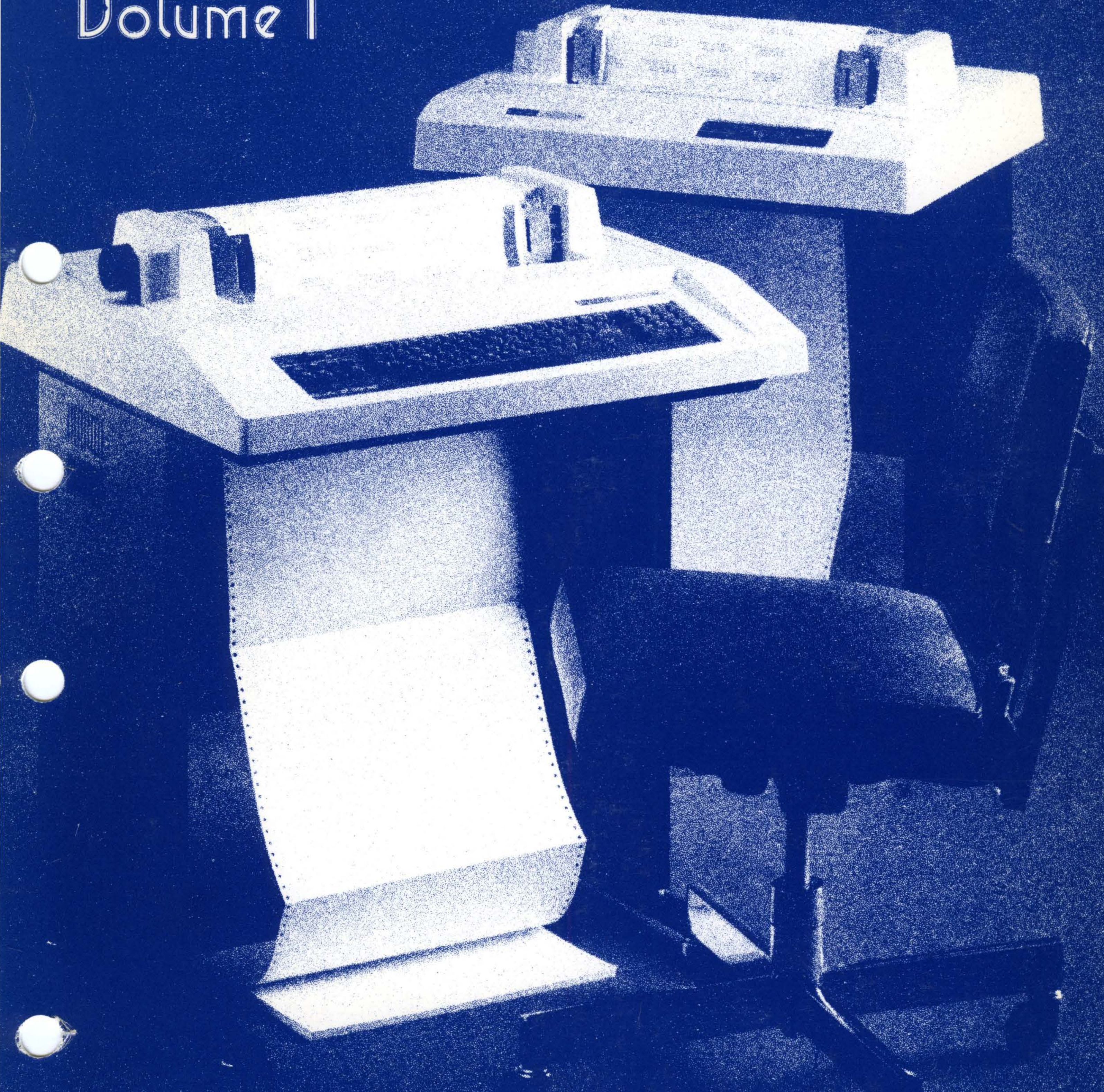
LA36/LA35 DECwriter II Maintenance Manual Volume I



digital

EK-1LA36-MM-001

LA36 DECwriter II MAINTENANCE MANUAL Volume I

digital equipment corporation • maynard, massachusetts

1st Edition, June 1975
2nd Printing (Rev), September 1976
2nd Edition, June 1977

Printed in U.S.A.

This document was set on DIGITAL's DECset-8000 computerized typesetting system.

9/77-14

CONTENTS

CONTENTS (CONT)

CONTENTS (CONT)

CONTENTS (CONT)

CONTENTS (CONT)

CONTENTS (CONT)

FIGURES

FIGURES (CONT)

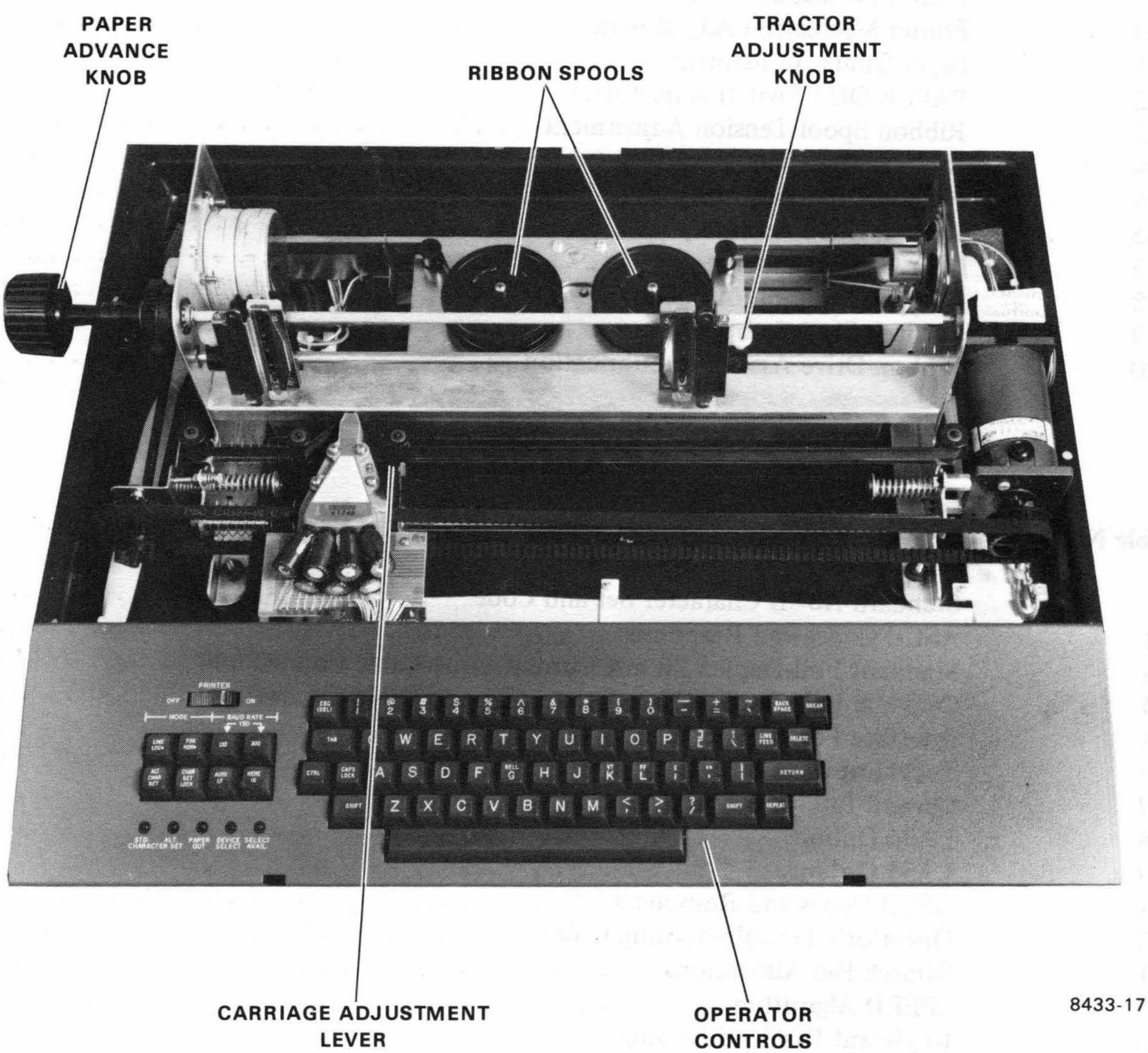
FIGURES (CONT)

FIGURES (CONT)

FIGURES (CONT)

FIGURES (CONT)

TABLES



LA36/LA35 DECwriter

CHAPTER 1
GENERAL DESCRIPTION

The LA36/LA35 DECwriter II is a fast, small, quiet 300 baud printer terminal for use as an economical hard-copy terminal in remote or local output or input/output applications. 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 (LA36) or received (LA36/LA35) in standard ASCII code at 3 rates: 110, 150, and 300 baud.

NOTE
This manual should be used to maintain LA37s. The LA37 is an LA36 with a APL/ASCII keyboard.

The printer produces a hard copy original plus up to 5 duplicate copies on tractor-driven continuous forms varying in width from 7.6 to 37.8 cm (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 lowercase ASCII characters (Table 1-1) is printed at a horizontal spacing of 3.9 characters per centimeter (10 characters per inch) and a vertical spacing of 2.3 lines per centimeter (6 lines per inch). A switch on the LA36 keyboard printed circuit board allows selection of a reduced set of 64 uppercase ASCII characters.

NOTE
On LA36 printers 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.

Table 1-1 Standard ASCII Character Set and Code

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

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 the printer mechanism and print head, which are mounted on a cabinet base. A complete mechanical breakdown of the DECwriter II is provided in Appendix B.

Electronic components are mounted on a keyboard assembly, logic board, and a power board. 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 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.

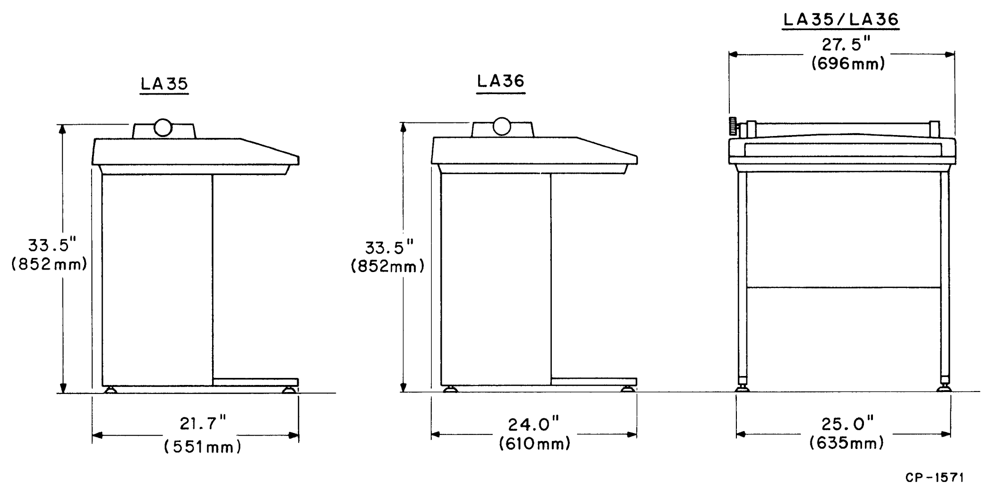


Figure 1-1 Outline Dimensions

1.2 FUNCTIONAL DESCRIPTION

A functional block diagram is shown in Figure 1-2. The DECwriter II 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.

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.

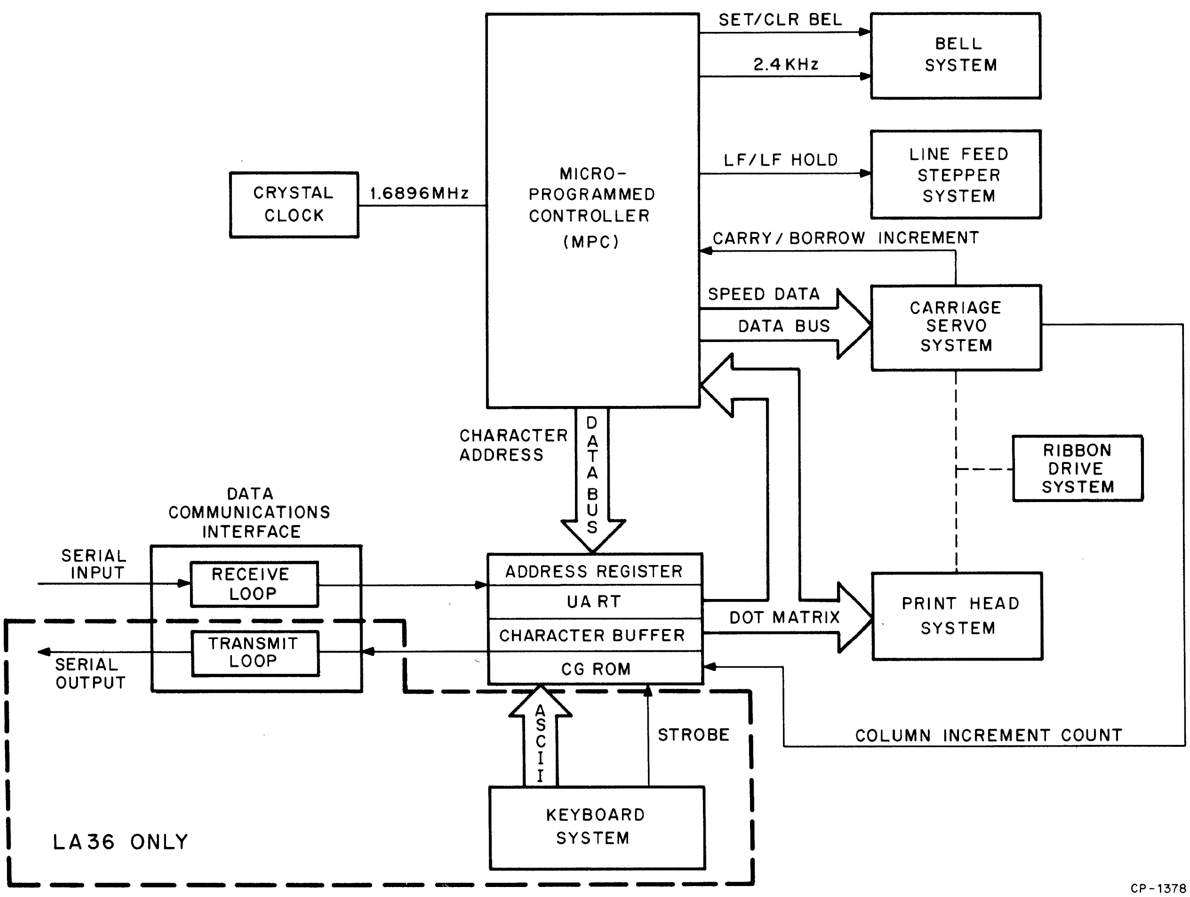


Figure 1-2 Simplified Functional Block Diagram

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 3.8 mm (0.15 inch) to the right of the end stop.

Incoming characters from the keyboard system (LA36) 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 that 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 0.25 mm (0.01 inch) of motion to form the 7 columns of the 7 3 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 Paragraph 1.2.5. Line feed operation is described in Paragraph 1.2.3.

Table 1-2 identifies the 7-bit ASCII codes generated by the LA36 keys and the responses of the LA36/LA35 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 378 mm (14.875 inches) wide. The hole spacing along the edge is 12.7 ± 0.254 mm (0.500 ± 0.010 inch) [non-accumulative over 0.508 mm (2.0 inches)] with a hole diameter of 3.81 to 4.064 mm (0.150 to 0.160 inch). Multipart forms of up to six sheets (and five carbon sheets) may be used, with a maximum allowable total thickness of 0.508 mm (0.020 inch), which is measured at about 20 lb/in^2 pressure. Card stock of one layer may be used, with a maximum thickness of 0.254 mm (0.010 inch). Multipart 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 0.0762 to 0.508 mm (0.003 to 0.020 inch).

A full 279.4 mm (11 inch) 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, Paragraph 3.2.1. The feed holes of the paper are engaged by 2 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 for 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 *4.2 mm (1/6 inch)*. This is performed in 33 ms, maximum, either singly or in succession. Consequently, the paper feed rate is 127 mm (5 inches or 30 lines) per second.

Table 1-2 ASCII Codes and Responses

ASCII Code	Character	KEYBOARD OPERATIONS To Transmit, Type Key(s) (LA36) SHIFT*	CTRL*	CHAR	RECEIVE OPERATIONS Character Printed	Action/Description
000	NUL	√	√	SPACE	None	None
001	SOH		√	A		
002	STX		√	B		
003	ETX		√	C		
004	EOT		√	D		
005	ENQ		√	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	√	√	–	None	None
040	SP			space bar	Blank Spacd	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 ASCII Codes and Responses (Cont)

ASCII Code	Character	KEYBOARD OPERATIONS To Transmit, Type Key(s) (LA36) SHIFT*	CTRL*	CHAR	RECEIVE OPERATIONS Character Printed	Action/Description
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	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 ASCII Codes and Responses (Cont)

ASCII Code	Character	KEYBOARD OPERATIONS To Transmit, Type Key(s) (LA36) SHIFT*	CTRL*	CHAR	RECEIVE OPERATIONS Character Printed	Action/Description
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 ASCII Codes and Responses (Cont)

		KEYBOARD OPERATIONS			RECEIVE OPERATIONS	
		To Transmit, Type Key(s) (LA36)				
ASCII Code	Character	SHIFT*	CTRL*	CHAR	Character Printed	Action/Description
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.

1.2.4 Ribbon Drive System

A 36.576 m (40 yard) long, 12.7 mm (0.5 inch) wide ribbon is wound upon two 101.6 mm (3-1/4 inch) 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, 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 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 2.54 mm (0.01 inch) 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 an 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 [2.54 mm (0.1 inch)]. 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 2 seconds have elapsed without a printable character input, the carriage moves 4 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 ±5 percent with 200 mV peak-to-peak maximum ripple.

Regulated volts of +12 V ±5 percent and -12 V ±5 percent, with 500 mV peak-to-peak 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

NOTE

The LA36 and LA35 have identical interfaces. However, the LA35 only utilizes the receive circuitry.

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 (polarities denote current flow) and Figure 1-3. Circuit operation is shown in Figure 1-4 (polarities denote current flow).

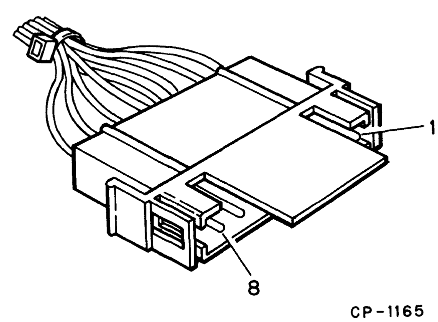


Figure 1-3 Current Loop Cable Connector Pin Designations

®Teletype is a registered trademark of Teletype Corporation.

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

Connector Pin Numbers			
To Logic Board Connector J3	To Host Computer Connector	Circuit	Description
P1–2	P2–3	Transmit (+) (keyboard)	Negative side of line
P1–5	P2–7	Transmit (–) (keyboard)	Positive side of line
P1–3	P2–2	Receive (+) (printer)	Negative side of line
P1–7	P2–5	Receive (–) (printer)	Positive side of line

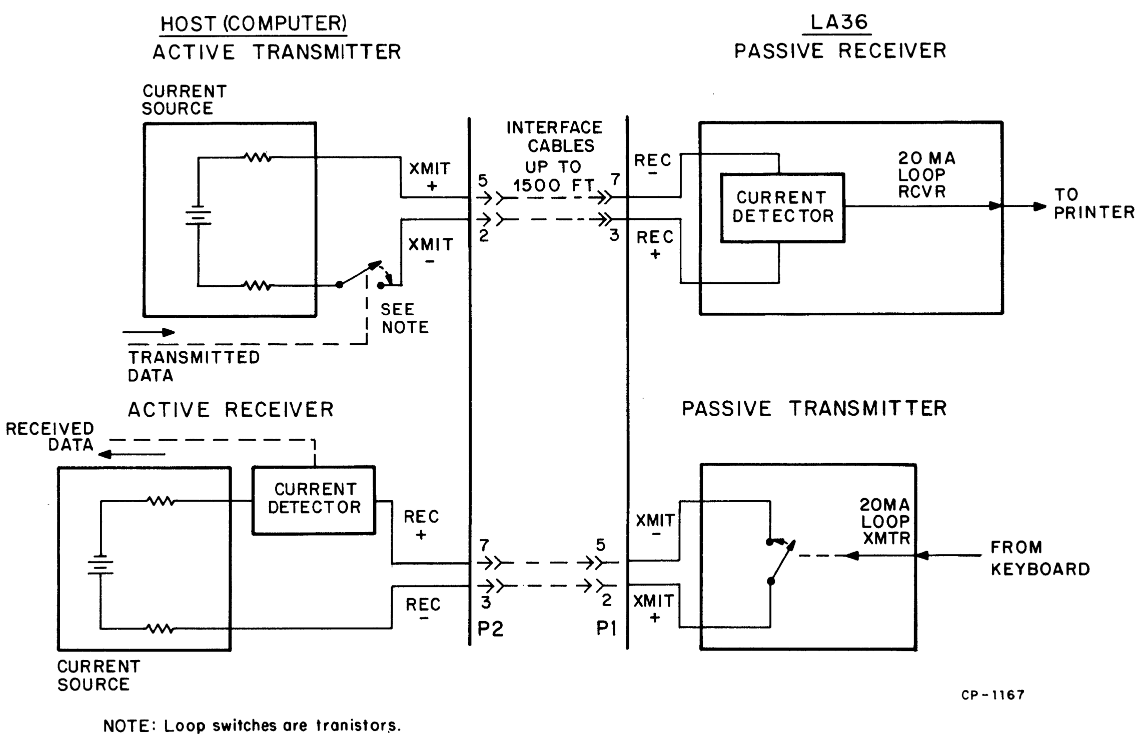


Figure 1-4 Standard Current Loop Interface

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.

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 the DECwriter II logic boards; the jumpers can be changed as described in Chapter 2, Paragraph 2.5.4. The configurations on the left of Figure 1-5 show the LA36 used as an active device, providing its own current source; the configurations on the right show the DECwriter II used in the half-duplex mode, both as a passive and an active device.

Cable pin connections are shown in Table 1-4.

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.

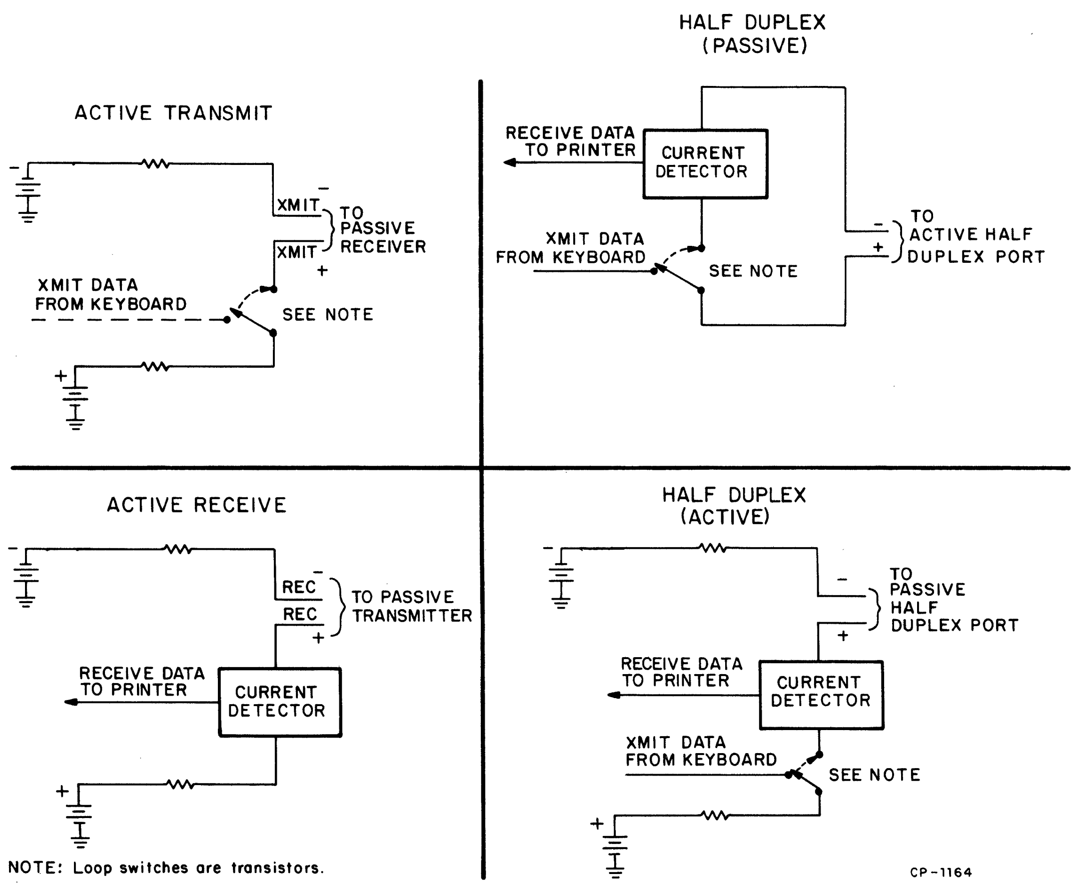


Figure 1-5 Optional Current Loop Configurations

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

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

1.2.9 Peripheral Interface Port
The LA36/LA35 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 cabinet.

1.2.10 Interface Options
The LA36 is capable of functioning with several different interfaces (options).

Tables 1-8 and 1-9 provide a general description of each interface option. For detailed information, refer to the appropriate chapter in Volume 2 of this manual.

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

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 OPTIONS

The basic LA36 DECwriter II can be expanded to provide the user with a number of function options for receiving, transmitting, and handling data. These functional options are described in Tables 1-8 and 1-9.

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 (LA36)
Printing	
Type	Impact 7 × 7 dot matrix
Character Size	0.175 × 0.25 cm (0.70 × 0.100 in)
Vertical Spacing	2.36 lines/cm (6 lines/in)
Horizontal Spacing	3.94 char/cm (10 char/in)
Carriage Return	500 ms, maximum
Line Feed	33 ms
Slew Speed (paper feed rate)	1.97 cm/sec (5 in/sec) (30 lines/sec)
LA36 Keyboard	Standard ASCII typewriter-like layout, mechanical contact with four parallel switches.
Transmission Rates	110 baud 11 bit; 1 start bit, 7 character bits, 1 parity bit, and 2 stop bits. 150 and 300 baud 10 bit; 1 start bit, 7 character bits, 1 parity bit, and 1 stop bit.
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	90–132 Vac, 180–264 Vac, 48–63 Hz, or 50/60 Hz ± 1 Hz (see note) 300 W, maximum (printing) 160 W (idle)
Ribbon	DIGITAL-specified nylon fabric, spool assembly 12.7 mm (0.5 in) wide ± 36.576 m (40 yards) long Order No. 36-10558

Table 1-6 Technical Characteristics (Cont)

Paper	
Variable Width	7.62 to 37.78 cm (3 to 14-7/8 in)
Single-Part	6.8 kg (15 lb) paper, minimum Card stock thickness of 0.25 mm (0.010 in), maximum
Multipart	2- to 6-part (see Notes) Thickness of 0.50 mm (0.020 in), maximum Tractor-drive, pin-feed **NOTES** **1. Multipart forms may have only one card part. The card must be the last part.** **2. NCR or 3M paper, up to 6-part, must use ribbon on top copy. First surface impact paper is not recommended.** **3. Continuous-feed, fan-fold business forms with 3- or 4-prong margin crimps on both margins (multipart) are recommended. Stapled forms are not recommended and may damage tractors and other areas of the machine. Dot or line glue margins are acceptable (if line is on one margin only). Do not line glue both margins as air will not be able to escape and poor impressions will result.**
Mechanical	
Mounting	Free-standing pedestal unit
LA36 Size	851 mm (33.5 in) H × 699 mm (27.5 in) W × 607 mm (24 in) D
LA35 Size	851 mm (33.5 in) H × 699 mm (27.5 in) W × 550 mm (21.7 in) D
LA36 Weight	46 kg (102 lb)
LA35 Weight	44.09 kg (97 lb)
Environment	
Temperature	Operating: 10° to 40° C (50° to 104° F) Non-operating: –40° to 66° C (–40° to 151° F)
Relative Humidity	Operating: 10 to 90% with a maximum wet bulb temperature of 28° C (82° F) and a minimum dew point of 2° C (36° F), noncondensing Nonoperating: 5 to 95%
Altitude	Operating: sea level to 3.04 km (8000 ft)
Ribbon	DIGITAL-specified nylon fabric, spool assembly 12.7 mm (0.5 in) wide ± 36.576 m (40 yards) long Order No. 36-10558 **NOTE** **50/60 Hz is applicable to printers with CVT transformers. This transformer can be identified by the capacitor mounted on top of the transformer frame.**

Table 1-7 Current Interface Specifications

	Minimum	Maximum
Transmitter (passive, isolated, goes to "mark" state when power is turned off)	**Minimum**	**Maximum**
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)	**Minimum**	**Maximum**
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 28.1 cm (15 ft) BC05F-15 supplied with LA36		
Cable extension is 4920 m (1500 ft), maximum		
Receiver/Transmitter (active/half duplex)	**Minimum**	**Maximum**
Voltage drop, marking	1.7 V	4.7 V
Spacing current	0.0 mA	3.0 mA
Marking current	15 mA	80 mA

NOTE

Standard configuration is passive transmitter and receiver. Active/half duplex are optional configurations. These configurations are jumper selectable. (See Paragraph 2.5, Interface Installation.)

Table 1-8 LA36 Options

Options	Name	Control Switch/Indicator	Description
LAXX-LB	Expander Option	None	The Expander Option Mounting Kit includes the logic, cables, and mounting hardware required to expand the LA36 to include options LAXX-LA, LAXX-KV, LAXX-KW, LAXX-KX, LAXX-KY, and LAXX-PK.
LAXX-PK	APL/ASCII Dual Character Set	ALT CHAR SET, CHAR SET LOCK, and STD/ALT CHARACTER SET Indicators	This option provides an APL alternate character set for use with the standard character set in the LA36.
LAXX-LA	Auto LF After CR	AUTO LF	When the AUTO LF switch is activated, the printer will automatically insert a line feed after each carriage return code typed during transmission. The LAXX-LA option can also be configured to execute a line feed after each received carriage return code. Any combination of these options can be used.
LAXX-LM	Acoustic Coupler	Carrier Detect Lamp	The acoustic coupler provides an interface between a telephone and the DECwriter.
LAXX-KV	Top of Forms Control	FORMS LENGTH Switch and SET TOP OF FORM Pushbutton	Controls mounted under the top cover provide the operator with a method of selecting the length of the paper to be used. After the desired setting is selected and the paper is lined up for proper vertical alignment, the operator presses the SET TOP OF FORM switch so that the internal logic will be preset to the paper length defined by the operator.

Table 1-8 LA36 Options (Cont)

Options	Name	Switch/Indicator	Description
LAXX-KW	Selective Addressing	DEVICE SELECT and SELECT AVAIL Lamps	The Selective Addressing Option allows the LA36 to communicate with other terminals on a single data communications channel.
LAXX-KX	Auto Answerback and Auto LF Options	HERE IS, AUTO LF	The Automatic Answerback Option allows the terminal to transmit a preprogrammed message of 20 characters (maximum). The message is initiated by pressing the HERE IS pushbutton, or upon receipt of the ENQ control code from another device. The LAXX-KX also incorporates the features of the Auto LF Option (LAXX-LA).
LAXX-KY	Forms Control and Vertical and Horizontal Tabs	Keyboard Keys	The Forms and Tabbing Option enables the terminal to set horizontal and vertical tab positions either locally or via the system software. This option also incorporates features of the Top of Forms Option (LAXX-KV) and operates in the same manner.
LAXX-LG	EIA/CCITT Interface	None	The LAXX-LG interface provides the user with an RS/232-C interface with modem control and includes a 3.54 m (9 ft) cable terminated with a standard EIA connector.
LAXX-KH	DF11 Mounting Kit	None	The DF11 Mounting Kit enables the user to mount one of the DIGITAL series DF11 communication options in the LA36.

Table 1-8 LA36 Options (Cont)

Options	Name	Switch/Indicator	Description
LAXX-KJ	Compressed Font Option	None	The Compressed Font Option is a mechanical option that provides the LA36 with the ability to print 132 columns on a form 21.59 cm (8-1/2 inches) wide.
LAXX-KK	14-Key Numeric Keypad	Keyboard Keys	The 14-key numeric keypad is located to the right of the keyboard and provides the operator with a convenient method of entering mathematical number sequences.
LAXX-LZ	Paper Out	PAPER OUT Lamp	Provides a visual indication for a paper-out condition. Prevents keyboard and received data from printing.
LAXX-LH	Current Loop Cable	None	20 mA current loop with Mate-N-Lok.
LAXX-LK	Current Loop Cable	None	20 mA current loop with 4-pin plug for DEC10.
LAXX-KG	EIA Interface	None	The LAXX-KG interface includes a 3.54 m (9 ft) cable terminated with a standard EIA connector (no modem control features).
LAXX-LN	Scale, Pointer, and Window Kit	Column Scale, Line Indicator, and Column Pointer	Operator convenience items that assist in positioning the print head on preprinted forms and in locating horizontal tabs.

Table 1-9 LA35 Options

Option	Name	Description
LAXX-LB	Expander Option Mount	The Expander Option Mounting Kit includes the logic, cables, and mounting hardware required to expand the LA35 to include options LAXX-LA, LAXX-KV, LAXX-KW, LAXX-KX, LAXX-KY, and LAXX-PK.
LAXX-PK	APL/ASCII Dual Character Set	This option provides an APL alternate character set for use with the standard character set in the LA35.
LAXX-LA	Auto LF After CR	The LAXX-LA option causes the printer to execute a line feed after each received carriage return code.
LAXX-KV	Top of Forms Control	Controls mounted under the top cover provide the operator with a method of selecting the length of the paper to be used. After the desired setting is selected and the paper is lined up for proper vertical alignment, the operator presses the SET TOP OF FORM switch so that the internal logic will be preset to this paper length as defined by the operator.
LAXX-KW	Selective Addressing	The Selective Addressing Option allows the LA35 to operate with other terminals on a single data communications channel.
LAXX-KX	Auto Answerback and Auto LF Options	The Automatic Answerback Option allows the terminal to transmit a preprogrammed message of 20 characters (maximum). The message is initiated upon receipt of the ENQ control code from another device. The LAXX-KX may be configured to incorporate the features of the Automatic Line Feed Option (LAXX-LA).
LAXX-KY	Forms Control, Vertical and Horizontal Tabs	The Forms and Tabbing Option enables the printer to set horizontal and vertical tab positions via the system software. This option also incorporates features of the Top of Forms Option (LAXX-KV) and operates in the same manner.

Table 1-9 LA35 Options (Cont)

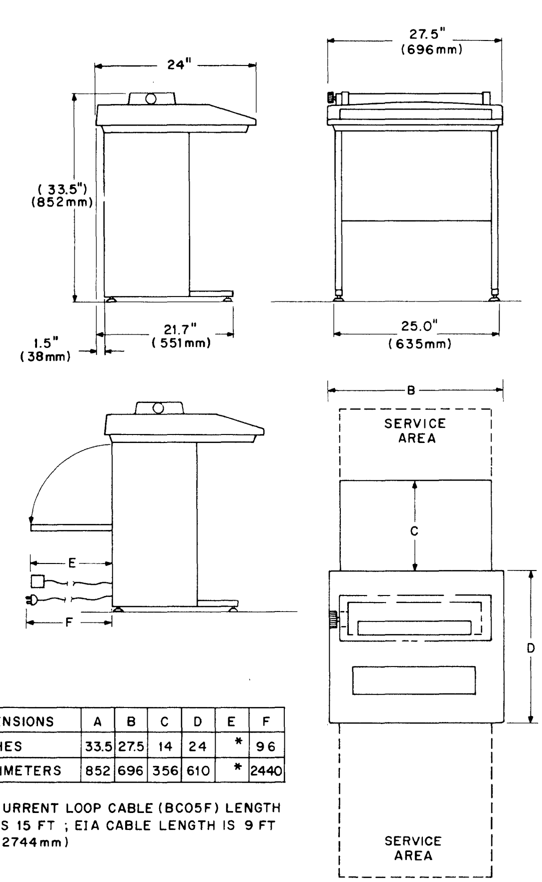
Option	Name	Description
LAXX-LM	Acoustic Coupler	The acoustic coupler provides an interface between a telephone and the DECwriter.
LAXX-LG	EIA/CCITT Interface	The LAXX-LG EIA/CCITT interface provides the user with an RS232-C interface with modem control and includes a 3.54 m (9 ft) cable terminated with a standard EIA connector.
LAXX-KH	DF11 Mounting Kit	The DF11 Mounting Kit enables the user to mount one of the DIGITAL series DF11 communication options in the LA35.
LAXX-KJ	Compressed Font Option	The Compressed Font Option is a mechanical option that provides the LA35 with the ability to print 132 columns on a form 21.59 cm (8-1/2 inches) wide.
LAXX-LC	TTL TO CCITT (V28 Converted and Modem Protector	The TTL to CCITT (V28) converter and modem protector is a BPO DATEL services interface that meets the requirements of CCITT (V28), with BPO-required modem protection circuitry.
LAXX-LH	Current Loop Cable	20 mA current loop with Mate-N-Lok
LAXX-LK	Curent Loop Cable	20 mA current loop with 4-pin plug for DEC10
LAXX-KG	EIA Interface	The LAXX-LG interface includes a 3.54 m (9 ft) cable terminated with a standard EIA connector.
LAXX-LN	Scale, Pointer, and Window Kit	These are operator convenience items that assist in positioning the print head on preprinted forms and for locating horizontal tabs

CHAPTER 2
INSTALLATION AND CHECKOUT GUIDE

2.1 GENERAL

This paragraph contains the step-by-step procedures for unpacking and unit checkout to ensure that the unit was not damaged during shipment and that the unit is operating properly prior to connection to the communication system.

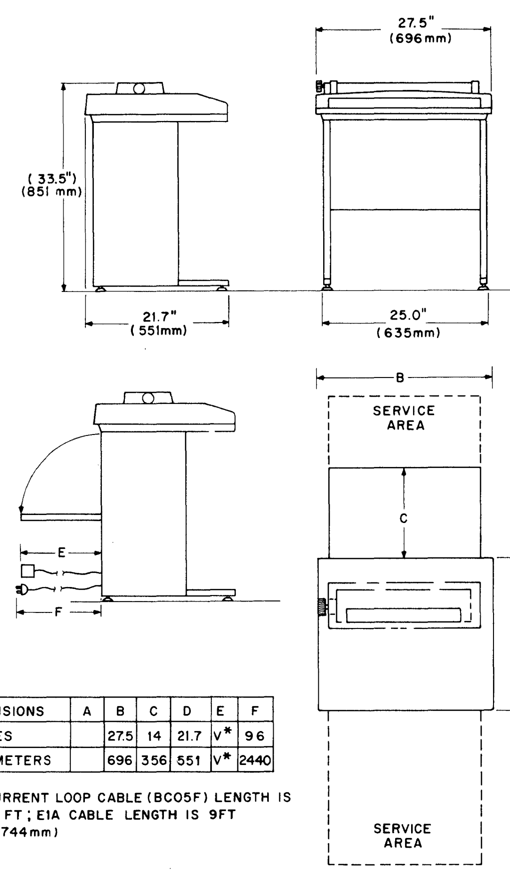
The DECwriter should be installed in an area that is free of excessive dust, dirt, corrosive fumes, and vapors. To ensure that the unit has proper ventilation and cooling, the ventilation openings on the side of the cabinet should not be obstructed. A minimum 10.2 cm (4 inch) clearance between units must be maintained at all times. Adequate service clearance must also be provided for servicing the unit. (Refer to Figures 2-1 and 2-2.)



DIMENSIONS	A	B	C	D	E	F
INCHES	33.5	27.5	14	24	*	96
MILLIMETERS	852	696	356	610	*	2440

* CURRENT LOOP CABLE (BC05F) LENGTH IS 15 FT ; EIA CABLE LENGTH IS 9 FT (2744mm)

Figure 2-1 LA36 Site Considerations



DIMENSIONS	A	B	C	D	E	F
INCHES		27.5	14	21.7	V*	96
MILLIMETERS		696	356	551	V*	2440

* CURRENT LOOP CABLE (BC05F) LENGTH IS 15 FT ; EIA CABLE LENGTH IS 9FT (2744mm)

Figure 2-2 LA35 Site Considerations

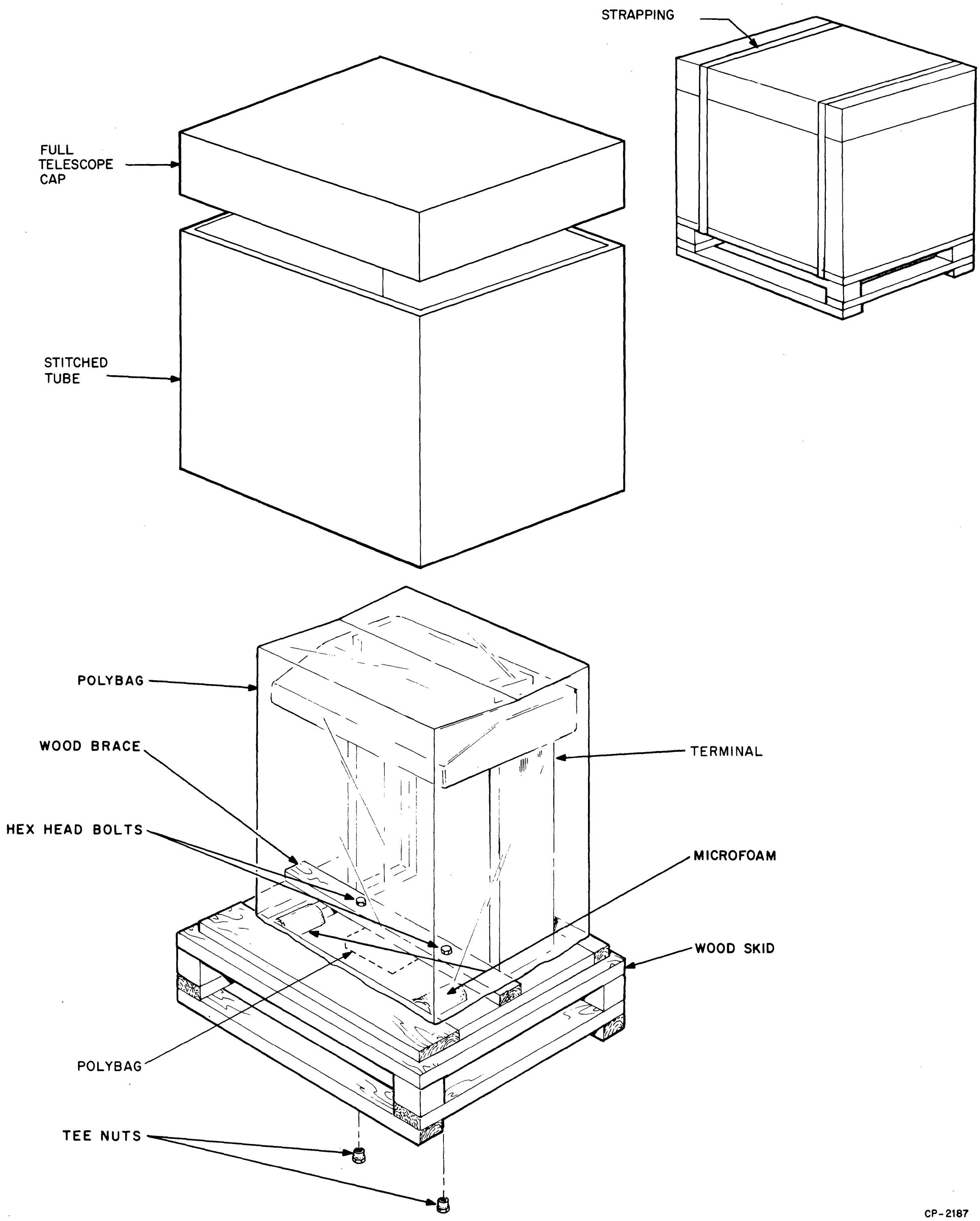


Figure 2-3 DECwriter Packaging

2.2 UNPACKING AND INSPECTION

The following procedure outlines the steps required for unpacking and inspecting the DECwriter.

1. Cut the nylon retaining straps from around the shipping carton and discard them.
2. Remove the outer cardboard shipping container.
3. Remove all shock-absorbing material and packing from around the DECwriter (Figure 2-3).
4. Remove the poly bag from the printer.
5. Remove the foam key protector pad from the keyboard (LA36).
6. Loosen and remove the hex-head bolt securing the wooden leg brace to the skid assembly. Remove the microfoam from around each leg of the DECwriter.
7. Carefully inspect the DECwriter cabinet, keyboard, and carriage assembly for possible shipping damage. Inspect and check the enclosed packing list for lost or missing items. Report any damage or missing items to the local DIGITAL Field Service Office or Sales Office and to the local carrier.
8. Remove the printer from the wooden shipping skid and place it in the desired location.
9. Lift the DECwriter top cover assembly; clip and remove the nylon cable tie securing the print head assembly (Figure 2-4). Remove the caution tag.

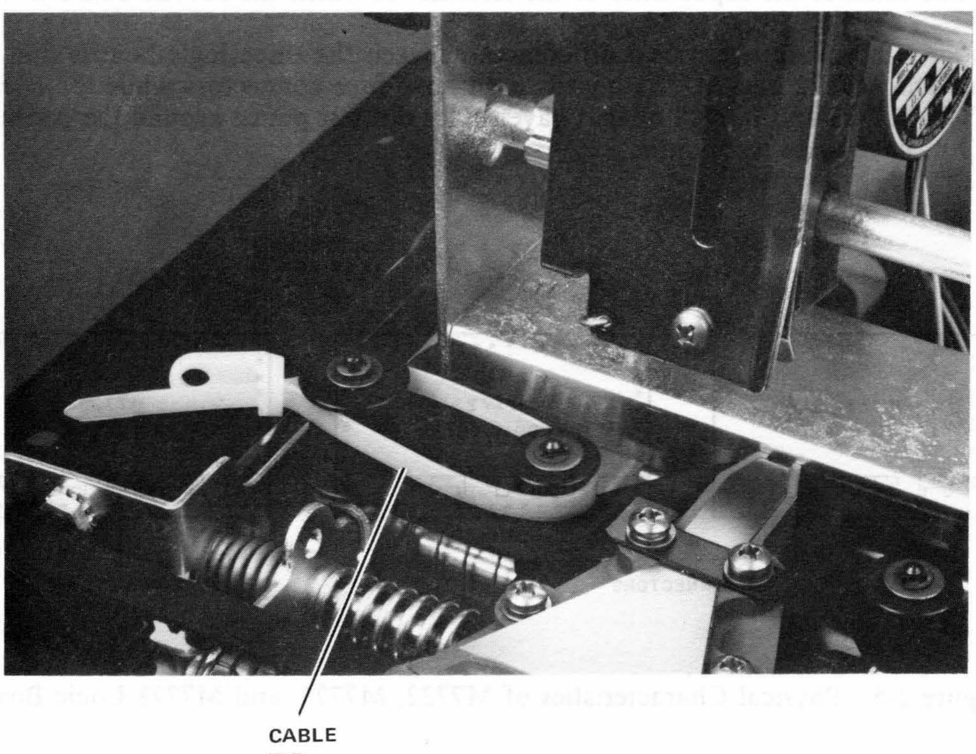


Figure 2-4 Cable Tie Location

10. Install and adjust the leveling feet on the DECwriter legs.

11. If necessary, wipe all outer surfaces with a clean, soft, lint-free cloth.

12. Connect the interface cable to the user's equipment. (See the DECwriter Interface Information.)

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

2.3 PACKING PROCEDURE

If it becomes necessary to ship your DECwriter to another location, repack it per the following procedure.

1. Remove the ribbon and paper.
2. Using a nylon cable tie, secure the print head assembly to prevent movement while in transit.
3. Pack the DECwriter as shown in Figure 2-3.

2.4 EASY IDENTIFICATION OF LOGIC BOARDS

There are three possible logic board models that can be installed in a DECwriter: M7722, M7723, and M7728. The M7722 board is typically factory installed in earlier LA36s while the M7723 and M7728 boards are found in newer terminals. The M7728 performs all functions of the M7722 and M7723 and is backward compatible for a direct replacement for either board. Replacing either board with an M7728 does not enhance the capabilities of the terminal in which the M7728 board is installed.

Figure 2-5 shows the obvious physical differences between the three logic boards that permit easy identification. The M7722 and M7723 boards each have four connectors while the M7728 has five connectors. The M7723 and M7728 boards have solder dot test points around the perimeter and the M7722 does not have these test points.

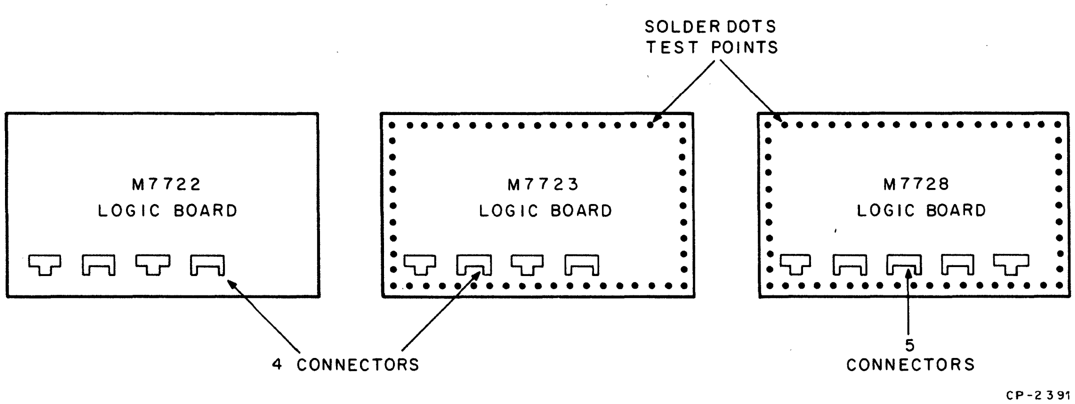


Figure 2-5 Physical Characteristics of M7722, M7723, and M7728 Logic Boards

2.5 INTERFACE INSTALLATION

1. Connect one of the following DECwriter interfaces.

NOTE
For additional installation information, refer to the LA36/LA35 DECwriter II User's Manual, EK-LA3635-OP-002.

- Current loop cable (see Table 1-7 for interface specifications); connect per Figure 2-6.
- DEC10 current loop cable; connect per Figure 2-7.
- EIA cable (LAXX-KG); connect per Figure 2-8.
- EIA cable (LAXX-LG); connect per Figure 2-8
- Acoustic coupler cable (LAXX-LM); connect per Figure 2-9. For additional acoustic coupler installation information, refer to LAXX-LM-4 Installation Procedure.

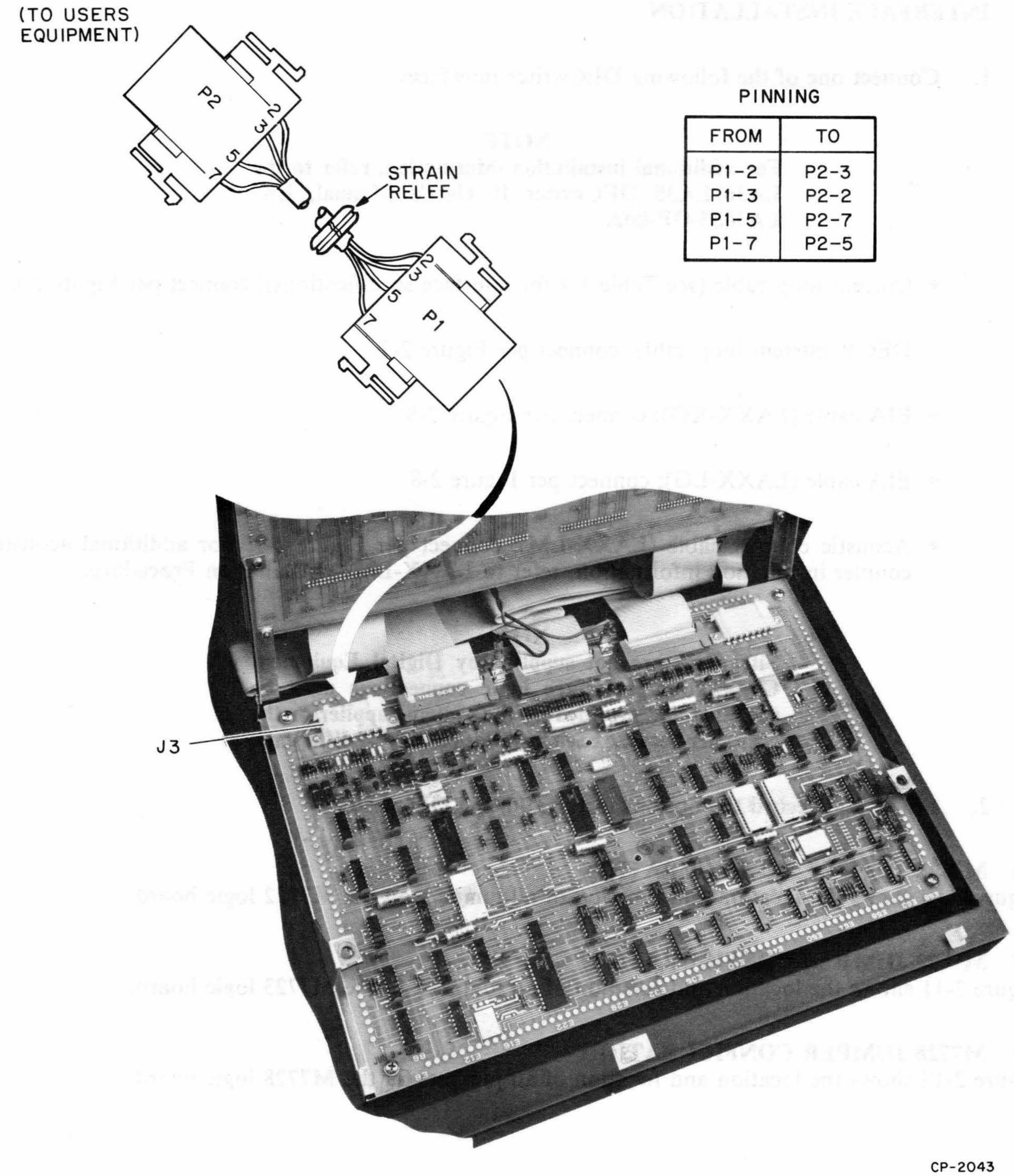
NOTE
Site plans are not supplied by Digital Equipment Corporation. Interface logic connections must be specified and provided by the system supplier or the customer because each installation may be different.

2. Check and record the options installed in the DECwriter.

2.6 M7722 JUMPER CONFIGURATION
Figure 2-10 shows the location and function of all jumpers on the M7722 logic board.

2.7 M7723 JUMPER CONFIGURATION
Figure 2-11 shows the location and function of all jumpers on the M7723 logic board.

2.8 M7728 JUMPER CONFIGURATION
Figure 2-12 shows the location and function of all jumpers on the M7728 logic board.



PINNING

FROM	TO
P1-2	P2-3
P1-3	P2-2
P1-5	P2-7
P1-7	P2-5

Figure 2-6 DECwriter Current Loop Cable Connection

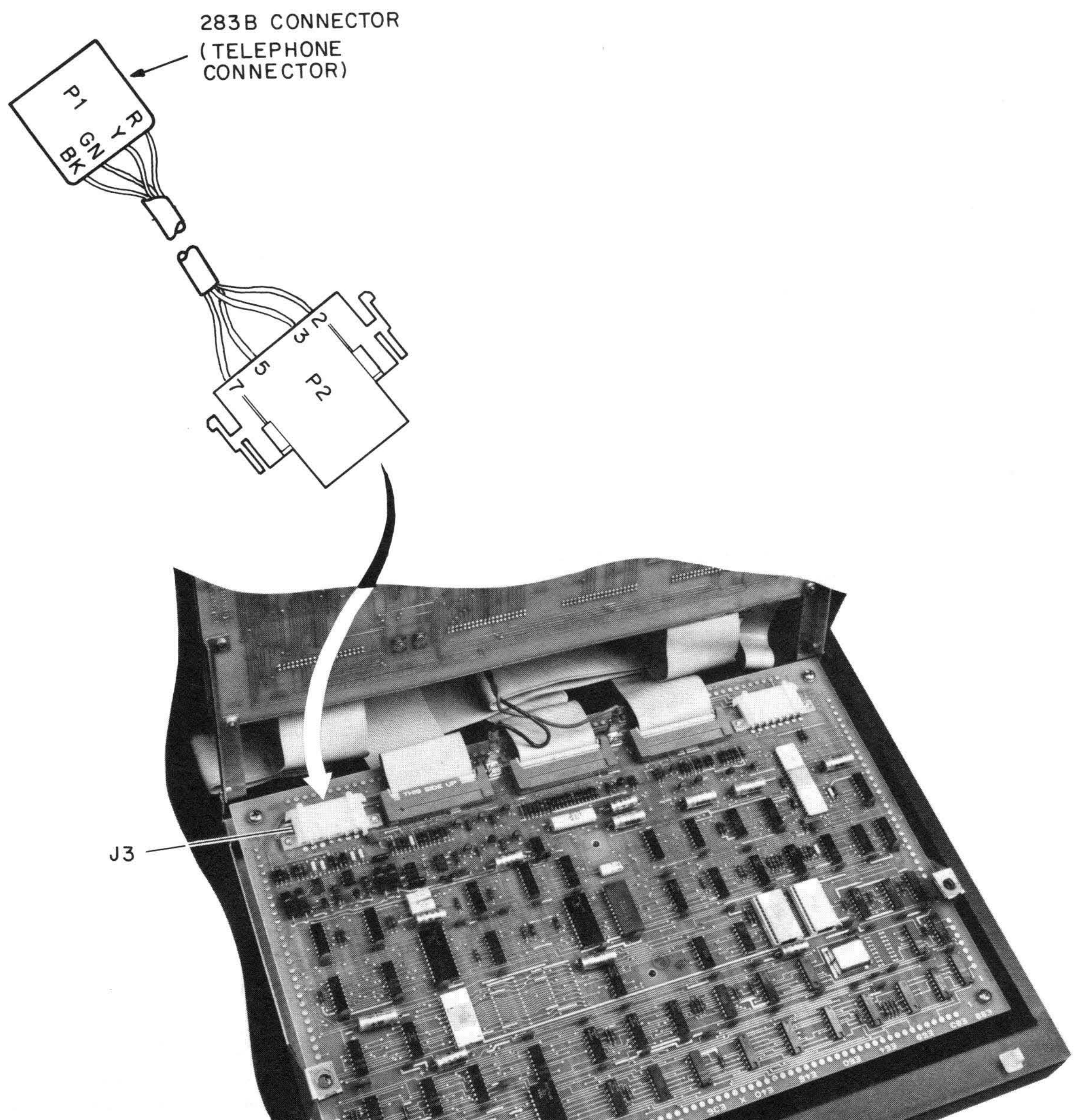


Figure 2-7 DECwriter DEC10 Current Loop Cable Connection

STANDARD EIA MODEM – TERMINAL INTERFACE CONNECTIONS

PIN	NAME	FUNCTION	EIA CIRCUIT DESIGNATION	SENT TO DATA TERMINAL EQUIPMENT (DECwriter)	SENT TO DATA COMMUNICATIONS EQUIPMENT
1	FG	FRAME GROUND	AA		
2	TD	TRANSMITTED DATA	BA		X
3	RD	RECEIVED DATA	BB	X	
4	RTS	REQUEST TO SEND (NOTE 1)	CA		X
7	SG	SIGNAL GROUND	AB		
8	DCD	DATA CARRIER DETECT (NOTE 2)	CF	X	
11	NONE	UNASSIGNED	NONE		
20	DTR	DATA TERMINAL READY (NOTE 1)	CD		X
22	RI	RING INDICATOR (NOTE 2)	CE	X	

NOTES:

1. REQUEST TO SEND AND DATA TERMINAL READY ALWAYS ASSERTED ON LAXX-KG.
2. DATA CARRIER DETECT AND RING INDICATOR NOT USED ON LAXX-KG.
3. POSITIVE VOLTAGE EQUALS BINARY ZERO, SPACE, ON.
4. NEGATIVE VOLTAGE EQUALS BINARY ONE, MARK, OFF.

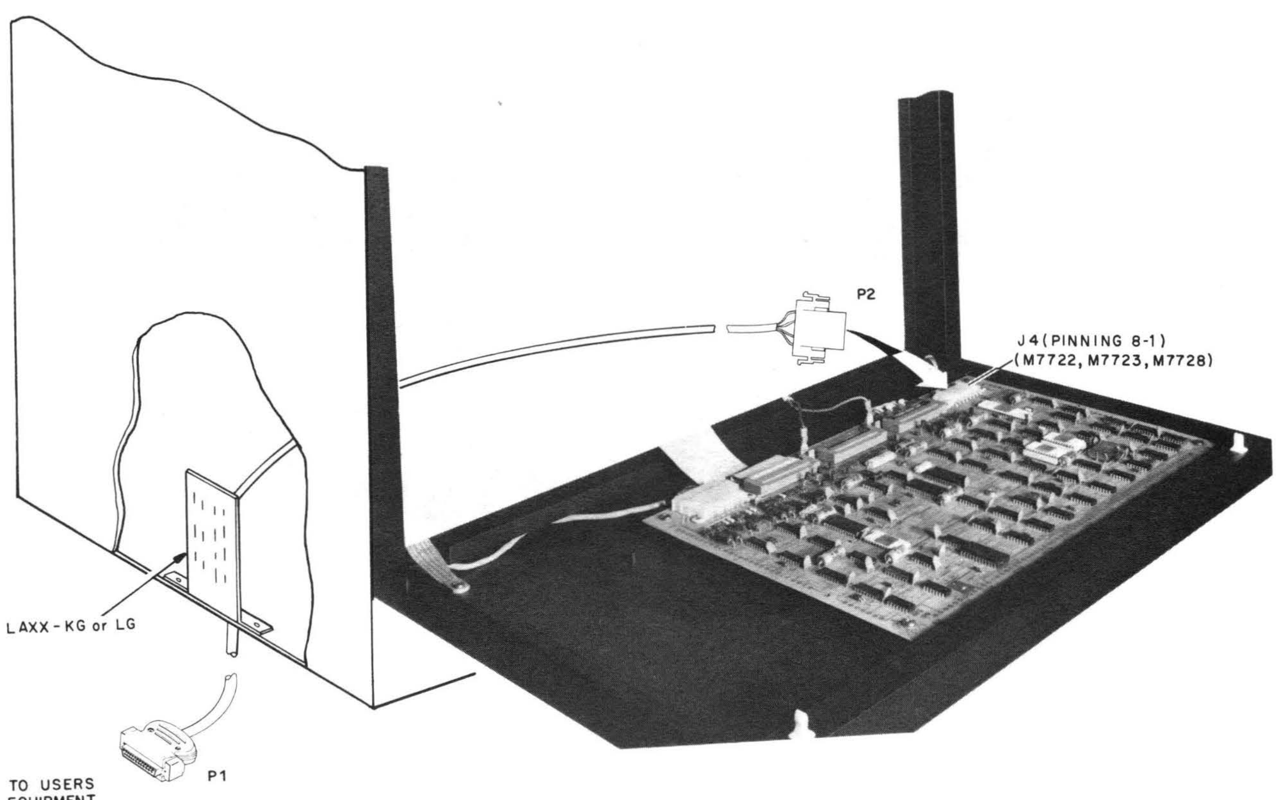


Figure 2-8 DECwriter EIA Logic Board Connection

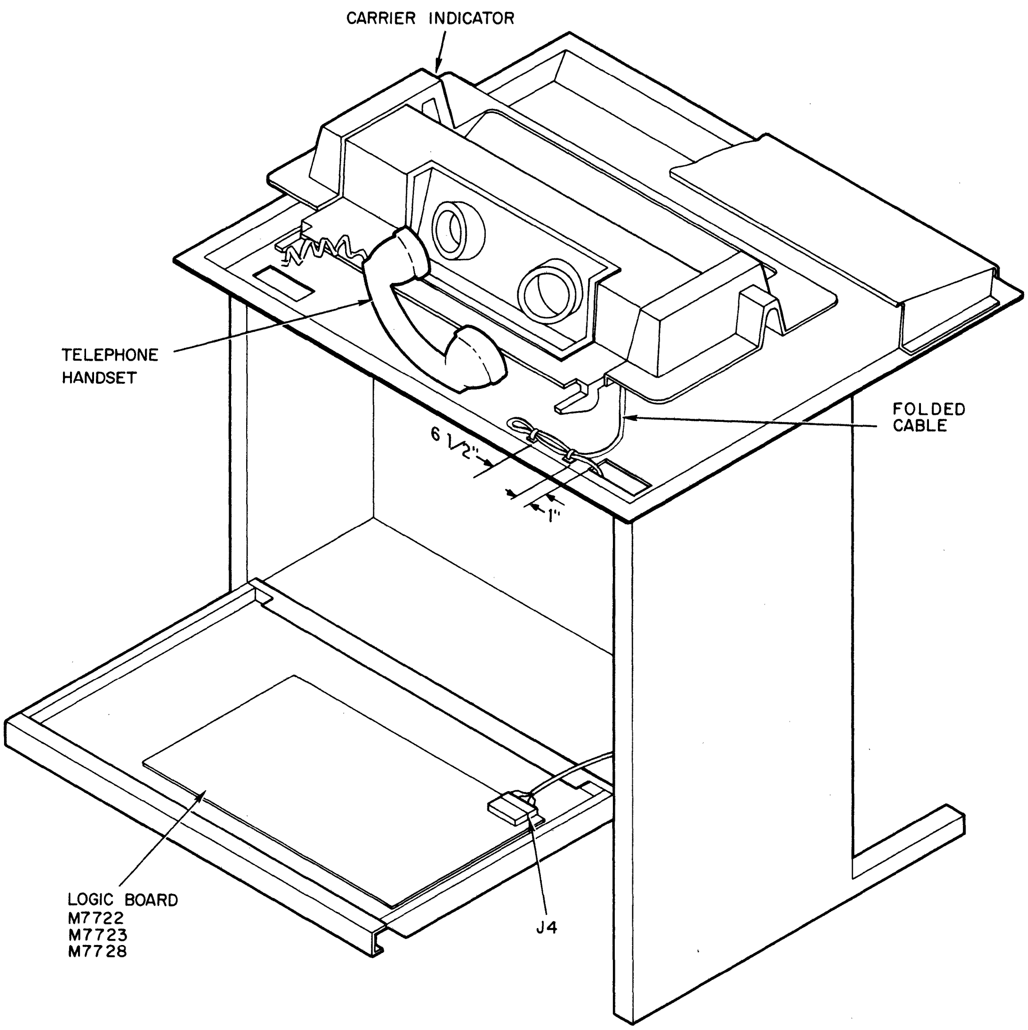


Figure 2-9 Acoustic Coupler Cable Connection

M7722 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	0	0	1	1	0	1	0	1	0	1	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 INSTALLED.
0 = JUMPER NOT INSTALLED.

M7722 PARITY CONFIGURATION JUMPERS

FUNCTION	W10
8TH BIT MARKING (NO PARITY)	0
EVEN PARITY	1

LEGEND:
1 = JUMPER INSTALLED.
0 = JUMPER NOT INSTALLED.

M7722 BELL VOLUME
W1 INSTALLED – STANDARD BELL VOLUME
W1 NOT INSTALLED – LOWER BELL VOLUME

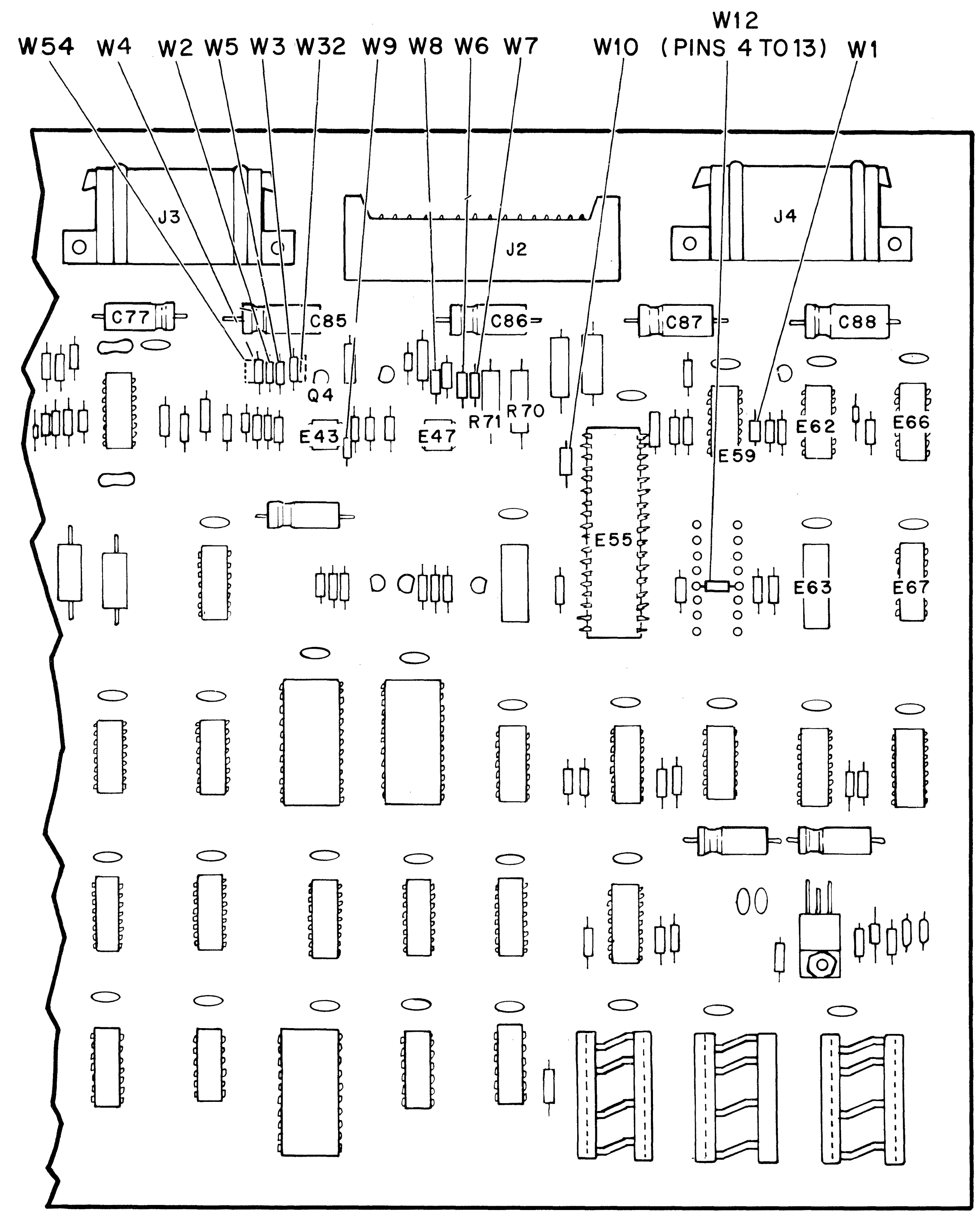


Figure 2-10 Location of Jumpers on M7722 Logic Board

JUMPER CONFIGURATIONS FOR M7723 LOGIC BOARD

FUNCTION	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
PASSIVE RECEIVE/ ACTIVE TRANSMIT	1	1	0	0	1	0	1	0	0	1
ACTIVE RECEIVE/ PASSIVE TRANSMIT	0	0	1	1	0	1	0	1	1	0
HALF-DUPLEX ACTIVE*	1	1	1	1	1	0	0	1	0	0
HALF-DUPLEX PASSIVE*	1	1	1	1	0	0	0	0	0	0

*CONNECT USER-MANUFACTURED CABLE BETWEEN J3-3 AND 5 AND OPERATING SYSTEM.

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

LEGEND
1 = JUMPER INSTALLED
0 = JUMPER NOT INSTALLED
X = DO NOT CARE

W1 INSTALLED	STANDARD BELL VOLUME
W1 NOT INSTALLED	LOWER BELL VOLUME
W12 NOT USED	NO FUNCTION

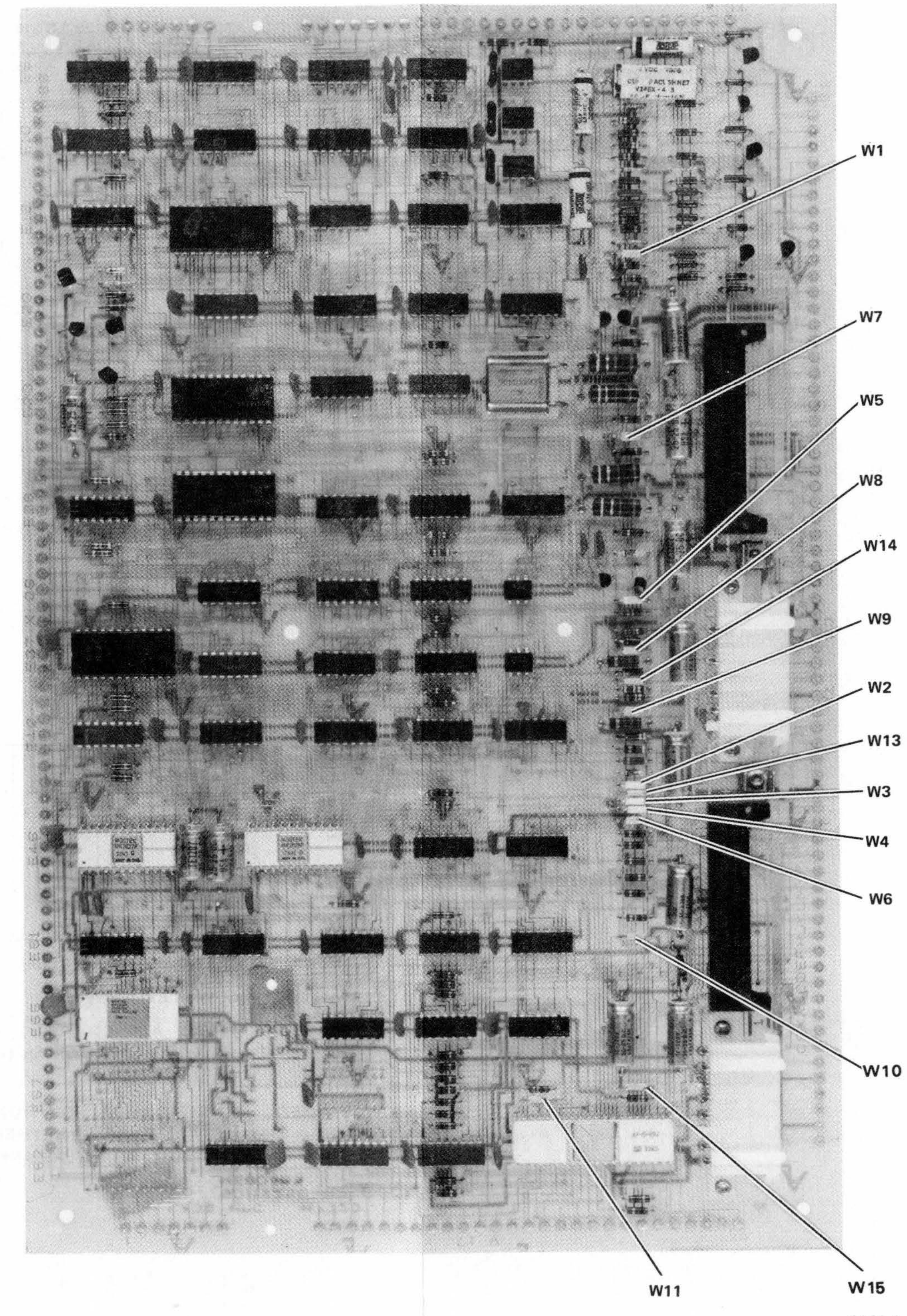


Figure 2-11 Location of Jumpers on M7723 Logic Board

JUMPER CONFIGURATIONS FOR M7728 LOGIC BOARD

FUNCTION	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
PASSIVE RECEIVE/ ACTIVE TRANSMIT	1	1	0	0	1	0	1	0	0	1
ACTIVE RECEIVE/ PASSIVE TRANSMIT	0	0	1	1	0	1	0	1	1	0
HALF-DUPLEX ACTIVE*	1	1	1	1	1	0	0	1	0	0
HALF-DUPLEX PASSIVE*	1	1	1	1	0	0	0	0	0	0

*CONNECT USER-MANUFACTURED CABLE BETWEEN J3-3 AND 5 AND OPERATING SYSTEM.

FUNCTION	W10	W11	W15	
8TH BIT MARKING	0	X	0	NO PARITY
8TH BIT SPACING	0	X	1	
EVEN PARITY	1	0	X	
ODD PARITY	1	1	X	

LEGEND:
1 = JUMPER INSTALLED.
0 = JUMPER NOT INSTALLED.
X = DO NOT CARE.

FUNCTION	W18	W19	W20
PRINT PARITY ERROR INDICATION	1	0	1
EIGHT BIT CONTROL OVER OPTIONS (NO PARITY DETECTION)	0	1	0

W1 INSTALLED	STANDARD BELL VOLUME
W1 NOT INSTALLED	LOWER BELL VOLUME
W12 INSERTED	PRINT ALL CHARACTERS TYPED WHETHER LOCAL OR ON LINE IN FULL OR HALF DUPLEX
W12 NOT INSTALLED	POSITION OF FDX/HDX SWITCH ESTABLISHES WHETHER TRANSMITTED CHARACTERS ARE PRINTED
W16 NOT USED	NO FUNCTION
W17 NOT USED	NO FUNCTION

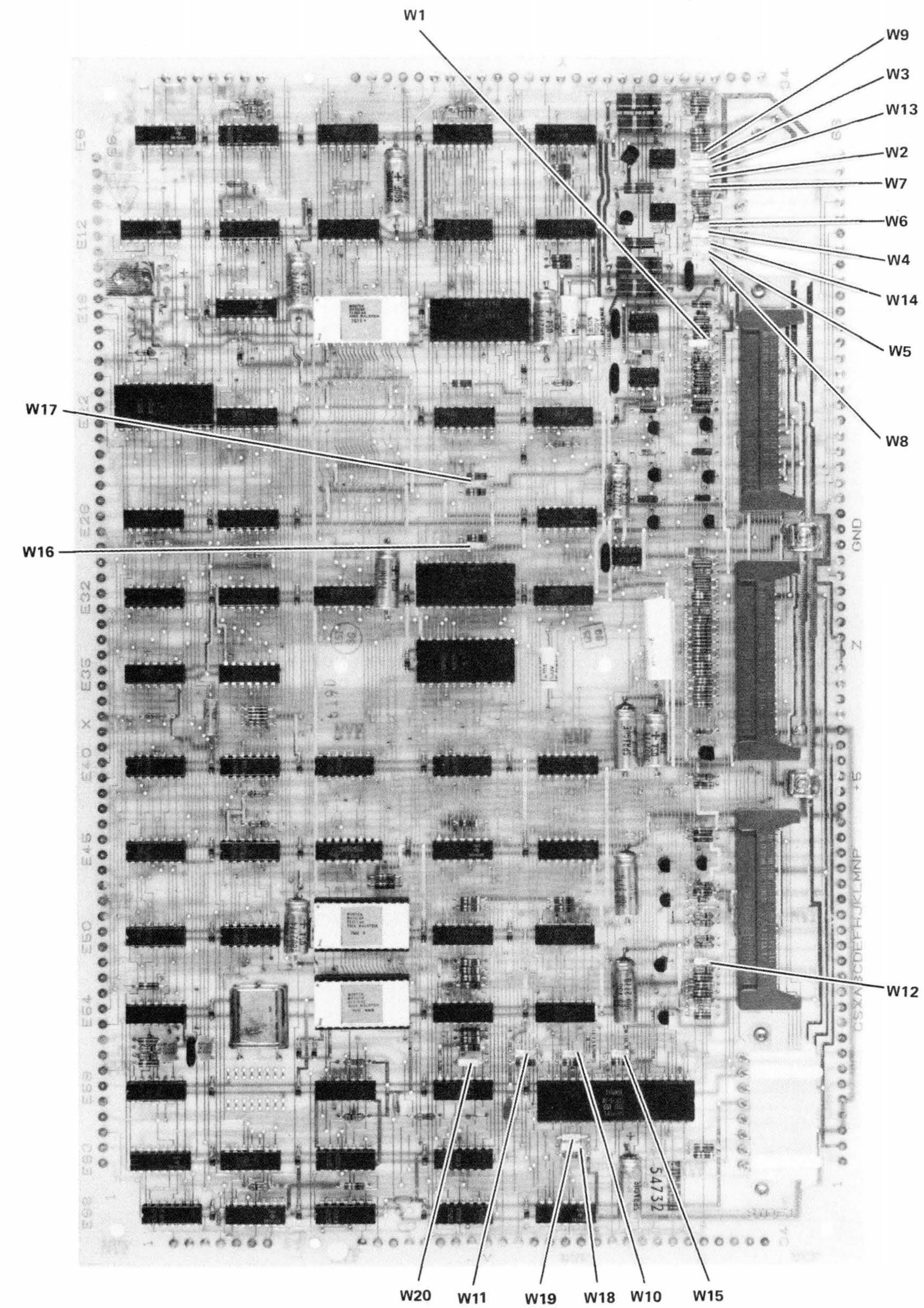


Figure 2-12 Location of Jumpers on M7728 Logic Board

2.9 LA36 CHECKOUT AND ACCEPTANCE PROCEDURES

Perform the following procedure. If the desired results are not achieved, refer to the troubleshooting guide in Chapter 6 (Table 6-4).

1. Install ribbon per ribbon installation procedure (Chapter 3).

2. Install paper per paper loading procedure (Chapter 3).

CAUTION

Before connecting the LA36 to a power source, ensure that the line voltage and frequency are compatible with the power requirements of the machine. Ensure that the POWER switch on the console is OFF.

3. Connect the LA36 line cord to the correct wall receptacle; press the control panel POWER switch to the ON position. The print head automatically positions itself to the left margin.

4. Set the baud rate to 300 and the LINE/LOC switch to LOC.

5. Press the LINE FEED key, hold down the CTRL key, and then press the BELL key. The stepping motor will advance the paper one line and the bell tone will sound. Type a line of characters. When the print head passes the 64th character position, the bell tone will sound.

6. Press the BACKSPACE key. The print head will move one character position to the left.

7. After 132 characters have printed, press the RETURN key and observe the return of the print head to the "home" position.

8. Set the BAUD RATE switches to the setting prescribed for the operating system.

NOTE

Both the 110 and 300 BAUD RATE switches must be depressed to obtain a baud rate of 150.

2.10 LA35 CHECKOUT AND ACCEPTANCE PROCEDURES

Perform the following procedure. If the desired results are not achieved, refer to the troubleshooting guide in Chapter 6.

1. Install ribbon per ribbon installation procedure (Chapter 3).

2. Install paper per paper loading procedure (Chapter 3).

CAUTION

Before connecting the LA35 to a power source, ensure that the line voltage and frequency are compatible with the power requirements of the machine. Ensure that the POWER switch on the console is OFF.

3. Connect the LA35 line cord to the correct wall receptacle; press the control panel POWER switch to the ON position. The print head automatically positions itself to the left margin.
4. Set the BAUD RATE switches to the applicable baud rate.
5. Set the LINE/LOC switch to LINE.
6. Run the applicable software and observe printout for the desired results.

CHAPTER 3
OPERATION

3.1 LA36 OPERATOR CONTROLS AND INDICATORS

NOTE
Dot on switch indicates function of switch when depressed.

7622-28

3.1.1 POWER ON/OFF Switch
The POWER ON/OFF switch connects and disconnects the line voltage to the LA36 DECwriter II. The POWER switch should be in the ON position for normal unit operation. When changing paper, ribbon, or adjusting the print head, the switch should be turned OFF.

3.1.2 LINE/LOC Switch
The LINE/LOC switch is a 2-position operator control switch. When in the LINE position, the LA36 is enabled to transmit and receive data. When in the LOC position, the LA36 receive/transmit lines are disabled and only local operations can be performed.

3.1.3 FDX/HDX Switch
The FDX/HDX switch controls the printing of transmitted keyboard characters. When in the FDX position, characters typed on the keyboard are transmitted; only received characters are printed. When in the HDX position, keyboard characters are both transmitted and printed; received characters are also printed. The operator should not attempt to transmit data when receiving data in the HDX mode.

7622-28

3.1.4 BAUD RATE Switches

The BAUD RATE switches select the rate at which characters are transmitted and received over the communication line.

Switch	Character Rate
110	10 characters/second
300	30 characters/second
110 and 300	15 characters/second

3.1.5 ALT CHAR SET Switch

When an alternate character set is installed, the ALT CHAR SET switch allows the operator to select either the standard ASCII character set (switch up) or the alternate character set (switch down).

3.1.6 CHAR SET LOCK Switch

The CHAR SET LOCK switch allows the operator to select manual (switch down) or automatic (switch up) character set switching. In the automatic mode, the transmitting device can change the character set by issuing the character codes switch in (control-O) or switch out (control-N). The switch-in code selects the standard ASCII character set. The switch-out code selects the alternate character set. In the manual mode, the character set is selected by the ALT CHAR SET control switch.

3.1.7 STD/ALT CHARACTER SET Indicators

The STD/ALT CHARACTER SET indicators give a visual indication of the selected character set. If no alternate character set option is installed, the STD indicator will always be illuminated when power is on.

3.1.8 AUTO LF Switch

The AUTO LF switch is an optional operator control that is inoperative unless option LAXX-LA or LAXX-KX is installed in the LA36. When either option is installed and the AUTO LF switch is enabled, an LF control code will be transmitted each time a carriage return code is transmitted.

3.1.9 HERE IS Switch

The HERE IS switch is an optional operator control that is inoperative unless option LAXX-KX is installed in the LA36. When the LAXX-KX is installed, depressing the HERE IS switch will cause a 20-character preprogrammed message to be transmitted.

3.1.10 PAPER OUT Indicator

When illuminated, the PAPER OUT indicator gives a visual indication that the LA36 is out of paper. Printing stops when the out-of-paper condition is detected.

7622-28

3.1.11 DEVICE SELECT Indicator

The DEVICE SELECT indicator, when illuminated, gives a visual indication that the LA36 has been selected as a slave terminal and can transmit data back to the transmitting unit. This indicator is only operative when the Selective Addressing Option LAXX-KW is installed in the LA36.

3.1.12 SELECT AVAIL Indicator

The SELECT AVAIL indicator gives a visual indication that the data communication channel is available and that the LA36 has the ability to initiate data transmission. This indicator is only operative when the Selective Addressing Option LAXX-KW is installed in the LA36.

3.1.13 CTRL Key

The CTRL key provides the LA36 operator with a method of transmitting ASCII control codes (000_8–037_8). Holding the CTRL key down and pressing any alphanumeric key or control key changes the standard alphanumeric ASCII code for that key to a control code (000_8–037_8).

3.1.14 CAPS LOCK Key

The 26 letter keys transmit only uppercase when the CAPS LOCK switch is down. None of the other keys are affected.

3.1.15 SHIFT Key

This is a momentary switch which, when depressed, allows selection of uppercase for all printable characters.

3.1.16 TAB Key

The printer does not respond to TAB (code 011_8) unless option LAXX-KY is installed.

3.1.17 ESC (SEL) Key

The ESC (SEL) key generates code 033_8. This provides the LA36 operator with a convenient method of generating an escape command code sequence. The printer does not respond to the escape code unless option LAXX-KY is installed.

3.1.18 REPEAT Key

The REPEAT key does not generate an ASCII code. However, when the REPEAT key is held down and any key is depressed, it causes the ASCII code for that character to be transmitted and printed at a repetition rate of approximately 15 characters/second (until the key is released).

7622-28

3.1.19 RETURN Key

The RETURN key generates code 015_8. The printer control logic causes the print head to be repositioned to the left-hand margin each time the carriage return character code is received. If a line feed (LF) character code follows the carriage return code, the line feed operation is executed simultaneously with the carriage return. With options LAXX-LA or LAXX-KX installed, the capability of adding a line feed command after the carriage return is included.

3.1.20 LINE FEED Key

The LINE FEED key generates code 012_8. The printer will advance the paper one line each time the LF code is received.

NOTE

Rapid paper advance can be obtained by placing the LA36 in the local mode and pressing the LINE FEED and REPEAT keys.

3.1.21 BACKSPACE Key

The BACKSPACE key generates code 010_8. The printer control logic causes the print head to move one position to the left each time a BACKSPACE code is received, until the print head reaches the left-hand margin.

3.1.22 DELETE Key

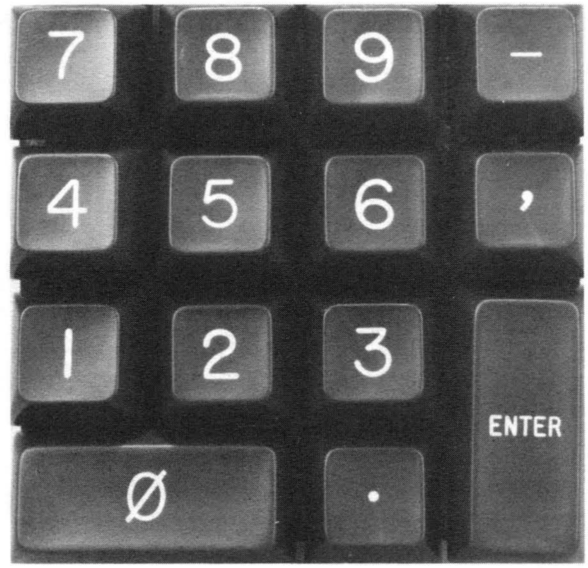
The DELETE key generates code 177_8. The printer does not respond to the delete code.

3.1.23 BREAK Key

The BREAK key is provided for users that utilize the half-duplex mode of transmission. The BREAK key allows the LA36 operator to interrupt incoming data flow by forcing the communication line from a mark mode into the space mode (until the BREAK key is released). If the LAXX-LG EIA interface is installed, a short space (230 ms) will be generated.

3.1.24 Numeric Keypad

The numeric keypad enables numbers to be entered in an adding machine fashion. Each key in the numeric keypad generates the same ASCII character as the corresponding key in the main keyboard. The ENTER key corresponds to the RETURN key.



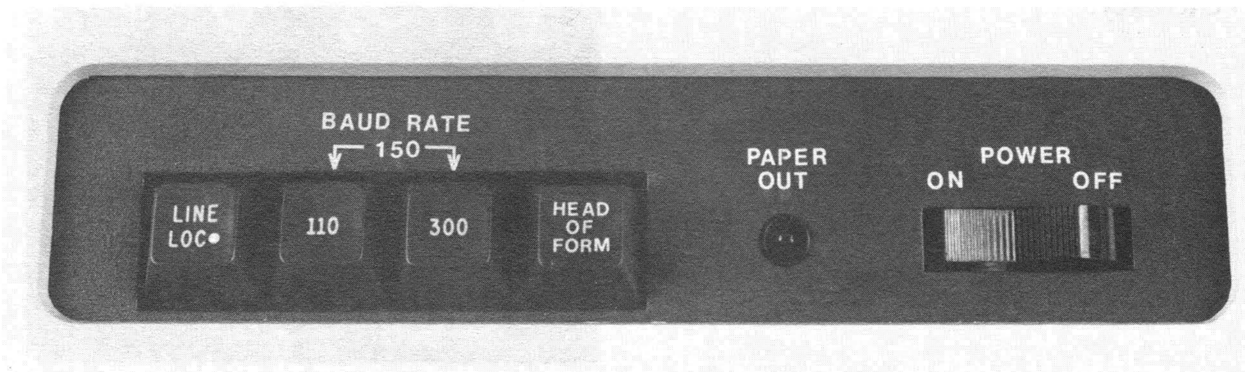
7622-9

3.1.25 Bell

The bell indicates that a bell code was received, or that the print head has reached column 64.

3.2 LA35 OPERATOR CONTROLS AND INDICATORS

NOTE
Dot on switch indicates function of switch when depressed.



7666-22

3.2.1 LINE/LOC Switch
The LINE/LOC switch is a 2-position operator control switch. When in the LINE position, the LA35 is enabled to receive data. When in the local mode, the LA35 receive line is disabled and only local operations can be performed.

3.2.2 BAUD RATE Switches
The BAUD RATE switches select the rate at which characters are received over the communication line.

Switch	Character Rate
110	10 characters/second
300	30 characters/second
110 and 300	15 characters/second

3.2.3 PAPER OUT Indicator
The PAPER OUT indicator, when illuminated, gives a visual indication that the LA35 is out of paper. Printing stops when the out-of-paper condition is detected.

3.2.4 POWER ON/OFF Switch
The POWER switch connects and disconnects the line voltage to the LA35 DECwriter. The POWER switch should be in the ON position for normal unit operation. When changing paper, ribbon, or adjusting the print head, the switch should be turned OFF.

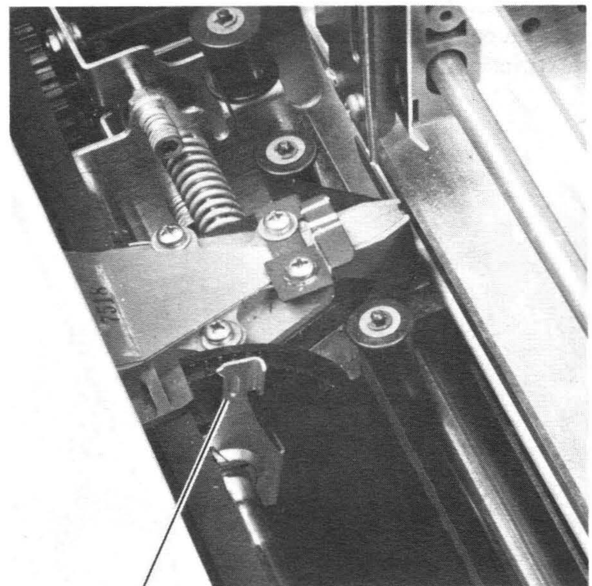
3.2.5 HEAD OF FORM Switch
This switch is operational only when the Top of Form Option is installed. Its function is to advance the paper to the head of the form.

3.2.6 Bell
The bell indicates that a bell code was received.

3.3 LA36/LA35 COMMON CONTROLS

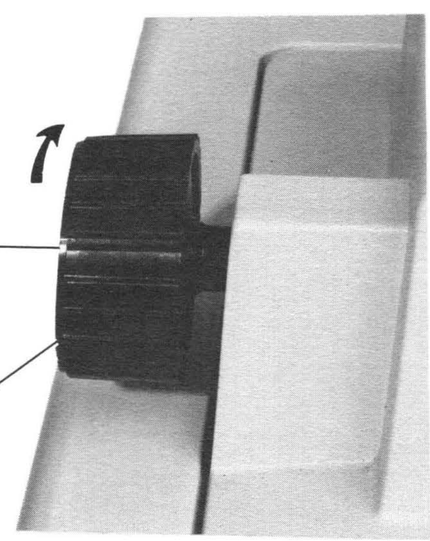
3.3.1 Carriage Adjustment Lever

The Carriage Adjustment lever controls the print head gap for single-part or multipart forms.



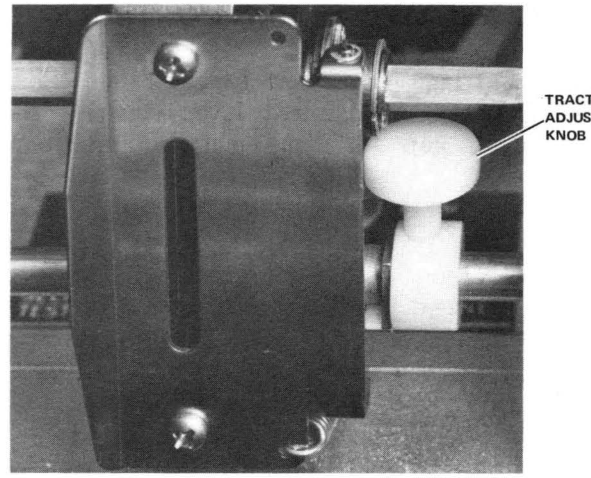
3.3.2 Paper Advance Knob

The Paper Advance knob pushes in to disengage the line feed gear train, allowing fine vertical adjustment of paper position. Coarse vertical adjustment is achieved by simply turning the knob. Each detent turned represents one line.



3.3.3 Tractor Adjust Knob

The Tractor Adjust knob allows fine horizontal adjustment of forms.



7595-7

3.3.4 Cover Interlock Switch

The cover interlock switch prevents the LA36 from operating when the cover is open. When the cover is opened, the PAPER OUT indicator will light and the keyboard will become inactive. The LINE/LOC switch or the POWER ON/OFF switch can be used to reactivate the LA36.

3.4 LOADING PAPER AND NEW FORMS

The LA36/LA35 can accept multipart forms, with widths from 7.62 to 37.8 cm (3 to 14-7/8 inches). When loading *new forms*, it is necessary to perform two adjustments:

1. Paper Positioning (Paragraph 3.4.1)
2. Impression Adjustment (Paragraph 3.4.2).

In addition, there is a horizontal positioning (Paragraph 3.4.3) and vertical positioning adjustment (Paragraph 3.4.4). The horizontal positioning adjustment allows the paper to be slightly shifted left or right. This procedure is especially useful when typing on preprinted forms with defined horizontal zones. The vertical positioning adjustment enables the paper to be adjusted vertically. Once these adjustments have been performed, *reloading paper* (Paragraph 3.4.5) becomes quick and simple, requiring a minimum of interruption.

3.4.1 Paper Positioning Procedure

1. Set the POWER switch to OFF.

2. Lift the cover.

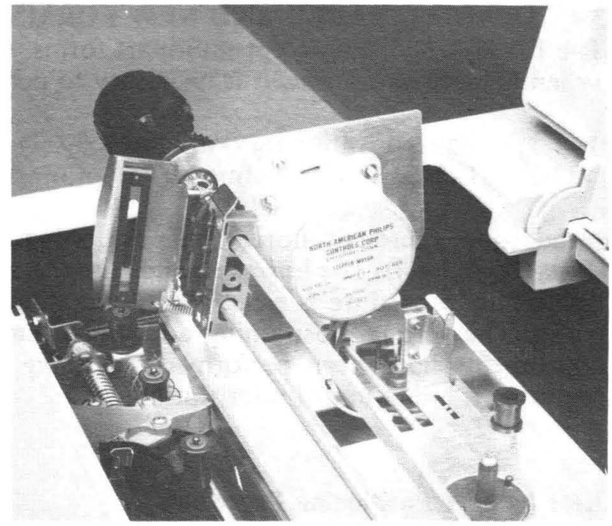
3. Place the tractor-feed paper on the floor between the legs of the LA36/LA35. (The term tractor-feed refers to the holes on either side of the paper.)

NOTE

Ensure that the leading edge of the forms is directly below and parallel to the feed slot.

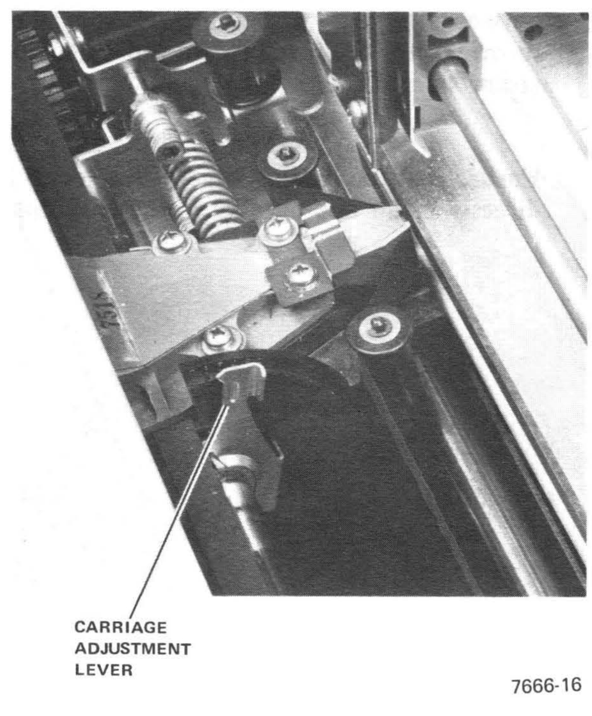
7666-14

4. Open the left tractor cover so that the tractor pins are exposed.



7666-32

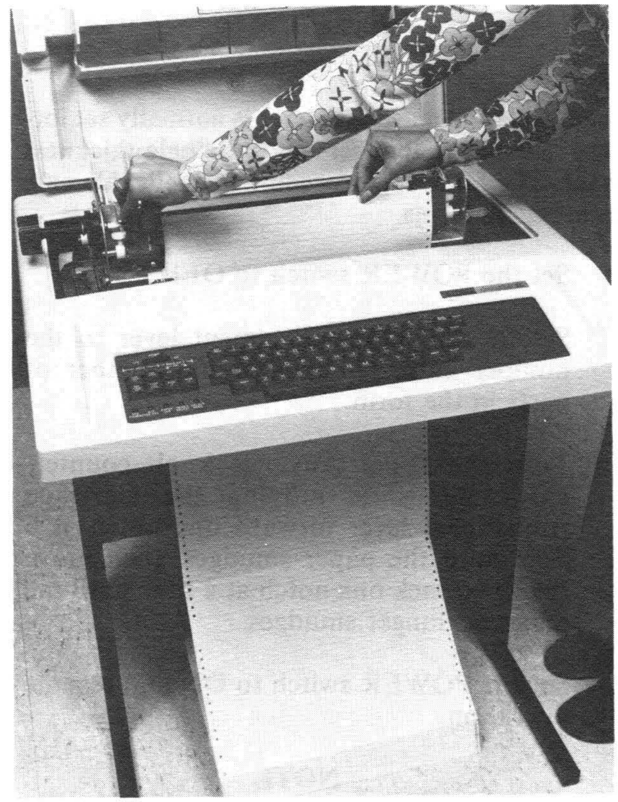
5. Move the Carriage Adjustment lever to the highest number (toward operator).



7666-16

6. Feed the paper through the load channel under the terminal and align the left paper margin holes over the left tractor pins.

7. Close the left tractor cover.



7666-33

8. Loosen the Tractor Adjustment knob on the right tractor about 1/2 turn.

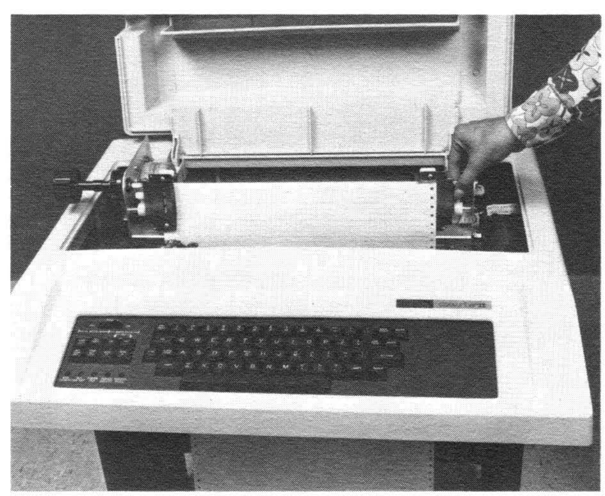
9. Open the right tractor cover and slide the tractor to a position where the holes on the right paper margin align directly over the tractor pins.

10. Close the tractor cover.

NOTE

Ensure that the paper does not pull against the tractor pins or bow in the middle.

11. Tighten the tractor adjustment, and proceed to the impression adjustment (Paragraph 3.4.2).



7666-35

3.4.2 Impression Adjustment

NOTE
The Carriage Adjustment lever is normally set forward (to notch number 1) for single-thickness paper. The following procedure is applicable only to multipart forms.

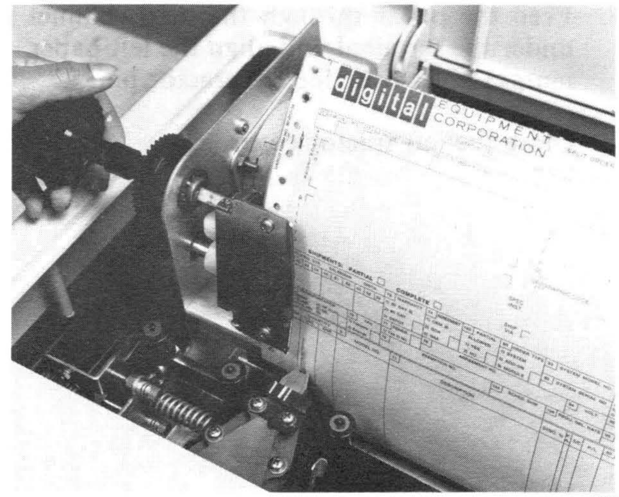
1. Set the POWER switch to OFF.

2. Set the Carriage Adjustment lever to the number corresponding to the number of parts in the form.

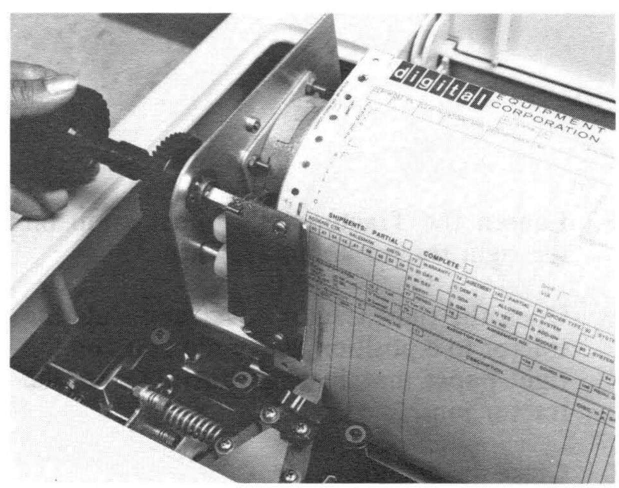
3. Turn the Paper Advance knob counterclockwise while moving the Carriage Adjustment lever forward one notch at a time until the paper smudges; then move the lever back one notch at a time until the paper no longer smudges.

4. Set the POWER switch to ON and resume operation.

NOTE
If the impression is unsatisfactory due to a worn ribbon, perform the ribbon installation procedure (Paragraph 3.5). An indication of a worn ribbon is that the first copy in a multipart copy is poor but the remaining copies are good.



7666-3



7666-6

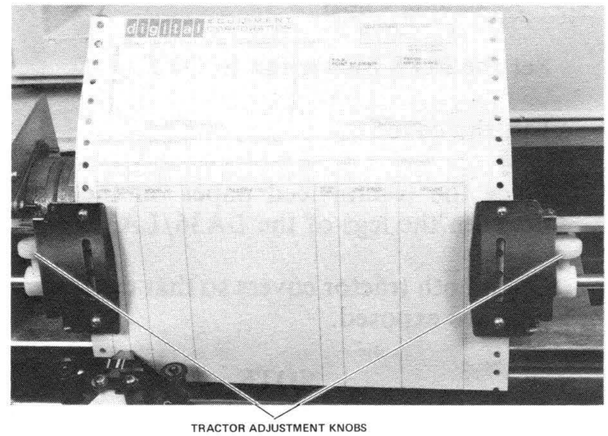
3.4.3 Horizontal Positioning Adjustment

The horizontal positioning adjustment enables the paper to be shifted left or right [1.27 cm (1/2 inch), maximum]. Shifting the paper provides a simple means of aligning the type within the appropriate columns on the paper.

1. Set the POWER switch to OFF.
2. Lift the cover and loosen both Tractor Adjustment knobs about 1/2 turn.
3. Move the tractors the desired amount [1.27 cm (1/2 inch), maximum] to have characters type in the appropriate columns.
4. Tighten the Tractor Adjustment knobs.

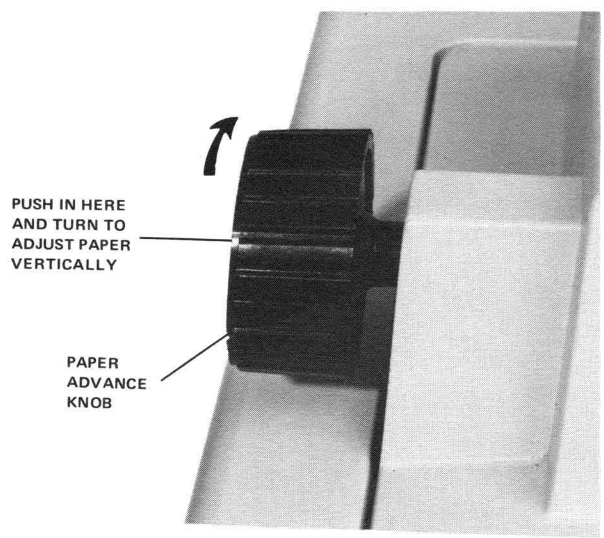
NOTE

Ensure that the paper does not pull against the tractor pins or bow in the middle.



3.4.4 Fine Vertical Positioning

For fine vertical positioning, press in and turn the Paper Advance knob.



3.4.5 Reloading Paper

1. Set the POWER switch to OFF.

2. Lift the cover.

3. Place the tractor-feed paper on the floor between the legs of the LA36/LA35.

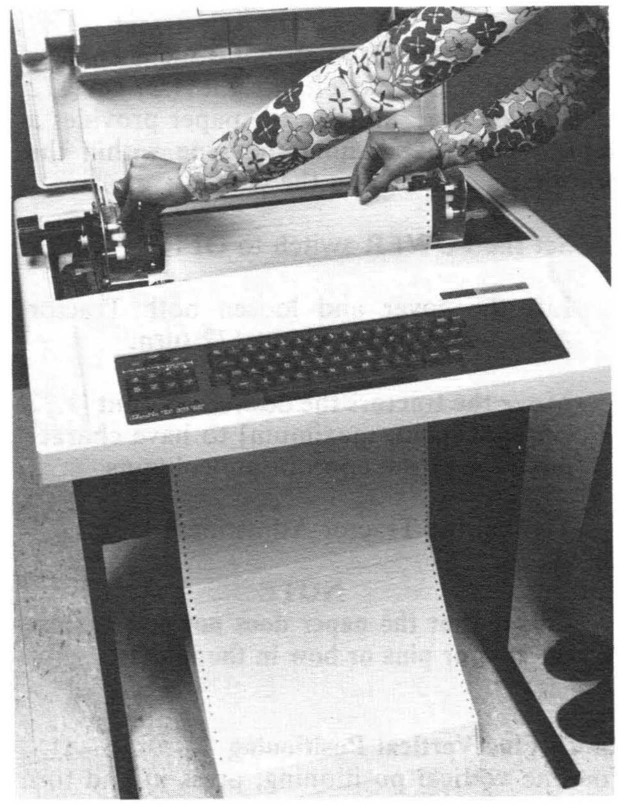
4. Open both tractor covers so that the tractor pins are exposed.

NOTE

Ensure that the leading edge of the forms is directly below and parallel to the feed slot.

5. Feed the paper through the load channel under the terminal and align the paper holes over the tractor pins.

6. Close the tractor covers.



7666-33

3.5 RIBBON INSTALLATION

The printer ribbon should last for 16 to 20 hours of actual printing at 30 characters/second (about 2 million characters). After 12 hours, or when the print 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 8 hours (approximately) of printing time is possible before the ink is completely used. At that time, the ribbon must be replaced by removing both spools and unthreading the ribbon. Replace with a new spool and ribbon assembly (Part No. 36-10558) and an empty spool. (One of the old spools may be used if desired.)

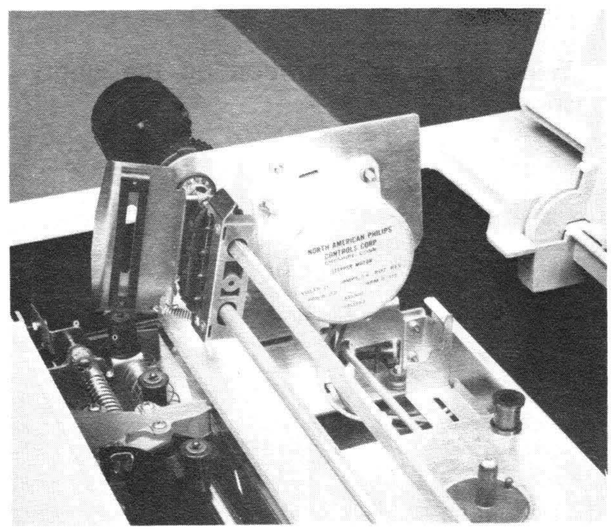
NOTE

Use only DIGITAL-recommended ribbons (Part No. 36-10558). Use of other ribbons can cause damage and void machine warranty.

1. Set the POWER switch to OFF and lift the cover.

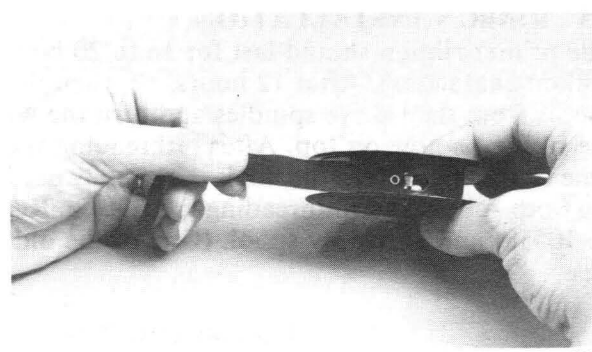
2. Record the setting of the Carriage Adjustment lever. Move the Carriage Adjustment lever to the highest number.

3. Remove the ribbon spools and ribbon. Save one spool to be used with the new ribbon.



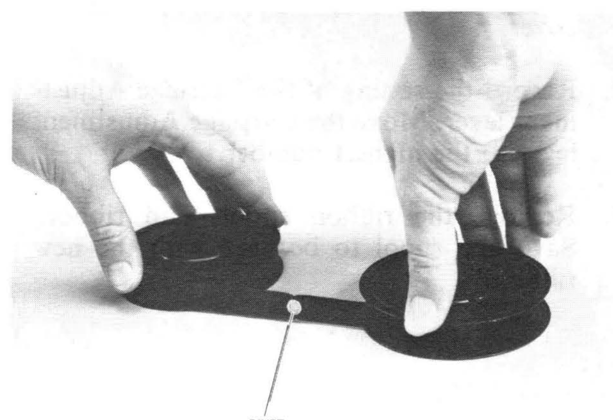
7666-32

4. Connect the hook on the end of the ribbon to the empty spool.

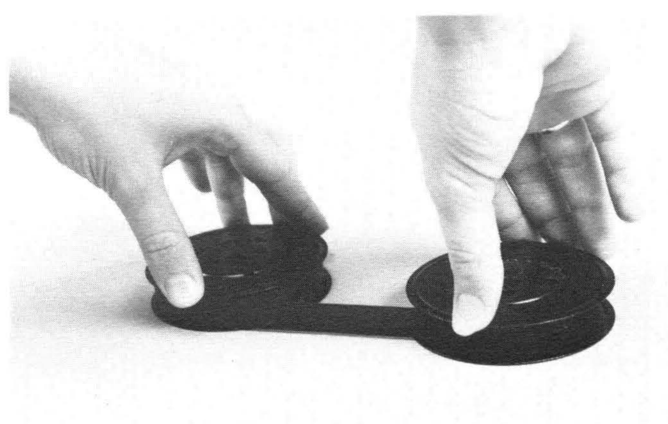


7666-17

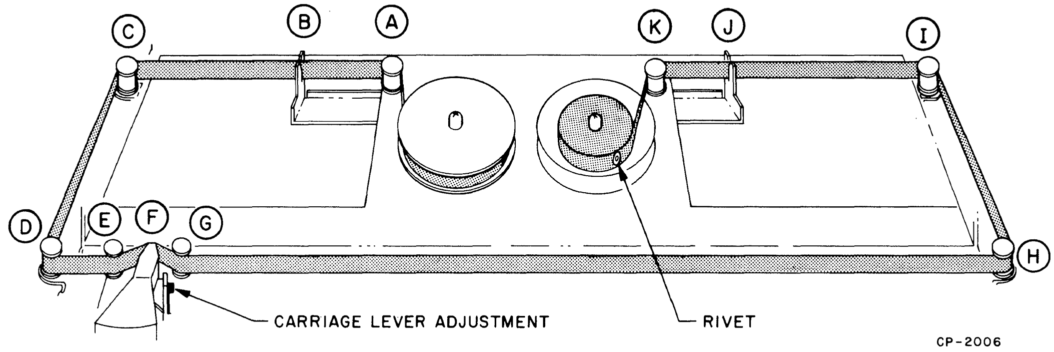
5. Wind 10 turns of ribbon on the empty spool.



7666-21



7622-22



6. Place the full spool on the left spindle and turn clockwise until it drops into position.
7. Guide the ribbon around idler spool A through guide B, and around the outside of idler spools C through E.
8. Guide around the front of head F and idler spools G through I.
9. Guide the ribbon through slot J (direction changing guide) and around idler spool K.
10. Turn the spool clockwise until it drops into position.
11. Take up the slack in the ribbon by turning the free moving spool.
12. Return the Carriage Adjustment lever to its original setting.

NOTE

The rivet located on the ribbon must be on the spool or between the spool and the direction changing guide.

Ribbon can be threaded in the opposite direction (from K to A).

3.6 DECwriter INTERFACE INFORMATION

3.6.1 Interface Description

NOTE

The LA35 and LA36 have identical interfaces. However, the LA35 utilizes only the receive circuitry.

There are three interface option kits available for the DECwriters: LAXX-LH, 20 mA Cable Option Kit; LAXX-LK, 20 mA Cable Option Kit (DEC10); LAXX-LG, EIA Interface Option Kit. Refer to Chapter 2 of this manual for installation instructions for these interfaces.

3.6.2 Interface Specifications

The interface specifications for the DECwriter serial 20 mA current loop are shown below.

Transmitter (LA36 only)

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

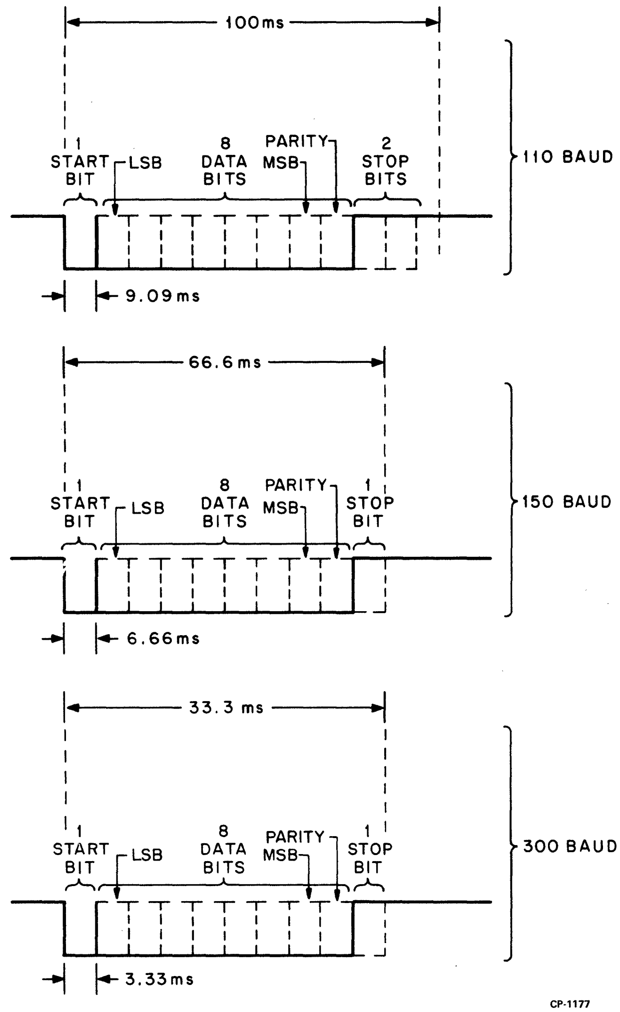
Receiver

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 LAXX-LH or LAXX-LK
[Cable extension up to 492 m (1500 ft) is permitted]



Serial Interface Timing Diagram

Receiver/Transmitter (LA36 only)

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

3.7 PROGRAMMER'S GUIDE

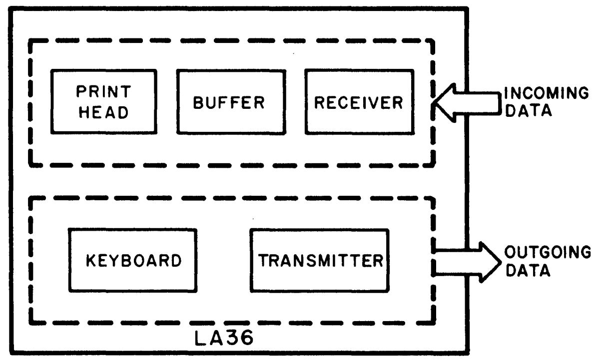
3.7.1 LA36 Programmer's Information

NOTE

All information in this paragraph is applicable to the LA35, with the exception of keyboard operations (Paragraph 3.7.3). This is due to the fact that the LA36 and LA35 receive operations and baud rates are identical.

3.7.2 Transmitting Characters and Commands

The only way an operator can transmit data is by typing keys on the keyboard. The 7-bit ASCII equivalent of each key is transmitted the instant a key is depressed.



CP-1166

3.7.3 Special Command Keys

3.7.3.1 CTRL Key – Holding down the CTRL key changes the ASCII code transmitted when another key is typed in that it forces bits 6 and 7 to 0. For example, the ASCII code for the letter "g" is 147 (1100111).

Bits 6 and 7

Holding down the CTRL key and typing the "G" key transmit the ASCII code 007 (0000111).

Bits 6 and 7 are forced to 0

The CTRL key enables the LA36 operator to transmit all ASCII control codes (000–037).

3.7.3.2 BREAK Key – The BREAK key is commonly used to manually interrupt the flow of data coming to the LA36. The function of the BREAK key is to cause the transmitted data signal from the LA36 to go to the space condition while the BREAK key is depressed. If the LAXX-LG EIA/CCITT interface is installed, then the BREAK signal is limited to approximately 230 ms.

3.7.4 Receiving Characters and Commands

The DECwriter receives commands as well as characters to be printed in the form of 7-bit ASCII codes.

Normally, the DECwriter prints characters and processes commands as fast as they are received. The one exception is the return operation (moving the print head back to the left margin). Return can take longer than the time interval between two successive data inputs. This is a normal condition for mechanical devices, which are slower than electronic signals. The normal programming practice is to compensate for this time lag by using filler characters (such as ASCII 000) to take up slack time.

In the LA35 and LA36, it is necessary that a single nonprinting, nonspacing character be sent after a carriage return or that carriage return is followed by 33.33 ms of idle (marking) line time.

The nonprinting, nonspacing character requirement is fulfilled by the line feed, (LF) code which normally will follow CR. The LF function will be executed simultaneously with CR.

Additional CR characters sent without an intervening character that causes printing or spacing will be disregarded.

Table 3-1 lists the 7-bit ASCII codes used by the DECwriter and indicates the operations performed by the printer. Note that some ASCII codes, though generated by the keyboard, are not recognized by the printer.

Table 3-1 ASCII Codes and Responses

		KEYBOARD OPERATIONS To Transmit, Type Key(s) (LA36)			RECEIVE OPERATIONS	
ASCII Code	Character	SHIFT*	CTRL*	CHAR	Character Printed	Action/Description
000	NUL	√	√	SPACE	None	None
001	SOH		√	A		
002	STX		√	B		
003	ETX		√	C		
004	EOT		√	D		
005	ENQ		√	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	√	√	–	None	None
040	SP			space bar	Blank Spaced	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 3-1 ASCII Codes and Responses (Cont)

ASCII Code	Character	KEYBOARD OPERATIONS To Transmit, Type Key(s) (LA36) SHIFT*	CTRL*	CHAR	RECEIVE OPERATIONS Character Printed	Action/Description
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	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 3-1 ASCII Codes and Responses (Cont)

		KEYBOARD OPERATIONS			RECEIVE OPERATIONS	
		To Transmit, Type Key(s) (LA36)				
ASCII Code	Character	SHIFT*	CTRL*	CHAR	Character Printed	Action/Description
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	Λ	√		Λ	Λ	
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 3-1 ASCII Codes and Responses (Cont)

ASCII Code	Character	KEYBOARD OPERATIONS To Transmit, Type Key(s) (LA36)			RECEIVE OPERATIONS	
		SHIFT*	CTRL*	CHAR	Character Printed	Action/Description
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.

3.8 USING THE LA36

The following steps are all that may be required to place your LA36 on-line.

1. Load paper (described in Paragraph 3.4).
2. Set LINE/LOC switch to LOC.
3. Set POWER switch to ON.
4. Select full-duplex or half-duplex mode (FDX/HDX switch).
5. Select character set (ALT CHAR SET and CHAR SET LOCK switches), if applicable.
6. Select AUTO LF, if applicable.
7. Select desired baud rate (BAUD RATE switches).
8. Set the LINE/LOC switch to LINE.

The LA36 is now on-line and ready to receive and transmit data.

3.9 USING THE LA35

Using the LA35 requires almost no operator intervention. The following steps are all that may be required to place the LA35 on-line.

1. Load paper.
2. Set the LINE/LOC switch to LINE.
3. Set the BAUD RATE switches to the appliable baud rate.
4. Set the POWER switch to ON.

The LA35 is now on-line and fully operational.

3.10 TROUBLESHOOTING

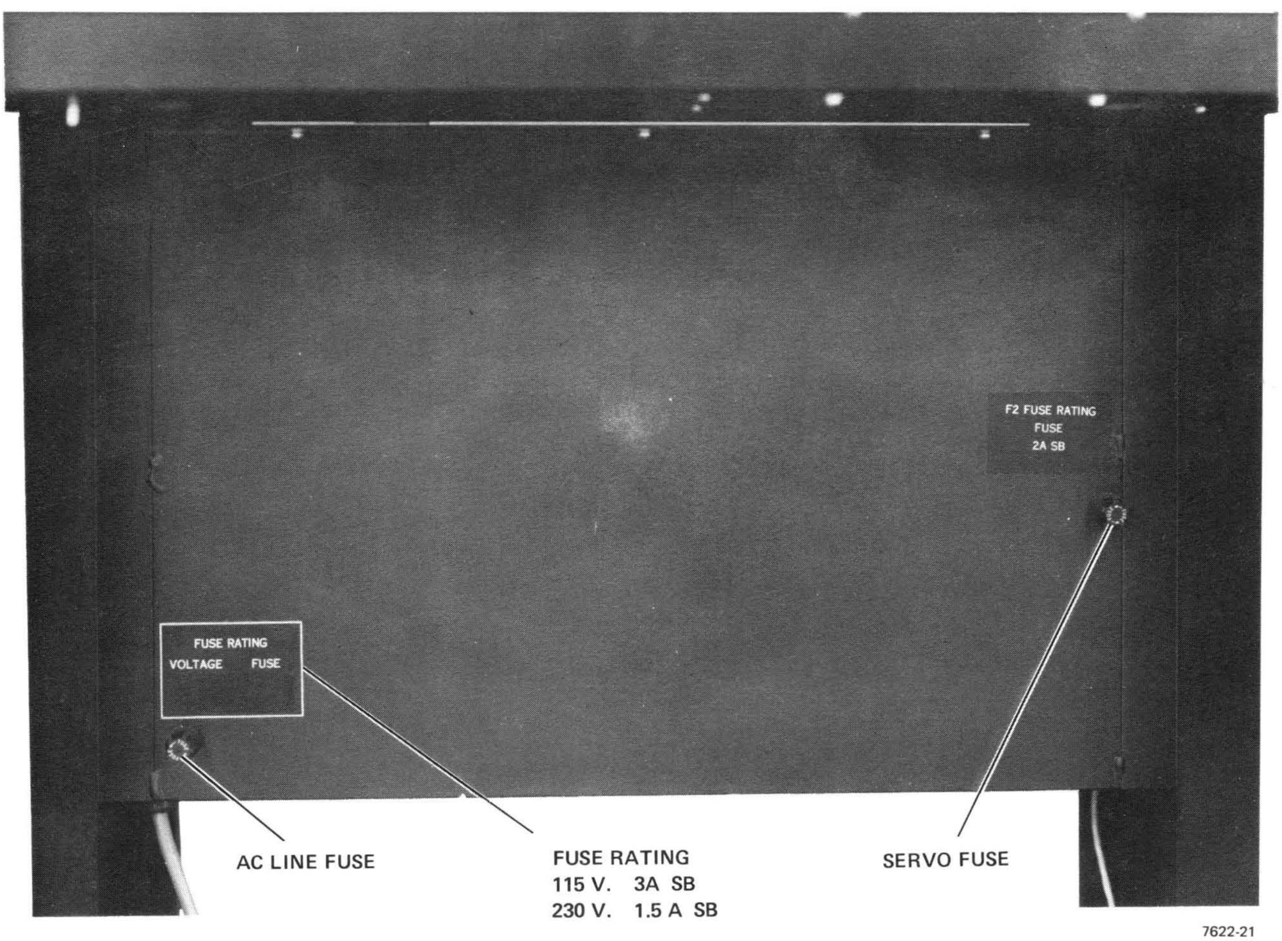
Operator-related troubleshooting information is listed in Table 3-2.

Table 3-2 Operator's Troubleshooting Guide

Symptom	Possible Cause and Corrective Action
DECwriter does not turn on when POWER switch is set to ON.	• AC power cord is not plugged into wall outlet – plug it in. • Current is not coming from wall outlet – check outlet with a known working electrical device (such as a lamp). • Check ac line fuse (following page). • If none of the above, contact your local Field Service Office.
Print head does not print characters.	• Check servo fuse – might be blown (following page). • Print head may be set too far from paper – adjust the Carriage Adjustment lever. • Check option interconnect cable (Chapter 2).
Light print	• Print head may be set too far from paper – adjust the Carriage Adjustment lever per impression adjustment procedure (Paragraph 3.4.2). • Ribbon ink has run out – replace ribbon. • Reverse ribbon after 8–12 hours of continuous printing. Ribbon should be reversed only once, then changed.
Paper does not advance	• Improper loading of paper – check tractor covers to ensure that they are closed. • Holes in paper are torn – turn DECwriter OFF and reload paper properly. • Paper snagged or caught by box.

Table 3-2 Operator's Troubleshooting Guide (Cont)

Symptom	Possible Cause and Corrective Action
Paper tearing on multipart forms	• Print head is exerting pressure on paper so that paper tears when it advances – check print head position control (adjust Carriage Adjustment lever). • Tension exerted on the paper by the tractors is incorrect.
Line bunching	• Tension exerted on the paper by the tractors is excessive.



LA36/LA35 Fuse Locations

CHAPTER 4
THEORY

This chapter contains microprogram information timing, detailed control logic theory, and mechanical theory for the DECwriter II. The program description is divided into two parts. The first part (Paragraph 4.1) is a general description supported by a flow diagram. The second part (Paragraphs 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 (Paragraph 4.3) is a functional system description supported by a block diagram. The second part (Paragraphs 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 Paragraph 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, DEC1 (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, cross reference is as follows.

DEC1	SET HDE
logic function	signal name

Signal abbreviations are explained in Appendix C, Table C-2. This table also lists signal source and destination information. A complete set of logic diagrams is provided in Chapter 10.

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 forward.) 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 include7.62 cm/sec (3 in/sec) for normal printing, 15.24 cm/sec (6 in/sec) for catch-up mode, 127 cm/sec (50 in/sec) for carriage return, slower speeds for carriage return slowdown, and 0 in/sec for idle.

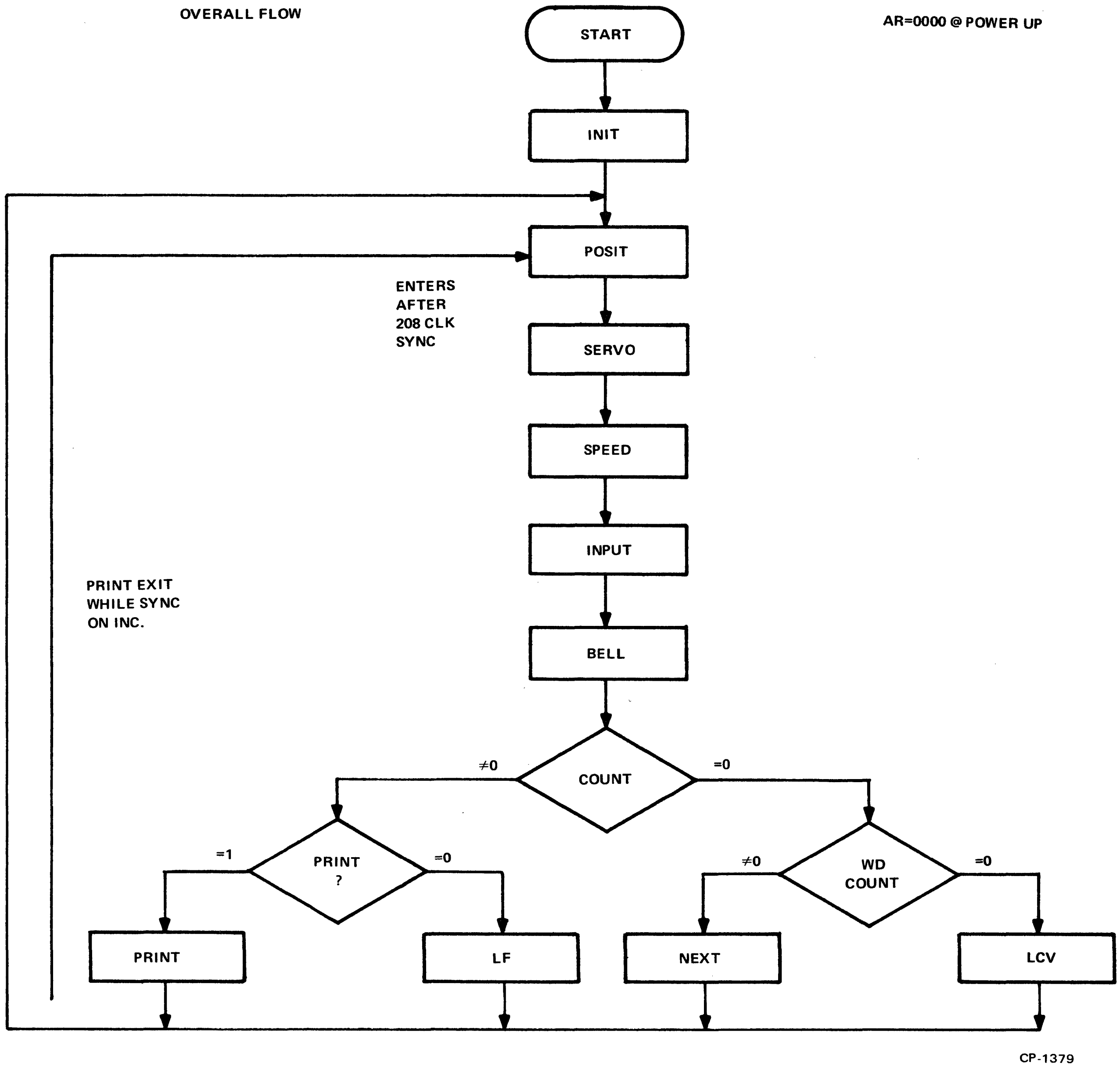


Figure 4-1 Microprogram Flow Diagram

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 sytem.

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. However, 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 (LSB) position of that word while timers for LCV, LINE FEED, PRINT, and INIT 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.

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 (WD CNT) 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 WD CNT 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 WD CNT 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.

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)

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 WD CNT = 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 four 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 dem ration 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 Initialize (INIT) Routine
The DECwriter 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.

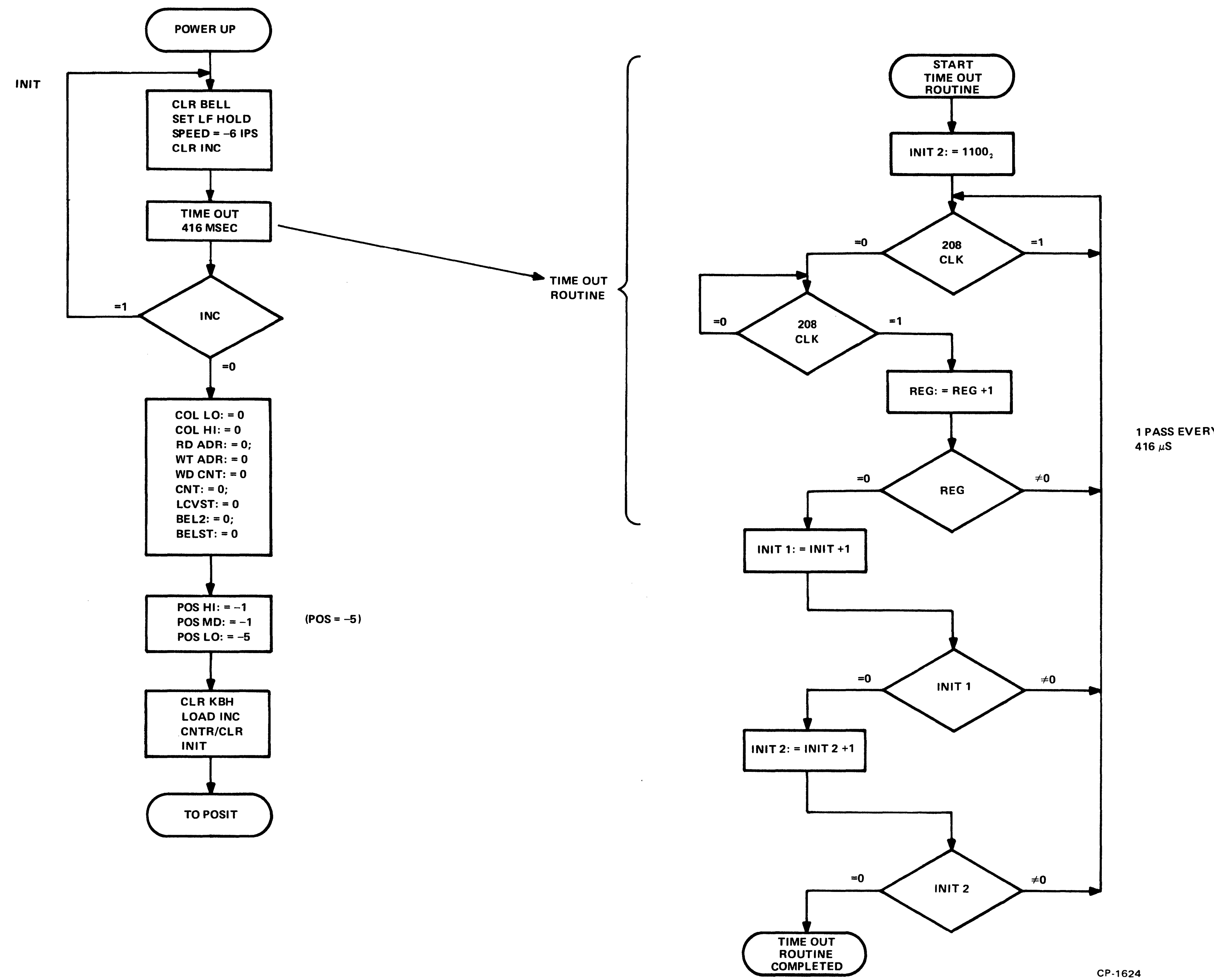


Figure 4-2 INIT Routine

4.1.3 Position (POSIT) Routine

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.

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.

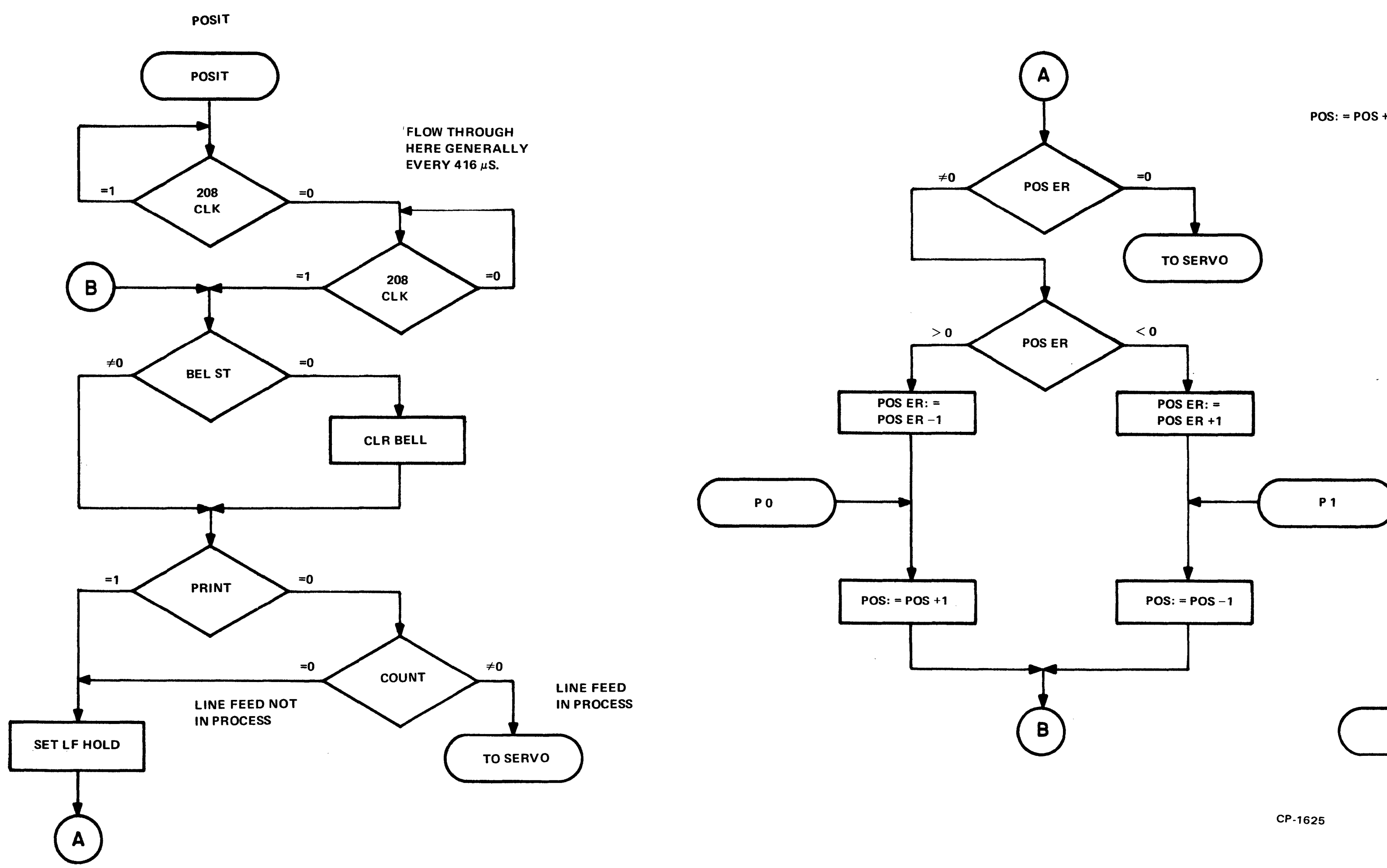
When a CR is received and processed, the program sets the column count to zero, thereby causing the SPEED routine to issue a suitable negative SPEED command that causes the carriage to return to the zero column position.

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.

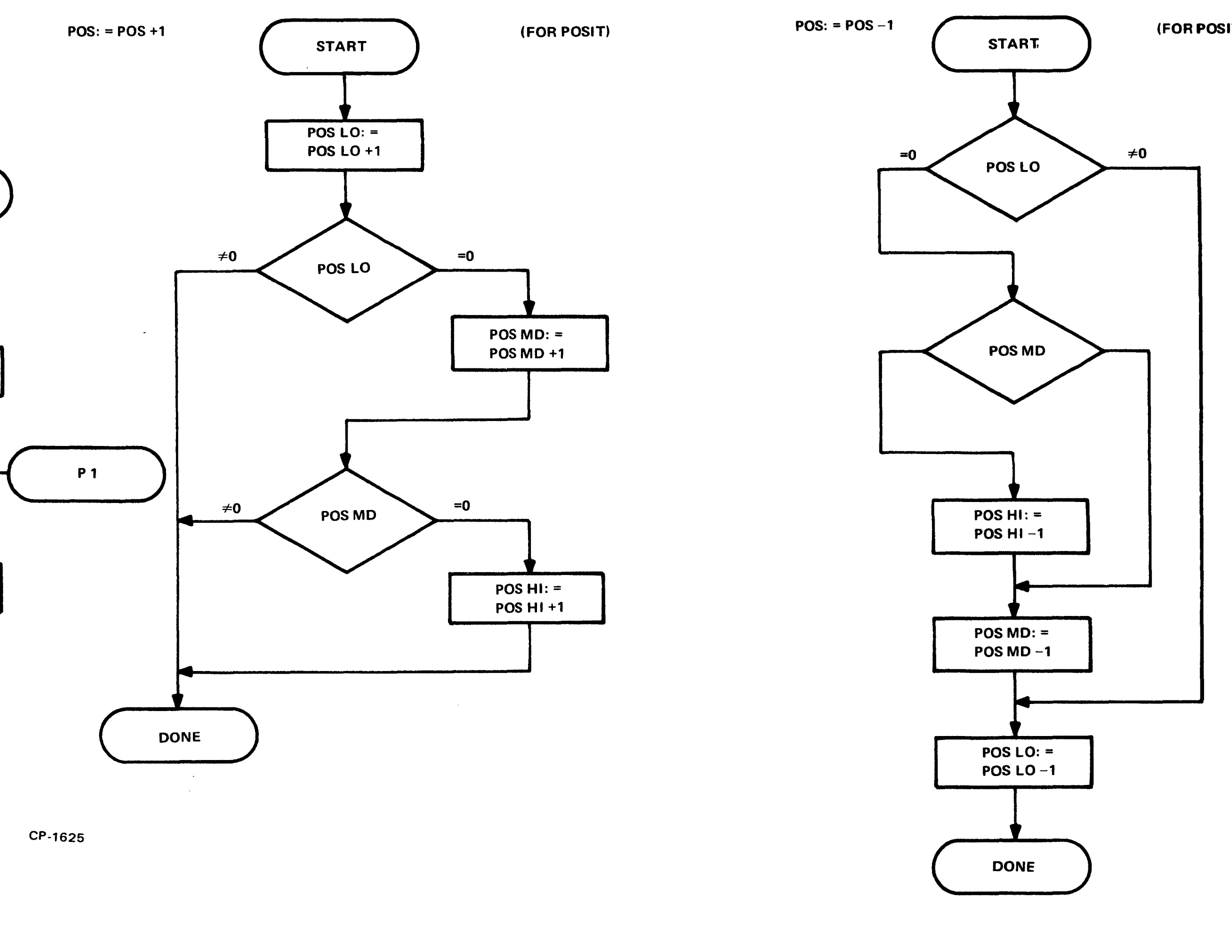
The POSIT routine, on the 208 μs clock, checks bell status and, if zero, clears the bell and checks PRINT. If PRINT is not zero, it checks the print bit and if it is a one, indicating no LF in progress, sets LF HOLD and proceeds. If LF is indicated by the print bit being 0, the count is checked to see 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, WD CNT, 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.



a. POSIT Routine



b. START Routine for Position

Figure 4-3 POSIT and START Routines

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.

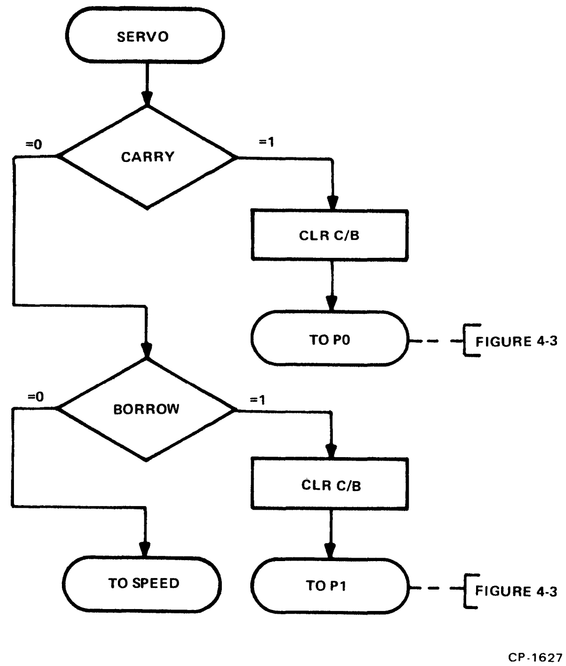


Figure 4-4 SERVO Routine

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 WD CNT and if it finds it zero (no characters to be processed), it causes the SPEED routine to command a speed of +3 in/sec (+ speed = print motion; - speed = return motion). If there *are* characters to be processed (WD CNT not equal to 0), it commands a speed of +6 in/sec to clear the buffer, providing ample time to be ready to print the next character.

Table 4-2 SPEED Algorithm

Count=0 Printing	WD CNT	Position	Speed (in/sec) += 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

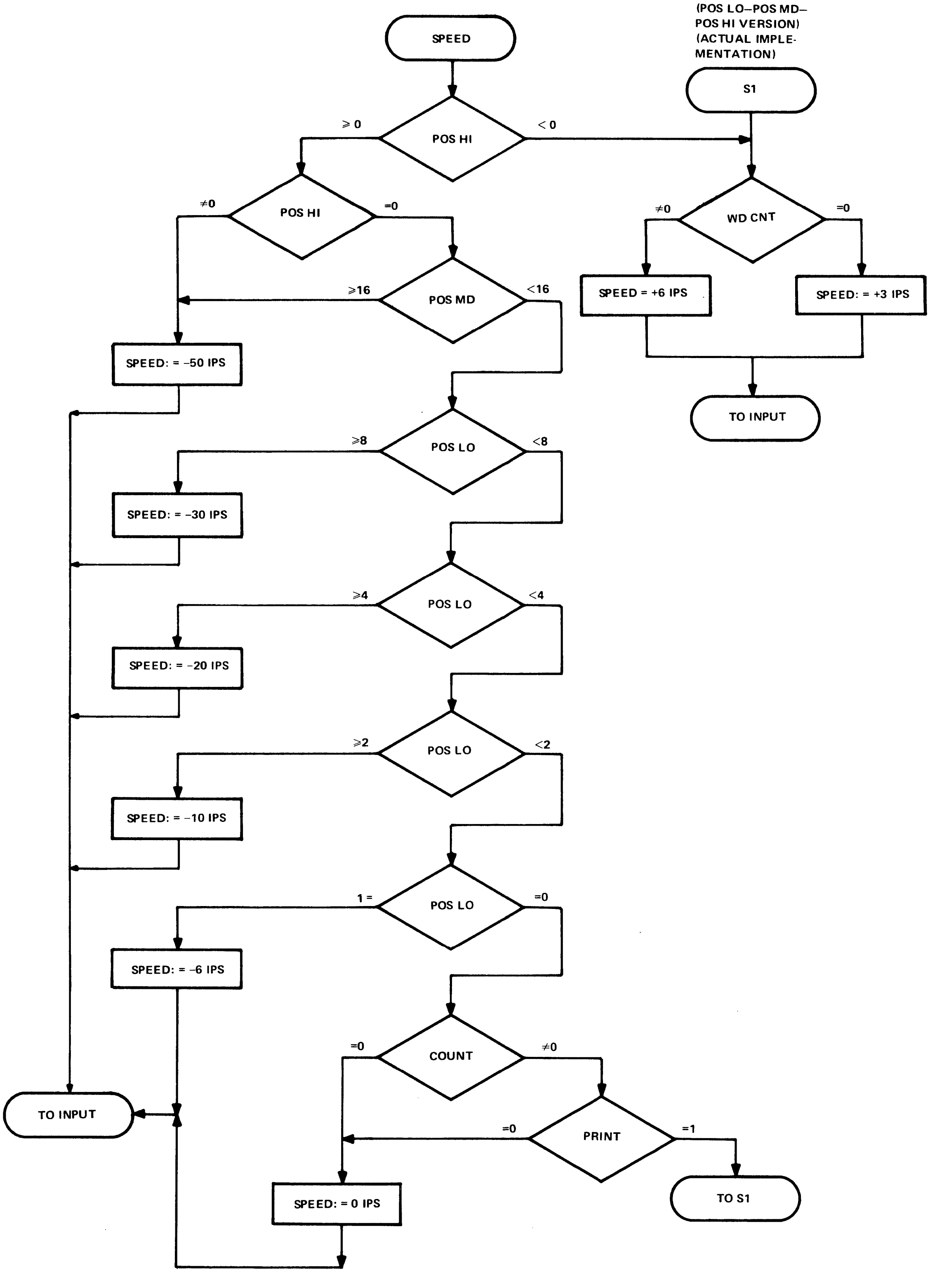


Figure 4-5 SPEED Routine

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 in/sec being issued.

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, an LF is indicated and a speed of 0 in/sec is commanded to complete the LF function. If the print bit is set however, WD CNT 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 WD CNT to see if the character buffer is full (WD CNT = 15). If so, it ignores any input from DA, using the UART as the 16th memory location, and proceeds immediately to service the bell.

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.

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.

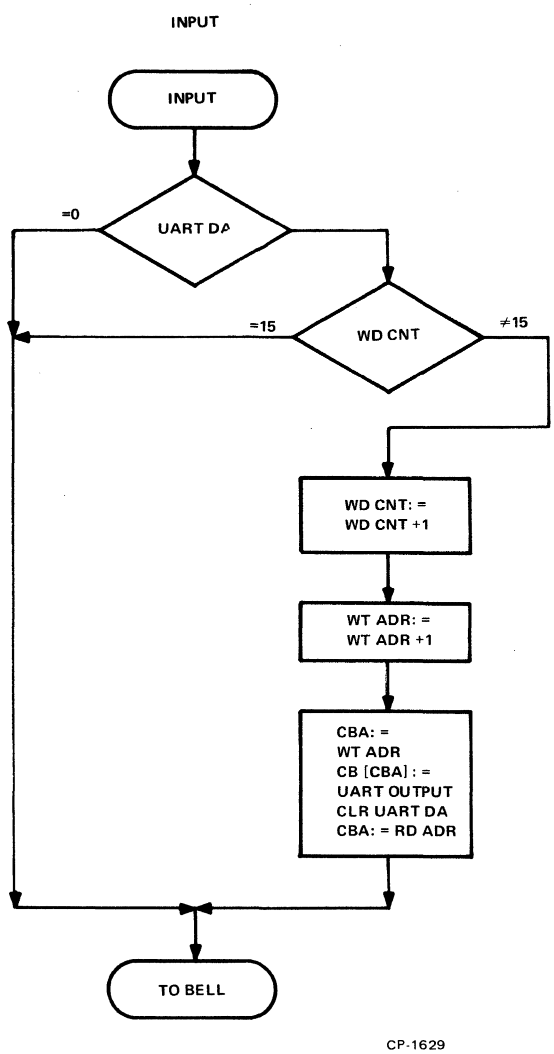


Figure 4-6 INPUT Routine

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.

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, an LF, or the next character, or to execute an LCV.

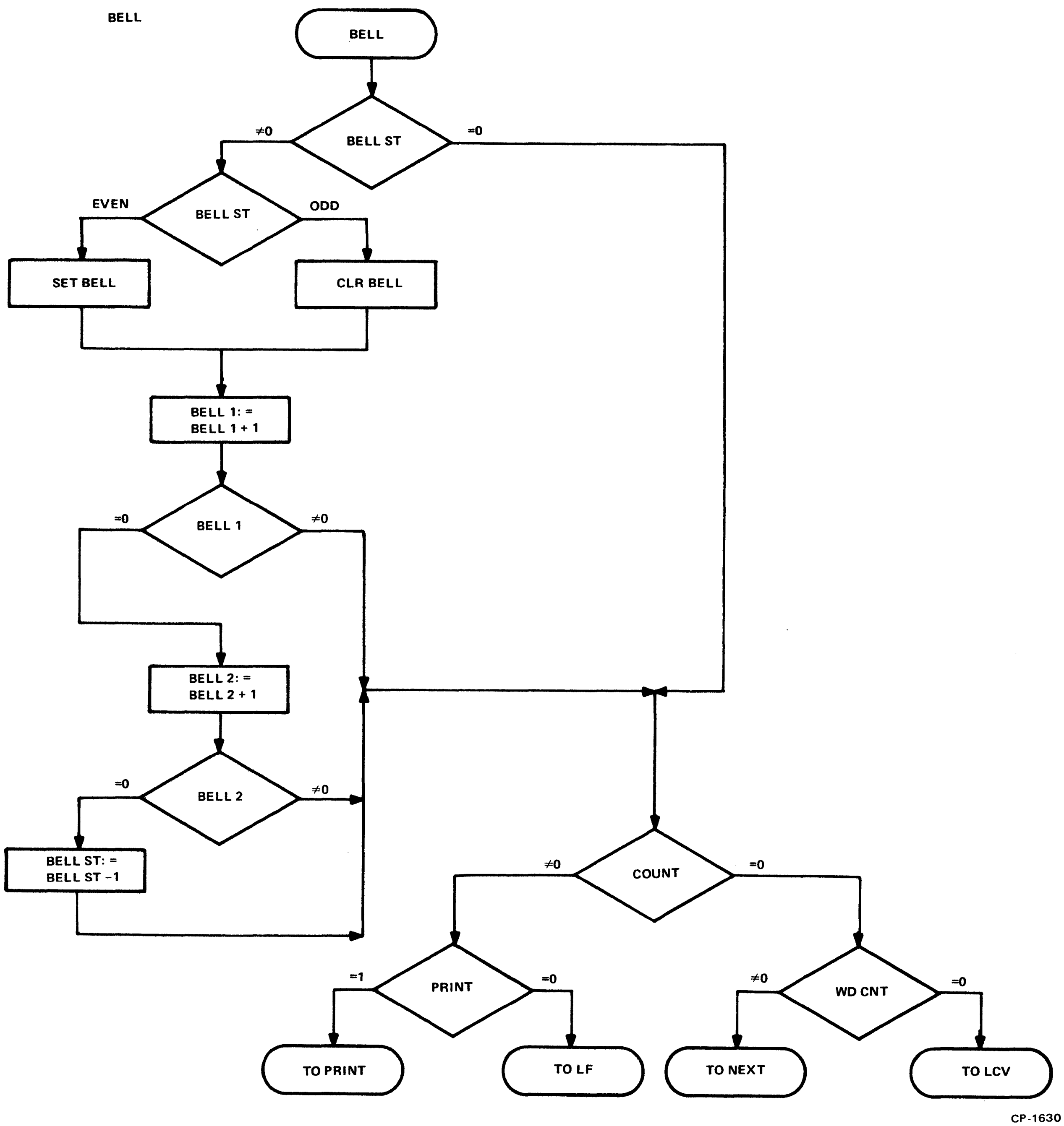


Figure 4-7 BELL Routine

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 μs 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 has 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, and 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 μs head drive enable (HDE).

NOTE

At all other times through this routine, operation is synchronized on the 416 μs 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 μs HDE is then timed out in PT1 and PT2 locations of the control RAM on the 1.184 μs 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.

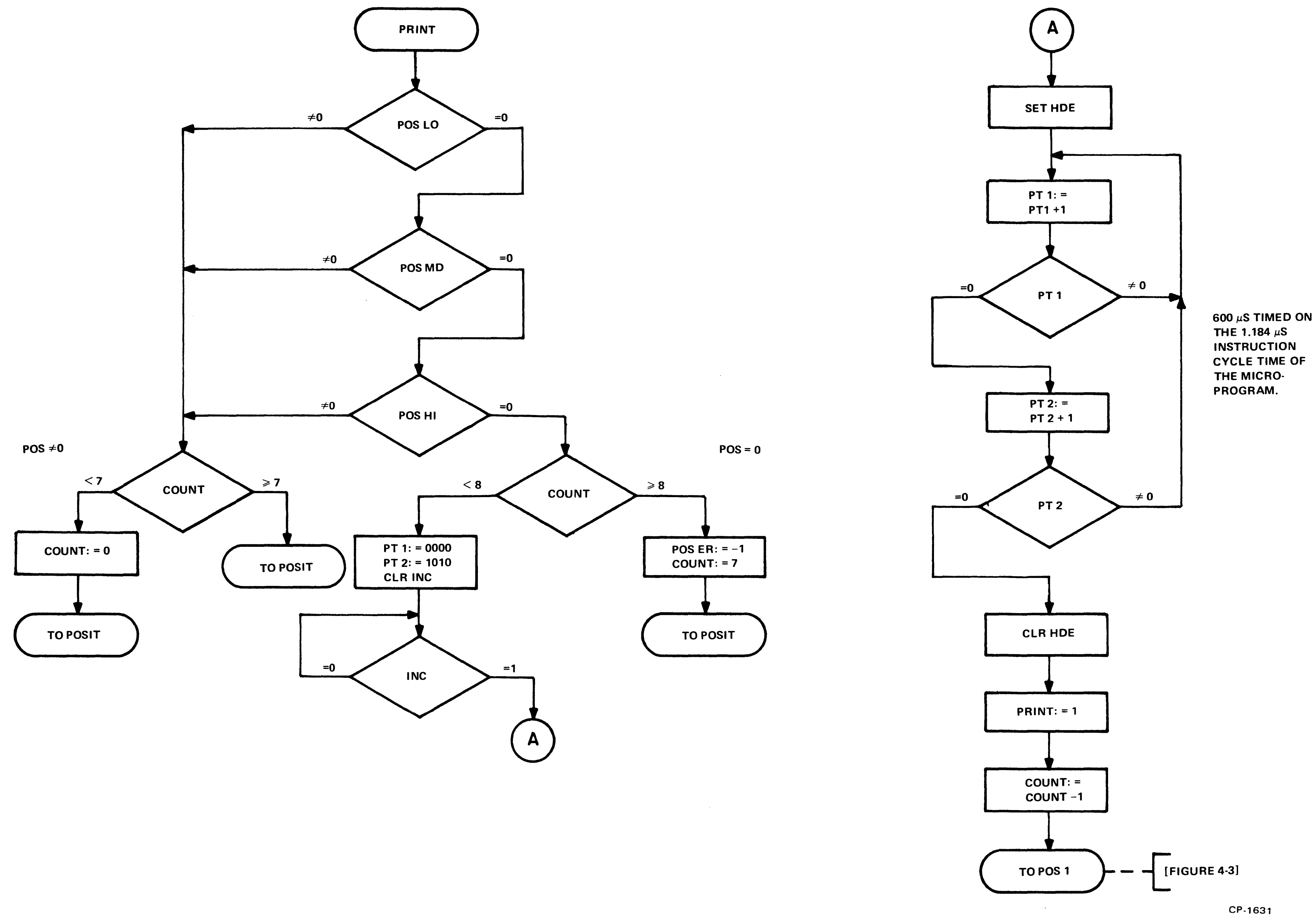


Figure 4-8 PRINT Routine

4.1.9 LINE FEED (LF) Routine

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

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 μs 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.

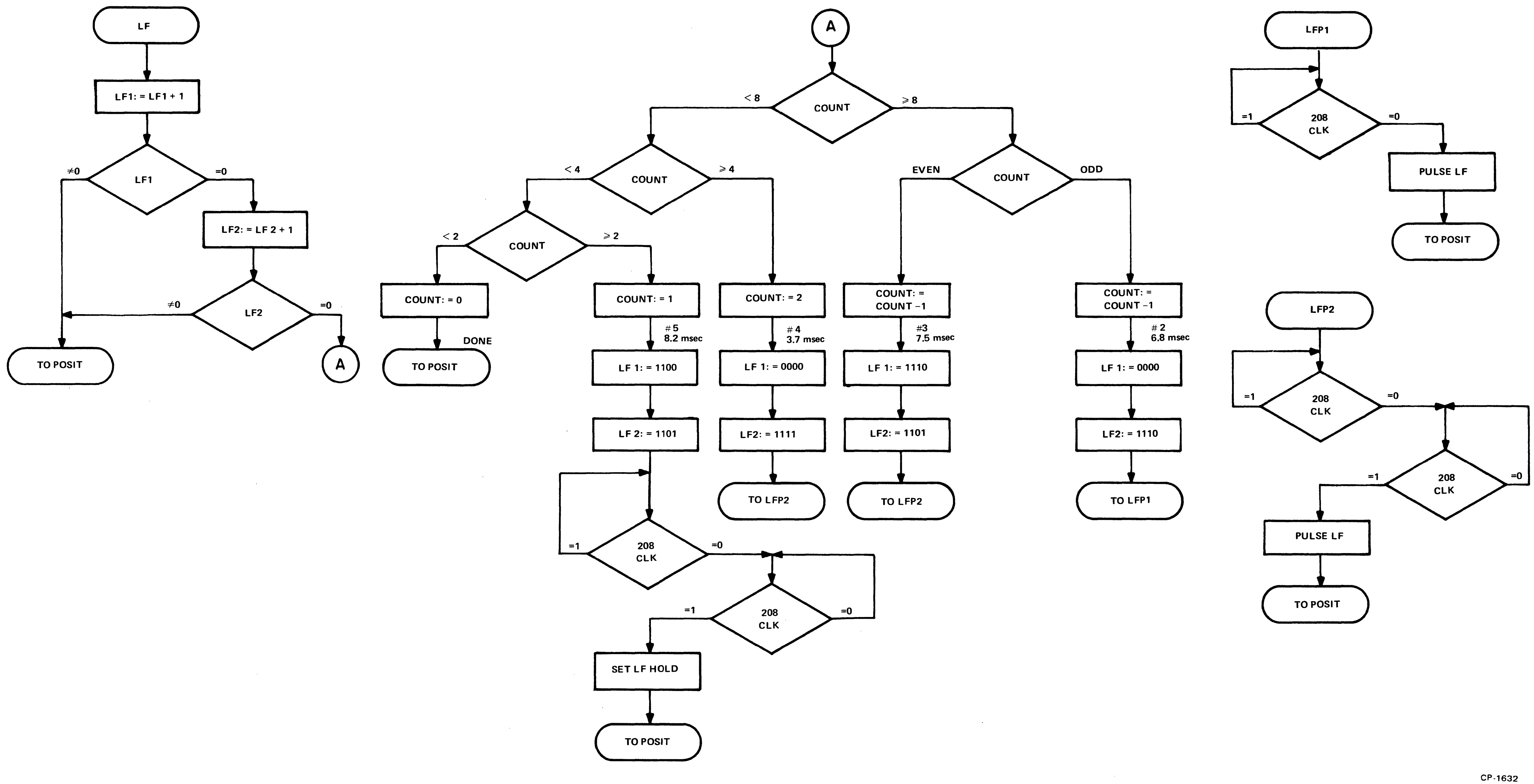


Figure 4-9 LINE FEED Routine

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 second time delay before the head is commanded to move 4 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 seconds 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.

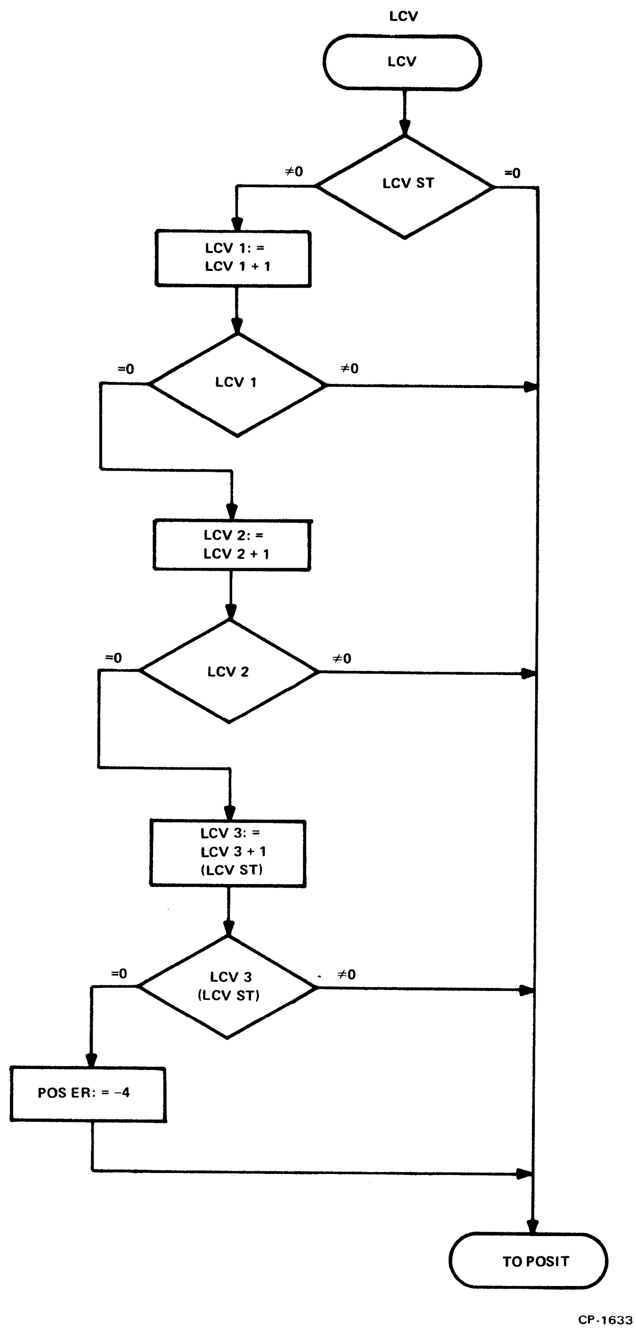


Figure 4-10 LCV Routine

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.

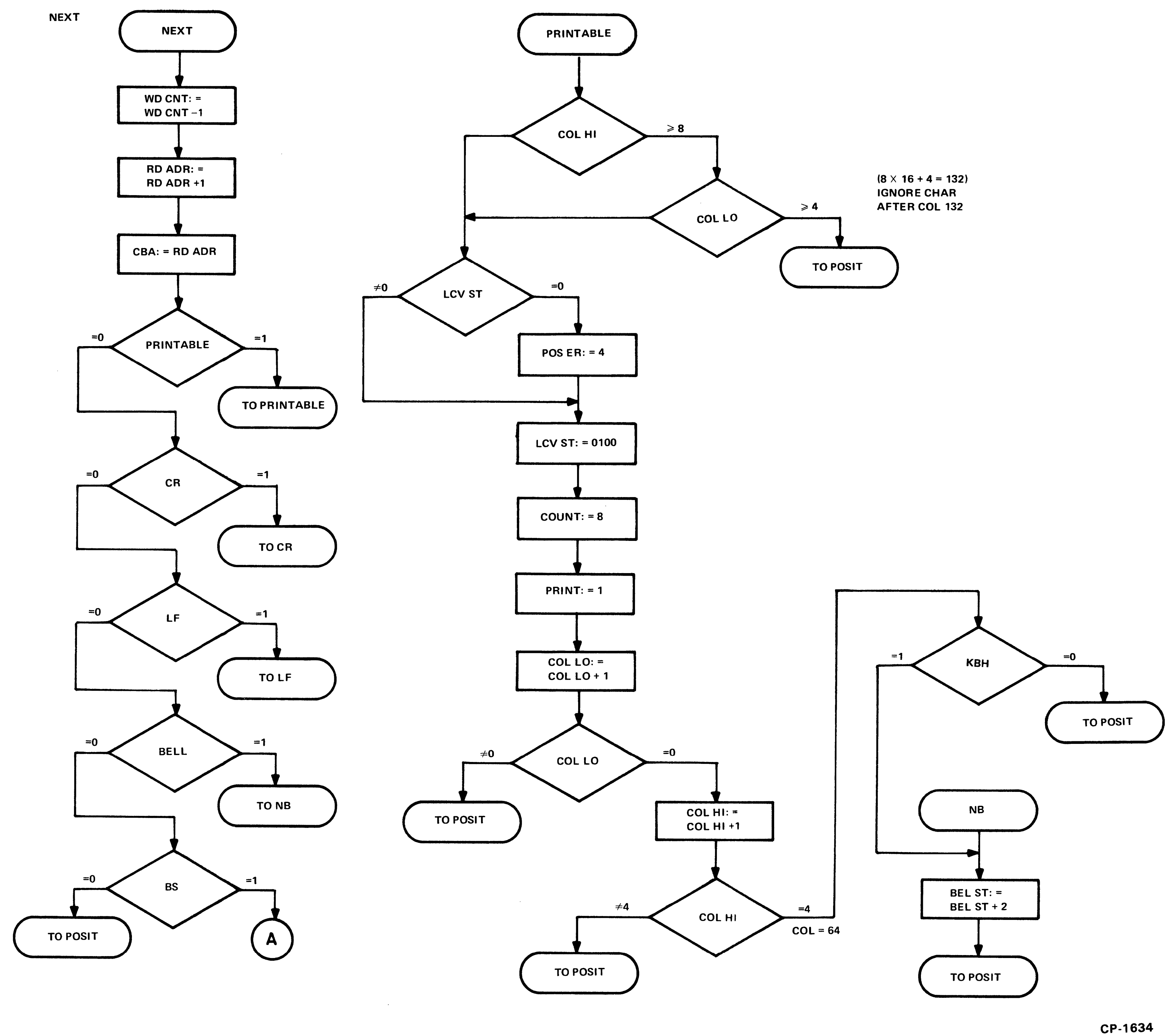


Figure 4-11 NEXT Routine
(Sheet 1 of 2)

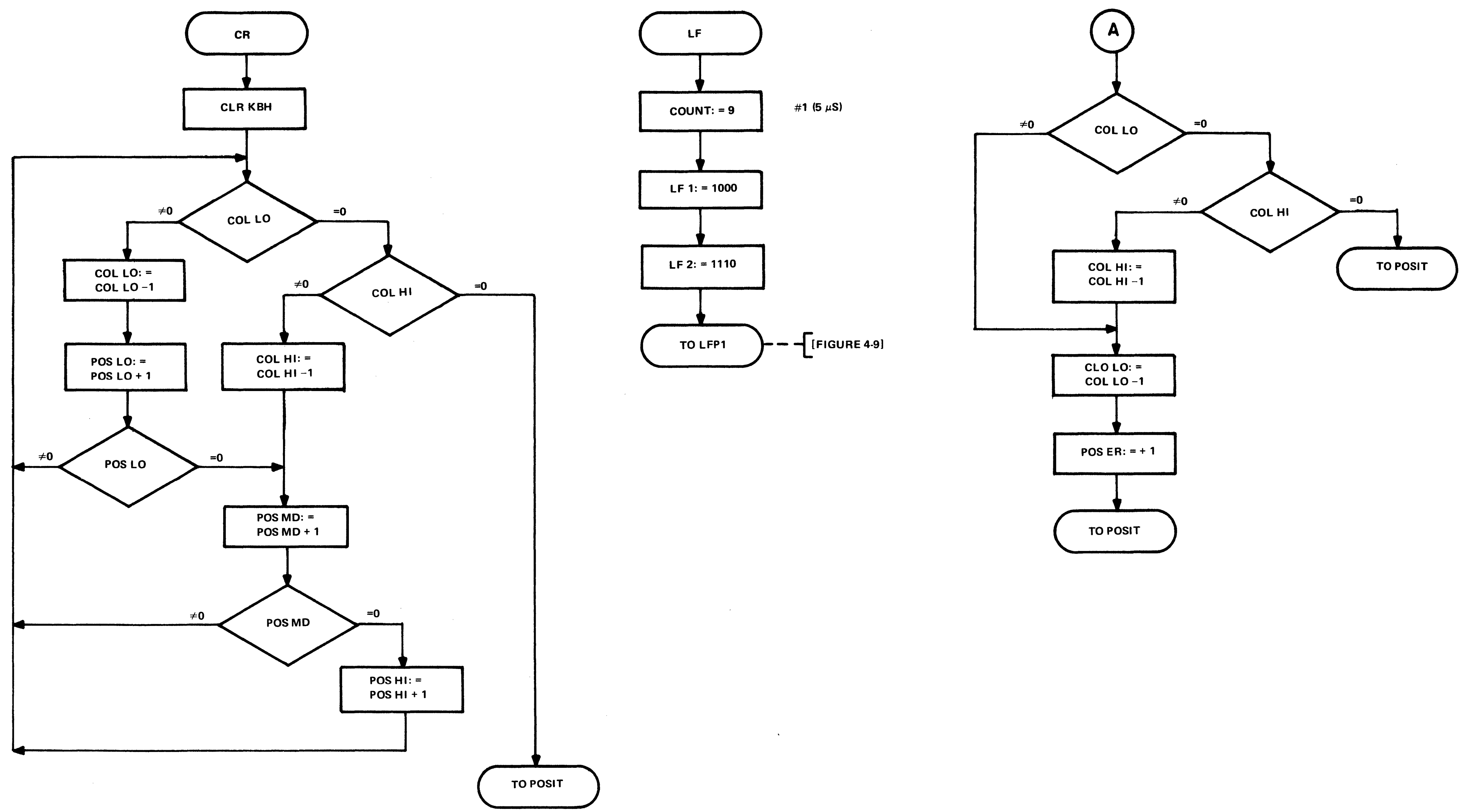


Figure 4-11 NEXT Routine
(Sheet 2 of 2)

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.

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 an 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.

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 are examined. 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 μs 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 $\geqslant 8$ and that COL LO is $\geqslant 4$. If these conditions are true, printing cannot occur and the program returns to POSIT, ignoring the current character until a CR occurs.

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 2 to form the 1.184 μs cycle time for the 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 paragraphs of this chapter.

4.3 M7722/M7723 CONTROL LOGIC

The LA36 control logic is implemented as a 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 an 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 that form the printable characters.

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 an 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 that allows microprogram control of the LA36 operation is illustrated in Figure 4-12.

The microprogram consists of a sequence of 512 instructions that 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 μs.

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 that 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 4-bit data bus register to load the next 4 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.

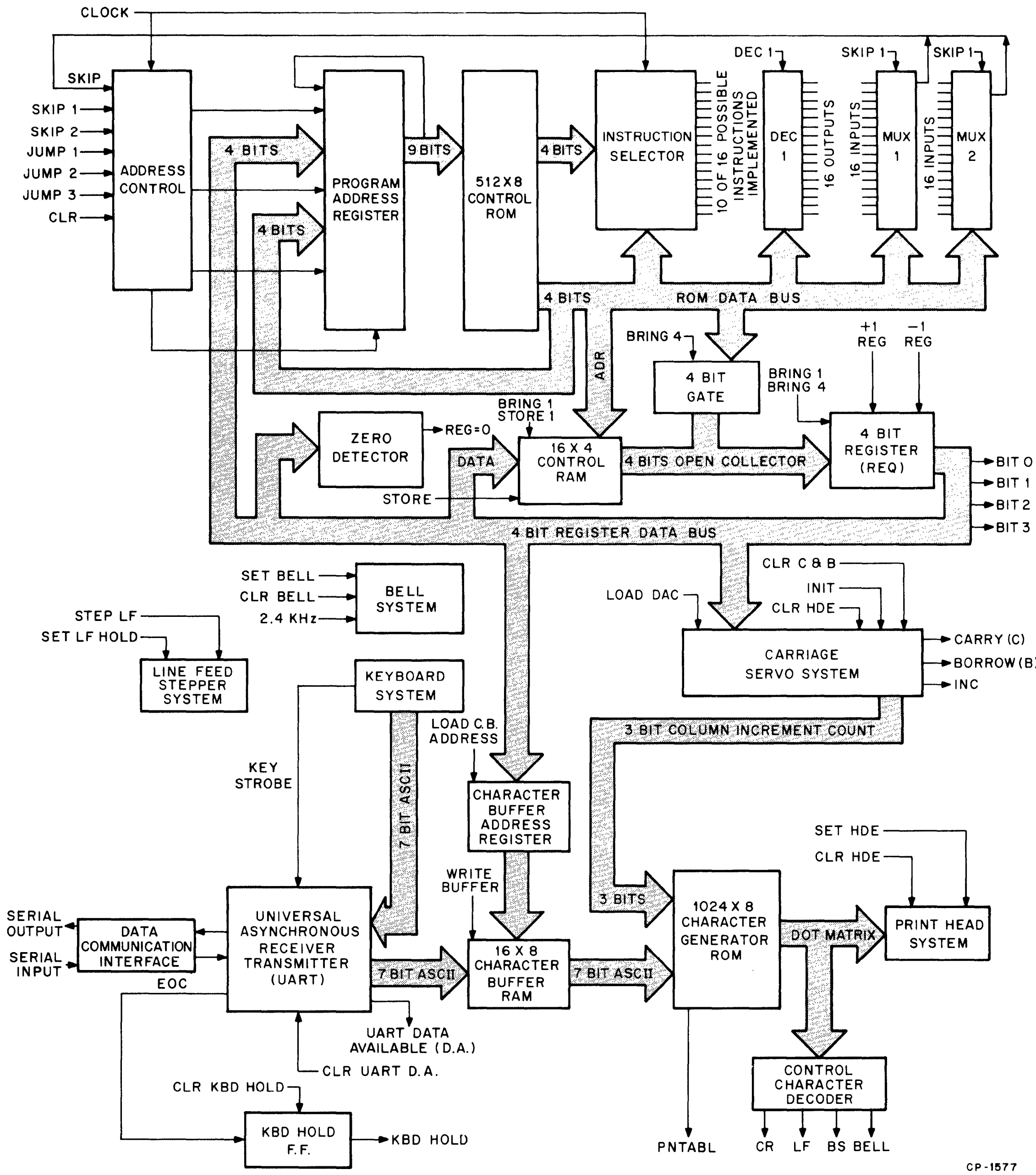


Figure 4-12 Control Logic Block Diagram

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 that are inputs to the skip multiplexers are UART DA, KBH, 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 that 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 that 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 DA, 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. The X and Y addresses (Table 4-4) for the numeric keypad are unique. This is due to the fact that the same characters are generated in the shifted and unshifted mode.

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 μs) 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 AKD (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 uppercase 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.

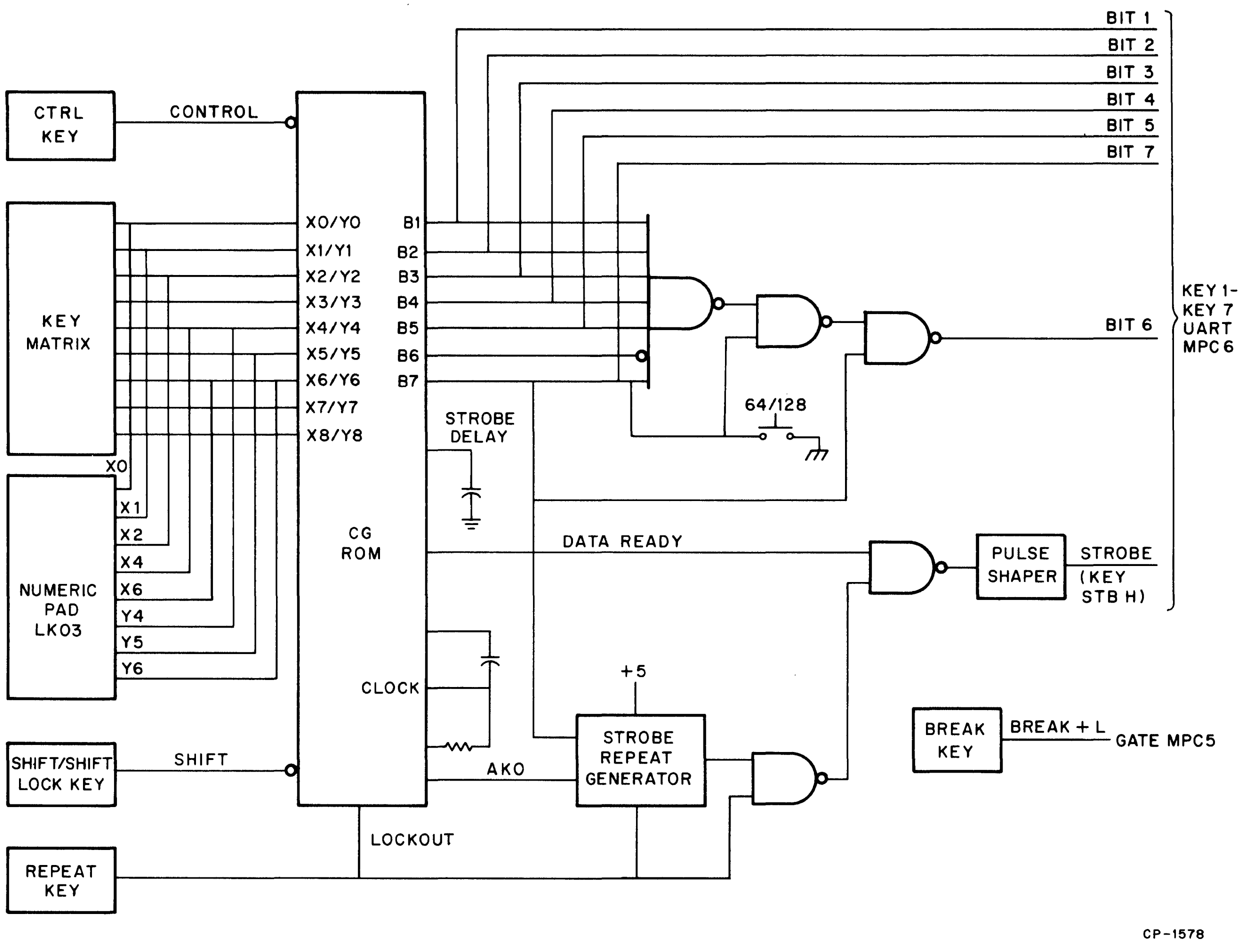


Figure 4-13 LK02/LK03 Keyboard Logic Diagram

Table 4-3 Keyboard ROM Addressing

Key	ASCII Code b7–b1	Octal Code	ROM Addressing X Line	ROM Addressing 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
1	0110001	61	7	9
e	1100101	145	5	7

Table 4-3 Keyboard ROM Addressing (Cont)

Key	ASCII Code b7–b1	Octal Code	ROM Addressing X Line	ROM Addressing Y Line
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
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

Table 4-3 Keyboard ROM Addressing (Cont)

Key	ASCII Code b7–b1	Octal Code	ROM Addressing X Line	ROM Addressing Y Line
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
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

Table 4-3 Keyboard ROM Addressing (Cont)

Key	ASCII Code b7–b1	Octal Code	ROM Addressing X Line	ROM Addressing Y Line
$	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
ETB	0010111	27	7	3
SI	0001111	17	5	1
SOH	0000001	1	3	9

Table 4-3 Keyboard ROM Addressing (Cont)

Key	ASCII Code b7–b1	Octal Code	ROM Addressing X Line	Y Line
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 Keyboard ROM Addressing (Cont)

Key	ASCII Code b7–b1	Octal Code	ROM Addressing X Line	ROM Addressing 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

Table 4-4 Numeric Keypad ROM Addressing

Key	ASCII Code b7–b1	Octal Code	ROM Addressing X Line	ROM Addressing Y Line
1	0110001	61	6	4
2	0110010	62	6	5
3	0110011	63	6	6
4	0110100	64	4	4
5	0110101	65	4	5
6	0110110	66	4	6
7	0110111	67	2	4
8	0111000	70	2	5
9	0111001	71	2	6
0	0110000	60	0	5
.	0101110	56	0	6
,	0101100	54	1	2
–	0101101	55	0	3
ENTER	0001101	15	4	2

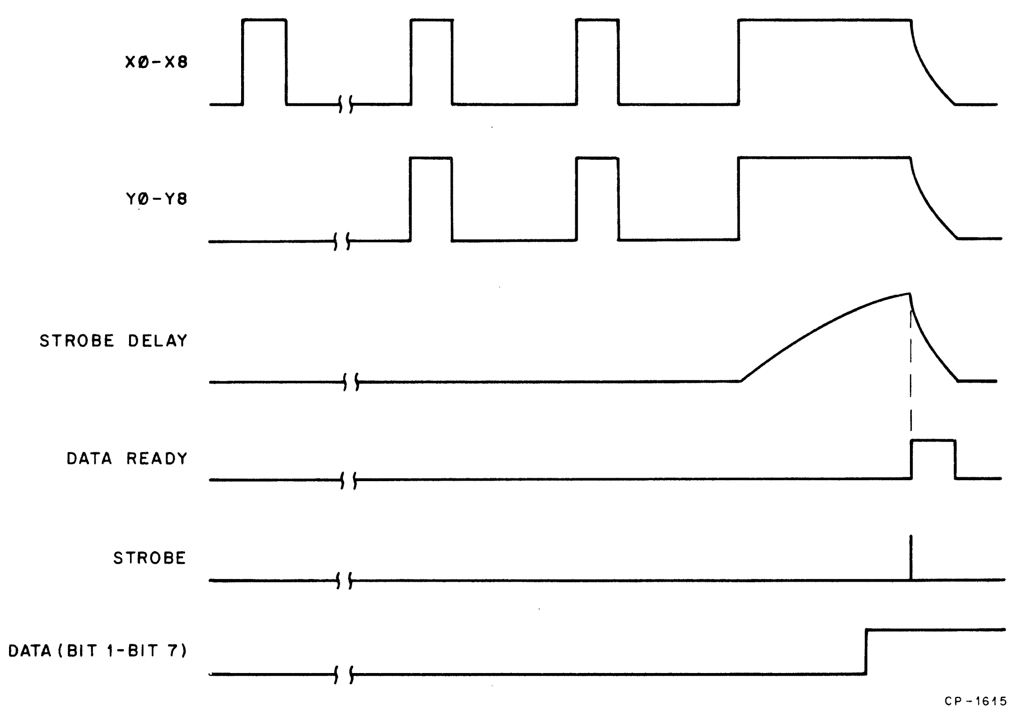


Figure 4-14 Keyboard Timing Diagram

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.

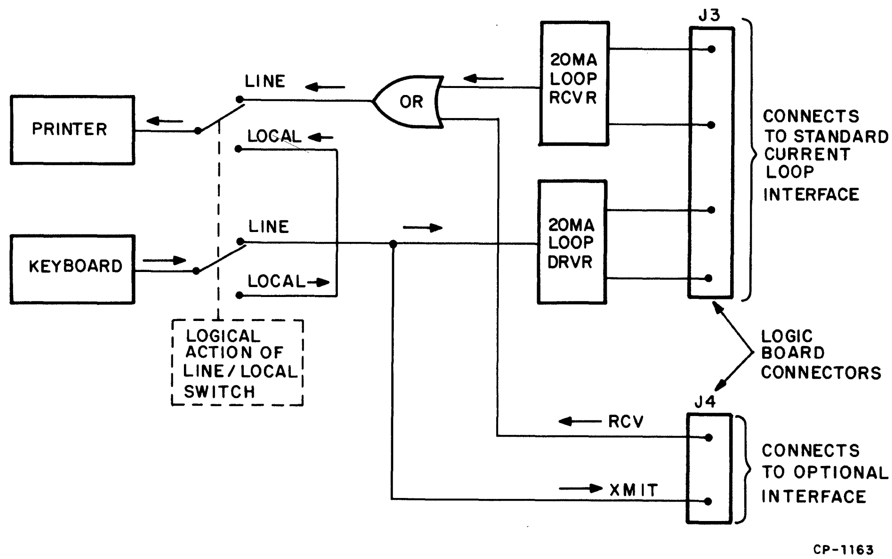


Figure 4-15 Data Communications Interface Diagram

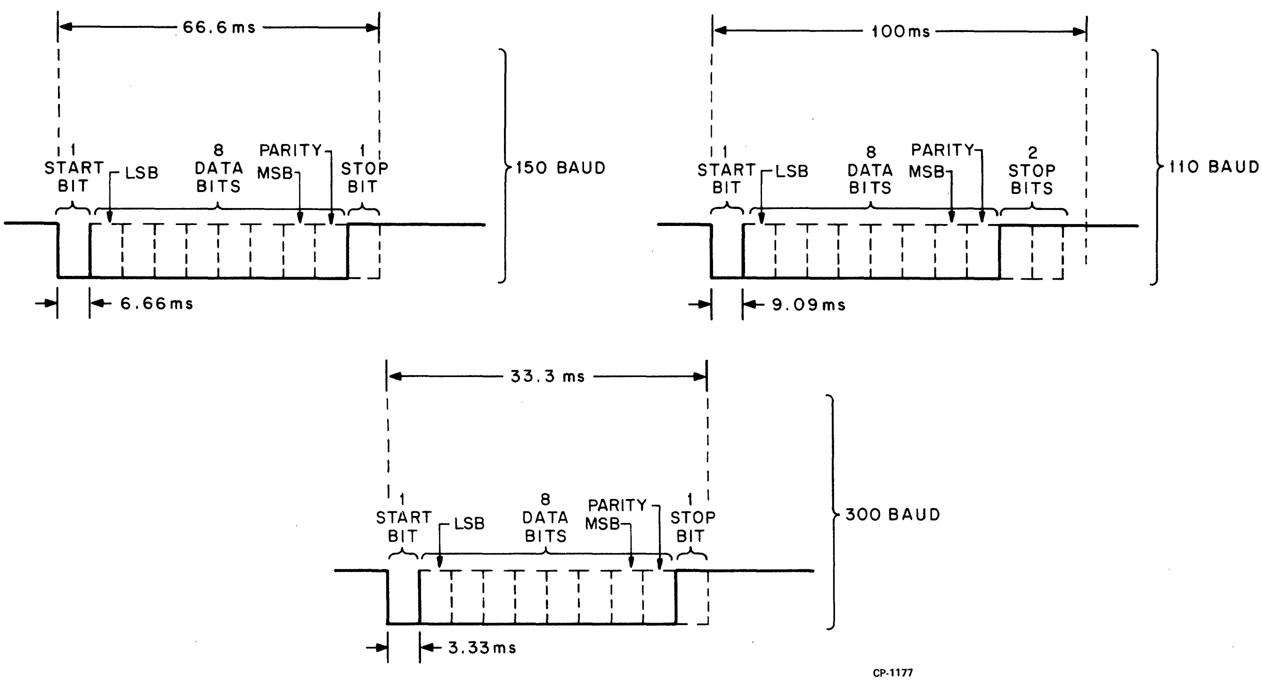


Figure 4-16 Data Communications Interface Timing Diagram

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.

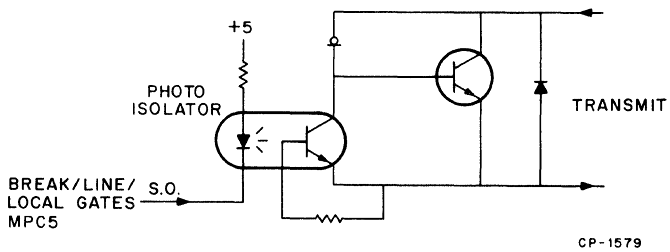


Figure 4-17 20 mA Loop Receiver Diagram

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.

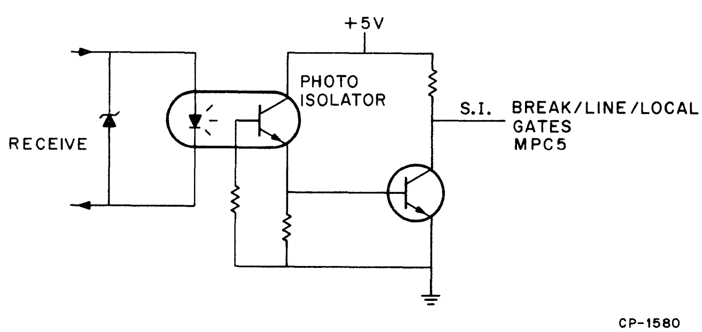


Figure 4-18 20 mA Loop Driver

4.6 CLOCK LOGIC

The clock frequencies used to time the 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 ÷11 binary counter and a ÷15 binary counter to produce the necessary timing signals and baud rate signals. The frequencies and time periods produced are shown in Table 4-5. Important timing relationships are shown in Figure 4-20.

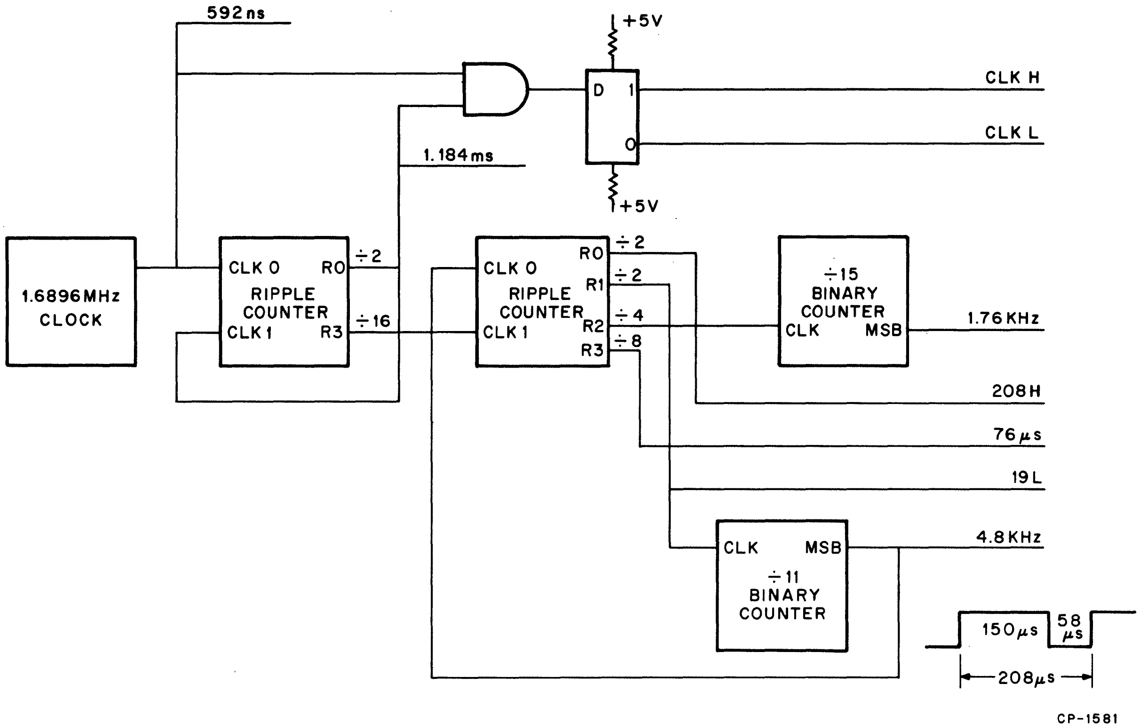


Figure 4-19 Clock Logic

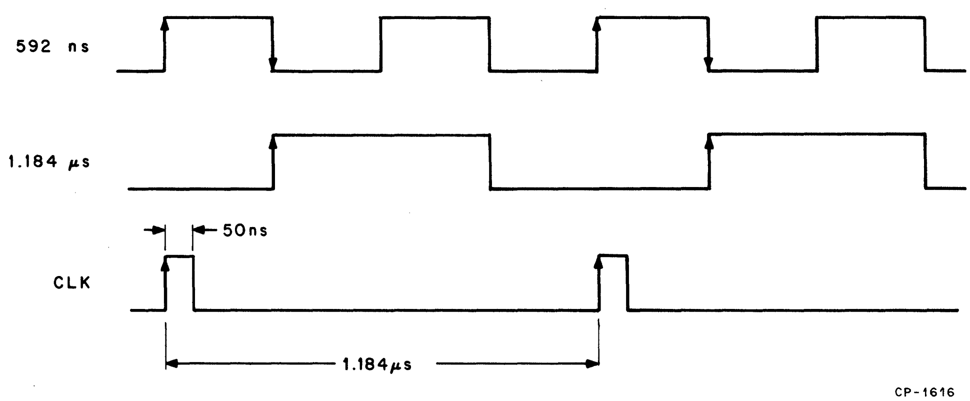


Figure 4-20 Clock Timing Relationship

Table 4-5 Clock Frequencies and Time Periods

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

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 on-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 (WU) 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.

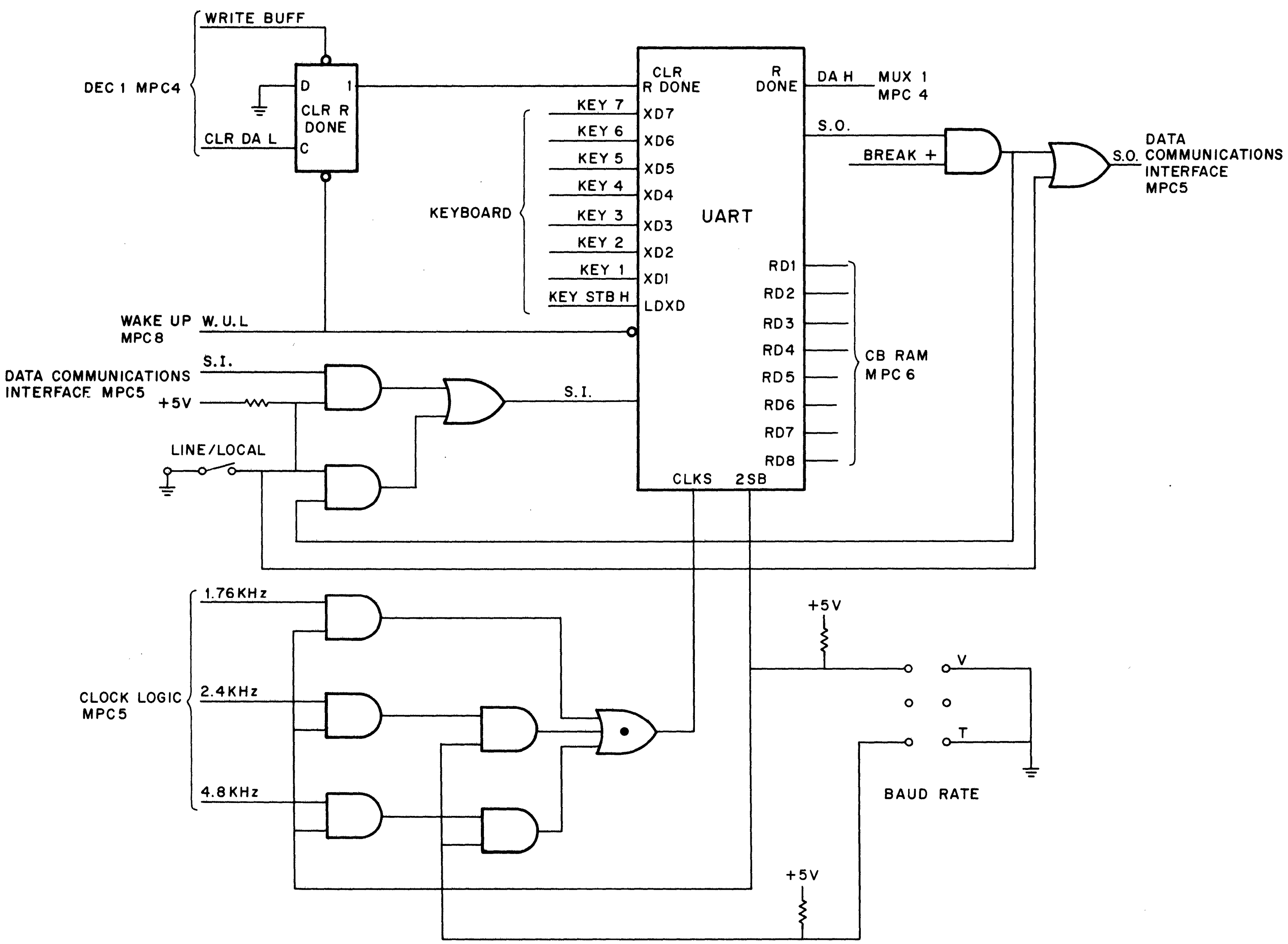


Figure 4-21 UART/Mode Selection and Baud Rate Selection Logic

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 4-6). 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.

Table 4-6 Baud Rate Switch Connections

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

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.

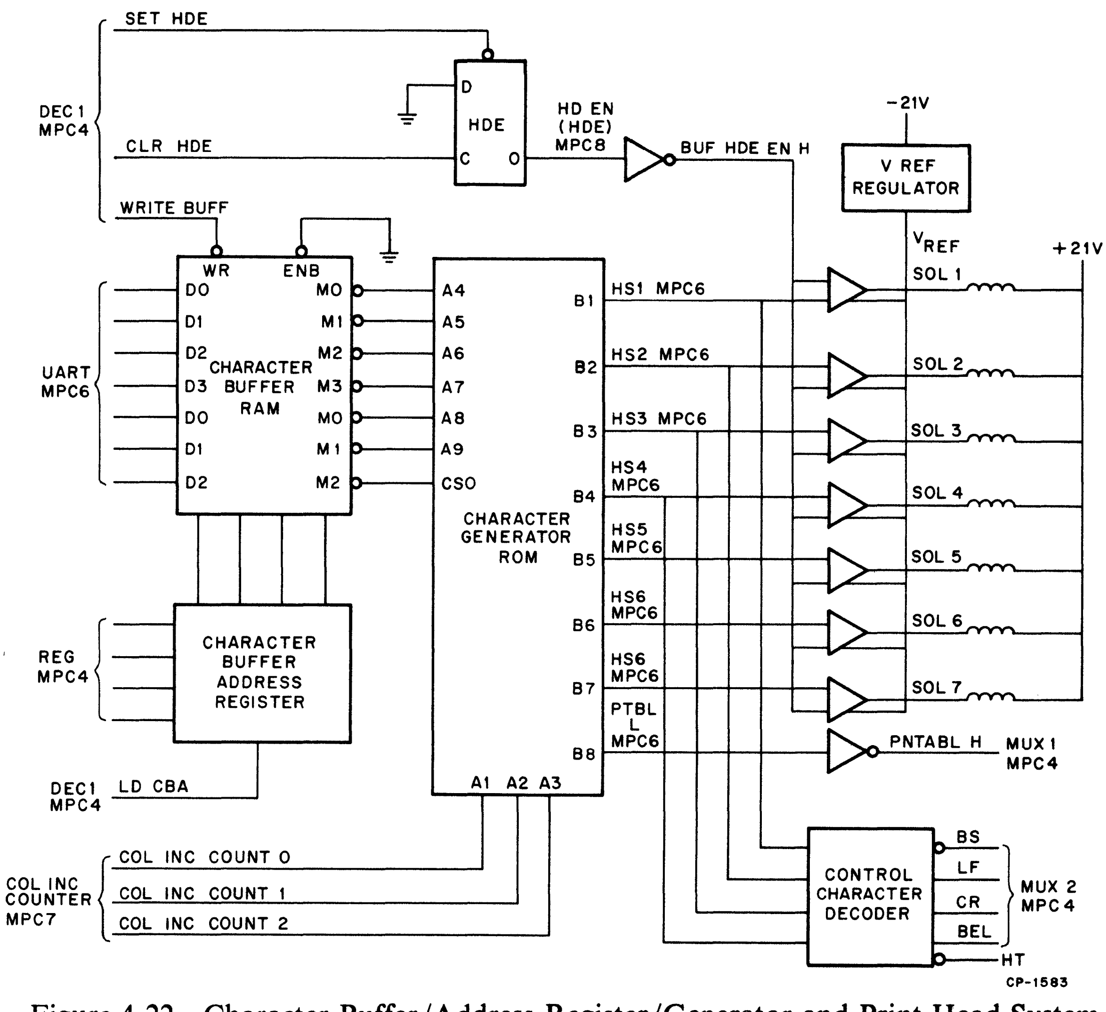


Figure 4-22 Character Buffer/Address Register/Generator and Print Head System

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 corre sponding address is incremented by the MPC. As each character is read from the buffer, it is decoded by the character generator ROM (CG 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 multistage 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 subsolumns.

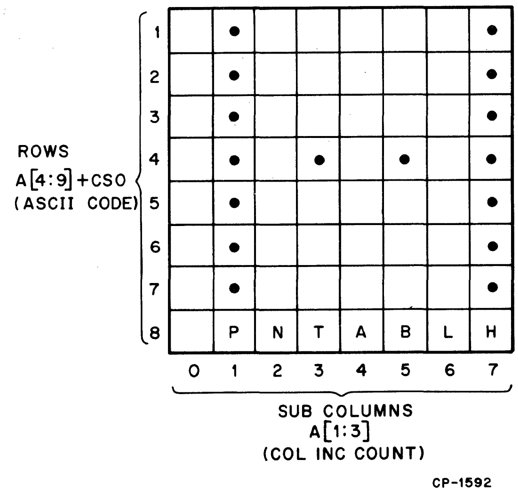


Figure 4-23 CG ROM Character Cell

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 MUX1 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.

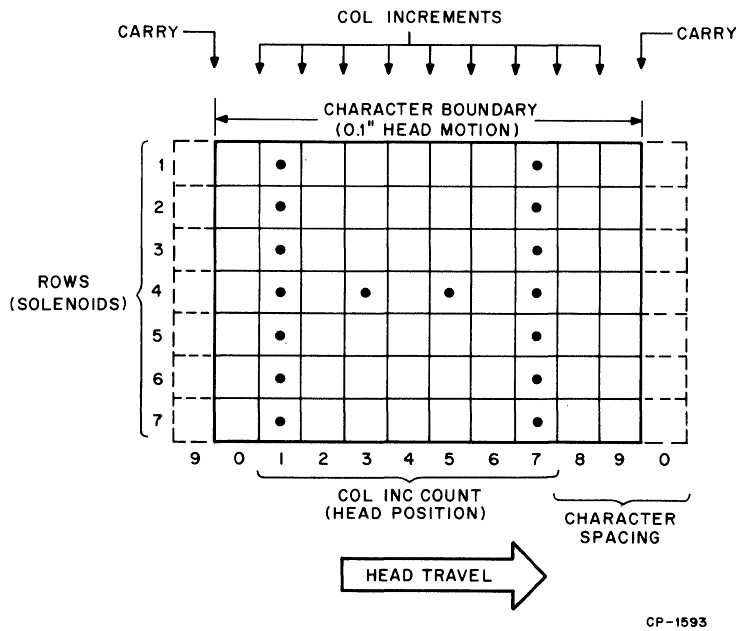


Figure 4-24 Print Head Operation

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 four of the seven 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 MUX2 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 DA L from DEC1. The various possible combinations of SPEED commands are shown in the truth table in Table 4-7. This register is cleared by WU L during wake-up (Paragraph 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 theoperational 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.

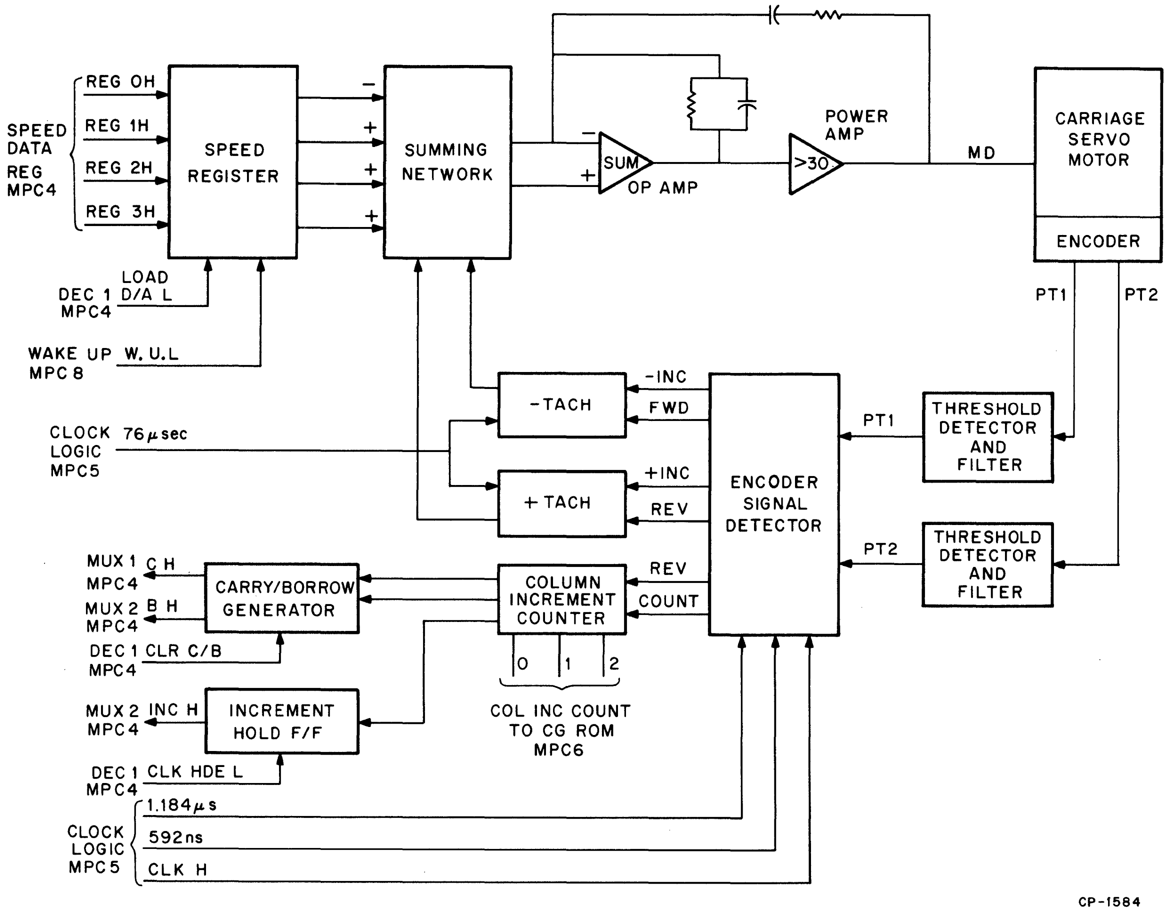


Figure 4-25 Carriage Servo System

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 μs timing signal from the clock logic. The +TACH and -TACH produce 76 μs 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.

Table 4-7 MPC SPEED Command Truth Table

Register Information Loaded into DA

DA (+ = PRINT, – = RETURN MOTION)

REG3 (1)	REG2 (1)	REG1 (1)	REG0 (1)	Nominal Speed (in/sec)
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

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 μs later, depending on the occurrence of the data with relation to the clock signal.

The second positive transition of the 76 μs clock signal clears the TACH flip-flops, thus providing a 76 μs 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.

The TACH pulses are algebraically combined with the SPEED command voltage in the summing network. This network contains precision 1 percent 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 counterbalances the SPEED commands.

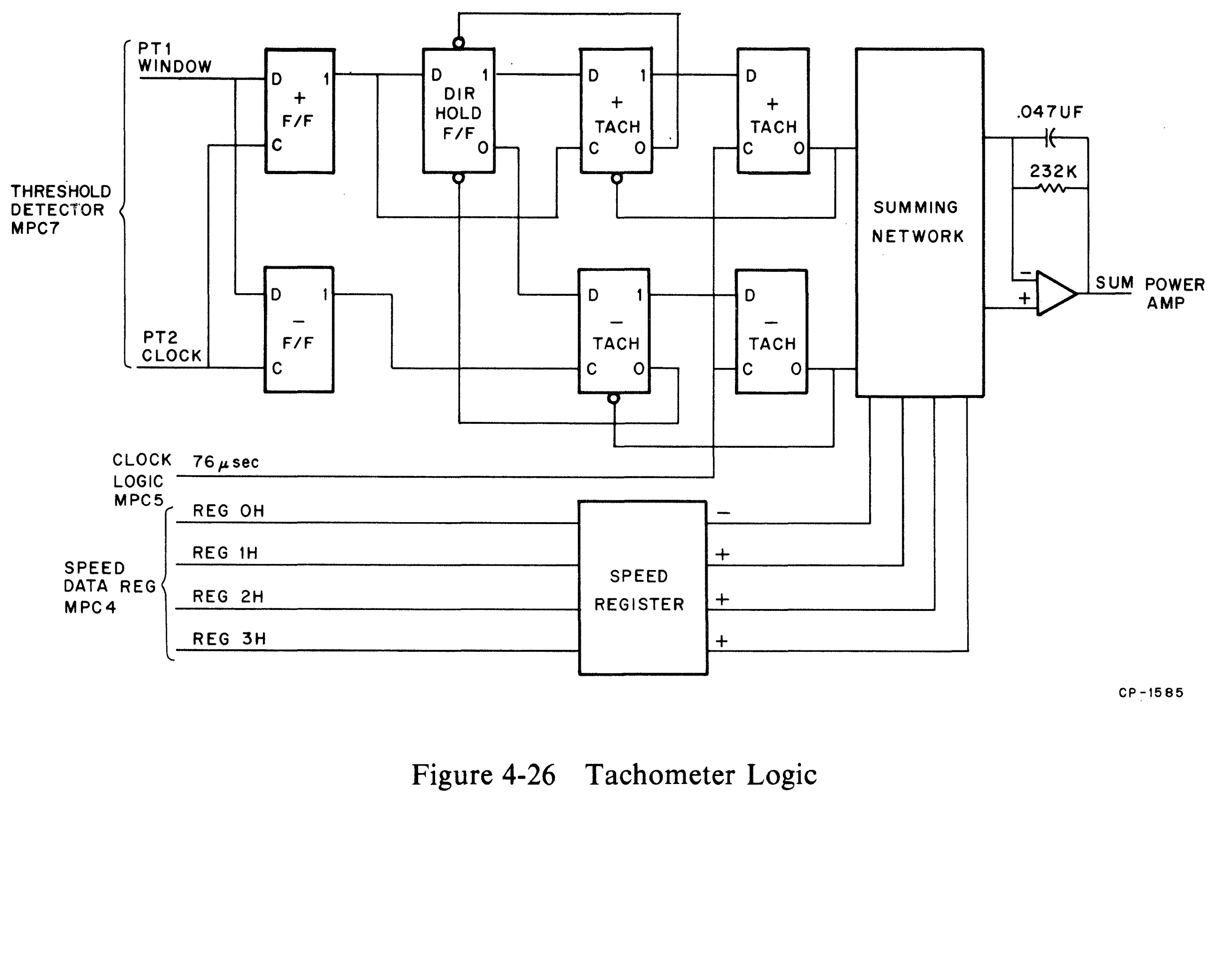


Figure 4-26 Tachometer Logic

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 degrees out of phase as shown in Figure 4-27. When the disk rotates in the forward direction, PT1 leads PT2 by 90 degrees. PT1 and PT2 are applied to two threshold detectors. PT1 and PT2 are approximately 0.5 to 1 V peak-to-peak 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.

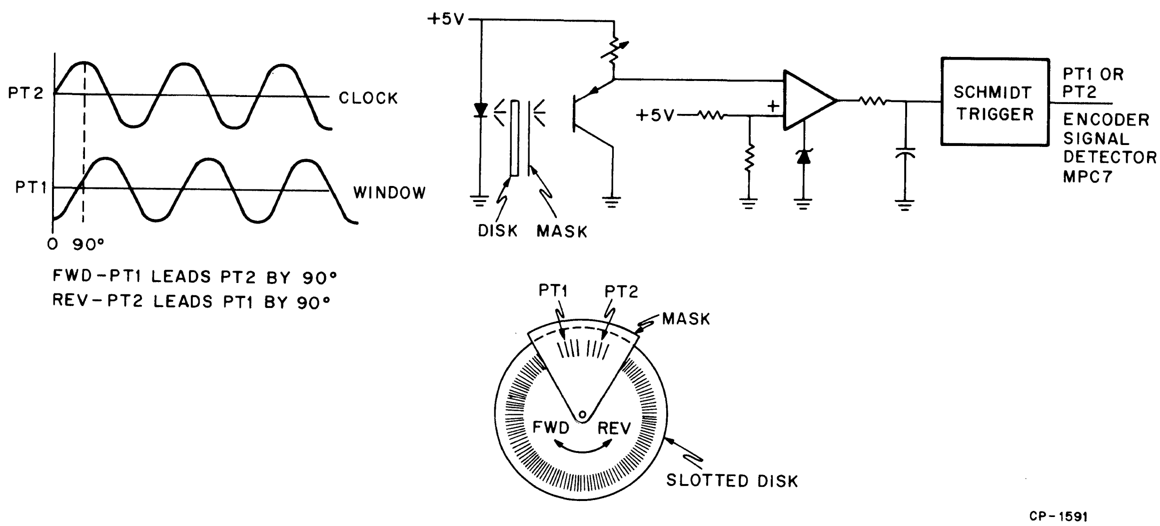


Figure 4-27 Encoder and Threshold Detector

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.

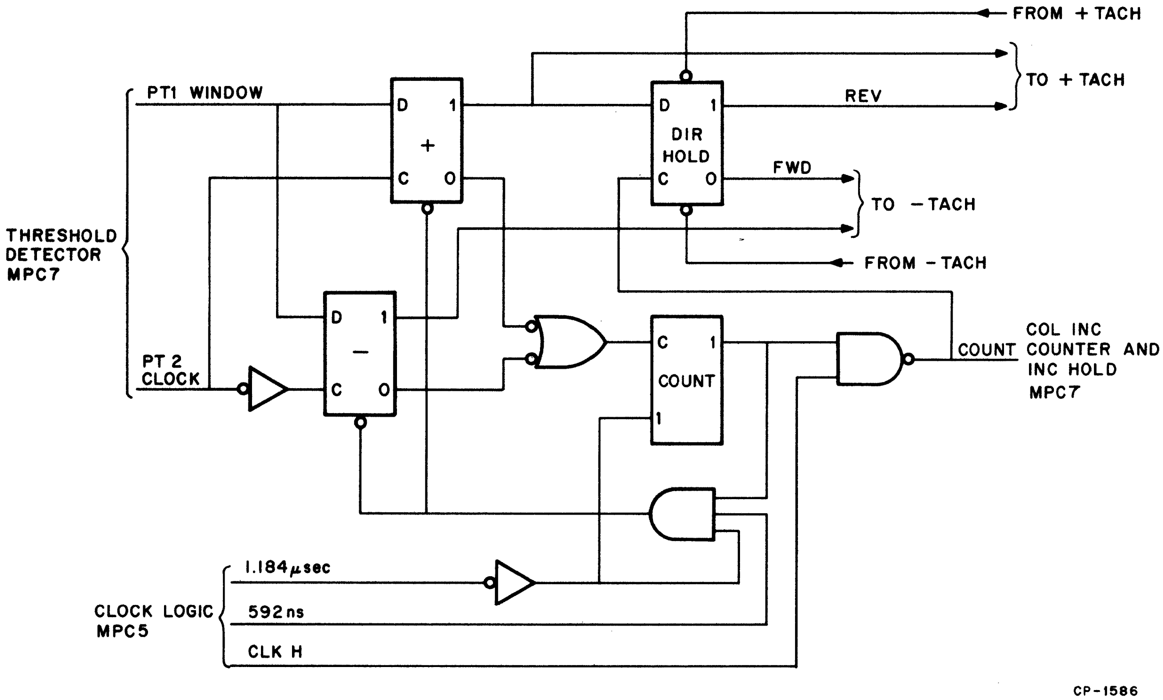


Figure 4-28 Encoder Signal Detector

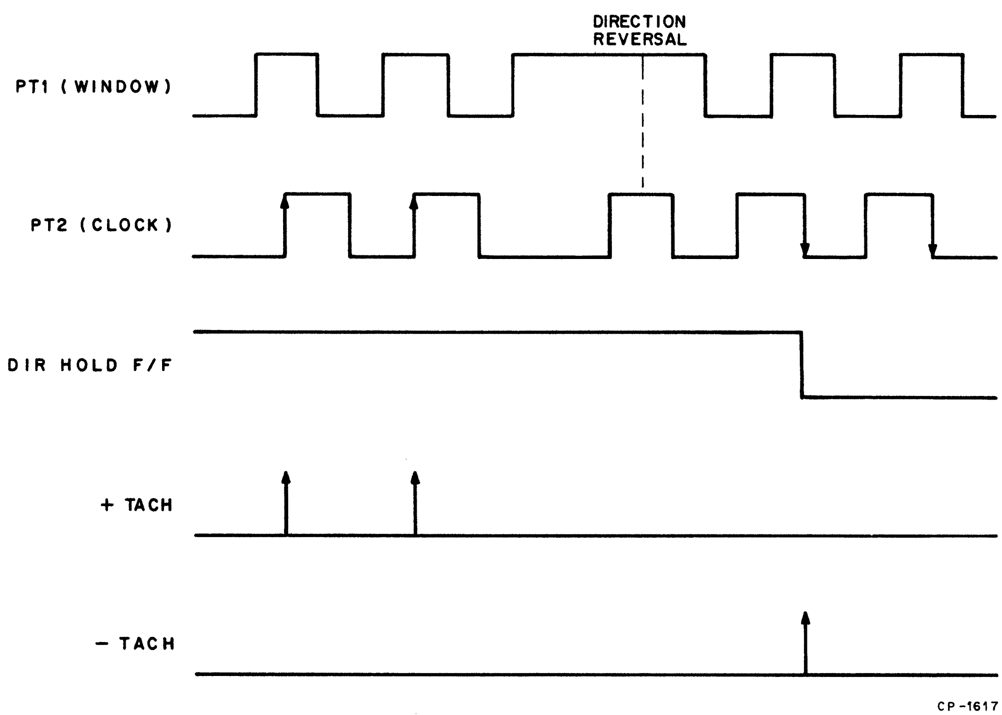


Figure 4-29 Increment Detection Timing

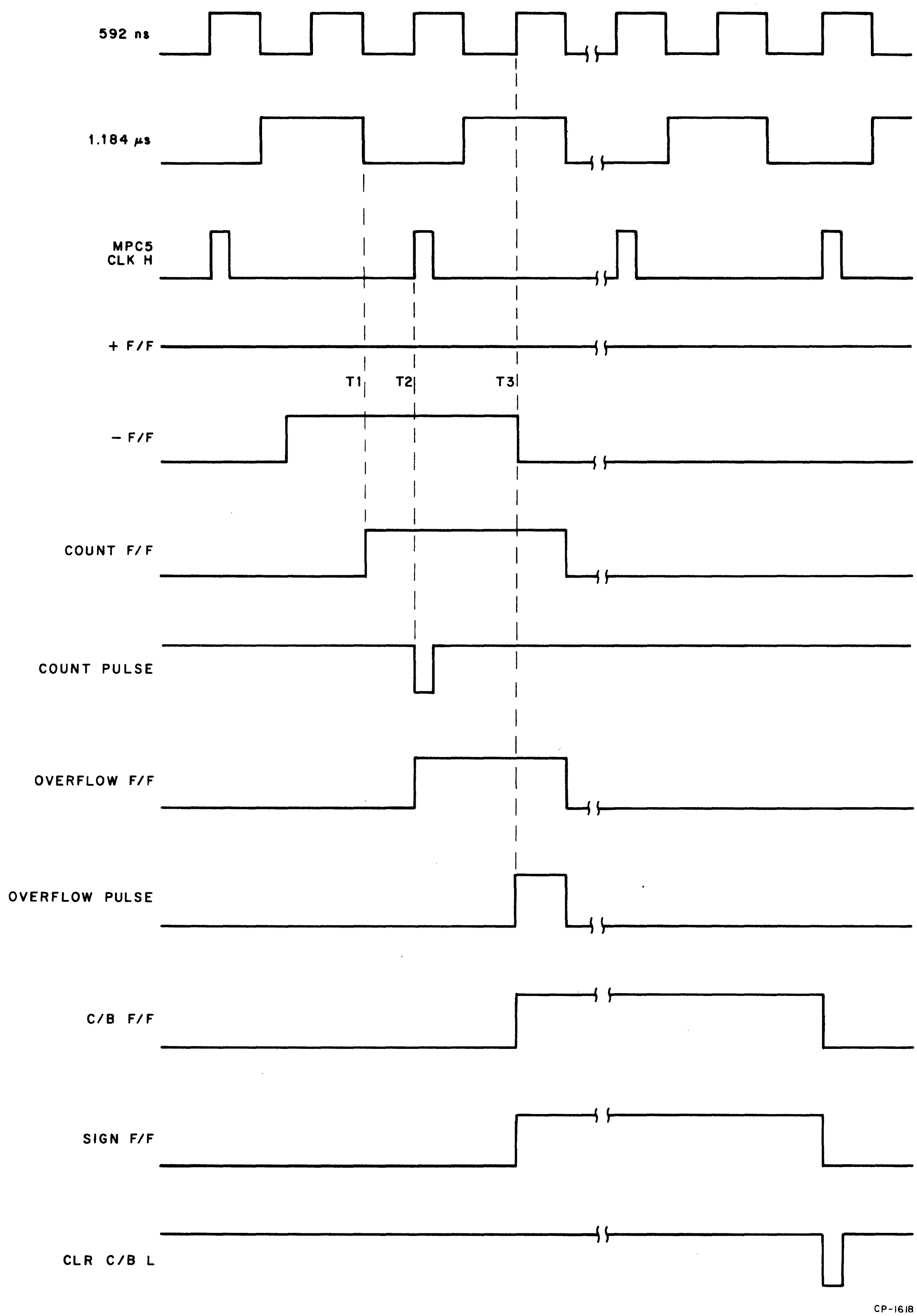


Figure 4-30 Encoder Signal Detector and Column Increment Counter Timing Diagram

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 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 lip-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.

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 μs 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.

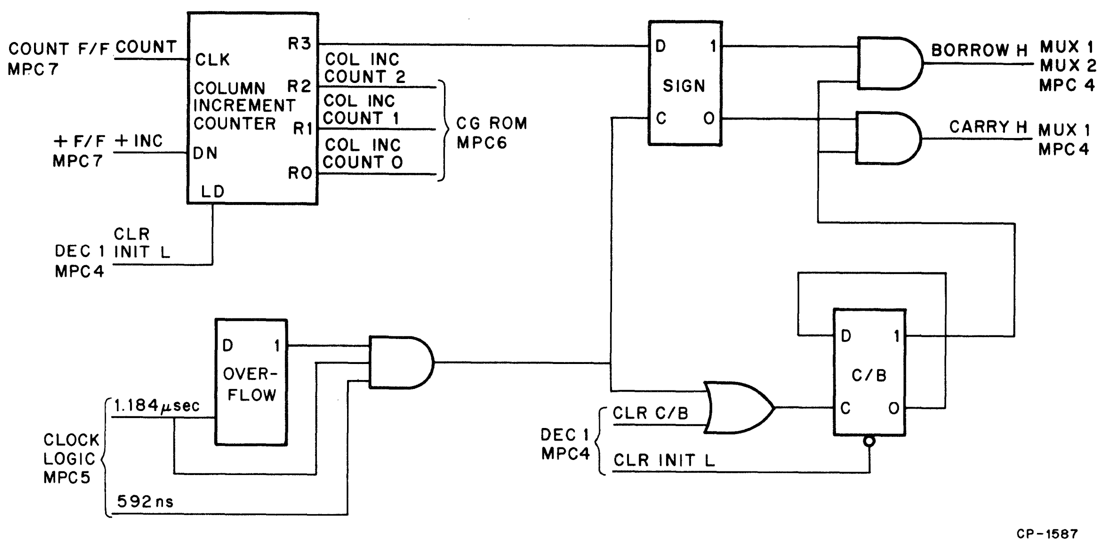


Figure 4-31 Column Increment Counter and C/B Generator Logic

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 WU 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 BELL pulse to the BELL HOLD flip-flop.

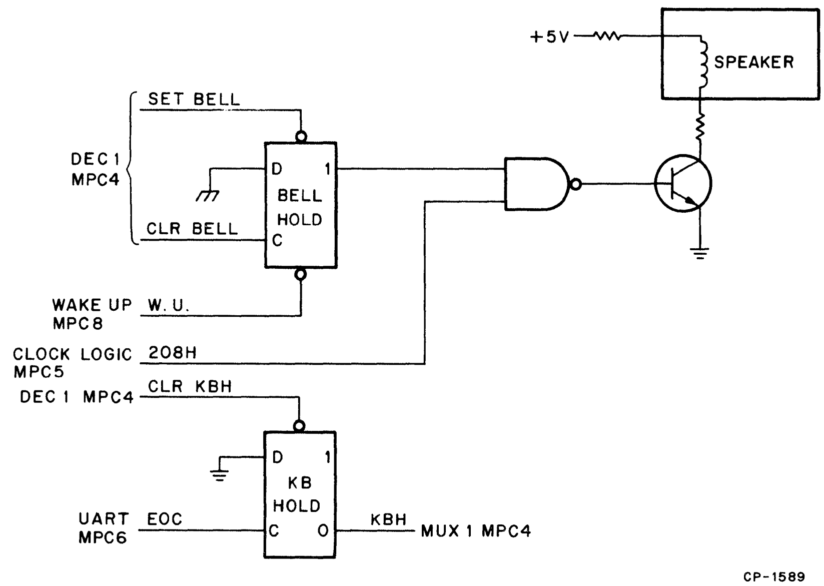


Figure 4-32 Bell System Logic

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.

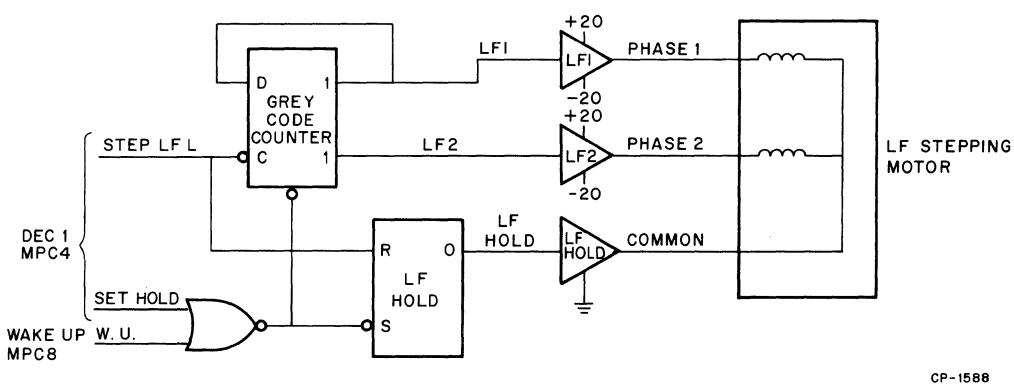


Figure 4-33 Line Feed Stepper System

The relationship of these pulses is shown in Figure 4-34. At power-up, WU 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. WU also clears the counter.

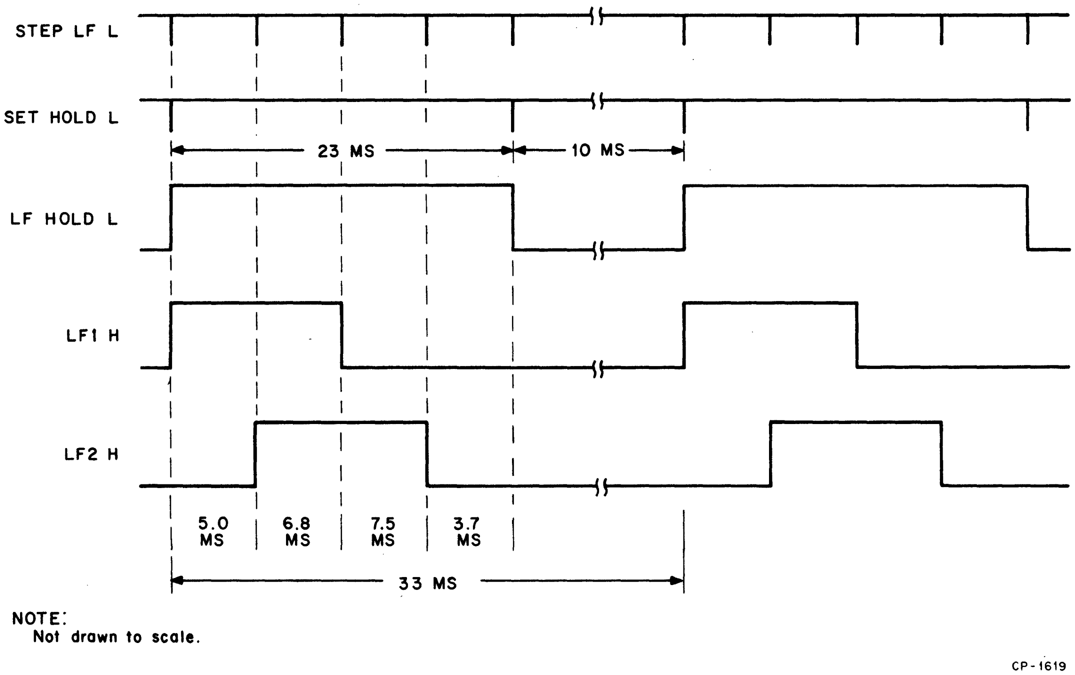


Figure 4-34 Line Feed Timing Diagram

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 4-8. The LF HOLD, LF1, and LF2 amplifiers are turned on and off accordingly. Each change causes the stepping motor to advance 15 degrees, providing four steps for each line advance and vertical spacing of 2.36 lines/cm (6 lines/inch). A complete line advance takes 33 ms ±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.

Table 4-8 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

4.12 WAKE-UP (WU) CIRCUIT

The wake-up circuit is shown on MPC8. This circuit is a time-delayed transistor switch that generates a 700 ms WU pulse. The WU pulse initializes the MPC logic before the MPC starts to run. WU 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 WU is at logic level zero. After one time constant (approximately 700 ms), the output transistor is turned off, WU 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 ±5 percent, -12 V ±5 percent, +5 V ±5 percent, and -9 V ±5 percent.

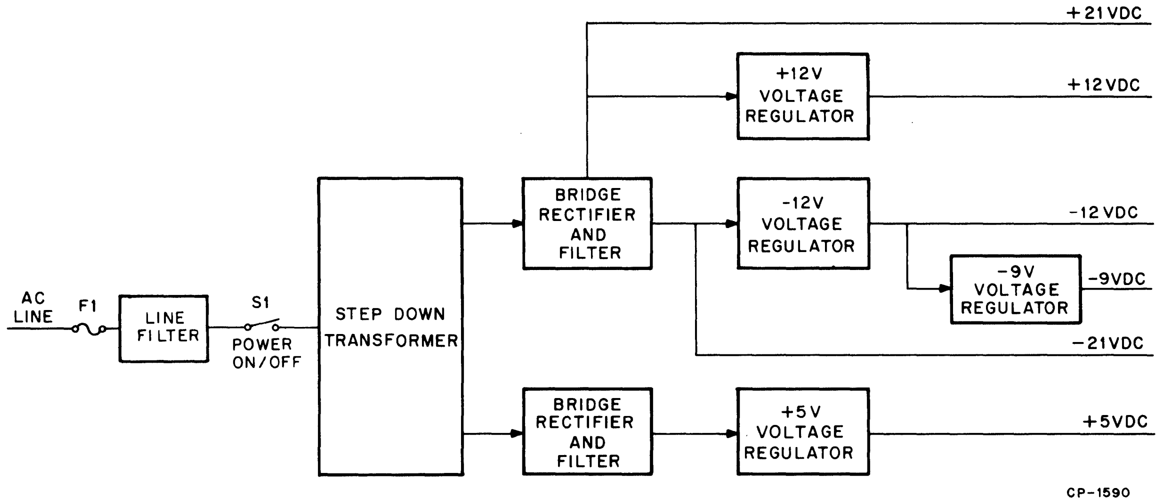


Figure 4-35 Power Supply Block Diagram

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 X 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 X 7 dot image of the selected character.

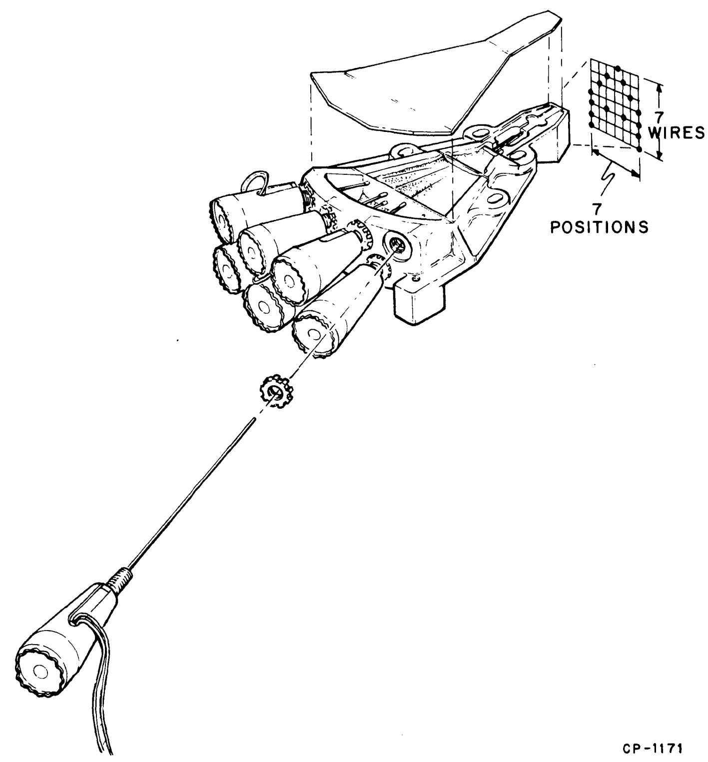


Figure 4-36 LA36 Printing Principle

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.

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 0.076 mm (0.003 inch) of gap and allows for a total of approximately 0.51 mm (0.020 inch) of paper gap.

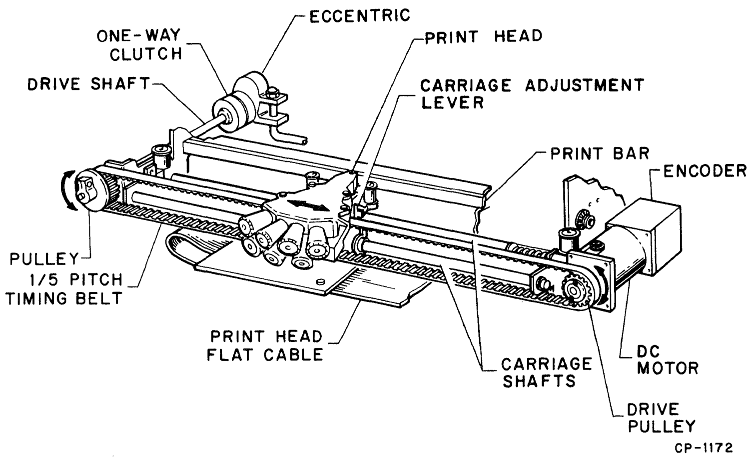


Figure 4-37 Carriage Subsystem

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 engage 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.

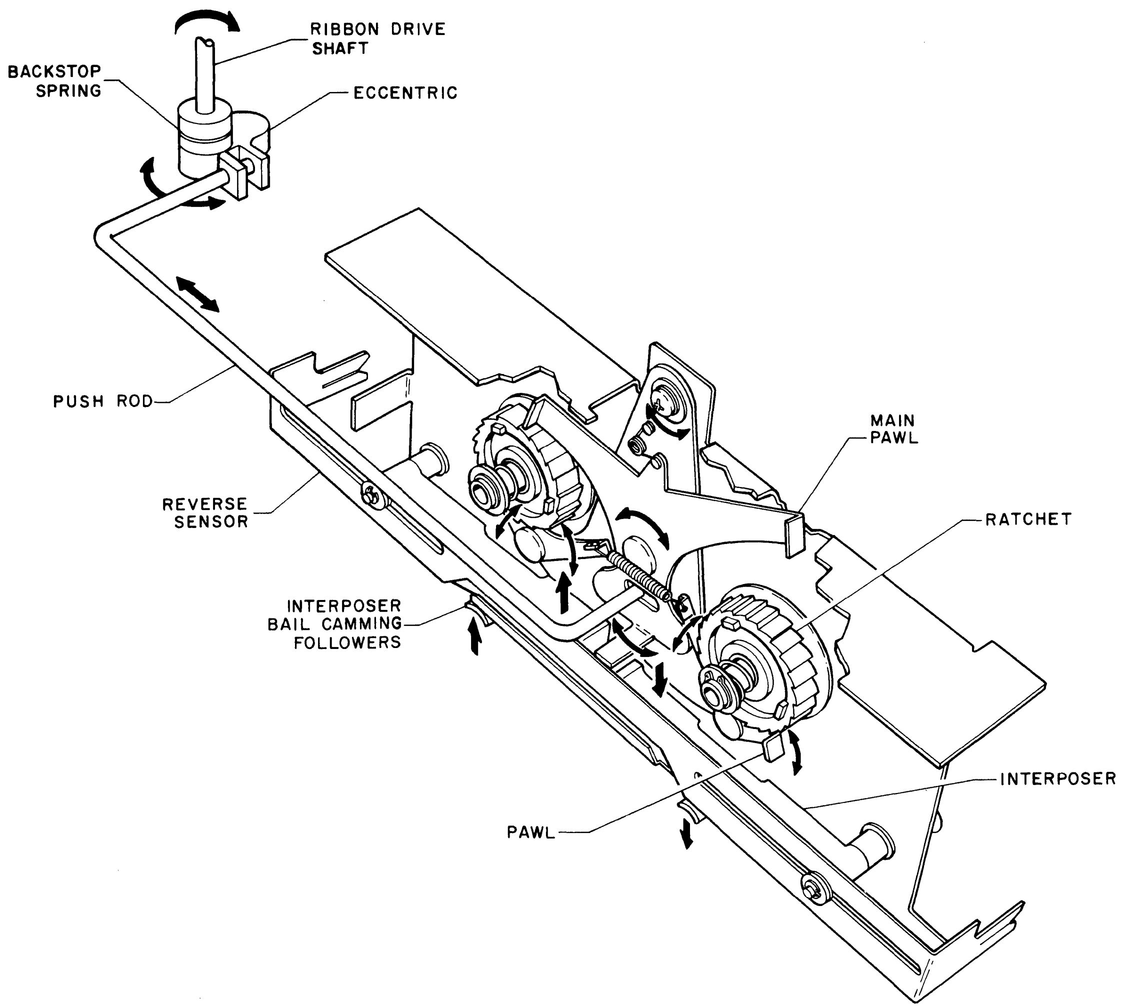


Figure 4-38 Ribbon Feed Subsystem

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.

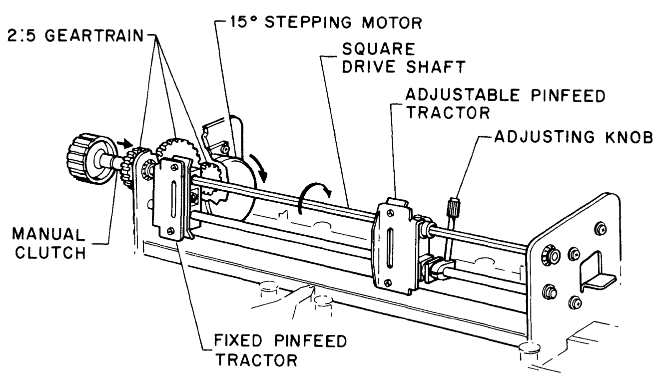


Figure 4-39 Paper Feed Subsystem

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 multipart forms and reduces hole distortion during paper feeding.

CHAPTER 5
UPGRADED LA36

5.1 GENERAL
The purpose of this chapter is to reflect the equipment changes incurred since the original publication. Changes of significant importance include:

1. M7723 Logic Board
2. M7728 Logic Board
3. Power Board Changes
4. Constant Voltage Transformer
5. New Bezel
6. Caps Lock Keyboard
7. Addition of Options.

5.2 LA35/LA36 MODEL VARIATIONS
The variations and associated model numbers for the LA35/LA36 are listed below.

Model No.	Designation	Variation
	LA35	
LA35-CE	LA35	90–132 V, 60 Hz
LA35-CF	LA35	180–264 V, 60 Hz
LA35-CH	LA35	90–132 V, 50 Hz
LA35-CJ	LA35	180–264 V, 50 Hz
LA35-DE	LA35	90–132 V, 60 Hz
LA35-DJ	LA35	180–264 V, 50 Hz
	LA36	
LA36-CE	LA36 with Numeric Pad and Paper Out	90–132 V, 60 Hz
LA36-CF	LA36 with Numeric Pad and Paper Out	180–264 V, 60 Hz
LA36-CH	LA36 with Numeric Pad and Paper Out	90–132 V, 50 Hz
LA36-CJ	LA36 with Numeric Pad and Paper Out	180–264 V, 50 Hz
LA36-DE	LA36	90–132 V, 60 Hz
LA36-DF	LA36	180–264 V, 60 Hz
LA36-DH	LA36	90–132 V, 50 Hz
LA36-DJ	LA36	180–264 V, 50 Hz

5.3 EASY IDENTIFICATION OF LOGIC BOARDS
There are three possible logic board models that can be installed in a DECwriter: M7722, M7723, and M7728. The M7722 board is typically factory installed in earlier LA36s while the M7723 and M7728 boards are found in newer terminals. The M7728 performs all functions of the M7722 and M7723 and is backward compatible for a direct replacement for either board. Replacing either board with an M7728 does not enhance the capabilities of the terminal in which the M7728 board is installed.

Figure 5-1 shows the obvious physical differences between the three logic boards that permit easy identification. The M7722 and M7723 boards each have four connectors while the M7728 has five connectors. The M7723 and M7728 boards have solder-dot test points around the perimeter and the M7722 does not have these test points.

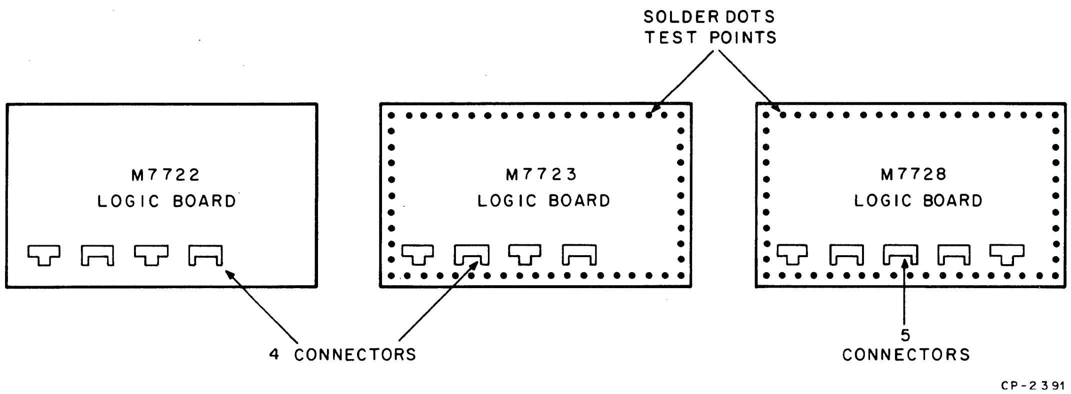


Figure 5-1 Physical Characteristics of M7722, M7723, and M7728 Logic Boards

5.3.1 Major Functional Differences Between M7722 and M7723 Logic Boards

There are three major functional differences between the M7722 and the M7723 logic boards.

1. Local Copy Feature

   M7722 – No local capability when terminal is operating on-line (sometimes called half-duplex mode).

   M7723 – Has local copy feature. Three-position front panel rocker switch permits printing when in local or on-line in half- or full-duplex mode.

2. Parity Selection

   M7722 – No received parity capabilities. Only even or no parity selection on transmission. No eighth bit spacing capability.

   M7723 – Choice of even or odd parity for both receiving or transmitting.

3. Paper Out Option
   M7722 – No provision for accepting the PAPER OUT switch.

   M7723 – Compatible with PAPER OUT switch.

5.3.2 M7722, M7723, and M7728 Jumper Configurations

The M7722, M7723, and M7728 jumper configurations are described in Chapter 3.

5.3.3 Functional Differences Between M7723 and M7728 Logic Boards

In addition to having all the features of the M7723 board, the M7728 can also provide the data and signal interface required when options are installed in an upgradable LA35/LA36. The M7728 has the same possible transmit and receive parity configuration as the M7723. In addition, the received parity error print indication (three vertical bars) can be suppressed in certain instances when the eighth level bit is used as a control code for the options.

5.3.4 M7728 Cabling Configurations/Option Combinations

The possible cabling configurations for the M7728 logic board are shown in Figure 5-2.

CAUTION

The ribbon cables between the logic board and the expander board must be installed so that one cable end (either end) has the ribbed side of the cable facing up and the other end has the smooth side up. Ensure that A connects to A at each cable end. Failure to observe this polarity may cause a logic board failure.

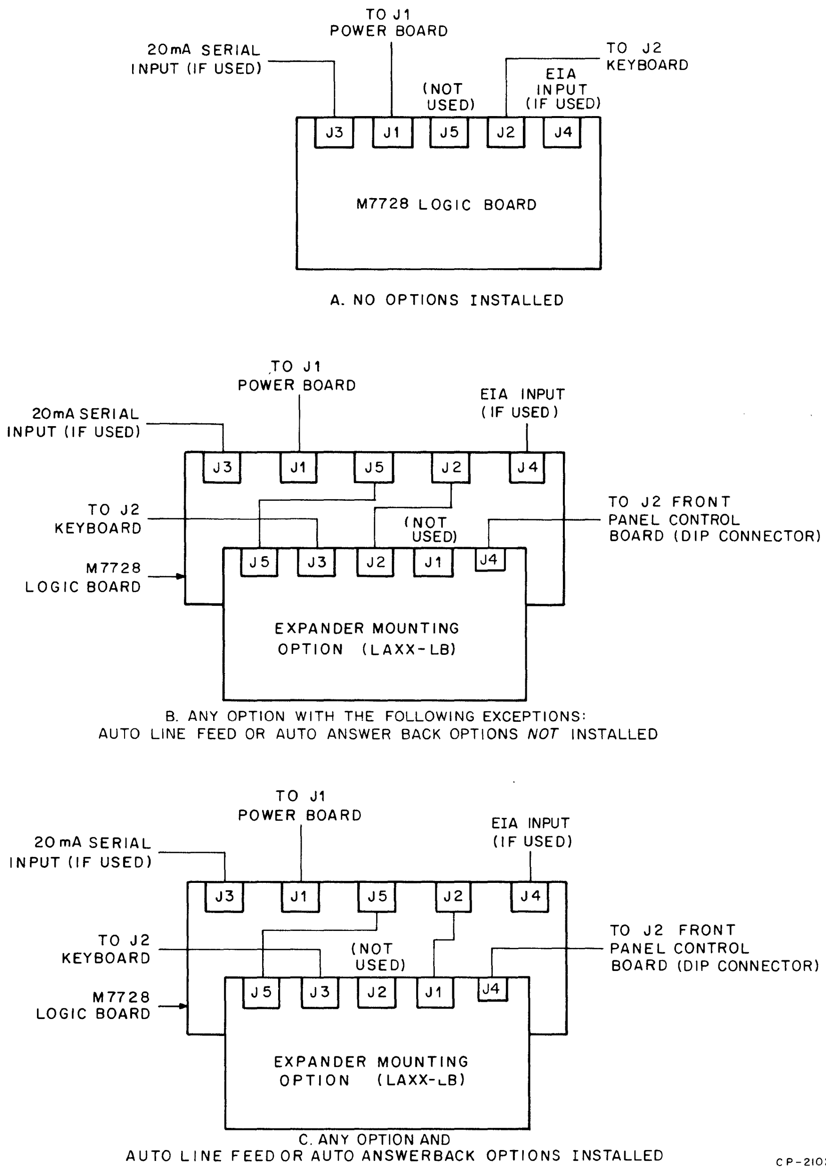


Figure 5-2 Cabling Configurations for the M7728 Logic Board

5.4 MAJOR POWER SUPPLY CHANGES

There are four major changes to the power supply.

1. The rating of the ac line fuse was increased from 2 A SB to 3 A SB for 115 V and from 1 A SB to 1.5 A SB for 230 V.
2. The two 1 A SB fuses in the line feed motor drive circuit were replaced with four 3/4 A SB fuses.
3. The 18,000 μF capacitor in the capacitor bank was replaced with a 37000 μF capacitor.
4. A constant voltage transformer (CVT) replaced the original transformer.

5.4.1 New Power Transformers

Upgradable LA35/LA36s have constant voltage power transformers installed to accommodate the increased power requirements of the options. There is a unique transformer model for 50 Hz operation and another model for 60 Hz operation. Both models function on either 115 or 220 Vac primary voltage and provide $\pm$24 and +11 Vdc at the secondary voltage.

5.5 NEW KEYBOARD BEZELS

The keyboard bezel associated with the upgradable LA36 is shown in Figure 5-3. There is no change in the bezel for upgradable LA35s. The LA36 also has another bezel configuration that accepts the 14-key Numeric Keypad Option which mounts to the right of the standard keyboard.

7622-28

Figure 5-3 LA36 Keyboard Bezel

5.6 CAPS LOCK KEYBOARD

The caps lock keyboard has a CAPS LOCK key substituted for the SHIFT LOCK key normally found on office equipment. When the CAPS LOCK is depressed, the 26-letter keys transmit only uppercase codes; all other keys print in lowercase.

5.7 LA35/LA36 OPTIONS

All options listed in Tables 1-8 and 1-9 can be installed in a LA35/LA36 DECwriter except for the 14-Key Numeric Keypad and the Paper Out Options.

5.8 DECwriter II - M7728 FUNCTIONAL DESCRIPTION

The following LA35/LA36 printers are designated as option-upgradable DECwriters.

LA36 Manufactured in U.S.A. - Serial numbers 02-21933 and higher
LA36 Manufactured in Ireland - Serial numbers 04-10450 and higher
LA35 Manufactured in U.S.A. - Serial numbers 5001 and higher

These printers have the increased power supply capability and the M7728 logic board required to accommodate the various available options.

The basic block diagram for the M7728 logic Bbard is shown in Figure 5-4. The major difference between this diagram and thè diagrams for the M7723 boards is in the data conversion block. All other functional areas operate in the same manner as in the other boards. The three items added to the data conversion are:

1. Expander Board
2. Options
3. Tri-State Buffer.

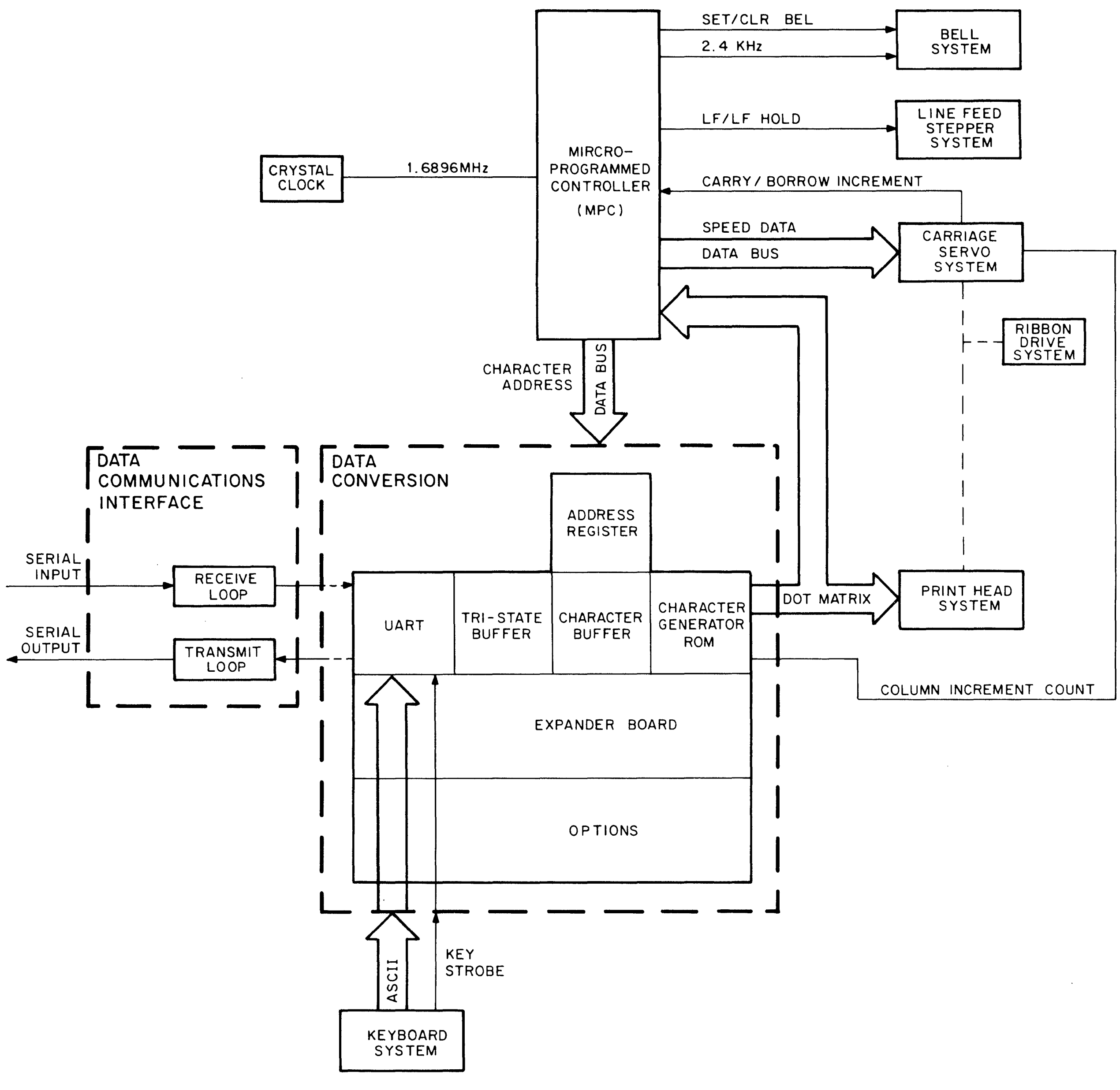


Figure 5-4 Basic Block Diagram of M7728 Logic Board

The data conversion block still performs its basic function of taking serial-in (SI) ASCII data and converting it to a 7 × 7 dot pattern that drives the print head. Transmitted keyboard data is converted to serial-out (SO) ASCII data by the data conversion block. These functions do not change in an upgradable printer; only now, certain options exercise control over both the receive and transmit data lines by blocking, inserting, or allowing data to pass.

The control logic for the M7728 board is shown in Figure 5-5. As stated previously, there is no difference in the operation, configuration, or programming of the Microprogrammed Controller (MPC). New identification numbers are assigned to the components and their physical location on the circuit board are changed, but the basic function of each remains the same. The new numbers and schematic sheet locations are noted on Figure 5-5.

The major area of change affects the receive and transmit data paths.

5.8.1 New Transmit Path

Keyboard data now passes through the expander board before it is applied to the transmit section of the UART. As this data is routed across the expander board, two switching methods are employed to ensure that installed options can break this data path and insert characters into the transmit data. This keyboard steering is shown in Figure 5-6. Hardware steering is accomplished by physically moving the cable to the UART between connectors J1 and J2 on the expander board. When inserted in J2, keyboard data and the keystroke is routed right across the expander board without any interruptions. When the Automatic Answerback Option or the Automatic Line Feed Option is installed, the cable is moved to J1 and the data path is now through these options. There is a logic switch in these options that allows the options to break the keyboard data path and insert either an answerback message or a line feed command. After inserting the option-generated characters and keystrokes, the logic switch allows keyboard data to pass out to the UART again.

5.8.2 New Receive Path

On the M7728 board, received data and parity error are routed through the UART to the tri-state buffer rather than right to the character buffer as on the M7722 and M7723 boards. This tri-state buffer permits the options to sample the UART output data before the character buffer receives it. The options monitor the incoming data on the bidirectional line and can insert data on this line to be applied to the character buffer. The output of the character buffer can be sampled by an Optional Character Set Option which can substitute a new dot matrix pattern for the pattern normally generated for this character by the character generator ROM.

5.8.3 Transmit Operation with Options Installed

Options that insert data into the keyboard data path between the keyboard and the transmit section of the UART require a timing control signal to ensure that the UART is ready to accept more data. This control signal is the XMIT RDY L signal which is a high level when the UART is not ready to accept another character and is low when another character can be processed. This signal is used to stroke both the option-generated character and keystroke out of the option. The XMIT RDY L signal associated with the last character generated by the option causes the logic switch to revert back to the normal position and allow keyboard data to pass again.

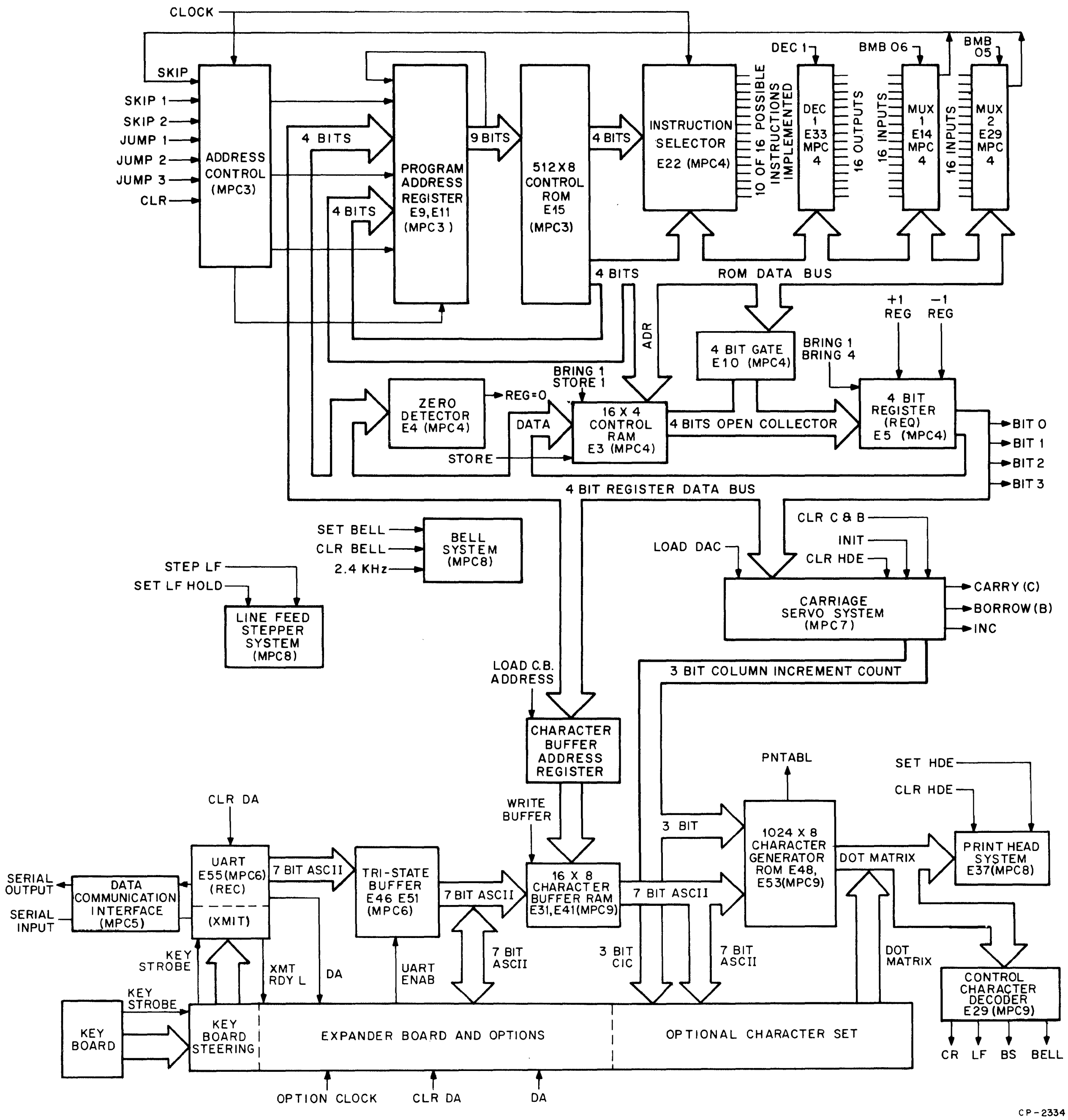


Figure 5-5 M7728 Control Logic Diagram

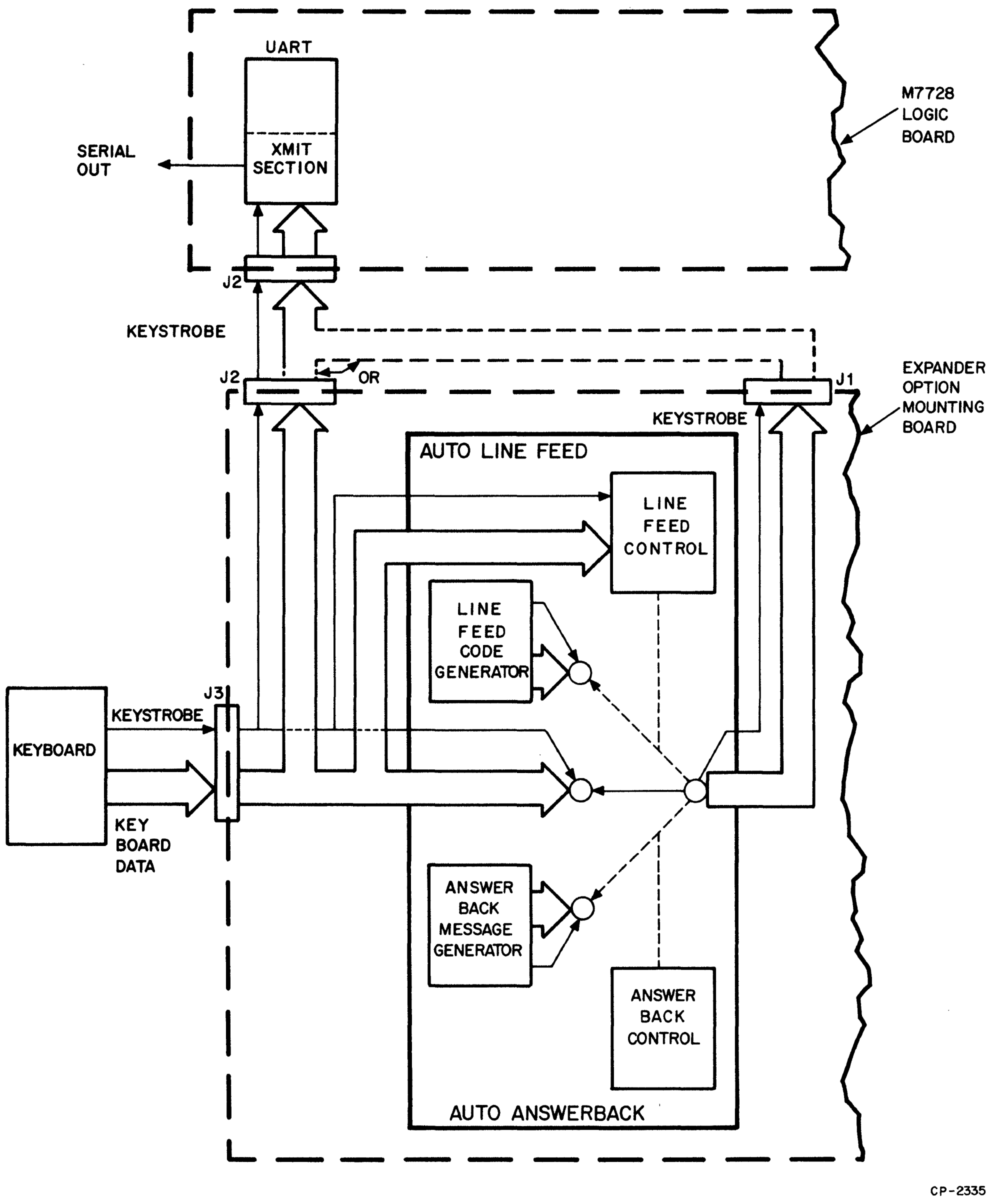


Figure 5-6 Steering of Keyboard Data

5.8.4 Receive Operation with Options Installed
Figure 5-7 shows the signals and components that affect the receive operation. After the UART converts incoming serial data into even parallel bits, it places these bits on the data lines to the tri-state buffer. Normally, as the UART is ready to output data, the data available (DA) line goes to a low level. The microprocessor uses this low level to load the seven bits into the character buffer. In the M7728 board, this DA signal is applied serially through all receive options before it is sent to the microprocessor.

At each option the DA signal initiates an option-decoding function on the character present on the bidirectional lines from the tri-state buffer. If the character is a command or code that is not recognized by the first option, the DA signal is passed along to the next option to be used to decode the character at that option.

After being routed through all options to the microprocessor, the character is loaded into the character buffer through the tri-state buffer. The remaining processes to the print head are the same as in the M7722 and M7723 boards.

If the character present at the output of the UART is decoded by an option, this option blocks the data through the tri-state buffer (using the UART ENAB signal). The option then places a character on the bidirectional lines to the character buffer and issues the DA signal to the microprocessor. As before, the microprocessor commands the character buffer to load, but now the character loaded is taken from the option, not from the UART through the tri-state buffer.

After processing a character, the microprocessor issues the clear data available (CLR DA) signal which causes the UART to place the next incoming character on the lines to the tri-state buffer. If an option is going to insert more than one character (as when performing a top-of-form operation), the option holds the tri-state buffer disabled, places another character on the bidirectional line, and issues another option-generated DA signal. This action continues until the option has finished inserting characters. The CLR DA signal associated with the last character inserted enables the tri-state buffer and received data now passes through in a normal manner.

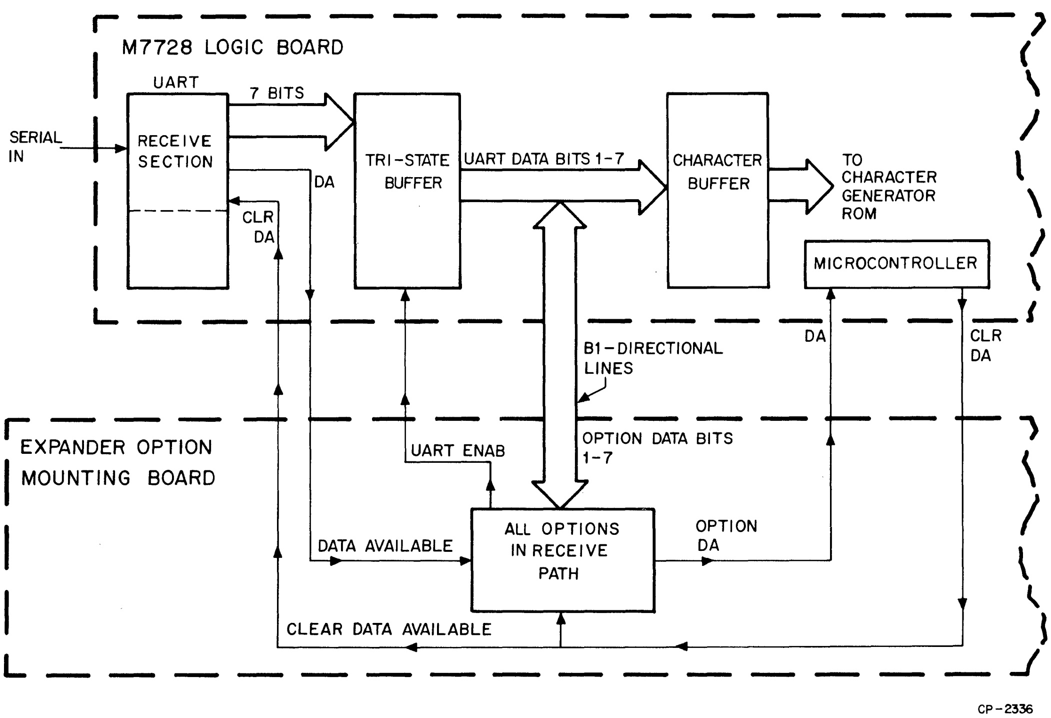


Figure 5-7 Receive Operations of M7728 Logic Board

CHAPTER 6
ELECTRICAL SERVICING

6.1 ELECTRICAL TESTS

The test equipment required for the electrical tests is listed in Table 6-1. 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 microprogrammed controller (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 Chapters 4 and 5. All measurements are dc-coupled and referenced to ground unless otherwise stated. VOLTS/DIV setting applies to both Channel 1 and Channel 2 unless otherwise stated.

Table 6-1 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 Part No. 29-19556 16-pin DEC Part 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 minimum
Resistor	–	1000 Ω, 1/4 W minimum

6.1.1 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/LOC switch set to LOC and the BAUD RATE switch set to 110.

NOTE

This note applies to printers with cover interlocks. The cover interlock must be overridden to perform the following tests. One method of overriding the interlock is to temporarily tape the interlock switch down.

Remove the printer housing from the LA36 as directed in Paragraph 7.2; lower the rear access door before performing any off-line tests.

6.1.1.1 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 (Figures 6-1 and 6-2) 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, line voltages, and value of current limiting test resistor. The values listed in Figures 6-3 through 6-12 are nominal and can be used as a guide.

1. Set the POWER switch to OFF.

2. While moving the print head toward the dc motor, slip the drive belt from the pulley on the motor shaft.

3. At the servo fuse (F2), pull off the lead going to the power board (Figure 6-1).

CAUTION

1. Power board damage may result if the test voltage is connected improperly in step 4.

2. Lead must not touch frame.

3. Remove fuse F1 from power board.

4. Apply +21 V to the servo motor by connecting the jumpers and the resistor between R104 (bottom lead) and the servo fuse F2 (Figure 6-1).

5. Set the POWER 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 6-3 through 6-9.

7. Set the POWER switch to OFF and connect –21 V (R105 bottom lead) to the motor as shown in Figure 6-2.

8. Repeat step 5. The motor should rotate in the negative direction (counterclockwise).

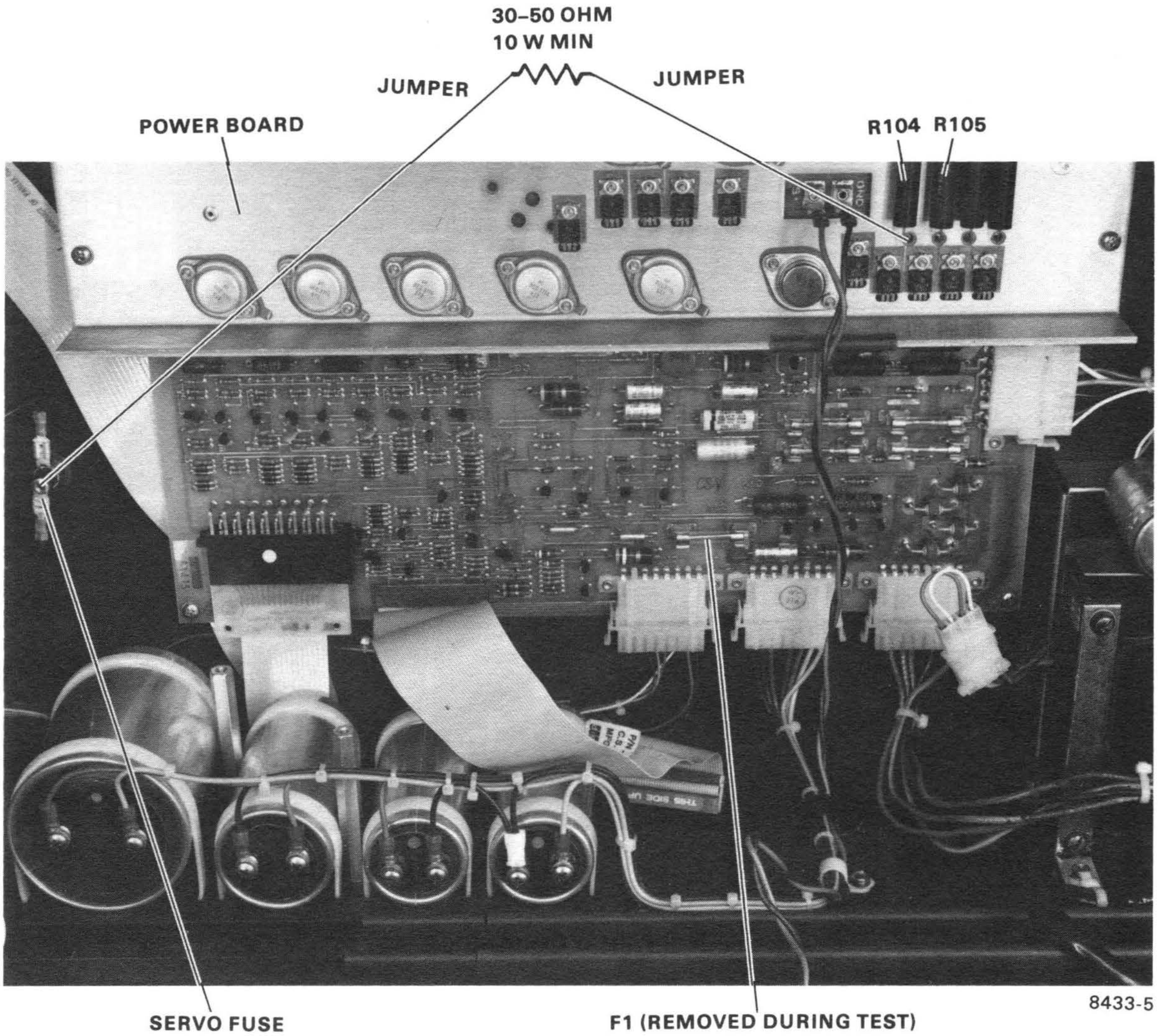
9. Check the waveforms at the test points shown in Figures 6-10 through 6-14.

NOTE

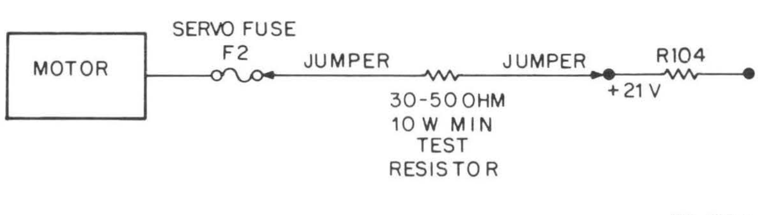
When reinstalling drive belt, ensure that left side plate spring is in place.

10. Turn POWER switch to OFF. Disconnect the test setup and reinstall the drive belt and the lead to the servo fuse (F2).

11. Reinstall fuse F1 on the power board, and set the POWER switch to ON.

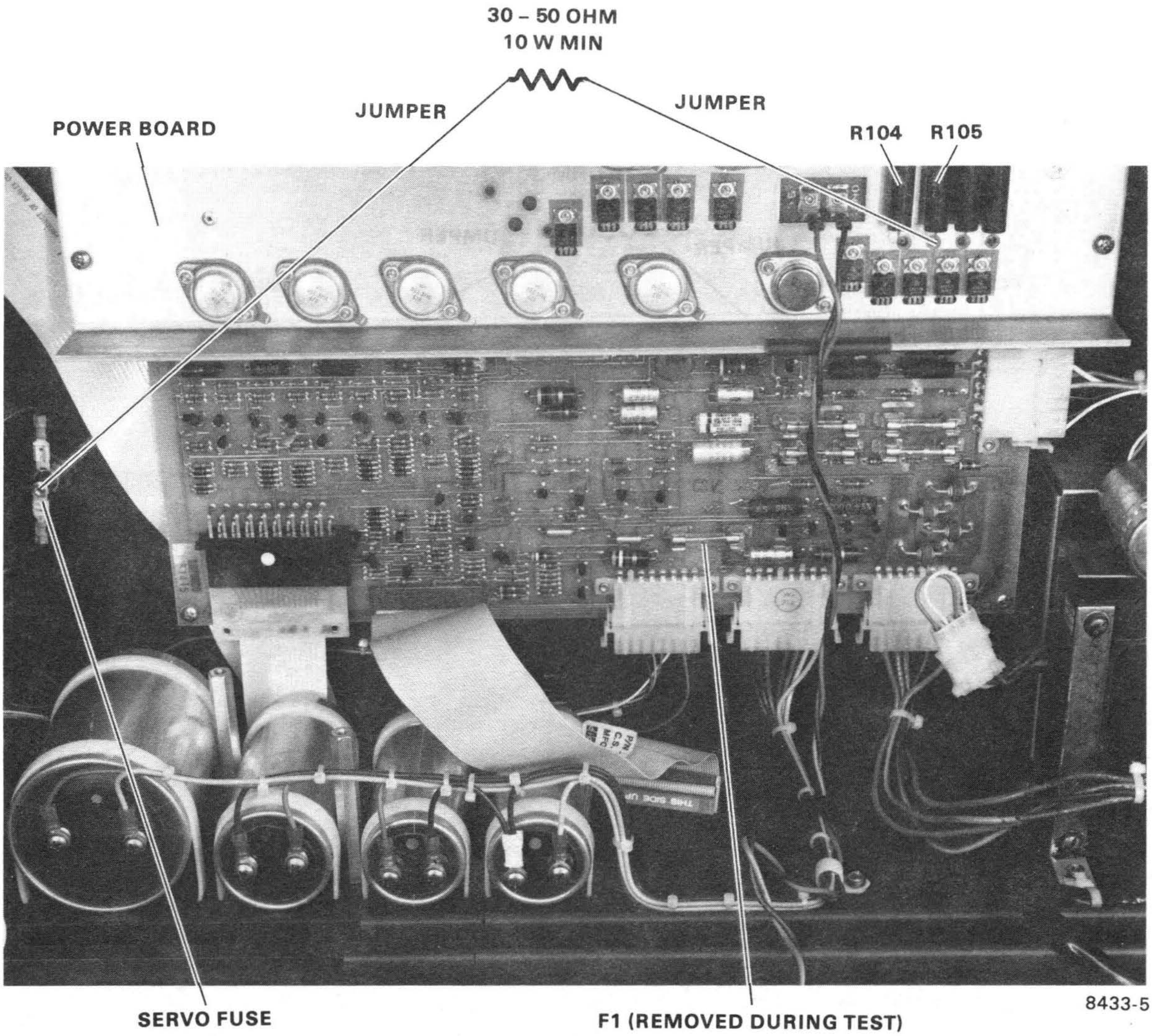


a. Physical Connection

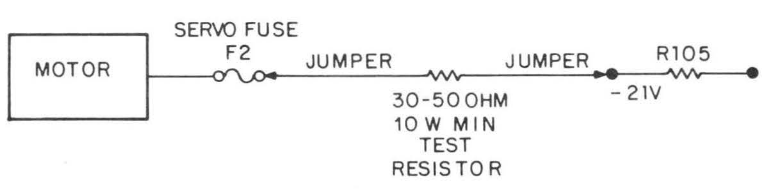


b. Electrical Connection

Figure 6-1 Encoder +21 V Test Setup



a. Physical Connection

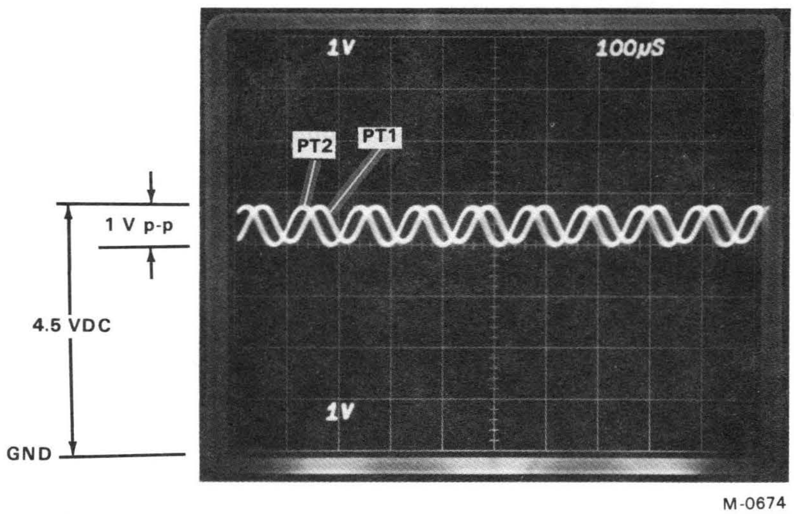


b. Electrical Connection

Figure 6-2 Encoder –21 V Test Setup

START OF ENCODER SIGNAL PROCESSING TEST WAVEFORMS

Start of Positive-Direction Encoder Tests



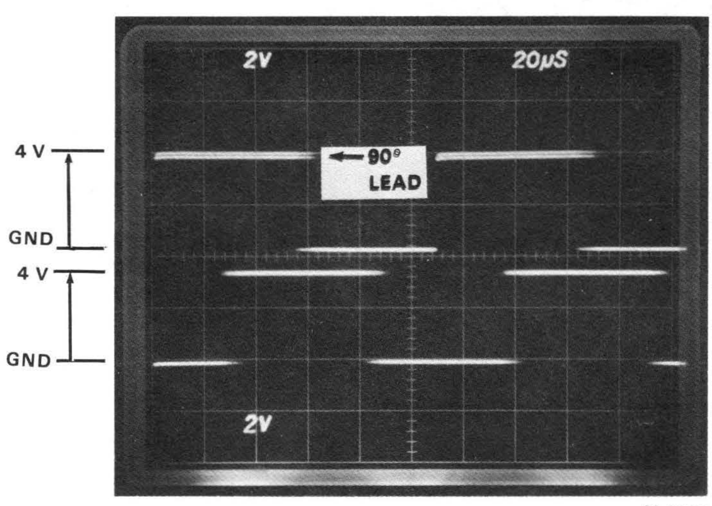
SCOPE SETUP

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

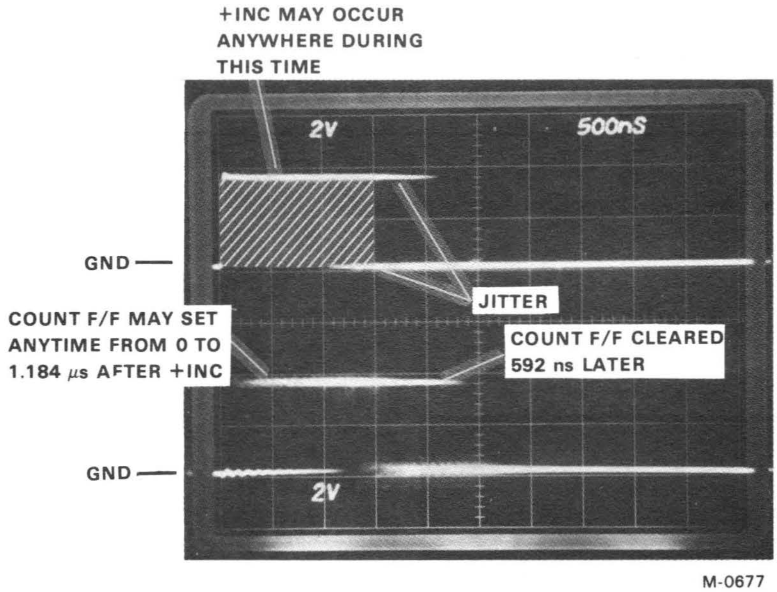
Figure 6-3 +PT1 and +PT2 Waveforms



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 +PT1 at:	M7722 E6-8 M7723 E2-8 M7728 E18-8
CH2 to +PT2 at:	M7722 E6-6 M7723 E2-6 M7728 E18-6

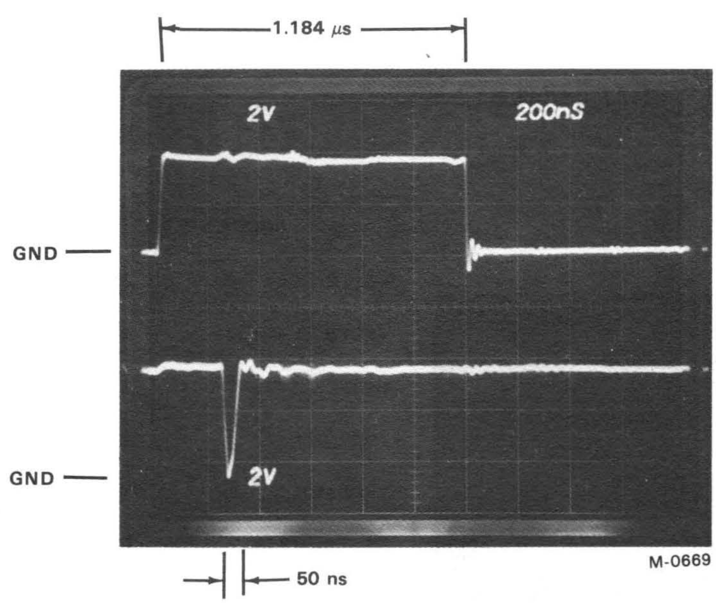
Figure 6-4 +PT1 and +PT2 Schmitt Waveforms



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 E8-9 M7723 E7-9 M7728 E50-9
CH2 to COUNT at:	M7722 E4-9 M7723 E13-9 M7728 E45-9

Figure 6-5 +INC and COUNT Flip-Flop Waveforms

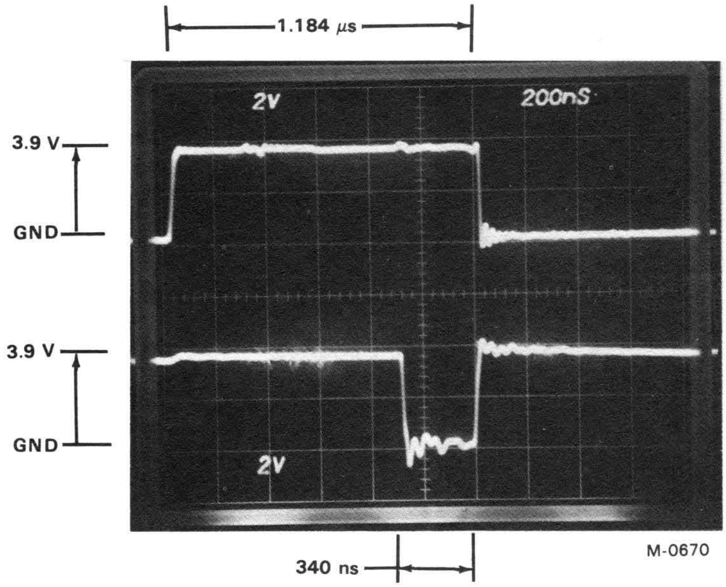


SCOPE SETUP

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 M7723 E13-9 M7728 E45-9
CH2 to COUNT pulse at:	M7722 E29-8 M7723 E18-8 M7728 E49-3

NOTE:
50 ns pulse (CH2) may vary in response to COUNT pulse (CH1).

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

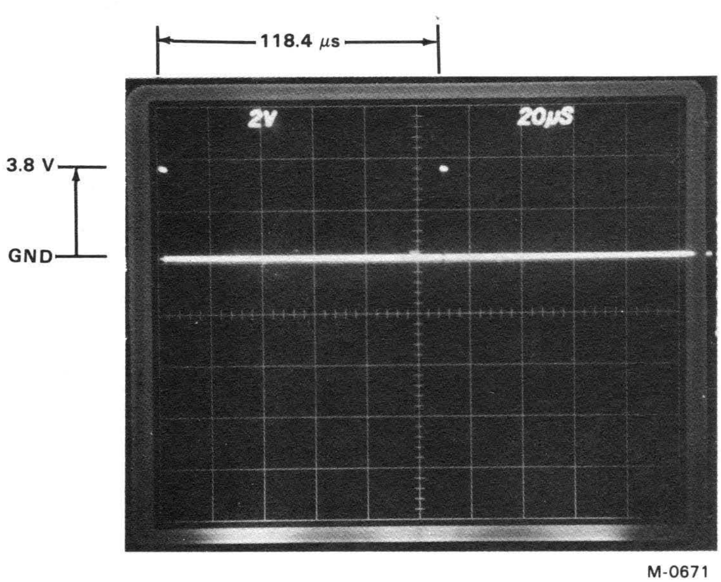


SCOPE SETUP

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 M7723 E13-9 M7728 E45-9
CH2 to CLR +/−F/F at:	M7722 E9-6 M7723 E3-6 M7728 E49-6

NOTE:
118.4 μs varies with the speed of the encoder motor.

Figure 6-7 COUNT Flip-Flop and CLR ± Flip-Flop Waveforms

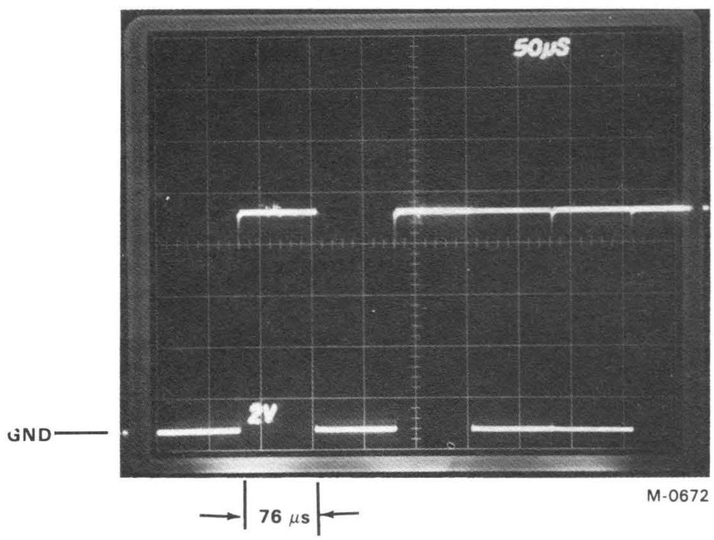


SCOPE SETUP

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 M7723 E7-9 M7728 E50-9

NOTE:
118.4 μs varies with the speed of the encoder motor.

Figure 6-8 +INC Waveform



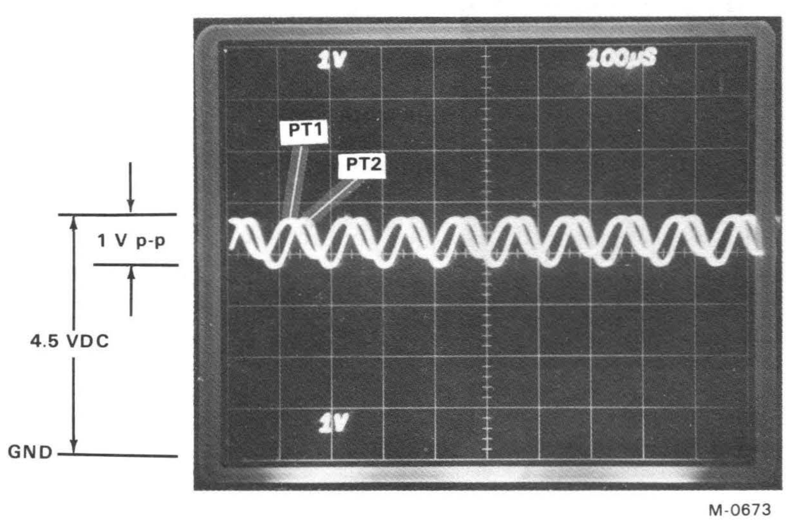
SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	50 µs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, INT, NEG
CH1 to +TACH at:	M7722 Q11-C M7723 Q11-C M7728 Q11-C

Figure 6-9 +TACH Waveform

End of Positive-Direction Encoder Tests

Start of Negative-Direction Encoder Tests



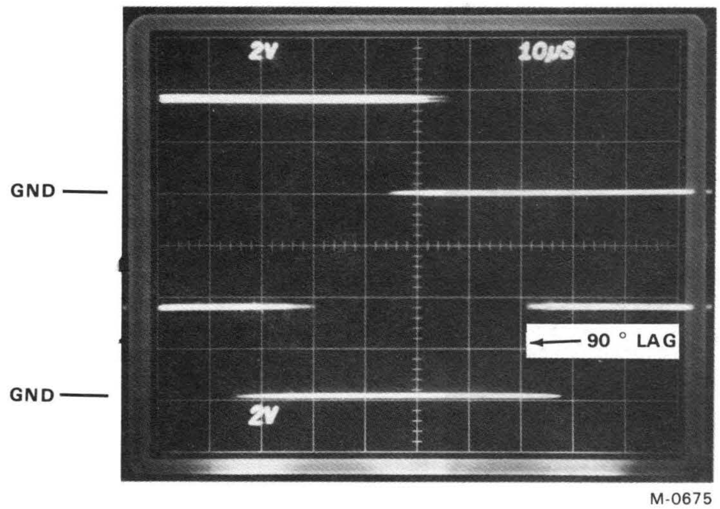
SCOPE SETUP

VOLTS/DIV:	1 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	VARIABLE–APPROX. 100 µs
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

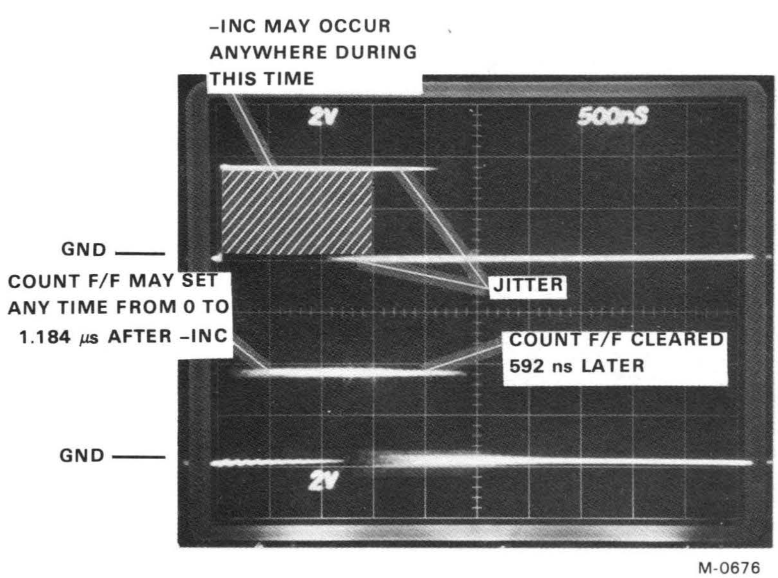
Figure 6-10 –PT1 and –PT2 Waveforms



SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	10 μs
TRIG SOURCE:	CH1, AC, POS, INT
CH1 to –PT1 at:	M7722 E6-8 M7723 E2-8 M7728 E18-8
CH2 to –PT2 at:	M7722 E6-6 M7723 E2-6 M7728 E18-6

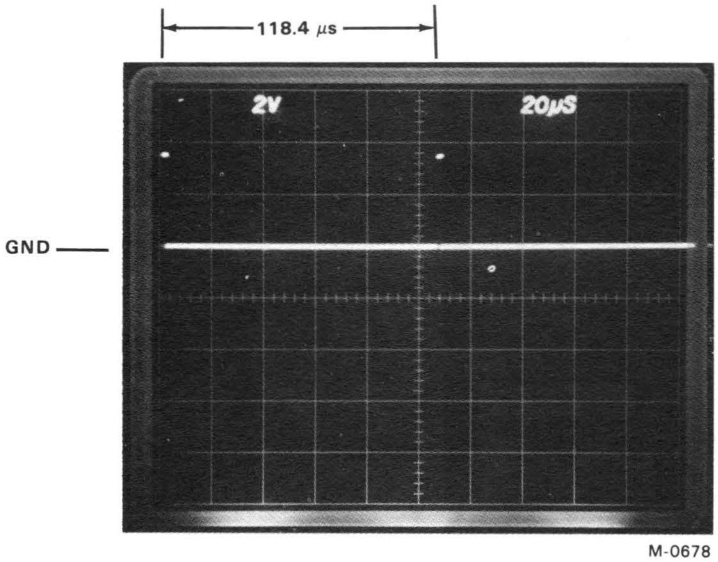
Figure 6-11 –PT1 and –PT2 Schmitt Waveforms



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 M7723 E7-5 M7328 E50-5
CH2 to COUNT at:	M7722 E4-9 M7723 E13-9 M7728 E45-9

Figure 6-12 –INC and COUNT Flip-Flop Waveforms

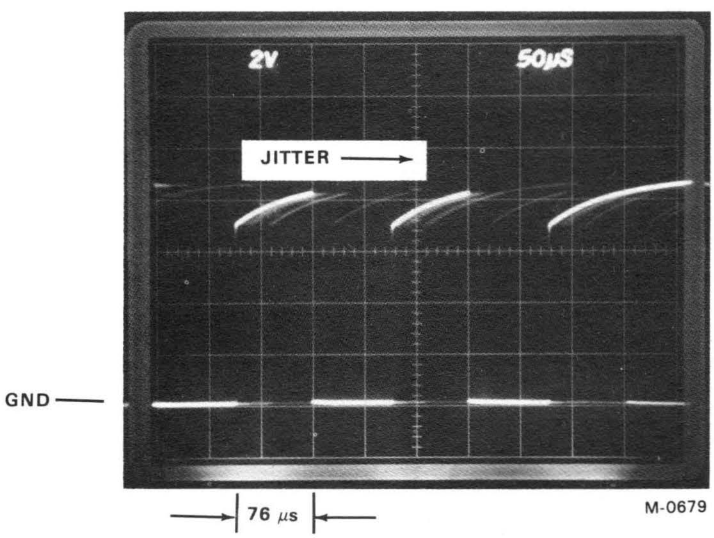


SCOPE SETUP

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 E8-5 M7723 E7-5 M7728 E50-5

NOTE:
118.4 µs varies with the speed of the encoder motor.

Figure 6-13 –INC Waveform



SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	50 µs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, DC, INT, NEG
CH1 to –TACH at:	M7722 Q12-C M7723 Q12-C M7728 Q12-C

Figure 6-14 –TACH Waveform

End of Negative-Direction Encoder Tests

END OF ENCODER SIGNAL PROCESSING TEST WAVEFORMS

6.1.1.2 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 15.24 cm/second (6 inches/second). 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 15.24 cm/second (6 inches/second).

1. Set the POWER switch to OFF, and set the LINE/LOC switch to LOC.

2. While moving the print head toward the dc motor, slip the drive belt from the pulley on the motor shaft.

3. Set the POWER switch to ON.

4. Check the waveforms at the test points indicated in Figures 6-15 through 6-22.

5. Jumper the base of Q3 to ground. This causes the servo motor to reverse direction and run at 15.24 cm/second (6 inches/second).

6. Check the waveforms at the test points as indicated in Figures 6-23 through 6-28.

NOTE
Voltages and time periods in the carriage servo system vary for different machines and line voltages. The values listed in Figures 6-15 through 6-22 are nominal and can only be used as troubleshooting guides.

7. Set POWER switch to OFF. Reinstall the drive belt and remove the jumper from the base of Q3.

8. Set POWER switch to ON.

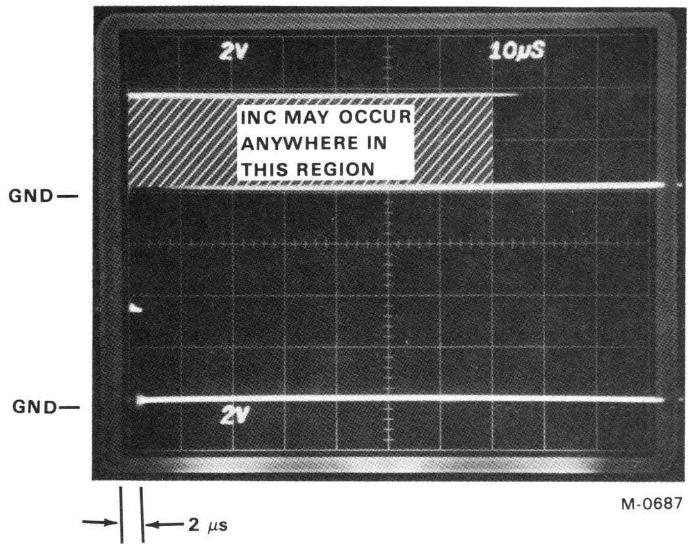
NOTE
Printers with PAPER OUT switches must be loaded with paper in order to run the following tests:

LF Stepping Test
Bell Test
Printable Character Test

To prevent wasting paper, do not feed the paper through the tractors during the line feed stepping test.

START OF SERVO SPEED TEST WAVEFORMS

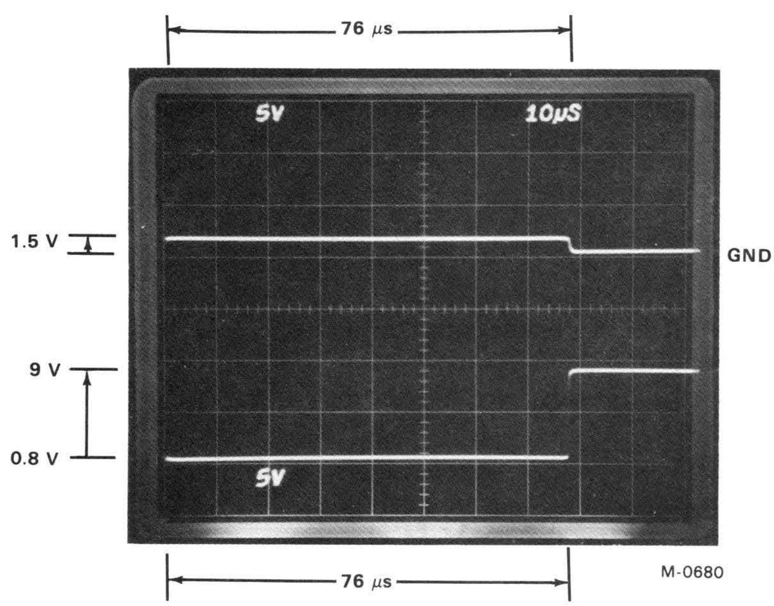
Start of Negative Speed Tests



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 INC at:	M7722 E5-9 M7723 E12-9 M7729 E54-9
CH2 to 76 µs CLOCK at:	M7722 E5-11 M7723 E12-11 M7728 E54-11

Figure 6-15 –INC and 76 µs CLOCK Waveforms



SCOPE SETUP

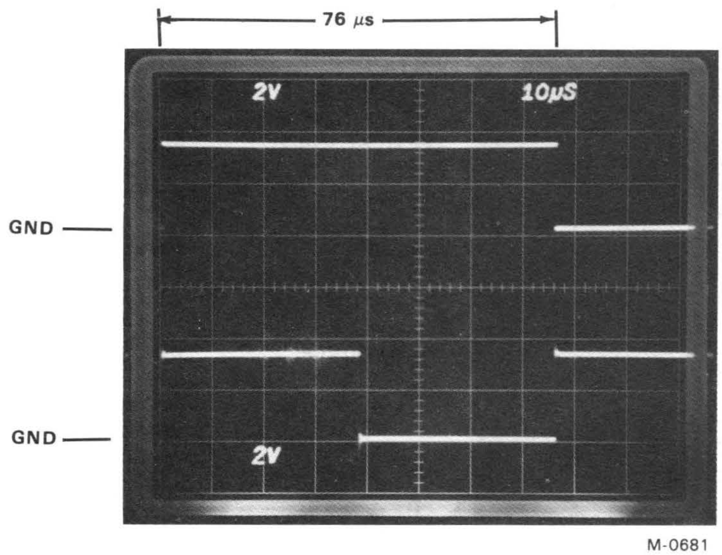
VOLTS/DIV:	5 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	10 µs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, POS, INT

CH1 to TACH at Q12-B on logic board

CH2 to TACH at Q12-C on logic board

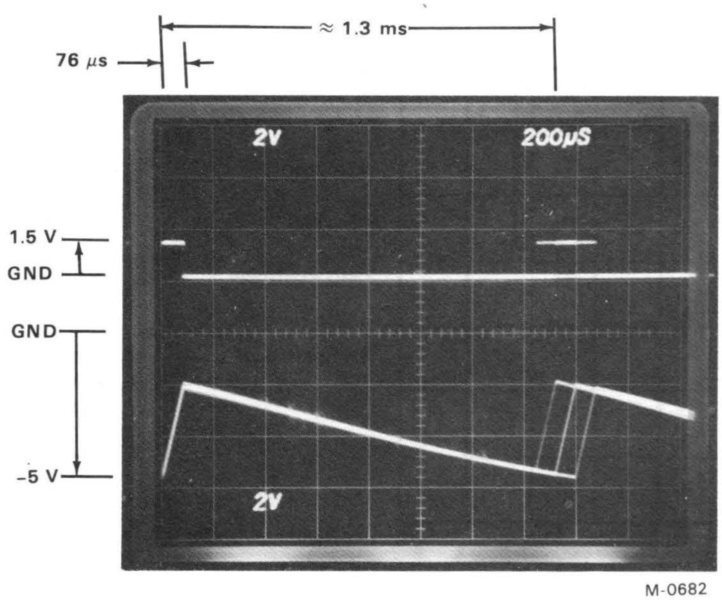
NOTE:
Turn power off when connecting scope leads.

Figure 6-16 –TACH Waveforms at Q12-B and Q12-C



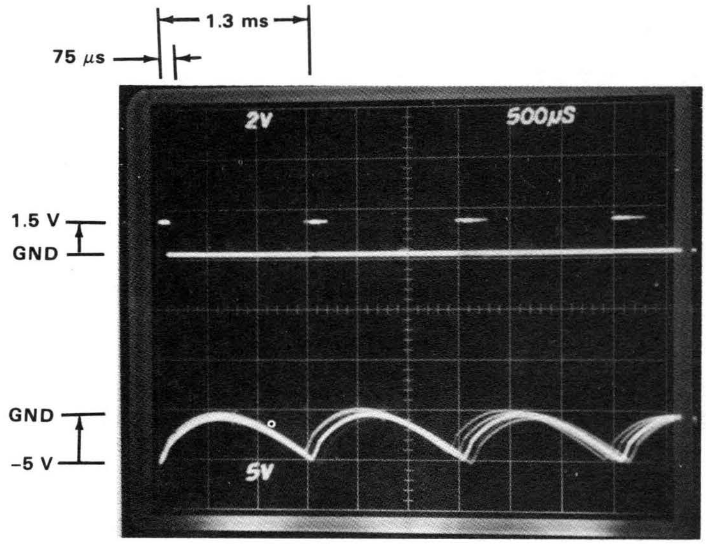
SCOPE SETUP	
VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	10 µs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, POS, INT
CH1 to -TACH at:	M7722 E5-5 M7723 E12-5 M7728 E54-5
CH2 to 76 µs at:	M7722 E5-3 M7723 E12-3 M7728 E54-3

Figure 6-17 -TACH and 76 µs Waveforms



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 Q12-B M7723 Q12-B M7728 Q12-B
CH2 to SUM at:	M7722 J1-B (1-6) M7723 J1-B (E1-6) M7728 J1-B (E27-6)

Figure 6-18 -TACH and SUM Waveforms at J1-B



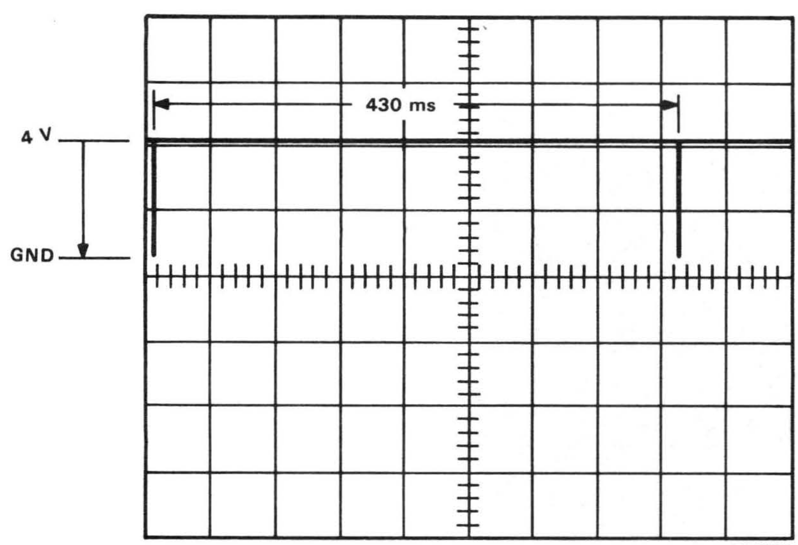
M-0683

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 M7723 Q12-B M7728 Q12-B

CH2 to MD at power board J4-8

Figure 6-19 –TACH and MD Waveforms



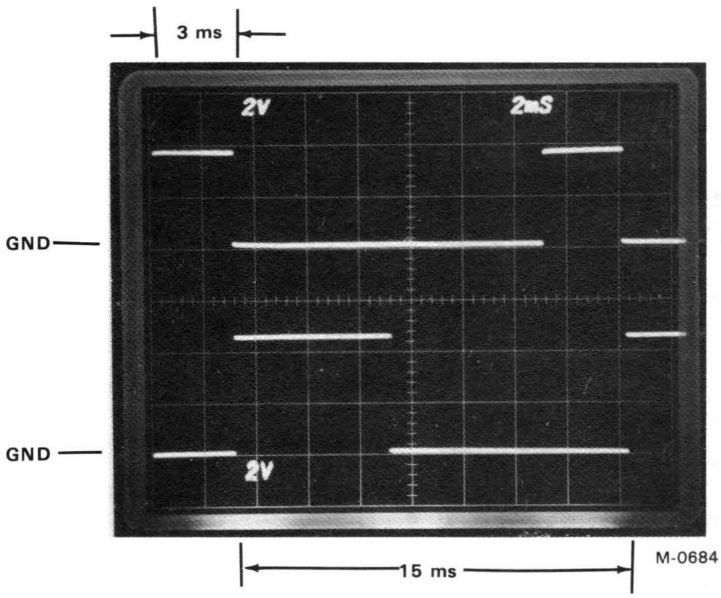
M-0725

SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	CH1
HORIZ DISPLAY:	A
TIME/DIV:	50 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, NEG, INT
CH1 to INC at:	M7722 E30-9 M7723 E22-9 M7728 E44-9

NOTE:
Waveform is flashing on and off scope.

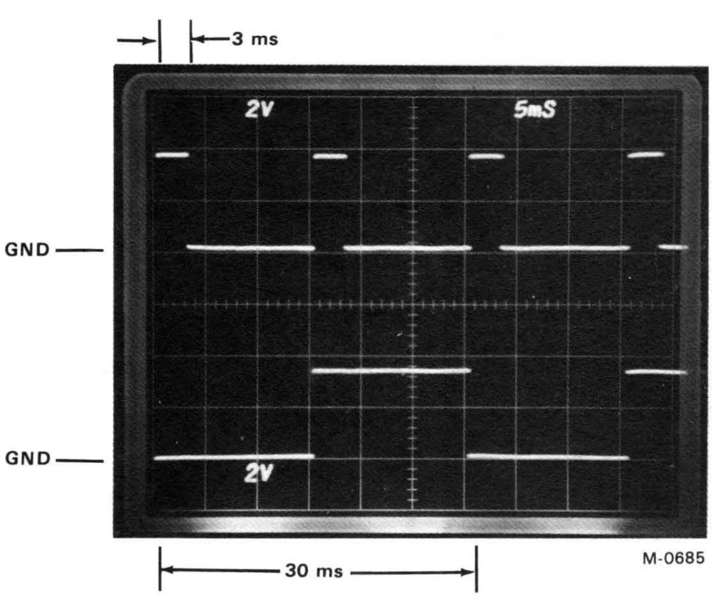
Figure 6-20 INC Waveform



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 M7723 E16-7 M7728 E43-7
CH2 to COL INC COUNT 2 at:	M7722 E16-6 M7723 E16-6 M7728 E43-6

Figure 6-21 COL INC COUNT 3 (MSB) and COL INC COUNT 2 Waveforms



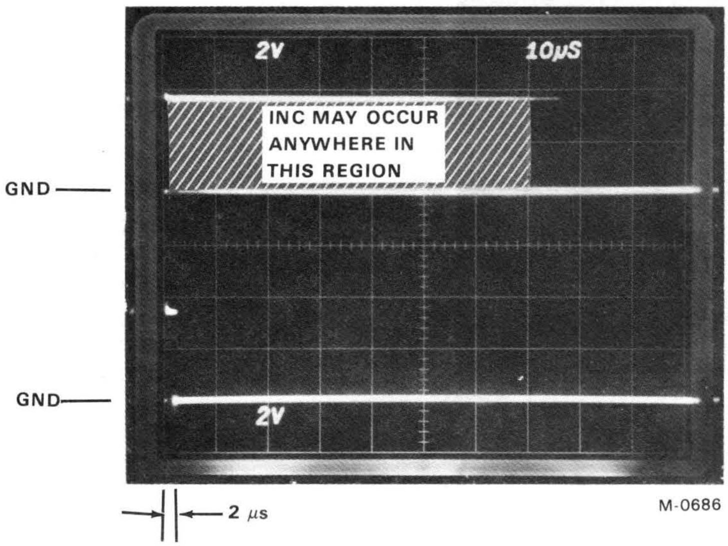
SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, INT, POS
CH1 to COL INC COUNT 3 (MSB) at:	M7722 E16-7 M7723 E16-7 M7728 E43-7
CH2 to BORROW H at:	M7722 E12-3 M7723 E10-6 M7728 E16-11

Figure 6-22 COL INC COUNT 3 (MSB) and BORROW H Waveforms

End of Negative Speed Tests

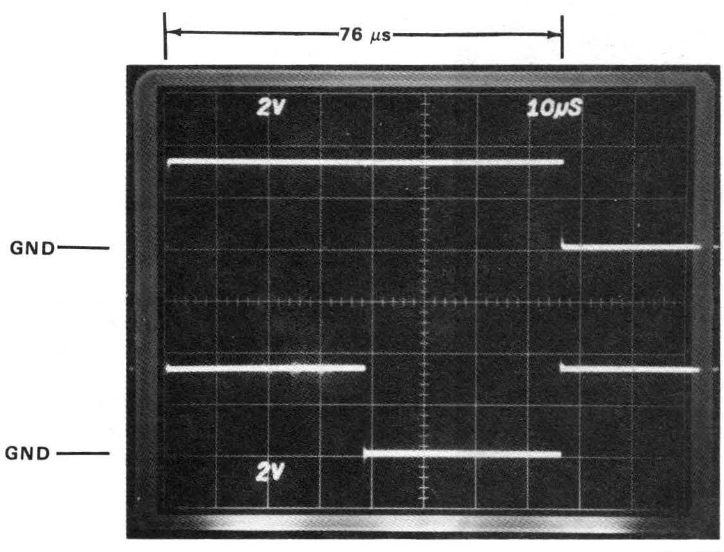
Start of Positive Speed Tests



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 +INC at:	M7722 E3-9 M7723 E17-9 M7728 E40-9
CH2 to −76 µs CLOCK at:	M7722 E3-11 M7723 E17-11 M7728 E40-11

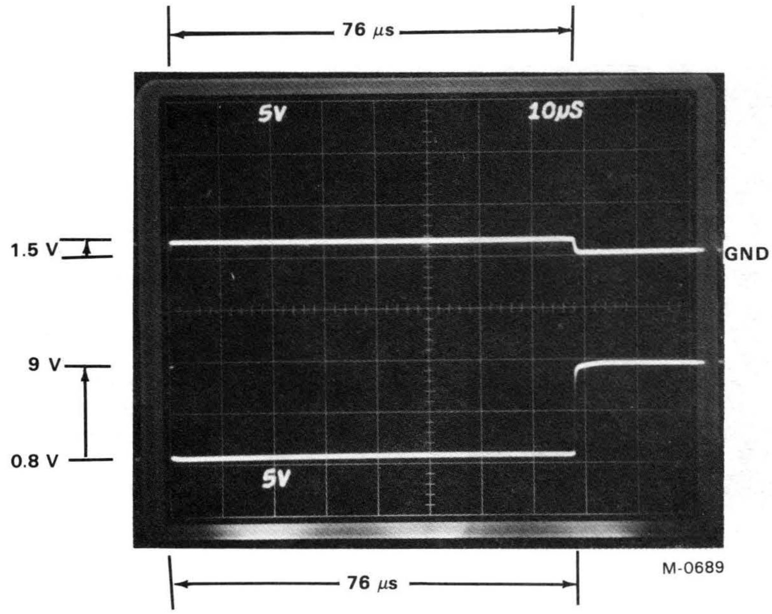
Figure 6-23 +INC and 76 µs Waveforms



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 +TACH at:	M7722 E3-5 M7723 E17-5 M7728 E40-5
CH2 to 76 µs at:	M7722 E3-3 M7723 E17-3 M7728 E40-3

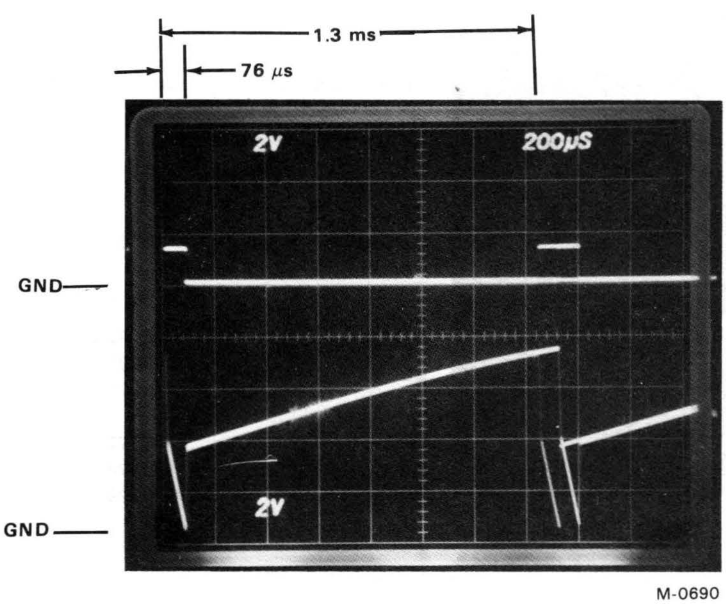
Figure 6-24 +TACH and 76 µs Waveforms



SCOPE SETUP

VOLTS/DIV:	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 M7723 Q11-B M7728 Q11-B
CH2 to +TACH at:	M7722 Q11-C M7723 Q11-C M7728 Q11-C

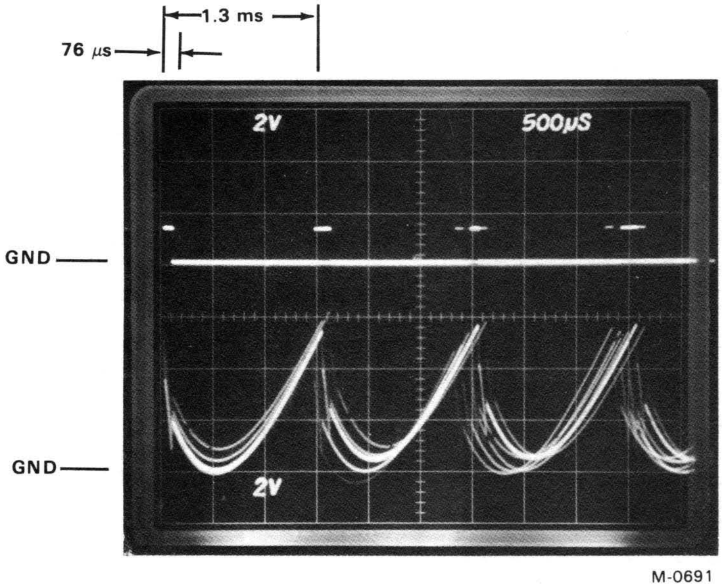
Figure 6-25 +TACH Waveforms at Q11-B and Q11-C



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 M7723 Q11-B M7728 Q11-B
CH2 to SUM at:	M7722 J1-B (E1-6) M7726 J1-B (E1-6) M7728 J1-B (E27-6)

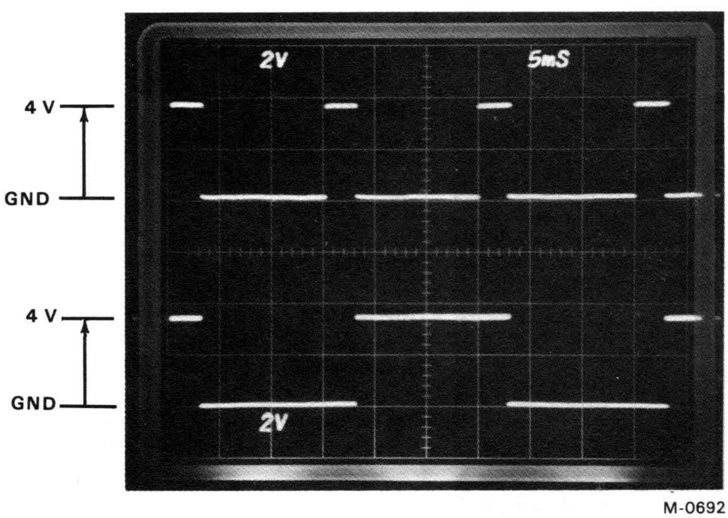
Figure 6-26 +TACH and SUM Waveforms



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 M7723 Q11-B M7228 Q11-B
CH2 to MD at power board J4-8	

Figure 6-27 +TACH and MD 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 M7723 E16-7 M7228 E43-7
CH2 to CARRY H at:	M7722 E7-6 M7723 E10-8 M7728 E16-8

Figure 6-28 COL INC COUNT 3 (MSB) and CARRY H Waveforms

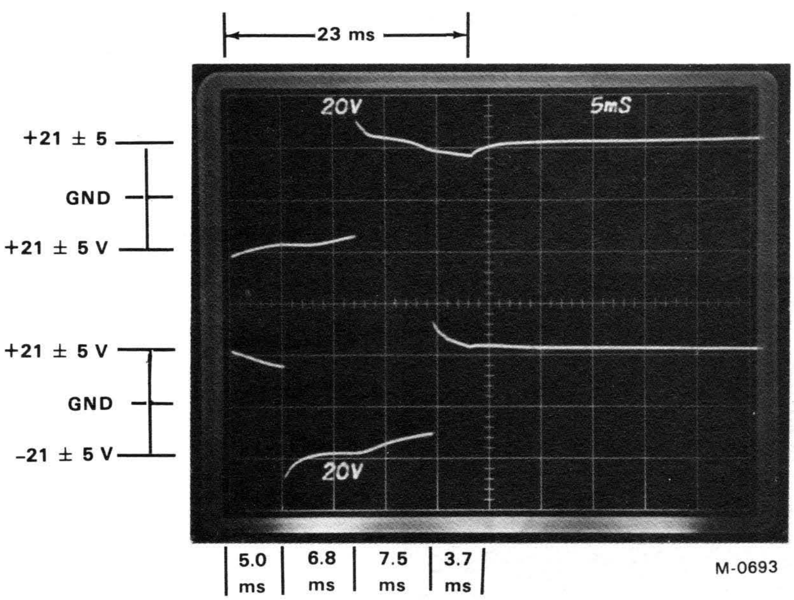
End of Positive Speed Tests

END OF SERVO SPEED TEST WAVEFORMS

6.1.1.3 Line Feed (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. Set POWER switch to ON, and LINE/LOC switch to LOC.
2. Press the LF key and the REPEAT key at the same time to get a sequence of line feeds.
3. Check the waveforms (with keys depressed) at the test points shown in Figures 6-29 through 6-35.

START OF LF STEPPING TEST WAVEFORMS



SCOPE SETUP

VOLTS/DIV:	20 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, NEG, INT

CH1 to PHASE 1 at power board J5-7

CH2 to PHASE 2 at power board J5-6

Figure 6-29 LF Motor Phase 1 and Phase 2 Waveforms

SCOPE SETUP

VOLTS/DIV:	20 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, POS, INT

CH1 to LF1 at power board Q34-C

CH2 to LF2 at power board Q36-C

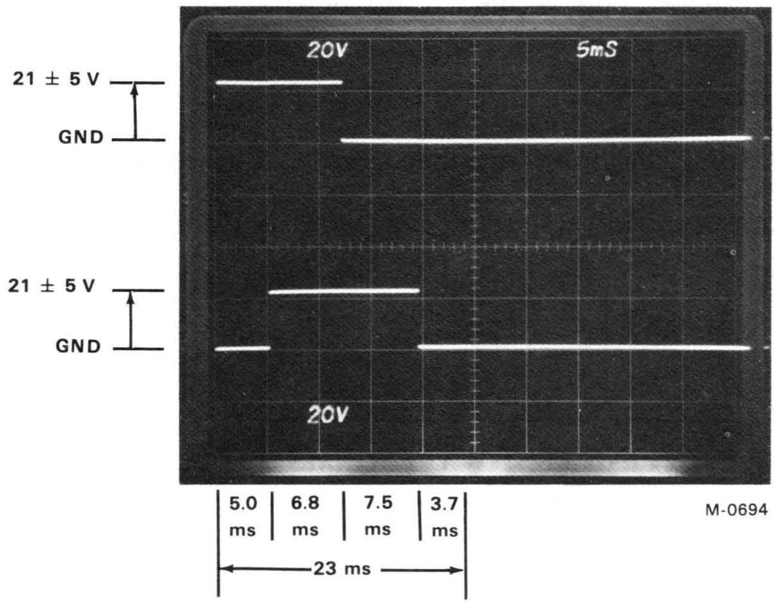


Figure 6-30 LF1 Waveform at TPA12 and LF2 Waveform at TPA15

SCOPE SETUP

VOLTS/DIV:	20 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, POS, INT

CH1 to LF1 at power board Q35-C

CH2 to LF2 at power board Q37-C

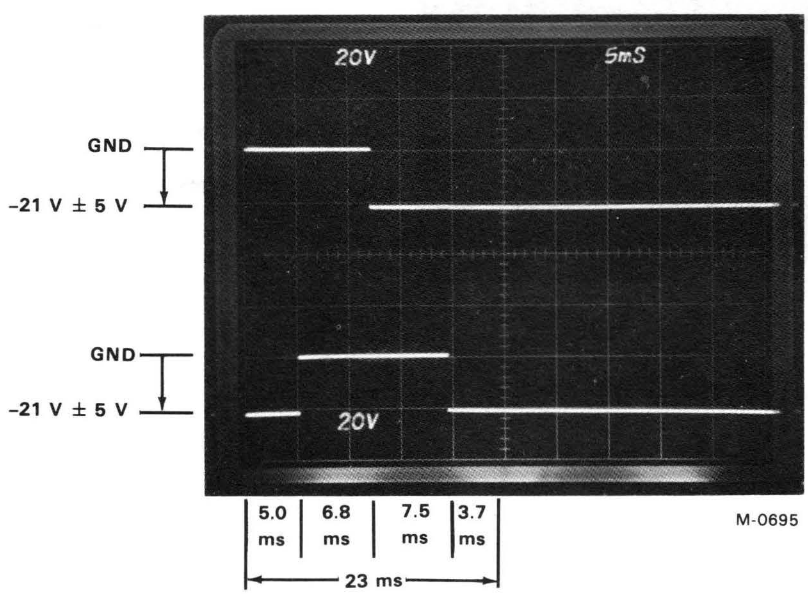
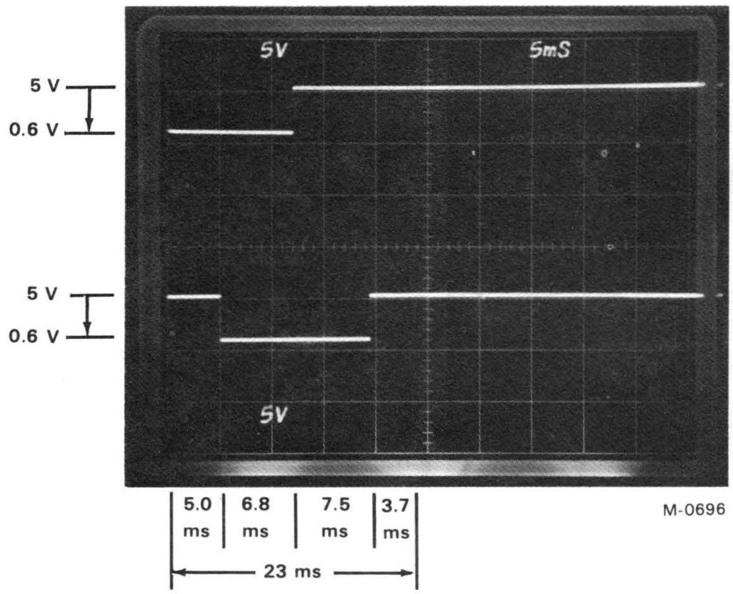


Figure 6-31 LF1 Waveform at TPA13 and LF2 Waveform at TPA16



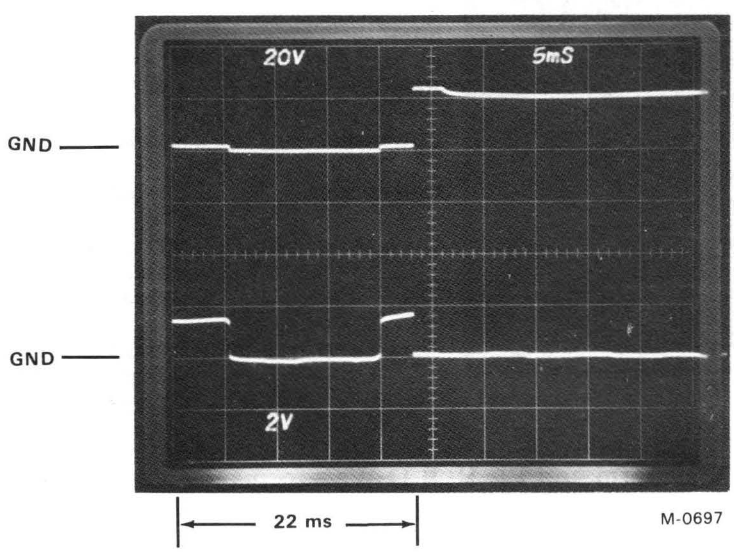
SCOPE SETUP

VOLTS/DIV:	5 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, NEG, INT

CH1 to LF1 at power board Q39-C

CH2 to LF2 at power board Q38-C

Figure 6-32 LF1 Waveform at TPA14 and LF2 Waveform at TPA17



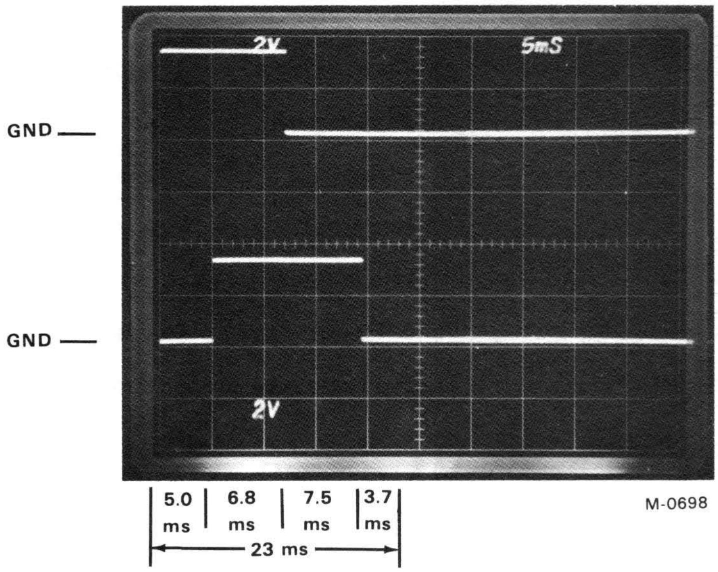
SCOPE SETUP

VOLTS/DIV:	CH1=20 V CH2=2 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, NEG, INT

CH1 to LF motor common return at power board J5-4

CH2 to LF HOLD at power board J1-29 (Q33-B)

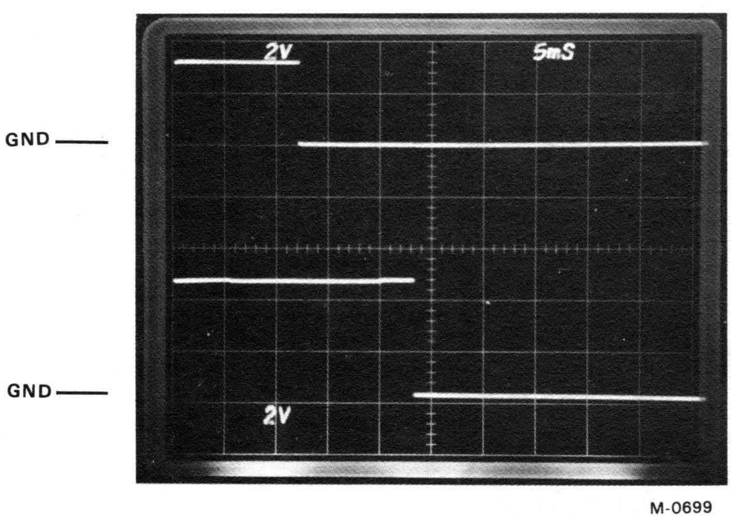
Figure 6-33 LF Motor Common Return and LF HOLD Waveforms



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 LF1 at:	M7722 E24-9 M7723 E8-10 M7728 E28-10
CH2 to LF2 at:	M7722 E24-5 M7723 E8-8 M7728 E28-8

Figure 6-34 LF1 Waveform at J1-JJ and LF2 Waveform at J1-P



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 LF1 at:	M7722 E24-9 M7723 E8-10 M7728 E28-10
CH2 to LF HOLD at:	M7722 E29-6 M7723 E5-5 M7728 E37-5

Figure 6-35 LF1 Waveform and LF HOLD Waveforms

END OF LF STEPPING TEST WAVEFORMS

6.1.1.4 Bell Test – This test drives the bell system logic, providing the signals required to trace the circuit.

1. Set POWER switch to ON, and LINE/LOC switch to LOC.
2. Hold down the CTRL key and press the BELL key and the REPEAT key.

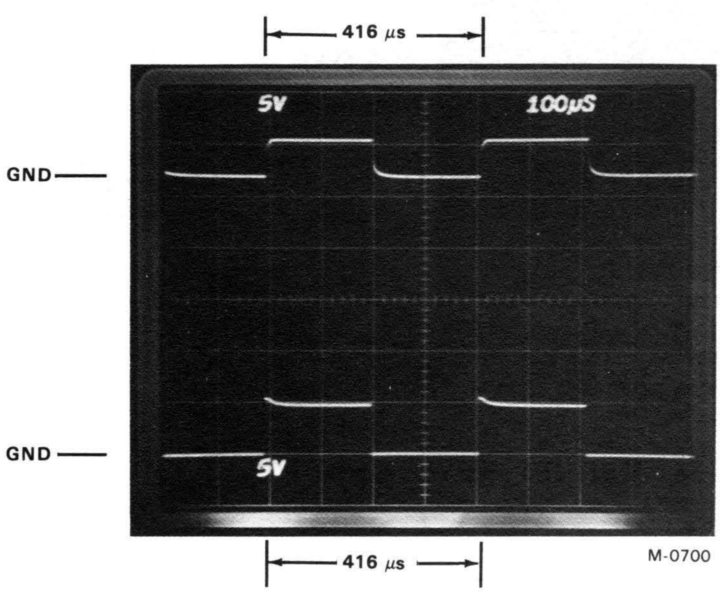
NOTE
CTRL and REPEAT keys can be taped down with scotch tape. Do not use masking tape; it will mar the surface.

3. Check the waveforms (with keys depressed) at the test points indicated in Figures 6-36 and 6-37.

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

4. Press the RETURN and REPEAT keys and check the waveforms at the test points indicated in Figure 6-38.

START OF BELL TEST WAVEFORMS



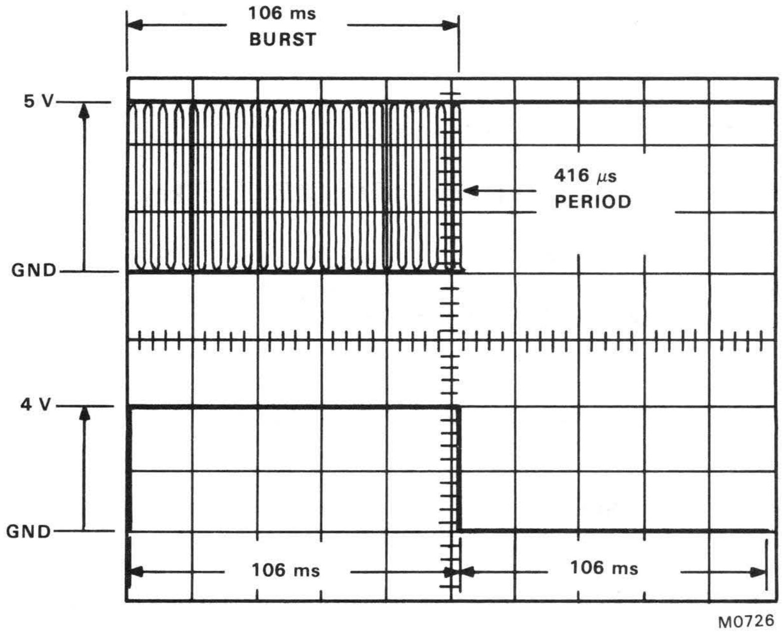
SCOPE SETUP

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

Figure 6-36 BELL Source and BELL SINK Waveforms



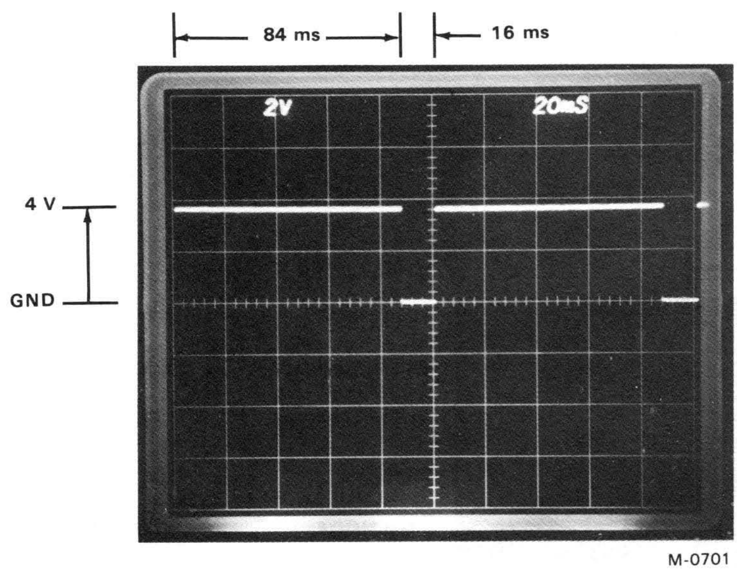
SCOPE SETUP

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 M7723 E14-5 M7728 E34-5

Figure 6-37 BELL SINK and BELL Waveforms



SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL 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 M7723 E22-6 M7728 E30-6

NOTE:
This is a difficult waveshape to observe.

Figure 6-38 KBH H Pulse Waveform

END OF BELL TEST WAVEFORMS

6.1.1.5 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.

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 (while depressing the keys) at the test points listed in Figures 6-39 through 6-49.
3. Momentarily press the SHIFT key and U key (simultaneously). Check test point 1 in Table 6-2 for the correct level.
4. Momentarily press the SHIFT key and "*" key (simultaneously). Check test point 1 in Table 6-2 for the correct level.
5. Repeat steps 3 and 4 for test points 2 through 7.
6. Momentarily press the SHIFT key and U key (simultaneously). Check test point 1 in Table 6-3 for the correct level.
7. Momentarily press the SHIFT key and "*" key (simultaneously). Check test point 1 in Table 6-3 for the correct level.
8. Repeat steps 6 and 7 for test points 2 through 7.

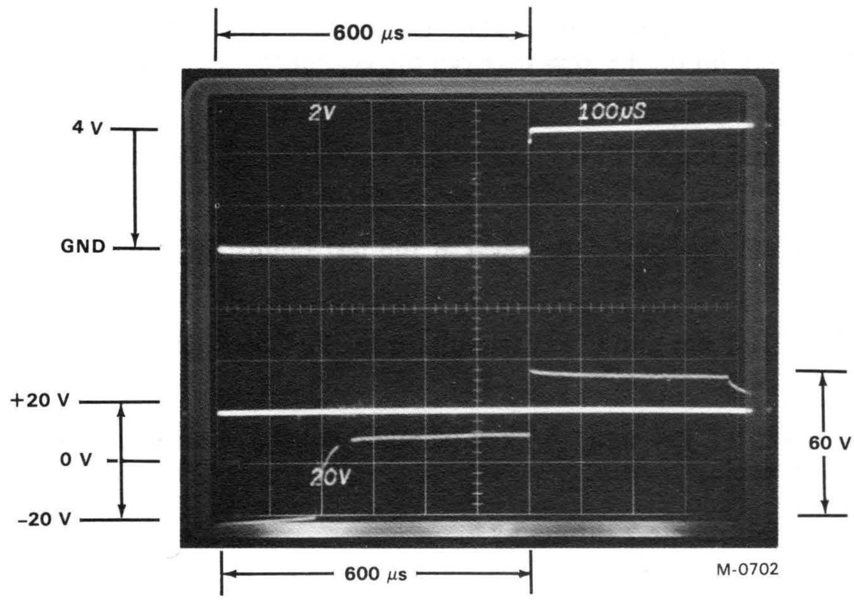
Table 6-2 UART Test

	Test Point			Character	
	M7722	M7723	M7728	U	*
1.	E55-26, E56-4	E58-26, E59-4	E55-26, E41-4	1	0
2.	E55-27, E56-6	E58-27, E59-6	E55-27, E41-6	0	1
3.	E55-28, E56-10	E58-28, E59-10	E55-28, E41-10	1	0
4.	E55-29, E56-12	E58-29, E59	E55-29, E41-12	0	1
5.	E55-30, E57-4	E58-30, E60-4	E55-30, E36-4	1	0
6.	E55-31, E57-6	E58-31, E60-8	E55-31, E36-6	0	1
7.	E55-32, E57-10	E58-32, E60-10	E55-32, E36-10	1	0

Table 6-3 Character Buffer Test

	Test Points			Character	
	M7722	M7723	M7728	U	*
1.	E28-18	E45-18	E48-18	0	1
2.	E28-17	E45-17	E45-17	1	0
3.	E28-16	E45-16	E45-16	0	1
4.	E28-15	E45-15	E45-15	1	0
5.	E28-14	E45-14	E45-14	0	1
6.	E28-13	E45-13	E45-13	1	0
7.	E28-22	E45-22	E48-22	0	1

START OF PRINTABLE CHARACTER TEST WAVEFORMS



SCOPE SETUP

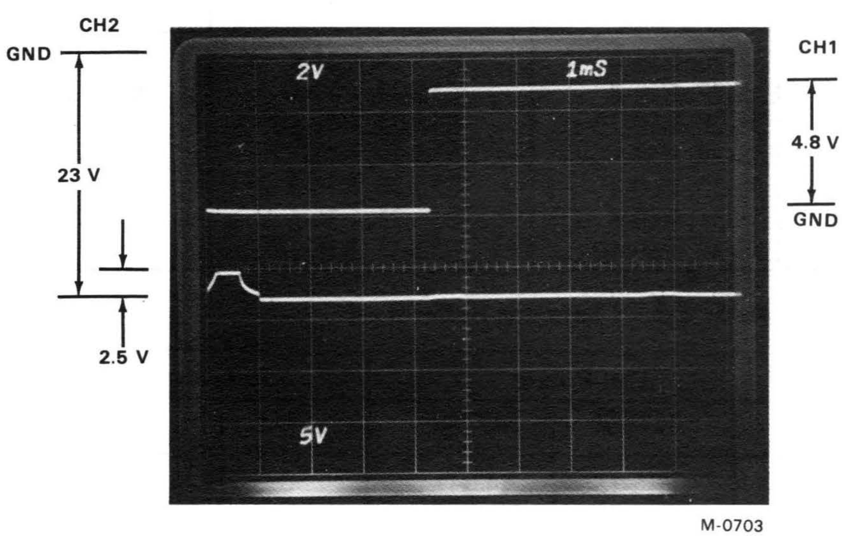
VOLTS/DIV:	CH1=2 V; CH2=20 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	100 μs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, NEG, INT

CH1 to HD EN at power board J1-4, Q22-B

CH2 to SOL1–SOL7 at power board J6 pins 8, 12, 4, 10 16, 6, or 4 (see note) (Q17-C, Q19-C, Q1-C, Q20-C, Q18-C, Q16-C, or Q21-C)

NOTE:
Pin numbers are marked on J6.

Figure 6-39 HD EN and SOL Waveforms at J6



SCOPE SETUP

VOLTS/DIV:	CH1=2 V CH2=5 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	1 ms
TRIG MODE:	AC
TRIG SOURCE:	CH2, AC, POS, INT

CH1 to HS1–HS7 at:

M7722 E25-4, E25-6, E20-4 E20-6, E20-8, E25-8, E20-10

M7723 E28-4, E28-6, E25-4 E25-6, E25-8, E28-8, E25-10

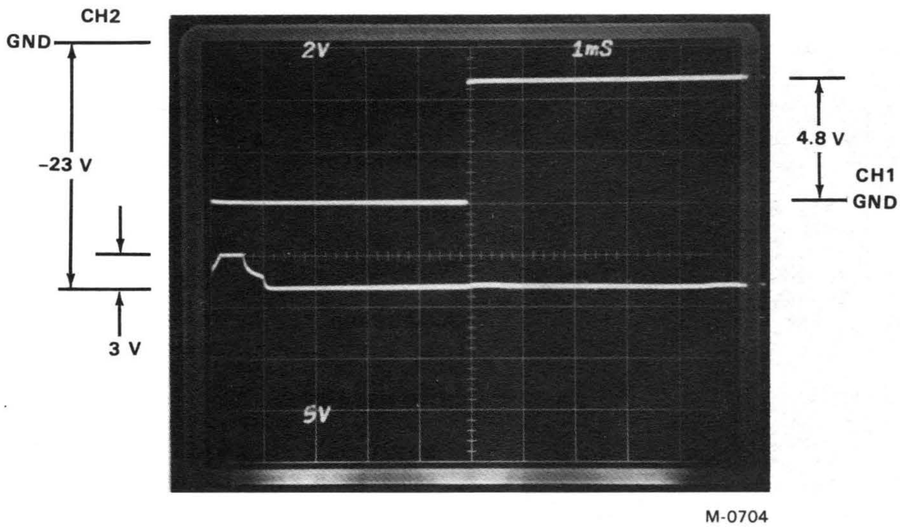
M7728 E47-1, E47-4, E47-10 E47-13, E52-1, E52-4, R52-10

CH2 to SD1–SD7 at power board:

Q6-E, Q14-E, Q2-E, Q38-E (see note), Q12-E, Q4-E, and Q12-E

NOTE:
Q38 has been changed to Q8 on REV T power board.

Figure 6-40 HS1 and SD1 Waveforms



SCOPE SETUP

VOLTS/DIV:	CH1 = 2 V CH2 = 5 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	1 ms
TRIG MODE:	AC
TRIG SOURCE:	CH2 V, AC, POS, INT

CH1 to HS1–HS7 at:

M7722 E25-4, E25-6, E20-4
E20-6, E20-8, E25-8, E20-10

M7723 E28-4, E28-6, E25-4, E26-6
E25-8, E28-8, E25-10

M7728 E47-1, E47-4, E47-10, E47-13
E52-1, E52-4, E52-10

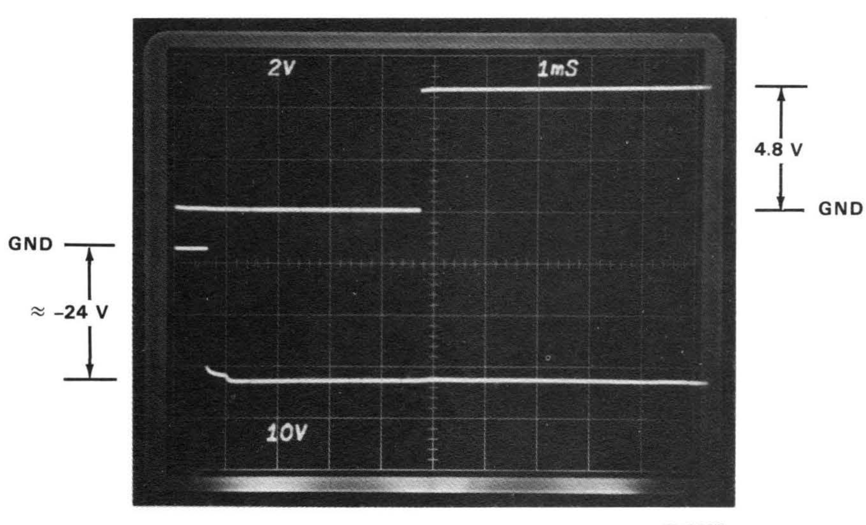
CH2 to SD1–SD7 at power board:

Q6-B, Q14-B, Q2-B, Q38-B (see notes),
Q12-B, Q4-B, and Q10-B

NOTES:

1. Q38 has been changed to Q8 on REV T power board.
2. Channel 2 test points are difficult to reach with most probes.

Figure 6-41 HS1 and SD1 Waveforms



SCOPE SETUP

VOLTS/DIV:	CH1 = 2 V CH2 = 10 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	1 ms
TRIG MODE:	AC
TRIG SOURCE:	CH2, AC, POS, INT

CH1 to HS1–HS7 at:

M7722 E25-4, E25-6, E20-4
E20-6, E20-8, E25-8, E20-10

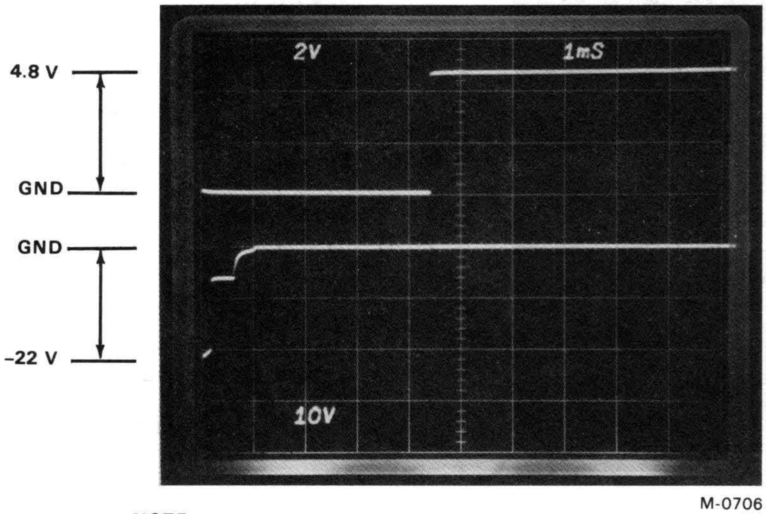
M7723 E28-4, E28-6, E25-4, E26-6
E25-8, E28-8, E25-10

M7728 E47-1, E47-4, E47-10, E47-13
E52-1, E52-4, E52-10

CH2 to SD1–SD7 at power board:

Q7-C, Q15-C, Q3-C, Q9-C,
Q13-C, Q5-C, and Q11-C

Figure 6-42 HS1 and SD1 Waveforms



NOTE:
Q38 has been changed to Q8 on REV T power board.

SCOPE SETUP

VOLTS/DIV:	CH1 = 2 V CH2 = 10 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	1 ms
TRIG MODE:	AC
TRIG SOURCE:	CH2, AC, NEG, INT

CH1 to HS1–HS7 at:

M7722 E25-4, E25-6, E20-4, E20-6, E20-8, E25-8, E25-10

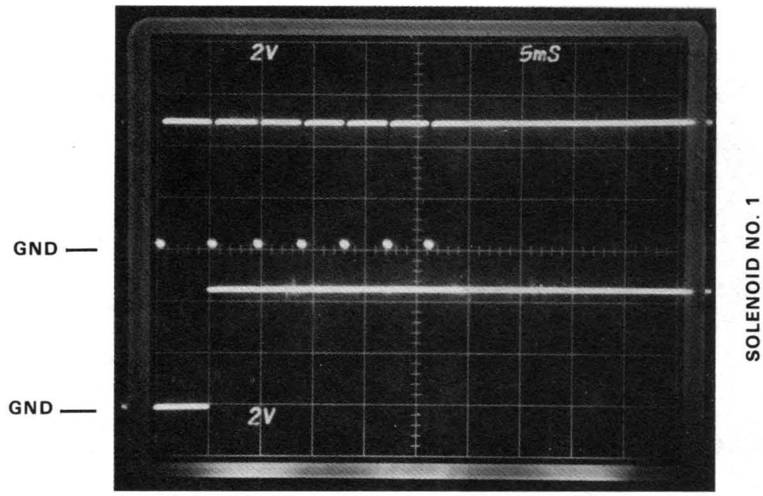
M7723 E28-4, E28-6, E25-4, E26-6 E25-8, E28-8, E25-10

M7728 E47-1, E47-4, E47-10, E47-13 E52-1, E52-4, E52-10

CH2 to SD1–SD7 at power board:

Q6-C, Q14-C, Q2-C, Q38-C (see note), Q12-C, Q8-C, and Q10-C

Figure 6-43 HS1 and SD1 Waveforms



HS1

SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH2, NEG, INT
CH1 to HD EN at:	M7722 E39-8, M7723 E18-6 M7728 E39-6

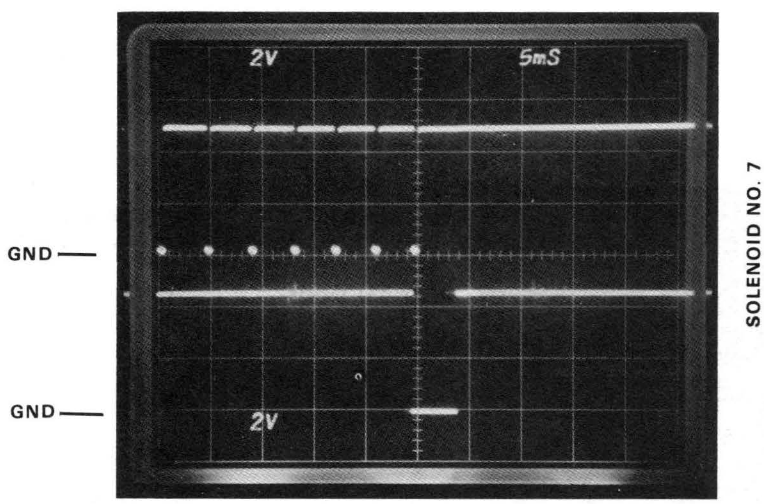
CH2 to HS1–HS7 at:

M7722 E25-4, E25-6, E20-4,
E20-6, E20-8, E25-8, E20-10

M7723 E28-4, E28-6, E25-4, E26-6
E25-8, E28-8, E25-10

M7728 E47-1, E47-4, E47-10, E47-13
E52-1, E52-4, E52-10

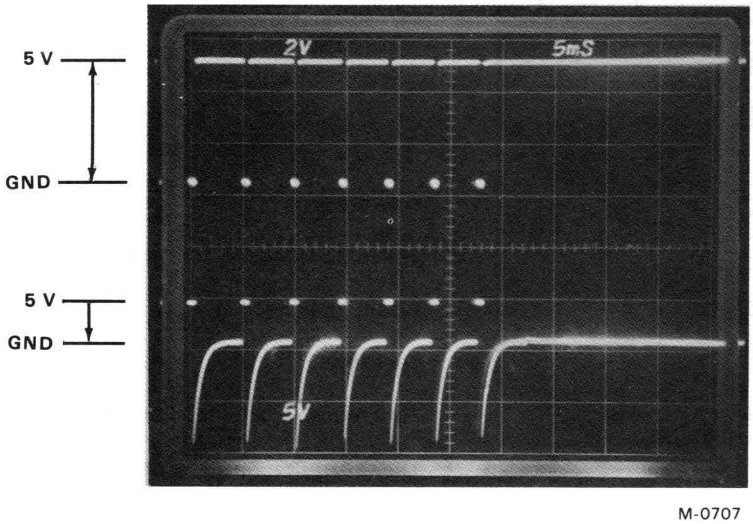
Pulse moves one position to the right for each new measurement: HS1–HS7.



HS7

M-0708

Figure 6-44 HD EN and HS1 Waveforms at J1

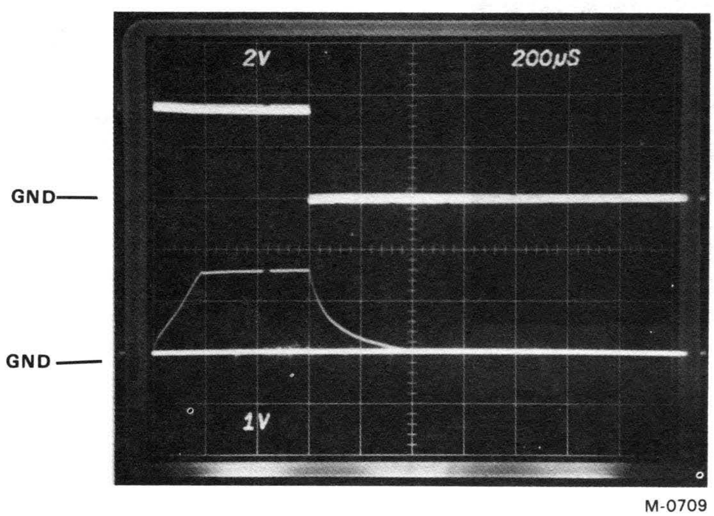


SCOPE SETUP

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):	M7722 E39-8 M7723 E18-6 M7723 E39-6

CH2 to BUFF HEAD EN H at power board Q22-C

Figure 6-45 HD EN and BUFF HEAD EN H Waveforms



SCOPE SETUP

VOLTS/DIV:	CH1=2 VDC COUPLED CH2=1 VAC COUPLED
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	200 µs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, POS, INT

WARNING

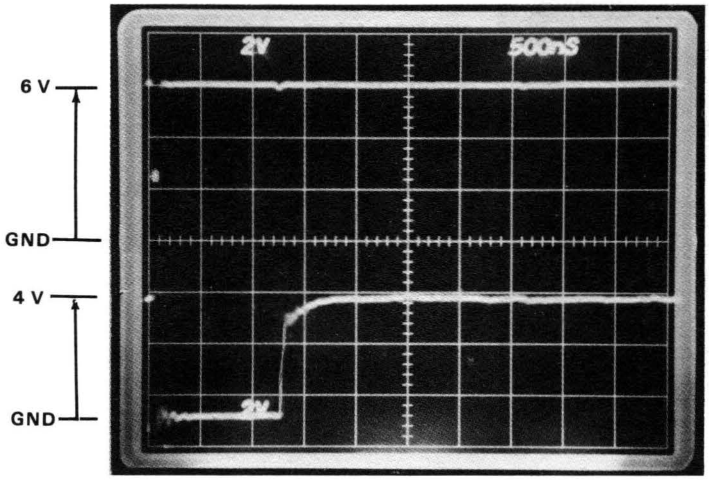
Float scope power line before making these connections.

CH1 to HD EN at:	M7722 E39-9 M7723 E35-9 M7723 E37-9

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

CH2 probe ground to −21 V

Figure 6-46 HD EN Voltage Waveform and SD Current Waveform



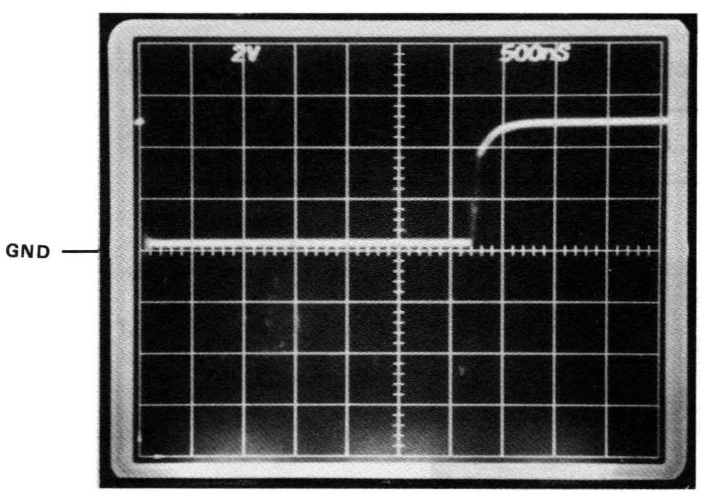
M-0710

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:	M7722 E60-10 M7723 E38-10 M7728 E30-10
CH2 to CLR R DONE at:	M7722 E60-8 M7723 E38-8 M7728 E30-8

NOTE:
Scope intensity may have to be turned up to make this waveshape visible.

Figure 6-47 WRITE BUFF L and CLR R DONE Waveforms



M-0711

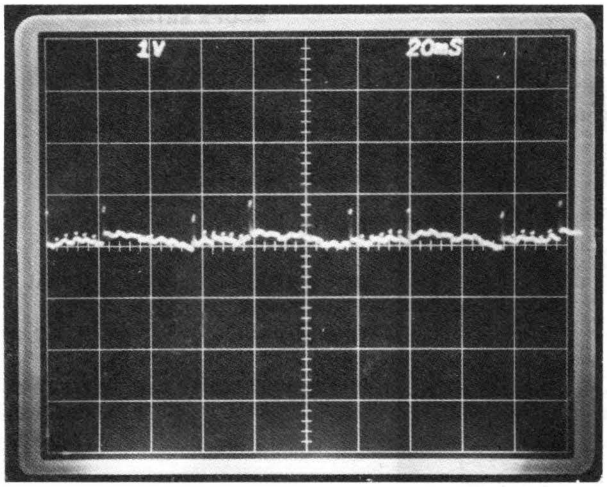
SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	CH1
HORIZ DISPLAY:	A
TIME/DIV:	500 ns
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, NEG, INT
CH1 to KEY STB at:	M7722 E67-4 M7723 E50-12 M7728 E56-2

NOTES:

1. Scope intensity may have to be turned up to make this waveshape visible.
2. This pulse is 500 ns wide on earlier keyboards.

Figure 6-48 KEY STB L Waveform



M-0712

SCOPE SETUP

VOLTS/DIV:	1 VAC COUPLED
VERTICAL MODE:	CH1
HORIZ DISPLAY:	A
TIME/DIV:	20 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, POS, INT

CH1 to power board Q25-E

NOTE:
M key was pressed to produce this waveshape.

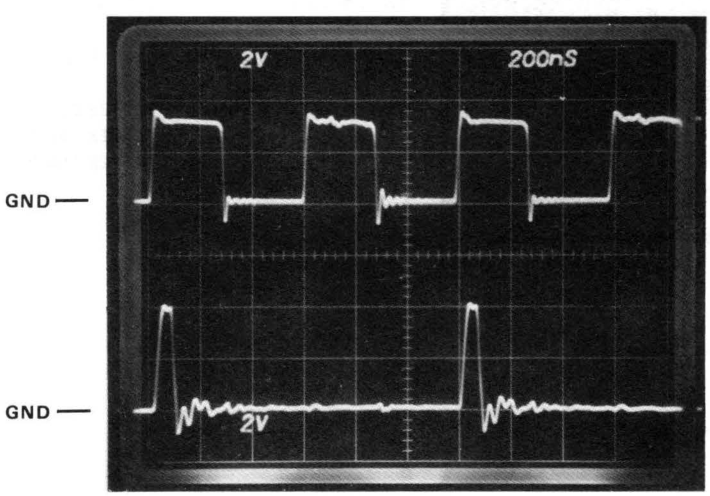
Figure 6-49 Power Board V REF Waveform

END OF PRINTABLE CHARACTER TEST WAVEFORMS

6.1.1.6 Clock Test – The clock test checks all clock frequencies and time periods in the initialize mode.

1. Set the POWER switch to ON.
2. Check the waveforms at the test points indicated in Figures 6-50 through 6-58.

START OF CLOCK TEST WAVEFORMS

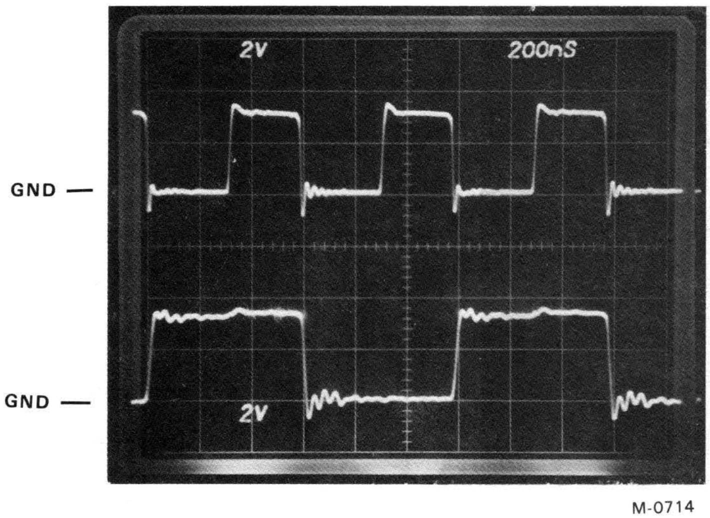


M-0713

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 592 ns at:	M7722 E64-10 M7723 E34-10 M7728 E19-10
CH2 to CLK H at:	M7722 E64-5 M7723 E34-5 M7728 E19-5

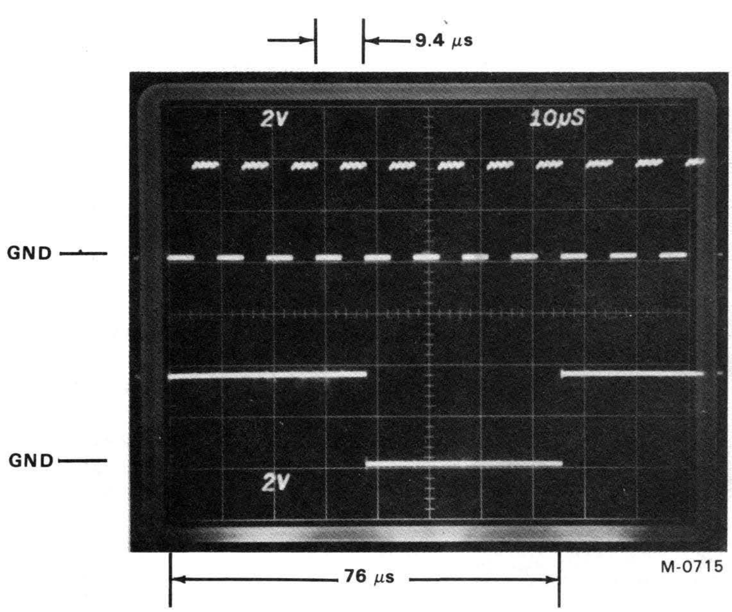
Figure 6-50 CLK H and 592 ns Waveforms



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 1.184 μs at:	M7722 E13-1 M7723 E21-1 M7728 E19-10
CH2 to 592 ns at:	M7722 E13-14 M7723 E21-14 M7728 E66-12

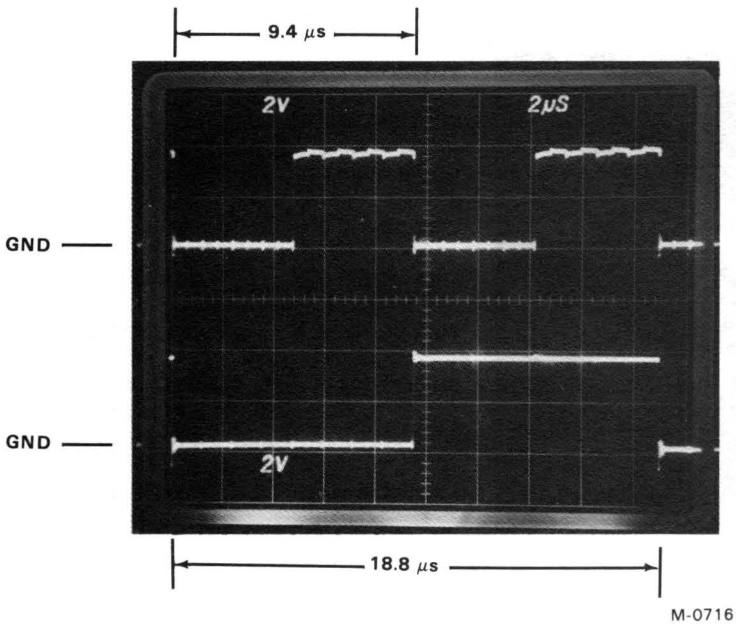
Figure 6-51 592 ns and 1.184 μs Waveforms



SCOPE SETUP

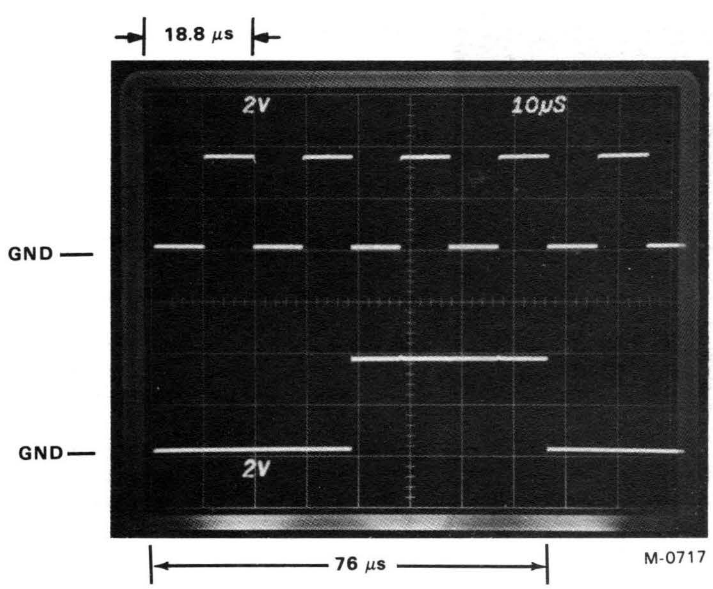
VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	10 μs
TRIG MODE:	NORMAL
TRIG SOURCE	CH1, AC, NEG, INT
CH1 to 9.4 μs at:	M7722 E26-1 M7723 E30-1 M7728 E68-1
CH2 to 76 μs at:	M7722 E26-11 M7723 E30-11 M7728 E68-11

Figure 6-52 9.4 μs and 76 μs Waveforms



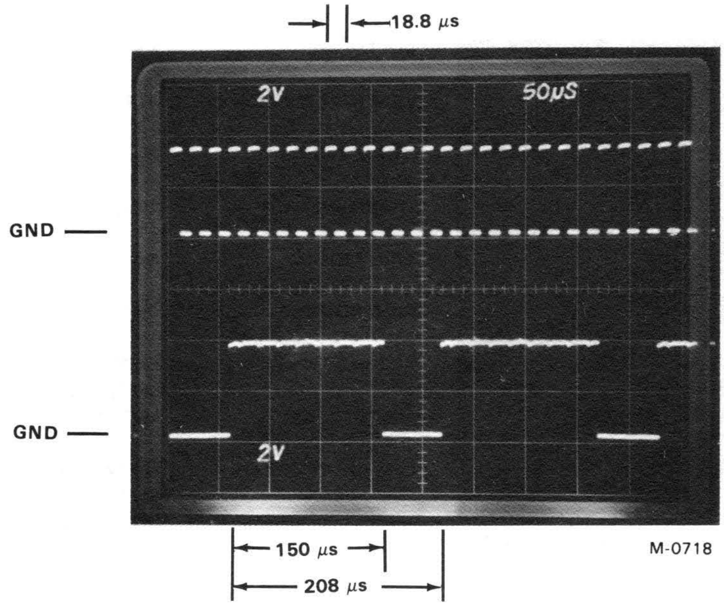
SCOPE SETUP	
VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
HORIZ DISPLAY:	A
TIME/DIV:	2 µs
TRIG MODE:	NORMAL
TRIG SOURCE	CH1, AC, NEG, INT
CH1 to 9.4 µs at:	M7722 E26-1 M7723 E30-1 M7728 E68-1
CH2 to 19L at:	M7722 E26-9 M7723 E30-9 M7728 E68-1

Figure 6-53 9.4 µs and 19L 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, NEG, INT
CH1 to 18.8 µs at:	M7722 E26-9 M7723 E30-9 M7728 E68-9
CH2 to 76 µs at:	M7722 E26-11 M7723 E30-11 M7728 E68-11

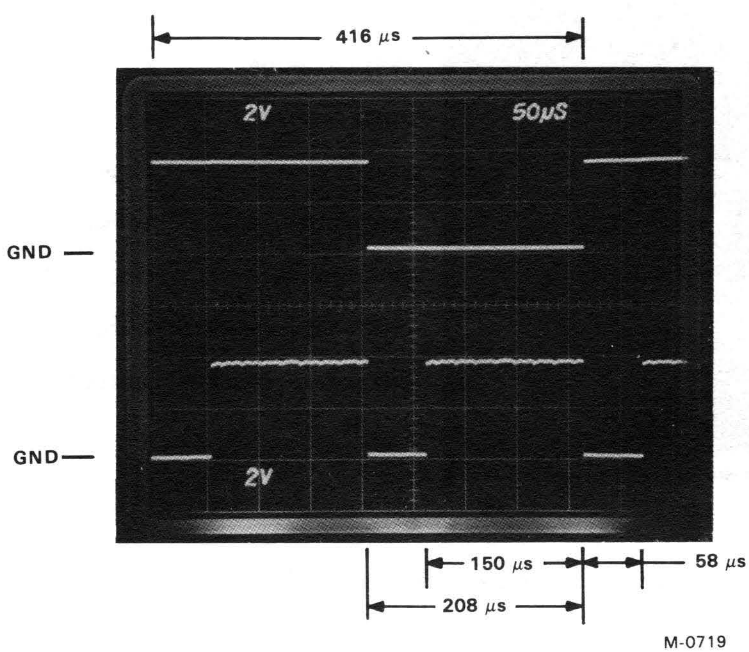
Figure 6-54 18.8 µs and 76 µs Waveforms



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 18.8 μs at:	M7722 E26-9 M7723 E26-9 M7728 E68-9
CH2 to 4.8 kHz at:	M7722 E63-11 M7723 E48-11 M7728 E63-11

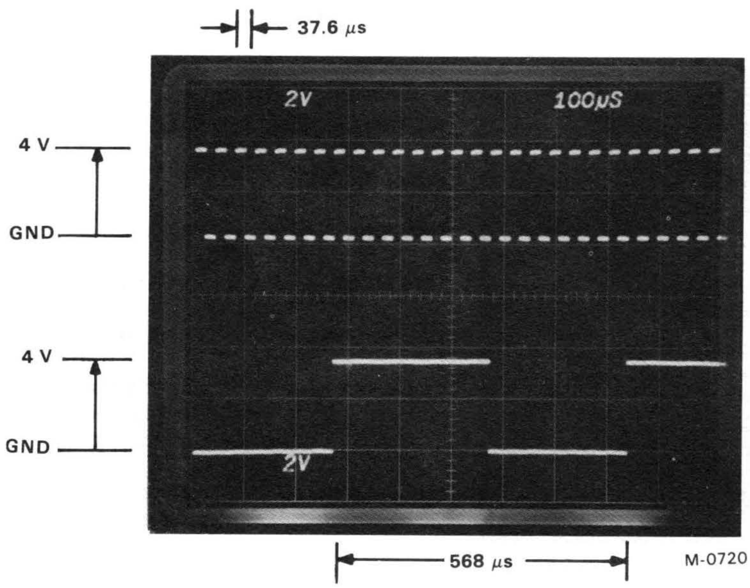
Figure 6-55 18.8 μs and 4.8 kHz Waveforms



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 208 H:	M7722 E26-12 M7723 E30-12 M7728 E68-12
CH2 to 4.8 kHz at:	M7722 E63-11 M7723 E48-11 M7728 E63-11

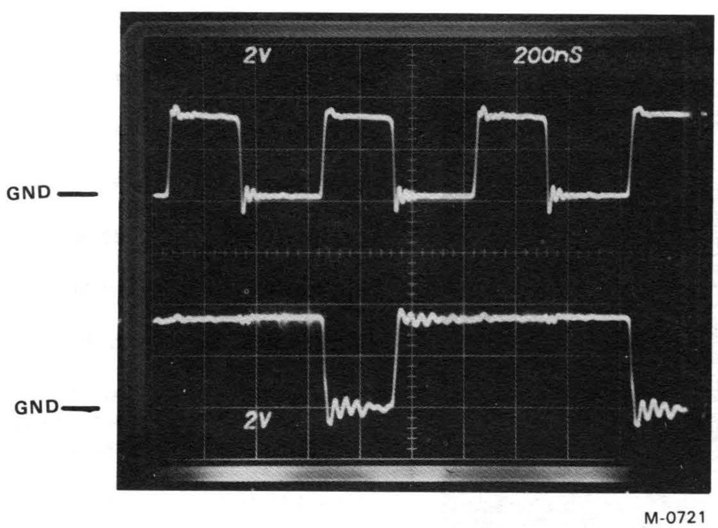
Figure 6-56 208 H and 4.8 kHz Waveforms



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 37.6 μs :	M7722 E26-8 M7723 E30-8 M7723 E68-8
CH2 to 1.76 kHz at:	M7722 E68-11 M7723 E47-11 M7728 E67-11

Figure 6-57 37.6 μs and 1.76 kHz Waveforms



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 529 ms at M7728 E61-10

CH2 to option clock at M7728 E61-8

Figure 6-58 M7728 Option Clock Waveform

END OF CLOCK TEST WAVEFORMS

6.1.2 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/LOC switch set to LINE. Remove the protective housing from the LA36 as directed in Chapter 7, and lower the rear access door before performing any on-line tests.

6.1.2.1 Current Loop Interface UART and Character Buffer Test – 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. The UART test checks the output of the UART. The buffer test checks the single character buffers and the AND gates between the buffer and UART.

1. Set the POWER switch to OFF.
2. Connect the transmit and receive loops back-to-back as shown in Figure 6-59.
3. Set the POWER switch to ON.
4. Set the BAUD RATE switch to 300.

Current Loop Test

5. Simultaneously press and hold the SHIFT, "*", and REPEAT keys while observing the waveforms at the test points listed in Figures 6-60 through 6-61.

UART/Single Character Buffer Test

6. Momentarily press the SHIFT key and "*" keys (simultaneously). Check test point 1 in Table 6-2 for the correct level.
7. Momentarily press the SHIFT key and "*" key (simultaneously). Check test point 1 in Table 6-2 for the correct level.
8. Repeat steps 6 and 7 for test points 2 through 7.
9. Momentarily press the SHIFT key and U key (simultaneously). Check test point 1 in Table 6-3 for the correct level.
10. Momentarily press the SHIFT key and "*" key (simultaneously). Check test point 1 in Table 6-3 for the correct level.
11. Repeat steps 9 and 10 for test poins 2 through 7.
12. Check the frequency at the appropriate logic module (M7722 – E55-40, M7723 – E58-40, M7728 – E55-40) for each baud rate.

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 6-55 and 6-56).

START OF CURRENT LOOP INTERFACE WAVEFORMS

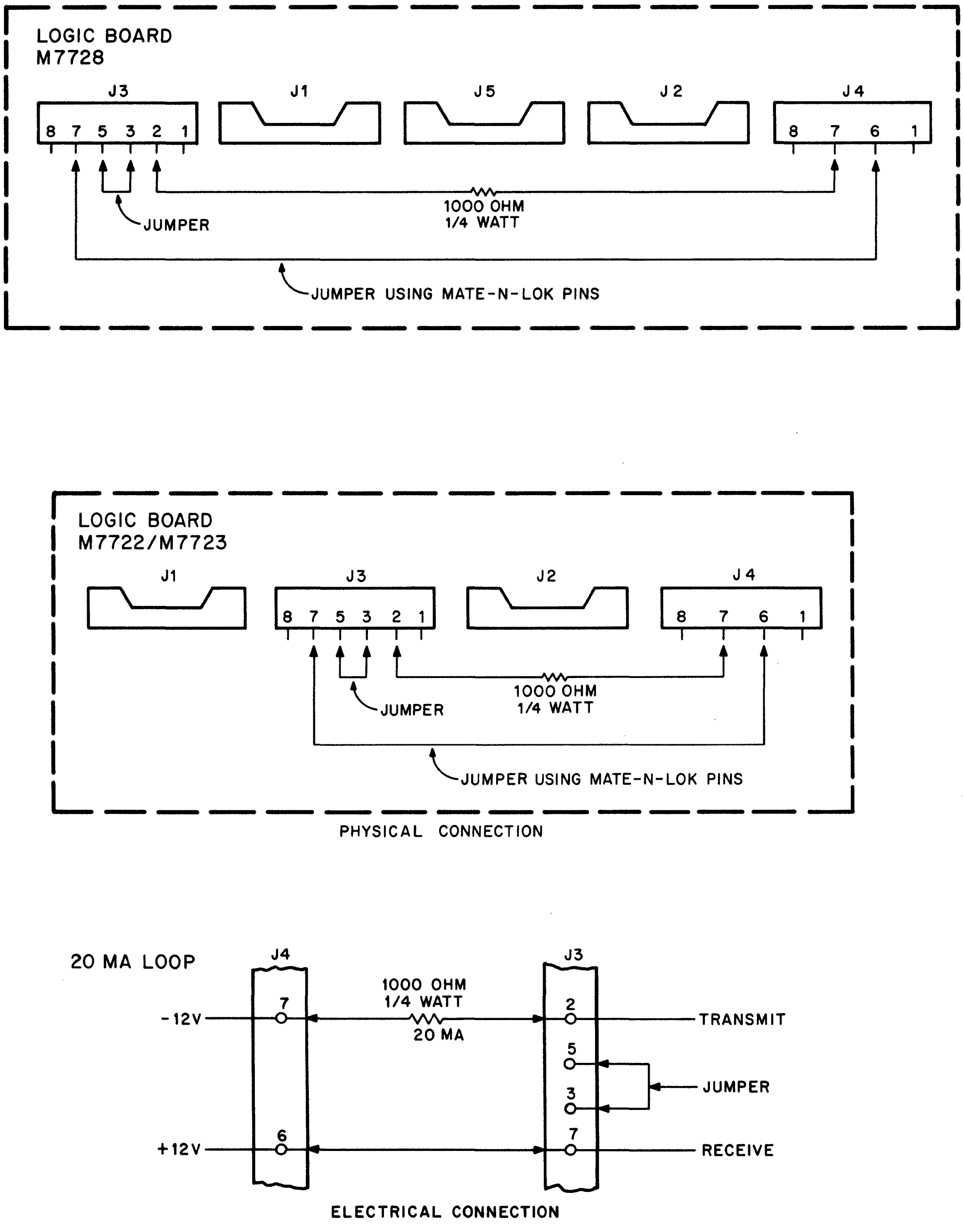
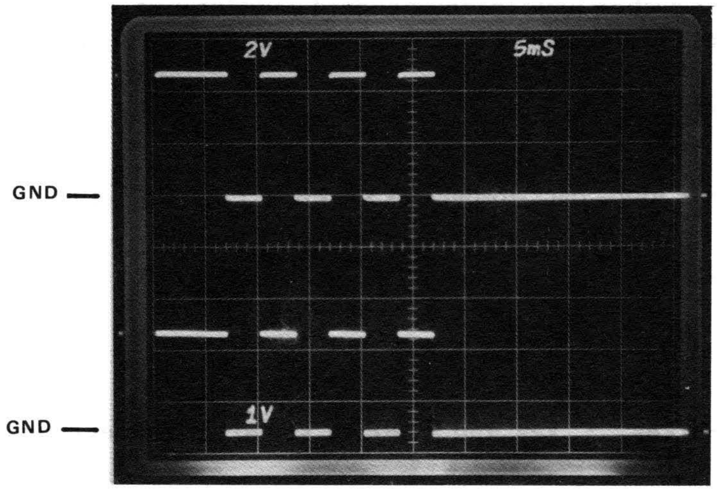


Figure 6-59 Current Loop Test Setup

SCOPE SETUP

VOLTS/DIV:	CH1=2 VDC COUPLED CH2=1 VAC COUPLED
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE	CH1, AC, POS, INT
CH1 to SI at:	M7722 E62-1 M7723 E52-1 M7728 E60-4

CH2 to receive at logic board J3-3



M-0722

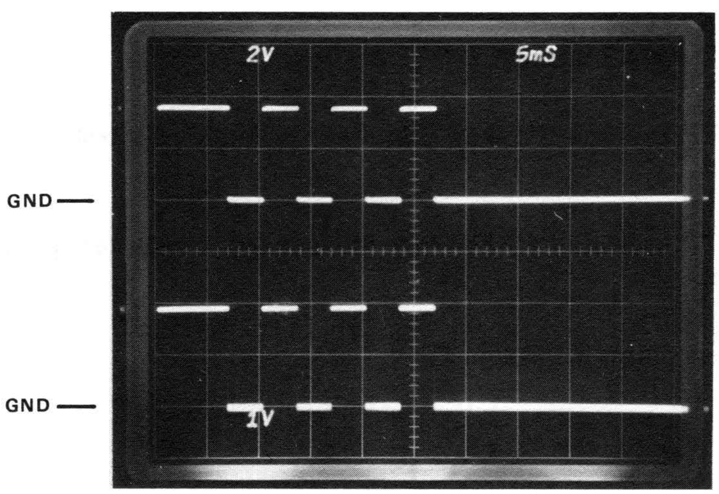
NOTE:
Mark = GND; Space = 5 V or 1.5 V.

Figure 6-60 Loop Receiver Waveforms

SCOPE SETUP

VOLTS/DIV:	CH1=2 VDC COUPLED CH2=1 VAC COUPLED
VERTICAL MODE:	CHOP
HORIZ DISPLAY:	A
TIME/DIV:	5 ms
TRIG MODE:	NORMAL
TRIG SOURCE	CH1, AC, NEG, INT
CH1 to SO at:	M7722 E66-11 M7723 E52-11 M7728 E61-11

CH2 to transmit at logic board J3-5



M-0723

NOTE:
Mark = GND; Space = 5 V or 1.5 V.

Figure 6-61 Loop Driver Waveforms

END OF CURRENT LOOP INTERFACE WAVEFORMS

6.1.2.2 Serial Line Interface – The serial line interface test checks the operation of the serial input (EIA) and serial output (EIA) 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 POWER switch to OFF.

2. Connect the transmit and receive loops back-to-back as shown in Figure 6-62.

3. Set the POWER switch to ON.

4. Set the BAUD RATE switch to 300.

5. Simultaneously press the SHIFT key, "*" key, and REPEAT key to get a series of printing characters.

6. Check the waveforms at the test points listed in Figure 6-63.

7. Momentarily press the SHIFT key and U key (simultaneously). Check test point 1 in Table 6-2 for the correct level.

8. Momentarily press the SHIFT key and U key (simultaneously). Check test point 1 in Table 6-2 for the correct level.

9. Repeat steps 7 and 8 for test points 2 through 7.

10. Momentarily press the SHIFT key and "*" key (simultaneously). Check test point 1 in Table 6-3 for the correct level.

11. Momentarily press the SHIFT key and "*" key (simultaneously). Check test point 1 in Table 6-3 for the correct level.

12. Repeat steps 10 and 11 for test points 2 through 7.

START OF SERIAL LINE INTERFACE WAVEFORMS

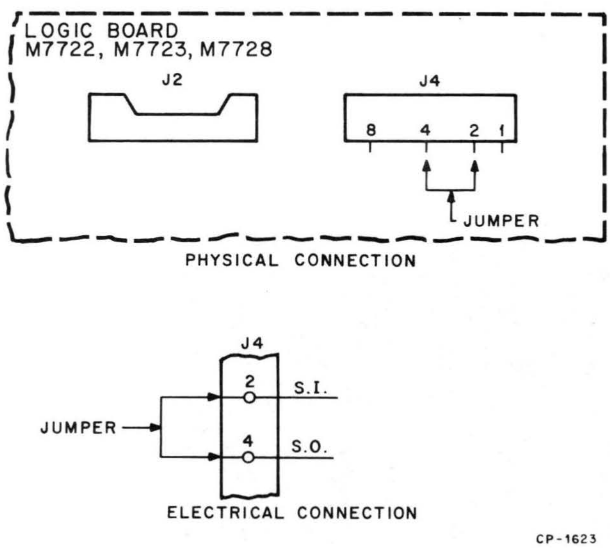
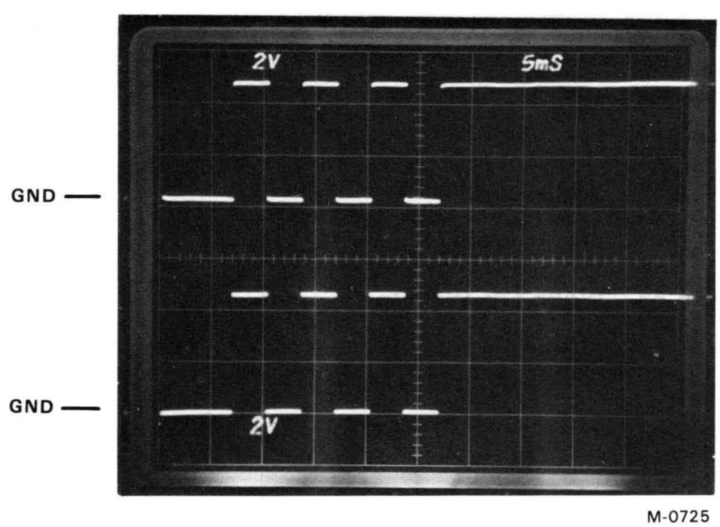


Figure 6-62 Serial Line Test Setup



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 SO at:	M7722 E29-12 M7723 E18-12 M7728 E60-12
CH2 to SI at:	M7722 E66-6 M7723 E53-2 M7728 E42-11

NOTE:
5 V = SPACE: GND = MARK

Figure 6-63 Serial Output and Serial Input Waveforms

END OF SERIAL LINE INTERFACE WAVEFORMS

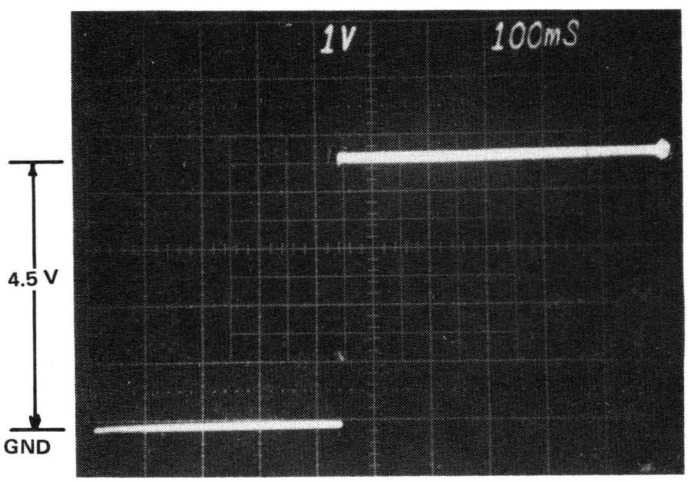
6.1.3 Wake-Up Test

This test checks the wake-up pulse upon initialization of the LA36.

NOTE

The scope probes must be connected to the test points specified in Figure 6-64 prior to applying power.

Set the POWER switch to ON, and observe Figure 6-64.



SCOPE SETUP

VOLTS/DIV:	1 V
VERTICAL MODE:	ALT
SWEEP:	SINGLE SWEEP
TIME/DIV:	100 ms
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, EXT, POS
CH1 to Wake-Up at:	M7722 E36-1 M7723 E14-1 M7728 E34-1 (See note 2.)

Notes:

1. This waveform is a dot moving across the scope. Upon power application the dot is a logic zero, it then goes to a logic one when wakeup is completed.
2. The transformer secondary power board (J3-4) was used to trigger the scope.

M-0558

Figure 6-64 Wake-Up Waveform

6.2 TROUBLESHOOTING CHARTS (ON-LINE TESTS)

The troubleshooting chart in Table 6-4 lists the common trouble symptoms that could be observed during installation checkout or during normal operation of the LA36. The sequence of these indications is important and the steps must be performed in the order presented. Read through symptoms 1–11 in Table 6-4, and perform the troubleshooting related to the selected symptom. If no symptom is given with the machine servicing request, perform the installation checkout procedure in Paragraph 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. Field-replaceable assemblies are the printer mechanism, print head, logic board, and power board. (Chassis-mounted parts are also replaceable.)

NOTE

Steps 1 through 3 can be used to troubleshoot the LA35.

Table 6-4 Troubleshooting Chart

Symptom	Problem Area	Probable Cause	Action	Reference
1. No response when POWER switch is set to ON (fan not operating, no lights).	Main printer power fuse	Blown	Unplug printer. Check F1 (3A Slo Blo at 115 V or 1.5 A Slo Blo at 230 V). Replace.	
	POWER switch	Switch failure	Replace S1.	
	Power harness	Poor connections	Unplug printer, check harness.	
	Voltage jumper connected to J1	Not plugged in or loose	Check harness and jumper.	
2. a. No response when POWER switch is set to ON (fan operating).	Servo fuse F2 (front of printer). Early printers, check F1, 2A SB on power board.	Blown	Turn off printer. Check servo fuse F2 (2 A Slo Blo).	
	Power transformer	Open winding	Check voltage.	
	Power board	Loss of low voltage	Check +12 V, -12 V, +5 V, +21 V, and -21 V	Table 6-5
b. Print head does not move.	Servo fuse	Servo fuse F2 (front of printer). Early printer, check F1 on power board.	Check fuse and replace (2 A Slo Blo).	

Table 6-4 Troubleshooting Chart (Cont)

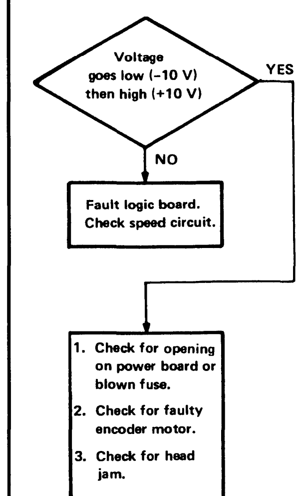
Symptom	Problem Area	Probable Cause	Action	Reference
2. b. Cont	Logic board, power board, carriage, or encoder motor	Faulty speed circuit on logic board, open on power board, jammed carriage, or inoperative motor	Connect probe to J1-B (sum output) on logic board. Set PRINTER switch (power) OFF then ON and observe voltage.	Speed circuits, Paragraph 6.1.1.2
				
		MPC portion of logic board	Replace logic board.	
3. Carriage moves violently or erratically from margin-to-margin or goes to either margin and stays there.	Power board	Loss of low voltage	Check +12 V, -12 V, +5 V, +21 V, and -21 V.	Table 6-5
	Logic board	Loss of clock signals	Perform clock test.	Paragraph 6.1.1.6
NOTE **If print head moves violently, remove the servo fuse prior to checking dc voltages (logic board), clock pulses, and servo amp (power board).**		No wake-up	Perform wake-up test.	
	Encoder	Encoder out of adjustment.	Perform encoder adjustment.	Paragraph 8.2

Table 6-4 Troubleshooting Chart (Cont)

Symptom	Problem Area	Probable Cause	Action	Reference
3. Cont	Logic Board	Encoder processing	Perform encoder signal processing test.	Paragraph 6.1.1.1 **NOTE** **To obtain negative and positive drive waveforms, perform setup described in Paragraph 6.1.1.2.**
	Power board	Servo amp	Check waveshapes and servo amp circuits on power board schematic.	Negative drive, Figure 6-19 Positive drive, Figures 6-26 and 6-27 Power board schematic sheets
4. No line feed when LINE FEED key is pressed (printer is in local mode). **NOTE** **Keyboard does not work when printer is out of paper.**	Paper	Paper jammed/feed holes torn	Check paper alignment.	Paragraph 3.4
	Line feed motor	Line feed fuses, motor or tractor drive shafts and tractor assemblies binding	a. Press in and turn Paper Advance knob to check for tractor and tractor shaft binding.	Chapter 7, tractor and tractor shaft replacement procedure
			b. Turn Paper Advance knob to check for motor and idler gear binding	Chapter 7, stepping motor replacement procedure
	Keyboard	Keyboard	Press space bar. No response when space bar is depressed. Check and replace keyboard or keyboard cable. If printer responds, continue with troubleshooting chart.	Paragraph 6.1.1.5
	Power board	LF motor fuses blown	Check F2 and F3, or F2 and F5 as applicable to power board.	

Table 6-4 Troubleshooting Chart (Cont)

Symptom	Problem Area	Probable Cause	Action	Reference
4. Cont		Amplifier output signals missing	Perform line feed stepping test and check:	Paragraph 6.1.1.3
			LF1 at Q34-C and LF2 at Q36-C	Figure 6-30
			LF1 at Q35-C and LF2 at Q37-C	Figure 6-31
			LF1 at Q39-C and LF2 at Q38-C.	Figure 6-32
		LF HOLD switch signals missing.	LF HOLD at Q33-C and LF MOTOR COMMON at Q33-B	Figure 6-33
	Logic board	Grey Code Counter output missing	Perform line feed stepping test and check:	Paragraph 6.1.1.3
			LF1 at M7728, E31-8 and LF2 at M7728, E31-6.	Figure 6-36
		LF HOLD flip-flop output missing	LF1 LF HOLD	Figure 6-35
	Tractors	Not feeding–worn or broken pin or out of alignment	Check, align, or replace.	Chapter 7
	Shafts	Binding	Check, align, or replace.	Chapter 7
	Clutch	Binding broken	Check, align, or replace.	Chapter 7
	Gears	Broken teeth, insufficient or excessive backlash	Check, align, or replace.	Chapter 7

Table 6-4 Troubleshooting Chart (Cont)

Symptom	Problem Area	Probable Cause	Action	Reference
5. No bell tone when CTRL and BELL keys are pressed.	Loudspeaker	Open voice coil	Check for approximately 2.4 kHz at speaker Faston. If signal is present, replace speaker.	
	Power board	Resistor or +5 V	Check and correct.	
	Logic board	BELL HOLD flip-flop M7722, E36; M7723, E14; M7728, E34	Perform bell test and check:	Paragraph 6.1.1.4 p-6-23
			BEL SOURCE at J5-1 and BEL SINK at J5-2	Figure 6-36
			BEL SINK at J5-2 and BEL at M7722, E36-5; M7723, E14-5; M7728, E34-5	Figure 6-37
			208 H at M7722, E26-12; M7723, E30-12; M7728, E68-12.	Figure 6-56
		KB HOLD flip-flop E51	Check KBH-H at M7722, E51-8; M7723, E22-6; M7728, E30-6 for a high (KBH must be high for any printable character).	Figure 6-38
	Keyboard	CTRL and Bell keys	Check keyboard keys	
6. No printout when "\" (slash) key is pressed; head does not move (LINE/LOC switch in LOC).	Logic board	PNTABL HI signal	Check the following:	Paragraph 6.1.1.5
			M7722, E25-10 M7723, E44-8 M7728, E61-6	PNTABL H = Approximately +4 V PNTABL = Approximately 0.8 V

Table 6-4 Troubleshooting Chart (Cont)

Symptom	Problem Area	Probable Cause	Action	Reference
7. No printout when "\" (slash) key is pressed. However, carriage moves across carriage bar and head solenoids sound as if they are firing.	Carriage	Carriage Adjustment lever is not set correctly.	Perform impression adjustment.	Paragraph 3.4.2
	Ribbon	Ribbon	Replace ribbon.	Paragraph 3.5
	Ribbon assembly, ribbon feed does not reverse or feed.	Out of adjustment	Check and adjust.	Chapter 8
		Paper path not clear	Check and clear.	Chapter 8
	NOTE **Ribbon runs out of ink due to repeated printing on the same portion of the ribbon.**	Phase adjustment	Check and adjust.	Figure 7-28
	Print head	Head alignment	Align head.	Chapter 8
8. Print head does not fire when pressing "\" key. However, carriage moves across carriage bar.	Print head assembly	Print head cable.	Replace print head.	Chapter 7
		Broken print head boar	Replace print head.	Chapter 7
	Power board	Power fault	Check +21 V and -21 V at power board circuit R104 and R105. Replace appropriate components or power board.	
		Voltage reference	Check Q25-E.	Figure 6-49
		NOTE **Head will not fire if V reference equals -21 V.**		

Table 6-4 Troubleshooting Chart (Cont)

Symptom	Problem Area	Probable Cause	Action	Reference
8. Cont	Power board or logic board	HDE signal	Perform printable character test and observe waveforms	
	Logic board	MPC	Replace logic board.	
9. Missing dots when "\" key is pressed (always same row) (all printable characters that use the missing row)	Power board	No solenoid drive signals for missing row	Perform printing character test and check S1-S7 at appropriate pin on J6 while printing. Check appropriate test points in drive amplifier for that row.	Perform printable character test, Paragraph 6.1.1.5.
		No head select signals for missing row	Check HS1–HS7 at appropriate points on power board.	
	Logic board	No head select signals for missing row	Check HS1–HS7 at appropriate points on logic board.	Perform printable character test, paragraph 6.1.1.5.
		Failed head select drivers or bad cable between logic board and power board	**NOTE** **If missing at this point, indicates that bit is missing in CG ROM output.**	
	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:	Paragraph 7.3
		Open Solenoid winding	Check winding	Figure 6-66
		Print head cable	Check print head cable	
(always same row, same letters)	Logic board	CG ROM	Replace logic board.	Paragraph 7.24

Table 6-4 Troubleshooting Chart (Cont)

Symptom	Problem Area	Probable Cause	Action	Reference
10. Printer stops prior to completing a printed line	Printer mechanism	Printer mechanism out of alignment	Perform printer mechanism adjustment procedure.	Chapter 8
	Power board	Servo fuse F1 blown	Check, determine the following causes before replacing fuse:	
		Ribbon mechanism jammed near end of ribbon	Check, adjust, or replace.	Paragraph 7.7
		Carriage binding on poorly adjusted carriage shafts	Check, align, or replace.	Paragraph 7.5
		Broken timing belt	Replace.	Paragraph 7.4
		Timing belt off pulley	Check and correct. Replace belt if worn or frayed.	Paragraph 7.4
11. Printer operates in local but not on-line mode.	Interface or interface connectors	Connection problem	Check connectors.	
	Logic board (in current loop operation)	Improper jumpers on current loop converters	Check, correct.	Chapter 2
		Failure in isolator circuits	Perform current loop interface test and check:	Paragraph 6.1.2.1
			S. I.	Figure 6-60
			S. O.	Figure 6-61
			TRANSMIT at J3-5.	
	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:	Paragraph 6.1.2.2
			S. O. at E29-12	Figure 6-63
			S. I. at E66-6.	Figure 6-63

Table 6-4 Troubleshooting Chart (Cont)

Symptom	Problem Area	Probable Cause	Action	Reference
12. Loss of position (Figure 6-65) when printing multiple lines.	Power supply	+5 V supply	Check +5 V supply for ripple or spikes.	Table 6-5 Figure 6-67
	Encoder	Dust on encoder disc	Carefully clean off encoder disc	Paragraph 8-2
	Logic board		Replace logic board.	Chapter 7
13. Uneven print density across the page.	Print bar	Out of adjustment	Check and adjust	Paragraph 8.5
	Power board	V reference	Check Q25-E	Figure 6-49
Printing light in areas	Print bar	Pitted	Replace.	Chapter 7
	Carriage rods	Out of adjustment	Check and adjust	Chapter 8
Printing density progressively drops off to no impressions.	Ribbon drive assembly	Out of adjustment	Check and adjust.	Chapter 8
		Bad drive clutch	Repair or replace	Chapter 7
		Broken backstop spring	Replace.	Chapter 7
	Print head	Out of adjustment	Check and adjust.	Chapter 7
Ribbon does not reverse	Ribbon feed does not reverse or feed	Broken ratchet tooth	Replace ratchet wheel	Chapter 7
		Push rod disengaged	Correct	Chapter 7
		Interposer adjustment	Adjust.	Chapter 7
Paper jams	Tractors	Out of adjustment	Check and adjust.	Chapter 8
		Paper path not clear	Check and adjust	Chapter 8
		Phase adjustment	Check and adjust.	Chapter 7
	Paper	Bad batch of paper	Replace paper	

Figure 6-65 Example of Lost Position (reduced 50 percent)

The microprogrammed controller (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.

Check all fuses and power supply voltages before beginning to troubleshoot. Fuse locations are shown in the Illustrated Parts Breakdown (Appendix B). Power supply voltages are shown in Table 6-5 and in Figure 6-67. Voltage measurements are referenced to ground unless otherwise indicated.

Table 6-5 DC Supply Voltages

Voltage		Tolerance (Volts)	Power Board Test Points	Current (Amps)
+5		±0.25	+5 V terminal	2.0
+12		±0.6	J1-3 (C16+)	0.2
-12		±0.6	J1-19 (C18-)	0.17
+21	(See note)	±5	R104 Bottom	5.0
-24		±2	R104 Bottom	
-21	(See note)	±5	R105 Bottom	5.0
-24		±2	R105 Bottom	

NOTE

21 V supply is 24 V on all printers with a constant voltage transformer.

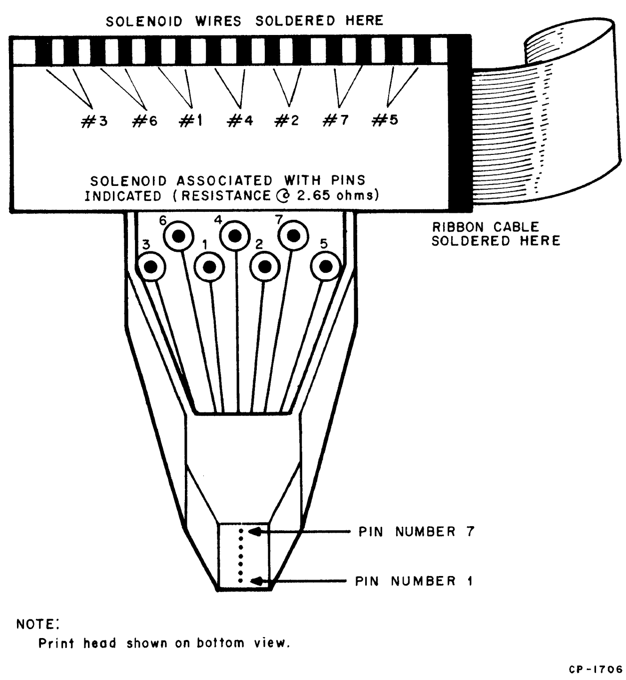


Figure 6-66 Print Head Solenoid Resistance Measurement

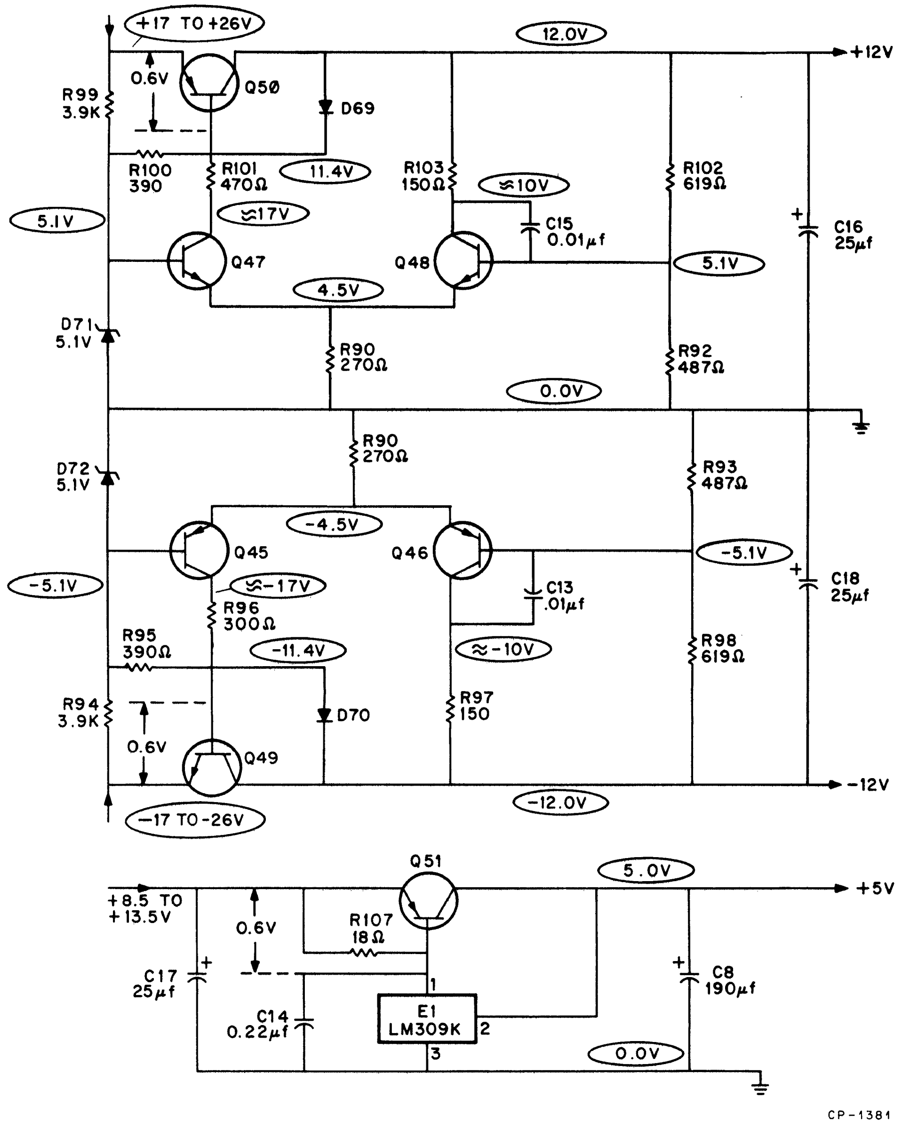


Figure 6-67 Typical Voltages for Power Supply Regulators

CHAPTER 7
MECHANICAL SERVICING

7.1 GENERAL
This chapter contains information pertaining to the removal, replacement, and adjustment of the mechanical subassemblies of the LA36/LA35.

NOTE
The procedures for servicing the LA36 can be used to service the LA35.

Figure 7-1 lists all the removal procedures in this chapter and the sequence in which these procedures are performed. As an example, Figure 7-1 illustrates that to remove the timing belt, the printer housing and print head removal procedures must be performed first.

DEC Field Service recommends that the following LA36 assemblies be replaced in their entirety in a field environment.

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

7.2 PRINTER HOUSING
The following procedure describes the removal and installation of the printer housing.

7.2.1 Printer Housing Removal

1. Remove power from the printer by disconnecting the ac plug.

2. Remove the printer paper and printer cover.

3. Remove the eight (6-18) screws and flat washers that secure the printer housing to the cabinet base (Figure 7-2) and set them aside.

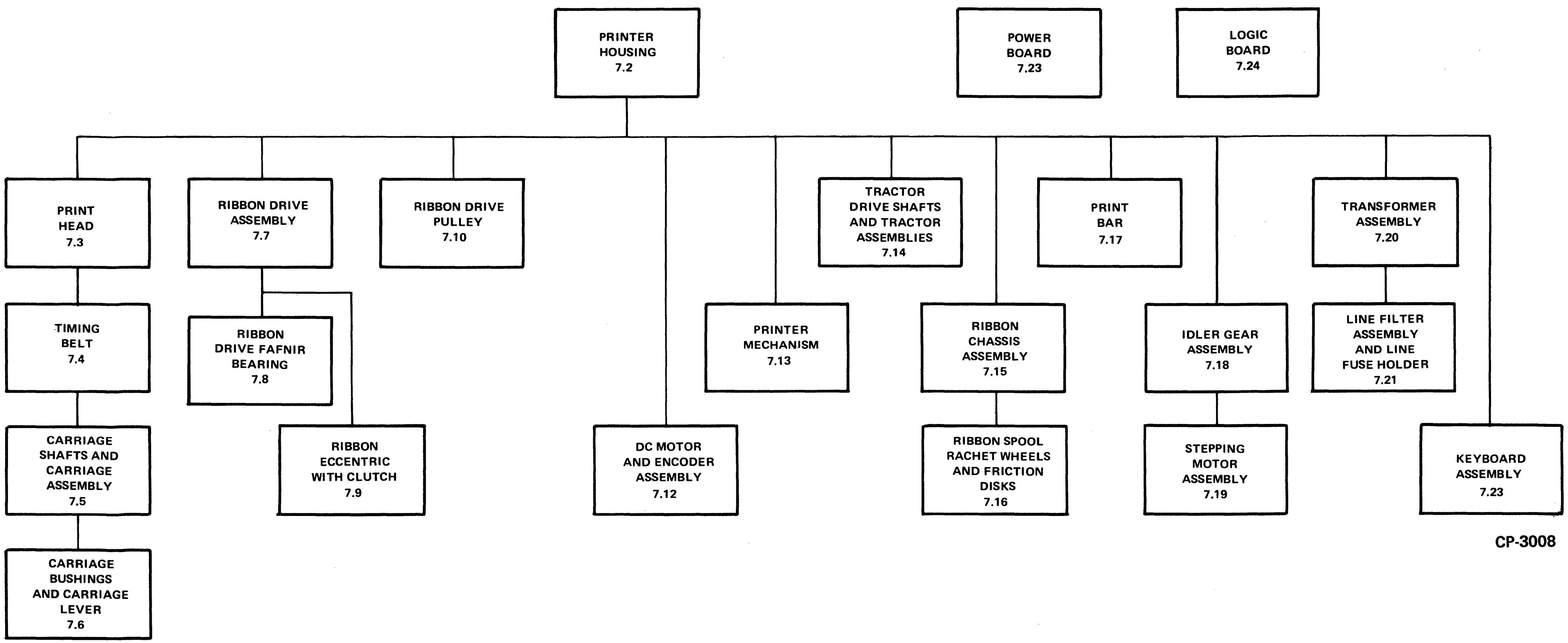


Figure 7-1 Assembly Removal Sequence

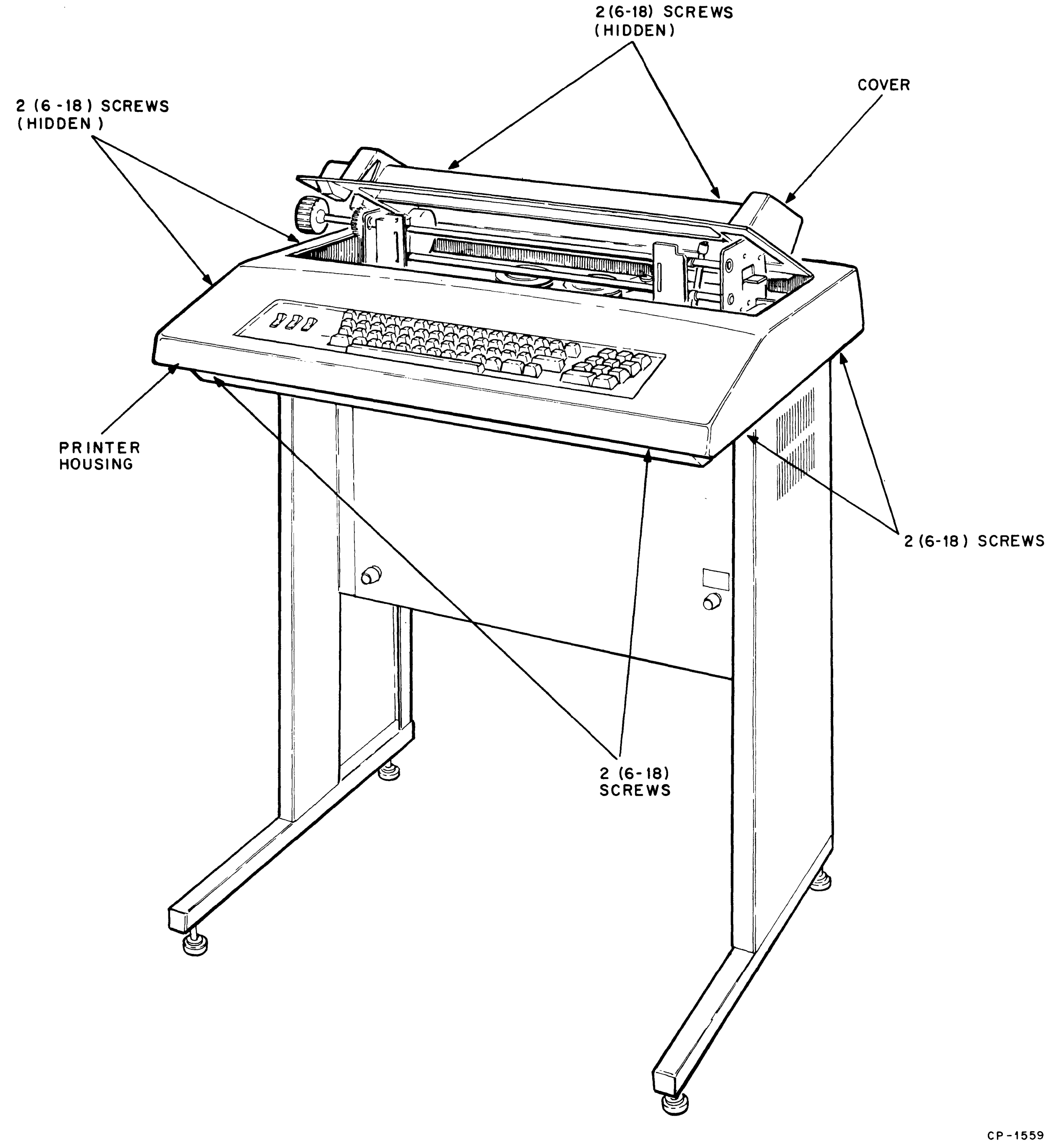


Figure 7-2 Printer Housing Removal

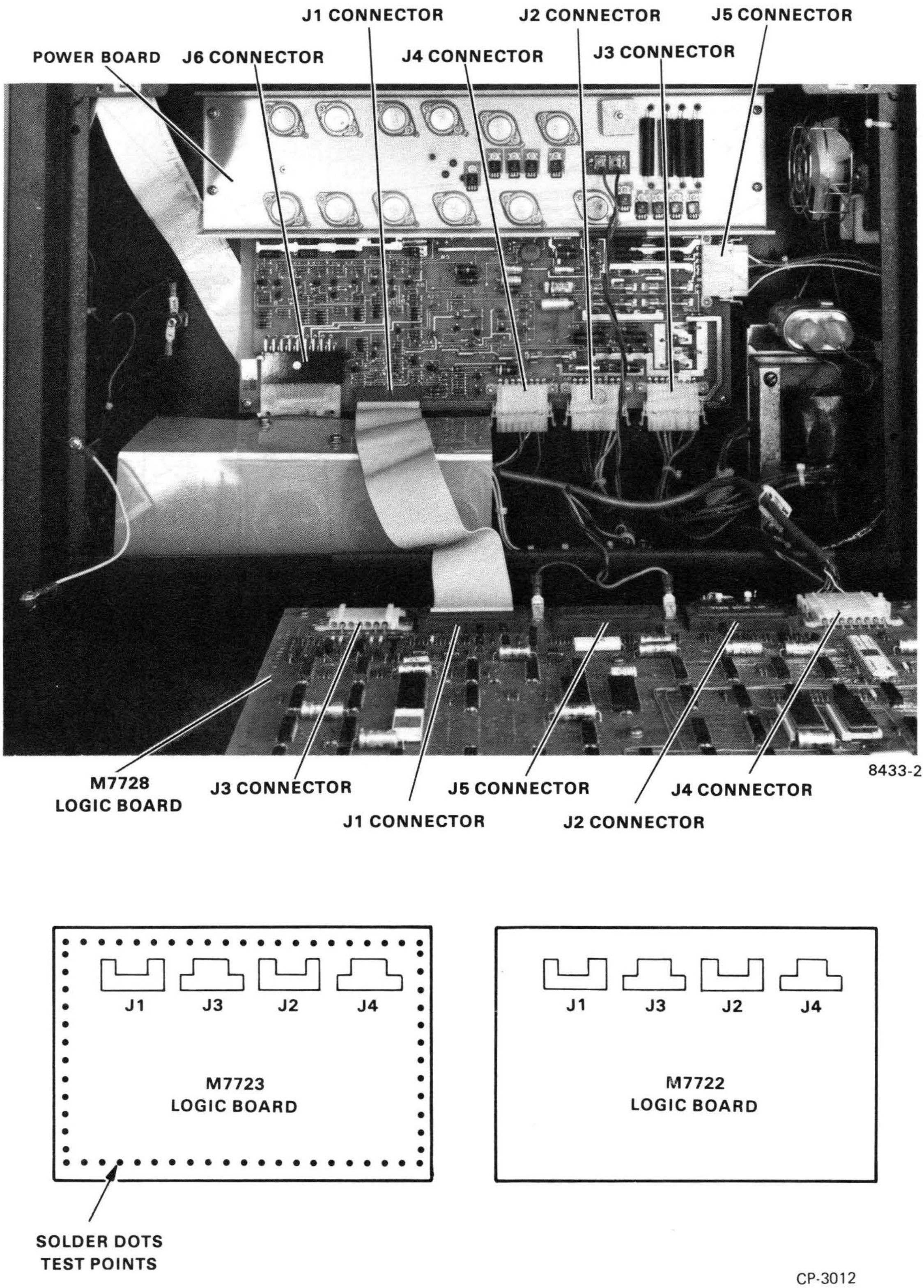


Figure 7-3 Power Board Connectors

7.2.2 Printer Housing Installation

1. Place the printer housing on the cabinet base and secure it with the eight (6-18) screws and flat washers. Torque the screws to 5.5 ± 1 in-lb.

2. Install the printer paper and cover.

3. Restore power.

7.3 PRINT HEAD ASSEMBLY

The following procedure describes the removal and installation of the print head assembly. When installing the print head, carriage alignment is checked and the print head is aligned. Failure to perform these procedures will shorten the head life and cause poor print quality.

7.3.1 Print Head Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).

2. Remove the ribbon spools and ribbon.

3. Open the rear access door on the cabinet.

4. Disconnect the ribbon cable connector from J6 on the power board (Figure 7-3).

5. Pull the ribbon cable from under the power board and up through the slot at the rear of the cabinet.

6. Remove the four (4-40) screws and kep nuts that secure the two ribbon cable clamps to the cabinet base (Figure 7-5).

7. Remove the four (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 7-4).

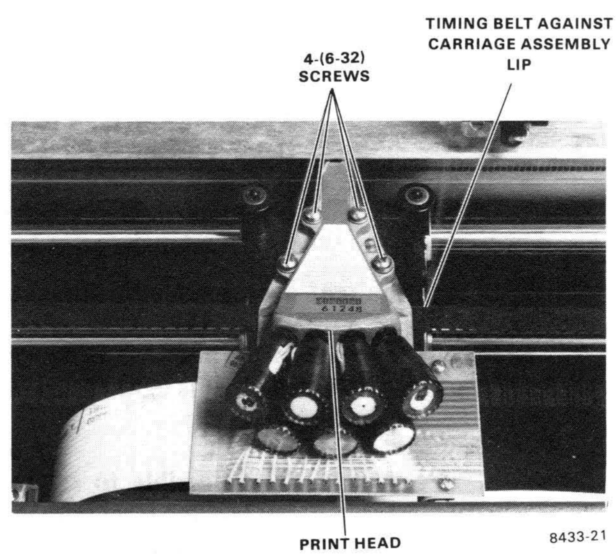


Figure 7-4 Print Head Removal

7.3.2 Print Head Installation

1. Dress the print head ribbon cable as shown in Figure 7-5 and secure the two ribbon cable clamps and terminal strip to the cabinet base with the four (4-40) screws and lockwashers.

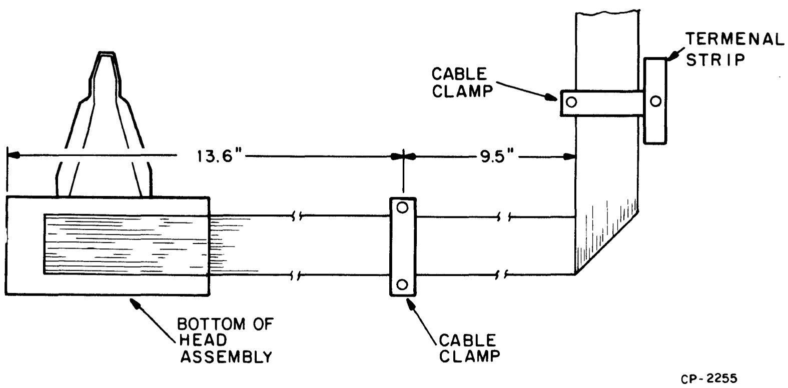


Figure 7-5 Print Head Cable

2. 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 (Figure 7-3).

   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. If you can place your finger in the cable loop (under the print head), there is adequate slack.

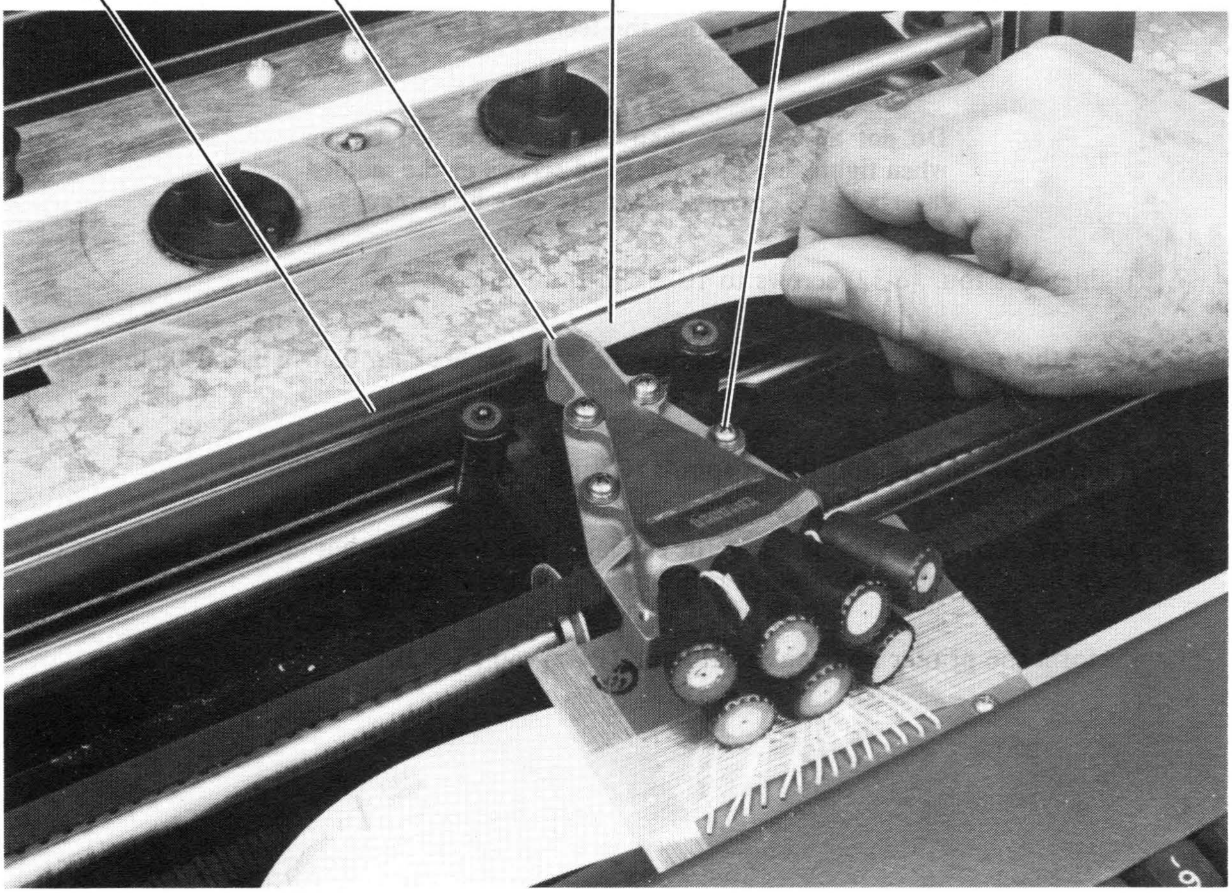
3. Close the rear access door on the cabinet.

4. Secure the new print head with the four (6-32) screws, lockwashers, and flat washers, ensuring that the timing belt is against the plastic lip (Figure 7-4). Make the screws finger tight.

   CAUTION
   It is possible to set the Carriage Adjustment lever beyond the minimum gap position. If this is down, the correct head gap adjustment cannot be made.

5. Set the Carriage Adjustment lever to the minimum gap position (detent closest to the print bar).

   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 0.3048 mm (0.012 inch) of clearance.



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 7-6 Print Head Adjustment

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 0.3048 mm (0.012 inch) of clearance.

6. Adjust the print head gap with the carriage in the center of travel. Place the 0.3048 mm (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 7-6).

CAUTION

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

7. Tighten the four (6-32) screws to 10 ±2 in-lb of torque.

8. Move the print head to the extreme right or left and check for 0.3048 ± 0.0508 mm (0.012 ± 0.002 inch) clearance.

9. Replace the ribbon and ribbon spools (Chapter 3).

10. Slide the carriage assembly along the carriage shaft to ensure that nothing is binding. Check to ensure that the ribbon is not rubbing against the line indicator.

11. Perform the printer housing installation (Paragraph 7.2.2).

7.4 TIMING BELT

The following procedure describes the removal and installation of the timing belt.

7.4.1 Timing Belt Removal

1. Perform the printer housing removal procedure (Paragraph 7.2).

2. Perform the print head removal procedure (Paragraph 7.3).

3. Push the carriage assembly to the extreme left. Slip the timing belt off the dc motor pulley while turning the pulley clockwise. Remove and discard the timing belt.

7.4.2 Timing Belt Installation

1. With the belt tension spring (Figure 7-7) in place, press the left-hand pulley against the printer mechanism and slip on the new timing belt.

NOTE

Earlier versions of the LA36 do not contain timing belt screws.

2. Rotate the timing belt screw until it just touches the ribbon drive assembly. Screws should not exert pressure on the ribbon drive assembly.

3. Perform the print head installation procedure (Paragraph 7.3).

4. Perform the printer housing installation procedure (Paragraph 7.2).

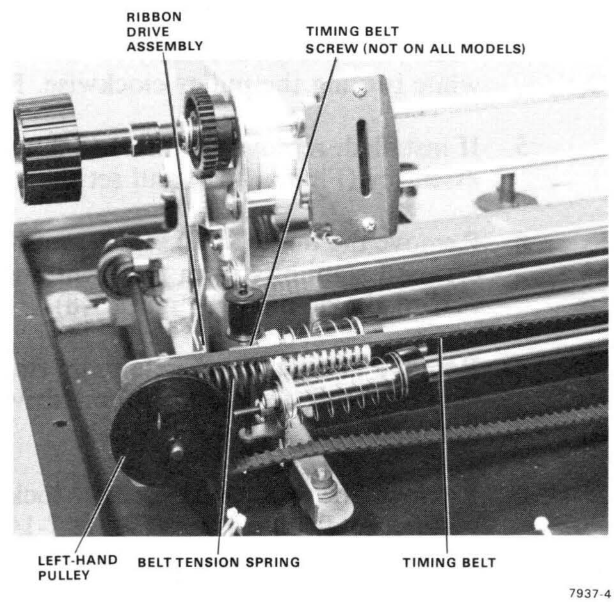


Figure 7-7 Belt Tension Spring Location

7.5 CARRIAGE ASSEMBLY AND CARRIAGE SHAFTS

The following procedure describes the removal and installation of the carriage assembly and/or the carriage shafts. The carriage shafts must be removed first in order to replace the carriage assembly.

7.5.1 Carriage Assembly and Carriage Shafts Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).
2. Remove the ribbon spools and ribbon.
3. Remove the four (6-32) screws, lockwashers, and flat washers that secure the print head to the carriage (Figure 7-4). Set the print head carefully on the cabinet base.
4. Push the carriage assembly to the extreme left. Slip the timing belt off the dc motor pulley while turning the pulley clockwise. Remove the belt.
5. If installed, remove the three (8-32) screws, washers, and lockwasher from the top of form assembly (Figure 7-18) and set the assembly aside.
6. Remove the three (8-32) screws, washers, and standoffs from the front and rear of the dc motor (Figure 7-8).
7. Remove the pushrod retaining ring (Figure 7-14) from the ribbon drive assembly.
8. Remove the one (8-32) screw, lockwasher, and flat washer (Figure 7-14) that secure the ribbon drive assembly to the upper pivot tab.
9. Remove the ribbon drive assembly by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up the ribbon drive assembly to clear the tab and remove.

NOTE
The nut on top of ribbon drive assembly is loose and can be easily lost.

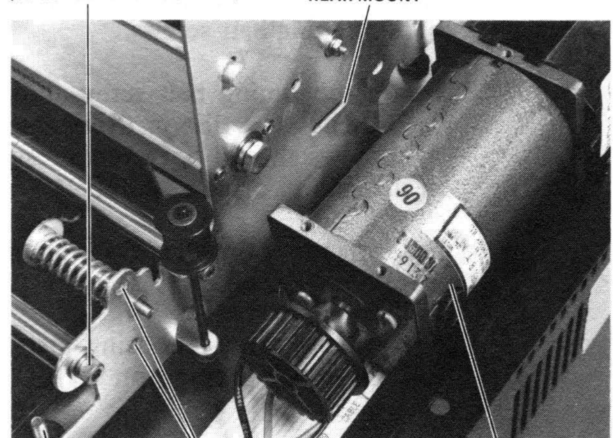


Figure 7-8 Carriage Shaft Screw Access

10. Mark both ends of each carriage shaft so that they may be reinstalled in their original position, if applicable.

11. Remove the two (10-32) screws, lockwashers, and flat washers connecting the front of the printer mechanism (Figure 7-8) to the cabint base.

12. Loosen the 7/16 hex-head (1/4-20) screw securing the print bar to the right-hand side plate approximately 5.8 mm (1/8 inch) (Figure 7-9).

NOTES

1. Record the location of any carriage shaft shims observed when removing the carriage shafts.

2. The oiler springs are connected to the end plates and are not part of the carriage assembly.

13. Remove the four (10-32) Allen-cap screws, split lockwashers, and flat washers from the ends of the two carriage shafts (Figure 7-9).

14. While holding the carriage shafts, gently tap the inside of the right-hand side plate with a wood or plasic mallet directly above the print bar (Figure 7-10). Lift up and pull out the carriage shaft or shafts from the oiler springs and the side plate.

15. Remove the defective carriage assembly or carriage shaft.

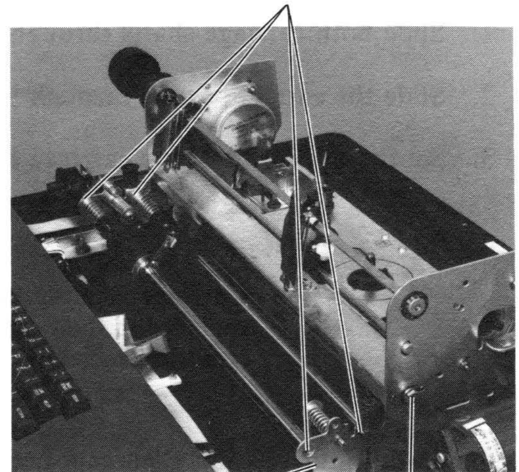


Figure 7-9 Carriage Shaft Removal

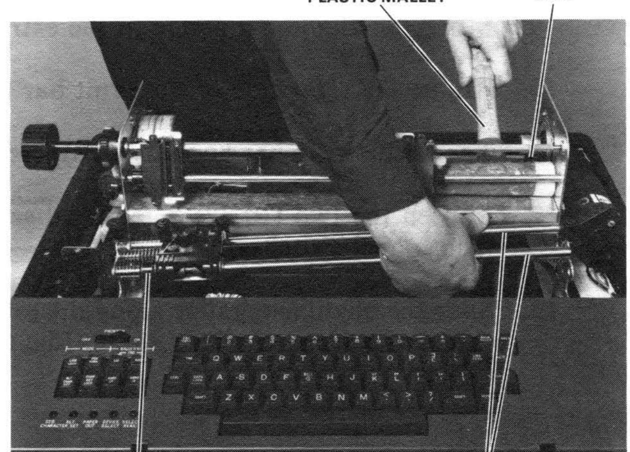


Figure 7-10 Printer Mechanism End Plate Loosening

7.5.2 Carriage Assembly and Carriage Shaft Installation

1. Slide both carriage shafts through the carriage assembly.
2. Slide the carriage shafts through the oilers (Figure 7-10) to the left end plate.
3. Set the other end of the carriage shafts into the right-hand end plate.

NOTE
Carriage shafts, when being installed, are to be replaced in their original positions, as marked in the removal procedure.

4. Install four (10-32) Allen-cap screws, flat washers, and lockwashers through the end plates and secure the carriage shafts.
5. Install the carriage shaft shims (if any) in the location observed during the removal procedure.
6. Hand tighten the screws, ensuring that the carriage shafts are seated in the end plates.
7. Torque the two carriage shafts to 18 ± 2 in-lb.
8. Set the alignment gauge on the extreme left side of the carriage shafts and zero the gauge by rotating the gauge bezel (Figure 7-5).
9. Move the alignment gauge to the extreme right of the carriage shafts.
10. Adjust the right side of the print bar to obtain an indication of 0 ± 0.0005 on the gauge.
11. Torque the 7/16 hex head (1/4-20) screw on the right side of the print bar to 75 ± 2 in-lb.
12. Loosen the two (10-32) Allen-head screws on the front carriage shaft (shaft closest to the front panel switches).
13. Slide the alignment gauge along the total length of the carriage shafts. It may be necessary to rotate the front carriage shaft (Figure 7-11), and/or add shims to obtain the following values:

    - The maximum deviation along the entire length of the carriage shafts is 0.004 (total indicator reading), with the two ends of the carriage shafts readings equal within 0.0015 inch.

14. Torque the front carriage shaft to 18 ± 2 in-lb and check the tolerances listed in step 13. Loosen the front carriage shaft and repeat step 13 if necessary.
15. Secure the dc motor with three (8-32) screws, washers, and standoffs. Torque to 18 ± 2 in-lb.
16. If applicable, secure top of form bracket assembly with three (8-32) screws, washers, and lockwashers. Torque to 18 ± 2 in-lb.

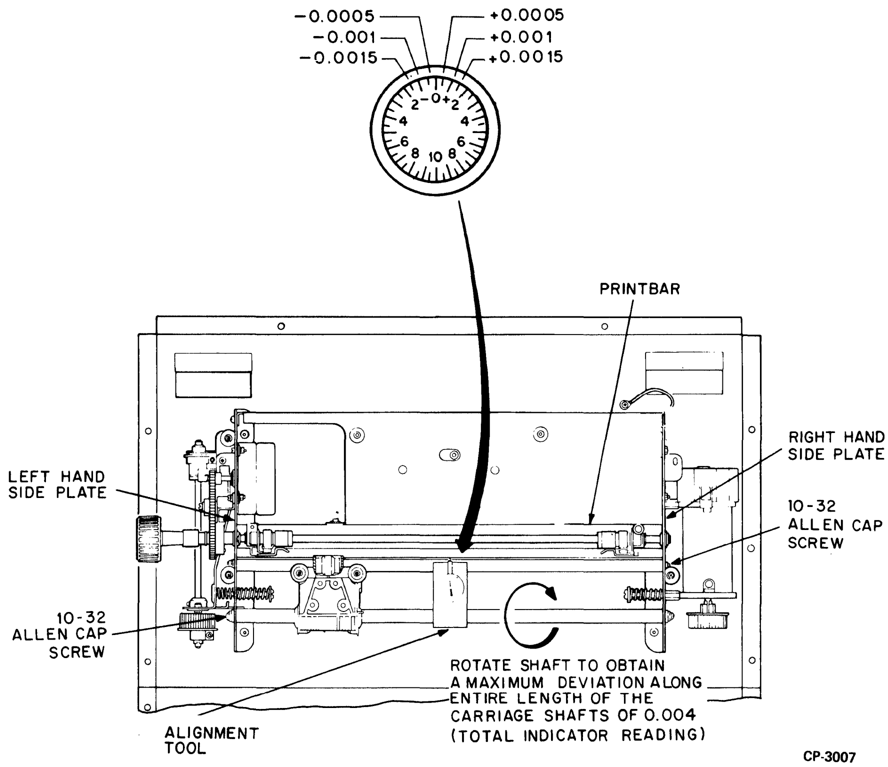


Figure 7-11 Carriage Shaft Parallelism/Alignment

17. Secure the front of the printer mechanism with two (10-32) screws, flat washers, and lock-washers. Torque to 5 ± in-lb.

NOTE
When installing the ribbon assembly, ensure that the PAPER OUT switch wires are under the pushrod.

18. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 7-14).

19. Move the ribbon assembly pushrod through the left-hand side plate. Move the rear of the ribbon drive assembly toward the side plate and engage the lower pivot point.

20. Slide the upper pivot point under the pivot tab on the side plate and secure with one (8-32) screw, lockwasher, and flat washer; hand tighten.

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

22. Insert the belt tension spring between the left-hand side plate and the ribbon drive assembly.

23. Slip the timing belt on the ribbon drive pulley and the dc motor pulley.

24. 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 7-15).

25. 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-lb of torque.

NOTE
The eccentric tab should be bent at a 90 degree angle (Figure 7-15) when viewed from the left side of the unit. If the angle is not at 90 degrees, bend to the correct angle. This is done to prevent the tab from touching the spring [0.254 to 0.508 mm (0.010 to 0.020 inch) clearance].

26. Perform the print head installation procedure (Paragraph 7.3.2).

27. Check the printer mechanism alignment (Chapter 8).

28. Perform the printer housing installation procedure (Paragraph 7.2.2).

7.6 CARRIAGE BUSHING AND CARRIAGE LEVER

The following procedure describes the removal and installation of the carriage bushing and carriage lever. To perform this procedure, the carriage assembly must be removed from the carriage shafts.

7.6.1 Carriage Bushing and Carriage Lever Removal

1. Perform the carriage assembly and carriage shafts removal procedure (Paragraph 7.5.1).

2. Place the carriage assembly on a workbench.

3. Remove the plain bushing (Figure 7-12).

4. To remove the eccentric bushing or carriage lever, set the lever to the position shown in Figure 7-13 and pry off one side of the carriage lever.

NOTE
Do not bend the carriage lever further than necessary.

5. Pull off the carriage lever and remove the eccentric bearings.

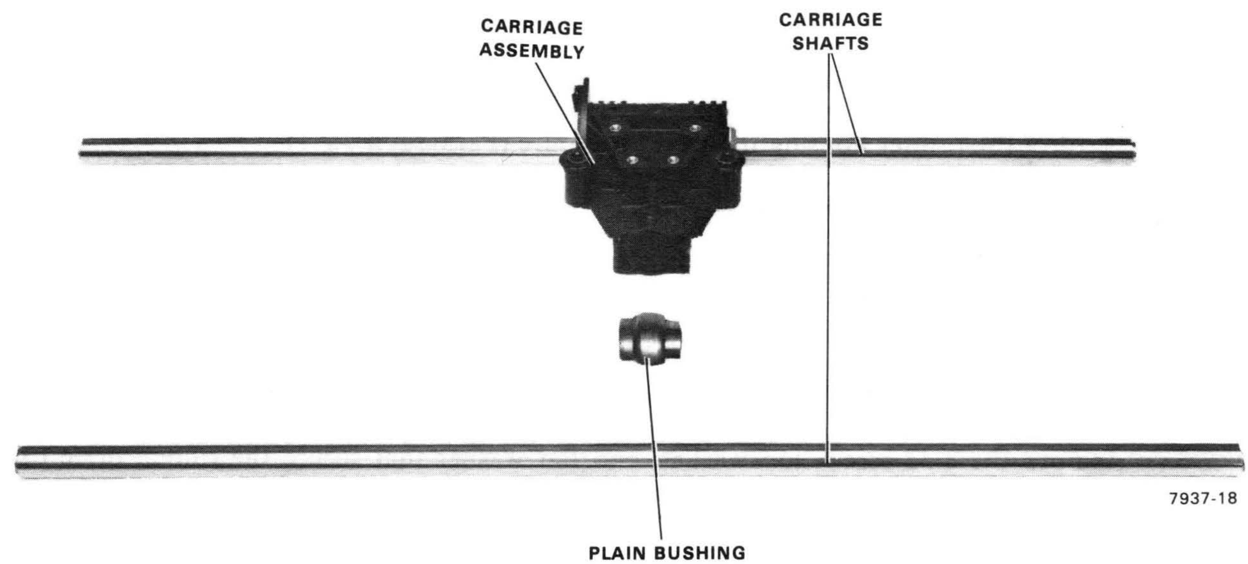


Figure 7-12 Plain Bushing and Spring Replacement

7.6.2 Carriage Bushing and Carriage Lever Installation

1. Install the new eccentric bushing in the carriage assembly.

2. Align the slots in the bushing with the carriage lever and snap the carriage lever into the carriage assembly (Figure 7-13). Set the carriage lever to the no. 1 position.

3. Insert the plain bushing into the carriage assembly (Figure 7-12).

4. Perform the carriage assembly and carriage shafts installation procedure (Paragraph 7.5.2).

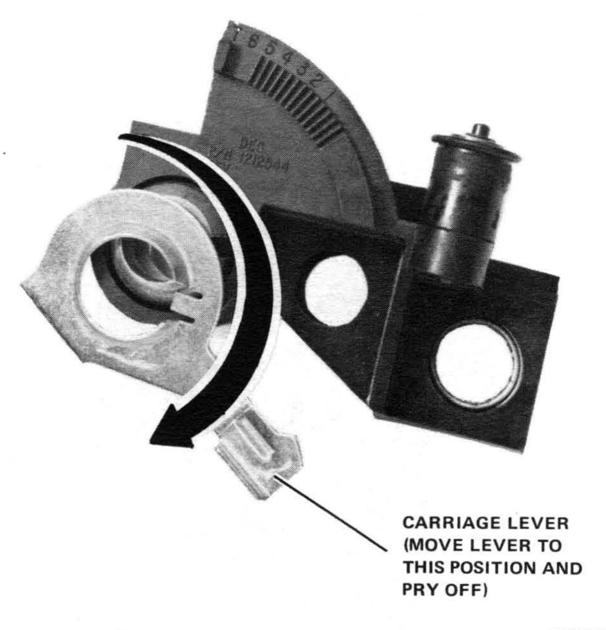


Figure 7-13 Carriage Lever
and Eccentric Bearing Replacement

7.7 RIBBON DRIVE ASSEMBLY

The following procedure describes the removal and installation of the ribbon drive assembly.

7.7.1 Ribbon Drive Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).
2. Remove the ribbon spools and ribbon.
3. Slip the timing belt off the dc motor pulley.
4. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 7-14).
5. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 7-14).
6. 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 7-14).
7. 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.

NOTE
The nut on ribbon drive assembly is loose and can be easily lost.

8. Carefully remove the ribbon drive and the pushrod.

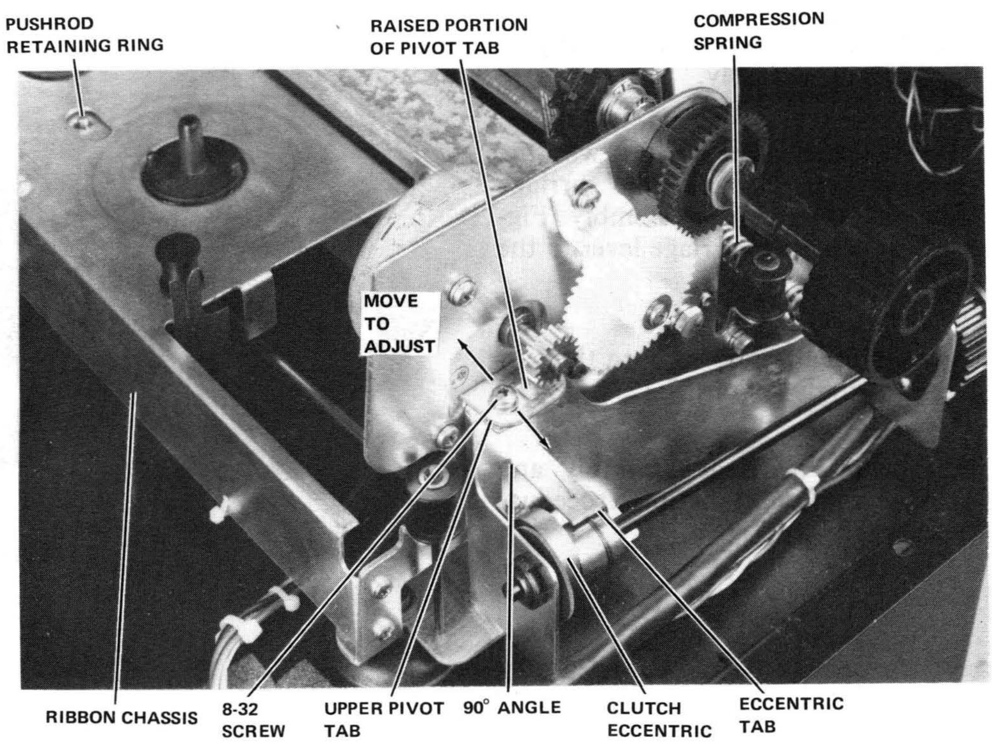


Figure 7-14 Ribbon Drive Assembly Removal

7.7.2 Ribbon Drive Assembly Installation

1. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point (Figure 7-14).

NOTE
Ensure that the PAPER OUT switch wires are under the pushrod when installing the ribbon drive assembly.

2. Push the pushrod through the left-hand side plate.

3. Push the rear of the drive assembly toward the side plate and engage the lower pivot point.

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

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

6. Insert the compression spring between the left-hand side plate and the ribbon drive.

7. Replace the timing belt on the ribbon drive pulley and the dc motor pulley.

8. 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 7-15).

9. 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-lb of torque.

NOTE
The eccentric tab should be bent at a 90 degree angle (Figure 7-14) when viewed from the left side of the unit. If the angle is not at 90 degrees, bend it to the correct angle. This is done to prevent the tab from touching the spring [0.254 to 0.508 mm (0.010 to 0.020 inch) clearance].

10. Replace the ribbon and ribbon spools.

11. Perform the printer housing installation procedure (Paragraph 7.2.2).

7.8 RIBBON DRIVE FAFNIR BEARING

The following procedure describes the removal and installation of the ribbon drive Fafnir bearing. To perform this procedure, the ribbon drive assembly must be removed.

7.8.1 Ribbon Drive Fafnir Removal

1. Perform the ribbon drive assembly removal procedure (Paragraph 7.7.1).
2. Loosen the 6-32 Allen-head screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 7-17).

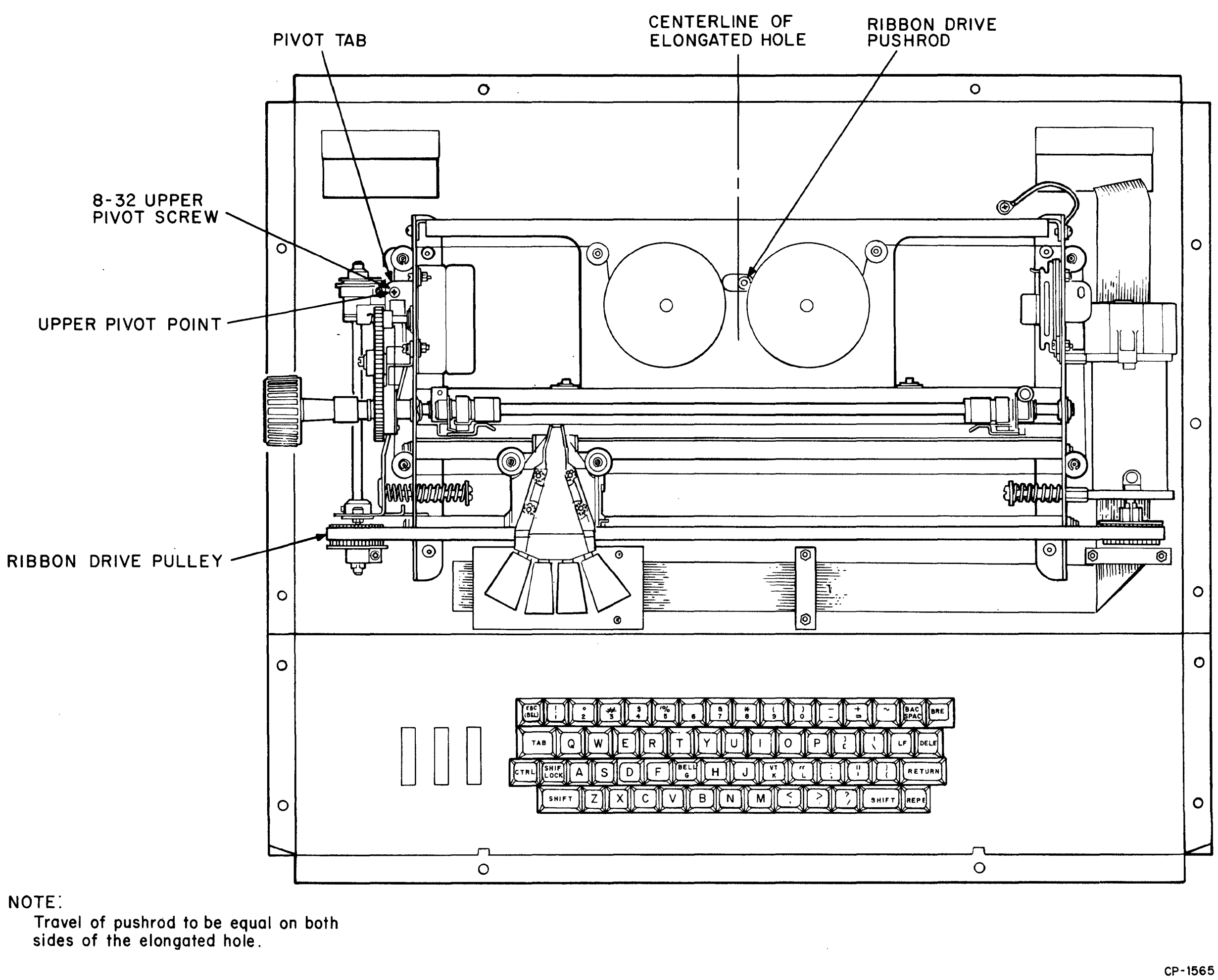


Figure 7-15 Ribbon Drive Adjustment

3. Remove the two (8-32) screws, nuts, and lockwashers that secure the Fafnir bearing to the ribbon drive bracket (Figure 7-16).

4. Loosen the 4-40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 7-16).

5. 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 the counterclockwise direction when pushing through the one-way clutch.)

6. Remove the Fafnir bearing from the ribbon drive shaft and set the bearing aside.

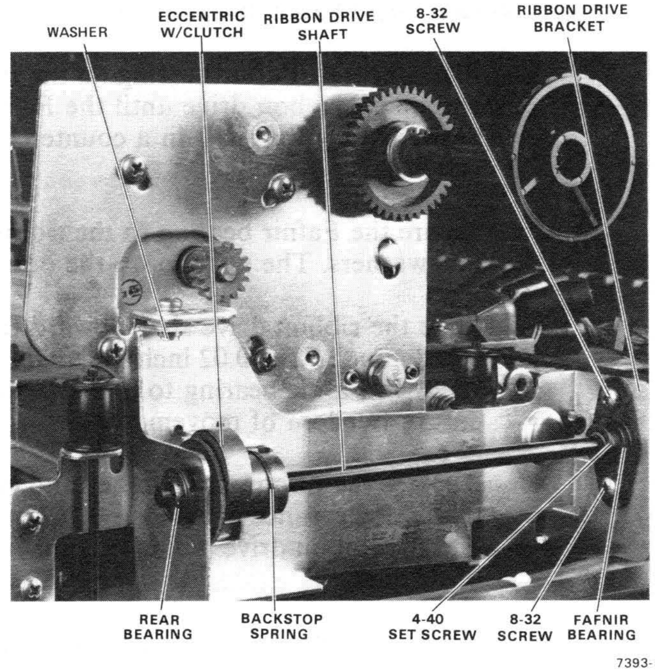


Figure 7-16 Fafnir Bearing Removal

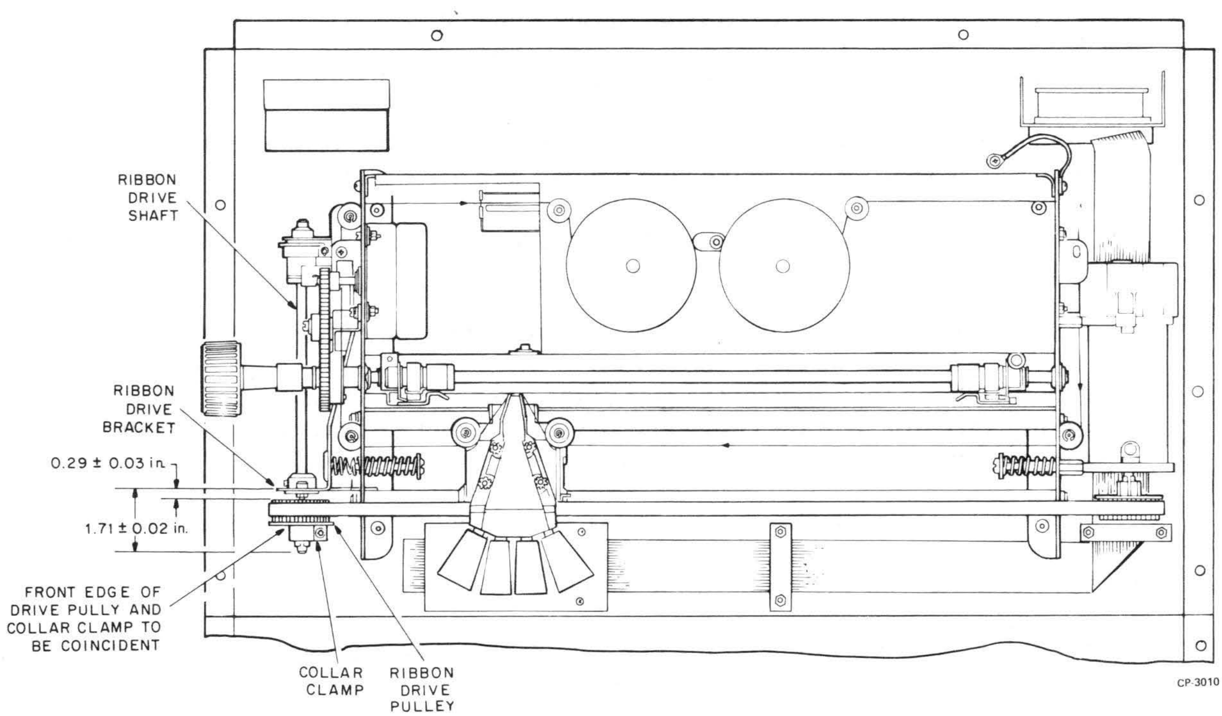


Figure 7-17 Ribbon Drive Shaft Adjustment

7.8.2 Ribbon Drive Fafnir Installation

1. 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.)

2. Secure the Fafnir bearing to the ribbon drive bracket with the two (8-32) screws, nuts, and lockwashers. The nuts go on the outside of the ribbon drive bracket.

3. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 43.434 ± 0.508 mm (1.71 ± 0.02 inch) beyond the ribbon drive bracket (Figure 7-17). Tighten the 4-40 screw-in Fafnir bearing to 8 ± 1 in-lb of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.

4. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust them to give a clearance of 7.366 ± 0.762 mm (0.29 ± 0.03 inch) between the ribbon drive bracket and the ribbon drive pulley (Figure 7-17). Tighten the 6-32 Allen-head screw to 12 ± 2 in-lb of torque.

5. Check that the coils of the backstop spring do not overlap.

6. Perform the ribbon drive assembly installation procedure (Paragraph 7.7.2).

7.9 RIBBON ECCENTRIC WITH CLUTCH/BACKSTOP SPRING

The following procedure describes the removal and installation of the ribbon eccentric with the clutch/backstop spring. To perform this procedure, the ribbon drive assembly must be removed.

7.9.1 Ribbon Eccentric with Clutch/Backstop Spring Removal

1. Perform the ribbon drive assembly removal procedure (Paragraph 7.7.1).

2. Loosen the 6-32 Allen-head screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley.

3. Loosen the 4-40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 7-16).

4. Remove the retaining ring that holds the pushrod in the ribbon eccentric (Figure 7-17).

5. Slide the ribbon shaft toward the rear of the ribbon drive assembly until it clears the Fafnir bearing, eccentric with the clutch and the rear bearing. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)

6. Remove the backstop spring from the ribbon eccentric with the clutch (Figure 7-16).

7.9.2 Ribbon Eccentric with Clutch/Backstop Spring Installation

1. Install the backstop spring on the new ribbon eccentric with the clutch or backstop spring. Apply one drop of No. 30 SAE oil on the spring.

2. Slide the pushrod into the ribbon eccentric and replace the retaining ring.

3. With the clutch, eccentric, and backstop spring assembled, engage the backstop spring in the clutch retaining tab.

4. 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.)

5. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 43.434 ± 0.508 mm (1.71 ± 0.02 inch) beyond the ribbon drive bracket (Figure 7-17). Tighten the 4-40 screw-in Fafnir bearing to 8 ± 1 in-lb of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.

6. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust them to give a clearance of 7.366 ± 0.762 mm (0.29 ± 0.03 inch) between the ribbon drive bracket and the ribbon drive pulley (Figure 7-17). Tighten the 6-32 screw to 12 ± 2 in-lb of torque.

7. Check that the coils of the backstop spring do not overlap.

8. Perform the ribbon drive assembly installation procedure (Paragraph 7.7.2).

7.10 RIBBON DRIVE PULLEY

The following procedure describes the removal and installation of the ribbon drive pulley.

7.10.1 Ribbon Drive Pulley Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).

2. Slip the timing belt off the dc motor pulley.

3. 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 7-17).

7.10.2 Ribbon Drive Pulley Installation

1. Remove the collar clamp from the defective pulley and hand press it onto the new drive pulley (front edges of the collar clamp and drive pulley to be coincident) (Figure 7-17).

2. Replace the ribbon drive pulley and the collar clamp on the ribbon drive shaft and adjust them to give a clearance of 7.366 ± 0.762 mm (0.29 ± 0.3 inch) between the ribbon drive bracket and the ribbon drive pulley (Figure 7-17). Tighten the 6-32 screw to 12 ± 2 in-lb of torque.

3. Slip the timing belt onto the pulleys.

4. Perform the printer housing installation procedure (Paragraph 7.2.2).

7.11 DC MOTOR AND ENCODER ASSEMBLY

The following procedure describes the removal and installation of the dc motor and encoder assembly. After completion of the dc motor and encoder installation, the encoder must be adjusted.

NOTE

If applicable, the top of form assembly must be removed to gain access to the dc motor rear mounting screw.

7.11.1 DC Motor and Encoder Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).
2. Remove the ribbon spools and ribbon.
3. Remove the 4-40 screw and nut from the terminal strip (Figure 7-18).
4. Slip the timing belt off the dc motor pulley.
5. Remove the dc motor cables from the cable clamps and fuse holder, and disconnect J4 from the power board. Cut any cable ties associated with the dc motor cable.
6. Remove the three (8-32) screws and hex standoffs that secure the dc motor to the right-hand side plate and remove motor (Figure 7-19).
7. If applicable, disconnect the ground wire from the dc motor.

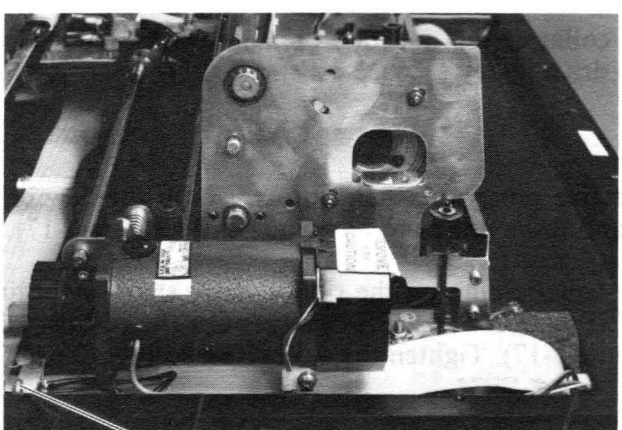


Figure 7-18 DC Motor/Encoder Cabling

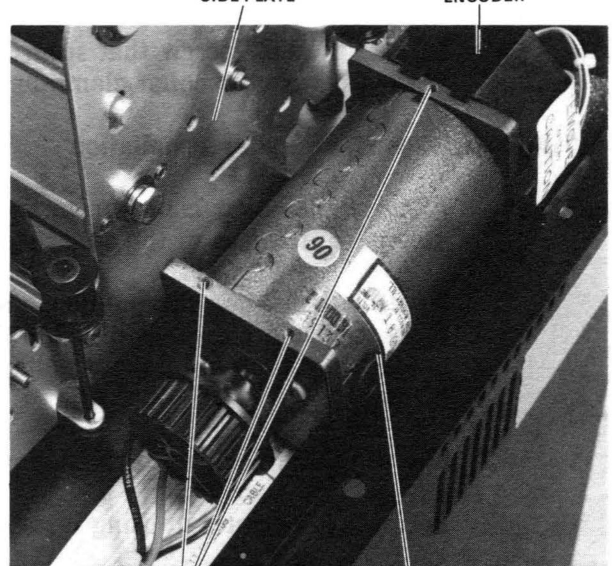


Figure 7-19 DC Motor/Encoder Removal

7.11.2 DC Motor and Encoder Assembly Installation

1. If applicable, connect the ground wire to the new dc motor.

2. Secure the new dc motor to the right-hand side plate with the three (8-32) screws and hex standoffs. Tighten the screws to 18 ± 2 in-lb.

3. Secure the capacitor terminal strip with a 4-40 screw and nut. Torque the 4-40 screw to 8 ± 1 in-lb.

4. Thread the dc motor and encoder cables down through the slot at the rear of the cabinet.

5. Secure the cables in the cable clamp and the fuse holder. Reconnect the connector to J4 on the power board.

7.11.3 Encoder Electrical Adjustment

The dc motor and encoder assembly *must* be checked after installation for the correct waveform timing relationships. If necessary, the encoder can be adjusted to achieve the correct timing relationships.

NOTE
If applicable, tape down cover interlock to perform adjustment.

1. Set up the scope as follows:

   - Volts/Division: 1 V
   - Time Division: approximately 20 μs

2. Disconnect the wire from the power board to the servo fuse holder. Using a test lead, connect +5 V from the logic board to the servo fuse holder.

3. Connect scope CH1 probe to M7722 E6-6, M7723 E2-6, or M7728 E18-6

4. Connect scope CH2 probe to M7722 E6-8, M7723 E2-8, or M7728 E18-8.

NOTE
The timing belt must be off the dc motor pulley when performing this procedure.

5. Carefully remove the encoder's protective cover. Do not apply any pressure to the disk when removing the cover.

6. Restore power to the LA36 (set the POWER switch to ON). The motor will rotate clockwise as viewed.

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 degrees.

7. Select channel 1, set it vertical to C1, and trigger the source to the channel 1.

8. Adjust the scope for one duty cycle full scale (Figure 7-20). Observe the duty cycle.

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

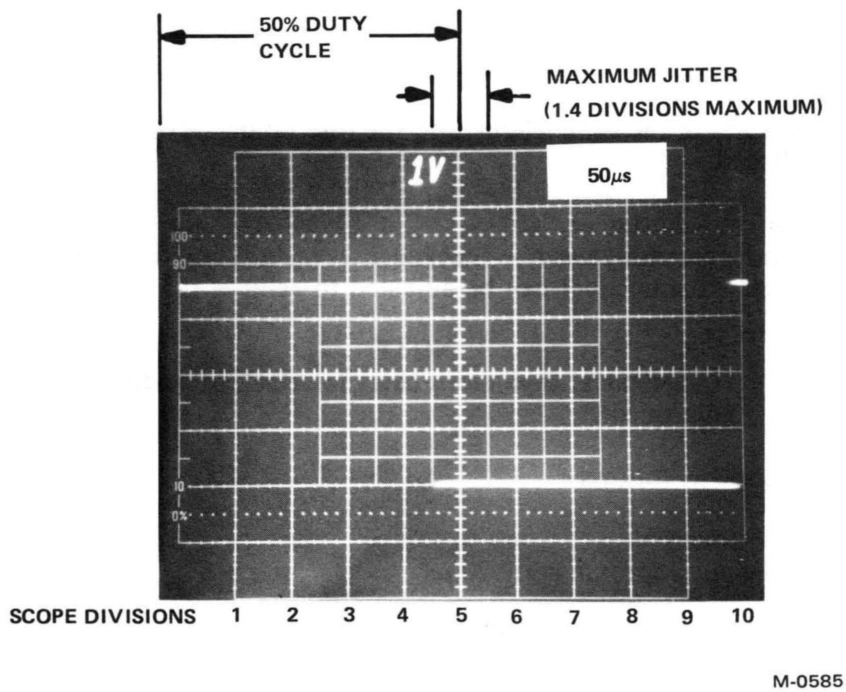


Figure 7-20 Encoder 50 Percent Duty Cycle Waveshape

9. If the channel 1 signal (Figure 7-20) does not have a 50 percent duty cycle (jitter included), adjust R1 on the encoder assembly (Figure 7-21).

10. Check the channel 1 jitter (Figure 7-20). The maximum allowable jitter is 1.4 divisions (or ±0.7 division).

11. Select channel 2, set vertial to C2, and trigger the source to channel 2.

12. Adjust the scope for one duty cycle full scale (Figure 7-20). Observe the duty cycle.

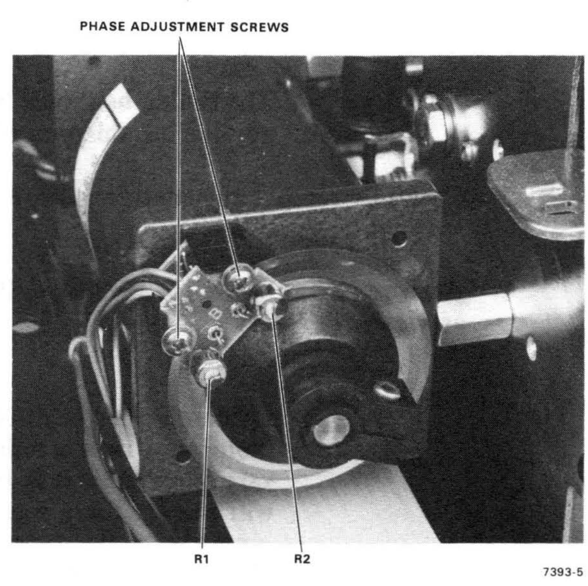


Figure 7-21 Encoder (Rear View)

13. If the channel 2 signal (Figure 7-20) does not have a 50 percent duty cycle (jitter included), adjust R2 on the encoder assembly (Figure 7-21).

14. Check the channel 2 jitter (Figure 7-20). Maximum allowable jitter is 1.4 divisions (or ±0.7 divisions).

15. Set up the scope per Figure 7-22.

16. Channel 2 should lead channel 1 by 90 degrees ± 20 degrees (Figure 7-22). If not, loosen the two encoder screws, reposition the encoder subassembly as required, and tighten the screws. Glyptol R1 and R2.

CAUTION

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

17. Turn the power off and carefully install the encoder cover.

18. Turn the power on and recheck the encoder waveshapes to ensure that the encoder disk has not been damaged when installing the cover.

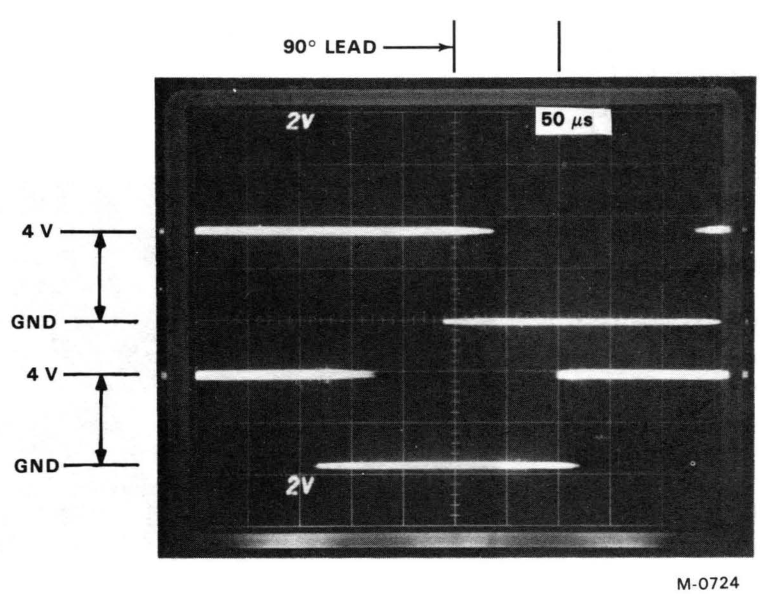
19. Turn the power off.

20. Remove the test lead between +5 V and the servo fuse holder. Reconnect the lead from the power board to the servo fuse holder.

21. Remove the scope leads and close the rear access door.

22. Reinstall the timing belt on the dc motor pulley.

23. Perform the printer housing installation procedure (Paragraph 7.2.2).



SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
TIME/DIV:	50 μs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, INT, POS
CH1 to:	M7722 E6-6 M7723 E2-6 M7728 E18-6
CH2 to:	M7722 E6-8 M7723 E2-8 M7728 E18-8

Figure 7-22 Encoder Phasing Adjustment

7.12 PRINTER MECHANISM ASSEMBLY

The following procedure describes the removal and installation of the printer mechanism assembly.

7.12.1 Printer Mechanism Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).
2. Remove the ribbon spools and ribbon.
3. Remove the four (6-32) screws, lockwashers, and flat washers that secure the print head to the carriage and set the print head (Figure 7-4) aside.
4. Open the rear access door.
5. Remove the stepping motor wires from the cable clamp and clip the necessary cable ties. Disconnect the connector from J5 on the power board. Pull the disconnected wires up through the cabinet base.
6. If applicable, remove the top of form assembly.
7. Remove the 6-32 screw, fastening ground wire to the cabinet base (Figure 7-23).
8. Remove the speaker wires.
9. Remove the 4-40 screw and nut from the terminal strip (Figure 7-18).
10. Remove the dc motor cables from the cable clamps and fuse holder, and disconnect J4 from the power board.

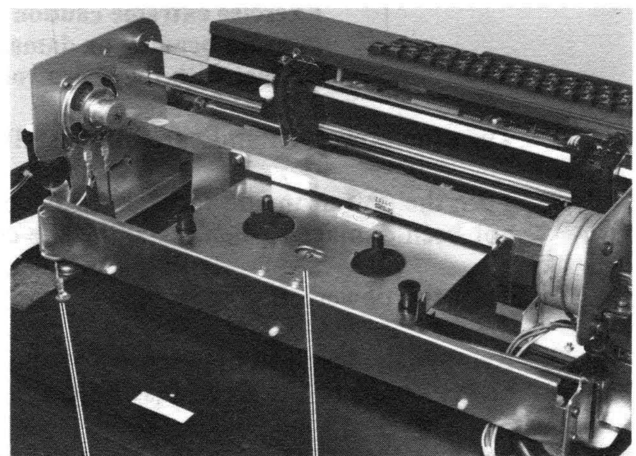


Figure 7-23 Printer Mechanism Removal Preparation

NOTE
When removing the printer mechanism, check for rubber spacers between the base and printer mechanism.

11. Remove the four (10-32) screws, lockwashers, and flat washers that secure the printer mechanism to the cabinet base (Figure 7-24). Carefully remove the printer mechanism from the cabinet base.

Figure 7-24 Printer Mechanism Removal

7.12.2 Printer Mechanism Installation

1. Remove the ground wire from the old printer mechanism and connect it to the new printer mechanism.

2. Slide the carriage assembly to the left side of the printer mechanism.

3. Tilt and carefully place the new printer mechanism on the cabinet base. For printers using rubber spacers, install the spacers between the printer mechanism and cabinet base.

4. Secure the printer mechanism with four (10-32) screws, lockwashers, and flat washers. Make the screws finger tight.

5. If applicable, secure the top of form assembly to new printer mechanism.

6. Thread the cables and wires down through the slots at the rear of the cabinet.

7. Secure the stepping motor wires in the cable clamp. Reconnect the connector to J5 on the power board.

8. Secure the dc motor wires in the cable clamps. Reconnect the wires to the fuse holder, and the connector to J4 on the power board.

9. Connect the ground wires from the printer mechanism with a 6-32 screw.

10. Connect the wires to the speaker.

11. Secure the terminal strip with a 4-40 screw and nut.

12. Dress the cables and wires inside the cabinet and install cable ties as deemed necessary.

13. Close the rear access door on the cabinet.

14. 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 7-25). Tighten the four (10-32) screws to 5 ± 1 in-lb of torque.

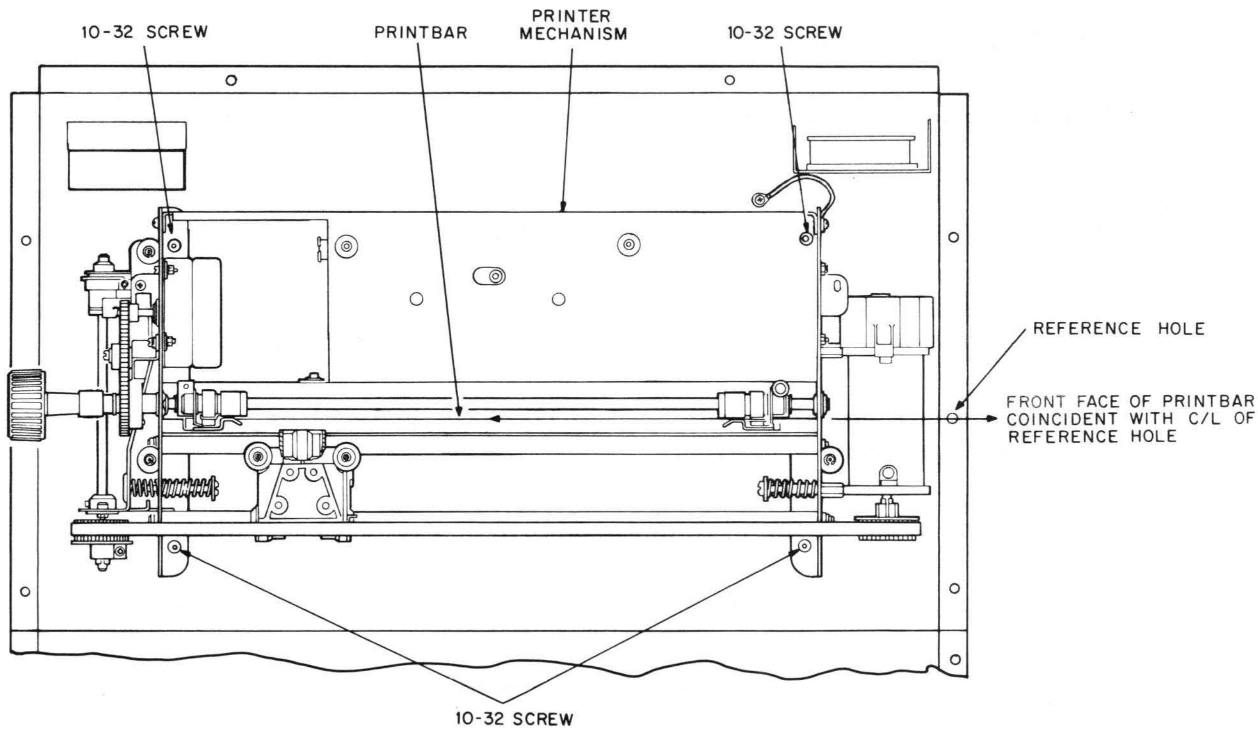


Figure 7-25 Printer Mechanism Alignment

15. Check that the carriage has 0.508 to 1.016 mm (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 7-5). If necessary, loosen the four (10-32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a 0.508 to 1.016 mm (0.020 to 0.040 inch) clearance (Figure 7-26).

16. 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. If the drag is encountered, perform paper guide and printer mechanism adjustment (Paragraph 8.6). Remove the paper from the machine.

17. Perform the print head installation procedure (Paragraph 7.3.2).

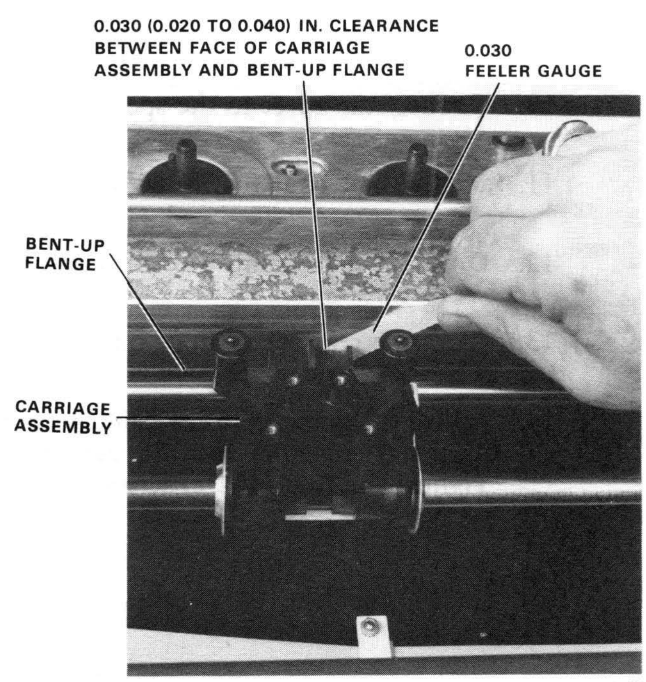


Figure 7-26 Printer Mechanism Adjustment

7.13 TRACTOR DRIVE SHAFTS AND TRACTOR ASSEMBLIES

The following procedure describes the removal and installation of the tractor drive shafts and tractor assemblies. The tractor assemblies slip off the drive shafts once the tractor drive shaft removal is completed.

7.13.1 Tractor Drive Shaft and Tractor Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).
2. Loosen the Tractor Adjustment knobs on both tractors.
3. Remove the two retaining rings (Figure 7-27) on the left-hand side of the tractor support shaft and drive shaft.
4. Slide both shafts to the left about 10.16 cm (4 inches) to remove the tractor assemblies. Pull the shafts (to the left) out of the left-hand end plate to remove the shafts.

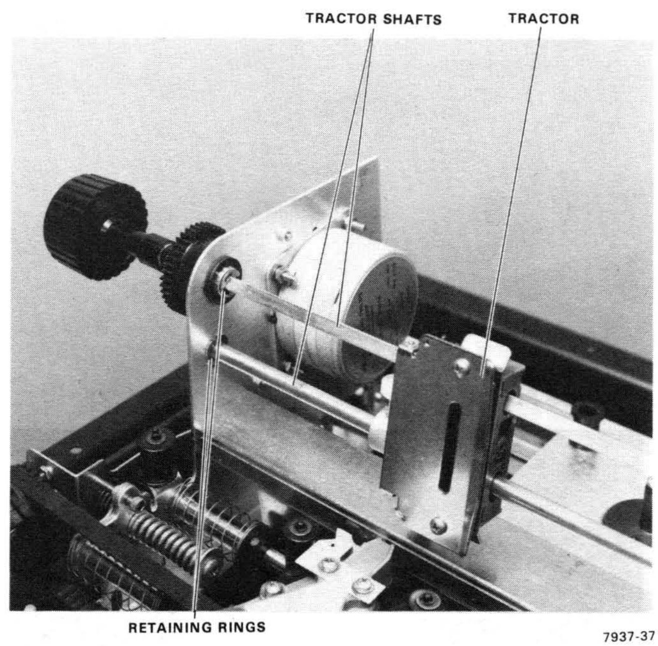


Figure 7-27 Tractor Removal

7.13.2 Tractor Drive Shaft and Tractor Assembly Installation

1. Replace the defective tractor or drive shaft.
2. Slide the two tractor shafts halfway through the left side plate.

NOTE

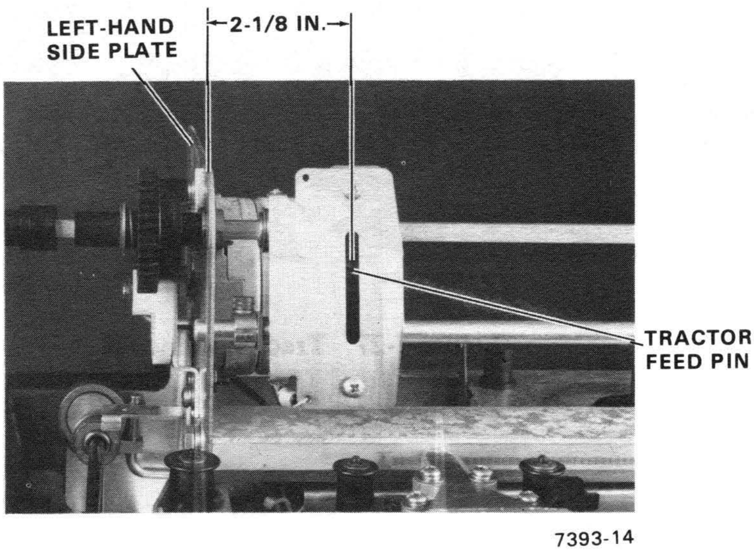
When installing the tractor assemblies, ensure that the index marks on the outside of the upper tractor bushings coincide with the same flat on the square shaft (Figure 7-28). If the bushings are not scribed, rotate the tractors until a tractor pin on both tractors are centered on the same flat.

3. Slide the tractor assemblies on the tractor shafts.
4. Position the tractor shafts in the side plates and secure them with three retaining rings (Figure 7-27).
5. Slide the left-hand tractor from side to side. If it appears to bind or have excessive drag on the shafts, grasp the bottom tractor shaft and move it up or down in its slots until the tractor slides easily on the shafts.

6. Slide the left-hand tractor to the left so that the feed pins are 53.975 mm (2-1/8 inches) from the left-hand side plate (Figure 7-28).

7. The right-hand tractor will be adjusted to the width of the paper or forms to be used.

8. Perform the printer housing installation procedure (Paragraph 7.2.2).



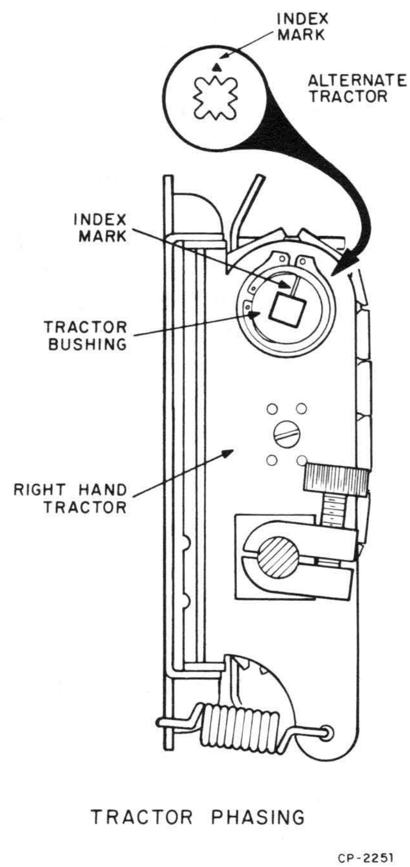


Figure 7-28 Tractor Phasing/Adjustment

7.14 RIBBON CHASSIS ASSEMBLY

The following procedure describes the removal and installation of the ribbon chassis assembly.

7.14.1 Ribbon Chassis Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).

2. Remove the ribbon spools and ribbon.

3. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 7-29).

4. Remove the four (6-32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates (Figure 7-29).

5. Remove the two (8-32) screws and lockwashers that secure the ribbon chassis to the print bar (Figure 7-29).

NOTE

A cover interlock switch is connected to the ribbon chassis on late model printers.

6. Remove the speaker leads.

7. Remove the ribbon chassis and set it aside.

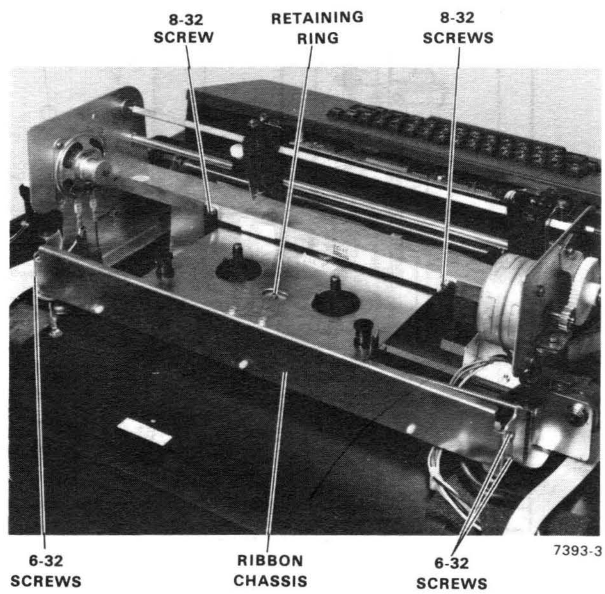


Figure 7-29 Ribbon Chassis Removal

7.14.2 Ribbon Chassis Assembly Installation

1. Secure the ribbon chassis to the print bar with the two (8-32) screws and lockwashers. Torque the screws to 18 ± 2 in-lb.

2. Replace the four (6-32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates. Torque the screws to 12 ± 2 in-lb.

3. Line up the hole in the ribbon chassis with the pushrod, and replace the retaining ring that holds the pushrod in place.

4. Connect the speaker leads to the speaker and secure it to the ribbon chassis with two cable ties.

5. Install the ribbon spools and ribbon.

6. 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 1.814 kg (4 lb) (Figure 7-30).

7. Perform the printer housing installation procedure (Paragraph 7.2.2).

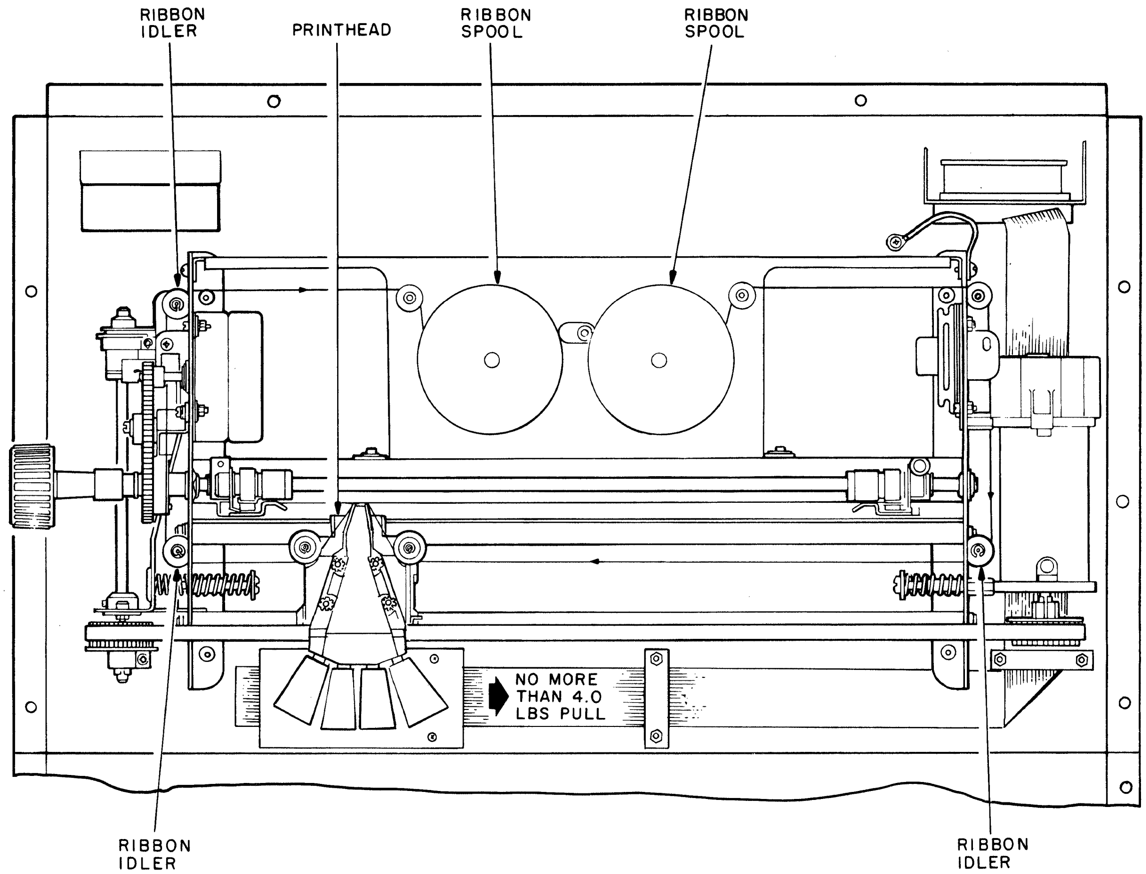


Figure 7-30 Ribbon Threading/Drag Test

7.15 RIBBON SPOOL RATCHET WHEELS AND FRICTION DISKS

The following procedure describes the removal and installation of the ribbon spool ratchet wheel(s) and friction disks. The ribbon chassis assembly must be removed first in order to remove the ribbon spool ratchet wheel(s) and friction disks.

7.15.1 Ribbon Spool Ratchet Wheel(s) and Friction Disk Removal

1. Perform the ribbon chassis assembly removal procedure (Paragraph 7.14.1).

2. Remove the adjusting screw and nut or retaining ring that secures the ratchet wheel and the spool driver in the ribbon chassis (Figure 7-31).

NOTES

1. Record the order in which the parts are removed.

2. See Illustrated Parts Breakdown for an exploded view.

3. Remove washers, compression ring, and ratchet wheel.

4. Set the ratchet wheel aside.

5. Remove the four old friction disks and clean each mounting surface.

6. Remove the protective paper from the four new friction disks and apply one each to the spool driver wheel, ratchet wheel, and to each side of the ribbon chassis. Be sure that the friction disk is applied to the side of the ratchet wheel that faces the ribbon chassis. Ensure that surfaces are free of oil and moisture.

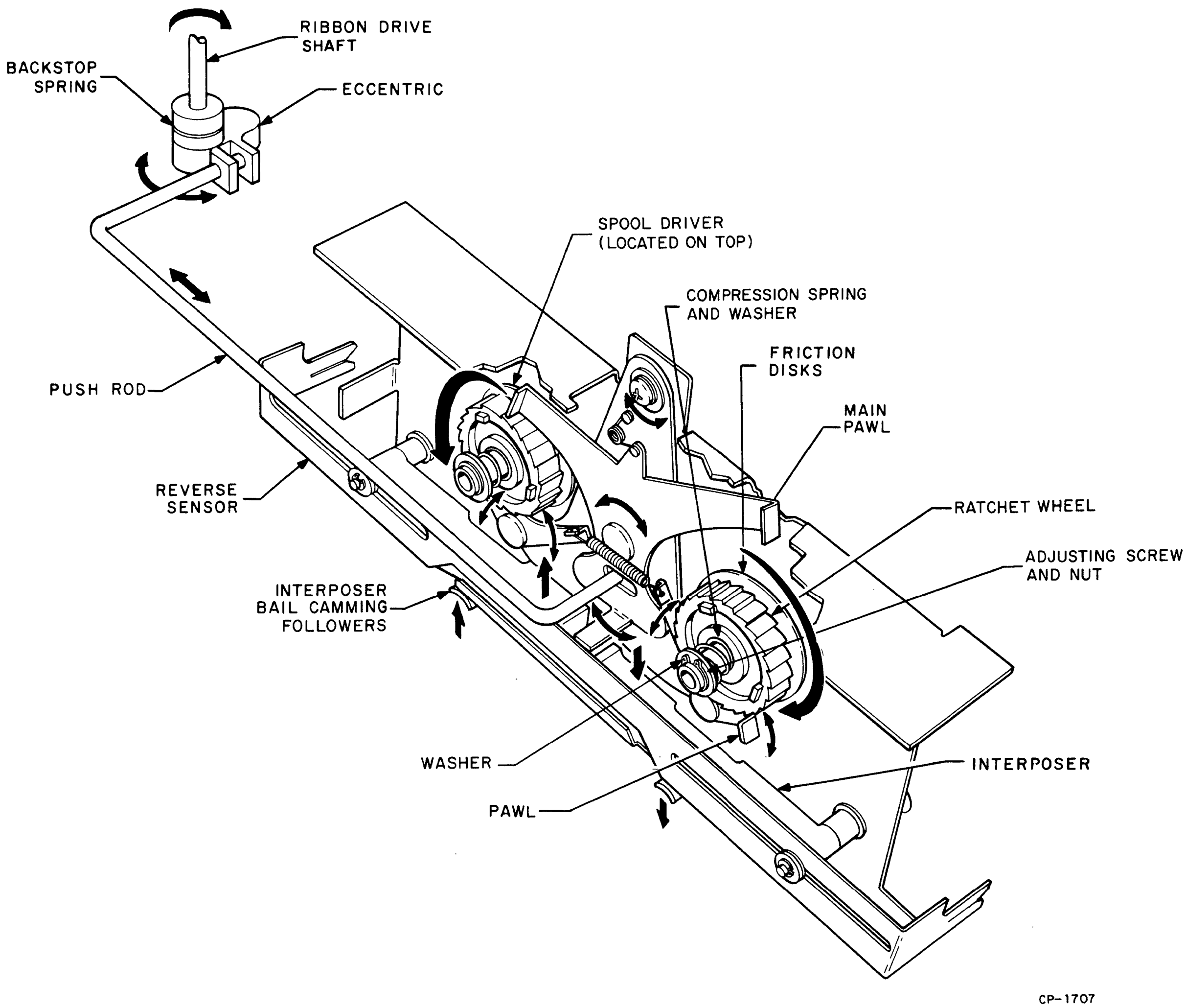


Figure 7-31 Friction Disk/Ratchet Wheel Replacement

7.15.2 Ribbon Spool Ratchet Wheel(s) and Friction Disk Installation

1. Replace the ratchet wheel, compression spring, and the washers. The ratchet wheel teeth must point in the direction shown in Figure 7-31.

2. Replace the screw and nut or retaining ring that secures the ratchet wheel and the ribbon spool in the ribbon chassis.

3. Perform the ribbon chassis assembly installation procedure (Paragraph 7.14.2).

7.16 PRINT BAR

The following procedure describes the removal and installation of the print bar. The alignment gauge must be used when performing this procedure.

7.16.1 Print Bar Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).
2. Remove the ribbon spools and ribbon.
3. Slip the belt off the dc motor pulley.
4. Remove the four (6-32) screws, lockwashers, and flat washers that secure the print head to the carriage and set the print head aside (Figure 7-4).
5. Move the carriage assembly all the way to the left.

NOTE

Observe the location of any shims between the carriage bars and the left-hand end plate.

6. Remove the three (8-32) screws and hex standoffs that secure the dc motor to the right side plate and set the motor on its side (Figure 7-21).
7. Remove the two (8-32) screws, lockwashers, and flat washers connecting the ribbon chassis to the print bar.
8. Remove the two (10-32) Allen-cap screws, split lockwashers, and flat washers, connecting the right side of the carriage shafts to the right-hand side plate (Figure 7-32).
9. Remove the 10-32 screw connecting the right front of the printer mechanism to the cabinet base (Figure 7-34).
10. Remove the two 7/16 hex-head (1/4-20) screws, lockwashers, and flat washers from the print bar (Figure 7-32).
11. Gently spread the right-hand side plate and remove the print bar.

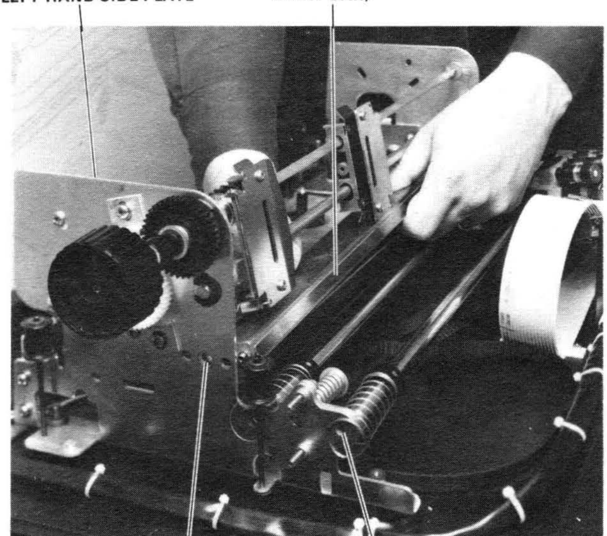


Figure 7-32 Print Bar Removal

7.16.2 Print Bar Installation

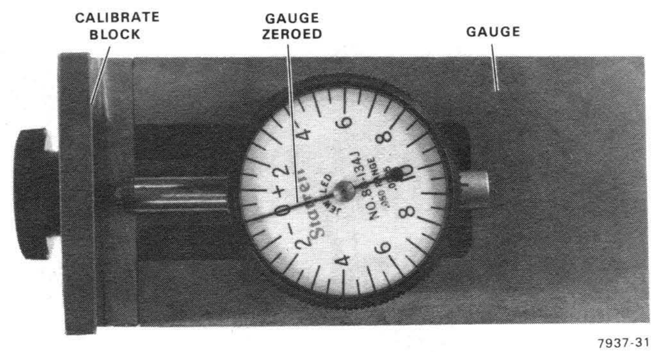


Figure 7-33 Calibrate Alignment Gauge and Block

1. Carefully slide the new print bar into position and insert the carriage shafts, print bar, and tractor shafts into the right side plate. Once in position, push the print bar as far back as possible (toward the ribbon chassis).

2. Reinstall the carriage shaft shims, if applicable, and secure the carriage shafts with two (10-32) Allen-cap screws, lockwashers, and flat washers. Torque the screws to 18 ± 2 in-lb.

3. Calibrate the alignment gauge by setting the dial to zero with the calibrate block screwed securely in place (Figure 7-33).

4. Remove the calibrate block from the front of the gauge and set the gauge on the extreme right of the carriage shafts (Figure 7-34).

5. Position the print bar for a zero indication on the gauge. Repeat this procedure with the gauge on the extreme left of the carriage shafts.

6. Secure the ends of the print bar with two (1/4-20) hex-head screws, lockwashers, and flat washers. Hand tighten the screws.

7. Repeat step 5 as many times as necessary, until the gauge indicates 0 ± 0.002 with the two end readings being equal within 0.0015.

8. Slide the gauge across the full length of the carriage shafts. The total indicator reading must not vary more than 0.004.

9. Torque the print bar with 7/16 hex-head nuts to 75 ± 5 in-lb.

10. Secure the ribbon chassis to the print bar with two (8-32) screws, lockwashers, and flat washers. Torque the screws to 18 ± 2 in-lb.

11. Install the 10-32 screw connecting the right front printer mechanism to the cabinet base (Figure 7-32).

12. Install the three (8-32) screws and hex standoffs that secure the dc motor to the right side plate (Figure 7-19).

13. Perform timing belt installation (Paragraph 7.4.2), and the printer housing installation procedures (Paragraph 7.2.2).

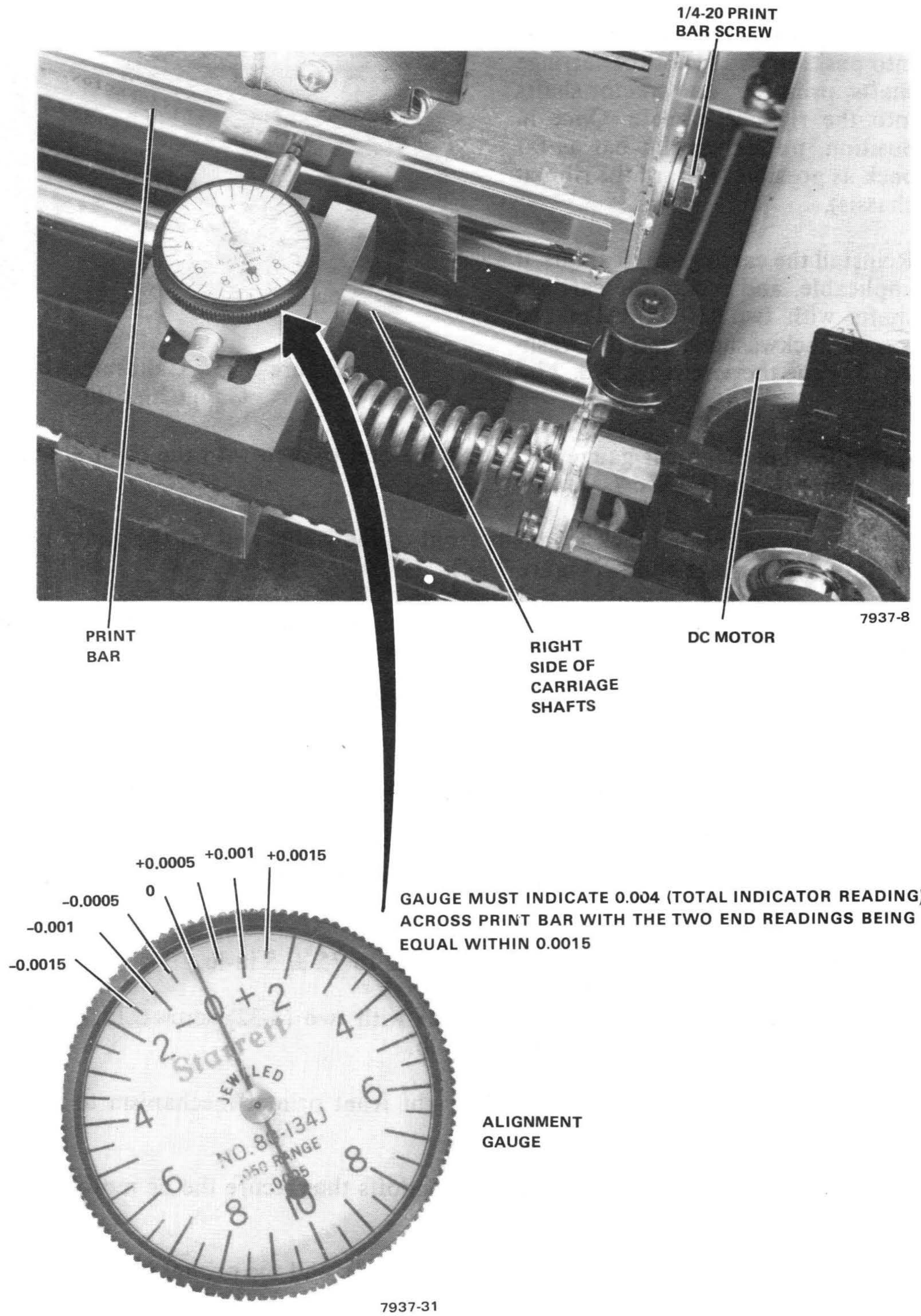


Figure 7-34 Print Bar Alignment

7.17 IDLER GEAR ASSEMBLY

The following procedure describes the removal and installation of the idler gear assembly.

7.17.1 Idler Gear Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).

2. Remove the two (8-32) screws, lockwashers, and flat washers that secure the idler gear assembly to the left-hand side plate (Figure 7-35).

7.17.2 Idler Gear Assembly Installation

1. Secure the new idler gear assembly to the left-hand side plate with the two (8-32) screws, lockwashers, and flat washers. Make the screws finger tight.

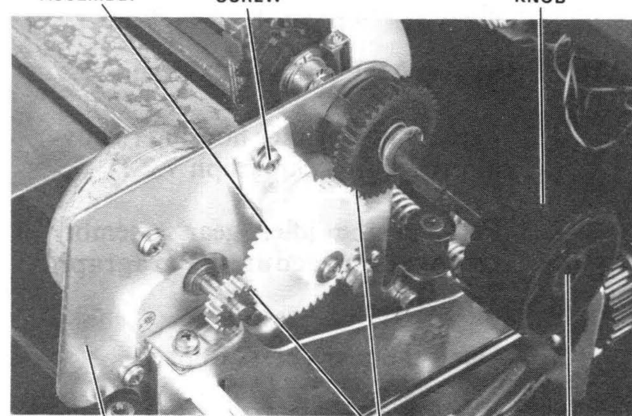


Figure 7-35 Idler Gear Assembly Removal

2. 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 0.0508 to 0.1778 mm (0.002 to 0.007 inch) between each pair of gears (Figure 7-35). (The idler gear should be free to slide in and out.) Rotate the gears to check the backlash in several places.

3. Tighten the two (8-32) screws to 18 ± 2 in-lb of torque.

4. Rotate the Paper Advance knob to ensure that the gears turn freely.

5. Perform the printer housing installation procedure (Paragraph 7.2.2).

*Backlash is the amount a gear turns prior to turning the gear it meshes with.

7.18 STEPPING MOTOR ASSEMBLY

The following procedure describes the removal and installation of the stepping motor. The idler gear assembly must be removed to remove the stepping motor assembly.

7.18.1 Stepping Motor Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).

2. Perform the idler gear assembly removal procedure (Paragraph 7.17.1).

3. Open the rear access door.

4. Remove the stepping motor wires from the cable clamp and clip the necessary cable ties. Disconnect the speaker leads. Disconnect the connector from J5 on the power board (Figure 7-3).

5. Pull the wires up through the slot at the rear of the cabinet.

6. Remove the four (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 7-36).

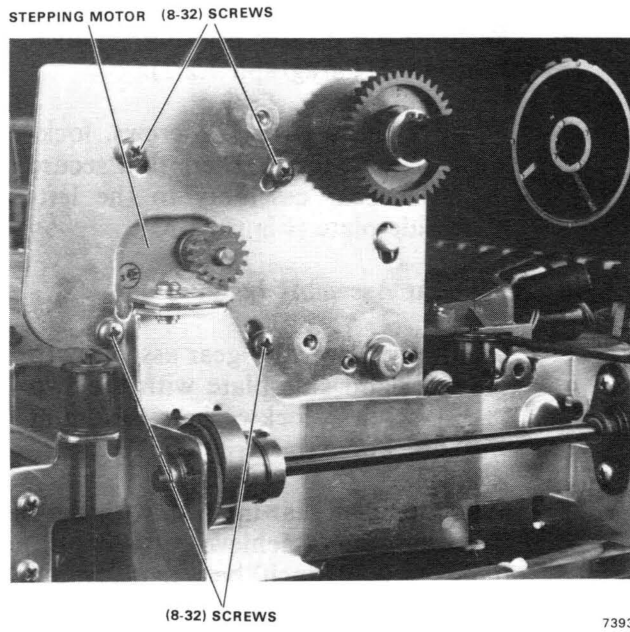


Figure 7-36 Stepping Motor Removal

7.18.2 Stepping Motor Assembly Installation

1. Secure the new stepping motor to the left-hand side plate with the four (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.)

2. Tighten the four (8-32) screws to 18 ± 2 in-lb of torque.

3. Secure the stepping motor wires with cable ties and thread them under the printer mechanism and pushrod and down through the slot at the rear of the cabinet. Connect the speaker leads to the speaker. Reconnect the connector to J5 on the power board.

4. Close the rear access door.

5. Perform the idler gear assembly installation procedure of the transformer assembly (Paragraph 7.17.2).

7.19 TRANSFORMER ASSEMBLY

The following procedure describes removal and installation procedure (Paragraph 7.17.2).

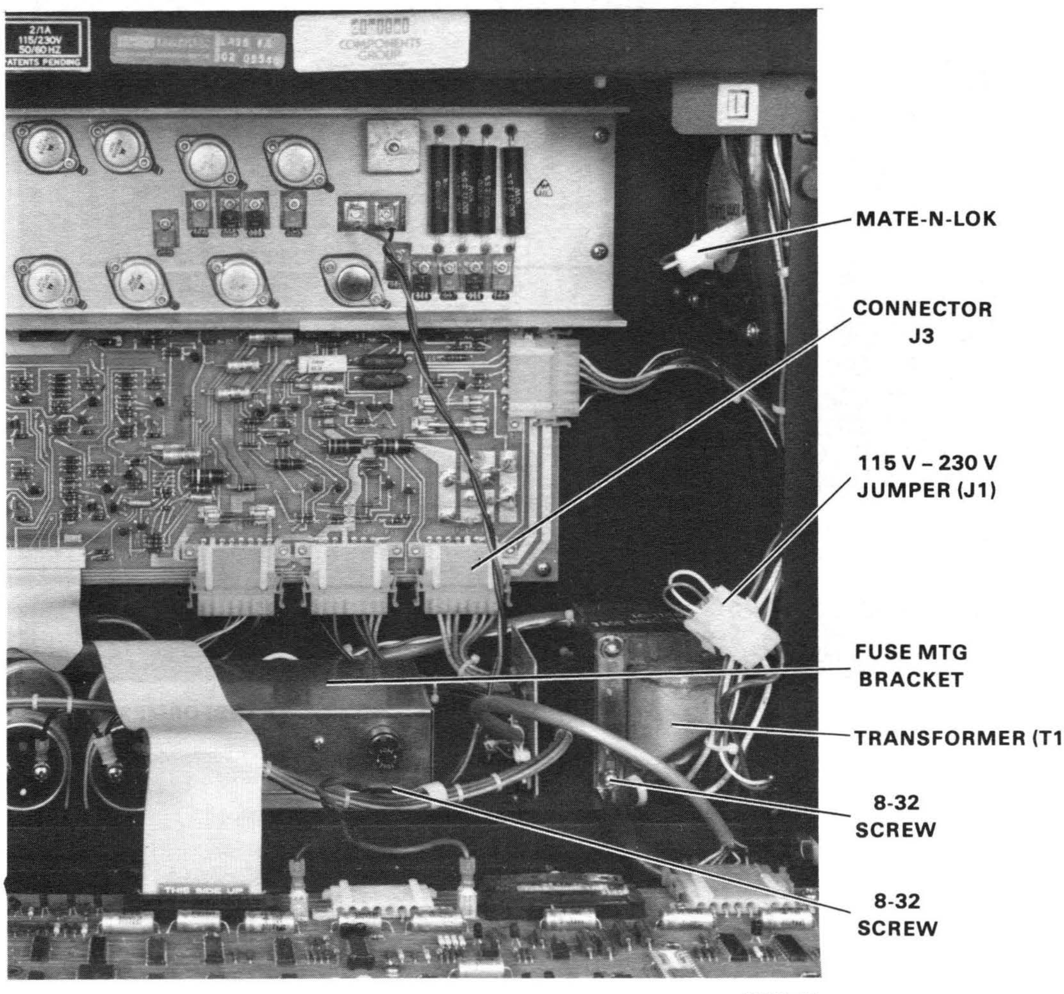
7.19.1 Transformer Assembly Removal

1. Remove the ac plug from the outlet box.
2. Perform printer housing removal procedure (Paragraph 7.2.1).
3. Open the rear access door on the cabinet.

WARNING
Power must be removed from the LA36 prior to performing this procedure.

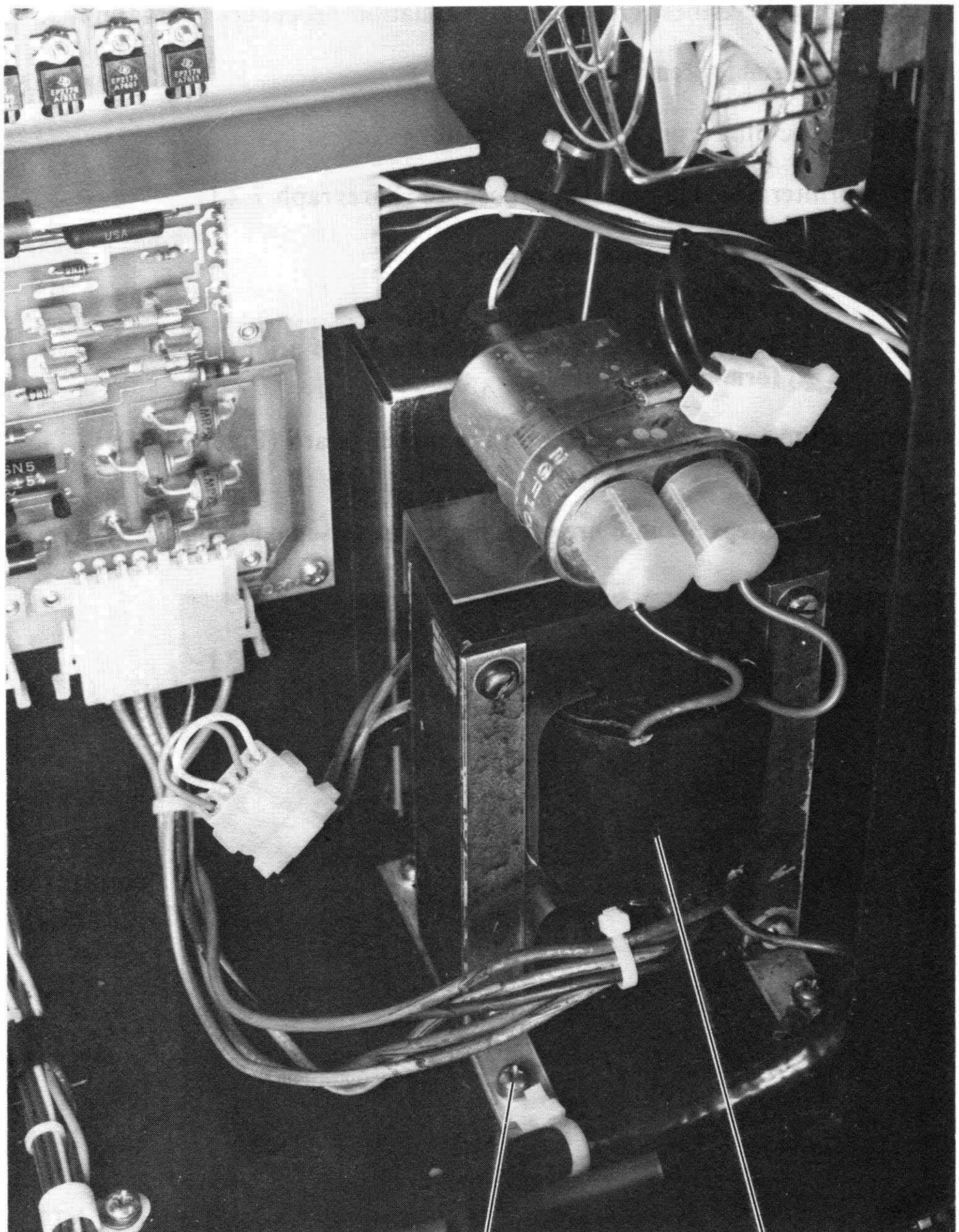
4. Disconnect the connector from J3 on the power board (Figure 7-37).

NOTE
Steps 5 and 6 are only applicable to some printers.



a. Early LA36 Printer

Figure 7-37 Transformer Removal (Sheet 1 of 2)



b. Current LA36 Printer

Figure 7-37 Transformer Removal (Sheet 2 of 2)

5. Remove the two (8-32) screws and lockwashers that secure the fuse mounting bracket to the cabinet (Figure 7-37).

6. Remove the green jumper wire from capacitor C5 (Figure 7-38).

7. Diconnect the quick-disconnect (Mate-N-Lok) from the fan assembly (Figure 7-37).

NOTE
Place a protective cloth or cardboard over the keys to prevent scratching the keyboard.

8. Remove the four (8-32) screws, lockwashers, and flat washers that secure the keyboard bezel to the cabinet base (Figure 7-9).

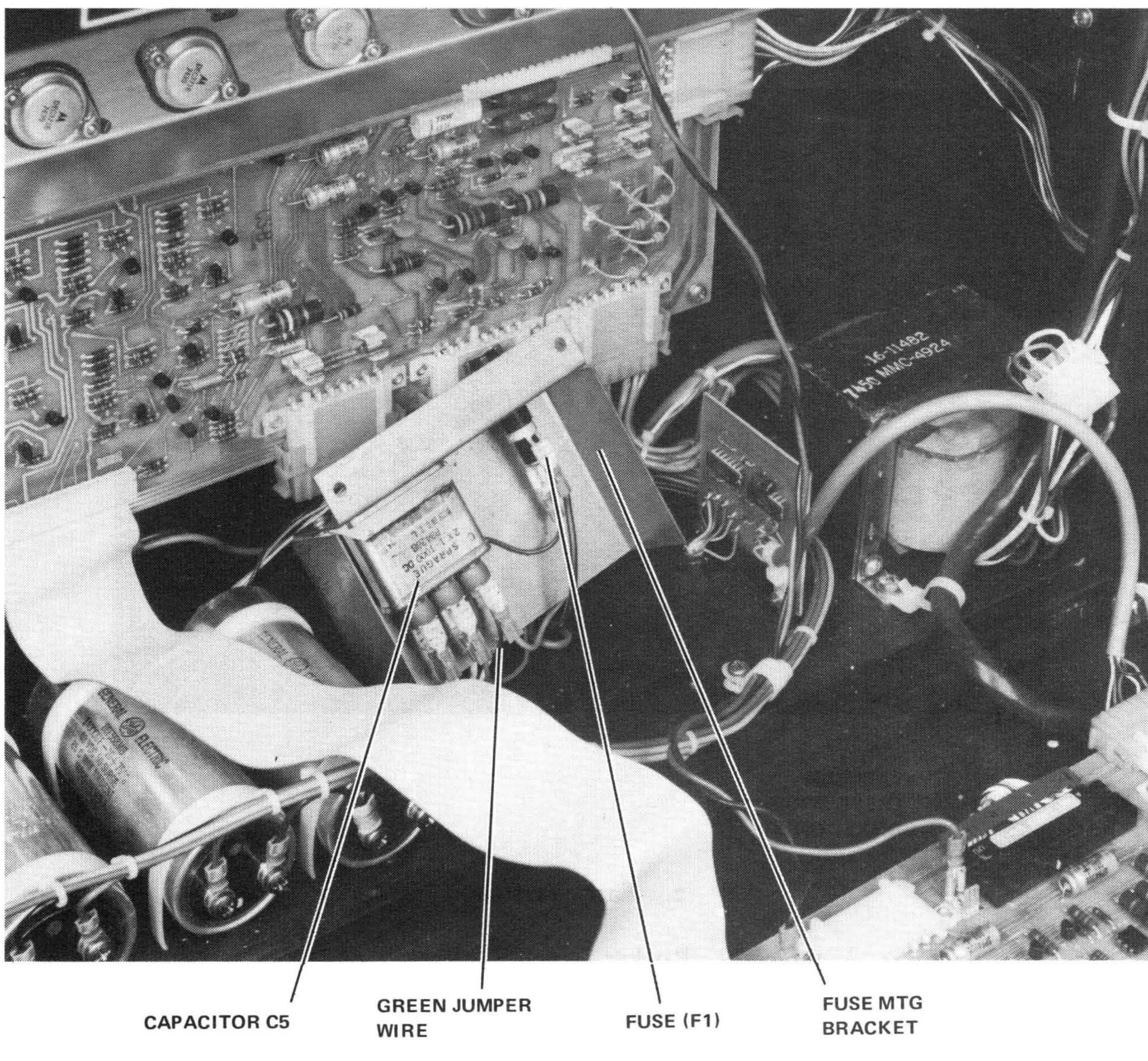


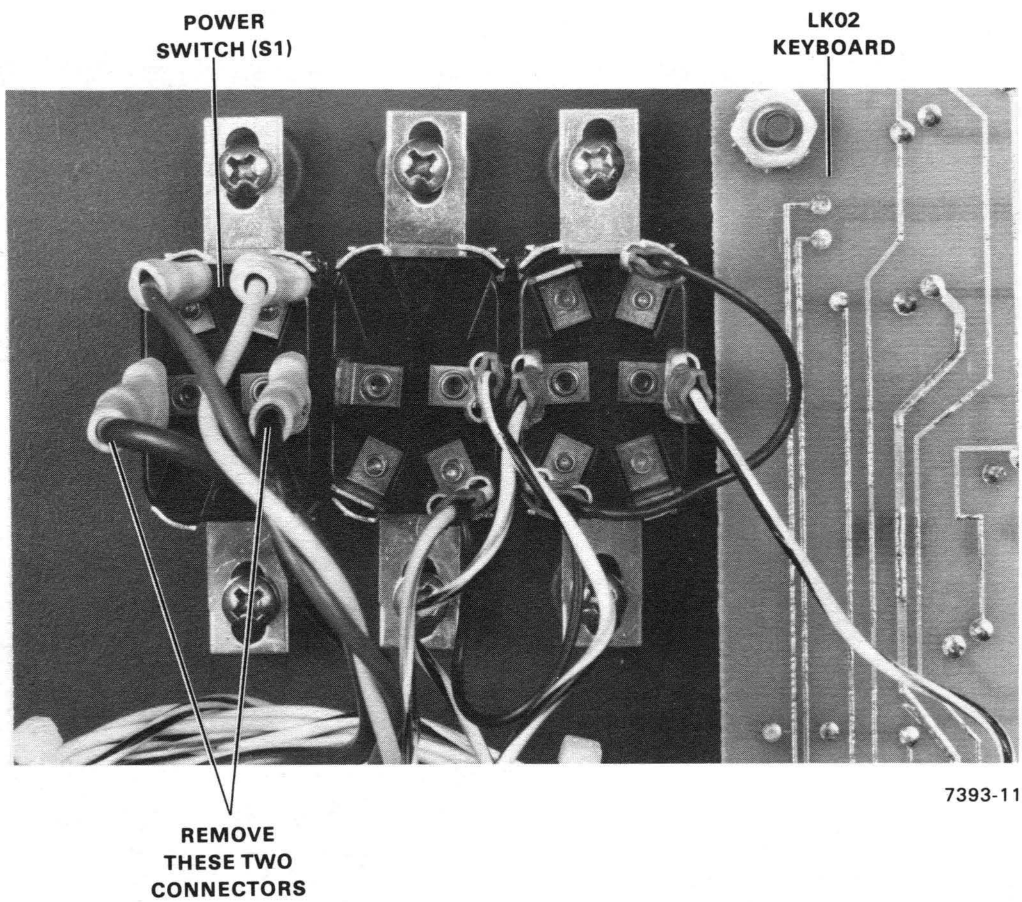
Figure 7-38 Capacitor C5

9. Turn the keyboard upside down and remove the quick-disconnect (Figure 7-39) from the POWER switch (S1).

10. If applicable, clip all the cable ties from the keyboard to the transformer.

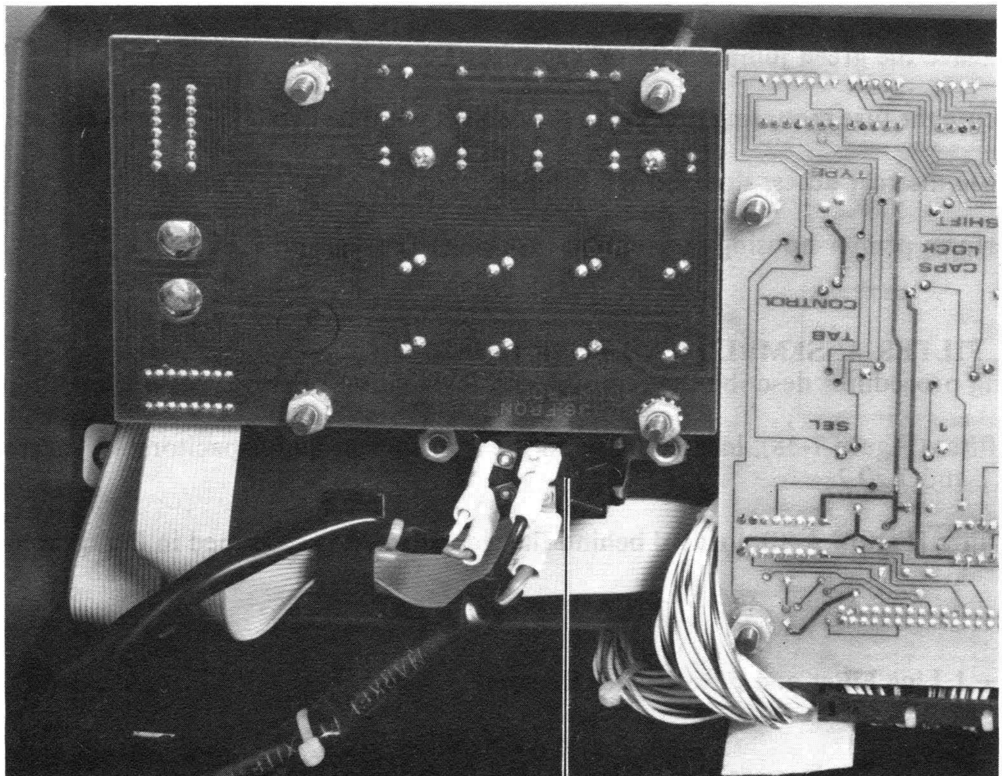
11. Pull the wires that were removed from the power switch (S1) down through the slot in the rear of the cabinet.

12. Remove the three or four (8-32) screws, lockwashers, and kep or captive nuts that secure the transformer to the cabinet base. Disconnect the 115 V/230 V jumper (Mate-N-Lok) from connector J1 and set the transformer aside (Figure 7-37).



a. Early Version

Figure 7-39 Rocker Switch S1 (Sheet 1 of 2)



b. Current Version

Figure 7-39 Rocker Switch S1 (Sheet 2 of 2)

7.19.2 Transformer Assembly Installation Procedure

1. Place the new transformer in the cabinet and secure with the three or four (8-32) screws, lockwashers, and kep or captive nuts. (Be sure to reconnect the ground strap to the screw on the transformer.) Tighten the ground strap screw to 20 ± 2 in-lb of torque.

2. Reconnect the Mate-N-Lok to the fan assembly.

3. Pull the wires up through the slot in the rear of the cabinet and reconnect the quick-disconnects to the power switch on the keyboard.

4. Replace the keyboard bezel and spacers if applicable, (spacers do not exist on all models) on the cabinet base and secure with the four (8-32) screws, lockwashers, and flat washers.

5. Dress the wires and cables from the keyboard to the transformer and secure with cable ties.

6. Reconnect the connector to J3 on the power board.

7. Connect the 115 V/230 V jumper (Mate-N-Lok) to the transformer.

NOTE
Steps 8 and 9 are applicable only to some model printers.

8. Replace the green jumper wire on capacitor C5.
9. Secure the fuse mounting bracket to the cabinet with the two (8-32) screws and lockwashers.
10. Close the rear access door on the cabinet.
11. Perform printer housing installation procedure (Paragraph 7.2.2).

7.20 LINE FILTER ASSEMBLY AND FUSE HOLDER

The following procedures describe the removal and installation of two types of line filters.

Type 1 line filter (Figure 7-38), located between the transformer and capacitors, is described in Paragraphs 7.20.1 and 7.20.2.

Type 2 line filter (Figure 7-40), located behind the transformer, is described in Paragraphs 7.20.3 and 7.20.4.

7.20.1 Type 1 Line Filter and Fuse Holder Removal

WARNING
Remove the LA36 ac plug from the outlet prior to performing this procedure.

1. Remove the LA36 ac plug from the ac outlet.
2. Open the rear access door on the cabinet.
3. Remove the two (8-32) screws and lockwashers that secure the fuse mounting bracket to the cabinet (Figure 7-37).

NOTE
Record the location of the wires to capacitor C5 and fuse F1 prior to performing the next step.

4. Disconnect all external wires that connect to capacitor C5 and fuse F1 (Figure 7-38).
5. Remove the fuse mounting bracket and set aside.

7.20.2 Type 1 Line Filter and Fuse Holder Installation

1. Install the new line filter or fuse holder in the fuse mounting.
2. Reconnect all external wires to capacitor C5 and fuse F1 in the new line filter.
3. Secure the fuse mounting bracket to the cabinet with the two (8-32) screws and lockwashers.
4. Close the rear access door on the cabinet.
5. Replace the printer paper and restore power to the LA36.

7.20.3 Type 2 Line Filter and Fuse Holder Removal

1. Perform the transformer removal procedure (Paragraph 7.19.1); however do not disconnect the transformer wires or cables.

2. Move the transformer slightly to the left, enabling a clear view of the filter assembly.

3. Remove the two (5/16) hex nuts and lockwashers, and remove the filter cover (Figure 7-40).

4. To replace the line filter, disconnect the leads and remove two (5/16) hex nuts, lockwashers, and spacers.

5. To remove the fuse holder, disconnect the two wires and remove the fuse holder nut.

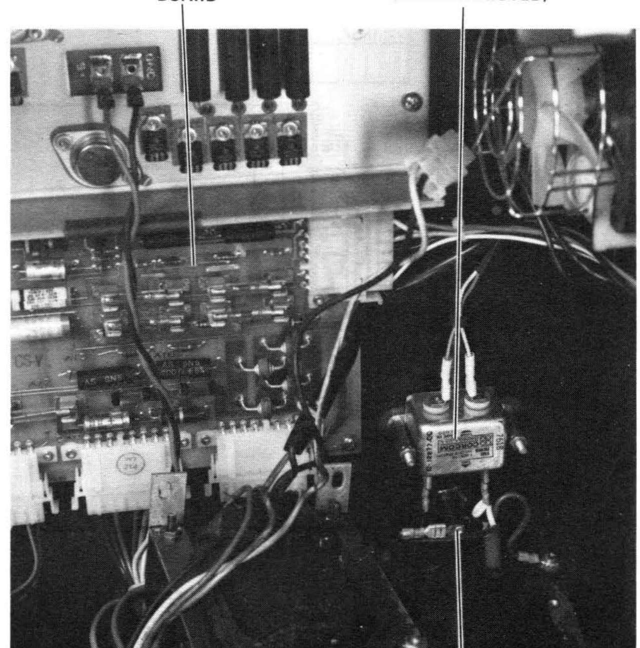


Figure 7-40 Type 2 Filter Assembly Removal

7.20.4 Type 2 Line Filter and Fuse Holder Installation

NOTE
When installing the line filter, the leads must be connected to the terminals recorded in the removal procedure.

1. Install the new fuse holder or line fuse.
2. Secure the line filter cover with two (5/16) hex nuts and lockwashers.
3. Perform the transformer assembly installation procedure (Paragraph 7.19.2).

7.21 LK02, LK03 KEYBOARD ASSEMBLY AND FRONT PANEL ASSEMBLY

The following procedure describes the removal and installation of the LK02, LK03 keyboard and front panel assembly.

7.21.1 Keyboard and Front Panel Assembly Removal

1. Perform the printer housing removal procedure (Paragraph 7.2.1).

2. Remove the four (8-32) screws, lockwashers, flat washers, and spacers that secure the keyboard bezel to the cabinet base (Figure 7-41).

3. Turn the keyboard bezel upside down on a piece of foam or bubble plastic, and remove the four (8-32) kep nuts that secure the appropriate keyboard to the be zel. Leave the four hex standoffs in place (Figures 7-42 through 44).

4. Lift the keyboard off the weld studs, disconnect the appropriate cable connectors from the keyboard, and set the keyboard aside.

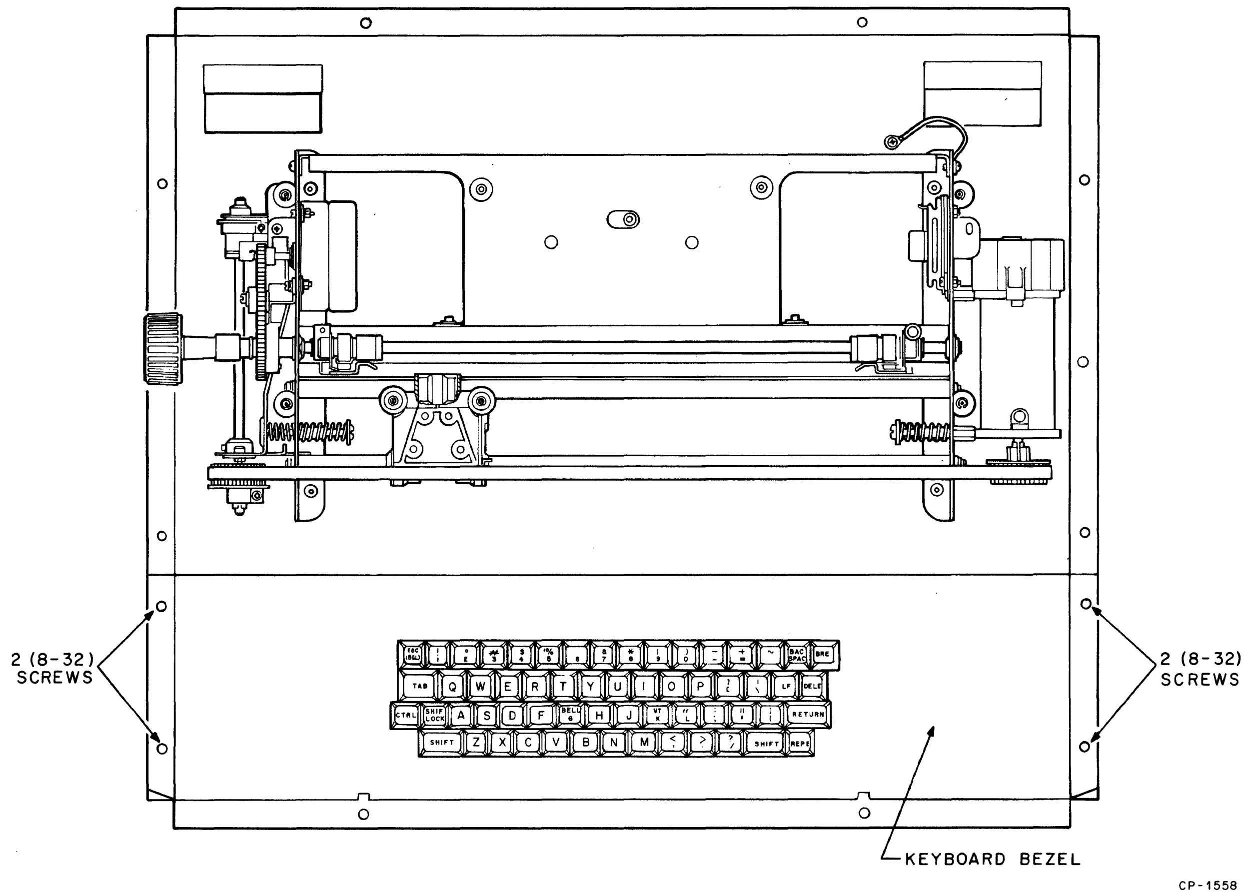


Figure 7-41 Keyboard Bezel Removal

7.21.2 LK02 Keyboard Assembly Installation

1. Reconnect the appropriate cable connectors to the new keyboard (Figures 7-42 through 44). Place the keyboard on the weld studs and secure with the four (8-32) kep nuts.

CAUTION

1. 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.

2. Ensure that the indicators on the front panel (if applicable) are properly seated in the bezel prior to securing keyboard bezel.

2. Replace the keyboard bezel on the cabinet base and secure with the four (8-32) screws, lockwashers, flat washers, and spacers.

3. Perform the printer housing installation procedure (Paragraph 7.2.2).

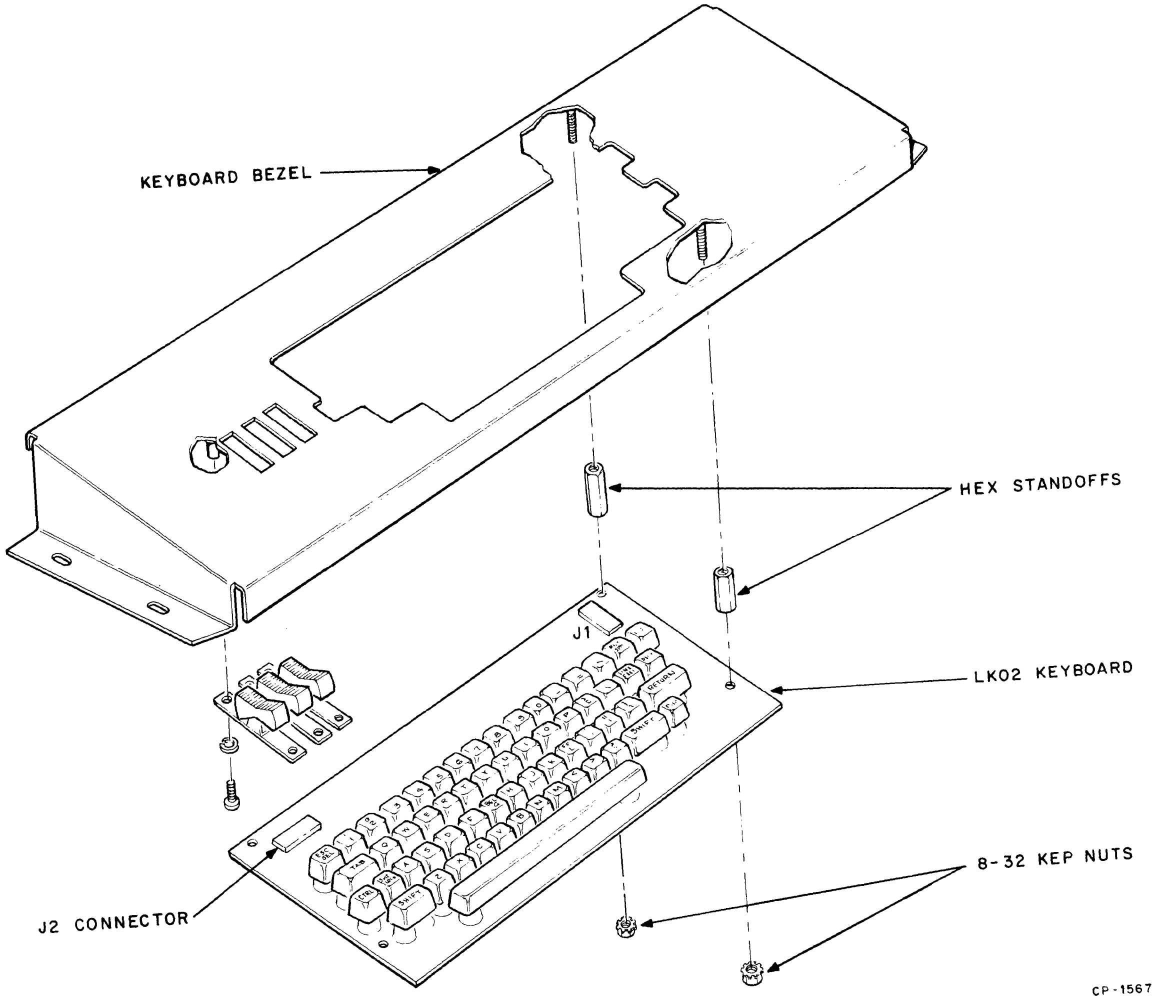


Figure 7-42 LK02 Keyboard Removal

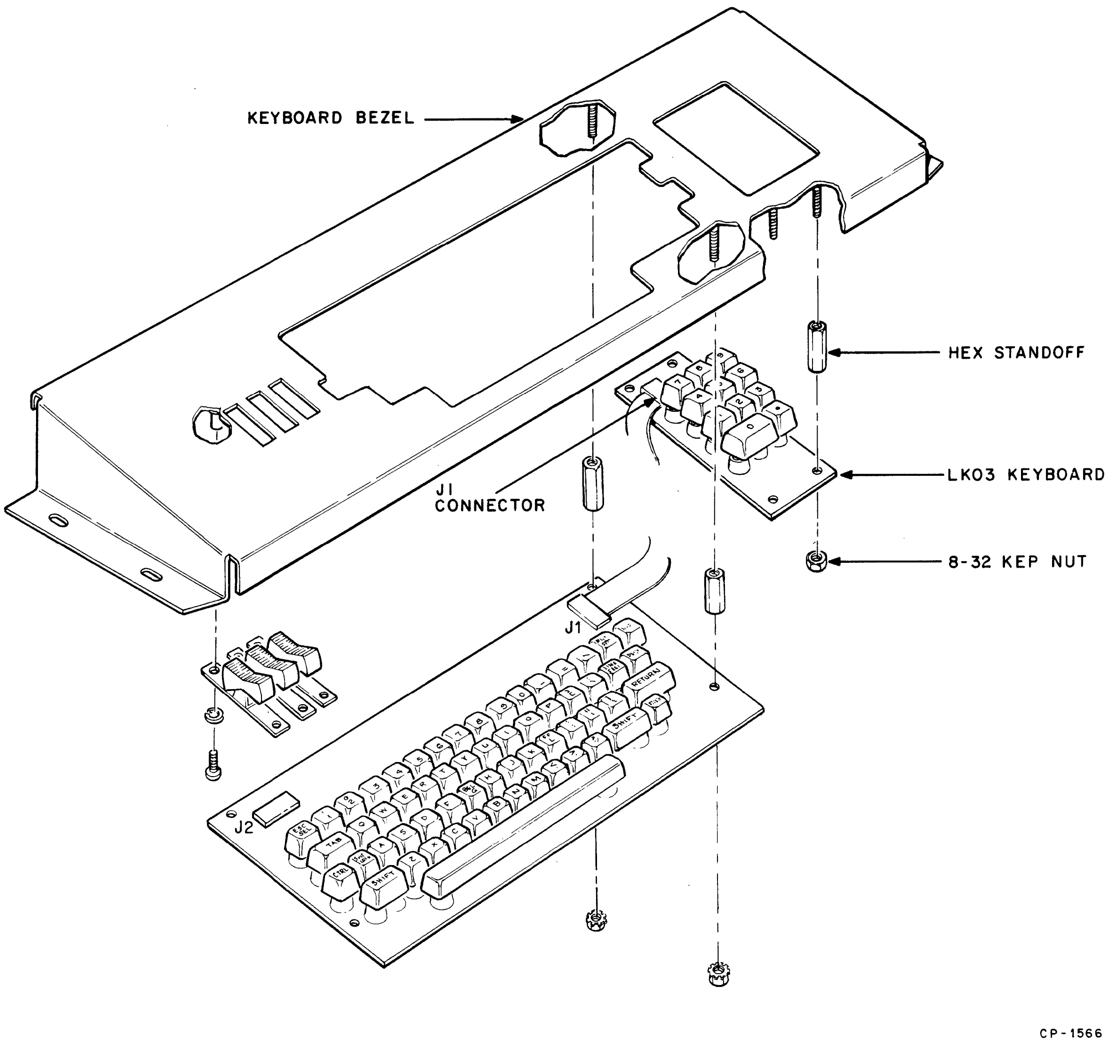


Figure 7-43 LK03 Keyboard Removal

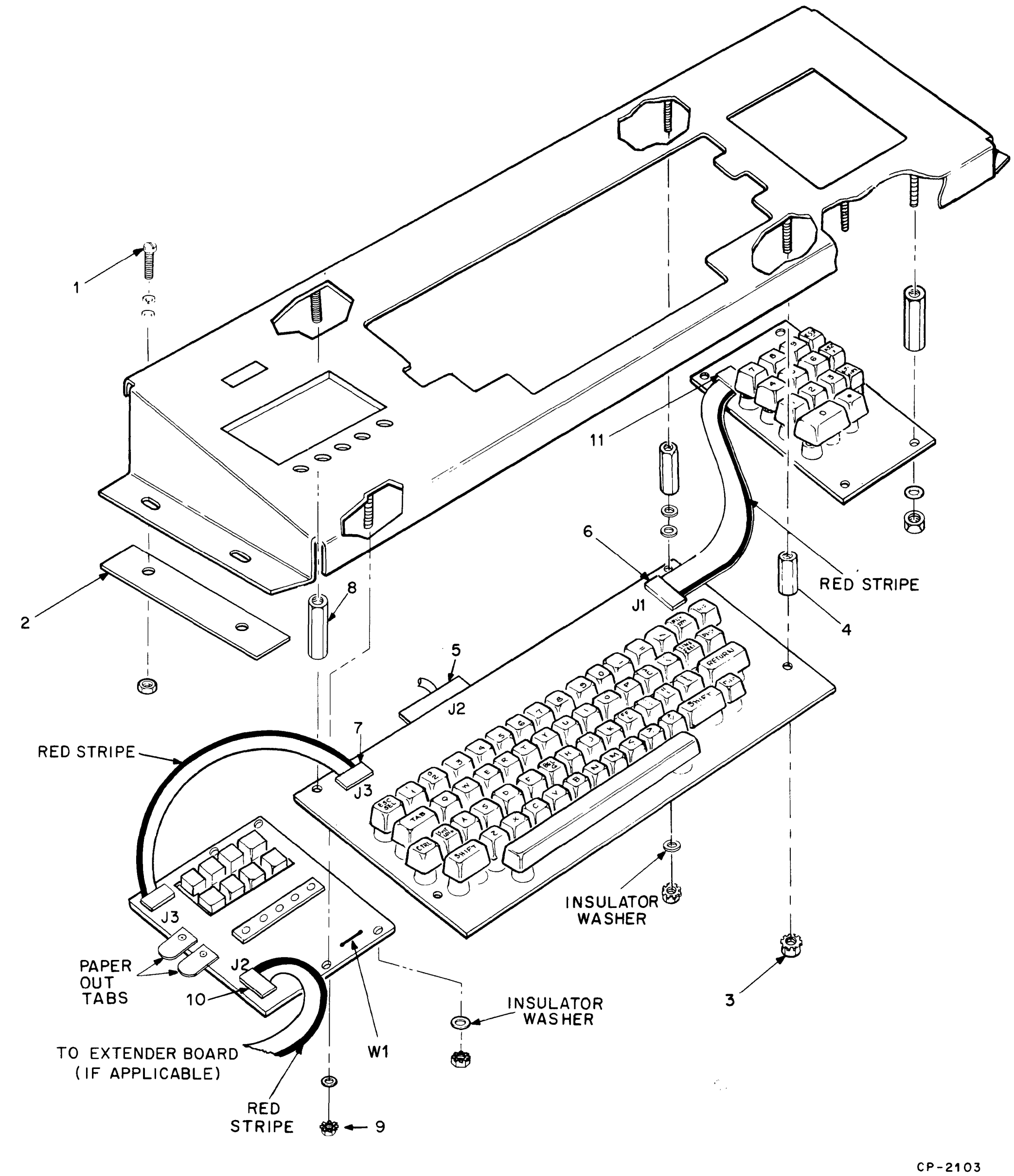


Figure 7-44 LK03 Keyboard and Control Pad Removal

7.22 POWER BOARD

The following procedure describes the removal and installation of the power board.

7.22.1 Power Board Removal

1. Remove the power from the LA36. Remove the printer paper.
2. Open the rear access door to the cabinet.
3. Disconnect the connectors from the jacks, and the quick-disconnects from +5 V (red) and ground (black) on the power board (Figure 7-3). Disconnect the connector from the power board to the jack on the logic board.
4. Remove the four (8-32) screws, lockwashers, and flat washers, and the two (8-32) hex nuts, lockwashers, and flat washers that secure the power board to the cabinet. Set the power board aside.

7.22.2 Power Board Installation

1. Place the new power board in the cabinet and secure it with the four (8-32) screws, lockwashers, and flat washers, and two (8-32) hex nuts, lockwashers, and flat washers. Torque 8-32 screws and hex nuts to 16 ± 2 in-lb.
2. Reconnect the connectors to the jacks, and the quick-disconnects to the +5 V (red) and ground (black) on the power board. Reconnect the connector to the jack on the logic board.
3. Close the rear access door on the cabinet.
4. Replace the printer paper and restore power to the LA36.

7.23 LOGIC BOARD

The following procedure describes the removal and installation of the logic board.

7.23.1 Logic Board Removal

1. Remove the power from the LA36. Remove the printer paper.
2. Open the rear access door on the cabinet.
3. Disconnect the connectors from logic board jacks (Figure 7-3), and the quick-disconnects from the +5 V (red) and ground (black) on the logic board.
4. Remove the six (8-32) screws that secure the logic board to the rear access door and set the logic board aside.

7.23.2 Logic Board Installation

1. Place the logic board on the standoffs, and secure them with six (8-32) screws. Tighten to 8 ± 1 in-lb.
2. Reconnect the connectors to logic board jacks, and the quick-disconnects to the +5 V (red) and ground (black) on the logic board.
3. Close the rear access door on the cabinet.
4. Replace the printer paper and restore power to the LA36.

CHAPTER 8
ADJUSTMENT PROCEDURES AND LUBRICATION

8.1 GENERAL
This chapter contains a detailed description of the following LA36 adjustments.

- Encoder Adjustment (Paragraph 8.2)
- Print Head Adjustment (Paragraph 8.3)
- Carriage Shaft Adjustment (Paragraph 8.4)
- Print Bar Adjustment (Paragraph 8.5)
- Paper Guide and Printer Mechanism Adjustment (Paragraph 8.6)
- Paper Out Switch Adjustment (Paragraph 8.7)
- Ribbon Tension Adjustment (Paragraph 8.8)
- Ribbon Drive Assembly Adjustment (Paragraph 8.9)
- Idler Gear Assembly Adjustment (Paragraph 8.10)
- Bumper Assembly Adjustment

The print bar and carriage shaft adjustments require exact tolerances and are not recommended as field procedures.

8.2 ENCODER ADJUSTMENT
The following procedure describes the two encoder adjustments. First, the encoder is adjusted for a 50 percent duty cycle; second, the phase relationship between the two channels is adjusted.

1. Set the POWER switch to OFF and perform the printer housing removal procedure (Paragraph 7.2.1).

2. Set up the scope as follows:

   - Volts/Division: 1 V
   - Time Division: approximately 50 μs

NOTE
This note applies to printers with cover interlocks. The cover interlock must be overridden to perform the following tests. One method of overriding the interlock is to temporarily tape the interlock switch down.

3. Disconnect the wire (servo lead) from the power board to the servo fuse holder (F2).

NOTES

1. Use extreme care to prevent the loose servo lead from shorting.

2. Ensure that the servo lead removed from the fuse holder is the one coming from the power board.

Using a test lead connect +5 V from the logic board to the servo fuse holder (F2).

4. Connect scope CH1 probe to E6-6 on the M7722 logic board (E2-6 on M7723, E18-6 on M7728).
5. Connect scope CH2 probe to E6-8 on the M7722 logic board (E2-8 on M7723, E18-8 on M7728).
6. Slip the timing belt off the dc motor pulley.
7. Restore power to the LA36 (set the POWER switch to ON). The motor will rotate clockwise as viewed from the front.
8. Select channel 1, set vertical to CH1, and trigger source to channel 1.
9. Adjust scope for one duty cycle full scale (Figure 8-1). Observe the duty cycle.

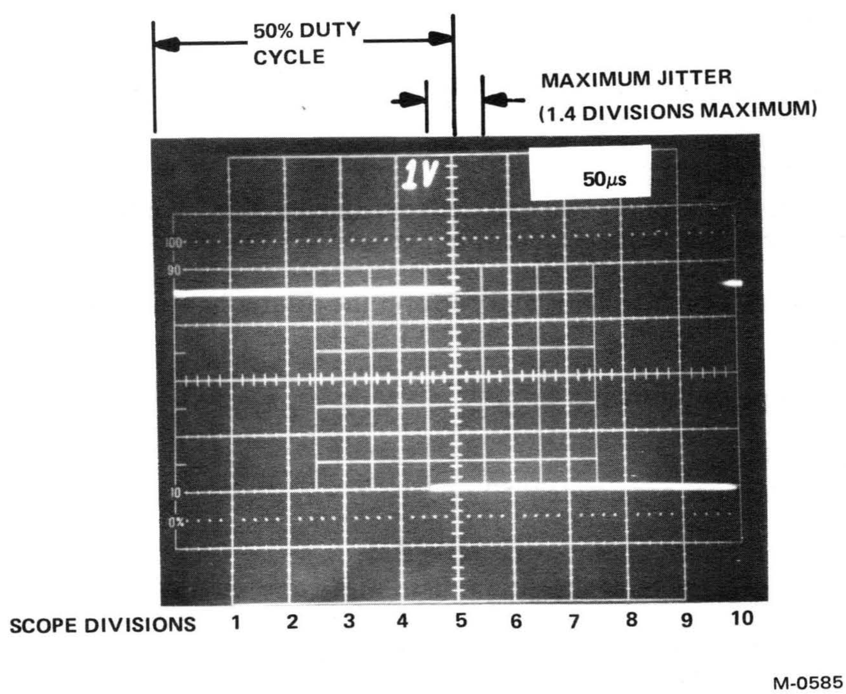


Figure 8-1 Encoder 50 Percent Duty Cycle Wave Shape

10. If the channel 1 signal (Figure 8-1) does not have a 50 percent duty cycle (jitter included), carefully remove the encoder cover and adjust R1 on the encoder assembly (Figure 7-2).

11. Check the channel 1 jitter (Figure 8-1). Maximum allowable jitter is 1.4 divisions (or ± 0.7 division).

12. Select channel 2, set vertical to CH2, and trigger source to channel 2.

13. Adjust the scope for one duty cycle full scale (Figure 8-1). Observe the duty cycle.

14. If the channel 2 signal (Figure 8-1) does not have a 50 percent duty cycle (jitter included), adjust R2 on the encoder assembly (Figure 8-2).

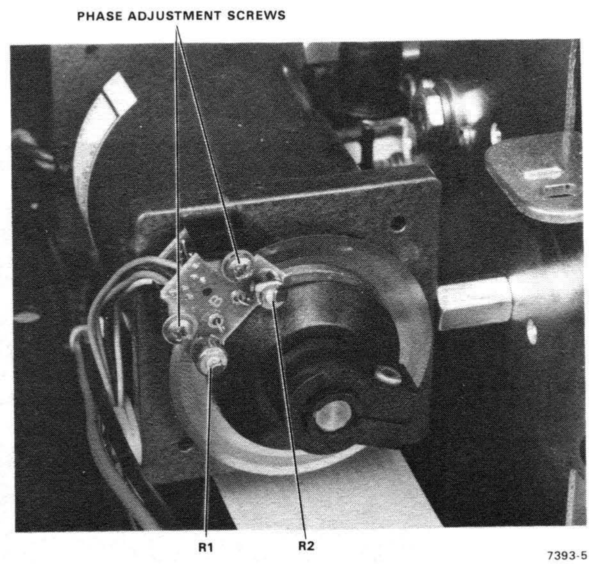


Figure 8-2 Encoder (Rear View)

15. Check the channel 2 jitter (Figure 8-1) Maximum allowable jitter is 1.4 divisions (or ± 0.7 division).

16. Set up scope per Figure 8-3.

CAUTION

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

17. Channel 2 should lead channel 1 by 90 degrees ± 20 degrees (Figure 8-3). If not, loosen the two encoder screws (Figure 8-2) and reposition the encoder subassembly as required and tighten the screws.

18. Turn the power off.

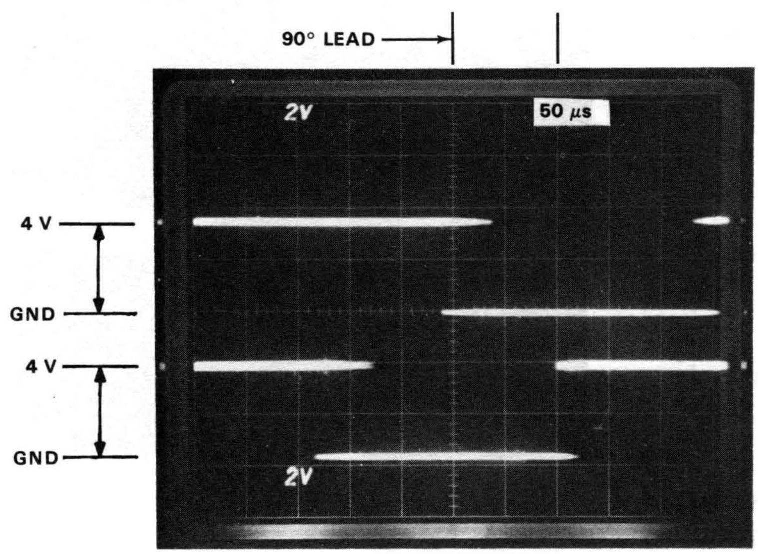
19. Glyptal both potentiometers and carefully replace the encoder cover.

20. Remove the test lead between +5 V and the servo fuse holder. Reconnect the lead from the power board to the servo fuse holder.

21. Remove the scope leads and close the rear access door.

22. Reinstall the timing belt on dc motor pulley.

23. Perform the printer housing installation procedure (Paragraph 7.2.2).



SCOPE SETUP

VOLTS/DIV:	2 V
VERTICAL MODE:	ALT
TIME/DIV:	50 µs
TRIG MODE:	NORMAL
TRIG SOURCE:	CH1, AC, INT, POS
CH1 to:	M7722 E6-6 M7723 E2-6 M7728 E18-6
CH2 to:	M7722 E6-8 M7723 E2-8 M7728 E18-8

M-0724

Figure 8-3 Encoder Phasing Waveshape

8.3 PRINT HEAD ADJUSTMENT

The following procedure describes the print head adjustment. Having the print head out of adjustment will result in poor print quality and shortened head life.

1. Set the POWER switch to OFF.

2. Perform the printer housing removal procedure (Paragraph 7.2.1).

   CAUTION
   It is possible to set the Carriage Adjustment lever beyond the minimum gap position. If this is done, the correct head gap adjustment cannot be made.

3. Set the Carriage Adjustment lever to the minimum gap position (detent closest to the print bar).

   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 0.3048 mm (0.012 inch) of clearance.

4. Place the 0.3048 mm (0.012 inch) flat feeler gauge between the print head jewel and the front surface of the print bar (Figure 8-4). Check for 0.3048 ± 0.0508 mm (0.012 ± 0.002 inch) clearance.

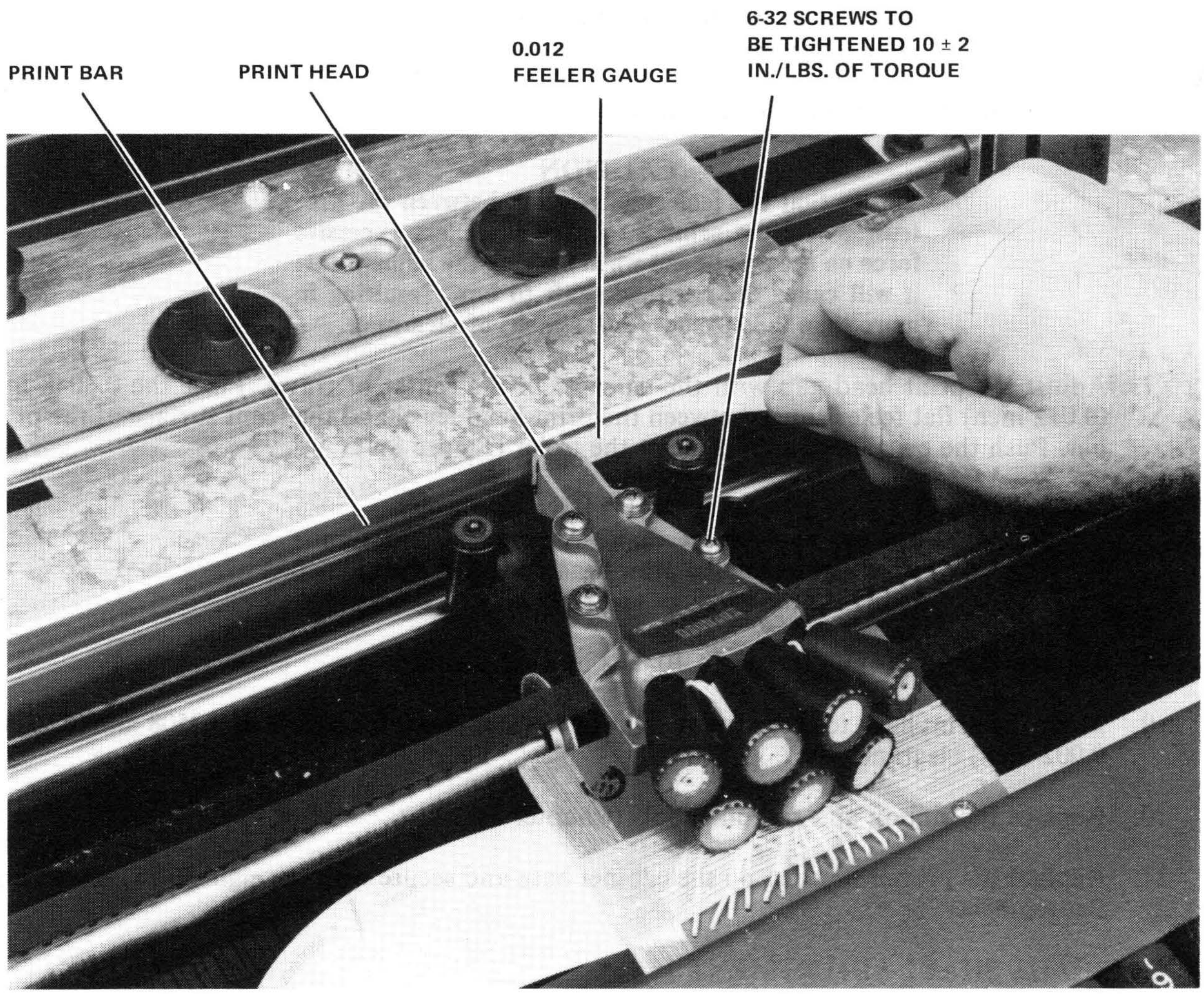


Figure 8-4 Print Head Adjustment

5. Move the print head to extreme right or left and check for 0.3048 ± 0.0508 mm (0.012 ± 0.002 inch) clearance.

NOTE
If the head is aligned properly do not perform the following steps. Restore the LA36 to its normal operating configuration.

6. Loosen the four (6-32) print head screws.

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 0.3048 mm (0.012 inch) of clearance.

7. Adjust the print head gap with the carriage in the center of travel. Place the 0.3048 mm (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 8-4).

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

8. Tighten the four (6-32) screws to 10 ± 2 in-lb of torque.

9. Move the print head to the extreme right or left and check for 0.3048 ± 0.0508 mm (0.012 ± 0.002 inch) clearance.

10. Replace the ribbon and ribbon spools (Chapter 3).

11. Replace the printer housing on the cabinet base and secure with the eight (6-18) screws and flat washers.

8.4 CARRIAGE SHAFT ADJUSTMENT

NOTE
The print bar must be in alignment prior to aligning the carriage shafts.

The following procedure describes the carriage shaft parallelism adjustment.

1. Set the POWER switch to OFF.

2. Perform the printer housing removal procedure (Paragraph 7.2.1).

3. Remove the ribbon and ribbon spools.

4. 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 (Figure 8-5).

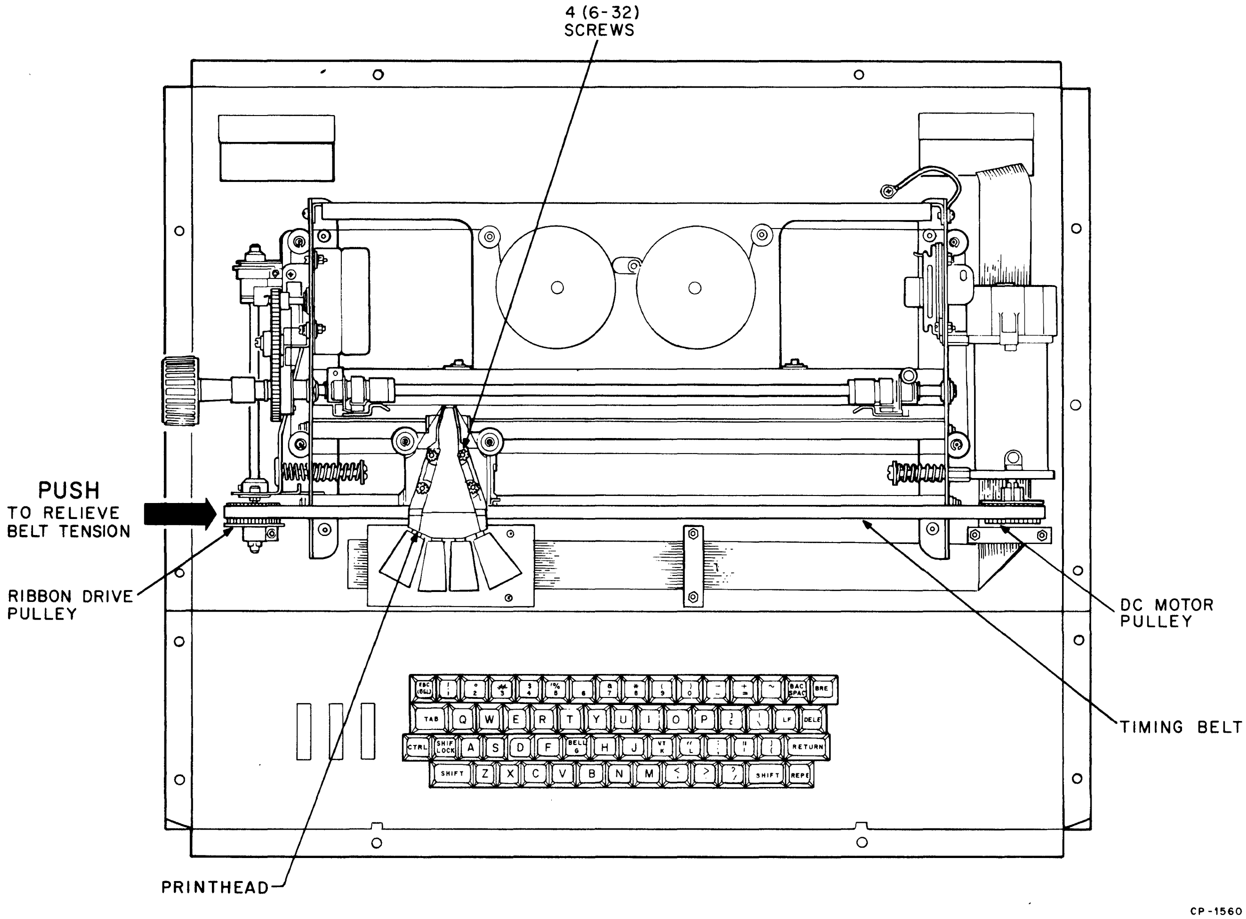


Figure 8-5 Timing Belt Removal

5. Set the alignment gauge on the carriage shafts (Figure 8-6) and zero the gauge by rotating the gauge bezel.

6. Slide the alignment gauge along the total length of the carriage shaft. The maximum deviation along the entire length of the carriage shafts is 0.004, with the two shaft ends being equal within 0.0015.

NOTE

If the carriage shafts are properly aligned, do not perform the following steps. Restore the LA36 to its normal operating configuration.

7. Loosen the two (10-32) Allen-cap screws on the carriage shaft closest to the front of the LA36. It may be necessary to remove the two timing belt pulleys to gain access to the carriage shaft Allen-cap screws. Note the location of any shims between the carriage shaft and the end plate.

NOTE

When rotating the carriage shafts, ensure that the shims, if any, do not fall or change position.

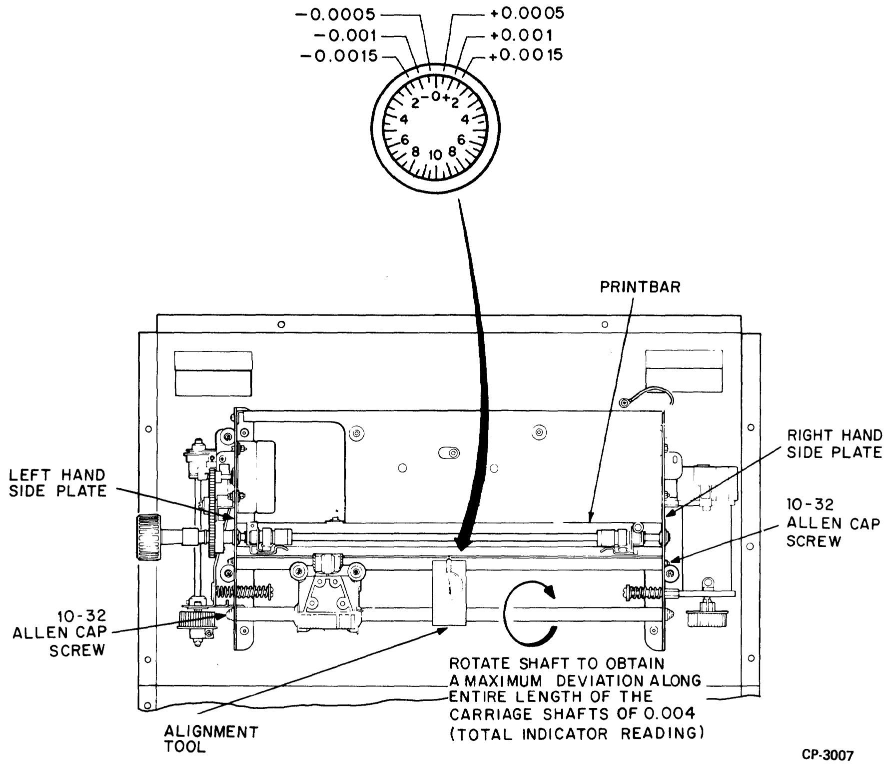


Figure 8-6 Carriage Shaft Parallelism/Alignment

8. Slide the alignment gauge along the total length of the carriage shafts.

   - The maximum deviation along the entire length of the carriage shafts is 0.004 with the two ends of the carriage shafts being equal within 0.0015. If necessary, rotate the shafts to obtain these values.

9. Torque the front carriage shaft to 18 ± 2 in-lb and check the tolerances listed in the above step. Loosen the front carriage shaft and repeat the above step if necessary.

NOTE
Replace the pulleys if applicable.

10. Insert the belt tension spring between the left-hand side plate and the ribbon drive.

11. 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.

12. Perform the print head adjustment procedure (Paragraph 8.3).

13. Perform the printer housing installation procedure (Paragraph 7.2.2).

8.5 PRINT BAR ADJUSTMENT

The following paragraph describes the print bar adjustment. Upon completion of this procedure, the print head must be checked for adjustment.

1. Set the POWER switch to OFF.
2. Perform the printer housing removal procedure (Paragraph 7.2.1).
3. Remove the ribbon and ribbon spools.
4. Calibrate the alignment gauge by setting the dial to zero with the calibrate block screwed securely in place (Figure 8-7).

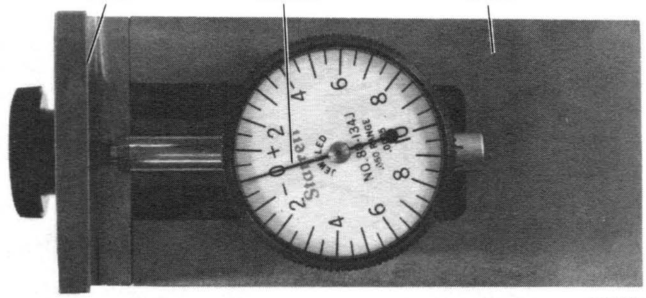


Figure 8-7 Alignment Gauge and Calibration Block

5. Remove the calibrate block from the front of the gauge and set the gauge on the extreme right of the carriage shafts (Figure 8-8). Record the gauge indication.
6. Repeat the above step with the gauge on the extreme left of the carriage shafts. The gauge should indicate 0 ± 0.002 with the two end readings being equal within 0.0015.

NOTE

If the print bar is properly aligned, do not perform the following steps. Restore the LA36 to its normal operating configuration.

7. Loosen the two hex-heaad (1/4-20) screws with a 7/16 wrench at each end of the print bar (Figure 7-9). Push the print bar as far back as possible (toward the ribbon chassis).
8. Move the gauge to the extreme right of the carriage shafts. Position the print bar for a zero indication on the gauge.

NOTE

It is possible to pass through the first zero indication on the gauge. If this happens, the print bar has been brought too far forward.

9. Repeat this procedure with the gauge on the extreme left of the carriage shafts.
10. Repeat the above two steps as many times as necessary until the gauge indicates 0 ± 0.002 with the two end readings being equal within 0.0015. Slide the gauge across the full length of the carriage shafts. The total indicator reading must not vary more than 0.004.
11. Torque the two 7/16 hex-head (1/4-20) screws at each end of the print bar to 75 ± 5 in-lb.
12. Insert the belt tension spring between the left-hand side plate and the ribbon drive.
13. Slip the timing belt on the ribbon drive pulley.
14. Perform the print head adjustment procedure (Paragraph 8.3).
15. Perform the printer housing installation procedure (Paragraph 7.2.2).

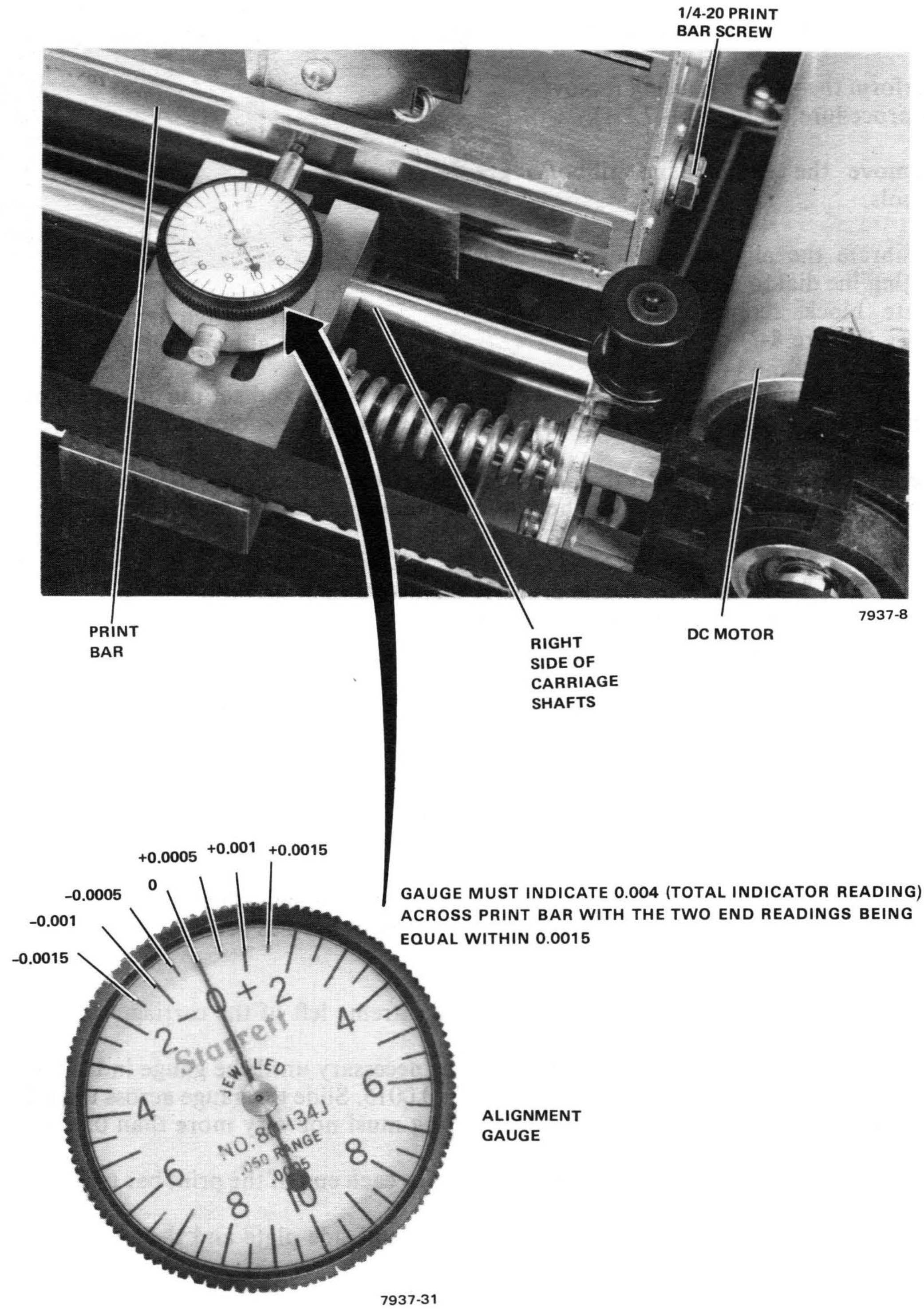


Figure 8-8 Print Bar Adjustment

8.6 PAPER GUIDE AND PRINTER MECHANISM ADJUSTMENT

This procedure is performed to ensure the correct spacing for the paper guide and printer mechanism.

1. Set the POWER switch to OFF.

2. Perform the printer housing removal procedure (Paragraph 7.2.1).

NOTE

It is not necessary to loosen the four printer mechanism screws when checking the alignment.

3. Loosen the four (10-32) screws that secure the printer mechanism to the cabinet base (Figure 8-9).

4. 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 8-9). Tighten the four (10-32) screws to 5 ± 1 in-lb of torque.

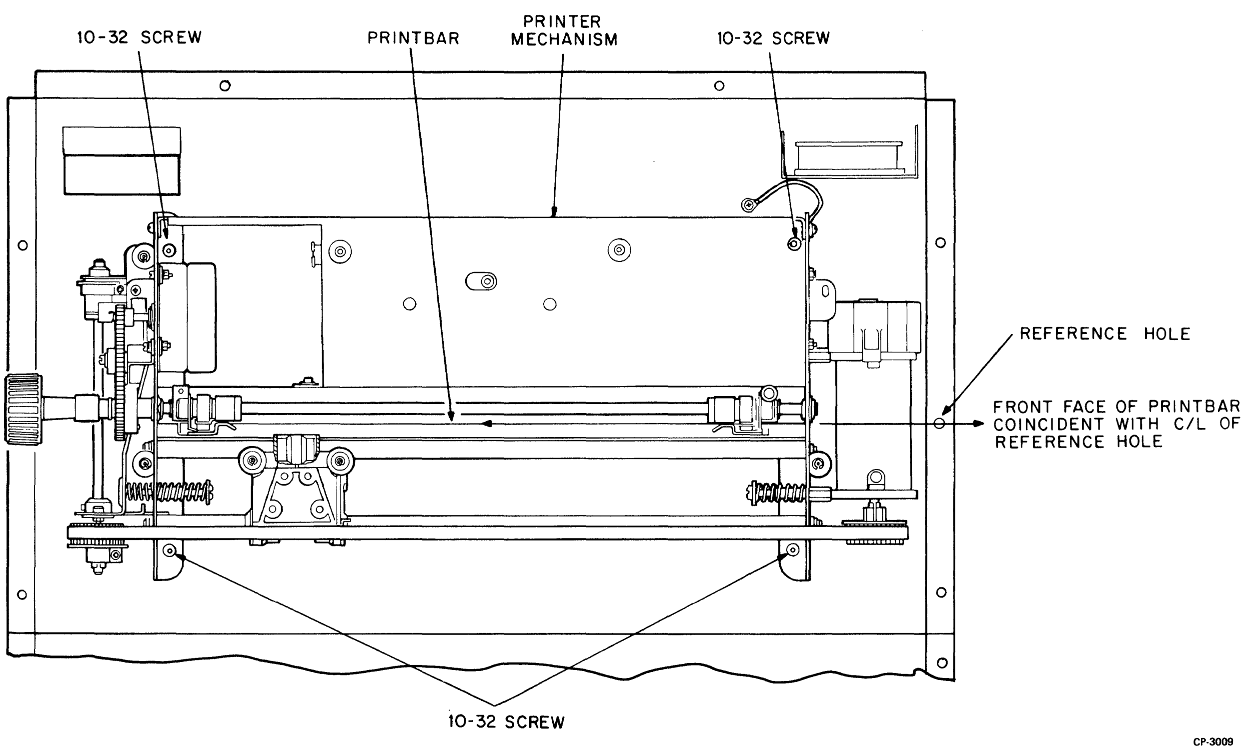


Figure 8-9 Printer Mechanism Alignment

5. Check that the carriage has 0.0508 to 0.1016 mm (0.20 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). If necessary, loosen the four (10-32) screws that secure the printer mechanism to the cabinet base and redjust the printer mechanism to attain a minimum of 0.0508 mm (0.020 inch) clearance (Figure 8-10).

6. Loosen the three (8-32) screws at the bottom of the paper guide and adjust for 2.54 to 3.556 mm (0.10 to 0.14 inch) gap between the paper guide and the bent-up flange of the base (Figure 8-11).

7. 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.

8. Perform the printer housing installation procedure (Paragraph 7.2.2).

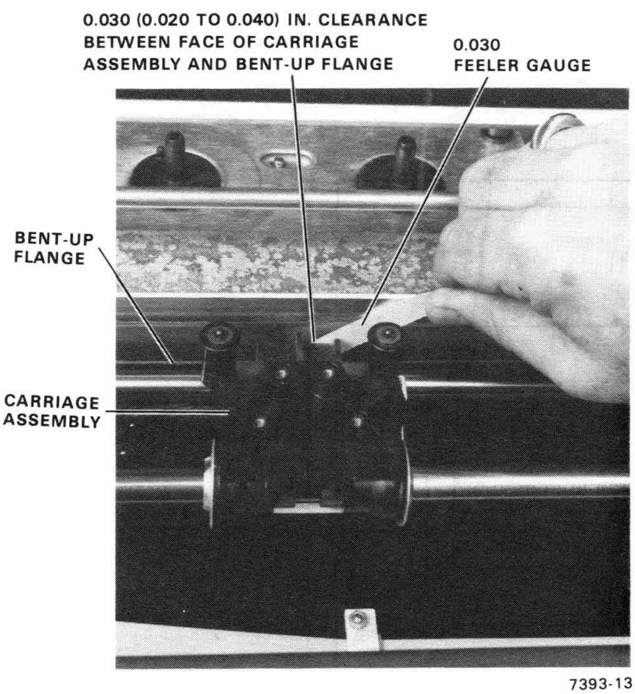


Figure 8-10 Printer Mechanism Adjustment

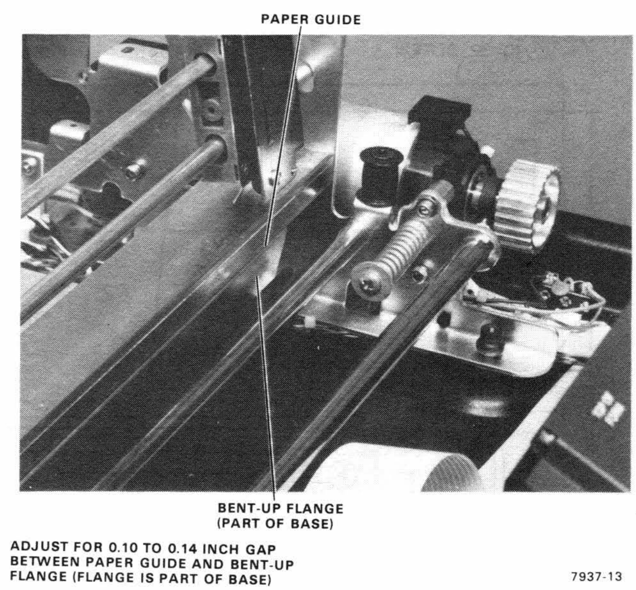


Figure 8-11 Paper Guide Adjustment

8.7 PAPER OUT SWITCH ADJUSTMENT

This procedure describes the PAPER OUT switch adjustment.

1. Set the POWER switch to OFF.
2. Lift up and remove the printer cover.

   NOTE

   If the screws cannot be loosened in the following step, it may be necessary to reform the switch arm to attain the adjustment.

3. Loosen the two (4-40) screws at the PAPER OUT switch.
4. Rotate the PAPER OUT switch counterclockwise (Figure 8-12) until the switch clicks (transfers). Then rotate the switch clockwise until the switch clicks again (transfers back). Tighten the two (4-40) screws to 5 ± 1 in-lb.
5. Replace the printer cover.
6. Restore power.

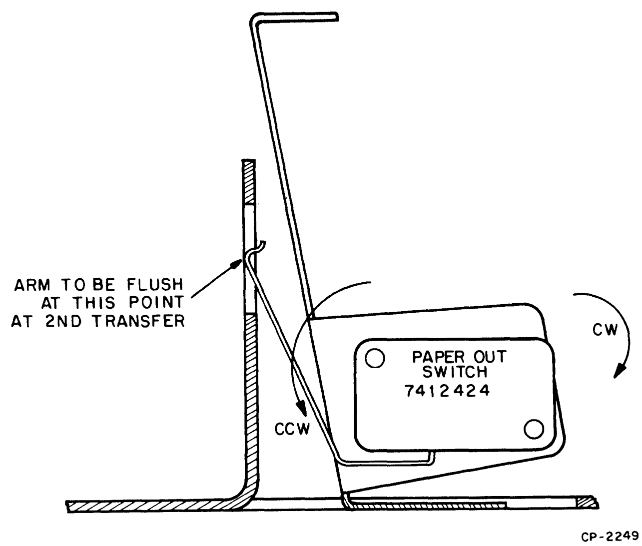


Figure 8-12 PAPER OUT Switch Adjustment

8.8 RIBBON TENSION ADJUSTMENT

The following procedure first checks the individual spool drag. Then, with the ribbon installed, a carriage drag test is performed, checking the system drag.

1. Set the POWER switch to OFF.
2. Lift up and remove the printer cover.
3. Remove the ribbon spools and ribbon.
4. Place an empty spool on the side not being driven.
5. Wind a small piece of string or ribbon on the empty spool. Measure the force required to pull the string in the direction the ribbon normally takes (Figure 8-13). The measured force should be 113.4 to 170.1 g (4 to 6 oz).

   NOTE

   If the desired indication is not achieved, it may be necessary to remove the VFU and takeup bracket assembly to make the adjustment.

6. Adjust the spool drag by tightening or loosening the adjustment screw, while holding the nut at the base of the screw. An 11/32-inch wrench is required to hold the nut.
7. Move the direction changing guide and check the remaining undriven spool for 113.4 to 170.1 g (4 to 6 oz) of tension.
8. Install the ribbon and spools.

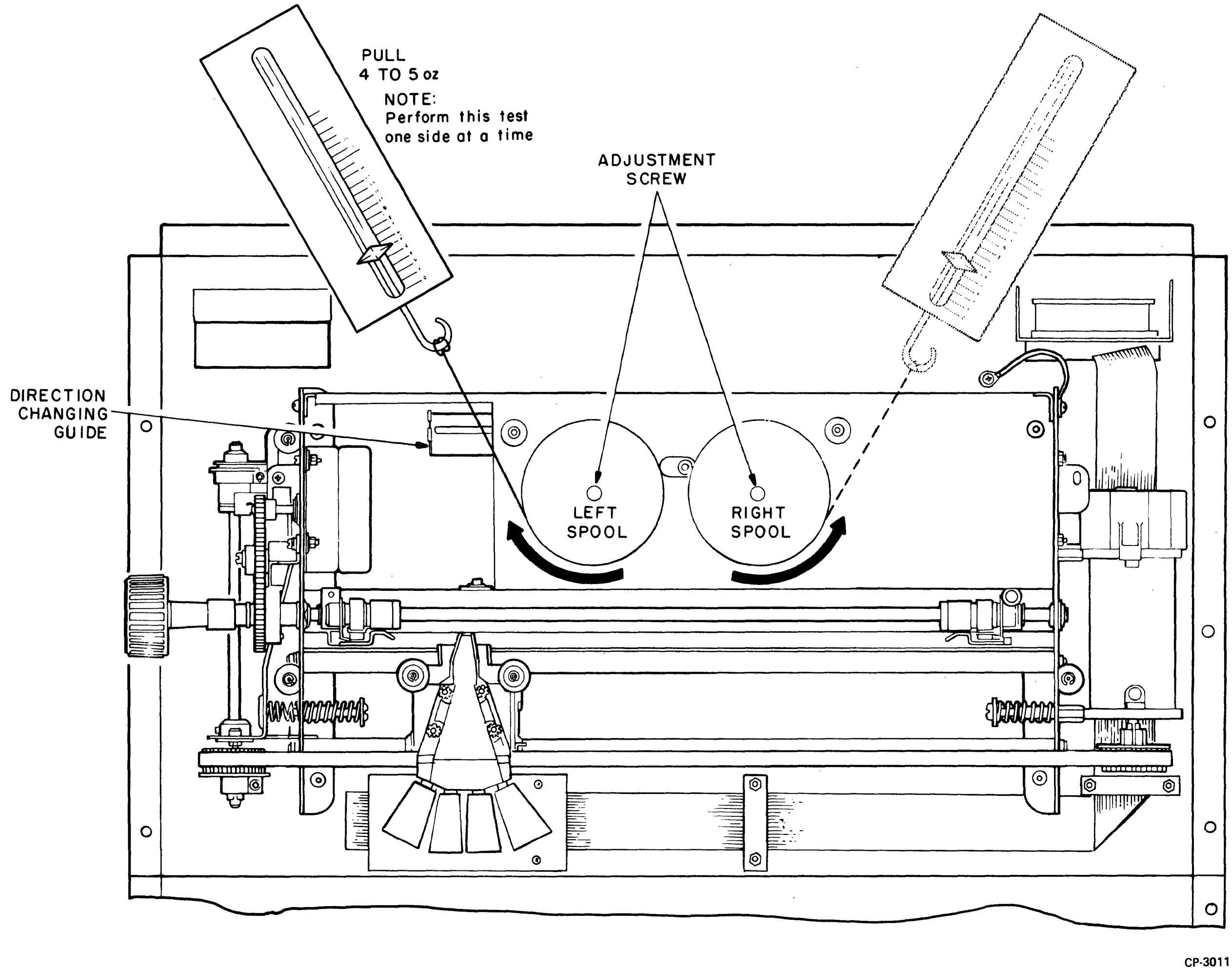


Figure 8-13 Ribbon Spool Tension Adjustment

9. 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 1.5876 kg (3.5 lb) (Figure 8-14). The ribbon should be moving right to left across the face of the print head when the pull test is made.

   Failure to achieve a pull of 1.5876 kg (3.5 lb) maximum could indicate a problem in one of the following areas:

   - Ribbon Path
   - Carriage Assembly (misaligned or damaged bearings)
   - Printer Assembly (damaged end plates)
   - Ribbon Chassis
   - Ribbon Drive Assembly.

10. Reinstall the printer cover.

11. Restore power.

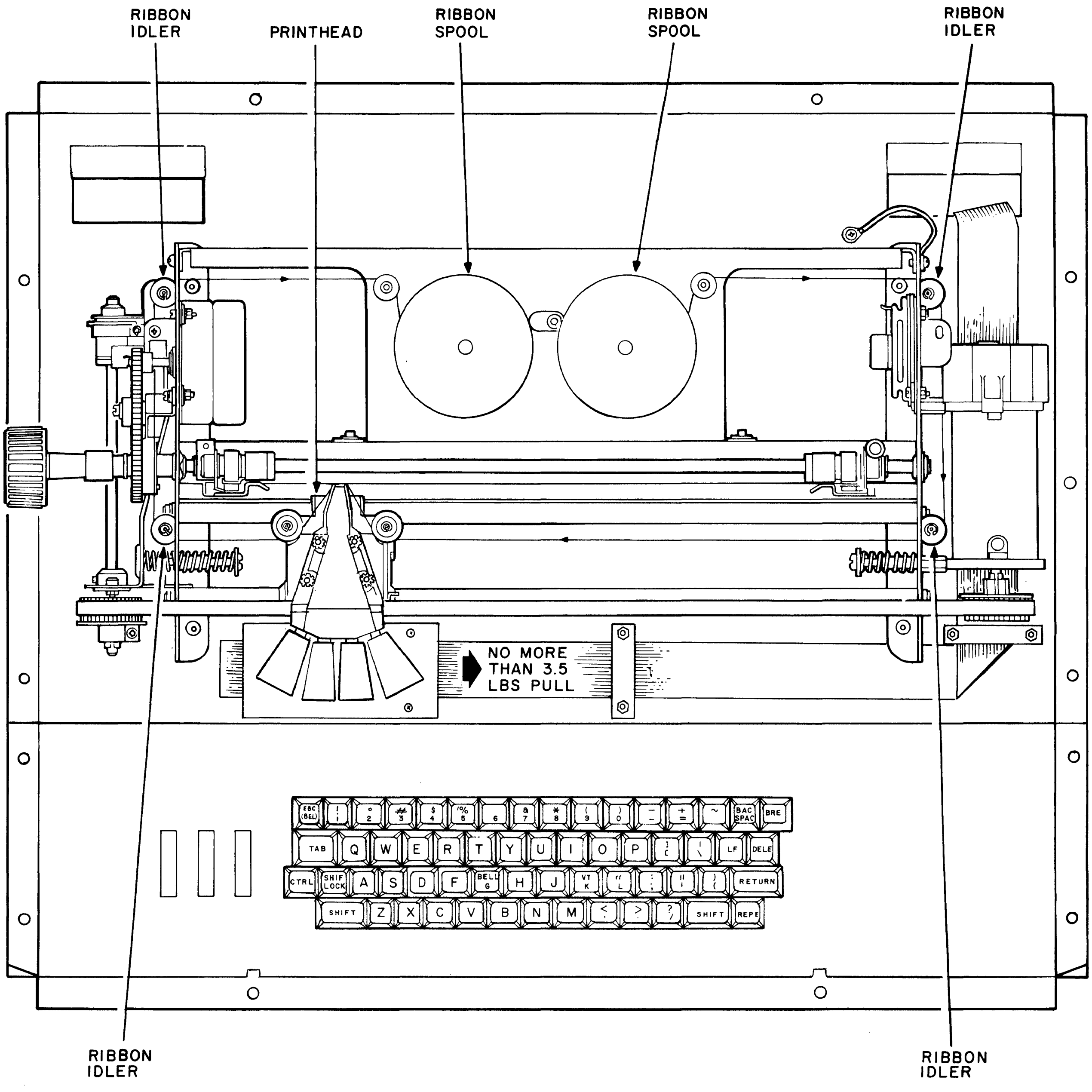


Figure 8-14 Ribbon Threading/Drag Test

8.9 RIBBON DRIVE ASSEMBLY ADJUSTMENT

This procedure describes the ribbon drive assembly adjustment.

1. Set the POWER switch to OFF.
2. Lift up and remove the printer cover.
3. Rotate the ribbon drive pulley on the ribbon drive until the clutch eccentric is at its highest point.
4. The ribbon drive pushrod should be at the center of the elongated hole (Figure 8-15). Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated hole. Travel should be equal on both sides of the centerline.
5. To adjust for the conditions listed in the above step, loosen the 8-32 upper pivot screw (Figure 8-16) and move the ribbon drive assembly the required amount.
6. Tighten the 8-32 screw to 18 ± 2 in-lb, and repeat step 4.
7. Replace the cover on the printer.
8. Restore power to the LA36.

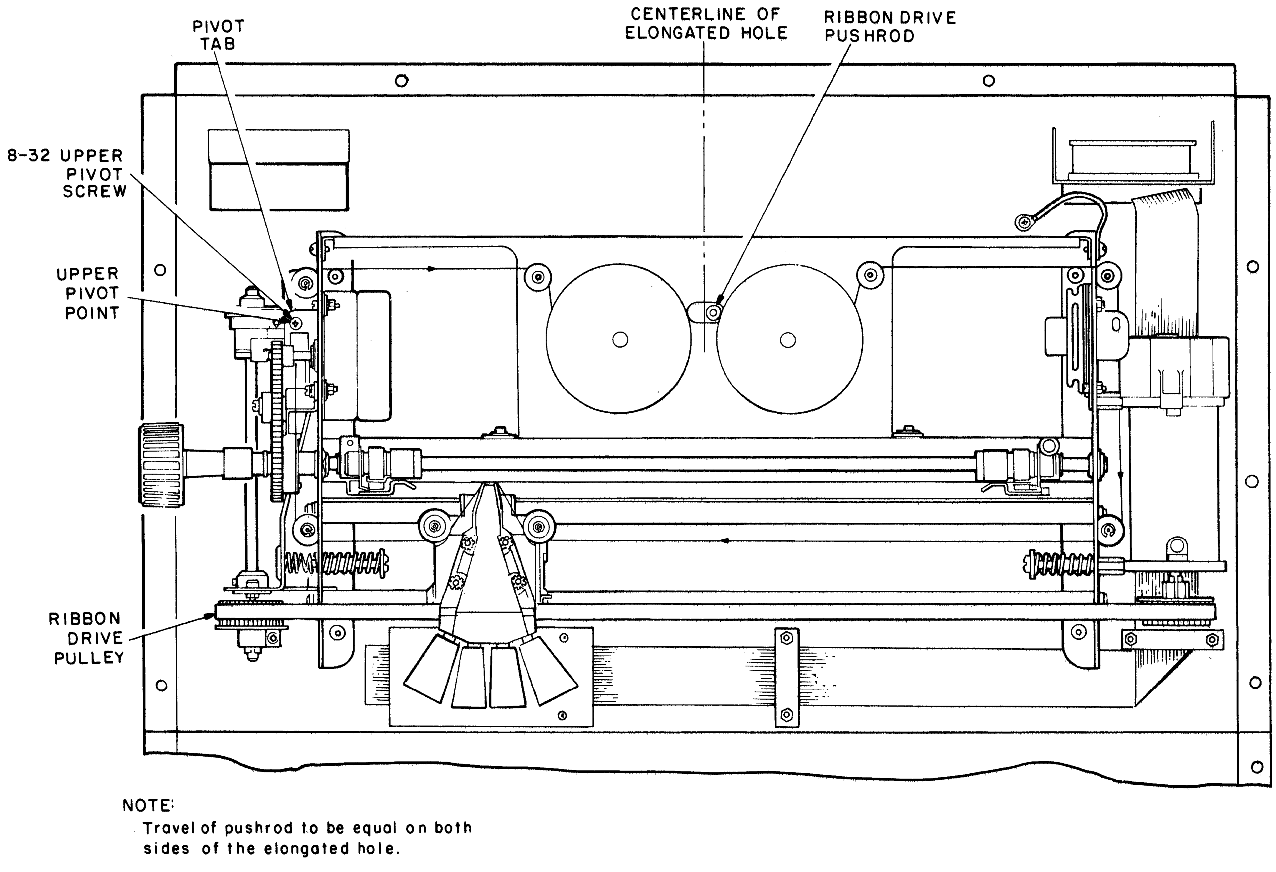


Figure 8-15 Ribbon Drive Adjustment

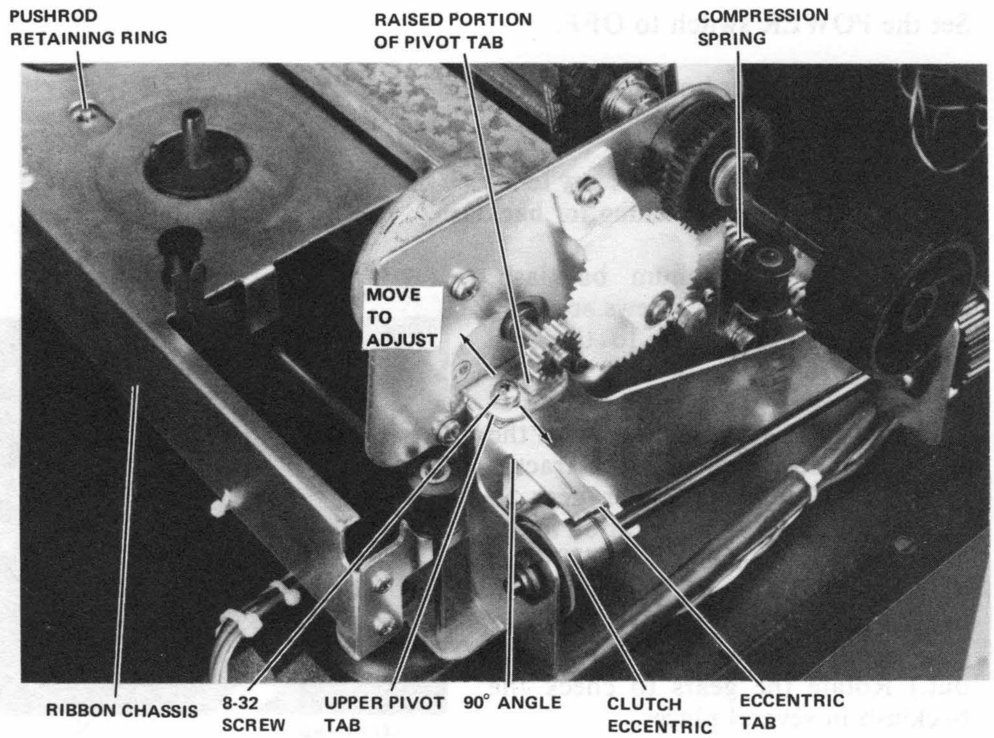


Figure 8-16 Ribbon Drive Assembly

8.10 IDLER GEAR ASSEMBLY ADJUSTMENT

The procedure adjusts the idler gear assembly for the correct amount of backlash.

1. Set the POWER switch to OFF.

2. Perform the printer housing removal procedure (Paragraph 7.2.1).

NOTE

It is not necessary to loosen the two idler gear screws when checking for backlash.

3. To adjust for minimum backlash, loosen the two (8-32) screws securing the idler gear assembly to the side plate (Figure 8-17).

4. 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 0.0508 to 0.1778 mm (0.002 to 0.007 inch) between each pair of gears (Figure 8-17). (The idler gear should be free to slide in and out.) Rotate the gears to check the backlash in several places.

5. Tighten the two (8-32) screws to 18 ± 2 in-lb of torque.

6. Perform the printer housing installation procedure (Paragraph 7.2.2).

7. Restore power to the LA36.

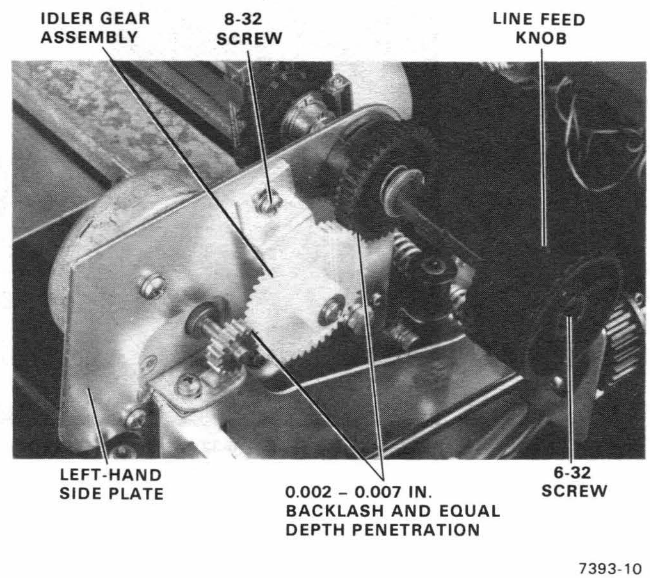


Figure 8-17 Idler Gear Assembly

*Backlash is the amount a gear turns prior to turning the gear it meshes with.

8.11 BUMPER ASSEMBLY ADJUSTMENT

Tighten the screws (Figure 8-18) until the top of the washer is 42.42 mm (1.67 inches) from the side plate on the left side, and 42.42 mm (1.67 inches) from the side plate on the right side. Center the spring around the screw.

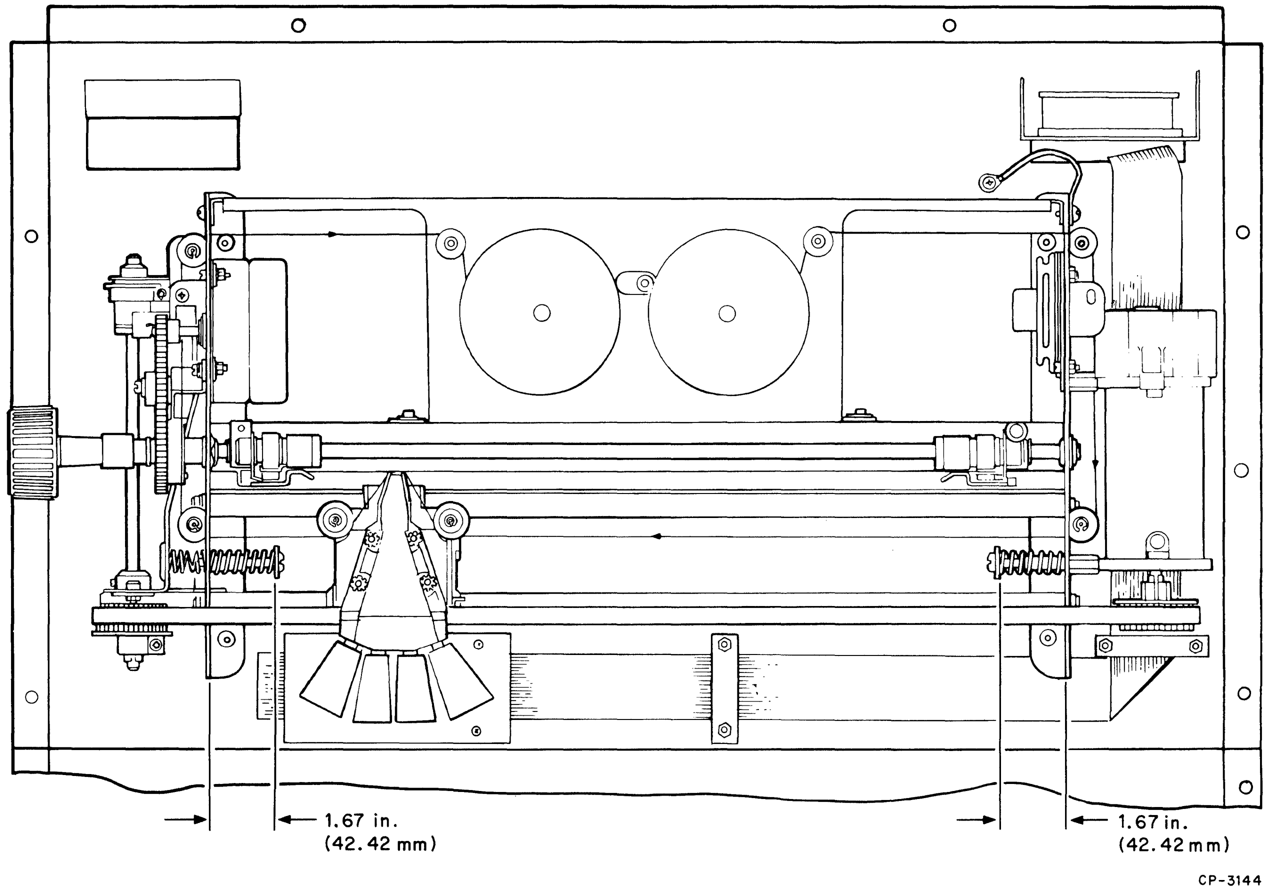


Figure 8-18 Bumper Assembly Adjustment

8.12 LUBRICATION

The DECwriter is factory lubricated; however, after an extended period of time, lubrication may be required (oiling should be done infrequently). Table 8-1 lists those areas that may require lubrication.

Table 8-1 Lubrication Points

Area	Lubricant	Amount
Carriage Shafts Figure 8-18)	DEC Part No. 49-01174, or Nye Oil No. 622-00	1 or 2 drops in each oiler
Ribbon Drive Assembly (Figure 8-19)	SAE 30	1 or 2 drops in each of the five places shown in Figure 8-19

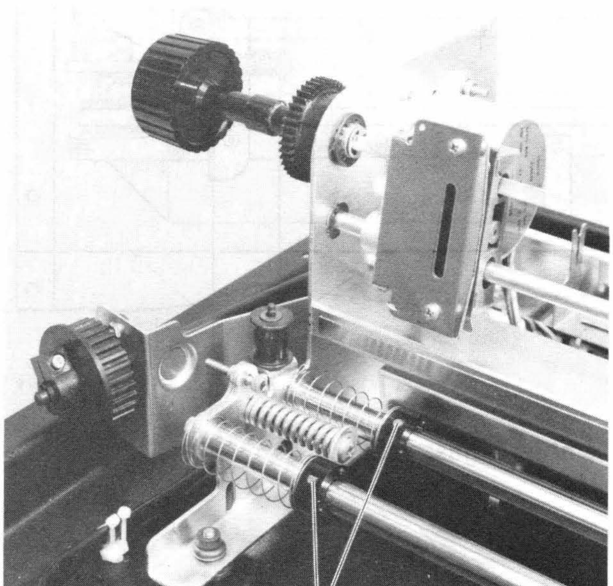


Figure 8-19 Carriage Shaft Lubrication

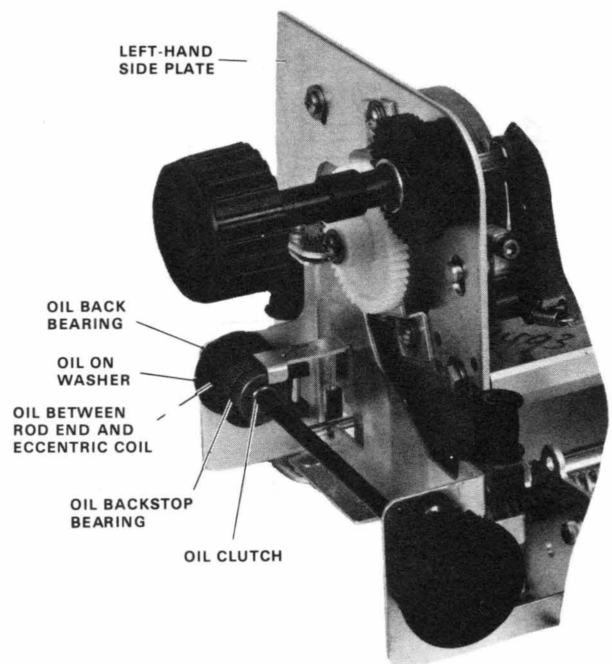
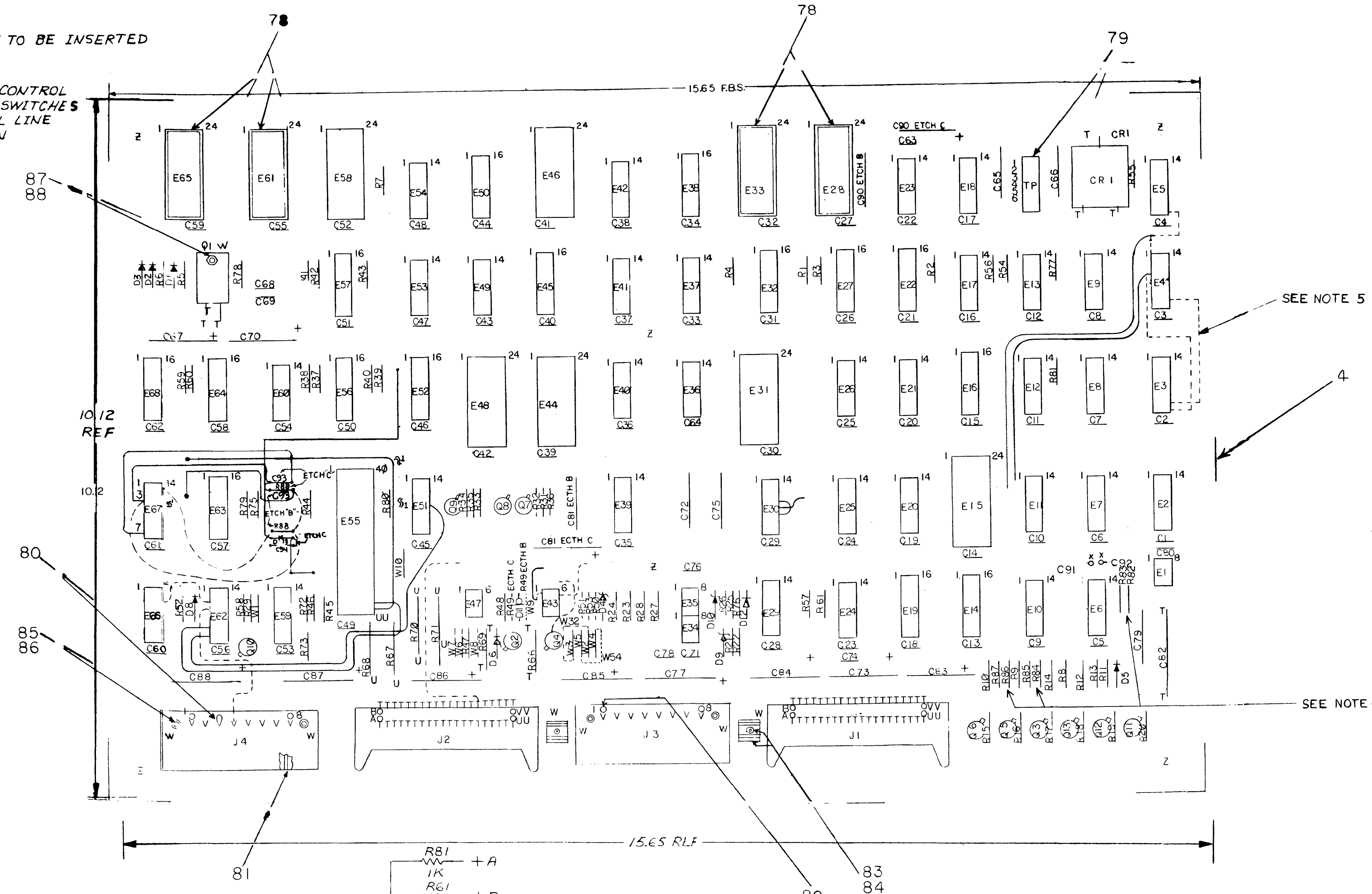


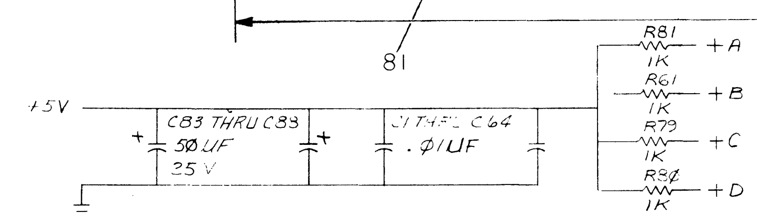
Figure 8-20 Ribbon Drive Assembly Lubrication

APPENDIX A
ENGINEERING DRAWINGS

NOTES:

1. * E27 & E48 NOT TO BE INSERTED
2. CONNECTORS:
   - J1 → J1 POWER
   - J2 → KEYBOARD/CONTROL SWITCHES
   - J3 → 20MA. SERIAL LINE
   - J4 → DF11 OPTION
3. PREFERRED CONFIGURATION
   E58 = 23-082A6 ("CROM")
   E61 = EMPTY
   E65 = EMPTY
   SUBSTITUTE CONFIGURATION
   E58 = EMPTY
   E61 = 23-083A4 ("PROM 1")
   E65 = 23-082A4 ("PROM Ø")
4. 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%
5. DOTTED LINES REPRESENT ADDED WIRES TO ETCH REVB BOARDS ONLY.
6. LOCATIONS OF R82 THRU R87 ARE SLIGHTLY DIFFERENT ON ETCH REV B BOARDS.
7. SUBSTITUTE CONFIGURATIONS ARE EQUAL IN PERFORMANCE TO PREFERRED CONFIGURATIONS. IT IS NOT NECESSARY TO CHANGE CONFIGURATIONS IN THE FIELD.





IC TYPE	GND	+ 5V
8640	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
MK2500P	12	24
UART	3	1

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

IC PIN LOCATIONS

FIRST USED ON OPTION MODEL: LA36

ETCH BOARD REV: B C

SEMICONDUCTOR CONVERSION CHART

PARTS LIST

digital EQUIPMENT CORPORATION

TITLE: LA36 (MPC1)

SIZE D, CODE CS, NUMBER M7722-Ø-1

SHEET 1 OF 8

PARTS LIST

QUANTITIES SHOWN REPRESENT PREFERRED CONFIGURATION

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
REF		X-Y COORDINATE HOLE LOCATION	K-CO-M7722-Ø-4	1
REF		ASSY/DRILLING HOLE LAYOUT	D-AH-M7722-Ø-5	2
REF		MODULE ECO HISTORY	B-MH-M7722-Ø-6	3
1		ETCHED CIRCUIT BOARD	5010823	4
3	C71,C76,C80	CAP 39PF,100V,5%,DIPPED MICA	1ØØØØ1Ø	5
1	C82	CAP.22UF,100V 10% MYLAR	1ØØØØ37	6
5	C65,C66,C72,C75,C79	CAP.047UF,100V 10% MYLAR	1ØØØØ51	7
70	C1 THRU C64,C68,C69,C74, C78,C91,C92	CAP.01UF 100V DISC	1ØØ161Ø-Ø1	8
1	C93	CAP .005uf 100V DISC	1001765	9
6	C67,C70,C73,C77,C81,C90	CAP 25UF 25V 20% AL EL	1ØØØØ75	10
6	C83 THRU C88	CAP 50UF 25V 10% AL EL	1ØØ1796	11
1	D1	DIODE D662	11ØØ113	12
4	D8,D5,D12,D13	DIODE D664	11ØØ114	13
2	D9,D10	DIODE IN748A 3.9V ZENER 5%	11ØØ122	14
1	D4	DIODE IN746A 3.3V ZENER 5%	11Ø486Ø	15
1	D6	DIODE IN4004	11Ø5796	16
2	D2,D3	DIODE .4M 5.1AZ1 5.1V ZENER 1%	1105873	17
2	J3,J4	CONN 8PIN MAT-N-LOK(SOCKET HOUSING)	12Ø934Ø	18
2	J1,J2	CONN 40PIN BERG	12Ø9941	19
2	R23,R27	RES 511 1/4W 1%	13Ø2411	20
3	R21,R25,R51	RES 1M ¼W 5%	13Ø9595	21
2	R29,R50	RES 47 ¼W 5%	13ØØ2Ø2	22
4	R6,R58,R7,R88	RES 100 ¼W 5%	13ØØ229	23
1	R47	RES 150 ¼W 5%	13ØØ25Ø	24
3	R33,R76,R49	RES 330 ¼W 5%	13ØØ295	25
34	R1 THRU R5, R32, R34, R35 R37 THRU R46, R52, R61, R72, R73, R75, R77 THRU R87, R55	RES 1K ¼W 5%	1300365	26
1	R31	RES 1.5K ¼W 5%	13ØØ391	27
1	~~R54, R56~~, R53	RES 10K ¼W 5%	13ØØ479	28
3	R13,R22,R26	RES 180 ¼W 5%	13Ø1322	29
1	R48	RES 68K ¼W 5%	13Ø1327	30
1	R11	RES 820 ¼W 5%	13Ø1775	31
6	R36,R59,R60,R57,R54,R56	RES 5.6K ¼W 5%	13Ø1874	32
1	C94	CAP .1Uf 100V DISC	1000030	33
1	R8	RES 100K ¼W 5%	13Ø2466	34
1	R18	RES 14.7K ¼W 1%	13Ø2941	35
2	R12,R14	RES 1K ¼W 1%	13Ø3114	36
4	R67,R68,R70,R71	RES 1K 1W 5%	13ØØ368	37
1	R19	RES 3.48K ¼W 1%	13Ø5114	38
1	R15	RES 121K ¼W 1%	13Ø5255	39
2	R9,R10	RES 232K ¼W 1%	13Ø5424	40
1	R17	RES 30.1K ¼W 1%	1311594	41
1	R16	RES 59K ¼W 1%	13ØØ525	42
~~1~~	~~R[illegible]~~	~~RES 470 ¼W 5%~~	~~13ØØ316~~	43
2	Q7,Q8	TRANSISTOR MPSA55	1510706	44
10	Q2,Q4,Q9,Q10,Q11,Q12,Q13 Q3,Q5,Q6	TRANSISTOR MPSAØ5	151Ø7Ø5	45
1	Q1	TRANSISTOR D45C8	151Ø598	46
1	CR 1 CR 1	CRYSTAL 1.6896 MHZ SUBSTITUTE CRYSTAL 1.6896 MHZ PREFERRED	181Ø245-Ø2 1811689	47

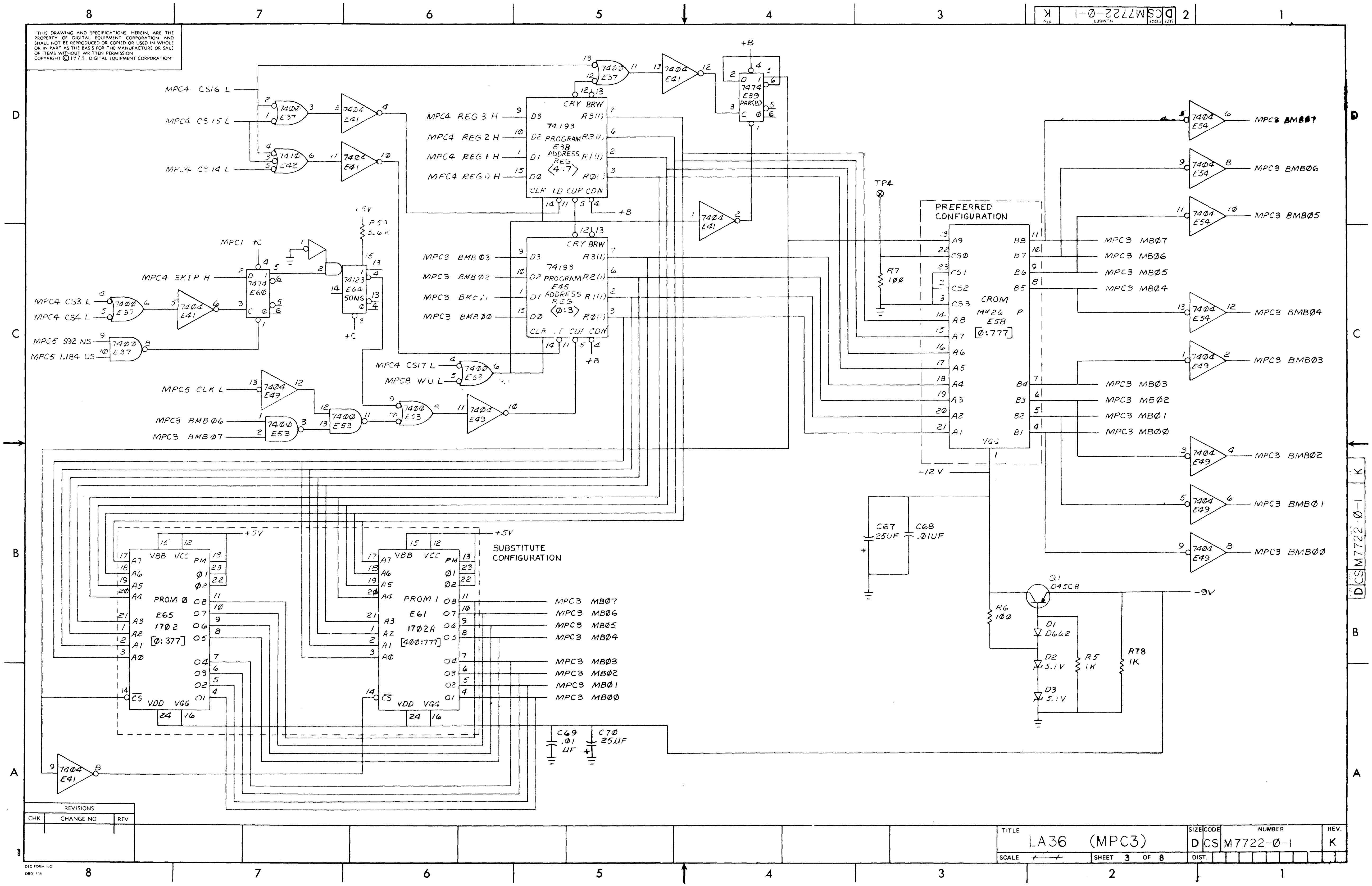
QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
11	E2,E3,E4,E5,E8,E24,E30,E39, E51,E60,E36	IC 7474	19Ø5547	48
6	E11,E12,E29,E37,E40,E53	IC 74ØØ	19Ø5575	49
2	E9,E42	IC 741Ø	19Ø5576	50
1	E23	IC 742Ø	19Ø5577	51
2	E21,E59	IC 74Ø1	19Ø559Ø	52
2	E13,E26	IC 7493A	19Ø9Ø54	53
~~1~~	~~E17~~	~~IC 38Ø~~	~~19Ø9485~~	54
10	E7,E10,E18,E20,E25,E41,E49 E54,E62,E67	IC 74Ø4	19Ø9686	55
2	E44,E46	IC 74154	19Ø97Ø1	56
1	E6	IC 7413	19Ø9989	57
3	E32,E38,E45	IC 74193	191ØØ18	58
2	E19,E50	IC 7442	191ØØ46	59
1	E66	IC 7437	191ØØ91	60
1	E16	IC 7419Ø	191ØØ95	61
2	E15,E31	IC 74150	191Ø153	62
3	E1,E34,E35	IC LM3 'AN DIP	191Ø282	63
3	E22,E56,E57	IC 7489, 3101	191Ø396	64
1	E64	IC 74123	191Ø436	65
1	E55	IC UART	191Ø459	66
2	E63,E68	IC 74161	191Ø65Ø	67
2	E14,E52	IC 74175	191Ø651	68
1	E28	IC MK2626P (NUMBER SET UNSLASHED Ø)	23071A6	69
2	E43,E47	IC 4N26 (SOC75)	1911998	70
~~1~~	~~E61~~	~~IC 1702A "PROM 1"~~	~~23083A4~~	71
1	E33	IC MK2627P (ALPHA SET)	23070A6	72
~~1~~	~~E28 (ALTERNATE)~~	~~IC MK2628P (NUMBER SET SLASHED Ø)~~	~~23072A6~~	73
~~1~~	~~E65~~	~~IC 1702A "PROM Ø"~~	~~23082A4~~	74
2	R66,R69	RES 18Ø 1/2W 5%	13ØØ26Ø	75
2	R24,R28	RES 5.11K 1/4W 1%	13Ø4854	76
1	R20	RES 2.15K 1/4W 1%	1311653	77
4	E28,E33,E61,E65	SOCKET IC 24 PIN	121Ø693	78
1		SOCKET IC 14 PIN (TP SOCKET)	121ØØ54	79
2		KEYING PLUG, MAT-N-LOK	1211595	80
11		SOCKETS, MAT-N-LOK 6132Ø-1	12Ø9456	81
5	W1 THRU W5	WIRE, INSULATED JUMPER	9ØØ9185	82
2		FASTON	9007113	83
2		EYELETS (FASTON)	9ØØ9ØØØ	84
4		EYELETS (MAT-N-LOK)	9007266	85
4		WASHER, FLAT, NYLON, #6	9ØØ67Ø7	86
1		SCREW, SLOTTED BIND. HD. 4-40 X 5/16	9ØØ6Ø1Ø-4	87
1		NUT, KEP, 4-4Ø	9ØØ6557	88
1	D11	DIODE MCL1301	110561C-0-0	89
~~1~~	~~R51~~	~~RES 120K ¼W 5%~~	~~1300539~~	90

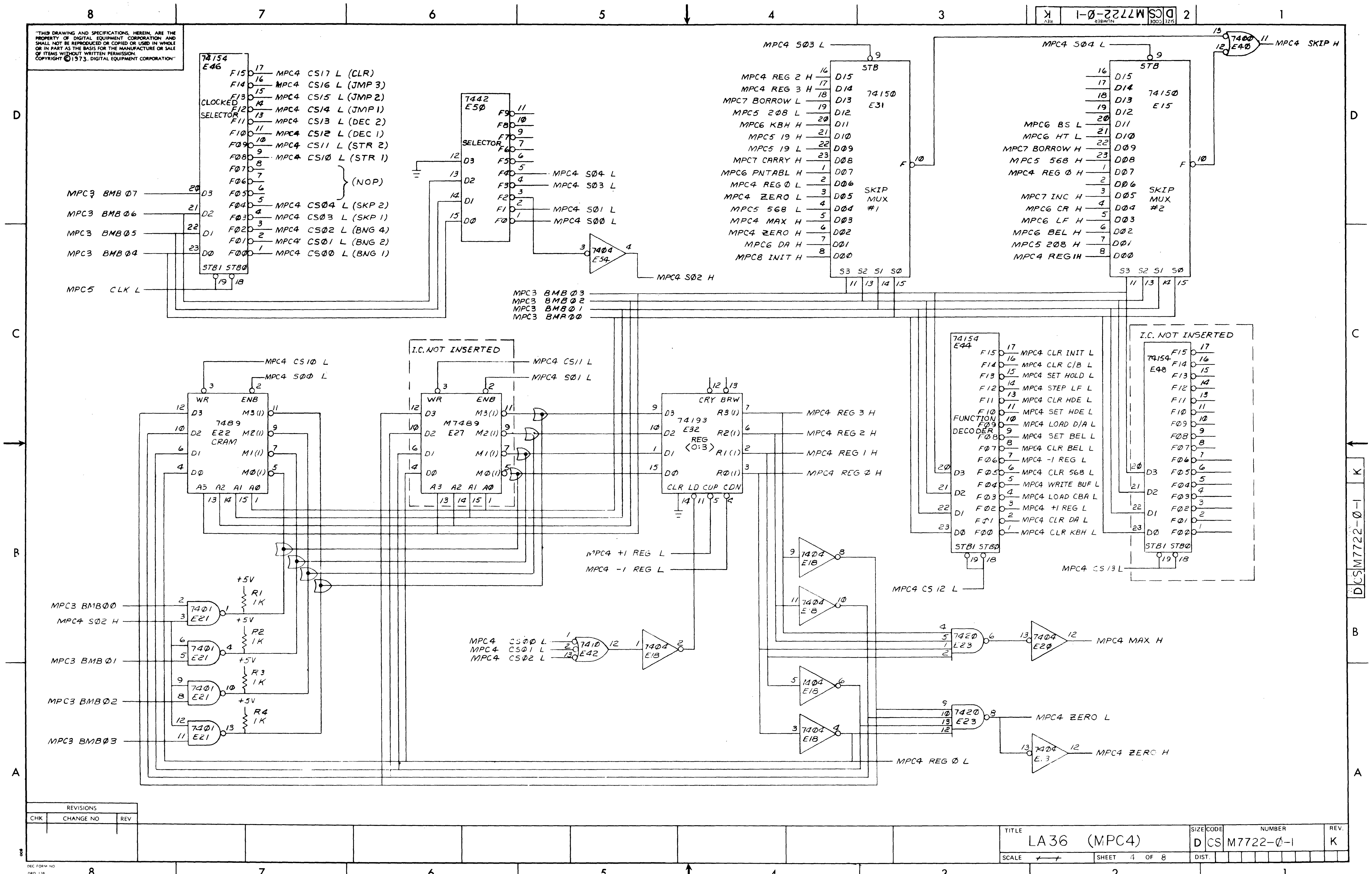
QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
				91
A/R		#30 INSULATED WIRE (GREEN)	9105740-55	92
				93
				94
A/R	FOR MOUNTING Q1	THERMAL COMPOUND	9008268	95
1	E58	I.C. MK2628P "CROM"	23082A6	96
1	E17	I.C. 8640	1911469	97

REVISIONS

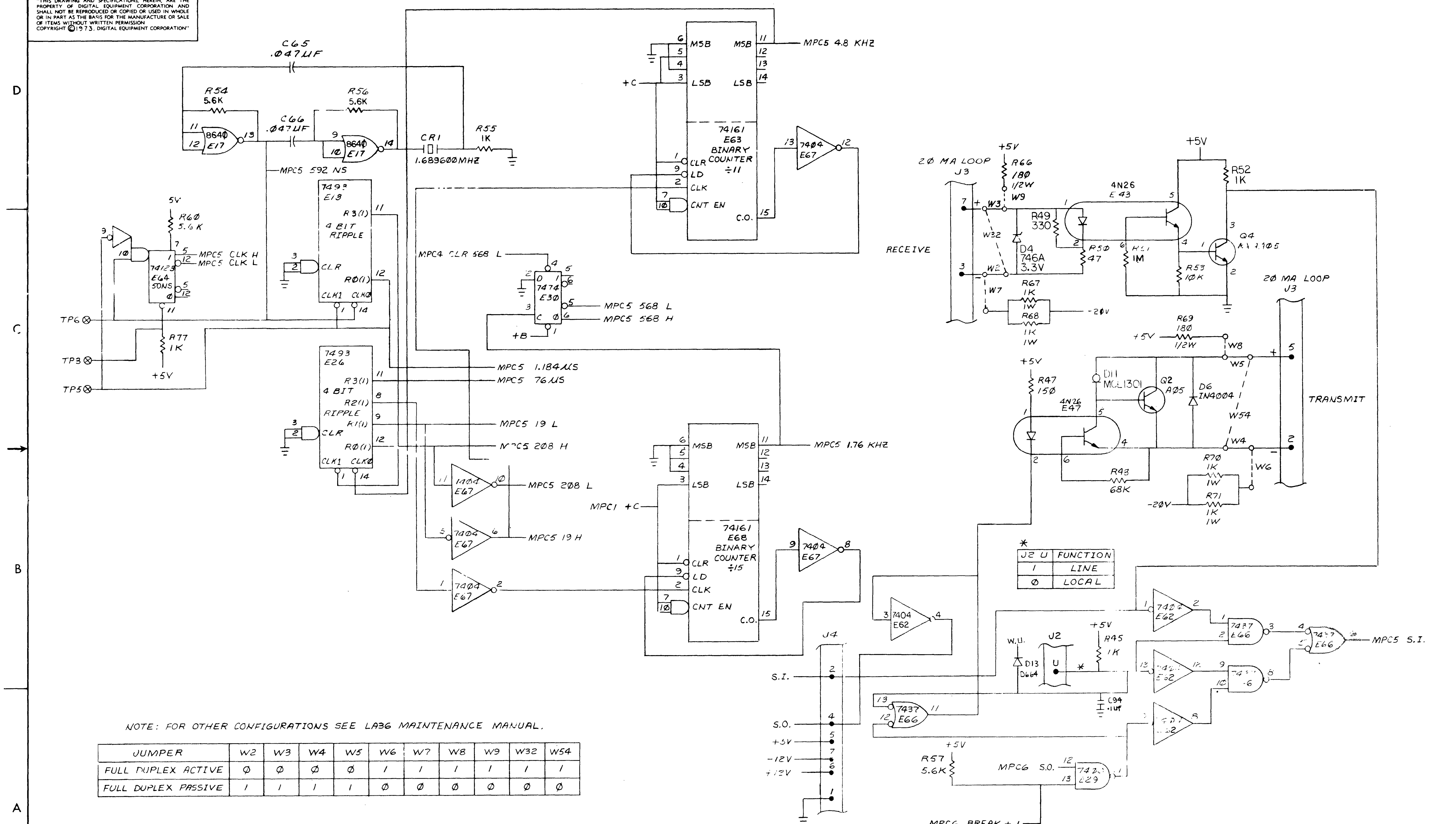
CHK	CHANGE NO	REV

TITLE	SIZE	CODE	NUMBER	REV
LA36 (MPC2)	D	CS	M7722-Ø-1	
SCALE — SHEET 2 OF 8	DIST.			


"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION COPYRIGHT © 1973 DIGITAL EQUIPMENT CORPORATION"
MPC4 CS16 L
MPC4 CS15 L
MPC4 CS14 L
MPC4 REG 3 H
MPC4 REG 2 H
MPC4 REG 1 H
MPC4 REG 0 H
74193 PROGRAM E38 ADDRESS REG <4:7>
74193 PROGRAM E45 ADDRESS REG <0:3>
MPC3 BMB03
MPC3 BMB02
MPC3 BMB01
MPC3 BMB00
MPC1 +C
MPC4 SKIP H
MPC4 CS3 L
MPC4 CS4 L
MPC5 592 NS
MPC5 1.184 US
74123 E64 50NS
MPC4 CS17 L
MPC8 WU L
MPC5 CLK L
MPC3 BMB06
MPC3 BMB07
TP4
PREFERRED CONFIGURATION
CROM MK26 P E58 [0:777]
MPC3 MB07
MPC3 MB06
MPC3 MB05
MPC3 MB04
MPC3 MB03
MPC3 MB02
MPC3 MB01
MPC3 MB00
MPC3 BMB07
MPC3 BMB06
MPC3 BMB05
MPC3 BMB04
MPC3 BMB03
MPC3 BMB02
MPC3 BMB01
MPC3 BMB00
-12 V
-9V
C67 25UF
C68 .01UF
Q1 D45C8
R6 100
R7 100
D1 D662
D2 5.1V
D3 5.1V
R5 1K
R78 1K
SUBSTITUTE CONFIGURATION
PROM 0 E65 1702 [0:377]
PROM 1 E61 1702A [400:777]
C69 .01 UF
C70 25UF
REVISIONS
CHK
CHANGE NO
REV
TITLE
LA36 (MPC3)
SIZE D
CODE CS
NUMBER M7722-0-1
REV. K
SCALE
SHEET 3 OF 8
DIST.



"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1973, DIGITAL EQUIPMENT CORPORATION"
74154 E46 CLOCKED SELECTOR
MPC4 CS17 L (CLR)
MPC4 CS16 L (JMP 3)
MPC4 CS15 L (JMP 2)
MPC4 CS14 L (JMP 1)
MPC4 CS13 L (DEC 2)
MPC4 CS12 L (DEC 1)
MPC4 CS11 L (STR 2)
MPC4 CS10 L (STR 1)
(NOP)
MPC4 CS04 L (SKP 2)
MPC4 CS03 L (SKP 1)
MPC4 CS02 L (BNG 4)
MPC4 CS01 L (BNG 2)
MPC4 CS00 L (BNG 1)
MPC3 BMB 07
MPC3 BMB 06
MPC3 BMB 05
MPC3 BMB 04
MPC5 CLK L
7442 E50 SELECTOR
MPC4 S04 L
MPC4 S03 L
MPC4 S01 L
MPC4 S00 L
7404 E54
MPC4 S02 H
MPC4 S03 L
74150 E31 SKIP MUX #1
MPC4 REG 2 H
MPC4 REG 3 H
MPC7 BORROW L
MPC5 208 L
MPC6 KBH H
MPC5 19 H
MPC5 19 L
MPC7 CARRY H
MPC6 PNTABL H
MPC4 REG 0 L
MPC4 ZERO L
MPC5 568 L
MPC4 MAX H
MPC4 ZERO H
MPC6 DA H
MPC8 INIT H
MPC4 S04 L
74150 E15 SKIP MUX #2
MPC6 BS L
MPC6 HT L
MPC7 BORROW H
MPC5 568 H
MPC4 REG 0 H
MPC7 INC H
MPC6 CR H
MPC6 LF H
MPC6 BEL H
MPC5 208 H
MPC4 REG1H
7400 E40
MPC4 SKIP H
MPC3 BMB 03
MPC3 BMB 02
MPC3 BMB 01
MPC3 BMB 00
74154 E44 FUNCTION DECODER
MPC4 CLR INIT L
MPC4 CLR C/B L
MPC4 SET HOLD L
MPC4 STEP LF L
MPC4 CLR HDE L
MPC4 SET HDE L
MPC4 LOAD D/A L
MPC4 SET BEL L
MPC4 CLR BEL L
MPC4 -1 REG L
MPC4 CLR 568 L
MPC4 WRITE BUF L
MPC4 LOAD CBA L
MPC4 +1 REG L
MPC4 CLR DA L
MPC4 CLR KBH L
MPC4 CS 12 L
I.C. NOT INSERTED
74154 E48
MPC4 CS 13 L
MPC4 CS10 L
MPC4 S00 L
7489 E22 CRAM
I.C. NOT INSERTED
MPC4 CS11 L
MPC4 S01 L
M7489 E27
74193 E32 REG <0:3>
MPC4 REG 3 H
MPC4 REG 2 H
MPC4 REG 1 H
MPC4 REG 0 H
MPC4 +1 REG L
MPC4 -1 REG L
7401 E21
MPC3 BMB00
MPC4 S02 H
MPC3 BMB01
MPC3 BMB02
MPC3 BMB03
+5V
R1 1K
R2 1K
R3 1K
R4 1K
MPC4 CS00 L
MPC4 CS01 L
MPC4 CS02 L
7410 E42
7404 E18
7420 E23
7404 E20
MPC4 MAX H
MPC4 ZERO L
MPC4 ZERO H
MPC4 REG 0 L
REVISIONS
CHK
CHANGE NO
REV
TITLE LA36 (MPC4)
SIZE D CODE CS NUMBER M7722-0-1 REV. K
SCALE
SHEET 4 OF 8
DIST.
DEC FORM NO DRD 13A



NOTE: FOR OTHER CONFIGURATIONS SEE LA36 MAINTENANCE MANUAL.

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

*

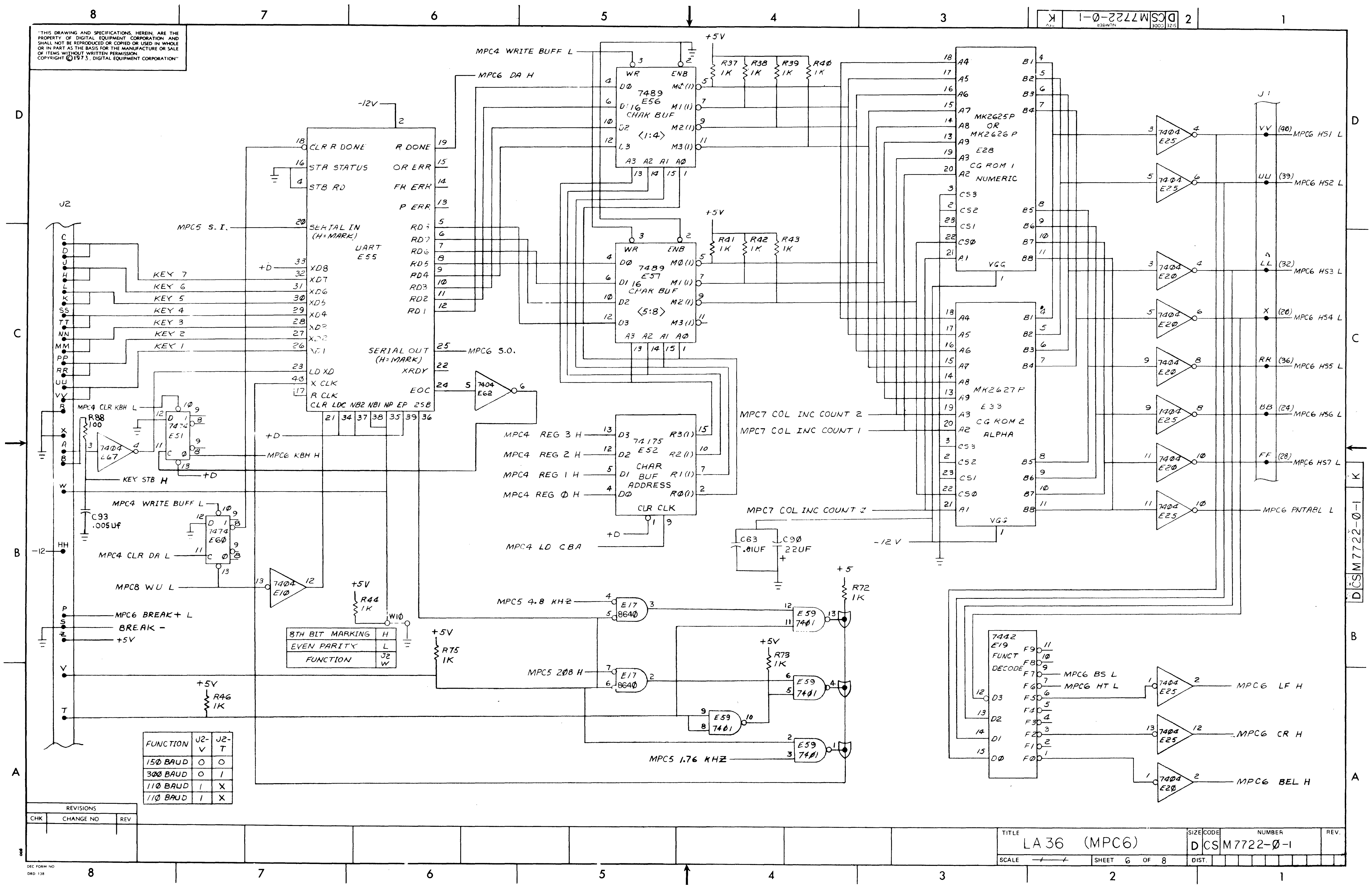
J2 U	FUNCTION
1	LINE
Ø	LOCAL

REVISIONS		
CHK	CHANGE NO	REV

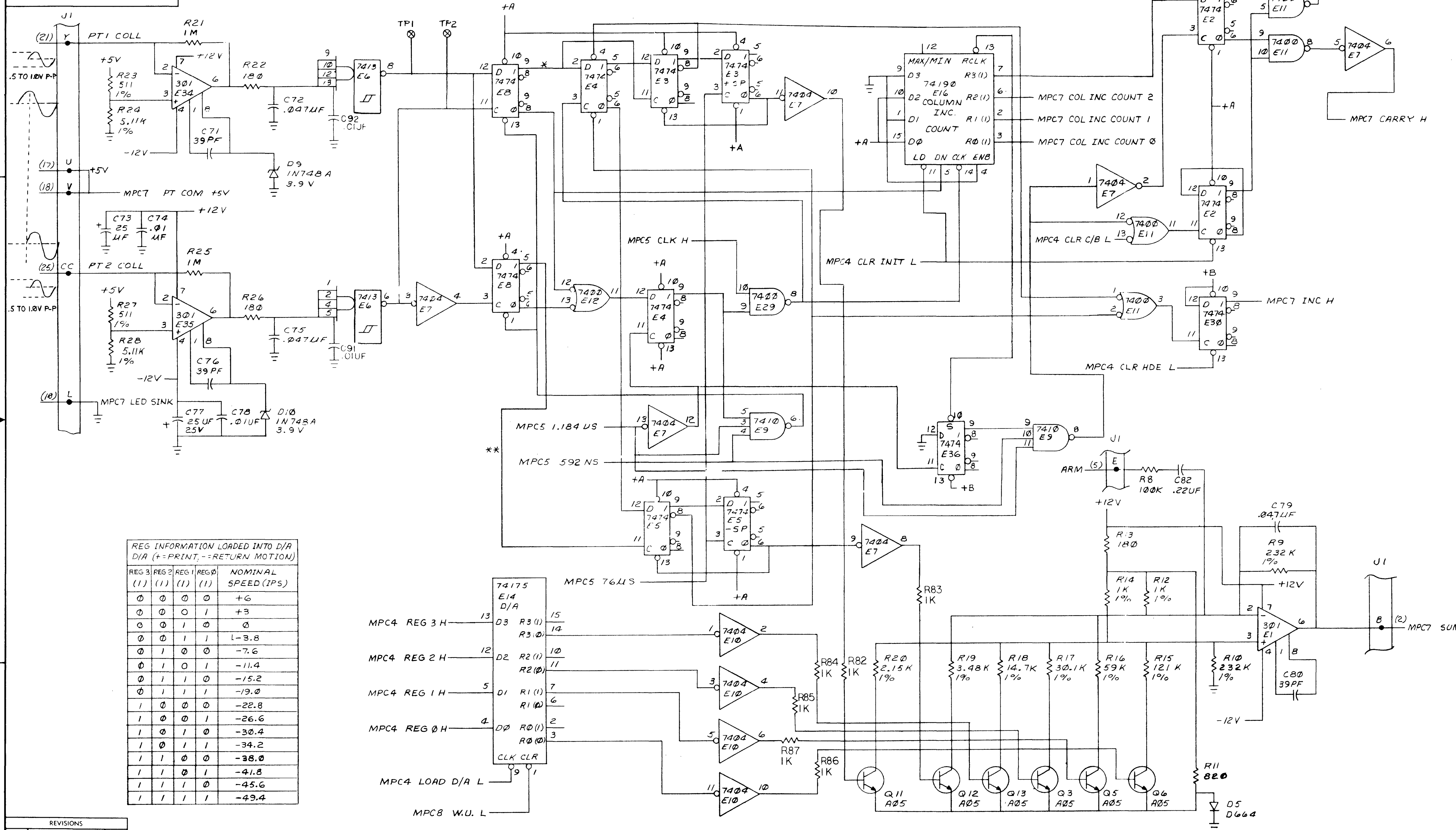
TITLE: LA36 (MPC5)

SIZE	CODE	NUMBER	REV.
D	CS	M7722-Ø-1	K

SCALE — SHEET 5 OF 8 DIST.


"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION COPYRIGHT © 1973, DIGITAL EQUIPMENT CORPORATION"
UART E55
7489 E56 CHAR BUF (1:4)
7489 E57 CHAR BUF (5:8)
74175 E52 CHAR BUF ADDRESS
MK2625P OR MK2626P E28 CG ROM 1 NUMERIC
MK2627P E33 CG ROM 2 ALPHA
7442 E19 FUNCT DECODE
MPC4 WRITE BUFF L
MPC6 DA H
MPC5 S.I.
MPC6 S.O.
MPC6 KBH H
MPC4 CLR KBH L
KEY STB H
MPC4 CLR DA L
MPC8 WU L
MPC6 BREAK+ L
BREAK -
MPC4 REG 3 H
MPC4 REG 2 H
MPC4 REG 1 H
MPC4 REG Ø H
MPC4 LD CBA
MPC7 COL INC COUNT 2
MPC7 COL INC COUNT 1
MPC5 4.8 KHZ
MPC5 208 H
MPC5 1.76 KHZ
MPC6 HS1 L
MPC6 HS2 L
MPC6 HS3 L
MPC6 HS4 L
MPC6 HS5 L
MPC6 HS6 L
MPC6 HS7 L
MPC6 PNTABL L
MPC6 BS L
MPC6 HT L
MPC6 LF H
MPC6 CR H
MPC6 BEL H
8TH BIT MARKING | H
EVEN PARITY | L
FUNCTION | J2 W
FUNCTION | J2-V | J2-T
150 BAUD | 0 | 0
300 BAUD | 0 | 1
110 BAUD | 1 | X
110 BAUD | 1 | X
REVISIONS
CHK | CHANGE NO | REV
TITLE LA36 (MPC6)
SIZE D CODE CS NUMBER M7722-Ø-1 REV. K
SCALE —/— SHEET 6 OF 8
DEC FORM NO DRD 138

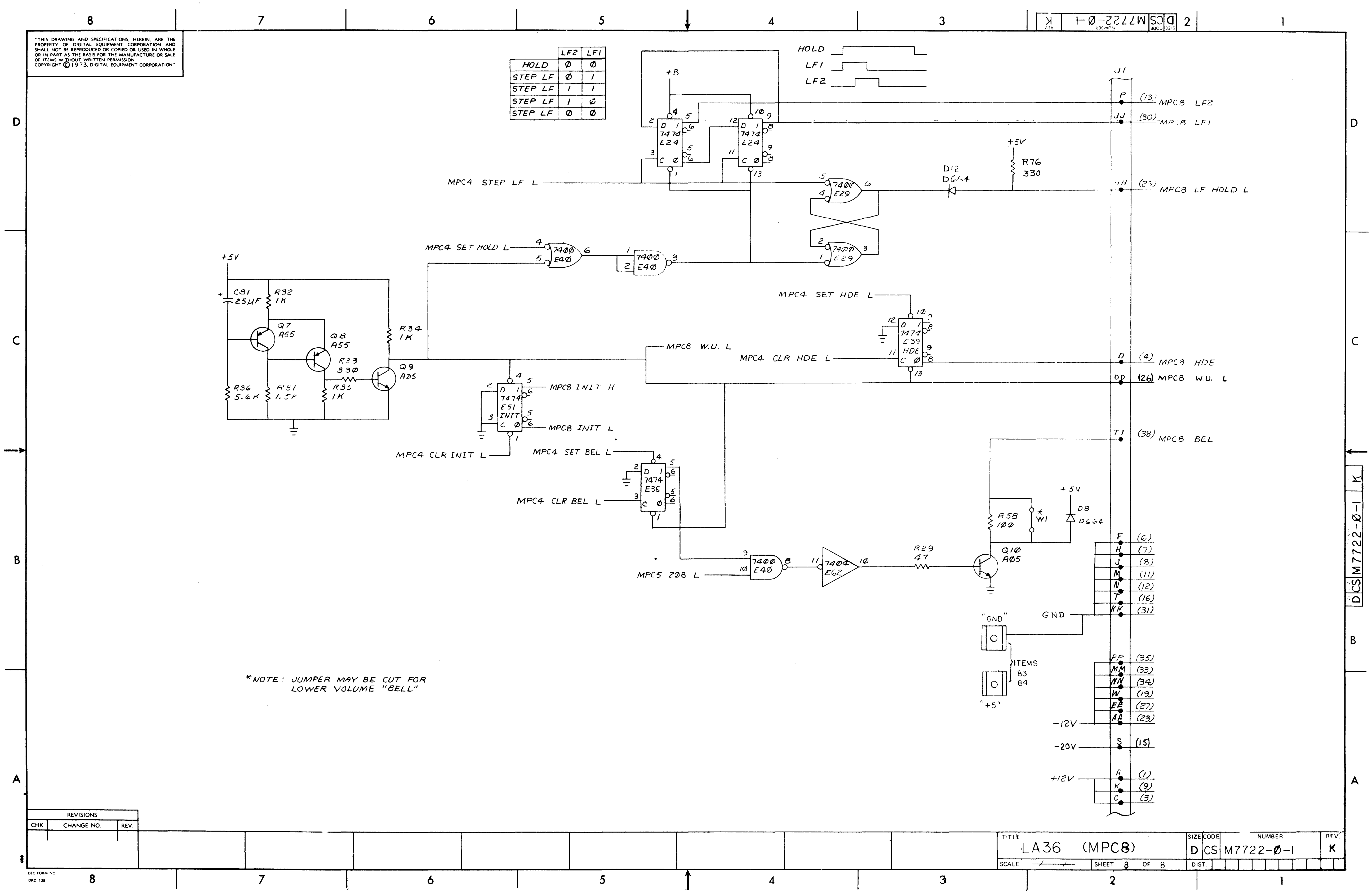
* PRINT MOTION (.Ø1Ø")
** RETURN MOTION (.Ø1Ø")



REG INFORMATION LOADED INTO D/A D/A (+=PRINT, -=RETURN MOTION)				
REG 3 (1)	REG 2 (1)	REG 1 (1)	REG Ø (1)	NOMINAL SPEED (IPS)
Ø	Ø	Ø	Ø	+6
Ø	Ø	O	1	+3
O	Ø	1	Ø	Ø
Ø	Ø	1	1	-3.8
Ø	1	Ø	Ø	-7.6
Ø	1	O	1	-11.4
Ø	1	1	Ø	-15.2
Ø	1	1	1	-19.Ø
1	Ø	Ø	Ø	-22.8
1	Ø	Ø	1	-26.6
1	Ø	1	Ø	-30.4
1	Ø	1	1	-34.2
1	1	Ø	Ø	-38.Ø
1	1	Ø	1	-41.8
1	1	1	Ø	-45.6
1	1	1	1	-49.4

REVISIONS		
CHK	CHANGE NO	REV

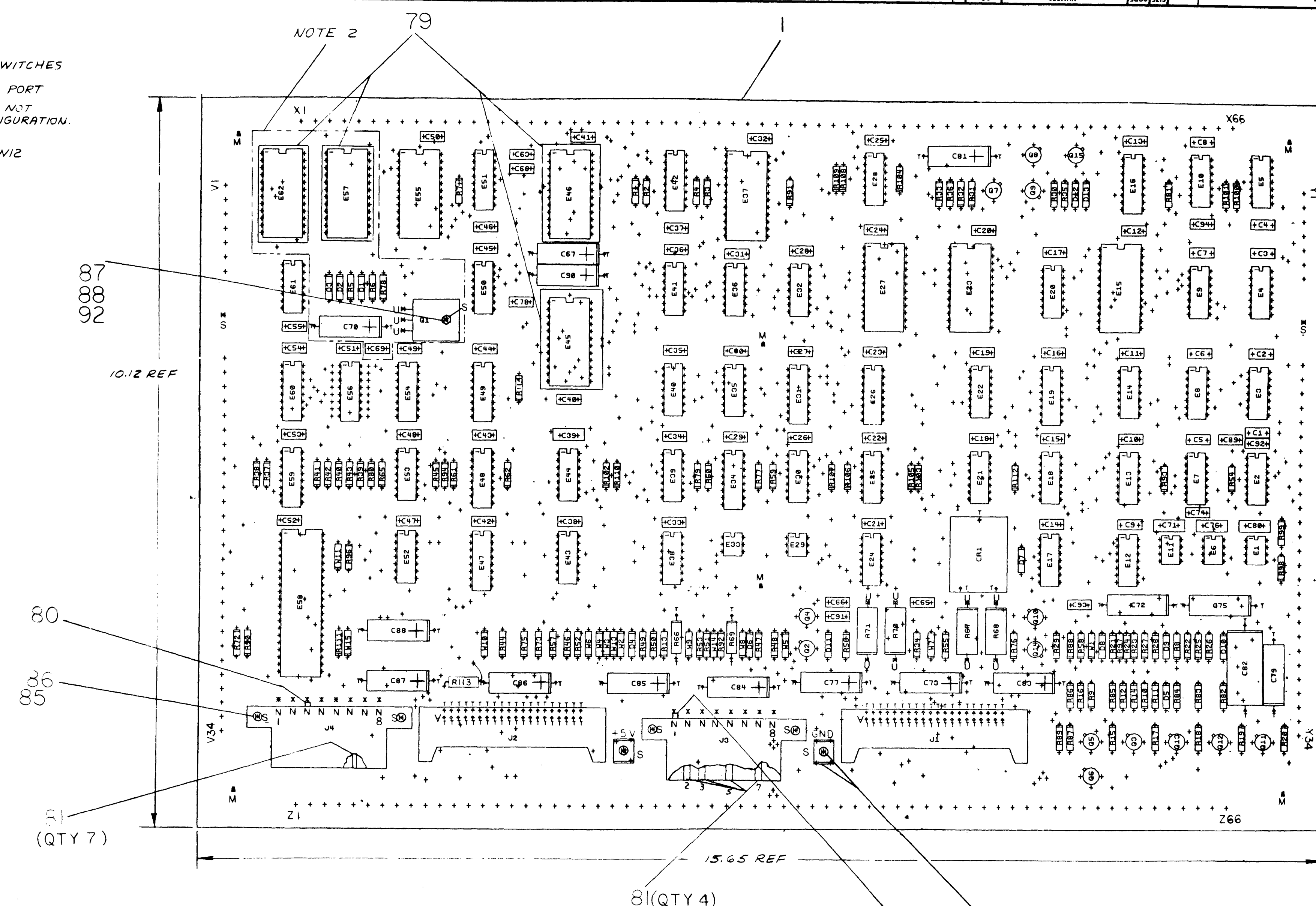
TITLE	SIZE	CODE	NUMBER	REV.
LA36 (MPC7)	D	CS	M7722-Ø-1	K
SCALE	SHEET 7 OF 8		DIST.	



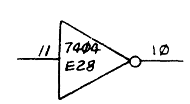
"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION
COPYRIGHT © 1973, DIGITAL EQUIPMENT CORPORATION"
HOLD
LF1
LF2
MPC4 STEP LF L
MPC4 SET HOLD L
MPC4 SET HDE L
MPC8 W.U. L
MPC4 CLR HDE L
MPC8 INIT H
MPC8 INIT L
MPC4 CLR INIT L
MPC4 SET BEL L
MPC4 CLR BEL L
MPC5 208 L
MPC8 LF2
MPC8 LF1
MPC8 LF HOLD L
MPC8 HDE
MPC8 W.U. L
MPC8 BEL
GND
-12V
-20V
+12V
ITEMS 83 84
*NOTE: JUMPER MAY BE CUT FOR LOWER VOLUME "BELL"
TITLE LA36 (MPC8)
D CS M7722-Ø-1
REV. K
SHEET 8 OF 8

NOTES:

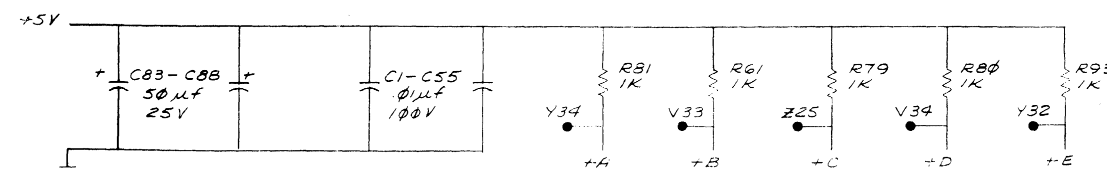
1. CONNECTORS:
   J1 → J1 POWER BOARD
   J2 → KEYBOARD/CONTROL SWITCHES
   J3 → 20MA. SERIAL LINE
   J4 → OPTIONAL INTERFACE PORT
2. COMPONENTS WITHIN OUTLINE NOT INSERTED IN PREFERRED CONFIGURATION.
3. REF DES NOT USED ARE: R63, R64, R74, C56-C62, C64, W12



SPARES:



E56 SPARE IC POSITION
E56-8 = GND
E56-16 = +5V



8C40	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
7492	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

DEC FORM NO. DRD 136.8

REV.	CHANGE NO.	CHK		
C	M7723-00001		J. Charter 5-29-75	J. BITTO
D	M7723-00002		J. Charter 10-2-75	J. BITTO
E	M7723-00003		L. Gilbert 29 OCT. 75	J. BITTO

REVISIONS

DEC NO.	EIA NO.	DEC NO.	EIA NO.

SEMICONDUCTOR CONVERSION CHART

FIRST USED ON OPTION MODEL: LA36

QTY	REF. DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.

PARTS LIST

ETCH BOARD REV. C

DRN. Joyce Netzer DATE 8/21/74
CHK'D. DATE 9/24/74
ENG. R. Fominka DATE 2-10-75
PROJ. ENG. DATE 2-10-75
PROD. DATE 2-10-75
NEXT HIGHER ASSY
SCALE
SHEET 1 OF 8

digital

TITLE: LA36 MPC

SIZE D CODE CS NUMBER M7723-Ø-1 REV. E

DIST.

PARTS LIST

QTY	REF. DESIGNATION	DESCRIPTION	PART NO	ITEM NO.
REF		X-Y COORDINATE HOLE LOCATION	K-CO-M7723-Ø-4	REF
REF		ASSY/DRILLING HOLE LAYOUT	D-AH-M7723-Ø-5	REF
REF		MODULE ECO HISTORY	B-MH-M7723-Ø-6	REF
1		ETCHED CIRCUIT BOARD	5011225	1
1	C82	CAP .22µf 1ØØV 1Ø% MYLAR	1000037	2
3	C72, C75, C79	CAP .Ø47µf 1ØØV 1Ø% MYLAR	1000051	3
*	C1-C55, C63, C68, C69, C74, C78, [illegible], C89, C92, C93, C94	CAP .Ø1µf 1ØØV DISC	100161[illegible]-01	4
2	C65, C66	CAP .ØØ5µf 1ØØV DISC	1001765	5
*	C67, C7Ø, C73, C77, C81, C9Ø	CAP 25µf 25V AL EL	1000075	6
6	C83 - C88	CAP 5Øµf 25V AL EL	1001796	7
3	C71, C76, C8Ø	CAP 39pf 1ØØV 5% DIPPED MICA	[illegible]	8
*	D1	DIODE D662	[illegible]	9
4	D5, D8, D7, D12	DIODE D664	[illegible]	10
2	D9, D1Ø	DIODE 1N748A 3.9V 5% ZENER	[illegible]	11
1	D4	DIODE 1N746A 3.3V 5% ZENER	[illegible]	12
1	D6	DIODE 1N4004	1105796	13
*	D2, D3, D13	DIODE .4M 5.1AZ1 5.1V 1% ZENER	1105873	14
1	D11	DIODE MCL13Ø1	1105610	15
2	J3, J4	CONN 8PIN MAT-N-LOK (SOCKET HOUSING)	1209340-00	16
2	J1, J2	CONN 4Ø PIN BERG	1209941	17
1	R5Ø	RES 47 1/4W 5% CC	1300202	18
*	R6, R7, R58, R9Ø, R91, R1Ø1	RES 1ØØ 1/4W 5% CC	1300229	19
2	R47, R113	RES 15Ø 1/4W 5% CC	1300250	20
3	R13, R22, R26	RES 19Ø 1/4W 5% CC	1301322	21
2	R66, R69	RES 18Ø 1/2W 5% CC	1300260	22
2	R89, R49	RES 22Ø 1/4W 5% CC	1300271	23
2	R3Ø, R114	RES 33Ø 1/4W 5% CC	1300295	24
2	R29, R88	RES 47Ø 1/4W 5% CC	1300316	25
2	R23, R27	RES 511 1/4W 1% MF	1302411	26
2	R11, R92	RES 82Ø 1/4W 5% CC	1301775	27
1	R17	RES 3Ø.1K 1/4W 1%	1311594	28
2	R12, R14	RES 1.00K 1/4W 1%	1303114	29
4	R67, R68, R7Ø, R71	RES 1K 1W 5% CC	1300368	30
1	R31	RES 1.5K 1/4W 5% CC	1300391	31
7	R82 - R87, R1ØØ	RES 2K 1/4W 5% CC	1302388	32
1	R2Ø	RES 2.15K 1/4W 1%	1311653	33
1	R19	RES 3.48K 1/4W 1%	1305114	34
2	R24, R28	RES 5.11K 1/4W 1%	1304854	35
6	R36, R54, R56, R57, R59, R6Ø	RES 5.6K 1/4W 5% CC	1301874	36
6	R33, R53, R44, R62, R96, R111	RES 1ØK 1/4W 5% CC	1300479	37
1	R18	RES 14.7K 1/4W 1% MF	1302941	38
*	R1-R5, R32, R34, R35, R45, R46, R37-R43, R52, R55, R61, R65, R72, R73, R75-R81, R93, R94, R99, R11Ø, R112	RES 1K 1/4W 5% CC	1300365	39
1	R16	RES 59.0K 1/4W 1% MF	1300525	40
1	R48	RES 68K 1/4W 5% CC	1301327	41
1	R8	RES 1ØØK 1/4W 5% CC	1302466	42
1	R51	RES 47ØK 1/4W 5% CC	1302398	43
1	R15	RES 121K 1/8W 1% MF	1305255	44
2	R9, R1Ø	RES 232K 1/8W 1% MF	1305424	45
2	R21, R25	RES 1M 1/4W 5% CC	1309595	46
3	Q7, Q8, Q15	TRANSISTOR MPSA55	1510706	47
11	Q2-Q6, Q9-Q14	TRANSISTOR MPSAØ5	1510705	48
*	Q1	TRANSISTOR D45C8	1510598	49
1	CR1	CRYSTAL 1.6896 MHZ	1811689	50
2	R97, R98	RES 1Ø 1/4W 5%	1301317	51

PARTS LIST

QTY	REF DESIGNATION	DESCRIPTION	PART NO	ITEM NO
11	E4, E7, E9, E12, E13, E14, E17, [illegible], E35, E39, E5	IC 7474	1905547	52
3	E18, E39, E44	IC 74ØØ	1905575	53
1	E3	IC 741Ø	1905576	54
1	E4Ø	IC 742Ø	1905577	55
2	E32, E43	IC 74Ø1	1905590	56
2	E21, E3Ø	IC 7493A	1909054	57
1	E24	IC 864Ø	1911469	58
7	E8, E25, E28, E41, E5Ø, E53, E61	IC 74Ø4	1909686	59
2	E15, E37	IC 74154	1909701	60
1	E2	IC 7413	1909989	61
3	E31, E49, E51	IC 74193	1910018	62
1	E26	IC 7442	1910046	63
1	E52	IC 7437	1910091	64
1	E16	IC 7419Ø	1910095	65
2	E23, E27	IC 7415Ø	1910153	66
3	E1, E6, E11	IC LM3Ø1 AN D.P	1910282	67
3	E42, E59, E6Ø	IC 7439	1910396	68
1	E34	IC 74123	1910436	69
1	E58	IC UART	1910959	70
2	E47, E48	IC 74161	1910650	71
2	E19, E54	IC 74175	1910651	72
1	E45	IC MK2626P (NO. SET UNSLASHED Ø)	230771A6	73
2	E29, E33	IC 50C75	1911998	74
				75
1	E46	IC MK2627P ALPHA SET)	23070A6	76
Ø	E45 (ALTERNATE)	IC MK2625P (NO. SET SLASHED Ø)	23072A6	77
3	E1Ø, E2Ø, E36	IC 74Ø8	1910155	78
*	MOUNTING E45, E46, E57, E62	SOCKET IC 24 PIN	1210693	79
2		KEYING PLUG, MAT-N-LOK	1211595	80
11		SOCKETS, MAT-N-LOK 6132Ø-3	1209456-01	81
5	W1 - W5	WIRE, INSULATED JUMPER	9009185	82
2		FASTON TERMINAL	9007113	83
2		EYELETS (FASTON MOUNTING)	9009000	84
4		EYELETS (MAT-N-LOK MOUNTING)	9006732	85
4		WASHER, FLAT, N-LOK #6	9006707	86
*	FOR MOUNTING Q1	SCREW, SLOTTED BIND HD 4-4Ø x 5/16	[illegible]	87
*	FOR MOUNTING Q1	NUT, KEP 4-4Ø	9006557	88
*	E55	IC MK2628P (CONTROL PROGRAM)	23082A6	89
*	E62	IC 17Ø2A "PROM Ø"	23082A4	90
*	E57	IC 17Ø2A "PROM 1"	23083A4	91
A/R	FOR MOUNTING Q1	THERMAL COMPOUND	9008268	92
8	R1Ø2 - R1Ø9	RES 47K 1/4W 5%	1302177	93
1	C91	CAP 470 PF 100V 5% DIPPED MICA	1000024	94

* SEE CONFIGURATION LIST FOR QUANTITY OF STARRED ITEMS.

CONFIGURATION LIST

PREFERRED CONFIGURATION: (WITH ROM CONTROL MEMORY- WITHOUT PROMS & -9V REGULATOR)

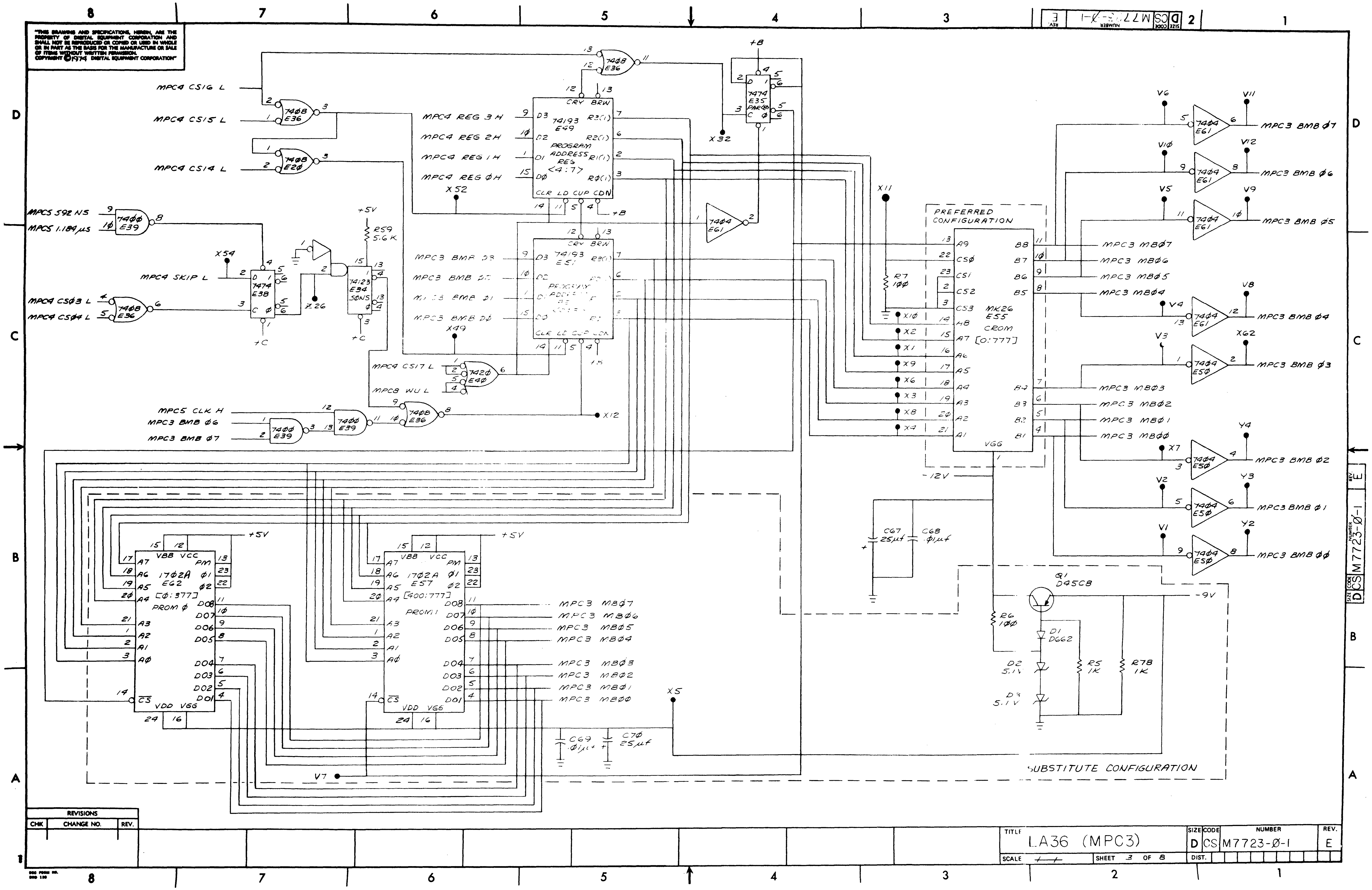
ITEM NO.	QUANTITY RETAINED	REF DESIGNATIONS RETAINED	REF DESIGNATIONS DELETED
4	63	ALL EXCEPT C69	C69
6	5	C67, C73, C77, C81, C9Ø	C7Ø
9	Ø		D1
14	1	D13	D2, D3
19	5	R7, R58, R9Ø, R91, R1Ø1	R6
39	33	ALL EXCEPT R5 & R78	R5, R78
49	Ø		Q1
79	2	FOR E45, E46	FOR E57, E62
89	1	E55	
9Ø	Ø		E62
91	Ø		E57
88	Ø		
87	Ø		

SUBSTITUTE CONFIGURATION: (WITHOUT ROM CONTROL MEMORY- WITH PROMS AND -9V REGULATOR)

ITEM NO.	QUANTITY RETAINED	REF DESIGNATIONS RETAINED	REF DESIGNATIONS DELETED
4	64	ALL	
6	6	ALL	
9	1	D1	
14	3	ALL	
19	6	ALL	
39	35	ALL	
49	1	Q1	
79	4	FOR E45, E46, E57, E62	
89	Ø		E55
9Ø	1	E62	
91	1	E57	
88	1		
87	1		

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE LA36 (MPC)
SIZE D CODE CS NUMBER M7723-Ø-1 REV. E
SCALE — SHEET 2 OF 8
DIST.

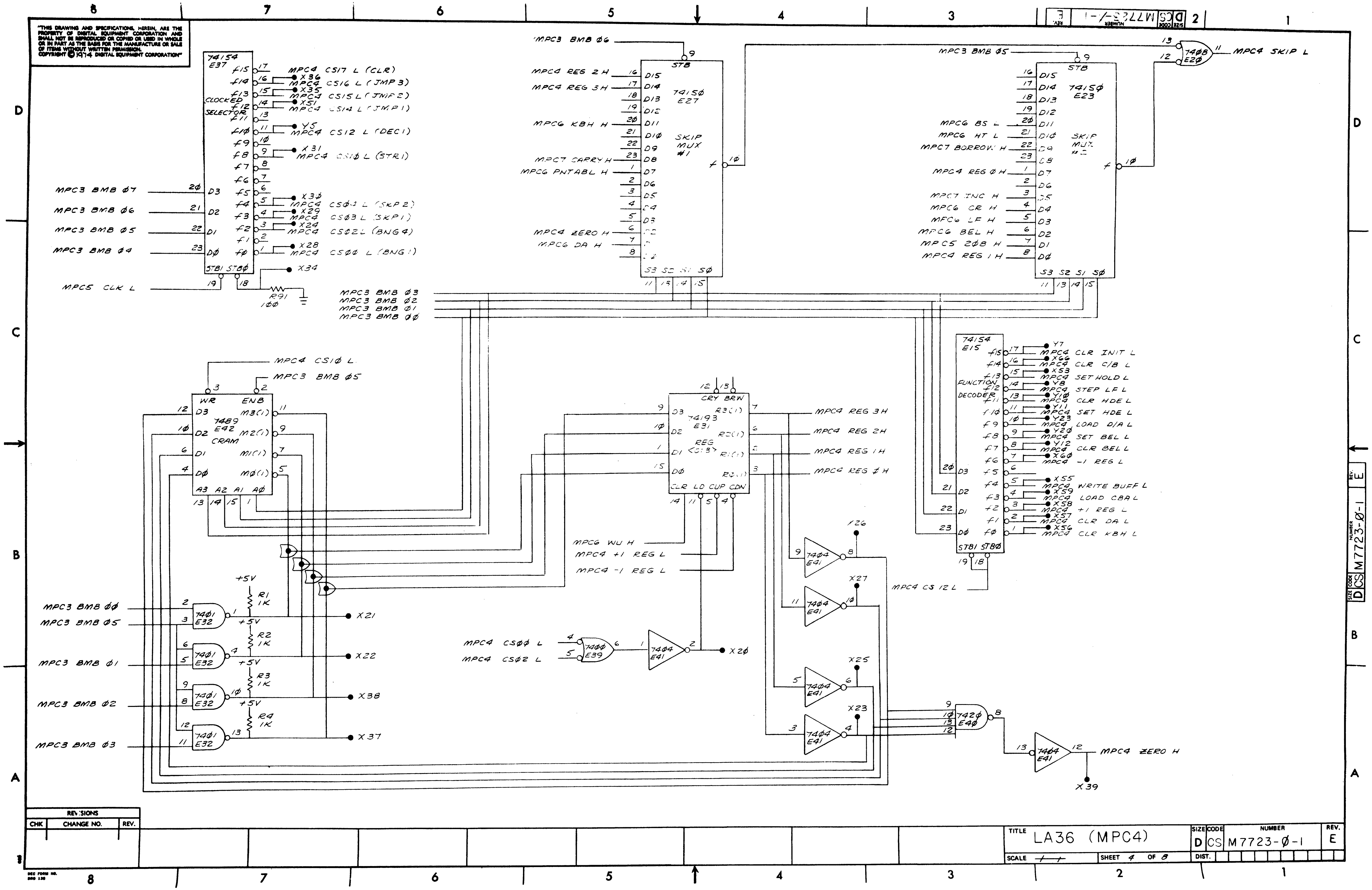


REVISIONS		
CHK	CHANGE NO.	REV.

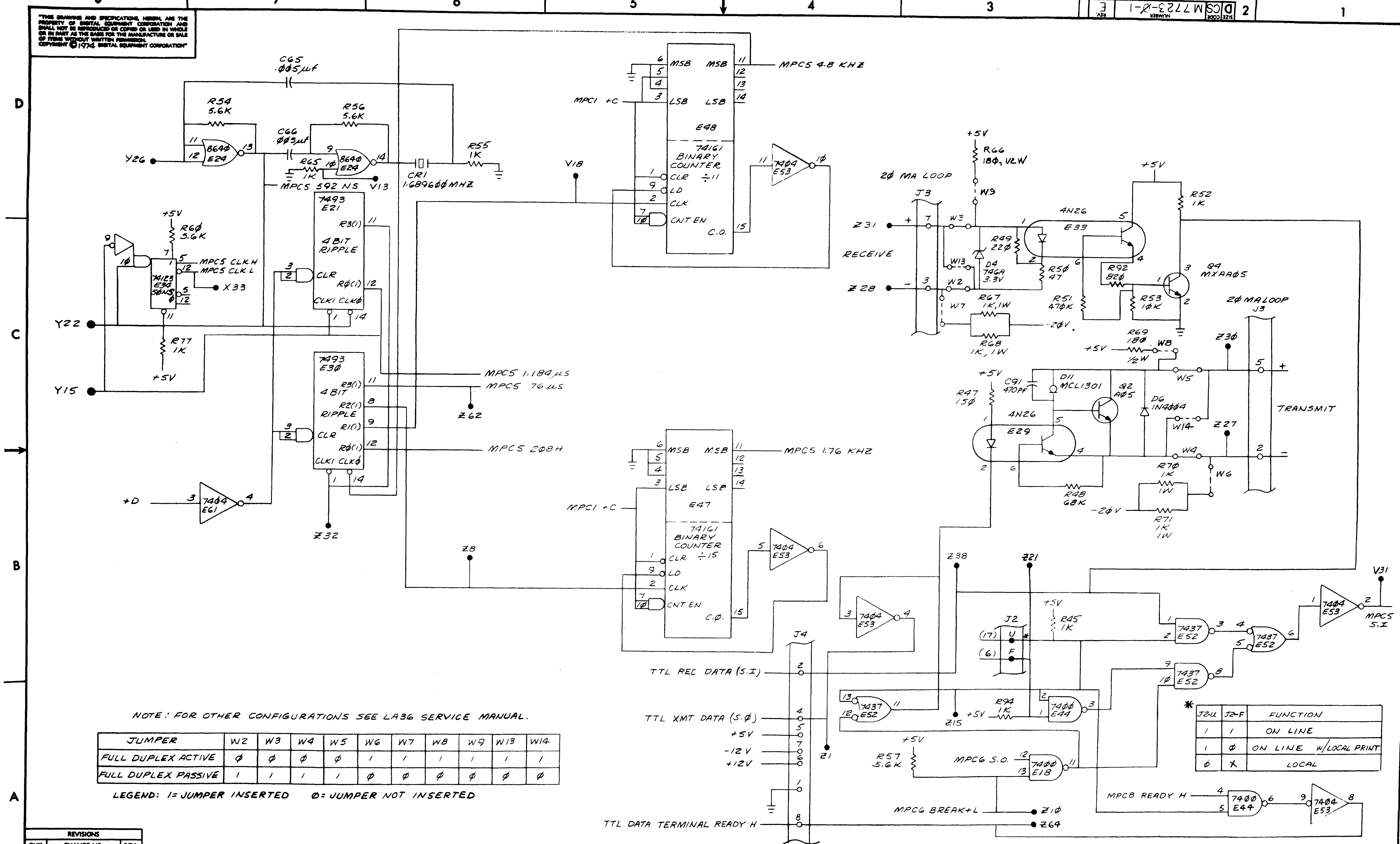
TITLE LA36 (MPC3)

SIZE	CODE	NUMBER	REV.
D	CS	M7723-Ø-1	E

SCALE — SHEET 3 OF 8



"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1974 DIGITAL EQUIPMENT CORPORATION"
74154 E37 CLOCKED SELECTOR
MPC3 BMB Ø7
MPC3 BMB Ø6
MPC3 BMB Ø5
MPC3 BMB Ø4
MPC5 CLK L
MPC4 CS17 L (CLR)
MPC4 CS16 L (JMP3)
MPC4 CS15 L (JMP2)
MPC4 CS14 L (JMP1)
MPC4 CS12 L (DEC1)
MPC4 CS1Ø L (STR1)
MPC4 CSØ4 L (SKP2)
MPC4 CSØ3 L (SKP1)
MPC4 CSØ2 L (BNG4)
MPC4 CSØØ L (BNG1)
R91 1ØØ
MPC3 BMB Ø3
MPC3 BMB Ø2
MPC3 BMB Ø1
MPC3 BMB ØØ
74150 E27 SKIP MUX #1
MPC4 REG 2 H
MPC4 REG 3 H
MPC6 KBH H
MPC7 CARRY H
MPC6 PNTABL H
MPC4 ZERO H
MPC6 DA H
74150 E23 SKIP MUX #2
MPC6 BS L
MPC6 HT L
MPC7 BORROW H
MPC4 REG Ø H
MPC7 INC H
MPC6 CR H
MPC6 LF H
MPC6 BEL H
MPC5 2Ø8 H
MPC4 REG 1 H
7408 E2Ø
MPC4 SKIP L
74154 E15 FUNCTION DECODER
MPC4 CLR INIT L
MPC4 CLR C/B L
MPC4 SET HOLD L
MPC4 STEP LF L
MPC4 CLR HDE L
MPC4 SET HDE L
MPC4 LOAD D/A L
MPC4 SET BEL L
MPC4 CLR BEL L
MPC4 -1 REG L
MPC4 WRITE BUFF L
MPC4 LOAD CBA L
MPC4 +1 REG L
MPC4 CLR DA L
MPC4 CLR KBH L
MPC4 CS12 L
MPC4 CS1Ø L
7489 E42 CRAM
74193 E31 REG <Ø:3>
MPC4 REG 3 H
MPC4 REG 2 H
MPC4 REG 1 H
MPC4 REG Ø H
MPC6 WU H
MPC4 +1 REG L
MPC4 -1 REG L
MPC4 CSØØ L
MPC4 CSØ2 L
7400 E39
7404 E41
7401 E32
MPC3 BMB ØØ
MPC3 BMB Ø5
MPC3 BMB Ø1
MPC3 BMB Ø2
MPC3 BMB Ø3
7420 E40
MPC4 ZERO H
REVISIONS
CHK CHANGE NO. REV.
TITLE LA36 (MPC4)
SIZE D CODE CS NUMBER M7723-Ø-1 REV. E
SCALE
SHEET 4 OF 8
DIST.



NOTE: FOR OTHER CONFIGURATIONS SEE LA36 SERVICE MANUAL.

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

LEGEND: 1= JUMPER INSERTED Ø= JUMPER NOT INSERTED

*

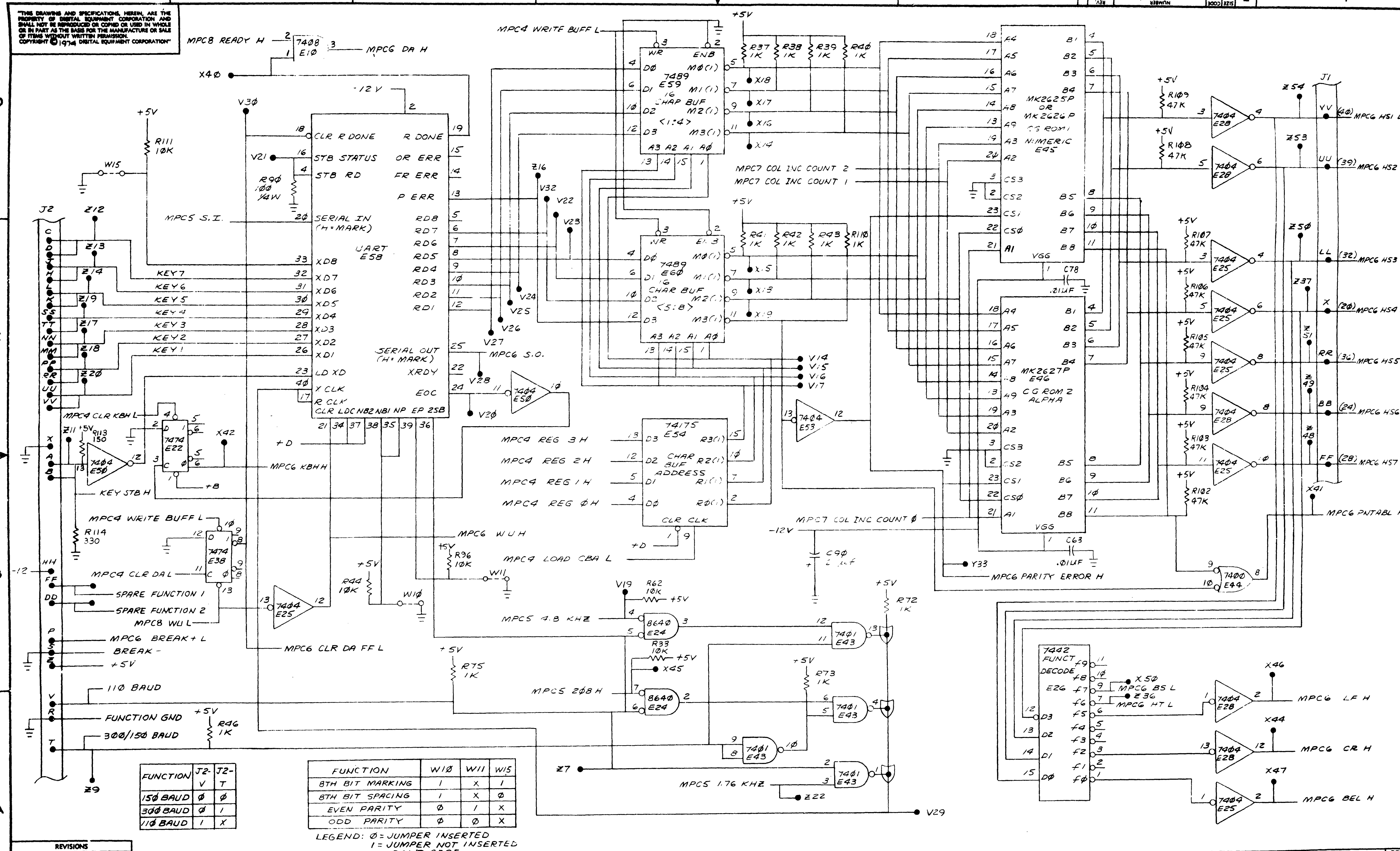
J2-U	J2-F	FUNCTION
1	1	ON LINE
1	Ø	ON LINE W/LOCAL PRINT
Ø	X	LOCAL

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE LA36 (MPC5)

SIZE D CODE CS NUMBER M7723-Ø-1 REV. E

SCALE — SHEET 5 OF 8 DIST.

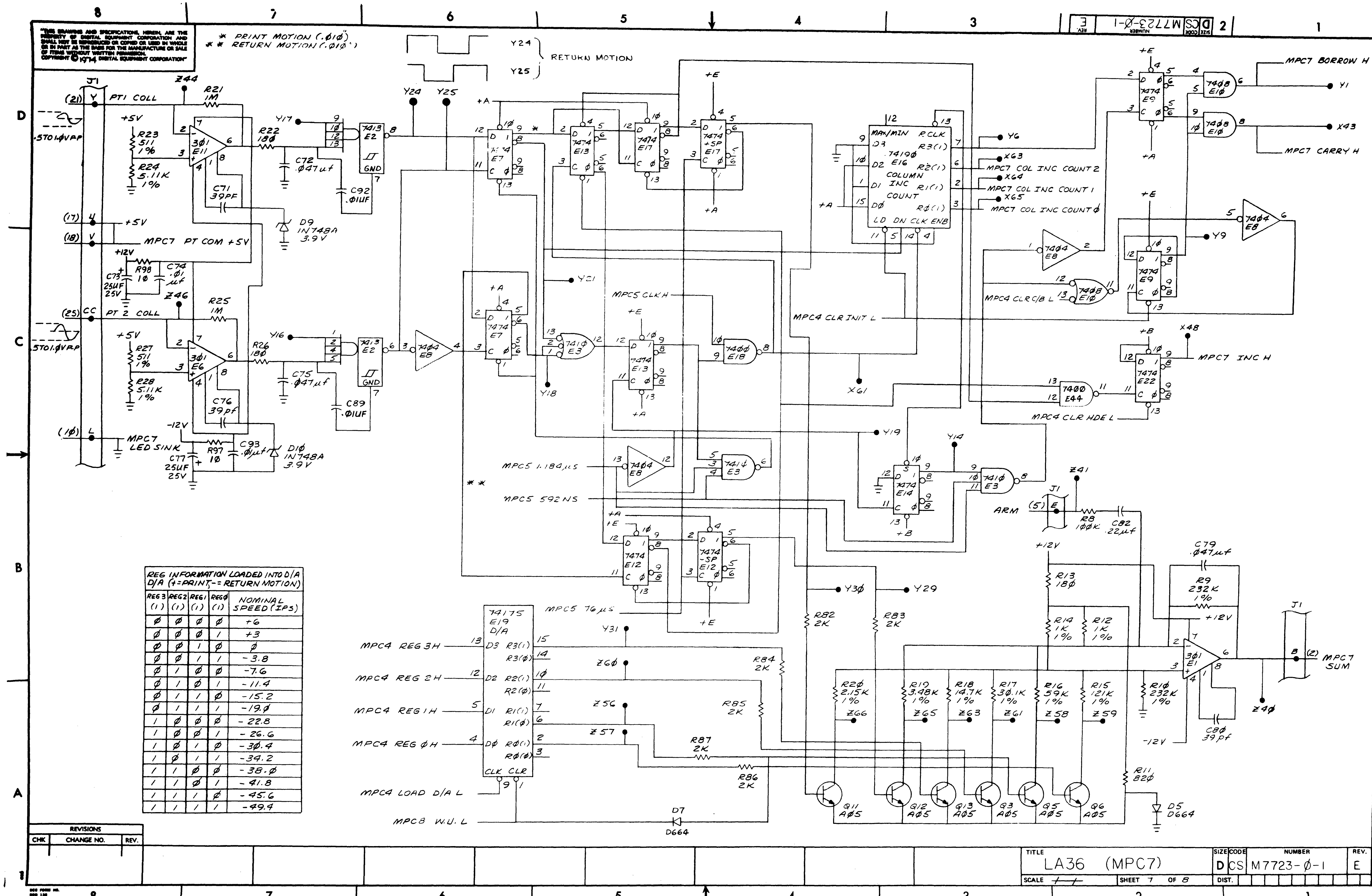


FUNCTION	J2-V	J2-T
15Ø BAUD	Ø	Ø
3ØØ BAUD	Ø	1
11Ø BAUD	1	X

FUNCTION	W1Ø	W11	W15
8TH BIT MARKING	1	X	1
8TH BIT SPACING	1	X	Ø
EVEN PARITY	Ø	1	X
ODD PARITY	Ø	Ø	X

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

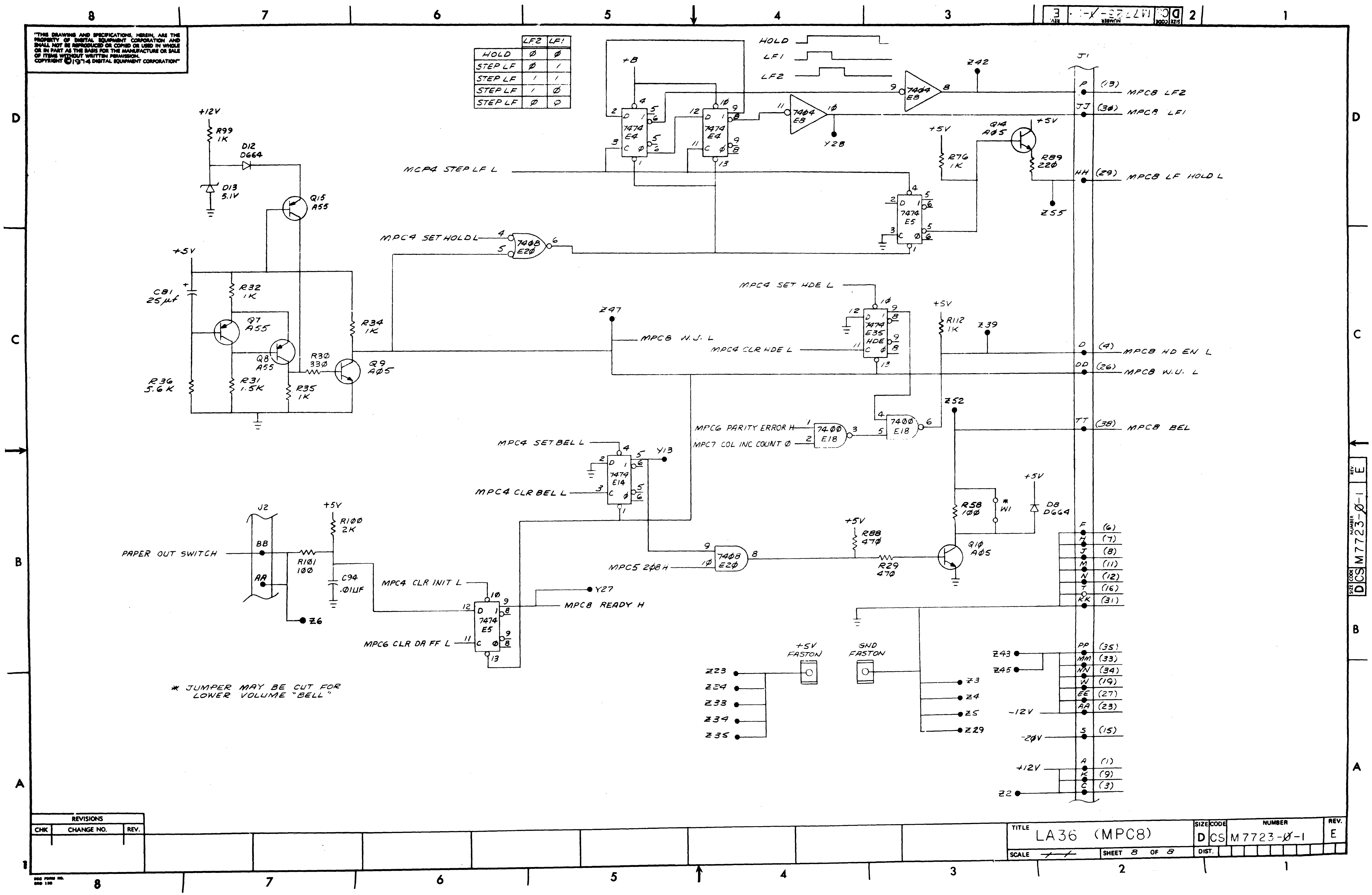
TITLE LA36 (MPC6)
SIZE D CODE CS NUMBER M7723-Ø-1 REV. E
SHEET 6 OF 8



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	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

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

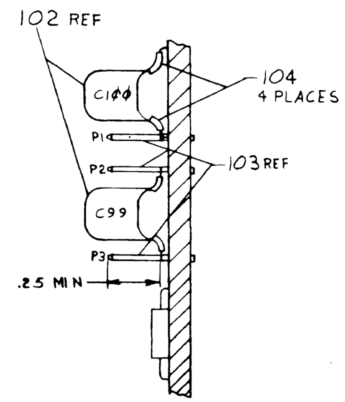
TITLE LA36 (MPC7) SIZE D CODE CS NUMBER M7723-0-1 REV. E SHEET 7 OF 8


"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1974 DIGITAL EQUIPMENT CORPORATION"
LF2 LF1
HOLD Ø Ø
STEP LF Ø 1
STEP LF 1 1
STEP LF 1 Ø
STEP LF Ø Ø
HOLD
LF1
LF2
MCP4 STEP LF L
MPC4 SET HOLD L
MPC4 SET HDE L
MPC8 W.J. L
MPC4 CLR HDE L
MPC6 PARITY ERROR H
MPC7 COL INC COUNT Ø
MPC4 SET BEL L
MPC4 CLR BEL L
PAPER OUT SWITCH
MPC4 CLR INIT L
MPC8 READY H
MPC6 CLR DA FF L
MPC5 2Ø8 H
MPC8 LF2
MPC8 LF1
MPC8 LF HOLD L
MPC8 HD EN L
MPC8 W.U. L
MPC8 BEL
+5V FASTON
GND FASTON
* JUMPER MAY BE CUT FOR LOWER VOLUME "BELL"
REVISIONS
CHK CHANGE NO. REV.
TITLE LA36 (MPC8)
SIZE D CODE CS NUMBER M7723-Ø-1 REV. E
SCALE
SHEET 8 OF 8
DIST.

NOTES:

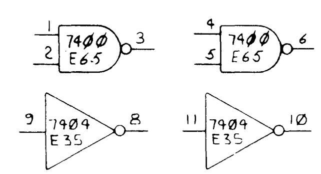
1. CONNECTORS:
   - J1 → J1 POWER BOARD
   - J2 → KEYBOARD
   - J3 → 20MA SERIAL LINE
   - J4 → OPTIONAL INTERFACE PORT
   - J5 → J5 EXPANDER OPTION MOUNTING BOARD
   - P1, P2, P3 → PARITY SWITCH
2. COMPONENTS WITHIN OUTLINE NOT INSERTED IN PREFERRED CONFIGURATION
3. REF DES NOT USED ARE: C60, C61, C62, C64, C48-C58, C96
4. MAXIMUM REF DES USED ARE: W20, R124, E66, C98, D14, J5, CR1, Q15
5. POST P1, P2 & P3 FOR PARITY SWITCH CONNECTORS

LEGEND	
NUMBER	VARIATION
M7728-0-1	NO PROVISIONS FOR EXTERNAL PARITY SWITCH
M7728-YA-1	PROVISIONS FOR EXTERNAL PARITY SWITCH

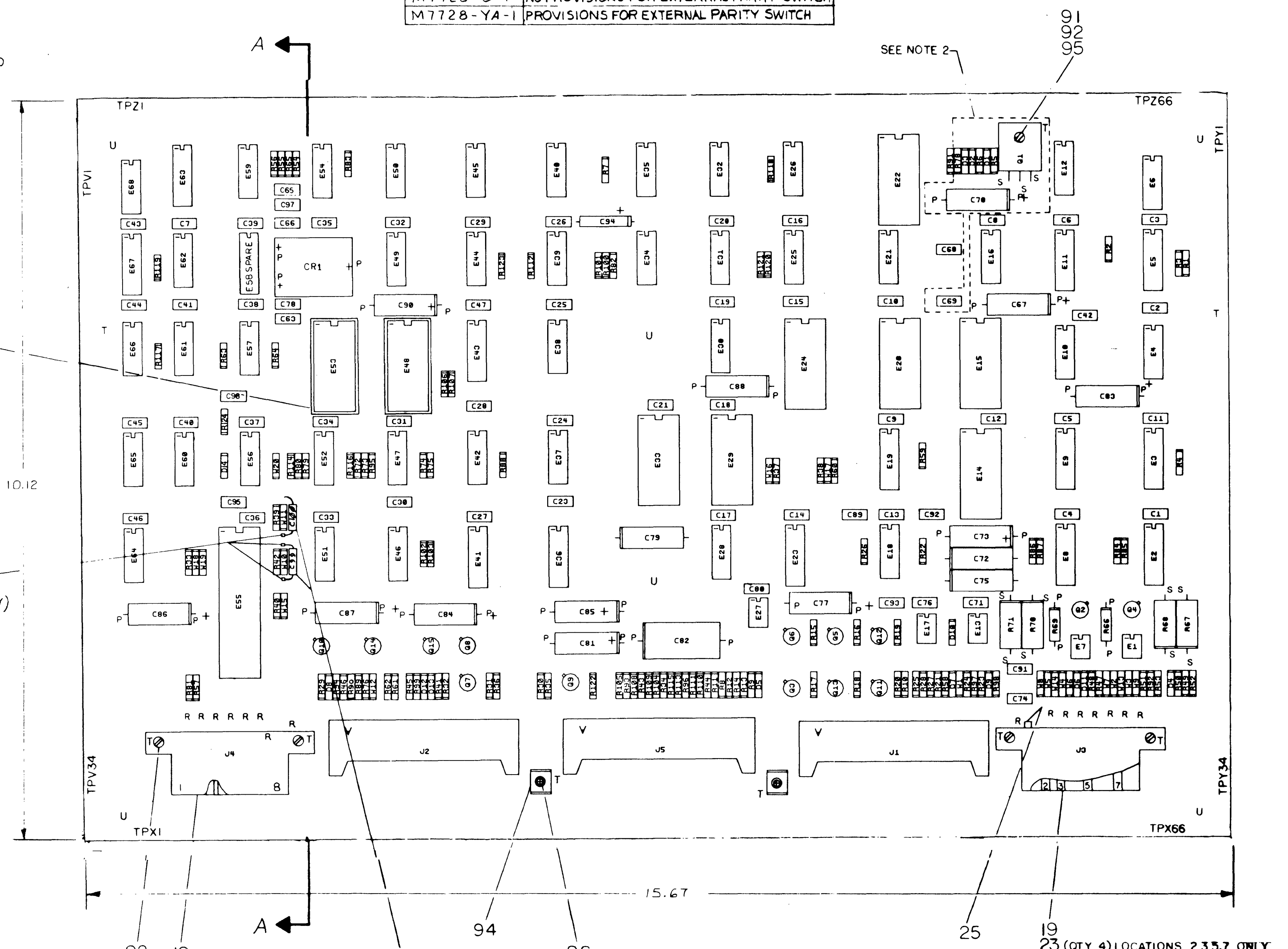


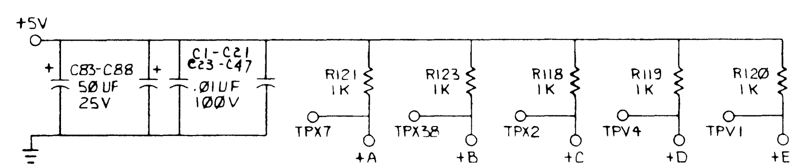
SECTION A-A
(YA VARIATION ONLY)

SPARES



E58 SPARE IC POSITION
E58-8 = GND
E58-16 = +5V





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
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.

PARTS LIST

FIRST USED ON OPTION MODEL: LA36

ETCH BOARD REV. C

CHANGE NO.	REV.
M7728-00004	E
M7728-00003	D
M7728-00002	C
M7728-00001	B

SEMICONDUCTOR CONVERSION CHART

DEC NO.	EIA NO.	DEC NO.	EIA NO.

DRN. Robert Koppenal DATE 5-23-75
CHK'D. DATE 5-23-75
ENG. DATE 5-23-75
PROJ. ENG.
PROD. DATE
NEXT HIGHER ASSY

digital

TITLE LA36 MPC

SIZE D CODE CS NUMBER M7728-0-1 REV. E

SCALE SHEET OF 9

QTY/VAR

M7728-YA-1	PEFERRED	SUBSTITUTE	REF. DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
REF	REF	REF		ASSY/DRILLING HOLE LAYOUT	E-AH-M7728 Ø-5	1
REF	REF	REF		MODULE ECO HISTORY	B-MH-M7728-Ø-6	2
1	1	1		ETCHED CIRCUIT BOARD	5011682	3
4	4	4	C71,C76,C80,C97	CAP39 PF 100V 5% DIPPED MICA	1000010	4
1	1	1	C91	CAP 470PF 100V 5% DIPPED MICA	1000024	5
1	1	1	C82	CAP 22UF 100V 10% MYLAR	1000037	6
3	3	3	C72,C75,C79	CAP 047UF 100V 10% MYLAR	1000051	7
5	5	6	C67,C73,C77,C81,C90	CAP 25UF 25V AL EL	1000075	8
53	53	54	C23-C47 C1-C21,C63,C68,C74 C78,C89,C92-C98	CAP .01UF 100V DISC	1001610-01	9
3	3	3	C65,C66,C99	CAP 005UF 100V DISC	1001765	10
6	6	6	C83-C88	CAP 50UF 25V AL EL	1001796	11
0	0	1		DIODE D662	1100113	12
5	5	5	D5.D7,D8,D12,D14	DIODE D664	1100114	13
2	2	2	D9.D10	DIODE IN748A 3 9V 5% ZENER	1100122	14
1	1	1	D4	DIODE IN746A 3 3V 5% ZENER	1104860	15
1	1	1	D11	DIODE MCL1301	1105610	16
1	1	1	D6	DIODE IN4004	1105796	17
1	1	3	D13	DIODE 4N5JAZ1 5 1V 1% ZENER	1105873	18
2	2	2	J3,J4	CONN 8 PIN MATE-N-LOCK(HOUSING)	1209340-00	19
3	3	3	J1,J2,J5	CONN 40 PIN BERG	1209941-02	20
~~3~~	~~3~~	~~3~~	~~J1,J2,J5~~	~~LATCH LEFT FOR BERG~~	~~1209941-03~~	~~21~~
~~3~~	~~3~~	~~3~~	~~J1,J2,J5~~	~~LATCH RIGHT FOR BERG~~	~~1209941-04~~	~~22~~
12	12	12		SOCKET, MATE-N-LOCK 61320-3	1209456-01	23
2	2	4	E48,E53	SOCKET, IC,24 PIN	1210693	24
1	1	1	J3	KEYING PLUG MATE-N-LOCK	1211595	25
1	1	1	R50	RES 47 ¼W 5% CC	1300202	26
5	5	6	R7,R33,R58,R91, R124	RES 100 ¼W 5% CC	1300229	27
2	2	2	R46,R47	RES 150, ¼W 5% CC	1300250	28
2	2	2	R66,R69	RES 180 ½W 5% CC	1300260	29
2	2	2	R49,R89	RES 220 ¼W 5% CC	1300271	30
2	2	2	R30 R90	RES 330 ¼W 5% CC	1300295	31
3	3	3	R29,R34,R88	RES 470 ¼W 5% CC	1300316	32
25	25	27	R1-R4,R32,R35,R45,R52,R55,R61-R65 R76,R94,R99,R112,R118-R123, R44	RES 1K ¼W 5% CC	1300365	33
4	4	4	R67,R68,R70,R71	RES 1K 1W 5% CC	1300368	34
1	1	1	R31	RES 1.5K ¼W 5% CC	1300391	35
18	15	18	R37-R43, R53, R102-R109, R117, R100	RES 10K ¼W 5% CC	1300479	36
1	1	1	R16	RES 59.0K ¼W 1% 100PPM MF RN55D-F	1300525	37
2	2	2	R97,R98	RES 10 ¼W 5% CC	1301317	38
3	3	3	R13,R22,R26	RES 180 ¼W 5% CC	1301322	39
1	1	1	R48	RES 68K ¼W 5% CC	1301327	40
2	2	2	R11,R92	RES 820 ¼W 5% CC	1301775	41
6	6	6	R36,R54,R56,R57,R59,R60	RES 5.6K ¼W 5% CC	1301874	42
8	8	8	R72-R75,R79-R81,R95	RES 47K ¼W 5% CC	1302177	43
14	14	14	R82-R87,R93,R96,R110,R111,R113-R116	RES. 2K 1/4W 5% CC	1302388	44
1	1	1	R51	RES 470K ¼W 5% CC	1302398	45
2	2	2	R27,R23	RES 511 ¼W 1% 100PPM MF RN55 D-F	1302411	46
1	1	1	R8	RES 100K ¼W 5% CC	1302466	47
1	1	1	R18	RES 14.7K ¼W 1% 100PPM MF RN55 D-F	1302941	48
2	2	2	R12,R14	RES 1.00K ¼W 1% 100PPM MF RN55 D-F	1303114	49
2	2	2	R24,R28	RES 5.11K ¼W 1% 100PPM MF RN55 D-F	1304854	50
1	1	1	R19	RES 3.48K ¼W 1% 100PPM MF RN55 D-F	1305114	51

QTY/VAR

M7728-YA-1	PEFERRED	SUBSTITUTE	REF. DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
1	1	1	R15	RES 121K ¼W 1% MF	1305255	52
2	2	2	R9,R10	RES 232K ¼W 1% MF	1305424	53
2	2	2	R21,R25	RES 1M ¼W 5% CC	1309595	54
1	1	1	R17	RES 30.1K ¼W 1% MF	1311594	55
1	1	1	R20	RES 2.15K ¼W 1% MF	1311653	56
0	0	1		TRANSISTOR D45C8	1510598	57
10	10	10	Q2-Q6,Q10-Q14	TRANSISTOR MPSA05	1510705	58
3	3	3	Q7,Q8,Q15	TRANSISTOR MPSA55	1510706	59
1	1	1	Q9	TRANSISTOR DEC6531B	1509338	60
1	1	1	CR1	CRYSTAL 1.6896 MHZ(WIRE LEADS)	1811689	61
11	11	11	E25,E26,E30,E31,E34,E37,E40 E44,E45,E50,E54	I.C. 7474	1905547	62
6	6	6	E32.E38 E39.E49,E60,E65	I.C. 7400	1905575	63
4	4	4	E10 E47,E52,E57	I.C. 7401	1905590	64
2	2	2	E66.E68	I.C. 7493A	1909054	65
5	5	5	E4,E21.E28.E35,E62	I.C. 7404	1909686	66
2	2	2	E22,E33	I.C. 74154	1909701	67
1	1	1	E18	I.C. 7413	1909989	68
3	3	3	E5.E9.E11	I.C. 74193	1910018	70
1	1	1	E23	I.C. 7442	1910046	71
1	1	1	E61	I.C. 7437	1910091	72
1	1	1	E43	I.C 74190	1910095	73
2	2	2	E14,E29	I.C. 74150	1910153	74
5	5	5	E6,E12,E16,E42,E64	I.C. 7408	1910155	75
3	3	3	E13,E17,E27	I.C. LM301AN DIP	1910282	76
3	3	3	E3,E36,E41	I.C. 7489	1910396	77
1	1	1	E19	I.C. 74123	1910436	78
1	1	1	E55	I.C. UART	1910459	79
2	2	2	E63,E67	I.C. 74161	1910650	80
2	2	2	E2,E8	I.C. 74175	1910651	81
2	2	2	E46,E51	I.C. 8093	1910837	82
1	1	1	E59	I.C. 8640	1911469	83
2	2	2	E1,E7	I.C. SOC75, 4N26	1911998	84
0	0	1		PROM,1702A,PROGRAMMED PROMØ	23082A4	85
0	0	1		PROM,1702A,PROGRAMMED PROM1	23083A4	86
1	1	1	E53	ROM,MK2627(ALPHA SET,ASCII)	23070A6	87
1	1	1	E48	ROM,MK2626(NO.SET, ASCII)	23071A6	88
1	1	0	E15	ROM,MK2628(CONTROL PROGRAM)	23082A6	89
0	0	1		SCREW,SLOTTED BIND HD 4.40 x5/16	9006010-4	90
0	0	1		NUT, KEP 4-40	9006557	91
4	4	4		WASHER, FLAT, NYLON #6	9006707	92
4	4	4		EYELET(MATE-N-LOCK MOUNTING)	9006732	93
2	2	2		FASTON TERMINAL	9007113	94
0	0	A/R		THERMAL COMPOUND	9008268	95
2	2	2		EYELET (FASTEN MOUNTING)	9009000	96
7	7	7	W1-W5,W18,W20	WIRE, INSULATED JUMPER	9009185	97
1	1	1	C95	CAP .1 UF 100V	1010978-36	98
1	1	1	R101	RES 270 1/4W 5% CC	1301972	99
1	1	1	C94	CAP 39UF 10V 10% TANT	1000076	100
1	1	1	E56	IC 7414	1911324	101
2	-	-	C99, C1ØØ	CAP .1µF 50V	1010978-36	102
3	-	-	P1, P2, P3	POST, WIRE WRAP	9009217	103
A/R	-	-		TUBING THINWALL, BLK	9107256	104

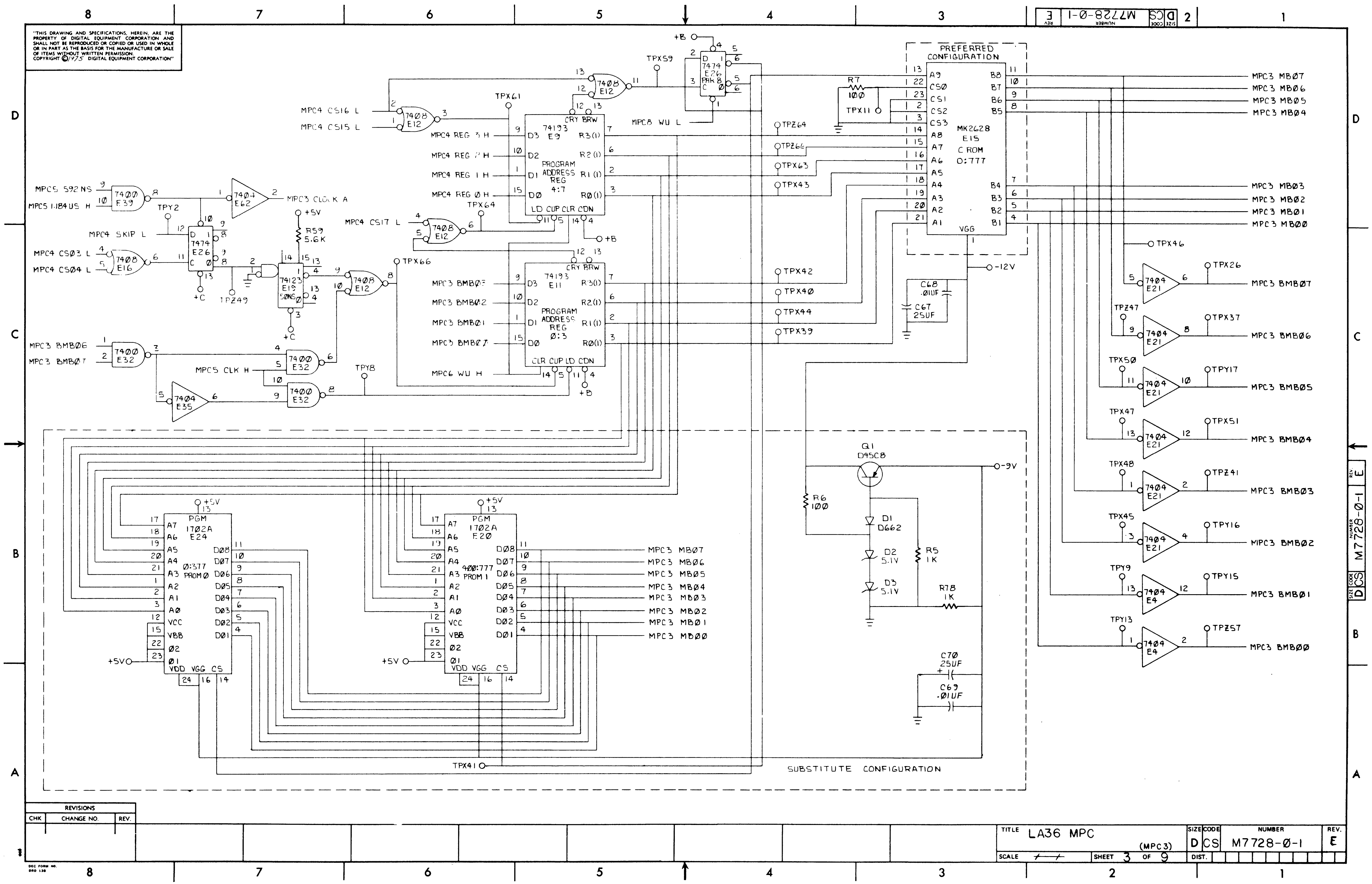
REVISIONS

CHK	CHANGE NO.	REV.

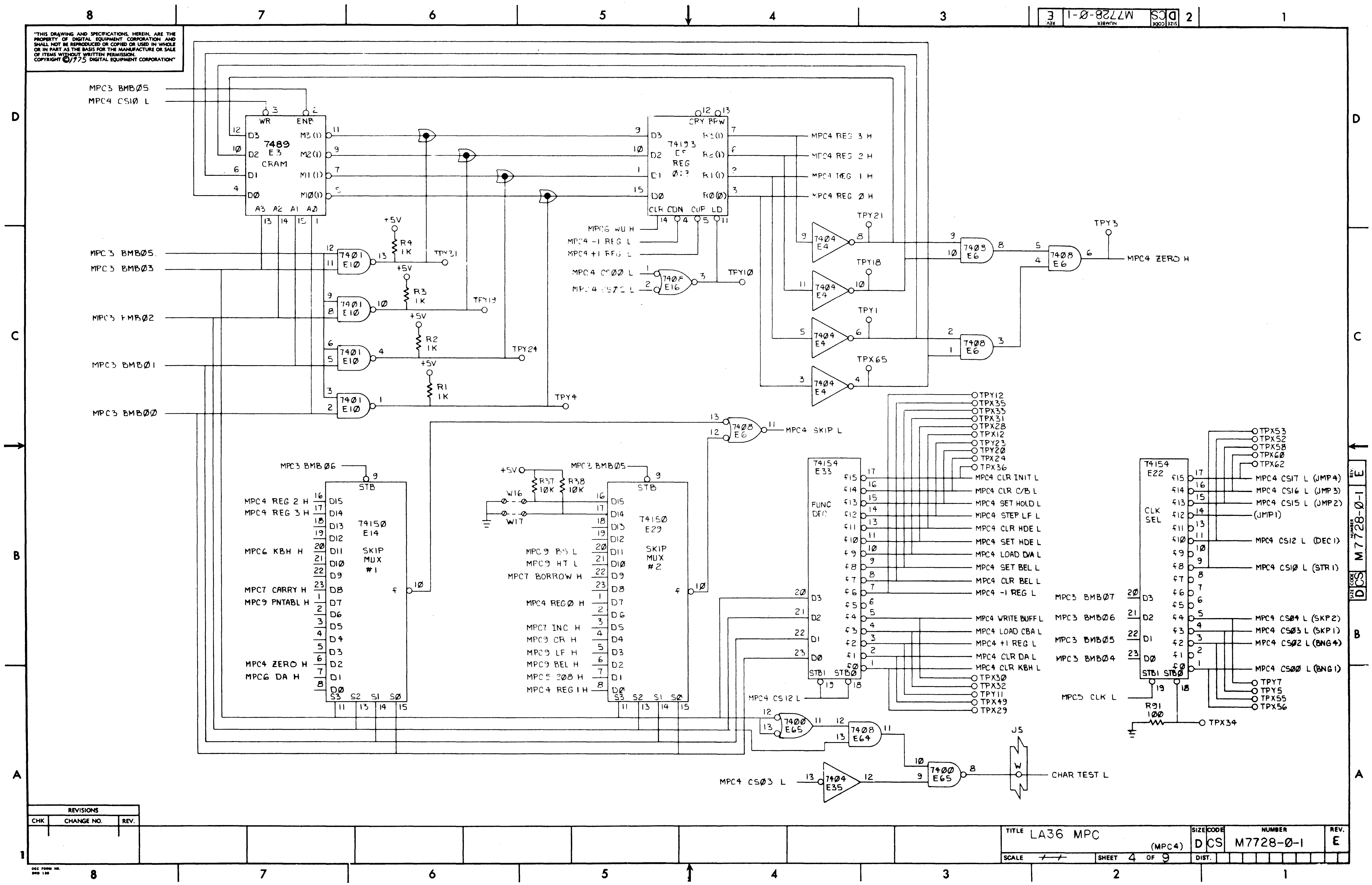
TITLE LA36 MPC

SIZE D CODE CS NUMBER M7728-Ø-1 REV. E

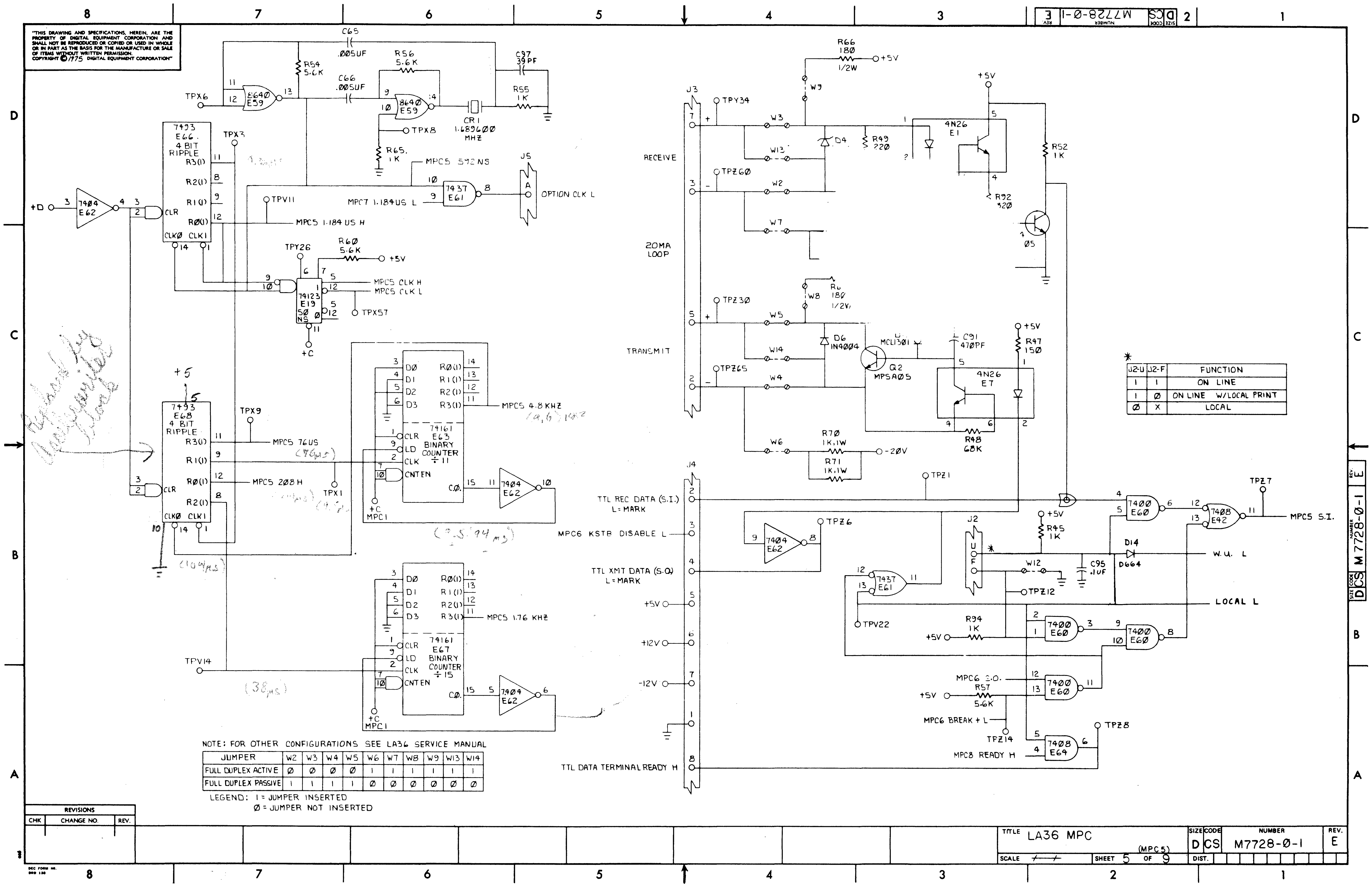
SCALE — SHEET 2 OF 9



"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION.
COPYRIGHT © 1975 DIGITAL EQUIPMENT CORPORATION"
PREFERRED CONFIGURATION
MK2628 E15 C ROM 0:777
74193 E9 PROGRAM ADDRESS REG 4:7
74193 E11 PROGRAM ADDRESS REG 0:3
PGM 1702A E24 0:377 PROM 0
PGM 1702A E20 400:777 PROM 1
SUBSTITUTE CONFIGURATION
MPC3 CLOCK A
MPC3 MB07
MPC3 MB06
MPC3 MB05
MPC3 MB04
MPC3 MB03
MPC3 MB02
MPC3 MB01
MPC3 MB00
MPC3 BMB07
MPC3 BMB06
MPC3 BMB05
MPC3 BMB04
MPC3 BMB03
MPC3 BMB02
MPC3 BMB01
MPC3 BMB00
REVISIONS
CHK
CHANGE NO.
REV.
TITLE LA36 MPC (MPC3)
SIZE D CODE CS NUMBER M7728-0-1 REV. E
SCALE
SHEET 3 OF 9
DIST.



"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1975 DIGITAL EQUIPMENT CORPORATION"
7489 E3 CRAM
74193 E5 REG
7401 E10
7404 E4
7408 E6
MPC4 ZERO H
MPC4 SKIP L
74150 E14 SKIP MUX #1
74150 E29 SKIP MUX #2
74154 E33 FUNC DEC
74154 E22 CLK SEL
CHAR TEST L
TITLE LA36 MPC (MPC4)
SIZE D CODE CS NUMBER M7728-Ø-1 REV. E
SHEET 4 OF 9



*

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

NOTE: FOR OTHER CONFIGURATIONS SEE LA36 SERVICE MANUAL

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

LEGEND: 1 = JUMPER INSERTED
Ø = JUMPER NOT INSERTED

REVISIONS		
CHK	CHANGE NO.	REV.

TITLE LA36 MPC (MPC5) — SIZE D, CODE CS, NUMBER M7728-Ø-1, REV. E
SCALE — SHEET 5 OF 9

TABLE I

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

TABLE II

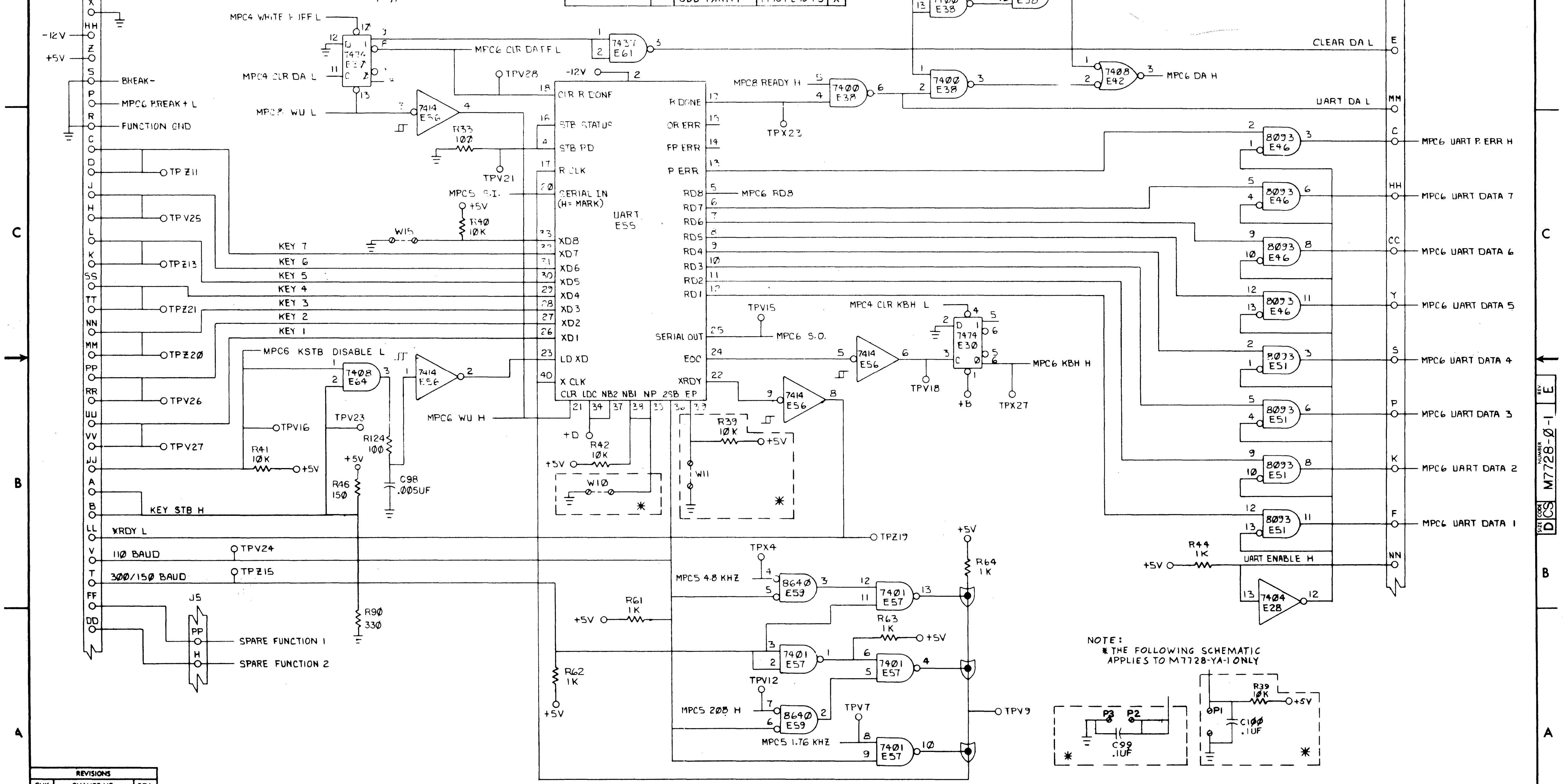
FUNCTION	W10	W11	W15
8TH BIT MARKING	1	X	1
8TH BIT SPACING	1	X	Ø
EVEN PARITY	Ø	1	X
ODD PARITY	Ø	Ø	X

LEGEND FOR TABLES I, II, & III: Ø = JUMPER INSERTED; 1 = JUMPER NOT INSERTED; X = DON'T CARE

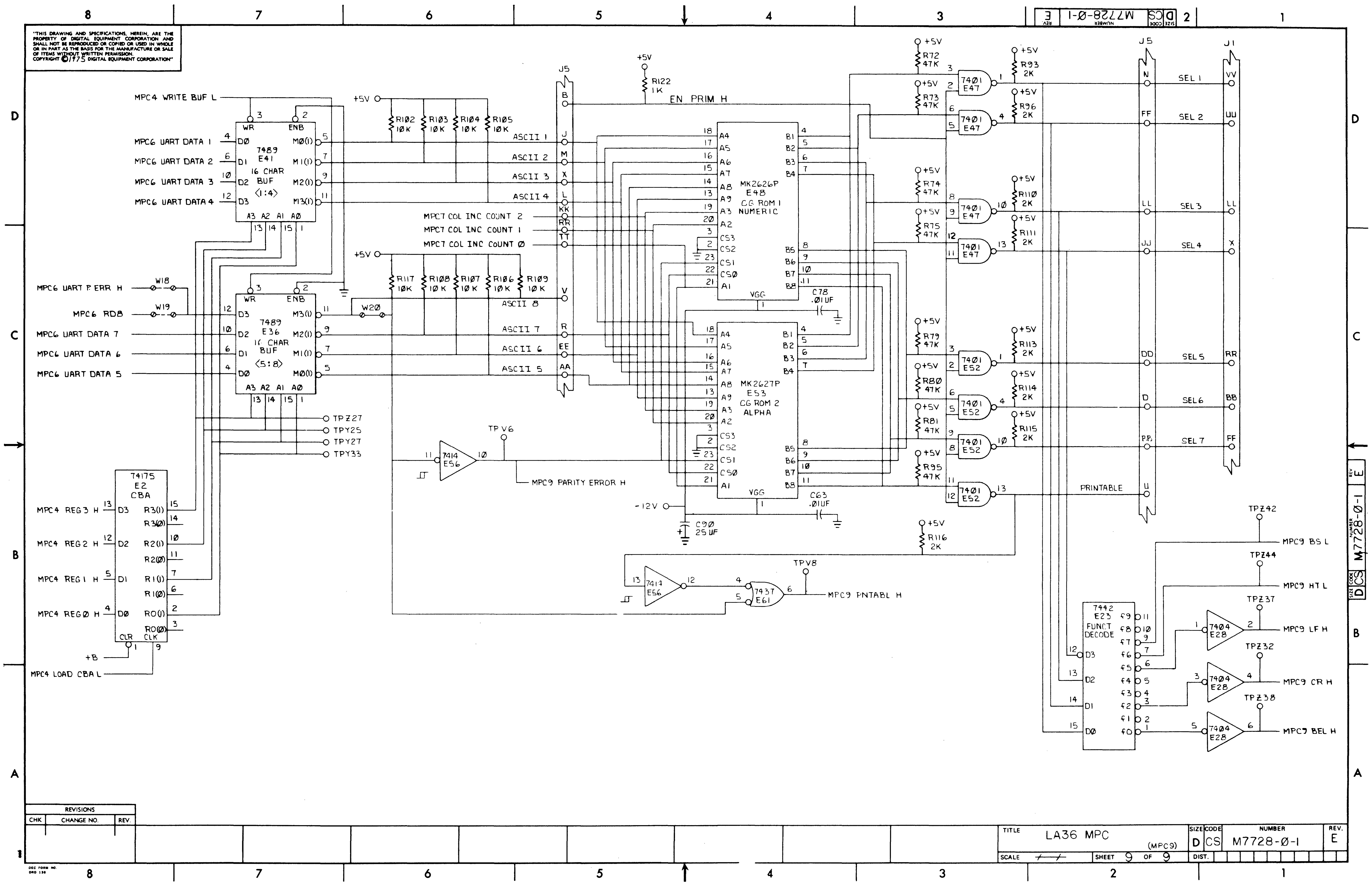
NOTE: THE FOLLOWING TABLE APPLIES TO M7728-YA-1 ONLY. W10 & W11 OMITTED.

TABLE III

WITH PARITY SWITCH		WITHOUT PARITY SWITCH		
FUNCTION	W15	FUNCTION	PARITY CONNECTION	W15
8TH BIT MARKING	1	8TH BIT MARKING	X	1
8TH BIT SPACING	Ø	8TH BIT SPACING	X	Ø
		EVEN PARITY	P2 TO P3	X
		ODD PARITY	P1 TO P2 TO P3	X

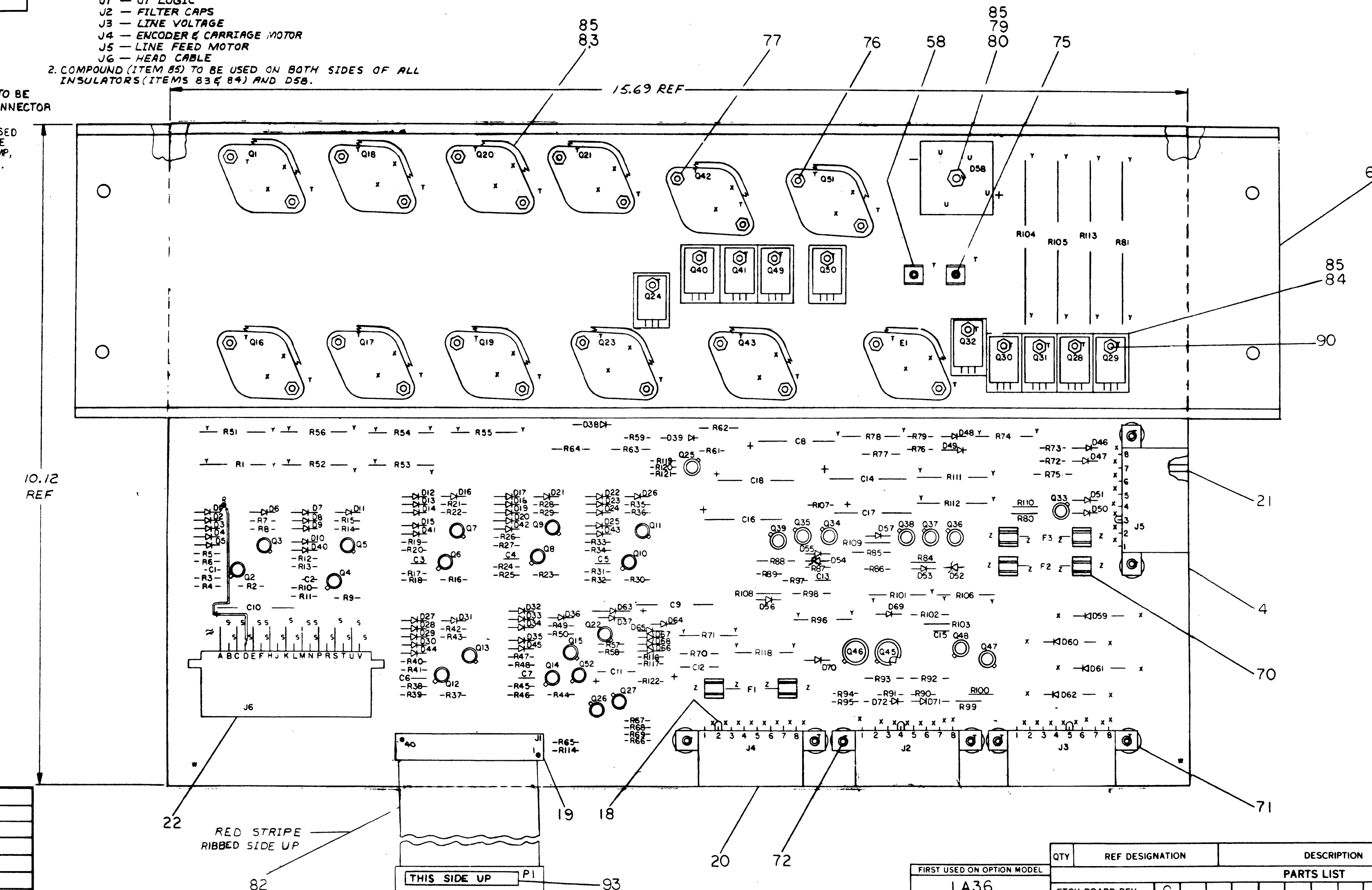


TITLE	LA36 MPC (MPC6)
SIZE	D
CODE	CS
NUMBER	M7728-Ø-1
REV.	E
SHEET	6 OF 9


"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1975 DIGITAL EQUIPMENT CORPORATION"
MPC4 WRITE BUF L
MPC6 UART DATA 1
MPC6 UART DATA 2
MPC6 UART DATA 3
MPC6 UART DATA 4
7489 E41 16 CHAR BUF (1:4)
7489 E36 16 CHAR BUF (5:8)
MPC6 UART P ERR H
MPC6 RD8
MPC6 UART DATA 7
MPC6 UART DATA 6
MPC6 UART DATA 5
ASCII 1
ASCII 2
ASCII 3
ASCII 4
ASCII 8
ASCII 7
ASCII 6
ASCII 5
MPC7 COL INC COUNT 2
MPC7 COL INC COUNT 1
MPC7 COL INC COUNT Ø
EN PRIM H
MK2626P E48 CG ROM 1 NUMERIC
MK2627P E53 CG ROM 2 ALPHA
TPZ27
TPY25
TPY27
TPY33
TP V6
MPC9 PARITY ERROR H
T4175 E2 CBA
MPC4 REG3 H
MPC4 REG2 H
MPC4 REG1 H
MPC4 REGØ H
MPC4 LOAD CBA L
TPV8
MPC9 PNTABL H
SEL 1
SEL 2
SEL 3
SEL 4
SEL 5
SEL 6
SEL 7
PRINTABLE
7442 E23 FUNCT DECODE
MPC9 BS L
MPC9 HT L
MPC9 LF H
MPC9 CR H
MPC9 BEL H
TITLE LA36 MPC (MPC9)
SIZE D CODE CS NUMBER M7728-Ø-1 REV. E
SHEET 9 OF 9
REVISIONS

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 2 AMP, SLOW-BLOW. (P/N 9007216).



IC TYPE	GND	+ 5V

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

IC PIN LOCATIONS

REV	CHANGE NO	
H	5410805-00006	J. BITTO
F	5410805-00005	P. HELLER
E	5410805-00004	P. HELLER
D	5410805-00003	P. HELLER
C	5410805-00002	HELLER
B	5410805-00001	P. HELLER

REVISIONS

FIRST USED ON OPTION MODEL: LA36

ETCH BOARD REV: C

DEC NO.	EIA NO.	DEC NO.	EIA NO.

SEMICONDUCTOR CONVERSION CHART

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.

PARTS LIST

DRN. / CHK'D / ENG. / PROJ. ENG. / PROD. — DATES 3/29/74, 7/13/74

NEXT HIGHER ASSY

digital EQUIPMENT CORPORATION, MAYNARD MASSACHUSETTS

TITLE: LA 36 POWER BOARD

SIZE D, CODE CS, NUMBER 5410805-0-1, REV. H

SCALE — SHEET 1 OF 5

DIST.

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
REF		X-Y COORDINATE HOLE LOCATION	K-CO-5410805-0-4	1
REF		ASSY/DRILLING HOLE LAYOUT	E-AH-5410805-0-5	2
REF		MODULE ECO HISTORY	B-MH-5410805-0-6	3
1		ETCHED CIRCUIT BOARD	5010806	4
3	C16,C17,C18	CAP 25UF 25V 10% AL EL	1000075	5
7	C1 THRU C7	CAP .005UF 100V 20% DISC	1001765	6
2	C13,C15	CAP .01UF 100V 20% DISC	1001610-01	7
1	C14	CAP .22UF 100V 10% MYLAR	1000037	8
1	C8	CAP 190UF 12V 20% AL EL	1009433	9
2	C9,C10	CAP 20UF 50V 10% AL EL	1002839	10
2	C11,C12	CAP 1.5UF 35V 10% TANT	1009725	11
25	D5,D6,D11,D16,D21,D26,D31, D36,D40 THRU D45,[illegible], D57,D64 THRU D70,D56	DIODE D664	1100114	12
28	D1 THRU D4,D7 THRU D10,D12 THRU D15,D17 THRU D20,D22 THRU D25,D27 THRU D30,D32 THRU D35	DIODE IN4744	1105648	13
7	D37, D46 THRU D51	DIODE IN4004	1105796	14
4	D59 THRU D62	DIODE IN4721	1110182	15
1	D58	BRIDGE	1110714	16
5	D71,D72,D38,D39,D63	DIODE .4W 5.1A21 5.1V 1% ZENER	1105873	17
4		KEYING PLUGS	1211595	18
1	J1	CONN 3M 40 PIN	1210073	19
4	J2,J3,J4,J5	CONN MAT-N-LOCK SOCKET HOUSING	1209340	20
28		SOCKETS (PC) AMP (61320-1)	1209456	21
1	J6	CONN H802 18PIN (MODIFIED)	5510831	22
1	R118	RES 47,¼W,5%	1301895	23
7	R1,R51,R52,R53,R54,R55,R56	RES 0.50 2W 1%	13[illegible]67	24
2	R111,R112	RES 4 5W W.W.	1311624	25
8	R80,R2,R9,R16,R23,R30,R37, R44	RES 100, ¼W 5%	1300229	26
1	R107	RES 18,¼W 5%	1302124	27
1	R62	RES 100,½W 5%	1300228	28
4	R104,R105,R81,R113	RES 100,10W 5%	1310597	29
2	R103,R97	RES 150,¼W,5%	1300250	30
2	R114,R121	RES 1.1K,¼W 5%	1301475	31
8	R4,R11,R18,R25,R32,R39, R45, R91	RES 220,¼,5%	1300271	32
2	R75,R77	RES 180 ,½W 5%	1300260	33
2	R74,R78	RES 200, 5W,5%	1309639	34
1	R90	RES 270,¼W 5%	1301972	35
1	R71	RES 390,2W,5%	1301864	36
1	R106	RES 270,2W, 10%	1300288	37
7	R3, ,R10, ,R17, ,R24 ,R31, ,R38, ,R46	RES 180 ,¼W,5%	1301322	38
1	R96	RES 300,2W,5%	1309855	39
2	R95,R100	RES 390,¼W 5%	1300309	40
1	R101	RES 470,2W,5%	1303062	41
1	R70	RES 39,½W,5%	1302336	42
2	R85,R88	RES 330,¼W 5%	1300291	43
1	R65,	RES 1K,¼W,5%	1300365	44
2	R63,R64	RES 1K,½W	1300364	45
2	R66,R67	RES 1.2K ¼W,5%	1301320	46

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
3	R58 R86, R89	RES. 2K 1/4W 5%	1302388	47
7	R6,R13,R20,R27,R34,R41, R48	RES 2.7K,¼W,5%	1300426	48
5	R94,R99,R116,R117,R122	RES 3.9K,¼W,5%	1300444	49
16	R5,R7,R12,R15,R19,R21, R26,R28,R33,R35,R40,R42 R47,R49,R68,R69	RES 4.7K,¼W,5%	1300447	50
9	R79,R76,R73,R72,R61,R57, R108,R109,R110	RES 10K,¼W,5%	1300479	51
7	R8,R14,R22,R29,R36,R43, R50	RES 18K,¼W 5%	1302465	52
1	R120	RES 560 ¼W 5%	1301890	53
2	R92,R93	RES 487 ¼W 1%	1311845	54
2	R98,R102	RES 619,¼W 1%	1305126	55
1	R59	RES 196,¼W 1%	1302956	56
1	R119	RES 121,⅛W 1%	1302957	57
2		FASTON TAB	9007113	58
8	Q23,Q1,Q16,Q17,Q18,Q19,Q20, Q21	TRANS 2N3716	1503069	59
9	Q2,Q4,Q6,Q8,Q10,Q12,Q14,Q38,Q39	TRANS 6531B	1509338	60
2	Q42,Q43	TRANS 3715	1503068	61
1	Q51	TRANS 2N3791	1509581	62
				63
6	Q33,Q34,Q36, .Q26 Q47,Q48	TRANS MPSA05	1510705	64
15	Q3,Q5,Q7,Q9,Q11,Q13, Q15,Q22,Q25,Q27,Q35,Q37, Q45,Q46,Q52	TRANS MPSA55	1510706	65
2	,Q41,Q49	TRANS D44C8	1510421	66
3	,Q40,Q24,Q50	TRANS D45C8	1510598	67
1	E1	IC LM309K REGULATOR	1910460	68
1		HEAT SINK	7411077	69
6		FUSE CLIPS	9009513-01	70
8		WASHERS, FLAT, NYLON #6	9006707	71
8		EYELET (MAT-N-LOK)	9007266	72
1	F1	FUSE 30 AMP, 32V, GLASS	9007240	73
2	F2, F3	FUSE 1AMP SLOW BLOW	9007212	74
2		EYELET	9009000	75
24		SCREW, PPH 4-40 X 1/2	9006013-01	76
34		NUT, KEP, 4-40	9006557	77
1		SCREW, PPH 6-32 X 15/16	9007838-01	79
1		NUT, KEP, 6-32	9006560	80
~~1~~		~~CONN, 40 PIN (CABLE END)~~	~~1211206~~	~~81~~
1		CABLE, POWER BOARD	C-AD-7010363-0-0	82
12		INSULATORS, TO3	9006721	83
10		INSULATOR	9009597	84
A/R		COMPOUND, THERMAL	9008268	85
1		GRIPLET	1210244	86
AR		WIRE, JUMPER #24 AWG INS.	9107688	87
2	R84, R87	RES. 1.5K, ¼W, 5%	1300391	88
2	D52,D54	DIODE, IN747A, 3.6V ZENER	1110672	89
10		SCREW, PPH 4-40 X 5/16	9006012-01	90
3	Q32, Q30, Q28	TRANS D44H8	1510707-00	91
2	Q29, Q31	TRANS D45H8	1570708-00	92
1		LABEL	3611567	93

SEE NOTE 4.

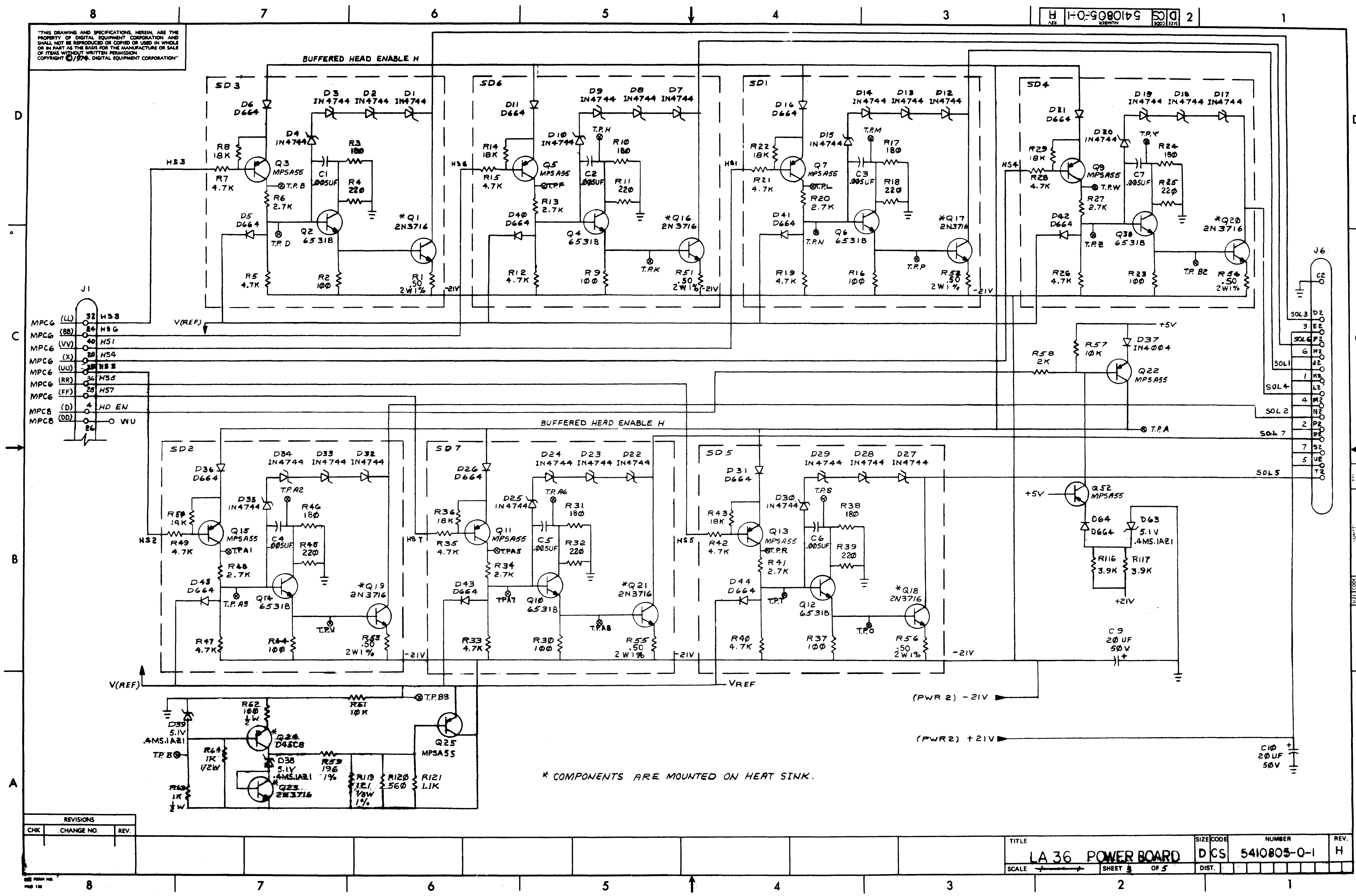
REVISIONS		
CHK	CHANGE NO.	REV.

TITLE LA 36 POWER BOARD

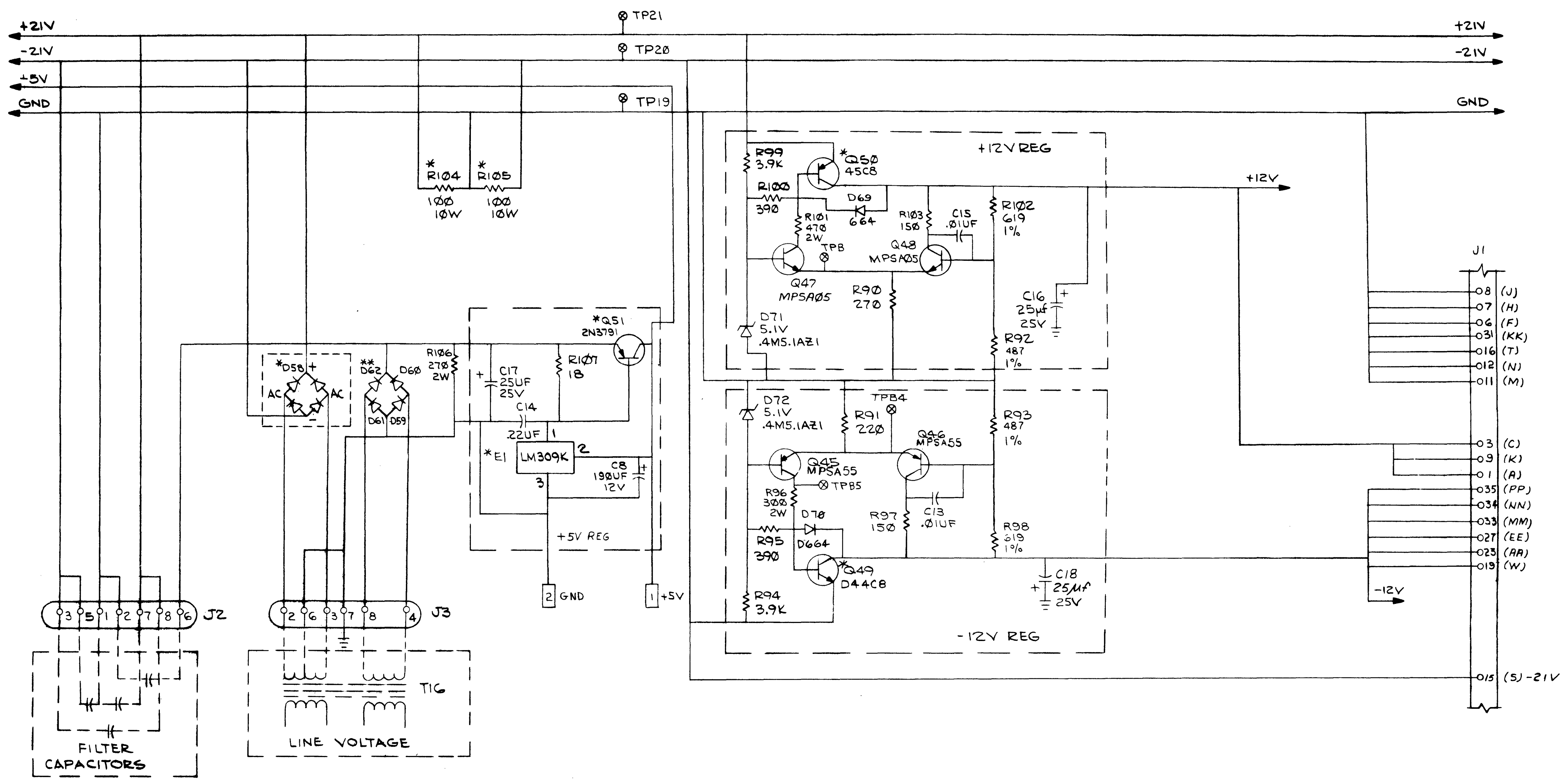
SIZE D CODE CS NUMBER 5410805-0-1 REV. H

SCALE — SHEET 2 OF 5 DIST.

D CS 5410805-0-1 H



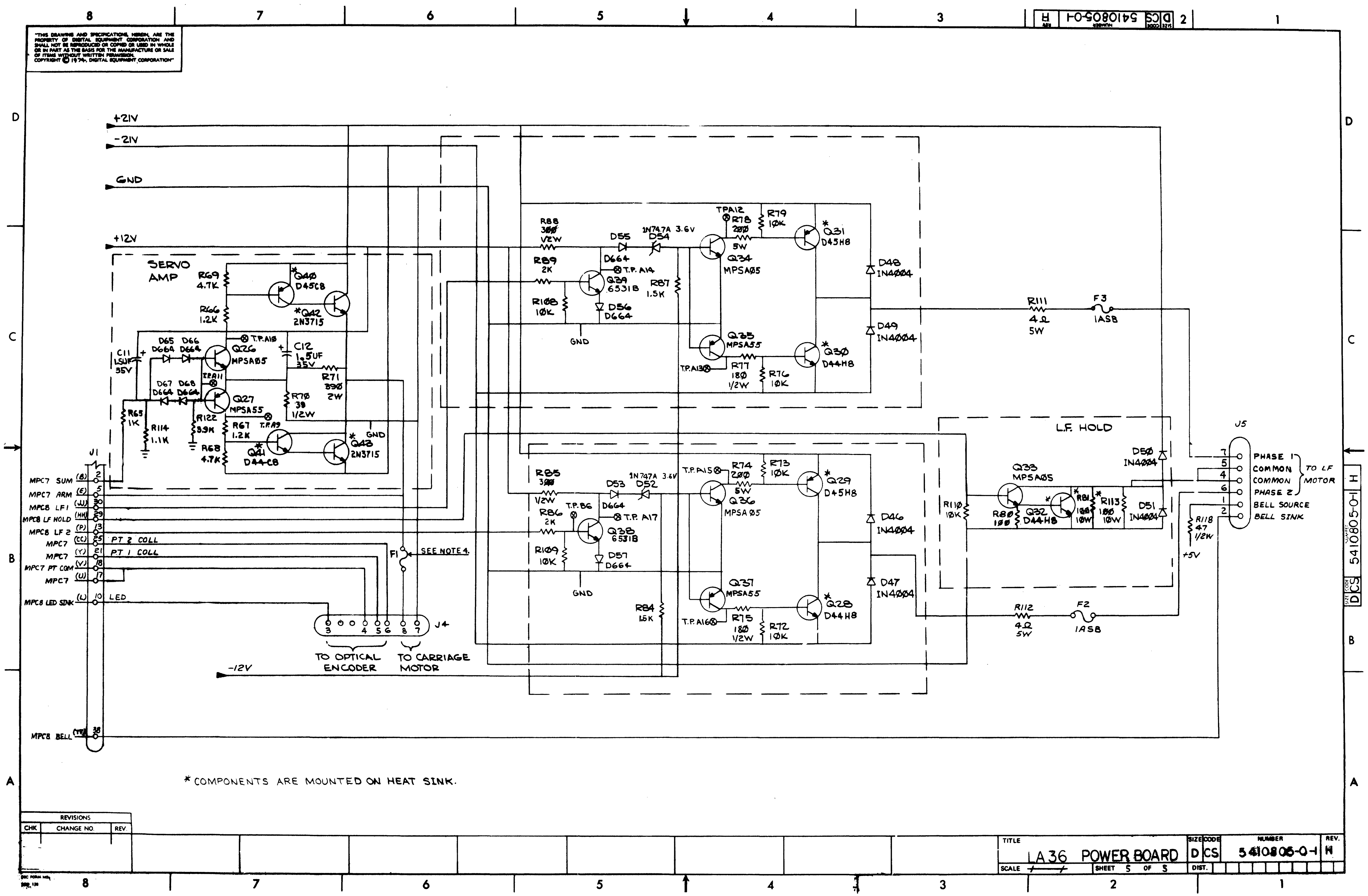
"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1974, DIGITAL EQUIPMENT CORPORATION"
BUFFERED HEAD ENABLE H
SD3
SD6
SD1
SD4
SD2
SD7
SD5
J1
J6
V(REF)
VREF
(PWR 2) -21V
(PWR2) +21V
* COMPONENTS ARE MOUNTED ON HEAT SINK.
TITLE LA 36 POWER BOARD
SIZE D CODE CS NUMBER 5410805-0-1 REV. H



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

TITLE	SIZE	CODE	NUMBER	REV.
LA36 POWER BOARD	D	CS	5410805-0-1	H

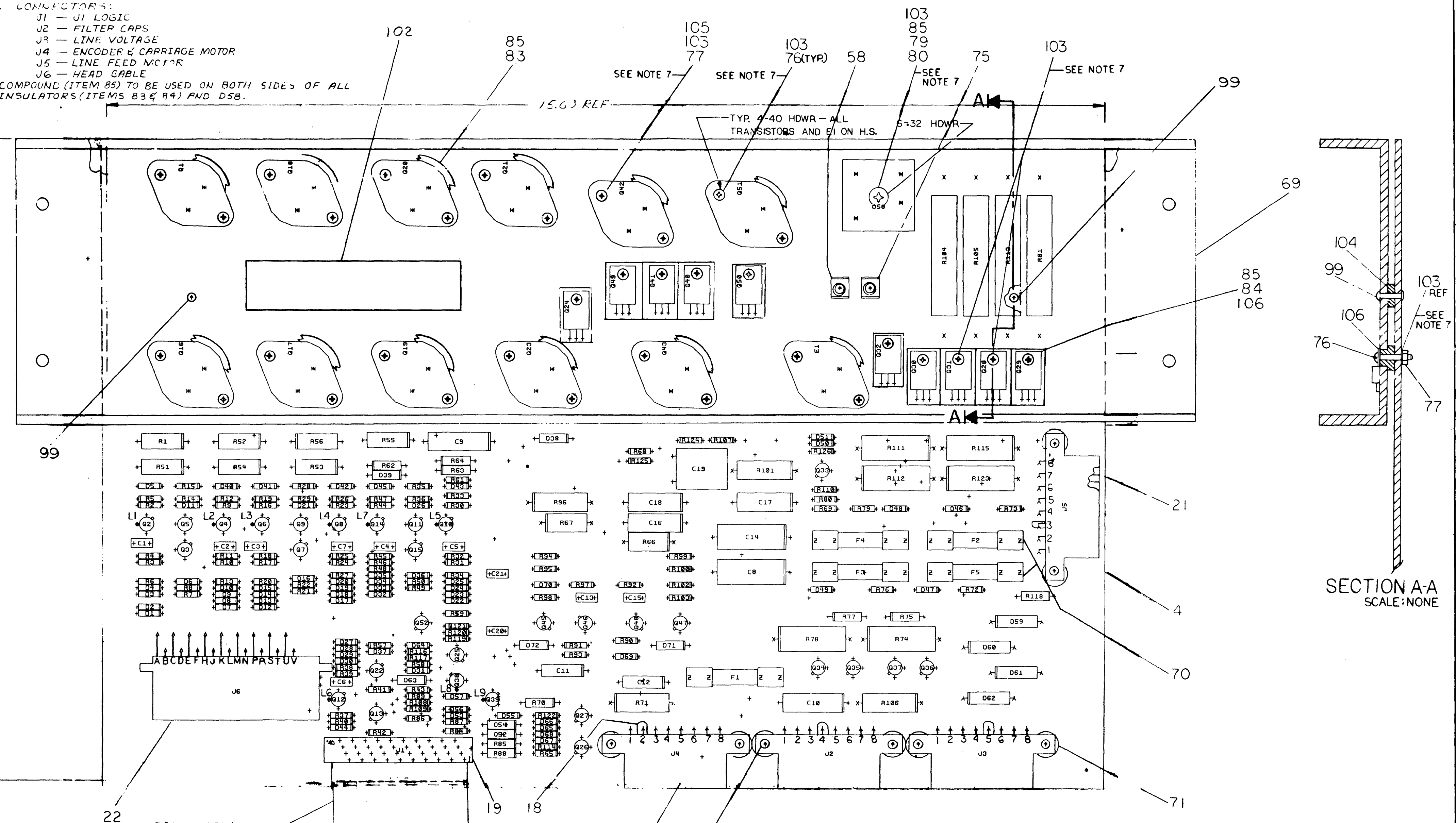
SHEET 4 OF 5


"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1974, DIGITAL EQUIPMENT CORPORATION"
+21V
-21V
GND
+12V
SERVO AMP
L.F. HOLD
TO OPTICAL ENCODER
TO CARRIAGE MOTOR
-12V
SEE NOTE 4.
PHASE 1
COMMON
COMMON
PHASE 2
BELL SOURCE
BELL SINK
TO LF MOTOR
MPC7 SUM
MPC7 ARM
MPC8 LF1
MPC8 LF HOLD
MPC8 LF 2
MPC7 PT 2 COLL
MPC7 PT 1 COLL
MPC7 PT COM
MPC7
MPC8 LED SINK
LED
MPC8 BELL
* COMPONENTS ARE MOUNTED ON HEAT SINK.
REVISIONS
CHK
CHANGE NO.
REV.
TITLE
LA36 POWER BOARD
SIZE D
CODE CS
NUMBER 5410805-0-1
REV. H
SHEET 5 OF 5
SCALE
DIST.

THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION
COPYRIGHT © DIGITAL EQUIPMENT CORPORATION

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 2 AMP, SLOW-BLOW. (P/N 90C7216).
5. RESISTORS R120 AND R[illegible] ARE TRIMMER RESISTORS WHICH MAY BE REMOVED IN TEST. IF A RESISTOR IS REMOVED IT MUST BE REMOVED COMPLETELY.
6. WHEN [illegible] TRANSISTORS WITH FERRITE BEAD, BE SURE THAT THE BASE LEAD PASSES THRU HOLE IN BEAD BEFORE MOUNTING TO BOARD.
7. INSTALL FIBER WASHER 9006693 BETWEEN KEP NUT AND P.C. BOARD FIVE PLACES AS SHOWN.



CONT. ON SHT 2.

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

FIRST USED ON OPTION MODEL: LA36

ETCH BOARD REV C

DEC NO.	EIA NO.	DEC NO.	EIA NO.

SEMICONDUCTOR CONVERSION CHART

DRN. / DATE 3/29/74
CHK'D. / DATE 5/1/74
ENG. / DATE
PROJ. ENG. / DATE
PROD. / DATE
NEXT HIGHER ASSY
SCALE
SHEET 1 OF 5

digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

TITLE: LA 36 POWER BOARD

SIZE D CODE CS NUMBER 5410805-0-1 REV. Y

CHANGE NO. / REVISIONS: 5410805-00001 through 5410805-00015 (J. BITTO, P. HELLER)

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
REF		X-Y COORDINATE HOLE LOCATION	K-CO-5410805-0-4	1
REF		ASSY/DRILLING HOLE LAYOUT	E-AH-5410805-0-5	2
REF		MODULE ECO HISTORY	B-MH-5410805-0-6	3
1		ETCHED CIRCUIT BOARD	5010806	4
3	C16,C17,C18	CAP 25UF 25V 10% AL EL	1000075	5
7	C1 THRU C7	CAP .005UF 100V 20% DISC	1001765	6
4	C13,C15,C20,C21	CAP .01UF 100V 20% DISC	1001610-01	7
1	C14	CAP .22UF 100V 10% MYLAR	1000037	8
1	C8	CAP 190UF 12V 20% AL EL	1009433	9
2	C9,C10	CAP 20UF 50V 10% AL EL	1002839	10
2	C11,C12	CAP 1 5UF 35V 10% TANT	1009725	11
25	D5,D6,D11,D16,D21,D26,D31, D36,D40 THRU D45,D53,D55 D57 D64 THRU D70,D56	DIODE D664	1100114	12
28	D1 THRU D4,D7 THRU D10,D12 THRU D15,D17 THRU D20,D22 THRU D25,D27 THRU D30,D32 THRU D35	DIODE 1N4744	1105648	13
7	D37, D46 THRU D51	DIODE IN4004	1105796	14
4	D59 THRU D62	DIODE MR752	1110615	15
1	D58	BRIDGE	1110714	16
5	D71,D72,D38,D39,D63	DIODE .4M 5.1AZ1 5.1V 1% ZENER	1105873	17
4		KEYING PLUGS	1211595	18
~~1~~	~~J1~~	~~CONN 3M 40 PIN~~	~~1210073~~	~~19~~
4	J2 J3 J4 J5	CONN MAT-N-LOCK SOCKET HOUSING	1209340	20
28		SOCKETS (PC) AMP (61320-1)	1209456-01	21
1	J6	CONN H802 18PIN (MODIFIED)	5510831	22
1	R118	RES 47,½W 5%	1301695	23
7	R1,R51,R52,R53 R54,R55,R56	RES 0.50 2W 1%	1311857	24
4	R111,R112,R115 R123	RES 4, 5W W W.	1311624	25
8	R80 R2 R9 R16 R23 R30 R37, R44	RES 100, ¼W 5%	1300229	26
1	R107	RES 18,¼W 5%	1302124	27
1	R62	RES 100,½W 5%	1300228	28
2	R104 R105,	RES 100,10W 5%	1310597	29
2	R103 R97	RES 150,¼W,5%	1300250	30
2	R114,R121	RES 1.1K,¼W 5%	1301475	31
8	R4 R11 R18 R25, R32, R39, R45, R91	RES 270,¼,5%	1300271	32
2	R75,R77	RES 180 ,½W 5%	1300260	33
2	R74,R78	RES 200, 5W,5%	1309639	34
1	R90	RES 270,¼W 5%	1301972	35
1	R71	RES 390,2W,5%	1301864	36
1	R106	RES 270,2W, 10%	1300288	37
7	R3, R10 ,R17, R24 R31 ,R38 ,R46	RES 180 ,¼W 5%	1301322	38
1	R96	RES 300,2W,5%	1309855	39
3	R95 R100,R126	RES 390,¼W 5%	1300309	40
1	R101	RES 470,2W 5%	1303062	41
1	R70	RES 39,½W,5%	1302336	42
2	R85 R88	RES 300 ,½W 5%	1300291	43
1	R65	RES 1K,¼W,5%	1300365	44
2	R63,R64	RES 1K,½W	1300364	45
2	R66 R67	RES 820,1W,5%	1302658	46

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
3	R58 R86, R89	RES. 2K 1/4W 5%	1302388	47
7	R6,R13,R20,R27,R34,R41, R48	RES 2.7K,¼W,5%	1300426	48
5	R94,R99,R116,R117,R122	RES 3.9K,¼W 5%	1300444	49
14	R5,R7,R12,R15,R19,R21, R26,R28,R33 R35,R40,R42 R47,R49,	RES 4.7K,¼W,5%	1300447	50
5	R57,R61,R108,R109,R110	RES 10K,¼W 5%	1300479	51
7	R8,R14,R22,R29,R36,R43, R50	RES 18K,¼W 5%	1302465	52
1	R120	RES 560 ¼W 5%	1301890	53
2	R92,R93,	RES 464 ¼W 1%	1303047	54
2	R98,R102	RES 619 ¼W 1%	1305126	55
1	R59	RES 196,¼W 1%	1302956	56
1	R119	RES 121,⅛W 1%	1302357	57
2		FASTON TAB	9007113	58
8	Q23,Q1,Q16,Q17,Q18,Q19,Q20, Q21	TRANS 2N3716	1503069	59
9	Q2,Q4,Q6,Q8,Q10,Q12 Q14,Q38,Q39	TRANS 65313	1509338	60
2	Q42,Q43	TRANS 3715	1503068	61
1	Q51	TRANS 2N3791	1509581	62
				63
6	Q33 Q34,Q36, Q26 Q47 Q48	TRANS MPSA05	1510705	64
15	Q3,Q5,Q7,Q9,Q11,Q13, Q15,Q22 Q25,Q27,Q35,Q37, Q45,Q46,Q52	TRANS MPSA55	1510706	65
5	Q28,Q30,Q32,Q41,Q49	TRANS TIP 31A	[illegible]	66
5	Q29,Q31,Q40,Q24,Q50	TRANS TIP 32A	[illegible]	67
1	E1	IC LM309K REGULATOR	1910460	68
1		HEAT SINK	7411077	69
10		FUSE CLIPS	9009513-01	70
8		WASHERS, FLAT, NYLON #6	9006707	71
8		EYELET (MAT-N-LOK)	9007266	72
1	F1	FUSE 30 AMP, 32V, GLASS	9007240	73
4	F2,F3,F4,F5	FUSE 3/4AMP SLOW BLOW	1211237	74
2		EYELET	9009000	75
34		SCREW, PPH 4-40 X .56	9008033-01	76
34		NUT, KEP, 4-40	9006557	77
1		SCREW, PPH 6-32 X 15/16	9007838-01	79
1		NUT, KEP, 6-32	9006560	80
1		~~CONN, 40 PIN (CABLE END)~~	~~1211206~~	81
1		CABLE, POWER BOARD	C-AL-7010363-0-0	82
12		INSULATORS, TO3	9006721	83
10		INSULATOR	9009597	84
A/R		COMPOUND, THERMAL	9008268	85
				86
				87
2	R84, R87	RES. 1.5K, ¼W, 5%	1300391	88
2	D52, D54	DIODE, IN747A, 3.6V ZENER	1110672	89
~~10~~		~~SCREW, PPH 4-40 X 7/16~~	~~9006012-01~~	~~90~~
				91
				92
1		LABEL	3611567	93
1	C19	CAP .1UFD 100V 20% DISC	1000030-00	94
6	R68,R69,R72,R73,R76,R79	RES. 470 1/4W 5%	1300316	95
				96
				97

SEE NOTE 4.

QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
2	R81,R113	RES 60,10W,5%	1312997	98
2		RIVET, BLIND	9006508	99
2	R124,R125	RES,FUSEABLE, 100, ¼W, 5%	1310881-03	100
9	L1-L9	BEAD, FERRITE	1613367-0-0	101
1		LABEL, ADHESIVE BACKED, PRINTED	A-PS-3613307-0-0	102
5		WASHER, FIBER FLAT	9006693	103
2		WASHER, FLAT	9006658	104
24		WASHER, LOCK INT	9006632	105
10		WASHER, RECTANGULAR	9009769	106

REVISIONS

CHK	CHANGE NO	REV
ETC	5410805-00017	U
H. Diamantis 7-16-76		
J. BITTO		
JRBitto 7/27/76		

CHK	CHANGE NO	REV
EIL	5410805-00018	V
	W. Hamel 30-AUG-76	
	J. BITTO	
	JRBitto 15 Sep 76	

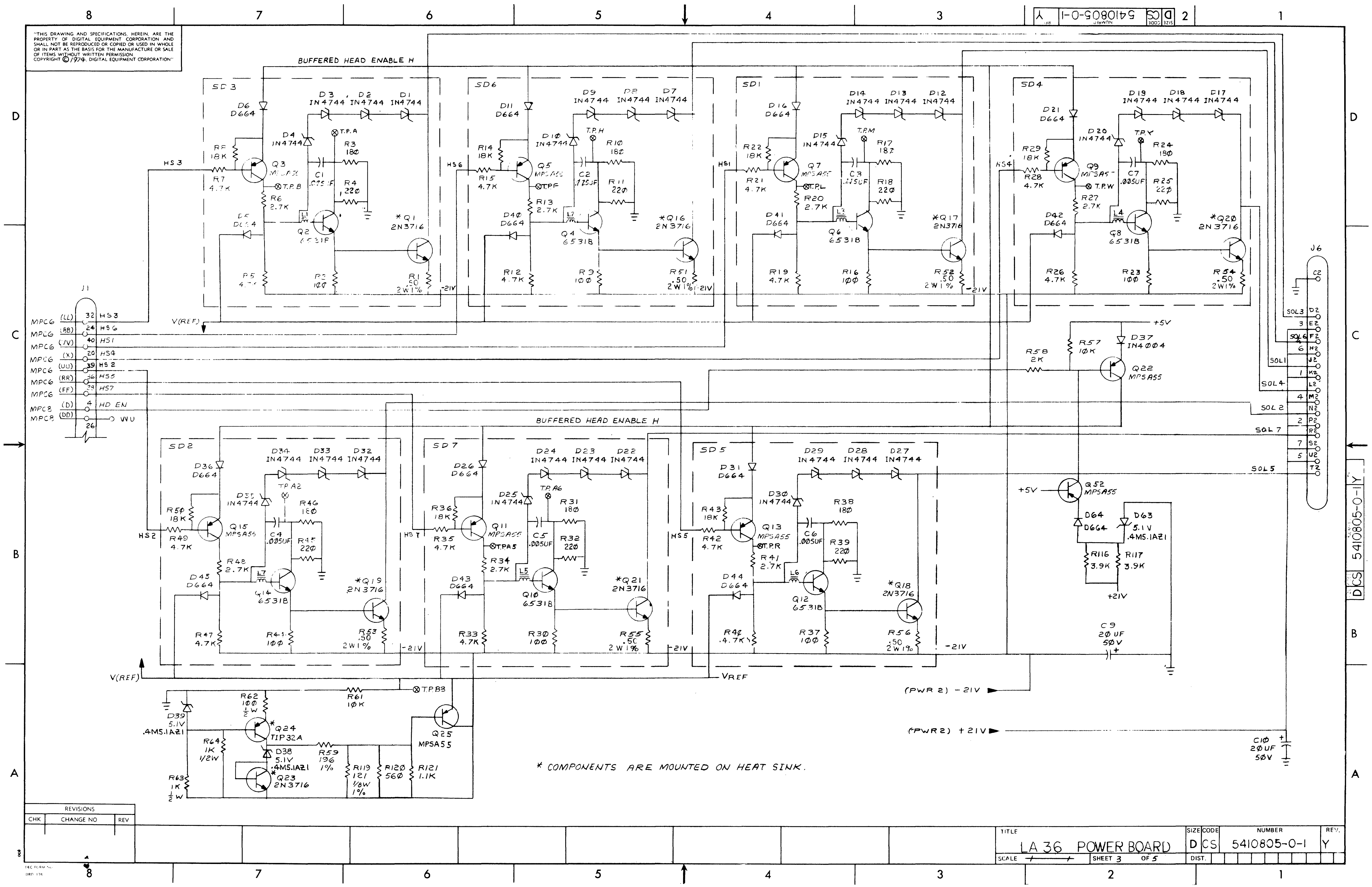
CHK	CHANGE NO	REV
	5410805-00020	W
	P. Grose 26 OCT 76	
	J. BITTO	
	JRBitto 16 NOV 76	

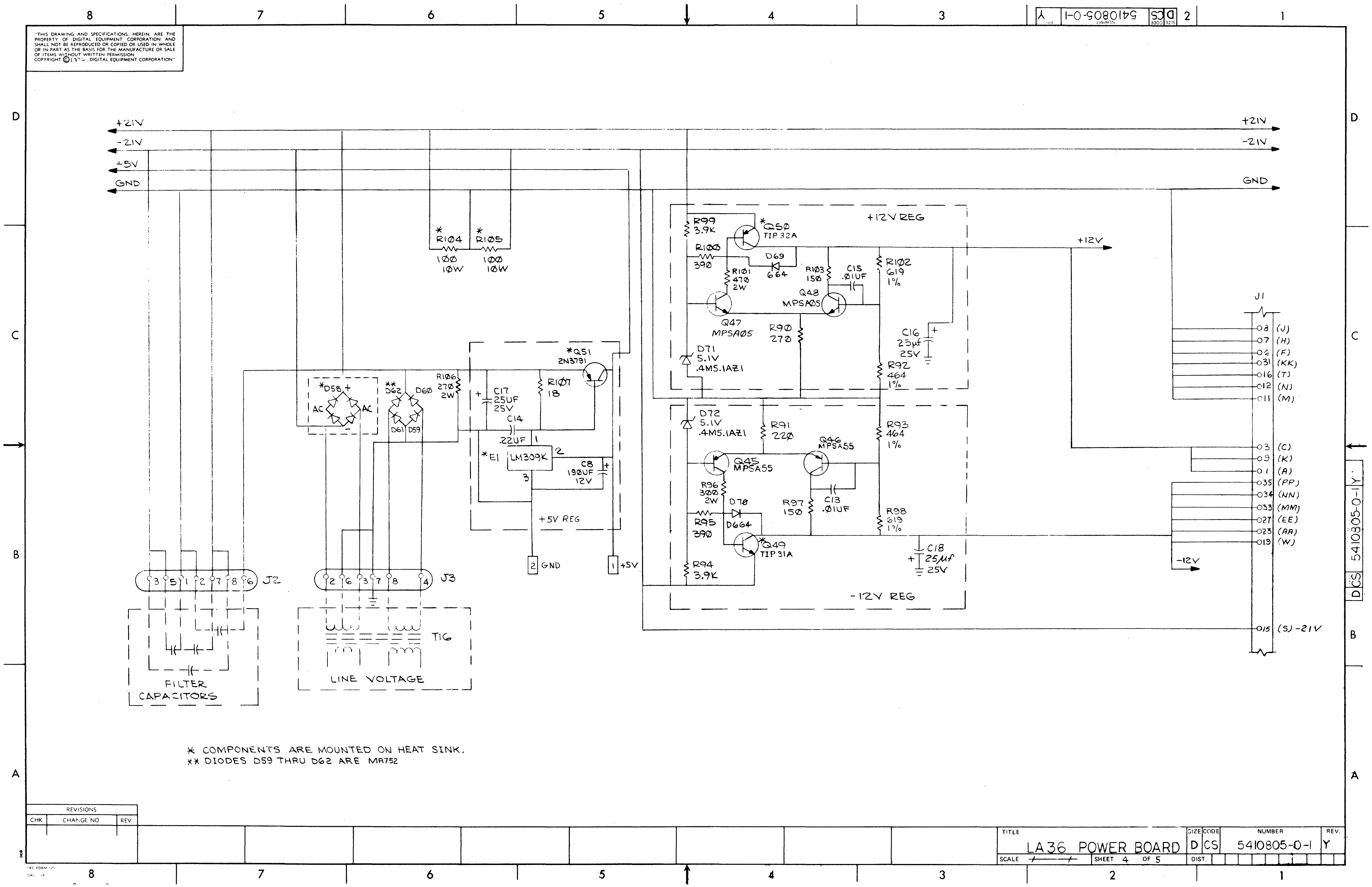
CHK	CHANGE NO	REV
	5410805-00021	Y
	R. VowLes 10-FEB-77	
	J. BITTO	
	JRBitto 28 Feb 77	

DEC FORM NO
DRD 138

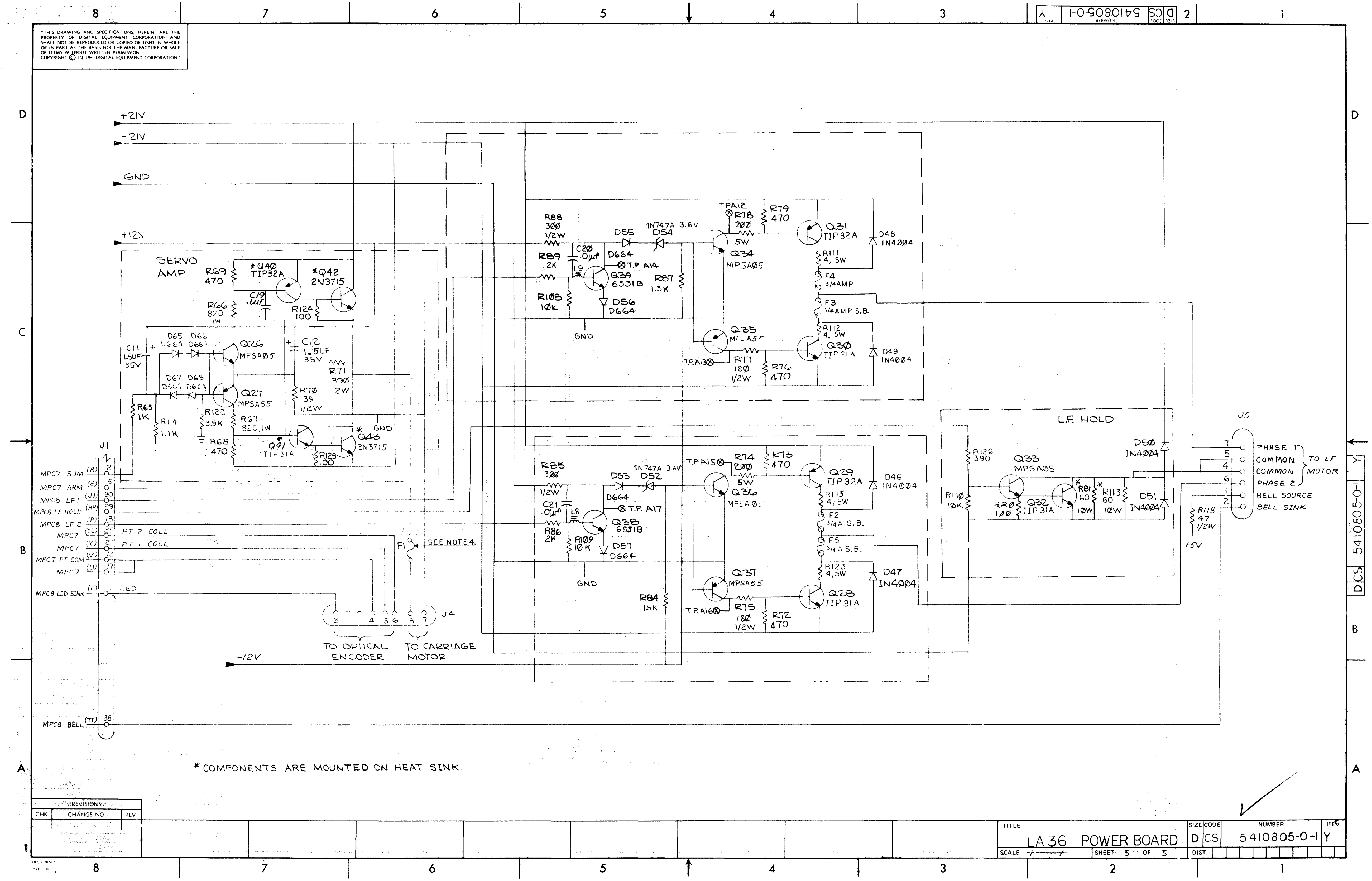
TITLE	SIZE	CODE	NUMBER	REV.
LA 36 POWER BOARD	D	CS	541Ø8Ø5-Ø-1	Y

SCALE — SHEET 2 OF 5 DIST.


"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1974, DIGITAL EQUIPMENT CORPORATION"
BUFFERED HEAD ENABLE H
SD3
SD6
SD1
SD4
SD2
SD7
SD5
V(REF)
VREF
(PWR 2) -21V
(PWR2) +21V
* COMPONENTS ARE MOUNTED ON HEAT SINK.
REVISIONS
CHK
CHANGE NO
REV
TITLE
LA 36 POWER BOARD
SIZE D
CODE CS
NUMBER 5410805-0-1
REV. Y
SHEET 3 OF 5



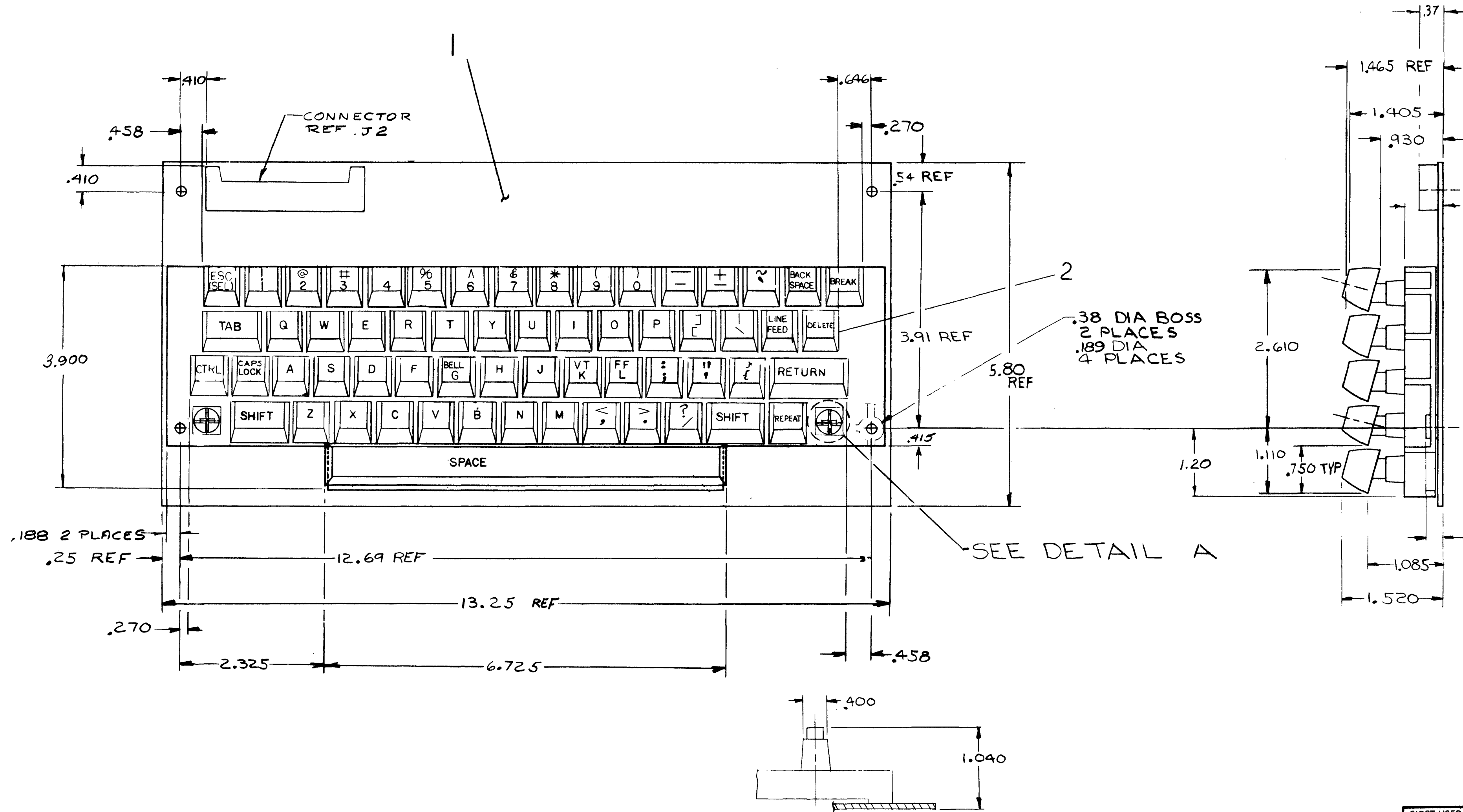
THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION
+21V
-21V
+5V
GND
*R104 100 10W
*R105 100 10W
+12V REG
R99 3.9K
*Q50 TIP 32A
R100 390
D69 664
R101 470 2W
R103 150
C15 .01UF
R102 619 1%
Q48 MPSA05
Q47 MPSA05
R90 270
C16 23µf 25V
D71 5.1V .4M5.1AZ1
R92 464 1%
+12V
J1
8 (J)
7 (H)
6 (F)
31 (KK)
16 (T)
12 (N)
11 (M)
3 (C)
9 (K)
1 (A)
35 (PP)
34 (NN)
33 (MM)
27 (EE)
23 (AA)
19 (W)
15 (S) -21V
-12V
D72 5.1V .4M5.1AZ1
R91 220
Q46 MPSA55
R93 464 1%
Q45 MPSA55
R96 300 2W
D70
R97 150
C13 .01UF
R98 619 1%
R95 390
D664
*Q49 TIP31A
C18 25µf 25V
R94 3.9K
-12V REG
*Q51 2N3791
R106 270 2W
C17 25UF 25V
R107 18
C14 .22UF
*E1 LM309K
C8 190UF 12V
+5V REG
2 GND
1 +5V
*D58
AC
AC
**D62
D60
D61
D59
J2
J3
T16
FILTER CAPACITORS
LINE VOLTAGE
* COMPONENTS ARE MOUNTED ON HEAT SINK.
** DIODES D59 THRU D62 ARE MR752
REVISIONS
CHK
CHANGE NO
REV
TITLE
LA36 POWER BOARD
SIZE D
CODE CS
NUMBER 5410805-0-1
REV. Y
SCALE
SHEET 4 OF 5
DIST.


"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION COPYRIGHT © 1974 DIGITAL EQUIPMENT CORPORATION"
+21V
-21V
GND
+12V
SERVO AMP
L.F. HOLD
TO OPTICAL ENCODER
TO CARRIAGE MOTOR
-12V
SEE NOTE 4.
PHASE 1
COMMON
COMMON
PHASE 2
BELL SOURCE
BELL SINK
TO LF MOTOR
MPC7 SUM
MPC7 ARM
MPC8 LF1
MPC8 LF HOLD
MPC8 LF 2
PT 2 COLL
PT 1 COLL
MPC7 PT COM
MPC8 LED SINK
LED
MPC8 BELL
*COMPONENTS ARE MOUNTED ON HEAT SINK.
TITLE LA36 POWER BOARD
SIZE D CODE CS NUMBER 5410805-0-1 REV Y
SHEET 5 OF 5

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-LKØ2-Ø-2	4
REF	ENGINEERING SPEC	A-SP-LKØ2-Ø-1	3
1	KEYCAP (SET)	D-PS-9009570-62	2
1	KEYSWITCH ARRAY & MODULE	D-CS-5410736-0-1	1

PARTS LIST

FIRST USED ON OPTION/MODEL	LKØ2
UNLESS OTHERWISE SPECIFIED DIMENSION IN INCHES	TOLERANCES: DECIMALS .xxx ±.005, .xx ±.02, .x ±.1; ANGLES ±0° 30'
REMOVE BURRS AND BREAK SHARP CORNERS/SURFACE QUALITY	
MATERIAL	—
FINISH	—
DRN	Arthur Mussault, 5/31/74
CHKD	Conboy, 7/15/74
ENG	Benson, 7/11/74
PROD ENG	Paul F. Nelson, 7-11-74
PROD	7/15/74
NEXT HIGHER ASSY.	B-DD-LKØ2-Ø
SCALE	NONE
SHEET	1 OF 1

digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

TITLE 63 KEY KEYBOARD ASSY

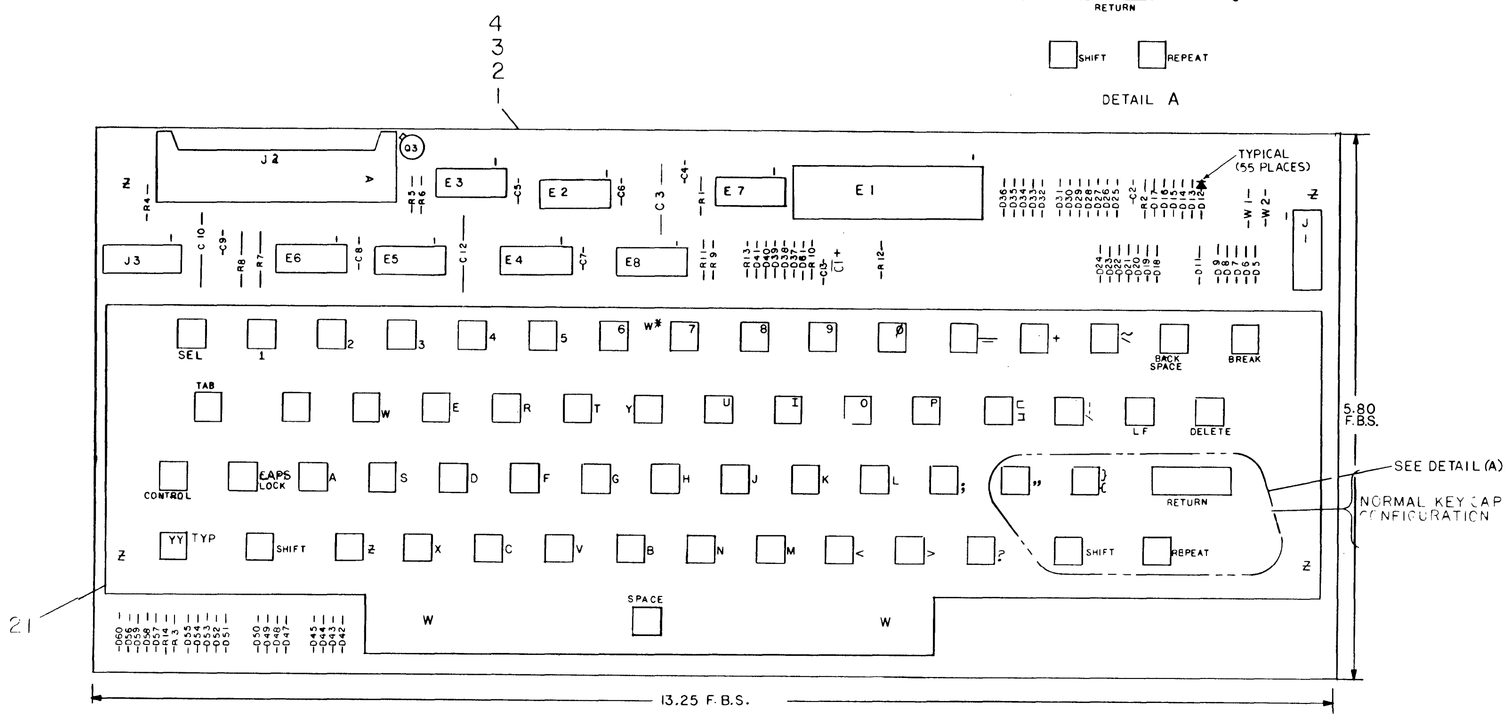
SIZE	CODE	NUMBER	REV.
D	UA	LKØ2-Ø-Ø	A

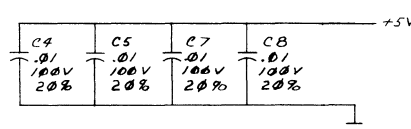
REVISIONS		
CHK	CHANGE NO.	REV
	LKØ2-00002	A
	C. BICKOFF 1-21-75	

DEC FORM NO DRD 100-1

This drawing and specifications, herein, are the property of Digital Equipment Corporation and shall not be reproduced or copied or used in whole or in part as the basis for the manufacture or sale of items without written permission. COPYRIGHT © 1973

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





5410736-YA-0	5410736-0-0	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
REF	REF		X-Y COORDINATE HOLE LOCATION	K-CO-5410736-0-4	1
REF	REF		ASSY/DRILLING HOLE LAYOUT	D-AH-5410736-0-5	2
REF	REF		MODULE ECO HISTORY	B-MH-5410736-0-6	3
1	1		ETCHED CIRCUIT BOARD	5010735	4
1	1	C3	CAP., .01UF, 100V 10% MYLAR	1005784	5
6	6	C4,C5,C7,C8,C9,C13	CAP., .01UF, 100V 20% DISC	1001610-01	6
1	1	C1	CAP., 1UF, 25V TANT	1010866-01	7
1	1	C2,	CAP, 180PF, 100V 5% MICH	1000020-00	8
2	2	C10,C12	CAP., 10UF, 20V 10% TANT	1004813	9
55	55	D5-D9, D11-D45, D47-D61	DIODE, D664	1100114-00	10
1	1	Q3	TRANSISTOR DEC 3009B	1503100-00	11
2	2	J1, J3	SOCKET (16 PINS)	1211813	12
1	1	J2	CONNECTOR, RIGHT ANGLE HEADER	1209941-02	13
1	1	XE1	SOCKET ROM	1212385-00	14
1	1	E2	I.C. 7404	1909686	15
2	2	E3, E8	I.C. 7400	1905575	16
2	2	E5, E6	I.C. 7437	1910091	17
1	1	E4	I.C. 9601	1909373	18
1	1	E1	I.C ROM.	23002C1	19
0	1	W1,	JUMPER (INSULATED .4)	9009185	20
1	1		63 KEYSWITCH ARRAY	D-AD-7009892-0-0	21
9	9	R1, R3, R4, R5, R10-R14	RES 1K 1/4W 5%	1300365-00	22
1	1	R6.	RES 3.9K 1/4W 5%	1300444-00	23
1	1	R9	RES 22K 1/4 W 5%	1301808-00	24
1	1	R2	RES 100K 1/4 W 5%	1302466-00	25
2	2	R7, R8	RES 2 OHM 1/2 W 5%	1309421-00	26
1	1	E7	I.C. 7410	1905576	27
1	0	W2	JUMPER (INSULATED .4)	9009185	28
1	1	C6	CAP 1,000 PF 100V 5% MICH	1000042-00	29

QTY

PARTS LIST

ETCH BOARD REV F

SEMICONDUCTOR CONVERSION CHART

DEC NO.	EIA NO.	DEC NO.	EIA NO.
IN759A	N.A.		
D664	IN3606		

REVISIONS

REV	CHANGE NO.		CHK
D	REVISED & REDRAWN	PAUL NELSON 2/4/75	
E	5410736-00003	P NELSON 5-22-75	
F	5410736-00005	J. BITTO 10-1-75	

DRN. POIRIER DATE 1-25-74
CHK'D DATE 3-7-75
ENG. P NELSON DATE 2-4-74
PROJ. ENG. DATE 2-4-74
PROD. DATE

NEXT HIGHER ASSY D-UA-LKØ2-0-0

SCALE
SHEET 1 OF 2

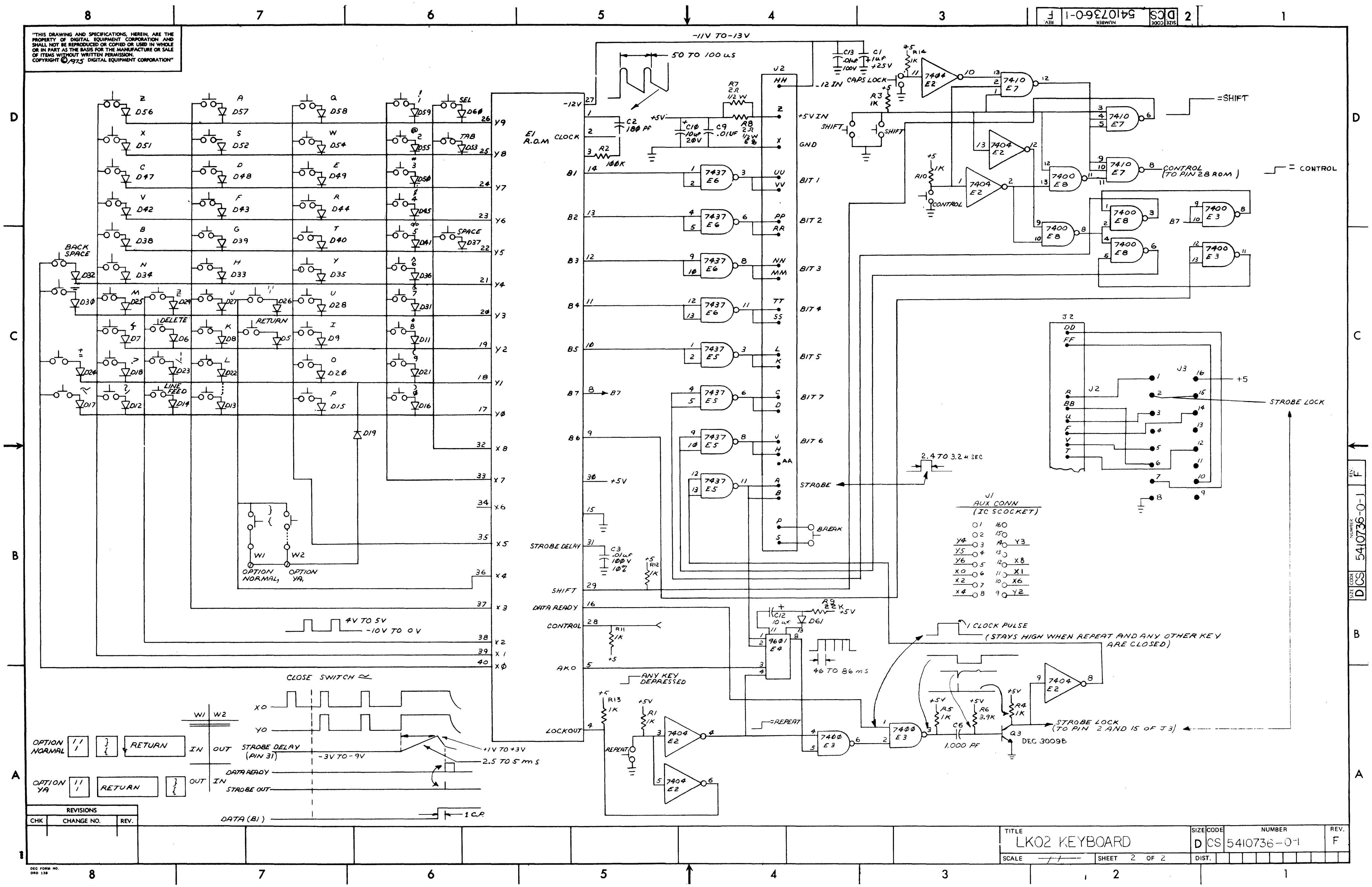
digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

TITLE LKØ2 KEYBOARD

SIZE D CODE CS NUMBER 5410736-0-1 REV. F

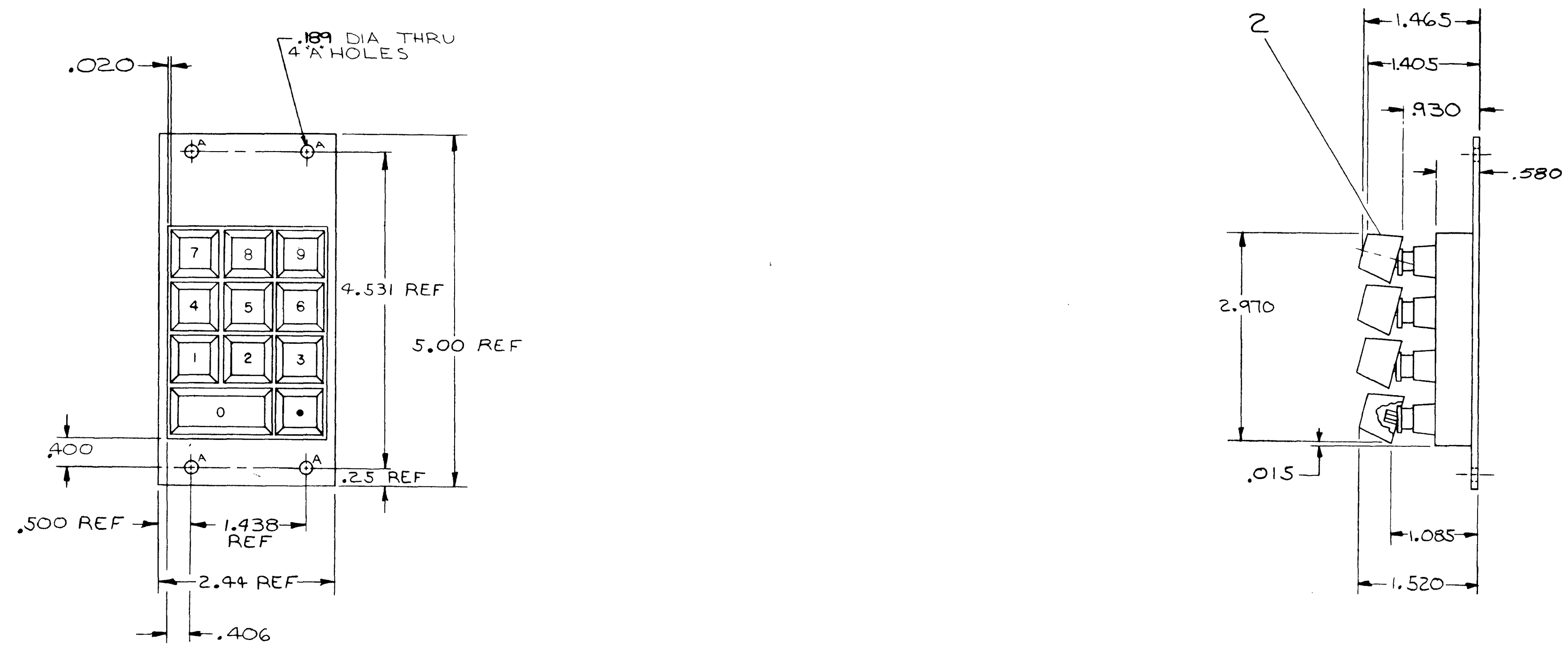
DEC FORM NO DRD-135

BRUNING 40-107 15968



"THIS DRAWING AND SPECIFICATIONS, HEREIN, ARE THE PROPERTY OF DIGITAL EQUIPMENT CORPORATION AND SHALL NOT BE REPRODUCED OR COPIED OR USED IN WHOLE OR IN PART AS THE BASIS FOR THE MANUFACTURE OR SALE OF ITEMS WITHOUT WRITTEN PERMISSION. COPYRIGHT © 1975 DIGITAL EQUIPMENT CORPORATION"
-11V TO -13V
50 TO 100 uS
E1
R.O.M.
CLOCK
STROBE DELAY
SHIFT
DATA READY
CONTROL
AKO
LOCKOUT
CAPS LOCK
SHIFT
CONTROL
=SHIFT
= CONTROL
CONTROL (TO PIN 28 ROM)
BIT 1
BIT 2
BIT 3
BIT 4
BIT 5
BIT 7
BIT 6
STROBE
BREAK
STROBE LOCK
J1
AUX CONN
(IC SCOCKET)
OPTION NORMAL
OPTION YA
4V TO 5V
-10V TO 0V
CLOSE SWITCH
ANY KEY DEPRESSED
=REPEAT
REPEAT
46 TO 86 mS
1 CLOCK PULSE
(STAYS HIGH WHEN REPEAT AND ANY OTHER KEY ARE CLOSED)
STROBE LOCK
(TO PIN 2 AND 15 OF J3)
DEC 3009B
1,000 PF
2.4 TO 3.2 u SEC
+1V TO +3V
2.5 TO 5 mS
-3V TO -9V
STROBE DELAY (PIN 31)
DATA READY
STROBE OUT
DATA (B1)
1 C.P.
REVISIONS
CHK
CHANGE NO.
REV.
TITLE
LK02 KEYBOARD
SIZE D
CODE CS
NUMBER 5410736-0-1
REV. F
SCALE
SHEET 2 OF 2
DIST.

NOTES:



REF	TEST SPEC	A-SP-LKØ2-Ø-2	4
REF	ENGINEERING SPEC	A-SP-LKØ2-Ø-1	3
1	KEYCAP SET (CURSOR SET C)	9009570-74	2
1	11 KEYSWITCH ARRAY & MODULE	D-CS-5410819-0-1	1
QTY.	DESCRIPTION	PART NO.	ITEM NO.

PARTS LIST

FIRST USED ON OPTION/MODEL: LKØ3

UNLESS OTHERWISE SPECIFIED DIMENSION IN INCHES. TOLERANCES
DECIMALS: .XXX ±.005, .XX ±.02, .X ±.1 — ANGLES: ±0° 30'
REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY ✓
MATERIAL —//—
FINISH —//—

DRN. Mike Dugan DATE 6-3-74
CHK'D DATE 7/1/74
ENG. DATE 7/1/74
PROJ ENG. DATE 7-11-74
PROD. DATE 7/1/74

digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

TITLE: 11 KEY KEYBOARD ASSY

NEXT HIGHER ASSY. B-DD-LKØ3-Ø
SCALE 1/1
SHEET 1 OF 1

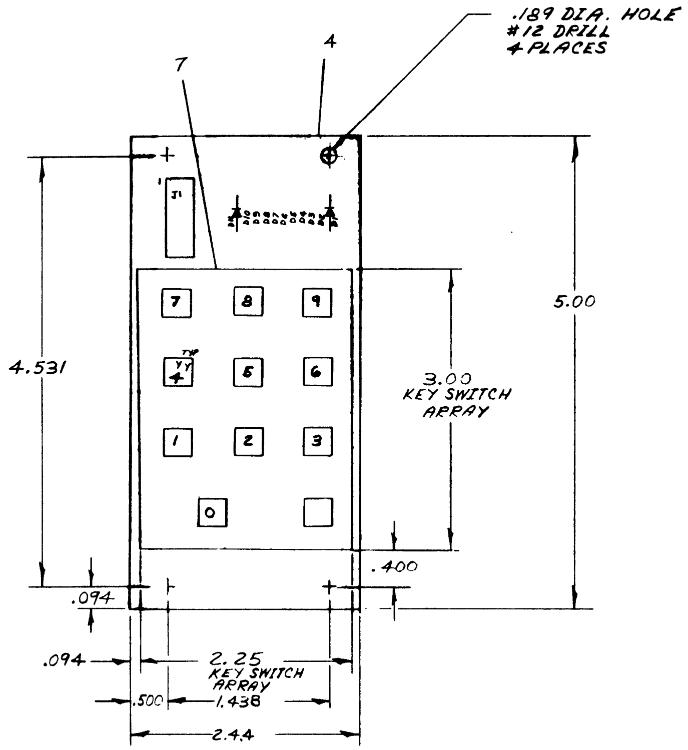
SIZE D CODE UA NUMBER LKØ3-Ø-Ø REV.

REVISIONS | CHANGE NO | REV | CHK

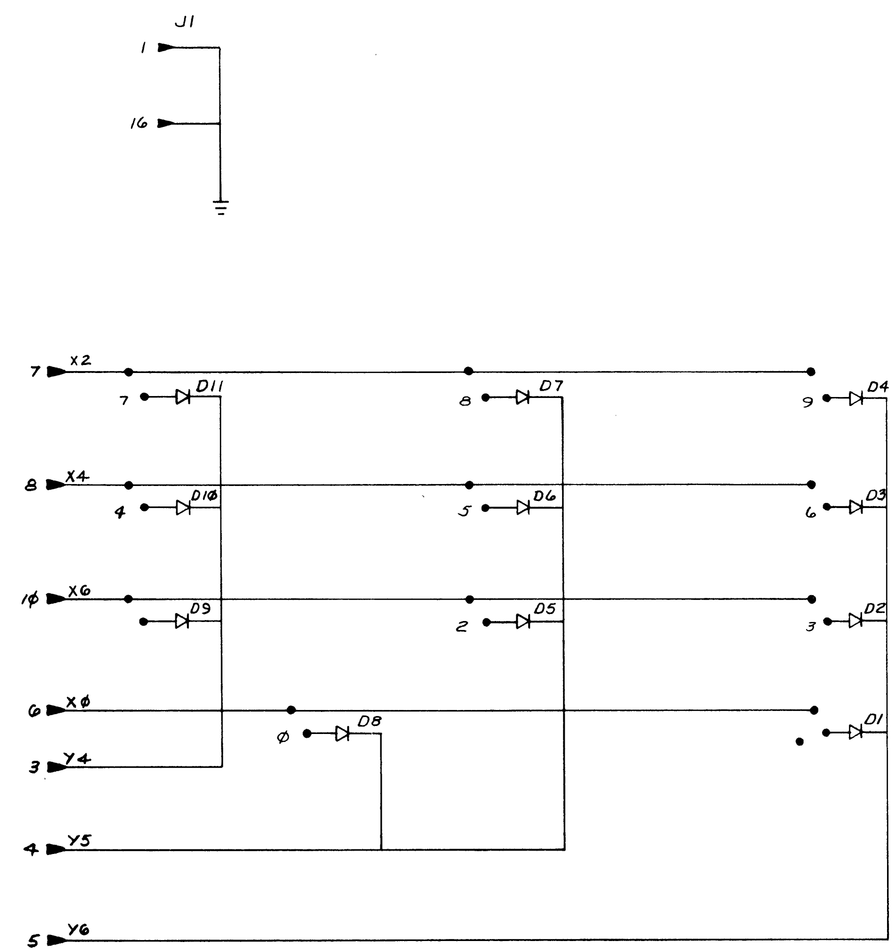
BRUNING 40-107 15968
DEC FORM NO DRD 100-A

NOTES:

1. ALL DIODES ARE D664.



DIMENSIONS FOR REFERENCE ONLY



QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
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
1		ETCHED CIRCUIT BOARD	5010818	4
11	D1 THRU D11	DIODES D664	1100114	5
1	J1	SOCKET (16 PINS)	1210025	6
1		11 KEYSWITCH ARRAY	D-AD-7009891-0-0	7

PARTS LIST

IC TYPE	GND	+ 5V

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

IC PIN LOCATIONS

FIRST USED ON OPTION MODEL: LA 36

ETCH BOARD REV: B

REV	CHANGE NO.	ORIGINATED	CHK
A	5410819-00001	P. E. NELSON 5-24-74	
B		8/6/74	

REVISIONS

DEC NO.	EIA NO.	DEC NO.	EIA NO.

SEMICONDUCTOR CONVERSION CHART

DRN: V. Dumouchelle — DATE 1-22-74
CHK'D — DATE 3-4-74
ENG: E. Nelson — DATE 2-4-74
PROJ. ENG.: E. Nelson — DATE 2-4-74
PROD. — DATE 2-5-74
NEXT HIGHER ASSY
SCALE
SHEET 1 OF 1

digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

TITLE: 11 KEYSWITCH ARRAY MODULE

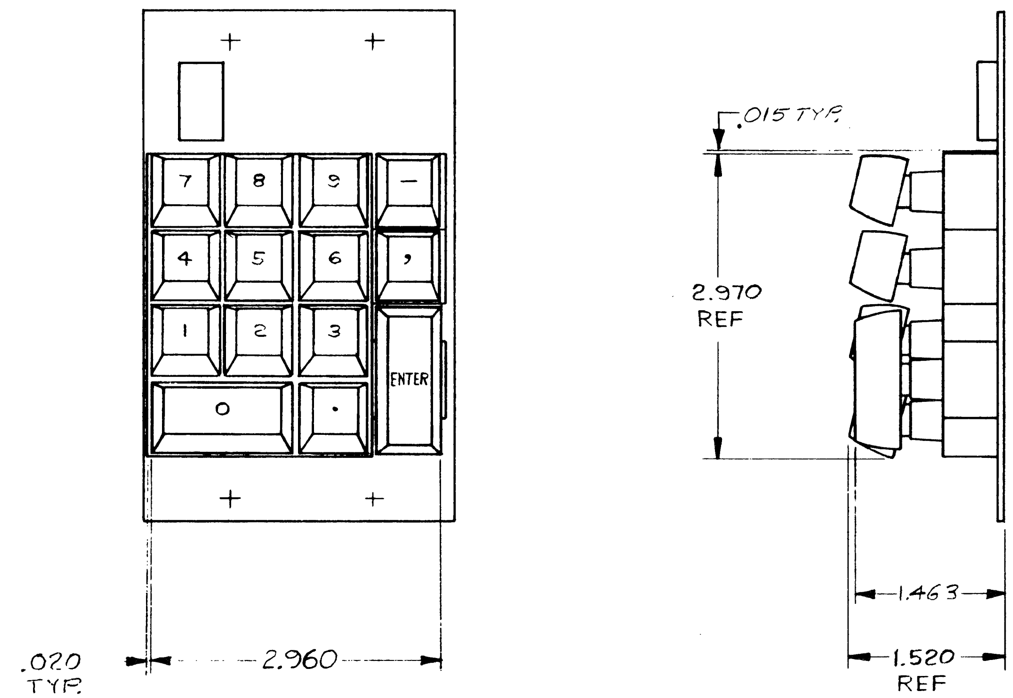
SIZE D CODE CS NUMBER 5410819-0-1 REV. B

DIST.

DEC FORM NO DRD 135-B

NOTES:

1. SOLVENT WELD ENTER KEY TO ITS KEY CAP ADAPTER WITH IPS "WELD ON" AT VENDOR'S OPTION. PLASTIC PIPE CEMENT NO 773 FOR ABS MANUFACTURED BY: INDUSTRIAL POLYCHEMICAL SERVICE BOX 471 GARDENA, CALIFORNIA 90247



ITEM NO.	QTY.	DESCRIPTION	PART NO.
4	REF	TEST SPEC	A-SP-LK02-Ø-2
3	REF	ENGINEERING SPEC	A-SP-LK02-Ø-1
2	1	KEYCAP SET	D-PS-1212287-74
1	1	14 KEYSWITCH ARRAY MOD.	D-CS-5411635-Ø-1

PARTS LIST

REVISIONS			
REV.	CHANGE NO.		CHK
A	LA36-00198	P. NELSON 31 MAR 76	P. E. Nelson

FIRST USED ON OPTION/MODEL: LK03-A

DIMENSIONAL TOLERANCE
DIMENSIONS ARE ~~MILLIMETERS~~ INCHES UNLESS OTHERWISE SPECIFIED

MILLIMETERS	INCHES	ANGLES
X,XX = ± 0,10	.XXX = ± .005	±0° 30'
X,X = ± 0,5	.XX = ± .02	
X = ± 2,	.X = ± .1	

THIRD ANGLE PROJECTION

REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY ✓

MATERIAL: SEE PARTS LIST

FINISH: —

		DATE
DRN.	B. Gilley	4-17-75
CHK'D		7/24/75
ENG.		7/24/75
PROD. ENG.	P. E. Nelson	7-28-75
PROD.		7/28/75

NEXT HIGHER ASSY.: E-AD-7009750-0-0

SCALE 1/1
SHEET 1 OF 1

digital

TITLE: 14 KEY KEYBOARD ASSY

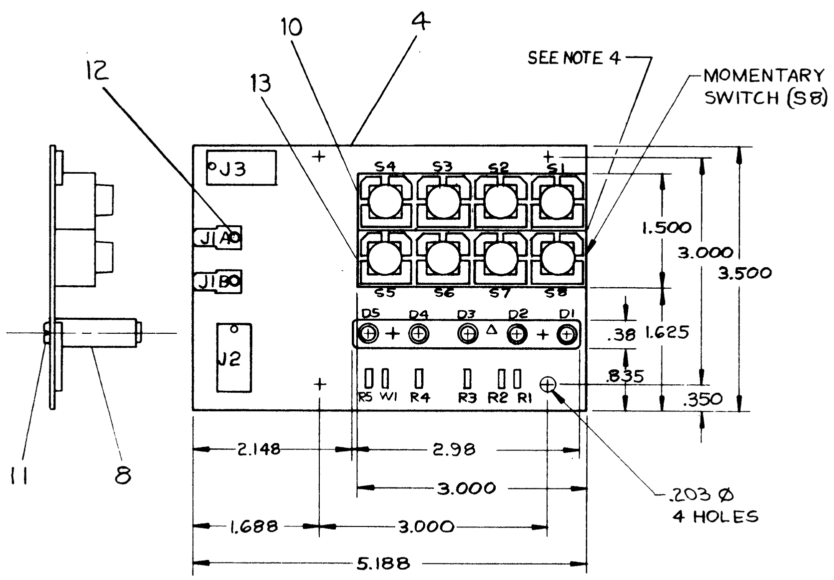
SIZE	CODE	NUMBER	REV.
C	UA	LK03-A-Ø	A

DIST.

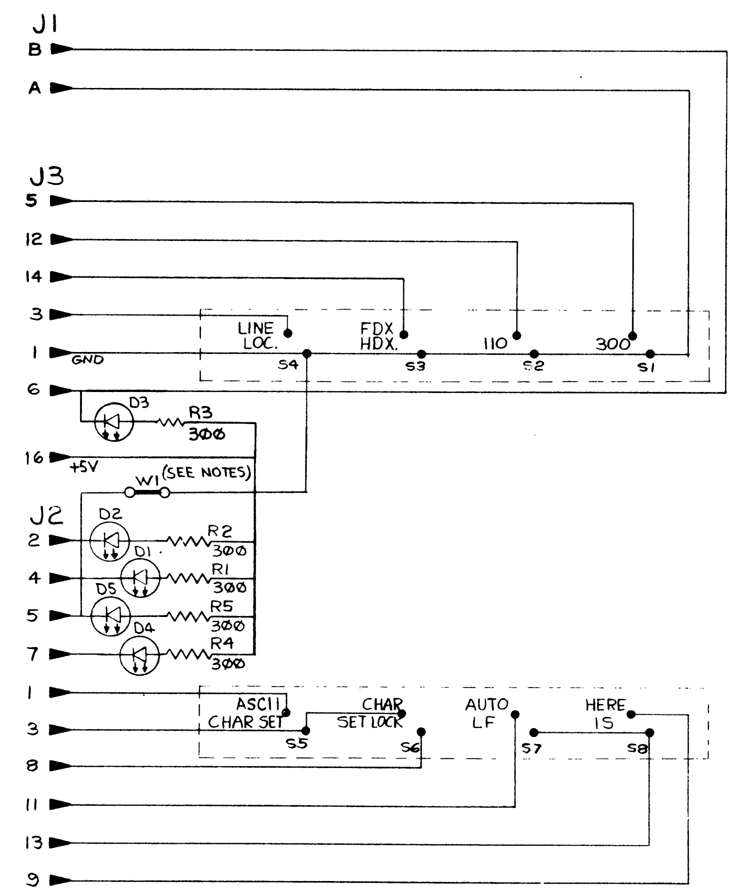
DEC FORM NO. DRC 100-8

NOTES:

1. WITH W1 INSERTED, LED D5 WILL ALWAYS BE ILLUMINATED
2. W1 MUST BE REMOVED WHEN INSTALLING ANY ALTERNATE PRINTING CHARACTOR SET (FOR EXAMPLE, APL OPTION LAXX-PK)
3. THERE IS NO PROVISION FOR W1 ON ETCH REV A.
4. APPLY ITEM 15 BETWEEN ITEMS 10 & 13



ALL DIMS ARE REF ONLY



QTY	REF. DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
REF		X-Y COORDINATE HOLE LOCATION	K-CO-5411727-0-4	1
REF		ASSY/DRILLING HOLE LAYOUT	D-AH-5411727-0-5	2
REF		MODULE ECO HISTORY	B-MH-5411727-0-6	3
1		ETCHED CIRCUIT BOARD	5011726	4
5	R1-R5	RESISTOR 300 1/4W 5%	1301425-00	5
2	J2, J3	SOCKET, I.C. 16 PIN	1211813-00	6
5	D1-D5	DIODE, L.E.D.	1110864-00	7
1		L.E.D. HOLDER	C-MD-7414073-00	8
2	J1A, J1B	FASTON TAB	9007112-00	9
1	S1-S4	KEYSWITCH, 4 LOCKING	C-AD-7011188-0-0	10
2		SCR, PPH THD CUT #4-40×5/16LG	9009236-1	11
2		EYELET	9009000-00	12
1	S5-S8	KEYSWITCH, 3 LOCKING	C-AD-7011526-00	13
1	W1	WIRE, INSULATED JUMPER (4 LG)	9009185-00	14
A/R		CEMENT, PERMA BOND	9009157	15

PARTS LIST

IC TYPE	GND	+5V

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

IC PIN LOCATIONS

FIRST USED ON OPTION MODEL: LA36

ETCH BOARD REV. C

REV.	CHANGE NO.	CHK	
C	5411727-00001	672	P. NELSON 11-10-75

REVISIONS

DEC NO.	EIA NO.	DEC NO.	EIA NO.

SEMICONDUCTOR CONVERSION CHART

		DATE
DRN.	D. Dilley	5-6-75
CHK'D.		7/18/75
ENG.		7/18/75
PROJ. ENG.	Paul E. McLam	7-18-75
PROD.		

NEXT HIGHER ASSY: C-AD-7011525-0-0

SCALE 1/1 SHEET 1 OF 1

digital

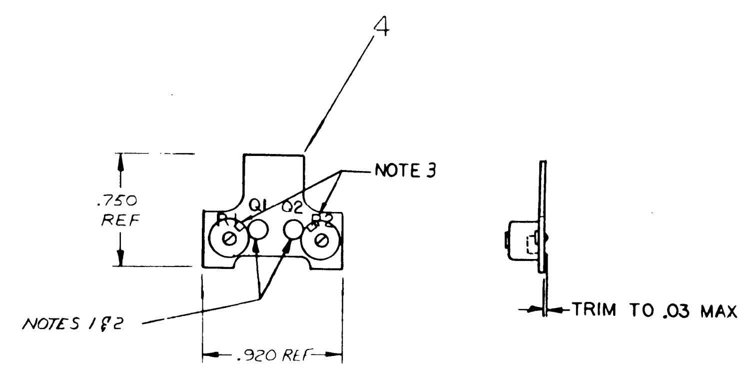
TITLE: FRONT PANEL CONTROL, ASSY

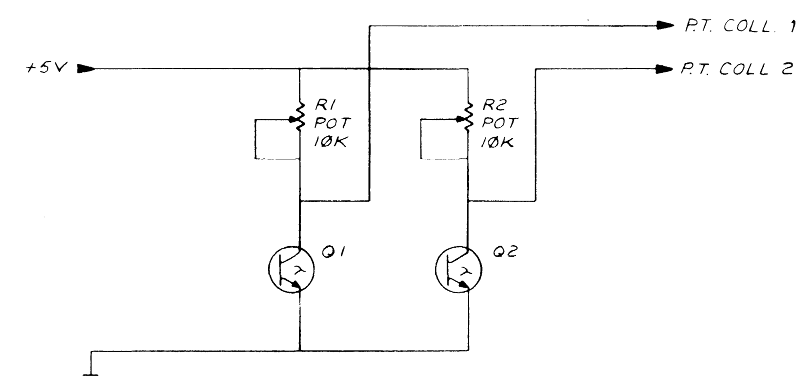
SIZE: D CODE: CS NUMBER: 5411727-0-1 REV. C

DIST.

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.





QTY	REF DESIGNATION	DESCRIPTION	PART NO.	ITEM NO.
REF		X-Y COORDINATE HOLE LOCATION	K-CO-5411049-0-4	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	D-IA-5010990-0-0	4
2	R1, R2	POTENTIOMETER 10K	1309150-12	5
2	Q1, Q2	PHOTOTRANSISTOR	1511906	6

PARTS LIST

ETCH BOARD REV C

REV	CHANGE NO.	CHK
D	5411049-C0C03	J BITTO
C	5411049-00002	J. BITTO
B	5411049-00001	C. BICKOFF

REVISIONS

DEC NO.	EIA NO.	DEC NO.	EIA NO.

SEMICONDUCTOR CONVERSION CHART

DRN. DATE 5/2/74
CHK'D. DATE
ENG. DATE 7-12-74
PROJ. ENG. DATE 7-12-74
PROD. DATE 1-15-74
NEXT HIGHER ASSY
SCALE
SHEET 1 OF 1

digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

TITLE LA36 ENCODER PC BOARD PHOTOTRANSISTOR

SIZE D CODE CS NUMBER 5411049-0-1 REV. D

DIST.

DEC FORM NO DRD-135

APPENDIX B
ILLUSTRATED PARTS BREAKDOWN

This chapter contains the LA36/35 IPB in its entirety. The page numbering and organization of the IPB have not been altered for this manual. Additional IPBs can be purchased using the number appearing in the upper right-hand corner of the following page.

To order send requests to:

Communications Services
Publications Stockroom
Digital Equipment Corporation
444 Whitney Street
Northborough, Massachusetts 01532

EK-LA36-IP-004

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.

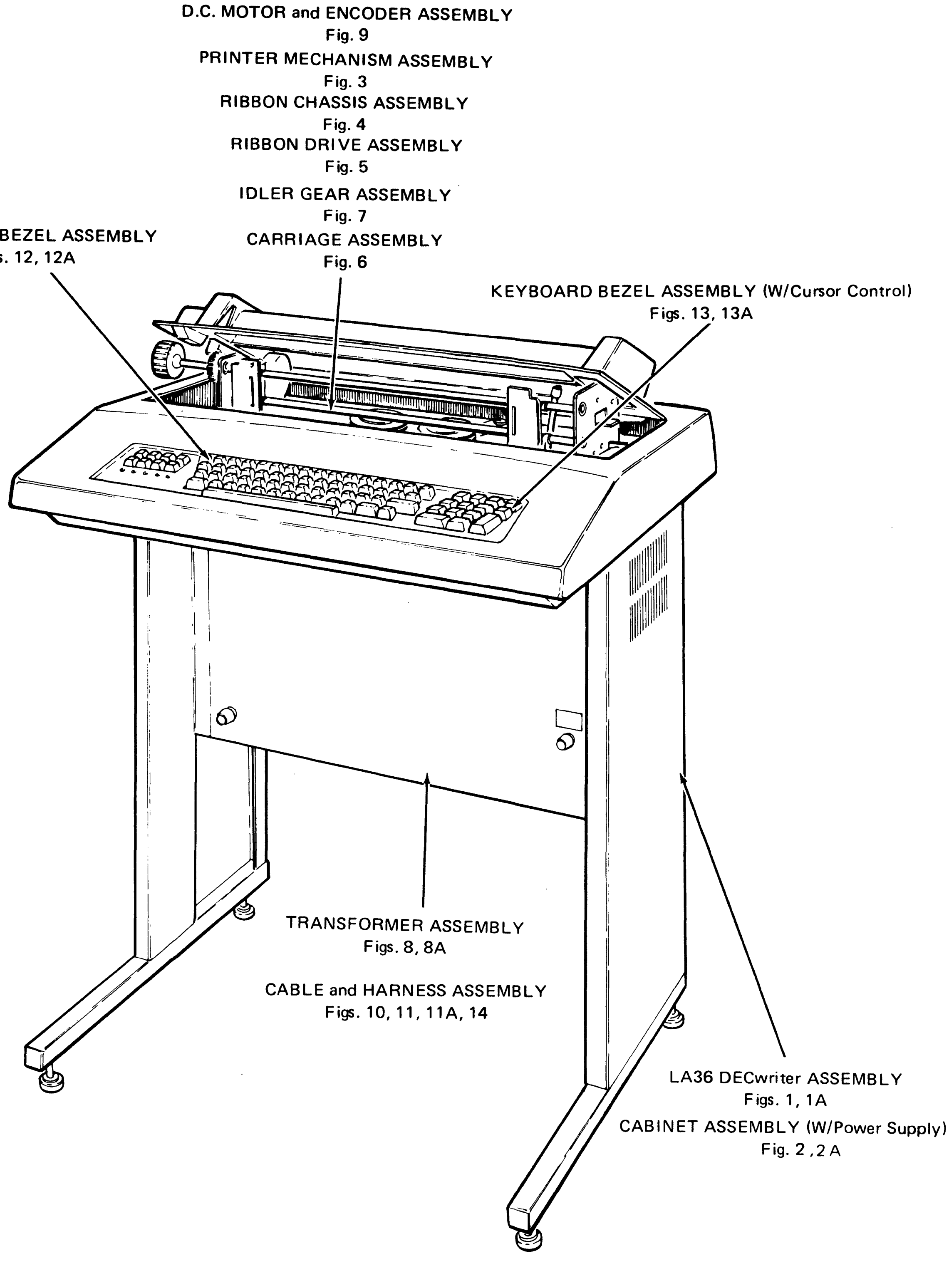
(NFR) Not Field Repairable — The (NFR) symbol is inserted after any assembly that is not to be field dismantled.

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

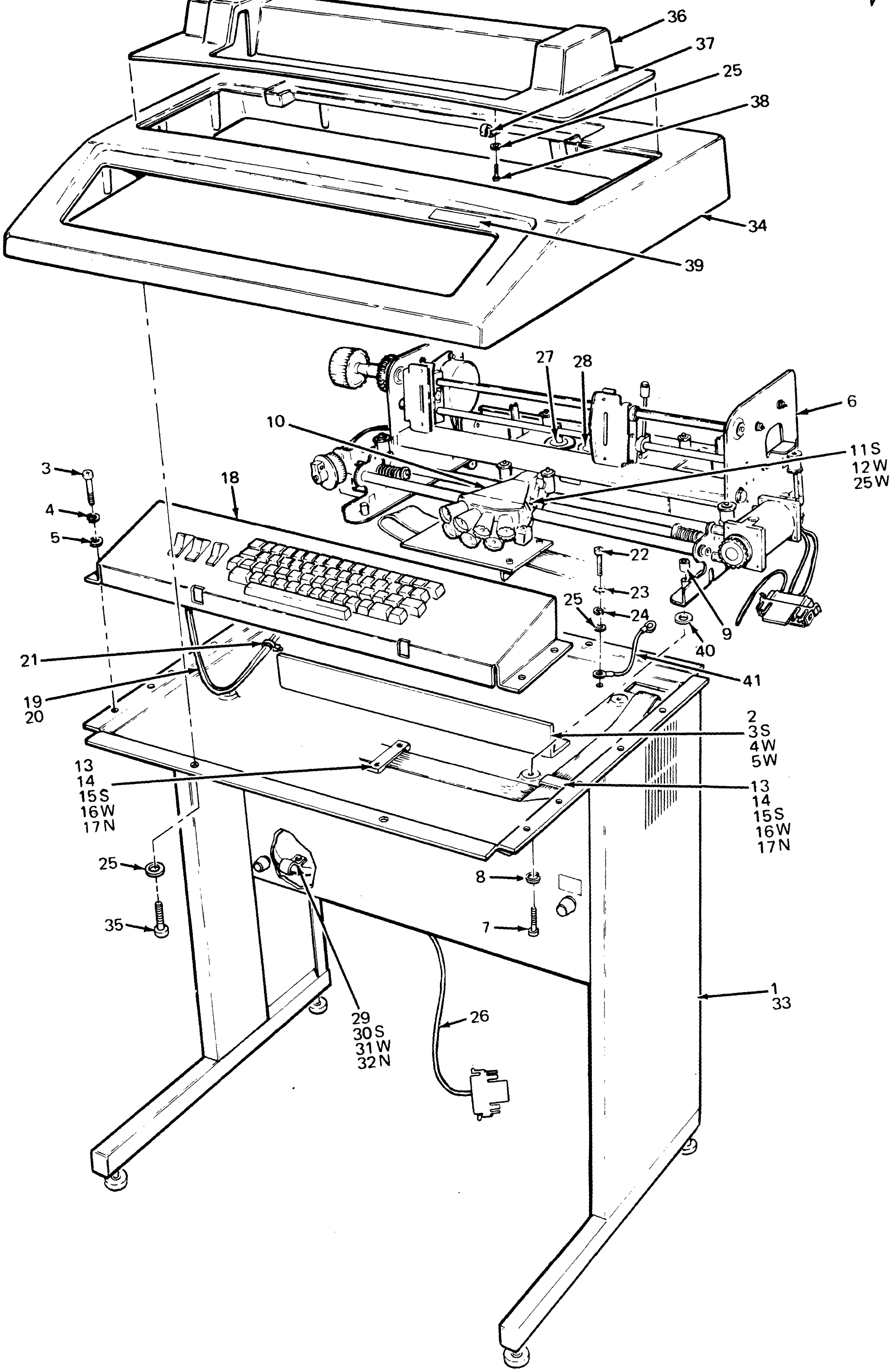
REVISION HISTORY

PRINTING	ECO LEVEL		DATE	PAGES AFFECTED
3rd Printing	LA36	00001-00184	2-18-76	This 3rd Printing EK-LA36-IP-003
"	70-096994	00000–00000		SUPERSEDES 2nd Printing EK-LA36-IP-002
4th Printing	LA36	00001-00251	9-23-76	This 4th Printing EK-LA36-IP-004
	70-09694	00000-00000		SUPERSEDES 3rd Printing EK-LA36-IP-003

Printed in U.S.A.



Major Assembly Locator, LA36 DECwriter II



LA36-02

Figure 1. LA36 DECwriter Assembly

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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, Phl 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, Phl 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, Phl 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, Phl 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, Phl 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 CODE	VENDOR PART NO.	REF FIG 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, Phl 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, Phl 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, Phl 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				
	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					

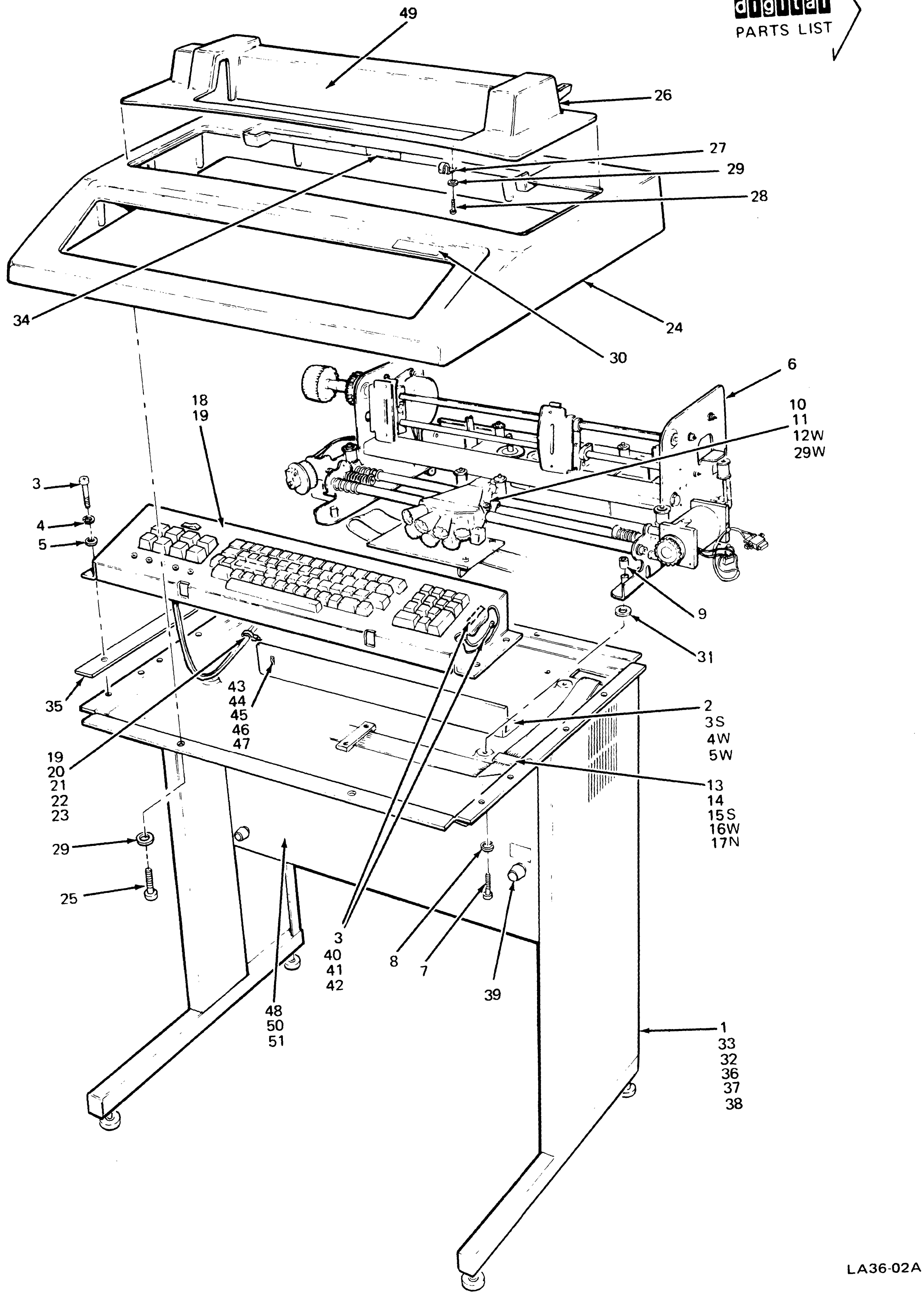


Figure 1A. LA36 DECwriter Assembly

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00165	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
1A–	MODEL LA36 DECwriter II						
	Code J – Used on Model LA36-CE (Numeric Pad, Paper Out, 60 Hz 90-132V)	LA36-CE		J			
	Code K – Used on Model LA36-CF (Numeric Pad, Paper Out, 60 Hz 180-264V)	LA36-CF		K			
	Code L – Used on Model LA36-CH (Numeric Pad, Paper Out, 50 Hz 90-132V)	LA36-CH		L			
	Code M – Used on Model LA36-CJ (Numeric Pad, Paper Out, 50 Hz 180-264V)	LA36-CJ		M			
	Code N – Used on Model LA36-DE (60 Hz, 90-132V)	LA36-DE		N			
	Code P – Used on Model LA36-DF (60 Hz, 180-264V)	LA36-DF		P			
	Code Q – Used on Model LA36-DH (50 Hz, 90-132V)	LA36-DH		Q			
	Code R – Used on Model LA36-DJ (50 Hz, 180-264V)	LA36-DJ		R			
	Code S – Used on Model LA36-AE (added) (60 Hz, 90-132V, BELL CANADA)	LA36-AE	00247	S			
1	*CABINET ASSEMBLY W/POWER SUPPLY (115V, 60 Hz)	70-09648-01		J, N			2A
	*CABINET ASSEMBLY W/POWER SUPPLY (230 V, 50 Hz)	70-09648-02		M, R			2A
	*CABINET ASSEMBLY W/POWER SUPPLY (115V, 50Hz)	70-09648-03		L, Q			2A
	*CABINET ASSEMBLY W/POWER SUPPLY (230V, 60 Hz)	70-09648-04		K, P			2A
	*CABINET ASSEMBLY W/POWER SUPPLY (115V, 60 Hz) (added)	70-09648-05	00247	S			2A
2	*Guide, Paper	74-12158-00					
3	*Screw, Phl 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		J-R			3
	*PRINTER MECHANISM ASSEMBLY (added)	70-09696-01	00247	S			3
7	*Screw, Phl Pan Hd No. 10-32 x .94	90-08955-01					
8	*Washer, Split Lock No. 10	90-07906-00					
9	*Nut, Wall No. 10-32	90-08896-00					
10	*PRINT HEAD ASSEMBLY (NFR)	70-09883-00					
11	*Screw, Phl Pan Hd No. 6-32 x .56	90-07793-01					
12	*Washer, Internal Tooth Lock No. 6	90-06633-00					
13	*Clamp, Cable	12-02704-00					
14	*Tape, Double Coated .50 wide	90-07834-00					
15	*Screw, Phl 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		NPQR			12A
	*KEYBOARD BEZEL ASSEMBLY (added)	70-09750-03	00247	S			12A
	*KEYBOARD BEZEL ASSEMBLY W/CURSOR CONTROL	70-09750-02		JKLM			13A
19	*KEYBOARD CABLE ASSEMBLY	70-11519-00	See Note 1				11A
20	*Jumper (deleted)	70-10001-11	00241				

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00165	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
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		J-R			
	*Housing (added)	74-11116-01	00247	S			
25	*Screw, Phl Pan Hd No. 6-18 x .50 Self Tapping	90-09630-01					
26	*Cover	74-11122-00		J-R			
	*Cover (added)	74-11122-01	00247	S			
27	*Clip, Cover	74-11818-00					
28	*Screw, Phl 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		J-R			
	*Nameplate, LAS36 (added)	36-13249-00	00247	S			
31	*Washer, Buna (deleted)	90-09684-00	00172				
32	*Jumper	70-10001-07					
33	*Jumper	70-10001-06					
34	*Decal, CAUTION/WARNING (deleted)	36-12483-00					
	*Decal, LA36 (added)	74-15561-00	00204				
35	*Spacer, Bezel	74-13675-00					
36	*Tubing, Heat Shrinkable	91-07253-09					
37	*Tie Wrap, Screw Down	90-07033-00					
38	*Clip, Harness	90-08340-00					
39	*Fuse Holder (deleted)	12-11638-00	00241				
40	*Washer, Ext. Tooth Lock No. 8	90-08072-00					
41	*Nut, Kep No. 8-32	90-06563-00					
42	*Decal, Ground Symbol	36-12680-00					
43	*Cable, Paper Out (deleted)	70-11657-00	See Note 2	J-M			
	*Jumper, Paper Out (added)	70-10001-14	00219	J-M			
44	*Tab, Adapter (added)	90-09797-00	00219	J-M			
45	*Switch, Rework	74-12424-00	See Note 2	J-M			
46	*Screw, Ph Pan Hd No. 4-40 x 9/16	90-08033-01	See Note 2	J-M			
47	*Nut, Kep No. 4-40	90-06557-00	See Note 2	J-M			
48	*Jumper (added)	70-10001-13	00219	J, K			
49	*Print Window (added)	12-12009-00	00206	J-M, Q-S			
50	*Mount, Cable Tie, Adhesive Backed (added)	90-08264-00	00179				
51	*Cable Tie (added)	90-07880-00	00179				
	ACCESSORIES						
	†Paper, Package of 100 Sheets	74-12103-00					
	†Ribbon Spool, W/Ribbon	36-10966-00					
	†Ribbon Spool, Empty	36-10558-00					
	LABELS/DECALS (Not Shown)						
	†Serial No. Tag (added)	36-13210-00	00241				
	†CSA Decal (added)	36-13211-00	00241				
	†Label, LA36	36-12391-00					
	†Label, Adhesive Back (RF1 Supression) (added)	36-13088-00	00248	M, R			
	Note 1: This Assembly no longer installed at this level. (Per ECO LA36-00205). See Figure 12 A.						
	Note 2: Items 43, 45, 46, 47 formally installed under Cabinet Assembly Figure 2. (Per ECO LA36-00190)						

digital PARTS LIST

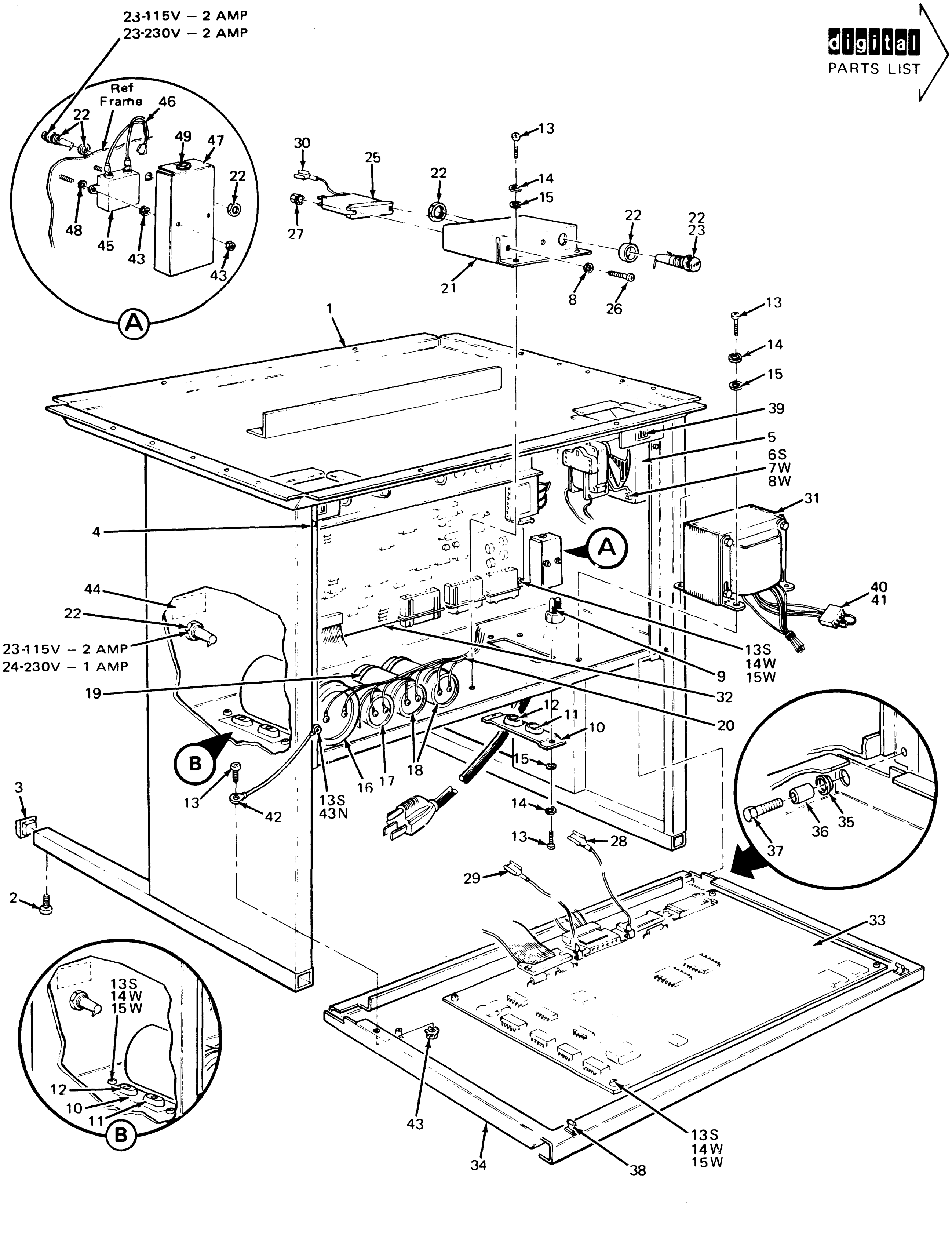


Figure 2. Cabinet Assembly (w/Power Supply)

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
2–	CABINET ASSEMBLY W/POWER SUPPLY (115V)	70-09648-01		ACEG			1
	CABINET ASSEMBLY W/POWER SUPPLY (230V)	70-09648-02		BDFH			1
1	*Frame Assembly	70-09649-00					
2	*Foot, Leveling (deleted)	90-07601-00					
	*Foot, Leveling (added)	90-09685-00	00059				
3	*Closure, Tubing (deleted)	12-11067-00					
	*Closure, Tubing (added)	12-11067-02	00059				
4	*Bumper, Rubber	90-09567-00					
5	*Fan, 115V (115 CFM) Rotron or IMC	12-09403-01					
	*Fan 115V (100 CFM) Torin (added)	12-11993-00	00055				
6	*Screw, Phl Pan Hd No. 8-32 x 1.75 (For Rotron or IMC Fan)	90-06046-01					
	*Screw Phl Pan Hd No. 8-32 x .25 (added) (For Torin Fan)	90-06035-01	00055				
7	*Washer, Lock Split No. 8 (For all fans)	90-06690-00					
8	*Washer, Flat No. 8 (For all fans)	90-06660-00					
9	*POWER CORD ASSEMBLY (115V)	70-09673-00		ACEG			
	*POWER CORD ASSEMBLY (230V)	70-09673-01		BDFH			
10	*Plate, Cover	74-11607-00					
11	*Strain Relief	90-08509-00					
12	*Strain Relief	90-09572-00					
13	*Screw, Phl Pan Hd No. 8-32 x .38	90-06037-01					
14	*Washer, Lock Split No. 8	90-06690-00					
15	*Washer, Flat No. 8	90-06660-00					
16	*Capacitor (C1) 33,000 MFD	10-11545-00					
17	*Capacitor (C2) 18,000 MFD	10-11643-00					
18	*Capacitor (C3,C4) 14,000 MFD	10-10187-00					
19	*Tie Wrap	90-09350-00					
20	*HARNESS ASSEMBLY, Capacitor	70-09895-00					10
21	*Bracket, Fuse Mounting (deleted)	74-11925-00	00052				
22	*Holder, Fuse	12-11638-00					
23	*Fuse, Slo-Blo 2 amp	90-07216-00		ABCDEFGH			
24	*Fuse, Slo-Blo 1 amp	90-07212-00		BDFH			
25	*Capacitor (C5) .1 MFD 1000V (deleted)	10-00034-00	00052				
26	*Screw, Phl Pan Hd No. 6-32 x .38 (deleted)	90-06022-01	00052				
27	*Nut, Kep No. 6-32 (deleted)	90-06560-00	00052				
28	*Jumper	70-10001-01					
29	*Jumper	70-10001-02					
30	*Jumper	70-10001-03					
31	*TRANSFORMER ASSEMBLY	70-09779-00					8
32	*POWER BOARD ASSEMBLY (LA36)	54-10805-00					
33	*LOGIC BOARD ASSEMBLY	M7722					
34	*Door, Cabinet	74-11120-00					
35	*Bushing, Snap-in Nylon	90-09561-00					
36	*Bushing, Nylon	90-09565-01					
37	*Screw, Hex Cap Hd No. 3/8-16 x 1.0	90-08922-09					
38	*Catch, Door Strike	90-09571-00					
39	*Catch, Door Latch	90-09571-01					
40	*Jumper (115V)	70-09905-01		ACEG			
41	*Jumper (230V)	70-09905-02		BDFH			
42	*Strap, Ground (added)	90-06990-00	00021				
43	*Nut, Kep. No. 8-32 (added)	90-06563-00	00021				
44	*Decal, Fuse (added)	74-13384-00	00052				
45	*Filter, EMI (added)	12-12003-00	00052				
46	*Jumper (added)	70-10001-04	00052				
47	*Cover, EMI Filter (added)	74-13286-00	00052				
48	*Washer, Lock Ext Tooth No. 8 (added)	90-08072-00	00052				
49	*Grommet, Rubber (added)	90-07013-00	00052				

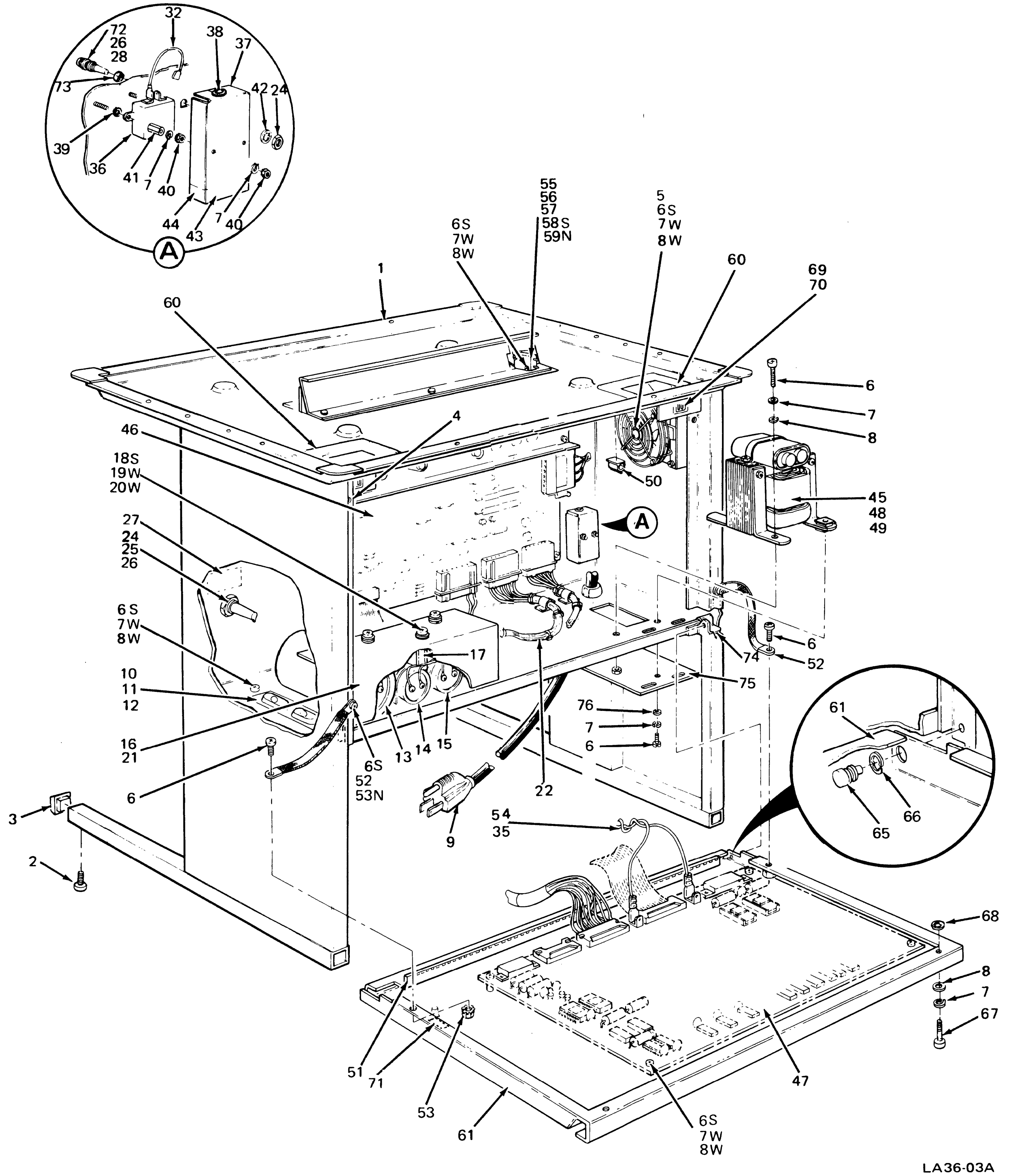


Figure 2A Cabinet Assembly W/Power Supply

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00118	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
2A–	CABINET ASSEMBLY W/POWER SUPPLY 115V (deleted)	70-09648-01		ACEG			I
	CABINET ASSEMBLY W/POWER SUPPLY 115V 60Hz (added)	70-09648-01	00138	JN			1A
	CABINET ASSEMBLY W/POWER SUPPLY 230V (deleted)	70-09648-02		BDFH			1
	CABINET ASSEMBLY W/POWER SUPPLY 230V 50 Hz (added)	70-09648-02	00138	MR			1A
	CABINET ASSEMBLY W/POWER SUPPLY 115V 50 Hz (added)	70-09648-03	00138	LQ			1A
	CABINET ASSEMBLY W/POWER SUPPLY 230V 60 Hz (added)	70-09648-04	00138	KP			1A
	CABINET ASSEMBLY W/POWER SUPPLY 115V 60 Hz (added)	70-09648-05	00247	S			1A
1	*Frame Assembly	70-09649-00					
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, Phl Pan Hd No. 8-32 x 1.75 (For Rotron) (deleted)	90-06046-01	00142				
	*Screw, Phl 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	00138	JNLQS			
	*POWER CORD ASSEMBLY (230V) (deleted)	70-09673-01		BDFH			
	*POWER CORD ASSEMBLY (230V) (added)	70-11045-00	00138	MRKP			
10	*Plate, Cover	74-11607-00					
11	*Strain Relief (deleted)	90-08509-00					
	*Strain Relief (added)	90-09678-00	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, Aluminum No. 10-32 x 3/8 x 3.00 (added)	90-06881-00	00164				
18	*Screw, Phl 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					10
23	*Bracket, Fuse Mounting (deleted)	74-11925-00	00052				
24	*Fuse Holder	12-11638-00					
25	*Fuse, Slo-Blo 2 amp	90-07216-00					
26	*Fuse, Slo-Blo 1 amp (deleted)	90-07212-00					
	*Fuse, Slo-Blo, 1.5 amp (added)	90-09740-00	00138	MRKP			
27	*Decal, Fuse, LA36	74-13384-00					
28	*Fuse, Slo-Blo 3 amp	90-07218-00		JNLQS			
29	*Capacitor, .1 MFD, 1000V (deleted)	10-00034-00	00052				
30	*Screw, Phl Pan Hd No. 6-32 x .38 (deleted)	90-06022-01	00052				
31	*Nut, Kep No. 6-32 (deleted)	90-06560-00	00052				

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00118	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
32	*Jumper, (deleted)	70-10001-04					
	*Jumper, (added)	70-10001-08	00139				
33	*Jumper, (deleted)	70-10001-02	00139				
34	*Jumper, (added)	70-10001-12	00177				
35	*Jumper, (added)	70-10001-11	00161				
36	*Filter, EMI (added)	12-12003-00	00052				
	*Filter, EMI (deleted)	12-12003-00					
	*Filter, EMI (added)	12-12877-00	00218				
37	*Cover, EMI Filter (added)	74-13286-00	00052				
38	*Grommet, Rubber (added)	90-07013-00	00052				
39	*Washer, External 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				
	*Spacer, No. 8 x .75 (deleted)	90-07868-00					
	*Spacer, No. 8 x 1.00 (added)	90-09285-00	00225				
42	*Washer, Internal 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	JNKPS			8A
	*TRANSFORMER ASSEMBLY 50 Hz (added)	70-09779-02	00138	MRLQ			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	J-R			
	*Logic Board Assembly (added)	M7728-YA	00247	S			
48	*Jumper, 110V	70-09905-01		JNLQS			
49	*Jumper, 220V	70-09905-02		MRKP			
50	*Clip, Harness (added)	90-08340-00	00162				
51	*Grommet (added)	90-07018-00	00162				
52	*Ground Strap (added)	90-06990-00	00162				
53	*Nut, Kep No. 8-32 (added)	90-06563-00	00162				
54	*Tubing, Heat Shrinkable (added)	91-07253-09	00161				
55	*Cable, Paper Out	70-11657-00	See Note				
56	*Switch, Rework	74-12424-00	See Note				
57	*Paper Guide	74-12158-00	See Note				
58	*Screw, Phl Pan Hd No. 4-40 x 9/16	90-08033-01	See Note				
59	*Nut, Kep No. 4-40	90-06557-00	See Note				
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)	90-09565-00	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				

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00118	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
73	*Spacer, Fuse Holder (added)	74-15374-00	00177				
74	*Clip Enclosure (added)	74-17011-00	00244				
75	*Cover, Transformer Opening (added)	74-17012-00	00244				
76	*Washer, Flat (added)	90-07983-00	00244				
	†Label, Fuse Rating (Not Shown)	74-12548-00					
	Note: Items 55, 56, 57, 58, 59 no longer installed at this Assembly Level. (See Figure 1A. Per ECO LA36-00190.)						

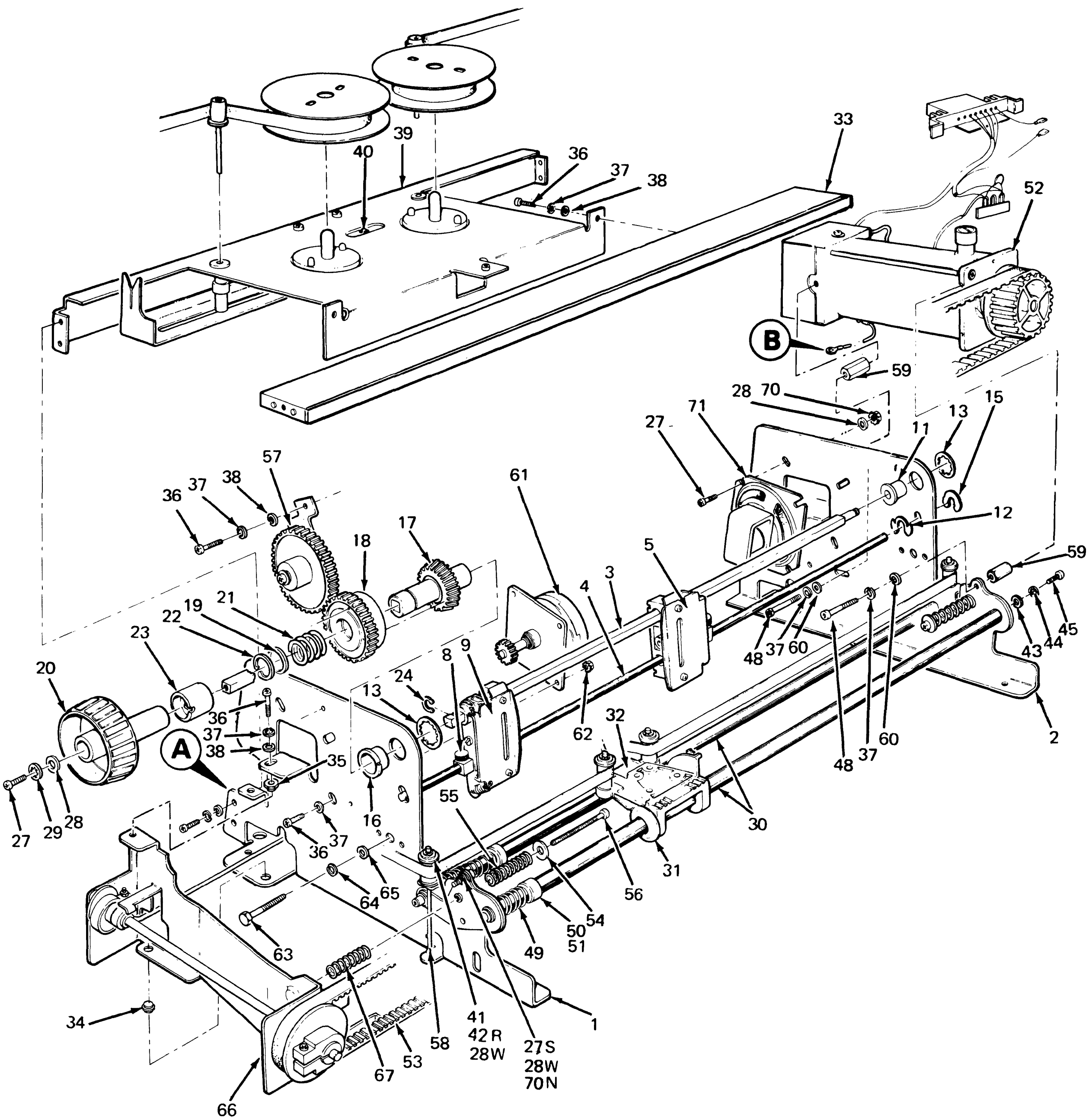


Figure 3 Printer Mechanism Assembly (Sheet 1 of 2)

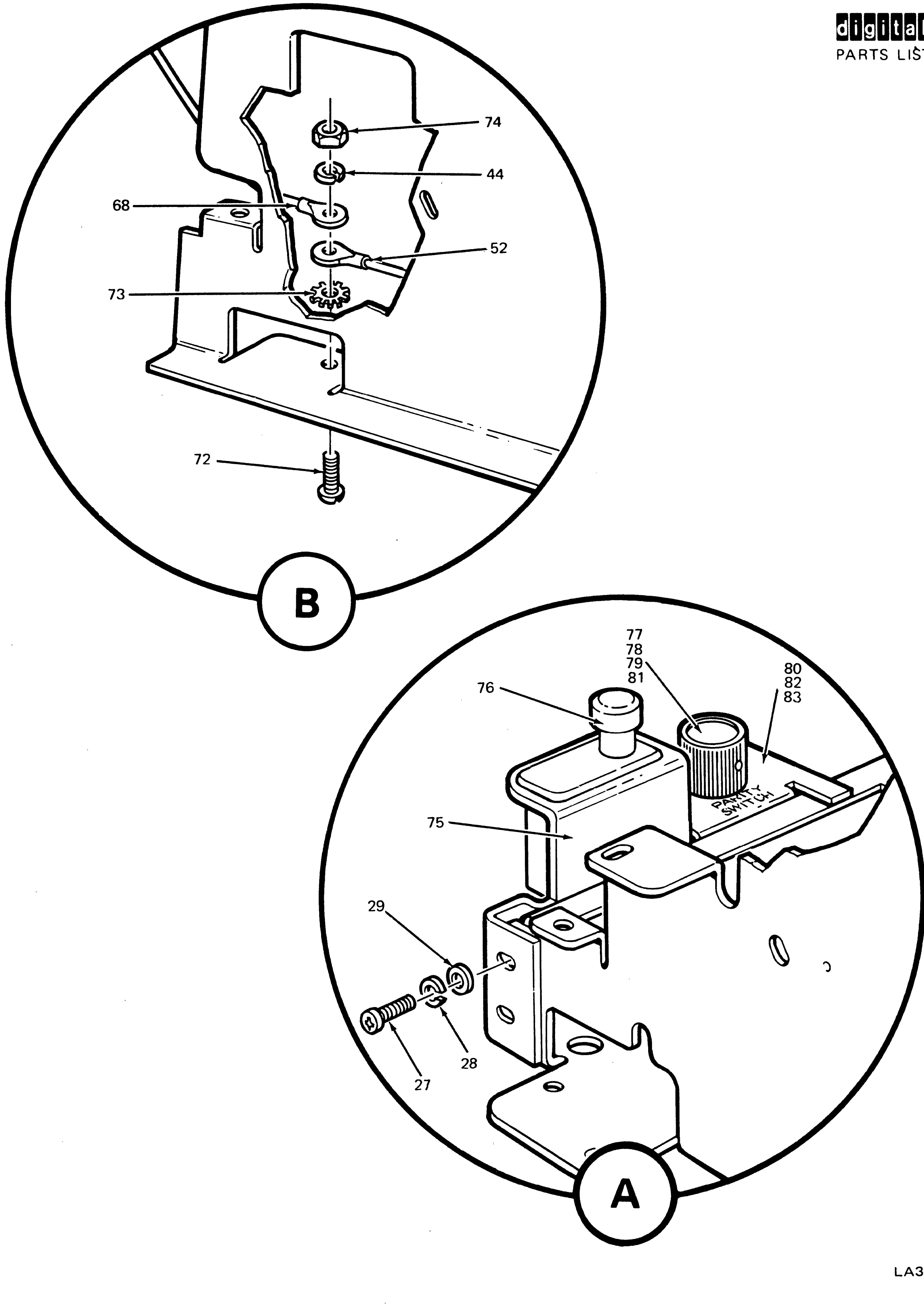


Figure 3 Printer Mechanism Assembly (Sheet 2 of 2)

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
3–	PRINTER MECHANISM ASSEMBLY	70-09696-00		A – R			1, 1A
	PRINTER MECHANISM ASSEMBLY (added)	70-09696-01	00247	S			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, Phl 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 (deleted)	70-10683-00					
	*Print Bar (added)	74-11072-00	00188				
34	*Pivot, Lower	74-11439-00					
35	*Ratchet, Pivot	74-11103-00					
36	*Screw, Phl 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	USED ON CODE	VENDOR CODE	VENDOR 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, Phl 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 .62	90-06242-09	00226				
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					
72	*Screw, Phl Truss Hd No. 10-32 x .50 (added)	90-06073-03	00189				
73	*Washer, External Lock No. 10 (added)	90-07651-00	00189				
74	*Nut, Hex No. 10 (added)	90-06564-00	00189				
75	*Bracket, Cover Interlock (added)	74-15802-00	00220				
76	*Switch, Interlock (added)	12-12255-01	00220				
77	*ROTARY SWITCH ASSEMBLY (added)	70-12781-00	00251	S			
78	**Rotary Switch (added)	12-13187-00	00251	S			
79	**Terminal, Quick Disconnect (added)	90-07655-01	00251	S			
80	*Decal, Parity (added)	74-16535-00	00251	S			
81	*Knob, Black (added)	12-10114-00	00251	S			
82	*Clamp, Cable 1/4 (added)	90-07081-00	00251	S			
83	*Screw, Phl Pan Hd No. 6-32 x .50 (added)	90-06024-00	00251	S			

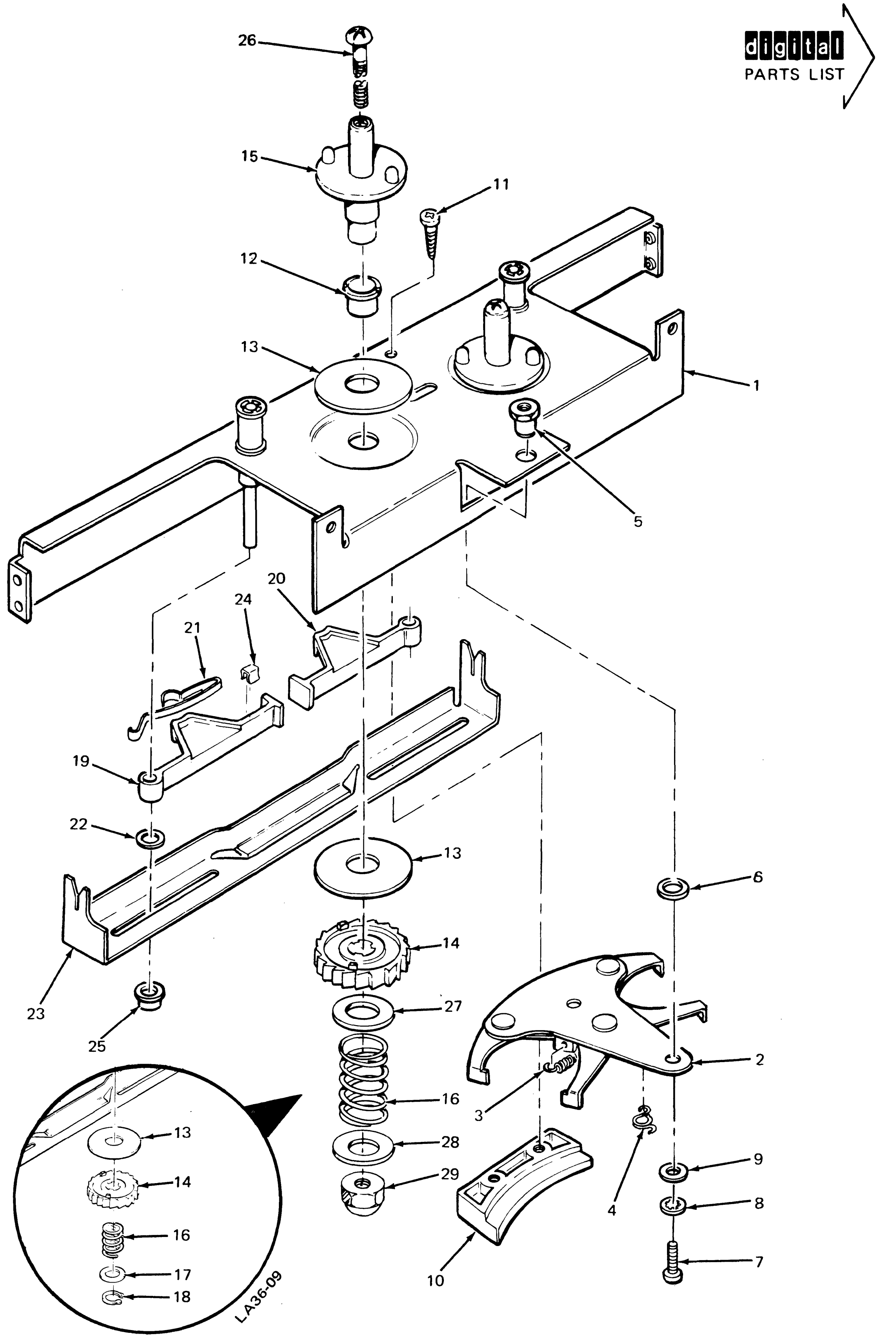


Figure 4. Ribbon Chassis Assembly

FIG & ITEM NO.	DESCRIPTION	M DEC PART NO.	ECO CUT-IN 70-09689 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
4–	RIBBON CHASSIS ASSEMBLY	70-09689-01	LA36 00213				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, Phl 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, Phl 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					
	*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					
	*Washer, Flat No. 6 (deleted)	90-06634-00	LA36 00186				
	*Washer, Flat No. 6 (added)	90-06707-00					
23	*Sensor, Reverse	74-11060-00					
24	*"U" Clip (added)	90-09748-00	LA36 00143				
25	*Cap, Standoff Spool	74-12976-00					
26	*Screw, Phl 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	F DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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					
	*Pulley, Timing (added)	12-12446-00	00155				
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					

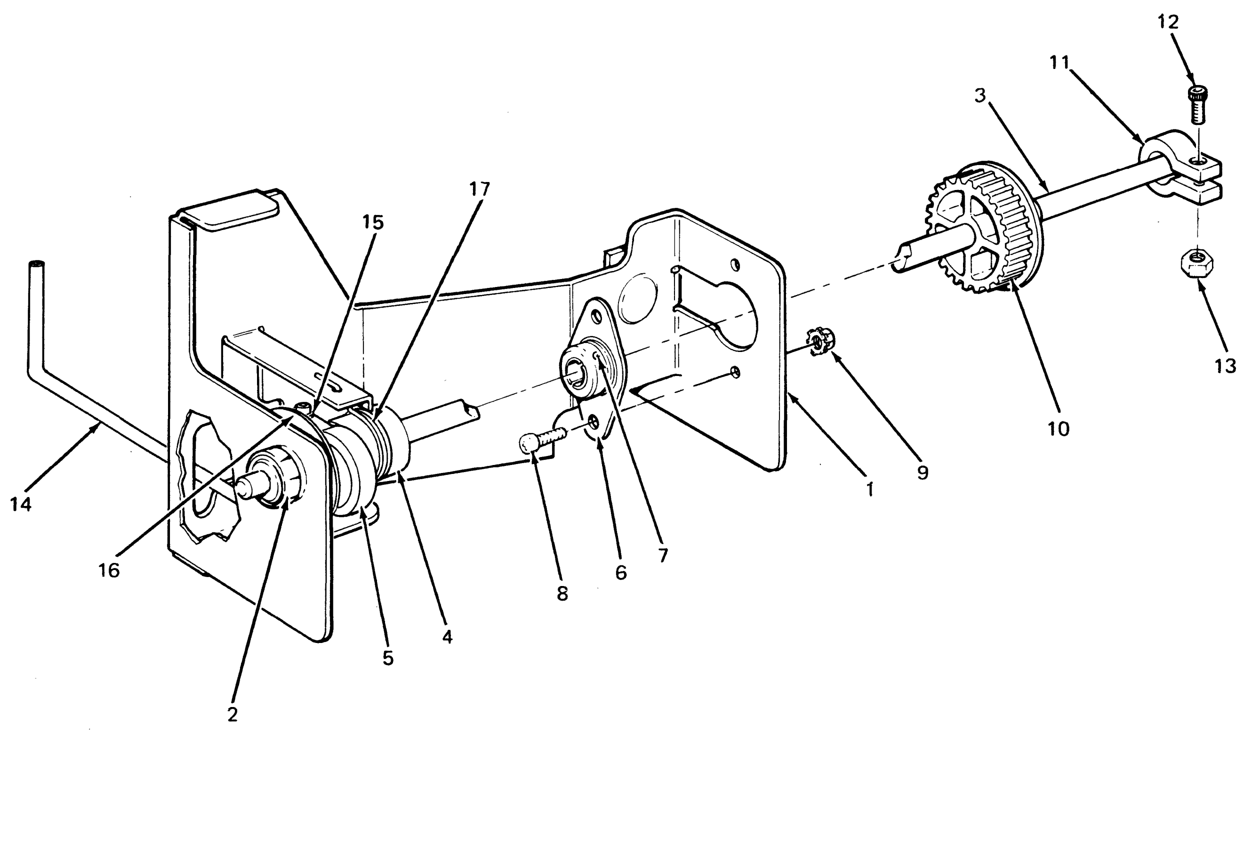


Figure 5. Ribbon Drive Assembly

FIG & ITEM NO.	DESCRIPTION	B DEC PART NO.	ECO CUT-IN 70-09692 00000	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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					

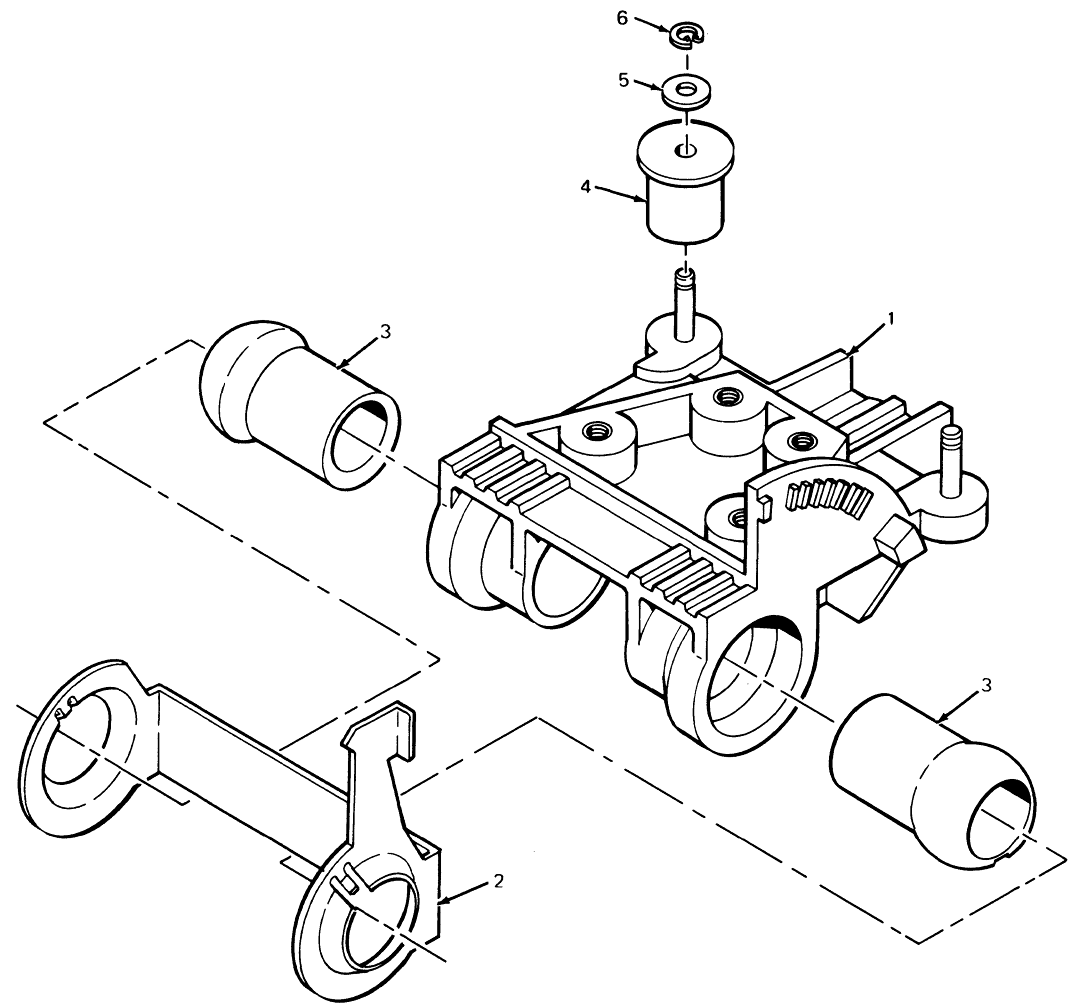


Figure 6. Carriage Assembly

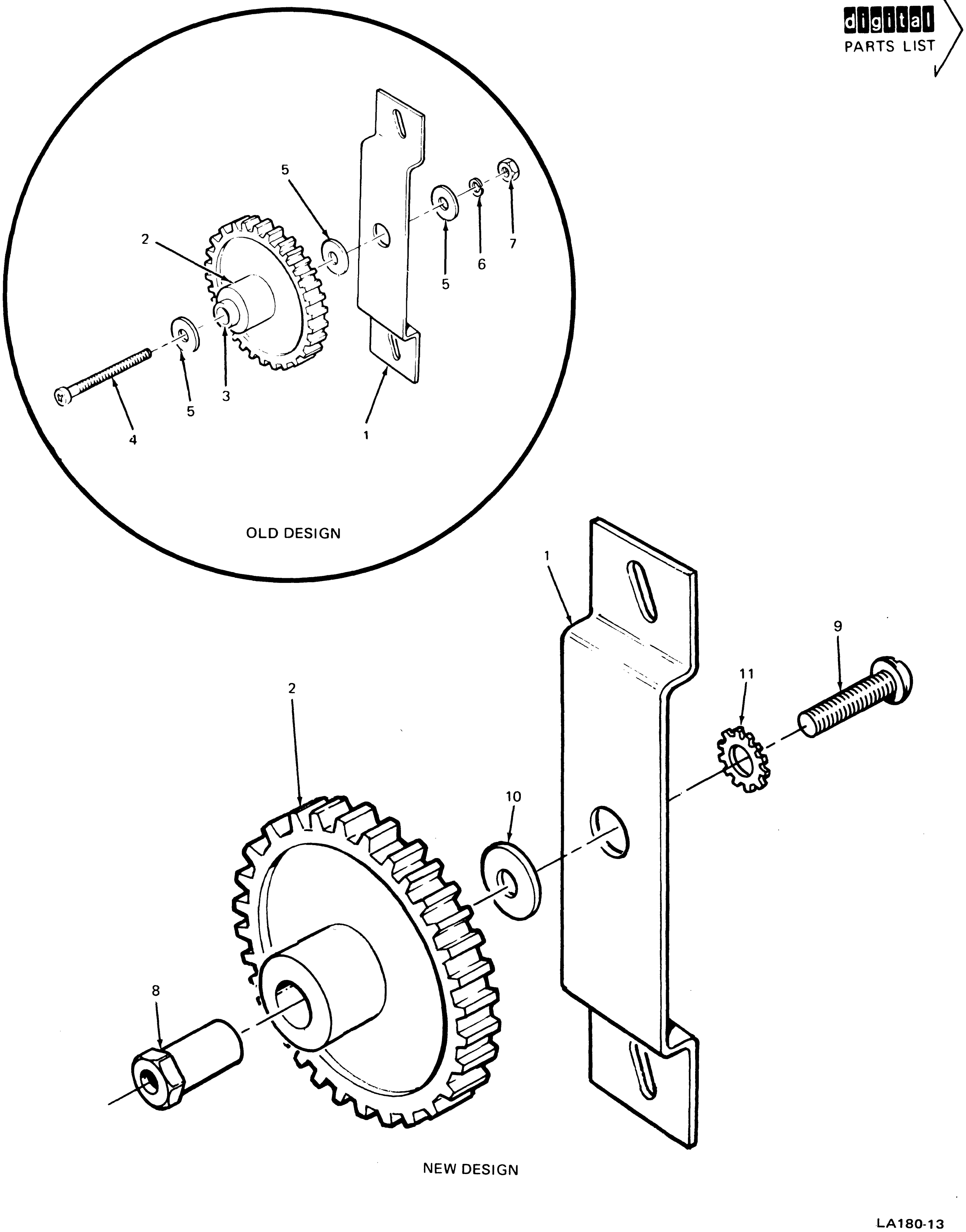


Figure 7. Idler Gear Assembly

FIG & ITEM NO.	DESCRIPTION	A DEC PART NO.	ECO CUT-IN 70-09694 00000	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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 (deleted)	74-11424-00	LA36 00223				
4	*Screw, Phl Pan Hd No. 8-32 x 1.00 (deleted)	90-06043-01	LA36 00223				
5	*Washer, Flat No. 8 (deleted)	90-06666-00	LA36 00223				
6	*Washer, Split Lock No. 8 (deleted)	90-06690-00	LA36 00223				
7	*Nut, Hex No. 8-32 (deleted)	90-06561-00	LA36 00223				
8	*Standoff, Gear (added)	74-16219-00	LA36 00223				
9	*Screw, Phl Truss Hd No. 8-32 x 1/2 (added)	90-06039-03	LA36 00223				
10	*Washer, Flat No. 8 (added)	90-06668-00	LA36 00223				
11	*Washer, External Tooth No. 8 (added)	90-08072-00	LA36 00223				

FIG & ITEM NO.	DESCRIPTION	F DEC PART NO.	ECO CUT-IN LA36 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
8–	TRANSFORMER ASSEMBLY (deleted)	70-09779-00	00138	A – H			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					

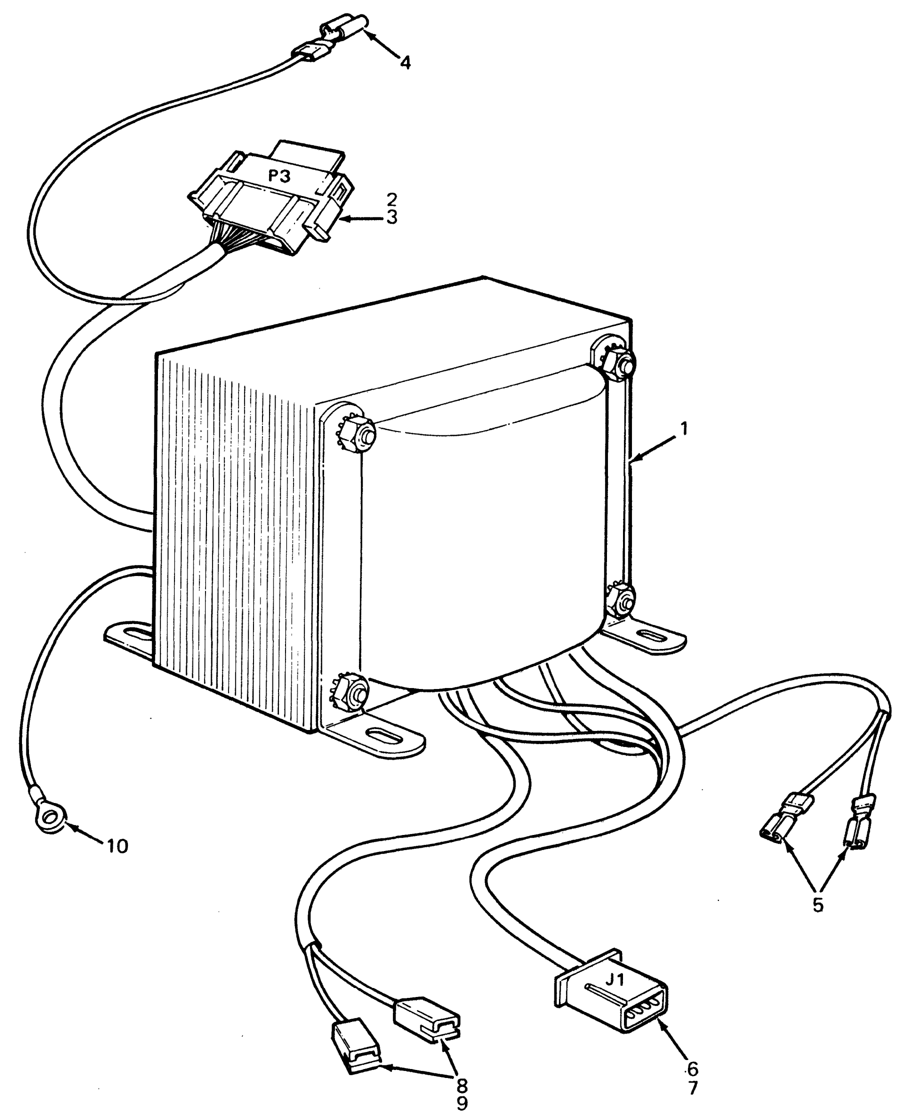


Figure 8. Transformer Assembly

FIG & ITEM NO.	DESCRIPTION	J DEC PART NO.	ECO CUT-IN LA36 00138	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
8A–	TRANSFORMER ASSEMBLY						2A
	Transformer Assembly (60 Hz)	70-09779-01		J N K P S			
	Transformer Assembly (50 Hz)	70-09779-02		M R L Q			
1	*Power Transformer (60 Hz) Includes Capacitors	16-12522-00					
	*Power Transformer (50 Hz) Includes Capacitors	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					

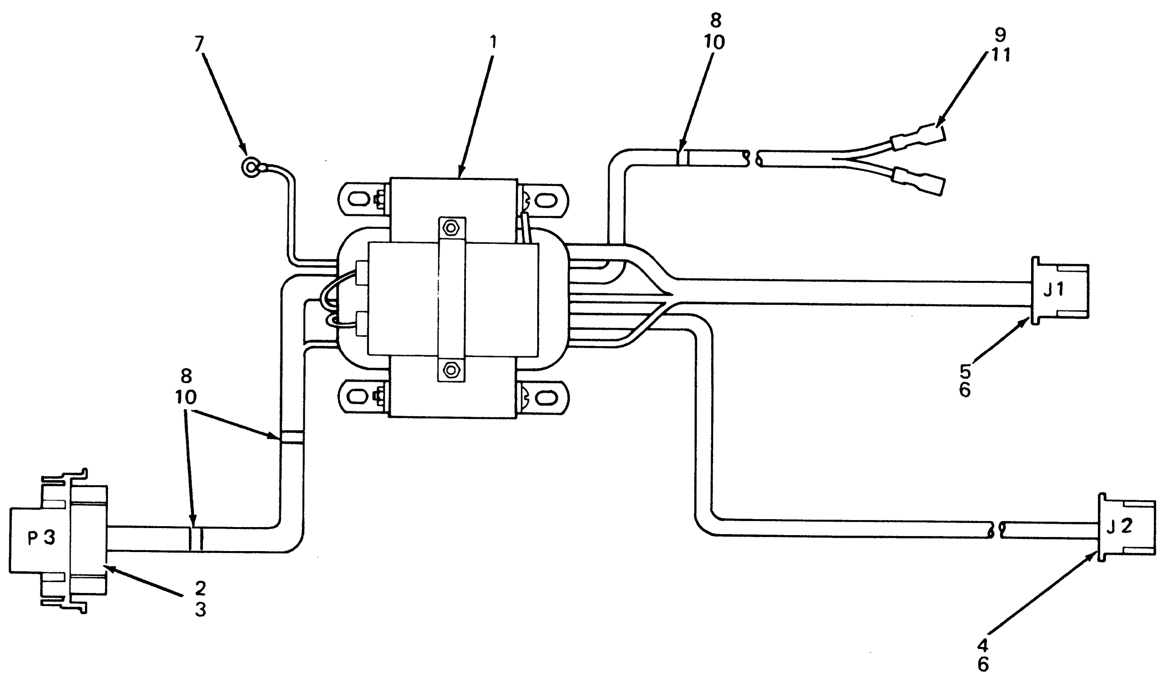
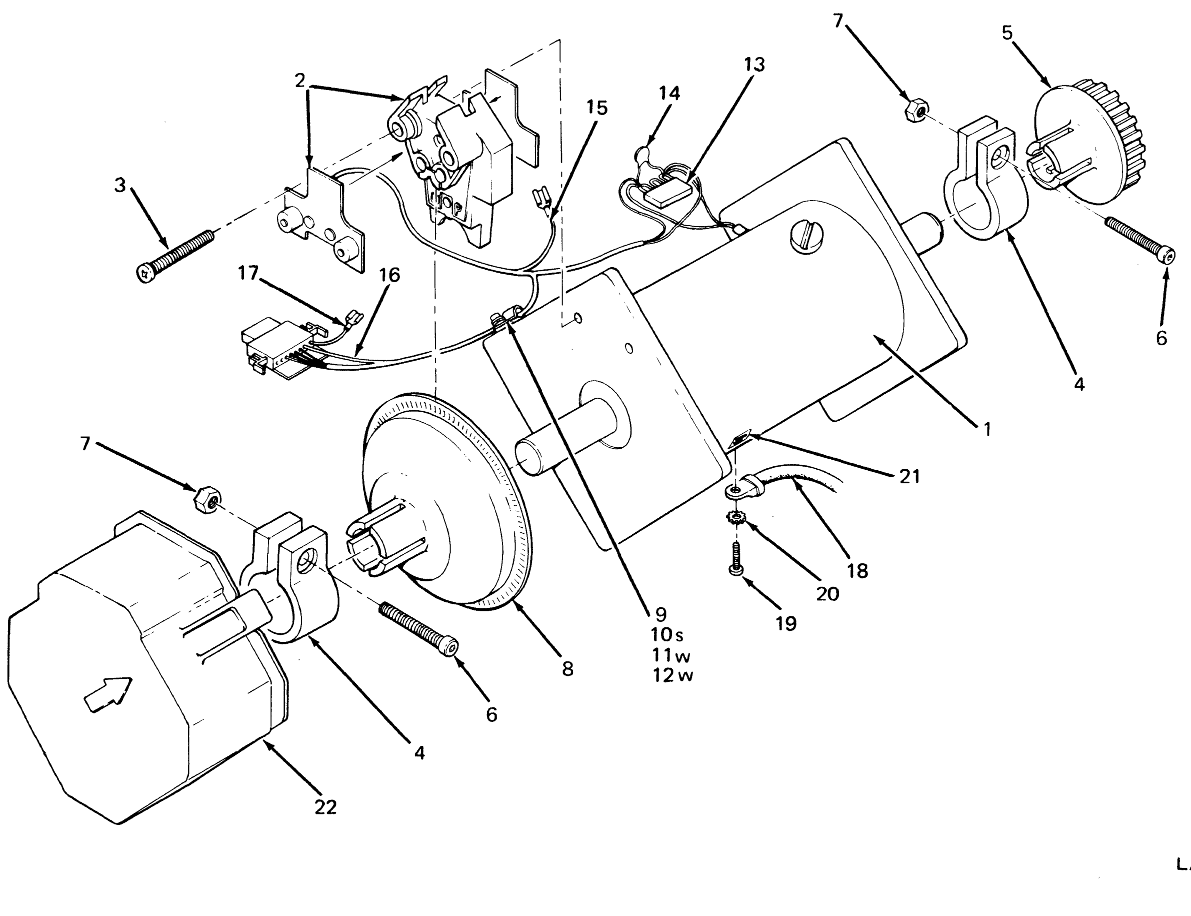


Figure 8A. Transformer Assembly

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00166	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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, Phl 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, Phl 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, Phl 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	B DEC PART NO.	ECO CUT-IN 70-09895 00000	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
10–	CAPACITOR HARNESS ASSEMBLY	70-09895-00					2, 2A
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				

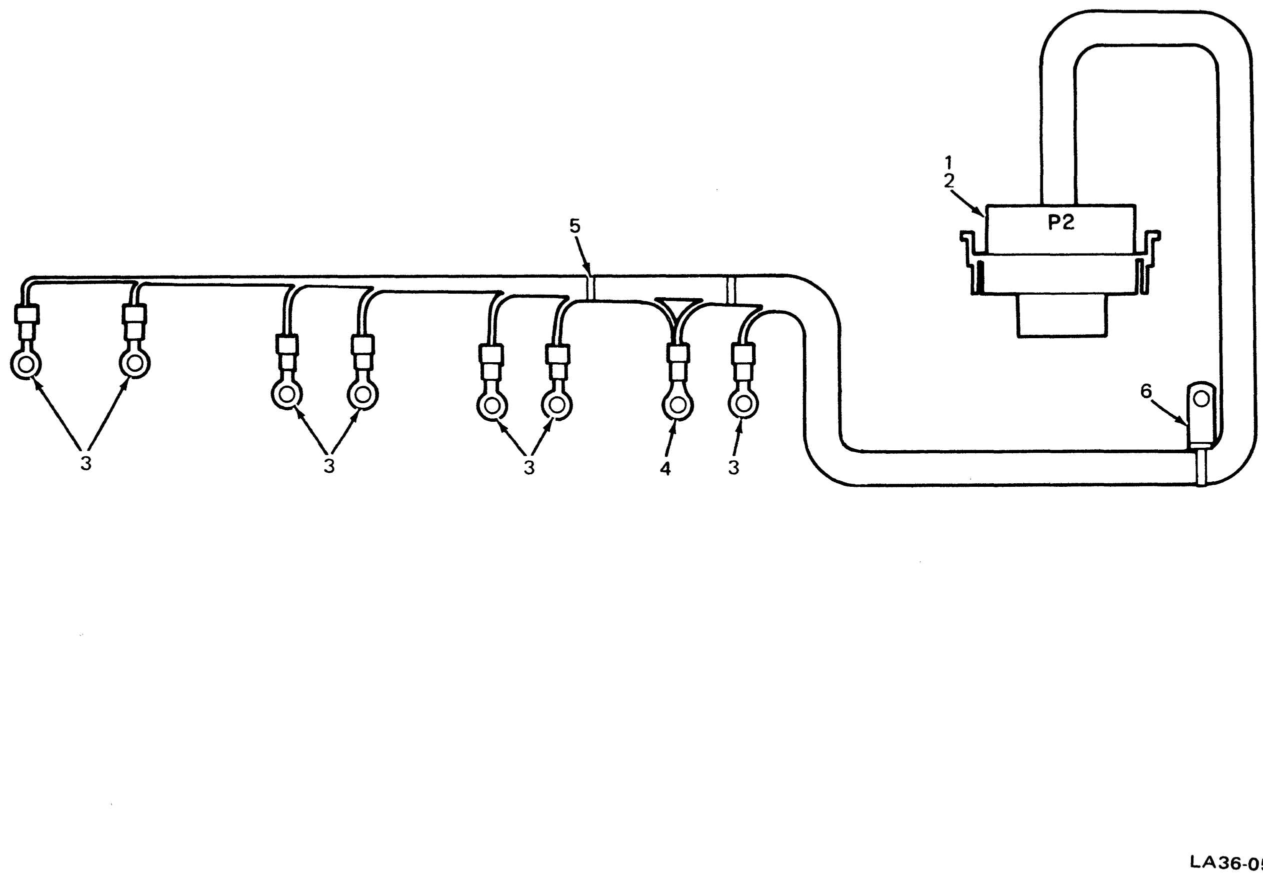


Figure 10. Capacitor Harness Assembly

FIG & ITEM NO.	DESCRIPTION	B DEC PART NO.	ECO CUT-IN 70-10000 00000	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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					

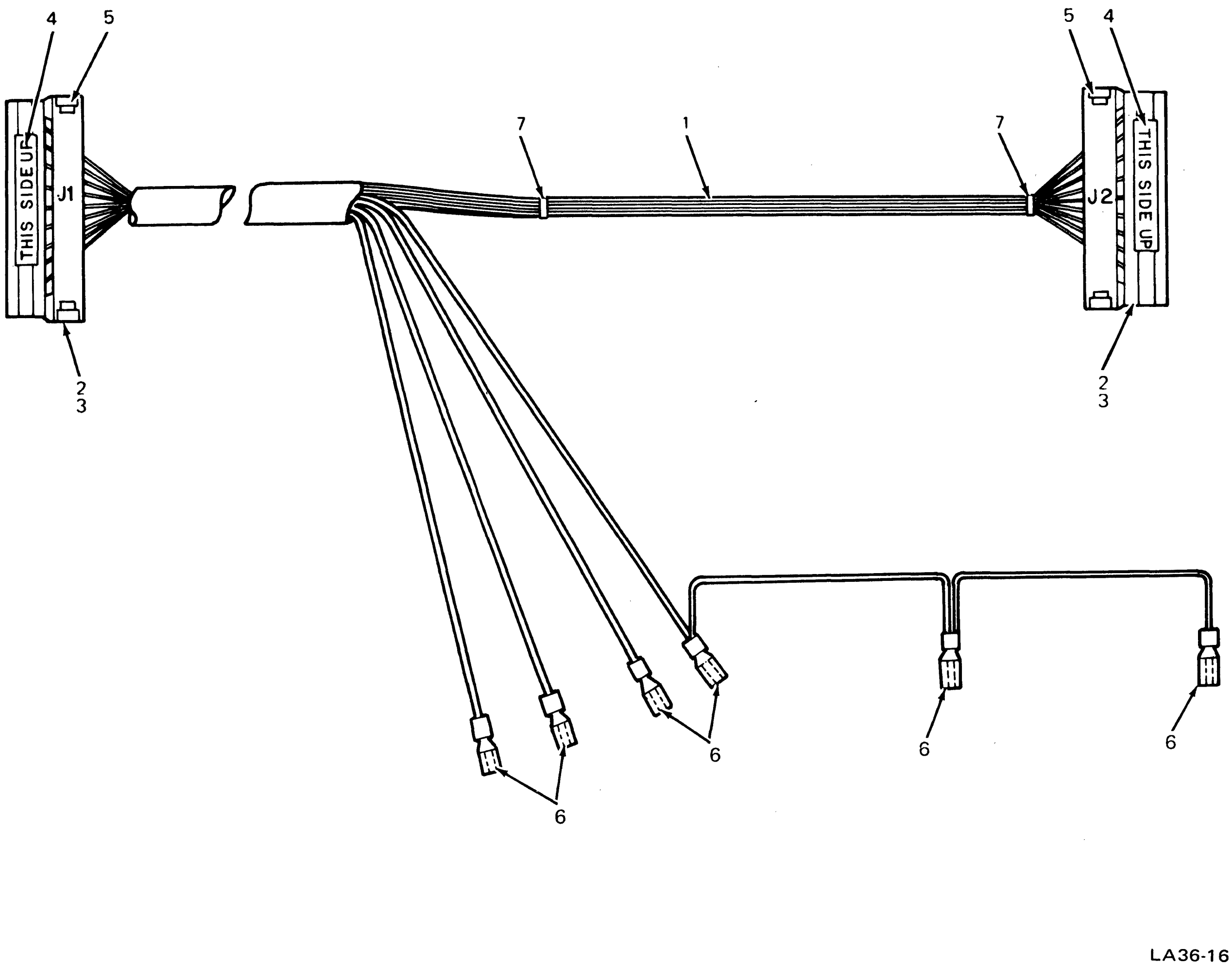


Figure 11. Cable Assembly (LA36 Keyboard)

FIG & ITEM NO.	DESCRIPTION	A DEC PART NO.	ECO CUT-IN LA36 00136	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
11A–	CABLE ASSEMBLY (LA36 Keyboard)	70-11519-00		J–R, S			12A 13A
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					

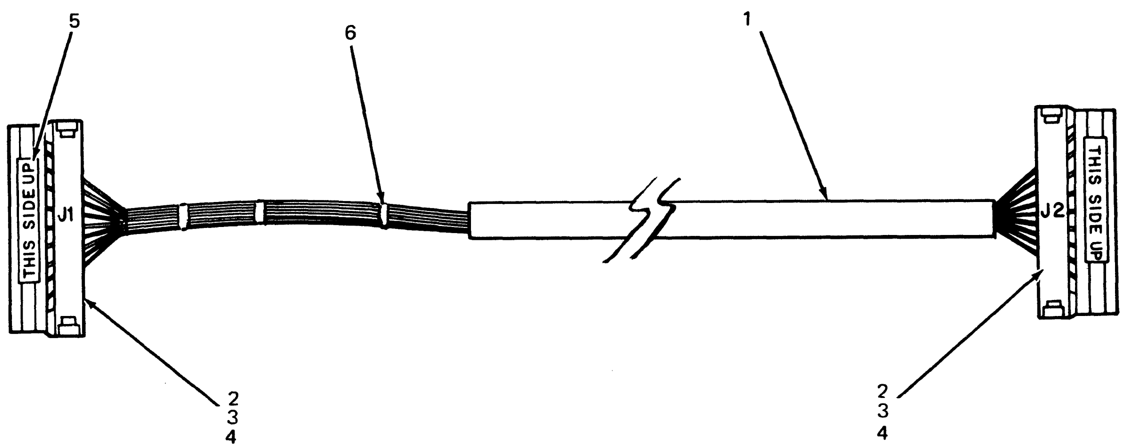


Figure 11A. Cable Assembly (LA36 Keyboard)

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN 70-09750 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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, Phl Pan Hd No. 6-32 x .31	90-06021-01					

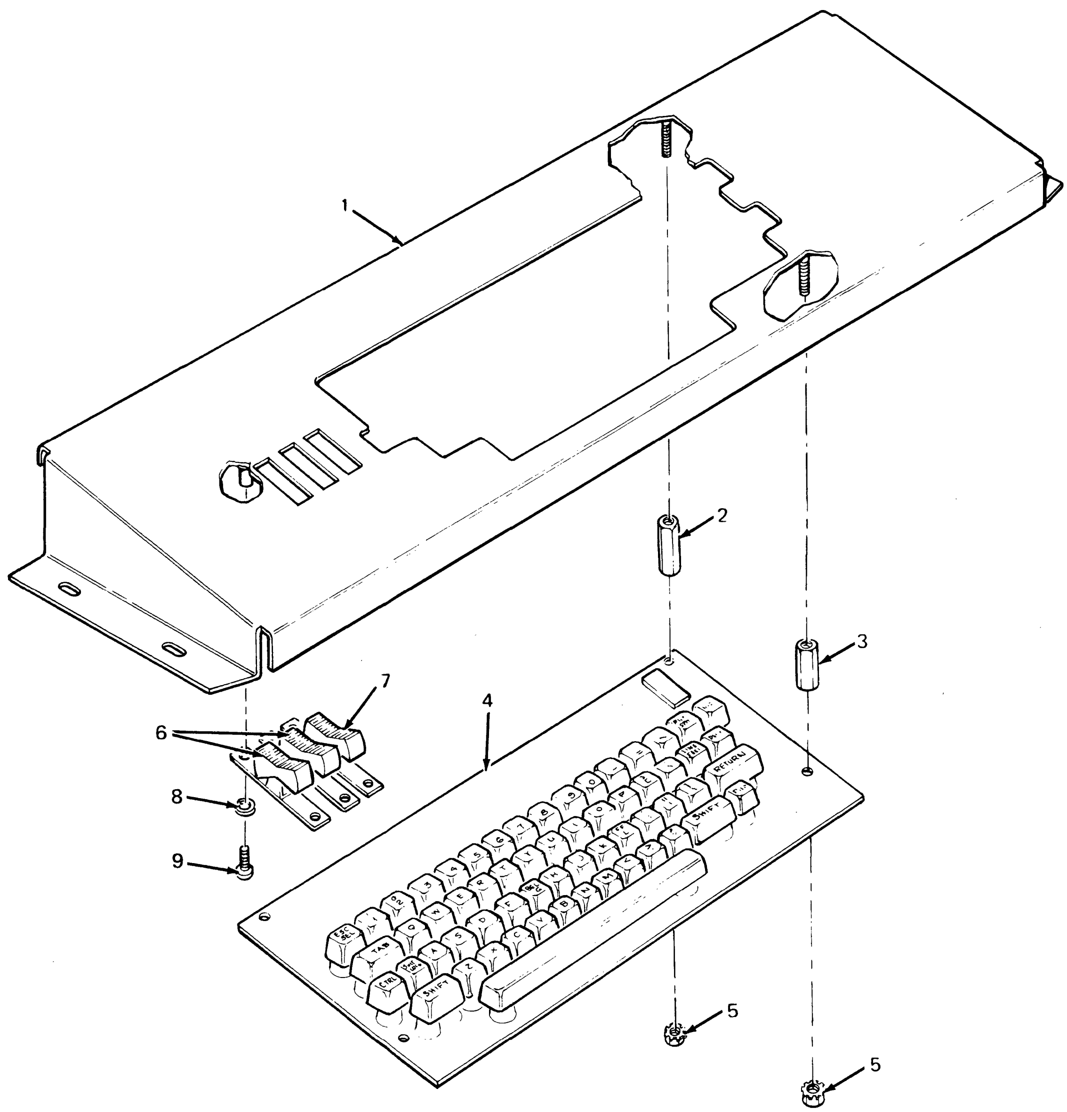


Figure 12. Keyboard Bezel Assembly

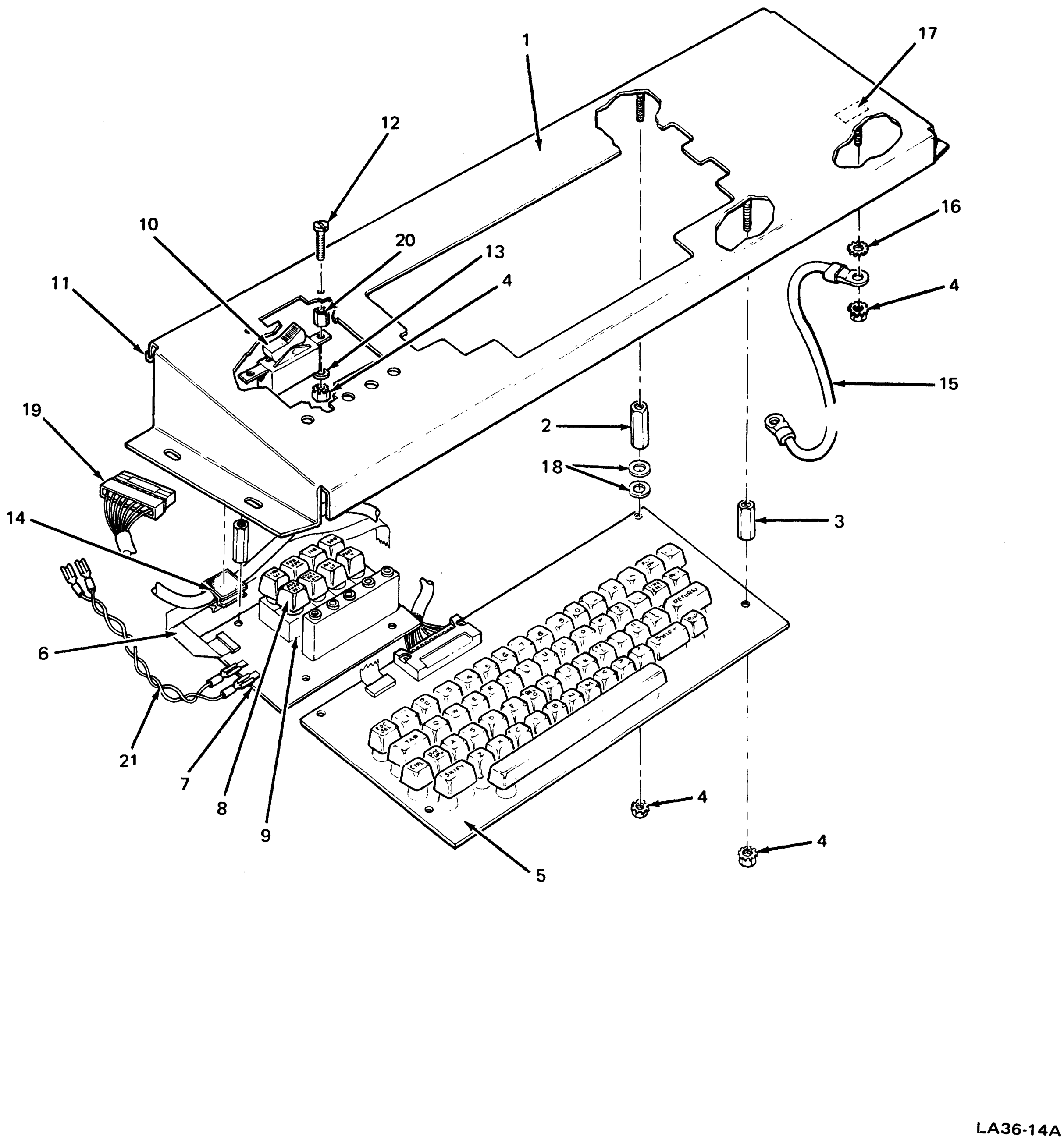


Figure 12A. Keyboard Bezel Assembly

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00163	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG NO.
12A–	KEYBOARD BEZEL ASSEMBLY	70-09750-01		NPQR			1A
	KEYBOARD BEZEL ASSEMBLY (added)	70-09750-03	00247	S			1A
1	*Bracket, Bezel	74-11427-01		NPQR			
	*Bracket, Bezel (added)	74-11427-03	00247	S			
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, S	(See IPB Manual EK-LK02-IP-)		
6	*Control Panel Cable	70-08612-OK		J–R, S			
7	*FRONT CONTROL PANEL ASSEMBLY	70-11525-00		J–R, S			
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, Phl Pan Hd No. 6-32 x .31 (deleted)	90-06021-01	00205				
13	*Washer, Split Lock No. 6-32 (deleted)	90-07801-00	00205				
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					
19	*KEYBOARD CABLE ASSEMBLY	70-11519-00	See Note				11A
20	*Spacer, No. 8 x .375 (added)	90-06802-00	00205				
21	*Jumper, Interlock (added)	70-10001-13	00219				
	Note: This Assembly formerly installed under Figure 1A. (Per ECO LA36-00219)						

FIG & ITEM NO.	DESCRIPTION	F DEC PART NO.	ECO CUT-IN 70-09750 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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	70-08612-0D					
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, Phl Pan Hd No. 6-32 x .31	90-06021-00					

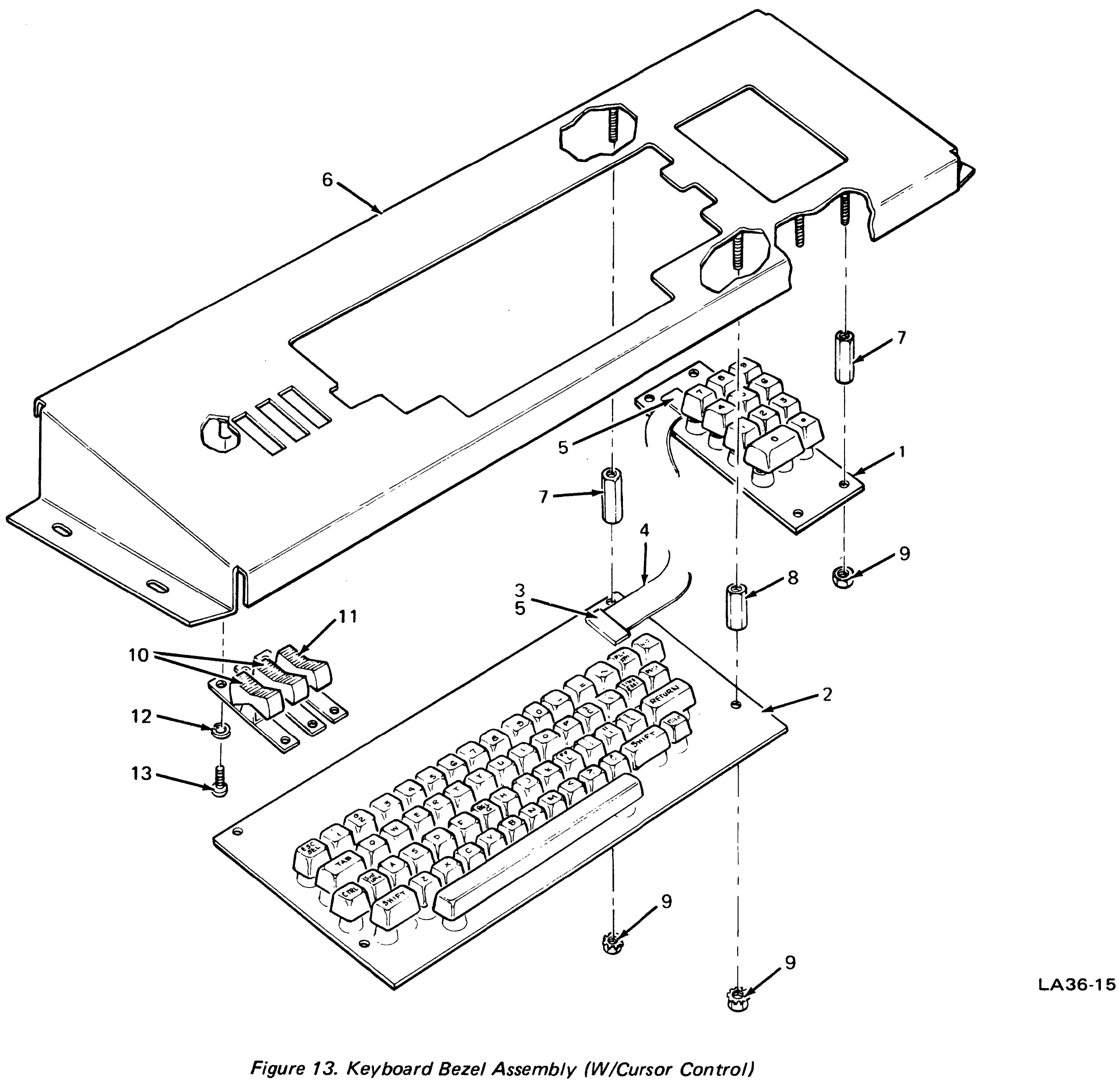
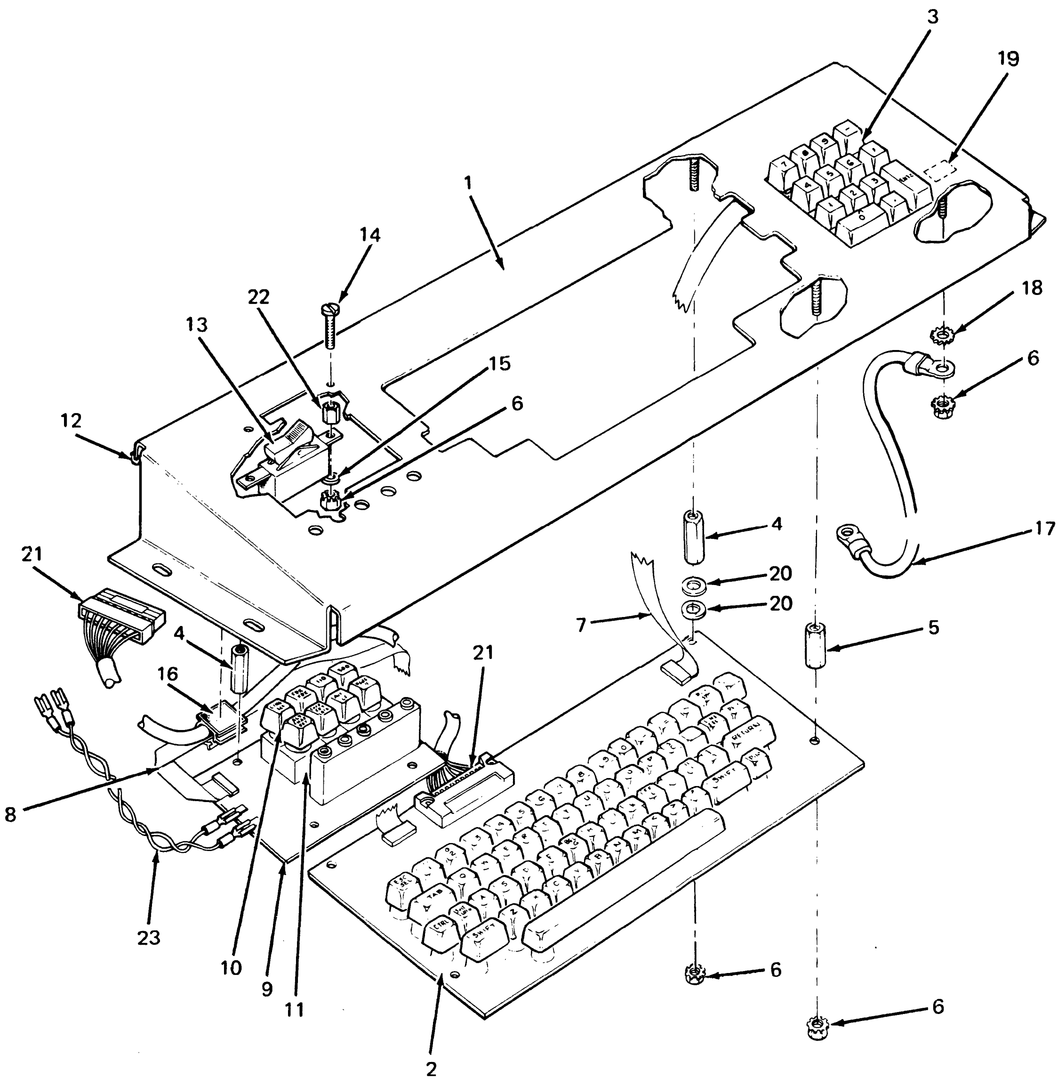


Figure 13. Keyboard Bezel Assembly (W/Cursor Control)



LA36-15A

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

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN LA36 00163	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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, Phl Pan Hd No. 6-32 x .31 (deleted)	90-06021-01	00205				
15	*Washer, Split Lock No. 6 (deleted)	90-07801-00	00205				
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					
21	*KEYBOARD CABLE ASSEMBLY	70-11519-00	See Note				11A
22	*Spacer, No. 8 x .375 (added)	90-06802-00	00205				
23	*Jumper, Interlock (added)	70-10001-13	00219				
	Note: This Assembly formerly installed under Figure 1A. (Per ECO LA36-00219)						

FIG & ITEM NO.	DESCRIPTION	DEC PART NO.	ECO CUT-IN BC05-F 00001	USED ON CODE	VENDOR CODE	VENDOR PART NO.	REF FIG 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

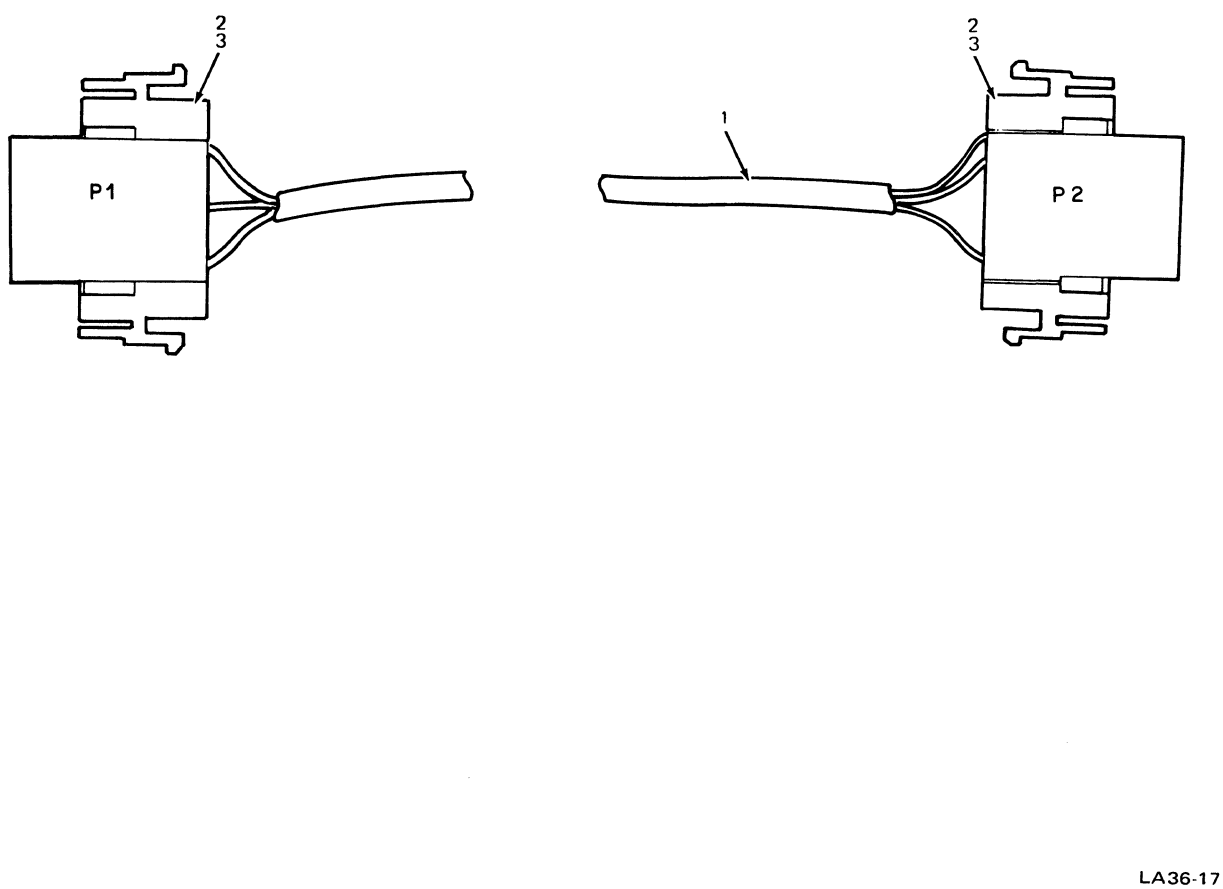


Figure 14. Cable Assembly (BC05F Interface)

APPENDIX C
REFERENCE DATA

C.1 ABBREVIATIONS
The abbreviations used in this manual are listed in Table C-1.

C.2 SIGNAL GLOSSARY
The signal names used in this manual are listed in Table C-2.

C.3 IC PIN LOCATION DRAWINGS
The pin locations of the integrated circuits used in the LA36 are shown at the end of this appendix.

Table C-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 C-1 Glossary of Abbreviations (Cont)

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
μs	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	Transitor To Transistor Logic
UART	Universal Asynchronous Receiver Transmitter
VREF	Voltage Reference

Table C-1 Glossary of Abbreviations (Cont)

WC	Word Count
WD CNT	Word Count
WT ADR	Write Address
XD	Read Access Memory Transmit Data
XMIT	Transmit

Table C-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 C-2 Signal Glossary (Cont)

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 C-2 Signal Glossary (Cont)

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 μs	1.184 μs	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

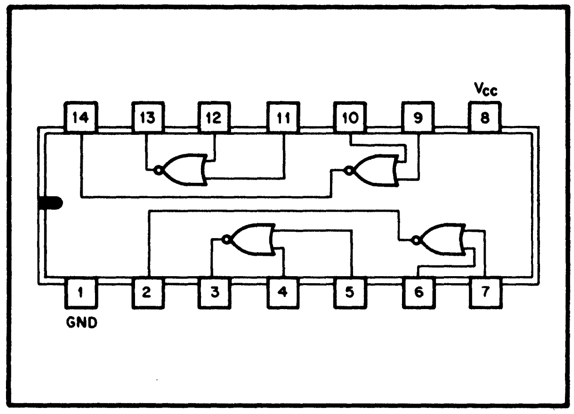
Table C-2 Signal Glossary (Cont)

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 μs	76 μs	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 C-2 Signal Glossary (Cont)

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)

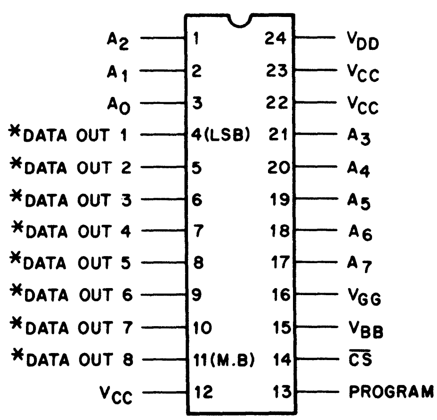
380 QUAD 2-INPUT NOR GATE



IC-0013

1702A 8-BIT REPROGRAMMABLE ROM

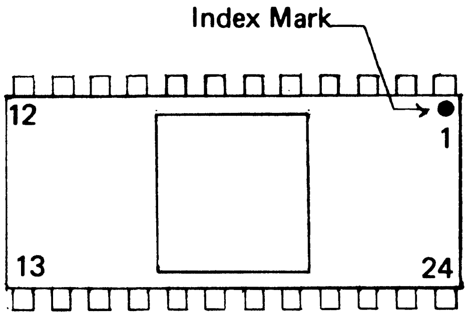
PIN CONFIGURATION



*THIS PIN IS THE DATA INPUT DURING PROGRAMMING

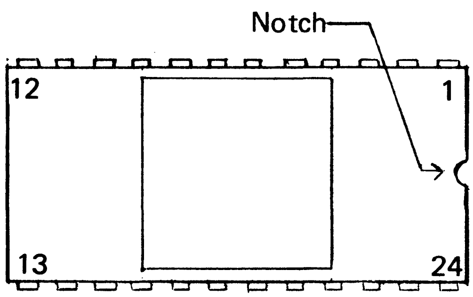
2627P A6–01 CHARACTER GENERATOR ALPHA

PACKAGE "A" – BENT LEADS

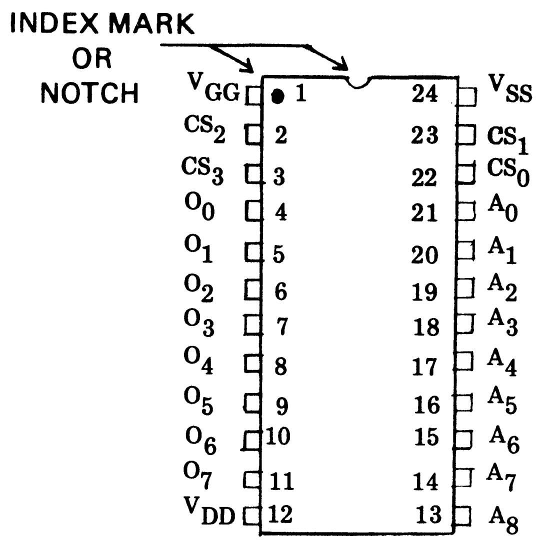


IC-0123

PACKAGE "B" – BRAZED LEADS



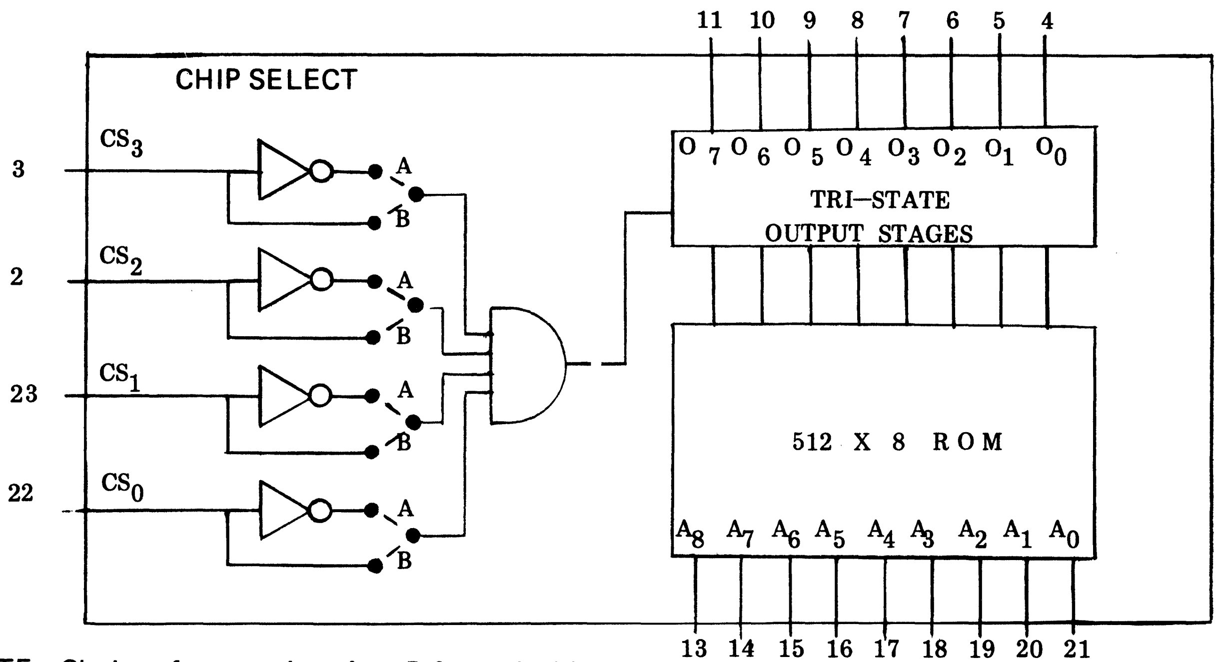
IC-0124



IC-0120

2627P A6-01 CHARACTER GENERATOR ALPHA (Cont)

FUNCTIONAL BLOCK DIAGRAM



NOTE: Choice of connection A or B for each chip select is available as a mask option.

IC-0121

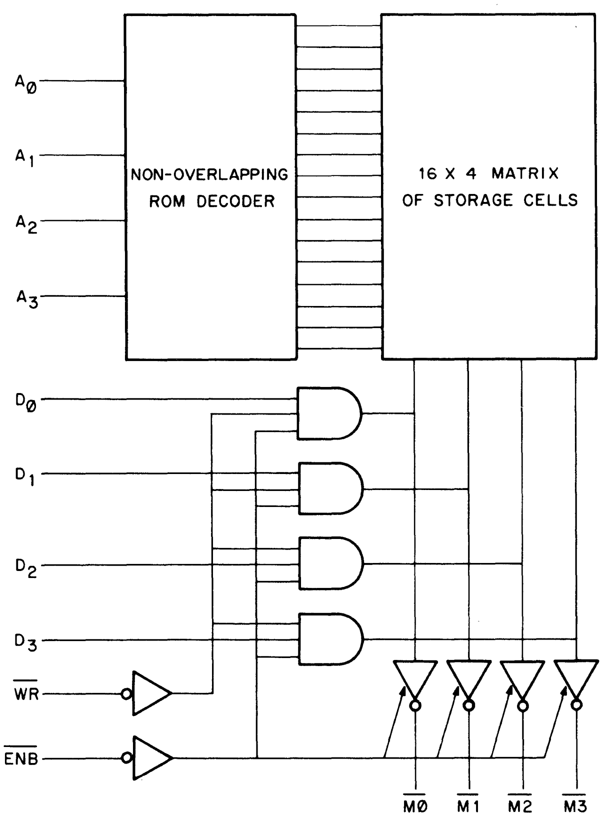
3101 RANDOM ACCESS MEMORY

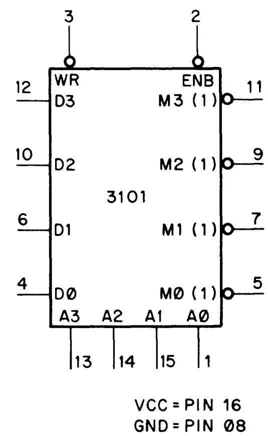
Easy memory expansion is provided by an active LOW chip select (ENB) input and open collector OR tieable outputs.

An active LOW Write line WR controls the writing/reading operation of the memory. When the chip-select and write lines are LOW the information on the four data inputs D_0 to D_0 is written into the addressed memory word.

Reading is performed with the chip select line LOW and the write line HIGH. The information stored in the addressed word is read out on the four inverting outputs M0 to M3.

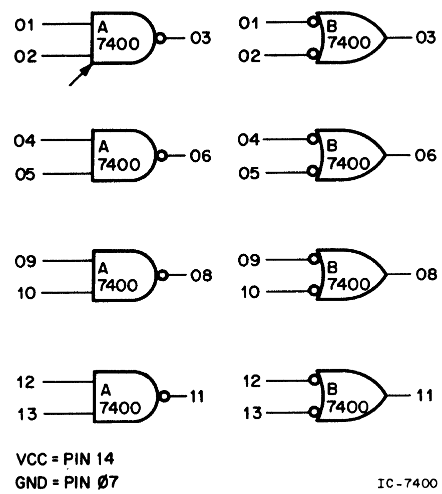
During the writing operation or when the chip select line is HIGH the four outputs of the memory go to an inactive high impedance state.



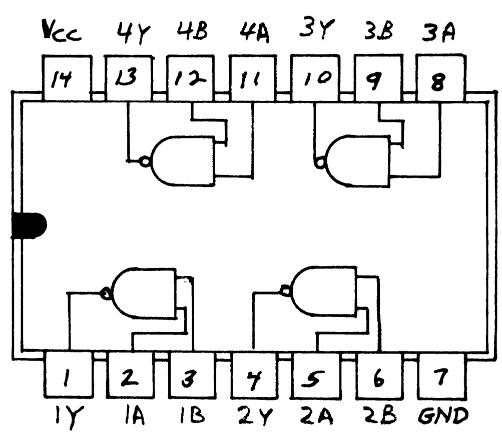


IC-3101

7400 QUAD 2-INPUT POSITIVE NAND GATE

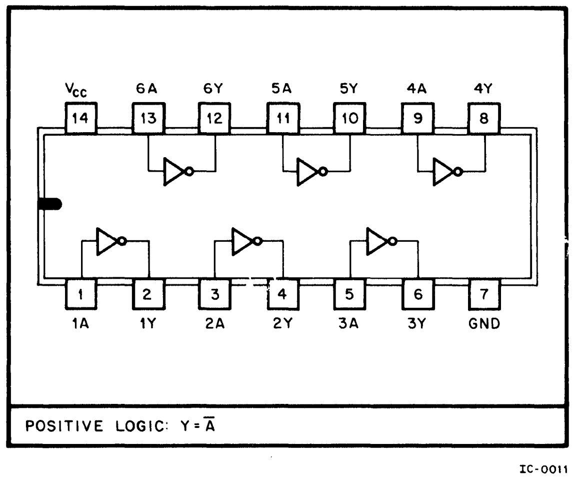


7401 NAND GATE-QUAD 2-PIN OPEN COLLECTOR

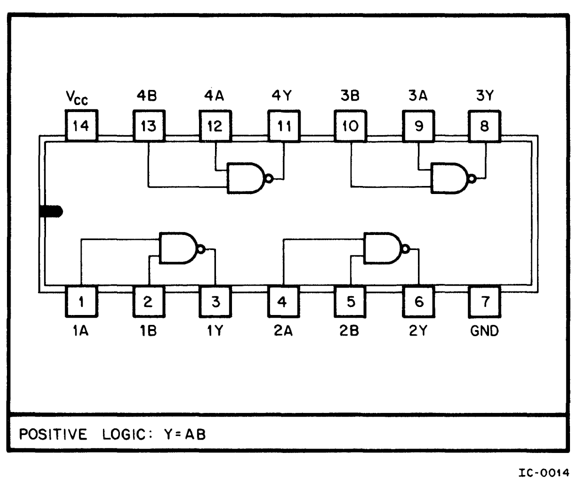


IC-0129

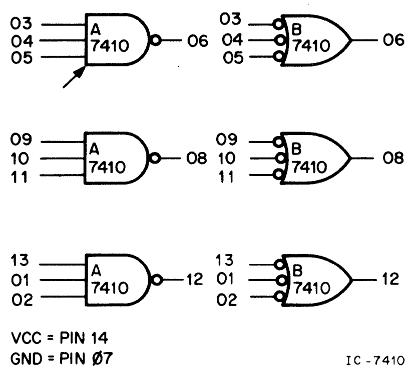
7404 HEX INVERTER



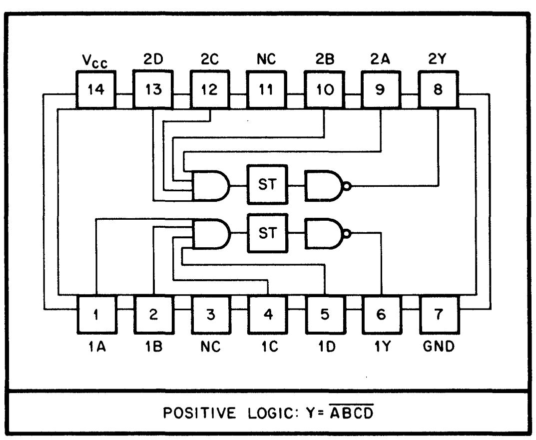
7408 QUAD 2-INPUT POSITIVE AND GATE



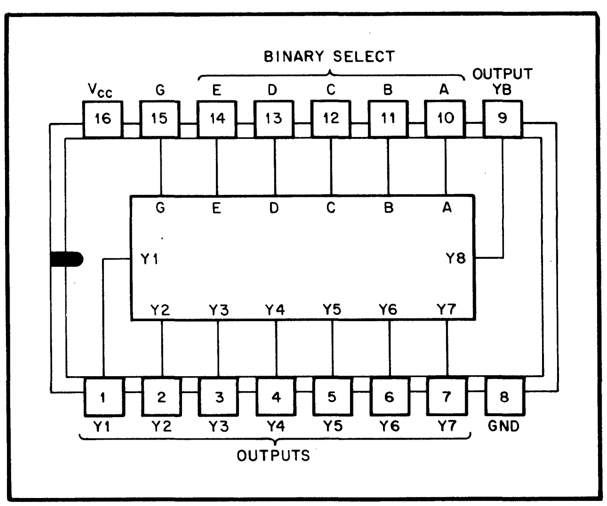
7410 TRIPLE 3-INPUT POSITIVE NAND GATE



7413 SCHMITT TRIGGER

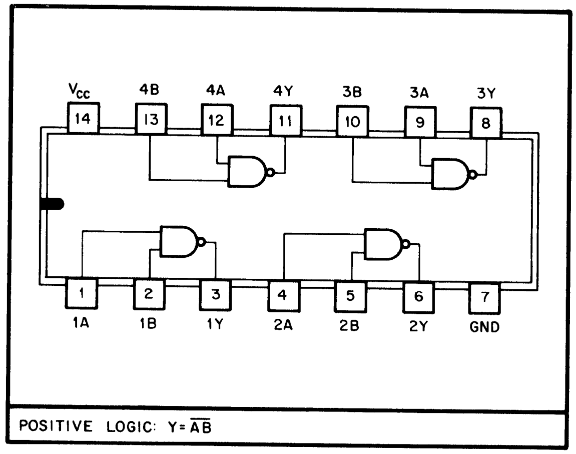


IC-0008



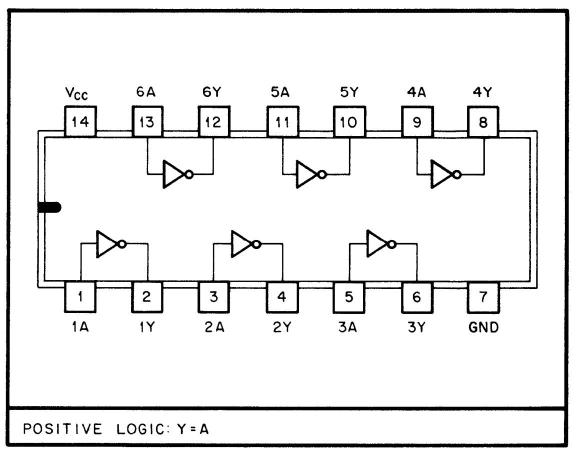
IC-0009

7416 HEX INVERTER BUFFER/DRIVER

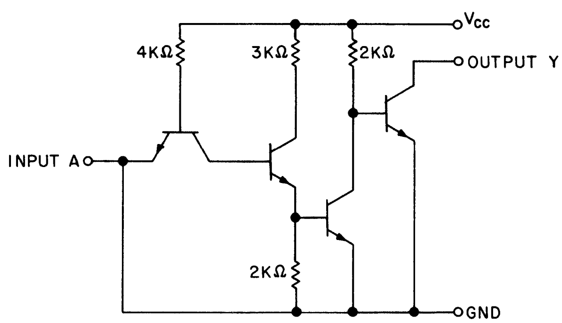


IC-0012

7417 HEX BUFFERS/DRIVERS



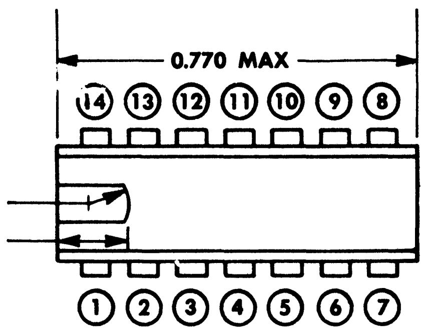
IC-0057



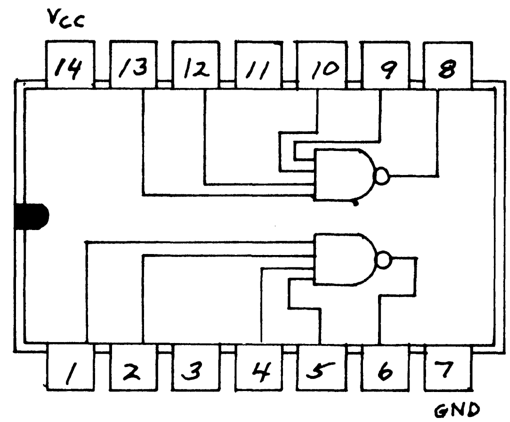
Component values shown are nominal.

IC-0056

7420 NAND GATE-DUAL 4-INPUT

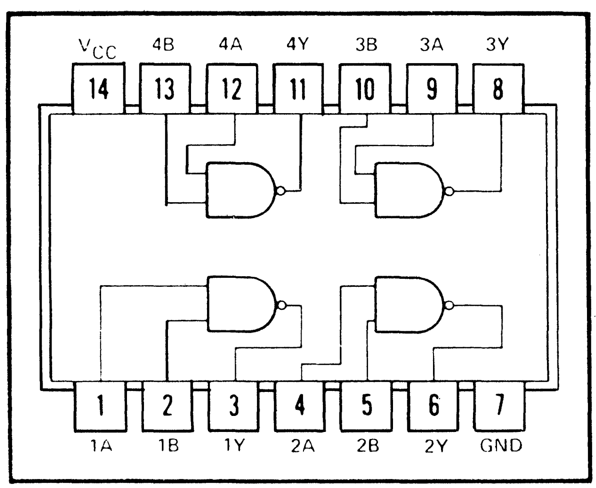


IC-0128



IC-0130

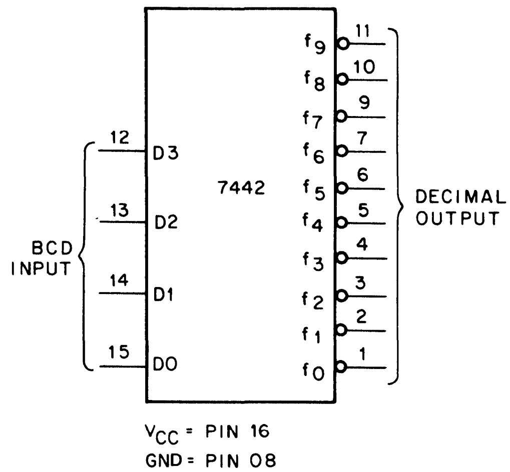
7437 NAND GATE-QUAD 2 IN BUFFER, 14 PIN



IC-0126

7442 4-LINE-TO-10-LINE DECODERS

These BCD-to-decimal decoders consist of eight inverters and ten 4-input NAND gates. The inverters are connected in pairs to make BCD input data available for decoding by the NAND gates.



IC-7442

7442
TRUTH TABLE

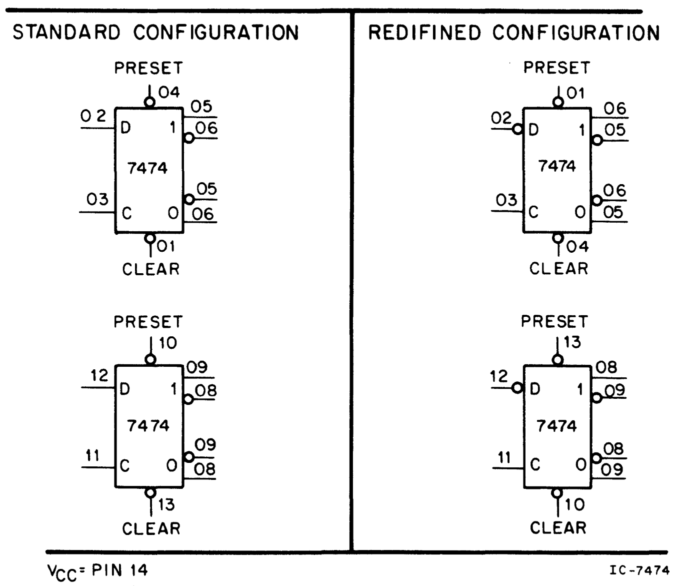
BCD Input				Decimal Output									
D3	D2	D1	D0	f0	f1	f2	f3	f4	f5	f6	f7	f8	f9
0	0	0	0	0	1	1	1	1	1	1	1	1	1
0	0	0	1	1	0	1	1	1	1	1	1	1	1
0	0	1	0	1	1	0	1	1	1	1	1	1	1
0	0	1	1	1	1	1	0	1	1	1	1	1	1
0	1	0	0	1	1	1	1	0	1	1	1	1	1
0	1	0	1	1	1	1	1	1	0	1	1	1	1
0	1	1	0	1	1	1	1	1	1	0	1	1	1
0	1	1	1	1	1	1	1	1	1	1	0	1	1
1	0	0	0	1	1	1	1	1	1	1	1	0	1
1	0	0	1	1	1	1	1	1	1	1	1	1	0
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	0	1	1	1	1	1	1	1	1	1	1	1	1
1	1	0	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	0	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1

7474 DUAL D-TYPE EDGE-TRIGGERED FLIP-FLOP

TRUTH TABLE FOR
7474 STANDARD CONFIGURATION
(EACH FLIP-FLOP)

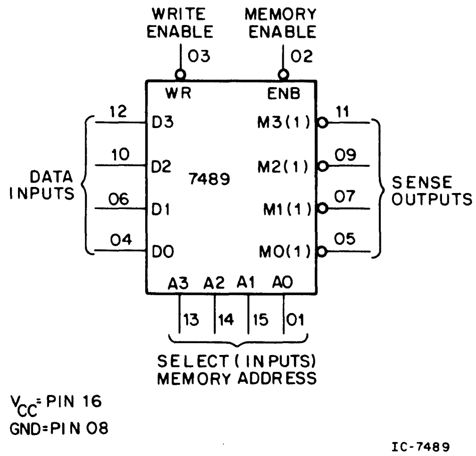
t_n			t_n+1	
Preset Pin 4(10)	Clear Pin 1(13)	D Input Pin 2(12)	1 Side Pin 5	0 Side Pin 6
High	High	Low	Low	High
High	High	High	High	Low
High	Low	X	Low	High
Low	High	X	High	Low
Low	Low	X	High	High

t_n = bit time before clock pulse.
t_n+1 = bit time after clock pulse.
X = irrelevant



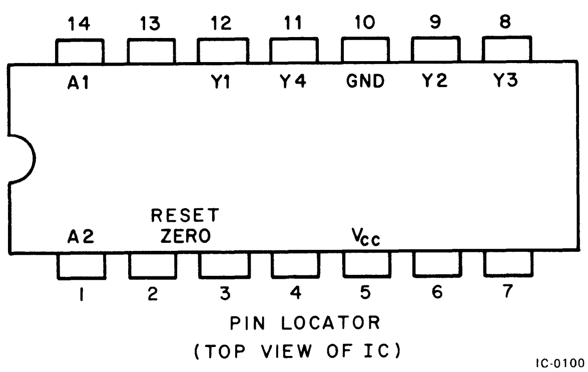
V_{CC}= PIN 14
GND= PIN 07

7489 64-BIT READ/WRITE MEMORY



ENB	WR	OPERATION	CONDITION OF OUTPUTS
L	L	Write (WR)	Complement of Write Data Inputs into addressed memory location.
L	H	Read (ENB)	Reads complement of word stored in selected memory location.
H	L	Inhibit Storage	Complement of Data Inputs
H	H	Do Nothing	High

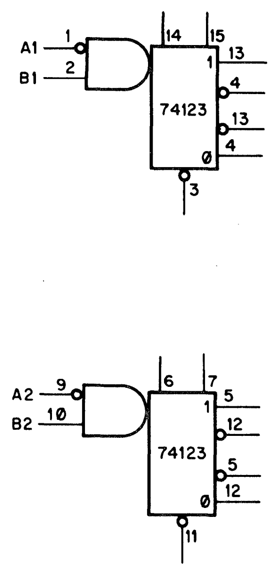
7493A COUNTER ASYNCHRONOUS UP, BINARY



74123 MONOSTABLE MULTIVIBRATOR

The 74123 Monostable Multivibrator provides dc triggering from gated low-level active (A) and high-level active (B) inputs. Overriding direct clear inputs and complementary outputs are also provided.

By triggering the input before the output pulse is terminated, the output pulse may be extended. The overriding clear capability permits any output pulse to be terminated at a predetermined time, independently of the external timing components.



+5V = PIN 16
GND = PIN 8

IC-74123A

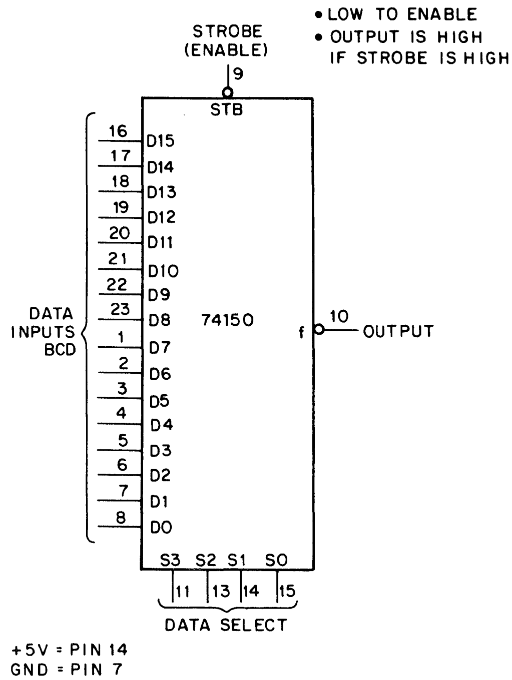
TRUTH TABLE

INPUTS		OUTPUTS	
A	B	1	0
H	X	L	H
X	L	L	H
L	↑	⊓	⊔
↓	H	⊓	⊔

NOTE: H = high level (steady state), L = low level (steady state), ↑ = transition from low to high level, ↓ = transition from high to low level, ⊓ = one high-level pulse, ⊔ = one low-level pulse, X = irrelevant (any input, including transitions).

IC-74123B

74150 DATA SELECTOR/MULTIPLEXER



74150 TRUTH TABLE

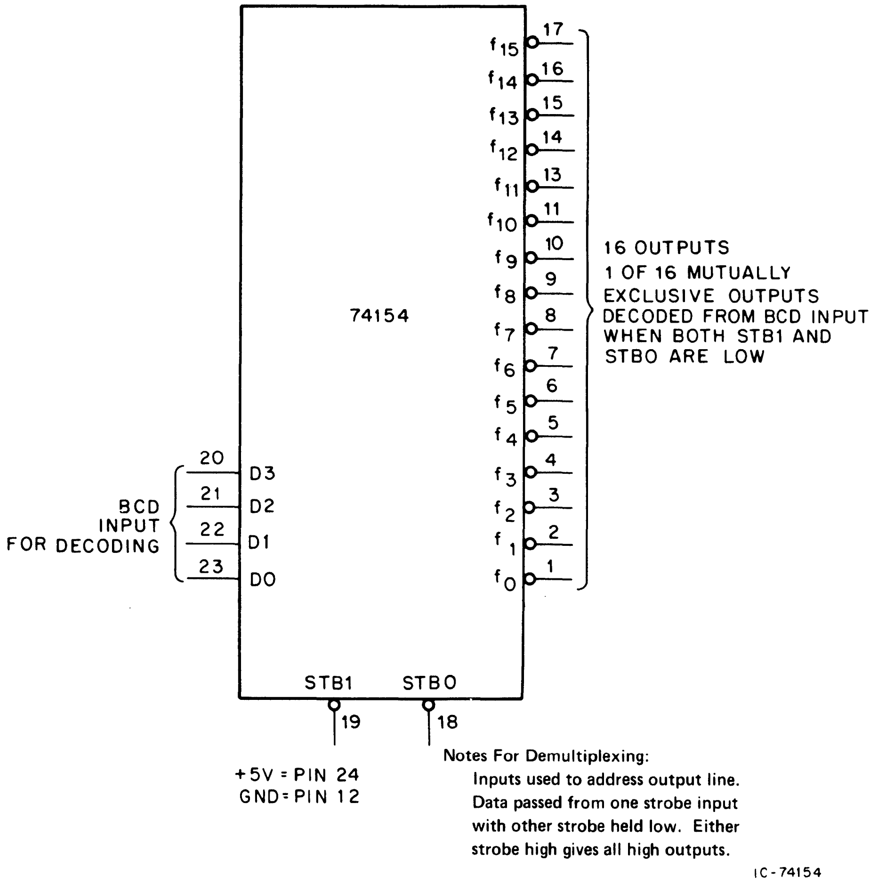
INPUTS																					OUTPUT
S3	S2	S1	S0	STROBE	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	f
X	X	X	X	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1
0	0	0	0	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1
0	0	0	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0
0	0	0	1	0	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1
0	0	0	1	0	X	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0
0	0	1	0	0	X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	X	1
0	0	1	0	0	X	X	1	X	X	X	X	X	X	X	X	X	X	X	X	X	0
0	0	1	1	0	X	X	X	0	X	X	X	X	X	X	X	X	X	X	X	X	1
0	0	1	1	0	X	X	X	1	X	X	X	X	X	X	X	X	X	X	X	X	0
0	1	0	0	0	X	X	X	X	0	X	X	X	X	X	X	X	X	X	X	X	1
0	1	0	0	0	X	X	X	X	1	X	X	X	X	X	X	X	X	X	X	X	0
0	1	0	1	0	X	X	X	X	X	0	X	X	X	X	X	X	X	X	X	X	1
0	1	0	1	0	X	X	X	X	X	1	X	X	X	X	X	X	X	X	X	X	0
0	1	1	0	0	X	X	X	X	X	X	0	X	X	X	X	X	X	X	X	X	1
0	1	1	0	0	X	X	X	X	X	X	1	X	X	X	X	X	X	X	X	X	0
0	1	1	1	0	X	X	X	X	X	X	X	0	X	X	X	X	X	X	X	X	1
0	1	1	1	0	X	X	X	X	X	X	X	1	X	X	X	X	X	X	X	X	0
1	0	0	0	0	X	X	X	X	X	X	X	X	0	X	X	X	X	X	X	X	1
1	0	0	0	0	X	X	X	X	X	X	X	X	1	X	X	X	X	X	X	X	0
1	0	0	1	0	X	X	X	X	X	X	X	X	X	0	X	X	X	X	X	X	1
1	0	0	1	0	X	X	X	X	X	X	X	X	X	1	X	X	X	X	X	X	0
1	0	1	0	0	X	X	X	X	X	X	X	X	X	X	0	X	X	X	X	X	1
1	0	1	0	0	X	X	X	X	X	X	X	X	X	X	1	X	X	X	X	X	0
1	0	1	1	0	X	X	X	X	X	X	X	X	X	X	X	0	X	X	X	X	1
1	0	1	1	0	X	X	X	X	X	X	X	X	X	X	X	1	X	X	X	X	0
1	1	0	0	0	X	X	X	X	X	X	X	X	X	X	X	X	0	X	X	X	1
1	1	0	0	0	X	X	X	X	X	X	X	X	X	X	X	X	1	X	X	X	0
1	1	0	1	0	X	X	X	X	X	X	X	X	X	X	X	X	X	0	X	X	1
1	1	0	1	0	X	X	X	X	X	X	X	X	X	X	X	X	X	1	X	X	0
1	1	1	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	X	1
1	1	1	0	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1	X	0
1	1	1	1	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	0	1
1	1	1	1	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	1	0

When used to indicate an input condition, X = LOGICAL 1 OR LOGICAL 0

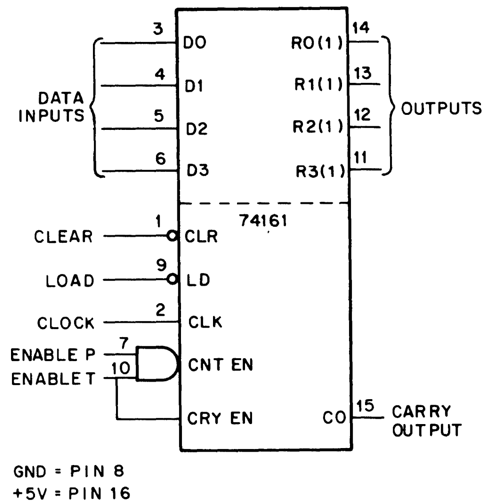
IC-74150

74154 4-LINE-TO-26-LINE DECODER/DEMULTIPLEXER

The 74154 4-Line to 16-Line Decoder decodes four binary-coded inputs into one of 16 mutually-exclusive outputs when both strobe inputs (G1 and G2) are low. The decoding function is performed by using the four input lines to address the output line, passing data from one of the strobe inputs with the other strobe input low. When either strobe input is high, all outputs are high.



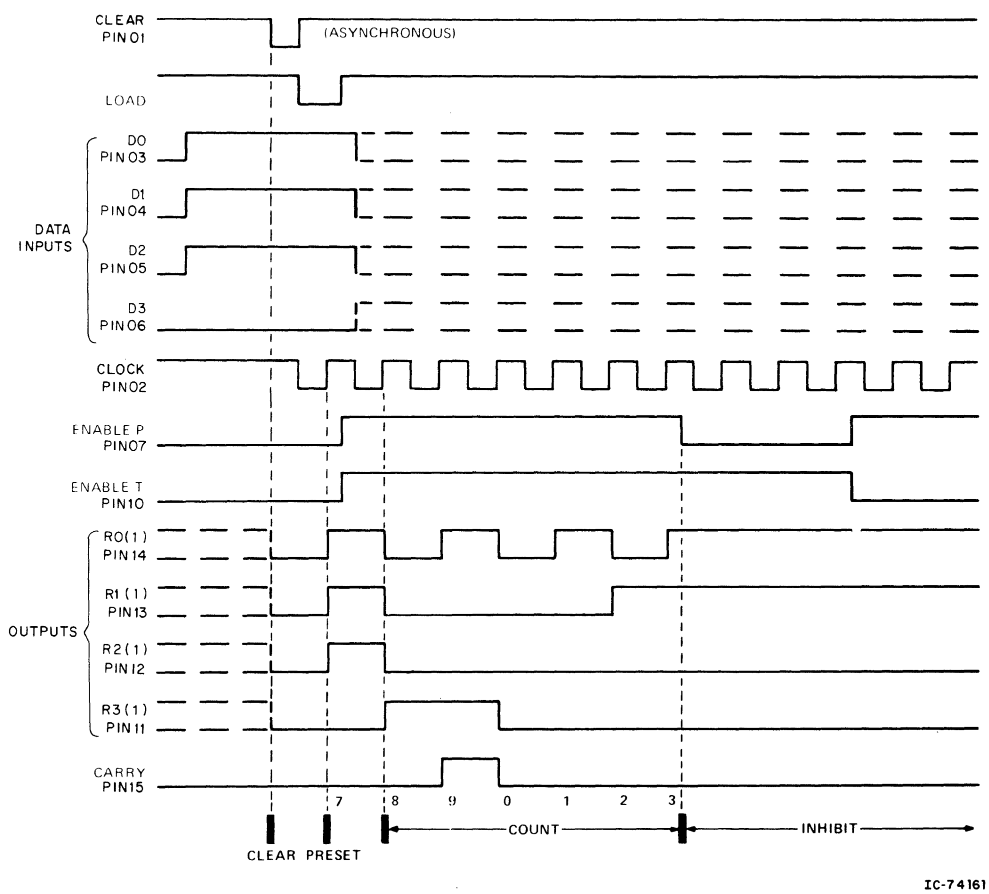
74161 4-BIT BINARY COUNTER



typical clear, preset, count, and inhibit sequences for 74161

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Preset to BCD seven.
3. Count to eight, nine, zero, one, two, and three.
4. Inhibit

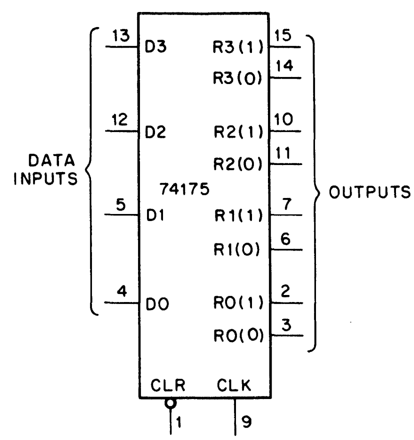


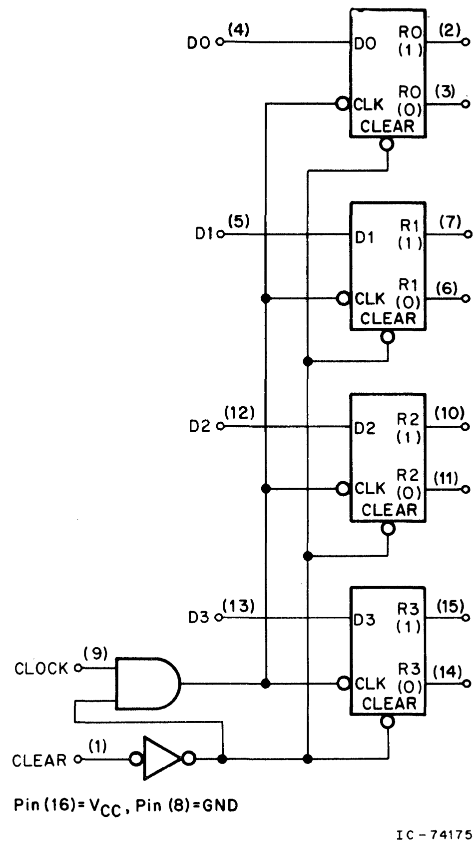
74175 QUAD D-TYPE FLIP-FLOP WITH CLEAR

TRUTH TABLE

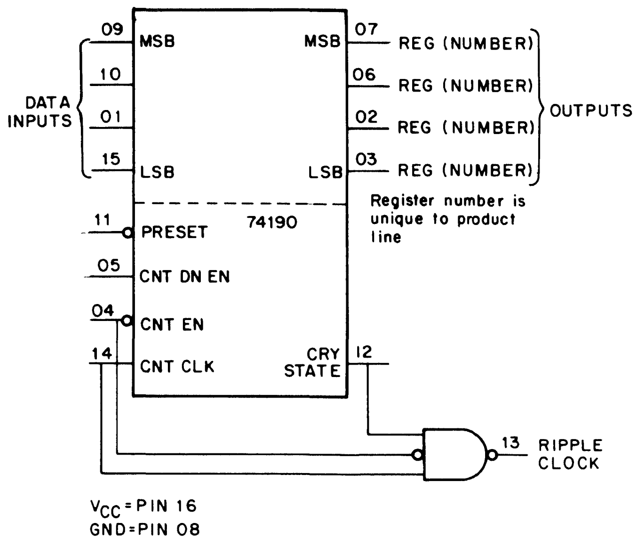
INPUT t_n	OUTPUTS t_{n+1}	
D	R(1)	R(0)
H	H	L
L	L	H

t_n = Bit time before clock pulse.
t_n+1 = Bit time after clock pulse.





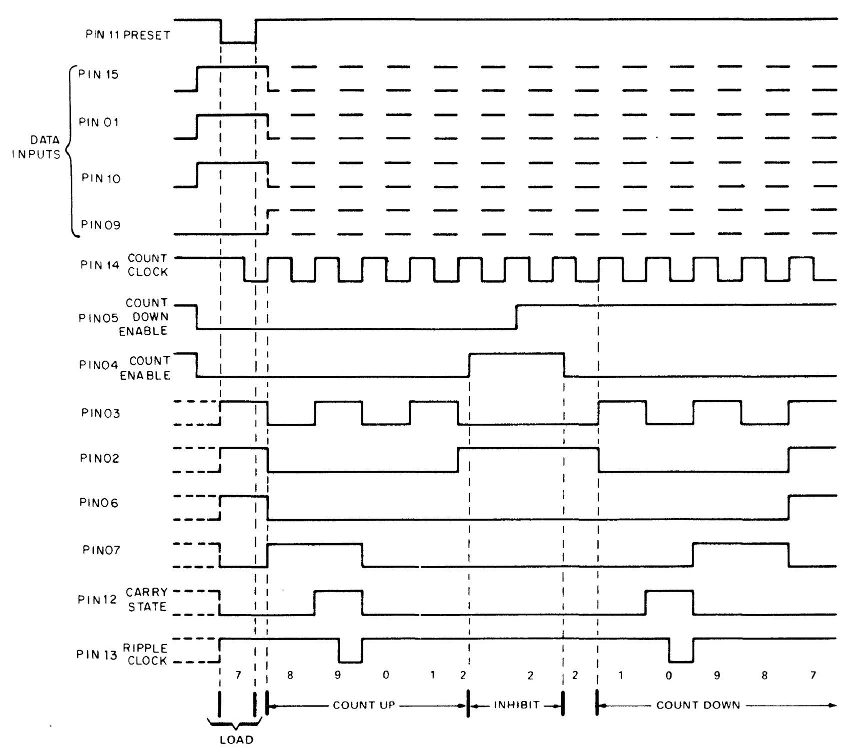
74190 COUNTER, SYNCHRONOUS UP/DOWN DECADE, 16 PIN



typical load, count, and inhibit sequences for 74190

Illustrated below is the following sequence:

1. Load (preset) to BCD seven.
2. Count up to eight, nine (maximum), zero, one, and two.
3. Inhibit.
4. Count down to one, zero (minimum), nine, eight, and seven.



IC-74190

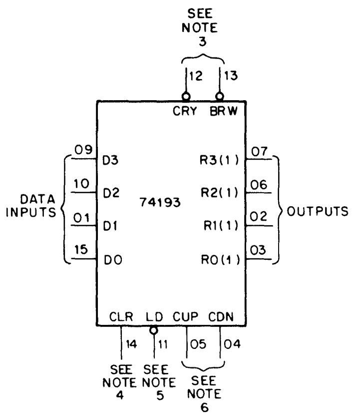
74193 SYNCHRONOUS 4-BIT UP/DOWN COUNTER

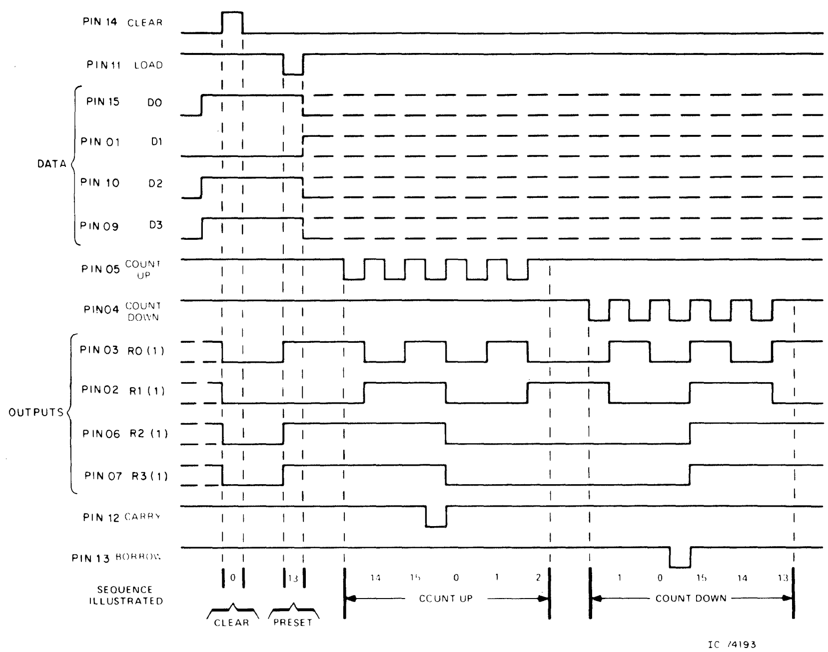
The 74193 Binary Counter has a individual asynchronous preset to each flip-flop, a fully independent clear input, internal cascading circuitry, and provides synchronous counting operations.

typical clear, load, and count sequences for 74193

Illustrated below is the following sequence:

1. Clear outputs to zero.
2. Load (preset) to BCD thirteen.
3. Count up to fourteen, fifteen, carry, zero, one, and two.
4. Count down to one, zero, borrow, fifteen, fourteen, and thirteen.



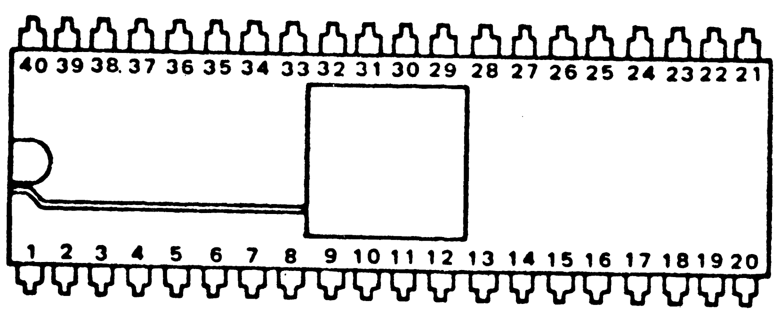


NOTES:

1. Clear overrides load, data, and count inputs.
2. When counting up, count down input must be high; when counting down, count-up input must be high.
3. Produce pulses equal to width of count pulses during: Underflow (BORROW) Overflow (CARRY)
4. CLR input high forces all outputs low. CLR overrides load, data and DN/UP inputs.
5. Preset to any state by applying input data with load input low. Output changes to agree with inputs independent of count pulses.
6. Select DN or UP clock while other is held high.

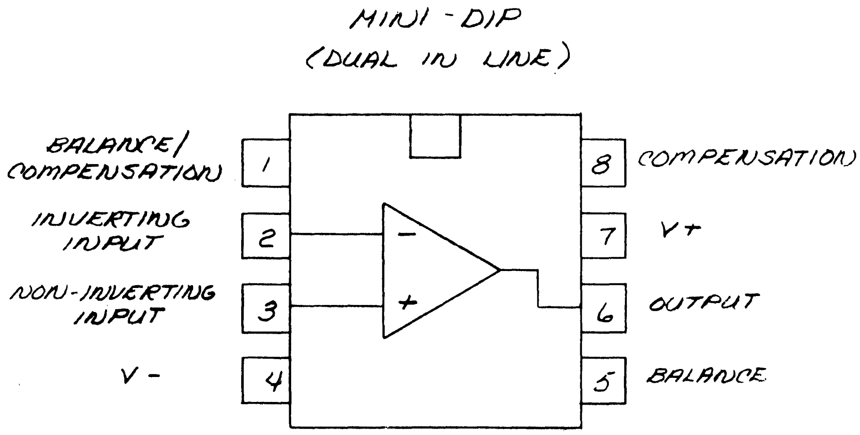
0119 UNIVERSAL ASYNCHRONOUS RECEIVER/TRANSMITTER

TOP VIEW



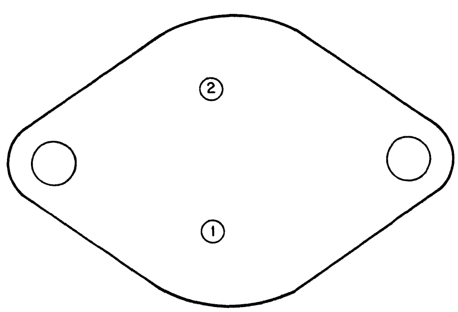
IC-0119

301 AN DIP OPERATIONAL AMPLIFIER



IC-0122

309 K REGULATOR



TERMINAL CONNECTIONS
PIN 1 = INPUT
PIN 2 = OUTPUT
CASE = GROUND

IC-0168

LA36 DECwriter II
Maintenance Manual
Volume I
EK-1LA36-MM-001

Reader's Comments

Your comments and suggestions will help us in our continuous effort to improve the quality and usefulness of our publications.

What is your general reaction to this manual? In your judgment is it complete, accurate, well organized, well written, etc.? Is it easy to use?

What features are most useful?

What faults do you find with the manual?

Does this manual satisfy the need you think it was intended to satisfy?

Does it satisfy *your* needs? Why?

Would you please indicate any factual errors you have found.

Please describe your position.

Name Organization

Street Department

City State Zip or Country

Fold Here

Do Not Tear - Fold Here and Staple

FIRST CLASS
PERMIT NO. 33
MAYNARD, MASS.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

Postage will be paid by:

Digital Equipment Corporation
Technical Documentation Department
Maynard, Massachusetts 01754

digital

DIGITAL EQUIPMENT CORPORATION, Corporate Headquarters: Maynard, Massachusetts 01754, Telephone: (617) 897-5111—SALES AND SERVICE OFFICES: UNITED STATES—ALABAMA, Huntsville • ARIZONA, Phoenix and Tucson • CALIFORNIA, El Segundo, Los Angeles, Oakland, Ridgecrest, San Diego, San Francisco (Mountain View), Santa Ana, Santa Clara, Stanford, Sunnyvale and Woodland Hills • COLORADO, Englewood • CONNECTICUT, Fairfield and Meriden • DISTRICT OF COLUMBIA, Washington (Lanham, MD) • FLORIDA, Ft. Lauderdale and Orlando • GEORGIA, Atlanta • HAWAII, Honolulu • ILLINOIS, Chicago (Rolling Meadows) • INDIANA, Indianapolis • IOWA, Bettendorf • KENTUCKY, Louisville • LOUISIANA, New Orleans (Metairie) • MARYLAND, Odenton • MASSACHUSETTS, Marlborough, Waltham and Westfield • MICHIGAN, Detroit (Farmington Hills) • MINNESOTA, Minneapolis • MISSOURI, Kansas City (Independence) and St. Louis • NEW HAMPSHIRE, Manchester • NEW JERSEY, Cherry Hill, Fairfield, Metuchen and Princeton • NEW MEXICO, Albuquerque • NEW YORK, Albany, Buffalo (Cheektowaga), Long Island (Huntington Station), Manhattan, Rochester and Syracuse • NORTH CAROLINA, Durham/Chapel Hill • OHIO, Cleveland (Euclid), Columbus and Dayton • OKLAHOMA, Tulsa • OREGON, Eugene and Portland • PENNSYLVANIA, Allentown, Philadelphia (Bluebell) and Pittsburgh • SOUTH CAROLINA, Columbia • TENNESSEE, Knoxville and Nashville • TEXAS, Austin, Dallas and Houston • UTAH, Salt Lake City • VIRGINIA, Richmond • WASHINGTON, Bellevue • WISCONSIN, Milwaukee (Brookfield) • INTERNATIONAL—ARGENTINA, Buenos Aires • AUSTRALIA, Adelaide, Brisbane, Canberra, Melbourne, Perth and Sydney • AUSTRIA, Vienna • BELGIUM, Brussels • BOLIVIA, La Paz • BRAZIL, Rio de Janeiro and Sao Paulo • CANADA, Calgary, Edmonton, Halifax, London, Montreal, Ottawa, Toronto, Vancouver and Winnipeg • CHILE, Santiago • DENMARK, Copenhagen • FINLAND, Helsinki • FRANCE, Grenoble and Paris • GERMANY, Berlin, Cologne, Frankfurt, Hamburg, Hannover, Munich and Stuttgart • HONG KONG • INDIA, Bombay • INDONESIA, Djakarta • IRELAND, Dublin • ITALY, Milan and Turin • JAPAN, Osaka and Tokyo • MALAYSIA, Kuala Lumpur • MEXICO, Mexico City • NETHERLANDS, Utrecht • NEW ZEALAND, Auckland • NORWAY, Oslo • PUERTO RICO, Santurce • SINGAPORE • SWEDEN, Gothenburg and Stockholm • SWITZERLAND, Geneva and Zurich • UNITED KINGDOM, Birmingham, Bristol, Edinburgh, Leeds, London, Manchester and Reading • VENEZUELA, Caracas •

Printed in U.S.A.