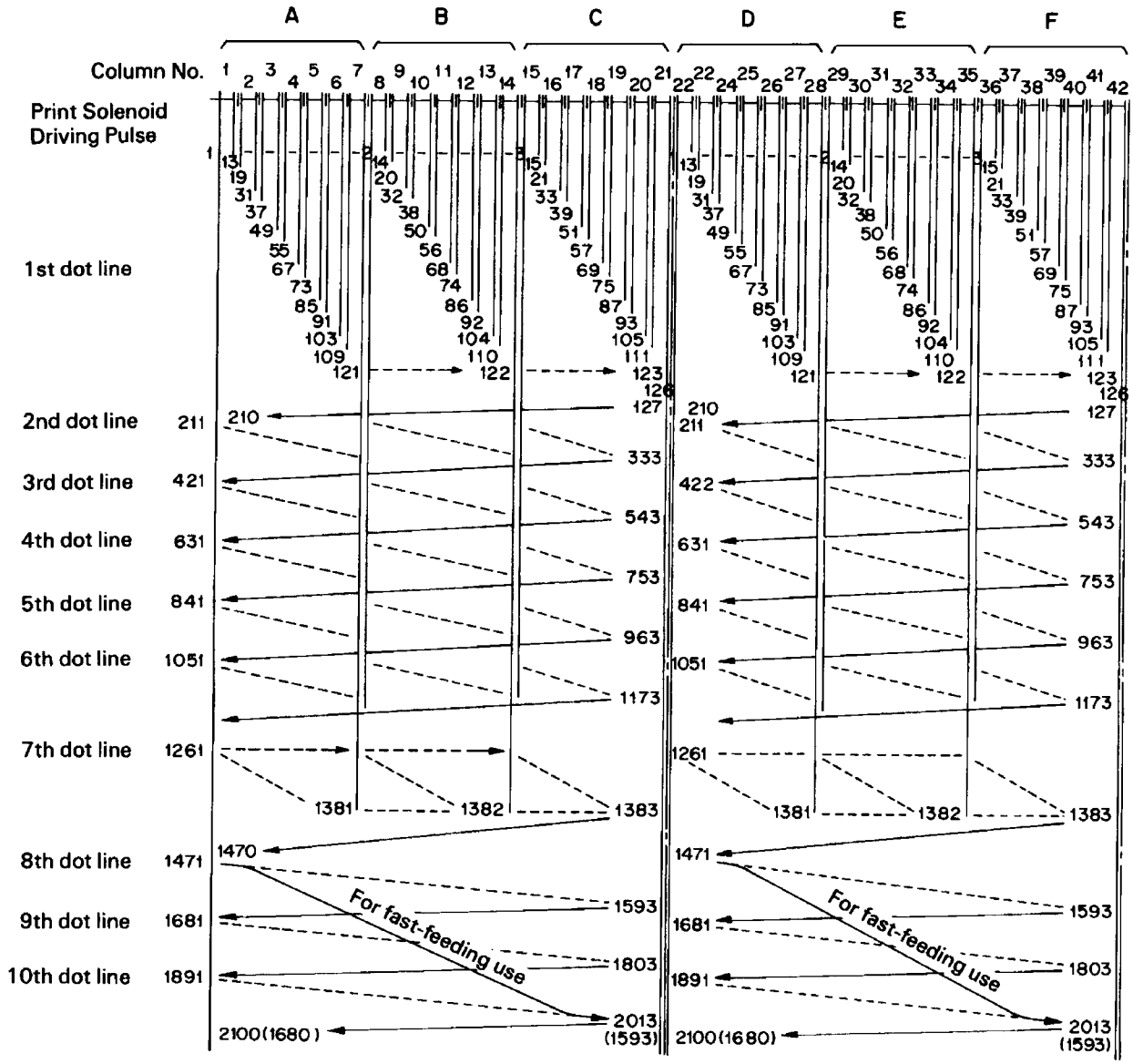


Fig. 1-22. Model-183 Detail Timing Signal T Distribution (5 x 7 Dot Matrix, 3-Dot Line Spacing)

NOTE: Numerals enclosed in parentheses indicate the number of Timing signals T in cases where the fast-feeding trigger magnet is driven at the 8th dot line and fast-feeding is conducted.

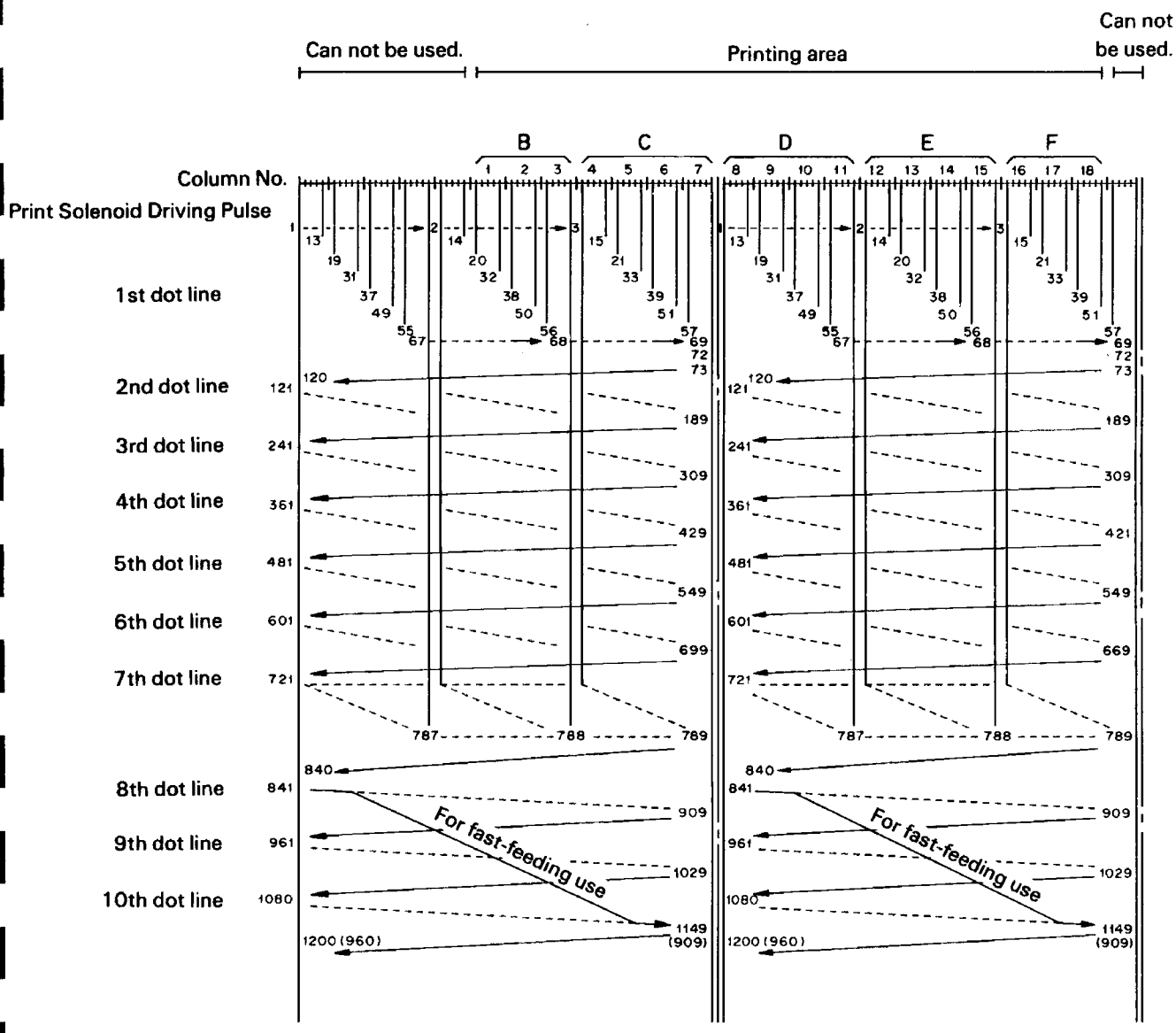


Fig. 1-23. Model-185 Detail Timing Signal T Distribution (5 x 7 Dot Matrix, 3-Dot Line Spacing)

NOTE: Numerals enclosed in parentheses indicate the number of Timing signals T in cases where the fast-feeding trigger magnet is driven at the 8th dot line and fast-feeding is conducted.

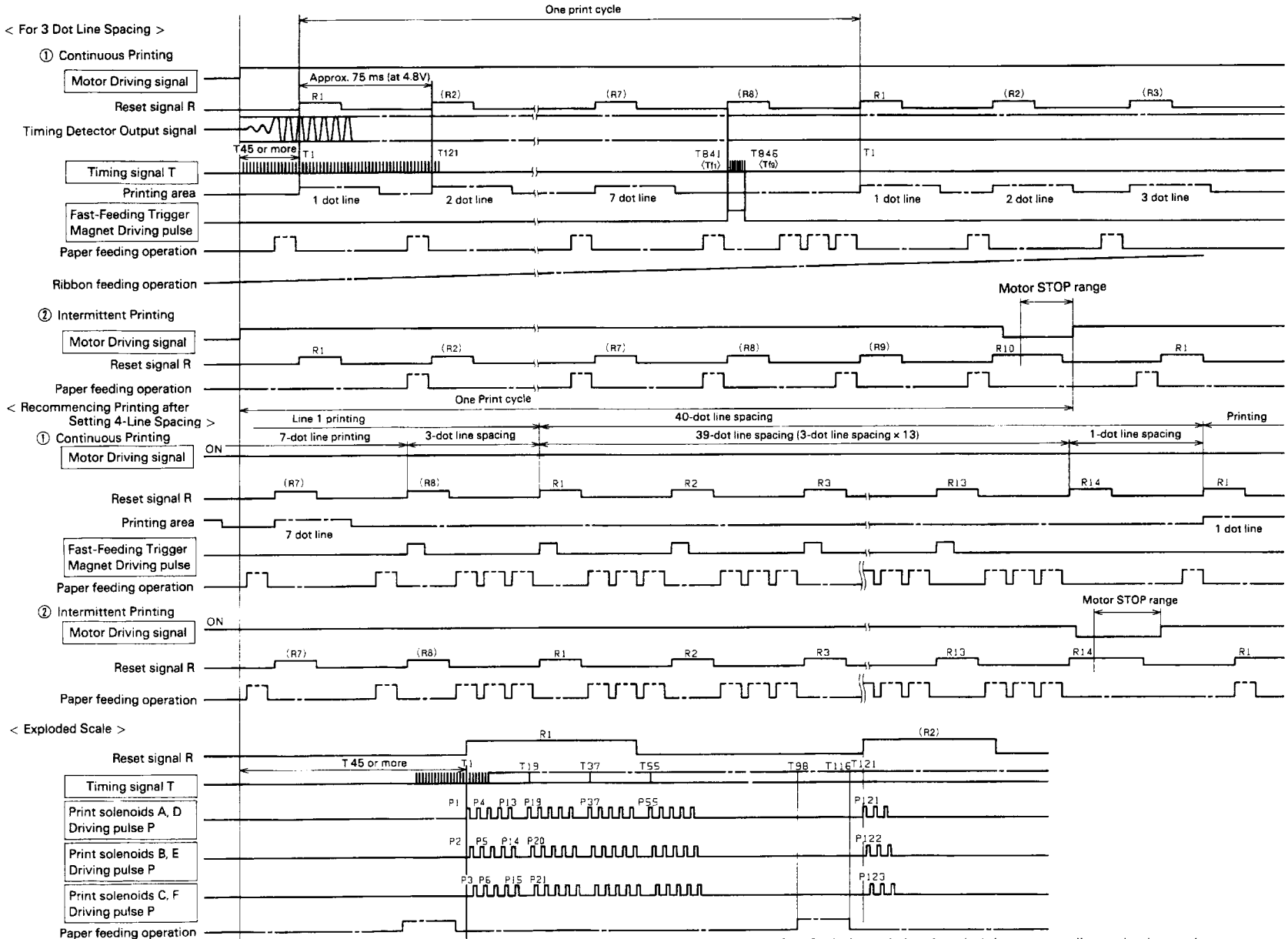


Fig. 1-24. Model-180 Timing Chart (5 x 7 Dot Matrix)

NOTES: 1. Items in brackets ( ) do not normally need to be used.
2. Numerals enclosed in brackets indicate Timing signal T in cases where Reset signal R8 has been detected.
3. Signals enclosed in a box must be supplied by the user.

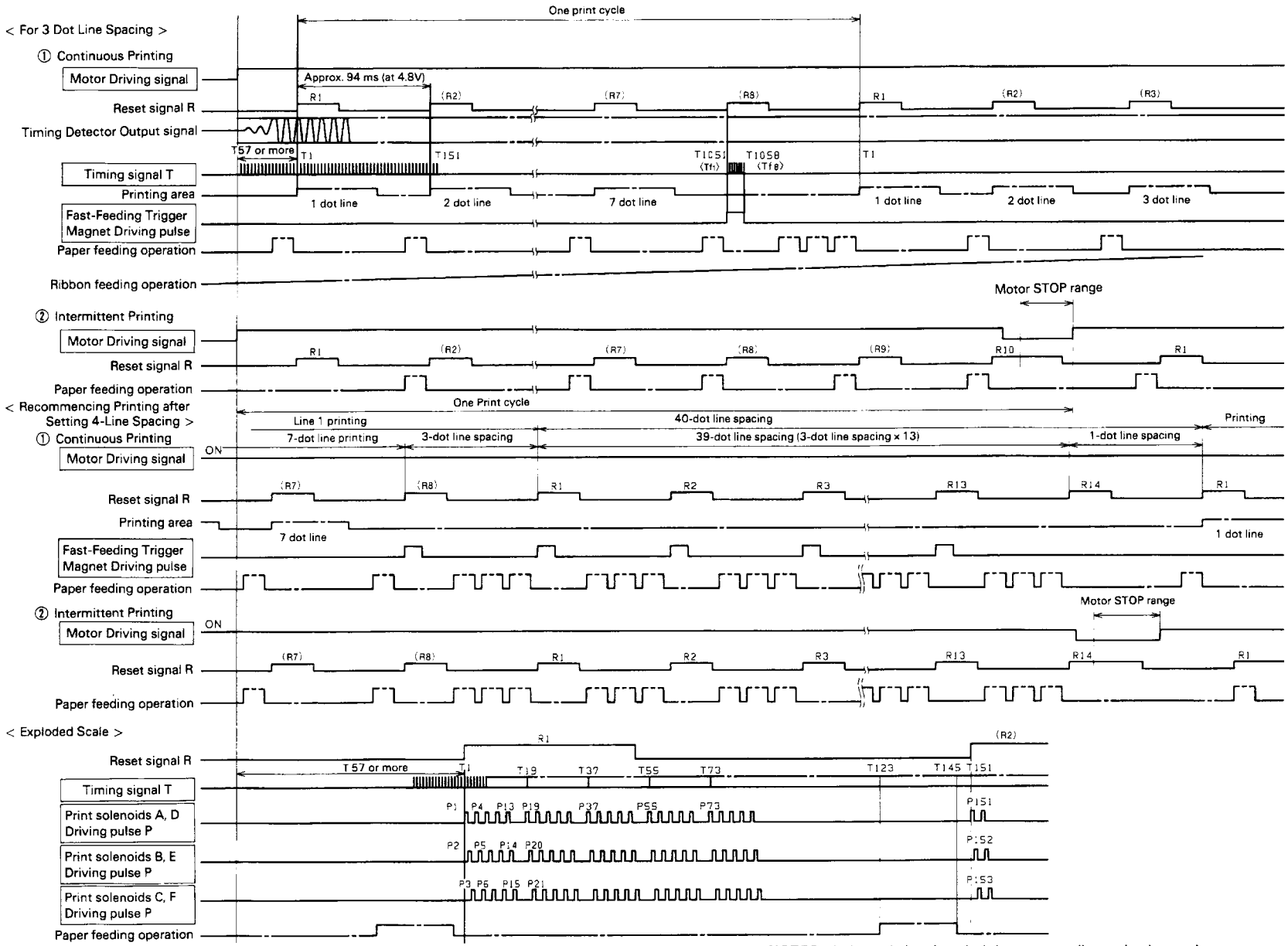


Fig. 1-25. Model-181 Timing Chart (5 × 7 Dot Matrix)

NOTES: 1. Items in brackets ( ) do not normally need to be used.
2. Numerals enclosed in brackets indicate Timing signal T in cases where Reset signal R8 has been detected.
3. Signals enclosed in a box must be supplied by the user.

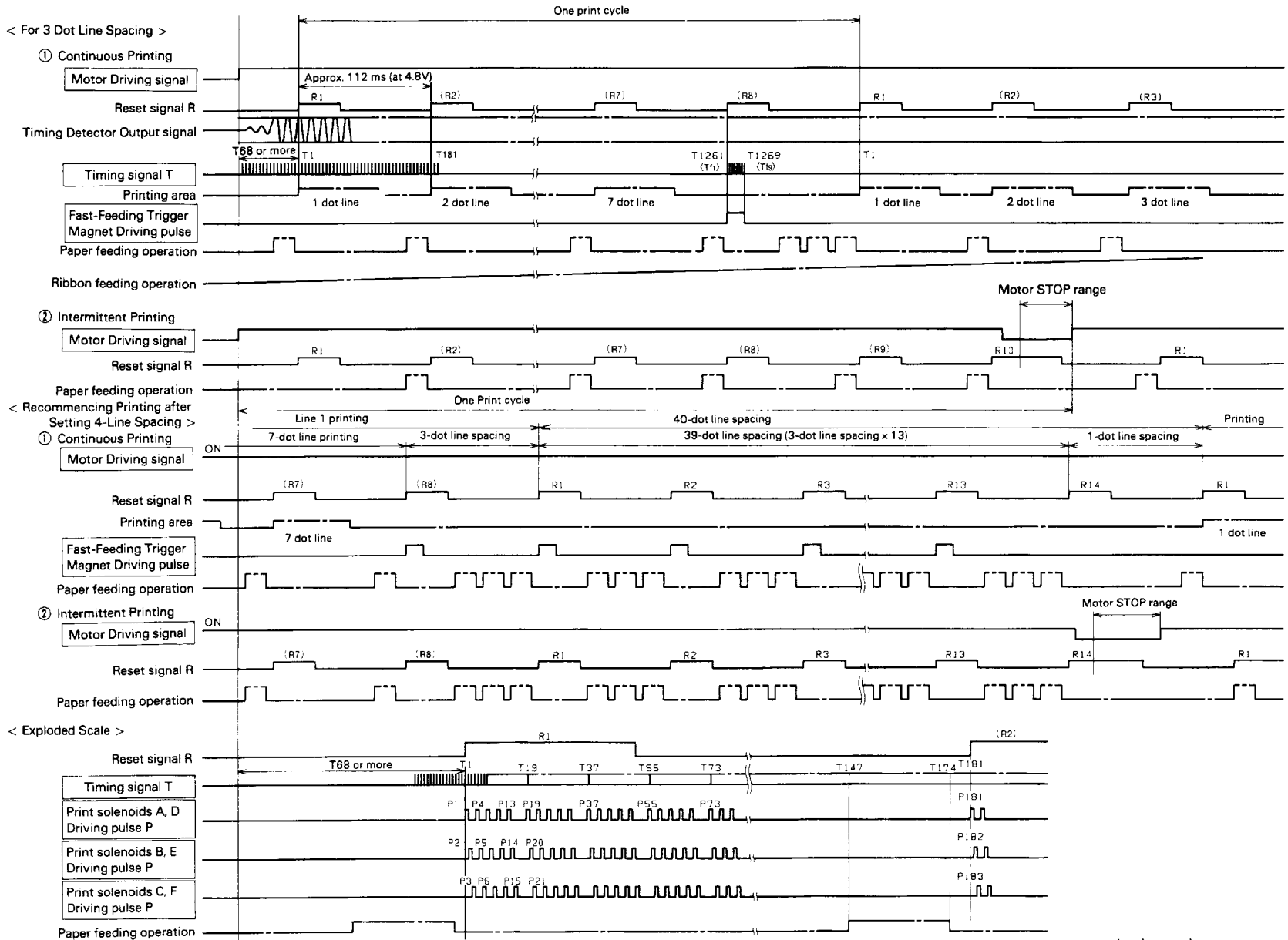


Fig. 1-26. Model-182 Timing Chart (5 x 7 Dot Matrix)

NOTES: 1. Items in brackets ( ) do not normally need to be used.
2. Numerals enclosed in brackets indicate Timing signal T in cases where Reset signal R8 has been detected.
3. Signals enclosed in a box must be supplied by the user.

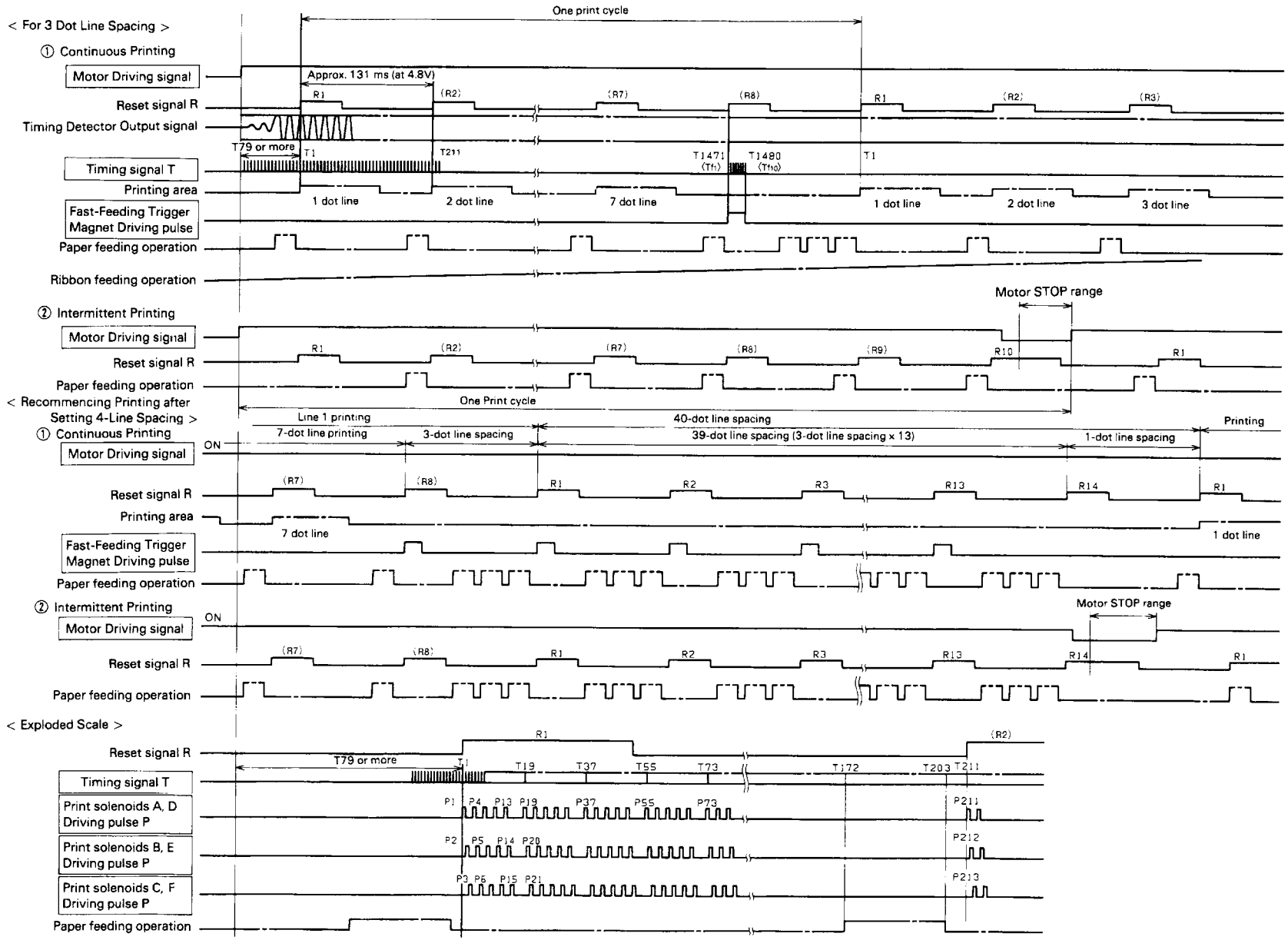


Fig. 1-27. Model-183 Timing Chart (5 × 7 Dot Matrix)

NOTES: 1. Items in brackets ( ) do not normally need to be used.
2. Numerals enclosed in brackets indicate Timing signal T in cases where Reset signal R8 has been detected.
3. Signals enclosed in a box must be supplied by the user.

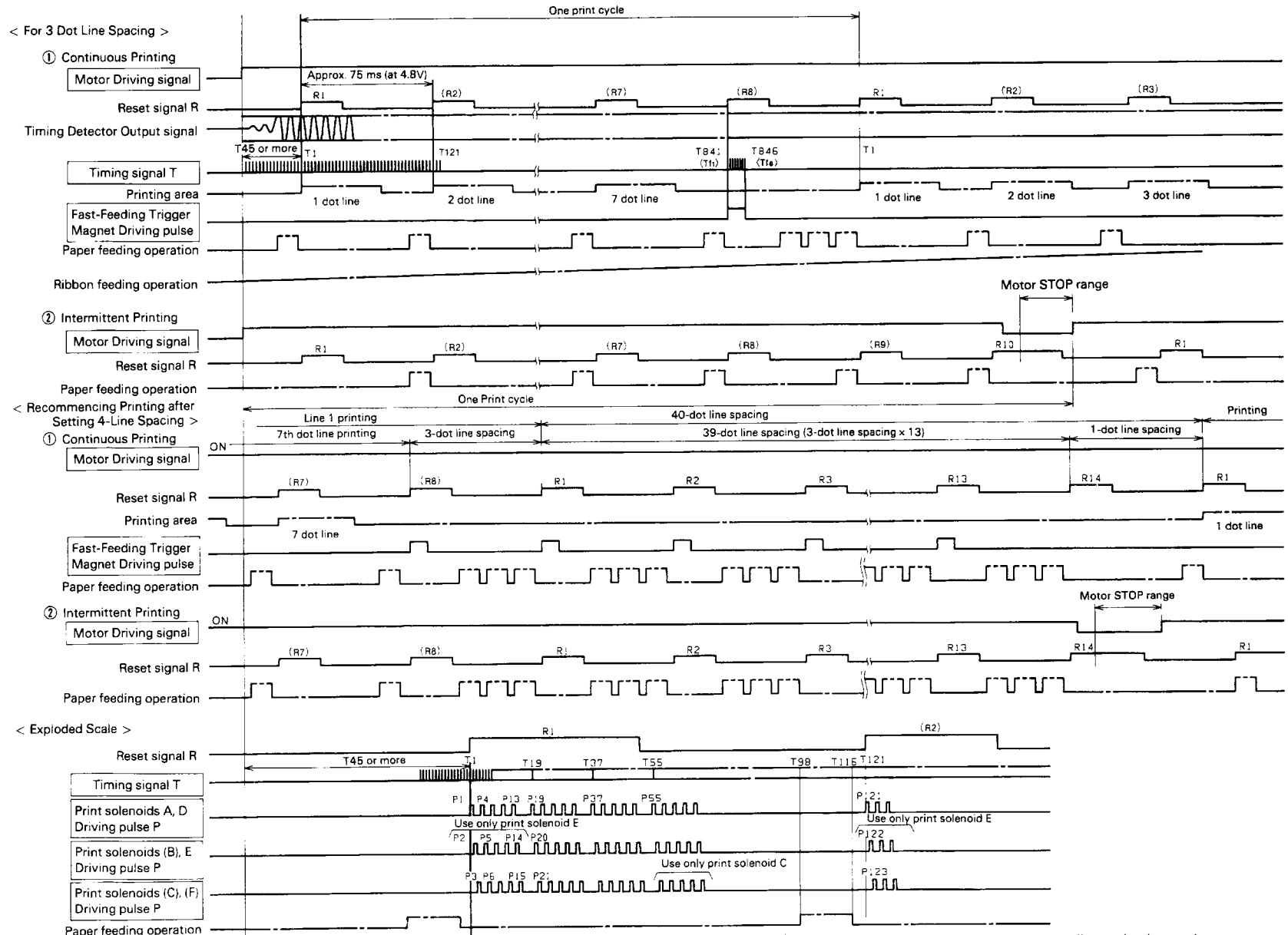


Fig. 1-28. Model-185 Timing Chart (5 x 7 Dot Matrix)

NOTES: 1. Items in brackets ( ) do not normally need to be used.
2. Numerals enclosed in brackets indicate Timing signal T in cases where Reset signal R8 has been detected.
3. Signals enclosed in a box must be supplied by the user.

CHAPTER 2

HANDLING, MAINTENANCE, AND REPAIR

CONTENTS

2.1 HANDLING THE PRINTER 2-1
2.1.1 Precautions on Printer Handling 2-1
2.1.2 Paper Setting Procedures 2-1
2.1.3 Ribbon Cassette Installation 2-2
2.2 MAINTENANCE 2-2
2.2.1 Cleaning 2-3
2.2.2 Inspection 2-3
2.3 REPAIR 2-4
2.3.1 Repair Levels 2-4
2.3.2 Repair Procedures 2-4
2.3.3 Troubleshooting Table 2-4
1. Motor doesn't rotate 2-4
2. Motor rotation doesn't stop 2-5
3. No dot printing is performed 2-5
4. Consecutively missing dots 2-5
5. Intermittently missing dots 2-5
6. Fluctuations in character width 2-5
7. Paper feeding cannot be performed 2-6
8. Uneven paper feeding pitch 2-6
9. Fast-feeding of paper cannot be performed 2-7
10. Paper is not released 2-7
11. Inking mechanism doesn't funciton 2-7
2.4 LUBRICANT APPLICATION 2-9
2.4.1 Lubricants 2-9
2.4.2 Lubrication Requirements 2-9
2.4.3 Lubrication Points 2-9
2.5 TOOL AND LUBRICATIONS 2-10
2.5.1 List of Tools 2-10
2.5.2. List of Lubricants 2-10
Fig. 3-2. Lubrication Points of Model-180 Series 3-17

2.1 HANDLING THE PRINTER

2.1.1 Precautions on Printer Handling

Precautions on transport

(1) When transporting this printer, never grasp it by the F.P.C., pattern section of the circuit board ass'y, ribbon cassette section or gear sections. (See Fig. 2-1.)

(2) Never expose the printer to stress or impact by dropping or striking it, placing two printers into contact or other means.

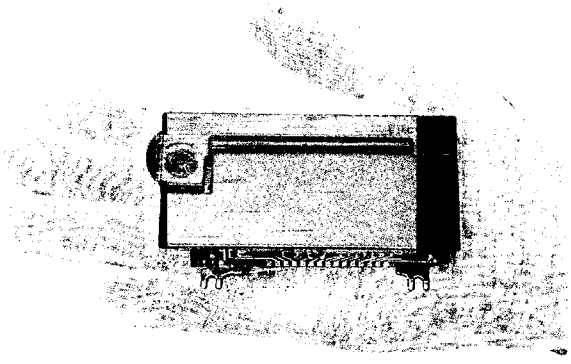


Fig. 2-1. Proper Handling of Printer

Precautions on storage

(1) Avoid storage in locations exposed to excessive dirt or dust, direct sunlight or excessive moisture.

(2) In case of long-term storage (over one month), place the printer into a polyethylene bag after wrapping it in anti-rust (VCI) paper, then stone it in a dry location.

Precautions on use

(1) Since this printer employes a permanent magnet (motor and detector section) and trigger magnets, avoid using it in locations exposed to excessive iron filings, dirt, dust or other foreign particles.

(2) Never perform a printing operation without the paper and ink roll ass'y installed.

(3) Since this printer employs a reed switch in its reset detector, magnetic material that will adversely affect the reed switch must not come close to or be installed near the printer.

(4) Never replenish the ink supply of the ink ribbon.

(5) Be sure to use only the paper prescribed in the specifications released by us(see subsection 1.1.2).

(6) Be sure to use only the standard ribbon cassette prescribed in the specifications released by us.

(7) During printing, never operate nor prevent rotation of the manual feed knob.

2.1.2 Paper Setting Procedures

Paper Insertion

Taken heed of the following points when inserting paper into the printer:

(1) Direction of paper insertion (see Fig. 2-2)

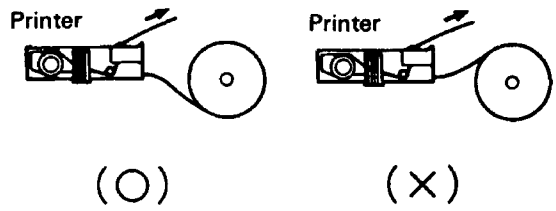


Fig. 2-2. Direction of Paper Insertion

(2) Shape of the leading edge of the Paper (See Fig. 2-3)

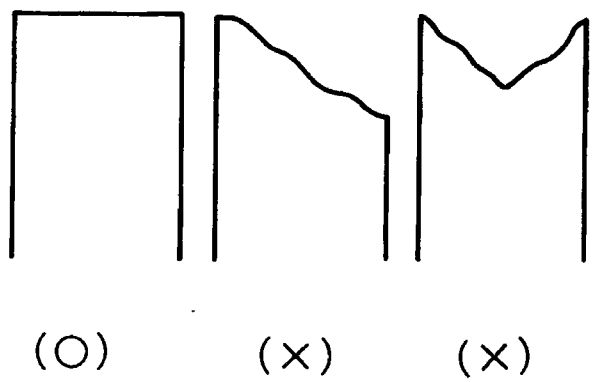


Fig. 2-3. Shape of the Leading Edge of the Paper

- Do not fold back the leading edge of the paper.
- Insert the paper straight into the printer in the direction of paper insertion.

During paper insertion, if the paper is pushed in the direction of feeding, it will more easily be caught by the paper feeding rollers thereby simplifying paper insertion.

Paper removal

It is important to always perform paper removal following one of the methods below.

(1) Remove the paper by using an electrical operation (switch ON printer power, then press the Line Feed (LF) button).

(2) Manipulate the manual feed knob to remove the paper.

(3) Manipulate the paper release mechanism then slowly pull the paper straight out in either the paper insertion direction or the reverse direction.

Never insert or remove the pape withgout carefully following the above precautions, because such handling may result in defective paper feeding or paper jams.

2.1.3 Ribbon Cassette Installation

Removing the ribbon cassette

As shown in Fig. 2-4, press the "A" section (indicated by PUSH) of the ribbon cassette in the ⇨ direction with your index finger so that the handle side (which is engaged with the spool gear) pops up, then pull the handle in the ➡ direction to remove the ribbon cassette.

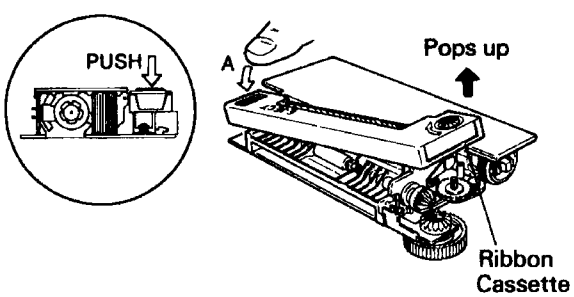


Fig. 2-4 Removal of the Ribbon Cassette

Ribbon cassette installation

Figs. 2-5 and 2-6 show the procedure for installing the ribbon cassette.

(1) The ribbon cassette used must conform to the standards prescribed in the specifications.

Never use non-standard types, because such use may result in such trouble as the malfunction of the printing lever or deterioration of printing quality.

(2) Before installing the ribbon cassette into the printer, use cassette into the printer, use your finger to turn the knob in the direction indicated in Fig. 2-5 to take up any slack in the ink ribbon.

(3) Place the ribbon cassette into the frame, then simultaneously press down on the knob and the "A" section as shown in Fig. 2-6.

(4) After setting is done, turn the knob again as in Step (2) above to take up slack in the ribbon and check that the ribbon is not bent and that the ribbon cassette is not loose.

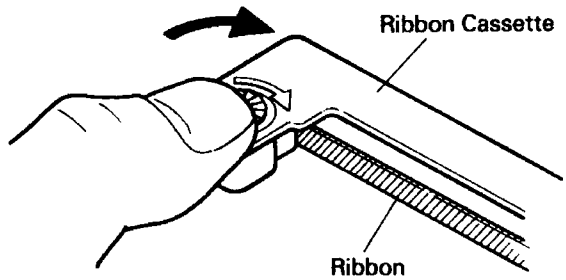


Fig. 2.5 Stretching of Ink ribbon

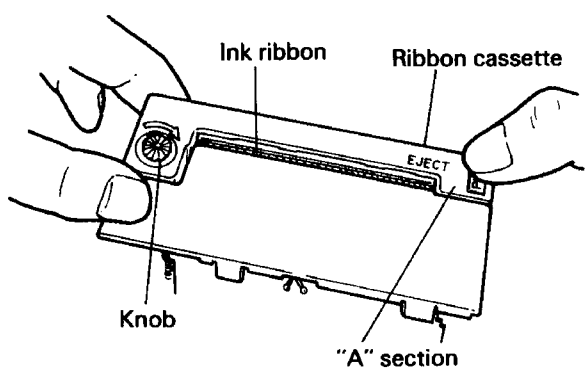


Fig. 2.6 Ribbon Cassette Installation

2.2 MAINTENANCE

To ensure the maintenance of this printer at its initial performance level throughout a long product life as well as preventing potential troubles, be sure to perform maintenance and management according to the points described in the following subsections.

2.2.1 Cleaning

Eliminating dirt or stains

Wipe off the soiled sections using alcohol.

Eliminating dust, scraps, and other foreign particles

The use of a vacuum cleaner is recommended to carefully draw out all foreign particles from every part of the printer.

NOTES:

1. Never use thinner, tricholoyene nor ketone solvents as such use may deteriorate or damage the plastic or rubber parts.
2. After cleaning is done, check the remaining lubrication of each section. If lubrication has become insufficient as a result of the elimination of dirt, dust, scraps, etc., apply additional lubricant. (See section 2.4, "LUBRICATION APPLICATION.")

2.2.2 Inspection

The maintenance and check-up procedures for this printer are grouped into two types: 1) daily checks that can be easily performed by the operator of the printer during the course of daily work, and 2) periodic checks that can be performed only by persons having a thorough understanding of the printer mechanisms. These maintenance and check procedures should be implemented according to the technical level of the person conducting them.

Daily check

In cases where the printer is used on a daily basis, confirm that the printer is being properly used by following the instructions of section 2.1, "HANDLING THE PRINTER." Ensure that the printer can always be used in optimum condition.

Periodic check

After every six months, perform the periodic maintenance and inspection procedures listed in the table below:

No.	Check Point	Standard	Remedy Method
1	Adhesion or penetration of dirt, paper scraps or dust, and other foreign particles within each printer section	● Check that excessive dirt, paper scraps or dust are not adhered to the operating sections and that no foreign particles have entered ● Check that no paper scraps or other foreign particles are stuck in the paper guide	● Carefully draw out any adhered particles with a vacuum cleaner ● Use tweezers or an equivalent tool to remove the foreign particles
2	Shape of the springs	● Check all springs for deformation	● Replace any deformed springs
3	Lubrication status	● See section 2.4, "LUBRICANT APPLICATION"	● Perform lubrication according to section 2.4, "LUBRICANT APPLICATION"
4	Operating check	● Check that the printing operation is normal ● Check that the paper-feeding operation is normal ● Check that the ribbon-feeding operation is normal	● See subsection 2.3.3, "Troubleshooting Table"
		● Observe each of the functions and check for malfunctions due to wear or deformation of parts, paper jam, etc.	● See subsection 2.3.3, "Troubleshooting Table" and section 2.4, "LUBRICANT APPLICATION"

2.3 REPAIR

In consideration of the level of expertise required for implementation of after-service and repair procedures for this printer, such procedures have been grouped into two rankings: Level A and Level B. The person in charge of repair, therefore, should perform the repair procedures after comparing the required level and his/her own level of expertise.

2.3.1 Repair Levels

LEVEL A: Requires general knowledge and technical skills regarding the operating principles and construction of the printer, but does not require previous repair experience.

LEVEL B: Requires knowledge regarding the operating principles and construction of the printer, technical skills capable of using tools for disassembly and assembly as well as measuring instruments, and previous repair experience.

2.3.2 Repair Procedures

In the case a problem occurs, thoroughly confirm its symptoms and condition, clarify the source of the problem according to subsection 2.3.3, "Troubleshooting Table," check the problem spot, then repair it.

Phenomenon
Check the symptoms of the trouble.

Condition
Compare the trouble status of the problem with the description of this column and locate the matching status.

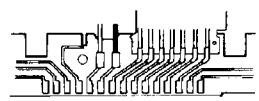
Cause
This column lists the potential causes on the basis of the trouble status, allowing the location of the trouble to be checked. It also lists the repair level for each cause, so be sure to refer to this column before attempting repair.

Check Point and Method
In correspondence to the cause, this column lists what parts to check as well as the checking procedure to be used. Be sure to inspect the check points according to the method described here.

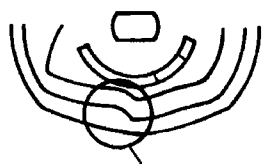
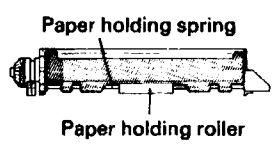
Repair Method
Repair the trouble area accoerding to the description in this column. If the initial symptoms and condition remain unchanged after performing the repair, check another item of the "Cause" column then perform the pertinent repair.

NOTES:
By performing repair in the sequence described above, you can achieve maximum efficiency with minimum errors in judgement.
To simplify the checking procedures during repair, Fig. 2-7, "Pin Assignment of the Circuit Board Ass'y" and Figs. 1-19 to 1-23, "Detail Timing Signal T Distribution" for each mechanism have been included for your reference.

2.3.3 Troubleshooting Table

Phenomenon	Condition	Cause	Level	Check Point & Method	Repair Method
1. Motor doesn't rotate	Motor doesn't rotate despite issuing of print instruction	(1) Defective contact between motor lead wires	A	● Check the conductivity between the motor lead wires and circuit board ass'y and between the motor terminals	● If there is no conductivity, perform resoldering.
		(2) Defect in input power supply to motor	B	● Check input power supply Check the input voltage between motor terminals of the connector using a tester or oscilloscope Rating: 4.8 $^{+0.7}_{-1.0}$ VDC	● Inspect and repair the power supply circuit.  (+) Red (–) Black
		(3) Defective motor	B	● Apply 3.8V to the motor terminals then check for rotation	● If the motor doesn't rotate, replace the motor unit.

Phenomenon	Condition	Cause	Level	Check Point & Method	Repair Method
2. Motor rotation doesn't stop.	Rotation doesn't stop despite the end of one print cycle	Defective R detector	B	● Rotate the cam sub unit then use an oscilloscope to check if a signal is generated from the R detector.	● If no signal is generated, replace the circuit board ass'y (including the reed switch).
3. No dot printing is performed.	Motor rotates normally, but no dot printing is performed.	(1) Broken common lead in FPC	A	● Check the conductivity between the common leads of the FPC	● If there is no conductivity, replace the printing head unit.
		(2) Defective contact between an FPC common lead and the circuit board ass'y	B	● Check the conductivity of the soldered section between the circuit board ass'y and FPC common leads.	● If there is not conductivity, perform resoldering.
4 Consecutively missing dots	Only specific heads never print (printing in multiplecolumn units is not performed)	(1) Broken lead in the head FPC	B	● Check the conductivity between the pertinent patterns of the FPC	● If there is no conductivity, replace the printing head unit.
		(2) Defective contact of the FPC	A	● Check the conductivity between the pertinent FPC terminals and the circuit board ass'y	● If there is no conductivity, perform resolderint.
		(3) Defective contact of a head coil lead	A	● Check the end of the pertinent head coil lead and it soldering onto FPC.	● If the soldering status is bad, perform resoldering.
		(4) Broken lead of head coil	B	● Check if the resistance of the pertinent head coil is within rated values (approx. 1.5 Ω@ 25°C).	● If outside rated values, replace the printing head unit.
		(5) Defective operation of head	B	● Check if the push bar and printing lever for the pertinent head operate smoothly.	● If operation is defective, replace the printing head unit.
5. Intermittently missing dots	Intermittently missing dots occur for only specific heads	(1) Defective contact of the FPC	A	● See Cause (2) of Phenomenon 4.	● If there is no conductivity, perform resoldering.
		(2) Defective contact of the head coil leads	A	● See Cause (3) of Phenomenon 4.	● If there is no conductivity, perform resoldering.
		(3) Malfunction of the head	B	● See Cause (5) of Phenomenon 4.	● If the head malfunctions, replace the printing head unit.
	Intermittently missing dots occur for all heads	Defective contact of FPC	A	● Check the conductivity between the common lead terminals of FPC and the circuit board ass'y	● If there is no conductivity, perform resoldering.
6. Fluctuations in character width	The character width fluctuates for only specific columns	(1) Wear or damage of the gears	B	● Check the first reduction gear, reduction gear, and inner gear of the cam sub unit for wear and damage.	● If worn or damaged, replace the pertinent part (motor unit, reduction unit or cam sub unit).

Phenomenon	Condition	Cause	Level	Check Point & Method	Repair Method
(6) Fluctuations in character width		(2) Wear of the cam groove of the cam sub unit	B	● Check the cam groove of the cam sub unit for wear.	● If worn, replace the cam sub unit.
7. Paper cannot be fed	All printing is done at one line without the paper being fed	(1) Defective paper supply	A	● Check if the paper used is of the rated width, thickness, and diameter. ● Check for blockage in the paper supply path	● Use the prescribed paper ● Remove any foreign matter in the paper supply path.
		(2) Bending or damage of one-way spring	B	● Check the paper feeding pawl spring for bending or damage.	● If bent or damaged, replace it.
		(3) Wear of the inner cam of the paper feeding cam	B	● Check the inner cam of the paper feeding cam for wear.  Check for wear	● If worn, replace the paper feeding cam.
		(4) Damage or wear of the paper feeding roller ass'y	B	● Check the gears and other parts of the paper feeding roller ass'y for damage or wear.	● If damaged or worn, replace the paper feeding platen unti.
		(5) Deformation of paper holding spring	B	● Check the spring of the paper holding section of the paper holding roller for deformation.  Paper holding spring Paper holding roller	● If deformed, replace the paper feeding platen unit.
		(6) Wear of the paper feeding lever	B	● Check the paper feeding lever for wear	● If worn, replace the frame ass'y
8. Uneven paper feeding pitch	Uneven line spacing of the printed paper or characters are battered	(1) Defective paper supply	A	● See Cause (1) of Phenomenon 7.	● Use the prescribed paper
		(2) Wear of the inner cam of the paper feeding cam	B	● See Cause (3) of Phenomenon 7.	
		(3) Wear or damage of the paper feeding roller ass'y	B	● See Cause (4) of Phenomenon 7.	
		(4) Stretching of the one-way spring	B	● Check the one-way spring for stretching	● If stretched, replace the paper feeding plate unit.

Phenomenon	Condition	Cause	Level	Check Point & Method	Repair Method
(8) Uneven paper feeding pitch		(5) Defective rotation of paper holding rollers	B	● Check the paper holding rollers for wear, damage or insufficient lubrication.	● If worn or damaged, replace the paper feeding platen unit. If lubrication is insufficient, perform lubrication. (See section 2.4, "LUBRICTION APPLICATION.")
		(6) Deformation or stretching of the paper holding spring	B	● See Cause (5) of Phenomenon 7.	
		(7) Wear or damage of the paper feeding lever	B	● See Cause (6) of Phenomenon 7.	
9. Fast-feeding of paper cannot be performed	One-pitch feeding can be normally performed, but three-pitch feeding cannot be performed.	(1) Defective paper supply	A	● See Cause 1 of Phenomenon 7.	● Use the prescribed paper and remove excess load from the paper supply path.
		(2) Defective conductivity of the trigger coil	B	● Connect a tester to both ends of the trigger coil, then check the conductivity. Resistance: approx. 20Ω (@ 25°C)	● If soldering is defective, perform proper resoldering. ● If resistance is abnormal, replace the trigger coil
		(3) Wear of the paper feeding cam	B	● Remove the paper feeding cam and check the wear status (~~~ section) of the cam groove. 	● If worn, replace the paper feeding cam.
10. Paper is not released.	Printing can be performed normally, but the paper is not released.	Lockinng of paper release lever	B	● Check if the teeth of the paper feeding transmission gear and paper feeding gear are locked.	● If locked, replace the paper release lever.
11. Inking mechanism doesn't fuction	Despite normal operation of the printing mechanism, the inking mechanism doesn't funciton	(1) Defective ribbon cassette	A	● Check if the ribbon of the ribbon cassette is rotating.	● If not rotating, replace the ribbon cassette.
		(2) Damage of the ribbon feeding cam	B	● Check the outer teeth of the ribbon feeding cam for damage.	● If damaged, replace the ribbon feeding cam.

Pin Assignment (Model-180/181/182/183)

Connection	Pin No.
Fast-feeding trigger magnet	1
Fast-feeding trigger magnet	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 common lead	12
Print solenoid (A)	13
Timing detector	14
Timing detector	15

Pin Assignment (Model-185)

Connection	Pin No.
Fast-feeding trigger magnet	1
Fast-feeding trigger magnet	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 common lead	12
Not used	13
Timing detector	14
Timing detector	15

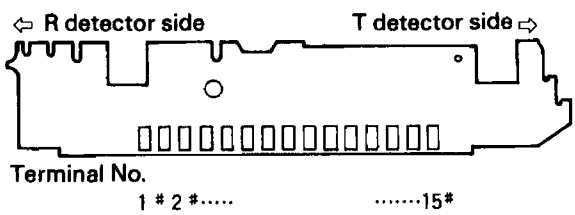


Fig. 2-12. Pin Assignment of Circuit Board Ass'y

2.4 LUBRICANT APPLICATION

Lubrication plays an important role in maintaining this printer at its initial performance level throughout a long product life as well as preventing potential troubles. Make sure to perform lubrication according to the following instructions.

2.4.1 Lubricants

The type of oil used greatly influences performance and durability, and special attention is required to its low-temperature characteristic. Consequently, the oils to be used with this printer are specified by us on the basis of the results of the thorough analyses of technical data for many types of oils and various experiments.
Note that the our specified oils are available in 40 cc (gm) metal cans or plastic containers (minimum supply unit).

< Reference >
The number of printers that can be lubricated using our minimum supply unit (40 cc) are as follows:

- G-18: Approx. 100 printers can be lubricated
- G-2: Approx. 100 printers can be lubricated
- O-3: Approx. 100 printers can be lubricated

2.4.2 Lubricant Requirements

- The three types of oils to be used with this printer are: G-18, G-2, and O-3.
- Before lubricant application during an assembly or disassembly procedcure, be sure to first thoroughly clean the part to be lubricated. The lubrication points are indicjated in subsection 2.4.3, "Lubrication Points" as well as in Fig. 3-2, "Lubrication Points of Model-180 Series" at the back of this manual. (The numbers in the table correspond to those of Fig. 3-2.)
- Lubrication should be performed at every overhaul or after every 400,000 printed characters. In cases where oil is wiped off during maintenance or inspection or a part has been disassembled or replaced, be sure to perform lubrication.

2.4.3 Lubrication Points (See also Fig. 3-2)

Nos. 1 and 2 require lubrication during assembly

No.	Lubrication Point	Oil Type
1	Shaft and shaft holder section of reduction unit	G-18
2	Shaft section of paper feeding transmission gear and the sliding section of the paper feeding gear.	O-3
3	Teeth of the gears in the reduction unit	G-18
4	Cam groove section of the cam sub unit (2 inflection points of the groove)	G-18
5	Contact point between the side surface of the cam sub unit and the Y-shaped section of the frame	G-18
6	Contact point between the trigger plate and trigger yoke	O-3
7	Contact point between the trigger lever and fast-feed lever	O-3
8	Goove section of the paper feeding cam	O-3
9	Shaft holder section of the cam shaft holder and the sliding section of the paper feeding cam	O-3
10	Contact point between the cam shaft holder section and the paper feeding cam	O-3
11	Contact point between the fast-feeding lever and the paper feeding cam	O-3
12	Contact point between the paper feeding cam and paper release lever	O-3
13	Contact point between the fulcrum of the paper feeding lever and the frame, and the engaged section of the paper feeding lever	G-2
14	Contact point between the fulcrum of the paper release lever and the frame	G-2
15	Type-E retainer section of the spool gear	G-2
16	One-way spring seciton	G-2
17	Worm section of the ribbon driving gear	O-3
18	Bent section of the head guide shafts of the printing head unit (8 points)	G-2
19	Contact point between the ribbon feeding gear and the frame	G-2
20	Shaft section of the paper holding rollers	O-3

2.5 TOOLS AND LUBRICANTS

2.5.1 List of Tools

No.	Tool Designation	Availability
1	Brush (fine)	○
2	Brush (medium)	○
3	Cleaning brush	○
4	Fine Phillips screwdriver #0	○
5	Fine Phillips screwdriver #1	○
6	Tweezers	○
7	Diagonal cutting nippers	○
8	Flat pliers #0	○
9	Electric soldering iron	○
10	ET holder #3	○
11	ET holder #4	○
12	Tool for holding the trigger lever	Ⓢ
13	Tool for pushing in the shaft holder	Ⓢ

○ Commercially available
Ⓢ Our special product

2.5.2 List of Lubricants

The below oils are required when performing maintenance or repair of the Model-180 series.

Item	Designation	Volume	Availability
Oil	O-3	40 cc	Ⓢ
Grease	G-2	40 cc	Ⓢ
Grease	G-18	40 cc	Ⓢ

Ⓢ Our special product

CHAPTER 3

DISASSEMBLY AND ASSEMBLY

CONTENTS

3.1 DISASSEMBLY 3-1
3.2 ASSEMBLY 3-1
A: Frame Unit, Motor Unit, Reduction Unit, Cam Sub Unit 3-2
B: Fast-Feeding Lever, Paper Feeding Cam, Ribbon Driving Gear, Circuit Board Ass'y 3-6
C: Timing Detector Unit, Printing Head Unit 3-9
D: Paper Feeding Platen Unit, Manual Knob, Paper Release Lever 3-11
E: Cover, Ribbon Cassette 3-14
Soldering (FPC of Printing Head Unit, Motor Lead Wires, Trigger Coil, Timing Detector Unit) 3-15
Fig. 3-1. Exploded View of Model-180 Series 3-16

3.1 DISASSEMBLY

- To disassemble this printer, perform the assembly procedures described in section 3.2, "ASSEMBLY" in the reverse sequence (excluding, however, the adjustments and lubrication). Disassembling printer components beyond the units disassembies shown in Fig. 3-1, "Exploded View of Model-180 Series" at the end of this manual may result in damage to the printer and its functions, so you are advised not to do so.

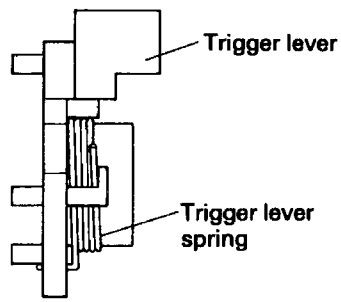
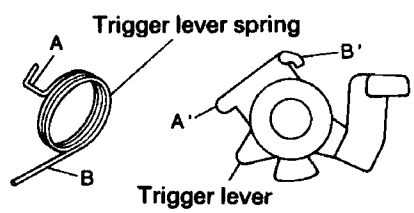
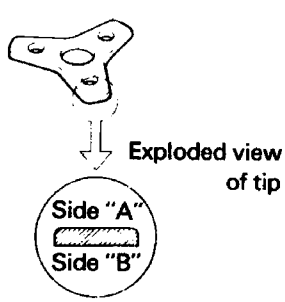
3.2 ASSEMBLY

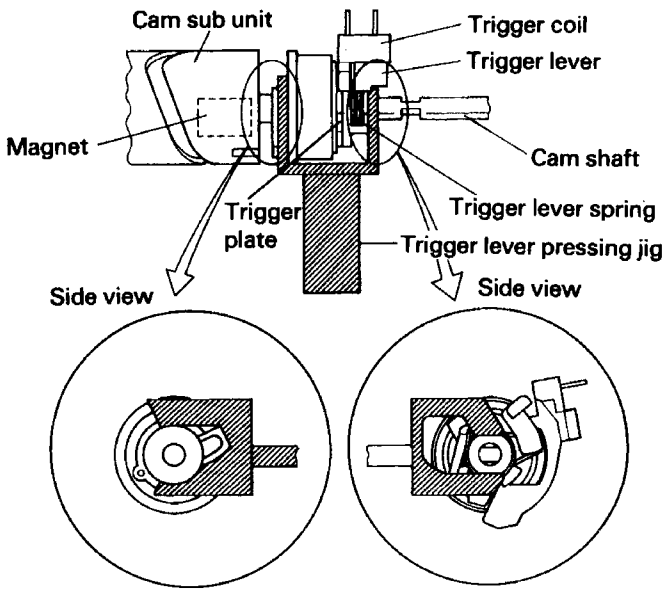
- The entire assembly process is divided into the five blocks.
- Performing assembly in accordance with the reassembly steps enables one complete printer to be efficiently assembled.
- A disassembly diagram is provided at the end of each block, indicating the assembly parts and their mounting positions (the frame, however, is shown in every disassembly diagram). Be sure to perform assembly while confirming the shape and mounting positions of the parts in Fig. 3-1, "Exploded View of Model-180 Series," at the end of this manual.
- Circled numbers in the Reassembly Step column indicate that lubrication is required during assembly of the component. Section 2.4.3, "Lubrication Points," describes the lubrication procedure in detail, including the lubrication required upon completing assembly of the printer. Be sure to perform lubrication while also referring to Fig. 3-2, "Lubrication Points of Model-180 Series" at the end of this manual.
- Small parts are all represented by abbreviations.

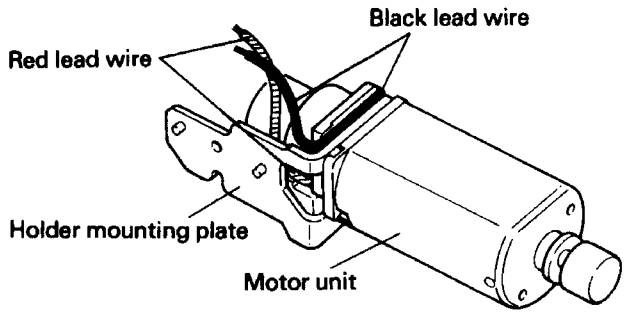
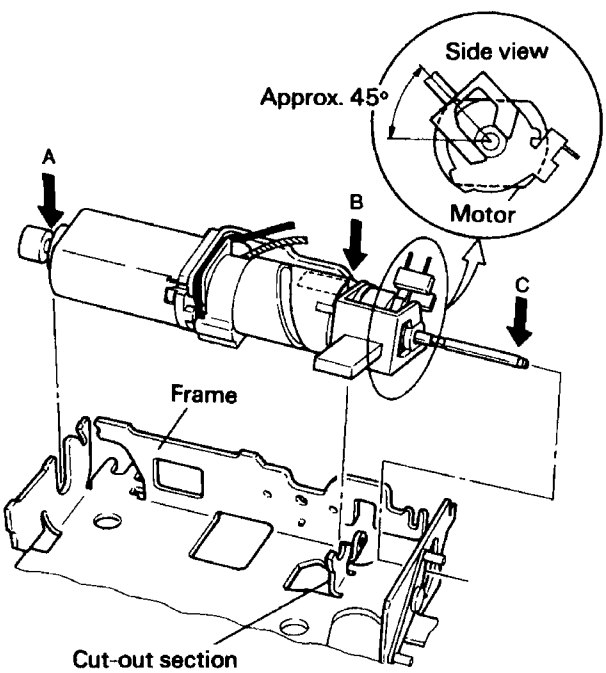
Table of Small Parts Abbreviations

RE: Type-E Retaining ring
CP: Cross-recessed head machine (Pan head)
CS: Cup Screw

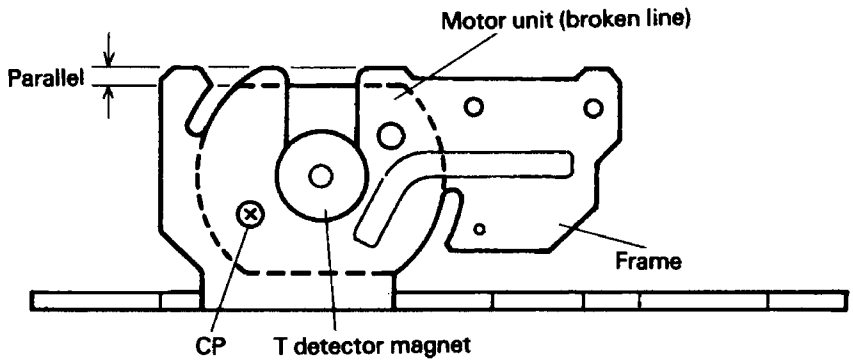
Assembly A — Frame Unit, Motor Unit, Reduction Unit, Cam Sub Unit

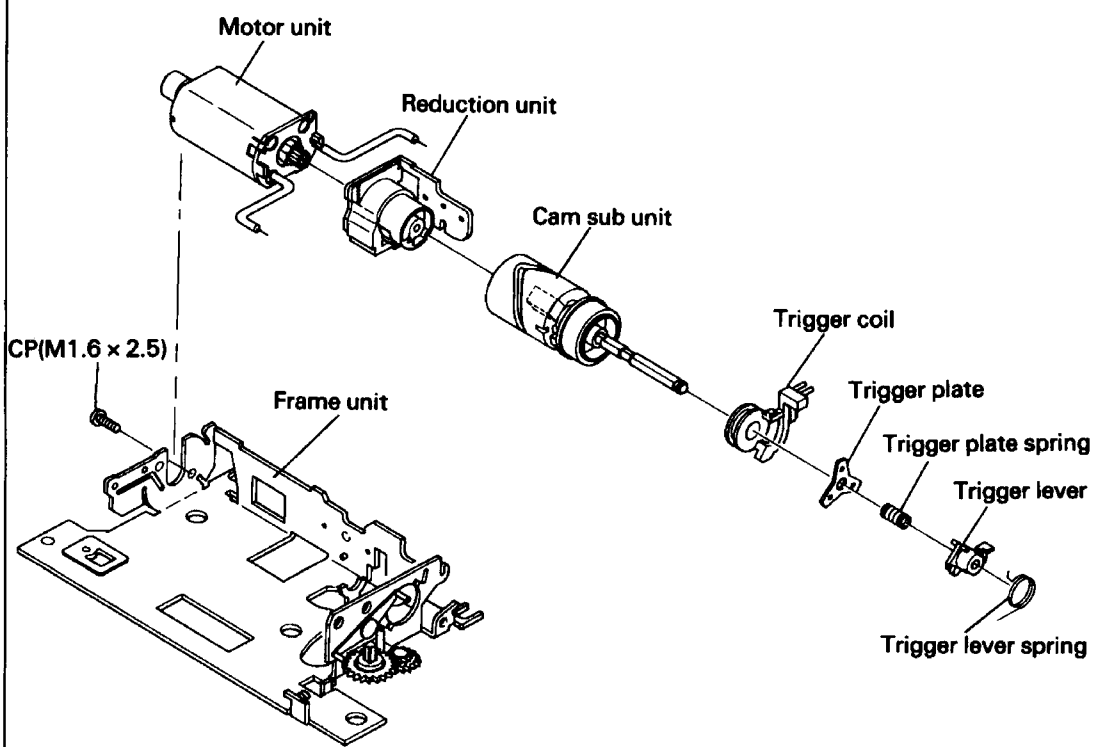
Reassembly Step	Name of Parts	Points of Assembly Work
1. 2	Frame unit ⓐ ~ ⓕ ⓐ Trigger lever spring ⓑ Trigger Lever	Perform subassembly of ⓐ ~ ⓕ. As shown in Fig. A, set the trigger lever spring onto the trigger lever. As shown in Fig. B, set the ends of the trigger lever spring onto the hooks of the trigger lever.  < Fig. A > (Set Section "A" onto "A'", and Section "B" onto "B'")  < Fig. B >
	ⓒ Trigger plate spring ⓓ Trigger plate	Set the trigger plate so that Side "B", shown in the fig. on the left, is on the trigger coil side. 

Reassembly Step	Name of Parts	Points of Assembly Work
	ⓔ Trigger coil ⓕ Cam sub unit	After setting parts ⓐ to ⓔ onto the cam shaft of the cam sub unit, match the 3 holes of the trigger plate with the 3 tabs of the trigger plate, then temporarily secure it using a trigger lever pressing jig as shown below. 
③	ⓖ, ⓗ ⓖ Reduction unit	Perform subassembly of ⓖ, and ⓗ Lubricate the following points: ● Shaft and shaft holder section of cam sub unit **NOTE:** The recduction unit differs according to the model. < Identification of the cam sub unit > **Model Name** / **Color of Intermediate and Reduction Gears** 180 — Red 181 — Brown 182 — Yellow 183 — Blue 185 — Red

Reassembly Step	Name of Parts	Points of Assembly Work
	ⓗ Motor unit	When docking the reduction unit and motor unit, pass the red lead wire of the motor through the square hole of the holder mounting plate and set its black lead wire into the holder groove (see fig. below) 
4	ⓐ ~ ⓗ	Assemble the subassembled parts of (1) and (2) above into the frame as follows: 1) When combining (1) and (2), set the pressing jig that was mounted in (1) into the status of the below fig. 2) Pass Section "C" of the below fig. through the hole of the frame, then set Section "A" into the U-shaped groove of the frame after matching the "B" section to the cut-out seciton of the frame. 

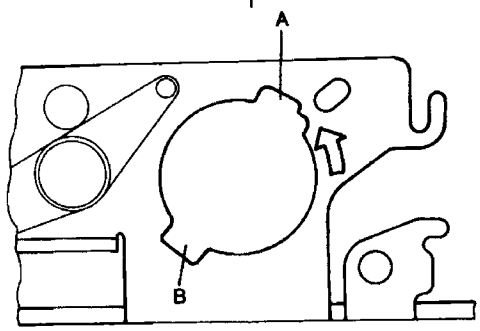
Reassembly Step	Name of Parts	Points of Assembly Work
5	CP(M1.6 × 2.5) × 1	● Tilt the motor unit and do not secure it (the flat outer surface of the motor unit must be parellel to the bottom surface of the frame). (See fig. below.)



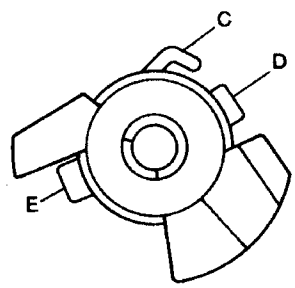


Assembly B **Fast-Feeding Lever, Paper Feeding Cam, Ribbon Driving Gear, Circuit Board Ass'y**

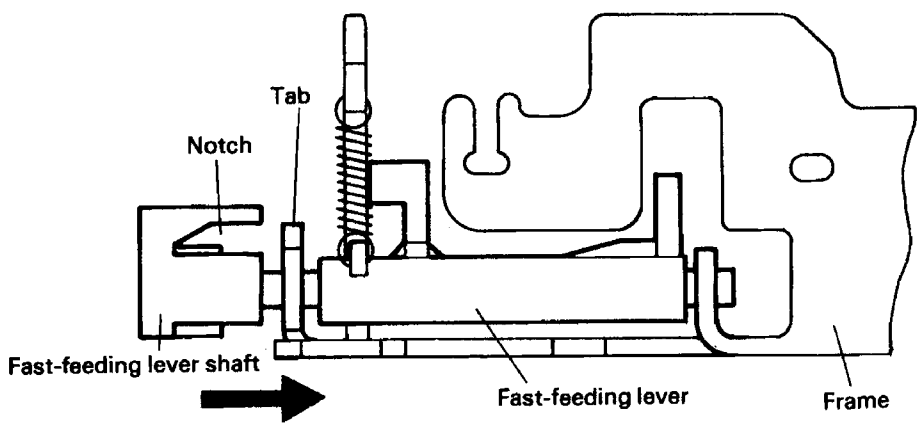
Reassembly Step	Name of Parts	Points of Assembly Work
1	Cam shaft holder	● Perform assembly according to ther instruction below: 1) Match Section "C" of the cam shaft holder to Section "A" of the frame, then set it. 2) Match "D" and "E" of the cam shaft holder to "A" and "B" of the frame, then rotate the cam shaft holder in the ⇨ arrow direction while pressing it in the cam shaft direction.
		NOTE: Stop rotation of the cam shaft holder when a clacking sound is heard. ● Remove the trigger lever pressing jig after setting of the cam shaft holder is completed, then move Section "C" of the cam shaft holder to the hook (straight) section of the trigger lever spring (see below fig.)
2 3	Fast-feeding lever Fast-feeding lever shaft	● Match the tab of the frame and the notch of the fast-feeding lever shaft, then apply pressure in the ➡ arrow direction until a clicking sound is heard (see below fig.).

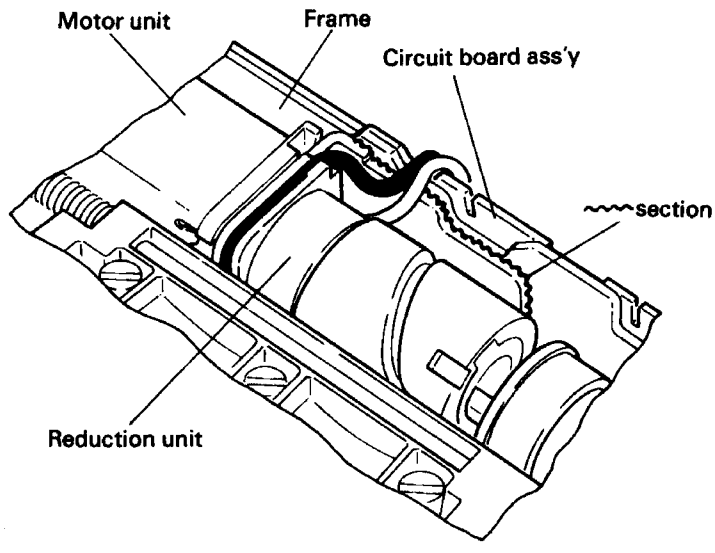
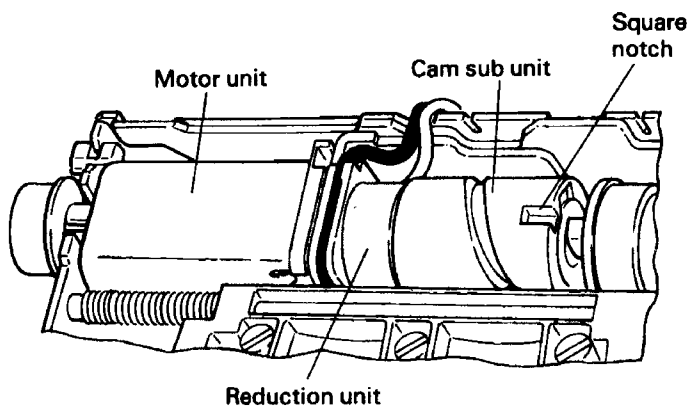


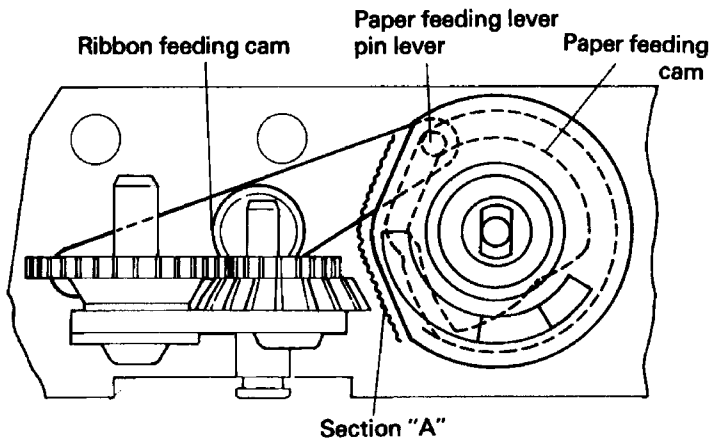
< Frame >

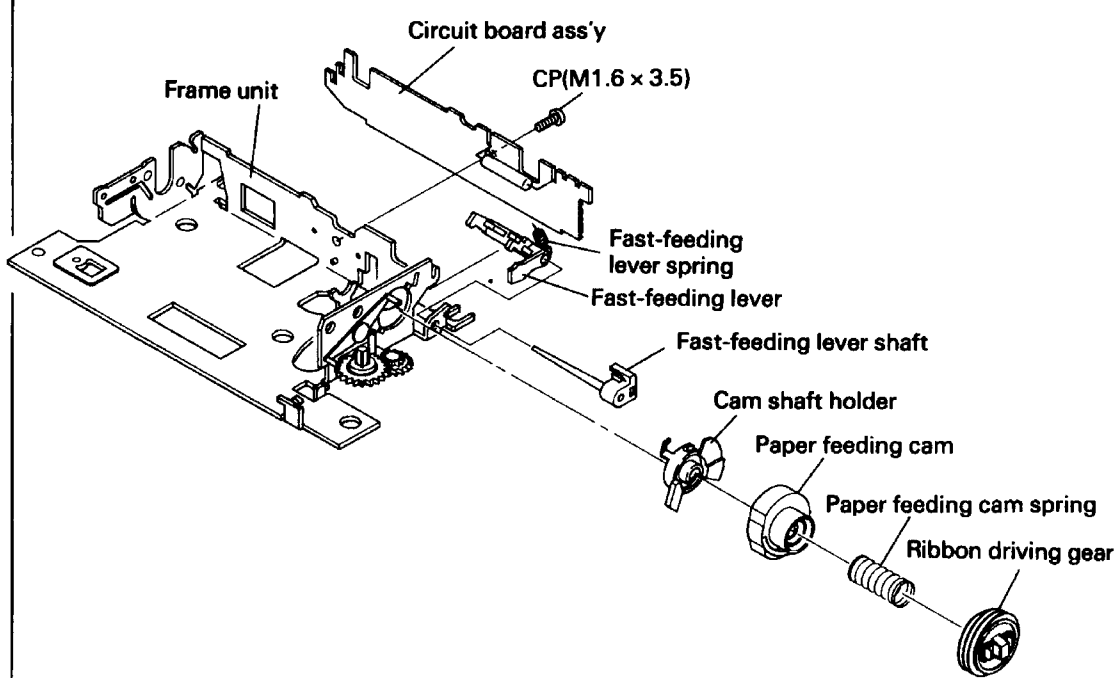


< Cam shaft holder >

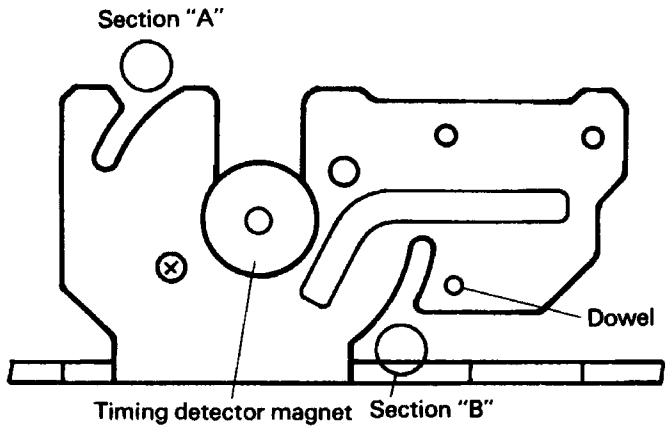
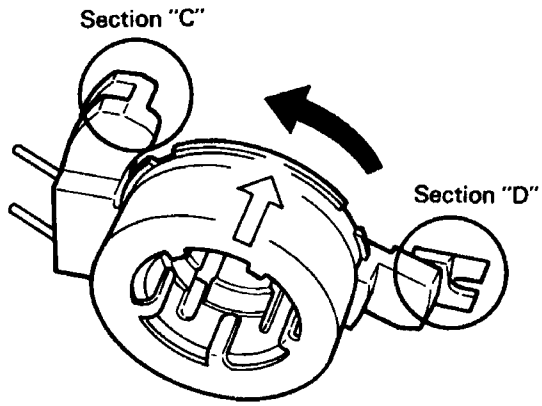


Reassembly Step	Name of Parts	Points of Assembly Work
4 5	Fast-feeding lever spring Circuit board ass'y CP(M1.6 x 3.5) x 1	● Secure the circuit board ass'y by matching the dowels of the reduction unit and the dowel holes of the frame before setting it, making sure there is no gap between the reduction unit and the frame (~~~ section). (See below fig.) 
6	Paper feeding cam	● Set the paper feeding cam as follows: 1) Rotate the motor by finger, and set it right above the square notch of the cam sub unit (see below fig.).  2) Set the paper feeding cam so that its Section "A" is on the ribbon feeding gear side, then incorporate it into the printer so that the pin seciton of the paper feeding lever enters the cam groove of the paper feeding cam.

Reassembly Step	Name of Parts	Points of Assembly Work
		
7 8	Paper feeding cam spring Ribbon driving gear	● Match the hole shape of the ribbon driving gear to the shape of the cam shaft, pressing it onto the shaft until a clicking sound is heard.

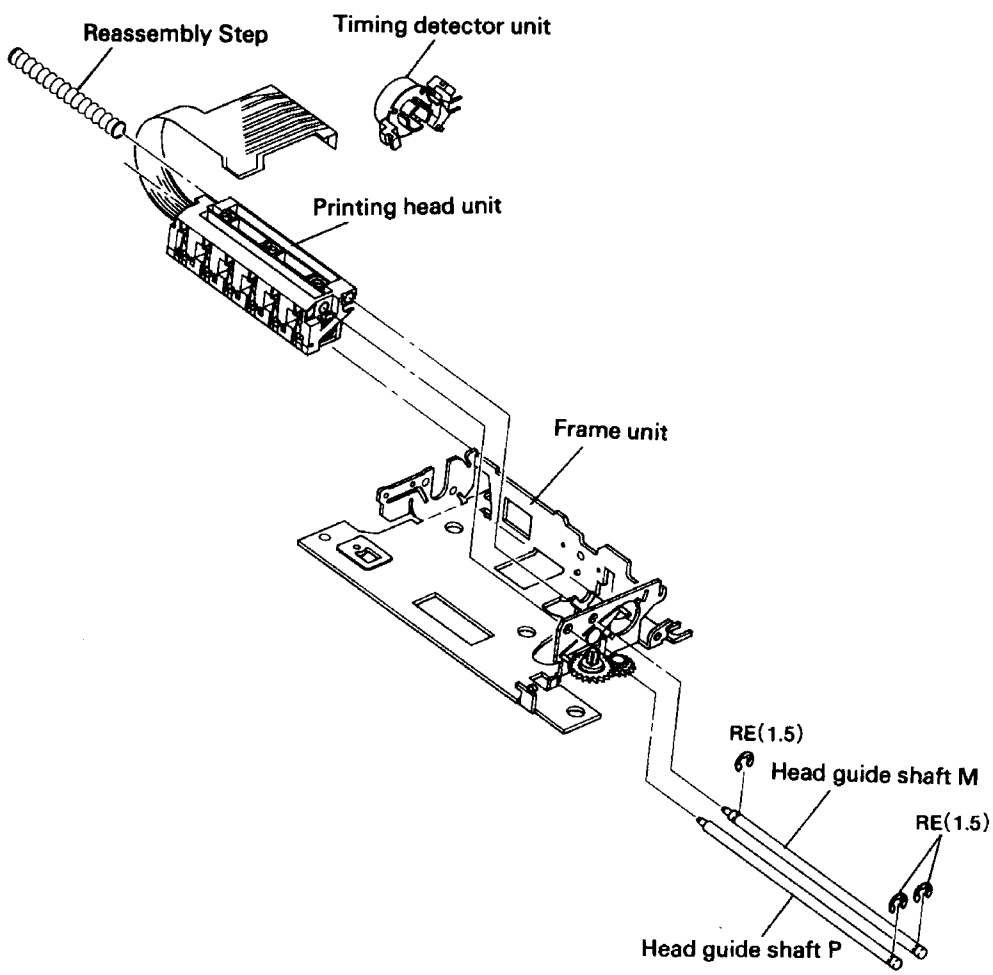


Assembly C — Timing Detector Unit, Printing Head Unit

Reassembly Step	Name of Parts	Points of Assembly Work
1	Timing detector unit	● Set the timing detector unit as follows: 1) Set the unit so that its Sections "C" and "D" are positioned in Sections "A" and "B" of the frame, then press the unit in the frame direction (⇨ arrow direction). 2) Rotate the unit in the ➡ arrow direction to lock its Section "D" onto the dowel of the frame.  < Frame >  < Timing detector ass'y >

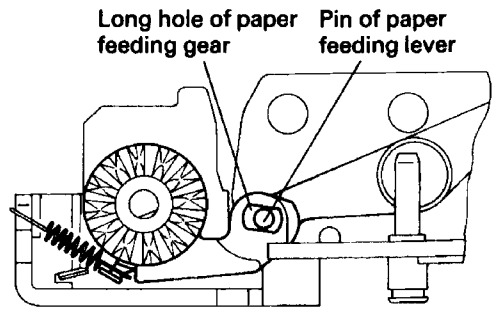
Reassembly Step	Name of Parts	Points of Assembly Work
2	Printing head unit	● Set the printing head unit by placing its moving pin into the cam groove of the cam sub unit. **NOTE:** The printing head unit differs according to the model. < Identification of the Printing Head Unit >
3	Head guide shafts (M.P) Return support spring RE(1.5) × 3	● Set the shafts onto the frame from the paper feeding lever side. **NOTE:** During the assembly process, take care not to damage the FPC of the printing head unit.

Model Name	Color of Printing Head Unit
180	Black
181	
182	
183	
185	Dark brown



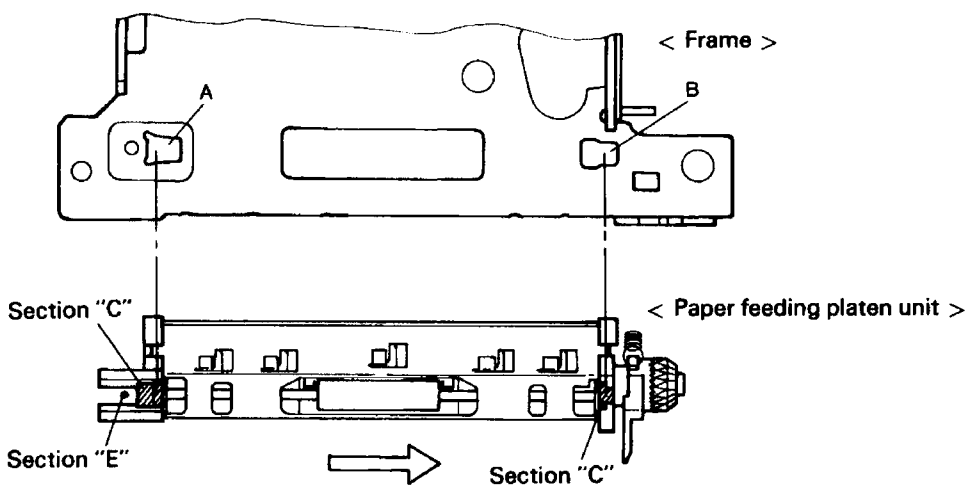
Assembly D — Paper Feeding Platen Unit, Manual Knob, Paper Release Lever

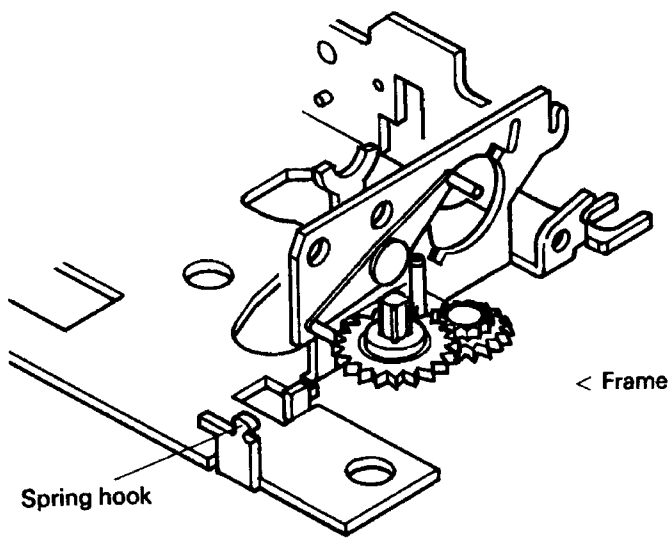
Reassembly Step	Name of Parts	Points of Assembly Work
1	Paper feeding platen unit CS(M2 x 3) x 1	● Set the unit as follows (see below fig.): 1) Place the long hole of the paper feeding gear over the pin of the paper feeding lever.



NOTE: When setting the unit, take care not to damage the long hole section of the paper feeding gear.

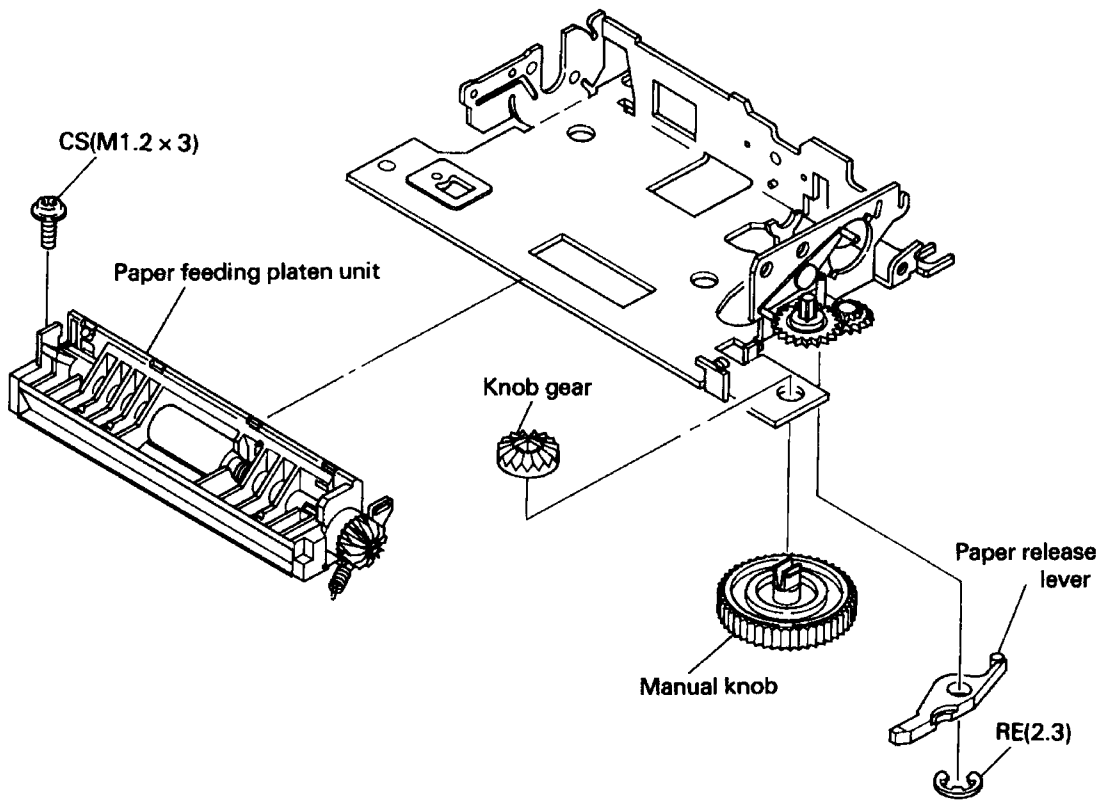
2) Match the positions of Sections "C" and "D" of the paper feeding platen unit with Holes "A" and "B" of the frame, then slide the paper feeding platen unti as far as possible in the ⇨ arrow direction while gently pressing it downward. (Check that the paper feeding platen unit is securely mounted.)



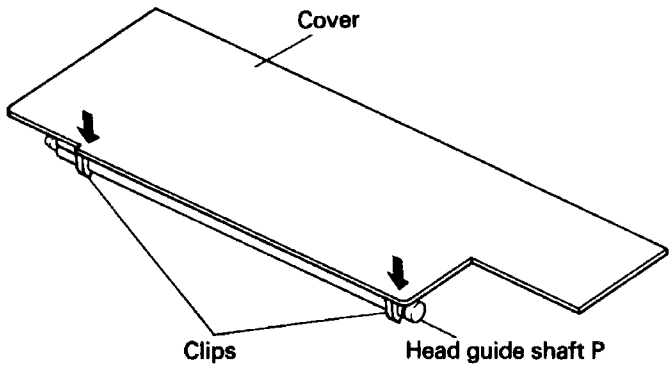
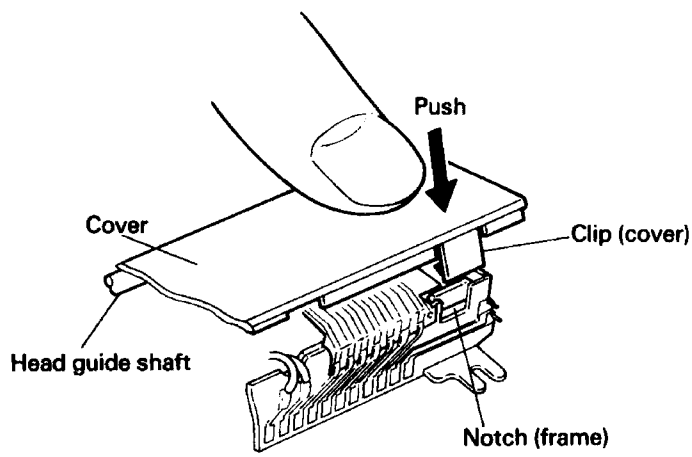
Reassembly Step	Name of Parts	Points of Assembly Work
		3) Secure Section "E" of the paper feeding platen unit by CS. **NOTE:** The paper feeding platen unit differs according to the model. < Identification of the Printing Head Unit > 4) Set the spring which is installed at the paper feeding transmission gear onto the spring holder of the frame. 

Model Name	Color of Printing Head Unit
180	Black
181	
182	
183	
185	Dark brown

Reassembly Step	Name of Parts	Points of Assembly Work
2 3 4	Paper release lever RE(2.3) × 1 Knob gear Manual knob	● Match the square hole of the knob gear with the claw of the manual knob, then press them together.

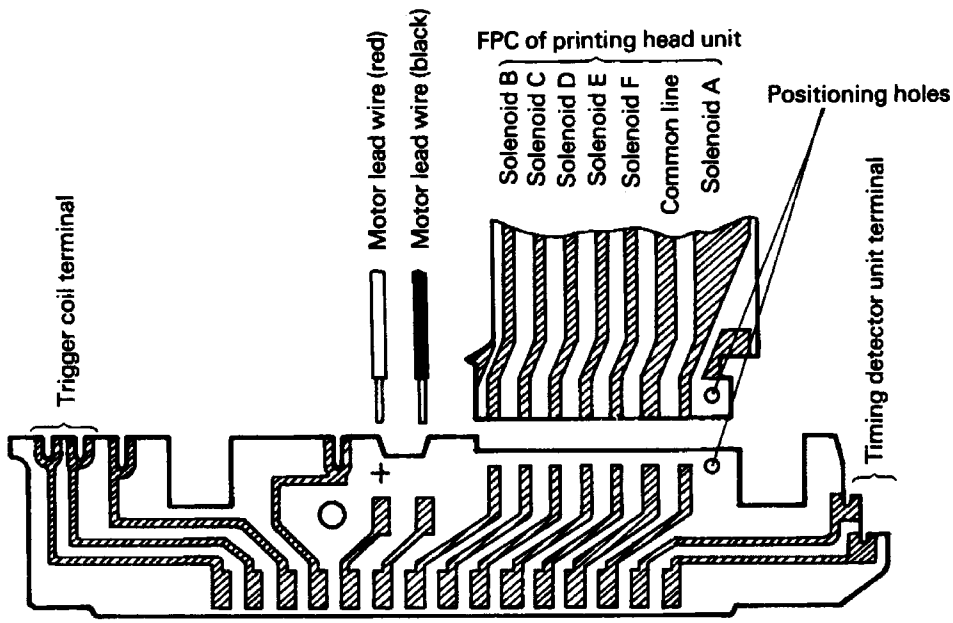


Assembly E **Cover, Ribbon Cassette**

Reassembly Step	Name of Parts	Points of Assembly Work
1	Cover	● Assemble the cover as follows (See below fig.): 1) Set the clips of the cover onto head guide shaft P, then gently press the sections above the clips in the ➡ arrow direction.  2) Set the two cover clips of the circuit board ass'y side completely into the notches of the frame.  **NOTE:** Assembly the cover carefully so as not to damage the clips of the cover.
2	Ribbon cassette	

Soldering (FPC of Printing Head Unit, Motor Lead Wires, Trigger Coil, Timing Detector Unit)

- Solder the FPC of printing head unit, motor lead wires, trigger coil and timing detector unit as shown in the figure.



NOTE:

- Perform soldering after matching the positioning hole of the printing head unit FPC and that of the circuit board ass'y
- Do not apply the soldering iron tip for an excessive period of time; that is, perform instantaneous soldering.

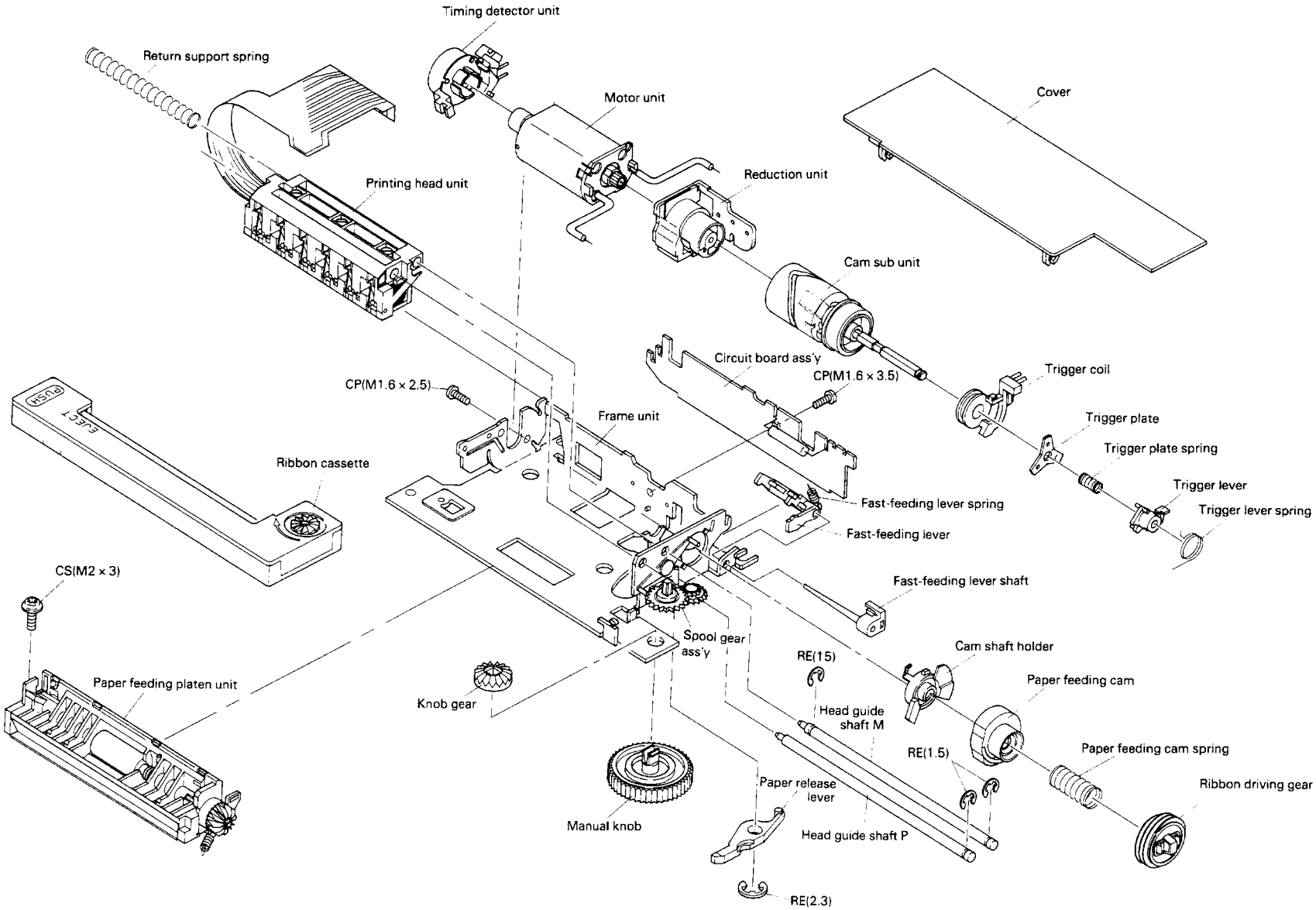


Fig. 3-1. Exploded View of Model-180 Series

EPSON

SEIKO EPSON CORPORATION

Printed in JAPAN 86040500