

Service Manual

Printer

Dot Matrix Printer

KX-P1150

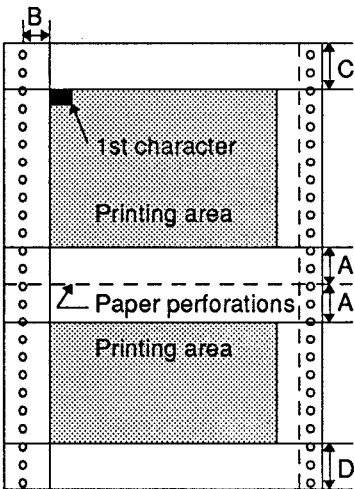
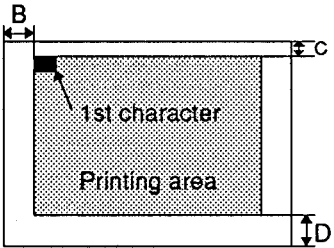


SPECIFICATIONS\ТЕХНИЧЕСКИЕ ХАРАКТЕРИСТИКИ
OPERATOR CONTROLS/INDICATORS\УПРАВЛЕНИЕ И ИНДИКАТОРЫ
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РАЗБОРКИ
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MECHANICAL FUNCTIONS\МЕХАНИЧЕСКИЕ ФУНКЦИИ
ELECTRONIC CIRCUIT BLOCK DIAGRAM\БЛОК-СХЕМА ЭЛЕКТРИЧЕСКОЙ
ЦЕПИ
ELECTRONIC CIRCUIT DESCRIPTIONS\ОПИСАНИЕ ЭЛЕКТРИЧЕСКОЙ ЦЕПИ
PARTS LIST AND LUBRICATION\СПИСОК ЗАПАСНЫХ ЧАСТЕЙ И СМАЗКА
PACKING MATERIALS\УПАКОВОЧНЫЕ МАТЕРИАЛЫ

Panasonic

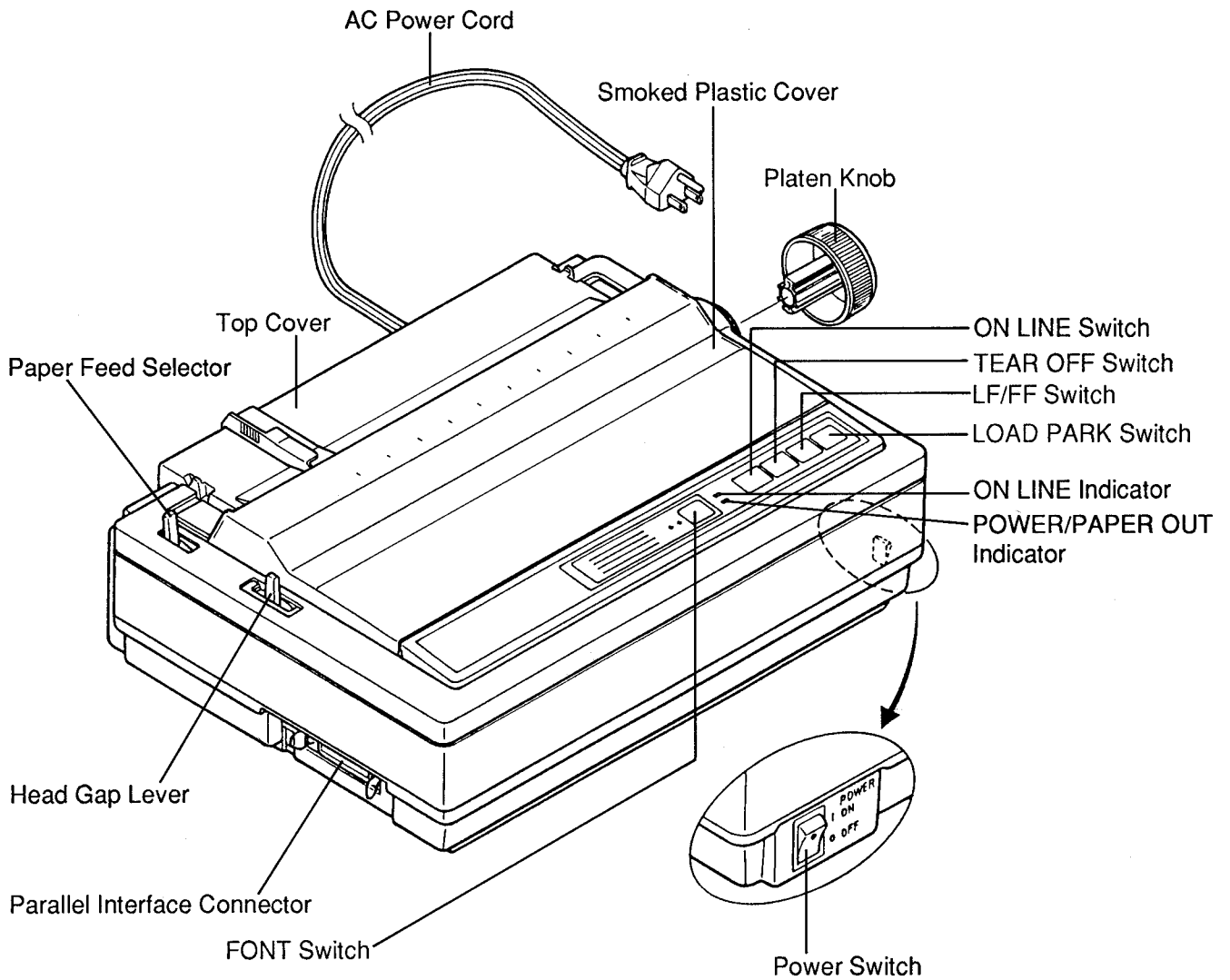
1. Specifications

Power requirements:	AC220-240V, 50/60Hz			
Current:	Idle: 0.1A; Maximum 0.7A			
Power consumption:	Max — 60 W Stand by — 5 W Self Test — 35 W			
Interface:	Centronics parallel			
Print mode:	Draft, Near Letter Quality (Courier, Bold PS, Times Roman, Sans Serif)			
Character sets:	96 ASCII characters, 33 International characters (14 countries + LEGAL Set no science), 158 IBM-PC special characters, 38 Multilingual characters			
Buffer:	4K (standard), additional 32K (optional KX-P44)			
Dot configuration:	Dot Diameter: 1/84 inch (0.3mm)			
		Draft	NLQ	
	Dot Alignment (HxV)	9x9	18x18	
	Dot Pitch	(H) 1/120"	1/240"	
		(V) 1/72"	1/144"	
Character size Normal characters:	0.074(W) x 0.097(H) inch (1.89 x 2.46 mm)			
Character per line (cpl) (per inch (25.4mm) (cpi)):		Draft, LQ	Elongated	
	Pica	80 cpl (10cpi)	40 cpl (5cpi)	
	Elite	96 cpl (12cpi)	48 cpl (6cpi)	
	Micron	120 cpl (15cpi)	60 cpl (7.5cpi)	
	Compressed	137 cpl (17cpi)	68 cpl (8.5cpi)	
	Elite compressed	160 cpl (20cpi)	80 cpl (10cpi)	
Print speed:		Micron	Elite	Pica
	Draft	240 cps	192 cps	160 cps
	Letter Quality	32 cps	38 cps	32 cps
Print direction:	Text printing: Bi-Directional Bit Image printing: Uni-Directional & Bi-Directional			
New line time:	Approx. 100 msec [with 1/6 inch (4.2 mm) line feeding]			
Paper feed:	Friction and Push Tractor			
Paper used:		Width	Weight	Height
	Fanfold paper	4-10 in (102-254mm)	16-24lbs.
	Single sheet	4-11.7 in (102-297mm)	14-24 lbs.	5-14.3 in (127-363mm)
	Envelopes	Standard business envelopes ie: #6, #10 size		
Paper thickness:	Total thickness of sheets must be less than 0.013 inch (0.32 mm).			
Number of copies:	Original + 3 non-carbon copies			
Printer emulation:	EPSON FX-850 IBM Proprinter III			

Storage environment:	Temperature: -4°F to 140°F (-20°C to + 60°C) Humidity: 10-90%RH																		
Operating environment:	Temperature: 50°F to 95°F (+10°C + 35°C) Humidity: 30-80%RH																		
Head service life:	Approx. 200 million strokes in draft mode																		
Ribbon:	Cassette seamless fabric ribbon Black ribbon cassette KX-P115/KX-P115i: Life expectancy (in Draft mode) (rolling ASCII) Approx. 4 million characters																		
Optional accessories:	Auto Cut Sheet Feeder (single bin) (KX-PT12) 32K Buffer Chip (KX-P44) Ribbon Cassette (black) (KX-P115/KX-P115i)																		
Dimensions:	17.1" (W) x 12.4" (D) x 5.3" (H) in. (434 x 314 x 134.5 mm)																		
Weight:	Approx. 10.6 lbs. (4.8 kg)																		
Printing area:	<p>Fanfold paper</p>  <p>Single sheets and Envelopes</p>  <table border="1" data-bbox="890 884 1396 1075"> <thead> <tr> <th colspan="2">Fanfold Paper</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>1" (25.4 mm)</td> </tr> <tr> <td>B</td> <td>0.7" (17.8 mm)</td> </tr> <tr> <td>C</td> <td>0.33" (8.38 mm)</td> </tr> <tr> <td>D</td> <td>1" (25.4 mm)</td> </tr> </tbody> </table> <p>A: Value A indicates the area near the paper perforations where the quality may not be optimum. B: Value B indicates the maximum distance between the sprockets and first printable character. (When the left tractor is set on the left end and the margin is set to 0.) C: Value C indicates the area from the top edge of the paper to the top of the first printed character. D: Value D indicates the position where paper out is detected and printing may not be optimum.</p> <table border="1" data-bbox="890 1473 1396 1624"> <thead> <tr> <th colspan="2">Single sheets and Envelopes</th> </tr> </thead> <tbody> <tr> <td>B</td> <td>1.5" (38 mm)</td> </tr> <tr> <td>C</td> <td>0.33" (8.38 mm)</td> </tr> <tr> <td>D</td> <td>1" (25.4 mm)</td> </tr> </tbody> </table> <p>B: Value B indicates the minimum distance between the edge of the paper and the first printable character. C: Value C indicates the area from the top edge of the paper to the top of the first printed character. D: Value D indicates the position where paper out is detected and printing may not be optimum. (When printing on envelopes, do not print on area where edges overlap. Print quality may not be optimum.)</p>	Fanfold Paper		A	1" (25.4 mm)	B	0.7" (17.8 mm)	C	0.33" (8.38 mm)	D	1" (25.4 mm)	Single sheets and Envelopes		B	1.5" (38 mm)	C	0.33" (8.38 mm)	D	1" (25.4 mm)
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Specifications are subject to change without notice.

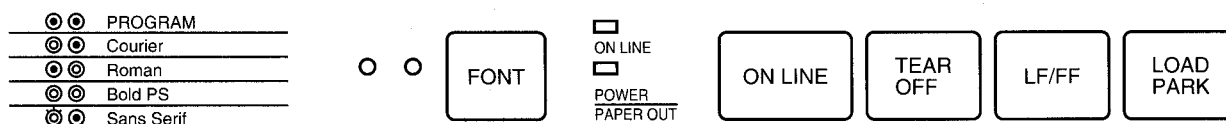
2. Operator Controls/Indicators



3. Setting of Controls

This section covers the basic operation of the printer. For more detailed operation, refer to the operator's manual.

3.1 Print Mode



- FONT switch:** Pressing this switch will select the font style.
- ON LINE switch:** This switch opens and closes the communication line with the computer.
- LF/FF switch:** Pressing this switch advances the paper one line at a time. Holding this switch advances the paper to the first print line of the next page.
- TEAR OFF switch:** Pressing this switch will advance or reverse the paper for tearing off.
- LOAD/PARK switch:** Pressing this switch will load or park the paper.
- FONT indicators:** These indicators identify which Font has been selected.
- ON LINE indicator:** This indicator is lit when the printer is in the ON LINE mode and is out in the OFF LINE mode.
- POWER/PAPER OUT indicator:** This indicator is lit when the power is on and paper is installed. It blinks when paper is not installed.

3.2 Service Operation

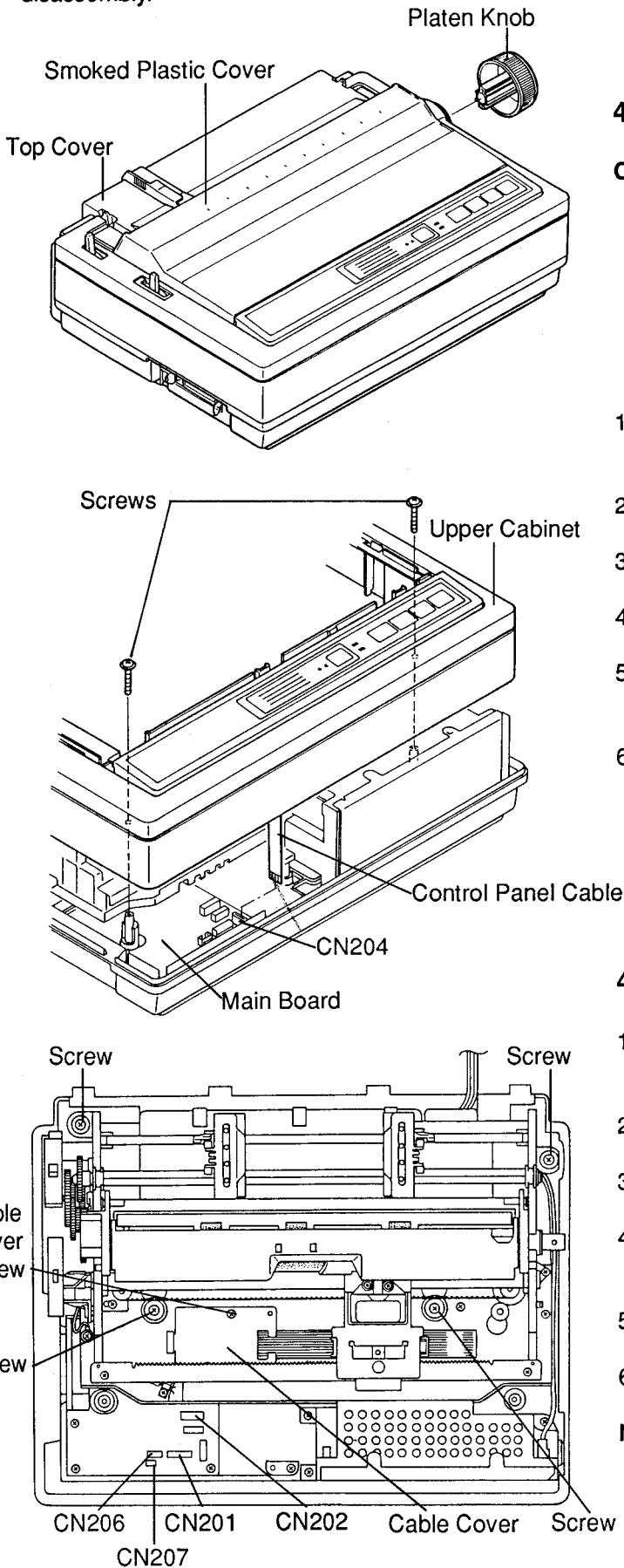
The following service functions can be executed when checking, adjusting or testing the printer.

Operating Switch	Function Name	Description
LF/FF switch + Power switch	Self. Printing Test	All characters stored in the FONT ROM are printed for 20 minutes.
ON LINE switch, LF/FF switch + Power switch	Print Timing	When adjusting the Print Timing, use this function. For more detailed information please refer to Section 5.2 Print Timing
ON LINE switch + Power switch	Head Aging	After installing the new printhead, use this function to check the movement of the printhead pins. Do not use this function more than 30 minutes.
FONT switch + Power switch	Hex-Dump	This function is for analyzing the data being printed by the printer. When the function is activated, all data received by the printer is printed in hexadecimal code.
TEAR OFF switch + Power switch	Demonstration Printing	The printer will perform Demonstration Printing.

Note: After completing each of the above checks, turn the power switch off to reset the unit.

4. Removal and Replacement Procedures

For safety and to avoid possible damage to electronic components, the AC line cord must be unplugged before disassembly.



4.1 Covers

Caution: The control panel board is installed on the upper cabinet. The control panel cable is attached to connector CN300 on the control panel board and connector CN204 on the main board.

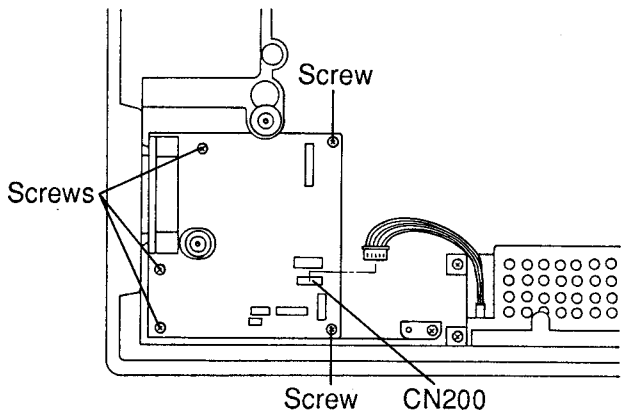
When lifting off the upper cabinet from the machine, be careful not to damage the connectors and control panel cable.

1. Remove the paper stand and smoked plastic cover.
2. Remove the platen knob.
3. Remove the screws (2) from the upper cabinet.
4. Lift off the upper cabinet.
5. Unplug the control panel cable from connector (CN204) on the main board.
6. Remove the Upper Cabinet.

4.2 Printing Mechanism

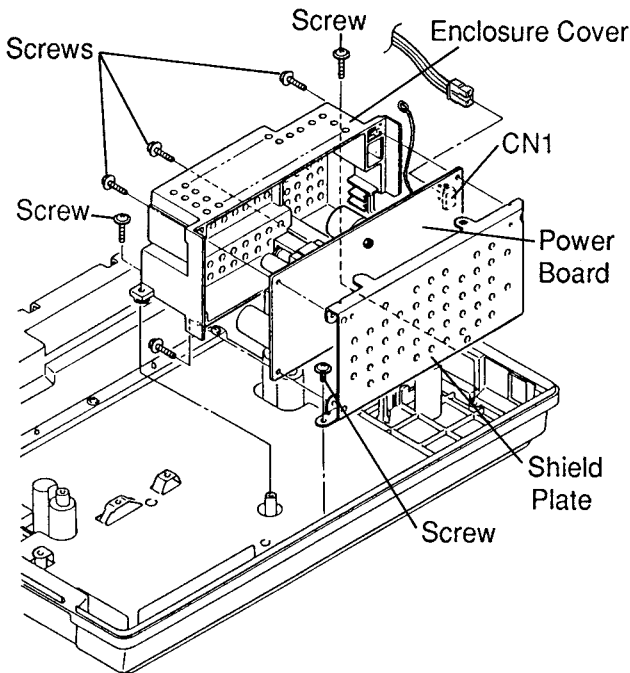
1. Unplug connectors CN201, CN202, CN206 and CN207.
2. Position the carriage on the right side.
3. Remove the cable cover screw and cover.
4. Unplug the printhead flat cable from connector (CN203) on the main board.
5. Remove the screws (4) from the chassis.
6. Lift off the printing mechanism.

Note: Use care when removing the cable cover to avoid damaging the print head flat cable.



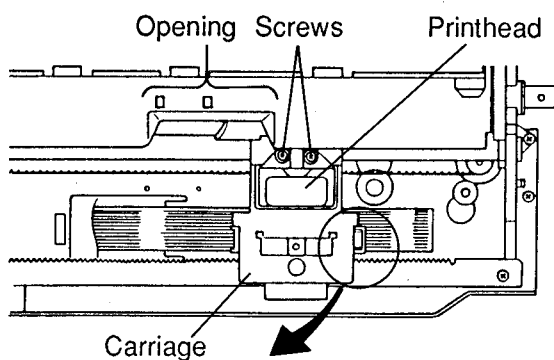
4.3 Main Board

1. Unplug connector (CN200) on Main Board.
2. Remove the screws (5) from the Main Board. The Main Board can now be removed.



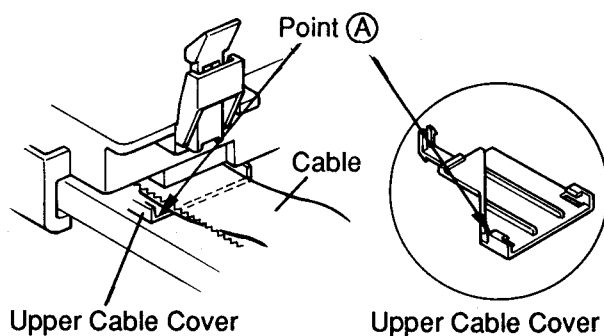
4.4 Power Board

1. Unplug connector CN1 on the power board.
2. Remove the screws (3) from the power supply unit.
3. Remove the screws (4) from the enclosure cover.
4. The enclosure cover, shield plate and power board can now be separated.



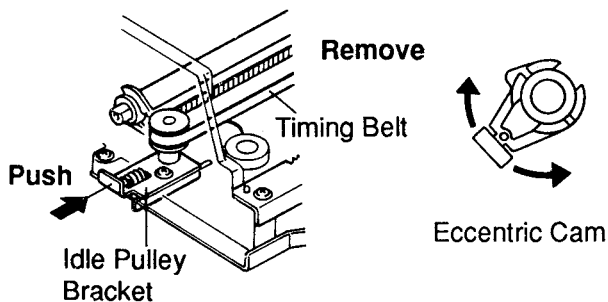
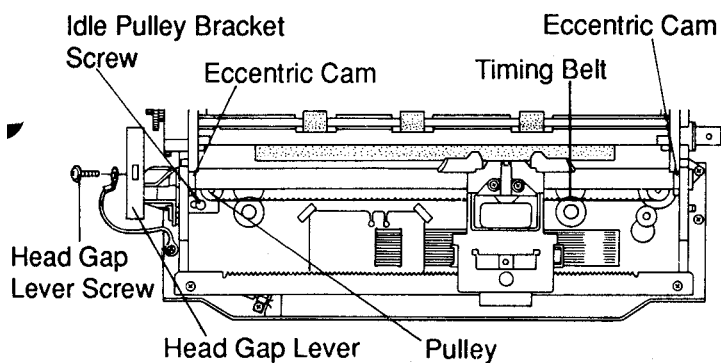
4.5 Printhead

1. Position the carriage at the opening.
2. Remove the screws (2) from the printhead.
3. Release the upper cable cover from the carriage by pushing down on the upper cable cover at point (A).
4. Remove the printhead by lifting the printhead and unplugging the printhead flat cable.



Note: When reinstalling the upper cable cover, ensure that the print head cable is not pinched by the cable cover latches.

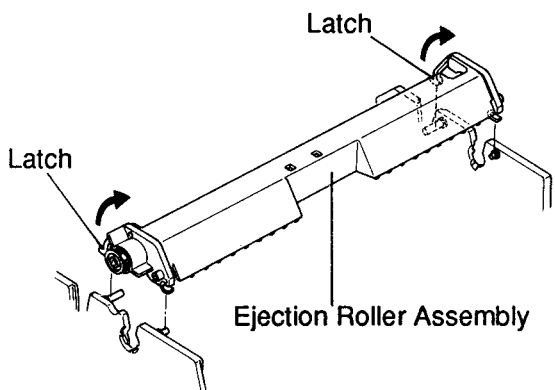
Note: When the printhead is installed, ensure that the head gap is correct. Refer to section 5.1.



4.6 Carriage Assembly

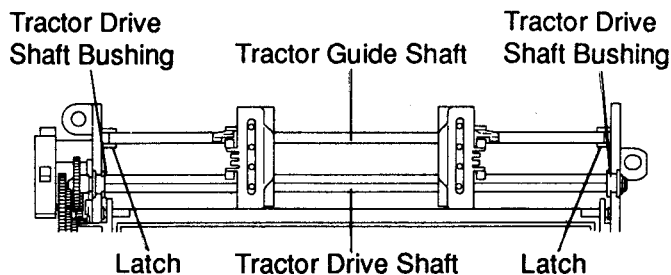
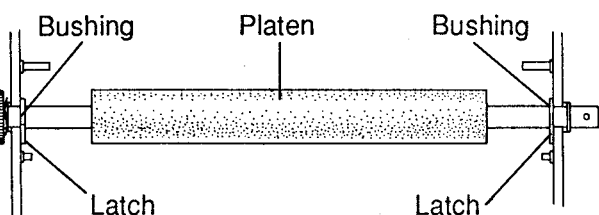
1. Loosen the idle pulley bracket screw (1) and release the timing belt from the pulley.
2. Remove the head gap lever screw, and Ground Wire. Remove the head gap lever.
3. Remove the carriage shaft eccentric cams from the right and left side frames by turning either clockwise or counter clockwise.
4. Slide the carriage shaft out from the left side and remove the carriage shaft.

Note: When installing the carriage assembly and its shaft, ensure that the head gap is properly adjusted. (Refer to section 5.1).



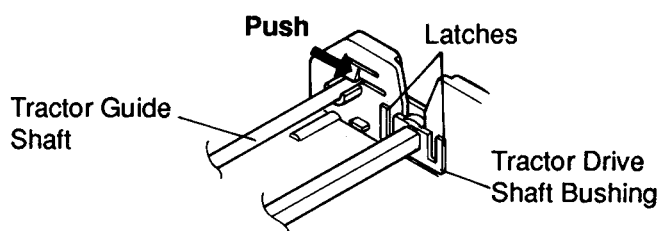
4.7 Platen Assembly

1. Release the latches on the ejection roller assembly.
2. Rotate the ejection roller assembly forward.
3. Remove the ejection roller assembly by lifting straight up.
4. Release the latch of the platen bushings from the left and right side frame. Rotate the bushings toward the rear of the machine.
5. Slide both platen bushings out of the frame by pushing them inward.
6. Lift off the platen assembly.



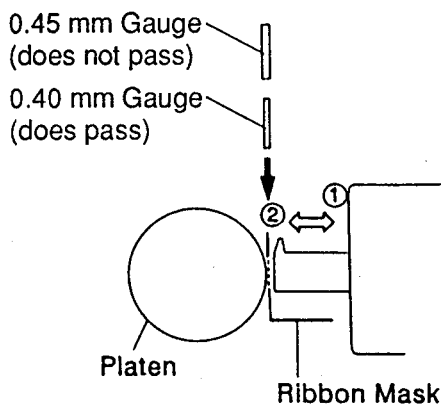
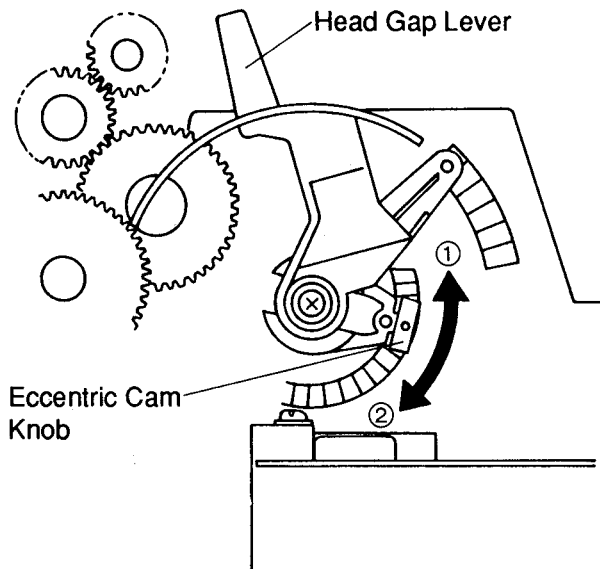
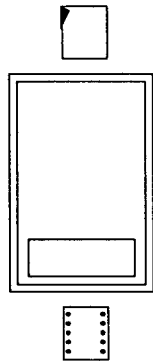
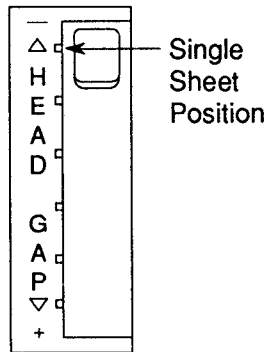
4.8 Tractor Assembly

1. Release the tractor guide shaft from the left and right side frame by pushing the latches.
2. Release the latches of the left and right tractor drive shaft bushings.
3. Lift off the tractor assembly.



5. Adjustment

(Head Gap Lever) (Paper Feed Selector)



5.1 Head Gap

1. Set the head gap lever to the single sheet position.
2. Set the paper feed selector to the "Single Sheet" position.
3. Ensure the printhead is firmly secured with 2 screws.
4. Move the carriage to the left side and adjust the head gap between the platen and the printhead for a clearance of 0.35mm-0.4mm by turning the left eccentric cam.
5. Move the carriage to the right side and adjust the gap as per step 4 above by turning the right eccentric cam.

Note: The projection on the eccentric cam is released from the adjustment hole by pulling the knob. Turning the eccentric cam one step causes $0.037\text{mm} \pm 0.052\text{mm}$ head movement.

Note: Use only a round wire feeler gauge of the specified dimension for this adjustment.

Note: The head gap adjustment is required when replacing the head, platen, carriage, carriage shaft or eccentric cams.

Note: Moving the head gap lever towards the ① position increases the head gap clearance, and moving toward the ② position decreases the clearance.

5.2 Print Timing

This adjustment is used for adjusting the print timing. There are 6 different speeds at which the print timing can be adjusted.

The print timing is adjusted using the following procedure:

1. Turn on the power while holding the ON LINE and LF/FF switches.
2. Press the FONT switch to print the "H" pattern. The "H" pattern will be printed for 4 full lines.
3. Check the print timing comparing the "H" pattern from line to line.
4. If the print timing is misaligned, adjust it by using the LF/FF (Move to right) and ON LINE (Move to left) switches and retry the printing for a final check.

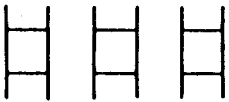
Note: Pressing the LF/FF or ON LINE switch moves the line in 1/1440 inch increments.

5. Press the TEAR OFF switch to select the next print speed.
6. Repeat steps 2-4 for each print speed.
7. Press the LOAD/PARK switch to save the print timing in memory. The printer will return to the normal print mode.

Note: If the second line of the "H" pattern is shifted by more than half of an "H" character, be sure the printing mechanism is normal before starting adjustment.

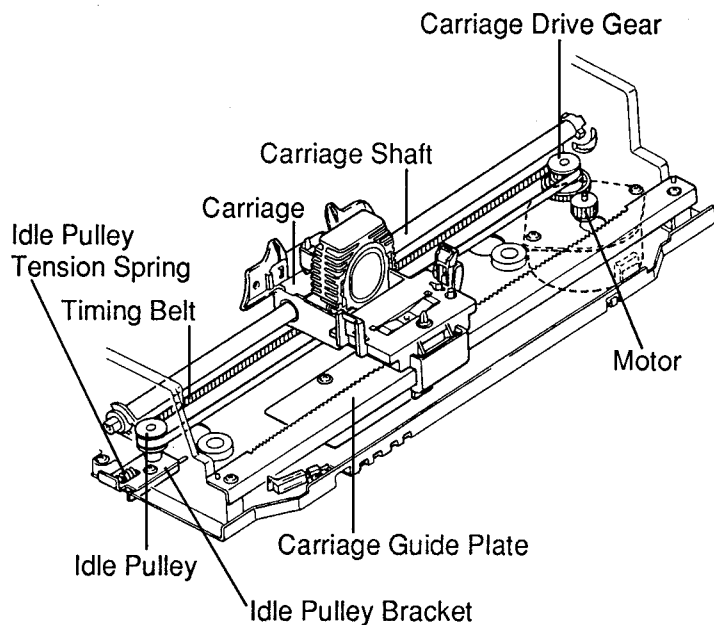


abnormal



normal

6. Mechanical Function



6.1 Carriage Drive System

The Carriage Drive System uses a pulse motor to move the carriage 1/60 inch per single drive pulse. The carriage slides on the carriage guide plate and carriage shaft when spacing to the right and left.

6.1.1 Power Transmission Mechanism

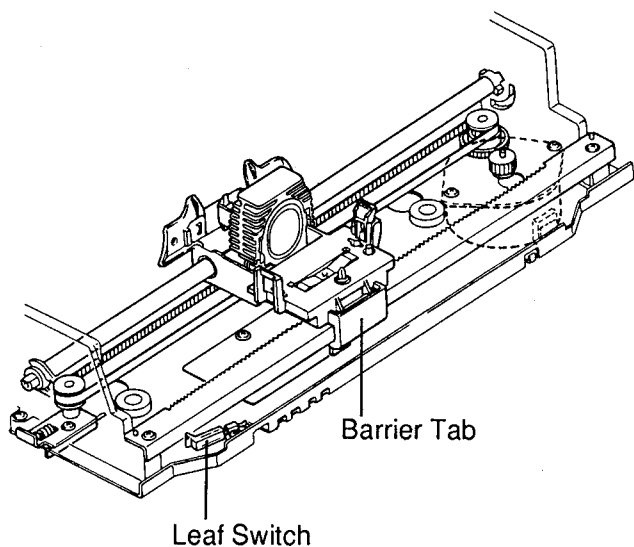
The rotation of the carriage motor is transmitted to the carriage through the carriage drive gear. The timing belt fixed under the carriage is looped around the idle pulley and carriage drive gear. This causes the carriage to move left and right along the carriage shaft. The timing belt is given proper tension by the idle pulley tension spring hooked between the pulley bracket and chassis.

6.1.2 Print Timing

Print timing for pica (1/60 inch) and elite (1/72 inch) is generated by a software operated timer. Refer to "Carriage Motor Drive Block" page 33.

6.1.3 Home Position Detector Mechanism

The home switch is a leaf switch located at the far left of the printer. Its function is to notify the CPU of the carriage reference position. During spacing operation, when the carriage approaches the left margin, the barrier tab, mounted under the carriage, actuates the home switch, generating the signal and indicating carriage position to the CPU.



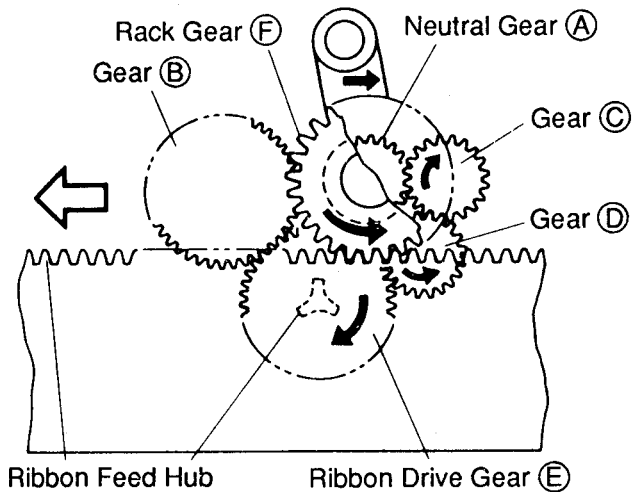


Fig.1 (Bottom View)

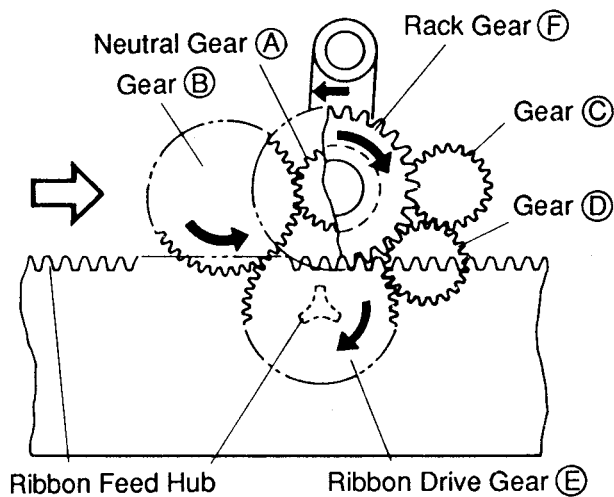


Fig.2 (Bottom View)

6.1.4 Ribbon Cassette Drive Mechanism

This function performs the ribbon feed operation in accordance with the movement of the carriage. The ribbon cassette drive mechanism is shown in Figures 1 and 2.

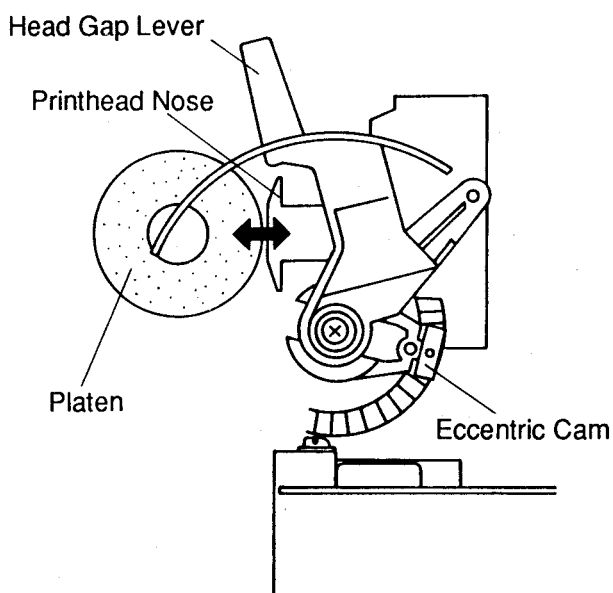
This mechanism gives uniform ribbon feed regardless of the direction of the carriage movement. It consists of the rack gear (F), ribbon drive gear (E) with the ribbon feed hub and 3 gears.

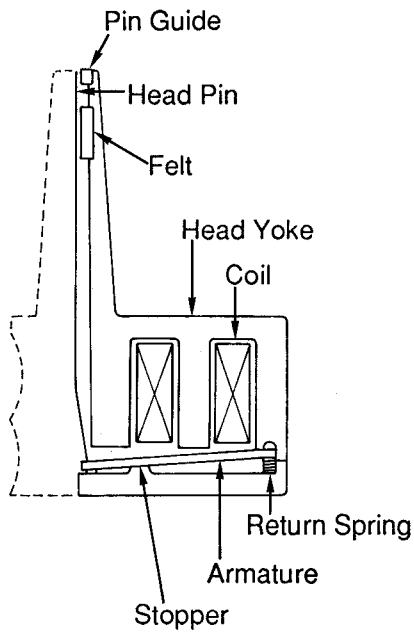
When the carriage moves to the right (Fig.1), rack gear (F) turns the neutral gear (A) counter-clockwise. The neutral gear (A) then engages with gear (D) via the gear (C) which turns the ribbon drive gear (E) clockwise with the hub.

When the carriage moves to the left (Fig.2), rack gear (F) turns neutral gear (A) clockwise. Neutral gear (A) then engages with gear (B) which turns ribbon drive gear (E) clockwise with the hub.

6.2 Paper Thickness Selection

Selection for the number of copies is made by changing the distance between the platen and the printhead nose tip. When the head gap lever is operated, the carriage shaft revolves on the eccentric cams, moving the carriage forward or backward.





6.3 Printhead

The printhead utilizes 9 electromagnets as a driving source, which causes the pins to strike the ink ribbon against the platen and onto the typing paper for matrix printing. The construction of the printhead is shown at the left.

6.3.1 Power Transmission Mechanism

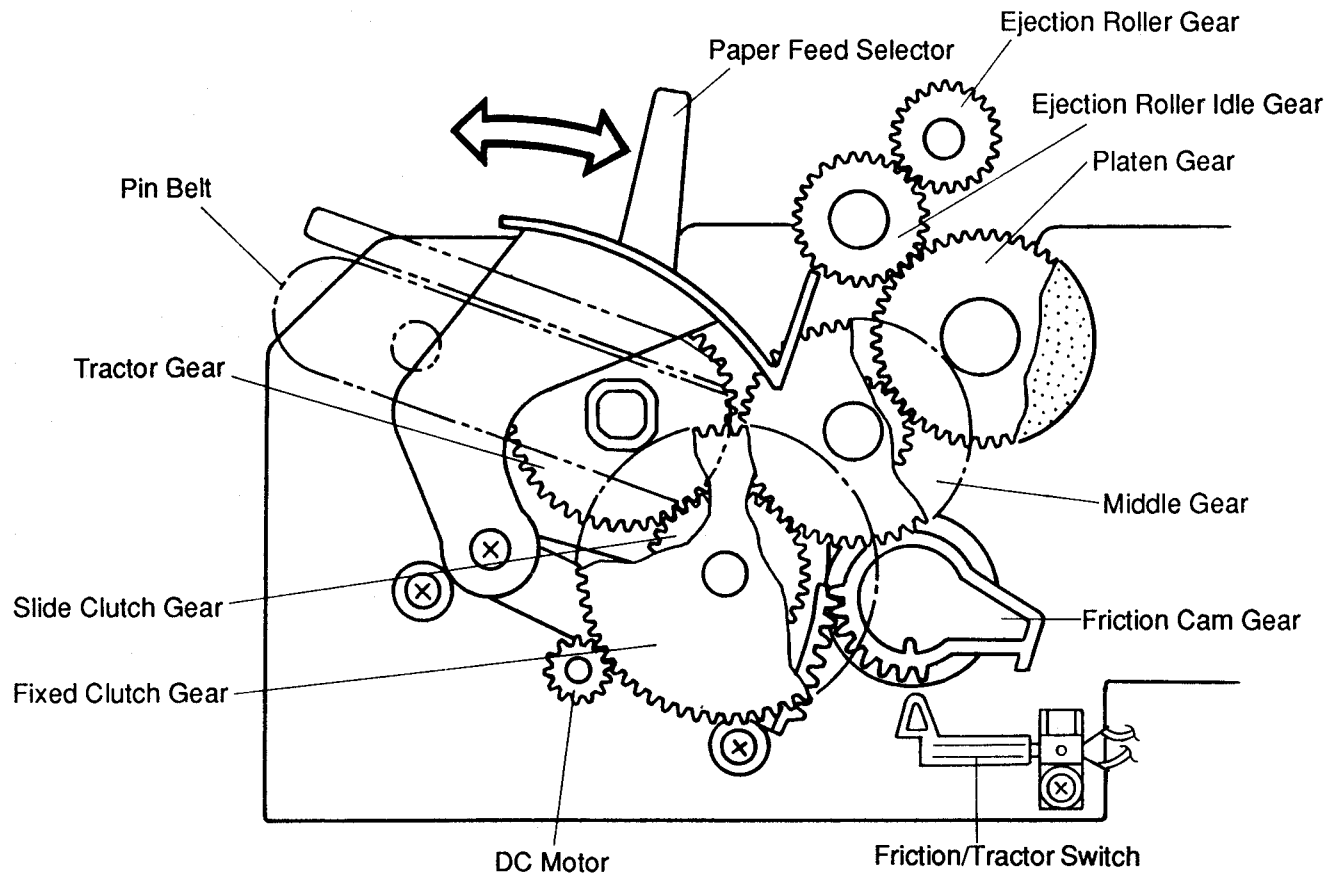
The set of 9 electromagnets consists of a one piece yoke and 9 coils. The armature which secures the pins is supported by this yoke.

6.3.2 Printhead Pin Operation

When the coil assembly is excited by a print signal, the armature is drawn in, and the pin secured by the armature is guided by the various guides to move in the direction of the platen. The pin strikes the ribbon to the paper. Next, the return spring moves the armature and pin from the platen back to the rest position.


6.4 Paper Feed Mechanism

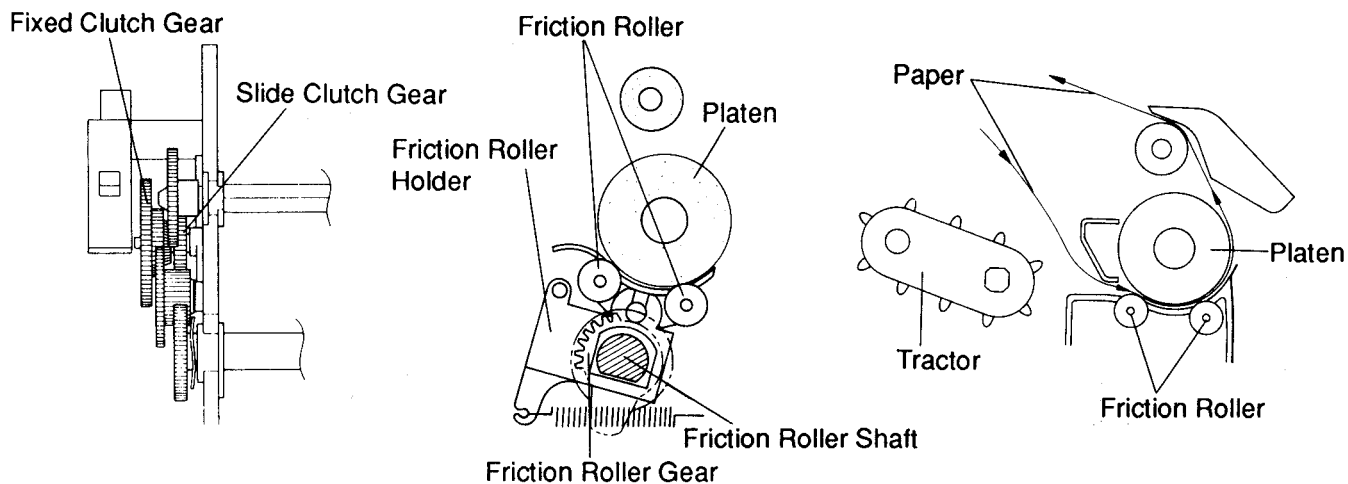
A DC pulse motor is used as a paper feed motor. Both continuous paper and single sheet can be fed by operating the paper feed selector. Continuous paper is loaded on both left and right sides of the pin belt on the tractor drive device. Continuous paper is fed from the rear of the printer. Single sheet is fed from the top of the printer. The paper feed mechanism is shown below.






6.4.1 Friction Paper Feed Mode

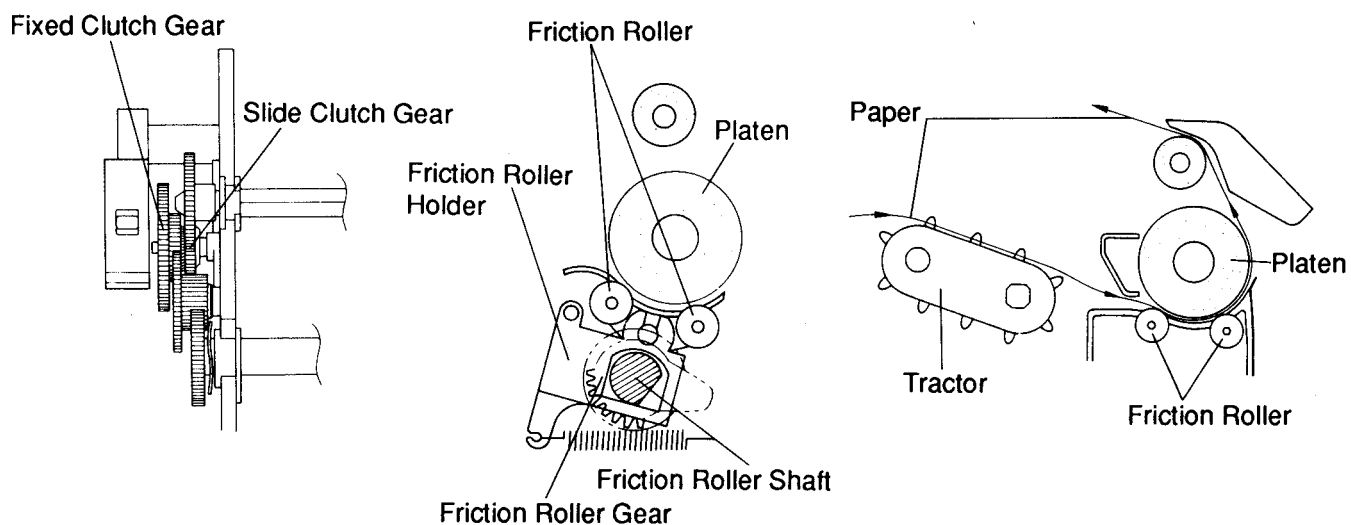
This mode is for feeding single sheet paper from the top of the printer in the friction paper feed position. By operating the paper feed selector, the fixed Clutch Gear is disengaged from the Slide Clutch Gear. As a result, the Tractor Gear is released from its power transmission mechanism.

When setting the paper feed selector at single sheet paper position, the Friction Roller Gear rotates in a clockwise direction. As a result, the Friction Roller Shaft revolves, allowing the Friction Rollers to contact the platen for gripping the paper when feeding. The Friction Roller Gear also pushes the leaf switch to notify the CPU that the selector is in the "  " Friction position.



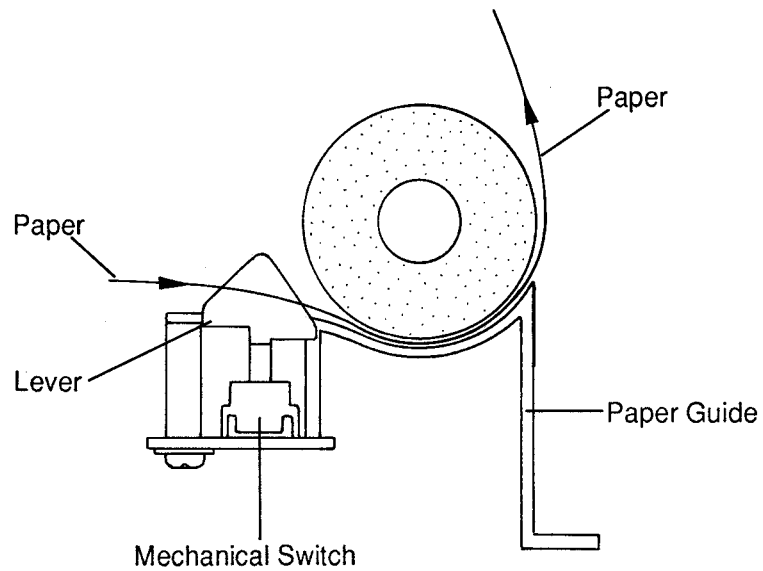
6.4.2 Tractor Paper Feed Mode

This mode is for feeding continuous paper from the rear of the printer. By moving the paper feed selector to the "  " Tractor position, the Slide Clutch Gear is engaged with the Fixed Clutch Gear. This enables turning of the tractor drive mechanism for push mode. When the paper feed selector moves to the "  " Tractor position the Friction Roller Gear is rotated in a counterclockwise direction. As a result, the Friction Roller Shaft revolves and moves the Friction Rollers away from the platen. This enables free paper passage from the rear of the machine. The Friction Roller Gear also breaks contact with the leaf switch to notify the CPU that the selector is in the "  " Tractor position.

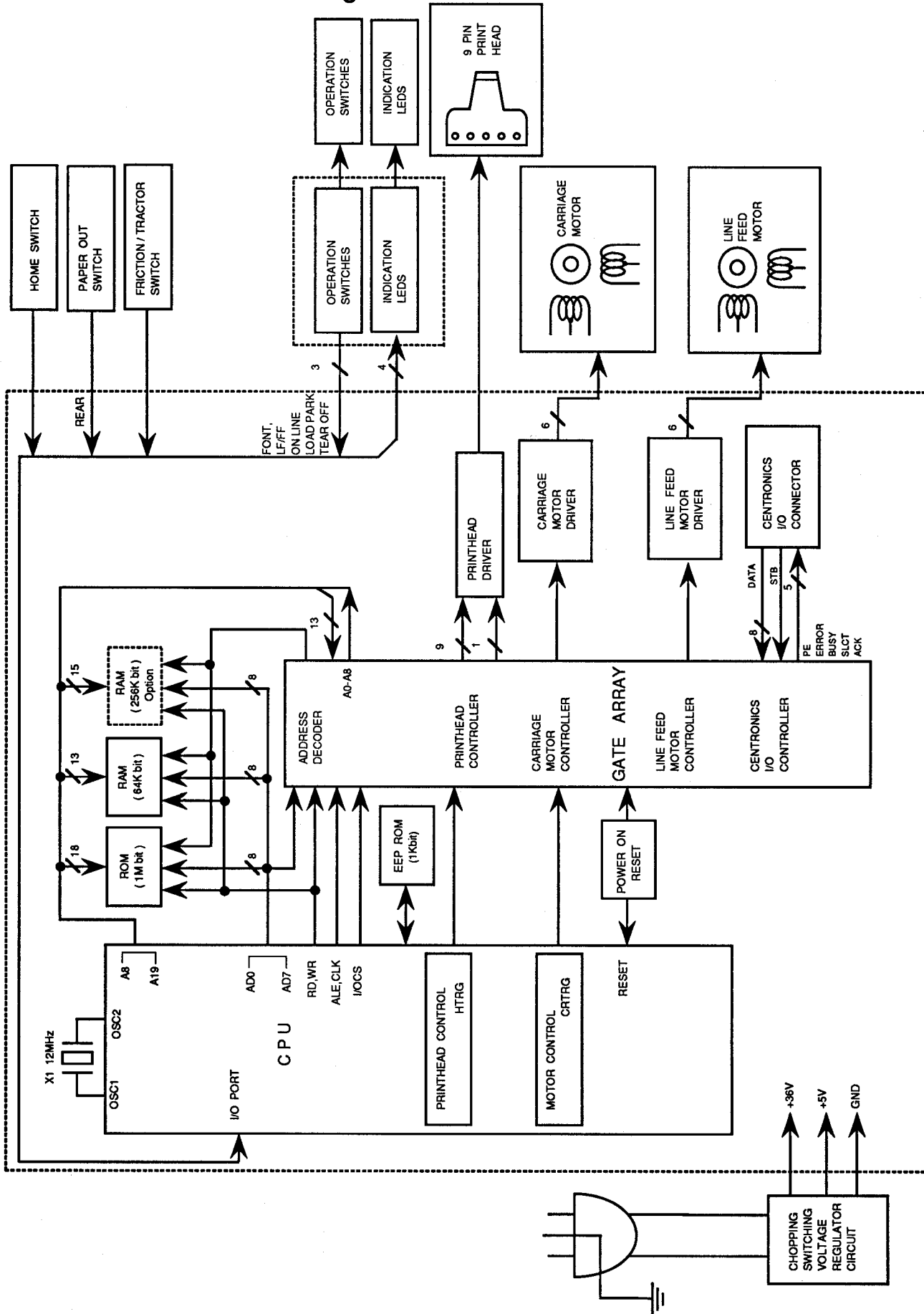


6.5 End of Paper Detector

The printer uses a mechanical switch for detecting paper out with continuous or single sheet paper. When paper is loaded in the printer, the lever is down, and the condition of the mechanical switch is on. This sends a signal to the CPU indicating paper loaded in the printer. When paper is out, the lever is up, and the condition of the mechanical switch is off. This removes the signal from the CPU indicating no paper is in the printer.



7. Electronic Circuit Block Diagram



8. Electronic Circuit Descriptions

8.1 Principle of Operation

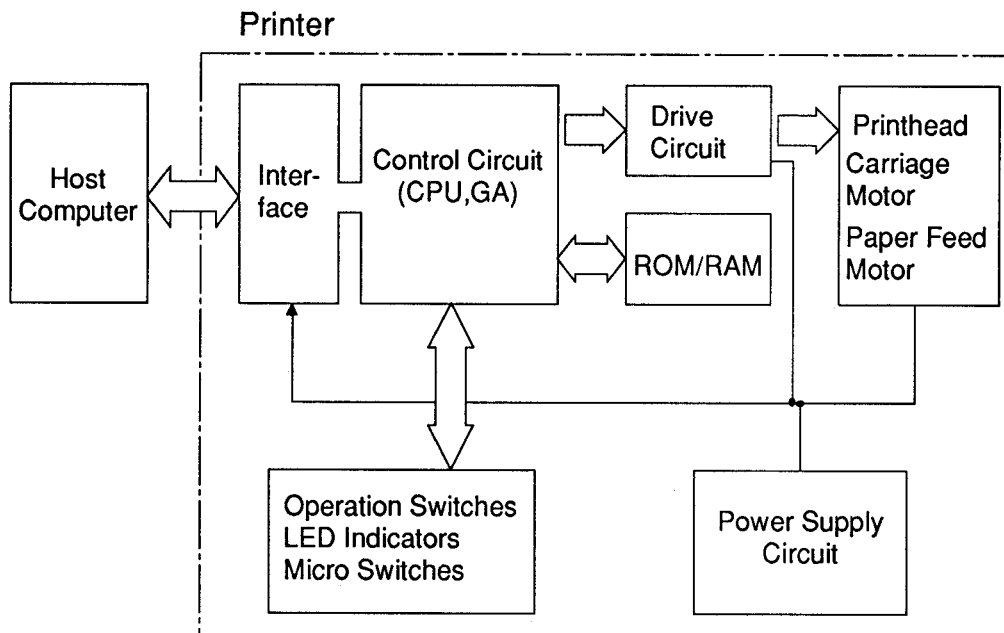
The KX-P1150 has three Micro switches. The home position switch sets a reference for the carriage and is necessary for aligning the first print position. The Friction/Tractor switch detects the selected method of paperfeed (Friction or Tractor).

The paper out switch detects paper end and prevents printing when the printer is out of paper.

The printer has three drive circuits; carriage spacing motor, paper feed motor and printhead.

The control panel is composed of switches and LEDs that indicate the various states of the printer.

Logic Diagram



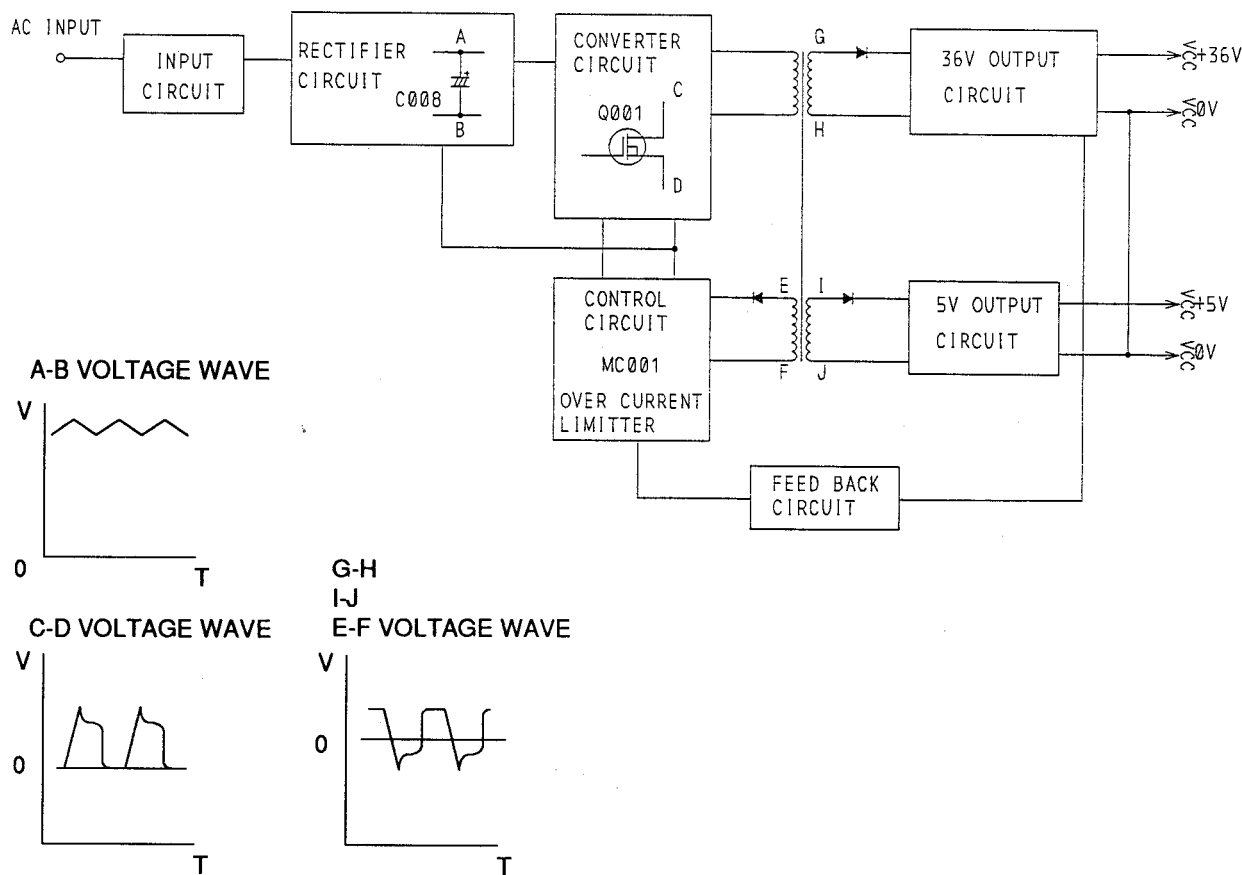
8.2 Circuitry

8.2.1 Power Supply Block

(1) Block Diagram and Schematic Diagram

IMPORTANT SAFETY NOTICE

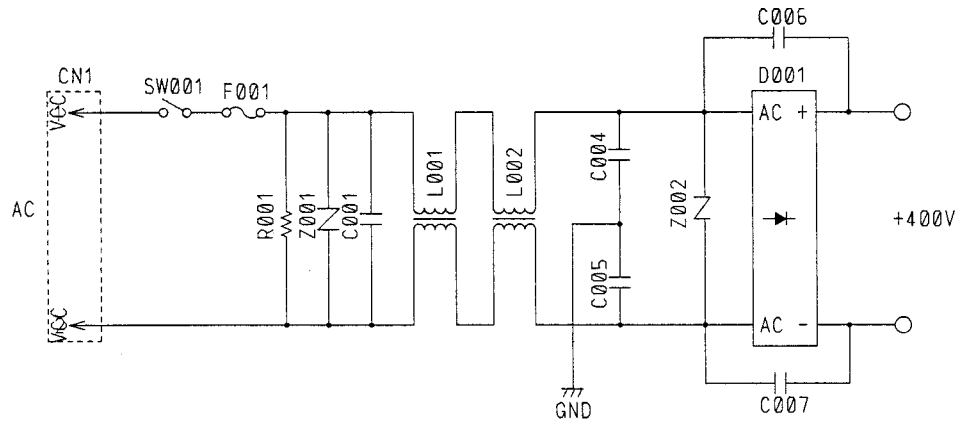
1. Do not attempt to repair this power supply. This supply requires proper calibration after any component replacement. Failure to do so may result in component damage, shock fire or other hazard.
2. High voltage is present on the power supply board. Use caution when measuring voltage levels.
3. Do not power on the power supply without the main logic board connected to the output side of the supply. Component damage could occur without a load connected to the supply.



(2) Description

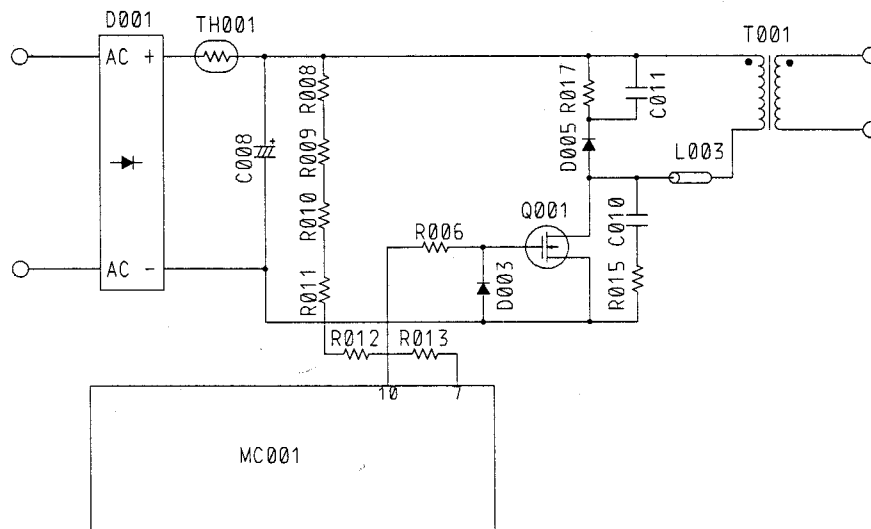
(a) Input Circuit

This circuit decreases RF and eliminates transient line noise. After the AC line voltage is filtered, it is supplied to the rectifier circuit. Fuse F001 protects the power supply from external power surges and internal current overloads.



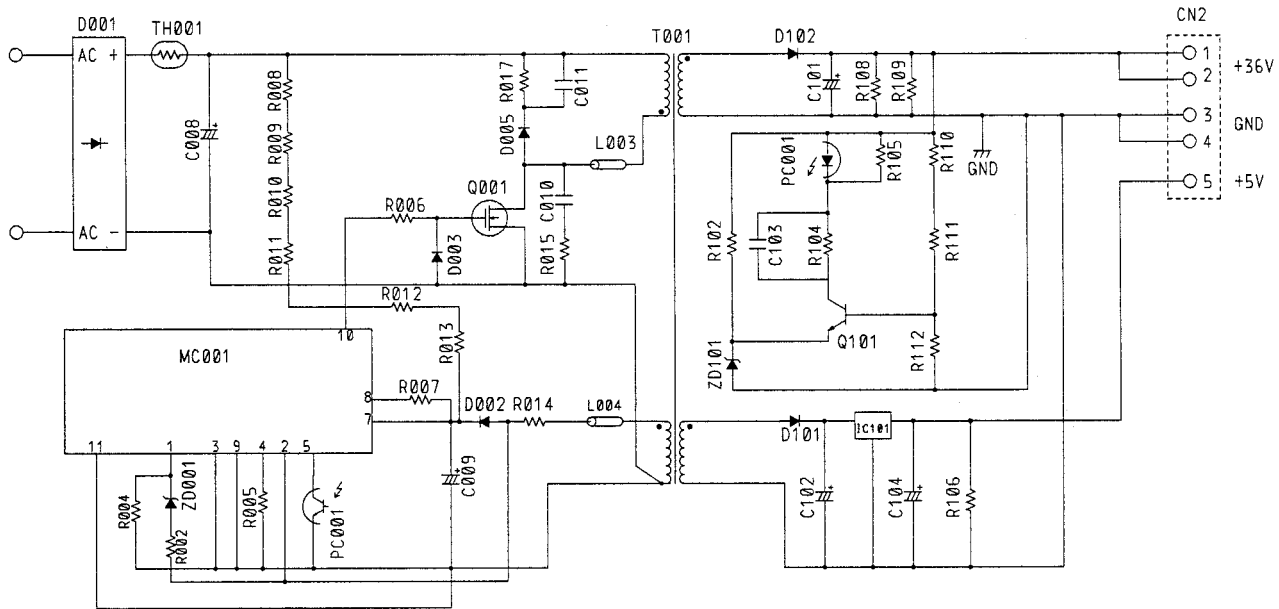
(b) Rectifier Circuit

The AC power is rectified by D001, then supplied to the converter circuit and provides the Kick-on voltage for control circuit (MC001) through R008-R013. Over current protection in this circuit is provided by TH001.



(c) Converter Circuit

This power supply produces 2 output voltages (+36VDC and +5VDC). The output voltages are stabilized by controlling the on and off period of Transformer T001, which is controlled by MC001 monitoring the +36VDC output and then turning Q001 on and off. +8VDC is input to IC101, a three pin regulator that regulates the +5VDC output.



(d) Control Circuit and Error Detection Circuit

When the +36VDC output voltage increases, the current of photocoupler PC001 increases, MC001 monitors this current level and controls on and off time of Q001. The turning on and off of Q001 controls the oscillation frequency of T001 which regulates the +36VDC output.

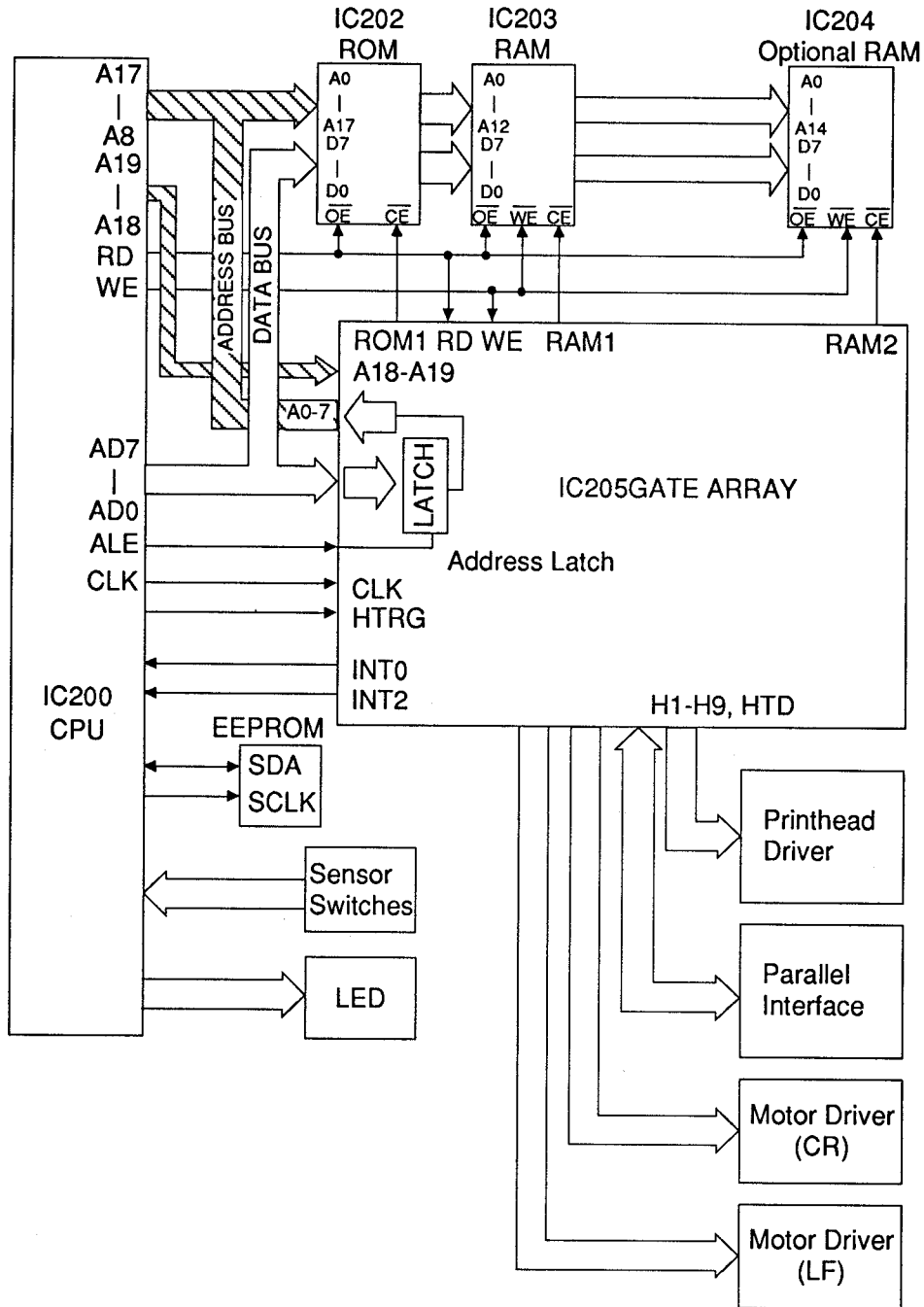
(e) Over Current Limiter

IC101 has built in over current protection and protects the +5VDC circuit from current overload. Control circuit MC001 provides over current protection for the +36VDC circuit by controlling Q001 turn on time by an internal limiter circuit.

8.2.2 CPU and Peripheral Circuit Block

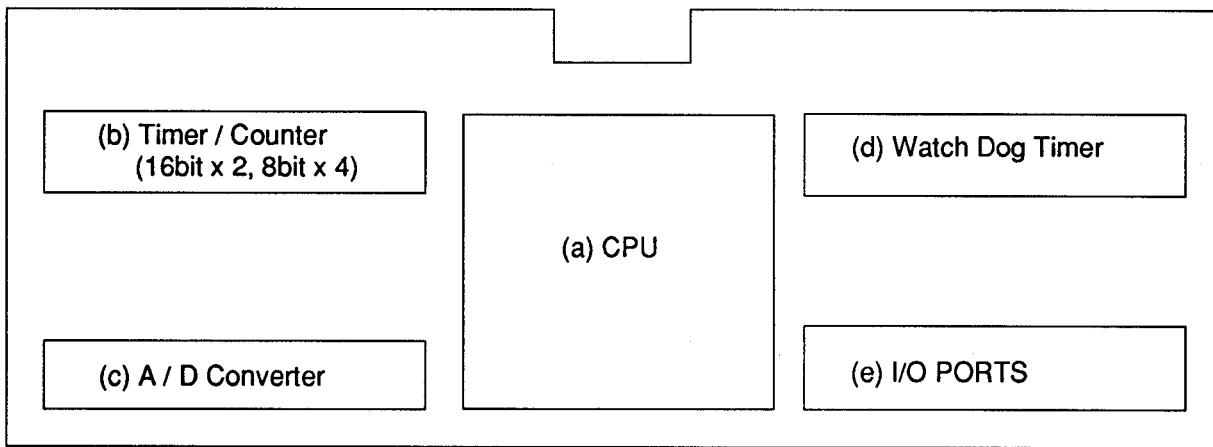
(1) This block diagram consists of the CPU (IC200), Gate Array (IC205), ROM (IC202), RAM (IC203) and optional RAM (IC204). It receives the data from the host computer, processes the input from the printhead overheat sensor and operation switches, and controls the carriage, paper feed motors, and the printhead.

ROM contains the operation program, which controls data processing and mechanical functions and the character generator, which determines the appearance of the characters.



(2) CPU Functions

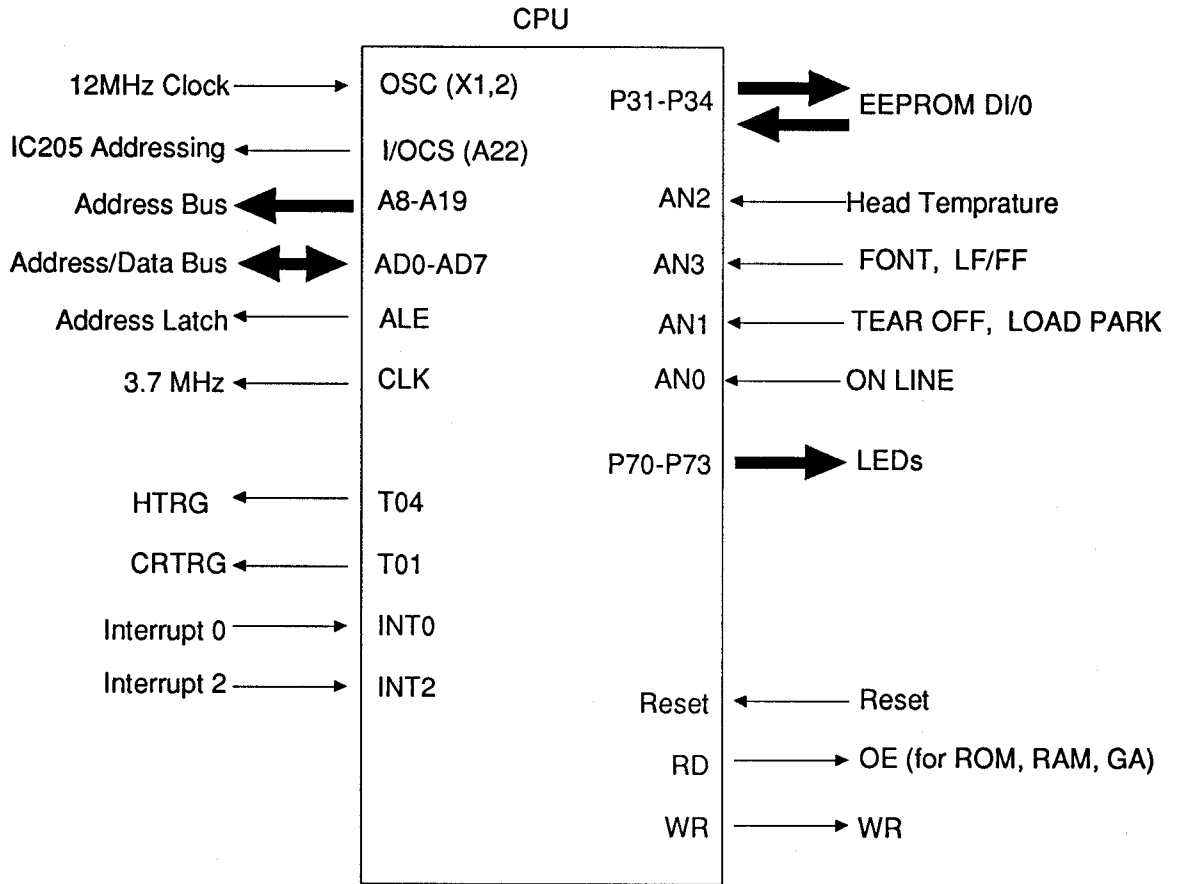
Block Diagram



- (a) CPU
This block mainly consists of the Program Counter, Arithmetic Logical Unit, and Instruction Decoder. This block fetches the program from the ROM, decodes the instructions, and processes it accordingly.
- (b) Timer/Counter
This block consists of two 16-bit timers and four 8-bit timers. They are used for generating the timing for the printhead and carriage motor.
- (c) A/D Converter
In this circuit, 8 bits/4 channel A/D Converters are prepared. One channel is used for sensing the overheat of the printhead and other channels are used for sensing the input of control panel switches.
- (d) Watch Dog Timer
When a program does not run properly, the CPU is reset.
- (e) I/O PORTS
These ports are used for sensing the input of Paper End, Friction/Tractor, Home switches and driving the LEDs in the control panel.

(3) CPU Pin Functions

The CPU has total of 64 pins and an 12MHz clock. It controls a 128KB ROM, 8KB RAM and 32KB optional RAM. These RAMs are used as an input buffer, line buffer, bit image buffer, and download area. The CPU pin functions are as follows.



(4) Gate Array

The gate array (IC205) is a 100 pin Flat Package, which consists of seven blocks.

(a) Head Drive Controller

The 9 Print Head Pins are controlled by a Head pin group controller. The Head Pin Trigger Pulse triggers generation of the Head Pin Signal from each group.

(b) Decoder

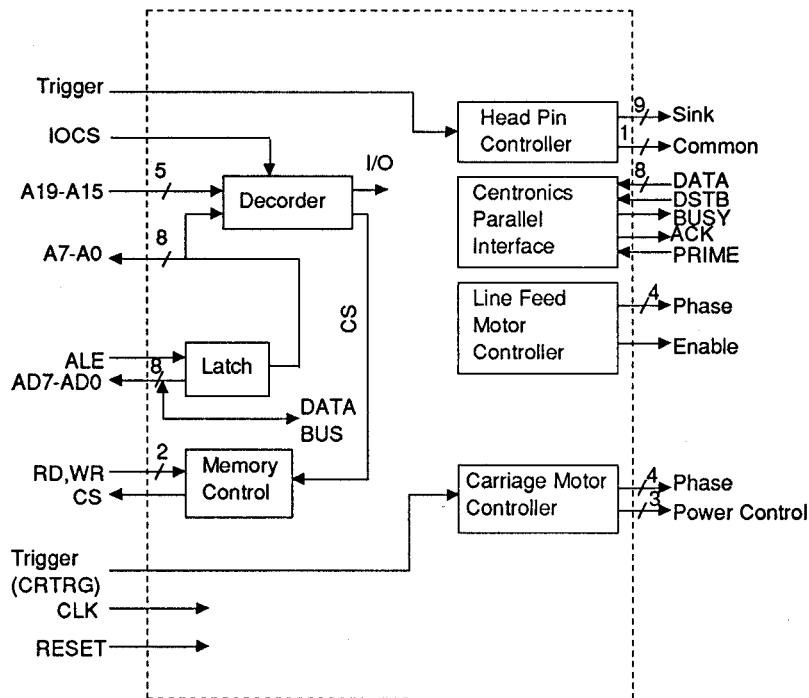
It is used for accessing ROM and RAMs, and used for refreshing RAMs.

(c) Handshake Interface

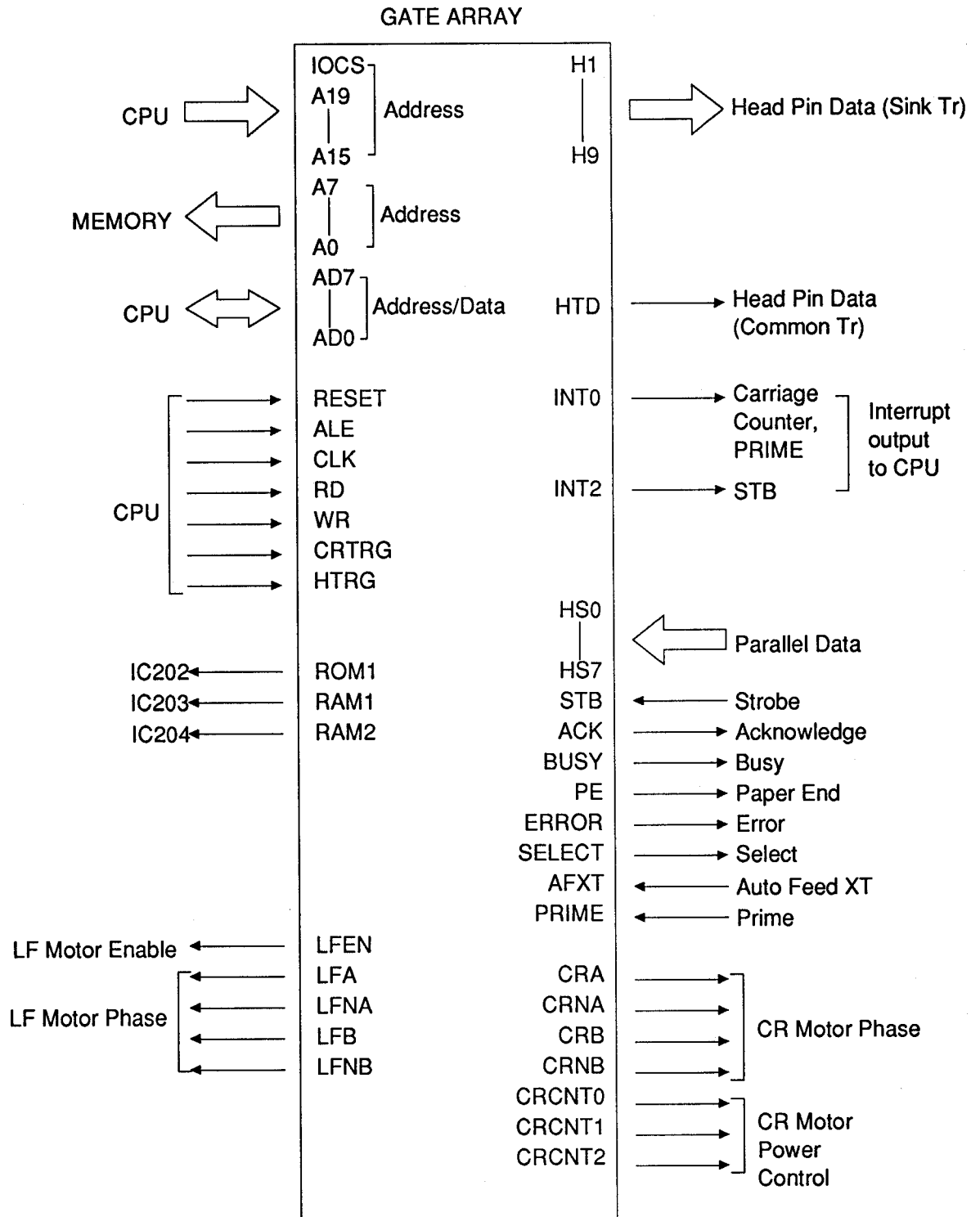
In this gate array, the Centronics Parallel Interface (usually called Handshake Interface) is prepared. The busy signal to the host computer is generated automatically when receiving the DSTB (data strobe) signal. The ACK (acknowledge) signal is also generated automatically when the busy signal turns to L level (Ready state).

(d) Pulse Generator for Stepper Motor

In this gate array the pulse generator for the stepper motor is prepared. This function is used for the carriage spacing motor and line feed motor. The motor driving pattern is generated automatically when the generator receives the starting signal. This pattern is synchronized with the output of the timer which determines motor pulse rate.



(5) Gate Array Pin Function
 The pin functions are as follows.



8.2.3 Parallel Interface Circuit

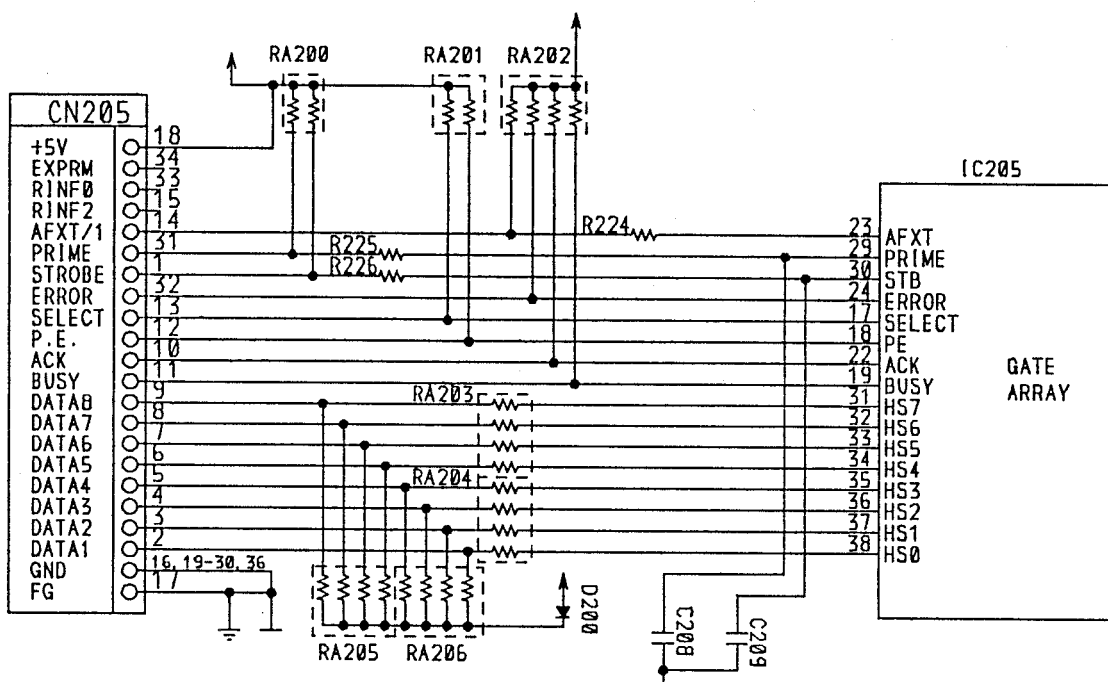
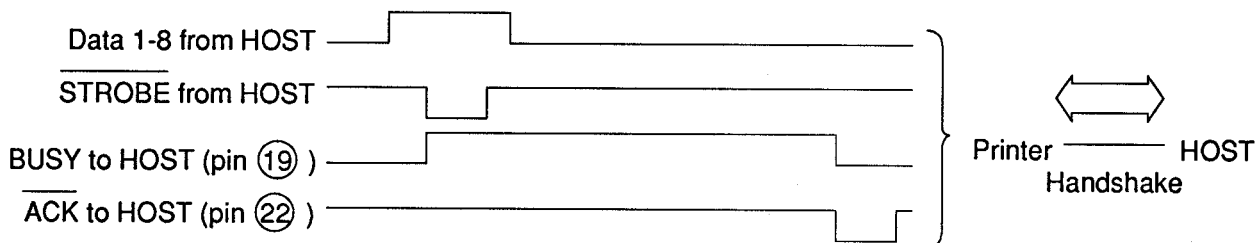
The Interface Block receives data from the host computer and generates the appropriate status signals. The handshake method is described in the following steps.

Process

- (1) A STROBE signal is sent from the host computer and is used to set the internal latch of the Gate Array. At the same time Gate Array pin (19) sends a BUSY signal to the host computer.
- (2) The CPU checks the internal latch of the Gate Array periodically and checks whether a STROBE is sent or not.
- (3) If a STROBE signal has been sent, the CPU reads the data through HS ports (HS0-HS7) of the Gate Array.
- (4) When the BUSY signal disappears, an ACK (Acknowledge) signal is sent to the host computer automatically during the time determined by software.
- (5) The CPU then determines from the received data as to whether it is a character code, control code or bit image data and processes the data accordingly.
- (6) The CPU processes another command (for instance; operation switch state check, motor drive during print).

Thus the data received by handshake is accomplished.

Timing Chart



8.2.4 Carriage Motor Drive Block

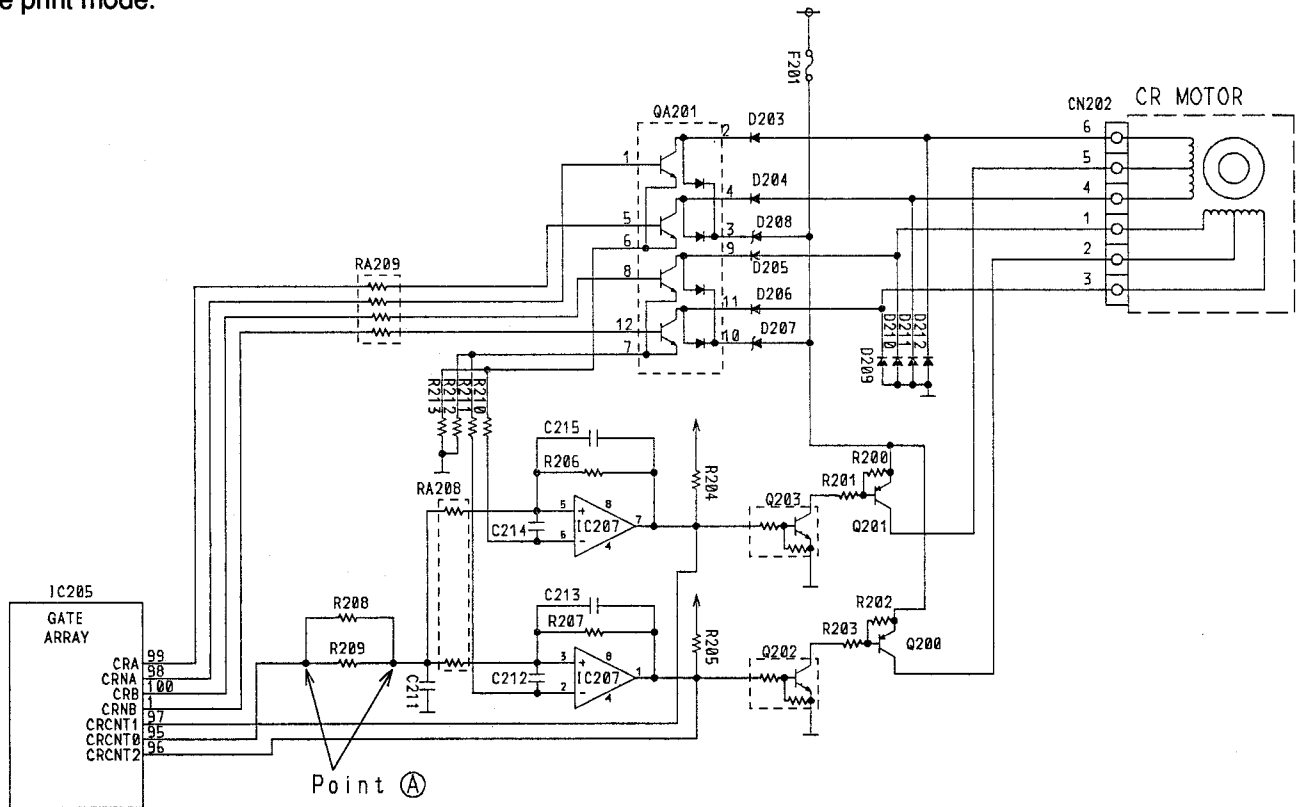
The Carriage motor is driven by the four signals from CRA, CRB, CRNA and CRNB, and is driven by 1-2 phase driving system.

The time interval is determined by the CPU's interval counter clock as generated from the CPU's clock.

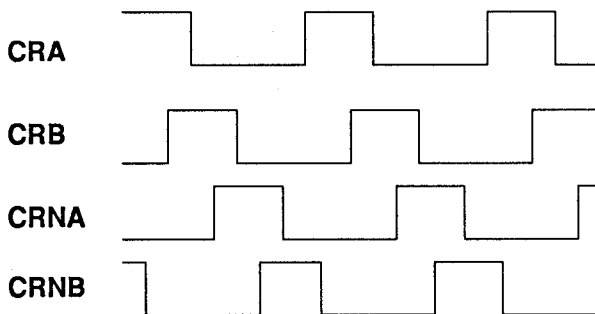
This circuit is a chopper drive circuit for fixing the amount of the current through the motor during stepping and has two threshold voltages (V_{SH} , V_{SL}). IC207 compares the voltage drop across R212 (R213) which is in proportion to the current through the motor. For example, when the voltage drop across R212 (R213) is larger than V_{SH} , IC207 is turned off and Q202 (Q203) is turned off, then Q200 (Q201) is turned off. At the same time, the current through the motor decreases, because the voltage drop across R212 (R213) decreases. When this voltage drop is smaller than V_{SL} , IC207 is turned on, and the current through the motor increases.

The amount of current through the motor is fixed during stepping by repeating this process.

These threshold voltage (V_{SH} , V_{SL}) are able to be changed by IC205 pin 95 H or L signal duty Ratio according to the print mode.



Timing Chart



Carriage Motor Coil Resistance Value

Pin No. (CN202)	Resistance Value
6-5	9.5 ± 0.7 ohms
4-5	9.5 ± 0.7 ohms
1-2	9.5 ± 0.7 ohms
3-2	9.5 ± 0.7 ohms

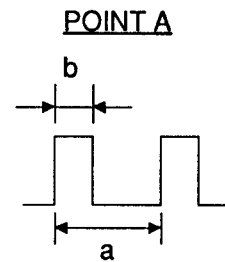
Pulse Rate Chart

Relation between the printing mode and the pulse rate is shown in the chart.

Printing Mode	Pulse Rate(PPS)	Current Control	
		CRCNTO	OUTPUT PULSE DUTY
Holding State	0	20/128	
DRAFT	10CPI	1953	10/128
	12CPI	1953	10/128
	15CPI	1953	10/128
	17CPI	977	6/128
	20CPI	977	6/128
LQ	10CPI	977	6/128
	12CPI	977	6/128
	15CPI	651	6/128
	17CPI	488	6/128
	20CPI	488	6/128

Note: The CRCNTO Output Pulse Duty Cycle is determined by dividing the on time of the pulse (b) by the total time of the pulse (a), measured at point A of the carriage motor drive circuit.

$$b/a = \text{CRCNTO Output Pulse Duty Cycle}$$

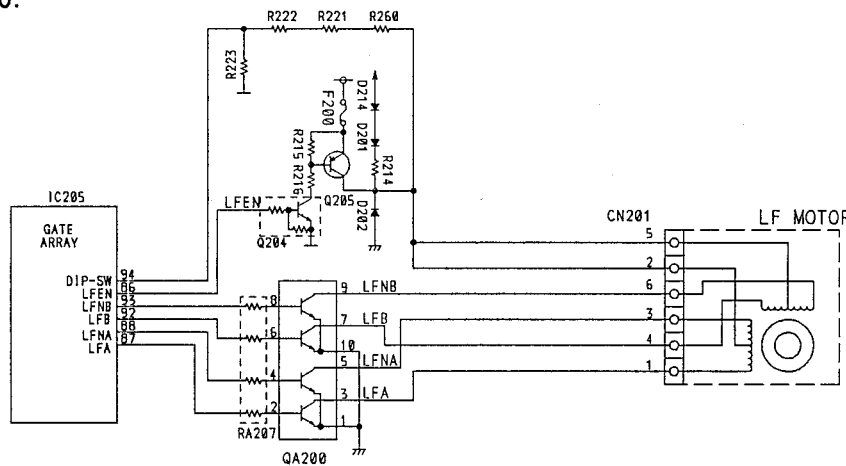


8.2.5 Paper Feed Motor Drive Block

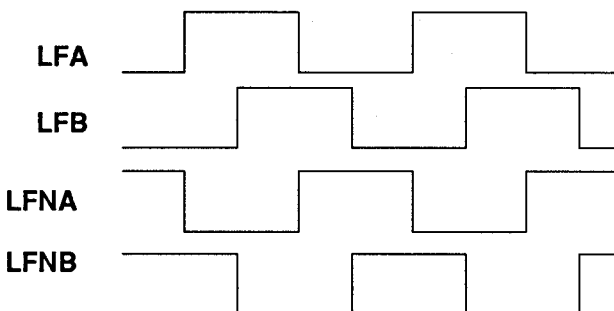
During paper feed, IC205 sets LFEN (pin 86) at the H level and turns on Q204 and Q205. +39V is then fed to the motor.

The driving method by LFA, LFNA, LFB, LFNB is a 2-2 driving system and the pulse rate is 400 pulses per second. When paper feed is not active, Q205 is turned off by LFEN (pin 86) L level signal and then a holding voltage (about 2V) is applied to the motor through R214.

The Line Feed Motor is protected from current overload by setting LFA, LFNA, LFB, LFNB and LFEN to a L level. This is controlled by the Dip-SW Port of IC205 (pin 94) detecting the collector voltage of Q205 through R221-R223 and R260.



Timing Chart



Paper Feed Motor

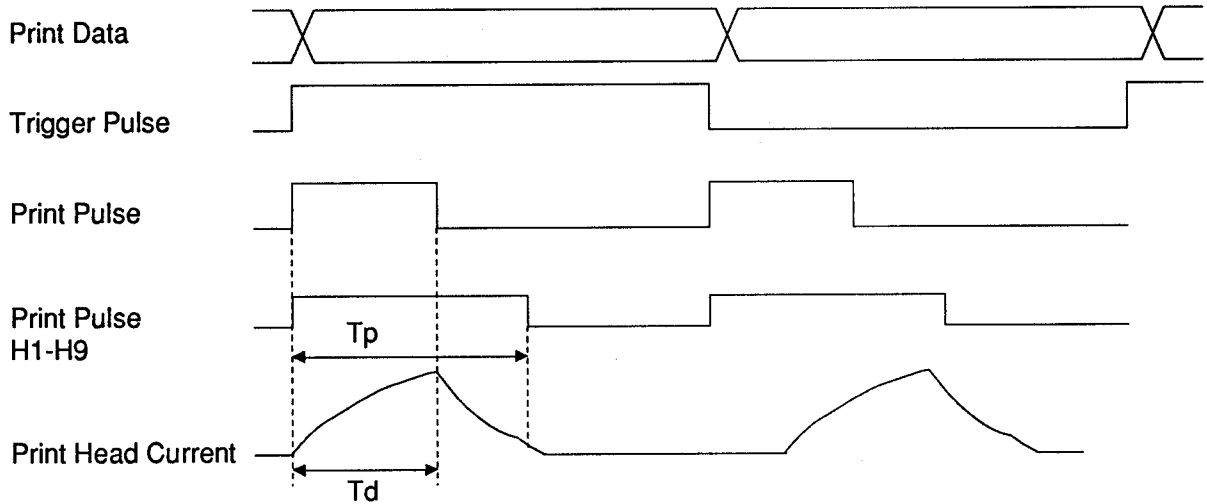
Pin No. (CN203)	Resistance Value
1-2	140 ± 10 ohms
3-2	140 ± 10 ohms
4-5	140 ± 10 ohms
6-5	140 ± 10 ohms

8.2.6 Head Drive Block

This block consists of Q208-216 and Q206, Q207. Q208-216 control each pin and Q206, Q207 control the power supplied to the printhead.

The CPU (IC200) sends the printhead trigger pulses from terminal TO4 to the Gate Array. During this time, the head pin solenoids are fired by Q206-216 according to the data received from the Gate Array as H1-H9. IC205 and Q206, Q207 control the current used to drive the pin solenoids. A thermistor is attached in the printhead and is used to detect overheating.

Timing Chart



Print Pulse Time

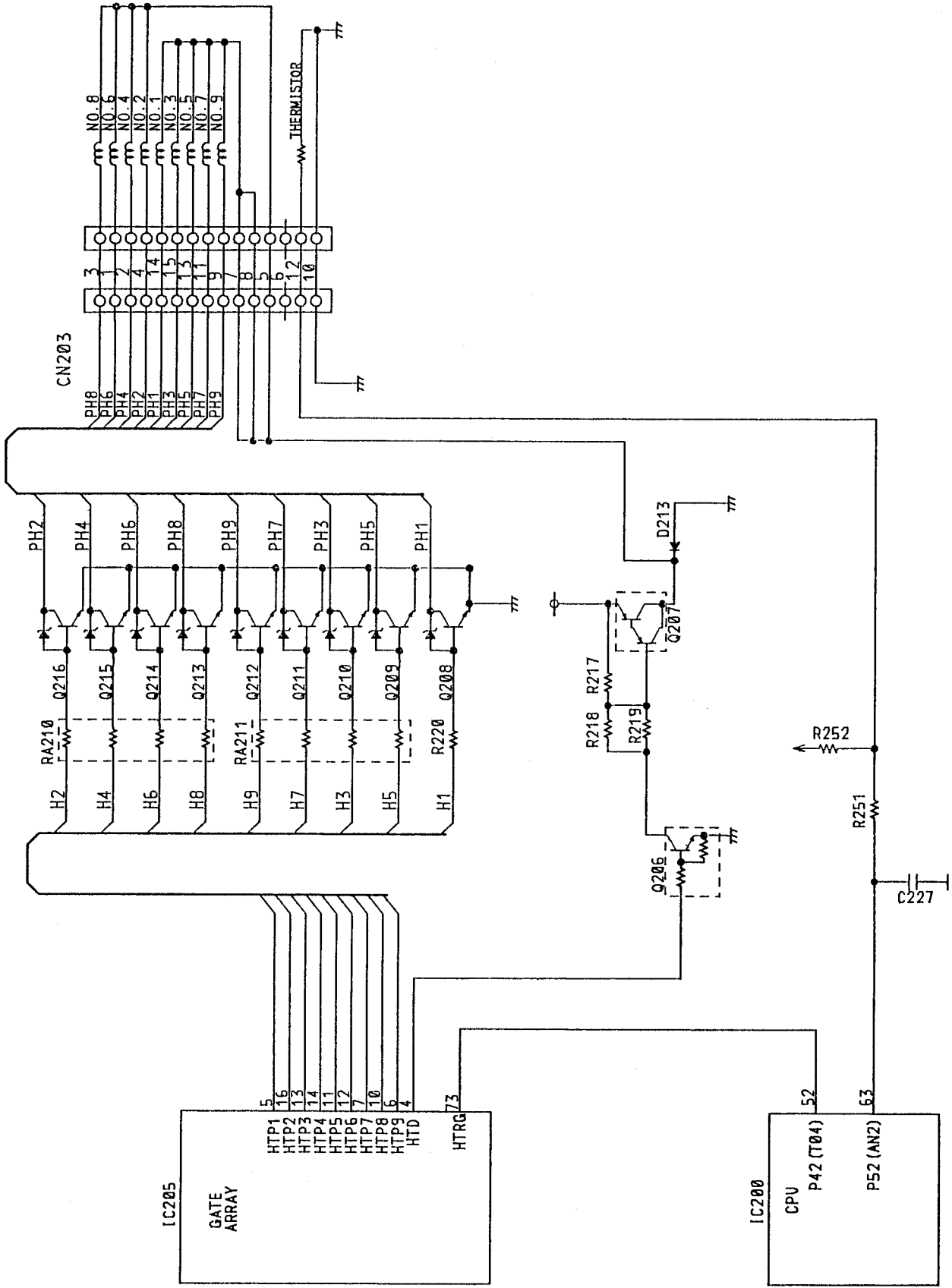
Print Mode	T_d	T_p
Draft	about 280 μ sec	about 492 μ sec
Bit Image	about 280 μ sec	about 492 μ sec

Printhead

Pin No. CN203	Resistance Value
1-5	24.9 \pm 0.5 ohms
2-5	24.9 \pm 0.5 ohms
3-5	24.9 \pm 0.5 ohms
4-5	24.9 \pm 0.5 ohms
9-7.8	24.9 \pm 0.5 ohms
11-7.8	24.9 \pm 0.5 ohms
13-7.8	24.9 \pm 0.5 ohms
14-7.8	24.9 \pm 0.5 ohms
15-7.8	24.9 \pm 0.5 ohms
10-12	Less than 37K \pm 8 Kohms (at 25°C)
6	OPEN

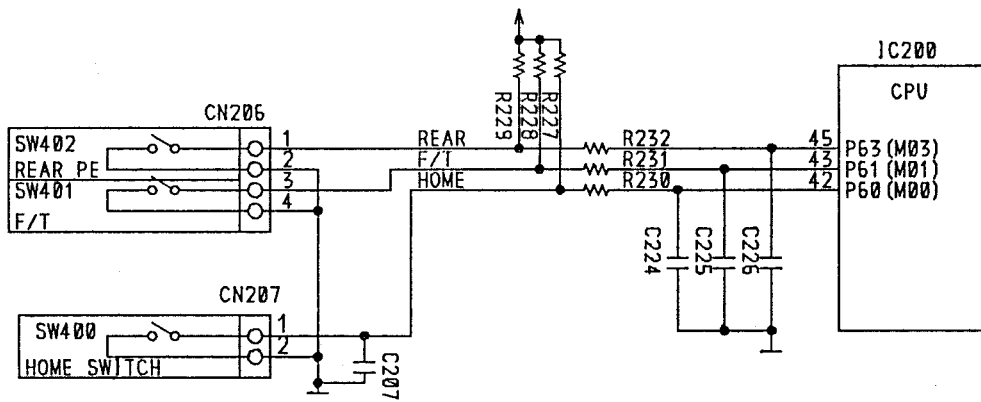
Print Head Driver

Circuit Diagram



8.2.7 Switch Circuits

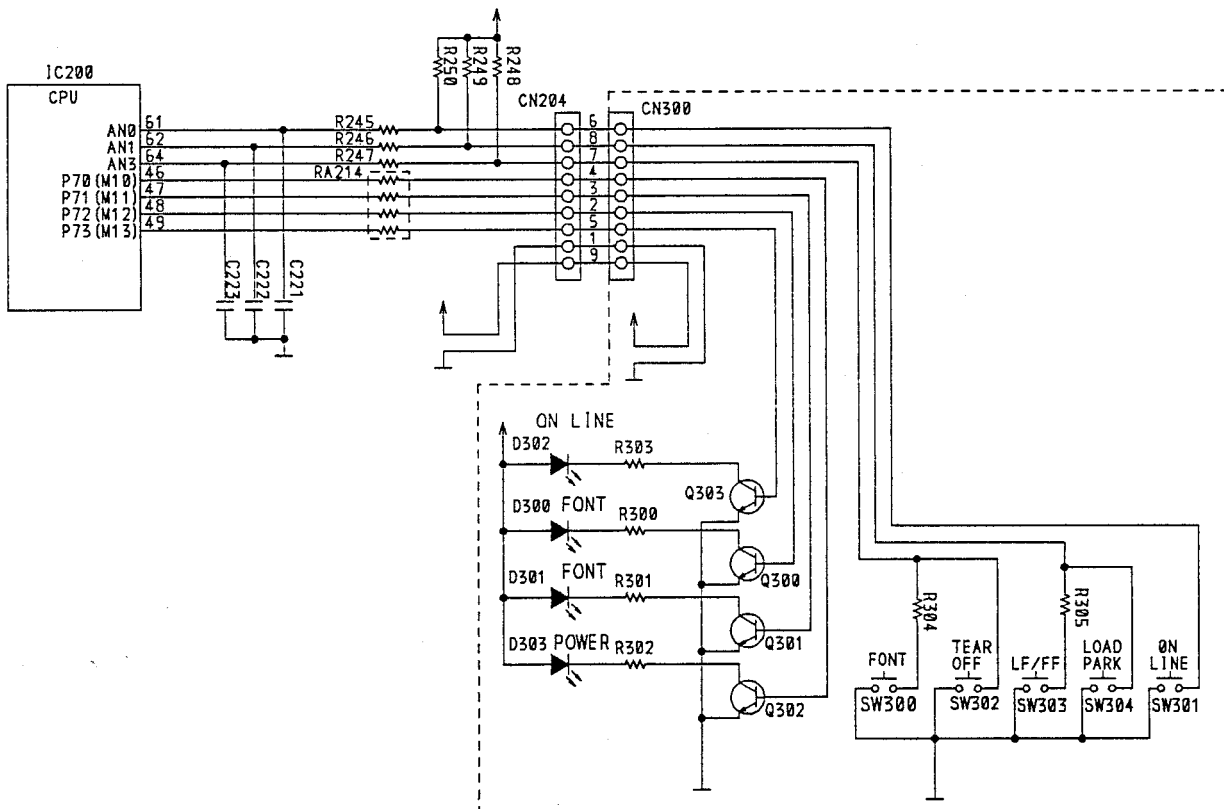
- (1) The purpose of the home position switch is to move the carriage to a reference position (home position) at the left end of the carriage when the power switch is turned on or when a Reset signal is generated. When the carriage comes to the home position, P60 (pin ④₂) changes from H to L level.
- (2) The paper out switch detects if the paper is in or out of the machine. When this switch detects paper out, P63 (pin ④₅) changes from H to L and the Power/Paper Out LED flashes to indicate paper out status.
- (3) The paper feed selector switch detects if the paper feed selector is in the friction or tractor position. If the paper feed selector switch is set to the friction position, P61 (pin ④₃) is L and if set to the tractor position, P61 (pin ④₃) is H.



8.2.8 Control Panel

The control panel is composed of 5 switches and 4 LEDs.

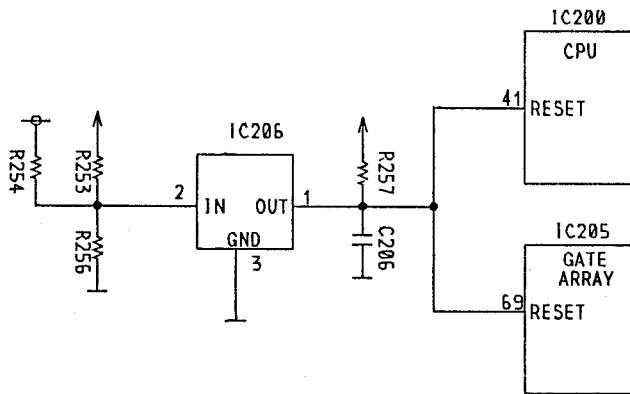
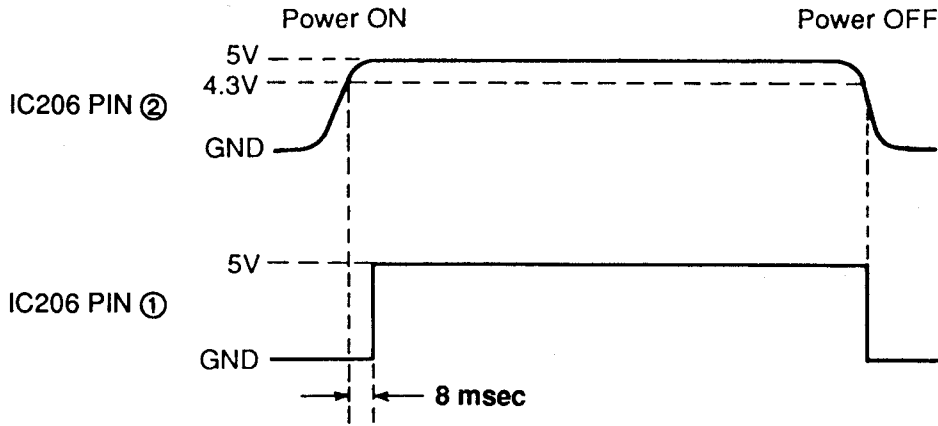
- (1) The ON LINE switch, switches between on-line and off-line and is input to IC200 (pin ⑥1). This switch is also used to change the current setting in the initial setup mode.
- (2) The LF/FF switch is for one-line or one page-feed paper feed and is input to IC200 (pin ⑥2).
- (3) The Font switch selects the character fonts and is input to the CPU (pin ⑥4). This switch is also used to select the item in the initial setup mode.
- (4) The TEAR OFF switch enables paper feeding to the tear off position and is input to the CPU (pin ⑥4).
- (5) The LOAD PARK switch enables automatic loading and feeding back of the fanfold paper and is input to the CPU (pin ⑥2).
- (6) The power/paper out LED lights when power is turned on and blinks when paper out is detected.
- (7) The ON LINE LED lights when at the on-line status.
- (8) Two Font LEDs display Font Type.



8.2.9 Reset, EEPROM

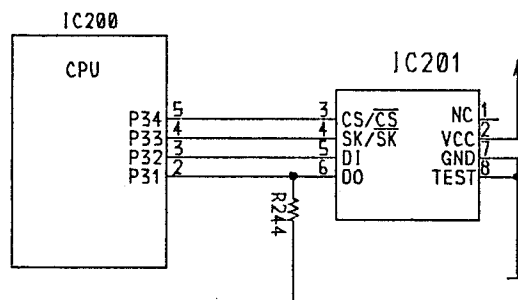
(1) Reset Circuit

The reset circuit is provided to initialize the gate array (IC205) and CPU (IC200). Approximately 8msec after the voltage at IC206 pin ② reaches approximately 4.3V, the reset terminal RES (pin ①) changes from L to H.

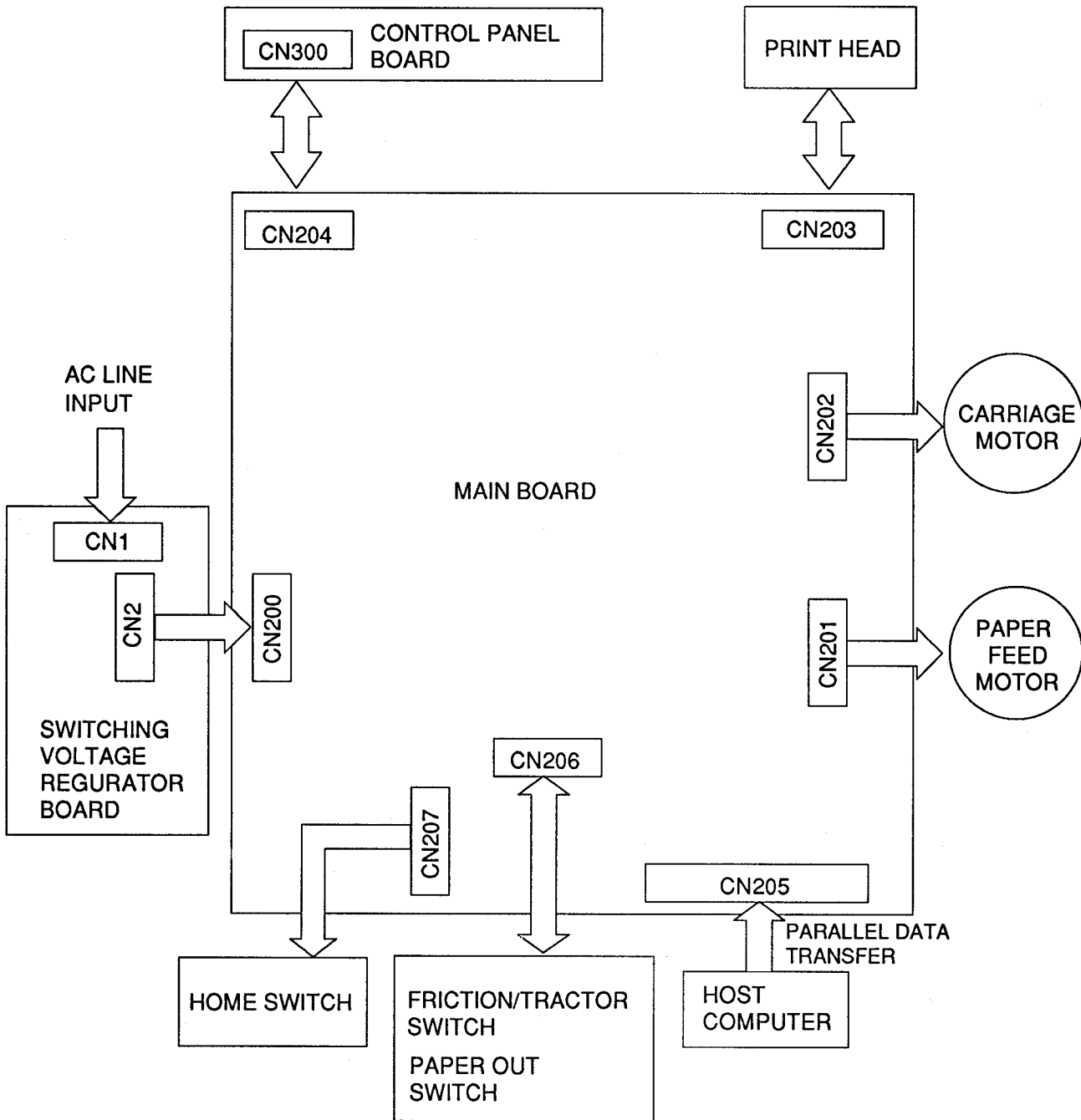


(2) EEPROM

This IC memorizes the setting such as printer mode character set, etc.



8.2.10 Logic Board Connection Diagram



8.3 Explanation of Connectors

8.3.1 Name of Connectors

Connector applications are shown below. For details, refer to tables.

CN1	: AC Power Supply	CN204	: Control Panel (LED, KEY)
CN2	: Power Supply (+36V,+5V,GND)	CN205	: Centronics I/O
CN200	: Power Supply (+36V,+5V,GND)	CN206	: Friction/Tractor Switch, Paper Out Switch
CN201	: Paper Feed Motor	CN207	: Home Switch
CN202	: Carriage Motor	CN300	: Control Panel
CN203	: Printhead		

8.3.2 Pin Assignment

CN1 (AC Power Supply)

Pin No.	Signal Name	Description	In/Out
1	AC	AC 220-240V	—
2	AC	AC 220-240V	—

CN2 ,CN200 (Power Supply +36V,+5V,GND)

Pin No.	Signal Name	Description	In/Out
1	DC +36V	For Printhead, Motor	—
2	DC +36V	For Printhead, Motor	—
3	GND	Ground	—
4	GND	Ground	—
5	DC +5V	For Main Board Logic Circuit	—

CN206 (Friction/Tractor Switch, Paper Out Switch)

Pin No.	Signal Name	Description	In/Out
1	SW	Paper Out Switch	In
2	SG	Signal Ground	Out
3	SW	Friction/Tractor Switch	In
4	SG	Signal Ground	Out

CN207 (Home Switch)

Pin No.	Signal Name	Description	In/Out
1	SW	Home Switch	In
2	SG	Signal Ground	Out

CN201 (Paper Feed Motor)

Pin No.	Signal Name	Description	In/Out
1	LFA	Line Feed Motor Phase A	In
2	SLF	Line Feed Motor Power Supply	Out
3	LFNA	Line Feed Motor Phase A	In
4	LFB	Line Feed Motor Phase B	In
5	SLF	Line Feed Motor Power Supply	Out
6	LFNB	Line Feed Motor Phase B	In

CN202 (Carriage Motor)

Pin No.	Signal Name	Description	In/Out
1	CRB	Carriage Motor Phase B	In
2	SCR	Carriage Motor Power Supply	Out
3	CRB	Carriage Motor Phase B	In
4	CRA	Carriage Motor Phase A	In
5	SCR	Carriage Motor Power Supply	Out
6	CRA	Carriage Motor Phase A	In

CN205 (Centronics I/O)

Pin No.	Return Side Pin No.	Signal Name	Description	In/Out
1	19	STB	Strobe	In
2	20	DATA1	Handshake Data 1	In
3	21	DATA2	Handshake Data 2	In
4	22	DATA3	Handshake Data 3	In
5	23	DATA4	Handshake Data 4	In
6	24	DATA5	Handshake Data 5	In
7	25	DATA6	Handshake Data 6	In
8	26	DATA7	Handshake Data 7	In
9	27	DATA8	Handshake Data 8	In
10	28	ACK	Acknowledge	Out
11	29	BUSY	Busy	Out
12		PE	Paper End	Out
13		SLCT	Select	Out
14		AFXT/1	Auto Feed XT	In
15		—	—	—
16		SG	Signal Ground	—
17		FG	Frame Ground	—
18		+5V	+5V	Out
31	30	PRIME	Prime	In
32		ERROR	Error	Out
33		—	—	—
34		—	—	—
35		—	—	—
36		SG	Signal Ground	—
19-30		SG	Signal Ground	—

CN203 (Print Head)

Pin No.	Signal Name	Description	In/Out
1	H6	Head Pin 6 Drive	Out
2	H4	Head Pin 4 Drive	Out
3	H8	Head Pin 8 Drive	Out
4	H2	Head Pin 2 Drive	Out
5	COMMON	H2, H4, H6, H8	Out
6	NC	Not Used	—
7	COMMON	H1, H3, H5, H7, H9	Out
8	COMMON	H1, H3, H5, H7, H9	Out
9	H9	Head Pin 9 Drive	Out
10	PTH	Connected to Signal Ground	Out
11	H7	Head Pin 7 Drive	Out
12	PTH	Connected to Signal Detect	In
13	H5	Head Pin 5 Drive	Out
14	H1	Head Pin 1 Drive	Out
15	H3	Head Pin 3 Drive	Out

CN204, CN300 (LED, Switches)

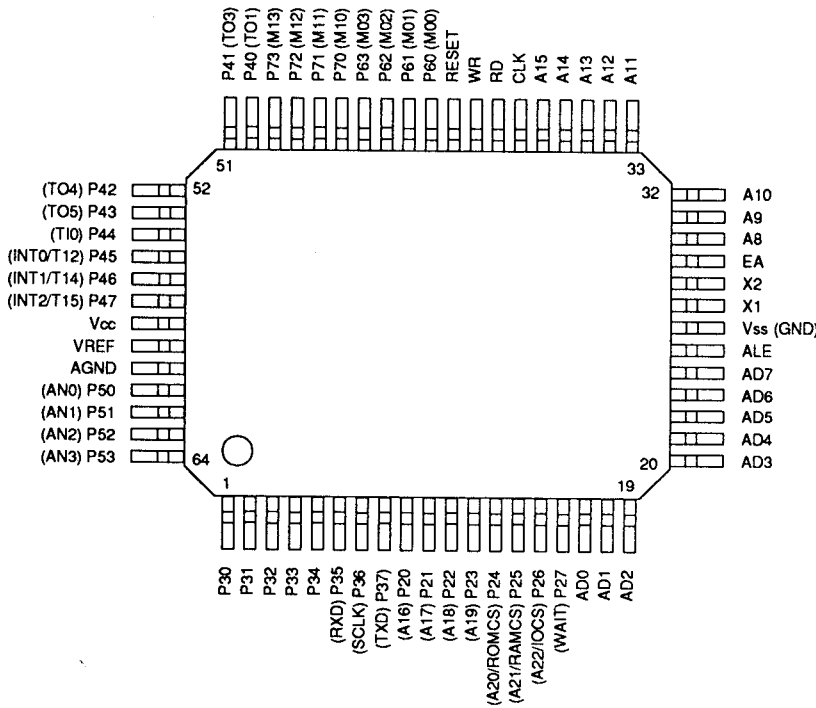
Pin No.	Signal Name	Description	In/Out
1	SG	Signal Ground	Out
2	LED	Font	Out
3	LED	Font	Out
4	LED	Power	Out
5	LED	ON LINE	Out
6	SW	On Line Switch	In
7	SW	Font, Tear Off Switches	In
8	SW	LF/FF, Load Park Switches	In
9	+5V	+5V	Out

8.4 IC Pin Configuration

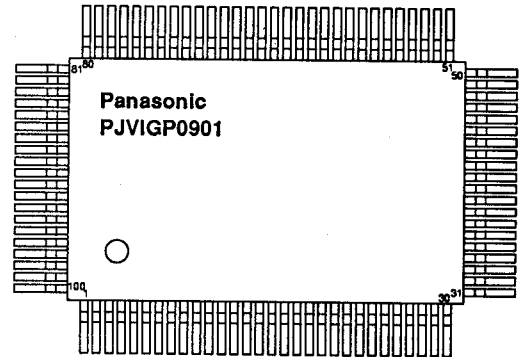
8.4.1 Logic Symbol Chart

Positive Logic	Negative Logic	Truth Table	Positive Logic	Negative Logic	Truth Table																														
NOT $C = \bar{A}$	 $C = \bar{A}$	<table border="1"> <tr><td>A</td><td>C</td></tr> <tr><td>L</td><td>H</td></tr> <tr><td>H</td><td>L</td></tr> </table>	A	C	L	H	H	L	NAND $C = \overline{AB}$	INVERT-OR $C = \overline{A+B}$	<table border="1"> <tr><td>A</td><td>B</td><td>C</td></tr> <tr><td>L</td><td>L</td><td>H</td></tr> <tr><td>L</td><td>H</td><td>H</td></tr> <tr><td>H</td><td>L</td><td>H</td></tr> <tr><td>H</td><td>H</td><td>L</td></tr> </table>	A	B	C	L	L	H	L	H	H	H	L	H	H	H	L									
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BUFFER $C = A$	 $C = A$	<table border="1"> <tr><td>A</td><td>C</td></tr> <tr><td>L</td><td>L</td></tr> <tr><td>H</td><td>H</td></tr> </table>	A	C	L	L	H	H	OR $C = A+B$	INVERT-NAND $C = \overline{\overline{AB}}$	<table border="1"> <tr><td>A</td><td>B</td><td>C</td></tr> <tr><td>L</td><td>L</td><td>L</td></tr> <tr><td>L</td><td>H</td><td>H</td></tr> <tr><td>H</td><td>L</td><td>H</td></tr> <tr><td>H</td><td>H</td><td>H</td></tr> </table>	A	B	C	L	L	L	L	H	H	H	L	H	H	H	H									
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AND $C = AB$	INVERT-NOR $C = \overline{A+B}$	<table border="1"> <tr><td>A</td><td>B</td><td>C</td></tr> <tr><td>L</td><td>L</td><td>L</td></tr> <tr><td>L</td><td>H</td><td>L</td></tr> <tr><td>H</td><td>L</td><td>L</td></tr> <tr><td>H</td><td>H</td><td>L</td></tr> </table>	A	B	C	L	L	L	L	H	L	H	L	L	H	H	L	NOR $C = \overline{A+B}$	INVERT-AND $C = \overline{AB}$	<table border="1"> <tr><td>A</td><td>B</td><td>C</td></tr> <tr><td>L</td><td>L</td><td>H</td></tr> <tr><td>L</td><td>H</td><td>L</td></tr> <tr><td>H</td><td>L</td><td>L</td></tr> <tr><td>H</td><td>H</td><td>L</td></tr> </table>	A	B	C	L	L	H	L	H	L	H	L	L	H	H	L
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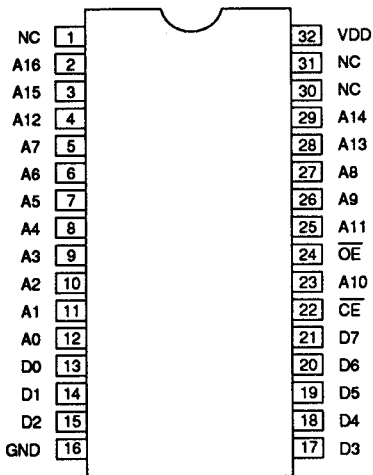
8.4.2 Pin Configuration



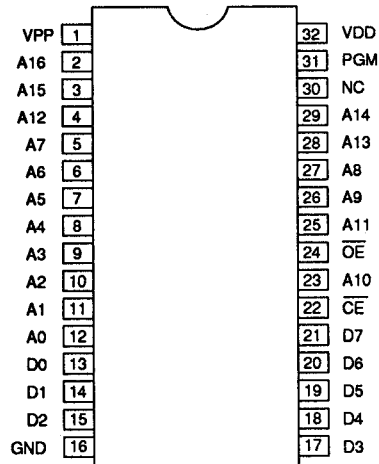
IC200 CPU
TMP90C845F



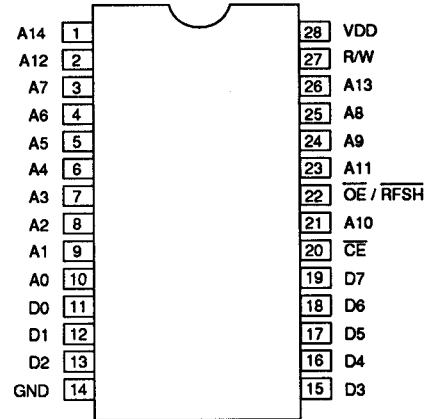
IC205 Gate Array
PJVIGP0901



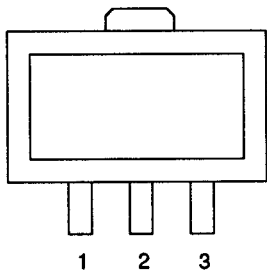
IC202 Mask ROM
1M bit



IC202 ROM
1M bit (D27C010-150)

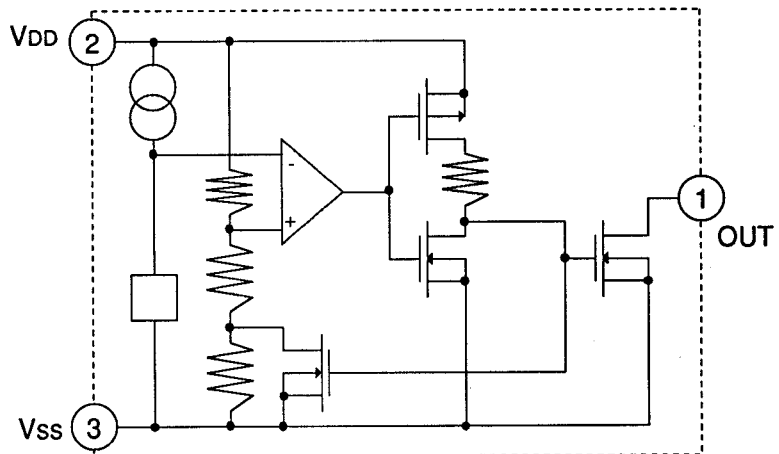


IC204 RAM (Option)
(TC51832)

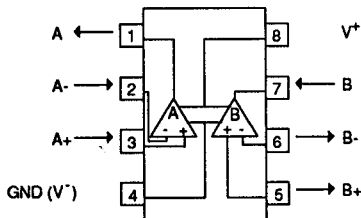


IC206
(S8054HN)

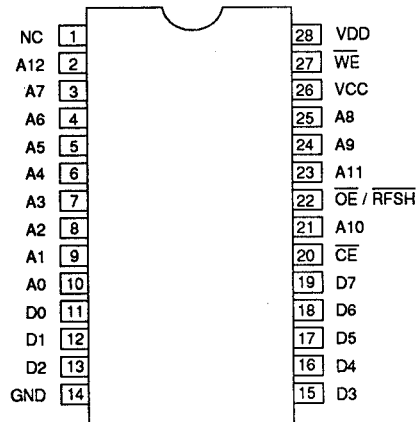
1 OUT
2 VDD
3 Vss



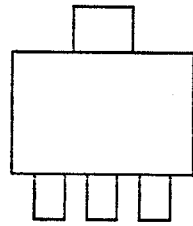
IC206



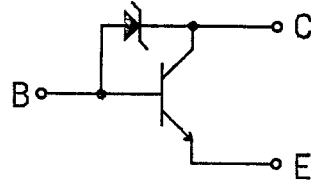
IC207
(LM393)



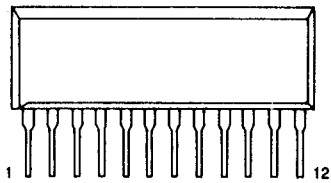
IC203 RAM
(LC3664)



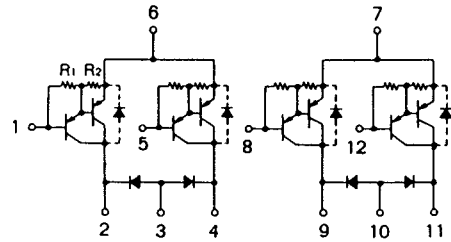
B C E
Q208-216
(2SD2170)



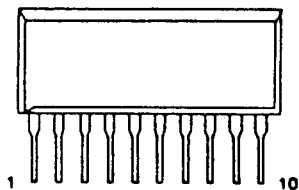
Printhead Driver



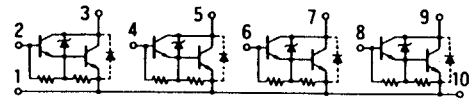
QA201
(MP4303)



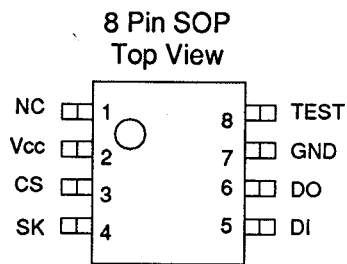
Paper Feed Motor Driver



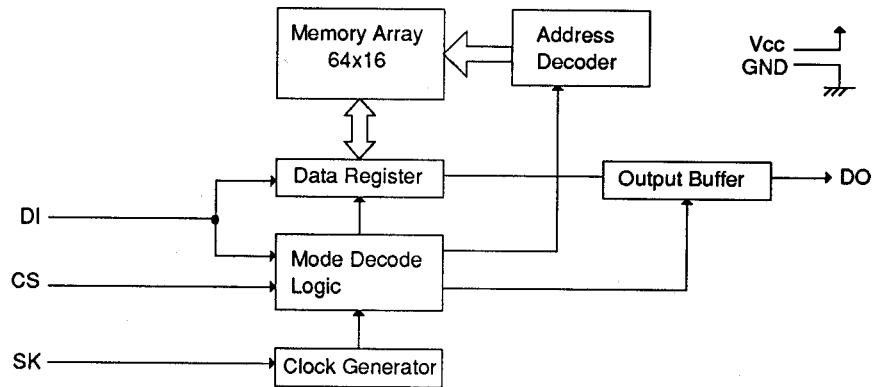
QA200
(STA471A)



Line Feed Motor Driver



IC201
(S2914AIF)



BLOCK DIAGRAM of IC201

8.4.3 Pin Assignment

IC200 CPU (TMP90C845F)

Pin No.	Symbol	Function	In/Out
1	P30	Not Used	—
2	P31	EEPROM DATA OUT	Out
3	P32	EEPROM DATA IN	In
4	P33	EEPROM Clock	Out
5	P34	EEPROM Chip Select	Out
6	RXD	Not Used	—
7	P36	Not Used	—
8	TXD	Not Used	—
9	A16	Address Bus 16	Out
10	A17	Address Bus 17	Out
11	A18	Address Bus 18	Out
12	A19	Address Bus 19	Out
13	A20	Not Used	—
14	A21	Not Used	—
15	IOCS	G.A. Chip Select	Out
16	WAIT	No Wait	In
17	AD0	Address Bus 0	In/Out
18	AD1	Address Bus 1	In/Out
19	AD2	Address Bus 2	In/Out
20	AD3	Address Bus 3	In/Out
21	AD4	Address Bus 4	In/Out
22	AD5	Address Bus 5	In/Out
23	AD6	Address Bus 6	In/Out
24	AD7	Address Bus 7	In/Out
25	ALE	Address Latch Enable	Out
26	GND	GND	In
27	X1	OSC In	In
28	X2	OSC Out	Out
29	EA	Extend Address (GND)	In
30	A8	Address Bus 8	Out
31	A9	Address Bus 9	Out
32	A10	Address Bus 10	Out

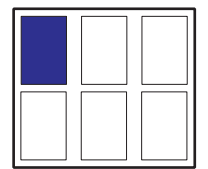
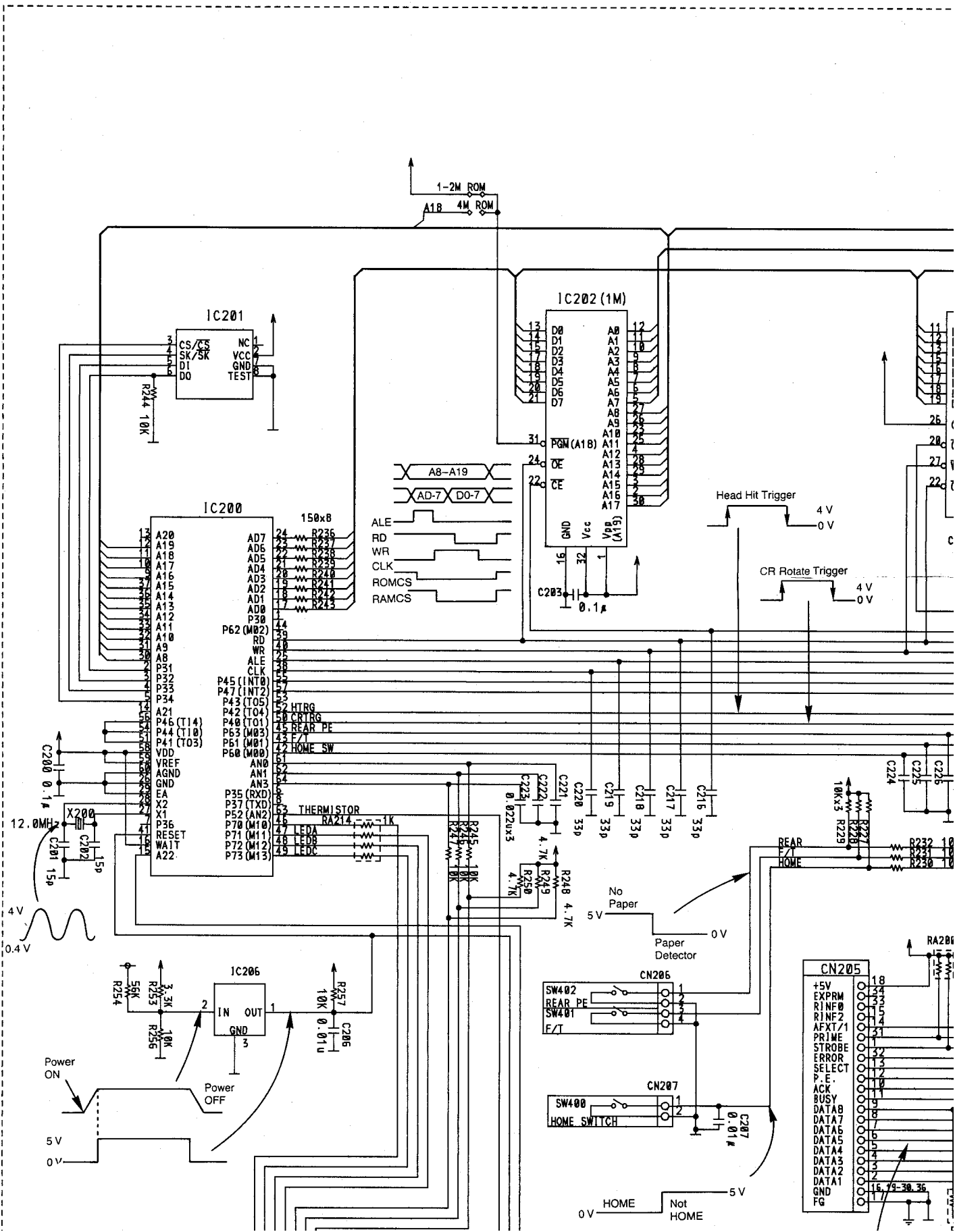
Pin No.	Symbol	Function	In/Out
33	A11	Address Bus 11	Out
34	A12	Address Bus 12	Out
35	A13	Address Bus 13	Out
36	A14	Address Bus 14	Out
37	A15	Address Bus 15	Out
38	CLK	System Clock	Out
39	RD	Read Enable	Out
40	WR	Write Enable	Out
41	RESET	Reset In	In
42	M00	Home Switch	In
43	M01	Friction/Tractor Switch	In
44	M02	Not Used	In
45	M03	Paper End Sensor	In
46	M10	On Line LED	Out
47	M11	Power LED	Out
48	M12	Font LED (Right)	Out
49	M13	Font LED (Left)	Out
50	TO1	CR Trigger Out	Out
51	TO3	Timer 3 Out	Out
52	TO4	Head PIN Trigger	Out
53	TO5	Not Used	—
54	TI0	Timer 1 In	In
55	INT0	Interrupt 0 In	In
56	T14	Timer 4 In	In
57	INT2	Interrupt 2 In	In
58	VCC	+5V	In
59	VREF	+5V	In
60	AGND	GND	In
61	AN0	On Line Key	In
62	AN1	Tear off ,Load park Key	In
63	AN2	Overheat Protector	In
64	AN3	Font,LF/FF Key	In

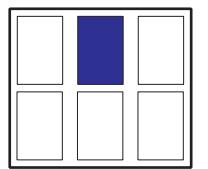
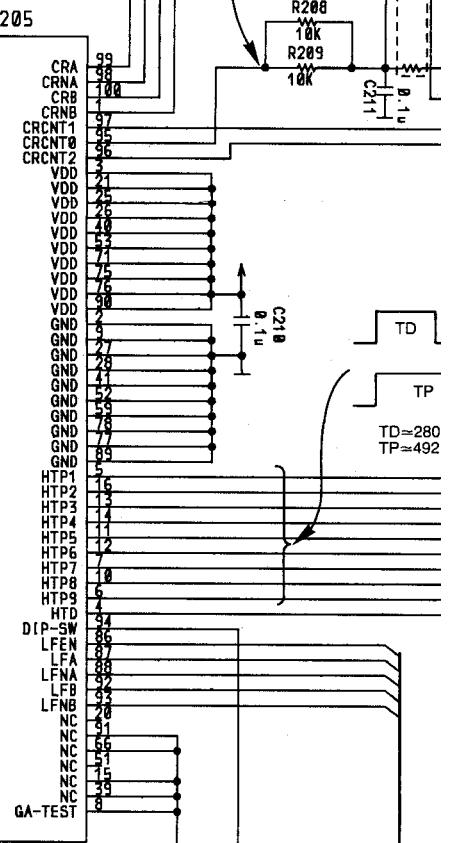
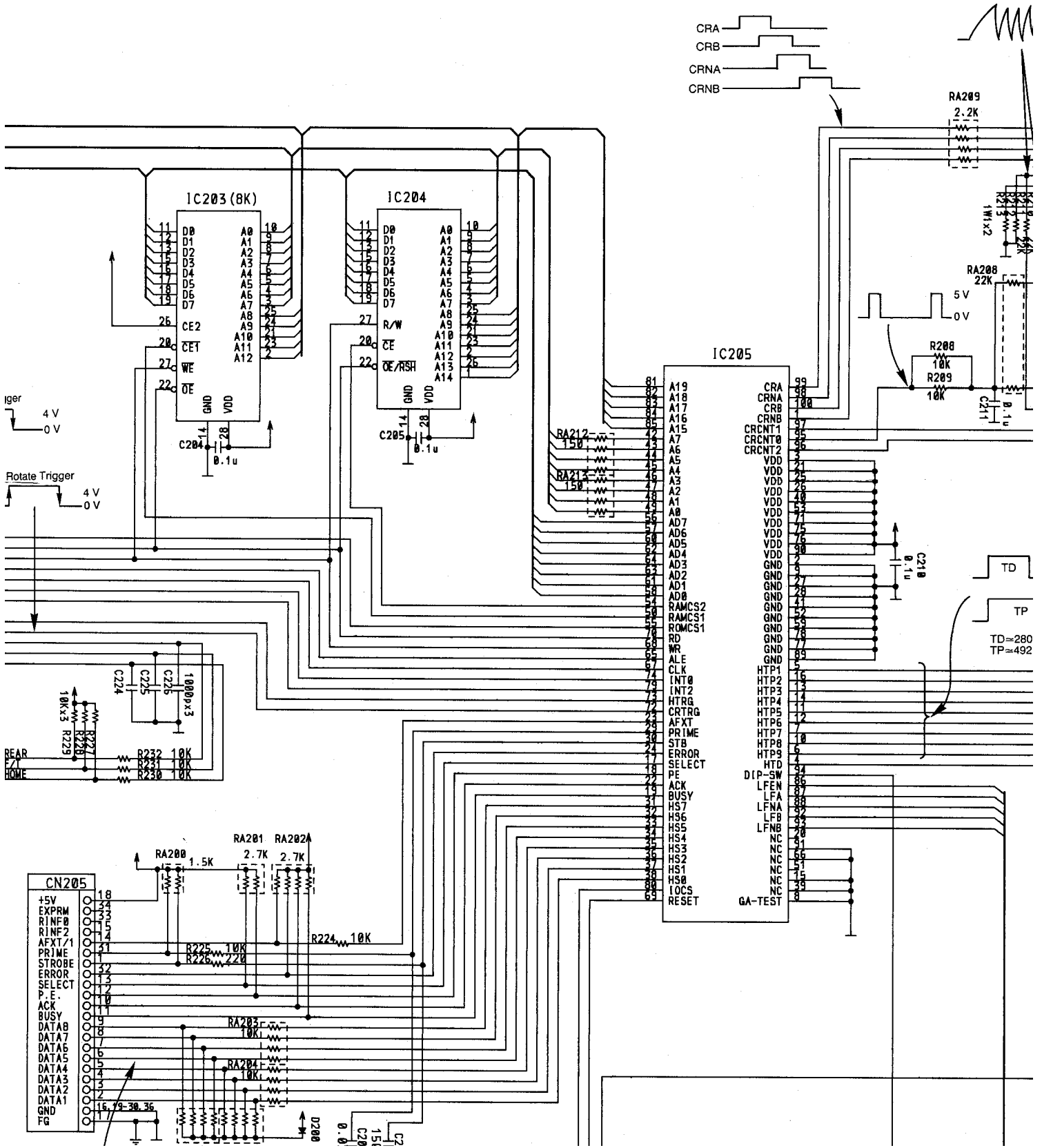
IC205 GA (PJVIGP2404)

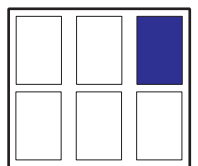
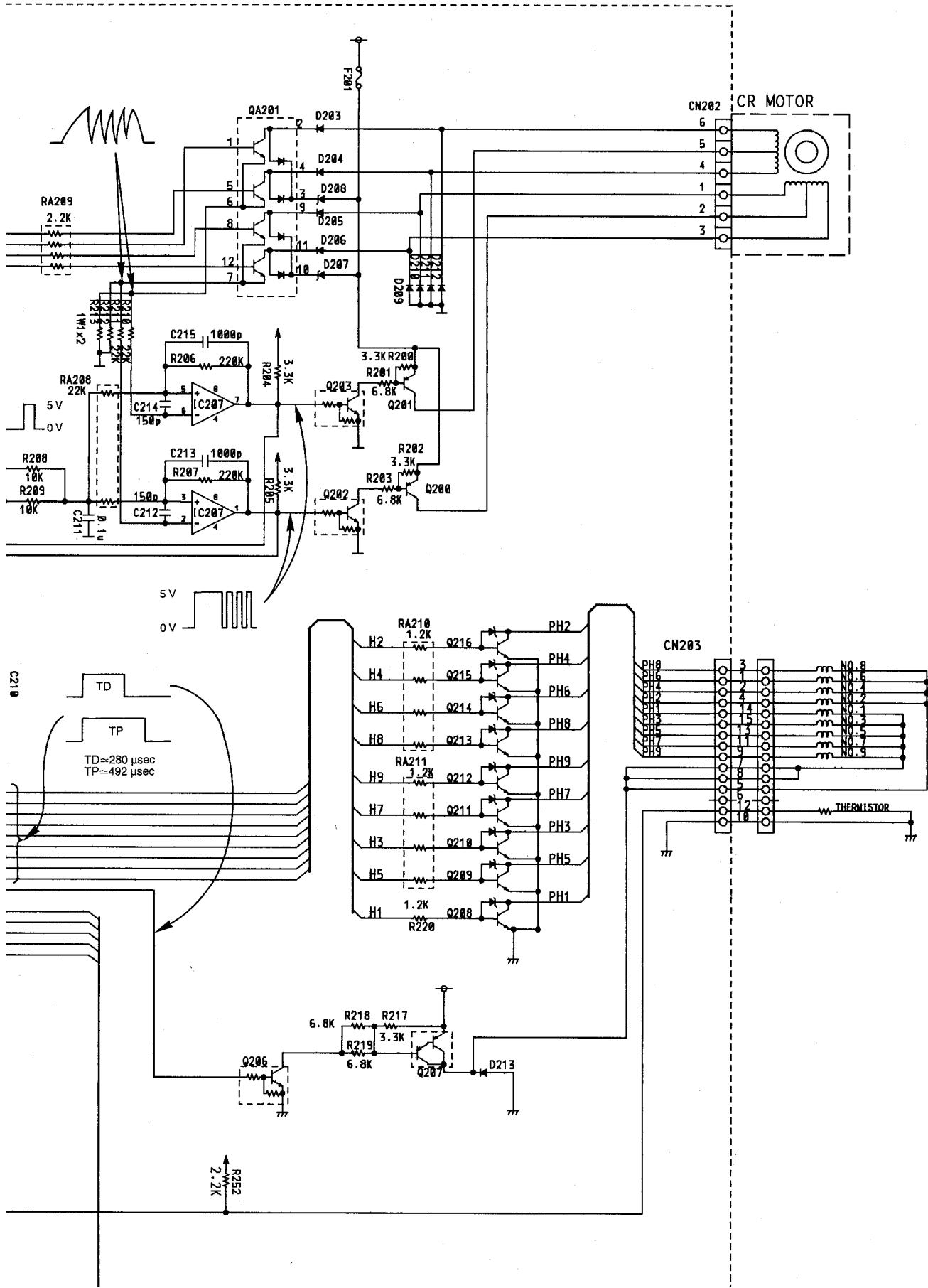
Pin No.	Symbol	Function	In/Out
1	CRNB	CR Motor B	Out
2	GND	Ground	In
3	VDD	+5V	In
4	HTD	Head Common	Out
5	HTP1	Head Pin 1	Out
6	HTP9	Head Pin 9	Out
7	HTP7	Head Pin 7	Out
8	TEST	G.A. Test pin	In
9	GND	Ground	In
10	HTP8	Head Pin 8	Out
11	HTP5	Head Pin 5	Out
12	HTP6	Head Pin 6	Out
13	HTP3	Head Pin 3	Out
14	HTP4	Head Pin 4	Out
15	GND	Ground	In
16	HTP2	Head Pin 2	Out
17	SELECT	SELECT	In
18	PE	PE	Out
19	BUSY	Busy to Host	Out
20	NC	Not Used	—
21	VDD	+5V	In
22	ACK	ACK to Host	Out
23	AFXT	AFXT	In
24	ERROR	ERROR	Out
25	VDD	+5V	In
26	VDD	+5V	In
27	GND	Ground	In
28	GND	Ground	In
29	PRIME	Prime	Out
30	STB	STB from Host	Out
31	HS7	Centronics Data 7	Out
32	HS6	Centronics Data 6	Out
33	HS5	Centronics Data 5	Out
34	HS4	Centronics Data 4	Out
35	HS3	Centronics Data 3	Out
36	HS2	Centronics Data 2	Out
37	HS1	Centronics Data 1	Out
38	HS0	Centronics Data 0	Out
39	GND	Ground	In
40	VDD	+5V	In
41	GND	Ground	In
42	A7	Address Bus A7	Out
43	A6	Address Bus A6	Out
44	A5	Address Bus A5	In
45	A4	Address Bus A4	In
46	A3	Address Bus A3	In
47	A2	Address Bus A2	In
48	A1	Address Bus A1	In
49	A0	Address Bus A0	In
50	RAMCS1	RAM1 Chip Enable	Out

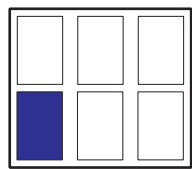
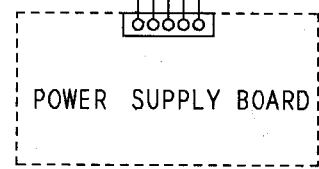
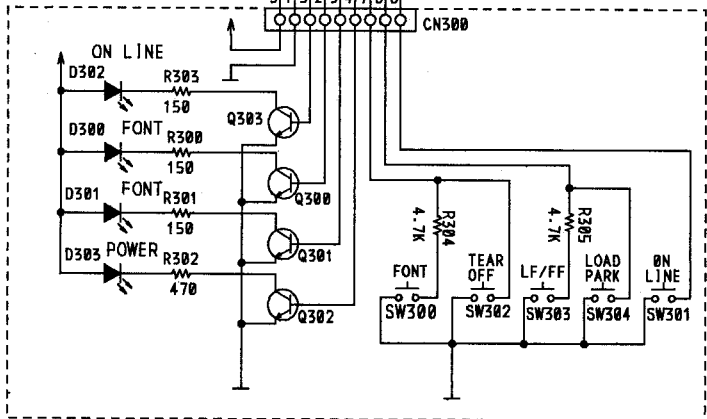
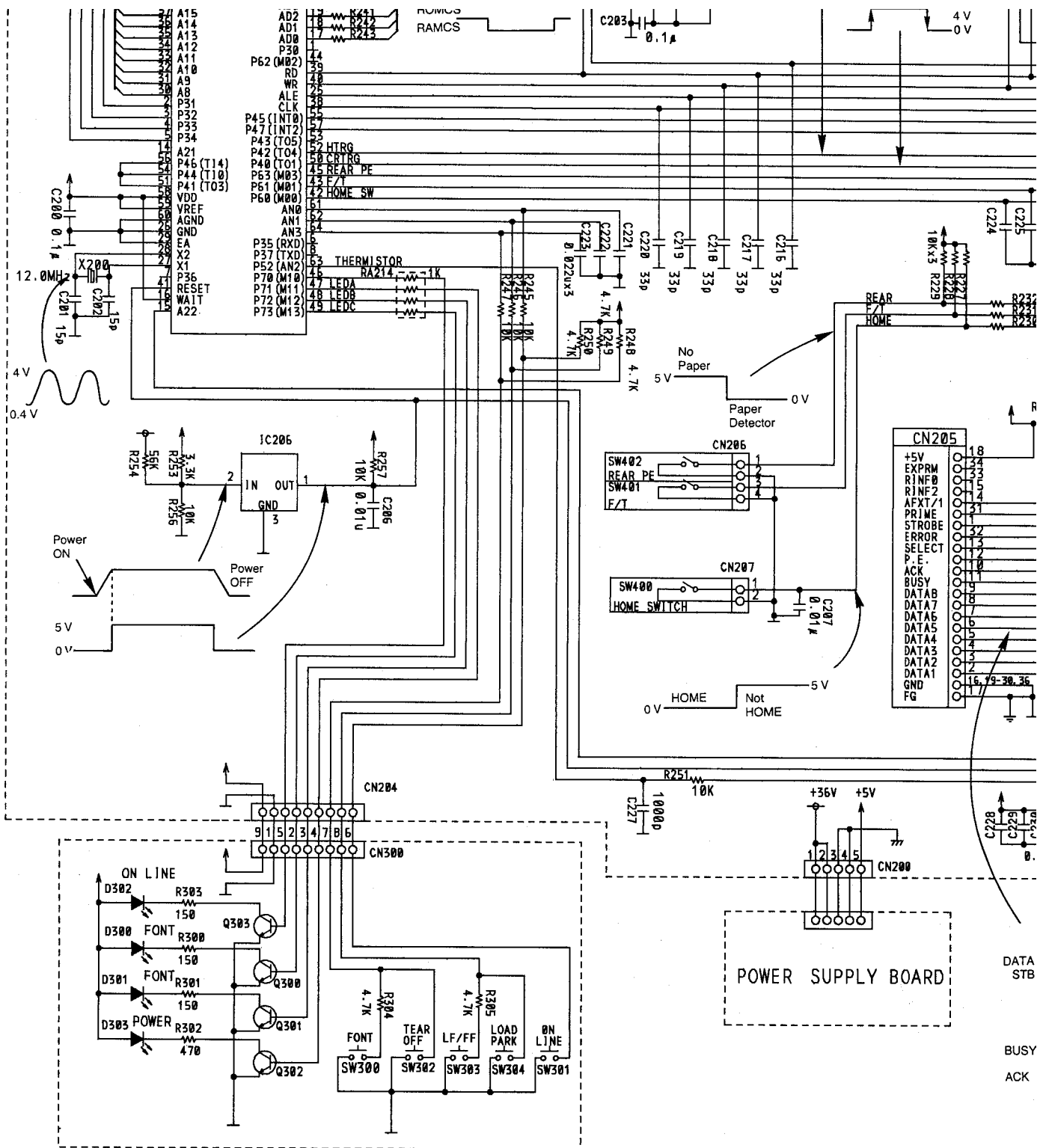
Pin No.	Symbol	Function	In/Out
51	NC	Not Used	—
52	GND	Ground	In
53	VDD	+5V	In
54	RAMCS2	RAM2 Chip Enable	Out
55	ROMCS1	ROM1 Chip Enable	Out
56	AD7	Address Data Bus 7	In/Out
57	AD6	Address Data Bus 6	In/Out
58	AD0	Address Data Bus 0	In/Out
59	GND	Ground	In
60	AD5	Address Data Bus 5	In/Out
61	AD1	Address Data Bus 1	In/Out
62	AD4	Address Data Bus 4	In/Out
63	AD2	Address Data Bus 2	In/Out
64	AD3	Address Data Bus 3	In/Out
65	ALE	Address Latch Enable	In
66	GND	Ground	In
67	CLK	System clock	In
68	WR	Write Enable	In
69	RESET	RESET	In
70	RD	Read Enable	In
71	VDD	+5V	In
72	CRTRG	Carriage Trigger	In
73	HTRG	Head Pin Trigger	In
74	INT0	Interrupt Request 0	Out
75	VDD	+5V	In
76	VDD	+5V	In
77	GND	Ground	In
78	GND	Ground	In
79	INT2	Interrupt Request 2	Out
80	IOCS	G.A. Chip Select	In
81	A19	Address Bus A19	In
82	A18	Address Bus A18	In
83	A17	Address Bus A17	In
84	A16	Address Bus A16	In
85	A15	Address Bus A15	In
86	LFEN	LF Enable	Out
87	LFA	LF Motor A	Out
88	LFNA	LF Motor A	Out
89	GND	Ground	In
90	VDD	+5V	In
91	GND	Ground	In
92	LFB	LF Motor B	Out
93	LFNB	LF Motor B	Out
94	DIP	Dip Switch In	In
95	CRCNT0	CR Power Control 0	Out
96	CRCNT2	CR Power Control 2	Out
97	CRCNT1	CR Power Control 1	Out
98	CRNA	CR Motor A	Out
99	CRA	CR Motor A	Out
100	CRB	CR Motor B	Out

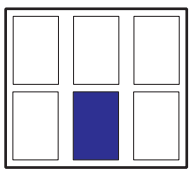
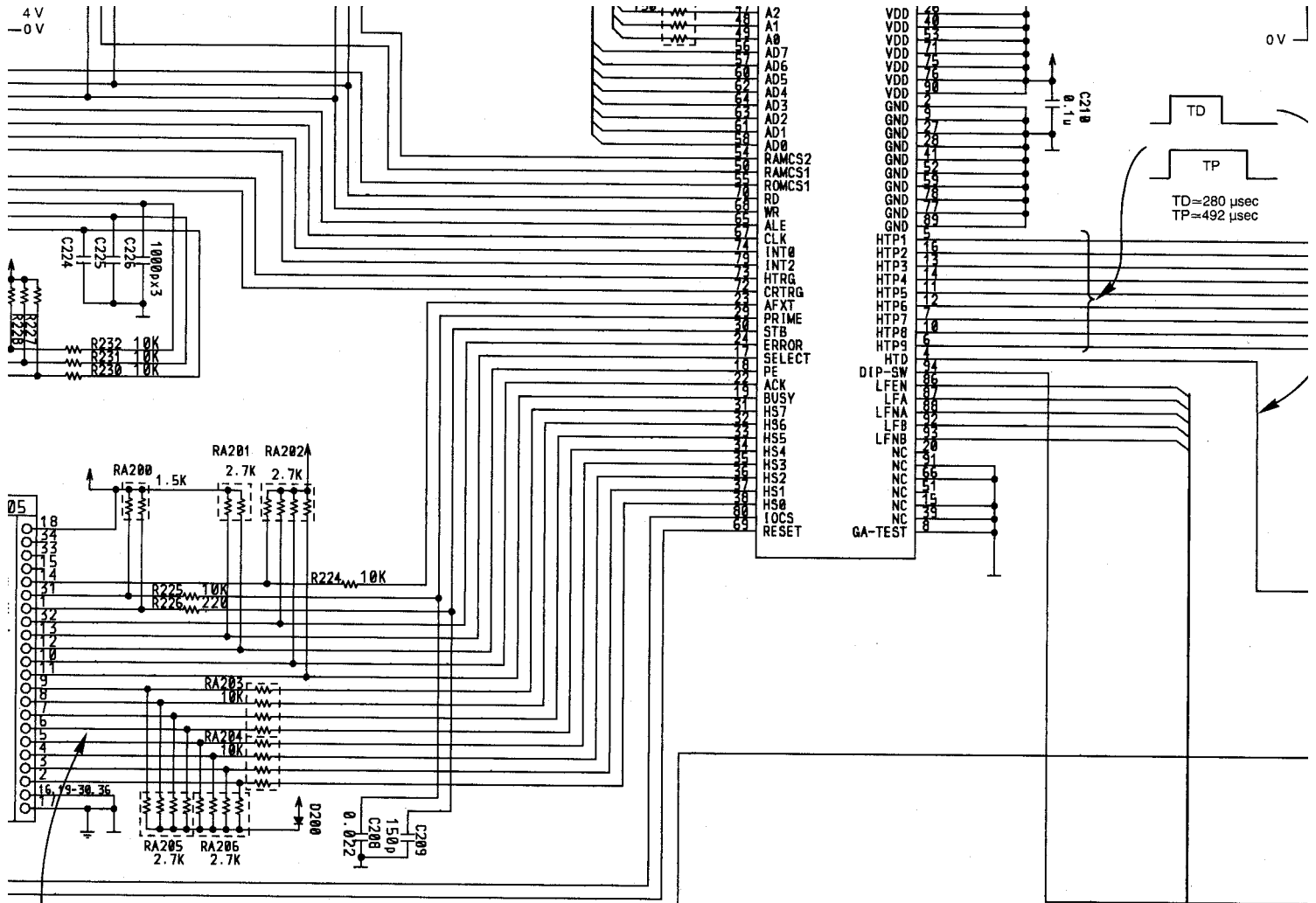
8.6 Schematic Diagram [Main Board]

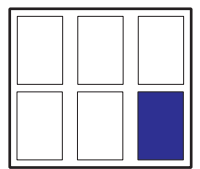
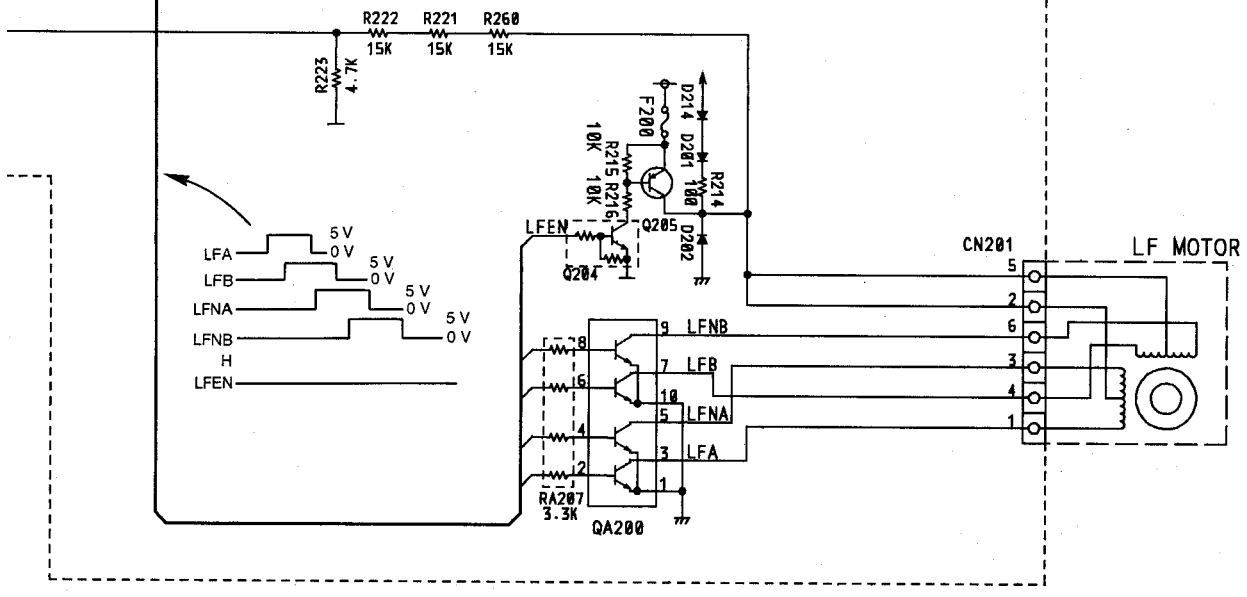
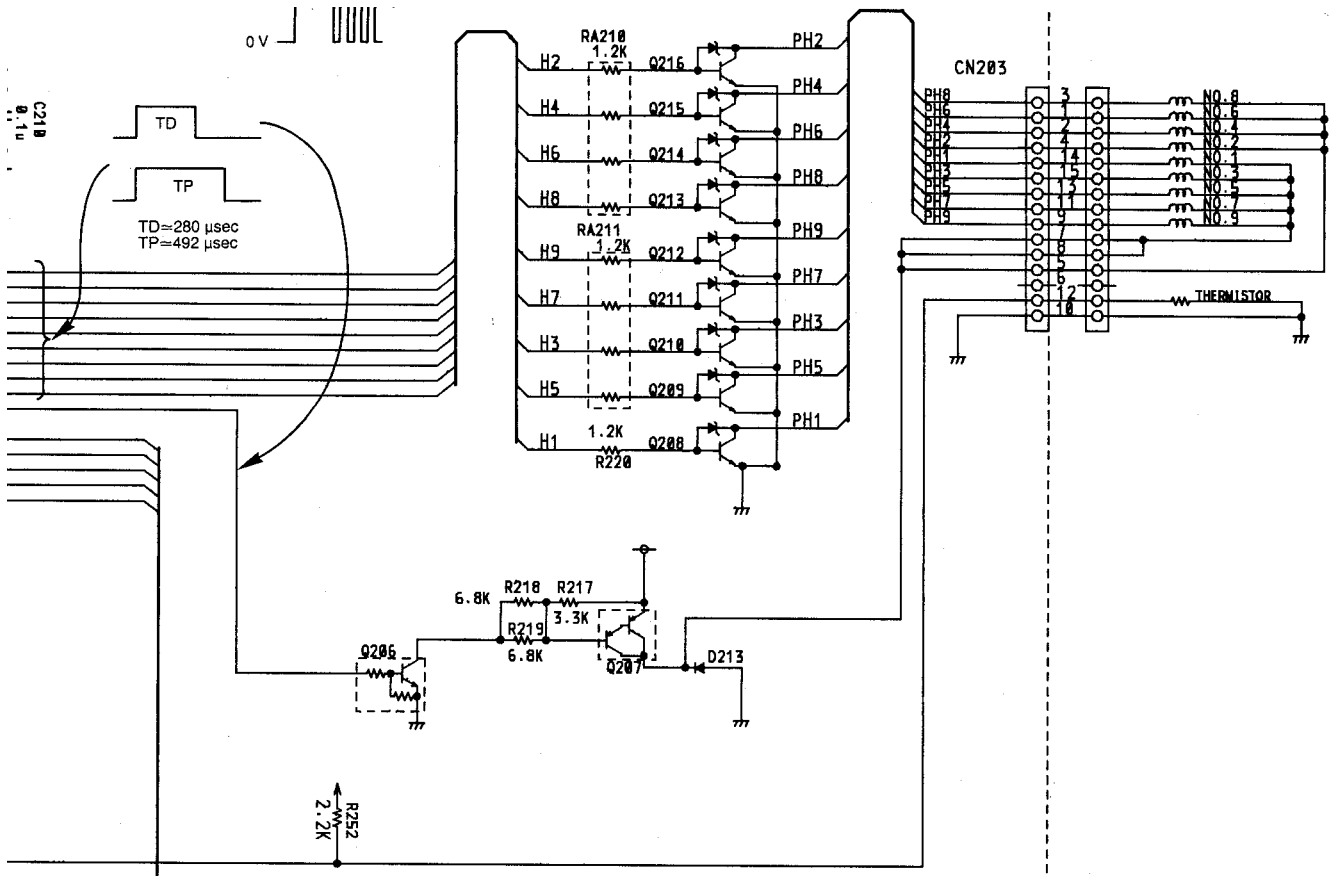








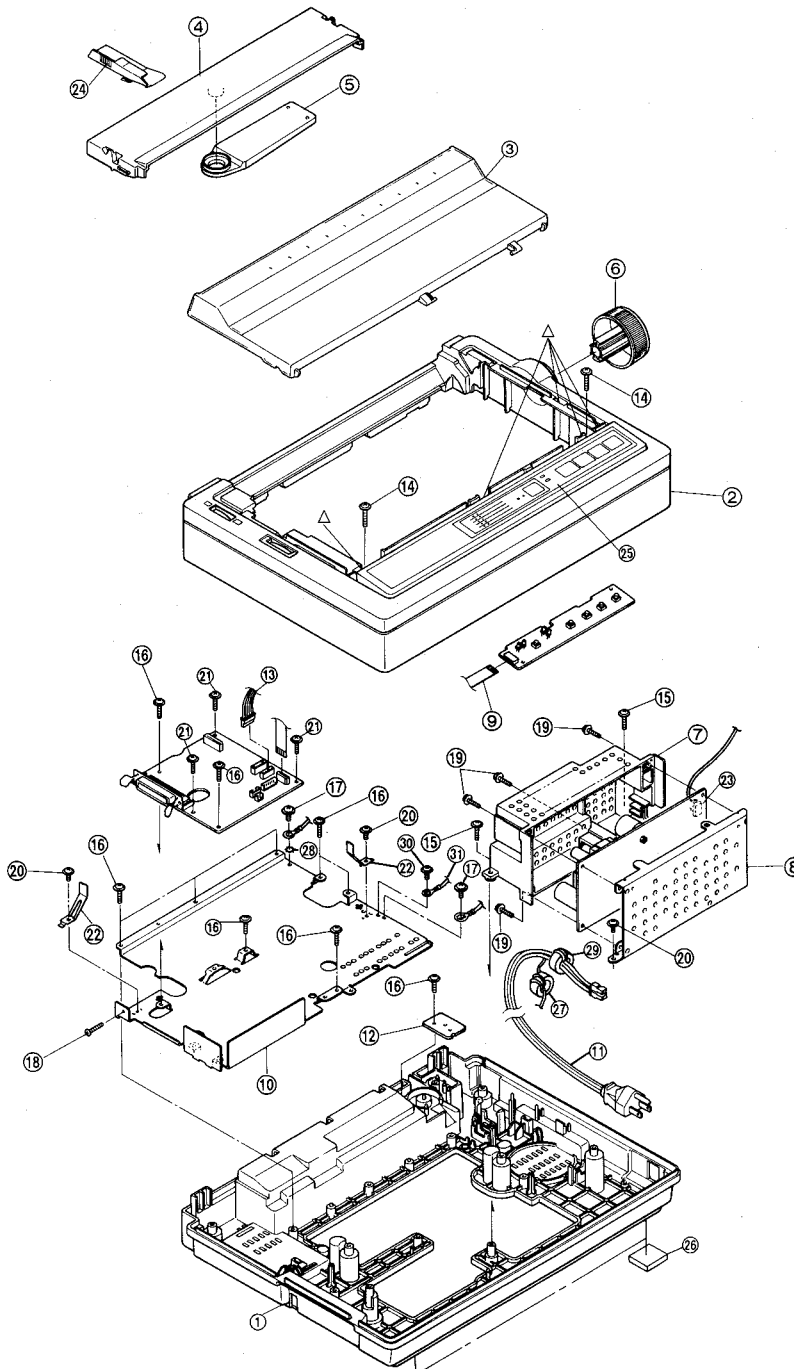




9. Parts List and Lubrication

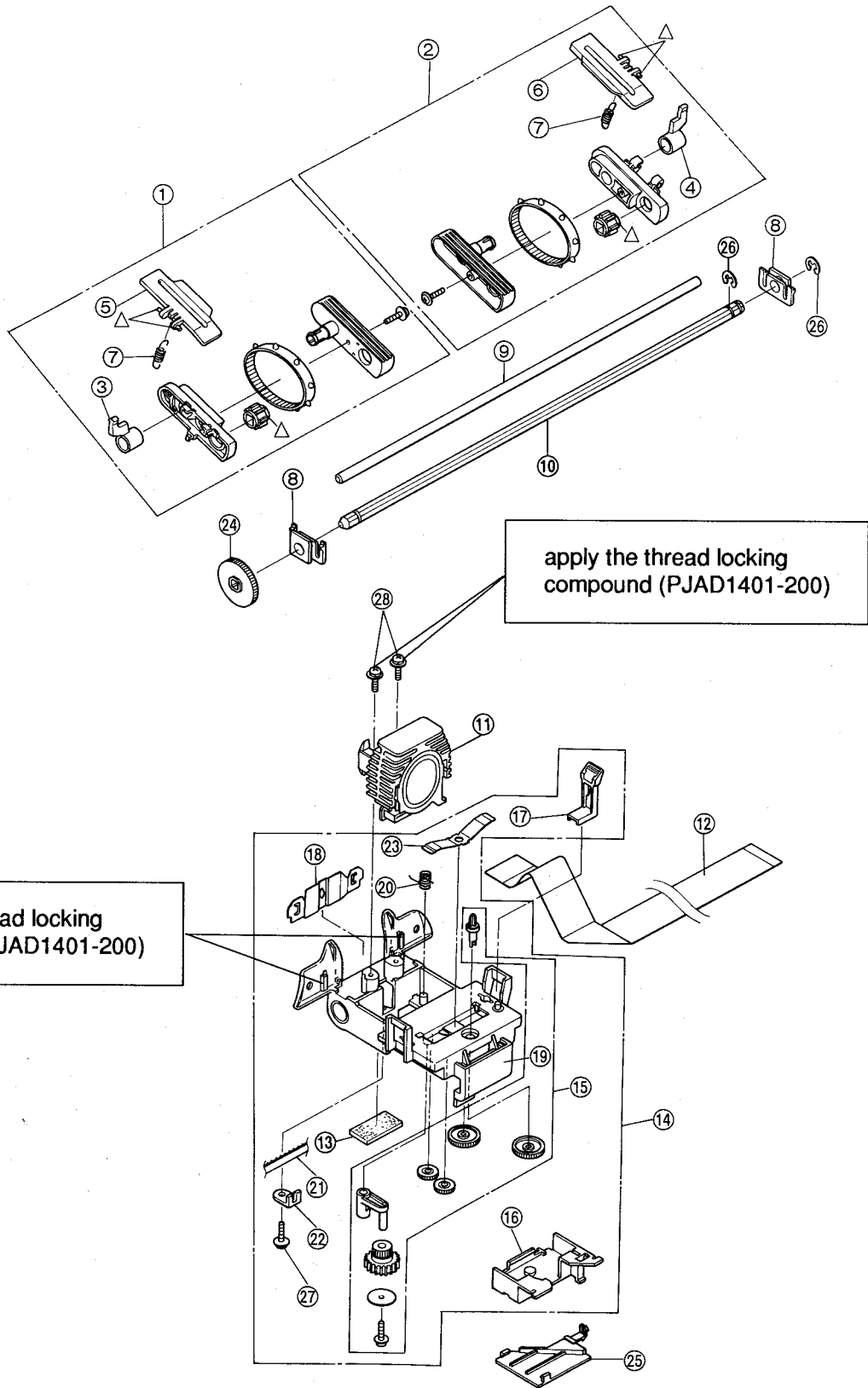
- Notes:
1. Important safety notice.
Components identified by Δ mark have special characteristics important for safety. When replacing any of these components, use only manufacturer's specified parts.
 2. The S mark is for service standard parts and may differ from production parts.
 3. The marking (RTL) indicates that the Retention Time is limited for this item. After the discontinuation of this assembly in production, the item will continue to be available for a specific period of time. The retention period of availability is dependent on the type of assembly, and in accordance with the laws governing part and product retention. After the end of this period, the assembly will no longer be available.

9.1 Cabinet

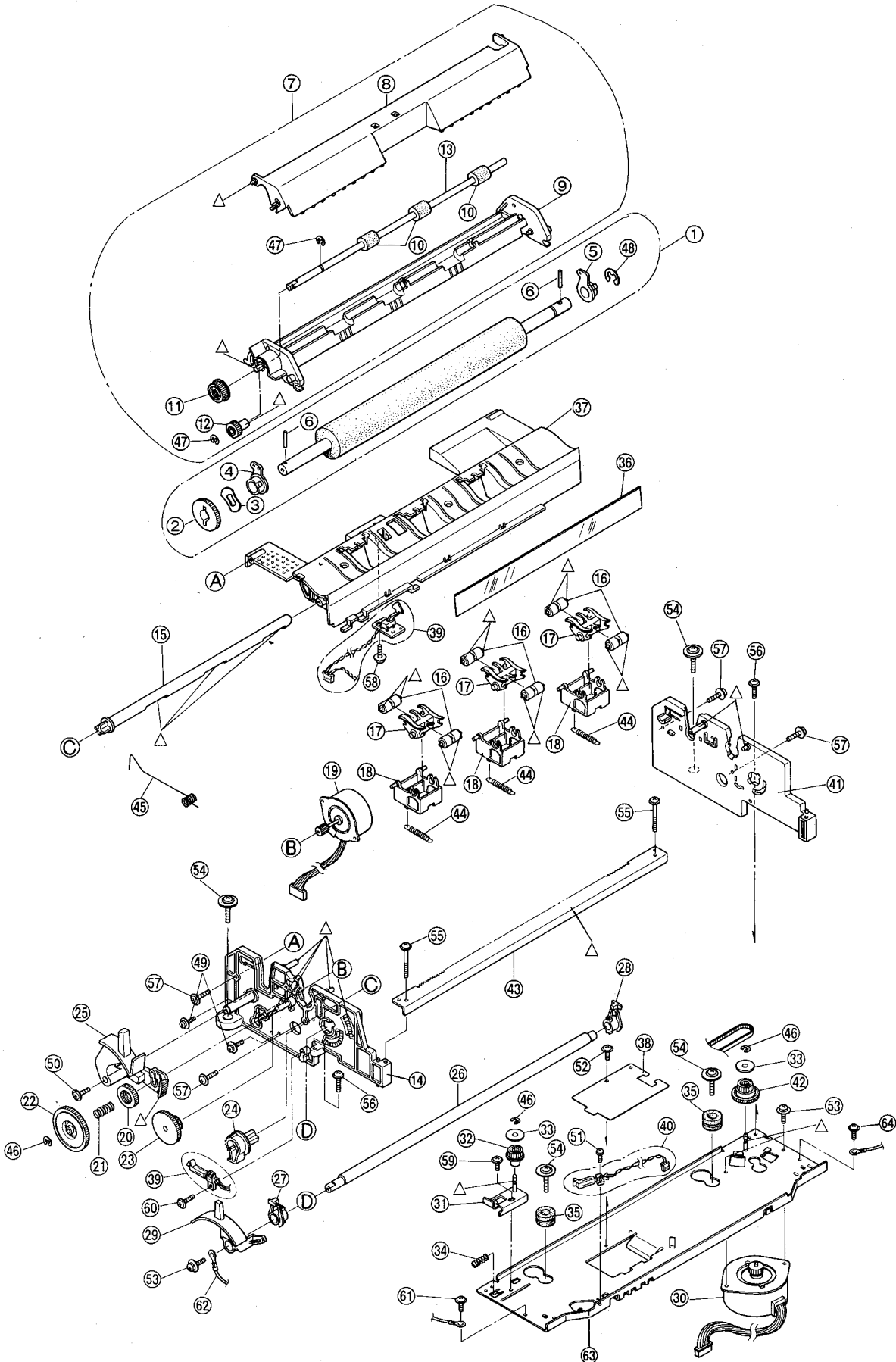


=Lubrication=
 Δ PJOL-SG3451

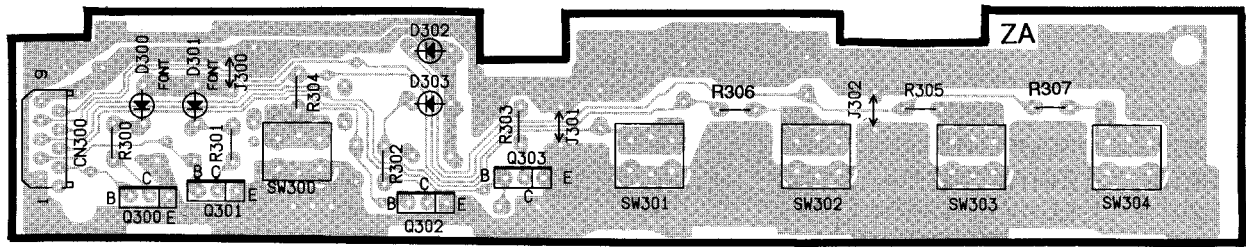
9.2 Tractor and Carriage



9.3 Chassis



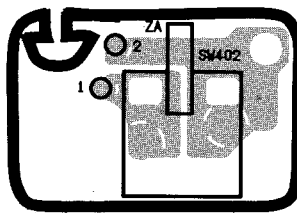
9.5 Control Panel Board



(Parts Side View)

Ref.No.	Part No.	Part Name and Description	Per Set	Remarks
D300-302	PJVDSL40MGF	Diode	3	
D303	PJVDSL40VRM	Diode	1	
Q300-303	PJVIDTC143ES	Transistor	4	
R300,301	ERDS2FJ151	150K 1/4W Carbon	2	S
R302	ERDS2FJ471	470K 1/4W Carbon	1	S
R303	ERDS2FJ151	150 1/4W Carbon	1	S
R304,305	ERDS2FJ472	4.7K 1/4W Carbon	2	S
SW300-304	EVQQS205K	Switch	5	
CN300	PJJS459Z	Connector	1	
PB2	PJWP1P1121M	Control Panel Board Complete	1	RTL
1	PJUP583Z	Control Panel Board Bare PCB	1	

9.6 Switch Board



(Parts Side View)

Ref.No.	Part No.	Part Name and Description	Per Set	Remarks
SW402	PJSH1A47Z	PE Switch	1	
1	PJUP625Z	Switch Board Bare PCB	1	