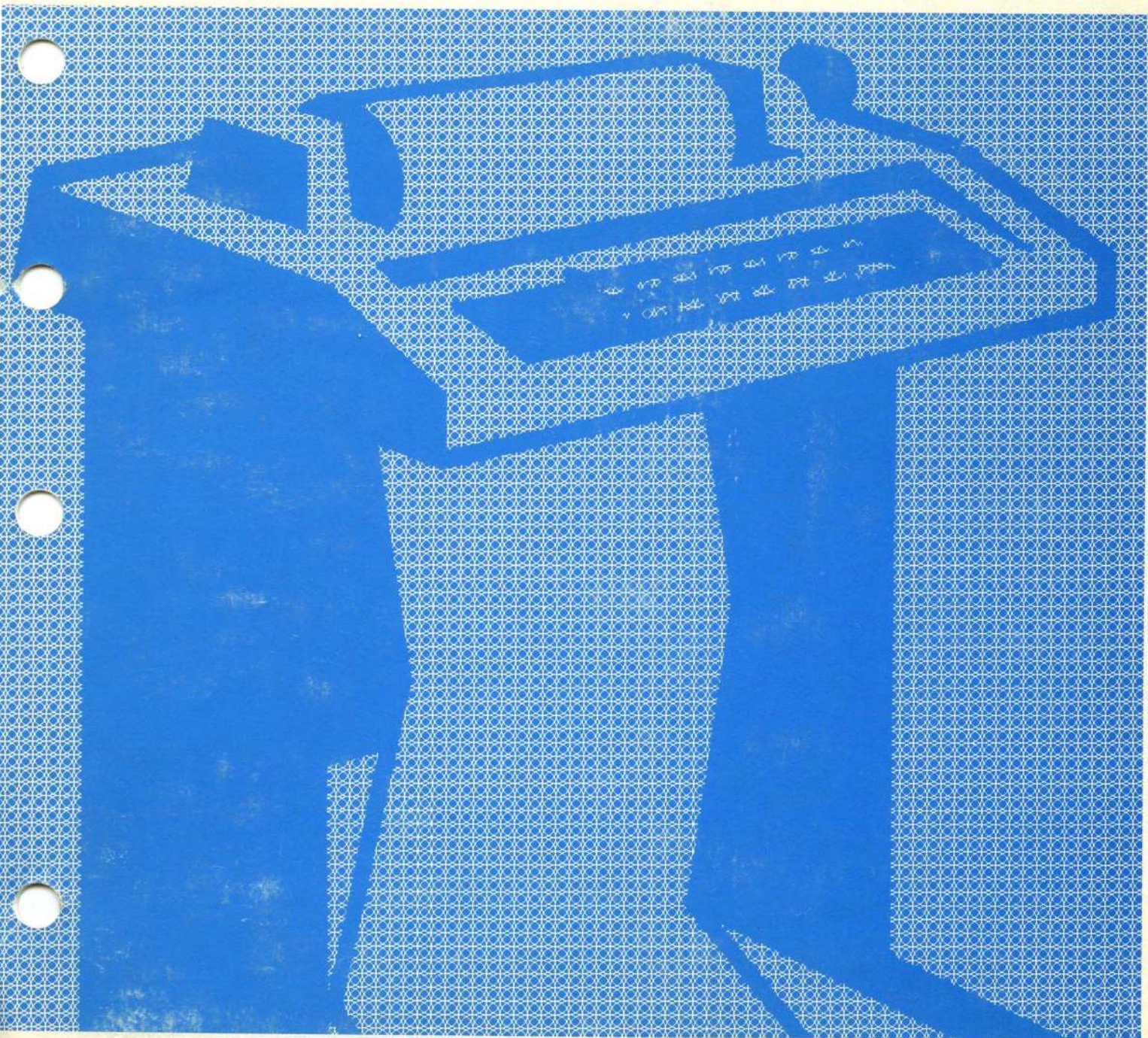


Digital Equipment Corporation
Maynard, Massachusetts

digital

LA36 DECwriter II MAINTENANCE MANUAL



LA36 DECwriter II MAINTENANCE MANUAL

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7037-14

LA36 DECwriter II

CHAPTER 1

GENERAL DESCRIPTION

The LA36 DECwriter II is a small, low cost printer that can be used both as a remote terminal and a local computer I/O device. A true 30-character per second throughput is provided for full utilization of a 300 baud communications line without the use of fill characters. Data can be sent or received in standard ASCII code at 3 rates: 110, 150 and 300 baud.

The printer produces a hard copy original plus up to 5 duplicate copies on tractor-driven continuous forms varying in width from 3 to 14-7/8 inches. Preprinted forms can be positioned in exact vertical alignment by operating a manual clutch on the tractor drive. The standard set of 96 upper and lower case ASCII characters (Table 1-1) is printed at a horizontal spacing of 10 characters per inch and a vertical spacing of 6 lines per inch. A switch on the keyboard printed circuit board allows selection of a reduced set of 64 upper case ASCII characters.

NOTE

On machines with serial numbers below 15700, this switch is internal. On units above 15700, this switch is accessible to an operator and is called "Keyboard Caps Lock Key."

1.1 PHYSICAL CHARACTERISTICS

The unit is a free-standing, pedestal-type terminal. Dimensions are shown in Figure 1-1. There are two major mechanical assemblies and three circuit boards in the unit. Mechanical assemblies are: Printer Mechanism and Print Head, which are mounted on a cabinet base. A complete mechanical breakdown of the LA36 is provided in Chapter 8.

Electronic components are mounted on a Keyboard Assembly, Logic Board, a Power Board and an EIA module for units operating in the EIA mode. The Logic Board, which contains all logic control function parts, is mounted on the rear door of the cabinet to simplify access during maintenance. The Power Board, which contains all power amplifier, driver, and dc power supply and regulator parts, is mounted against the rear wall of the cabinet. Large components, such as the power transformer, EIA module, and filter capacitors are mounted on the base of the cabinet. The line cord enters at the base of the cabinet. A fan mounted inside the cabinet provides forced-air cooling. Low-voltage, high-energy terminals are protected against accidental shorts by fuses.

1.2 FUNCTIONAL DESCRIPTION

A functional block diagram is shown in Figure 1-2. The LA36 prints by moving a 7-wire print head horizontally along the print line, firing the individual wires at the appropriate times to produce a 7 × 7 dot matrix character.

The print head travels on a carriage system and is connected to the drive system by a timing belt. A reversible dc servo motor provides the drive power for the print head and for the ribbon drive mechanism. An encoder on the motor produces feedback pulses that are used by the logic to keep track of the print head position.

Table 1-1
Standard ASCII Character Set and Code

0 1 0	0 1 1	1 0 0	1 0 1	1 1 0	1 1 1	B7 B6 B5
COL2	COL3	COL4	COL5	COL6	COL7	B4 B3 B2 B1
SP	0	@	P	\	F	0 0 0 0
!	1	A	Q	3	R	0 0 0 1
"	2	B	R	b	r	0 0 1 0
#	3	C	S	c	s	0 0 1 1
\$	4	D	T	d	t	0 1 0 0
%	5	E	U	e	u	0 1 0 1
&	6	F	V	f	v	0 1 1 0
'	7	G	W	g	w	0 1 1 1
(	8	H	X	h	x	1 0 0 0
)	9	I	Y	i	y	1 0 0 1
*	:	J	Z	j	z	1 0 1 0
+	:	K	[	k	{	1 0 1 1
,	<	L	\	l	|	1 1 0 0
-	=	M	]	m	}	1 1 0 1
.	>	N	^	n	~	1 1 1 0
/	?	O	_	o	DEL	1 1 1 1

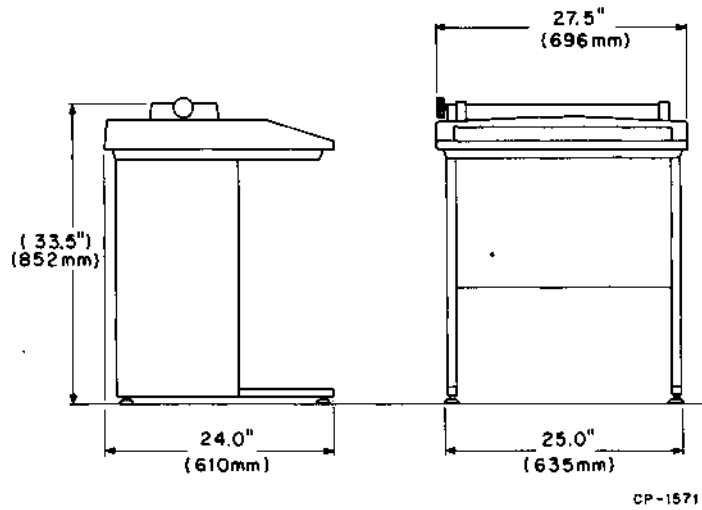
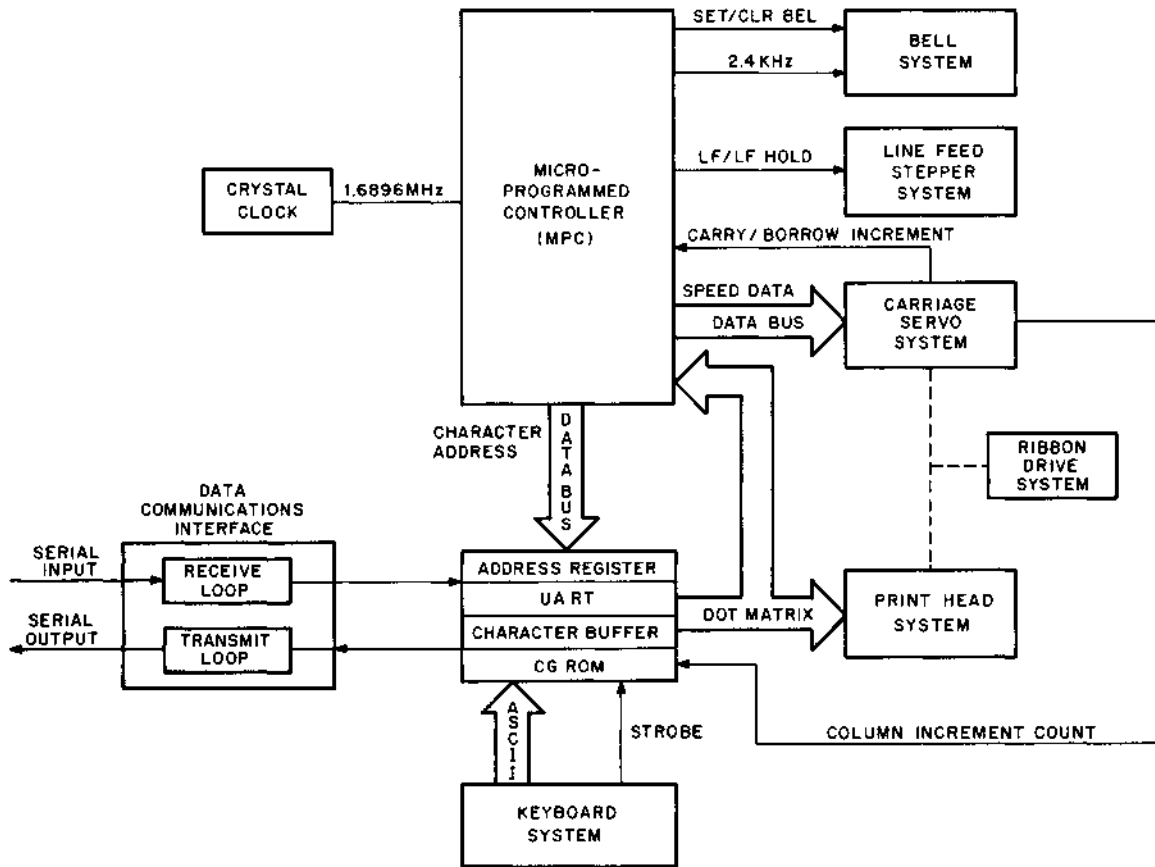


Figure 1-1 Outline Dimensions



CP-1378

Figure 1-2 Functional Block Diagram

Line feeding is accomplished by a pin-feed tractor system that is driven by a stepping motor through a simple gear mechanism.

A Microprogrammed Controller (MPC) is used to control the printer.

1.2.1 Character Printing

At power up, the print head is moved slowly to the left until it hits the end stop. This point is used as a reference by the MPC to determine the *location* of the printed line. The first print column is set about 0.15 in. to the right of the end stop.

Incoming characters from the Keyboard System or the Data Communications Interface are placed in a 16 character read/write FIFO (First-In, First-Out) buffer. Under normal operation, the buffer will never overflow; however, in case of overflow, the most recently received character is lost.

Detection of printable characters and decoding of control characters is performed by the MPC based on information stored in the Character Generation ROM (Read Only Memory). This allows the implementation of arbitrary character sets simply by changing the ROM.

In the standard ASCII character set, there are 95 character codes which are interpreted as *printable*. For each of these characters, the Carriage Servo System is commanded to move through one character cell. The print head solenoids are energized each 0.01 in. of motion to form the 7 columns of the 7 × 7 dot matrix for the character. The 96th character code (DELETE) is a nonprinting, nonspacing control code.

Four additional codes are interpreted by the MPC: Carriage Return (CR), Line Feed (LF), Backspace (BS) and Bell (BEL). The remaining 28 ASCII codes are nonprinting, nonspacing control codes that cause no operation in the printer.

Carriage return and backspace operations are described in Section 1.2.5. Line feed operation is described in Section 1.2.3.

Table 1-2 identifies the 7-bit ASCII codes generated by the LA36 keys and the responses of the LA36 to all incoming codes.

1.2.2 Bell Operation

Receipt of the Bell character causes an audible tone to be produced. A separate tone burst is produced from each of up to eight bell codes received in succession.

If the keyboard has been active during the printing of a line, the audible tone is generated when the carriage passes the 64th character position.

1.2.3 Paper Feeding

The LA36 is designed for pin-feed paper up to 14.875 in. wide. The hole spacing along the edge is 0.500 in. ± 0.010 in. (non-accumulative over 2.0 in.) with a hole diameter of 0.150 in. to 0.160 in. Multi-part forms of up to six sheets (and five carbon sheets) may be used, with a maximum allowable total thickness of 0.020 in. (measured at about 20 psi pressure). Card stock of one layer may be used, with a maximum thickness of 0.007 in. Multi-part forms may have only *one* card part; the card must be the *last* part. A print head gap control (Figure 3-1) is provided for the operator to adjust for the thickness of various forms, which range from 0.003 in. to 0.020 in.

**Table 1-2
ASCII Codes and Responses**

ASCII Code	Character	KEYBOARD OPERATIONS			RECEIVE OPERATIONS	
		To Transmit, Type Key(s)			Character Printed	Action/Description
		SHIFT*	CTRL*	CHAR		
000	NUL	✓	✓	SPACE	None	None
001	SOH		✓	A	↑	↑
002	STX		✓	B		
003	ETX		✓	C		
004	EOT		✓	D		
005	ENO		✓	E		
006	ACK		✓	F		None
007	BEL		✓	BELL		Sound Alarm Bell
010	BS		✓	H		Backspace one position
011	HT		✓	I		None
012	LF		✓	J		Advance Paper one line
013	VT		✓	VT		None
014	FF		✓	FF		None
015	CR		✓	M		Move print head to left margin
016	SO		✓	N		None
017	SI		✓	O		↑
020	DLE		✓	P		
021	DC1		✓	Q		
022	DC2		✓	R		
023	DC3		✓	S		
024	DC4		✓	T		
025	NAK		✓	U		
026	SYN		✓	V		
027	ETB		✓	W		
030	CAN		✓	X		
031	EM		✓	Y		
032	SUB		✓	Z		
033	ESC		✓	[
034	FS		✓	\		
035	GS		✓	=		
036	RS	✓	✓	~	↓	↓
037	US		✓	DELETE	None	None
040	SP			space bar	Blank Space	Print character, move print head one position to the right.

*A check in this column indicates the key (SHIFT or CTRL) that must be held down while the character key is typed. If both keys are checked, then both keys must be held down.

Table 1-2 (Cont)
ASCII Codes and Responses

ASCII Code	Character	KEYBOARD OPERATIONS			RECEIVE OPERATIONS	
		To Transmit, Type Key(s)			Character Printed	Action/Description
		SHIFT*	CTRL*	CHAR		
041	!	✓		!	!	Print character, move print head one position to the right.
042	"	✓		"	"	
043	#	✓		#	#	↑
044	\$	✓		\$	\$	
045	%	✓		%	%	
046	&	✓		&	&	
047	'			'	'	
050	(✓		((
051)	✓))	
052	*	✓		*	*	
053	+	✓		+	+	
054	,			,	,	
055	.	✓		.	.	
056	.			.	.	
057	/			/	/	
060	0			0	0	
061	1			1	1	
062	2			2	2	
063	3			3	3	
064	4			4	4	
065	5			5	5	
066	6			6	6	
067	7			7	7	
070	8			8	8	
071	9			9	9	
072	:	✓		:	:	
073	:			:	:	
074	<	✓		<	<	
075	=			=	=	
076	>	✓		>	>	
077	?	✓		?	?	
100	@	✓		@	@	
101	A	✓		A	A	
102	B	✓		B	B	
103	C	✓		C	C	↓
104	D	✓		D	D	

*A check in this column indicates the key (SHIFT or CTRL) that must be held down while the character key is typed.
If both keys are checked, then both keys must be held down.

Table 1-2 (Cont)
ASCII Codes and Responses

ASCII Code	Character	KEYBOARD OPERATIONS			RECEIVE OPERATIONS	
		To Transmit, Type Key(s)			Character Printed	Action/Description
		SHIFT*	CTRL*	CHAR		
105	E	✓		E	E	Print character, move print head one position to the right.
106	F	✓		F	F	
107	G	✓		G	G	↑
110	H	✓		H	H	
111	I	✓		I	I	↓
112	J	✓		J	J	
113	K	✓		K	K	
114	L	✓		L	L	
115	M	✓		M	M	
116	N	✓		N	N	
117	O	✓		O	O	
120	P	✓		P	P	
121	Q	✓		Q	Q	
122	R	✓		R	R	
123	S	✓		S	S	
124	T	✓		T	T	
125	U	✓		U	U	
126	V	✓		V	V	
127	W	✓		W	W	
130	X	✓		X	X	
131	Y	✓		Y	Y	
132	Z	✓		Z	Z	
133	[[[
134	\			\	\	
135]	✓]]	
136	^	✓		^	^	
137	-			-	-	
140	`			`	`	
141	a			A	a	
142	b			B	b	
143	c			C	c	
144	d			D	d	
145	e			E	e	
146	f			F	f	
147	g			G	g	↓
150	h			H	h		Print character, move print head one position to the right.

*A check in this column indicates the key (SHIFT or CTRL) that must be held down while the character key is typed. If both keys are checked, then both keys must be held down.

Table 1-2 (Cont)
ASCII Codes and Responses

ASCII Code	Character	KEYBOARD OPERATIONS			RECEIVE OPERATIONS	
		To Transmit, Type Key(s)			Character Printed	Action/Description
		SHIFT*	CTRL*	CHAR		
151	i			I	i	Print character, move print head one position to the right.
152	j			J	j	
153	k			K	k	↑
154	l			L	l	
155	m			M	m	
156	n			N	n	
157	o			O	o	
160	p			P	p	
161	q			Q	q	
162	r			R	r	
163	s			S	s	
164	t			T	t	
165	u			U	u	
166	v			V	v	
167	w			W	w	
170	x			X	x	
171	y			Y	y	
172	z			Z	z	
173	{			{	{	
174	|	✓		|	|	
175	}	✓		}	}	
176	~	✓		~	~	Print character, move print head one position to the right.
177	DEL			DELETE	None	None

*A check in this column indicates the key (SHIFT or CTRL) that must be held down while the character key is typed. If both keys are checked, then both keys must be held down.

A full 11-in. high box of paper may be placed under the rear of the printer stand. The paper is fed through a slot under the mechanism. Loading can be facilitated by opening the head gap to maximum with the printer cover open. Special attention should then be given to readjusting the head gap to the corresponding paper thickness setting as directed in Chapter 3, Section 3.2.1. The feed holes of the paper are engaged by two tractors of 11 pins each after passing through the print station. Supports are provided for the incoming and outgoing paper to prevent interference.

The drive tractors may be adjusted horizontally to register properly with any form with hole spacing in the casework, and are provided with a knob for manual paper advance. The shaft is driven through a reduction gear by a stepper motor. Each line feed operation advances the paper $1/6$ in. This is performed in 33 ms maximum, either singly or in succession. Consequently, paper feed rate is 5 inches (or 30 lines) per second.

1.2.4 Ribbon Drive System

A 40-yard, 0.5-in. wide ribbon is wound upon two 3-1/4 in. diameter spools. Two rivets are provided in the ribbon, one near each end, to serve as a reversing tripper.

Power from the carriage drive motor moves the ribbon through a drive belt and a one-way clutch and a reversing mechanism. The clockwise motion of the motor during printing is used to drive the ribbon; no ribbon motion occurs during carriage return. The drive is *always* connected to one of the two spools. The connecting mechanisms are controlled by a power shift which is triggered by the reversing sensors. As one spool empties, the rivet on the ribbon pushes a lever into the path of a shift tab which flips the ratchet from one reel to the other. Ribbon tension of 3 oz. is maintained by drags composed of spring-loaded disk brakes on each spool hub.

1.2.5 Carriage Servo System

The Carriage Servo System is a dc servo mechanism that contains a power amplifier driving a conventional permanent-magnet dc motor which drives the carriage through a timing belt. The movement of the motor shaft and hence the position of the carriage is detected by an optical incremental encoder which produces one pulse for each 0.01 in. of carriage motion.

A one-decade, up/down BCD (Binary Coded Decimal) counter keeps track of the carriage position within a character space. The overflow of this counter is monitored by a MPC and is used to determine the carriage position and for other control functions. The speed of the motor during printing, carriage return, and LCV (Last Character Visibility) is controlled by the MPC by means of a register which in turn controls the output voltage of the power amplifier feeding the motor.

Printing is accomplished by moving the print head from left to right across the space to be occupied by the character. When a BCD counter indicates that the carriage is at a given dot position, the appropriate solenoids are energized to print. If the carriage is to the right of the starting position for the character, the carriage is moved to the left of the starting position before printing commences. If there is a second printing character in storage while a character is being printed, the carriage speed is increased to catch up. When printing is complete, the carriage stops.

When a backspace character is received, the carriage is moved to the left a distance of one character cell (0.1 in.). This function allows character overprinting without an intervening carriage return.

When a carriage return character is received, the carriage is moved to the left-hand margin. Carriage speed is a function of the distance between the carriage and the left-hand margin. The time required to return the carriage to the margin is compensated for by an accelerated print rate until no more than one character is in the buffer.

When approximately two seconds have elapsed without a printable character input, the carriage moves four character spaces to the right to permit the operator to see the last character. When printing is to be resumed, the carriage moves to the left to begin printing.

1.2.6 Power Supply

The main power supply is an unregulated supply with nominal output voltages of +21 Vdc and -21 Vdc. The minimum instantaneous output voltage is 15 V for full load and minimum line voltage.

The 5 V supply for the logic has a regulation of $\pm 5\%$ with 200 mV p-p maximum ripple.

Regulated voltages of +12 V $\pm 5\%$ and -12 V $\pm 5\%$, with 500 mV p-p maximum ripple are provided for operational amplifier and MOS (Metal Oxide Semiconductor) circuits. A -9 Vdc regulator is included on the Logic Board when the PROM (Programmable Read Only Memory) option is supplied.

1.2.7 Standard Current Loop Interface

The standard interface is a full-duplex, passive 20 mA current loop similar to a Teletype[®] interface. The cable pin connections are shown in Table 1-3 and Figure 1-3. (Polarities denote current flow.) Circuit operation is shown in Figure 1-4. (Polarities denote current flow.)

Table 1-3
Standard Full-Duplex
20 mA Current Loop Cable Connections

Connector Pin Numbers		Circuit	Description
To Logic Board Connector J3	To Host Computer Connector		
P1-2 <i>black</i>	P2-3 <i>grn</i>	Transmit (+) (keyboard)	Negative side of line
P1-5 <i>wht</i>	P2-7	Transmit (-) (keyboard)	Positive side of line
P1-3 <i>red</i>	P2-2 <i>wht</i>	Receive (+) (printer)	Negative side of line
P1-7 <i>grn</i>	P2-5	Receive (-) (printer)	Positive side of line

Typing each specific key causes the LA36 transmitter switch to be opened and closed in a pattern that defines the key.

The 20 mA communications circuit will operate wherever the current source is located. A device is said to be *active* if it supplies the current for the communications loop and *passive* if it receives current from another device.

The LA36 is shipped with a 20 mA cable (BC05F) to interface the terminal as a passive device to a computer, or to another peripheral device that is operating as an active device.

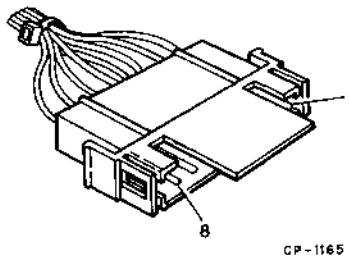


Figure 1-3 Current Loop Cable Connector Pin Designations

[®]Teletype is a registered trademark of Teletype Corporation.

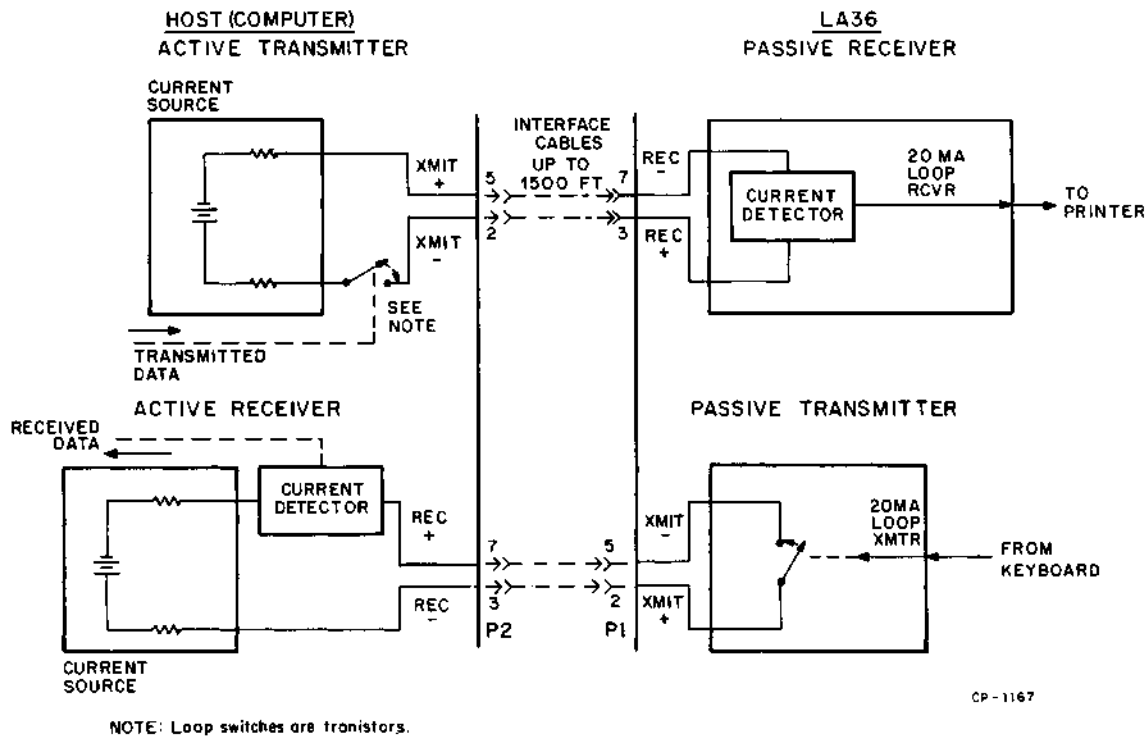


Figure 1-4 Standard Current Loop Interface

1.2.8 Optional Half-Duplex, (Active or Passive) Current Loop Interface

In the half-duplex mode, transmission between two devices can take place in only one direction at a time; however, no keyboard lockout is provided. Any of the configurations shown in Figure 1-5 can be obtained by using jumpers on LA36 Logic Boards; the jumpers can be changed as described in Chapter 2 Section 2.5.4. The configurations on the left of the diagram show the LA36 used as an active device, providing its own current source; the configurations on the right show it being used in the half-duplex mode, both as a passive and an active device.

Cable pin connections are shown in Table 1-4.

Table 1-4
Optional Half-Duplex
20 mA Current Loop Cable Connections

Connector Pin Numbers		Circuit	Description
To Logic Board Connector J3	To Host Computer Connector		
P1-5	P2-3	Transmit (+) (keyboard)	Negative side of line
P1-3	P2-5	Receive (-) (printer)	Positive side of line

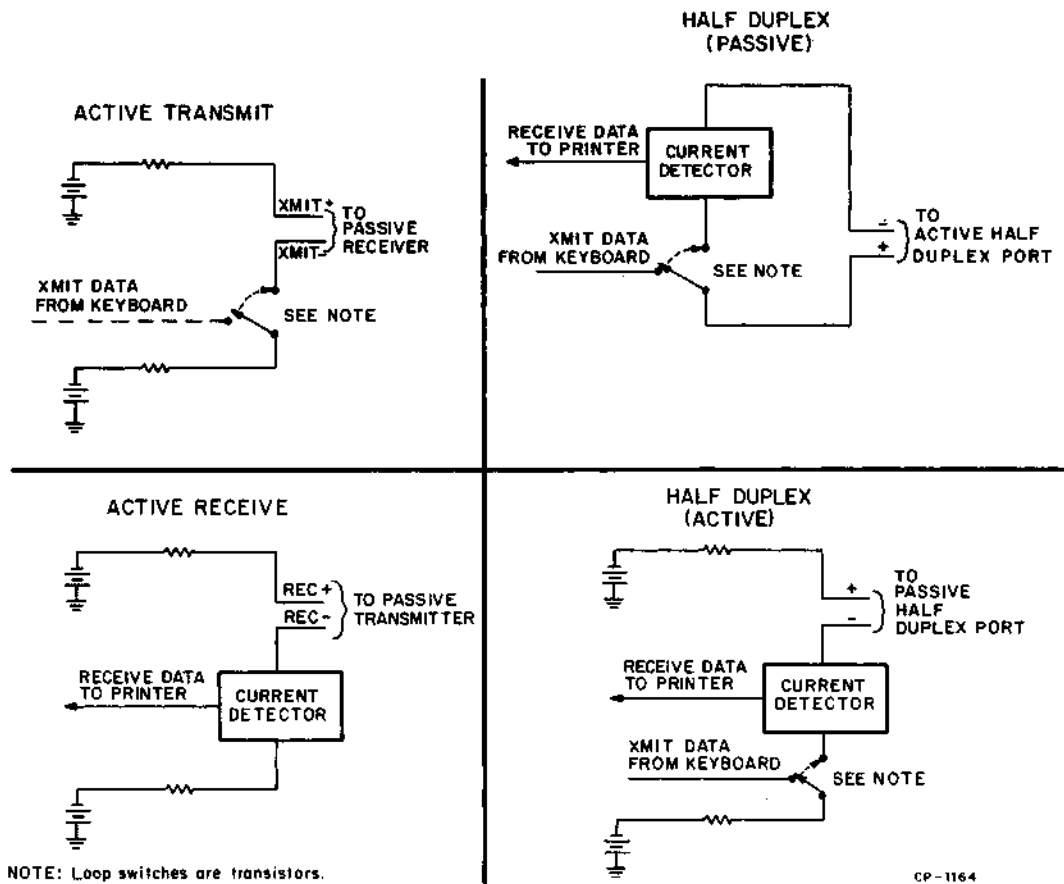


Figure 1-5 Optional Current Loop Configurations

The active connection defeats the isolation of signal line and local circuits, requiring that appropriate protective measures, such as high potential breakdown grounds (lighting arrestors, etc.) be installed on the signal line and that care be taken to ensure that protective (frame) ground is connected.

1.2.9 Peripheral Interface Port

The LA36 has a connector for non-current loop interfaces. The connection is via a straight 8-pin Mate-N-Lok connector, J4, with the pin designations listed in Table 1-5.

The interface using this port is physically mounted within the LA36 cabinet.

1.3 TECHNICAL CHARACTERISTICS

The technical characteristics of the LA36 DECwriter II are listed in Table 1-6. The interface specifications for the LA36 serial 20 mA current loop are shown in Table 1-7.

1.4 OPTIONAL FEATURES AND ACCESSORIES

Optional features and accessories are listed in Table 1-6.

1.4.1 EIA/CCITT Interface

The LA36 is optionally available with interfacing capability that complies with the requirements of EIA Standard RS-232-C and CCITT Recommendation V-24. It is supplied with a 9-ft cable terminated in a standard EIA connector (Figure 6-53). The cable mounts through the interface opening in the bottom of the LA36 chassis and plugs into connector J4 on the LA36 Logic Board. Connector pins are shown in the Table 1-8.

**Table 1-5
Interface Port Connector Pins**

Pin	Function
1	Unused
2	-12 V, up to 125 mA to optional interface
3	+12 V, up to 125 mA to optional interface
4	+5 V, up to 500 mA to optional interface
5	Serial output of LA36 to optional interface TTL level, will drive 10 unit loads.
6	Mechanical keying plug (no electrical connection).
7	Serial input to LA36 from optional interface TTL level (must be capable of driving 10 unit loads).
8	Ground

**Table 1-6
Technical Characteristics**

Main Specifications	Printing Speed: 30 char/sec throughput, serial asynchronous
	Number of columns: 132
	Printing Characters: 96 ASCII/character set (95 + DELETE)
	Control Characters: 32 ASCII/character set
	Keyboard Characters: 128
Printing	Type: impact 7 X 7 dot matrix
	Character size: 0.175 X 0.25 cm (0.70 X 0.100 in.)
	Vertical spacing: 6 lines/inch (2.36 lines/cm)
	Horizontal spacing: 10 char/inch (3.94 char/cm)
	Carriage return: 500 ms max.
	Line feed: 33 ms
	Slew speed (paper feed rate): 5 in/sec (30 lines/sec) (1.97 cm/sec)

**Table 1-6 (Cont)
Technical Characteristics**

Keyboard	Standard ASCII typewriter-like layout, mechanical contact with four parallel switches.
Paper Handling	Tractor feed, 3 engaging pins, movable right-hand tractor for 3 to 14-7/8 in. forms, manual print gap adjustment for 1 to 6 part forms, vernier vertical adjustment for custom preprinted forms.
Paper	<p>Single-Part: 12 to 20 lb. (card up to 0.007 thick)</p> <p>Multi-Part: 2 to 6 part (no cards except last copy)</p> <p>Max. thickness (no card) 0.020 in. Max. thickness (single card, last copy) 0.020 in.</p>

NOTE

NCR or 3M paper (up to 6-part) must use ribbon on top copy. First surface impact paper is not recommended.

Continuous feed, fan-fold business forms with 3- or 4-prong margin crimps on both margins (multi-part).

NOTE

Stapled forms are not recommended and may damage tractors and other areas of the machine. Dot or line glue margins are acceptable (if line glue is on one margin only).

CAUTION

Do not line glue both margins; air will not be able to escape and poor impressions will result.

Transmission Rates	110 baud 11 bit, 150 and 300 baud 10 bit; switch-selectable at keyboard panel
Modes of Operation	Local or full duplex on-line, switch-selectable at keyboard panel
Parity	None
Interface	Integrated 20 mA current loop, full-duplex passive operation. Connectors are 8-pin Mate-N-Lok type.
Power	<p>90–132 Vac, 48–63 Hz 180–264 Vac, 48–63 Hz 300 W max. (printing)</p> <p>160 W (non-printing)</p>
Mechanical	<p>Mounting: free-standing pedestal unit</p> <p>Size: 33.5 in. (852 mm) H × 27.5 in. (696 mm) W × 24 in. (610 mm) D</p> <p>Weight: 102 lbs. (46 kg)</p>

**Table 1-6 (Cont)
Technical Characteristics**

Environment	<p>Temperature: 10° to 40° C (50° to 104° F) – operating -40° to 66° C (-40° to 151° F) – non-operating</p> <p>Humidity: 10% to 90% – operating 5% to 95% – non-operating</p> <p>Altitude: Sea level to 8000 feet (3.04 Km) – operating</p> <p>Acoustical Noise: Sound pressure level: 65 dB max. between 31.5 and 8000 Hz Speech interference level: 65 dB max at 500, 1000 and 8000 Hz</p>
Ribbon	<p>Digital-specified nylon fabric, spool assembly 0.5 in. wide X 40 yards</p> <p>Order # 36-10558</p>
Model	LA36-CA DECwriter II 20 mA serial interface, 90–132 Vac, 48–63 Hz
OPTIONS	
Interface	<p>EIA RS232C/CCITT V-24 DF11 Series</p> <p>Active operation, full- or half-duplex (no charge, customer installable jumpers)</p>
Parity	Even parity (no charge, customer installable jumpers)
Numeric Pad	11-key
Keyboard Characters	96, LA30 DECwriter compatible (no charge, customer selectable by internal or external key switch)
Power	180–264 Vac, 48–63 Hz (no charge, customer installable jumpers)
ACCESSORIES	
Casters, Shelf and Paper Tray	Model Designation LAXX-KA
Casters only	LAXX-KB
Shelf only	LAXX-KC
Paper Tray only	LAXX-KD
Character Set	Non-standard character sets are available.

**Table 1-7
Interface Specifications**

Transmitter

(Passive, isolated, goes to "Mark" state when power is turned off.)

	Min.	Max.
Open circuit voltage (of circuit being driven)	5.0 V	40 V
Voltage drop, Marking	0.5 V	2.0 V
Spacing current	0.4 mA	2.0 mA
Marking current	20 mA	80 mA

Receiver

(Passive, isolated)

	Min.	Max.
Voltage drop, Marking	1.2 V	2.7 V
Spacing current	0.0 mA	3.0 mA
Marking current	15 mA	80 mA

Cable

4-conductor

Standard 15-ft BC05F-15 supplied with LA36

Cable extension is 1500 ft. max.

Receiver/Transmitter

(Active, half-duplex)

	Min.	Max.
Voltage drop, Marking	1.7 V	4.7 V
Spacing current	0.0 mA	3.0 mA
Marking current	15 mA	80 mA

Table 1-8
EIA/CCITT Interface Connector Pins

Pin No.	EIA Circuit Designations	Circuit Descriptions
1	AA	Protective Ground (electrically connected to the LA36 chassis)
7	AB	Signal Ground (common return)
2	BA	Transmitted Data (from keyboard)
3	BB	Received Data (to printer)
4	CA	Request to Send (always asserted)
20	CD	Data Terminal Ready (always asserted)



CHAPTER 2

INSTALLATION

This chapter outlines unpacking and inspection procedures, installation, cable connections, and unit checkout. A brief discussion of site considerations is also provided.

2.1 SITE CONSIDERATIONS

The LA36 DECwriter II should be located in an area free of excessive dust, dirt, corrosive fumes or vapors. To ensure proper cooling, the ventilation openings on the sides of the cabinet should have no obstructions within 4 in. (See Figure 2-1.)

2.2 SYSTEM CONFIGURATION

Adequate clearance must be provided for servicing the machine. Figure 2-1 illustrates cabinet service area dimensions.

2.3 UNPACKING AND INSPECTION

To unpack and inspect the LA36, proceed as follows:

1. Remove the outer cardboard shipping container carefully so as not to damage any of the inner contents. (Use care when using carton knives and prying tools.)
2. Remove all shock absorbing laminated material from around the printer and set it aside.
3. Remove the poly bag from the printer and discard it.
4. Remove the foam pad from the top of the keyboard along with the two filament tapes that secure it to the frame.
5. Lift the LA36 cover and clip the cable tie that secures the head in the left-most position.

CAUTION

Do not allow the tie to fall into the machine.

6. Inspect the external surface for possible shipping damage. Check the packing list. Report any damaged or missing items to the local DEC Field Service or Sales Office.
7. Ensure that the cover hinge and fasteners are intact.
8. If it appears that the cover has been dislodged in shipping, inspect the internal mechanical parts to see if damage has been done.

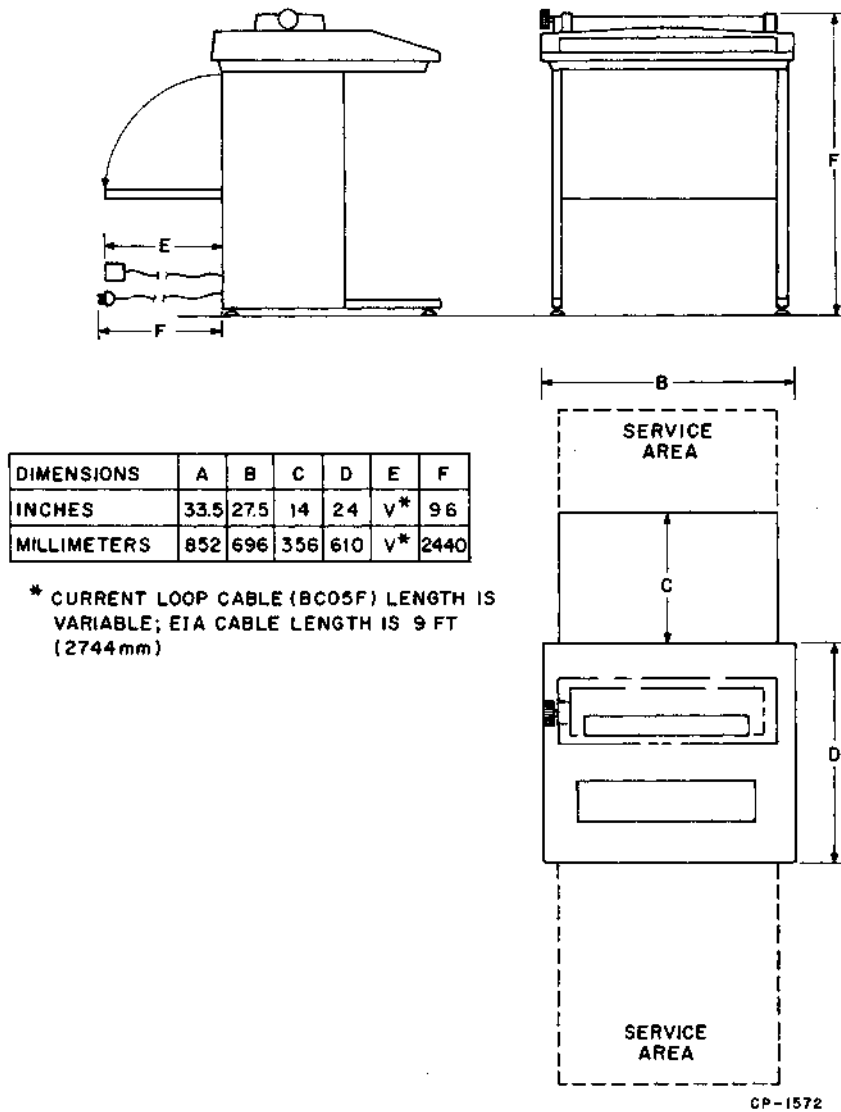


Figure 2-1 Site Considerations

9. Check to see that the keyboard bezel has not shifted (keys should not bind).
10. Open the rear access door and check the security of all connectors.
11. Locate the DECwriter II near its operating position.

2.4 INSTALLATION PROCEDURE

The LA36 DECwriter II is equipped with leveling feet. It is not necessary to bolt it to the floor. To install the LA36, proceed as follows:

1. Locate the DECwriter II at its final operating position.
2. Adjust the leveling feet on the stand until the unit is leveled.

3. If necessary, wipe all outer surfaces with a clean, soft, lint-free cloth.
4. Remove the power cable from its storage position and connect it to the power source.

CAUTION

Before connecting the LA36 to local power, ensure that line voltage and frequency are compatible with the power requirements of the machine. (See Table 1-6.) Ensure that the **POWER** switch on the console is **OFF**.

5. Remove the interface cable from its storage position in the cabinet and connect it to the interface logic designated for that system or remote installation (see Site Plan).

NOTE

Site plans are not supplied by Digital Equipment Corporation. Interface logic connections must be specified by the system supplier or the customer because each installation may be different.

6. Upper Case and Lower Case Character Selection – To set up the LA36 so that it will only print upper case characters, set the slide switch on the printed circuit board of the Keyboard Assembly to the proper position.

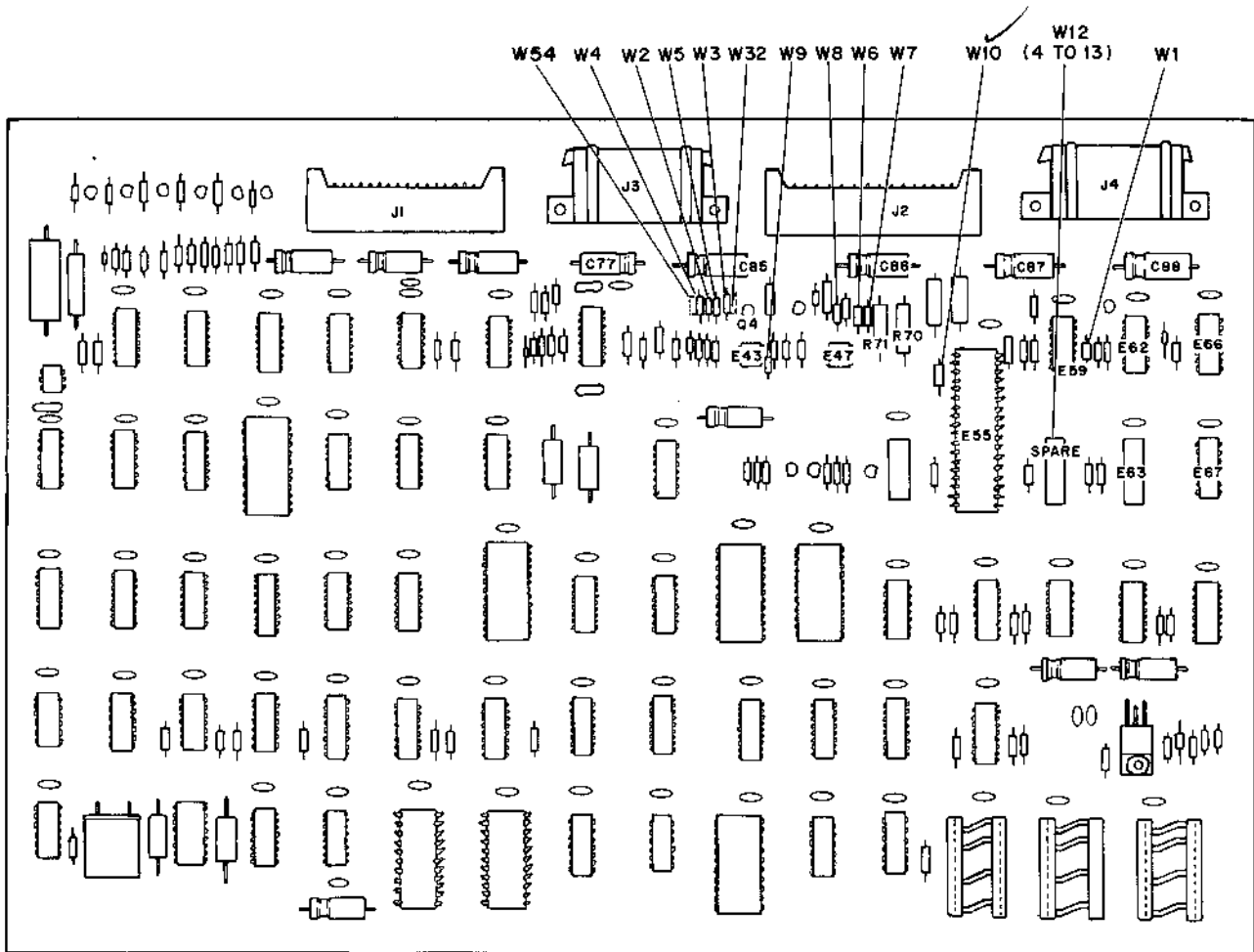
The slide switch can be changed in units with serial numbers lower than 6930 by exercising steps 1 through 4 in Section 5.2.3. Then it will be necessary to remove the phenolic locking strip on the switch to enable it to be changed. This phenolic locking strip has not been installed on units with serial numbers 6930 or higher. With units 6930 or higher, exercise only steps 1 and 2 of Section 5.2.3. Change the switch by reaching in the opening in the lower left-hand corner of the bezel cover. Refer to Chapter 8 for the switch location.

7. Parity Setting – The LA36 is configured with no parity. To modify this configuration, insert or remove jumpers as directed in Table 2-1. Jumper locations are shown in Figure 2-2.
8. Bell Volume – To lower the volume of the bell tone, cut jumper W1.
9. Current Loop – The LA36 is normally configured for full-duplex passive operation. To modify this configuration, insert or remove jumpers as directed in Table 2-2.

Table 2-1
Parity Configuration Jumpers

Function	W10
8th Bit Marking	1
Even Parity	0

Legend: 0 = Jumper inserted
1 = Jumper not inserted



CP-1573

Figure 2-2 Jumper Location Diagram

2.5 CHECKOUT AND ACCEPTANCE PROCEDURES

Check the following items before running the electrical checkout procedure.

1. Open the top cover of the LA36 and ensure that it is equipped with a supply of ribbon, threaded through to the take-up reel. If not, install as directed in Chapter 3.
2. Install paper as directed in Chapter 3.
3. Connect the LA36 to the correct power source and set the POWER switch to ON. If the fan does not run, refer to symptom 1 of Table 5-2.
4. Set the POWER switch to OFF and then to ON; observe the initializing operation of the print head. The head should move to the right, then to the left as far as the stop, then back to the right and stop at the 4th character position – Last Character Visibility (LCV). If the print head does not initialize correctly, refer to symptom 2 of Table 5-2.

**Table 2-2
Current Loop Configuration Jumpers**

Jumper	W2	W3	W4	W5	W6	W7	W8	W9	W12	W32	W54
Full-Duplex Active	0	0	0	0	1	1	1	1	0	1	1
Full-Duplex Passive	1	1	1	1	0	0	0	0	0	0	0
Passive Receive/ Active Transmit	1	1	0	0	1	0	1	0	0	0	1
Active Receive/ Passive Transmit	1	1	1	1	0	0	0	0	0	0	0
Half-Duplex Active*	1	1	1	1	1	0	0	1	0	0	0
Half-Duplex Passive*	1	1	1	1	0	0	0	0	0	0	0

*Connect user-manufactured cable between J3-3 and 5 and operating system.

Legend: 1 = Jumper inserted
0 = Jumper not inserted

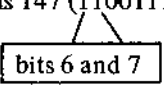
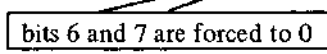
5. Set the BAUD RATE switch to 300 and the LINE/LOCAL switch to LOCAL.
6. Press the LINE FEED key and then hold down the CTRL key and press the BELL key. The stepping motor should advance the paper one line and the bell tone should sound. If not, refer to symptoms 3 and 4a of Table 5-2.
7. Press the / (slash) or @ key and the REPEAT key. The print head should travel smoothly along the print bar and print the corresponding character. When the print head passes the 64th character position, the bell tone should sound. If the bell tone does not sound, refer to symptom 4b of Table 5-2. If the print head hangs up trying to print a character, refer to symptom 5 of Table 5-2. If other symptoms appear, look for the corresponding symptom in Table 5-2.
8. Press the BACKSPACE key. If the print head does not move one character position to the left, refer to symptom 13 of Table 5-2.
9. Press the RETURN key after 132 characters have printed and observe the return of the print head to the "home" (LCV) position. It should take approximately 1/2 second. If it takes longer, refer to symptom 12 of Table 5-2.
10. Set the BAUD RATE switch to the setting prescribed for the operating system.
11. Set the LINE/LOCAL switch to LINE and run customer-provided programs to check that the unit operates satisfactorily when connected to the system.

CHAPTER 3 OPERATION

3.1 OPERATOR CONTROLS

The LA36 DECwriter II operator controls are described in Table 3-1 and illustrated in Figure 3-1.

**Table 3-1
Control and Function Keys**

Control/Key	Description
CTRL Key	<p>Holding down the CTRL key when a character is typed forces bits 6 and 7 of the ASCII code for the character to 0. For example, the ASCII code for the letter "g" is 147 (1100111)</p> <div style="margin-left: 100px;">  </div> <p>Holding down the CTRL key and typing g transmits ASCII code 007 (0000111)</p> <div style="margin-left: 100px;">  </div> <p>The CTRL key enables the LA36 operator to transmit all ASCII control codes (000-037).</p>
BREAK Key	<p>The BREAK key is commonly used to forcibly interrupt the flow of data coming to the LA36. It is provided for users with software written for half-duplex operation.</p> <p>In half-duplex operation, only one set of lines exist between the terminal and the host computer. If the host computer has control of the lines, BREAK is the only means of forcing an interrupt.</p>
POWER Switch	The POWER switch controls the ac line voltage to the LA36.
LINE/LOCAL Switch	The LINE/LOCAL switch connects the LA36 to the transmit and receive lines in the LINE position, and disconnects it in the LOCAL position.
ESC(SEL) Key	The ESC(SEL) key enables the LA36 operator to generate an Escape command. Standard programming conventions dictate that receipt of ESC (ASCII code 033) directs the receiving device to treat the next character as a command. Commands encoded in this manner are called <i>Escape Sequences</i> . It is the responsibility of the host computer programmer to define the exact Escape Sequence for each application.

**Table 3-1 (Cont)
Control and Function Keys**

Control/Key	Description								
TAB Key	The TAB key generates ASCII code 011. The programmer must design the software to translate TAB commands into the proper number of space commands to be sent back to the LA36.								
LINE FEED (LF) Key	The LINE FEED key generates ASCII code 012. The MPC advances the paper one line each time LF is typed. <p align="center">NOTE</p> <p align="center">Rapid off-line paper advance may be accomplished by placing the machine in LOCAL and depressing the LF and REPEAT keys simultaneously.</p>								
BACKSPACE Key	The BACKSPACE key generates ASCII code 010. The microprogram moves the print head one position to the left each time the BACKSPACE key is typed.								
RETURN Key	The RETURN key generates ASCII code 015. The microprogram positions the print head at the left margin each time the RETURN key is depressed.								
REPEAT Key	The REPEAT key, by itself, transmits no code to a host computer. Holding down the REPEAT key and depressing a character key causes the ASCII code for the character to be transmitted repeatedly at 15 cps until either the REPEAT key or character key is released.								
BAUD RATE Switch	The BAUD RATE switch controls the rate at which characters are transmitted and/or received. <table align="center"> <thead> <tr> <th>Switch Position</th> <th>Character Rate</th> </tr> </thead> <tbody> <tr> <td>110</td> <td>10 char/sec</td> </tr> <tr> <td>150</td> <td>15 char/sec</td> </tr> <tr> <td>300</td> <td>30 char/sec</td> </tr> </tbody> </table>	Switch Position	Character Rate	110	10 char/sec	150	15 char/sec	300	30 char/sec
Switch Position	Character Rate								
110	10 char/sec								
150	15 char/sec								
300	30 char/sec								
Carriage Adjustment Lever	The carriage adjustment lever controls the print head gap for single- or multi-part forms.								
Tractor Adjustment Knob	The Tractor Adjustment knob releases the tractor, allowing the use of paper of varying widths.								
Paper Advance Knob	The Paper Advance knob pushes in and disengages the line feed gear train to allow fine vertical adjustment of paper position.								
Ribbon	The ribbon reverses automatically. It must be periodically turned over and/or changed.								

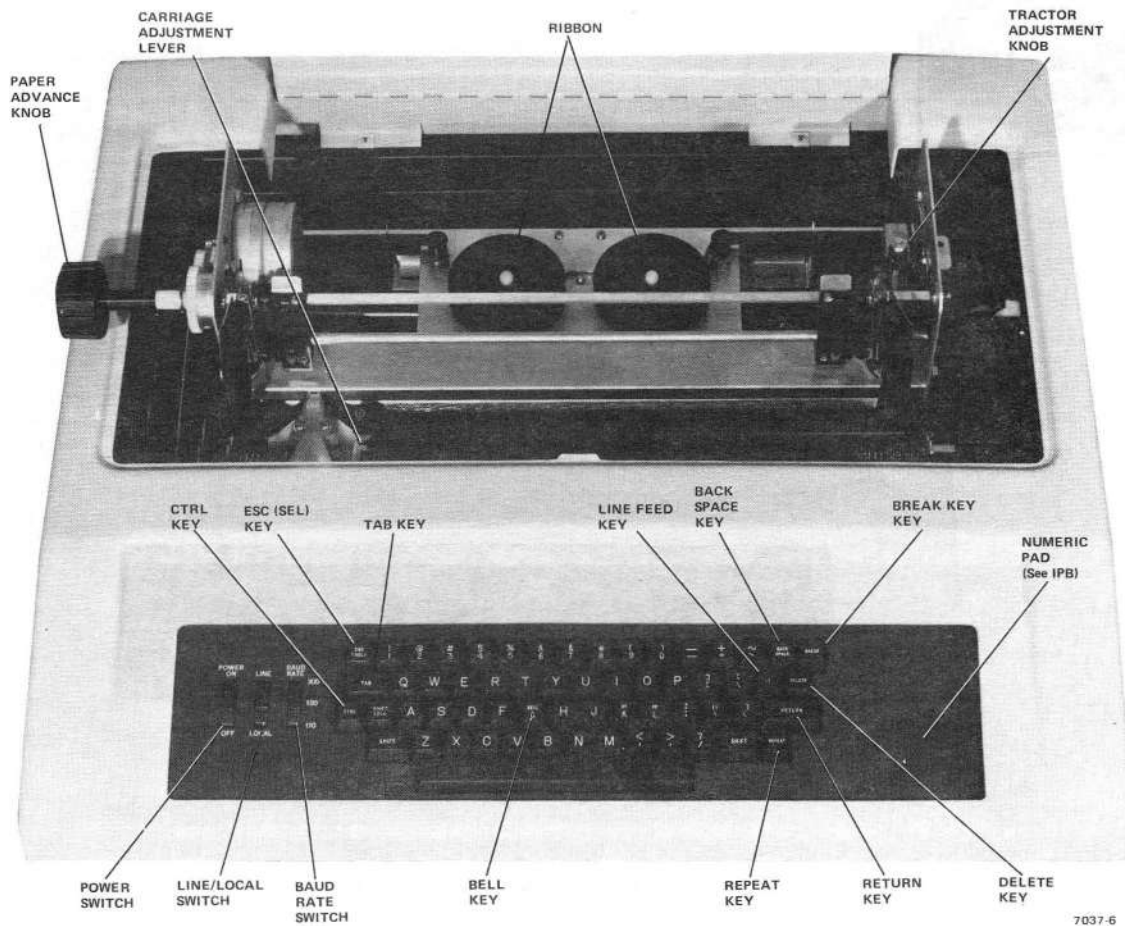


Figure 3-1 Operator Controls

3.2 OPERATING PROCEDURES

3.2.1 Loading Paper

1. Set POWER switch to OFF.
2. Move the Carriage Adjustment Lever (Figure 3-2) toward the keyboard as far as possible; this creates space for inserting paper.
3. Place tractor-feed paper on the floor between the legs of the LA36. (The term tractor-feed refers to the holes on either side of the paper.)
4. Open both tractor covers (Figure 3-4) so that the tractor pins are exposed. Insert the left side of the paper with the holes aligned directly over the tractor pins. Close the left side tractor cover.
5. Feed the paper through the load channel under the terminal. Draw the paper up as it passes between the print head and the print bar (Figure 3-3).

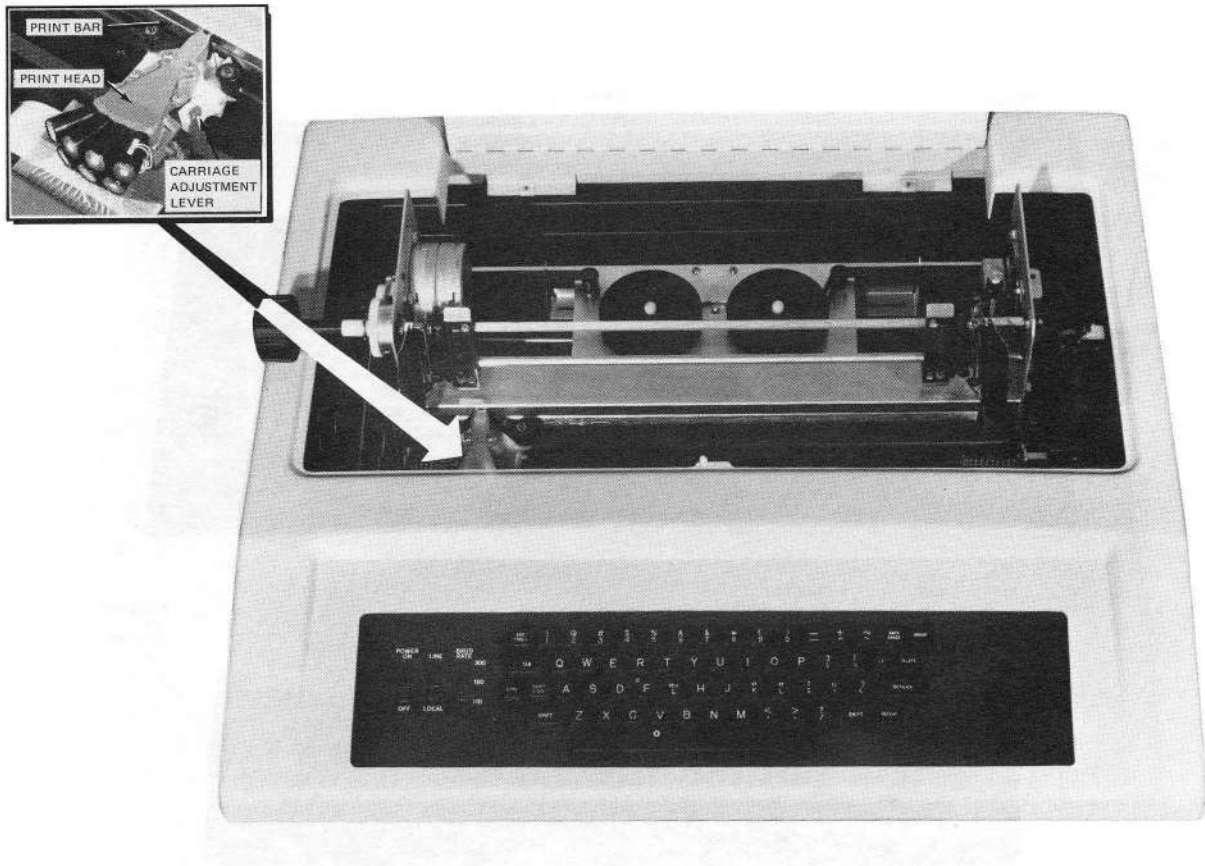


Figure 3-2 Carriage Adjustment Lever

6. Loosen the Tractor Adjustment Knob (Figure 3-4) on the right tractor (about 1/4 turn). The tractor will now slide freely to the left or right. Slide the tractor to a position where the holes on the right margin align directly over the tractor pins. Tighten the tractor adjustment knob and close the cover.

NOTE

In order to ensure proper paper feeding, do not tension paper too tightly. If tension is excessive, the following problems may occur:

1. Paper holes will be distorted.
 2. Paper may become dislodged from tractor.
 3. Spacing between lines may become uneven.
7. Adjust the carriage adjustment lever so that the print head is near, but not exerting pressure on the paper. There should be no friction between the paper and the print head as either moves.

The right side of the carriage is numbered 1–7; positions 1–6 correspond (approximately) to 1–6 part forms.



7037-3

Figure 3-3 Paper Loading

To check for proper print head alignment:

- a. Manually turn the Paper Advance Control counterclockwise. If the print head is set too close, the paper will be smudged as it moves up past the print head.
- b. Set the POWER switch to ON; set the LINE/LOCAL switch to LOCAL. Type a short line of text. If the print head is too far from the paper, the characters will not print or they will not have uniform dot density.

CAUTION

Failure to properly adjust the print head gap can reduce the life of the head.

The Paper Advance Knob (Figure 3-5) can be pushed in to position the paper such that the text is printed directly above the horizontal lines. Type a short line of text to check paper positioning.

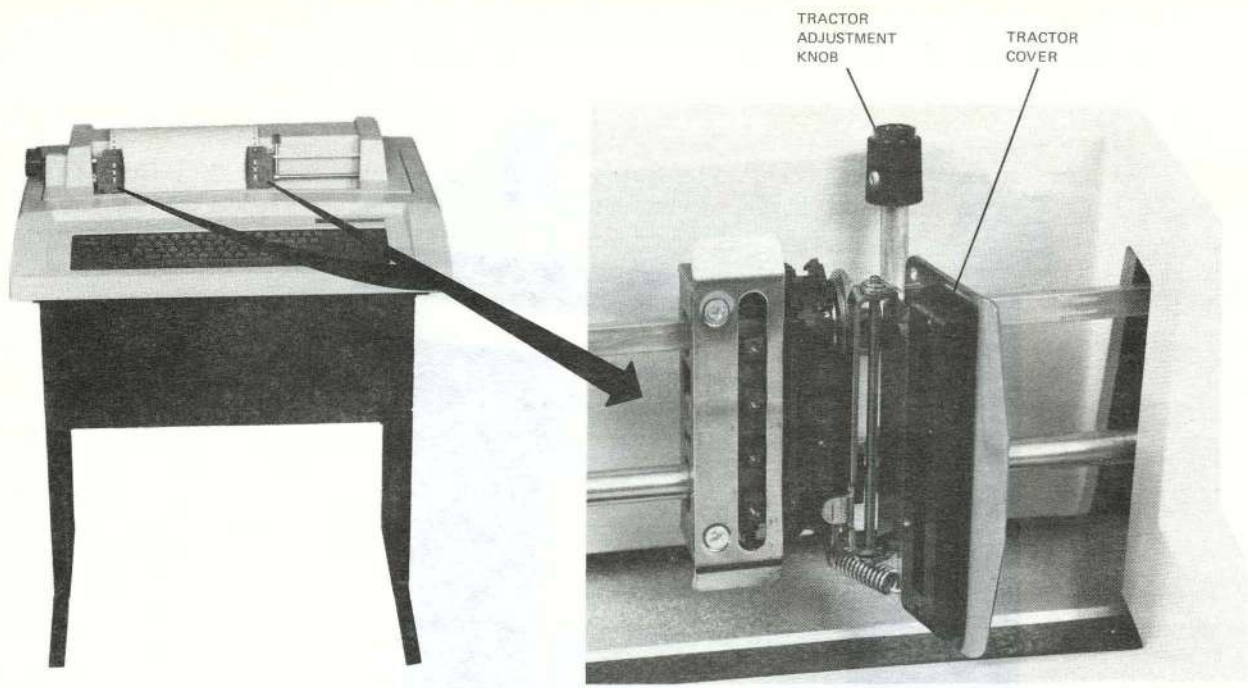


Figure 3-4 Tractor Adjustment Knob

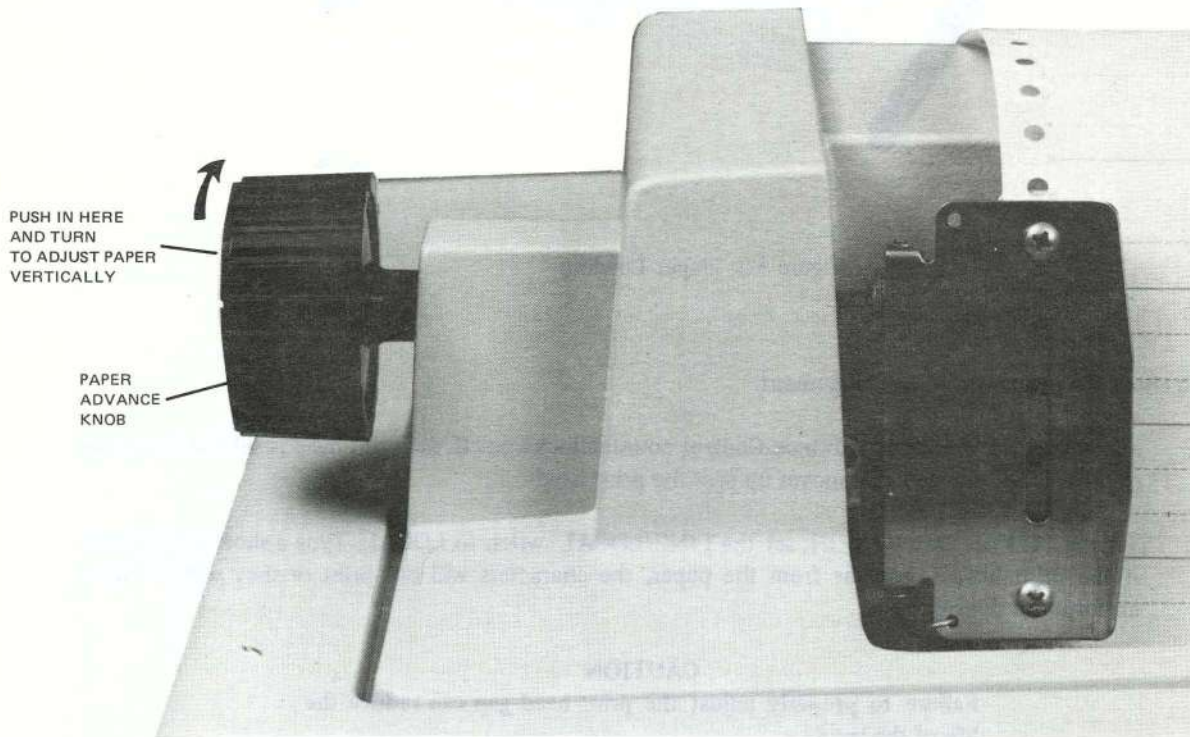


Figure 3-5 Paper Advance Knob

3.2.2 Changing Ribbon

The printer ribbon should last for 8 to 12 hours of actual printing at 30 characters/second or about one million characters. After 12 hours, or if the printout density becomes too light, remove both ribbon spools from their drive spindles and turn the whole assembly over so that the previous lower edge of the ribbon is now on top. After rethreading the ribbon, another 4 hours (approx.) of printing time is possible before the ink is completely used up. At that time, the ribbon must be replaced by removing both spools and unthreading the ribbon. Replace with a new spool and ribbon assembly (#36-10558) and an empty spool. (One of the old spools may be used if desired.)

1. Set POWER switch to OFF.
2. Raise the top cover.
3. Move the Carriage Adjustment Lever (Figure 3-2) toward the keyboard. This moves the print head away from the paper to create enough space to remove the ribbon.
4. Lift the ribbon (Figure 3-6) off the print head and unwind it from the idler spools.
5. Lift the two ribbon reels from their hubs.
6. Place the full reel of new ribbon on the left hub and play out enough ribbon to feed through the slot, around the idler spools, and in front of the print head.

Wind the ribbon around the outside of the right-hand idler spools and through the right-hand slot in the Ribbon Direction Changing Guide.

NOTE

Use only Digital recommended ribbons (part No. 36-10558); use of other than Digital recommended ribbons can cause damage and void machine warranty.

Ensure that the rivet is on the ribbon spool side of the Ribbon Direction Changing Guide.

The ribbon direction guides control the direction of ribbon movement. When the ribbon on the left reel is nearly played out, the rivet is drawn into contact with the direction changing guide. Since the rivet cannot pass through the guide, it moves the guide away from the reel, automatically changing the direction of ribbon flow. If the rivet is on the print head side of the guide, it will:

- a. Not act to change ribbon direction
 - b. Move around the idlers, stall the machine and blow the 2 A Slo Blo servo fuse.
7. Take up any slack in the ribbon by turning the takeup reel clockwise.
 8. Return the carriage adjustment lever to its original position.

CAUTION

Head life may be reduced if carriage lever is not properly adjusted.

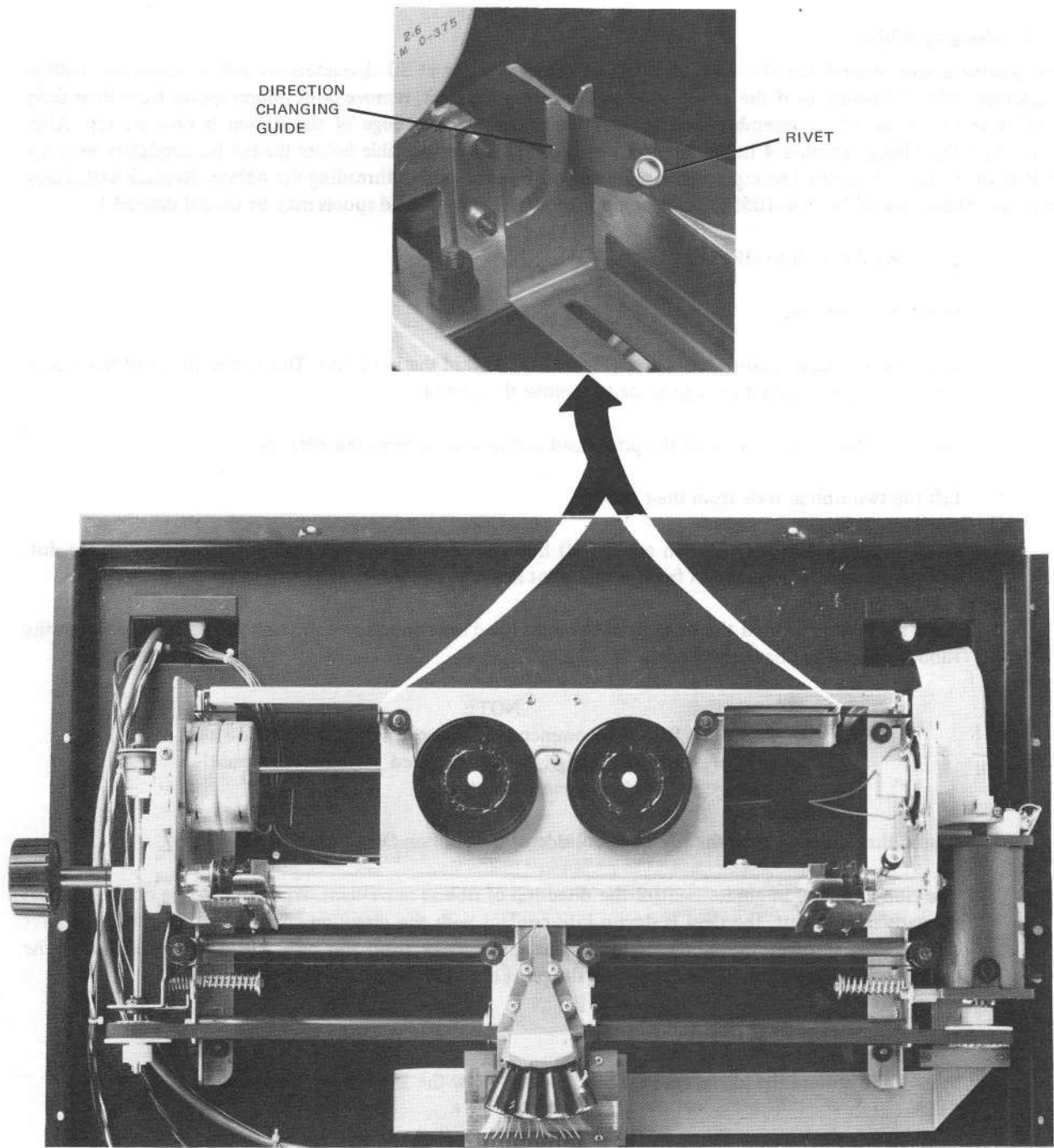


Figure 3-6 Ribbon Direction Changing Guide

3.2.3 Troubleshooting

Operator-related troubleshooting information is listed in Table 3-2.

**Table 3-2
Operator Troubleshooting**

Symptom	Possible Cause and Corrective Action
LA36 does not turn on when POWER switch is set to ON	<ul style="list-style-type: none"> ● AC power cord is not plugged into wall outlet – plug it in.
Print head does not print characters	<ul style="list-style-type: none"> ● Current is not coming from wall outlet – check outlet with a known working electrical device (such as a lamp). ● Interface cord might be loose and thus a contact may not be made – “jiggle” the cord slightly. ● Print head may be set too far from paper – adjust the carriage adjustment lever as directed in Table 3-1.
Light print	<ul style="list-style-type: none"> ● Print head may be set too far from paper – adjust the carriage adjustment lever as directed in Table 3-1. ● Ribbon ink has run out – replace ribbon. <p>Change ribbon every 8–12 hours of continuous printing.</p>
Paper does not advance	<ul style="list-style-type: none"> ● Improper loading of paper – check tractor covers to ensure that they are closed. ● Holes in paper are torn – turn LA36 OFF and reload paper properly. ● Paper snagged or caught by box.
Paper tearing on multi-part forms	<ul style="list-style-type: none"> ● Print head is exerting pressure on paper so that paper tears when it advances – check carriage adjustment control lever position. ● Tension exerted on the paper by the tractors is incorrect. Adjust by changing horizontal position of right hand tractor.
Line bunching	<ul style="list-style-type: none"> ● Tension exerted on the paper by the tractors is excessive. Adjust by changing horizontal position of right hand tractor.
No keyboard or printer response	<ul style="list-style-type: none"> ● LINE/LOCAL switch set to wrong position.

3.3 CAUTIONS

Keep the cover closed at all times except when changing the ribbon.

Use only a lint-free cloth when cleaning the cover and the keyboard. Do not use solvents or harsh cleaning agents to clean the LA36. If excessively dirty, a mild detergent solution or desk top cleaner may be used sparingly.

Do not use any LA36 surface area to hold pencils, paper clips, staples, etc. If an object accidentally falls into the machine, turn the POWER switch to OFF, unplug the power cord from the wall outlet, and carefully remove the object.

Tear paper only along perforations. Support paper on the LA36 cover when tearing to avoid distorting the tractor-feed holes in the paper still in the machine.

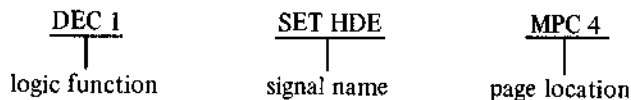
CHAPTER 4

THEORY

This chapter contains microprogram information, timing, detailed control logic theory, and mechanical theory for the LA36. The program description is divided into two parts. The first part (Section 4.1) is a general description supported by a flow diagram. The second part (Sections 4.1.1 through 4.1.11) is a series of detailed descriptions of the routines supported by detailed flow diagrams. A detailed description of the Scratch Pad Memory is presented before the routine descriptions.

The control logic theory is also divided into two parts. The first part (Section 4.3) is a functional system description supported by a block diagram. The second part (Sections 4.4 through 4.13) is a series of detailed descriptions of the functional systems supported by block diagrams and detailed logic diagrams. Mechanical theory of operation is presented in Section 4.14. The mechanical descriptions are supported by simplified diagrams. The logic functions and signal names that are used in these diagrams and descriptions are cross referenced to improve usability.

For example, DEC 1 (Decoder 1) is a logic function that appears on a block diagram. The location of this function in both the simplified and detailed logic diagrams is identified by the notation, MPC4 (Microprogrammed Controller, page 4). Signal names, SET HDE for example, are cross referenced in the same manner, using the signal source for reference. Thus, a complete cross reference is:



Signal abbreviations are explained in Appendix A, Table A-2. This table also lists signal source and destination information. A complete set of logic diagrams is provided in Chapter 7.

4.1 PROGRAM DESCRIPTION

The microprogram consists of several instruction sequences connected by major decision nodes as shown in Figure 4-1.

The first sequence is the Initialize (INIT) routine. This routine initializes all the control RAM locations and moves the print head to the left margin. The next sequence is the Position (POSIT) routine. Requests for print head position changes (such as for print or carriage return) are processed. All position information is in units of character cells and is stored in locations of the control RAM (Random Access Memory). In addition, indications of print head position change are processed. (CARRY is equal to one column reverse.) The SERVO routine interacts with the POSIT and SPEED routines to correct position error. In the SPEED routine, a SPEED is commanded to the Carriage Servo System based on the difference between actual and desired print head positions. Possible speeds include 3 in./sec for normal printing, 6 in./sec for catch-up mode, 50 in./sec for carriage return, slower speeds for carriage return slowdown, and 0 in./sec for idle.

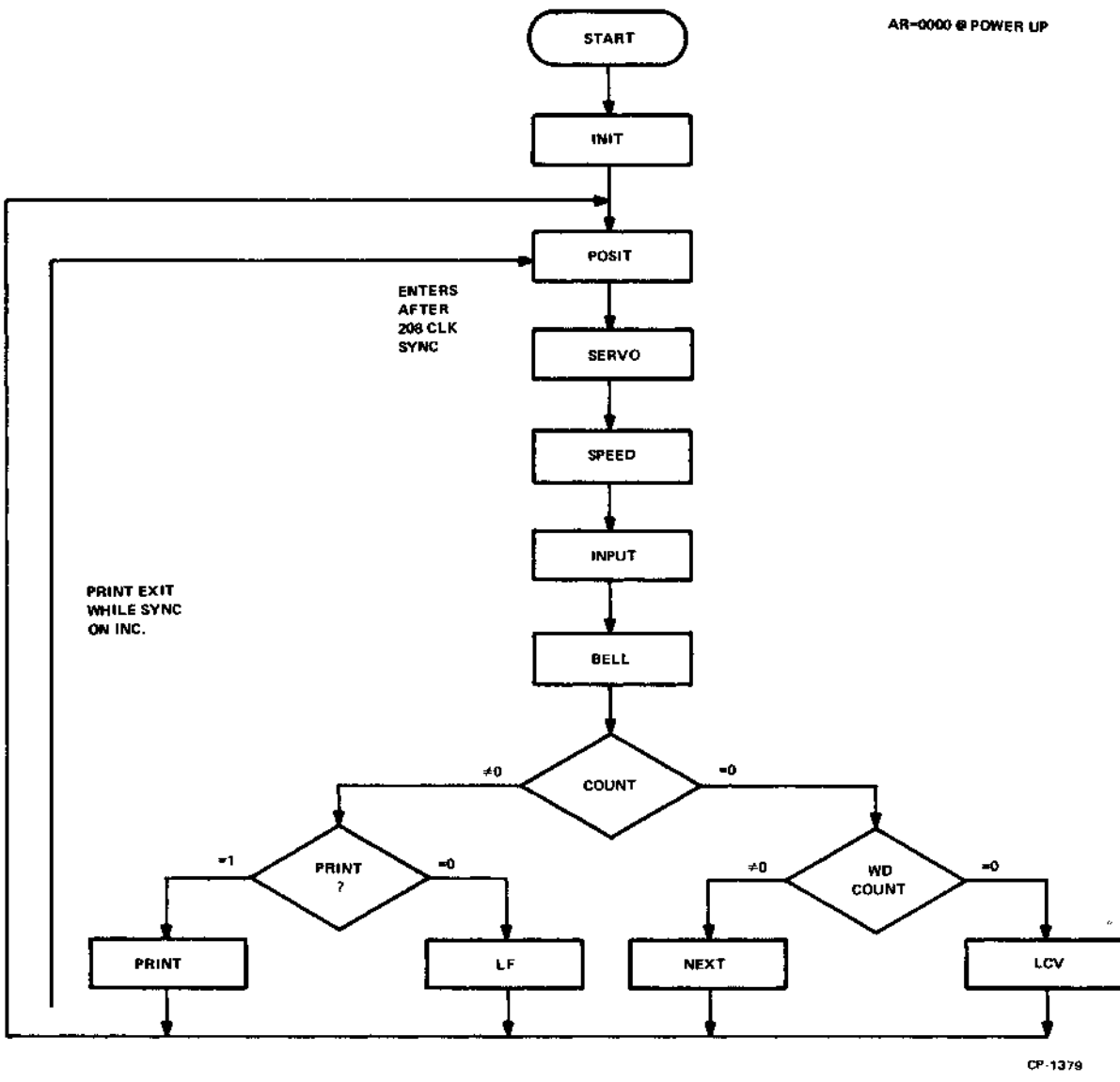


Figure 4-1 Microprogram Flow Diagram

The INPUT routine operates the Character Buffer Address register as a First-In/First-Out (FIFO) memory. It uses three locations of the control RAM as read address, write address, and word count.

The BELL routine activates the Bell System and times the duration of the audible tone bursts.

The PRINT routine requests print head motion and activates the print head solenoids to form the 7 × 7 dot matrix characters. The LINE FEED routine times the four steps and the settling time for the Line Feed Stepper System.

The Last Character Visibility (LCV) routine is entered when no character is being processed. It times the head step-over delay and requests print head motion.

The NEXT routine is the mate to the INPUT routine. It processes characters out of the FIFO memory and sets up the conditions in the control RAM which will cause their execution.

If the character to be processed is printable, the PRINT routine is activated. If necessary, a recovery from the LCV position is requested. If the column is 64 and the keyboard has been active on this line, the end-of-line warning is sounded.

If the character is carriage return, the desired print head position change is entered in the control RAM. The POSIT and SPEED routines complete the execution of carriage return. Backspace is processed in a similar manner.

If the character is line feed, then the Line Feed Step Timing sequence is initiated.

If a bell character is received, the BELL routine is notified. Up to eight sequential bell characters can be processed and will sound as separate tone bursts.

All other characters cause no action. If 132 characters have been printed on the current line, normally printable characters also cause no action. Thus, overprinting does not occur.

4.1.1 Scratch Pad Memory

The variables that are monitored by the microprogram are stored in the control RAM (Random Access Memory), which is used as a Scratch Pad Memory. Memory locations are utilized as listed in Table 4-1.

The control RAM provides space for 16 words to keep track of various operational conditions within the LA36 during its operating cycle. Each memory location in this control RAM is 4 bits wide. Some locations are dedicated exclusively to a specific function and other locations are shared. The *dedicated* locations are used for those functions that need to be monitored at all times; the *shared* locations are used for variables that are applicable only during certain times in the operating cycle of the machine; e.g., at one portion of the sequence it is important to keep track of position error but in other portions it is important to time a line feed, print, or Initialize function; but because these functions are mutually exclusive in time, they can share the same set of bit positions in the control RAM. Note that these various functions do not use exclusive bits in a particular location but rather use all four bits of that location at different times. An exception is location 12 in which the variable "Print" is continuously stored in the least significant bit position of that word while timers for LCV, Line Feed, Print, and Initialize are alternately stored in the upper three bits. When timing, these bits are incremented each time by 2 instead of 1 to preserve the proper state of the LSB which is (1) for Print and (0) for Line Feed.

Locations 0, 1, and 2 of the control RAM are used to monitor carriage position within each printable line and are, at all times, an indication of where the head (or carriage) is *actually* located. Locations 3 and 4 provide a total of 8 bits that indicate the column in which the last character was printed (or, in a sense, where the carriage *should be* located).

**Table 4-1
Scratch Pad Allocations**

Octal Location	Mnemonic	Usage
0	POS LO	12-Bit Carriage Position (Relative to column)
1	POS MD	
2	POS HI	
3	COL LO	8-Bit Column Count (Records columns printed)
4	COL HI	
5	RD ADR LCV 1	Character Buffer Read Address LCV Timer
6	WT ADR LCV 1	Character Buffer Write Address To Keep WT ADR=RD ADR
7	WD CNT	Character Buffer Character Count
10		Unused
11	COUNT	Print Dot Count, LF Pulse Count
12	PRINT LCV 2 LF 1 PT 1 INIT 1	LSB=1 for Print LCV Timer Line Feed Timer Print Timer Init Timer
13	POS ER LF 2 PT 2 INIT 2	Position Error Line Feed Timer Print Timer Init Timer
14	LCV ST LCV 3	LCV Status LCV Timer
15	BELL 1	Bell Timer
16	BELL 2	Bell Timer
17	BELL ST	Bell Count (Status)

Positions 5, 6, and 7 are used to control the operation of the character buffer (FIFO). These are Read Address, Write Address and Word (Character) Count. When the Word Count (WC) is equal to 0 (Buffer Empty) it does not matter what the Read or the Write addresses are if they are equal to each other. This ensures that upon receipt of the next character, these addresses will continue to track each other.

The Read and Write addresses in positions 5 and 6 share those positions with one of the LCV timers for timing out the 1.3-second head step-over function for LCV. This is feasible because LCV will occur only when WC is equal to 0; while the Read and Write addresses are equal these positions are available for timing that function. Upon receipt of the next character from the UART, the Write address and WC are incremented. When that character is read out of the buffer, the Read address is incremented, creating an equal condition again between locations 5 and 6.

Location 11 is used in combination with location 12 as a counting location for either the dot print or line feed functions. As previously stated, the LSB of location 12 is set during dot printing and cleared during line feeding. These states are maintained by incrementing the timer bits in location 12 by 2 each time instead of by 1. When the Count in location 11 is zero, the printer is neither printing nor line feeding and location 12 can be used as an LCV timer. Location 12 is also used as a timer during Initialize.

Location 13 is used as a position error count for use by those routines that alter the position of the carriage by anything less than 8 columns in either direction. These routines are Print, which alters the position by 1 to print the next character and LCV, which changes the position by +4 on an interruption of printing and by -4 on a resumption of printing.

Backspace, which is not represented on such in a scratch pad location, is implemented by manipulation of position error in location 13. When that location is decremented by 1, the Position Count in locations 0, 1, and 2 are used in the SPEED routine to command the head to move back one column.

Location 14 contains LCV Status and LCV Timer information. Although LCV Status is required only when WC=0, it must be preloaded to a value (12_8), which when counted up to zero, will consume 1.3 seconds (the time delay required before the head is moved to the right 4 columns for LCV). This preloaded value becomes the most significant part of the LCV timer.

Locations 15, 16, and 17 are used to control the bell. To sound the bell, a 2.4 kHz clock from the logic is gated to the loudspeaker with a flip-flop that is, in turn, controlled by the microprogram. In this way, the microprogram determines both the length of the bell tone and time between bell tones.

Bell tone ON/OFF time is set at 106 ms. This is timed in locations 15 and 16. Location 17 is a Bell Count or status position, allowing up to 8 bell tones to be executed continuously. By using this scheme, successive bell codes can be sensed and accumulated at a rate of 30 per second without the necessity of intervening fill characters, and then applied to the speaker at a rate of about 5 tones per second. A graphic demonstration of this is seen when it is realized that the 9th bell code would be received before the first bell tone had ceased.

4.1.2 Initialization Routine (INIT)

The LA36 power up circuit holds the Address Register (AR) at zero and inhibits the system clock until dc power is up (within 300 to 700 ms). At the end of this period, the AR is left at zero and the first instruction is executed. This instruction tests the INIT and if set, causes the program to enter the INIT routine (Figure 4-2).

This routine clears all flags, clears the control RAM, clears the function enable latches, and sets a low negative velocity for the carriage. When the carriage finds the left travel limit, the left-hand margin position is set to zero, INIT is cleared, and the program progresses to the POSIT routine. This routine is never reentered except in the event of a power down.

4.1.3 Position Routine (POSIT)

The POSIT routine (Figure 4-3) is very closely interrelated with the SPEED routine. As described in the discussion of the scratch pad allocations, the first three locations are a constant indication of *actual* carriage position, and the next two locations are a constant indication of the *desired* carriage position. Every time the carriage is moved for any purpose, the first three locations are changed accordingly, and every time the printer is caused to print a character, the next two locations are modified. When these two counts are equal, no carriage motion occurs, but when they are unequal, a position error is generated and an appropriate SPEED command is issued to constantly keep these two sets of locations equal to each other. Because of this, some motion of the printer can be caused by the program simply by altering these variables in the control RAM location dedicated to that particular monitoring function.

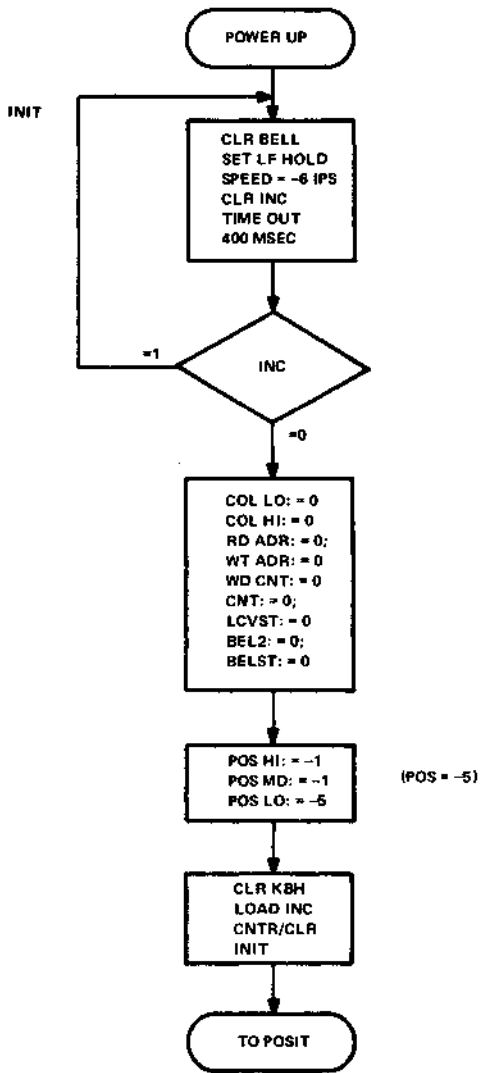


Figure 4-2 Initialize Routine

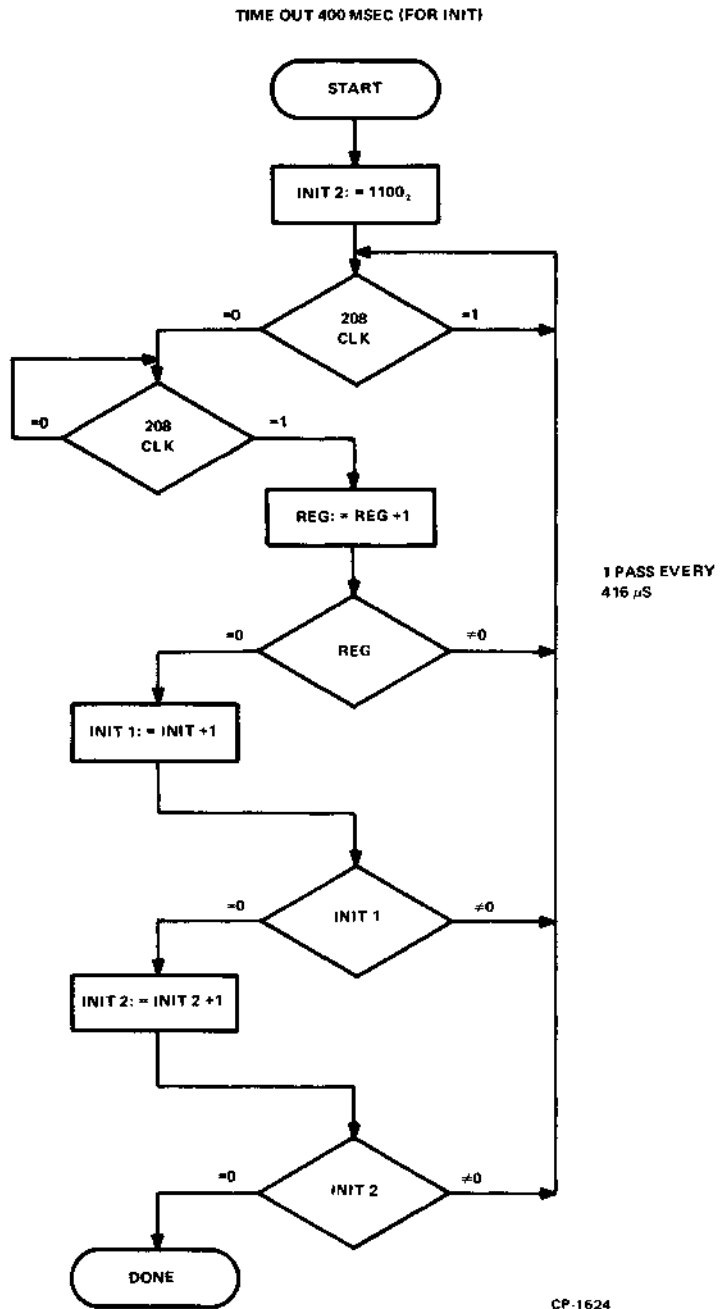


Figure 4-2a Start Routine for Initialize

CP-1624

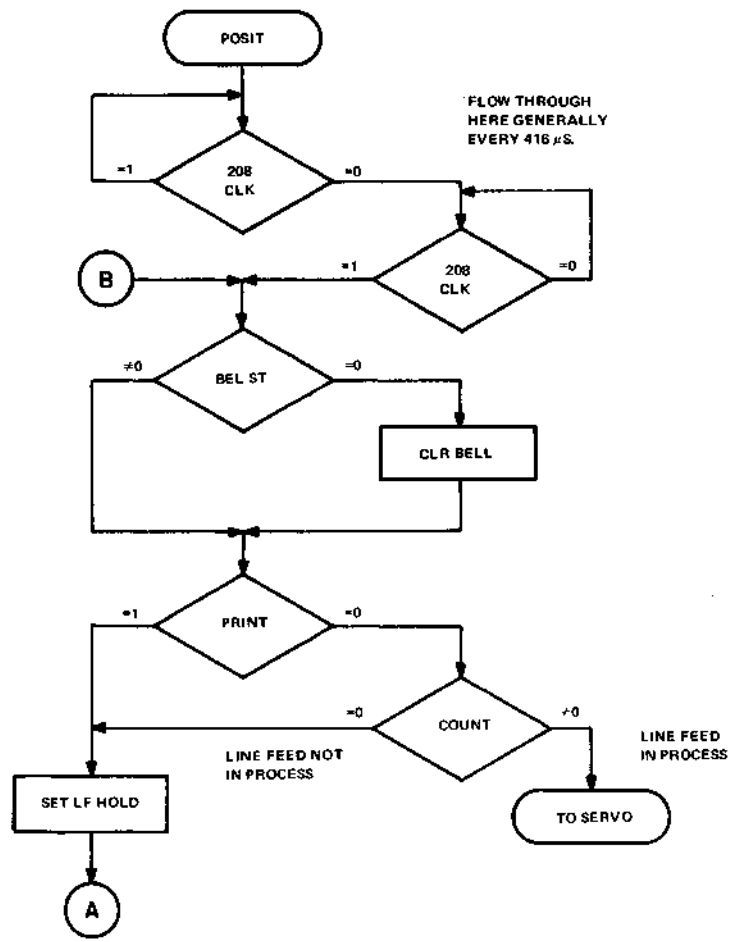
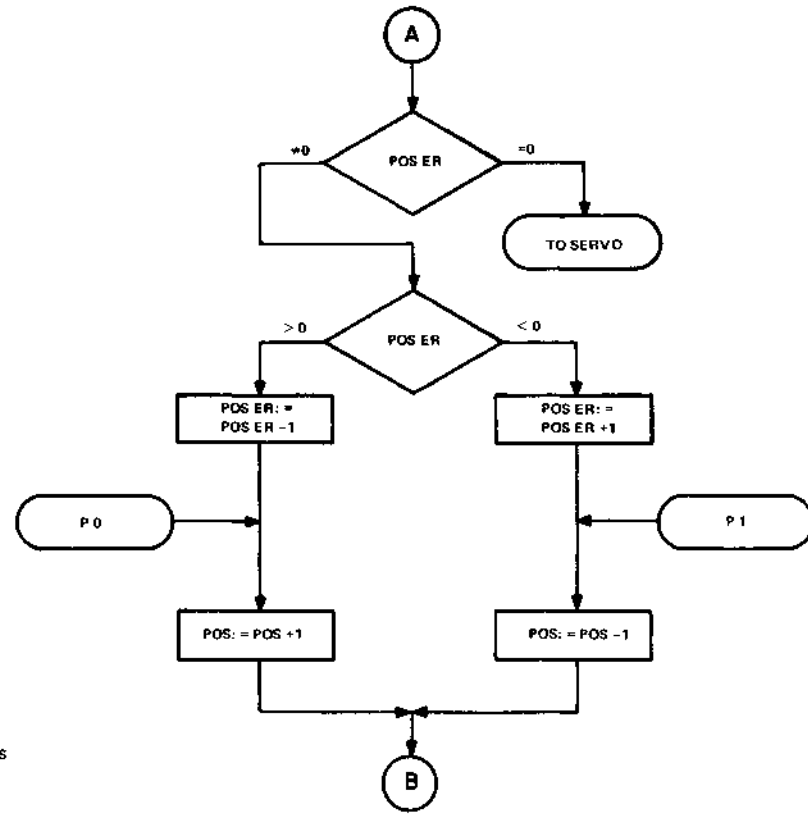


Figure 4-3 Position Routine



CP-1625

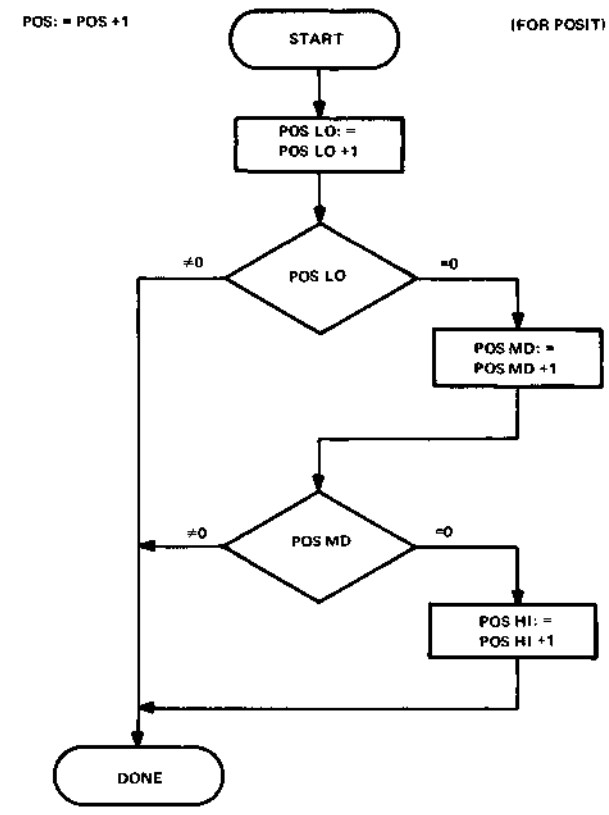
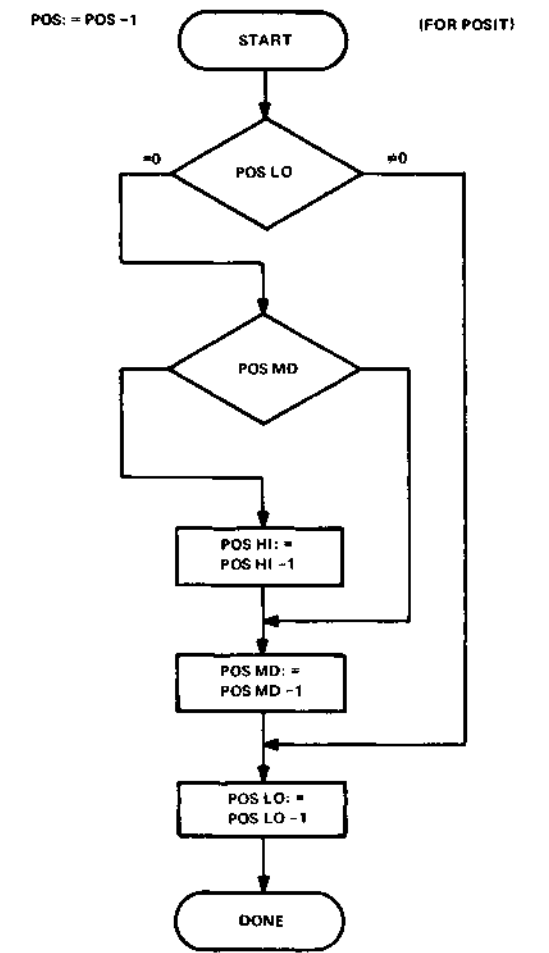


Figure 4-3a Start Routine for Position



CP-1626

The operations that alter these position variables as a result of carriage motion are Carriage Return (CR), LCV, and Print. The function that causes carriage motion as a result of altering the variables is *Backspace*, *Line Feed* and *Bell* do not affect the position of the carriage.

When a CR is received and processed, the program sets the Column Count to zero, thereby causing the SPEED routine to issue a suitable negative SPEED command that causes the carriage to return to the zero column position.

In LCV, if a timeout has completed following receipt of the last character, -4 is put in position error, while true column position is preserved, thereby causing the SPEED routine to command the head to move four columns to the right. In *Backspace* however, one is subtracted from the true *column* position so that the validity of the column variable is preserved.

The POSIT routine, on the 208 μ s clock, checks Bell Status and, if zero, clears the bell and checks Print. If Print is not zero, it checks the Print Bit and if it is a one, indicating no LF in progress, sets LF HOLD and proceeds. If LF is indicated by the Print Bit being 0, the count is checked to see if it has completed that line feed, and if it has not (non-zero count) it proceeds to the SERVO routine to continue that operation. If count is zero, then the line feed is complete and it sets LF HOLD before proceeding with the POSIT routine.

At this point the program checks the position error variable and, if it is zero, proceeds to the SERVO routine. If an error exists (non-zero), it checks the degree of error and its direction (positive or negative) on a triple-precision basis, and corrects the error by incrementing or decrementing the position variable until no carries or borrows are sensed.

This is the only time that any SPEED commands are issued to the Carriage Servo System. All SPEED commands are a function of POSIT, WC, and Print as determined in the SPEED algorithm; and all processing of carriage position is done by the POSIT routine, whether the printer is doing a carriage return, printing, or just correcting position randomly.

4.1.4 SERVO Routine

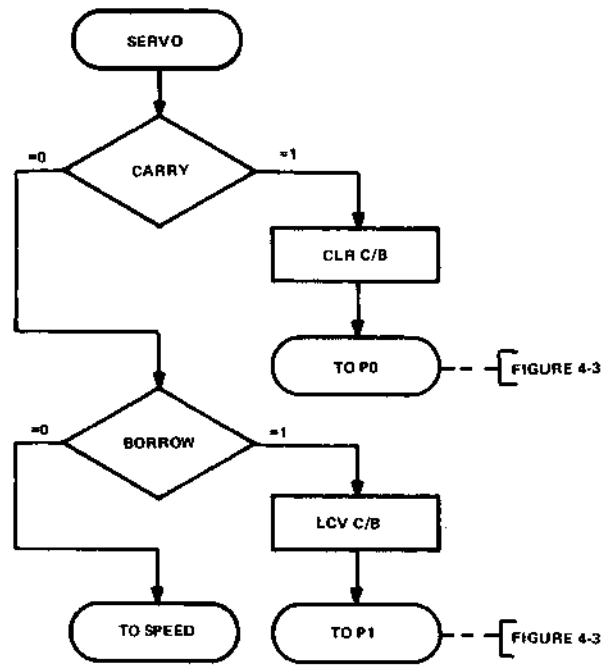
The SERVO routine (Figure 4-4) interacts with the POSIT and SPEED routines. In this routine, the carries and borrows that are generated as the head moves through character cell boundaries are checked and cleared until the position error is corrected. Each time a carry or borrow is sensed, it is cleared and the program returns to the appropriate node in the POSIT routine. Finally, when no carries or borrows are sensed, the program proceeds to the SPEED routine.

4.1.5 SPEED Routine

The SPEED routine (Figure 4-5) checks the position variable in the first three locations in the control RAM on a triple-precision basis, and considers Word Count in location 7, the Print Dot Count in location 10, and the state of the Print Bit. The SPEED algorithm is represented statistically in Table 4-2.

The first pass through the program is implemented for situations in which either the returning carriage has overshot its mark or the carriage has been accidentally moved left while the printer was static in an LCV state. The program checks position relative to Column Count and finds it less than zero. At this point the program checks Word Count and if it finds it zero (no characters to be processed) it causes the SPEED routine to command a speed of +3 ips (+ speed = print motion; - speed = return motion). If there *are* characters to be processed (WC not equal to 0), it commands a speed of +6 ips to clear the buffer, providing ample time to be ready to print the next character.

If in checking the high order position bits for zero, the program finds them *not* equal to 0, the actual carriage position is indicated to be positive (to the right) and greater than 16 columns from where it should be. This results in the maximum SPEED command of -50 ips being issued.

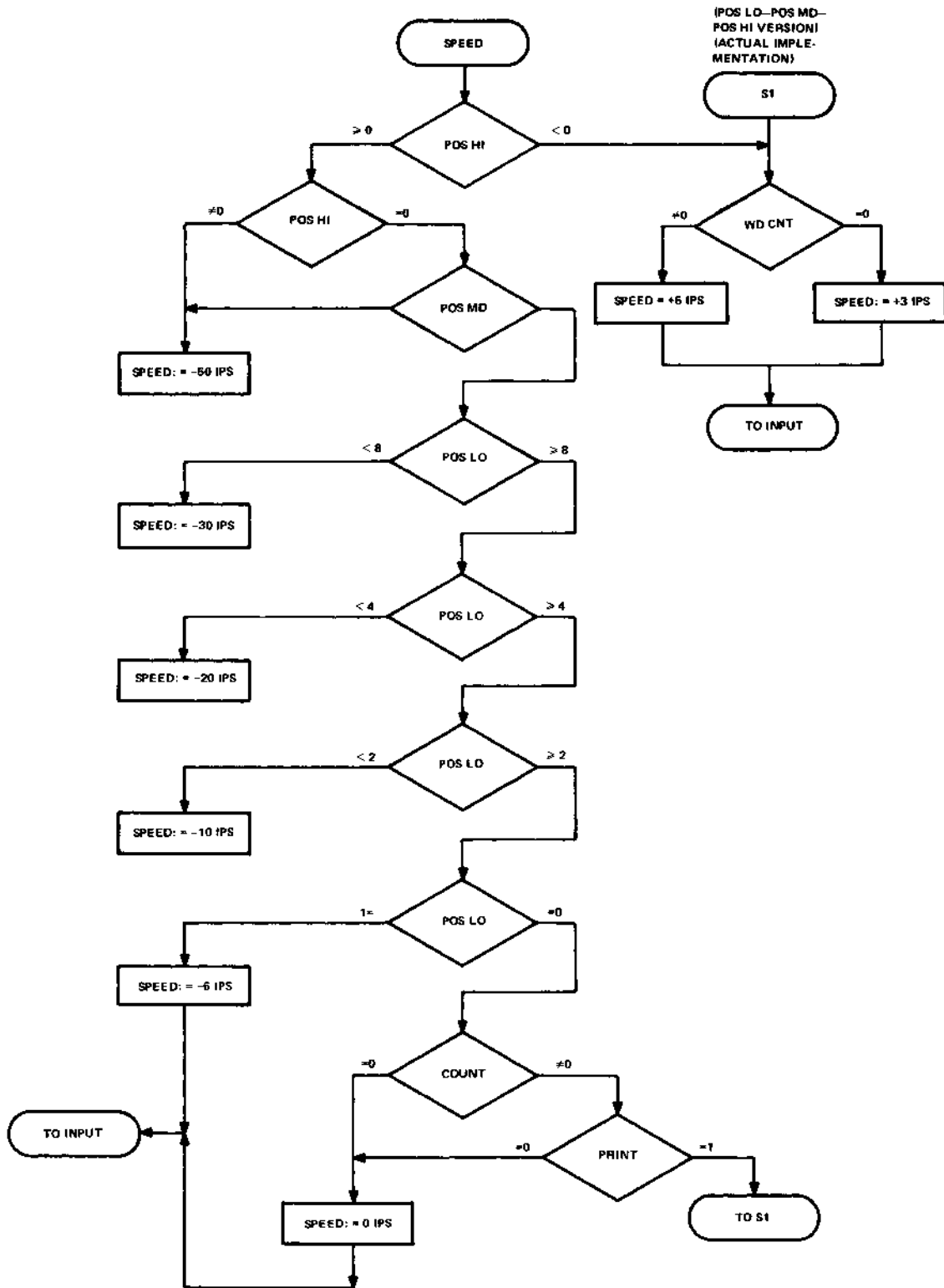


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Figure 4-4 Servo Routine

Table 4-2
SPEED Algorithm

Count = 0 Print = 1	WD CT	Position	Speed (ips) + = Print - = Return Motion
		≥ 16	-50
		≥ 8	-30
		≥ 4	-20
		≥ 2	-10
		= 1	-6
= 0		= 0	0
= 1	= 0	= 0	+3
= 1	= 1	= 0	+6
	= 0	< 0	+3
	= 1	< 0	+6



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Figure 4-5 Speed Routine

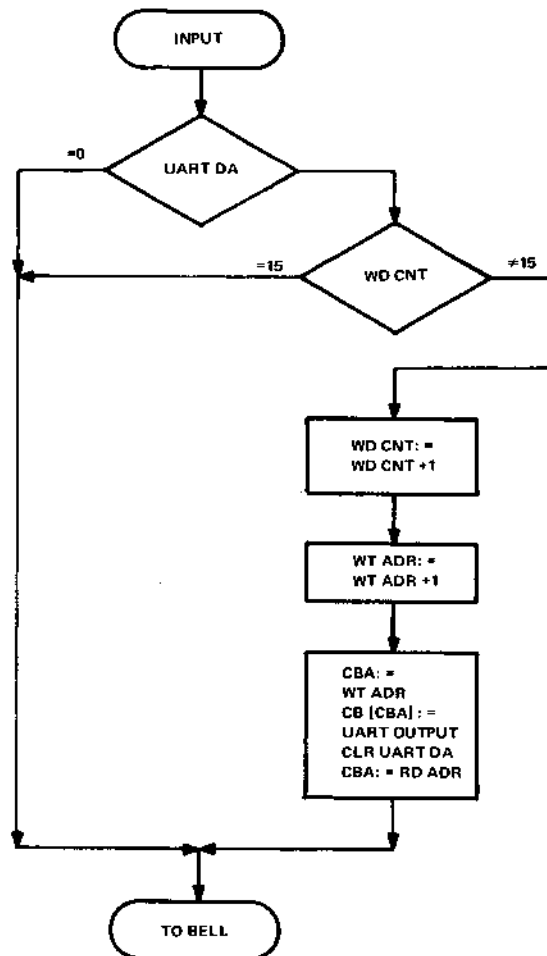
As the carriage begins to move in response to this command, the program loops through its sequence checking the middle four, and then the low four bits of POSIT; and, as each condition is satisfied, the SPEED commands are diminished to cause the head to slow down smoothly until it has reached the correct position. At this point, carriage motion stops and the program enters the INPUT routine if the Count is zero. If it is not zero, the Print Bit is checked and if it is cleared, a LF is indicated and a speed of 0 ips is commanded to complete the LF function. If the Print Bit is set however, WC is checked to see if a positive speed of either +3 or +6 is required to print the current character without losing the next character.

4.1.6 INPUT Routine

The INPUT routine (Figure 4-6) checks UART Data Available (DA) and if cleared (no character) it steps immediately to the BELL routine. If DA is set, the program checks Word Count (WD CT) to see if the Character Buffer is full (WD CT=15). If so, it ignores any input from DA, using the UART as the 16th memory location, and proceeds immediately to service the bell. If not full, it increments the Word Count, increments the Write Address, and performs the output operation (clearing the DA bit and setting the Read Address).

NOTE

The UART can act as the 16th memory location for up to 33 ms even though data is available. After this period the character will be lost when the UART writes in another character.



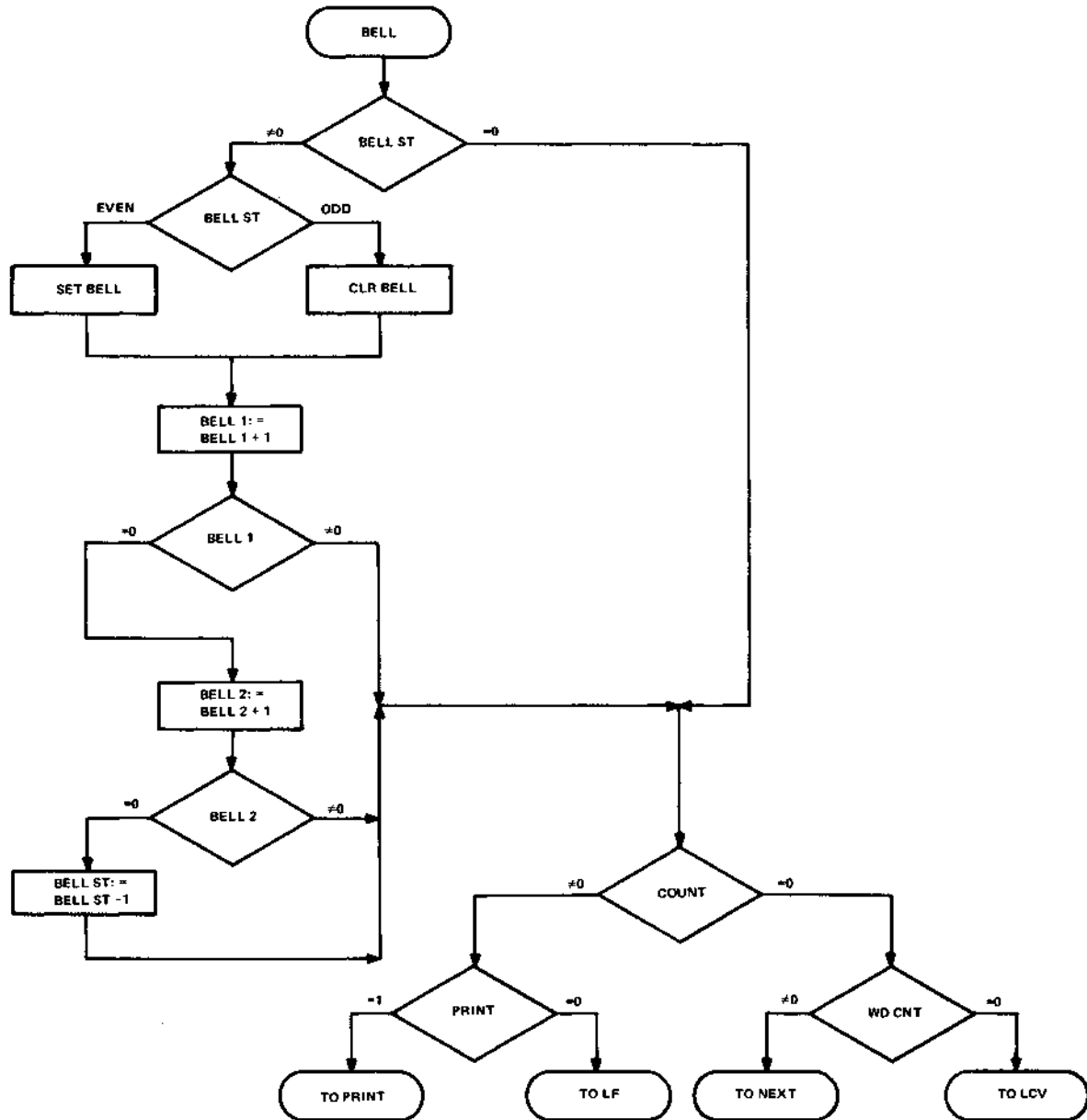
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Figure 4-6 Input Routine

If WD CNT is not equal to 15, Word Count is incremented, Write Address is incremented, the character is put into the buffer at the new Write Address, and UART DA is cleared as the program proceeds to the BELL routine.

4.1.7 BELL Routine

The BELL routine (Figure 4-7) turns the bell on for 106 ms and off for 106 ms, for each bell that is received and stored in the Bell Status location in the control RAM.



CP-1630

Figure 4-7 Bell Routine

If Bell Status is zero, no bells are required and the routine falls through to check Count, Print, and Word Count. Here the decision is made to process either a Print, a LF, or the next character, or to execute an LCV.

If Bell Status is not zero, the status is checked to see if it is odd or even (for each bell code received, two counts are stored in status, one to turn it on and one to turn it off).

The bell timers in location 15 and 16 provide 4-bits of each Count. The bits in either location 15 or location 16 are incremented during each pass until that timer has reached zero (106 ms) and Bell Status either becomes odd and the bell is turned off, or even and the bell is turned on. Each pass through the loop takes 416 μ s and it takes 256 passes to fully cycle each timer, providing 106 ms of on time and 106 ms of off time. Each time a timer reaches zero, one is subtracted from Bell Status until the total number of bells commanded have been executed.

4.1.8 PRINT Routine

Before entering the PRINT routine (Figure 4-8), the program sequenced through the BELL routine where it found that the Count location was not zero and that the Print Bit in location 12 was set, indicating that a printable character was in the buffer. These conditions caused the program to enter the PRINT routine.

Upon entering the PRINT routine, the program checks the position locations to be sure that they are all equal to zero. This is done to prevent the start of print at some position other than the beginning of the character cell.

The program checks position from low order through high order in 4-bit bytes, and if any are non-zero, it checks Count and returns to the POSIT routine, looping until Count is less than the seven dot positions of a character. At this point it sets Count to zero, loops once more through POSIT and returns to PRINT.

In this pass, the program drops through to check Count again. This time Count should equal 8 as set in the NEXT routine. The program verifies this by checking the MSB of location 11 in the control RAM. If this bit is set, it signals the start of print (meaning that the head should start moving to the right). To start this motion, the program subtracts one from Position Error, sets Count to 7 (to prevent a repeat of this branch), and returns to POSIT to loop through again so that the SPEED routine can command head motion.

This time through, POSIT is still 0 relative to column, Count is less than 8 (7); the program presets the Print Timers, and clears the Increment indication. It waits then for Increment to set, and when it does it sets the 600 μ s Head Drive Enable (HDE).

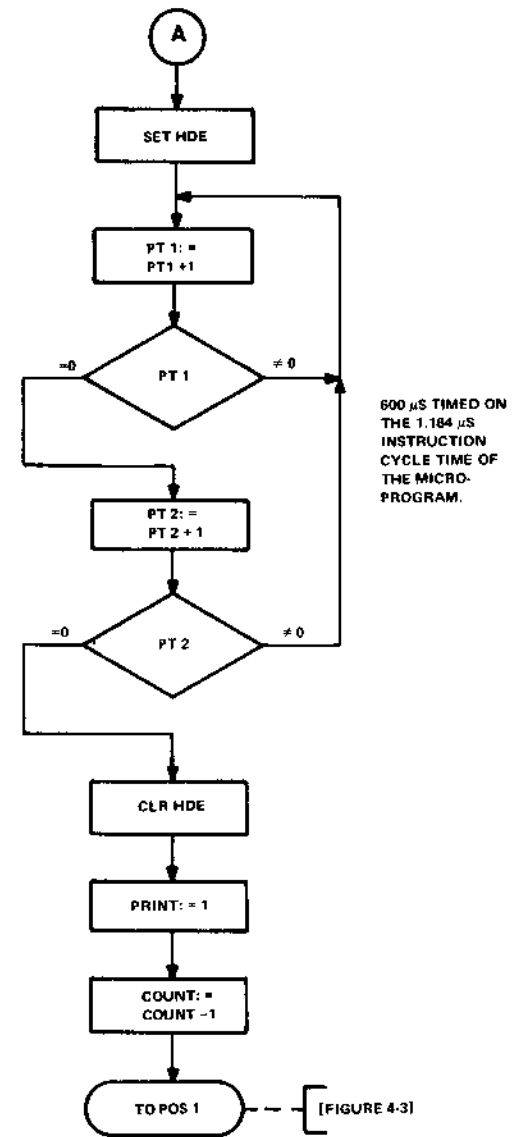
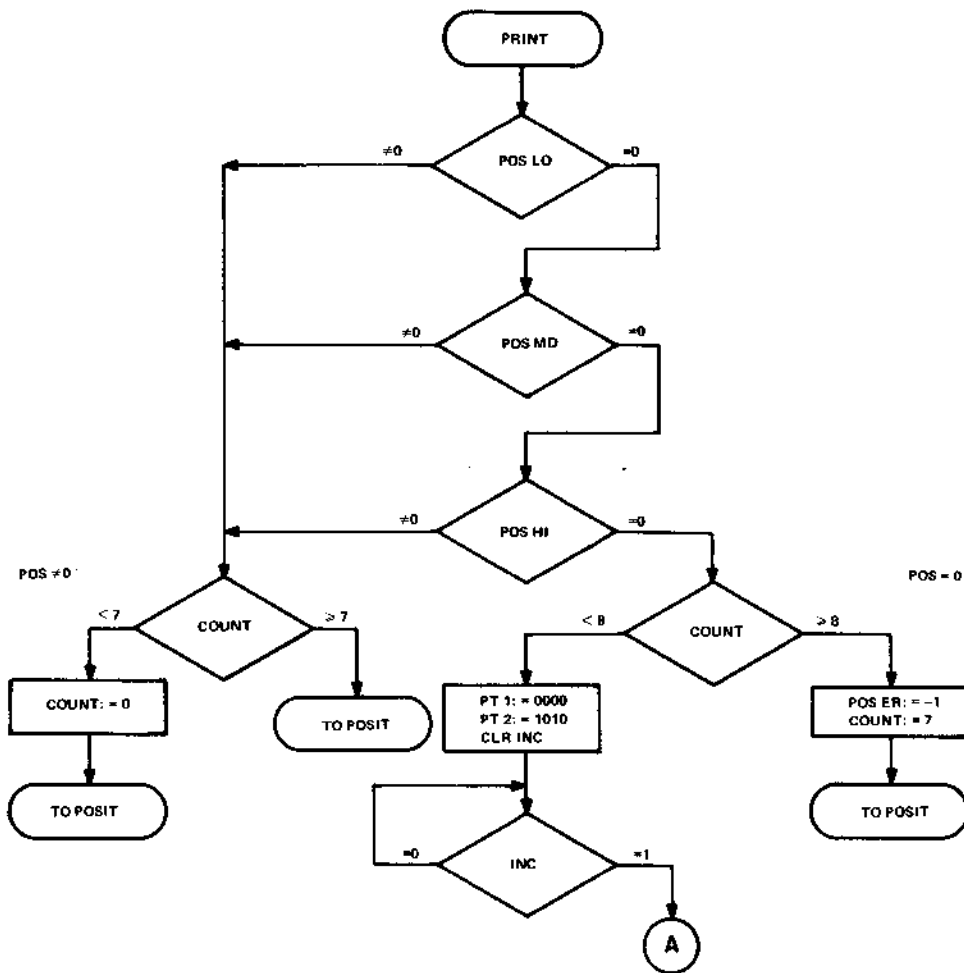
NOTE

At all other times through this routine, operation is synchronized on the 416 μ s clock, but at this point continuation of program flow is predicated on the fact that an incremental motion of the head has been accomplished.

The 600 μ HDE is then timed out in PT1 and PT2 locations of the control RAM on the 1.184 μ instruction timing cycle of the microprogram. During this time the character is printed. At the end of that time, HDE is cleared, print is reset to 1, Count is set once again to -1, and the program reenters the POSIT routine.

4.1.9 LINE FEED Routine

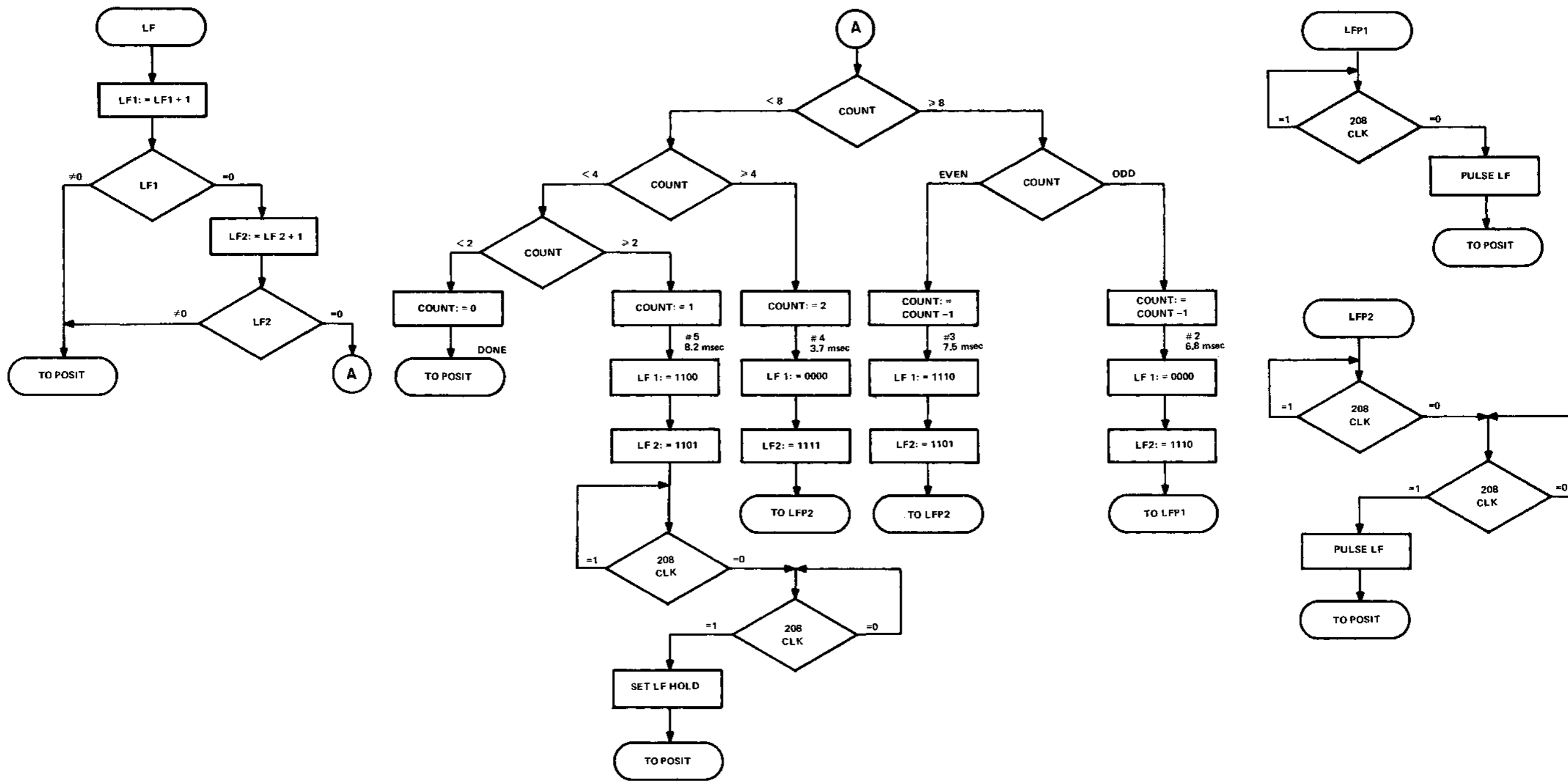
If, while passing through the BELL routine, Count was not equal to 0 and the Print Bit in location 12 is cleared, the program enters the LINE FEED routine (Figure 4-9).



[FIGURE 4-3]

CP-1631

Figure 4-8 Print Routine



CP-1632

Figure 4-9 Line Feed Routine

Upon entering the routine the program finds Count equal to 9 (as set in the NEXT routine) and a preset in LF1 and LF2. On the trailing edge of the 208 μ s clock, the LF motor is pulsed and the program returns to POSIT.

Upon reentering the LF routine, the program checks Count and if 8 or more, it checks to see if it is odd or even. If even (as it should be 8), it decrements Count and uses the timers LF1 and LF2 to count out 7.5 ms. At this time a second pulse is sent to the LF motor. If Count had been odd, a count of 7 would be indicated and 6.8 ms would be counted before a motor pulse was issued.

The program then counts 3.7 ms and issues a pulse, and then 8.2 ms. This time it sets LF HOLD and returns to find Count equal to 0. This completes the subroutine that issues four discrete motor pulses to step the motor one line increment and then issues the HOLD signal as part of the last increment.

4.1.10 LCV Routine

If, while passing through the BELL routine, both Count and Word Count were found to be zero, the program enters the LCV routine (Figure 4-10) and places an initial count into LCV Status.

This routine uses the LCV Status (location 14), the Print Timer in location 12 (since printing is not being done), and locations 5 and 6 in parallel. The latter two locations are normally used as Read and Write addresses, but they are not needed in this case, so they can be used in parallel to maintain their equality so that the next time they are required they will function to keep a proper tally on the Character Buffer.

These combined locations then form a 12-bit counter to count the 1.3 sec time delay before the head is commanded to move four columns to the right by setting -4 into position error.

When the next printable character is sensed in the NEXT routine, the LCV Status is checked (after a check for column 132) and, if found zero, causes a +4 to be put into position error to move the head back to printing position. At this time it also initializes LCV Status so that it will count the 1.3 sec the next time it is needed.

From this it can also be seen that LCV ceases and the same initialization of LCV Status occurs if a printable character is received during LCV timeout.

4.1.11 NEXT Routine

If, while passing through the BELL routine, Count was zero but Word Count was not equal to zero, the program enters the NEXT routine (Figure 4-11).

The program first decrements the Word Count, then increments the Read Address, and puts that Read Address into the Character Buffer Address (CBA) register causing the character stored at that address to be exposed to the Character Generator ROM. The ROM is designed to output an additional bit, that when set indicates that the character is printable, and when cleared indicates that the character is not printable.

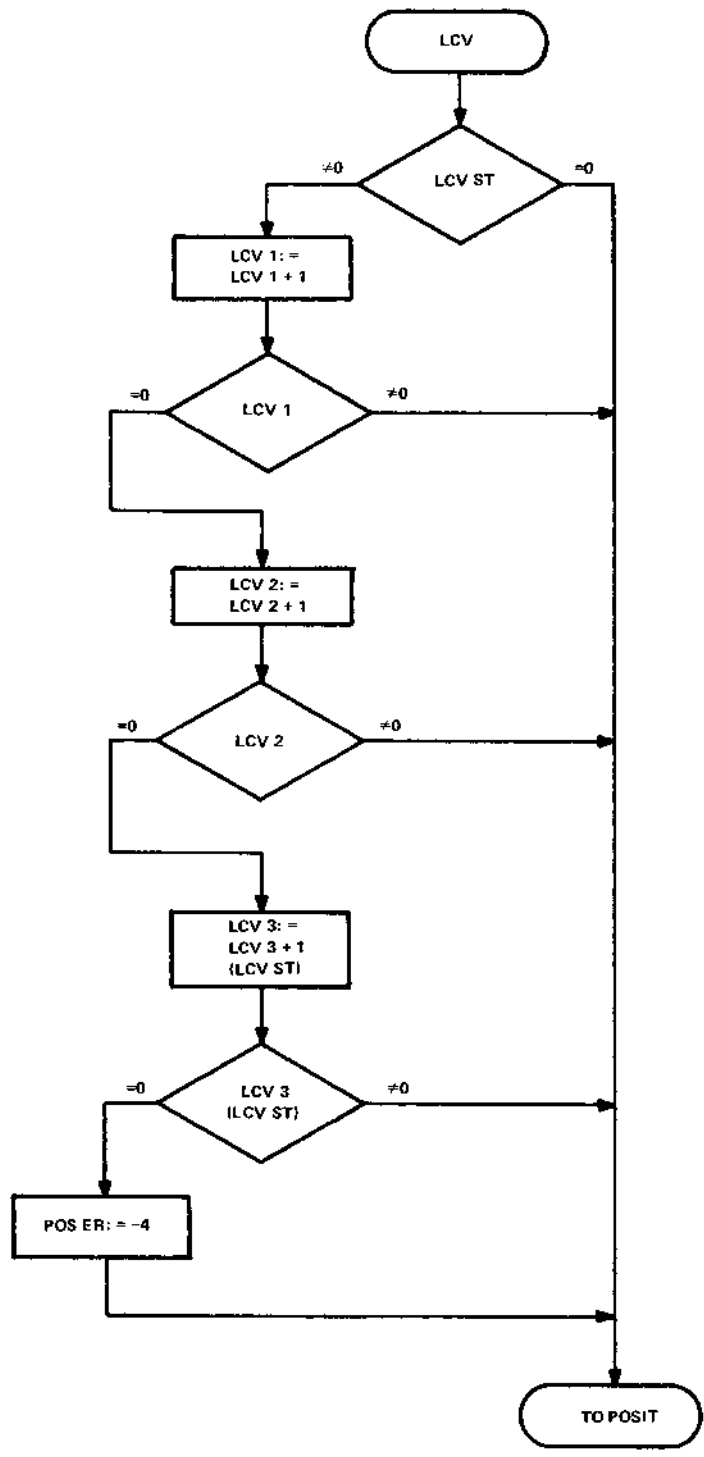
At this point, the program enters one of four subroutines to process one of five possible conditions.

If the character is not printable, and it is neither a CR, LF, BELL, or BS, the program exits and reenters POSIT because the character falls within the control character category that requires no machine action.

If the non-printable character is a LF, the program enters that subroutine. Count is set to 9 and the proper preset is put in the Line Feed Timer locations before progressing to the LINE FEED routine.

If the non-printable character is a BELL, two is added to the status and the program exits to POSIT.

If the non-printable character is a BS, the program enters that subroutine, where one is subtracted from column (provided the head is not at column zero) and adds one to position error. The program then returns to POSIT and then to the SPEED routine where the carriage is commanded to move one space to the left.



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Figure 4-10 Last Character Visibility Routine

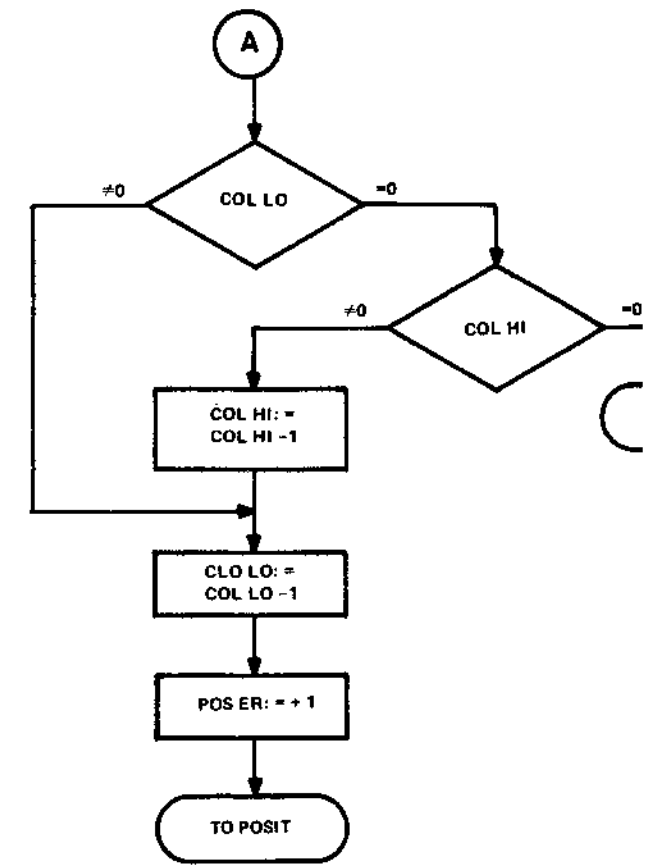
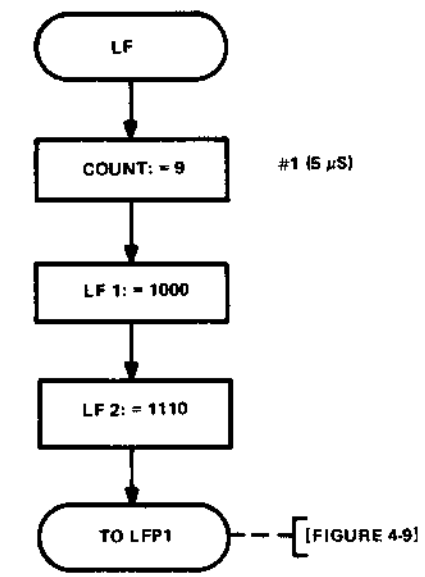
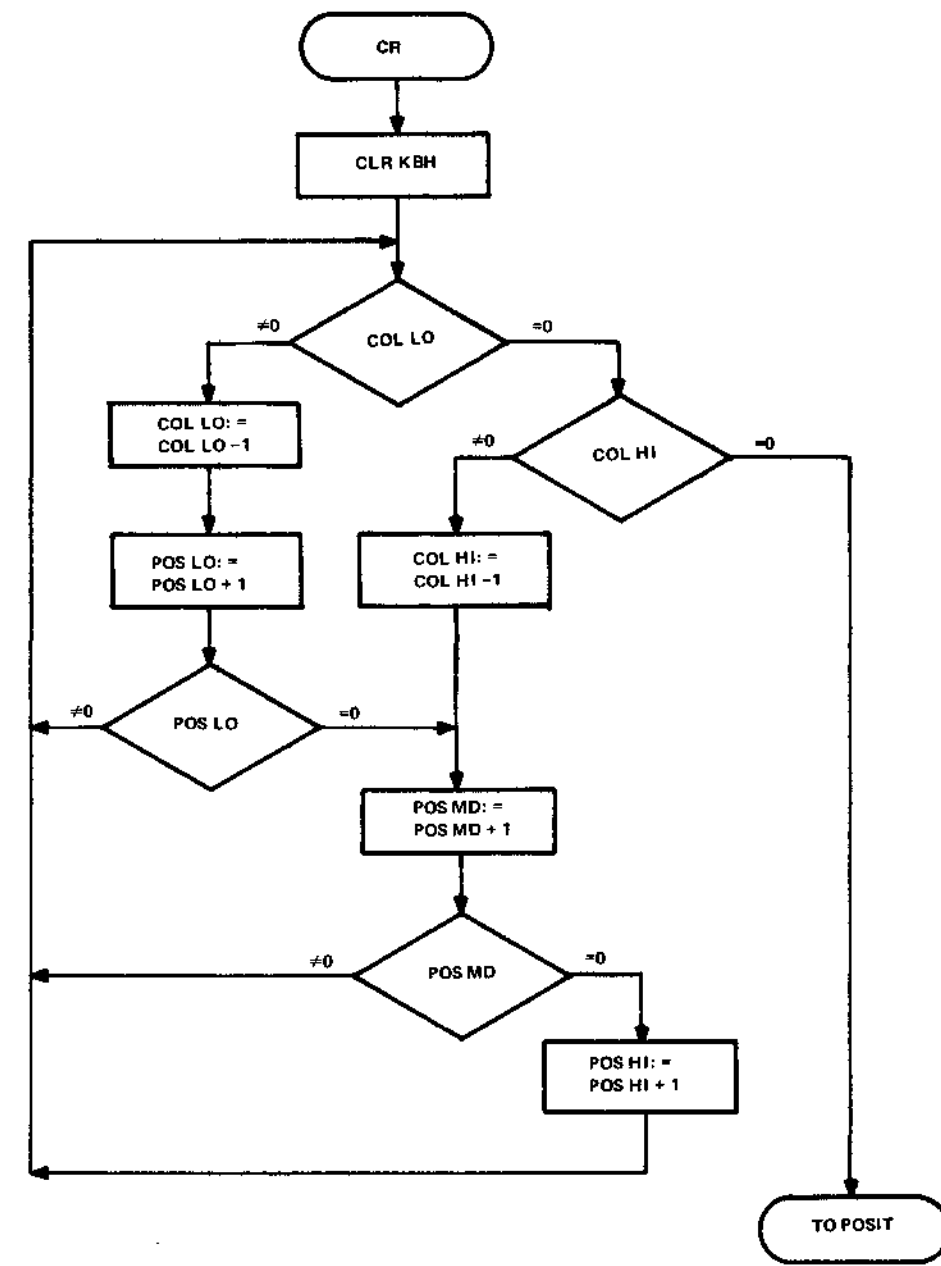
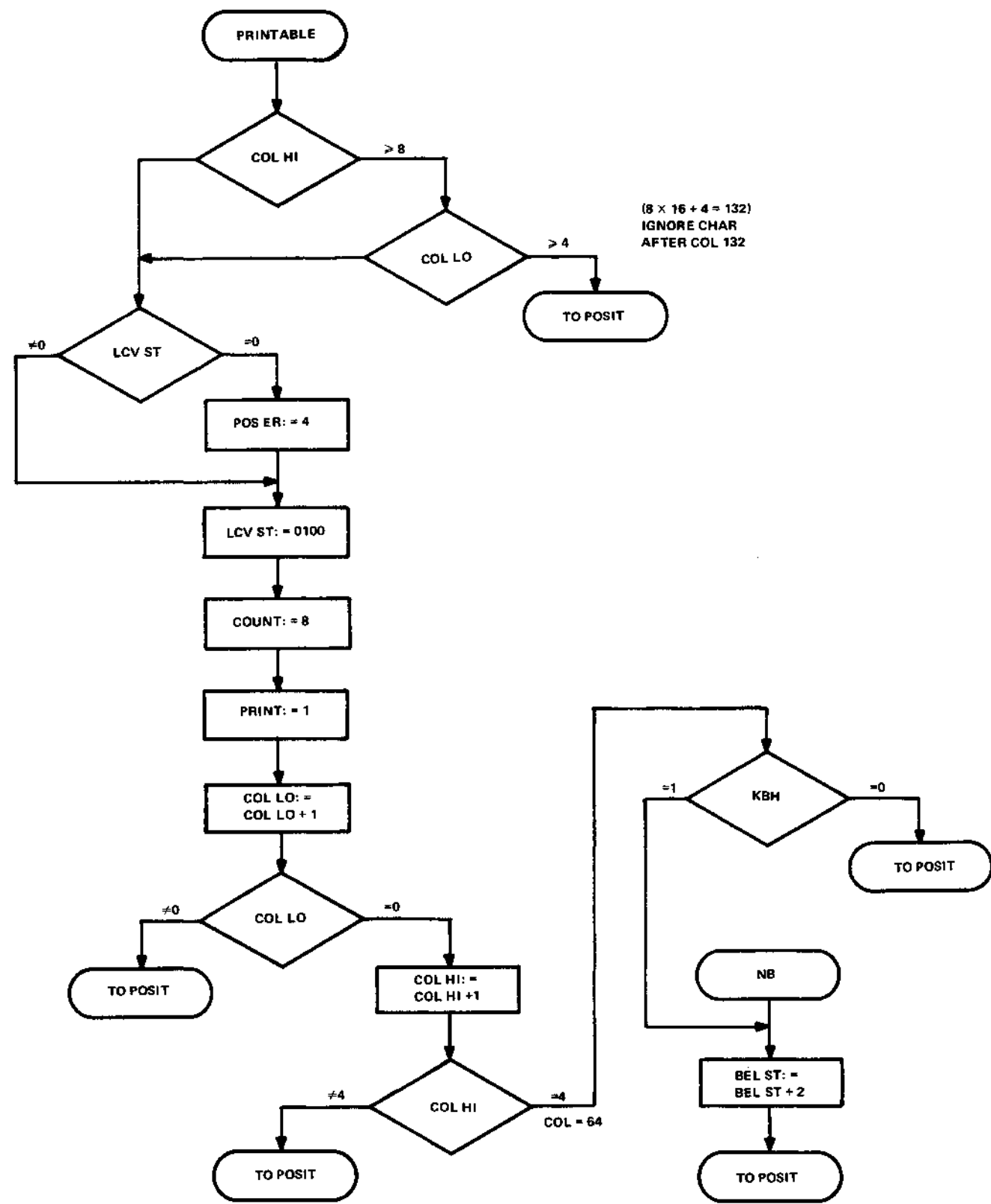
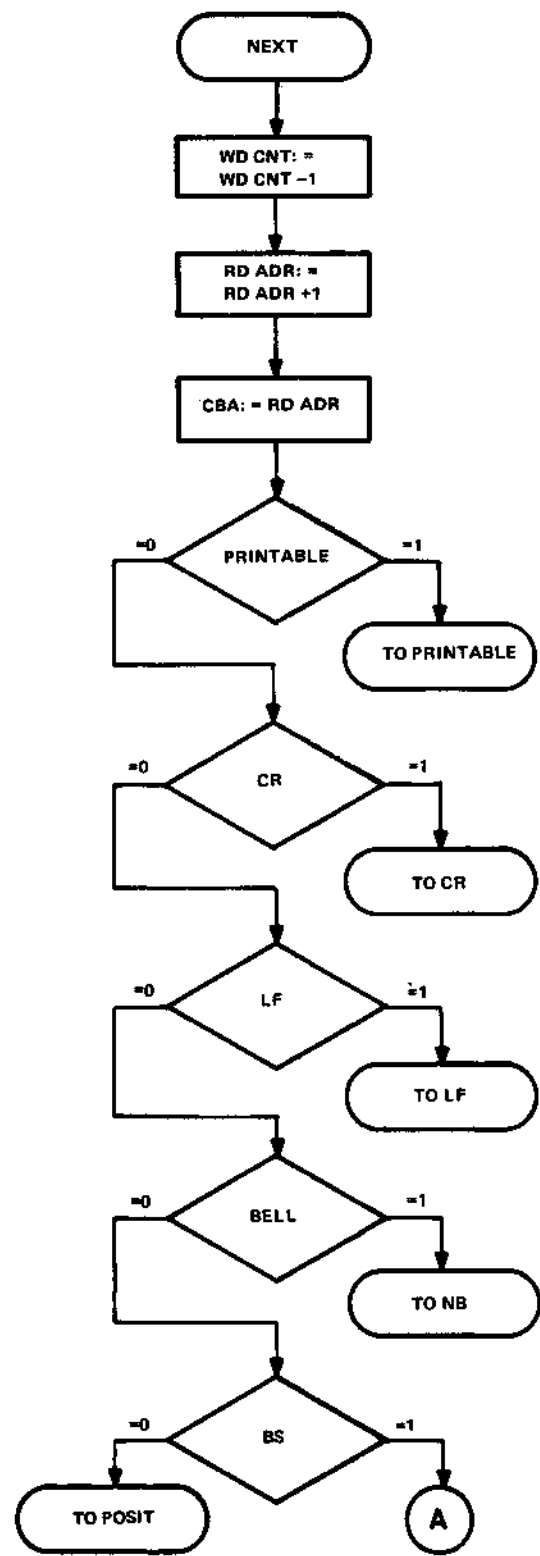


Figure 4-11 Next Routine

If the non-printable character is a CR, the program enters that subroutine. It immediately clears Keyboard Hold (KBH) and examines the low order bits of the column locations.

The function of this routine is to set Column to zero (since that is where the carriage should be) and to modify the position location by a factor equal to the number of columns away from column zero that the head is actually situated when a CR is received.

This is done in the routine in two parts: first the low order bits are examined and then the high order bits. Each column byte is then decremented and each position byte is incremented until the operation is complete. The maximum number of passes through this loop is 32, which requires 100 μ s of time to complete the subroutine.

If the Print Bit indicates that the character is printable, the program determines whether or not the carriage is at column 132. It does this by determining that COL HI is ≥ 8 and that COL LO is ≥ 4 . If these conditions are true, printing cannot occur and the program returns to POSIT ignoring the current character until a CR occurs.

If Column does not equal 132, Column is incremented and examined again; this time to determine if the head is now at column 64 (since a bell tone must be sounded at this point if the keyboard is in use).

Since 64 is a multiple of 8, it is only necessary to check for an overflow from the low order of Column to the high order. The program first checks LCV Status and, if zero, sets 4 in position error. It then puts 4 in LCV Status, sets Count to 8, and increments the low order of Column. If COL LO is not zero, the program returns to POSIT. If it is now zero, the high order of Column is incremented. If at this time COL HI does not equal 4, the program returns to POSIT and when it gets to the PRINT routine, it begins laying down the dots for the character.

If COL HI is equal to 4 after it is incremented, Column 64 is indicated and the program checks KBH. If it is not set, the program progresses to POSIT and proceeds through the normal print sequence. If KBH is set, the program adds 2 to Bell Status, returns to POSIT, and rings the bell.

4.2 TIMING

The timing of all operations in the LA36 is derived from a crystal clock which operates at 1.6896 MHz. The clock output frequency is divided by two to form the 1.184 μ s cycle time for the microprogrammed controller (MPC). Additional divisions provide timing pulses for the Carriage Servo System and the data communication at 300 baud, 150 baud, and 110 baud. A division of the clock rate is also used by the MPC for timing the LF, BELL, LCV, and INIT functions. Timing diagrams are provided in the applicable sections of this chapter.

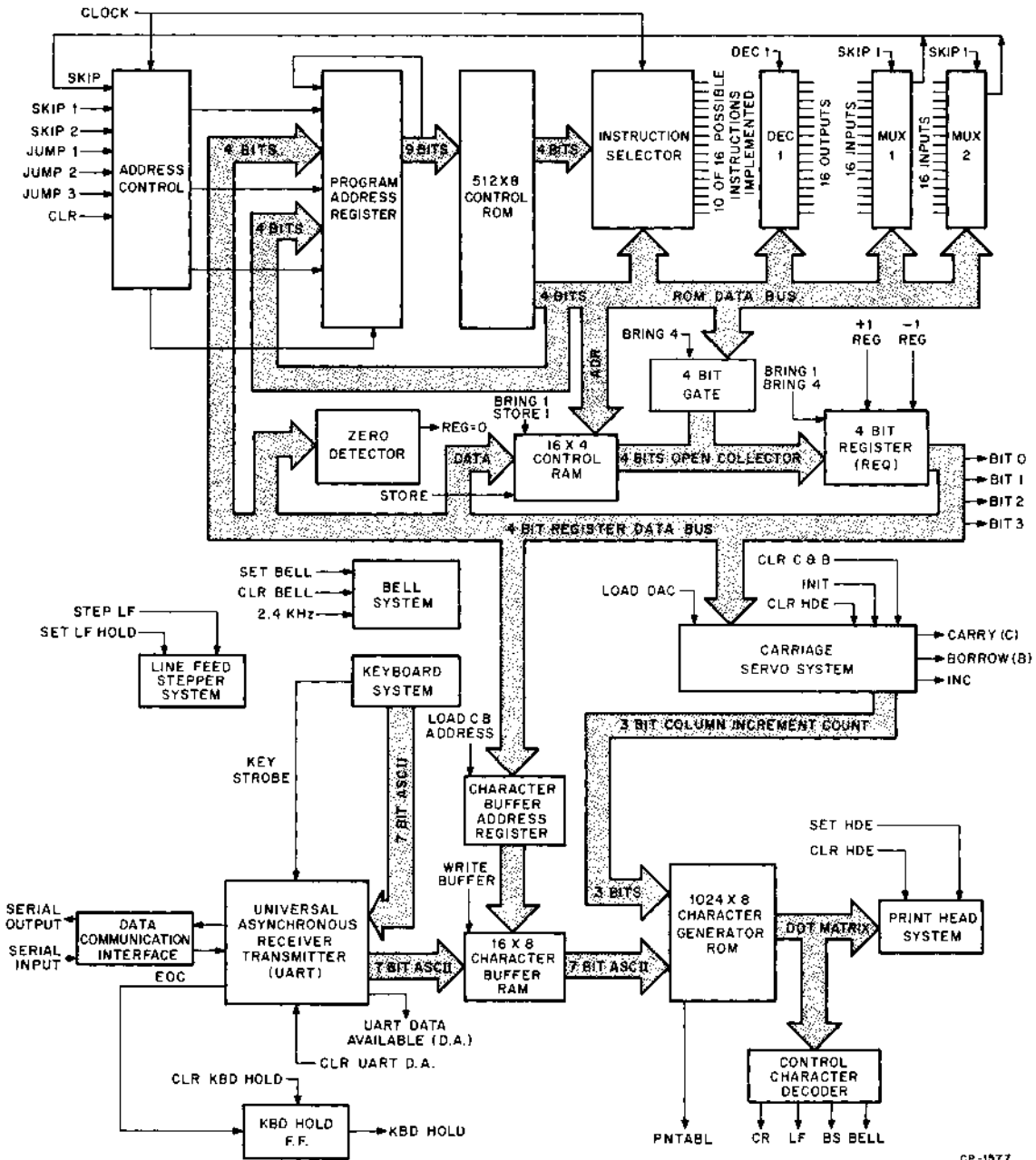
4.3 CONTROL LOGIC

The LA36 control logic is implemented as a microprogrammed controller (MPC). A block diagram of this logic is shown in Figure 4-12.

Characters from the Keyboard System or the data communications interface are processed through the UART, to the Character Buffer under control of the MPC. This buffer accumulates characters during a carriage return, eliminating the need for fill characters. Printing speed is doubled after a carriage return to catch up with the accumulated characters.

The MPC causes characters in the buffer to be presented to the character generator ROM on a FIFO basis. The Character Generator ROM generates the dot matrix for the printable characters and contains control character decode information for the non-printable characters. It also provides a printable/non-printable indication to the MPC.

The MPC activates the Carriage Servo System and the Print Head System in order to move the print head through a character cell and print the seven columns of seven dots which form the printable characters.



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Figure 4-12 Control Logic Block Diagram

Upon detection of a CR character, the MPC activates the Carriage Servo System to move the print head to the left margin. Similarly, a BS character causes the print head to move one character position to the left.

Upon detection of a LF character, the MPC activates the LF Stepper System in order to advance the paper one line.

In response to a bell character or as an end-of-line warning, the MPC activates the Bell System in order to produce an audible tone.

Transmission of characters from the keyboard, through the UART, to the data communications interface is done without microprogram control. The act of transmitting a character is stored in the KBD HOLD flip-flop. The MPC generates the end-of-line warning only on lines in which the KBD HOLD flip-flop has been set.

The structure which allows microprogram control of the LA36 operation is illustrated in Figure 4-12.

The microprogram consists of a sequence of 512 instructions which reside in the control ROM. Each instruction consists of eight bits. The upper four bits define the general class of instruction; the lower four bits define the particular operation to be performed.

Selection of a particular instruction in the microprogram is performed by the Program Address register. This register generally acts as a counter, thus causing instructions to be executed sequentially at the rate of one every 1.184 μ s.

The Sequential Instruction flip-flop may be interrupted by instructions of the classes referred to as JUMP1, JUMP2, JUMP3, CLR, SKIP1, and SKIP2.

The JUMP1 instruction causes the Address Control Logic to be activated in order to load the lower four bits of the instruction (ROM DATA BUS) into the lower four bits of the two-program Address register. Any transfer of control which does not change the upper five bits of the address may use this instruction and is thus limited to use for jumps within any one of thirty-two 16-word pages of the microprogram.

The JUMP2 instruction has the same effect as the JUMP1 instruction except that it also uses the four-bit register Data Bus to load the next four bits of the Program Address register. Thus, the combination of an instruction that loads the register (described below) and a JUMP2 instruction can affect a transfer within one of the two 256-word halves of memory.

The JUMP3 instruction is similar to the JUMP2 instruction with the additional effect that the most significant bit of the Address register is toggled. This causes the jump to be to the opposite half of memory as the instruction being executed.

The CLR instruction resets the contents of the Program Address register to zero. The Program Address register is also reset to zero on power up.

The SKIP1 and SKIP2 instructions are conditional skip instructions. The conditions are the inputs to MUX1 and MUX2. The lower four bits of the skip instruction specify which of 16 inputs to sample. If the selected input is asserted when the skip instruction occurs, then the Address Control Logic causes the address to increment by two rather than by one during a single instruction cycle. Signals which are inputs to the SKIP multiplexers are UART Data Available, KBD Hold, servo control data (CARRY, BORROW, INC), each of the four bits of REG (BIT0, BIT1, BIT2, BIT3), the control character indications (CR, LF, BS, BELL), the printable indication, the REG equals 0 indication, and a real-time clock.

Instructions which do not modify the normal sequential flow are BRING4, BRING1, STORE1, and DEC1.

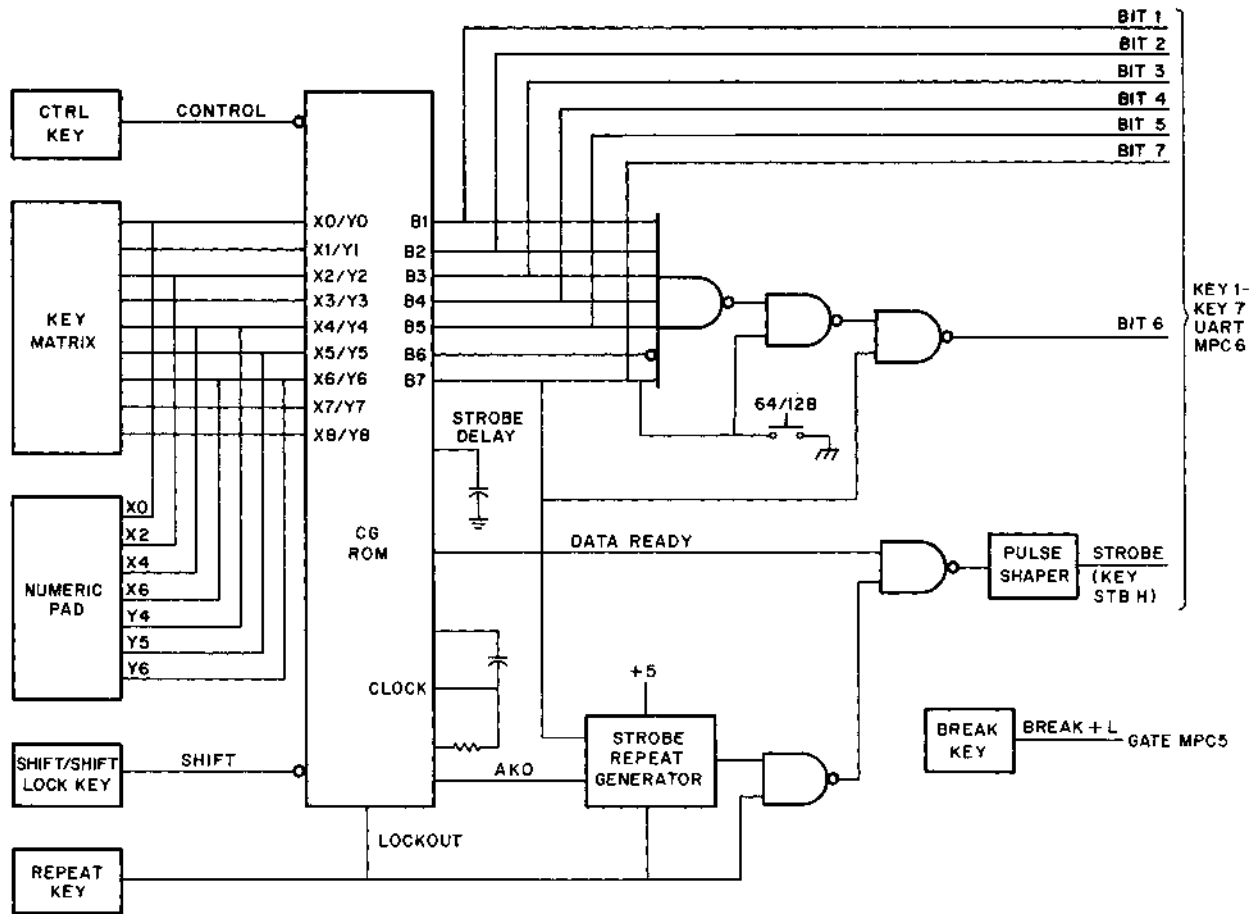
The BRING4 instruction performs an immediate load of data from the lower four bits of the instruction to the 4-bit register (REG). This is accomplished by enabling the 4-bit gate and loading the register.

The BRING1 instruction is used to fetch data from one of sixteen 4-bit memory locations in the control RAM to the REG. The lower four bits of the instruction select the memory location. The instruction is executed by enabling and loading the memory.

The DEC1 instruction is the means by which the MPC transmits commands to the systems which it is controlling. The lower four bits of the instruction specify which of 16 outputs of the DEC1 decoder will be pulsed. The outputs of the decoder are CLR UART Data Available, CLR KBH, CLR Carry/Borrow, CLR INC, CLR HDE (combined with CLR INC), SET HDE, LOAD CB Address, WRITE BUFFER, +1 REG (adds 1 to REG), -1 REG (subtracts 1 from REG), SET BELL, CLR BELL, Load DAC (D/A) (commands speed to Servo System), CLR INIT (sets left margin at power up), STEP LF, and SET LF HOLD.

4.4 KEYBOARD SYSTEM

A simplified diagram of the Keyboard System logic is shown in Figure 4-13. The Keyboard System generates the 7-bit, parallel ASCII codes listed in Table 4-3. These codes are stored in a 3600-bit ROM that is controlled by an internal 10–20 kHz clock. The ROM has a scan cycle time of 6.5–9 ms. It is addressed asynchronously by X and Y pulses from the KEY MATRIX or the NUMERIC PAD.



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Figure 4-13 LK02 Keyboard Logic Diagram

Table 4-3
Keyboard ROM Addressing

Key	ASCII Code b7-b1	Octal Code	ROM Addressing	
			X Line	Y Line
Esc	0011011	33	8	9
2	0110010	62	7	8
r	1110010	162	5	6
h	1101000	150	3	4
[	1011011	133	2	3
,	0101100	54	1	2
=	0111101	75	0	1
l	0110001	61	7	9
c	1100101	145	5	7
g	1100111	147	3	5
m	1101101	155	1	3
0	0110000	60	7	0
w	1110111	167	5	8
f	1100110	146	3	6
n	1101110	156	1	4
-	0101101	55	0	3
9	0111001	71	7	1
q	1110001	161	5	9
d	1100100	144	3	7
b	1100010	142	1	5
BS	0001000	10	0	4
8	0111000	70	7	2
p	1110000	160	5	0
s	1110011	163	3	8
v	1110110	166	1	6
7	0110111	67	7	3
0	1101111	157	5	1
a	1100001	141	3	9
c	1100011	143	1	7
SP	0100000	40	8	5
6	0110110	66	7	4
i	1101001	151	5	2
{	1111011	173	4	1
;	0111011	73	3	0
x	1111000	170	1	8
5	0110101	65	7	5
u	1110101	165	5	3
CR	0001101	15	4	2
l	1101100	154	3	1
LF	0001010	12	2	0
z	1111010	172	1	9
4	0110100	64	7	6
y	1111001	171	5	4
'	0100111	47	4	3
k	1101011	153	3	2
\	1011100	134	2	1
/	0101111	57	1	0

Table 4-3 (Cont)
Keyboard ROM Addressing

Key	ASCII Code b7-b1	Octal Code	ROM Addressing	
			X Line	Y Line
HT	0001001	11	8	8
3	0110011	63	7	7
t	1110100	164	5	5
j	1101010	152	3	3
DEL	1111111	177	2	2
.	0101110	56	1	1
\	1100000	140	0	0

SHIFT MODE

ESC	0011011	33	8	9
@	1000000	100	7	8
R	1010010	122	5	6
H	1001000	110	3	4
|	1011101	165	2	3
<	0111100	74	1	2
+	0101011	53	0	1
!	0100001	41	7	9
E	1000101	105	5	7
G	1000111	107	3	5
M	1001101	115	1	3
)	0101001	51	7	0
W	1010111	127	5	8
F	1000110	106	3	6
N	1001110	116	1	4
—	1011111	137	0	3
(	0101000	50	7	1
Q	1010001	121	5	9
D	1000100	104	3	7
B	1000010	102	1	5
BS	0001000	10	0	4
*	0101010	52	7	2
P	1010000	120	5	0
S	1010011	123	3	8
V	1010110	126	1	6
&	0100110	46	7	3
O	1001111	117	5	1
A	1000001	101	3	9
C	1000011	103	1	7
SP	0100000	40	8	5
^	1011110	136	7	4
I	1001001	111	5	2
}	1111101	175	4	1
:	0111010	72	3	0
X	1011000	130	1	8
%	0100101	45	7	5

Table 4-3 (Cont)
Keyboard ROM Addressing

Key	ASCII Code b7-b1	Octal Code	ROM Addressing	
			X Line	Y Line
U	1010101	125	5	3
CR	0001101	15	4	2
L	1001100	114	3	1
LF	0001010	12	2	0
Z	1011010	132	1	9
\$	0100100	44	7	6
Y	1011001	131	5	4
"	0100010	42	4	3
K	1001011	113	3	2
!	1111100	174	2	1
?	0111111	77	1	0
HT	0001001	11	8	8
#	0100011	43	7	7
T	1010100	124	5	5
J	1001010	112	3	3
DEL	1111111	177	2	2
>	0111110	76	1	1
~	1111110	176	0	0
CONTROL MODE				
ESC	0011011	33	8	9
DC2	0010010	22	7	8
DC2	0010010	22	5	6
BS	0001000	10	3	4
ESC	0011011	33	2	3
FF	0001100	14	1	2
GS	0011101	35	0	1
DC1	0010001	21	7	9
ENQ	0000101	5	5	7
BEL	0000111	7	3	5
CR	0001101	15	1	3
DLE	0010000	20	7	0
ETB	0010111	27	5	8
ACK	0000110	6	3	6
SO	0001110	16	1	4
CR	0001101	15	0	3
EM	0011001	31	7	1
DC1	0010001	21	5	9
EOT	0000100	4	3	7
STX	0000010	2	1	5
BS	0001000	10	0	4
CAN	0011000	30	7	2
DLE	0010000	20	5	0
DC3	0010011	23	3	8
SYN	0010110	26	1	6

Table 4-3 (Cont)
Keyboard ROM Addressing

Key	ASCII Code b7-b1	Octal Code	ROM Addressing	
			X Line	Y Line
ETB	0010111	27	7	3
SI	0001111	17	5	1
SOH	0000001	1	3	9
ETX	0000011	3	1	7
NUL	0000000	0	8	5
SYN	0010110	26	7	4
HT	0001001	11	5	2
ESC	0011011	33	4	1
ESC	0011011	33	3	0
CAN	0011000	30	1	8
NAK	0010101	25	7	5
NAK	0010101	25	5	3
CR	0001101	15	4	2
FF	0001100	14	3	1
LF	0001010	12	2	0
SUB	0011010	32	1	9
DC4	0010100	24	7	6
EM	0011001	31	5	4
BEL	0000111	7	4	3
VT	0001011	13	3	2
FS	0011100	34	2	1
SI	0001111	17	1	0
HT	0001001	11	8	8
DC3	0010011	23	7	7
DC4	0010100	24	5	5
LF	0001010	12	3	3
DEL	1111111	177	2	2
SO	0001110	16	1	1
NUL	0000000	0	0	0
SHIFT AND CONTROL MODE				
ESC	0011011	33	8	9
NUL	0000000	0	7	8
DC2	0010010	22	5	6
BS	0001000	10	3	4
GS	0011101	35	2	3
FS	0011100	34	1	2
VT	0001011	13	0	1
SOH	0000001	1	7	9
ENQ	0000101	5	5	7
BEL	0000111	7	3	5
CR	0001101	15	1	3
HT	0001001	11	7	0
ETB	0010111	27	5	8
ACK	0000110	6	3	6

Table 4-3 (Cont)
Keyboard ROM Addressing

Key	ASCII Code b7-b1	Octal Code	ROM Addressing	
			X Line	Y Line
SO	0001110	16	1	4
US	0011111	37	0	3
BS	0001000	10	7	1
DC1	0010001	21	5	9
EOT	0000100	4	3	7
STX	0000010	2	1	5
BS	0001000	10	0	4
LF	0001010	12	7	2
DLE	0010000	20	5	0
DC3	0010011	23	3	8
SYN	0010110	26	1	6
ACK	0000110	6	7	3
SI	0001111	17	5	1
SOH	0000001	1	3	9
ETX	0000011	3	1	7
NUL	0000000	0	8	5
RS	0011110	36	7	4
HT	0001001	11	5	2
GS	0011101	35	4	1
SUB	0011010	32	3	0
CAN	0011000	30	1	8
ENQ	0000101	5	7	5
NAK	0010101	25	5	3
CR	0001101	15	4	2
FF	0001100	14	3	1
LF	0001010	12	2	0
SUB	0011010	32	1	9
EOT	0000100	4	7	6
EM	0011001	31	5	4
STX	0000010	2	4	3
VT	0001011	13	3	2
FS	0011100	34	2	1
US	0011111	37	1	0
HT	0001001	11	8	8
ETX	0000011	3	7	7
DC4	0010100	24	5	5
LF	0001010	12	3	3
DEL	1111111	177	2	2
RS	0011110	36	1	1
RS	0011110	36	0	0

When a key switch is closed for at least 6 ms the X and Y pulses address the corresponding character cell in the ROM. The timing for character processing is shown in Figure 4-14. After a 2.5–5 ms delay (3 ms nominal) to ensure that the switch closure did not result from contact bounce, a DATA READY pulse lasting one ROM clock period (50–100 μ s) is output by the ROM. This pulse is gated to the Pulse Shaper and differentiated to produce a 350–750 ns STROBE pulse, which strobes the parallel data to the UART. The STROBE pulse is also applied to the STROBE REPEAT GENERATOR together with the AKO (any key depressed) logic level. If the REPEAT key switch is closed while another key switch is closed (except SHIFT, SHIFT LOCK, CTRL and TAB), the STROBE REPEAT GENERATOR produces a series of pulses, one every 46–86 ms. These pulses are gated with the REPEAT logic level and the DATA READY pulses to repeat the STROBE at a rate of 15 per second as long as the REPEAT key is closed. The REPEAT logic level is also applied to the ROM to lock out all other key closures during a REPEAT.

When the 64/128 switch is open, data bit 6 is gated out. Consequently, only upper case character codes are strobed to the UART.

The SHIFT, SHIFT LOCK and CTRL key switches inhibit bits 6 and 7 in the ROM so that upper level character codes or control codes are output when these keys are closed. The DELETE code is unaffected by these key switches.

4.5 DATA COMMUNICATIONS INTERFACE

A simplified diagram of the Data Communications Interface is shown in Figure 4-15. Timing is shown in Figure 4-16.

4.5.1 20 mA Loop Receiver

A simplified diagram of the Loop Receiver is shown in Figure 4-17. Signal line current can be up to 80 mA. Higher currents will activate the zener diode, which limits the receiver voltage drop to 1.6 V for currents up to 1 A. Any current over 15 mA is interpreted as a mark; any current under 3 mA is interpreted as a space. Isolation of 1500 V is provided by the Photo Isolator.

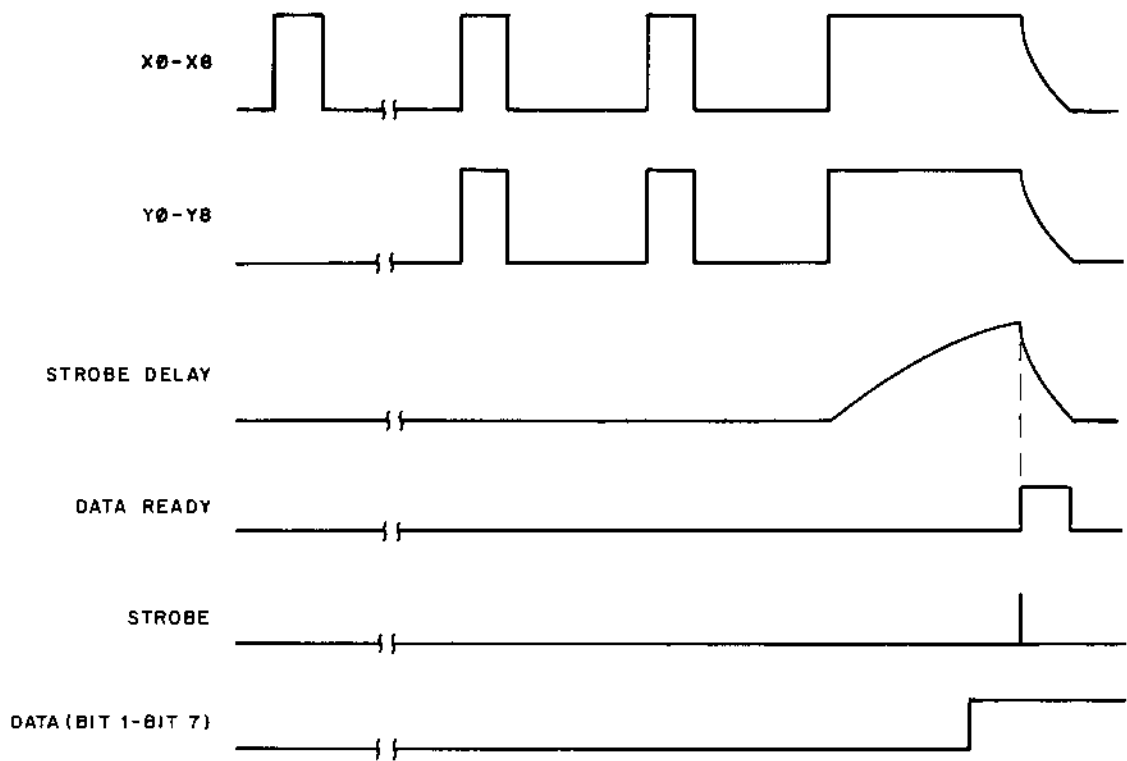
4.5.2 20 mA Loop Driver

A simplified diagram of the Loop Driver is shown in Figure 4-18.

Isolation of 1500 V is provided by the Photo Isolator. The circuit goes to the MARK state for currents as low as 20 mA when the MPC is idling or when the LA36 power is turned off. Signal line current must be limited to 80 mA. Voltages exceeding 40 V should not be used to drive the loop.

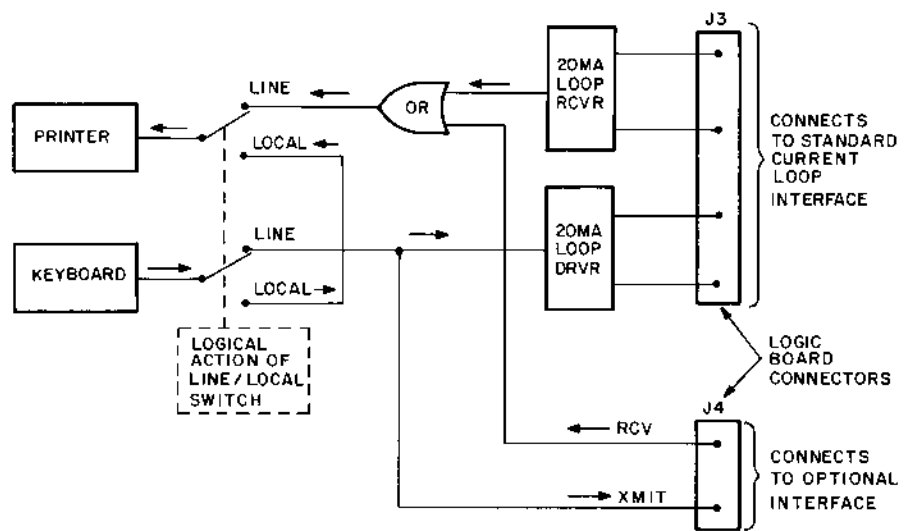
4.6 CLOCK LOGIC

The clock frequencies used to time the Microprogrammed Controller (MPC) are obtained as shown in Figure 4-19. All frequencies are derived from a Crystal Oscillator and Shaper that generates a 1.6896 MHz square wave. This signal is divided down by two ripple counters, a $\div 11$ binary counter and a $\div 15$ binary counter to produce the necessary timing signals and baud rate signals. The frequencies and time periods produced are shown in Table 4-4. Important timing relationships are shown in Figure 4-20.



CP-1615

Figure 4-14 Keyboard Timing Diagram



CP-1163

Figure 4-15 Data Communications Interface Diagram

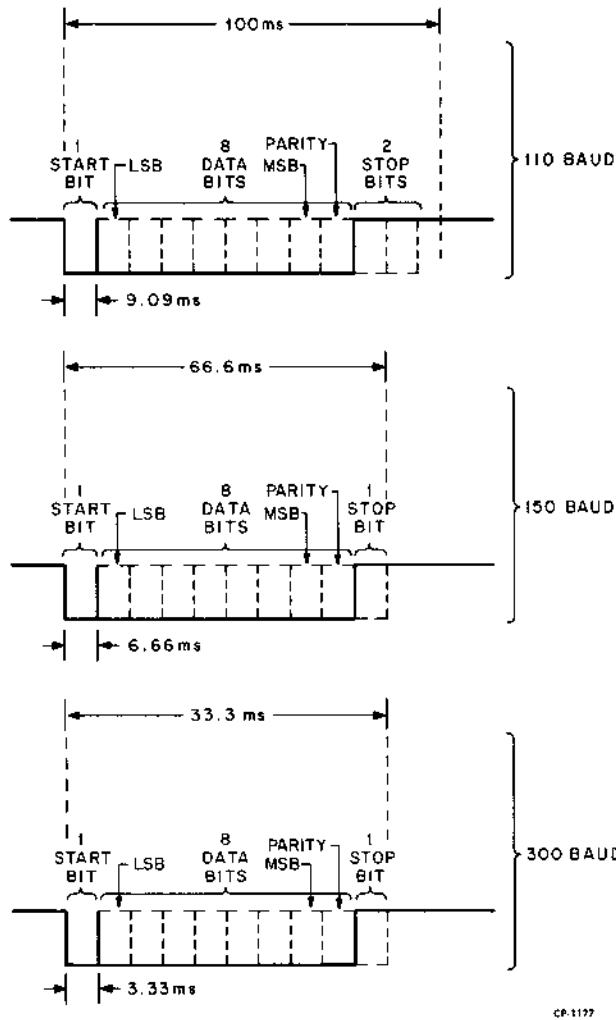


Figure 4-16 Data Communications Interface Timing Diagram

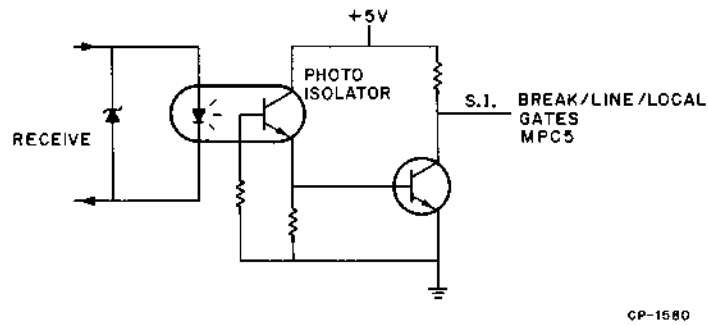


Figure 4-17 20 mA Loop Receiver Diagram

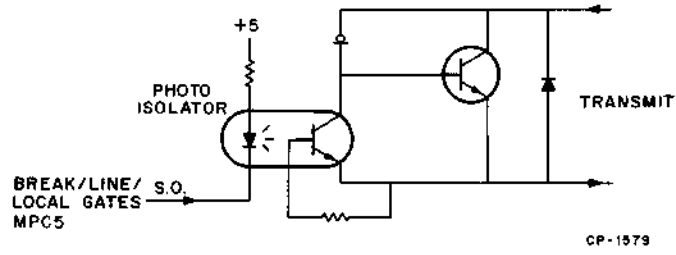


Figure 4-18 20 mA Loop Driver

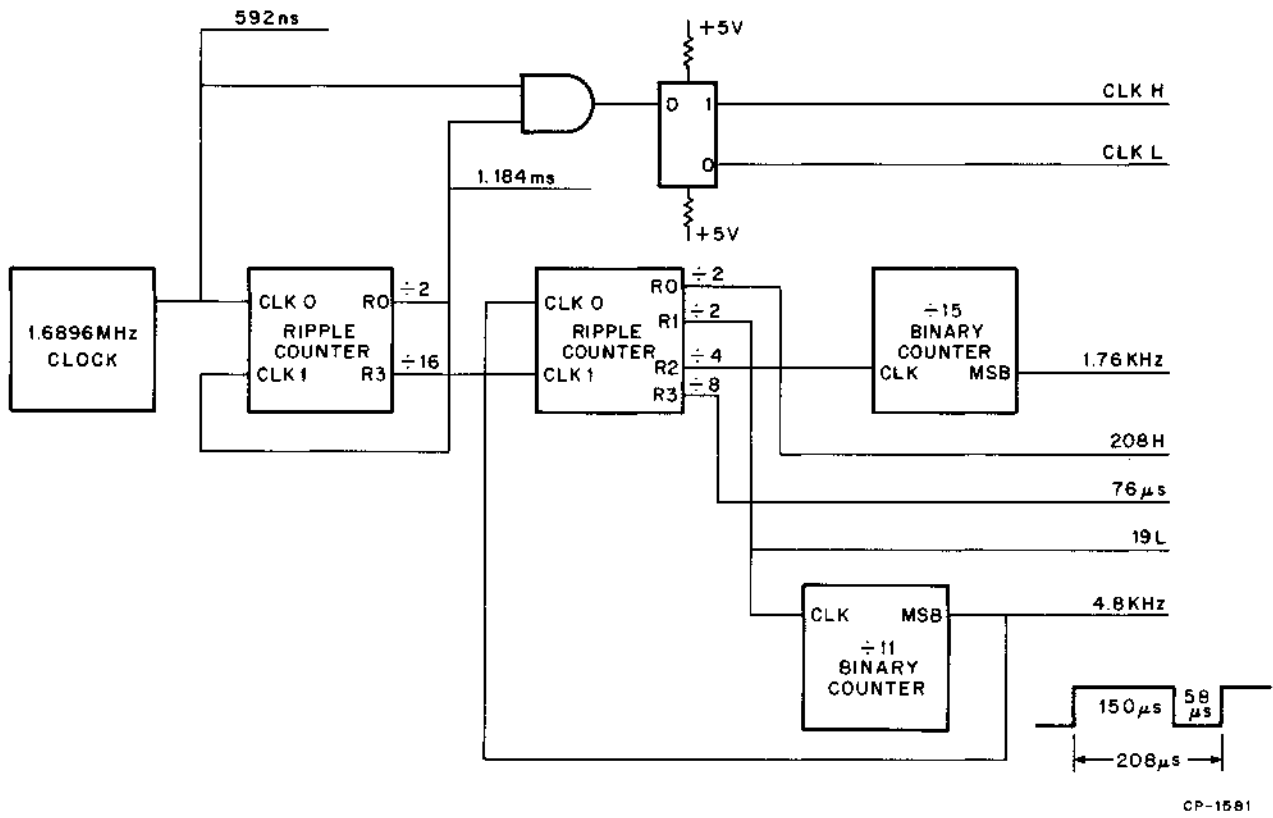
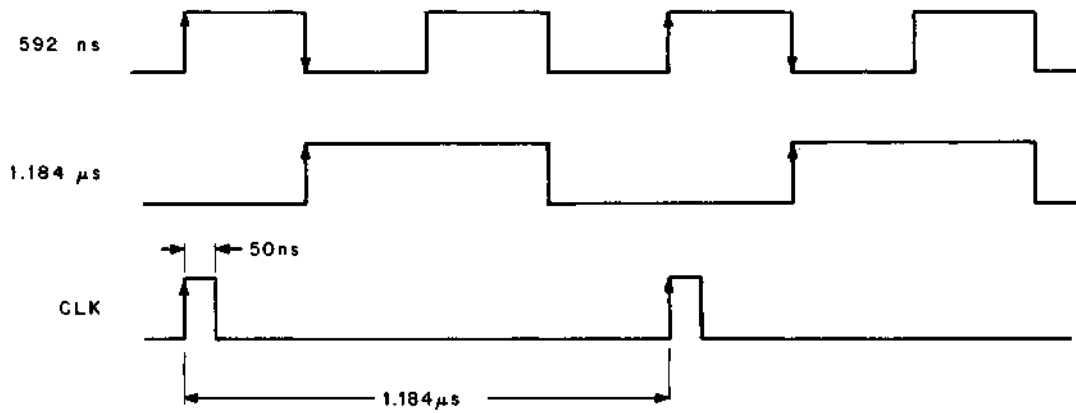


Figure 4-19 Clock Logic

Table 4-4
Clock Frequencies and Time Periods

Frequency	Time Period
1.6896 MHz	592 ns
844 kHz	1.184 μ s
844 kHz (CLK)	50 ns pulse/1.184 μ s time period
106 kHz	9.4 μ s
53 kHz	18.8 μ s
26.5 kHz	37.7 μ s
13.25 kHz	75.5 μ s
4.8 kHz	208.3 μ s
2.4 kHz	416.7 μ s
1.7 kHz	588.2 μ s



CP-1616

Figure 4-20 Clock Timing Relationship

4.7 UNIVERSAL ASYNCHRONOUS RECEIVER/TRANSMITTER (UART)

A simplified diagram of this logic is shown in Figure 4-21. Depending on the operating mode (LOCAL or LINE), ASCII data is applied to the UART from the Keyboard System or from the Data Communications Interface. Keyboard data is 7-bit parallel ASCII. Interface data is serial.

Initially, the CLR R DONE flip-flop and the UART are cleared by the WAKE UP pulse from the Wake-up circuit. During on-line transmission, parallel data from the keyboard are transferred to the UART by KEY STB H and converted to serial data, which is applied to the Data Communications Interface. In the LOCAL mode, the serial output of the UART is gated directly back to the serial input. Consequently, no data is transmitted but a MARK is sent to indicate that the terminal is not active. Incoming data is locked out by the gating.

In either mode, the serial input data is assembled and converted to parallel data by the UART. Then, the UART outputs a DA flag to notify the MPC which issues a WRITE BUFF pulse. This pulse sets the CLR R DONE flip-flop. After the character has been stored in the character buffer, the MPC issues a CLR DA pulse. This pulse clocks the CLR R DONE flip-flop, which clears R DONE in the UART so that the next character can be processed.

The rate at which characters are transmitted or received by the UART depends on the BAUD RATE that has been selected by the BAUD RATE switch. Three signals from the Clock Logic are applied to the baud rate gates: 1.76 kHz, 2.4 kHz and 4.8 kHz. These gates are controlled by the BAUD RATE switch as indicated by the truth table (Table 4-5). The selected signal is applied to the clock inputs of the UART.

A BREAK - from the keyboard will interrupt the MARK on the serial output line. This is the serial equivalent of sending a START bit, followed by a continuous space and no stop bit, which is often interpreted as a Transmission Interrupt by the receiving device.

4.8 CHARACTER BUFFER/GENERATOR AND PRINT HEAD SYSTEM

A simplified diagram of this logic is shown in Figure 4-22. Characters from the UART are stored in the Character Buffer RAM (CB RAM). This is a 15 character FIFO memory that is always read-enabled because the ENB input is grounded. Characters are written into successive locations in the buffer by the WRITE BUFF pulse from DEC1.

The Read or Write addresses of the character location are stored in the Character Buffer Address register. Addresses are clocked to the Character Buffer by LD CBA from DEC1. Each time a character is written or read, the corresponding address is incremented by the MPC. As each character is read from the buffer, it is decoded by the Character Generator ROM (CB ROM), which is a 1024 × 8 ROM that stores a dot matrix pattern in a cell for every printable character and a unique code for each non-printable control character. Each character cell is defined by a 7 × 7 dot matrix as shown in Figure 4-23. Rows are selected by the ASCII code, A(4:9) and CS0. Subcolumns are selected by the COLumn INCrement COUNT, A(1:3). The dot matrix is output to the solenoid amplifiers. The first bit location in each row (subcolumn 0) contains all 0s. All bits in the eighth row are used to identify printable and non-printable characters. This row contains all 1s for printable characters and all 0s for non-printable characters. There is one multi-stage amplifier for each solenoid. These amplifiers convert the Head Select logic levels (HS1 to HS7) to drive current for the solenoids. The last stage of the amplifier is clamped to +60 V by a zener-controlled voltage regulator. This reduces the effects of the voltage produced by the inductive load of the solenoid and ensures that the wires retract completely between subcolumns.

Solenoid current is regulated by the VREF Regulator. This regulator provides a constant current source for uniform density of character impressions, regardless of resistance and temperature variations.

The dot pattern is synchronized with the position of the print head by the COL INC COUNT as shown in Figure 4-24. The print head solenoids are fired according to the position of the print head. The MPC continuously checks the Printable Character Indication (PNTABL H) in MUX 1 and sends a Head Enable (HD EN) pulse to the amplifiers when the print head is at a subcolumn boundary. Each time this pulse is received, the appropriate solenoids are fired and a subcolumn of dots is printed.

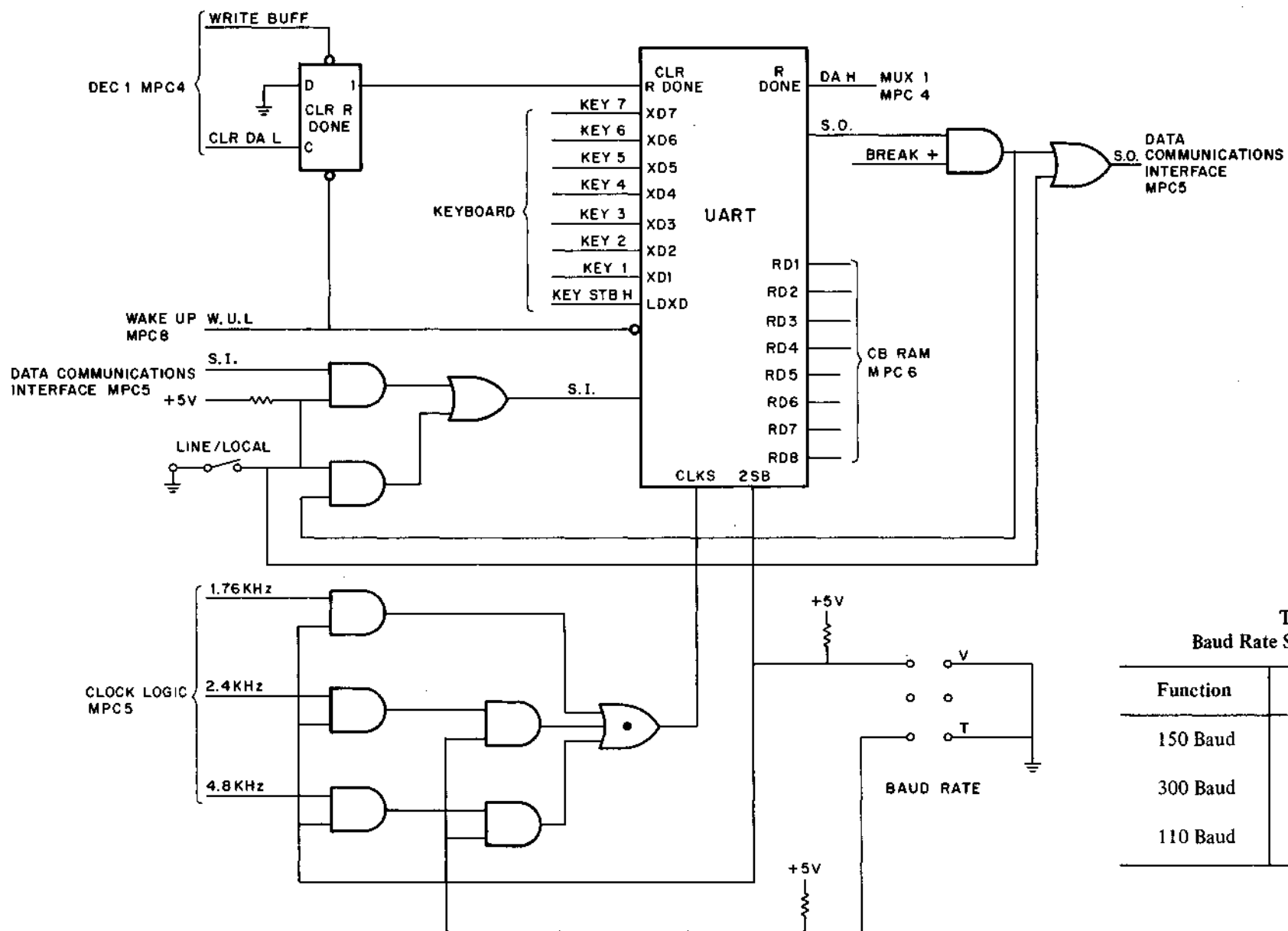


Table 4-5
Baud Rate Switch Connections

Function	J2-V	J2-T
150 Baud	0	0
300 Baud	0	1
110 Baud	1	X

CP-1582

Figure 4-21 UART/Mode Selection and Baud Rate Selection Logic

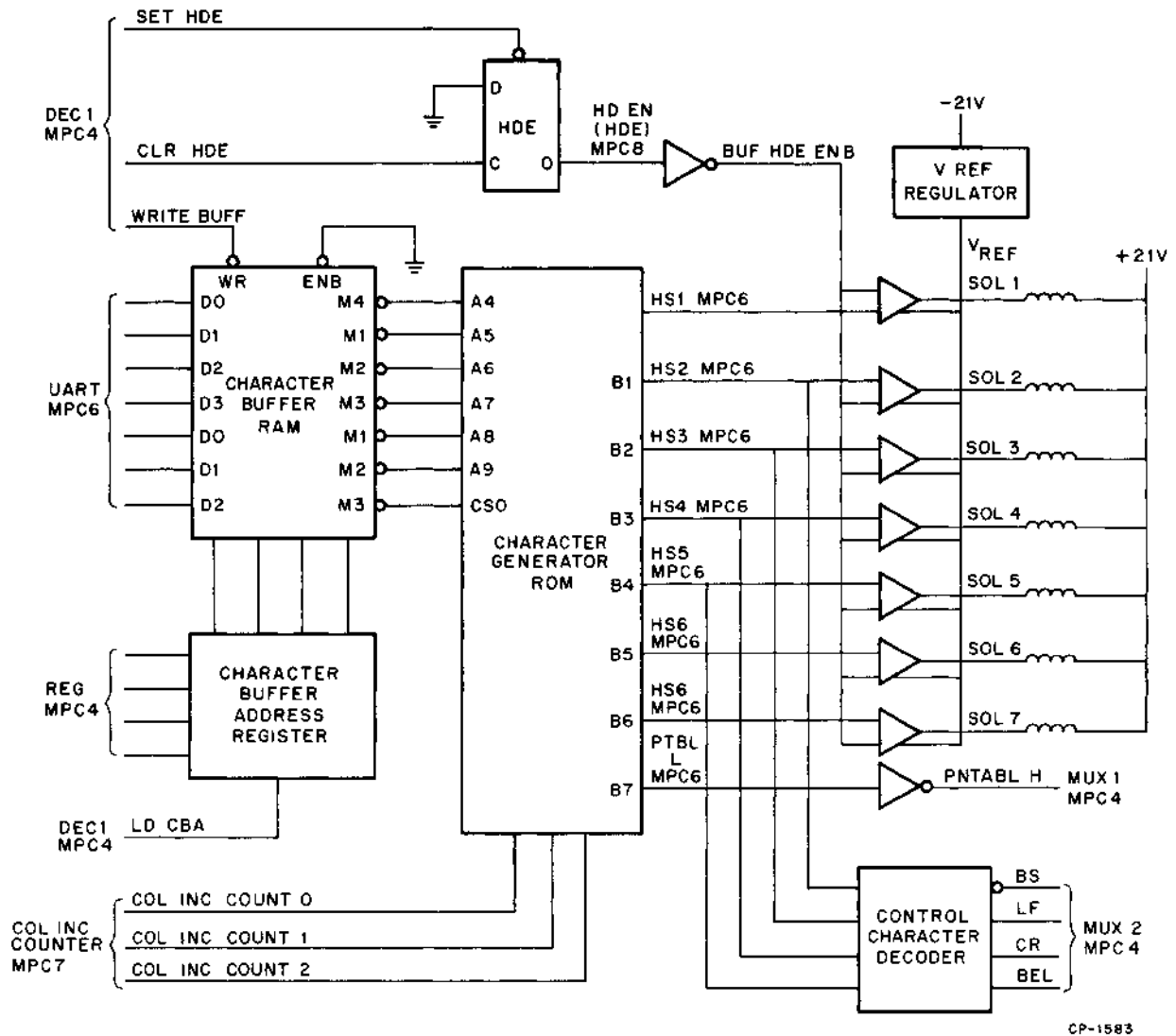


Figure 4-22 Character Buffer/Address Register/Generator and Print Head System

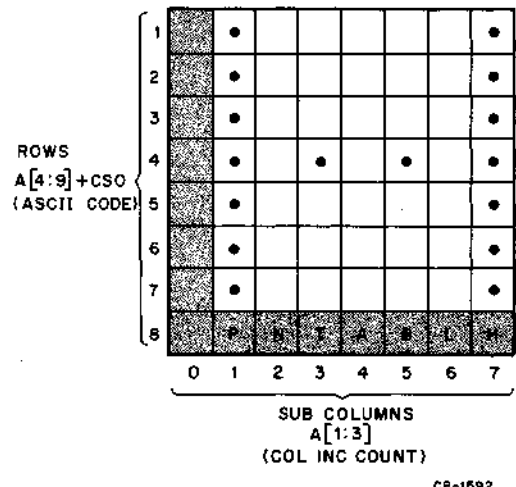


Figure 4-23 CG ROM Character Cell

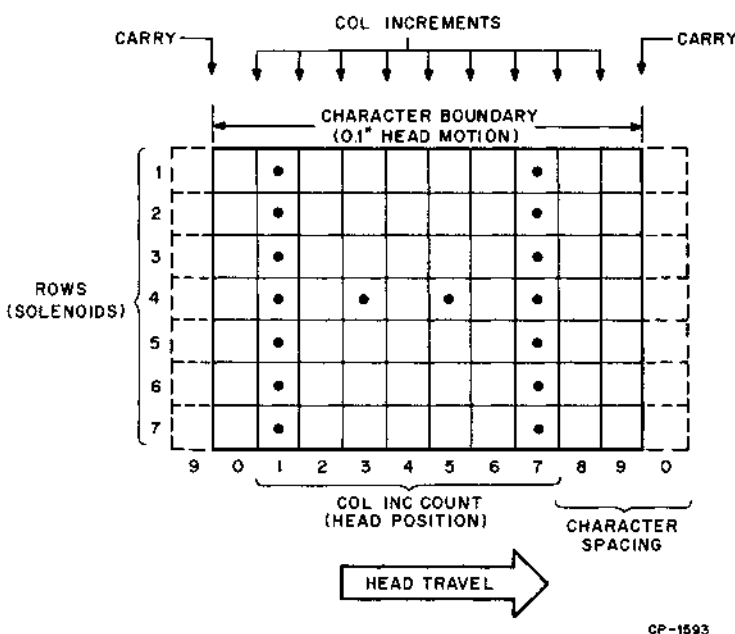


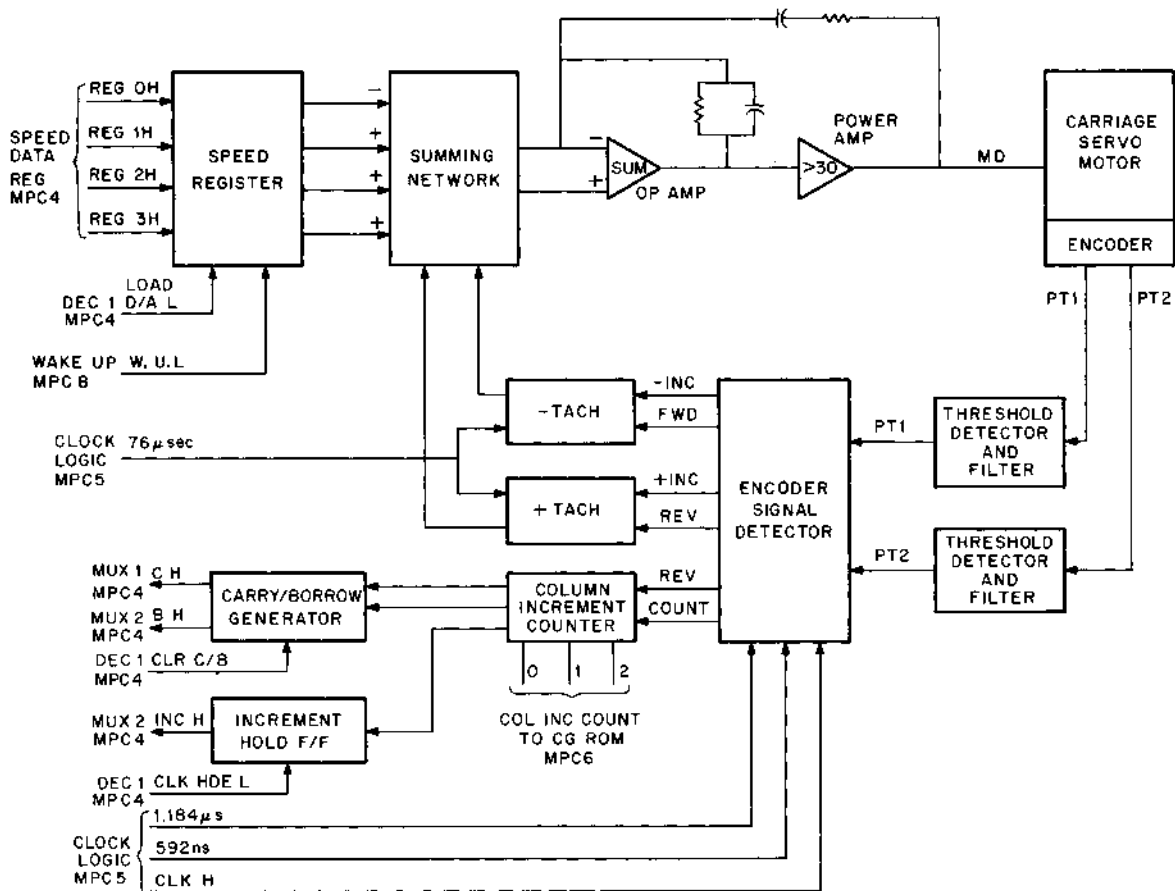
Figure 4-24 Print Head Operation

Dots are *never* printed in subcolumns 0, 8 and 9. These subcolumns are used for the fixed spacing between characters. The dot patterns are arranged so that two dots never print in the same row of adjacent subcolumns. This ensures consistent dot quality and optimizes solenoid power consumption by allowing the solenoids to retract completely before they are fired again.

When the MPC detects a Non-Printable Indication (PNTABL L) it does not send a HD EN pulse. Instead, the character is decoded by the Control Character Decoder. Only 4 of the 7 bits from the CG ROM are needed to identify the four control characters: Backspace (BS), Line Feed (LF), Carriage Return (CR) and Bell (BEL). These codes are applied to MUX 2 and processed by the MPC.

4.9 CARRIAGE SERVO SYSTEM

A block diagram of the Carriage Servo System is shown in Figure 4-25. The speed and direction of the carriage motor are determined by the speed data from the MPC. This information is stored in the SPEED register. When a change of speed is required, the appropriate data is generated by the MPC and loaded into the register by LOAD D/A L from DEC1. The various possible combinations of SPEED commands are shown in the truth table in Table 4-6. This register is cleared by W.U. L during wake-up (refer to Section 4.12). The speed data in the SPEED register is applied to the Summing Network together with the output of the + and - TACHs. The sum of these voltages is amplified and smoothed by the Operational Amplifier and the feedback networks; the result is a dc voltage called SUM. This voltage is amplified by the Power Amplifier to produce the current required to drive the Carriage Servo Motor. A positive voltage drives the motor clockwise, moving the carriage forward from left to right. A negative voltage drives the motor and the carriage in the opposite direction.



CP-1684

Figure 4-25 Carriage Servo System

**Table 4-6
MPC SPEED Command Truth Table**

Register Information Loaded into D/A

D/A (+ = PRINT, - = RETURN MOTION)

Reg3 (1)	Reg2 (1)	Reg1 (1)	Reg0 (1)	Nominal Speed (ips)
0	0	0	0	+6
0	0	0	1	+3
0	0	1	0	0
0	0	1	1	-3.8
0	1	0	0	-7.6
0	1	0	1	-11.4
0	1	1	0	-15.2
0	1	1	1	-19.0
1	0	0	0	-22.8
1	0	0	1	-26.6
1	0	1	0	-30.4
1	0	1	1	-34.2
1	1	0	0	-38.0
1	1	0	1	-41.8
1	1	1	0	-45.6
1	1	1	1	-49.4

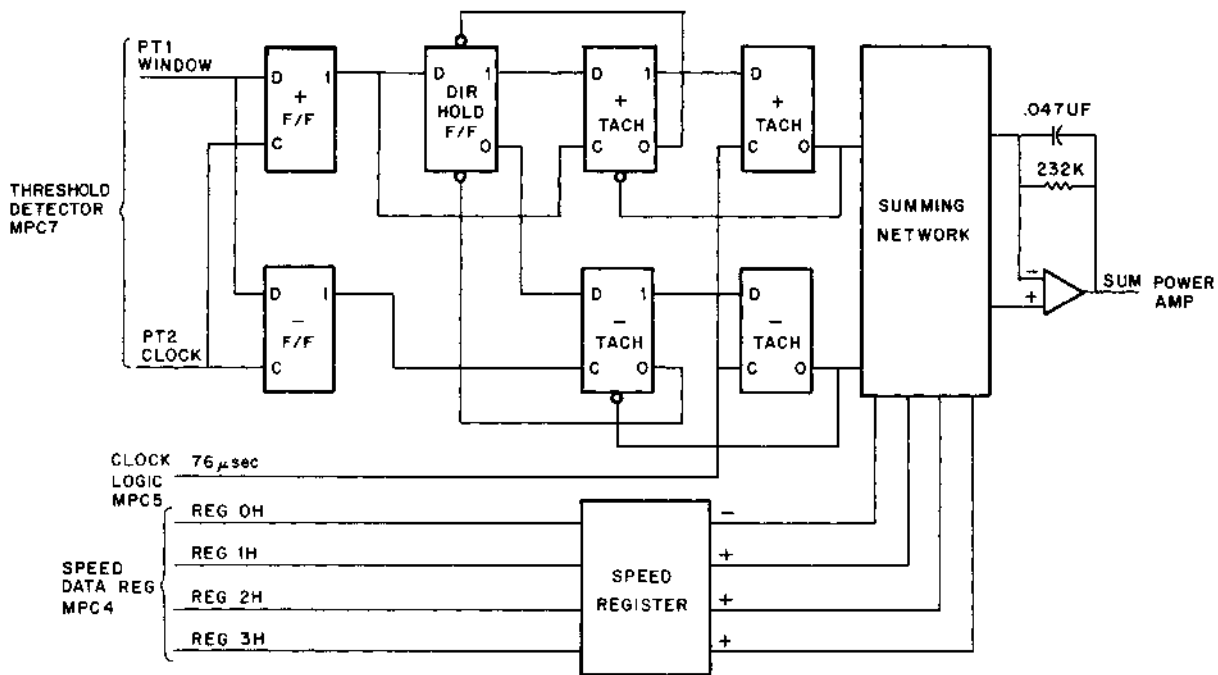
The encoder on the motor shaft generates two feedback signals: PT1 and PT2. These signals are applied to the dual-channel Threshold Detector and Filter, which converts them from sine waves to square waves for processing by the Encoder Signal Detector which is controlled by the CLK H, 1.184 ms and 592 ns timing signals from the Clock Logic. The Encoder Signal Detector produces a COUNT pulse and logic level commands for the +TACH and the -TACH, which are clocked by a 76 μ s timing signal from the clock logic. The +TACH and -TACH produce 76 μ s velocity feedback pulses, which are algebraically combined (summed) with the SPEED command to smoothly correct the speed and direction of the motor. Increment data is stored in the Increment Hold (INC H) flip-flop. This flip-flop is cleared by the CLR HDE L pulse from MPC4. Whenever the + or - TACH flip-flop is set, INC H is clocked; thus providing data for the MPC, which uses it to synchronize the printed dots with the carriage position.

The COUNT pulses produced by the Encoder Signal Detector are counted by the COL INC Counter. The output of this counter provides column position feedback data for the CG ROM. Counter overflow is stored in the Carry/Borrow Generator to provide print head position change feedback data for the MPC.

4.9.1 Tachometer, Summing Network and Sum Amplifier

Increment pulses are converted to velocity feedback by the Tachometer Logic shown in Figure 4-26. When an increment occurs, it is stored in the appropriate TACH flip-flop. The increment data is transferred to the flip-flops immediately, but the transfer of the TACH pulse to the Summing Network may occur anywhere from 0 to 76 μ s later, depending on the occurrence of the data with relation to the clock signal.

The second positive transition of the 76 μ s clock signal clears the TACH flip-flops, thus providing a 76 μ s pulse to the Summing Network for each increment. The TACH flip-flops are inhibited on the first increment following a direction reversal to keep the print head from oscillating.



CP-1585

Figure 4-26 Tachometer Logic

The TACH pulses are algebraically combined with the SPEED command voltage in the Summing Network. This network contains precision 1% resistors that produce weighted voltages from both the TACH pulses and the SPEED commands. The TACH pulses are of opposite polarity from the SPEED command voltages. Consequently, the feedback pulses oppose (buck) the SPEED commands. The sum of the two voltages is amplified by the Sum Amplifier and fed back to the negative input of the amplifier via the active Low Pass Filter to smooth the TACH pulses. The result is an average dc voltage (SUM) which produces feedback that exactly counter-balances the SPEED commands.

4.9.2 Encoder and Threshold Detector

The Encoder circuit and mechanism are illustrated in Figure 4-27. The light sources from two light-emitting diodes (LEDs) are focused on a slotted disk that is mounted on the motor shaft in front of a slotted mask and two infrared-sensing phototransistors. Rotation of the disk creates an interference pattern that causes the phototransistors to generate two sine waves, PT1 and PT2. These sine waves are always 90° out of phase as shown in Figure 4-27. When the disk rotates in the forward direction PT1 leads PT2 by 90°. PT1 and PT2 are applied to two Threshold Detectors. PT1 and PT2 are approximately 0.5 to 1 V p-p centered around a threshold of approximately 4.5 V. When the signal is above the threshold, the output is -0.7 V and when the signal is below the threshold the output is 3.9 V. These signals are filtered by an RC circuit and shaped into square waves by Schmitt triggers. The Schmitt triggers logically invert the output of the Threshold Detectors, thus providing a logic high for encoder levels above the threshold and a logic low for encoder levels below the threshold.

4.9.3 Encoder Signal Detector

The Encoder Signal Detector contains four flip-flops: +, -, DIR HOLD and COUNT. A simplified diagram for this logic is shown in Figure 4-28. Incremental changes are detected by using PT1 as a window and PT2 as a clock as shown in Figure 4-29. Encoder square wave PT1 is applied to the data inputs of the + and - flip-flops and PT2 is applied to the clock inputs.

The + flip-flop is set by positive-going edges that occur during positive windows and the - flip-flop is set by negative-going pulses that occur during positive windows. Direction reversals are latched by the DIR HOLD flip-flop.

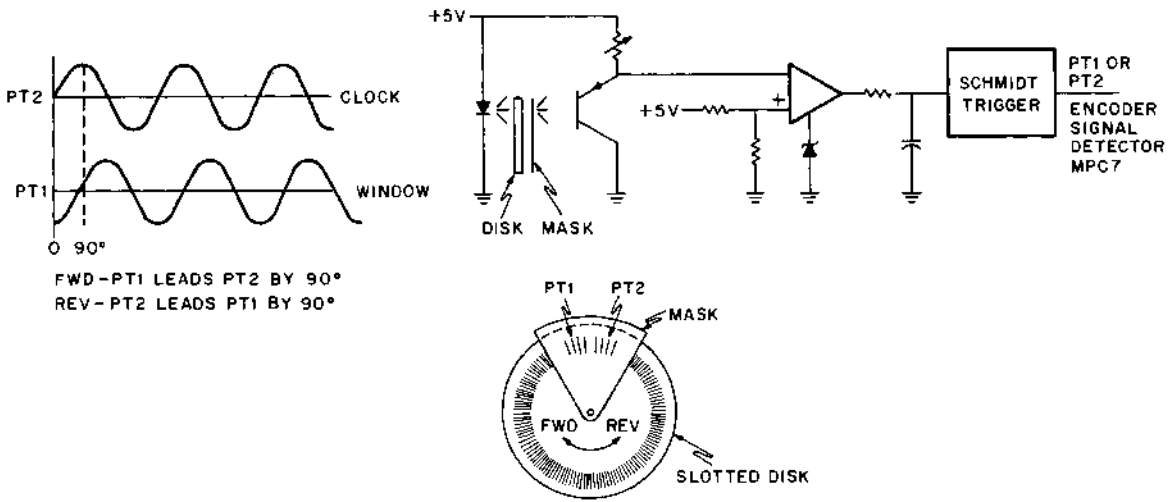
When either the + or - flip-flop is set, increment data is stored in the COUNT flip-flop. At time state T1, this flip-flop is clocked by the negative-going edge of the 1.184 μs pulse as shown in Figure 4-30. At time state T2 the COUNT pulse is gated to the COL INC Counter by CLK H.

At time state T3, the + and - flip-flops are cleared by the positive-going edge of the 592 ns pulse in order to process succeeding increments.

4.9.4 Column Increment Counter and Carry/Borrow Generator

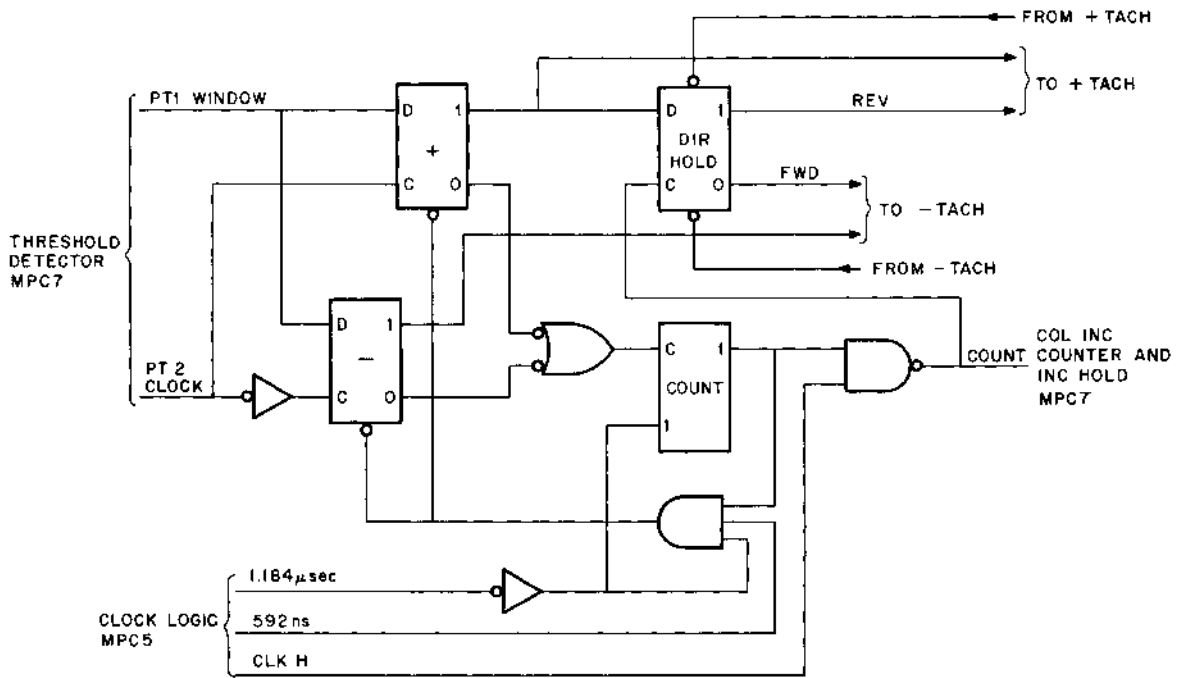
A simplified diagram for this logic is shown in Figure 4-31; timing is shown in Figure 4-30. When either the + or - flip-flop in the Encoder Signal Detector is set, increment data is stored in the COUNT flip-flop. At time state T2, the COUNT pulse is gated to the Column Increment (COL INC) Counter by CLK H. The negative-going edge of the COUNT pulse clocks the counter.

The COL INC Counter is a BCD counter which counts up if the COUNT pulses result from a positive increment and down if they result from a negative increment. Overflow from the counter is stored in the OVERFLOW flip-flop and gated to the SIGN and Carry/Borrow (C/B) flip-flops. At time state T1, the OVERFLOW flip-flop is cleared by the 1.184 μs pulse from MPC5. At time state T2, the OVERFLOW flip-flop is set by the OVERFLOW increment. At time state T3, the OVERFLOW pulse is gated to the SIGN flip-flop and the C/B flip-flop by the 592 ns pulse.



CP-1591

Figure 4-27 Encoder and Threshold Detector



CP-1586

Figure 4-28 Encoder Signal Detector

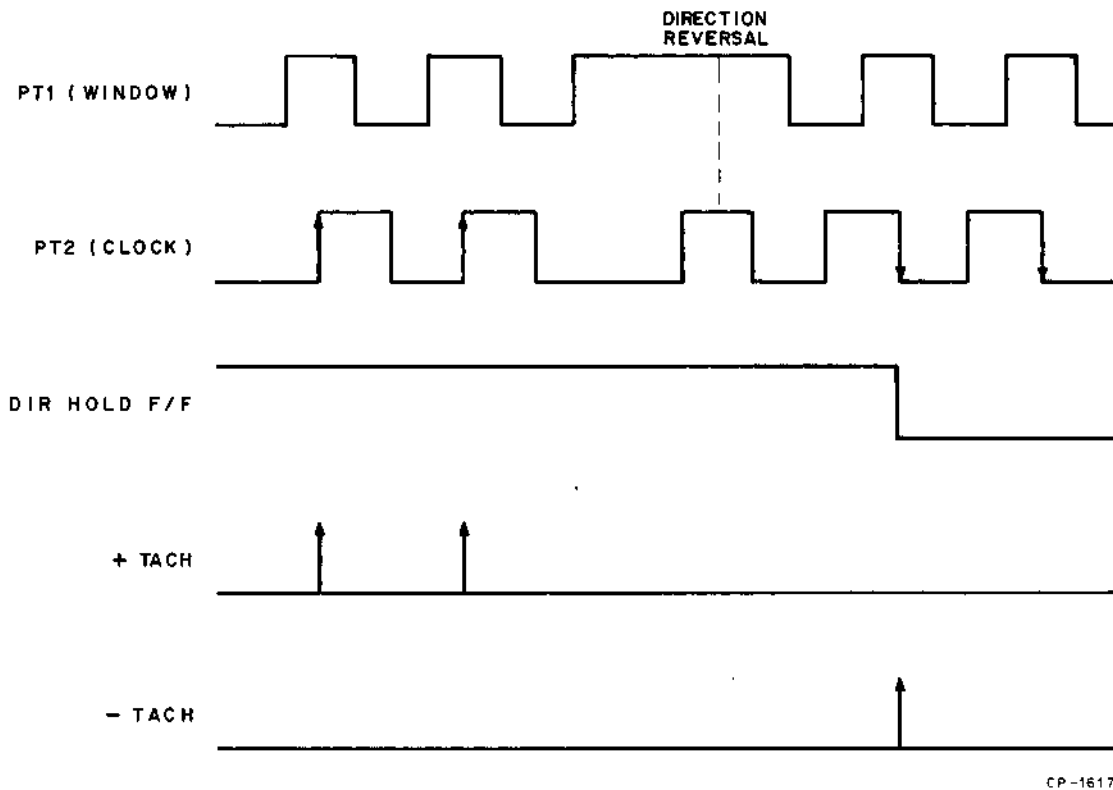


Figure 4-29 Increment Detection Timing

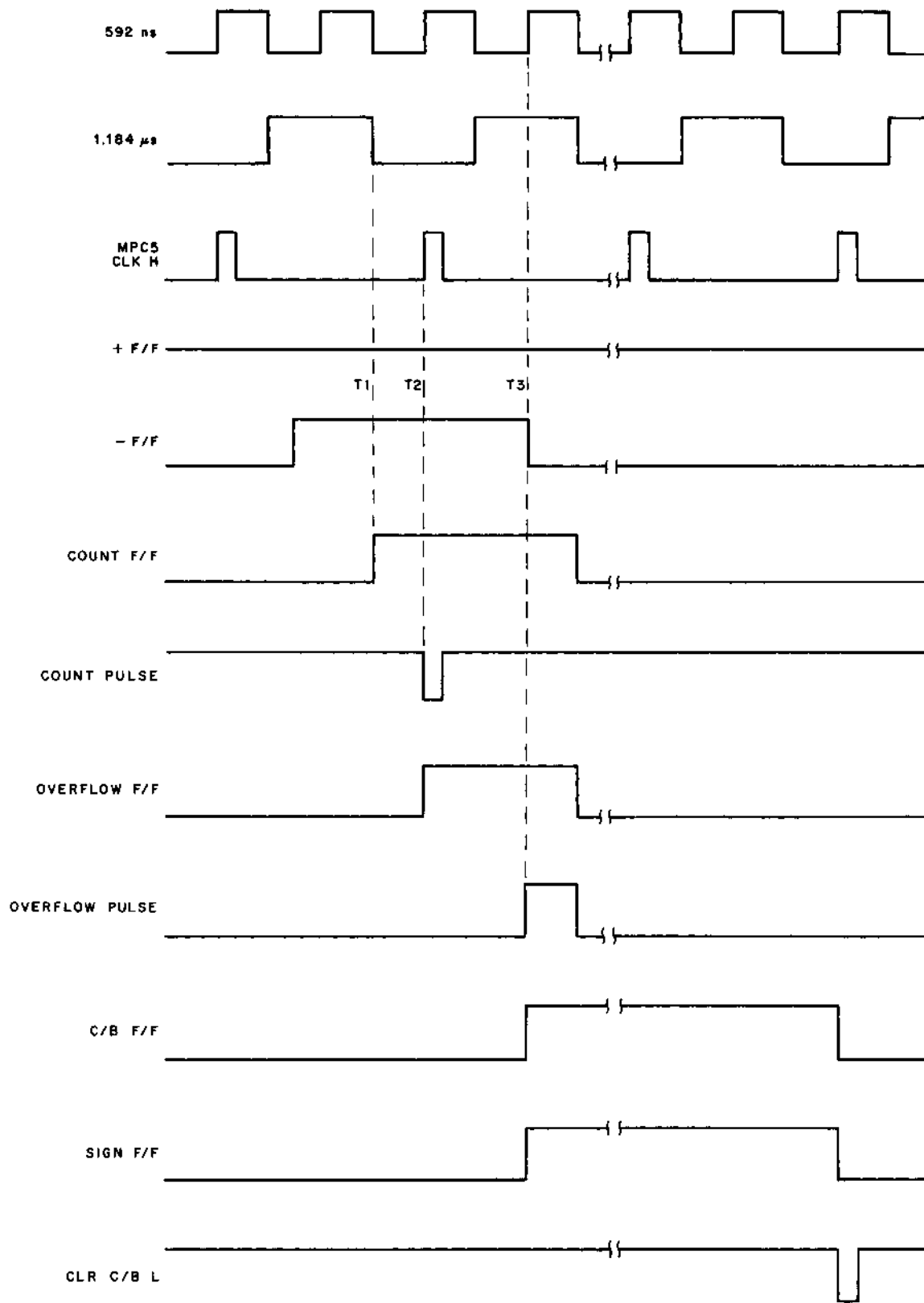
This toggles the C/B flip-flop to indicate that an overflow occurred. If the counter has just reached 9, the SIGN flip-flop is set to a 1 and a BORROW H is sent to the MPC. If the counter has just reached 0, the SIGN flip-flop is set to 0 and a CARRY H is sent to the MPC. The C/B and SIGN flip-flops are sampled by the MPC every 416 μ s and the C/B flip-flop is retoggled by CLR C/B after each sample is taken.

The CLR INIT command is issued by the MPC at the end of the INIT routine to set the COL INC Counter to 5 and clear the C/B flip-flop.

4.10 BELL SYSTEM

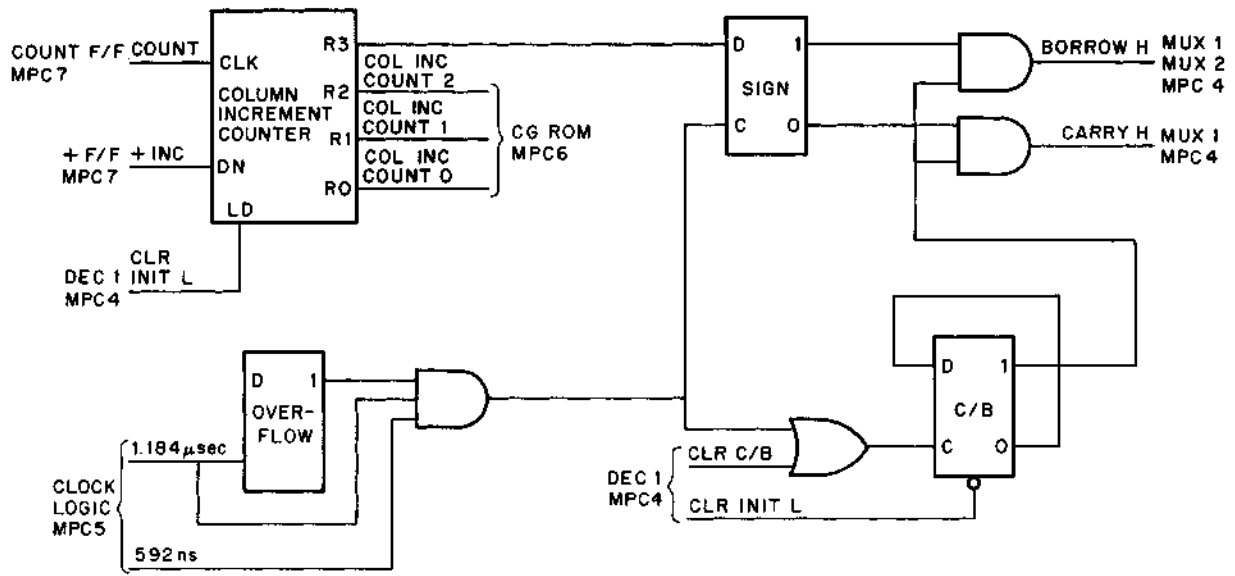
A simplified logic diagram of the Bell System is shown in Figure 4-32. Initially, the BELL HOLD flip-flop is cleared by W.U. from the wake-up circuit. When a bell is required, the BELL HOLD flip-flop is set by a SET BELL pulse from the DEC1. This gates a 2.4 kHz signal (208H) to the speaker via a transistor switch, (Q10) to produce an audible tone. The MPC controls the duration of the tone, by clocking the BELL HOLD flip-flop with the CLR BELL pulse at 100 ms intervals.

When the MPC is initialized or the print head passes the 132nd column, the KB HOLD flip-flop is set by a CLR KBH L pulse from DEC1. Each time a character is shifted into the UART, the KB HOLD flip-flop is clocked by EOC (End Of Character). When the print head passes the 64th column, the MPC checks KBH. If it is set, the MPC sends a SET BEL pulse to the BELL HOLD flip-flop.



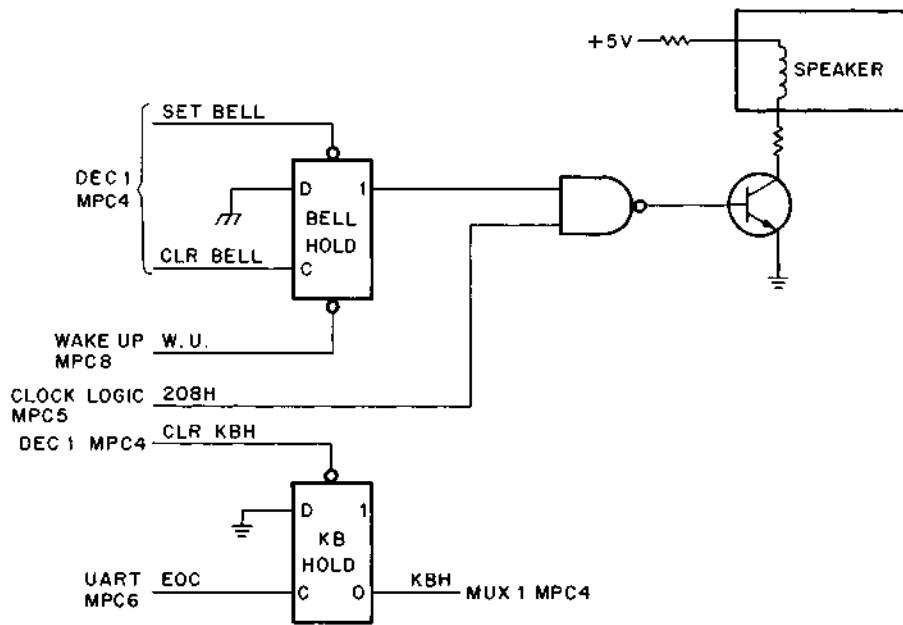
CP-1618

Figure 4-30 Encoder Signal Detector and Column Increment Counter Timing Diagram



CP-1587

Figure 4-31 Column Increment Counter and C/B Generator Logic



CP-1589

Figure 4-32 Bell System Logic

4.11 LINE FEED STEPPER SYSTEM

A simplified logic diagram of the Line Feed Stepper System is shown in Figure 4-33.

Four STEP commands and a HOLD command are issued by the MPC when a line feed is required. The STEP LF L command pulses are applied to the clock inputs of a Grey Code Counter and to the data input of the LF HOLD flip-flop. The SET HOLD L command pulse is applied to clear inputs of the counter and the set input of the LF HOLD flip-flop.

The relationship of these pulses is shown in Figure 4-34. At power up, W.U. sets the LF HOLD flip-flop, causing the LF amplifiers and the LF HOLD amplifier to apply a holding current to both phases of the LF stepping motor. W.U. also clears the counter.

When a line feed command sequence is issued by the MPC, the LF HOLD flip-flop is reset and the STEP LF pulses are decoded by the counter as shown in the truth table in Table 4-7. The LF HOLD, LF1 and LF2 amplifiers are turned on and off accordingly. Each change causes the stepping motor to advance 15° , providing four steps for each line advance and vertical spacing of 6 lines per inch. A complete line advance takes $33 \text{ ms} \pm 5\%$ nominal.

After the line advance is completed, another SET HOLD pulse is sent by the MPC and the LF HOLD flip-flop is set again. A 10 ms delay (typical) between line feeds allows the stepping motor to settle. The minimum settling time is 8.2 ms.

4.12 WAKE-UP CIRCUIT

The Wake-Up Circuit is shown on MPC8. This circuit is a time-delayed transistor switch that generates a 700 ms W.U. pulse. The W.U. pulse initializes the MPC logic before the MPC starts to run. W.U. pulse duration is dependent on the RC time constant of the resistor and capacitor across the +5 V power supply. During power up, the output transistor is turned on and W.U. is at logic level zero. After one time constant (approximately 700 ms), the output transistor is turned off, W.U. goes to logic level one and the MPC starts to run.

4.13 POWER SUPPLY AND REGULATOR

A block diagram of the Power Supply circuits is shown in Figure 4-35. The ac line voltage is stepped down by a transformer, rectified and filtered to produce +21 V, -21 V and +5 V.

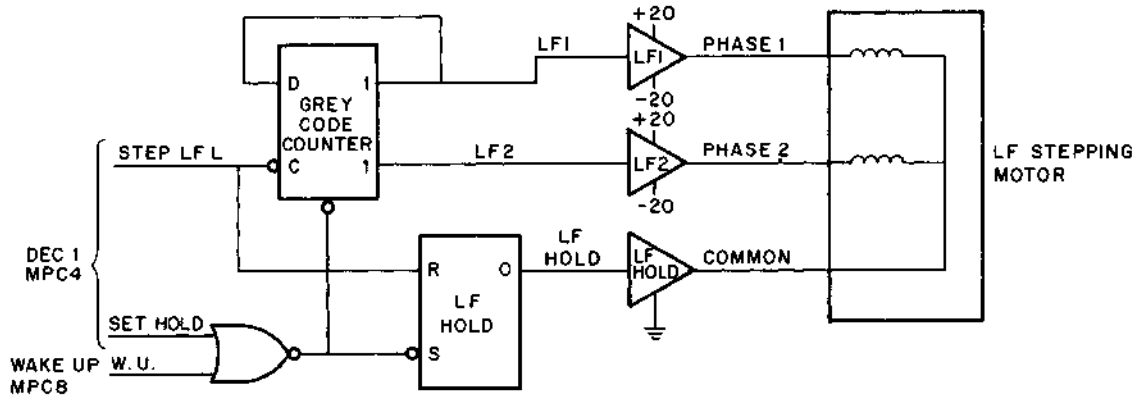
These voltages are regulated to produce +12 V $\pm 5\%$, -12 V $\pm 5\%$, +5 V $\pm 5\%$ and -9 V $\pm 5\%$.

4.14 PRINTER MECHANISM

The LA36 is an incremental impact printer that uses a 7-wire solenoid-activated print head which moves horizontally and prints characters in a 7×7 dot matrix. A fixed print bar is impacted by pressure on an inked ribbon traveling between the horizontally-moving print head and the paper. Figure 4-36 illustrates the printing principle used in the LA36. Seven individually selectable solenoids are mounted in a cluster on the Print Head Assembly. The armatures of the solenoids are fitted with long wires that function as the printing element by impacting the inked ribbon against the paper.

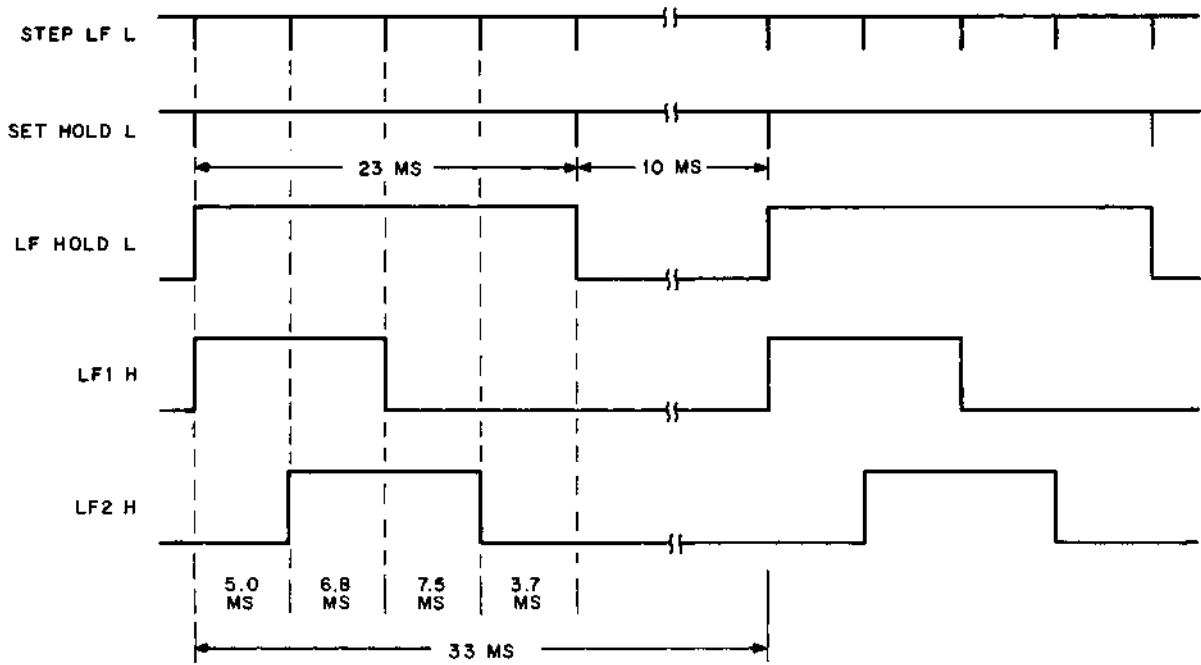
Each printed character is inscribed by positioning the print head at seven discrete horizontal positions as it traverses the paper. For each of the seven horizontal positions, a combination of solenoids is activated to produce a 7×7 dot image of the selected character.

The printer mechanism of the LA36 is made up of several functional subsystems: the Carriage Subsystem, the Ribbon Feed Subsystem, and the Paper Feed Subsystem.



CP-1588

Figure 4-33 Line Feed Stepper System



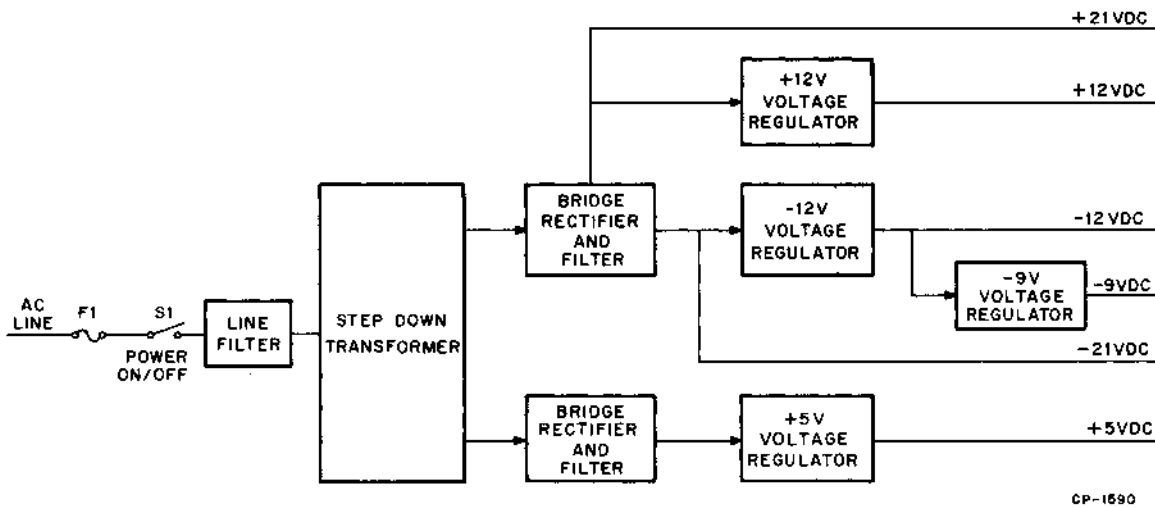
NOTE:
Not drawn to scale.

CP-1619

Figure 4-34 Line Feed Timing Diagram

Table 4-7
LF Pulse Truth Table

	LF2	LF1
Hold	0	0
Step LF	0	1
Step LF	1	1
Step LF	1	0
Step LF	0	0



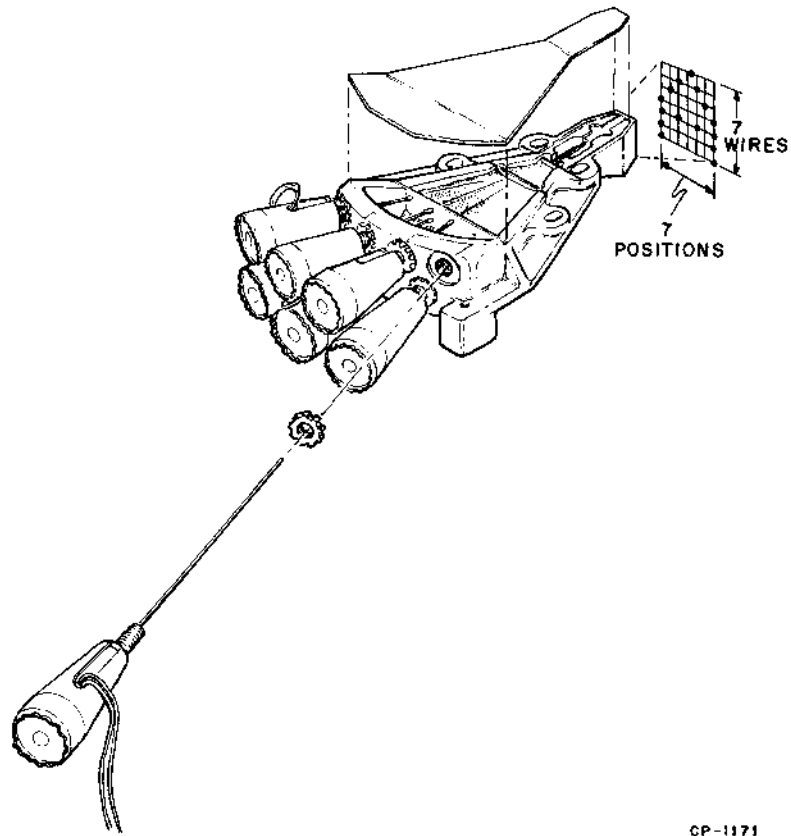
CP-1590

Figure 4-35 Power Supply Block Diagram

4.14.1 Carriage Subsystem

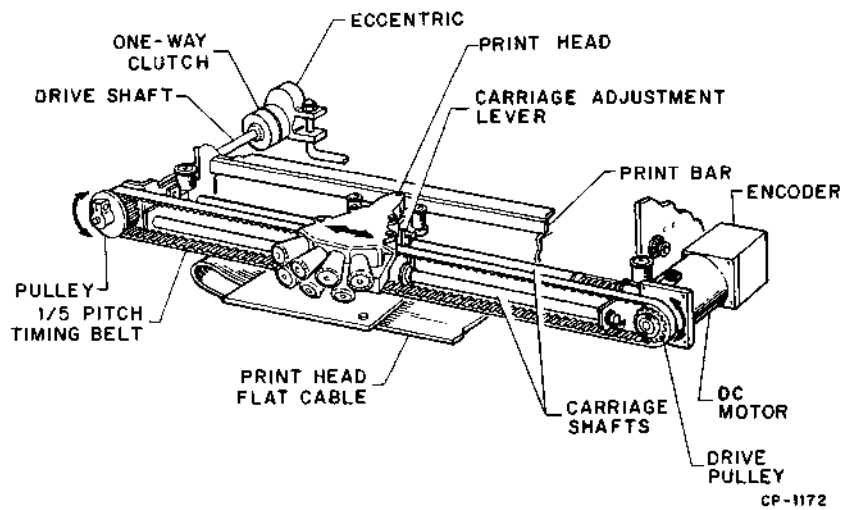
The Carriage Subsystem (Figure 4-37) includes the print head and the carriage which ride on the two support shafts that extend the full width of the printer mechanism. The carriage is driven by a timing belt which is held captive between the print head and the carriage and runs on a pulley at each end. The right-hand pulley is mounted on the dc servo motor, which provides the driving power for the carriage. The left-hand pulley is mounted on the ribbon drive shaft and transmits power to the Ribbon Feed Subsystem.

The carriage supports and positions the print head relative to the print bar and provides for adjustment of the paper gap by means of a detented adjustment lever on the right side of the carriage. Each detent position represents approximately 0.003 inch of gap and allows for a total of approximately 0.020 inch of paper gap.



CP-1171

Figure 4-36 LA36 Printing Principle



CP-1172

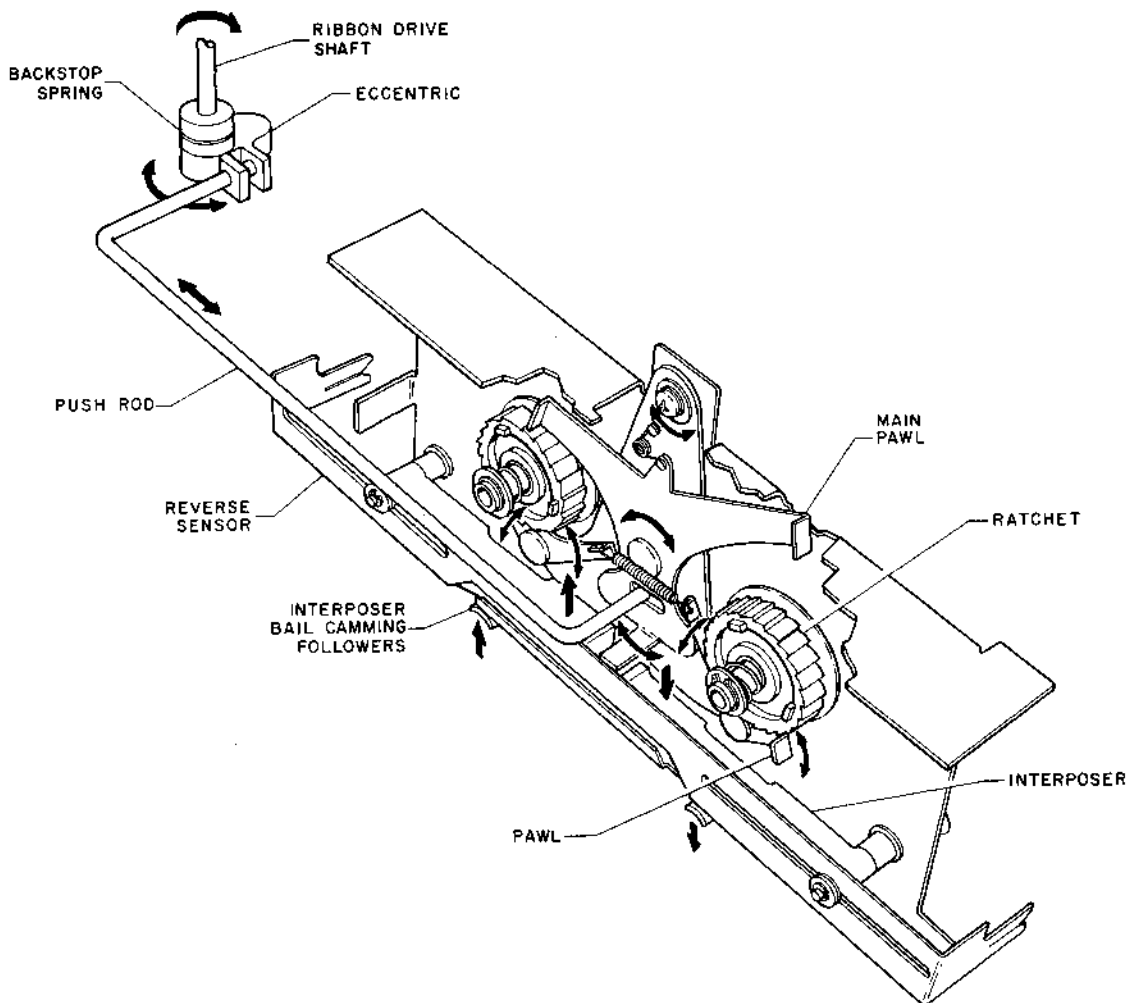
Figure 4-37 Carriage Subsystem

4.14.2 Ribbon Feed Subsystem

The Ribbon Feed Subsystem (Figure 4-38) consists of a ribbon drive and a ribbon reversal mechanism. The left-hand pulley, attached to the ribbon drive shaft, drives the ribbon feed through a one-way clutch/eccentric, a pushrod, and a ratchet/pawl mechanism. The one-way clutch allows for ribbon feed during the printing cycle and inhibits feed during the carriage return cycle. A brake on the one-way clutch allows the eccentric to turn in one direction only. The eccentric on the ribbon drive shaft translates rotary motion to linear motion and drives the ratchet/pawl by means of a pushrod. The ratchet/pawl mechanism translates linear motion to the rotary motion required to turn the ribbon reels. The main pawl and the upper pawls, due to their unique arrangement, alternately perform drive and backlash functions, depending upon the direction in which the pushrod is traveling. When shifted to the left or to the right by the rivet at the ends of the ribbon, the reverse sensor cams an interposer into the path of the tab on the main pawl. The blocking action of the interposer and the pivoting action of the ratchet base assembly shift the main pawl and engages the upper pawl in the opposite ratchet wheel.

Ribbon reversal is accomplished by carriage motion rather than by ribbon motion. This eliminates the possibility of carriage stalls due to excessive tension during the reversing action.

Constant ribbon tension is maintained by a friction disk on each ribbon reel.



CP-1175

Figure 4-38 Ribbon Feed Subsystem

4.14.3 Paper Feed Subsystem

The Paper Feed Subsystem (Figure 4-39) includes a stepping motor, a manual clutch, and two pin-fed tractors.

The stepping motor connects to the tractors through a 2:5 gear train and a square drive shaft. The driven gear on the square shaft is fitted with a manual clutch that uncouples the gear train from the square shaft when the line feed knob is axially depressed. This allows fine vertical adjustments when preprinted forms are used.

The stepping motor executes four steps for each line advance to ensure that the tractors will always initialize on an integral line when the machine is turned on.

The use of tractors permits flat surface feeding which eliminates interleaf slippage in multi-part forms and reduces hole distortion during paper feeding.

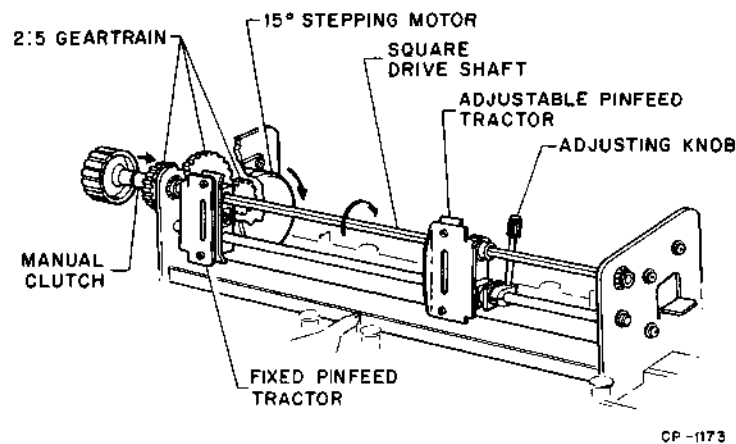


Figure 4-39 Paper Feed Subsystem

CHAPTER 5

ELECTRICAL SERVICING

5.1 ELECTRICAL TESTS

The test equipment required for the electrical tests is listed in Table 5-1. Equivalent test equipment may be substituted. Two kinds of tests are provided: off-line and on-line. No diagnostics are required to perform these tests. No waveforms are provided for the MPC section of the Logic Board because special test equipment is required for accurate measurement and interpretation. Theoretical timing data and program descriptions are provided in Chapter 4. All measurements are dc-coupled and referenced to ground unless otherwise stated. Waveforms are idealized. VOLTS/DIV setting applies to both Channel 1 and Channel 2 unless otherwise stated.

5.1.1 Off-Line Tests

The Off-Line Tests provide a means of obtaining test data in a stand-alone mode. All tests are performed with the LINE/LOCAL switch set to LOCAL and the BAUD RATE switch set to 110.

Remove the protective housing from the LA36 as directed in Section 5.2.1, Steps 1 and 2; lower the rear access door before performing any Off-Line Tests.

5.1.1.1 Encoder Signal Processing Test – The Encoder Signal Processing Test checks the open loop operation of the Threshold Detectors, Encoder Signal Detector, and the +/- TACH in the Carriage Servo System using test voltages to drive the servo motor.

NOTE

The Current Limiting Resistor shown in the test setup diagrams can be omitted, but caution should be exercised to prevent damage.

To check the circuits that drive the motor in the *positive* direction, perform Steps 1–6; to check the circuits that drive the motor in the *negative* direction, perform Steps 7–9.

NOTE

The voltages and time periods in the Carriage Servo System vary for different machines and line voltages. The values listed in Figures 5-3 – 5-12 are nominal and can only be used as troubleshooting guides.

1. Set the POWER ON/OFF switch to OFF.
2. Slip the drive belt from the pulley on the motor shaft. Release the tension on the timing belt by pressing the spring-loaded ribbon drive assembly.

**Table 5-1
Test Equipment and Special Tools**

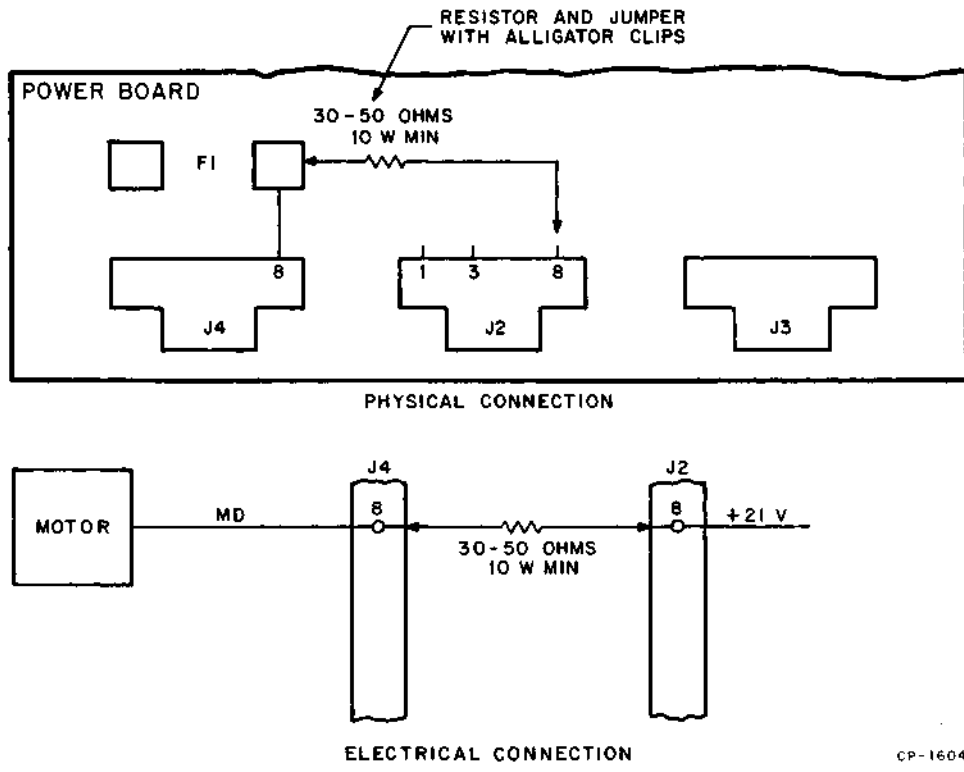
Equipment	Manufacturer	Designation
Multimeter	Triplett or Simpson	Model 630 NA or 620
Oscilloscope	Tektronix	Type 454 (or equivalent)
IC Clip	A.P. Inc.	24 pin DEC No. 29-19556 16 pin DEC No. 29-10246
X10 Probe	Tektronix	P 6010 (or equivalent)
Slip-on-Tip	Tektronix	013-0090-00 (or equivalent)
EZ Hook	Pomona Electronic	3925 (or equivalent)
Resistor	—	30 to 50 Ω , 10 W min.
Resistor	—	1000 Ω , 1/4 W min.

3. Remove the servo fuse (F1) from the Power Board.
4. Connect +21 V to the motor as shown in Figure 5-1.

CAUTION

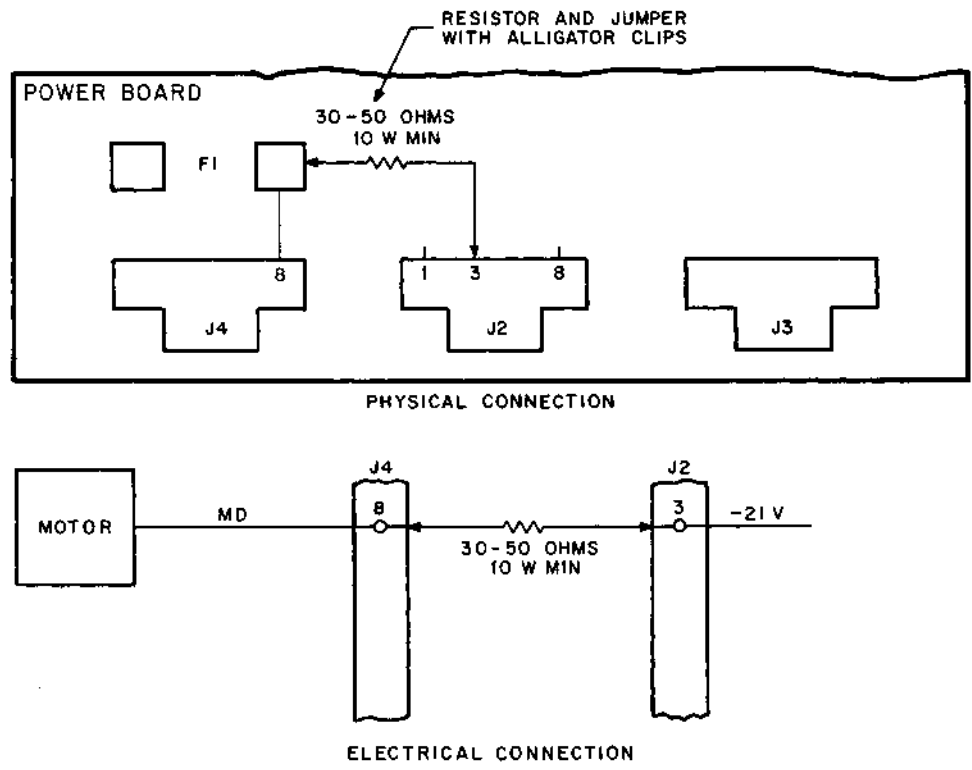
Power Board damage may result if the test voltage is connected improperly in Step 4.

5. Set POWER ON/OFF switch to ON. The motor should rotate in the positive direction (clockwise as viewed from the front of the LA36).
6. Check the waveforms at the test points shown in Figures 5-3 – 5-8.
7. Set POWER ON/OFF switch to OFF and connect 21 V to the motor as shown in Figure 5-2.
8. Repeat Step 5. The motor should rotate in the negative direction (counterclockwise).
9. Check the waveforms at the test points shown in Figures 5-11 – 5-12.
10. Disconnect the test setup and reinstall the drive belt and the servo fuse (F1).



CP-1604

Figure 5-1 Encoder +21 V Test Setup



CP-1605

Figure 5-2 Encoder -21 V Test Setup

5.1.1.2 Servo Speed Test – The Servo Speed Test checks the closed loop operation of the Servo Amplifier, Sum Amplifier, Summing Network, and Column Increment Counter in the Carriage Servo System in the Initialize mode. To check the negative feedback logic and the Carry/Borrow Logic, perform Steps 1–4. The motor runs in reverse at a speed of 6 in./sec. To check the positive feedback logic and the Carry/Borrow Generator, perform Steps 1–3 and Steps 5 and 6. The motor runs forward at a speed of 6 in./sec.

1. Set the ON/OFF switch to OFF.
2. Push the left drive pulley to the right to release the tension on the drive belt; slip the belt from the right drive pulley.
3. Set the ON/OFF switch to ON.
4. Check the waveforms at the test points indicated in Figures 5-13 – 5-20.
5. Jumper the base of Q3 to ground. This causes the servo motor to reverse direction and run at 6 in./sec.
6. Check the waveforms at the test points indicated in Figures 5-21 – 5-26.

NOTE

Voltages and time periods in the Carriage Servo System vary for different machines and line voltages. The values listed in Figures 5-13 – 5-20 are nominal and can only be used as troubleshooting guides.

7. Reinstall the drive belt and remove the jumper from the base of Q3.

5.1.1.3 LF Stepping Test – This test causes the LF stepping motor to run continuously. It generates signals to test the Grey Code Counter, both channels of the amplifier and the LF HOLD circuit.

1. Press the LF key and the REPEAT key at the same time to get a sequence of line feeds.
2. Check the waveforms at the test points shown in Figures 5-27 through 5-33.

5.1.1.4 Bell Test – This test drives the Bell System logic, providing the signals required to trace the circuit.

1. Hold down the CTRL key and press the BELL key and the REPEAT key.
2. Check the waveforms at the test points indicated in Figures 5-34 and 5-35.

NOTE

Voltage measurements at J5-2 taken with W1 jumper inserted.

3. Press the RETURN and REPEAT keys and check the waveforms at the test points indicated in 5-36.

5.1.1.5 Printable Character Test – This test checks the operation of the Printer Logic in the LOCAL mode. Various printing characters are used to provide test data that can be easily interpreted. The / (slash) character generates a single dot in each column. The U and * characters generate complementary ASCII codes that test every bit on the lines between the keyboard, the UART, the Character Buffer and the CG ROM. Sixteen characters are used to create a buffer full condition.

1. Press the / (slash) key and the REPEAT key to get a series of printing characters that have one dot in every column.

2. Check the waveforms at the test points listed in Figures 5-37 – 5-47.
3. Press the SHIFT LOCK key and strike the U key 16 times to fill the Character Buffer. Check the test points for the U character, one at a time as follows:

Test Point M7722	Character		Test Point M7722	Character	
	U	*		U	*
E55-26 and E56-4	1	0	E28-18	0	1
E55-27 and E56-6	0	1	E28-17	1	0
E55-28 and E56-10	1	0	E28-16	0	1
E55-29 and E56-12	0	1	E28-15	1	0
E55-30 and E60-4	1	0	E28-14	0	1
E55-31 and E60-6	0	1	E28-13	1	0
E55-32 and E60-10	1	0	E28-12	0	1

4. Press the SHIFT LOCK key and strike the * key 16 times to fill the Character Buffer. Check the test points for the * character one at a time as shown above.

5.1.1.6 Clock Test – The Clock Test checks all clock frequencies and time periods in the Initialize mode.

1. Set the ON/OFF switch to ON.
2. Check the waveforms at the test points indicated in Figures 5-48 – 5-55.

5.1.2 On-Line Tests

The On-Line Tests provide a means of obtaining test data in a simulated on-line mode. All tests are performed with the LINE/LOCAL switch set to LINE. Remove the protective housing from the LA36 as directed in Section 5.2.1, Steps 1 and 2 and lower the rear access door before performing any On-Line Tests.

5.1.2.1 Current Loop Interface – The Current Loop Interface Test checks the operation of the 20 mA current loops (transmit and receive) for the standard configuration. On-line operation is simulated by connecting the transmit and receive loops back-to-back through a Current Limiting Resistor.

1. Set the ON/OFF switch to OFF.
2. Connect the transmit and receive loops back-to-back as shown in Figure 5-56.
3. Set the POWER ON/OFF switch to ON.
4. Set the BAUD RATE switch to 300.

5. Press the SHIFT LOCK key, the) (close parenthesis) key and the REPEAT key to get a series of printing characters that have one dot in every row.
6. Check the waveforms at the test points listed in Figures 5-57 – 5-58.
7. Press the SHIFT LOCK key; hold down the U key and the REPEAT key and check the test points for the character U, one at a time.

Test Point M7722	Character		Test Point M7722	Character	
	U	*		U	*
E55–26 and E56–4	1	0	E28–18	0	1
E55–27 and E56–6	0	1	E28–17	1	0
E55–28 and E56–10	1	0	E28–16	0	1
E55–29 and E56–12	0	1	E28–15	1	0
E55–30 and E60–4	1	0	E28–14	0	1
E55–31 and E60–6	0	1	E28–13	1	0
E55–32 and E60–10	1	0	E28–12	0	1

8. Press the SHIFT LOCK key; hold down the * key; the REPEAT key and check the test points for the * character, one at a time.
9. Check the frequency at M7722 E55–40 for each position of the BAUD RATE switch:

Position	Frequency
300	4.8 kHz
150	2.4 kHz
110	1.76 kHz

The time periods should be the same as the corresponding Clock Logic signals (Figures 5-53 and 5-54).

5.1.2.2 Serial Line Interface – The Serial Line Interface Test checks the operation of the serial input and serial output and mode selection logic for the standard configuration. On-line operation is simulated by connecting the transmit and receive logic back-to-back through a jumper.

1. Set the ON/OFF switch to OFF.
2. Connect the transmit and receive loops back-to-back as shown in Figure 5-59.

3. Set the POWER ON/OFF switch to ON.
4. Set the BAUD RATE switch to 300.
5. Press the SHIFT LOCK key and the) (close parenthesis) key and the REPEAT key to get a series of printing characters that have one dot in every row.
6. Check the waveforms at the test points listed in Figure 5-60.
7. Press the SHIFT LOCK key; hold down the U key and the REPEAT key and check the test points for the character U, one at a time.

Test Point M7722	Character		Test Point M7722	Character	
	U	*		U	*
E55-26 and E56-4	1	0	E28-18	0	1
E55-27 and E56-6	0	1	E28-17	1	0
E55-28 and E56-10	1	0	E28-16	0	1
E55-29 and E56-12	0	1	E28-15	1	0
E55-30 and E60-4	1	0	E28-14	0	1
E55-31 and E60-6	0	1	E28-13	1	0
E55-32 and E60-10	1	0	E28-12	0	1

8. Press the SHIFT LOCK key; hold down the * key; the REPEAT key and check the test points for the * character, one at a time.

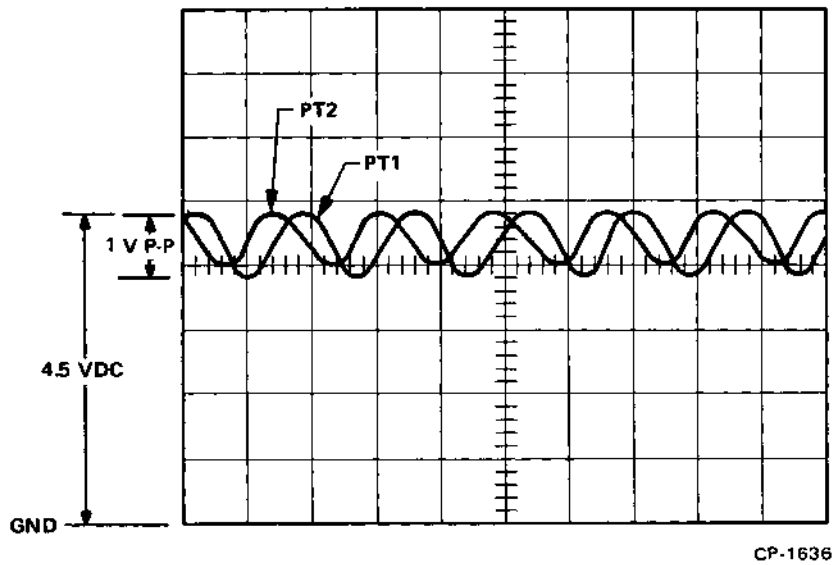
5.1.3 Troubleshooting Charts

The Troubleshooting Chart in Table 5-2 lists the common trouble symptoms that could be observed during installation checkout or during normal operation of the LA36. If no symptom is given with the machine servicing request, perform the installation checkout procedure in Section 2.5 to determine the status of the machine. This procedure and the Troubleshooting Chart are cross-referenced to aid in diagnosing problems. Appropriate paragraphs and figures in this manual are referenced to provide additional information needed to isolate defective components and realign, adjust, or replace assemblies. Replaceable assemblies are: Printer Mechanism, Print Head, Keyboard, Numeric Pad, Logic Board and Power Board. (Chassis-mounted parts are also replaceable.)

The MPC section of the Logic Board is not listed as a probable cause because it is quite difficult to field test this section correctly without special test equipment. Replace the Logic Board whenever an MPC fault is suspected. *Do not attempt to replace components on the Logic Board, Power Board, or Keyboard.*

Check all fuses and power supply voltages before beginning to troubleshoot. Fuse locations are shown in the Illustrated Parts Breakdown (Chapter 8). Power supply voltages are shown in Table 5-3 and in Figures 5-61 and 5-62. Voltage measurements are referenced to ground unless otherwise indicated.

START OF ENCODER SIGNAL PROCESSING TEST WAVEFORMS



SCOPE SETUP

VOLTS/DIV: 1 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: VARIABLE—
APPROX.
75 μs/DIV

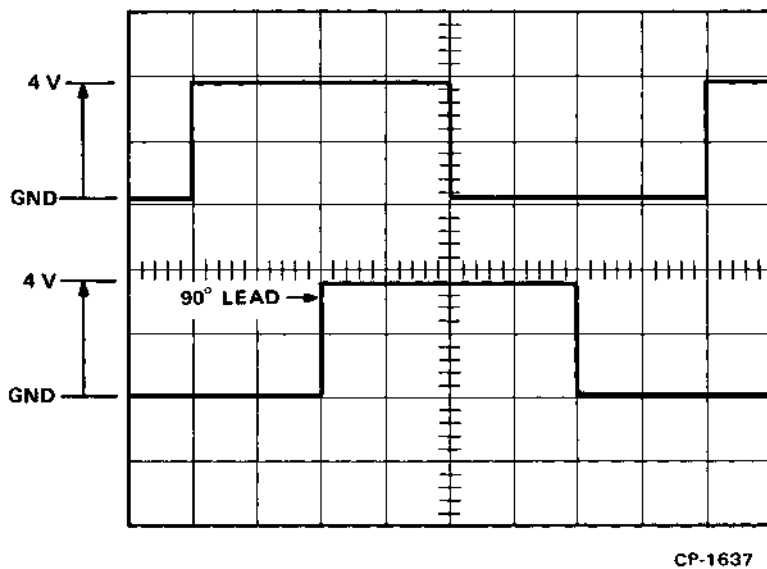
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC,
INT, POS

CH1 to +PT1 at Power Board J4-5

CH2 to +PT2 at Power Board J4-6

Figure 5-3 +PT1 and +PT2 Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 μs

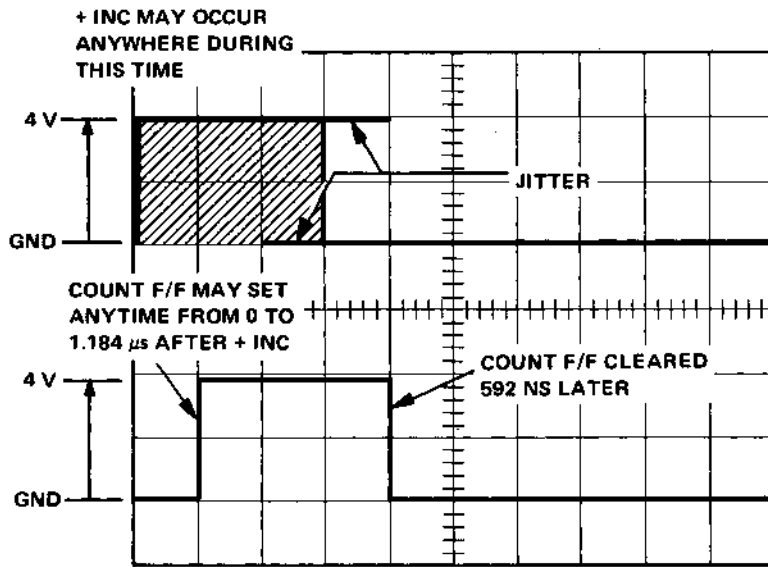
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to +PT1 at M7722 TP1 (E6-8)

CH2 to +PT2 at M7722 TP2 (E6-6)

Figure 5-4 +PT1 and +PT2 Schmidt Waveforms



CP-1638

SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 500 ns

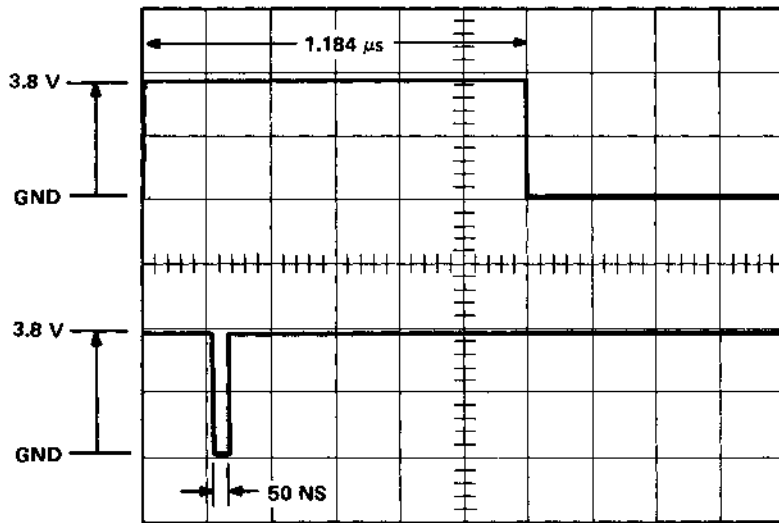
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, INT, POS

CH1 to +INC at M7722 E8-9

CH2 to COUNT at M7722 E4-9

Figure 5-5 +INC and COUNT Flip-Flop Waveforms



CP-1639

SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 ns

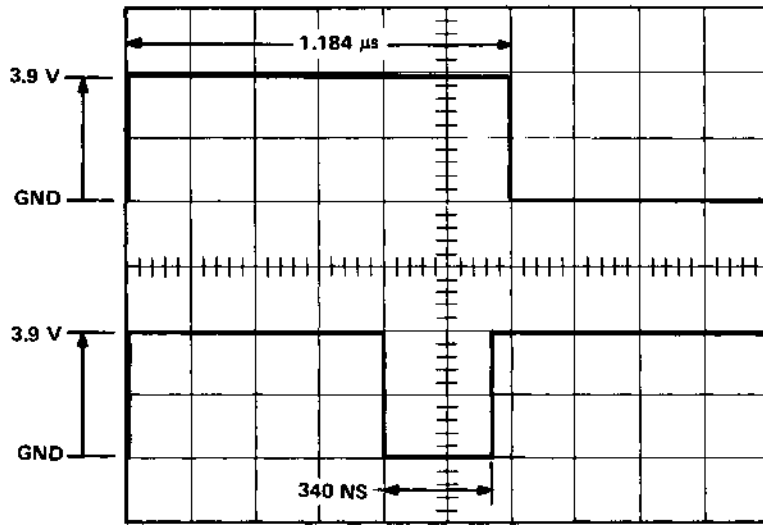
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, INT, POS

CH1 to COUNT F/F at M7722 E4-9

CH2 to COUNT Pulse at M7722 E29-8

Figure 5-6 COUNT Flip-Flop and COUNT Pulse Waveforms

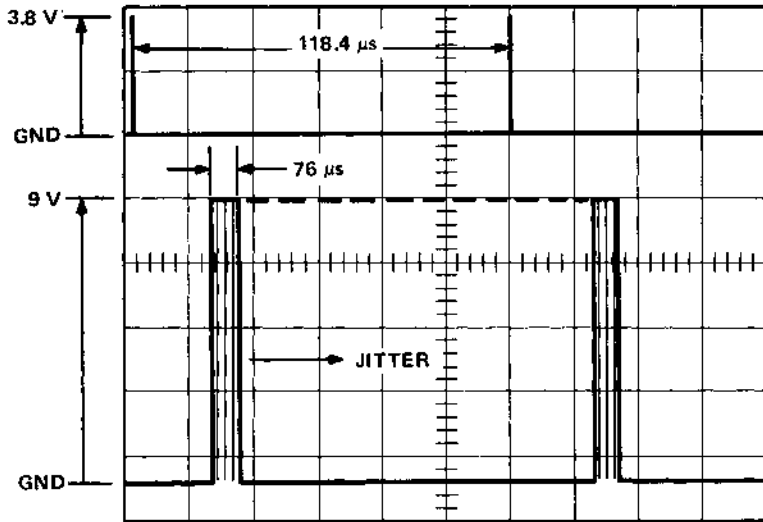


CP-1640

SCOPE SETUP

VOLTS/DIV: 2 V
VERTICAL MODE: ALT
HORIZ DISPLAY: A
TIME/DIV: 200 ns
TRIG MODE: NORMAL
TRIG SOURCE: CH1, AC, INT, POS
CH1 to COUNT F/F at M7722 E4-9
CH2 to CLR +/- F/F at M7722 E9-6

Figure 5-7 COUNT Flip-Flop and CLR ± Flip-Flop Waveforms

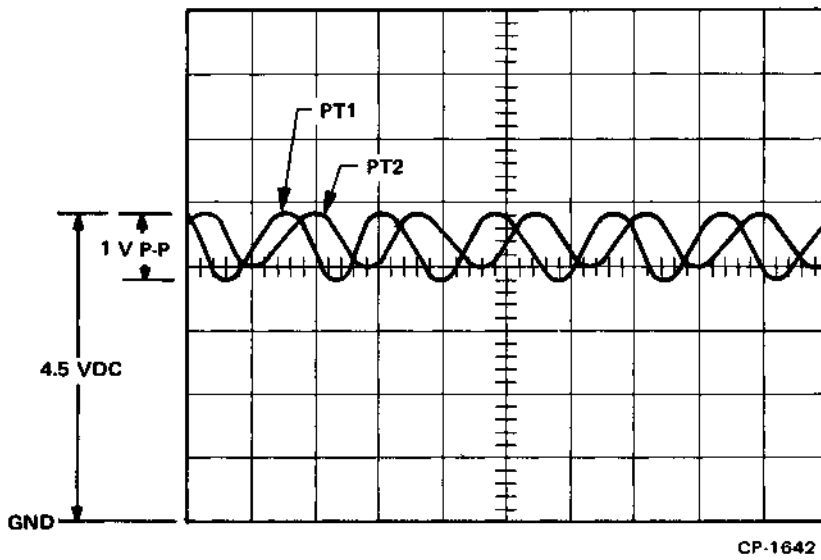


CP-1641

SCOPE SETUP

VOLTS/DIV: 2 V
VERTICAL MODE: ALT
HORIZ DISPLAY: A
TIME/DIV: 20 μs
TRIG MODE: NORMAL
TRIG SOURCE: CH1, AC, INT, POS
CH1 to +INC at M7722 E8-9
CH2 to +TACH at M7722 Q11-C

Figure 5-8 +INC and +TACH Waveforms



SCOPE SETUP

VOLTS/DIV: 1 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: VARIABLE—
APPROX.
75 μ s

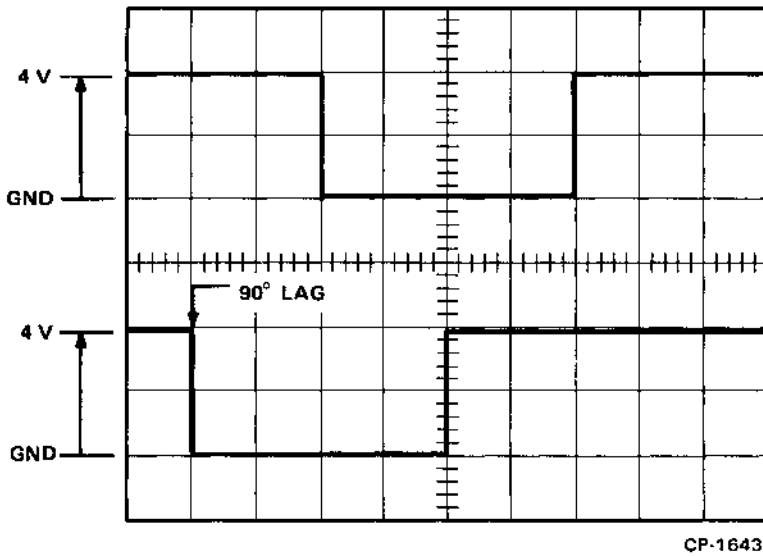
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC,
INT, POS

CH1 to PT1 at Power Board J4-5

CH2 to PT2 at Power Board J4-6

Figure 5-9 -PT1 and -PT2 Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

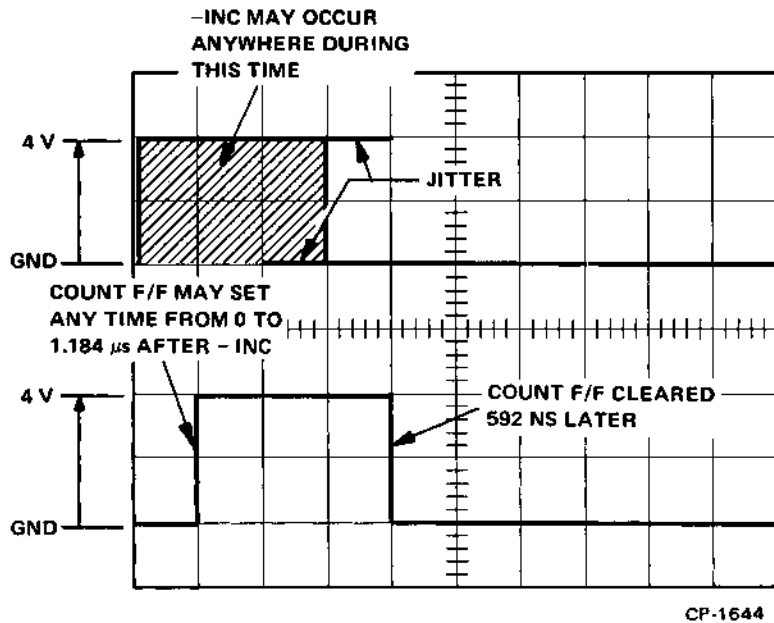
TIME/DIV: 10 μ s

TRIG SOURCE: CH1, AC, POS, INT

CH1 to -PT1 at M7722 TP1 (E6-8)

CH2 to -PT2 at M7722 TP2 (E6-6)

Figure 5-10 -PT1 and -PT2 Schmidt Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 500 ns

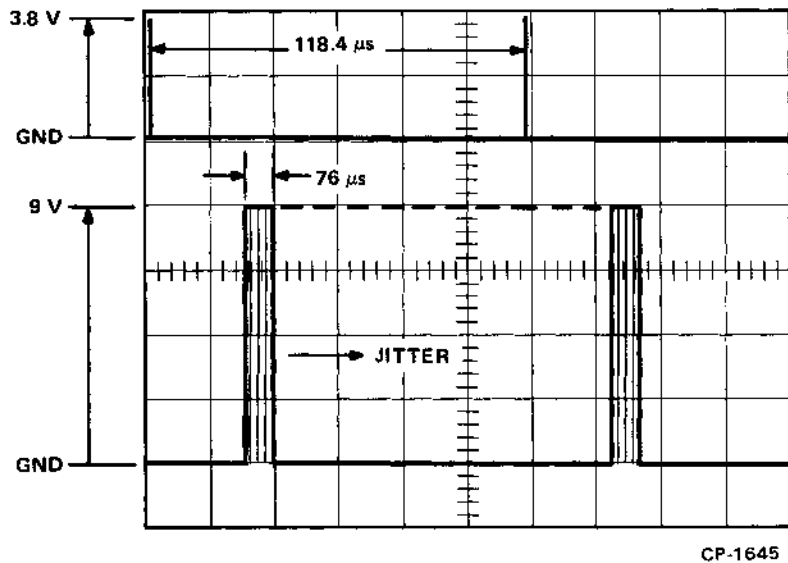
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, INT, POS

CH1 to -INC at M7722 E8-5

CH2 to COUNT at M7722 E4-9

Figure 5-11 -INC and COUNT Flip-Flop Waveforms



SCOPE SETUP

VOLTS/DIV: CH1=2 V; CH2=5 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 20 μ s

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, INT, POS

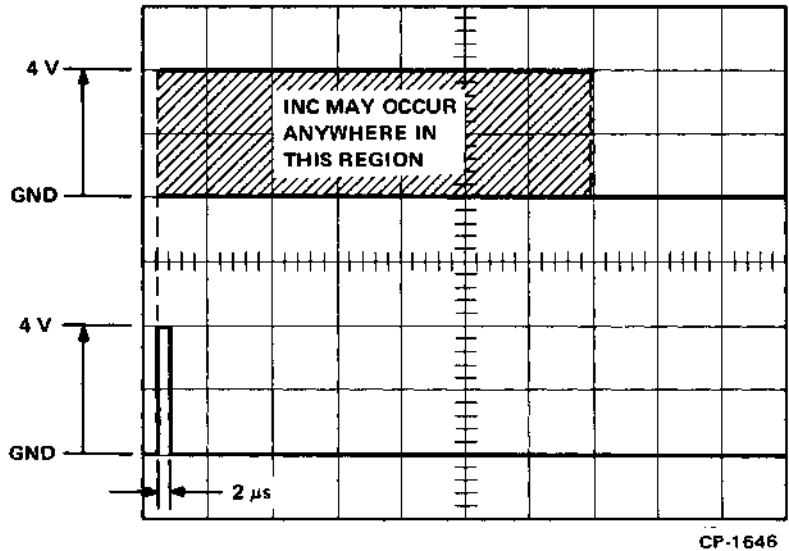
CH1 to -INC at M7722 E8-5

CH2 to -TACH at M7722 Q12-C

Figure 5-12 -INC and -TACH Waveforms

END OF ENCODER SIGNAL PROCESSING TEST WAVEFORMS

START OF SERVO SPEED TEST WAVEFORMS



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 μ s

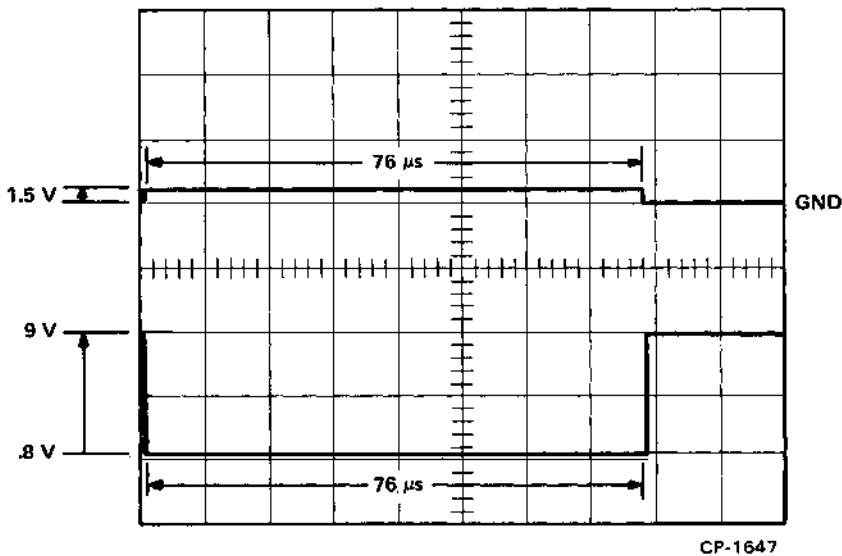
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to INC at M7722 E5-9

CH2 to 76 μ s CLOCK at M7722 E5-11

Figure 5-13 - INC and 76 μ s CLOCK Waveforms



SCOPE SETUP

VOLTS/DIV: 5 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 μ s

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to TACH at M7722 Q12-B

CH2 to TACH at M7722 Q12-C

Figure 5-14 - TACH Waveforms at Q12-B and Q12-C

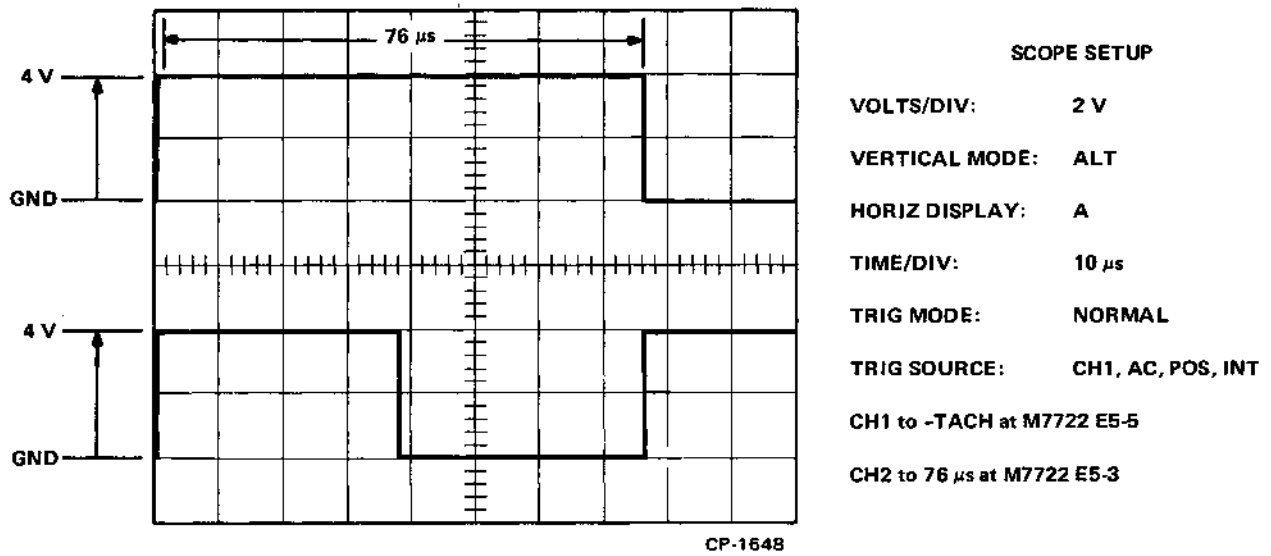


Figure 5-15 -TACH and 76 μ s Waveforms

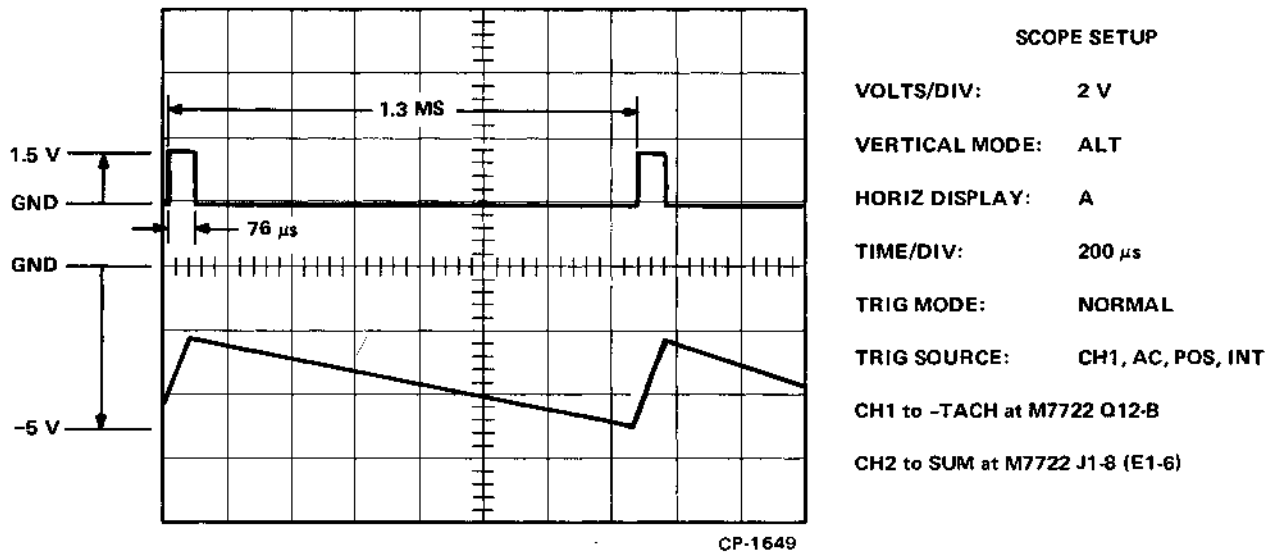
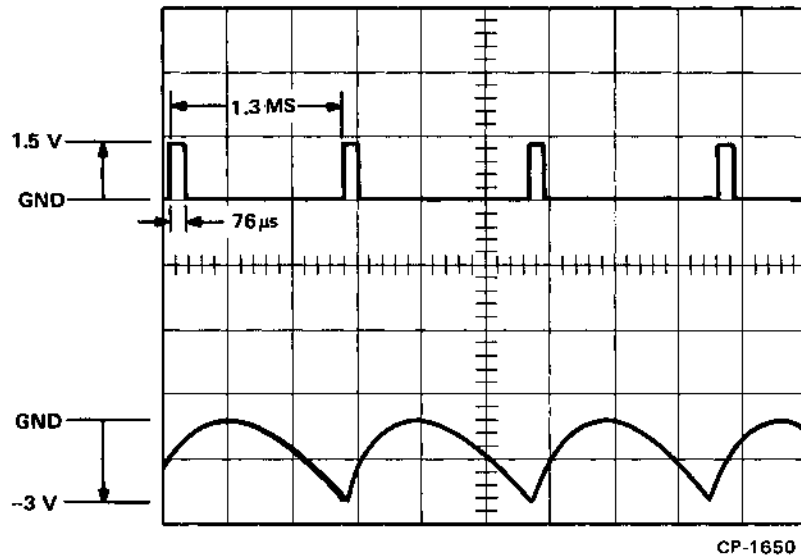


Figure 5-16 -TACH Waveform and SUM Waveform at J1-B



SCOPE SETUP

VOLTS/DIV: CH1=2 V; CH2=5 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 500 μs

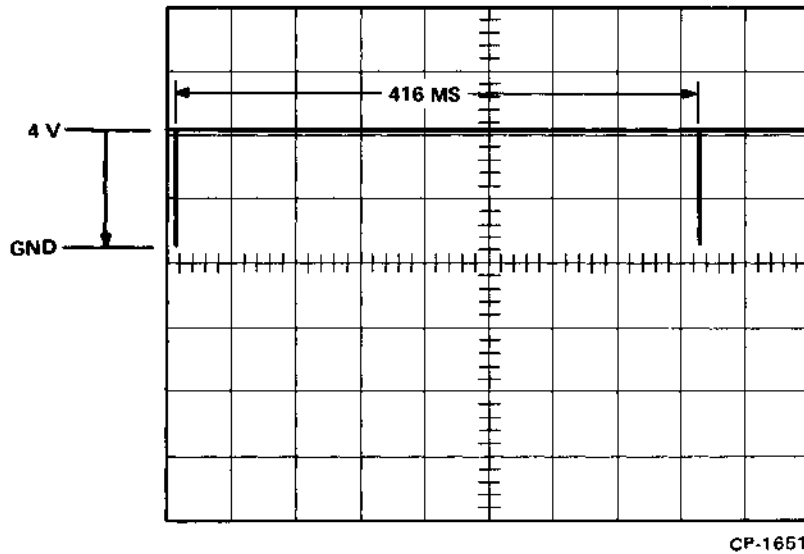
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to -TACH at M7722 Q12-B

CH2 to MD at Power Board J4-8

Figure 5-17 -TACH and MD Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: CH 1

HORIZ DISPLAY: A

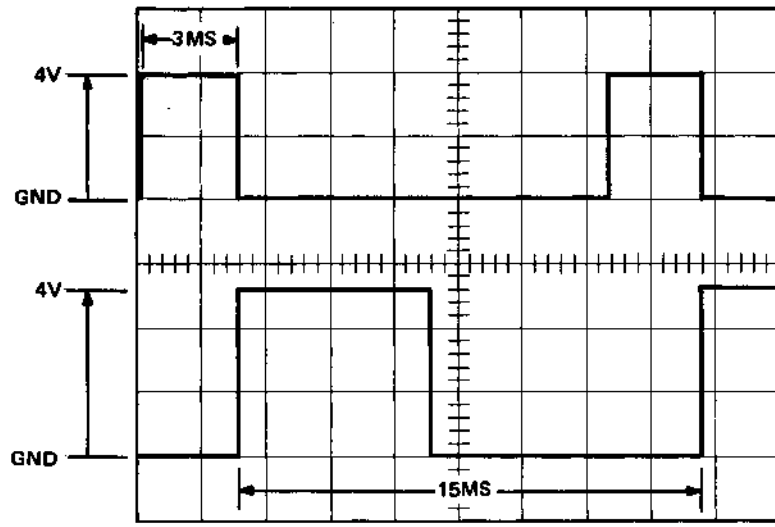
TIME/DIV: 50 ms

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

CH1 to INC at M7722 E30-9

Figure 5-18 INC Waveform



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 2 ms

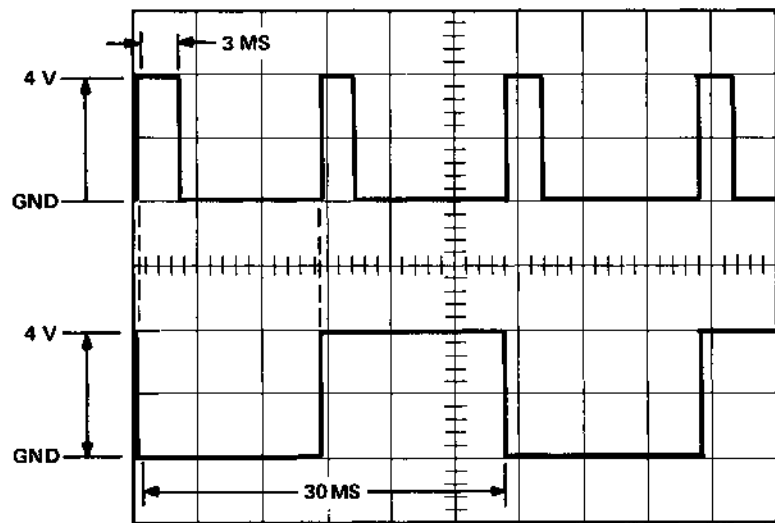
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to COL INC COUNT (MSB) at M7722 E16-7

CH2 to COL INC COUNT 2 at M7722 E16-6

Figure 5-19 COL INC COUNT 3 (MSB) and COL INC COUNT 2 Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 5 ms

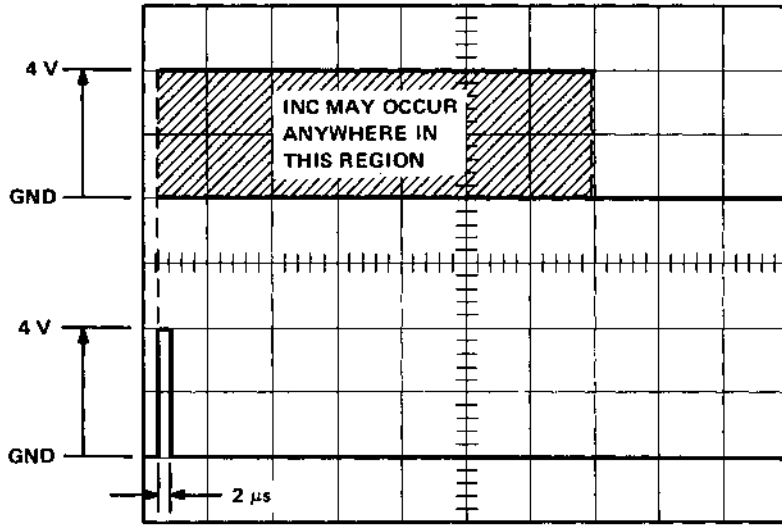
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to COL INC COUNT 3 (MSB) at M7722 E16-7

CH2 to BORROW H at M7722 E12-3

Figure 5-20 COL INC COUNT 3 (MSB) and BORROW H Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 μ s

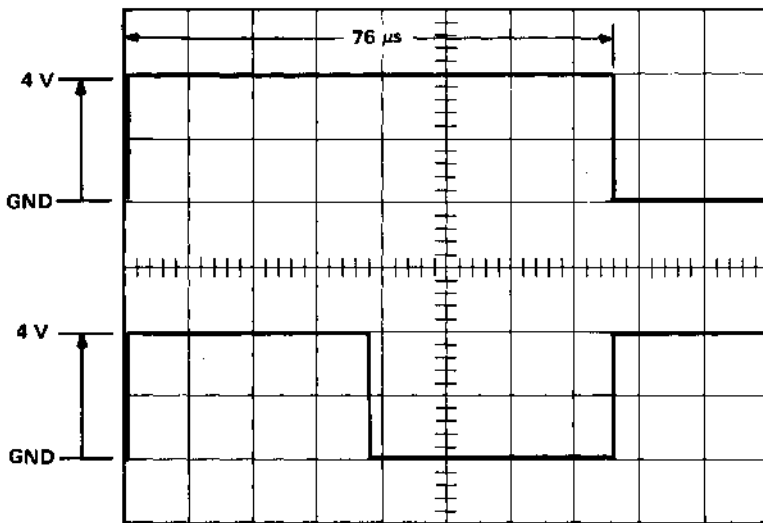
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to +INC at M7722 E3-9

CH2 to -76 μ s CLOCK at M7722 E3-11

Figure 5-21 +INC and 76 μ s Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 μ s

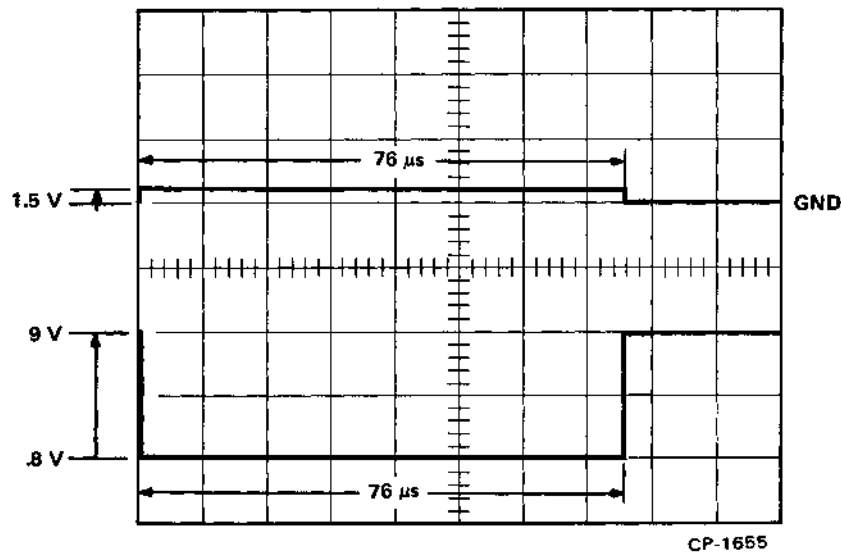
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to +TACH at M7722 E3-5

CH2 to 76 μ s at M7722 E3-3

Figure 5-22 +TACH and 76 μ s Waveforms



SCOPE SETUP

VOLTS/DIV: CH1=5 V;
CH2=5 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 μs

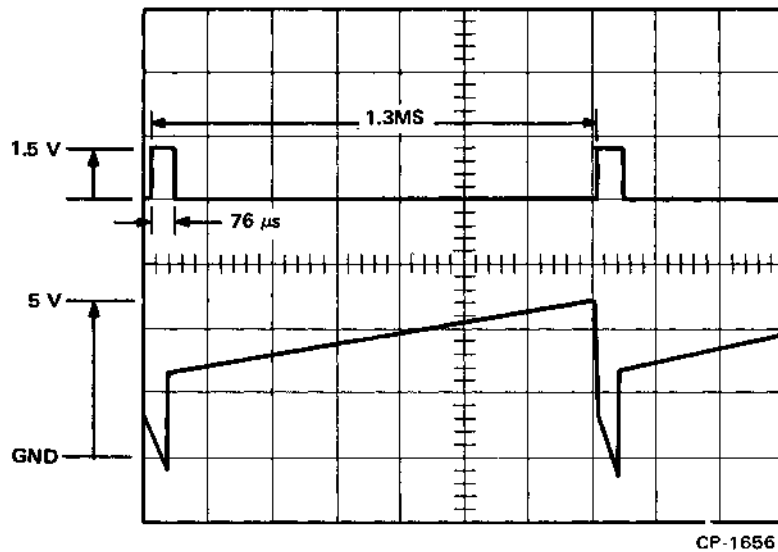
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC,
POS, INT

CH1 to +TACH at M7722 Q11-B

CH2 to +TACH at M7722 Q11-C

Figure S-23 +TACH Waveforms at Q11-B and Q11-C.



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 μs

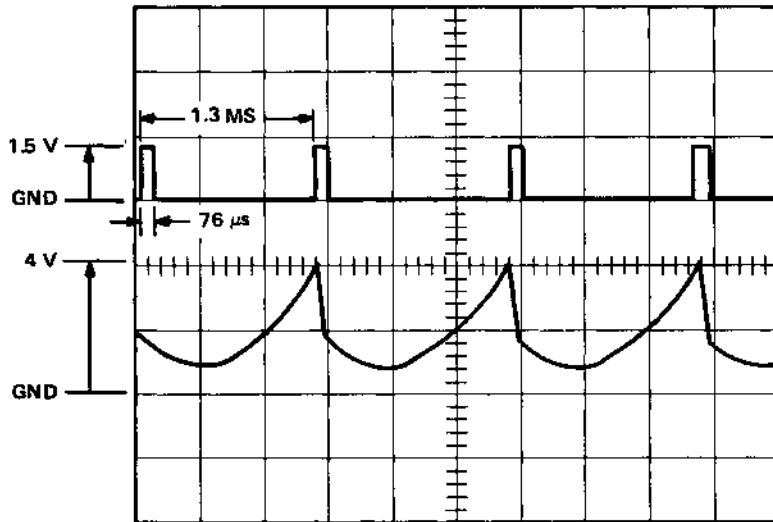
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to +TACH at M7722 Q11-B

CH2 to SUM at J1-B (E1-6)

Figure S-24 +TACH and SUM Waveforms

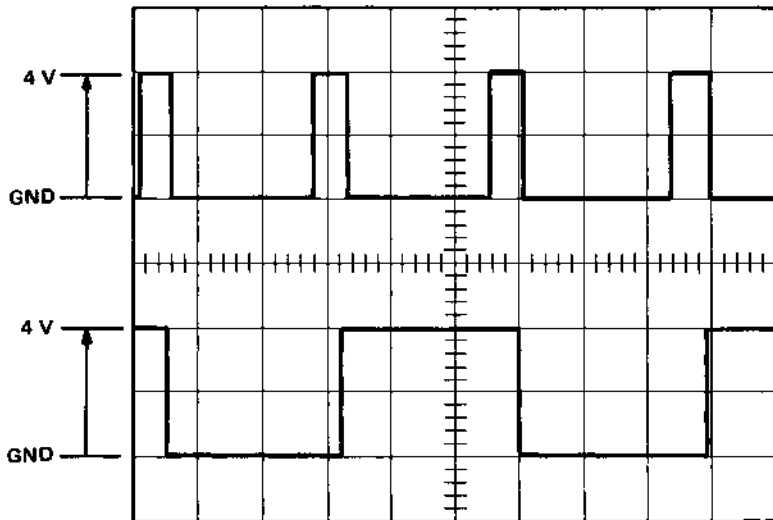


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Figure 5-25 +TACH and MD Waveforms

SCOPE SETUP

VOLTS/DIV: 2 V
 VERTICAL MODE: ALT
 HORIZ DISPLAY: A
 TIME/DIV: 500 μs
 TRIG MODE: NORMAL
 TRIG SOURCE: CH1, AC, POS, INT
 CH1 to +TACH at M7722 Q11-B
 CH2 to MD at J4-8



CP-1658

Figure 5-26 COL INC COUNT 3 (MSB) and CARRY H Waveforms

SCOPE SETUP

VOLTS/DIV: 2 V
 VERTICAL MODE: ALT
 HORIZ DISPLAY: A
 TIME/DIV: 5 ms
 TRIG MODE: NORMAL
 TRIG SOURCE: CH1, AC, POS, INT
 CH1 to COL INC COUNT 3 (MSB) at M7722 E16-7
 CH2 to CARRY H at M7722 E7-6

END OF SERVO SPEED TEST WAVEFORMS

START OF LF STEPPING TEST WAVEFORMS

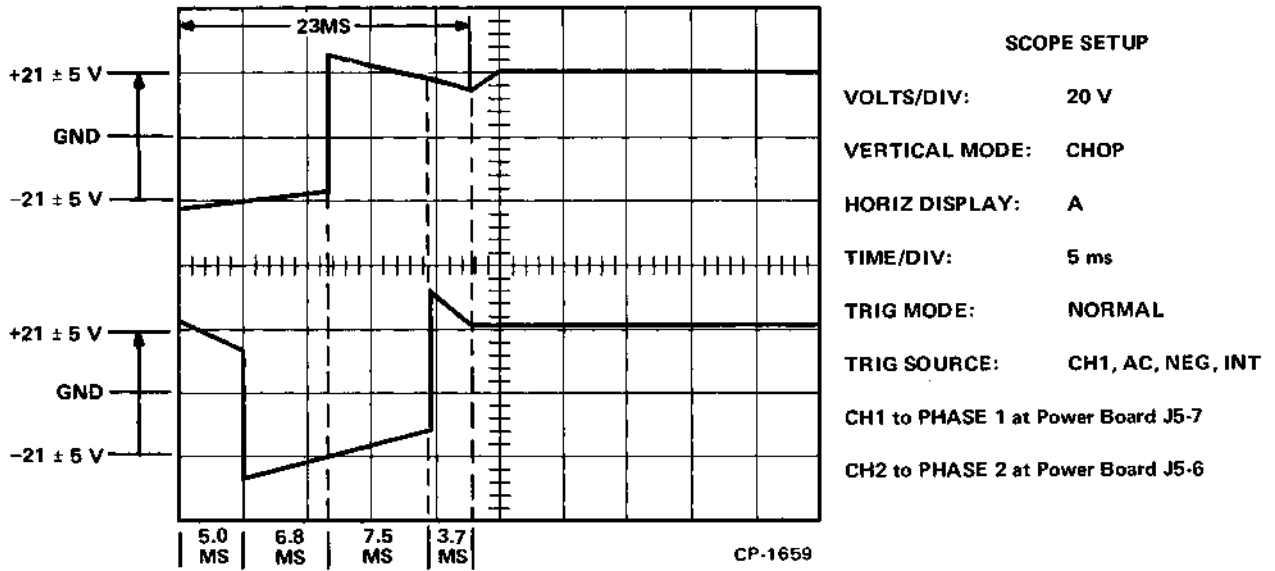


Figure 5-27 LF Motor Phase 1 and Phase 2 Waveforms

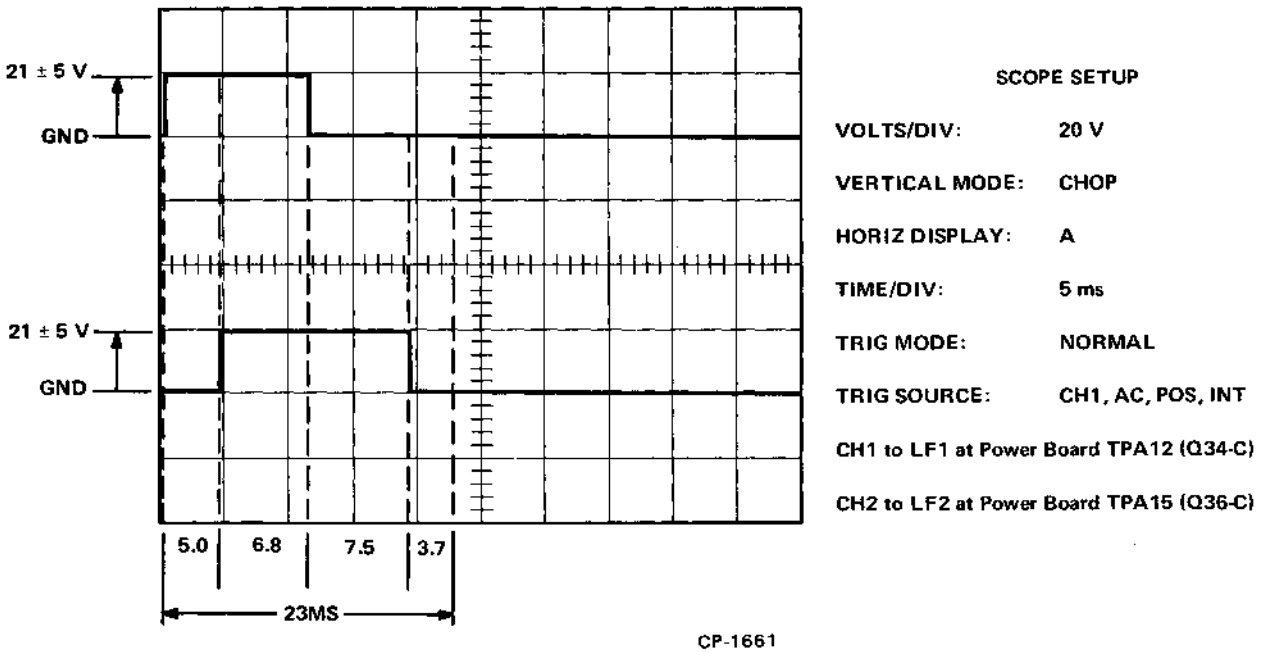


Figure 5-28 LF1 Waveform at TPA12 and LF2 Waveform at TPA15

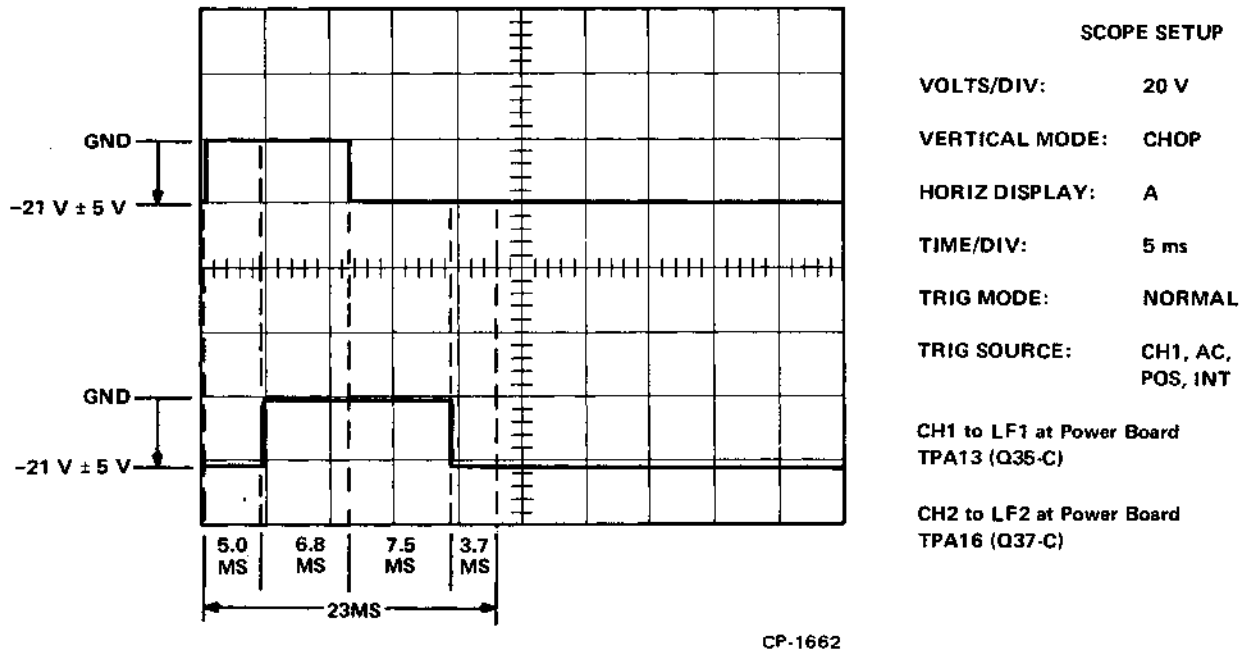


Figure 5-29 LF1 Waveform at TPA13 and LF2 Waveform at TPA16

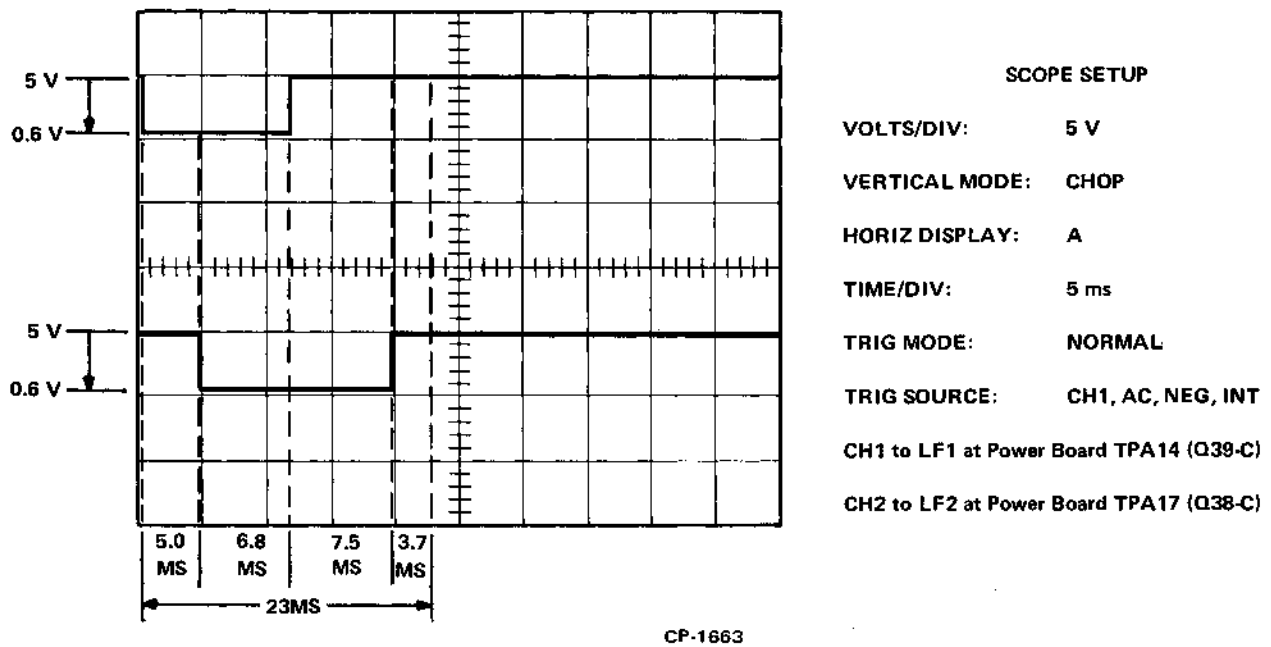


Figure 5-30 LF1 Waveform at TPA14 and LF2 Waveform at TPA17

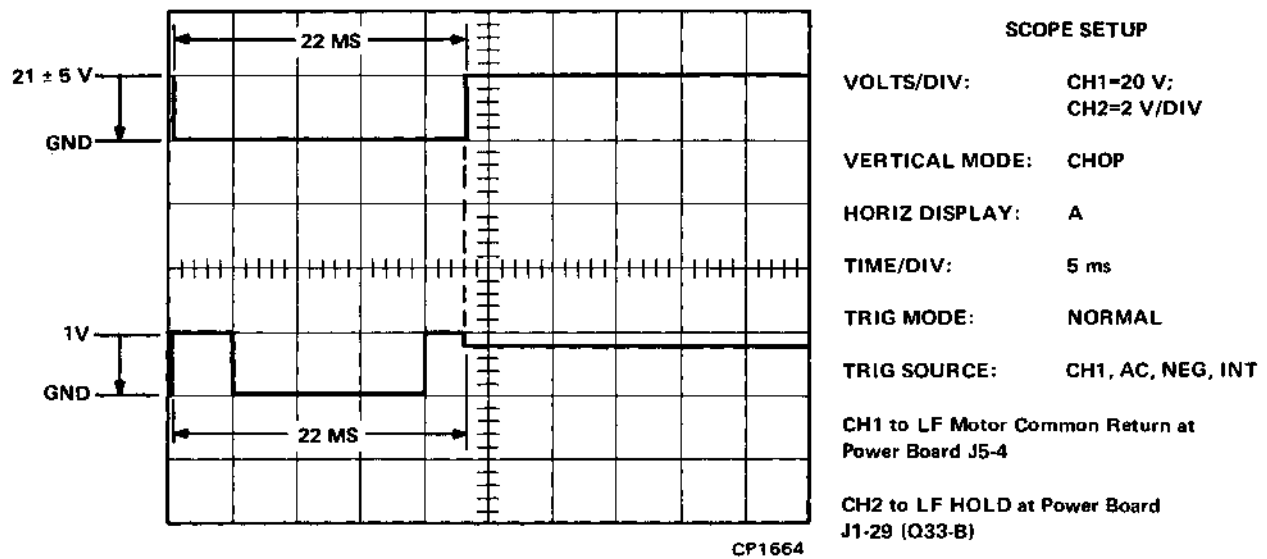


Figure 5-31 LF Motor Common Return and LF HOLD Waveforms

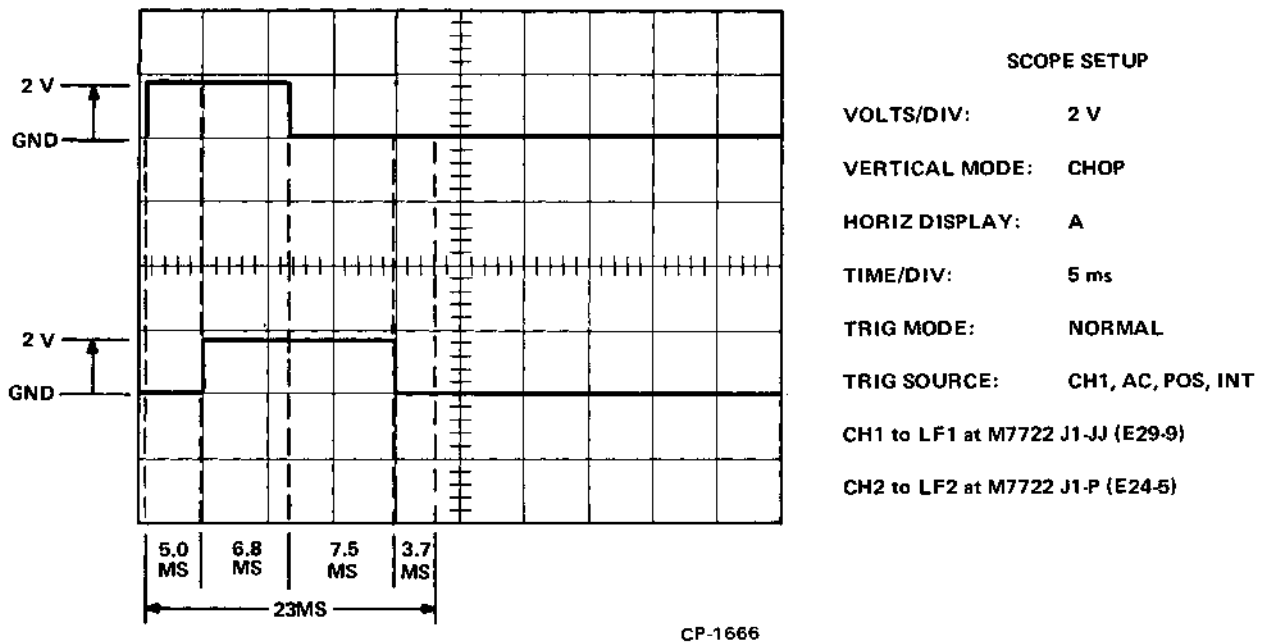


Figure 5-32 LF1 Waveform at J1-JJ and LF2 Waveform at J1-P

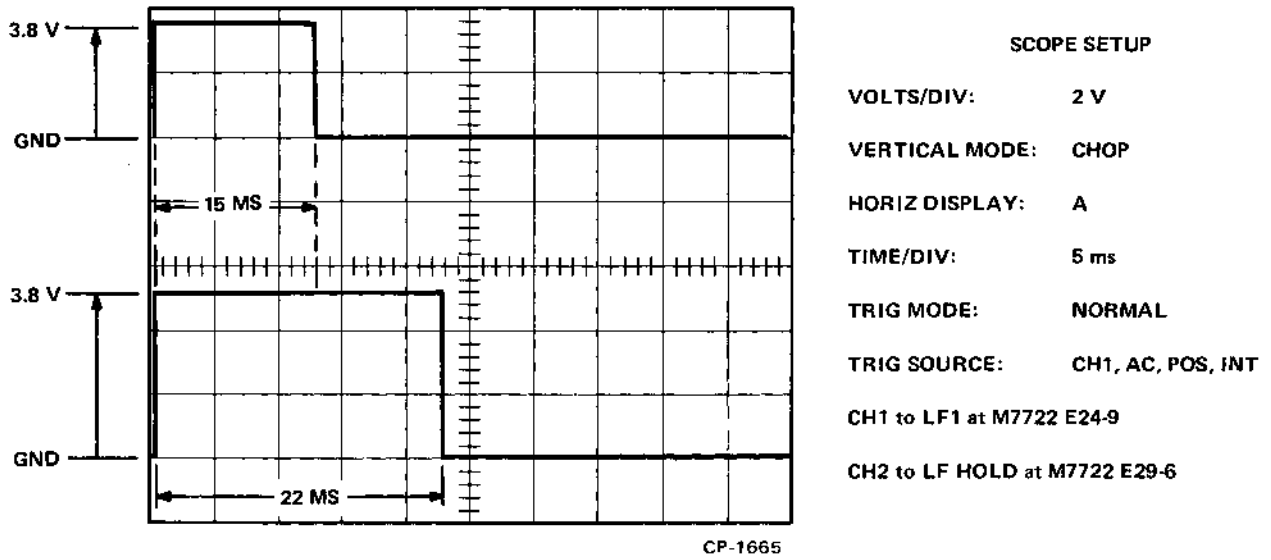
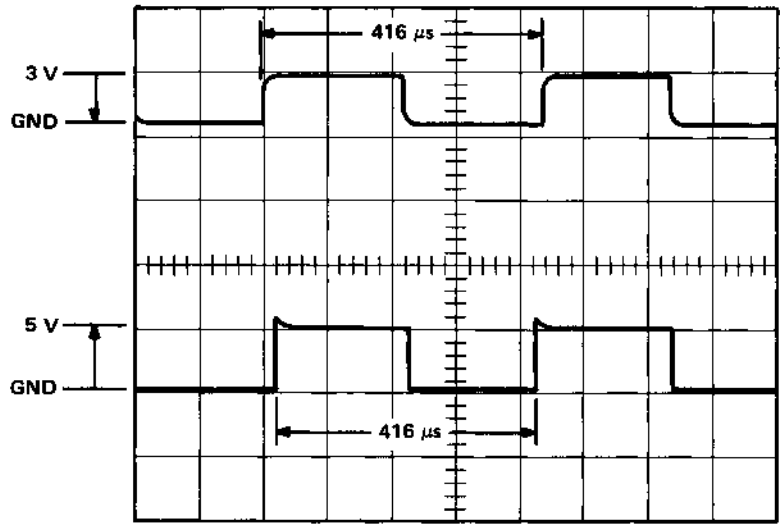


Figure 5-33 LF1 Waveform at E24-9 and LF HOLD Waveform at E29-6

END OF LF STEPPING TEST WAVEFORMS

START OF BELL TEST WAVEFORMS



SCOPE SETUP

VOLTS/DIV: 5 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 100 μs

TRIG MODE: NORMAL

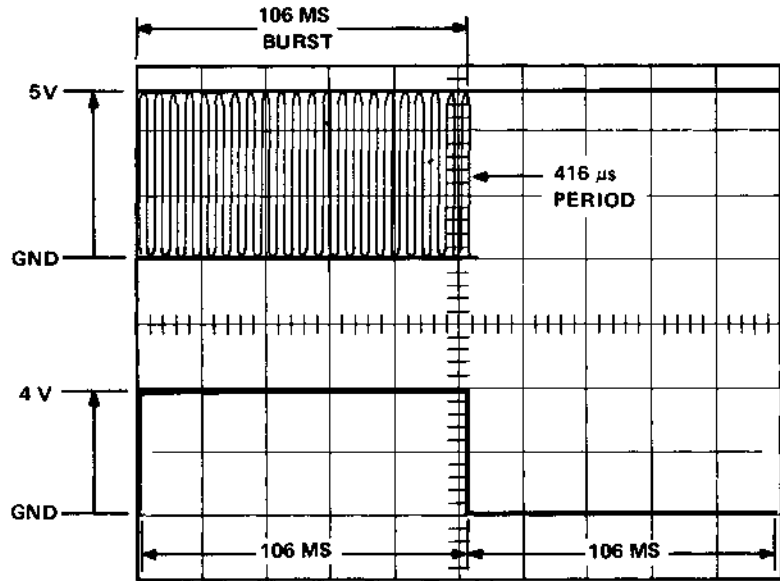
TRIG SOURCE: CH1, AC, NEG, INT

CH1 to BELL Source at Power Board J5-1

CH2 to BELL SINK at Power Board J5-2

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Figure 5-34 BELL Source and BELL SINK Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 20 ms

TRIG MODE: NORMAL

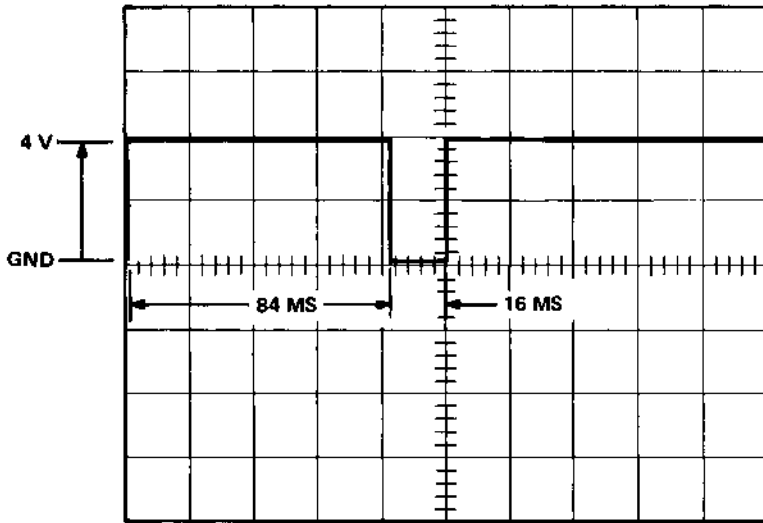
TRIG SOURCE: CH1, AC, POS, INT

CH1 to BELL SINK at Power Board J5-1

CH2 to BEL at M7722 E36-5

CP-1667

Figure 5-35 BELL SINK and BEL Waveforms



CP-1669

SCOPE SETUP

VOLTS/DIV: 2 V
VERT MODE: CH1
HORIZ DISPLAY: A
TIME/DIV: 20 ms
TRIG MODE: NORMAL
TRIG SOURCE: CH1, AC, POS, INT
CH1 to KBH H at M7722 E51-8

Figure 5-36 KBH H Pulse Waveform

END OF BELL TEST WAVEFORMS

START OF PRINTABLE CHARACTER TEST WAVEFORMS

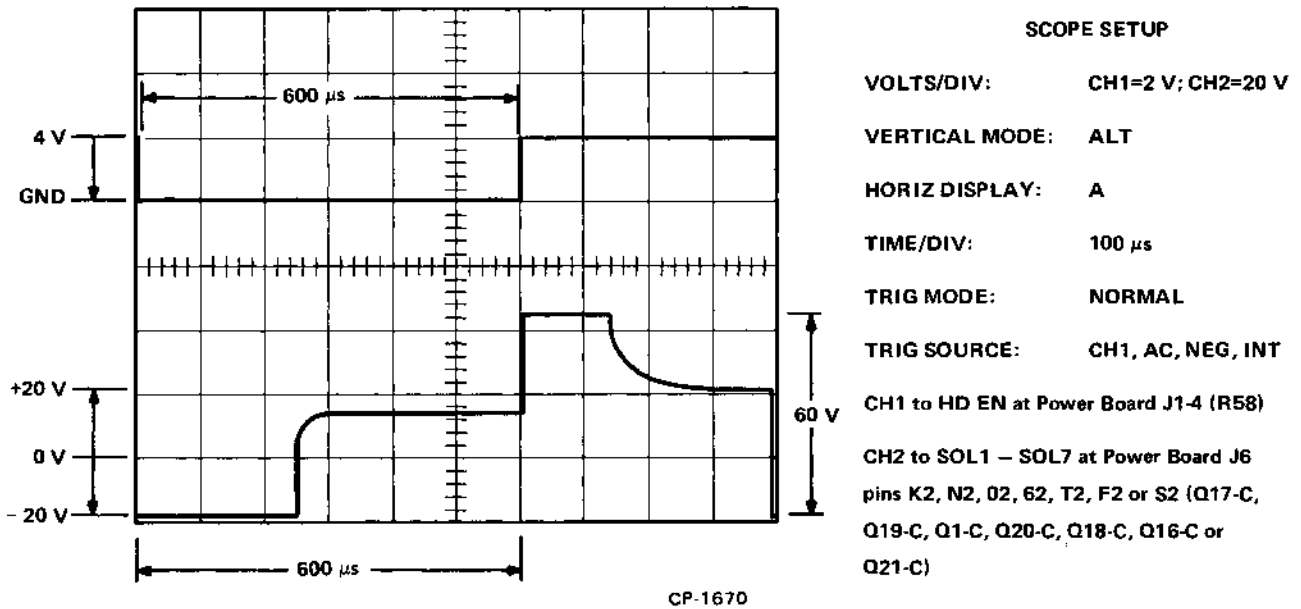


Figure 5-37 HD EN and SOL Waveforms at J6

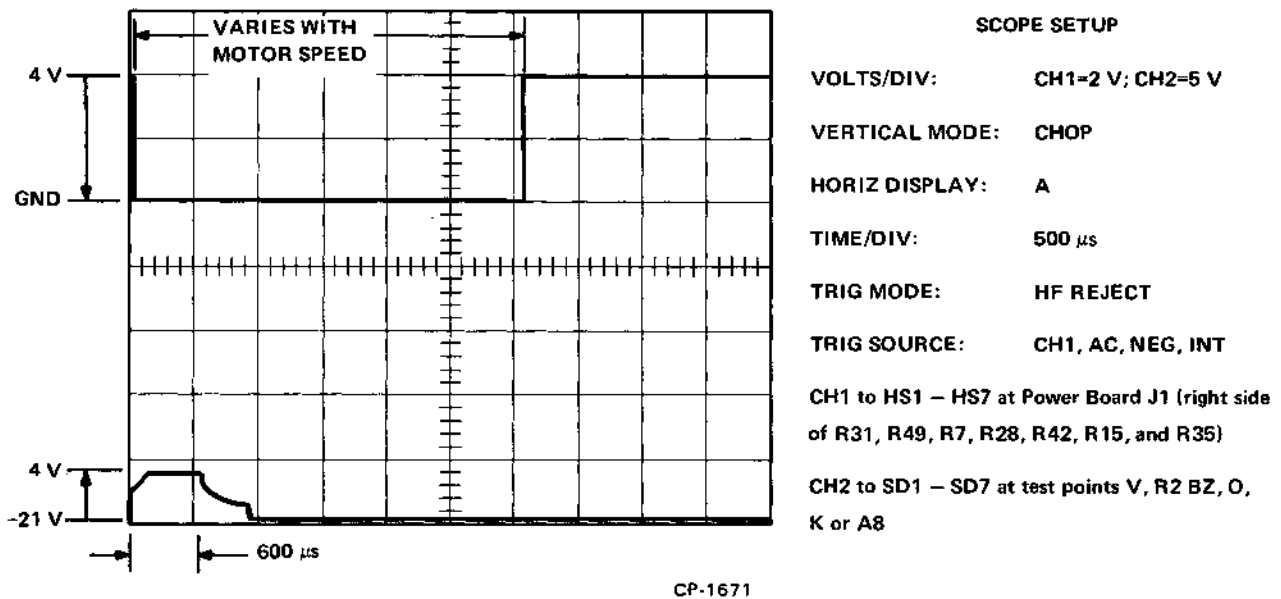


Figure 5-38 HS1 and SD1 Waveforms at TPP

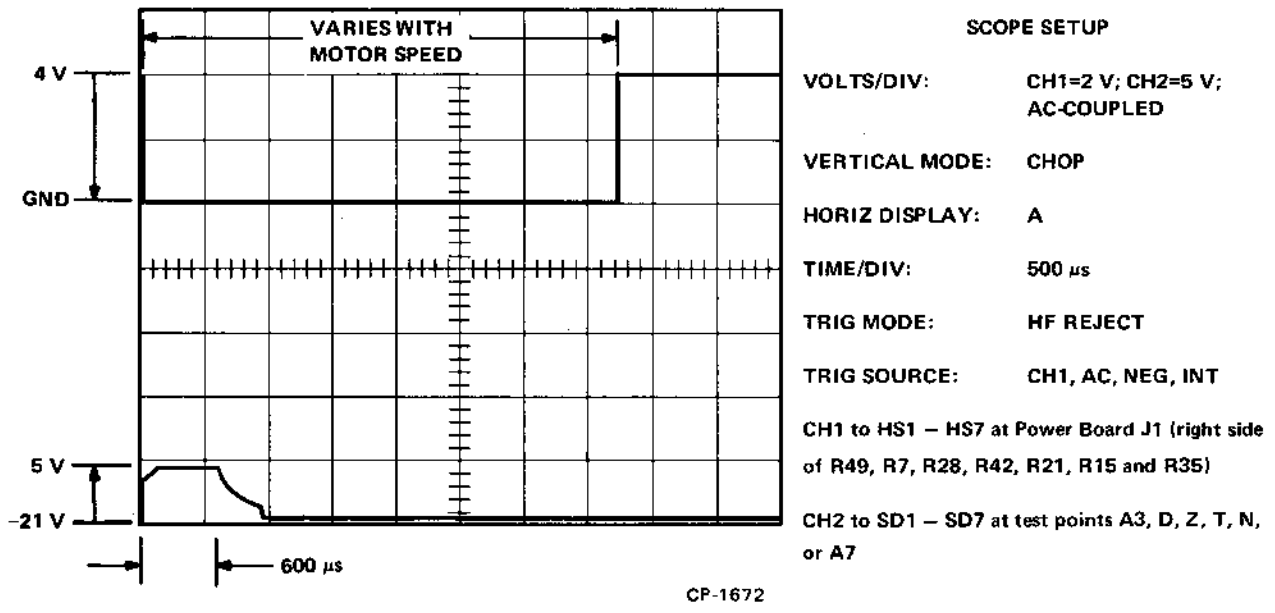


Figure 5-39 HS1 and SD1 Waveforms at TPN

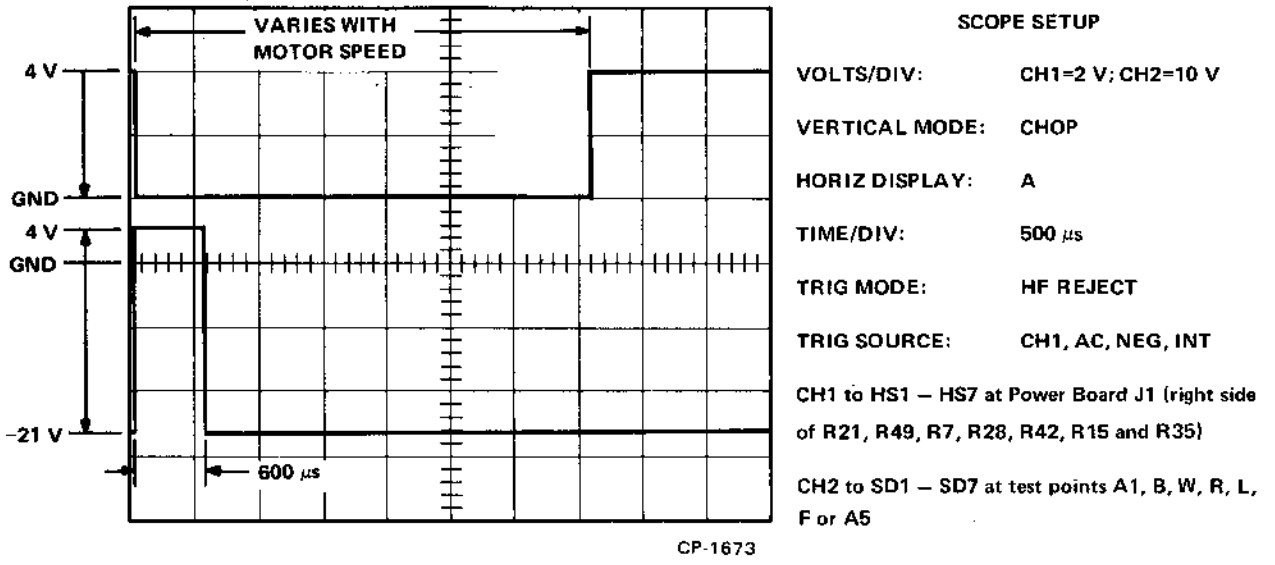
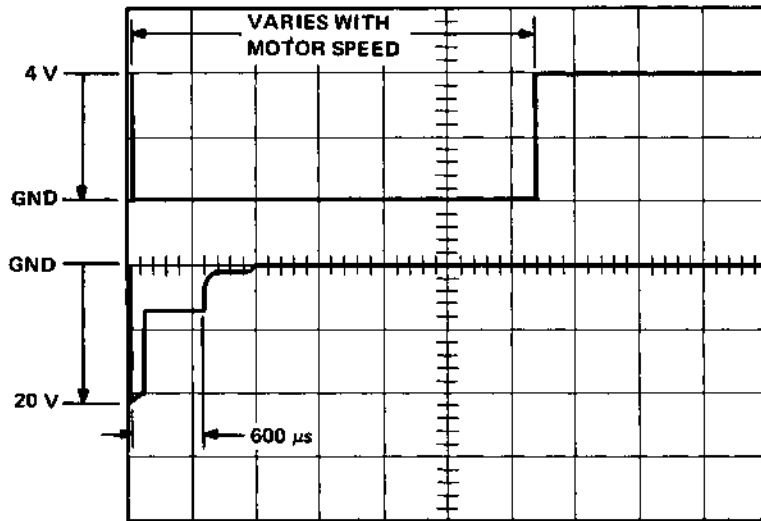


Figure 5-40 HS1 and SD1 Waveforms at TPL



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SCOPE SETUP

VOLTS/DIV: CH1=2 V; CH2=10 V

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 500 μs

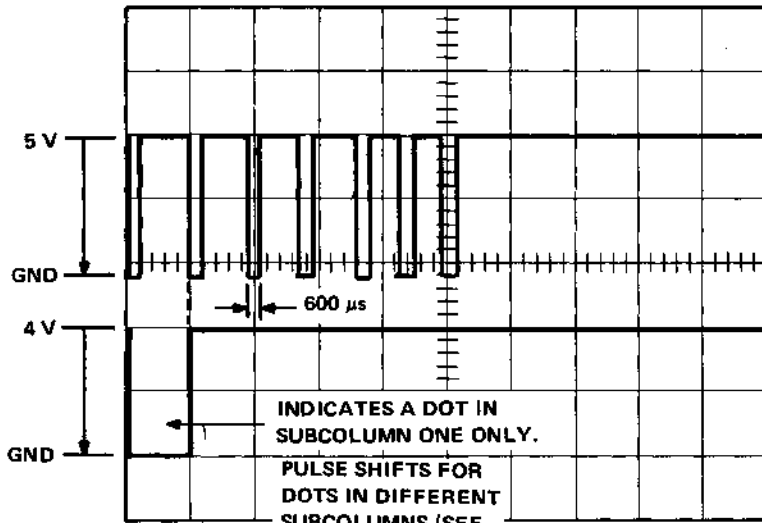
TRIG MODE: HF REJECT

TRIG SOURCE: CH1, AC, NEG, INT

CH1 to HS1 – HS7 at Power Board J1 (right side of R21, R49, R7, R28, R42, R15, and R35)

CH2 to SD1 – SD7 at test points M, A2, R3 (right side), Y, S, H, or A6

Figure 5-41 HS1 and SD1 Waveforms at TPM



CP-1675

SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 5 ms

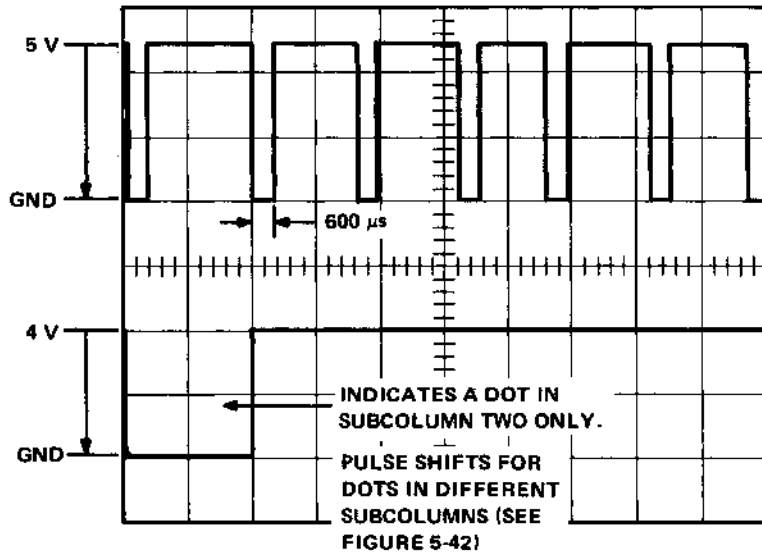
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

CH1 to HD EN at J1 (R58) (E39-8)

CH2 to HS1 – HS7 at Power Board J1 (right side of R21, R49, R7, R28, R42, R15, and R35)

Figure 5-42 HD EN and HS7 Waveforms at J1 (R35)



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 2 ms

TRIG MODE: NORMAL

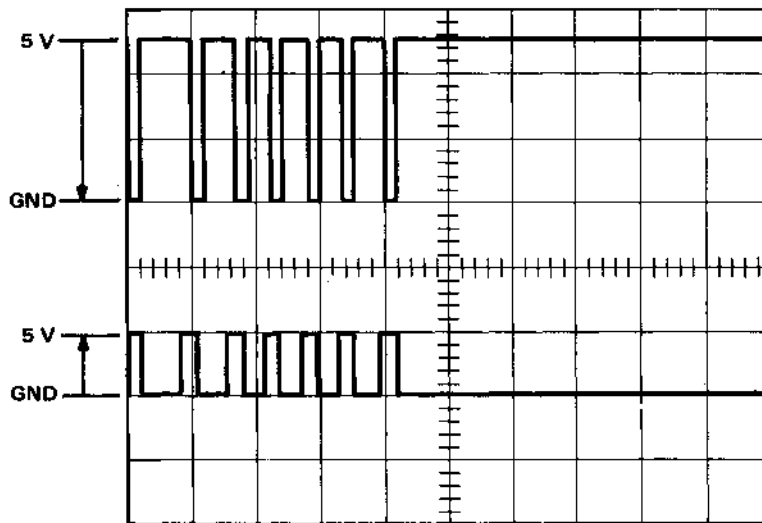
TRIG SOURCE: CH1, AC, NEG, INT

CH1 to HD EN at J1-D (R58) (E39-8)

CH2 to HS1 – HS7 at Power Board J1 (right side of R21, R49, R7, R28, R42, R15 and R35)

CP-1676

Figure 5-43 HD EN and HS6 Waveforms at J1 (R15)



SCOPE SETUP

VOLTS/DIV: CH1=2 V; CH2=5 V

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 5 ms

TRIG MODE: NORMAL

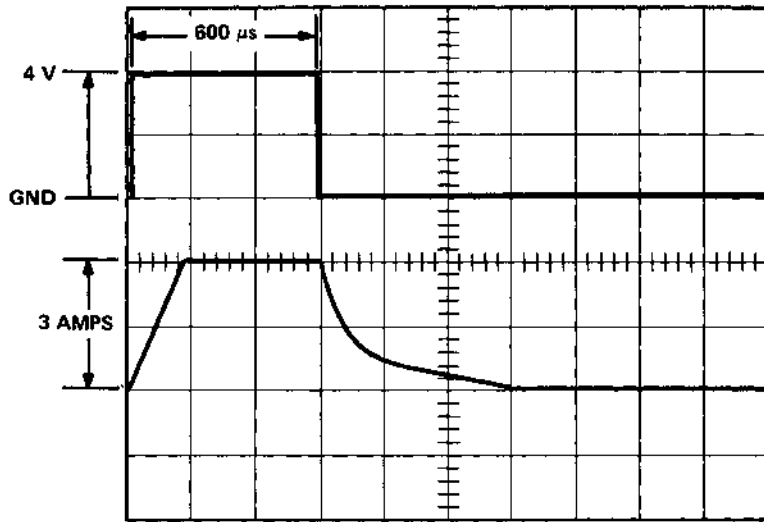
TRIG SOURCE: CH1, AC, NEG, INT

CH1 to HD EN at J1 (R58)

CH2 to BUFF HEAD EN H at TPA

CP-1677

Figure 5-44 HD EN and BUFF HEAD EN H Waveforms



CP-1678

SCOPE SETUP

VOLTS/DIV: CH1=2 V AC-COUPLED;
CH2=1 V

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 200 μs

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CAUTION

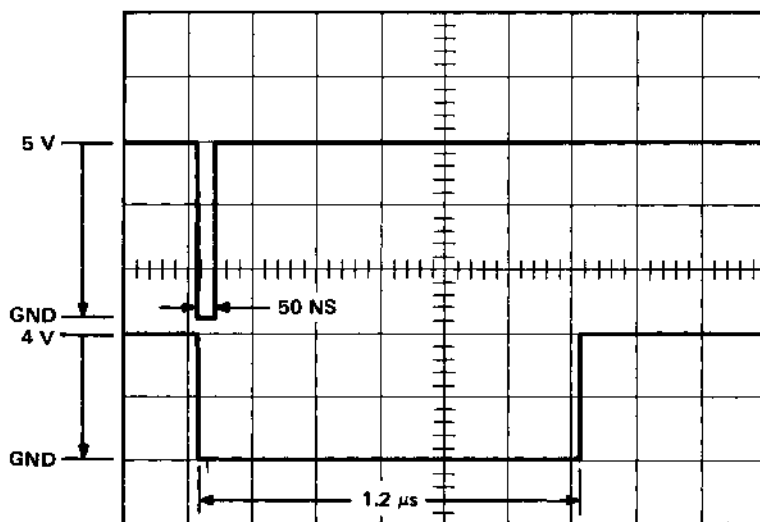
Float scope power line before making these connections.

CH1 to HD EN at M7722 E39-9

CH2 to SD1 – SD7 at R52, R53, R1, R54, R56, R51, R55

Probe ground on -21 V

Figure 5-45 HD EN Voltage Waveform and SD Current Waveform



CP-1679

SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 ns

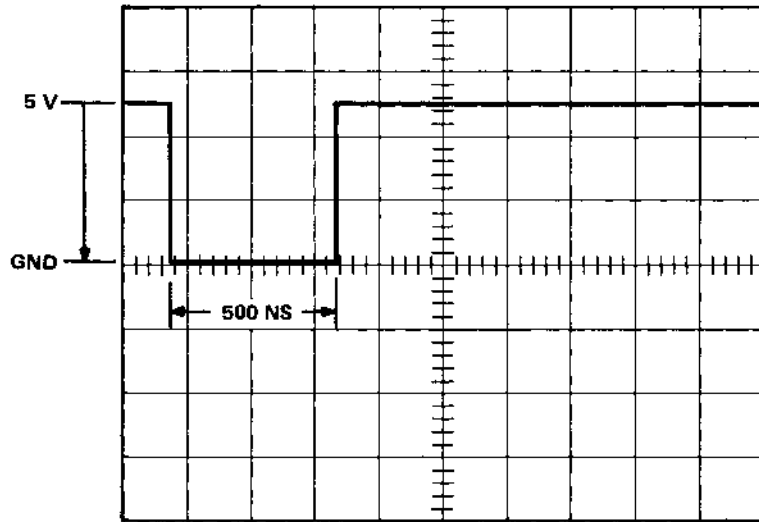
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

CH1 to WRITE BUFF L at E60-10

CH2 to CLR R DONE at E60-8

Figure 5-46 WRITE BUFF L and CLR R DONE Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: CH1

HORIZ DISPLAY: A

TIME/DIV: 200 ns

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

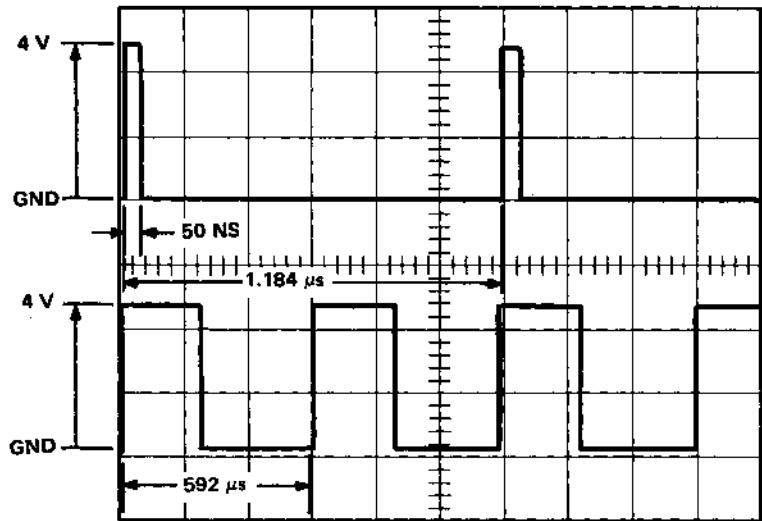
CH1 to KEY STB L at M7722 E67-4

CP-1680

Figure 5-47 KEY STB L Waveform

END OF PRINTABLE CHARACTER TEST WAVEFORMS

START OF CLOCK TEST WAVEFORMS



CP-1681

SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 ns

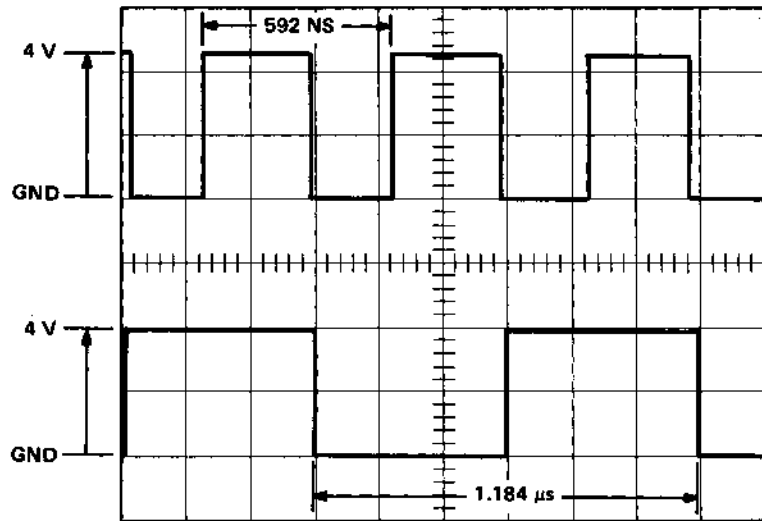
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to CLK H at M7722 E64-5

CH2 to 592 ns at M7722 E64-10

Figure 5-48 CLK H and 592 ns Waveforms



CP-1682

SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 μs

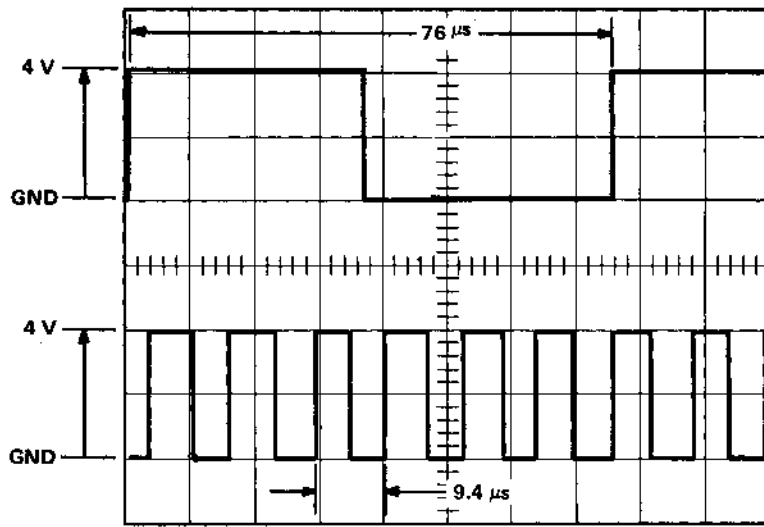
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to 1.184 μs at M7722 E13-1

CH2 to 592 ns at M7722 E13-14

Figure 5-49 592 ns and 1.184 μs Waveforms

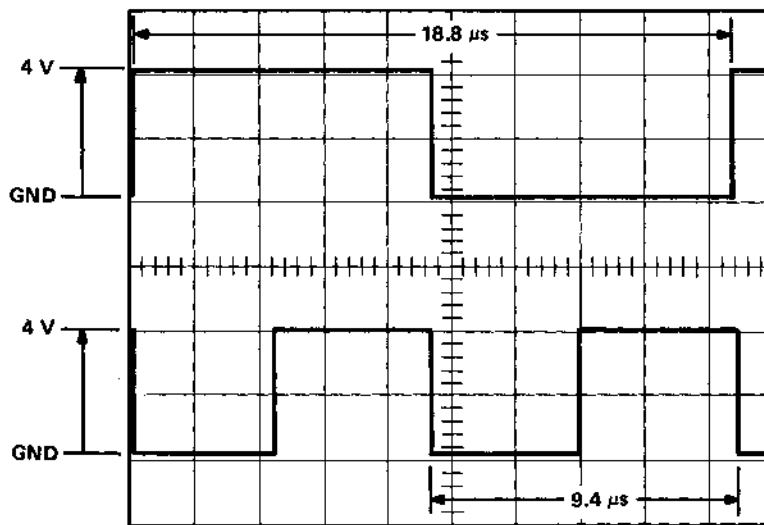


CP-1683

SCOPE SETUP

VOLTS/DIV: 2 V
 VERTICAL MODE: ALT
 HORIZ DISPLAY: A
 TIME/DIV: 10 μs
 TRIG MODE: NORMAL
 TRIG SOURCE: CH1, AC, POS, INT
 CH1 to 76 μs at M7722 E26-11
 CH2 to 9.4 μs at M7722 E26-1

Figure 5-50 76 μs and 9.4 μs Waveforms

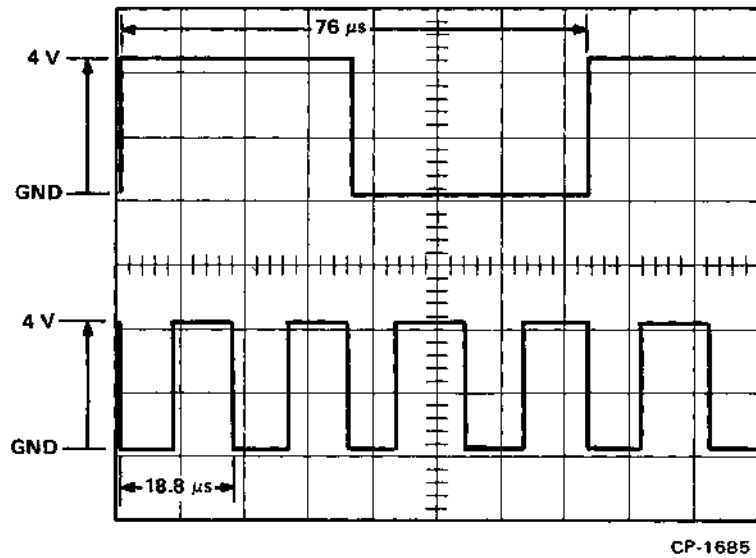


CP-1684

SCOPE SETUP

VOLTS/DIV: 2 V
 VERTICAL MODE: ALT
 HORIZ DISPLAY: A
 TIME/DIV: 2 μs
 TRIG MODE: NORMAL
 TRIG SOURCE: CH1, AC, POS, INT
 CH1 to 19L at M7722 E26-9
 CH2 to 9.4 μs at M7722 E26-1

Figure 5-51 19 L and 9.4 μs Waveforms

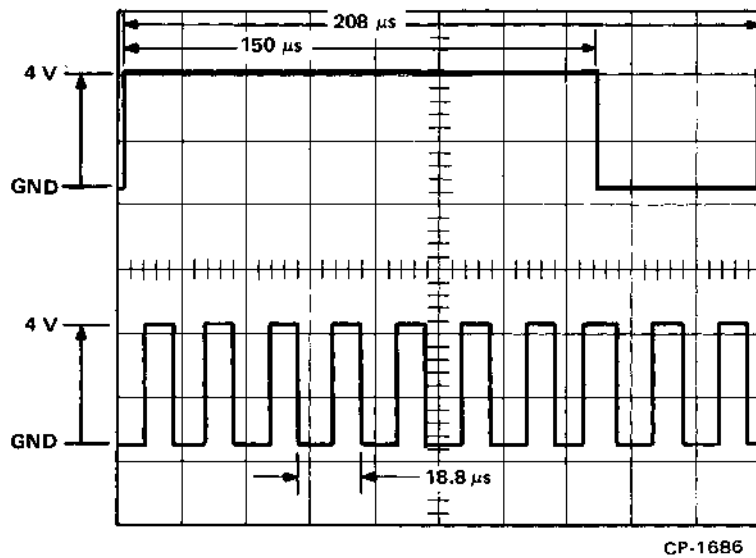


SCOPE SETUP

VOLTS/DIV: 2 V
 VERTICAL MODE: ALT
 HORIZ DISPLAY: A
 TIME/DIV: 10 μs
 TRIG MODE: NORMAL
 TRIG SOURCE: CH1, AC, POS, INT

CH1 to 76 μs at M7722 E26-11
 CH2 to 18.8 μs at M7722 E26-9

Figure 5-52 76 μs and 18.8 μs Waveforms

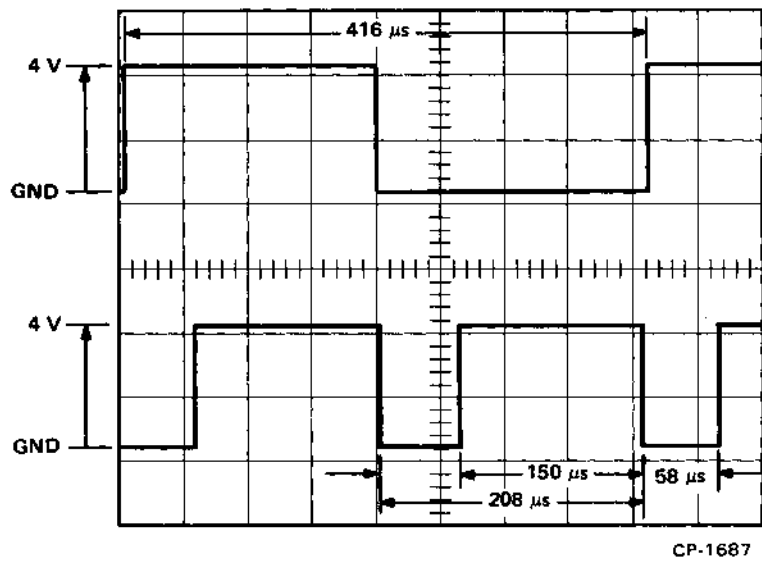


SCOPE SETUP

VOLTS/DIV: 2 V
 VERTICAL MODE: ALT
 HORIZ DISPLAY: A
 TIME/DIV: 20 μs
 TRIG MODE: NORMAL
 TRIG SOURCE: CH1, AC, POS, INT

CH1 to 4.8 kHz at M7722 E63-11
 CH2 to 18.8 μs at M7722 E26-9

Figure 5-53 4.8 kHz and 18.8 μs Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 50 μs

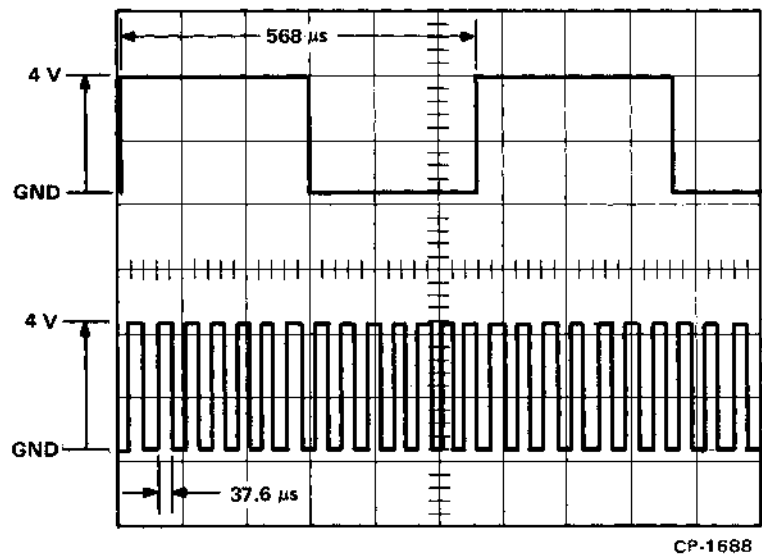
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to 208H at M7722 E26-12

CH2 to 4.8 kHz at M7722 E63-11

Figure 5-54 208 H and 4.8 kHz Waveforms



SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 100 μs

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

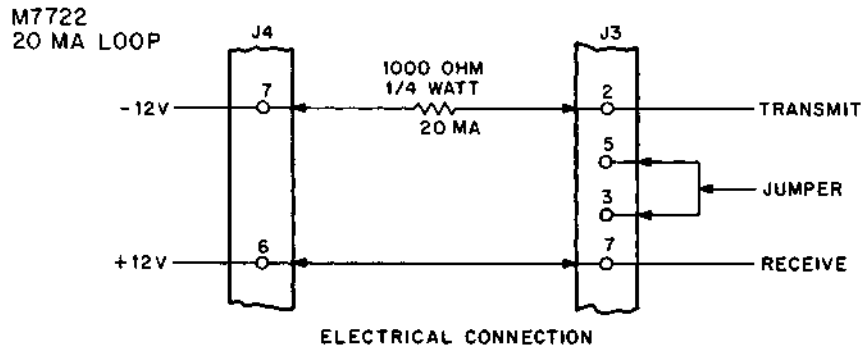
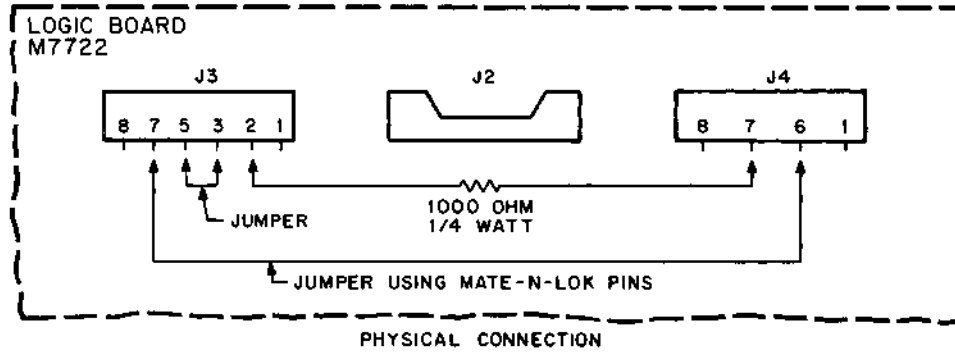
CH1 to 1.76 kHz at M7722 E68-11

CH2 to 37.6 μs at M7722 E26-8

Figure 5-55 1.76 kHz and 37.6 μs Waveforms

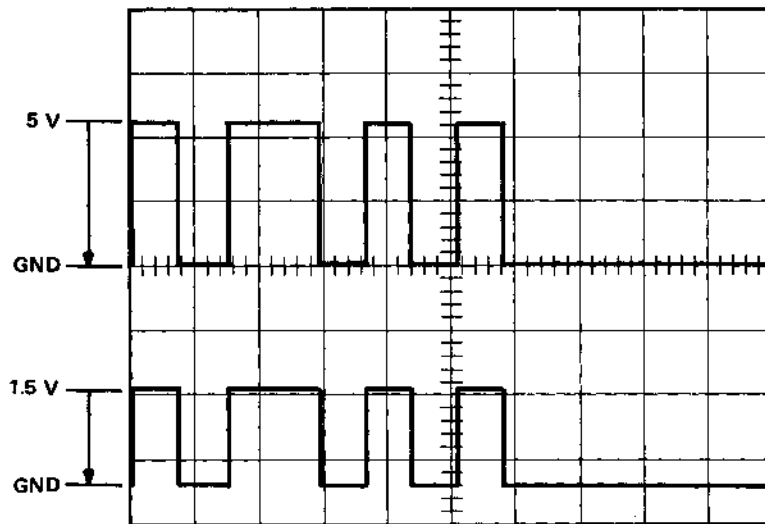
END OF CLOCK TEST WAVEFORMS

START OF CURRENT LOOP INTERFACE WAVEFORMS



CP-1606

Figure 5-56 Current Loop Test Setup



SCOPE SETUP

VOLTS/DIV: CH1=2 V DC-COUPLING;
CH2=1 V AC-COUPLING

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 5 ms

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

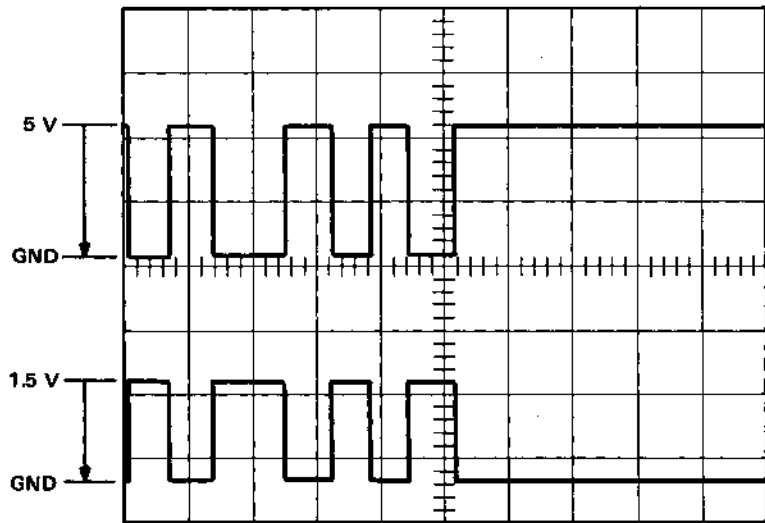
CH1 to S.I. at M7722 J4-2 (E62-1)

CH2 to RECEIVE at M7722 J3-3

NOTE: MARK = GND; SPACE = 5 V or 1.5 V

CP-1689

Figure 5-57 Loop Receiver Waveforms



SCOPE SETUP

VOLTS/DIV: CH1=2 V DC-COUPLING;
CH2=1 V AC-COUPLING

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 5 ms

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

CH1 to S.O. at M7722 E66-11

CH2 to TRANSMIT at M7722 J3-5

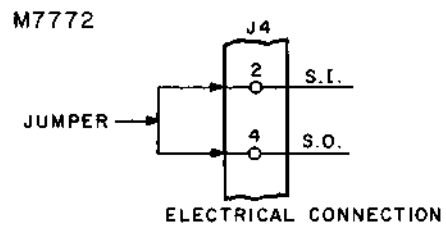
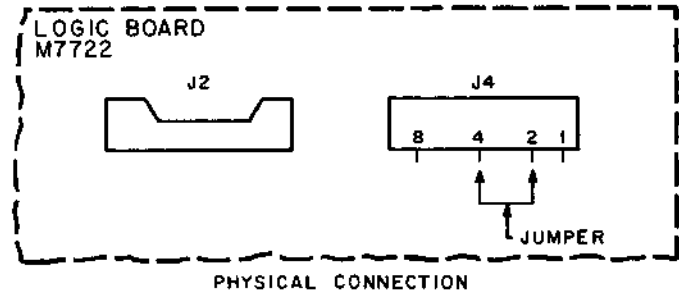
NOTE: MARK = GROUND; SPACE = 5 V or 1.5 V

CP-1690

Figure 5-58 Loop Driver Waveforms

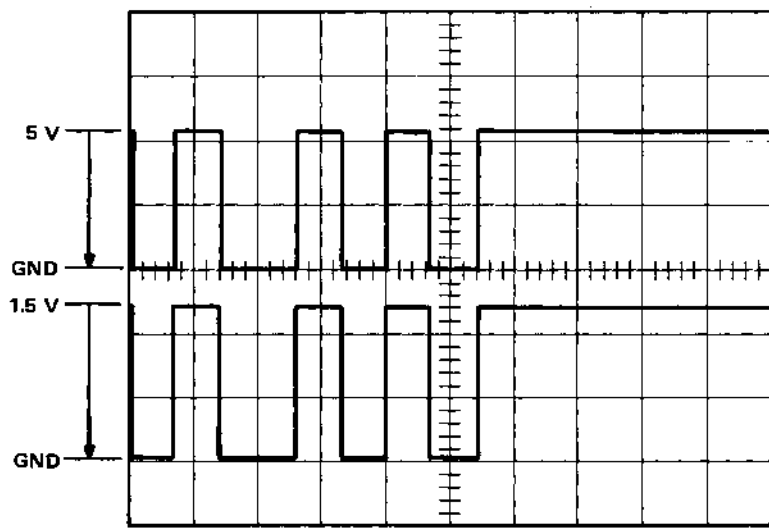
END OF CURRENT LOOP INTERFACE WAVEFORMS

START OF SERIAL LINE INTERFACE WAVEFORMS



CP-1623

Figure 5-59 Serial Line Test Setup



NOTE: 5 V = SPACE; GND = MARK

CP-1691

- SCOPE SETUP**
- VOLTS/DIV: 2 V
 - VERTICAL MODE: CHOP
 - HORIZ DISPLAY: A
 - TIME/DIV: 5 ms
 - TRIG MODE: NORMAL
 - TRIG SOURCE: CH1, AC, POS, INT
 - CH1 to S.O. at M7722 E29-12
 - CH2 to S.I. at M7733 E66-6

Figure 5-60 Serial Output and Serial Input Waveforms

END OF SERIAL LINE INTERFACE WAVEFORMS

**Table 5-2
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
1. No response (Fan not operating)	Main Printer Power Fuse	Blown	Unplug printer. Check F1 (2 A Slo Blo @ 125 V or 1 A Slo Blo @ 250 V). Replace.	Table 5-3 Section 6.1.16 Section 6.1.15
	Power Harness	Poor connections	Unplug printer, check, correct.	
	Voltage Jumper J3 (110 V vs 220 V)	Not plugged in or loose	Check, correct, or trace harness.	
	Power Transformer	Open winding	Unplug printer. Check voltages.	
	Fan	Mechanical interference	Check free movement.	

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
2. Print head does not initialize; carriage moves violently or erratically from margin-to-margin or goes to either margin and stays there.	Logic Board	Loss of clock signals.	Check 592 ns at E64-10	Figure 5-48
		Loss of speed control feedback.	Perform Encoder Signal Processing Test and check:	Sections 5.1.1.1 and 6.1.13
		a. Encoder	PT1 and PT2 at J4-5 and J4-6	Figures 5-3 or 5-9
		b. Threshold Detector	PT1 and PT2 at TP1 (E6-8) and TP2 (E6-6) If signal is present but misadjusted, adjust Encoder.	Figures 5-4 or 5-10
		c. Encoder Signal Detector	+INC at E8-9 and COUNT F/F at E4-9 or -INC at E7-5 and COUNT F/F at E13-9	Figure 5-5 or Figure 5-11
		d. +/-TACH	+INC at E8-9 and +TACH at Q11-C or -INC at E8-5 and -TACH at Q12-C	Figure 5-8 or Figure 5-12
	Power Board	Encoder Motor fuse blown	Check F1(2ASB)	
		Failure in servo amplifier	Perform Encoder Signal Processing Test and check:	Sections 5.1.1.1 and 6.1.14
			MD at F1 (R71 side)	saturated - + direction -21 ± 5 V - direction +21 ± 5 V
			SUM at J1-B (E1-6)	saturated - + direction -10 V - direction +10 V
Encoder	Defective	Replace motor and Encoder if the Encoder cannot be adjusted.	Section 6.1.6	

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
3. No line feed, but bell operates	Paper	Paper jammed/feed holes torn	Check paper alignment	Section 3.2.1
	Tractors	Not feeding -- worn or broken pin, or out of alignment	Check, align, or replace	Section 6.1.11
	Shafts	Binding	Check, align, or replace	Sections 6.2.2 and 6.2.3
	Clutch	Binding, broken	Check, align, or replace	Section 6.2.6
	Gears	Broken teeth, insufficient backlash	Check, adjust, or replace	Sections 6.1.10 and 6.2.14
	Motor	Open cable or winding	Perform Line Feed Stepping Test and check signals from Power Board: Phase 1 at J5-7 Phase 2 at J5-6	Sections 5.1.1.3, 6.1.12, and 5.1.13 Figure 5-27
	Power Board	LF Motor fuses blown	Check F2 and F3 (1ASB)	
		Amplifier output signals missing	Perform Line Feed Stepping Test and check: LF1 at TPA12 and LF2 at TPA15	Sections 5.1.1.3 and 6.1.14 Figure 5-28
LF1 at TPA13 and LF2 at TPA16			Figure 5-29	
LF1 at TP14 and LF2 at TP17	Figure 5-30			
	LF HOLD switch signals missing	LF HOLD at J5-4 and LF MOTOR COMMON at J1-29	Figure 5-31	

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
3. (continued)	Logic Board	Grey Code Counter output missing LF HOLD flip-flop output missing	Perform Line Feed Stepping Test and check: LF1 at J1-JJ and LF2 at J1-P LF1 at E24-9 and LF HOLD at E29-6	Section 5.1.1.3 and 6.1.13 Figure 5-32 Figure 5-33

Table 5-2 (Cont)
Troubleshooting Chart

Symptom	Problem Area	Probable Cause	Action	Reference
4. No bell tone, but line feed operates	Loudspeaker	Open voice coil	Remove BEL lead and ground it. Cone should click. If not, check continuity and replace speaker.	
	Wiring	Open or loose	Check security of wiring and correct.	
No bell tone at 64th print position	Power Board	Resistor or +5 V	Check and correct.	
	Logic Board	BELL HOLD flip-flop E36	Perform Bell Test and check: BEL SOURCE at J5-1 and BEL SINK at J5-2 BEL SINK at J5-2 and BEL at E36-5 208 L at E40-10 KBH at E51-8	Sections 5.1.1.4 and 6.1.13 Figure 5-34 Figure 5-35 Figure 5-53 Figure 5-36
		KB HOLD flip-flop E51		

Table 5-2 (Cont)
Troubleshooting Chart

Symptom	Problem Area	Probable Cause	Action	Reference
5. Print head initializes and bell and line feed both operate, but printer hangs up on a printable character, i.e., the print head does not move and character will not print.	Carriage shaft, drive belt or pulleys	Binding. F1 (2A Slo Blo) will blow	Set POWER switch to OFF and move carriage <i>manually</i> . If binding occurs, check tolerance.	Section 6.1.8
	Logic Board	PNTABL H logic level missing	Set POWER switch to ON. Perform Printing Character Test and check: PNTABL H at E33-11 ASCII codes at E55-26, E56 and E28.	Sections 5.1.2.5 and 6.1.13 +4 V Section 5.1.2.5, Step 3

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
6. Printable characters replaced by spaces, but line feed operates.	Logic Board	HDE flip-flop E39	Perform Printable Character Test and check: HD EN at J1-D (R58) HDE at E39-8	Sections 5.1.1.5 and 6.1.13 Figure 5-43
	Power Board	Buffer Q22	Perform Printable Character Test and check: HD EN at J1-4 (R58) and BUFF HEAD EN H at T.P.A.	Sections 5.1.1.5 and 6.1.14 Figure 5-44
		V REF current regulator	V REF at T.P. B3 V REF at T.P. B	2.6 V ±1% with respect to -21 V -5.1 V ± 5 V

Table 5-2 (Cont)
Troubleshooting Chart

Symptom	Problem Area	Probable Cause	Action	Reference
7. Missing dots (always same row) (all printable characters that use the missing row)	Print Head	Stuck or broken impact wire	Power down and up. Retry. If condition exists, let it run. If condition does not clear, check the following before replacing head:	Section 6.1.1
		Open solenoid winding	Check winding.	Figure 5-63
	Power Board	No solenoid drive signals for missing row	Perform Printing Character Test and check SOL1–SOL7 at appropriate pin on J6 while printing. Check appropriate test points in Drive Amplifier for that row.	Sections 5.1.1.5 and 6.1.14 Figures 5-38–5-44
		No head select signals for missing row	Check HS1 L-HS7 L at appropriate pin on J1.	Figures 5-38 and 5-44
	Logic Board	No head select signals for missing row	Check HS1 L-HS7 L at appropriate pin on J1.	Figures 5-42 and 5-43
Failed head select drivers		Check HS1 H-HS7 H at appropriate pins on E20 and E25.	Figures 5-42 and 5-43 (inverted)	
(always same row, same letters)	Logic Board	CG ROM E28 and E33	Replace Logic Board	Section 6.1.13

Note

If missing at this point indicates that bit is missing in the CGROM output.

Table 5-2 (Cont)
Troubleshooting Chart

Symptom	Problem Area	Probable Cause	Action	Reference
8. No print, no space, but (LF/BEL operate).	Logic Board	Loss of printable bit.	Check PNTABL at E25-10.	PNTABL H = +4 V PNTABL L = 0.8 V

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
9. Occasional to constant over-print or bunching of characters in a line or misplaced dots within a character	Carriage	Binding on shafts	Check and adjust	Section 6.1.8
	Power Board	Sluggish motor due to defective servo amplifier	Perform Servo Speed Test and check: SUM at J1-2 MD at J4-8	Sections 5.1.1.2 and 6.1.14 Figure 5-16
	Encoder	Out of adjustment	See Symptom 2	Figure 5-17

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
10. Printer stops in middle of line	Power Board	Servo Fuse F1 blown	Check, determine the following causes before replacing fuse:	
		Ribbon mechanism jammed near end of ribbon	Check, adjust, replace	Section 6.1.7
		Carriage binding on poorly adjusted carriage shafts	Check, align, or replace	Section 6.1.8
		Broken timing belt	Replace	Section 6.1.2
		Timing belt off pulley	Check and correct. Replace belt if worn or frayed.	Section 6.1.2

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
11. Printer operates in LOCAL but not ON-LINE	Interface or interface connectors	Connection problem	Check connectors	
	Logic Board (in current loop operation)	Improper jumpers on current loop converters	Check, correct	Section 2.4 step 9 6.1.13
		Failure in isolator circuits	Perform Current Loop Interface Test and check:	Section 5.1.2.1
			S. I. at E62-1 S.O. at E66-11 TRANSMIT at J3-5	Figure 5-57 Figure 5-58
	LINE/LOCAL switch	Switch shorted to LOCAL condition	Check, replace	
(In EIA operation or option)	Failure in gating logic	Perform Serial Line Interface Test and check: S. O. at E29-12 S. I. at E66-6	Section 5.1.2.2 Figure 5-60	

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
12. Lost characters after 16 characters have printed in a line following a carriage return	Printer Mechanism	Binding of carriage or shafts is causing extended carriage return time	Check and adjust	Sections 6.1.5 and 6.1.8
	Logic Board	Incorrect SPEED commands	Perform Servo Speed Test and check: -TACH at Q12-B and SUM at J1-B +TACH at Q11-B and SUM at J1-B	Sections 5.1.2.2 and 6.1.13 Figure 5-16 Figure 5-24

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
13. Incorrect characters printed or no backspace during ON-LINE operation	Logic Board	Missing or added data bits	Perform Printable Character Test and check ASCII codes at the listed test points	Section 5.1.1.5, Steps 3 and 4 and Section 6.1.13
	Keyboard	Same as above	Perform Printable Character Test and check ASCII codes at E55-26, 27, 28, 29, 30, 31 and 32	Section 5.1.1.5, Steps 3 and 4. Section 6.1.3 and 6.1.4

**Table 5-2 (Cont)
Troubleshooting Chart**

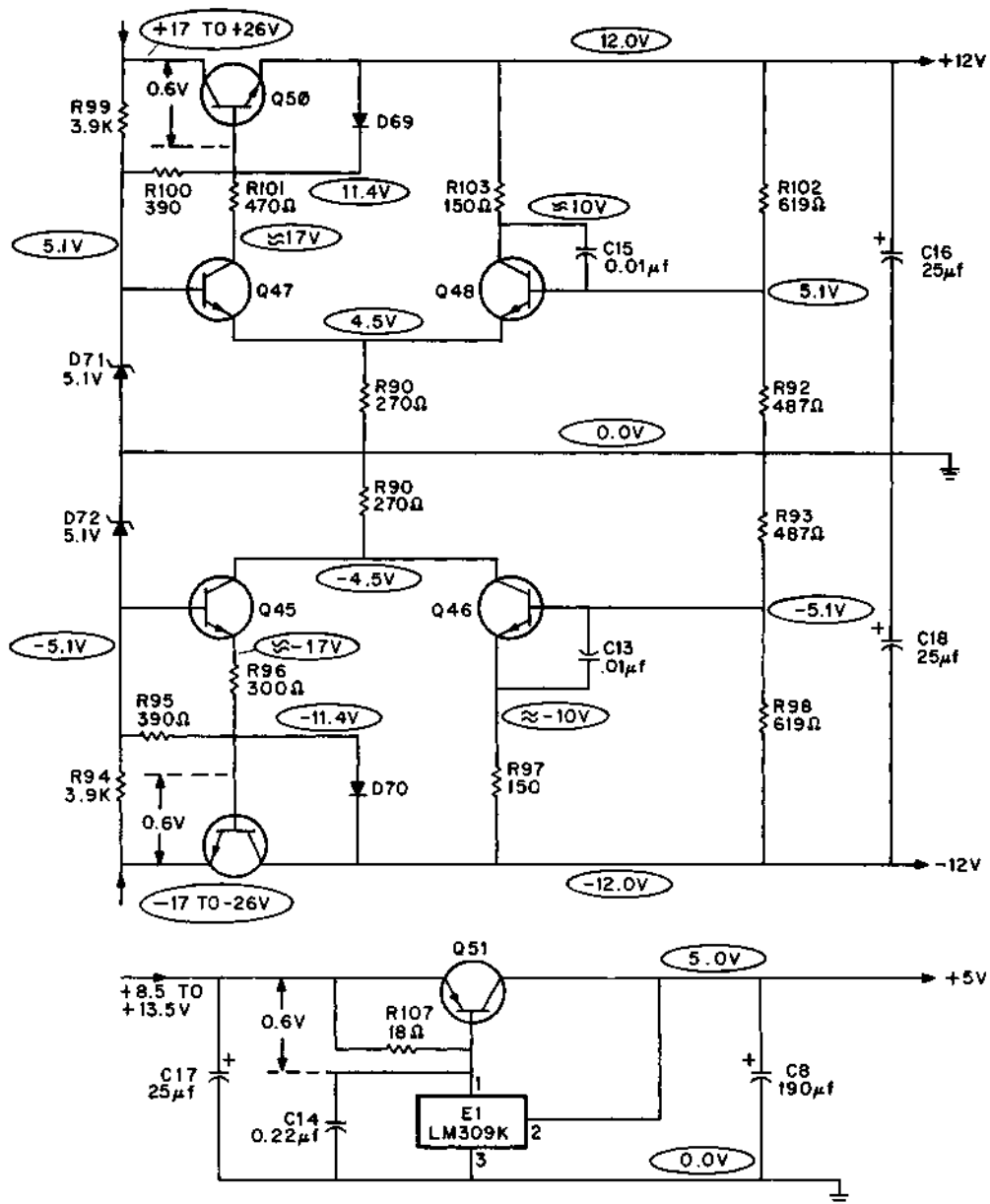
Symptom	Problem Area	Probable Cause	Action	Reference
14. Uneven print density across the page	Print Bar	Out of adjustment	Check, adjust	Section 6.1.8
Printing light in areas	Print Bar	Pitted	Replace	Section 6.2.1
Printing density progressively drops off to no impressions	Ribbon Feed Assembly	Out of adjustment	Check and adjust	Section 6.1.7
		Bad Drive Clutch	Repair or replace	Section 6.2.9
On Tab printing		Broken backstop spring	Replace	Section 6.2.10
	Print Head	Out of adjustment	Check and adjust	Section 6.1.1
	Left Tractor	Out of adjustment	Check and adjust	Section 6.1.11
Ribbon does not reverse	Ribbon feed does not reverse or feed	Broken ratchet tooth	Replace ratchet wheel	Section 6.2.13
		Push rod disengaged	Correct	
		Interposer adjustment incorrect	Adjust	Section 6.1.7
Paper jams	Tractors	Out of adjustment	Check and adjust	Section 6.1.11
		Paper path not clear	Check and clear	
		Phase adjustment	Check and adjust	Section 6.1.11

**Table 5-2 (Cont)
Troubleshooting Chart**

Symptom	Problem Area	Probable Cause	Action	Reference
15. Margin drift (line-to-line loss of carriage position)	Encoder	Out of adjustment or marginal	Perform Encoder Signal Processing Test and check: PT1 at TP1 (E6-8) PT2 at TP2 (E6-6) If signal is present but misadjusted, adjust Encoder. Replace motor and Encoder if Encoder cannot be adjusted.	Sections 5.1.1.1 and 5.2.6 Figures 5-4 and 5-10 Section 6.1.6
	Logic Board	Defective connector	Check cable to J1	
		Loss of SUM amplifier feedback	Perform Servo Speed Test and check:	Sections 5.1.2.1 and 6.1.13
			SUM at J1-B	Figures 5-16 and 5-24
	Power Board	Defective connector	Check cables to J1 and J4	
		Loss of servo amplifier linearity	Perform Servo Speed Test and test and check: MD at J4-8	Sections 5.1.2.1 and 6.1.14 Figures 5-17 and 5-25

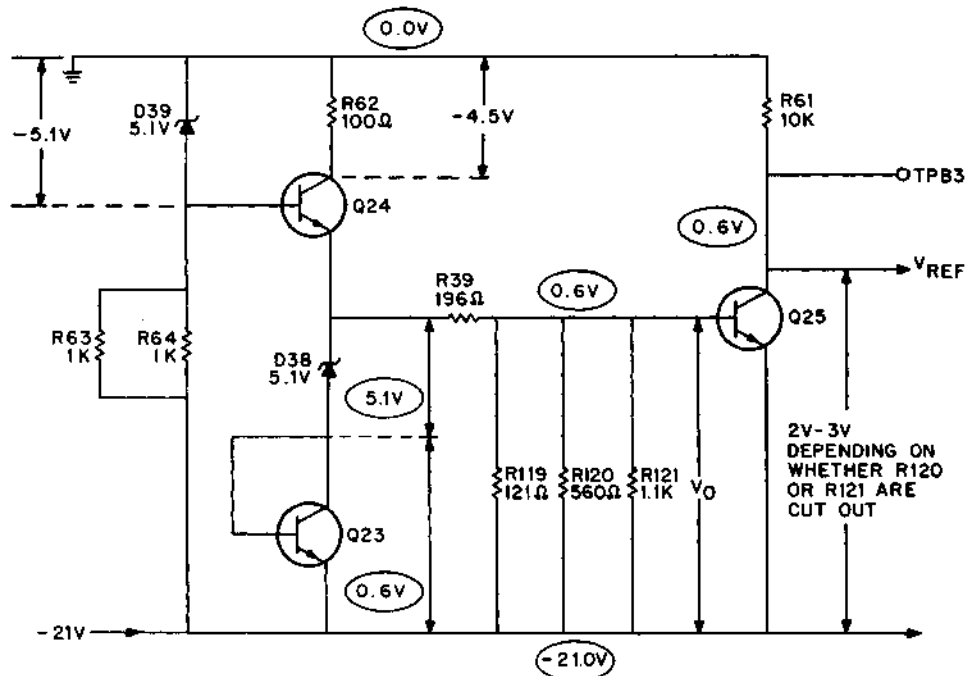
**Table 5-3
DC Supply Voltages**

Line Current	Line Voltage	TP20	J1-3	J1-35	TP20	TPB3	TP21
	Normal	+5	+12	-12	-21	-21 Ref (Vref)	+21
0.9 to 2.4 A	125 Vac	+4.9	+11.6	-11.7	-25.6	-23.0	+25.6
1 to 1.6 A	115 Vac	+4.9	+11.6	-11.7	-23.6	-21.1	+23.6
1.2 to 1.6 A	105 Vac	+4.9	+11.6	-11.7	-21.5	-19.0	+21.5
0.9 to 1.8 A	100 Vac						
0.8 to 1.8 A	95 Vac	+4.9	+11.6	-11.7	-19.2	-16.7	+19.9
0.8 to 1.7 A	90 Vac	+4.9	+11.6	-11.7	-17.9	-15.4	+19.9



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Figure 5-61 Typical Voltages for Power Supply Regulators

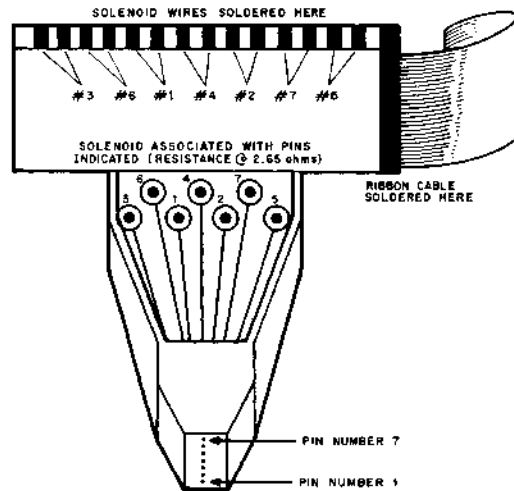


NOTE:
R120, R121, or both may
be removed in test.

OUTPUT VOLTAGE (V _O) OF DIVIDER				
R120	IN	IN	OUT	OUT
R121	IN	OUT	IN	OUT
V _O	1.82	1.93	2.04	2.16

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Figure 5-62 Typical Voltages for V_{Ref} Supply



NOTE:
Print head shown on bottom view.

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Figure 5-63 Print Head Solenoid Resistance Measurement

CHAPTER 6

MECHANICAL SERVICING

6.1 REMOVAL, REPLACEMENT, AND ADJUSTMENT PROCEDURES

This section contains information pertaining to the removal, replacement and adjustment of the mechanical assemblies of the LA36. Section 5.3 covers the disassembly, assembly and adjustment of the component parts of the LA36.

All mechanical assemblies and component parts of the LA36, except the following, may be repaired in the field:

1. Print Head Assembly
2. DC Motor and Encoder Assembly
3. Tractor Assemblies
4. Ribbon Drive Assembly
5. Ribbon Chassis Assembly
6. Carriage Assembly

6.1.1 Print Head Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and the ribbon.
4. Open the rear access door on the cabinet.
5. Disconnect the ribbon cable connector from J6 on the Power Board (Figure 6-2).
6. Pull the ribbon cable from under the Power Board and up through the slot at the rear of the cabinet.
7. Remove the 4 (4–40) screws and kep nuts that secure the two ribbon cable clamps to the cabinet base (Figure 6-3).
8. Remove the 4 (6–32) screws, lockwashers and flat washers that secure the print head to the carriage and remove the print head and the ribbon cable (Figure 6-4).

9. Secure the new print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.
10. Dress the ribbon cable under the dc motor, down through the slot in the rear of the cabinet, under the Power Board and reconnect the ribbon cable connector to J6 on the Power Board.
11. Secure the two ribbon cable clamps to the cabinet base with the 4 (4–40) screws and lockwashers.

CAUTION

Move the carriage to the extreme left to ensure that there is adequate slack in the print head cable to prevent any strain being placed on the cable or print head board.

12. Close the rear access door on the cabinet.
13. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

14. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

15. Tighten the 4 (6–32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

16. Move the print head to the extreme right or left and check for 0.012 ± 0.002 -inch clearance.
17. Replace the ribbon and ribbon spools (Figure 6-7).
18. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
19. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

20. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.1.2 Timing Belt

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and the ribbon.
4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage and set the print head aside (Figure 6-4).
5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage, and ribbon drive pulley. Discard the timing belt (Figure 6-8).
6. Engage the new timing belt on the ribbon drive pulley; push on the spring-loaded ribbon drive and engage the timing belt on the dc motor pulley and the carriage.
7. Secure the print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.
8. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

9. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

10. Tighten the 4 (6–32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

11. Move the print head to the extreme right or left and check for 0.012 ±0.002-inch clearance.
12. Replace the ribbon and ribbon spools (Figure 6-7).
13. With the ribbon wound on the left spool and moving left to right at the moment of ribbon reversal, a pull test on the carriage from left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7).
14. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
15. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.1.3 LK02 Keyboard Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the 4 (8–32) screws, lockwashers, flat washers and spacers that secure the keyboard bezel to the cabinet base (Figure 6-9).
4. Turn the keyboard bezel upside down on a piece of foam or bubble plastic and remove the 4 (8–32) keps that secure the keyboard to the bezel. Leave the four hex standoffs in place (Figure 6-10).
5. Lift the keyboard off the weld studs, disconnect the Berg connector from J2 on the keyboard and set the keyboard aside (Figure 6-10). If the equipment also uses an LK03 keyboard, disconnect the connector from J1 on the keyboard.
6. Reconnect the Berg connector to J2 on the new keyboard. Place the keyboard on the weld studs and secure with the 4 (8–32) keps.
7. Replace the keyboard bezel on the cabinet base and secure with the 4 (8–32) screws, lockwashers, flat washers and spacers.

CAUTION

Ensure that the spacers are placed under the keyboard bezel. Failure to do so may result in damage to the print head because of interference with the keyboard connector.

8. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
9. Replace the printer cover, printer paper and restore power to the LA36.

6.1.4 LK03 Keyboard Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.

2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the 4 (8–32) screws, lockwashers, flat washers and spacers that secure the keyboard bezel to the cabinet base (Figure 6-10).
4. Turn the keyboard bezel upside down on a piece of foam or bubble plastic and remove the 4 (8–32) keps that secure the keyboard to the bezel. Leave the four hex standoffs in place (Figure 6-11).
5. Lift the keyboard off the weld studs, disconnect the connector from J1 on the keyboard and set the keyboard aside (Figure 6-11).
6. Reconnect the connector to J1 on the new keyboard, place the keyboard on the weld studs and secure with the 4 (8–32) keps.
7. Replace the keyboard bezel on the cabinet base and secure with the 4 (8–32) screws, lockwashers, flat washers and spacers.

CAUTION

Ensure that the spacers are placed under the keyboard bezel. Failure to do so may result in damage to the print head because of interference with the keyboard connector.

8. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
9. Replace the printer cover, printer paper and restore power to the LA36.

6.1.5 Printer Mechanism Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Remove the 4 (6–32) screws, lockwashers and flat washers that secure the print head to the carriage and set the print head aside (Figure 6-4).
5. Open the rear access door on the cabinet.
6. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).
7. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).
8. Pull the cables and wires up through the slots at the rear of the cabinet.
9. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.

10. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).
11. Remove the printer mechanism from the cabinet base and set aside.
12. Place the new printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.
13. Thread the cables and wires down through the slots at the rear of the cabinet.
14. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.
15. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.
16. Dress the cables and wires inside the cabinet and install cable ties as deemed necessary.
17. Close the rear access door on the cabinet.
18. Adjust the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ± 1 in/lbs of torque.
19. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).
20. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.
21. Secure the print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.
22. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

23. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

24. Tighten the 4 (6–32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

25. Move the print head to the extreme right or left and check for 0.012 ± 0.002 -inch clearance.
26. Replace the ribbon and ribbon spools (Figure 6-7).
27. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
28. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
29. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.1.6 DC Motor and Encoder Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Open the rear access door on the cabinet.
4. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).
5. Pull the cables up through the slot at the rear of the cabinet.
6. Push the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley (Figure 6-8).
7. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate and set the motor aside (Figure 6-16).
8. Secure the new dc motor to the right-hand side plate with the 3 (8–32) screws and hex standoffs.
9. Thread the dc motor and encoder cables down through the slot at the rear of the cabinet.
10. Secure the cables in the cable clamp. Reconnect the connector to J4 on the Power Board.
11. Perform the Encoder Adjustment at the end of this section.

12. Close the rear access door on the cabinet.
13. Push on the ribbon drive and engage the timing belt on the dc motor pulley.
14. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
15. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
16. Replace the printer cover, printer paper and restore power to the LA36.

Encoder Adjustment

The Motor and Encoder Assembly requires both electrical and mechanical adjustment. The electrical adjustment should be made first. If the tolerances can be met, mechanical adjustment is not necessary. The electrical adjustment must be repeated whenever a mechanical adjustment is made.

1. Release the tension on the timing belt by pressing the spring-loaded ribbon drive assembly; slip the timing belt from the pulley on the motor shaft.
2. Lower the rear access door.
3. Set scope as follows:

VERTICAL DISPLAY CH1 and CH2:	2 V/DIV (X10 PROBES)
COUPLING CH1 and CH2:	DC
VERTICAL MODE:	SELECT CH1
TIME BASE:	100 μ s/DIV
TRIGGER:	NORMAL
SOURCE:	SELECT CH1
SLOPE:	POSITIVE
LEVEL:	POSITIVE

4. Connect scope CH1 probe to PIN 8 of E-6 and CH2 probe to PIN 6 of E-6 or to TP1 and TP2 of Logic Board M7722.
5. Turn power on, motor will rotate clockwise as viewed from the Encoder end.

NOTE

If the Encoder is drastically out of adjustment, the motor may turn in either direction and the speed may vary from very fast to zero. Encoder readjustment will correct these conditions.

If the Motor is turning counterclockwise, the waveform for quadrature will be reversed. That is, CH1 will lead by 90°.

6. Select Channel 1, set vertical to CH1 and trigger source to CH1, then check waveform for 50% Duty Cycle (Figure 6-17).

NOTE

Use uncalibrated sweep and adjust variable sweep for 1 cycle to equal 10 divisions, thus 50% Duty Cycle is equal to 5 divisions.

If adjustment is necessary, refer to Step 8.

7. Select Channel 2, set vertical to CH2 and trigger source to CH2, then check for 50% Duty Cycle as in Step 6.

If adjustment is necessary, refer to Step 8.

8. To make adjustments on Encoder, carefully remove the protective housing on the rear of the motor.
 - a. To adjust CH1 Duty Cycle, adjust R-2 (Figure 6-18) on Encoder until correct.
 - b. To adjust CH2 Duty Cycle, adjust R-1 (Figure 6-18) on Encoder until correct.
 - c. Gylptol both pots and re-check adjustment. Jitter should not exceed 1.4 divisions (Figure 6-19) measured from leading edge to trailing edge.

9. Select Channel 1 as trigger source and set vertical mode to alternate.

Channel 2 should lead Channel 1 by $90^\circ \pm 20^\circ$ (Figure 6-20). If not, loosen the two Encoder screws reposition the Encoder Subassembly as required and tighten screws.

CAUTION

Exercise extreme caution when adjusting Encoder to avoid bending or damaging the disk or coming in contact with the rotating disk.

10. Turn power off.
11. Replace Encoder cover carefully.
12. Reinstall timing belt by pressing the spring-loaded ribbon drive assembly to release tension; slip the timing belt onto the pulley on the motor shaft.
13. Replace the printer housing.
14. Close rear access door.

6.1.7 Ribbon Drive Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).

3. Remove the ribbon spools and ribbon.
4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).
6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).
7. Remove the 8–32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).
8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-21).
9. Carefully remove the ribbon drive and the pushrod.
10. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.
11. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.
12. Insert the compression spring between the left-hand side plate and the ribbon drive.
13. Push the rear of the drive assembly toward the side plate and engage the lower pivot point.
14. Slide the upper pivot point under the pivot tab on the side plate and secure with the 8–32 screw, lockwasher and flat washer. Make the screw finger tight.

NOTE

Before pushing the upper pivot point under the pivot tab, ensure that the flat side of the pivot is resting against the raised portion of the pivot tab.

15. Replace the retaining ring that holds the pushrod in the ribbon chassis.
16. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.
17. Replace the ribbon and ribbon spools (Figure 6-7).
18. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center (Figure 6-22).
19. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque.

NOTE

The eccentric tab should be bent at a 90° angle (Figure 6-21) when viewed from the left side of the unit. If the angle is not at 90°, bend to the correct angle.

20. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
21. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
22. Replace the printer cover, printer paper and restore power to the LA36.

6.1.8 Carriage Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).
5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).
6. Open the rear access door on the cabinet.
7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).
8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).
9. Pull the cables and wires up through the slots at the rear of the cabinet.
10. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.
11. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).
12. Set the printer mechanism on the workbench.
13. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.
14. Remove the two speaker leads.
15. Remove the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).
16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).

17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)
18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).
19. Remove the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).
20. Carefully remove the right-hand side plate (Figure 6-23).
21. Carefully slide the carriage off the two carriage shafts. (Place your hand beneath the carriage to catch the plain bushing as it slides off the rear carriage shaft.)
22. Replace the plain bushing in the new carriage and slide the bushing and the new carriage onto the carriage shafts.
23. Replace the right-hand side plate.
24. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.
25. On equipment with serial number 6219 and below replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.
26. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.
27. Replace the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ± 2 in/lbs of torque.
28. Replace the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws (be sure to place the ground strap on the top screw and tighten the screw to 20 ± 2 in/lbs of torque).
29. Loosen the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-23).
30. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.
31. Loosen the 10–32 screw that secures the front carriage shaft to the left-hand side plate.
32. Set up and calibrate the Print Bar Alignment Tool (94-11424-2). (Refer to Section 5.3.17.)
33. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).
34. Slide the tool to the right until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).

35. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.
36. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 \pm 2 in/lbs of torque.

NOTE

This adjustment ensures that the face of the print bar is 2.562 inch from the center line of the front carriage shaft.

37. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).
38. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

NOTE

This adjustment preloads the front carriage shaft to compensate for distortion caused by the heavy spring tension of the Ribbon Drive Assembly.

39. Tighten the 2 (10-32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 \pm 2 in/lbs of torque.
40. Tighten the 2 (8-32) screws that secure the ribbon chassis to the print bar.
41. Secure the Encoder motor to the right-hand side plate with the 3 (8-32) screws and the hex standoffs.
42. Place the printer mechanism on the cabinet base and secure with the 4 (10-32) screws, lockwashers and Buna washers. Make the screws finger tight.
43. Thread the cables and wires down through the slots at the rear of the cabinet.
44. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.
45. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.
46. Dress the cables and wires inside the cabinet and install cable ties as deemed necessary.
47. Close the rear access door on the cabinet.
48. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10-32) screws to 4 \pm 1 in/lbs of torque.
49. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10-32) screws that secure the printer mechanism to the cabinet base and realign the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

50. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.
51. Secure the print head to the carriage with the 4 (6–32) screws and lockwashers. Make the screws finger tight.
52. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

53. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

54. Tighten the 4 (6–32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

55. Move the print head to the extreme right or left and check for 0.012 ± 0.002 -inch clearance.
56. Replace the ribbon and ribbon spools (Figure 6-7).
57. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
58. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
59. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.1.9 Ribbon Chassis Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Clip the three cable ties that secure the speaker wires to the ribbon chassis (Figure 6-25).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-25).
6. Remove the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates (Figure 6-25).
7. Remove the 2 (8–32) screws and lockwashers that secure the ribbon chassis to the print bar (Figure 6-25).
8. Remove the ribbon chassis and set aside.
9. Secure the new ribbon chassis to the print bar with the 2 (8–32) screws and lockwashers.
10. Replace the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates. (Be sure to attach the ground strap to the top screw on the right-hand side and tighten the ground screw 20 ± 2 in/lbs of torque.)
11. Replace the retaining ring that holds the pushrod in the ribbon chassis.
12. Secure the speaker wires to the ribbon chassis with cable ties.
13. Remove the 4 (6–32) screws, lockwashers and flat washers that secure the print head to the carriage and set the print head aside.
14. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).
15. Lift the printer mechanism at the front, tilt toward the rear and let the mechanism rest on the side plates (Figure 6-26).
16. Slide the reverse sensor to the right and rotate the ribbon drive pulley several times. Measure the clearance between the main pawl tab and the right-hand interposer (Figure 6-26).
17. Slide the reverse sensor to the left and rotate the ribbon drive pulley until the main pawl shifts to the opposite side. Rotate the pulley several more times.
18. Measure the clearance between the main pawl tab and the left-hand interposer.
19. The two clearances must be equal within 0.020 inch.
20. If the two clearances are not equal within 0.020 inch, move the upper pivot point toward the side having the greatest clearance. Tighten the upper pivot screw.

21. Perform Steps 16–18. If the clearances are not within 0.020 inch, loosen the upper pivot screw and readjust the upper pivot.
22. When the clearances are equal within the 0.020 inch, tighten the upper pivot screw to 18 ± 2 in/lbs of torque.
23. Rotate the printer mechanism back into place on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make screws finger tight.
24. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ± 1 in/lbs of torque.
25. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).
26. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.
27. Secure the print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.
28. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

29. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

30. Tighten the 4 (6–32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

31. Move the print head to the extreme right or left and check for 0.012 ± 0.002 -inch clearance.

32. Replace the ribbon and ribbon spools (Figure 6-7).
33. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
34. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
35. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.1.10 Idler Gear Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the idler gear assembly to the left-hand side plate (Figure 6-27).
4. Secure the new idler gear assembly to the left-hand side plate with the 2 (8–32) screws, lockwashers and flat washers. Make the screws finger tight.
5. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27). (The idler gear should be free to slide in and out.)
6. Tighten the 2 (8–32) screws to 18 ± 2 in/lbs of torque.
7. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
8. Replace the printer cover, printer paper and restore power to the LA36.

6.1.11 Tractor Assembly (RH or LH)

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Loosen the screw shaft on the right-hand tractor and the 10–32 screw on the left-hand tractor (Figure 6-28).
3. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)

4. Grasp the line feed knob and pull the square tractor drive shaft out of the right- and left-hand tractors (Figure 6-28).
5. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-28).
6. Remove the tractor support shaft and the right- and left-hand tractors from the side plates.
7. Replace whichever tractor is defective.
8. Replace the tractor support shaft in the side plates.
9. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

NOTE

Ensure that the index marks on the outside of the upper tractor bushings coincide with the same flat on the square shaft (Figure 6-29). If the bushings are not scribed, rotate the tractors until a tractor pin on both tractors is centered on the same flat.

10. Push the square tractor drive shaft through the left-hand side plate and through the left- and right-hand tractors.
11. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.
12. Slide the left-hand tractor to the left so that the feed pins are 1-7/8 inches from the left-hand side plate. Tighten the 10–32 screw on the left-hand tractor (Figure 6-29).
13. Slide the right-hand tractor from side to side. If it appears to bind or have excessive drag on the shafts, grasp the tractor support shaft and move it up or down in its slots until the tractor slides easily on the shafts.
14. The right-hand tractor will be adjusted to the width of paper or forms to be used.
15. Replace the printer cover, printer paper and restore power to the LA36.

6.1.12 Stepping Motor Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the idler gear to the left-hand side plate (Figure 6-27).
5. Open the rear access door on the cabinet.

6. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).
7. Pull the wires up through the slot at the rear of the cabinet.
8. Use a Pin Removal Tool (AMP P/N 1-305183-1) and remove the four motor leads from pin Nos. 4, 5, 6 and 7 on the connector (Figure 6-30).
9. Remove the 4 (8–32) screws, flat washers, lockwashers and hex nuts that secure the stepping motor to the left-hand side plate. Set the stepping motor aside (Figure 6-31).
10. Use a Pin Insertion Tool (AMP P/N 91002-1) to insert the leads on the new stepping motor in connector pin Nos. 4, 5, 6 and 7 (Figure 6-30).
11. Secure the new stepping motor to the left-hand side plate with the 4 (8–32) screws, flat washers, lockwashers and hex nuts. The hex nuts and lockwashers go on the inside of the left-hand side plate. (Allow the stepping motor to drop to its lowest point in the elongated slots.)
12. Tighten the 4 (8–32) screws to 18 ± 2 in/lbs of torque.
13. Secure the idler gear to the left-hand side plate with the 2 (8–32) screws, lockwashers and flat washers. Make the screws finger tight.
14. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27).
15. Tighten the 2 (8–32) screws to 18 ± 2 in/lbs of torque.
16. Secure the stepping motor wires and the speaker wires with cable ties and thread them under the printer mechanism and pushrod and down through the slot at the rear of the cabinet. Reconnect the connector to J5 on the Power Board.
17. Secure the bundled wires in the cable clamp.
18. Replace the ribbon and ribbon spools.
19. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
20. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
21. Replace the printer cover, printer paper and restore power to the LA36.

6.1.13 Logic Board Assembly (M7722)

1. Remove power from the LA36. Remove the printer paper.
2. Open the rear access door on the cabinet.

3. Disconnect the connectors from J1, J2, J3 and the quick-disconnects from the +5 V (red) and ground (black) on the Logic Board (Figure 6-32). If the EIA option is installed, disconnect the connector from J4. (There will not be a connector in J2.)
4. Remove the 6 (8–32) screws, lockwashers and flat washers that secure the Logic Board to the rear access door and set the Logic Board aside (Figure 6-32).
5. Place the new Logic Board on the standoffs and secure to the rear access door with the 6 (8–32) screws, lockwashers and flat washers. (Looking from the rear, loop the cable clamp over the right-front standoff before securing the Logic Board.) Tighten the screws to 16 ± 2 in/lbs of torque.
6. Reconnect the connectors to J1, J2 and J3 and the quick-disconnects to the +5 V (red) and ground (black) on the Logic Board.
7. Close the rear access door on the cabinet.
8. Replace the printer paper and restore power to the LA36.

6.1.14 Power Board Assembly

1. Remove power from the LA36 and remove the printer paper.
2. Open the rear access door on the cabinet.
3. Disconnect the connectors from J2, J3, J4, J5, J6 and the quick-disconnects from the +5 V (red) and ground (black) on the Power Board. Disconnect the connector from J1 on the Logic Board (Figure 6-33).
4. Remove the 6 (8–32) screws, lockwashers and flat washers that secure the Power Board to the cabinet. Set the Power Board aside (Figure 6-33).
5. Place the new Power Board in the cabinet and secure with the 6 (8–32) screws, lockwashers and flat washers. Tighten the screws to 16 ± 2 in/lbs of torque.
6. Reconnect the connectors to J2, J3, J4, J5, J6 and the quick-disconnects to the +5 V (red) and ground (black) on the Power Board. Reconnect the connector to J1 on the Logic Board.
7. Close the rear access door on the cabinet.
8. Replace the printer paper and restore power to the LA36.

6.1.15 Fan Assembly

1. Remove power from the LA36. Remove the printer paper.
2. Open the rear access door on the cabinet.
3. Remove the 4 (6–32) screws and lockwashers that secure the fan to the cabinet (Figure 6-34).
4. Disconnect the quick-disconnect from the fan and set the fan aside (Figure 6-34).
5. Reconnect the quick-disconnect to the new fan.

6. Secure the fan to the cabinet with the 4 (6–32) screws and lockwashers.
7. Close the rear access door on the cabinet.
8. Replace the printer paper and restore power to the LA36.

6.1.16 Transformer Assembly

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Open the rear access door on the cabinet.
4. Disconnect the connector from J3 on the Power Board (Figure 6-35).
5. Remove the 2 (8–32) screws and lockwashers that secure the fuse mounting bracket to the cabinet (Figure 6-35).
6. Remove the green jumper wire from capacitor C5 (Figure 6-36).
7. Disconnect the quick-disconnect from the fan assembly (Figure 6-35).
8. Remove the 4 (8–32) screws, lockwasher and flat washers that secure the keyboard bezel to the cabinet base (Figure 6-9).
9. Turn the keyboard upside down and remove the quick-disconnects from the left-most rocker switch (Figure 6-37).
10. Clip all the cable ties from the keyboard to the transformer.
11. Pull the two wires that were removed from the rocker switch down through the slot in the rear of the cabinet.
12. Remove the 4 (8–32) screws, lockwashers and kep nuts that secure the transformer to the cabinet base. Disconnect the 115 V–230 V jumper from connector J1 and set the transformer aside (Figure 6-35).
13. Place the new transformer in the cabinet and secure with the 4 (8–32) screws, lockwashers and kep nuts. (Be sure to reconnect the ground strap to the rear screw on the transformer.) Tighten the ground strap screw to 20 ± 2 in/lbs of torque.
14. Pull the two wires up through the slot in the rear of the cabinet and reconnect the quick-disconnects to the rocker switch on the keyboard.
15. Replace the keyboard bezel on the cabinet base and secure with the 4 (8–32) screws, lockwashers and flat washers.
16. Reconnect the quick-disconnect to the fan assembly.
17. Dress the wires and cables from the keyboard to the transformer and secure with cable ties.

18. Reconnect the connector to J3 on the Power Board.
19. Replace the green jumper wire on capacitor C5.
20. Secure the fuse mounting bracket to the cabinet with the 2 (8–32) screws and lockwashers.
21. Close the rear access door on the cabinet.
22. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
23. Replace the printer cover, printer paper and restore power to the LA36.

6.1.17 Line Filter Assembly

1. Remove power from the LA36 and remove the printer paper.
2. Open the rear access door on the cabinet.
3. Remove the 2 (8–32) screws and lockwashers that secure the fuse mounting bracket to the cabinet (Figure 6-35).
4. Disconnect all external wires that connect to capacitor C5 and fuse F1 (Figure 6-36).
5. Remove the fuse mounting bracket and set aside.
6. Reconnect all external wires to capacitor C5 and fuse F1 in the new line filter.
7. Secure the fuse mounting bracket to the cabinet with the 2 (8–32) screws and lockwashers.
8. Close the rear access door on the cabinet.
9. Replace the printer paper and restore power to the LA36.

6.2 DISASSEMBLY, ASSEMBLY AND ADJUSTMENT PROCEDURES

6.2.1 Print Bar

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).
5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).
6. Open the rear access door on the cabinet.

7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).
8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).
9. Pull the cables and wires up through the slots at the rear of the cabinet.
10. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.
11. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).
12. Set the printer mechanism on the workbench.
13. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.
14. Remove the two speaker leads.
15. Remove the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).
16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).
17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)
18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).
19. Remove the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).
20. Carefully remove the right-hand side plate (Figure 6-23).
21. Remove the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-38).
22. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the left-hand side plate. Set the print bar aside (Figure 6-38).
23. Secure the new print bar to the left-hand side plate with the 1/4-20 screw, lockwasher and flat washer. (Ensure that the narrow chamber is facing up.)
24. Replace the right-hand side plate.
25. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

26. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.
27. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.
28. Replace the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ± 2 in/lbs of torque.
29. Replace the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws. (Be sure to place the ground strap on the top screw and tighten the screw to 20 ± 2 in/lbs of torque.)
30. Replace the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-23). Make the screws finger tight.
31. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.
32. Loosen the 10–32 screw that secures the front carriage shaft to the left-hand side plate.
33. Set up and calibrate the Print Bar Alignment Tool (94-11424-2). (Refer to Section 6.2.17.)
34. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).
35. Slide the tool to the left until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).
36. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.
37. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 ± 2 in/lbs of torque.

NOTE

This adjustment ensures that the face of the print bar is 2.562 inch from the center line of the front carriage shaft.

38. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).
39. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

NOTE

This adjustment preloads the front carriage shaft to compensate for distortion caused by the heavy spring tension of the Ribbon Drive Assembly.

40. Tighten the 2 (10–32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 ± 2 in/lbs of torque.
41. Tighten the 2 (8–32) screws that secure the ribbon chassis to the print bar.
42. Secure the encoder motor to the right-hand side plate with the 3 (8–32) screws and the hex standoffs.
43. Place the printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.
44. Thread the cables and wires down through the slots at the rear of the cabinet.
45. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.
46. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.
47. Dress the cables and wires inside the cabinet and install cable ties as deemed necessary.
48. Close the rear access door on the cabinet.
49. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ± 1 in/lbs of torque.
50. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).
51. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.
52. Secure the print head to the carriage with the 4 (6–32) screws and lockwashers. Make the screws finger tight.
53. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

54. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

55. Tighten the 4 (6-32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

56. Move the print head to the extreme right or left and check for 0.012 ± 0.002 -inch clearance.
57. Replace the ribbon and ribbon spools (Figure 6-7).
58. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
59. Replace the printer housing on the cabinet base and secure with the 8 (6-18) screws and flat washers.
60. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.2.2 Tractor Drive Shaft

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Loosen the screw shaft on the right-hand tractor and the 6-32 screw on the left-hand tractor (Figure 6-39).
3. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)
4. Grasp the line feed knob and pull the tractor drive shaft to the left, out of the right-hand side plate (Figure 6-39).
5. Remove the 6-32 screw from the end of the tractor drive shaft (Figure 6-40).

6. Remove the line feed clutch, coupling and the line feed knob from the tractor drive shaft (Figure 6-40).
7. Replace the line feed clutch, coupling and line feed knob on the new tractor drive shaft. Secure with the 6–32 screw.

NOTE

Ensure that the index marks on the outside of the upper tractor bushings coincide with the same flat on the square shaft (Figure 6-29). If the bushings are not scribed, rotate the tractors until a tractor pin on both tractors is centered on the same flat.

8. Push the square tractor drive shaft through the left-hand side plate and through the left- and right-hand tractors.
9. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.
10. Slide the left-hand tractor to the left so that the feed pins are 1-7/8 inches from the left-hand side plate. Tighten the 10–32 screw on the left-hand tractor (Figure 6-29).
11. Slide the right-hand tractor from side to side. If it appears to bind or have excessive drag on the shafts, grasp the tractor support shaft and move it up or down in its slots until the tractor slides easily on the shafts.
12. The right-hand tractor will be adjusted to the width of paper or forms to be used.
13. Replace the printer cover, printer paper and restore power to the LA36.

6.2.3 Tractor Support Shaft

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Loosen the screw shaft on the right-hand tractor and the 10–32 screw on the left-hand tractor (Figure 6-41).
3. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-41).
4. Remove the tractor support shaft from the left- and right-hand tractors through the right-hand side plate (Figure 6-41).

NOTE

As the tractor shaft clears each tractor, catch the clamp collar as it falls free of the tractor and the shaft.

5. Slide the new tractor support shaft through the slot in the right-hand side plate, the screw shaft clamp collar and the right-hand tractor, then through the left-hand tractor, the clamp collar and the left-hand plate.
6. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

7. Slide the left-hand tractor to the left so that the feed pins are 1-7/8 inches from the left-hand side plate. Tighten the 10-32 screw on the left-hand tractor (Figure 6-29).
8. Slide the right-hand tractor from side to side. If it appears to bind or have excessive drag on the shafts, grasp the tractor support shaft and move it up or down in its slots until the tractor slides easily on the shafts.
9. The right-hand tractor will be adjusted to the width of paper or forms to be used.
10. Replace the printer cover, printer paper and restore power to the LA36.

6.2.4 Carriage Shaft(s)

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6-18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Remove the 4 (6-32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).
5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).
6. Open the rear access door on the cabinet.
7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).
8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).
9. Pull the cables and wires up through the slots at the rear of the cabinet.
10. Remove the 6-32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.
11. Remove the 4 (10-32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).
12. Set the printer mechanism on the workbench.
13. Remove the 3 (8-32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.
14. Remove the two speaker leads.
15. Remove the 2 (6-32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).

16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).
17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)
18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).
19. Remove the 2 (10-32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).
20. Carefully remove the right-hand side plate (Figure 6-23).
21. Carefully slide the carriage off the two carriage shafts. (Place your hand beneath the carriage to catch the plain bushing as it slides off the rear carriage shaft.)
22. Remove the 10-32 screw, lockwashers and flat washer that secure the front or rear carriage shaft to the left-hand side plate (dependent on which shaft is to be replaced) (Figure 6-42).
23. Secure the front or rear carriage shaft to the left-hand side plate with the 10-32 screw, lockwasher and flat washer. If the rear carriage shaft is replaced, tighten the screw to 18 ± 2 in/lbs of torque and at the same time, loosen the 10-32 screw on the front shaft. If the front carriage shaft is replaced, make the 10-32 screw finger tight.
24. Replace the plain bushing and the carriage on the carriage shafts.
25. Replace the right-hand side plate.
26. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.
27. On equipment with serial number 6219 and below, replace the flat washer and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.
28. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.
29. Replace the 2 (10-32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ± 2 in/lbs of torque.
30. Replace the 2 (6-32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws. (Be sure to place the ground strap on the top screw and tighten the screw to 20 ± 2 in/lbs of torque.)
31. Loosen the 2 (8-32) screws that secure the ribbon chassis to the print bar (Figure 6-23).
32. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.

33. Loosen the 10–32 screw that secures the front carriage shaft to the left-hand side plate.
34. Set up and calibrate the Print Bar Alignment Tool (94-11424-2). (Refer to Section 6.2.17.)
35. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).
36. Slide the tool to the left until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).
37. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.
38. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 ± 2 in/lbs of torque.

NOTE

This adjustment ensures that the face of the print bar is 2.562 inch from the center line of the front carriage shaft.

39. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).
40. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

NOTE

This adjustment preloads the front carriage shaft to compensate for distortion caused by the heavy spring tension of the ribbon drive assembly.

41. Tighten the 2 (10–32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 ± 2 in/lbs of torque.
42. Tighten the 2 (8–32) screws that secure the ribbon chassis to the print bar.
43. Secure the encoder motor to the right-hand side plate with the 3 (8–32) screws and the hex standoffs.
44. Place the printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.
45. Thread the cables and wires down through the slots at the rear of the cabinet.
46. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.
47. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.
48. Dress the cables and wires inside the cabinet and install cable ties as deemed necessary.
49. Close the rear access door on the cabinet.

50. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ± 1 in/lbs of torque.
51. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).
52. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.
53. Secure the print head to the carriage with the 4 (6–32) screws and lockwashers. Make the screws finger tight.
54. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

55. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

56. Tighten the 4 (6–32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

57. Move the print head to the extreme right or left and check for 0.012 ± 0.002 -inch clearance.
58. Replace the ribbon and ribbon spools (Figure 6-7).
59. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
60. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

61. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.2.5 Carriage Plain Bushing

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).
5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).
6. Open the rear access door on the cabinet.
7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).
8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).
9. Pull the cables and wires up through the slots at the rear of the cabinet.
10. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.
11. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).
12. Set the printer mechanism on the workbench.
13. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.
14. Remove the two speaker leads.
15. Remove the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).
16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).

17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)
18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).
19. Remove the 2 (10-32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).
20. Carefully remove the right-hand side plate (Figure 6-23).
21. Carefully slide the carriage off the two carriage shafts. (Place your hand beneath the carriage to catch the plain bushing as it slides off the rear carriage shaft.)
22. Replace the new plain bushing in the carriage and slide the bushing and the carriage on the carriage shafts.
23. Replace the right-hand side plate.
24. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.
25. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.
26. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.
27. Replace the 2 (10-32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ± 2 in/lbs of torque.
28. Replace the 2 (6-32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws. (Be sure to place the ground strap on the top screw and tighten the screw to 20 ± 2 in/lbs of torque.)
29. Loosen the 2 (8-32) screws that secure the ribbon chassis to the print bar (Figure 6-23).
30. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.
31. Loosen the 10-32 screw that secures the front carriage shaft to the left-hand side plate.
32. Set up and calibrate the print bar alignment tool (94-11424-2). (Refer to Section 6.2.17.)
33. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).
34. Slide the tool to the left until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).

35. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.
36. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 ± 2 in/lbs of torque.

NOTE

This adjustment ensures that the face of the print bar is 2.562 inch from the center line of the front carriage shaft.

37. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).
38. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

NOTE

This adjustment preloads the front carriage shaft to compensate for distortion caused by the heavy spring tension of the Ribbon Drive Assembly.

39. Tighten the 2 (10-32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 ± 2 in/lbs of torque.
40. Tighten the 2 (8-32) screws that secure the ribbon chassis to the print bar.
41. Secure the encoder motor to the right-hand side plate with the 3 (8-32) screws and the hex standoffs.
42. Place the printer mechanism on the cabinet base and secure with the 4 (10-32) screws, lockwashers and Buna washers. Make the screws finger tight.
43. Thread the cables and wires down through the slots at the rear of the cabinet.
44. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.
45. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.
46. Dress the cables and wires inside the cabinet and install cable ties as deemed necessary.
47. Close the rear access door on the cabinet.
48. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10-32) screws to 4 ± 1 in/lbs of torque.
49. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10-32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

50. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.
51. Secure the print head to the carriage with the 4 (6-32) screws and lockwashers. Make the screws finger tight.
52. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

CAUTION

It is possible to rotate the carriage adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

53. Adjust the print head gap with the carriage in the center of travel. Place a 12-inch long, 0.012-inch flat feeler gauge between the print head jewel and the front surface of the print bar. Push the print head snug against the feeler (Figure 6-6).

CAUTION

Ensure that the feeler gauge rides between the protrusions on the print head. Do not exert excessive force on the print head when making the adjustment; it will cause the carriage shaft to bow, resulting in more than 0.012-inch of clearance.

54. Tighten the 4 (6-32) screws to 10 ± 2 in/lbs of torque.

CAUTION

Do not apply more than the recommended torque when tightening the print head screws or the moulded inserts in the carriage assembly may be damaged.

55. Move the print head to the extreme right or left and check for 0.012 ± 0.002 inch clearance.
56. Replace the ribbon and ribbon spools (Figure 6-7).
57. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
58. Replace the printer housing on the cabinet base and secure with the 8 (6-18) screws and flat washers.
59. Replace the printer cover, printer paper and restore power to the LA36.

CAUTION

Before beginning operation, ensure that the carriage adjustment lever is in the correct position (dependent on the thickness of the paper).

6.2.6 Tractor Drive Gear/Line Feed Clutch

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Loosen the 2 (8–32) screws that secure the idler gear assembly to the left-hand side plate (Figure 6-27).
3. Remove the 6–32 screw and flat washer that secure the line feed knob to the tractor drive shaft (Figure 6-27).
4. Remove the line feed knob, coupling, the tractor drive gear and the line feed clutch hub from the tractor drive shaft (Figure 6-43).
5. Replace the new tractor drive gear and line feed clutch on the tractor drive shaft.
6. Replace the line feed knob and coupling on the tractor drive shaft and secure with the 6–32 screw and flat washer.
7. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27). The idler gear should be free to slide in and out.
8. Tighten the 2 (8–32) screws to 18 ± 2 in/lbs of torque.
9. Replace the printer cover, printer paper and restore power to the LA36.

6.2.7 Ribbon Drive Pulley

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-44).
4. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and the drive pulley (Figure 6-44).
5. Remove the collar clamp from the defective drive pulley and hand press onto the new drive pulley (front edges of collar clamp and drive pulley to be coincident) (Figure 6-45).
6. Replace the ribbon drive pulley and the collar clamp on the ribbon drive shaft and adjust to give a clearance of $9/32$ inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-44). Tighten the 6–32 screw to 6 ± 2 in/lbs of torque.
7. Engage the timing belt on the ribbon drive pulley, push on the ribbon drive and engage the timing belt on the motor pulley.
8. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
9. Replace the printer cover, printer paper and restore power to the LA36.

6.2.8 Ribbon Drive Fafnir Bearing

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).
6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).
7. Remove the 8–32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).
8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-21).
9. Carefully remove the ribbon drive along with the pushrod.
10. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 6-44).
11. Remove the 2 (8–32) screws and kep nuts that secure the Fafnir bearing to the ribbon drive bracket (Figure 6-46).
12. Loosen the 4–40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 6-46).
13. Push the ribbon drive shaft toward the rear of the ribbon drive until the shaft clears the ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
14. Remove the Fafnir bearing from the ribbon drive shaft and set the bearing aside.
15. Place the new Fafnir bearing on the ribbon drive shaft and push the shaft toward the pulley end of the ribbon drive until the Fafnir bearing can be seated in the ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
16. Secure the Fafnir bearing to the ribbon drive bracket with the 2 (8–32) screws and kep nuts. The kep nuts go on the outside of the ribbon drive bracket.
17. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 1-1/2 inches beyond the ribbon drive bracket (Figure 6-47). Tighten the 4–40 screw in Fafnir bearing to 5 ± 1 in/lbs of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.
18. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust to give a clearance of 9/32 inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-45). Tighten the 6–32 screw to 6 ± 2 in/lbs of torque.

19. Check that the coils of the backstop spring do not overlap.
20. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.
21. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.
22. Insert the compression spring between the left-hand side plate and the ribbon drive.
23. Push the rear of the drive assembly toward the side plate and engage the lower pivot point.
24. Slide the upper pivot point under the pivot tab on the side plate and secure with the 8–32 screw, lockwasher and flat washer. Make the screw finger tight.

NOTE

Before pushing the upper pivot point under the pivot tab, ensure that the flat side of the pivot is resting against the raised portion of the pivot tab.

25. Replace the retaining ring that holds the pushrod in the ribbon chassis.
26. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.
27. Replace the ribbon and ribbon spools (Figure 6-7).
28. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.
29. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ± 2 in/lbs of torque (Figure 6-22).
30. With the ribbon wound on the left spool and moving left to right at the moment of ribbon reversal, a pull test on the carriage from left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7).
31. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
32. Replace the printer cover, printer paper and restore power to the LA36.

6.2.9 Ribbon Eccentric With Clutch

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).

6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).
7. Remove the 8-32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).
8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-21).
9. Carefully remove the ribbon drive along with the pushrod.
10. Loosen the 6-32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 6-44).
11. Loosen the 4-40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 6-46).
12. Remove the retaining ring that holds the pushrod in the ribbon eccentric (Figure 6-46).
13. Slide the ribbon drive shaft toward the rear of the Ribbon Drive Assembly until it clears the Fafnir bearing, eccentric with clutch and the rear bearing. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
14. Remove the backstop spring from the ribbon eccentric with clutch (Figure 6-46).
15. Install the backstop spring on the new ribbon eccentric with clutch. Apply one drop of No. 20 or 30 SAE oil on the spring.
16. Slide the pushrod into the ribbon eccentric and replace the retaining ring.
17. With the clutch, eccentric and backstop spring assembled, engage the backstop spring in the clutch retaining tab.
18. Slide the ribbon drive shaft through the rear bearing, eccentric washer, eccentric with clutch, Fafnir bearing and ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
19. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 1-1/2 inches beyond the ribbon drive bracket (Figure 6-47). Tighten the 4-40 screw in Fafnir bearing to 5 ± 1 in/lbs of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.
20. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust to give a clearance of 9/32 inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-45). Tighten the 6-32 screw to 6 ± 2 in/lbs of torque.
21. Check that the coils of the backstop spring do not overlap.
22. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.
23. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.
24. Insert the compressing spring between the left-hand side plate and the ribbon drive.

25. Push the rear of the drive assembly toward the side plate and engage the lower pivot point.
26. Slide the upper pivot point under the pivot tab on the side plate and secure with the 8–32 screw, lockwasher and flat washer. Make the screw finger tight.

NOTE

Before pushing the upper pivot point under the pivot tab, ensure that the flat side of the pivot is resting against the raised portion of the pivot tab.

27. Replace the retaining ring that holds the pushrod in the ribbon chassis.
28. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.
29. Replace the ribbon and ribbon spools (Figure 6-7).
30. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.
31. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ± 2 in/lbs of torque (Figure 6-22).
32. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
33. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
34. Replace the printer cover, printer paper and restore power to the LA36.

6.2.10 Backstop Spring

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).
6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).
7. Remove the 8–32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).

8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-24).
9. Carefully remove the ribbon drive along with the pushrod.
10. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 6-44).
11. Loosen the 4–40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 6-46).
12. Remove the retaining ring that holds the pushrod in the ribbon eccentric (Figure 6-46).
13. Slide the ribbon drive shaft toward the rear of the Ribbon Drive Assembly until it clears the Fafnir bearing, eccentric with clutch and the rear bearing. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
14. Remove the backstop spring from the ribbon eccentric with clutch (Figure 6-46). Set the spring aside.
15. Install the new backstop spring on the ribbon eccentric with clutch. Apply one drop of No. 20 or 30 SAE oil on the spring.
16. Slide the pushrod into the ribbon eccentric and replace the retaining ring.
17. With the clutch, eccentric and backstop spring assembled, engage the backstop spring in the clutch retaining tab.
18. Slide the ribbon drive shaft through the rear bearing, eccentric washer, eccentric with clutch, Fafnir bearing and ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
19. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 1-1/2 inches beyond the ribbon drive bracket (Figure 6-47). Tighten the 4–40 screw in Fafnir bearing to 5 ± 1 in/lbs of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.
20. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust to give a clearance of $9/32$ inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-45). Tighten the 6–32 screw to 6 ± 2 in/lbs of torque.
21. Check that the coils of the backstop spring do not overlap.
22. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.
23. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.
24. Insert the compression spring between the left-hand side plate and the ribbon drive.
25. Push the rear of the drive assembly toward the side plate and engage the lower pivot point.

26. Slide the upper pivot point under the pivot tab on the side plate and secure with the 8–32 screw, lockwasher and flat washer. Make the screw finger tight.

NOTE

Before pushing the upper pivot point under the pivot tab, ensure that the flat side of the pivot is resting against the raised portion of the pivot tab.

27. Replace the retaining ring that holds the pushrod in the ribbon chassis.
28. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.
29. Replace the ribbon and ribbon spools (Figure 6-7).
30. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.
31. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ± 2 in/lbs of torque (Figure 6-22).
32. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
33. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
34. Replace the printer cover, printer paper and restore power to the LA36.

6.2.11 Ribbon Drive Rear Bearing

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).
6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).
7. Remove the 8–32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).
8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-21).

9. Carefully remove the ribbon drive along with the pushrod.
10. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 6-44).
11. Loosen the 4–40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 6-46).
12. Slide the ribbon drive shaft toward the rear of the ribbon drive assembly until it clears the Fafnir bearing, eccentric with clutch and the rear bearing. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
13. On machines with serial number 7999 and below, remove the rear bearing by pushing on the bearing to snap it out of the ribbon drive bracket. On machines with serial number 8000 and above, remove the retaining ring and push the bearing out of the ribbon drive bracket.
14. Replace the new rear bearing in the ribbon drive bracket.
15. With the clutch, eccentric and backstop spring assembled, engage the backstop spring in the clutch retaining tab.
16. Slide the ribbon drive shaft through the rear bearing, eccentric washer, eccentric with clutch, Fafnir bearing and ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)
17. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 1-1/2 inches beyond the ribbon drive bracket (Figure 6-47). Tighten the 4–40 screw in Fafnir bearing to 5 ± 1 in/lbs of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.
18. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust to give a clearance of 9/32 inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-45). Tighten the 6–32 screw to 6 ± 2 in/lbs of torque.
19. Check that the coils of the backstop spring do not overlap.
20. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.
21. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.
22. Insert the compression spring between the left-hand side plate and the ribbon drive.
23. Push the rear of the drive assembly toward the side plate and engage the lower pivot point.
24. Slide the upper pivot point under the pivot tab on the side plate and secure with the 8–32 screw, lockwasher and flat washer. Make the screw finger tight.

NOTE

Before pushing the upper pivot point under the pivot tab, ensure that the flat side of the pivot is resting against the raised portion of the pivot tab.

25. Replace the retaining ring that holds the pushrod in the ribbon chassis.

26. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.
27. Replace the ribbon and ribbon spools (Figure 6-7).
28. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.
29. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8-32 upper pivot screw to 18 ± 2 in/lbs of torque (Figure 6-22).
30. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
31. Replace the printer housing on the cabinet base and secure with the 8 (6-18) screws and flat washers.
32. Replace the printer cover, printer paper and restore power to the LA36.

6.2.12 Ribbon Spool Friction Disks

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6-18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Clip the three cable ties that secure the speaker wires to the ribbon chassis (Figure 6-25).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-25).
6. Remove the 4 (6-32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates (Figure 6-25).
7. Remove the 2 (8-32) screws and lockwashers that secure the ribbon chassis to the print bar (Figure 6-21).
8. Remove the ribbon chassis and set on the workbench.
9. Remove the retaining ring that secures the ratchet wheel and the driver spool in the ribbon chassis (Figure 6-48).
10. Remove the brake washer, compression spring and the ratchet wheel (Figure 6-48).
11. Pull the defective disks off the ratchet wheel and the ribbon chassis (Figure 6-48).
12. Remove the protective paper from the two new friction disks and apply one to the ribbon chassis and the other to the ratchet wheel. Be sure the friction disks are applied to the right side of the ratchet wheel. Ensure that the surfaces are free of oil and moisture.

When you apply the friction disk on the left-hand ratchet wheel, the teeth must be pointing in a clockwise direction. On the right-hand ratchet wheel the teeth must be pointing in a counterclockwise direction.

13. Replace the ratchet wheel, compression spring and the brake washer.
14. Replace the retaining ring that secures the ratchet wheel and the ribbon spool in the ribbon chassis.
15. Secure the new ribbon chassis to the print bar with the 2 (8–32) screws and lockwashers.
16. Replace the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates. (Be sure to attach the ground strap to the top screw on the right-hand side and tighten the ground screw 20 ± 2 in/lbs of torque.)
17. Replace the retaining ring that holds the pushrod in the ribbon chassis.
18. Secure the speaker wires to the ribbon chassis with cable ties.
19. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.
20. Replace the ribbon and ribbon spools (Figure 6-7).
21. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.
22. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ± 2 in/lbs of torque (Figure 6-22).
23. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.
24. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
25. Replace the printer cover, printer paper and restore power to the LA36.

6.2.13 Ribbon Spool Ratchet Wheel(s)

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the ribbon spools and ribbon.
4. Clip the three cable ties that secure the speaker wires to the ribbon chassis (Figure 6-25).
5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-25).

6. Remove the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates (Figure 6-25).
7. Remove the 2 (8–32) screws and lockwashers that secure the ribbon chassis to the print bar (Figure 6-25).
8. Remove the ribbon chassis and set on the workbench.
9. Remove the retaining ring that secures the ratchet wheel and the driver spool in the ribbon chassis (Figure 6-48).
10. Remove the brake washer, compression spring and the ratchet wheel.
11. Remove the ratchet wheel and set aside.
12. Remove the protective paper from the two new friction disks and apply one to the ribbon chassis and the other to the new ratchet wheel. Be sure the friction disks are applied to the right side of the ratchet wheel. Ensure that surfaces are free of oil and moisture.

When you apply the friction disk on the left-hand ratchet wheel, the teeth must be pointing in a clockwise direction. On the right-hand ratchet wheel the teeth must be pointing in a counterclockwise direction.

13. Replace the ratchet wheel, compression spring and the brake washer.
14. Replace the retaining ring that secures the ratchet wheel and the ribbon spool in the ribbon chassis.
15. Secure the new ribbon chassis to the print bar with the 2 (8–32) screws and lockwashers.
16. Replace the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates. (Be sure to attach the ground strap to the top screw on the right-hand side and tighten the ground screw 20 ± 2 in/lbs of torque.)
17. Replace the retaining ring that holds the pushrod in the ribbon chassis.
18. Secure the speaker wires to the ribbon chassis with cable ties.
19. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.
20. Replace the ribbon and ribbon spools (Figure 6-7).
21. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.
22. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ± 2 in/lbs of torque (Figure 6-22).
23. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

24. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
25. Replace the printer cover, printer paper and restore power to the LA36.

6.2.14 Idler Gear

1. Remove power from the LA36. Remove the printer paper and the printer cover.
2. Remove the 8 (6–18) screws and flat washers that secure the printer housing to the cabinet base and set the housing aside (Figure 6-1).
3. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the idler gear assembly to the left-hand side plate (Figure 6-27).
4. Remove the 8–32 screws, flat washers and kep nut that secure the idler gear to the gear bracket (Figure 6-27).
5. Remove the screw, flat washers and idler tube, from the idler gear and set the gear aside.
6. Replace the idler tube, flat washers and screw in the new idler gear (one flat washer on either side of the idler gear).
7. Secure the idler gear to the gear bracket with the 8–32 screw, flat washers and kep nut. Tighten the screw to 18 ± 2 in/lbs of torque.
8. Secure the idler gear assembly to the left-hand side plate with the 2 (8–32) screws, lockwashers and flat washers. Make the screws finger tight.
9. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27). (The idler gear should be free to slide in and out.)
10. Tighten the 2 (8–32) screws to 18 ± 2 in/lbs of torque.
11. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.
12. Replace the printer cover, printer paper and restore power to the LA36.

6.2.15 Rear Door Bushing(s)

1. Remove power from the LA36.
2. Open the rear access door on the cabinet.
3. Remove the appropriate 3/8–16 screw and bushings that secure the rear access door to the cabinet (Figure 6-49).
4. Replace the defective bushing(s).
5. Secure the rear access door to the cabinet with the 3/8–16 screws and bushings. Tighten the screw to 18 ± 2 in/lbs of torque.

6.2.16 Cover Spring Clips

1. Lift the cover on the LA36.
2. Remove the 6–18 screw and flat washer that secure the spring clip to the cover (Figure 6-50).
3. Secure a new spring clip to the cover with the 6–18 screw and flat washer. Tighten the screw to 5.5 in/lbs of torque.

6.2.17 Carriage Alignment Tool Setup

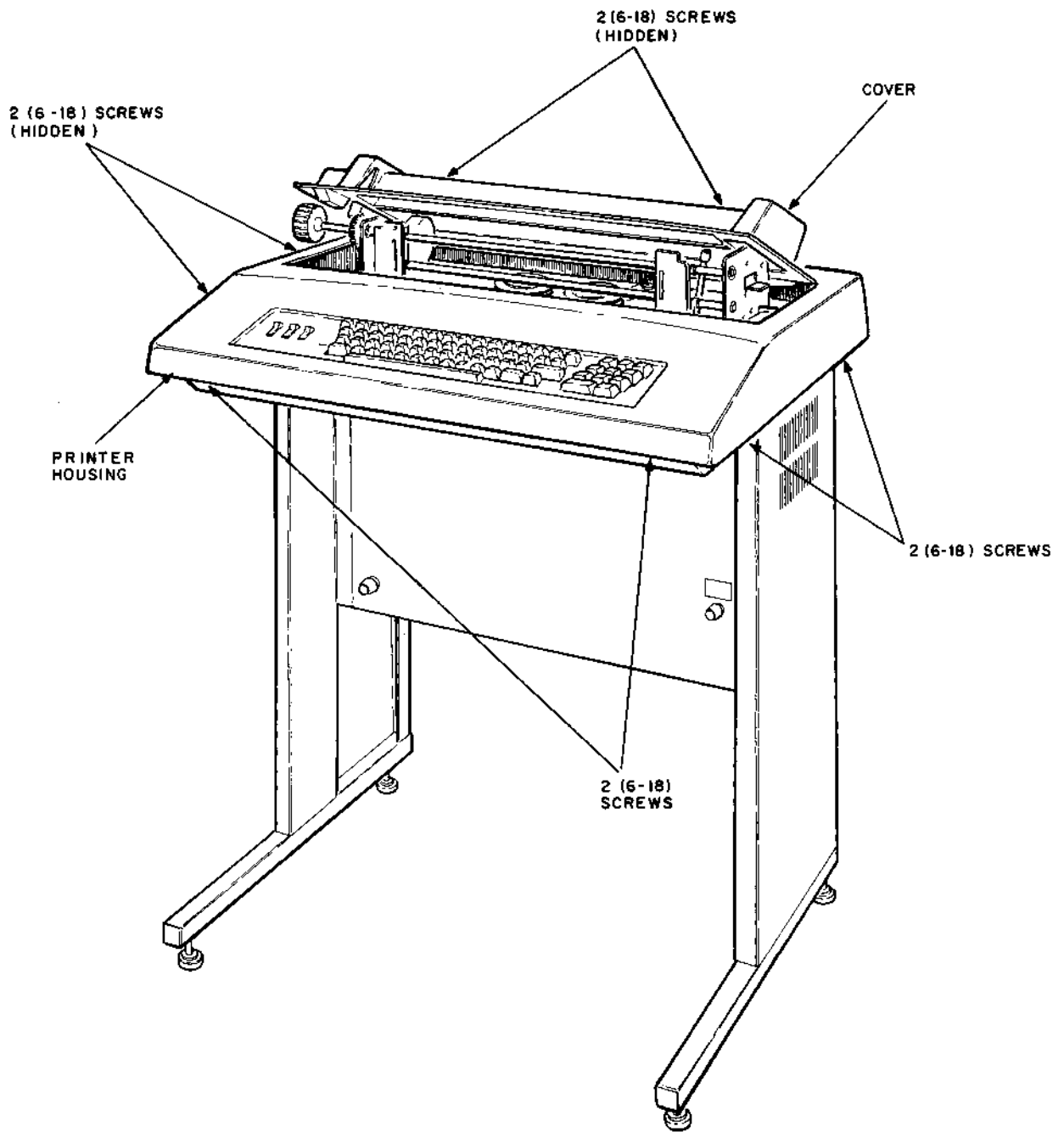
1. Place the setting block on the two dowel pins on the base block and secure with the 1/4-20 cap screw (Figure 6-51).
2. Loosen the 8–32 button head screw that secures the dial indicator to the base block.
3. Slide the dial indicator toward the setting block until the indicator needle moves at least 0.015 from its initial resting point. Tighten the button head screw and set the indicator to zero.
4. Remove the setting block from the base block.
5. The alignment tool is now calibrated to obtain a 2.562 inch measurement between the print bar and the front carriage shaft.

6.2.18 Tractor Gap Adjustment

With the tractor cover closed, there should be 0.025–0.030 inch clearance between the raised portion of the tractor cover and the stripper plate. To attain the desired clearance, open the tractor cover and with a pair of pliers carefully bend the adjusting tab (Figure 6-52).

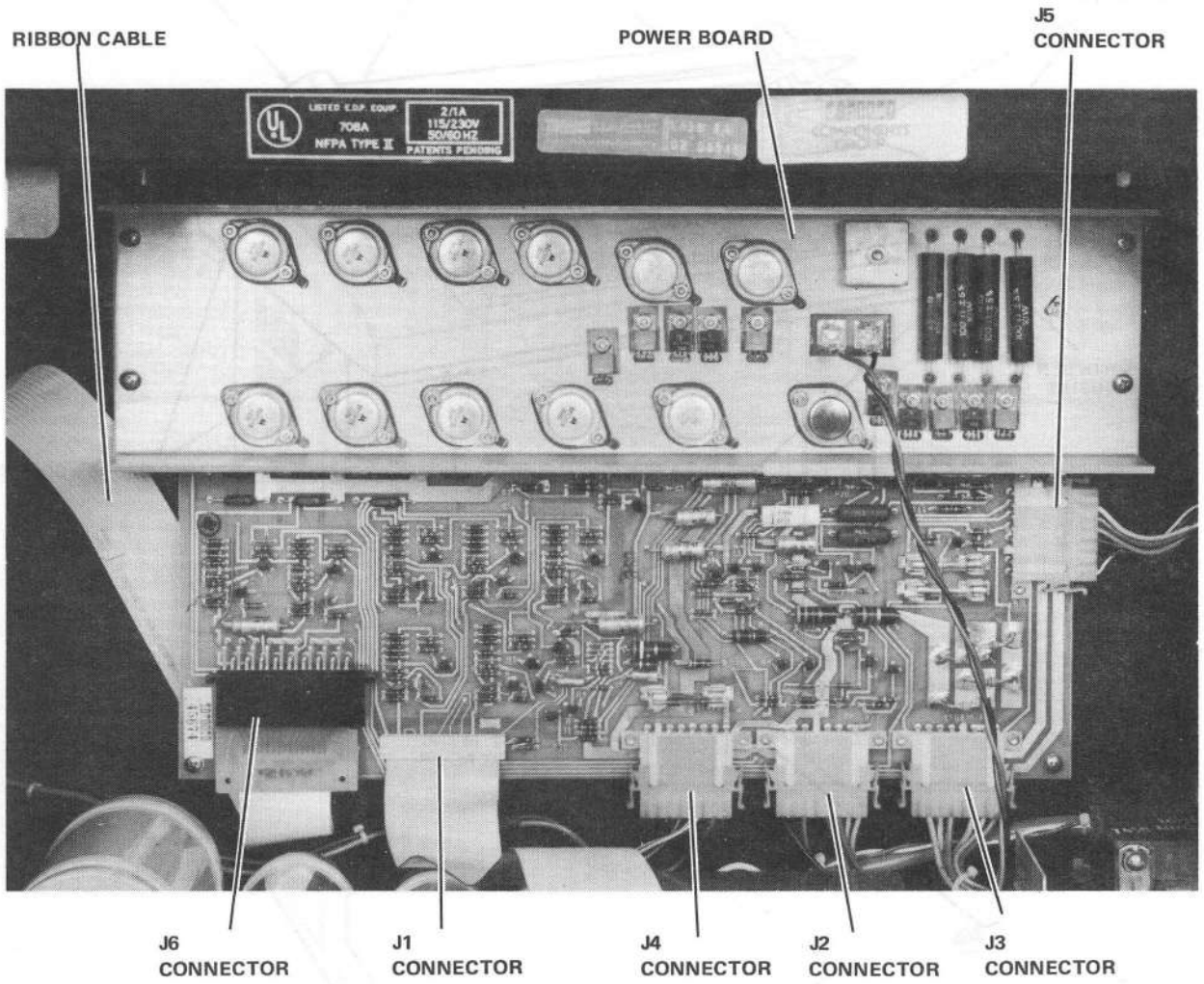
6.2.19 EIA (DF11-A) Interface

1. Remove power from the LA36. Remove the printer paper.
2. Open the rear access door on the cabinet.
3. Disconnect the EIA connector from the transmission media.
4. Disconnect the connector from J4 on the Logic Board (Figure 6-53).
5. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the EIA interface bracket to the cabinet base (Figure 6-53). Set the EIA interface aside.
6. Secure the new EIA interface to the cabinet base with the 2 (8–32) screws, lockwashers and flat washers.
7. Reconnect the connector to J4 on the Logic Board.
8. Reconnect the connector to the transmission media.
9. Close the rear access door on the cabinet.
10. Replace the printer paper and restore power to the LA36.



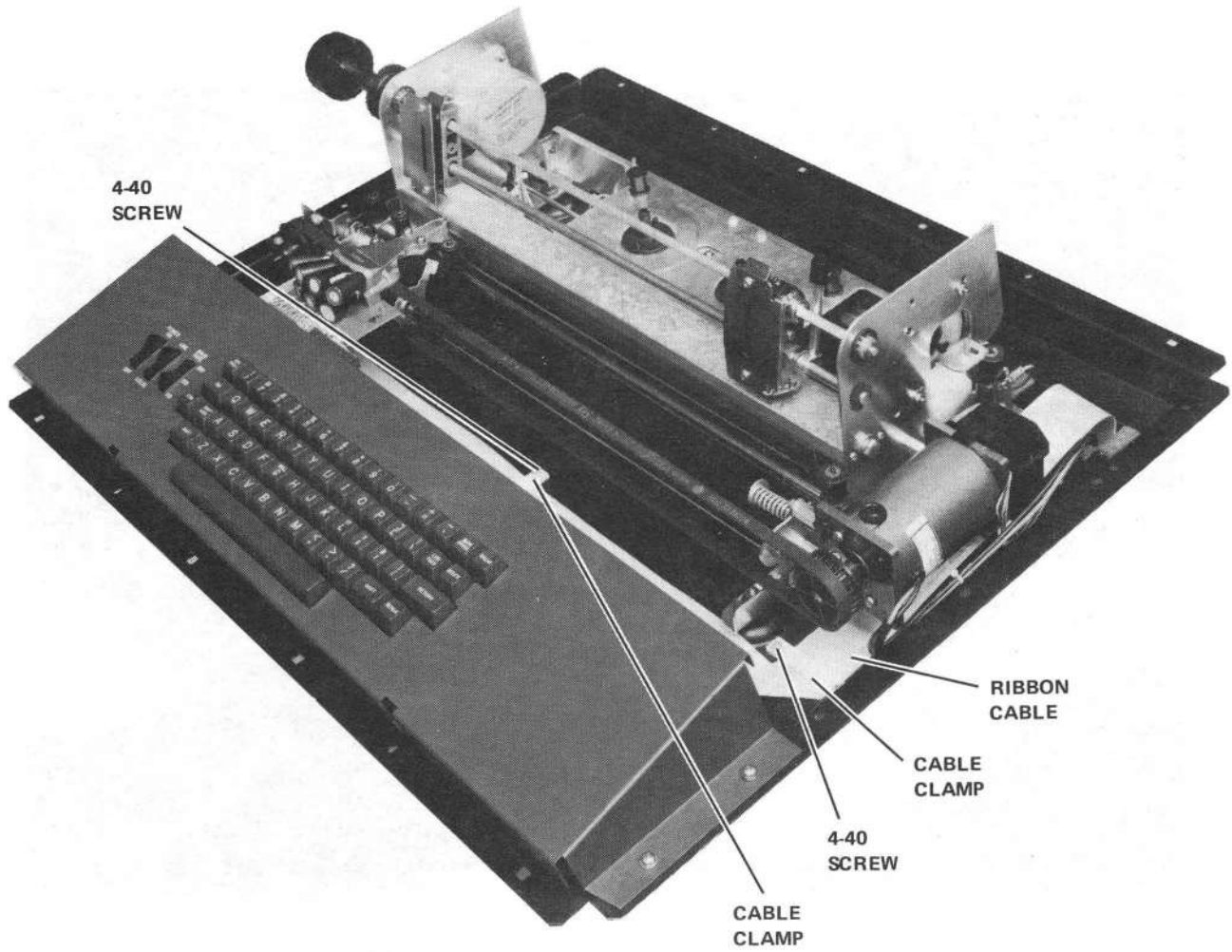
CP-1559

Figure 6-1 Housing Removal



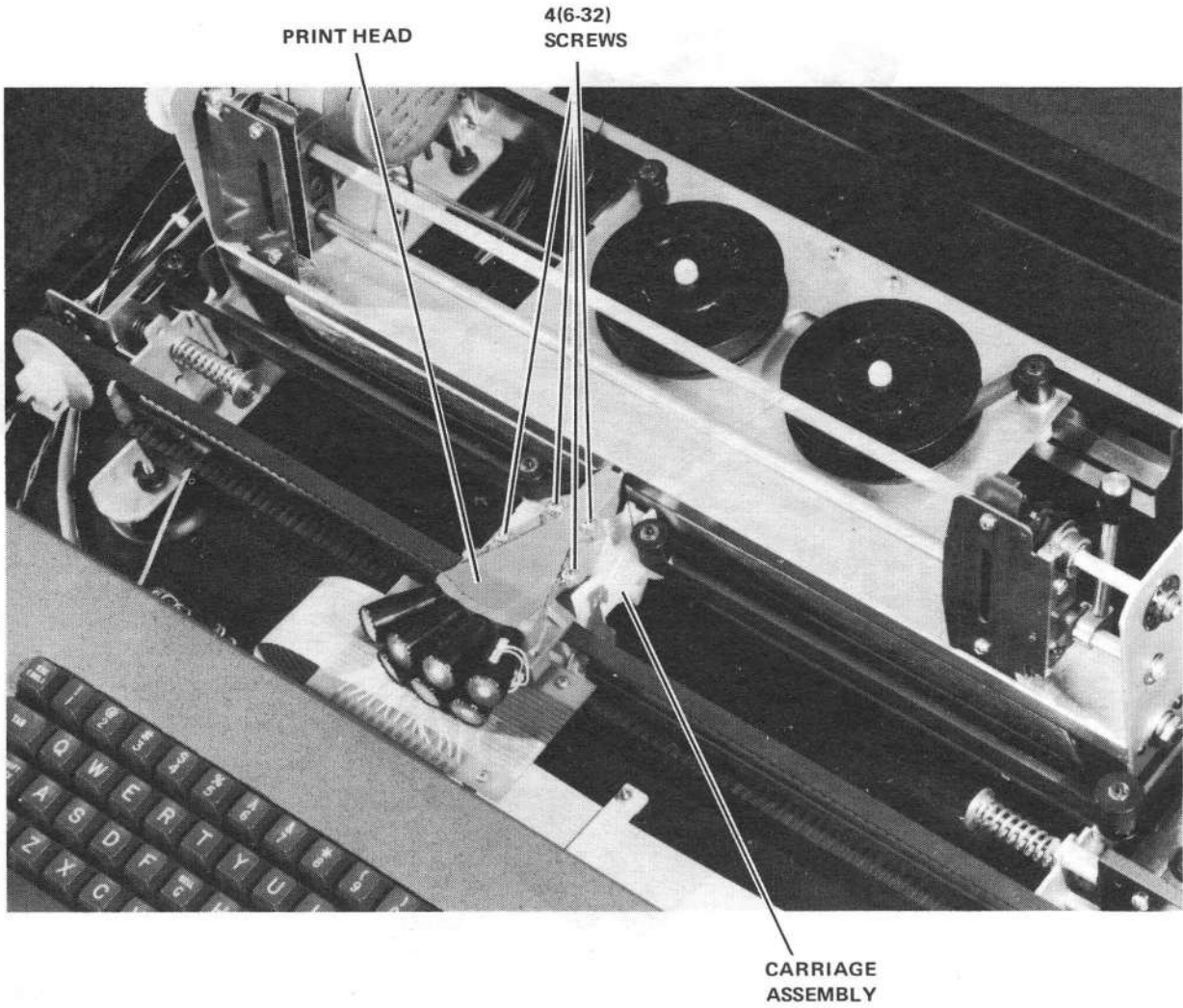
7393-16

Figure 6-2 Power Board Connectors



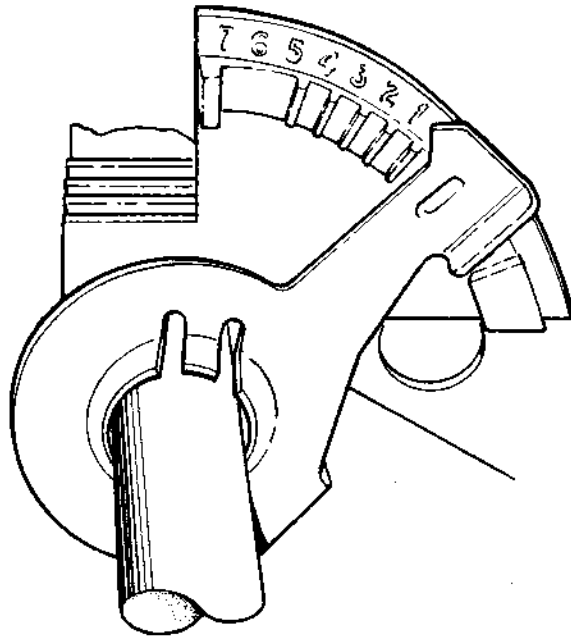
7393-04

Figure 6-3 Ribbon Cable Clamps



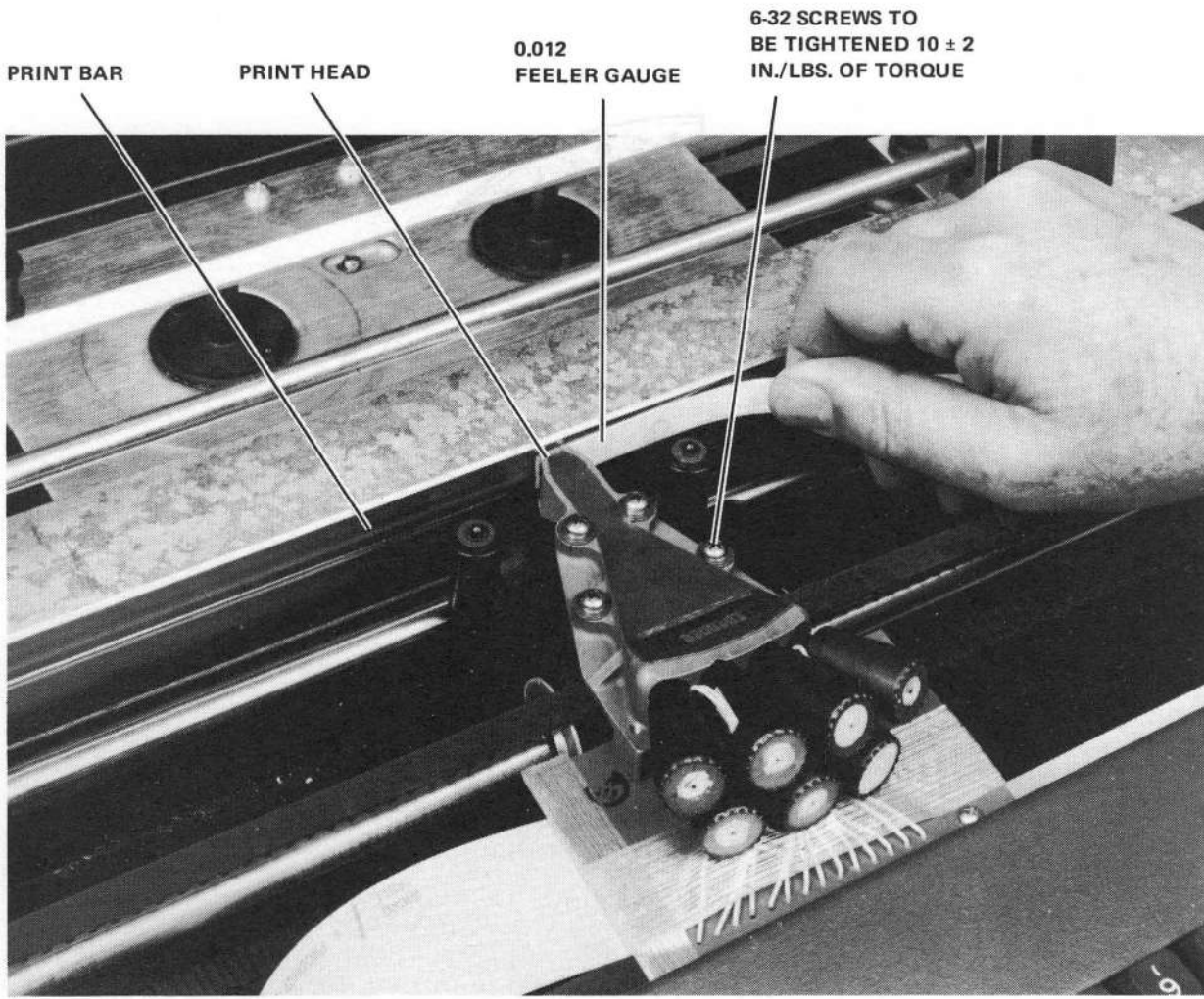
7037-05

Figure 6-4 Print Head Removal



CP-1552

Figure 6-5 Carriage Adjustment Lever



CAUTION
ENSURE THAT FEELER GAUGE IS INSERTED
BETWEEN THE PROTRUSIONS ON THE
PRINthead. FAILURE TO DO SO WILL RESULT
IN IMPROPER CLEARANCE AND SHORTEN
THE LIFE OF THE PRINthead.

7393-06

Figure 6-6 Print Head Adjustment

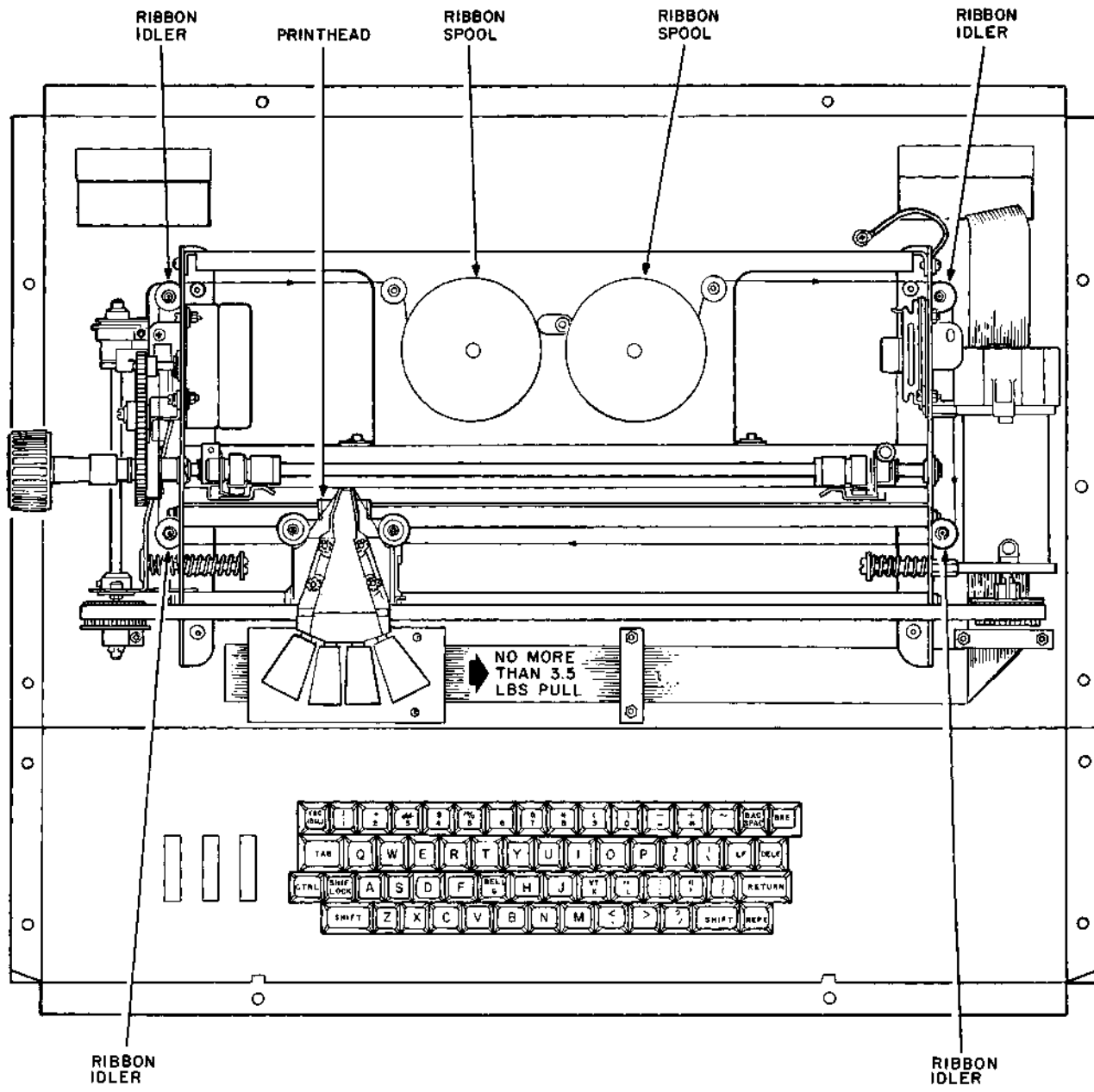
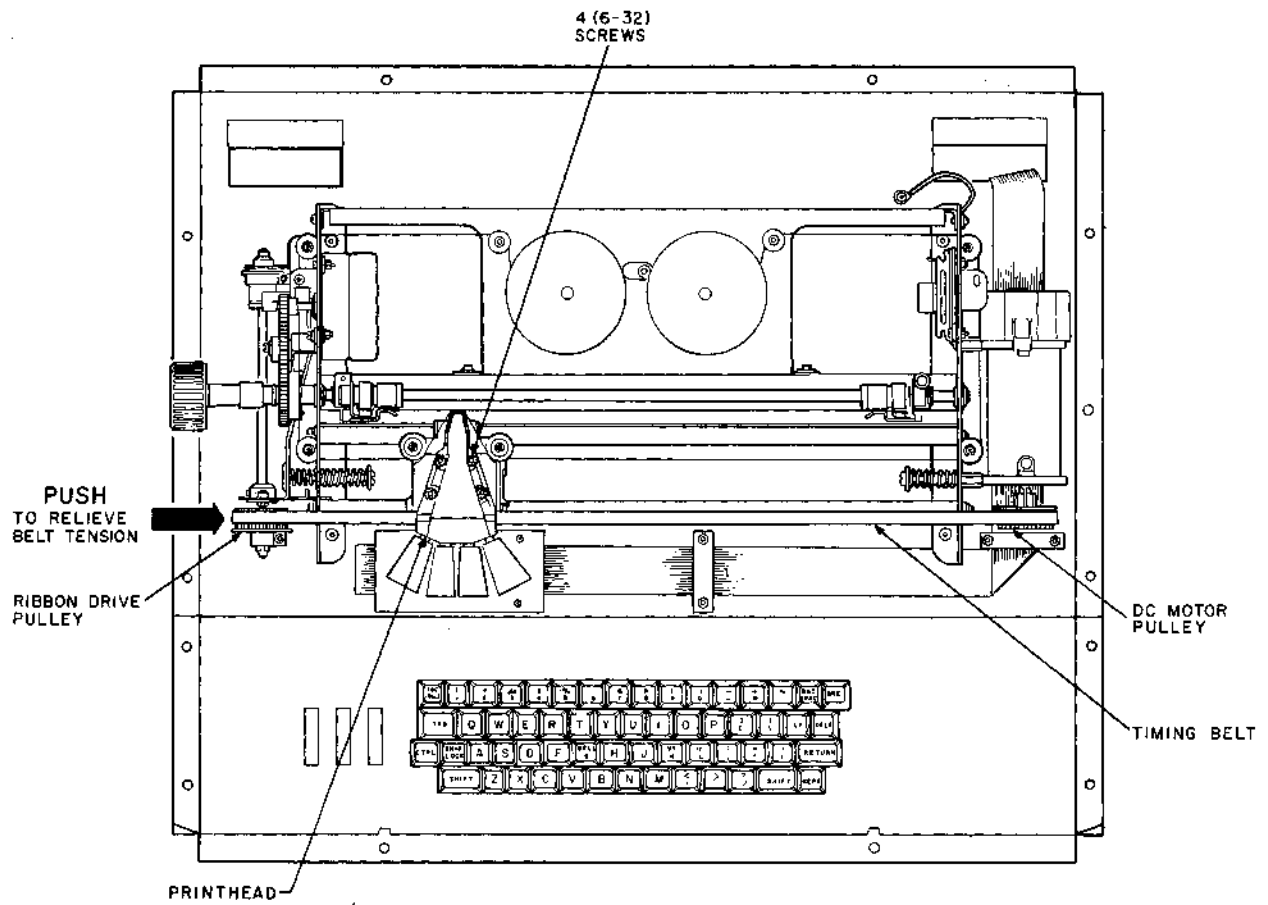


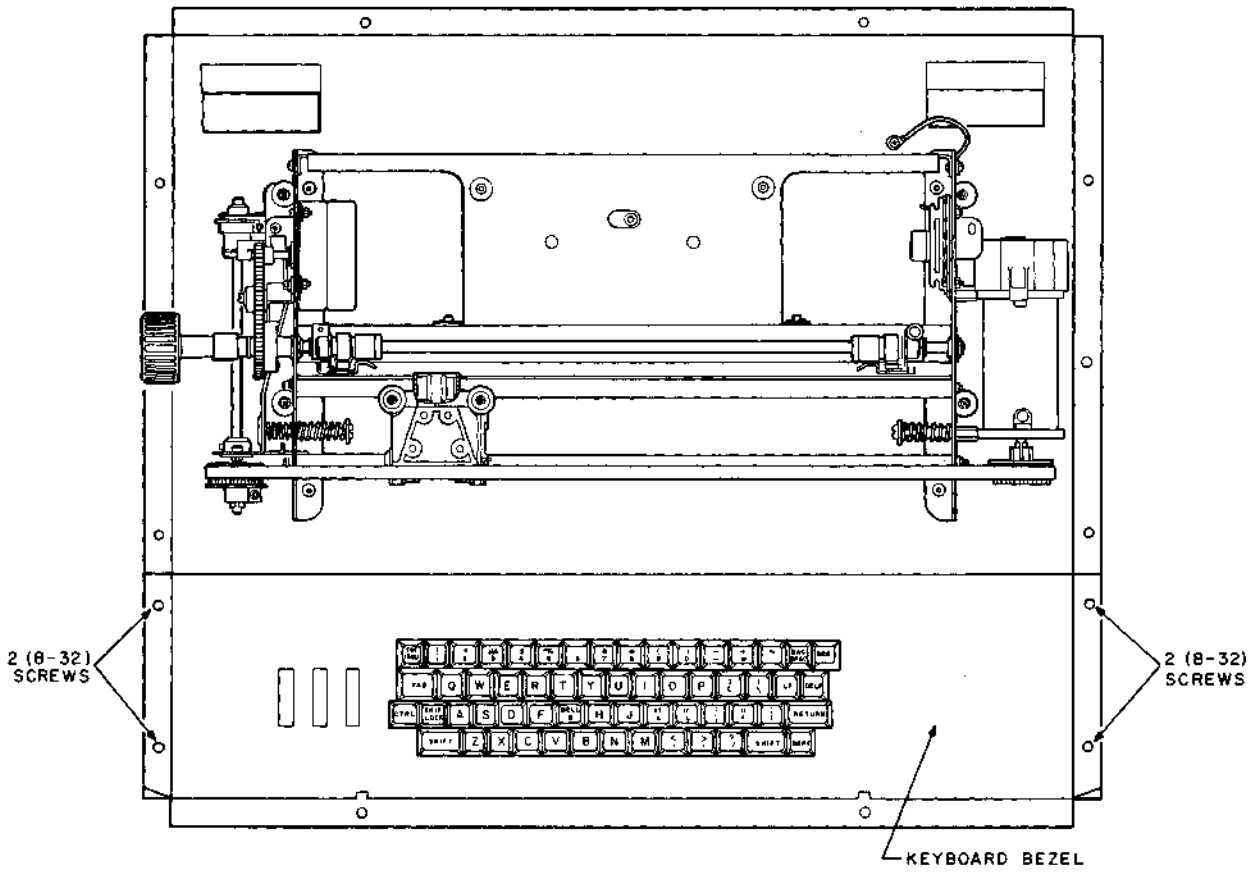
Figure 6-7 Ribbon Threading/Drag Test

CP-1554



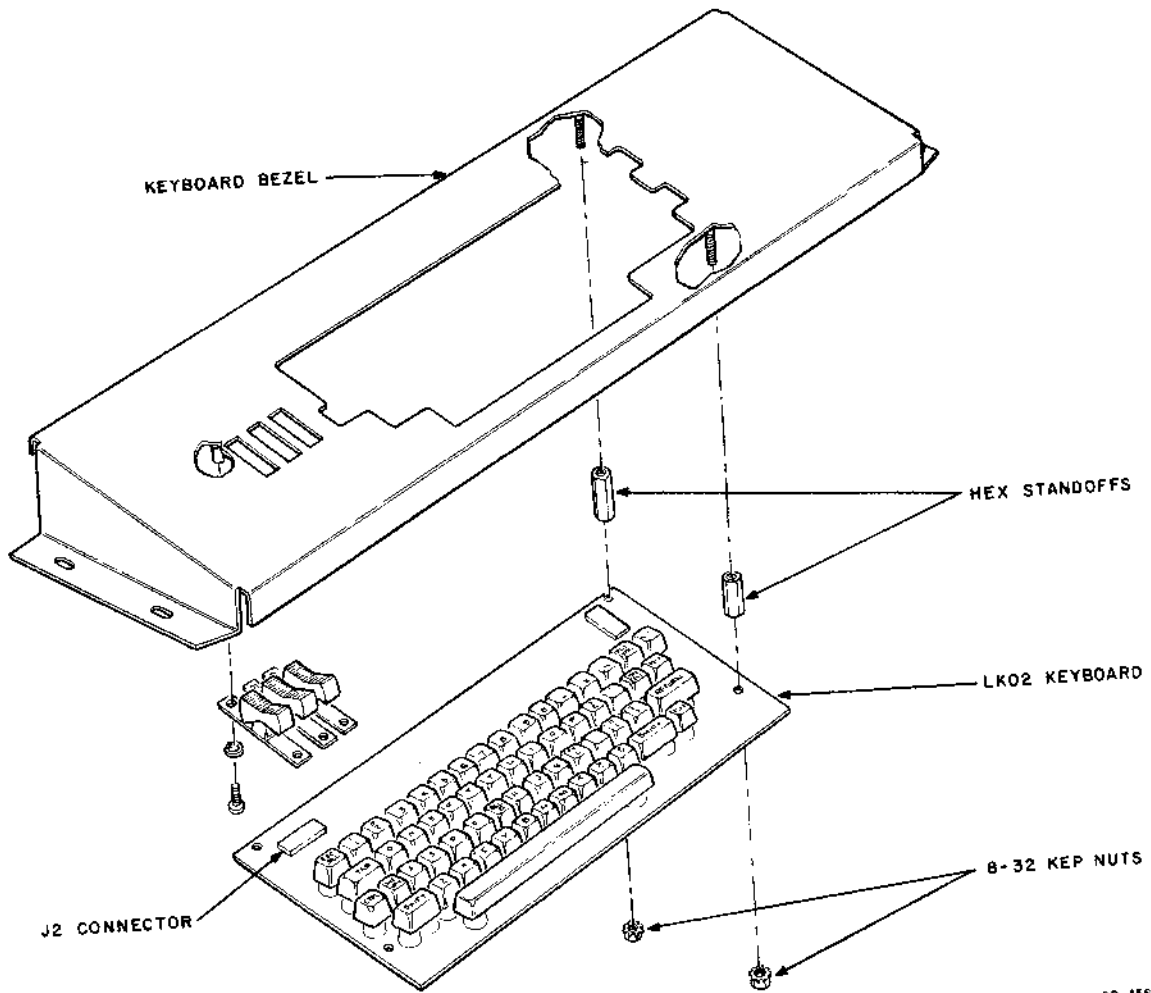
CP-1560

Figure 6-8 Timing Belt Removal



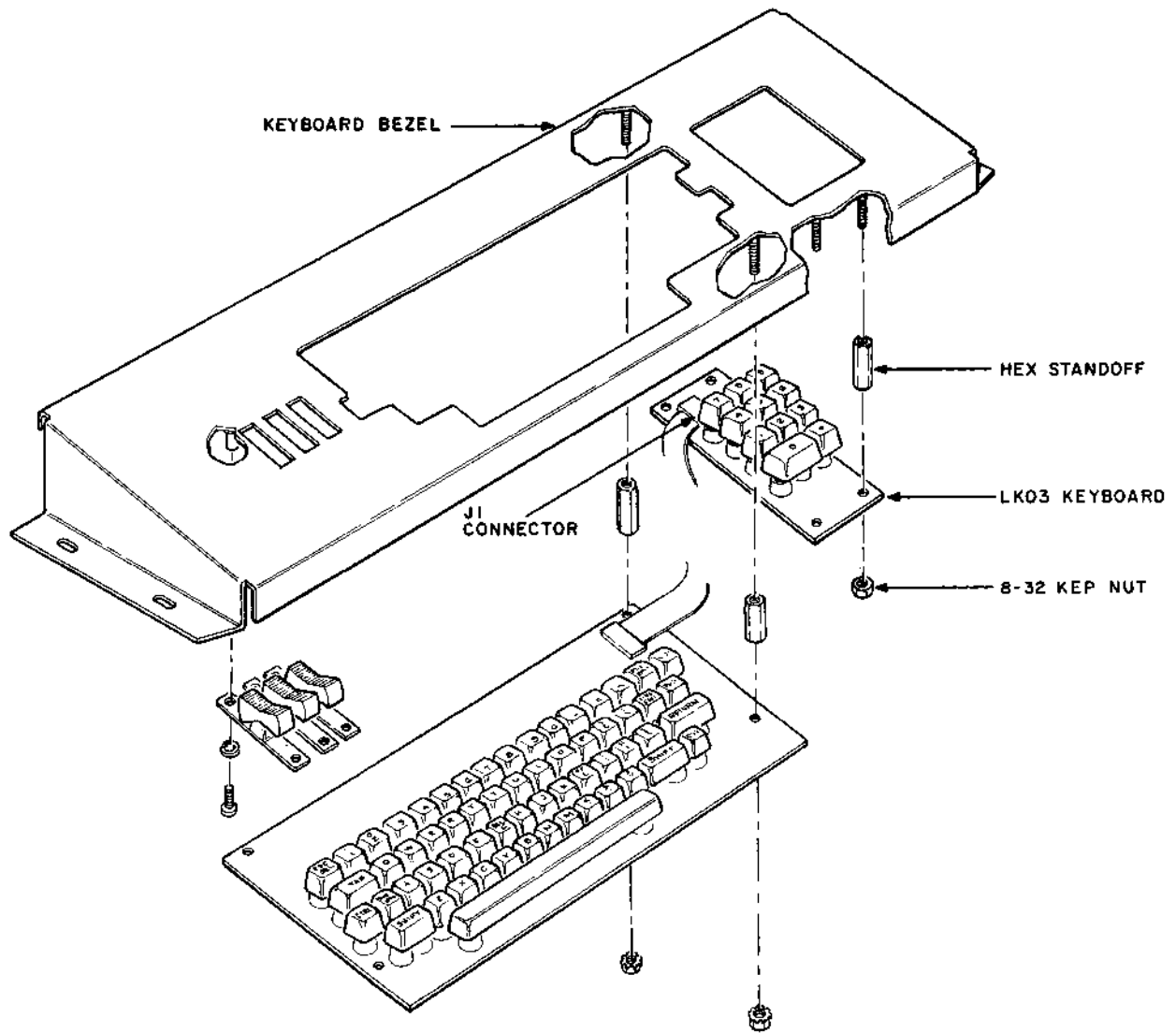
CP-1558

Figure 6-9 Keyboard Bezel Removal



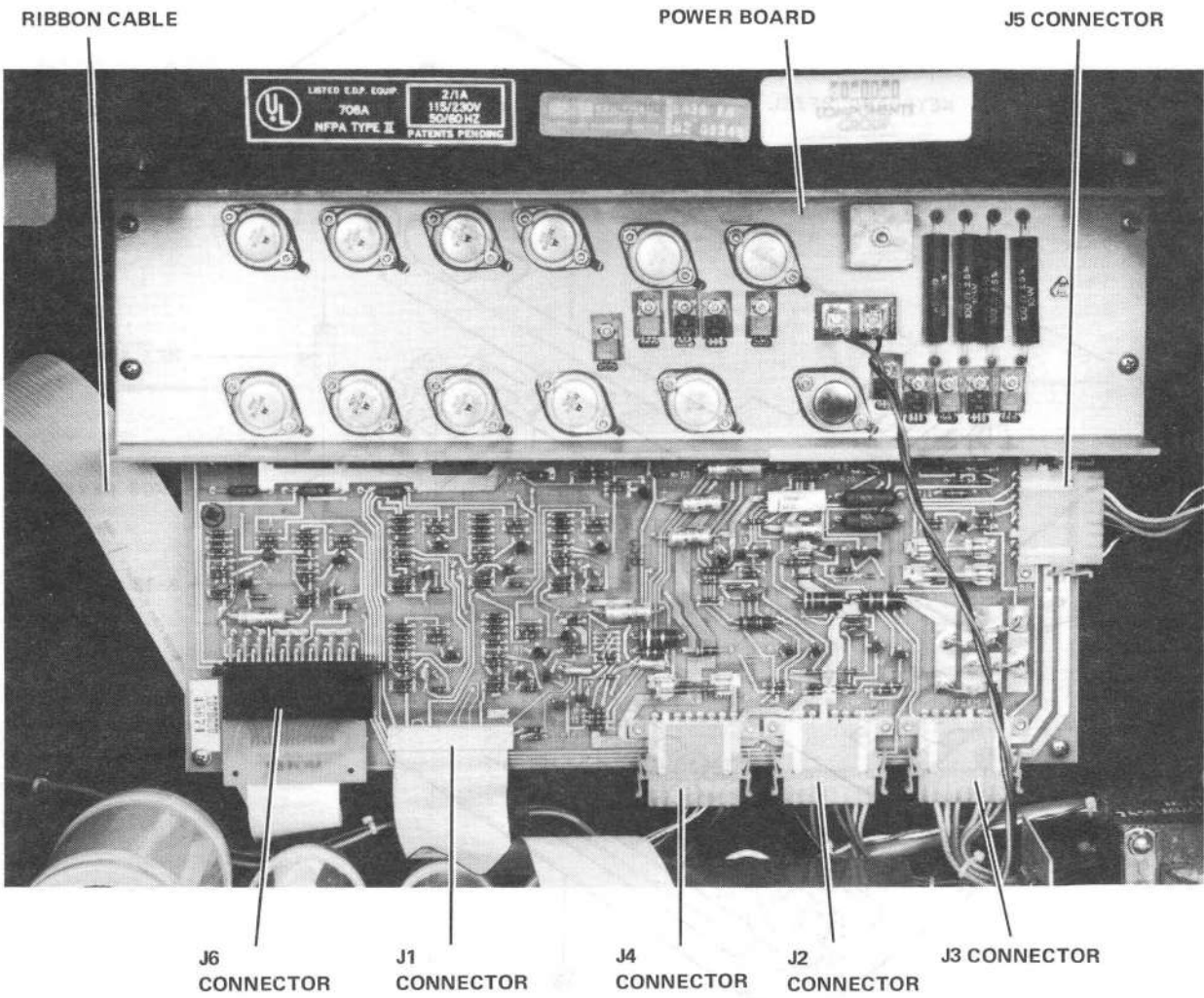
CP-1567

Figure 6-10 LK02 Keyboard Removal



CP-1566

Figure 6-11 LK03 Keyboard Removal



7393-16

Figure 6-12 Power Board Connectors

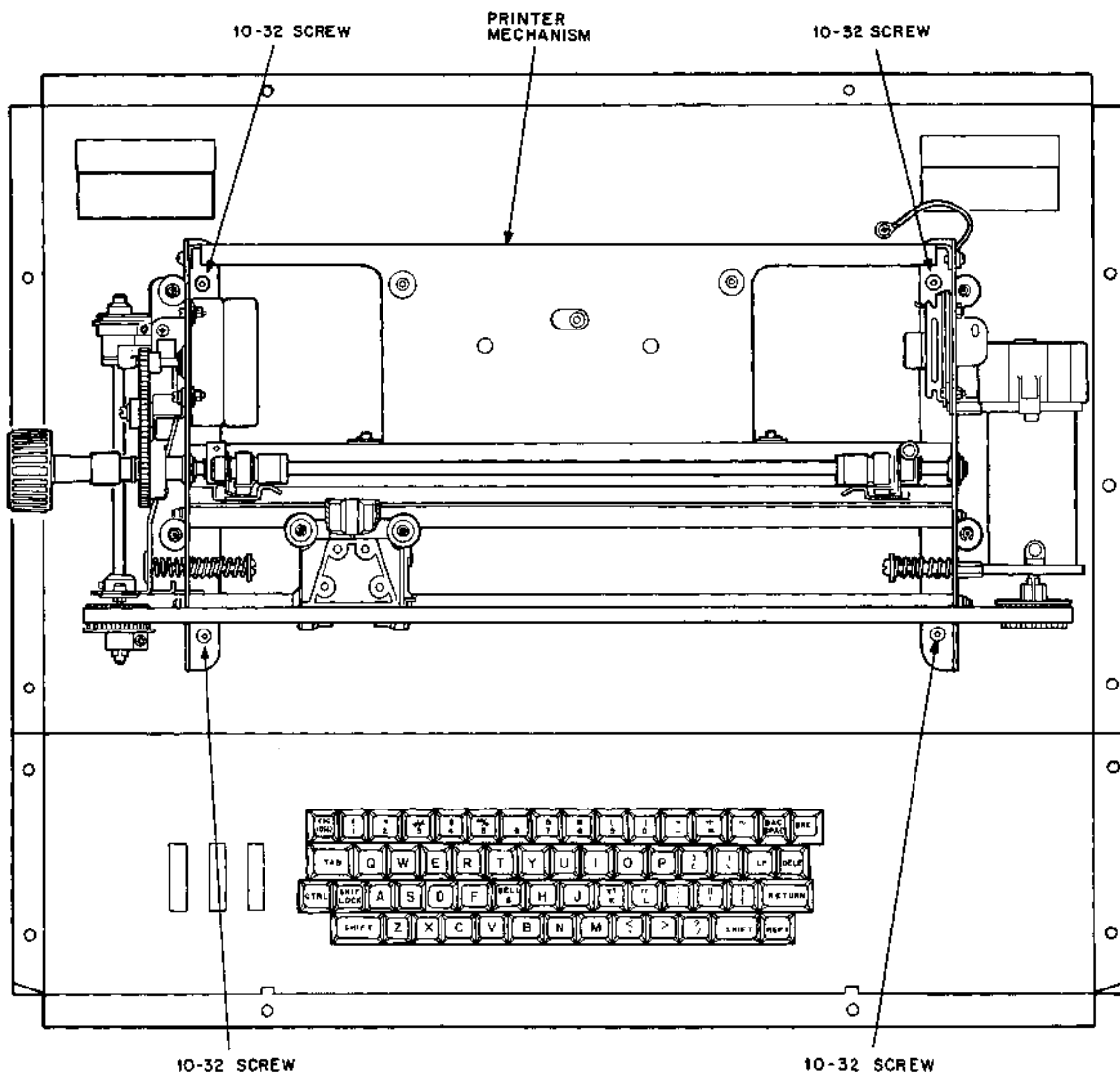
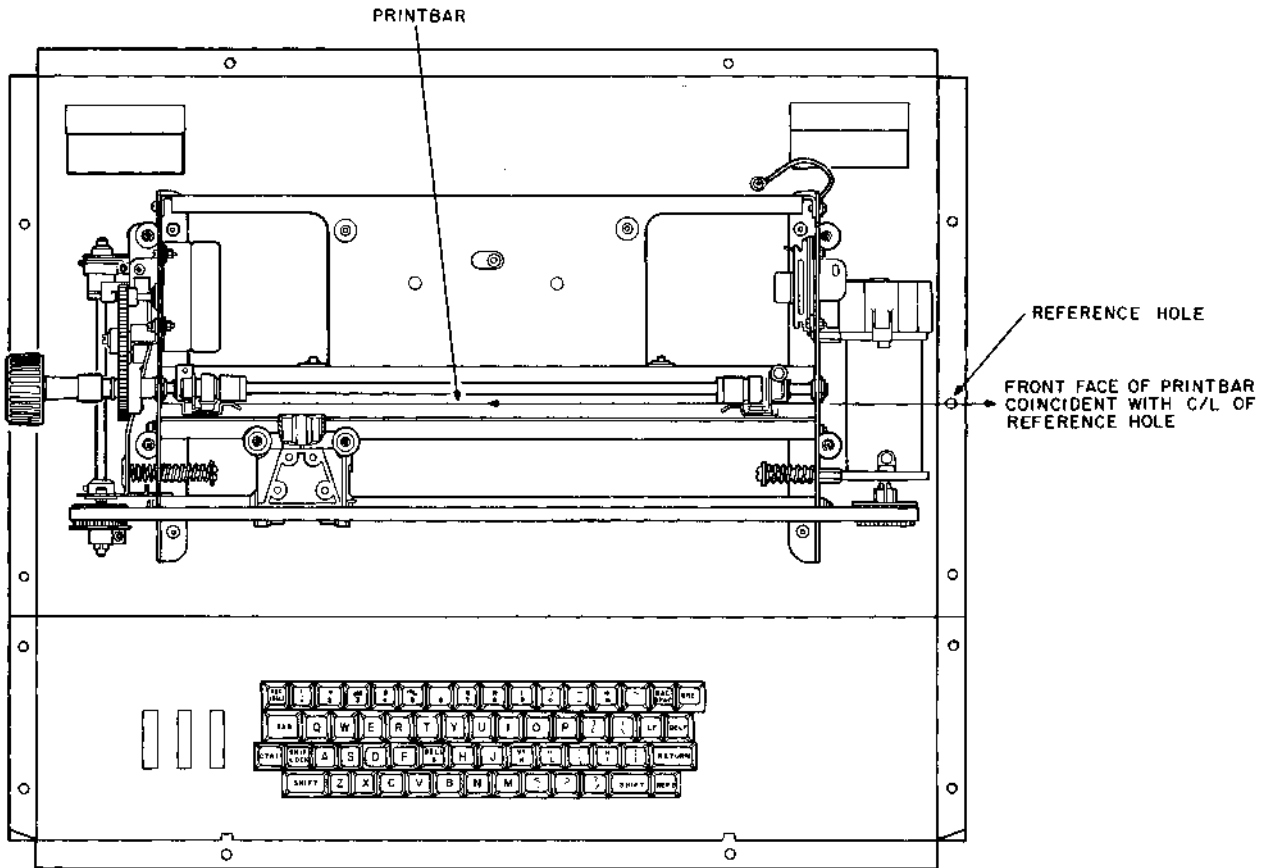
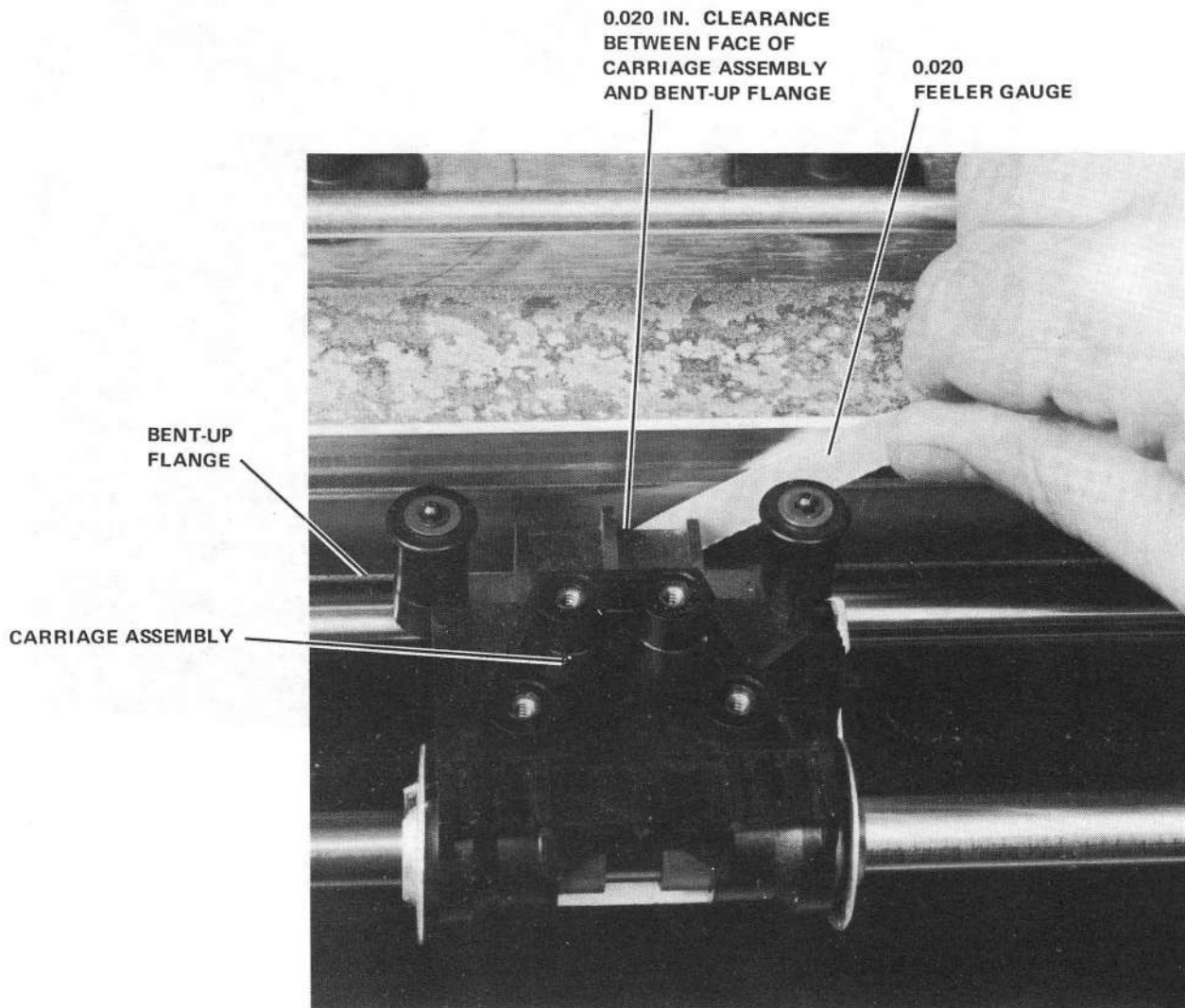


Figure 6-13 Printer Mechanism Removal



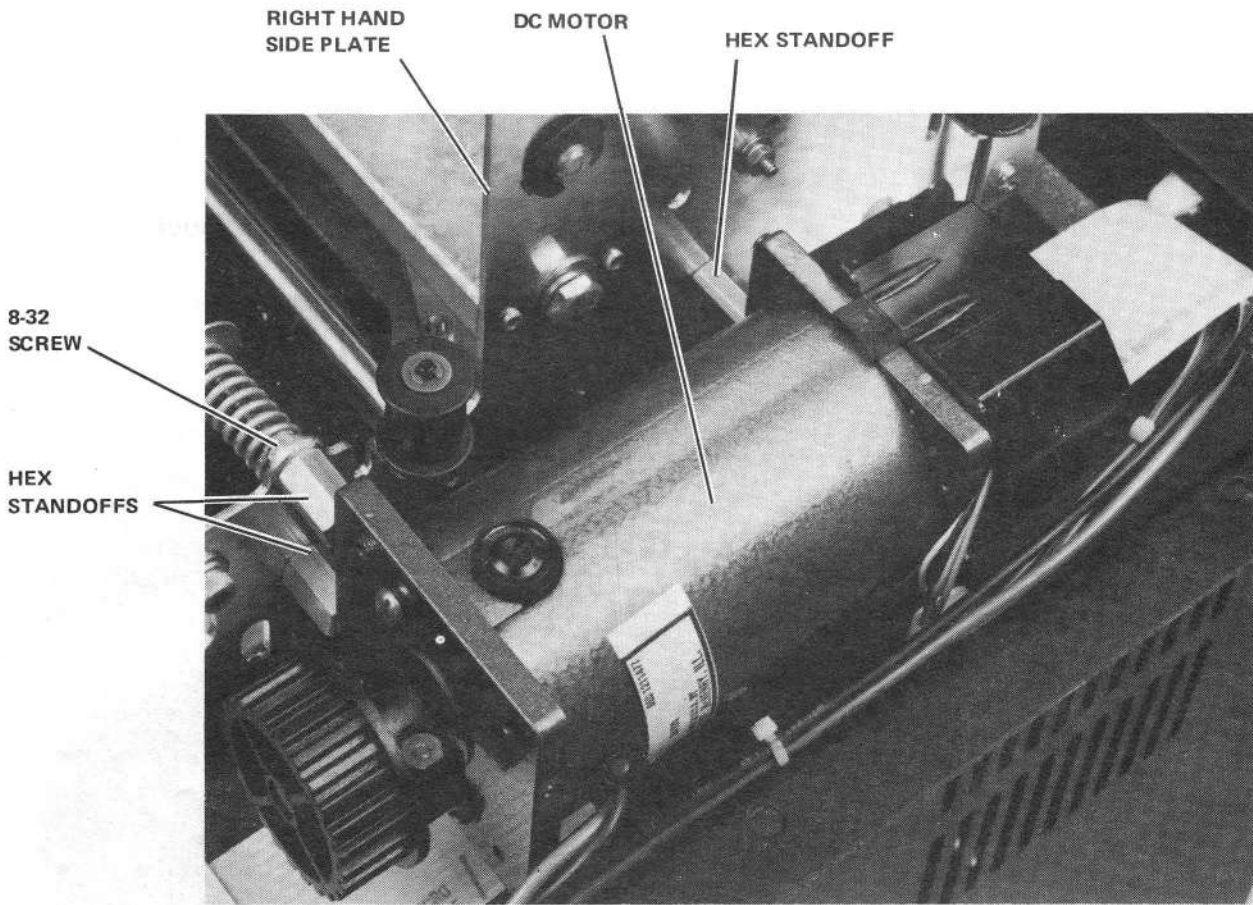
CP-1561

Figure 6-14 Printer Mechanism Alignment



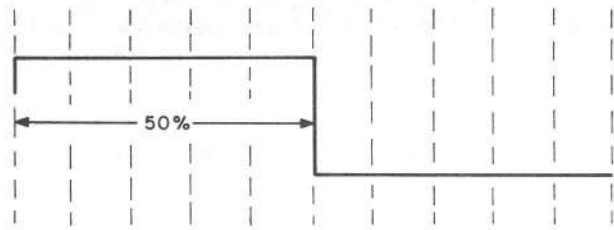
7393-13

Figure 6-15 Printer Mechanism Adjustment



7393-12

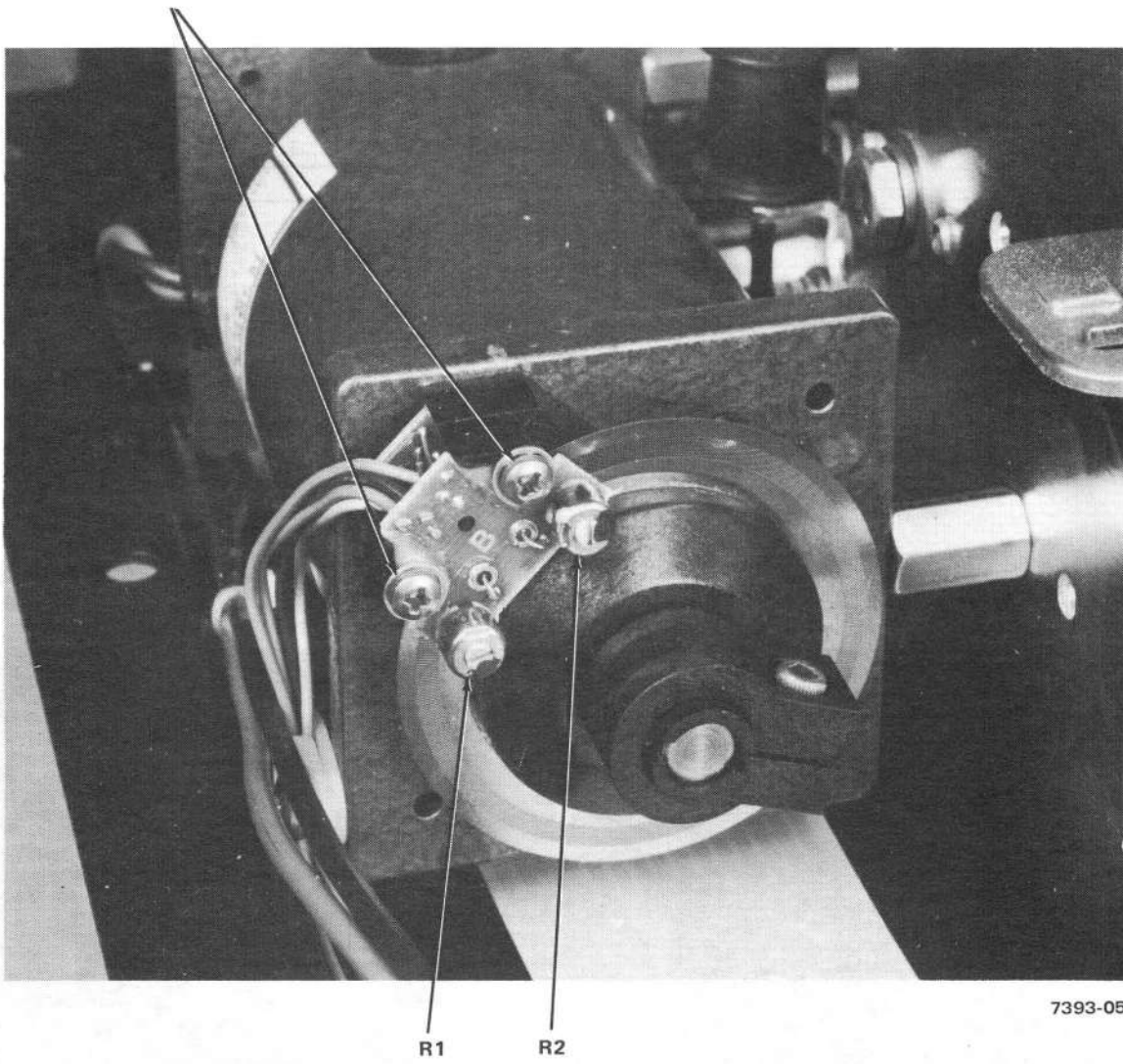
Figure 6-16 DC Motor Removal



CP-1621

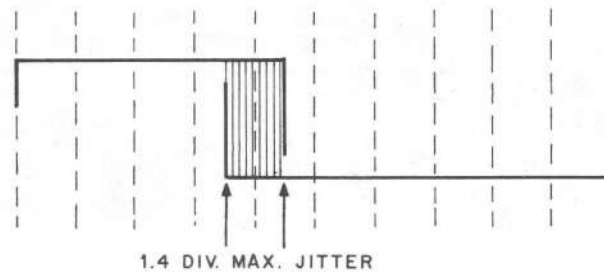
Figure 6-17 PT1 or PT2 Waveform

PHASE ADJUSTMENT SCREWS



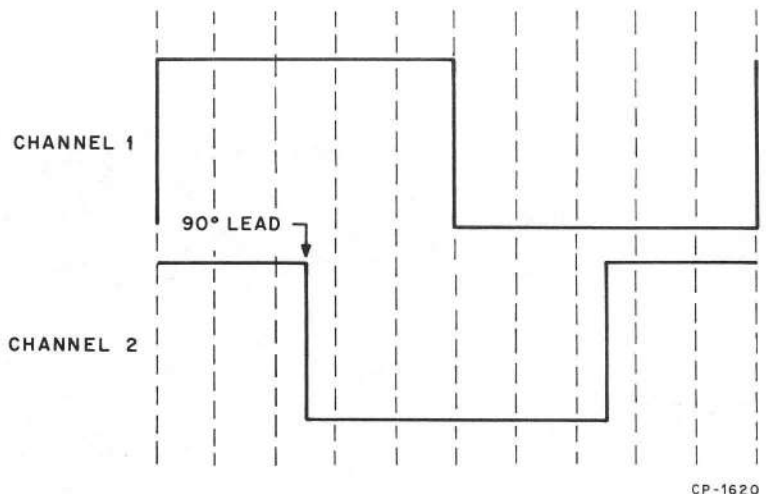
7393-05

Figure 6-18 Encoder (Rear View)



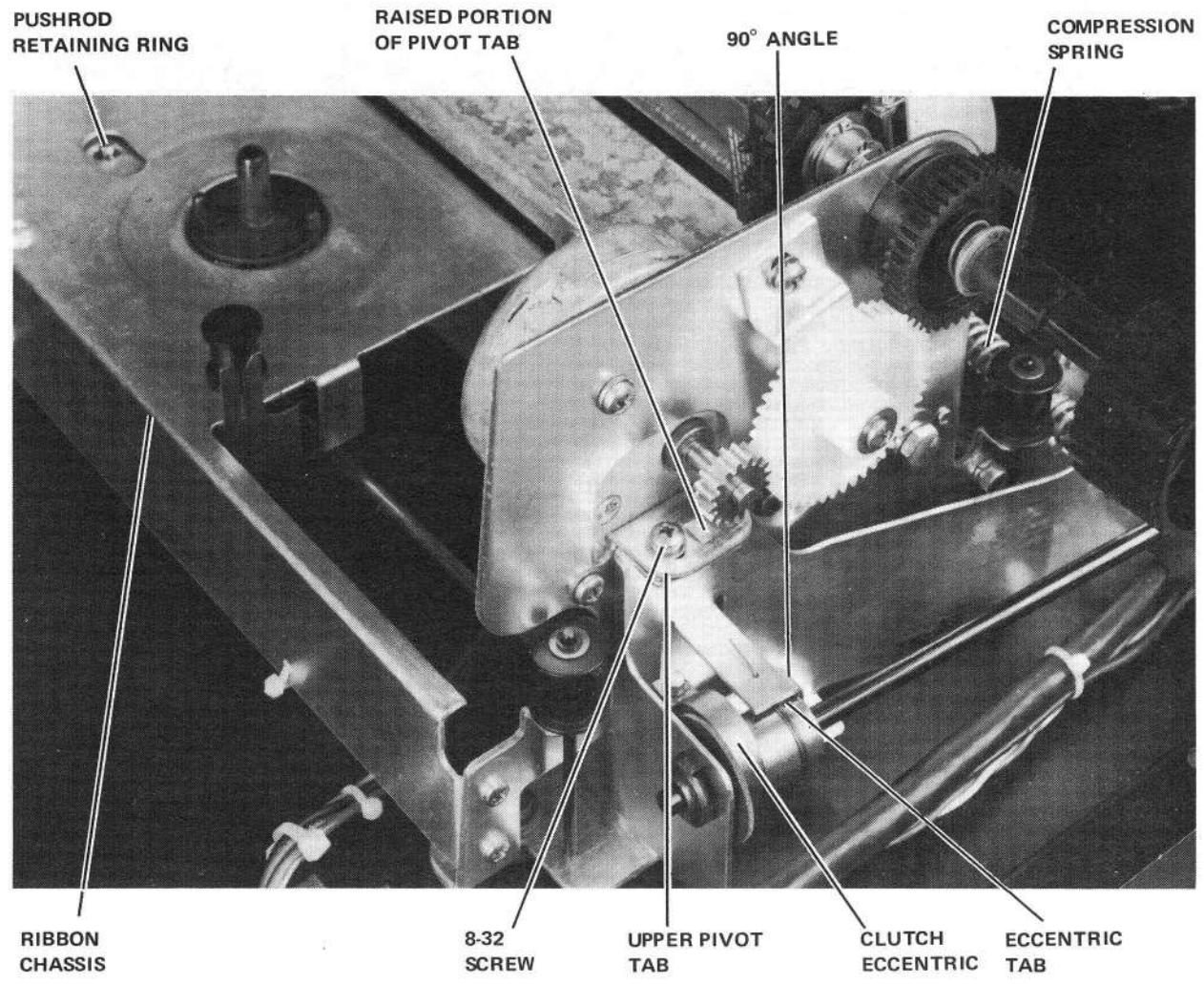
CP - 1622

Figure 6-19 Encoder Jitter



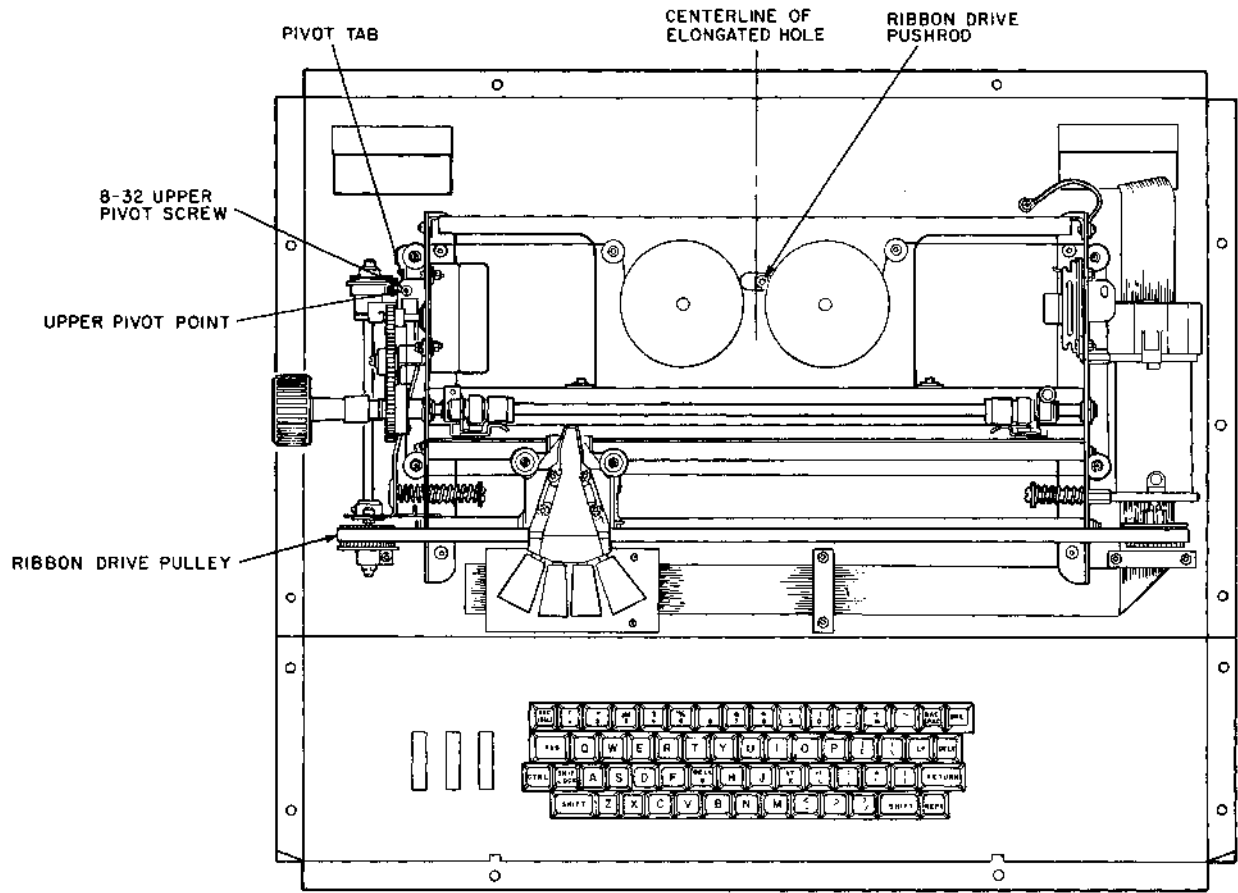
CP-1620

Figure 6-20 PT1 and PT2 Waveforms



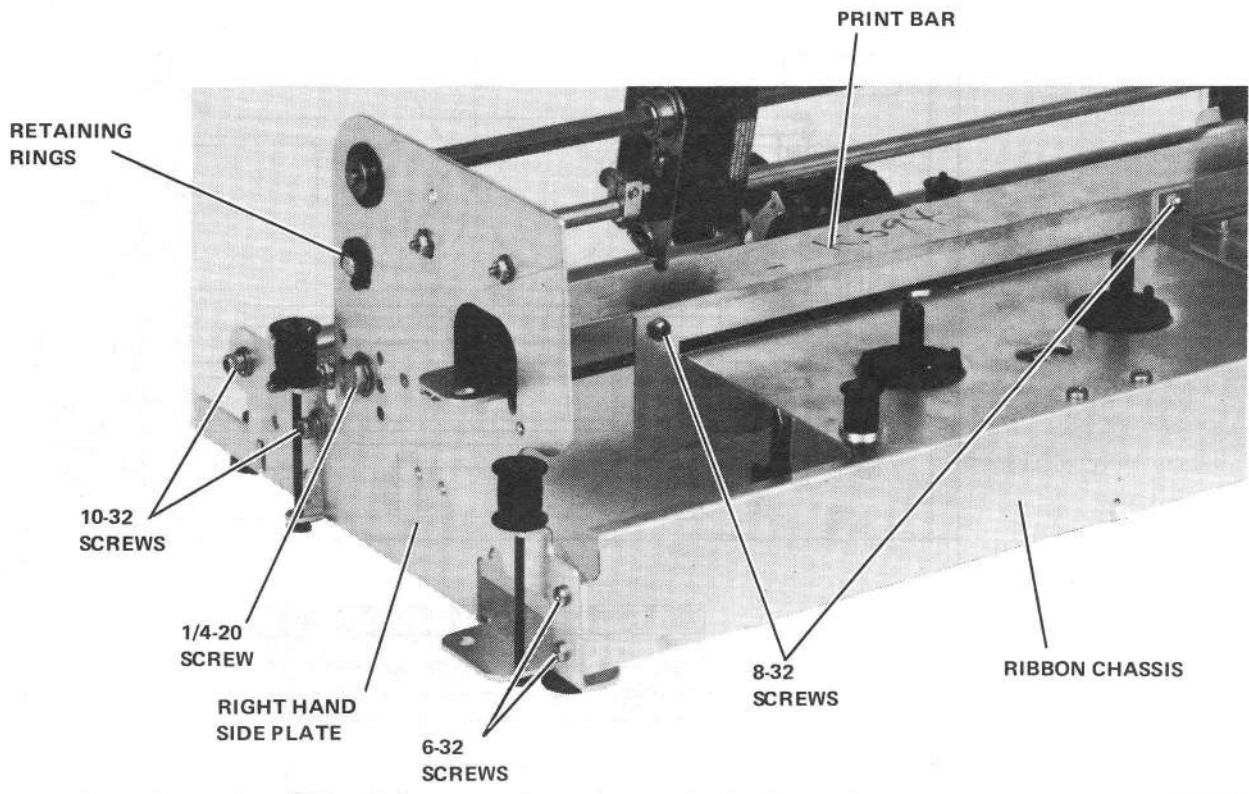
7393-10

Figure 6-21 Ribbon Drive Removal



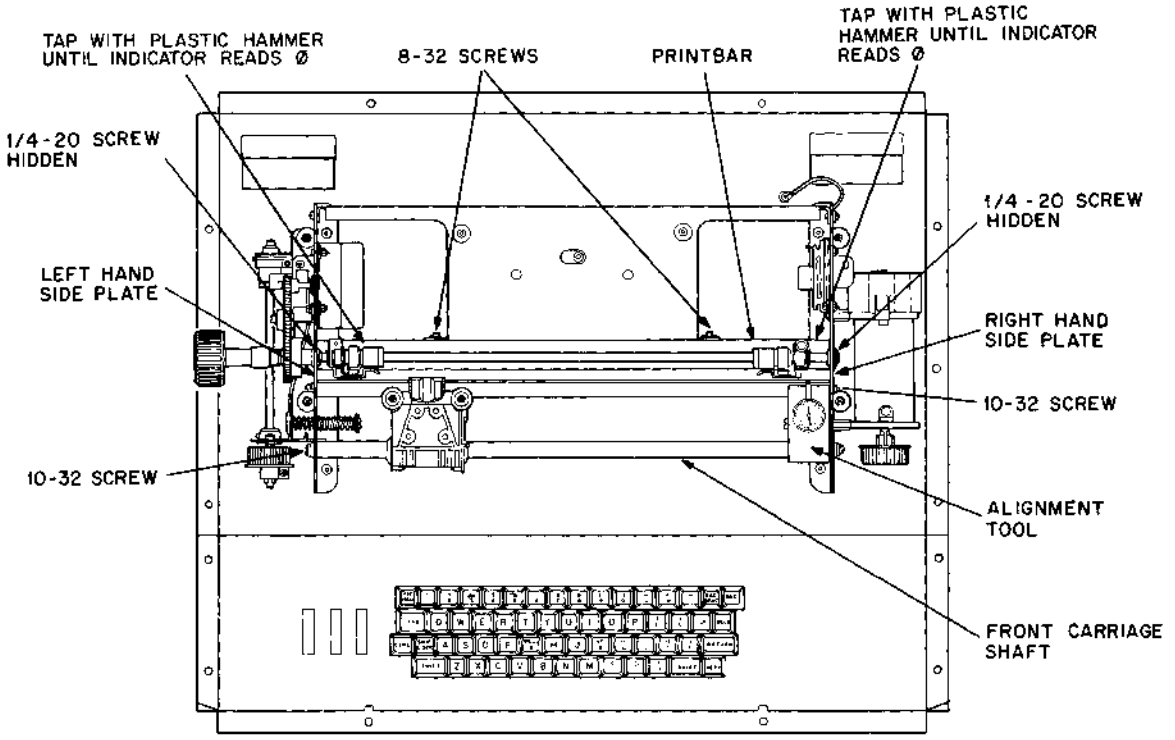
CP-1565

Figure 6-22 Ribbon Drive Adjustment

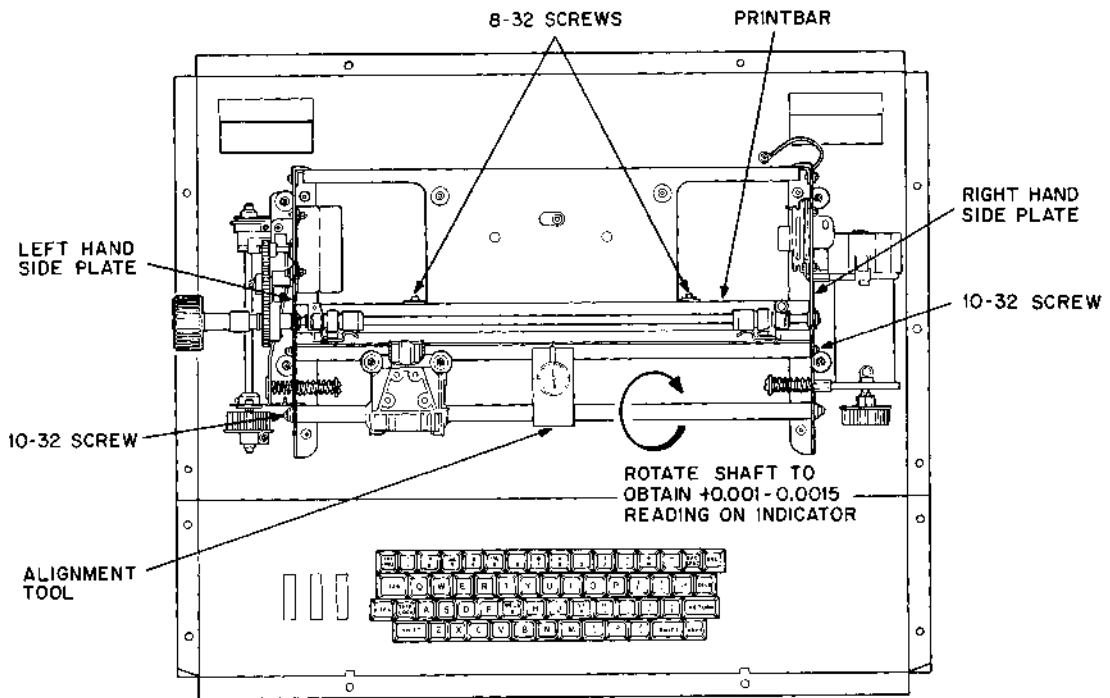


7135-04

Figure 6-23 Carriage Removal



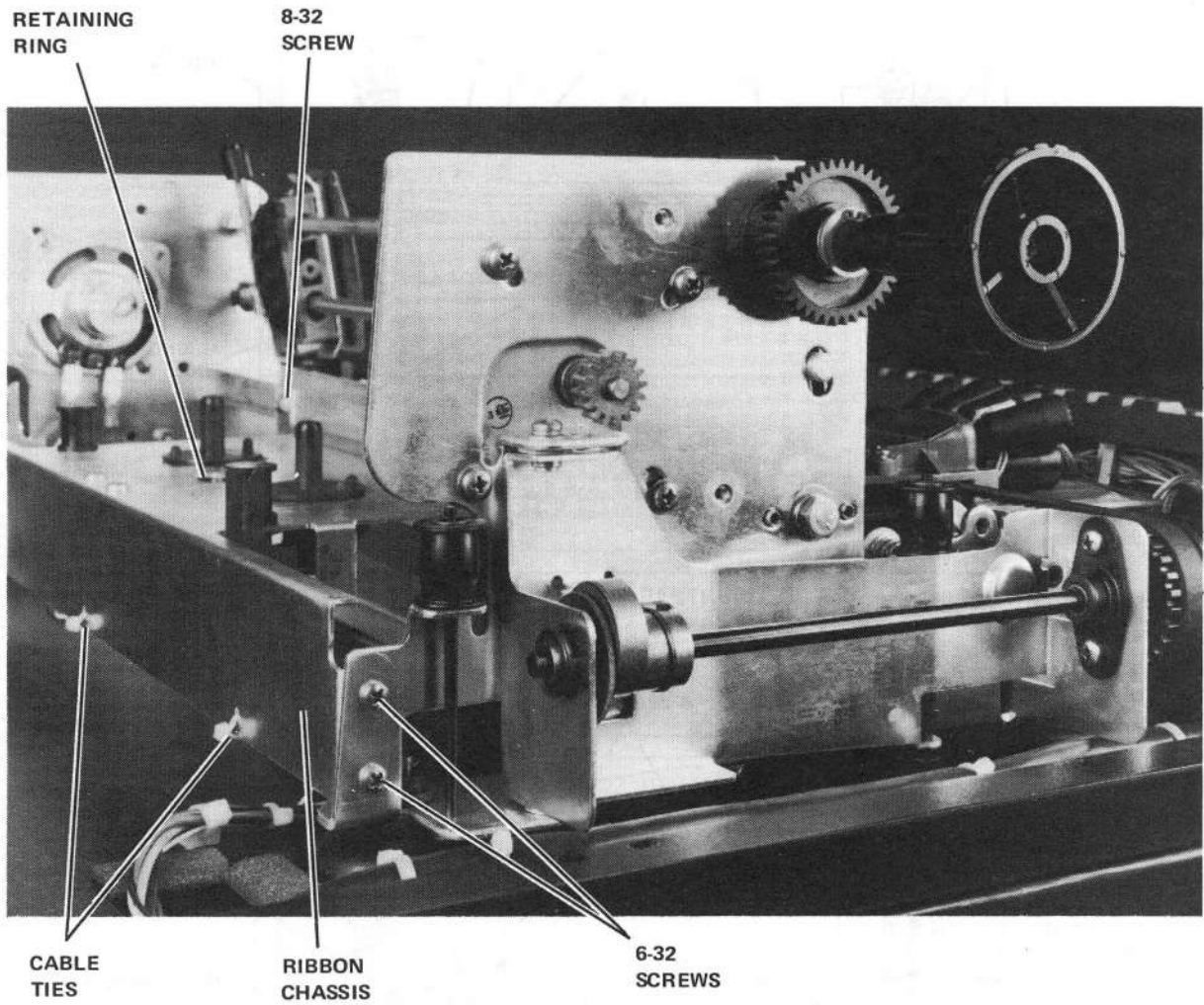
PRINTBAR ALIGNMENT



PRINTBAR PARALLELISM

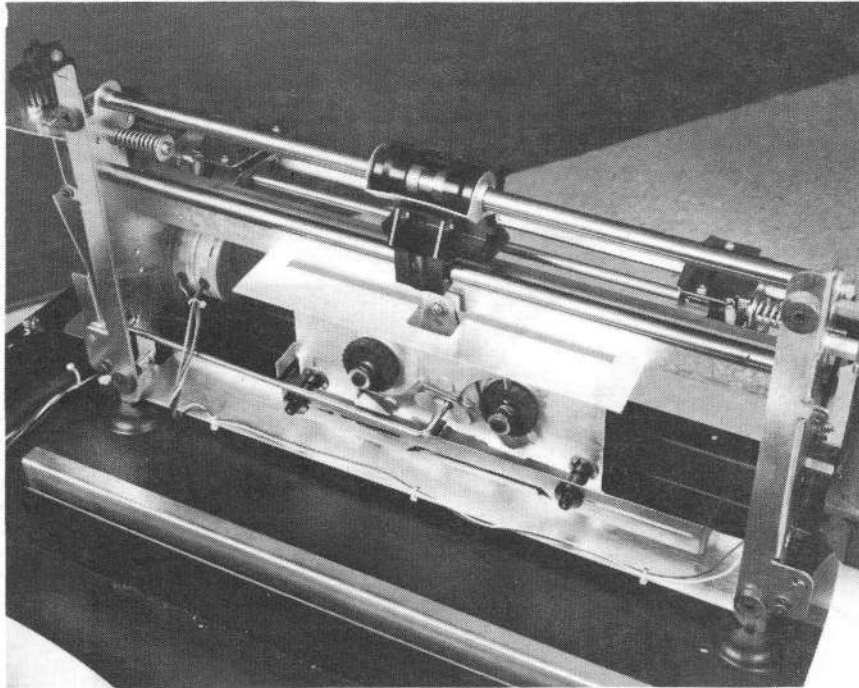
CP-1557

Figure 6-24 Print Bar Alignment/Parallelism

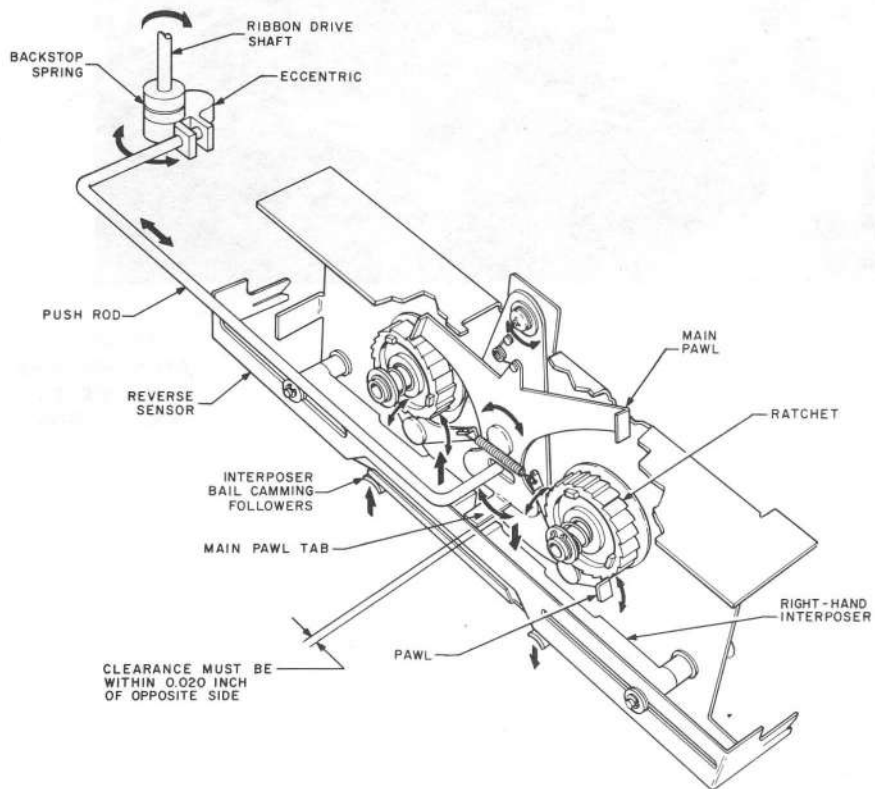


7393-3

Figure 6-25 Ribbon Chassis Removal

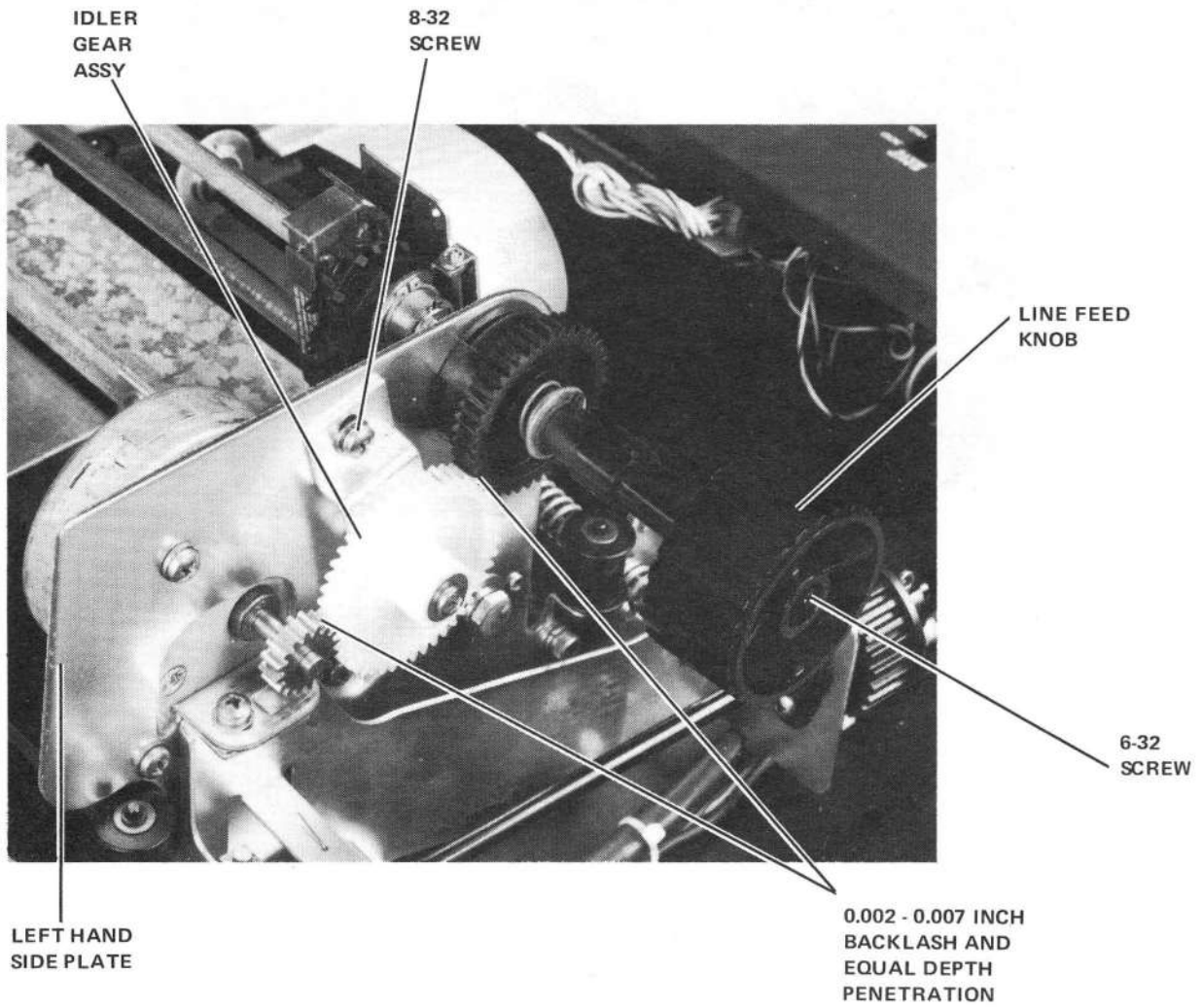


7393-15



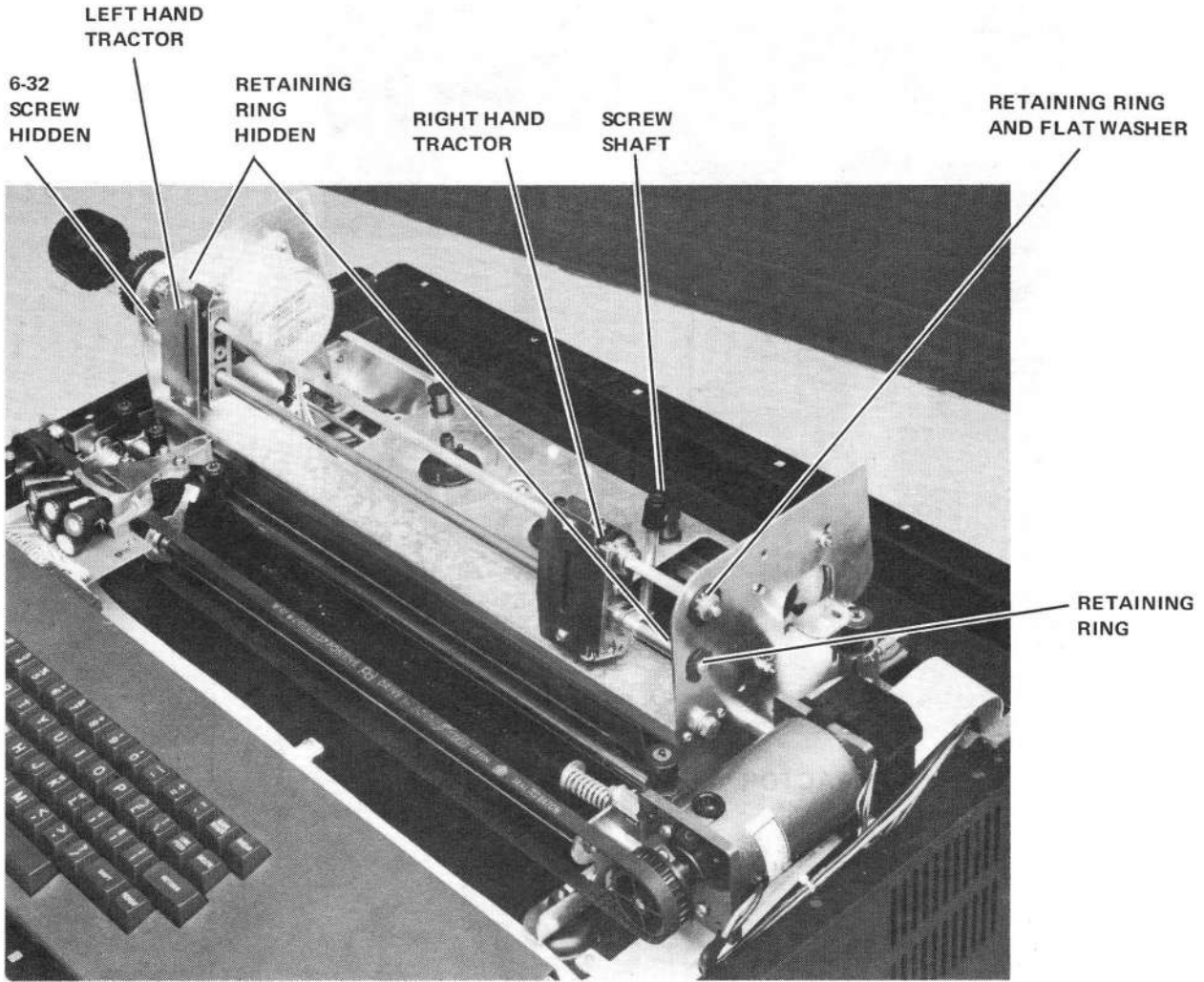
CP-1555

Figure 6-26 Ribbon Drive Adjustment



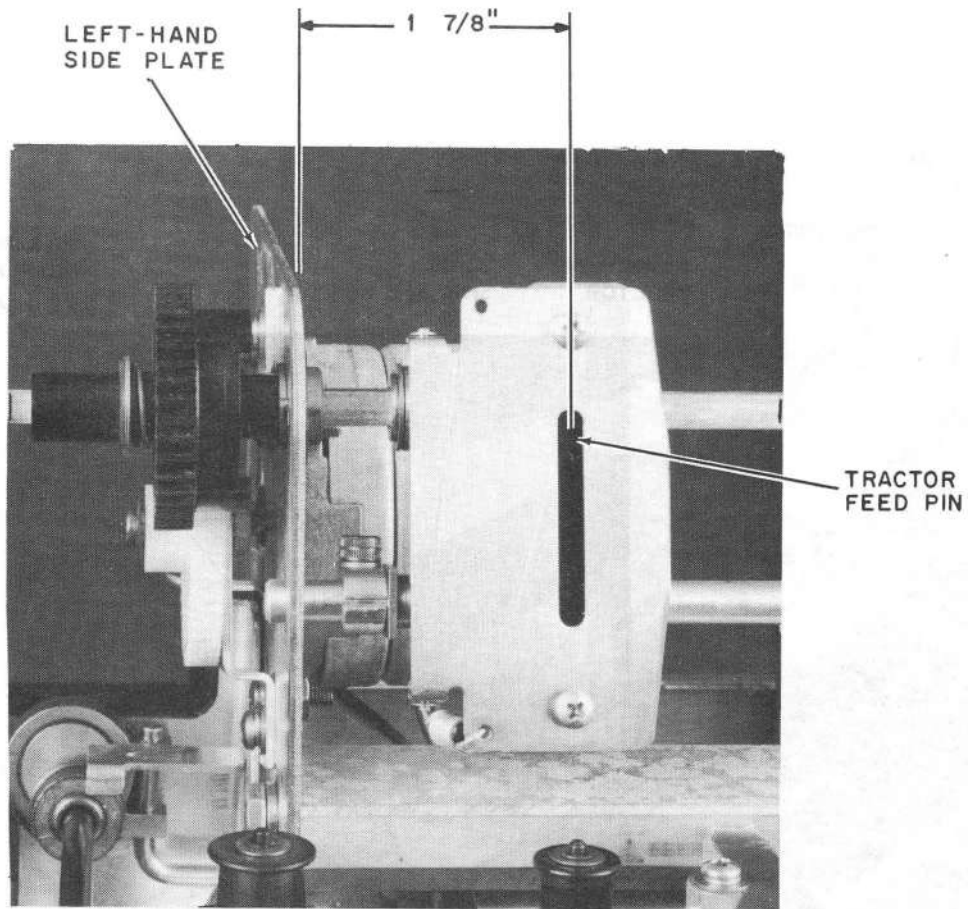
7393-10

Figure 6-27 Idler Gear Removal



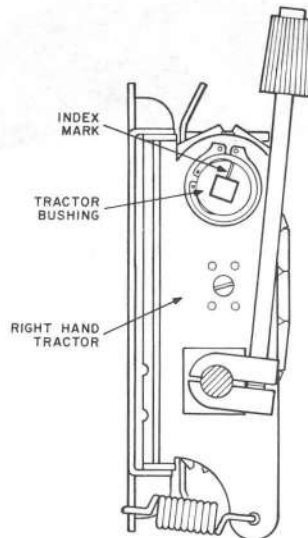
7393-4

Figure 6-28 Tractor Removal



TRACTOR ADJUSTMENT

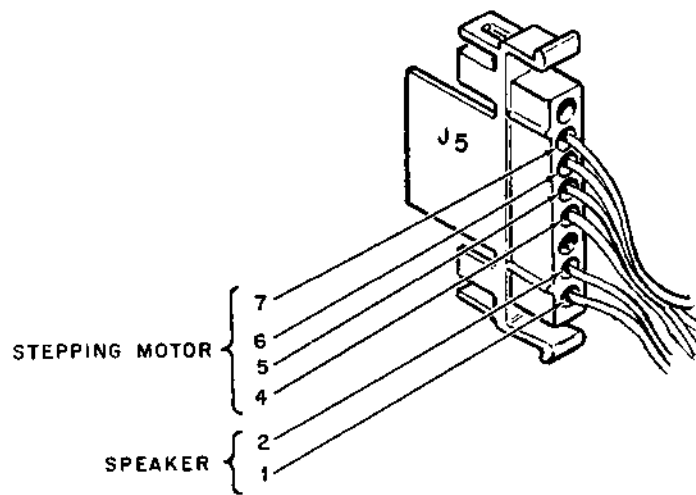
7393-14



TRACTOR PHASING

CP-1396

Figure 6-29 Tractor Phasing/Adjustment

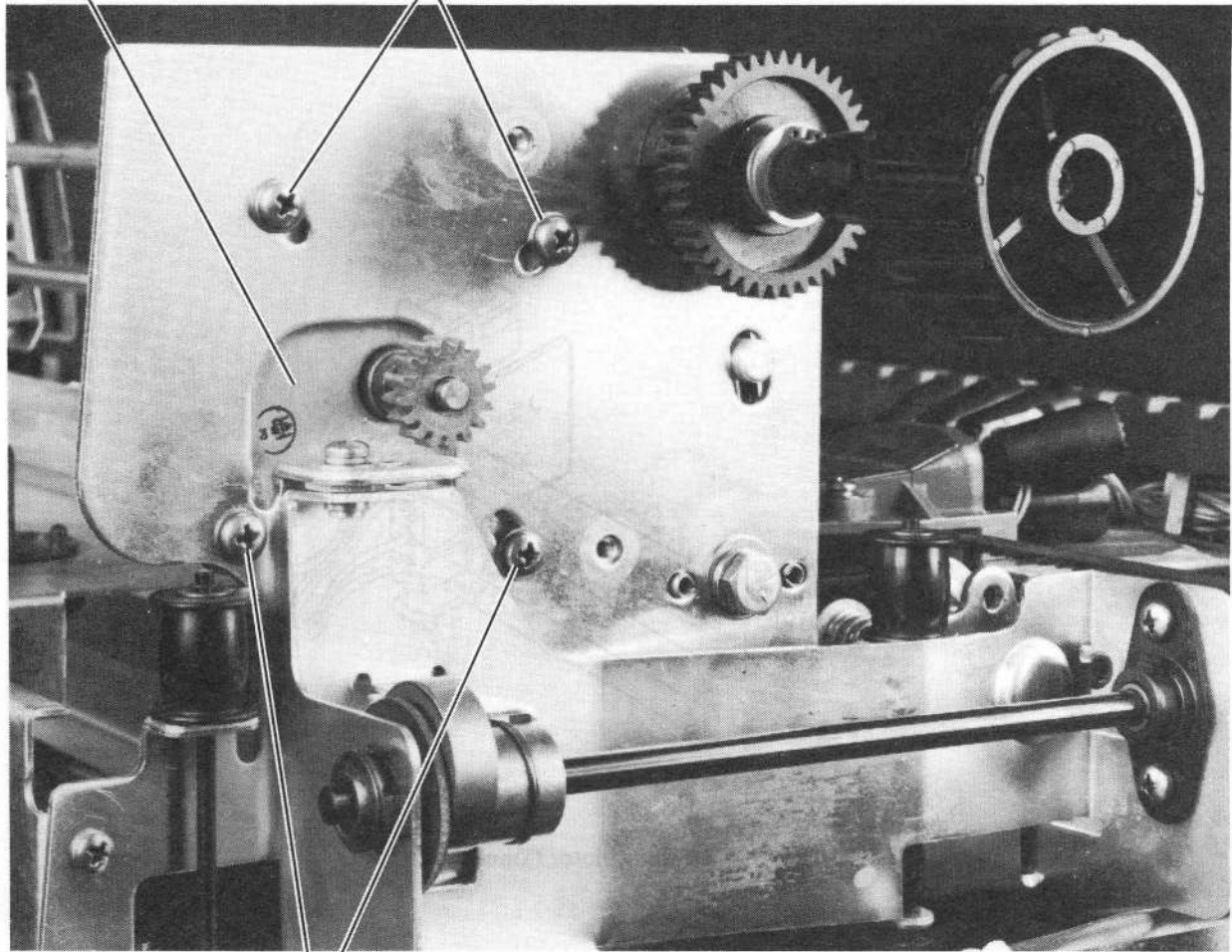


CP - 1569

Figure 6-30 Stepping Motor Connector (J5)

STEPPING MOTOR

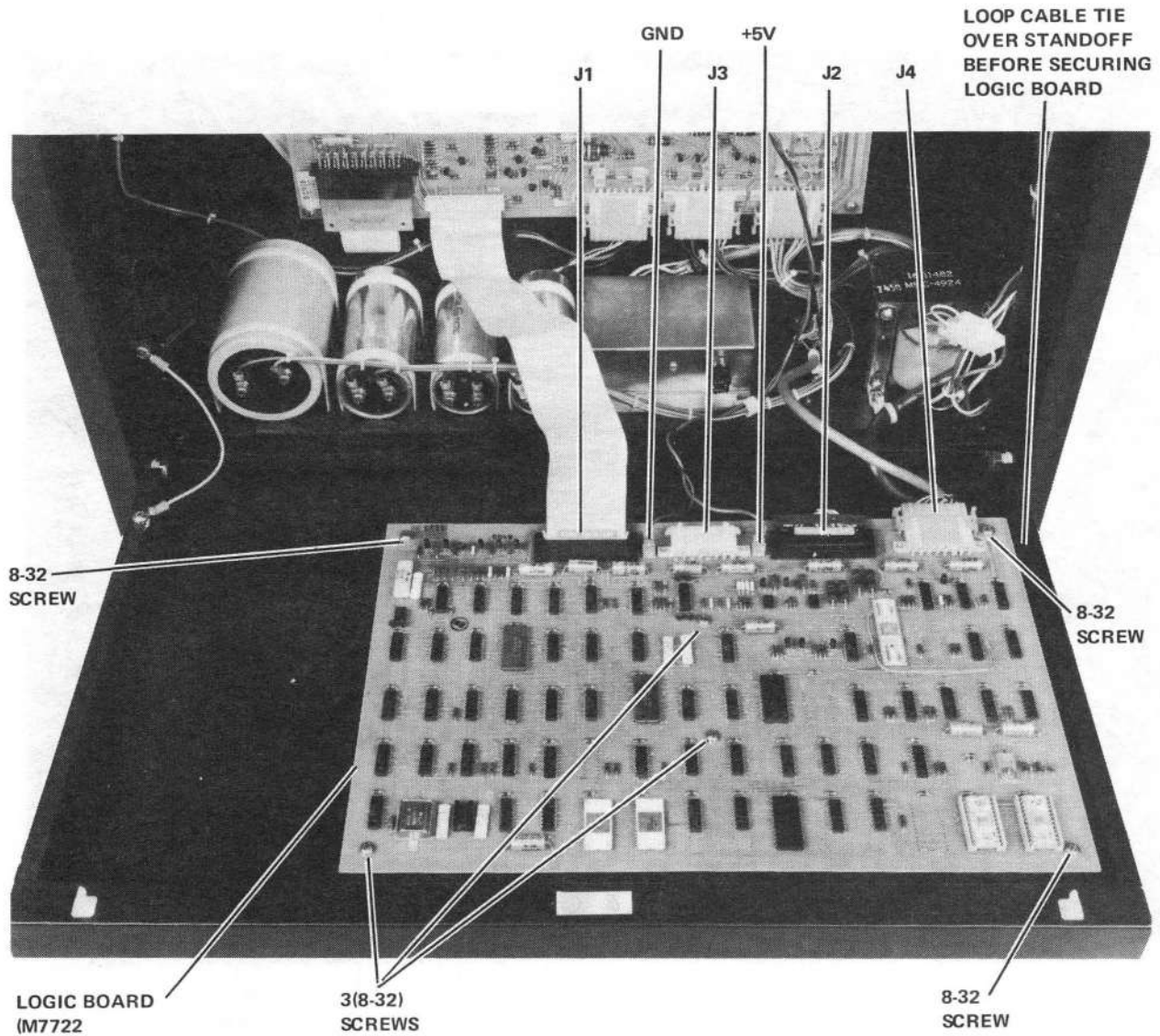
(8-32) SCREWS



(8-32) SCREWS

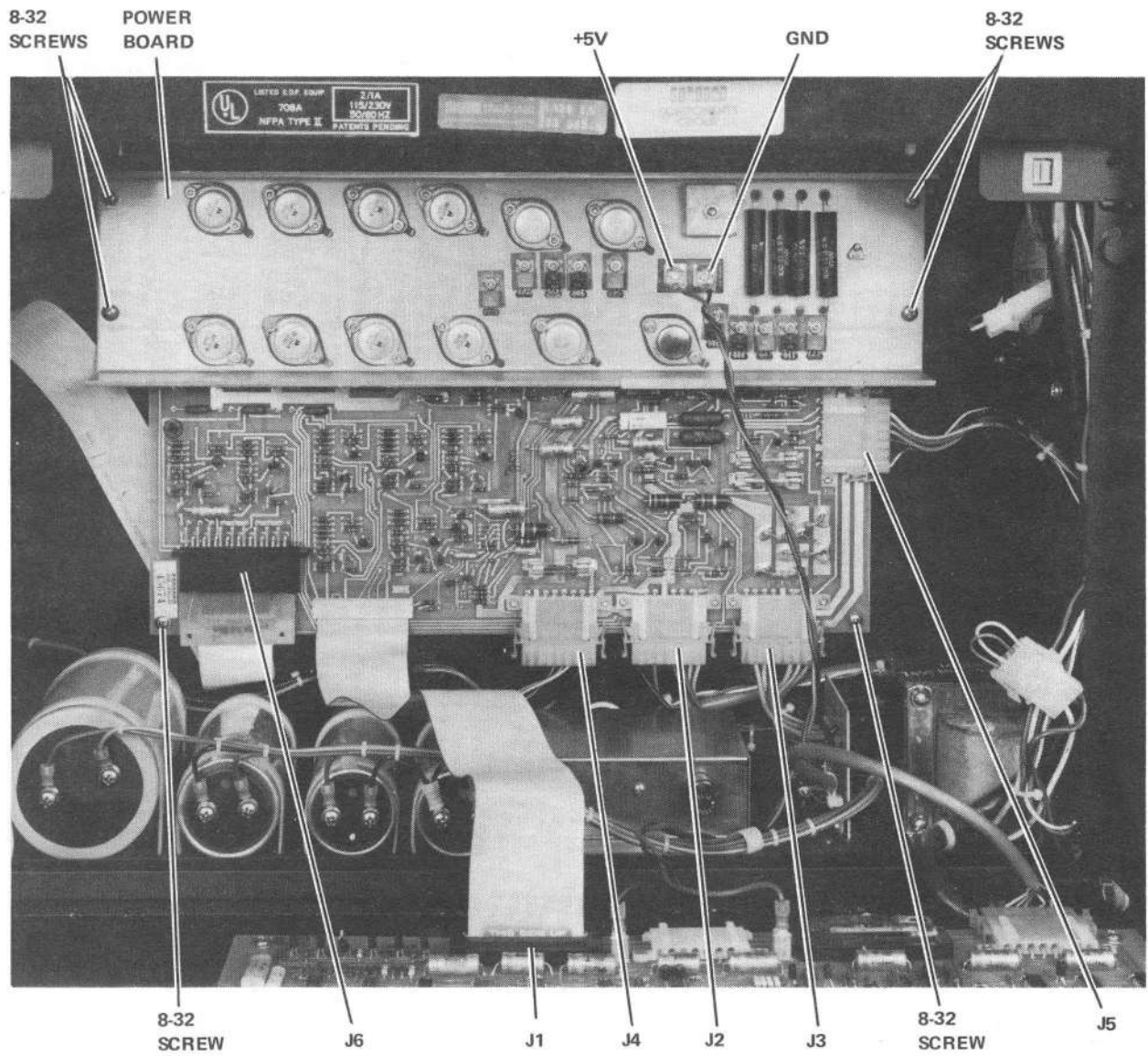
7393-3

Figure 6-31 Stepping Motor Removal



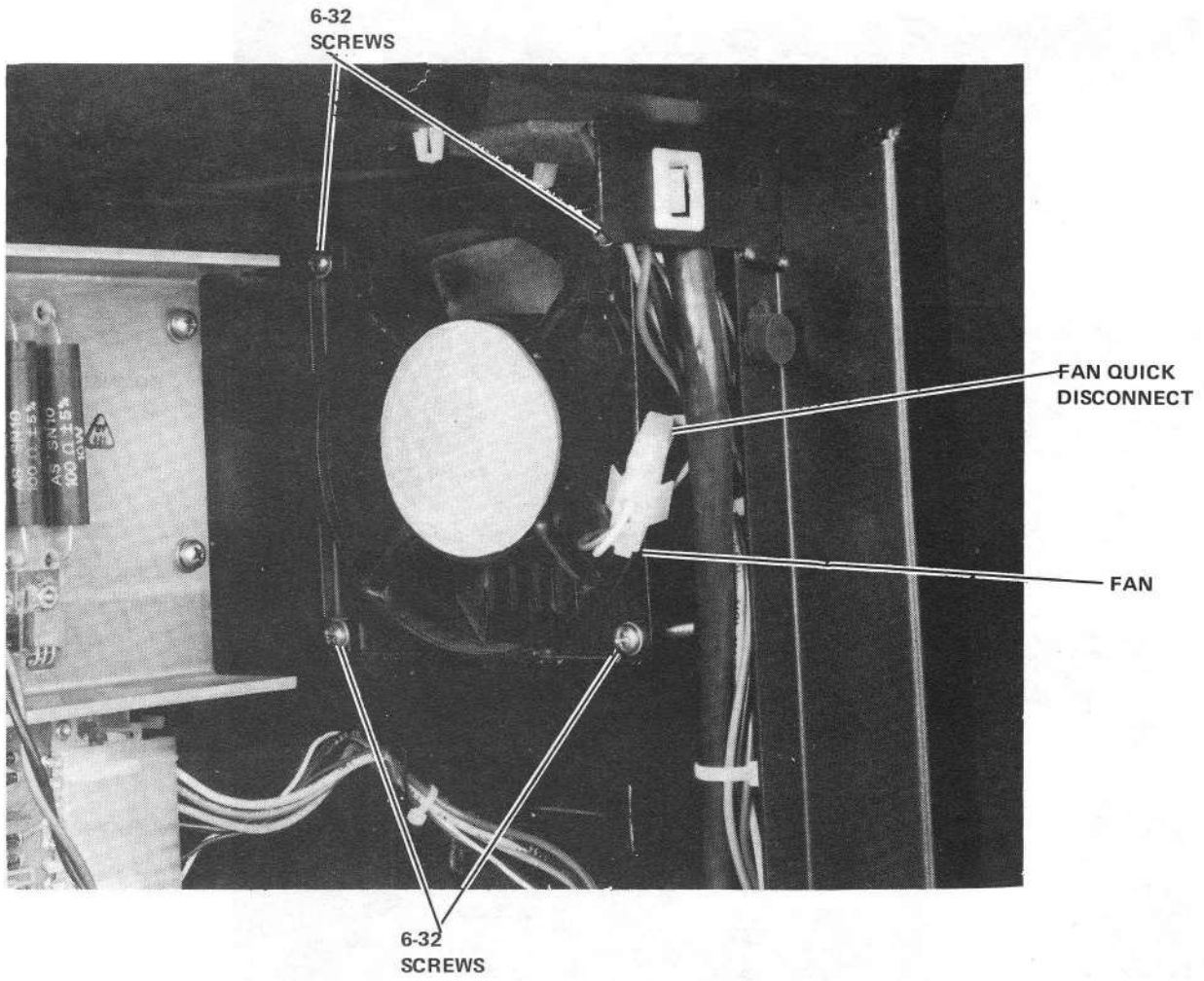
7393-8

Figure 6-32 Logic Board Removal



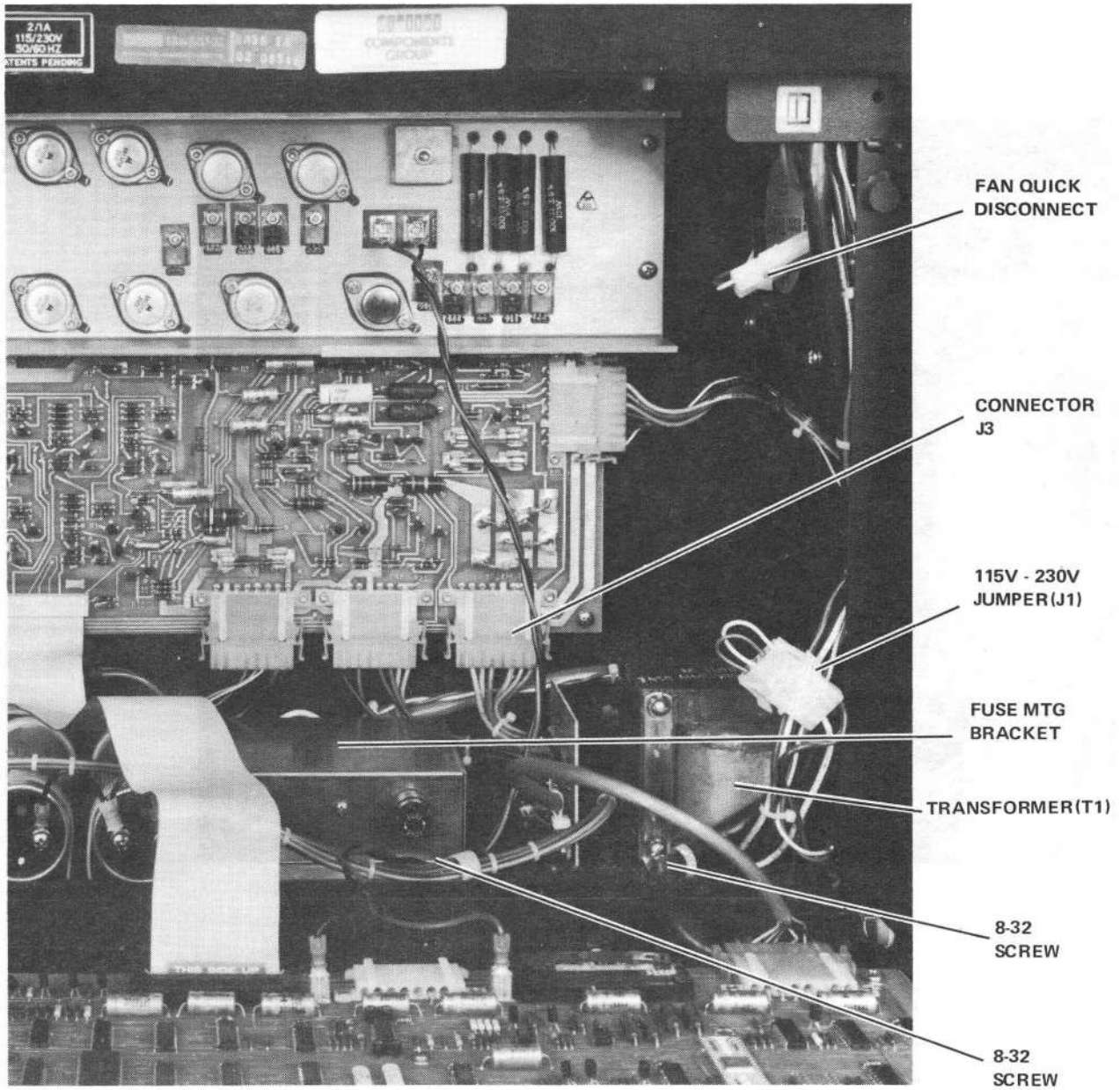
7393-16

Figure 6-33 Power Board Removal



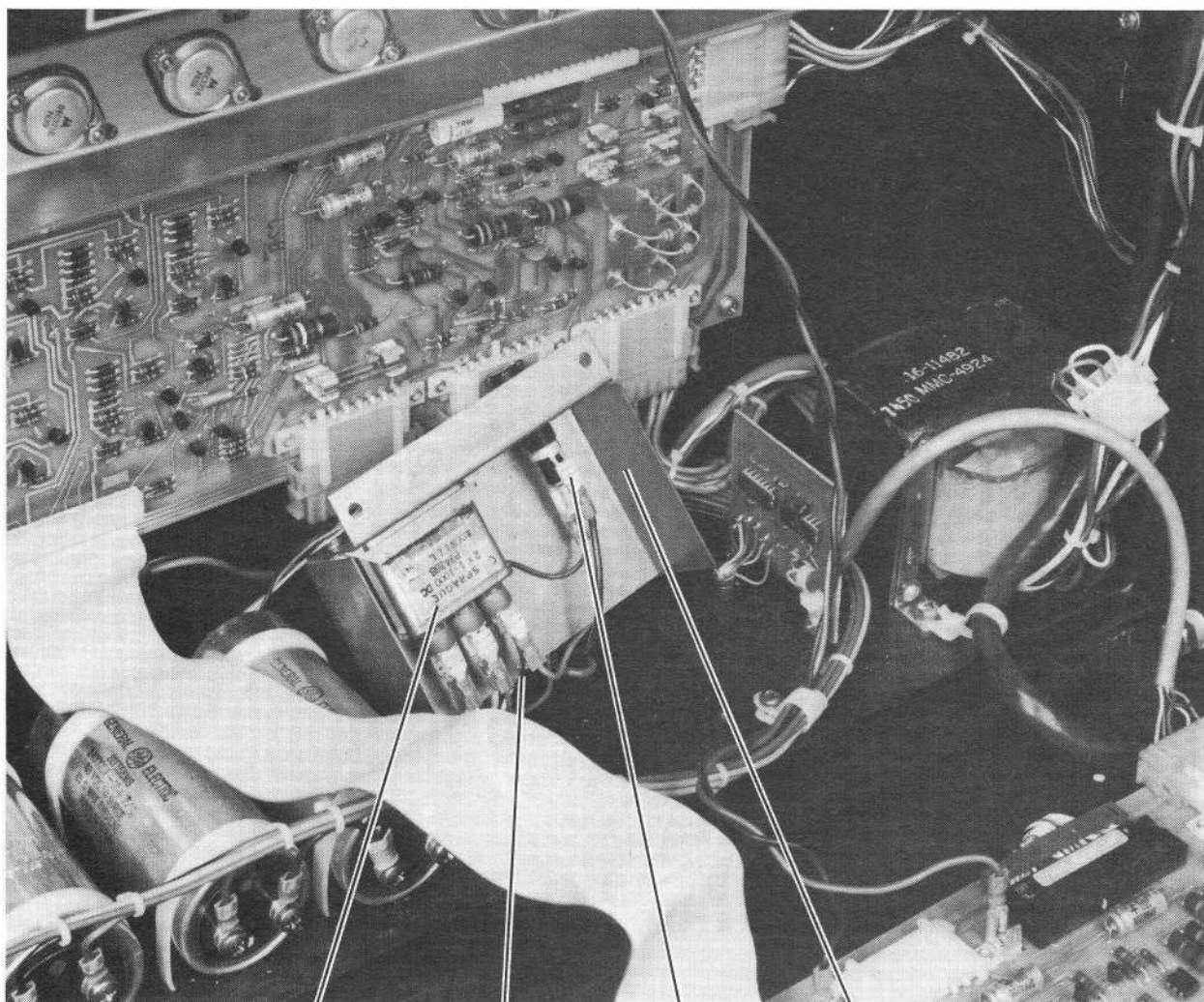
7393-2

Figure 6-34 Fan Removal



7393-16

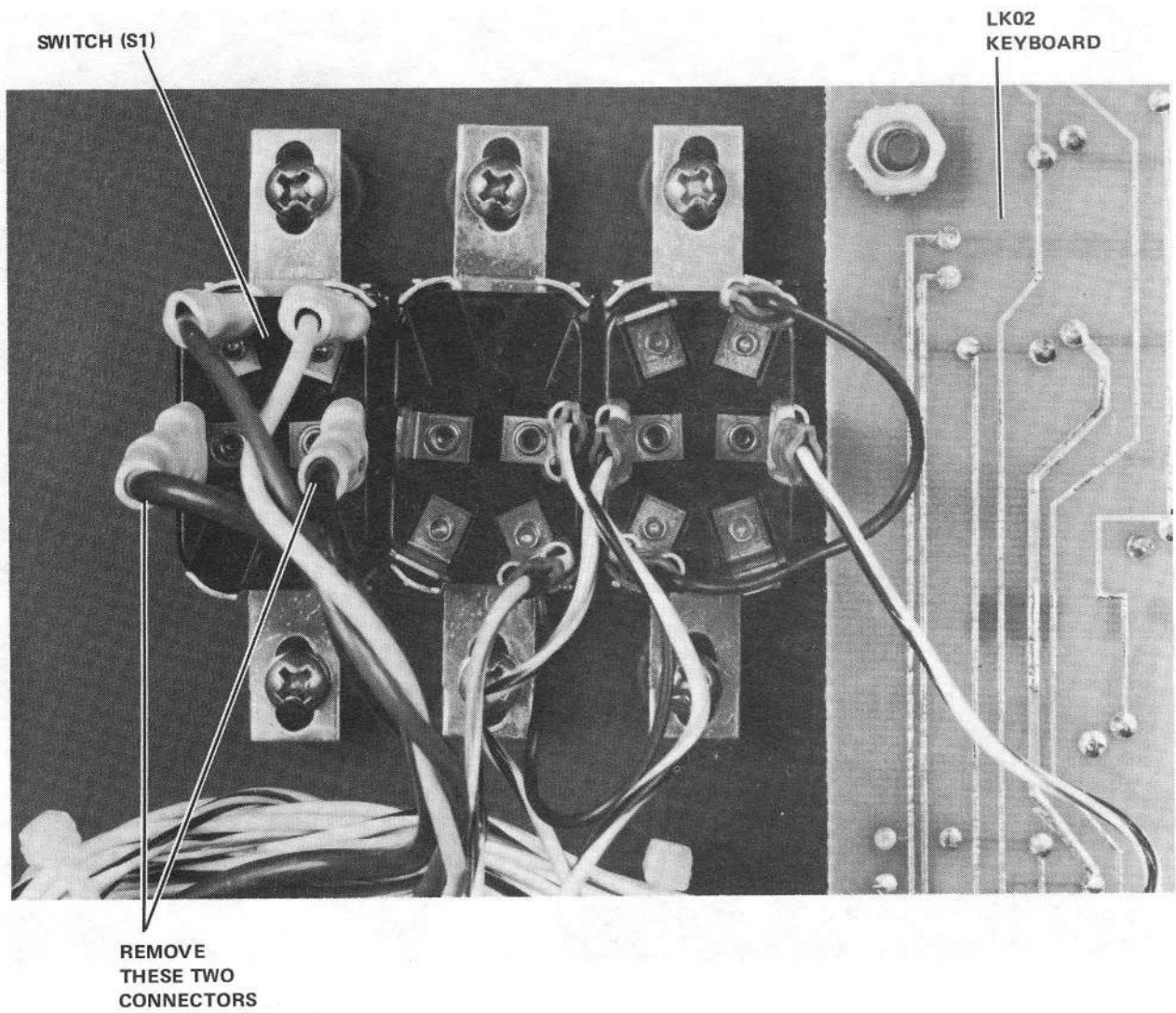
Figure 6-35 Transformer Removal



CAPACITOR C5 GREEN JUMPER WIRE FUSE (F1) FUSE MTG BRACKET

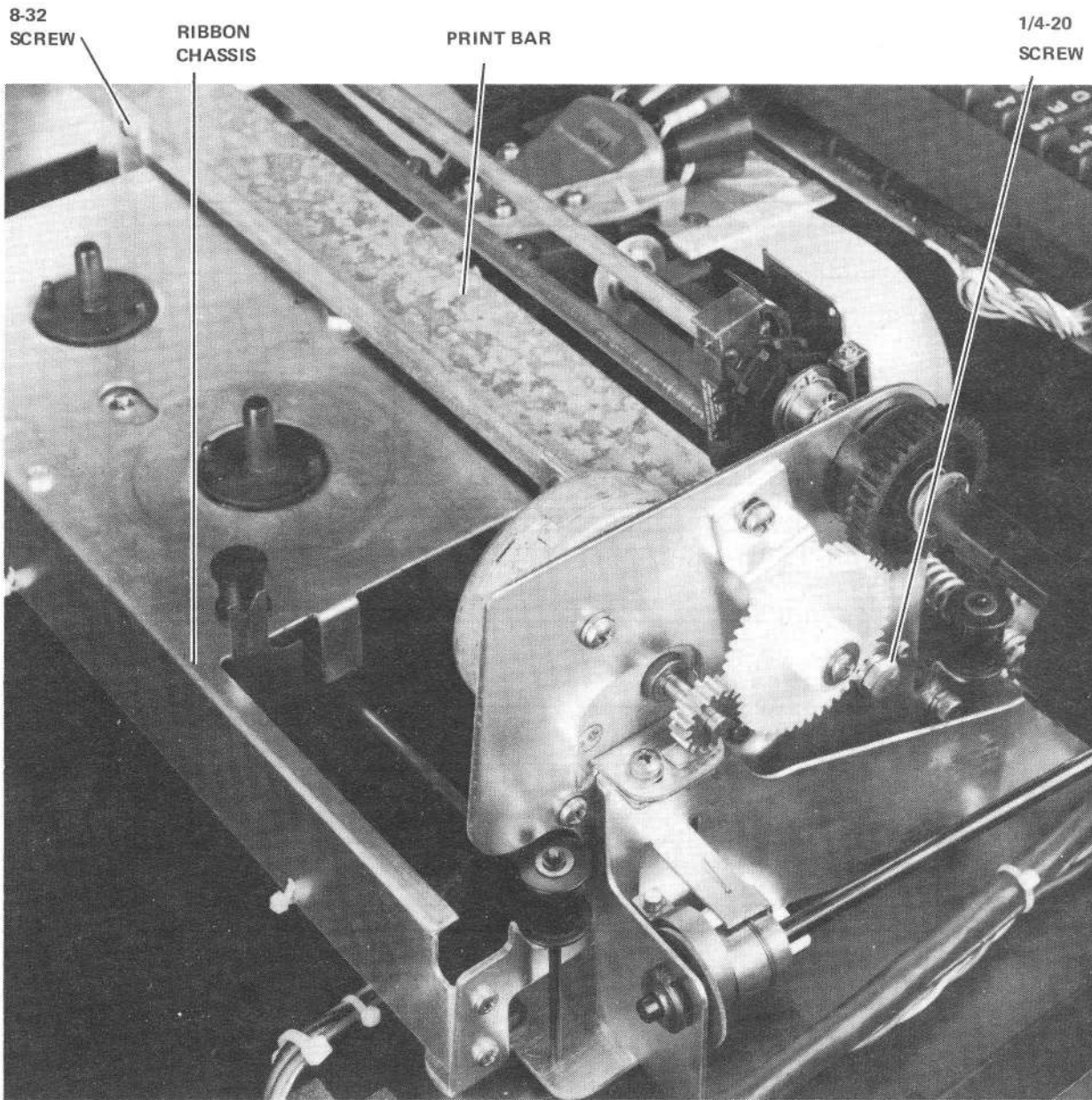
7393-7

Figure 6-36 Capacitor C5



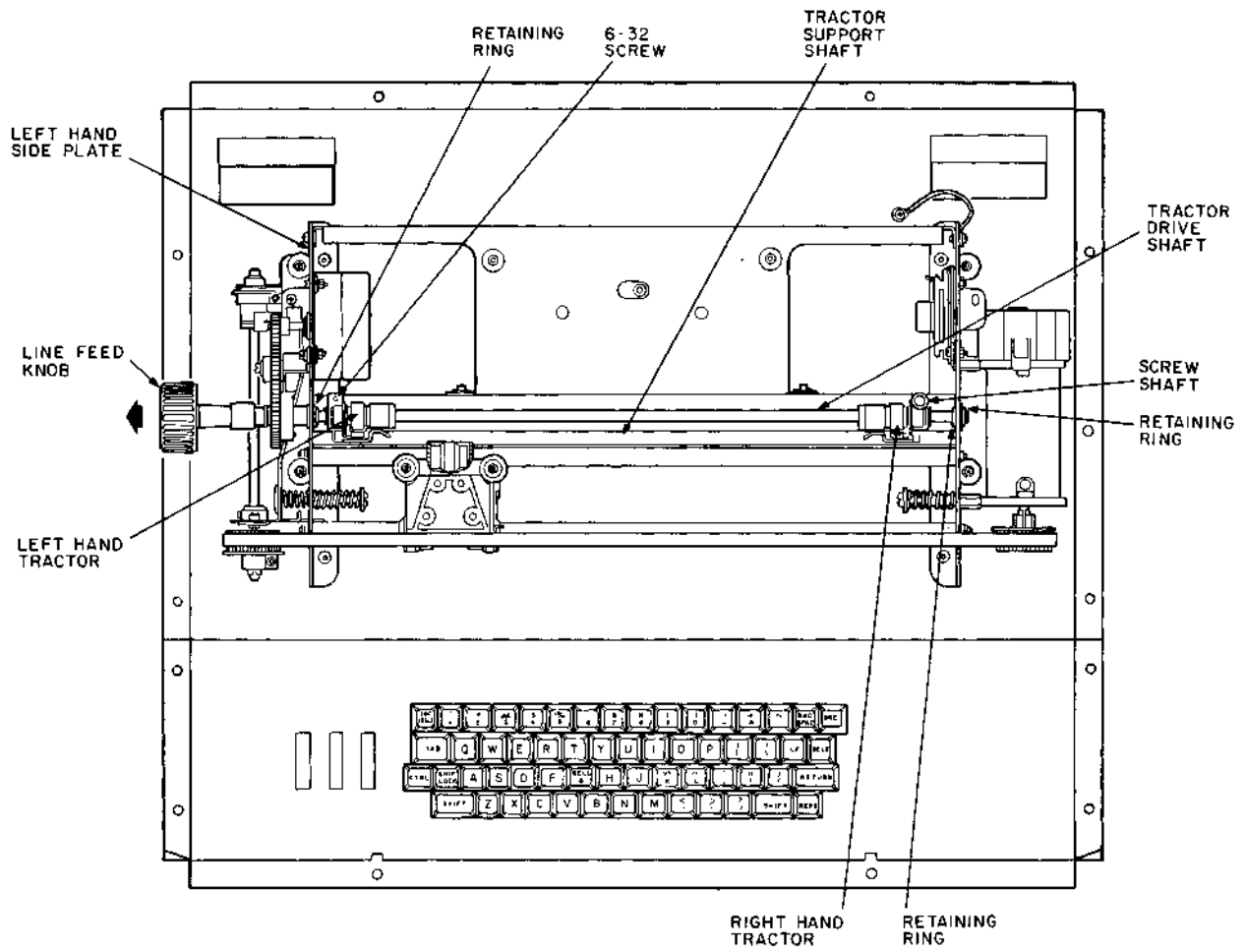
7393-11

Figure 6-37 Rocker Switch S1



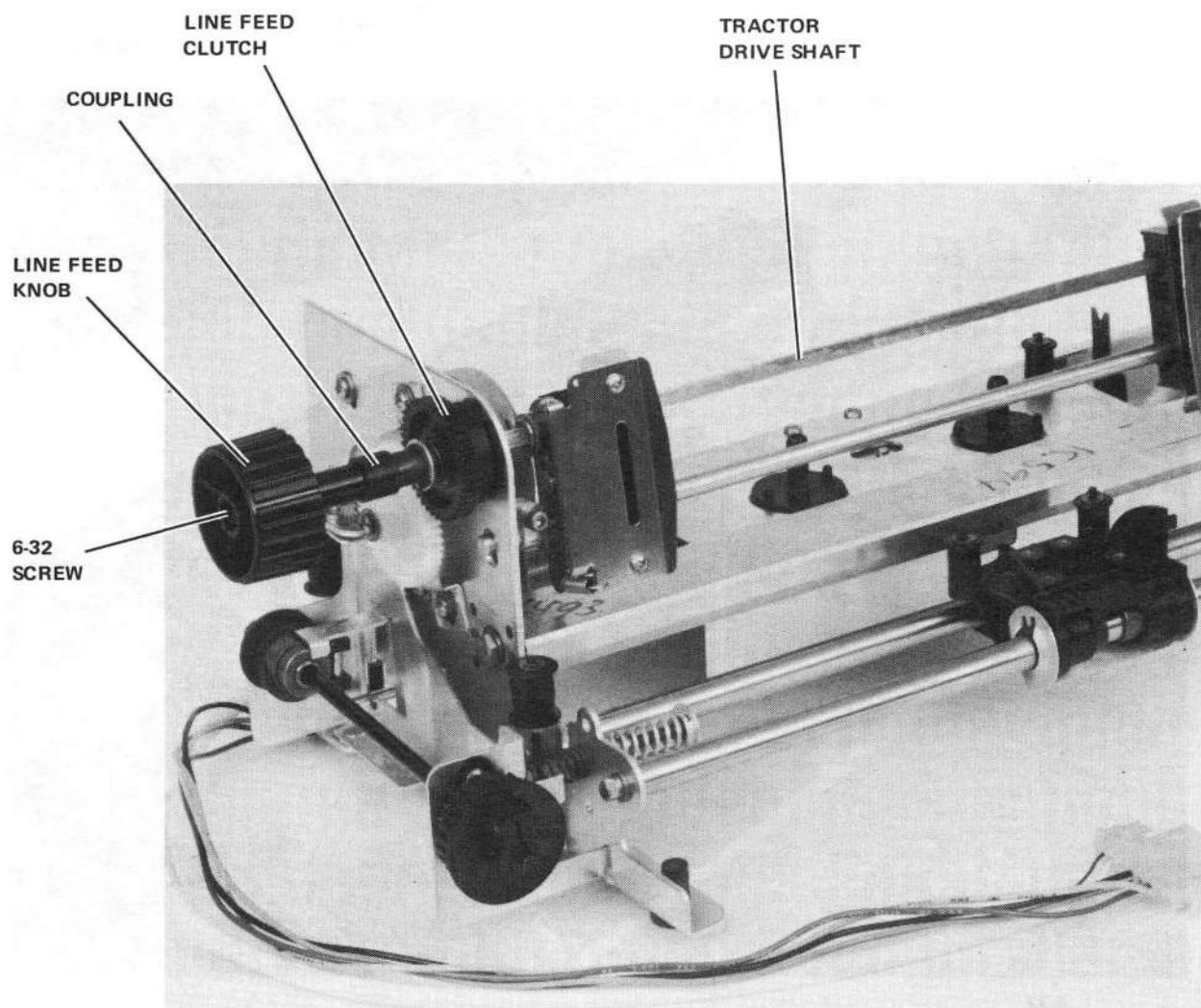
7393-10

Figure 6-38 Print Bar Removal



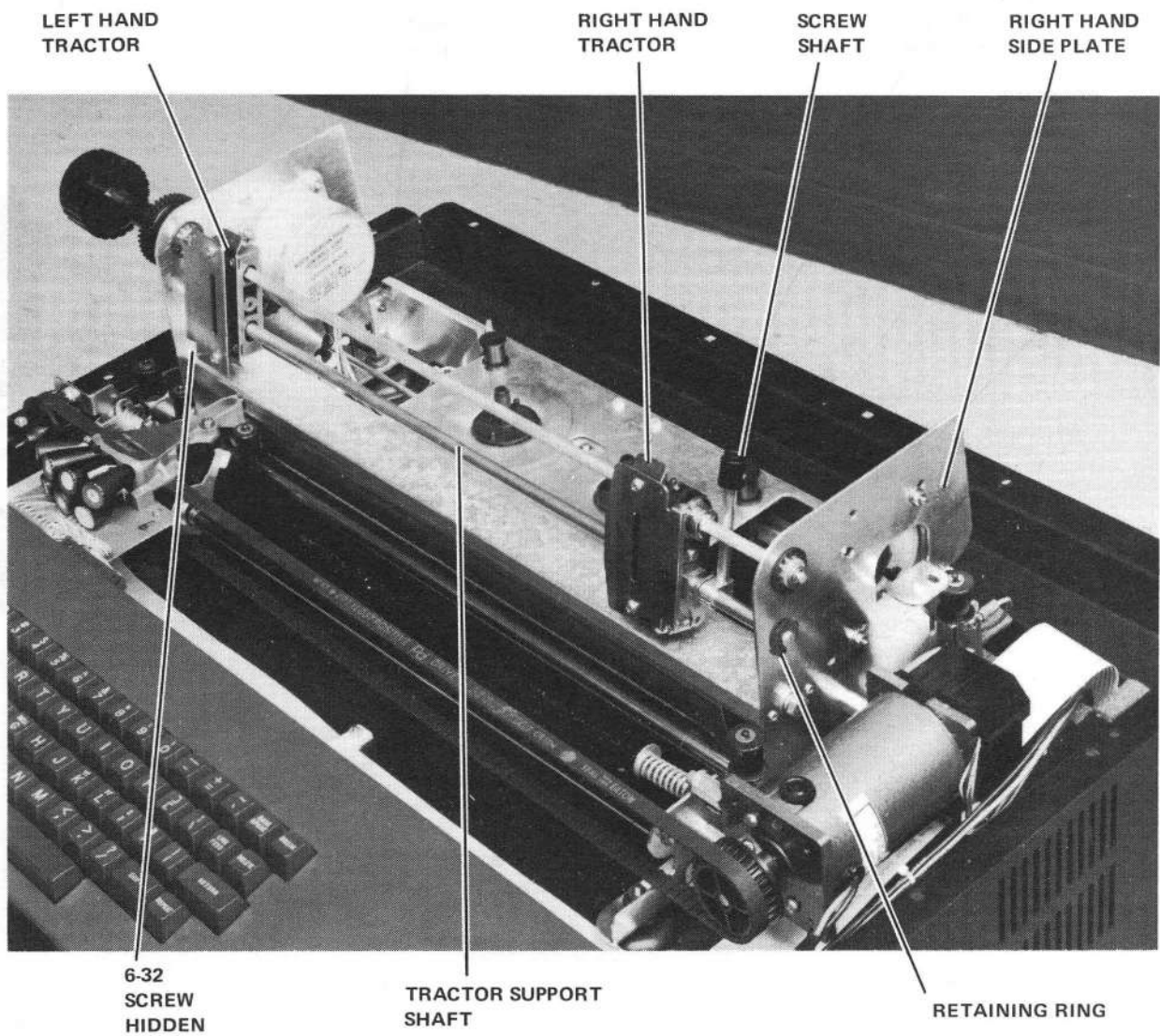
CP-1564

Figure 6-39 Tractor Drive Shaft Removal



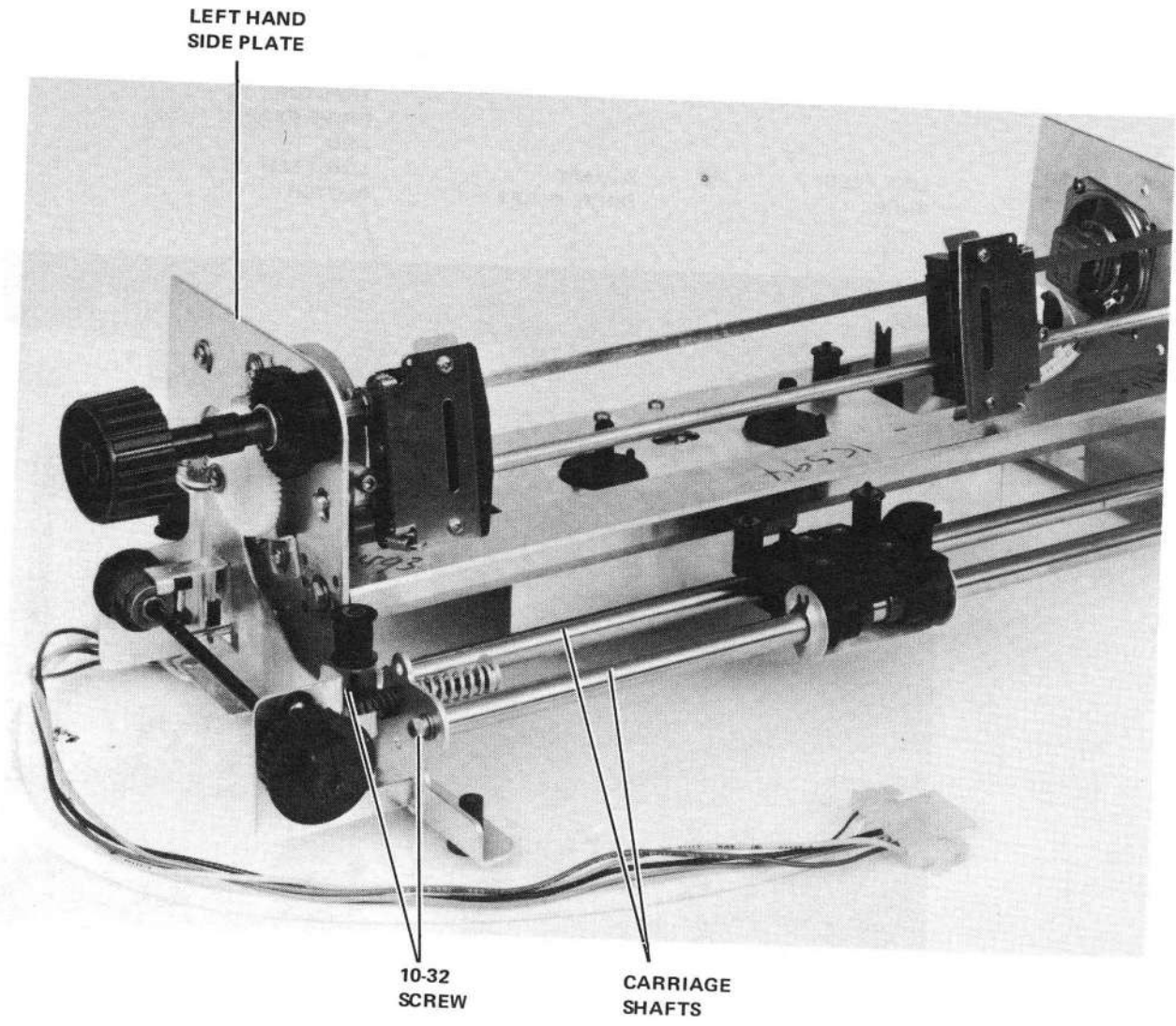
7135-12

Figure 6-40 Line Feed Clutch/Knob Removal



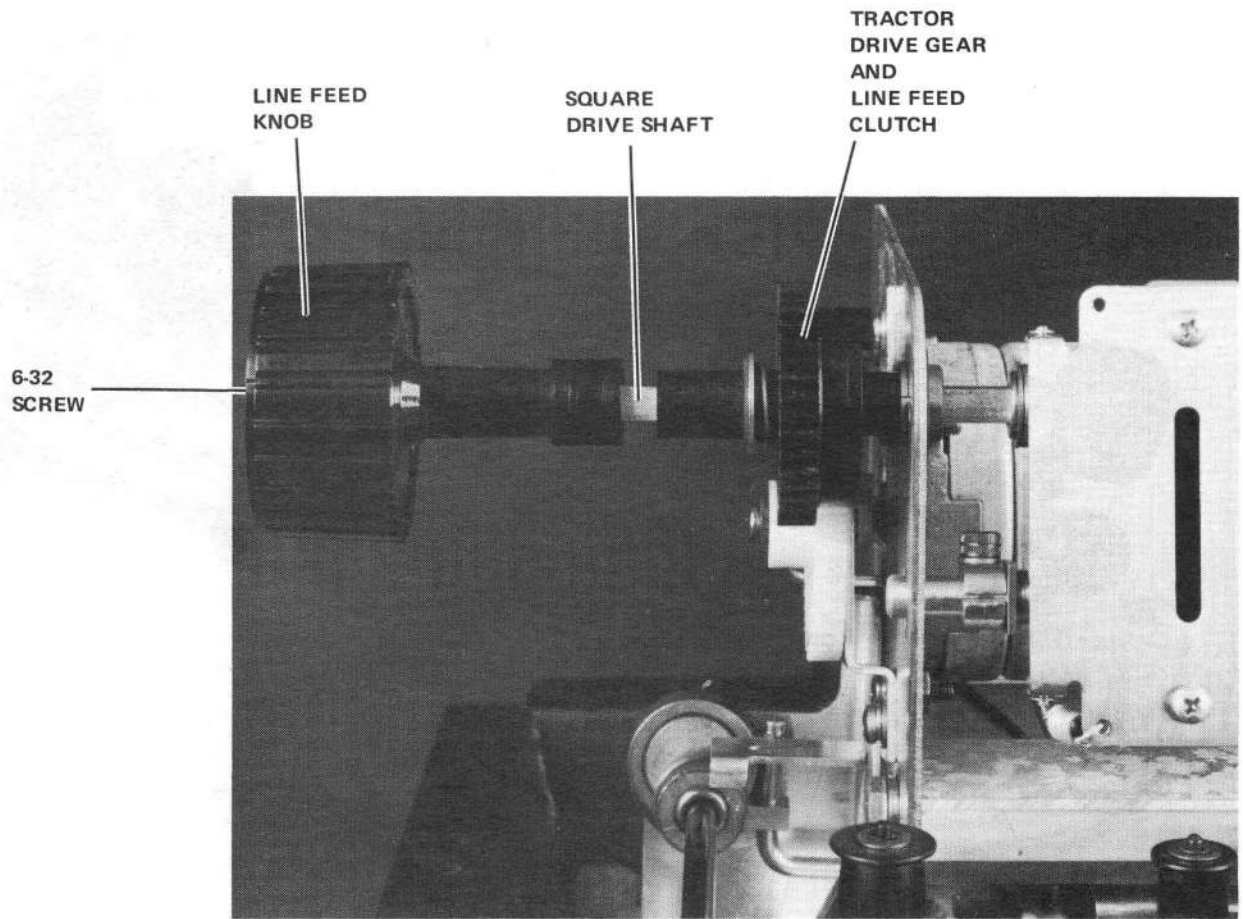
7393-4

Figure 6-41 Tractor Support Shaft Removal



7135-12

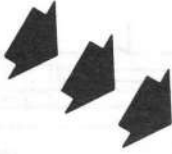
Figure 6-42 Carriage Shaft Removal



7393-14

Figure 6-43 Tractor Drive Gear Removal

PUSH IN THIS
DIRECTION TO
REMOVE
TIMING BELT

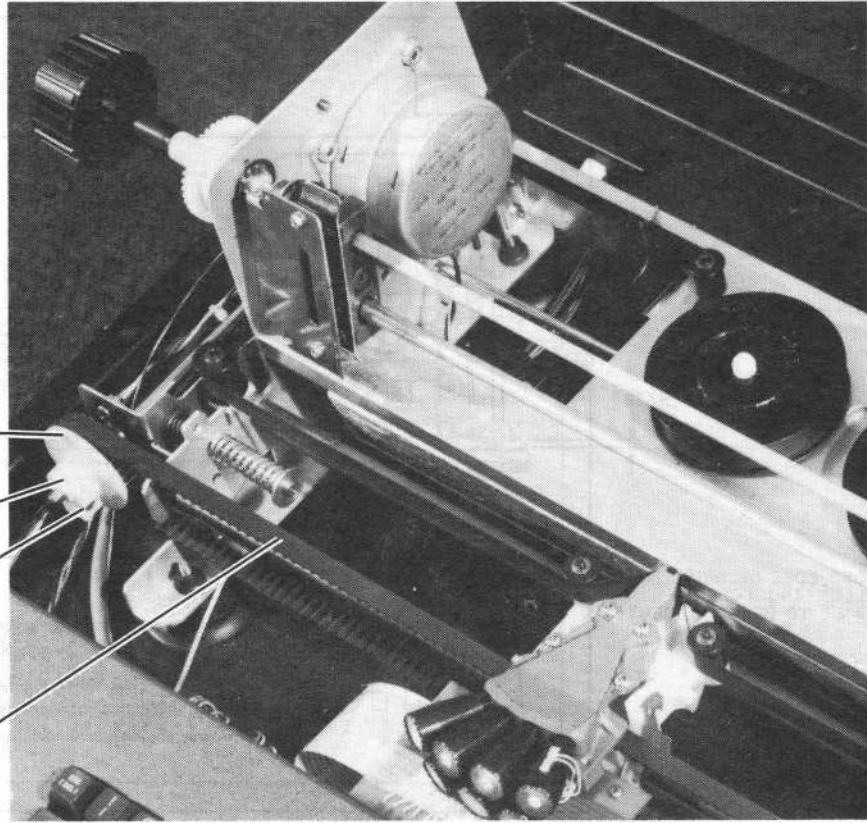


RIBBON DRIVE
PULLEY

COLLAR CLAMP

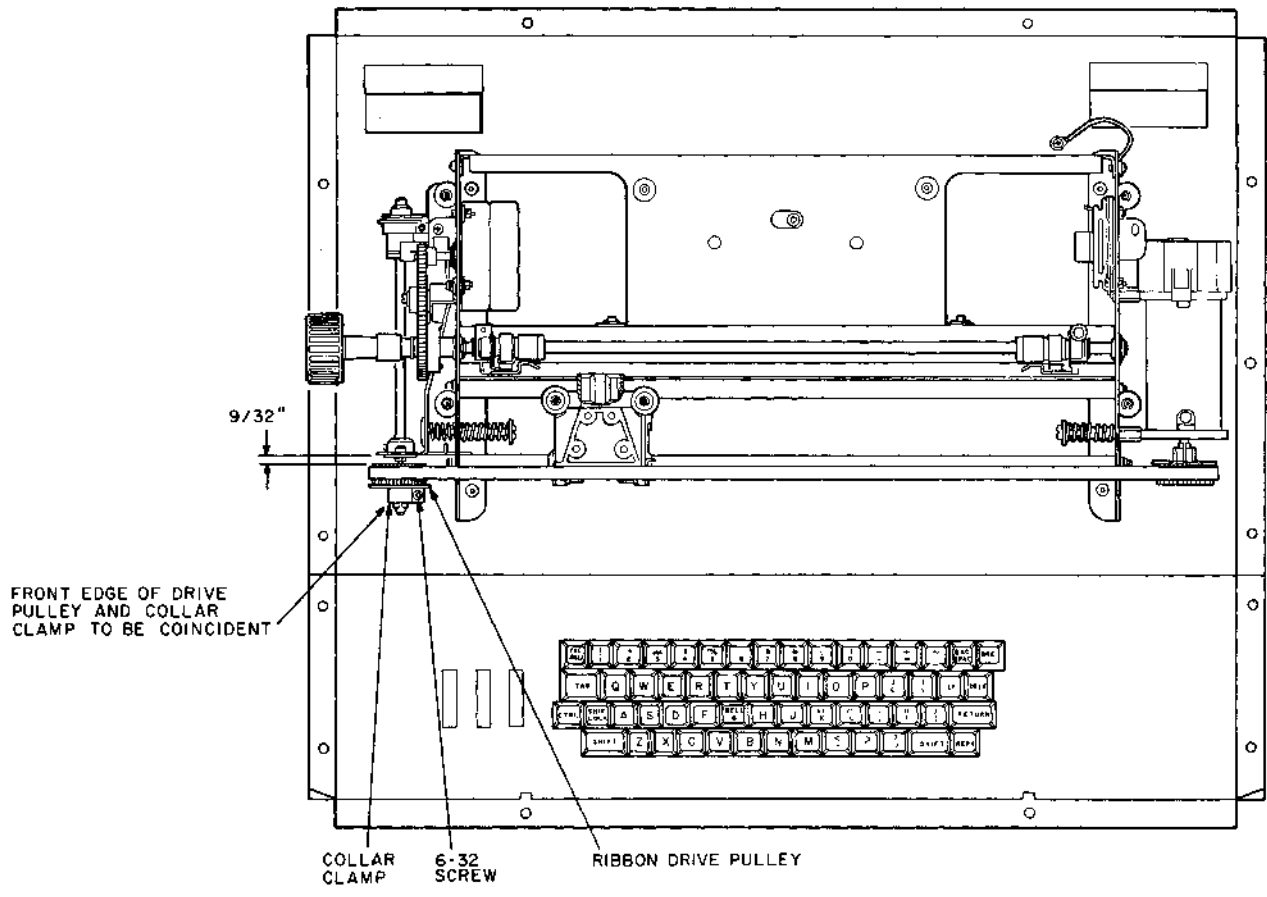
6-32
SCREW

TIMING BELT



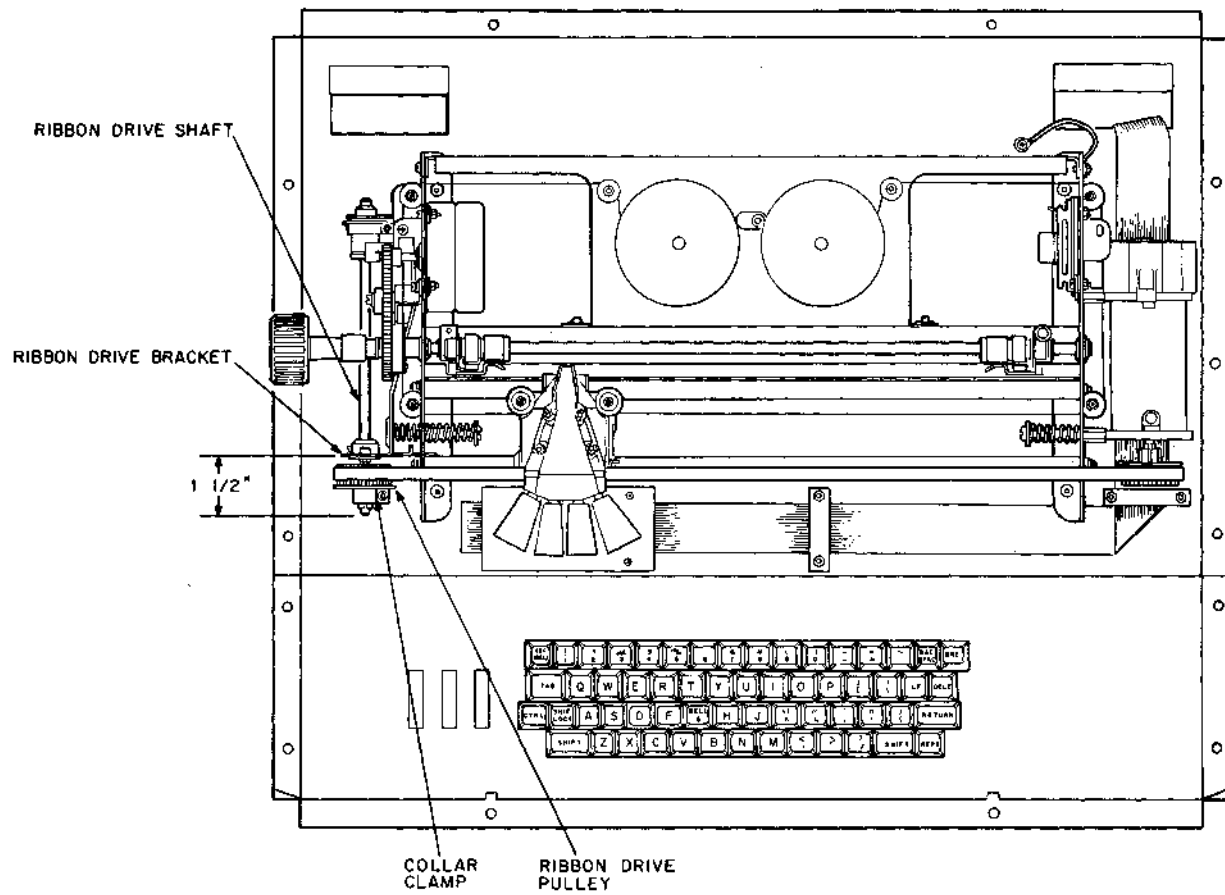
7037-5

Figure 6-44 Ribbon Drive Pulley Removal



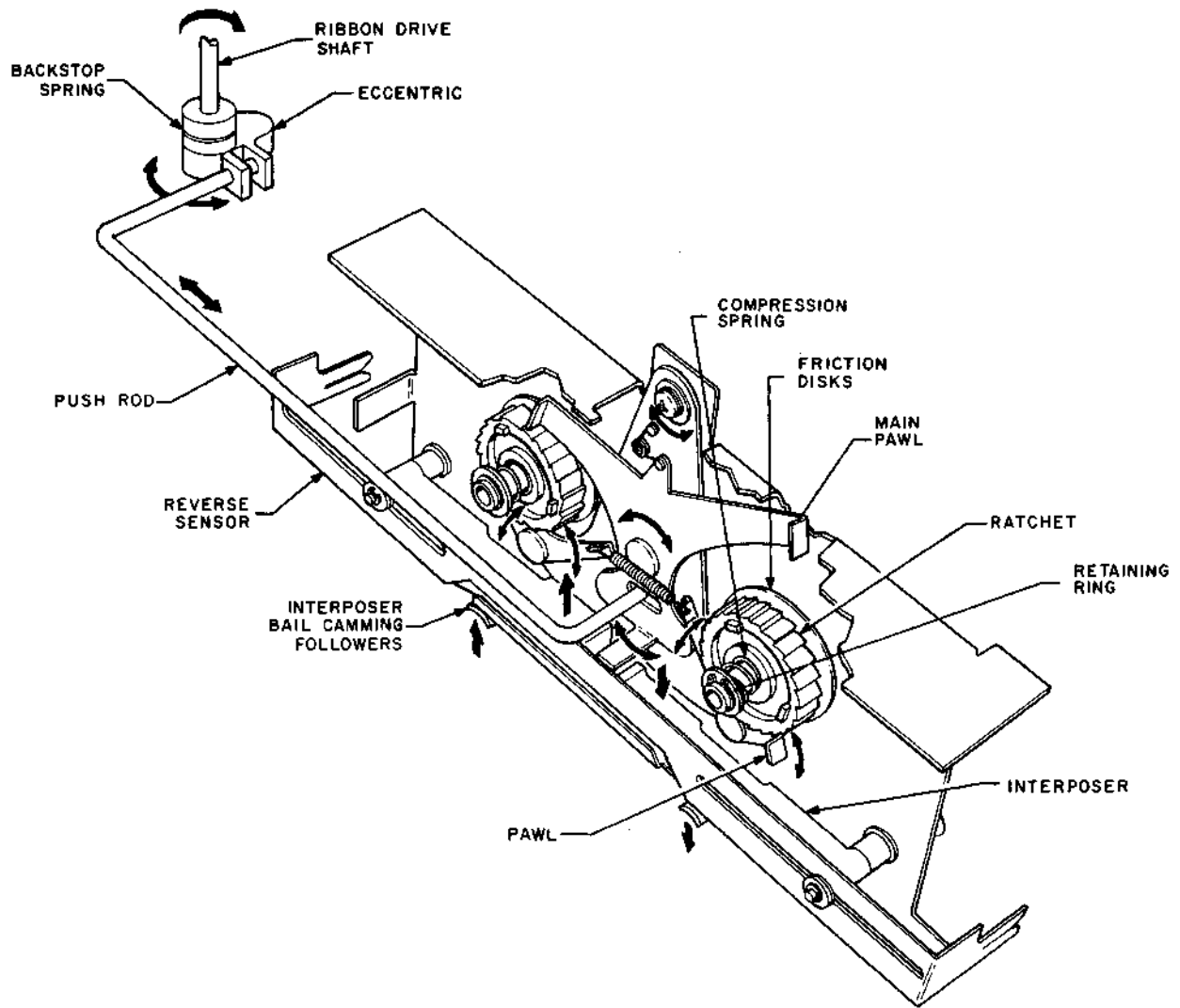
CP-4563

Figure 6-45 Ribbon Drive Pulley Adjustment



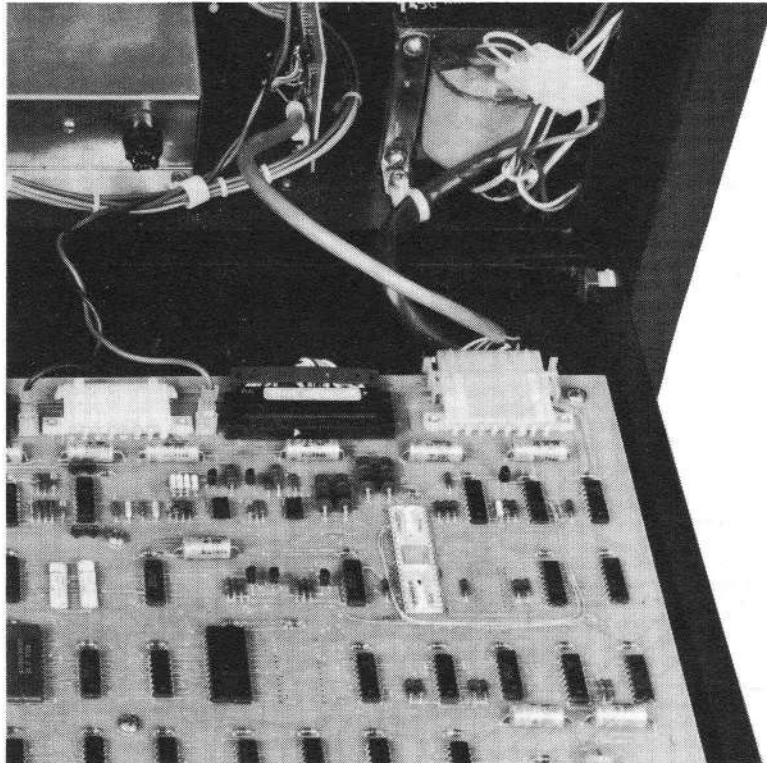
CP-1570

Figure 6-47 Ribbon Drive Shaft Adjustment



CP-1707

Figure 6-48 Friction Disk/Ratchet Wheel Replacement



7393-08

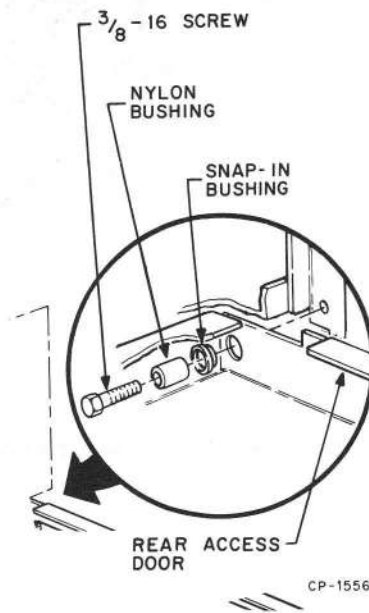


Figure 6-49 Rear Door Bushing Replacement

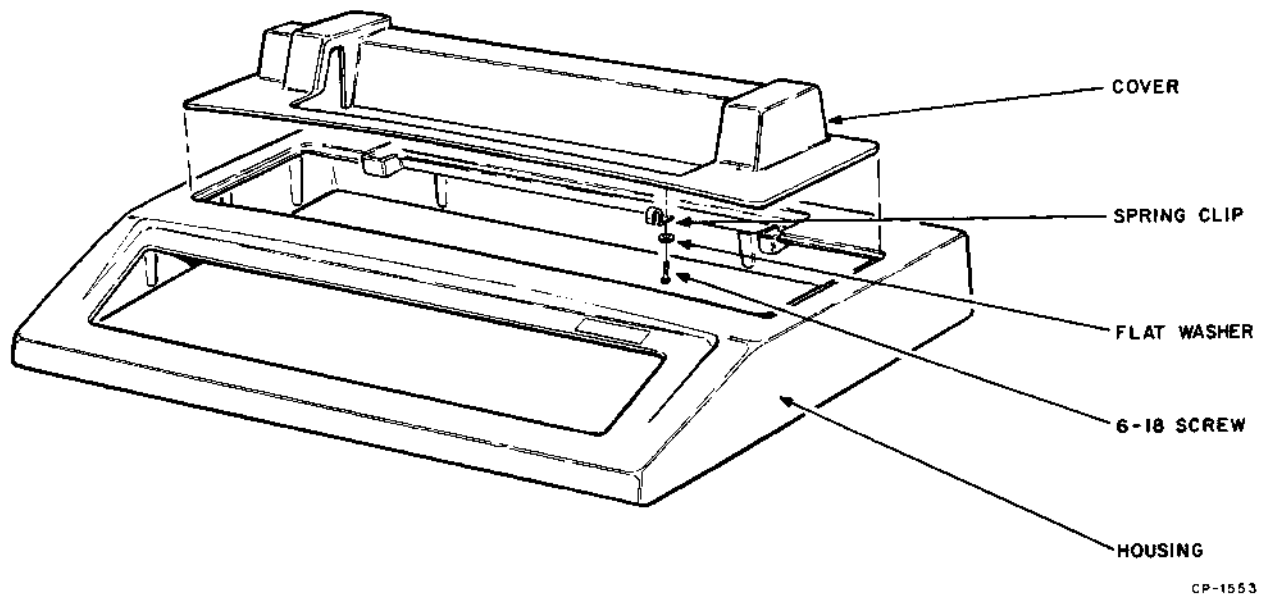


Figure 6-50 Cover Spring Clips

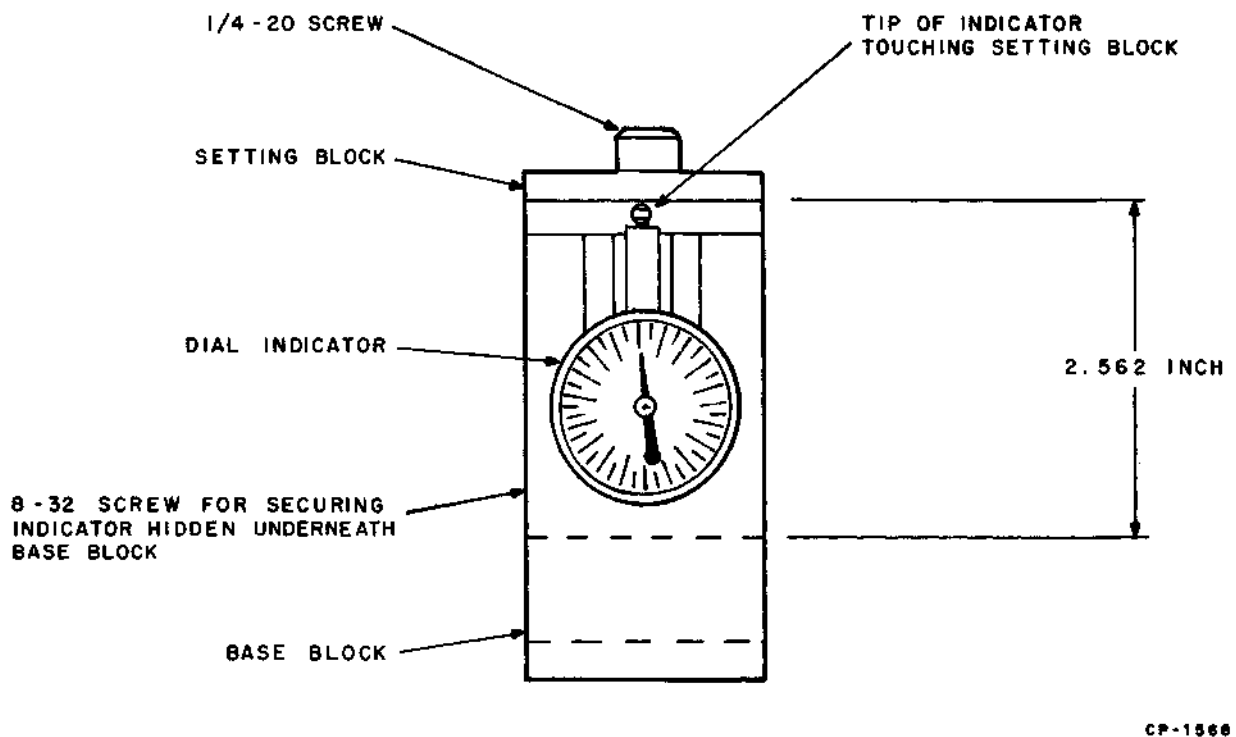
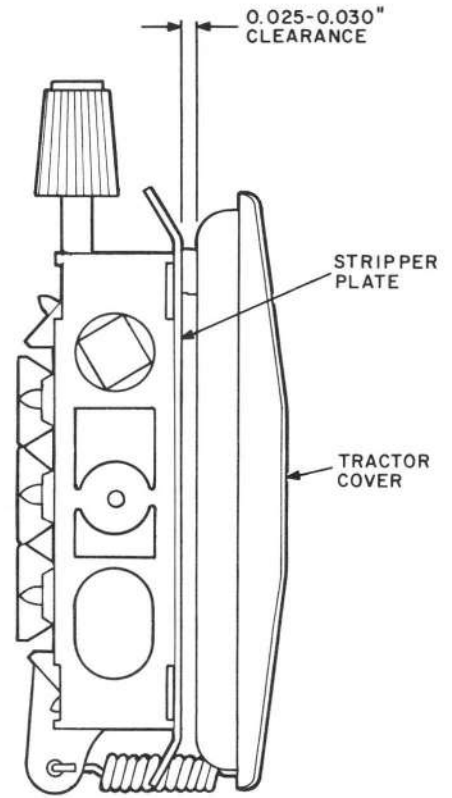
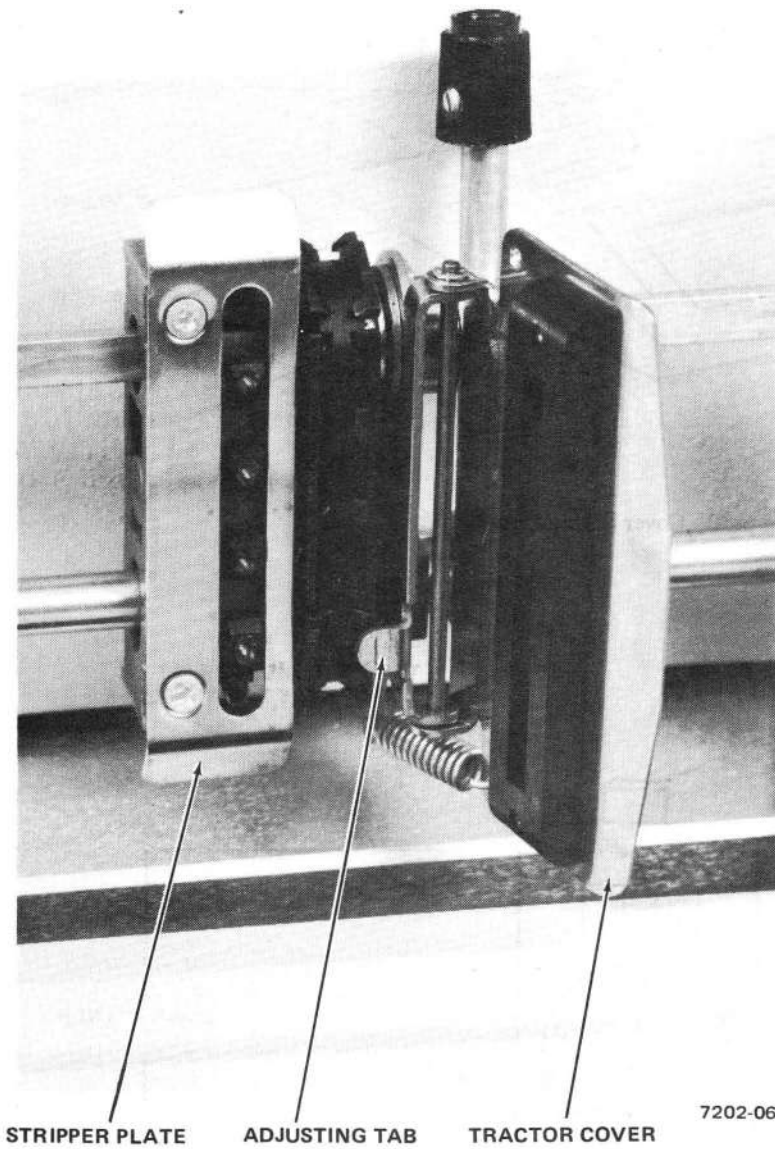
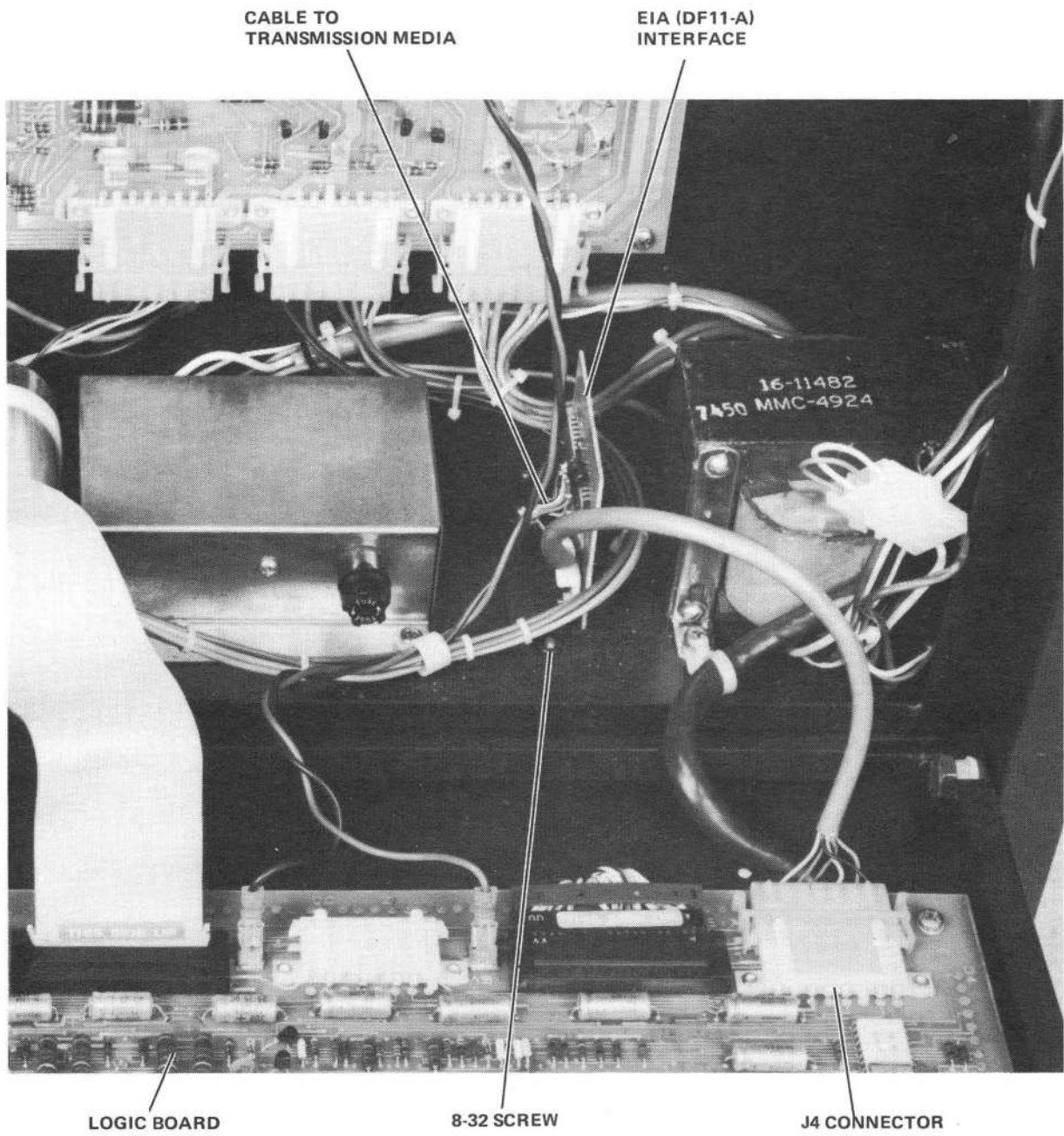


Figure 6-51 Carriage Alignment Tool Setup



CP-1635

Figure 6-52 Tractor Gap Adjustment



7393-9

Figure 6-53 EIA (DF11-A) Interface

CHAPTER 7 ENGINEERING DRAWINGS AND MATERIAL LISTS

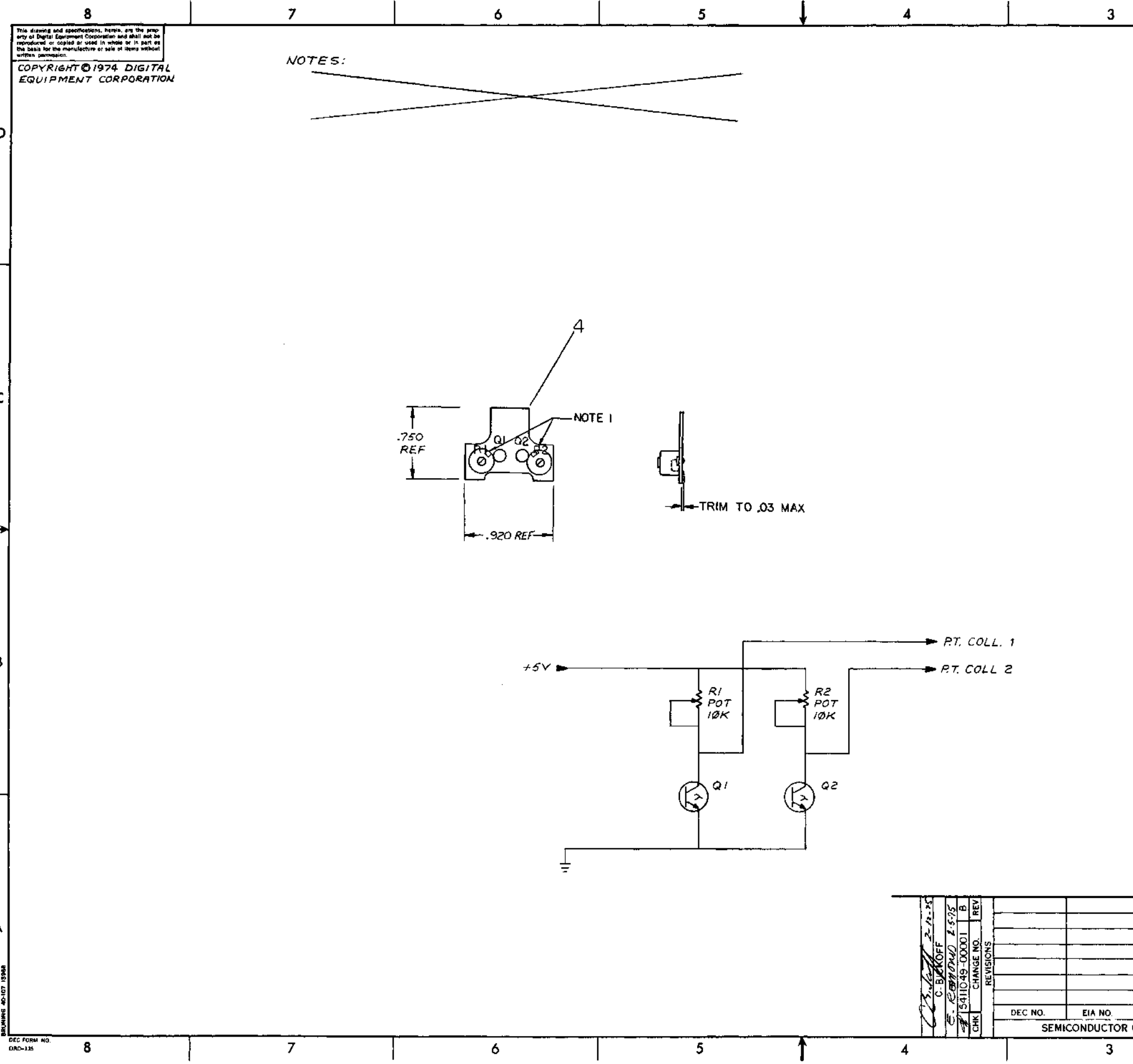
This chapter contains two Customer Print Sets for the LA36. The following drawings are included for DECwriters with serial numbers 21932 and lower.

Title	Drawing No.
LA36 Option Arrangement	E-AR-LA36-0-1
LA36 Power Schematic	D-CS-LA36-0-5
LA36 Logic Board	D-CS-M7722-0-1 (8 Sheets)
LA36 Power Board	D-CS-5410805-0-1 (5 Sheets)
LA36 Encoder PC Board Phototransistor	D-CS-5411049-0-1
63 Key Keyboard Assembly	D-UA-LK02-0-0
LK02 Keyboard	D-CS-5410736-0-1 (2 Sheets)
11 Key Keyboard Assembly	D-UA-LK03-0-0
11 Keyswitch Array Module	D-CS-5410819-0-1

The other print set is for DECwriters with serial numbers 21933 and higher (option upgradable models).

Title	Drawing No.
LA36 Power Board	D-CS-5410805-0-1 (6 Sheets)
LA36 Logic Board	D-CS-M7728-0-1 (9 Sheets)
LA36 Encoder PC Board	D-CS-5411049-0-1
63 Key Keyboard Assembly	D-UA-LK02-0-0
LK02 Keyboard	D-CS-5410736-0-1 (2 Sheets)
14 Key Keyboard Assembly	C-UA-LK03-A-0

Signal Glossary Table for M7728 Logic Board.



REF	X-Y COORDINATE HOLE LOCATION	K-CO-5411049-0-1	1	
REF	ASSY/DRILLING HOLE LAYOUT	D-AH-5411049-0-5	2	
REF	MODULE ECO HISTORY	B-MH-5411049-0-6	3	
REF	ETCHED CIRCUIT BOARD	DIA-5010770-0-0	4	
2	R1, R2	POTENTIOMETER 10K	1309150-12	5
2	Q1, Q2	PHOTO TRANSISTOR	1511906	6

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
PARTS LIST				
ETCH BOARD REV B				

DRN	DATE	5/8/74
CHR'D	DATE	7-1-74
ENG	DATE	7-11-74
PRD. ENG	DATE	7-18-74
PROD.	DATE	2-15-74

DEC NO.	EIA NO.	DEC NO.	EIA NO.
SEMICONDUCTOR CONVERSION CHART			

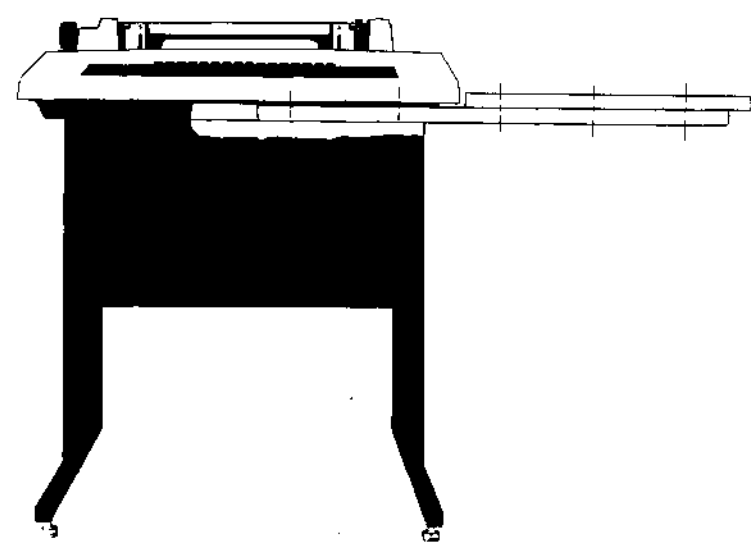
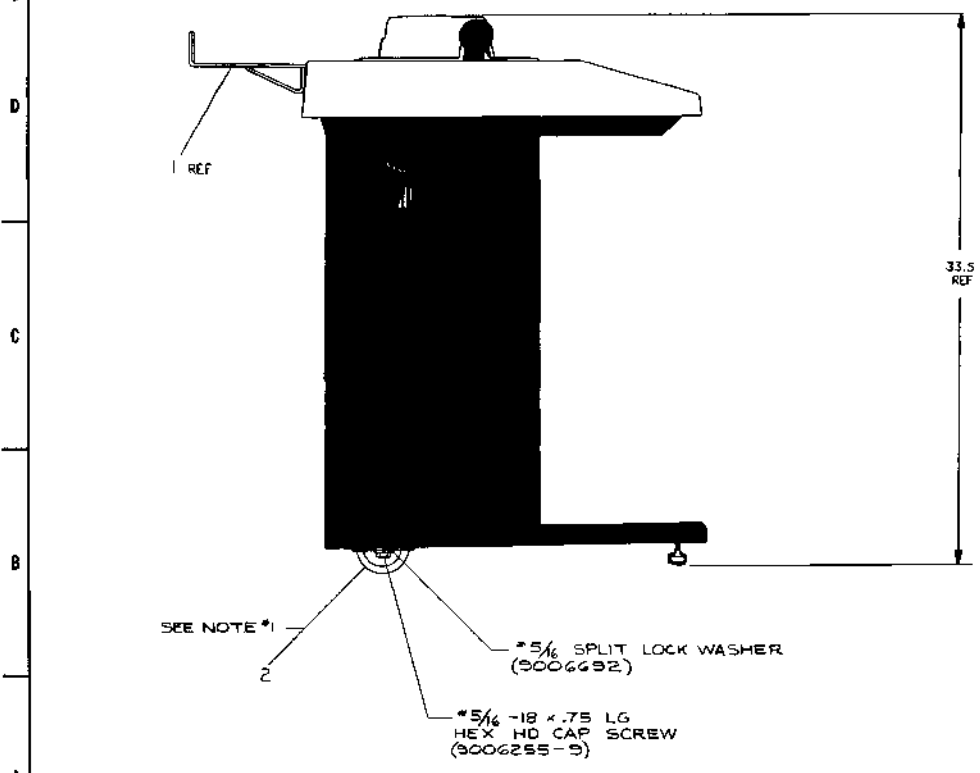
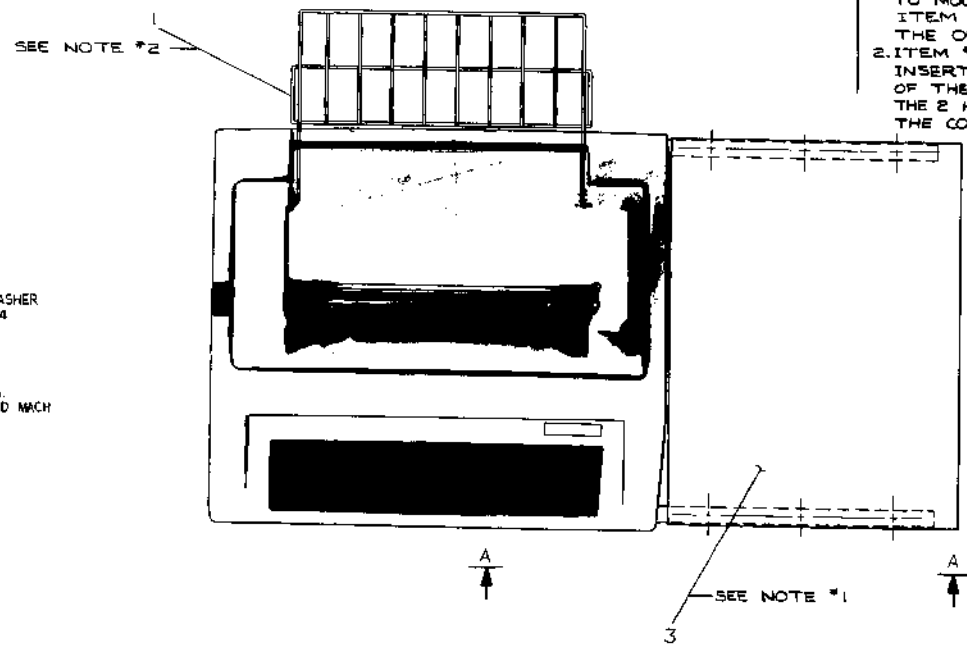
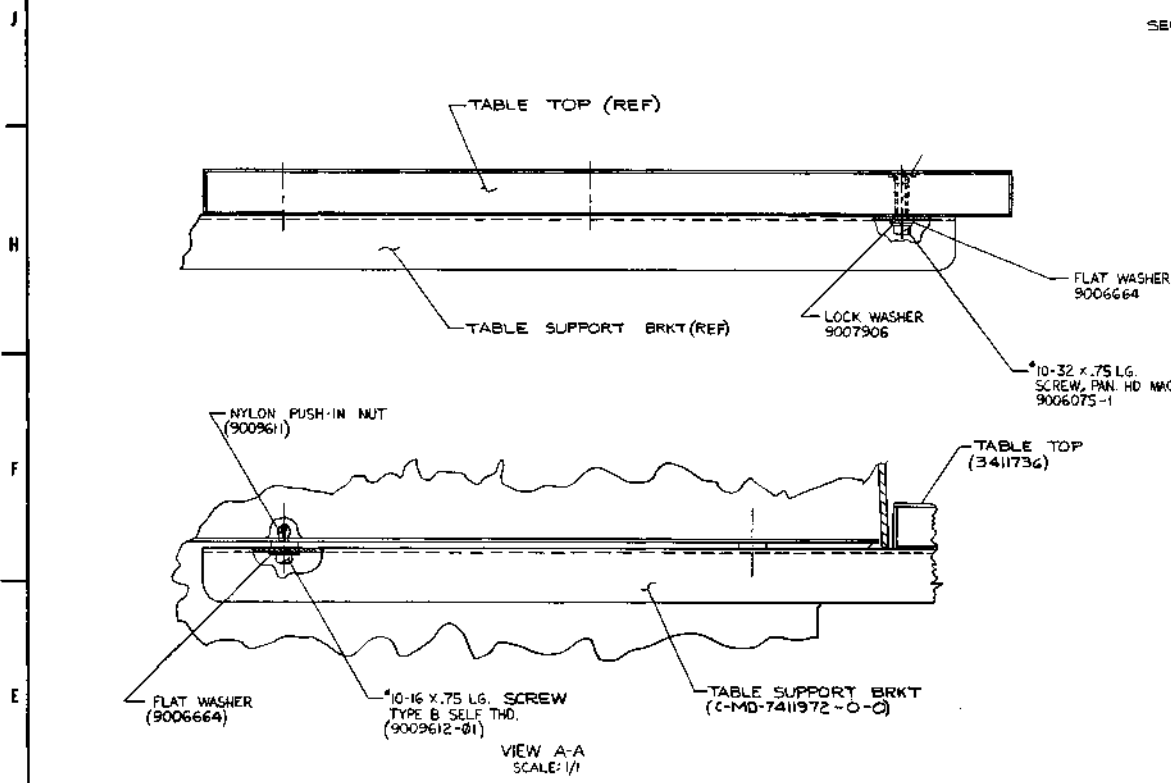
SCALE	1	OF	1
SHEET	1	OF	1

digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS	TITLE LA36 ENCODER PC BOARD PHOTOTRANSISTOR
SIZE CODE D/CS	NUMBER 5411049-0-1
REV. B	

DCS 5411049-0-1 B
 DCS 5411049-0-1 B

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NOTES:
 1. ALL HARDWARE NECESSARY TO MOUNT ITEM #2 AND ITEM #3 IS SUPPLIED IN THE OPTIONS KIT.
 2. ITEM #1 IS INSTALLED BY INSERTING THE BENT ENDS OF THE "PAPER BASKET" INTO THE 2 HOLES PROVIDED ON THE COVER AS SHOWN.

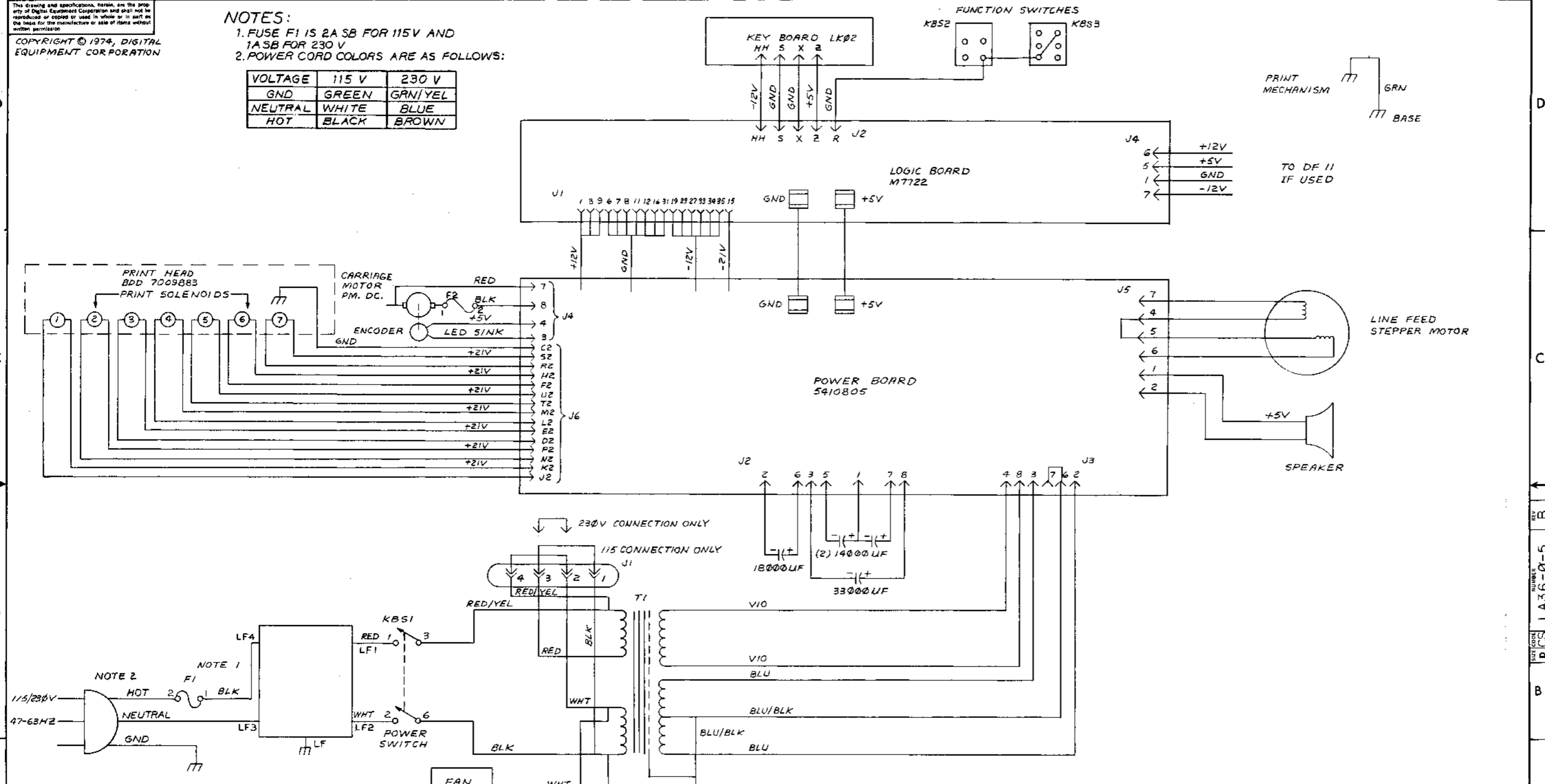


FIRST USED OR OPTION/MODEL		QTY.	DESCRIPTION	PART NO.	REV.																
LA36																					
DIMENSIONAL TOLERANCE		PARTS LIST																			
DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED		<table border="1"> <tr> <th>QTY.</th> <th>DESCRIPTION</th> <th>PART NO.</th> <th>REV.</th> </tr> <tr> <td>1</td> <td>LA36 TABLE ASSTY-PL-7009897-0-0</td> <td>3</td> <td></td> </tr> <tr> <td>2</td> <td>WHEEL ASSEMBLY C-AD-7009751-0-0</td> <td>2</td> <td></td> </tr> <tr> <td>1</td> <td>BASKET, PAPER D-1A-7412016-0-0</td> <td>1</td> <td></td> </tr> </table>				QTY.	DESCRIPTION	PART NO.	REV.	1	LA36 TABLE ASSTY-PL-7009897-0-0	3		2	WHEEL ASSEMBLY C-AD-7009751-0-0	2		1	BASKET, PAPER D-1A-7412016-0-0	1	
QTY.	DESCRIPTION	PART NO.	REV.																		
1	LA36 TABLE ASSTY-PL-7009897-0-0	3																			
2	WHEEL ASSEMBLY C-AD-7009751-0-0	2																			
1	BASKET, PAPER D-1A-7412016-0-0	1																			
MATERIAL		TITLE LA36 OPTION ARRANGEMENT																			
FINISH		PARTS LIST																			
SCALE 1" = 1"		<table border="1"> <tr> <th>SECTION</th> <th>NUMBER</th> <th>REV.</th> </tr> <tr> <td>B-DD-LA36-C</td> <td>E</td> <td>1R</td> </tr> <tr> <td>LA36-0-1</td> <td></td> <td></td> </tr> </table>				SECTION	NUMBER	REV.	B-DD-LA36-C	E	1R	LA36-0-1									
SECTION	NUMBER	REV.																			
B-DD-LA36-C	E	1R																			
LA36-0-1																					

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NOTES:
 1. FUSE F1 IS 2A 5B FOR 115V AND 1A 5B FOR 230 V
 2. POWER CORD COLORS ARE AS FOLLOWS:

VOLTAGE	115 V	230 V
GND	GREEN	GRN/YEL
NEUTRAL	WHITE	BLUE
HOT	BLACK	BROWN



QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
PARTS LIST				
	ETCH BOARD-REV			
	DRN	DATE	digital EQUIPMENT CORPORATION	
	CHKD	DATE	WAYNAND, MASSACHUSETTS	
	ENG	DATE	TITLE	
	PROJ. ENG.	DATE	LA36	
	PROD.	DATE	POWER SCHEMATIC	
	NEXT HIGHER ASSY	DATE	SIZE CODE: NUMBER REV.	
			DCS LA36-0-5 B	
	SCALE		DIST.	
	SHEET 1 OF 1			

REV	CHANGE NO.	REV
1	1	A
2	2	B
3	3	C
4	4	D
5	5	E
6	6	F
7	7	G
8	8	H
9	9	I
10	10	J

SEMICONDUCTOR CONVERSION CHART

DRAWING NO. 007 15846

REV. 007 15846
 DCS LA36-0-5
 B

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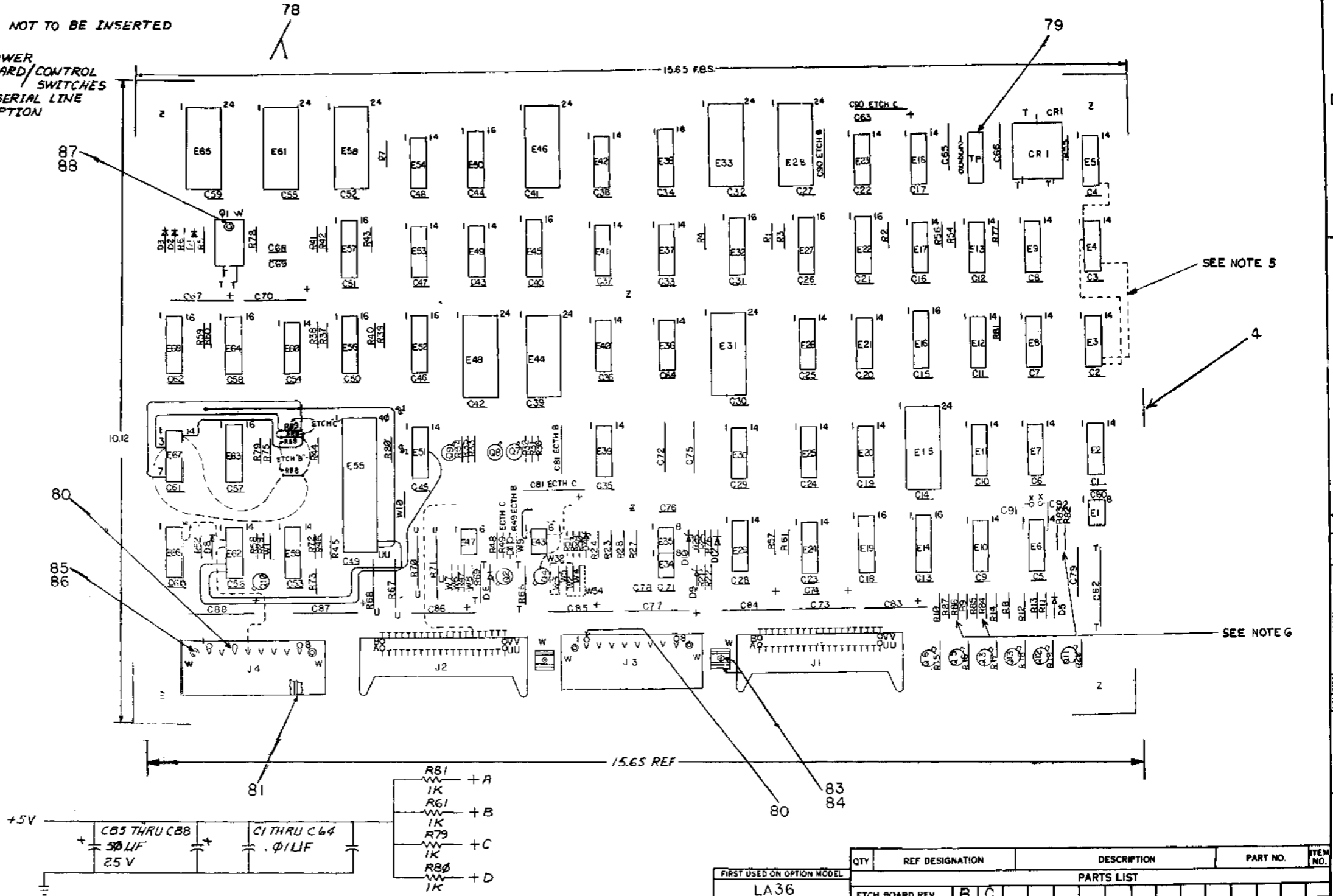
NOTES:

- * E27 & E48 NOT TO BE INSERTED
- CONNECTORS:
 J1 → J1 POWER
 J2 → KEYBOARD/CONTROL SWITCHES
 J3 → 20MA. SERIAL LINE
 J4 → DFII OPTION

- PREFERRED CONFIGURATION
 E58 • 23-082A6 ('CROM')
 E61 • EMPTY
 E65 • EMPTY
 SUBSTITUTE CONFIGURATION
 E58 • EMPTY
 E61 • 23-083A4 ('PROM 1')
 E65 • 23-082A4 ('PROM 0')

- PREFERRED CONFIGURATION
 E17 • I.C. 8640
 R54 • 5.6K 1/4W 5%
 R55 • 1K 1/4W 5%
 R56 • 5.6K 1/4W 5%
 SUBSTITUTE CONFIGURATION
 E17 • I.C. 380
 R54 • 10K 1/4W 5%
 R55 • 470 1/4W 5%
 R56 • 10K 1/4W 5%

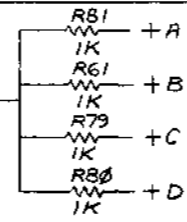
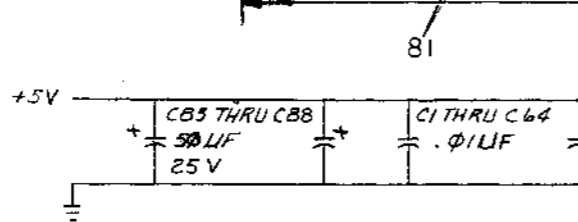
- DOTTED LINES REPRESENT ADDED WIRES TO ETCH REV B BOARDS ONLY.
- LOCATIONS OF R82 THRU R87 ARE SLIGHTLY DIFFERENT ON ETCH REV B BOARDS.
- SUBSTITUTE CONFIGURATIONS ARE EQUAL IN PERFORMANCE TO PREFERRED CONFIGURATIONS. IT IS NOT NECESSARY TO CHANGE CONFIGURATIONS IN THE FIELD.



8640 C	1	8
LM301A	NONE	NONE
1702	NONE	12, 15
74123	8	16
74150	12	24
74154	12	24
74161	8	16
74175	8	16
74190	8	16
74193	8	16
7442	8	16
7489	8	16
7493	10	5
MK2600P	12	24
UART	3	1
IC TYPE	GND	+5V

GND AND 5V ARE USUALLY PIN 7 AND 14 RESPECTIVELY. EXCEPTIONS ARE STATED ABOVE.

IC PIN LOCATIONS



QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
	LA36	ETCH BOARD REV B C		

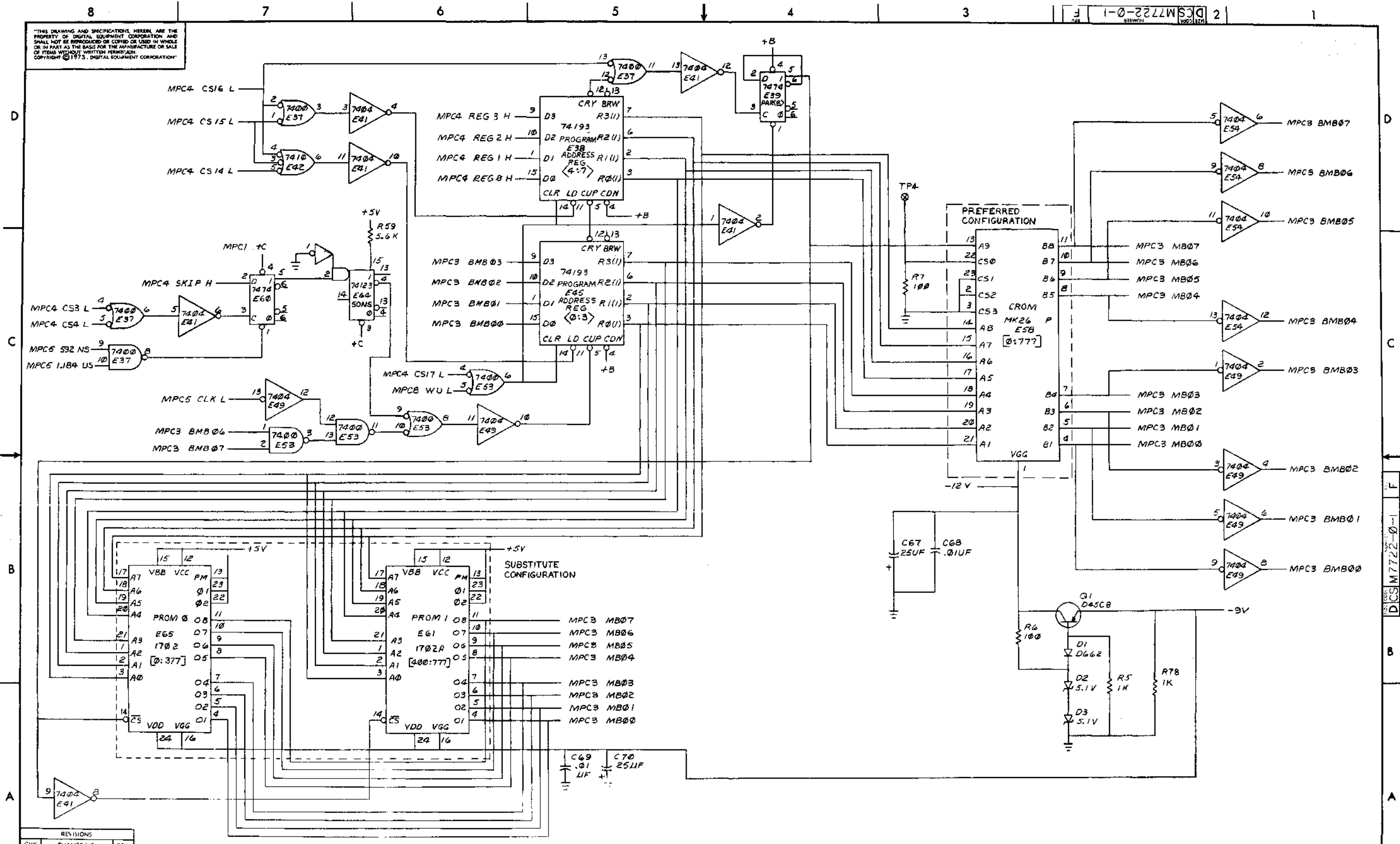
DRN	DATE	10-21-73
CHK'D	DATE	10/20/73
ENG	DATE	10/17/73
PRD	DATE	10/17/73
PROG	DATE	10/17/73

digital EQUIPMENT CORPORATION
 TITLE: LA36 (MPCI)
 NUMBER: DCSM7722-0-1
 SHEET 1 OF 8

REV	CHANGE NO.	REV
1	1	1

SEMICONDUCTOR CONVERSION CHART

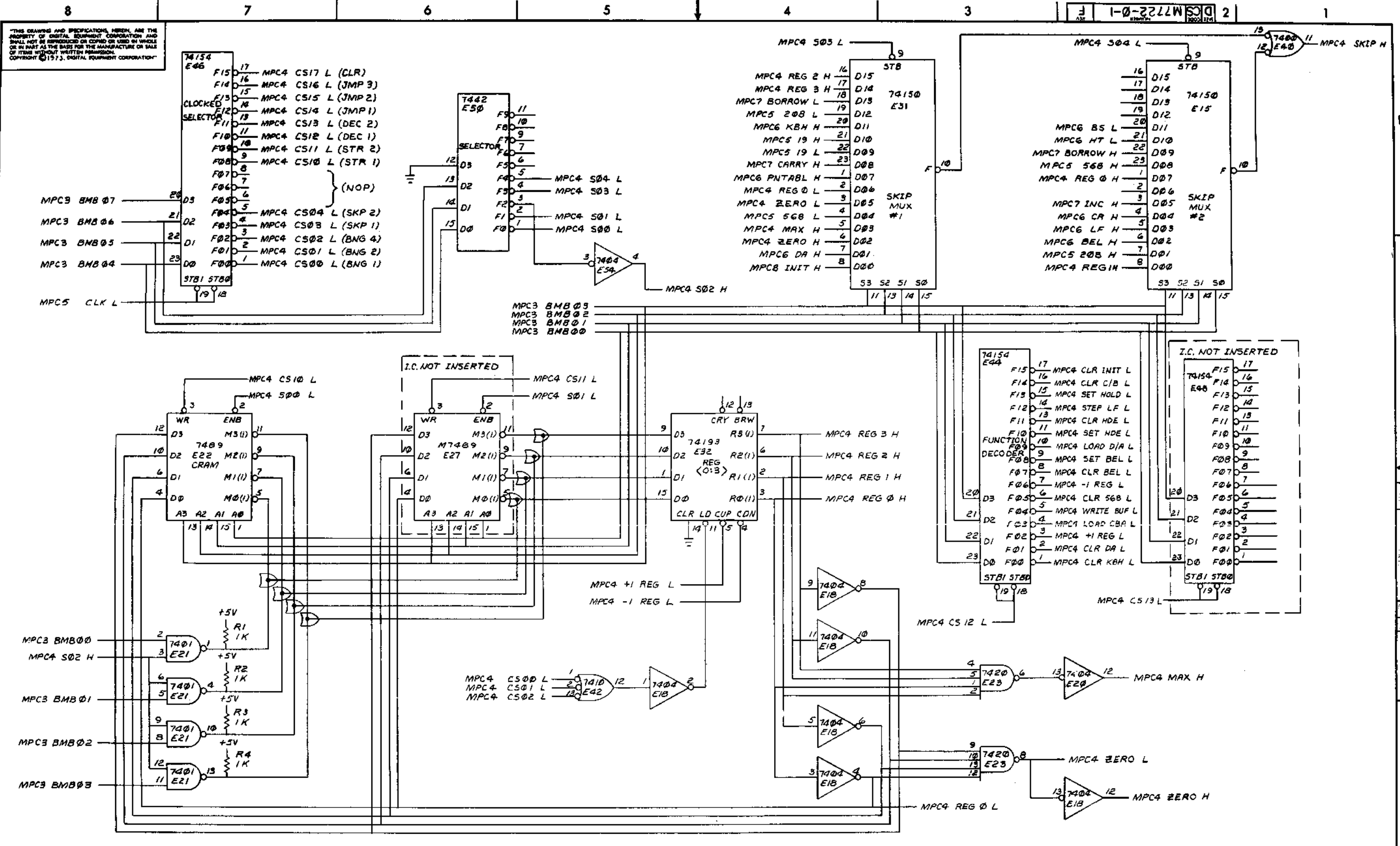
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REVISIONS

CHK	CHANGE NO.	REV.

TITLE		LA36 (MPC3)		SIZE CODE	NUMBER	REV.
SCALE		SHEET 3 OF 8		DIST.		



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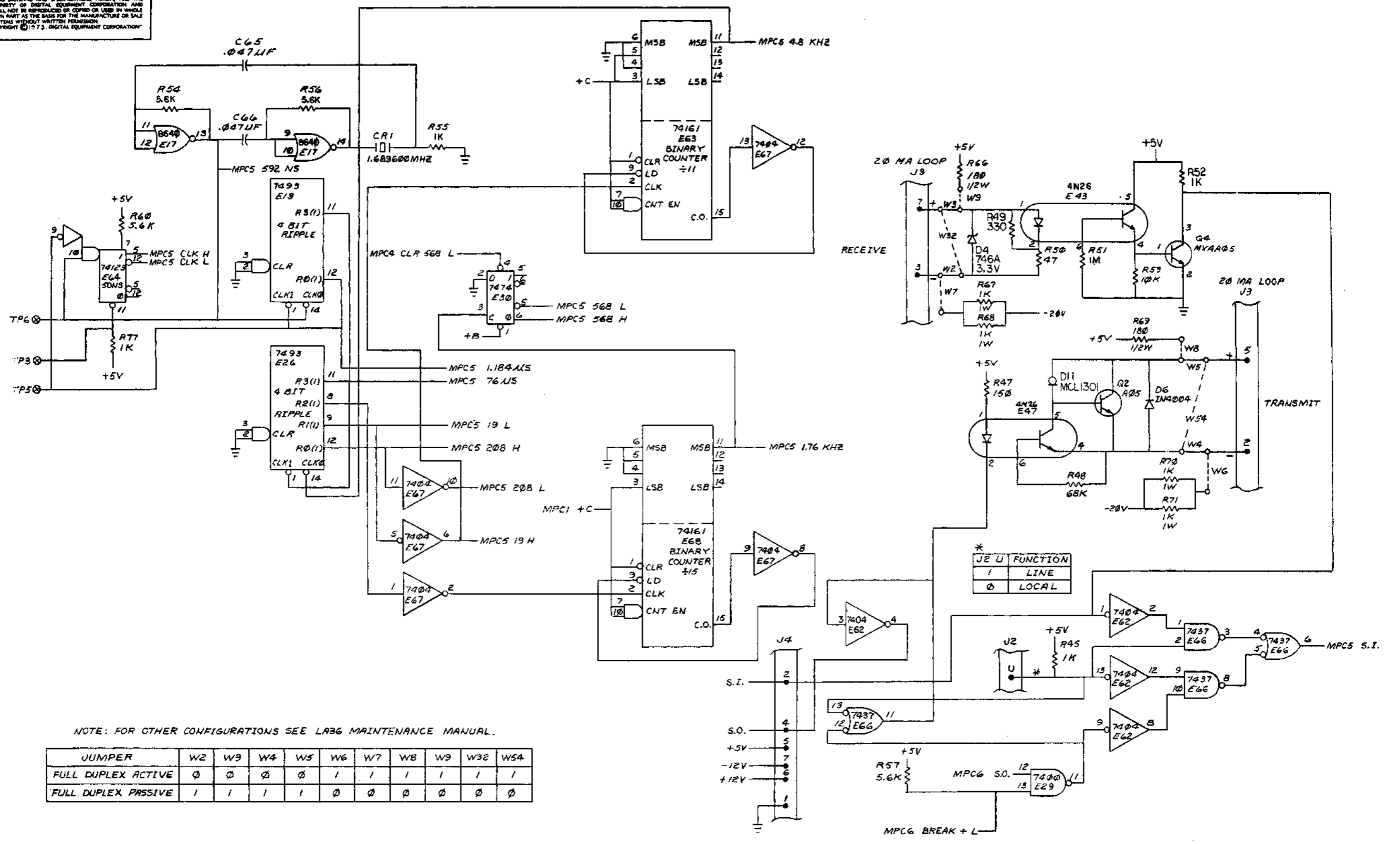
REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 (MPC4)	SIZE/DWG	D CS M7722-0-1	NUMBER		REV.	F
SCALE		SHEET	4 OF 8	DIST.			

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D
C
B
A

D
C
B
A



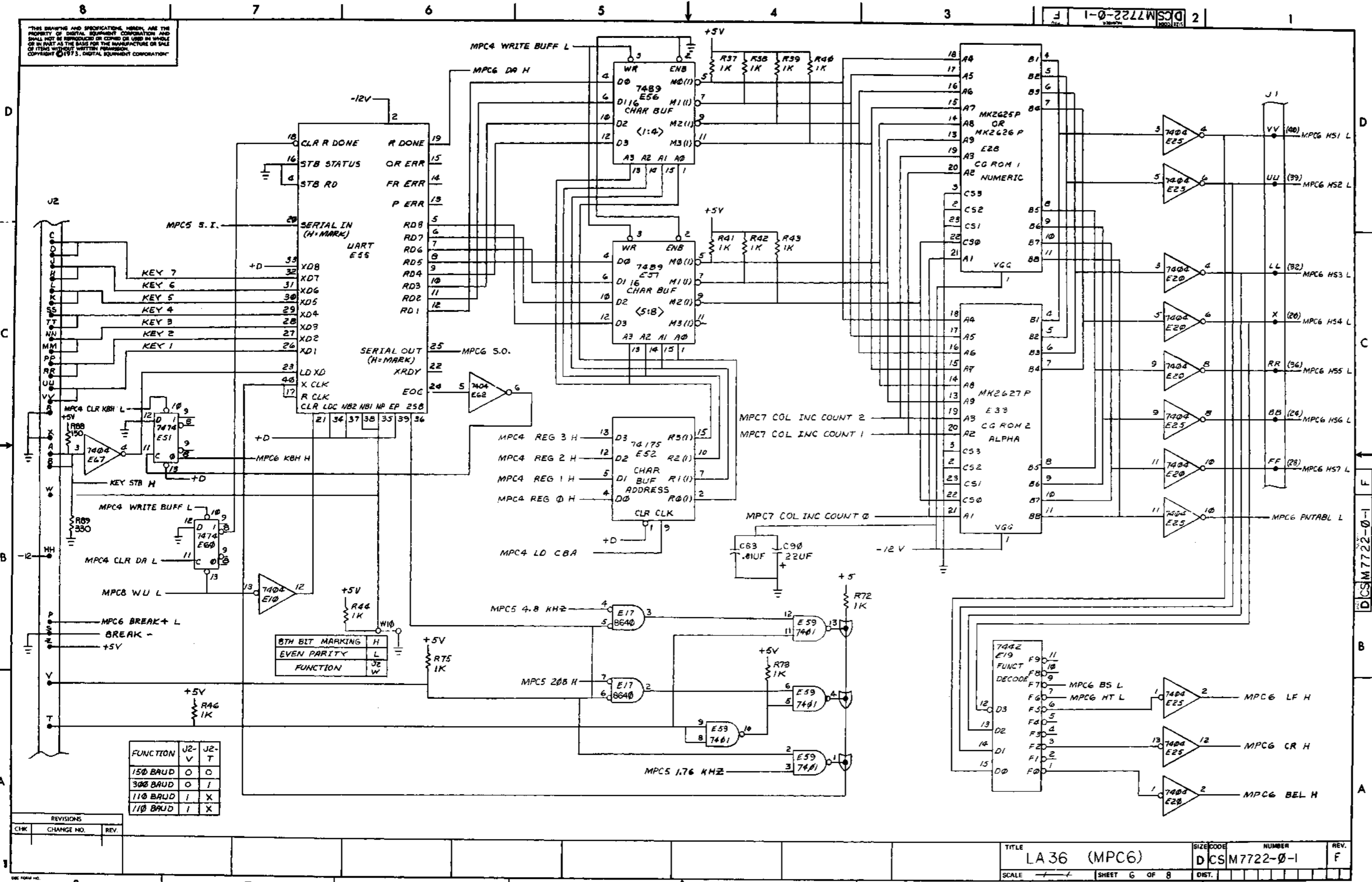
NOTE: FOR OTHER CONFIGURATIONS SEE LA36 MAINTENANCE MANUAL.

JUMPER	W2	W3	W4	W5	W6	W7	W8	W9	W32	W54
FULL DUPLEX ACTIVE	0	0	0	0	1	1	1	1	1	1
FULL DUPLEX PASSIVE	1	1	1	1	0	0	0	0	0	0

* J2 U FUNCTION

1	LINE
0	LOCAL

REVISIONS		
CHK	CHANGE NO.	REV



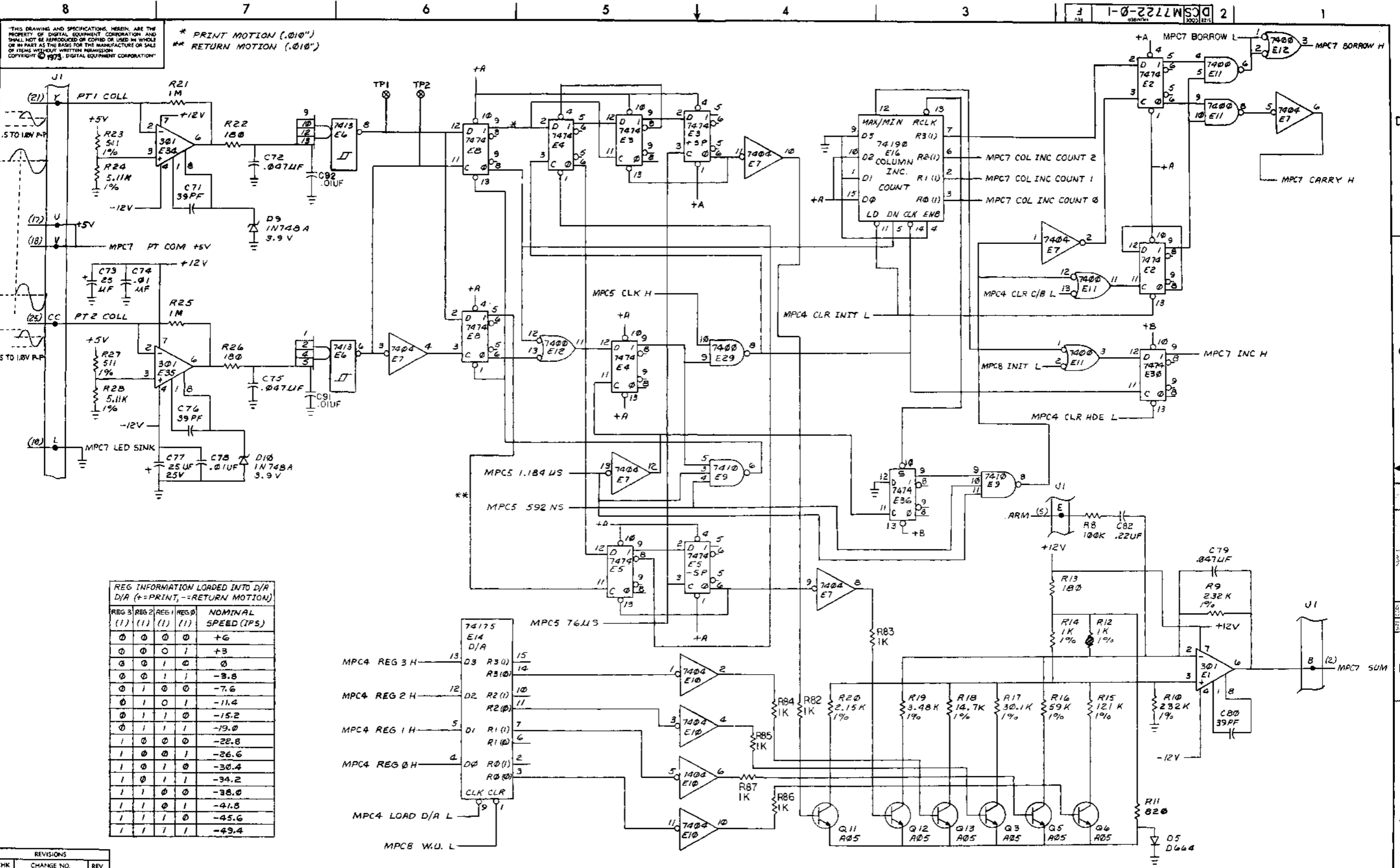
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FUNCTION	J2-V	J2-T
150 BAUD	0	0
300 BAUD	0	1
110 BAUD	1	X
110 BAUD	1	X

8TH BIT MARKING	H
EVEN PARITY	L
FUNCTION	J2 W

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA 36 (MPC6)	SIZE CODE	DCSM7722-0-1	NUMBER		REV.	F
SCALE	1/1	SHEET	6 OF 8	DIST.			



* PRINT MOTION (.010")
 ** RETURN MOTION (.010")

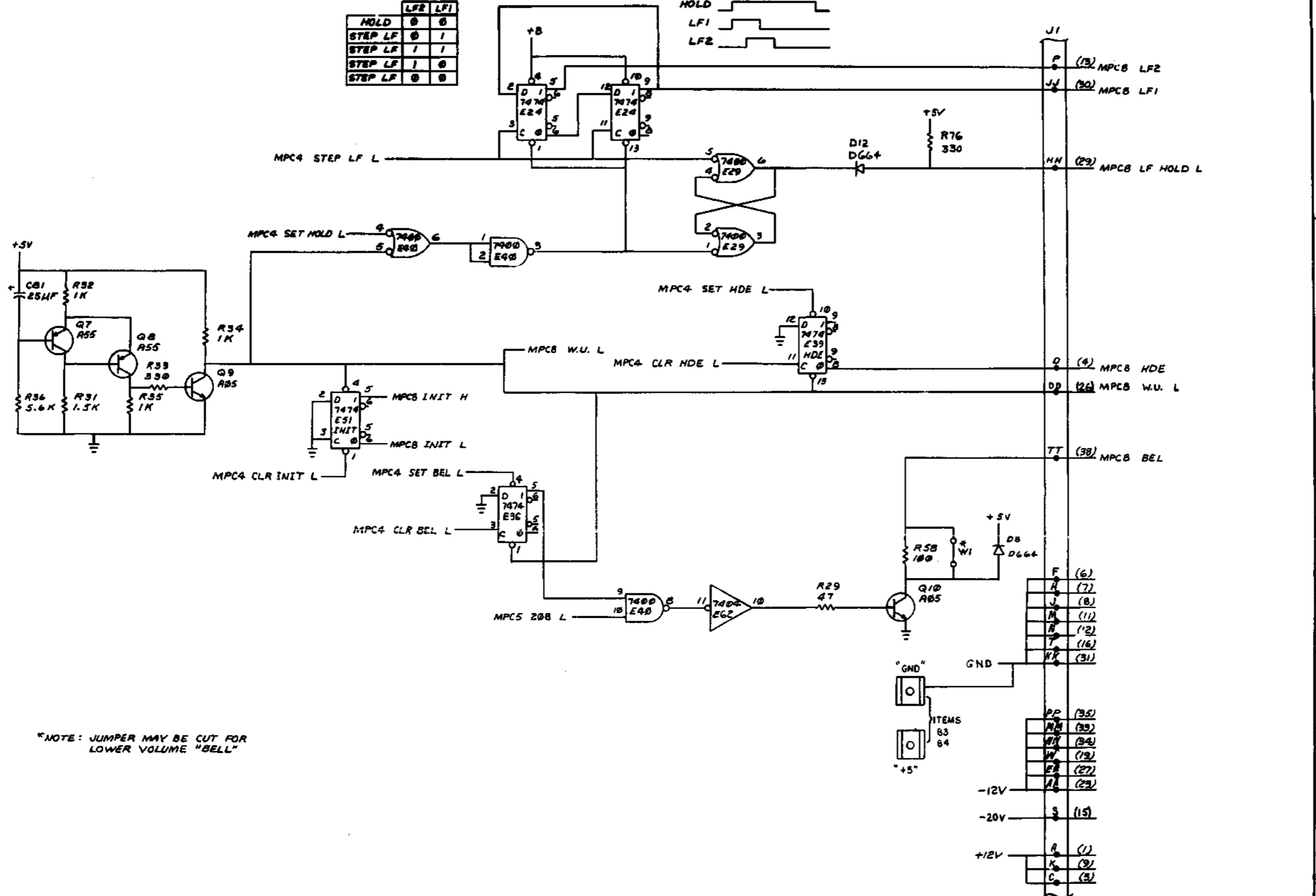
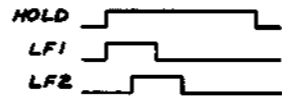
REG INFORMATION LOADED INTO D/A				
D/A (+=PRINT, -=RETURN MOTION)				
REG 3	REG 2	REG 1	REG 0	NOMINAL SPEED (IPS)
(1)	(1)	(1)	(1)	
0	0	0	0	+6
0	0	0	1	+3
0	0	1	0	-3.8
0	1	0	0	-7.6
0	1	0	1	-11.4
0	1	1	0	-15.2
0	1	1	1	-19.0
1	0	0	0	-22.8
1	0	0	1	-26.6
1	0	1	0	-30.4
1	0	1	1	-34.2
1	1	0	0	-38.0
1	1	0	1	-41.8
1	1	1	0	-45.6
1	1	1	1	-49.4

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 (MPC7)	SIZE CODE	D CS M7722-0-1	NUMBER	7	REV.	F
SCALE		SHEET	7	OF	8	DIST.	

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	LF2	LF1
HOLD	0	0
STEP LF	0	1
STEP LF	1	1
STEP LF	1	0
STEP LF	0	0



"NOTE: JUMPER MAY BE CUT FOR LOWER VOLUME 'BELL'"

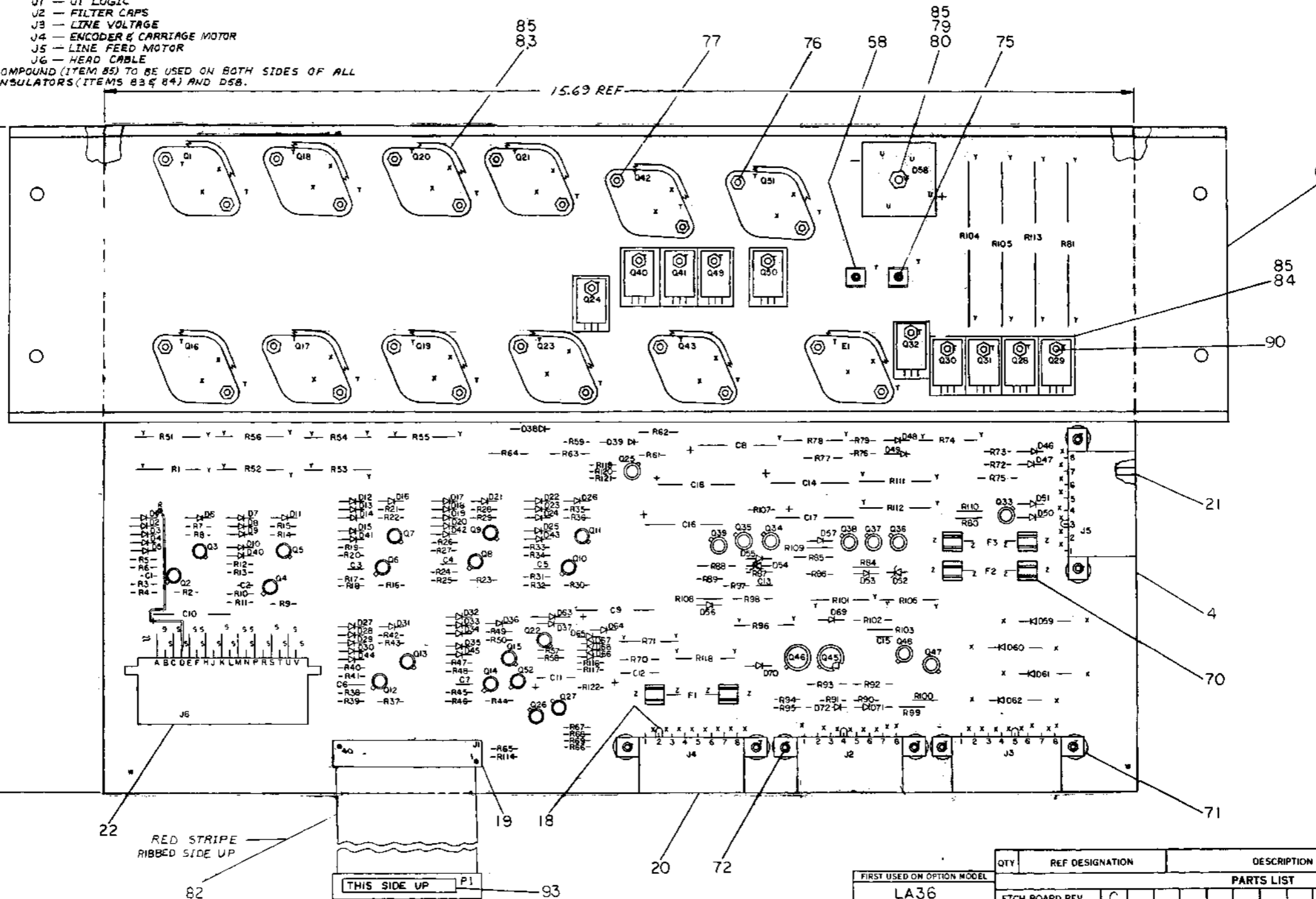
REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 (MPC8)	SIZE/DWG	DCS M7722-0-1	NUMBER		REV.	F
SCALE		SHEET	8	OF	8	DWT.	

NOTES:

- 1. **CONNECTORS:**
- J1 - J1 LOGIC
- J2 - FILTER CAPS
- J3 - LINE VOLTAGE
- J4 - ENCODER & CARRIAGE MOTOR
- J5 - LINE FEED MOTOR
- J6 - HEAD CABLE
- 2. COMPOUND (ITEM 85) TO BE USED ON BOTH SIDES OF ALL INSULATORS (ITEMS 83 & 84) AND D58.

- 3. "THIS SIDE UP" STICKER TO BE INSTALLED ON CABLE CONNECTOR P1 AS SHOWN.
- 4. IF SERVO MOTOR IS NOT FUSED EXTERNALLY ON CABINET, THE VALUE OF F1 WILL BE 2AMP, SLOW-BLOW. (P/N 90Q2216).



GND		+5V	
IC TYPE	GND	+5V	
GND AND 5V ARE USUALLY PIN 7 AND 14 RESPECTIVELY. EXCEPTIONS ARE STATED ABOVE.			
IC PIN LOCATIONS			

5/18/75

REV	DATE	DESCRIPTION
1	5-17-75	J. BITTIO
2	8-22-75	P. HELLER
3	1-23-76	P. HELLER
4	3-5-76	P. HELLER
5	1-17-75	P. HELLER
6	1-22-74	P. HELLER
7	10-3-74	P. HELLER
8	1-17-74	P. HELLER
9	1-17-74	P. HELLER
10	1-17-74	P. HELLER

FIRST USED ON OPTION MODEL		QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
LA36			ETCH BOARD REV	C		
PARTS LIST						
SEMICONDUCTOR CONVERSION CHART				DRN	DATE	DATE
DEC NO.	EIA NO.	DEC NO.	EIA NO.	CHK'D	DATE	DATE
				ENG	DATE	DATE
				PROL	DATE	DATE
				PROD	DATE	DATE
				NEXT HIGHER ASSY		
				SCALE		
				SHEET 1 OF 5		

digital EQUIPMENT CORPORATION
MAYNARD, MASSACHUSETTS

TITLE
LA 36
POWER BOARD

SIZE CODE: DCS 5410805-0-1
NUMBER: H
REV. H

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Table with columns: QTY, REF DESIGNATION, DESCRIPTION, PART NO., ITEM NO. Rows include components like X-Y COORDINATE HOLE LOCATION, ASSY/DRILLING HOLE LAYOUT, MODULE ECO HISTORY, ETCHED CIRCUIT BOARD, CAP 28UF 25V 10% AL EL, etc.

Table with columns: QTY, REF DESIGNATION, DESCRIPTION, PART NO., ITEM NO. Rows include components like RES 2K 1/4W 5%, RES 2.7K, 1/2W, 5%, RES 3.9K, 1/2W, 5%, etc.

SEE NOTE 4.

Table with columns: REVISIONS, CHK, CHANGE NO., REV.

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D

C

B

A

D

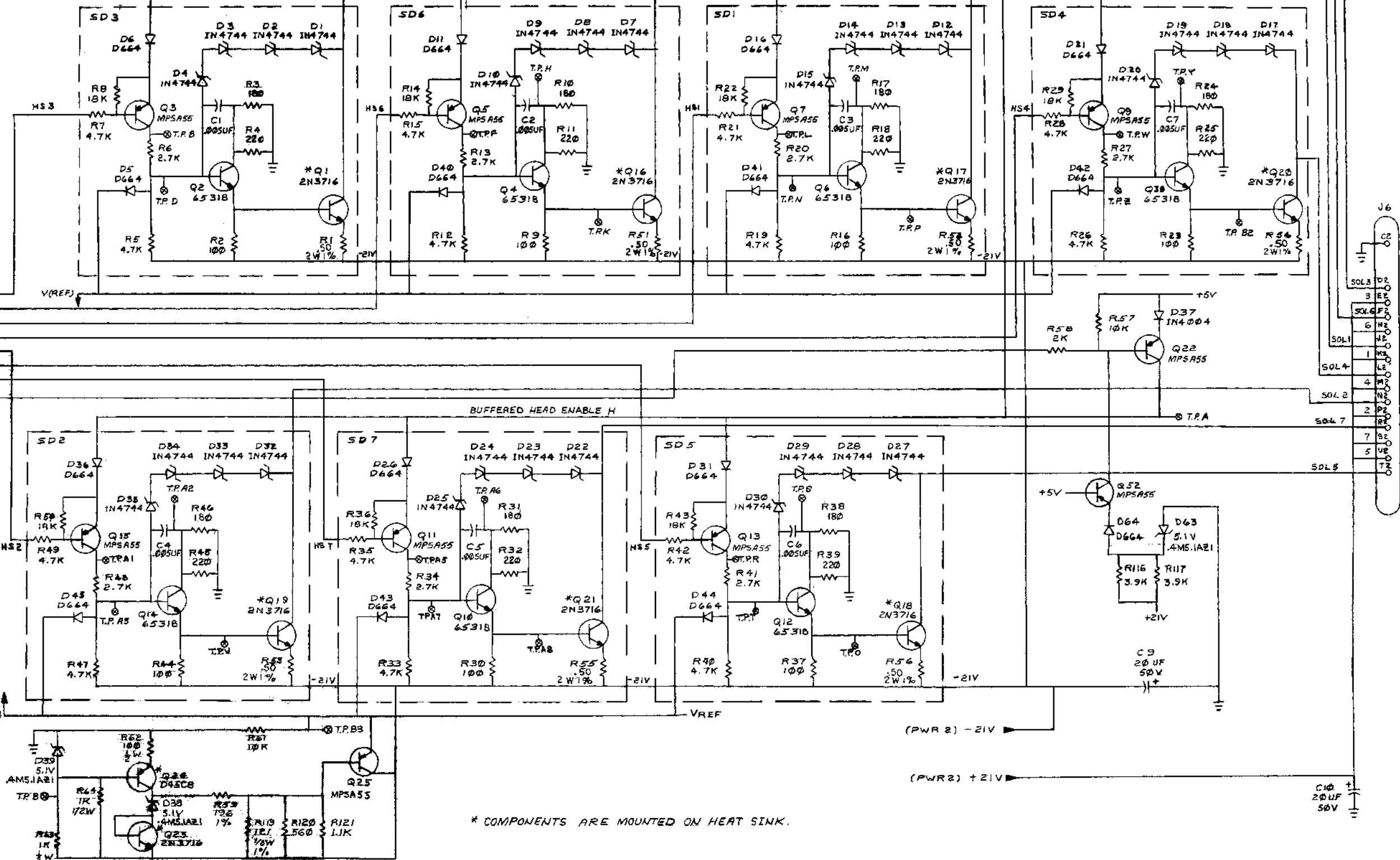
C

B

A

BUFFERED HEAD ENABLE H

BUFFERED HEAD ENABLE H



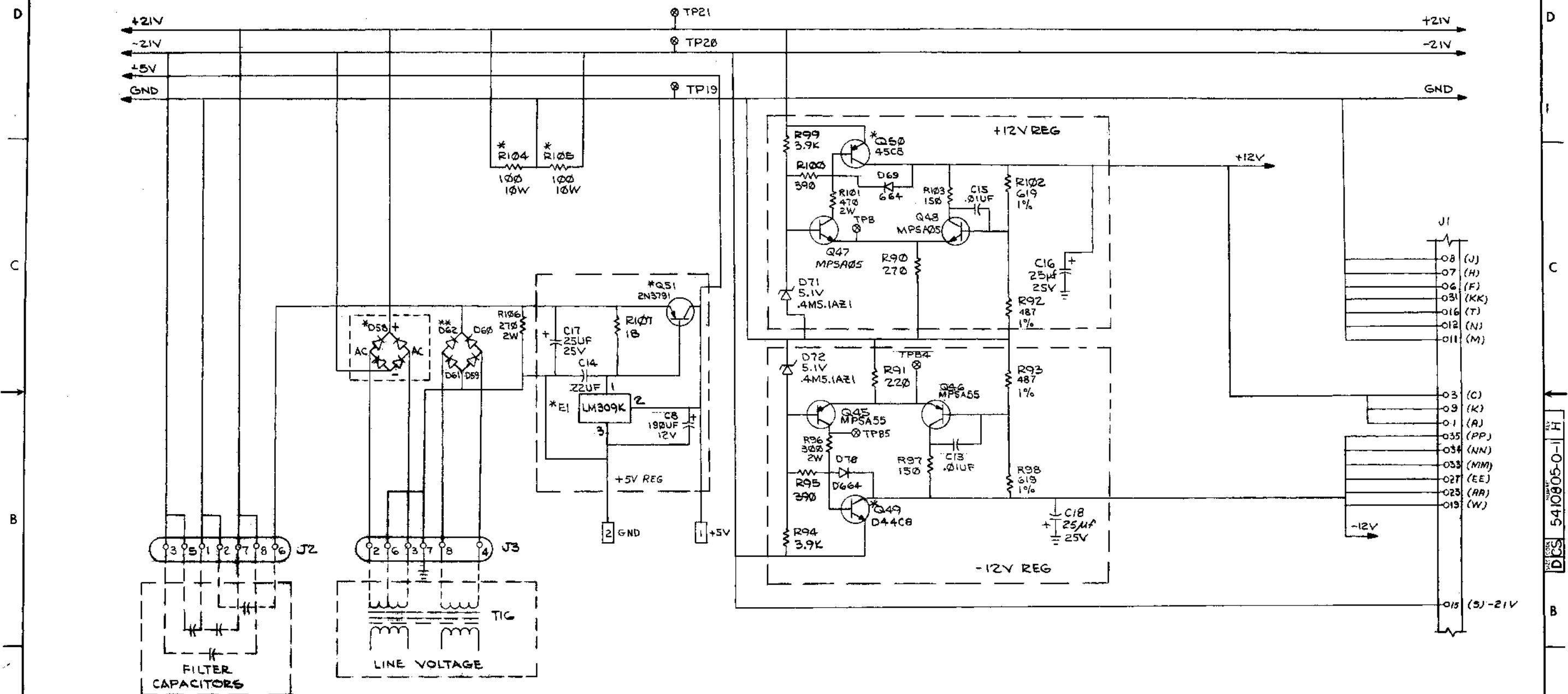
- MPC6 (LL) 32 HS3
- MPC6 (BB) 34 HS6
- MPC6 (VV) 40 HS1
- MPC6 (X) 20 HS4
- MPC6 (UU) 38 HS2
- MPC6 (RR) 36 HS5
- MPC6 (FF) 28 HS7
- MPC6 (D) 4 HD EN
- MPC6 (DD) 26 WU

- SOL3 3 ES
- SOL6 6 ES
- SOL1 1 ES
- SOL4 4 ES
- SOL2 2 ES
- SOL7 7 ES
- SOL5 5 ES

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA 36 POWER BOARD	SIZE/COOB	DCS	NUMBER	5410805-0-1	REV.	H
SCALE		SHEET	3	OF	5	DIST.	

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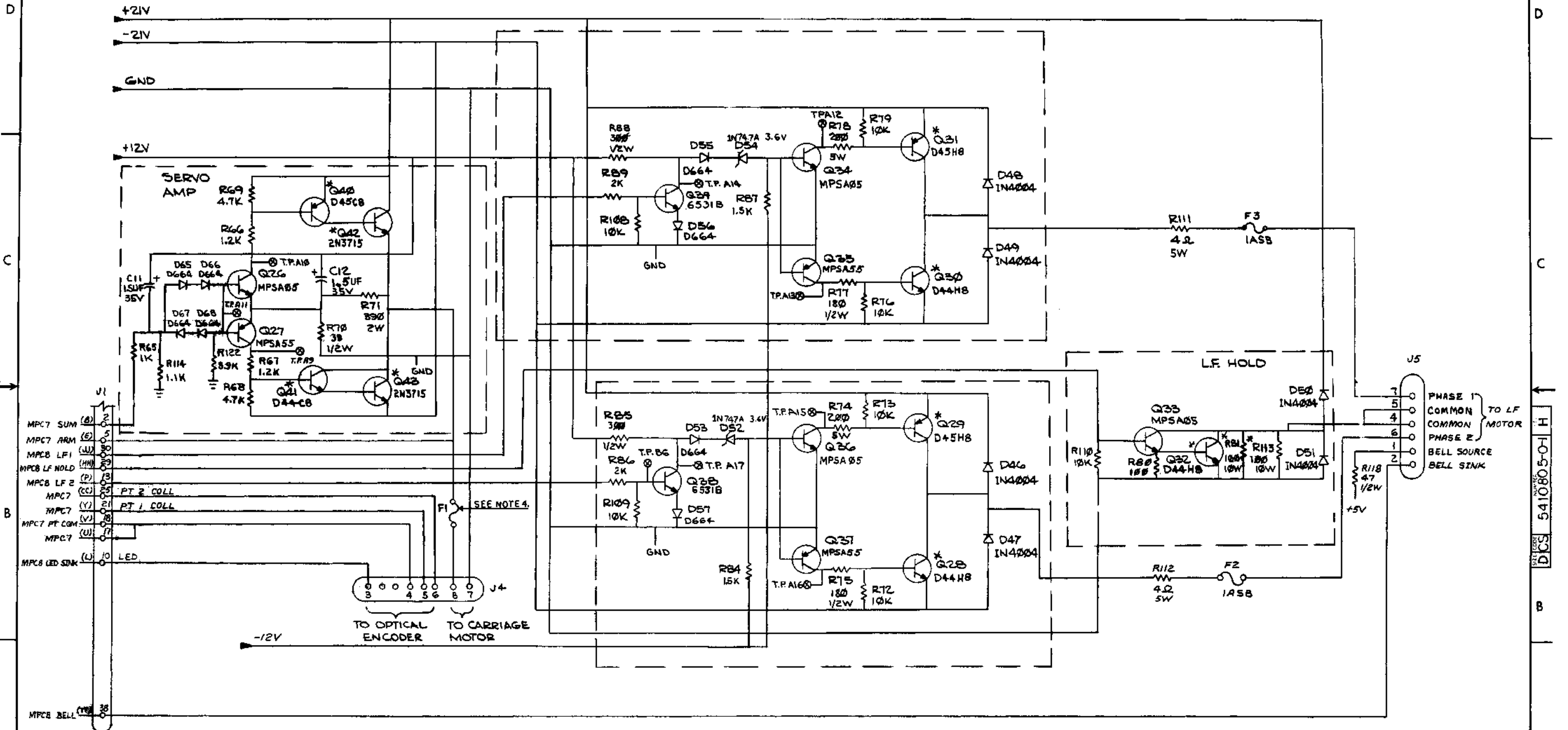


* COMPONENTS ARE MOUNTED ON HEAT SINK.
 ** DIODES D59 THRU D62 ARE 1N4721.

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 POWER BOARD	SIZE CODE	DCS	NUMBER	5410805-0-1	REV.	H
SCALE	SHEET 4 OF 5		DIST.				

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* COMPONENTS ARE MOUNTED ON HEAT SINK.

REVISIONS		
CHK	CHANGE NO.	REV.

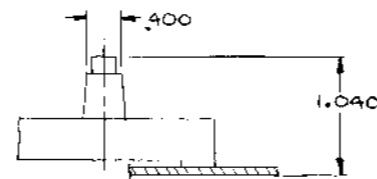
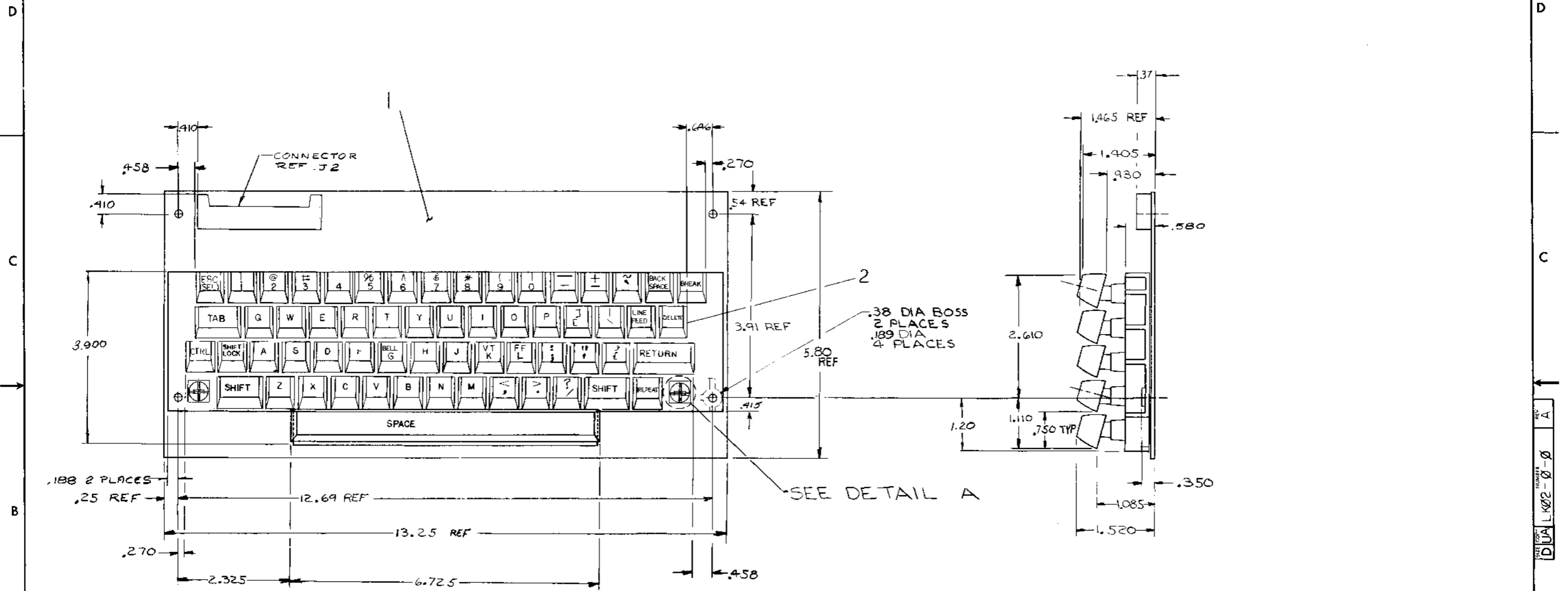
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SCALE	1/1	SHEET	5	OF	5	DIST.	

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DO NOT SCALE DRAWING

NOTES:

- ITEM 5, SHIPPING CARTON, TO BE USED ONLY FOR SEPERATE KEYBOARD SHIPMENT.



DETAIL A
SHOWN WITHOUT
KEYCAP AND ADAPTER

1	DIE CUT FOLDER	A-FS-9905441	5
REF	TEST SPEC	A-SP-LK02-0-2	4
REF	ENGINEERING SPEC	A-SP-LK02-0-1	3
1	KEYCAP (SET)	D-PS-9009570-62	2
1	KEYSWITCH ARRAY & MODULE	D-CS-5410736-04	1

FIRST USED ON OPTION/MODEL		PARTS LIST	
QTY.	DESCRIPTION	PART NO.	ITEM NO.
LK02			
UNLESS OTHERWISE SPECIFIED DIMENSION IN INCHES		DRM <i>Arthur Munnich</i>	DATE 5/31/74
TOLERANCES		CHKD <i>Z. Rankin</i>	DATE 7/15/74
DECIMALS	ANGLES	ENG. <i>W. Berman</i>	DATE 7/17/74
.xxx = .005	±0° 30'	PROV. ENG. <i>Paul F. Nelson</i>	DATE 7-11-74
.xx = .02		PROD. <i>J. P. L...</i>	DATE 7/1/74
.x = .1			
REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY 7		NEXT HIGHER ASSY.	
MATERIAL		B-DD-LK02-0	SIZE CODE
FINISH		DUA LK02-0-0	NUMBER
		SCALE NONE	REV. A
		SHEET 1 OF 1	DIST.

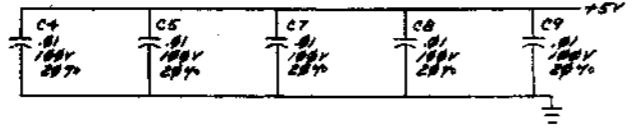
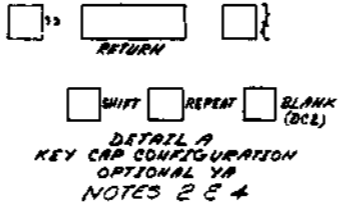
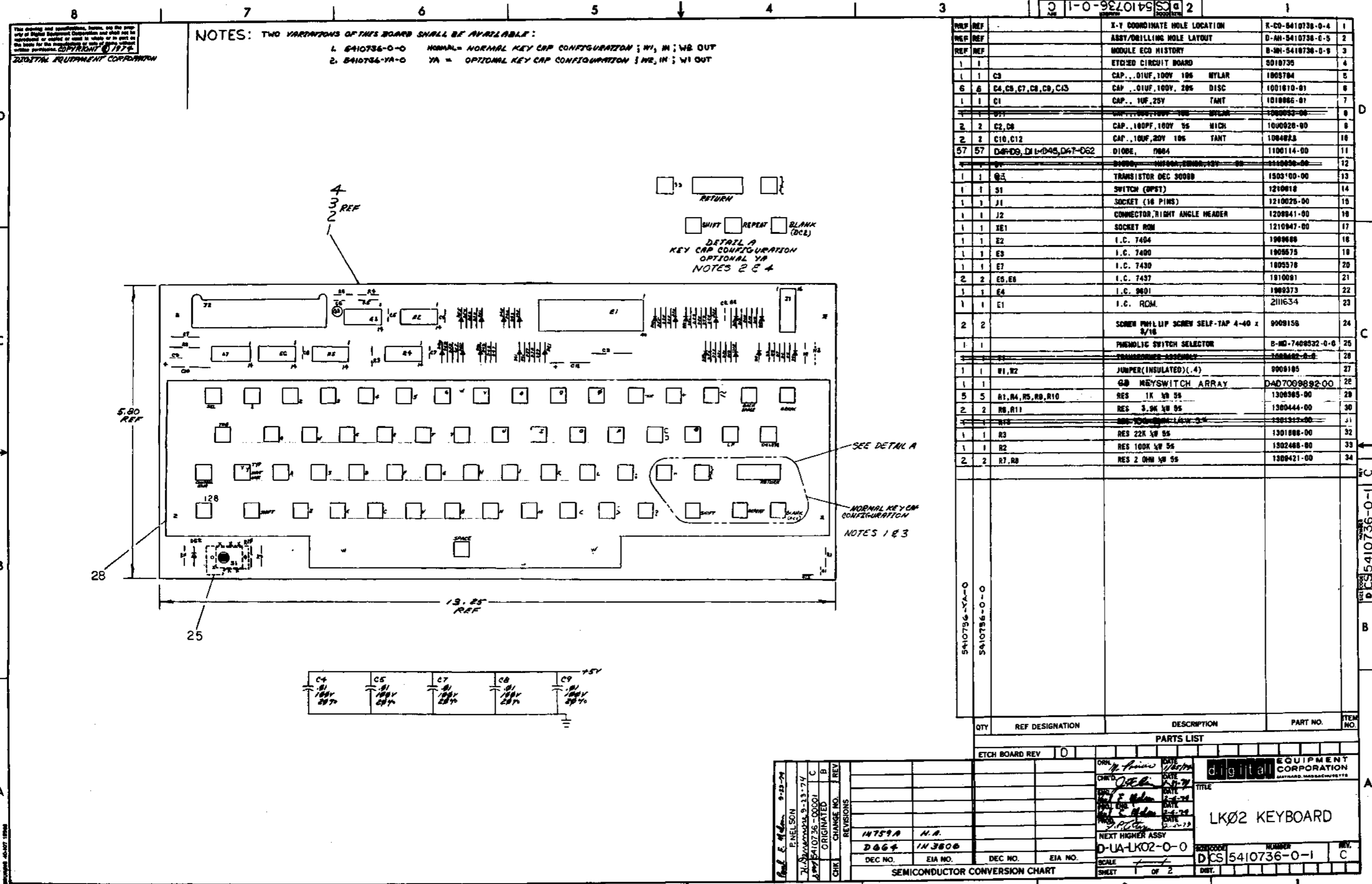
REV.	CHANGE NO.	DATE
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B	C. BICKOFF	1-20-74

REV. FORM NO. 010-6

NOTES: TWO VARIATIONS OF THIS BOARD SHALL BE AVAILABLE:

- 1. 5410736-0-0 NORMAL - NORMAL KEY CAP CONFIGURATION ; W1, W2 ; W3 OUT
- 2. 5410736-YA-0 YA - OPTIONAL KEY CAP CONFIGURATION ; W2, W3 ; W1 OUT

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QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
		X-Y COORDINATE HOLE LOCATION	K-CO-5410736-0-4	1
		ASBY/DRILLING HOLE LAYOUT	D-MH-5410736-0-5	2
		MODULE ECO HISTORY	B-MH-5410736-0-9	3
1	1	ETCHED CIRCUIT BOARD	5018735	4
1	1	CAP. .01UF, 100V 10% NYLAR	1005784	5
6	6	C4, C5, C7, C8, C9, C13	1001810-01	6
1	1	CAP. .1UF, 25V TANT	1018885-01	7
2	2	C2, C6	1000953-00	8
2	2	C10, C12	1000920-00	9
57	57	D47-D9, D11-D45, D47-D62	1004873	10
		D10B1, 7804	1100114-00	11
		TRANSISTOR DEC 30000	1503100-00	12
1	1	SWITCH (DPST)	1210618	13
1	1	SOCKET (16 PINS)	1210025-00	14
1	1	CONNECTOR, RIGHT ANGLE HEADER	1208841-00	15
1	1	SOCKET ROM	1210947-00	16
1	1	I.C. 7404	1009668	17
1	1	I.C. 7400	1005575	18
1	1	I.C. 7430	1005576	19
2	2	I.C. 7457	1010091	20
1	1	I.C. 9601	1009373	21
1	1	I.C. ROM	2111634	22
2	2	SCREW PHILLIP SCREW SELF-TAP 4-40 x 3/16	9009156	23
1	1	PHENOLIC SWITCH SELECTOR	B-MO-7408532-0-0	24
		TRANSFORMER ASSEMBLY	1008492-0-2	25
1	1	W1, W2	9009185	26
1	1	GB KEYSWITCH ARRAY	DAD7009882-00	27
5	5	R1, R4, R5, R9, R10	1308365-00	28
2	2	R6, R11	1300444-00	29
1	1	R3	1301313-00	30
1	1	R2	1301886-00	31
1	1	R7	1302468-00	32
2	2	R7, R8	1308421-00	33

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
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ETCH BOARD REV 0

SEMICONDUCTOR CONVERSION CHART

REV	DATE	DESCRIPTION
14759A	N.A.	
D064	1A 3800	

digital EQUIPMENT CORPORATION

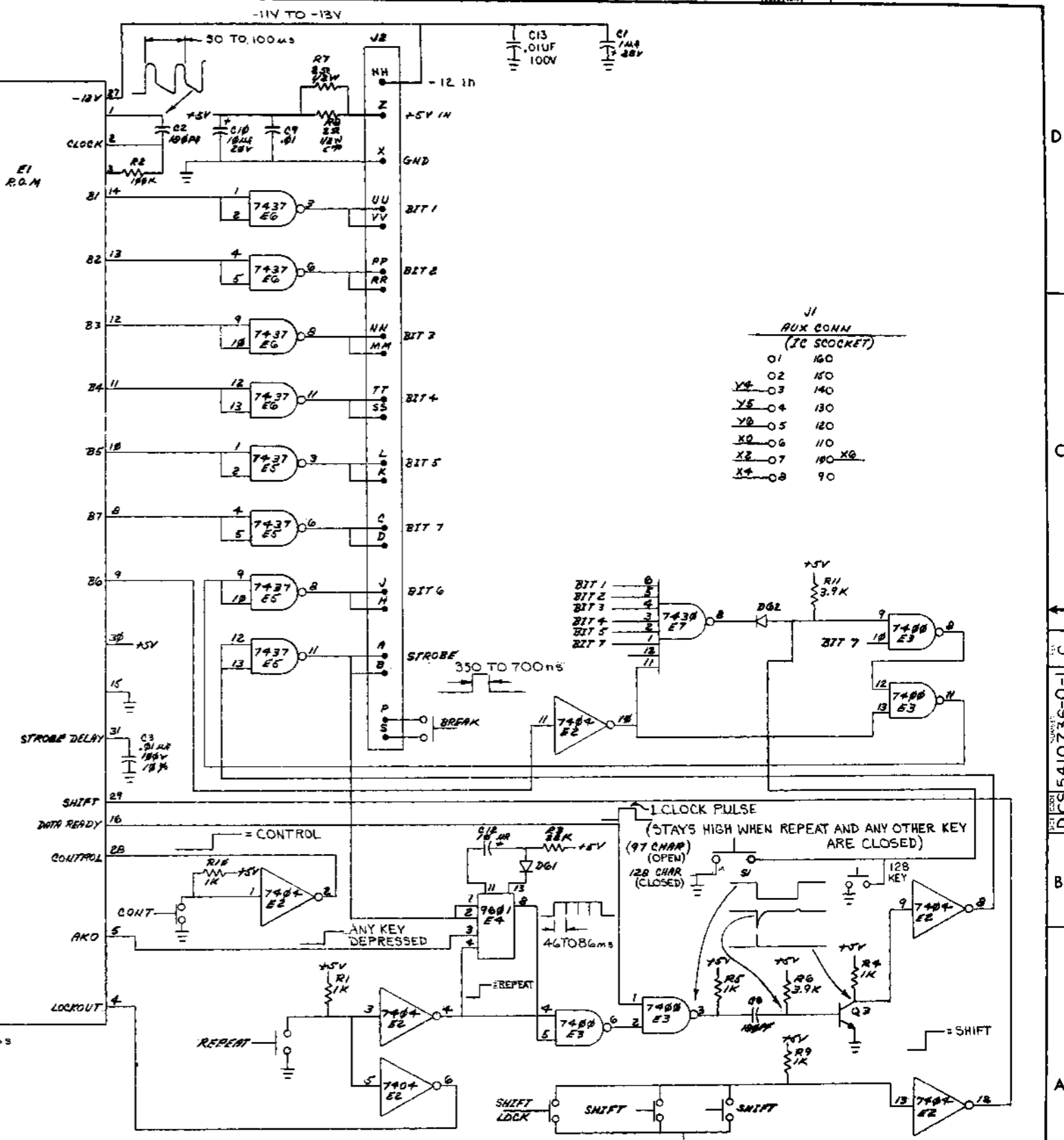
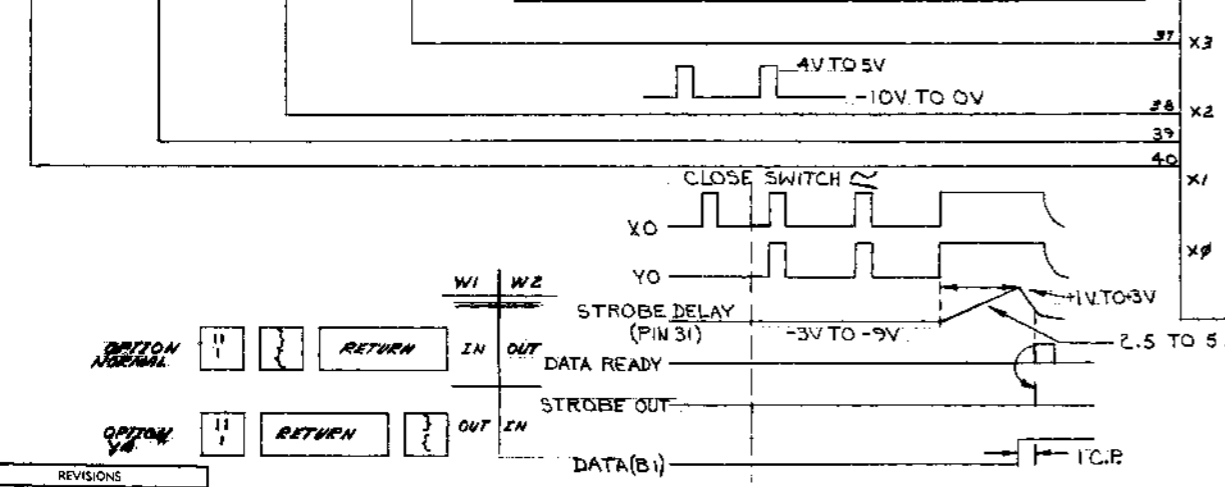
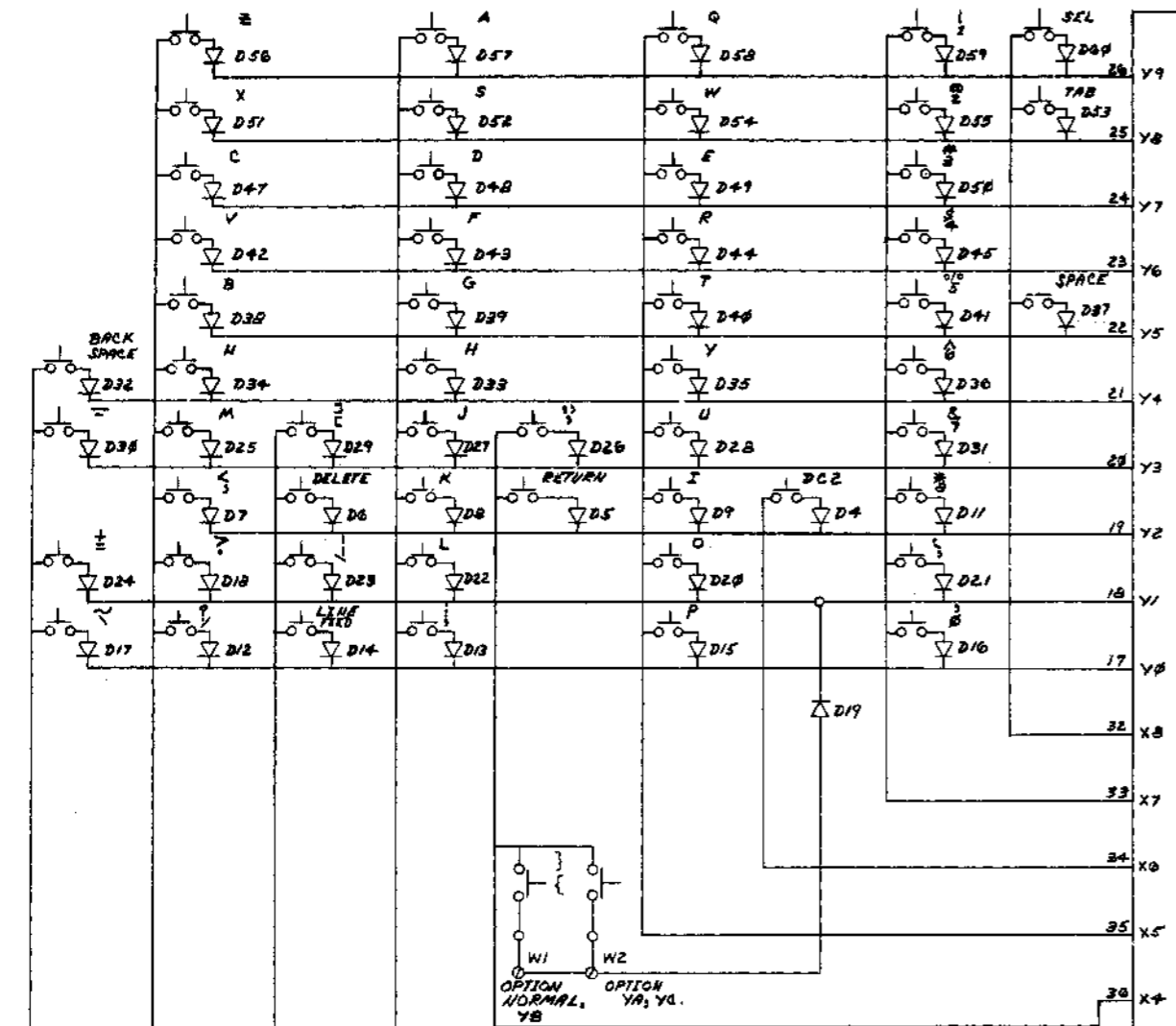
LK02 KEYBOARD

0-UA-LK02-0-0

DCS 5410736-0-1

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NOTES:
1. UNLESS OTHERWISE SPECIFIED
DIODES ARE DGG4.

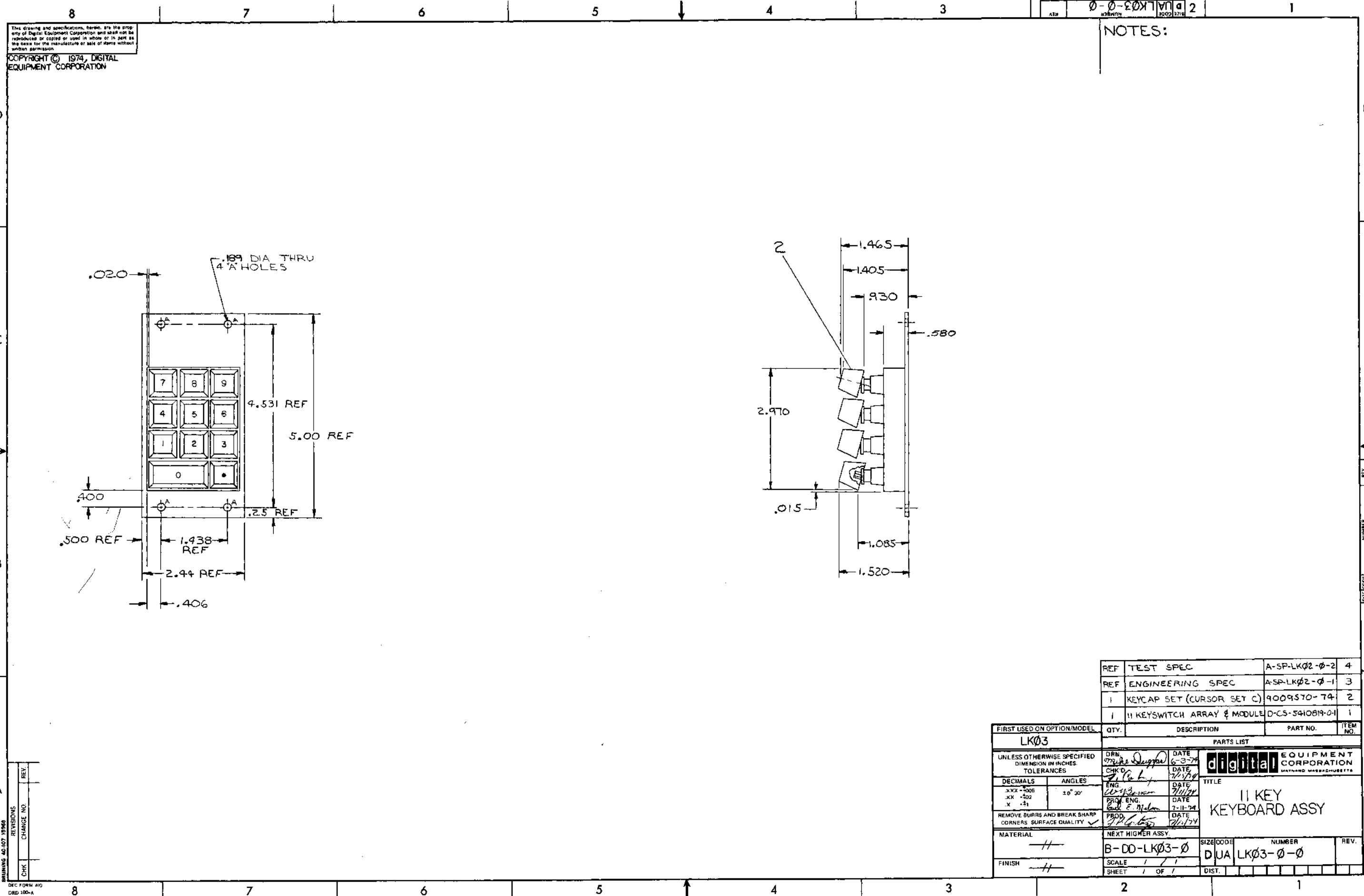


J1
AUX CONN
(IC SOCKET)

O1	160
O2	160
Y4	140
Y5	130
Y6	120
X0	110
X2	100 X6
X4	90

REVISIONS

CHK	CHANGE NO.	REV.



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NOTES:

REF	TEST SPEC	A-SP-LK02-0-2	4
REF	ENGINEERING SPEC	A-SP-LK02-0-1	3
1	KEYCAP SET (CURSOR SET C)	9009570-74	2
1	11 KEYSWITCH ARRAY & MODULE	D-CS-5410819-01	1

QTY.	DESCRIPTION	PART NO.	ITEM NO.
PARTS LIST			
LK03			
UNLESS OTHERWISE SPECIFIED DIMENSION IN INCHES		TOLERANCES	
DECIMALS	ANGLES		
.XX +.005	±0° 30'		
.X -.002			
.X ±.01			
REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY			
NEXT HIGHER ASSY			
MATERIAL	B-DD-LK03-0		REV.
FINISH	SCALE 1/1		
SHEET 1 OF 1		SIZE CODE	NUMBER
		DUA	LK03-0-0
		DIST.	

REVISIONS
 CHANGE NO.
 CHECK
 DATE

REV.
 NUMBER
 DUA LK03-0-0

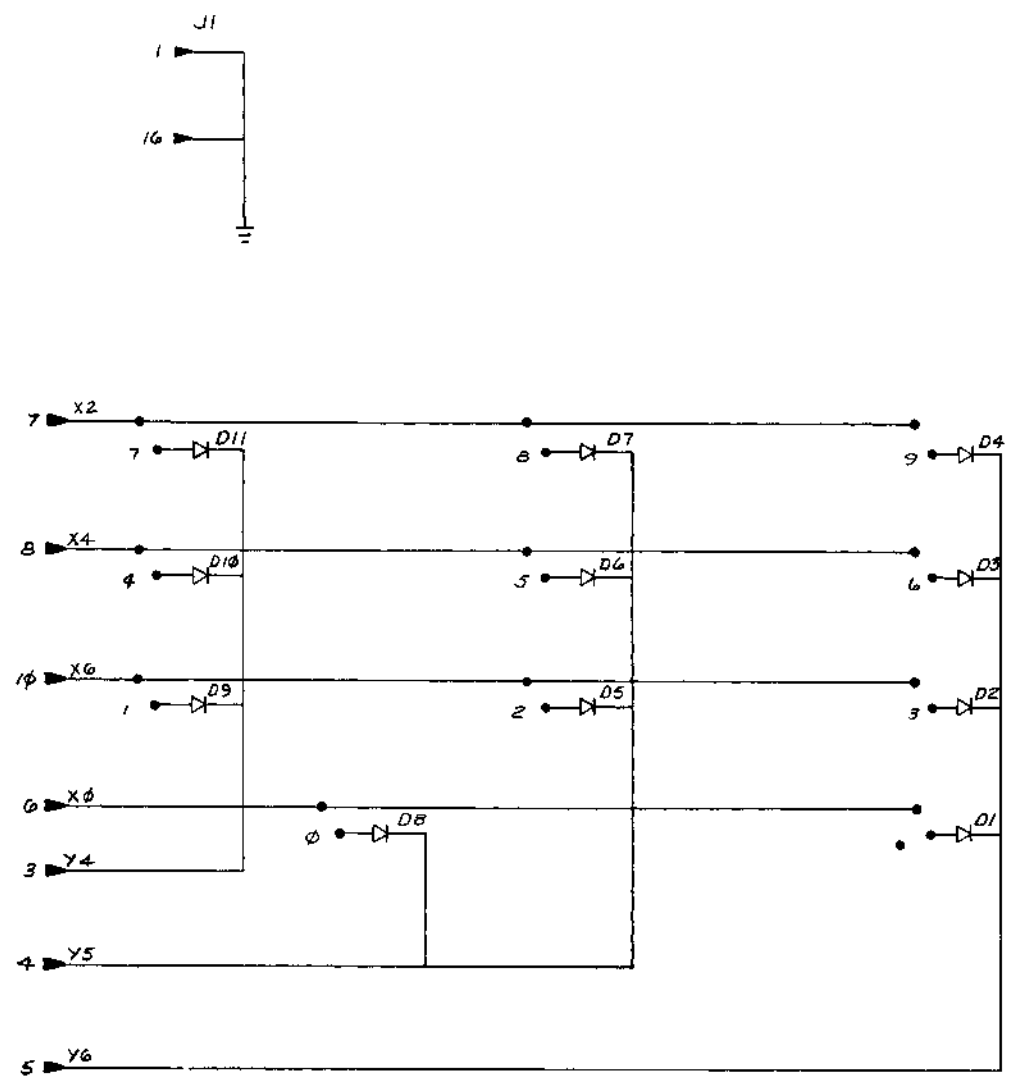
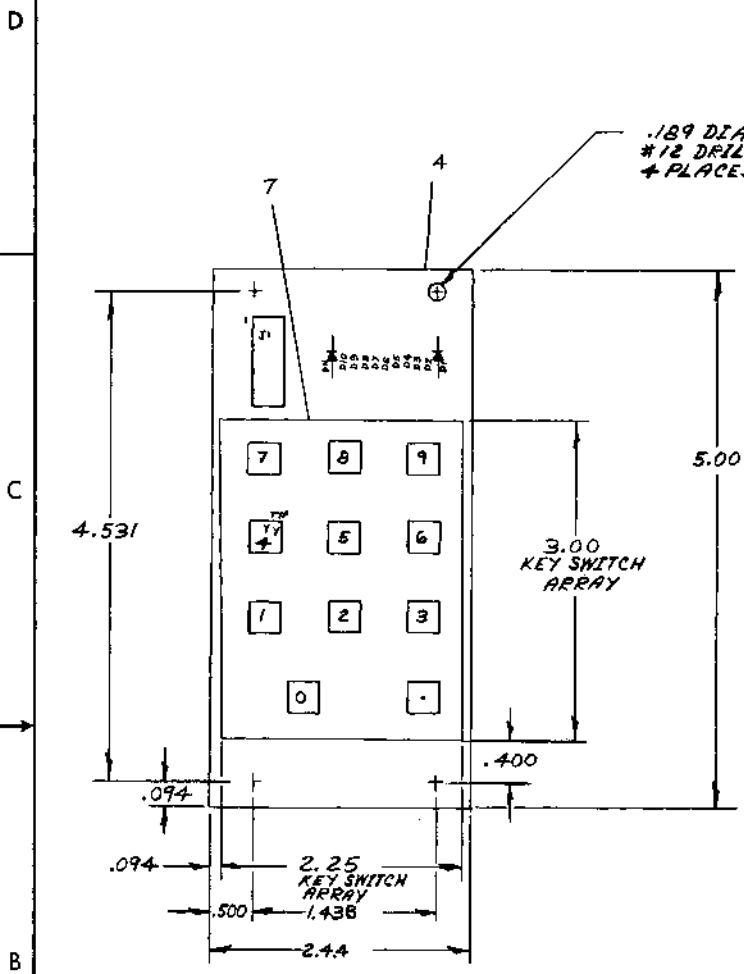
8 7 6 5 4 3 2 1

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NOTES:
 1. ALL DIODES ARE D664.

8 1-0-6180179 SCS D 2

REF	X-Y COORDINATE HOLE LOCATION	K-CO-5410819-0-4	1
REF	ASSY/DRILLING HOLE LOCATION	D-AH-5410819-0-5	2
REF	MODULE ECO HISTORY	B-MH-5410819-0-6	3
I	ETCHED CIRCUIT BOARD	5010819	4
II	D1 THRU D11	DIODES D664	1100114
I	J1	SOCKET (16 PINS)	1210025
I		11 KEYSWITCH ARRAY	D-AD-7008891-0-0



DIMENSIONS FOR REFERENCE ONLY

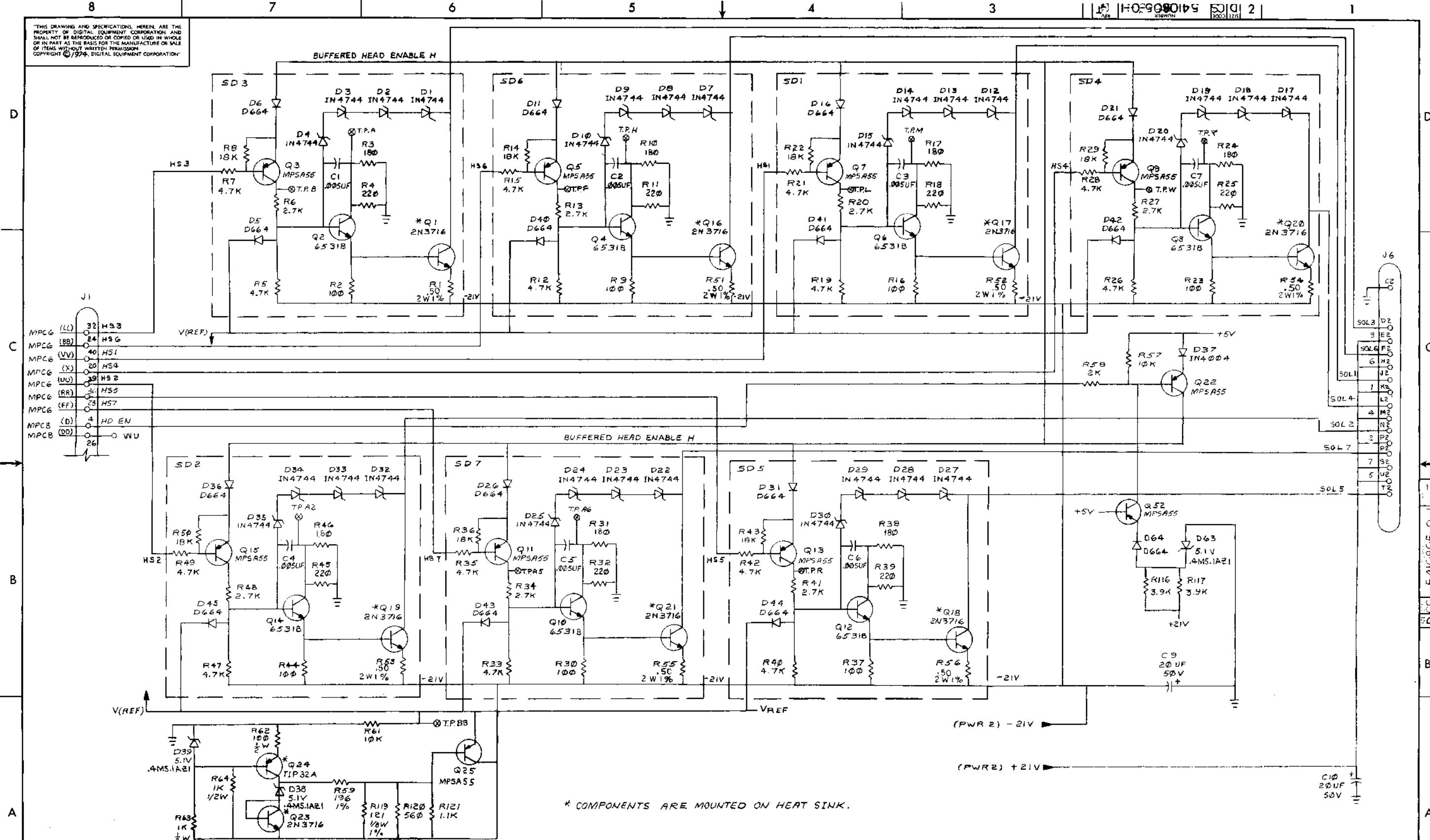
IC TYPE	GND	+5V
GND AND 5V ARE USUALLY PIN 7 AND 14 RESPECTIVELY. EXCEPTIONS ARE STATED ABOVE.		
IC PIN LOCATIONS		

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.																				
PARTS LIST																								
ETCH BOARD REV B																								
FIRST USED ON OPTION MODEL LA 36																								
<table border="1"> <tr> <td>DRN</td> <td>V.C. Morrone</td> <td>DATE</td> <td>1-22-74</td> </tr> <tr> <td>CHK'D</td> <td>Elc</td> <td>DATE</td> <td>9-27-74</td> </tr> <tr> <td>ENGR</td> <td>P. E. Nelson</td> <td>DATE</td> <td>1-24-74</td> </tr> <tr> <td>PROJ. ENG.</td> <td>P. E. Nelson</td> <td>DATE</td> <td>1-24-74</td> </tr> <tr> <td>PROD.</td> <td>J.P. [unclear]</td> <td>DATE</td> <td>2-2-74</td> </tr> </table>					DRN	V.C. Morrone	DATE	1-22-74	CHK'D	Elc	DATE	9-27-74	ENGR	P. E. Nelson	DATE	1-24-74	PROJ. ENG.	P. E. Nelson	DATE	1-24-74	PROD.	J.P. [unclear]	DATE	2-2-74
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<table border="1"> <tr> <td colspan="2">digital EQUIPMENT CORPORATION</td> <td colspan="2">TITLE</td> <td>REV.</td> </tr> <tr> <td colspan="2">MAYNARD, MASSACHUSETTS</td> <td colspan="2">II KEYSWITCH ARRAY MODULE</td> <td>B</td> </tr> <tr> <td>SIZE/CODE</td> <td>NUMBER</td> <td colspan="2">DCS 5410819-0-1</td> <td></td> </tr> <tr> <td>DIST.</td> <td></td> <td colspan="2"></td> <td></td> </tr> </table>					digital EQUIPMENT CORPORATION		TITLE		REV.	MAYNARD, MASSACHUSETTS		II KEYSWITCH ARRAY MODULE		B	SIZE/CODE	NUMBER	DCS 5410819-0-1			DIST.				
digital EQUIPMENT CORPORATION		TITLE		REV.																				
MAYNARD, MASSACHUSETTS		II KEYSWITCH ARRAY MODULE		B																				
SIZE/CODE	NUMBER	DCS 5410819-0-1																						
DIST.																								

DEC FORM NO. DRD 132 B

DCS 5410819-0-1 B

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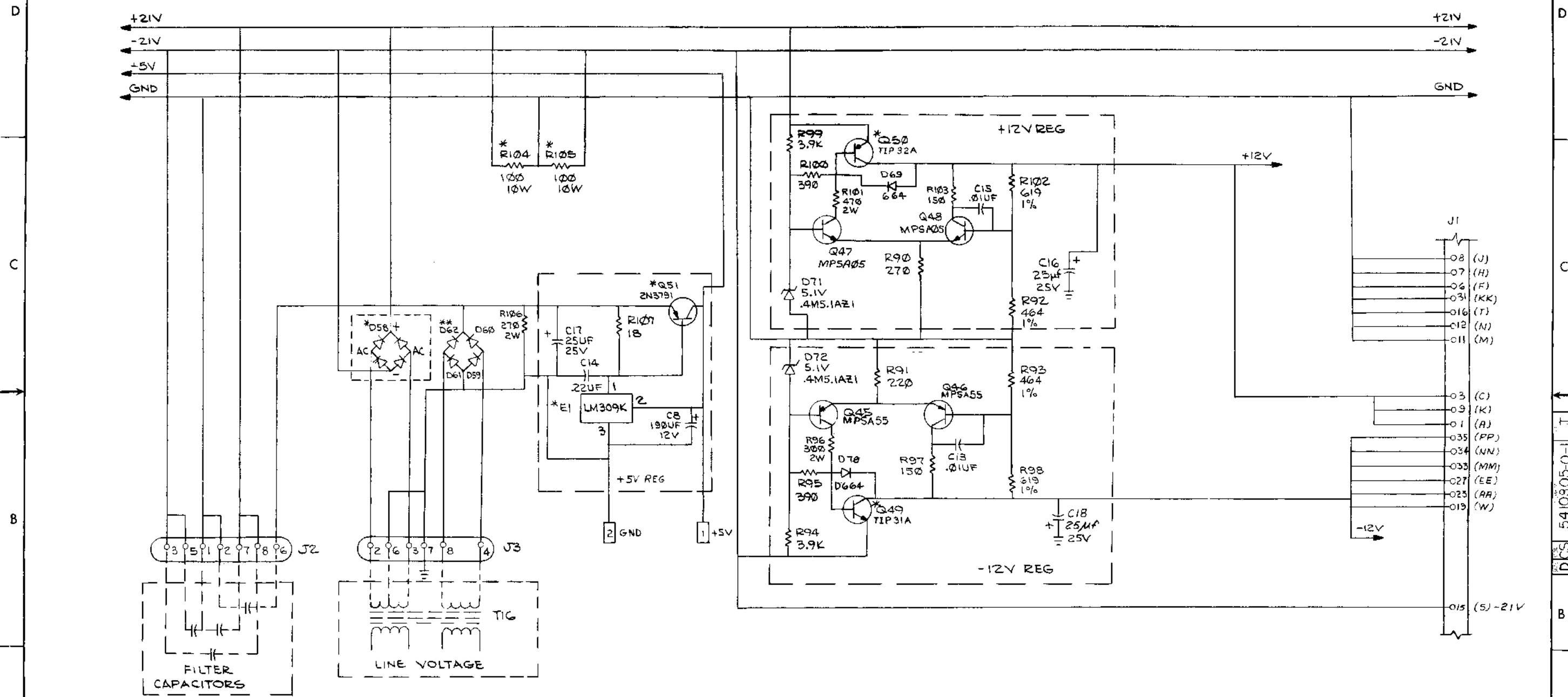


* COMPONENTS ARE MOUNTED ON HEAT SINK.

REVISIONS		
CHK	CHANGE NO	REV

TITLE	LA 36 POWER BOARD	SIZE CODE	D CS	NUMBER	5410805-0-1	REV.	HT
SCALE	→ → →	SHEET	3	OF	5	DIST.	

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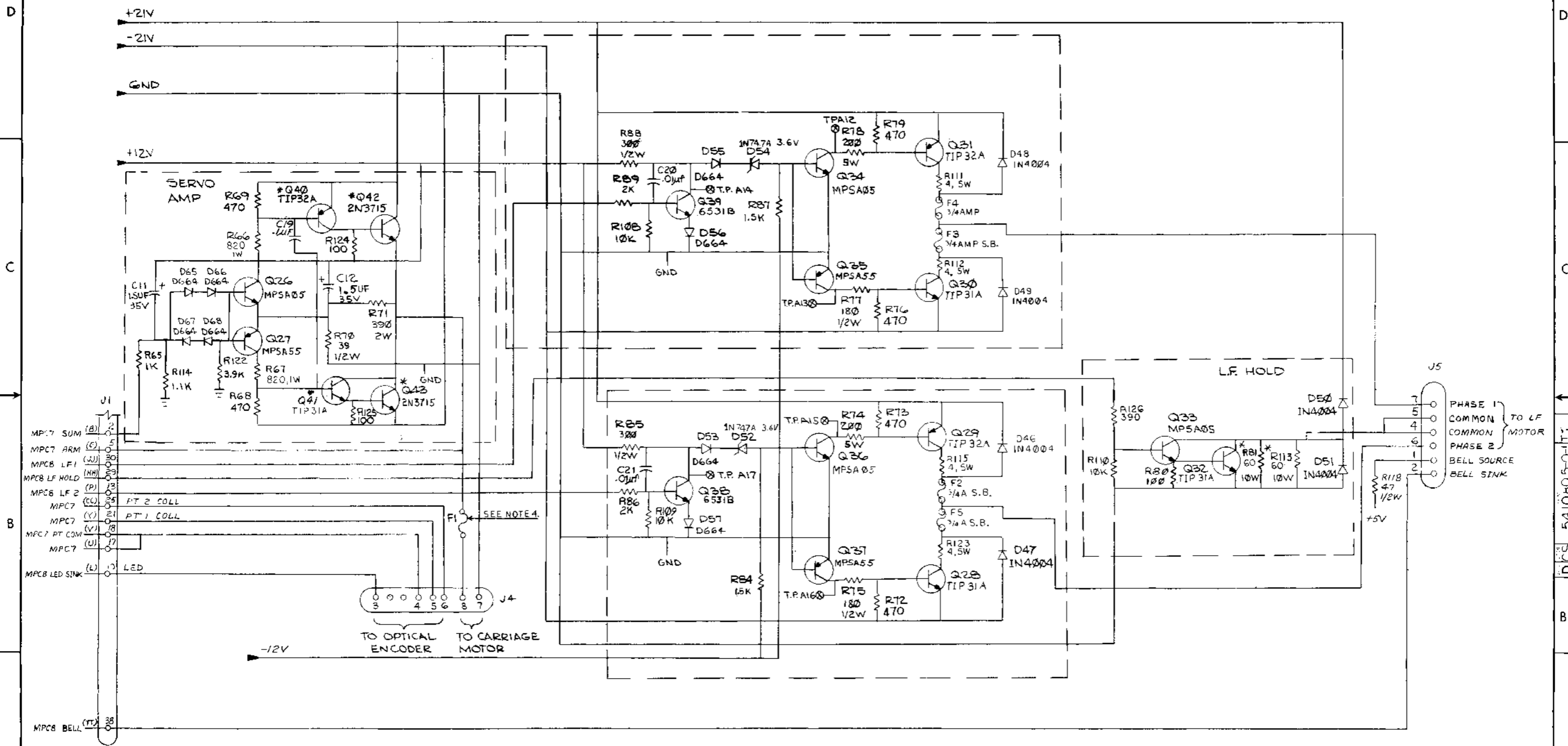


* COMPONENTS ARE MOUNTED ON HEAT SINK.
 ** DIODES D59 THRU D62 ARE M9752

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 POWER BOARD	SIZE CODE	DCS	NUMBER	5410805-0-1	REV.	T
SCALE	1:1	SHEET	4	OF	5	DIST.	

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* COMPONENTS ARE MOUNTED ON HEAT SINK.

REVISIONS		
CHK	CHANGE NO	REV.

TITLE	LA36 POWER BOARD	SIZE CODE	D CS	NUMBER	5410805-0-1	REV.	T
SCALE	1/1	SHEET	5	OF	5	DIST.	

**Signal Glossary for M7728
Logic Board**

Mnemonic	Definition	Source	Destination
MPC3 BMB00	Buffered Memory Bit 0	E4-2	(MPC3) E11-15; (MPC4) E3-1, E10-2, E14-15, E29-15, E33-23
MPC3 BMB01	Buffered Memory Bit 1	E4-12	(MPC3) E11-1; (MPC4) E3-15, E10-5, E14-14, E29-14, E33-23
MPC3 BMB02	Buffered Memory Bit 2	E21-4	(MPC3) E11-10; (MPC4) E3-14, E10-8, E14-13, E29-13, E33-21, E64-13
MPC3 BMB03	Buffered Memory Bit 3	E21-2	(MPC3) E11-9; (MPC4) E3-13, E10-11, E14-11, E29-11, E33-20, E65-12, 13
MPC3 BMB04	Buffered Memory Bit 4	E21-12	(MPC4) E22-23
MPC3 BMB05	Buffered Memory Bit 5	E21-10	(MPC3) E32-2; (MPC4) E3-2, E10-3,6,9,12, E29-9, E22-22
MPC3 BMB06	Buffered Memory Bit 6	E21-8	(MPC3) E32-1; (MPC4) E14-9, E22-21
MPC3 BMB07	Buffered Memory Bit 7	E2-6	(MPC3) E32-2; (MPC4) E22-20
MPC3 CLOCK A		E62-2	(MPC7) E49-4, E49-10
MPC4 REG 0 H	Register 0	E5-3	(MPC4) E29-1; (MPC3) E9-15; (MPC7) E8-4; (MPC9) E2-4
MPC4 REG 1 H	Register 1	E5-2	(MPC4) E29-8; (MPC3) E9-1; (MPC7) E8-5; (MPC9) E2-5
MPC4 REG 2 H	Register 2	E5-6	(MPC4) E14-16; (MPC3) E9-2; (MPC7) E8-12; (MPC9) E2-12
MPC4 REG 3 H	Register 3	E5-7	(MPC4) E14-17; (MPC3) E9-9; (MPC7) E8-13; (MPC9) E2-13
MPC4 ZERO H		E6-6	(MPC4) E14-6
MPC4 CS00 L (BNG 1)	Clocked Selector 04	E22-1	(MPC4) E16-1
MPC4 CS02 L (BNG 4)	Clocked Selector 04	E22-3	(MPC4) E16-2
MPC4 CS03 L (SKP 1)	Clocked Selector 04	E22-4	(MPC4) E35-13; (MPC3) E16-4
MPC4 CS04 L (SKP 2)	Clocked Selector 04	E22-5	(MPC3) E16-5
MPC4 CS10 L (STR 1)	Clocked Selector 04	E22-9	(MPC4) E3-3
MPC4 CS12 L (DEC 1)	Clocked Selector 04	E22-11	(MPC4) E33-18, 19

**Signal Glossary for M7728 (Cont)
Logic Board**

Mnemonic	Definition	Source	Destination
MPC4 CS15 L (JMP 2)	Clocked Selector 04	E22-15	(MPC3) E12-1
MPC4 CS16 L (JMP 3)	Clocked Selector 04	E22-16	(MPC3) E12-2, 13
MPC4 CS17 L (JMP 4)	Clocked Selector 04	E22-17	(MPC3) E12-4
MPC4 CLR INIT L	Clear Initialize	E33-17	(MPC7) E25-13, E43-11; (MPC8) E34-10
MPC4 CLR C/B L	Clear Carries or Borrows	E33-16	(MPC7) E39-13
MPC4 SET HOLD L	Set Hold	E35-15	(MPC8) E42-4
MPC4 STEP LF L	Step Line Feed	E33-14	(MPC8) E31-3, 11; E37-4
MPC4 CLR HDE L	Clear Head Drive Enable	E33-13	(MPC7) E44-13; (MPC8) E37-11
MPC4 SET HDE L	Set Head Drive Enable	E33-11	(MPC8) E37-10
MPC4 LOAD D/A L	Load Digital/Analog	E33-10	(MPC7) E8-9
MPC4 SET BEL L	Set Bell	E33-9	(MPC8) E34-4
MPC4 CLR BEL L	Clear Bell	E33-8	(MPC8) E34-3
MPC4 -1 REG L	Decrement Register	E33-7	(MPC4) E5-4
MPC4 WRITE BUFF L	Write Buffer	E33-5	(MPC6) E30-10; (MPC9) E41-3, E36-3
MPC4 LOAD CBA L	Load Character Buffer Address	E33-4	(MPC9) E2-9
MPC4 +1 REG L	Increment Register	E33-3	(MPC4) E5-5
MPC4 CLR DA L	Clear Data Available	E33-2	(MPC6) E30-11
MPC4 CLR KBH L	Clear Keyboard Hold	E33-1	(MPC6) E30-4
MPC4 SKIP L	Skip	E6-11	(MPC3) E26-12
MPC4 CHAR TEST L	Character Test	E65-8	(MPC4) J5-W
MPC5 S. I.	Serial IN	E42-11	(MPC6) E55-20
MPC5 592 NS	592 NS	E66-14	(MPC3) E39-9
MPC5 1.184 US H	1.184 μ s	E66-12	(MPC3) E39-10; (MPC7) E62-13
MPC5 CLK H	Clock	E19-5	(MPC3) E32-5, 10, (MPC7) E49-1

Signal Glossary for M7728 (Cont)
Logic Board

Mnemonic	Definition	Source	Destination
MPC5 CLK L	Clock	E19-12	(MPC4) E22-19
MPC5 76 US	76 μ s	E68-11	(MPC7) E54-3, E40-3
MPC5 208 H	208	E68-12	(MPC4) E29-7; (MPC6) E59-7; (MPC8) E42-10
MPC5 4.8 KHZ	4.8 kHz	E63-11	(MPC6) E59-4
MPC5 1.76 KHZ	1.76 kHz	E67-11	(MPC6) E57-8
MPC5 OPTION CLK L		E61-8	(MPC5) J5-A
MPC6 REQ TO SEND H	Request To Send	R41	(MPC6) J2-JJ
MPC6 UART DATA 1	UART Data 1	E55-12	(MPC9) E41-4
MPC6 UART DATA 2	UART Data 2	E55-11	(MPC9) E41-6
MPC6 UART DATA 3	UART Data 3	E55-10	(MPC9) E41-10
MPC6 UART DATA 4	UART Data 4	E55-9	(MPC9) E41-12
MPC6 UART DATA 5	UART Data 5	E55-8	(MPC9) E36-4
MPC6 UART DATA 6	UART Data 6	E55-7	(MPC9) E36-6
MPC6 UART DATA 7	UART Data 7	E55-6	(MPC9) E36-10
MPC6 UART P, ERR H	UART Parity Error	E55-13	(MPC9) E36-12
MPC6 KBH H	Keyboard Hold	E30-6	(MPC4) E14-20
MPC6 S. O.	Serial Out	E55-25	(MPC5) E60-12
MPC6 RD8	RD8	E55-5	(MPC9) E36-12
MPC6 WU H	Wake Up	E56-4	(MPC4) E5-14; (MPC3) E11-14, E9-14
MPC6 CLR DA FF L	Clear	E30-8	(MPC8) E34-11
MPC6 DA H	Data Available	E42-3	(MPC4) E14-7
MPC6 BREAK + L		J2-P	(MPC5) E60-13
MPC7 COL INC CNT 0	Column Increment Count 0	E43-3	(MPC8) E39-2; (MPC9) E48-21, E53-21
MPC7 COL INC CNT 1	Column Increment Count 1	E43-2	(MPC9) E48-20, E53-20
MPC7 COL INC CNT 2	Column Increment Count 2	E43-6	(MPC9) E48-19, E53-19

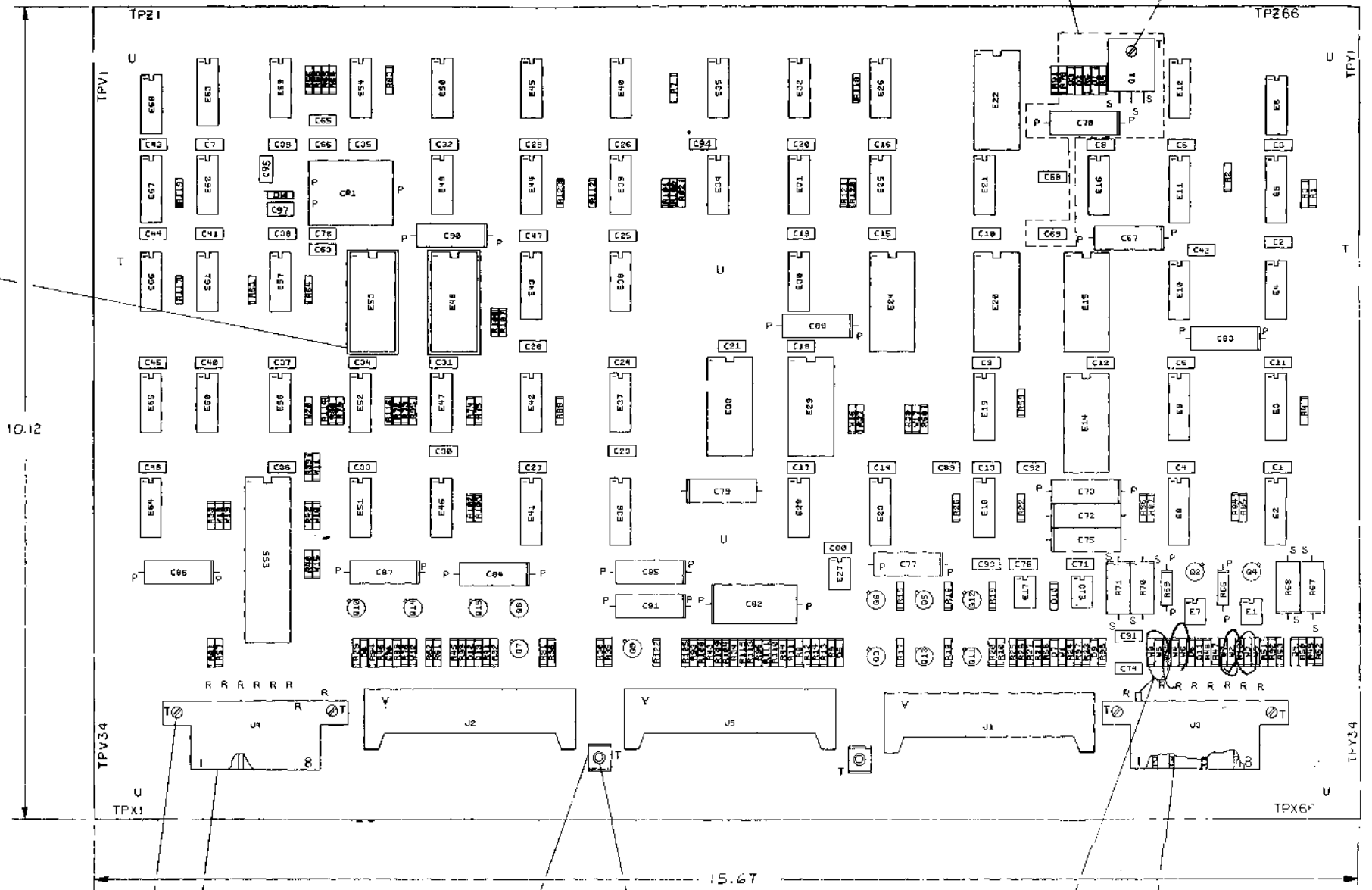
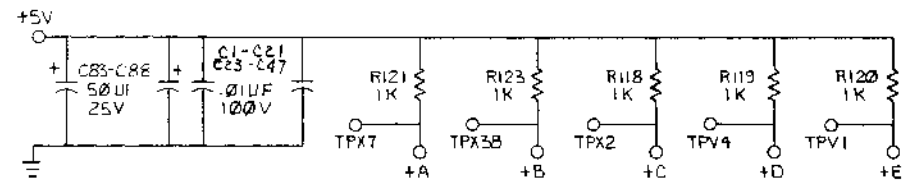
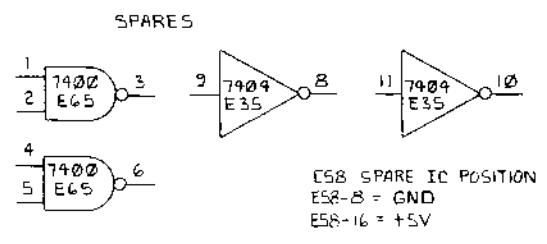
Signal Glossary for M7728 (Cont)
Logic Board

Mnemonic	Definition	Source	Destination
MPC7 BORROW H	Borrow	E16-11	(MPC4) E29-22
MPC7 CARRY H	Carry	E16-8	(MPC4) E14-23
MPC7 1.184 US L	1.184 μ s	E62-12	(MPC5) E61-9
MPC7 SUM	Sum	C79	J1-B
MPC7 ARM	Arm	R8	J1-E
MPC7 INC H	Increment	E44-9	(MPC4) E29-3
MPC8 W. U. L	Wake Up	Q9-C	(MPC8) E34-1, 13, E42-5, E37-13, J1-DD, J5-Z; (MPC6) E30-13; E56-3; (MPC3) E26-1; (MPC7) E8-1
MPC8 READY H	Ready	E34-9	(MPC6) E38-5; (MPC5) E64-4
MPC8 LF2	Line Feed 2	E28-8	J1-P
MPC8 LF1	Line Feed 1	E28-10	J1-JJ
MPC8 LF HOLD L	Line Feed Hold	Q14-E	J1-D
MPC8 HD EN L	Head Drive Enable	E39-6	J1-DD
MPC8 BEL	Bell	R58	J1-TT
MPC9 PNTABL H	Printable	E61-6	(MPC4) E14-1
MPC9 BS L	Back Space	E23-9	(MPC4) E29-20
MPC9 HTL	Horizontal Tab	E23-7	(MPC4) E29-21
MPC9 LF H	Line Feed	E23-6	(MPC4) E29-5
MPC9 CR H	Carriage Return	E23-3	(MPC4) E29-4
MPC9 BEL H	Bell	E23-1	(MPC4) E29-6
MPC9 ERROR H	Parity Error	E56-10	(MPC7) E39-1

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NOTES:

- CONNECTORS:
 J1 → J1 POWER BOARD
 J2 → KEYBOARD
 J3 → 20MA. SERIAL LINE
 J4 → OPTIONAL INTERFACE PORT
 J5 → J5 EXPANDER OPTION MOUNTING BOARD
- COMPONENTS WITHIN OUTLINE NOT INSERTED IN PREFERRED CONFIGURATION
- REF DES NOT USED ARE:
 C60, C61, C62, C64, C48-C58
- MAXIMUM REF DES USED ARE:
 W20, R123, E66, C97, D14, J5, CR1, Q15



8640	1	8
LM301A	—	—
1702A	—	16
74123	8	16
74150	12	24
74154	12	24
74161	8	16
74175	8	16
74190	8	16
74193	8	16
7442	8	16
7499	8	16
7493	10	5
MK2600P	12	24
UART	3	1
IC TYPE	GND	+5V

GND AND 5V ARE USUALLY PIN 7 AND 14 RESPECTIVELY EXCEPTS ARE STATED ABOVE

IC PIN LOCATIONS

92 19
 93 23 (QTY 8)

94 96

25 19
 23 (QTY 4) LOCATIONS 1,3,5,7 ONLY

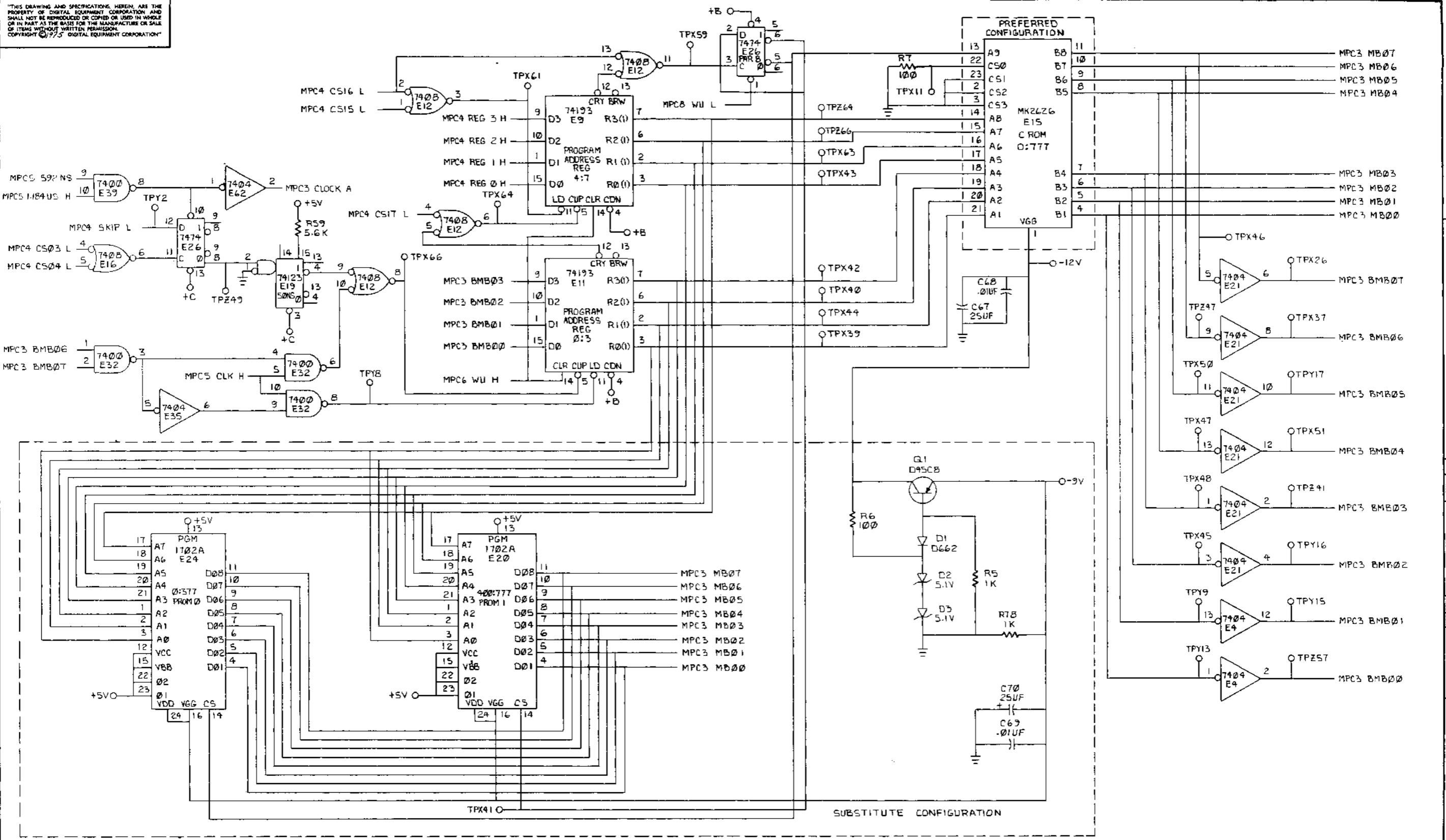
QTY	REF. DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
FIRST USED ON OPTION MODEL LA36				
ETCH BOARD REV. E				
PARTS LIST				
DRY. Robert Hopper		DATE 5-23-75		
CHK'D. James A. Lurie		DATE 5-28-75		
ENG. Roy Spradley		DATE 5-28-75		
PROD. ENG. J. J. ...		DATE 1-31-75		
PROD. J. Plutsky		DATE 5-16-75		
TITLE LA36 MPC				
SEMICONDUCTOR CONVERSION CHART		SCALE DIST.		
DEC. NO. EIA. NO. DEC. NO. EIA. NO.		NUMBER M728-0-1		
SHEET OF 9		REV. C		

J. BITTO 12/10/75
 M728-0-0002 C
 R. LOMICKA 7-14-75
 M728-0-0001 B
 M728-0-0001 REV.

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D
C
B
A

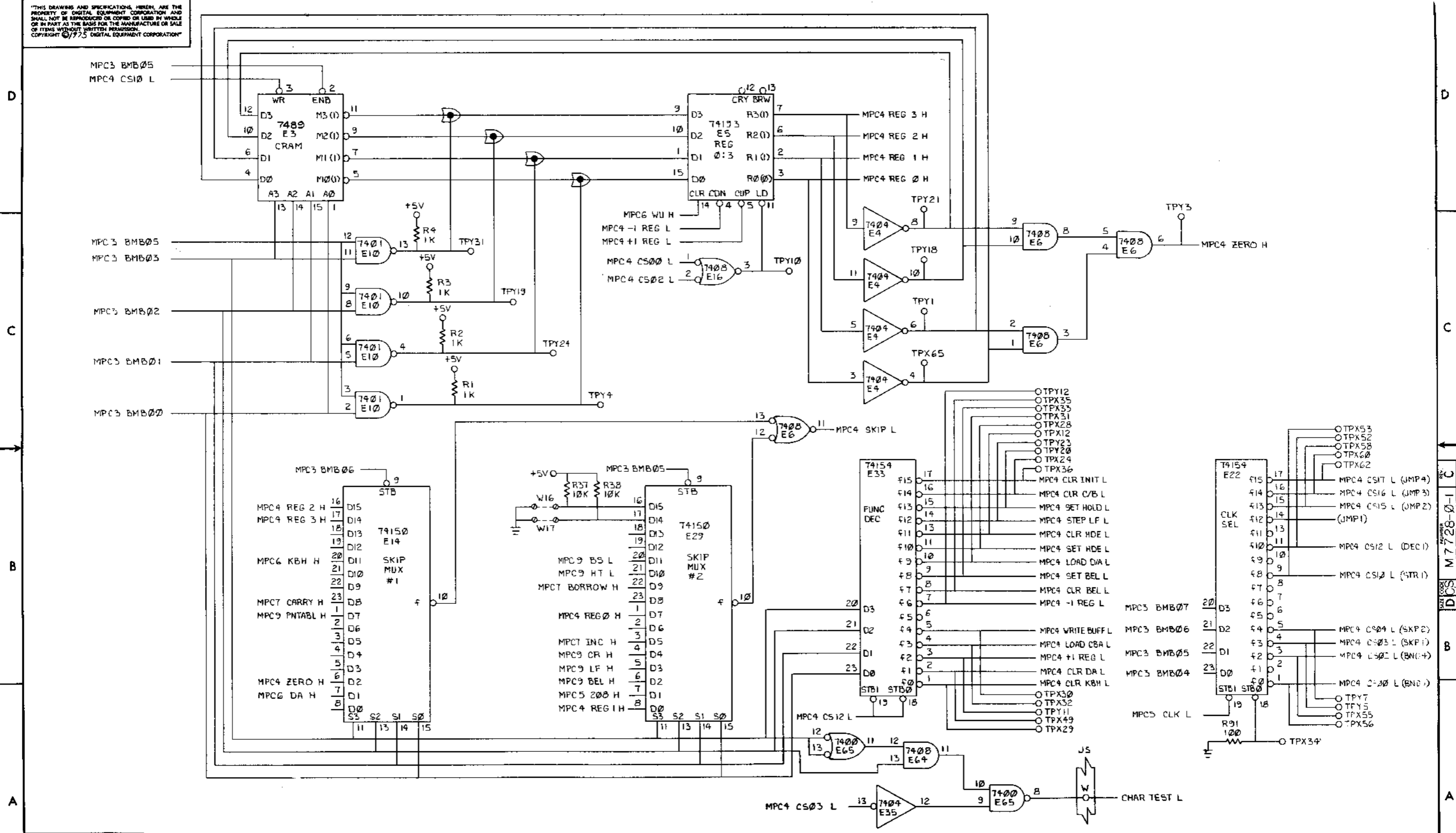
D
C
B
A



REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 MPC	SIZE CODE	DCS	NUMBER	M7728-0-1	REV.	C
SCALE	1/1	SHEET	3	OF	9	DIST.	

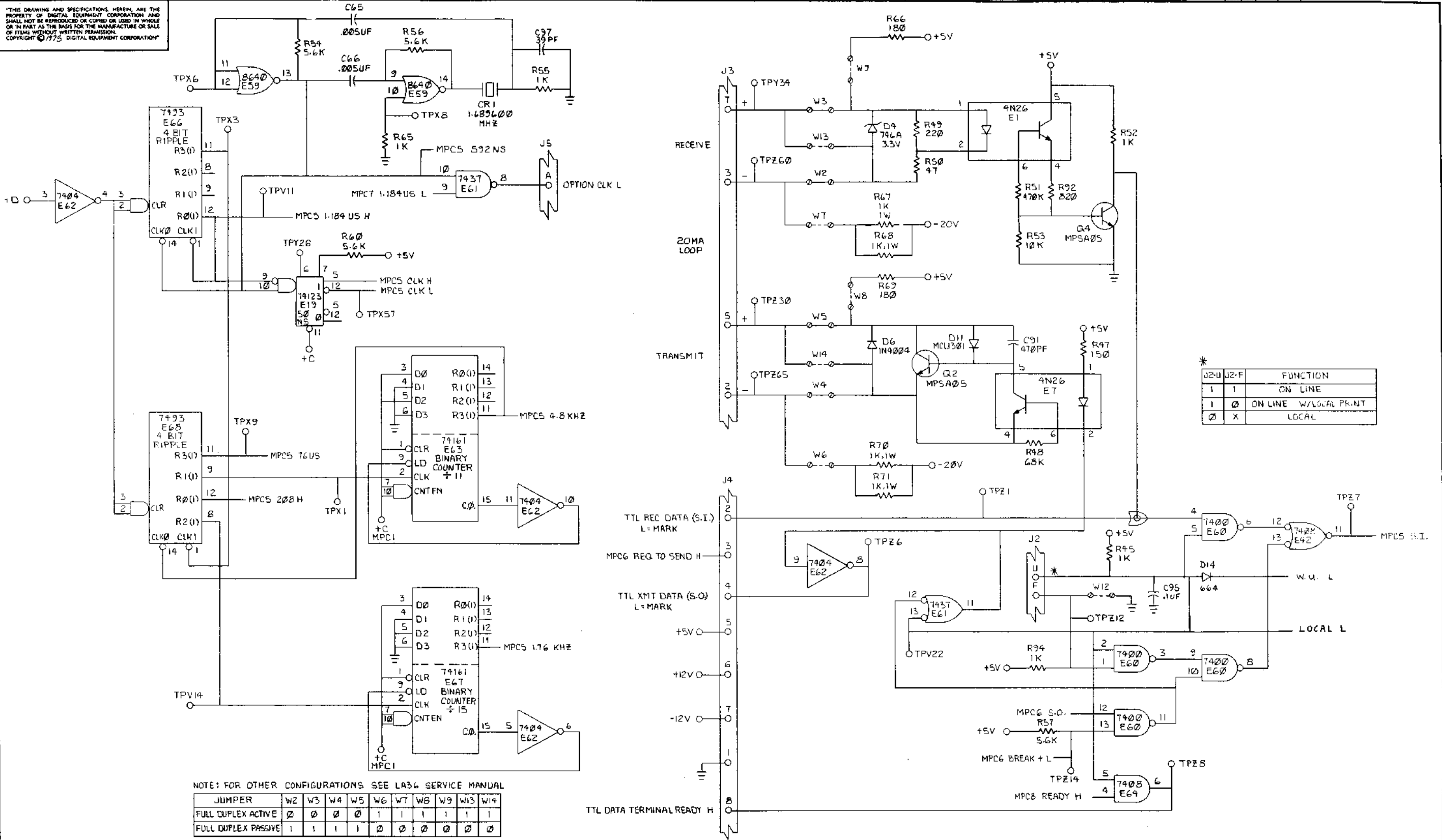
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REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 MPC (MPC4)	SIZE CODE	DCS	NUMBER	M7728-0-1	REV.	C
SCALE	1:1	SHEET	4	OF	9	DIST.	

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J2-U	J2-F	FUNCTION
1	1	ON LINE
1	0	ON LINE W/LOCAL PRINT
0	X	LOCAL

NOTE: FOR OTHER CONFIGURATIONS SEE LA36 SERVICE MANUAL

JUMPER	W2	W3	W4	W5	W6	W7	W8	W9	W13	W14
FULL DUPLEX ACTIVE	0	0	0	0	1	1	1	1	1	1
FULL DUPLEX PASSIVE	1	1	1	1	0	0	0	0	0	0

LEGEND: 1 = JUMPER INSERTED
0 = JUMPER NOT INSERTED

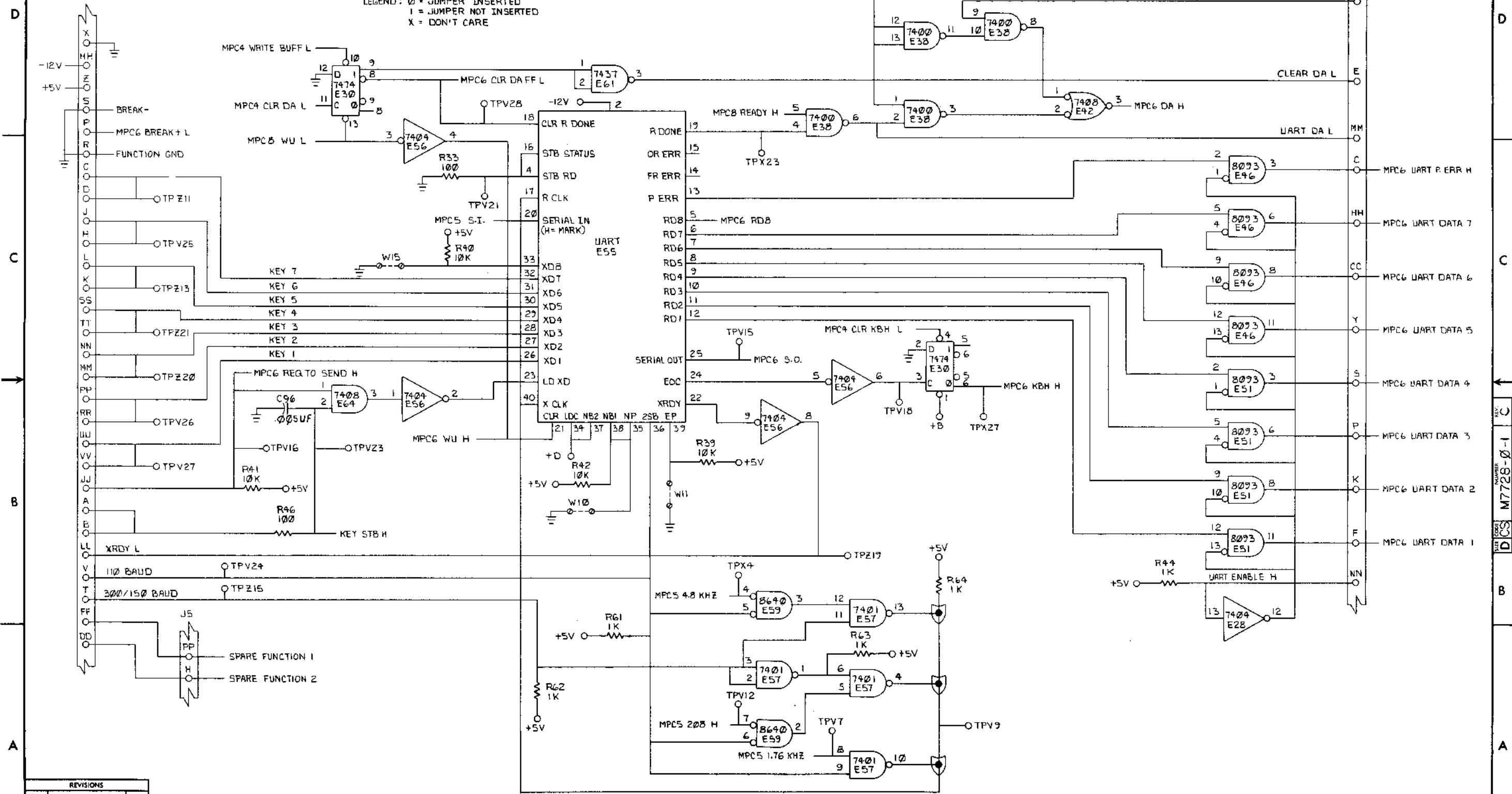
REVISIONS		
CHK	CHANGE NO.	REV.

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FUNCTION	J2-V	J2-T
150 BAUD	0	0
300 BAUD	0	1
110 BAUD	1	X

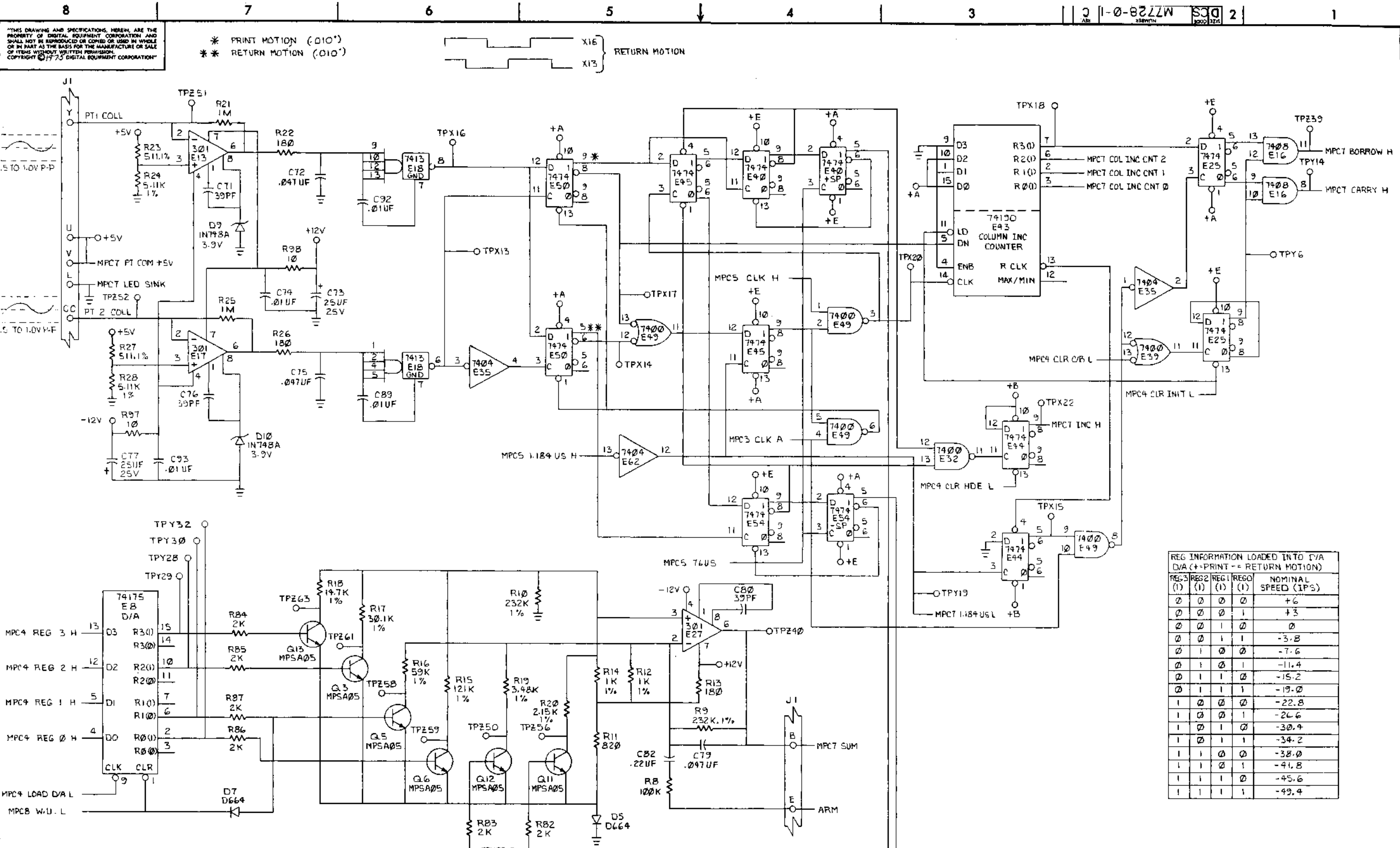
FUNCTION	W10	W11	W15
8TH BIT MARKING	1	X	1
8TH BIT SPACING	1	X	0
EVEN PARITY	0	1	X
ODD PARITY	0	0	X

LEGEND: 0 = JUMPER INSERTED
1 = JUMPER NOT INSERTED
X = DON'T CARE



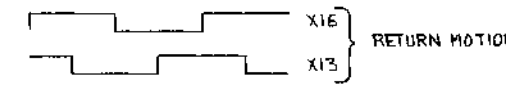
REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 MPC	SIZE CODE	D CS	NUMBER	M7728-0-1	REV.	C
SCALE	1/1	SHEET	6	OF	9	DIST.	



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* PRINT MOTION (010*)
 ** RETURN MOTION (010*)



REG INFORMATION LOADED INTO D/A
 D/A (+ = PRINT - = RETURN MOTION)

REG 3 (1)	REG 2 (1)	REG 1 (1)	REG 0 (1)	NOMINAL SPEED (IPS)
0	0	0	0	+6
0	0	0	1	+3
0	0	1	0	0
0	0	1	1	-3.8
0	1	0	0	-7.6
0	1	1	0	-11.4
0	1	1	1	-15.2
1	0	0	0	-19.0
1	0	0	1	-22.8
1	0	1	0	-26.6
1	0	1	1	-30.4
1	1	0	0	-34.2
1	1	0	1	-38.0
1	1	1	0	-41.8
1	1	1	1	-45.6
1	1	1	1	-49.4

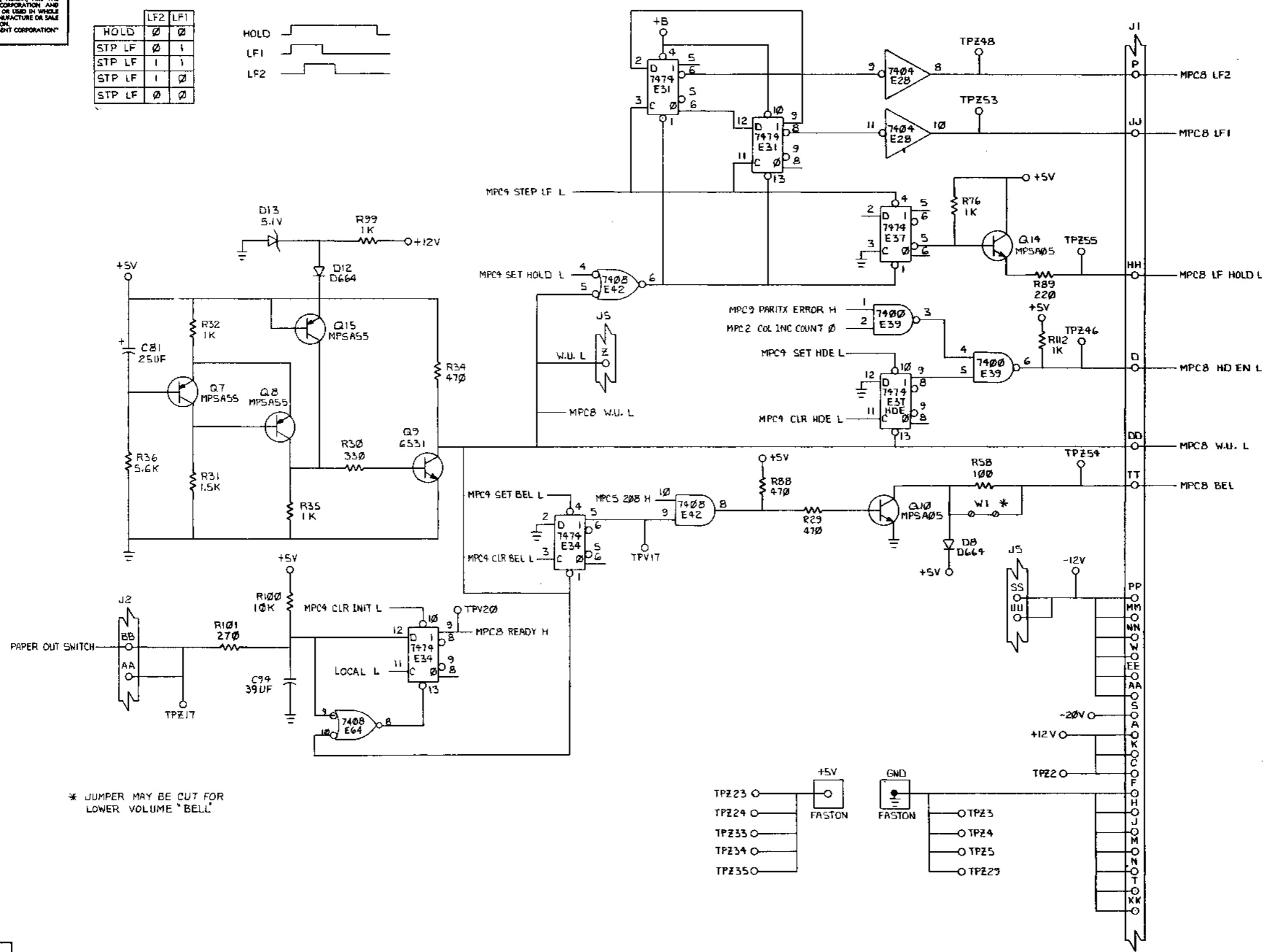
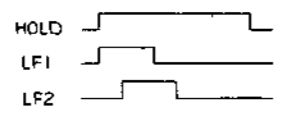
REVISIONS

CHK	CHANGE NO.	REV.

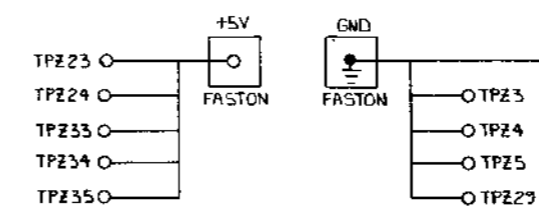
TITLE LA36 MPC
 (MPC7)
 SIZE CODE DCS
 NUMBER M7728-0-1
 REV. C
 SHEET 7 OF 9

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	LF2	LF1
HOLD	0	0
STP LF	0	1
STP LF	1	1
STP LF	1	0
STP LF	0	0



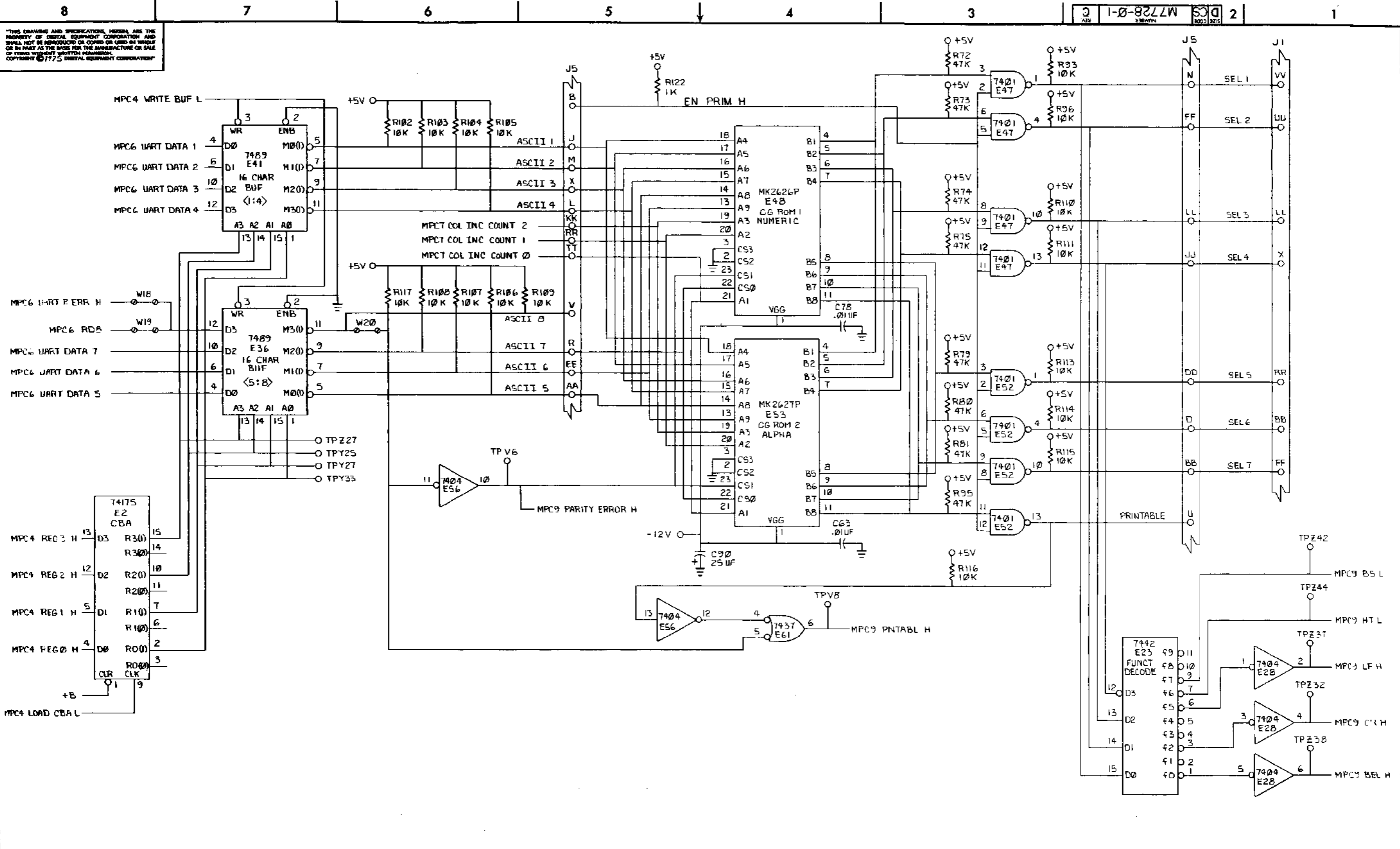
* JUMPER MAY BE CUT FOR LOWER VOLUME "BELL"



REVISIONS		
CHK	CHANGE NO.	REV.

TITLE LA36 MPC		SIZE CODE DCS	NUMBER M7728-0-1	REV. C
SCALE	SHEET 8 OF 9	DIST.		

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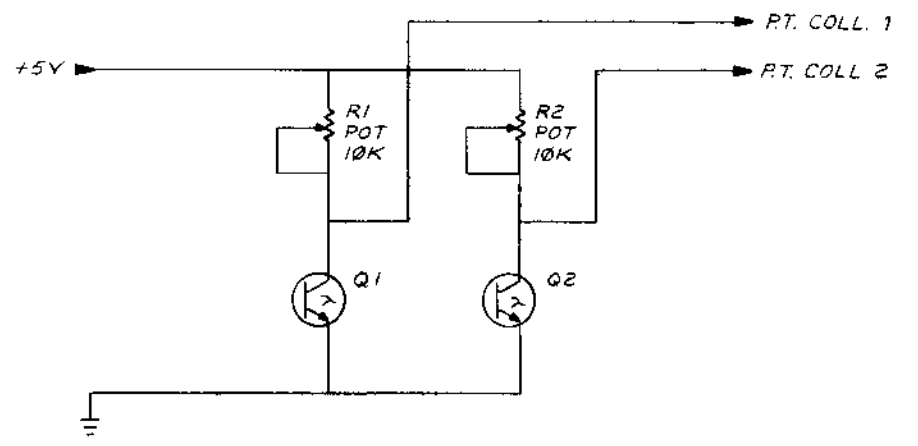
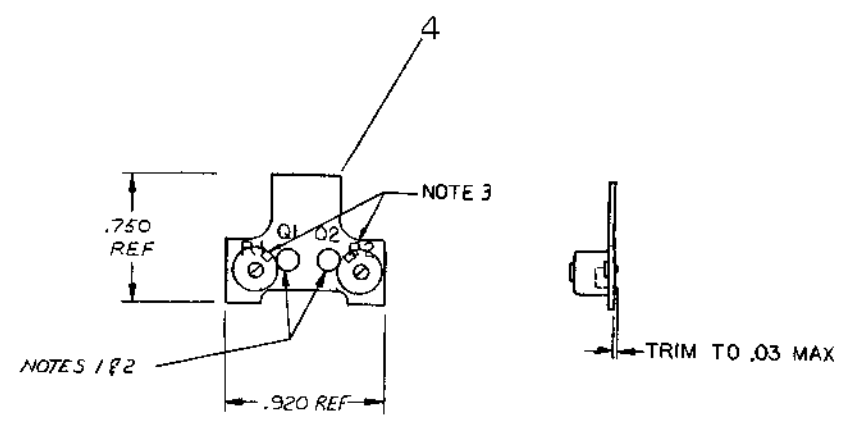
REVISIONS		
CHK	CHANGE NO.	REV.

TITLE	LA36 MPC	SIZE CODE	D CS	NUMBER	M7728-0-1	REV.	C
SCALE	1/1	SHEET	9	OF	9	DIST.	

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- NOTES:
1. HEAT APPLIED TO Q1 AND Q2 DURING SOLDERING SHALL NOT EXCEED 285° C FOR A PERIOD OF 15 SECONDS.
 2. FINISHED HOLE SIZE FOR MOUNTING Q1 AND Q2 SHALL BE .078 MIN., .083 MAX.
 3. R1 AND R2 MUST BE ORIENTED AS SHOWN, WITH NOTCH TOWARD CENTER OF BOARD.



REF	X-Y COORDINATE HOLE LOCATION	K-CO-5411049-04	1	
REF	ASSY/DRILLING HOLE LAYOUT	D-AH-5411049-05	2	
REF	MODULE ECO HISTORY	B-MH-5411049-06	3	
REF	ETCHED CIRCUIT BOARD	D-1A-5010990-00	4	
2	R1, R2	POTENTIOMETER 10K	1309150-12	5
2	Q1, Q2	PHOTOTRANSISTOR	1511906	6

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
PARTS LIST				
ETCH BOARD REV B				
DRN		DATE	 digital EQUIPMENT CORPORATION NATHAN, MASSACHUSETTS	
CHK'D		DATE		
ENG		DATE		
PROJ. ENG		DATE		
PROD.		DATE		
NEXT HIGHER ASSY			TITLE	
DEC NO.			LA36	
EIA NO.			ENCODER PC BOARD	
DEC NO.			PHOTOTRANSISTOR	
EIA NO.			TITLE	
SCALE			SIZE CODE	
SHEET / OF /			D/CS 5411049-0-1	
SEMICONDUCTOR CONVERSION CHART			NUMBER	
			REV.	
			C	

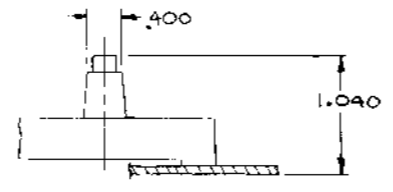
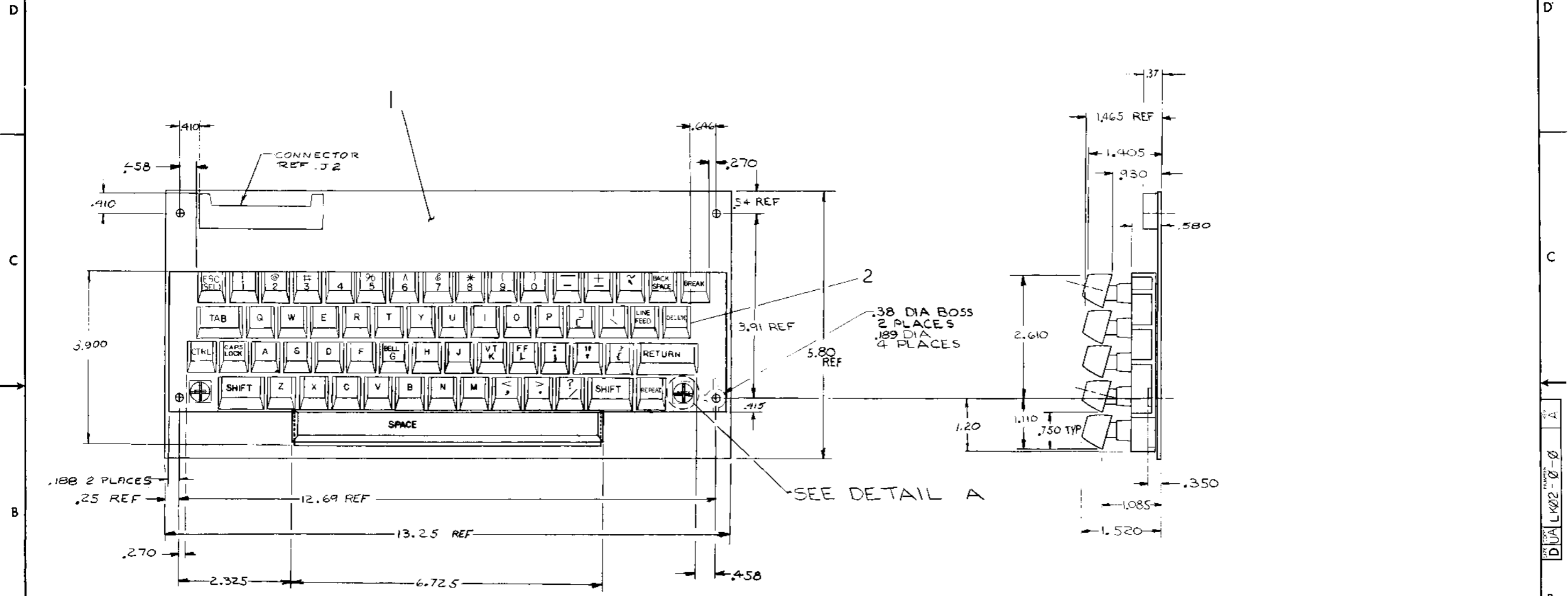
DEC FORM NO. DRD-135

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DO NOT SCALE DRAWING

NOTES:

1. ITEM #5, SHIPPING CARTON, TO BE USED ONLY FOR SEPERATE KEYBOARD SHIPMENT.



DETAIL A SHOWN WITHOUT KEYCAP AND ADAPTER

QTY.	DESCRIPTION	PART NO.	ITEM NO.
1	DIE CUT FOLDER	A-PS-9905441	5
REF	TEST SPEC	A-SP-LK02-0-2	4
REF	ENGINEERING SPEC	A-SP-1LK02-0-1	3
1	KEYCAP (SET)	D-PS-9009570-62	2
1	KEYSWITCH ARRAY & MODULE	D-CS-541073-0-01	1

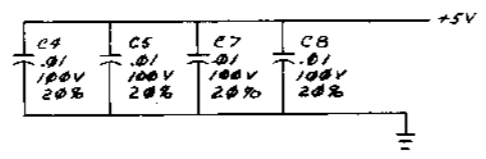
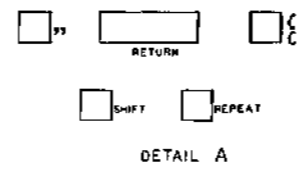
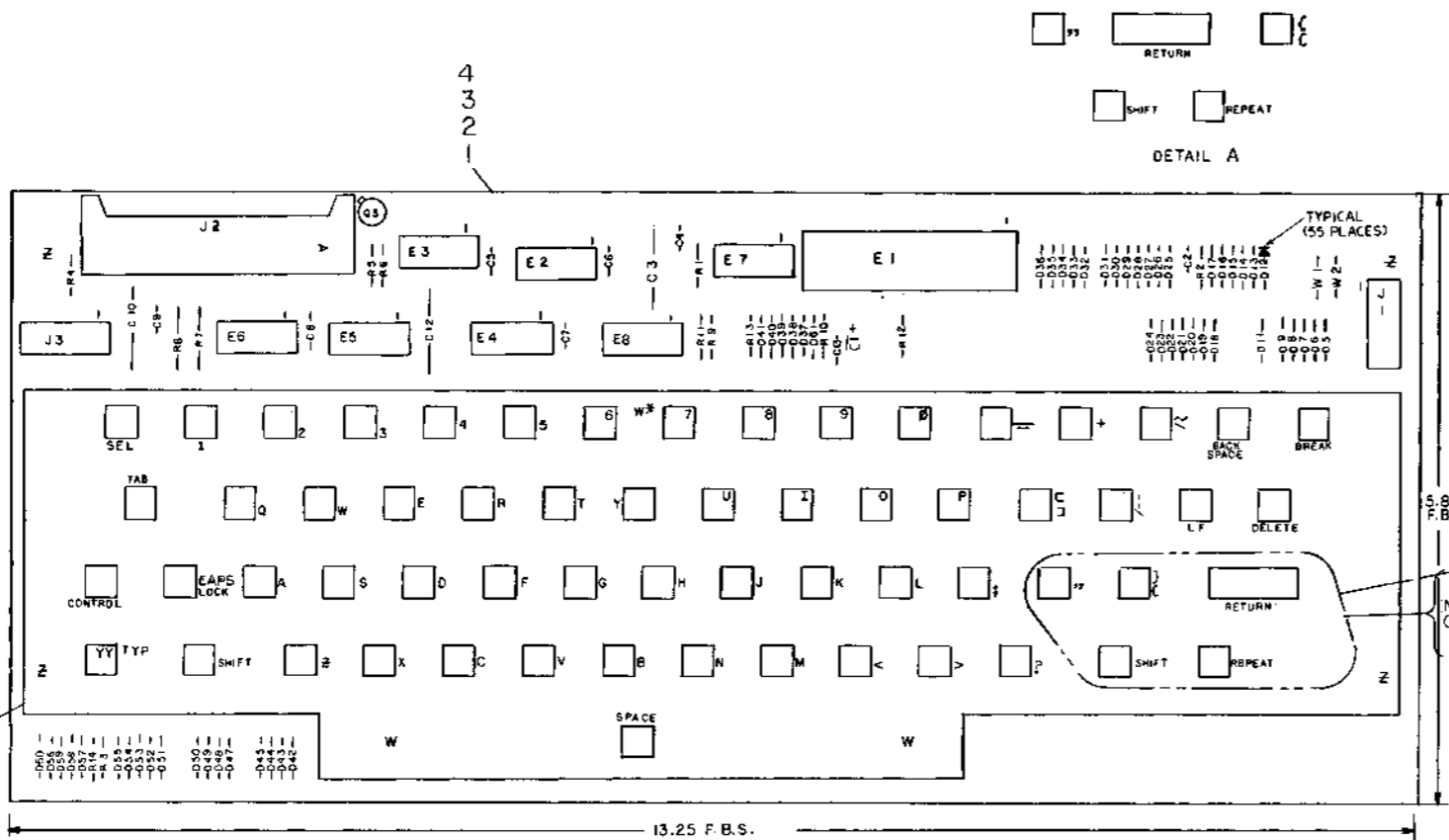
FIRST USED ON OPTION/MODEL		DATE		PARTS LIST	
LK02		DRW	DATE	PARTS LIST	
UNLESS OTHERWISE SPECIFIED DIMENSION IN INCHES		DRW	5/31/74	PARTS LIST	
TOLERANCES		CHKD	DATE	PARTS LIST	
DECIMALS	ANGLES	ENG	DATE	PARTS LIST	
.XXX ±.005	±0° 30'	ENG	DATE	PARTS LIST	
.XX ±.02		PROD	DATE	PARTS LIST	
.X ±.1		PROD	DATE	PARTS LIST	
REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY Y				PARTS LIST	
MATERIAL		NEXT HIGHER ASSY.		PARTS LIST	
		B-DD-LK02-0		PARTS LIST	
FINISH		SCALE NONE		PARTS LIST	
		SHEET 1 OF 1		PARTS LIST	
		SIZE CODE		PARTS LIST	
		DUA		PARTS LIST	
		NUMBER		PARTS LIST	
		LK02-0-0		PARTS LIST	
		REV.		PARTS LIST	
				PARTS LIST	

REV.	CHANGE NO.	REV.
A	LK02-00002	A
B	LK02-00003	B
C	LK02-00004	C

CHK: [Signature]
 ENG: [Signature]
 PROD: [Signature]

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NOTES: TWO VARIATIONS OF THIS BOARD SHALL BE AVAILABLE:
 1. 5410736-0-NORMAL= NORMAL KEY CAP CONFIGURATION; W1, IN; W2, OUT
 2. 5410736-9A-0 9A= OPTIONAL KEY CAP CONFIGURATION; W2, IN; W1 OUT



REF REF	QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
			X-Y COORDINATE HOLE LOCATION	K-CO-5410736-0-4	1
			ASSY/DRILLING HOLE LAYOUT	D-AH-5410736-0-5	2
			MODULE ECO HISTORY	B-MH-5410736-0-6	3
			ETCHED CIRCUIT BOARD	5010735	4
			CAP, .01UF, 100V 10% MYLAR	1005784	5
			CAP, .01UF, 100V 20% DISC	1001610-01	6
			CAP, .1UF, 25V TANT	1010866-01	7
			CAP, 180PF, 100V 5% NICH	1000020-00	8
			CAP, 10UF, 20V 10% TANT	1004813	9
			DIODE, D664	1100114-00	10
			TRANSISTOR DEC 3009B	1503100-00	11
			SOCKET (16 PINS)	1211813	12
			CONNECTOR, RIGHT ANGLE HEADER	1209941-02	13
			SOCKET ROM	1212385-00	14
			I.C. 7404	1909686	15
			I.C. 7400	1905575	16
			I.C. 7437	1910091	17
			I.C. 9601	1909373	18
			I.C. ROM	2300201	19
			JUMPER (INSULATED .4)	9009185	20
			63 KEYSWITCH ARRAY	D-AD-1009892-0	21
			RES 1K 1/4W 5%	1300365-00	22
			RES 3.9K 1/4W 5%	1300444-00	23
			RES 22K 1/4W 5%	1301808-00	24
			RES 100K 1/4W 5%	1302466-00	25
			RES 2 OHM 1/2W 5%	1309421-00	26
			I.C. 7410	1905576	27
			JUMPER (INSULATED .4)	9009185	28
			CAP 1000 PF 100V 5% NICH	1000042-00	29

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.

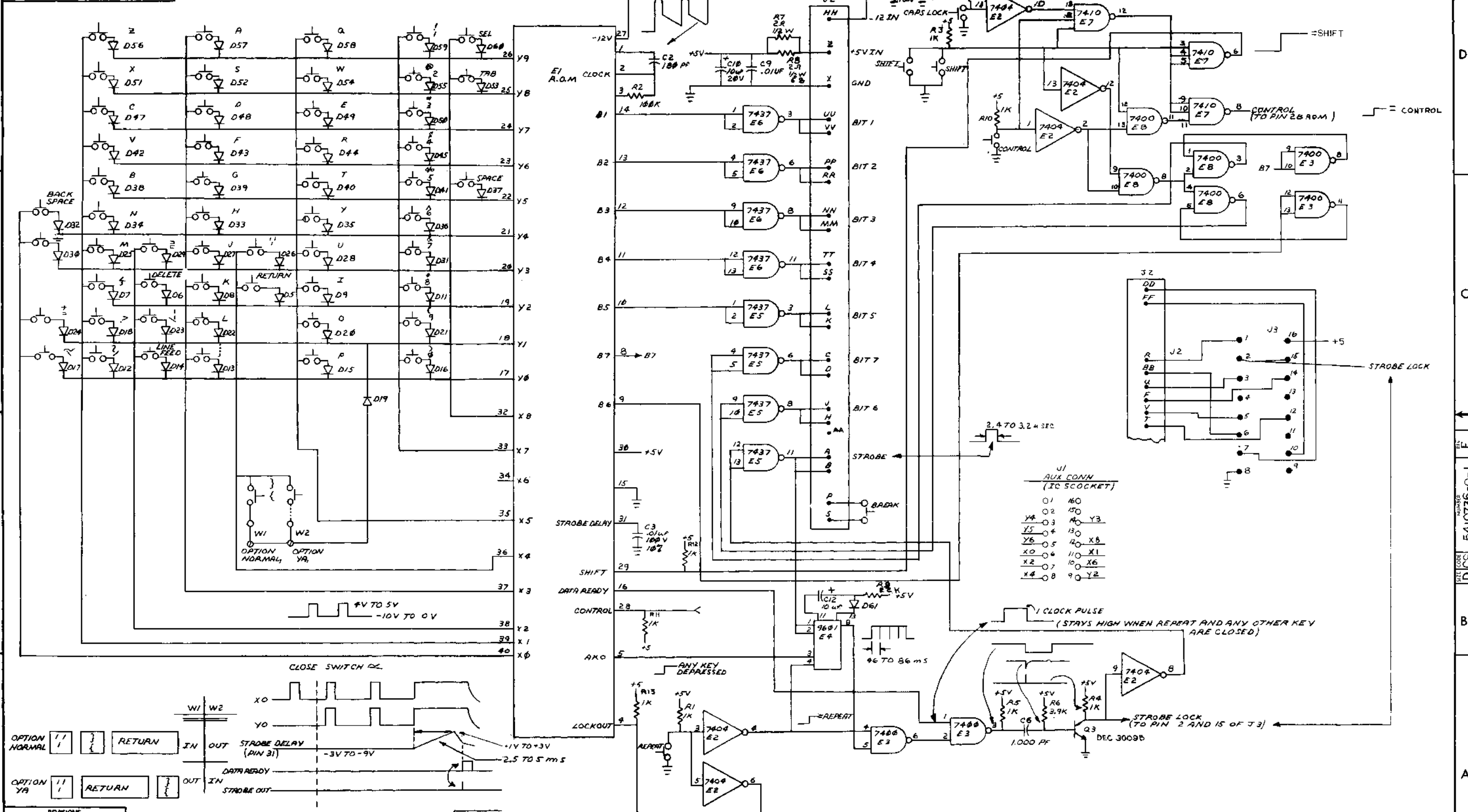
REV	DATE	DESCRIPTION
1	2-2-74	J. BITTO
2	3-7-74	P. NELSON
3	2-4-74	P. NELSON
4	2-4-74	P. NELSON

REV	DATE	DESCRIPTION
1	2-2-74	J. BITTO
2	3-7-74	P. NELSON
3	2-4-74	P. NELSON
4	2-4-74	P. NELSON

DEC NO.	EIA NO.	DEC NO.	EIA NO.
SEMICONDUCTOR CONVERSION CHART			
SCALE	SHEET		1 OF 2

ETCH BOARD REV F		DRN POIRIER DATE 1-25-74	 digital EQUIPMENT CORPORATION <small>NATIAK, MASSACHUSETTS</small>
CHK'D [Signature]		DATE 3-7-74	
ENG P NELSON DATE 2-4-74		TITLE LK02 KEYBOARD	
PROJ. ENG P NELSON DATE 2-4-74		NEXT HIGHER ASSY D-UA-LK02-0-0	
PROD. DATE		SIZE CODE D CS 5410736-0-1	NUMBER REV. E

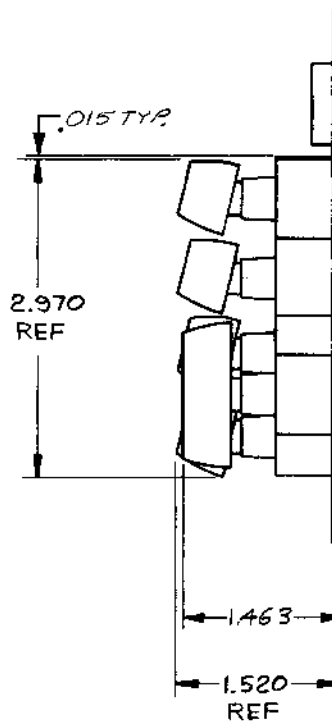
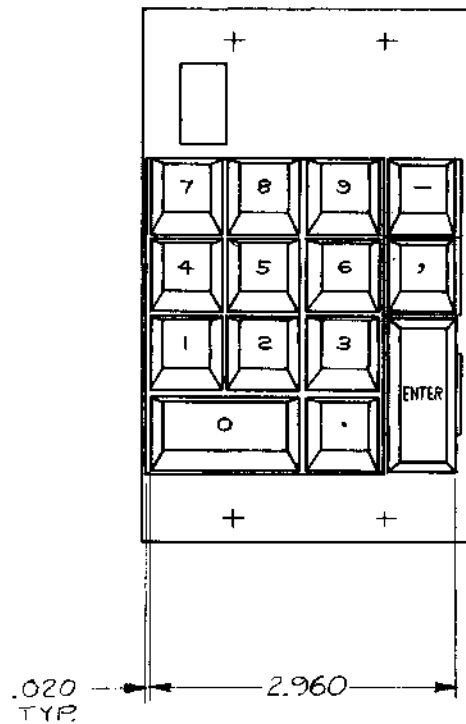
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REVISIONS			TITLE		SIZE CODE	NUMBER	REV.
CHK	CHANGE NO.	REV.	LK02 KEYBOARD		DCS	5410736-0-1	F
			SCALE		SHEET	2 OF 2	DIST.

SHEET NUMBER 5410736-0-1

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REF	TEST SPEC	A-SP-LK02-0-2	4
REF	ENGINEERING SPEC	A-SP-LK02-0-1	3
1	KEYCAP SET	D-PS-1212287-74	2
1	14 KEYSWITCH ARRAY MOD.	D-CS-5411635-0-1	1

QTY.	DESCRIPTION	PART NO.	ITEM NO.
PARTS LIST			
DRN.	<i>B. Gilby</i>	DATE	4-17-75
CHK'D	<i>W. Benson</i>	DATE	7/24/75
ENG.	<i>W. Benson</i>	DATE	7/24/75
PROD. ENG.	<i>F. E. Nelson</i>	DATE	7-28-75
PROD.	<i>J. L. Lutz</i>	DATE	7/24/75
NEXT HIGHER ASSY.			
SIZE CODE	C UA	NUMBER	LK03-A-0
REV.			

FIRST USED ON OPTION/MODEL		
LK03-A		
DIMENSIONAL TOLERANCE		
DIMENSIONS ARE <u>MILLIMETERS</u> INCHES		
UNLESS OTHERWISE SPECIFIED		
MILLIMETERS	INCHES	ANGLES
X,XX ± 0.10	.XXX ± .005	± 0° 30'
X.X ± 0.5	.XX ± .02	
± .2	.X ± .1	
THIRD ANGLE PROJECTION	REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY ✓	
	MATERIAL SEE PARTS LIST	
FINISH	SCALE 1/1	

REVISIONS	REV.
CHANGE NO.	
CHK	

REV. NUMBER LK03-A-0

DEC FORM NO. 500 100-B

CHAPTER 8

ILLUSTRATED PARTS BREAKDOWN

8.1 HOW TO USE THE IPB

8.1.1 General

This IPB is compiled following the organization and nomenclature of the engineering drawing structure.

8.1.2 Major Assembly Locator

The Major Assembly Locator (first illustration) is an index that provides a description and a figure reference for all illustrations used in this chapter.

8.1.3 Indented Parts List

This chapter identifies each assembly being broken down (figure reference callout), and all parts of that assembly. Further breakdown of an assembly is shown by an asterisk (*) preceding the item callouts in the Description Column. The number of asterisks preceding an item is used to denote the subordination of that item with respect to the Major Assembly. A single asterisk preceding an item description indicates that the item is part of the major assembly being illustrated. Items that are subordinate to single asterisk items, are denoted by two asterisks (**) and immediately follow the related single asterisk item. Additional asterisks are used, as required, to denote further subordination. This system of part identification, provides a means for the user to identify the next higher assembly item and make alternate selections for parts when the required replacement part or assembly is not immediately available.

8.1.4 Column Callout Description

8.1.4.1 Figure & Item – Indicates the figure number and item number of each part.

8.1.4.2 Description – Lists the name of the part and pertinent specifications (when required). Asterisks preceding the description denote the subordination of the part to the next higher assembly.

8.1.4.3 DEC Part No. – Lists the DEC part ordering number. A blank in this column indicates a DEC part number was not assigned at the time of publication.

8.1.4.4 ECO Cut-In – The notation at the top of this column indicates the ECO level of the system (option), at which the IPB was initially prepared. Subsequent ECO level designations, that modify existing parts or add new parts to the device, are inserted in the ECO Cut-In column next to the part that is added or modified. A bracket ([]) preceding the item description is used to indicate the parts affected by ECO's.

8.1.4.5 Vendor Code/Part No. – Indicates vendor parts that are not stocked by DEC. Refer to the Field Service Spares Catalog (vendor part number to DEC part number) for the vendor code cross-reference.

8.1.4.6 Used On Code – Letters in this column correspond to the variation codes assigned in Figure 1. Parts with an Alpha notation(s) are used only in those option variations. A blank indicates that the part is used on all option variations.

8.1.4.7 Ref Fig No. – A cross reference between illustrations. For each Major Assembly, the number in this column denotes the figure of the next higher assembly. For all subassemblies, the number in this column denotes the figure showing additional detailed breakdown.

8.1.5 Symbol Usage

8.1.5.1 Hardware Designators – Alpha designators for screws (S), washers (W), nuts (N), and retaining rings (R) are inserted after the item number callouts on the illustration when stacked item numbers are used.

8.1.5.2 Attaching Hardware – The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

8.1.5.3 (NFR) Not Field Repairable – The (NFR) symbol is inserted after any assembly that is not to be field dismantled.

8.1.5.4 Other Symbols – Any other symbols that are required for kits, accessories, etc., will be explained and appear as part of the item description.

ILLUSTRATED PARTS BREAKDOWN

LA36 DECwriter II

HOW TO USE THE IPB

GENERAL

This IPB is compiled following the organization and nomenclature of the engineering drawing structure.

MAJOR ASSEMBLY LOCATOR

The Major Assembly Locator (first illustration) is an index that provides a description and a figure reference for all illustrations used in this manual.

INDENTED PARTS LIST

This manual identifies each assembly being broken down (figure reference callout), and all parts of that assembly. Further breakdown of an assembly is shown by an asterisk (*) preceding the item callouts in the Description Column. The number of asterisks preceding an item is used to denote the subordination of that item with respect to the Major Assembly. A single asterisk preceding an item description indicates that the item is part of the major assembly being illustrated. Items that are subordinate to single asterisks items, are denoted by two asterisks (***) and immediately follow the related single asterisk item. Additional asterisks are used, as required, to denote further subordination. This system of part identification, provides a means for the user to identify the next higher assembly item and make alternate selections for parts when the required replacement part or assembly is not immediately available.

COLUMN CALLOUT DESCRIPTION

Figure & Item — Indicates the figure number and item number of each part.

Description — Lists the name of the part and pertinent specifications (when required). Asterisks preceding the description denote the subordination of the part to the next higher assembly.

DEC Part No. — Lists the DEC part ordering number. A blank in this column indicates a DEC part number was not assigned at the time of publication.

ECO Cut-In — The notation at the top of this column indicates the ECO level of the system (option), at which the IPB was initially prepared. Subsequent ECO level designations, that modify existing parts or add new parts to the device, are inserted in the ECO Cut-In column next to the part that is added or modified. A bracket ([]) preceding the item description is used to indicate the parts affected by ECO's.

Vendor Code/Part No. — Indicates vendor parts that are not stocked by DEC. Refer to the Field Service Spares Catalog (vendor part number to DEC part number) for the vendor code cross-reference.

Used On Code — Letters in this column correspond to the variation codes assigned in Figure 1. Parts with an Alpha notation(s) are used only in those option variations. A blank indicates that the part is used on all option variations.

Ref Fig No. — A cross reference between illustrations. For each Major Assembly, the number in this column denotes the figure of the next higher assembly. For all subassemblies, the number in this column denotes the figure showing additional detailed breakdown.

SYMBOL USAGE

Hardware Designators — Alpha designators for screws (S), washers (W), nuts (N), and retaining rings (R) are inserted after the item number callouts on the illustration when stacked item numbers are used.

Attaching Hardware — The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

(NFR) Not Field Repairable — The (NFR) symbol is inserted after any assembly that is not to be field dismantled.

Other Symbols — Any other symbols that are required for kits, accessories, etc., will be explained and appear as part of the item description.

REVISION HISTORY

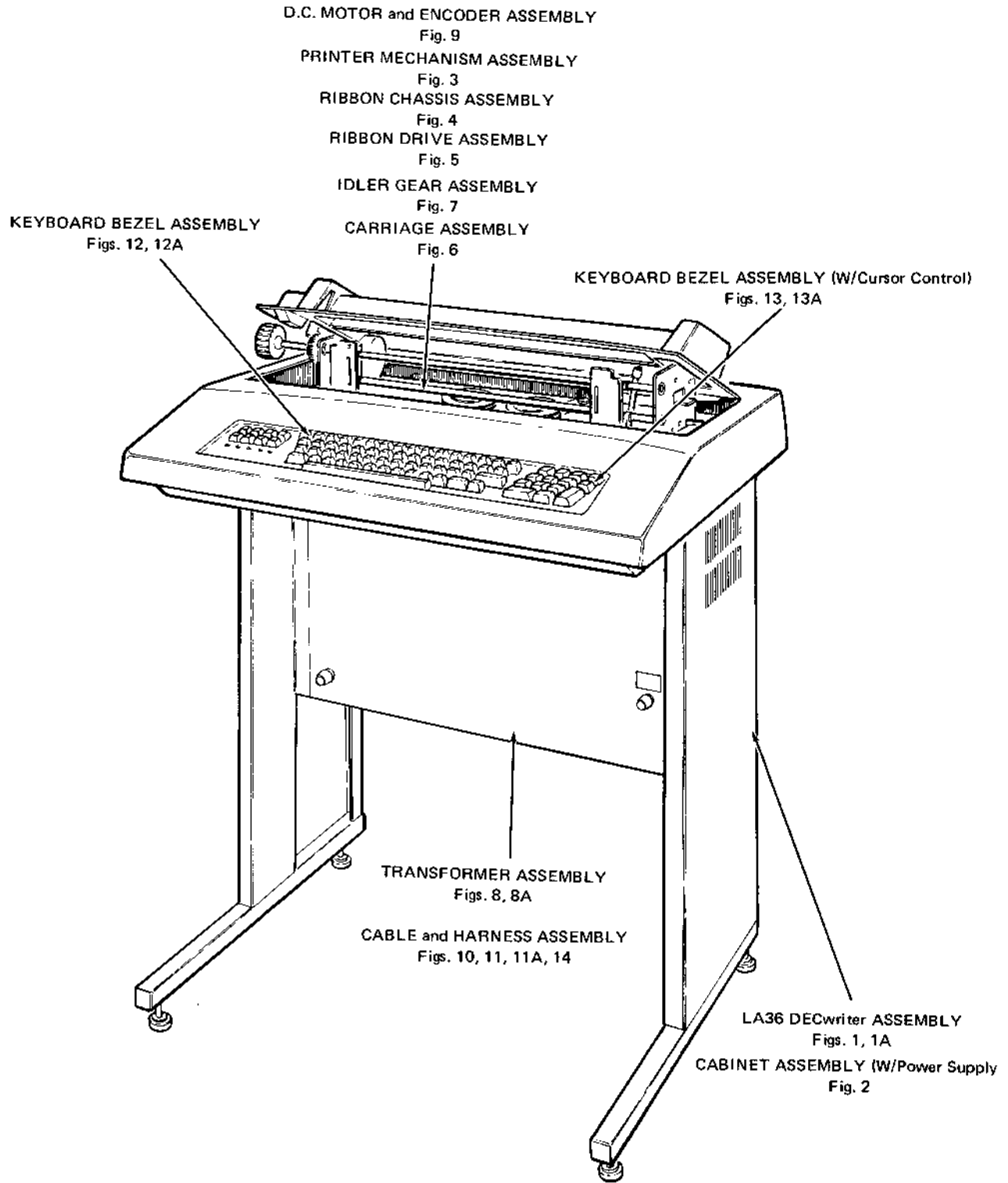
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LA36-01

Major Assembly Locator, LA36 DECwriter II

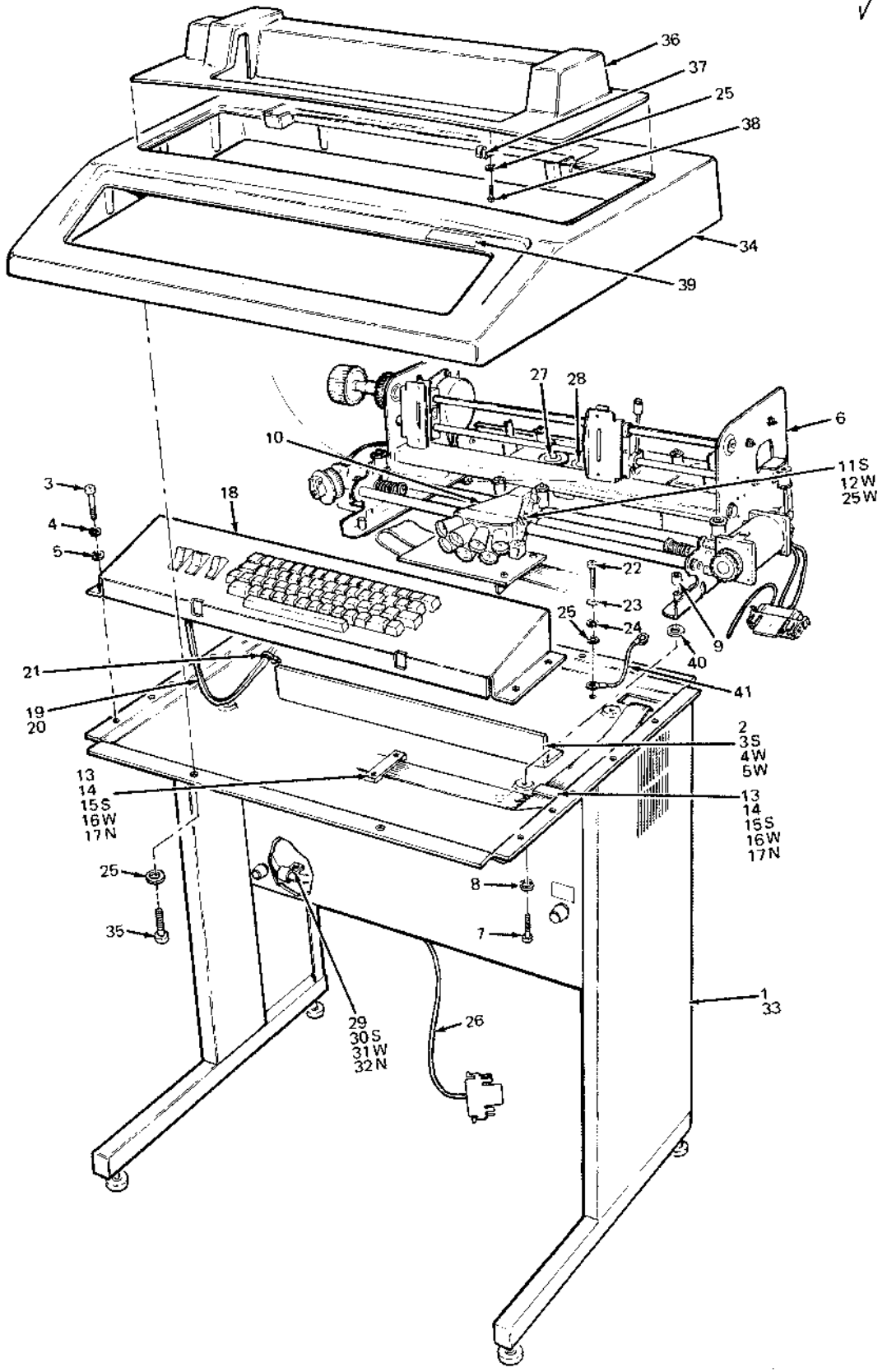


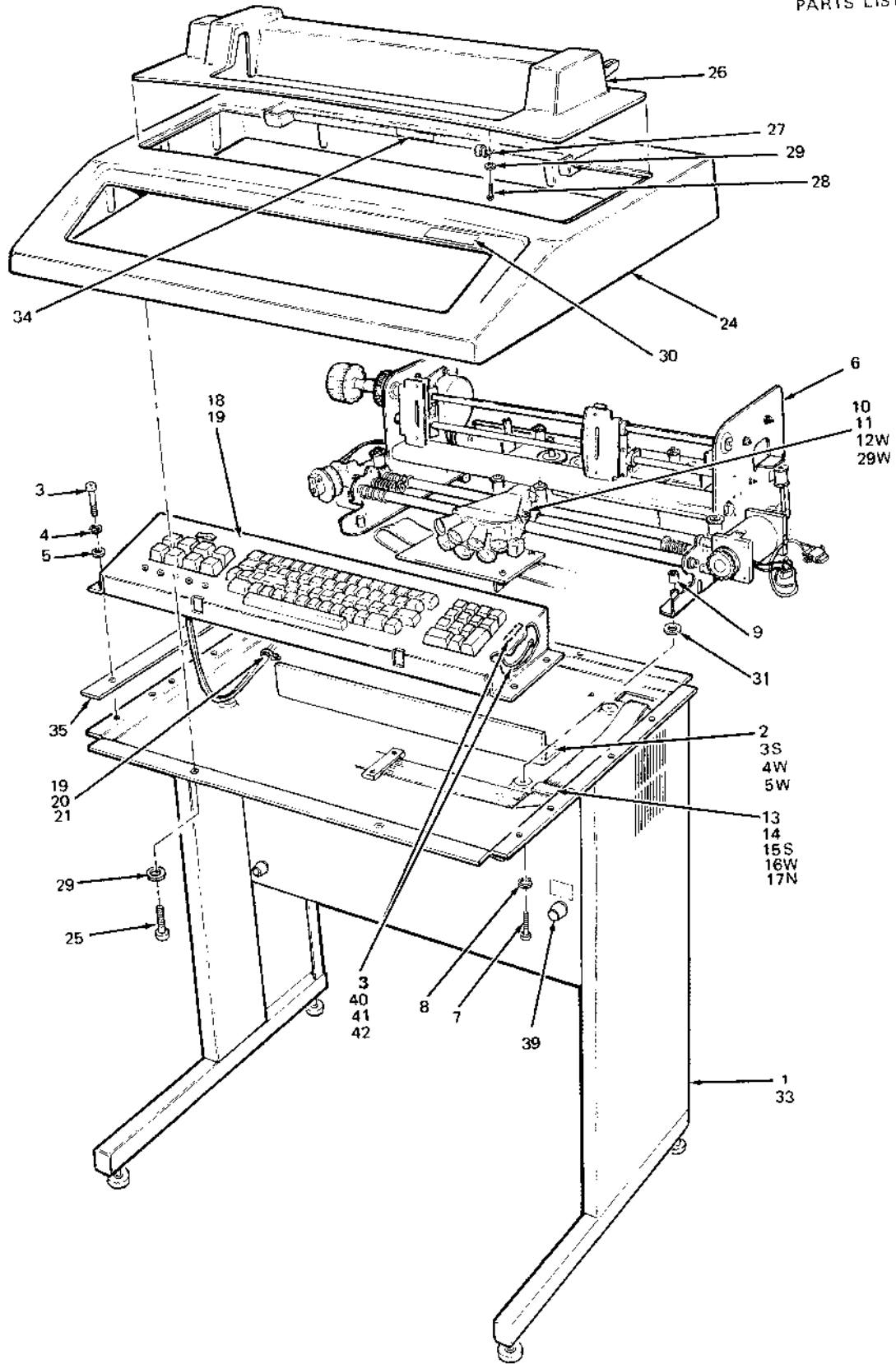
Figure 1. LA36 DECwriter Assembly

LA36-02

IPB-LA36

FIG & ITEM NO.	DESCRIPTION	R DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
1-	MODEL LA36 DECwriter II						
	Code A used on LA36-CA (deleted) (20 mA Current Loop, Numeric Pad, 115V)	LA36-CA	00165	A			
	Code B used on LA36-CB (deleted) (20 mA Current Loop, Numeric Pad, 230V)	LA36-CB	00165	B			
	Code C used on LA36-CC (deleted) (20 mA Current Loop, Numeric Pad, 115V, PDP-10)	LA36-CC	00165	C			
	Code D used on LA36-CD (deleted) (20 mA Current Loop, Numeric Pad, 230V, PDP-10)	LA36-CD	00165	D			
	Code E used on LA36-DA (deleted) (20 mA Current Loop, 115V)	LA36-DA	00165	E			
	Code F used on LA36-DB (deleted) (20 mA Current Loop, 230V)	LA36-DB	00165	F			
	Code G used on LA36-DC (deleted) (20 mA Current Loop, 115V, PDP-10)	LA36-DC	00165	G			
	Code H used on LA36-DD (deleted) (20 mA Current Loop, 230V, PDP-10)	LA36-DD	00165	H			
1	*CABINET ASSEMBLY W/POWER SUPPLY (115V) (deleted)	70-09648-01	00138	ACEG			2
	*CABINET ASSEMBLY W/POWER SUPPLY (230V) (deleted)	70-09648-02	00138	BDFH			2
2	*Guide, Paper (deleted)	74-11430-00					
	*Guide, Paper (added)	74-12158-00	00052				
3	*Screw, Phi Pan Hd No. 8-32 x .38	90-06037-01					
4	*Washer, Flat No. 8	90-06660-00					
5	*Washer, Lock Split No. 8	90-06690-00					
6	*PRINTER MECHANISM ASSEMBLY	70-09696-00					3
7	*Screw, Phi Pan Hd No. 10-32 x .94	90-08955-01					
8	*Washer, Lock Split No. 10	90-07906-00					
9	*Nut, Well No. 10-32	90-08896-00					
10	*PRINT HEAD ASSEMBLY (NFR)	70-09883-00					
11	*Screw, Phi Pan Hd No. 6-32 x .56	90-07793-01					
12	*Washer, Lock Int Tooth No. 6	90-06633-00					
13	*Clamp, Cable	12-02704-00					
14	*Tape, Double Coated, .50 Wide	90-07834-00					
15	*Screw, Phi Pan Hd No. 4-40 x .38	90-06011-01					
16	*Washer, Flat No. 4	90-06658-00					
17	*Nut, Kep No. 4-40	90-06557-00					
18	*KEYBOARD BEZEL ASSEMBLY	70-09750-01		EFGH			12
	*KEYBOARD BEZEL ASSEMBLY (With Numeric Pad)	70-09750-02		ABCD			13
19	*CABLE ASSEMBLY (LA36 Keyboard)	70-10000-00		A-H			11
20	*Jumper (LA36 Keyboard, Not Shown)	70-10001-04					
21	*Cable Tie	90-07031-00					
22	*Screw, Phi Pan Hd No. 6-32 x .38	90-06022-01					
23	*Washer, Lock Ext Tooth No. 6	90-07649-00					
24	*Washer, Lock Split No. 6	90-07801-00					
25	*Washer, Flat No. 6	90-06653-00					

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
1-							
26	*CABLE ASSEMBLY (BC05F Interface)	BC05F-15		ABEF			14
27	*Ribbon Spool (w/Ribbon)	36-10558-00					
28	*Ribbon Spool (Empty)	36-10966-00					
29	*Clamp, Cable (deleted)	90-07089-00	00052				
30	*Screw, Phi Pan Hd No. 10-32 x .38 (deleted)	90-06071-01	00052				
31	*Washer, Flat No. 10 (deleted)	90-06664-00	00052				
32	*Nut, Kep No. 10-32 (deleted)	90-06565-00	00052				
33	*Connector, P2, Pin Housing, Mate-N-Lok (Plugs into PB-J5)	12-09340-01					
34	*Housing	74-11116-00					
35	*Screw, Phi Pan Hd No. 6-18 x .50 (Self Tapping)	90-09630-01					
36	*Cover	74-11122-00					
37	*Clip, Cover	74-11818-00					
38	*Screw, Phi Pan Hd No. 6-18 x .38 (Self Tapping)	90-09622-01					
39	*Nameplate (LA36)	36-11826-00					
40	*Washer, Buna (added)	90-09684-00	00053				
41	*Jumper (added)	70-10001-07	00052				
42	*Spacer, Bezel (added)	74-13675-00	00119				
	Accessories/Options						
	†Paper (Package of 100 sheets)	74-12103-00					
	†Basket, Paper	74-12016-00					
	†Table Top	34-11736-00					
	†Bracket, Table Support	74-11972-00					
	†Table Assembly	70-09897-00					
	†Wheel Assembly	70-09751-00					
	†Wheel, Caster	74-11826-00					
	†Bracket, Wheel	74-11824-00					

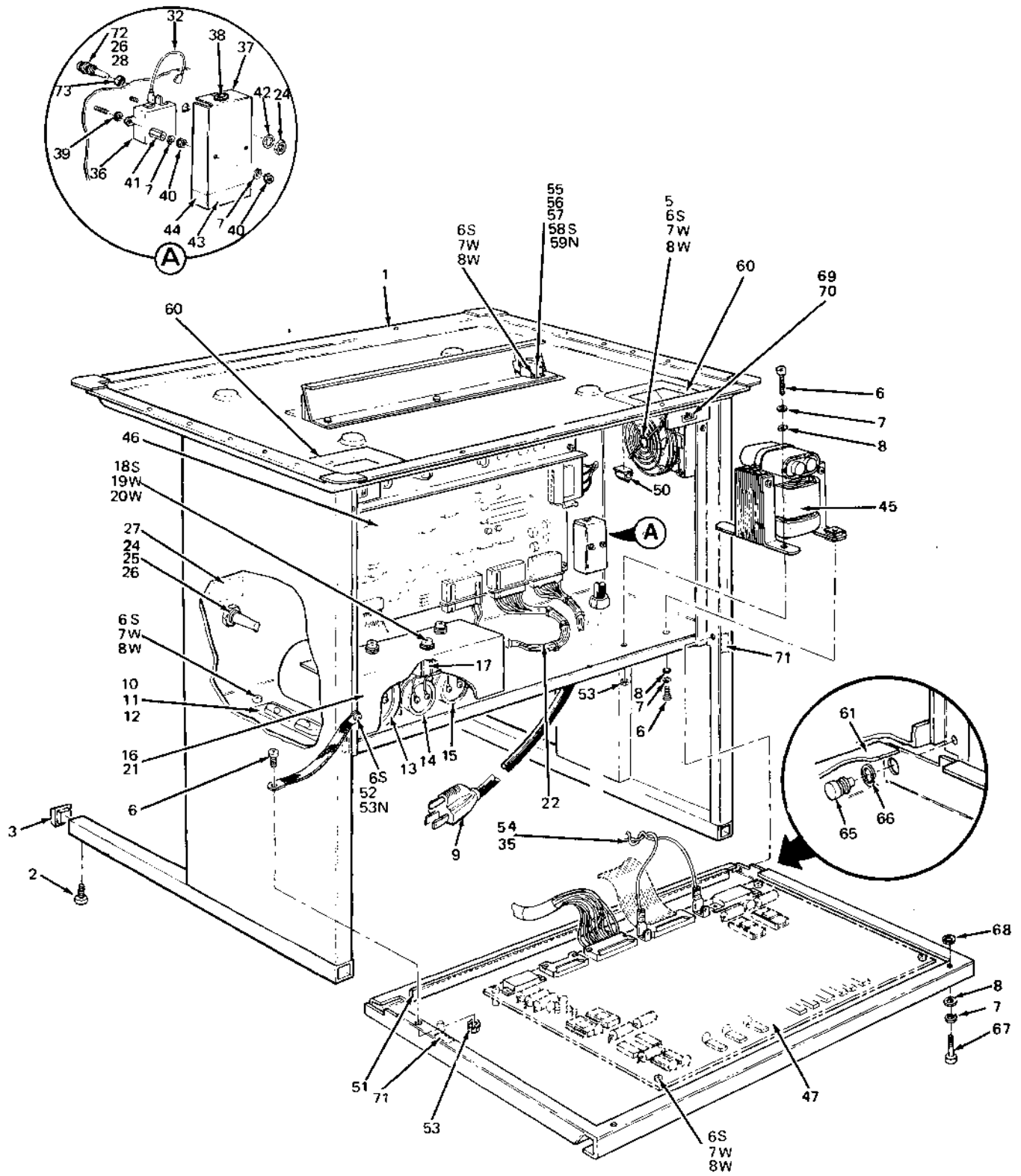


LA36-02A

Figure 1A. LA36 DECwriter Assembly

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00165	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
1A-	MODEL LA36 DECwriter II						
	Code J used on LA36-CE (Numeric Pad, Paper Out, 60 Hz, 90-132 V)	LA36-CE		J			
	Code K used on LA36-CF (Numeric Pad, Paper Out, 60 Hz, 180-264 V)	LA36-CF		K			
	Code L used on LA36-CH (Numeric Pad, Paper Out, 50 Hz, 90-132 V)	LA36-CH		L			
	Code M used on LA36-CJ (Numeric Pad, Paper Out, 50 Hz, 180-264 V)	LA36-CJ		M			
	Code N used on LA36-DE (60 Hz, 90-132 V)	LA36-DE		N			
	Code P used on LA36-DF (60 Hz, 180-264 V)	LA36-DF		P			
	Code Q used on LA36-DH (50 Hz, 90-132 V)	LA36-DH		Q			
	Code R used on LA36-DJ (50 Hz, 180-264 V)	LA36-DJ		R			
1	*CABINET ASSEMBLY W/POWER SUPPLY (110V, 60 Hz)	70-09648-01		J N			2
	*CABINET ASSEMBLY W/POWER SUPPLY (220V, 50 Hz)	70-09648-02		M R			2
	*CABINET ASSEMBLY W/POWER SUPPLY (110V, 50 Hz)	70-09648-03		L Q			2
	*CABINET ASSEMBLY W/POWER SUPPLY (220V, 60 Hz)	70-09648-04		K P			2
2	*Guide, Paper	74-12158-00					
3	*Screw, Phi Pan Hd No. 8-32 x .38	90-06037-01					
4	*Washer, Flat No. 8	90-06660-00					
5	*Washer, Split Lock No. 8	90-06690-00					
6	*PRINTER MECHANISM ASSEMBLY	70-09696-00					3
7	*Screw, Phi Pan Hd No. 10-32 x .94	90-08955-01					
8	*Washer, Split Lock No. 10	90-07906-00					
9	*Nut, Well No. 10	90-08896-00					
10	*PRINT HEAD ASSEMBLY (NFR)	70-09883-00					
11	*Screw, Phi Pan Hd No. 6-32 x .56	90-07793-01					
12	*Washer, Int Tooth Lock No. 6	90-06633-00					
13	*Clamp, Cable	12-02704-00					
14	*Tape, Double Coated, .50 wide	90-07834-00					
15	*Screw, Phi Pan Hd No. 4-40 x .38	90-06011-01					
16	*Washer, Flat No. 4	90-06658-00					
17	*Nut, Keps No. 4-40	90-06557-00					
18	*KEYBOARD BEZEL ASSEMBLY	70-09750-01		NPQR			12A
	*KEYBOARD BEZEL ASSEMBLY W/CURSOR CONTROL	70-09750-02		JKLM			13A
19	*KEYBOARD CABLE ASSEMBLY (LA36)	70-11519-00					11A
20	*Jumper	70-10001-11					
21	*Cable Tie	90-07031-00					
22	*Connector, P2, Pin Housing, 8 Pin Mate-N-Lok (Not Shown)	12-09340-01					
23	*Cable Tie Mount (Not Shown)	90-07867-00					
24	*Housing	74-11116-00					

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00165	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
1A-							
25	*Screw, Phi Pan Hd No. 6-18 x .50 (Self Tapping)	90-09630-01					
26	*Cover	74-11122-00					
27	*Clip, Cover	74-11818-00					
28	*Screw, Phi Pan Hd No. 6-18 x .38 (Self Tapping)	90-09622-01					
29	*Washer, Flat No. 6	90-06653-00					
30	*Nameplate, LA36	36-11826-00					
31	*Washer, Buna (deleted)	90-09684-00	00172				
32	*Jumper	70-10001-07					
33	*Jumper	70-10001-06					
34	*Decal, CAUTION/WARNING	36-12483-00					
35	*Spacer, Bezel	74-13675-00					
36	*Tubing, Heat Shrinkable	90-07253-09					
37	*Cable Tie, Screw Down	90-07033-00					
38	*Clip, Harness	90-08340-00					
39	*Fuse Holder	12-11638-00					
40	*Washer, External Tooth Lock No. 8	90-08072-00					
41	*Nut, Keps No. 8-32	90-06563-00					
42	*Decal, Ground Symbols	36-12680-00					
	ACCESSORIES						
	1Paper, Package of 100 Sheets	74-12103-00					
	1Ribbon Spool, w/Ribbon	36-10966-00					
	1Ribbon Spool, Empty	36-10558-00					

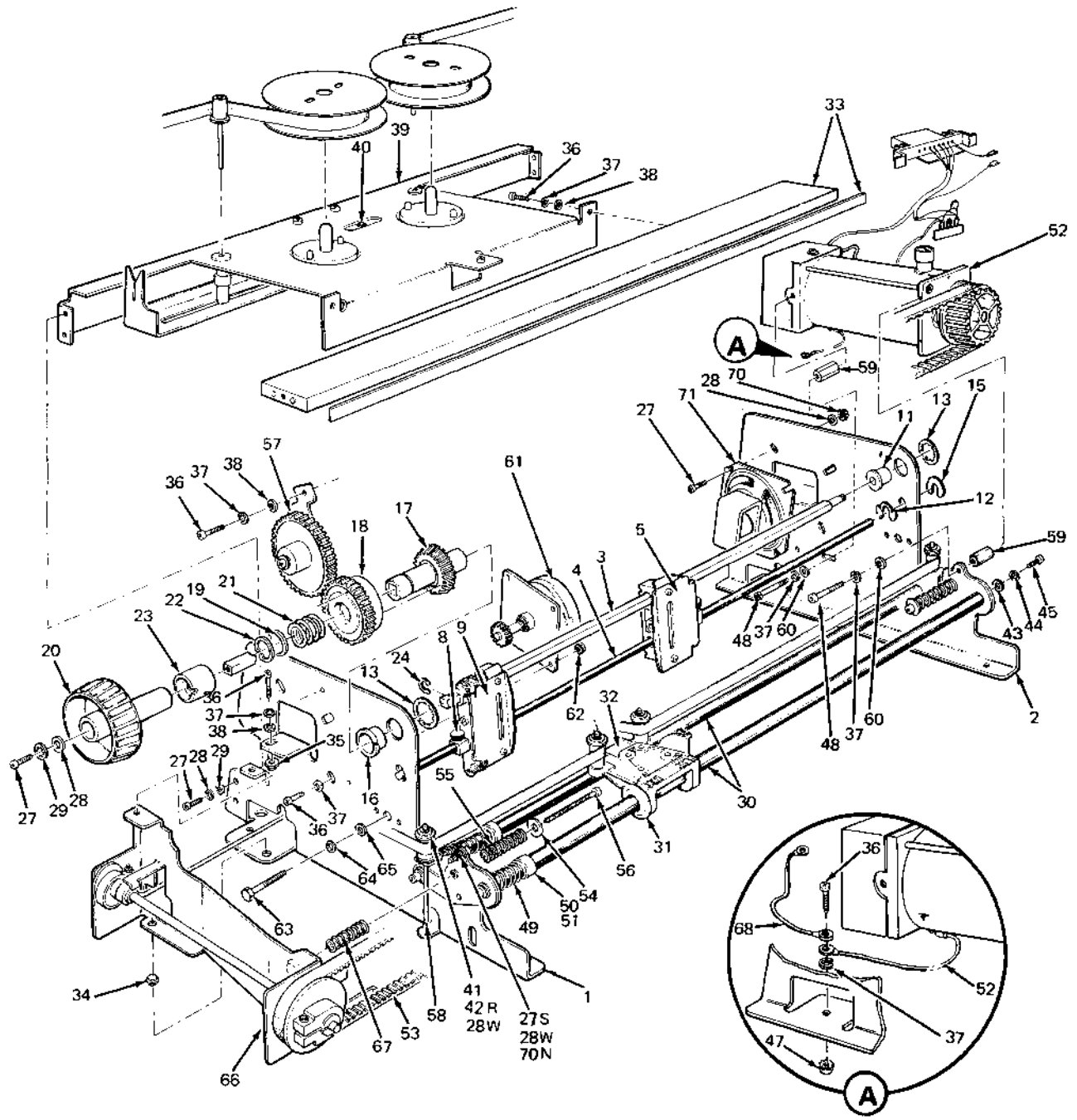


LA36-03A

Figure 2. Cabinet Assembly (W/Power Supply)

FIG & ITEM NO.	DESCRIPTION	A B		USED ON CODE	VENDOR		REF FIG NO.
		DEC PART NO.	ECO CUT-IN LA36 00001		CODE	PART NO.	
2--	CABINET ASSEMBLY W/POWER SUPPLY 115V (deleted)	70-09648-01		ACEG			1A
	CABINET ASSEMBLY W/POWER SUPPLY 110V, 60 Hz (added)	70-09648-01	00138	JN			
	CABINET ASSEMBLY W/POWER SUPPLY 230V (deleted)	70-09648-02		BDFH			
	CABINET ASSEMBLY W/POWER SUPPLY 220V, 50 Hz (added)	70-09648-02	00138	MR			
	CABINET ASSEMBLY W/POWER SUPPLY 110V, 50 Hz (added)	70-09648-03	00138	LQ			
	CABINET ASSEMBLY W/POWER SUPPLY 220V, 60 Hz (added)	70-09648-04	00138	KP			
1	*Frame Assembly	70-09649-00					10
2	*Foot, Leveling (deleted)	70-07601-00					
	*Foot, Leveling (added)	90-09685-00	00059				
3	*Closure, Tubing (deleted)	12-11067-00					
	*Closure, Tubing (added)	12-11067-02	00059				
4	*Bumper, Rubber (deleted)	90-09567-00	00118				
5	*Fan, 115V (115 CFM) Rotron or IMC (deleted)	12-09403-01					
	*Fan, 115V (100 CFM) Torin (deleted)	12-11993-00					
	*Fan, 115V (35 CFM) (added)	12-12581-02	00142				
6	*Screw, Phi Pan Hd No. 8-32 x 1.75 (For Rotron) (deleted)	90-06046-01	00142				
	*Screw, Phi Pan Hd No. 8-32 x .38 (added)	90-06037-01	00164				
7	*Washer, Split Lock No. 8	90-06690-00					
8	*Washer, Flat No. 8	90-06660-00					
9	*POWER CORD ASSEMBLY (115V) (deleted)	70-09673-00		ACEG			
	*POWER CORD ASSEMBLY (120V) (added)	70-09673-00		JNLQ			
	*POWER CORD ASSEMBLY (230V) (deleted)	70-09673-01		BDFH			
	*POWER CORD ASSEMBLY (230V) (added)	70-11045-00		MRKP			
10	*Plate, Cover	74-11607-00					
11	*Strain Relief (deleted)	90-08509-00					
	*Strain Relief (added)	90-09768-00	00164				
12	*Strain Relief	90-09572-00					
13	*Capacitor, 33,000 MFD	10-11545-00					
14	*Capacitor, 18,000 MFD (deleted)	10-11643-00					
	*Capacitor, 37,000 MFD (added)	10-10426-00	00138				
15	*Capacitor, 14,000 MFD	10-10187-00					
16	*Cover, Capacitor (added)	74-15114-00	00164				
17	*Spacer, No. 10-32 x .375 x 3.00 (added)	90-06881-00	00164				
18	*Screw, Phi Pan Hd No. 10-32 x .50 (added)	90-06073-00	00164				
19	*Washer, Split Lock No. 10 (added)	90-07906-00	00164				
20	*Washer, Flat No. 10 (added)	90-06664-00	00164				
21	*Tie Wrap	90-09350-00					
22	*HARNESS ASSEMBLY (Capacitor)	70-09895-00					
23	*Bracket, Fuse Mounting (deleted)	74-11925-00	00052				
24	*Fuse Holder	12-11638-00					
25	*Fuse, Slo-Blo 2 amps	90-07216-00					
26	*Fuse, Slo-Blo 1 amp (deleted)	90-07212-00					
	*Fuse, Slo-Blo 1.5 amp (added)	90-09740-00	00138				
27	*Decal, Fuse	74-13384-00					
28	*Fuse, Slo-Blo 3 amp	90-07218-00					

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
2-							
29	*Capacitor, .1 MFD, 1000V (deleted)	10-00034-00	00052				
30	*Screw, Phi Pan Hd No. 6-32 x .38 (deleted)	90-06022-01	00052				
31	*Nut, Kep No. 6-32 (deleted)	90-06560-00	00052				
32	*Jumper (deleted)	70-10001-04					
	*Jumper (added)	70-10001-08	00139				
33	*Jumper (deleted)	70-10001-02	00139				
34	*Jumper	70-10001-12	00177				
35	*Jumper (added)	70-10001-11	00161				
36	*Filter, EMI (added)	12-12003-00	00052				
37	*Cover, EMI Filter (added)	74-13286-00	00052				
38	*Grommet, Rubber (added)	90-07013-00	00052				
39	*Washer, Ext Tooth No. 8 (added)	90-08072-00	00052				
40	*Nut, Hex No. 8-32 (added)	90-06561-00	00163				
41	*Spacer, No. 8 x .75 (added)	90-07868-00	00163				
42	*Washer, Int Tooth (added)	90-08292-00	00156				
43	*Grommet (added)	90-09718-02	00156				
44	*Grommet (added)	90-09718-03	00156				
45	*TRANSFORMER ASSEMBLY (deleted)	70-09779-00		A-H			8
	*TRANSFORMER ASSEMBLY (60 Hz) (added)	70-09779-01	00138	JNKP			8A
	*TRANSFORMER ASSEMBLY (50 Hz) (added)	70-09779-02	00138	LQMR			8A
46	*Power Board Assembly	54-10805-00					
47	*Logic Board Assembly (deleted)	M7722	00103				
	*Logic Board Assembly (deleted)	M7723					
	*Logic Board Assembly (added)	M7728	00135				
48	*Jumper, 110V	70-09905-01					
49	*Jumper, 220V	70-09905-02					
50	*Clip, Harness (added)	90-08340-00	00162				
51	*Grommet (added)	90-09718-00	00162				
52	*Ground Strap (added)	90-06990-00	00021				
53	*Nut, Kep No. 8-32 (added)	90-06563-00	00021				
54	*Tubing, Heat Shrink (added)	91-07253-09	00161				
55	*Cable, Paper out (added)	70-11657-00	00162				
56	*Switch, Rework (added)	74-12424-00	00162				
57	*Paper Guide (added)	74-12158-00	00162				
58	*Screw, Phi Pan Hd No. 4-40 x 9/16 (added)	90-08033-01	00162				
59	*Nut, Keps No. 4-40 (added)	90-06557-00	00162				
60	*Foam, Protective	74-14144-00					
61	*Door, Cabinet	74-11120-00					
62	*Bushing, Snap in Nylon (deleted)	90-09561-00	00164				
63	*Bushing, Nylon (deleted)	90-09565-01	00164				
64	*Screw, Hex Hd Cap No. 3/8-16 x 1.0 (deleted)	90-08922-09	00164				
65	*Pivot, Door (added)	74-15068-00	00164				
66	*E-Ring, External (added)	90-09773-00	00164				
67	*Screw, Special (added)	74-15067-00	00164				
68	*E-Ring, External (added)	90-09772-00	00164				
69	*Catch, Door Strike	90-09571-00					
70	*Catch, Door Latch	90-09571-01					
71	*Decal, Ground (added)	36-12680-00	00162				
72	*Fuse Holder (added)	12-12893-00	00177				
73	*Spacer, Fuse Holder (added)	74-15374-00	00177				

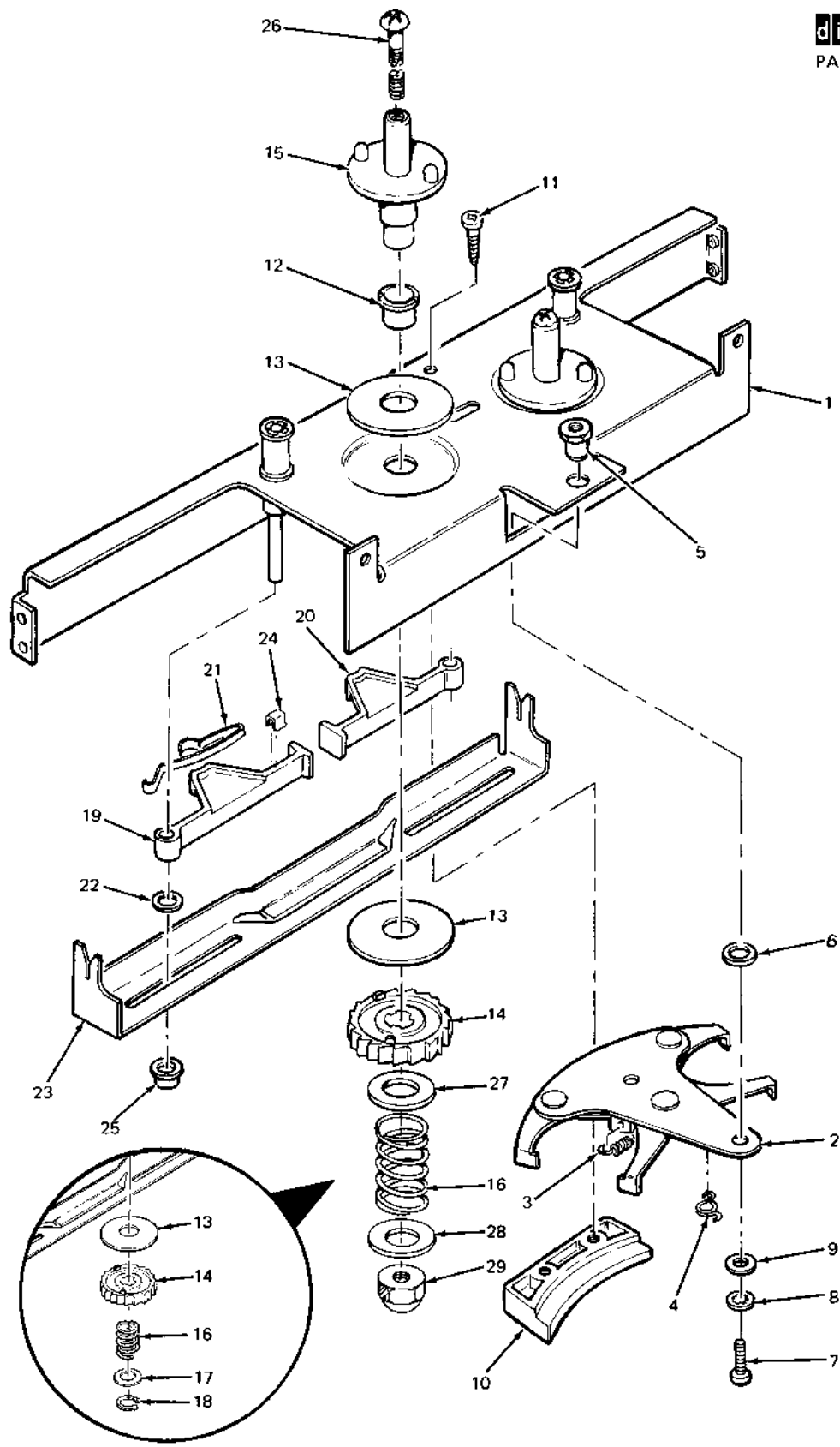


LA36-07A

Figure 3. Printer Mechanism Assembly

FIG & ITEM NO.	DESCRIPTION	T DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
3-	PRINTER MECHANISM ASSEMBLY	70-09696-00					1A
1	*Plate, Side (LH)	74-11028-01					
2	*Plate, Side (RH)	74-11028-02					
3	*Shaft, Tractor Drive	74-11075-00					
4	*Shaft, Tractor Support	74-11076-00					
5	*TRACTOR ASSEMBLY (RH) (deleted)	70-09693-03					
	*TRACTOR ASSEMBLY (RH) w/Lock (added)	12-11662-05	00173				
6	**Shaft, Screw (deleted)	74-11908-00	00173				
7	**Retaining Ring (added)	90-09582-00	00039				
	**Retaining Ring (deleted)	90-09582-00	00173				
8	*Screw, Tractor Lock (added)	74-14433-00					
9	*TRACTOR ASSEMBLY (LH) (deleted)	70-09693-04					
	*TRACTOR ASSEMBLY (LH) w/Lock (added)	12-11662-04	00173				
10	*Washer, Flat No. 10 (deleted)	90-06664-00	00028				
11	*Bushing, Tractor Shaft Retaining	74-11425-00					
12	*Retaining Ring	90-09579-00					
13	*Retaining Ring Push-on	90-09257-00					
14	*Retaining Ring (deleted)	90-07975-00	00028				
15	*Retaining Ring Prong Lock	90-09581-00					
16	*Collar, Side Plate	74-11098-03					
17	*Hub, Clutch	74-11441-00					
18	*Gear, Drive Clutch	74-11440-00					
19	*Washer, Clutch	74-11443-00					
20	*Knob, Line Feed	74-11437-00					
21	*Spring, Compression	90-09592-00					
22	*Retaining Ring	90-09580-02					
23	*Adapter, Line Feed	74-12535-00					
24	*Retaining Ring (added)	90-09644-00	00028				
25	*Spring, Compression (added)	12-12353-00	00154				
	*Spring, Compression (deleted)	12-12353-00	00173				
26	*Washer, .697 OD x .375 ID x .062 (added)	90-07858-00	00154				
	*Washer, .697 OD x .375 ID x .062 (deleted)	90-07858-00	00173				
27	*Screw, Nylock 6-32 x .50 (deleted)	90-09591-01					
	*Screw, Phi Pan Hd No. 6-32 x .38 (added)	90-06022-00	00028				
28	*Washer, Flat No. 6	90-06653-01					
29	*Washer, Int Tooth Lock No. 6	90-06633-00					
30	*Shaft, Carriage	74-11033-00					
31	*CARRIAGE ASSEMBLY	70-09692-00					6
32	*Bushing, Plain	74-11108-00					
33	*PRINT BAR ASSEMBLY	70-10683-00					
34	*Pivot, Lower	74-11439-00					
35	*Ratchet, Pivot	74-11103-00					
36	*Screw, Phi Pan Hd No. 8-32 x .38	90-06037-01					
37	*Washer, Split Lock No. 8	90-06690-00					
38	*Washer, Flat No. 8	90-06660-00					
39	*RIBBON CHASSIS ASSEMBLY	70-09689-00					4
40	*Retaining Ring	90-09580-00					
41	*Frame, Ribbon Idler w/Bushing	74-11576-00					
42	*Retaining Ring	90-09273-00					
43	*Washer, Flat No. 10	90-06664-00					
44	*Washer, Split Lock No. 10	90-07906-00					

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR CODE	PART NO.	REF FIG NO.
3-							
45	*Screw, Socket Hd Cap No. 10-32 x .50	90-06346-08					
46	*Spring, Compression	90-09673-00					
47	*Nut, Lock No. 8-32	90-09061-00					
48	*Screw, Socket Hd Cap No. 8-32 x 1.00	90-07988-08					
49	*Spring (added)	74-13699-00	00082				
50	*Wick (added)	74-13698-00	00082				
51	*Reservoir, Oil (added)	74-13672-00	00082				
52	*DC MOTOR and ENCODER ASSEMBLY	70-09691-00					9
53	*Belt, Timing (deleted)	12-11583-00					
	*Belt, Timing (added)	12-11583-01	00155				
54	*Retainer, Bumper Spring	74-11412-00					
55	*Spring, Carriage Bumper	74-11816-00					
56	*Screw, Phi Pan Hd No. 10-32 x 2.00	90-06081-01					
57	*IDLER GEAR ASSEMBLY	70-09694-00					7
58	*Shaft, Idler	74-11575-00					
59	*Standoff, Hex .620	90-09583-00					
60	*Washer, Flat No. 8 x .062	90-06662-00					
61	*Stepping Motor, 16 V DC	12-11563-00					
62	*Nut, Kep No. 8-32	90-06563-00					
63	*Screw, Hex Hd Machine No. 1/4-20 x .50	90-06241-09					
64	*Washer, Split Lock No. 1/4	90-07797-00					
65	*Washer, Flat No. 1/4	90-06676-00					
66	*RIBBON DRIVE ASSEMBLY	70-09690-00					5
67	*Spring, Compression	90-09578-00					
68	*Ground Strap	70-10001-05					
69	*Decal, Ground Symbol (added)	36-12680-00	00166				
70	*Nut, Kep No. 6-32	90-06560-00					
71	*Speaker, 2-1/2 in. Perm Magnet	12-10299-00					

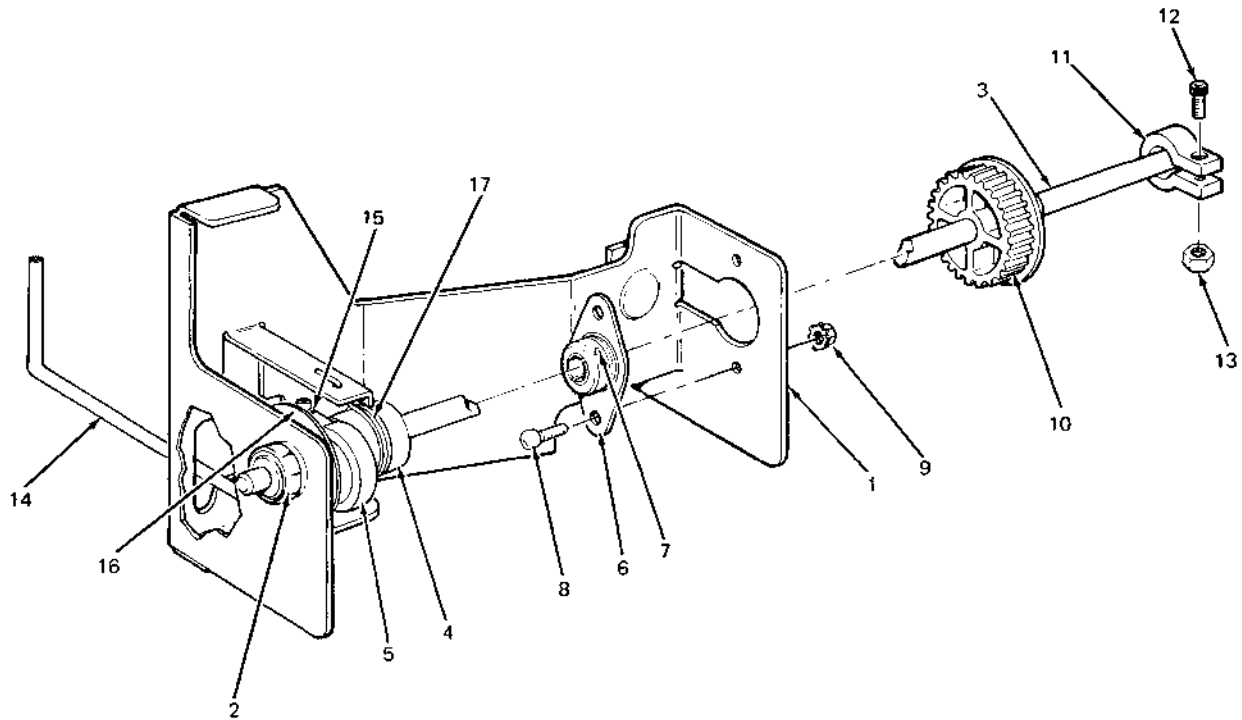


LA36-09A

Figure 4. Ribbon Chassis Assembly

FIG & ITEM NO.	DESCRIPTION	M DEC PART NO.	ECO CUT-IN 70-09689 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
4-	RIBBON CHASSIS ASSEMBLY	70-09689-00					3
1	*Chassis, Ribbon w/Inserts	70-09680-00					
2	*Base Assembly, Ratchet	70-09697-00					
3	*Spring, Upper Pawl	74-11105-00					
4	*Spring, Main Pawl	74-11090-00					
5	*Pivot, Ratchet	74-11103-00					
6	*Washer, Ratchet	74-11061-00					
7	*Screw, Phi Pan Hd No. 8-32 x .31	90-06036-01					
8	*Washer, Lock Int Tooth No. 8 (deleted)	90-06634-00	LA36 00113				
	*Washer, Split Lock No. 8	90-06690-00					
9	*Washer, Flat No. 8	90-06662-00					
10	*Guide, Shoe	74-11419-00					
11	*Screw, Phi Pan Hd No. 8-32 x .38, Self Tapping	90-09586-01					
12	*Collar, Side Plate	74-11098-02					
13	*Disk, Friction	74-11405-00	LA36 00083				
14	*Wheel, Ratchet	74-11432-00					
15	*Driver, Spool	74-11048-00					
16	*Spring, Compression (deleted)	90-09584-00	LA36 00116				
	*Spring, Compression (added)	12-12353-00					
17	*Washer, Brake (deleted)	74-11106-00	LA36 00079				
18	*Retaining Ring (deleted)	90-09580-00	LA36 00079				
19	*Interposer, L.H.	74-11058-01					
20	*Interposer, R.H.	74-11058-02					
21	*Spring, Interposer	74-11087-00					
22	*Washer, Flat No. 6 (deleted)	90-06707-00	LA36 00113				
	*Washer, Flat No. 6 (added)	90-06634-00					
23	*Sensor, Reverse	74-11060-00					
24	*"U" Clip (added)	90-09748-00	LA36 00143				
25	*Cap, Standoff Spool	74-12976-00					
26	*Screw, Phi Pan Hd No. 8-32 x 2.75 (added)	90-06050-01	LA36 00083				
27	*Washer, .687 x .375 (added)	90-07858-00	LA36 00083				
28	*Washer, .625 x .200 (added)	90-06668-00	LA36 00083				
29	*Nut, Elastic Stop No. 8-32 (added)	90-09061-00	LA36 00083				

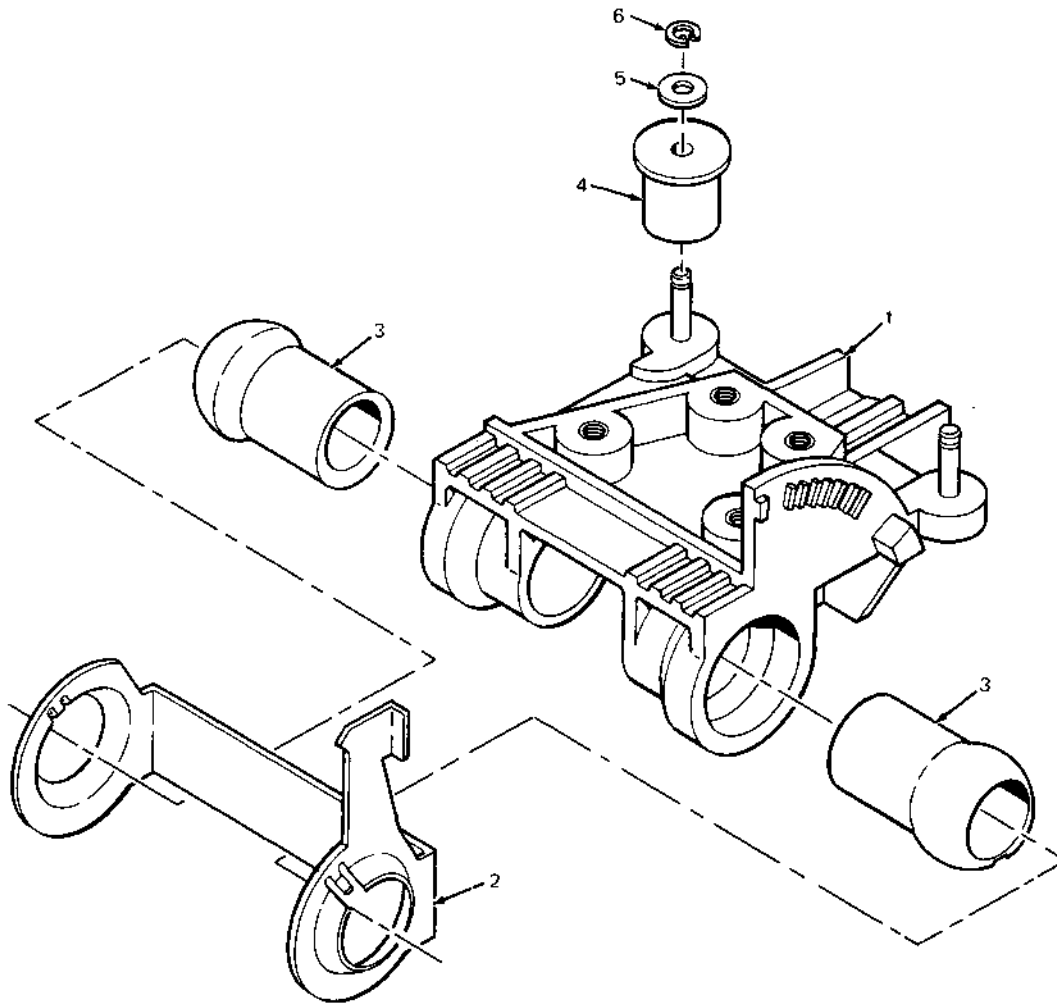
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	F ECO CUT-IN LA36 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
5-	RIBBON DRIVE ASSEMBLY	70-09690-00					3
1	*Bracket, Ribbon Drive	74-11113-00					
2	*Bearing, Self Aligning	12-11649-00					
3	*Shaft, Ribbon Idler	74-11068-00					
4	*Ribbon Eccentric, w/Clutch	74-11578-00					
5	*Rod, End	74-11084-00					
6	*Bearing	12-11650-00					
7	*Screw, Soc Hd Cap No. 4-40 x .12	90-09651-08					
8	*Screw, Phl Pan Hd No. 8-32 x .31	90-06036-01					
9	*Nut, Kep No. 8-32	90-06563-00					
10	*Pulley, Timing (deleted)	74-11035-02	00155				
	*Pulley, Timing (added)	12-12446-00					
11	*Clamp, Collar	74-11124-00					
12	*Screw, Soc Hd Cap No. 6-32 x .38	90-08045-08					
13	*Nut, Hex No. 6-32	90-08957-00					
14	*Pushrod	74-11046-00					
15	*Retaining Ring	90-09580-00					
16	*Washer, Eccentric	74-11123-00					
17	*Spring, Backstop	74-11426-00					



LA36-08A

Figure 5. Ribbon Drive Assembly

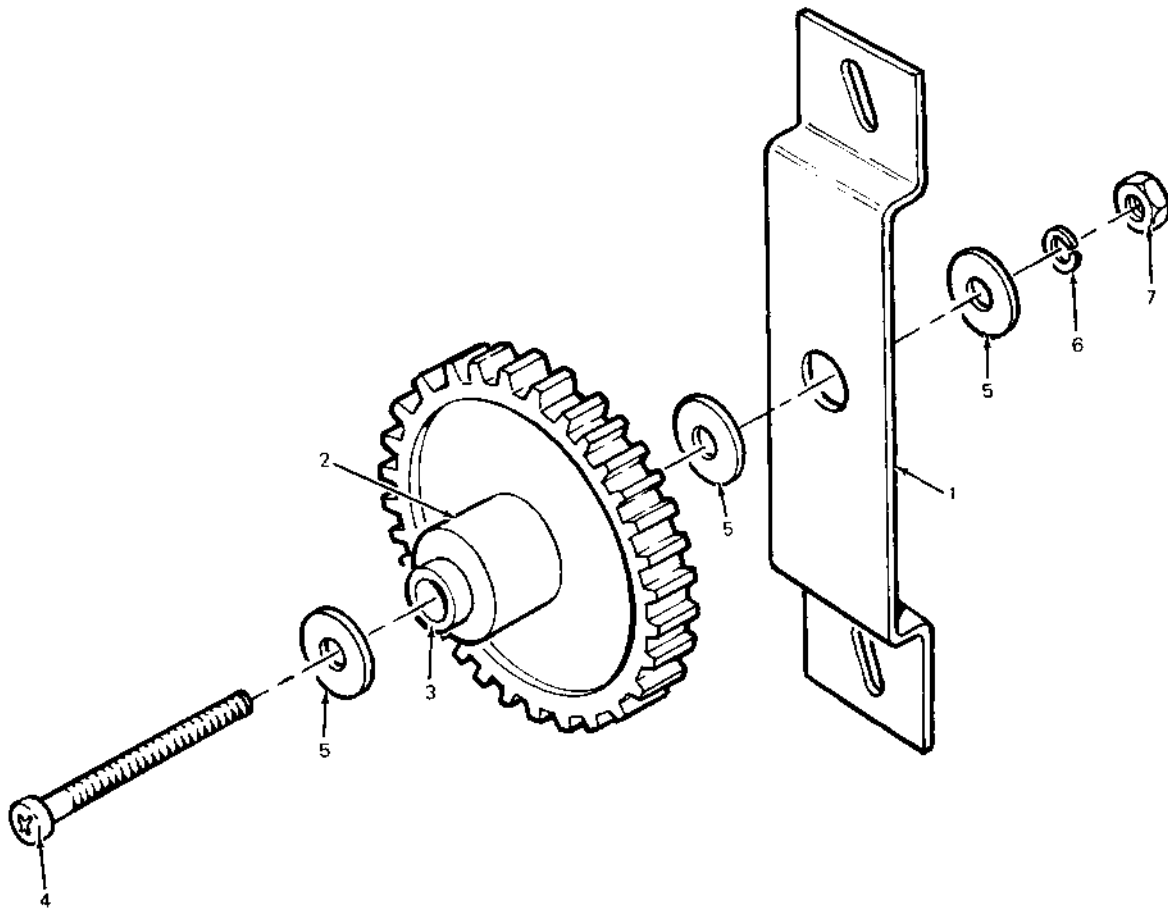
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09692 00000	USED ON CODE	VENDOR		REF FIG. NO.
					CODE	PART NO.	
6-	CARRIAGE ASSEMBLY	70-09692-00					3
1	*Carriage	74-11109-00					
2	*Lever, Carriage Adjustment	74-11110-00					
3	*Bushing, Eccentric	74-11107-00					
4	*Idler, Carriage Ribbon, w/Idler	74-11577-00	LA36 00011				
5	*Washer, Flat No. 6	90-06653-00					
6	*Retaining Ring	90-08528-00					



LA36-12

Figure 6. Carriage Assembly

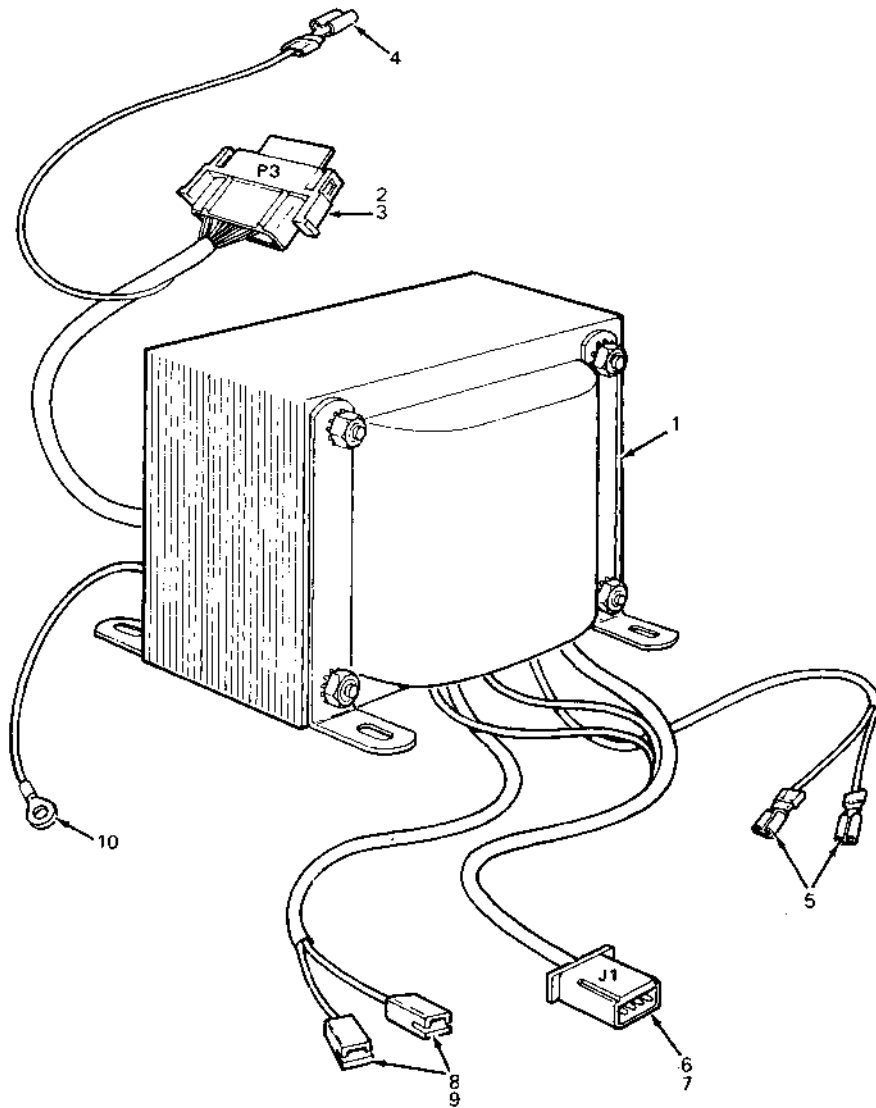
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09694 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
7-	IDLER GEAR ASSEMBLY	70-09694-00					3
1	*Bracket, Gear	74-11420-00					
2	*Gear, 48 Tooth	12-11656-00					
3	*Tube, Idler	74-11424-00					
4	*Screw, Phi Pan Hd No. 8-32 x 1.00	90-06043-01					
5	*Washer, Flat No. 8	90-06666-00					
6	*Washer, Split Lock No. 8	90-06690-00					
7	*Nut, Hex No. 8-32	90-06561-00					



LA36-13

Figure 7. Idler Gear Assembly

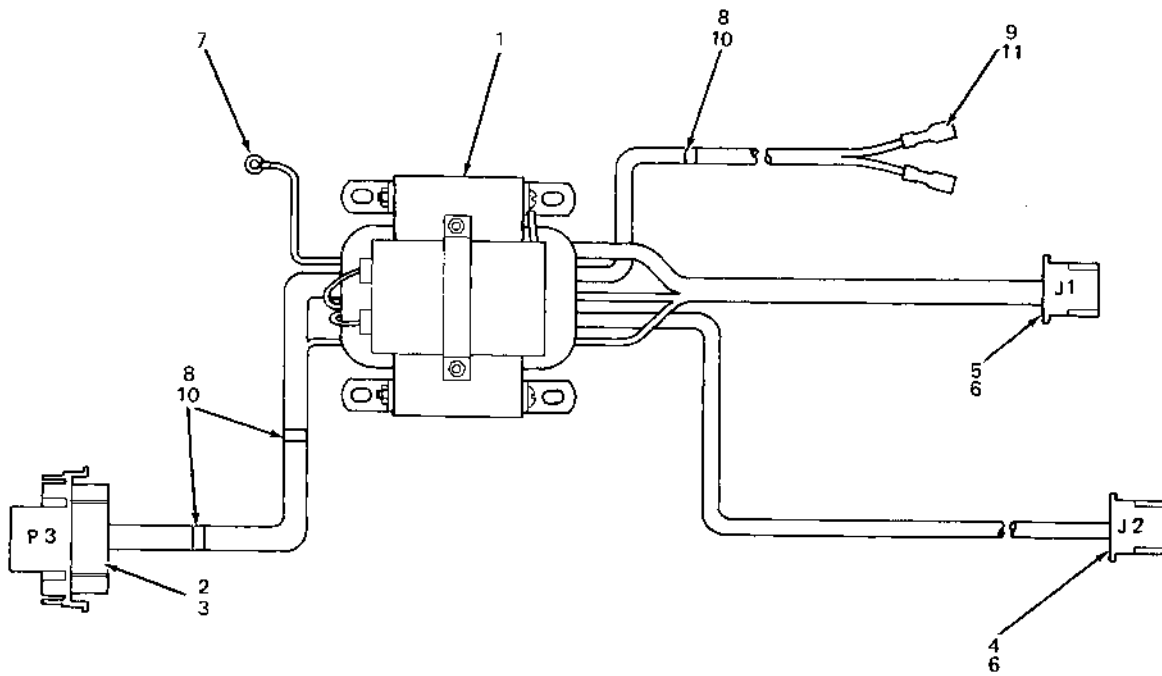
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	F ECO CUT-IN LA36 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
8-	TRANSFORMER ASSEMBLY (deleted)	70-09779-00	00138				2
1	*Power Transformer (deleted)	16-11482-00	00138				
2	*Connector (P3) Pin Housing, 8 Pin Mate-N-Lok	12-09340-01					
3	*Terminal, Pin Contact	12-09378-00					
4	*Terminal, Quick-Connect (deleted)	90-07919-00	00052				
5	*Terminal, Quick-Connect (deleted)	90-07917-00	00124				
6	*Connector (J1) Free-Hanging, 4 Socket Mate-N-Lok (deleted)	12-10821-04	00124				
7	*Terminal, Socket Contact (deleted)	12-09379-00	00124				
8	*Connector (J2, J3) Socket Housing AMP (deleted)	12-10820-01	00124				
9	*Terminal, Socket Contact (deleted)	12-10820-02	00124				
10	*Terminal, Ring Tongue	90-07928-00					



LA36-06

Figure 8. Transformer Assembly

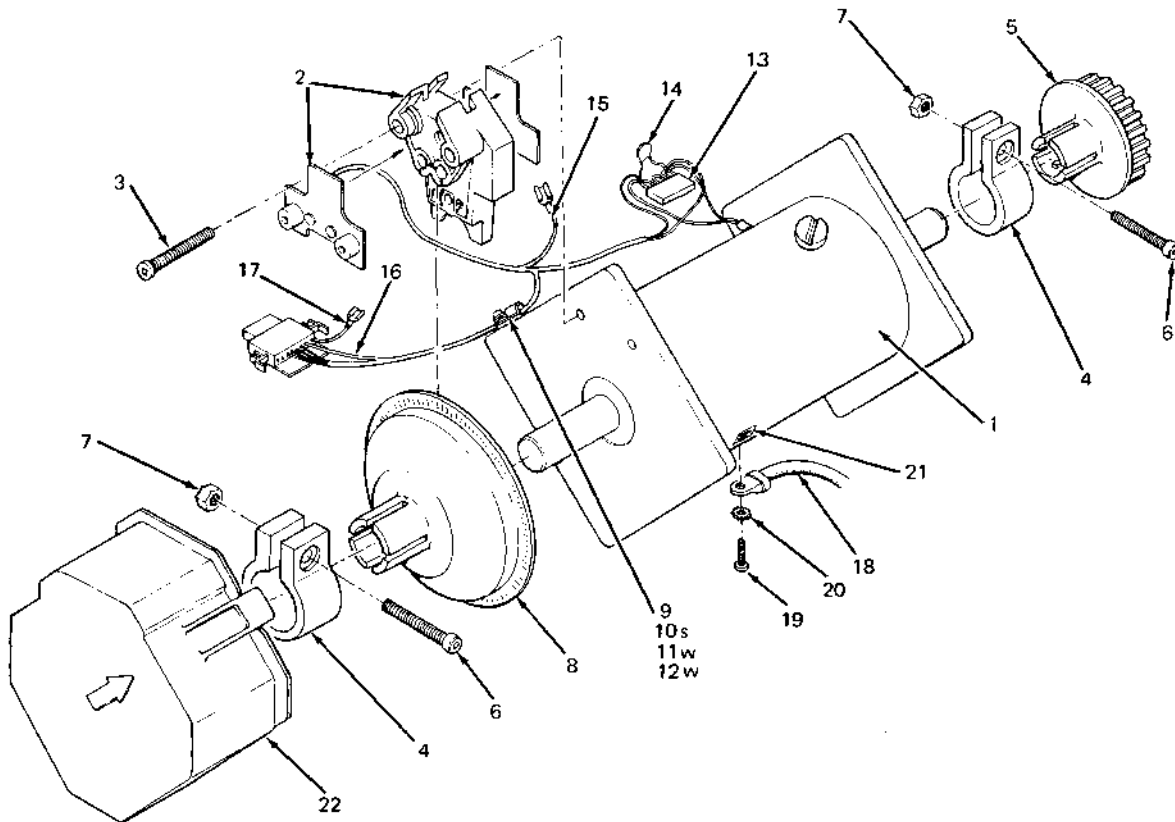
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00138	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
8A-	TRANSFORMER ASSEMBLY Transformer Assembly (60 Hz) Transformer Assembly (50 Hz)	70-09779-01 70-09779-02					2
1	*Power Transformer (60 Hz) *Power Transformer (50 Hz)	16-12522-00 16-12521-00					
2	*Connector (P3), Pin Housing, 8 Pin Mate-N-Lok	12-09340-01					
3	*Terminal, Pin Contact	12-09378-00					
4	*Connector (J2) Pin Housing, 3 Pin Mate-N-Lok	12-10821-03					
5	*Connector (J1) Pin Housing, 4 Pin Mate-N-Lok	12-09351-04					
6	*Terminal, Pin Contact	12-09379-00					
7	*Terminal, Ring Tongue	90-07928-00					
8	*Cable Tie	90-07031-00					
9	*Tubing, Heat Shrinkable	91-07253-09					
10	*Tubing, Extruded	91-07244-00					
11	*Terminal, Quick Connect	90-07970-00					



LA36-06A

Figure 8A. Transformer Assembly

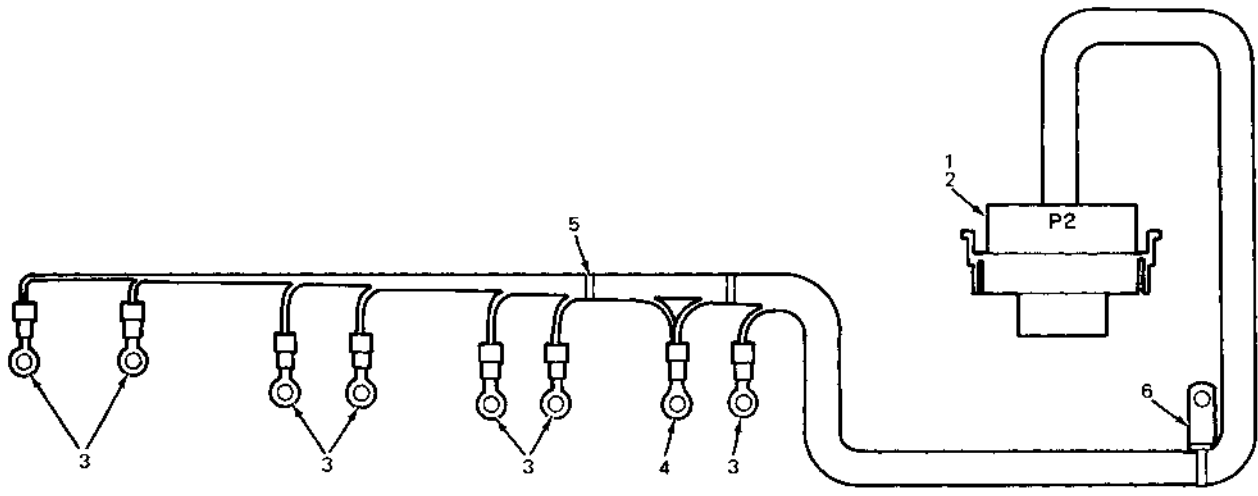
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00166	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
9-	D.C. MOTOR and ENCODER ASSEMBLY	70-09691-00					3
1	*Motor, D.C.	70-09780-00					
2	*Encoder Base Harness Assembly	70-09777-00					
3	*Screw, Phi Pan Hd No. 4-40 x .75	90-06015-01					
4	*Clamp, Collar	74-11124-00					
5	*Pulley, Timing	74-11035-01					
6	*Screw, Soc Hd Cap No. 6-32 x .38	90-08045-08					
7	*Nut, Hex No. 6-32	90-08957-00					
8	*Disk Assembly	70-09778-00					
9	*Clamp, Cable	90-07079-00					
10	*Screw, Phi Pan Hd No. 8-32 x .31	90-06036-01					
11	*Washer, Split Lock No. 8	90-06090-00					
12	*Washer, Flat No. 8	90-06661-00					
13	*Terminal, Strip Tie Down	90-07004-00					
14	*Capacitor (.01 MFD)	10-01010-01					
15	*Jumper	70-10001-09					
16	*Jumper	70-10001-10					
17	*Jumper	70-10001-07					
18	*Jumper	70-10001-05					
19	*Screw, Phi Pan Hd No. 6-32 x .18	90-08020-01					
20	*Washer, Ext Tooth No. 6	90-07649-00					
21	*Decal, Ground	36-12680-00					
22	*Dust Cover, Encoder	74-11416-00					



LA36-18

Figure 9. D.C. Motor and Encoder Assembly

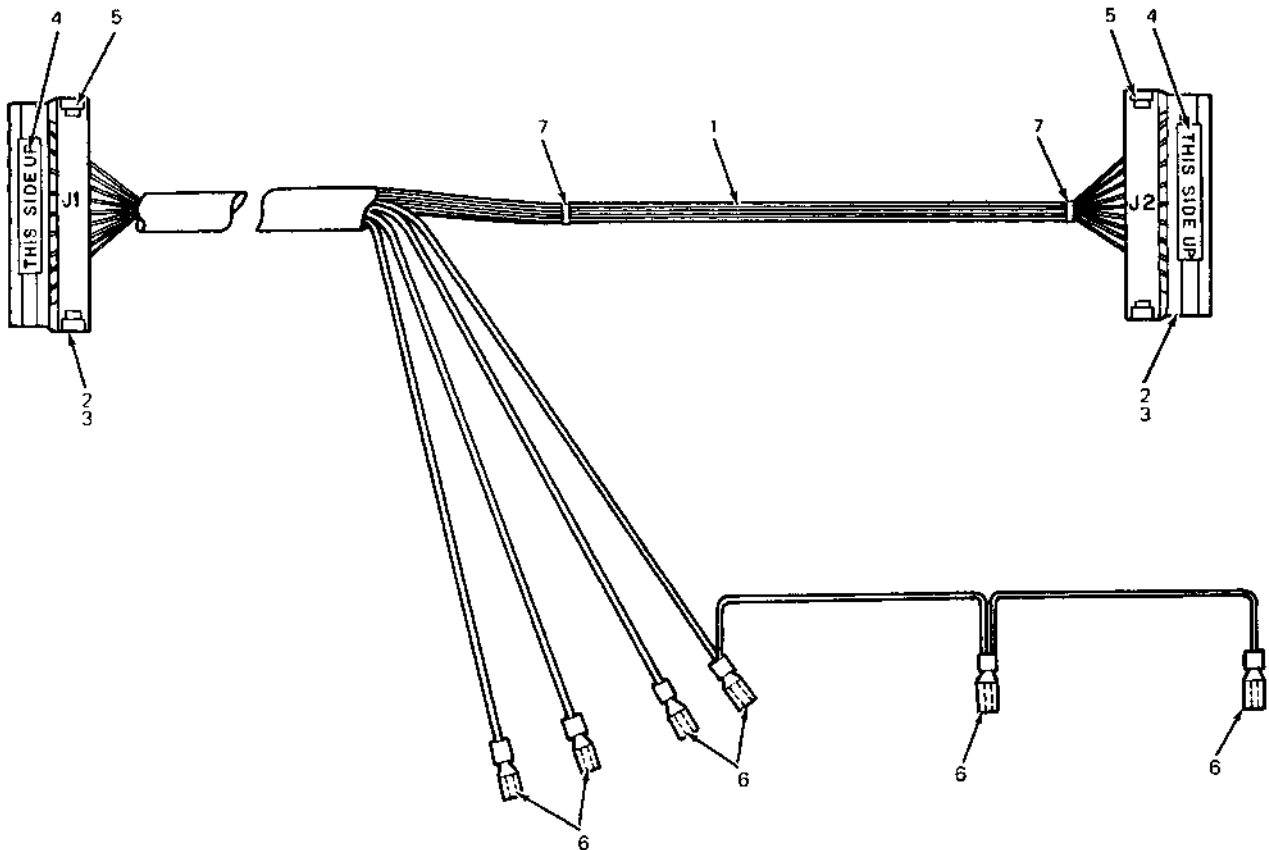
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09895 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
10-	CAPACITOR HARNESS ASSEMBLY	70-09895-00					2
1	*Connector, P2, Pin Housing, 8 Pin Mate-N-Lok	12-09340-01					
2	*Terminal, Pin Contact	12-09378-00					
3	*Connector, Solderless	90-07928-00					
4	*Connector, Solderless	90-07926-00					
5	*Tie Wrap	90-07031-00					
6	*Tie Wrap, Screw Down (deleted)	90-07033-00	LA36 00181				



LA36-05

Figure 10. Capacitor Harness Assembly

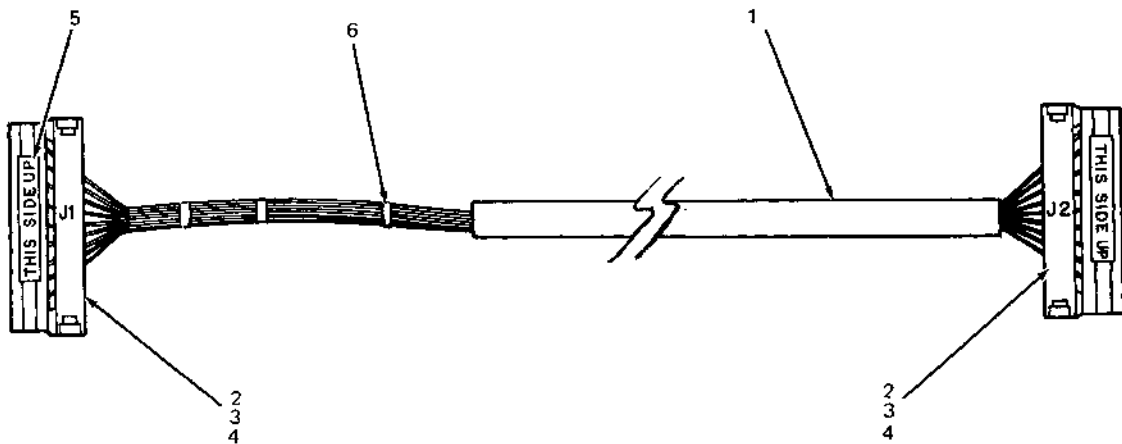
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-10000 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
11-	CABLE ASSEMBLY (LA36 Keyboard) (deleted)	70-10000-00	LA36 00136	A-H			1
1	*Cable, 24 Conductor (No. 22 AWG)	17-00011-01					
2	*Housing, Termination Berg	12-10918-15					
3	*Socket, Crimp	12-10089-07					
4	*Label, (THIS SIDE UP)	36-11567-00					
5	*Strain Relief	12-11166-00					
6	*Connector, Solderless (deleted)	90-07917-00					
	*Connector, Solderless (added)	90-07970-00	LA36 00136				
7	*Tie Wrap	90-07031-00					



LA36-16

Figure 11. Cable Assembly (LA36 Keyboard)

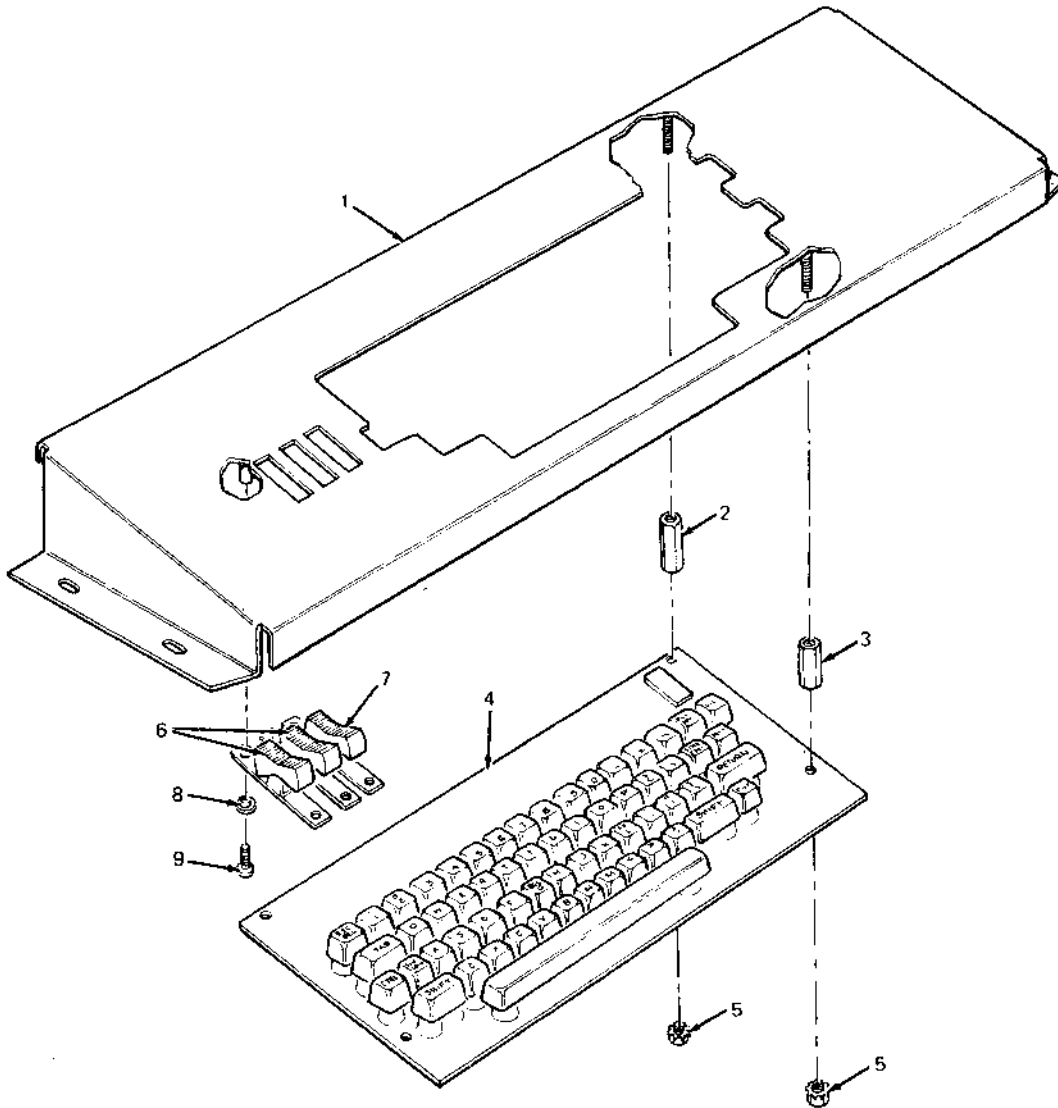
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00136	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
11A-	CABLE ASSEMBLY (LA36 Keyboard)	70-11519-00		J-R			1A
1	*Cable, 24 Conductor (No. 22 AWG)	17-00011-01					
2	*Connector, Housing 44 Pin Berg	12-10918-15					
3	*Terminals, Socket Crimp	12-10089-07					
4	*Strain Relief	12-11166-00					
5	*Label (THIS SIDE UP)	36-11567-00					
6	*Tie Wraps	90-07031-00					



LA36-16A

Figure 11A. Cable Assembly (LA36 Keyboard)

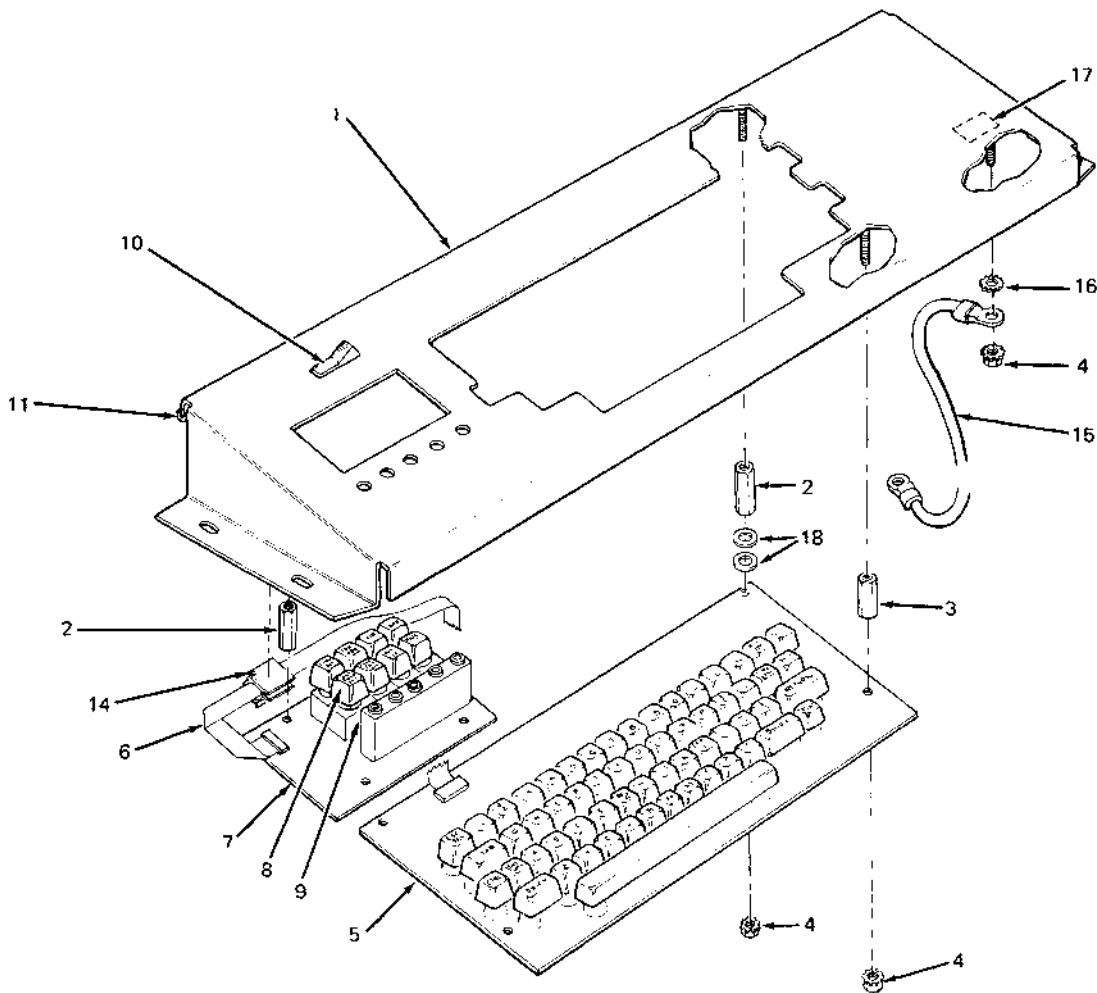
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09750 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
12-	KEYBOARD BEZEL ASSEMBLY (deleted)	70-09750-01	LA36 -00163	EFGH			1
1	*Bracket, Bezel	74-11427-01		EFGH			
2	*Spacer, Hex No. 8 x 1.00	90-09285-00					
3	*Spacer, Hex No. 8 x .75	90-07868-00					
4	*LK02 KEYBOARD ASSEMBLY	LK02-00.		EFGH (See IPB Manual EK-LK02-IP-)			
5	*Nut, Kep No. 8-32	90-06563-00					
6	*Switch, Rocker (DPST)	12-11621-00					
7	*Switch, Rocker (3 Position)	12-11732-00					
8	*Washer, Split Lock No. 6	90-07801-00					
9	*Screw, Phi Pan Hd No. 6-32 x .31	90-06021-01					



LA36-14

Figure 12. Keyboard Bezel Assembly

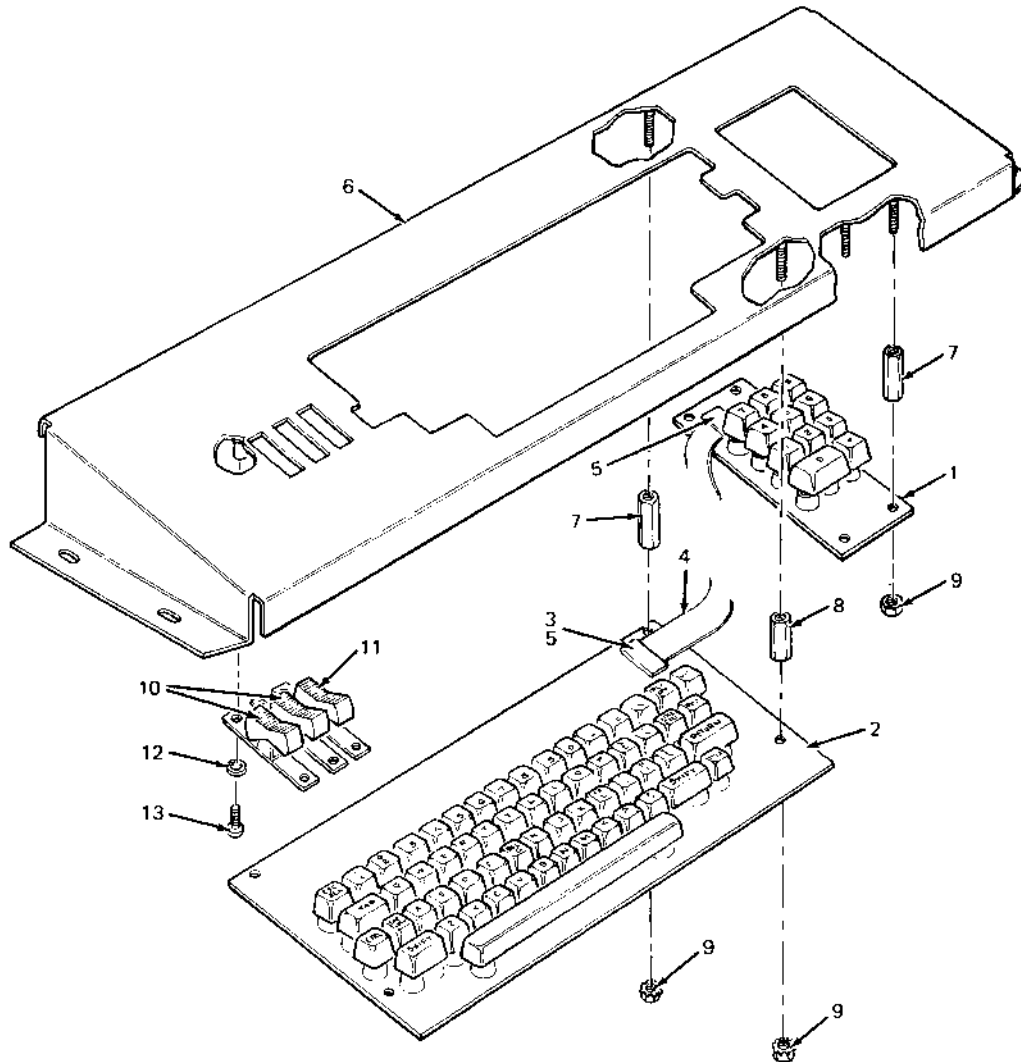
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	G	ECO CUT-IN LA36 00163	USED ON CODE	VENDOR		REF FIG NO.
						CODE	PART NO.	
12A-	KEYBOARD BEZEL ASSEMBLY	70-09750-01			NPQR			1A
1	*Bracket, Bezel	74-11427-01			NPQR			
2	*Spacer, Hex No. 8 x 1.00	90-09235-00						
3	*Spacer, Hex No. 8 x .75	90-07868-00						
4	*Nut, Kep No. 8-32	90-06563-00						
5	*LK02 KEYBOARD ASSEMBLY	LK02-00			J-R	(See IPB Manual EK-LK02-IP.)		
6	*Control Panel Cable	70-08612-0K			J-R			
7	*FRONT CONTROL PANEL ASSEMBLY	70-11525-00			J-R			
8	**Keycap Set	12-12287-E3						
9	**Front Control Panel Assembly	54-11727-00						
10	*Switch, Rocker (DPST)	12-11621-00						
11	*Grommet	90-09713-01						
12	*Screw, Phi Pan Hd No. 6-32 x .31	90-06021-01						
13	*Washer, Split Lock No. 6-32	90-07801-00						
14	*Harness Clip	90-08340-00						
15	*Jumper	70-10001-05						
16	*Washer, External Tooth No. 8	90-08072-00						
17	*Decal, Ground Symbol	36-12680-00						
18	*Washer, Flat Nylon No. 8	90-06708-00						



LA36-14A

Figure 12A. Keyboard Bezel Assembly

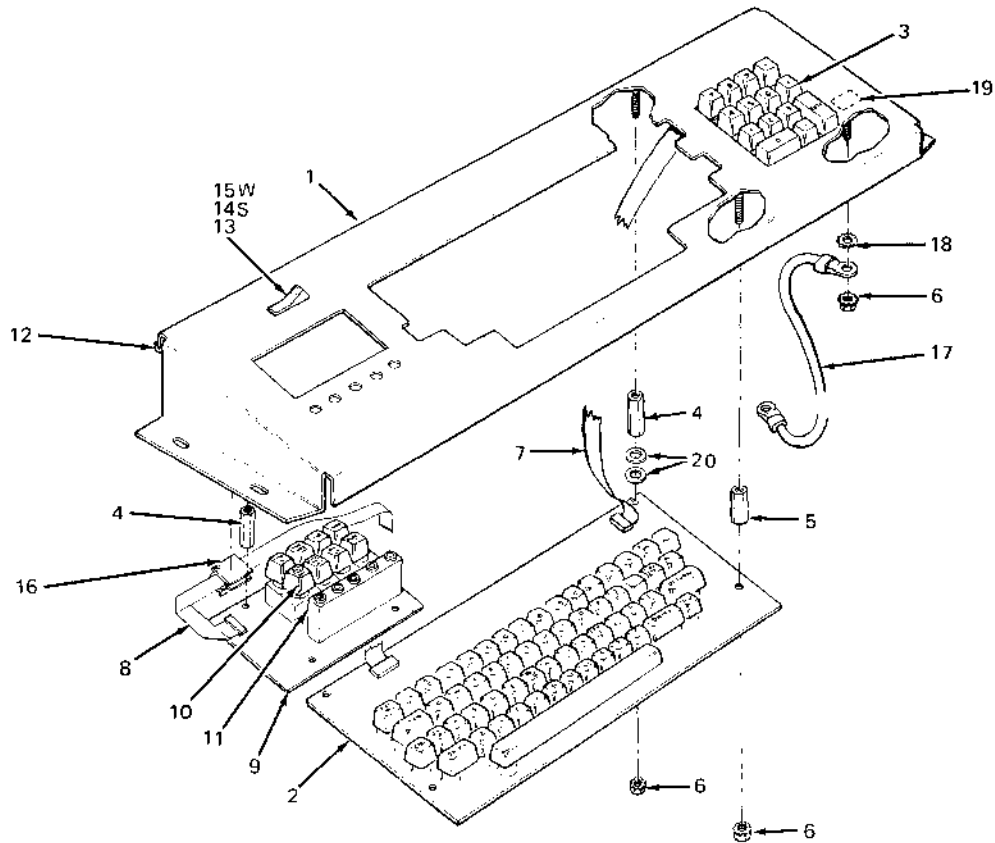
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09750 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
13-	KEYBOARD BEZEL ASSEMBLY (deleted) (With Cursor Control)	70-09750-02	LA36 -00163	ABCD			1
1	*LK03 KEYBOARD ASSEMBLY (deleted)	LK03-00	LA36 -00136	ABCD (See IPB Manual EK-LK03-IP-)			
2	*LK02 KEYBOARD ASSEMBLY	LK02-00		A-H (See IPB Manual EK-LK02-IP-)			
3	*Cable, Keyboard	70-08612-00					
4	**Cable, 16 Conductor	91-07738-00					
5	**Connector, Dual In Line 16 Pin	12-10722-00					
6	*Bracket, Bezel	74-11427-02		ABCD			
7	*Spacer, Hex No. 8 x 1.00	90-09825-00					
8	*Spacer, Hex No. 8 x .75	90-07868-00					
9	*Nut, Kep No. 8-32	90-06563-00					
10	*Switch, Rocker (DPST)	12-11621-00					
11	*Switch, Rocker (3 Position) (deleted)	12-11732-00	LA36 -00136				
12	*Washer, Split Lock No. 6	90-07801-00					
13	*Screw, Phi Pan Hd No. 6-32 x .31	90-06021-00					



LA36-15

Figure 13. Keyboard Bezel Assembly (W/Cursor Control)

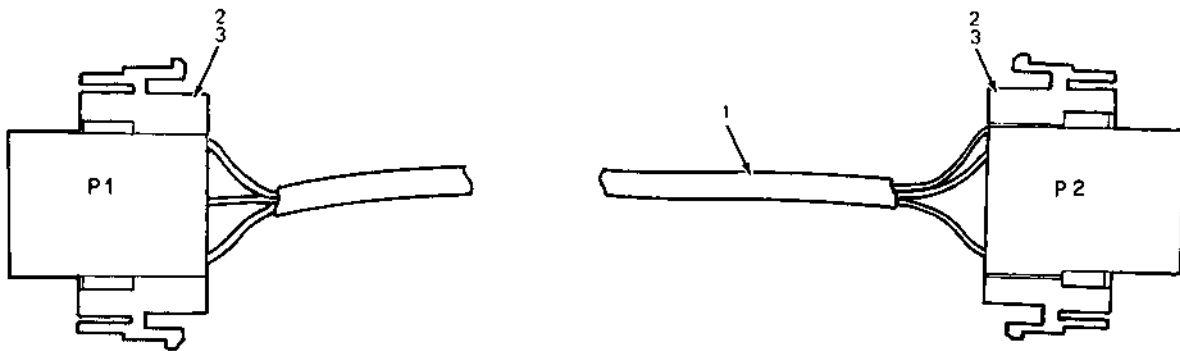
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	G	ECO CUT-IN LA36 00163	USED ON CODE	VENDOR		REF FIG NO.
						CODE	PART NO.	
13A-	KEYBOARD BEZEL ASSEMBLY (With Cursor Control)	70-09750-02			JKLM			1A
1	*Bracket, Bezel	74-11427-02						
2	*LK02 KEYBOARD ASSEMBLY	LK02-00			J-R (See IPB Manual EK-LK02-IP.)			
3	*LK03A KEYBOARD ASSEMBLY	LK03A-00			JKLM (See IPB Manual EK-LK03A-IP.)			
4	*Spacer, Hex No. 8 x 1.00	90-09285-00						
5	*Spacer, Hex No. 8 x .75	90-07868-00						
6	*Nut, Kep No. 8-32	90-06563-00						
7	*Cable (Keyboard to Cursor)	70-08612-0D						
8	*Cable (Control Panel to Keyboard)	70-08612-0K						
9	*FRONT CONTROL PANEL ASSEMBLY	70-11525-00						
10	**Keycap Set	12-12287-00						
11	**Front Control Panel Assembly	70-11727-00						
12	*Grommet	90-09713-01						
13	*Switch, Rocker (DPST)	12-11621-00						
14	*Screw, Phi Pan Hd No. 6-32 x .31	90-06021-01						
15	*Washer, Split Lock No. 6	90-07801-00						
16	*Harness Clip	90-08340-00						
17	*Jumper	70-10001-05						
18	*Washer, External Tooth No. 8	90-08072-00						
19	*Decal, Ground Symbol	36-12680-00						
20	*Washer, Flat Nylon No. 8	90-06708-00						



LA36-15A

Figure 13A. Keyboard Bezel Assembly (w/Cursor Control)

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN BC05-F 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
14-	CABLE ASSEMBLY (BC05F Interface) (deleted)	BC05F-15	LA36-00165	ABEF			1
1	*Cable, 4 Conductor (No. 22 AWG)	91-07706-00					
2	*Connector (P1, P2) Pin Housing, Mate-N-Lok	12-09340-01					
3	*Terminal, Pin Contact	12-09378-03					
							DEC



LA36-17

Figure 14. Cable Assembly (BC05F Interface)

ILLUSTRATED PARTS BREAKDOWN

LK02 KEYBOARD

HOW TO USE THE IPB

GENERAL

This IPB is compiled following the organization and nomenclature of the engineering drawing structure.

MAJOR ASSEMBLY LOCATOR

The Major Assembly Locator (first illustration) is an index that provides a description and a figure reference for all illustrations used in this manual.

INDENTED PARTS LIST

This manual identifies each assembly being broken down (figure reference callout), and all parts of that assembly. Further breakdown of an assembly is shown by an asterisk (*) preceding the item callouts in the Description Column. The number of asterisks preceding an item is used to denote the subordination of that item with respect to the Major Assembly. A single asterisk preceding an item description indicates that the item is part of the major assembly being illustrated. Items that are subordinate to single asterisks items, are denoted by two asterisks (**) and immediately follow the related single asterisk item. Additional asterisks are used, as required, to denote further subordination. This system of part identification, provides a means for the user to identify the next higher assembly item and make alternate selections for parts when the required replacement part or assembly is not immediately available.

COLUMN CALLOUT DESCRIPTION

Figure & Item — Indicates the figure number and item number of each part.

Description — Lists the name of the part and pertinent specifications (when required). Asterisks preceding the description denote the subordination of the part to the next higher assembly.

DEC Part No. — Lists the DEC part ordering number. A blank in this column indicates a DEC part number was not assigned at the time of publication.

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Ref Fig No. — A cross reference between illustrations. For each Major Assembly, the number in this column denotes the figure of the next higher assembly. For all subassemblies, the number in this column denotes the figure showing additional detailed breakdown.

SYMBOL USAGE

Hardware Designators — Alpha designators for screws (S), washers (W), nuts (N), and retaining rings (R) are inserted after the item number callouts on the illustration when stacked item numbers are used.

Attaching Hardware — The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

(NFR) Not Field Repairable — The (NFR) symbol is inserted after any assembly that is not to be field dismantled.

Other Symbols — Any other symbols that are required for kits, accessories, etc., will be explained and appear as part of the item description.

REVISION HISTORY

PRINTING	ECO LEVEL	DATE	PAGES AFFECTED
2nd Printing	LK02 00000-00001	1-30-76	This 2nd Printing EK-LK02-IP-002 SUPERSEDES 1st Printing DEC-LK02-IPB-1 (NOTE THAT THE DOCUMENT NO. OF THIS IPB HAS CHANGED)
"	54-10736 00001-0003A		
"	70-09892 00000-00000		

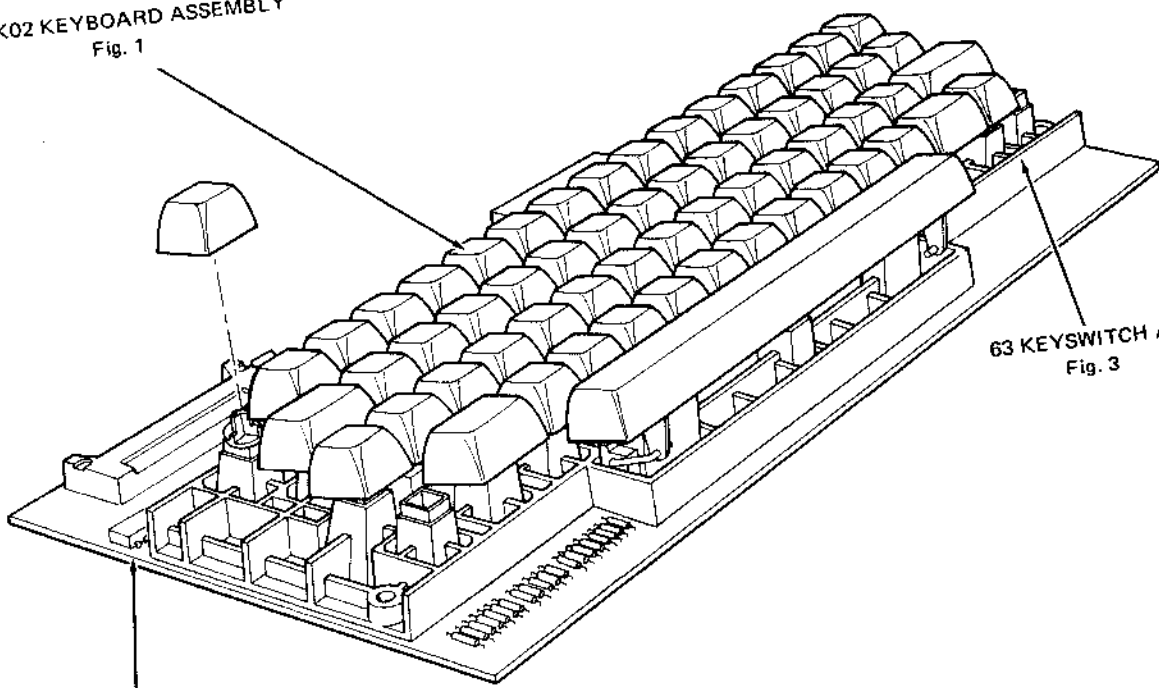
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DEC is not responsible for errors which may appear in the technical description (including illustrations and photographs) of the products covered by this manual.

None of the descriptions contained in this manual imply the granting of any license whatsoever to make, use or sell equipment constructed in accordance therewith.

LK02 KEYBOARD ASSEMBLY
Fig. 1



63 KEYSWITCH ARRAY
Fig. 3

LK02 KEYBOARD MODULE
Fig. 2-2A-2B

LK02-01

Major Assembly Locator, LK02 Keyboard

IPB-LK02

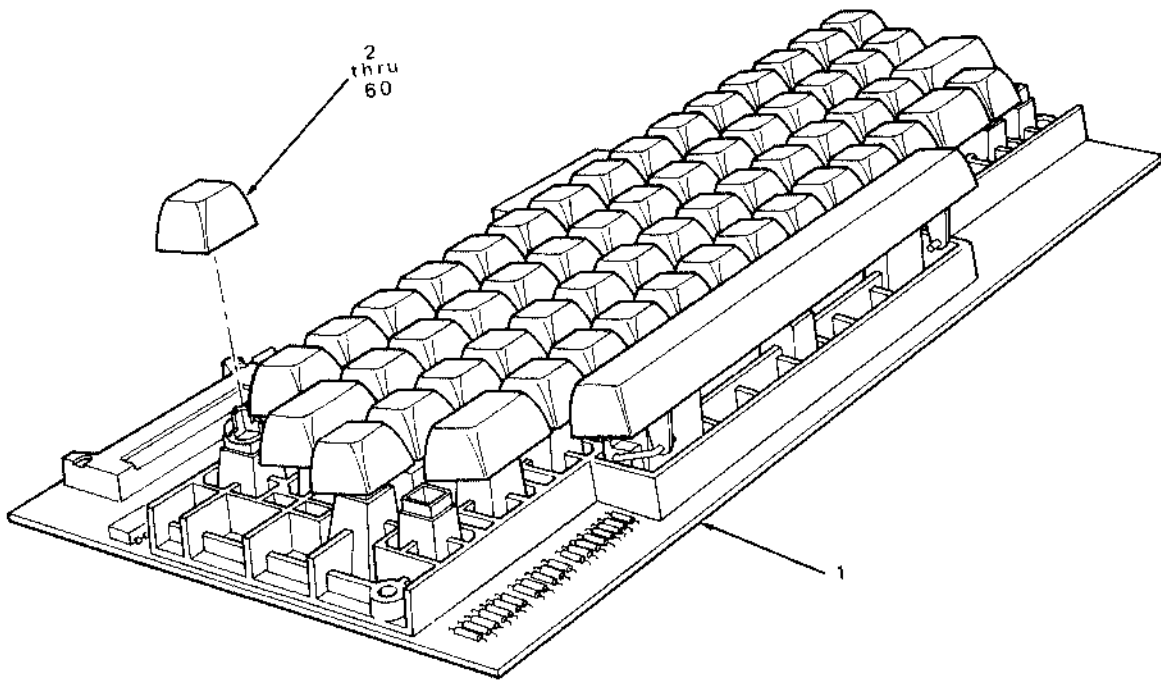


Figure 1. LK02 Keyboard Assembly

LK02-01

1PB-LK02

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	E ECO CUT-IN LK02 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
1-	LK02 KEYBOARD ASSEMBLY	LK02-00					
1	*KEYBOARD MODULE	54-10736-00					2
2	*KEY CAP, SINGLE Complete Set (Includes Caps Item 3 thru Item 60)	12-12287-62					
3	**Key Cap, Single A	12-12287-01					
4	**Key Cap, Single B	12-12287-02					
5	**Key Cap, Single C	12-12287-03					
6	**Key Cap, Single D	12-12287-04					
7	**Key Cap, Single E	12-12287-05					
8	**Key Cap, Single F	12-12287-06					
9	**Key Cap, Single BELL G	12-12287-07					
10	**Key Cap, Single H	12-12287-08					
11	**Key Cap, Single I	12-12287-09					
12	**Key Cap, Single J	12-12287-10					
13	**Key Cap, Single VT K	12-12287-B4					
14	**Key Cap, Single FF L	12-12287-B5					
15	**Key Cap, Single M	12-12287-13					
16	**Key Cap, Single N	12-12287-14					
17	**Key Cap, Single O	12-12287-15					
18	**Key Cap, Single P	12-12287-16					
19	**Key Cap, Single Q	12-12287-17					
20	**Key Cap, Single R	12-12287-18					
21	**Key Cap, Single S	12-12287-19					
22	**Key Cap, Single T	12-12287-20					
23	**Key Cap, Single U	12-12287-21					
24	**Key Cap, Single V	12-12287-22					
25	**Key Cap, Single W	12-12287-23					
26	**Key Cap, Single X	12-12287-24					
27	**Key Cap, Single Y	12-12287-25					
28	**Key Cap, Single Z	12-12287-26					
29	**Key Cap, Single ()	12-12287-27					
30	**Key Cap, Single ! 1	12-12287-28					
31	**Key Cap, Single @ 2	12-12287-29					
32	**Key Cap, Single # 3	12-12287-30					
33	**Key Cap, Single \$ 4	12-12287-31					
34	**Key Cap, Single % 5	12-12287-32					
35	**Key Cap, Single Δ 6	12-12287-33					
36	**Key Cap, Single & 7	12-12287-34					
37	**Key Cap, Single * 8	12-12287-35					
38	**Key Cap, Single | 9	12-12287-36					
39	**Key Cap, Single } 0	12-12287-37					
40	**Key Cap, Single + =	12-12287-38					
41	**Key Cap, Single - -	12-12287-39					
42	**Key Cap, Single []	12-12287-40					
43	**Key Cap, Single RETURN	12-12287-41					
44	**Key Cap, Single LF	12-12287-42					
45	**Key Cap, Single REPEAT	12-12287-43					
46	**Key Cap, Single ESC (SEL)	12-12287-44					
47	**Key Cap, Single TAB	12-12287-45					
48	**Key Cap, Single CTRL	12-12287-46					
49	**Key Cap, Single ~ \	12-12287-47					
50	**Key Cap, Single : ;	12-12287-48					

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LK02 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
1-							
51	**Key Cap, Single " "	12-12287-49					
52	**Key Cap, Single DELETE	12-12287-50					
53	**Key Cap, Single \	12-12287-51					
54	**Key Cap, Single SHIFT	12-12287-52					
55	**Key Cap, Single ? /	12-12287-53					
56	**Key Cap, Single > .	12-12287-54					
57	**Key Cap, Single < ,	12-12287-55					
58	**Key Cap, Single CAPS LOCK	12-12287-56					
59	**Key Cap, Single BACK SPACE	12-12287-57					
60	**Key Cap, Single BREAK	12-12287-58					

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 54-10736 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
2--	LK02 KEYBOARD MODULE (ETCH REV. D)	54-10736-00					1
1	*Board, Etched Circuit	50-10735-00					
2	*Capacitor (C3) .01μF, 100V, 10% Mylar	10-05784-00					
3	*Capacitor (C4, C5, C7, C8, C9, C13) .01 μF, 100V, 20% Disc	10-01610-01					
4	*Capacitor (C1) 1 μF, 25V Tant	10-10866-01					
5	*Capacitor (C2, C6) 180 pF, 100V, 5% Mich	10-00020-00					
6	*Capacitor (C10, C12) 10 μF, 20V, 10% Tant	10-04813-00					
7	*Diode (D4-D9, D11-D45, D47-D62) D664	11-00114-00					
8	*Transistor (Q3) DEC 3009B	15-03100-00					
9	*Switch (S1) (DPST)	12-10919-00					
10	*Socket (J1) IC 16 Pin	12-10025-00					
11	*Connector (J2) Right Angle Header	12-09941-00					
12	*Socket (XE1) Rom	12-10947-00					
13	*I.C. (E2) 7404	19-09686-00					
14	*I.C. (E3) 7400	19-05575-00					
15	*I.C. (E7) 7430	19-05570-00					
16	*I.C. (E5, E6) 7437	19-10091-00					
17	*I.C. (E4) 9601	19-09373-00					
18	*I.C. (E1) ROM	21-11634-00					
19	*Selector, Phenolic Switch	74-09532-00					
20	*Screw, Phi Self Tapping No. 4-40 x 3/16	90-09159-00					
21	*63 KEYSWITCH ARRAY	70-09892-00					3
22	*Resistor (R1, R4, R5, R9, R10) 1K, 1/4W, 5%	13-00365-00					
23	*Resistor (R6, R11) 3.9K, 1/4W, 5%	13-00444-00					
24	*Resistor (R3) 22K, 1/4W, 5%	13-01808-00					
25	*Resistor (R2) 100K, 1/4W, 5%	13-02466-00					
26	*Resistor (R7, R8) 2 ohm, 1/2W, 5%	13-09421-00					

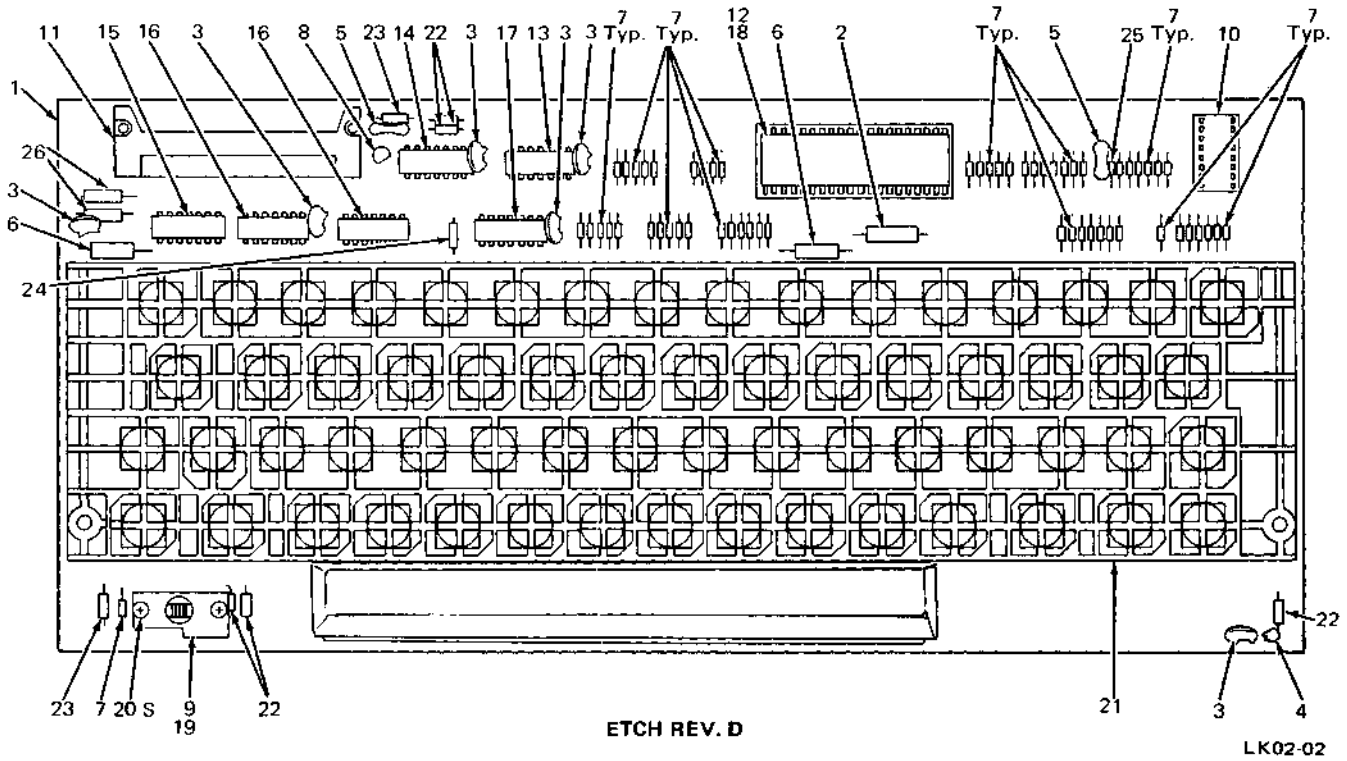
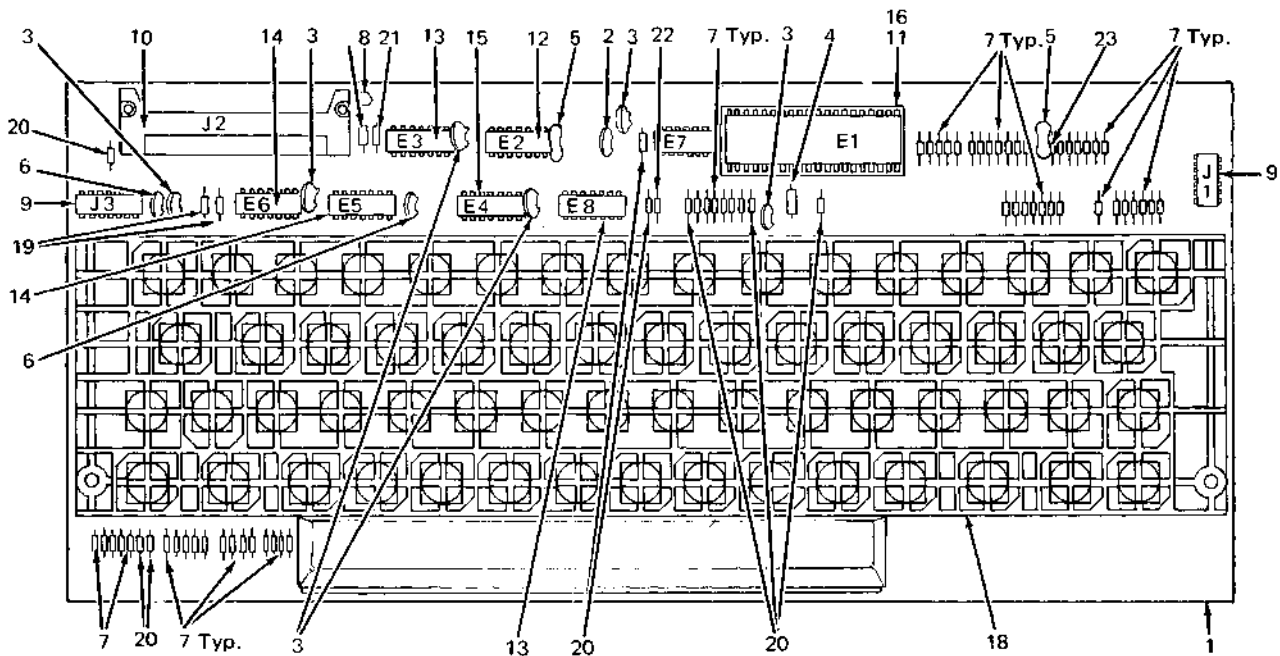


Figure 2. LK02 Keyboard Module (Etch Rev. D)

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 54-10736 00002	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
2A-	LK02 KEYBOARD MODULE (ETCH REV. E)	54-10736-00					1
1	*Board, Etched Circuit	50-10735-00					
2	*Capacitor (C3) .01 μ F, 100V, 10% Mylar	10-05784-00					
3	*Capacitor (C4, C5, C7, C8, C9, C13) .01 μ F, 100V, 20% Disc	10-01610-01					
4	*Capacitor (C1) 1 μ F, 25V Tant	10-10866-01					
5	*Capacitor (C2, C6) 180 pF, 100V, 5% Mich	10-00020-00					
6	*Capacitor (C10, C12) 10 μ F, 20V, 10% Tant	10-04813-00					
7	*Diode (D5-D9, D11-45, D47-61) D664	11-00114-00					
8	*Transistor (Q3) DEC 3009B	15-03100-00					
9	*Socket (J1, J3) I.C. 16 Pin	12-11813-00					
10	*Connector (J2) Right Angle Header	12-09941-00					
11	*Socket (XE1) Rom (deleted)	12-10947-00					
	*Socket (XE1) Rom (added)	12-12385-00	0002B				
12	*I.C. (E2) 7404	19-09686-00					
13	*I.C. (E3, E8) 7400	19-05575-00					
14	*I.C. (E5, E6) 7437	19-10091-00					
15	*I.C. (E4) 9601	19-09373-00					
16	*I.C. (E1) Rom (deleted)	21-11634-01					
	*I.C. (E1) Rom (added)	23-002C1-00	0002B				
17	*I.C. (E7) 7410	19-05576-00					
18	*63 KEYSWITCH ARRAY	70-09892-00					3
19	*Resistor (R7, R8) 2 ohms, 1/2W, 5%	13-09421-00					
20	*Resistor (R1, R3, R4, R5, R10-14) 1K, 1/4W, 5%	13-00365-00					
21	*Resistor (R6) 3.9K, 1/4W, 5%	13-00444-00					
22	*Resistor (R9) 22K, 1/4W, 5%	13-01803-00					
23	*Resistor (R2) 100K, 1/4W, 5%	13-02466-00					



ETCH REV. E

LK02-2A

Figure 2A. LK02 Keyboard Module (Etch Rev. E)

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 54-10736 00003	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
2B-	LK02 KEYBOARD MODULE (ETCH REV F)	54-10736-00					1
1	*Board, Etched Circuit	50-10735-00					
2	*Capacitor (C3) .01 μ F, 100V, 10% Mylar	10-05784-00					
3	*Capacitor (C4, C5, C7, C8, C9, C13) .01 μ F, 100V, 20% Disc	10-01610-01					
4	*Capacitor (C1) 1 μ F, 25V Tant	10-10866-01					
5	*Capacitor (C2) 180 pF, 100V, 5% Mich	10-00020-00					
6	*Capacitor (C10, C12) 10 μ F, 20V, 10% Tant	10-04813-00					
7	*Diode (D5-D9, D11-D45, D47-D61) D664	11-00114-00					
8	*Transistor (Q3) DEC 3009B	15-03100-00					
9	*Socket (J1, J3) IC 16 Pin	12-11813-00					
10	*Connector (J2) Right Angle Header	12-09941-00					
11	*Socket (XE1) Rom	12-12385-00					
12	*I.C. (E2) 7404	19-09686-00					
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14	*I.C. (E5-E6) 7437	19-10091-00					
15	*I.C. (E4) 9601	19-09373-00					
16	*I.C. (E1) Rom	23-002C1-00					
17	*I.C. (E7) 7410	19-05576-00					
18	*63 KEYSWITCH ARRAY	70-09892-00					3
19	*Resistor (R7, R8) 2 ohm, 1/2W, 5%	13-09421-00					
20	*Resistor (R1, R3-R5, R10-R14) 1K, 1/4W, 5%	13-00365-00					
21	*Resistor (R6) 3.9K, 1/4W, 5%	13-00444-00					
22	*Resistor (R9) 22K, 1/4W, 5%	13-01808-00					
23	*Resistor (R2) 100K, 1/4W, 5%	13-02466-00					
24	*Capacitor (C6) 1,000 pF, 100V, 5% Mich	10-00042-00					

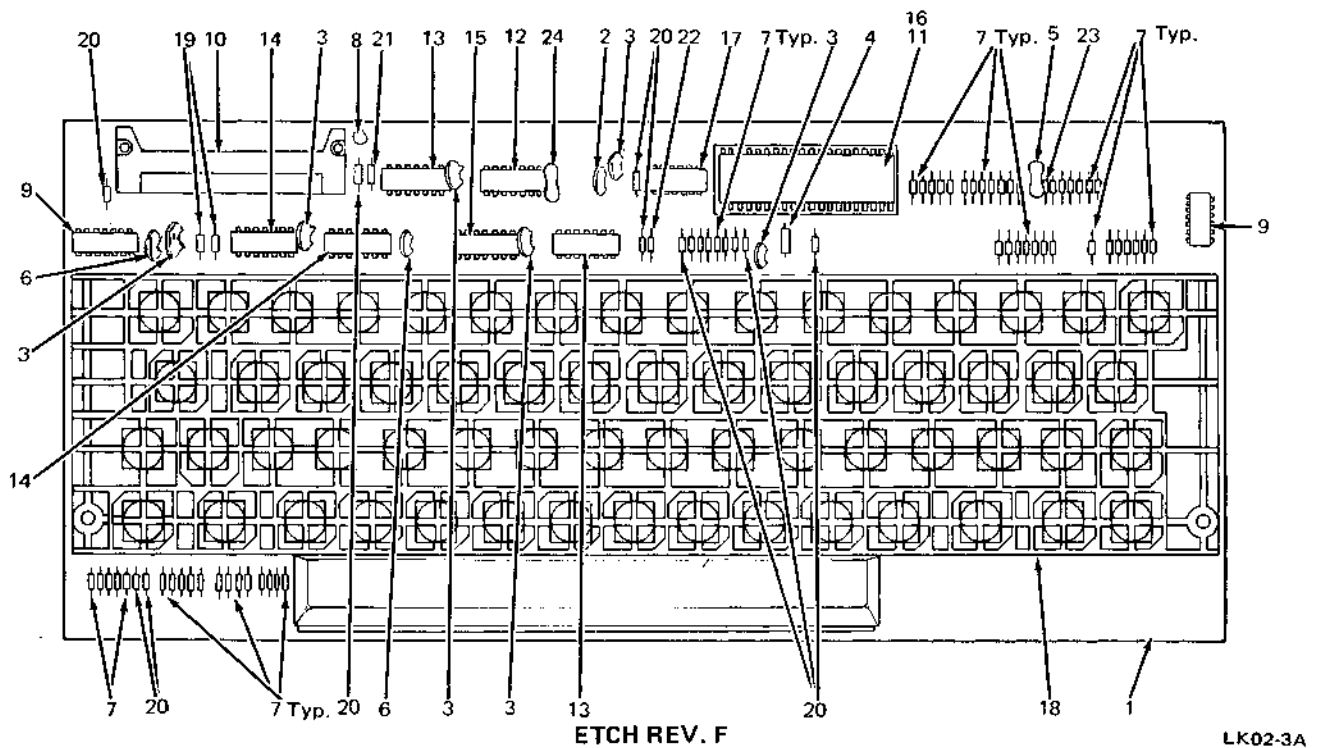
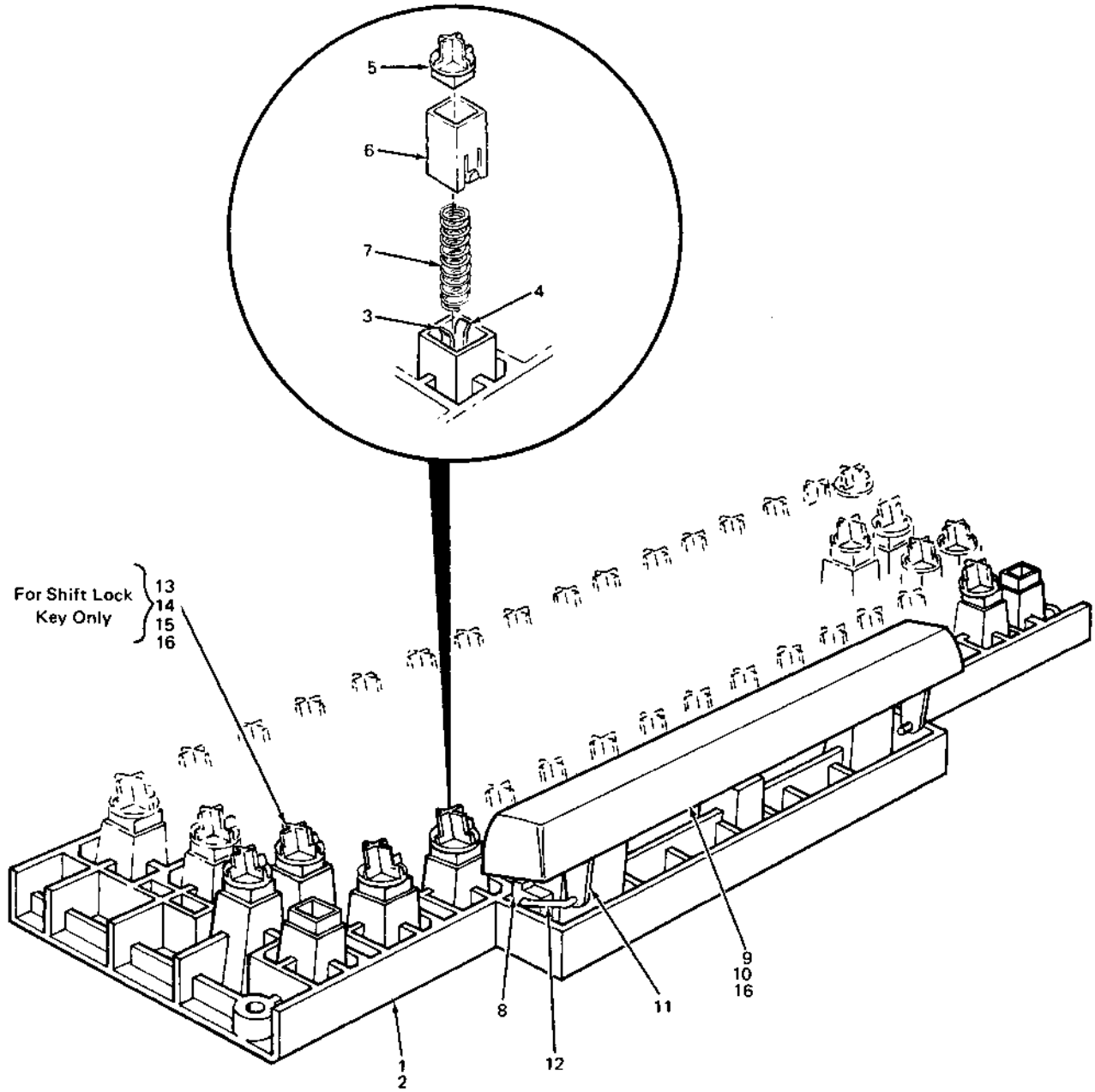


Figure 2B. LK02 Keyboard Module (Etch Rev. F)



LK02-04

Figure 3. 63 Keyswitch Array

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN	USED ON CODE	VENDOR		REF FIG NO.
			70-09892 00000		CODE	PART NO.	
3-	63 KEYSWITCH ARRAY	70-09892-00					2
1	*HOUSING ASSEMBLY	70-10035-00					
2	**Housing, Keyswitch	12-11859-00					
3	**Contact, Solid	12-11866-00					
4	**Contact, Quadfurcated	12-11865-00					
5	*Adapter, Key Cap	12-11860-00					
6	*Plunger	12-11862-00					
7	*Spring, Compression	12-11863-01					
8	*Retainer, Equalizer Bar	12-11861-00					
9	*SPACE BAR ASSEMBLY	70-09939-00					
10	**Space Bar	12-11857-00					
11	**Bracket, Equalizer Bar	12-11864-00					
12	**Bar, Equalizer	12-11858-00					
13	*Wire, Cam Follower (For Shift Lock Only)	12-12006-00					
14	*Wire, Pin Lock (For Shift Lock Only)	12-12007-00					
15	*Plunger, Shift Lock (For Shift Lock Only)	12-12005-00					
16	*Spring, Compression (For Shift Lock and Space Bar only)	12-11863-03					

DEC

ILLUSTRATED PARTS BREAKDOWN

LK03 KEYBOARD

HOW TO USE THE IPB

GENERAL

This IPB is compiled following the organization and nomenclature of the engineering drawing structure.

MAJOR ASSEMBLY LOCATOR

The Major Assembly Locator (first illustration) is an index that provides a description and a figure reference for all illustrations used in this manual.

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This manual identifies each assembly being broken down (figure reference callout), and all parts of that assembly. Further breakdown of an assembly is shown by an asterisk (*) preceding the item callouts in the Description Column. The number of asterisks preceding an item is used to denote the subordination of that item with respect to the Major Assembly. A single asterisk preceding an item description indicates that the item is part of the major assembly being illustrated. Items that are subordinate to single asterisks items, are denoted by two asterisks (**) and immediately follow the related single asterisk item. Additional asterisks are used, as required, to denote further subordination. This system of part identification, provides a means for the user to identify the next higher assembly item and make alternate selections for parts when the required replacement part or assembly is not immediately available.

COLUMN CALLOUT DESCRIPTION

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REVISION HISTORY

PRINTING	ECO LEVEL	DATE	PAGES AFFECTED
1st Printing	LK03 00000 - 00000	12-2-74	N/A
"	54-10819 00001 - 00001		"
"	70-09891 00000 - 00000		"

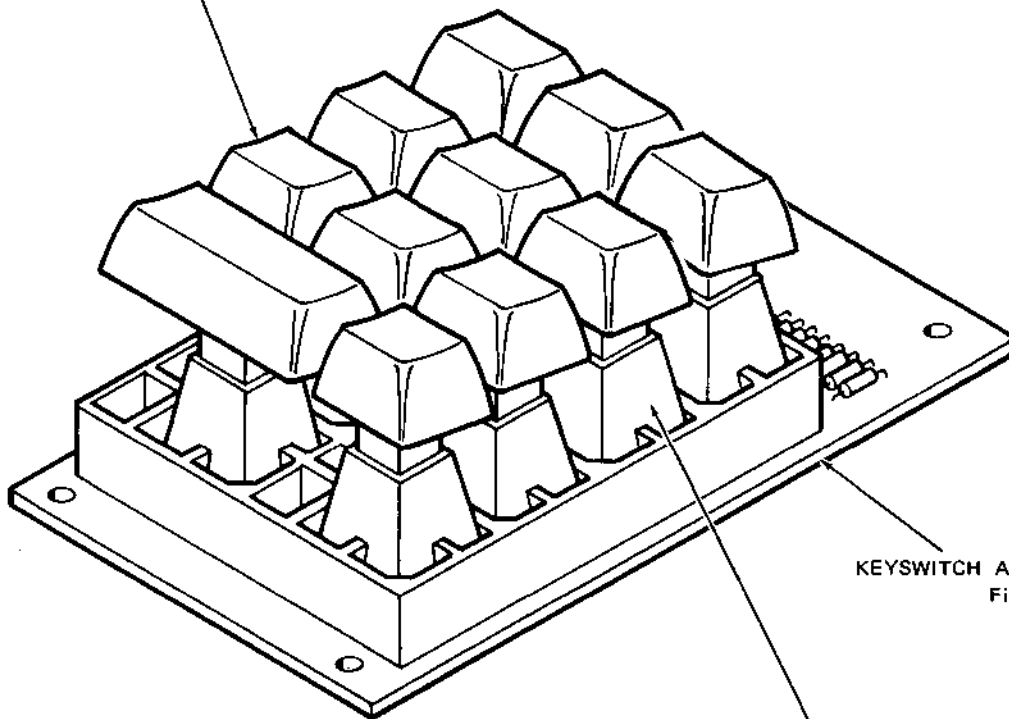
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LK03 KEYBOARD ASSEMBLY
Fig. 1



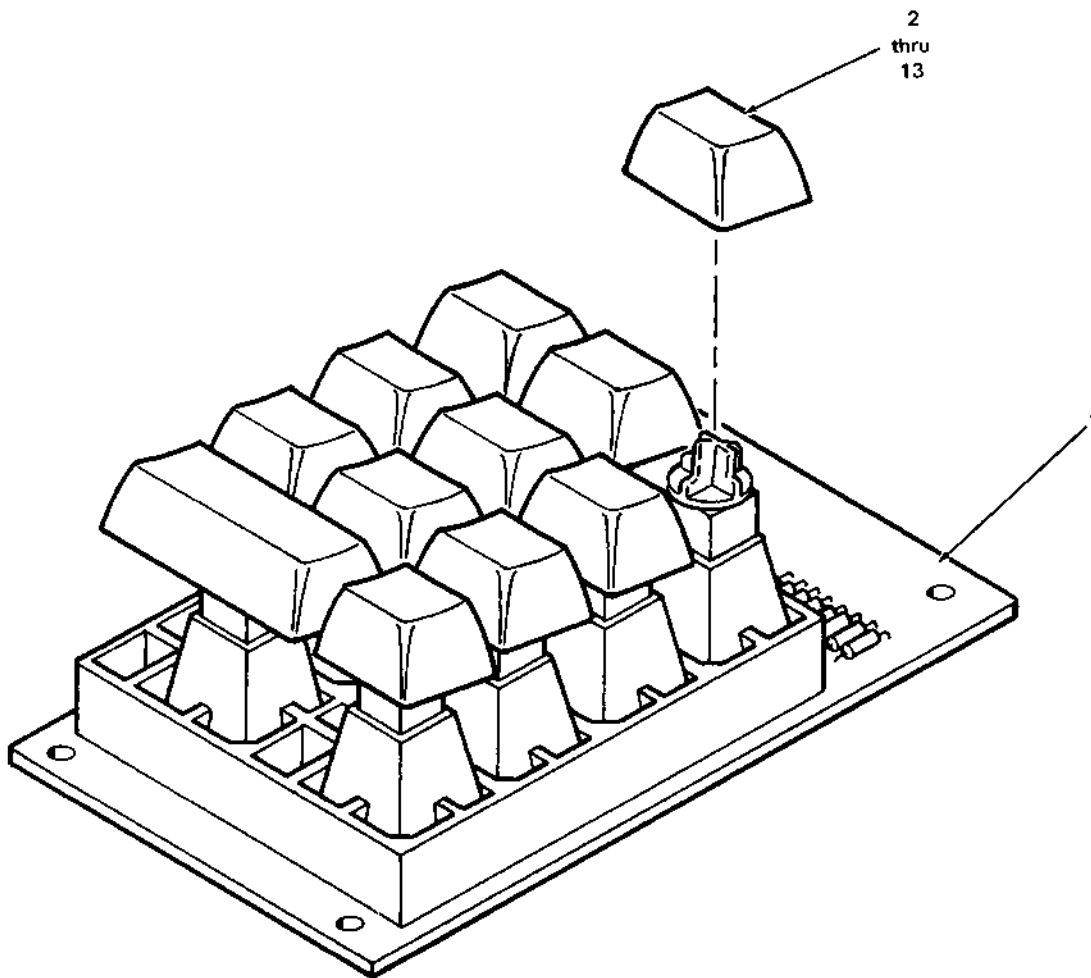
KEYSWITCH ARRAY MODULE
Fig. 2

KEYSWITCH ARRAY ASSEMBLY
Fig. 3

LK03-01

Major Assembly Locator, LK03 Keyboard

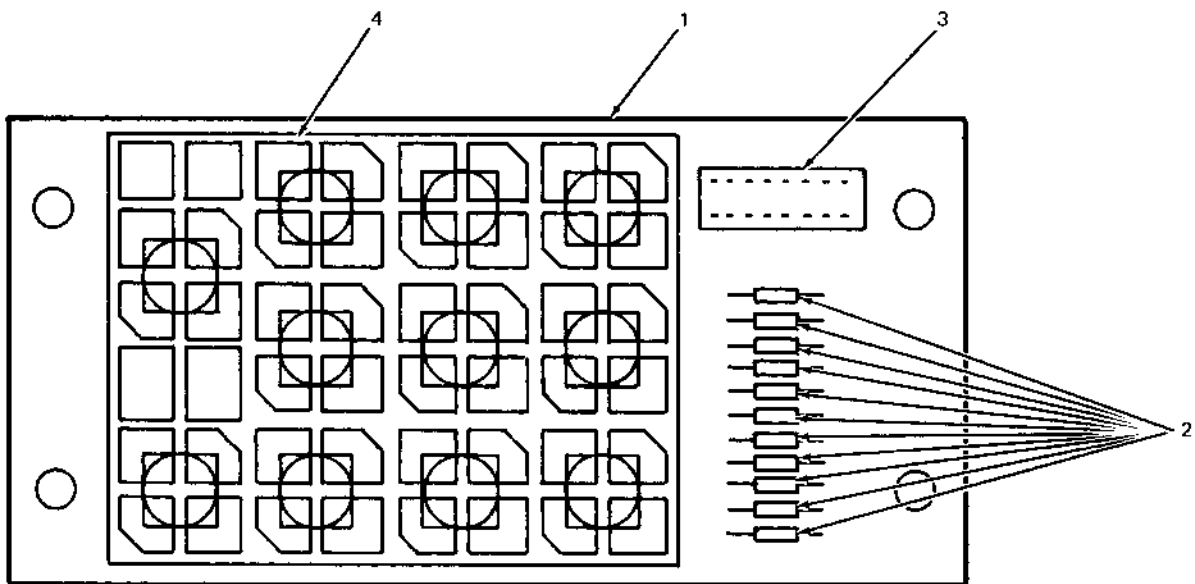
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LK03 00000	USED ON CODE	VENDOR CODE	PART NO.	REF FIG NO.
1-	LK03 KEYBOARD ASSEMBLY	LK03-00					
1	*KEYSWITCH ARRAY MODULE	54-10819-00					2
2	*KEY CAP, SINGLE Complete Set (Includes Caps Item 3 thru Item 13)	90-09570-74					
3	**Key Cap, Single 0	90-09570-63					
4	**Key Cap, Single 1	90-09570-64					
5	**Key Cap, Single 2	90-09570-65					
6	**Key Cap, Single 3	90-09570-66					
7	**Key Cap, Single 4	90-09570-67					
8	**Key Cap, Single 5	90-09570-68					
9	**Key Cap, Single 6	90-09570-69					
10	**Key Cap, Single 7	90-09570-70					
11	**Key Cap, Single 8	90-09570-71					
12	**Key Cap, Single 9	90-09570-72					
13	**Key Cap, Single .	90-09570-73					



LK03-02

Figure 1. LK03 Keyboard Assembly

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 54-10819 00001	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
2-	KEYSWITCH ARRAY MODULE (ETCH REV. B)	54-10819-00					1
1	* Board, Etched Circuit	50-10818-00					3
2	* Diode (D1 thru D11) D664	11-00114-00					
3	* Socket (J1) 16 Pin	12-10025-00					
4	* KEYSWITCH ARRAY	70-09891-00					

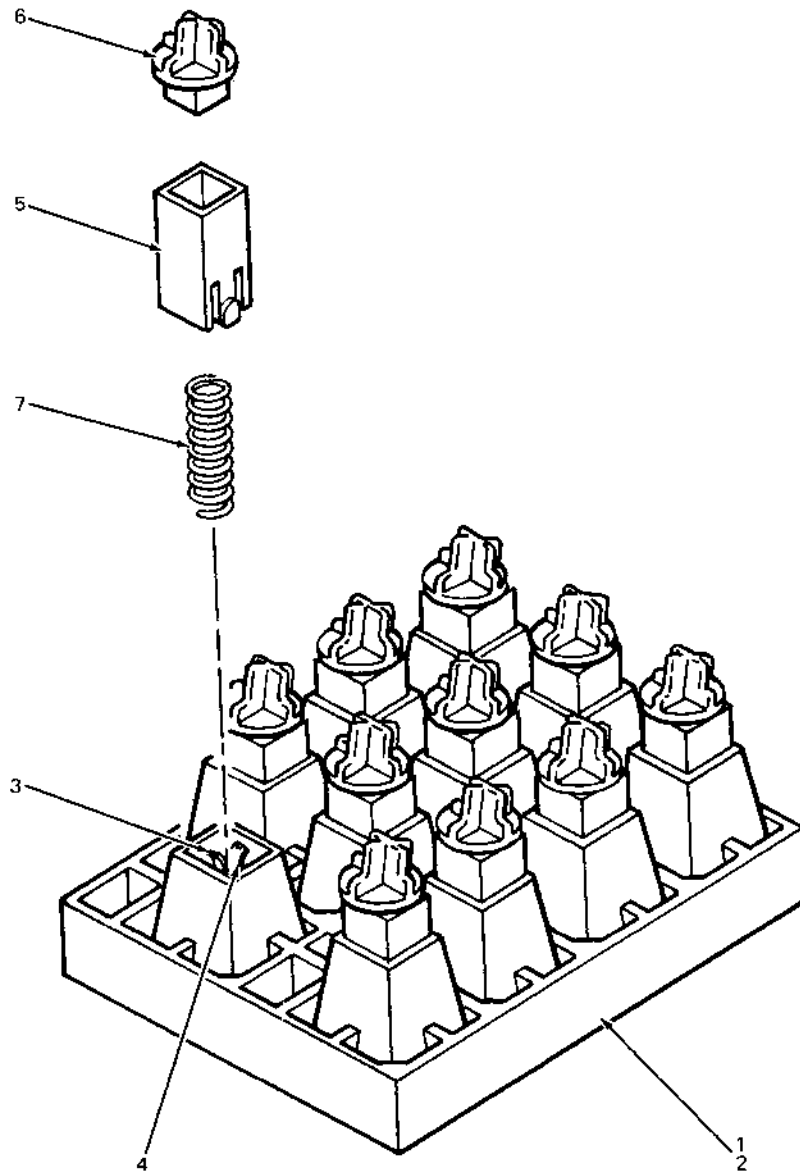


ETCH REV. B

LK03-03

Figure 2. Keyswitch Array Module (Etch Rev. B)

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09891 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
3-	KEYSWITCH ARRAY ASSEMBLY	70-09891-00					2
1	*HOUSING ASSEMBLY	70-10033-00					
2	**Housing, Keyswitch	12-11859-01					
3	**Contact, Solid	12-11866-00					
4	**Contact, Quadfurcated	12-11865-00					
5	*Plunger	12-11862-00					
6	*Adapter, Key Cap	12-11860-00					
7	*Spring, Compression	12-11863-01					
							DEC



LK03-04

Figure 3. Keyswitch Array Assembly

ILLUSTRATED PARTS BREAKDOWN

LK03A KEYBOARD

HOW TO USE THE IPB

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Ref Fig No. — A cross reference between illustrations. For each Major Assembly, the number in this column denotes the figure of the next higher assembly. For all subassemblies, the number in this column denotes the figure showing additional detailed breakdown.

SYMBOL USAGE

Hardware Designators — Alpha designators for screws (S), washers (W), nuts (N), and retaining rings (R) are inserted after the item number callouts on the illustration when stacked item numbers are used.

Attaching Hardware — The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

(NFR) Not Field Repairable — The (NFR) symbol is inserted after any assembly that is not to be field dismantled.

Other Symbols — Any other symbols that are required for kits, accessories, etc., will be explained and appear as part of the item description.

REVISION HISTORY

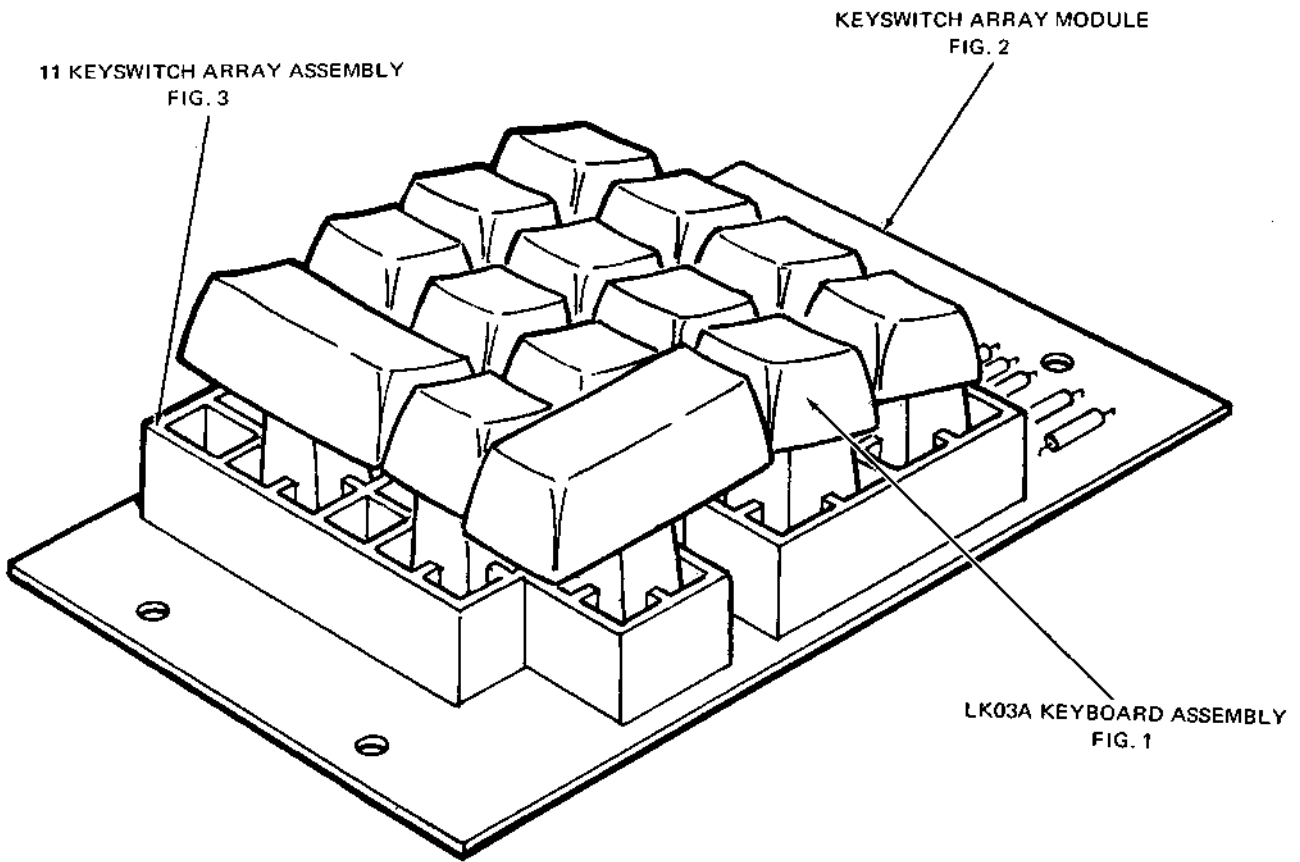
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1st Printing	LK03A 00000 - 00000	1-30-76	N/A
"	54-11635 00000 - 00000		
"	70-09891 00000 - 00000		

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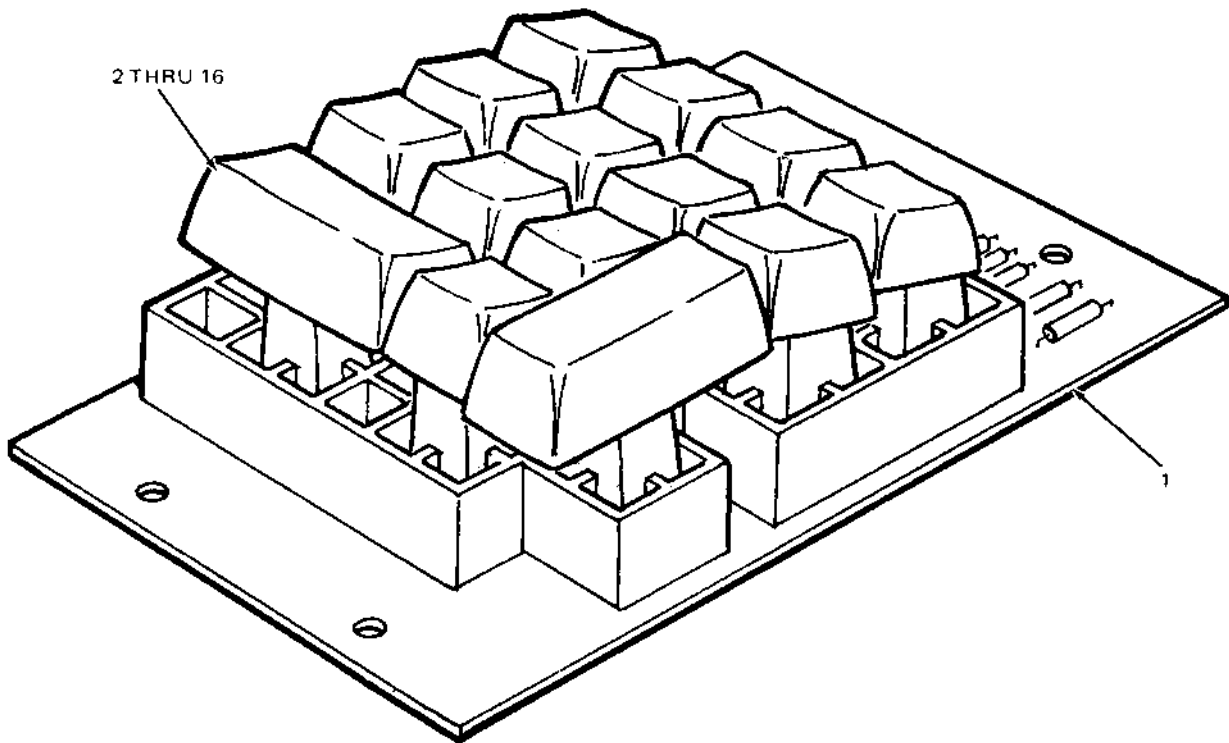
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LK03A-01

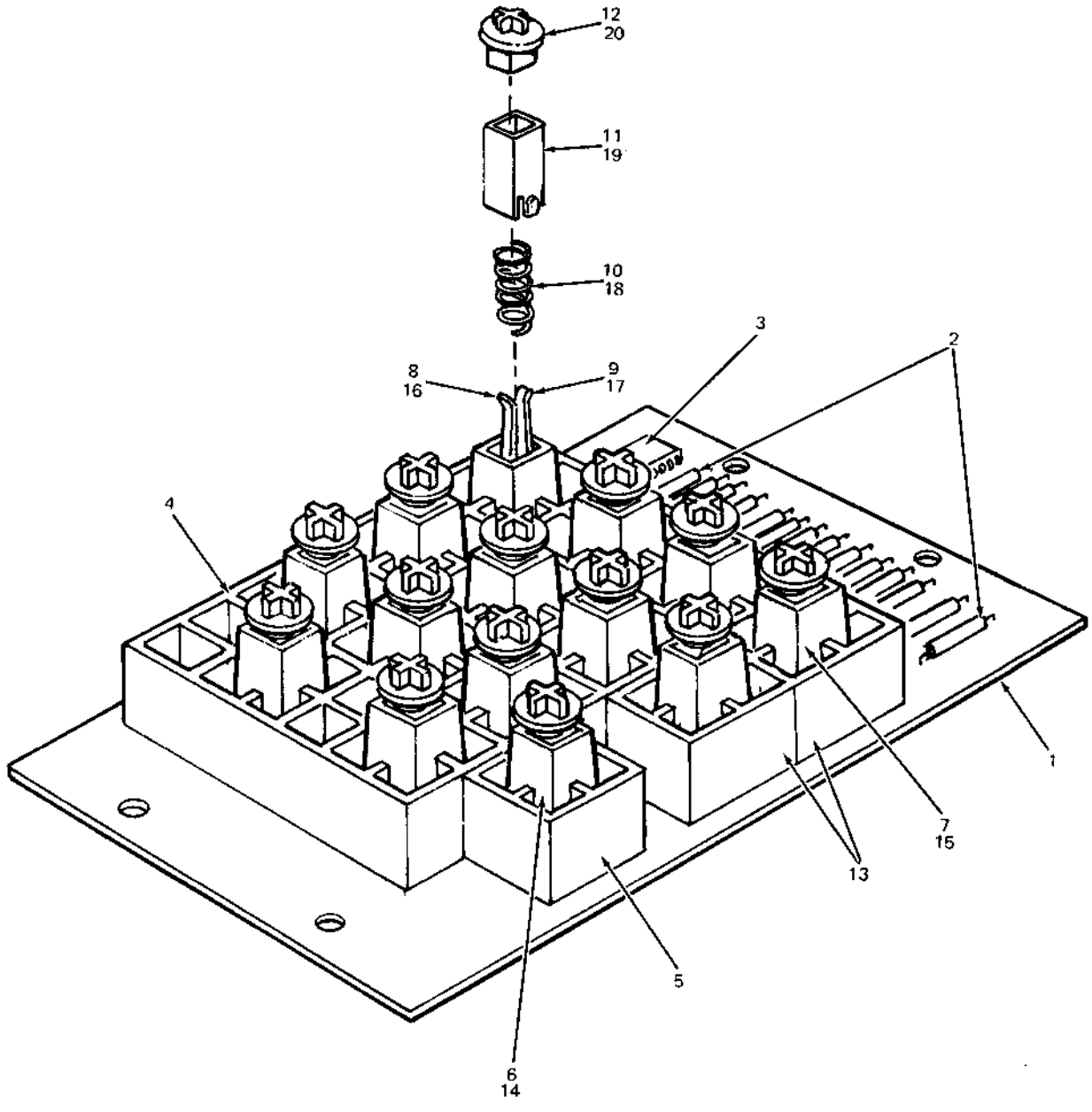
Major Assembly Locator

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LK03A 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
1-	LK03A KEYBOARD ASSEMBLY	LK03A					
1	*KEYSWITCH ARRAY MODULE (14 KEY)	54-11635-00					2
2	*KEYCAP SET	12-12287-74					
3	**Key-Cap, Single 0	12-12287-63					
4	**Key-Cap, Single 1	12-12287-64					
5	**Key-Cap, Single 2	12-12287-65					
6	**Key-Cap, Single 3	12-12287-66					
7	**Key-Cap, Single 4	12-12287-67					
8	**Key-Cap, Single 5	12-12287-68					
9	**Key-Cap, Single 6	12-12287-69					
10	**Key-Cap, Single 7	12-12287-70					
11	**Key-Cap, Single 8	12-12287-71					
12	**Key-Cap, Single 9	12-12287-72					
13	**Key-Cap, Single . (Decimal Point)	12-12287-73					
14	**Key-Cap, ENTER	12-12287-01					
15	**Key-Cap, Single -	12-12287-E2					
16	**Key-Cap, Single ,	12-12287-E4					



LK03A-01

Figure 1. LK03A Keyboard Assembly

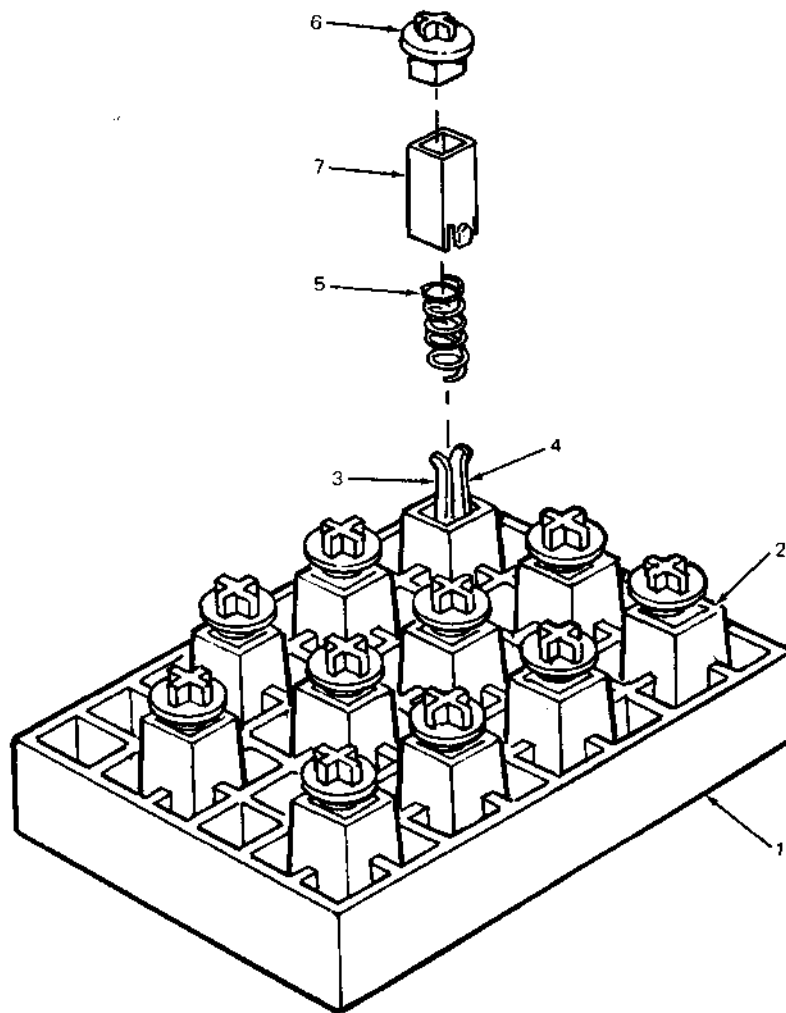


LK03A-02

Figure 2. Keyswitch Array Assembly

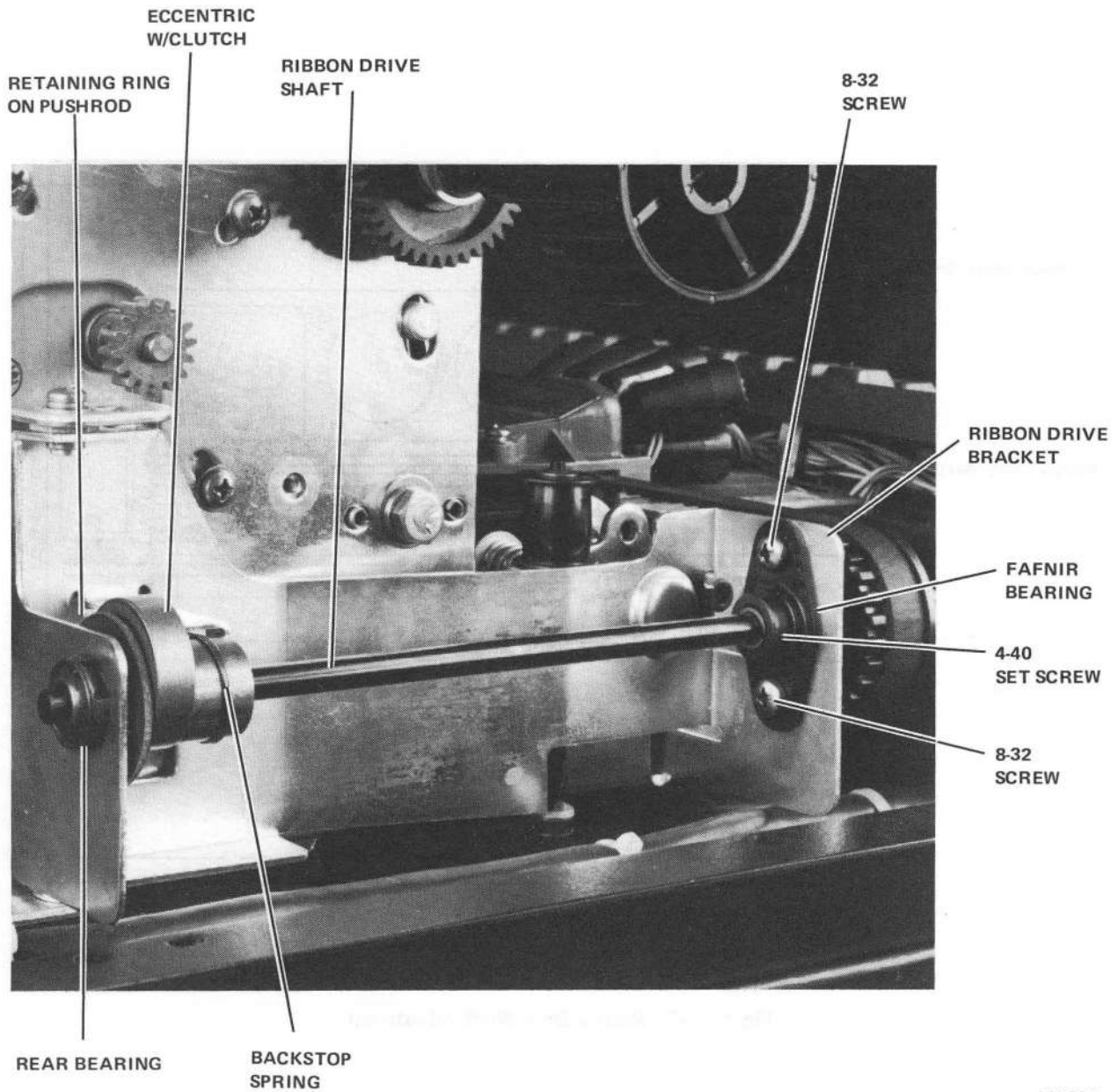
FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 54-11635 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
2-	KEYSWITCH ARRAY ASSEMBLY (ETCH REV C)	54-11635-00					1
1	*Board, Etched Circuit	50-11634-00					
2	*Diode (D1-D14) D664	11-00114-00					
3	*Socket (J1)	12-11813-00					
4	*11 KEYSWITCH ARRAY	70-09891-00					3
5	*SINGLE KEYSWITCH (KS1)	70-11111-01					
6	**Housing Assembly	70-11110-00					
7	***Housing, Keyswitch	12-11859-04					
8	***Contact, Solid	12-11866-00					
9	***Contact, Quadfurcated	12-11865-00					
10	**Spring, Compression	12-11863-01					
11	**Plunger	12-11862-00					
12	**Adapter, Key-Cap Straight	12-12677-00					
13	*SINGLE KEYSWITCH (KS2, KS3)	70-11111-00					
14	**Housing Assembly	70-11110-00					
15	***Housing, Keyswitch	12-11859-04					
16	***Contact, Solid	12-11866-00					
17	***Contact, Quadfurcated	12-11865-00					
18	**Spring, Compression	12-11863-01					
19	**Plunger	12-11862-00					
20	**Adapter, Tilted	12-11860-00					

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09891 00000	USED ON CODE	VENDOR		REF FIG NO.
					CODE	PART NO.	
3-	11 KEYSWITCH ARRAY ASSEMBLY	70-09891-00					2
1	*Housing Assembly	70-10033-00					
2	**Housing, Keyswitch	12-11859-00					
3	**Contact, Solid	12-11866-00					
4	**Contact, Quadfurcated	12-11865-00					
5	*Spring Compression	12-11863-01					
6	*Adapter, Key-Cap	12-11860-00					
7	*Plunger	12-11862-00					
							DEC



LK03A-03

Figure 3. 11 Keyswitch Array Assembly



7393-3

Figure 6-46 Fafnir Bearing Removal

APPENDIX A

REFERENCE DATA

A.1 ABBREVIATIONS

The abbreviations used in this manual are listed in Table A-1.

A.2 SIGNAL GLOSSARY

The signal names used in this manual are listed in Table A-2.

A.3 IC PIN LOCATION DRAWINGS

The pin locations of the Integrated Circuits used in the LA36 are illustrated in Figures A-1 through A-29.

Table A-1
Glossary of Abbreviations

2SB	Two Stop Bits
AKO	Any Key On
AMP	Amplifier
AR	Address Register
BCD	Binary Coded Decimal
BEL	Bell
BS	Backspace
BUF	Buffer
BUFF	Buffer
C/B	Carry/Borrow
CB RAM	Character Buffer Read Access Memory
CBA	Character Buffer Address
CG ROM	Character Generator Read Only Memory
CHAR	Character
CLK	Clock
CLR	Clear
CM	Centimeter
CNTR	Counter
COL	Column
COL HI	Column High
COL LO	Column Low
CONTROL RAM	Control Read Access Memory
CRAM	Control Read Access Memory
CTRL	Control
D/A	Digital to Analog
DAC	Digital to Analog
DEC	Decoder
DIR	Direction
DM	Down
DRVR	Driver
ENB	Enable
ER	Error
F/F	Flip Flop
FIFO	First In/First Out
H	High
HDE	Head Drive Enable
INC	Increment
INIT	Initialize
IPS	Inches Per Second

Table A-1 (Cont)
Glossary of Abbreviations

KBD	Keyboard
KBH	Keyboard Hold
kHz	Kilohertz
L	Low
LCV	Last Character Visibility
LF	Line Feed
LSB	Least Significant Bit
M	Meter
MHz	Megahertz
mm	Millimeter
MPC	Microprogrammed Controller
μ s	Microseconds
ms	Milliseconds
MSB	Most Significant Bit
MUX	Multiplexer
NB	Number Of Bits
ns	Nanoseconds
POS HI	Position High
POS LO	Position Low
POS MD	Position Middle
POS	Position
POSIT	Position
PT	PRINT Timer
R	Read or Register
RAM	Read Access Memory
RCV	Receive
RCVR	Receiver
RD ADR	Read Address
RD	Read or Register
RD	Receive Data
REG	Register
ROM	Read Only Memory
ST	Status
SYNC	Synchronize
TACH	Tachometer
TTL	Transistor To Transistor Logic
UART	Universal Asynchronous Receiver Transmitter
VREF	Voltage Reference

Table A-1 (Cont)
Glossary of Abbreviations

WC	Word Count
WD CNT	Word Count
WT ADR	Write Address
XD	Read Access Memory Transmit Data
XMIT	Transmit

**Table A-2
Signal Glossary**

Mnemonic	Definition	Source	Destination
BELL SINK	Bell Return	J5-2	Speaker
BELL SOURCE	+5 V to Bell	R118	J5-1, Speaker
COMMON	From LF Motor	J5-4	LF Motor
PHASE 1	To LF Motor	J5-7	LF Motor
PHASE 2	To LF Motor	J5-6	LF Motor
SOL 1:7	Solenoid Driver Outputs to Head Solenoids		
MPC3 BMB00	Buffered Memory Bit 0	E58-4 or E61-4	E49-9, E21-2 E31-15, E15-15
MPC3 BMB01	Buffered Memory Bit 1	E58-5 or E61-5	E49-5, E21-5 E31-14, E15-14
MPC3 BMB02	Buffered Memory Bit 2	E58-6 or E61-6	E49-3, E21-8 E31-13, E15-13
MPC3 BMB03	Buffered Memory Bit 3	E58-7 or E61-7	E49-1, E21-11 E31-11, E15-11
MPC3 BMB04	Buffered Memory Bit 4	E58-8 or E61-8	E54-13, E46-23 E50-15
MPC3 BMB05	Buffered Memory Bit 5	E58-9 or E61-9	E54-11, E46-22 E50-14
MPC3 BMB06	Buffered Memory Bit 6	E58-10 or E61-10	E54-9, E53-1 E46-21, E50-13
MPC3 BMB07	Buffered Memory Bit 7	E58-11 or E61-11	E54-5, E53-2 E46-20
MPC3 MB00	Memory Bit 00	E58-4 or E61-4	—
MPC3 MB01	Memory Bit 01	E58-5 or E61-5	—
MPC3 MB02	Memory Bit 02	E58-6 or E61-6	—
MPC3 MB03	Memory Bit 03	E58-7 or E61-7	—
MPC3 MB04	Memory Bit 04	E58-8 or E61-8	—
MPC3 MB05	Memory Bit 05	E58-9 or E61-9	—

Table A-2 (Cont)
Signal Glossary

Mnemonic	Definition	Source	Destination
MPC3 MB06	Memory Bit 06	E58-10 or E61-10	--
MPC3 MB07	Memory Bit 07	E58-11 or E61-11	--
MPC4 CLR BEL	Clear Bell	E44-9	E36-3
MPC4 CLR C/B	Clear Carries or Borrows	E44-16	E11-13
MPC4 CLR DA	Clear Data Available	E44-2	E60-11
MPC4 CLR HDE	Clear Head Drive Enable	E44-13	E39-11, E30-11
MPC4 CLR INIT	Clear Initialize	E44-17	E51-1
MPC4 CLR KBH	Clear Keyboard Hold	E44-1	E51-10
MPC4 CLR 568	Clear 568	E44-6	E15-23, E31-4 E30-4
MPC4 CS00	Clocked Selector 04	E46-1	E42-1
MPC4 CS01	Clocked Selector 04	E46-2	E42-2
MPC4 CS02	Clocked Selector 04	E46-3	E42-13
MPC4 CS03	Clocked Selector 04	E46-4	E37-4
MPC4 CS04	Clocked Selector 04	E46-5	E37-5
MPC4 CS10	Clocked Selector 04	E46-9	--
MPC4 CS11	Clocked Selector 04	E46-10	E27-3
MPC4 CS12	Clocked Selector 04	E46-11	E44-18, 19
MPC4 CS13	Clocked Selector 04	E46-13	E44-18, 19
MPC4 CS14	Clocked Selector 04	E46-14	E42-5
MPC4 CS15	Clocked Selector 04	E46-15	E37-1, E42-3
MPC4 CS16	Clocked Selector 04	E46-16	E37-2, E37-13 E42-4
MPC4 CS17	Clocked Selector 04	E46-17	E53-4

Table A-2 (Cont)
Signal Glossary

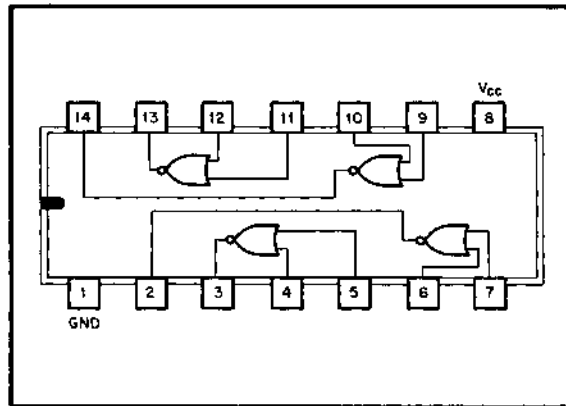
Mnemonic	Definition	Source	Destination
MPC4 LOAD CBA	Load Character Buffer Address	E44-4	E52-9
MPC4 LOAD D/A	Load Digital/Analog	E44-10	E14-9
MPC4 MAX	Maximum	E23-6	E31-5, E14-4, 5, 12, 13
MPC4 REG0:3	Register	E32-2, 3, 6, 7	E52-4, 5, 12, 13 E38-1, 5, 9, 10
MPC4 S000	Selector 0	E50-1	E22-2
MPC4 S001	Selector 1	E50-2	E27-2
MPC4 S002	Selector 2	E50-3	E21-3
MPC4 S003	Selector 3	E50-4	E31-9
MPC4 S004	Selector 4	E50-5	E15-9
MPC4 SET BEL	Set Bell	E44-9	E36-4
MPC4 SET HDE	Set Head Drive Enable	E44-11	E39-10
MPC4 SET HOLD	Set Hold	E44-15	E40-4
MPC4 STEP LF	Step Line Feed	E44-14	E24-3, 11, E29-5
MPC4 SKIP	Skip	E40-11	E60-2
MPC4 WRITE BUF	Write Buffer	E44-5	E60-10, E56-3
MPC4 ZERO	Zero	E23-8	E18-13, E31-3, 6
MPC4 -1 REG	Decrement Register	E44-7	E32-4
MPC4 +1 REG	Increment Register	E44-3	E32-5
MPC5 CLK	Clock	E64-5, 12	E46-18, 19, E29-10, E49-13
MPC5 S.I.	Serial In	E66-6	E55-20
MPC5 1.184 μ s	1.184 μ s	E13-12	E37-10, E13-1, E64-9, E7-13, E9-3, 11
MPC5 1.76 kHz	1.76 kHz	E68-11	E30-3, E59-3

Table A-2 (Cont)
Signal Glossary

Mnemonic	Definition	Source	Destination
MPC5 4.8 kHz	4.8 kHz	E63-11	E26-14, E17-4
MPC5 19	19	E26-9	E67-5, E31-21, 22
MPC5 76 μ s	76 μ s	E26-11	E3-3, E5-3
MPC5 208	208	E26-12	E40-10, E67-11, E17-7, E15-7, E31-19
MPC5 568	568	E30-5, 6	E64-10, E9-4, 10 E13-14, E37-9
MPC5 592 ns	592 ns	E17-13	E20-1
MPC6 BEL	Bell	E19-1	E15-6
MPC6 BS	Back Space	E19-9	E15-20
MPC6 CR	Carriage Return	E19-3	E25-13, E15-4
MPC6 DA	Data Available	E55-19	E31-7
MPC6 HS1:7	Head Select	E28-4 to 11 and E33-4 to 11	Head Solenoid Drivers
MPC6 HT	Horizontal Tab	E19-7	E15-21
MPC6 KBH	Keyboard Hold	E51-8	E31-20
MPC6 LF	Line Feed	E19-6	E25-1, E15-5
MPC6 PNTABL	Printable	E33-11	E25-11, E31-1
MPC6 S.O.	Serial Out	E55-25	E29-12
MPC7 BORROW	Borrow	E12-3	E12-1, E15-22 E31-18
MPC7 CARRY	Carry	E7-6	E31-23
MPC7 COL INC COUNT 0:2	Column Increment Count	E16-2, 3, 6	E28-19 to 21, E33-19 to 21
MPC7 INC	Increment	E30-9	E15-3
MPC7 PT COM +5 V	Print Timer Common	J1-U, V	J1-13, 17 (R1, R2)

Table A-2 (Cont)
Signal Glossary

Mnemonic	Definition	Source	Destination
MPC7 SUM	Sum	E1-6 (J1-B)	
MPC8 BEL	Bell	R58	J1-TT, J1-38
MPC8 HDE (HDEM)	Head Drive Enable	E39-8	J5-2
MPC8 INIT	Initialize	E51-5, 6	E11-2, E31-8
MPC8 LF1	Line Feed 1	E24-9	J1-JJ
MPC8 LF2	Line Feed 2	E24-5	J1-P
MPC8 LF HOLD	Line Feed Hold	E29-6	J1-HH
MPC8 W.U.	Wake Up	Q9-C	E53-5, E10-12, E36-1, J1-DD, E14-1
P.T. COLL 1	Print Timer Collector 1	Q1-C (J1-21)	J1-Y (E34-2)
P.T. COLL 2	Print Timer Collector 2	Q2-C (J1-25)	J1-CC (E35-2)



IC-0013

Figure A-1 380 Quad 2-Input NOR Gate

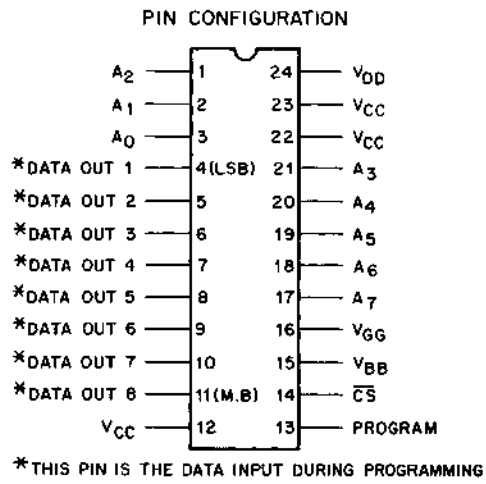
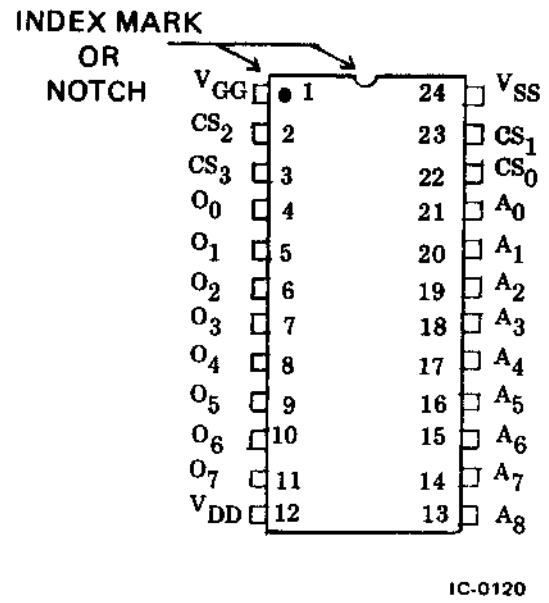
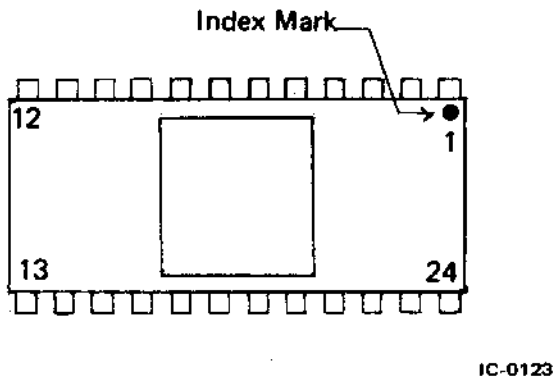


Figure A-2 1702A 8-Bit Reprogrammable ROM

PACKAGE "A" - BENT LEADS



PACKAGE "B" - BRAZED LEADS

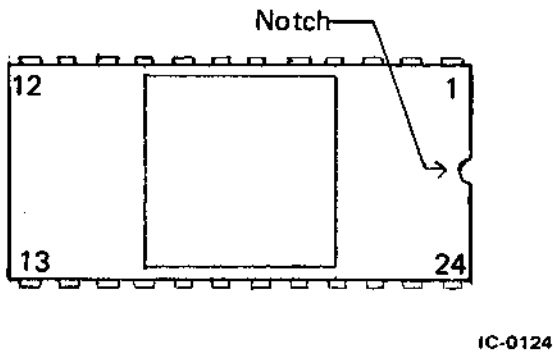
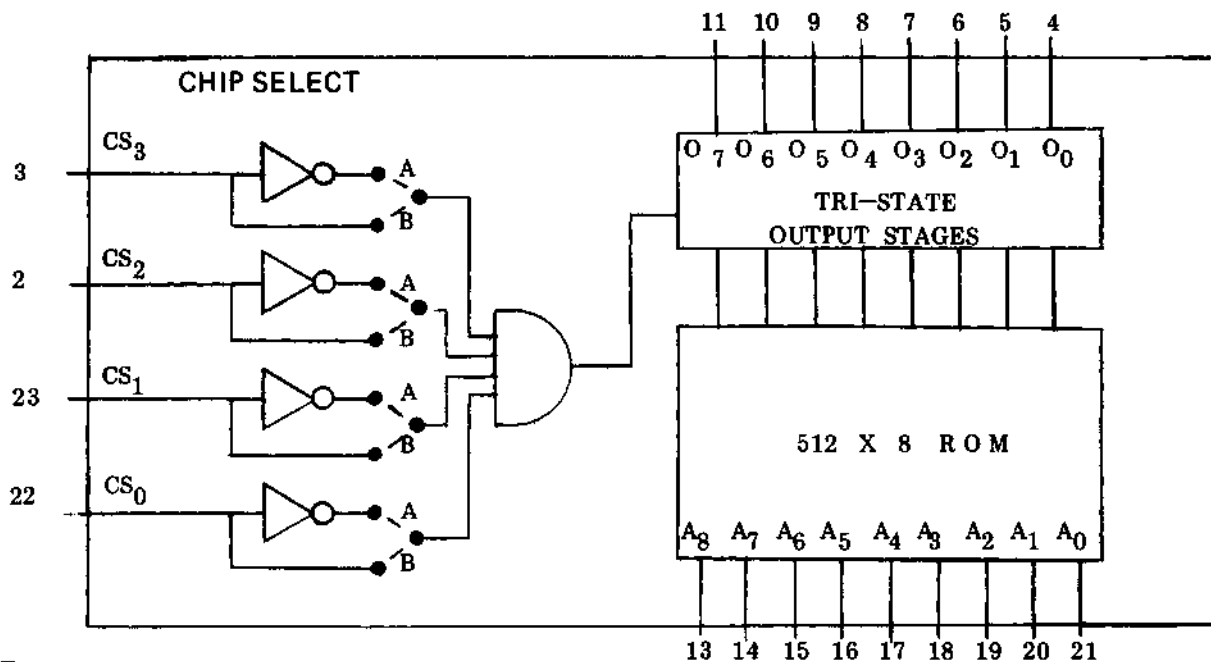


Figure A-3 2627P A6-01 Character Generator Alpha (Sheet 1 of 2)

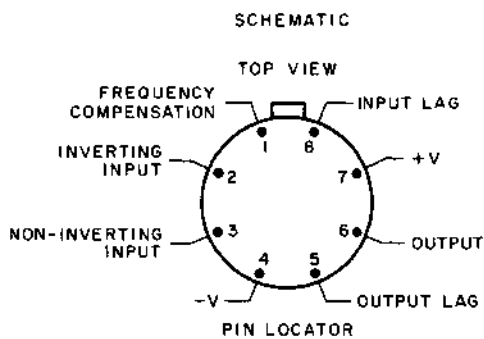
FUNCTIONAL BLOCK DIAGRAM



NOTE: Choice of connection A or B for each chip select is available as a mask option.

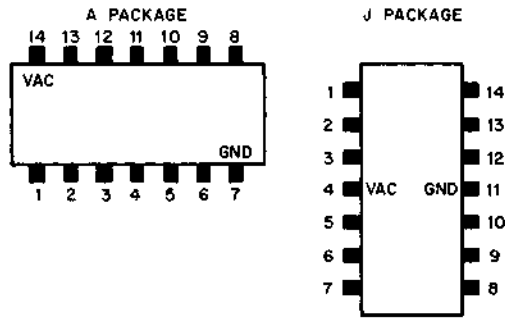
IC-0121

Figure A-3 2627P A6-01 Character Generator Alpha (Sheet 2 of 2)



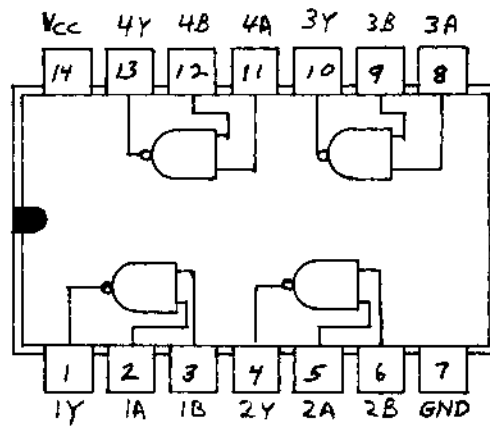
IC-0105

Figure A-4 3101 Random Access Memory



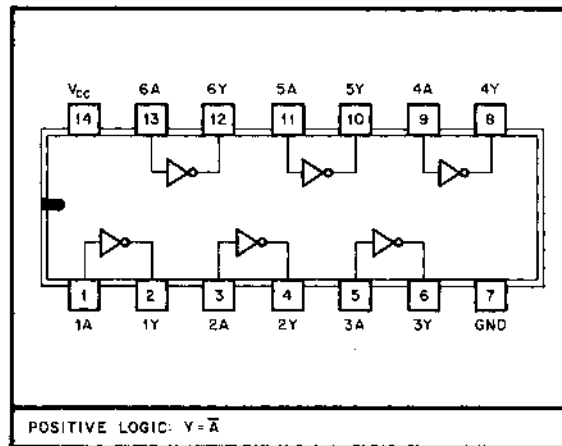
IC-0022

Figure A-5 7400 Quad 2-Input Positive NAND Gate



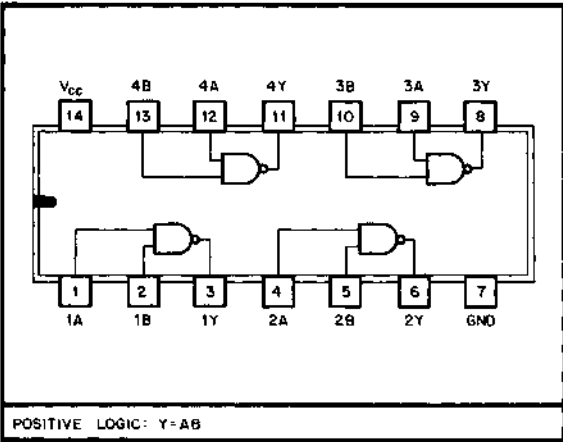
IC-0129

Figure A-6 7401 NAND Gate-Quad 2-Pin Open Collector



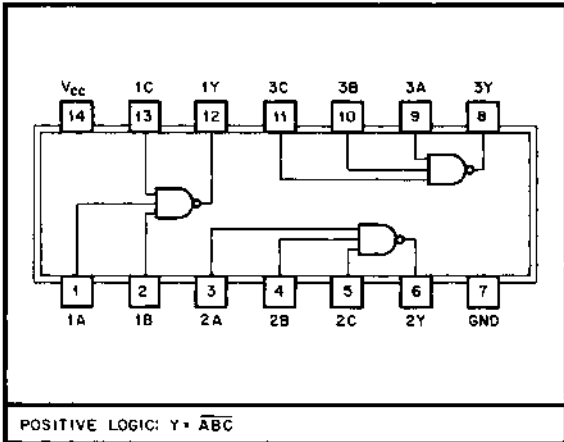
IC-0011

Figure A-7 7404 Hex Inverter



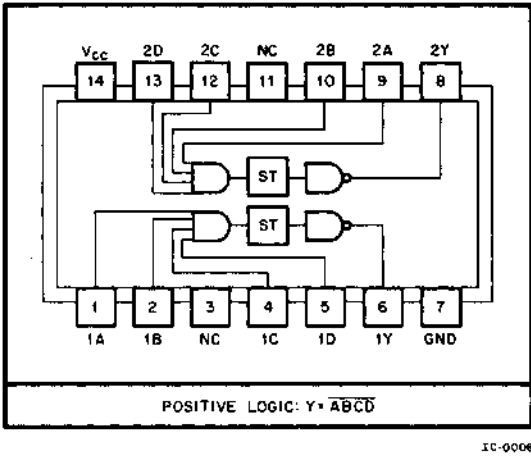
IC-0014

Figure A-8 7408 Quad 2-Input Positive AND Gate

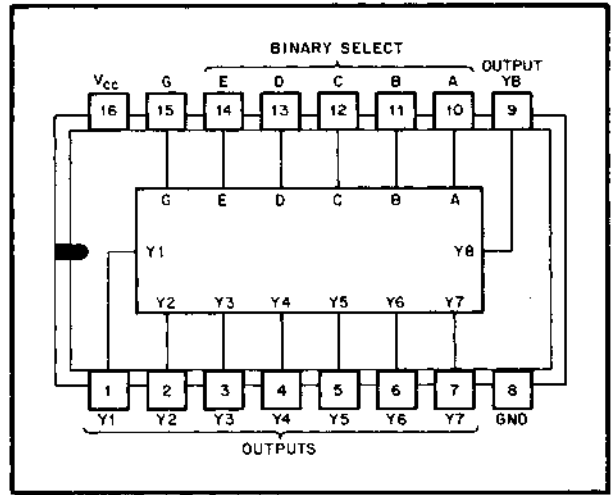


IC-0010

Figure A-9 7410 Triple 3-Input Positive NAND Gate

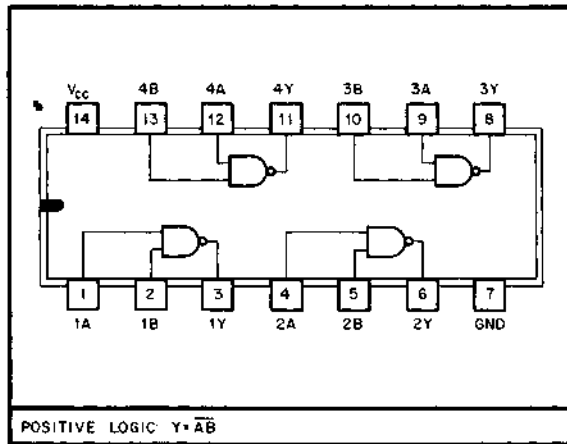


IC-0008



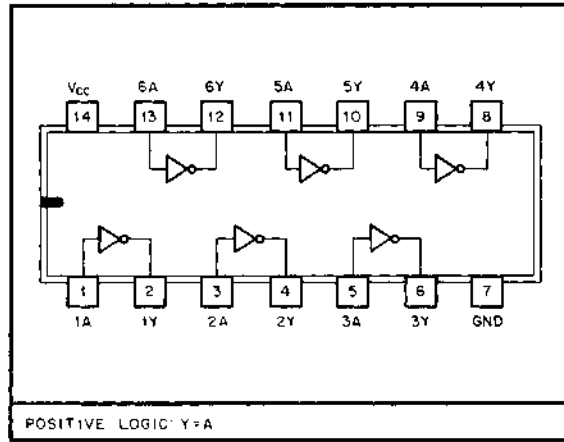
IC-0009

Figure A-10 7413 Schmidt Trigger

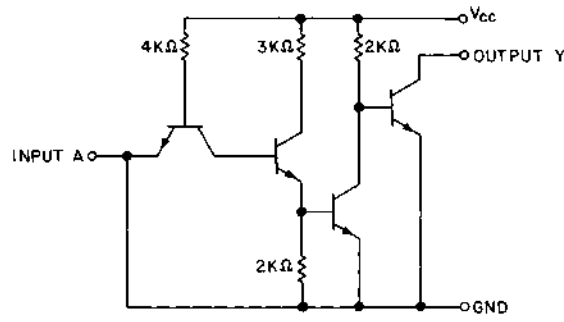


IC-0012

Figure A-11 7416 Hex Inverter Buffer/Driver



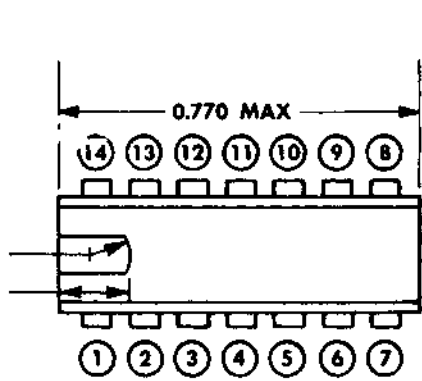
IC-0057



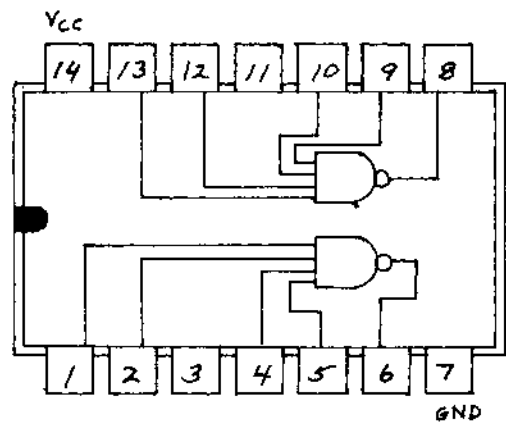
Component values shown are nominal

IC-0056

Figure A-12 7417 Hex Buffers/Drivers



IC-0128

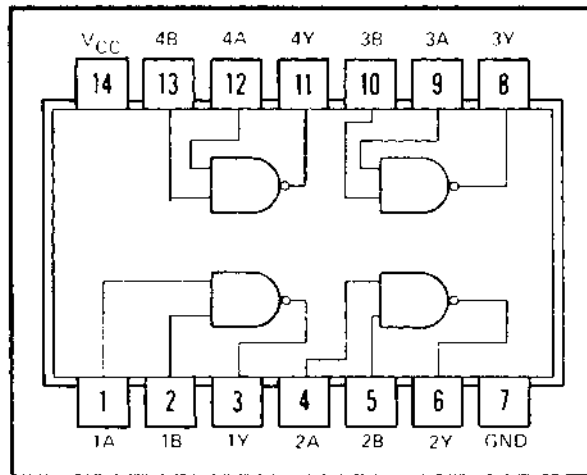


IC-0130

Figure A-13 7420 NAND Gate-Dual 4-Input

No Package Drawing Available

Figure A-14 7423



IC-0126

Figure A-15 7437 NAND Gate-Quad 2 In Buffer, 14 Pin

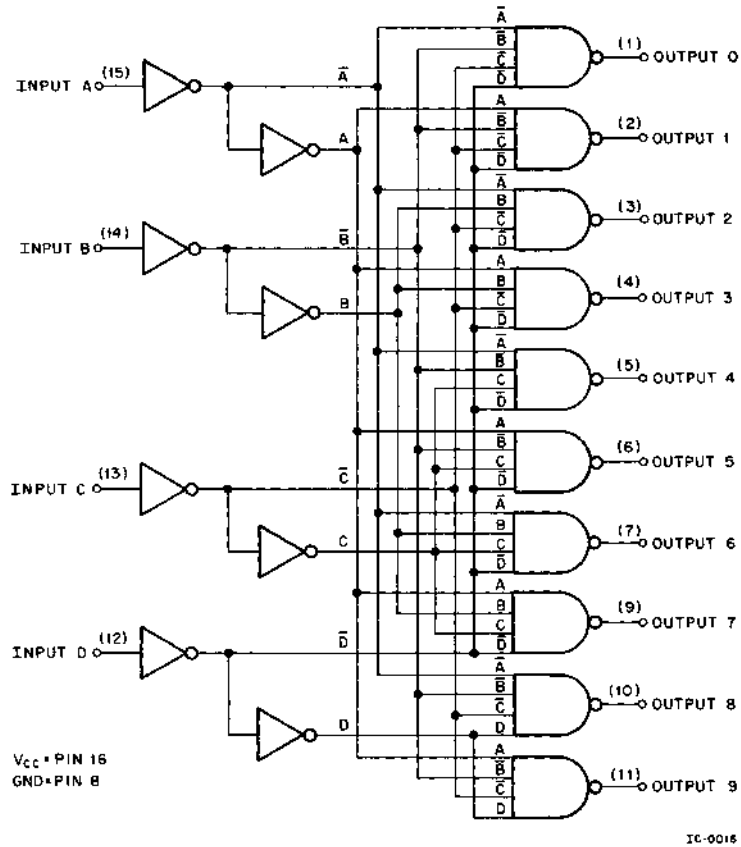
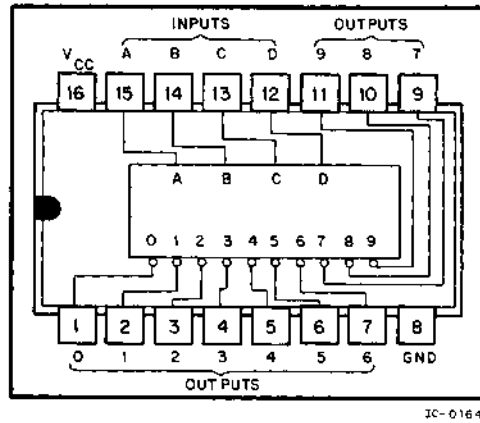
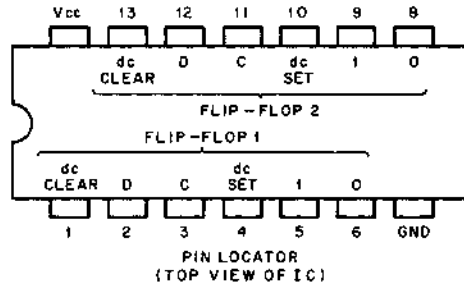
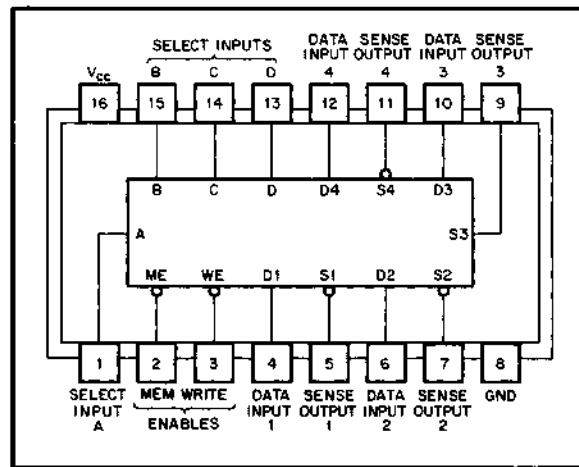


Figure A-16 7442 4-Line-to-10-Line Decoders



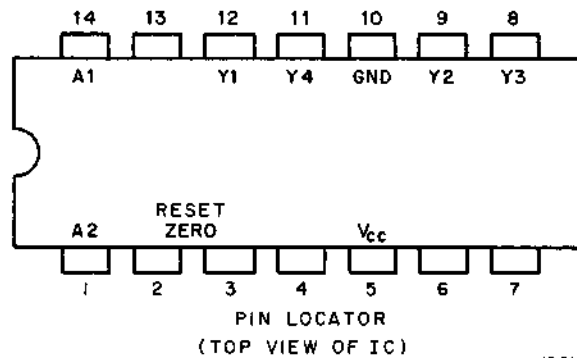
IC-0001

Figure A-17 7474 Dual D-Type Edge-Triggered Flip-Flop



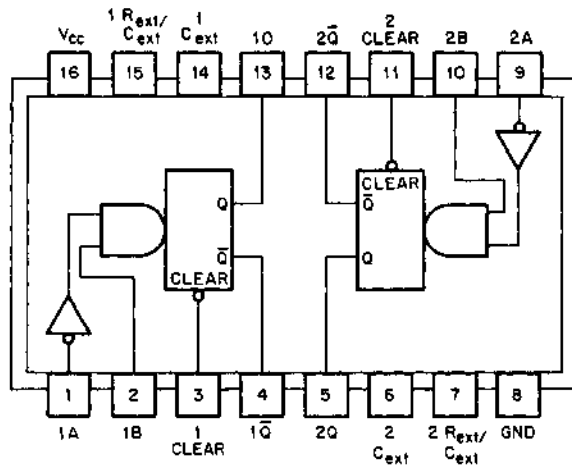
IC-0007

Figure A-18 7489 64-Bit Read/Write Memory



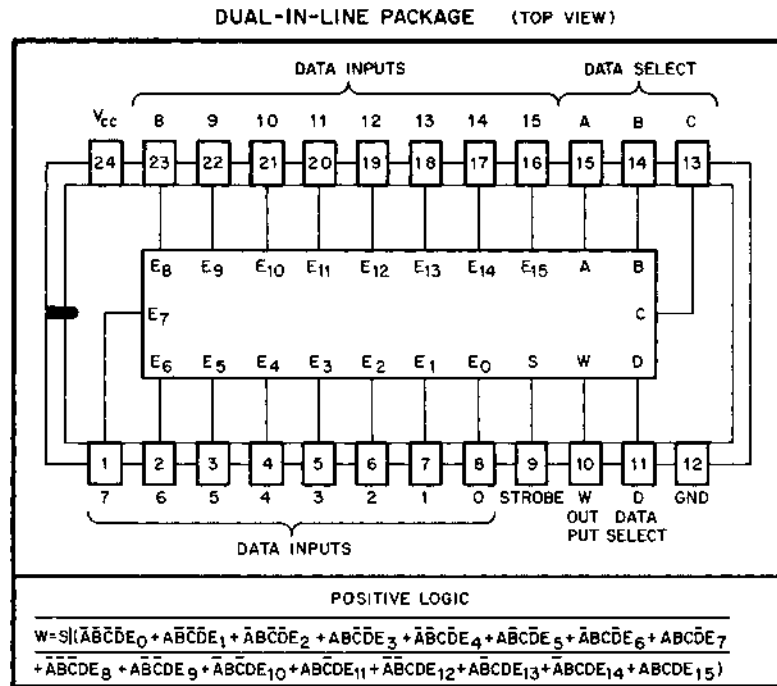
IC-0100

Figure A-19 7493A Counter Asynch Up, Binary



FUNCTIONAL LOGIC / PIN LOCATOR

Figure A-20 74123 Monostable Multivibrator



1C-0117

Figure A-21 74150 Data Selector/Multiplexer

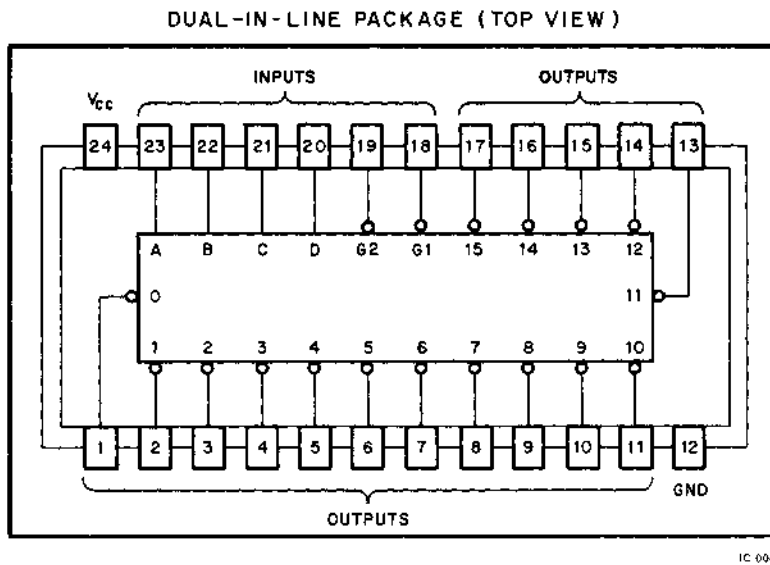


Figure A-22 74154 4-Line-to-26-Line Decoder/Demultiplexer

No Package Drawing Available

Figure A-23 74161 4-Bit Binary Counter

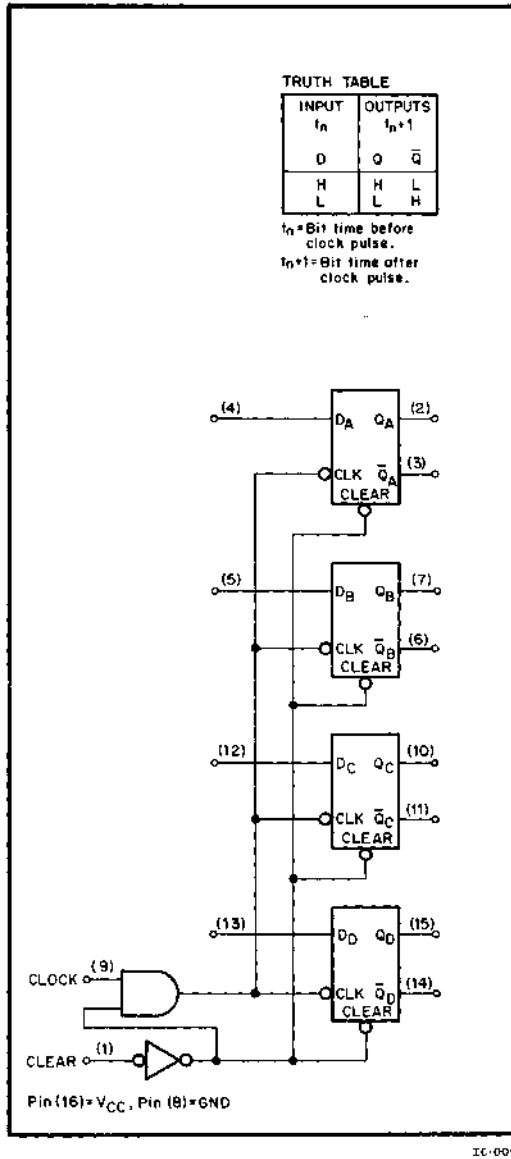
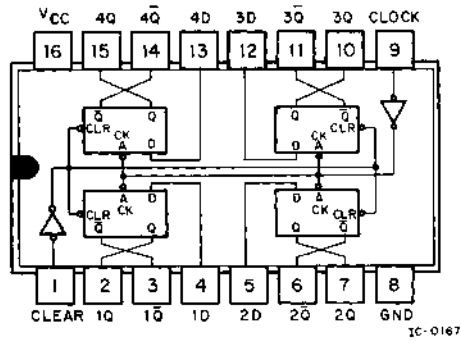
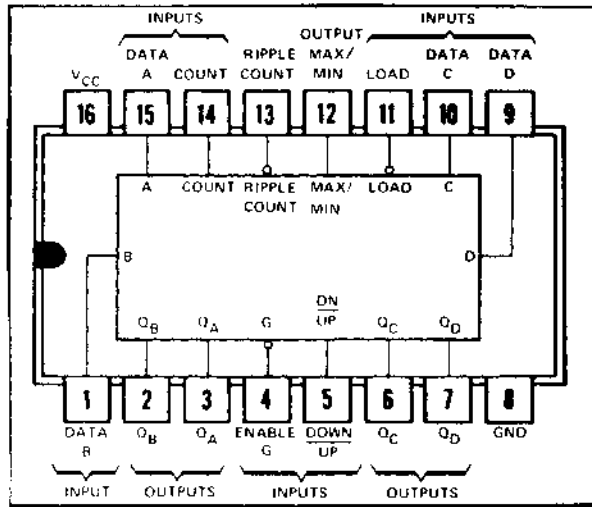
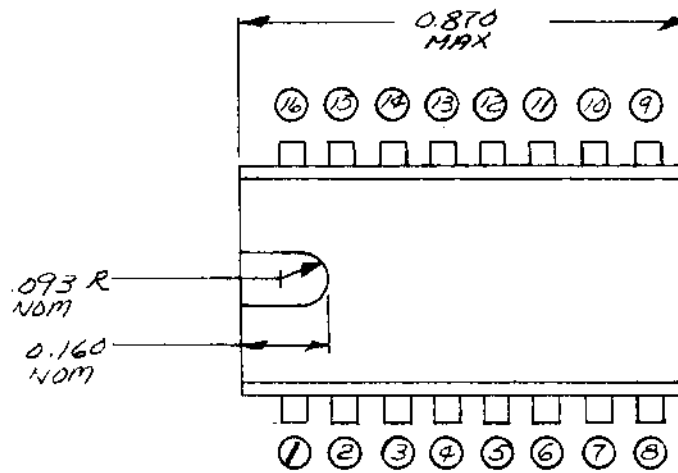


Figure A-24 74175 Quad D-Type Flip-Flop with Clear

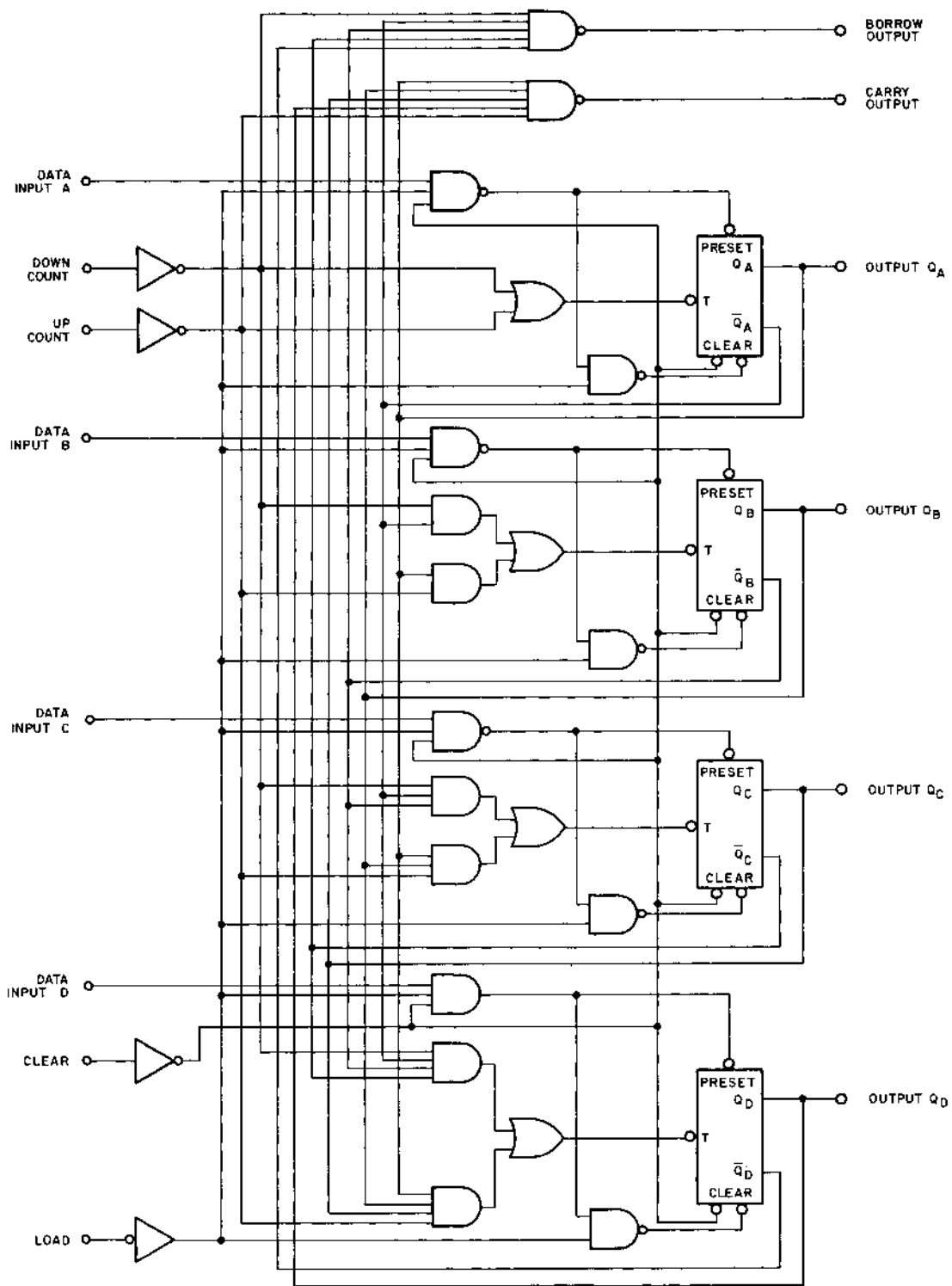


IC-0127



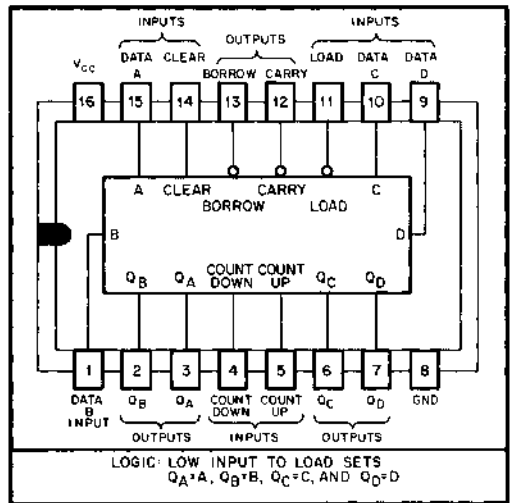
IC-0131

Figure A-25 74190 Counter, Synch Up/Down Decade, 16 Pin



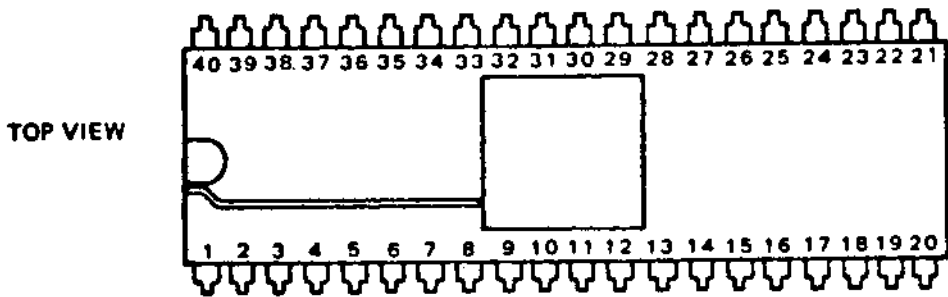
IC-0002

Figure A-26 74193 Synchronous 4-Bit Up/Down Counter (Sheet 1 of 2)



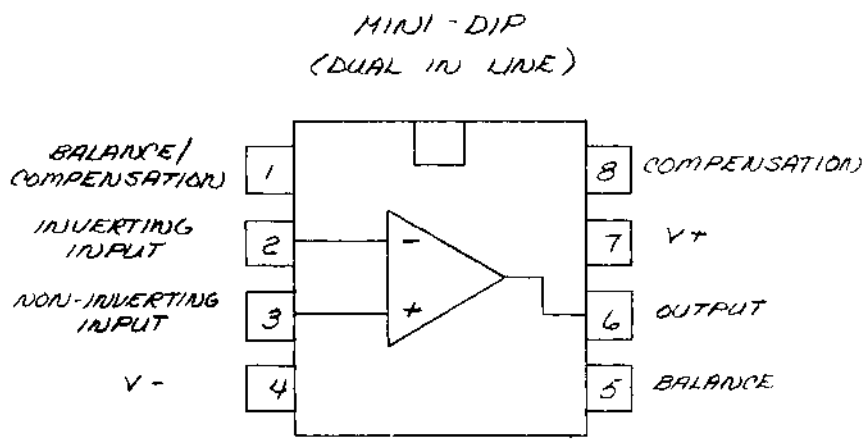
IC-0101

Figure A-26 74193 Synchronous 4-Bit Up/Down Counter (Sheet 2 of 2)



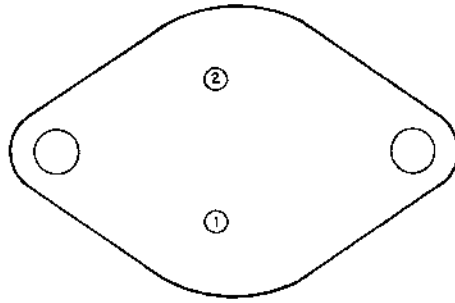
IC-0119

Figure A-27 Universal Asynchronous Receiver Transmitter



IC-0122

Figure A-28 301 AN DIP Operational Amplifier



TERMINAL CONNECTIONS

PIN 1 = INPUT
PIN 2 = OUTPUT
CASE = GROUND

IC-0168

Figure A-29 309 K Regulator

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