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LQ - 1500

SERVICE MANUAL

EPSON[®]

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INTRODUCTION

This technical manual describes the principle of mechanical and electrical operations, as well as the maintenance and repair procedures, of the EPSON LO-1500 Dot Matrix Printer.

Chapters 4 through 6 of the manual deal with the fundamental troubleshooting, maintenance and repair of the LO-1500.

For detail on the disassembly, assembly, troubleshooting and maintenance of the Model-3660 Printer Mechanism, refer to the separately published "Technical Manual of EPSON Model-3660".

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

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1 .1 Product Overview

The LO-1500 is a serial terminal printer, featuring 200 CPS, bi-directional printing (draft pica mode) with logical seeking capability, and 24 x 24 dot-matrix character formation. All interfaces for the LO-1500 which permit connection of the printer to various computers are optional. The interface circuit boards are cartridge type, which can be set snugly into the housing.

Should maintenance or repair be required, the printer mechanism and circuit boards of the LQ-1500 are readily replaceable. The technician can perform maintenance and repair quite easily by referring to this manual.

1.2 LQ-1500 Interface Overview

(1) Centronics-compatible, parallel interface

This standard communication link permits data exchange with many computers without modification or addition of other peripheral devices.

(2) RS-232C/Current Loop Serial Interface

A 20 mA current loop type, serial interface which permits the printer to receive data at a bit rate ranging from 75 to 19200 BPS.

(3) IEEE-488 Interface

An optional interface which permits parallel communication between the printer and any computer or measuring instrument which is equipped with bus structure conforming the IEEE-488 Std. 488-1975.

1.3 General Specifications

(1) Printing Method Impact dot matrix

(2) Character 1. Draft
 2. Near letter quality (LO)
 3. Proportional (standard)
 4. Multi-font (with option card)
 5. Super/subscript in each above character style. (1 to 4.)

(3) Character Structure

Character	Normal	Super/Subscript
Draft	9 x 17 font	7 x 11 font
LO	15 x 17 font	11 x 11 font
Proportional	37 x 17 font	23 x 11 font

(4) Character Size See Table 1. on the page 1-3

(5) Column Width See Table 1. on the page 1 - 3.

(6) Print Speed See Table 1. on the page 1 - 3.

(7) Paper Feed Friction feed (standard)
 Adjustable tractor feed (option)

(8) Paper

① Cut sheet

Paper width 182 mm to 364 mm

Paper thickness 0.06 mm to 0.1 mm

Weighing 45 kg to 70 kg (52 to 82 g/m*)

② Fanfold paper

p a p e r w i d t h 101 mm to 406 mm

C o p i e s 4 sheets max. (include original)

Paper thickness and Weight

The Number of Sheets	Weighing	Paper Thickness	Setting of the Head Adjusting Lever
1	45 to 70 kg (52 to 82 g/m ²)	0.06 to 0.1 mm	2nd step
2	30 to 35 kg (35 to 40 g/m ²)	0.1 mm	2nd step
3	30 to 35 kg (35 to 40 g/m ²)	0.15 m	3rd step
4	30 to 35 kg (35 to 40 g/m ²)	0.2 mm	4th step

Notes:

1. Jointing finish of copies should be point or line pasting.
2. Release the friction feed during the tractor feed operation.
3. Set the head adjusting lever as shown in above table.

However, adjust the step setting within range +1 step, depending on print density.

- (9) Paper Insertion Rear
- (1 0) Line Spacing 1/6", 1/8" or programmable
- (1 1) Print Direction..... Bidirectional printing with logical seeking.
In bit image and double-strike mode, unidirectional printing from left to right is selected when the power is ON.
Bidirectional printing is also possible using ESC U.
- (1 2) Line Feed Repeat Rate 120 ms/line (when 1/6" line feed is performed intermittently)
100 ms/line (when 1/6" line feed is performed continuously)
- (1 3) Ribbon.. Exclusive cartridge ribbon (Black)

Table 1

Print mode	*1 C.W.	*2 Char.W.	*3 D. D.	Printed Speed (CPS)		*4 Char. Size (mm)		*5 S/S Char. Size (mm)	
	(CPL)	(CPI)	(DPI)	Draft	LQ	Width	Height	Width	Height
Pica	136	10	120	200	67	2.1	2.5	1.7	1.7
Enlarged	68	5	120	100	33	4.2	2.5	3.4	1.7
Emphasized	136	10	120	100	67	2.3	2.5	1.9	1.7
Emphasized & Enlarged	68	5	120	50	33	4.6	2.5	3.8	1.7
Condensed	233	17	240	167	—	1.0	2.5	0.8	1.7
Condensed & Enlarged	116	8.6	240	83	—	2.0	2.5	1.7	1.7
Elite	163	12	180	162	80	1.4	2.5	1.7	1.7
Enlarged	81	6	180	81	40	2.8	2.5	3.4	1.7
Emphasized	163	12	180	81	80	1.6	2.5	1.9	1.7
Emphasized & Enlarged	81	6	180	40	40	3.2	2.5	3.8	1.7
Condensed	272	20	240	200	—	1.0	2.5	0.8	1.7
Condensed & Enlarged	136	10	240	100	—	2.0	2.5	1.7	1.7
Proportional	116	8.6	360	—	57	2.6	2.5	—	—
Enlarged	58	4.3	360	—	28	5.2	2.5	—	—
Emphasized	116	8.6	360	—	57	2.8	2.5	—	—
Emphasized & Enlarged	58	4.3	360	—	28	5.6	2.5	—	—
Proportional Super/Subscript	174	12.8	360	—	86	—	—	1.7	1.7
Enlarged	87	6.4	360	—	43	—	—	3.4	1.7
Emphasized	174	12.8	360	—	86	—	—	1.8	1.7
Emphasized & Enlarged	87	6.4	360	—	43	—	—	3.7	1.7

*1 C.W. = Column Width

*2 Char.W. = Character Width

*3 D.D. = Dot Density

*4 Char. Size = Character Size

*5 S/S Char. Size = Super/Subscript Character Size

Notes:

1. Above values for Proportional are calculated by width of the max. character "W".
2. DPI of LQ (except Proportional) is 180.

(14) Environment

Temperature	Operating	5°C to 35°C (41°F to 95°F)
	Storage	-30°C to 65°C
Humidity.....	Operating	10% to 80% (No condensation)
	Storage	5% to 85% (No condensation)
Resistance to impact.....	Operating	1G (1 msec. max.)
	Storage	2G (1 msec. max.)
Resistance to vibration.....	Operating	0.25G, 55 Hz (max.)
	Storage	0.5 G, 55 Hz (max.)
Insulation resistance	10 megohms between AC power line and chassis.	
Dielectric strength.....	AC 1KV (R.M.S.), 50 or 60 Hz for more than 1 minute between AC power line and chassis.	

(15) Electrical Requirement

Power supply	AC 90V to 132V (for U.S.A.)
	AC 198V to 264V (for Europe)
Frequency	49.5 to 60.5 Hz
Power consumption	300 VA max.
	60 VA typ.

(16) Reliability

MTBF.....	5 × 10 ⁶ lines (excluding head life expectancy)
Print head life expectancy.....	2 × 10 ⁸ strokes (at every dot wire on the print head)
Ribbon life expectancy	3 × 10 ⁶ characters (Draft)

(17) Physical Dimensions and Weight

Dimensions.....	130 (H) × 604 (W) × 363 (D) mm
	With tractor unit 183 (H) mm
	With cut sheet feeder 320 (H) mm
Weight.....	14 kg (including I/F Unit)

1.4 Major Components

The LQ-1500 consists, in a broad classification, of the following five major components

- (1) Housing
- (2) Model-3660 printer mechanism
- (3) Control circuit boards
- (4) Interface circuit boards
- (5) Power supply circuit boards

The housing of the LQ-1500 consists of an upper case and lower case. The lower case is designed to facilitate mounting of the following components.

Circuitry for the LQ-1500 is located on five different boards: the UXFIL and UXPS/PSU 24E boards which house the power supply; the UXMCL board, which contains most of the control circuitry; the UXDRV, which handles print mechanism drive circuitry, and a interface board (IUPIF or IURS or IUIE) which serves as computer interface.

(1) Housing (Fig. 1 .1)

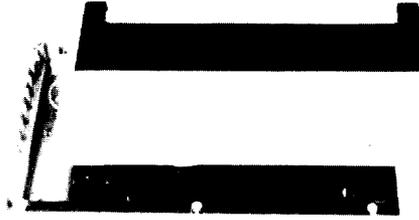


Fig 1 .1 Upper and lower cases

(2) Model-3660 printer mechanism (Fig. 1.2)

The mechanism is an assembly of all the mechanical components including two stepper motors, a print head, a ribbon feeding mechanism, a carriage assembly, sensors, and a frame section. One stepper motor operates the print head carriage, while the other works as the paper feed motor. The Model-3660 is designed to permit easy maintenance.

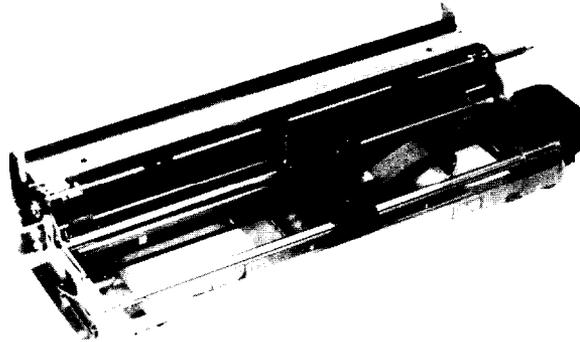


Fig. 1.2 Model-3660 printer mechanism

(3) Contrl circuit boards (Fig. 1.3)

The control circuit is distributed between two circuit boards, the UXMCL and UXDRV. The UXMCL circuit board performs the central processing, and the UXDRV circuit board drives the Model-3660 printer mechanism.

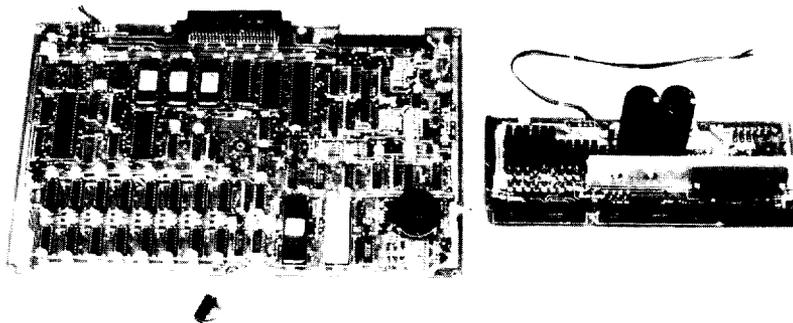


Fig. 1.3 Control circuit boards

(4) Interface circuit boards (Fig. 1.4)

An interface circuit board exchanges data between the host computer and UXMCL circuit board.

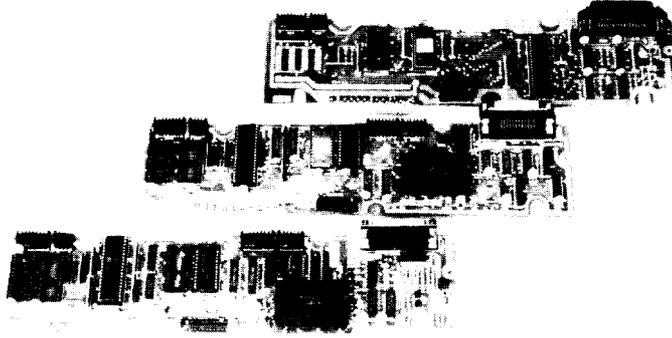
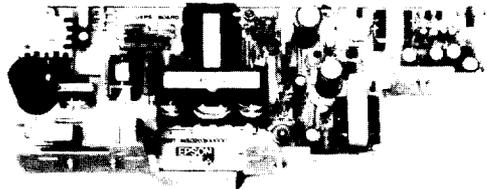


Fig. 1.4 Interface circuit board

(5) Power supply circuit boards (Fig. 1.5)

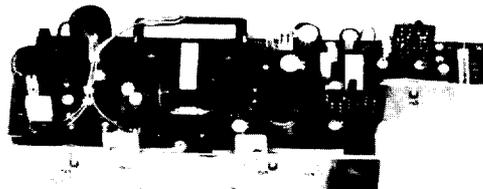
The power supply circuit of the LQ-1500, consists of two major components, the UXFIL and UXPS/PSU 24E circuit boards. Both circuit boards are located in the rear righthand corner. The UXPS/PSU 24E circuit board supplies DC +24V, +12V, -12V and +5V to the control circuit and the interface circuit.



UXPS



Fig 1.5 Power supply circuit board (100/120V version)



PSU 24E

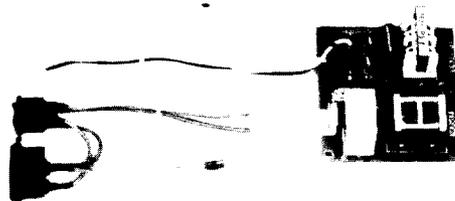


Fig 1.6 Power supply circuit board (220/240V version)

CHAPTER 2

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2.1 General

This chapter provides the description of signals at the various connectors electrically interconnecting such major components as printer mechanism, control circuits, interface circuit, power supply circuit, and control panel of EPSON LO-1500 Terminal Printer, and explains the operating principles of the various mechanism around the electric circuit of the printer.

2.2 Connection Diagram (Fig. 2.1)

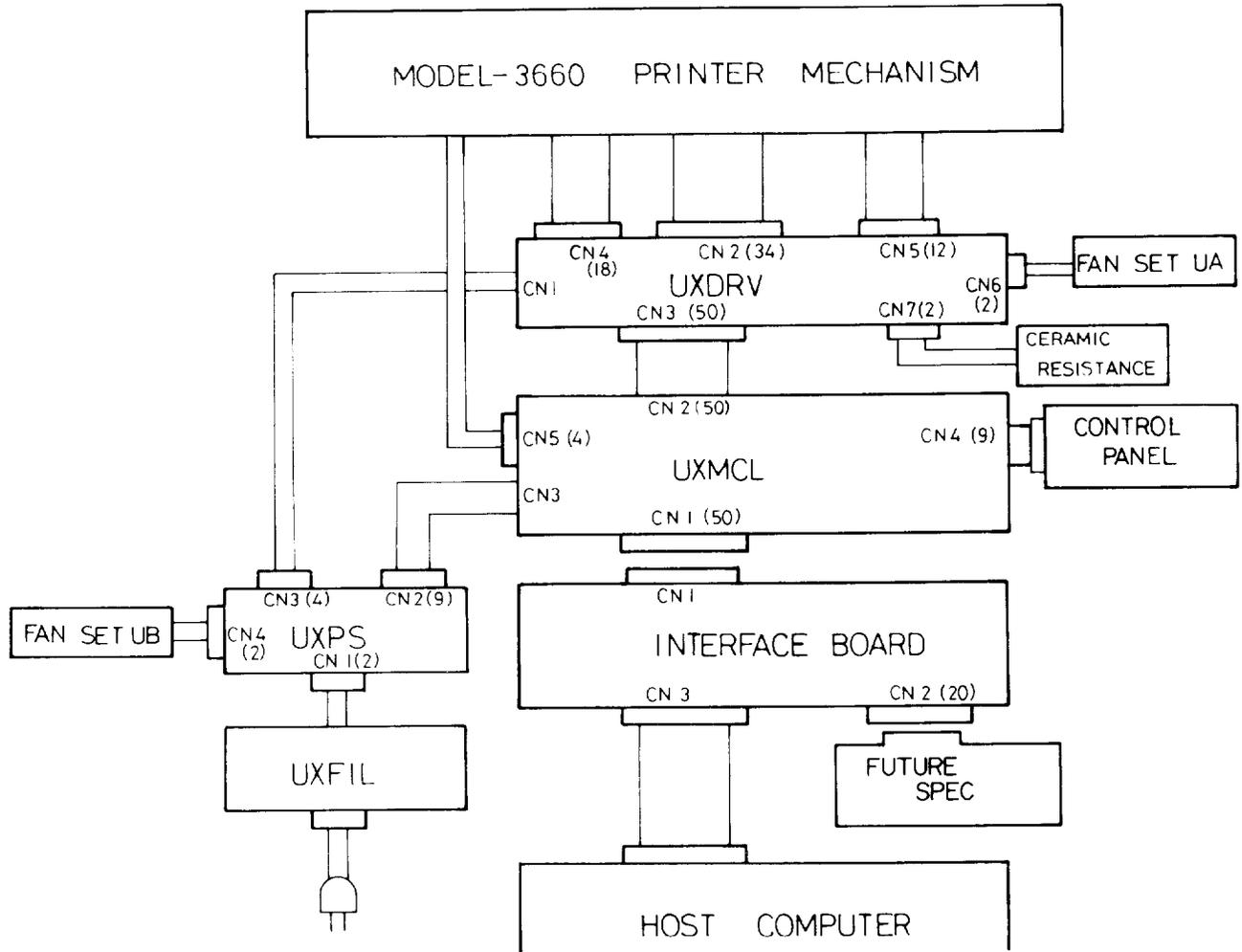


Fig. 2.1 Connection diagram

The CPU Z-80A provides overall control of the LQ-1500. In addition the LQ-1500 is supported by two slave CPUs: the 8042(8742), which controls the carriage motor; the 8041(8741), which controls the paper feed motor.

Other major LSIs include:

- 8255AC5 Output port for head pin drive data
- 8259A Interrupt controller
- 8253-5** **Timer counter**
- 2764(231 28) ROM which stores control programs and character patterns
- uPD41 6-3 RAM which is used as the input data and print data buffer
- uPB6101 -009 Gate array which controls LSIs by receiving control signals from CPU Z-80A

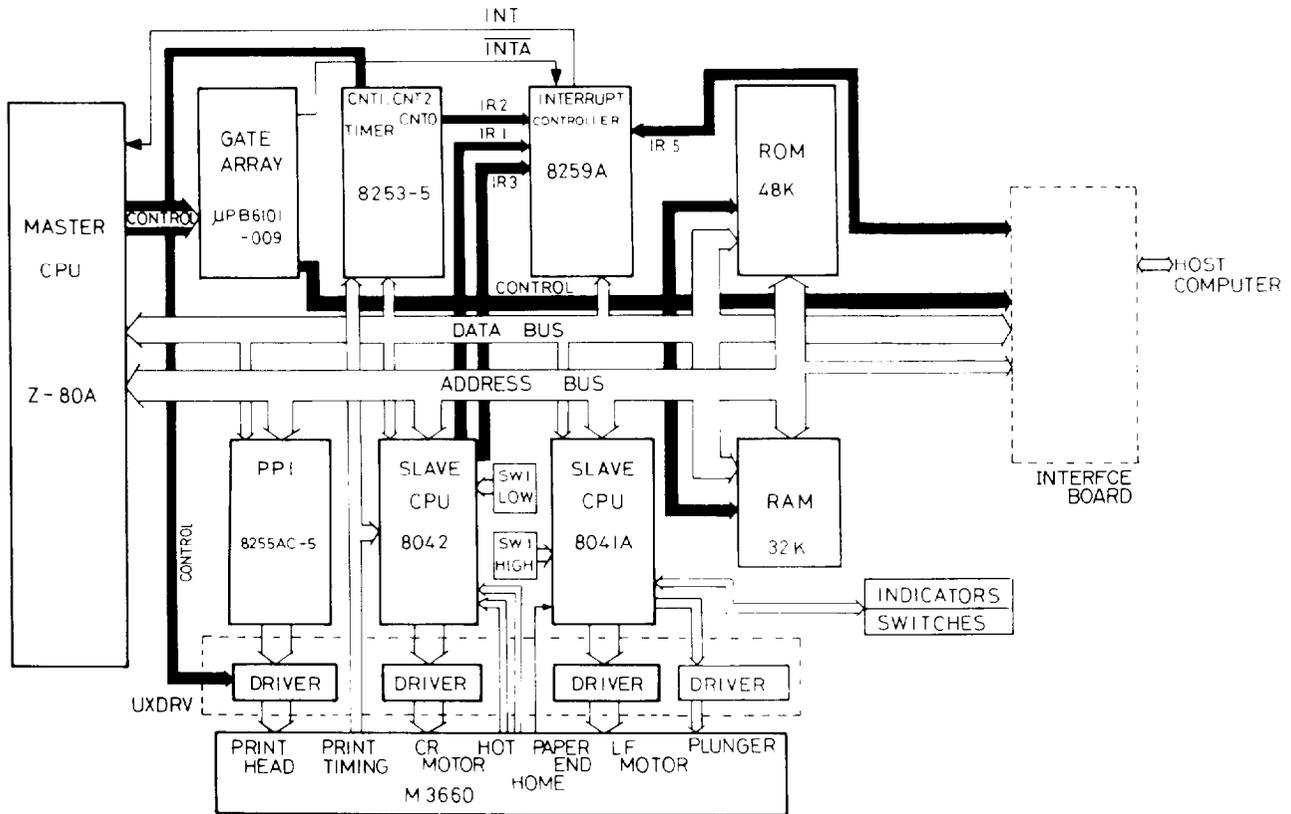


Fig. 2.2 Block diagram

2.3 Connector Pin Assignment

2.3.1 Connector on UXMCL circuit board

1) Table 2.1 CN1 pin assignment

- (a) Use Used for data exchange between the main circuit board and the interface circuit board
- (b) Number of pins 50

Table 2.1 Pin assignment (CN1 of UXMCL)

Signal Pin No.	Signal	Direction	Description
1	GND		Logic ground
2	GND		Logic ground
3	Vx	OUT	The SLCT signal is made HIGH at +5V power on.
4	PE	OUT	DC level signal to indicate the end of paper. Low = Normal operating condition. High = Paper supply depleted.
5	RST IN	IN	High = Normal operating condition, the pulse width must be more than 50 μ s at the receiving terminal. Low = Reset printer is initialized. Print buffer is cleared.
6	ERR	OUT	This signal becomes LOW when the printer is in the following conditions: 1. PAPER END state (sensed at line feed) 2. OFF-LINE state 3. Print failure due to other abnormal condition * The PAPER END state is sensed at line feed. * If DIP SW2-2 on the interface circuit board is turned on or ESC8 has been input to the printer, the ERROR signal does not become LOW even in the PE condition.
7	GND		
8	IBUSY	IN	Low = Input buffer is not full. High = Input buffer is full. The signal is used to turn on the READY lamp of the indicator.
9	EXTPRG	OUT	External program selection signal (Not used at the moment)
10	MRD	OUT	Memory read signal LOW output is made when BUSACK = High at $\overline{\text{MRQ}}$, RD. However, it is not output in the INTACK cycle.
11	ICSCG	OUT	External character selection signal (Not used at the moment)
12	ICSPRG	OUT	External program selection signal (Not used at the moment)
13	A12	OUT	Address bit 12
14	A13	OUT	Address bit 13
15	A10	OUT	Address bit 10
16	A11	OUT	Address bit 11
17	A8	OUT	Address bit 8
18	A9	OUT	Address bit 9
19	A6	OUT	Address bit 6
20	A7	OUT	Address bit 7

Signal Pin No.	Signal	Direction	Description
21	A4	OUT	Address bit 4
22	A5	OUT	Address bit 5
23	A2	OUT	Address bit 2
24	A3	OUT	Address bit 3
25	A0	OUT	Address bit 0
26	A1	OUT	Address bit 1
27	GND		Logic ground
28	GND		Logic ground
29	D6	IN/OUT	Data bit 6
30	D7	IN/OUT	Data bit 7
31	D4	IN/OUT	Data bit 4
32	D5	IN/OUT	Data bit 5
33	D2	IN/OUT	Data bit 2
34	D3	IN/OUT	Data bit 3
35	D0	IN/OUT	Data bit 0
36	D1	IN/OUT	Data bit 1
37	GND		Logic ground
38	GND		Logic ground
39	IR4	IN	Interrupt request signal, priority 4
40	IR5	IN	Interrupt request signal, priority 5
41	ICS7	OUT	Chip select signal of I/O port 8255 AC-5 on the interface circuit board. * This signal is LOW when 8255AC-5 is selected, or HIGH otherwise.
42	DACK3	-	Not used
43	RSTOUT	OUT	<ul style="list-style-type: none"> ● Reset signal generated to the interface circuit board. ● When this signal becomes LOW, the printer controller is reset to an initial status and the print buffer is cleared. ● Normally this signal is HIGH, and the pulse width must be 50 μs or more at the receiving terminal.
44	ICS 6	OUT	Chip select signal of the slave CPU on the option board. * This signal is LOW when 8042 is selected, or HIGH otherwise.
45	IRD	OUT	I/O read signal. With the IRD signal LOW 8255AC-5 sends data or status to CPU via the data bus.
46	IWR	OUT	I/O write signal. With the IWR signal LOW 8255AC-5 receives data or control signal sent from CPU via the data bus.
47	+5(V)		+5(V) DC
48	+5(V)		+5(V) DC
49	+12(V)		Used when the IURS circuit board is mounted.
50	-12(V)		

Note: "Direction" refers to the direction of signal as viewed from the UXMCL circuit board

2) Table 2.2 CN2 pin assignment

(a) Use Data exchange between the main circuit board UXMCL and the driver circuit board UXDRV.

(b) Number of pins 50

Table 2.2 Pin assignment (CN2 of UXMCL)

Signal Pin No.	Signal	Direction	Description
1	H24	OUT	Print head # 24 control signal
2	H21	OUT	Print head # 21 control signal
3	H11	OUT	Print head # 11 control signal
4	H14	OUT	Print head # 14 control signal
5	H5	OUT	Print head # 5 control signal
6	H8	OUT	Print head # 8 control signal
7	H17	OUT	Print head # 17 control signal
8	H2	OUT	Print head # 2 control signal
9	H7	OUT	Print head # 7 control signal
10	H20	OUT	Print head # 20 control signal
11	H4	OUT	Print head # 4 control signal
12	H1	OUT	Print head # 1 control signal
13	H10	OUT	Print head # 10 control signal
14	H23	OUT	Print head # 23 control signal
15	H15	OUT	Print head # 15 control signal
16	H3	OUT	Print head # 3 control signal
17	H12	OUT	Print head # 12 control signal
18	H18	OUT	Print head # 18 control signal
19	H6	OUT	Print head # 6 control signal
20	H9	OUT	Print head # 9 control signal
21	H19	OUT	Print head # 19 control signal
22	H22	OUT	Print head # 22 control signal
23	H13	OUT	Print head # 13 control signal
24	H16	OUT	Print head # 16 control signal
25	CRD	OUT	CR motor control signal D phase
26	CRB	OUT	CR motor control signal B phase
27	CRC	OUT	CR motor control signal C phase
28	CRA	OUT	CR motor control signal A phase
29	SPAB	OUT	CR motor control A & B phase common line current determination of constant-current circuit
30	SPCD	OUT	CR motor control C & D phase common line current determination of constant-current circuit
31	CRHOLD	OUT	CR motor hold signal. With this signal HIGH, +5V hold voltage is applied to the CR motor
32	LFHOLD	OUT	LF motor hold signal. With this signal HIGH, +5V hold voltage is applied to the LF motor.

Signal Pin No.	Signal	Direction	Description
33	LFA	OUT	LF motor control signal A phase
34	LFB	OUT	LF motor control signal B phase
35	LFC	OUT	LF motor control signal C phase
36	LFD	OUT	LF motor control signal D phase
37	PLA	OUT	Paper hold lever control signal for the auto sheet load mechanism
38	HOT1	IN	Head temperature signal 1. At temperatures of 100°C or above, the voltage surpasses the comparison voltage of about 2.7V of the comparator.
39	HOT2	IN	Head temperature signal 2
40	+5(V)		+5V DC
41	GND		Logic ground
42	GND		Logic ground
43	PE	IN	<ul style="list-style-type: none"> ● DC Level signal to indicate the end of paper ● Normally the signal is LOW, and becomes HIGH when paper is gone.
44	MTS	IN	CR motor phase switching timing signal
45	DTS	IN	Print timing signal
46	GND		
47	SFAN	—	Not used
48	Vp		+24V DC
49	$\overline{\text{HDBRK}}$	In	This signal is LOW when current is flowing through the head pin drive coil, or HIGH otherwise.
50	Gp		+24V DC Ground

Note: "Direction" refers to the direction of signal as viewed from the UXMCL circuit board.

3) Table 2.3 CN3 pin assignment

- (a) Use To supply power from the power supply board UXPS/PSU 24E to the main circuit board UXMCL.
 (b) Number of pins 9

Table 2.3 Pin assignment (CN3 of UXMCL)

Signal Pin No.	Signal	Direction	Description
1	Vx	IN	+5V DC output when stable voltage of +24V or +5V is supplied.
2	+12V	IN	+12V DC
3	-12V	IN	-12V DC
4	+5V	IN	+5V DC
5	+5V	IN	+5V DC
6	GL	-	Logic ground
7	GL	-	Logic ground
8	PWD	IN	This signal becomes LOW when supply voltage of +24V or +5V has become unstable.
9	PSCUT	Out	Power supply cut signal. Low: Normal operating condition. High: When there is a problem with the print head or a driver transistor is defective.

Note: "Direction" refers to the direction of signal as viewed from the UXMCL circuit board.

4) Table 2.4 CN4 pin assignment

- (a) Use Signal exchange between the control panel on the UXMCL circuit board.
 (b) Number of pins 8

Table 2.4 Pin assignment (CN4 of UXMCL)

Signal Pin No.	Signal	Direction	Description
1	GL	-	Logic ground
2	SLSW	IN	Auto sheet load signal
3	LFSW	IN	Line feed signal
4	FFSW	IN	Form feed signal
5	ONSW	IN	ON/OFF line signal
6	RDY LP	OUT	READY LED drive signal
7	PELP	OUT	Paper end LED drive signal
8	ON LINE	OUT	ON LINE LED drive signal

Note: "Direction" refers to the direction of signal as viewed from the UXMCL circuit board.

5) Table 2.5 CN5 pin assignment

- (a) Use Exchange of head/home position signals between the printer mechanism Model-3660 and the main circuit board.
- (b) N u m b e r o f p i n s 4

Table 2.5 Pin assignment (CN5 of UXMCL)

Signal Pin No.	Signal	Direction	Description
1	GND	-	HOME (HP) sensor GND
2	HOME	IN	Signal from HOME (HP) sensor. This signal is HIGH when the carriage is at the home position.
3	GND	-	HOME (HP) sensor GND
4	HLED	OUT	HP sensor LED power supply

Note: "Direction" refers to the direction of signal as viewed from the UXMCL circuit board.

2.3.2 Connector on UXDRV circuit board

1) Table 2.6 CN1 pin assignment

- (a) Use To supply power from the power supply board UXPS/PSU 24E to the driver circuit board UXDRV.
- (b) N u m b e r o f p i n s 4

Table 2.6 Pin assignment (CN1 of UXDRV)

Signal Pin No.	Signal	Description
1	+24V	+24V DC head pin drive
2	+24V	+24V DC
3	Gp	+24V DC power supply GND
4	Gp	+24V DC power supply GND

2) Table 2.7 CN2 pin assignment

- (a) Use Data exchange between the driver circuit board and the Model-3660 printer mechanism.
- (b) Number of pins 34

Table 2.7 Pin assignment (CN2 of UXDRV)

Signal Pin No.	Signal	Direction	Description
1	SHIELD	-	Power supply ground
2	HD24	OUT	Print solenoid # 24 drive signal
3	TF	IN	Signal from the front head temperature sensor (HOT 1)
4	HD12	OUT	Print solenoid # 12 drive signal
5	TCOM	OUT	Temperature sensor common line +5V supply

Signal Pin No.	Signal	Direction	Description
6	HD18	OUT	Print solenoid # 18 drive signal
7	TR	IN	Signal from the rear head temperature sensor (HOT 2)
8	HD9	OUT	Print solenoid # 9 drive signal
9	HD11	OUT	Print solenoid # 11 drive signal
10	HD2	OUT	Print solenoid # 2 drive signal
11	HD21	OUT	Print solenoid # 21 drive signal
12	HD7	OUT	Print solenoid # 7 drive signal
13	HD15	OUT	Print solenoid # 15 drive signal
14	HD23	OUT	Print solenoid # 23 drive signal
15	HD6	OUT	Print solenoid # 6 drive signal
16	HDCOM	OUT	Print solenoid common line
17	HD20	OUT	Print solenoid # 20 drive signal
18	HDCOM	OUT	Print solenoid common line
19	HD5	OUT	Print solenoid # 5 drive signal
20	HDCOM	OUT	Print solenoid common line
21	HD10	OUT	Print solenoid # 10 drive signal
22	HD3	OUT	Print solenoid # 3 drive signal
23	HD17	OUT	Print solenoid # 17 drive signal
24	DH	OUT	Print solenoid # 1 drive signal
25	HD	OUT	Print solenoid # 19 drive signal
26	HD13	OUT	Print solenoid # 13 drive signal
27	HDCOM	OUT	Print solenoid common line
28	HD16	OUT	Print solenoid # 16 drive signal
29	HDCOM	OUT	Print solenoid common line
30	HD22	OUT	Print solenoid # 22 drive signal
31	HDCOM	OUT	Print solenoid common line
32	HD8	OUT	Print solenoid # 8 drive signal
33	HD14	OUT	Print solenoid # 14 drive signal
34	HD4	OUT	Print solenoid # 4 drive signal

Note: "Direction" refers to the direction of signal as viewed from the UXDRV circuit board.

3) CN3 pin assignment

Refer to Table 2.2.

4) Table 2.8 CN4 pin assignment

- (a) U s e Exchange of carriage motor signals between the drive circuit board and the Model-3660 printer mechanism.
 (b) Number of pins 18

Table 2.8 Pin assignment (CN4 of UXDRV)

Signal Pin No.	Signal	Direction	Description
1	OCRA	OUT	CR motor drive signal A phase
2	OCRB	OUT	CR motor drive signal B phase
3	CMAB	OUT	CR motor drive A & B common line
4	OCRC	OUT	CR motor drive signal C phase
5	OCRD	OUT	CR motor drive signal D phase
6	CMCD	OUT	CR motor drive C & D common line
7	NC	-	Not used
8	+5V	OUT	DTS sensor power (+5V)
9	DLED	OUT	DTS sensor LED power
10	IDTS	IN	DTS sensor signal
11	GND	-	DTS sensor ground
12	GND	-	DTS sensor shield
13	NC	-	Not used
14	+5V	OUT	MTS sensor power (+5V)
15	MLED	OUT	MTS sensor LED power
16	IMTS	IN	MTS sensor signal
17	GND	-	MTS sensor ground
18	GND	-	MTS sensor shield

Note: "Direction" refers to the direction of signal as viewed from the UXDRV circuit board

5) Table 2.9 CN5 pin assignment

- (a) Use..... Exchange of control signals between the drive circuit board and the Model-3660 printer mechanism for paper feed motor or paper hold release plunger.
- (b) Number of pins 12

Table 2.9 Pin assignment (CN5 of UXDRV)

Signal Pin No.	Signal	Direction	Description
1	OLFA	OUT	Paper feed motor A phase
2	OLFB	OUT	Paper feed motor B phase
3	OLFC	OUT	Paper feed motor C phase
4	OLFD	OUT	Paper feed motor D phase
5	LFCOM	OUT	Paper feed motor common line (+24V)
6	LFCOM	OUT	Paper feed motor common line (+24V)
7	+24V	OUT	Paper hold release plunger (+) (+24V)
8	PLNGR	OUT	Paper hold release plunger (-) (+24V)
9	NC	-	Not used
10	+5V	OUT	Paper end sensor power (+5V)
11	$\overline{\text{IPE}}$	IN	Paper end sensor signal
12	GND	-	Paper end sensor ground

Note: "Direction" refers to the direction of signal as viewed from the UXDRV circuit board.

6) Table 2.10 CN6 pin assignment

- (a) Use To supply power to the fan set UA from the driver circuit board.
- (b) Number of pins .. 2

Table 2.10 Pin assignment (CN6 of UXDRV)

Signal Pin No.	Signal	Description
1	FAN 1 +	Fan power +24V
2	FAN 1 -	Fan power ground

7) Table 2.11 CN7 pin assignment

- (a) Use Connection of the driver circuit board and the ceramic resistance
- (b) N u m b e r o f p i n s 2

Table 2.11 Pin assignment (CN7 of UXDRV)

Signal Pin No.	Signal	Description
1	+24V	Cement resistance connection terminal
2	HLDR	Cement resistance connection terminal

2.3.3 Connector on UXPS/PSU 24E circuit board

1) CN1 pin assignment

AC power is supplied from UXFIL circuit board

2) CN2 pin assignment

Refer to 2.3.1 3) Table 2.3

3) CN3 pin assignment

Refer to 2.3.2 1) Table 2.6

4) Table 2.12 CN4 pin assignment

(a) Use To supply power from the UXPS/PSU 24E circuit board to the fan set UB.

(b) Number of pins 2

Table 2.12 Pin assignment (CN4 of UXPS/PSU 24E)

Signal Pin No.	Signal	Description
1	FAN +	Fan power +24V
2	FAN -	Fan power ground

2.4 Electrical Circuits

2.4.1 Power circuit

Overview

The power supply circuit of the LQ-1500 consists of a fuse and filter circuit and power supply circuit.

The output voltages are +5, +12 and -12V for logic circuits and +24V for printer drive.

The power supply circuit, employs a switching power supply system in which the input voltage is directly rectified for use.

Table 2.13 Voltage utilization

Output	Voltage Range	Nominal Current	Use
+5 Include Vx	4.9 ~ 5.1V	2.5A	Logic circuit
+24	23.3 ~ 25.7V	6.0A	Printer drive
+12	11.7 ~ 13.3V	0.15A	RS-232C, Power for DRAM
-12	11.7 ~ 13.3V	0.15A	RS-232C, Power for DRAM

[A] 100V/120V version circuit

1. Noise filter circuit (100/120V version)

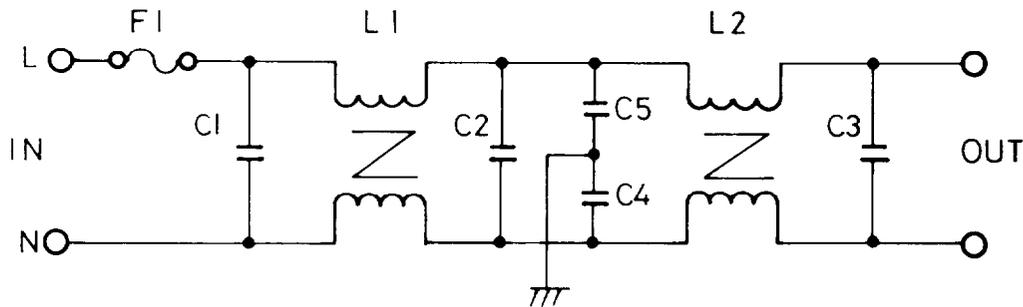


Fig. 2.3 Noise filter circuit

The noise filter circuit is mounted on the UXFIL board together with the fuse. Incoming AC flows through the power switch and fuse before being filtered by a noise suppression circuit on the UXFIL board. The filter circuitry limits electrical interference both to and from the printer.

2. Rectifying circuit and inrush current prevention circuit (100/120V version)

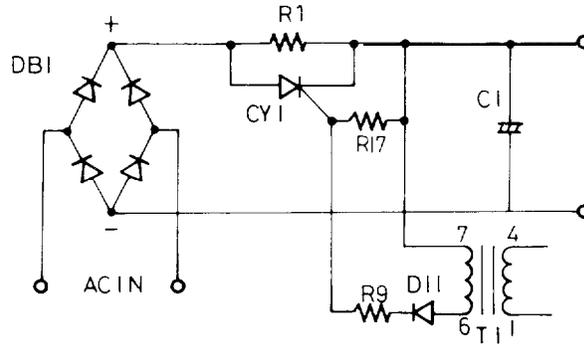


Fig. 2.4 Rectifying circuit and inrush current prevention circuit

In this power supply system, the AC input is directly rectified by the diode bridge DB1 and the output voltages are as shown above.

An explosion-proof valve is provided in the upper part of the case of smoothing condenser C1. If an abnormal voltage is applied to C1, the explosion-proof valve will open, rendering the part inoperative.

In this power supply system, an inrush current flows at power on. Immediately after power on, when C1 is not charged, an excessive charging current that may flow can cause the trouble of fuse F1 or DB1. To prevent it, R1 limits the inrush current. In other words, C1 is charged through R1 at the time of power on. With the start of power supply, a voltage is generated at the output of transformer T1, and this is rectified by D11 and thyristor CY1 is triggered. Now the thyristor shorts both the ends of R1, thus completing the action of preventing Inrush current. The thyristor is conducting electricity as long as the power supply is on.

When the thyristor does not conduct electricity because of some trouble, the power supply remains normal, but R1 gets heated abnormally. Also, R1 may sometimes be disconnected when fuse F1 is blown.

3. Converter circuit (100/120V version)

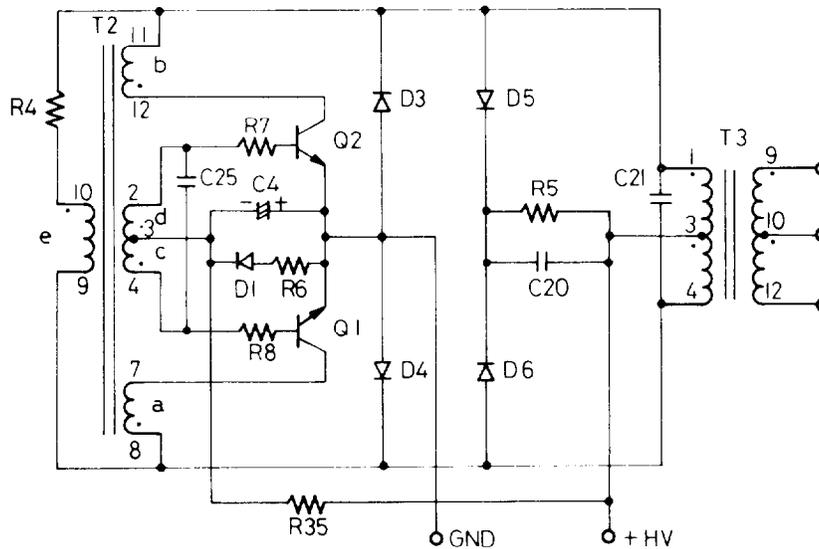


Fig. 2.5 Converter circuit

In this circuit, transistors Q1 and Q2 alternately supply current to the windings of transformer T3, producing AC voltage as the output. 50/60 Hz input is frequency converted into 20 kHz through the action of pulse transformer T3. This circuit starts oscillating automatically at about 20 kHz by transformer T2. With the power supply on, R35 causes the base current to flow and either Q1 or Q2 turns on. Once started, the base current is supplied from windings a and b, so that the transistor, which has been off, turns on instantly. T2, which is a current transformer, is in a positive feedback connection. 1/10 of the collector current from windings c and d as the base current. Oscillation frequency is determined by the length of time it takes the core of T2 to become magnetically saturated after excitation from windings a and b.

When this occurs, the transistor which has been of opposite polarity is generated at T3.

Winding e adds this voltage to the base current and thus prepares the transistor which has been off, to turn on. Then oscillation continues, with the trigger voltage from winding e applied to Q1 and Q2 alternately. R4 limits the current that flows to winding e.

The voltage drop caused by R6 and D1 is smoothed by C4 to produce an inverse bias voltage when Q1 or Q2 turns off. D3 and D4 are used as the by-pass when part of the magnetic energy is returned to the input power. D5 and D6 clamp the spike voltage generated by T3 at switching to the DC input voltage via R5 and C20.

The clamp voltage is about twice as large as the DC input voltage. C21 reduces the transitional switching loss of Q1 and Q2. Q1 and Q2 are parts most liable to develop failure.

Note: When troubleshooting the power supply, Q1 and Q2 should be among the first check points. When either of these transistors are isolated as a trouble source, both must be replaced. Replacing only one of the transistors can result in continued problems.

4. Power transformer circuit (100/120V version)

The variable leakage transformer not only performs power transformation by insulating the load from higher voltage, but also stabilizes the output voltage by controlling the current flow to the control winding. The VLT raises the DC output voltage by sending DC current into control winding f. From this current, the VLT outputs a stabilized waveform.

With 20 kHz AC voltage applied to the input windings a and b, the pulse-width controlled AC voltage can be obtained from the windings c and d. The winding e, which is an auxiliary power source of about 9V, is used to drive the control winding f.

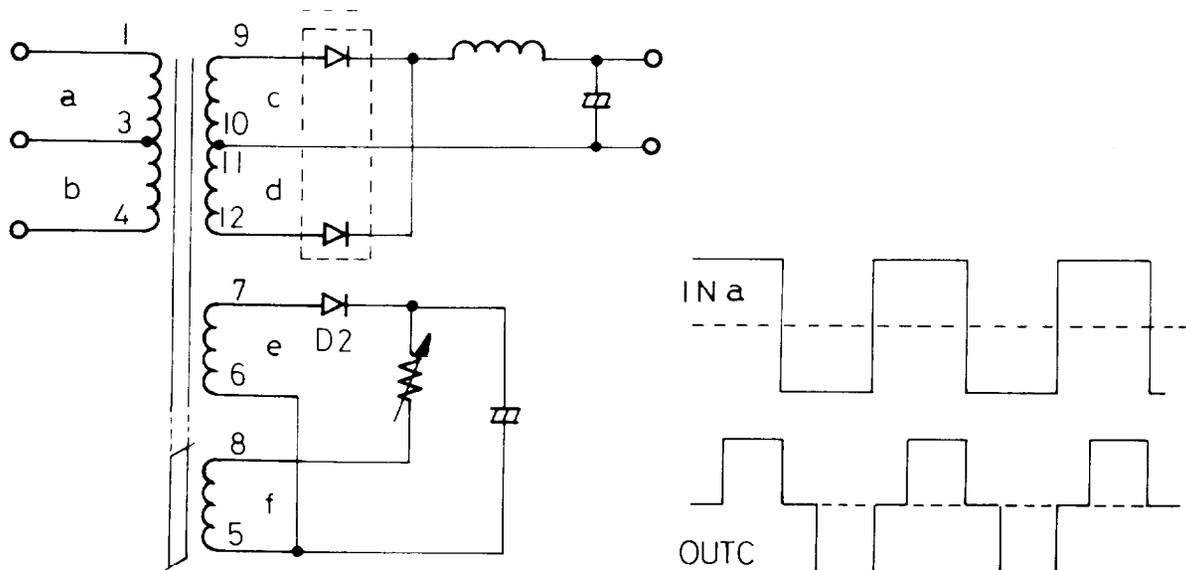


Fig. 2.6 Power transformer circuit

5. +24V output circuit (100/120V version)

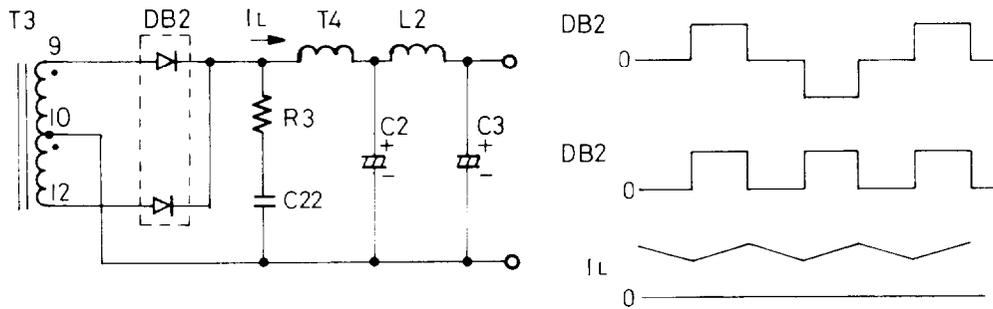


Fig. 2.7 +24V output circuit

The +24V output circuit is capable of supplying an average current of 6A. In this circuit, the pulse-width controlled voltage from VLT is rectified and smoothed. The output which is a pulse voltage, rectified by DB2 is smoothed by choke coil T4 and C2, so a continuous load current flows.

T4, excited by the output voltage of DB2, stores magnetic energy. When the current stops flowing from the VLT, T4 discharges the magnetic energy, so the load current flows continuously.

C22 and R3 prevent the spike voltage from occurring as a result of rectification. L2 and C3 constitute a spike prevention filter.

6. Output control circuit (100/120V version)

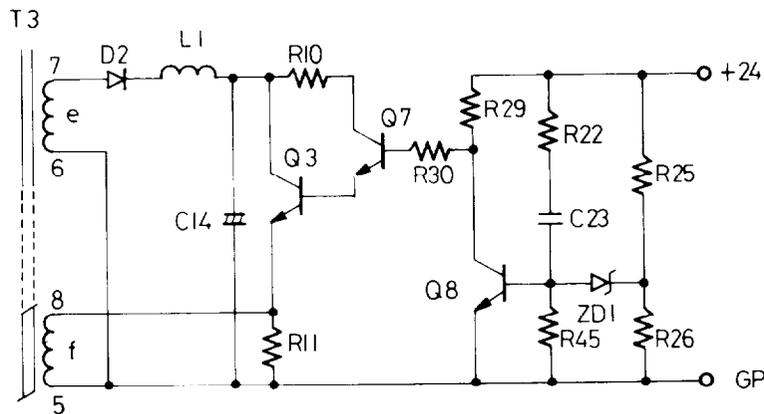


Fig. 2.8 Output control circuit

In this circuit, the output voltage is detected and the output is stabilized by controlling the current flowing to the control winding f of VLT. The current to the control winding is supplied from e, which is the auxiliary power source, and is driven by Q3 and Q7.

The output voltage is detected by zener diode ZD1. A constant output voltage is maintained which adjusts the base current of Q7 as assuring a constant current flow to ZD1.

If too much current flows to winding f as a result of machine malfunction, the system is short circuited, winding f is cut off and output drops below 12V.

R22 and C23 advance the phase so as to maintain a stable output voltage. L1 and C14 constitute an auxiliary power source smoothing filter.

7. Output cutoff circuit (100/120V version)

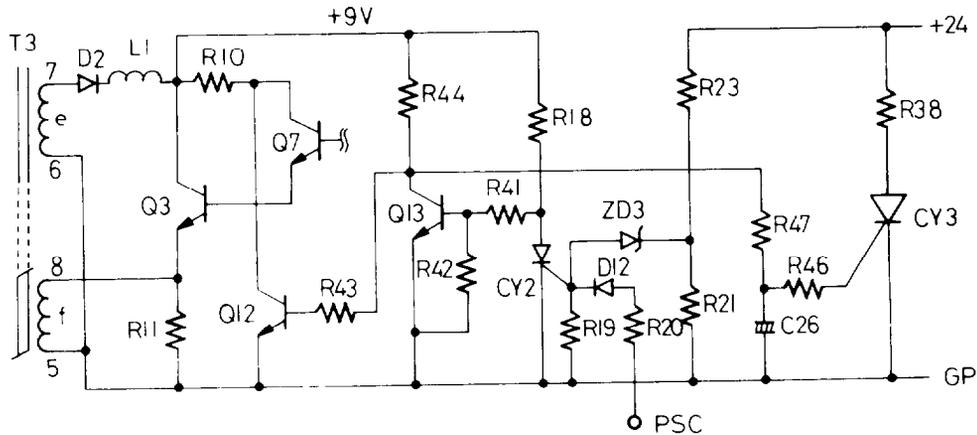


Fig. 2.9 Output cutoff circuit

The output cutoff circuit is activated when the PSC signal is input or 30V or more is output as a result of a malfunction.

When the thyristor CY2 is kept on, Q13 turns on Q12 and stops the base current of Q3, so that power is not supplied to the control winding of VLT. Then +24V output is shorted by triggering the thyristor CY3. A PSC signal is output due to failure of a printhead drive transistor.

8. DC-DC converter (100/120V version)

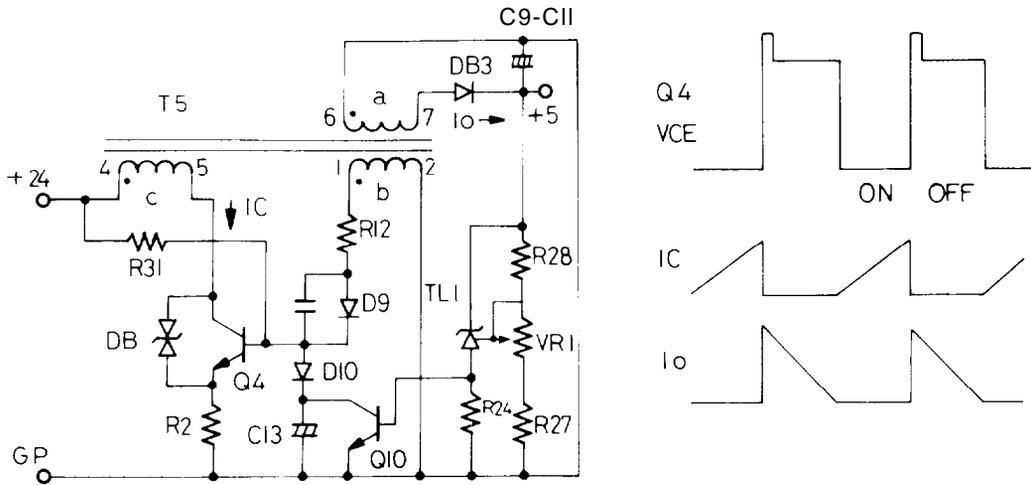


Fig. 2.10 DC-DC converter circuit

In this circuit, outputs of +5, +12 and -12V are produced from +24V.

This circuit starts oscillating automatically at power on.

As the base current flows through R31 and Q4 turns on. With winding c excited, an electromotive force is generated in winding b. Q4 turns on quickly because positive feedback of the voltage in winding b is made to the base current of Q4.

With Q4 switched on, the current flowing to winding c continues increasing until it is restricted by the base current value.

Q4 is turned off quickly by a counterelectromotive force generated in winding b, when increase in collector current stops.

The magnetic energy stored in transformer T5 during the ON period is discharged to the load side during the OFF period. When the magnetic energy is discharged, the counter electromotive force in winding b is lost and Q4 starts turning on again. The output is stabilized by controlling the average current flowing to the winding c.

As +5V output begins to rise, the current flowing into the winding c is reduced, and as it begins to drop, the current flowing into the winding c is increased. These controls are performed with Q10 shunting the base current flowing to Q4. The voltage detector TL1 adjusts the base current of Q10 to maintain the +5V output constant.

The oscillation frequency of the circuit lowers with more load current or rises with less load current.

Under no load, the oscillation becomes intermittent. Normally the circuit operates at about 30 kHz.

D10 and C13 rectify and smooth the base voltage of Q4.

D13, which is a two-way zener diode, clamps the surge voltage generated by T5 to 68V to protect Q4.

VR1 is used to set the +5V output voltage.

9. +5V output circuit (100/120V version)

+5V output is used for the logic circuit.

The current flowing through DB3 charges C9 through 11. The extremely large current value, however causes a large output voltage ripple which is smoothed by Ls and C12.

10. 12V output circuit (100/120V version)

12V output, which is not stable, is used by RS-232C.

Since the DC-DC converter stabilizes the output by detecting +5V, the output voltage drops to about 5V when +5V is under no load.

11. Vx. PWD circuit (100/120V version)

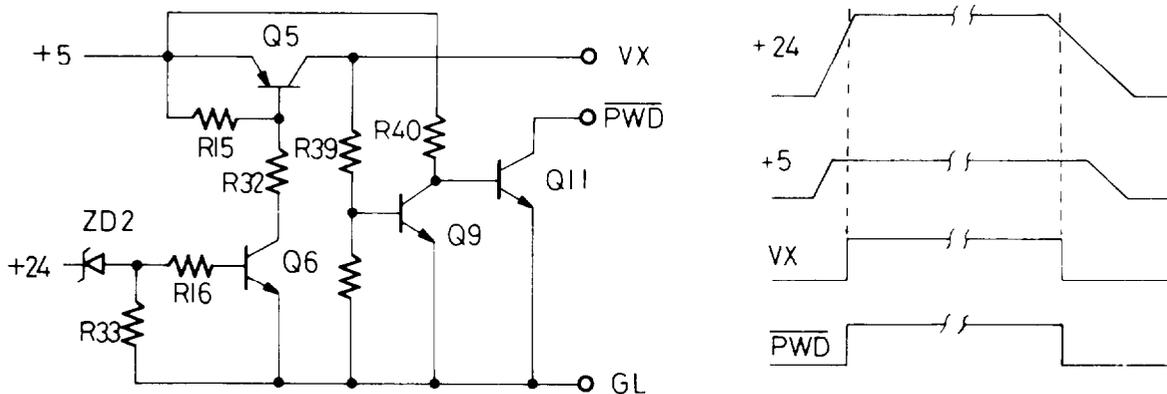


Fig. 2.11 Vx. PWD

Vx is output when +5V and +24V voltages become stabilized and is used to prevent the misoperation of the printer when the power supply is turned on or off.

+5V make from +24V, retains the stable condition longer than +24V. Therefore, Vx is output when the +24V output is +21 V or above.

A voltage drop on the +24V line due to a power failure or machine malfunction turns Q11 on and triggers the PWD signal. When PWD is output the CPU is reset and the printer is stopped.

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