SERVICE MANUAL

MPS-1000

NOVEMBER 1986 PN-319907-01

commodore COMPUTERS

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Commodore Business Machines, Inc.
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PRECAUTIONS

Precautionary notations throughout the text are categorized relative to 1) personal injury, and 2) damage to equipment:

DANGER Signals a precaution which, if ignored, could result in serious or fatal personal injury. Great caution should be excercised in performing procedures preceded by a DANGER heading.

WARNING Signals a precaution which, if ignored, could result in damage to equipment.

The precautionary measures itemized below should always be observed when performing repair/ maintenance procedures.

DANGER

1. ALWAYS DISCONNECT THE PRODUCT FROM BOTH THE POWER SOURCE AND THE HOST COMPUTER BEFORE PERFORMING ANY MAINTENANCE OR REPAIR PROCEDURE.
2. NO WORK SHOULD BE PERFORMED ON THE UNIT BY PERSONS UNFAMILIAR WITH BASIC SAFETY MEASURES AS DICTATED FOR ALL ELECTRONICS TECHNICIANS IN THEIR LINE OF WORK.
3. WHEN PERFORMING TESTING AS DICTATED WITHIN THIS MANUAL, DO NOT CONNECT THE UNIT TO A POWER SOURCE UNTIL INSTRUCTED TO DO SO. WHEN THE POWER SUPPLY CABLE MUST BE CONNECTED, USE EXREME CAUTION IN WORKING ON POWER SUPPLY AND OTHER ELECTRONIC COMPONENTS.

WARNING

1. REPAIRS ON OUR PRODUCT SHOULD BE PERFORMED ONLY BY OUR CERTIFIED REPAIR TECHNICIAN.
2. MAKE CERTAIN THAT THE SOURCE VOLTAGE IS THE SAME AS THE RATED VOLTAGE, LISTED ON THE SERIAL NUMBER/RATING PLATE. IF OUR PRODUCT HAS A PRIMARY AC RATING DIFFERENT FROM THE AVAILABLE POWER SOURCE, DO NOT CONNECT IT TO THE POWER SOURCE.
3. ALWAYS VERIFY THAT OUR PRODUCT HAS BEEN DISCONNECTED FROM THE POWER SOURCE BEFORE REMOVING OR REPLACING PRINTED CIRCUIT BOARDS AND/OR INDIVIDUAL CHIPS.
4. IN ORDER TO PROTECT SENSITIVE μp CHIPS AND CIRCUITRY, USE STATIC DISCHARGE EQUIPMENT, SUCH AS ANTI-STATIC WRIST STRAPS, WHEN ACCESSING INTERNAL COMPONENTS.
5. REPLACE MALFUNCTIONING COMPONENTS ONLY WITH THOSE COMPONENTS RECOMMENDED BY THE MANUFACTURER; INTRODUCTION OF SECOND-SOURCE ICs OR OTHER NONAPPROVED COMPONENTS MAY DAMAGE THE PRODUCT AND VOID ANY APPLICABLE OUR WARRANTY.

PREFACE

This manual describes theory of operation, maintenance, and repair of high-quality, multifunctional, dot matrix printer: Commandore MPS-1000. The manual concentrates on the features of the MPS-1000.
The instructions and procedures included herein are intended for the experienced repair technician, and attention should be given to the precautions on the preceding page. The chapters are organized as follows:

Chapter 1 – Provides a general product overview, lists specifications, and illustrates the main components of the printer.

Chapter 2 – Describes the theory of printer operation.

Chapter 3 – Discusses the options.

Chapter 4 – Includes a step-by-step guide for product disassembly, assembly, and adjustment.

Chapter 5 – Provides the approved techniques for troubleshooting.

Chapter 6 – Describes preventive maintenance techniques and lists lubricants and adhesives required to service the equipment.

Chapter 7 – Includes IC descriptions, schematics, and reference materials.

* The contents of this manual are subject to change without notice.

REVISION TABLE

REVISION	DATE ISSUED	CHANGE DOCUMENT
A	July 1, 1986	1st issue

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CHAPTER 1
PRODUCT DESCRIPTION

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1.1 FEATURES

The Commodore MPS-1000 is multifunctional, impact dot matrix printer capable of producting bidirectional print at 100 characters per second. The printer feature small size, light weight, and high performance, including the following functions:

(1) Impact dot matrix printing.
(2) 9 needles – print head.
(3) 100 cps printing speed for Draft printing.
(4) 20 cps printing speed for NLQ printing.
(5) Friction feed.
(6) Tractor feed.
(7) Cut Sheet Feeder (optional).
(8) Three printing mode.

Commodore mode with Comodore serial interface.
IBM-5152+ mode with Commodore serial interface.
IBM-5152+ mode with Commodore parallel interface.

NOTE: IBM 5152+ mode is IBM5152 compatible with enhancement.

(9) Near Letter Quality 1 font resident for each mode.

1.2 SPECIFICATIONS

Operation Characteristics

(a) Commodore mode

Printing speed:
- Draft (Pica): 100 cps
- Double-width: 50 cps
- NLQ: 20 cps
- Double-width NLQ: 10 cps

Line spacing: 1/216" to 127/216" (1/6" at power on)

Dot matrix format:
- 12W x 18H NLQ characters
- 9W x 9H standard characters
- 6W x 8H standard characters (for Graphics characters)
- 12W x 7H reversed standard characters

Character sets:
- Commodore Graphics character set
- Commodore Business character set

Character size:

Character Pitch	Width (mm)	Height (mm)
Pica	2.1	3.1
Double-width	4.2	3.1
Reversed Draft	4.2	2.5

Column width (maximum characters/line):

Character Pitch	Column Width	Column/inch
Pica	80	10
Double-width	40	5
Reversed Draft	40	5

Printing direction: Bidirectional with logical seeking in the text mode and Graphic characters. Unidirectional (left to right) in the bit image mode or set from a DIP switch.

Duty cycle: Sustain a print rate of 9 dots per character on an 80-character line after temperature stabilization.

Line feed time: Approximately 150 ms/line for 1/6" line spacing.
Pproximately 100 ms/line for a page feed.

Paper feed method:
- Friction feed.
- Tractor feed.
- Cut sheet feeder (optional).

(b) IBM 5152+ mode (for both interfaces)

Printing speed:

Pica:	100 cps
Double-width:	50 cps
Emphasized:	50 cps
Double-width emphasized:	25 cps
Condensed:	82 cps
Double-width condensed:	41 cps
Elite:	60 cps
Double-width elite:	30 cps

Line spacing: Programmable Minimum 1/216" (1/6" at power on)

Dot matrix format:
9W x 9H standard characters
6W x 12H standard characters (for Graphics characters)
12W x 18H NLQ characters

Character sets:
Draft ASCII characters
Draft Internatinal characters
Graphics characters
NLQ ASCII
NLQ International

Character size:

Character Pitch	Width (mm)	Height (mm)
Pica	2.1	3.1
Elite	1.4	3.1
Condensed	1.05	3.1
Double-width Pica	4.2	3.1
Double-width Elite	2.8	3.1
Double-width Condensed	2.1	3.1
Emphasized	2.1	3.1
Double-width Emphasized	4.2	3.1
Super/Subscript	depends on pitch.	1.6

Column width (maximum characters/line):

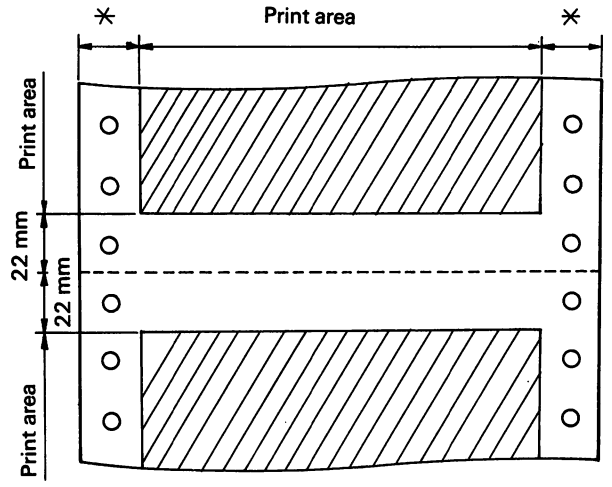
Character Pitch	Column Width	Column/inch
Pica	80	10
Elite	96	12
Condensed	132 (137)*	17
Double-width Pica	40	5
Double-width Emphasized	40	5
Double-width Elite	48	6
Double-width Condensed	66 (68)*	8.5
Emphasized	80	10

NOTE: * When Left/Right margin is set with ESC X.

Printing direction:	Bidirectional with logical seeking in the text mode and Graphic characters. Unidirectional (left to right) in the bit image mode or programmable from a host computer.
Duty cycle:	same as Commodore mode.
Line feed time:	same as Commodore mode.
Paper feed method:	same as Commodore mode.

Paper Specifications

Fanfold paper:	The adjustable tractor feed can handle paper 101.6 mm (4") to 254 mm (10") wide.
Cut sheet:	The built-in friction feed mechanism can handle paper 182 mm (7.15") to 216 mm (8.5") wide.
Copies:	Up to 2 sheets (including the original) Total paper thickness not to exceed 0.13 mm (0.005").
Paper path:	Rear
Basic weight of paper:	46.5 to 81.4 g/square m for 1 sheet. 39.5 to 52.3 g/square m for multi-form.
Ribbons exclusive:	Black ribbon cartridge.
Printable area:	Fanfold paper: See Fig. 1-1 Cut sheet: See Fig. 1-2



The border width indicated by the asterisks (*) varies according to the paper width.
With 254 mm paper, the border width is 25.4 mm.
With 241 mm paper, the holder width is 19 mm.

Fig. 1-1. Printable Area of Fanfold Paper

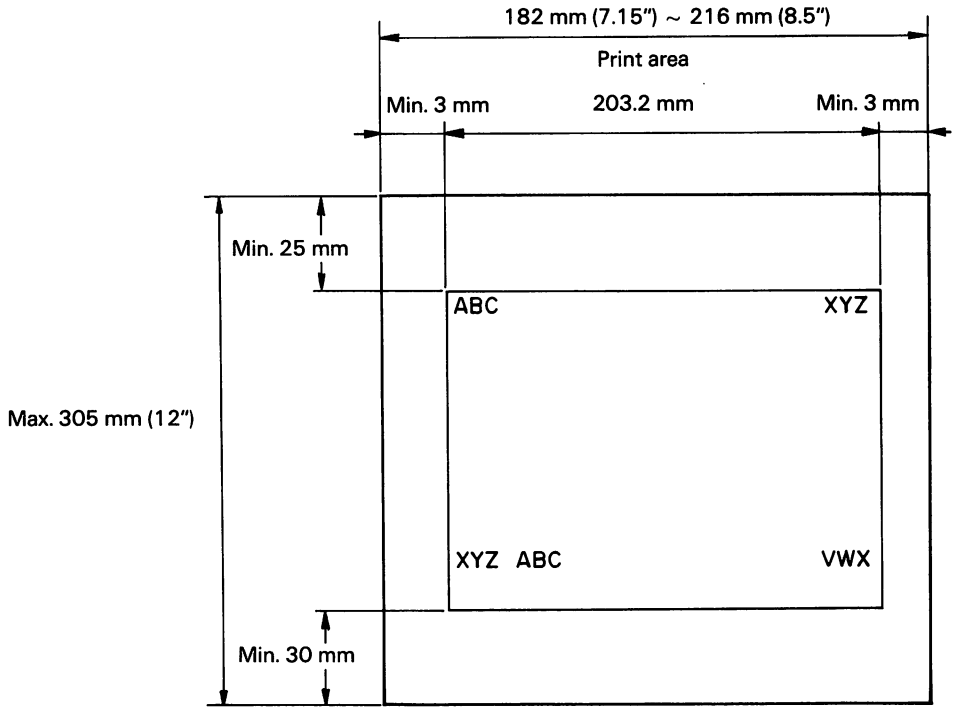


Fig. 1-2 Printable Area of Cut Sheet

Electrical Specifications

Power line voltage:	AC 120V ± 10% AC 220V ± 10% AC 240V ± 10%
Power line freequency range:	49.5 Hz to 60.5 Hz
Power consumption:	60 VA maximum
D.C. insulation resistance:	Over 10 M ohms (between the AC line and chassis)
Dielectric strength:	1000 VAC, 1 min. (for 120 VAC version) 1500 VAC, 10 sec. (for 220/240 VAC version)

Environmental Specifications

Temperature	Storage:	–30°C to 65°C (–22°F to 149°F)
	Operating:	5°C to 35°C (41°F to 95°F)
Humidity	Storage:	5% to 85% RH (no condensation)
	Operating:	10% to 80% RH (no condensation)
Shock	Storage:	2G, 1 msec.
	Operating:	1G, 1 msec.
Vibration	Storage:	0.50 G (55 Hz max.)
	Operating:	0.25 G (55 Hz max.)

Reliability Specifications

MCBF – Mechanism	3 million lines (excluding print head)
Life of Print head	100 million characters
Life of Ribbon	1 million characters

NOTE: MCBF: Mean Cycle Between Failure.

Safety Standard Agency and Radio Frequency Interference. (R.F.I.)

Safety Standard:	UL 114 (U.S.A.)
	CSA 22.2 number 0,154 (Canada)
	Applied by Commodore (TBD)
	VDE 0806 (Germany)
R.F.I.	FCC class B (U.S.A.)

Physical specifications

Dimensions:	Height: 84 mm
	Width: 421 mm
	Depth: 314 mm
Weight:	5.2 kg

1.3 INTERFACE OVERVIEW

The MPS-1000 printer has Commodore serial interface and Centronics parallel interface. It has three combination modes of control systems and interfaces.

Commodore control system with Commodore serial interface.
IBM 5152+ control system with Commodore serial interface.
IBM 5152+ control system with Centronics parallel interface.

This section describes the specifications of each interface.

1.3.1 Commodore Serial Interface

The serial interface is used when the printer is in its Commodore mode or IBM 5152+ mode. Connector pin assignments and a description of respective interface signals are shown in follow.

(1) Input connector (TCS 0560-01-1010)

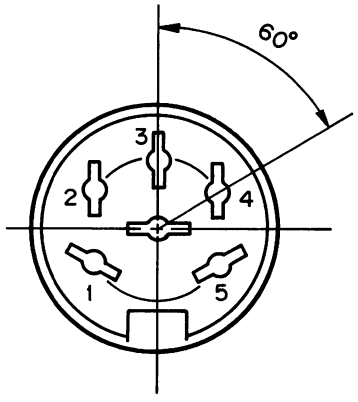


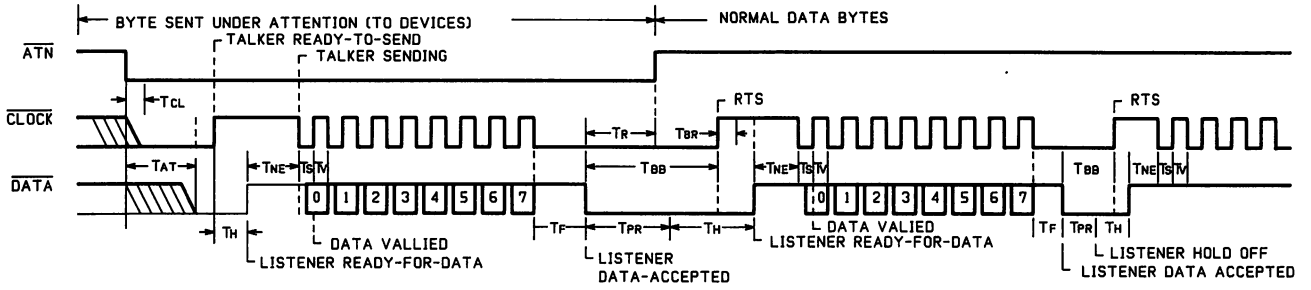
Fig. 1-3. Serial Connector

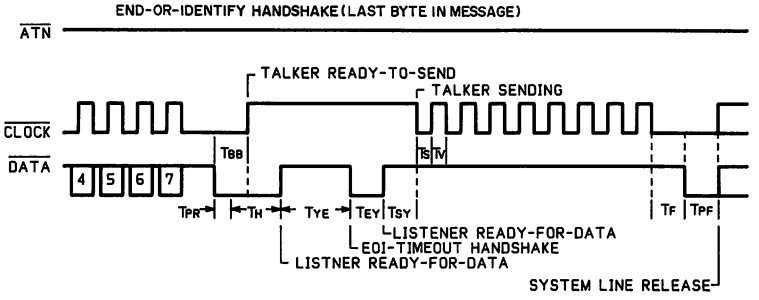
Table 1-1. Serial Connector Pin Assignments

Pin No.	Signal	Direction	Description
1	SERIAL $\overline{SRQ}$	OUT	Always "HIGH". (Pulled up to +5V through a 3.3 kΩ register.)
2	GND	–	GND
3	SERIAL $\overline{ATN}$	IN	Low when the host sends a command to devices.
4	SERIAL CLK	IN	Synchronous signal when the host transmits a serial data.
5	SERIAL DATA	IN/OUT	Signal when the host transmits serial data, or to verify the device status.
6	$\overline{RESET}$	IN	Reset input.

NOTES: 1. When Commodore serial I/F is selected, disconnect parallel cable.
2. Direction refers to the direction of signal flow as viewed from the printer.

(2) Serial Interface Timing Chart





SERIAL BUS TIMING		EXTERNAL DEVICE						NOTES
		LISTENER (μSEC)			TALKER (μSEC)			
DESCRIPTION	SYM.	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
ATN RESPONSE	TAT	–	–	1000				If MAX. time exceeded, device not present error.
LISTENER HOLD OFF (NRFD)	TH	0	–					Listner must hold off until CLK = HIGH
NON-EOI RESPONSE TO (RFD)	TNE	20	40	200	40	80	–	If MAX. time exceeded, EOI response required.
BIT SETUP	TS	20	70	–	40	60	–	
DATA VALID	TV	20	40	–	60	80	–	
FRAME HANDSHAKE	TF	20	60	1000				If MAX. time exceeded, frame error.
FRAME TO RELEASE OF ATN	TR	20	80	–				
TIME BETWEEN BYTES	TBB	100	–	–				
DOI RESPONSE TIME	TYE	200	250	–				
EOI RESPONSE HOLD	TEI	100	–	–	70	90	–	
TALKER RESPONSE LIMIT	TRY	20	60	200				
BYTE-ACKNOWLEDGE	TPR	20	30	–	60	80	–	
TALK-ATN RELEASE	TTK	20	60	100				
TALK-ATN ACKNOWLEDGE	TDC	0	20	–				
TALK-ATN ACK HOLD	TDA	90	100	–				
EOI-BYTE ACK	TER	60	–	180	20	–	180	TED series computer
ATN TO CLOCK LOW	TCL	–	40	100				If used with VIC-20, TCL MAX. 3000 μsec.
TALK ERROR RELEASE	TRR				20	–	–	

Fig. 1-4. Serial Interface Timing Chart

(3) Serial interface protocols

Explanation of Terms: LA – Listen address
TA – Talk address
SA – Secondary address
SA (O) – Secondary address open
SA (C) – Secondary address close
DB – Data byte
FN – File name byte
eoi – End or identify handshake
TKATN – Talk-Atn handshake

Command	Abbreviation	Binary Value
Talk Address	(TA)	010x xxxx
Listen Address	(LA)	001x xxxx
Untalk	(UNTLK)	0101 1111
Unlisten	(UNLSN)	0011 1111
Secondary Address Open	(SA(O))	1111 yyyy
Secondary Address Close	(SA(C))	1110 yyyy
Secondary Address Normal	(SA)	011z zzzz

NOTE: 1. Device Address (TA) (LA) = x xxxx values 0-30 possible
- 0 – 3 Intrnal device
- 4 – 7 Normal CBM printers
- 8 – 11 normal disk units
- 12 – 30 unused

2. Channel address (SA(O)) (SA(C)) = yyyy values 0 – 15 possible
- 0 PRG-TYPE Read Data Channel (special)
- 1 PRG-TYPE Write Data Channel (special)
- 12 – 14 Channel for all file types (read/write)
- 15 Unit command channel (read/write)

3. Normal Secondary address (SA) = z zzzz values 0 – 31 possible

Load: This routine loads data bytes from any input device directly into the host memory.
LA SA (O) FN1 FN2...FNn-1 eoi FNn UNLSN =>
TA SA TKATN DB1 DB2...DBn-1 eoi DBn UNTLK =>
TA SA (C) UNLSN

Save: This routine saves a section of memory.
LA SA (O) FN1 FN2...FNn-1 eoi FNn UNLSN =>
TA SA DB1 DB2... DBn-1 eoi DBn UNLSN =>
LA SA (C) UNLSN

Open: This routine is used to open a logical file for I/O operations.
with SA LA SA (O) FN1 FN2...FNn-1 eoi FNn UNLSN

Close: This routine is used to close a logical file after all I/O operations have been completed on
with SA that file.
LA SA (C) UNLSN

Chkout: This routine must be called before any data is sent to any output device.
with SA LA SA

Chkin: This routine is called to define any previously opened channel as a input channel.
with SA TA SA TLKATN

Chrout: This uses a single character buffer, and will send previously buffered character, if any exists. This buffer is also sent along with eoi, prior to sending any SERIAL BUS COMMAND sequence (LA, TA, SA(O), SA(C), SA ULTLK, UNLSN).

Chrin: This routine is called to get a byte of data from a channel already set up as a input channel.
DBc or eoi DBc (if external device sends eoi)

Getin: – see Chrin –

Clrchn: This routine is used to clear and restore all open channels to there default values.
If Chkin channel open: UNTLK
If Chkout channel open: eoi DBc UNLSN

Clall: – see Clrchn –

Stop: This routine is used to detect the stop key. If stop key down, Clrchn called.

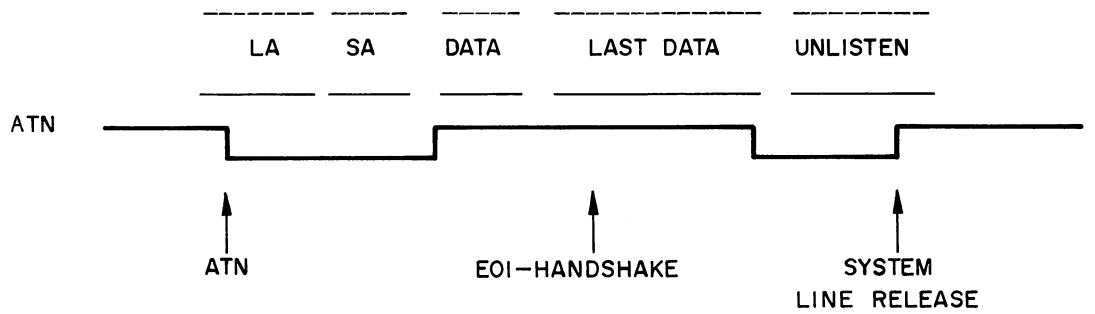


Fig. 1-5. Data Structure

NOTE:
1. Data is processed by synchronous transfer with CLOCK.
2. The first bit is the LSB. All bits are of 8-bit construction.
3. Listener address data is 24H or 25H, device 4 and 5 respectively.
4. SA is 6XH, 0FXH, 0EXH, where X is 00H... 0FH.

1.3.2 Centronics Parallel Interface

The parallel interface is used when the printer is in its IBM 5152+ mode. Connector pin assignments and a description of respective interface signals are shown in follow.

(1) Connector pin assignment

Table 1-2. Parallel Connector Pin Assignments

Signal Pin No.	Return Pin No.	Signal	Direction	Description
1	19	$\overline{\text{STROBE}}$	In	$\overline{\text{STROBE}}$ pulse to read data in. Pulse width must be more than 0.5 μs at receiving terminal.
2	20	DATA 1	In	These signals represent information of the 1st to 8th bits of paralle data, respectively. Each signal is at "HIGH" level when data is logical "I" and "LOW" when logical "0".
3	21	DATA 2	In	
4	22	DATA 3	In	
5	23	DATA 4	In	
6	24	DATA 5	In	
7	25	DATA 6	In	
8	26	DATA 7	In	
9	27	DATA 8	In	
10	28	$\overline{\text{ACKNLG}}$	Out	Approx. 5 μs pulse. "LOW" indicates that data has been received and that the printer is ready to accept other data.
11	29	BUSY	Out	A "HIGH" signal indicates that the printer cannot receive data. The signal becomes "HIGH" in the following cases: 1. During data entry 2. During printing operation 3. During printer error status
12	30	PE	Out	A "HIGH" signal indicates that the printer is out of paper.
13	—	—	—	pulled up to +5V through 3.3 k ohms resistance.
14	—	NC	—	Not used.
15	—	NC	—	Not used.
16	—	0V	—	Logic ground level.
17	—	CHASSIS GND	—	Printer chassis GND. In the printer, the chassis GND and the logic GND are isolated from each other.
18	—	NC	—	Not used.
19 to 30	—	GND	—	TWISTED-PAIR RETURN signal GND level.

Signal Pin No.	Return Pin No.	Signal	Direction	Description
31	—	$\overline{\text{INIT}}$	In	When the level of this signal becomes "LOW", the printer controller is reset to its initial state and the print normally at "HIGH" level, and its pulse width must be more than 50 μs at the receiving terminal.
32	—	$\overline{\text{ERROR}}$	Out	The level of this signal becomes "LOW" when the printer is in — 1. PAPER END state 2. OFF-LINE state 3. Error state
33	—	GND	—	Same as for pins 19 – 30.
34	—	NC	—	Not used.
35	—	—	—	Pulled up to +5V through 3.3 k ohms resistance.
36	—	NC	—	Not used.

NOTE:
1. "Direction" refers to the direction of signal flow as viewed from the printer.
2. "Return" denotes "TWISTED PAIR RETURN" and is to be connected at signal ground level.
   As to the wiring for the interface, be sure to use a twisted-pair cable for each signal and never fail to complete connection of the Return side. To prevent noise effectively, these cables should be shielded and connected to the chassis of the host computer and the printer, respectively.
3. All interface conditions are based on TTL level. Both the rise and fall times of each signal must be less then 0.2μs.
4. Data transfer must not be carried out by ignoring the $\overline{\text{ACKNLG}}$ or BUSY signal.
   (Data transfer to this printer can be carried out only after confirming the $\overline{\text{ACKNLG}}$ signal or when the level of the BUSY signal is "LOW".)
5. Under normal conditions, printer cable pins 11, 12 and 32 are activated when out of paper is detected.
   ESC 8 code disable pins 11 and 32 from the PE (Paper-End) signal, but it does not disable pin 12.
6. When parallel I/F is selected, disconnect Commodore serial cable.

(2) Parallel interface timing chart

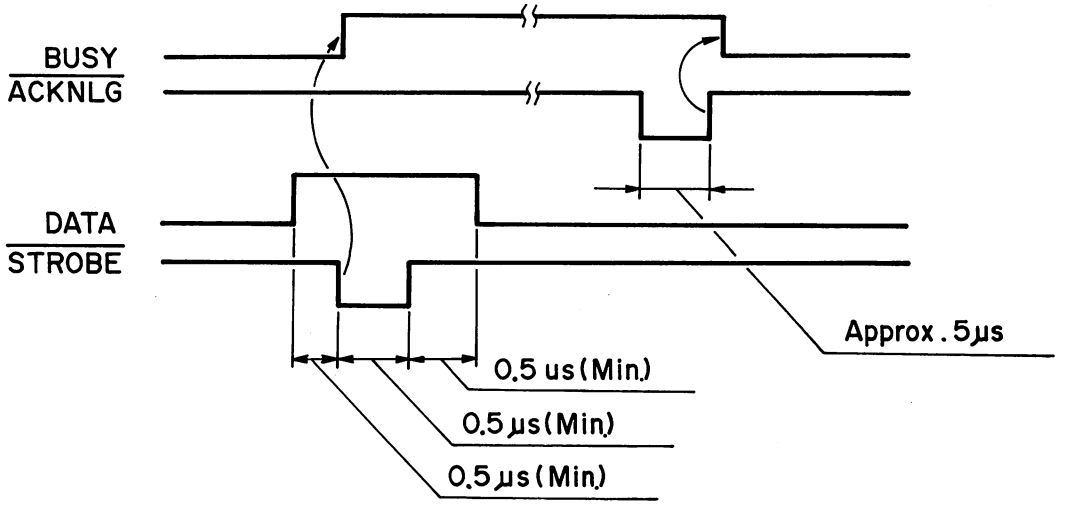


Fig. 1-6. Parallel Interface Timing Chart

1.4 MAIN COMPONENTS

The MPS-1000 includes four major subassemblies – the power supply, the circuit boards, COMI interface board, and printer mechanism – all of which are housed in a two-piece plastic case.
The kinds of circuit board are described in follow.

CATX Board: Main Control Circuit Board for 120V and 240 V Ver.
UNIT No. Y560201400□□

CATX Board: Main Control Circuit Board of 220V Ver.
UNIT No. Y560201500□□

COMI Board: Interface Circuit Board
UNIT No. Y561208000□□

CFIL Board: Filter Circuit Board
UNIT No. Y560202500□□ (120V Ver.)
UNIT No. Y560202200□□ (220/240V Ver.)

COMPNL Board: Control Panel Board
UNIT No. Y563501000□□

1.4.1 Power Supply Circuit (Figs. 1-7 and 1-8)

A DC regulator, line filter, and power transformer make up the power supply, which converts the AC line voltage to DC voltages usable by the printer subassemblies. A fuse is inserted in the input circuit to prevent product damage due to overcurrent. The power supply components are connected to the lower case as illustrated.

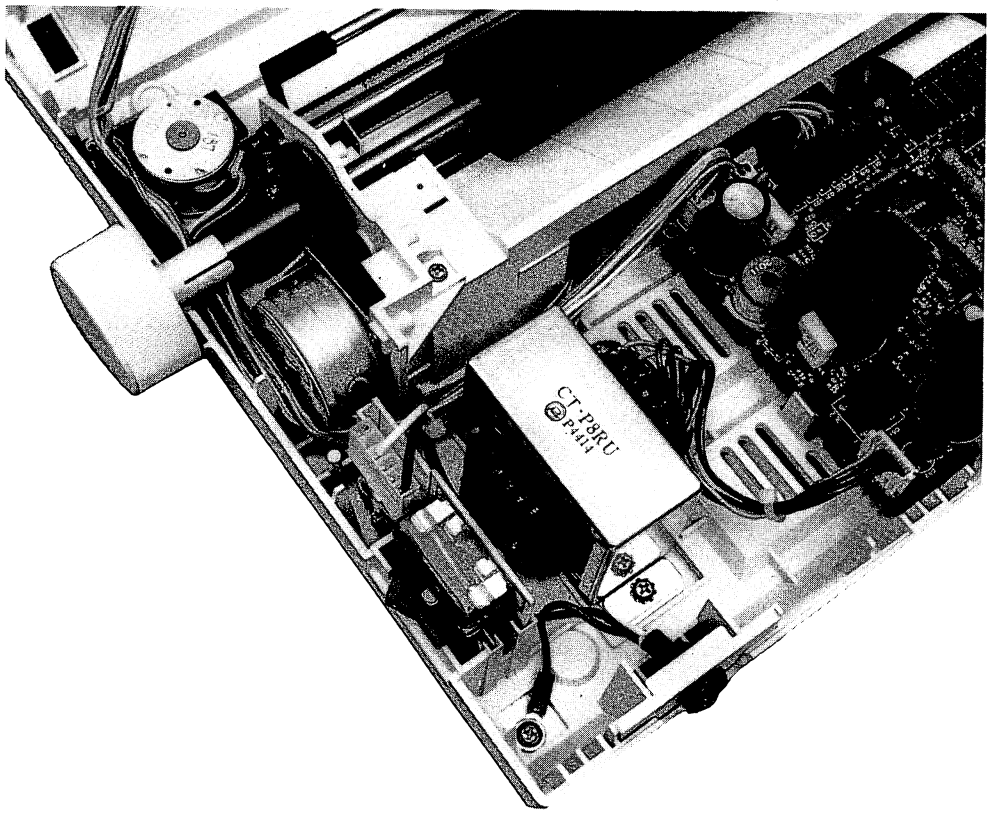


Fig. 1-7. Power Supply Components (120V Version)

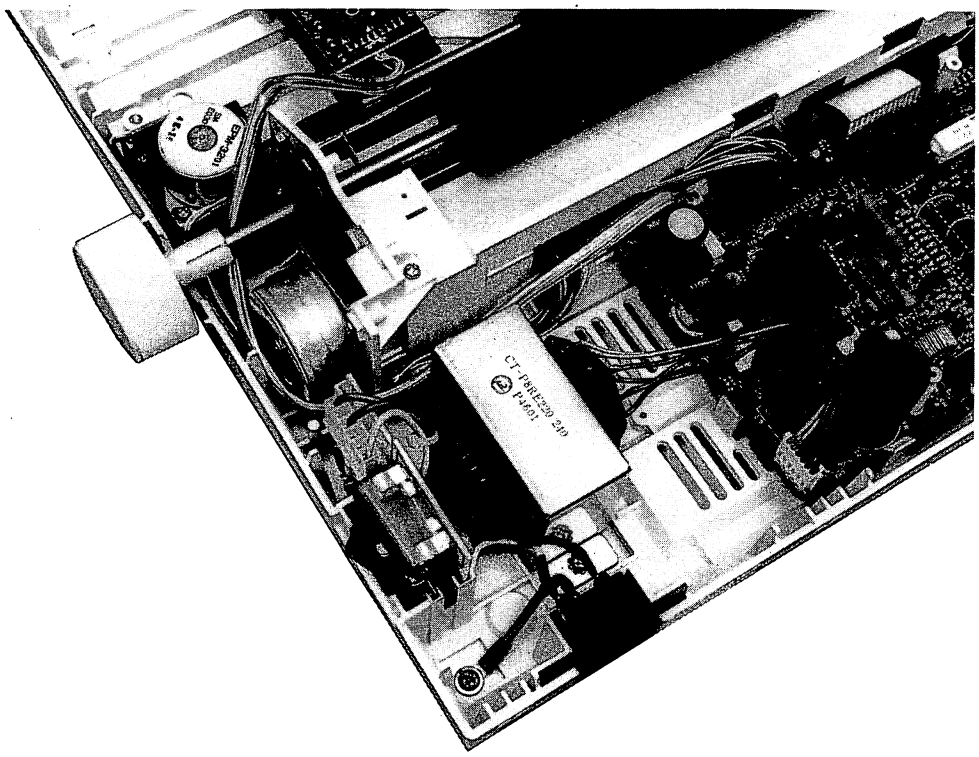


Fig. 1-8. Power Supply Components (220 and 240V Version)

1.4.2 CATX Control Board (Figs. 1-9 and 1-10)

The CATX circuit board includes all of the logic components which control operation of the printer, including a 7810 CPU, a 2k-byte 6116 RAM, and driver ICs for the carriage and paper feed motors. A gate array is also incorporated into the simple design of the circuit.
The difference of Fig. 1-9 and Fig. 1-10 is only DIP SW2.

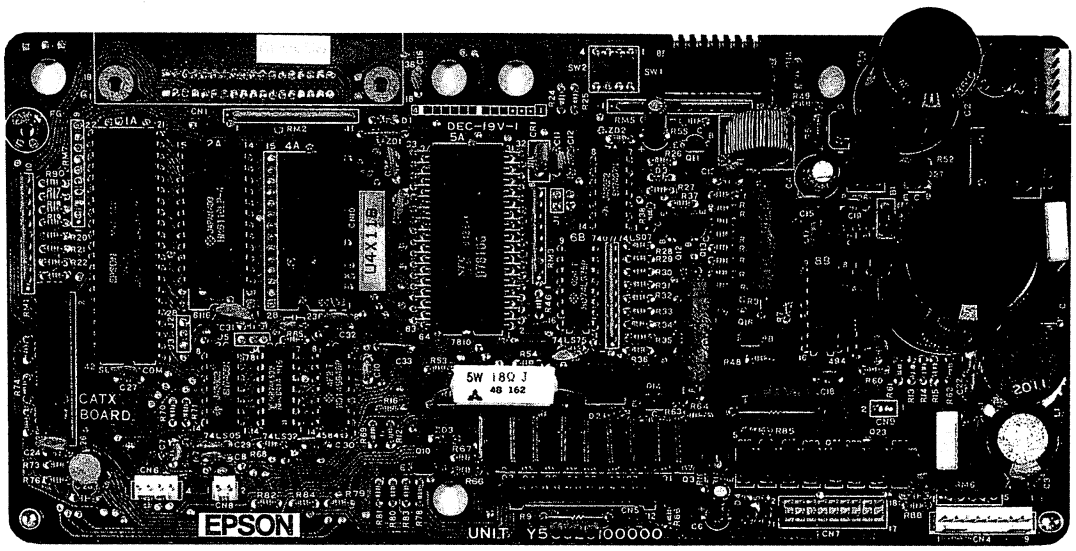


Fig. 1-9. CATX Control Board (120V and 240V Version)

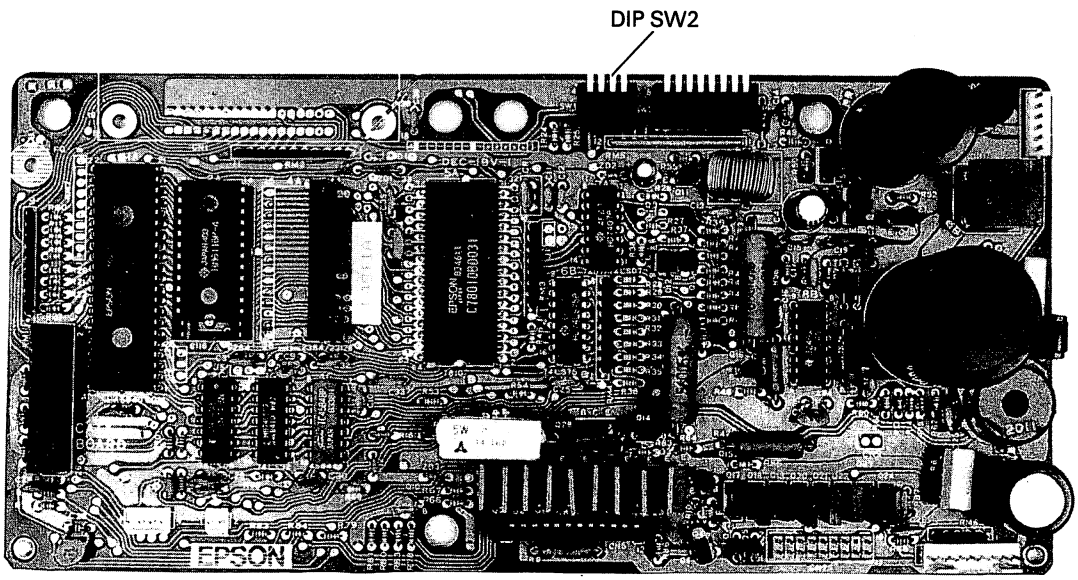


Fig. 1-10. CATX Control Board (220V Version)

1.4.3 COMI Interface Board (Fig. 1-11)

The COMI Interface Board is mounted on the CATX circuit board. It consists of a serial interface connector for Commodor and IBM modes, a centronics parallel interface connector for IBM mode and a control 27256 ROM.

The CPU7810 on the CATX board is controlled by program in this ROM.

There are two kinds of control ROM:

27256 (CE8-E□) is used for 120V and 240V Version.

27256 (CE8-L□) is used for 220V Version.

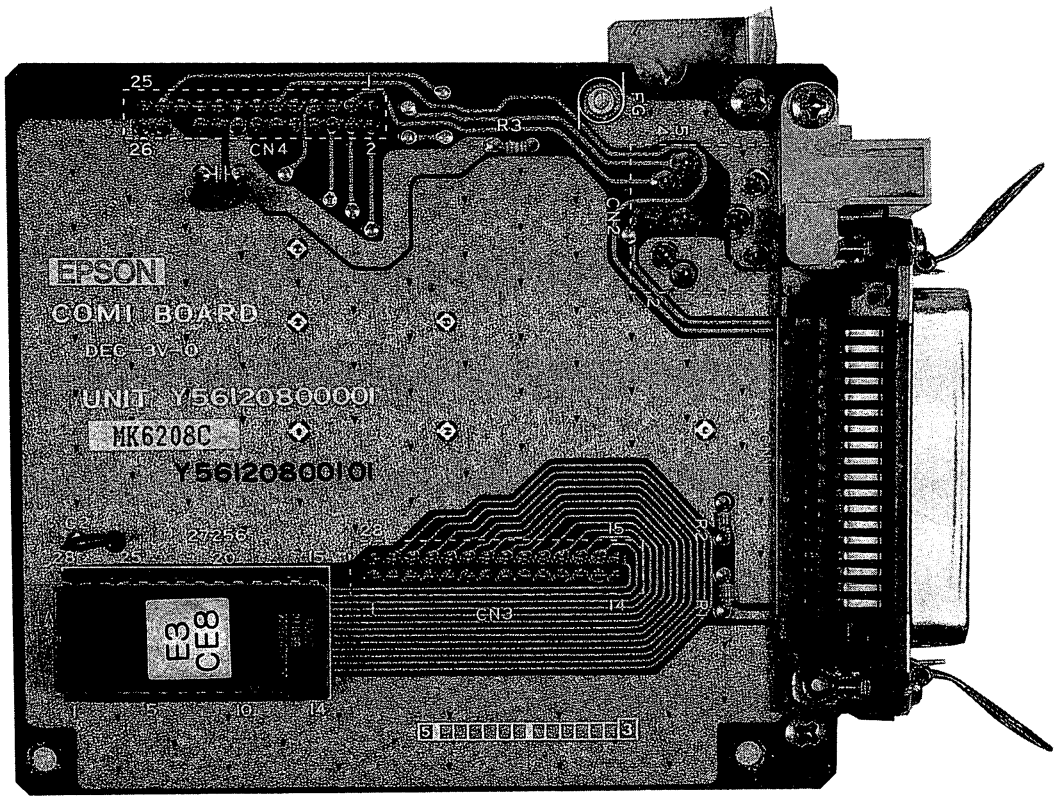


Fig. 1-11. COMI Board

1.4.4 Printer Mechanism (Fig. 1-12)

The printer mechanism is composed of a friction platen, simplified carriage assembly, paper feed and carriage motors, printhead, ribbon feed mechanism, sensors and detachable sprocket unit. A cut sheet feeder are available as options.

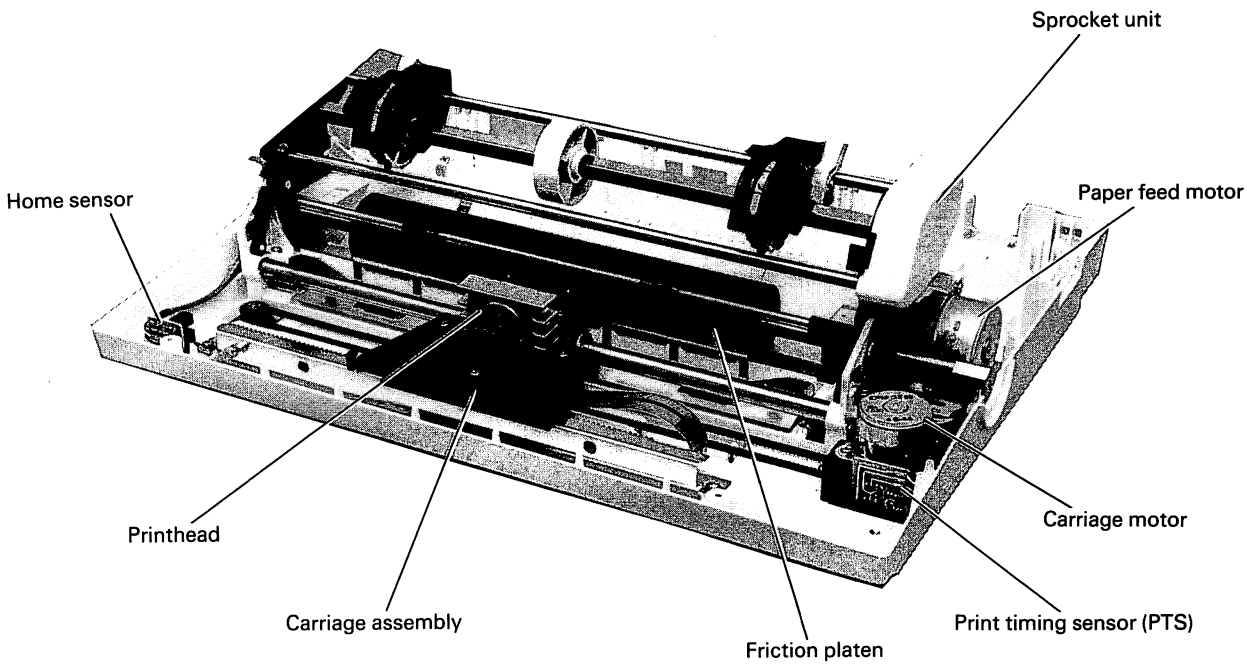


Fig. 1-12. Printer Mechanism

1.4.5 Housing (Fig. 1-13)

The housing, consisting of the upper and lower cases, accomodates the printer mechanism, control circuit board, and the power supply circuit as described above. The lower case is designed to facilitate easy access, removal, and replacement of those components. (The lower case is also used as a frame for the printer mechanism.)

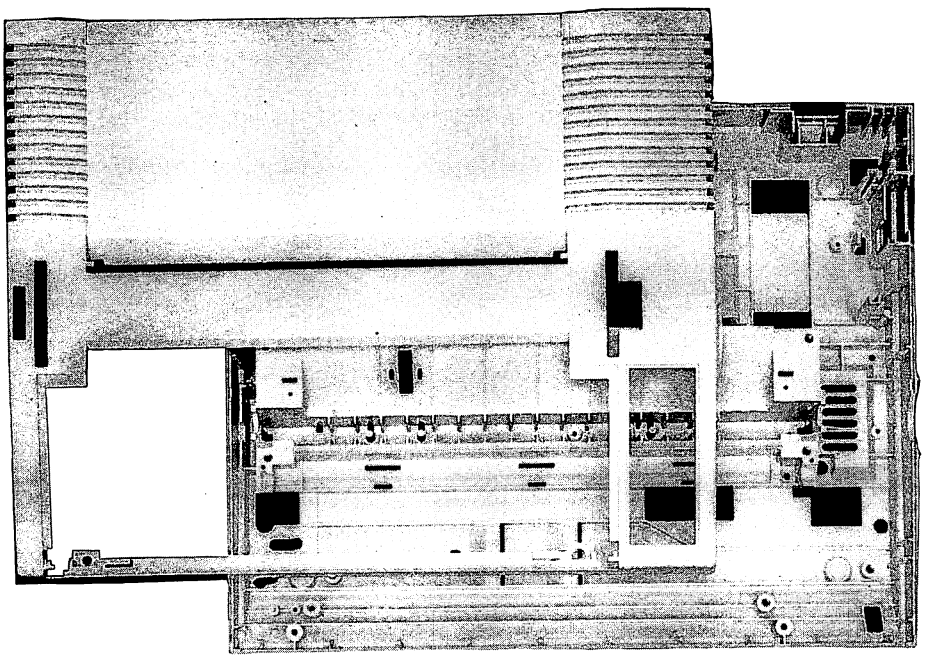


Fig. 1-13. Housing (Upper Case and Lower Case)

1.5 SELF TEST

The printer has a self-test function to check the following.

(1) ROM, RAM check

(2) Print head operation and print quality

(3) Operation of the printer mechanism (motor, ribbon cartridge mechanism, drive belt, etc.)

The self-test function is preprogrammed in the printer's circuit and can be performed by turning the power switch on while pressing the LF switch for testing Draft mode or the FF switch for testing NLQ mode.
All characters provided by the internal software are printed out on the paper.
The self-test funciton, however, can't be performed when the printer is out of paper.

If there is any trouble on ROM, the printer displays it be blinking ONLINE LED in below timing. (See Fig. 1-14.)

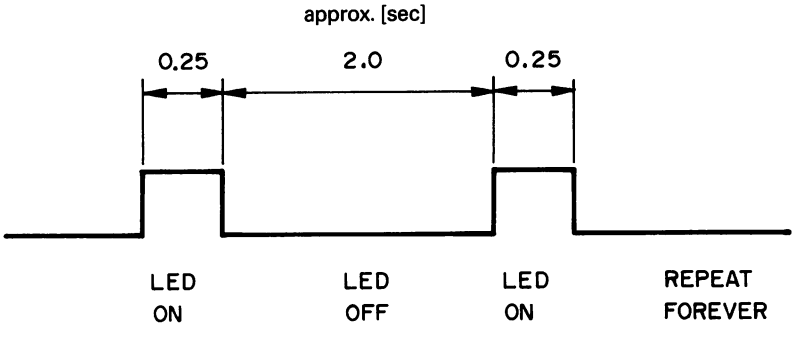


Fig. 1-14. ROM Error Occurance

If there is any trouble on RAM, the printer displays it by blinking ONLINE LED in below timing. (See Fig. 1-15.)

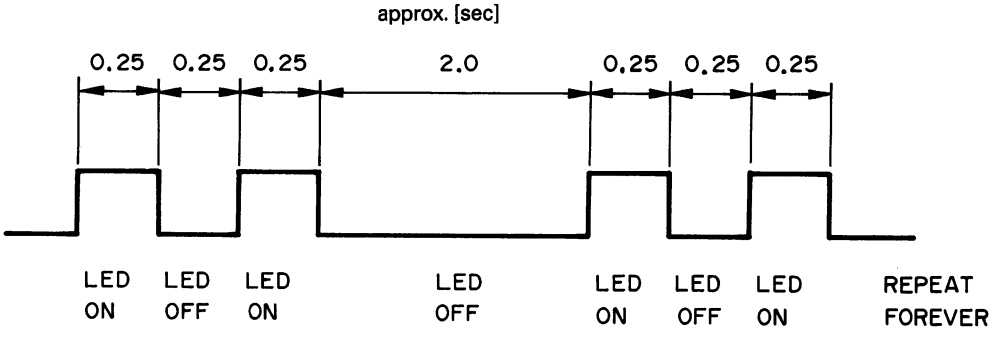


Fig. 1-15. RAM Error Occurance

1.6 DIP SWITCH AND JUMPER SETTINGS

The DIP SW is positioned at the rear center of the printer, and has the functions as shown in Table 1-3 and 1-6 for 120V and 240V Version and Table 1-4 and 1-7 for 220V Version.
Table 1-8 describes jumpers available on the CATX board. Note that the states of the DIP switches are read only when the power is switched on.

Table 1-3. DIP Switch Setting for Commodore Mode (120V and 240V Version)

SW NO.	Function	ON	OFF	Factory Setting
1-1	Print Mode Selection	5152+	Commodore	OFF
1-2	Device Select	5	4	OFF
1-3	Buzzer	Mute	Beep	OFF
1-4	Controls the Cut-sheet Feeder	Valid	Invalid	OFF
1-5	NLQ/Draft Selection	NLQ	Draft	OFF
1-6	Page Length	12"	11"	OFF
1-7	Paper-out Sensor	Inactive	Active	OFF
1-8	Select Printing Direction	Unidirection	Bidirection	OFF

Table 1-4. DIP Switch Setting for Commodore Mode (220V Version)

SW NO.	Function	ON	OFF	Factory Setting
1-1	Print Mode Selection	5152+	Commodore	OFF
1-2	Device Select	5	4	OFF
1-3	Select Printing Direction	Unidirection	Bidirection	OFF
1-4	Controls the Cut-sheet Feeder	Valid	Invalid	OFF
1-5	NLQ/Draft Selection	NLQ	Draft	OFF
1-6 1-7 1-8	International Character Sets	See Table 1-5		
2-1	Page Length	11"	12"	OFF
2-2	—	—	—	OFF
2-3	Paper-out Sensor	Inactive	Active	OFF
2-4	Buzzer	Mute	Beep	OFF

Table 1-5. International Character Sets

1-6	1-7	1-8	Country
OFF	OFF	OFF	ASCII (USA/UK/Netherlands)
OFF	OFF	ON	Denmark/Norway
OFF	ON	OFF	Sweden/Finland
OFF	ON	ON	Germany
ON	OFF	OFF	France/Belgium
ON	OFF	ON	Italy
ON	ON	OFF	Switzerland
ON	ON	ON	Spain

Table 1-6. DIP Switch Setting for IBM 5152+ Mode (120V and 240V Version)

SW NO.	Function	ON	OFF	Factory Setting
1-1	Print Mode Selection	5152+	Commodore	OFF
1-2	Device Select CG Select	5 Table 2	4 Table 1	OFF OFF
1-3	Interface	Serial	Parallele	OFF
1-4	Controls the Cut-sheet Feeder	Valid	Invalid	OFF
1-5	NLQ/Draft Selection	NLQ	Draft	OFF
1-6	Page length	12"	11"	OFF
1-7	Paper-out Sensor	Inactive	Active	OFF
1-8	Auto LF with CR	Valid	Invalid	OFF

NOTE: 1. When in the IBM mode with Centronics Parallel Interface (DIP SW. 1-1 on and DIP SW. 1-3 off), DIP SW. 1-2 is defined to CG select.

2. When in the IBM mode with Commodore Serial Interface (DIP SW. 1-1 on and DIP SW. 1-3 on), DIP SW. 1-2 is defined to Device select. And in this state default CG table is set to Table 1.

Table 1-7. DIP Switch Setting for IBM 5152+ Mode (220V Version)

SW NO.	Function	ON	OFF	Factory Setting
1-1	Print Mode Selection	5152+	Commodore	OFF
1-2	Device Select	5	4	OFF
1-3	Auto LF with CR	Valid	Invalid	OFF
1-4	Controls the Cut-sheet Feeder	Valid	Invalid	OFF
1-5	NLQ/Draft Selection	NLQ	Draft	OFF
1-6	Character Set Selection	Table 2	Table 1	OFF
1-7	IBM International Group	Group II subset	Group I U.S.A.	OFF
1-8	Interface	Serial	Parallel	OFF
2-1	Page Length	12"	11"	OFF
2-2	—	—	—	OFF
2-3	Paper-out Sensor	Inactive	Active	OFF
2-4	Buzzer	Mute	Beep	OFF

NOTE: When in the IBM mode with Centronics Parallel Interface (DIP SW. 1-1 on and DIP SW. 1-8 off), DIP SW. 1-2 is not define any function.

Table 1-8 Jumper Settings

Jumper No.	Description	Factory Setting
J1	ON: Latches the data at the trailing edge of $\overline{\text{STROBE}}$ OFF: Latches the data at the leading edge of $\overline{\text{STROBE}}$	OFF
J2	ON: 2K RAM OFF: 8K RAM	ON
J3	ON: 8K RAM OFF: 2K RAM	OFF
J4	ON: 8K or 16K ROM OFF: 32K ROM	OFF
J5	ON: 32K ROM OFF: 8K or 16K ROM	ON
J6	ON: μPD7811 OFF: μPD7810	OFF

CHAPTER 2
PRINCIPLES OF OPERATION

LIST OF FIGURES

LIST OF TABLES

2.1 SIGNAL FLOW AND CONNECTOR PIN ASSIGNMENT

The interconnection of the primary subassemblies of the MPS-1000 is diagrammed in Figure 2-1, blow. Table 2-1 and 2-2 summarize the purpose, size, and type of the connectors designated in the figure, and Table 2-3 through 2-10 list the signals exchanged on each.

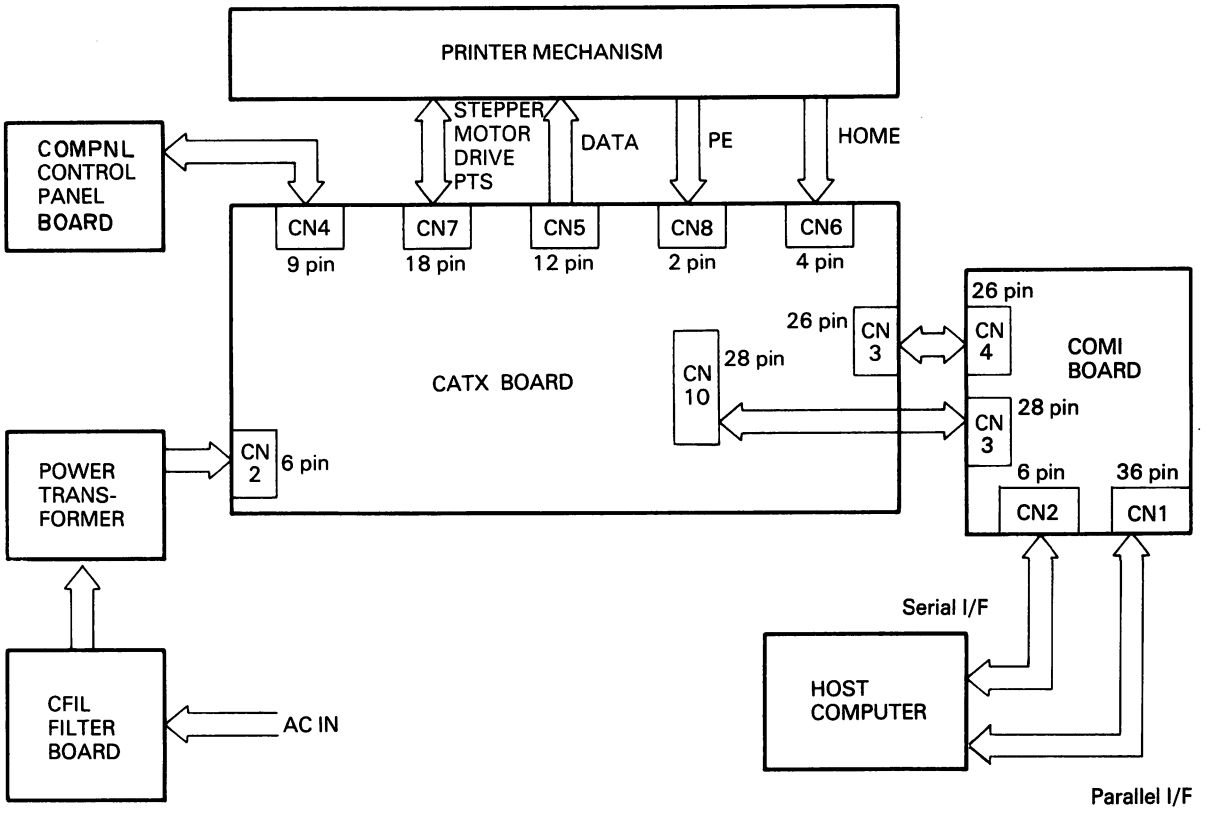


Fig. 2-1. Cable Connections

Table 2-1. CATX Board Connector Summary

Connector	Purpose	Pins	Reference Table
CN2	Power supply to control circuit board	6	2-3
CN3	COMI Board to control circuit board	26	2-4
CN4	Control panel to control circuit board	9	2-5
CN5	Control circuit board to printhead	12	2-6
CN6	HOME (HP) sensor to control board	4	2-7
CN7	Control board to carriage and paper feed motors and PTS sensor	18	2-8
CN8	PE sensor to control board	2	2-9
CN10	COMI Board to control circuit board	28	2-10

Table 2-2. COMI Board Connector Summary

Connector	Purpose	Pins	Reference Table
CN1	Parallel interface	36	1-2
CN2	Serial interface	6	1-1
CN3	From CN10 of CATX	28	2-10
CN4	From CN3 of CATX	26	2-4

Table 2-3. CN2 Pin Assignment (Power)

Pin	Signal	Lead Color	Description
1	AC3	Blue	12V AC for optional interface
2	AC3	Blue	
3	AC2	Purple	10V AC for logic circuit
4	AC2	Purple	
5	AC1	Red	28V AC for stepper motor.
6	AC1	Red	

Table 2-4. CN3 Pin Assignment (COMI CN4)

Pin	Signal	Direction	Description
1	$\overline{\text{ERR}}$	Out	Error
2	PE	Out	Paper end
3	D7 (CLK)	In	Data bit 7 (Serial CLK)
4	BUSY	Out	Ready
5	D6 ($\overline{\text{ATN}}$)	In	Data bit 6 (Serial $\overline{\text{ATN}}$)
6	ACK	Out	Acknowledge
7	D5	In	Data bit 5
8	$\overline{\text{INIT}}$ ($\overline{\text{RESET}}$)	In	Initial ($\overline{\text{RESET}}$)
9	D4	In	Data bit 4
10	$\overline{\text{STB}}$	In	Strobe
11	D8	In	Data bit 8
12	AC12	Out	Not used
13	$\overline{\text{RS}}$	Out	Reset
14	AC12	Out	Not used
15	D3	In	Data bit 3
16	+5	Out	+5V DC
17	D2	In	Data bit 2
18	+24	Out	Not used
19	D1	In	Data bit 1
20	+12	Out	Not used
21	P/S	In	Not used
22	—	—	—
23	$\overline{\text{SELIN}}$ (S DATA)	In	Select in (Serial DATA)
24	GL	—	Ground
25	TXD $\overline{\text{PET}}$/TRS	In	Not used
26	GL	—	Ground

NOTE: Signal direction is viewed from the control circuit board.
The parenthesized descriptions are for the serial interface.

Table 2-5. CN4 Pin Assignment (Control Panel)

Pin	Signal	Direction	Description
1	+5	Out	LED drive power
2	RDY LP	Out	READY LED drive signal
3	PE LP	Out	PAPER END LED drive signal
4	BUZZER	Out	Buzzer drive signal
5	ON LINE LP	Out	ON LINE LED drive signal
6	ON LINE SW	In	ON/OFF LINE switching signal
7	LF SW	In	LINE FEED signal
8	FF SW	In	FORM FEED signal
9	GL	—	Logic ground

NOTE: Signal direction is viewed from the control circuit board.

Table 2-6. CN5 Pin Assignment (Printhead)

Pin	Signal	Direction	Description
1	HD2	Out	Print solenoid #2 drive signal
2	HD4	Out	Print solenoid #4 drive signal
3	HD6	Out	Print solenoid #6 drive signal
4	HD8	Out	Print solenoid #8 drive signal
5	HD9	Out	Print solenoid #9 drive signal
6	+24	Out	Print solenoid common line (+24V Power)
7	+24	Out	Print solenoid common line (+24V Power)
8	+24	Out	Print solenoid common line (+24V Power)
9	HD5	Out	Print solenoid #5 drive signal
10	HD7	Out	Print solenoid #7 drive signal
11	HD1	Out	Print solenoid #1 drive signal
12	HD3	Out	Print solenoid #3 drive signal

NOTE: Signal direction is viewed from the control circuit board.

Table 2-7. CN6 Pin Assignment (HP sensor)

Pin	Signal	Direction	Description
1	G_H	—	HOME (HP) sensor GND
2	HOME	In	HOME (HP) sensor R signal
3	G_H	—	HOME (HP) sensor GND
4	H +5	Out	HP sensor LED power

NOTE: Signal direction is viewed from the control circuit board.

Table 2-8. CN7 Pin Assignment (Motors and PTS)

Pin	Signal	Direction	Description
1	CR A	Out	Carriage motor phase A
2	CR C	Out	Carriage motor phase C
3	CR B	Out	Carriage motor phase B
4	CR D	Out	Carriage motor phase D
5	CR COM	Out	Carriage motor phases C & D common line
6	CR COM	Out	Carriage motor phases A & B common line
7	LF A	Out	Paper feed motor phase A
8	LF C	Out	Paper feed motor phase C
9	LF B	Out	Paper feed motor phase B
10	LF D	Out	Paper feed motor phase D
11	LF COM	Out	Paper feed motor phases A & B common line
12	LF COM	Out	Paper feed motor phases C & D common line
13	G_L	—	PTS sensor GND
14	M +5	Out	PTS sensor LED power (+5V DC)
15	MTS	In	PTS sensor timing signal
16	NC	—	Not used
17	G_L	—	PTS sensor shield
18	G_L	—	PTS sensor shield

NOTE: Signal direction is viewed from the control circuit board.

Table 2-9. CN8 Pin Assignment (PE Sensor)

Pin	Signal	Direction	Description
1	PE +	In	Paper end sensor + side (PE signal)
2	PE –	—	Paper end sensor – side (Logic ground)

NOTE: Signal direction is viewed from the control circuit board.

Table 2-10. CN10 Pin Assignment (COMI CN3)

Pin	Signal	Direction	Description
1	ROM1	—	ROM V_{PP}
2	ROM2	Out	A12
3	ROM3	Out	A7
4	ROM4	Out	A6
5	ROM5	Out	A5
6	ROM6	Out	A4
7	ROM7	Out	A3
8	ROM8	Out	A2
9	ROM9	Out	A1
10	ROM10	Out	A0
11	ROM11	In	D0
12	ROM12	In	D1
13	ROM13	In	D2
14	ROM14	—	GND
15	ROM15	In	D3
16	ROM16	In	D4
17	ROM17	In	D5
18	ROM18	In	D6
19	ROM19	In	D7
20	ROM20	Out	$\overline{CE}$
21	ROM21	Out	A10
22	ROM22	Out	$\overline{OE}$
23	ROM23	Out	A11
24	ROM24	Out	A9
25	ROM25	Out	A8
26	ROM26	Out	A13
27	ROM27	Out	A14
28	ROM28	Out	V_{CC} +5V

NOTE: Signal direction is viewed from the CATX board.

2.2 POWER SUPPLY CIRCUIT

The power supply circuit in the printer is diagrammed in Fig. 2-2; the circuit includes noise filter, transformer, and +24 and +5VDC regulator circuits, enabling the voltages listed in Table 2-11 to be output.

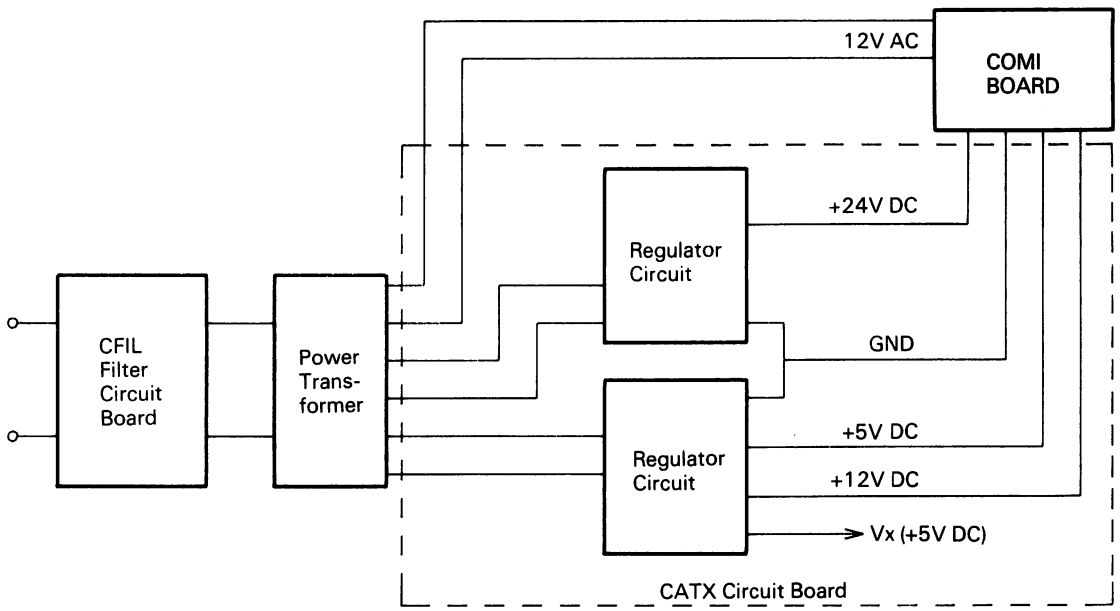


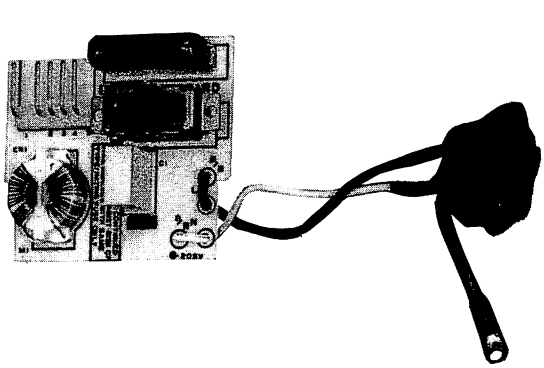
Fig. 2-2. Power Supply Block Diagram

Table 2-11. Power Supply Voltages

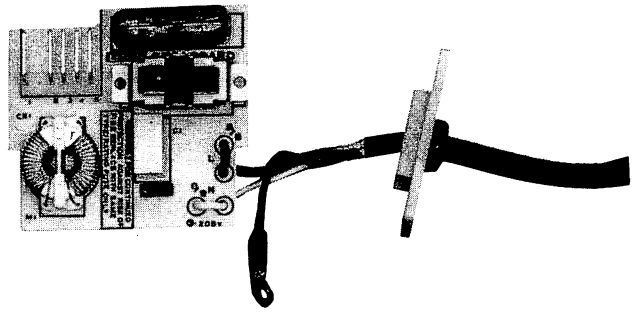
Voltage	Application
+24V	Carriage motor drive Paper feed motor drive Print solenoid drive Optional interface circuit board voltage
+5V (Vcc)	Logic circuit drive Carriage motor holding voltage Paper feed motor holding voltage LED voltage Optional interface circuit board voltage
+12V	Buzzer voltage
AC 12V	Not used
V x (+5V)	Power reset

2.2.1 Filter Circuit (Fig. 2-3)

The CFIL filter circuit board assembly includes the fuse, power switch, and AC input cable. The AC line voltage is filtered by C1 and M1 before being supplied to the transformer primary. The circuit also inhibits outgoing noise to the power line.



220/240V Version



120V Version

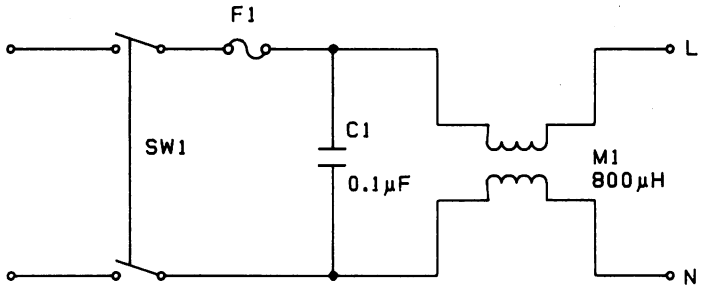


Fig. 2-3. CFIL Filter Board

2.2.2 Power Transformer (Fig. 2-4)

The power transformer converts the 120 or 220/240V AC input to approximately 10V AC and 28V AC, as illustrated below.

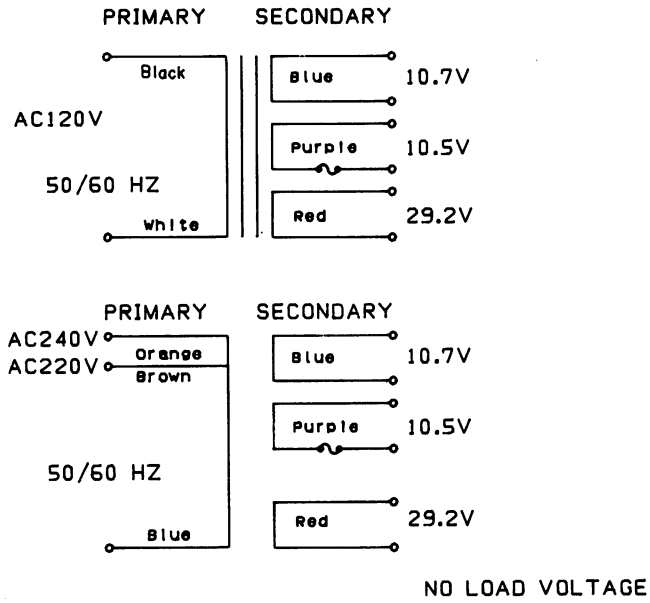
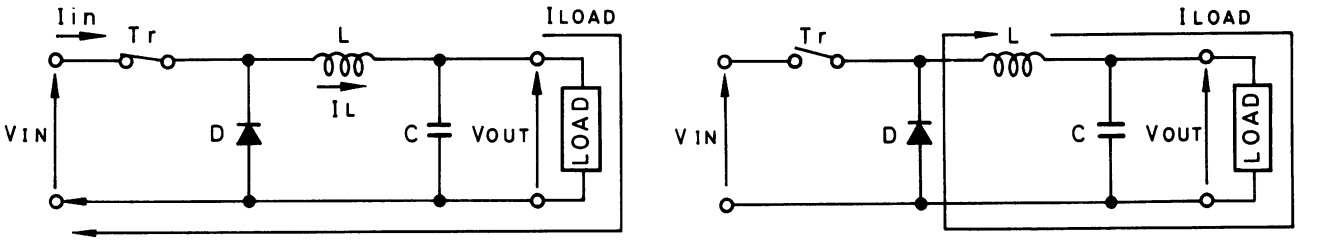


Fig. 2-4. Power Transformer Windings

2.2.3 Rectifier and Regulator Circuits

Two rectifier and regulator circuits, discussed in the following sections, are used to convert the 10V AC and 28V AC from the transformer to +24 and +5 DC voltages for the motors and logic circuitry. Both use "chopping" switching regulation, based on the principles illustrated in Figs. 2-5 and 2-6 and described in the following text.

Basic Chopping Circuit



Current Flow with Tr On

Current Flow with Tr Off

Fig. 2-5. Chopping Switching Regulator Operation

The transistor is turned on and off at a specified duty cycle. When the transistor is on (Ton), input voltage (Vin) is supplied to L and C and load current IL flows. When the transistor is off (Toff), energy accumulated in choke coil L is supplied to the load via diode D. The output voltage (Vout) can be expressed as follows, and is maintained by varying Ton in accordance with changes in Vout:

$$Vout = Vin \times \frac{Ton}{T}$$

Ton: time Tr is on
Toff: time Tr is off
T : Ton + Toff

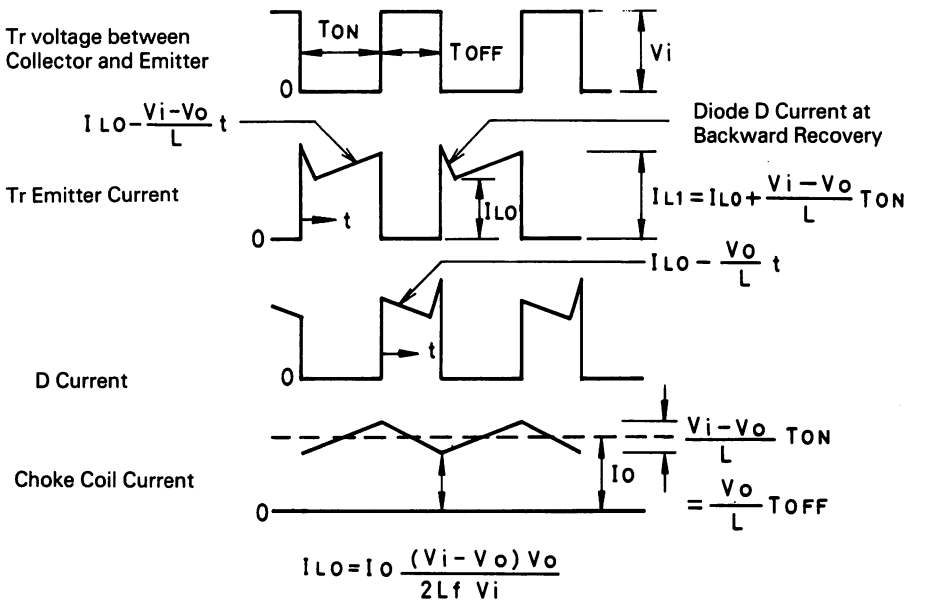


Fig. 2-6. Choke Input Filter Current Waveform

2.2.3.1 +24V Switching Regulator Operation

Voltage over 28V AC from the transformer secondary is applied to the +24V rectifier circuit (Fig. 2-7) through bridge rectifier DB1, where it is full-wave rectified before being regulated at the 494 regulator at 8B. The +24V regulator circuit includes the 494, switching transistors, and a flywheel diode and choke input filter.

- **494 Regulator IC (Figs. 2-8 and 2-9)**

  Fig. 2-8 diagrams the internal circuitry of the 494; the operation of the 494 in relation to the +24V regulator circuit is shown in Fig. 2-9.

  ICs EA1 and EA2 are differential amplifiers. EA1 is used to detect the output voltage, which is determined by resistors R13, R14 and R15 (Fig. 2-9). EA2 is used to detect the output current, determined by R60, R15, R6, R13, and R14, enabling an average 1A current to flow. (Max. 4.4A)

  The oscillation frequency is determined by C17 and R57, and is set at approximately 27KHz. The pulse-width modulator (PWM) compares the outputs of EA1 and EA2 with the sawtooth wave from the oscillation circuit. The feedback terminal, pin 3, is used for phase correction; the dead time control terminal, pin 4, uses the input voltage to control the transistors off time.

  The output control terminal, pin 13, selects push/pull or parallel output. The Vref (Ref out) terminal, pin 14, outputs a +5V (± 0.25V) reference voltage.

  Approximately 0.44V, divided by R14, R13, and R15, is input to the inverse terminal, pin 15, of EA2. If no output voltage is generated, approximately 0.03V is input, equaling the resistance-divided +5V reference voltage from pin 14. R6 monitors the value of the load current at the non-inverse terminal, pin 16. The overcurrent terminal operates when R6 receives approximately 4.4A.

  The +5V reference voltage is input at the inverse terminal of differential amplifier EA1 via R61. Approximately +5V is also input at the non-inverse terminal of EA1, pin1, derived from +24V resistance-divided by R13, R14, and R15. The accuracy of the output is determined by the accuracy of these reference voltages.

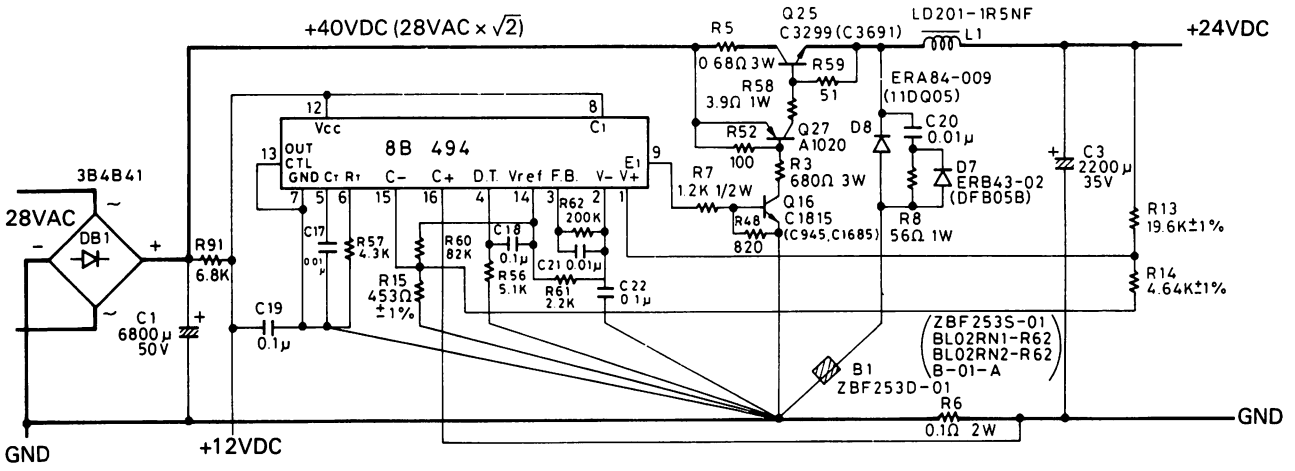


Fig. 2-7. +24V Regulator Circuit

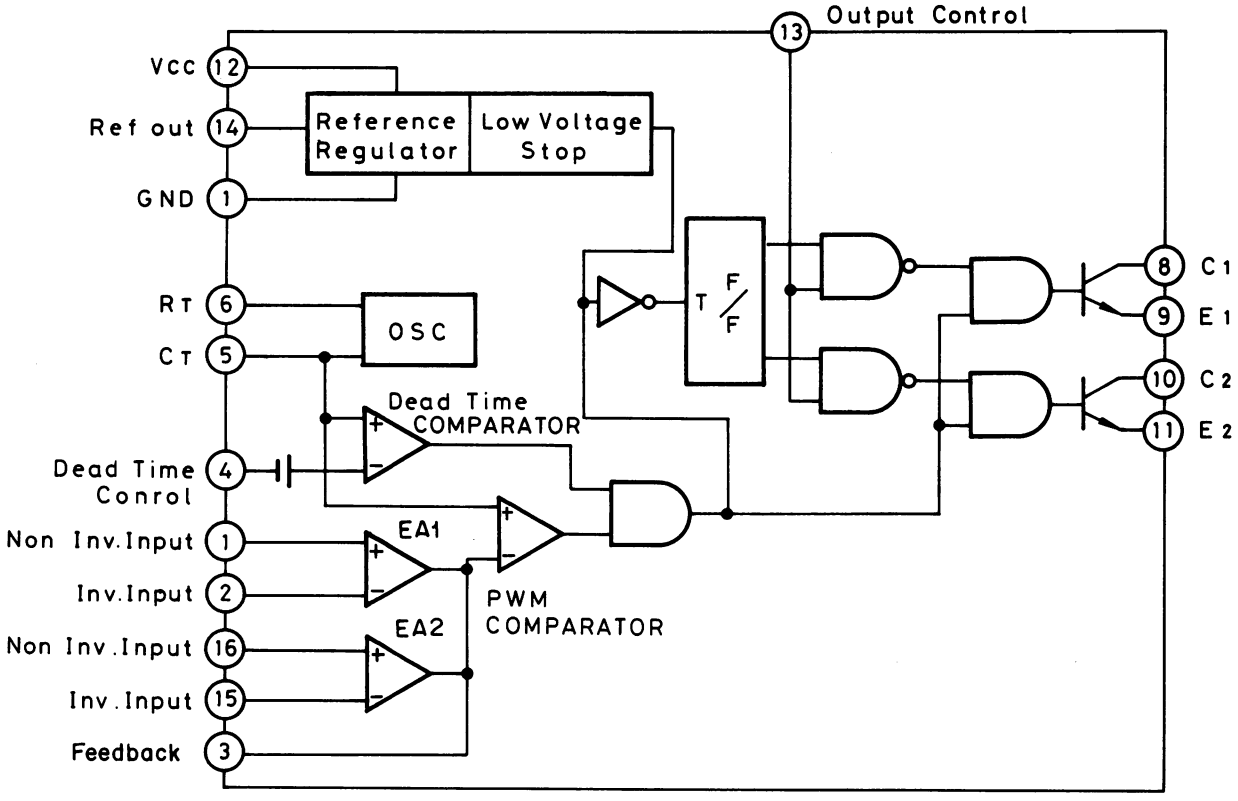
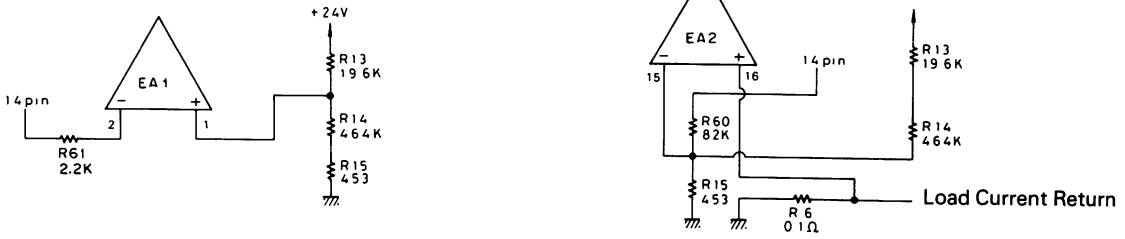


Fig. 2-8. 494 IC Block Diagram



Voltage Control

Current Limitation

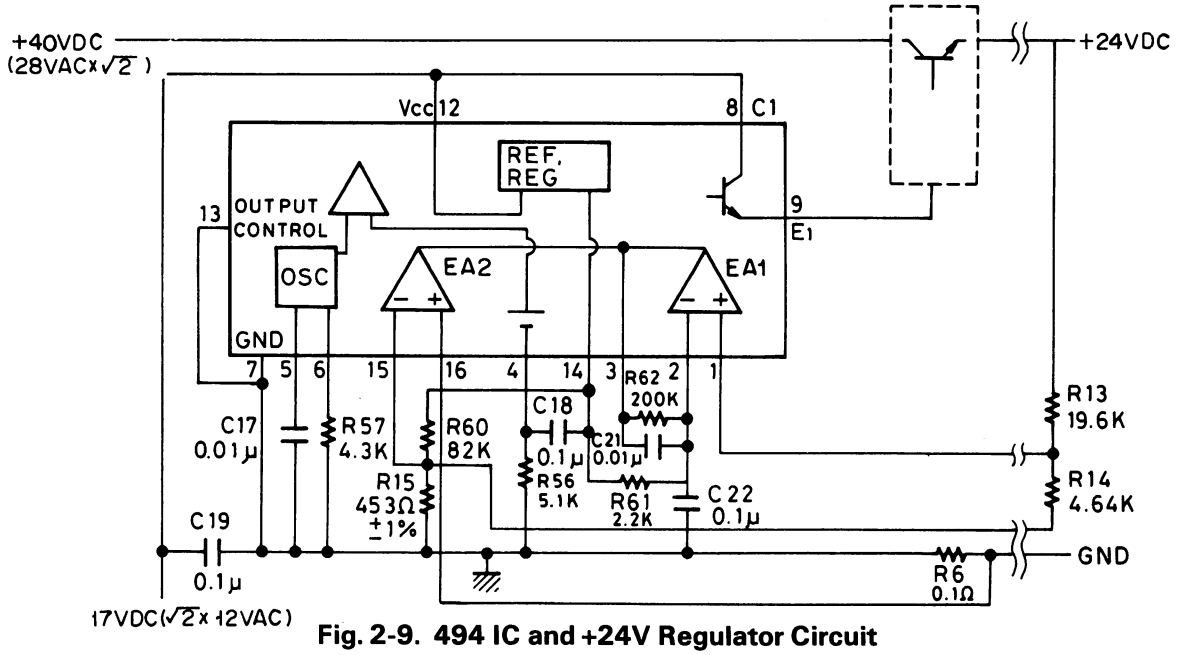


Fig. 2-9. 494 IC and +24V Regulator Circuit

- **Switching Transistors (Fig. 2-10)**

  Darlington transistors Q25 and Q27 increase the current amplification rate, operating in the following sequence:

Control Pulse ON → Q16 ON → Q27 ON → Q25 ON

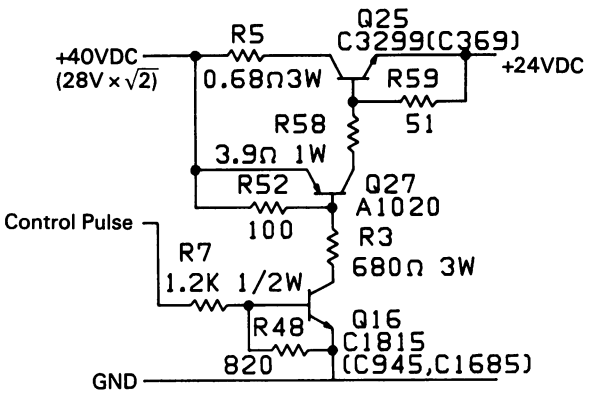


Fig. 2-10. Switching Transistors Q25 and Q27

- **Flywheel Diode and Choke Input Filter (Fig. 2-11)**

  Diode D8 in the +24V circuit is a flywheel diode. R8, C20, and D7 limit noise and maintain power efficiency.

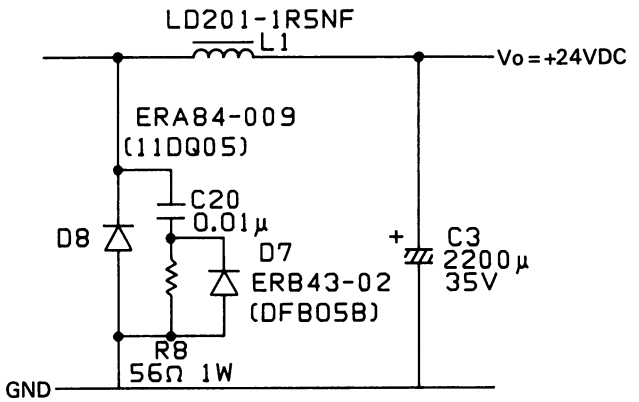


Fig. 2-11. Flywheel Diode and Choke Input Filter

2.2.3.2 +5V Regulator Circuit (Fig. 2-12)

Voltage of approximately 10V AC from the transformer secondary is applied to DB2, where it is full-wave rectified before being regulated by the regulator, SR1, a 78L05A.

Rectified +14V DC ($\sqrt{2}$ x 10) is input to the input terminal of the 78L05 via R51 as the bias current. The input produces a +5V reference voltage, which is monitored by the output terminal and compared with the voltage at the output side. If the voltage at the output side is lower than the reference voltage, Q26 turns on until an upper voltage boundary is reached, at which point the transistor oscillates off and potential again drops; when the voltage approaches the lower boundary, the process repeats.

Resistors R49 and R50 divide the resistance, causing approximately 60kHz of the oscillation frequency to determine.

Capacitor C14 is used to quickly switch the output of transistor. Approximately 1A may be supplied in this circuit.

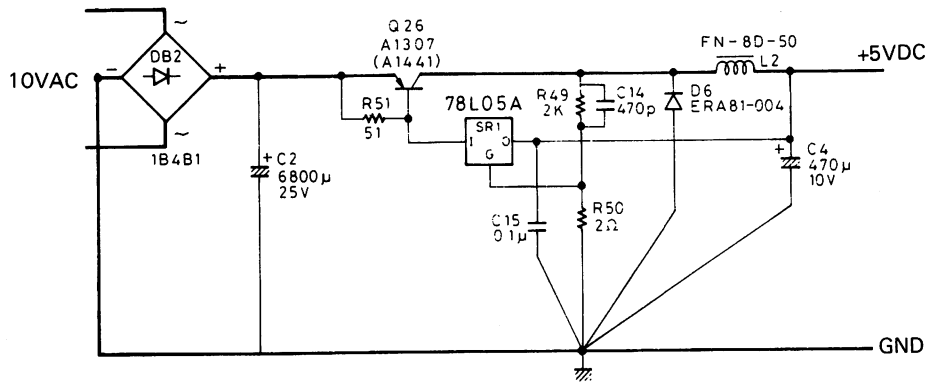


Fig. 2-12. +5V DC Regulator Circuit

2.2.4 Vx Circuit

The Vx circuit is used during system reset and supplies a +5V pull-up voltage to the stepper motor. Zener diode ZD2 is connected via R85 to the +24V line; ZD2 is biased at 4V, causing point A (Fig. 2-13) to become 4V. Q11 turns on when 4.6V (the zener voltage plus the potential drop in sequential direction at the PN junction) is supplied to its emitter. This circuit enables correct operation of the motor and efficient system reset.

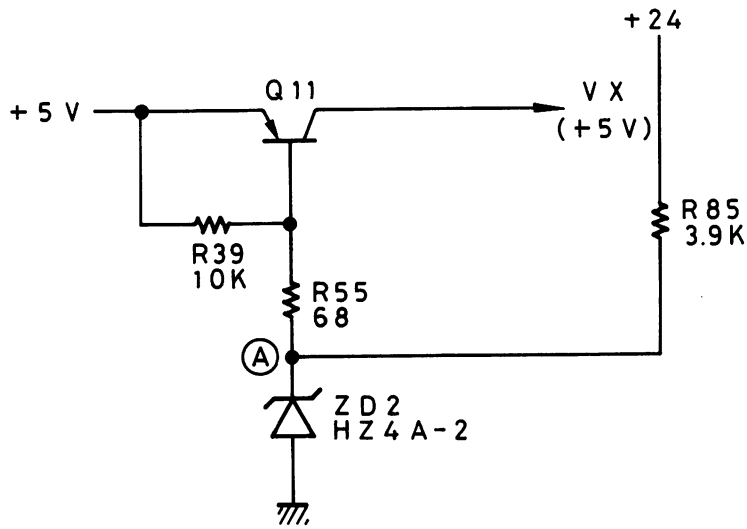


Fig. 2-13. Vx Voltage Circuit

2.3 CATX CONTROL BOARD OPERATION

The operation of the CATX control board is diagrammed in Fig. 2-14; the board includes reset, data input and decoding, carriage motor drive, paper feed motor drive, and printhead drive circuits.

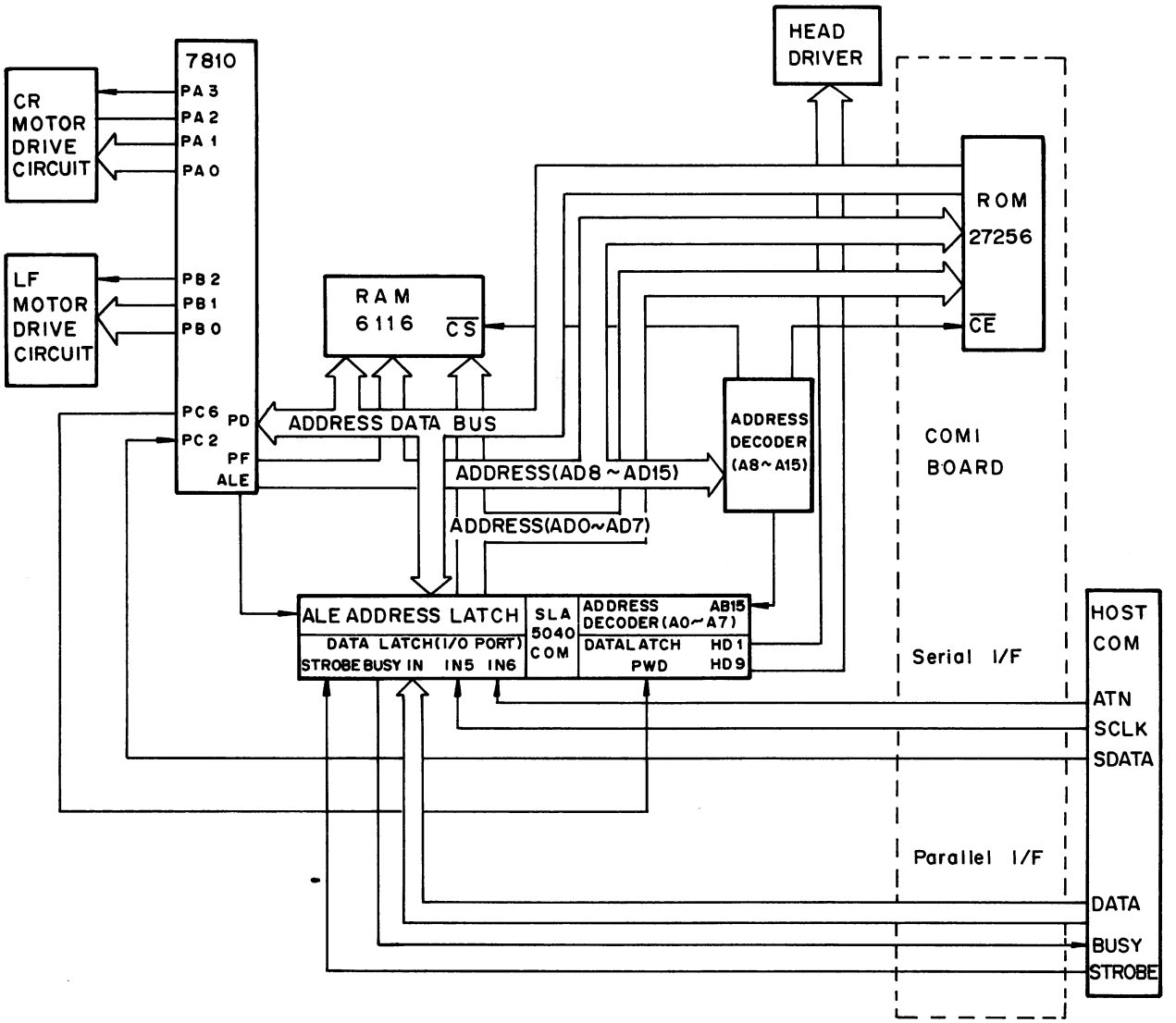


Fig. 2-14. Block Diagram

2.3.1 Reset Circuit (Fig. 2-15)

System reset occurs at power on, or upon receipt of the $\overline{INIT}$ signal from the host. Power on reset occurs when the +5V from the Vx circuit is applied to the reset circuit; the 7810 requires approximately 6 μs to reset, the entire circuit requires approximately 47 ms. The $\overline{RESET}$ signal is output low for the time constant Z = CR(S). D3 is used to discharge C5 when power is turned off, permitting the unit to be switched on and off rapidly.

Pin 4 of IC4C goes low when a low $\overline{INIT}$ signal is input at the interface connector, as in system or I/O reset at the host. A filter circuit eliminates line noise, the Schmitt trigger modifies the wave, and the resulting $\overline{RESET}$ signal is applied for the duration of $\overline{INIT}$.

With $\overline{RESET}$, the following initialization sequence occurs:

1. The printhead moves to the left margin, home position.
2. The pointer position in the print buffer is rewritten.
3. DIP switch settings are made valid.
4. The software is initialized (default value of initalization is written to the working registers.)
5. If the printer is supplied with paper, the ON LINE/READY status is entered.

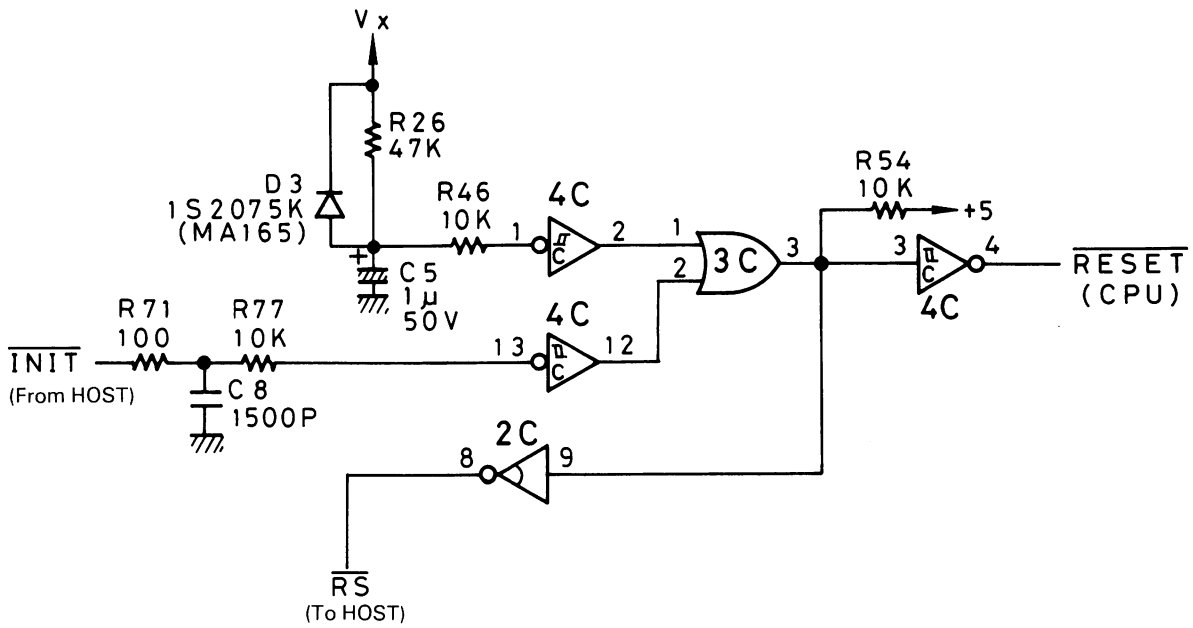


Fig. 2-15. Reset Circuit

2.3.2 Decoding and Data Flow

2.3.2.1 Decoding

During decoding, the Mode 1 and Mode 2 terminals of the CPU are pulled high; the CPU is therefore able to access the full, 64K-byte external memory.

The CPU outputs both address (AB0 – AB7) and data (DB0 – DB7) to ports PD0 – PD7. The gate array uses the ALE signal to separate the data of addresses; when ALE is high, addresses AB0 – AB7 are output from ports PD0 – PD7 to AB0 – AB7 of the SLA5040COM, and are latched at the trailing edge of the ALE signal. Addresses AB8 – AB15 are output to port PF0 – PF7 of the 7810 CPU.

For ROM, an individual memory position becomes active when PF7 is low, enabling logical addresses from 0000H to 7FFFH to be accessed.

For RAM accessing, PF7 is high and PF6 is low, causing addresses from 8000H to 0BFFFH to be logically accessible; however, the RAM size limits actual accesses to the 2k-byte range of 0A000H to 0A7FFH.

The CPU uses memory mapping for I/O access from the SLA5040 COM. The SLA5040 COM uses AB15 as a chip select signal to enable the gate array: when PF7 is high and PF5 is low, logical addresses from 8000H to 9FFFH and 0C000H to 0DFFFH are accessible; however, only the 8000H to 8005H range is actually used as addresses AB0 – AB7 are decoded by the SLA5040 COM.

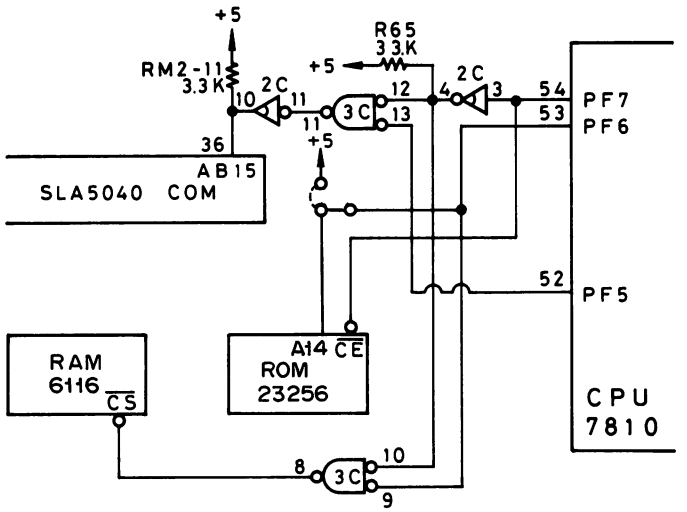


Fig. 2-16 Address Decoder Circuit

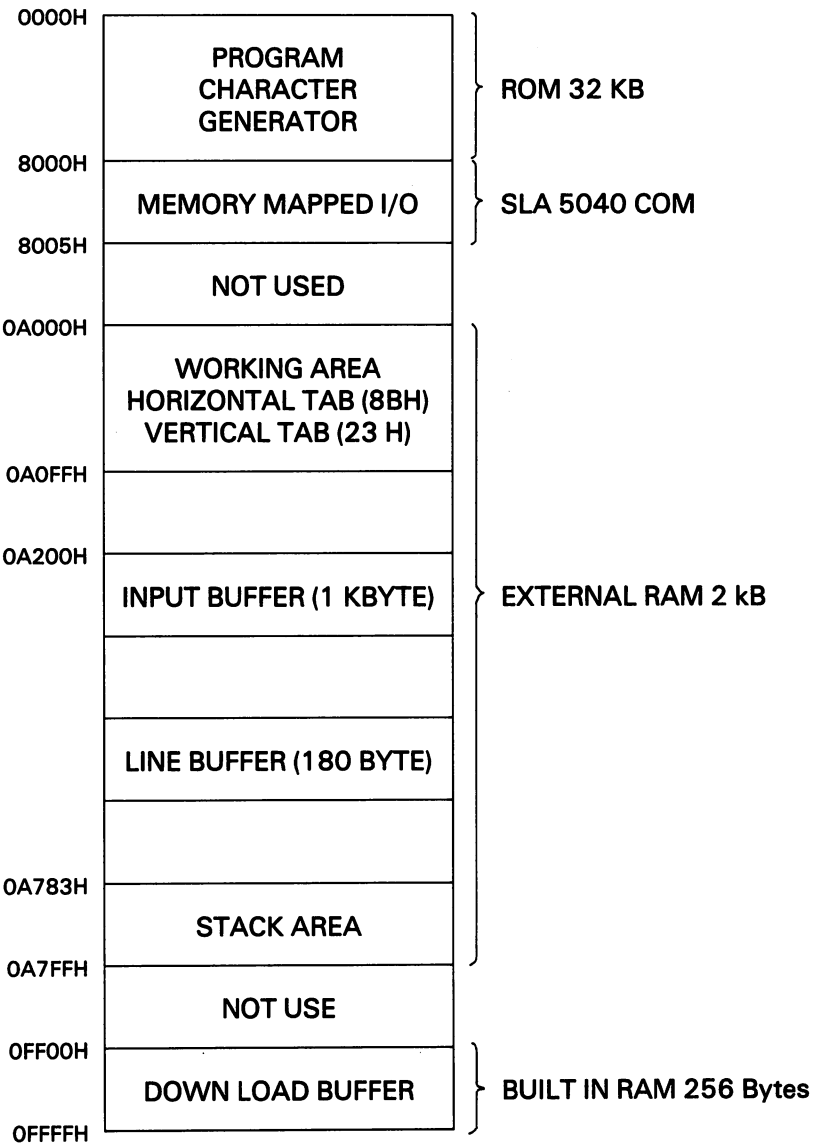


Fig. 2-17. Memory Map

2.3.2.2 Data Flow with parallel interface

The 7810 main microprocessor is controlled by the program in the 32K-byte ROM on the COMI Board to perform serial or parallel data transfer with the host. Data transfer between buffers is diagrammed in Fig. 2-18.

HOST COM: Load the data on an interface data line

HOST COM: Set the $\overline{\text{STROBE}}$ signal to low

SLA5040 COM: Latch the data in the gate array by the $\overline{\text{STROBE}}$ signal from host computer

SLA5040 COM: Automatically output the BUSY signal to the host by the $\overline{\text{STROBE}}$ signal

CPU7810: Input of the $\overline{\text{STROBE}}$ signal is recognized by reading address 8X01H 1..... Recognized 0..... Not Recognized

CPU7810: Read the latched data in the SLA5040 COM by reading address 8X00H and automatically clear the BUSY signal output from the SLA5040 COM

CPU7810: Store the input data in the input buffer area ① and increment the pointer

Continue the above steps until either a CR-LF is received or the input buffer becomes full

CPU7810: Set PB3 to high to forcibly output the BUSY signal (Output only at buffer full)

CPU7810: Analyze the control codes (control characters) of the input buffer: if a download code is received, the download data are transferred to the download buffer ②'; if a control code is received, the data is set in the working area; if the data is not a control or downloard code, the data (ASCII code) are stored in the line buffer ②.

The carriage timing is omitted. (Refer to Section 2.3.5)

CPU7810: Fetch one character from the line buffer and send the print data D7 ~ D0 from the corresponding character generator to the SLA5040 COM ③. (This is enabled by saving to address 8X02H)

CPU7810: Send print data D7 (pin 9 of HED) to the SLA5040 COM ③. (This is enabled by saving to address 8X03H)

CPU7810: Setting PC6 to low causes $\overline{\text{PWD}}$ to be set low to output the data from HD1 ~ HD9 of the SLA5040 COM, and start the CPU built-in timer at the same time. (When setting $\overline{\text{PWD}}$ to low, measure the voltage on the +24V line to determine the energizing pulse width)

CPU7810: Setting PC6 to high after the energizing pulse time passes causes $\overline{\text{PWD}}$ to be set high with outputs HD1 ~ 9 of the SLA5040 COM set to low. (1 column of the character is complete)

CPU7810: New data are received as space becomes available in the input buffer ④.

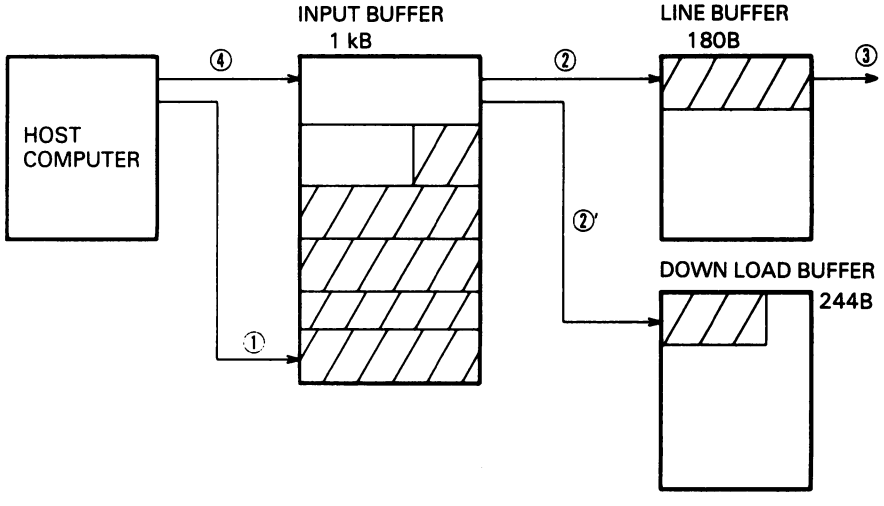


Fig. 2-18. Input and Download Buffering

2.3.3 Carriage Motor Control

The carriage motor control circuit is diagrammed in Fig. 2-19. This circuit uses unipolar drive with a direct drive system by the CPU and a star connection as well in hardware. A two-two phase excitation method is employed in software (Refer to Table 2-13), and the LS75 at 6B is a latch which buffers drive transistors Q18 ~ Q20 while 1G and 2G are high.

The pulse motor current drops due to reactance influence while rotating. However, no reactance influence occurs when the pulse motor stops. The voltage output to the motor is changed corresponding to print mode to maintain constant current during various motor states, as described in Table 2-12.

Table 2-12. Carriage Motor Voltages

Speed	Font	Voltage	Motor PPS
High speed	Pica	+24V	600 PPS
Low speed	Condensed	+17V	270 PPS
Holding	—	+5V	—

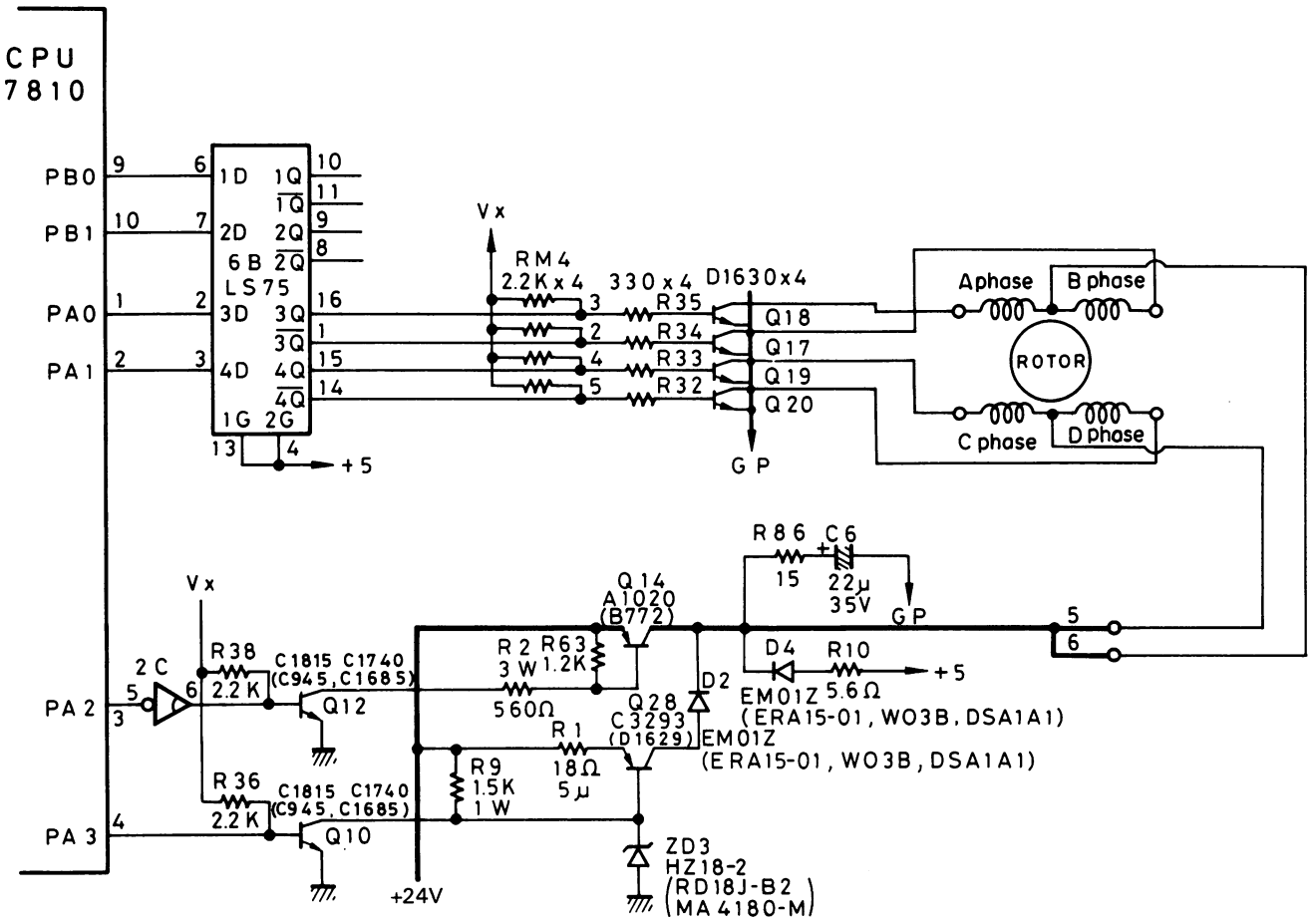


Fig. 2-19. Carriage Control Circuit

Voltage is selected by the following sequence:

Pica: CPU PA2 goes low, IC2C pin 6 goes high, Q12 turns on, Q14 turns on, and +24V is output to the motor.

Condensed: CPU PA3 goes low, Q10 turns off, Q28 Vb = 18V, and +17V are output to the motor.

Holding: CPU PA2 and PA3 go high, IC2C pin 6 goes low and Q10 turns on, Q12 turns off and Q28 Vb = 0V, Q14 turns off and Q28 Vc = 0V, and +5V are output to the motor through the R10 and D4.

The motor timing circuit is diagrammed in Fig. 2-20. As the motor rotates a corresponding motor-position timing signal is generated by the PTS sensor beneath the motor (Refer to Fig. 2-21); this signal is fed back into the CPU, where motor speed is monitored in a closed loop during acceleration and constant speed.

- **At acceleration**

  When the timing signal is received before a set time has elapsed, the timing signal is ignored and the phase is switched with the established timing. (Refer to Fig. 2-22 (a)).

  If the PTS signal is received after the set period, the phase is switched in conjunction with receipt of PTS. (Refer to Fig. 2-22 (b)).

  A new set time is required for the next phase selection. The set time requires twelve kinds of time data to correspond with each drive speed of 600 PPS and 270 PPS, as shown in Table 2-14 (a), to fetch each of these for every phase selection.

- **At constant speed**

  The following set time performs the closed loop control:

  1.67 ms ± 10 μs at 600 PPS

  3.70 ms ± 10 μs at 270 PPS

- **At deceleration**

  An open loop control is performed. The PTS signal from the printer mechanism and the set time are not checked. The deceleration timing data performs phase selection in sequential order as shown in Table 2-14 (b).

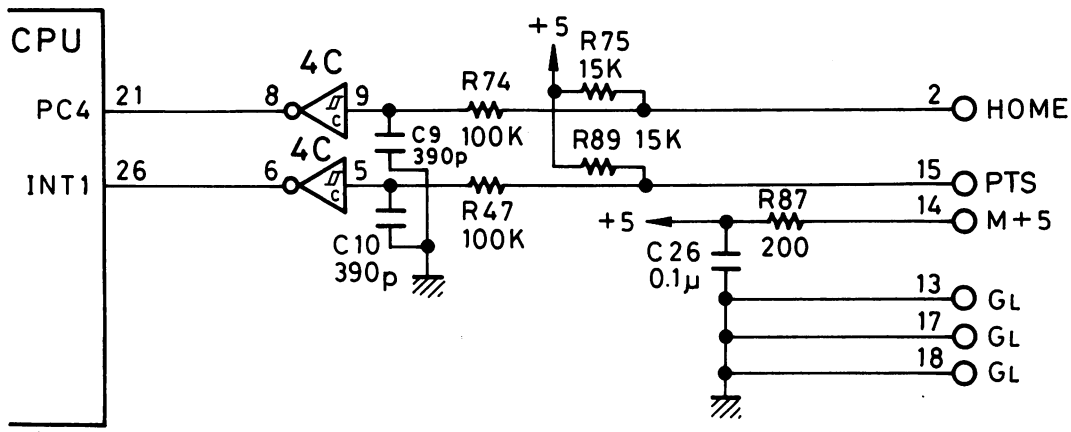


Fig. 2-20. Carriage Motor Timing Circuit

NOTE: INT1 is a maskable interrupt input of the edge trigger (leading edge).

Table 2-13. Carriage Motor Drive Sequence

a) When driving the carriage from left to right (clockwise)

Step	A phase	B phase	C phase	D phase
1	ON	OFF	OFF	ON
2	ON	OFF	ON	OFF
3	OFF	ON	ON	OFF
4	OFF	ON	OFF	ON

b) When driving the carriage from right to left (counterclock-wise)

Step	A phase	B phase	C phase	D phase
1	ON	OFF	ON	OFF
2	ON	OFF	OFF	ON
3	OFF	ON	OFF	ON
4	OFF	ON	ON	OFF

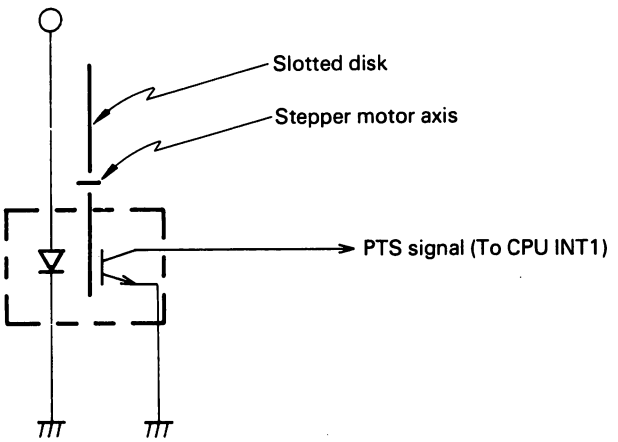


Fig. 2-21. PTS Sensor Operation

Table 2-14. Carriage Time Data

a) Acceleration Time Data

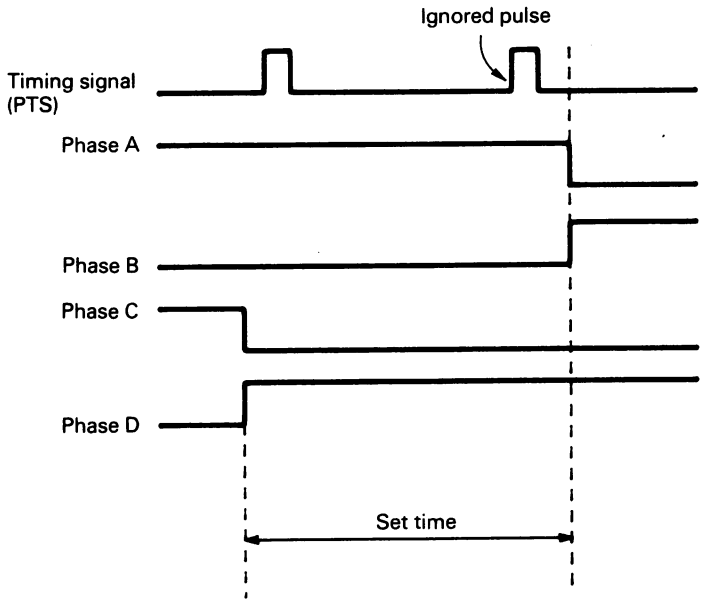
Data No.	Set Time (ms)	
	600 PPS	270 PPS
1	4.50	5.50
2	3.30	4.70
3	2.70	4.20
4	2.30	3.91
5	2.10	3.80
6	2.00	3.70
7	1.95	3.70
8	1.92	3.70
9	1.90	3.70
10	1.85	3.70
11	1.80	3.70
12	1.76	3.70

Time Accuracy
$\pm 30\mu s$

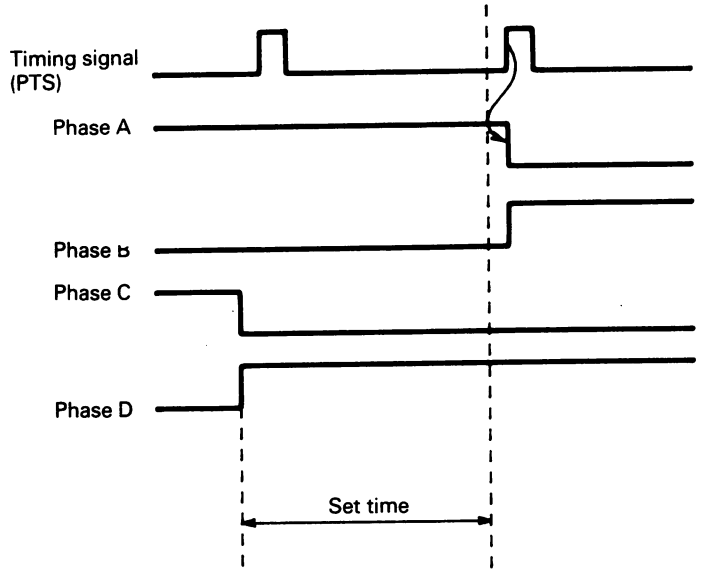
b) Deceleration Time Data

Data No.	Set Time (ms)	
	600 PPS	270 PPS
1	1.68	3.70
2	1.72	3.70
3	1.76	3.70
4	1.84	3.70
5	2.00	3.70
6	2.12	3.70
7	2.28	3.70
8	2.48	3.80
9	2.80	3.91
10	3.20	4.20
11	3.52	4.70
12	4.00	5.50

Time Accuracy
$\pm 30\mu s$



(a) PTS occurs before the set time



(b) PTS occurs after the set time

Fig. 2-22. Closed Loop Operation

2.3.4 Paper Feed Motor Control

The paper feed motor advances the platen a fixed increment by switching current at the drive coil for direct, uniploar drive.

The paper feed motor control circuit (Fig. 2-23) outputs two two-phase signals for drive, and the LS75 at 6B is a latch which buffers drive transistors Q21 ~ Q24 while 1G and 2G and high. The stepper motor requires current even in the halt state; therefore, the voltage is decreased to eliminate heat build-up, as described below, when motor rotation stops.

The Commodore MPS-1000 performs acceleration and deceleration control. However, this control is not used for less than 10 steps. Tables 2-15 through 2-18 describe paper feed motor timing, the drive sequence, and paper feed pitch.

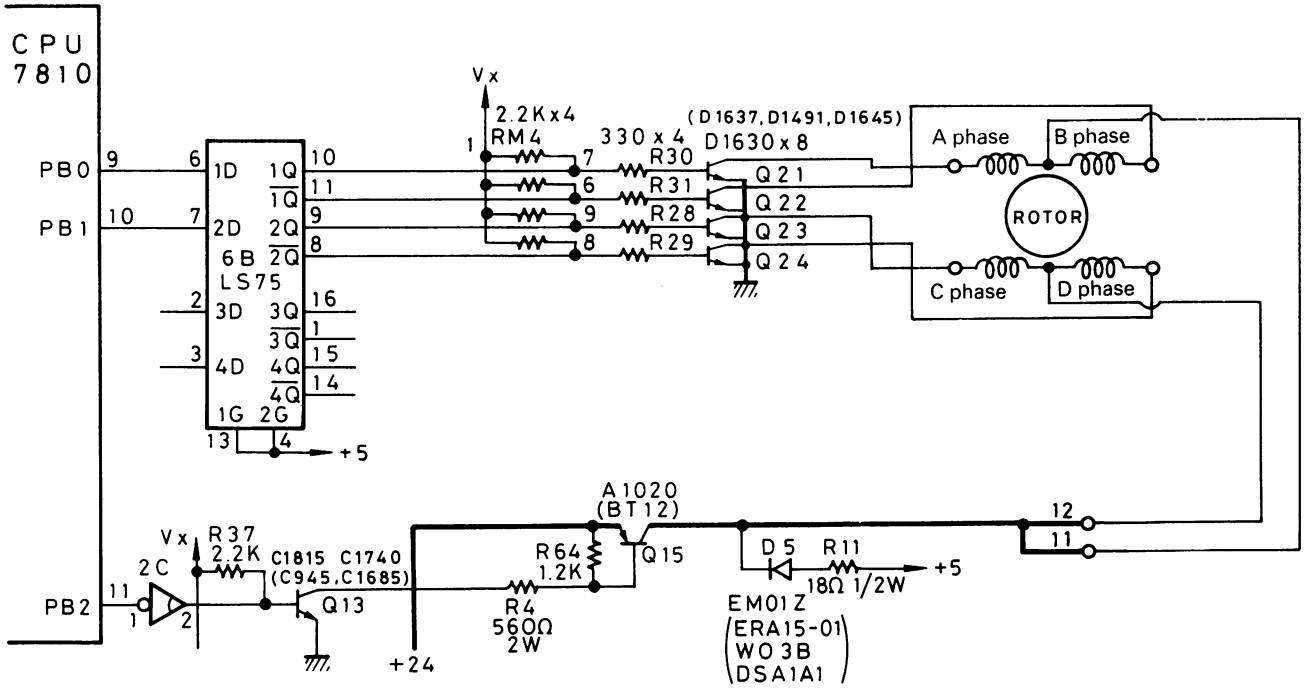


Fig. 2-23. Paper Feed Motor Control Circuit

Voltage Selection:

Stop → Rotation: CPU PB2 goes low, IC2C pin 2 goes high, Q13 turns on, Q15 turns on, and +24V is supplied to the motor.

Rotation → Stop: CPU PB2 goes high, IC2C pin 2 goes low, Q13 turns off, Q15 turns off, and +5V is supplied to the motor through R11 and D5.

Table 2-15. Acceleration Control

Step No.	Set Time [ms]
tC1	4.2
tC2	3.7
tC3	3.3
tC4	3.0
tC5	2.8

TIME Accuracy
+300 μs
−50 μs

Table 2-16. Deceleration Control

Step No.	Set Time [ms]
tD1	3.0
tD2	3.3
tD3	3.7
tD4	4.2

TIME Accuracy
+300 μs
−50 μs

Table 2-17. Paper Feed Motor Drive Sequence

Step No.	A phase	B phase	C phase	D phase
1	ON	OFF	ON	OFF
2	ON	OFF	OFF	ON
3	OFF	ON	OFF	ON
4	OFF	ON	ON	OFF

Table 2-18. Paper Feed Pitch

Paper Feed Pitch	Paper Feed Step	Paper Feed Time
0.12 mm (1/216")	1 pulse	—
4.23 mm (1/6")	36 pulses	124 ms
3.18 mm (1/8")	27 pulses	99 ms
2.82 mm (1/9")	24 pulses	90 ms

2.3.5 Printhead Control

The PTS signal is used to time the firing location of the printhead as described in Fig. 2-24. Data output to the printhead is described in Section 2.3.2 and printhead/carriage operation in Section 2.5.

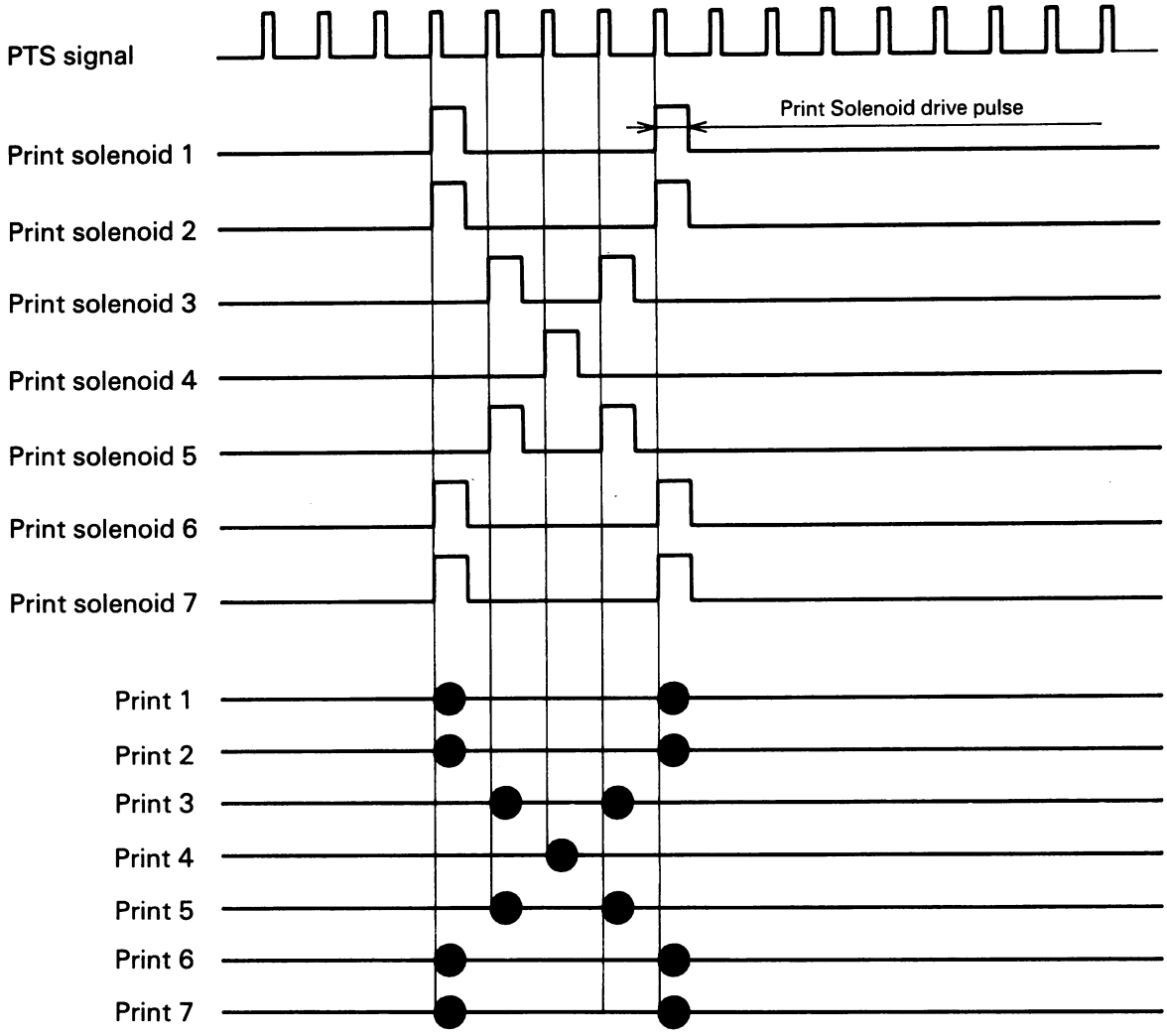


Fig. 2-24. Print Timing

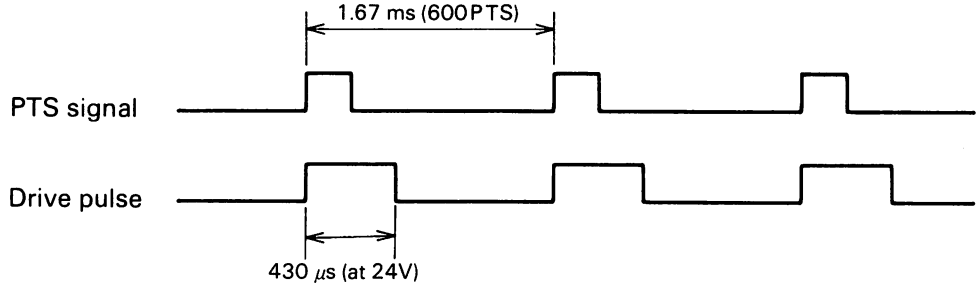


Fig. 2-25. Energizing Pulse

2.3.6 Buzzer and PE Lamp Circuit (Fig. 2-26)

The buzzer receives an output pulse from the CPU at the buffer of the open collector. The buzzer drive voltage is drived by the resistance dividing by the +12V DC non-stabilized power source. This prevents the buzzer from riding on the +5V power.

The PE LED flickers according to by the signals from the paper end sensor.

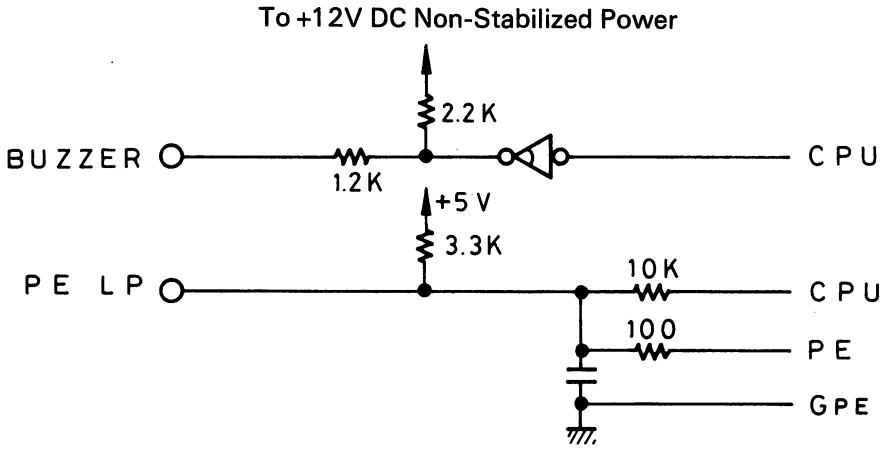


Fig. 2-26. Buzzer and PE Circuit

2.3.7 AD Converter (Fig. 2-27)

The 7810 CPU has a built-in, 8-bit A-D converter and a multiplexer to enable input of eight lines, AN0 to AN7. AVcc and AVss supply power to the A-D converter; +24V is biased through R69 and +5V is obtained at zener diode ZD1. To determine the energizing pulse width, +24V is resistance divided by R16 and R12 to input about 4.34V (at 24V) to AN0. Diode D1 is used to discharge C16 when the power is OFF; R53 and C16 perform a simple sample holding; and C34 and C35 are decoupling capacitors.

The other analog input terminals are connected to the DIP switch and verify the DIP switch status when power is turned on.

When the +24V line risis above 27.1V, the abnormal voltage is recognized, the carriage motor stops, and the user is alerted of the condition by the buzzer.

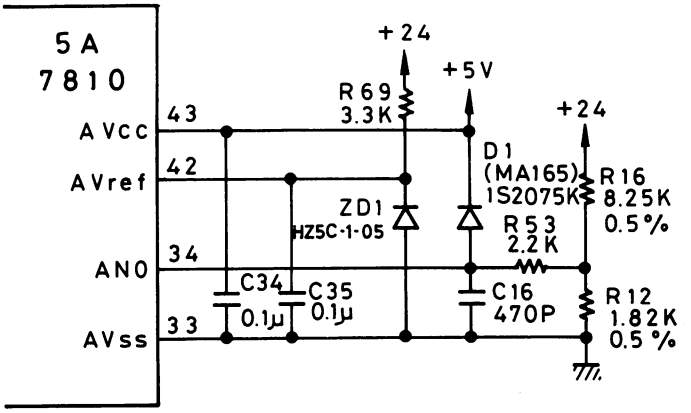


Fig. 2-27. AD Converter

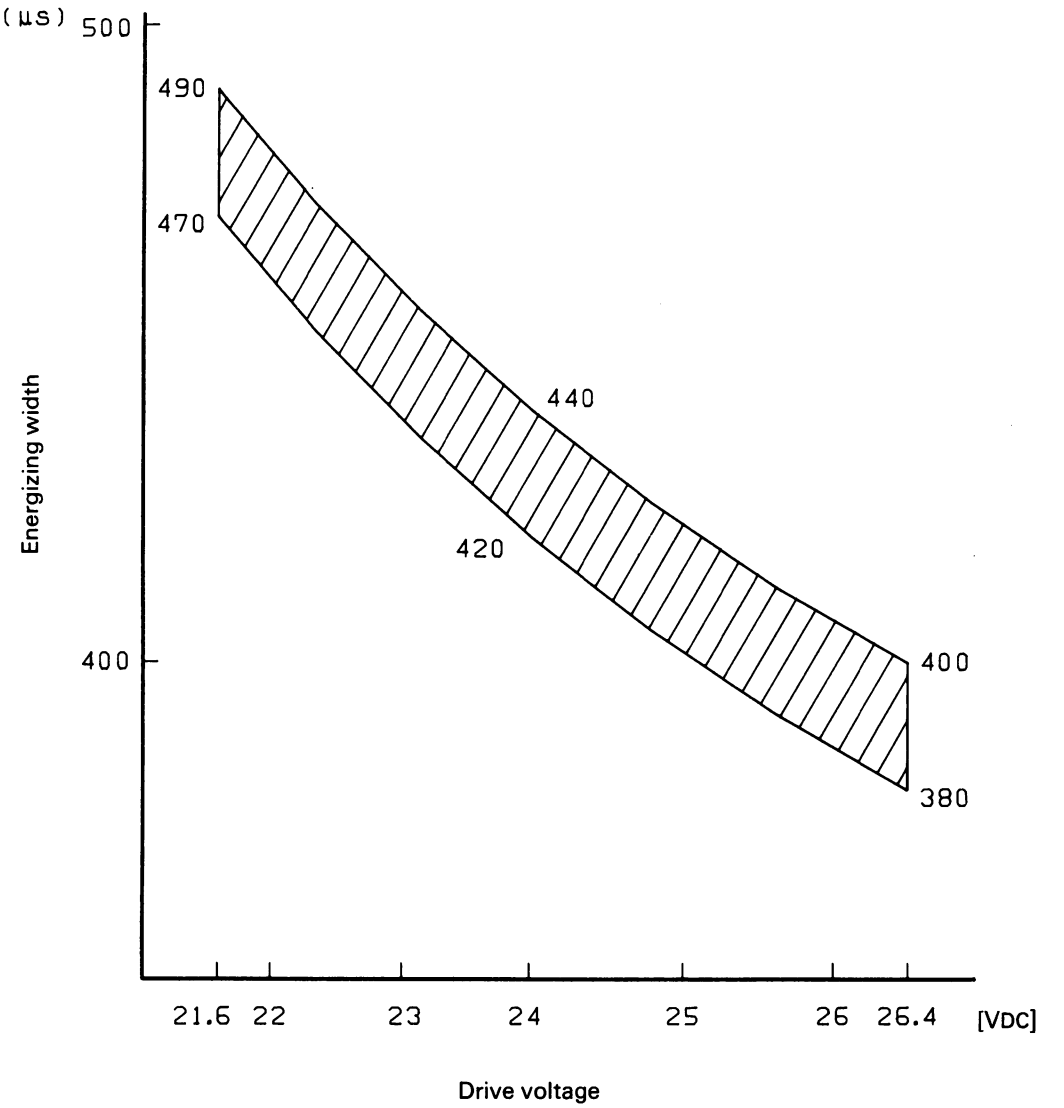


Fig. 2-28. Relationship between Head Driver Voltage and Energizing Pulse Width

2.5 PRINTER MECHANISM OPERATION

The printer mechanism (Fig. 2-29) comprises the HOME POSITION (HP), PTS, and PAPER END (PE) sensors, the carriage components, the platen assembly, the printhead, and the ribbon drive mechanism.

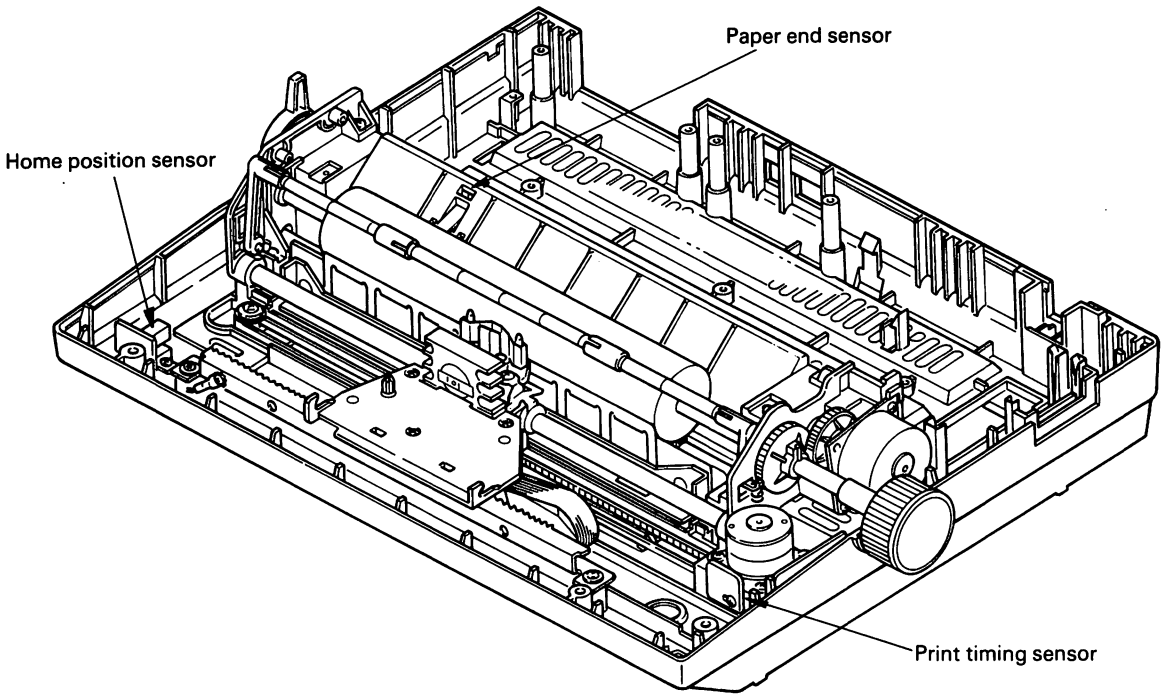


Fig. 2-29. Printer Mechanism

2.5.1 Sensors (Fig. 2-30)

The home position (HP) sensor determines the left margin reference for print timing. The HP sensor assembly is composed of a stationary sensor at the lower left of the mechanism and a sensor flag located on the lower left of the carriage. The output signal goes high when the flag intercepts the optical axis of the photosensor.

The print timing signal (PTS) sensor outputs timing signals in relation to carriage motor rotation speed. The PTS sensor is composed of a slotted disk, mounted on the motor shaft, and a sensor plate. The output signal goes low when the slot of the sensor disk passes the optical axis of the photosensor.

The paper end (PE) sensor outputs a signal when the printer is out of paper. The PE assembly consists of a lever on the paper guide and a microswitch; when no paper is present at the sensor, a continuity signal is ouput.

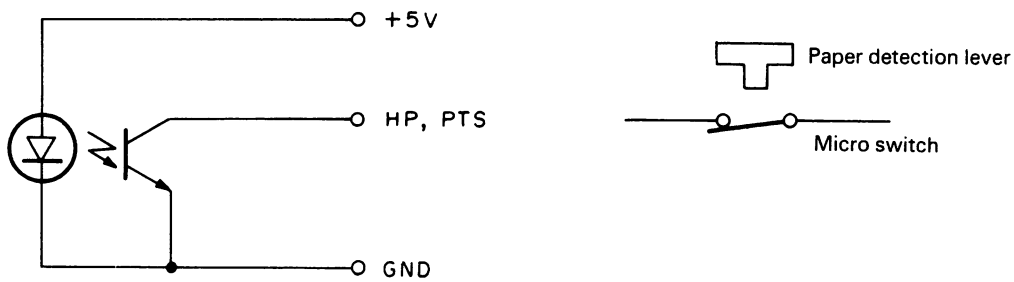


Fig. 2-30. Sensor Operation

2.5.2 Carriage Mechanism (Fig. 2-31)

The carriage is moved bidirectionally by the timing belt, driven via the driving pulley and the carriage motor. The components of the mechanism are shown below.

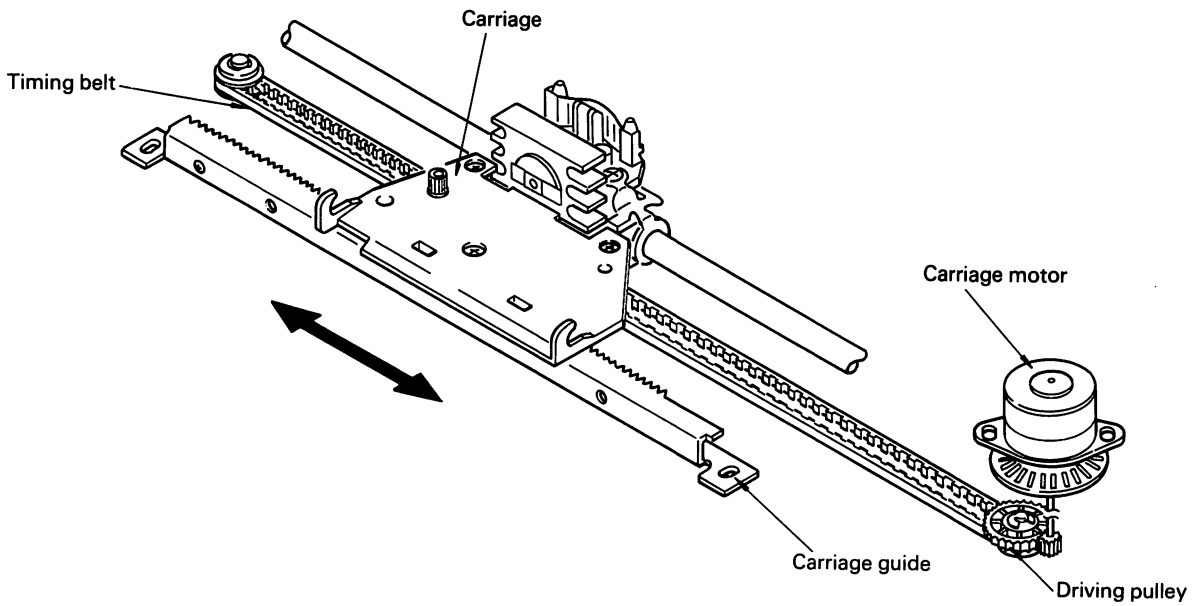


Fig. 2-31. Carriage Mechanism

2.5.3 Paper Feed Mechanism (Figs. 2-32 and 2-33)

A friction platen is standard on the MPS-1000; to use tractor feed paper, a detachable sprocket assembly is available. Each of these assemblies operates in normal and high speed modes.

When using the friction platen (Fig. 2-32), paper is placed between the platen, paper feed rollers, and the paper support roller. As the platen motor operates, the transmission gears rotate in the direction indicated in the figure; paper is pressed against the platen by the rollers and advanced according to motor control. The release lever frees the paper from the platen.

When the sprocket assembly is installed above the platen (Fig. 2-33), the sprocket gear interconnects with the motor transmission gear assembly and the sprocket tractors are advanced accordingly. The paper support roller provides slight tension during paper feed, and the release lever should be in the open position.

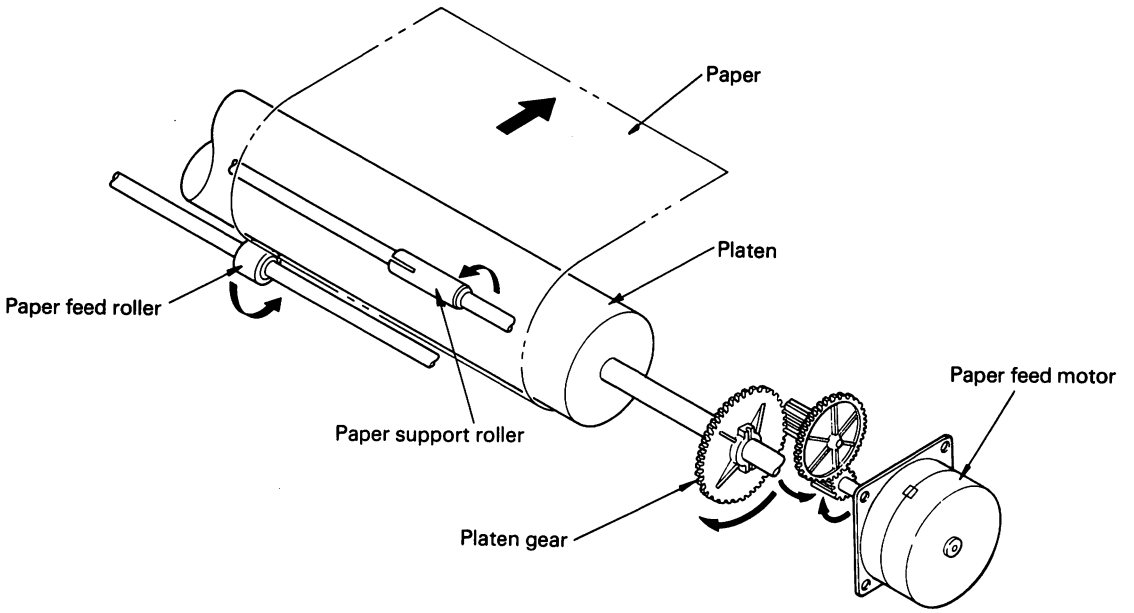


Fig. 2-32. Friction Feed Mechanism

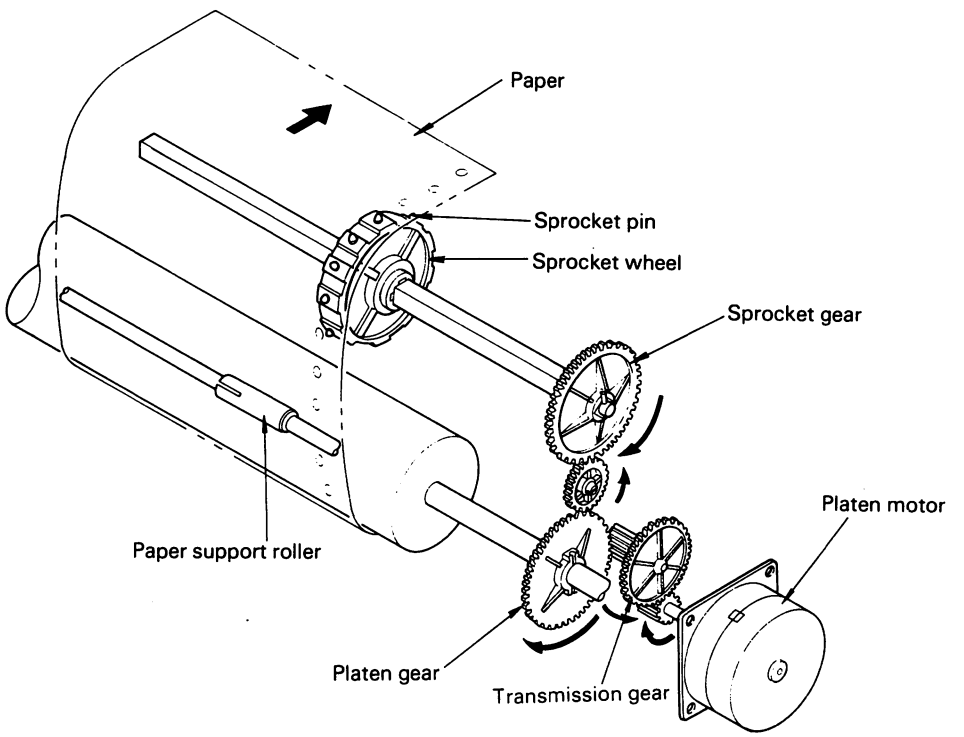


Fig. 2-33. Sprocket Feed Mechanism

2.5.4 Printhead (Fig. 2-34)

When current flows to a drive coil, the electromagnent within the printhead causes the printhead pin to fire and the wire strikes the ribbon; following energization, the actuator plate returns to its original position and the wire is held in a wait state.

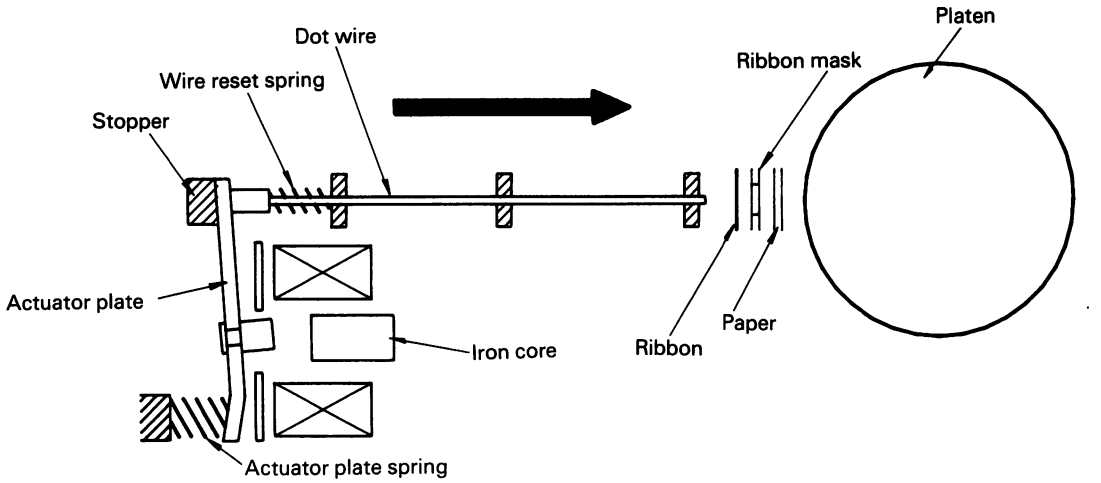


Fig. 2-34. Printhead Firing

2.5.5 Ribbon Drive Mechanism (Fig. 2-35)

The components for ribbon drive are included in the drive gear assembly on the carriage and within the ribbon cartridge (Fig. 2-35). The gear configuration provides for counterclockwise revolution of the ribbon drive gear and unidirectional ribbon movement. The ribbon braking spring improves spring tension.

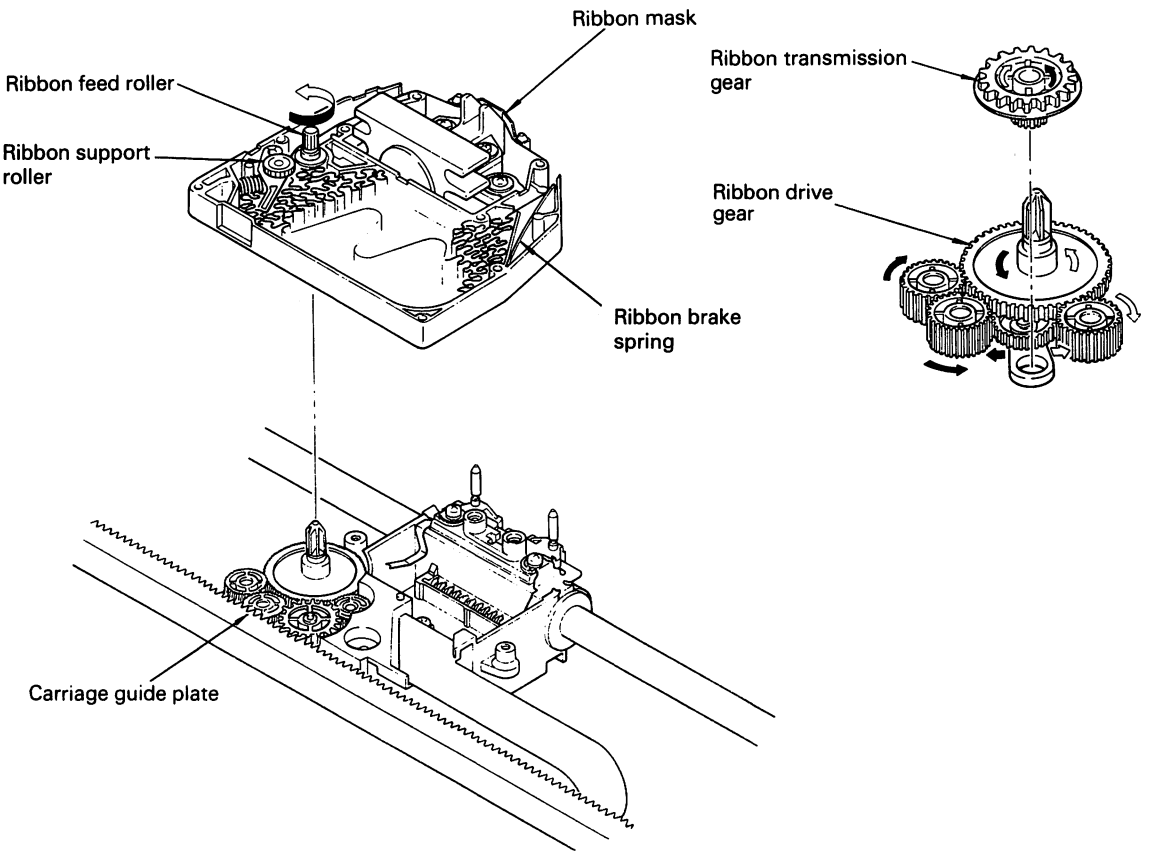


Fig. 2-35. Ribbon Drive Mechanism

CHAPTER 3
OPTIONAL EQUIPMENT

Intentionally omitted at this time.

CHAPTER 4
DISASSEMBLY, ASSEMBLY, AND ADJUSTMENT

LIST OF FIGURES

LIST OF TABLES

4.1 GENERAL REPAIR INFORMATION

This chapter describes how to remove the MPS-1000 main components for maintenance or repair. The tools and measuring instruments listed in Tables 4-1 and 4-2 are recommended for use when disassembling and/or repairing the printers.

Table 4-1. Repair Tools

Tool	Type	Part No.	Vendor Part No.
Brush #1	○	601162-28	B741400200
Brush #2	○	601162-29	B741400100
Cleaning brush	○	601162-30	B741600100
Round nose pliers	○	601162-31	B740400100
Tweezers	○	601162-32	B741000100
Electric soldering iron	○	601162-33	B740200100
E-ring holder 3	○	601162-34	B740800500
E-ring holder 5	○	601162-35	B740800700
Phillips Screwdriver No. 1	○	601162-36	B743800100
Phillips Screwdriver No. 2	○	601162-37	B743800200
Thickness gauge (0.65 mm)	Ⓔ	601162-38	B776700601
Tension gauge (2000 g)	○	601162-39	B747700100
Box screwdriver (7 mm wide)	○	601162-40	B741700200

○ = Commercially available
Ⓔ = EPSON exclusive tool

Table 4-2. Measuring Instruments

Name	Description	Class
Oscilloscope	50 MHz	A
Tester		A
Multimeter		B
Logic analyzer		B

A = Mandatory
B = Recommended

4.2 DISASSEMBLY AND ASSEMBLY

The section describes removal of the main subassemblies of the printer. Component replacement is accomplished by reversing the removal procedure, noting any reassembly comments at the end of each section.

4.2.1 Upper Case Removal (Fig. 4-1)

1. Remove paper from the printer.
2. Remove the platen knob.
3. Remove two screws ① from the upper case.
4. Lift the front edge of the case and move it backward until the control panel is exposed.
5. Remove the control panel ③ from the upper case ②, then remove the upper case. (To remove the control panel, depress the hook in the direction shown by the arrow).

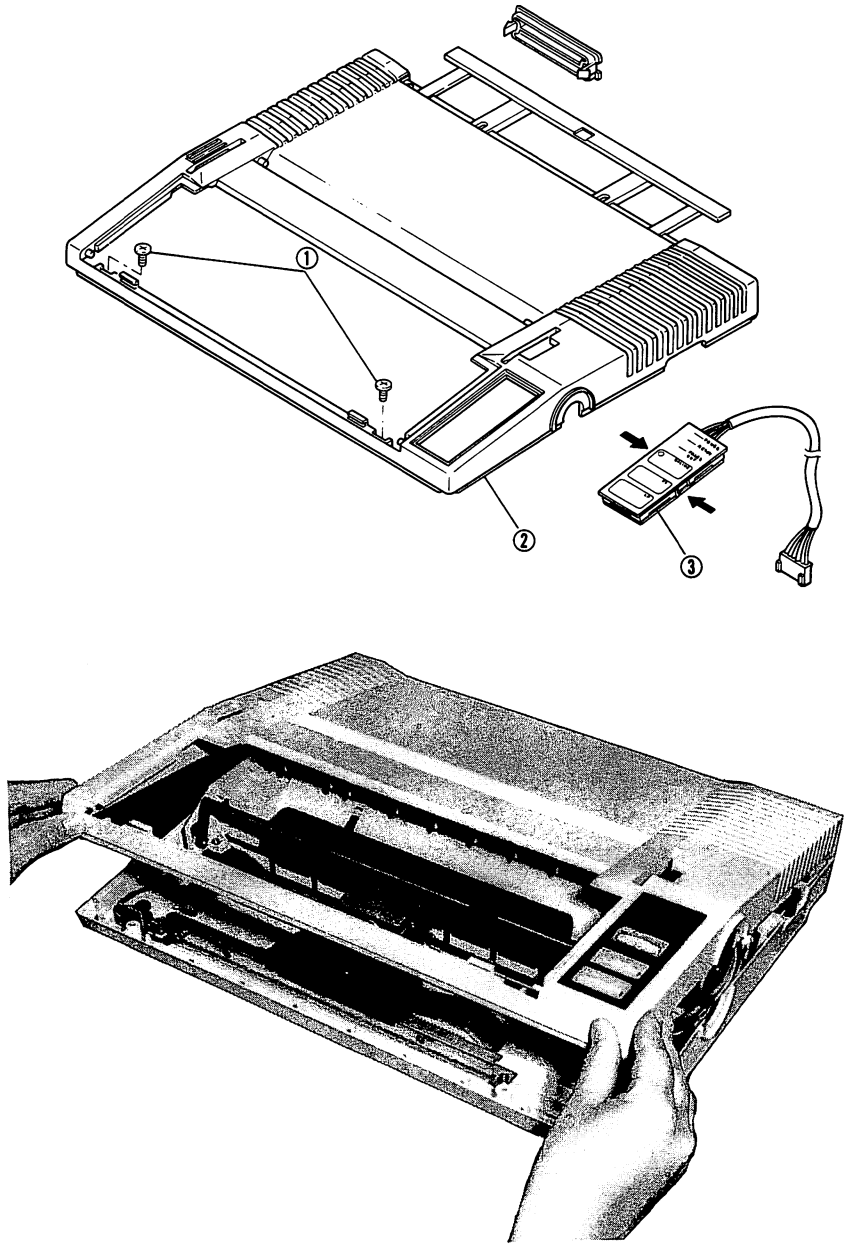


Fig. 4-1. Upper Case Removal

4.2.2 COMI Board Removal (Fig. 4-2)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Remove three screws ①, securing the COMI board.
3. Remove the screw ②, securing the Frame ground.
4. Lift the COMI Board to disconnect it from connectors CN3 and CN10.

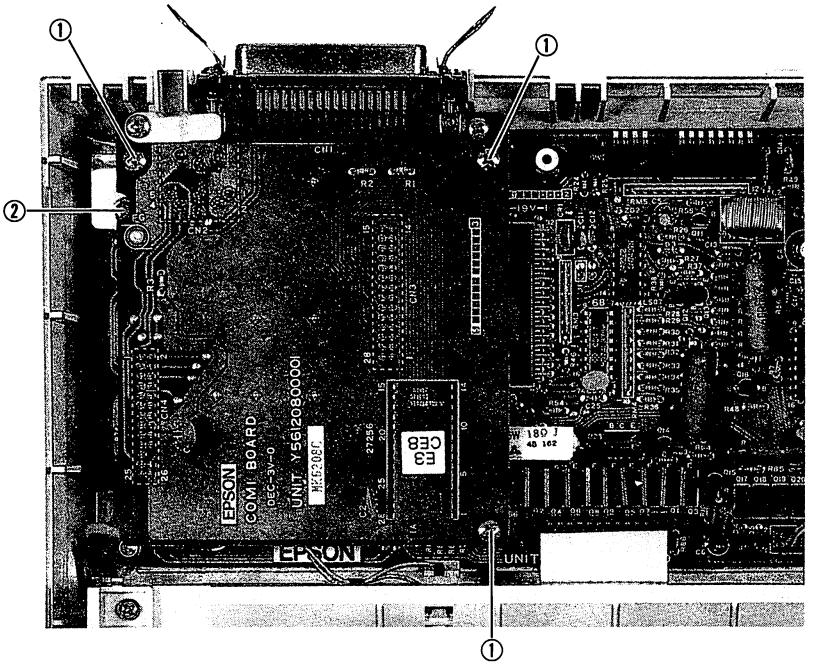


Fig. 4-2. COMI Board Removal

4.2.3 CATX Circuit Board Remove (Fig. 4-3)

1. Disconnect the power cord.
2. Remove the upper case. (Refer to Section 4.2.1)
3. Remove the COMI board. (Refer to Section 4.2.2)
4. Disconnect connectors CN6, CN2, CN4, CN7, CN8, and CN5 from the CATX circuit board.
5. Release the five clamps ① on the lower case and carefully remove the CATX circuit board.

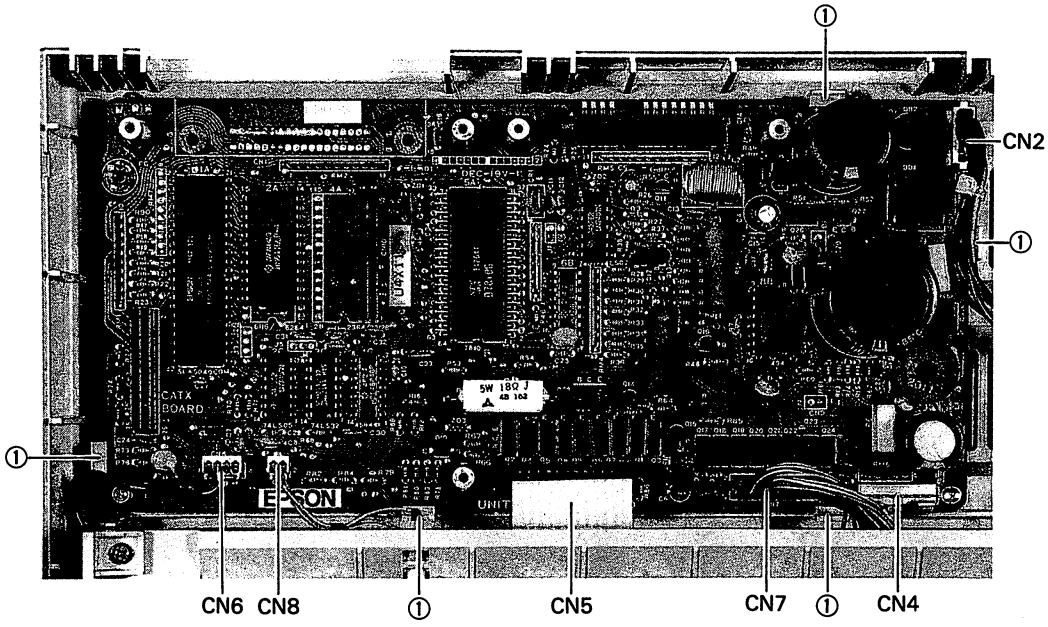


Fig. 4-3. CATX Circuit Board Removal

WARNING

When reinstalling the CATX board, verify that no connector wires are caught beneath it.

4.2.4 Power Transformer Removal (Fig. 4-4)

1. Turn the power switch OFF, unplug the power cord from the power source, and disconnect the printer from any peripheral device.
2. Remove the upper case. (Refer to 4.2.1)
3. Disconnect connector CN2 from the CATX circuit board.
4. Disconnect connector CN1 from the filter circuit board.
5. Remove two screws ① securing the power transformer ②, and carefully remove the transformer. (The transformer auxiliary board may be removed at the same time).

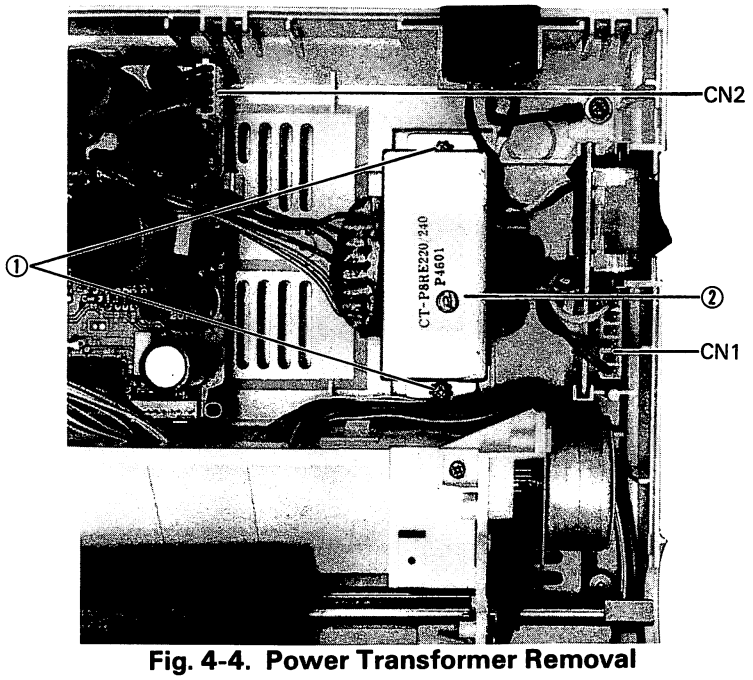


Fig. 4-4. Power Transformer Removal

4.2.5 Filter Circuit Board Removal (Fig. 4-5)

1. Turn the power switch OFF, unplug the power cord from the power source, and disconnect the printer from any peripheral devices.
2. Remove the upper case. (Refer to Section 4.2.1)
3. Disconnect connector CN1 from the filter circuit board.
4. Remove screw ①, which secures the A.C. ground wire.
5. Remove the clamp ② from the lower case which securies the filter circuit board ③, and carefully remove the board.

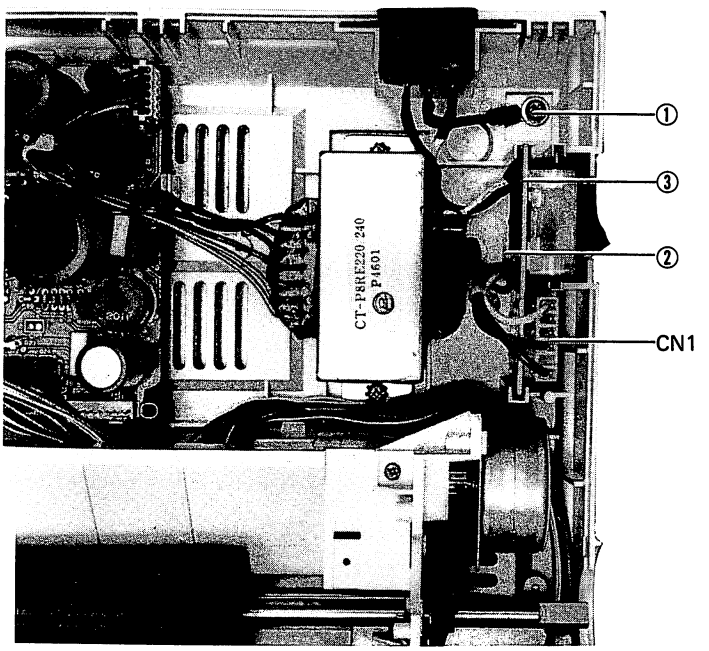


Fig. 4-5. Filter Circuit Board Removal

4.2.6 Printhead Removal (Fig. 4-6)

1. Remove the printer cover.
2. Remove screws ① from the printhead unit.
3. Lift the printhead ② straight up to remove.

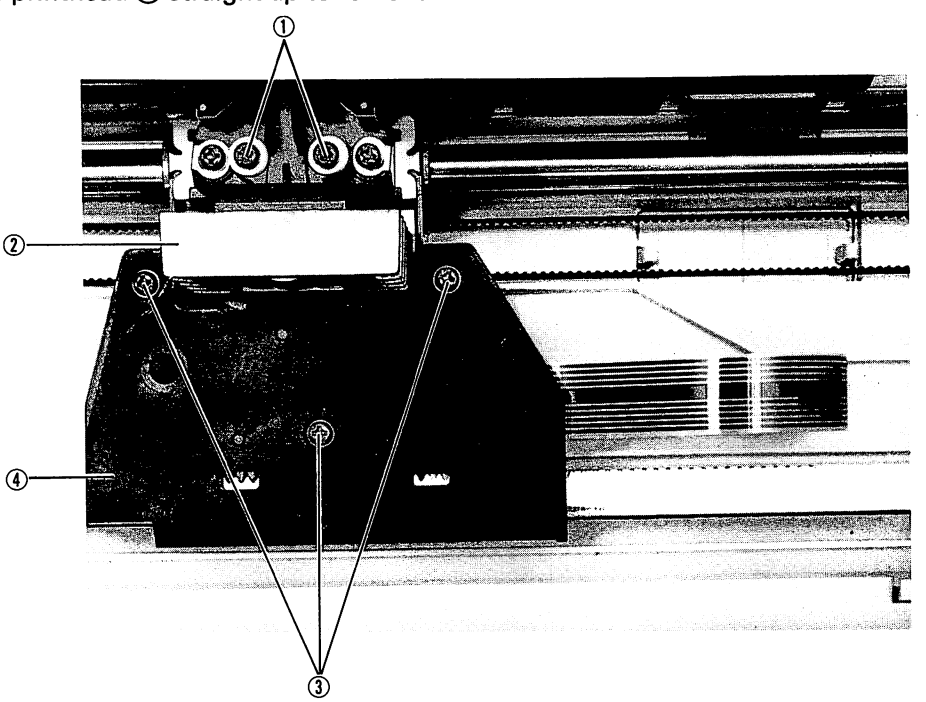


Fig. 4-6. Printhead and Head Cable Removal

4.2.7 Head Cable Removal (Figs. 4-6 and 4-7)

1. Remove the printer cover.
2. Remove the printhead. (Refer to Section 4.2.6)
3. Remove three screws ③ from the cartridge base and remove the base ④. (Refer to Fig. 4-6)
4. Remove screws ② from head cable ①.
5. Remove connector ③ of the head cable toward the front of the printer. Remove from dowel ④ of the carriage and lift.
6. Hold the plastic tabs on the head cable (marked with arrows) and pull to remove the cable from connector ⑤.

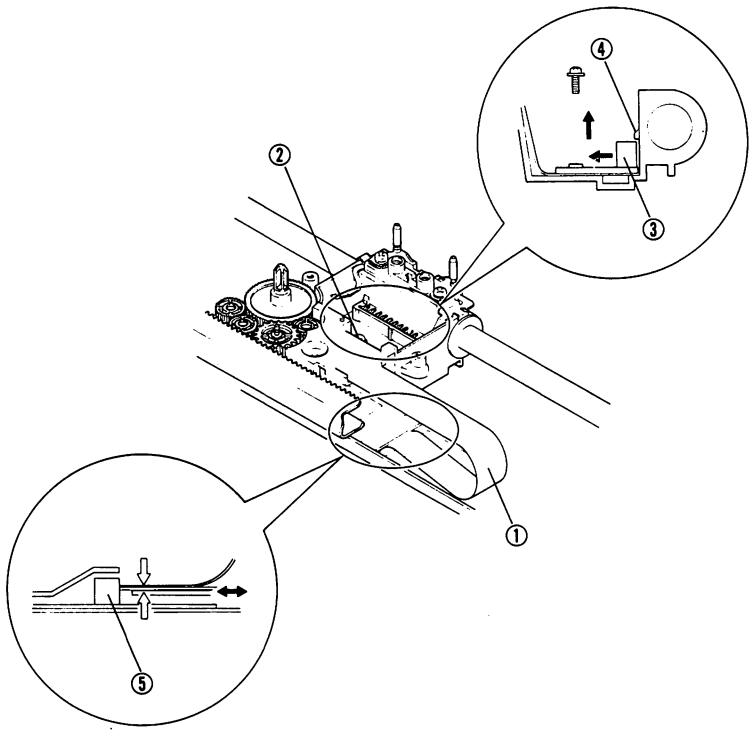


Fig. 4-7. Head Cable Removal

4.2.8 Home Position Sensor Removal (Fig. 4-8)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Remove the COMI board. (Refer to Section 4.2.2)
3. Remove connector CN6 from the CATX circuit board.
4. Remove screw ① from HP sensor ② and carefully remove the sensor.

4.2.9 Paper End Sensor Removal (Fig. 4-8)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Remove the COMI board. (Refer to Section 4.2.2)
3. Remove the CATX circuit board. (Refer to Section 4.2.3)
4. Disconnect connector CN8 from the CATX circuit board.
5. Release hooks ③ from the PE sensor unit ④ and carefully remove the sensor.

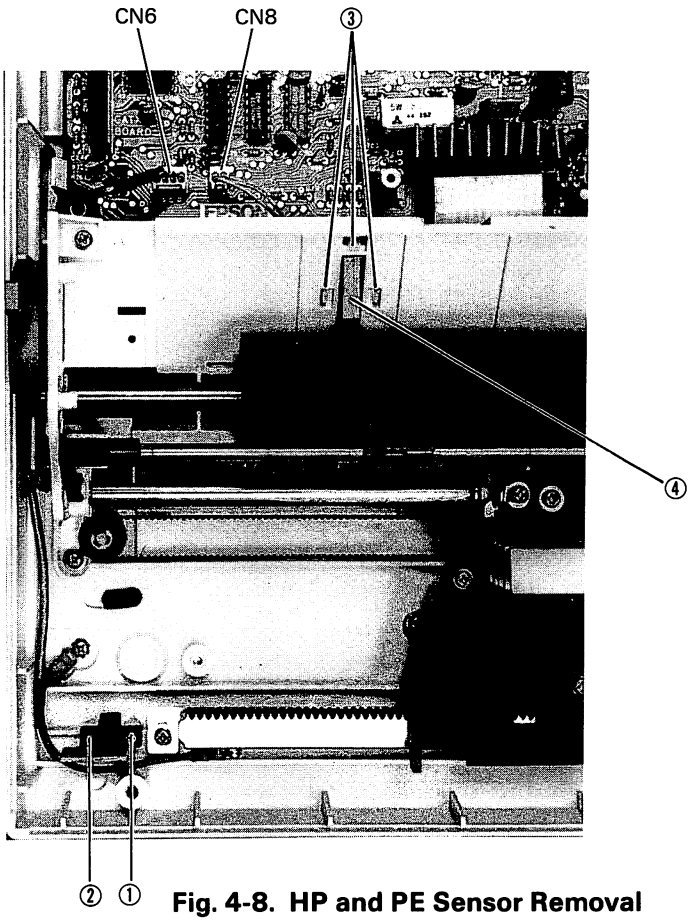


Fig. 4-8. HP and PE Sensor Removal

4.2.10 PTS Sensor Removal (Fig. 4-9)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Cut wire band ① from the lead wires of the PTS sensor.
3. Disconnect connector CN7 from the CATX circuit board and remove the connectors for the PTS sensor.
4. Release screw ② from PTS sensor ③ and carefully remove the sensor.

NOTE: Following reassembly refer to section 4.3.4 and adjust the PTS sensor.

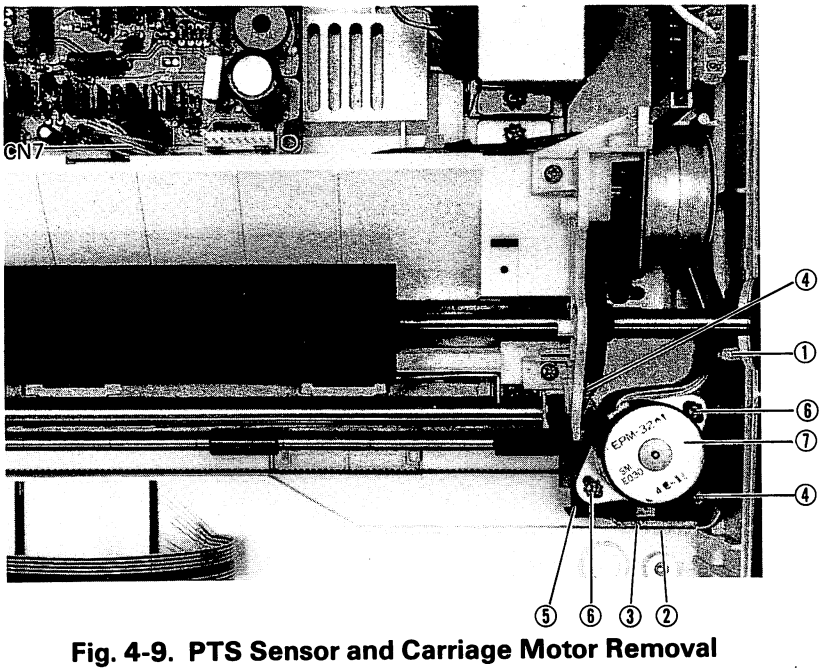


Fig. 4-9. PTS Sensor and Carriage Motor Removal

4.2.11 Carriage Motor Removal (Fig. 4-9)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Cut wire band ① from the lead wires of the carriage motor.
3. Disconnect connector CN7 from the CATX circuit board, and remove the connectors for the carriage motor.
4. Remove screws ④ from the carriage motor heat sink ⑤ and remove the heat sink.
5. Remove screws ⑥ from the carriage motor ⑦, then carefully remove the motor.

NOTE: When mounting the carriage motor, the PTS sensor position must be adjusted (Section 4.3.4) and the backlash between the carriage motor and the belt driven pulley must also be set (Section 4.3.2).

4.2.12 Paper Feed Motor Removal (Figs. 4-10 and 4-11)

1. Removal the upper case. (Refer to Section 4.2.1)
2. Loosen the four fixing screws ① securing the left ② and right ③ side frames.
3. Lift the side frames to remove.
4. Disconnect connector CN7 from the CATX circuit board and remove the connectors for the paper feed motor.
5. Remove screws ④, which secure the paper feed motor ⑤, and carefully remove the motor. (Refer to Fig. 4-11)
6. To disassemble the side frames/support roller, refer to Fig. 4-11.

NOTE: When the side frames and the paper feed motor are reassembled, verify that the operation of the release lever is smooth, and adjust the backlash between the motor and the transmission gear. (Refer to Section 4.3.1)

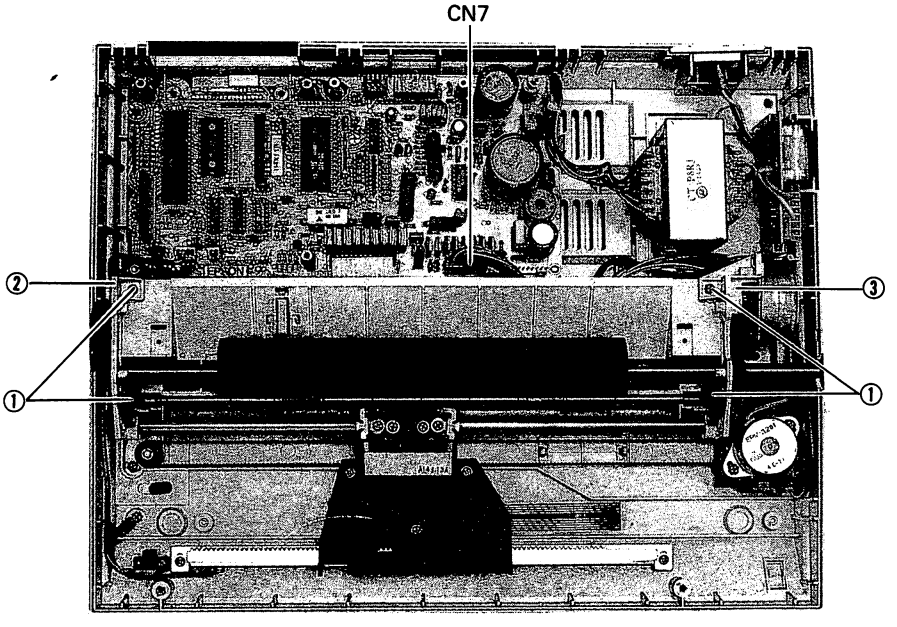


Fig. 4-10. Paper Feed Motor Removal

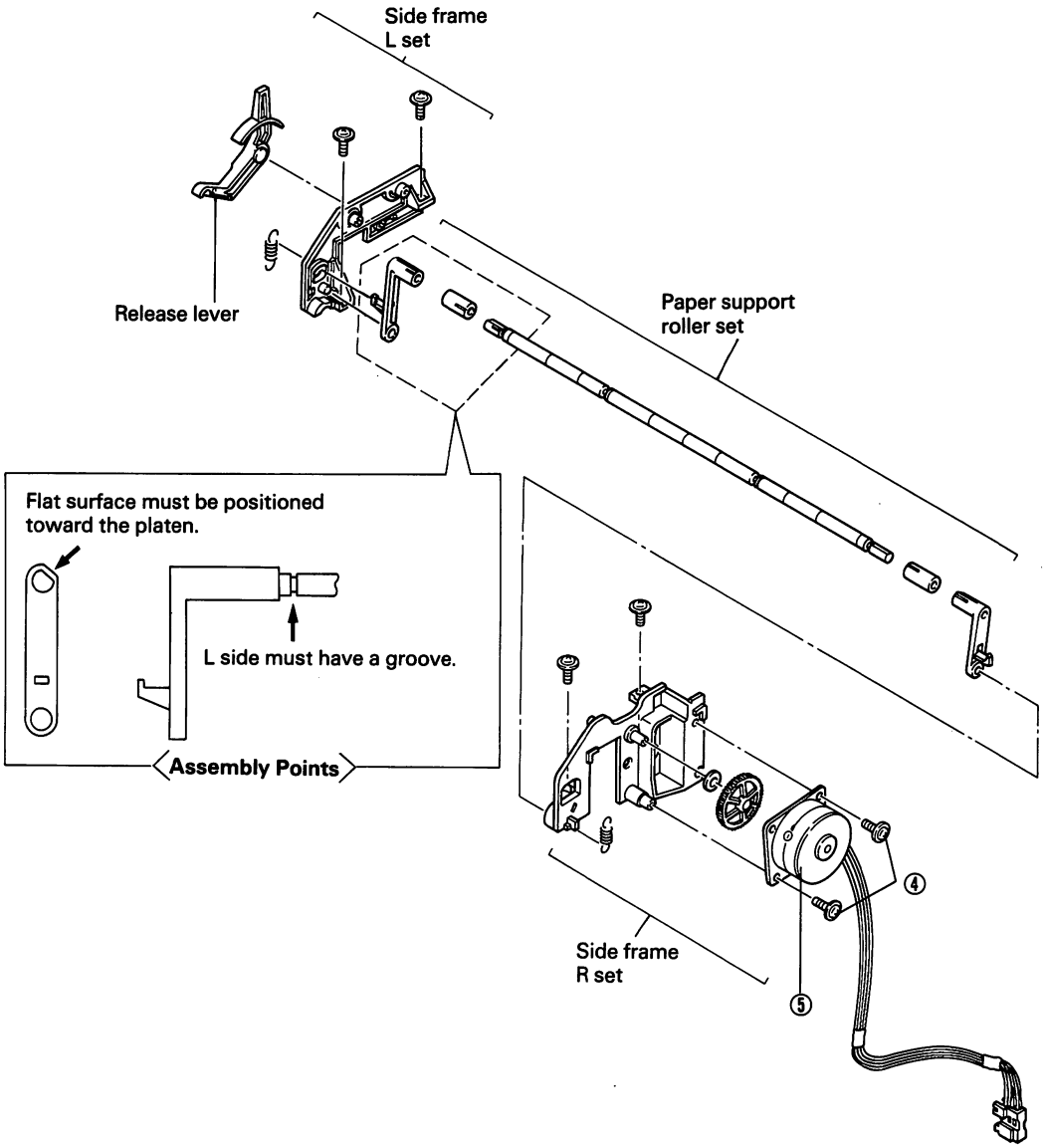


Fig. 4-11. Side Frame and Paper Support Roller Disassembly

4.2.13 Paper Feed Mechanism Removal (Figs. 4-12 and 4-13)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Remove the side frames and paper support roller set. (Refer to Section 4.2.12)
3. Lift the platen unit.
4. Remove eight hooks ① from the back of the unit.
5. Lift the four paper feed roller spring guides ② straight up to remove.
6. Slide the paper feed roller shaft ③ in the direction of the arrow to remove. (The paper feed roller ④ and paper feed roller springs ⑤ may be removed at the same time).

NOTE: When mounting the platen unit, the printhead gap must be properly adjusted. (Refer to Section 4.3.6)

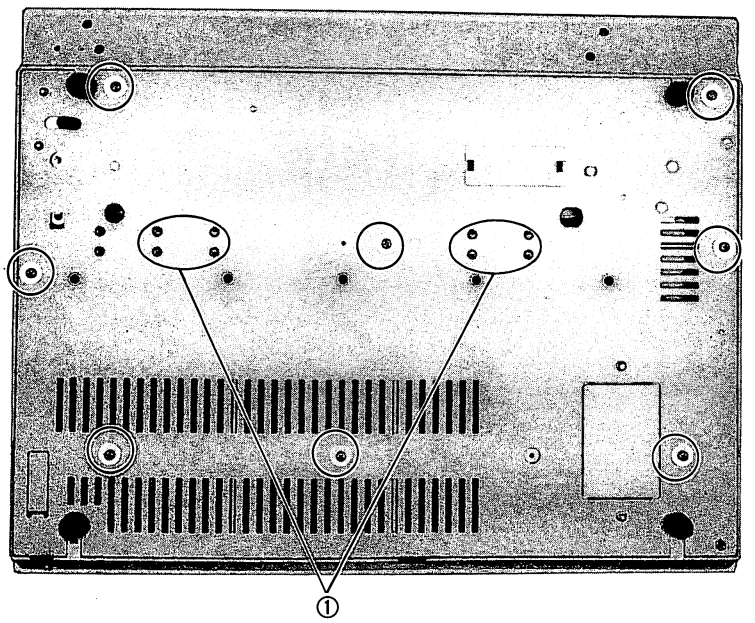


Fig. 4-12. Position of Hooks

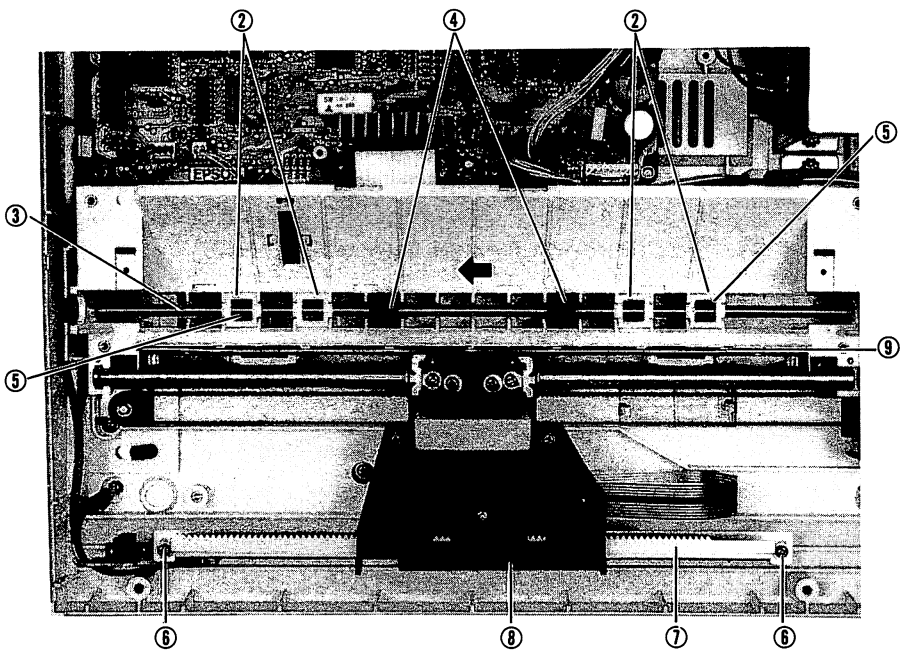


Fig. 4-13. Paper Feed Mechanism Removal

4.2.14 Paper Guide Auxiliary Plate Removal (Fig. 4-13)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Remove the side frames and paper support roller set. (Refer to Section 4.2.12)
3. Remove the timing belt from the carriage (Refer to Section 4.2.15)
4. Remove two screws ⑥ from the carriage guide plate. Remove the carriage guide shaft ⑦ and the carriage unit ⑧.
5. Remove the paper guide auxiliary plate ⑨.

NOTE: When mounting the paper guide auxiliary plate, the position of the carriage guide plate must be properly adjusted (Section 4.3.5) and the printhead gap must be set (Section 4.3.6).

4.2.15 Timing Belt Removal (Fig. 4-14)

1. Remove the upper case. (Refer to Section 4.2.1)
2. Remove two screws ① to remove carriage motor heat sink ②.
3. Remove the bottom cap ③ from the rear side of the unit.
4. Place the carriage unit in the holes of the removed bottom cap, and remove timing belt ⑤ from carriage unit ④.
5. Loosen screws ⑥ on the belt tension plate and remove the timing belt.

NOTE: When assembling the timing belt, the tension must be properly adjusted (Section 4.3.3) and the backlash between the carriage motor and the belt driven pulley must be set (Section 4.3.2).

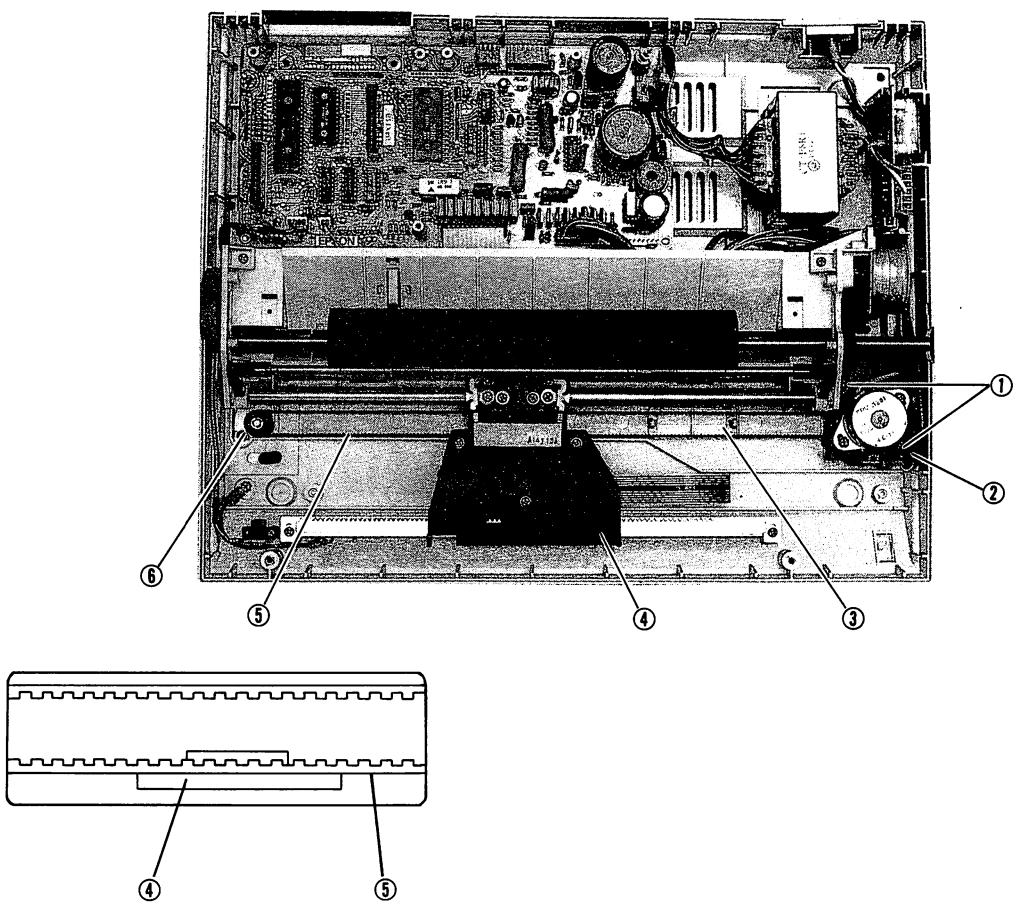


Fig. 4-14. Timing Belt Removal

4.2.16 Printer Circuit Board Removal (Fig. 4-15 and 4-16)

1. Remove the eight screws which secure the base plate from the rear side of the unit. (Refer to Fig. 4-12)
2. Remove the upper case. (Refer to Section 4.2.1)
3. Remove the timing belt from the drive gear. (Refer to Section 4.2.15)
4. Remove screw ① from the lead wires on the carriage guide plate.
5. Remove head cable ② from the connector.
6. Remove the side frames and paper support roller set. (Refer to Section 4.2.12)
7. Remove the two fixing screws ③ to remove the carriage guide plate.
8. Remove the carriage guide shaft ④.
9. Remove screws ⑤ to remove the carriage guide shaft holder.
10. Remove screws ⑥ to remove the PF motor holder.
11. Remove screws ⑦ to remove the power transformer.
12. Remove the COMI board. (Refer to Section 4.2.2)
13. Remove the CATX circuit board.
14. Remove cable CN5 from the CATX circuit board.
15. Lift the lower case to remove it from the base plate.
16. Remove screw ⑨ to remove printer circuit board plate ⑩. The belt tension plate ⑪ may be removed at the same time (Figure 4-16).

WARNING

When assembling the printer circuit board set, be sure no cables are caught beneath the base plate when it is inserted into the lower case, or beneath the CATX circuit board when it is installed.

NOTE: The timing belt must be properly adjusted after reassembly (Section 4.3.3), the backlash between the carriage motor and the belt driven pulley must be set (Section 4.3.2), the position of the carriage guide plate must be verified (Section 4.3.5), and the printhead gap must be properly adjusted (Section 4.3.6).

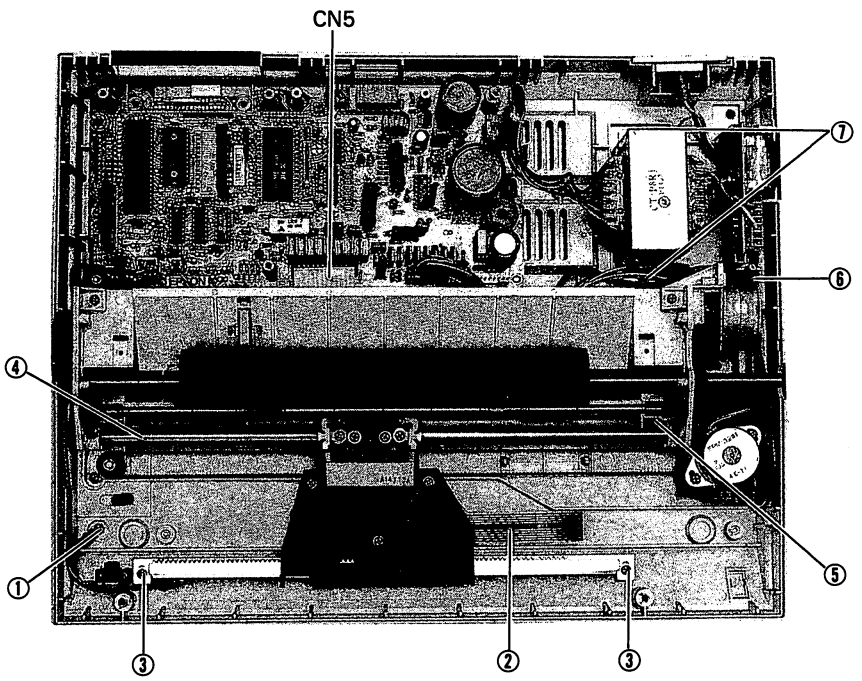


Fig. 4-15. Printer Circuit Board Removal

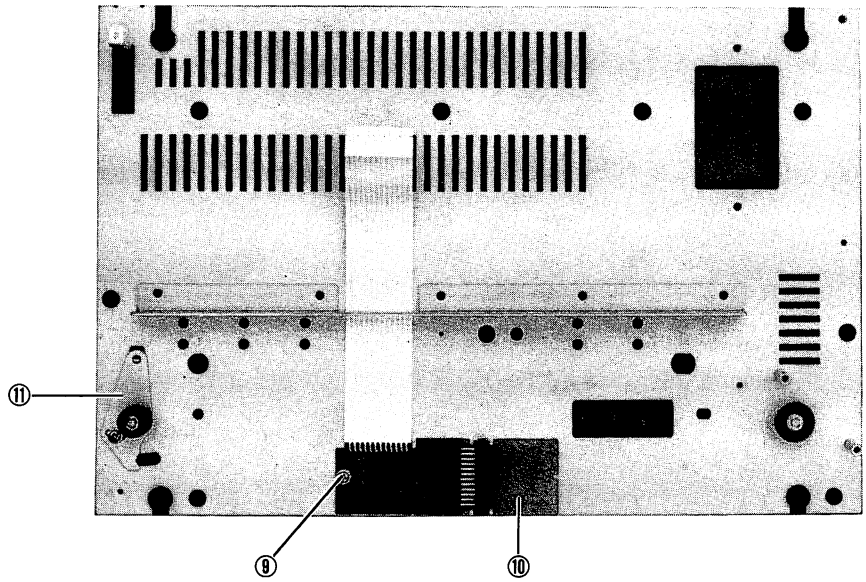


Fig. 4-16. Belt Tension Plate Removal

4.2.17 Sprocket Unit Removal (Figs. 4-17 through 4-21)

1. Depress the sprocket mounting levers, roll the sprocket assembly back, then slide the unit forward to remove it from the printer.
2. Remove the side covers ① from the left and right sides of the sprocket assembly.
3. Remove the four nuts ② from the left and right sides.
4. Remove the E-ring ③ from the left side, and remove the bearing ④.
5. Remove the left side plate ⑤.
6. Remove the sproket guide shaft ⑥.
7. Remove the sproket L set ⑦, the paper guide roller ⑧, the sproket R set ⑨, and the right side plate ⑩.
8. Remove the pin ⑪, and the pinion ⑫.
9. Disassemble the L and R sprocket sets (Refer to Fig. 4-20).

NOTE: When the sprocket unit is assembled, position the wheels as shown in Fig. 4-21 and make certain the unit is horizontally aligned.

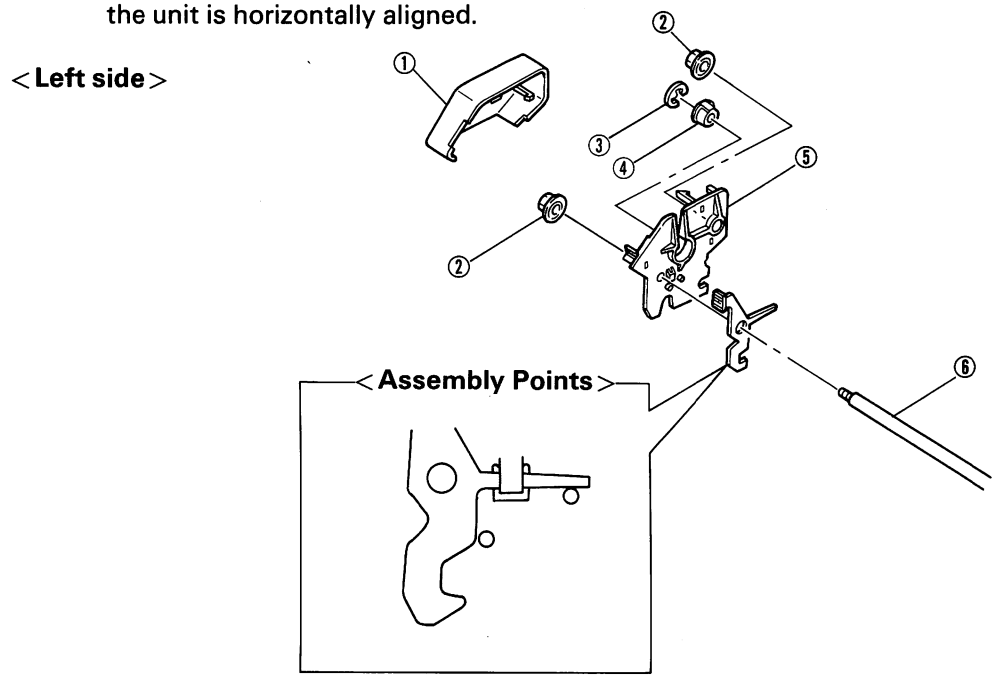


Fig. 4-17 Left Side Plate Removal

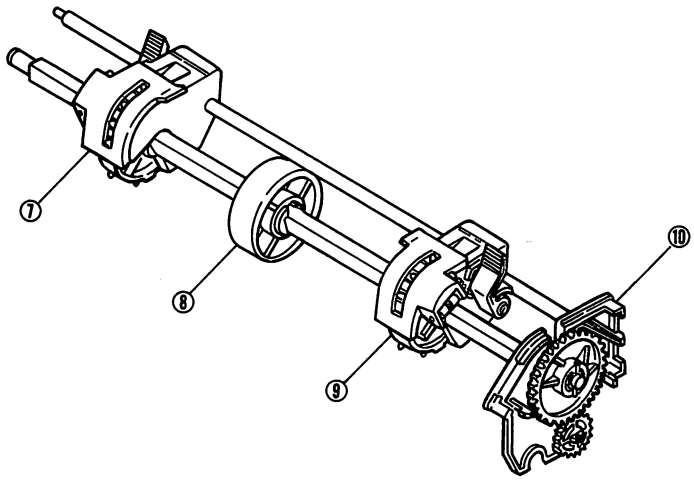


Fig. 4-18. Sprocket Set Removal

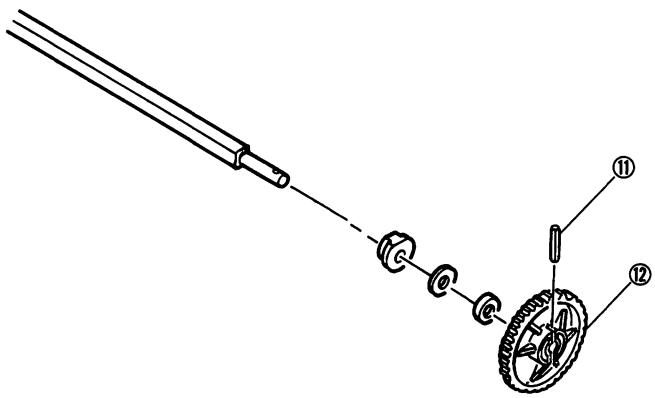


Fig. 4-19. Sprocket Pinion Removal

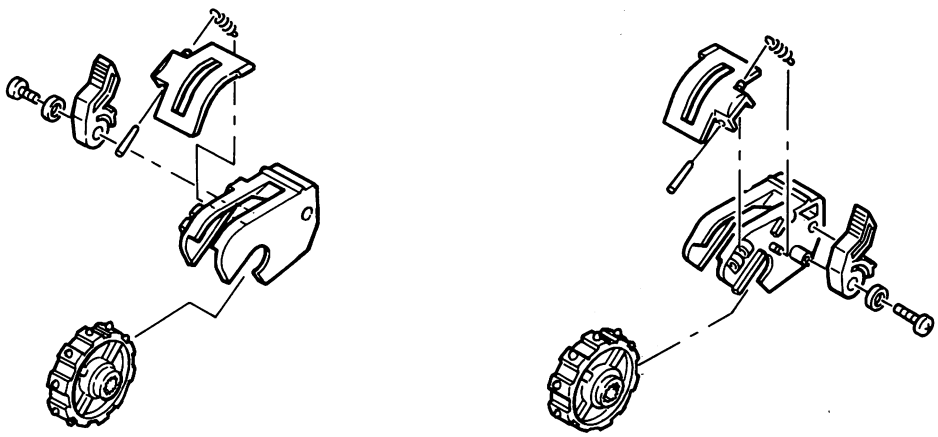


Fig. 4-20. Sprocket Set Disassembly

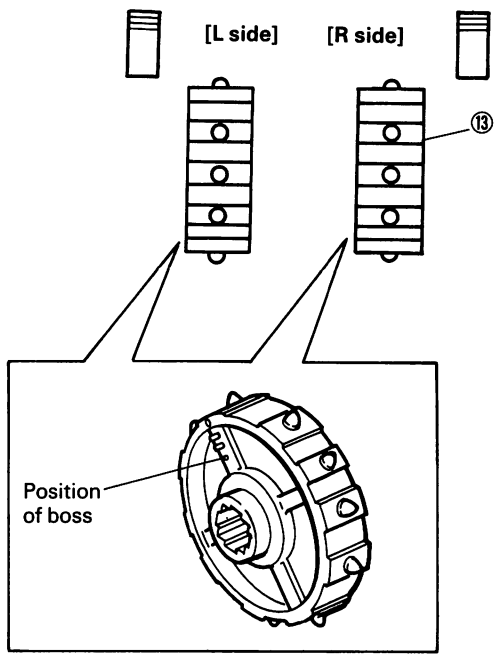


Fig. 4-21. Wheel Positions

4.3 ADJUSTMENT

When the paper feed motor or carriage motor, timing belt, PTS sensor unit, carriage guide plate, or platen is removed from the printer, reinstallation requires adjustment according to the following procedures.

4.3.1. Paper Feed Motor Backlash Adjustment (Fig. 4-22)

1. Loosen the screws on the paper feed motor and move the motor so that the distance between the paper feed motor shaft gear and the transmission gear is minimized but the gears do not bind.
2. Manually rotate the platen to verify operation of the assembly without slippage or binding.
3. When the adjustment is correct, tighten the screws.

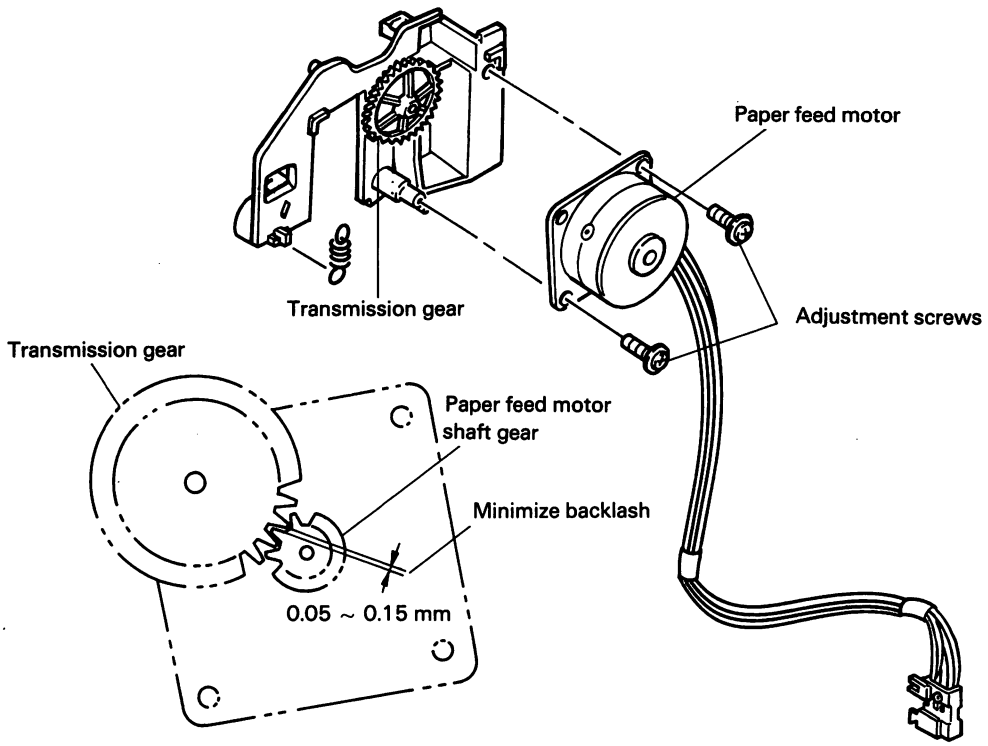


Fig. 4-22. Paper Feed Motor Backlash Adjustment

4.3.2 Carriage Motor Backlash Adjustment (Fig. 4-23)

1. Loosen the screws on the carriage motor heat sink.
2. Move the carriage motor manually to adjust the backlash so there is no slippage or binding when the timing belt is moved manually back and forth.
3. When the adjustment is correct, tighten the screws.

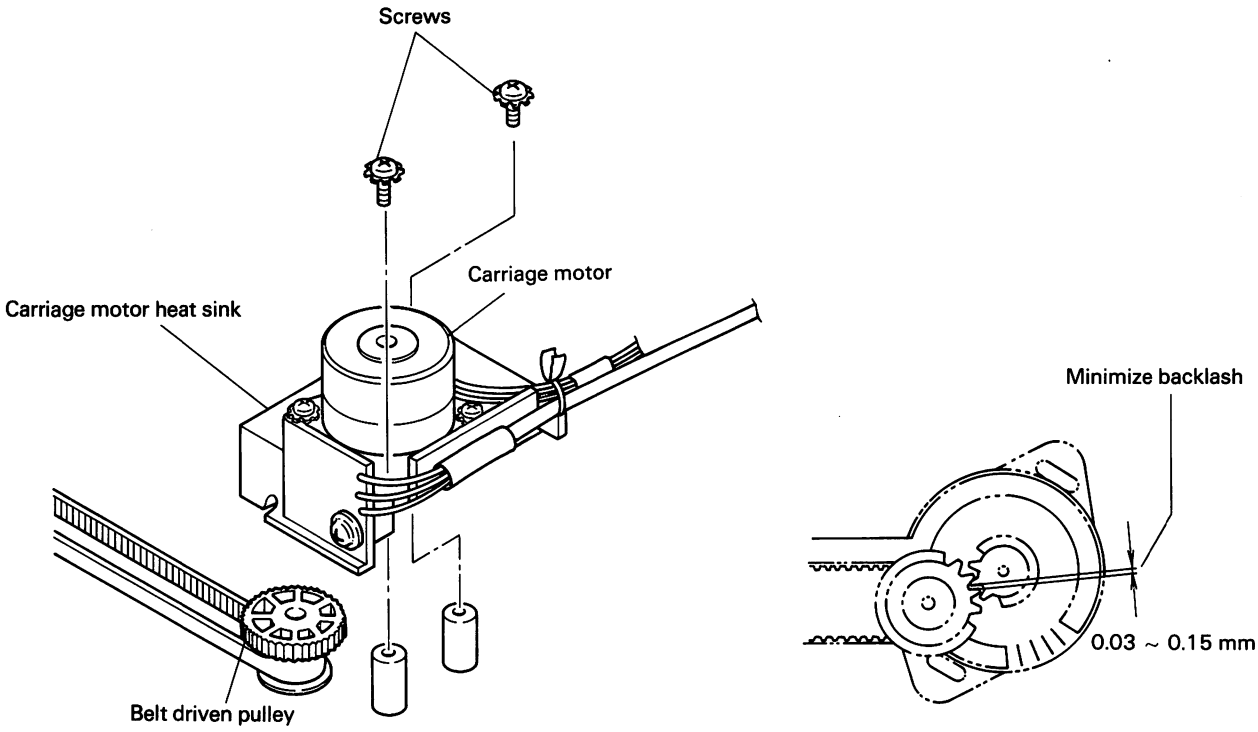


Fig. 4-23. Carriage Motor Backlash Adjustment

4.3.3 Timing Belt Tension Adjustment (Fig. 4-24)

1. Loosen the screw on the belt tension plate.
2. Insert a tension gauge through the side frame and into the hole on the tension plate, then adjust the plate position so that 1500 ±50 gr tension is applied.
3. When the adjustment is correct, tighten the screw.

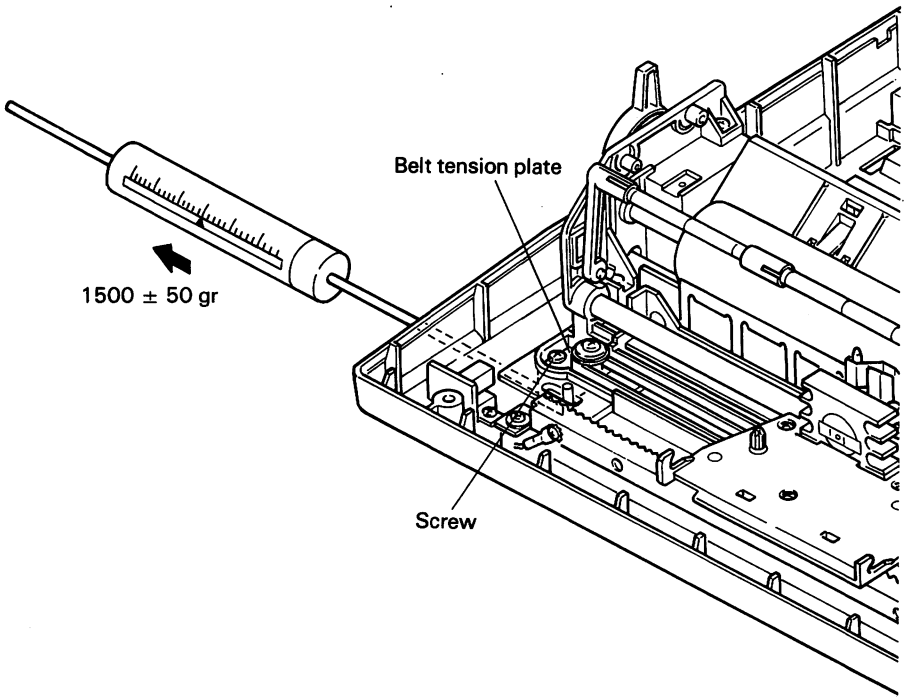


Fig. 4-24. Tension Adjustment of Timing Belt

4.3.4 PTS Sensor Adjustment (Figs. 4-25 and 4-26)

1. Activate the printer and use a synchroscope to verify that the cycle (T) of the PTS signal is approximately the same in both directions.
   If the waveform deviates from the permissible tolerance, perform step 2.
2. Insert a screwdriver through the hole used to secure the front cap (Refer to Fig. 4-26). Loosen the screw securing the PTS sensor set.
3. Move the PTS sensor set in the direction shown by the arrow to perform the necessary adjustment.
4. Tighten the screw.

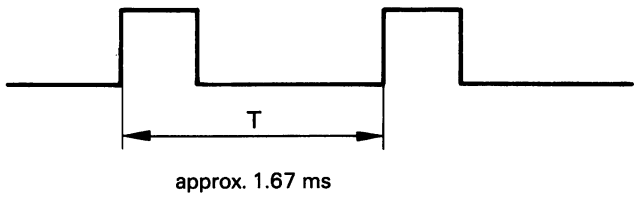


Fig. 4-25. PTS Signal Synchronization

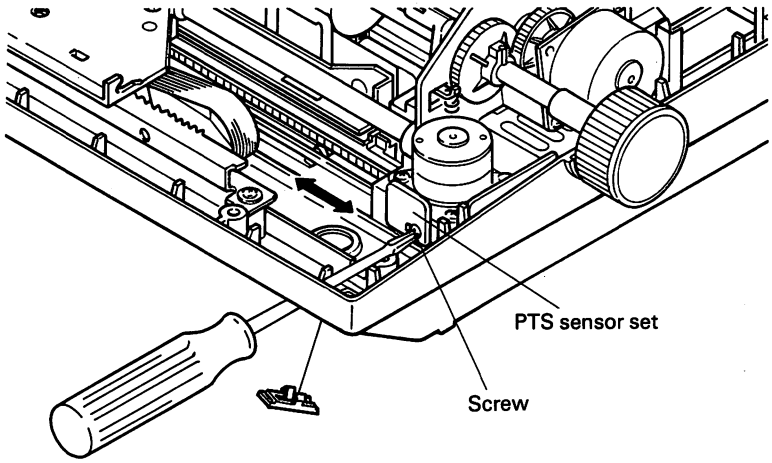


Fig. 4-26. Position Adjustment of PTS Sensor

4.3.5 Carriage Guide Plate Adjustment (Fig. 4-27)

1. Loosen the screw on the carriage guide plate.
2. Move the carriage guide until the tension between the ribbon transmission gear and the guide is maximized without binding. Slide the carriage assembly back and forth to test the adjustment along the length of the platen.
3. When the adjustment is correct, tighten the screws, then verify the adjustment.

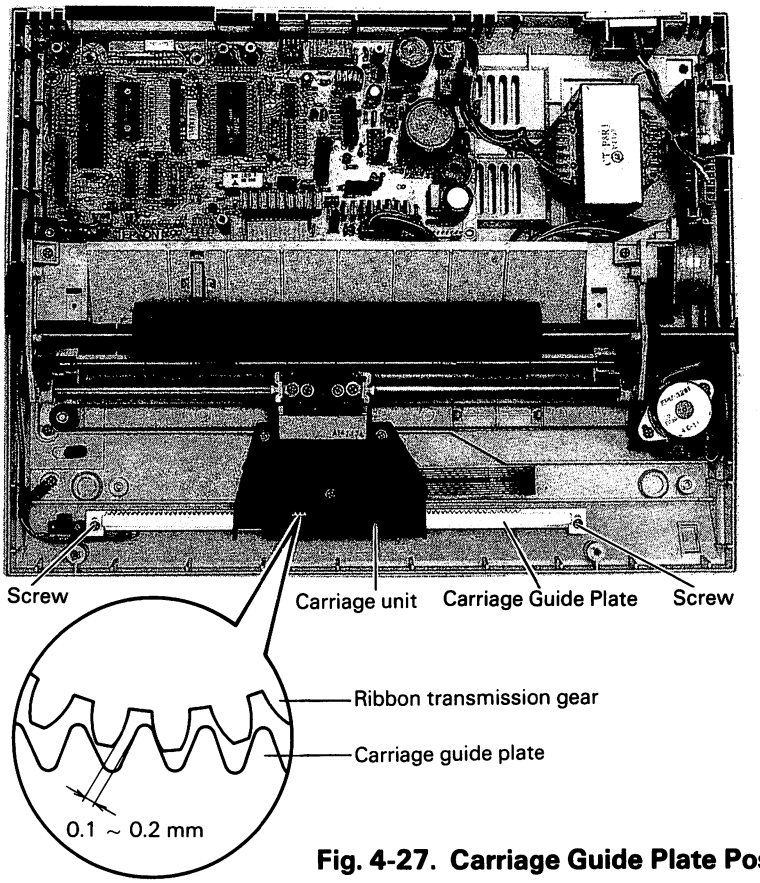


Fig. 4-27. Carriage Guide Plate Position Adjustment

4.3.6 Printhead Gap Adjustment (Figs. 4-28 through 4-30)

1. Remove the ribbon mask (see Fig. 4-28).
2. Loosen the two screws on the ribbon mask guide.
3. Move the carriage to the middle of the platen and use a 0,65 mm feeler gauge to adjust the gap between the ribbon mask guide (and top wire of the printhead) and the platen.
4. When the adjustment is correct, tighten the screws, then verify the adjustment at the center and ends of the carriage.
5. Verify the positions of the head holder and shaft holder according to Fig. 4-30.
6. Install the ribbon mask.

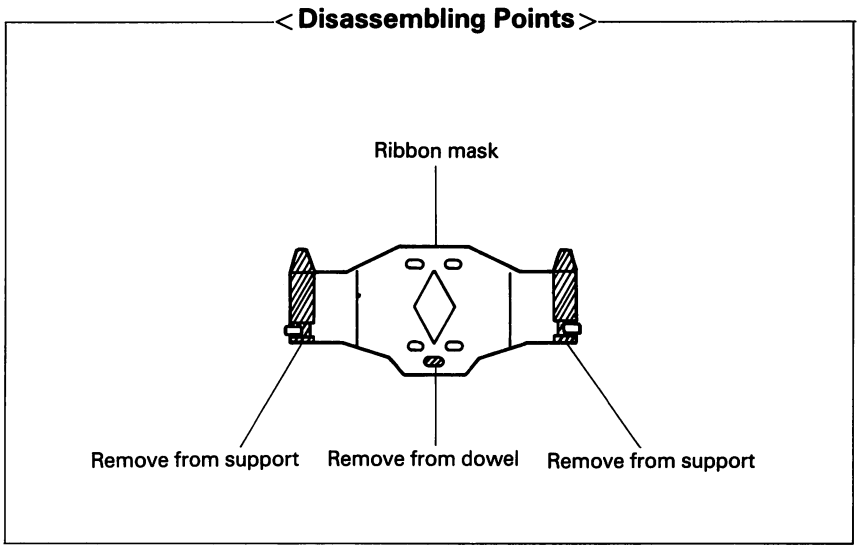


Fig. 4-28. Ribbon Mask Removal

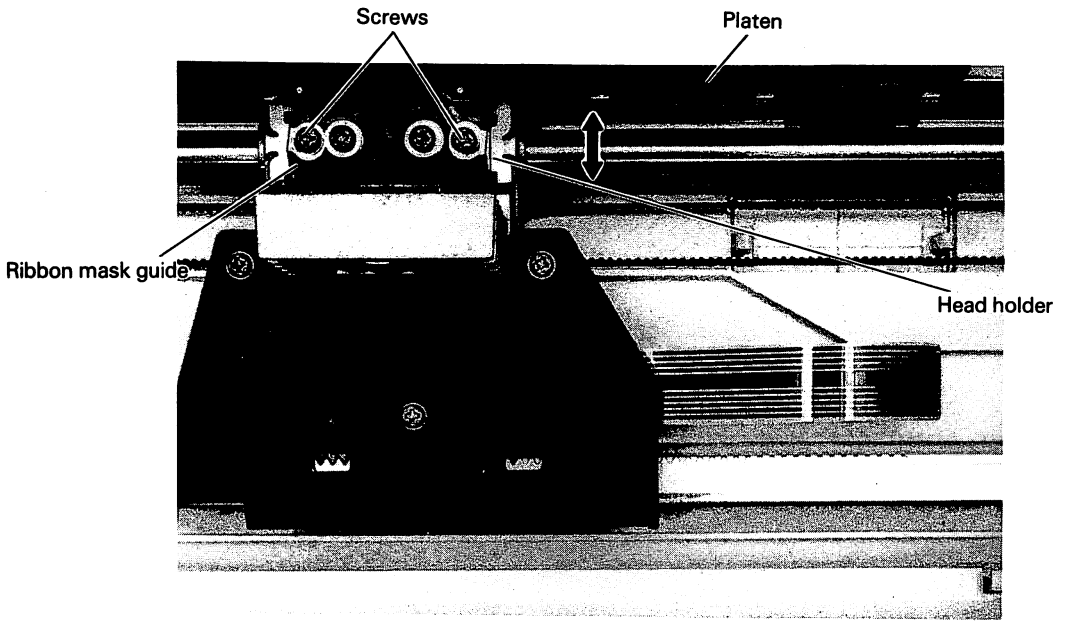


Fig. 4-29. Platen Gap Adjustment

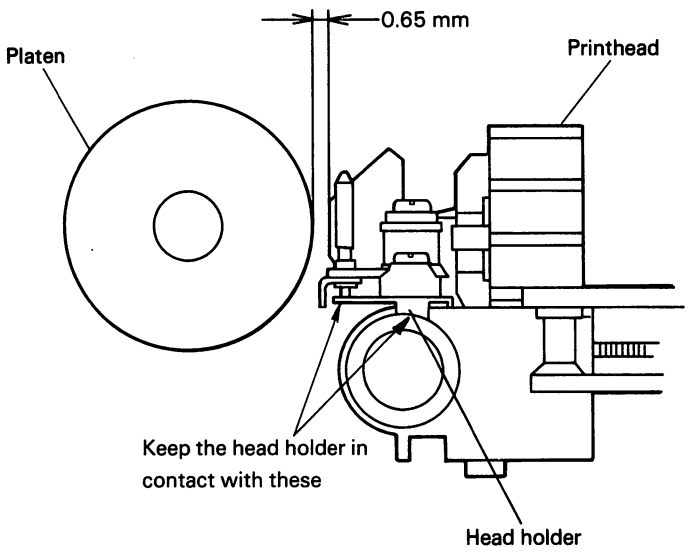


Fig. 4-30. Platen Gap

CHAPTER 5
TROUBLESHOOTING

LIST OF FIGURES

LIST OF TABLES

5.1 TROUBLESHOOTING PROCEDURE

When followed in order of presentation, the problem evaluation procedures outlined below are felt to be the most efficient method for isolating a defective component. Once the malfunctioning component is identified, refer to the Disassembly Assembly and Adjustment section for repair/replacement instructions, and to Table 5-1 for replacement part numbers.

1. Problem Diagnosis By Symptom
   Procedure: Symptom diagnosis by evaluation of printer malfunction signals; procedures performed with aid of tester or multimeter, as required. (No use of oscilloscope or synchroscope.)
   NOTE: If problem diagnosis is performed by replacing the defective unit without testing with an oscilloscope or synchroscope, be sure to verify that the replacement component is not defective.
   Level: Requires a thorough familiarity with printers and their principles of operation.
2. Diagnosis By Component Evaluation
   Procedure: Component evaluation by inspection and/or component exchange.
   Multimeter or tester used as required.
   Level: Requires a thorough familiarity with printers and their principles of operation.
3. Problem Diagnosis by Circuit Evaluation
   Procedure: Circuit evaluation using an oscilloscope to identify deviant waveforms.
   Level: Requires a high-degree of electronics knowledge.

WARNING

Perform each check item which appears on the troubleshooting flow chart. When a unit or a component part is replaced without following this procedure, the replacement unit or component may be damaged again in the same manner.

NOTE: If you become caught in a loop or lose track of your position in a flowchart, return to the beginning and start again.

Table 5-1. Replacement Parts

Component	Part Number
Filter Circuit Board (CFIL) 120V	Y560202500
Filter Circuit Board (CFIL) 220/240V	Y560202200
CATX Circuit Board (For 120V and 240V Version)	Y560201400
CATX Circuit Board (For 220V Version)	Y560201500
Main CPU (μPD 7810G)	X400078100
23256 EPROM	————
Control Panel (COMPNL)	Y563501000
6116 SRAM	X400161164
Regulator IC (494)	X440034940
Fuse (1A) 120V	X502040040
Fuse (315 mA) 220/240V	X502015010
Power Transformer (CT-P8RU-1) 120V	Y435501800
Power Transformer (CT-P8RE-1) 220V/240V	Y435501600
Power Transformer (CT-P8RE-1) 240V/220V	Y435501700
COMI Circuit Board	Y561201800
Reed Switch (P.E. Sensor)	F322151000
PTS Sensor Board Assembly	F322054000
HP Sensor Board Assembly	F322154000
Carriage Motor	F322052000
Paper Feed Motor	F322003000
Printhead	F406100000

Table 5-2. Troubleshooting Tools

Item	Description	Part No.	Vendor Part No.
Cable #938	Extension between CATX Board and COMI Board 26 pins	601162-41	Y42232000
Cable #E503	Extension between CATX Board and COMI Board 28 pins	601162-42	B765101501

5.2 PROBLEM DIAGNOSIS BY SYMPTOM

This section addresses those symptoms which are clear indicators of a particular component malfunction.

Problem indicators are discussed as follows:

Printer Does Not Operate with Power Switch ON

- Carriage does not move.
- No indicator on the control panel lights.

Abnormal Carriage Operation

- Carriage moves away from home position at power ON.
- Although the carriage returns to the home position, the printer does not enter READY mode.

Incorrect Printing (in self-test) with Normal Carriage Operation

- No printing is executed.
- Some dots do not appear.

Incorrect Color Printing

- Specified color is not printed.

Abnormal Paper Feed

- No paper is fed.
- Separation between lines varies with irregular paper feed.

Abnormal Operation of Control Panel

- No paper is fed (by operation of the LF or FF switch) in OFF-LINE mode.
- No operation mode is set from the control panel.
- ON-LINE or OFF-LINE mode is not obtained.

Incorrect Printing in ON-LINE Mode

- Carriage operates normally at power ON and the result of the self-test is correct. However, the print data from the computer is not output normally.

(1) Printer Does Not Operate With Power Switch ON

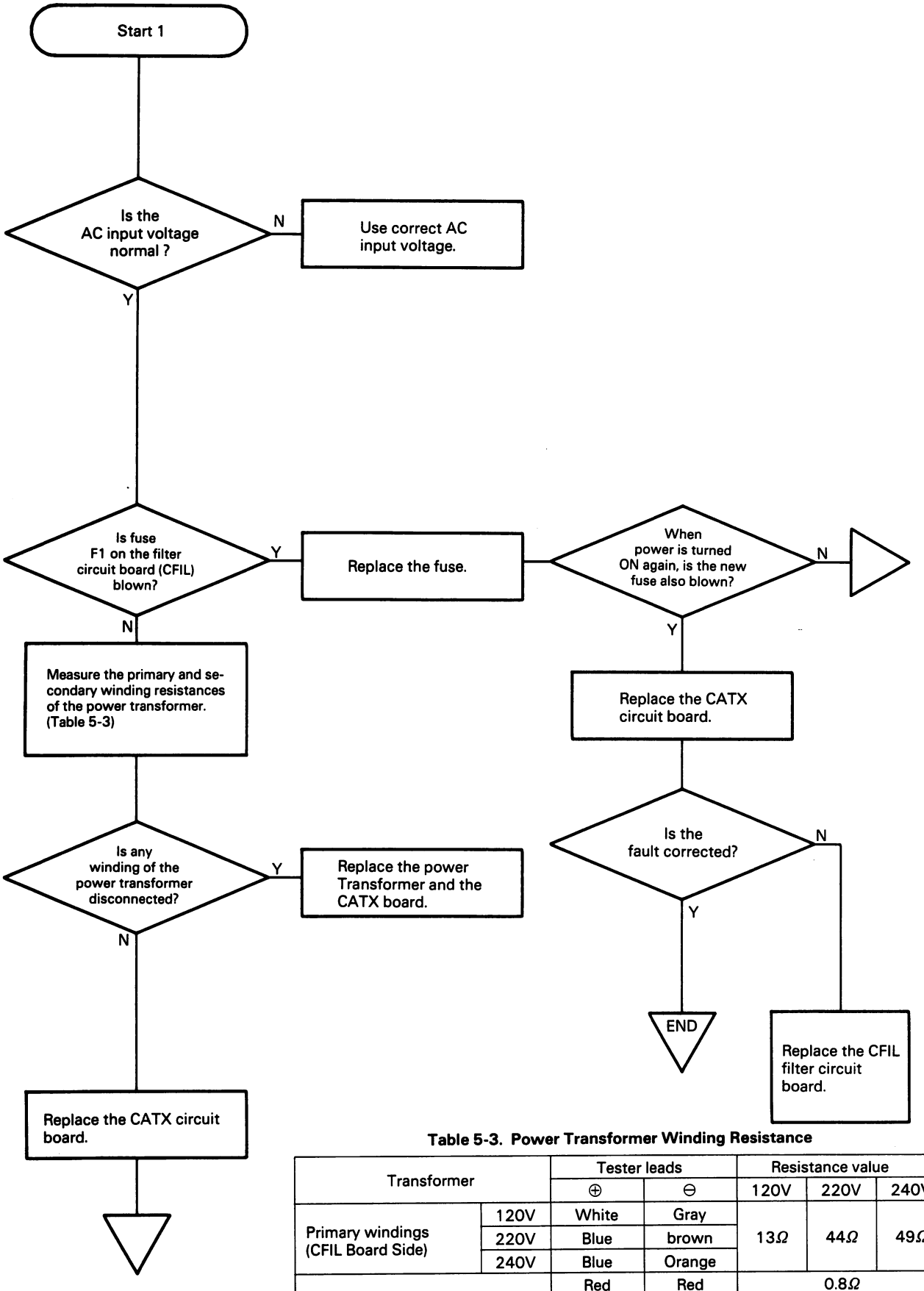
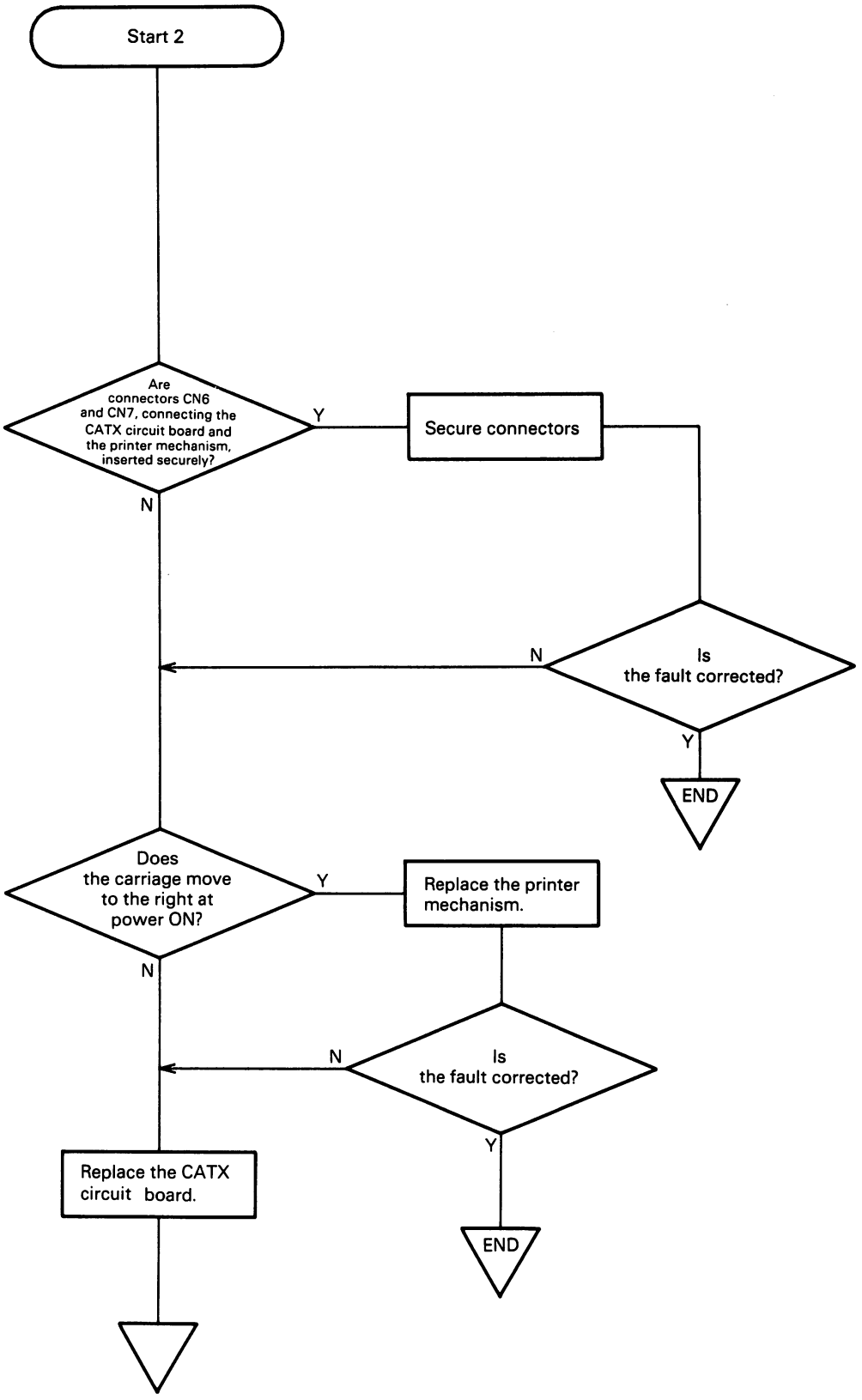


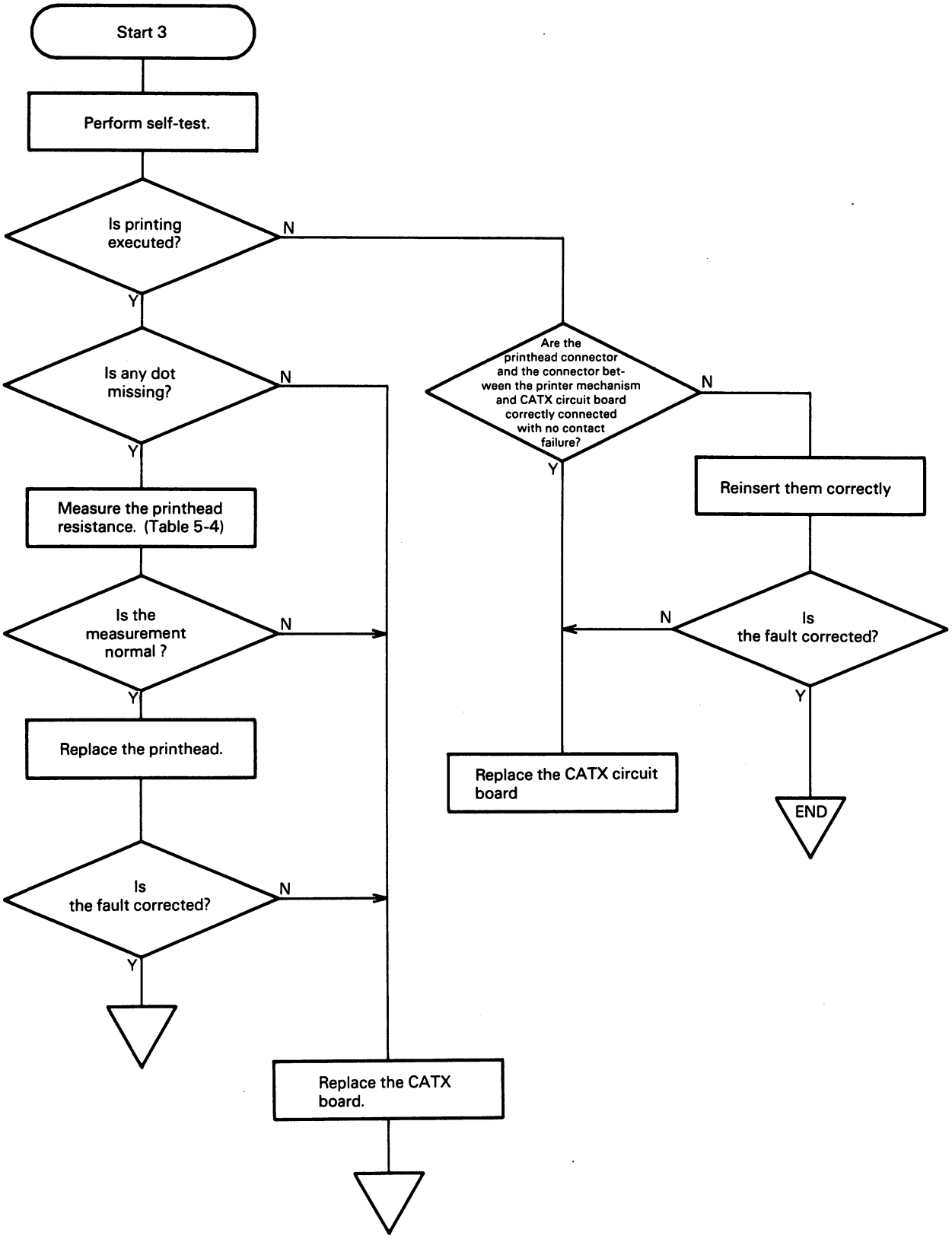
Table 5-3. Power Transformer Winding Resistance

Transformer		Tester leads ⊕	Tester leads ⊖	Resistance value 120V	Resistance value 220V	Resistance value 240V
Primary windings (CFIL Board Side)	120V	White	Gray	13Ω	44Ω	49Ω
	220V	Blue	brown			
	240V	Blue	Orange			
Secondary windings (CATX Board Side)		Red	Red	0.8Ω		
		Purple	Purple	0.4Ω		
		Blue	Blue	17Ω		

(2) Abnormal Operation Of Carriage



(3) Incorrect Printing (in self-test) With Normal Carriage Operation



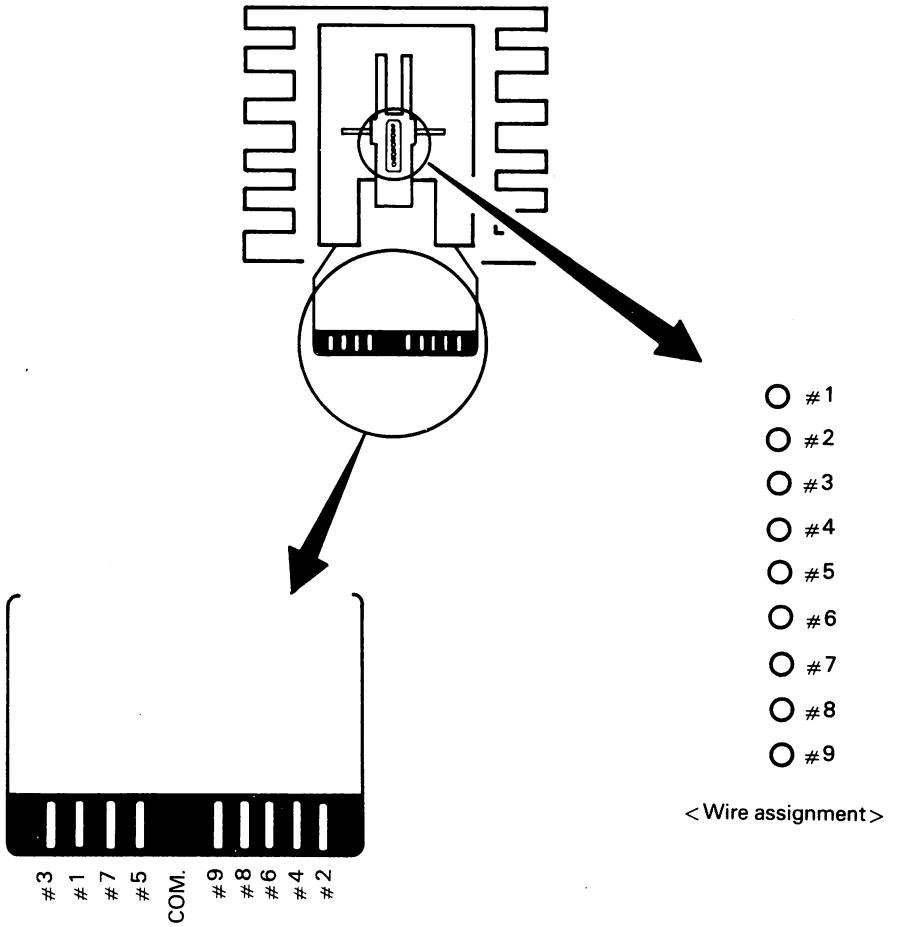
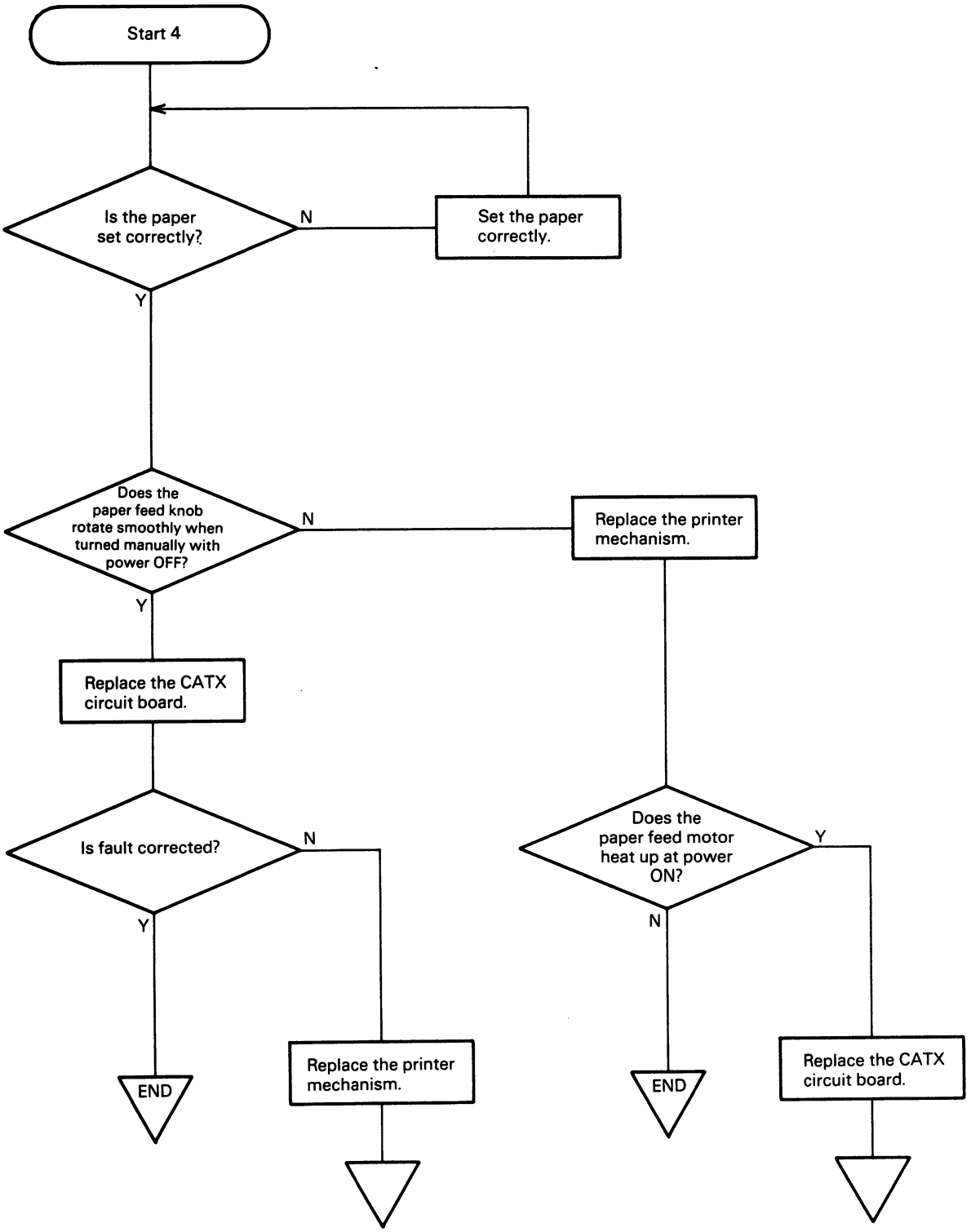


Fig. 5-1. Printhead Cable Diagram

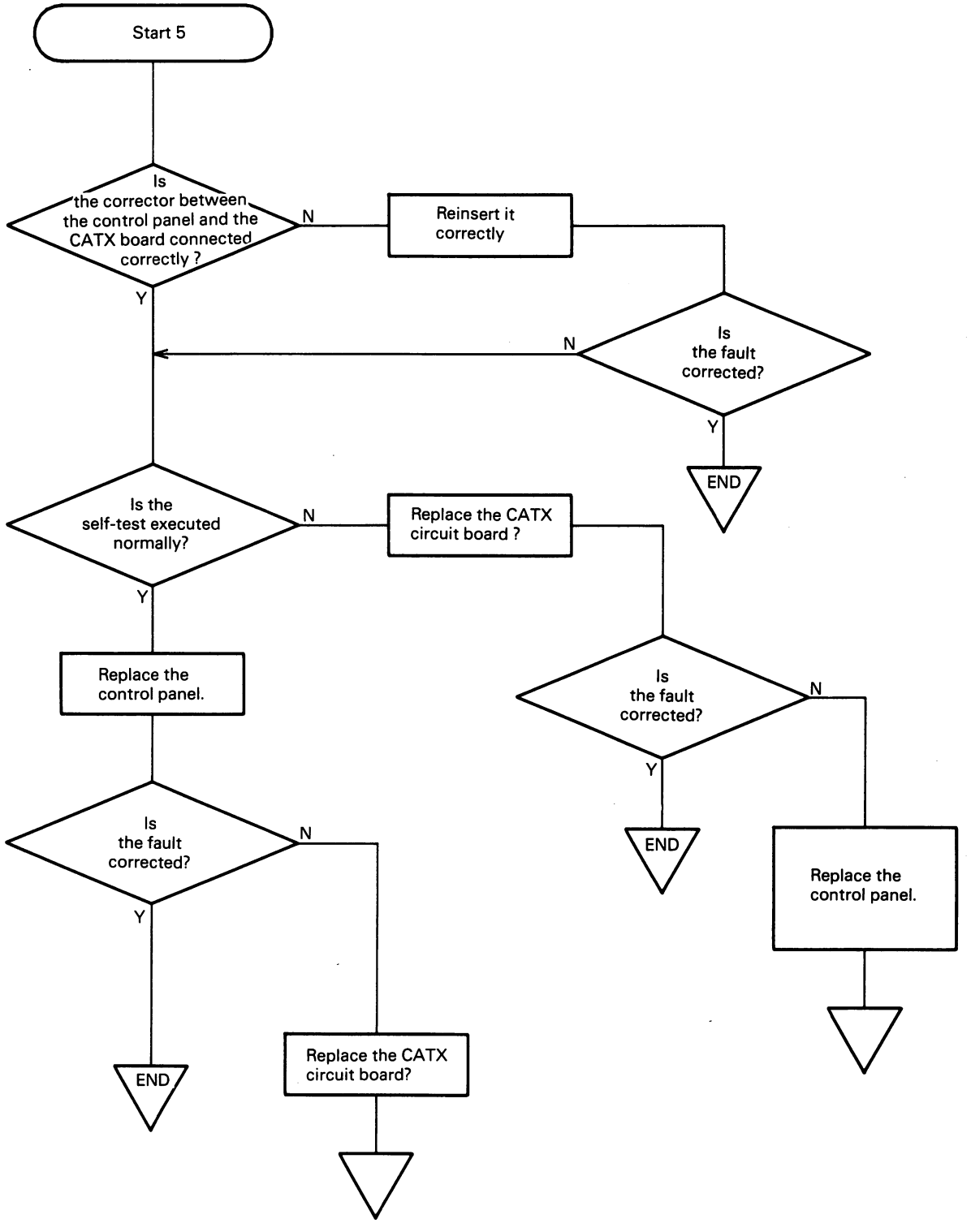
Table 5-4. Printhead Resistance

Test Leads		Resistance value
Positive lead ⊕	Negative lead ⊖	
Common line	Each dot wire	Approx. 22 ohms

(4) Abnormal Paper Feed (with normal printing)

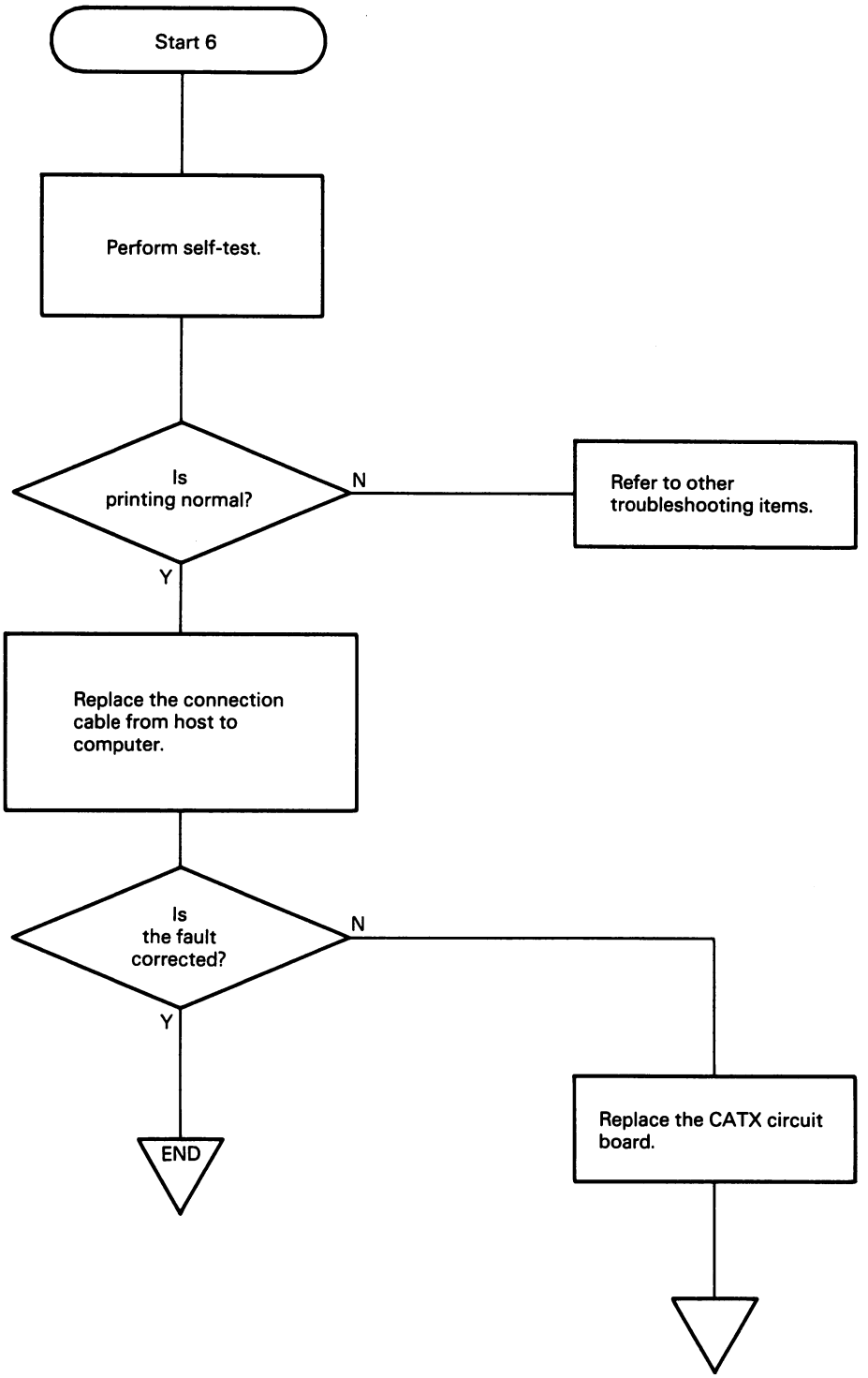


(5) Abnormal Operation Of Control Panel

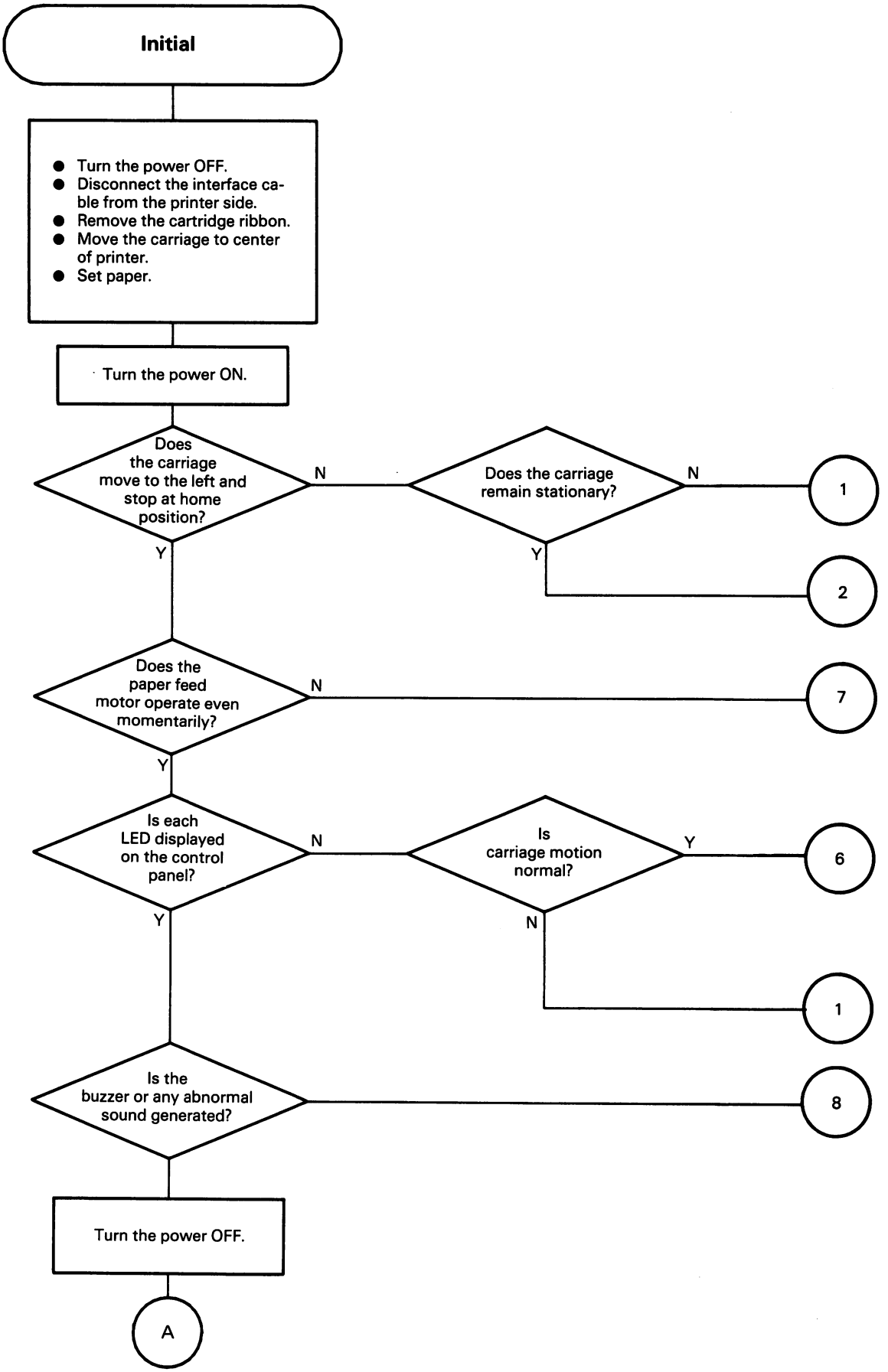


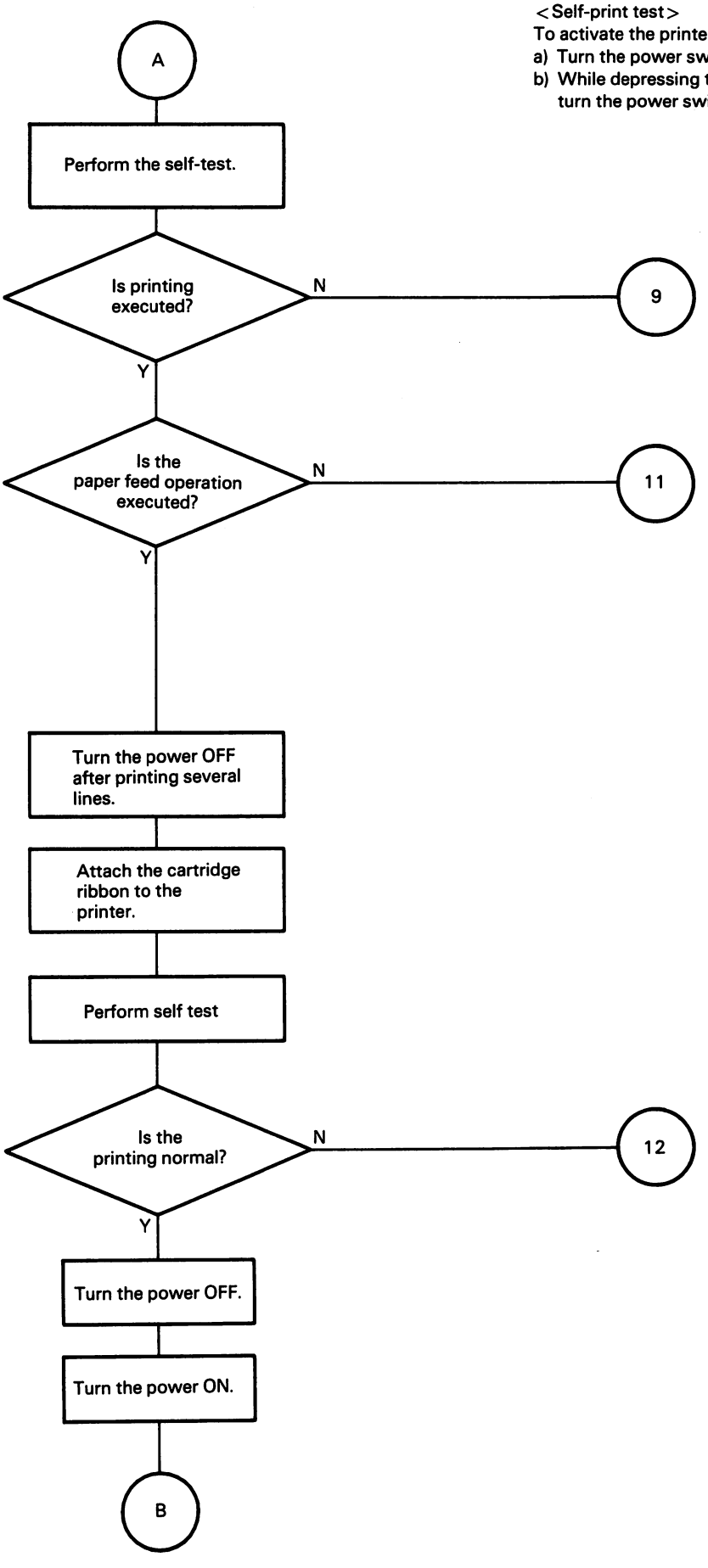
(6) Incorrect Printing In ON-LINE Mode

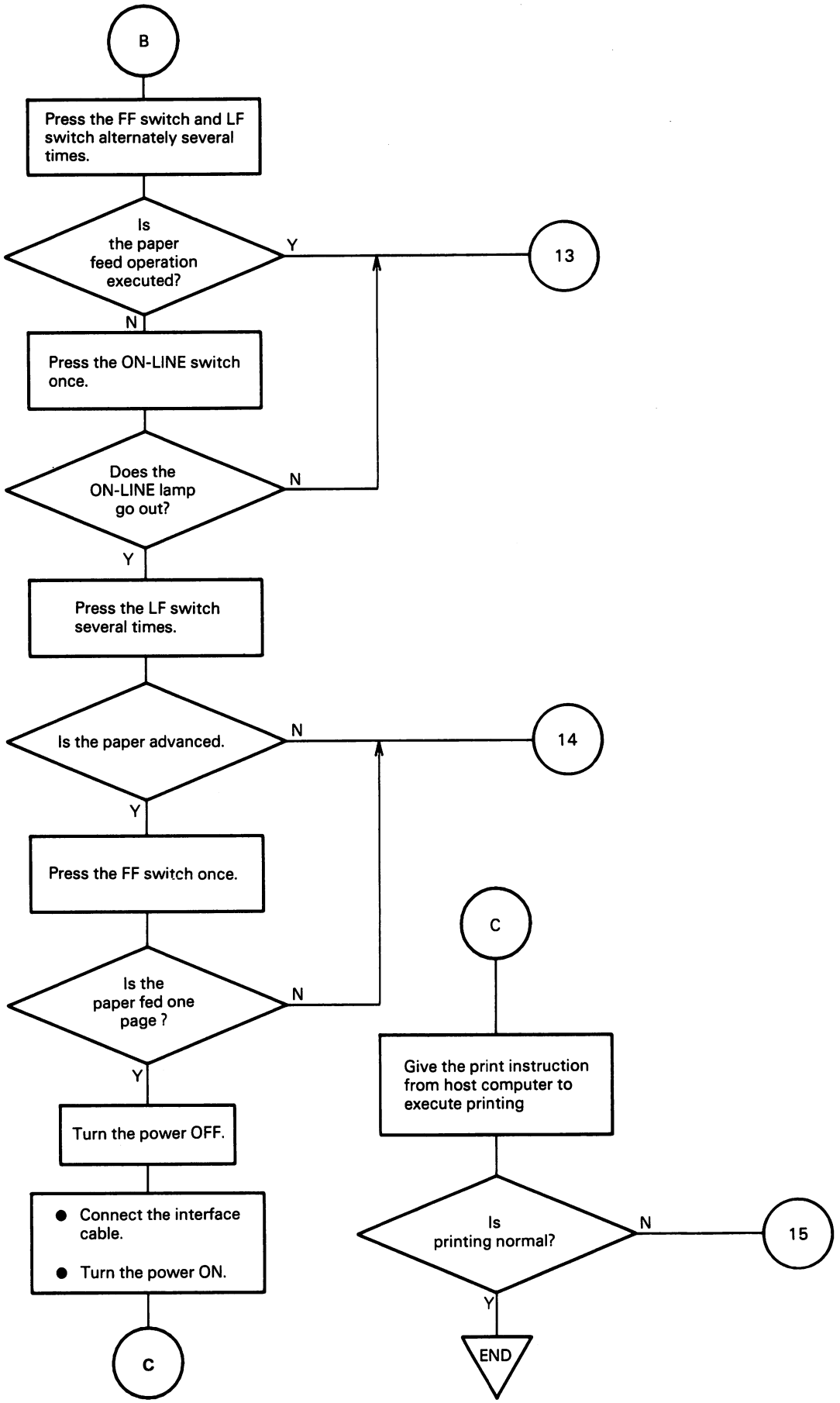
NOTE: It is assumed that the host computer operates normally.



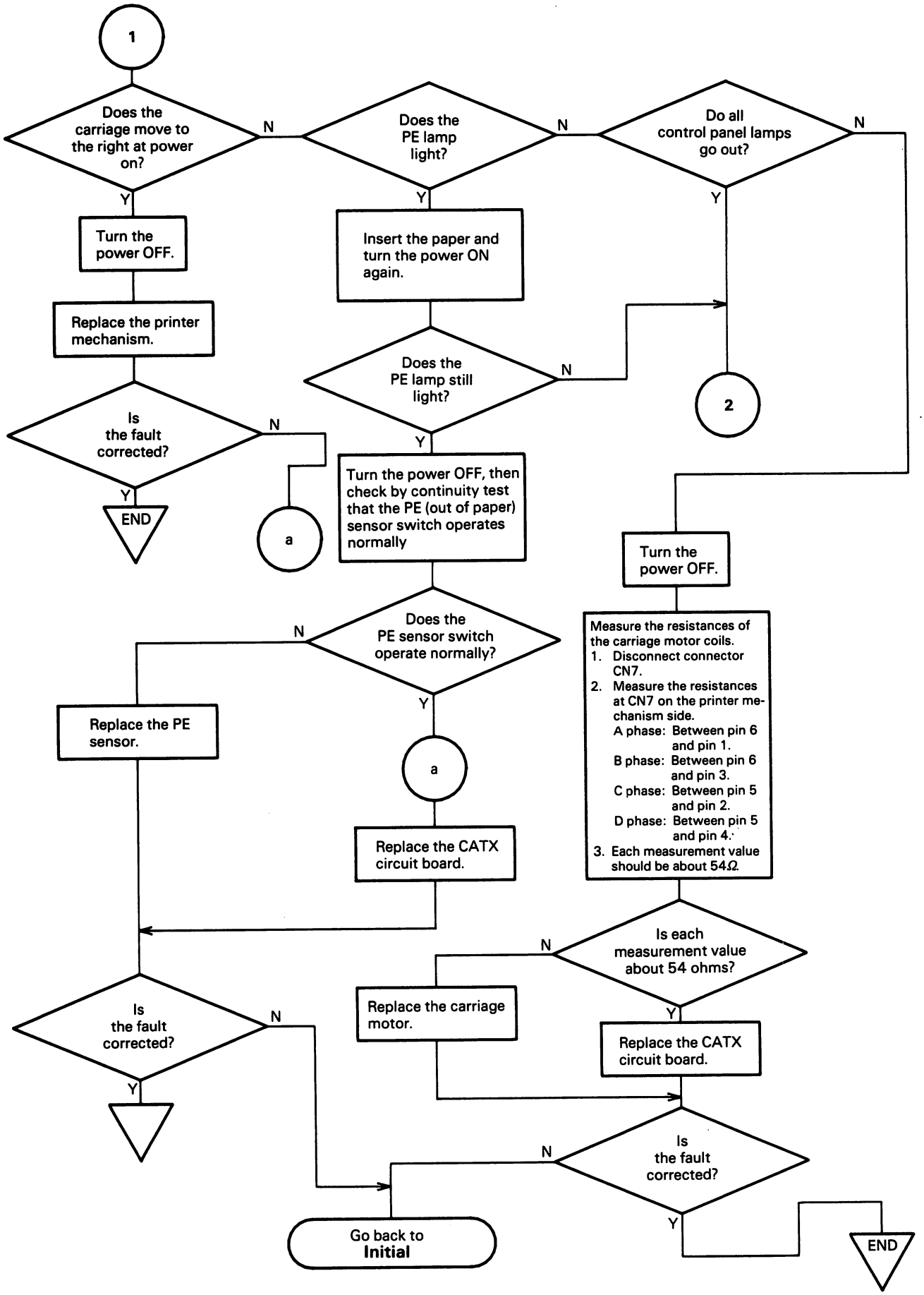
5.3 DIAGNOSIS BY COMPONENT EVALUATION




<Self-print test>
To activate the printer self-test:
a) Turn the power switch OFF.
b) While depressing the line feed (LF) switch, turn the power switch ON.
A
Perform the self-test.
Is printing executed?
N
9
Y
Is the paper feed operation executed?
N
11
Y
Turn the power OFF after printing several lines.
Attach the cartridge ribbon to the printer.
Perform self test
Is the printing normal?
N
12
Y
Turn the power OFF.
Turn the power ON.
B

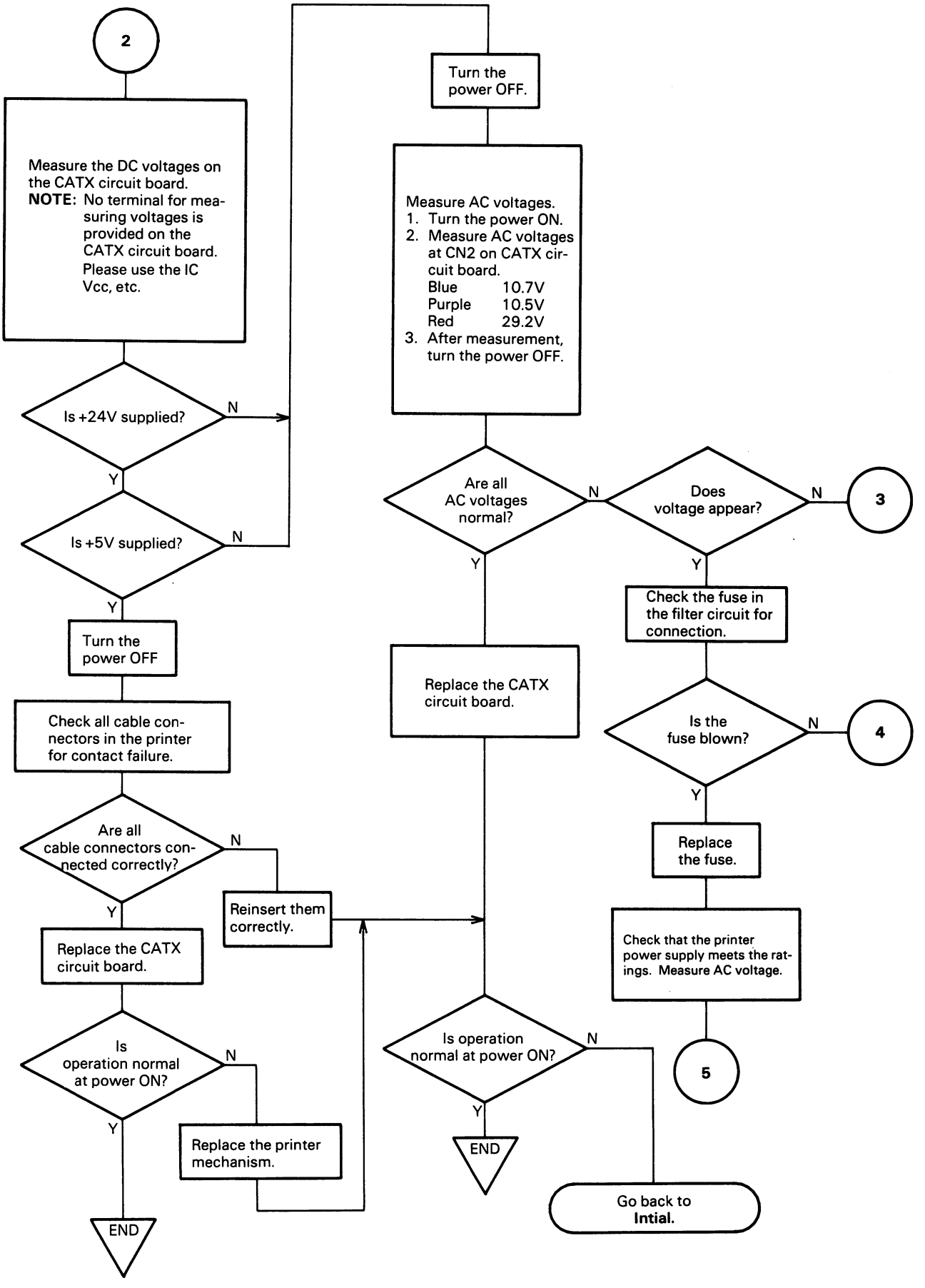

B
Press the FF switch and LF switch alternately several times.
Is the paper feed operation executed?
Y
13
N
Press the ON-LINE switch once.
Does the ON-LINE lamp go out?
N
Y
Press the LF switch several times.
Is the paper advanced.
N
14
Y
Press the FF switch once.
Is the paper fed one page ?
N
Y
Turn the power OFF.
● Connect the interface cable.
● Turn the power ON.
C
C
Give the print instruction from host computer to execute printing
Is printing normal?
N
15
Y
END

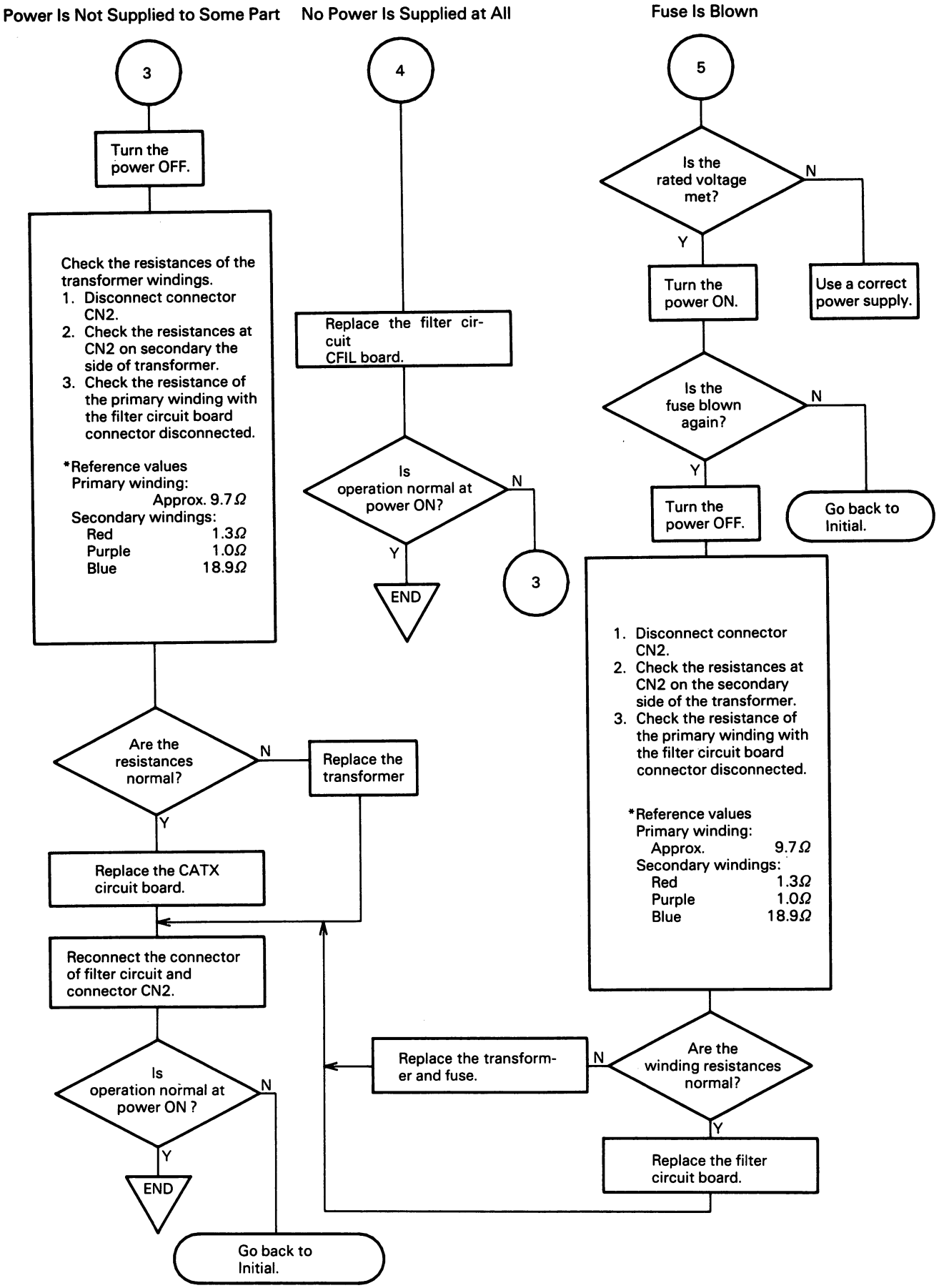
Carriage Does Not Return to Home Position at Power ON



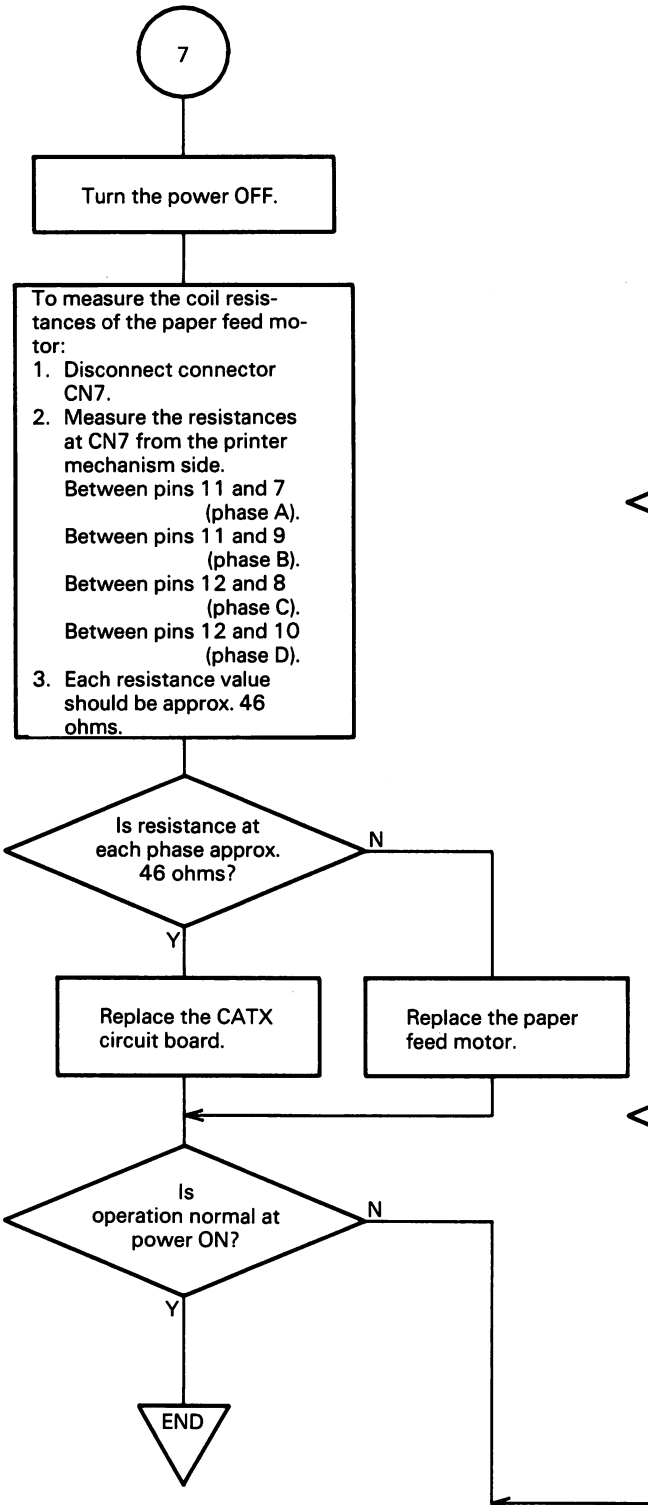
Carriage Does Not Move

No DC Voltage Appears

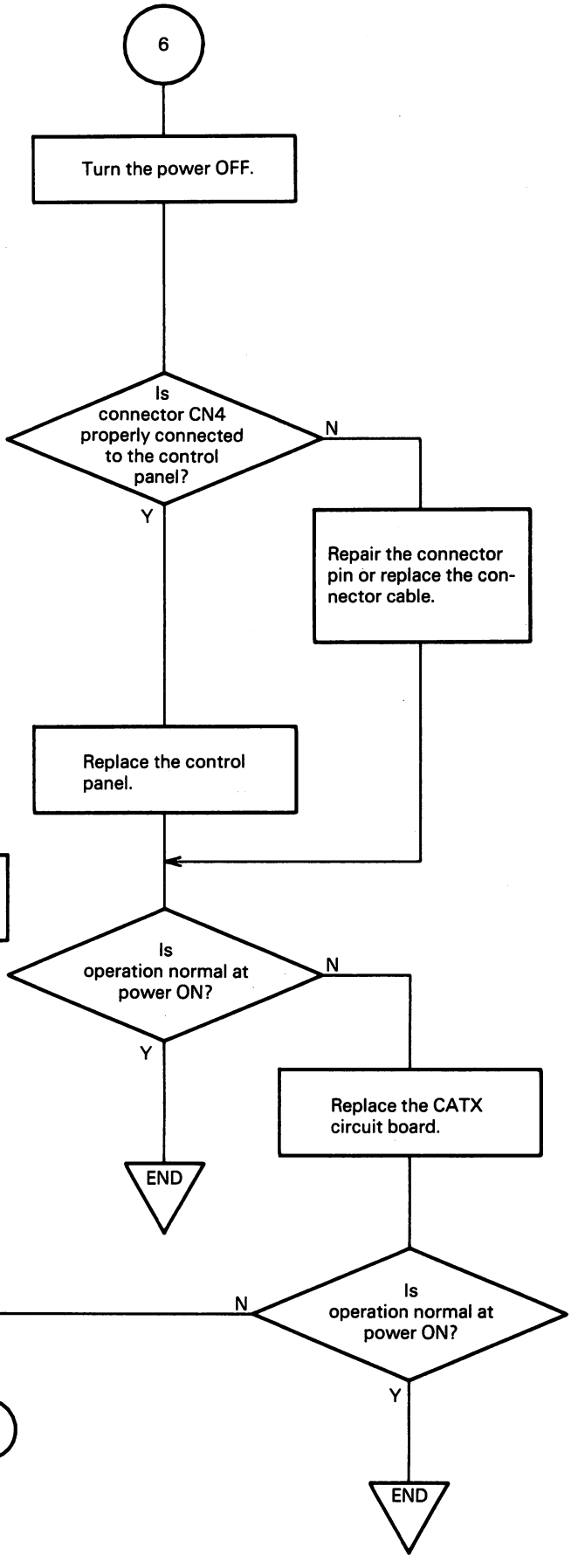



Power Is Not Supplied to Some Part
No Power Is Supplied at All
Fuse Is Blown
3
Turn the power OFF.
Check the resistances of the transformer windings.
1. Disconnect connector CN2.
2. Check the resistances at CN2 on secondary the side of transformer.
3. Check the resistance of the primary winding with the filter circuit board connector disconnected.
*Reference values
Primary winding:
Approx. 9.7Ω
Secondary windings:
Red 1.3Ω
Purple 1.0Ω
Blue 18.9Ω
Are the resistances normal?
N
Replace the transformer
Y
Replace the CATX circuit board.
Reconnect the connector of filter circuit and connector CN2.
Is operation normal at power ON ?
N
Y
END
Go back to Initial.
4
Replace the filter circuit CFIL board.
Is operation normal at power ON?
N
Y
END
3
5
Is the rated voltage met?
N
Y
Use a correct power supply.
Turn the power ON.
Is the fuse blown again?
N
Y
Go back to Initial.
Turn the power OFF.
1. Disconnect connector CN2.
2. Check the resistances at CN2 on the secondary side of the transformer.
3. Check the resistance of the primary winding with the filter circuit board connector disconnected.
*Reference values
Primary winding:
Approx. 9.7Ω
Secondary windings:
Red 1.3Ω
Purple 1.0Ω
Blue 18.9Ω
Are the winding resistances normal?
N
Replace the transformer and fuse.
Y
Replace the filter circuit board.

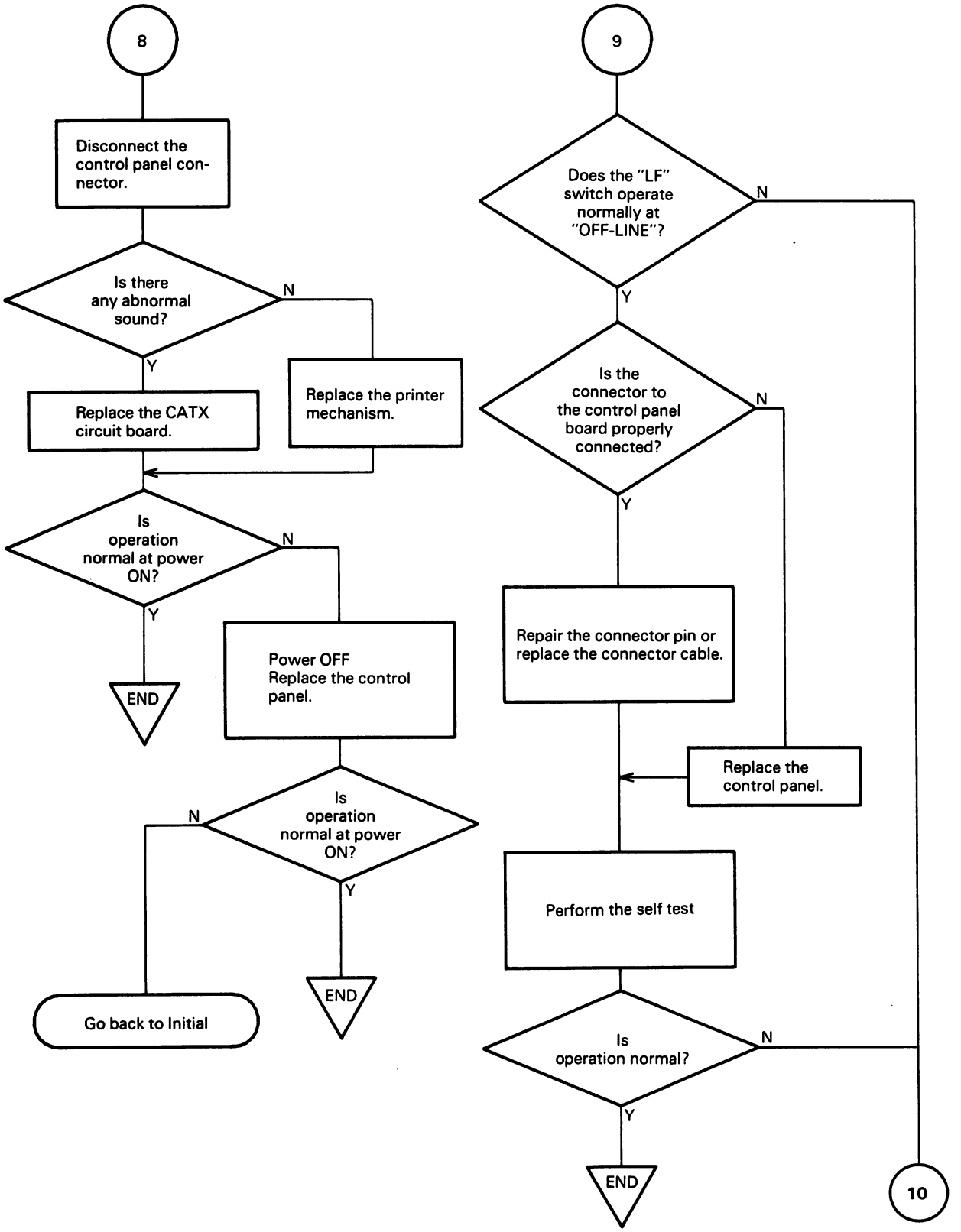
Power Feed Motor Does Not Operate



Indication on Control Panel is Incorrect.

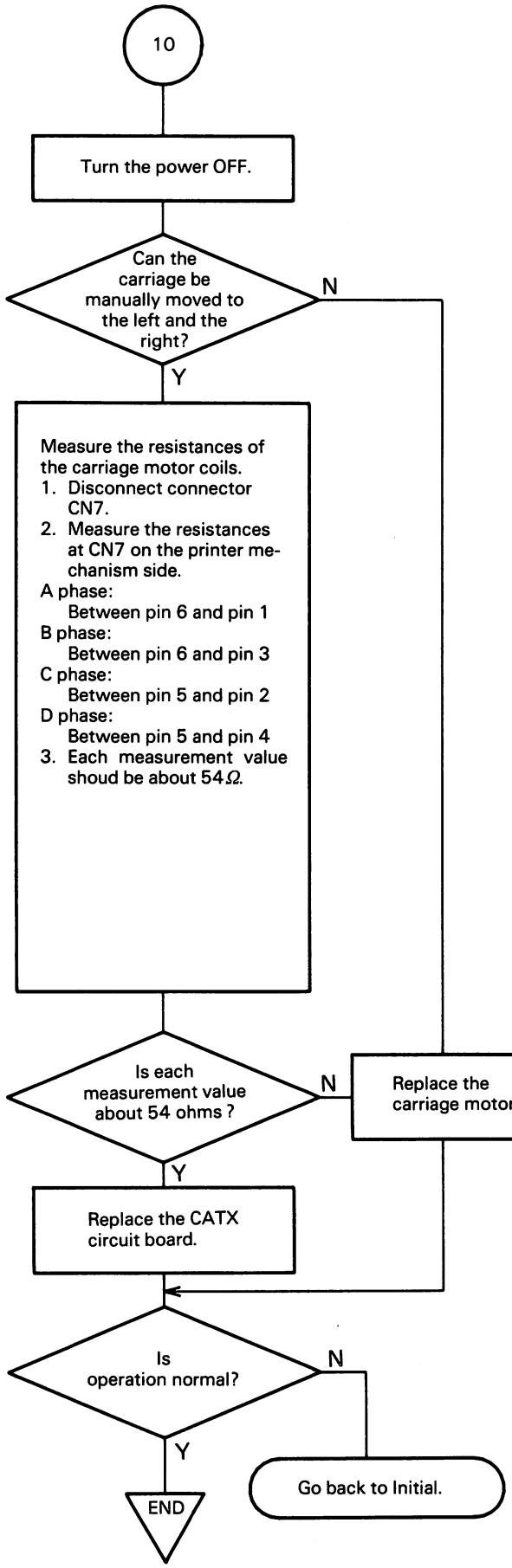


Buzzer or Abnormal Sound is Generated. Carriage Does not Move at Self Test. No.1

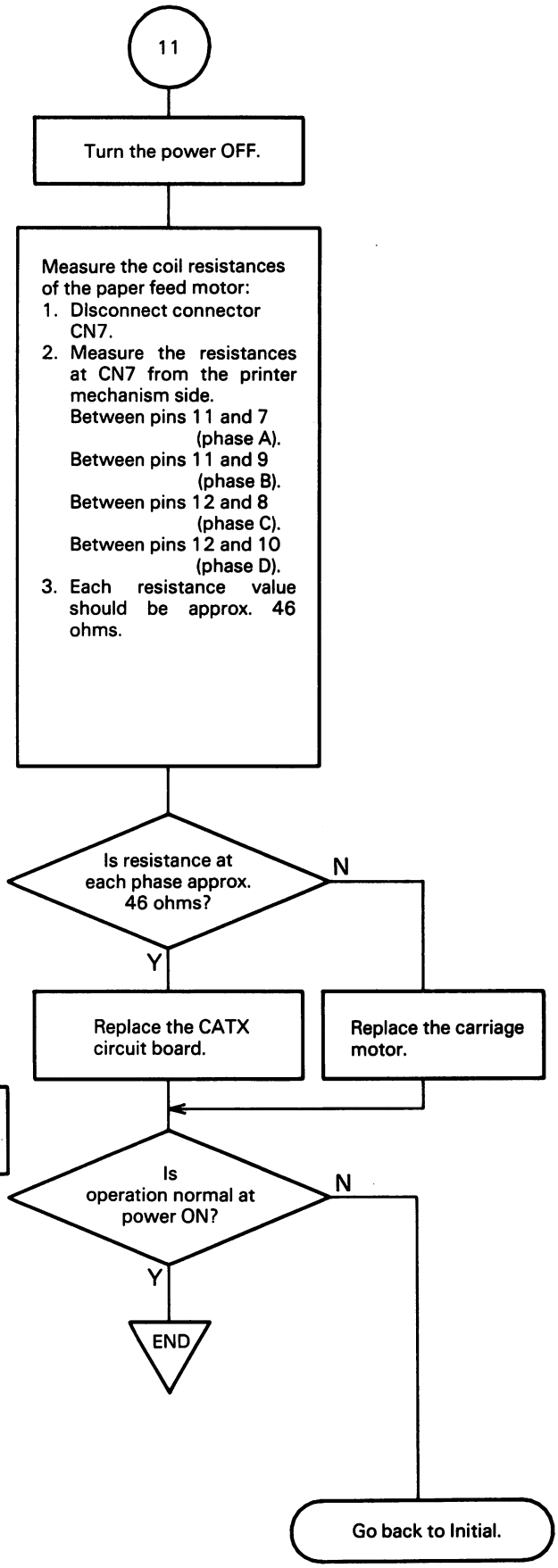


Carriage Does not Move at Self Test

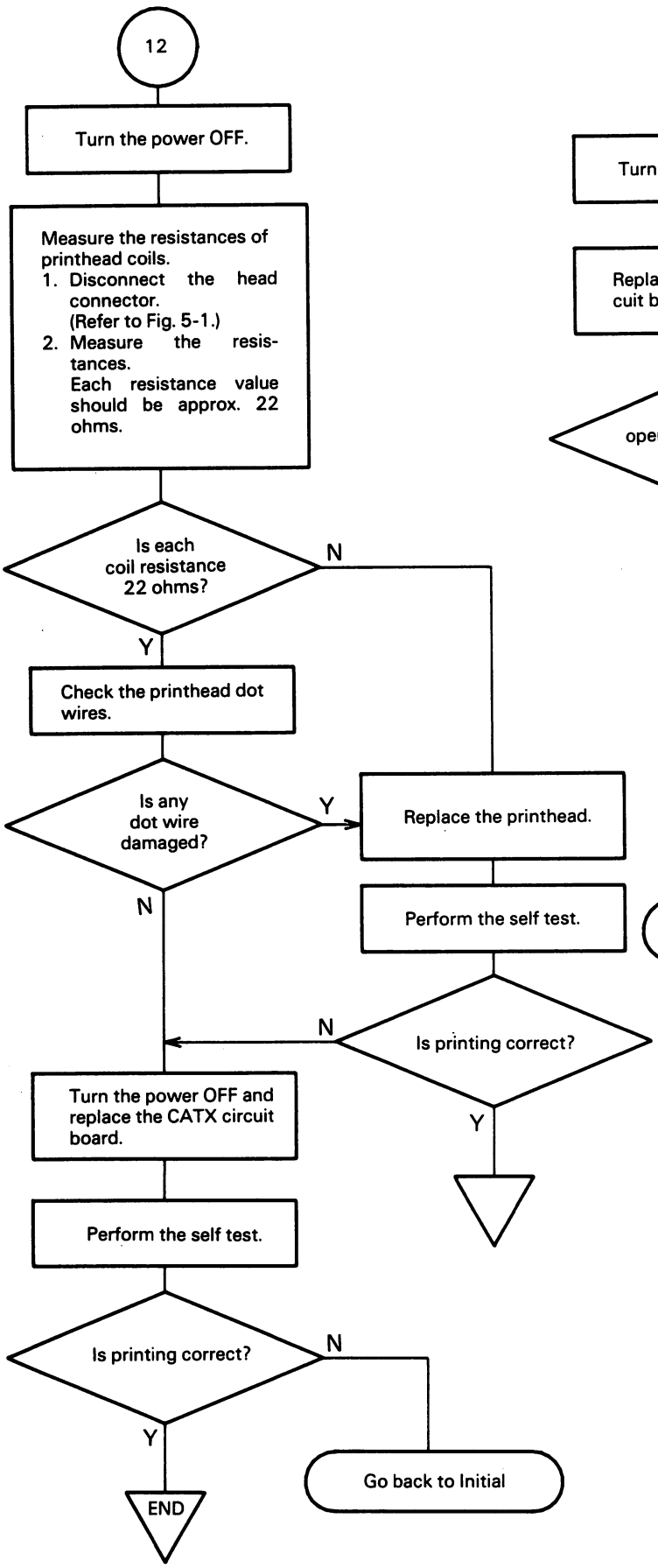
No. 2



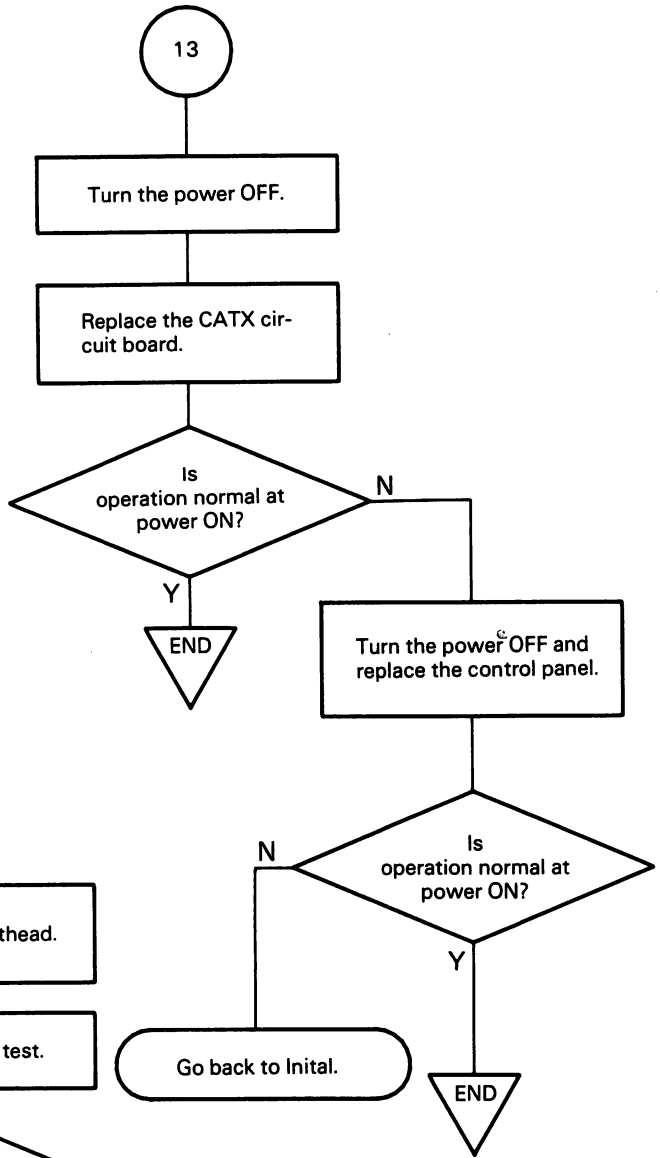
Paper Feed is not normal



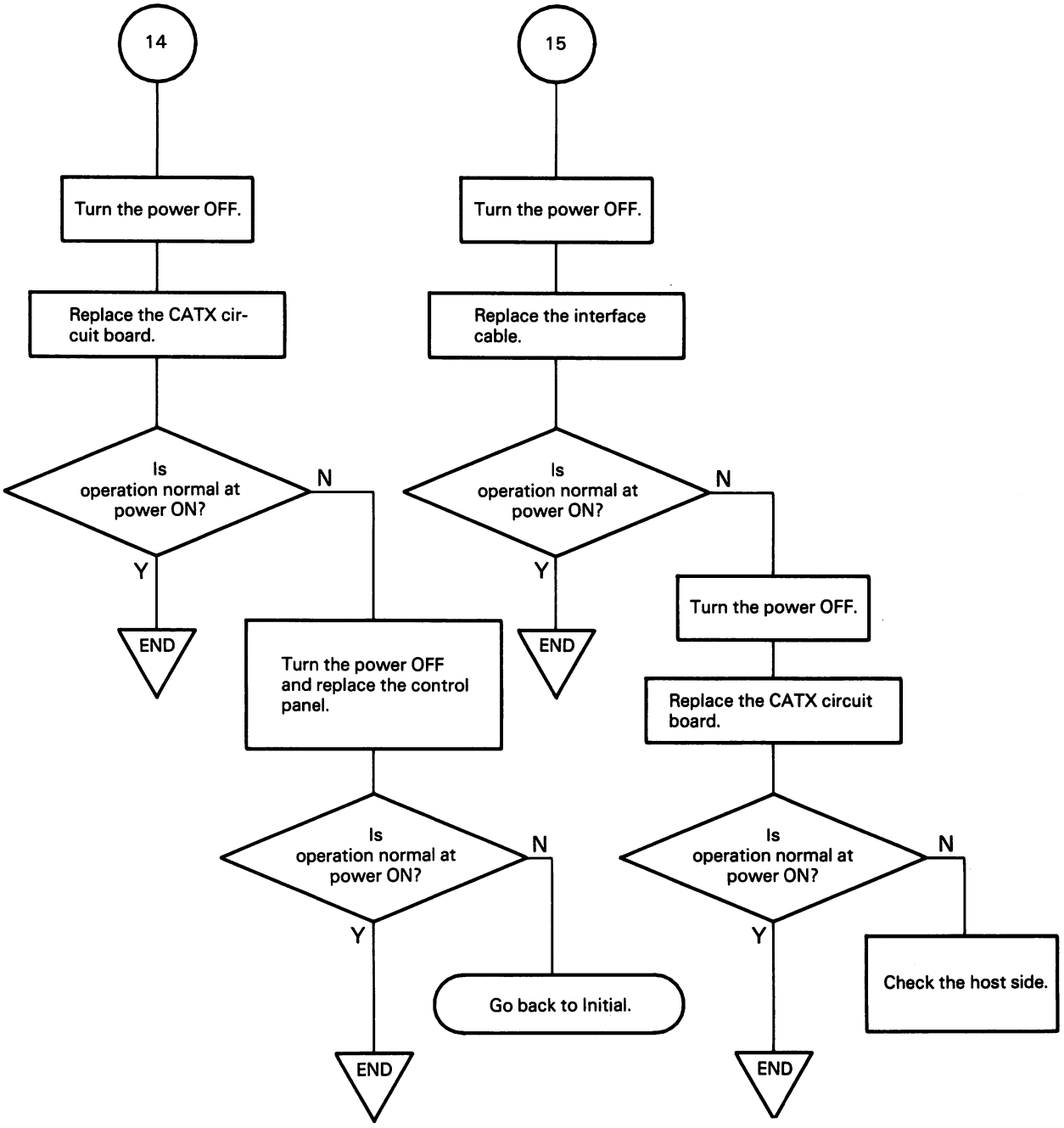
Printing Is Incorrect



Switches on Control Panel Function in ON-LINE Mode



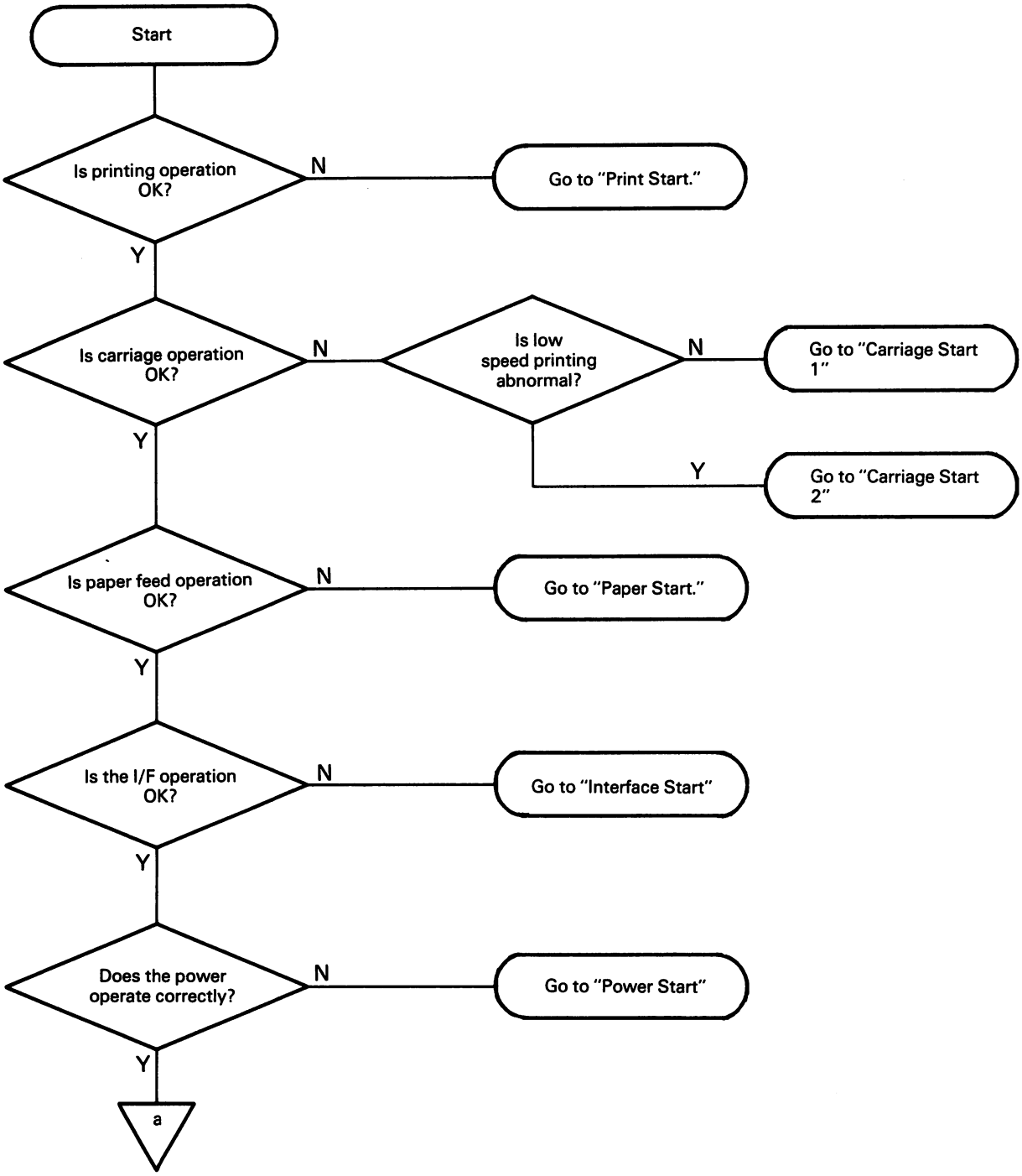
LF and FF Switches Do Not Operate in OFF-LINE Operation is Incorrect With Host Computer Connected.

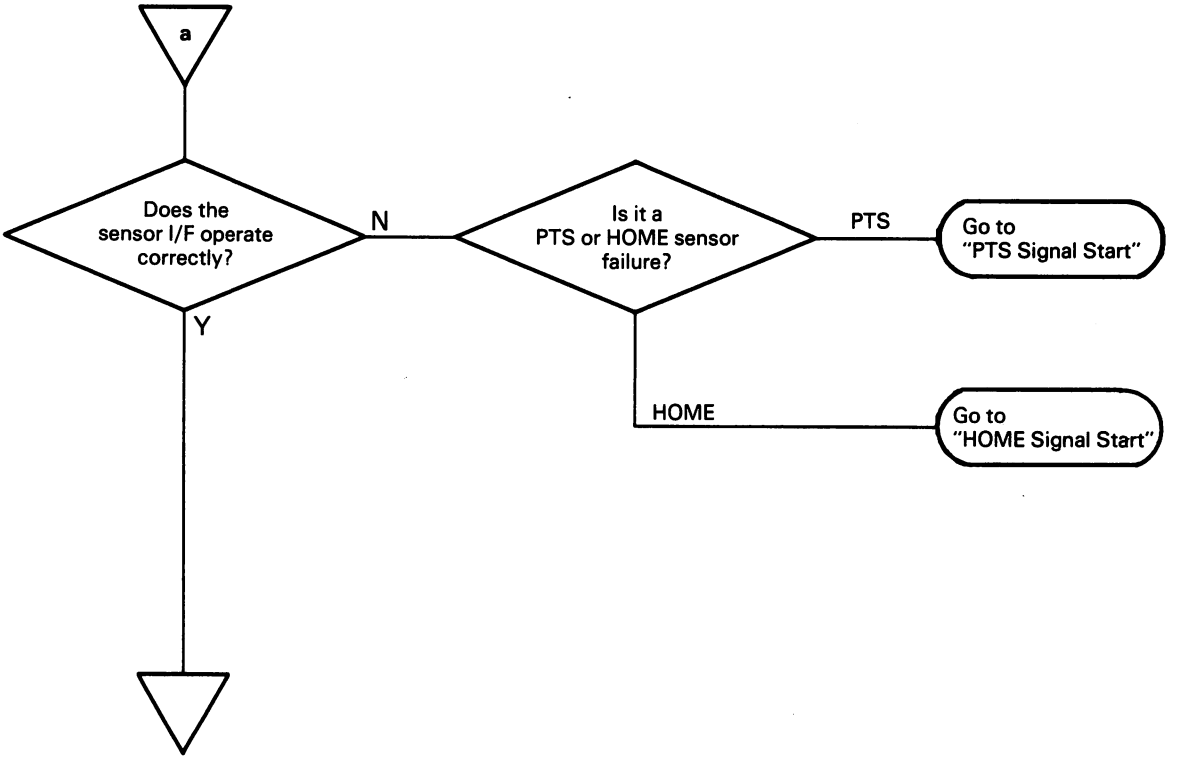


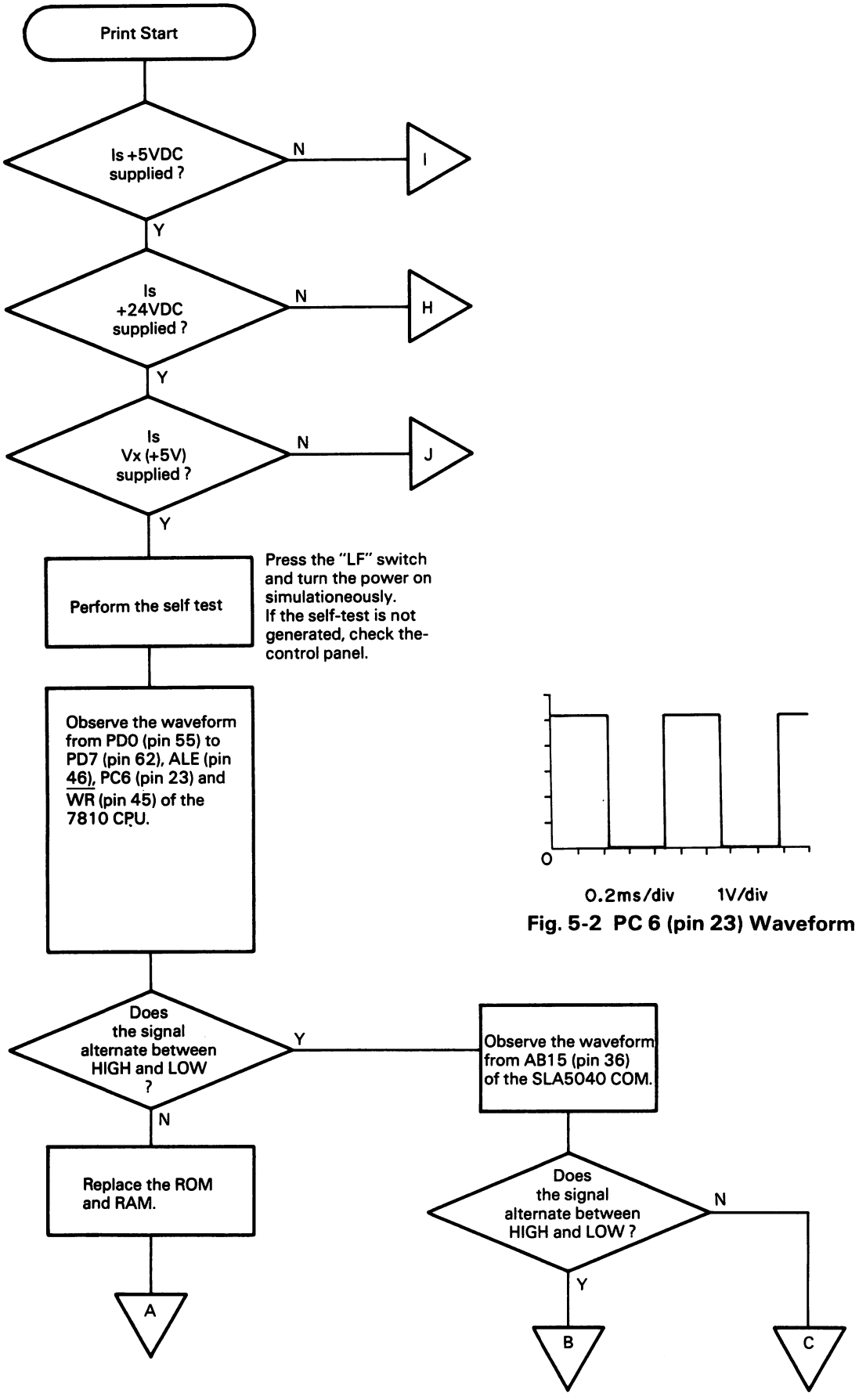
5.4 PROBLEM DIAGNOSIS BY CIRCUIT EVALUATION

5.4.1 Troubleshooting the CATX Circuit Board

The following test procedures require use of an oscilloscope or a synchroscope.




a
Does the sensor I/F operate correctly?
N
Is it a PTS or HOME sensor failure?
PTS
Go to "PTS Signal Start"
HOME
Go to "HOME Signal Start"
Y



0.2ms/div 1V/div

Fig. 5-2 PC 6 (pin 23) Waveform

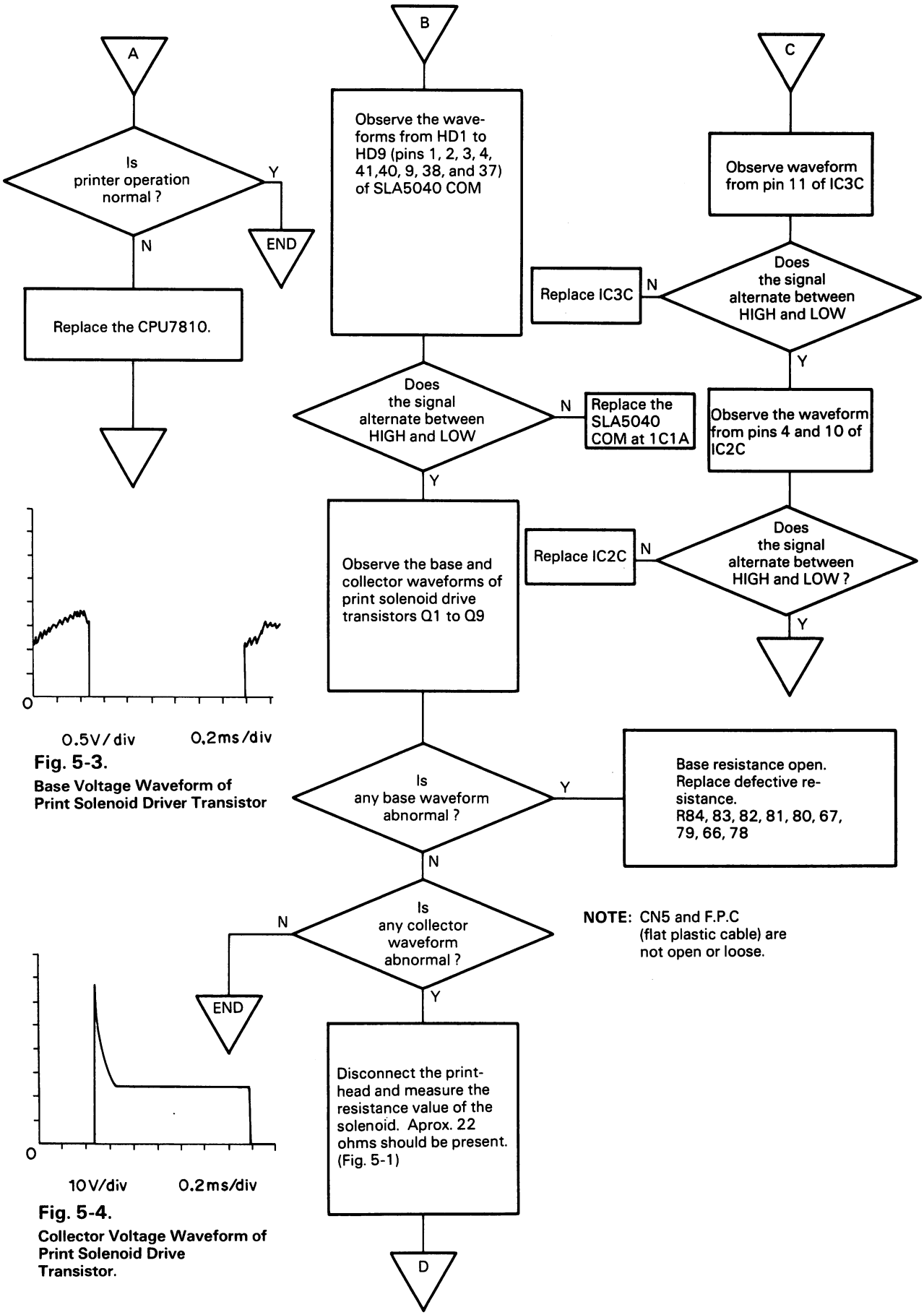
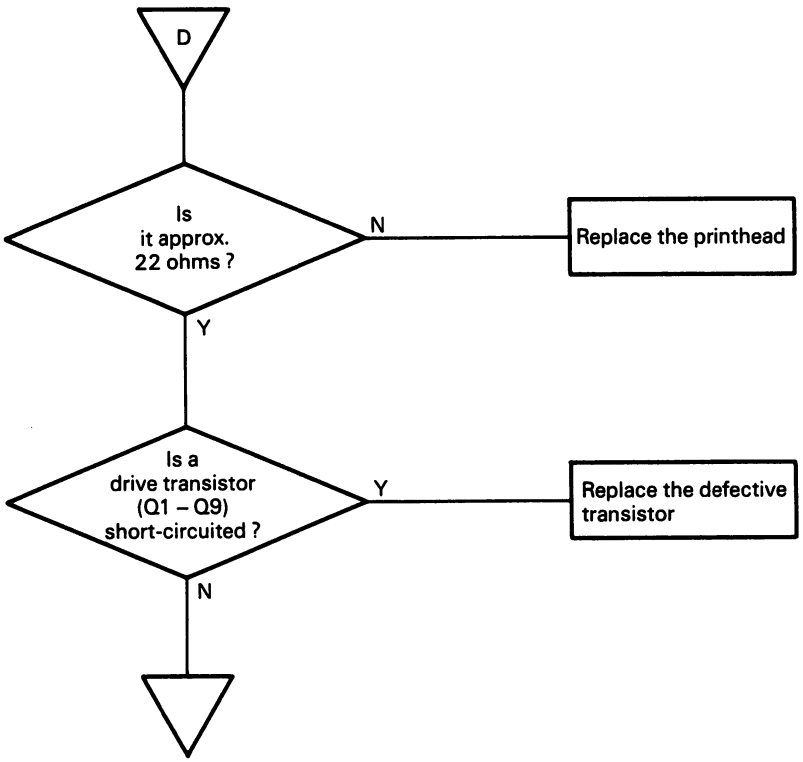


Fig. 5-3.
Base Voltage Waveform of Print Solenoid Driver Transistor

Fig. 5-4.
Collector Voltage Waveform of Print Solenoid Drive Transistor.

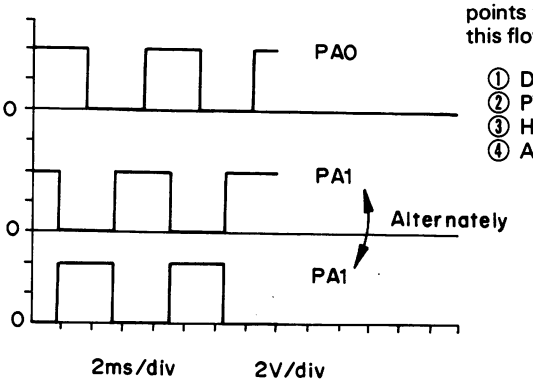

D
Is
it approx.
22 ohms ?
N
Replace the printhead
Y
Is a
drive transistor
(Q1 – Q9)
short-circuited ?
Y
Replace the defective
transistor
N

NOTE: Set in the pica mode by turning DIP SW 1-1 and 1-2 OFF

Carriage Start 1

Perform self test in pica mode.

Observe the waveform from PA0 (pin 1) and PA1 (pin 2) of CPU7810



Check the following points prior to entering this flow chart:

① DC Voltages
② PTS Signal
③ HOME Signal
④ A-D Converter

Fig. 5-5. PA0 and PA1 Voltage Waveform

Does the signal alternate between HIGH and LOW ?

N → Replace the ROM and RAM.

Y

Observe the wavefrom from 3$\overline{Q}$ (pin 1), 3Q (pin 16), 4$\overline{Q}$ (pin 15) and 4Q (pin 14) of IC6B.

Is the carriage operation normal ?

Y → END

N → Replace the 7810CPU.

Do all wavefroms appear ?

N → Replace IC6B.

Y

Measure the resistance value of RM4 common ... pin 1 approx. 1.9 kohms

Is the resistance value normal ?

N → Replace RM4.

Y

Observe base voltage waveforms of CR motor dirve transistors Q17 ~ Q20.

E

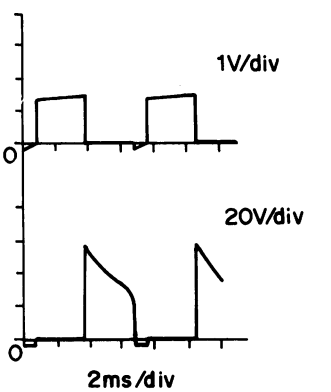
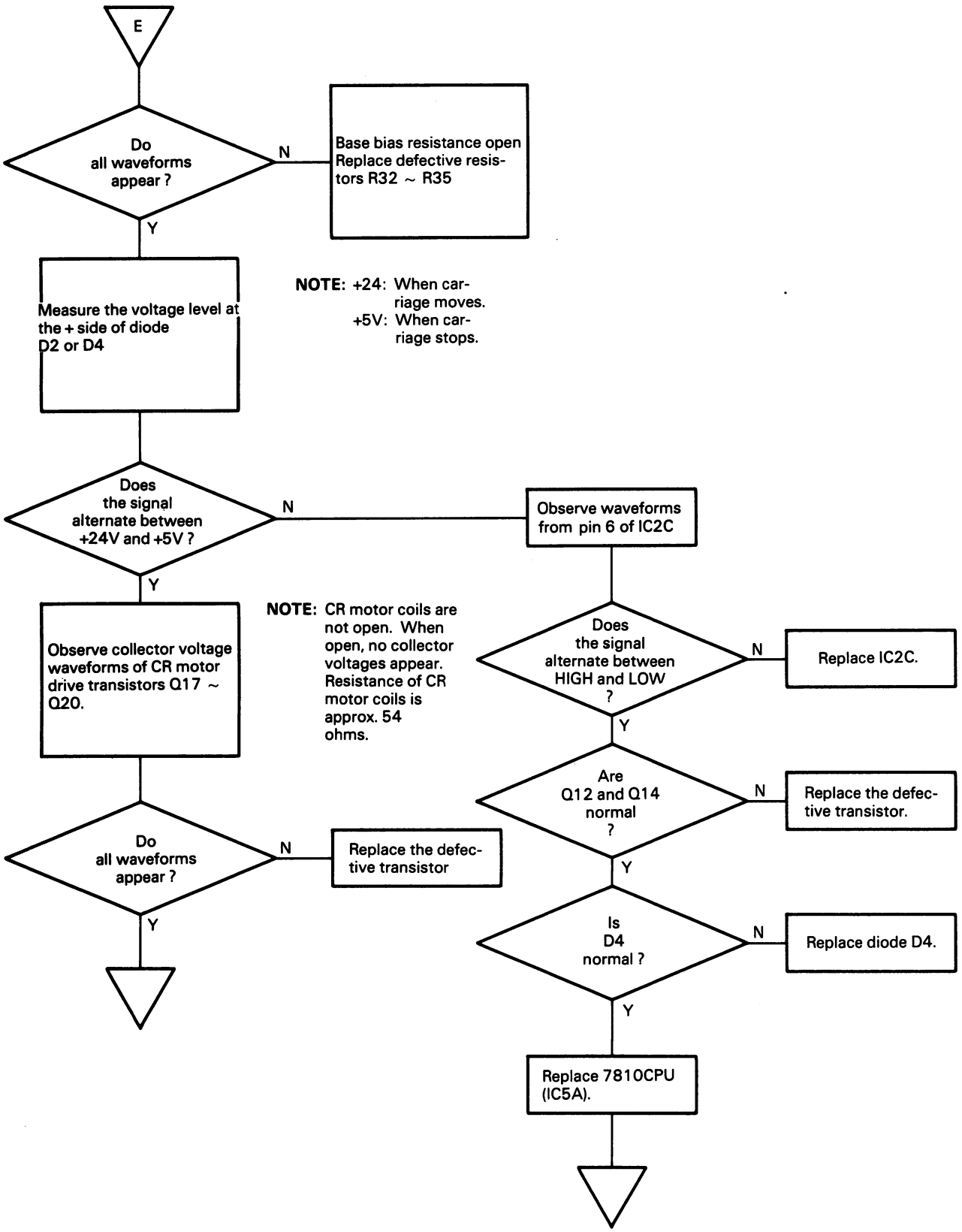
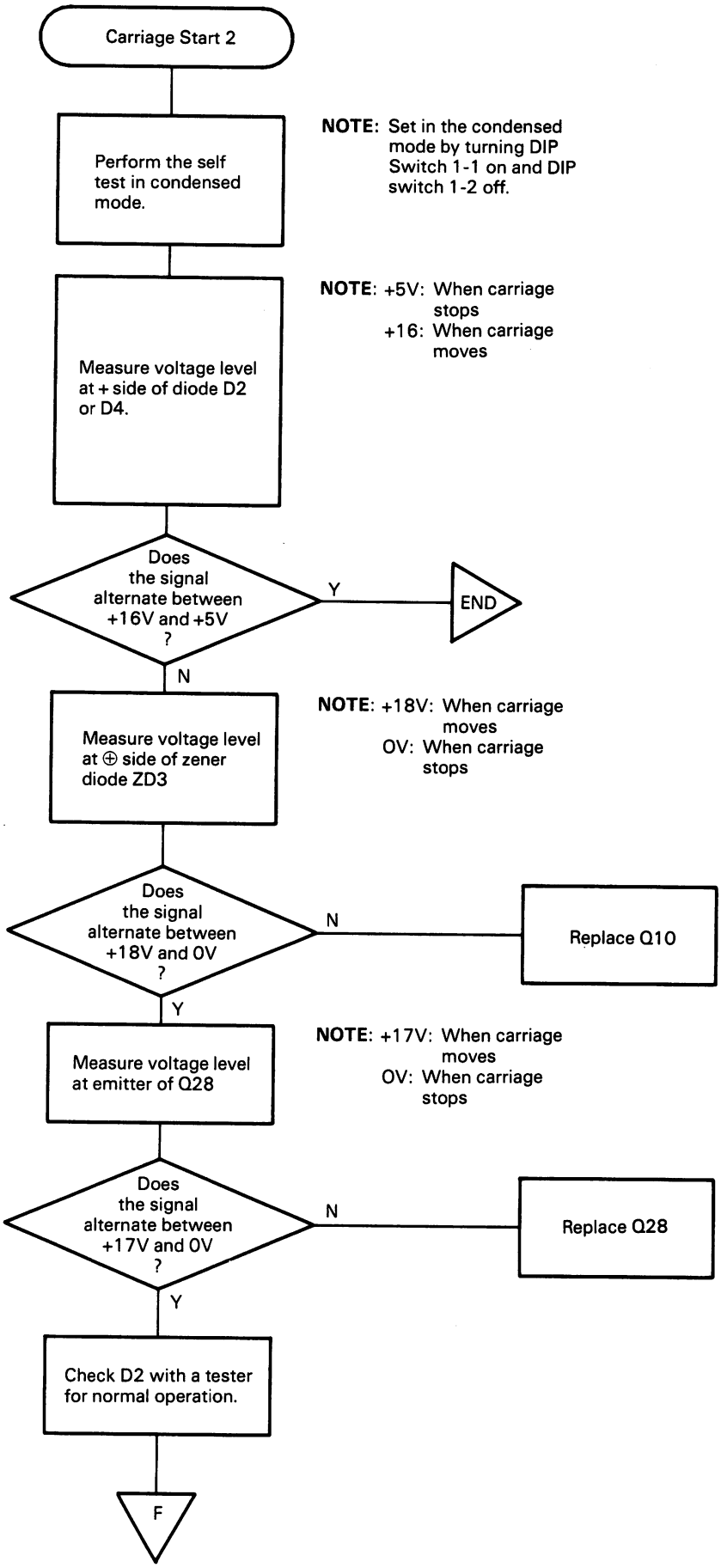
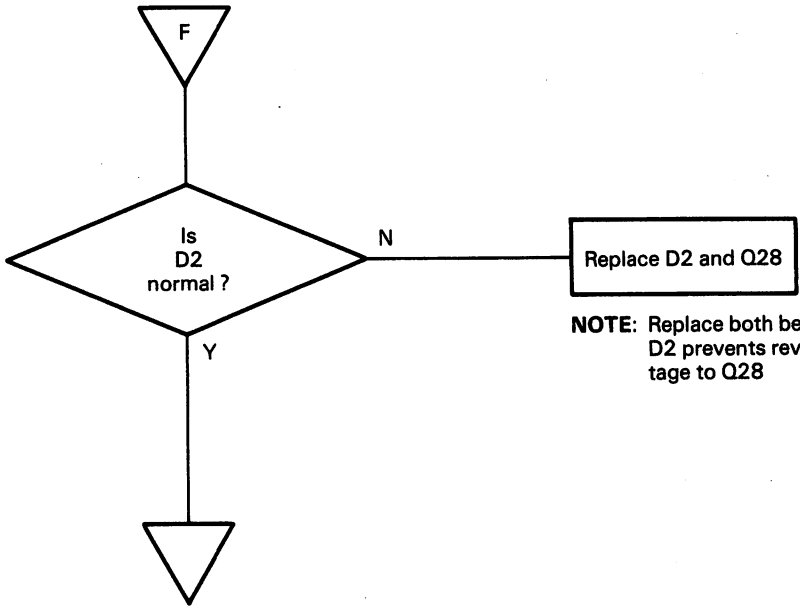


Fig. 5-6.
CR Motor Switching Transistor Collector Voltge Waveform (Lower). Base Voltage Waveform (Upper).


E
Do all waveforms appear ?
N
Base bias resistance open Replace defective resistors R32 ~ R35
Y
Measure the voltage level at the + side of diode D2 or D4
NOTE: +24: When carriage moves.
+5V: When carriage stops.
Does the signal alternate between +24V and +5V ?
N
Observe waveforms from pin 6 of IC2C
Y
Observe collector voltage waveforms of CR motor drive transistors Q17 ~ Q20.
NOTE: CR motor coils are not open. When open, no collector voltages appear. Resistance of CR motor coils is approx. 54 ohms.
Does the signal alternate between HIGH and LOW ?
N
Replace IC2C.
Y
Are Q12 and Q14 normal ?
N
Replace the defective transistor.
Y
Do all waveforms appear ?
N
Replace the defective transistor
Y
Is D4 normal ?
N
Replace diode D4.
Y
Replace 7810CPU (IC5A).


Carriage Start 2
Perform the self test in condensed mode.
NOTE: Set in the condensed mode by turning DIP Switch 1-1 on and DIP switch 1-2 off.
Measure voltage level at + side of diode D2 or D4.
NOTE: +5V: When carriage stops
+16: When carriage moves
Does the signal alternate between +16V and +5V ?
Y
END
N
Measure voltage level at ⊕ side of zener diode ZD3
NOTE: +18V: When carriage moves
0V: When carriage stops
Does the signal alternate between +18V and 0V ?
N
Replace Q10
Y
Measure voltage level at emitter of Q28
NOTE: +17V: When carriage moves
0V: When carriage stops
Does the signal alternate between +17V and 0V ?
N
Replace Q28
Y
Check D2 with a tester for normal operation.
F



NOTE: Replace both because D2 prevents reverse voltage to Q28

Check the following points prior to entering this flow chart:
① DC voltage
② A-D converter

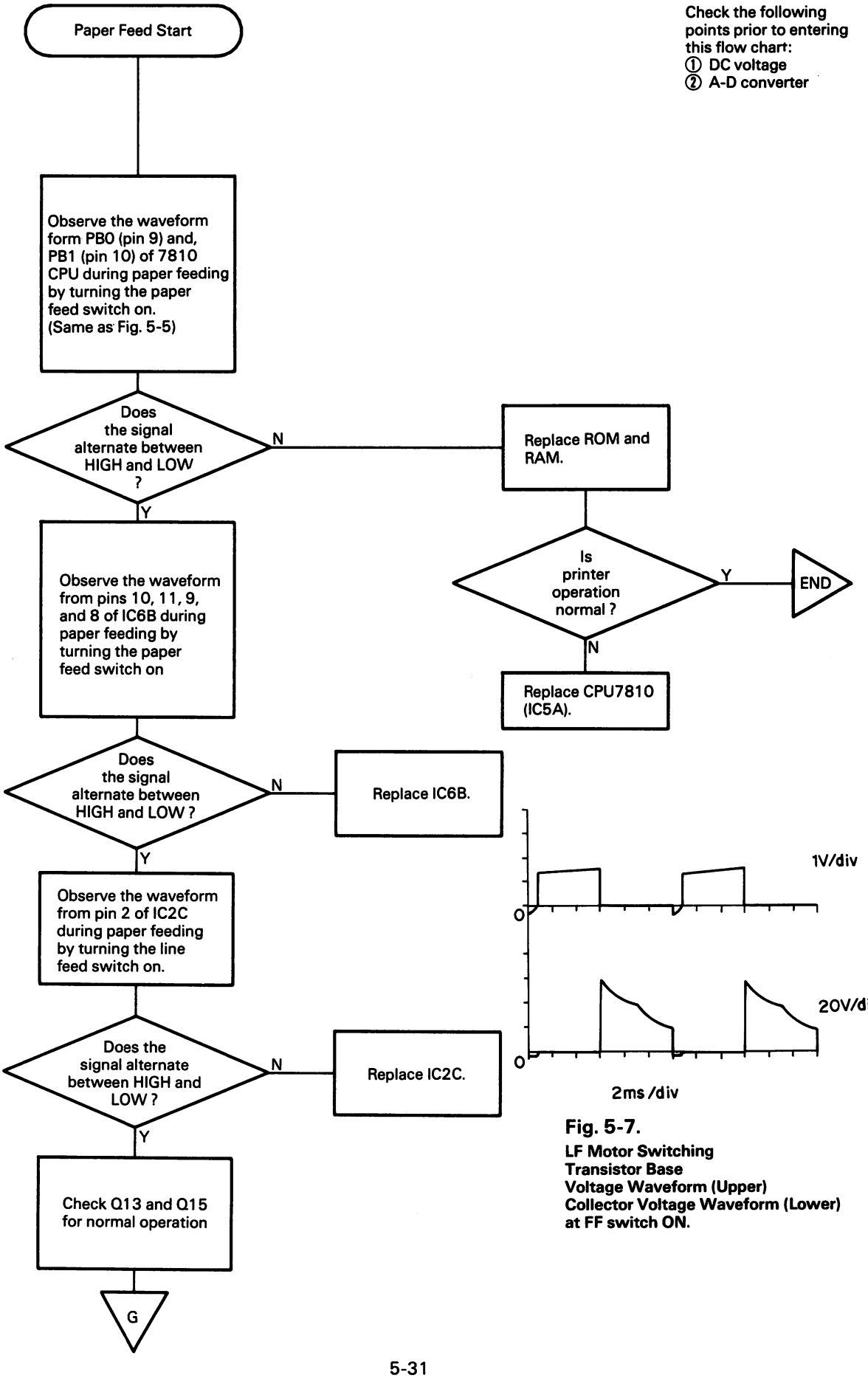
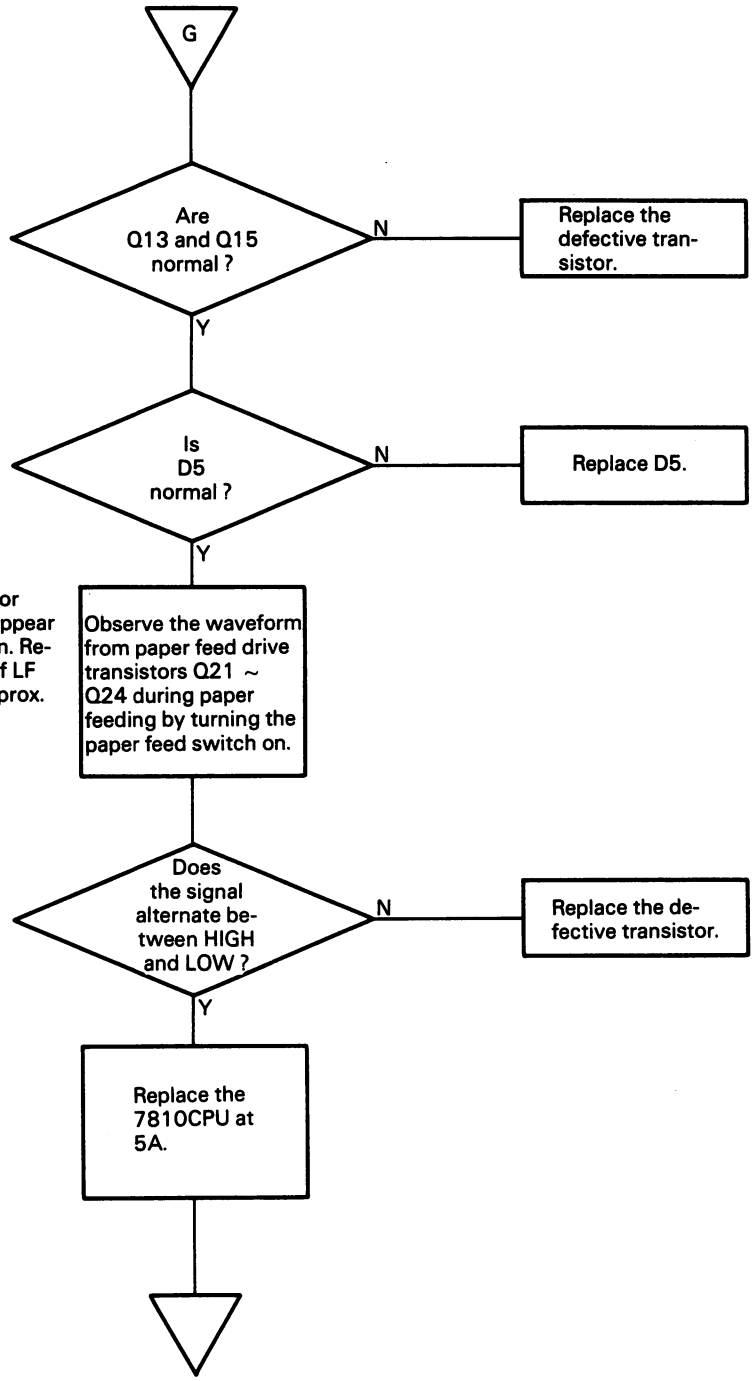
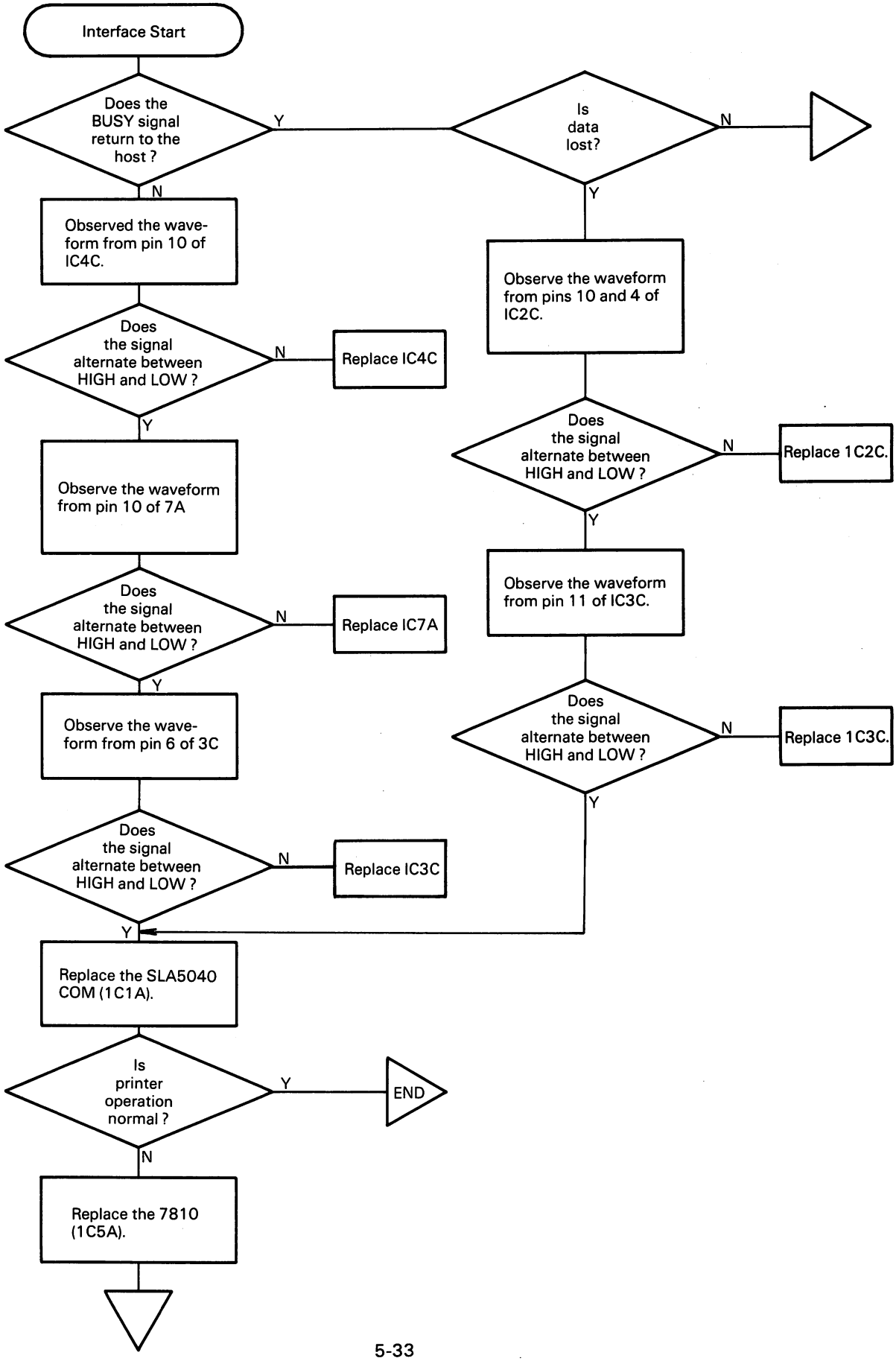
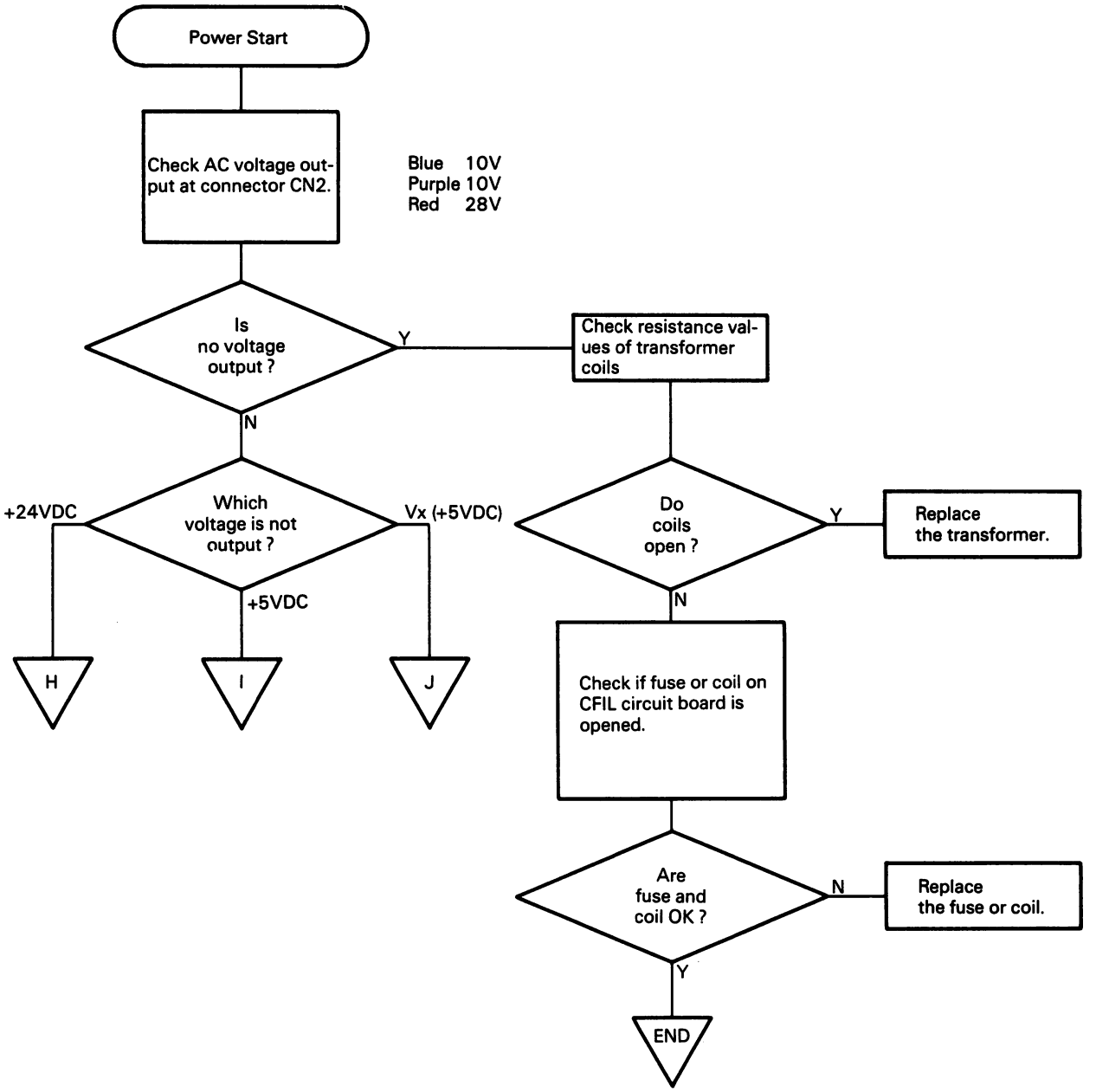


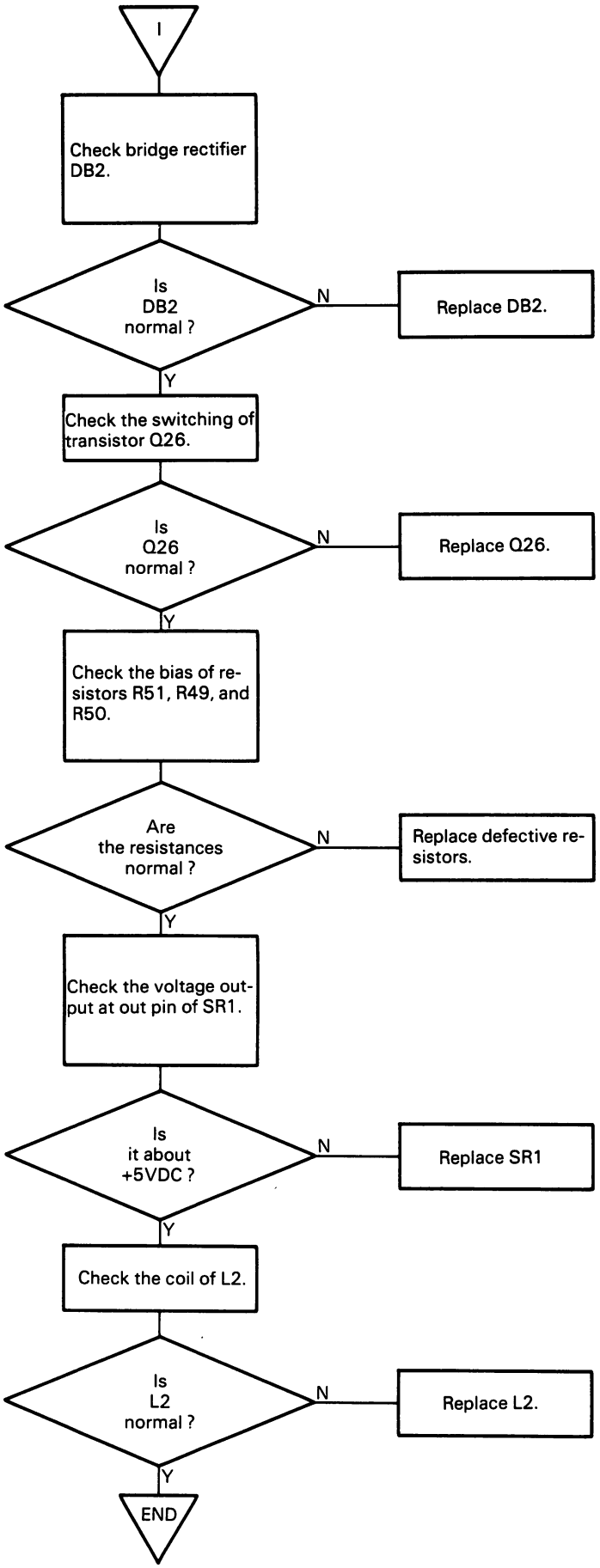
Fig. 5-7.
LF Motor Switching Transistor Base Voltage Waveform (Upper) Collector Voltage Waveform (Lower) at FF switch ON.

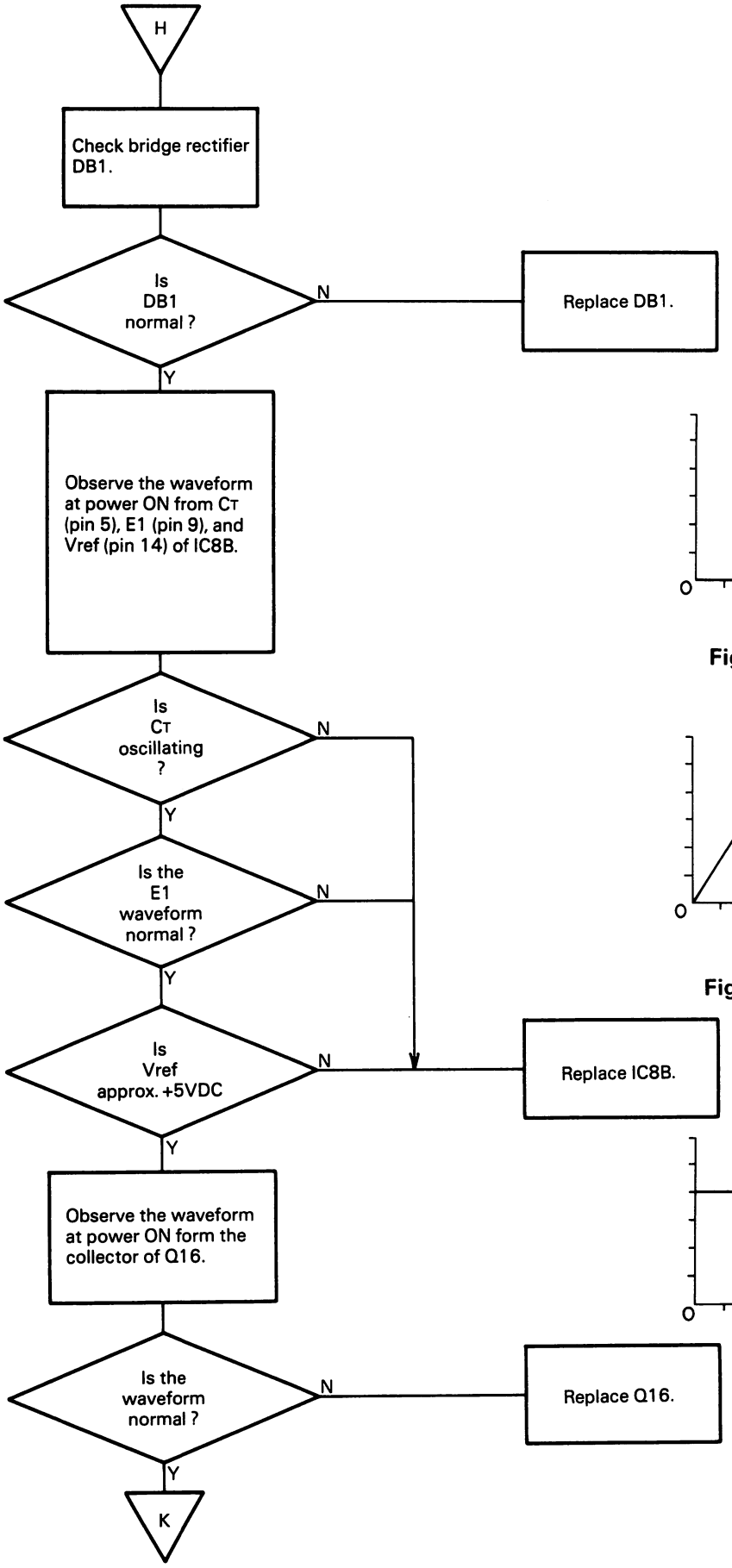


NOTE: No collector voltages appear when open. Resistance of LF coils is approx. 46 ohms


Interface Start
Does the BUSY signal return to the host ?
Y
N
Is data lost?
N
Y
Observed the wave-form from pin 10 of IC4C.
Observe the waveform from pins 10 and 4 of IC2C.
Does the signal alternate between HIGH and LOW ?
N
Replace IC4C
Y
Does the signal alternate between HIGH and LOW ?
N
Replace 1C2C.
Y
Observe the waveform from pin 10 of 7A
Observe the waveform from pin 11 of IC3C.
Does the signal alternate between HIGH and LOW ?
N
Replace IC7A
Y
Does the signal alternate between HIGH and LOW ?
N
Replace 1C3C.
Y
Observe the wave-form from pin 6 of 3C
Does the signal alternate between HIGH and LOW ?
N
Replace IC3C
Y
Replace the SLA5040 COM (1C1A).
Is printer operation normal ?
Y
END
N
Replace the 7810 (1C5A).


Power Start
Check AC voltage output at connector CN2.
Blue 10V
Purple 10V
Red 28V
Is no voltage output ?
Y
Check resistance values of transformer coils
N
Which voltage is not output ?
+24VDC
Vx (+5VDC)
+5VDC
H
I
J
Do coils open ?
Y
Replace the transformer.
N
Check if fuse or coil on CFIL circuit board is opened.
Are fuse and coil OK ?
N
Replace the fuse or coil.
Y
END


I
Check bridge rectifier DB2.
Is DB2 normal ?
N
Replace DB2.
Y
Check the switching of transistor Q26.
Is Q26 normal ?
N
Replace Q26.
Y
Check the bias of resistors R51, R49, and R50.
Are the resistances normal ?
N
Replace defective resistors.
Y
Check the voltage output at out pin of SR1.
Is it about +5VDC ?
N
Replace SR1
Y
Check the coil of L2.
Is L2 normal ?
N
Replace L2.
Y
END



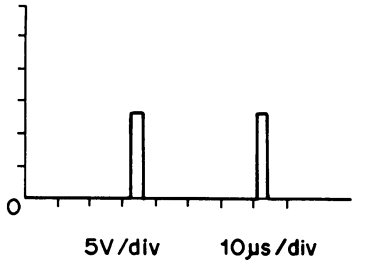


Fig. 5-8. CT Waveform

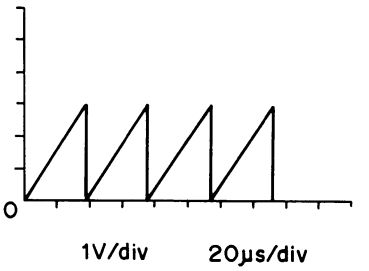


Fig. 5-9. EI Waveform

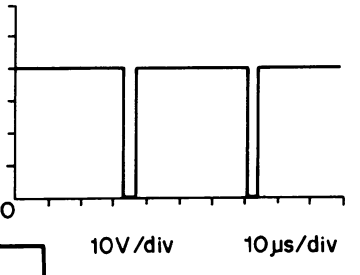


Fig. 5-10. Q16 Collector Waveform

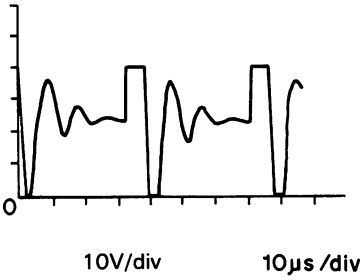
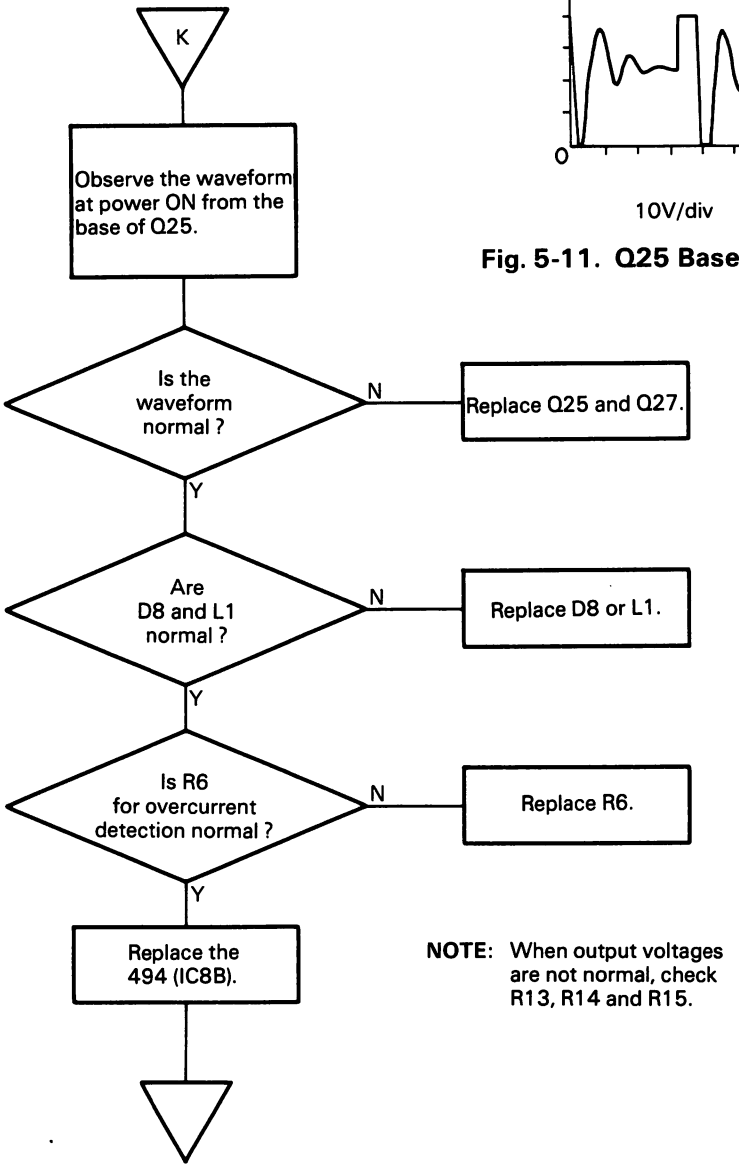
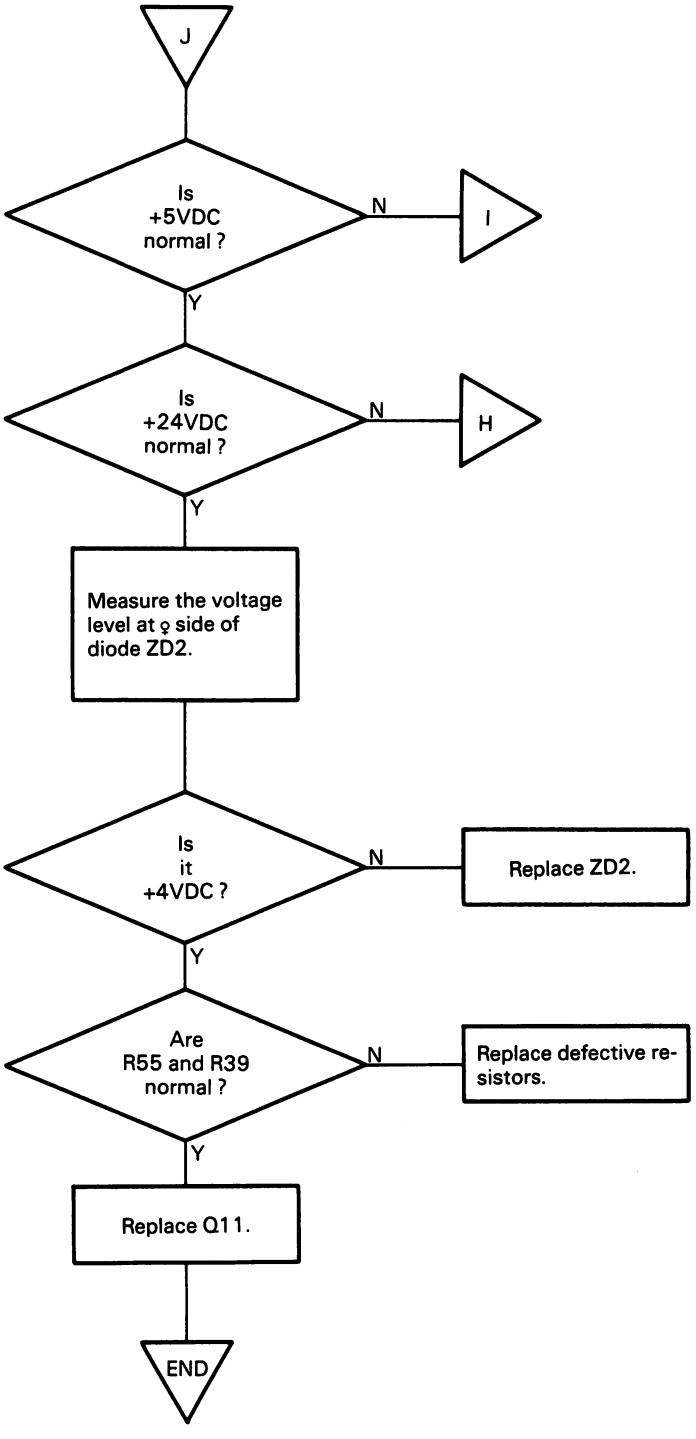


Fig. 5-11. Q25 Base Voltage Waveform



NOTE: When output voltages are not normal, check R13, R14 and R15.


J
Is +5VDC normal ?
N
I
Y
Is +24VDC normal ?
N
H
Y
Measure the voltage level at ϙ side of diode ZD2.
Is it +4VDC ?
N
Replace ZD2.
Y
Are R55 and R39 normal ?
N
Replace defective resistors.
Y
Replace Q11.
END

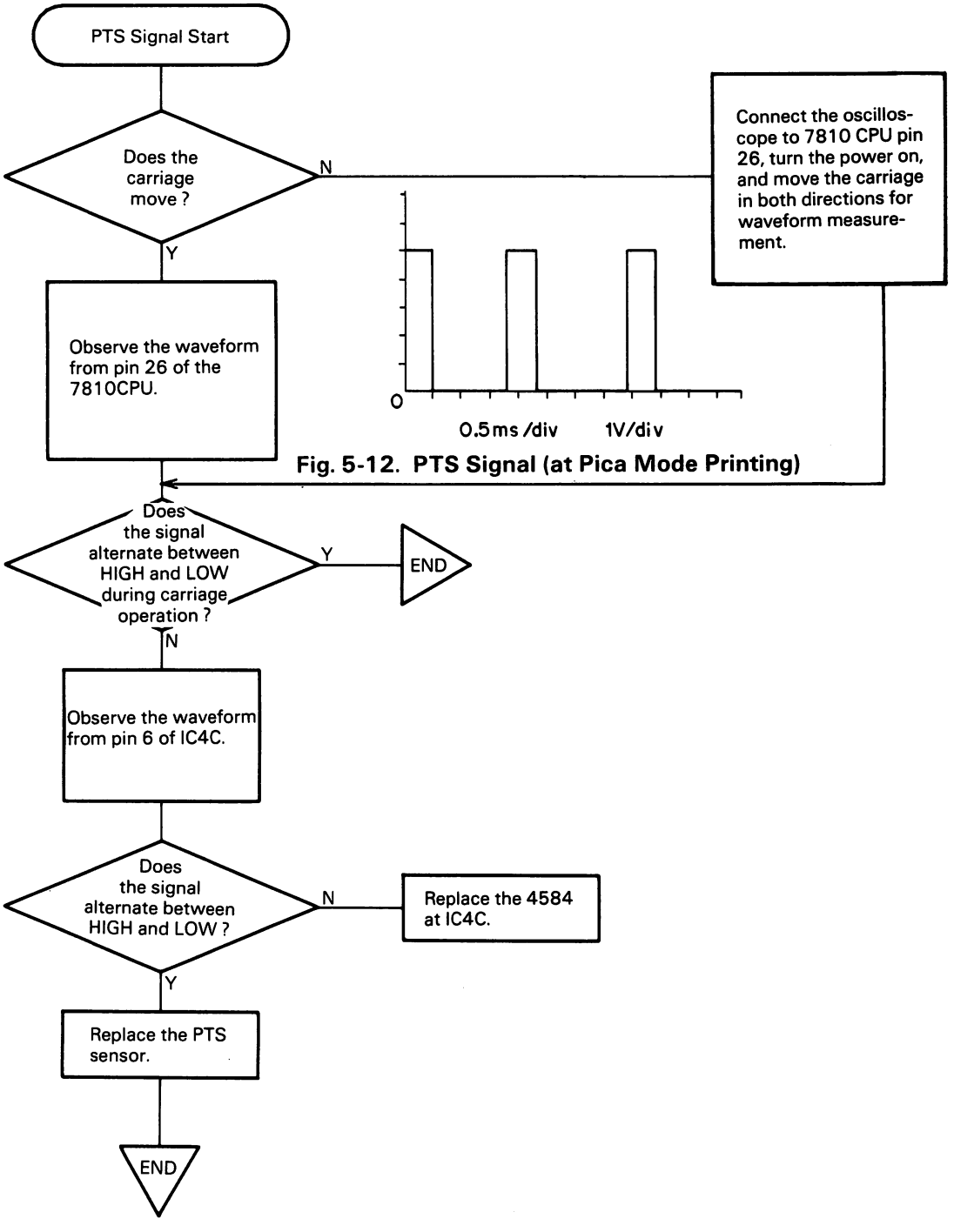
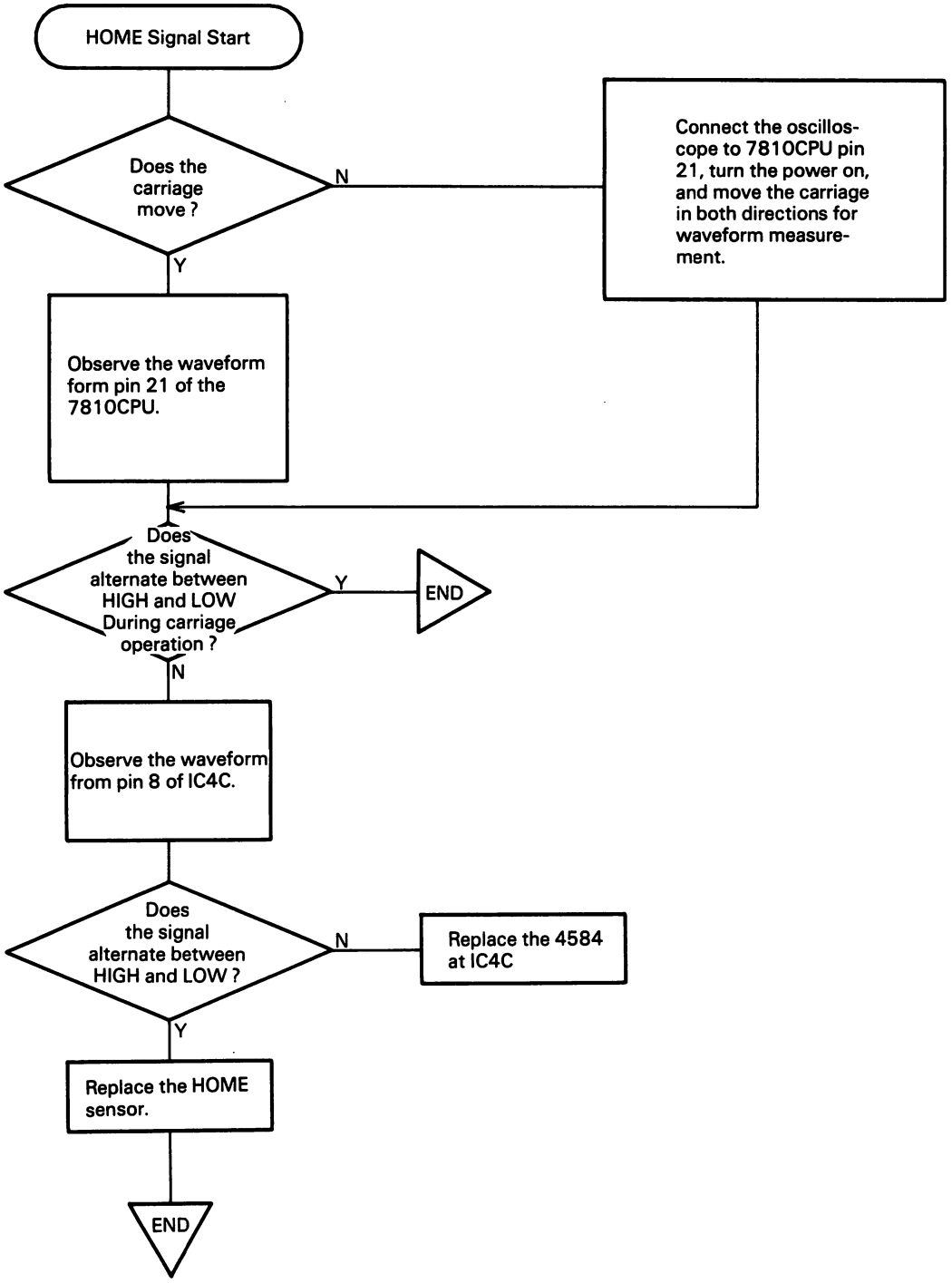


Fig. 5-12. PTS Signal (at Pica Mode Printing)


HOME Signal Start
Does the carriage move ?
N
Y
Connect the oscilloscope to 7810CPU pin 21, turn the power on, and move the carriage in both directions for waveform measurement.
Observe the waveform form pin 21 of the 7810CPU.
Does the signal alternate between HIGH and LOW During carriage operation ?
Y
END
N
Observe the waveform from pin 8 of IC4C.
Does the signal alternate between HIGH and LOW ?
N
Replace the 4584 at IC4C
Y
Replace the HOME sensor.
END

5.4.2 Troubleshooting the Printer Mechanism

If a problem occurs, carefully check its symptoms, isolate its cause according to the troubleshooting instructions given in Table 5-5, and repair it. The troubleshooting information in Table 5-5 is given in the following five columns for easy and efficient analysis and remedy of the problem without errors.

(1) PROBLEM
Indentify problems.

(2) SYMPTOM
Check trouble against the symptoms given in this column if it can be identified.

(3) CAUSE
Check trouble against the causes specified in this column according to trouble sympton. Refer to the repair levels specified for each cause.

(4) CHECKPOINT
Observe the instructions given in this column for checking trouble points.

(5) REPAIR METHOD
Make repairs according to the instructions given in this column. If the same problem or symptom persists as before even after repairs, check other items in the column of causes and try again.

Table 5-5. Troubleshooting the Printer Mechanism

Problem	Symptom	Cause	Checkpoint	Method
1. Carriage motor does not rotate.	The carriage motor does not operate at all at power ON.	Foreign substances are lodged in the gears or mechanism.	Move the timing belt manually to check if the carriage motor roatates.	● Remove foreign substances.
		The carriage motor is defective.	Check the continuity of each phase.	● Replace the carriage motor.
2. Carriage does not move.	The carriage motor rotates in the normal state, but the carriage does not move.	The belt transmission pulley and belt driven pulley are defective.	Check for broken or worn gears.	● Replace the belt transmission pulley. ● Replace the belt driven pulley.
		The cartridge ribbon is defective.	Remove the cartridge ribbon to check if the carriage moves.	● Replace the cartridge ribbon.
		The carriage is defective.	Check for foreign substances lodged in the carriage or for broken or worn gears.	● Remove foreign substances. ● Replace the gear in the carriage unit.
	The carriage operates abnormally.	The HP sensor is defective.	Check for foreign substances lodged in the HP sensor.	● Remove foreign substances.
			Use an oscilloscope to check the output waveforms.	● Replace the HP sensor set.
3. Printing is not executed.	The carriage moves, but printing is not exeecuted.	The common wires of the head cable are cracked or disconnected.	Check the continuity of the common wires of the head cable.	● Replace the head cable set.
		The head cable connectors are not connected.	Verify that the printhead is mounted in the right position.	● Reinsert the printhead unit.
			Check the connector continuity.	● Replace the head cable set.
		The common wires of the printer cable are cracked or disconnected.	Check the continuity of the common wires of the printer cable.	● Replace the printer circuit board set.
	The paper end is not printed.	The paper guide auxiliary plate is not in the right position.	Verify that the paper guide auxiliary plate is mounted in the right position.	● Reinsert the paper guide auxiliary plate.

Table 5-5. Troubleshooting the Printer Mechanism (cont'd)

Problem	Symptom	Cause	Checkpoint	Method
4. Dot is not imprinted.	A specific dot is no imprinted.	The printhead is defective.	Verify that the dot wire is not broken or missing.	● Replace the printhead unit.
			Check the resistances of the head coil.	● Replace the printhead unit.
	The dot is not printed sometimes.	The cable head is not connected correctly.	Verify that the head cable is firmly inserted into the connector.	● Insert the head cable firmly.
			Check for dirt around the head cable connector.	● Clean and reconnect.
		The printhead is defective.	Verify that the tip of the dot wire is not worn.	● Replace the printhead unit.
			Check the resistances of the head coil.	● Replace the printhead unit.
5. Printing color is light, and the printing density is not uniform.	The overall printing color is light, the overall printing density is not uniform.	The printhead is defective.	Verify that the tip of the dot wire is not worn.	● Replace the printhead unit.
			Check the resistances of the head coil.	● Replace the printhead unit.
		The platen gap is not properly adjusted.	Check the gap between the tip of the dot wire and the platen.	● Readjust the platen gap.
6. Paper is not fed.	Printing is executed, but the paper is not fed, or the paper feed pitch is not normal.	The release lever does not operate correctly.	Verify that the release lever is in the right position.	● Place it in the right position.
		Foreign substances are caught in the paper path.	Verify that no foreign substances are lodged in the paper guide path.	● Remove any foreign substances.
		The paper feed motor does not drive the gear correctly.	Verify that no foreign substances are lodged between the gears (paper feed transmission gear, etc), and that the gears are not broken or worn.	● Remove the foreign substances. ● Replace the paper feed transmission gear. ● Replace the platen gear. ● Replace the sprocket gear. ● Replace the sprocket transmission gear.
		The sprocket unit is defective.	Verify that the sprocket wheel is positioned correctly.	● Readjust the sprocket wheel.
7. Ribbon is not fed.	The ribbon is not fed.	The cartridge ribbon is defective.	Verify that ribbon is fed when the cartridge ribbon is rotated manually by the knob.	● Replace the cartridge ribbon.
		The cartridge is defective.	Verify that the ribbon drive gear rotates when the carriage moves.	● Replace the gears in the cartridge unit.

Table 5-5. Troubleshooting the Printer Mechanism (cont'd)

Problem	Symptom	Cause	Checkpoint	Method
	The ribbon is fed only when the carriage moves to the right (or to the left).	The ribbon planetary lever is defective.	Verify that the ribbon driven gear rotates when the carriage moves.	● Replace the ribbon planetary lever set.
8. Paper becomes stained.	The paper becomes ink stained where printing is not executed.	The ribbon mask is not in the right position.	Verify that the ribbon mask is in the right position.	● Readjust the ribbon mask.
		The platen gap is not properly adjusted.	Check the gap between the tip of the dot wire and the platen.	● Readjust the platen gap.
9. Printing is executed without paper setting.	Printing is executed without paper setting.	The PE sensor is defective.	Use a tester to verify the microswitch turns ON/OFF when the paper is inserted/drawn out.	● Replace the PE sensor unit.
			Verify that the PE sensor lever moves smoothly.	● Replace the PE sensor unit.

CHAPTER 6
MAINTENANCE

LIST OF FIGURES

LIST OF TABLES

6.1 PREVENTIVE MAINTENANCE

Proper maintenance is essential to maintain optimal printer performance for the longest possible period and to minimize malfunction frequency. Preventive maintenance includes regular cleaning of the case exterior, using alcohol, and occasional vacuuming of the mechanism interior to remove dust and paper particles. Following cleaning, refer to Section 6.2 to verify that the unit is adequately lubricated. Before returning the serviced printer to the consumer, inspect the springs and paper feed rollers and the basic operation of the unit.

WARNING

Disconnect the printer from the power supply before performing maintenance. Do not use thinner, trichloroethylene, or ketone-based solvents on the plastic components of the printer.

6.2 LUBRICATION AND ADHESIVE APPLICATION

We recommend that the points illustrated in Figure 6-1 be lubricated, according to the schedule listed in Table 6-1, with G-14, which has been extensively tested and found to comply with the needs of the Commodore MPS-1000 printer. Lubricate the printer when it is disassembled for part replacement, or every 6 months or 3,000,000 lines of print, whichever comes first. Be sure that the parts to be lubricated are clean before applying lubricant, and avoid excessive application, which may damage related parts.

Adhesive application is necessary at the points listed in Table 6-2 when the unit is disassembled, or as needed following routine maintenance. We recommend Neji-lock green #2 adhesive to be applied to the points diagrammed in Figure 6-1; apply adhesive to one-third the edge of screws and at the edges of sensor boards, and avoid overflow of excess to related parts.

Table 6-1. Lubrication Schedule

Ref	Lubrication Point
1	Teeth of the carriage guide plate
2	Carriage assembly
3	Shaft of platen transmission gear
4	Carriage guide shaft

G-14 is available in 40 cc containers.
Part No.: 601162-43 (Vendor P/N: B701400001)

Table 6-2. Adhesive Application Points

Ref	Application Point
5	Belt tension plate securing screw
6	PTS sensor securing screw
7	Two ribbon mask securing screws
8	Point where timing belt is connected beneath the carriage

Neji-lock green #2 is a commercially available adhesive.
Part No.: 601162-44 (Vendor P/N: B730200100)

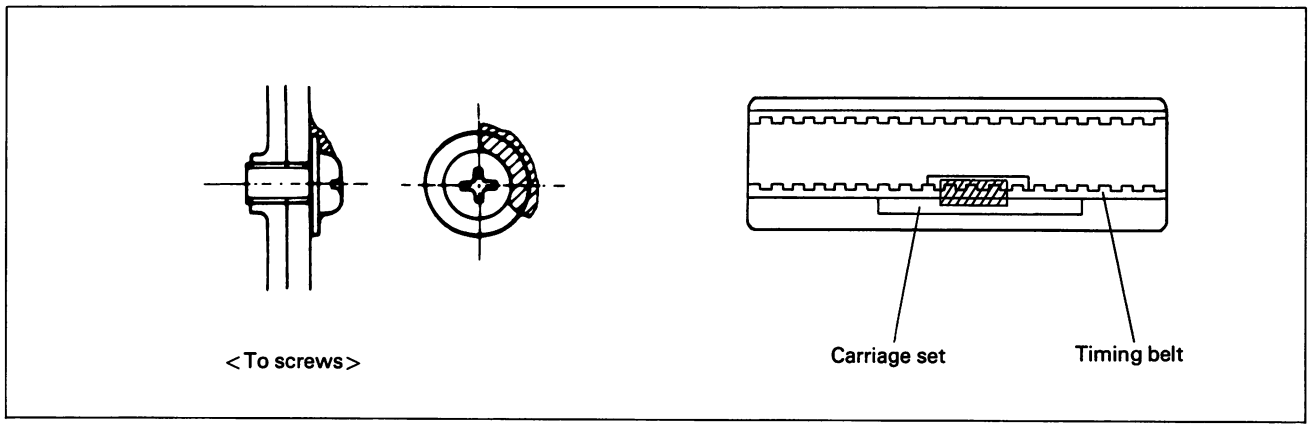


Fig. 6-1. Correct Adhesive Application

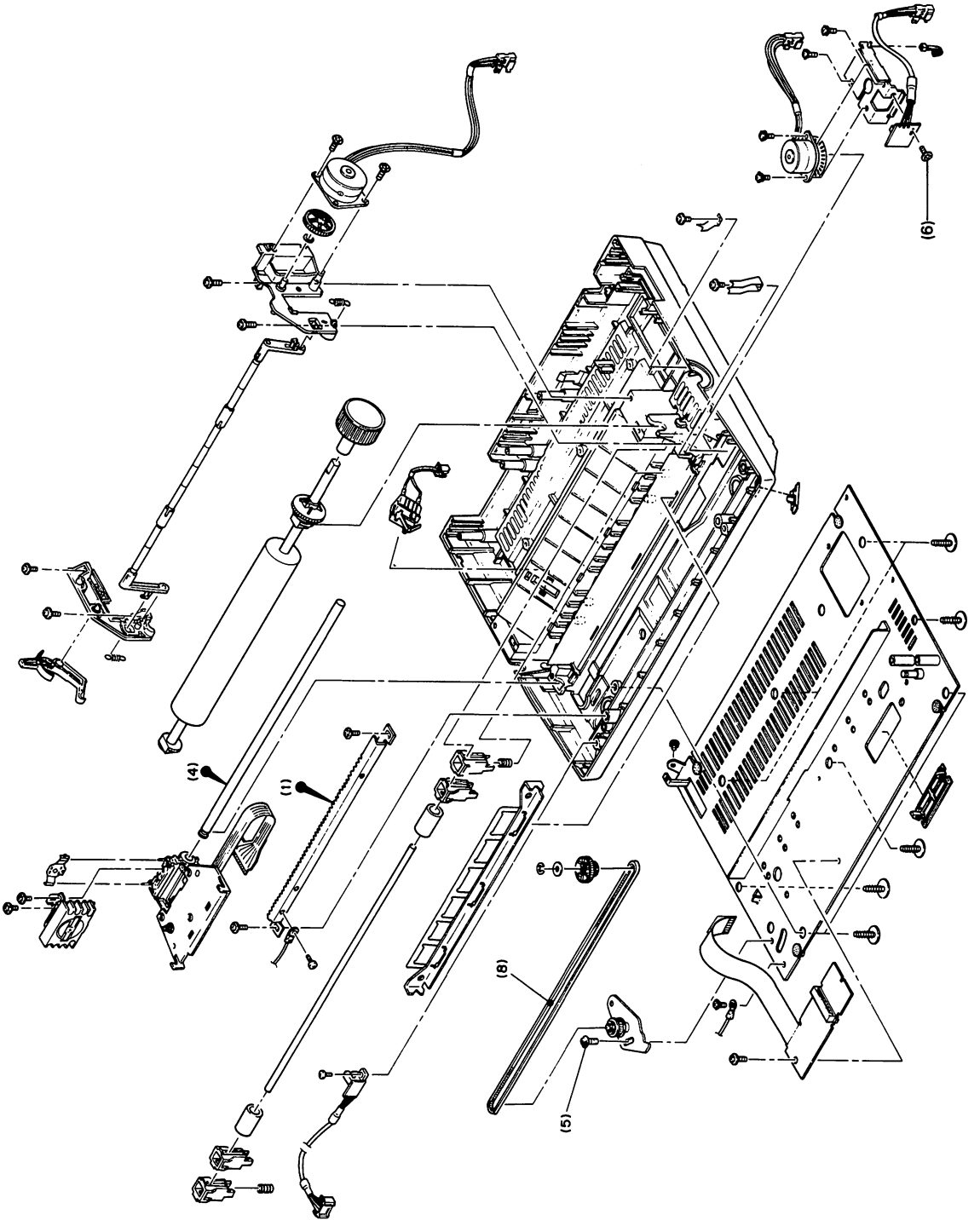


Fig. 6-2. Lubrication and Adhesive Application Points Drawing 1

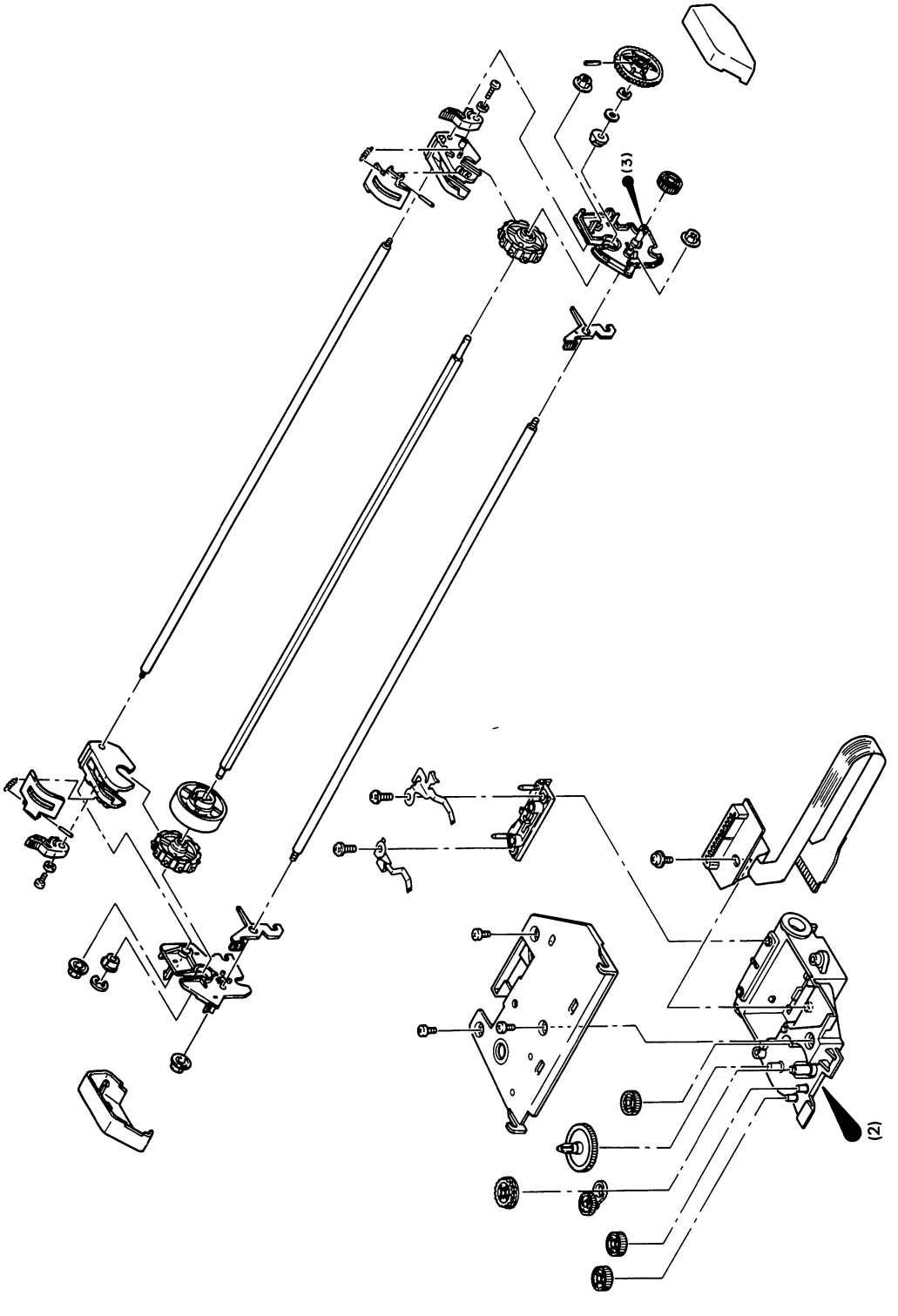


Fig. 6-3. Lubrication and Adhesive Application Points Drawing 2

CHAPTER 7
REFERENCE MATERIALS AND SCHEMATICS

LIST OF FIGURES

LIST OF TABLES

7.1 IC DESCRIPTIONS

This section describes the primary ICs on the CATX board (Table 7-1) and supplements the data provided in Chapter 2. Tables 7-2 and 7-3 list associated transistors.

Table 7-1. CATX Board LSIs

Name of IC	Part Number	Type	Location
μPD7810G	X400078100	CPU	5A
E05020AA	Y560800001	SLA5040 COM	1A
μPC494C	X440064940	Switching regulator	8B
μPC78L05A	X440078052	Regulator	SR1
7505	X420100050	Hex Inverter	2C
7407	X420100070	Hex Buffer/Driver	7A
74LS32	X420300320	Quad 2-Input OR	3C
74LS75	X420300750	4 Bit Bistable Latch	6B
TC4584BP	X460458400	Hex Schmitt Trigger	4C
HM6116LP	X400161164	S-RAM	2A

Table 7-2. CATX Board Transistors

Name of Transistor	Part Number	Type	Location
2SA1015	X300101509	PNP 50V 0.4W	Q11
2SA1020	X300102009	PNP 50V 2A 0.9W	Q27, 14, 15
2SC1815	X302181509	NPN 60V 0.4W	Q10, 12, 13, 16
2SA1307	X300130700	50V 5A 20W	Q26
2SC3293	X302329300		Q1 ~ 9, 28
2SC3299	X302329900	50V 5A 20W	Q25
2SD1630	X303163000		Q17 ~ 24

Table 7-3. COMI Board LSI

Name of IC	Part Number	Type	Location
27256	–	ROM	1A

7.1.1 7810/7811 Microprocessor

Figures 7-1 and 7-2 describe the 7810/7811 microprocessor, and Tables 7-4 through 7-7 describe its functions.

PA7 – 0	:	Port A
PB7 – 0	:	Port B
PC7 – 0	:	Port C
PD7 – 0	:	Port D
$\overline{\text{PF7 – 0}}$	:	Port F
$\overline{\text{NMI}}$	:	Non-maskable Interrupt
INTI	:	Interrupt Request
MODE 0.1	:	Mode 0.1
X1, X2	:	Crystal
AN7 – 0	:	Analog Input
$\overline{\text{RD}}$	:	Read Strobe
$\overline{\text{WR}}$	:	Write Strobe
ALE	:	Address Latch Enable
$\overline{\text{RESET}}$	:	Reset
VAref	:	Reference Voltage

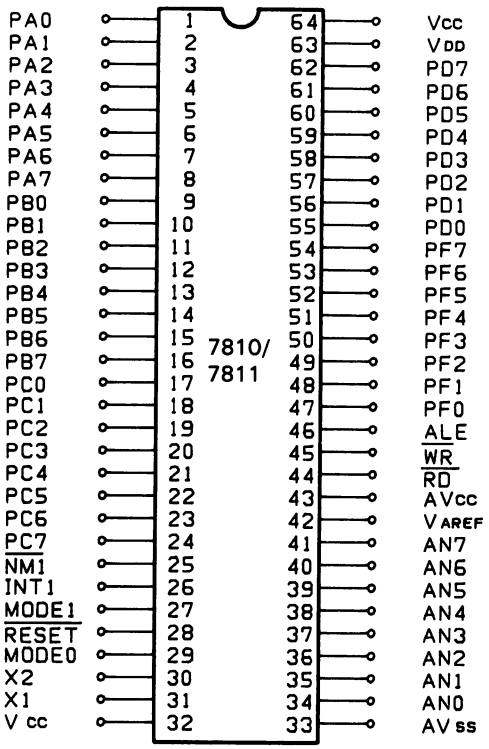


Fig. 7-1. 7810/7811 Pin Diagram

- 256 bytes built-in RAM (addresses 0FFOOH-0FFFFH)
- 4096 bytes mask-ROM (7811 only, addresses 0-0FFH)
- Direct addressing of up to 64K bytes
- 8-bit A/D converter
- 158 instructions
- 1 μs instruction cycle
- 16-bit event counter
- Two 8-bit timer counters
- 3 external and 8 internal interrupts; 6 levels priority and 6 interrupt addresses
- General purpose serial interface (asynchronous, synchronous, and I/O modes)
- I/O line (7811: 40-bit I/O port; 7810: 24 bits edge detection, 4 inputs)
- Zero cross detection
- Standby function
- Built-in clock pulse circuit
- NMOS

Table 7-4. 7810/7811 Port Functions

Pin	Signal	Direction	Description
1 ~ 8	PA0 ~ 7	I/O	Port A. Eight-bit I/O with output latch. I/O possible by mode A (MA) register. Output high.
9 ~ 16	PB0 ~ 7	I/O	Port B. Eight-bit I/O with output latch. I/O possible by mode B register (MB). Output high.
17 ~ 24	PC0 ~ 7	I/O	Port C. Eight-bit I/O with output latch. Port/control mode can be set by mode control C (MCC) register. Output high.
25	$\overline{NMI}$	IN	Non-maskable interrupt of the edge trigger (trailing edge).
26	INTI	IN	Maskable interrupt input of the edge trigger (leading edge). Also used as the AC input zero cross detecting terminal.
27, 29	MODE 1, 0	I/O	7811: 0 = low and 1 = high 7810 modes set in accordance with external memory (see Table 7-5).
28	$\overline{RESET}$	IN	Low reset
30, 31	X2, X1	–	Crystal connection for built-in clock pulse. When clock pulse is supplied externally, input must be to X1.
32	Vss	–	Supply voltage, Vss, OV
33	AVss	–	Analog Vss
34 ~ 41	AN0 ~ 7	IN	Eight analog inputs of A/D converter. AN7 ~ 4 can be used as the input terminals to detect the leading edge and to set the test flag upon detection of the trailing edge
42	Varef	IN	Reference voltage
43	AVcc	–	Analog Vcc
44	$\overline{RD}$	OUT	Read strobe. Low at the read machine cycle and at reset, high at other times.
45	$\overline{WR}$	OUT	Write strobe. Low during the write machine cycle and at reset, high at other times.
46	ALE	OUT	Address latch enable. Latches the lower 8 address bits to access external memory.
47 ~ 54	PF0 ~ 7		Port F 7811: Port bit-by bit I/O possible by mode F register. In extension mode, gradual address output assignment is possible in accordance with the size of external memory. See Table 7-6. 7810: By setting modes 0 and 1, assignment to the address bus (AB15 ~ 8) can be made in accordance with the size of the external memory. The remaining terminals can be used as I/O ports. See Table 7-7.
55 ~ 62	PD0 ~ 7		Port D. 7811: Port bit-by-bit I/O possible. In extension mode, PD7-0 act as the multiplexed address/data bus (AD7-0). 7810: Multiplexed address/data bus to access external memory.
63	V_{DD}	–	Supply voltage, V_{DD}, +5V
64	Vcc	–	Supply voltage, Vcc, +5V

Table 7-5. 7810 Mode Setting

Mode 1	Mode 0	External memory
0	0	4KB Addresses 0 to OFFF
0	1 (Note)	16KB Addresses 0 to 3FFF
1 (Note)	1 (Note)	64KB Addresses 0 to FEFF

Table 7-6. 7811 Port F Operation

PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0	External Memory
Port	Port	Port	Port	Port	Port	Port	Port	256 bytes (max.)
Port	Port	Port	Port	AB11	AB10	AB9	AB8	4K bytes (max.)
Port	Port	AB13	AB12	AB11	AB10	AB9	AB8	16K bytes (max.)
AB15	AB14	AB13	AB12	AB11	AB10	AB9	AB8	60K bytes (max.)

Table 7-7. 7810 Port F Operation

MODE 1	MODE 0	PF7	PF6	PF5	PF4	PF3	PF2	PF1	PF0	External Memory
0	0	Port	Port	Port	Port	AB11	AB10	AB9	AB8	4K bytes
0	1	Port	Port	AB13	AB12	AB11	AB10	AB9	AB8	16K bytes
1	1	AB15	AB14	AB13	AB12	AB11	AB10	AB9	AB8	64K bytes

NOTE: Pull-up is made.

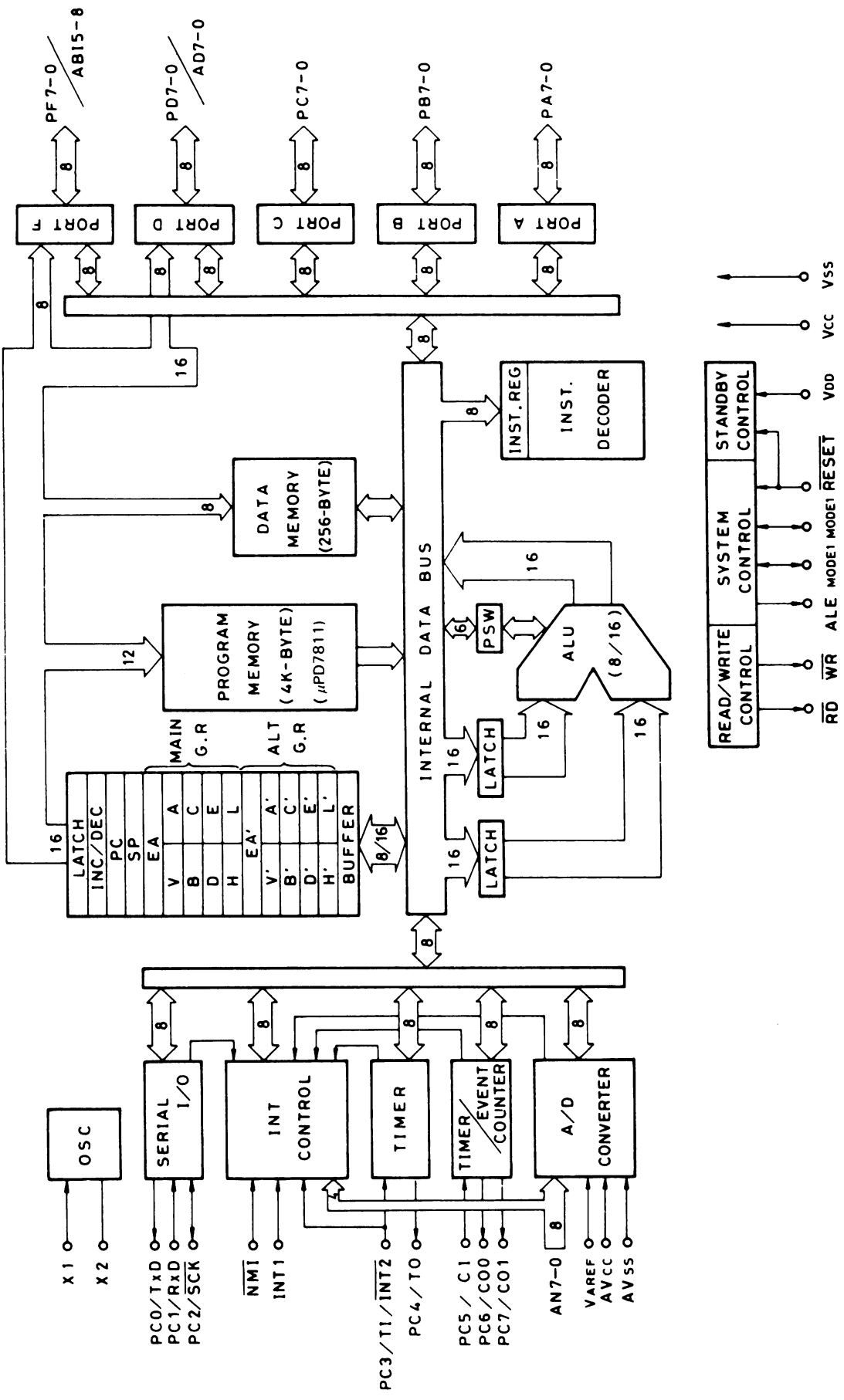


Fig. 7-2. 7810/7811 Block Diagram

CPU Timing (Figs. 7-3 through 7-5)

Three oscillations define one state. The OP code fetch requires four states: during T1 to T3, program memory is read; instructions are interpreted during T4. AB15-8 are output from T1 to T4. AD7 ~ 0 (PD7 ~ 0) are used in the multiplex mode; the address is latched during T1 at the ALE signal. Since the memory addressed is enabled after disengaging the driver (AD7 ~ 0), $\overline{RD}$ is output from T1-T3, fetched at T3, and processed internally at T4.

ALE and $\overline{RD}$ signals are executed from T1-T3; the OP code fetch for these two signals is performed at T4. $\overline{WR}$ is output from the middle of T1 to the beginning of T3. The address and ALE timing is the same as that for memory read; however, following address output, AD7 ~ 0 (PD7 ~ 0) are not disabled, and write data are output at AD7 ~ 0 at the beginning of T1 and the end of T3.

NOTE: When PD7 ~ 0 are set to the multiplexed address (AD7 ~ 0)/data bus and PF7 ~ 0 to the address bus (AB7 ~ 0), the $\overline{RD}$ and $\overline{WR}$ signals in the machine cycle are high when memory is not being accessed.

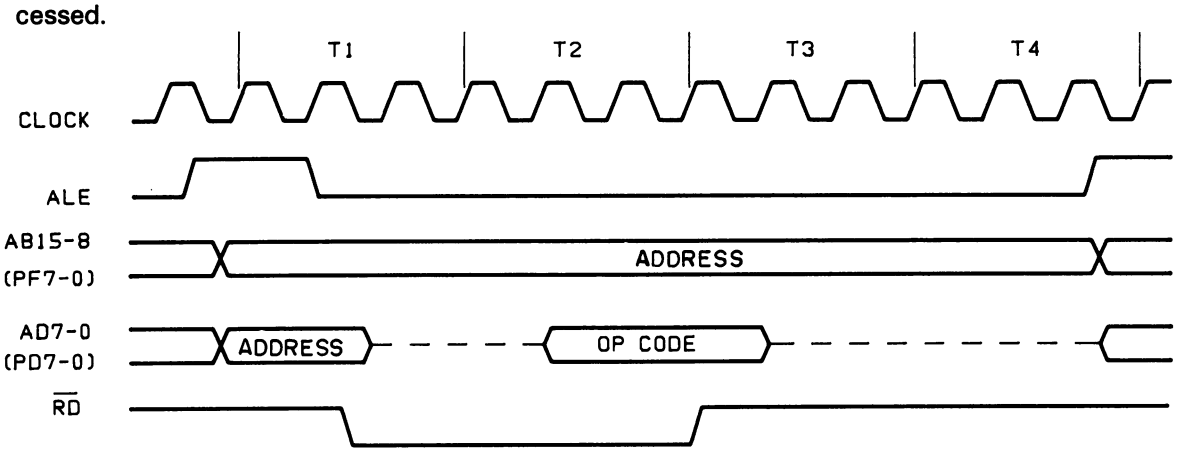


Fig. 7-3. OP Code Fetch Timing

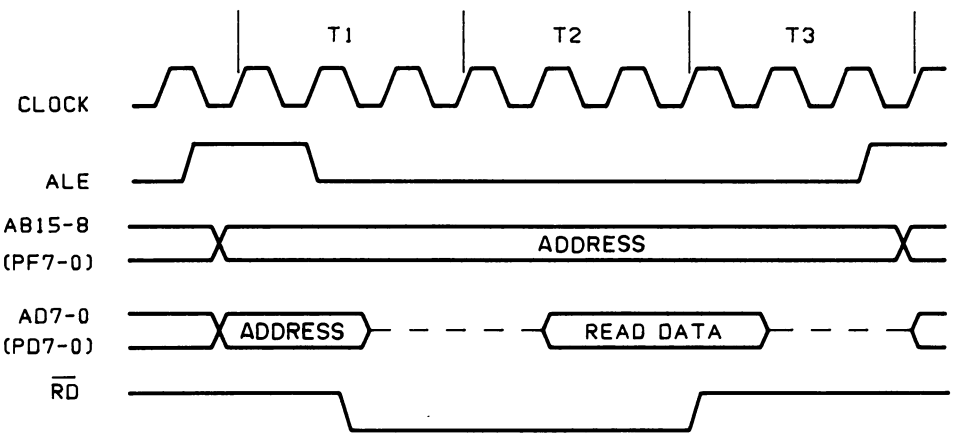


Fig. 7-4. Memory Read Timing

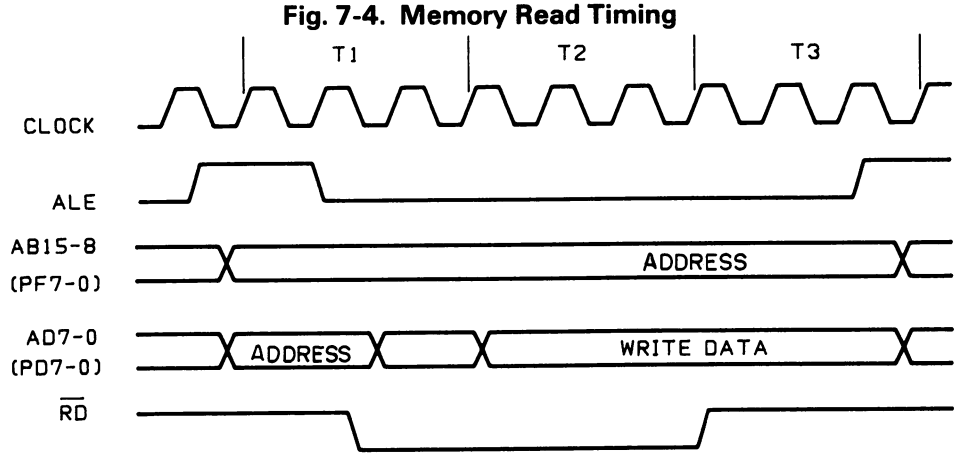


Fig. 7-5. Memory Write Timing

7.1.2 494 Regulator IC

The 494 regulator IC is described in Figures 7-6 and 7-7 and Table 7-8.

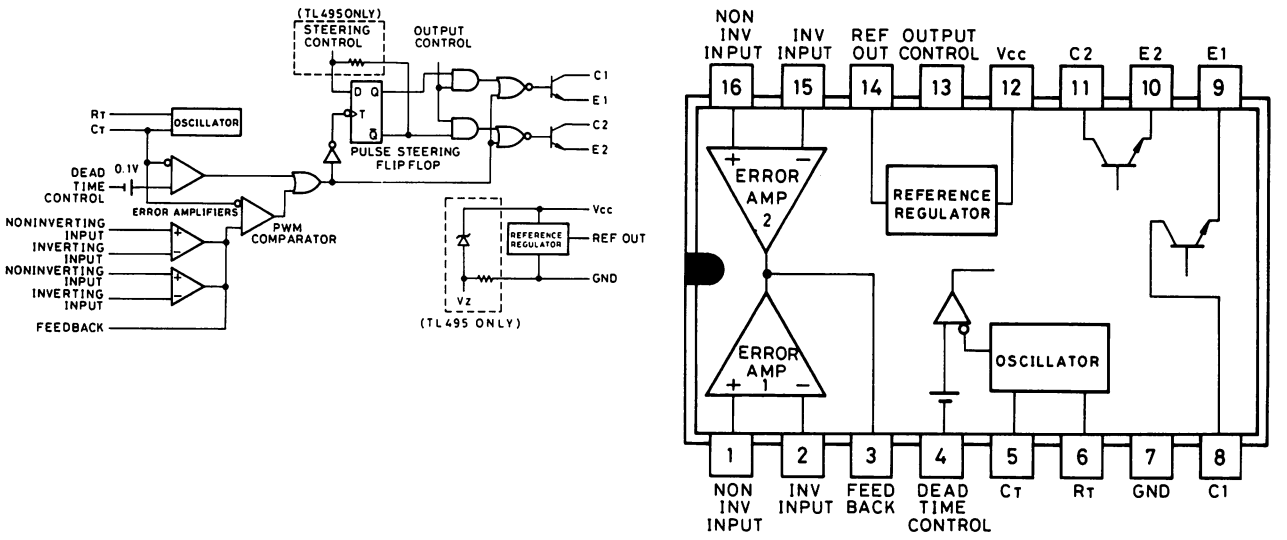


Fig. 7-6. 494 IC Pin and Block Diagrams

Table 7-8. 494 IC Port Functions

Pin	Signal	Description
1	NON INV	Non. Inv. Input of error amplifier for output voltage detection.
2	INV	Inv. Input of error amplifier for output voltage detection.
3	FEEDBACK	Feedback for phase correction.
4	CONTROL	Controls transistor OFF time.
5	CT	Capacitor for oscillation frequency adjustment.
6	RT	Resistor for oscillation frequency adjustment.
7	GND	Ground
8	C1	Transistor collector for pulse amplification.
9	E1	Transistor emitter for pulse amplification.
10	E2	Transistor emitter for pulse amplification.
11	C2	Transistor collector for pulse amplification.
12	Vcc	Power
13	OUTPUT CONTROL	Selection of parallel or push-pull.
14	REF OUT	+5V reference voltage
15	INV	Inv. Input of error amplifier for output current detection.
16	NON INV	Non. Inv. of error amplifier for output current detection.

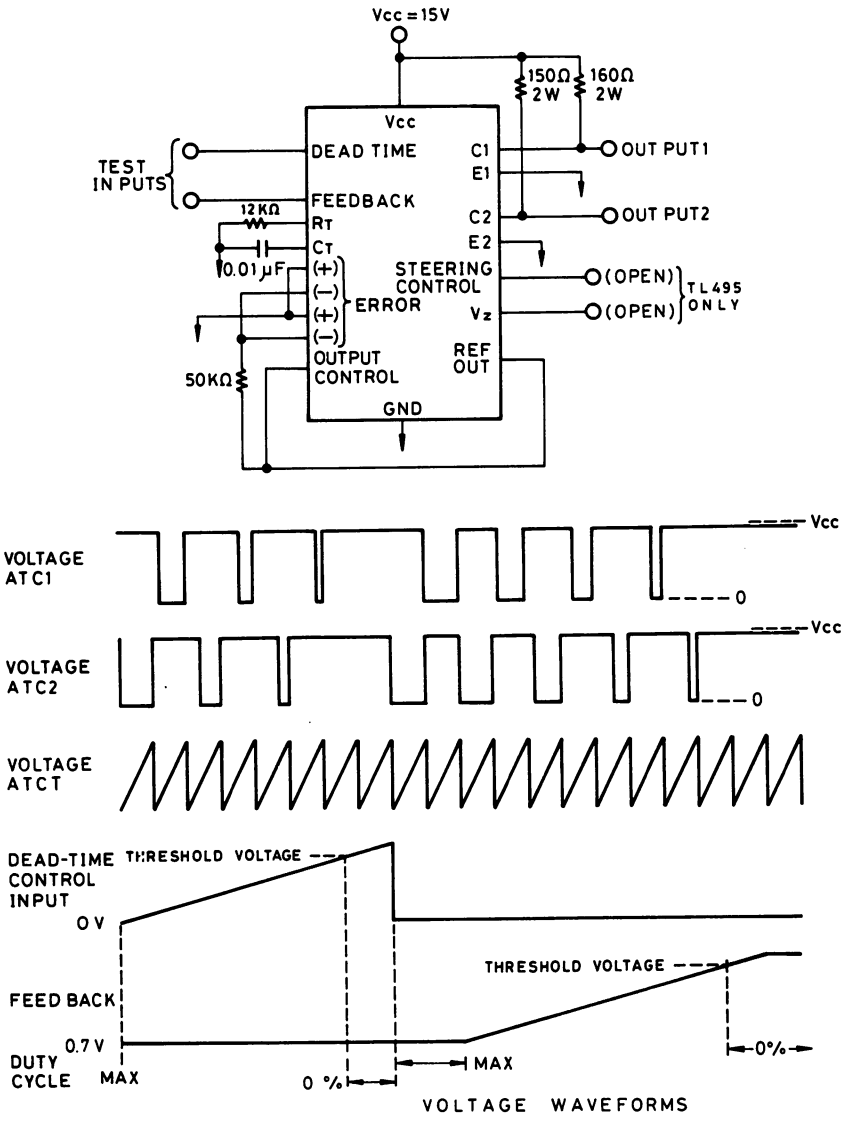


Fig. 7-7. 494 Dead Time and Feedback Control

7.1.3 SLA5040 COM

Figure 7-8 diagrams the pin assignment of the SLA 5040 COM gate array. Tables 7-9 and 7-10 describe its functions.

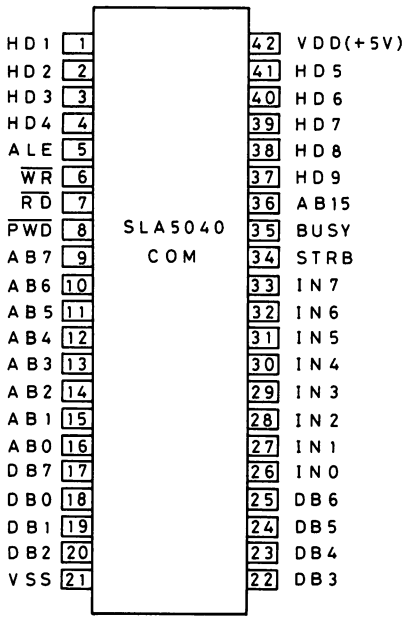


Fig. 7-8. SLA5040 COM Pin Diagram

Table 7-9. SLA5040 COM Port Functions

Pin	Signal	Direction	Description
1 ~ 4 and 37 ~ 41	HD1 ~ 9	Out	Head data written to 02H and 03H and output by $\overline{PWD}$..
5	ALE	In	Address latch enable. When high, DB0 ~ 7 are output to AB0 ~ 7. When ALE is low, the data are latched.
6	$\overline{WR}$	In	Strobe for writing head data, and timing parameter of the STROBE signal.
7	$\overline{RD}$	In	Strobe for reading input data.
8	$\overline{PWD}$	In	Power down signal. HD1-9 are output when $\overline{PWD}$ low. When $\overline{PWD}$ is high, HD1 ~ 9 are low.
9 ~ 16	AB0 ~ 7	Out	Lower addresses latched by ALE.
17 ~ 20 and 22 ~ 25	DB0 ~ 7	In	Address/data bus. Tri-state I/O; multiplexed address/ data bus.
21	Vss	—	Ground
26 ~ 33	IN 0 ~ 7	In	Data is latched-in by STROBE signal and can be read by 00H. And Data can be read directly at 04H.
34	STRB	In	Strobe pulse to latch-in data.
35	BUSY	Out	Output high when STROBE is input.
36	AB 15	In	Address bus 15. Chip select.
42	VDD	In	+5V

● Functions of SLA5040 COM

1. The 7810 outputs both address (AB0 ~ AB7) and data (DB0 ~ DB7) to port PD0 ~ PD7. The gate array uses the ALE signal to separate the signals; when ALE is high the addresses (AB0 ~ AB7) from ports PD0 ~ PD7 are output to terminals AB0 ~ AB7 of the SLA5040 COM and are latched by the trailing edge of the ALE signal.
2. The data (IN0 ~ IN7) is latched by the positive edge of the STROBE signal and SLA5040 COM automatically outputs the BUSY signal.
3. The SLA5040 COM has the six functions described in Table 7-10.

Table. 7-10. SLA5040 COM Address Assignment

Address	R/W	Pin name	Function
00H	R	DB0 ~ DB7	The data which is latched by STROB pulse can be read at 00H by clearing the BUSY signal.
01H	R	DB0	Input of the STROB signal is recognized by reading 01H. 1: Recognized 0: Not recognized
02H	W	DB0 ~ DB7 HD8 ~ HD1	HD1 ~ 8 are latched by writing to 02H, and are output when $\overline{PWD}$ is low.
03H	W	DB7 H9	HD9 is latched by writing to 03H, and is output when $\overline{PWD}$ is low.
04H	R	IN0 ~ IN7 DB0 ~ DB7	The input data (IN0 ~ IN7) can be read directly at 04H with an unchanged BUSY signal.
05H	W	DB0	The output timing of the BUSY signal: 0: Positive edge of STRB signal 1: Negative edge of STRB signal

NOTE: 00H ~ 05H are the values at which address bits A0 ~ 7 are decoded in the gate array. AB15 is input by decoding A8 ~ 15, thus enabling address mapping.

Correspondence between the data (D0 ~ 7) and the head data (HD0 ~ 9) is as follows:

D7 → HD1	D7 → HD9
D6 → HD2	
∫ ∫	
D0 → HD8	
Address 02H	Address 03H

7.1.4 6116 Static RAM

The external pin assignment and internal circuitry of the 6116 SRAM are illustrated in Figure 7-9. Table 7-11 describes port functions of the IC.

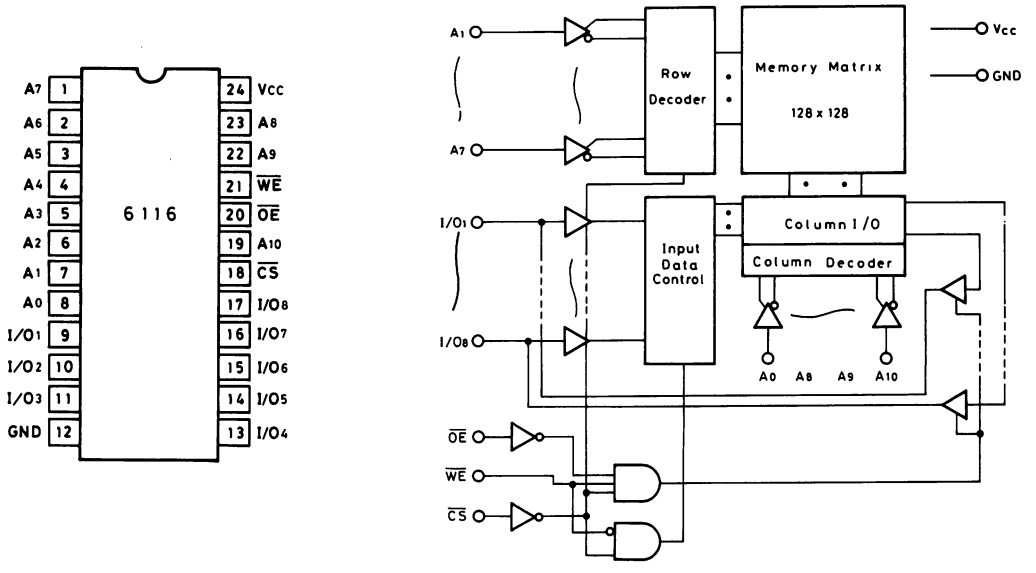


Fig. 7-9. 6116 Pin and Block Diagrams

- High-speed access: HM6116/P-2 ..... 120 ns
  HM6116/P-3 ..... 150 ns
  HM6116/P-4 ..... 200 ns
- +5V power
- Low electric consumption: Operation ..... 180 mw (typ)
  Standby ..... 100 mw (typ)
- Complete static memory (clock timing and strobe not required)
- All TTL compatible I/O
- Access and cycle times equal
- Standard 16K EPROM/MROM compatible pin arrangement

Table 7-11. 6116 Static RAM Port Functions

Pin	Signal	Direction	Description
1 ~ 8	A7 ~ A0	In	Address input
9 ~ 11 and 13 ~ 17	I/O_1 ~ I/O_8	In/Out	Data Input/Data Output
12	GND	–	Ground
18	$\overline{CS}$	In	Chip select
19	A10	In	Address input
20	$\overline{OE}$	In	Output enable
21	$\overline{WE}$	In	Write enable
22, 23	A9, A8	In	Address input
24	Vcc	In	+5V power supply

7.1.5 Miscellaneous TTL and CMOS Devices

Figures 7-10 through 7-14 illustrate the internal circuitry of the primary TTL and CMOS devices used in the printer.

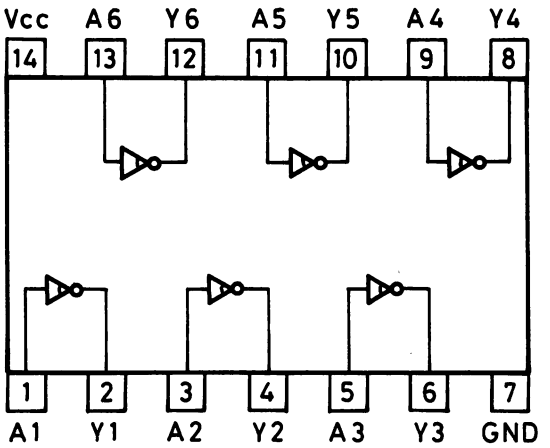


Fig. 7-10. 05 Hex Inverter with OC

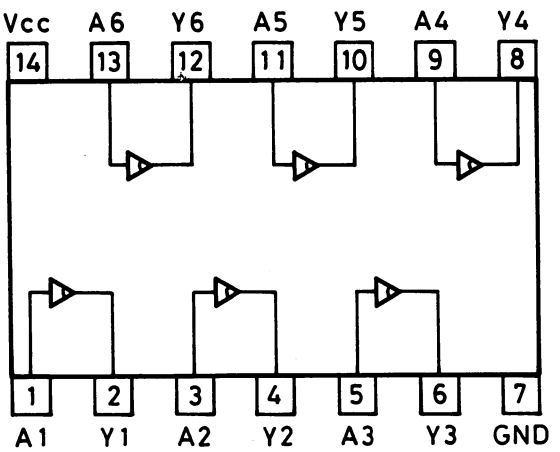
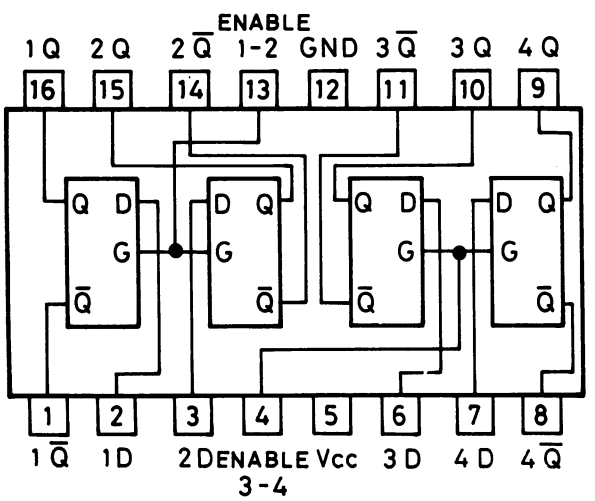


Fig. 7-11. 07 Hex Buffer with OC



FUNCTION TABLE
(Each Latch)

In puts		Out puts	
D	G	Q	Q̄
L	H	L	H
H	H	H	L
X	L	Qo	Q̄o

Fig. 7-12. 75 Quad Latch

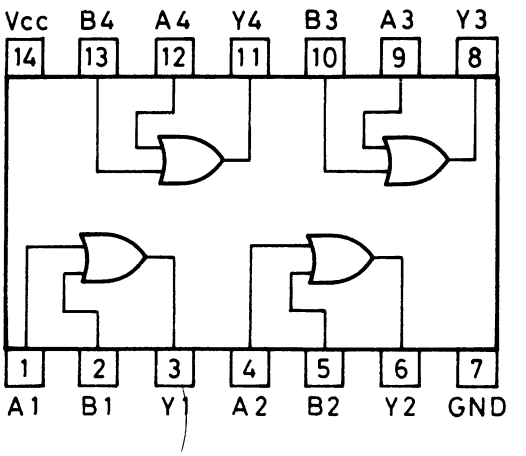


Fig. 7-13. Quad 2-Input OR

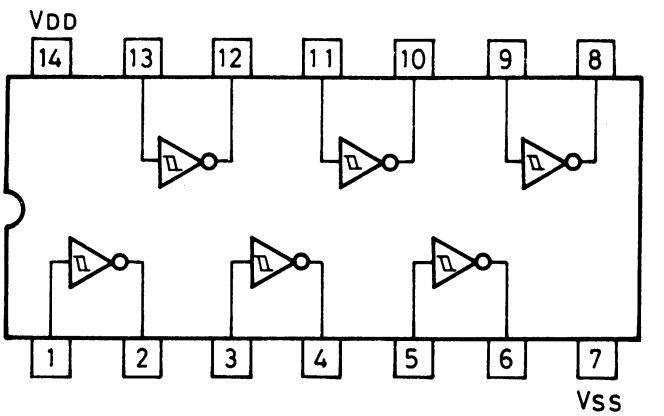


Fig. 7-14. 4584 Hex Schmitt Trigger

7.2 EXPLODED DIAGRAMS, SCHEMATICS AND PARTS LIST

Figures 7-15 through 7-17 are exploded (assembly) and schematic diagrams provided to supplement the text. Table 7-12 lists the parts number and the item description.

Table 7-12. Parts List

Commodore part numbers are provided for reference only and do not indicate the availability of parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Approved cross-references for TTL chips, Transistors, etc. are available in manual form through the Service Department, order part #314000-01. Unique or non-standard parts will be stocked by Commodore and are indicated on the parts list by a "C". Vendor Name and part number have been provided for your convenience in ordering custom or unique parts.

Ref. No.	Part No.	Item Description
	601160-00A	MPS-1000 PRINTER (UL)
	601160-00B	MPS-1000 PRINTER (CSA)
	601160-00C	MPS-1000 PRINTER (VDE)
	601160-00D	MPS-1000 PRINTER (BSI)
	601160-00G	MPS-1000 PRINTER (AUST)
	601160-00H	MPS-1000 PRINTER (DOMESTIC)
100	601160-01	LOWER CASE C (553-1010)
101	601160-02	UPPER CASE ASS'Y EC
102	601160-03	C.T.B. SCREW (M4 x 12)
103	601160-04	PRINTER COVER C (553-1040)
104	601160-05	SEPARATOR (553-006)
105	601160-06	FRONT CAP C (553-1050)
107	601160-07	BOTTOM CAP C (553-1060)
108	601160-08	BASE PLATE ASS'Y EA (553-S101)
109	601160-09	C.T.P.B.F. SCREW (M3 x 10)
110	601160-10	C.P.(P). SCREW (M3 x 10)
111	601160-11	C.P.O SCREW (M3 x 5)
112	601160-12	LOGO PLATE C
113	601160-13	RUBBER STAND (553-016)
114	601160-14	KNOB (553-1100)
201	601160-15	PULSE MOTOR AD
202	601160-16	C.T.P.B.(P). (M3 x 8)
203	601160-17	SIDE FRAME R
204	601160-18	PF TRANSMISSION GEAR
205	601160-19	LEAF SPRING (5 x 0.15 x 10)
206	601160-20	C.P.(P). SCREW (M3 x 10)
207	601160-21	SIDE FRAME L
208	601160-22	RELEASE LEVER C
209	601160-23	PAPER HOLDING LEVER SPRING
210	601160-24	PF MOTOR SITTING PLATE
211	601160-25	C.P.(P.) SCREW (M3 x 5)
212	601160-26	MOTOR UNIT EA
217	601160-28	BELT TENSION PLATE ASS'Y EA
218	601160-29	CUP SCREW (M3 x 4)
224	601160-30	TIMING BELT
225	601160-31	BELT DRIVING PULLEY ASS'Y EA
226	601160-32	PLAIN WASHER (4 x 0.2 x 7.75)
227	601160-33	RETAINING RING TYPE-E (3)
231	601160-34	PE SENSOR UNIT EA
232	601160-35	HP SENSOR ASS'Y EA
233	601160-36	C.T.P.B. SCREW (M3 x 8)
234	601160-37	TERMINAL BOARD ASS'Y EA
240	601160-39	CARRIAGE UNIT EA
241	601160-40	HEAD CABLE ASS'Y EA

Table 7-12. Parts List (Cont'd)

Ref. No.	Part No.	Item Description
242	601160-41	HEAD SITTING PLATE L
243	601160-42	HEAD SITTING PLATE R
244	601160-43	C.P.(P). SCREW (M3 x 8)
245	601160-44	C.P.(P). SCREW (M3 x 6)
260	601160-45	CARRIAGE GUIDE SHAFT
261	601160-46	C, GUIDE SHAFT SITTING PLATE
263	601160-48	CARRIAGE GUIDE PLATE
264	601160-49	LEAD WIRE
265	601160-50	C.P. (P). SCREW (M3 x 8)
266	601160-51	C.B. SCREW (M3 x 3)
268	601160-53	RIBBON MASK
270	601160-55	PLATEN UNIT EA
280	601160-56	PAPER FEED ROLLER SPRING GUIDE
281	601160-57	PAPER FEED ROLLER SPRING
282	601160-58	PAPER FEED ROLLER
283	601160-59	PAPER FEED ROLLER SHAFT
284	601160-60	PAPER HOLDING ROLLER ASS'Y EA
285	601160-61	PAPER GUIDE PLATE ASS'Y EA
300	601160-62	CATX CIRCUIT BOARD UNIT
1A	601160-64	LSI (E05020AA)
5A	601160-65	LSI (MPU 78010BD)
2C	601160-66	TTL-IC (HEX INVERTER)
3C	601160-67	TTL-IC (QUAD 2-INPUT OR)
6B	601160-68	TTL-IC (4BIT BISTABLE LATCH)
7A	601160-69	TTL-IC (HEX INV. BUFFER/DRIVER)
4C	601160-70	C-MOS IC (HEX SCHMITT TRIGGER)
8B	601160-71	LINEAR IC (TL 494)
SR1	601160-72	IC (5VDC REGULATOR)
2A	601160-73	RAM (2KX8BIT)
Q1-9,28	601160-74	TR. (50V 2A 20W)
Q10,12,13	601160-75	TR. (40V 100MA 0.3W)
Q14,15	601160-76	TR. (PNP 60V 0.9W)
Q11	601160-77	TR. (40V 100MA 0.3W)
Q17-24	601160-78	TR. (60V 2A 10W)
Q25	601160-79	TR. (60V 5A 20W)
Q26	601160-80	TR. (60V 5A 20W)
Q27	601160-81	TRANSISTOR (50V 0.9W)
Q16	601160-82	TRANSISTOR (60V 100MA 0.4W)
ZD1	601160-83	ZENER DIODE (4.95-5.05V)
ZD2	601160-84	ZENER DIODE (3.51-3.69V 250MA)
ZD3	601160-85	ZENER DIODE (17.55-18.4V 250MA)
D1,3	601160-86	DIODE (35V 100MA)
D2,4,5	601160-87	DIODE (SI 100V 1A)
D6	601160-88	DIODE (40V 1A)
D7	601160-89	DIODE (SI 200V 0.5A)
D8	601160-90	DIODE (90V 1A)
DB1	601160-91	RECTIFIER STACK (100V 3A)
DB2	601160-92	RECTIFIER STACK (100V 1.5A)
CR1	601160-93	CERAMIC OSCILLATOR (11MHZ)
C1	601160-94	AL. ELECT. CAP. (6800μF DC50V)
C2	601160-95	AL. ELECT. CAP. (6800μF DC25V)
C3	601160-96	AL. ELECT. CAP. (2200μF DC35V)
C4	601160-97	AL. ELECT. CAP. (470μF DC10V)
C5	601160-98	AL. ELECT. CAP. (1.0μF DC50V)

Table 7-12. Parts List (Cont'd)

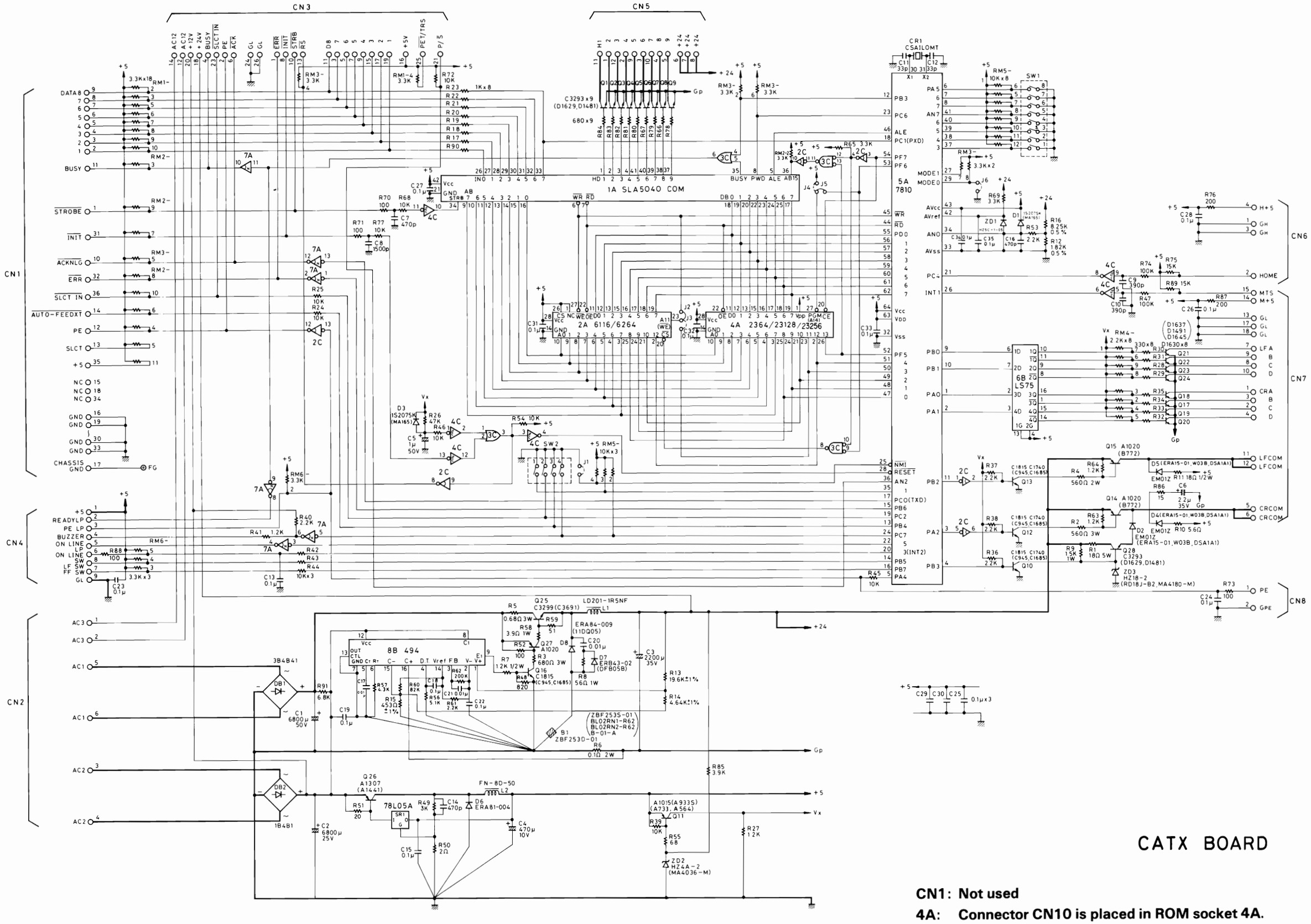
Ref. No.	Part No.	Item Description
C6	601160-99	AL. ELECT. CAP. (22μF DC35V)
C7,14,16	601161-00	CERA. CAP. (470pF DC50V)
C8	601161-01	CERA. CAP. (1500pF DC50V)
C9,10	601161-02	CERA. CAP. (390μF DC50V)
C11,12	601161-03	CERA. CAP. (33pF DC50V)
C13,15,18, 19,25-35	601161-04	CERA. CAP. (0.1μF DC25V)
C20	601161-05	CERA. CAP. (0.01μF DC50V)
C21	601161-06	CERA. CAP. (0.01μF DC25V)
C17	601161-07	FILM CAP. (0.01μF DC50V)
RM1	601161-08	RES. ARRAY (3.3kΩ 1/8W-9)
RM2	601161-09	RES. ARRAY (3.3kΩ 1/8W-10)
RM3	601161-10	RES. ARRAY (3.3kΩ 1/8W-7)
RM4	601161-11	RES. ARRAY (2.2kΩ 1/8W-8)
RM5	601161-12	RES. ARRAY (10kΩ 1/8-11)
RM6	601161-13	RES. ARRAY (3.3kΩ 1/8-4)
R1	601161-14	CEMENT RES. (18Ω 5W)
R5	601161-15	CEMENT RES. (0.68Ω 3W)
R6	601161-16	CEMENT RES. (0.1Ω 2W)
R2	601161-17	MET. OX. F. RES. (560Ω 3W)
R3	601161-18	MET. OX. F. RES. (680Ω 3W)
R4	601161-19	MET. OX. F. RES. (560Ω 2W)
R8	601161-20	MET. OX. F. RES. (56Ω 1W)
R9	601161-21	MET. OX. F. RES. (1.5kΩ 1W)
R58	601161-22	MET. OX. F. RES. (3.9Ω 1W)
R12	601161-23	HIGH STABILIZED MET. F. RES.
R13	601161-24	HIGH STABILIZED MET. F. RES.
R14	601161-25	HIGH STABILIZED MET. F. RES.
R15	601161-26	HIGH STABILIZED MET. F. RES.
R16	601161-27	HIGH STABILIZED MET. F. RES.
R7	601161-28	CARBON F. RES. (1.2kΩ 1/2W)
R10	601161-29	CARBON F. RES. (5.6Ω 1/4W)
R11	601161-30	CARBON F. RES. (18Ω 1/2W)
R17-23,90	601161-31	CARBON F. RES. (1kΩ 1/4W)
R24,25,39, 42-46,54, 68,72,77	601161-32	CARBON F. RES. (10kΩ 1/4W)
R26	601161-33	CARBON F. RES. (47kΩ 1/4W)
R27,41 63,64	601161-34	CARBON F. RES. (1.2kΩ 1/4W)
R28-35	601161-35	CARBON F. RES. (330Ω 1/4W)
R36-38,40, 53,61	601161-36	CARBON F. RES. (2.2kΩ 1/4W)
R47,74	601161-37	CARBON F. RES. (100kΩ 1/4W)
R48	601161-38	CARBON F. RES. (820Ω 1/4W)
R49	601161-39	CARBON F. RES. (3kΩ 1/4W)
R50	601161-40	CARBON F. RES. (20Ω 1/4W)
R51	601161-41	CARBON F. RES. (51Ω 1/4W)
R52,70,71, 73,88	601161-42	CARBON F. RES. (100Ω 1/4W)
R85	601161-43	CARBON F. RES. (3.9kΩ 1/4W)
826	601161-44	FLANGE NUT (M4)
R55	601161-45	CARBON F. RES. (68Ω 1/4W)
R56	601161-46	CARBON F. RES. (5.1kΩ 1/4W)

Table 7-12. Parts List (Cont'd)

Ref. No.	Part No.	Item Description
R57	601161-47	CARBON F. RES. (4.3kΩ 1/4W)
R60	601161-48	CARBON F. RES. (82kΩ 1/4W)
R62	601161-49	CARBON F. RES. (200kΩ 1/4W)
R65,69	601161-50	CARBON F. RES. (3.3kΩ 1/4)
R75,89	601161-51	CARBON F. RES. (15kΩ 1/4W)
R66,67	601161-52	CARBON F. RES. (680Ω 1/4W)
78-84		
R76,87	601161-53	CARBON F. RES. (200Ω 1/4W)
R86	601161-54	CARBON F. RES. (15Ω 1/4W)
R91	601161-55	CARBON F. RES. (6.8kΩ 1/4W)
B1	601161-56	FERRITE BEAD
L1	601161-57	CHOKE COIL
L2	601161-58	CHOKE COIL
SW1	601161-59	DIP SWITCH (8P)
CN2	601161-60	CONNECTOR (6 PIN)
CN3	601161-61	CONNECTOR (26 PIN)
CN4	601161-62	CONNECTOR (9 PIN)
CN5	601161-63	CONNECTOR (12 PIN)
CN6	601161-64	CONNECTOR (4 PIN)
CN7	601161-65	CONNECTOR (18 PIN)
CN8	601161-66	CONNECTOR (2 PIN)
CN10	601161-67	CONNECTOR (28 PIN)
350	601161-68	COMI BOARD UNIT
352	601161-69	C.T.P. SCREW (M3 x 8)
353	601161-70	REAR COVER C
R1-3	601161-71	CARBON F. RES. (3.3kΩ 1/4W)
C1,2	601161-72	CERA. CAP. (0.1μF 25V, +80%, −20%)
4A	601161-73	IC SOCKET (28 PIN)
4A	601161-74	P-ROM (27256-CE8-E2)
CN1	601161-75	CONNECTOR (36 PIN)
CN2	601161-76	CONNECTOR (6 PIN)
CN3	601161-77	CONNECTOR (28 PIN)
CN4	601161-78	CONNECTOR (26 PIN)
400	601161-79	COMPNL PANEL UNIT
500	601161-80	CFIL CIRCUIT BOARD UNIT
501	601161-81	POWER TRANSF. SET
502	601161-82	FUSE (MDL-1A)
503	601161-83	FUSE COVER
504	601161-84	FITTING PLATE
505	601161-85	C.P.O. SCREW (M4 x 8)
506	601161-86	POWER CABLE
507	601161-87	CUP SCREW (M4 x 6)
508	601161-89	OUTSIDE TOOTHED LOCK WASHER M4
800	601161-90	SPROCKET UNIT EC
801	601161-91	SIDE COVER R (C) (553-1070)
802	601161-92	SIDE COVER L (C) (553-1080)
803	601161-93	SPROCKET SHAFT
804	601161-94	SPROCKET GEAR
805	601161-95	PLATEN PLAIN BEARING
806	601161-96	SPRING PIN (2 x 14)
807	601161-97	LEAF SPRING (6 x 0.15 x 11)
808	601161-98	PLAIN WASHER (6 x 1 x 10)
809	601161-99	SPROCKET FRAME L
810	601162-00	SPROCKET WHEEL

Table 7-12. Parts List (Cont'd)

Ref. No.	Part No.	Item Description
811	601162-01	PAPER HOLDING COVER L
812	601162-02	PAPER HOLDING COVER SPRING
813	601162-03	SPROCKET LOCK LEVER
814	601162-04	G-PIN
815	601162-05	PLAIN WASHER (3 x 0.5 x 8)
816	601162-06	C.T.P. SCREW (M3 x 6)
817	601162-07	SPROCKET FRAME R
818	601162-08	PAPER HOLDING COVER R
819	601162-09	SPROCKET MOUNTING PLATE L
820	601162-10	SPROCKET MOUNTING PLATE R
821	601162-11	SPROCKET GUIDE SHAFT
822	601162-12	LOCK LEVER
823	601162-13	SPROCKET TRANSMISSION GEAR
824	601162-14	PAPER GUIDE ROLLER
825	601162-15	RETAINING RING TYPE-E (5)



CN1: Not used

4A: Connector CN10 is placed in ROM socket 4A.

Fig. 7-15. CATX Circuit Diagram

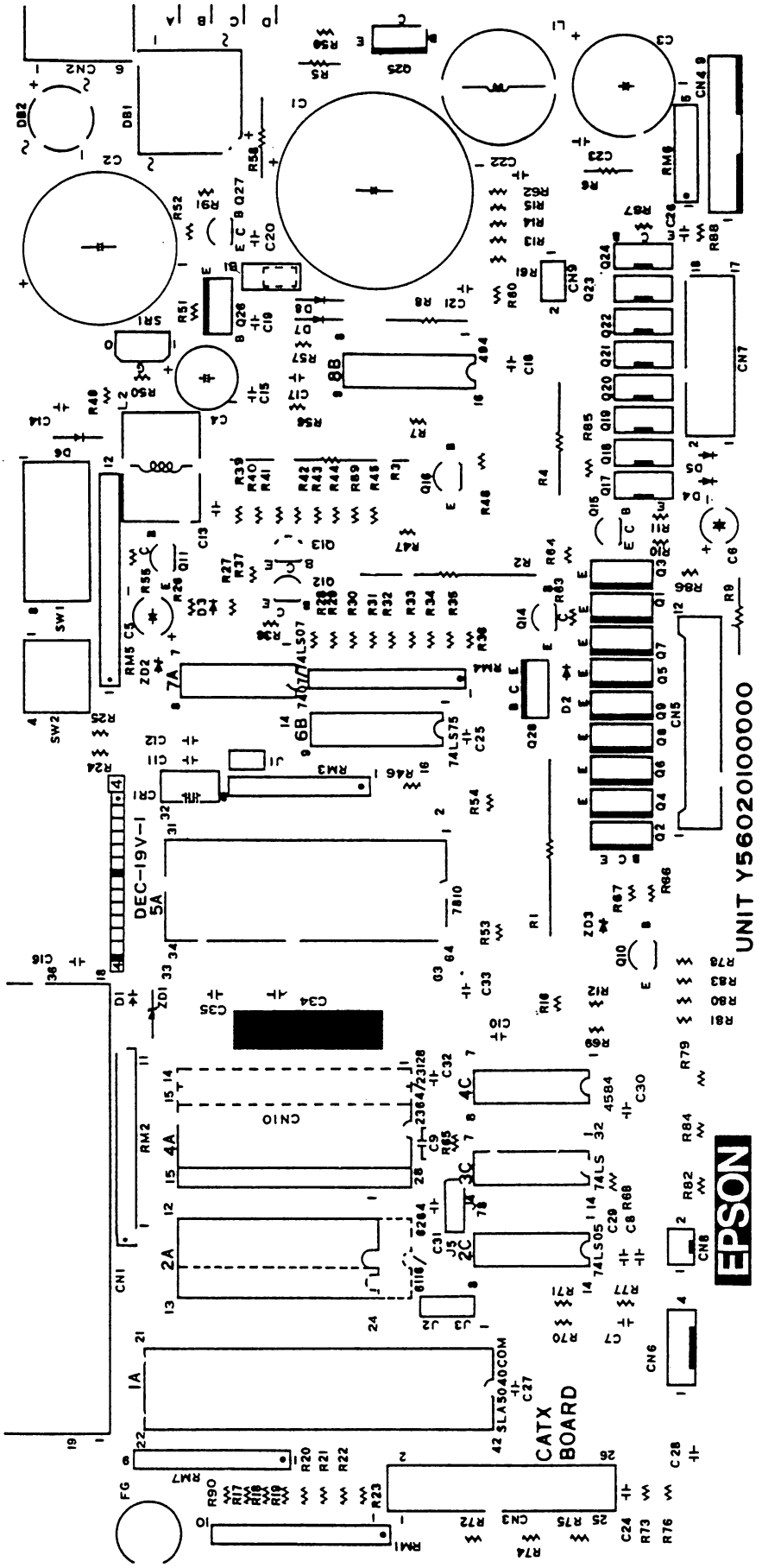


Fig. 7-16. CATX Component Layout

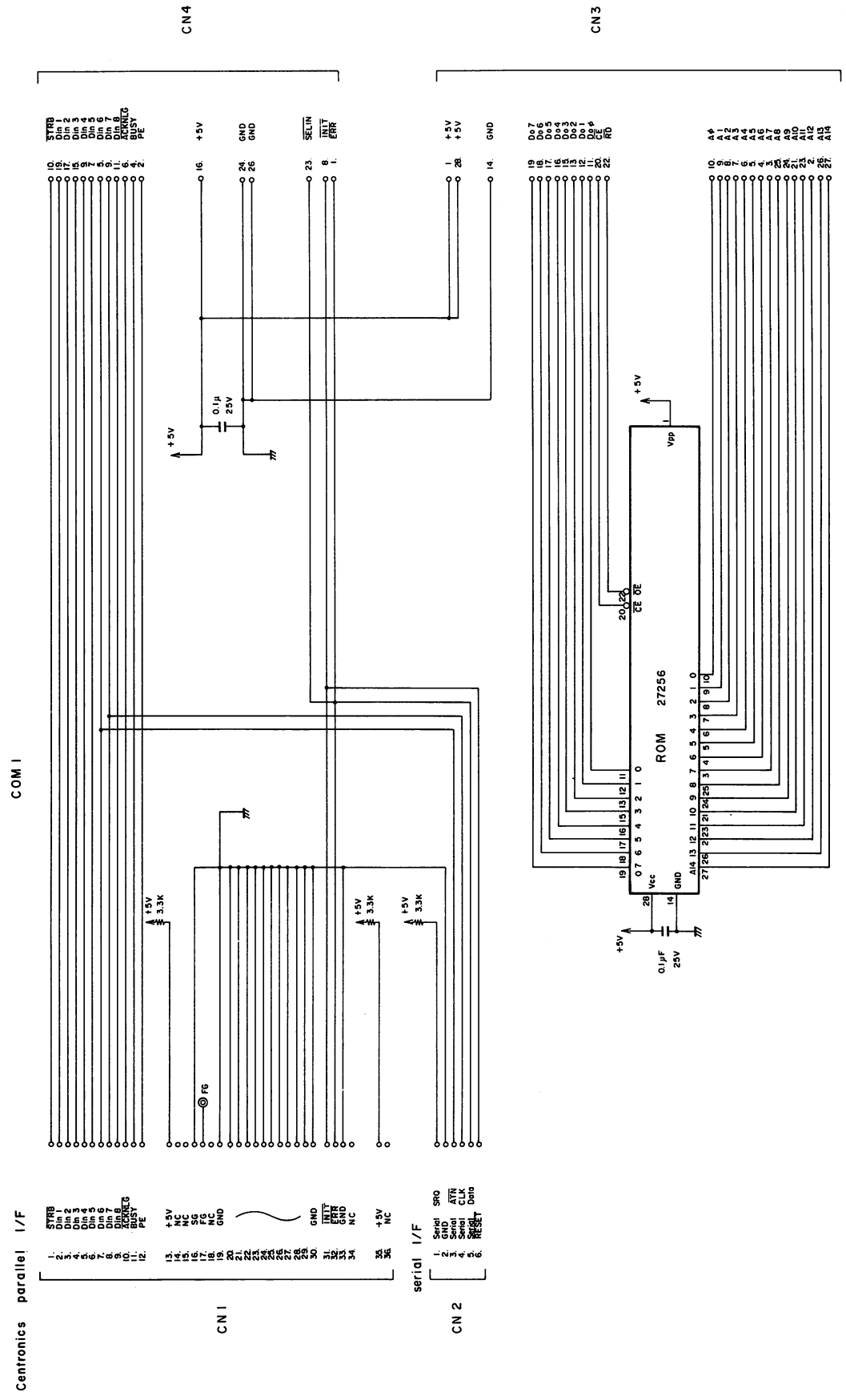


Fig. 7-17. COMI Board Circuit Diagram

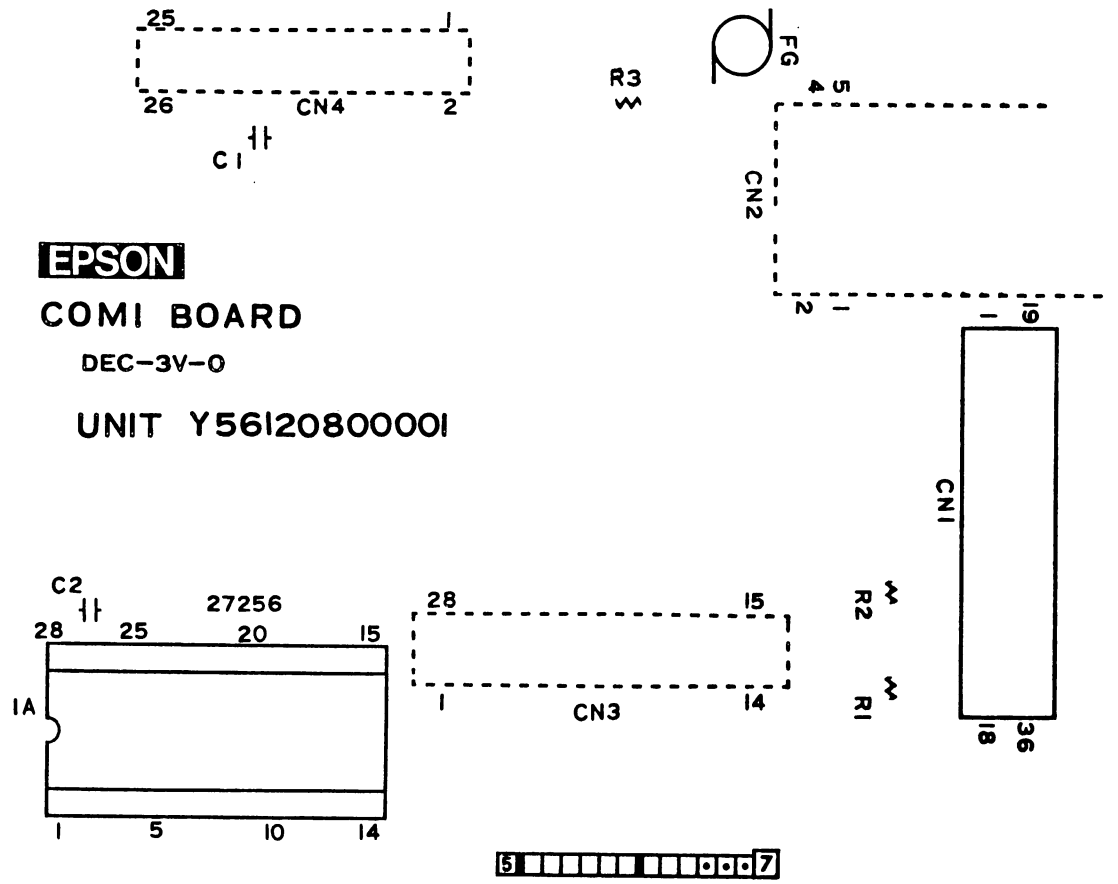


Fig. 7-18. COMI Board Component Layout

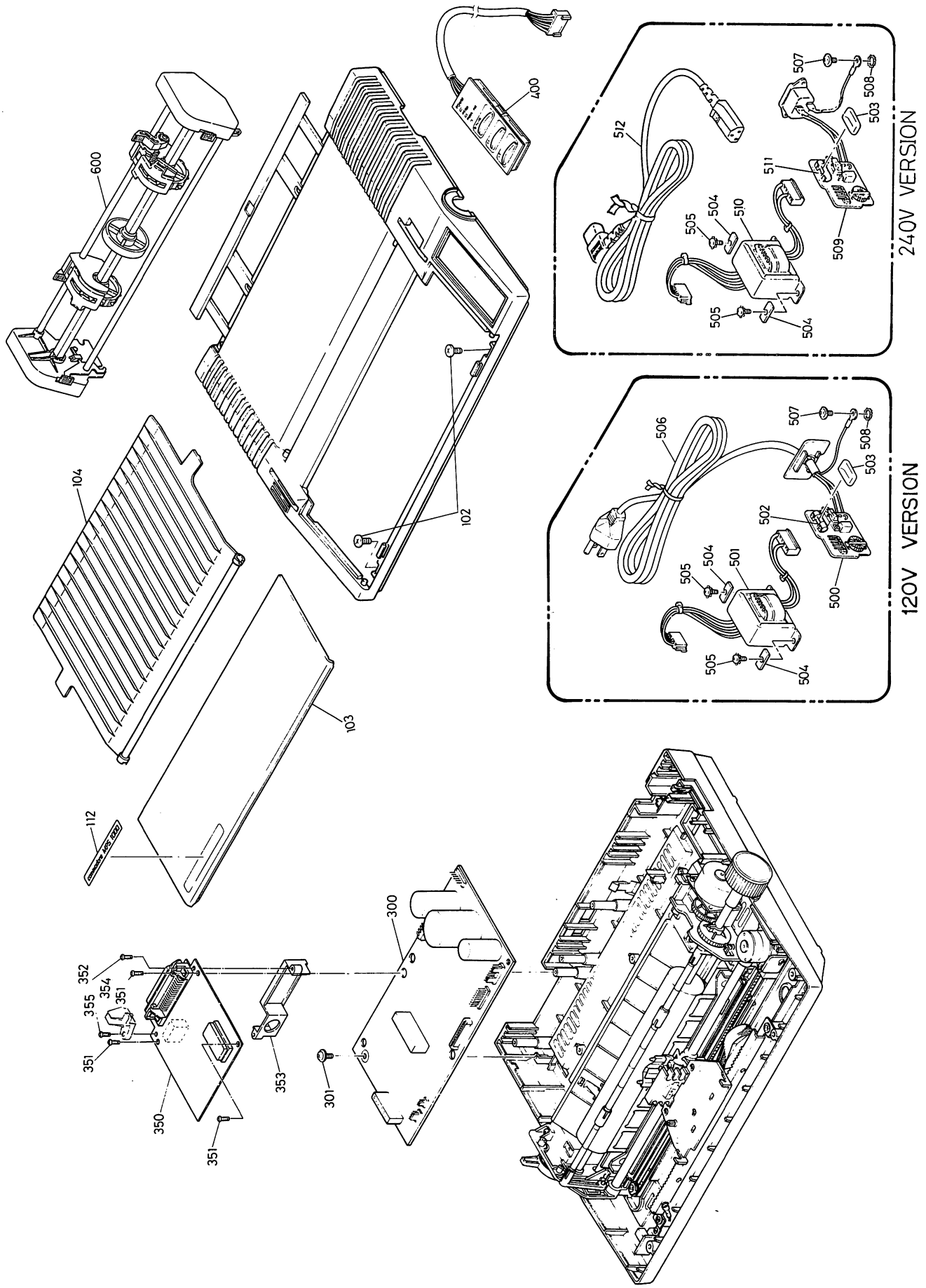


Fig. 7-19. Exploded Diagram 1

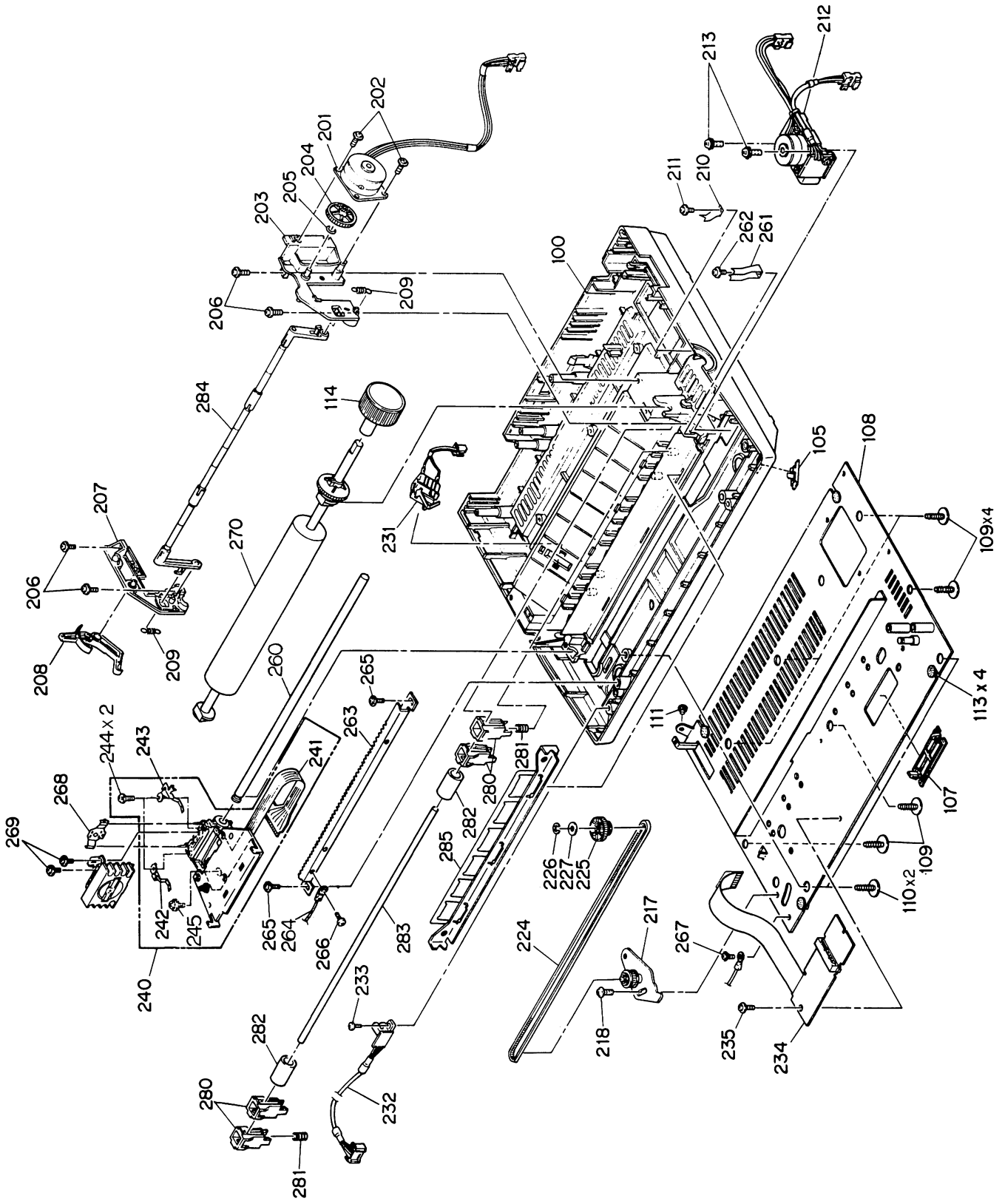


Fig. 7-20. Exploded Diagram 2

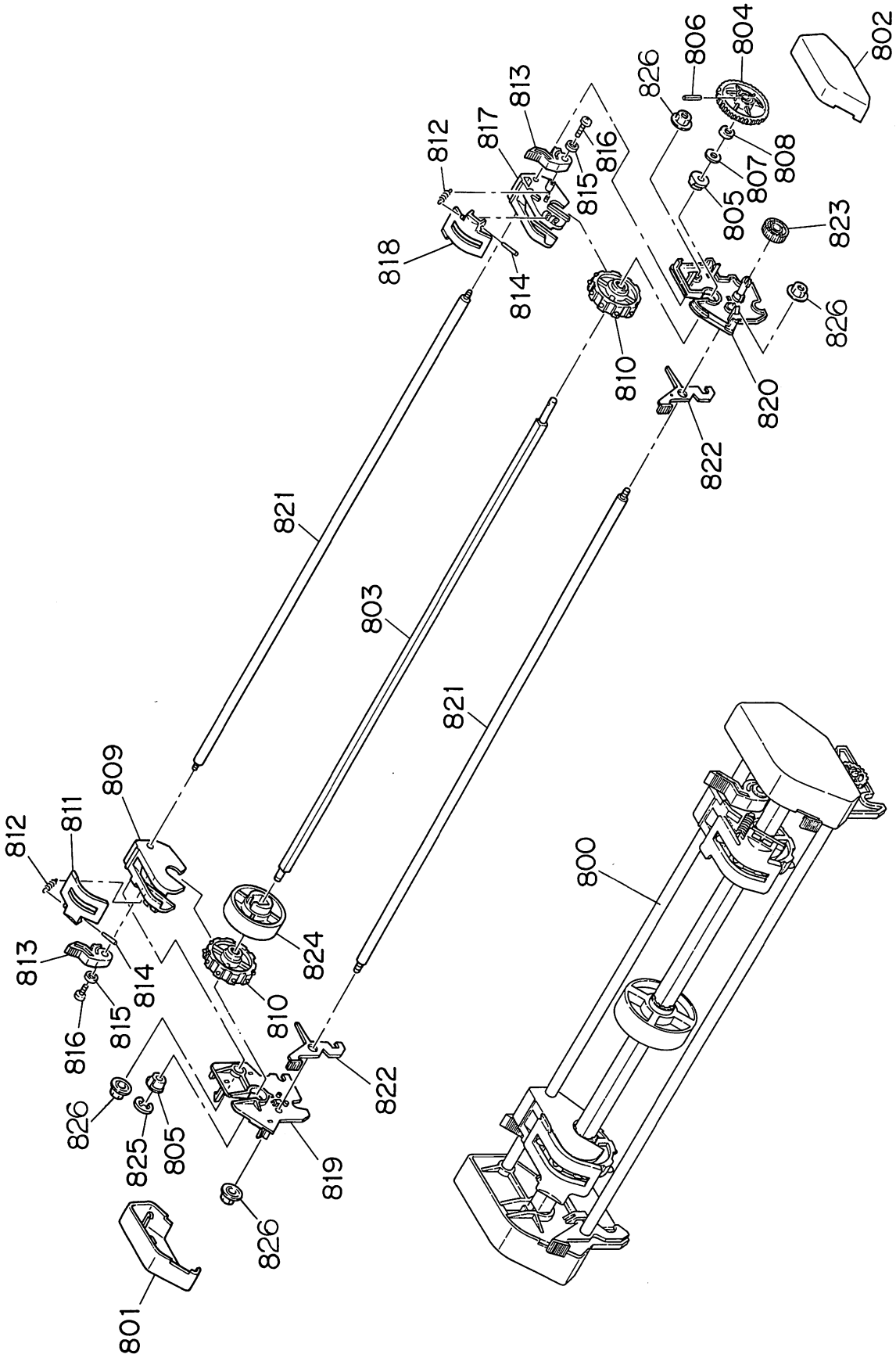


Fig. 7-21. Exploded Diagram 3