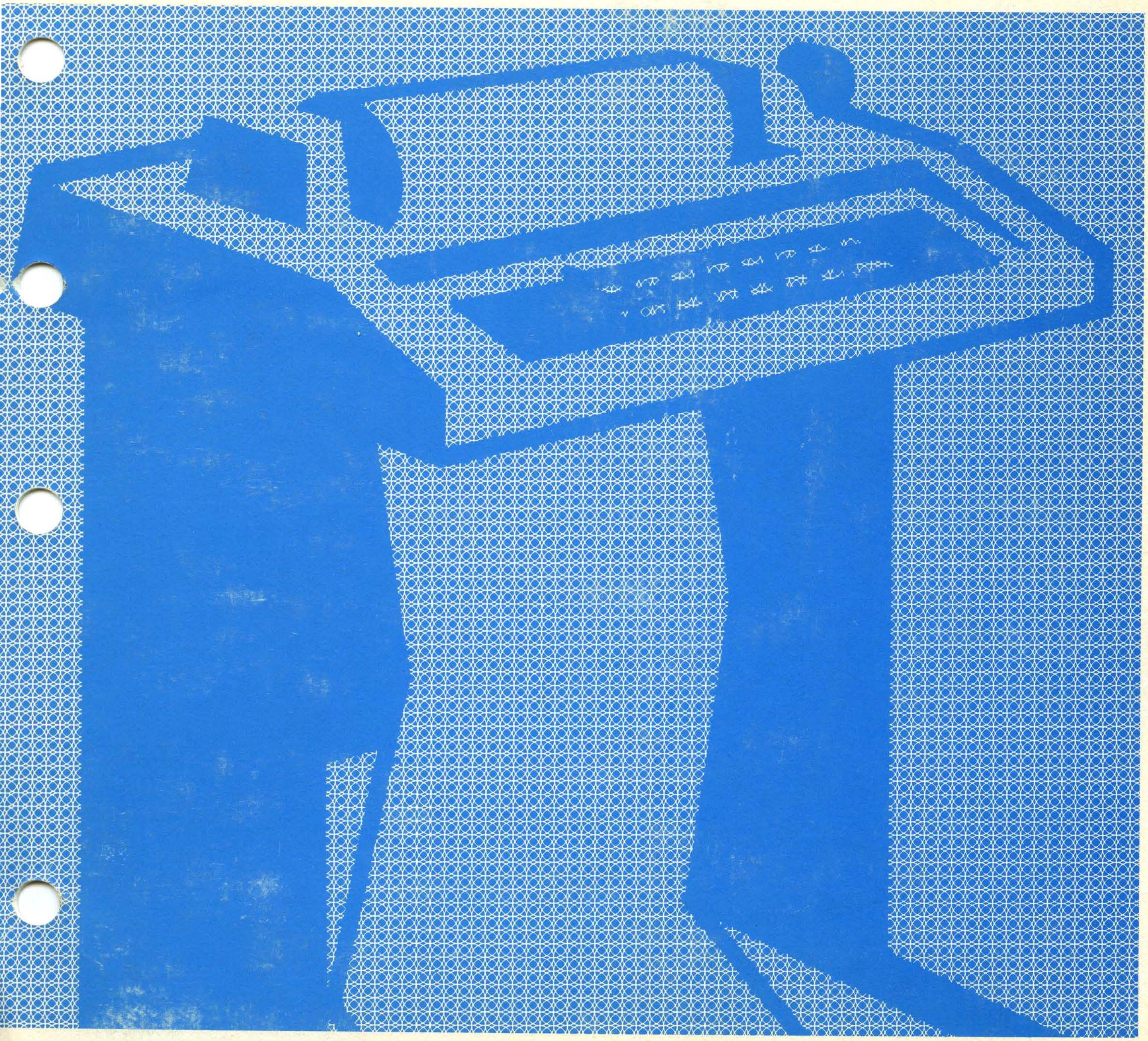
Digital Equipment Corporation
Maynard, Massachusetts

# LA36 DECwriter II
# MAINTENANCE MANUAL



EK-LA36-MM-001

# LA36 DECwriter II MAINTENANCE MANUAL

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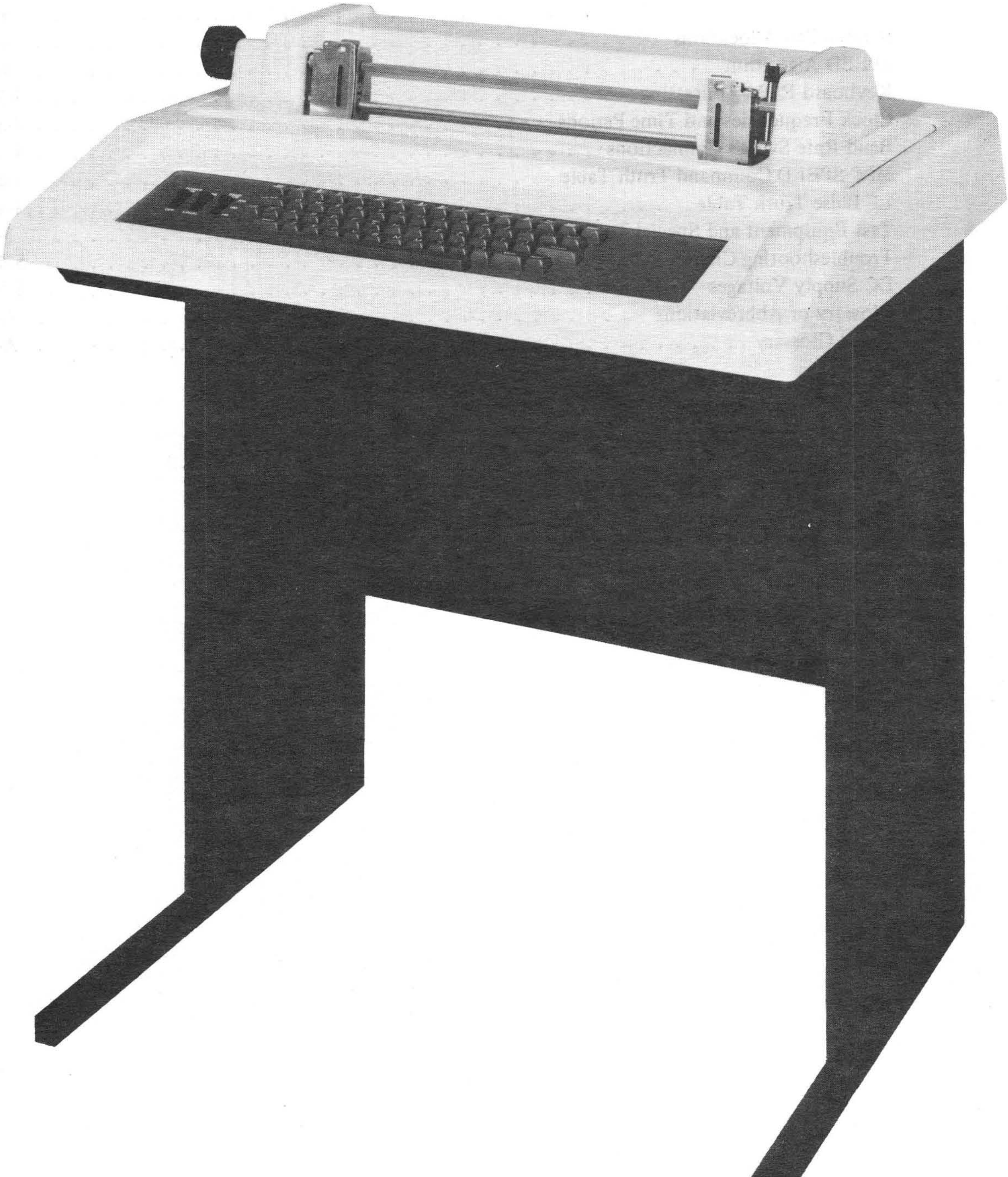

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LA36 DECwriter II

# CHAPTER 1
# GENERAL DESCRIPTION

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

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

**NOTE**

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

## 1.1 PHYSICAL CHARACTERISTICS

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

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

## 1.2 FUNCTIONAL DESCRIPTION

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

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

**Table 1-1**
**Standard ASCII Character Set and Code**

| 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 |

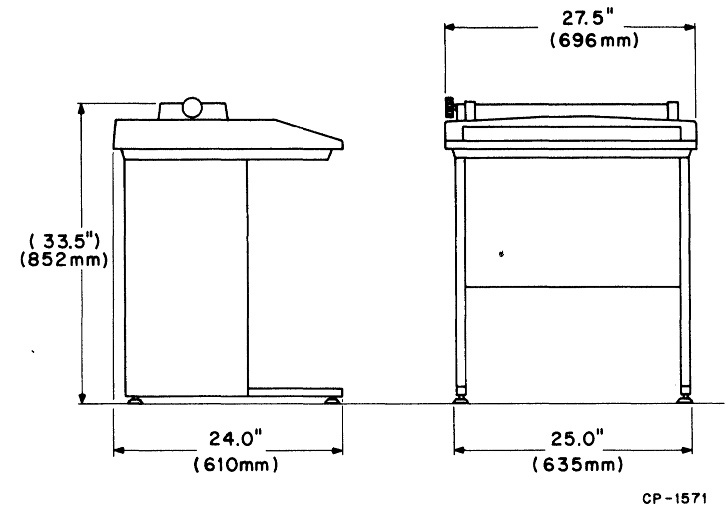



Figure 1-1 Outline Dimensions

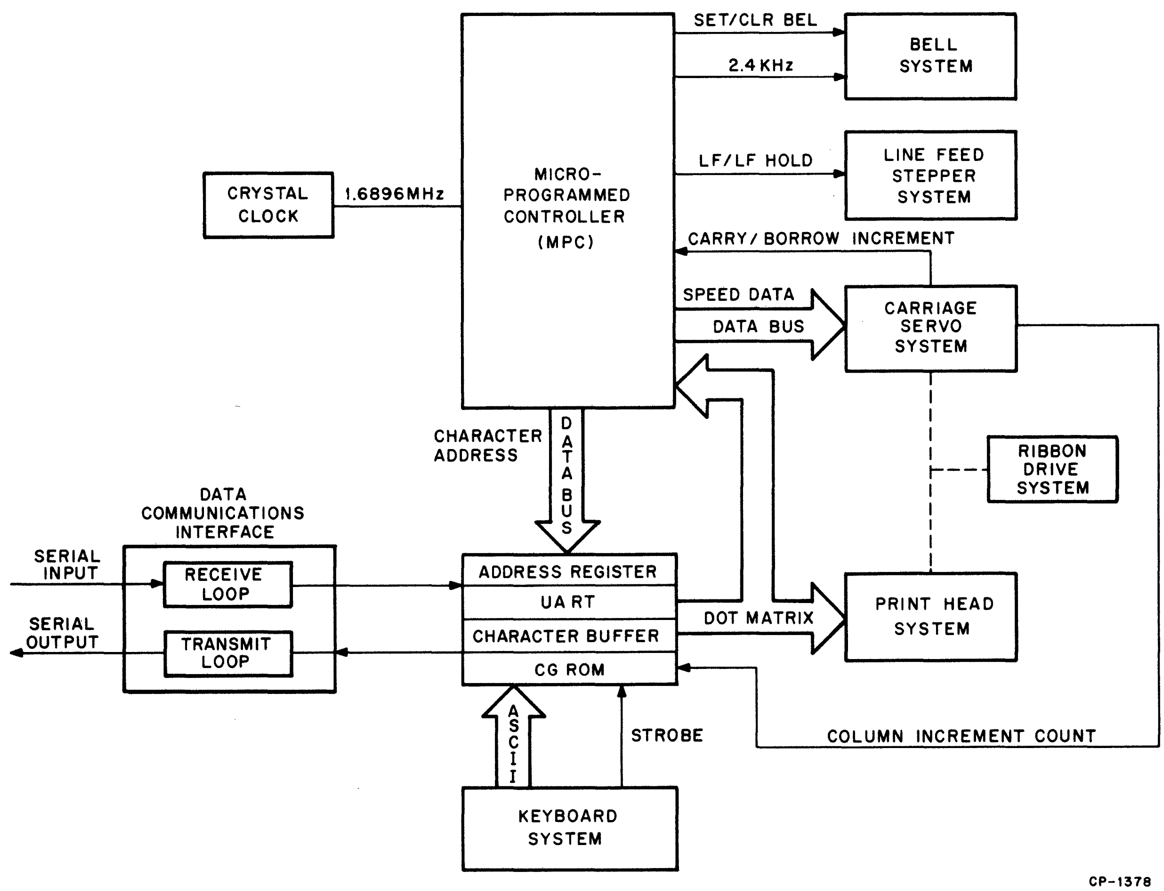



Figure 1-2 Functional Block Diagram

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

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

### 1.2.1 Character Printing

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

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

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

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

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

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

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

### 1.2.2 Bell Operation

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

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

### 1.2.3 Paper Feeding

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

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

| | | KEYBOARD OPERATIONS | | | RECEIVE OPERATIONS | |
|---|---|---|---|---|---|---|
| | | To Transmit, Type Key(s) | | | | |
| 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 | | √ | DELETE | None | None |
| 040 | SP | | | space bar | Blank Space | Print character, move print head one position to the right. |

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

Table 1-2 (Cont)
ASCII Codes and Responses

| | | KEYBOARD OPERATIONS | | | RECEIVE OPERATIONS | |
|---|---|---|---|---|---|---|
| | | To Transmit, Type Key(s) | | | | |
| ASCII Code | Character | SHIFT* | CTRL* | CHAR | 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 (Cont)
ASCII Codes and Responses

| | | KEYBOARD OPERATIONS | | | RECEIVE OPERATIONS | |
|---|---|---|---|---|---|---|
| | | To Transmit, Type Key(s) | | | | |
| 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 | ∧ | √ | | ∧ | ∧ | |
| 137 | — | | | — | — | |
| 140 | ` | | | ` | ` | |
| 141 | a | | | A | a | |
| 142 | b | | | B | b | |
| 143 | c | | | C | c | |
| 144 | d | | | D | d | |
| 145 | e | | | E | e | |
| 146 | f | | | F | f | |
| 147 | g | | | G | g | |
| 150 | h | | | H | h | Print character, move print head one position to the right. |

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

**Table 1-2 (Cont)**
**ASCII Codes and Responses**

| | | KEYBOARD OPERATIONS | | | RECEIVE OPERATIONS | |
|---|---|---|---|---|---|---|
| | | To Transmit, Type Key(s) | | | | |
| 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.

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

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

### 1.2.4 Ribbon Drive System

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

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

### 1.2.5 Carriage Servo System

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

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

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

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

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

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

### 1.2.6 Power Supply

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

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

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

### 1.2.7 Standard Current Loop Interface

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

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

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

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

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

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

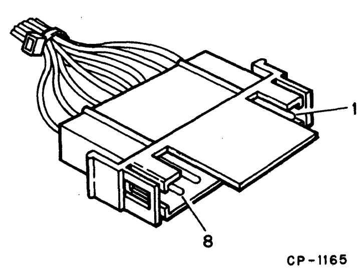



Figure 1-3 Current Loop Cable Connector Pin Designations

®Teletype is a registered trademark of Teletype Corporation.

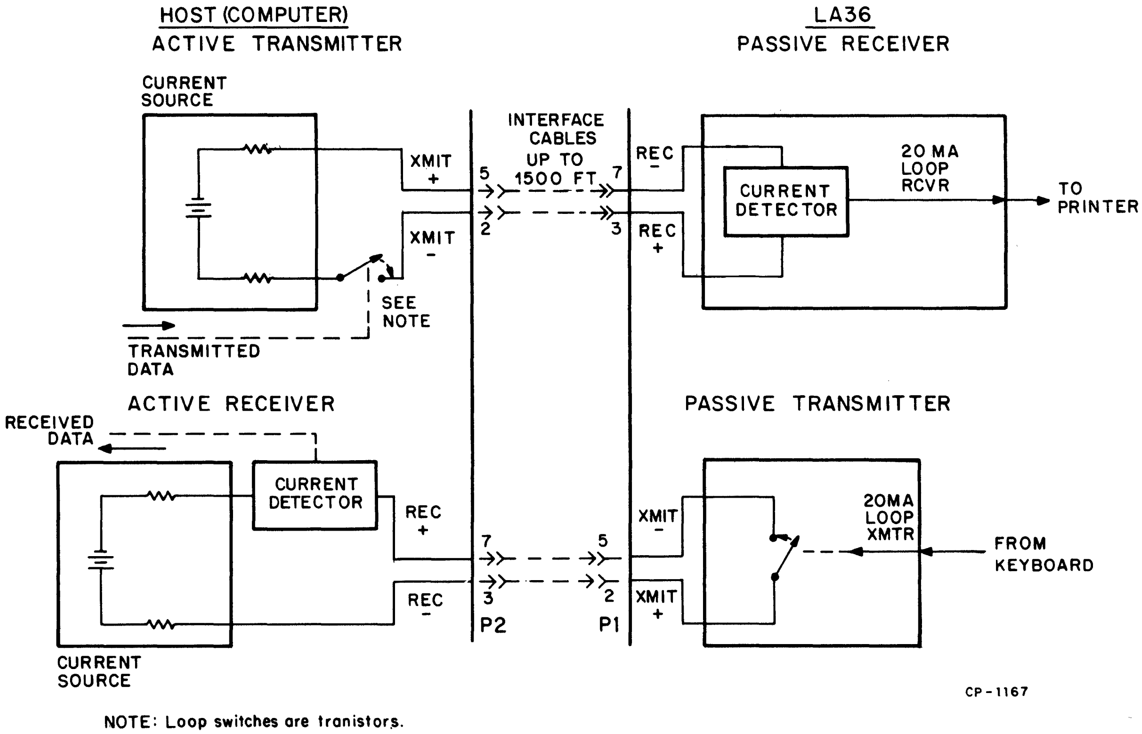



Figure 1-4 Standard Current Loop Interface

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

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

Cable pin connections are shown in Table 1-4.

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

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

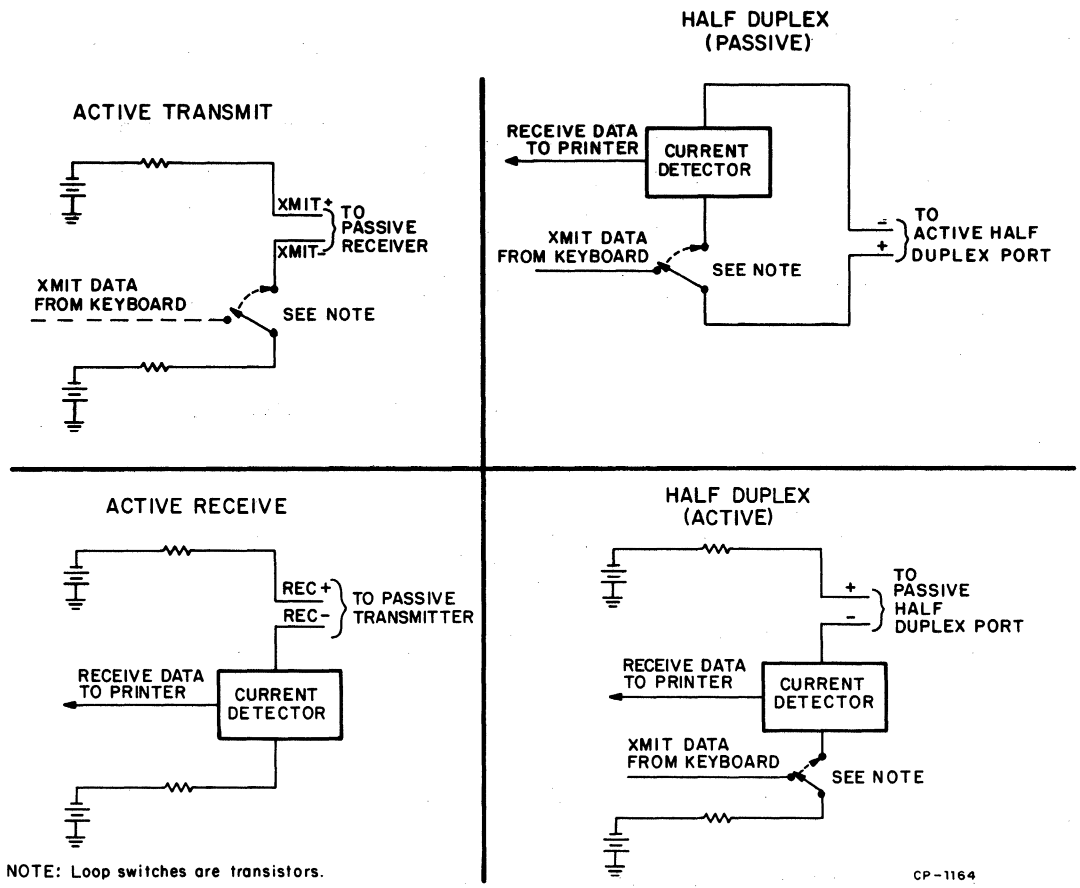



Figure 1-5 Optional Current Loop Configurations

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

### 1.2.9 Peripheral Interface Port

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

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

## 1.3 TECHNICAL CHARACTERISTICS

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

## 1.4 OPTIONAL FEATURES AND ACCESSORIES

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

### 1.4.1 EIA/CCITT Interface

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

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

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

**Table 1-6**
**Technical Characteristics**

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

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

| | |
|---|---|
| Keyboard | Standard ASCII typewriter-like layout, mechanical contact with four parallel switches. |
| Paper Handling | Tractor feed, 3 engaging pins, movable right-hand tractor for 3 to 14-7/8 in. forms, manual print gap adjustment for 1 to 6 part forms, vernier vertical adjustment for custom preprinted forms. |
| Paper | Single-Part: 12 to 20 lb. (card up to 0.007 thick)<br><br>Multi-Part: 2 to 6 part (no cards except last copy)<br><br>Max. thickness (no card) 0.020 in.<br>Max. thickness (single card, last copy) 0.020 in.<br><br>**NOTE**<br>**NCR or 3M paper (up to 6-part) must use ribbon on top copy. First surface impact paper is not recommended.**<br><br>Continuous feed, fan-fold business forms with 3- or 4-prong margin crimps on both margins (multi-part).<br><br>**NOTE**<br>**Stapled forms are not recommended and may damage tractors and other areas of the machine. Dot or line glue margins are acceptable (if line glue is on one margin only).**<br><br>**CAUTION**<br>**Do not line glue both margins; air will not be able to escape and poor impressions will result.** |
| Transmission Rates | 110 baud 11 bit, 150 and 300 baud 10 bit; switch-selectable at keyboard panel |
| Modes of Operation | Local or full duplex on-line, switch-selectable at keyboard panel |
| Parity | None |
| Interface | Integrated 20 mA current loop, full-duplex passive operation. Connectors are 8-pin Mate-N-Lok type. |
| Power | 90–132 Vac, 48–63 Hz<br>180–264 Vac, 48–63 Hz<br>300 W max. (printing)<br><br>160 W (non-printing) |
| Mechanical | Mounting: free-standing pedestal unit<br><br>Size: 33.5 in. (852 mm) H X 27.5 in. (696 mm) W X 24 in. (610 mm) D<br><br>Weight: 102 lbs. (46 kg) |

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

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

Table 1-7
**Interface Specifications**

**Transmitter**

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

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

**Receiver**

(Passive, isolated)

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

**Cable**

4-conductor

Standard 15-ft BC05F-15 supplied with LA36

Cable extension is 1500 ft. max.

**Receiver/Transmitter**

(Active, half-duplex)

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

Table 1-8
EIA/CCITT Interface Connector Pins

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

# CHAPTER 2
# INSTALLATION

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

## 2.1 SITE CONSIDERATIONS

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

## 2.2 SYSTEM CONFIGURATION

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

## 2.3 UNPACKING AND INSPECTION

To unpack and inspect the LA36, proceed as follows:

1. Remove the outer cardboard shipping container carefully so as not to damage any of the inner contents. (Use care when using carton knives and prying tools.)

2. Remove all shock absorbing laminated material from around the printer and set it aside.

3. Remove the poly bag from the printer and discard it.

4. Remove the foam pad from the top of the keyboard along with the two filament tapes that secure it to the frame.

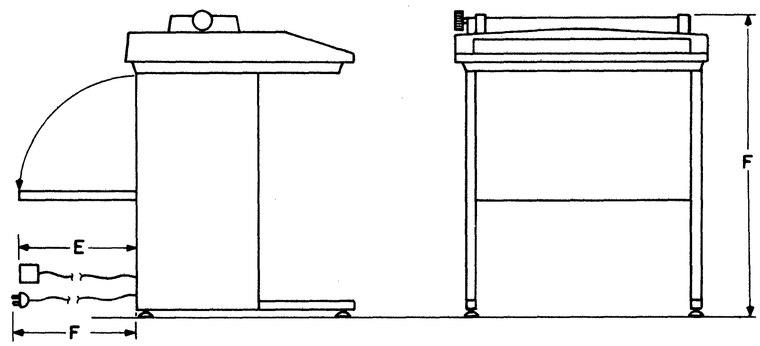
5. Lift the LA36 cover and clip the cable tie that secures the head in the left-most position.

**CAUTION**
**Do not allow the tie to fall into the machine.**

6. Inspect the external surface for possible shipping damage. Check the packing list. Report any damaged or missing items to the local DEC Field Service or Sales Office.

7. Ensure that the cover hinge and fasteners are intact.

8. If it appears that the cover has been dislodged in shipping, inspect the internal mechanical parts to see if damage has been done.




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

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

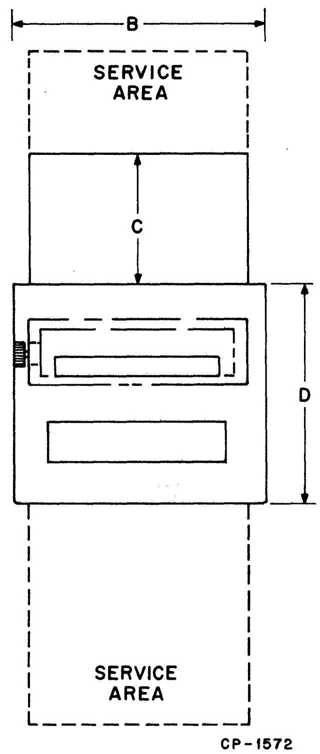



Figure 2-1 Site Considerations

9. Check to see that the keyboard bezel has not shifted (keys should not bind).

10. Open the rear access door and check the security of all connectors.

11. Locate the DECwriter II near its operating position.

## 2.4 INSTALLATION PROCEDURE

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

1. Locate the DECwriter II at its final operating position.

2. Adjust the leveling feet on the stand until the unit is leveled.

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

4. Remove the power cable from its storage position and connect it to the power source.

**CAUTION**

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

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

**NOTE**

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

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

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

7. Parity Setting – The LA36 is configured with no parity. To modify this configuration, insert or remove jumpers as directed in Table 2-1. Jumper locations are shown in Figure 2-2.

8. Bell Volume – To lower the volume of the bell tone, cut jumper W1.

9. Current Loop – The LA36 is normally configured for full-duplex passive operation. To modify this configuration, insert or remove jumpers as directed in Table 2-2.

**Table 2-1**
**Parity Configuration Jumpers**

| Function | W10 |
|---|---|
| 8th Bit Marking | 1 |
| Even Parity | 0 |

Legend: 0 = Jumper inserted
1 = Jumper not inserted

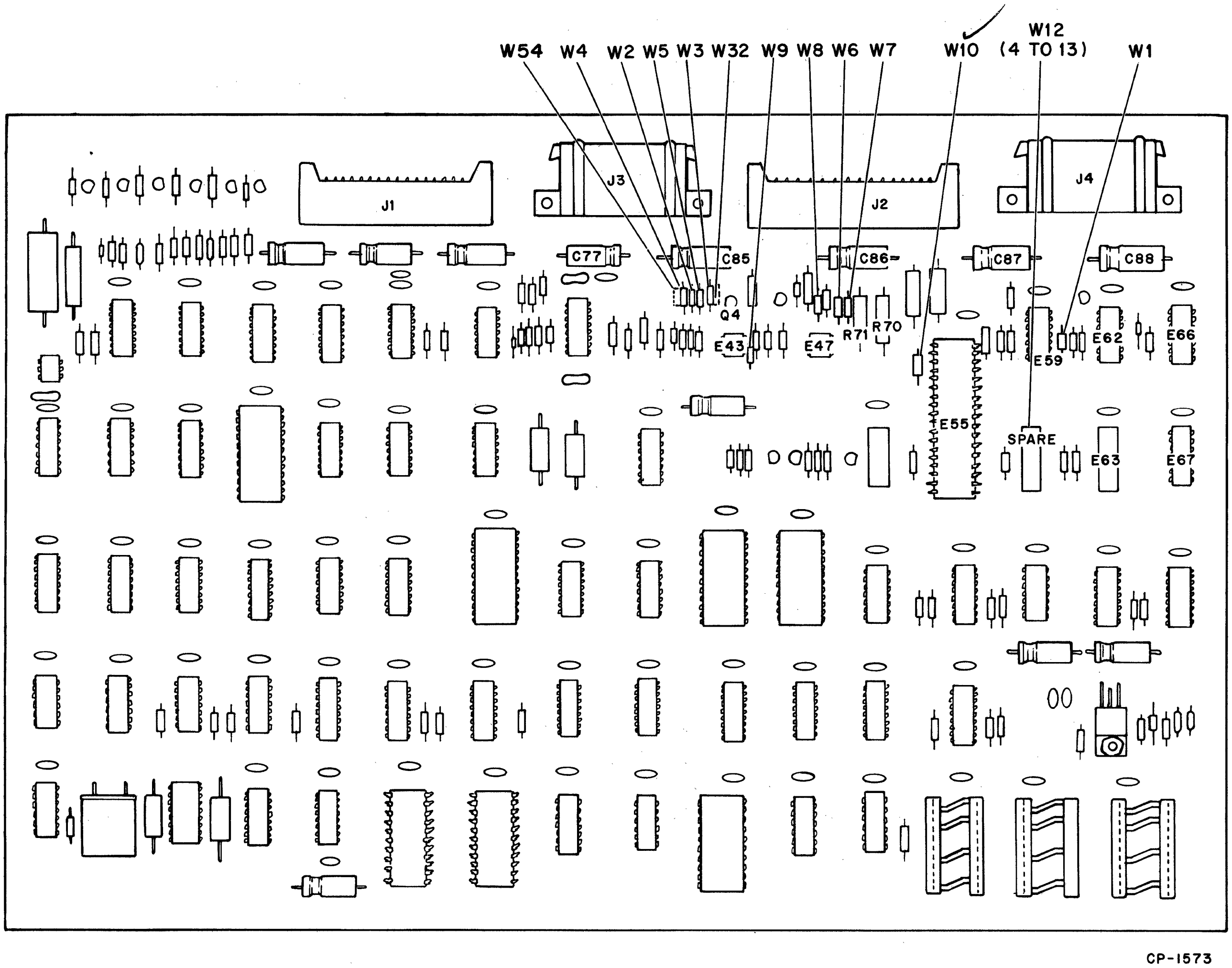



Figure 2-2 Jumper Location Diagram

## 2.5 CHECKOUT AND ACCEPTANCE PROCEDURES

Check the following items before running the electrical checkout procedure.

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

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

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

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

Legend: 1 = Jumper inserted
0 = Jumper not inserted

5. Set the BAUD RATE switch to 300 and the LINE/LOCAL switch to LOCAL.

6. Press the LINE FEED key and then hold down the CTRL key and press the BELL key. The stepping motor should advance the paper one line and the bell tone should sound. If not, refer to symptoms 3 and 4a of Table 5-2.

7. Press the / (slash) or @ key and the REPEAT key. The print head should travel smoothly along the print bar and print the corresponding character. When the print head passes the 64th character position, the bell tone should sound. If the bell tone does not sound, refer to symptom 4b of Table 5-2. If the print head hangs up trying to print a character, refer to symptom 5 of Table 5-2. If other symptoms appear, look for the corresponding symptom in Table 5-2.

8. Press the BACKSPACE key. If the print head does not move one character position to the left, refer to symptom 13 of Table 5-2.

9. Press the RETURN key after 132 characters have printed and observe the return of the print head to the "home" (LCV) position. It should take approximately 1/2 second. If it takes longer, refer to symptom 12 of Table 5-2.

10. Set the BAUD RATE switch to the setting prescribed for the operating system.

11. Set the LINE/LOCAL switch to LINE and run customer-provided programs to check that the unit operates satisfactorily when connected to the system.

# CHAPTER 3
# OPERATION

## 3.1 OPERATOR CONTROLS

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

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

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

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

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

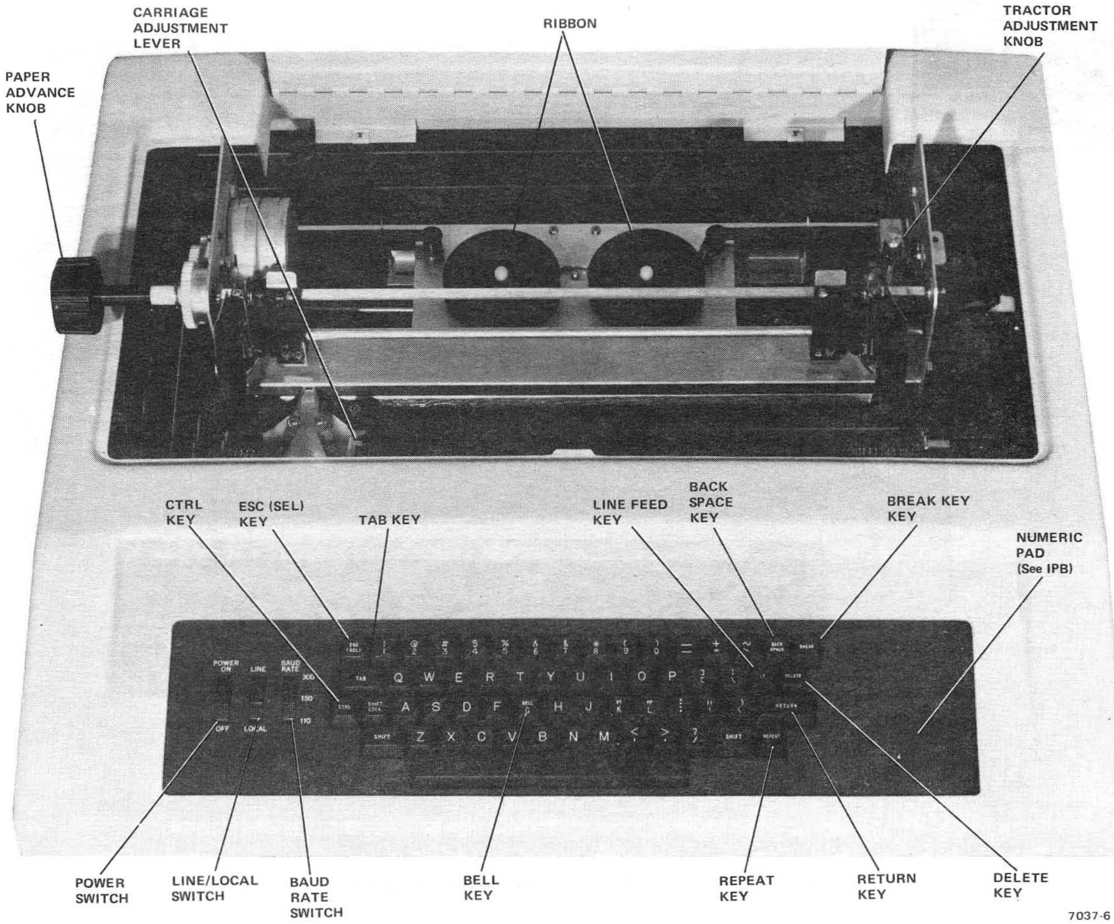



Figure 3-1 Operator Controls

## 3.2 OPERATING PROCEDURES

### 3.2.1 Loading Paper

1. Set POWER switch to OFF.

2. Move the Carriage Adjustment Lever (Figure 3-2) toward the keyboard as far as possible; this creates space for inserting paper.

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

4. Open both tractor covers (Figure 3-4) so that the tractor pins are exposed. Insert the left side of the paper with the holes aligned directly over the tractor pins. Close the left side tractor cover.

5. Feed the paper through the load channel under the terminal. Draw the paper up as it passes between the print head and the print bar (Figure 3-3).

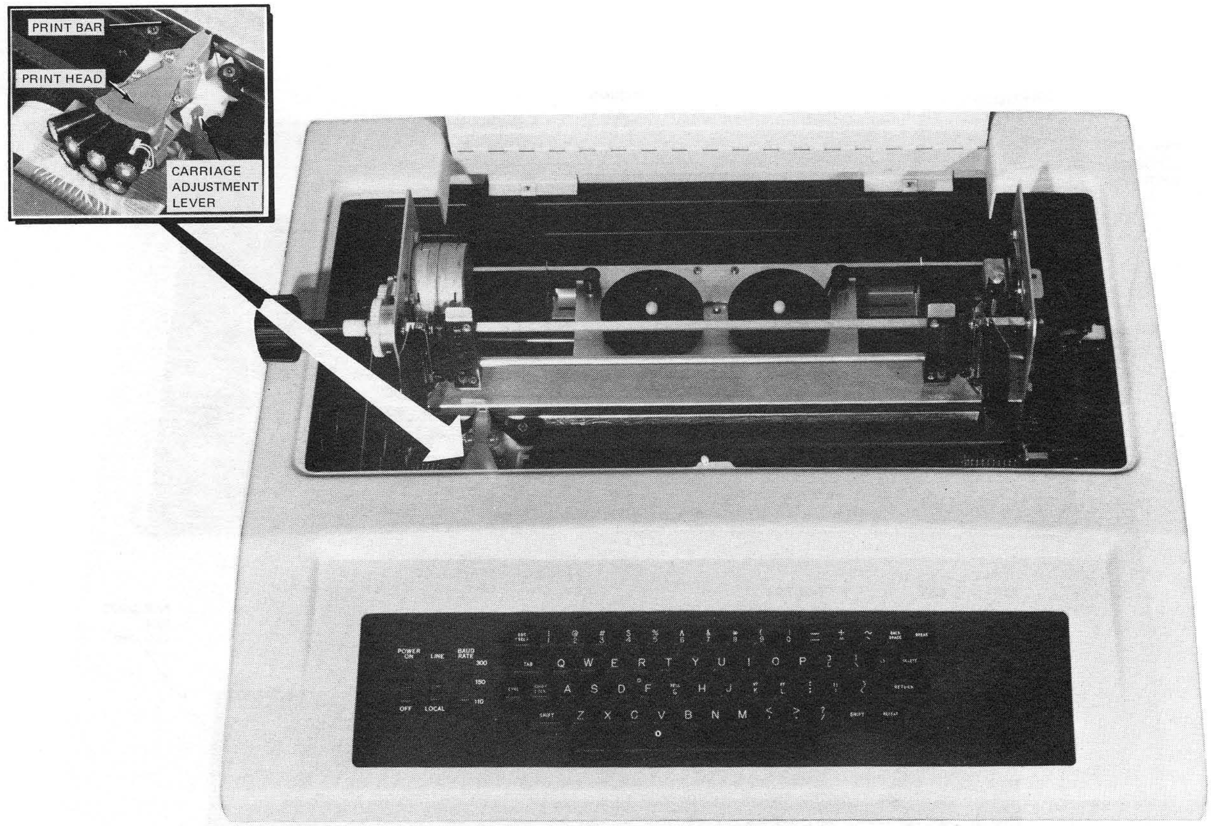



Figure 3-2 Carriage Adjustment Lever

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

**NOTE**

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

**1. Paper holes will be distorted.**
**2. Paper may become dislodged from tractor.**
**3. Spacing between lines may become uneven.**

7. Adjust the carriage adjustment lever so that the print head is near, but not exerting pressure on the paper. There should be no friction between the paper and the print head as either moves.

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

Figure 3-3 Paper Loading

To check for proper print head alignment:

a. Manually turn the Paper Advance Control counterclockwise. If the print head is set too close, the paper will be smudged as it moves up past the print head.

b. Set the POWER switch to ON; set the LINE/LOCAL switch to LOCAL. Type a short line of text. If the print head is too far from the paper, the characters will not print or they will not have uniform dot density.

**CAUTION**

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

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

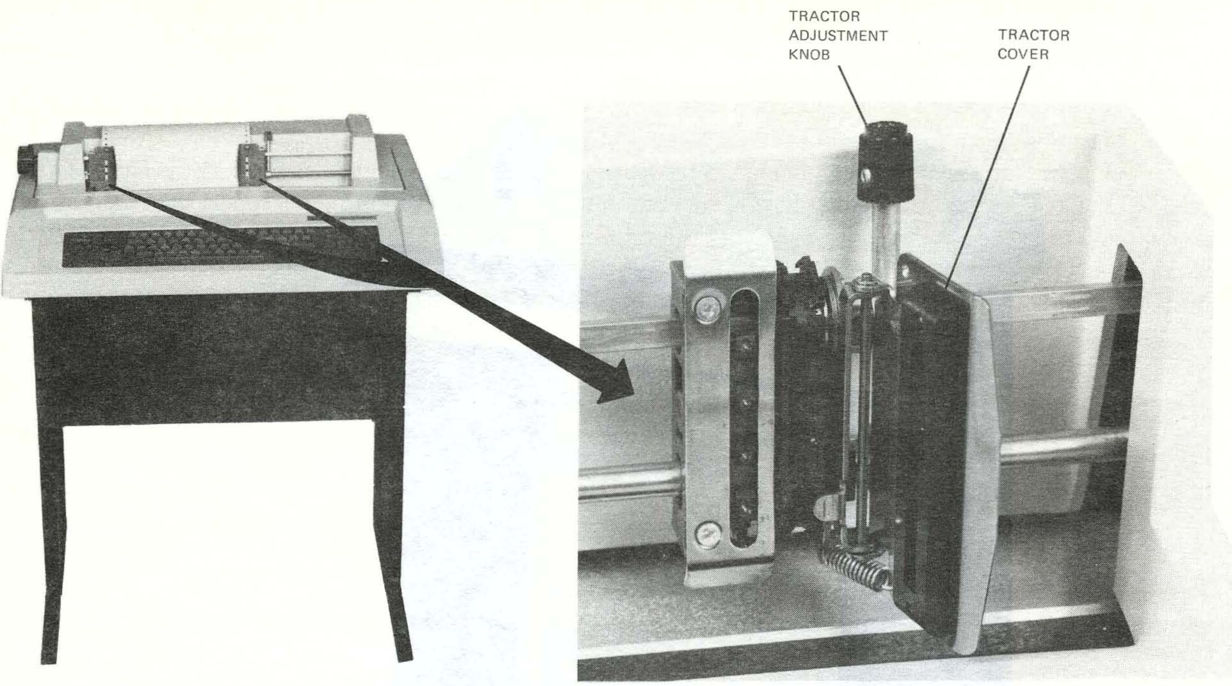



Figure 3-4 Tractor Adjustment Knob

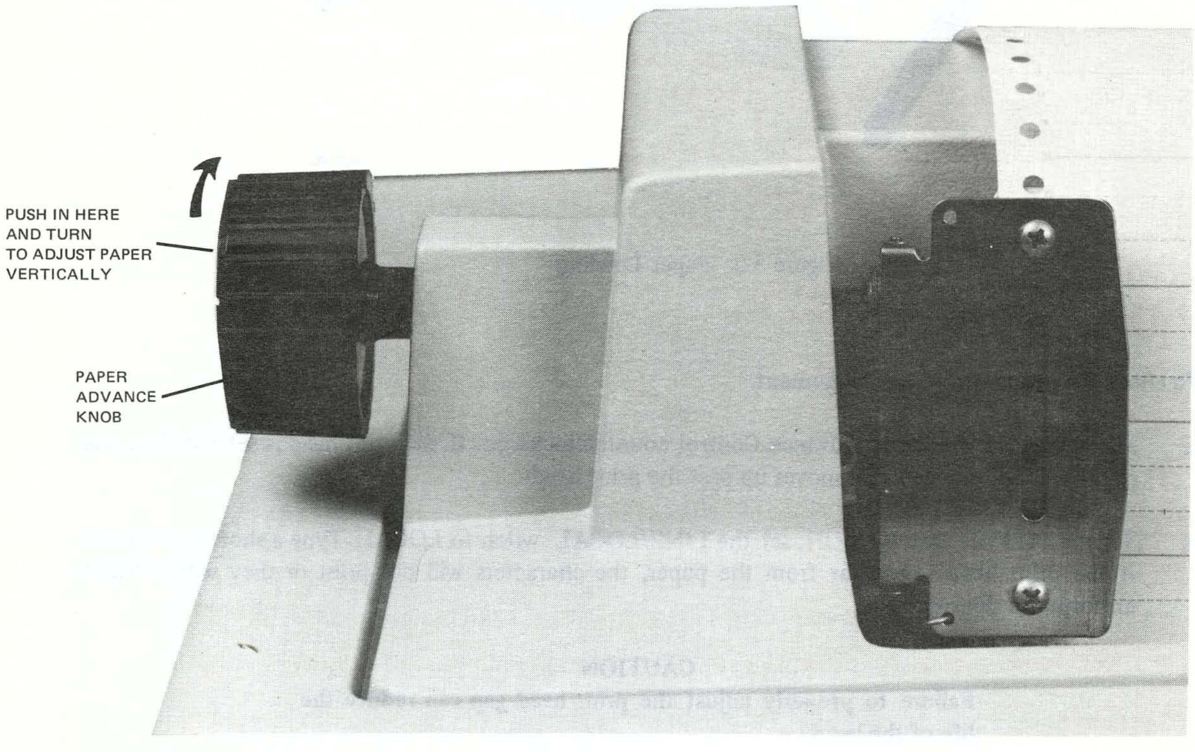



Figure 3-5 Paper Advance Knob

### 3.2.2 Changing Ribbon

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

1. Set POWER switch to OFF.

2. Raise the top cover.

3. Move the Carriage Adjustment Lever (Figure 3-2) toward the keyboard. This moves the print head away from the paper to create enough space to remove the ribbon.

4. Lift the ribbon (Figure 3-6) off the print head and unwind it from the idler spools.

5. Lift the two ribbon reels from their hubs.

6. Place the full reel of new ribbon on the left hub and play out enough ribbon to feed through the slot, around the idler spools, and in front of the print head.

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

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

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

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

   a. Not act to change ribbon direction

   b. Move around the idlers, stall the machine and blow the 2 A Slo Blo servo fuse.

7. Take up any slack in the ribbon by turning the takeup reel clockwise.

8. Return the carriage adjustment lever to its original position.

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

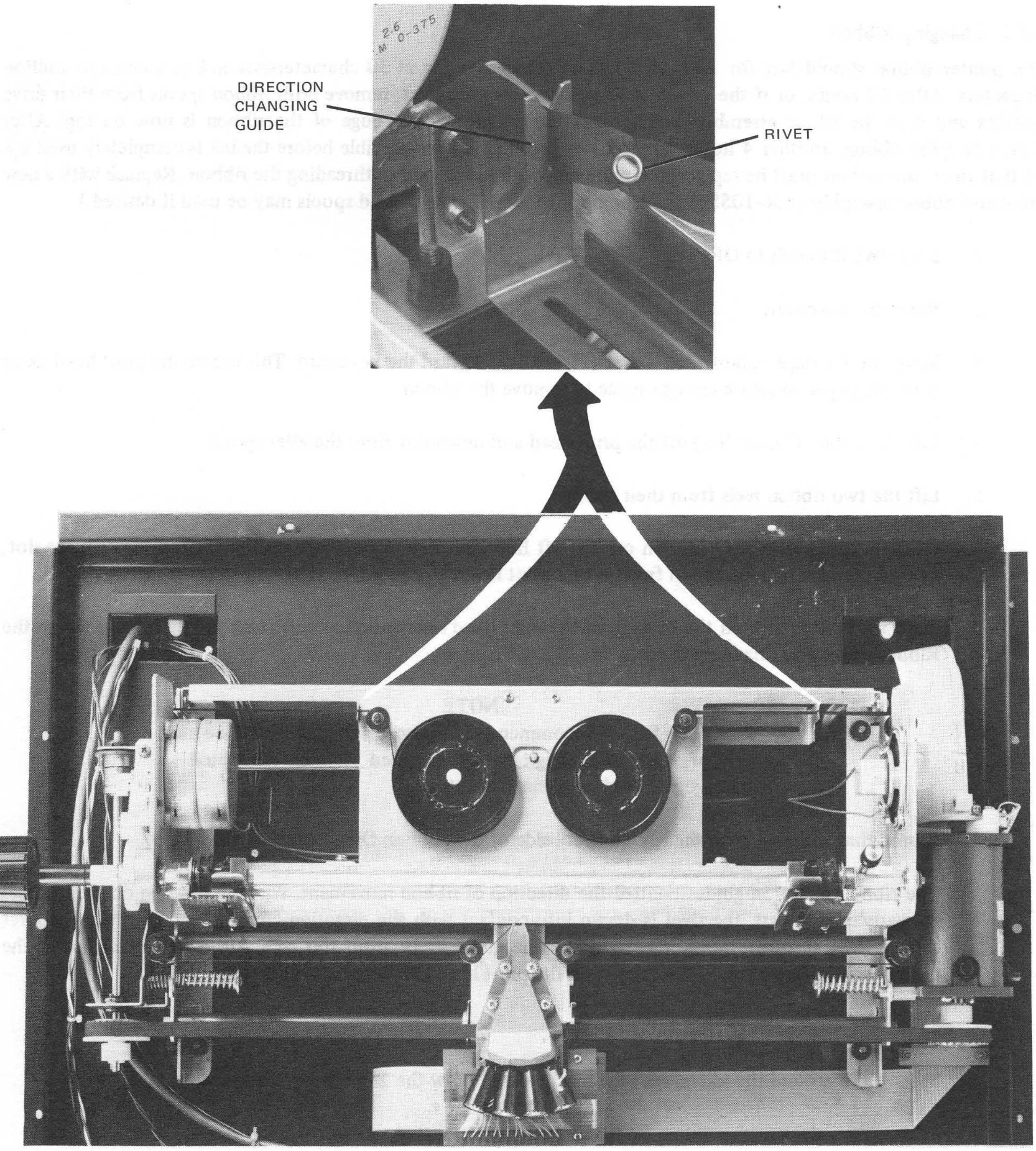



Figure 3-6 Ribbon Direction Changing Guide

### 3.2.3 Troubleshooting

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

**Table 3-2**
**Operator Troubleshooting**

| Symptom | Possible Cause and Corrective Action |
|---|---|
| LA36 does not turn on when POWER switch is set to ON | • 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). |
| Print head does not print characters | • Interface cord might be loose and thus a contact may not be made – "jiggle" the cord slightly. |
| | • Print head may be set too far from paper – adjust the carriage adjustment lever as directed in Table 3-1. |
| Light print | • Print head may be set too far from paper – adjust the carriage adjustment lever as directed in Table 3-1. |
| | • Ribbon ink has run out – replace ribbon. |
| | Change ribbon every 8–12 hours of continuous printing. |
| Paper does not advance | • Improper loading of paper – check tractor covers to ensure that they are closed. |
| | • Holes in paper are torn – turn LA36 OFF and reload paper properly. |
| | • Paper snagged or caught by box. |
| Paper tearing on multi-part forms | • Print head is exerting pressure on paper so that paper tears when it advances – check carriage adjustment control lever position. |
| | • Tension exerted on the paper by the tractors is incorrect. Adjust by changing horizontal position of right hand tractor. |
| Line bunching | • Tension exerted on the paper by the tractors is excessive. Adjust by changing horizontal position of right hand tractor. |
| No keyboard or printer response | • LINE/LOCAL switch set to wrong position. |

## 3.3 CAUTIONS

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

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

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

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

# CHAPTER 4
# THEORY

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

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

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

| | | |
|---|---|---|
| DEC 1 | SET HDE | MPC 4 |
| logic function | signal name | page location |

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

### 4.1 PROGRAM DESCRIPTION

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

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

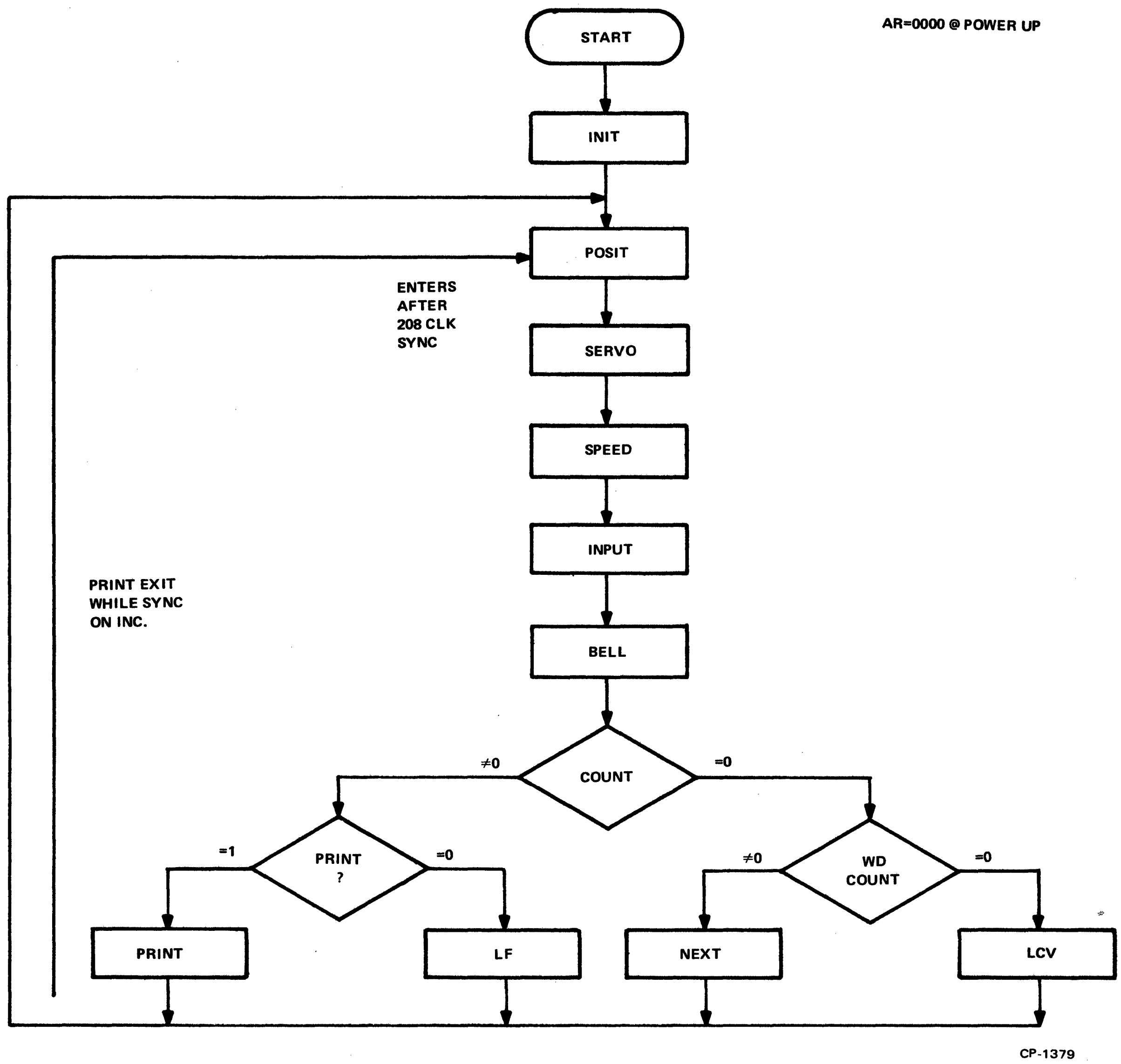



Figure 4-1 Microprogram Flow Diagram

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

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

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

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

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

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

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

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

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

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

### 4.1.1 Scratch Pad Memory

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

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

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

**Table 4-1**
**Scratch Pad Allocations**

| Octal Location | Mnemonic | Usage |
|---|---|---|
| 0 | POS LO | 12-Bit Carriage Position (Relative to column) |
| 1 | POS MD | |
| 2 | POS HI | |
| 3 | COL LO | 8-Bit Column Count (Records columns printed) |
| 4 | COL HI | |
| 5 | RD ADR<br>LCV 1 | Character Buffer Read Address<br>LCV Timer |
| 6 | WT ADR<br>LCV 1 | Character Buffer Write Address<br>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<br>LCV 2<br>LF 1<br>PT 1<br>INIT 1 | LSB=1 for Print<br>LCV Timer<br>Line Feed Timer<br>Print Timer<br>Init Timer |
| 13 | POS ER<br>LF 2<br>PT 2<br>INIT 2 | Position Error<br>Line Feed Timer<br>Print Timer<br>Init Timer |
| 14 | LCV ST<br>LCV 3 | LCV Status<br>LCV Timer |
| 15 | BELL 1 | Bell Timer |
| 16 | BELL 2 | Bell Timer |
| 17 | BELL ST | Bell Count (Status) |

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

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

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

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

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

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

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

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

### 4.1.2 Initialization Routine (INIT)

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

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

### 4.1.3 Position Routine (POSIT)

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

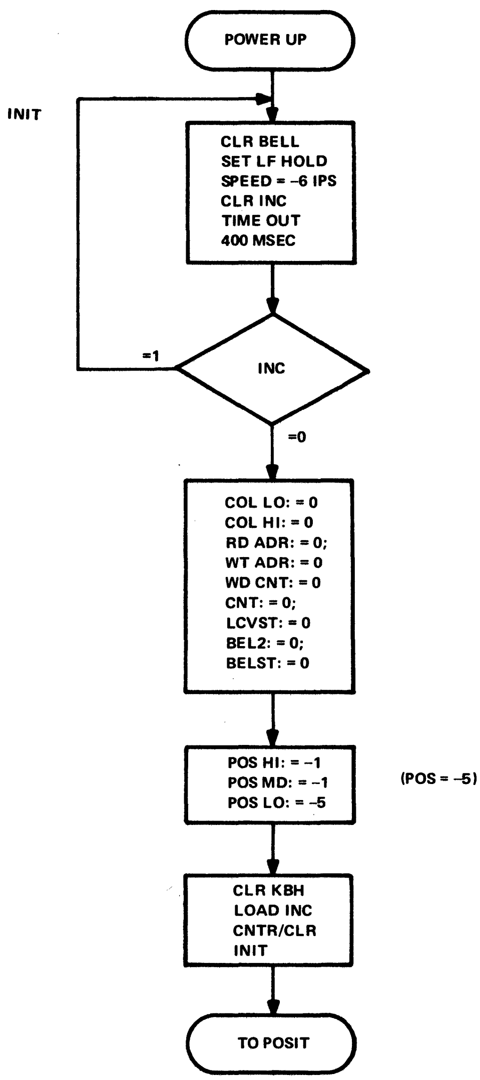



Figure 4-2 Initialize Routine

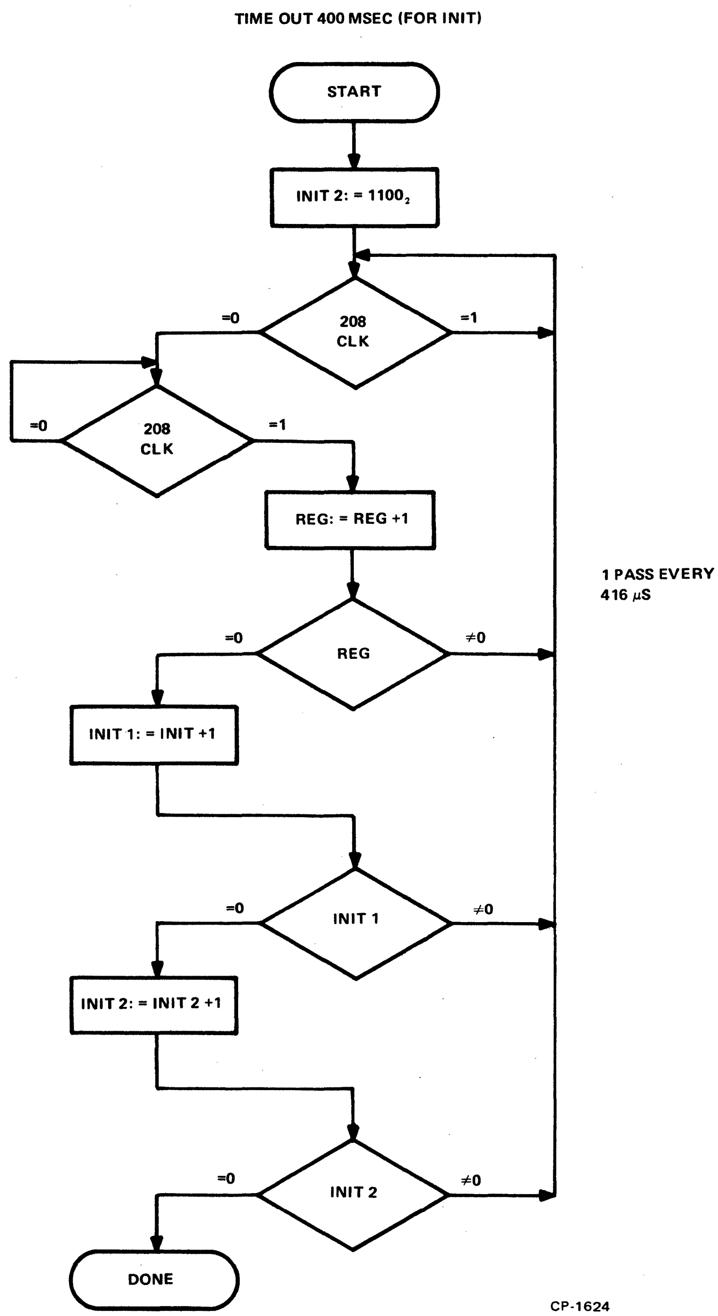



Figure 4-2a Start Routine for Initialize

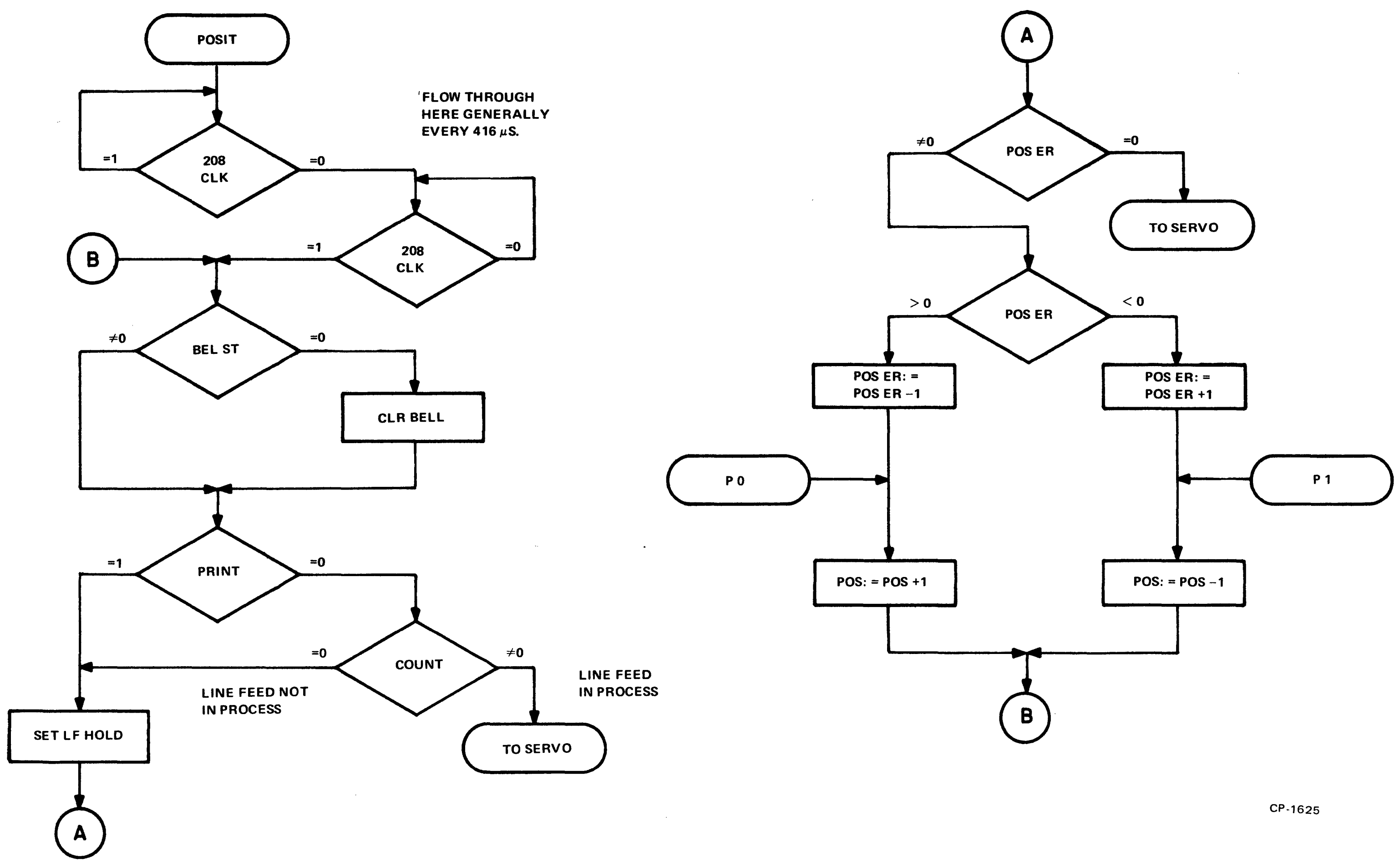



Figure 4-3 Position Routine

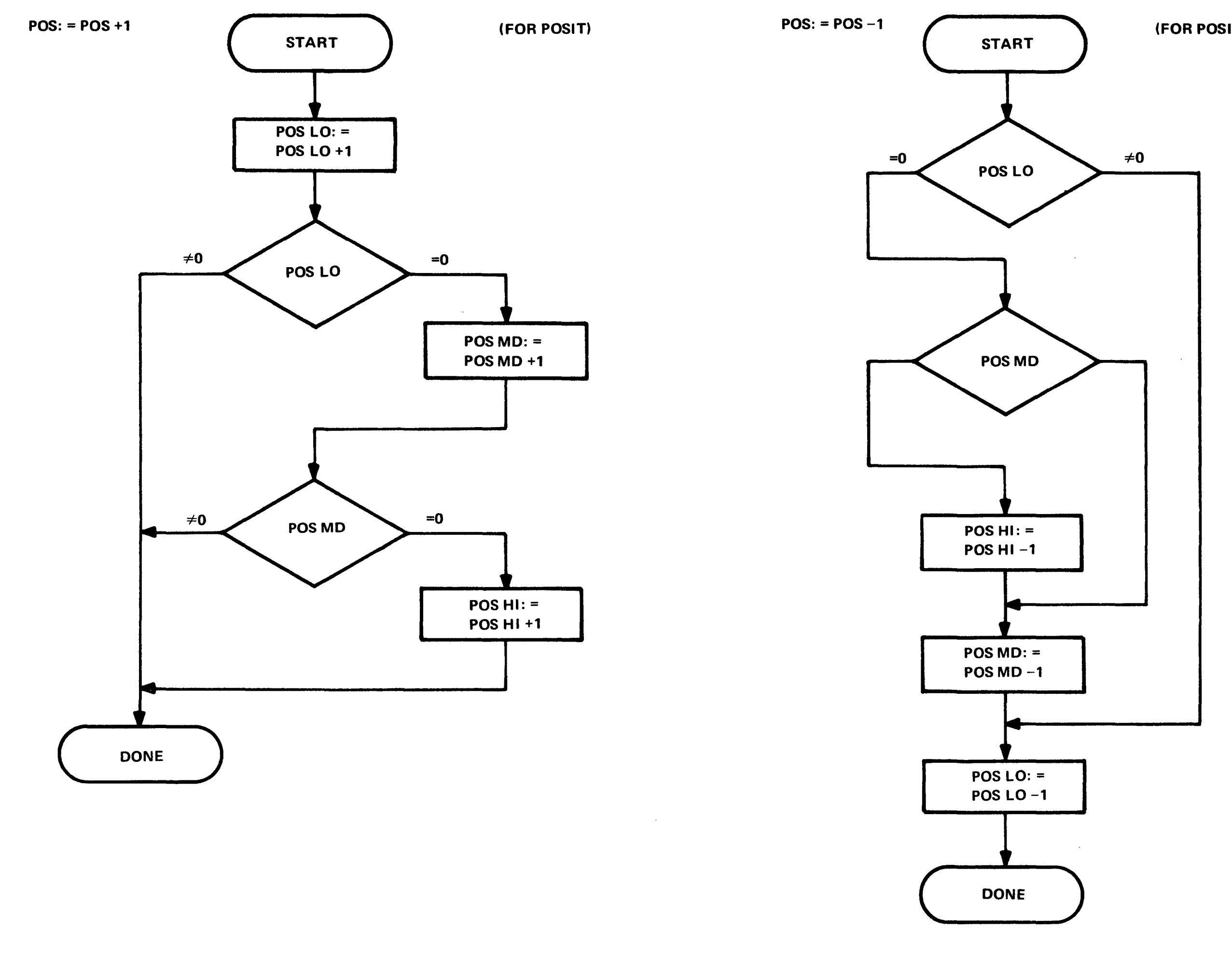



Figure 4-3a Start Routine for Position

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

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

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

#### 4.1.4 SERVO Routine

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

#### 4.1.5 SPEED Routine

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

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

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

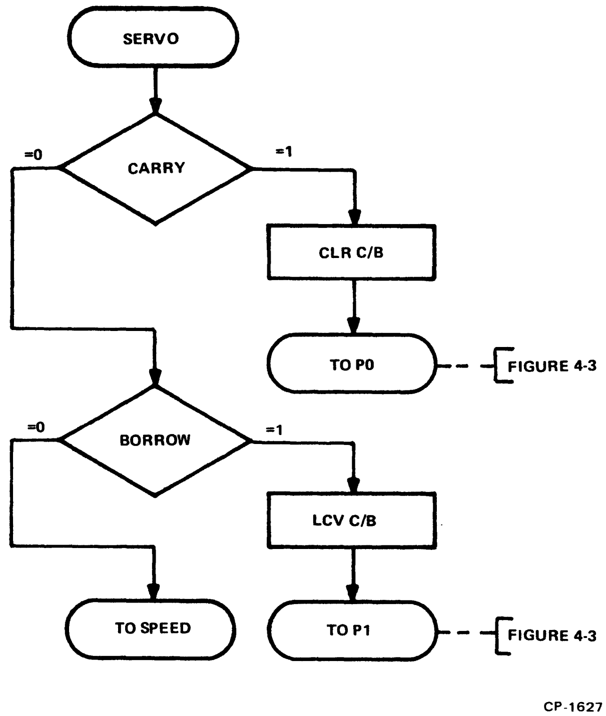



Figure 4-4 Servo Routine

**Table 4-2**
**SPEED Algorithm**

| Count = 0<br>Print = 1 | WD<br>CT | Position | Speed (ips)<br>+ = Print<br>- = Return Motion |
|---|---|---|---|
| | | $\geqslant 16$ | -50 |
| | | $\geqslant 8$ | -30 |
| | | $\geqslant 4$ | -20 |
| | | $\geqslant 2$ | -10 |
| | | = 1 | -6 |
| = 0 | | = 0 | 0 |
| = 1 | = 0 | = 0 | +3 |
| = 1 | = 1 | = 0 | +6 |
| | = 0 | < 0 | +3 |
| | = 1 | < 0 | +6 |

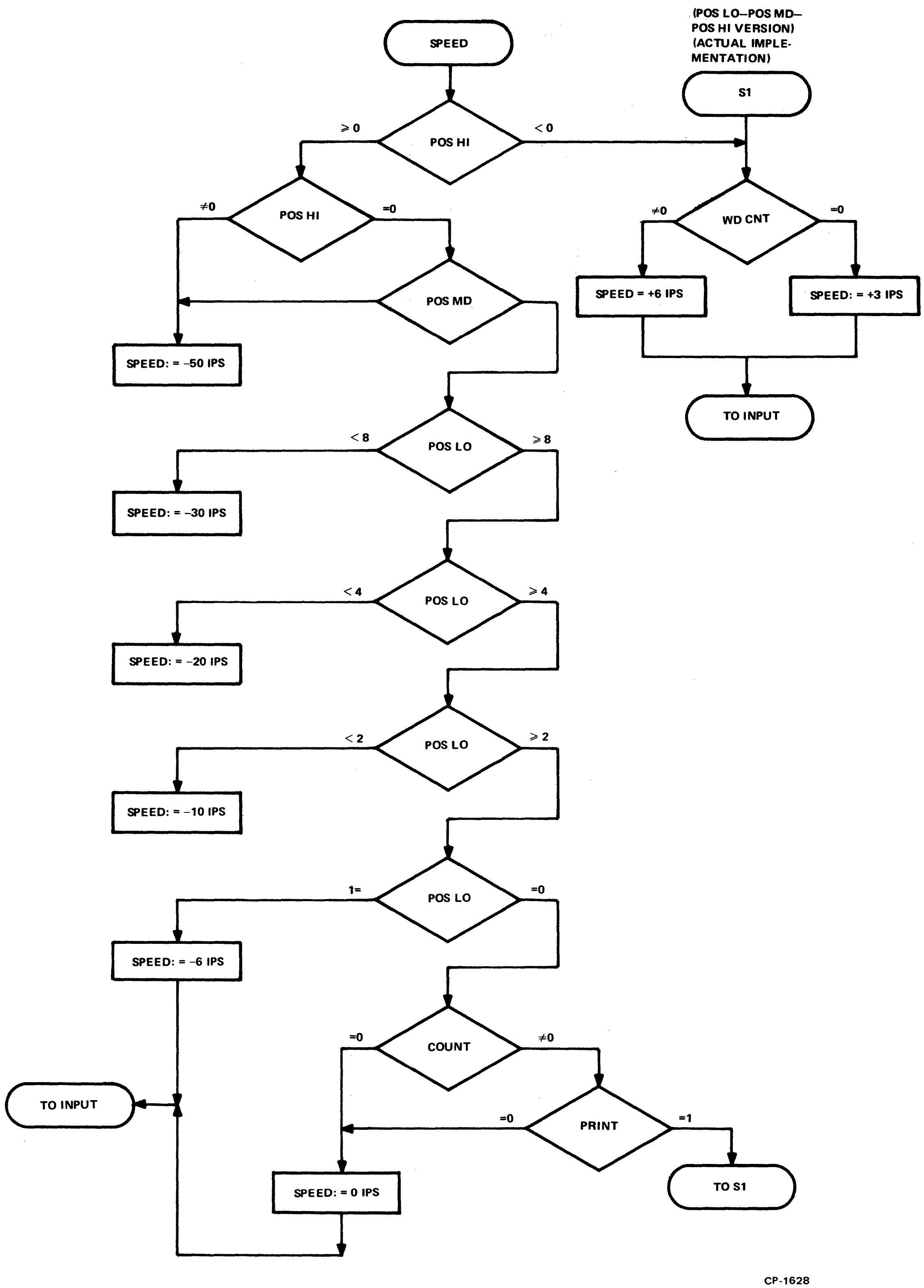



Figure 4-5 Speed Routine

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

### 4.1.6 INPUT Routine

The INPUT routine (Figure 4-6) checks UART Data Available (DA) and if cleared (no character) it steps immediately to the BELL routine. If DA is set, the program checks Word Count (WD CT) to see if the Character Buffer is full (WD CT=15). If so, it ignores any input from DA, using the UART as the 16th memory location, and proceeds immediately to service the bell.

**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.**

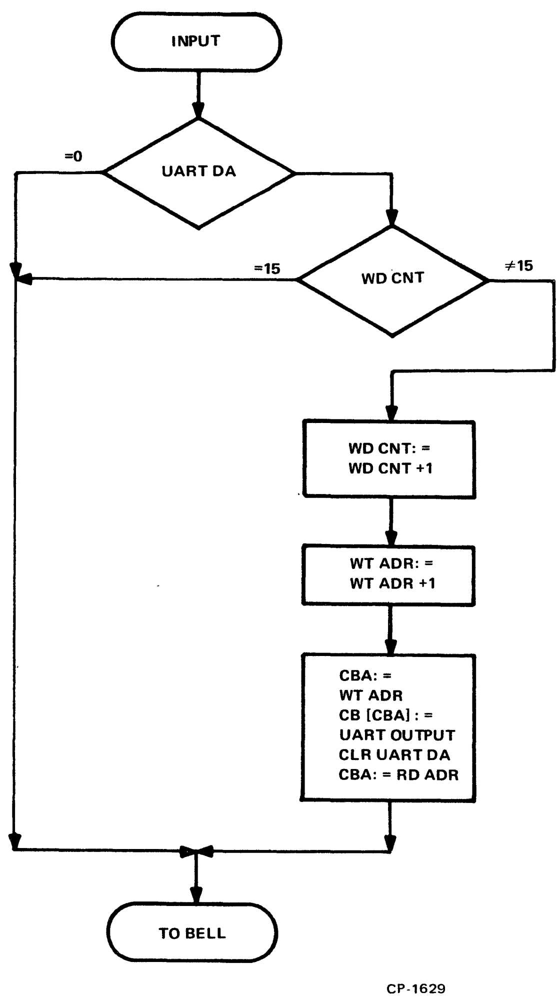



Figure 4-6 Input Routine

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

### 4.1.7 BELL Routine

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

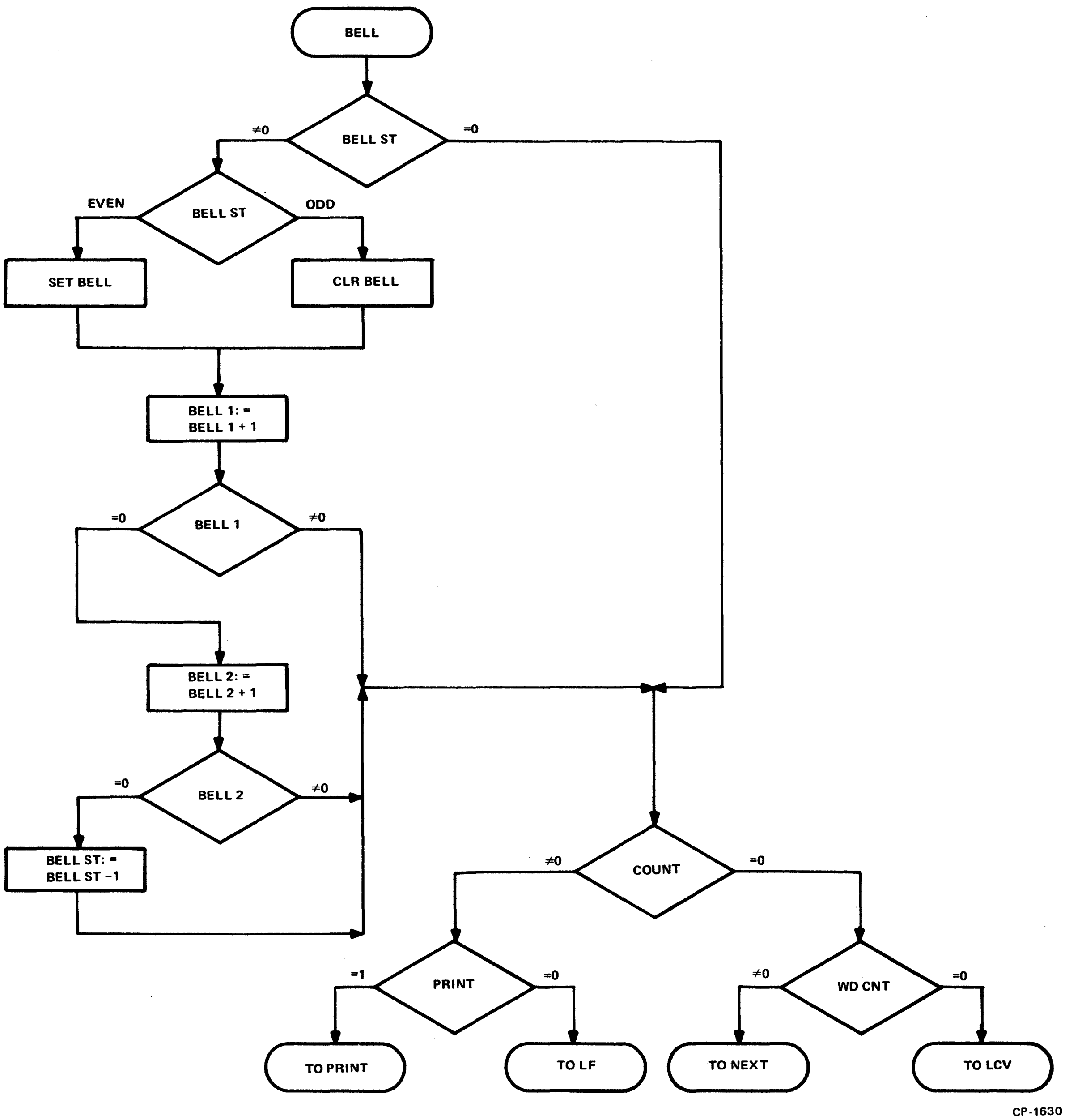



Figure 4-7 Bell Routine

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

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

The bell timers in location 15 and 16 provide 4-bits of each Count. The bits in either location 15 or location 16 are incremented during each pass until that timer has reached zero (106 ms) and Bell Status either becomes odd and the bell is turned off, or even and the bell is turned on. Each pass through the loop takes 416 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 have been executed.

### 4.1.8 PRINT Routine

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

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

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

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

This time through, POSIT is still 0 relative to column, Count is less than 8 (7); the program presets the Print Timers, and clears the Increment indication. It waits then for Increment to set, and when it does it sets the 600 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 μ HDE is then timed out in PT1 and PT2 locations of the control RAM on the 1.184 μ instruction timing cycle of the microprogram. During this time the character is printed. At the end of that time, HDE is cleared, print is reset to 1, Count is set once again to −1, and the program reenters the POSIT routine.

### 4.1.9 LINE FEED Routine

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

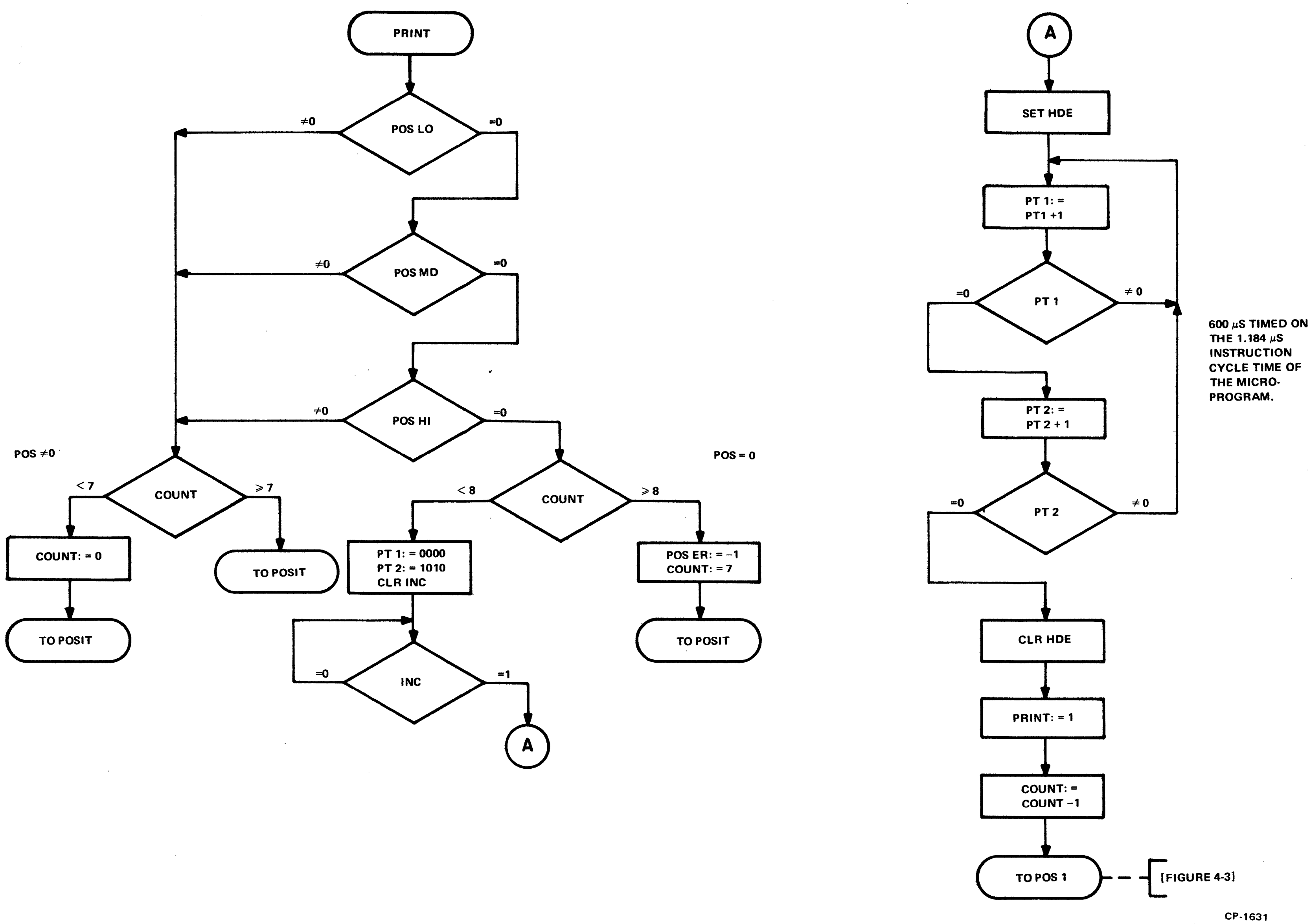



Figure 4-8 Print Routine

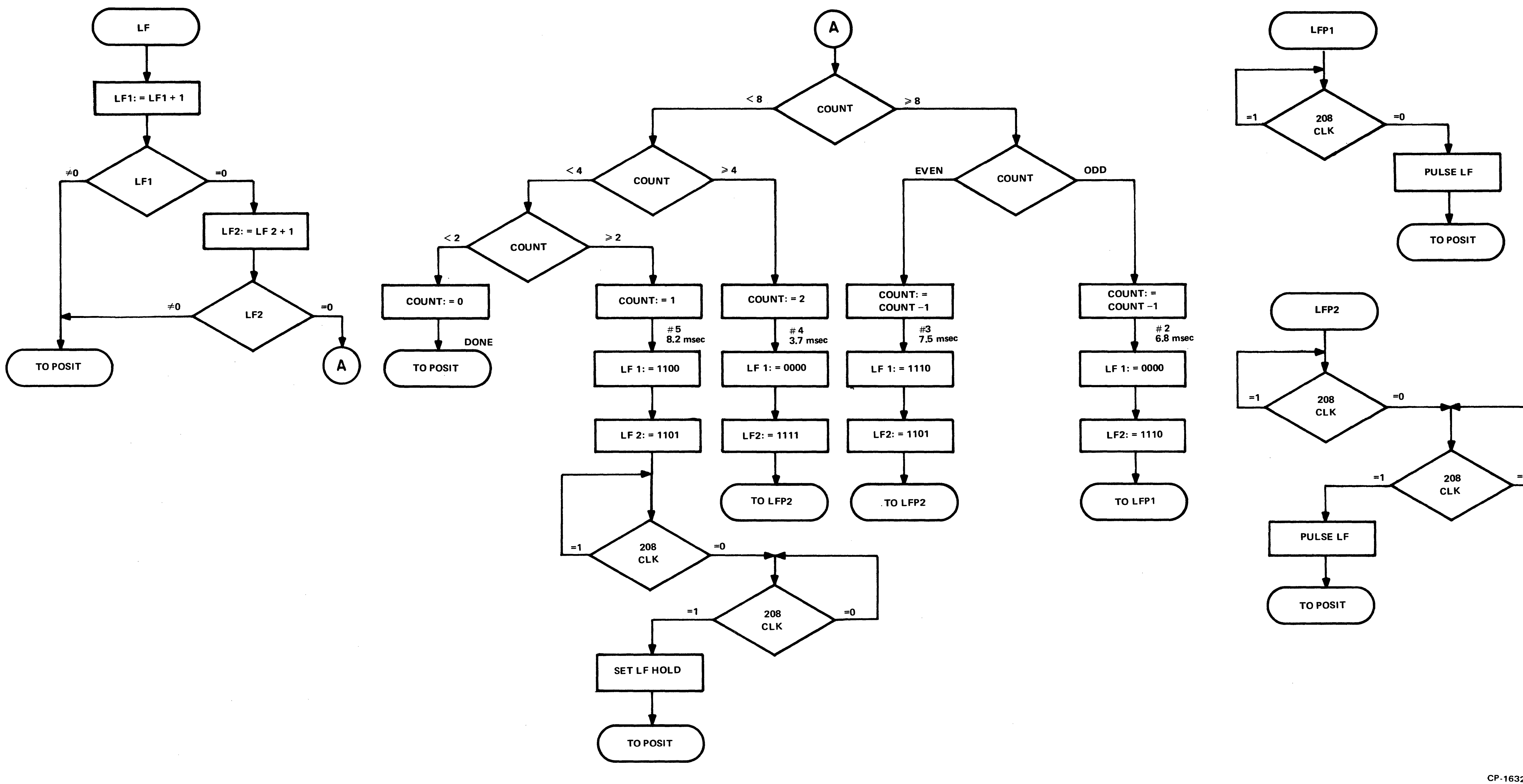



Figure 4-9 Line Feed Routine

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

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

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

### 4.1.10 LCV Routine

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

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

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

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

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

### 4.1.11 NEXT Routine

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

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

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

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

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

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

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

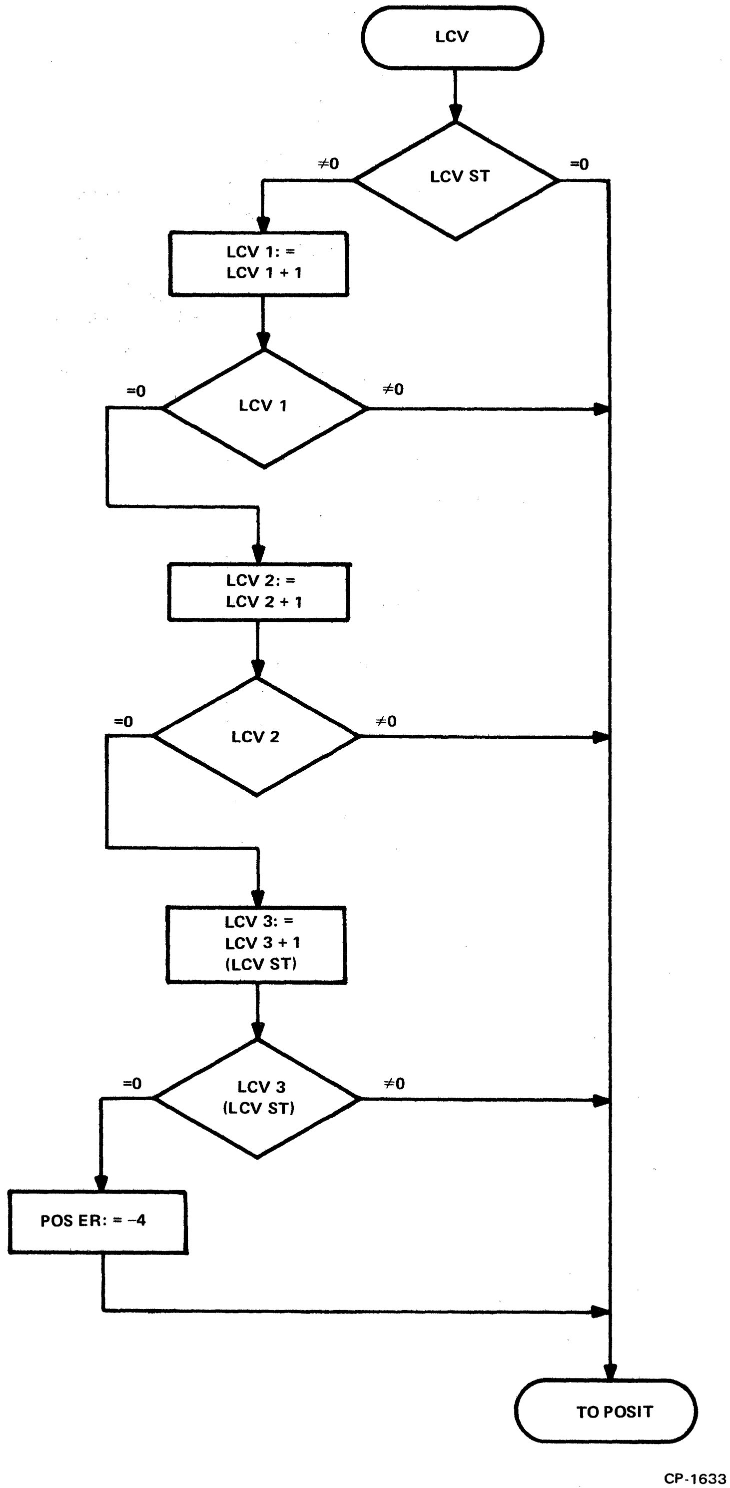



Figure 4-10 Last Character Visibility Routine

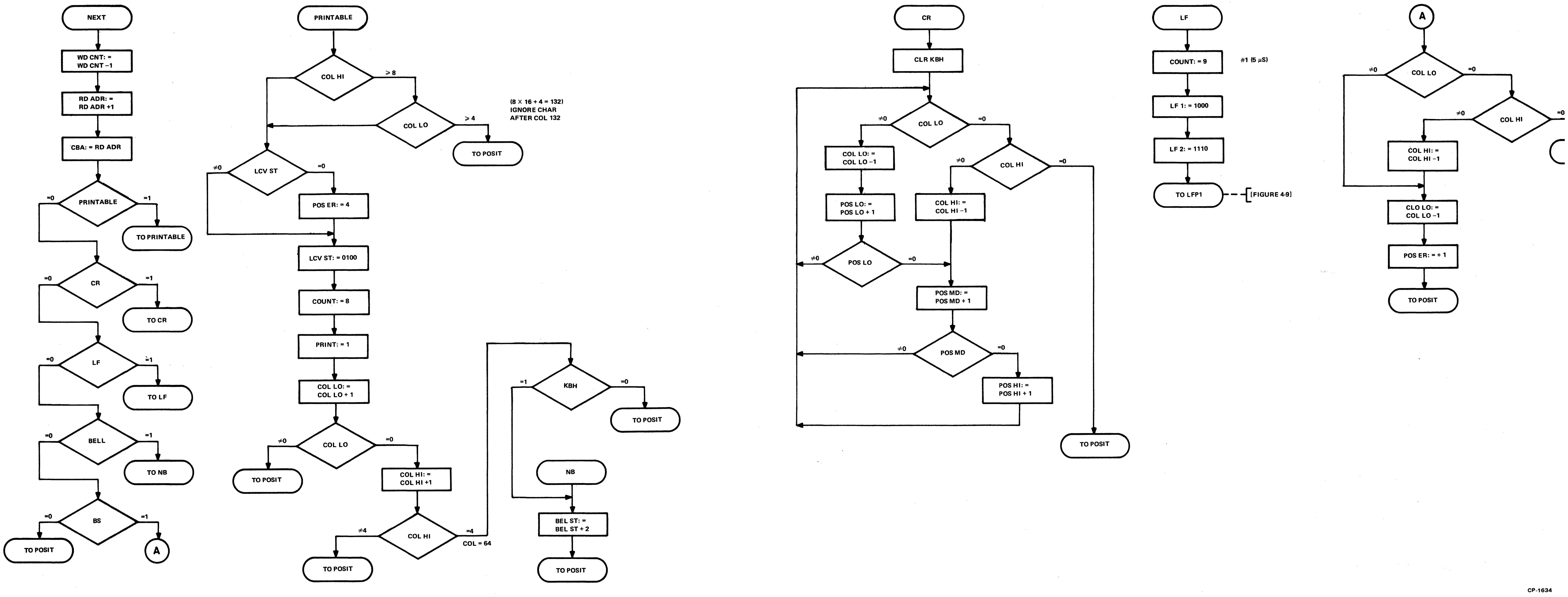



Figure 4-11 Next Routine

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

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

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

If the Print Bit indicates that the character is printable, the program determines whether or not the carriage is at column 132. It does this by determining that COL HI is $\geqslant 8$ 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.

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

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

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

## 4.2 TIMING

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

## 4.3 CONTROL LOGIC

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

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

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

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

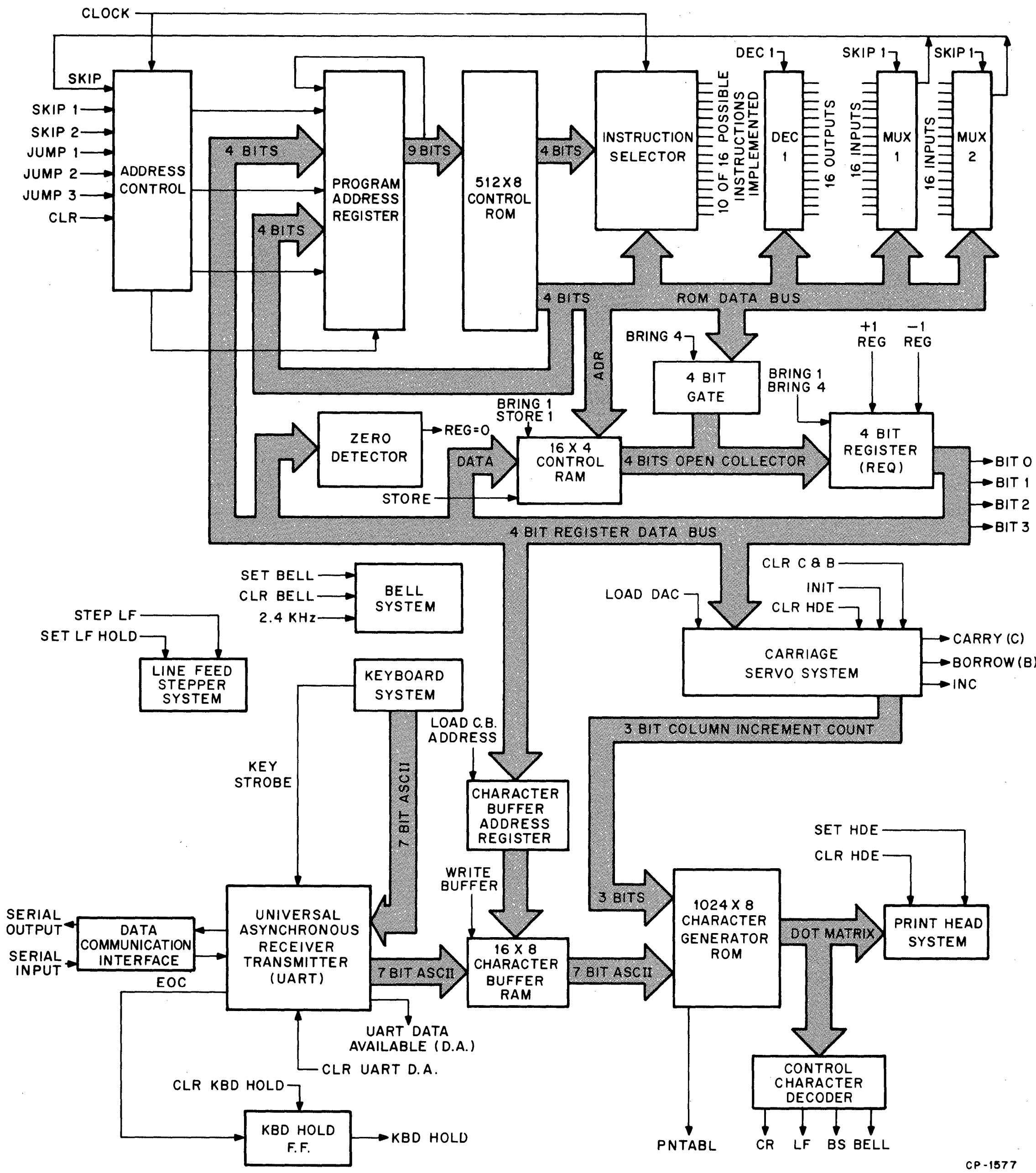



Figure 4-12 Control Logic Block Diagram

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

## 4.4 KEYBOARD SYSTEM

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

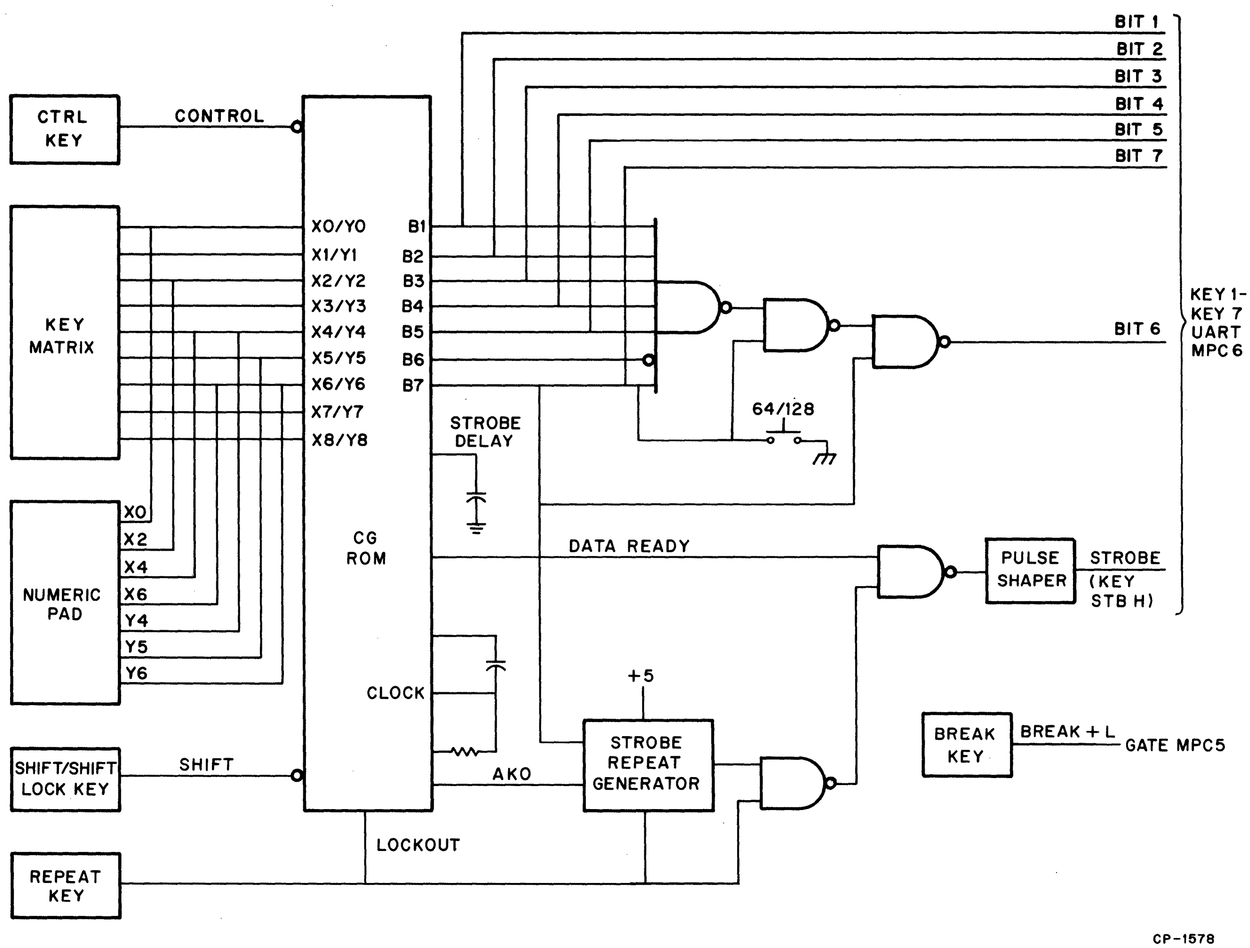



Figure 4-13 LK02 Keyboard Logic Diagram

**Table 4-3**
**Keyboard ROM Addressing**

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

**Table 4-3 (Cont)**
**Keyboard ROM Addressing**

| Key | ASCII Code b7–b1 | Octal Code | ROM Addressing X Line | Y Line |
|---|---|---|---|---|
| HT | 0001001 | 11 | 8 | 8 |
| 3 | 0110011 | 63 | 7 | 7 |
| t | 1110100 | 164 | 5 | 5 |
| j | 1101010 | 152 | 3 | 3 |
| DEL | 1111111 | 177 | 2 | 2 |
| . | 0101110 | 56 | 1 | 1 |
| \ | 1100000 | 140 | 0 | 0 |
| **SHIFT MODE** | | | | |
| ESC | 0011011 | 33 | 8 | 9 |
| @ | 1000000 | 100 | 7 | 8 |
| R | 1010010 | 122 | 5 | 6 |
| H | 1001000 | 110 | 3 | 4 |
| ] | 1011101 | 165 | 2 | 3 |
| < | 0111100 | 74 | 1 | 2 |
| + | 0101011 | 53 | 0 | 1 |
| ! | 0100001 | 41 | 7 | 9 |
| E | 1000101 | 105 | 5 | 7 |
| G | 1000111 | 107 | 3 | 5 |
| M | 1001101 | 115 | 1 | 3 |
| ) | 0101001 | 51 | 7 | 0 |
| W | 1010111 | 127 | 5 | 8 |
| F | 1000110 | 106 | 3 | 6 |
| N | 1001110 | 116 | 1 | 4 |
| — | 1011111 | 137 | 0 | 3 |
| ( | 0101000 | 50 | 7 | 1 |
| Q | 1010001 | 121 | 5 | 9 |
| D | 1000100 | 104 | 3 | 7 |
| B | 1000010 | 102 | 1 | 5 |
| BS | 0001000 | 10 | 0 | 4 |
| * | 0101010 | 52 | 7 | 2 |
| P | 1010000 | 120 | 5 | 0 |
| S | 1010011 | 123 | 3 | 8 |
| V | 1010110 | 126 | 1 | 6 |
| & | 0100110 | 46 | 7 | 3 |
| O | 1001111 | 117 | 5 | 1 |
| A | 1000001 | 101 | 3 | 9 |
| C | 1000011 | 103 | 1 | 7 |
| SP | 0100000 | 40 | 8 | 5 |
| ∧ | 1011110 | 136 | 7 | 4 |
| I | 1001001 | 111 | 5 | 2 |
| } | 1111101 | 175 | 4 | 1 |
| : | 0111010 | 72 | 3 | 0 |
| X | 1011000 | 130 | 1 | 8 |
| % | 0100101 | 45 | 7 | 5 |

Table 4-3 (Cont)
Keyboard ROM Addressing

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

Table 4-3 (Cont)
Keyboard ROM Addressing

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

Table 4-3 (Cont)
Keyboard ROM Addressing

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

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

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

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

### 4.5 DATA COMMUNICATIONS INTERFACE

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

#### 4.5.1 20 mA Loop Receiver

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

#### 4.5.2 20 mA Loop Driver

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

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

### 4.6 CLOCK LOGIC

The clock frequencies used to time the Microprogrammed Controller (MPC) are obtained as shown in Figure 4-19. All frequencies are derived from a Crystal Oscillator and Shaper that generates a 1.6896 MHz square wave. This signal is divided down by two ripple counters, a ÷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 4-4. Important timing relationships are shown in Figure 4-20.

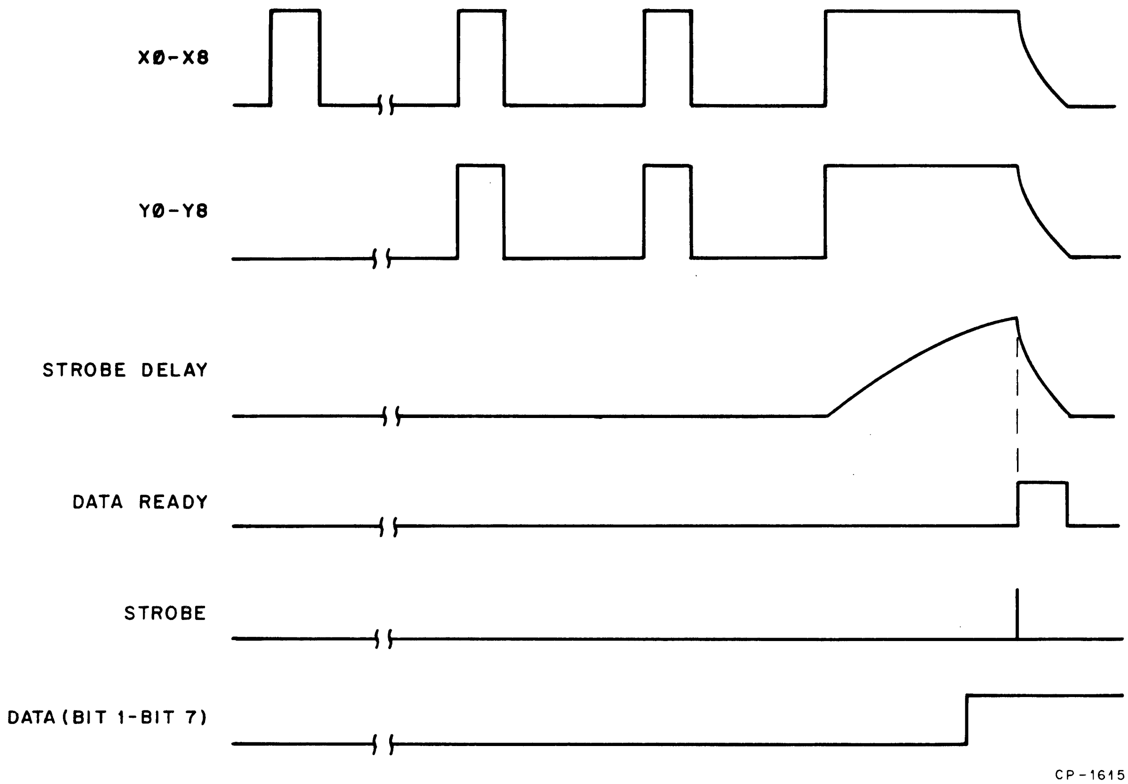



Figure 4-14 Keyboard Timing Diagram

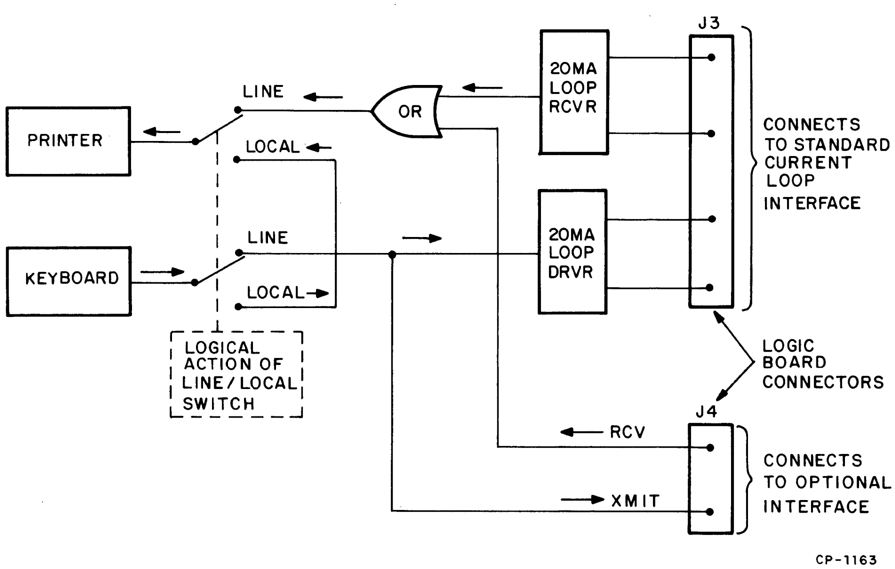



Figure 4-15 Data Communications Interface Diagram

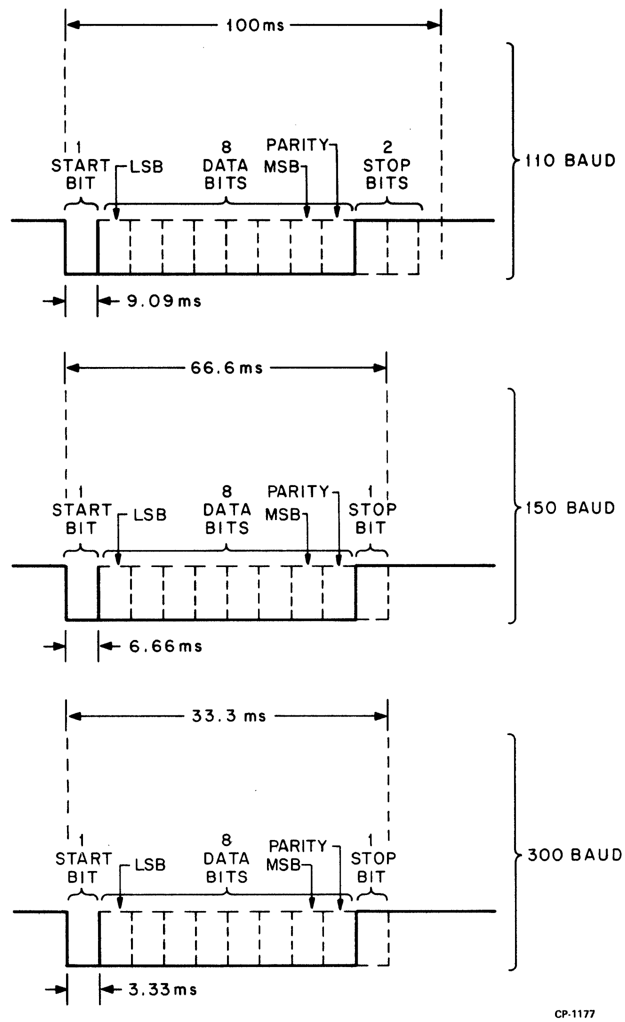



Figure 4-16 Data Communications Interface Timing Diagram

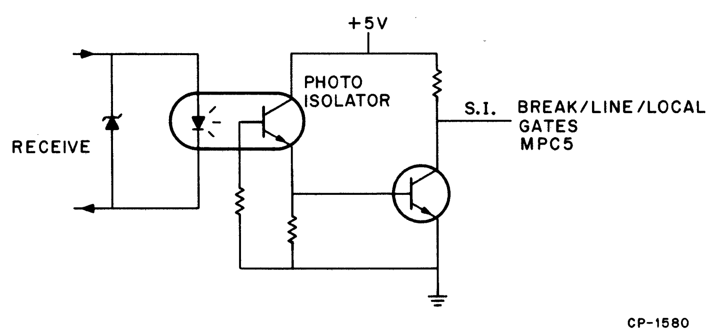



Figure 4-17 20 mA Loop Receiver Diagram

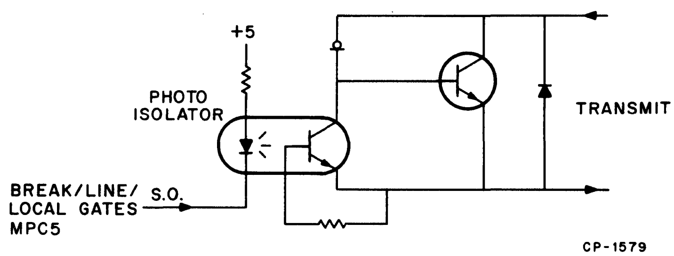



Figure 4-18 20 mA Loop Driver

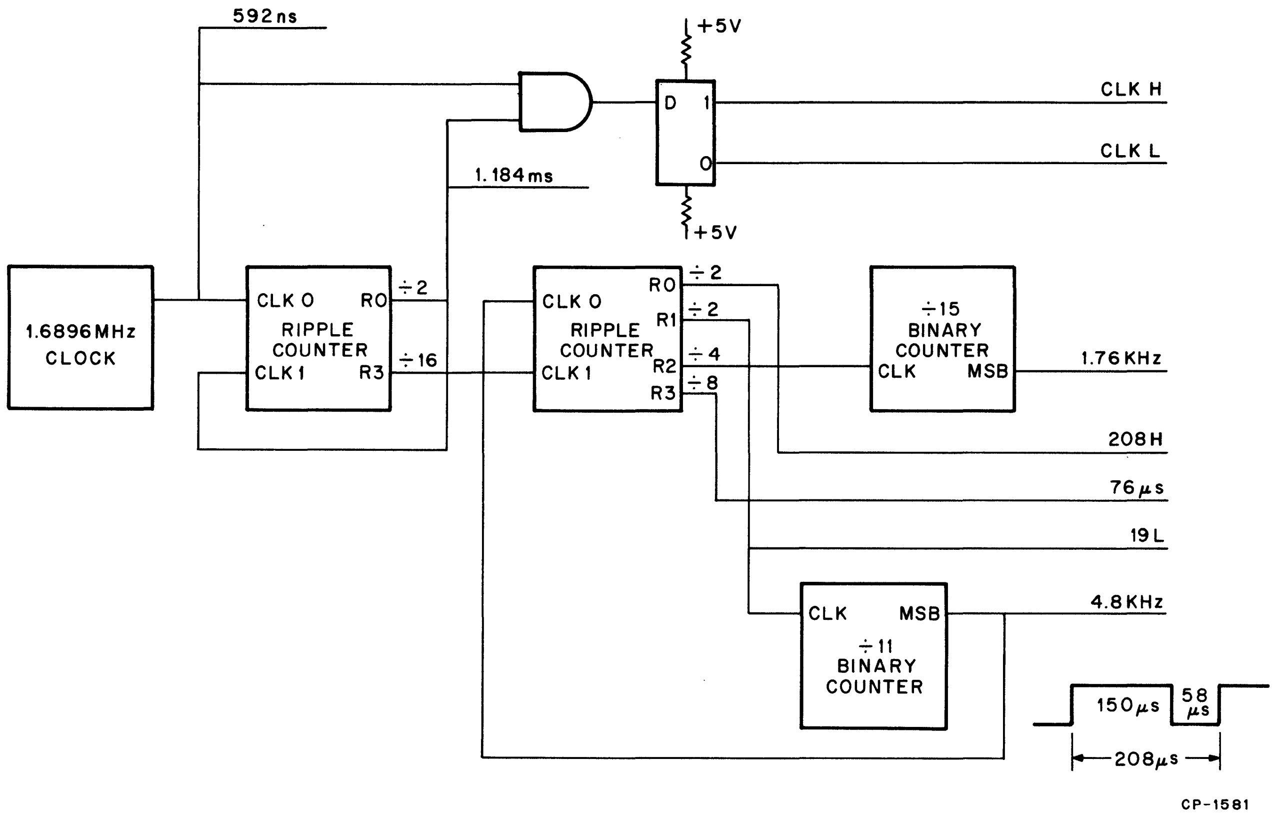



Figure 4-19 Clock Logic

**Table 4-4**
**Clock Frequencies and Time Periods**

| Frequency | Time Period |
|---|---|
| 1.6896 MHz | 592 ns |
| 844 kHz | 1.184 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 |

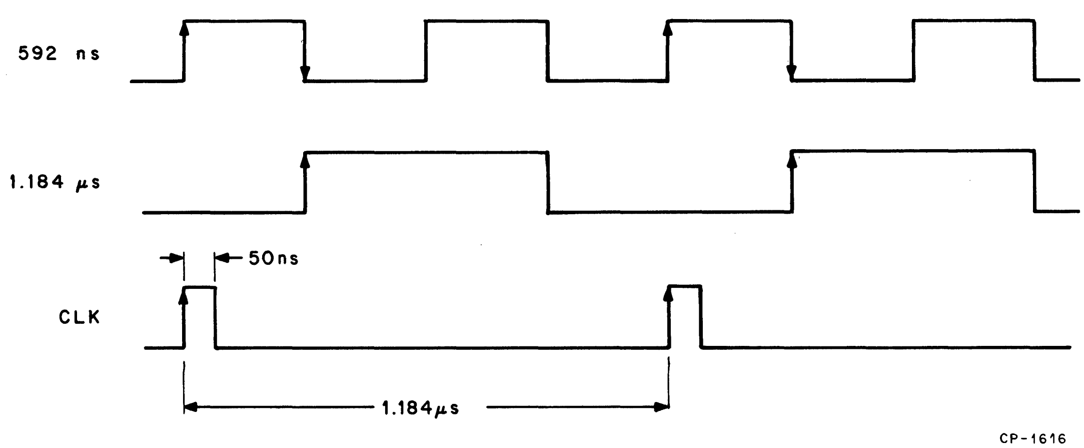



Figure 4-20 Clock Timing Relationship

## 4.7 UNIVERSAL ASYNCHRONOUS RECEIVER/TRANSMITTER (UART)

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

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

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

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

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

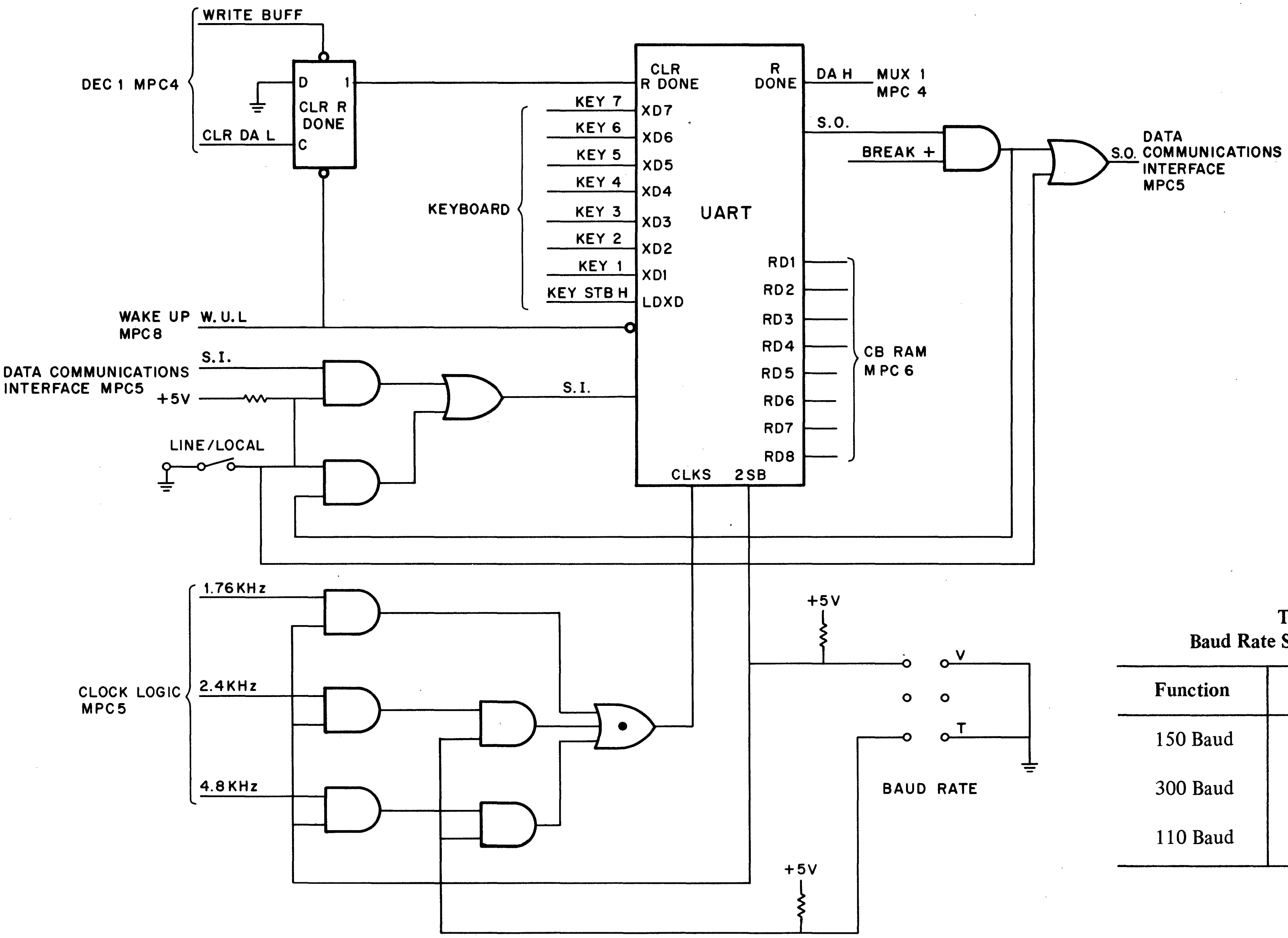
## 4.8 CHARACTER BUFFER/GENERATOR AND PRINT HEAD SYSTEM

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

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

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

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




CP-1582

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

**Table 4-5**
**Baud Rate Switch Connections**

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

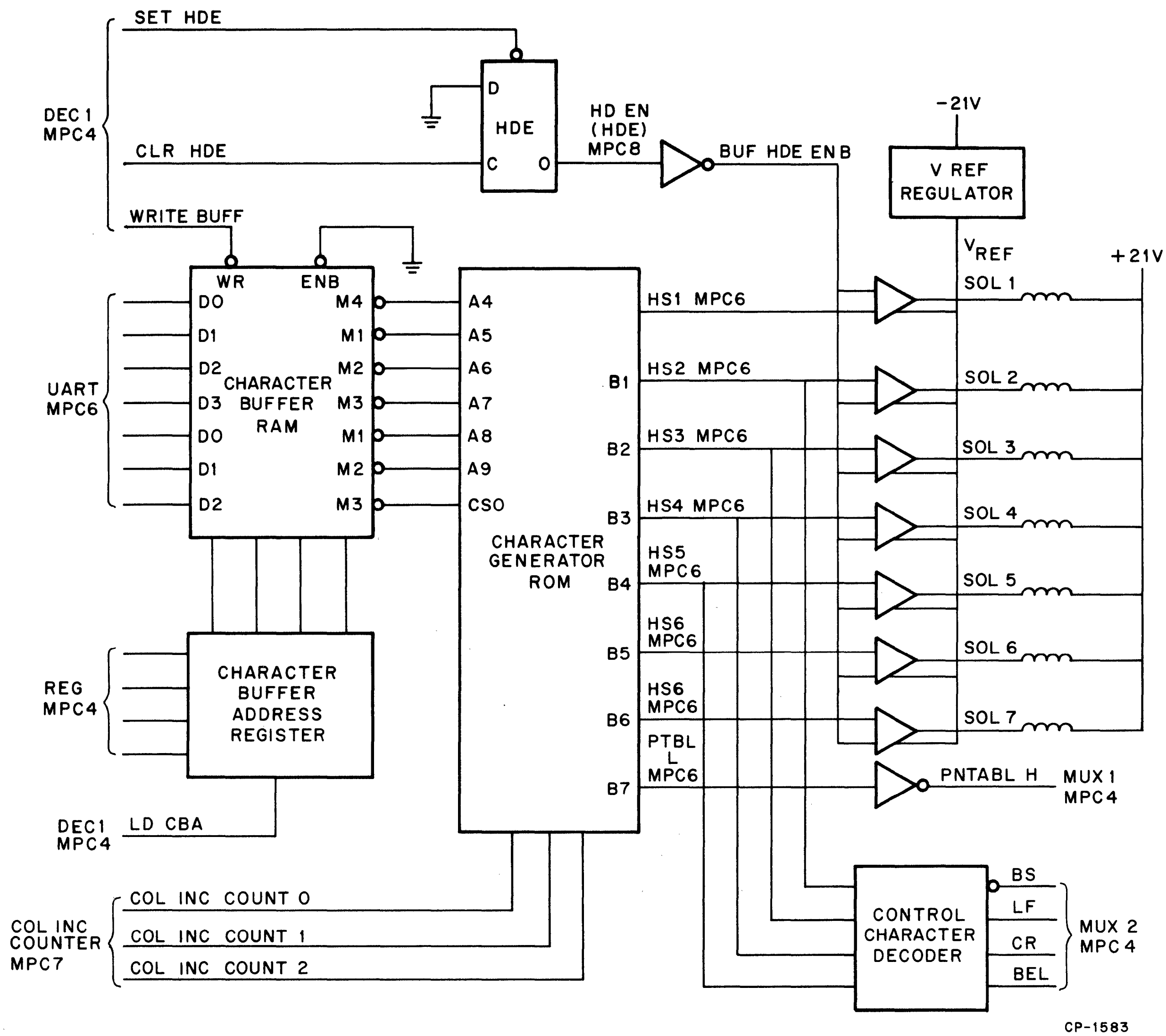



Figure 4-22 Character Buffer/Address Register/Generator and Print Head System

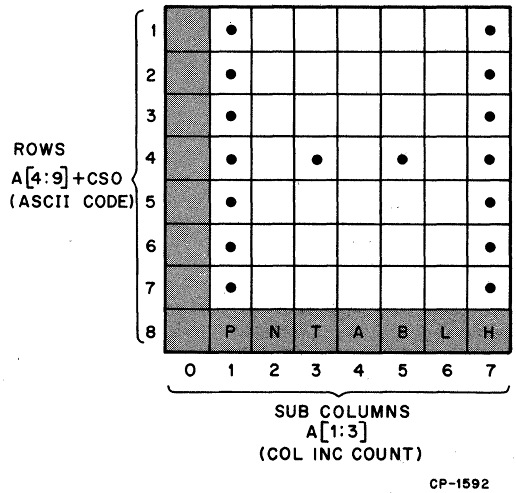



Figure 4-23 CG ROM Character Cell

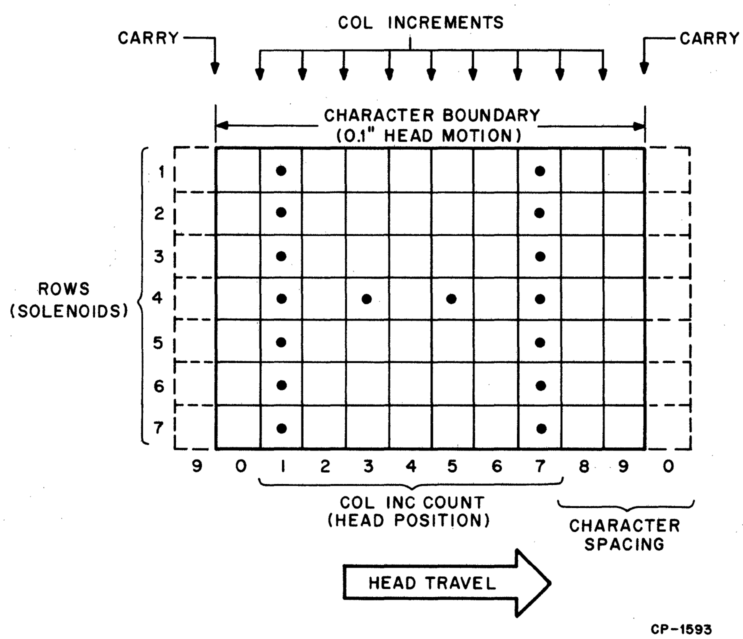



Figure 4-24 Print Head Operation

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

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

## 4.9 CARRIAGE SERVO SYSTEM

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

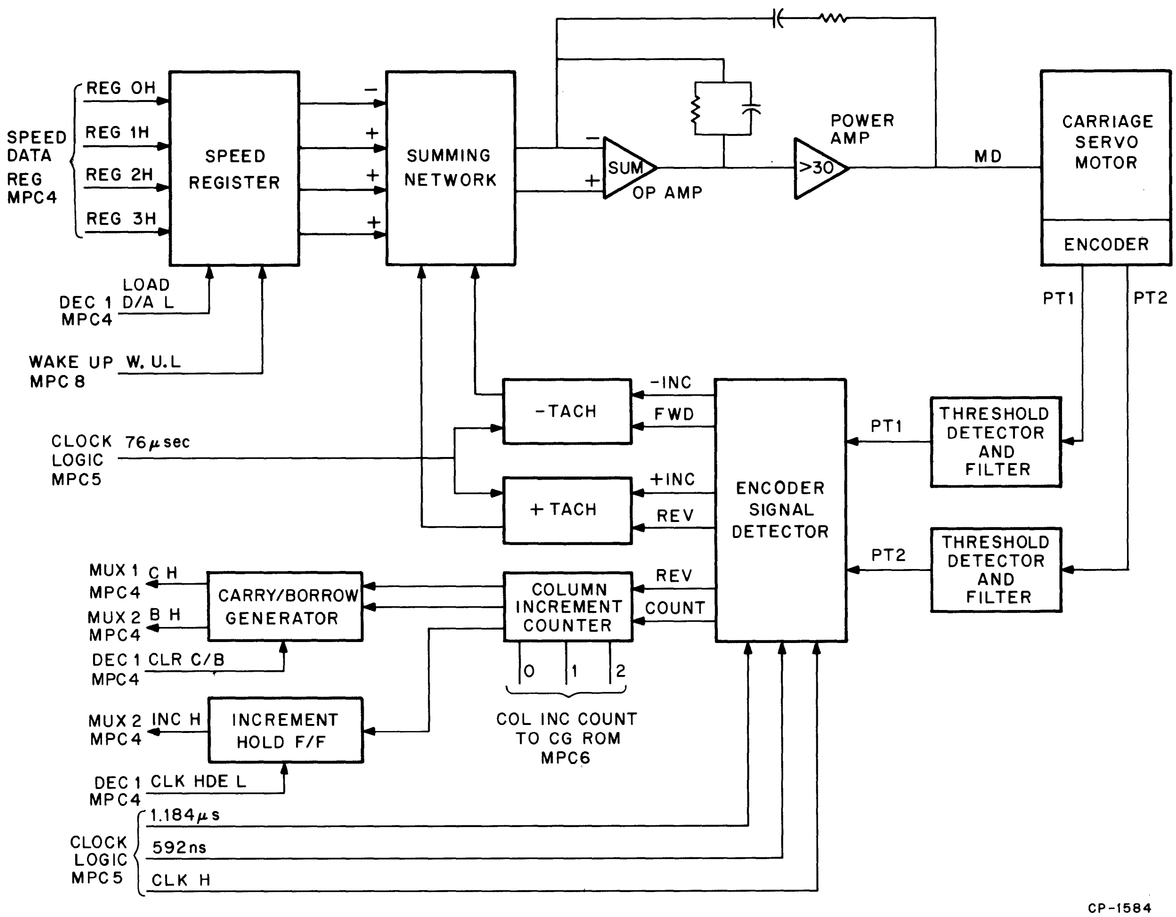



Figure 4-25 Carriage Servo System

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

**Register Information Loaded into D/A**

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

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

The encoder on the motor shaft generates two feedback signals: PT1 and PT2. These signals are applied to the dual-channel Threshold Detector and Filter, which converts them from sine waves to square waves for processing by the Encoder Signal Detector which is controlled by the CLK H, 1.184 ms and 592 ns timing signals from the Clock Logic. The Encoder Signal Detector produces a COUNT pulse and logic level commands for the +TACH and the -TACH, which are clocked by a 76 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.

### 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.

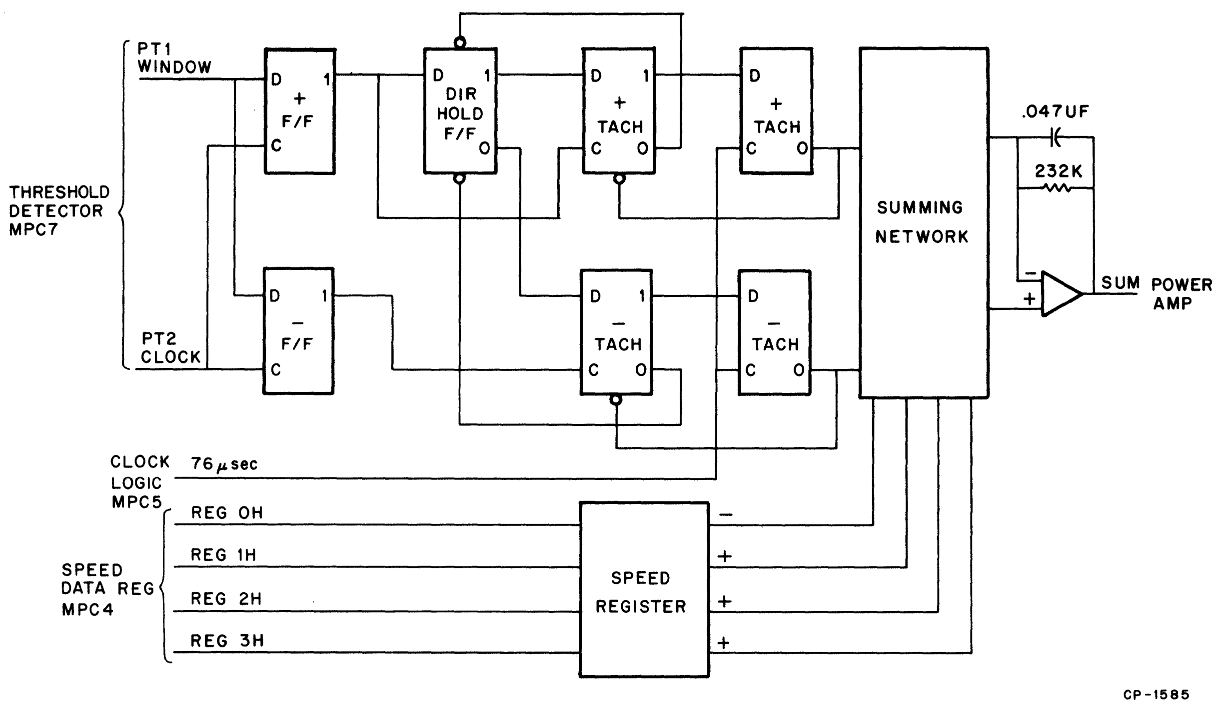



Figure 4-26 Tachometer Logic

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

### 4.9.2 Encoder and Threshold Detector

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

### 4.9.3 Encoder Signal Detector

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

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

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

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

### 4.9.4 Column Increment Counter and Carry/Borrow Generator

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

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

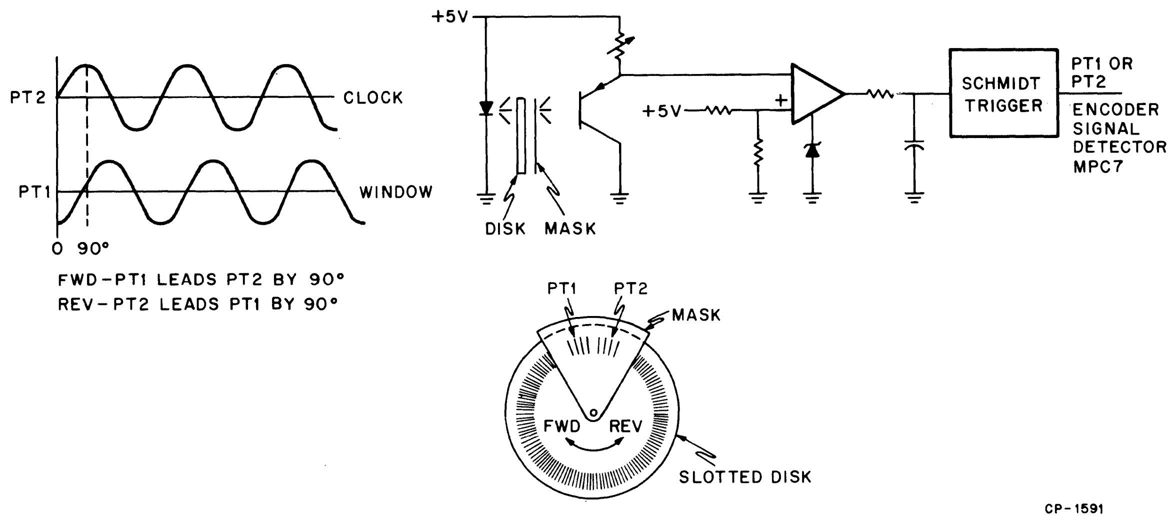



Figure 4-27 Encoder and Threshold Detector

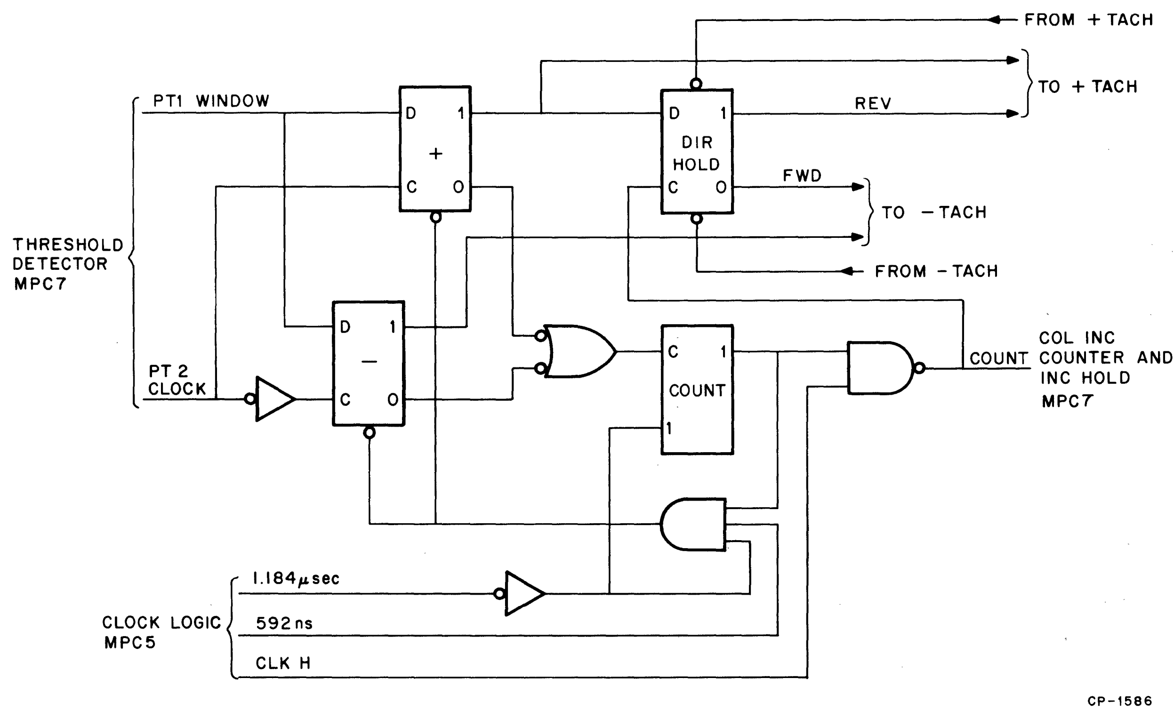



Figure 4-28 Encoder Signal Detector

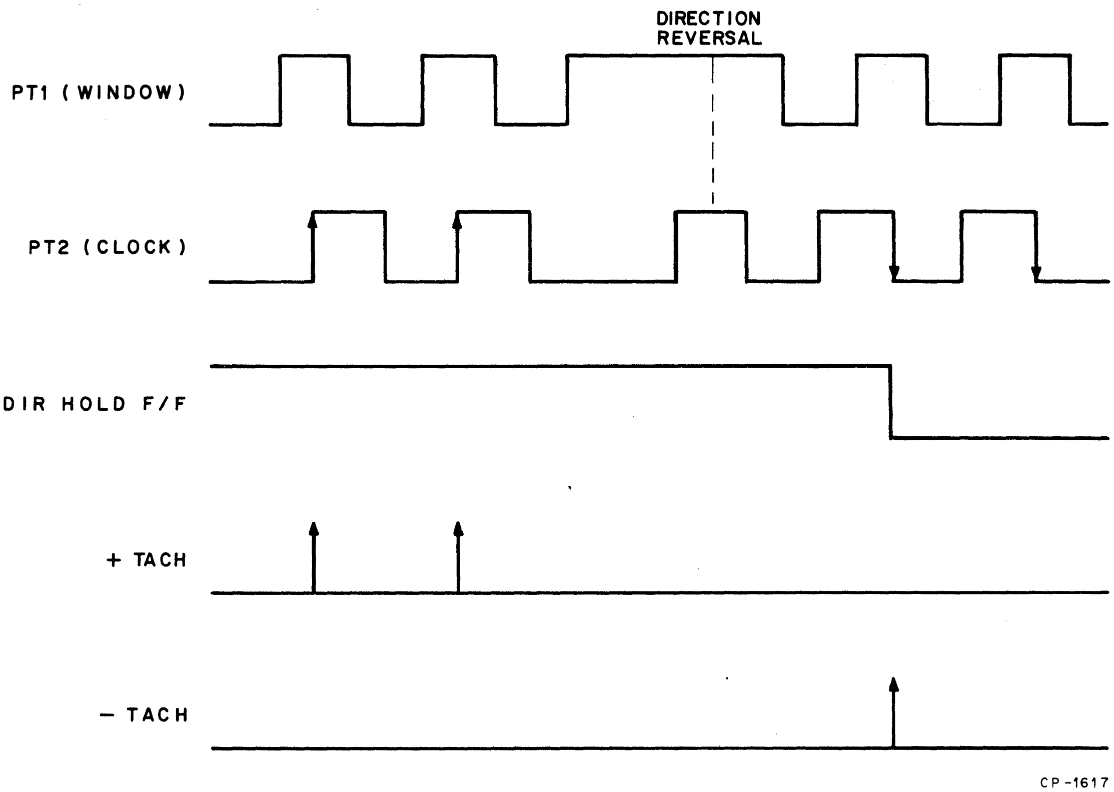



Figure 4-29 Increment Detection Timing

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

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

## 4.10 BELL SYSTEM

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

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

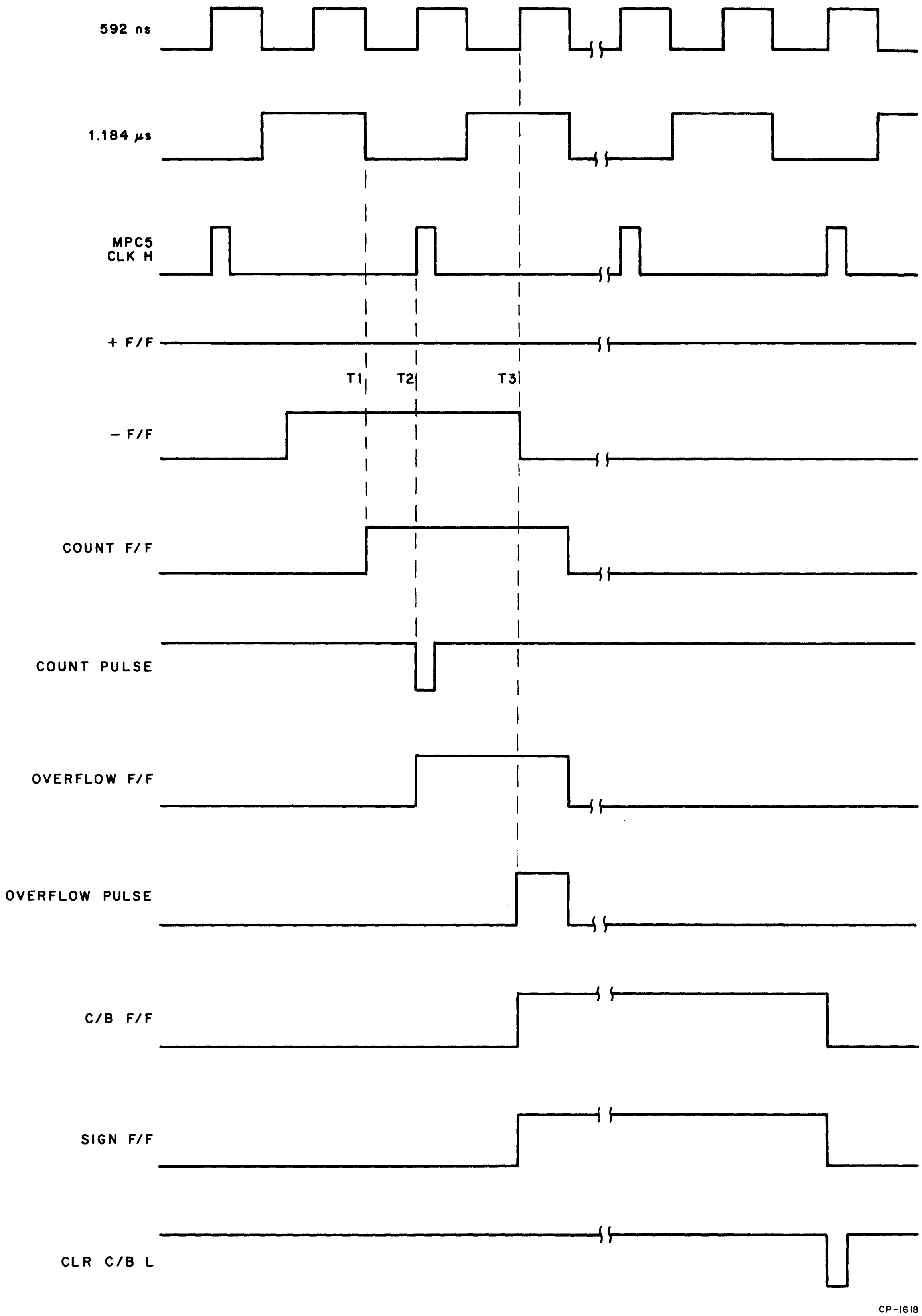



Figure 4-30 Encoder Signal Detector and Column Increment Counter Timing Diagram

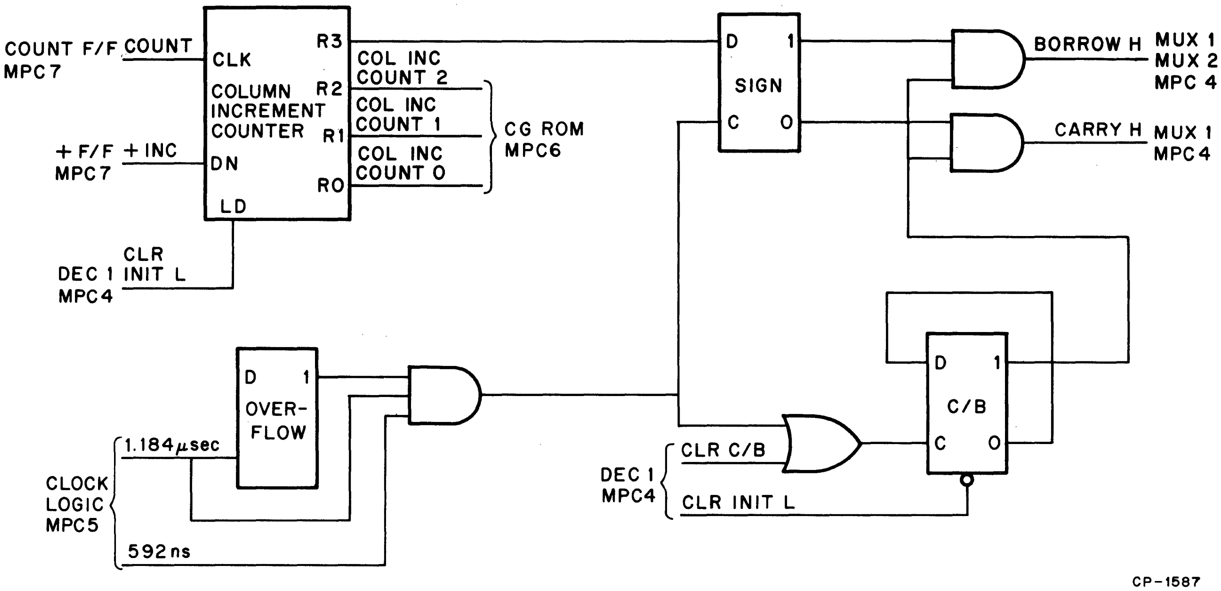



Figure 4-31 Column Increment Counter and C/B Generator Logic

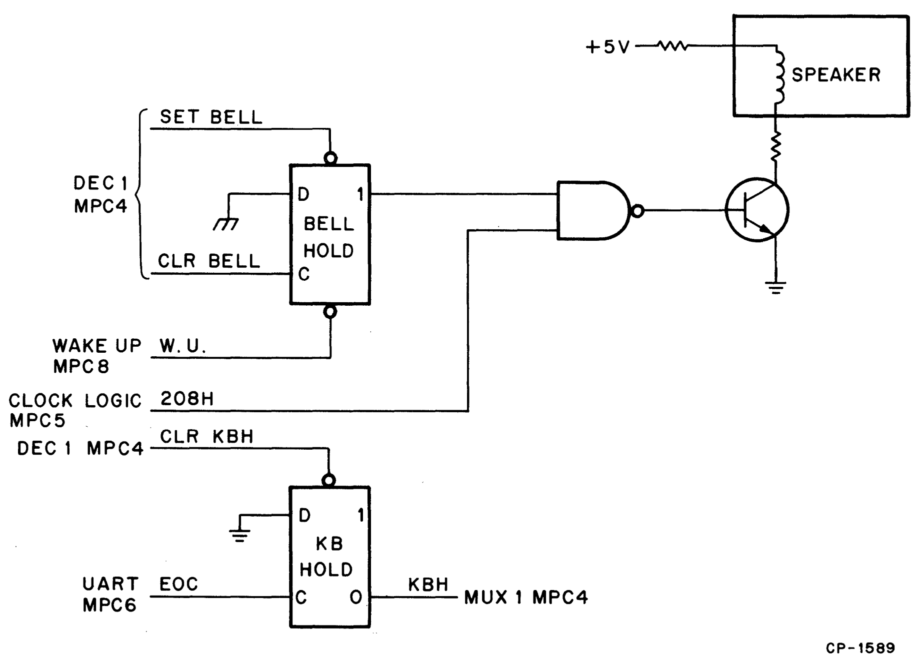



Figure 4-32 Bell System Logic

## 4.11 LINE FEED STEPPER SYSTEM

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

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

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

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

## 4.12 WAKE-UP CIRCUIT

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

## 4.13 POWER SUPPLY AND REGULATOR

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

These voltages are regulated to produce +12 V ±5%, −12 V ±5%, +5 V ±5% and −9 V ±5%.

## 4.14 PRINTER MECHANISM

The LA36 is an incremental impact printer that uses a 7-wire solenoid-activated print head which moves horizontally and prints characters in a 7 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.

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.

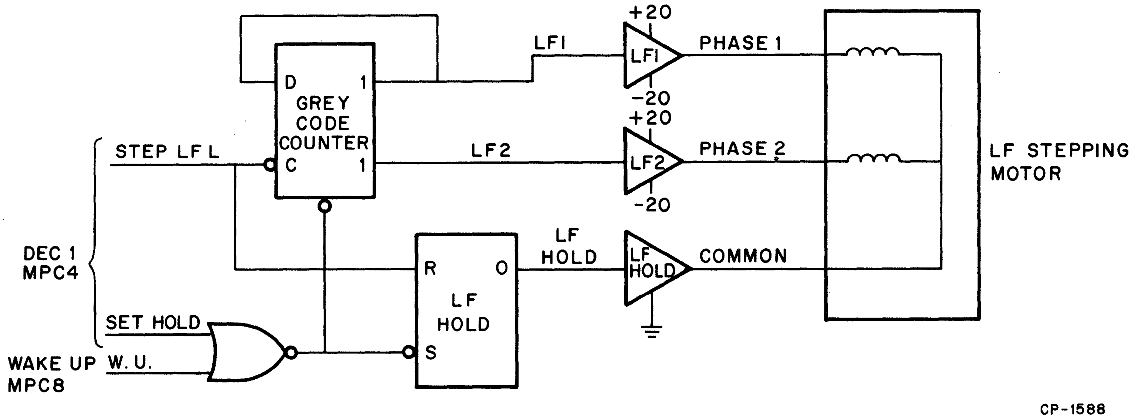



Figure 4-33 Line Feed Stepper System

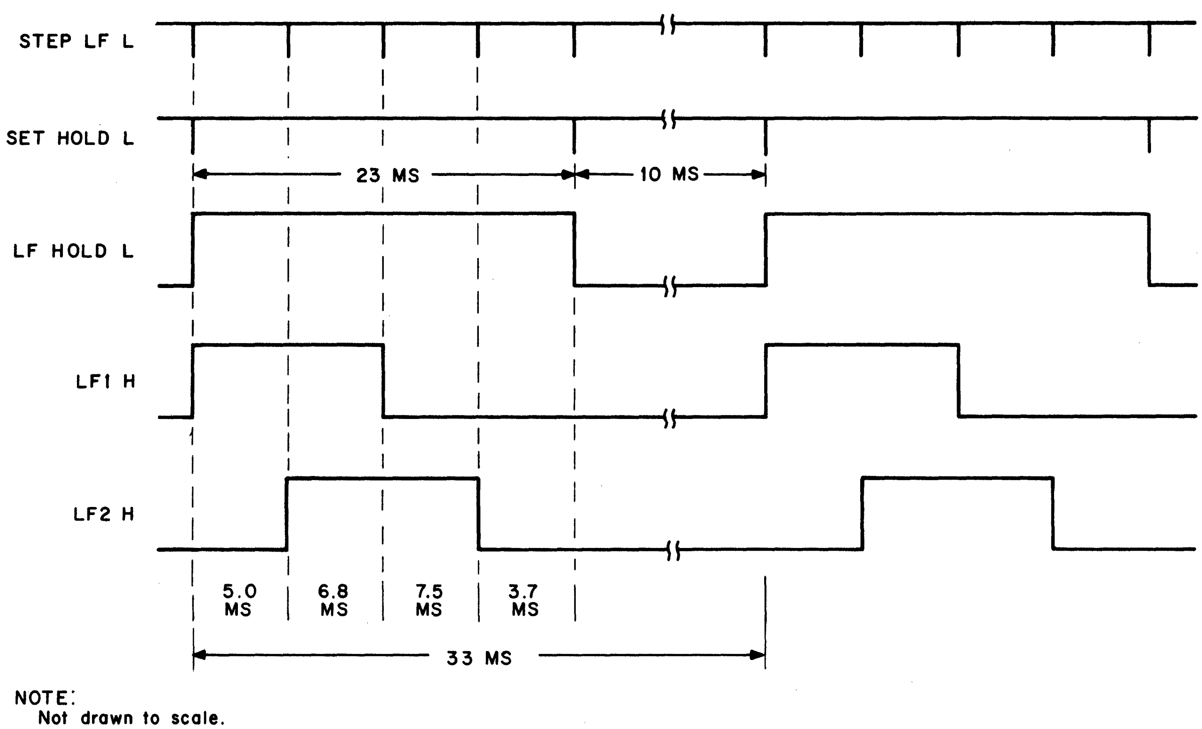



Figure 4-34 Line Feed Timing Diagram

Table 4-7
LF Pulse Truth Table

| | LF2 | LF1 |
|---|---|---|
| Hold | 0 | 0 |
| Step LF | 0 | 1 |
| Step LF | 1 | 1 |
| Step LF | 1 | 0 |
| Step LF | 0 | 0 |

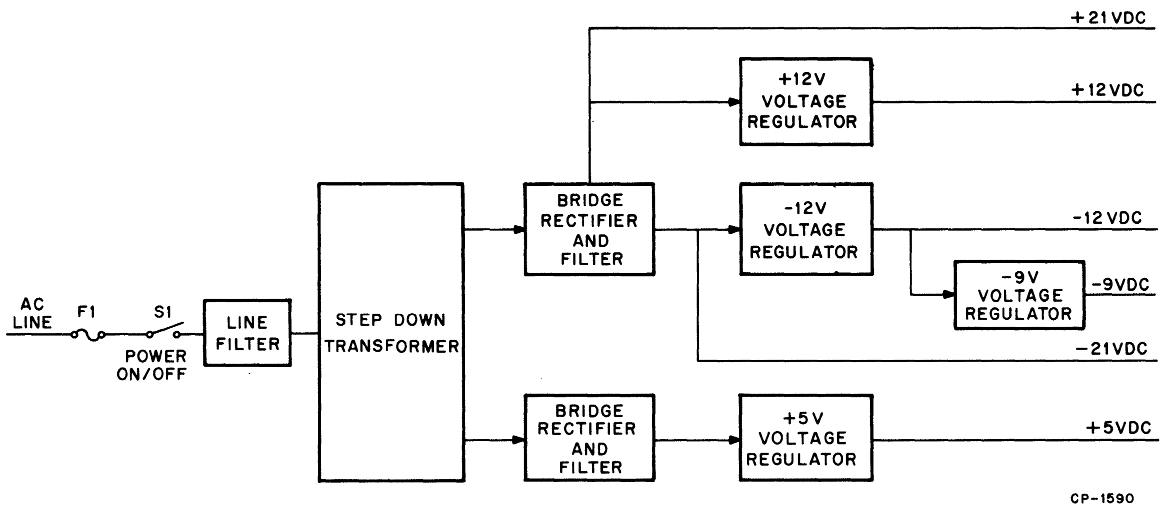



Figure 4-35 Power Supply Block Diagram

### 4.14.1 Carriage Subsystem

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

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

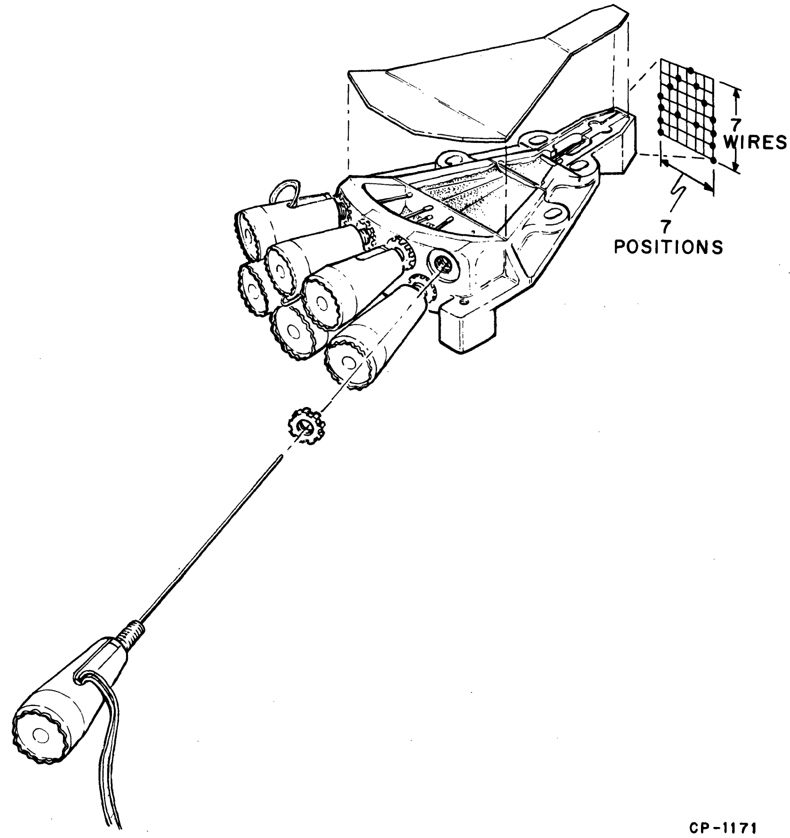



Figure 4-36 LA36 Printing Principle

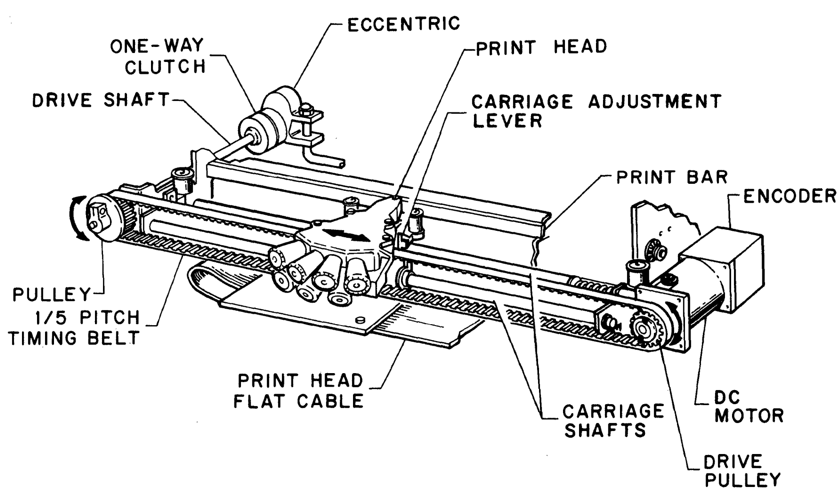



Figure 4-37 Carriage Subsystem

### 4.14.2 Ribbon Feed Subsystem

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

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

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

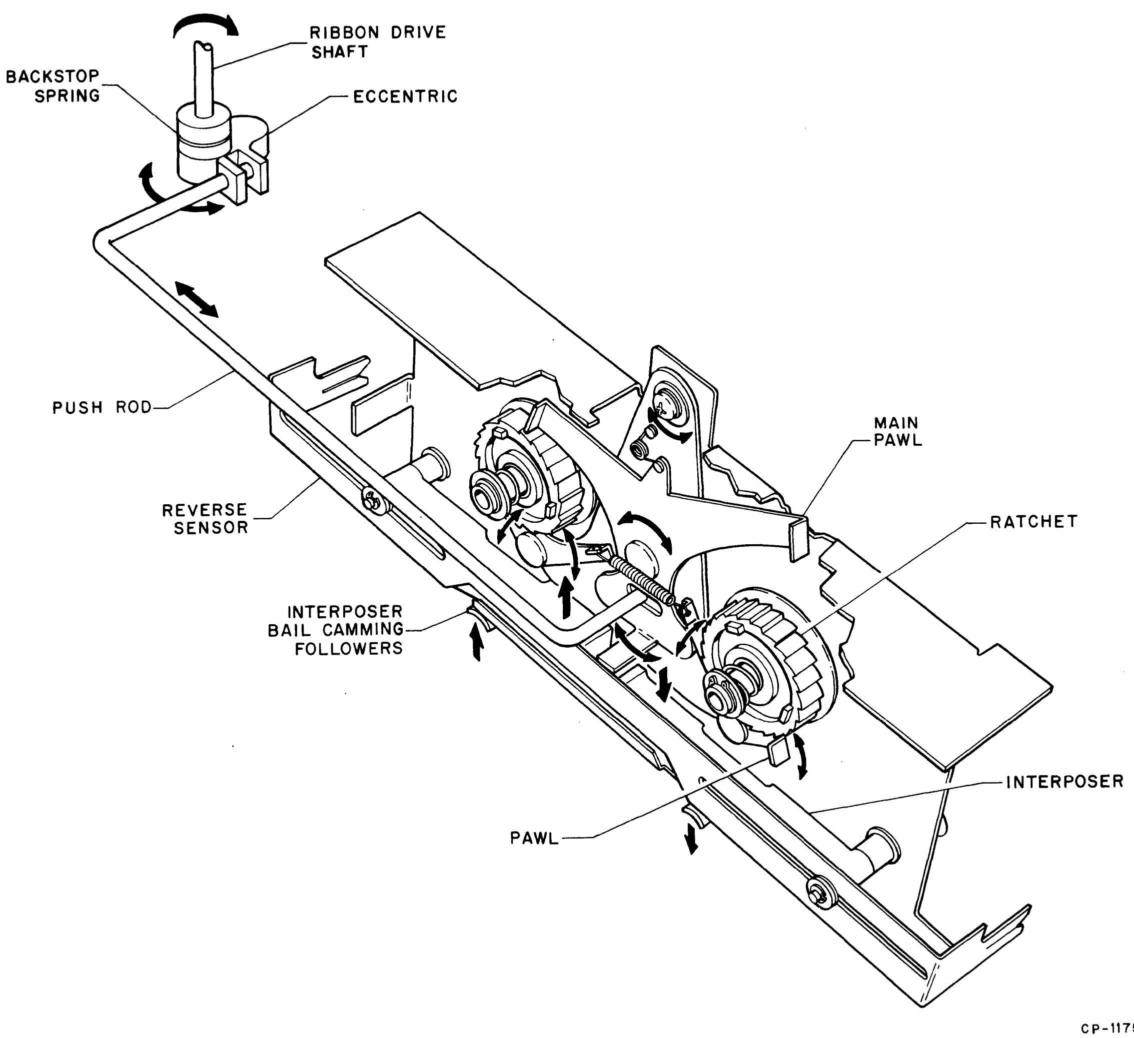



Figure 4-38 Ribbon Feed Subsystem

### 4.14.3 Paper Feed Subsystem

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

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

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

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

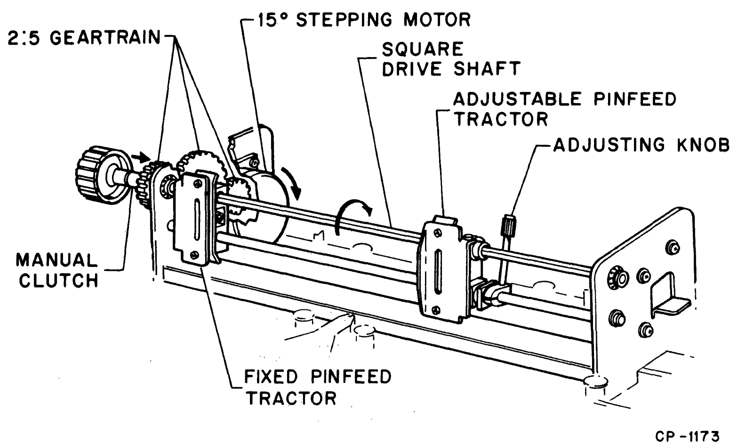



Figure 4-39 Paper Feed Subsystem

# CHAPTER 5
# ELECTRICAL SERVICING

## 5.1 ELECTRICAL TESTS

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

### 5.1.1 Off-Line Tests

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

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

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

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

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

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

1. Set the POWER ON/OFF switch to OFF.

2. Slip the drive belt from the pulley on the motor shaft. Release the tension on the timing belt by pressing the spring-loaded ribbon drive assembly.

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

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

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

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

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

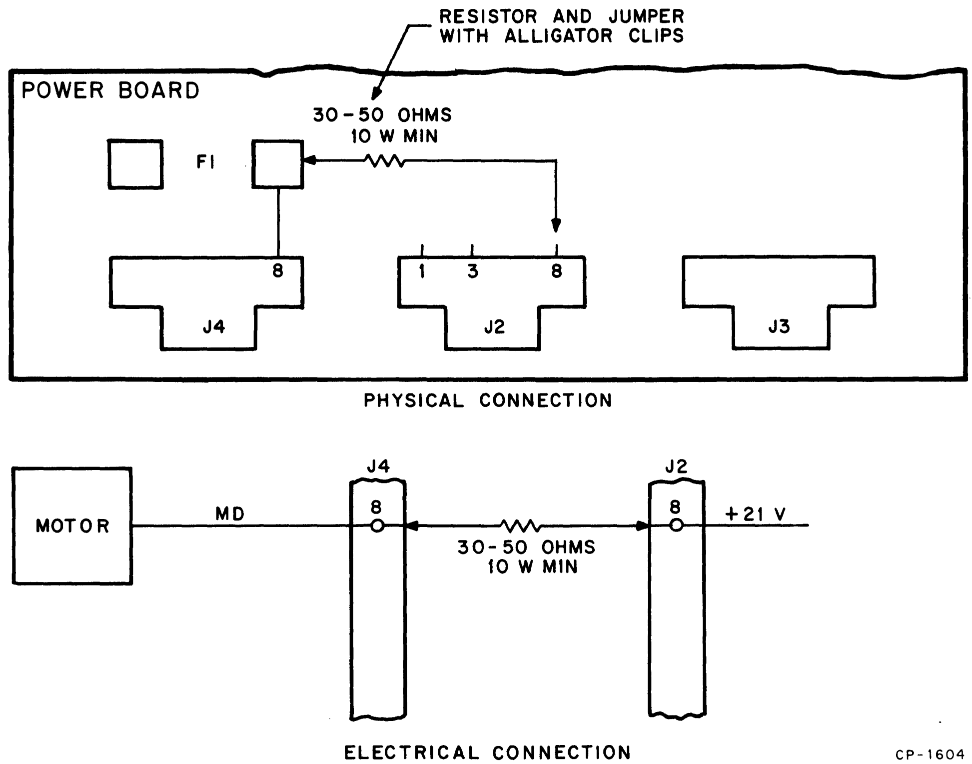



Figure 5-1 Encoder +21 V Test Setup

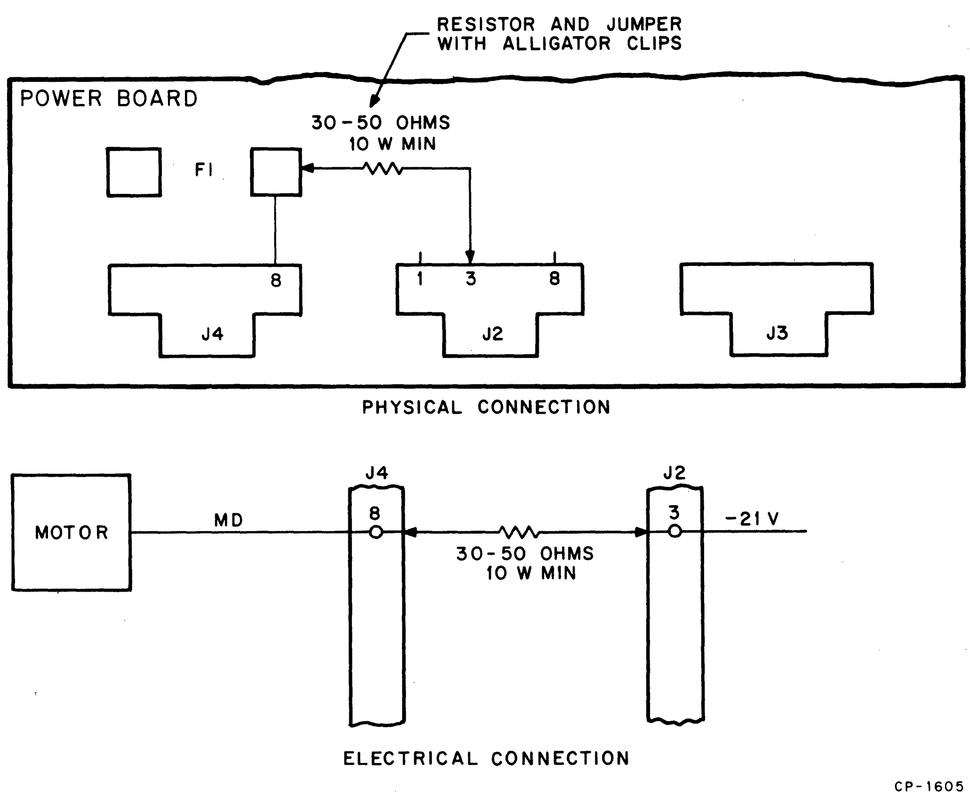



Figure 5-2 Encoder -21 V Test Setup

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

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

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

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

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

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

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

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

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

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

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

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

2. Check the waveforms at the test points listed in Figures 5-37 – 5-47.

3. Press the SHIFT LOCK key and strike the U key 16 times to fill the Character Buffer. Check the test points for the U character, one at a time as follows:

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

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

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

1. Set the ON/OFF switch to ON.

2. Check the waveforms at the test points indicated in Figures 5-48 – 5-55.

### 5.1.2 On-Line Tests

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

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

1. Set the ON/OFF switch to OFF.

2. Connect the transmit and receive loops back-to-back as shown in Figure 5-56.

3. Set the POWER ON/OFF switch to ON.

4. Set the BAUD RATE switch to 300.

5. Press the SHIFT LOCK key, the ) (close parenthesis) key and the REPEAT key to get a series of printing characters that have one dot in every row.

6. Check the waveforms at the test points listed in Figures 5-57 – 5-58.

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

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

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

9. Check the frequency at M7722 E55–40 for each position of the BAUD RATE switch:

| Position | Frequency |
|---|---|
| 300 | 4.8 kHz |
| 150 | 2.4 kHz |
| 110 | 1.76 kHz |

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

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

1. Set the ON/OFF switch to OFF.

2. Connect the transmit and receive loops back-to-back as shown in Figure 5-59.

3. Set the POWER ON/OFF switch to ON.

4. Set the BAUD RATE switch to 300.

5. Press the SHIFT LOCK key and the ) (close parenthesis) key and the REPEAT key to get a series of printing characters that have one dot in every row.

6. Check the waveforms at the test points listed in Figure 5-60.

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

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

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

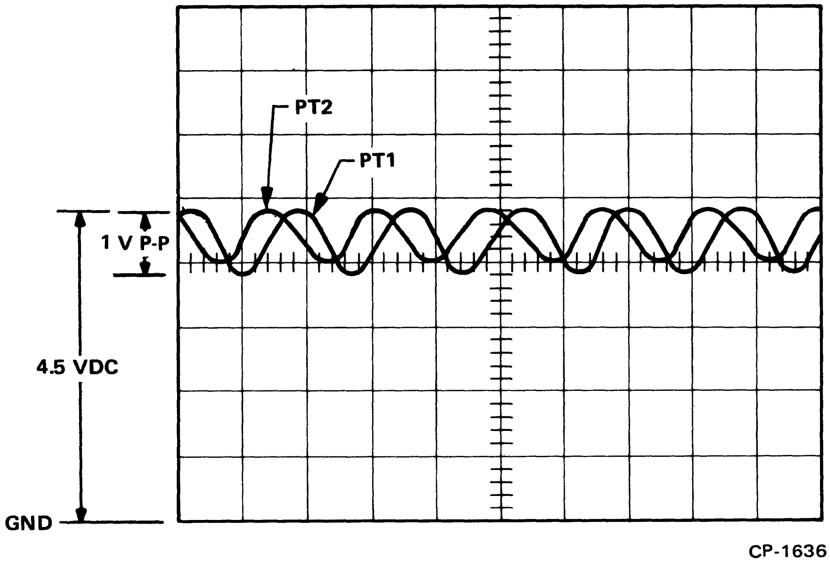
### 5.1.3 Troubleshooting Charts

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

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

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

## START OF ENCODER SIGNAL PROCESSING TEST WAVEFORMS



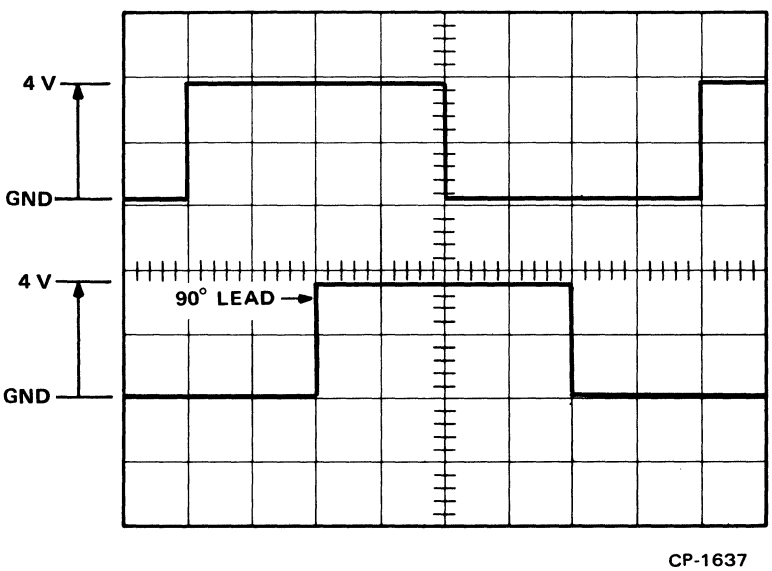

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 1 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | VARIABLE– APPROX. 75 μs/DIV |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to +PT1 at Power Board J4-5

CH2 to +PT2 at Power Board J4-6

Figure 5-3 +PT1 and +PT2 Waveforms



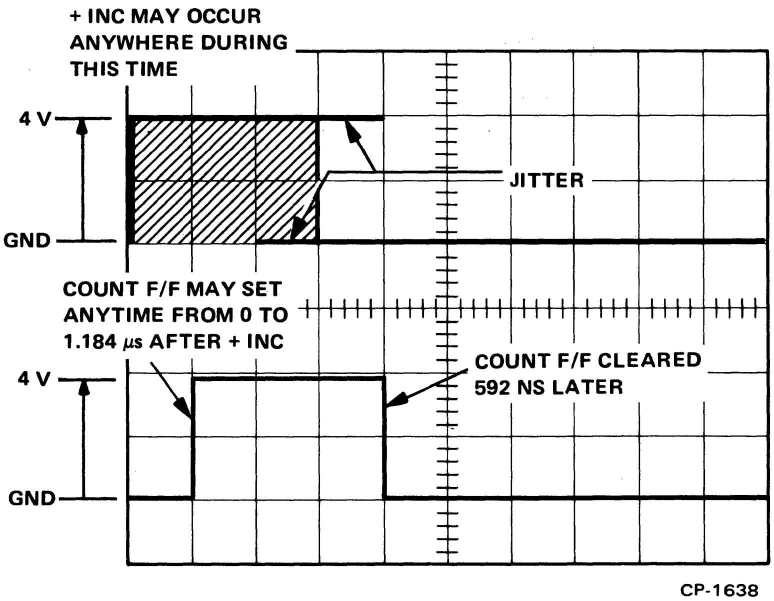

**SCOPE SETUP**

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

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

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

Figure 5-4 +PT1 and +PT2 Schmidt Waveforms



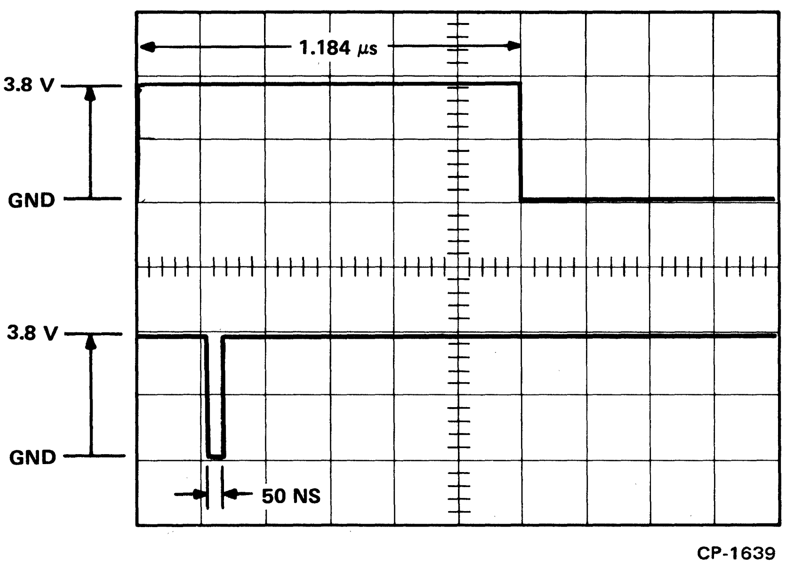

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 500 ns |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to +INC at M7722 E8-9

CH2 to COUNT at M7722 E4-9

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



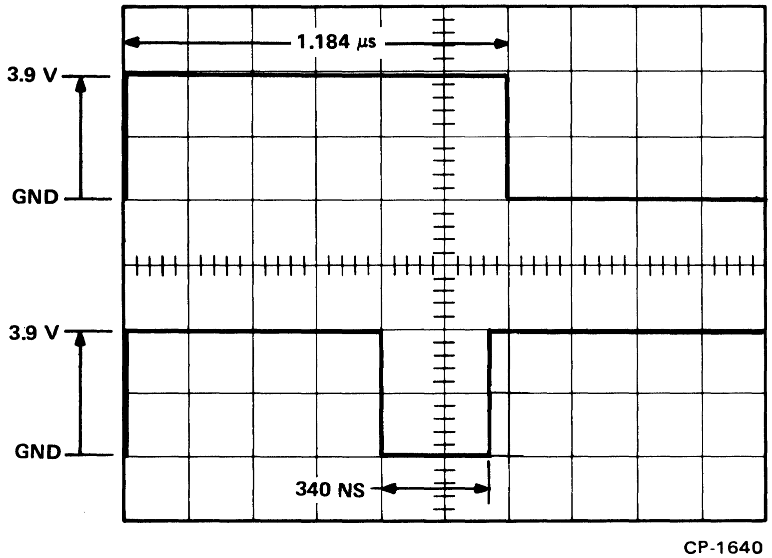

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 200 ns |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to COUNT F/F at M7722 E4-9

CH2 to COUNT Pulse at M7722 E29-8

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

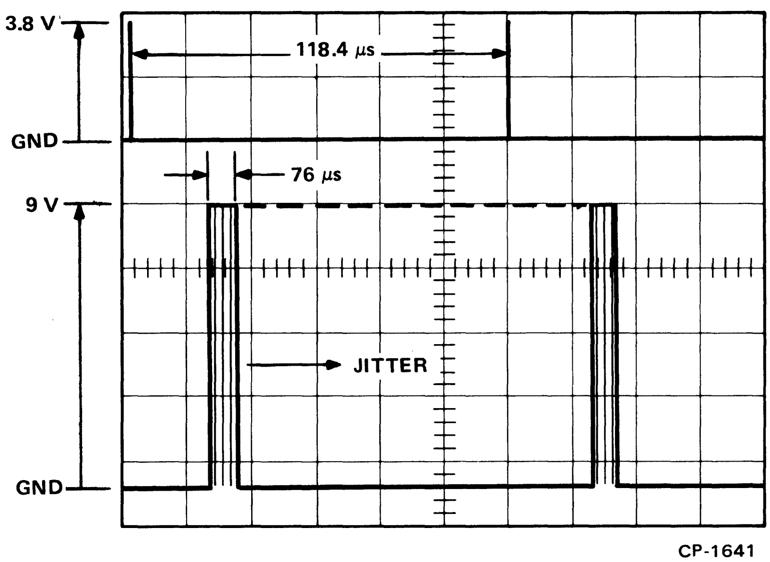



| SCOPE SETUP | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 200 ns |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to COUNT F/F at M7722 E4-9

CH2 to CLR +/- F/F at M7722 E9-6

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

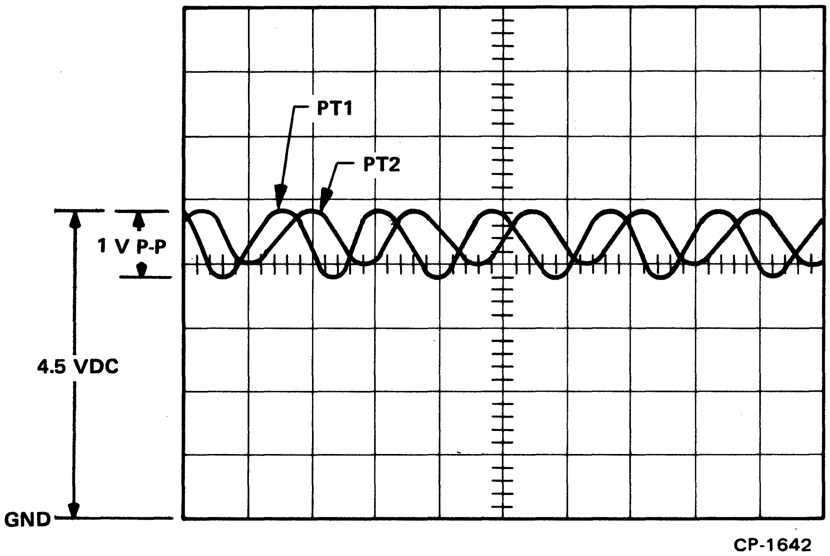



| SCOPE SETUP | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 20 µs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to +INC at M7722 E8-9

CH2 to +TACH at M7722 Q11-C

Figure 5-8 +INC and +TACH Waveforms



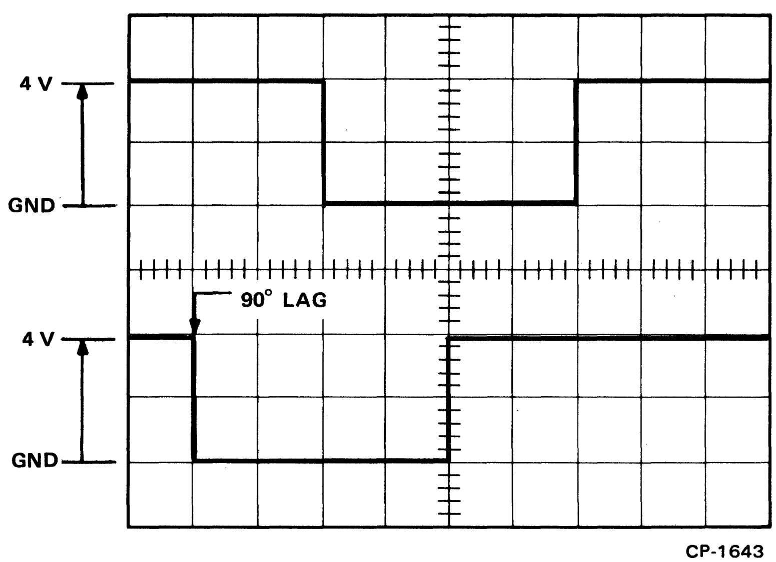

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 1 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | VARIABLE– APPROX. 75 $\mu$s |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to PT1 at Power Board J4-5

CH2 to PT2 at Power Board J4-6

Figure 5-9 -PT1 and -PT2 Waveforms



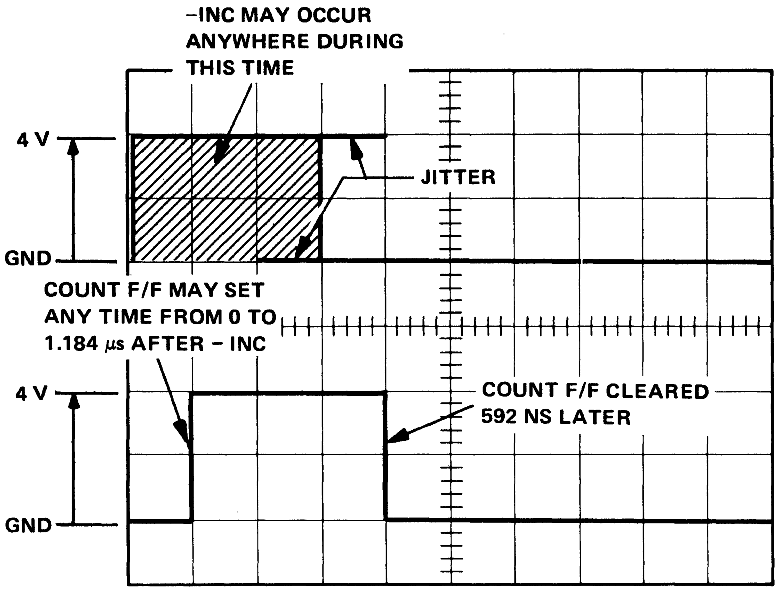

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 10 $\mu$s |
| TRIG SOURCE: | CH1, AC, POS, INT |

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

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

Figure 5-10 -PT1 and -PT2 Schmidt Waveforms




SCOPE SETUP

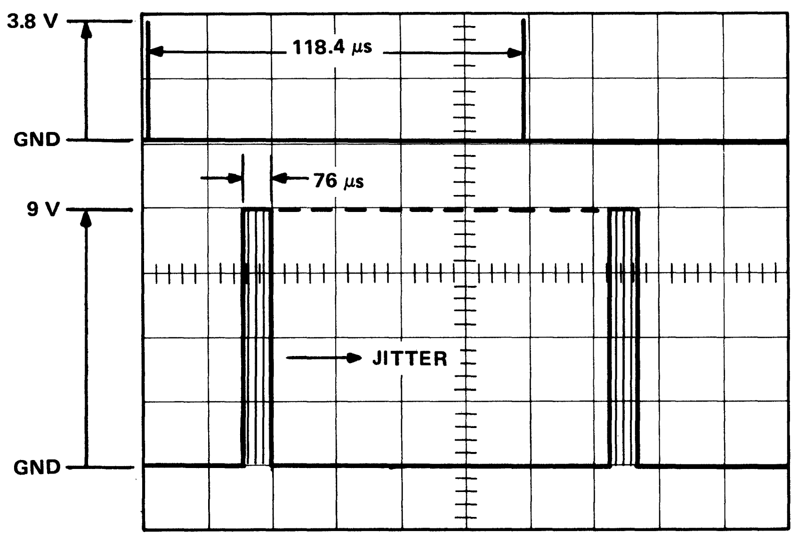
| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 500 ns |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to -INC at M7722 E8-5

CH2 to COUNT at M7722 E4-9

CP-1644

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




SCOPE SETUP

| | |
|---|---|
| VOLTS/DIV: | CH1=2 V; CH2=5 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 20 μs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, INT, POS |

CH1 to -INC at M7722 E8-5

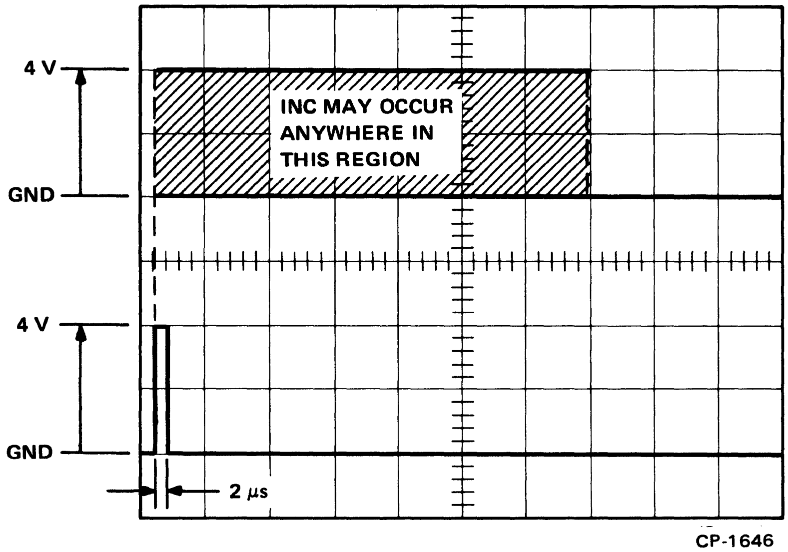
CH2 to -TACH at M7722 Q12-C

CP-1645

Figure 5-12 - INC and - TACH Waveforms

**END OF ENCODER SIGNAL PROCESSING TEST WAVEFORMS**

## START OF SERVO SPEED TEST WAVEFORMS



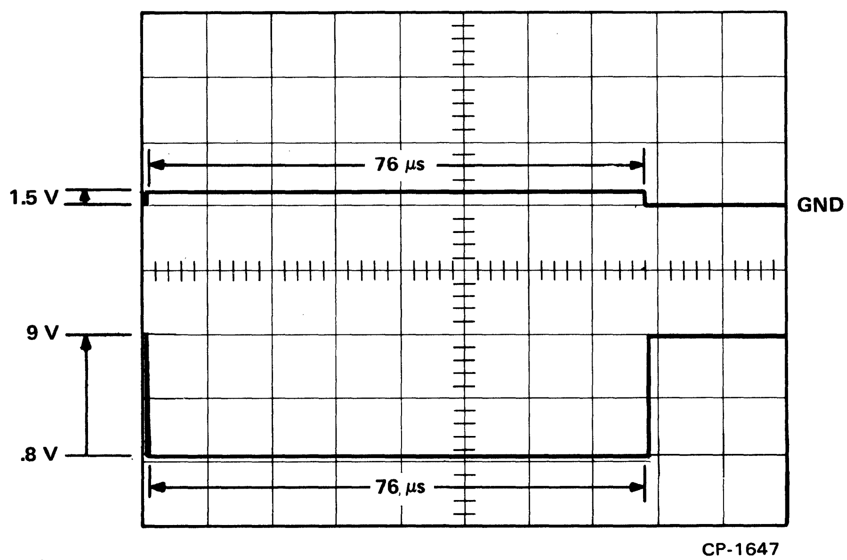

**SCOPE SETUP**

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

CH1 to INC at M7722 E5-9

CH2 to 76 μs CLOCK at M7722 E5-11

Figure 5-13 – INC and 76 μs CLOCK Waveforms



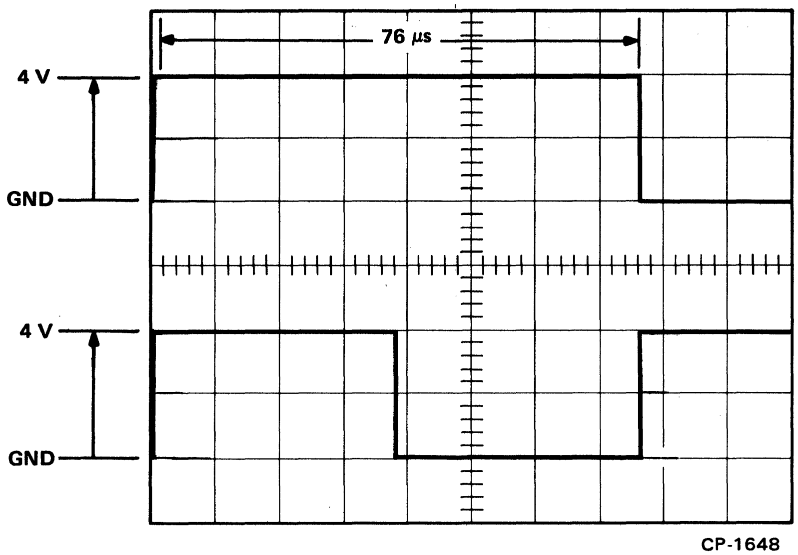

**SCOPE SETUP**

| | |
|---|---|
| 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 M7722 Q12-B

CH2 to TACH at M7722 Q12-C

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



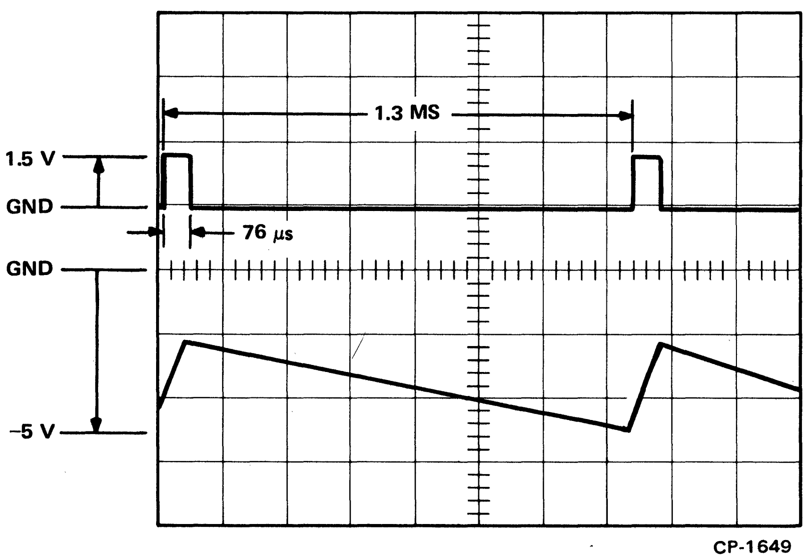

**SCOPE SETUP**

| | |
|---|---|
| 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

CH2 to 76 µs at M7722 E5-3

Figure 5-15 -TACH and 76 µs Waveforms



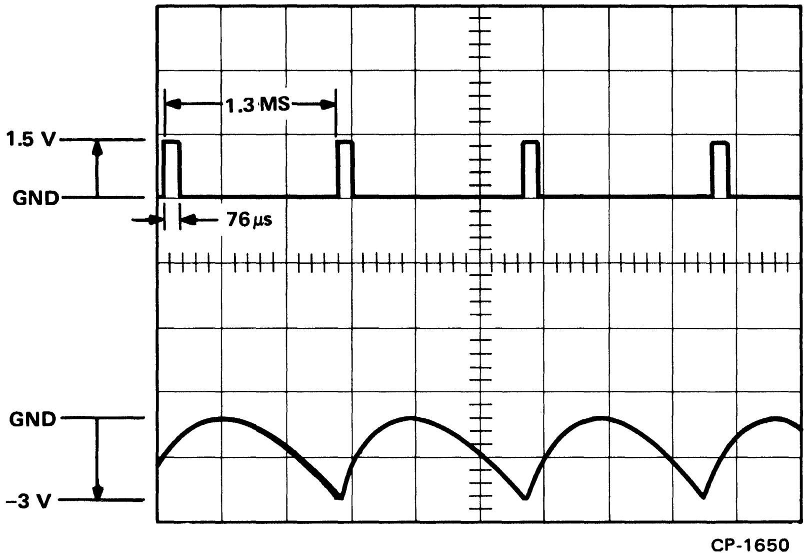

**SCOPE SETUP**

| | |
|---|---|
| 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

CH2 to SUM at M7722 J1-8 (E1-6)

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



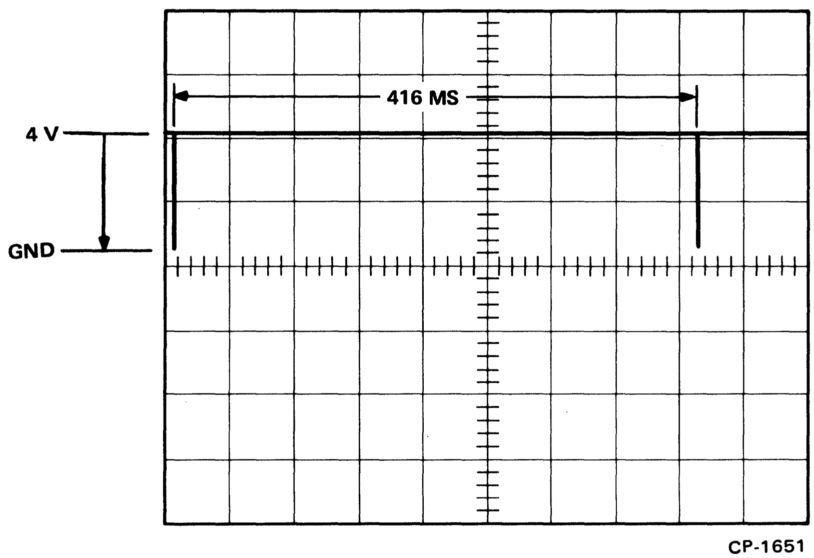

SCOPE SETUP

| | |
|---|---|
| VOLTS/DIV: | CH1=2 V; CH2=5 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 500 μs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

CH1 to -TACH at M7722 Q12-B

CH2 to MD at Power Board J4-8

Figure 5-17 -TACH and MD Waveforms

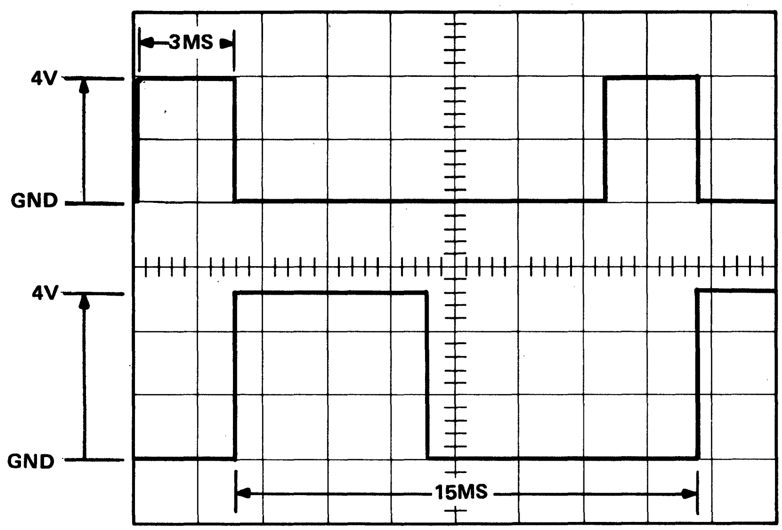



SCOPE SETUP

| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | CH 1 |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 50 ms |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, NEG, INT |

CH1 to INC at M7722 E30-9

Figure 5-18 INC Waveform




CP-1652

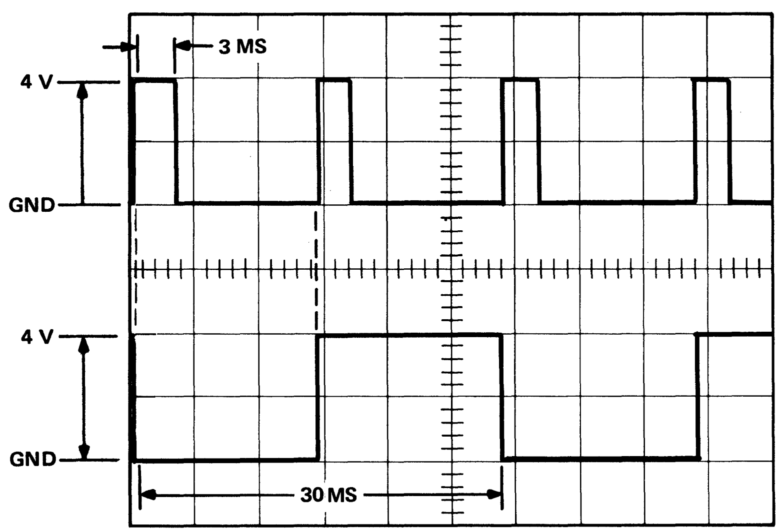
**SCOPE SETUP**

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

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

CH2 to COL INC COUNT 2 at M7722 E16-6

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




CP-1653

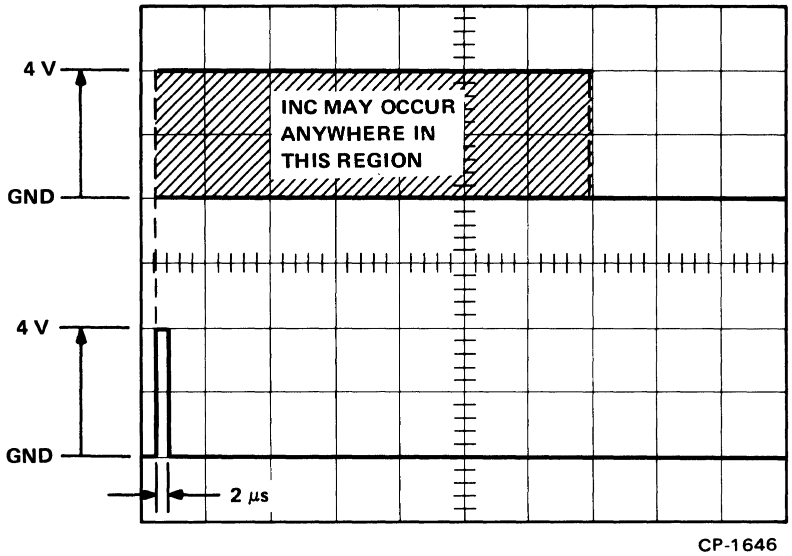
**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 5 ms |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

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

CH2 to BORROW H at M7722 E12-3

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




**SCOPE SETUP**

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 µs

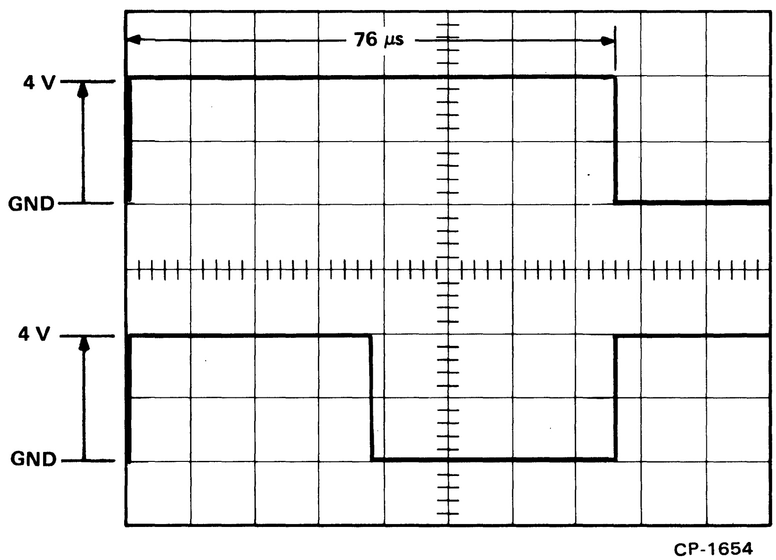
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to +INC at M7722 E3-9

CH2 to -76 µs CLOCK at M7722 E3-11

Figure 5-21 +INC and 76 µs Waveforms




**SCOPE SETUP**

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 10 µs

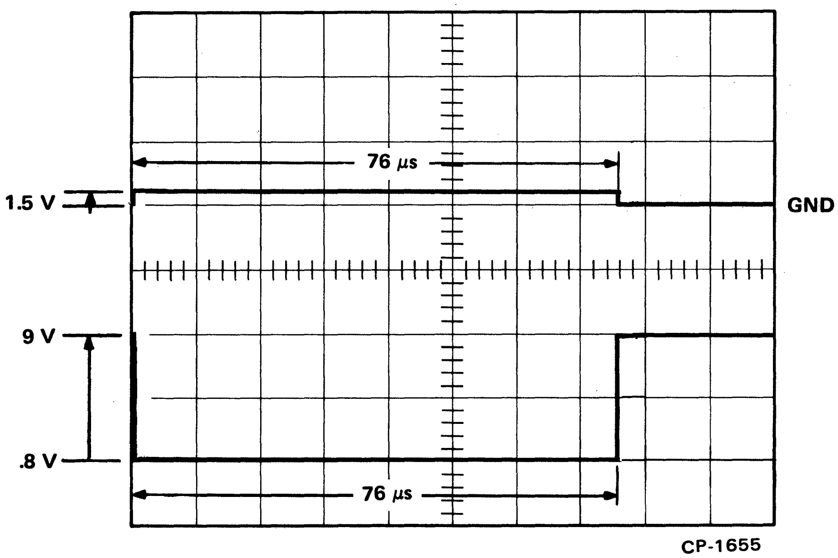
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to +TACH at M7722 E3-5

CH2 to 76 µs at M7722 E3-3

Figure 5-22 +TACH and 76 µs Waveforms



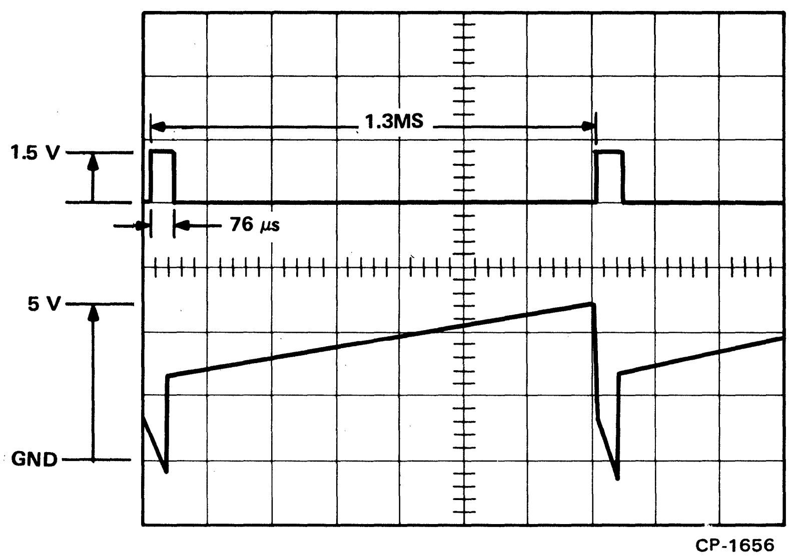

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | CH1=5 V; CH2=5 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 10 μs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

CH1 to +TACH at M7722 Q11-B

CH2 to +TACH at M7722 Q11-C

Figure 5-23 +TACH Waveforms at Q11-B and Q11-C



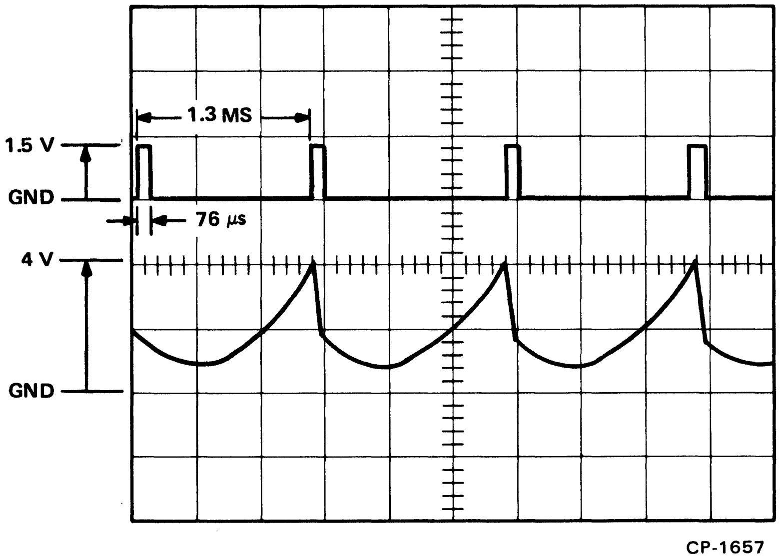

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 200 μs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

CH1 to +TACH at M7722 Q11-B

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

Figure 5-24 +TACH and SUM Waveforms



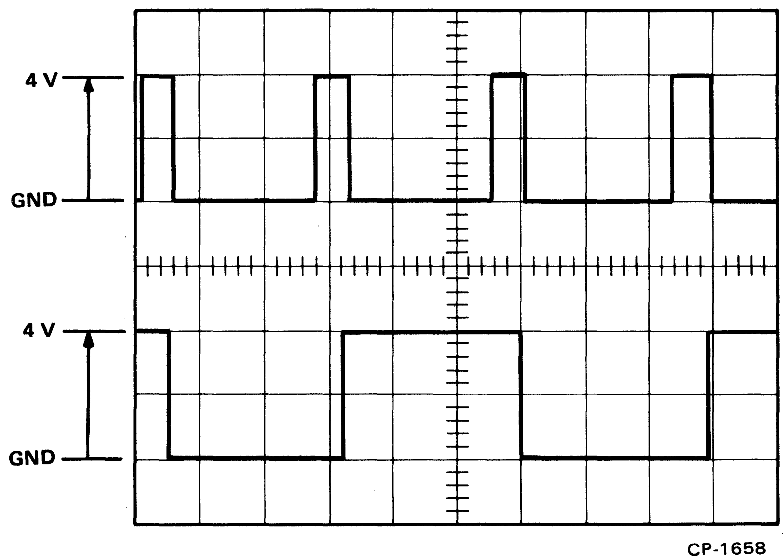

**SCOPE SETUP**

| | |
|---|---|
| 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

CH2 to MD at J4-8

Figure 5-25 +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 |

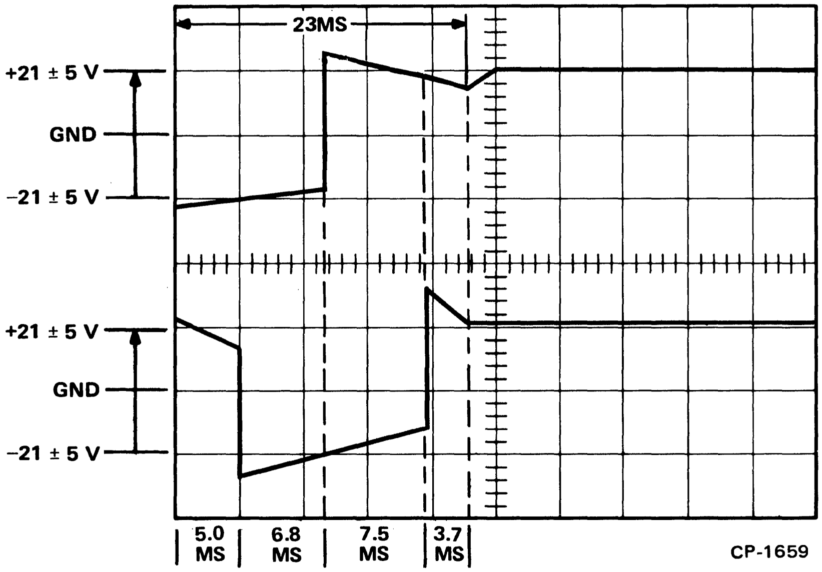
CH1 to COL INC COUNT 3 (MSB) at M7722 E16-7

CH2 to CARRY H at M7722 E7-6

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

**END OF SERVO SPEED TEST WAVEFORMS**

## START OF LF STEPPING TEST WAVEFORMS



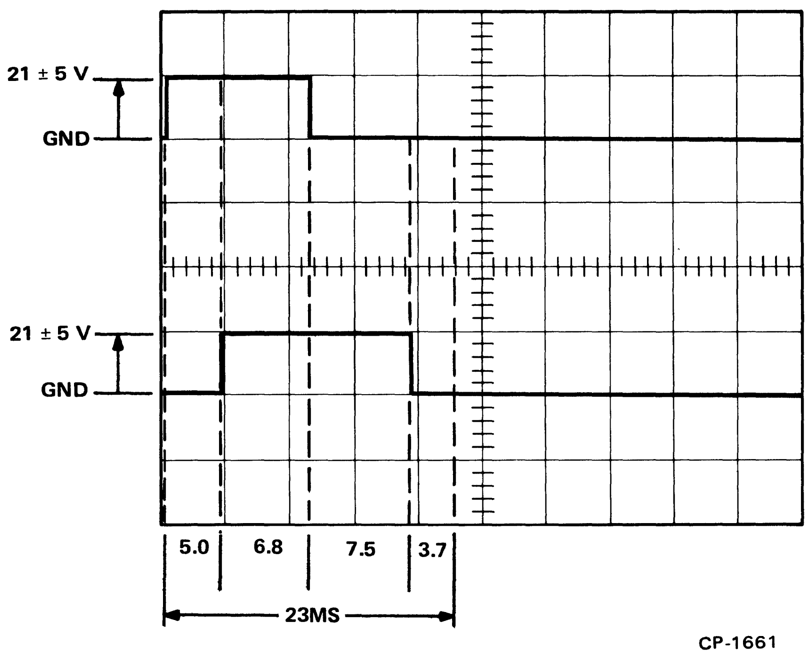

**SCOPE SETUP**

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



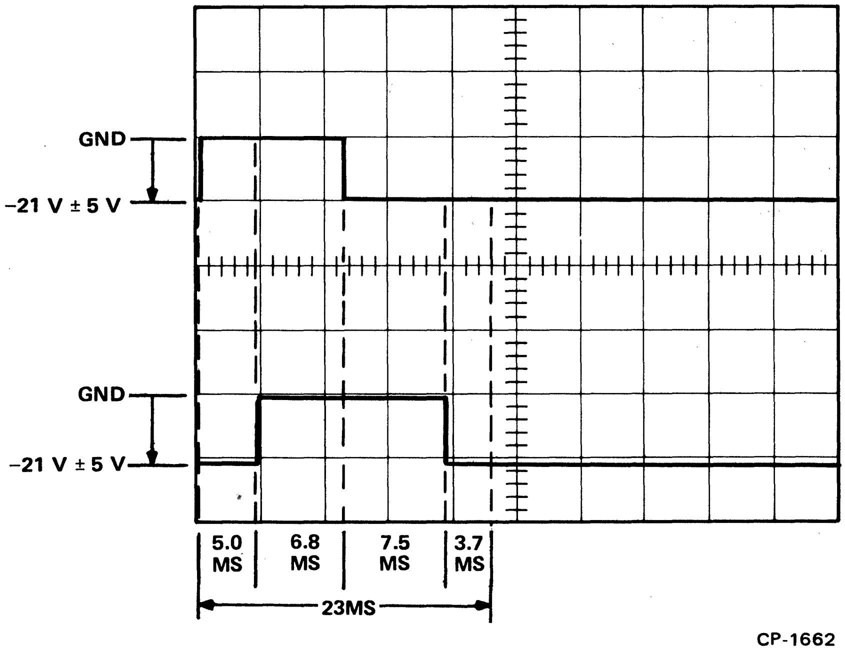

**SCOPE SETUP**

| | |
|---|---|
| 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 TPA12 (Q34-C)

CH2 to LF2 at Power Board TPA15 (Q36-C)

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



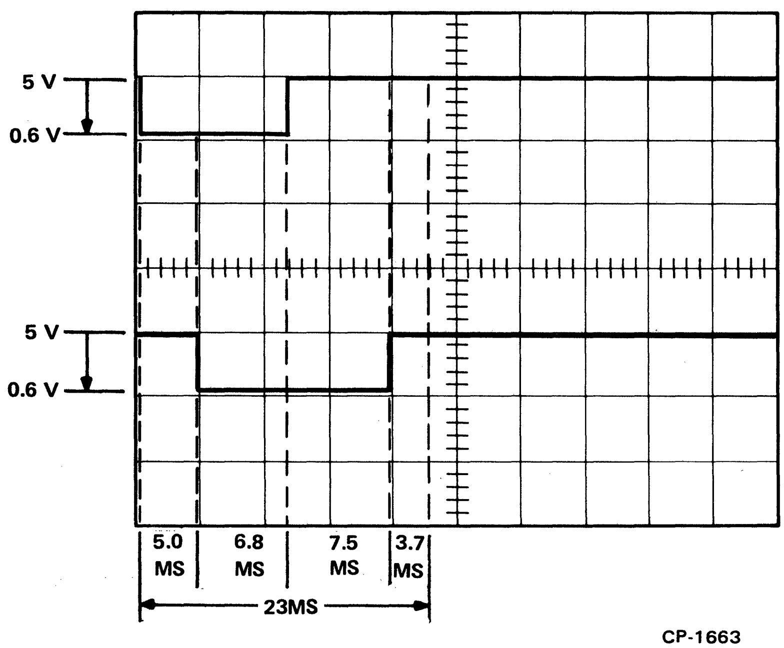

**SCOPE SETUP**

| | |
|---|---|
| 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 TPA13 (Q35-C)

CH2 to LF2 at Power Board TPA16 (Q37-C)

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



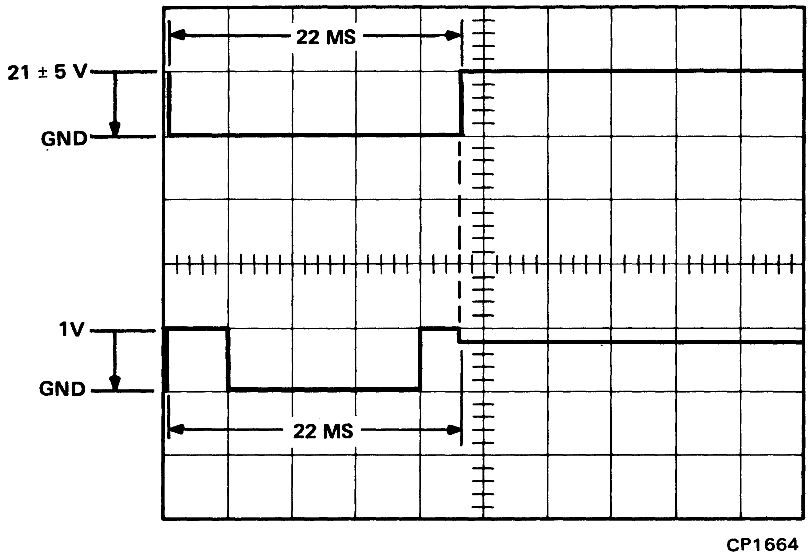

**SCOPE SETUP**

| | |
|---|---|
| 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 TPA14 (Q39-C)

CH2 to LF2 at Power Board TPA17 (Q38-C)

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



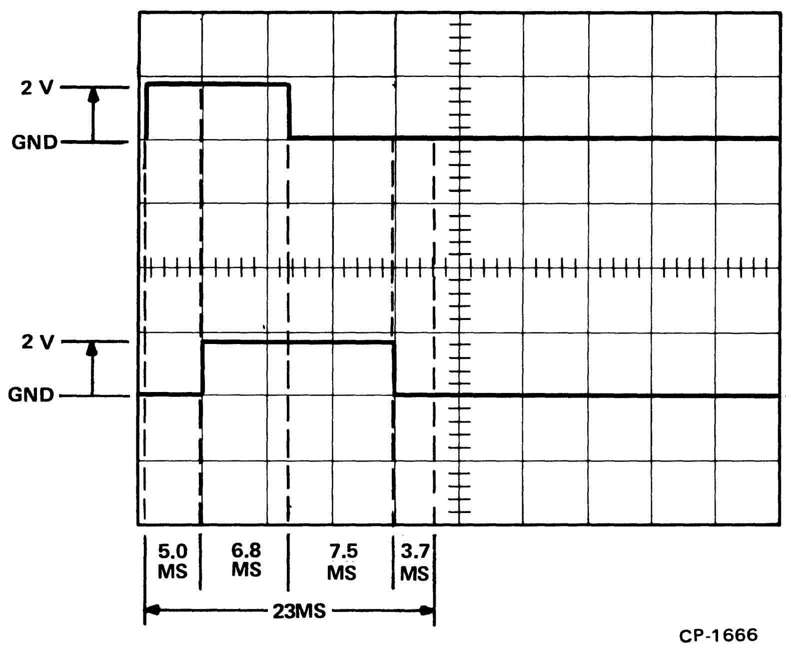

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | CH1=20 V; CH2=2 V/DIV |
| 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 5-31 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 J1-JJ (E29-9)

CH2 to LF2 at M7722 J1-P (E24-5)

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

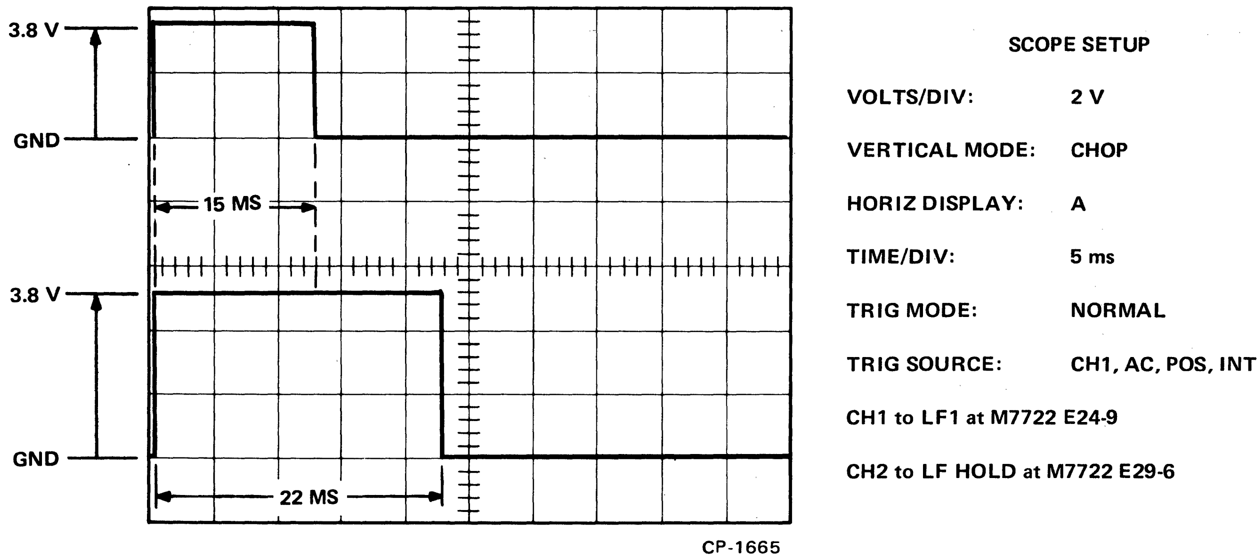
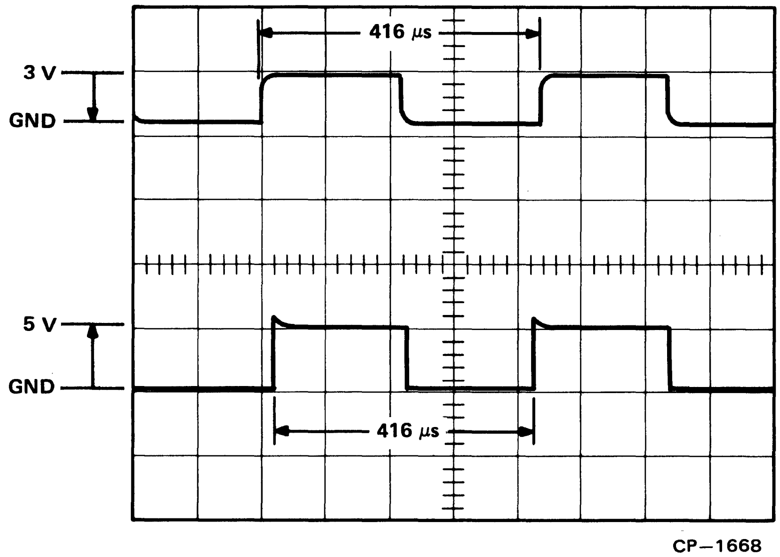



Figure 5-33 LF1 Waveform at E24-9 and LF HOLD Waveform at E29-6

**END OF LF STEPPING TEST WAVEFORMS**

# START OF BELL TEST WAVEFORMS



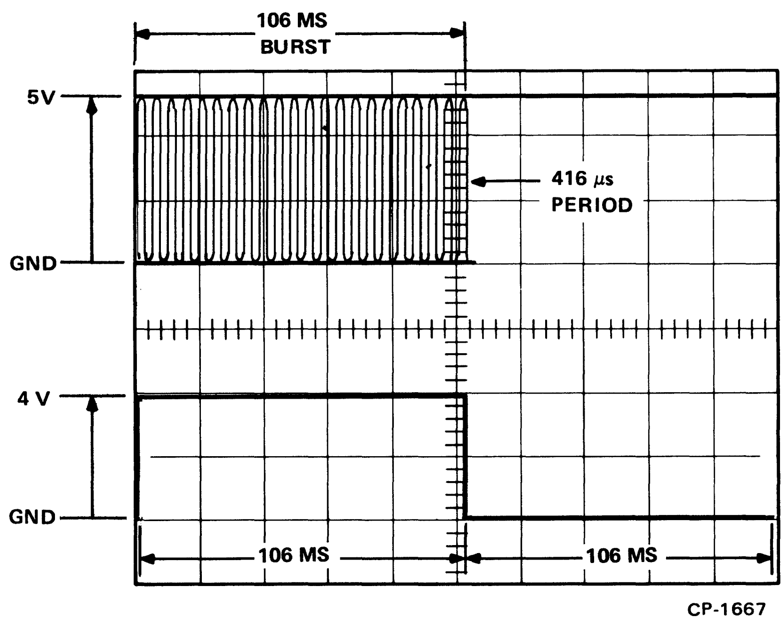

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 5 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 100 μs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, NEG, INT |

CH1 to BELL Source at Power Board J5-1

CH2 to BELL SINK at Power Board J5-2

Figure 5-34 BELL Source and BELL SINK Waveforms



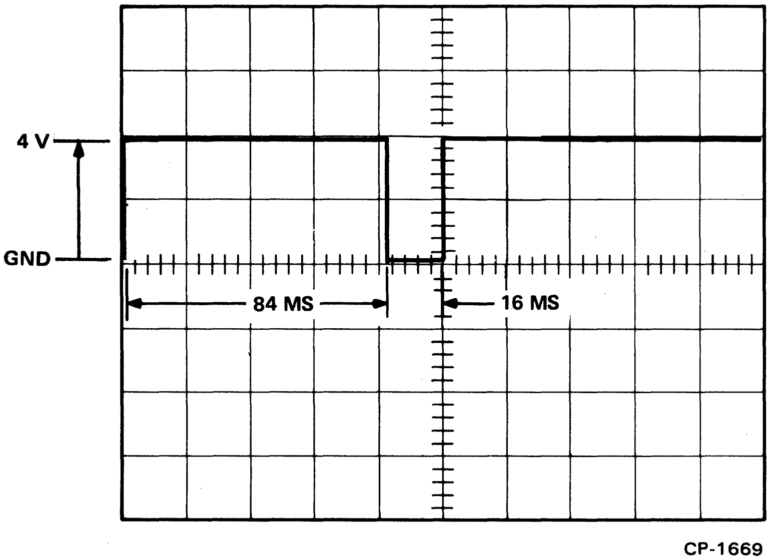

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | CHOP |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 20 ms |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

CH1 to BELL SINK at Power Board J5-1

CH2 to BEL at M7722 E36-5

Figure 5-35 BELL SINK and BEL Waveforms




SCOPE SETUP

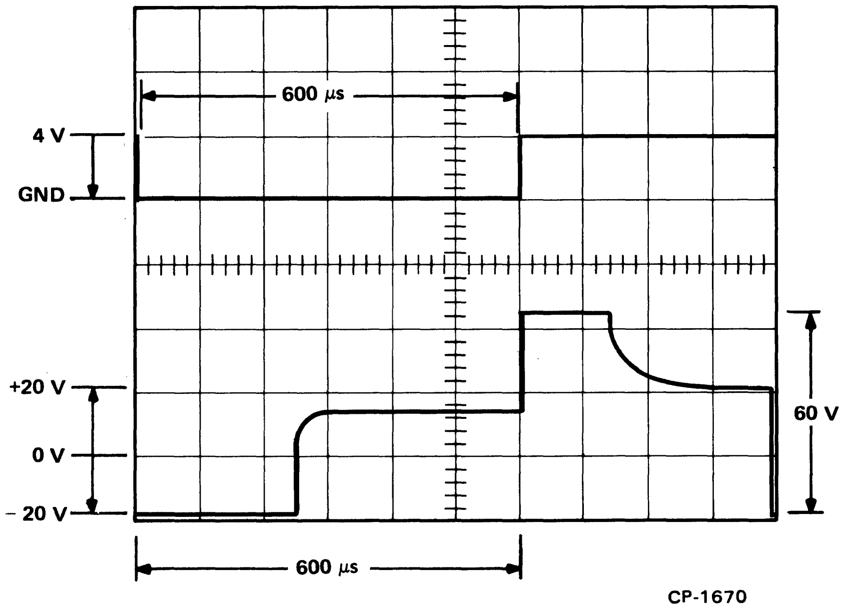
| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERT MODE: | CH1 |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 20 ms |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

CH1 to KBH H at M7722 E51-8

Figure 5-36 KBH H Pulse Waveform

**END OF BELL TEST WAVEFORMS**

## START OF PRINTABLE CHARACTER TEST WAVEFORMS



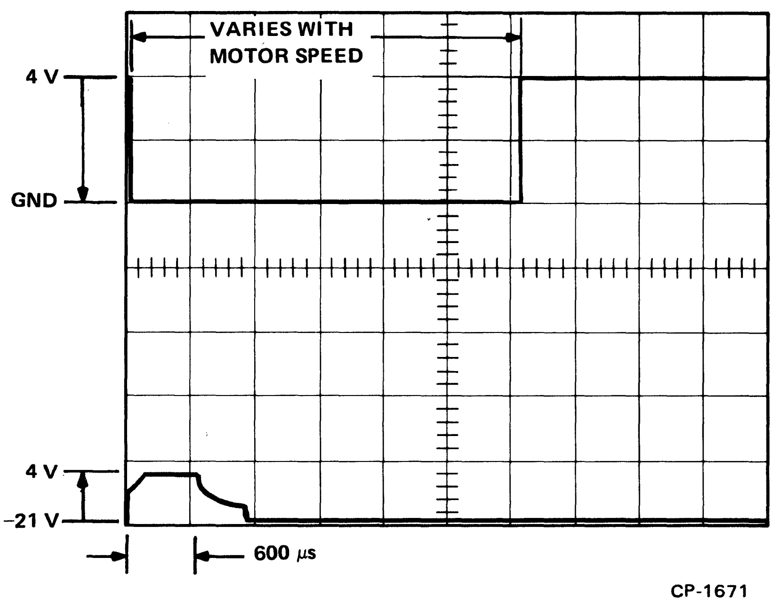

SCOPE SETUP

| | |
|---|---|
| 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 (R58)

CH2 to SOL1 – SOL7 at Power Board J6 pins K2, N2, 02, 62, T2, F2 or S2 (Q17-C, Q19-C, Q1-C, Q20-C, Q18-C, Q16-C or Q21-C)

Figure 5-37 HD EN and SOL Waveforms at J6



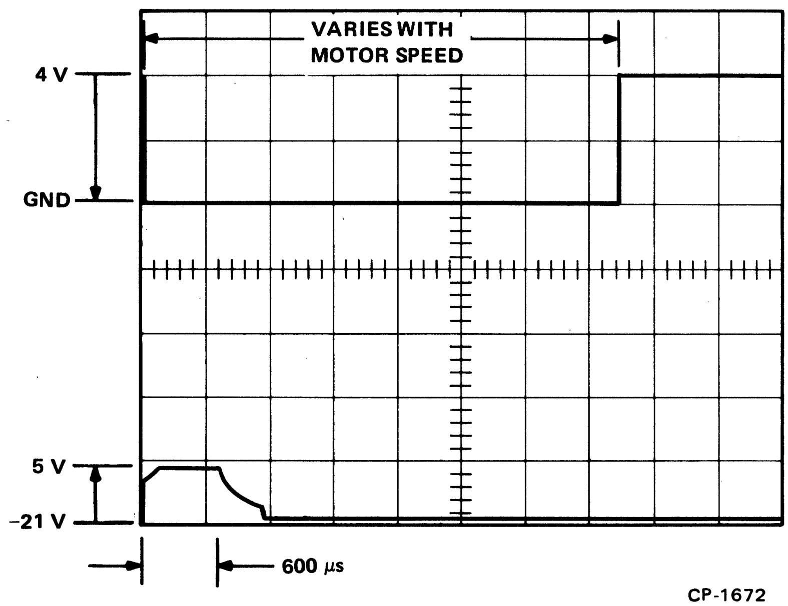

SCOPE SETUP

| | |
|---|---|
| VOLTS/DIV: | CH1=2 V; CH2=5 V |
| VERTICAL MODE: | CHOP |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 500 µs |
| TRIG MODE: | HF REJECT |
| TRIG SOURCE: | CH1, AC, NEG, INT |

CH1 to HS1 – HS7 at Power Board J1 (right side of R31, R49, R7, R28, R42, R15, and R35)

CH2 to SD1 – SD7 at test points V, R2 BZ, O, K or A8

Figure 5-38 HS1 and SD1 Waveforms at TPP



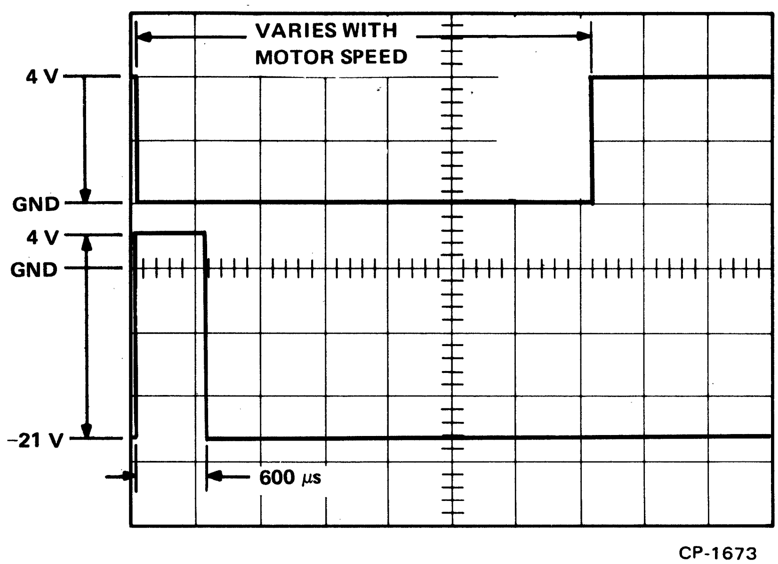

SCOPE SETUP

| | |
|---|---|
| VOLTS/DIV: | CH1=2 V; CH2=5 V; AC-COUPLED |
| VERTICAL MODE: | CHOP |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 500 µs |
| TRIG MODE: | HF REJECT |
| TRIG SOURCE: | CH1, AC, NEG, INT |

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

CH2 to SD1 – SD7 at test points A3, D, Z, T, N, or A7

Figure 5-39 HS1 and SD1 Waveforms at TPN



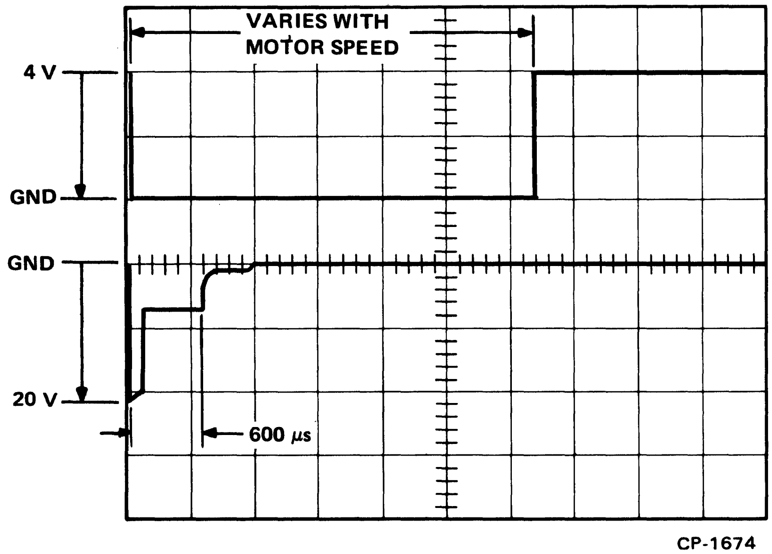

SCOPE SETUP

| | |
|---|---|
| VOLTS/DIV: | CH1=2 V; CH2=10 V |
| VERTICAL MODE: | CHOP |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 500 µs |
| TRIG MODE: | HF REJECT |
| TRIG SOURCE: | CH1, AC, NEG, INT |

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

CH2 to SD1 – SD7 at test points A1, B, W, R, L, F or A5

Figure 5-40 HS1 and SD1 Waveforms at TPL



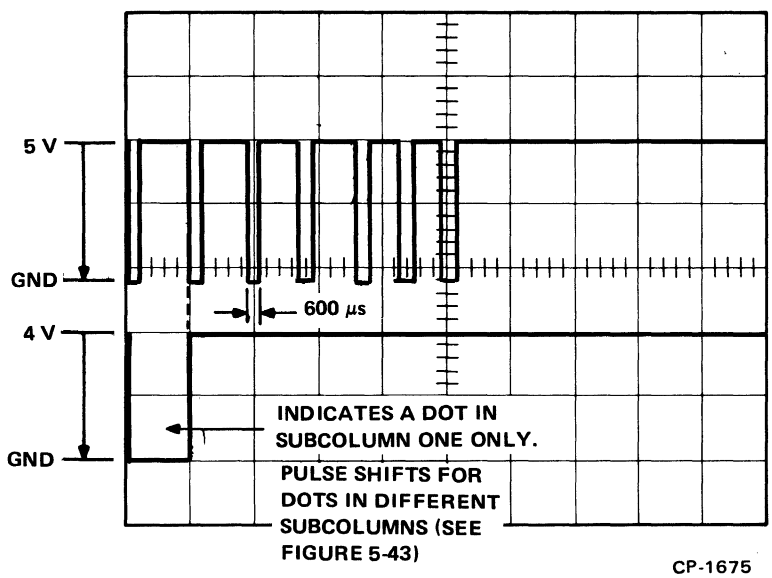

**SCOPE SETUP**

| | |
|---|---|
| VOLTS/DIV: | CH1=2 V; CH2=10 V |
| VERTICAL MODE: | CHOP |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 500 μs |
| TRIG MODE: | HF REJECT |
| TRIG SOURCE: | CH1, AC, NEG, INT |

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

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

Figure 5-41 HS1 and SD1 Waveforms at TPM



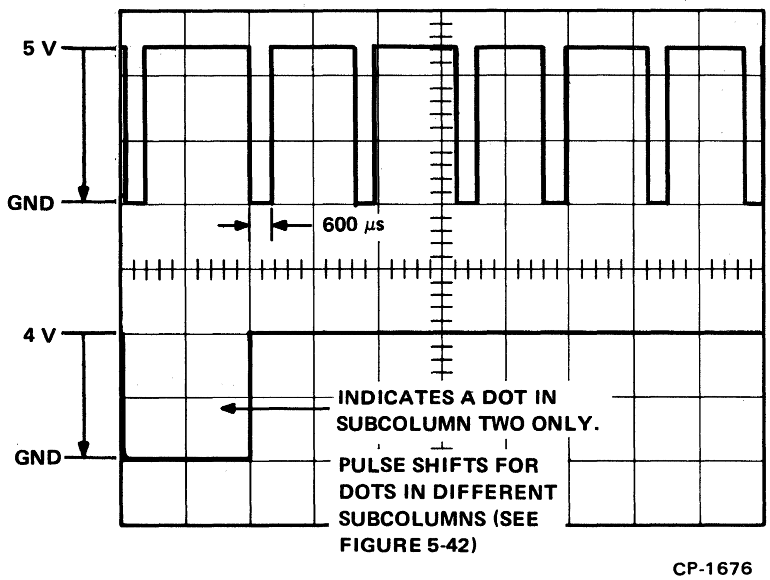

**SCOPE SETUP**

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

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

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

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




SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 2 ms

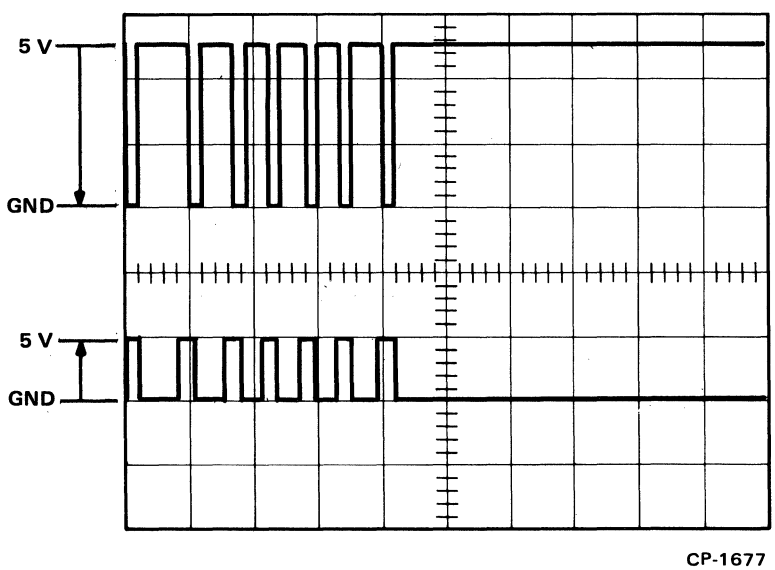
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

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

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

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




SCOPE SETUP

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

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 5 ms

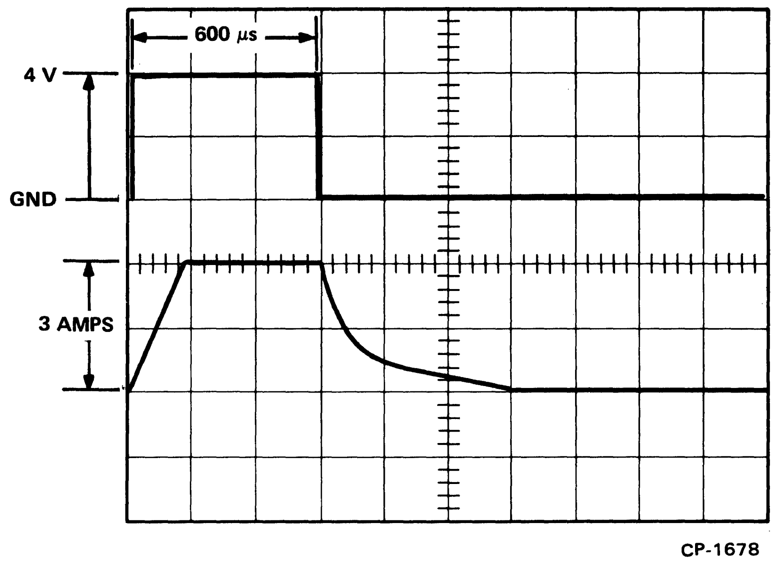
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

CH1 to HD EN at J1 (R58)

CH2 to BUFF HEAD EN H at TPA

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




SCOPE SETUP

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

VERTICAL MODE: CHOP

HORIZ DISPLAY: A

TIME/DIV: 200 μs

TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CAUTION

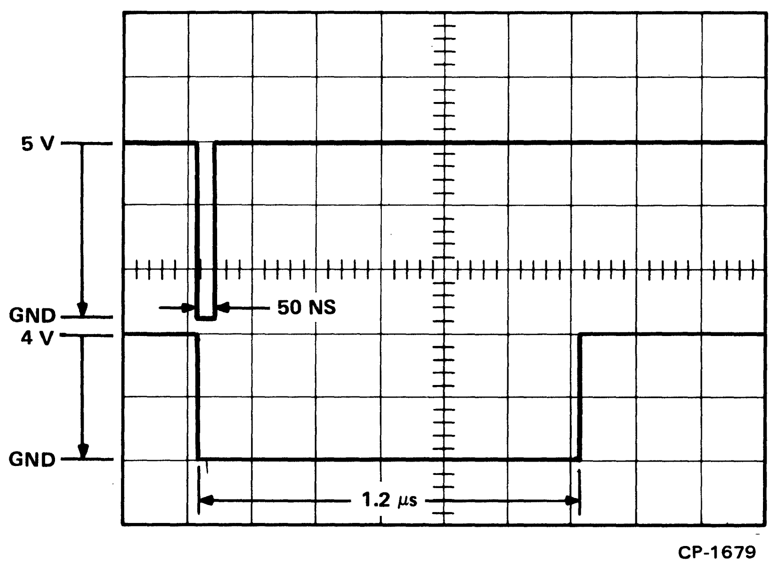
Float scope power line before making these connections.

CH1 to HD EN at M7722 E39-9

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

Probe ground on –21 V

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




SCOPE SETUP

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 ns

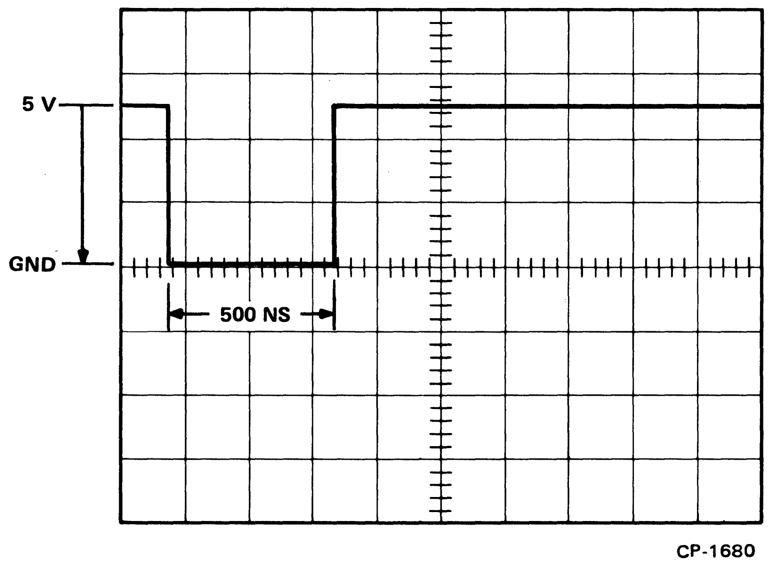
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, NEG, INT

CH1 to WRITE BUFF L at E60-10

CH2 to CLR R DONE at E60-8

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




SCOPE SETUP

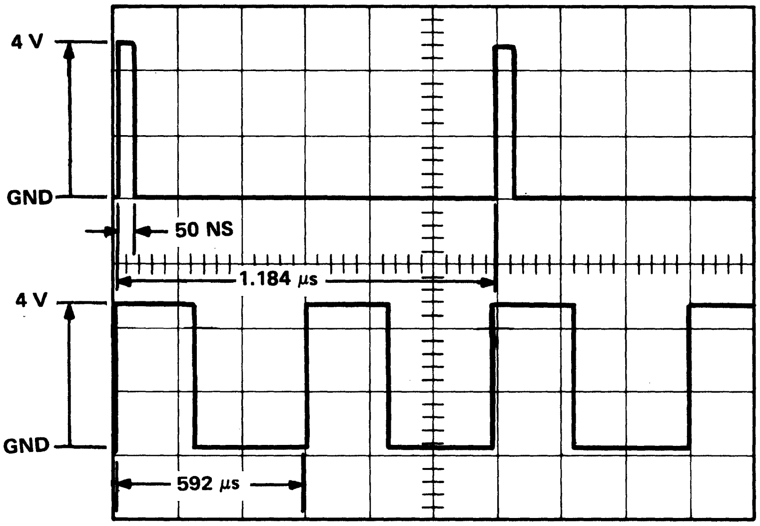
| | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | CH1 |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 200 ns |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, NEG, INT |

CH1 to KEY STB L at M7722 E67-4

Figure 5-47 KEY STB L Waveform

**END OF PRINTABLE CHARACTER TEST WAVEFORMS**

## START OF CLOCK TEST WAVEFORMS




CP-1681

**SCOPE SETUP**

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 ns

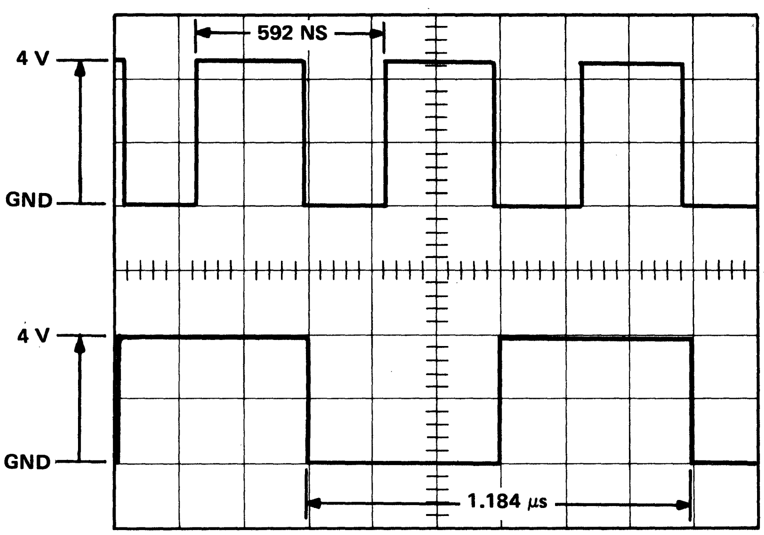
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to CLK H at M7722 E64-5

CH2 to 592 ns at M7722 E64-10

Figure 5-48 CLK H and 592 ns Waveforms




CP-1682

**SCOPE SETUP**

VOLTS/DIV: 2 V

VERTICAL MODE: ALT

HORIZ DISPLAY: A

TIME/DIV: 200 μs

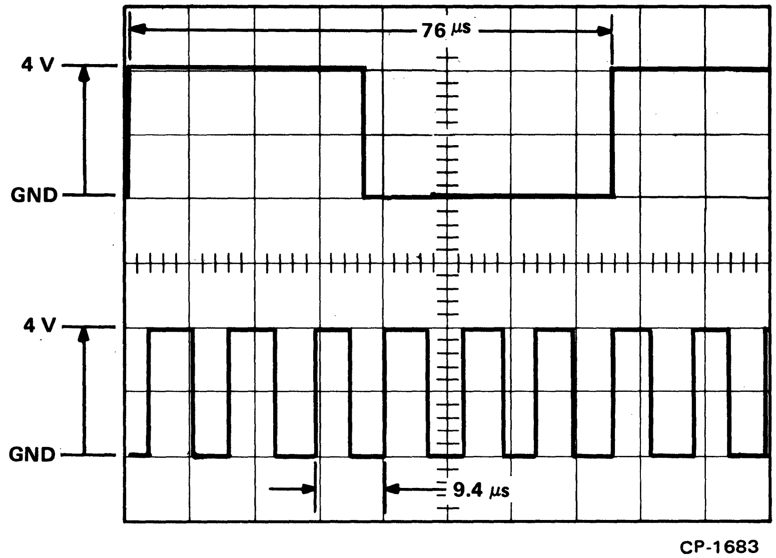
TRIG MODE: NORMAL

TRIG SOURCE: CH1, AC, POS, INT

CH1 to 1.184 μs at M7722 E13-1

CH2 to 592 ns at M7722 E13-14

Figure 5-49 592 ns and 1.184 μs Waveforms



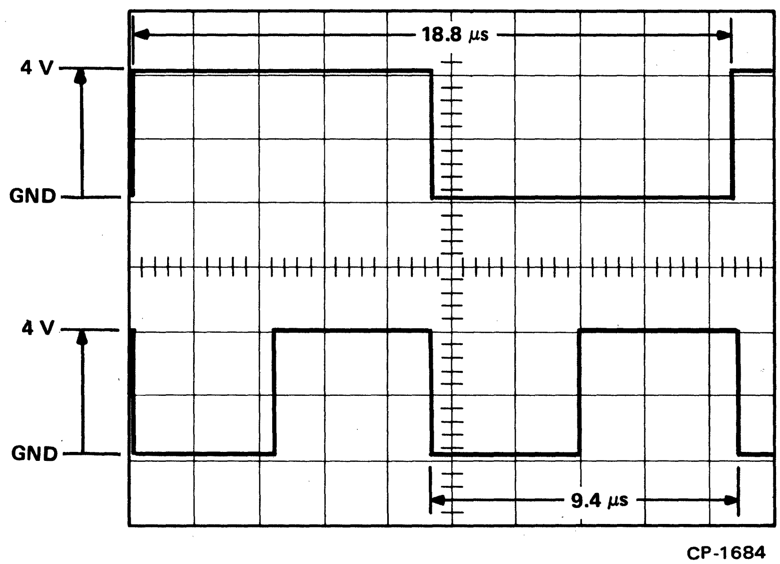

**SCOPE SETUP**

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

CH1 to 76 µs at M7722 E26-11

CH2 to 9.4 µs at M7722 E26-1

Figure 5-50 76 µs and 9.4 µs Waveforms



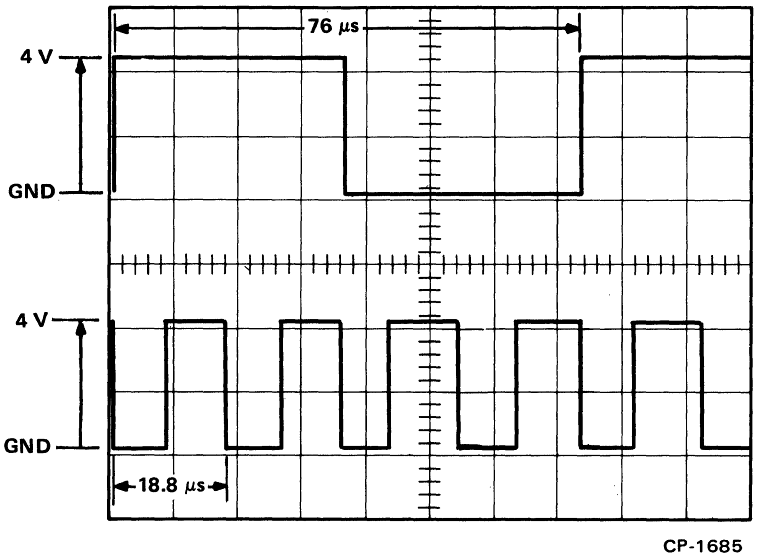

**SCOPE SETUP**

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

CH1 to 19L at M7722 E26-9

CH2 to 9.4 µs at M7722 E26-1

Figure 5-51 19 L and 9.4 µs Waveforms



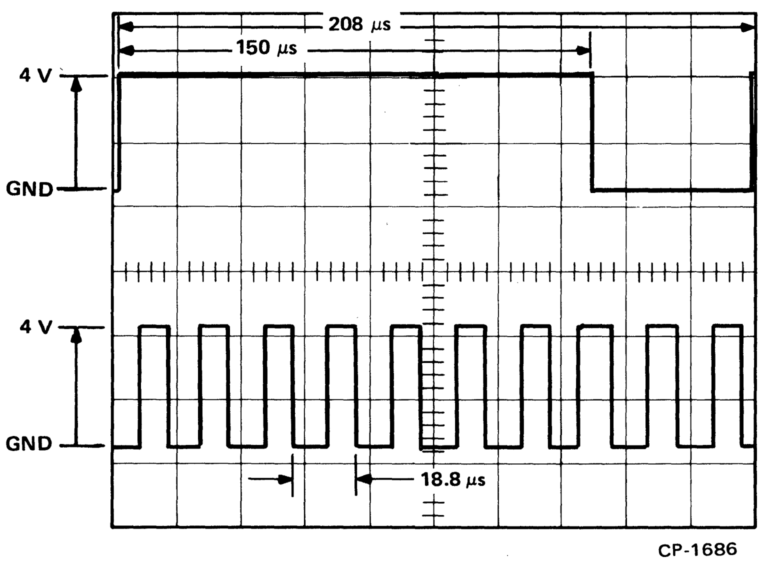

**SCOPE SETUP**

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

CH1 to 76 µs at M7722 E26-11

CH2 to 18.8 µs at M7722 E26-9

Figure 5-52 76 µs and 18.8 µs Waveforms



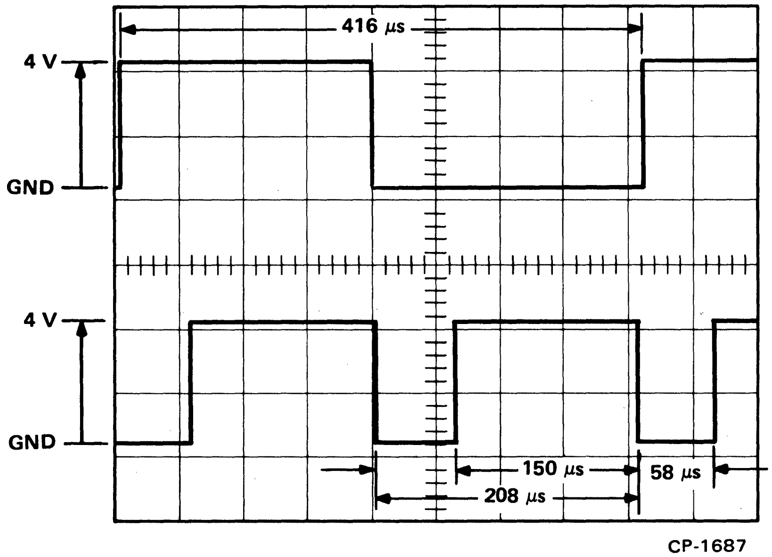

**SCOPE SETUP**

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

CH1 to 4.8 kHz at M7722 E63-11

CH2 to 18.8 µs at M7722 E26-9

Figure 5-53 4.8 kHz and 18.8 µs Waveforms

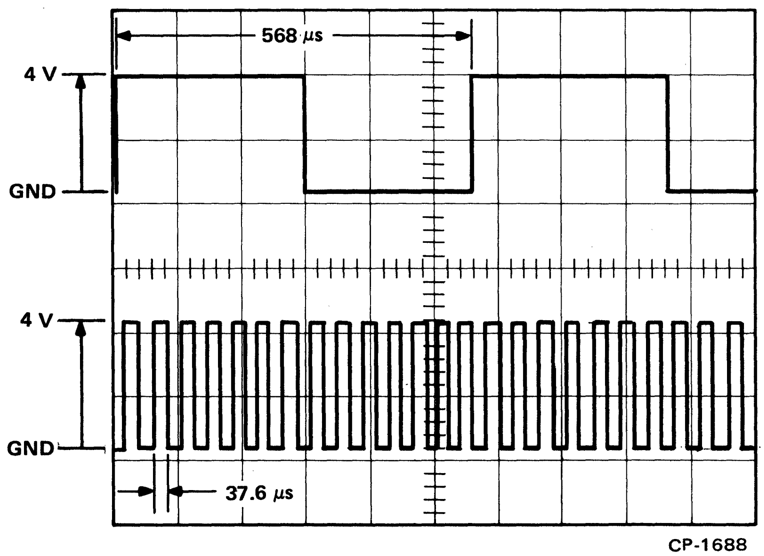



| SCOPE SETUP | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 50 μs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

CH1 to 208H at M7722 E26-12

CH2 to 4.8 kHz at M7722 E63-11

Figure 5-54 208 H and 4.8 kHz Waveforms




| SCOPE SETUP | |
|---|---|
| VOLTS/DIV: | 2 V |
| VERTICAL MODE: | ALT |
| HORIZ DISPLAY: | A |
| TIME/DIV: | 100 μs |
| TRIG MODE: | NORMAL |
| TRIG SOURCE: | CH1, AC, POS, INT |

CH1 to 1.76 kHz at M7722 E68-11

CH2 to 37.6 μs at M7722 E26-8

Figure 5-55 1.76 kHz and 37.6 μs Waveforms

**END OF CLOCK TEST WAVEFORMS**

## START OF CURRENT LOOP INTERFACE WAVEFORMS

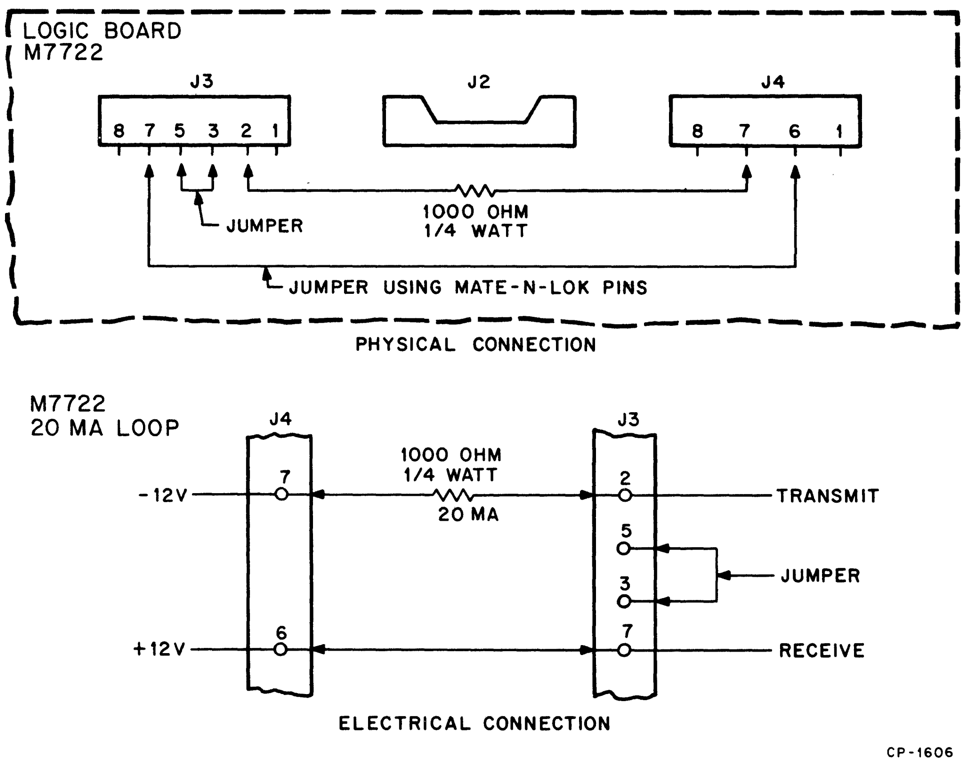



Figure 5-56 Current Loop Test Setup

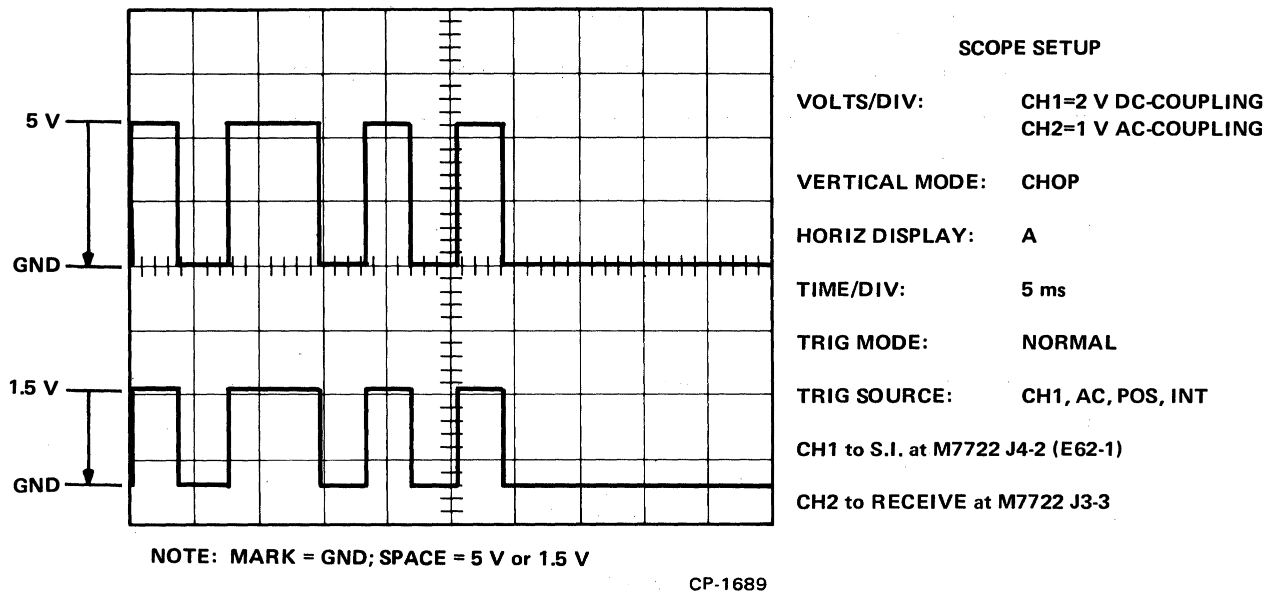



Figure 5-57 Loop Receiver Waveforms

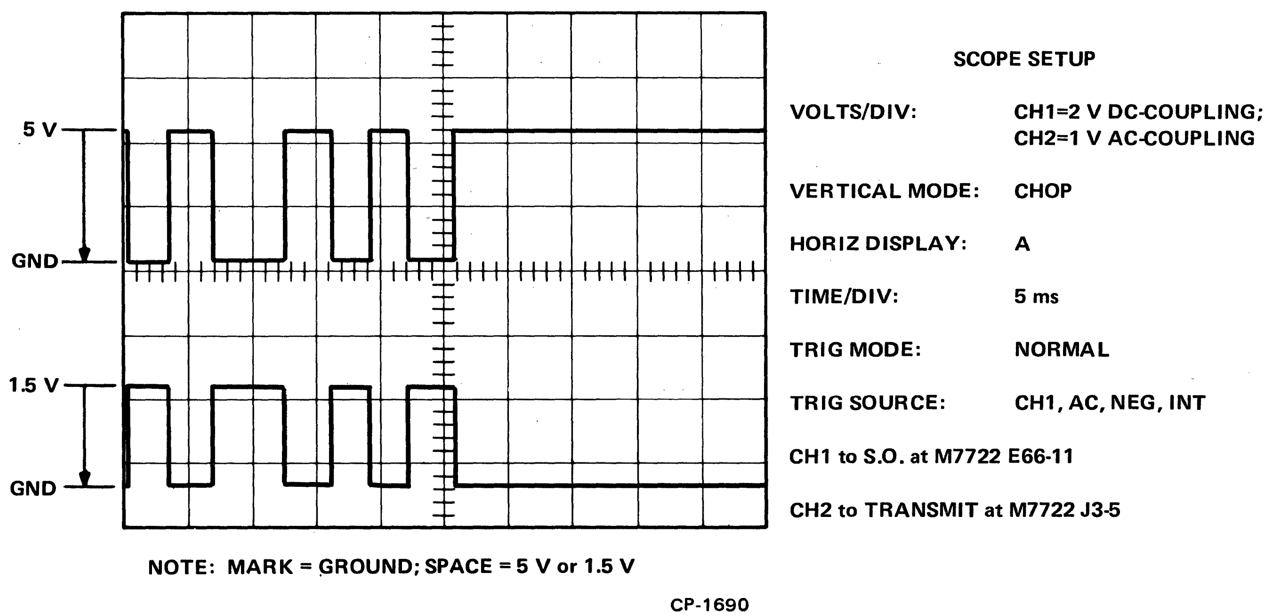



Figure 5-58 Loop Driver Waveforms

**END OF CURRENT LOOP INTERFACE WAVEFORMS**

**START OF SERIAL LINE INTERFACE WAVEFORMS**

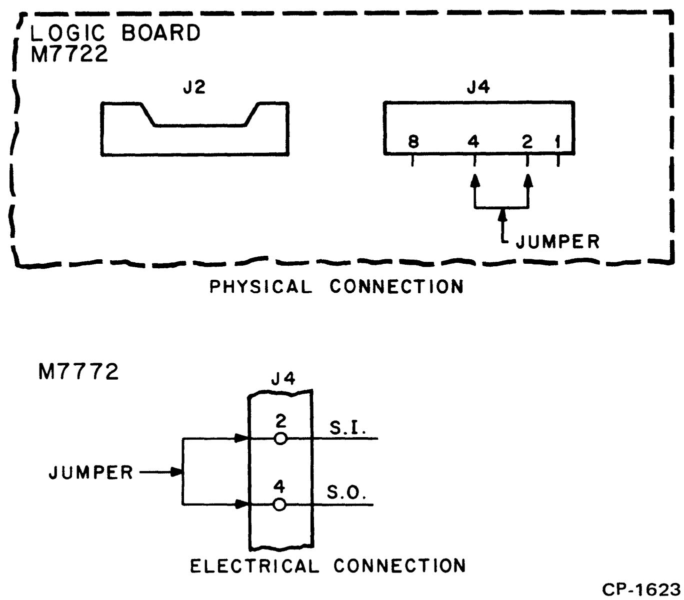
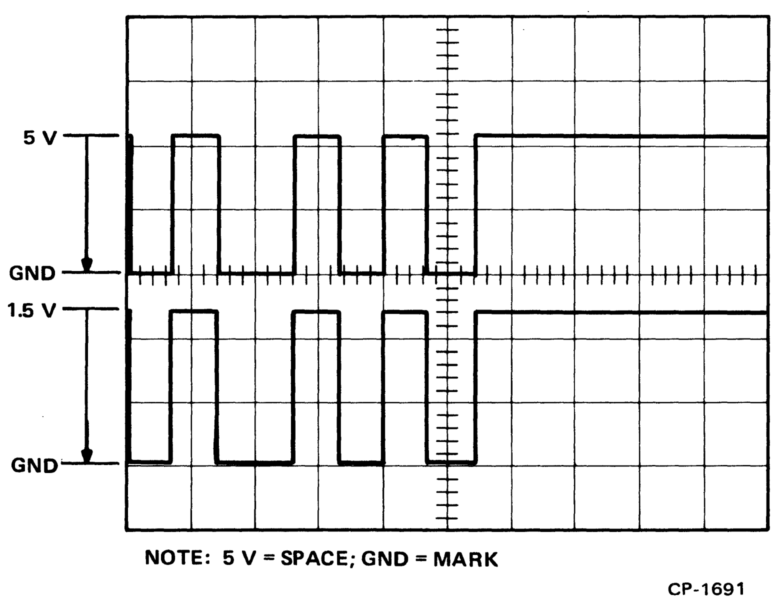



Figure 5-59 Serial Line Test Setup




**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 S.O. at M7722 E29-12

CH2 to S.I. at M7733 E66-6

Figure 5-60 Serial Output and Serial Input Waveforms

**END OF SERIAL LINE INTERFACE WAVEFORMS**

Table 5-2
Troubleshooting Chart

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

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

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

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

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

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

| Symptom | Problem Area | Probable Cause | Action | Reference |
|---|---|---|---|---|
| 11. Printer operates in LOCAL but not ON-LINE | Interface or interface connectors | Connection problem | Check connectors | |
| | Logic Board (in current loop operation) | Improper jumpers on current loop converters | Check, correct | Section 2.4 step 9<br>6.1.13 |
| | | Failure in isolator circuits | Perform Current Loop Interface Test and check: | Section 5.1.2.1 |
| | | | S. I. at E62-1 | Figure 5-57 |
| | | | S.O. at E66-11 | Figure 5-58 |
| | | | 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: | Section 5.1.2.2 |
| | | | S. O. at E29-12 | Figure 5-60 |
| | | | S. I. at E66-6 | |

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-2 (Cont)
Troubleshooting Chart

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

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

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

Table 5-2 (Cont)
Troubleshooting Chart

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

Table 5-3
DC Supply Voltages

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

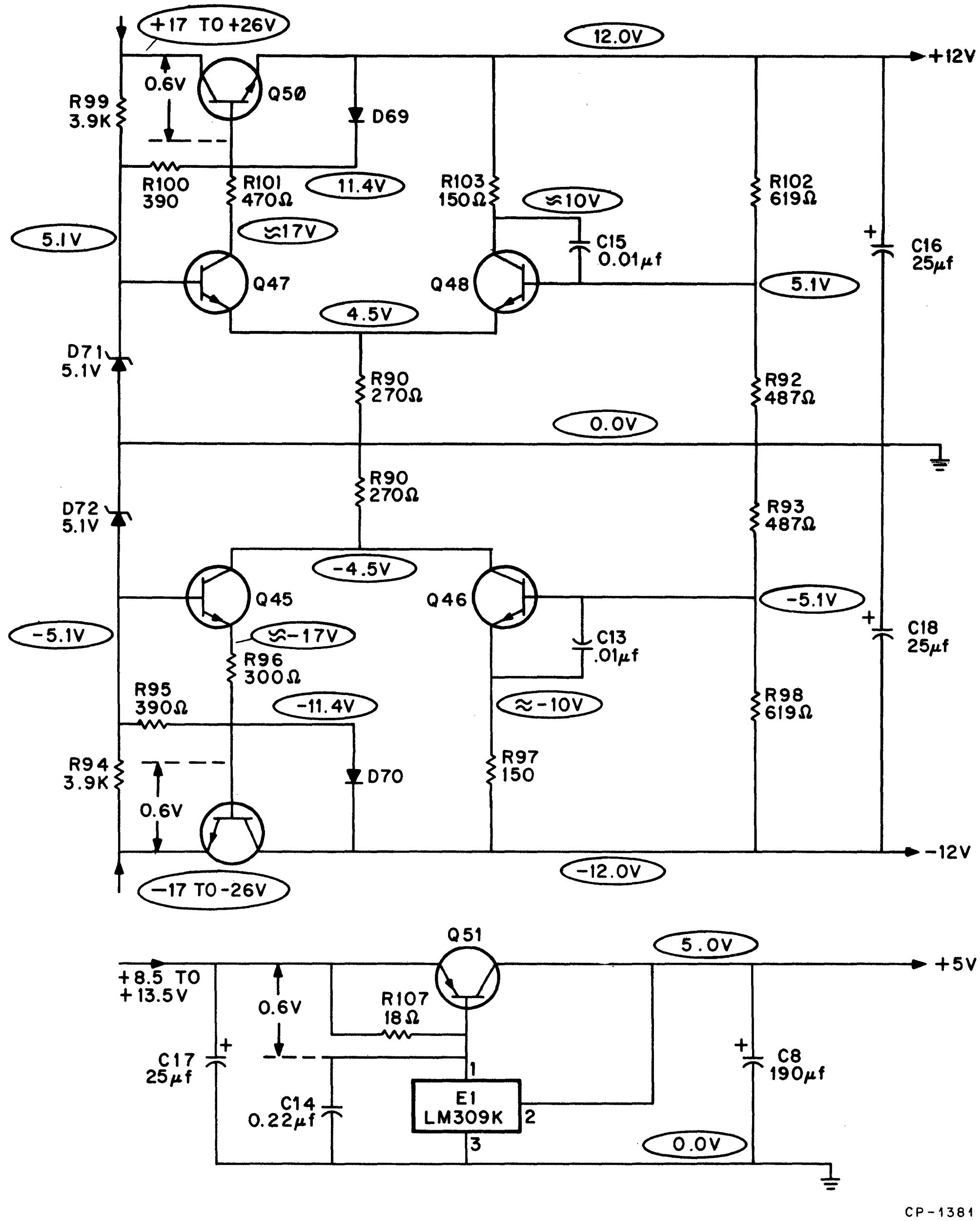
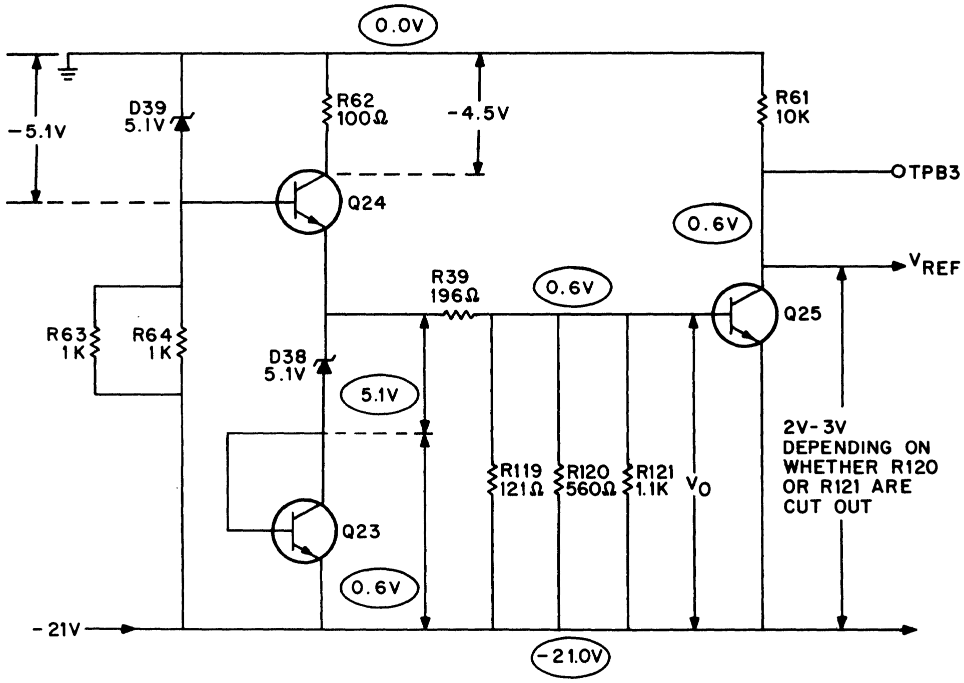



Figure 5-61 Typical Voltages for Power Supply Regulators

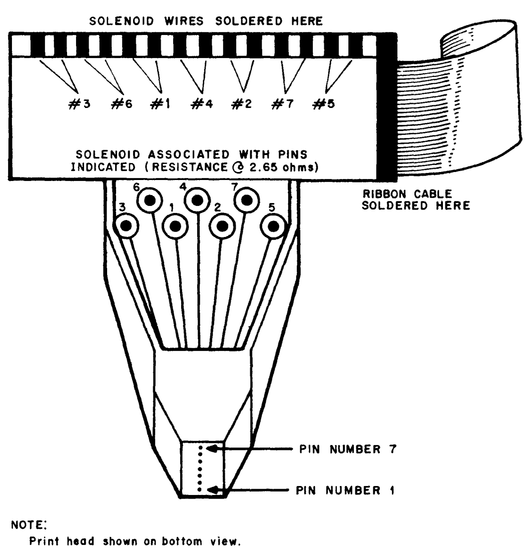



NOTE:
R120, R121, or both may be removed in test.

| OUTPUT VOLTAGE (VO) OF DIVIDER | | | | |
|---|---|---|---|---|
| R120 | IN | IN | OUT | OUT |
| R121 | IN | OUT | IN | OUT |
| VO | 1.82 | 1.93 | 2.04 | 2.16 |

CP-1380

Figure 5-62 Typical Voltages for VRef Supply




NOTE:
Print head shown on bottom view.

CP-1706

Figure 5-63 Print Head Solenoid Resistance Measurement

# CHAPTER 6
# MECHANICAL SERVICING

## 6.1 REMOVAL, REPLACEMENT, AND ADJUSTMENT PROCEDURES

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

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

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

### 6.1.1 Print Head Assembly

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

9. Secure the new print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.

10. Dress the ribbon cable under the dc motor, down through the slot in the rear of the cabinet, under the Power Board and reconnect the ribbon cable connector to J6 on the Power Board.

11. Secure the two ribbon cable clamps to the cabinet base with the 4 (4–40) screws and lockwashers.

**CAUTION**

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

12. Close the rear access door on the cabinet.

13. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

**CAUTION**

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

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

**CAUTION**

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

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

**CAUTION**

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

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

17. Replace the ribbon and ribbon spools (Figure 6-7).

18. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

19. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

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

### 6.1.2 Timing Belt

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

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

3. Remove the ribbon spools and the ribbon.

4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage and set the print head aside (Figure 6-4).

5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage, and ribbon drive pulley. Discard the timing belt (Figure 6-8).

6. Engage the new timing belt on the ribbon drive pulley; push on the spring-loaded ribbon drive and engage the timing belt on the dc motor pulley and the carriage.

7. Secure the print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.

8. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

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

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

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

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

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

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

12. Replace the ribbon and ribbon spools (Figure 6-7).

13. With the ribbon wound on the left spool and moving left to right at the moment of ribbon reversal, a pull test on the carriage from left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7).

14. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

**CAUTION**

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

### 6.1.3 LK02 Keyboard Assembly

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

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

3. Remove the 4 (8–32) screws, lockwashers, flat washers and spacers that secure the keyboard bezel to the cabinet base (Figure 6-9).

4. Turn the keyboard bezel upside down on a piece of foam or bubble plastic and remove the 4 (8–32) kep nuts that secure the keyboard to the bezel. Leave the four hex standoffs in place (Figure 6-10).

5. Lift the keyboard off the weld studs, disconnect the Berg connector from J2 on the keyboard and set the keyboard aside (Figure 6-10). If the equipment also uses an LK03 keyboard, disconnect the connector from J1 on the keyboard.

6. Reconnect the Berg connector to J2 on the new keyboard. Place the keyboard on the weld studs and secure with the 4 (8–32) kep nuts.

7. Replace the keyboard bezel on the cabinet base and secure with the 4 (8–32) screws, lockwashers, flat washers and spacers.

**CAUTION**

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

8. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.1.4 LK03 Keyboard Assembly

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

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

3. Remove the 4 (8–32) screws, lockwashers, flat washers and spacers that secure the keyboard bezel to the cabinet base (Figure 6-10).

4. Turn the keyboard bezel upside down on a piece of foam or bubble plastic and remove the 4 (8–32) kep nuts that secure the keyboard to the bezel. Leave the four hex standoffs in place (Figure 6-11).

5. Lift the keyboard off the weld studs, disconnect the connector from J1 on the keyboard and set the keyboard aside (Figure 6-11).

6. Reconnect the connector to J1 on the new keyboard, place the keyboard on the weld studs and secure with the 4 (8–32) kep nuts.

7. Replace the keyboard bezel on the cabinet base and secure with the 4 (8–32) screws, lockwashers, flat washers and spacers.

**CAUTION**

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

8. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.1.5 Printer Mechanism Assembly

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

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

3. Remove the ribbon spools and ribbon.

4. Remove the 4 (6–32) screws, lockwashers and flat washers that secure the print head to the carriage and set the print head aside (Figure 6-4).

5. Open the rear access door on the cabinet.

6. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).

7. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).

8. Pull the cables and wires up through the slots at the rear of the cabinet.

9. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.

10. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).

11. Remove the printer mechanism from the cabinet base and set aside.

12. Place the new printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.

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

14. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.

15. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.

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

17. Close the rear access door on the cabinet.

18. Adjust the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ±1 in/lbs of torque.

19. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

20. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.

21. Secure the print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.

22. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

**CAUTION**

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

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

**CAUTION**

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

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

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

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

26. Replace the ribbon and ribbon spools (Figure 6-7).

27. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

28. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

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

### 6.1.6 DC Motor and Encoder Assembly

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

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

3. Open the rear access door on the cabinet.

4. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).

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

6. Push the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley (Figure 6-8).

7. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate and set the motor aside (Figure 6-16).

8. Secure the new dc motor to the right-hand side plate with the 3 (8–32) screws and hex standoffs.

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

10. Secure the cables in the cable clamp. Reconnect the connector to J4 on the Power Board.

11. Perform the Encoder Adjustment at the end of this section.

12. Close the rear access door on the cabinet.

13. Push on the ribbon drive and engage the timing belt on the dc motor pulley.

14. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

15. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

**Encoder Adjustment**

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

1. Release the tension on the timing belt by pressing the spring-loaded ribbon drive assembly; slip the timing belt from the pulley on the motor shaft.

2. Lower the rear access door.

3. Set scope as follows:

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

4. Connect scope CH1 probe to PIN 8 of E-6 and CH2 probe to PIN 6 of E-6 or to TP1 and TP2 of Logic Board M7722.

5. Turn power on, motor will rotate clockwise as viewed from the Encoder end.

**NOTE**

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

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

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

**NOTE**

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

If adjustment is necessary, refer to Step 8.

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

If adjustment is necessary, refer to Step 8.

8. To make adjustments on Encoder, carefully remove the protective housing on the rear of the motor.

   a. To adjust CH1 Duty Cycle, adjust R-2 (Figure 6-18) on Encoder until correct.

   b. To adjust CH2 Duty Cycle, adjust R-1 (Figure 6-18) on Encoder until correct.

   c. Gylptol both pots and re-check adjustment. Jitter should not exceed 1.4 divisions (Figure 6-19) measured from leading edge to trailing edge.

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

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

**CAUTION**

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

10. Turn power off.

11. Replace Encoder cover carefully.

12. Reinstall timing belt by pressing the spring-loaded ribbon drive assembly to release tension; slip the timing belt onto the pulley on the motor shaft.

13. Replace the printer housing.

14. Close rear access door.

### 6.1.7 Ribbon Drive Assembly

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

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

3. Remove the ribbon spools and ribbon.

4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).

5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).

6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).

7. Remove the 8–32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).

8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-21).

9. Carefully remove the ribbon drive and the pushrod.

10. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.

11. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.

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

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

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

**NOTE**

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

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

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

17. Replace the ribbon and ribbon spools (Figure 6-7).

18. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center (Figure 6-22).

19. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque.

**NOTE**

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

20. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

21. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.1.8 Carriage Assembly

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

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

3. Remove the ribbon spools and ribbon.

4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).

5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).

6. Open the rear access door on the cabinet.

7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).

8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).

9. Pull the cables and wires up through the slots at the rear of the cabinet.

10. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.

11. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).

12. Set the printer mechanism on the workbench.

13. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.

14. Remove the two speaker leads.

15. Remove the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).

16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).

17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)

18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).

19. Remove the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).

20. Carefully remove the right-hand side plate (Figure 6-23).

21. Carefully slide the carriage off the two carriage shafts. (Place your hand beneath the carriage to catch the plain bushing as it slides off the rear carriage shaft.)

22. Replace the plain bushing in the new carriage and slide the bushing and the new carriage onto the carriage shafts.

23. Replace the right-hand side plate.

24. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

25. On equipment with serial number 6219 and below replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.

26. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.

27. Replace the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ±2 in/lbs of torque.

28. Replace the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws (be sure to place the ground strap on the top screw and tighten the screw to 20 ±2 in/lbs of torque).

29. Loosen the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-23).

30. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.

31. Loosen the 10–32 screw that secures the front carriage shaft to the left-hand side plate.

32. Set up and calibrate the Print Bar Alignment Tool (94-11424-2). (Refer to Section 5.3.17.)

33. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).

34. Slide the tool to the right until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).

35. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.

36. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 ±2 in/lbs of torque.

**NOTE**

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

37. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).

38. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

**NOTE**

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

39. Tighten the 2 (10–32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 ±2 in/lbs of torque.

40. Tighten the 2 (8–32) screws that secure the ribbon chassis to the print bar.

41. Secure the Encoder motor to the right-hand side plate with the 3 (8–32) screws and the hex standoffs.

42. Place the printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.

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

44. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.

45. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.

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

47. Close the rear access door on the cabinet.

48. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ±1 in/lbs of torque.

49. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and realign the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

50. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.

51. Secure the print head to the carriage with the 4 (6–32) screws and lockwashers. Make the screws finger tight.

52. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

**CAUTION**

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

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

**CAUTION**

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

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

**CAUTION**

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

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

56. Replace the ribbon and ribbon spools (Figure 6-7).

57. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

58. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

**CAUTION**

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

### 6.1.9 Ribbon Chassis Assembly

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

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

3. Remove the ribbon spools and ribbon.

4. Clip the three cable ties that secure the speaker wires to the ribbon chassis (Figure 6-25).

5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-25).

6. Remove the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates (Figure 6-25).

7. Remove the 2 (8–32) screws and lockwashers that secure the ribbon chassis to the print bar (Figure 6-25).

8. Remove the ribbon chassis and set aside.

9. Secure the new ribbon chassis to the print bar with the 2 (8–32) screws and lockwashers.

10. Replace the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates. (Be sure to attach the ground strap to the top screw on the right-hand side and tighten the ground screw 20 ±2 in/lbs of torque.)

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

12. Secure the speaker wires to the ribbon chassis with cable ties.

13. Remove the 4 (6–32) screws, lockwashers and flat washers that secure the print head to the carriage and set the print head aside.

14. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).

15. Lift the printer mechanism at the front, tilt toward the rear and let the mechanism rest on the side plates (Figure 6-26).

16. Slide the reverse sensor to the right and rotate the ribbon drive pulley several times. Measure the clearance between the main pawl tab and the right-hand interposer (Figure 6-26).

17. Slide the reverse sensor to the left and rotate the ribbon drive pulley until the main pawl shifts to the opposite side. Rotate the pulley several more times.

18. Measure the clearance between the main pawl tab and the left-hand interposer.

19. The two clearances must be equal within 0.020 inch.

20. If the two clearances are not equal within 0.020 inch, move the upper pivot point toward the side having the greatest clearance. Tighten the upper pivot screw.

21. Perform Steps 16–18. If the clearances are not within 0.020 inch, loosen the upper pivot screw and readjust the upper pivot.

22. When the clearances are equal within the 0.020 inch, tighten the upper pivot screw to 18 ±2 in/lbs of torque.

23. Rotate the printer mechanism back into place on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make screws finger tight.

24. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ±1 in/lbs of torque.

25. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

26. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.

27. Secure the print head to the carriage with the 4 (6–32) screws, lockwashers and flat washers. Make the screws finger tight.

28. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

**CAUTION**

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

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

**CAUTION**

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

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

**CAUTION**

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

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

32. Replace the ribbon and ribbon spools (Figure 6-7).

33. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

34. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

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

### 6.1.10 Idler Gear Assembly

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

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

3. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the idler gear assembly to the left-hand side plate (Figure 6-27).

4. Secure the new idler gear assembly to the left-hand side plate with the 2 (8–32) screws, lockwashers and flat washers. Make the screws finger tight.

5. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27). (The idler gear should be free to slide in and out.)

6. Tighten the 2 (8–32) screws to 18 ±2 in/lbs of torque.

7. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.1.11 Tractor Assembly (RH or LH)

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

2. Loosen the screw shaft on the right-hand tractor and the 10–32 screw on the left-hand tractor (Figure 6-28).

3. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)

4. Grasp the line feed knob and pull the square tractor drive shaft out of the right- and left-hand tractors (Figure 6-28).

5. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-28).

6. Remove the tractor support shaft and the right- and left-hand tractors from the side plates.

7. Replace whichever tractor is defective.

8. Replace the tractor support shaft in the side plates.

9. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

**NOTE**

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

10. Push the square tractor drive shaft through the left-hand side plate and through the left- and right-hand tractors.

11. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.

12. Slide the left-hand tractor to the left so that the feed pins are 1-7/8 inches from the left-hand side plate. Tighten the 10–32 screw on the left-hand tractor (Figure 6-29).

13. Slide the right-hand tractor from side to side. If it appears to bind or have excessive drag on the shafts, grasp the tractor support shaft and move it up or down in its slots until the tractor slides easily on the shafts.

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

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

### 6.1.12 Stepping Motor Assembly

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

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

3. Remove the ribbon spools and ribbon.

4. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the idler gear to the left-hand side plate (Figure 6-27).

5. Open the rear access door on the cabinet.

6. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).

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

8. Use a Pin Removal Tool (AMP P/N 1-305183-1) and remove the four motor leads from pin Nos. 4, 5, 6 and 7 on the connector (Figure 6-30).

9. Remove the 4 (8–32) screws, flat washers, lockwashers and hex nuts that secure the stepping motor to the left-hand side plate. Set the stepping motor aside (Figure 6-31).

10. Use a Pin Insertion Tool (AMP P/N 91002-1) to insert the leads on the new stepping motor in connector pin Nos. 4, 5, 6 and 7 (Figure 6-30).

11. Secure the new stepping motor to the left-hand side plate with the 4 (8–32) screws, flat washers, lockwashers and hex nuts. The hex nuts and lockwashers go on the inside of the left-hand side plate. (Allow the stepping motor to drop to its lowest point in the elongated slots.)

12. Tighten the 4 (8–32) screws to 18 ±2 in/lbs of torque.

13. Secure the idler gear to the left-hand side plate with the 2 (8–32) screws, lockwashers and flat washers. Make the screws finger tight.

14. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27).

15. Tighten the 2 (8–32) screws to 18 ±2 in/lbs of torque.

16. Secure the stepping motor wires and the speaker wires with cable ties and thread them under the printer mechanism and pushrod and down through the slot at the rear of the cabinet. Reconnect the connector to J5 on the Power Board.

17. Secure the bundled wires in the cable clamp.

18. Replace the ribbon and ribbon spools.

19. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

20. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.1.13 Logic Board Assembly (M7722)

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

2. Open the rear access door on the cabinet.

3. Disconnect the connectors from J1, J2, J3 and the quick-disconnects from the +5 V (red) and ground (black) on the Logic Board (Figure 6-32). If the EIA option is installed, disconnect the connector from J4. (There will not be a connector in J2.)

4. Remove the 6 (8–32) screws, lockwashers and flat washers that secure the Logic Board to the rear access door and set the Logic Board aside (Figure 6-32).

5. Place the new Logic Board on the standoffs and secure to the rear access door with the 6 (8–32) screws, lockwashers and flat washers. (Looking from the rear, loop the cable clamp over the right-front standoff before securing the Logic Board.) Tighten the screws to 16 ±2 in/lbs of torque.

6. Reconnect the connectors to J1, J2 and J3 and the quick-disconnects to the +5 V (red) and ground (black) on the Logic Board.

7. Close the rear access door on the cabinet.

8. Replace the printer paper and restore power to the LA36.

### 6.1.14 Power Board Assembly

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

2. Open the rear access door on the cabinet.

3. Disconnect the connectors from J2, J3, J4, J5, J6 and the quick-disconnects from the +5 V (red) and ground (black) on the Power Board. Disconnect the connector from J1 on the Logic Board (Figure 6-33).

4. Remove the 6 (8–32) screws, lockwashers and flat washers that secure the Power Board to the cabinet. Set the Power Board aside (Figure 6-33).

5. Place the new Power Board in the cabinet and secure with the 6 (8–32) screws, lockwashers and flat washers. Tighten the screws to 16 ±2 in/lbs of torque.

6. Reconnect the connectors to J2, J3, J4, J5, J6 and the quick-disconnects to the +5 V (red) and ground (black) on the Power Board. Reconnect the connector to J1 on the Logic Board.

7. Close the rear access door on the cabinet.

8. Replace the printer paper and restore power to the LA36.

### 6.1.15 Fan Assembly

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

2. Open the rear access door on the cabinet.

3. Remove the 4 (6–32) screws and lockwashers that secure the fan to the cabinet (Figure 6-34).

4. Disconnect the quick-disconnect from the fan and set the fan aside (Figure 6-34).

5. Reconnect the quick-disconnect to the new fan.

6. Secure the fan to the cabinet with the 4 (6–32) screws and lockwashers.

7. Close the rear access door on the cabinet.

8. Replace the printer paper and restore power to the LA36.

### 6.1.16 Transformer Assembly

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

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

3. Open the rear access door on the cabinet.

4. Disconnect the connector from J3 on the Power Board (Figure 6-35).

5. Remove the 2 (8–32) screws and lockwashers that secure the fuse mounting bracket to the cabinet (Figure 6-35).

6. Remove the green jumper wire from capacitor C5 (Figure 6-36).

7. Disconnect the quick-disconnect from the fan assembly (Figure 6-35).

8. Remove the 4 (8–32) screws, lockwasher and flat washers that secure the keyboard bezel to the cabinet base (Figure 6-9).

9. Turn the keyboard upside down and remove the quick-disconnects from the left-most rocker switch (Figure 6-37).

10. Clip all the cable ties from the keyboard to the transformer.

11. Pull the two wires that were removed from the rocker switch down through the slot in the rear of the cabinet.

12. Remove the 4 (8–32) screws, lockwashers and kep nuts that secure the transformer to the cabinet base. Disconnect the 115 V–230 V jumper from connector J1 and set the transformer aside (Figure 6-35).

13. Place the new transformer in the cabinet and secure with the 4 (8–32) screws, lockwashers and kep nuts. (Be sure to reconnect the ground strap to the rear screw on the transformer.) Tighten the ground strap screw to 20 ±2 in/lbs of torque.

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

15. Replace the keyboard bezel on the cabinet base and secure with the 4 (8–32) screws, lockwashers and flat washers.

16. Reconnect the quick-disconnect to the fan assembly.

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

18. Reconnect the connector to J3 on the Power Board.

19. Replace the green jumper wire on capacitor C5.

20. Secure the fuse mounting bracket to the cabinet with the 2 (8–32) screws and lockwashers.

21. Close the rear access door on the cabinet.

22. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.1.17 Line Filter Assembly

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

2. Open the rear access door on the cabinet.

3. Remove the 2 (8–32) screws and lockwashers that secure the fuse mounting bracket to the cabinet (Figure 6-35).

4. Disconnect all external wires that connect to capacitor C5 and fuse F1 (Figure 6-36).

5. Remove the fuse mounting bracket and set aside.

6. Reconnect all external wires to capacitor C5 and fuse F1 in the new line filter.

7. Secure the fuse mounting bracket to the cabinet with the 2 (8–32) screws and lockwashers.

8. Close the rear access door on the cabinet.

9. Replace the printer paper and restore power to the LA36.

## 6.2 DISASSEMBLY, ASSEMBLY AND ADJUSTMENT PROCEDURES

### 6.2.1 Print Bar

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

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

3. Remove the ribbon spools and ribbon.

4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).

5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).

6. Open the rear access door on the cabinet.

7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).

8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).

9. Pull the cables and wires up through the slots at the rear of the cabinet.

10. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.

11. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).

12. Set the printer mechanism on the workbench.

13. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.

14. Remove the two speaker leads.

15. Remove the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).

16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).

17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)

18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).

19. Remove the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).

20. Carefully remove the right-hand side plate (Figure 6-23).

21. Remove the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-38).

22. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the left-hand side plate. Set the print bar aside (Figure 6-38).

23. Secure the new print bar to the left-hand side plate with the 1/4-20 screw, lockwasher and flat washer. (Ensure that the narrow chamber is facing up.)

24. Replace the right-hand side plate.

25. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

26. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.

27. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.

28. Replace the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ±2 in/lbs of torque.

29. Replace the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws. (Be sure to place the ground strap on the top screw and tighten the screw to 20 ±2 in/lbs of torque.)

30. Replace the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-23). Make the screws finger tight.

31. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.

32. Loosen the 10–32 screw that secures the front carriage shaft to the left-hand side plate.

33. Set up and calibrate the Print Bar Alignment Tool (94-11424-2). (Refer to Section 6.2.17.)

34. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).

35. Slide the tool to the left until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).

36. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.

37. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 ±2 in/lbs of torque.

**NOTE**

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

38. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).

39. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

**NOTE**

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

40. Tighten the 2 (10–32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 ±2 in/lbs of torque.

41. Tighten the 2 (8–32) screws that secure the ribbon chassis to the print bar.

42. Secure the encoder motor to the right-hand side plate with the 3 (8–32) screws and the hex standoffs.

43. Place the printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.

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

45. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.

46. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.

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

48. Close the rear access door on the cabinet.

49. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ±1 in/lbs of torque.

50. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

51. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.

52. Secure the print head to the carriage with the 4 (6–32) screws and lockwashers. Make the screws finger tight.

53. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

**CAUTION**

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

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

**CAUTION**

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

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

**CAUTION**

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

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

57. Replace the ribbon and ribbon spools (Figure 6-7).

58. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

59. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

**CAUTION**

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

### 6.2.2 Tractor Drive Shaft

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

2. Loosen the screw shaft on the right-hand tractor and the 6–32 screw on the left-hand tractor (Figure 6-39).

3. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)

4. Grasp the line feed knob and pull the tractor drive shaft to the left, out of the right-hand side plate (Figure 6-39).

5. Remove the 6–32 screw from the end of the tractor drive shaft (Figure 6-40).

6. Remove the line feed clutch, coupling and the line feed knob from the tractor drive shaft (Figure 6-40).

7. Replace the line feed clutch, coupling and line feed knob on the new tractor drive shaft. Secure with the 6–32 screw.

**NOTE**

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

8. Push the square tractor drive shaft through the left-hand side plate and through the left- and right-hand tractors.

9. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.

10. Slide the left-hand tractor to the left so that the feed pins are 1-7/8 inches from the left-hand side plate. Tighten the 10–32 screw on the left-hand tractor (Figure 6-29).

11. Slide the right-hand tractor from side to side. If it appears to bind or have excessive drag on the shafts, grasp the tractor support shaft and move it up or down in its slots until the tractor slides easily on the shafts.

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

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

### 6.2.3 Tractor Support Shaft

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

2. Loosen the screw shaft on the right-hand tractor and the 10–32 screw on the left-hand tractor (Figure 6-41).

3. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-41).

4. Remove the tractor support shaft from the left- and right-hand tractors through the right-hand side plate (Figure 6-41).

**NOTE**

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

5. Slide the new tractor support shaft through the slot in the right-hand side plate, the screw shaft clamp collar and the right-hand tractor, then through the left-hand tractor, the clamp collar and the left-hand plate.

6. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

7. Slide the left-hand tractor to the left so that the feed pins are 1-7/8 inches from the left-hand side plate. Tighten the 10–32 screw on the left-hand tractor (Figure 6-29).

8. Slide the right-hand tractor from side to side. If it appears to bind or have excessive drag on the shafts, grasp the tractor support shaft and move it up or down in its slots until the tractor slides easily on the shafts.

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

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

### 6.2.4 Carriage Shaft(s)

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

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

3. Remove the ribbon spools and ribbon.

4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).

5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).

6. Open the rear access door on the cabinet.

7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).

8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).

9. Pull the cables and wires up through the slots at the rear of the cabinet.

10. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.

11. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).

12. Set the printer mechanism on the workbench.

13. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.

14. Remove the two speaker leads.

15. Remove the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).

16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).

17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)

18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).

19. Remove the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).

20. Carefully remove the right-hand side plate (Figure 6-23).

21. Carefully slide the carriage off the two carriage shafts. (Place your hand beneath the carriage to catch the plain bushing as it slides off the rear carriage shaft.)

22. Remove the 10–32 screw, lockwashers and flat washer that secure the front or rear carriage shaft to the left-hand side plate (dependent on which shaft is to be replaced) (Figure 6-42).

23. Secure the front or rear carriage shaft to the left-hand side plate with the 10–32 screw, lockwasher and flat washer. If the rear carriage shaft is replaced, tighten the screw to 18 ±2 in/lbs of torque and at the same time, loosen the 10–32 screw on the front shaft. If the front carriage shaft is replaced, make the 10–32 screw finger tight.

24. Replace the plain bushing and the carriage on the carriage shafts.

25. Replace the right-hand side plate.

26. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

27. On equipment with serial number 6219 and below, replace the flat washer and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.

28. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.

29. Replace the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ±2 in/lbs of torque.

30. Replace the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws. (Be sure to place the ground strap on the top screw and tighten the screw to 20 ±2 in/lbs of torque.)

31. Loosen the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-23).

32. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.

33. Loosen the 10–32 screw that secures the front carriage shaft to the left-hand side plate.

34. Set up and calibrate the Print Bar Alignment Tool (94-11424-2). (Refer to Section 6.2.17.)

35. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).

36. Slide the tool to the left until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).

37. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.

38. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 ±2 in/lbs of torque.

**NOTE**

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

39. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).

40. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

**NOTE**

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

41. Tighten the 2 (10–32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 ±2 in/lbs of torque.

42. Tighten the 2 (8–32) screws that secure the ribbon chassis to the print bar.

43. Secure the encoder motor to the right-hand side plate with the 3 (8–32) screws and the hex standoffs.

44. Place the printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.

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

46. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.

47. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.

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

49. Close the rear access door on the cabinet.

50. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ±1 in/lbs of torque.

51. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

52. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.

53. Secure the print head to the carriage with the 4 (6–32) screws and lockwashers. Make the screws finger tight.

54. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

**CAUTION**

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

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

**CAUTION**

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

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

**CAUTION**

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

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

58. Replace the ribbon and ribbon spools (Figure 6-7).

59. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

60. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

**CAUTION**

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

### 6.2.5 Carriage Plain Bushing

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

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

3. Remove the ribbon spools and ribbon.

4. Remove the 4 (6–32) screws and lockwashers that secure the print head to the carriage. Carefully lay the print head aside (Figure 6-4).

5. Push on the spring-loaded ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley, carriage and ribbon drive pulley. Lay the timing belt aside (Figure 6-8).

6. Open the rear access door on the cabinet.

7. Remove the stepping motor and speaker wires from the cable clamp and clip necessary cable ties. Disconnect the connector from J5 on the Power Board (Figure 6-12).

8. Remove the dc motor and encoder cables from the cable clamp. Disconnect the connector from J4 on the Power Board (Figure 6-12).

9. Pull the cables and wires up through the slots at the rear of the cabinet.

10. Remove the 6–32 screw that secures the ground wire to the right-hand side plate. Release the ground wire and replace the screw in the right-hand side plate.

11. Remove the 4 (10–32) screws, lockwashers and Buna washers that secure the printer mechanism to the cabinet base (Figure 6-13).

12. Set the printer mechanism on the workbench.

13. Remove the 3 (8–32) screws and hex standoffs that secure the dc motor to the right-hand side plate (Figure 6-16). Set the dc motor aside.

14. Remove the two speaker leads.

15. Remove the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis (Figure 6-23).

16. Remove the two retaining rings that secure the tractor support shaft in the right-hand side plate (Figure 6-23).

17. On equipment with serial number 6219 and below, remove the retaining ring and flat washers that secure the tractor drive shaft in the right-hand side plate. (Note the quantity of flat washers removed.) On equipment with serial number 6220 and higher, remove the retaining ring that secures the tractor drive shaft in the left-hand side plate. (The retaining ring and flat washers have been eliminated on the right-hand side.)

18. Remove the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate (Figure 6-23).

19. Remove the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate (Figure 6-23).

20. Carefully remove the right-hand side plate (Figure 6-23).

21. Carefully slide the carriage off the two carriage shafts. (Place your hand beneath the carriage to catch the plain bushing as it slides off the rear carriage shaft.)

22. Replace the new plain bushing in the carriage and slide the bushing and the carriage on the carriage shafts.

23. Replace the right-hand side plate.

24. Replace the two retaining rings that secure the tractor support shaft in the right-hand side plate.

25. On equipment with serial number 6219 and below, replace the flat washers and retaining ring that secure the tractor drive shaft in the right-hand side plate. On serial number 6220 and higher, replace the retaining ring that secures the tractor drive shaft in the left-hand side plate.

26. Replace the 1/4-20 screw, lockwasher and flat washer that secure the print bar to the right-hand side plate. Make the screw finger tight.

27. Replace the 2 (10–32) screws, lockwashers and flat washers that secure the two carriage shafts to the right-hand side plate. Tighten the rear screw only to 18 ±2 in/lbs of torque.

28. Replace the 2 (6–32) screws and lockwashers that secure the right-hand side plate to the ribbon chassis. Tighten the screws. (Be sure to place the ground strap on the top screw and tighten the screw to 20 ±2 in/lbs of torque.)

29. Loosen the 2 (8–32) screws that secure the ribbon chassis to the print bar (Figure 6-23).

30. Loosen the 1/4-20 screw that secures the print bar to the left-hand side plate, then make screw finger tight. Push the print bar to the rear as far as possible.

31. Loosen the 10–32 screw that secures the front carriage shaft to the left-hand side plate.

32. Set up and calibrate the print bar alignment tool (94-11424-2). (Refer to Section 6.2.17.)

33. Place the alignment tool on the two carriage shafts with the vee slot resting on the front shaft (Figure 6-24).

34. Slide the tool to the left until it rests against the right-hand side plate. With a plastic hammer, tap the print bar toward the front of the machine until the indicator reads zero (Figure 6-24).

35. Remove the alignment tool and place it on the extreme left-hand side of the carriage shaft against the right-hand side plate. Again tap the print bar until the indicator reads zero.

36. Tighten the 2 (1/4-20) screws that secure the print bar to the right- and left-hand side plates to 30 ±2 in/lbs of torque.

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

37. With the carriage at the extreme left-hand side plate, place the alignment tool on the carriage shafts in the center of carriage travel with the indicator button resting against the face of the print bar (Figure 6-24).

38. Slowly rotate the front carriage shaft until the indicator reads +0.001 to 0.0015 (Figure 6-24).

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

39. Tighten the 2 (10–32) screws that secure the front carriage shaft to the right- and left-hand side plates to 18 ±2 in/lbs of torque.

40. Tighten the 2 (8–32) screws that secure the ribbon chassis to the print bar.

41. Secure the encoder motor to the right-hand side plate with the 3 (8–32) screws and the hex standoffs.

42. Place the printer mechanism on the cabinet base and secure with the 4 (10–32) screws, lockwashers and Buna washers. Make the screws finger tight.

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

44. Secure the stepping motor and speaker wires in the cable clamp. Reconnect the connector to J5 on the Power Board.

45. Secure the dc motor and encoder cables in the cable clamp. Reconnect the connector to J4 on the Power Board.

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

47. Close the rear access door on the cabinet.

48. Align the position of the printer mechanism (front to back) so that the front surface of the print bar coincides with the centerline of the reference holes in the cabinet (Figure 6-14). Tighten the 4 (10–32) screws to 4 ±1 in/lbs of torque.

49. Check that the carriage has 0.020 to 0.040-inch clearance from the bent-up flange on the cabinet base when the carriage adjustment lever is in the minimum gap position (detent closest to the print bar) (Figure 6-5). If necessary, loosen the 4 (10–32) screws that secure the printer mechanism to the cabinet base and readjust the printer mechanism to attain a minimum of 0.020 inch clearance (Figure 6-15).

50. Replace the paper in the machine but do not feed it up into the tractors. Pull the paper up through the cabinet and the printer mechanism to ensure that there is no drag on the paper. Remove the paper from the machine.

51. Secure the print head to the carriage with the 4 (6–32) screws and lockwashers. Make the screws finger tight.

52. Set the carriage adjustment lever to the minimum gap position (detent closest to the print bar) (Figure 6-5).

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

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

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

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

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

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

56. Replace the ribbon and ribbon spools (Figure 6-7).

57. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

58. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

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

### 6.2.6 Tractor Drive Gear/Line Feed Clutch

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

2. Loosen the 2 (8–32) screws that secure the idler gear assembly to the left-hand side plate (Figure 6-27).

3. Remove the 6–32 screw and flat washer that secure the line feed knob to the tractor drive shaft (Figure 6-27).

4. Remove the line feed knob, coupling, the tractor drive gear and the line feed clutch hub from the tractor drive shaft (Figure 6-43).

5. Replace the new tractor drive gear and line feed clutch on the tractor drive shaft.

6. Replace the line feed knob and coupling on the tractor drive shaft and secure with the 6–32 screw and flat washer.

7. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27). The idler gear should be free to slide in and out.

8. Tighten the 2 (8–32) screws to 18 ±2 in/lbs of torque.

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

### 6.2.7 Ribbon Drive Pulley

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

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

3. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-44).

4. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and the drive pulley (Figure 6-44).

5. Remove the collar clamp from the defective drive pulley and hand press onto the new drive pulley (front edges of collar clamp and drive pulley to be coincident) (Figure 6-45).

6. Replace the ribbon drive pulley and the collar clamp on the ribbon drive shaft and adjust to give a clearance of 9/32 inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-44). Tighten the 6–32 screw to 6 ±2 in/lbs of torque.

7. Engage the timing belt on the ribbon drive pulley, push on the ribbon drive and engage the timing belt on the motor pulley.

8. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.2.8 Ribbon Drive Fafnir Bearing

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

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

20. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.

21. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.

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

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

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

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

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

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

27. Replace the ribbon and ribbon spools (Figure 6-7).

28. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.

29. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque (Figure 6-22).

30. With the ribbon wound on the left spool and moving left to right at the moment of ribbon reversal, a pull test on the carriage from left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7).

31. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.2.9 Ribbon Eccentric With Clutch

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

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

3. Remove the ribbon spools and ribbon.

4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).

5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).

6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).

7. Remove the 8-32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).

8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-21).

9. Carefully remove the ribbon drive along with the pushrod.

10. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 6-44).

11. Loosen the 4–40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 6-46).

12. Remove the retaining ring that holds the pushrod in the ribbon eccentric (Figure 6-46).

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

14. Remove the backstop spring from the ribbon eccentric with clutch (Figure 6-46).

15. Install the backstop spring on the new ribbon eccentric with clutch. Apply one drop of No. 20 or 30 SAE oil on the spring.

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

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

18. Slide the ribbon drive shaft through the rear bearing, eccentric washer, eccentric with clutch, Fafnir bearing and ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)

19. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 1-1/2 inches beyond the ribbon drive bracket (Figure 6-47). Tighten the 4–40 screw in Fafnir bearing to 5 ±1 in/lbs of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.

20. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust to give a clearance of 9/32 inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-45). Tighten the 6–32 screw to 6 ±2 in/lbs of torque.

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

22. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.

23. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.

24. Insert the compressing spring between the left-hand side plate and the ribbon drive.

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

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

**NOTE**

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

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

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

29. Replace the ribbon and ribbon spools (Figure 6-7).

30. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.

31. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque (Figure 6-22).

32. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

33. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.2.10 Backstop Spring

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

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

3. Remove the ribbon spools and ribbon.

4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).

5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).

6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).

7. Remove the 8–32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).

8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-24).

9. Carefully remove the ribbon drive along with the pushrod.

10. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 6-44).

11. Loosen the 4–40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 6-46).

12. Remove the retaining ring that holds the pushrod in the ribbon eccentric (Figure 6-46).

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

14. Remove the backstop spring from the ribbon eccentric with clutch (Figure 6-46). Set the spring aside.

15. Install the new backstop spring on the ribbon eccentric with clutch. Apply one drop of No. 20 or 30 SAE oil on the spring.

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

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

18. Slide the ribbon drive shaft through the rear bearing, eccentric washer, eccentric with clutch, Fafnir bearing and ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)

19. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 1-1/2 inches beyond the ribbon drive bracket (Figure 6-47). Tighten the 4–40 screw in Fafnir bearing to 5 ±1 in/lbs of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.

20. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust to give a clearance of 9/32 inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-45). Tighten the 6–32 screw to 6 ±2 in/lbs of torque.

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

22. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.

23. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.

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

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

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

**NOTE**

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

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

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

29. Replace the ribbon and ribbon spools (Figure 6-7).

30. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.

31. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque (Figure 6-22).

32. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

33. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.2.11 Ribbon Drive Rear Bearing

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

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

3. Remove the ribbon spools and ribbon.

4. Push on the ribbon drive to relieve the tension on the timing belt and disengage the belt from the dc motor pulley and the ribbon drive pulley (Figure 6-8).

5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-21).

6. Rotate the ribbon drive pulley until the clutch eccentric is at its highest point (Figure 6-21).

7. Remove the 8–32 screw, lockwasher and flat washer that secure the ribbon drive to the upper pivot tab on the left-hand side plate (Figure 6-21).

8. Remove the ribbon drive by pulling out at the top. This will free the assembly from the upper pivot tab. Lift up on the ribbon drive to clear the lower pivot. Rotate the drive counterclockwise and pull toward the rear. This will free the retaining stop foot and allow the compression ring to drop free (Figure 6-21).

9. Carefully remove the ribbon drive along with the pushrod.

10. Loosen the 6–32 screw that secures the collar clamp and drive pulley to the ribbon drive shaft. Remove the collar clamp and drive pulley (Figure 6-44).

11. Loosen the 4–40 set screw that secures the Fafnir bearing on the ribbon drive shaft (Figure 6-46).

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

13. On machines with serial number 7999 and below, remove the rear bearing by pushing on the bearing to snap it out of the ribbon drive bracket. On machines with serial number 8000 and above, remove the retaining ring and push the bearing out of the ribbon drive bracket.

14. Replace the new rear bearing in the ribbon drive bracket.

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

16. Slide the ribbon drive shaft through the rear bearing, eccentric washer, eccentric with clutch, Fafnir bearing and ribbon drive bracket. (Always turn the shaft in a counterclockwise direction when pushing through the one-way clutch.)

17. Slide the ribbon drive shaft toward the front of the ribbon drive until it extends 1-1/2 inches beyond the ribbon drive bracket (Figure 6-47). Tighten the 4–40 screw in Fafnir bearing to 5 ±1 in/lbs of torque. Turn the shaft in a clockwise direction to ensure freedom of movement.

18. Replace the ribbon drive pulley and collar clamp on the ribbon drive shaft and adjust to give a clearance of 9/32 inch between the ribbon drive bracket and the ribbon drive pulley (Figure 6-45). Tighten the 6–32 screw to 6 ±2 in/lbs of torque.

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

20. Rotate the ribbon drive pulley on the new ribbon drive until the clutch eccentric is at its highest point.

21. Push the pushrod through the left-hand side plate and engage the retaining stop foot in the left-hand side plate.

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

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

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

**NOTE**

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

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

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

27. Replace the ribbon and ribbon spools (Figure 6-7).

28. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.

29. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque (Figure 6-22).

30. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

31. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.2.12 Ribbon Spool Friction Disks

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

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

3. Remove the ribbon spools and ribbon.

4. Clip the three cable ties that secure the speaker wires to the ribbon chassis (Figure 6-25).

5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-25).

6. Remove the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates (Figure 6-25).

7. Remove the 2 (8–32) screws and lockwashers that secure the ribbon chassis to the print bar (Figure 6-21).

8. Remove the ribbon chassis and set on the workbench.

9. Remove the retaining ring that secures the ratchet wheel and the driver spool in the ribbon chassis (Figure 6-48).

10. Remove the brake washer, compression spring and the ratchet wheel (Figure 6-48).

11. Pull the defective disks off the ratchet wheel and the ribbon chassis (Figure 6-48).

12. Remove the protective paper from the two new friction disks and apply one to the ribbon chassis and the other to the ratchet wheel. Be sure the friction disks are applied to the right side of the ratchet wheel. Ensure that the surfaces are free of oil and moisture.

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

13. Replace the ratchet wheel, compression spring and the brake washer.

14. Replace the retaining ring that secures the ratchet wheel and the ribbon spool in the ribbon chassis.

15. Secure the new ribbon chassis to the print bar with the 2 (8–32) screws and lockwashers.

16. Replace the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates. (Be sure to attach the ground strap to the top screw on the right-hand side and tighten the ground screw 20 ±2 in/lbs of torque.)

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

18. Secure the speaker wires to the ribbon chassis with cable ties.

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

20. Replace the ribbon and ribbon spools (Figure 6-7).

21. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.

22. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque (Figure 6-22).

23. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

24. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

### 6.2.13 Ribbon Spool Ratchet Wheel(s)

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

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

3. Remove the ribbon spools and ribbon.

4. Clip the three cable ties that secure the speaker wires to the ribbon chassis (Figure 6-25).

5. Remove the retaining ring that holds the pushrod in the ribbon chassis (Figure 6-25).

6. Remove the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates (Figure 6-25).

7. Remove the 2 (8–32) screws and lockwashers that secure the ribbon chassis to the print bar (Figure 6-25).

8. Remove the ribbon chassis and set on the workbench.

9. Remove the retaining ring that secures the ratchet wheel and the driver spool in the ribbon chassis (Figure 6-48).

10. Remove the brake washer, compression spring and the ratchet wheel.

11. Remove the ratchet wheel and set aside.

12. Remove the protective paper from the two new friction disks and apply one to the ribbon chassis and the other to the new ratchet wheel. Be sure the friction disks are applied to the right side of the ratchet wheel. Ensure that surfaces are free of oil and moisture.

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

13. Replace the ratchet wheel, compression spring and the brake washer.

14. Replace the retaining ring that secures the ratchet wheel and the ribbon spool in the ribbon chassis.

15. Secure the new ribbon chassis to the print bar with the 2 (8–32) screws and lockwashers.

16. Replace the 4 (6–32) screws and lockwashers that secure the ribbon chassis to the right- and left-hand side plates. (Be sure to attach the ground strap to the top screw on the right-hand side and tighten the ground screw 20 ±2 in/lbs of torque.)

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

18. Secure the speaker wires to the ribbon chassis with cable ties.

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

20. Replace the ribbon and ribbon spools (Figure 6-7).

21. Rotate the ribbon drive pulley and check the travel of the pushrod to either side of center of the elongated slot in the ribbon chassis. The travel should be equal on either side of center.

22. To attain equal travel, move the ribbon drive upper pivot point in the direction of the shortest distance of travel. When travel is equal on both sides of the elongated hole, tighten the 8–32 upper pivot screw to 18 ±2 in/lbs of torque (Figure 6-22).

23. With the ribbon fully wound on the left spool, the ribbon moving right to left across the face of the print head and the ribbon grommet starting to pull the reverse sensor to the right, a pull test on the carriage from the left to right should indicate a pull of no more than 3.5 lbs (Figure 6-7). As a minimum, the ribbon should be moving right to left across the face of the print head when the pull test is made.

24. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

**6.2.14 Idler Gear**

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

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

3. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the idler gear assembly to the left-hand side plate (Figure 6-27).

4. Remove the 8–32 screws, flat washers and kep nut that secure the idler gear to the gear bracket (Figure 6-27).

5. Remove the screw, flat washers and idler tube, from the idler gear and set the gear aside.

6. Replace the idler tube, flat washers and screw in the new idler gear (one flat washer on either side of the idler gear).

7. Secure the idler gear to the gear bracket with the 8–32 screw, flat washers and kep nut. Tighten the screw to 18 ±2 in/lbs of torque.

8. Secure the idler gear assembly to the left-hand side plate with the 2 (8–32) screws, lockwashers and flat washers. Make the screws finger tight.

9. With the idler gear in mesh with the stepping motor gear and the tractor drive gear, adjust the idler gear to achieve equal depth penetration and a backlash of 0.002 to 0.007 inch between each pair of gears (Figure 6-27). (The idler gear should be free to slide in and out.)

10. Tighten the 2 (8–32) screws to 18 ±2 in/lbs of torque.

11. Replace the printer housing on the cabinet base and secure with the 8 (6–18) screws and flat washers.

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

**6.2.15 Rear Door Bushing(s)**

1. Remove power from the LA36.

2. Open the rear access door on the cabinet.

3. Remove the appropriate 3/8–16 screw and bushings that secure the rear access door to the cabinet (Figure 6-49).

4. Replace the defective bushing(s).

5. Secure the rear access door to the cabinet with the 3/8–16 screws and bushings. Tighten the screw to 18 ±2 in/lbs of torque.

### 6.2.16 Cover Spring Clips

1. Lift the cover on the LA36.

2. Remove the 6–18 screw and flat washer that secure the spring clip to the cover (Figure 6-50).

3. Secure a new spring clip to the cover with the 6–18 screw and flat washer. Tighten the screw to 5.5 in/lbs of torque.

### 6.2.17 Carriage Alignment Tool Setup

1. Place the setting block on the two dowel pins on the base block and secure with the 1/4-20 cap screw (Figure 6-51).

2. Loosen the 8–32 button head screw that secures the dial indicator to the base block.

3. Slide the dial indicator toward the setting block until the indicator needle moves at least 0.015 from its initial resting point. Tighten the button head screw and set the indicator to zero.

4. Remove the setting block from the base block.

5. The alignment tool is now calibrated to obtain a 2.562 inch measurement between the print bar and the front carriage shaft.

### 6.2.18 Tractor Gap Adjustment

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

### 6.2.19 EIA (DF11-A) Interface

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

2. Open the rear access door on the cabinet.

3. Disconnect the EIA connector from the transmission media.

4. Disconnect the connector from J4 on the Logic Board (Figure 6-53).

5. Remove the 2 (8–32) screws, lockwashers and flat washers that secure the EIA interface bracket to the cabinet base (Figure 6-53). Set the EIA interface aside.

6. Secure the new EIA interface to the cabinet base with the 2 (8–32) screws, lockwashers and flat washers.

7. Reconnect the connector to J4 on the Logic Board.

8. Reconnect the connector to the transmission media.

9. Close the rear access door on the cabinet.

10. Replace the printer paper and restore power to the LA36.

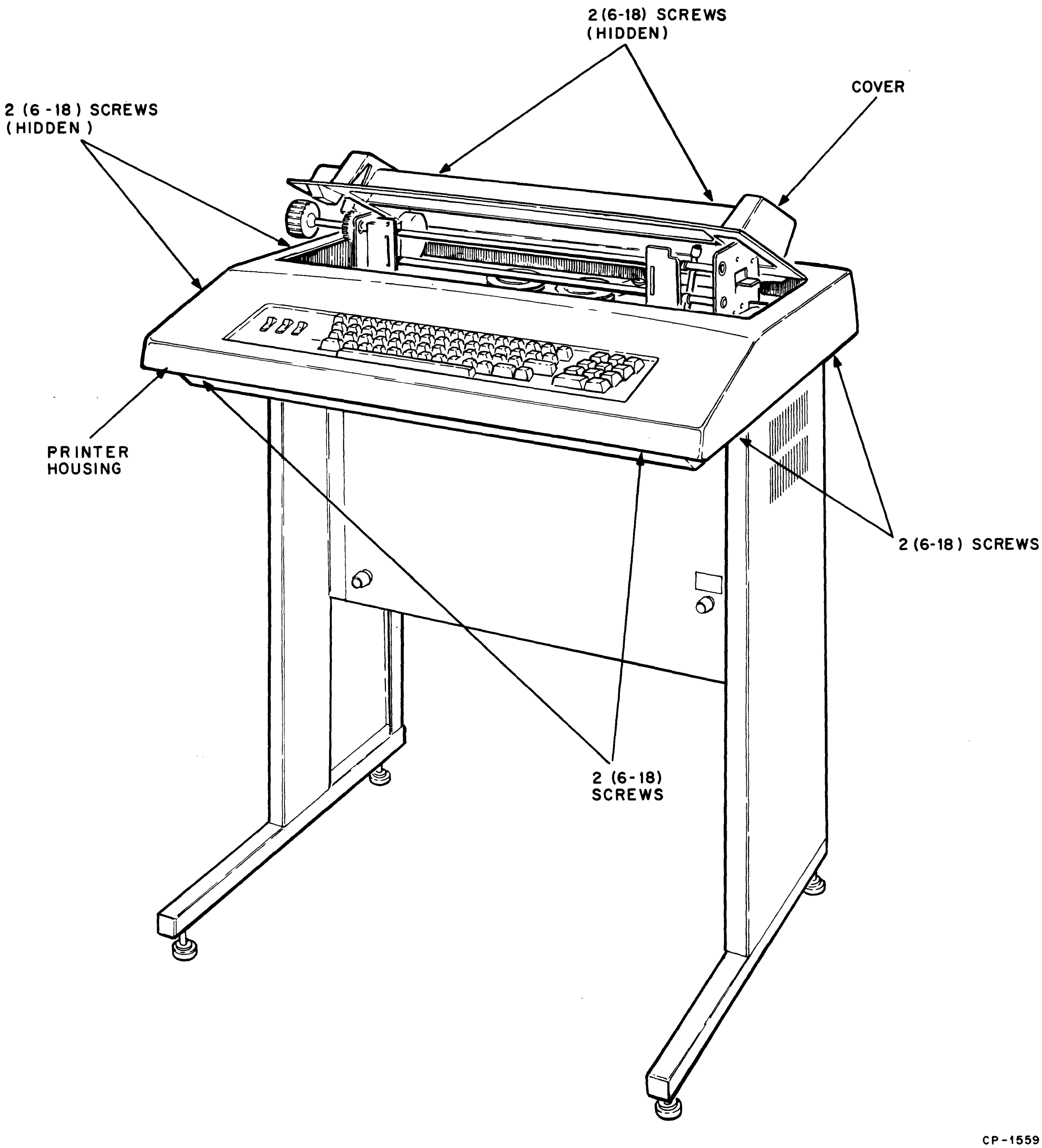



Figure 6-1 Housing Removal

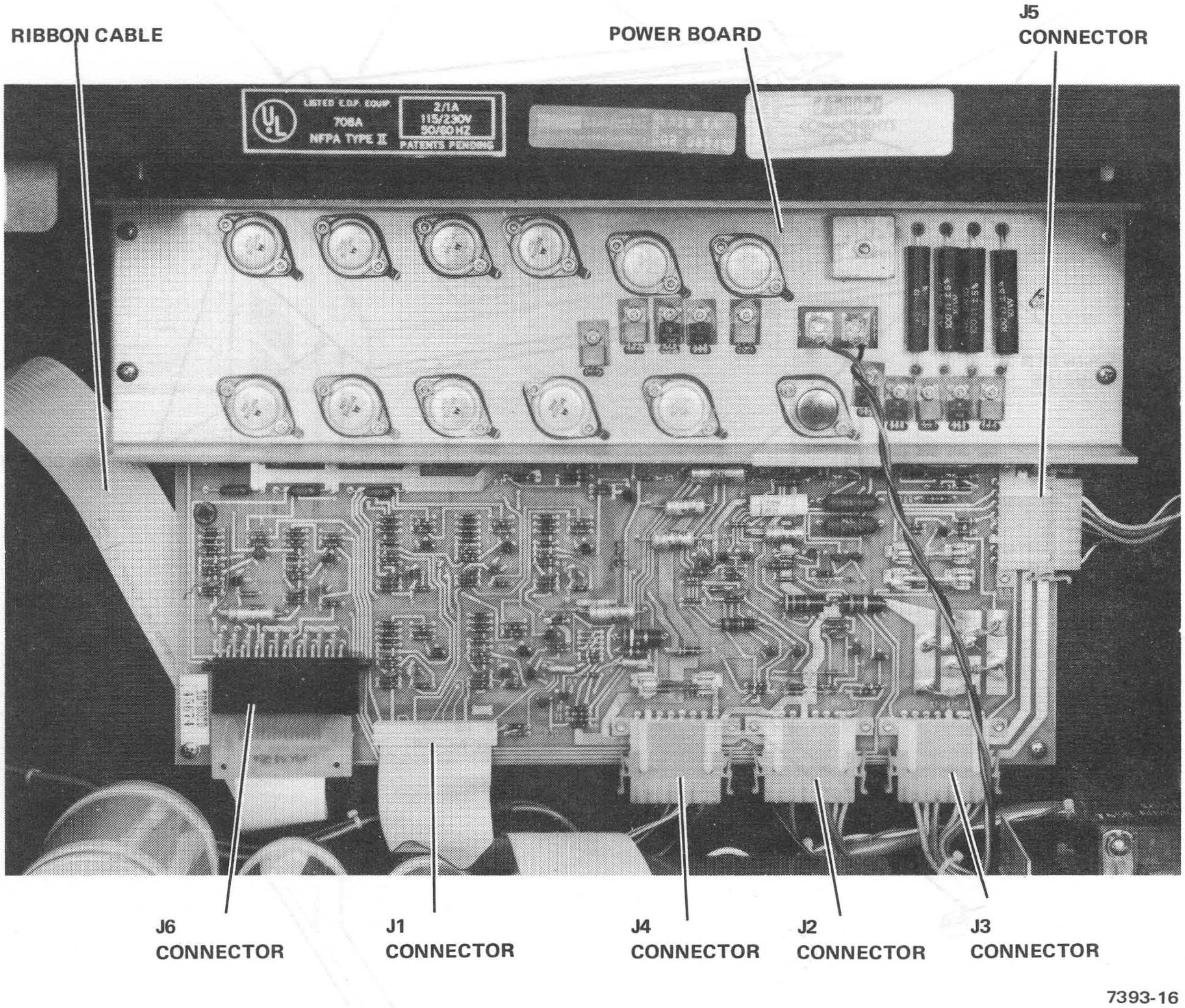



Figure 6-2 Power Board Connectors

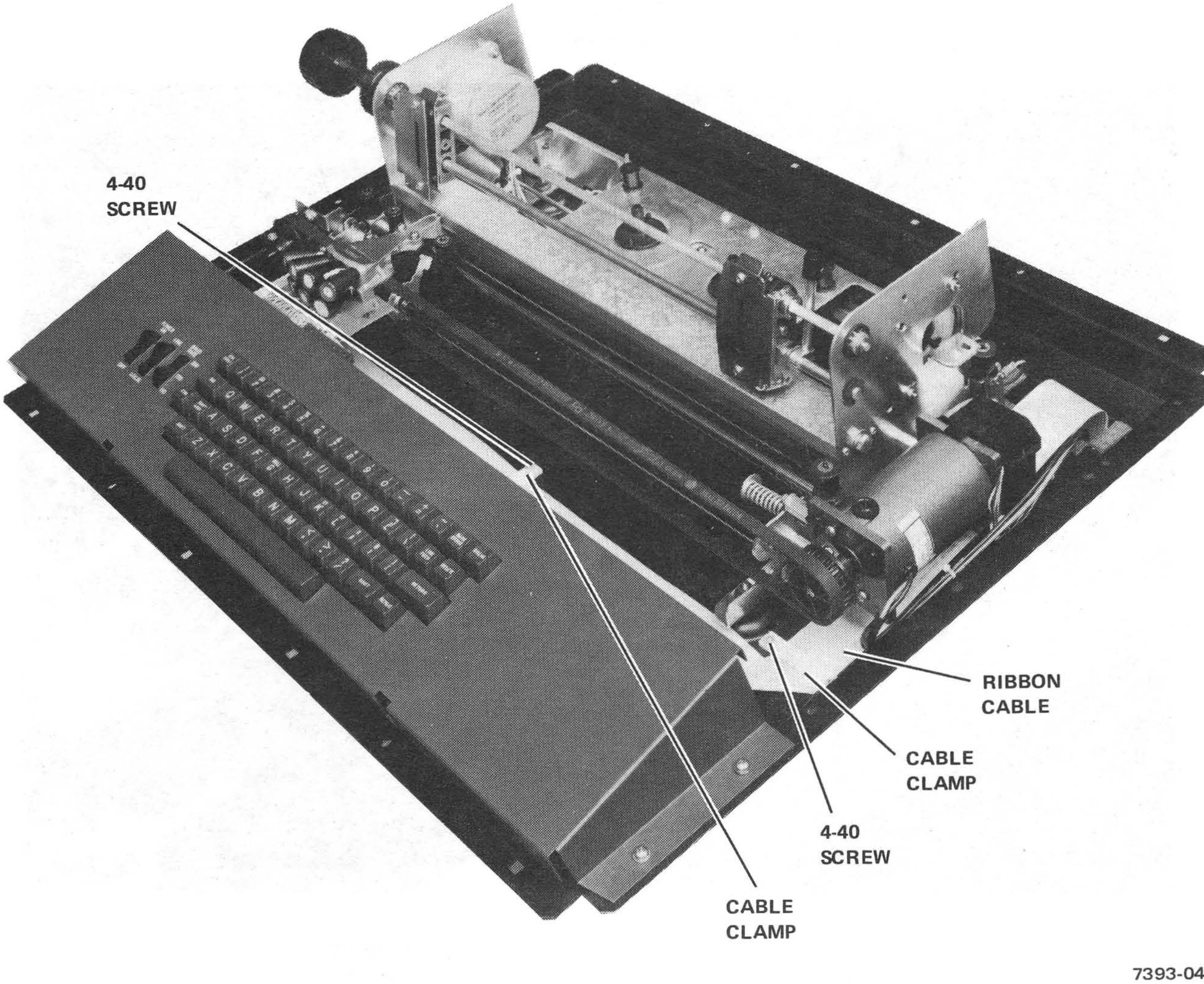



Figure 6-3 Ribbon Cable Clamps

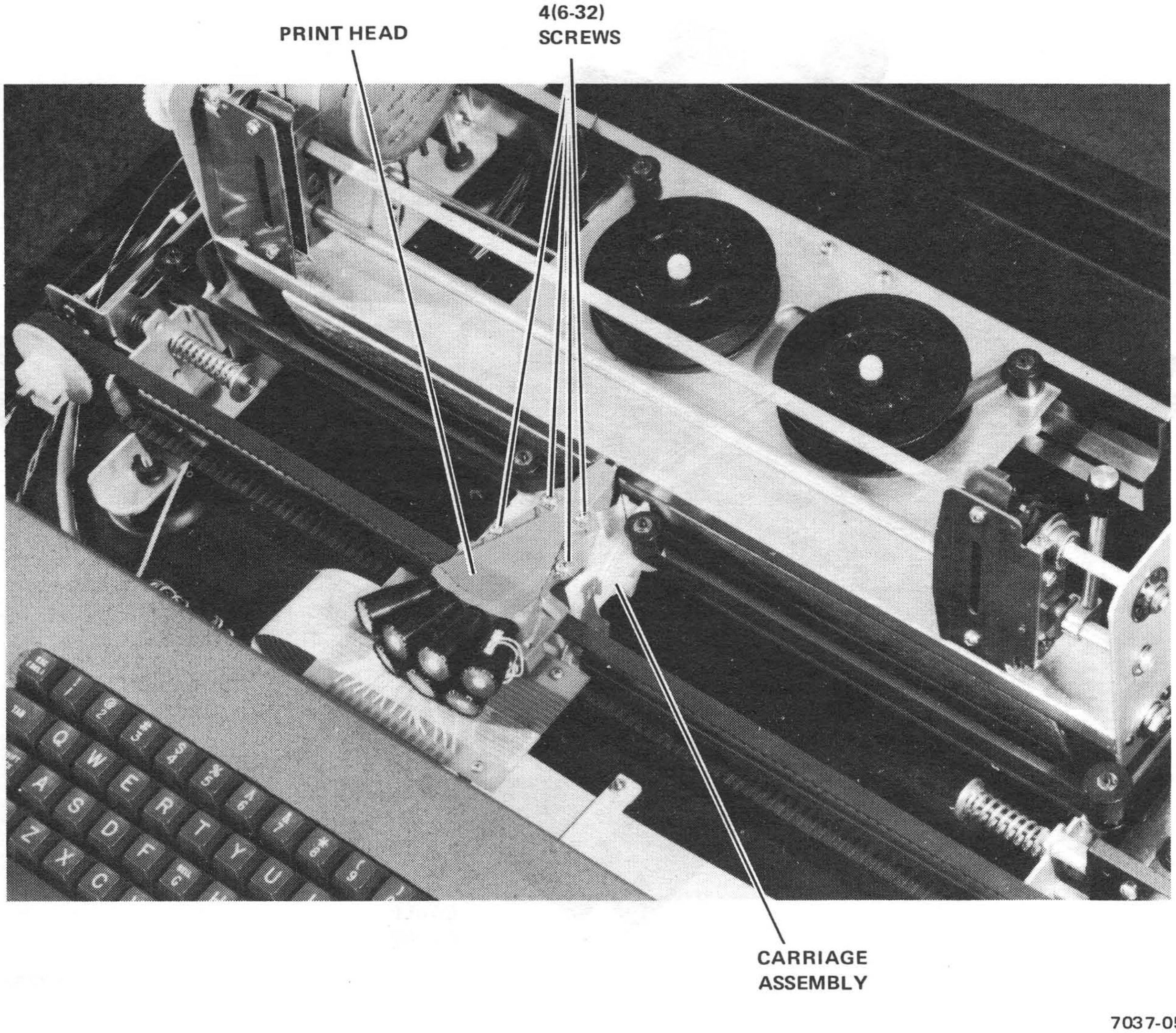



Figure 6-4 Print Head Removal

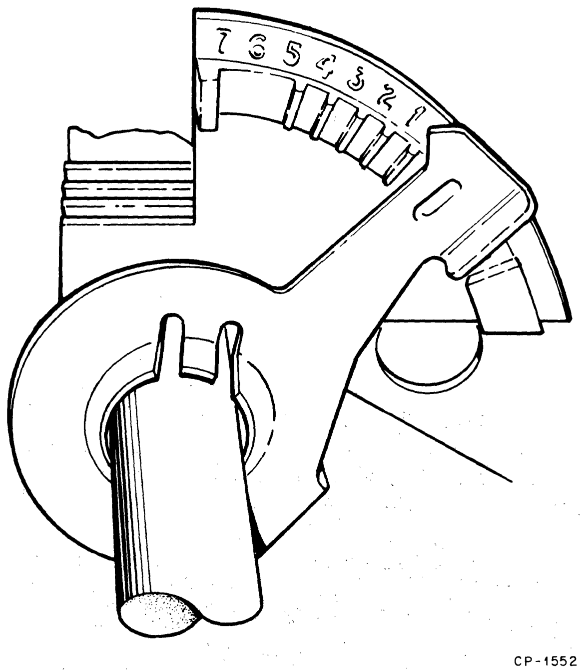
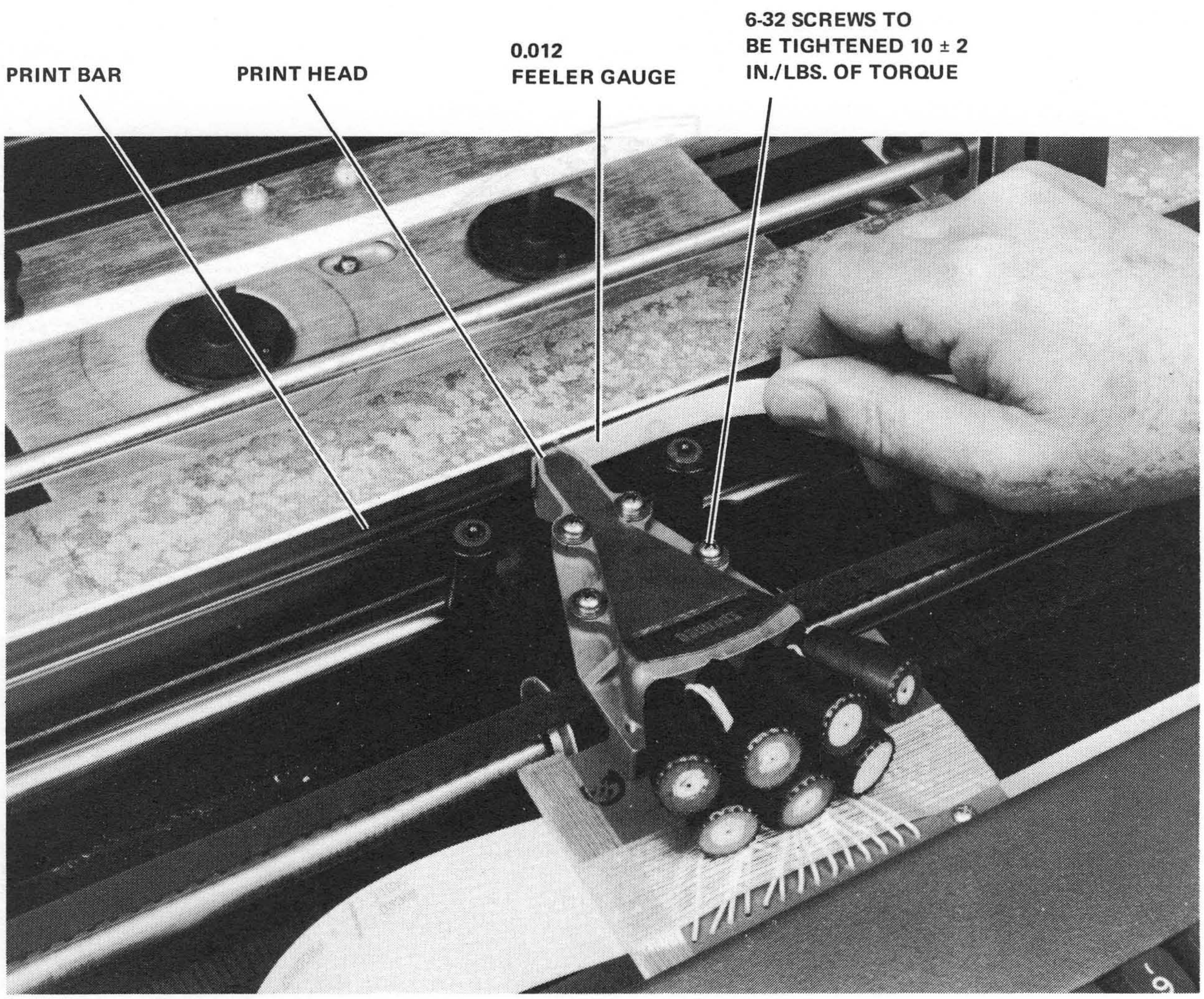



Figure 6-5 Carriage Adjustment Lever




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

7393-06

Figure 6-6 Print Head Adjustment

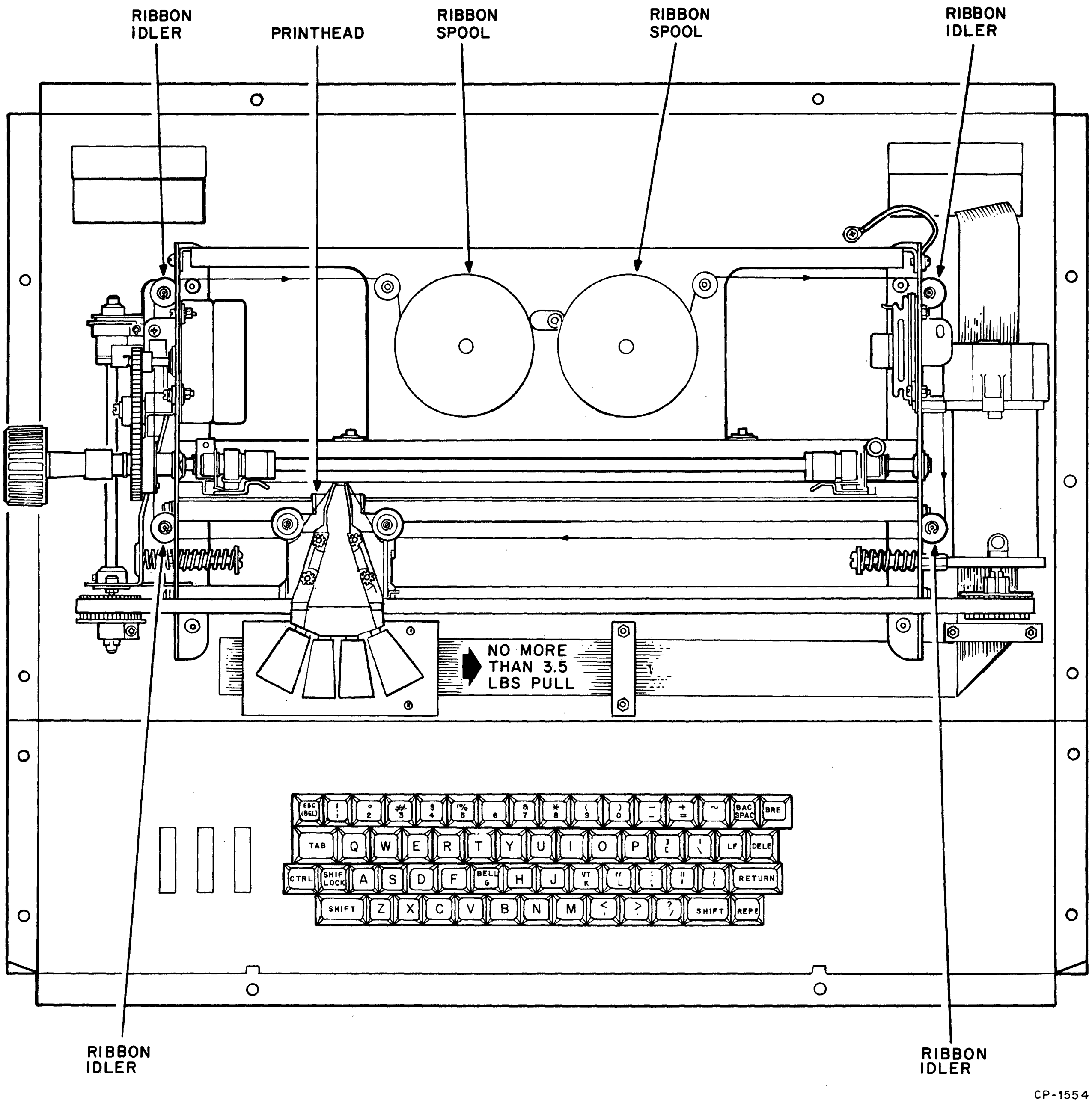



Figure 6-7 Ribbon Threading/Drag Test

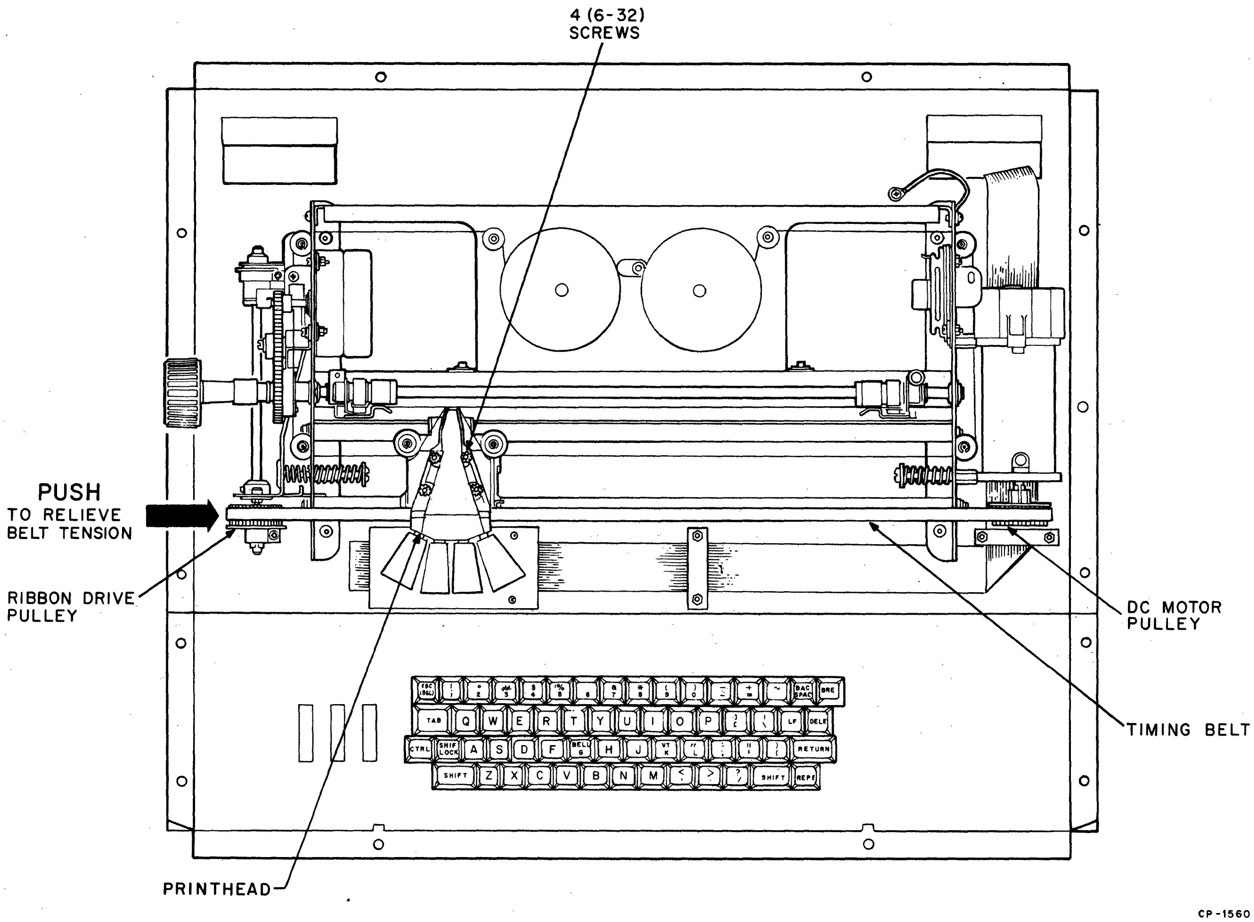



Figure 6-8 Timing Belt Removal

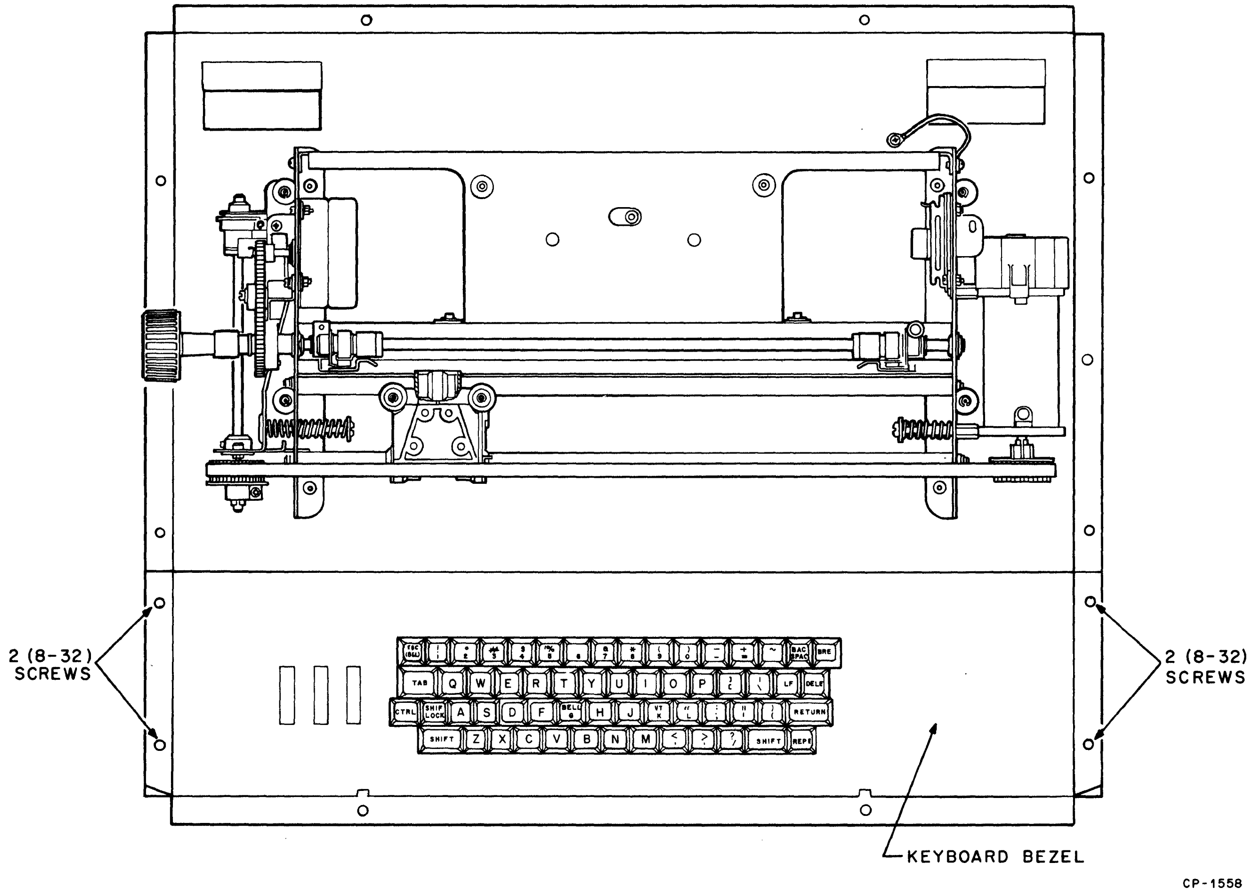



Figure 6-9 Keyboard Bezel Removal

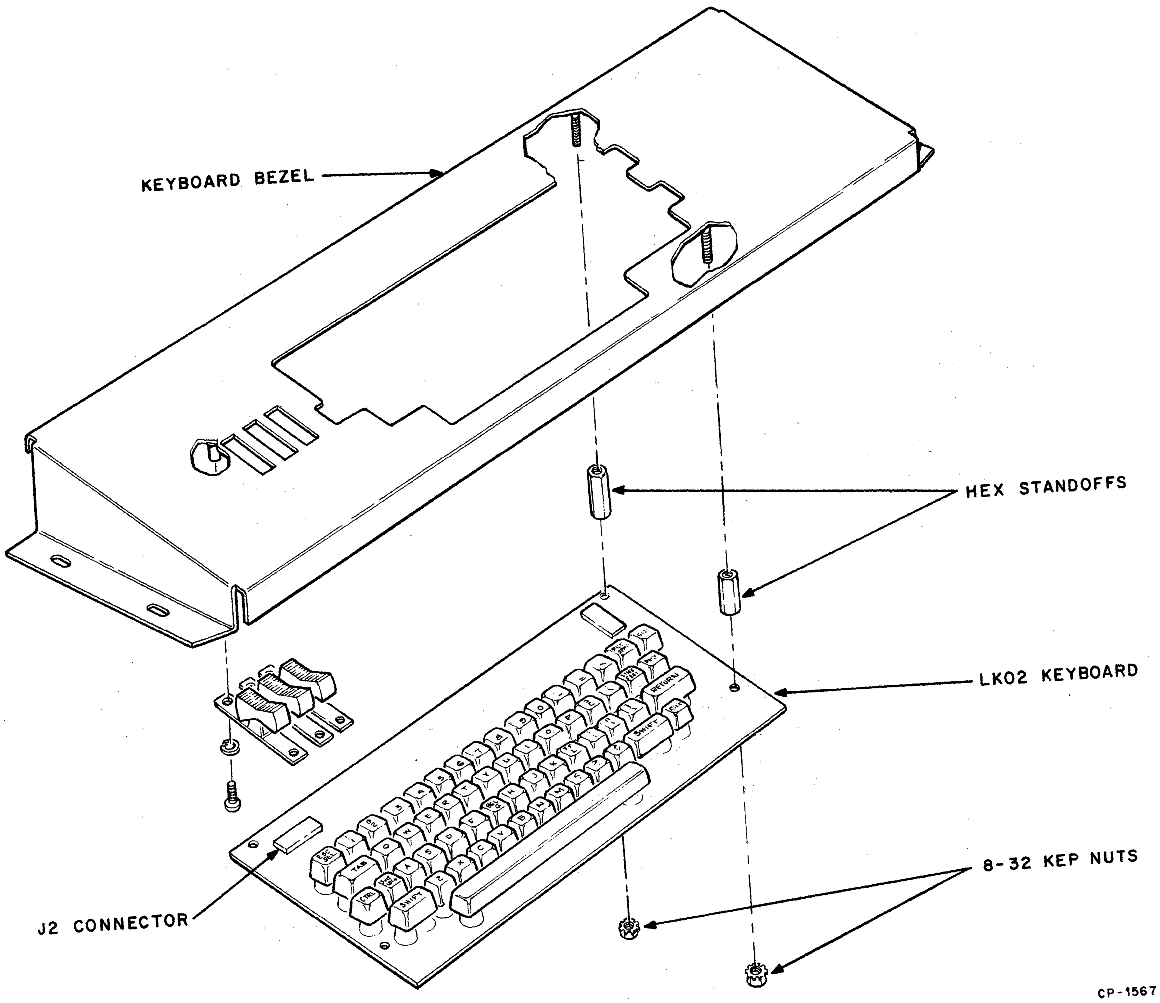



Figure 6-10 LK02 Keyboard Removal

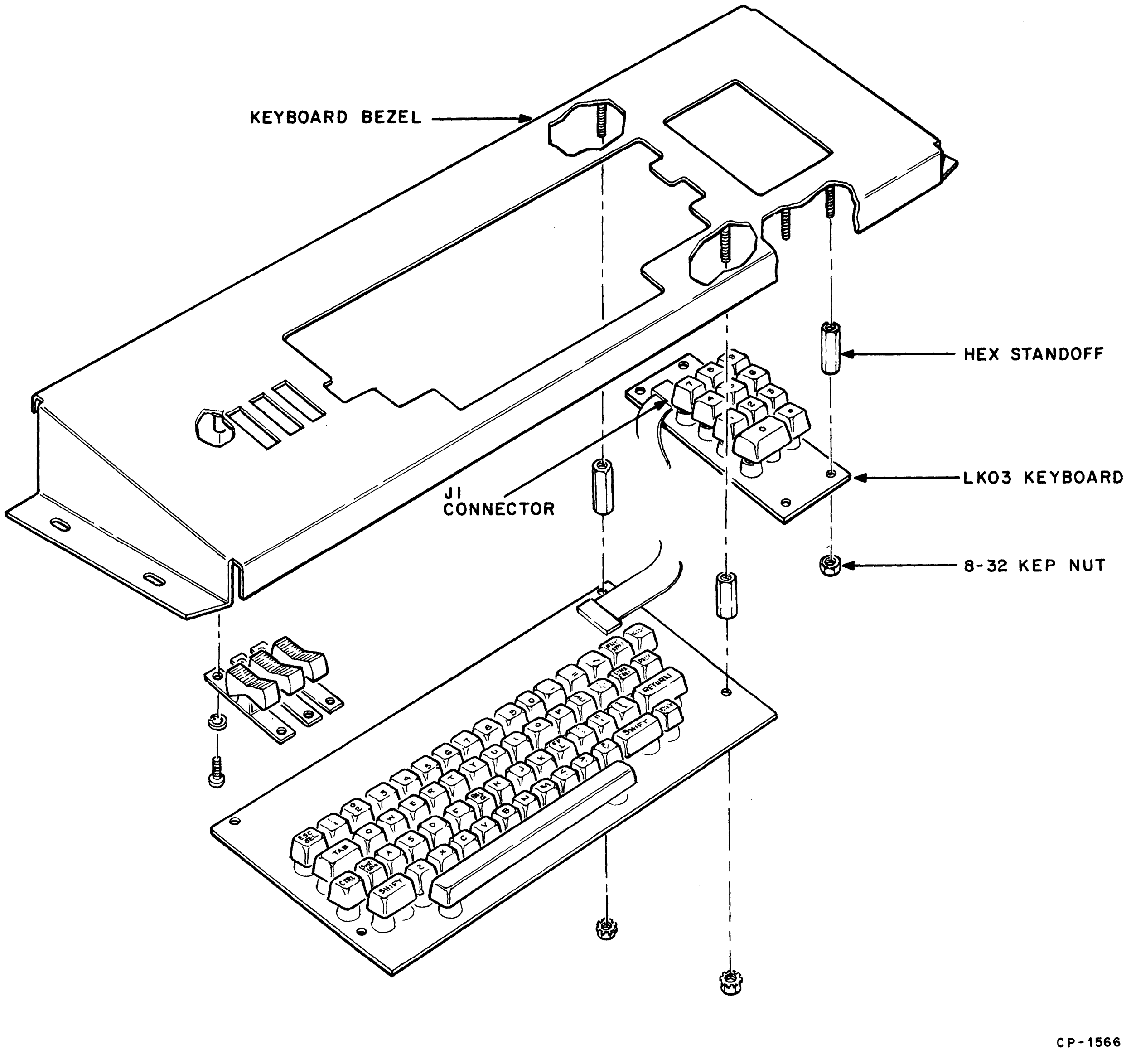



Figure 6-11 LK03 Keyboard Removal

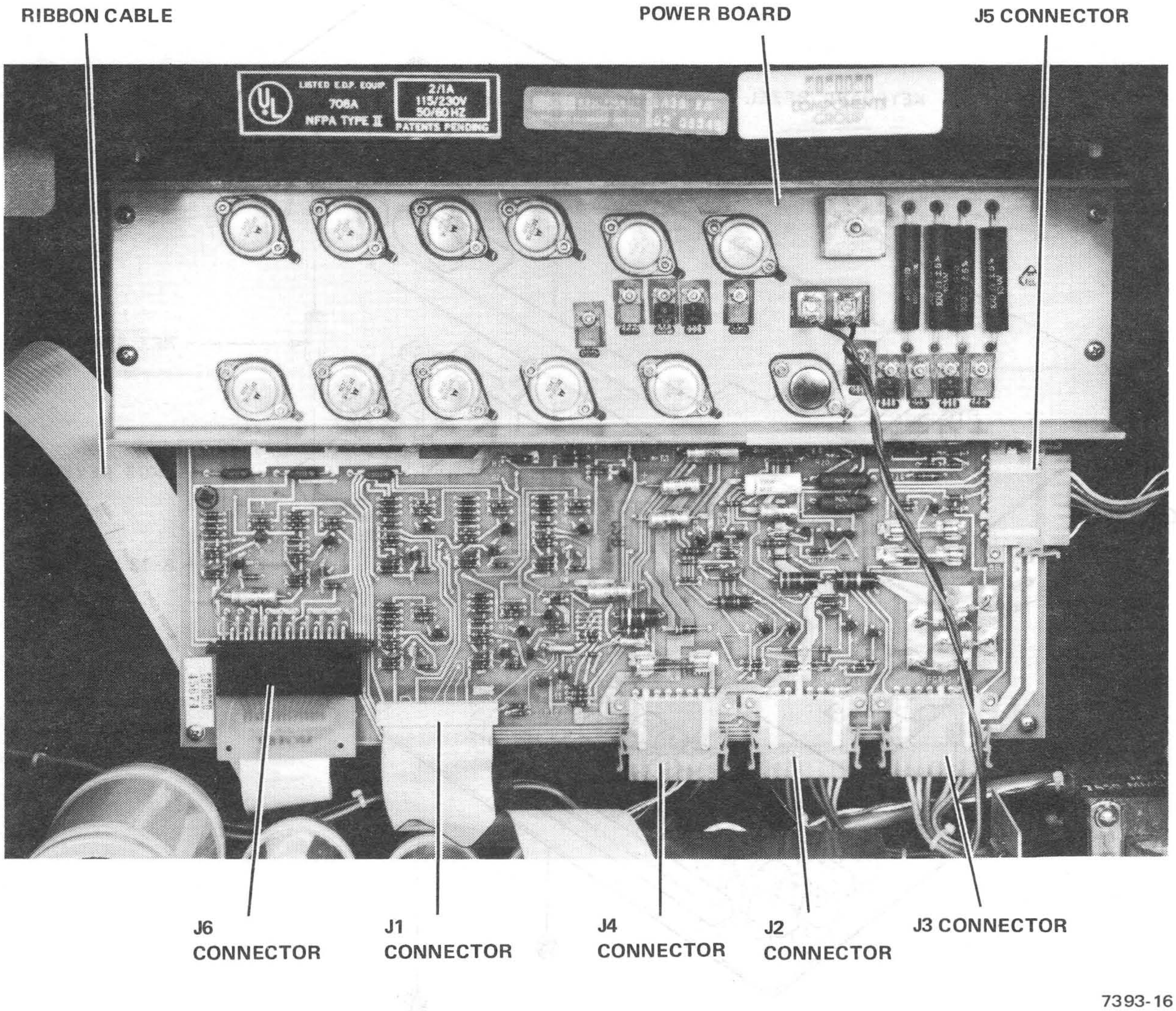



Figure 6-12 Power Board Connectors

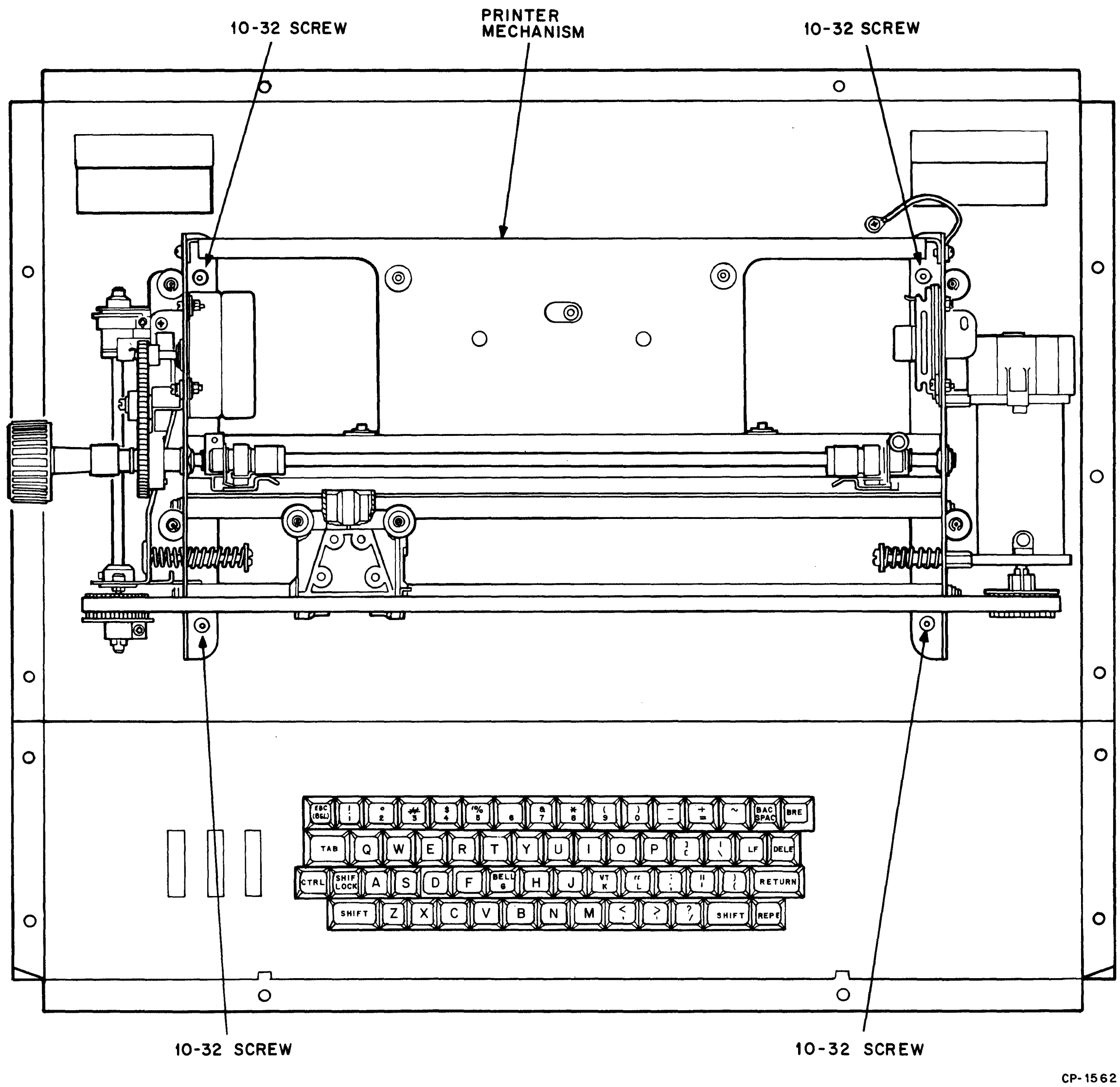



Figure 6-13 Printer Mechanism Removal

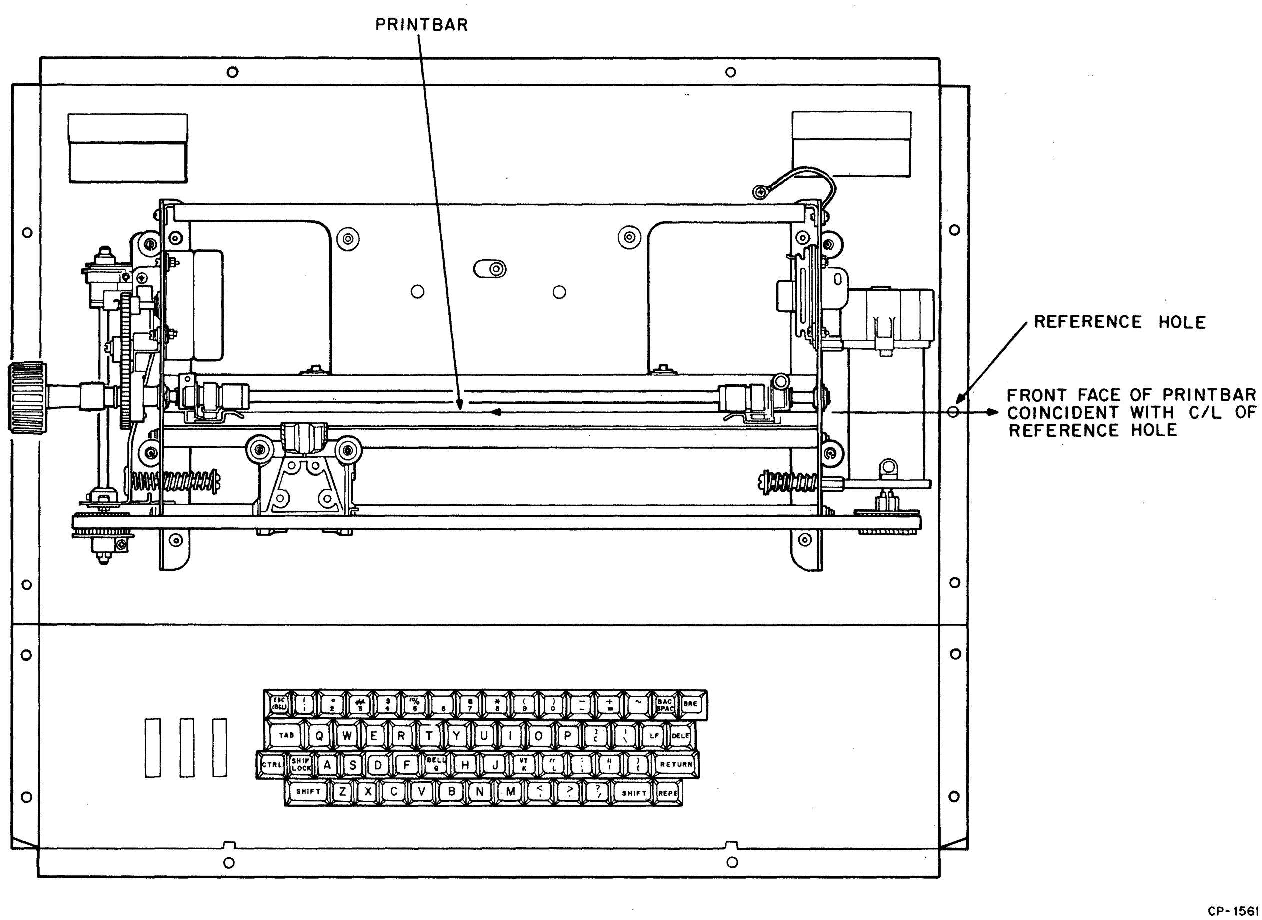



Figure 6-14 Printer Mechanism Alignment

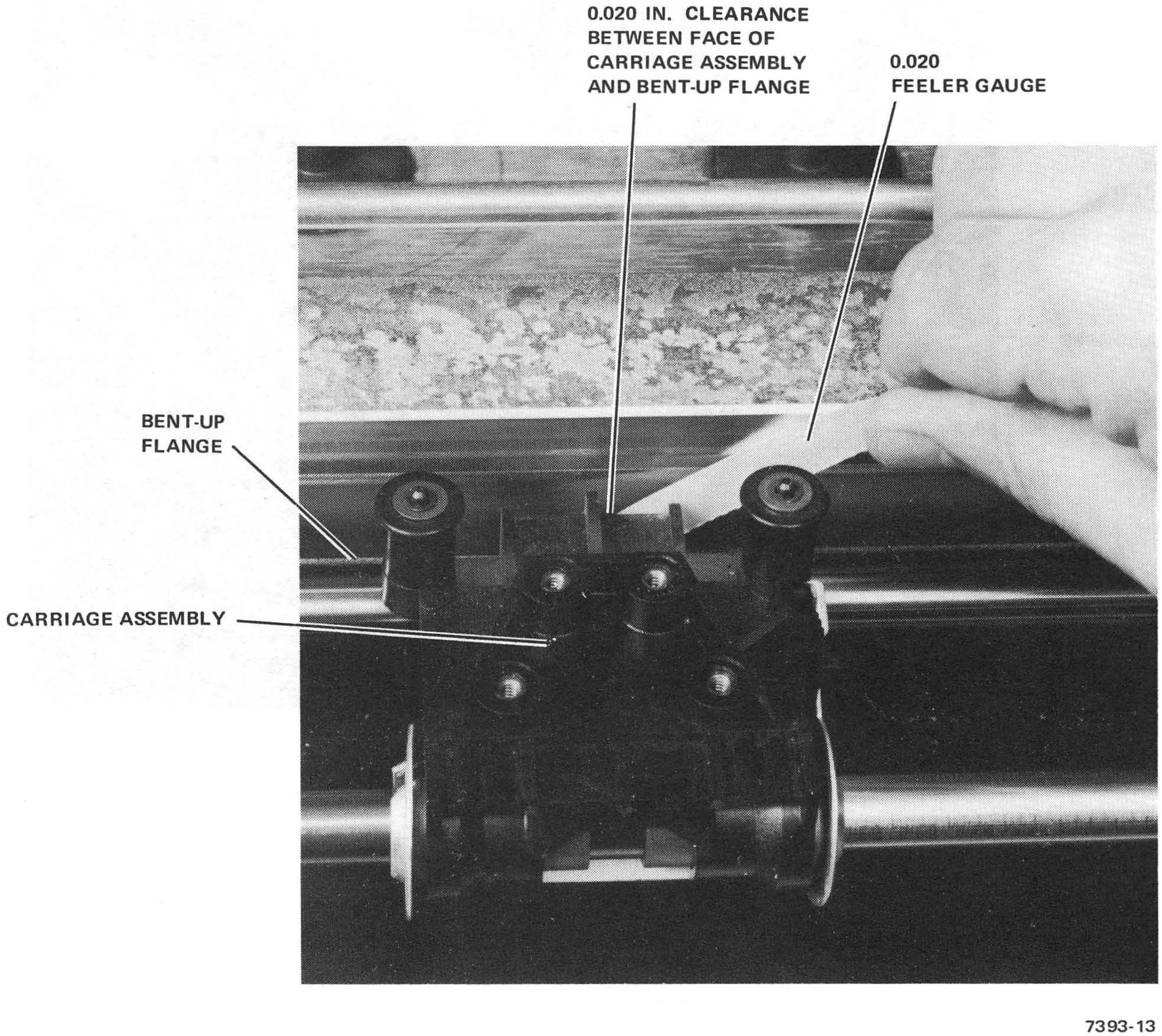



Figure 6-15 Printer Mechanism Adjustment

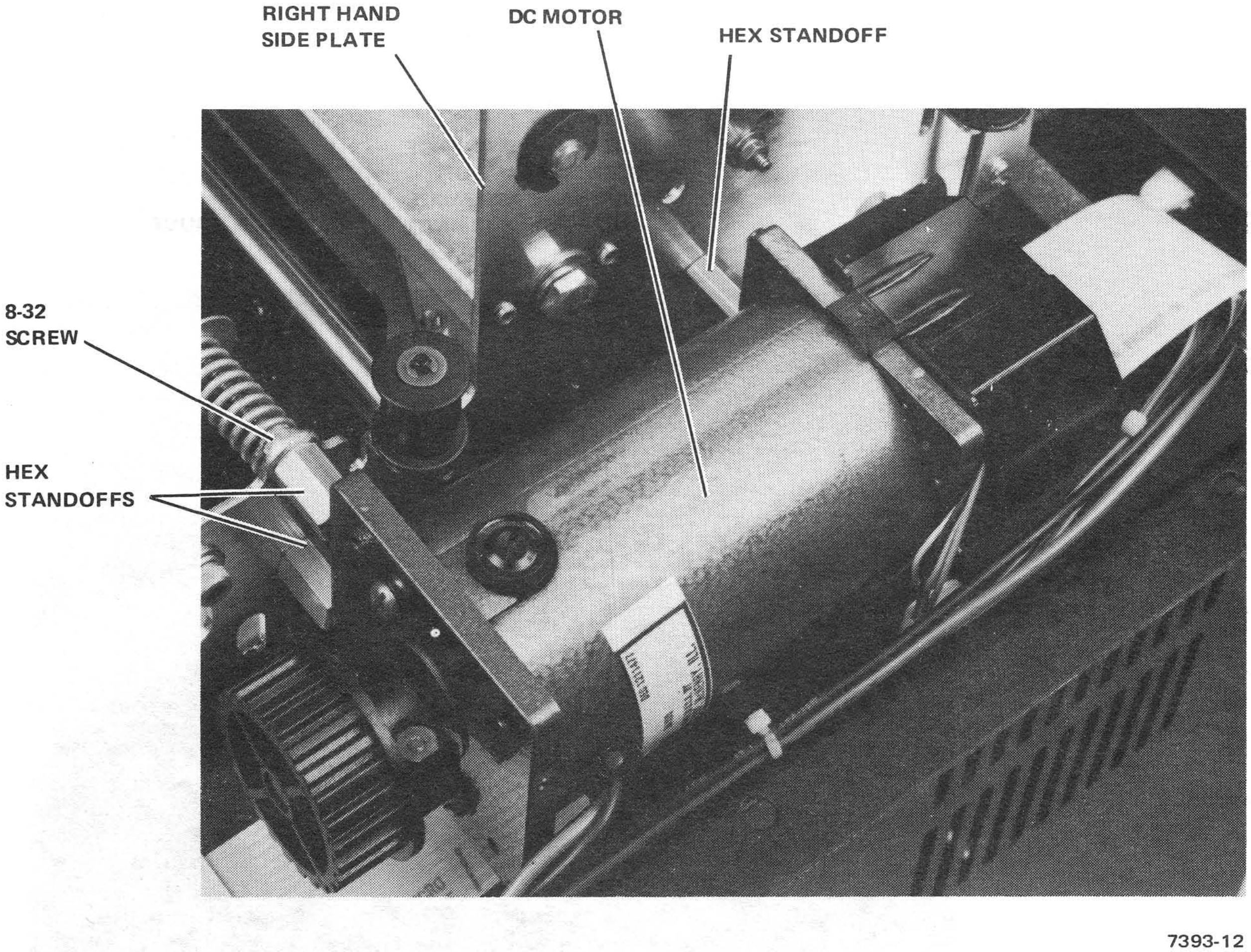



Figure 6-16 DC Motor Removal

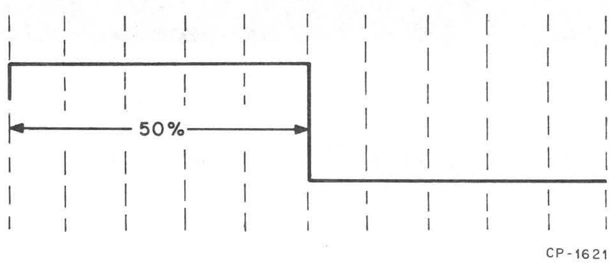



Figure 6-17 PT1 or PT2 Waveform

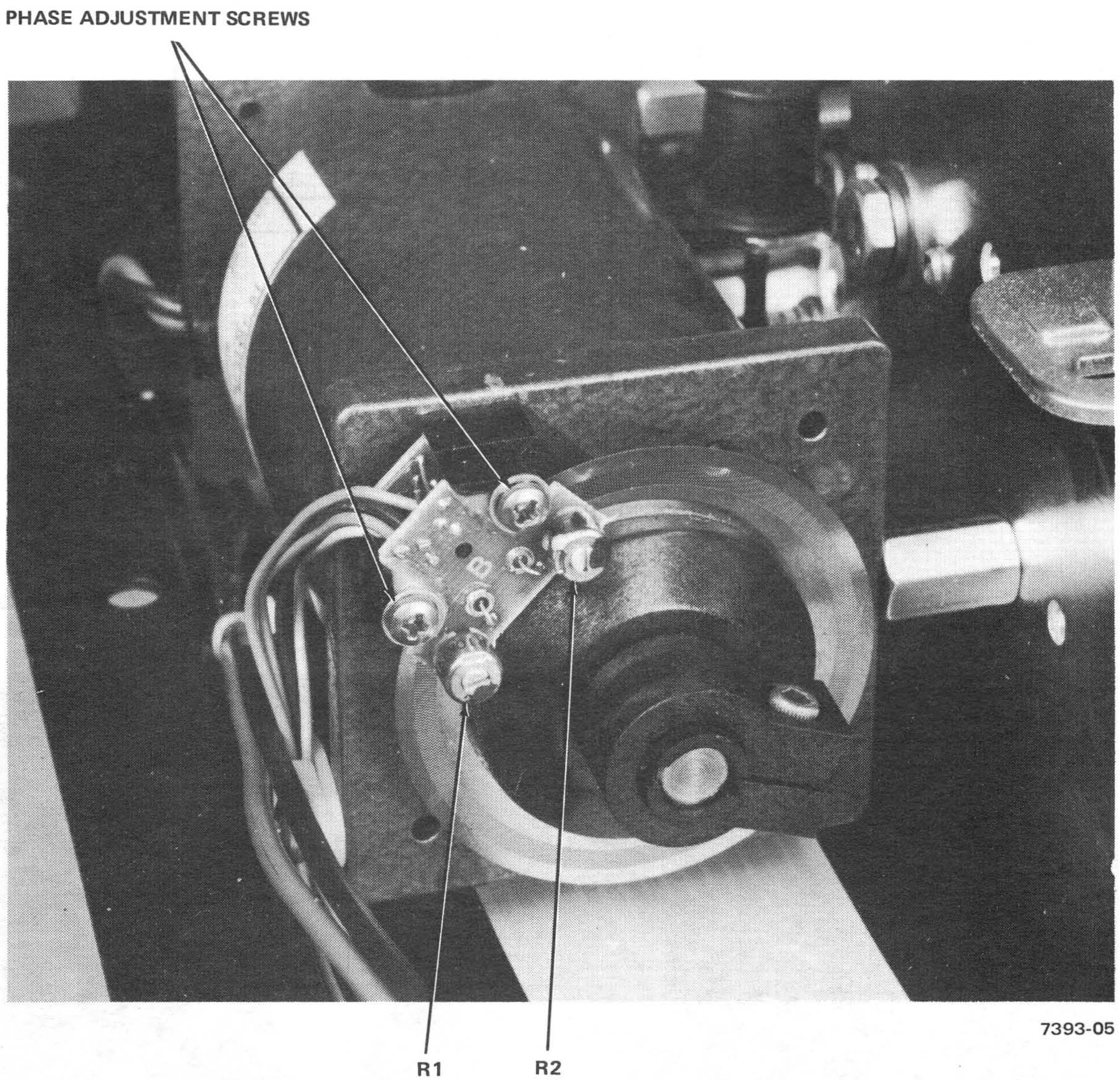



Figure 6-18 Encoder (Rear View)

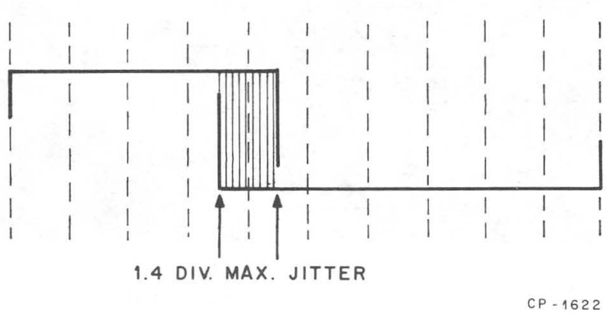



Figure 6-19 Encoder Jitter

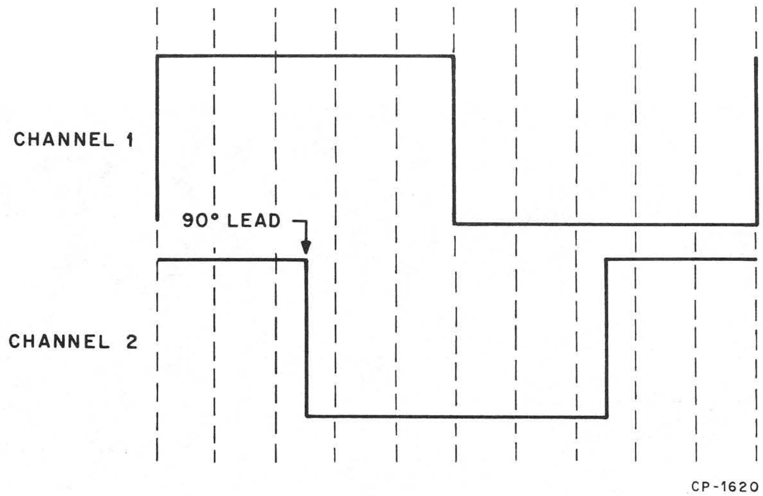



Figure 6-20 PT1 and PT2 Waveforms

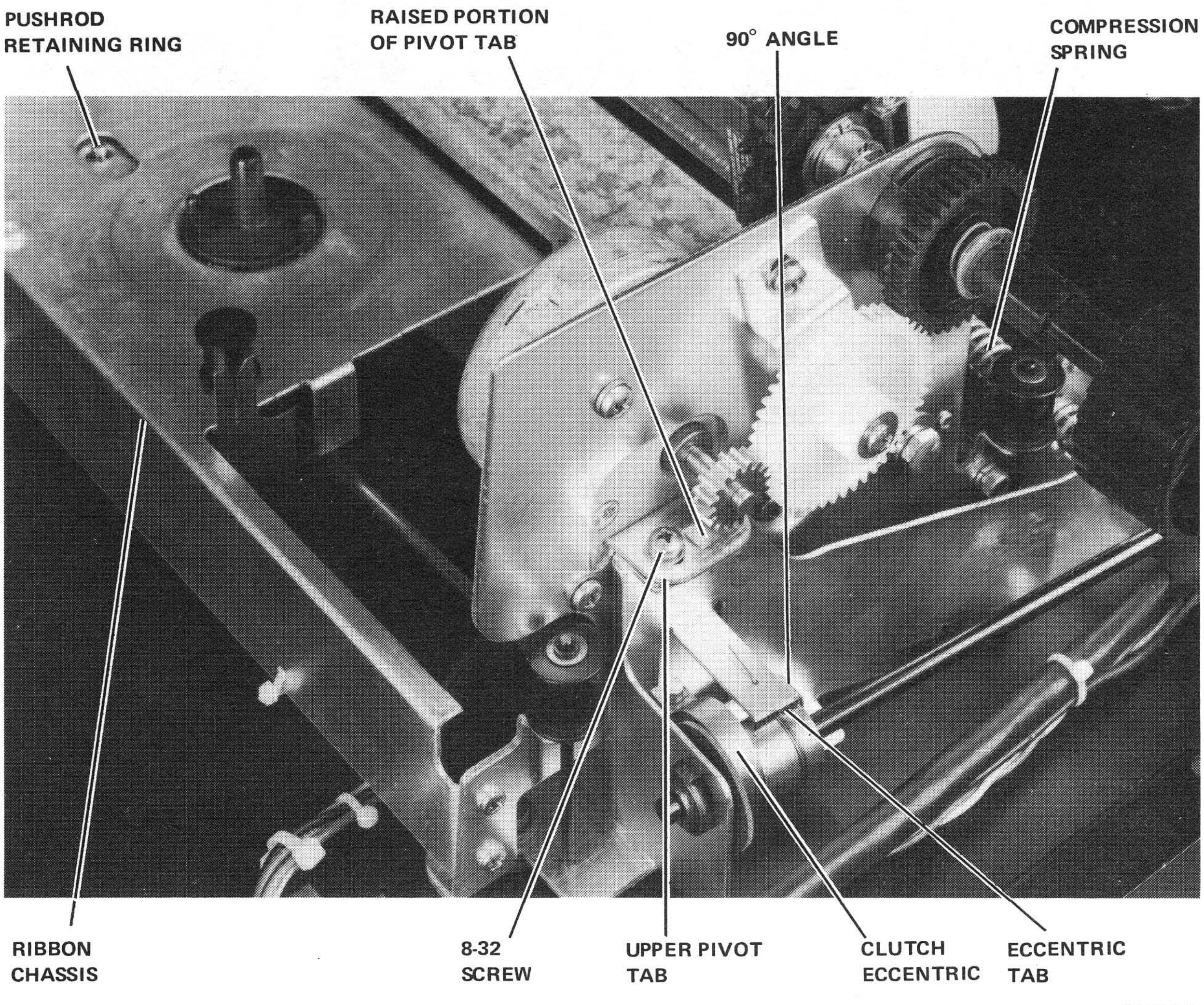



Figure 6-21 Ribbon Drive Removal

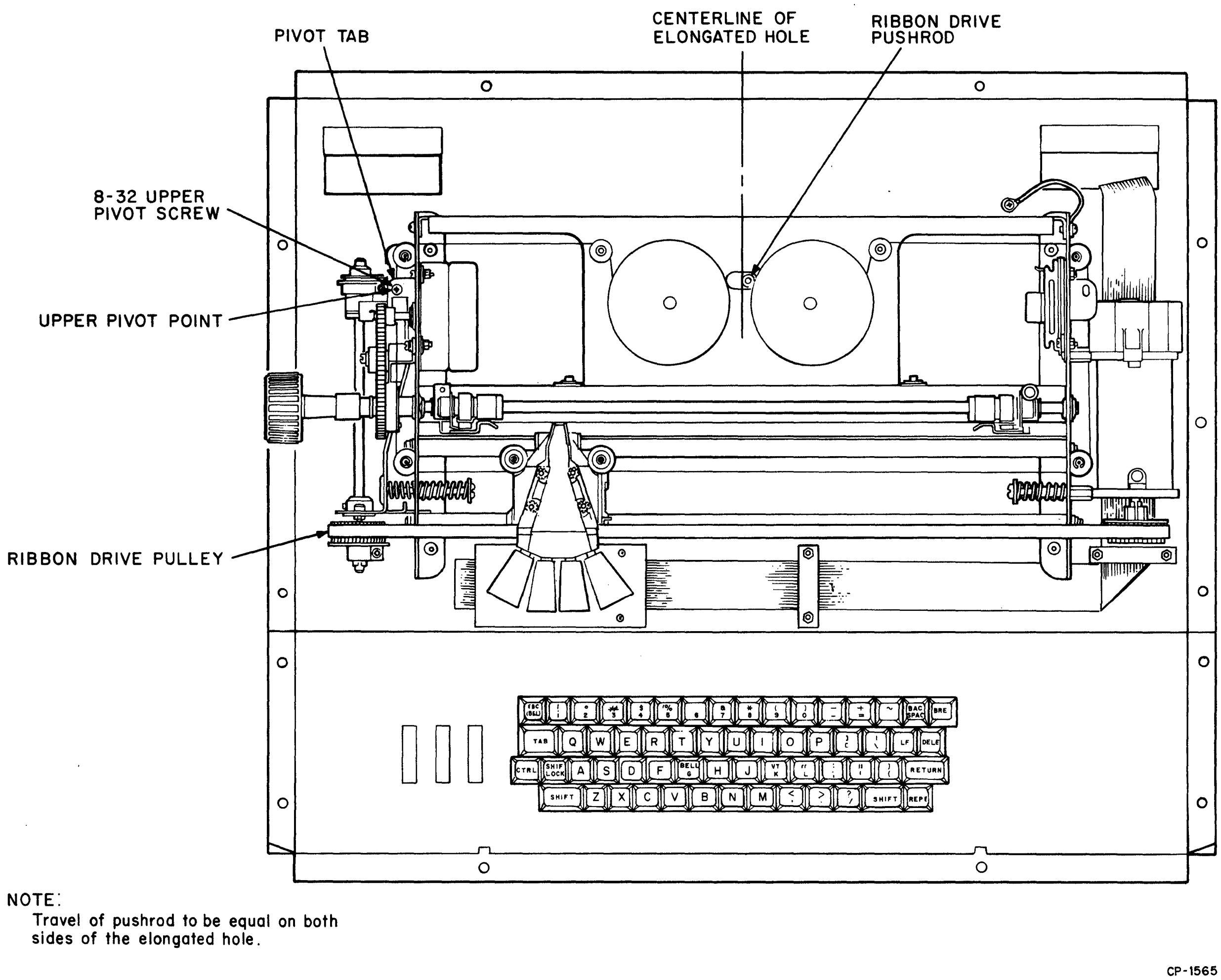



Figure 6-22 Ribbon Drive Adjustment

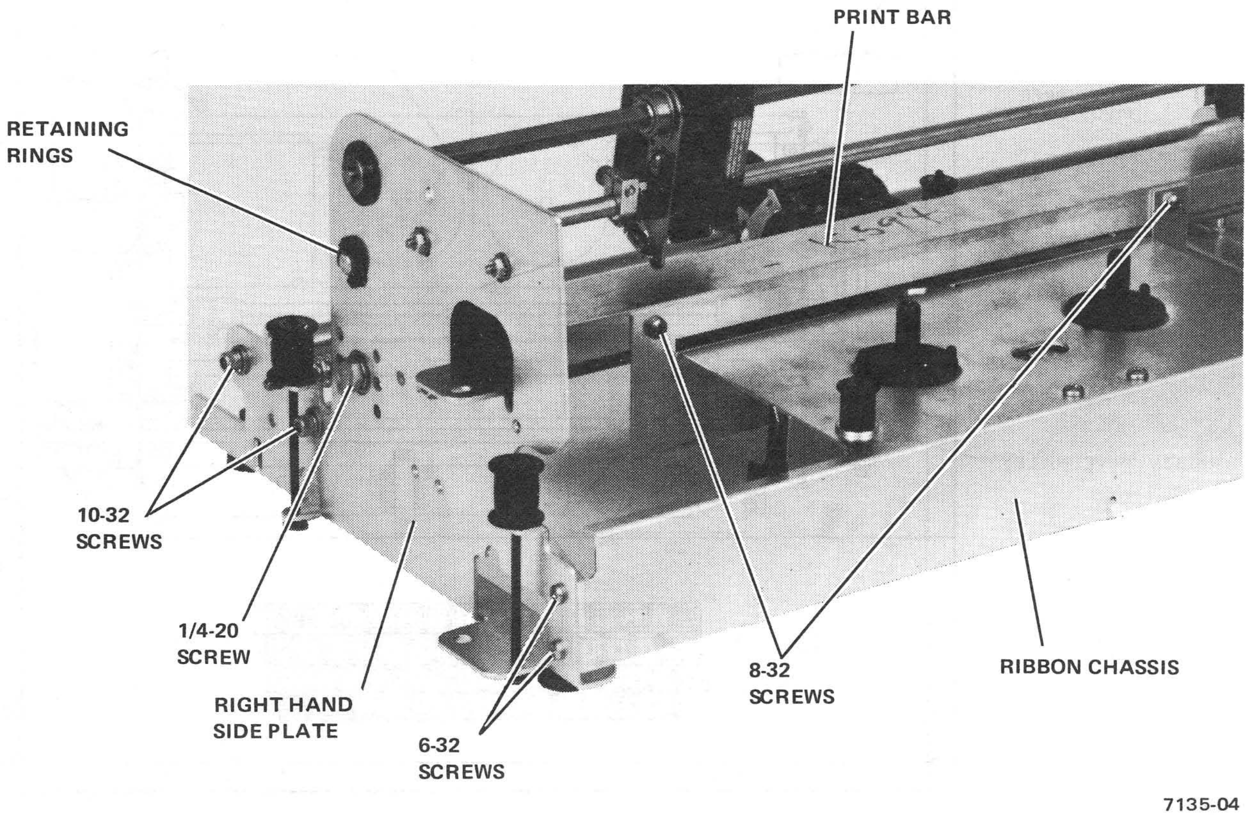
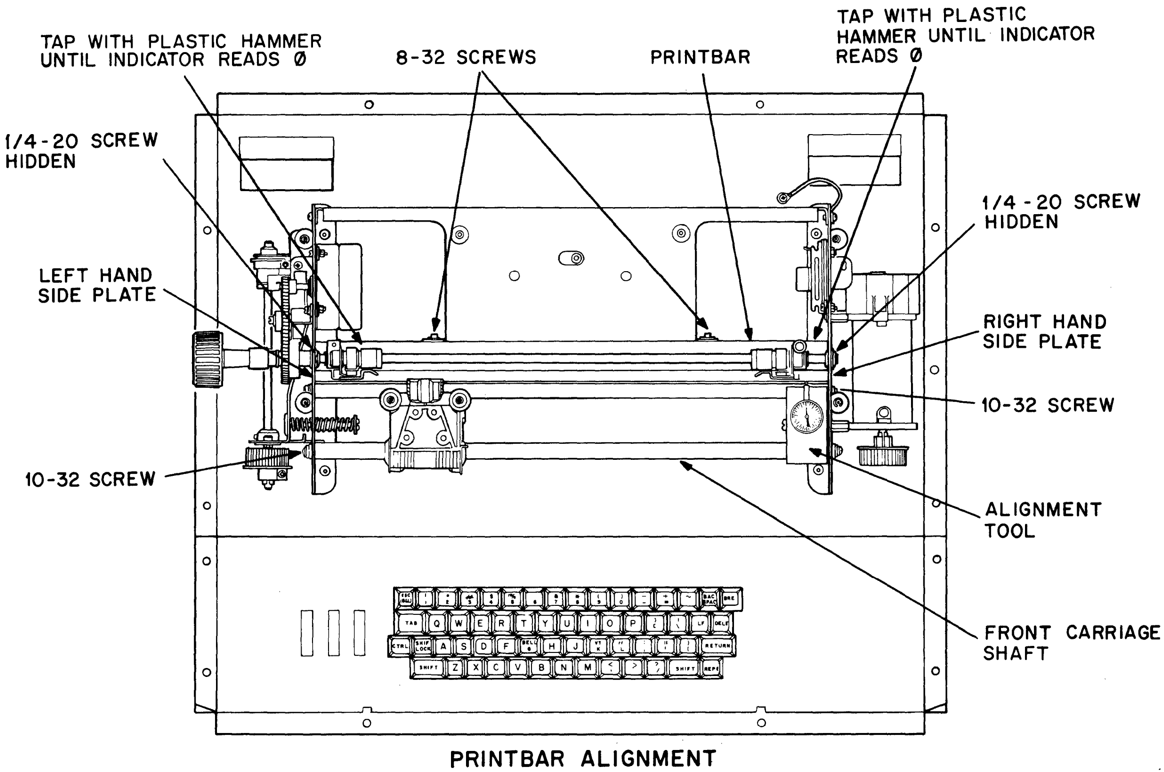



Figure 6-23 Carriage Removal



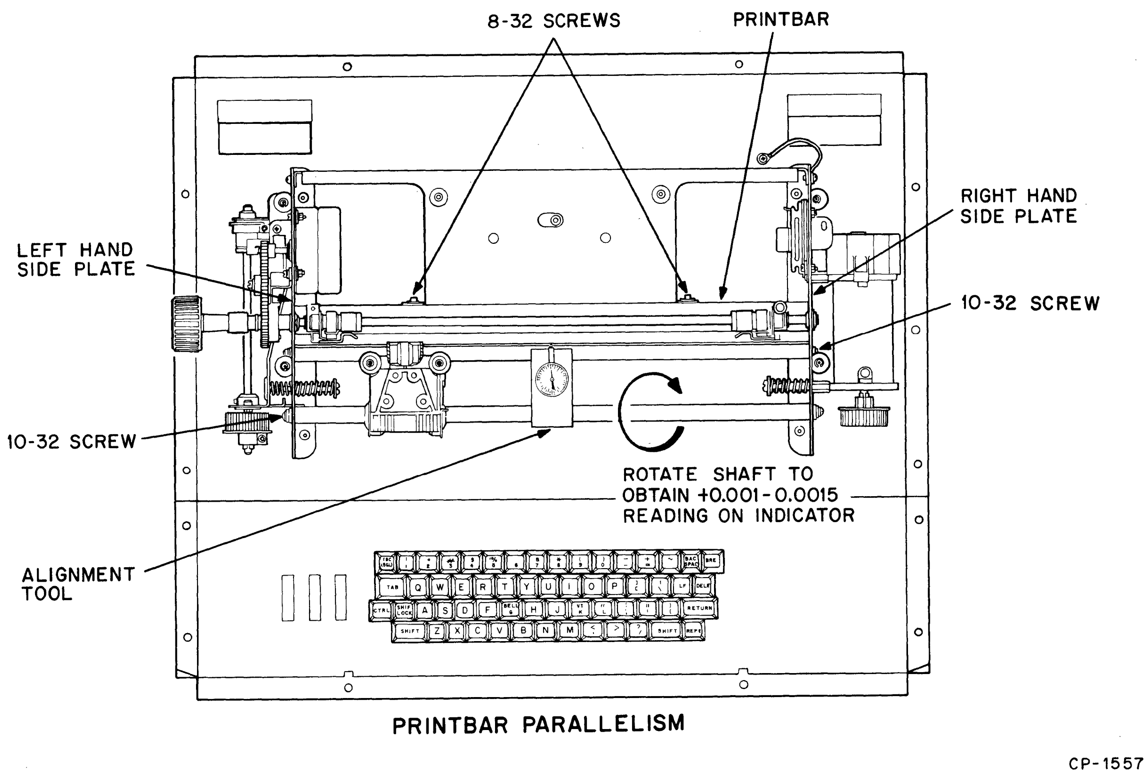




Figure 6-24 Print Bar Alignment/Parallelism

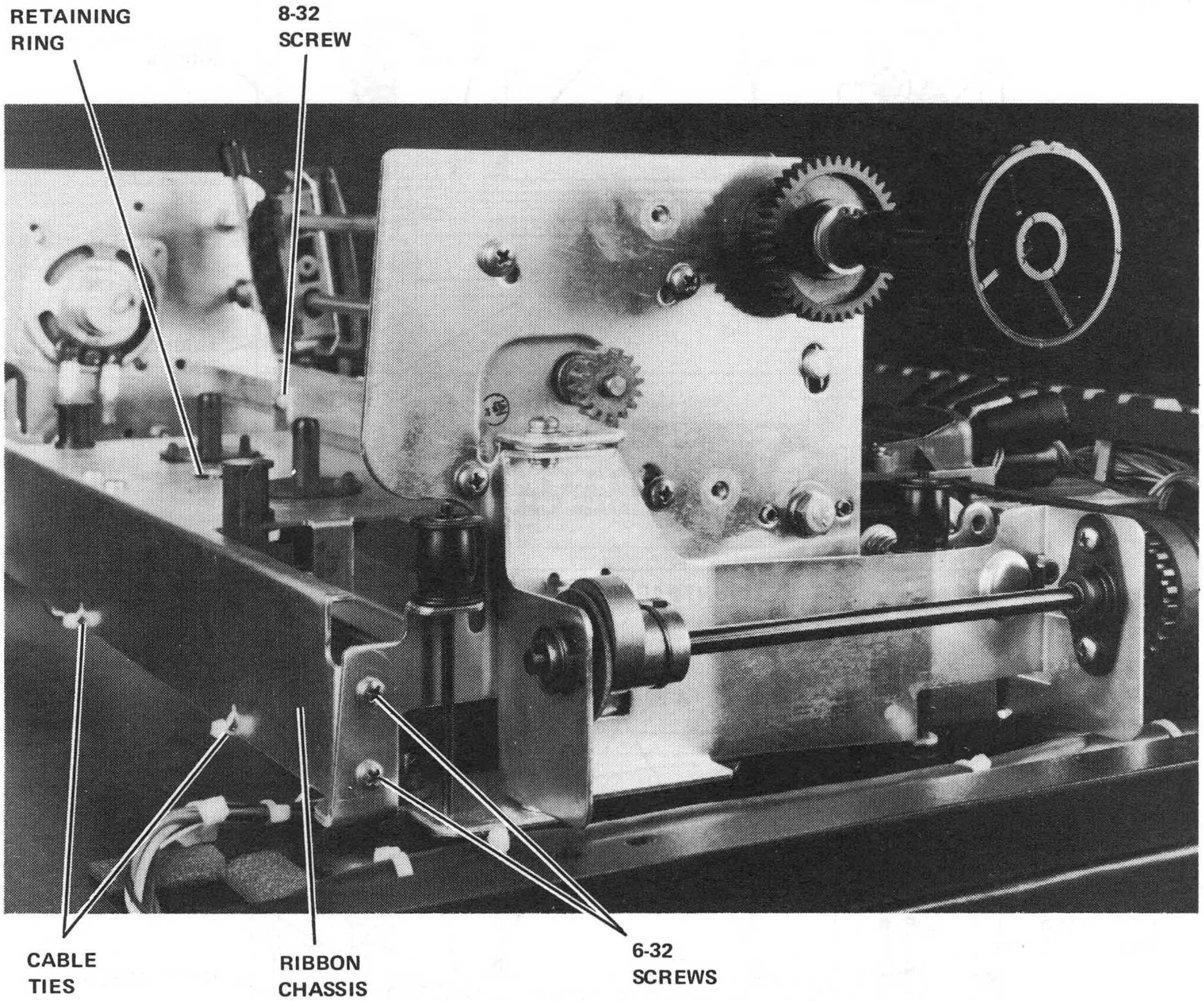



Figure 6-25 Ribbon Chassis Removal

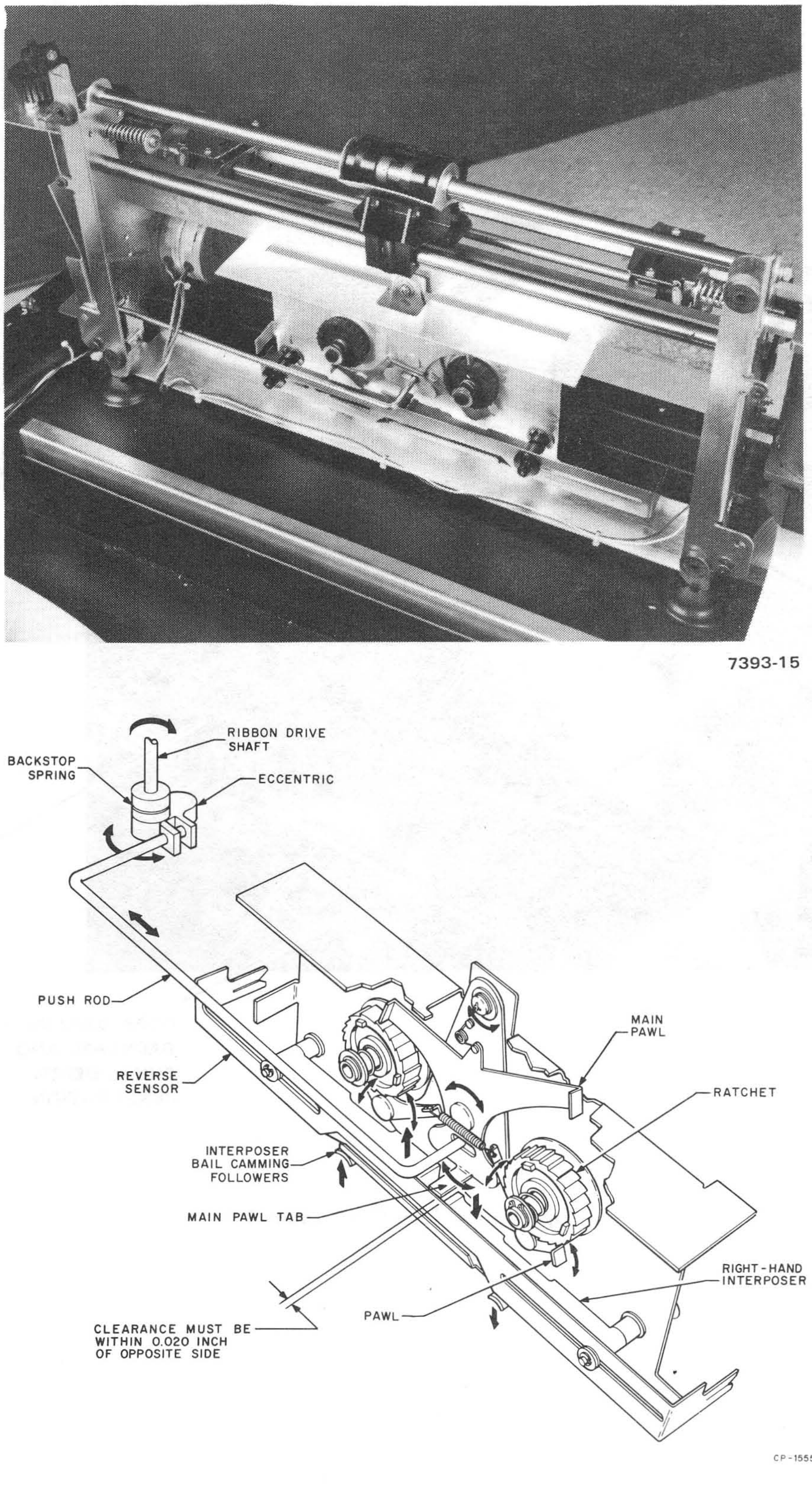



Figure 6-26 Ribbon Drive Adjustment

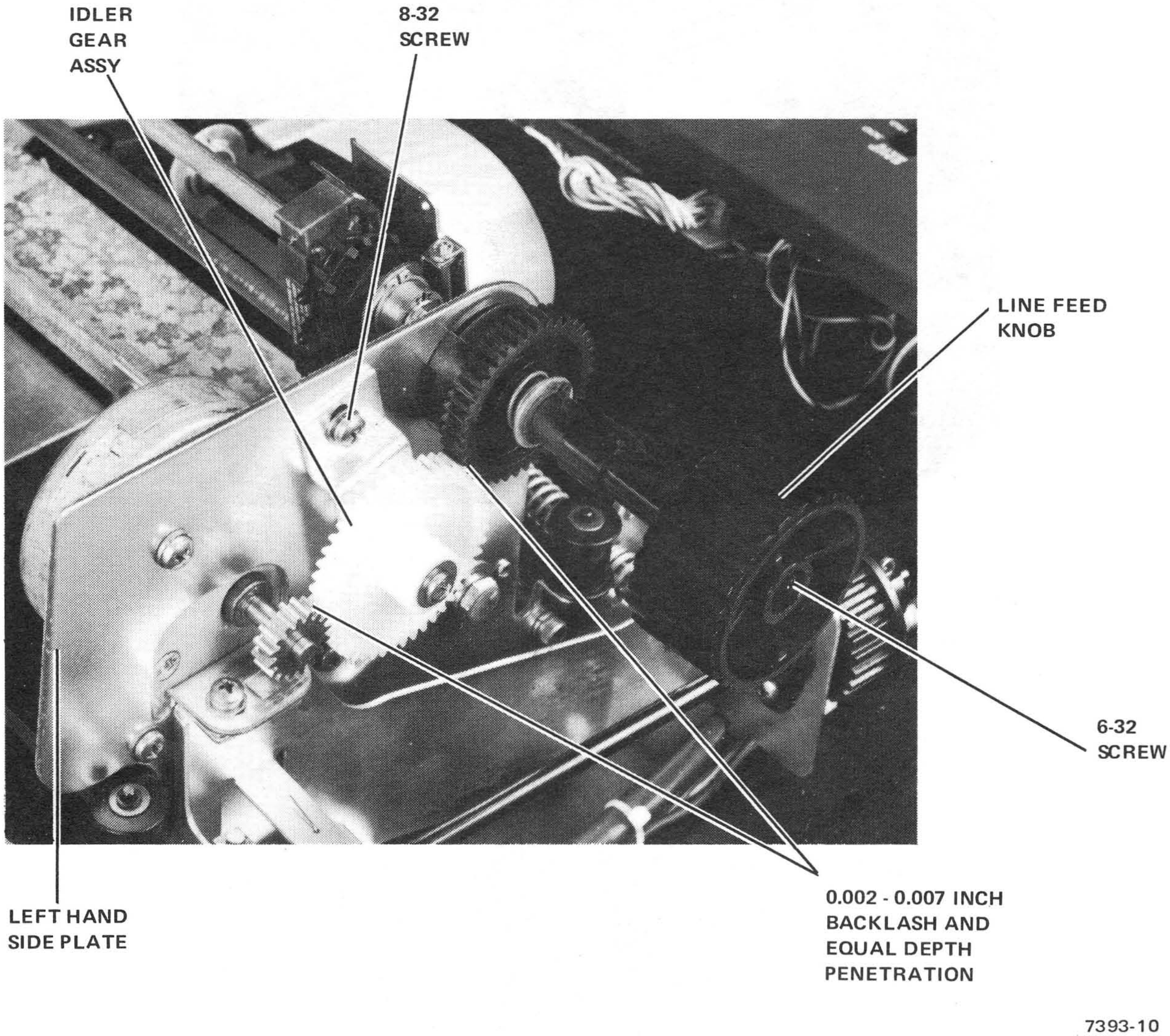



Figure 6-27 Idler Gear Removal

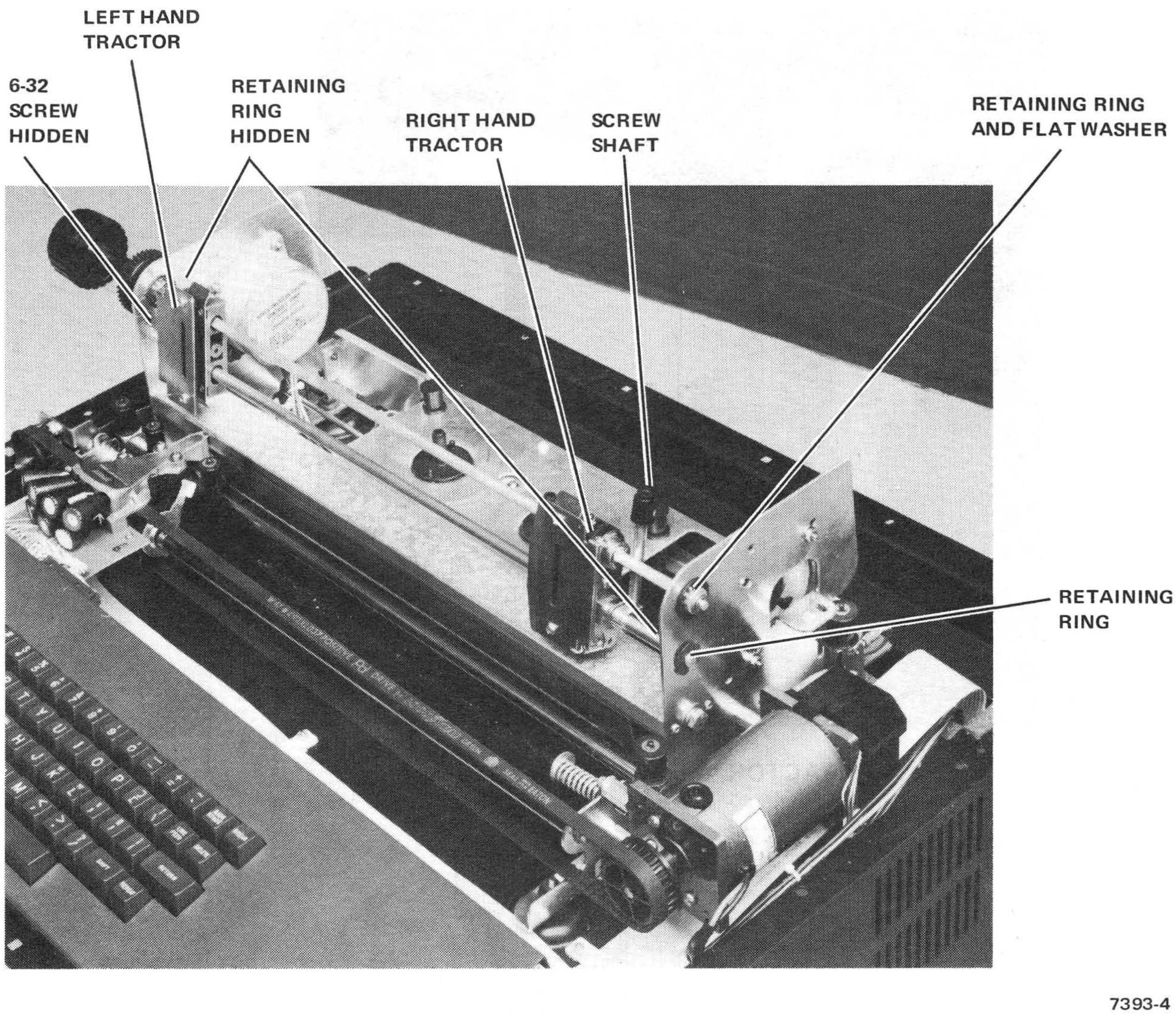
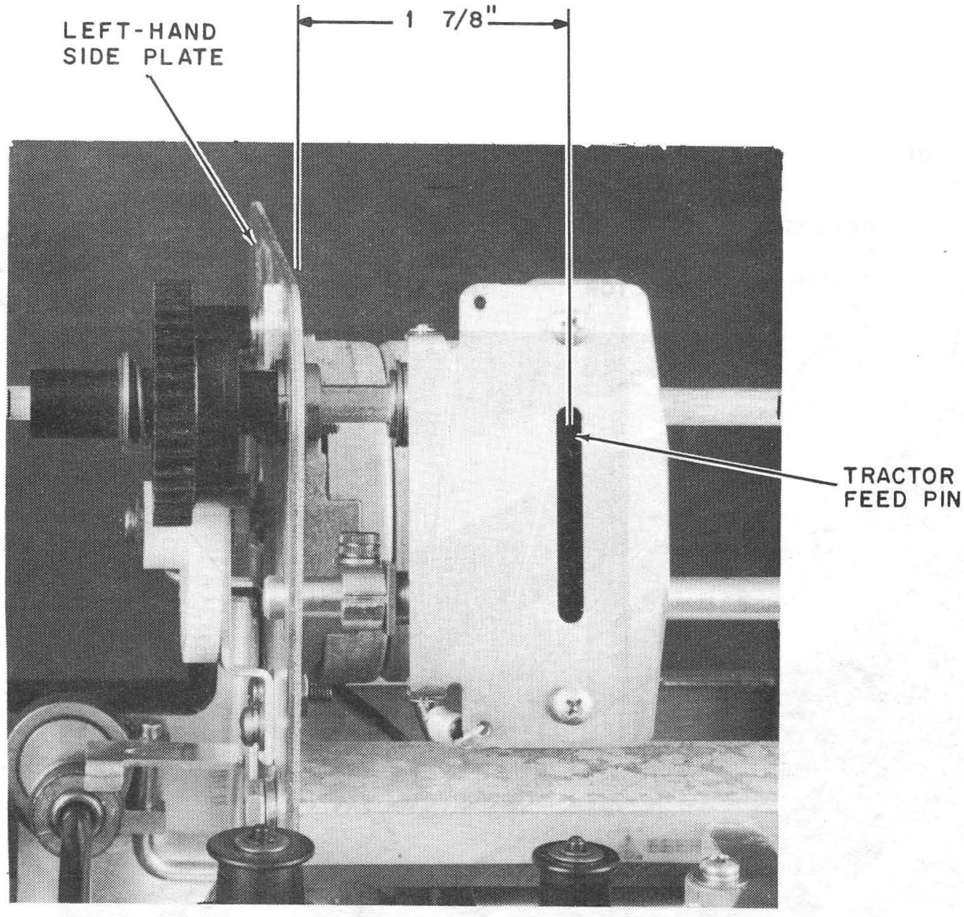
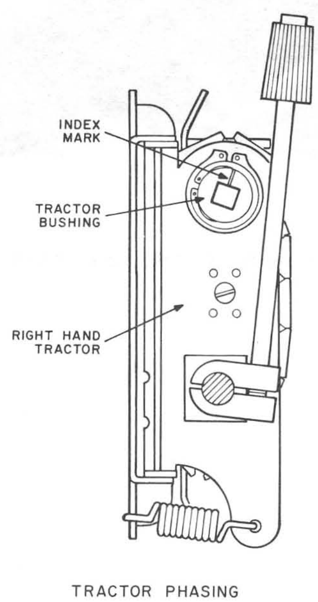



Figure 6-28 Tractor Removal




TRACTOR ADJUSTMENT




TRACTOR PHASING

Figure 6-29 Tractor Phasing/Adjustment

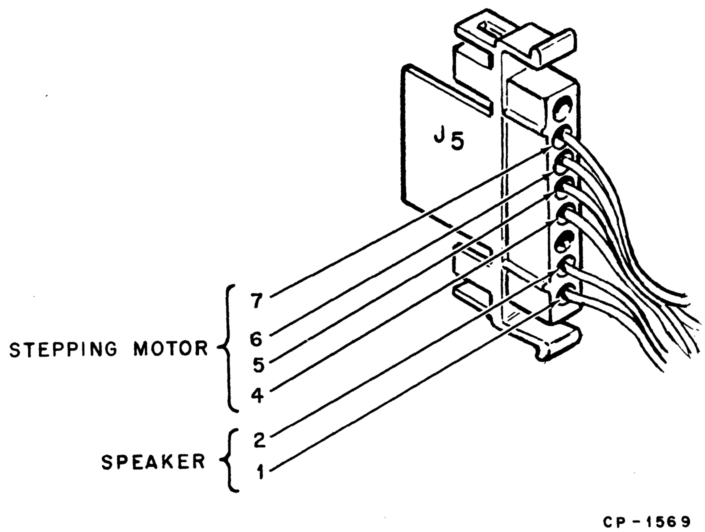



Figure 6-30 Stepping Motor Connector (J5)

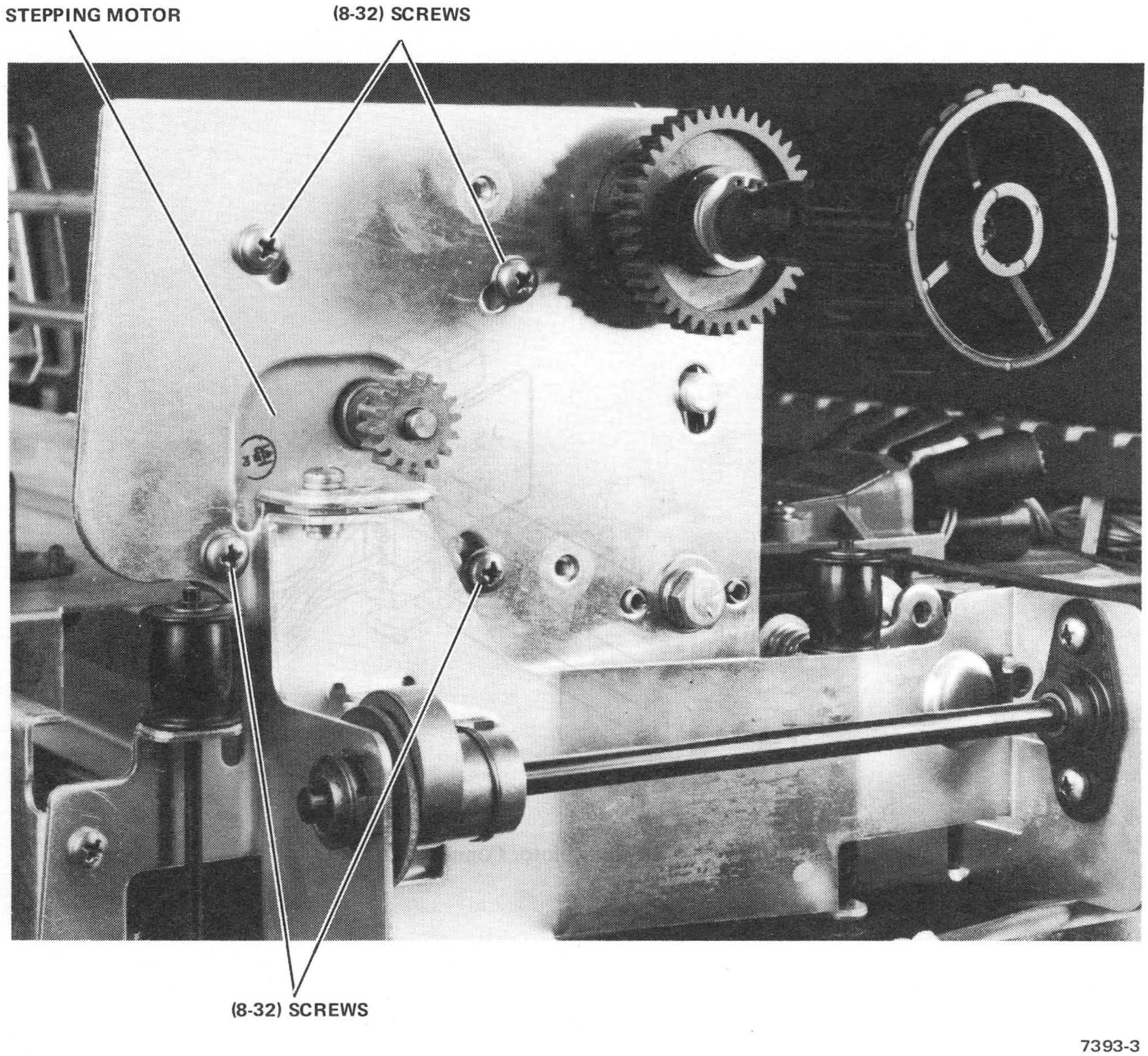



Figure 6-31 Stepping Motor Removal

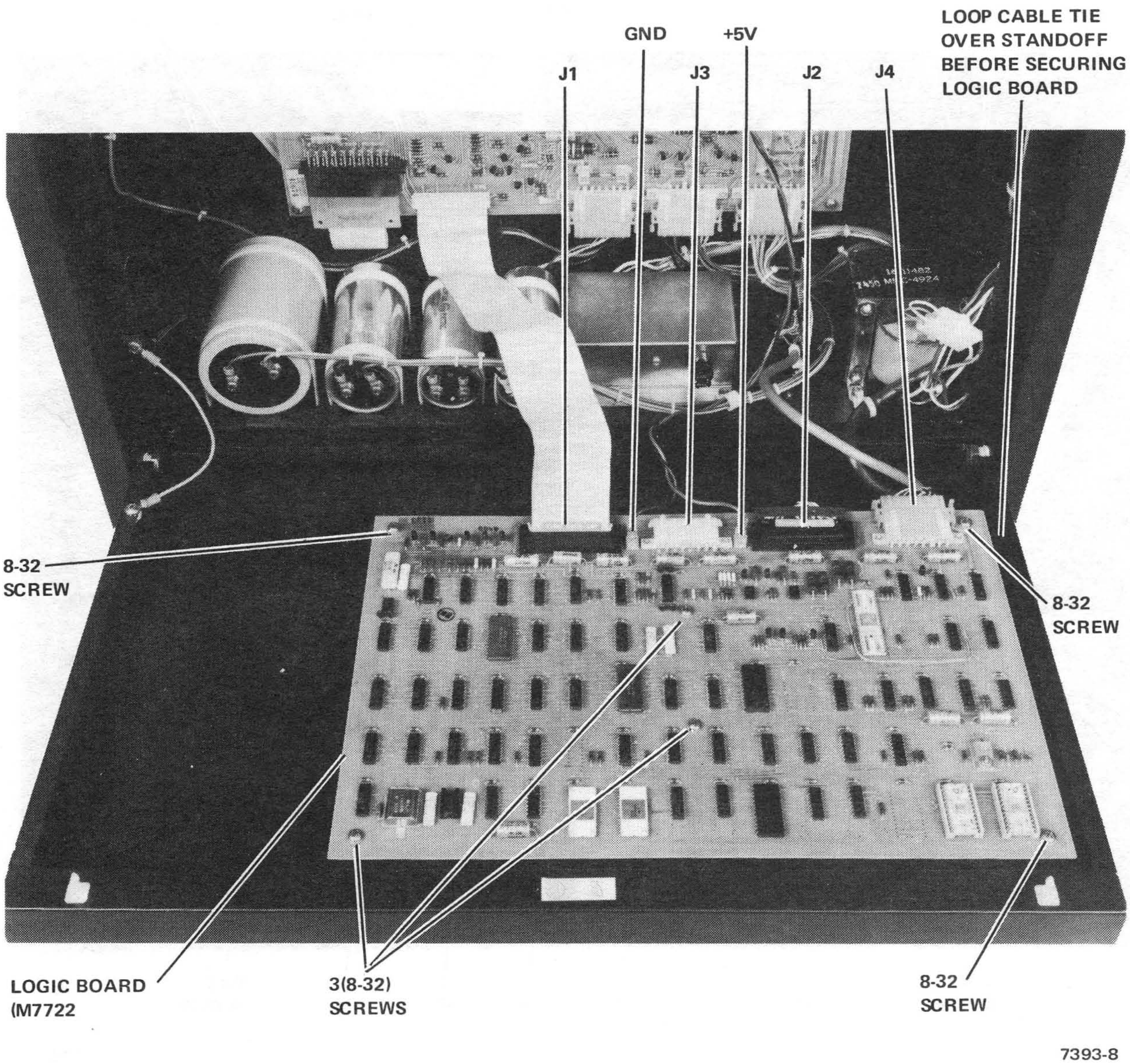



Figure 6-32 Logic Board Removal

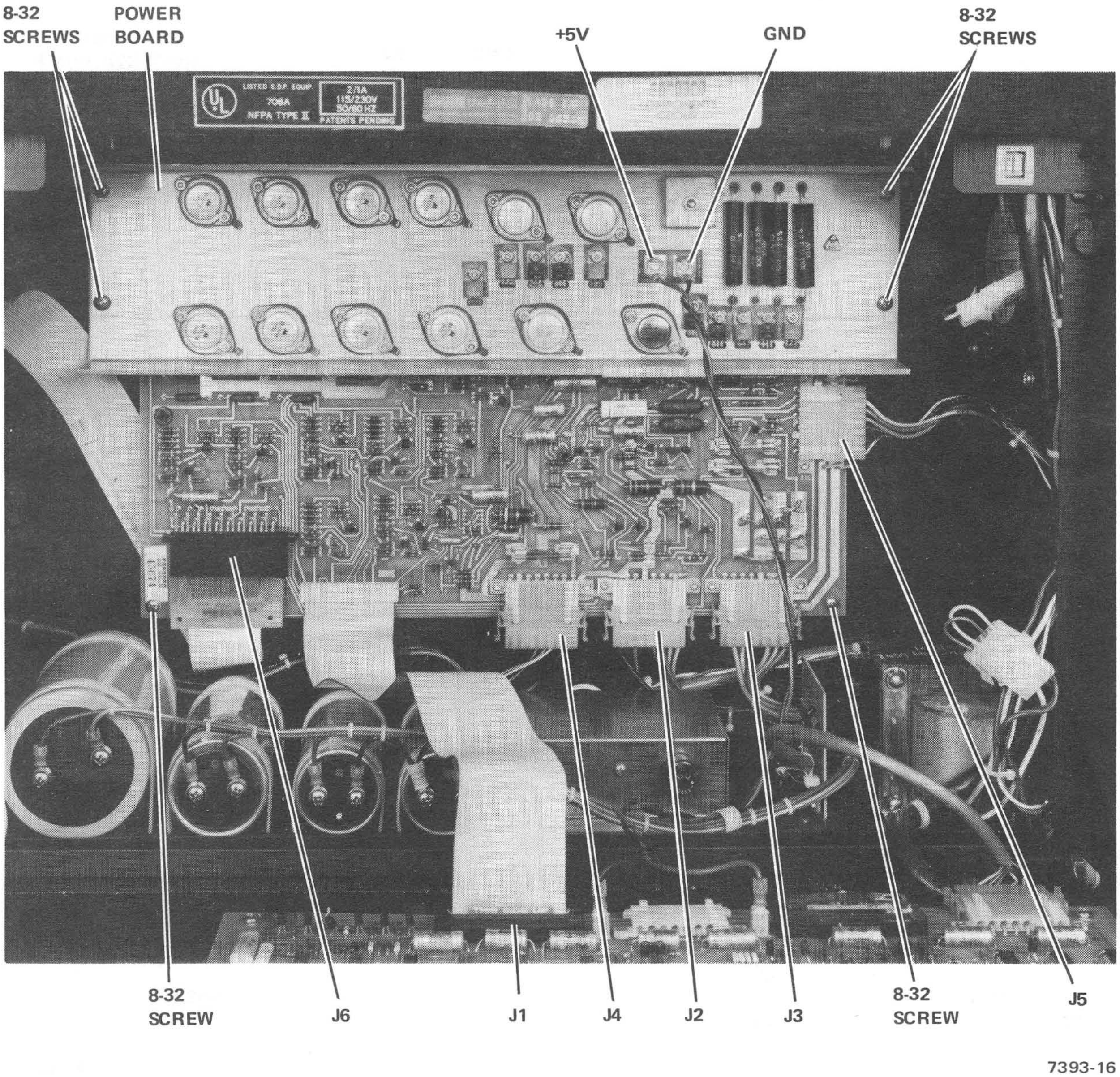



Figure 6-33 Power Board Removal

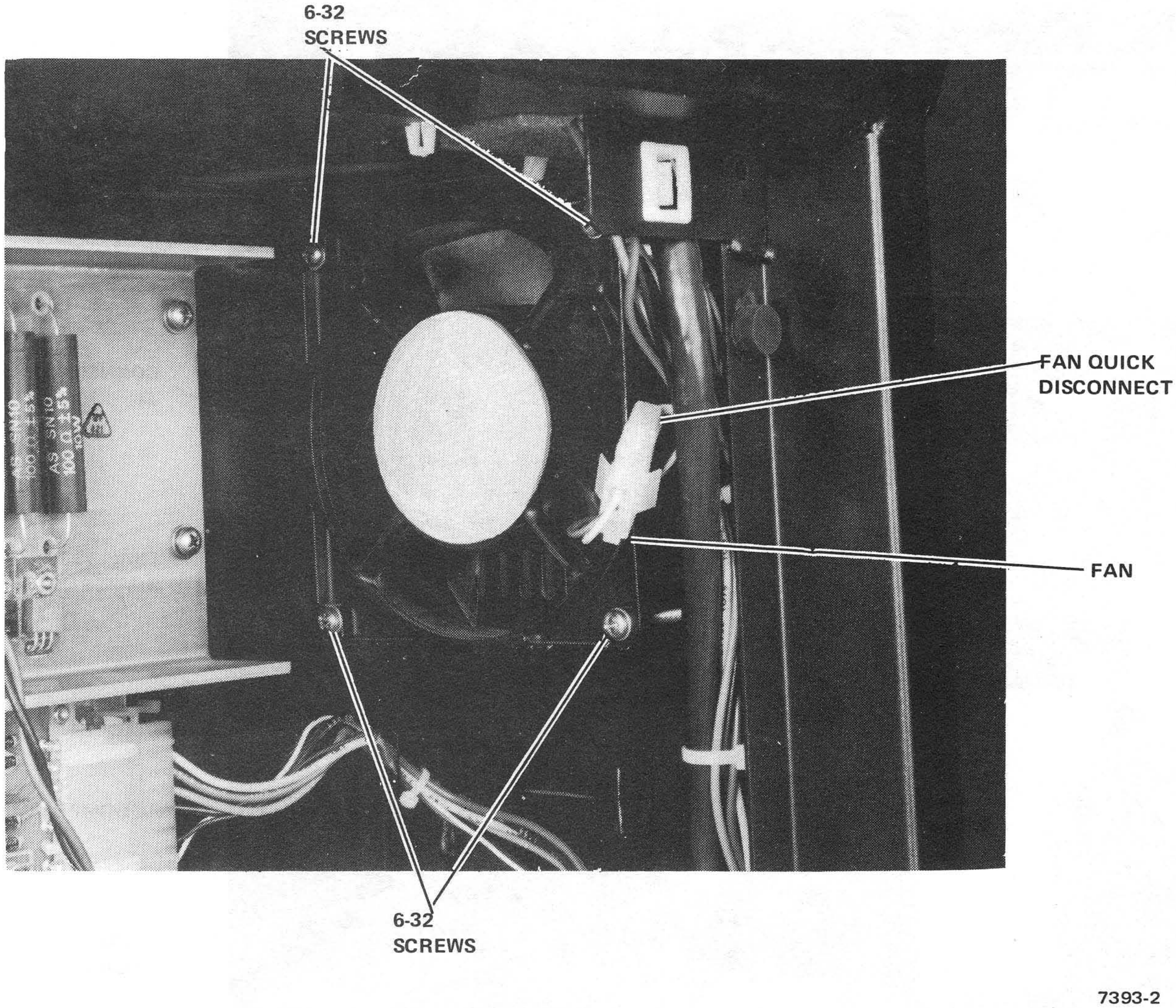
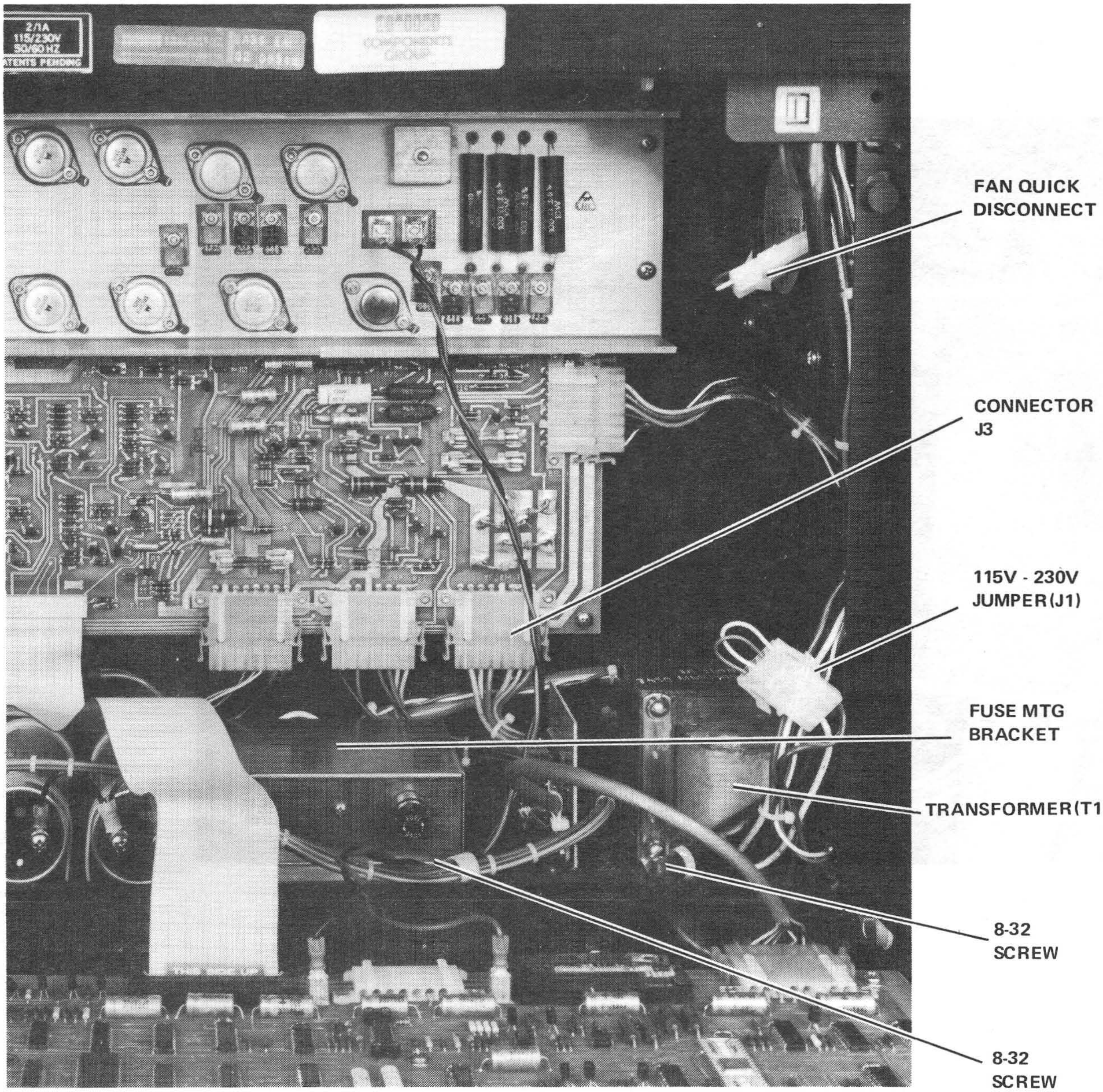



Figure 6-34 Fan Removal




7393-16

Figure 6-35 Transformer Removal

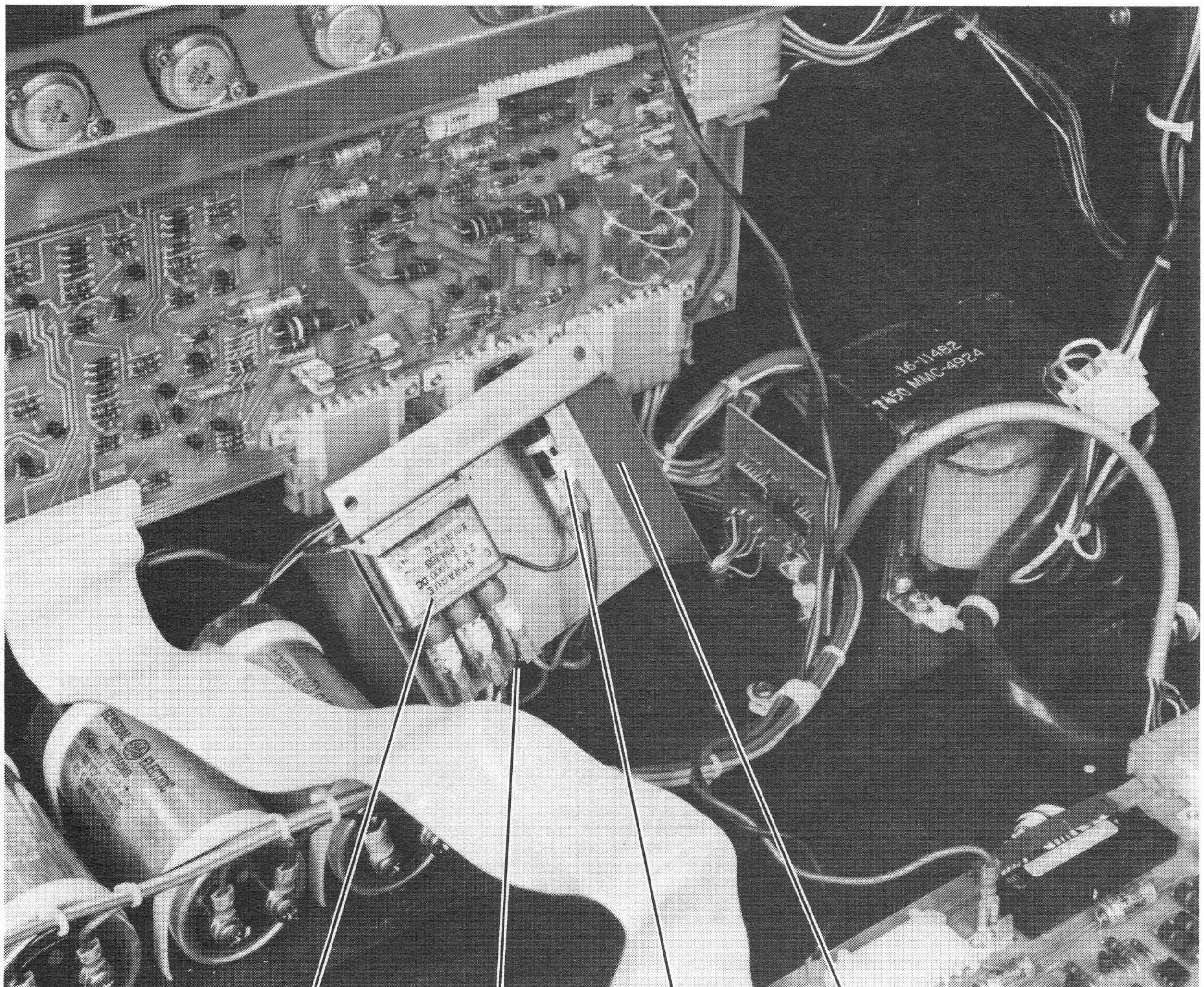



Figure 6-36 Capacitor C5

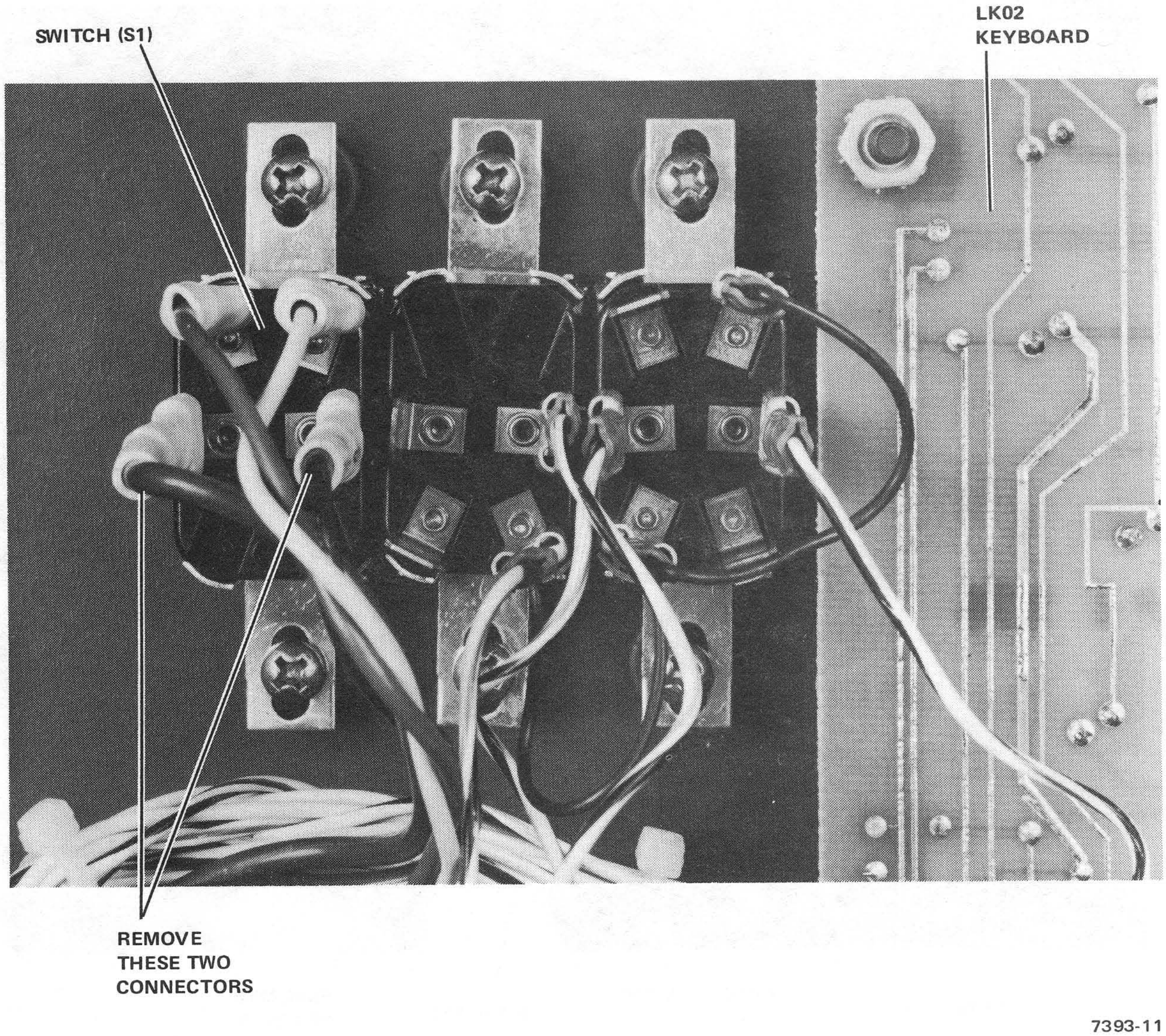



Figure 6-37 Rocker Switch S1

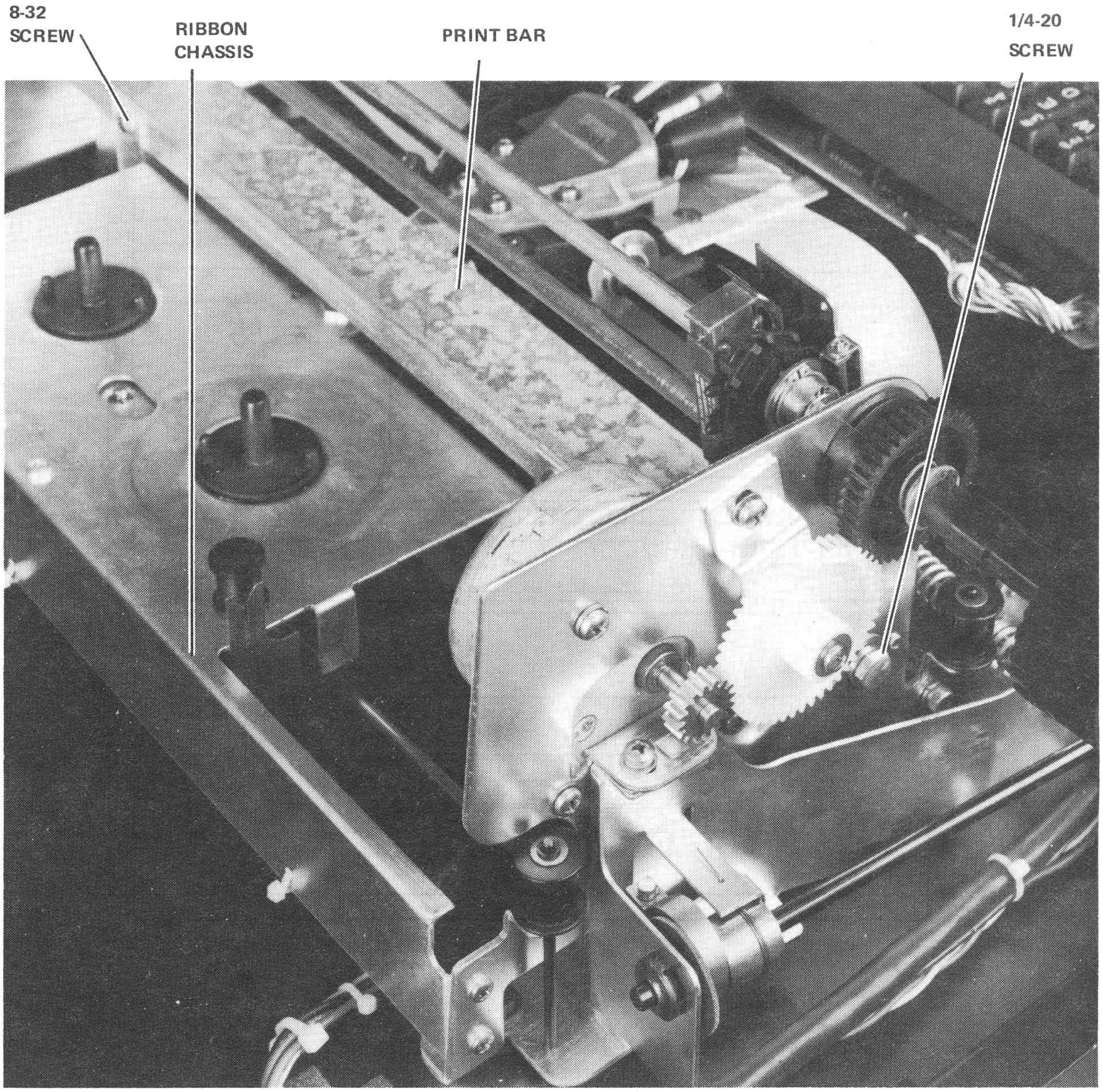



Figure 6-38 Print Bar Removal

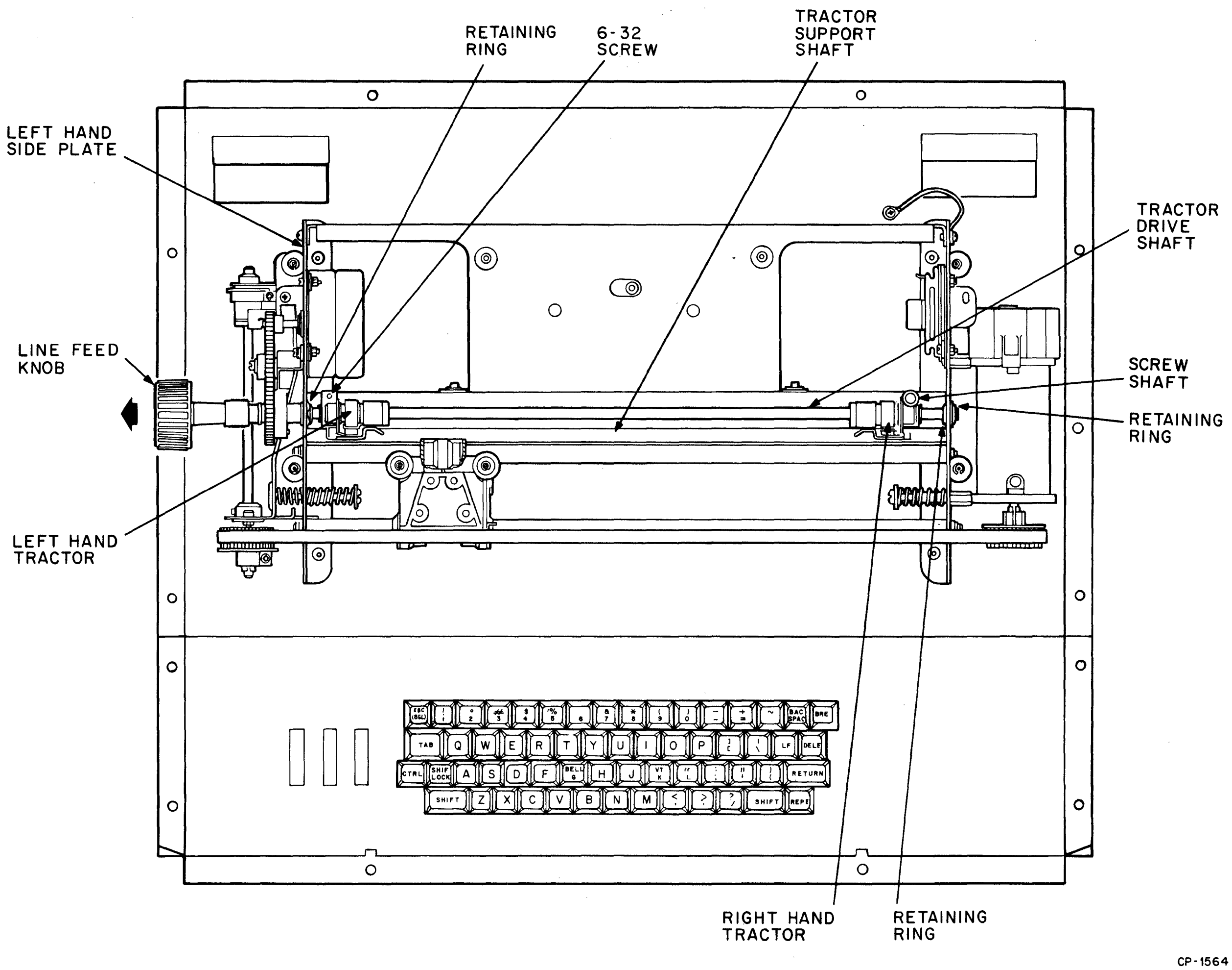



Figure 6-39 Tractor Drive Shaft Removal

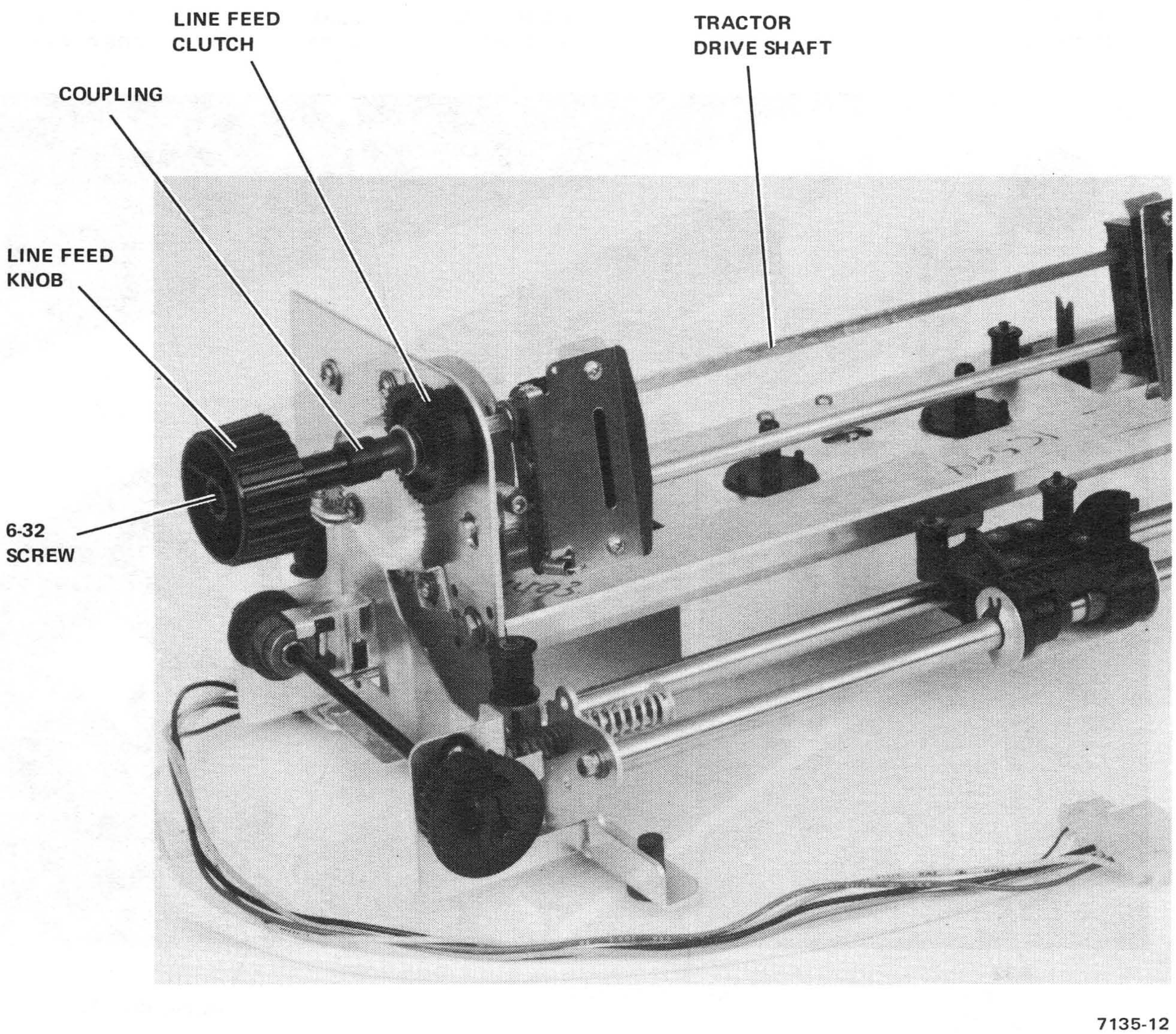



Figure 6-40 Line Feed Clutch/Knob Removal

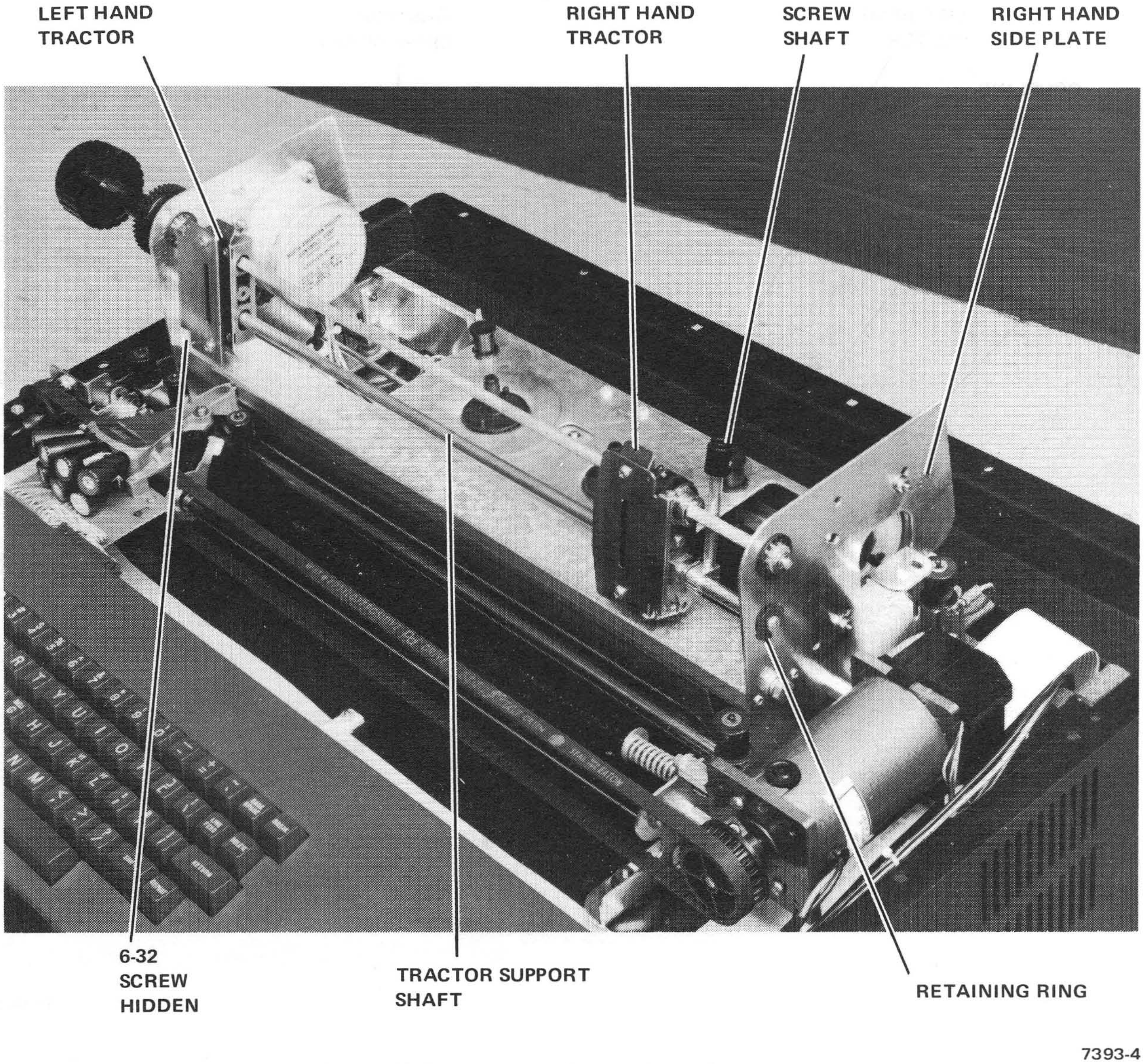



Figure 6-41 Tractor Support Shaft Removal

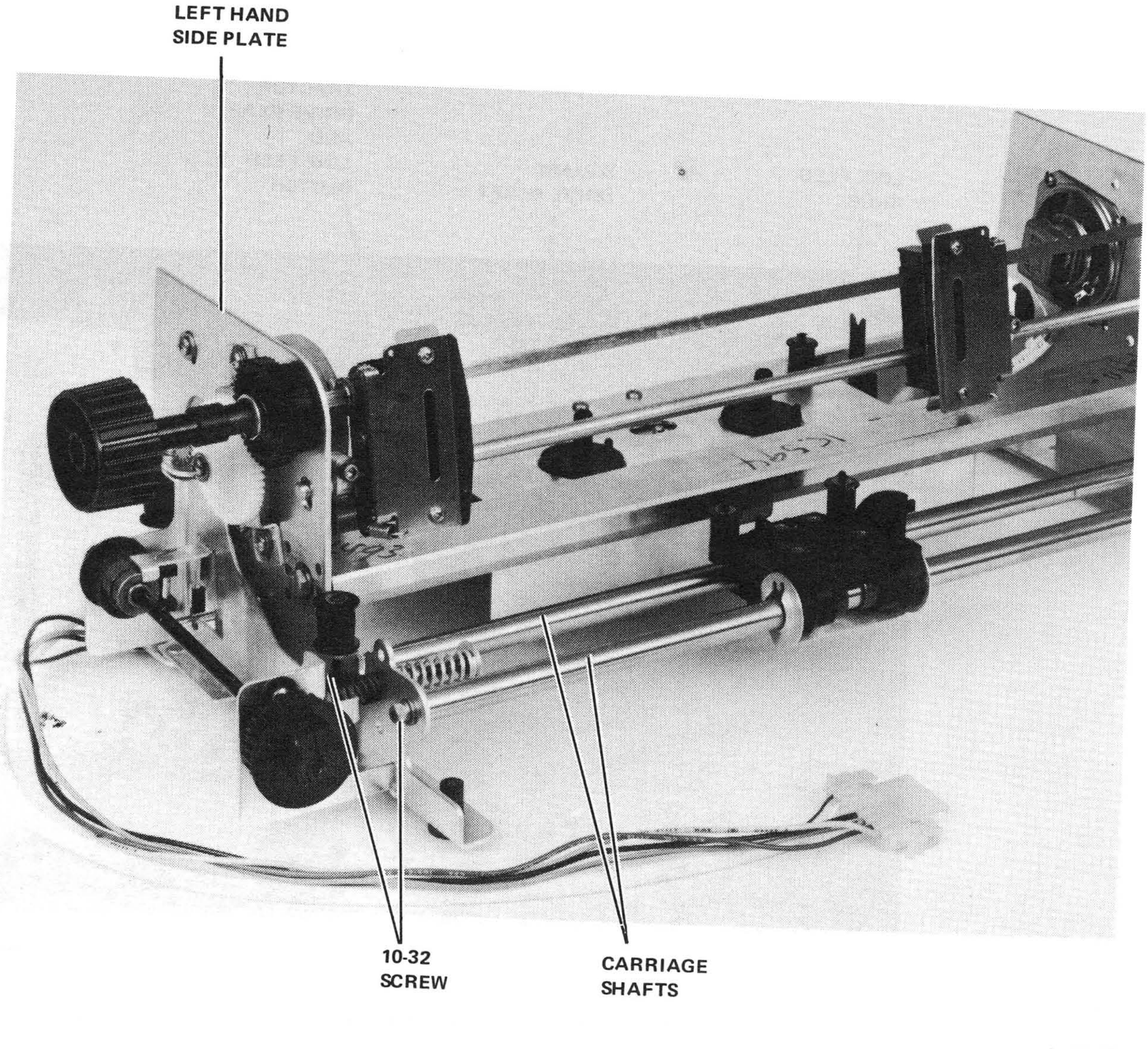



Figure 6-42 Carriage Shaft Removal

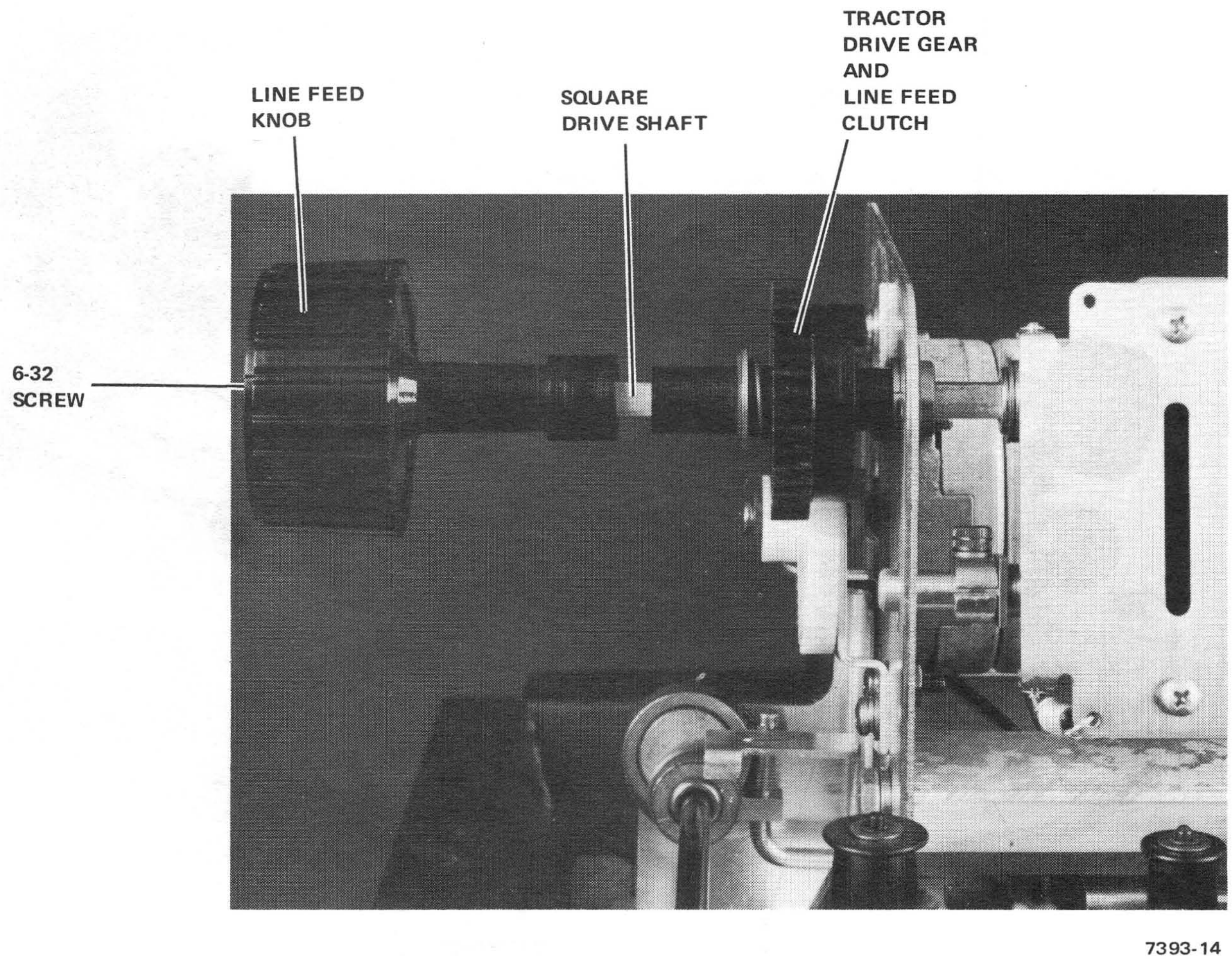
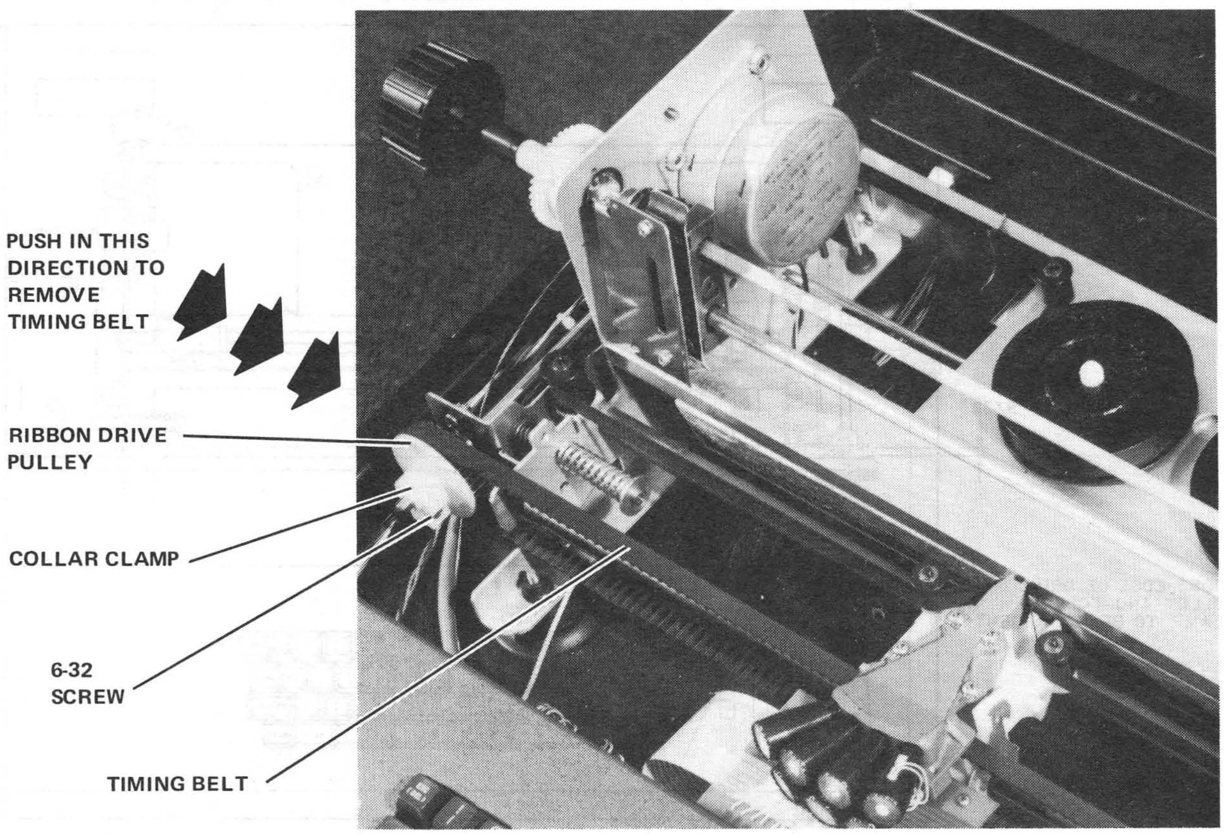



Figure 6-43 Tractor Drive Gear Removal




7037-5

Figure 6-44 Ribbon Drive Pulley Removal

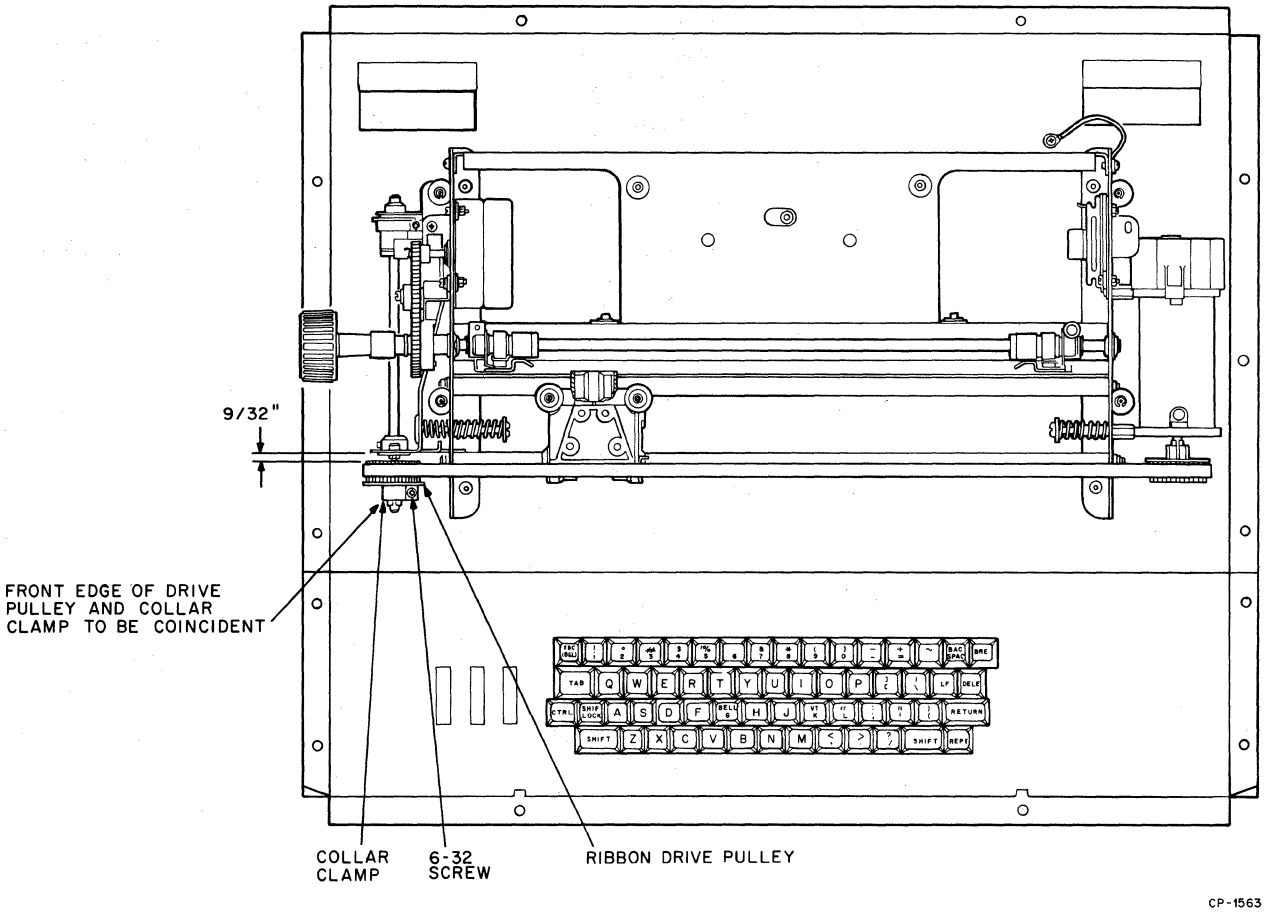



Figure 6-45 Ribbon Drive Pulley Adjustment

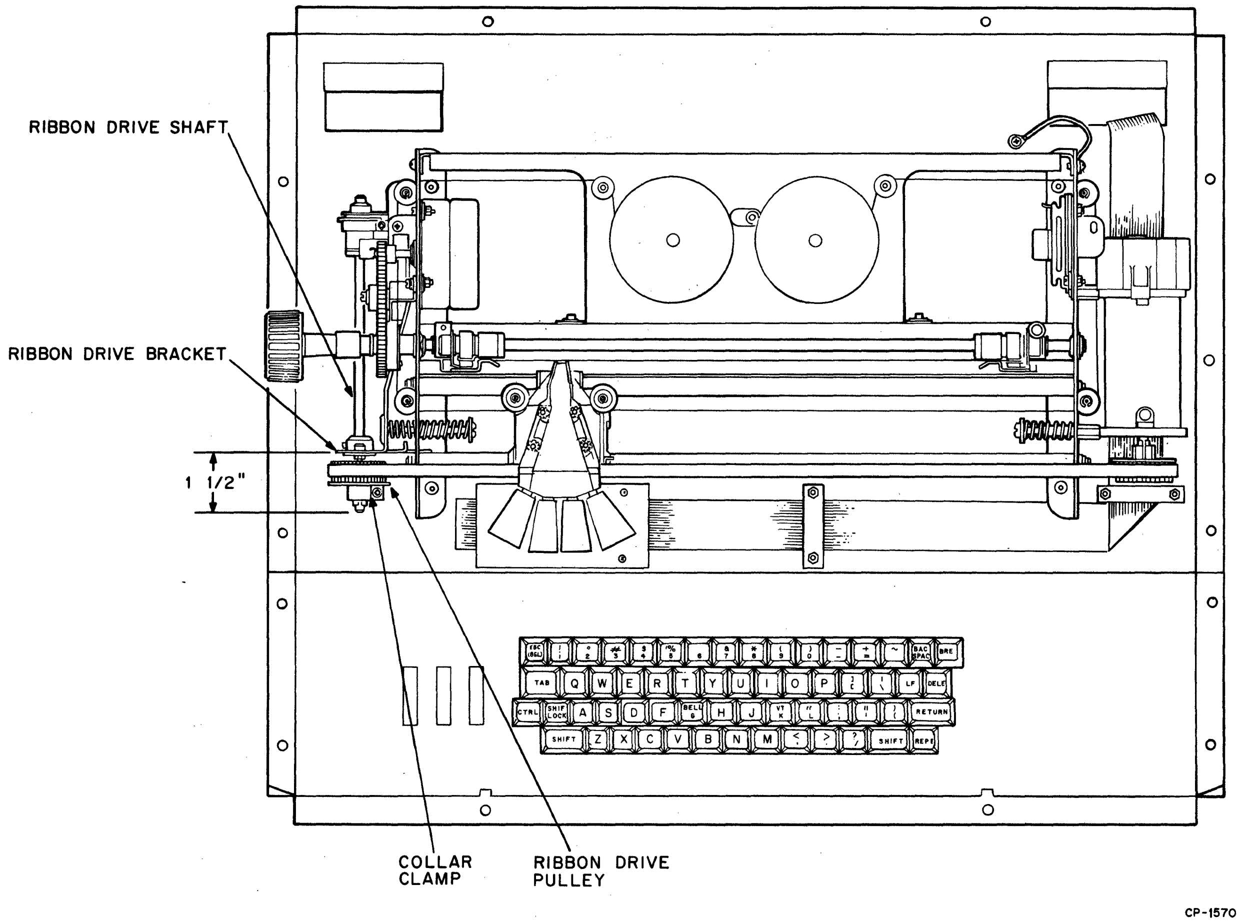



Figure 6-47 Ribbon Drive Shaft Adjustment

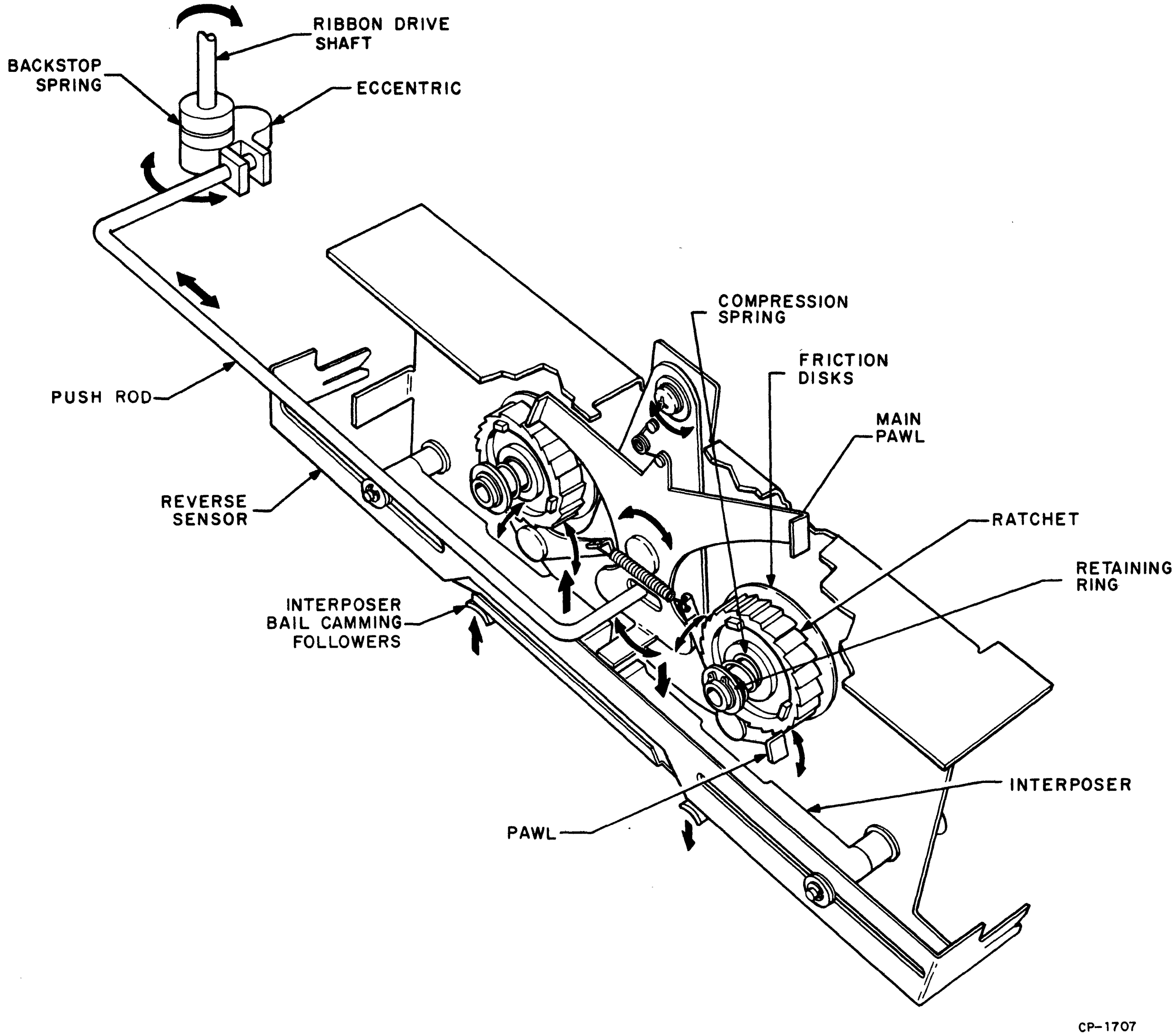
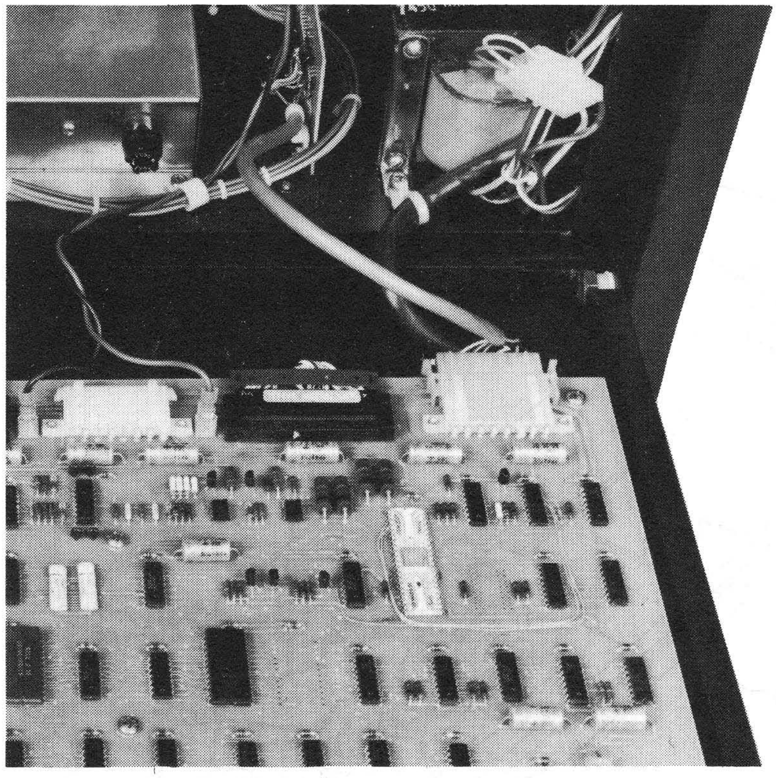



Figure 6-48 Friction Disk/Ratchet Wheel Replacement



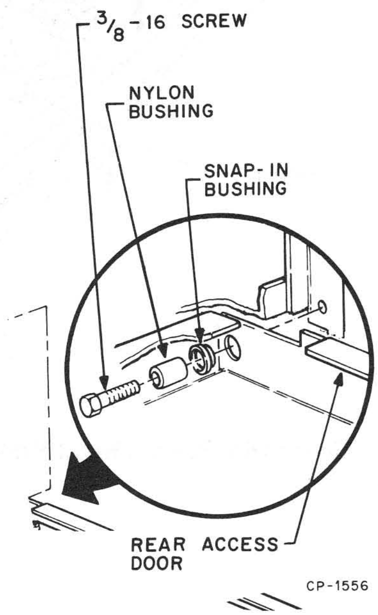




Figure 6-49 Rear Door Bushing Replacement

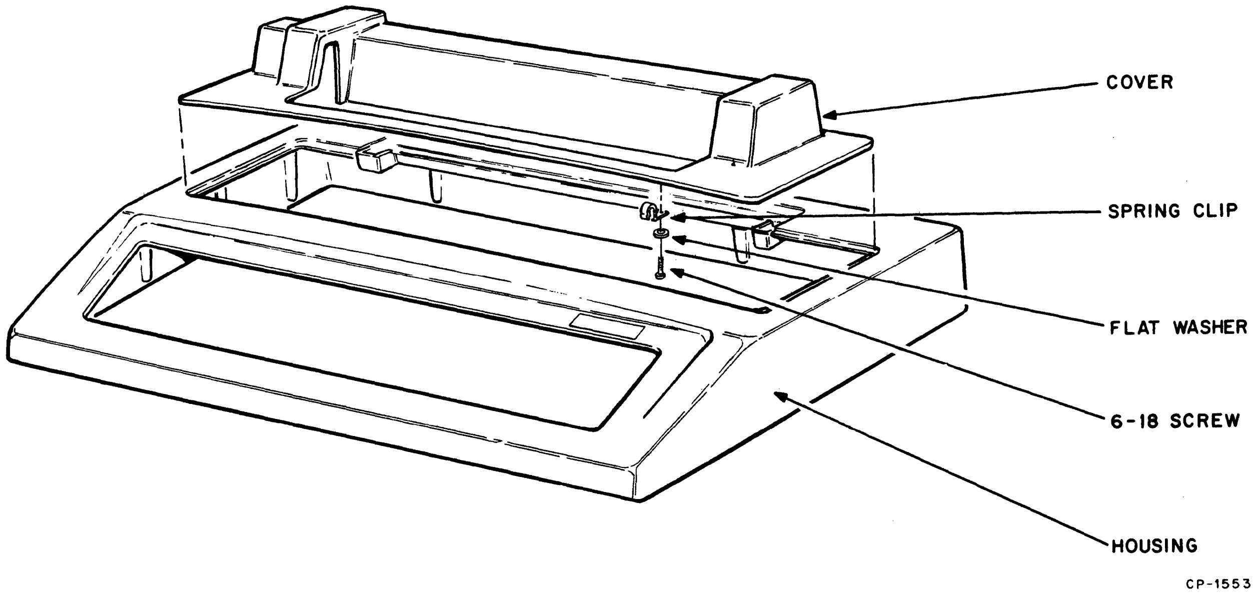



Figure 6-50 Cover Spring Clips

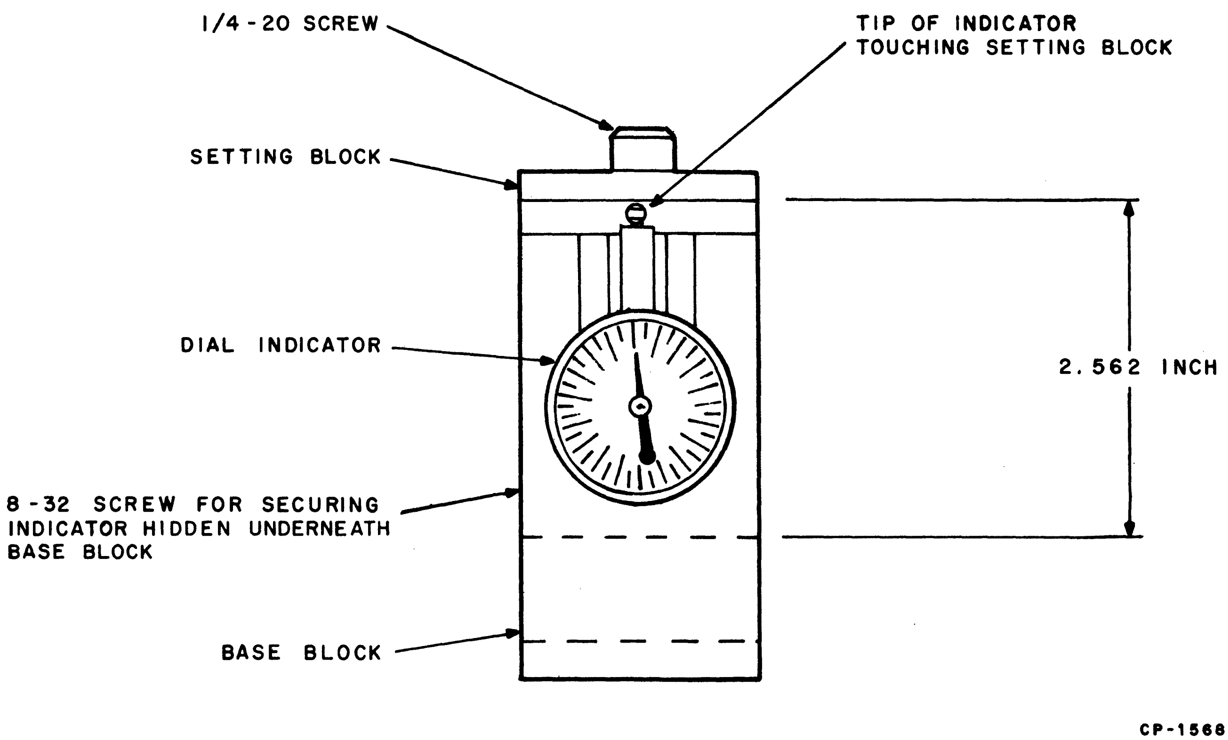
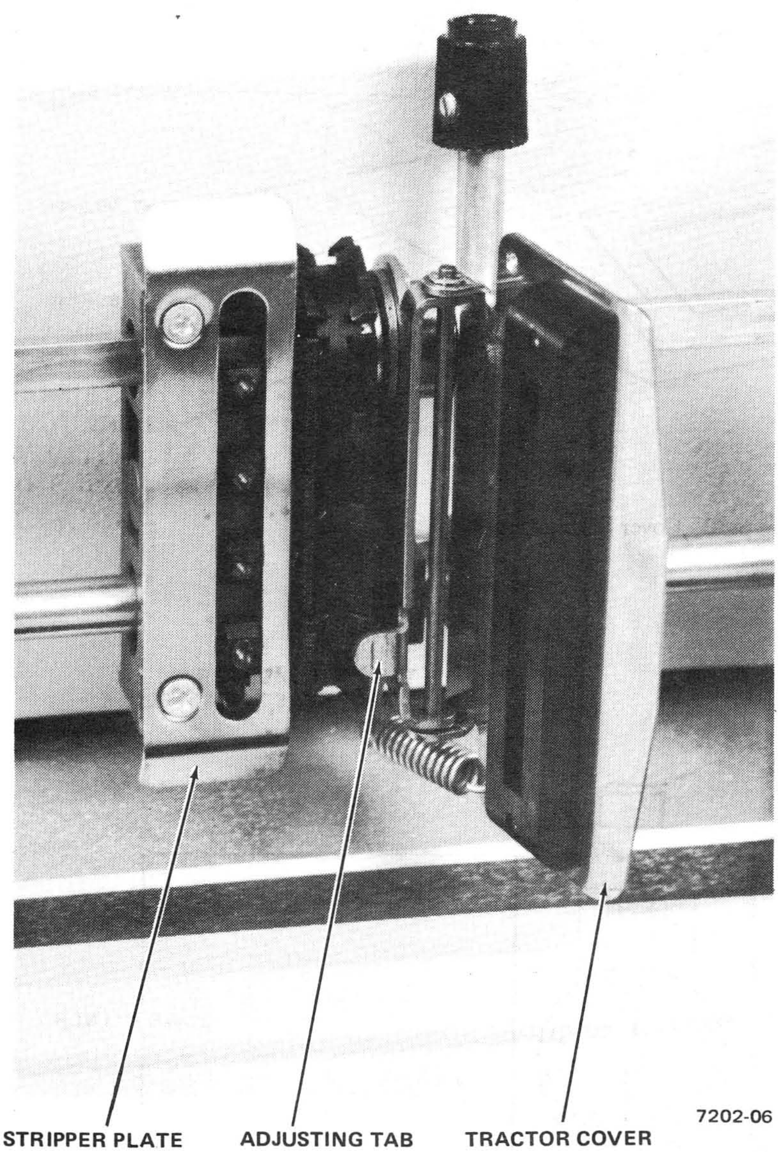



Figure 6-51 Carriage Alignment Tool Setup



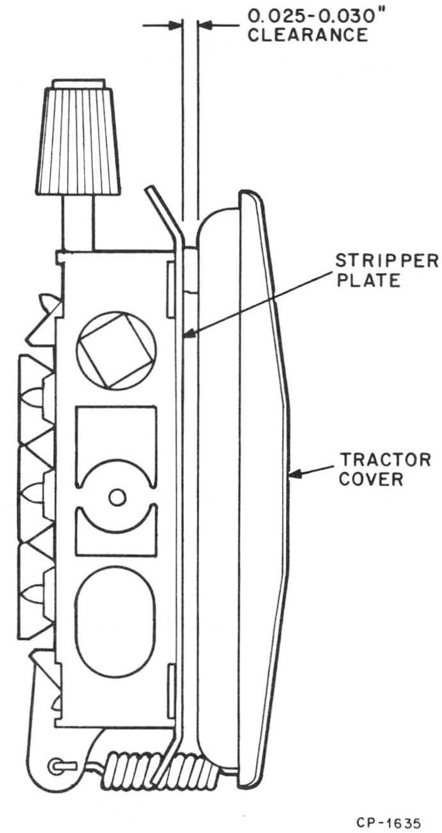




Figure 6-52 Tractor Gap Adjustment

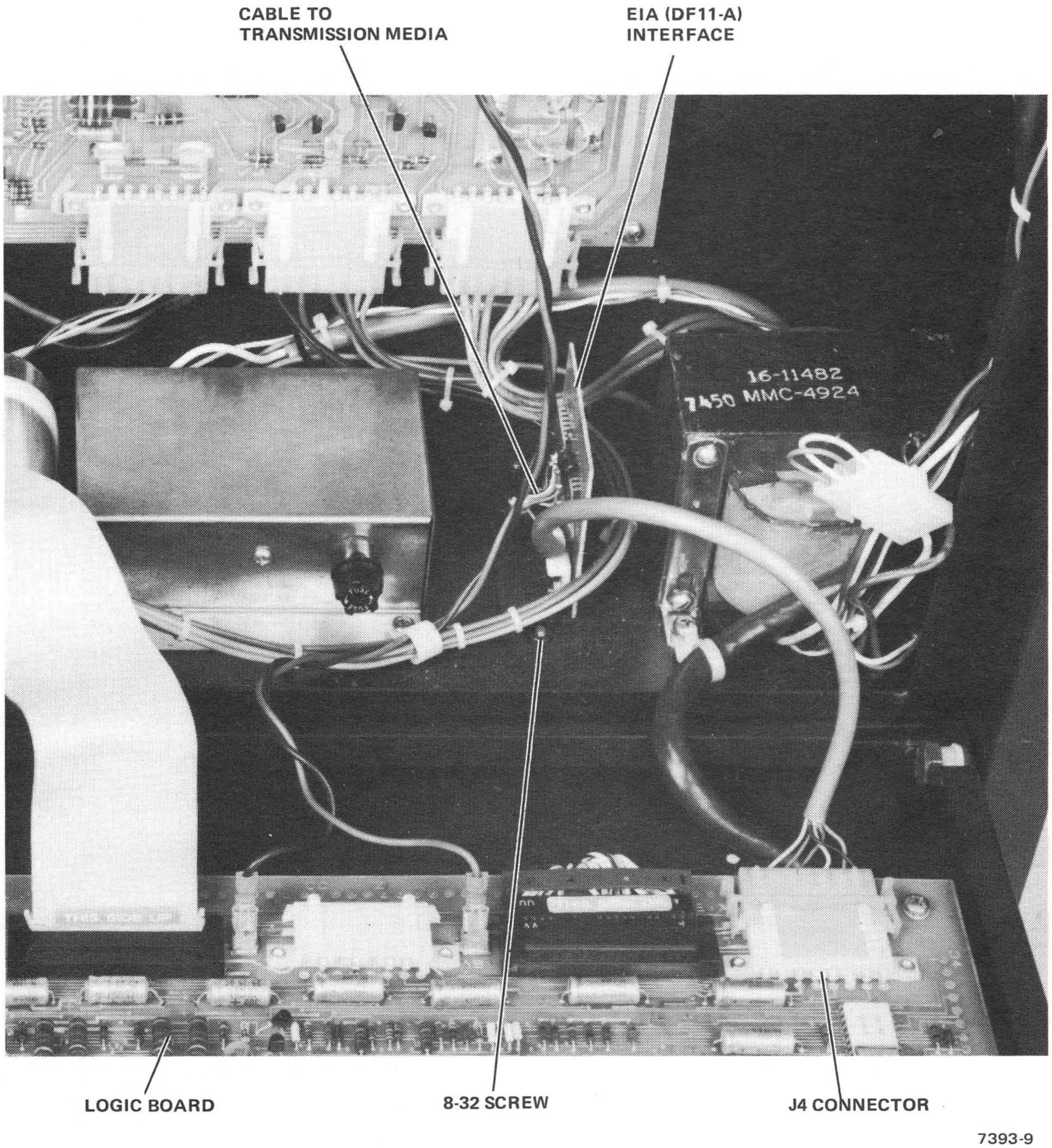



Figure 6-53 EIA (DF11-A) Interface

# CHAPTER 7
# ENGINEERING DRAWINGS AND MATERIAL LISTS

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

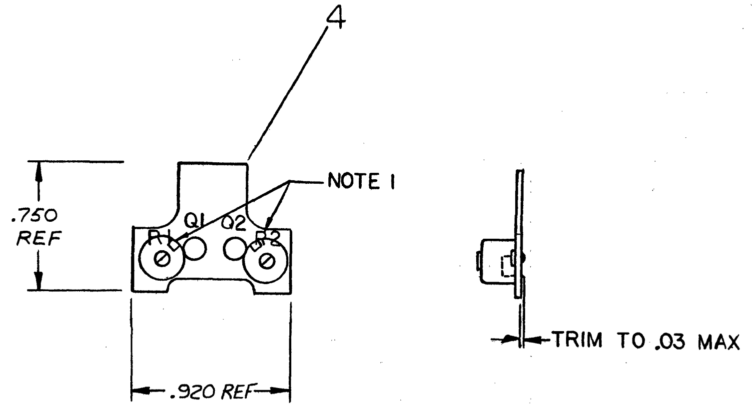
| Title | Drawing No. |
|---|---|
| LA36 Option Arrangement | E-AR-LA36-0-1 |
| LA36 Power Schematic | D-CS-LA36-0-5 |
| LA36 Logic Board | D-CS-M7722-0-1 (8 Sheets) |
| LA36 Power Board | D-CS-5410805-0-1 (5 Sheets) |
| LA36 Encoder PC Board Phototransistor | D-CS-5411049-0-1 |
| 63 Key Keyboard Assembly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

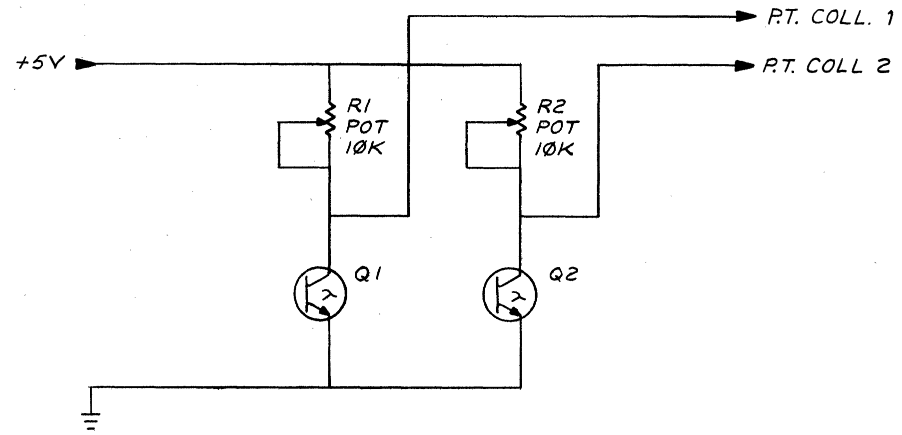
The other print set is for DECwriters with serial numbers 21933 and higher (option upgradable models).

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

Signal Glossary Table for M7728 Logic Board.

NOTES:




| 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 B

| REV | CHANGE NO. | | |
|---|---|---|---|
| B | 5411049-00001 | E. RAYMOND 2-5-75 | C. BICKOFF 2-12-75 |

REVISIONS

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|
| | | | |

SEMICONDUCTOR CONVERSION CHART

| | | |
|---|---|---|
| DRN. | K. Darakjian | DATE 5/2/74 |
| CHK'D | | DATE 5-2-74 |
| ENG. | R. Hammel | DATE 7-12-74 |
| PROJ. ENG. | C. Bickoff | DATE 7-12-74 |
| PROD. | F. P. Cortez | DATE 7-15-74 |

NEXT HIGHER ASSY

SCALE —

SHEET 1 OF 1

digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

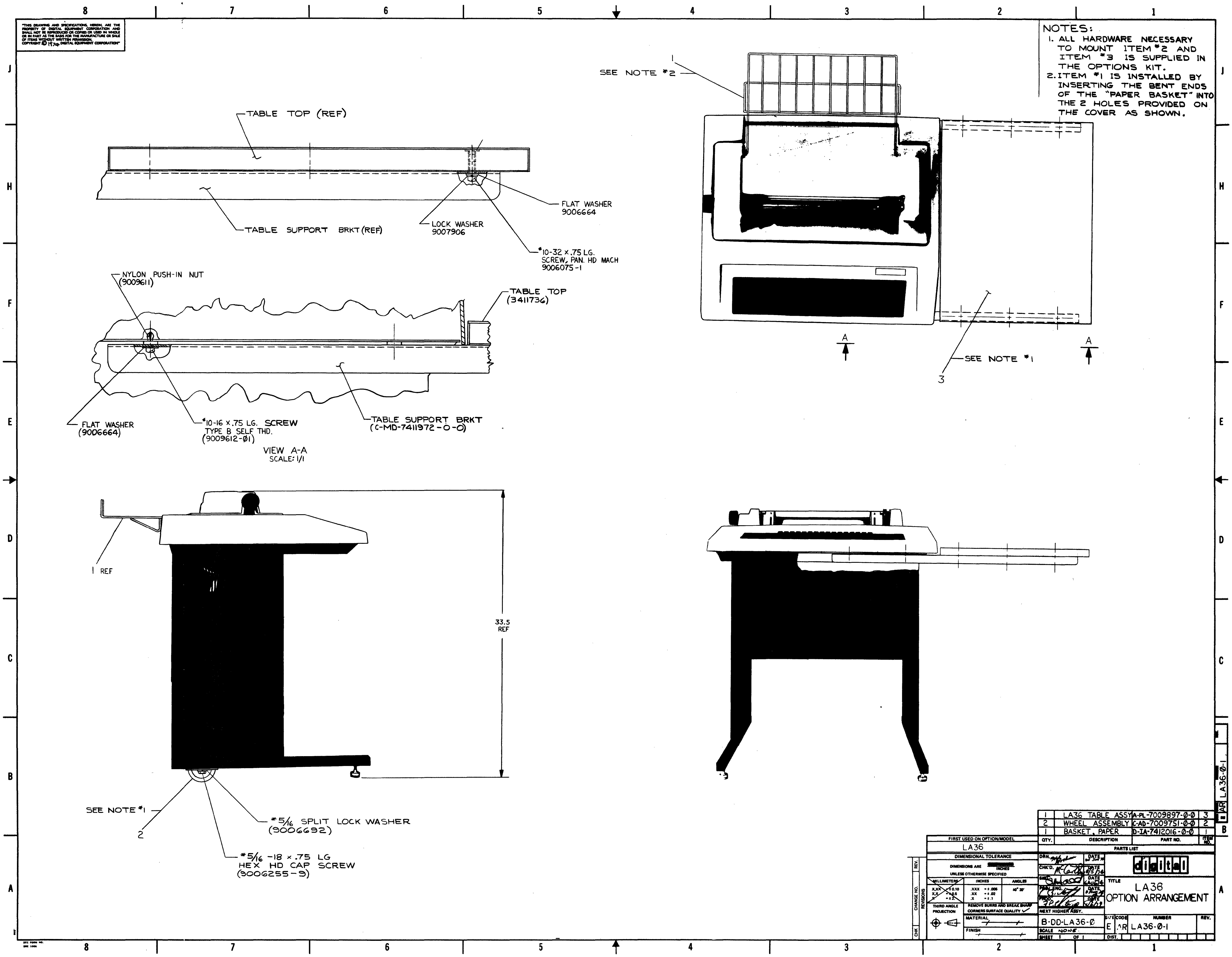
TITLE LA36 ENCODER PC BOARD PHOTOTRANSISTOR

| SIZE | CODE | NUMBER | REV. |
|---|---|---|---|
| D | CS | 5411049-0-1 | B |

DIST.

DEC FORM NO. DRD-135

BRUNING 40-107 15968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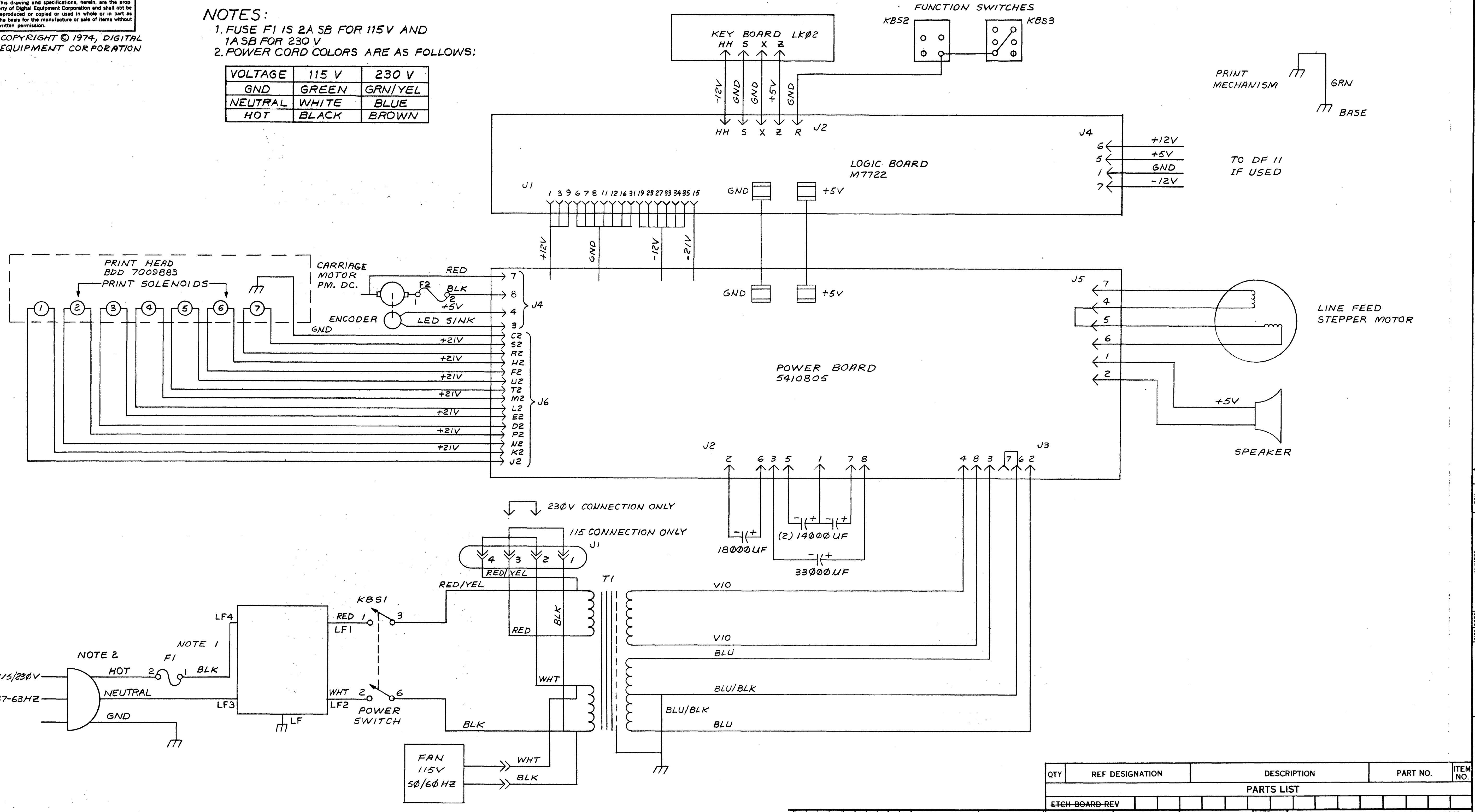
NOTES:
1. ALL HARDWARE NECESSARY TO MOUNT ITEM #2 AND ITEM #3 IS SUPPLIED IN THE OPTIONS KIT.
2. ITEM #1 IS INSTALLED BY INSERTING THE BENT ENDS OF THE "PAPER BASKET" INTO THE 2 HOLES PROVIDED ON THE COVER AS SHOWN.
TABLE TOP (REF)
TABLE SUPPORT BRKT (REF)
LOCK WASHER 9007906
FLAT WASHER 9006664
#10-32 x .75 LG. SCREW, PAN. HD MACH 9006075-1
NYLON PUSH-IN NUT (9009611)
TABLE TOP (3411736)
FLAT WASHER (9006664)
#10-16 x .75 LG. SCREW TYPE B SELF THD. (9009612-01)
TABLE SUPPORT BRKT (C-MD-7411972-0-0)
VIEW A-A
SCALE: 1/1
SEE NOTE #2
1
A
A
SEE NOTE #1
3
1 REF
33.5 REF
SEE NOTE #1
2
#5/16 SPLIT LOCK WASHER (9006692)
#5/16 -18 x .75 LG HEX HD CAP SCREW (9006255-9)
1 LA36 TABLE ASSY A-PL-7009897-0-0 3
2 WHEEL ASSEMBLY C-AD-7009751-0-0 2
1 BASKET, PAPER D-IA-7412016-0-0 1
QTY. DESCRIPTION PART NO. ITEM NO.
PARTS LIST
FIRST USED ON OPTION/MODEL
LA36
DIMENSIONAL TOLERANCE
DIMENSIONS ARE 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
FINISH
REV.
CHANGE NO.
CHK
REVISIONS
DRN. DATE
CHK'D. DATE 6/5/74
ENG. DATE 6AUG74
PROJ. ENG. DATE
PROD. DATE
NEXT HIGHER ASSY.
B-DD-LA36-0
SCALE NONE
SHEET 1 OF 1
digital
TITLE
LA36
OPTION ARRANGEMENT
SIZE CODE NUMBER REV.
E AR LA36-0-1
DIST.
AR LA36-0-1

NOTES:

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

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




| QTY | REF DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|

PARTS LIST

~~ETCH BOARD REV~~

| REV | CHANGE NO. | | |
|---|---|---|---|
| B | LA36-00076 | E. Campbell 3-26-75 | J. BITTO 3/27/75 |
| A | LA36-00052 | G. Woodka 2-11-75 | E. NEAL 2/12/75 |

REVISIONS

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|

SEMICONDUCTOR CONVERSION CHART

DRN. 7/12/74 · CHK'D. 7/15/74 · ENG. 7/15/74 · PROJ. ENG. 7/15/74 · PROD. 7/15/74

NEXT HIGHER ASSY

digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

TITLE LA36 POWER SCHEMATIC

SIZE D CODE CS NUMBER LA36-0-5 REV. B

SCALE SHEET 1 OF 1

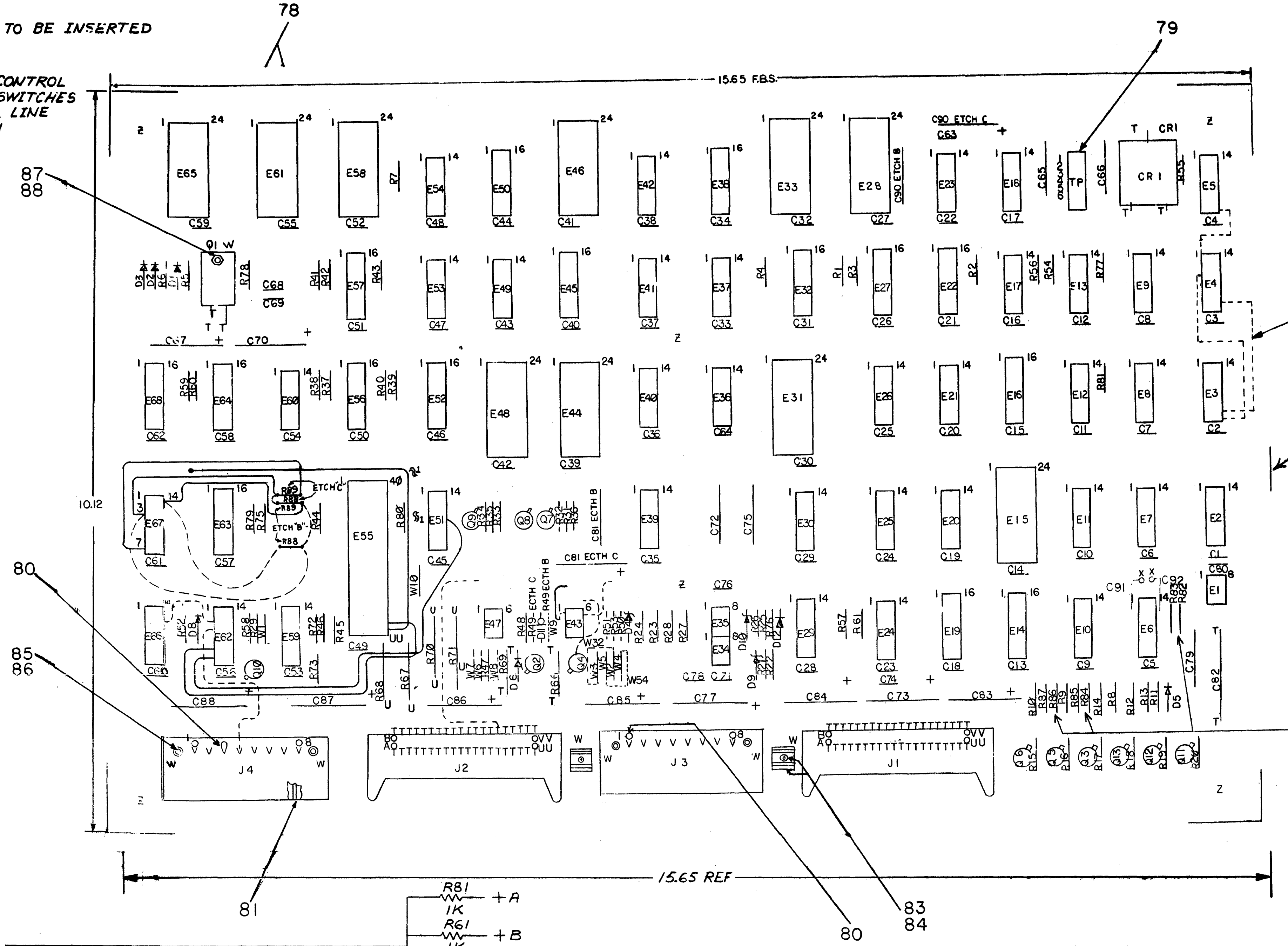
DEC FORM NO. DRD-135

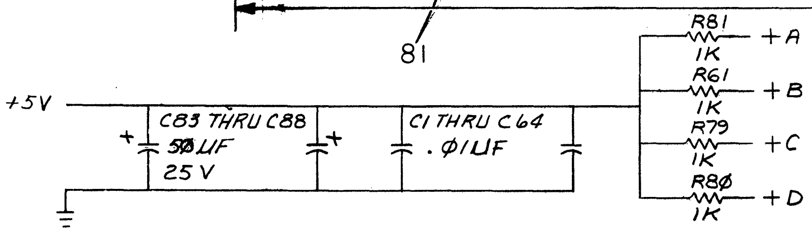
## NOTES:

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.




| | | |
|---|---|---|
| 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 |
| 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

| CHK | CHANGE NO. | REV |
|---|---|---|
| | M7722-00001 | B |
| | M7722-00002 | C |
| | M7722-00003 | D |
| | M7722-00004 | E |
| | M7722-00004 | F |

REVISIONS

FIRST USED ON OPTION MODEL: LA36

ETCH BOARD REV: B C

| QTY | REF DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|

PARTS LIST

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|

SEMICONDUCTOR CONVERSION CHART

DRN. DATE 12-21-73
CHK'D. DATE
ENG. DATE
PROD. ENG. DATE
PROD. DATE

NEXT HIGHER ASS'Y

digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

TITLE: LA36 (MPC1)

SIZE D CODE CS NUMBER M7722-Ø-1 REV. F

SCALE —

SHEET 1 OF 8

DIST.

DEC FORM NO. DRD 135-8

# PARTS LIST

QUANTITIES SHOWN REPRESENT PREFERRED CONFIGURATION

| QTY | REF DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|
| REF | | X-Y COORDINATE HOLE LOCATION | K-CO-M7722-0-4 | 1 |
| REF | | ASSY/DRILLING HOLE LAYOUT | D-AH-M7722-0-5 | 2 |
| REF | | MODULE ECO HISTORY | B-MH-M7722-0-6 | 3 |
| 1 | | ETCHED CIRCUIT BOARD | 5010823 | 4 |
| 3 | C71,C78,C80 | CAP 39PF,100V,5%,DIPPED MICA | 1000010 | 5 |
| 1 | C82 | CAP.22UF,100V 10% MYLAR | 1000037 | 6 |
| 5 | C85,C86,C72,C75,C79 | CAP.047UF,100V 10% MYLAR | 1000051 | 7 |
| 70 | C1 THRU C64,C88,C89,C74, C76,C91,C92 | CAP.01UF 100V DISC | 1001610-01 | 8 |
| | | | | 9 |
| 6 | C67,C70,C73,C77,C81,C90 | CAP 25UF 25V 20% AL EL | 1000075 | 10 |
| 6 | C83 THRU C88 | CAP 50UF 25V 10% AL EL | 1001796 | 11 |
| 1 | D1 | DIODE D662 | 1100113 | 12 |
| 3 | D8,D5,D12 | DIODE D664 | 1100114 | 13 |
| 2 | D9,D10 | DIODE IN748A 3.9V ZENER 5% | 1100122 | 14 |
| 1 | D4 | DIODE IN746A 3.3V ZENER 5% | 1104860 | 15 |
| 1 | D6 | DIODE IN4004 | 1105796 | 16 |
| 2 | D2,D3 | DIODE .4W 5.1AZ1 5.1V ZENER 1% | 1105873 | 17 |
| 2 | J3,J4 | CONN 8PIN MAT-N-LOK(SOCKET HOUSING) | 1209340 | 18 |
| 2 | J1,J2 | CONN 40PIN BERG | 1209941 | 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% | 1300202 | 22 |
| 3 | R6,R58,R7 | RES 100 ¼W 5% | 1300229 | 23 |
| 2 | R47,R88 | RES 150 ¼W 5% | 1300250 | 24 |
| 4 | R33,R76,R49,R89 | RES 330 ¼W 5% | 1300295 | 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% | 1300391 | 27 |
| 1 | ~~R54,R60~~,R53 | RES 10K ¼W 5% | 1300479 | 28 |
| 3 | R13,R22,R26 | RES 180 ¼W 5% | 1301322 | 29 |
| 1 | R48 | RES 68K ¼W 5% | 1301327 | 30 |
| 1 | R11 | RES 820 ¼W 5% | 1301775 | 31 |
| 6 | R36,R59,R60,R57,R54,R56 | RES 5.6K ¼W 5% | 1301874 | 32 |
| | | | | 33 |
| 1 | R8 | RES 100K ¼W 5% | 1302466 | 34 |
| 1 | R18 | RES 14.7K ¼W 1% | 1302941 | 35 |
| 2 | R12,R14 | RES 1K ¼W 1% | 1303114 | 36 |
| 4 | R67,R68,R70,R71 | RES 1K 1W 5% | 13Ø0368 | 37 |
| 1 | R19 | RES 3.48K ¼W 1% | 1305114 | 38 |
| 1 | R15 | RES 121K ¼W 1% | 1305255 | 39 |
| 2 | R9,R10 | RES 232K ¼W 1% | 1305424 | 40 |
| 1 | R17 | RES 30.1K ¼W 1% | 1311594 | 41 |
| 1 | R16 | RES 59K ¼W 1% | 13ØØ525 | 42 |
| ~~1~~ | ~~R66~~ | ~~RES 470 ¼W 5%~~ | ~~1300318~~ | 43 |
| 2 | Q7,Q8 | TRANSISTOR MPSA55 | 1510706 | 44 |
| 10 | Q2,Q4,Q9,Q10,Q11,Q12,Q13 Q3,Q5,Q6 | TRANSISTOR MPSA05 | 1510705 | 45 |
| 1 | Q1 | TRANSISTOR D45C8 | 151Ø598 | 46 |
| 1 | CR 1<br>CR 1 | CRYSTAL 1.~~6896 MHZ~~ SUBSTITUTE<br>CRYSTAL 1.6896 MHZ PREFERRED | 1810245-Ø2<br>1811689 | 47 |

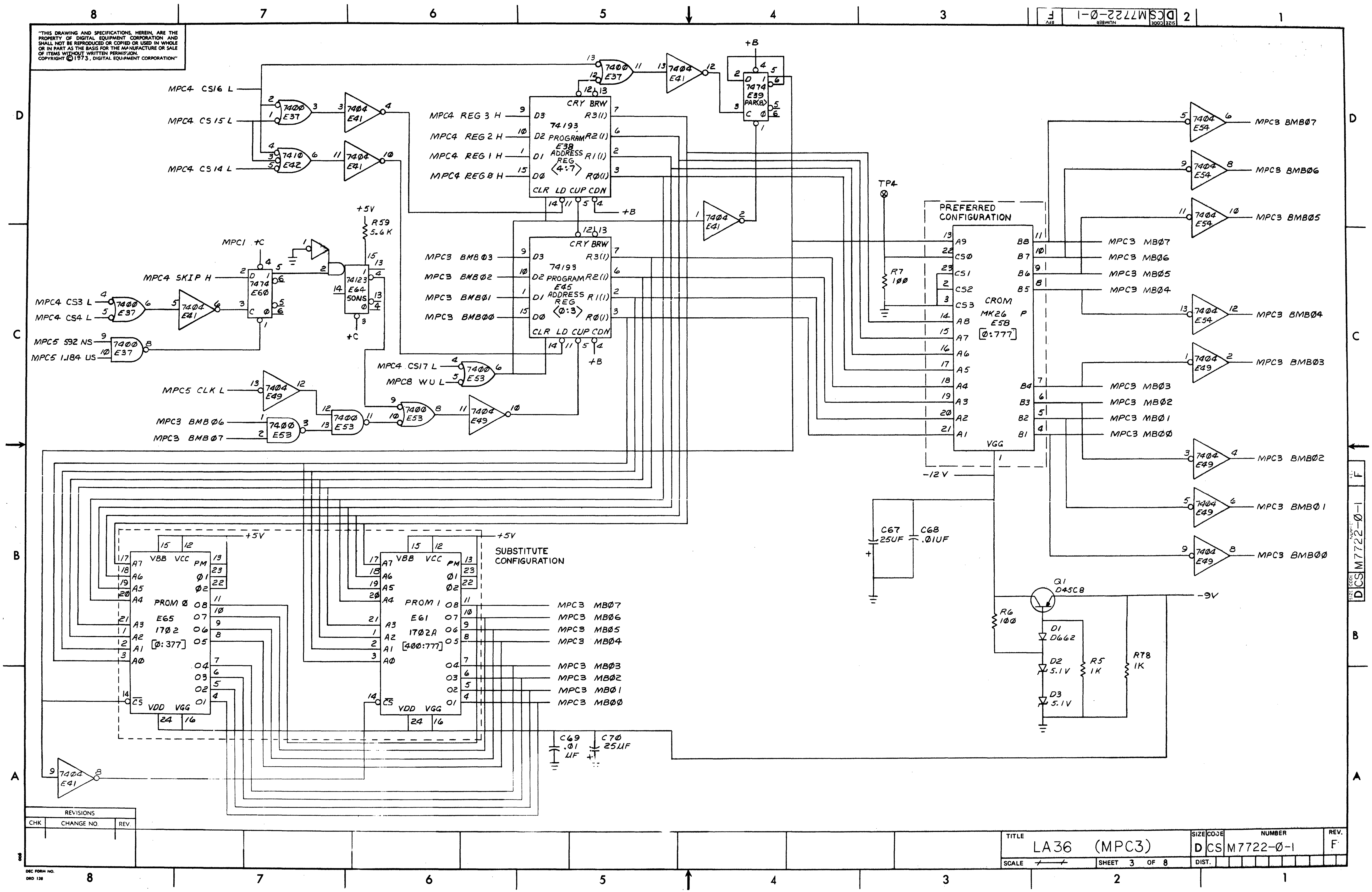
| QTY | REF DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|
| 11 | E2,E3,E4,E5,E8,E24,E30,E39, E51,E60,E36 | IC 7474 | 1905547 | 48 |
| 6 | E11,E12,E29,E37,E40,E53 | IC 7400 | 1905575 | 49 |
| 2 | E9,E42 | IC 7410 | 1905576 | 50 |
| 1 | E23 | IC 7420 | 1905577 | 51 |
| 2 | E21,E59 | IC 7401 | 1905590 | 52 |
| 2 | E13,E26 | IC 7493A | 1909054 | 53 |
| ~~1~~ | ~~E17~~ | ~~IC 8__~~ | ~~1909483~~ | 54 |
| 10 | E7,E10,E18,E20,E25,E41,E49 E54,E62,E67 | IC 7404 | 1909686 | 55 |
| 2 | E44,E46 | IC 74154 | 1909701 | 56 |
| 1 | E6 | IC 7413 | 1909989 | 57 |
| 3 | E32,E38,E45 | IC 74193 | 1910018 | 58 |
| 2 | E19,E50 | IC 7442 | 1910046 | 59 |
| 1 | E66 | IC 7437 | 1910091 | 60 |
| 1 | E16 | IC 74190 | 1910095 | 61 |
| 2 | E15,E31 | IC 74150 | 1910153 | 62 |
| 3 | E1,E34,E35 | IC LM301AN DIP. | 1910282 | 63 |
| 3 | E22,E56,E57 | IC 7489,3101 | 1910396 | 64 |
| 1 | E64 | IC 74123 | 1910436 | 65 |
| 1 | E55 | IC UART | 1910459 | 66 |
| 2 | E63,E68 | IC 74161 | 1910650 | 67 |
| 2 | E14,E52 | IC 74175 | 1910651 | 68 |
| 1 | E28 | IC MK2626P (NUMBER SET UNSLASHED Ø) | 23071A6 | 69 |
| 2 | E43,E47 | IC 4N26 (SOC75) | 1911998 | 70 |
| ~~1~~ | ~~E67~~ | ~~IC 1702A "PROM 1"~~ | ~~23083A4~~ | 71 |
| 1 | E33 | IC MK2627P (ALPHA SET) | 23070A6 | 72 |
| ~~1~~ | ~~E33 (ALTERNATE)~~ | ~~IC MK2628P (NUMBER SET SLASHED Ø)~~ | ~~23072A6~~ | 73 |
| ~~1~~ | ~~E63~~ | ~~IC 1702A "PROM Ø"~~ | ~~23082A4~~ | 74 |
| 2 | R66,R69 | RES 18Ø 1/2W 5% | 130026Ø | 75 |
| 2 | R24,R28 | RES 5.11K 1/4W 1% | 13Ø4854 | 76 |
| 1 | R20 | RES 2.15K 1/4W 1% | 1311653 | 77 |
| 2 | 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 | 9ØØ7113 | 83 |
| 2 | | EYELETS (FASTON) | 9ØØ9ØØØ | 84 |
| 4 | | EYELETS (MAT-N-LOK) | 9ØØ7266 | 85 |
| 4 | | WASHER, FLAT, NYLON, #6 | 9ØØ67Ø7 | 86 |
| 1 | | SCREW, SLOTTED BIND.HD.4-40X5/16 | 9ØØ6Ø1Ø-4 | 87 |
| 1 | | NUT, KEP, 4-4Ø | 9ØØ6557 | 88 |
| 1 | D11 | DIODE MCL1301 | 1105610-0-0 | 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 | 90C8268 | 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 | F |
| SCALE | SHEET 2 OF 8 | DIST. | | |

DEC FORM NO. DRD 137



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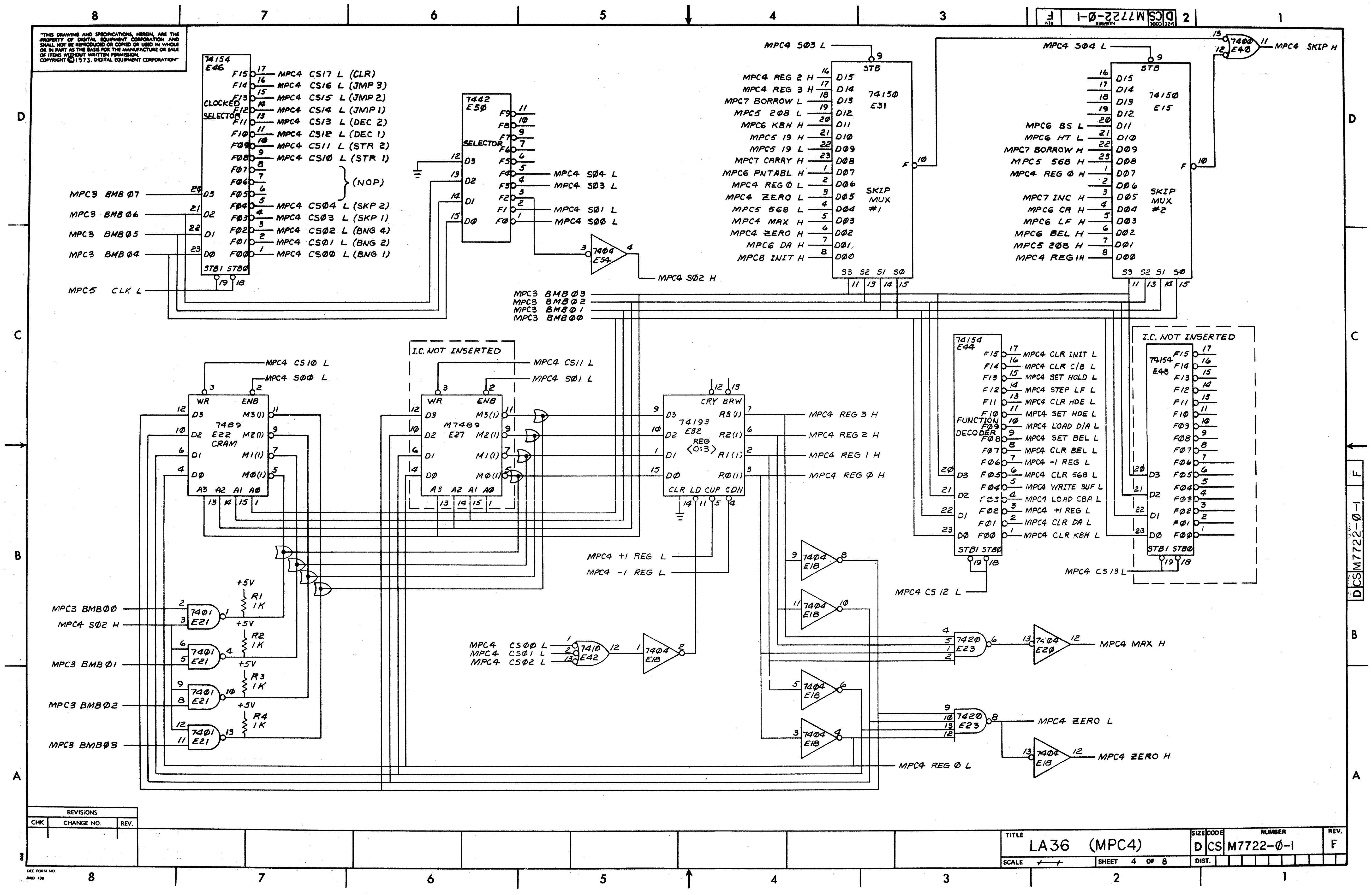
MPC4 CS16 L
MPC4 CS15 L
MPC4 CS14 L
MPC4 REG 3 H
MPC4 REG 2 H
MPC4 REG 1 H
MPC4 REG Ø H
74193 PROGRAM ADDRESS REG E38 <4:7>
74193 PROGRAM ADDRESS REG E45 <Ø:3>
MPC3 BMBØ3
MPC3 BMBØ2
MPC3 BMBØ1
MPC3 BMBØØ
MPC1 +C
MPC4 SKIP H
MPC4 CS3 L
MPC4 CS4 L
MPC5 592 NS
MPC5 1.184 US
7474 E60
74123 E64 50NS
R59 5.6K
MPC4 CS17 L
MPC8 WU L
MPC5 CLK L
MPC3 BMBØ6
MPC3 BMBØ7
7474 E39 PAR(B)
TP4
R7 100
PREFERRED CONFIGURATION
CROM MK26 E58 [Ø:777]
MPC3 MBØ7
MPC3 MBØ6
MPC3 MBØ5
MPC3 MBØ4
MPC3 MBØ3
MPC3 MBØ2
MPC3 MBØ1
MPC3 MBØØ
MPC3 BMBØ5
MPC3 BMBØ4
MPC3 BMBØ3
MPC3 BMBØ2
MPC3 BMBØ1
MPC3 BMBØØ
-12V
C67 25UF
C68 .01UF
Q1 D45C8
-9V
R6 100
D1 D662
D2 5.1V
D3 5.1V
R5 1K
R78 1K
SUBSTITUTE CONFIGURATION
PROM Ø E65 1702 [Ø:377]
PROM 1 E61 1702A [400:777]
C69 .01 UF
C70 25UF
TITLE LA36 (MPC3)
SIZE D CODE CS NUMBER M7722-Ø-1 REV. F
SHEET 3 OF 8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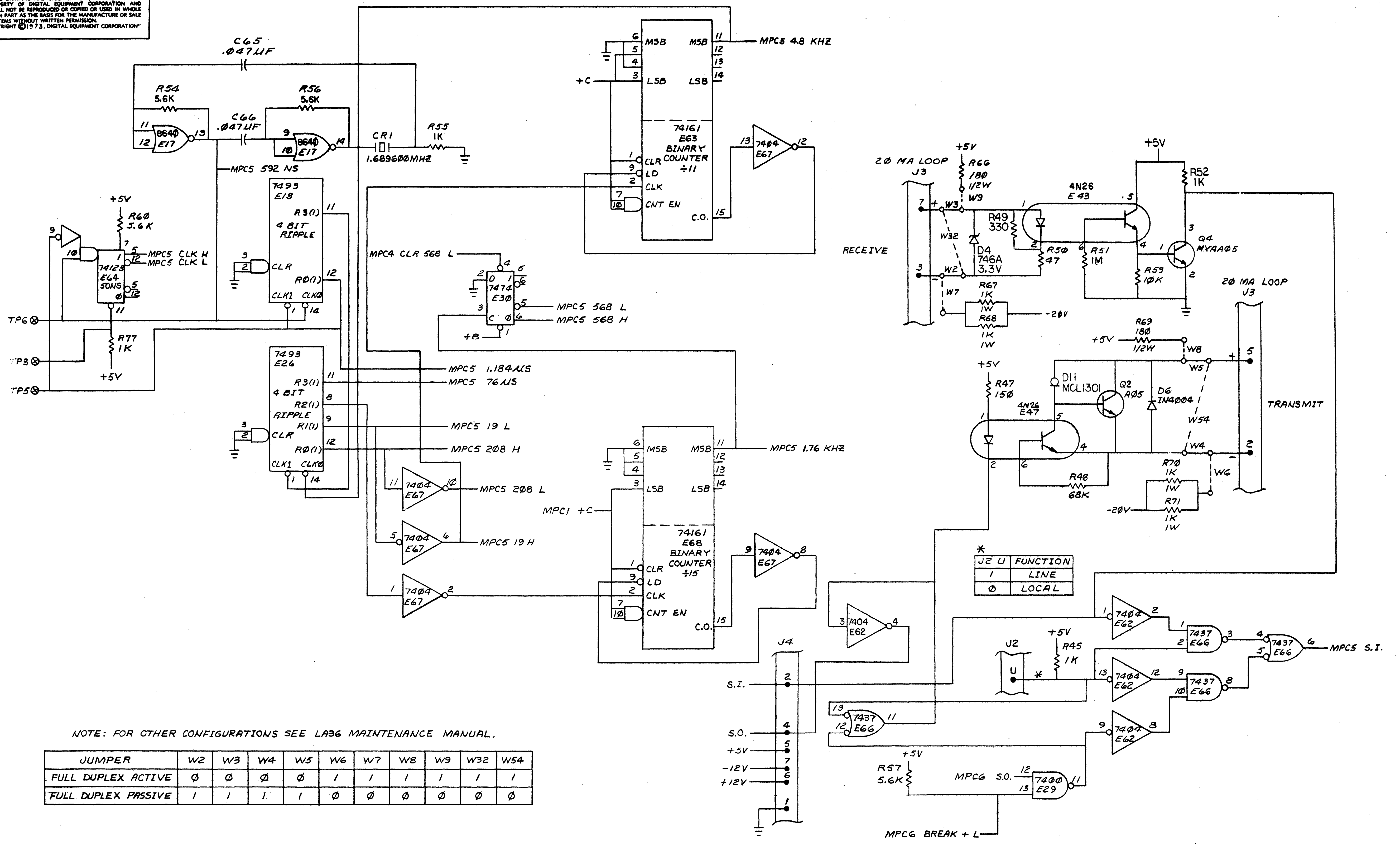
74154 E46 CLOCKED SELECTOR
MPC4 CS17 L (CLR)
MPC4 CS16 L (JMP 3)
MPC4 CS15 L (JMP 2)
MPC4 CS14 L (JMP 1)
MPC4 CS13 L (DEC 2)
MPC4 CS12 L (DEC 1)
MPC4 CS11 L (STR 2)
MPC4 CS10 L (STR 1)
(NOP)
MPC4 CS04 L (SKP 2)
MPC4 CS03 L (SKP 1)
MPC4 CS02 L (BNG 4)
MPC4 CS01 L (BNG 2)
MPC4 CS00 L (BNG 1)
MPC3 BMB 07
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 CS13 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 (013)
MPC4 REG 3 H
MPC4 REG 2 H
MPC4 REG 1 H
MPC4 REG 0 H
MPC4 +1 REG L
MPC4 -1 REG L
MPC3 BMB00
MPC4 S02 H
MPC3 BMB01
MPC3 BMB02
MPC3 BMB03
7401 E21
+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. F
SCALE
SHEET 4 OF 8
DIST.




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 | / | / | / | / | / | / |
| FULL DUPLEX PASSIVE | / | / | / | / | Ø | Ø | Ø | Ø | Ø | Ø |

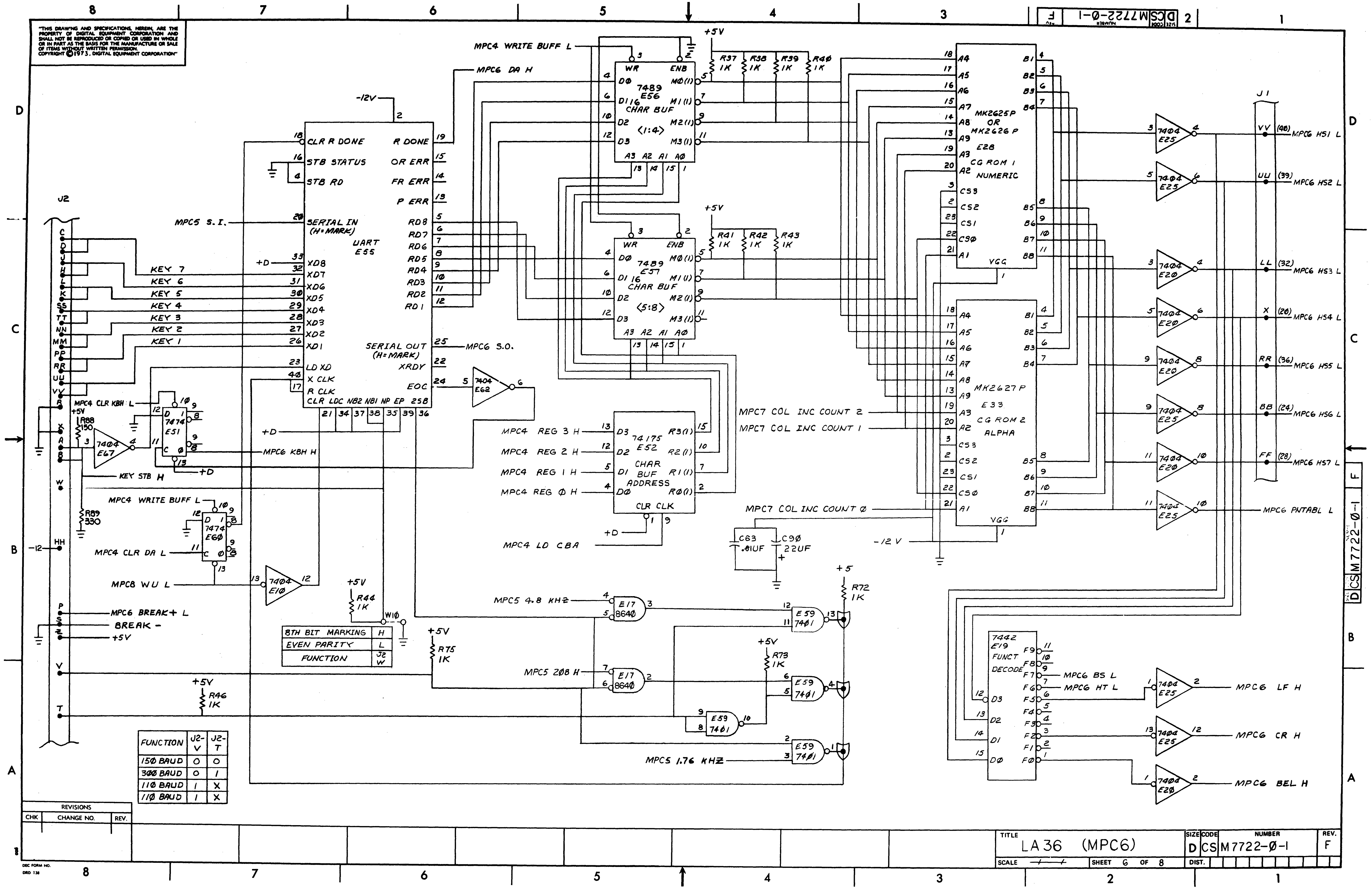
| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

TITLE LA36 (MPC5)

SIZE D CODE CS NUMBER M7722-Ø-1 REV. F

SCALE — SHEET 5 OF 8

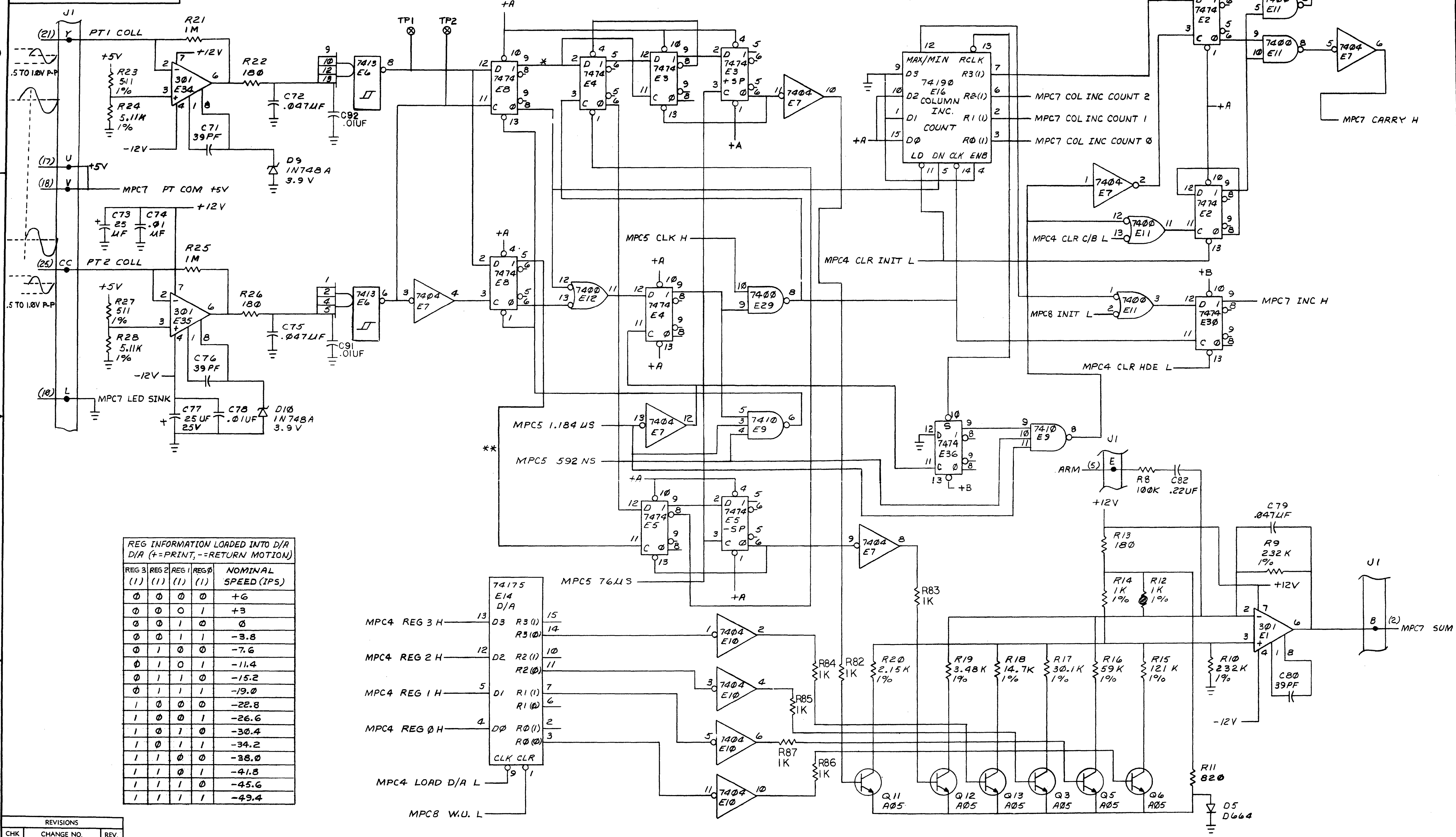
DEC FORM NO. DRD 138




| TITLE | SIZE | CODE | NUMBER | REV. |
|---|---|---|---|---|
| LA36 (MPC6) | D | CS | M7722-Ø-1 | F |

SCALE — SHEET 6 OF 8

* 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 |
| Ø | 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 |

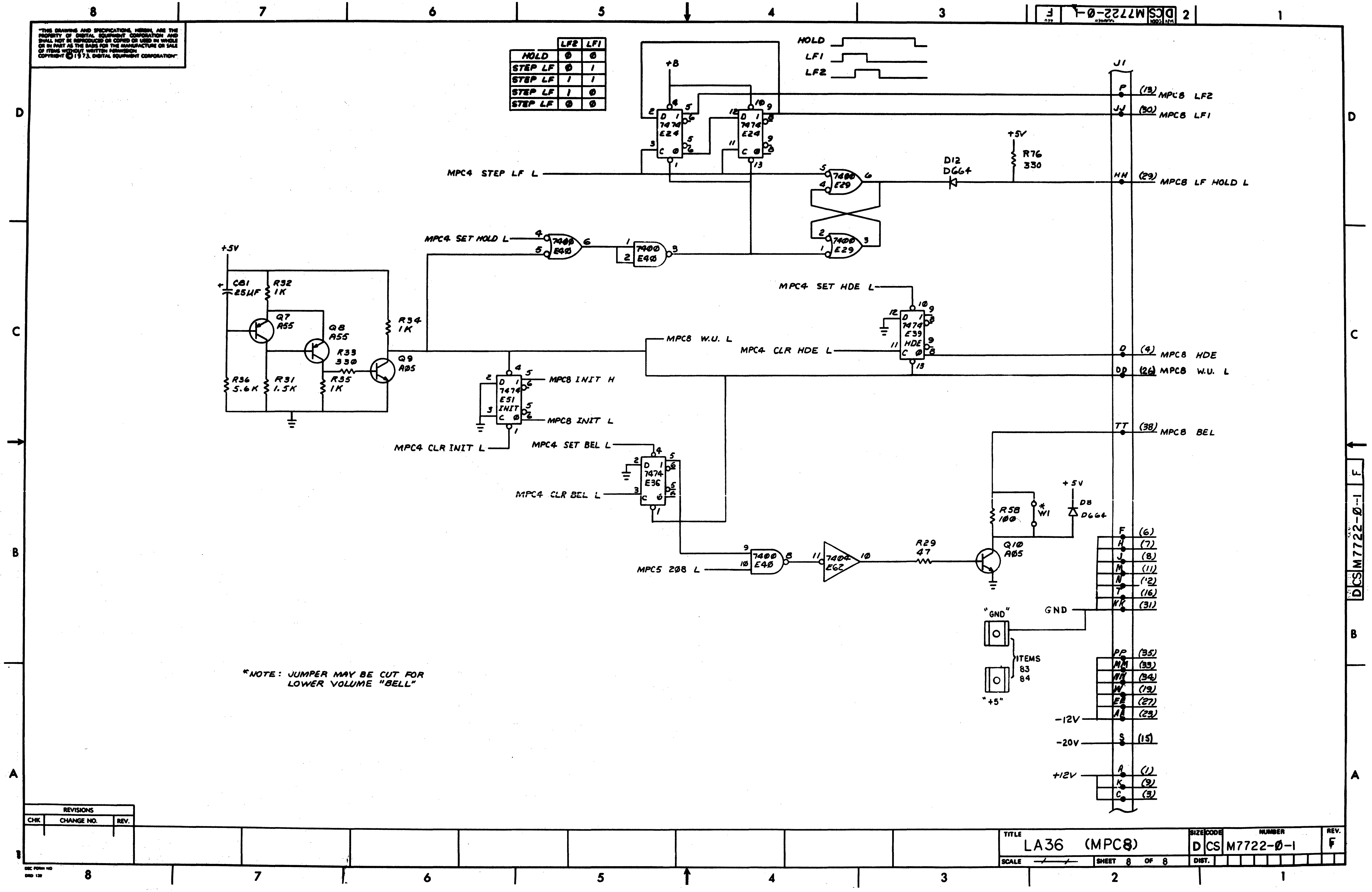
| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

TITLE LA36 (MPC7)

SIZE D CODE CS NUMBER M7722-Ø-1 REV. F

SCALE — SHEET 7 OF 8 DIST.

DEC FORM NO. DRD 138



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| | LF2 | LF1 |
| --- | --- | --- |
| HOLD | 0 | 0 |
| STEP LF | 0 | 1 |
| STEP LF | 1 | 1 |
| STEP LF | 1 | 0 |
| STEP LF | 0 | 0 |
HOLD
LF1
LF2
MPC4 STEP LF L
MPC4 SET HOLD L
MPC4 SET HDE L
MPC4 CLR HDE L
MPC4 CLR INIT L
MPC4 SET BEL L
MPC4 CLR BEL L
MPC5 208 L
MPC8 W.U. L
MPC8 INIT H
MPC8 INIT L
7474 E24
7474 E39 HDE
7474 E51 INIT
7474 E36
7400 E29
7400 E40
7404 E62
D12 D664
R76 330
+5V
C81 25µF
R32 1K
Q7 A55
Q8 A55
R34 1K
R33 330
Q9 A05
R36 5.6K
R31 1.5K
R35 1K
R58 100
*W1
D8 D664
R29 47
Q10 A05
J1
(13) MPC8 LF2
(30) MPC8 LF1
(29) MPC8 LF HOLD L
(4) MPC8 HDE
(26) MPC8 W.U. L
(38) MPC8 BEL
GND
"GND"
"+5"
ITEMS 83 84
-12V
-20V
+12V
*NOTE: JUMPER MAY BE CUT FOR LOWER VOLUME "BELL"
REVISIONS
CHK
CHANGE NO.
REV.
TITLE LA36 (MPC8)
SCALE
SHEET 8 OF 8
SIZE D CODE CS NUMBER M7722-Ø-1 REV. F
DIST.
D CS M7722-Ø-1 F

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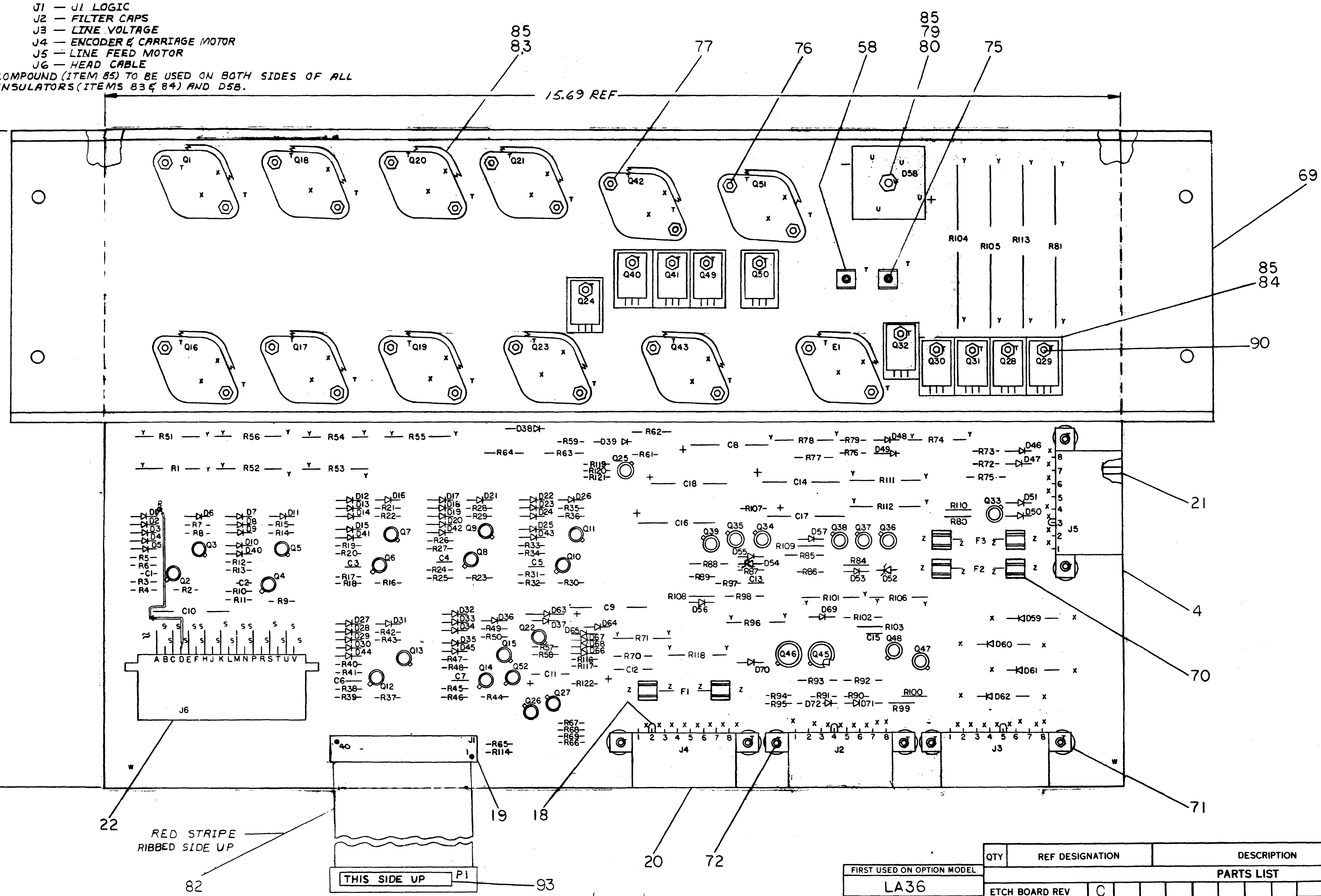
## NOTES:

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. | CHK |
|---|---|---|
| H | 5410805-0006 | J. BITTO 5/15/75 |
| F | 5410805-00005 | P. HELLER 2-26-75 |
| E | 5410805-00004 | P. HELLER 2-5-75 |
| D | 5410805-00003 | P. HELLER 1-29-74 |
| C | 5410805-00002 | HELLER 10-3-74 |
| B | 5410805-00001 | P. HELLER 7-12-74 |

REVISIONS

FIRST USED ON OPTION MODEL: LA36

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|

SEMICONDUCTOR CONVERSION CHART

| QTY | REF DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|

PARTS LIST

ETCH BOARD REV C

DRN. DATE 3/29/74
CHK'D. DATE 5/13/74
ENG. P. Heller DATE 5/13/74
PROJ. ENG. DATE 5/13/74
PROD. DATE 5/13/74
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 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 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 .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 | 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% | 1311867 | 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 300,¼W 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 — SEE NOTE 4. |
| 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 7/16 | 9006012-01 | 90 |
| 3 | Q32, Q30, Q28 | TRANS D44H8 | 1510707-00 | 91 |
| 2 | Q29, Q31 | TRANS D45H8 | 1570708-00 | 92 |
| 1 | | LABEL | 3611567 | 93 |
| | | | | |

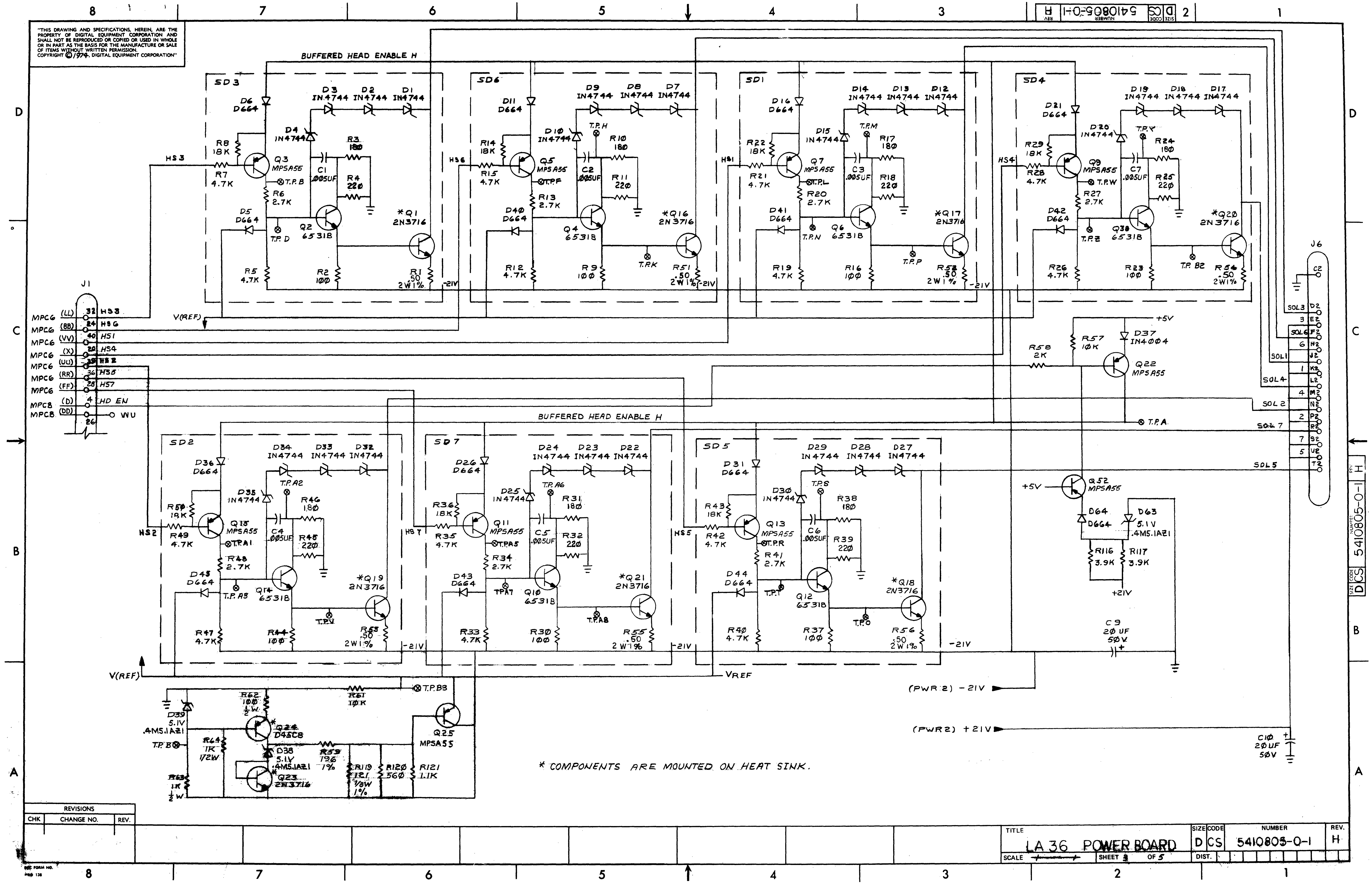
| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

TITLE LA 36 POWER BOARD

| SIZE | CODE | NUMBER | REV. |
|---|---|---|---|
| D | CS | 5410805-0-1 | H |

SCALE — SHEET 2 OF 5 DIST.

DEC FORM NO. DRD 138



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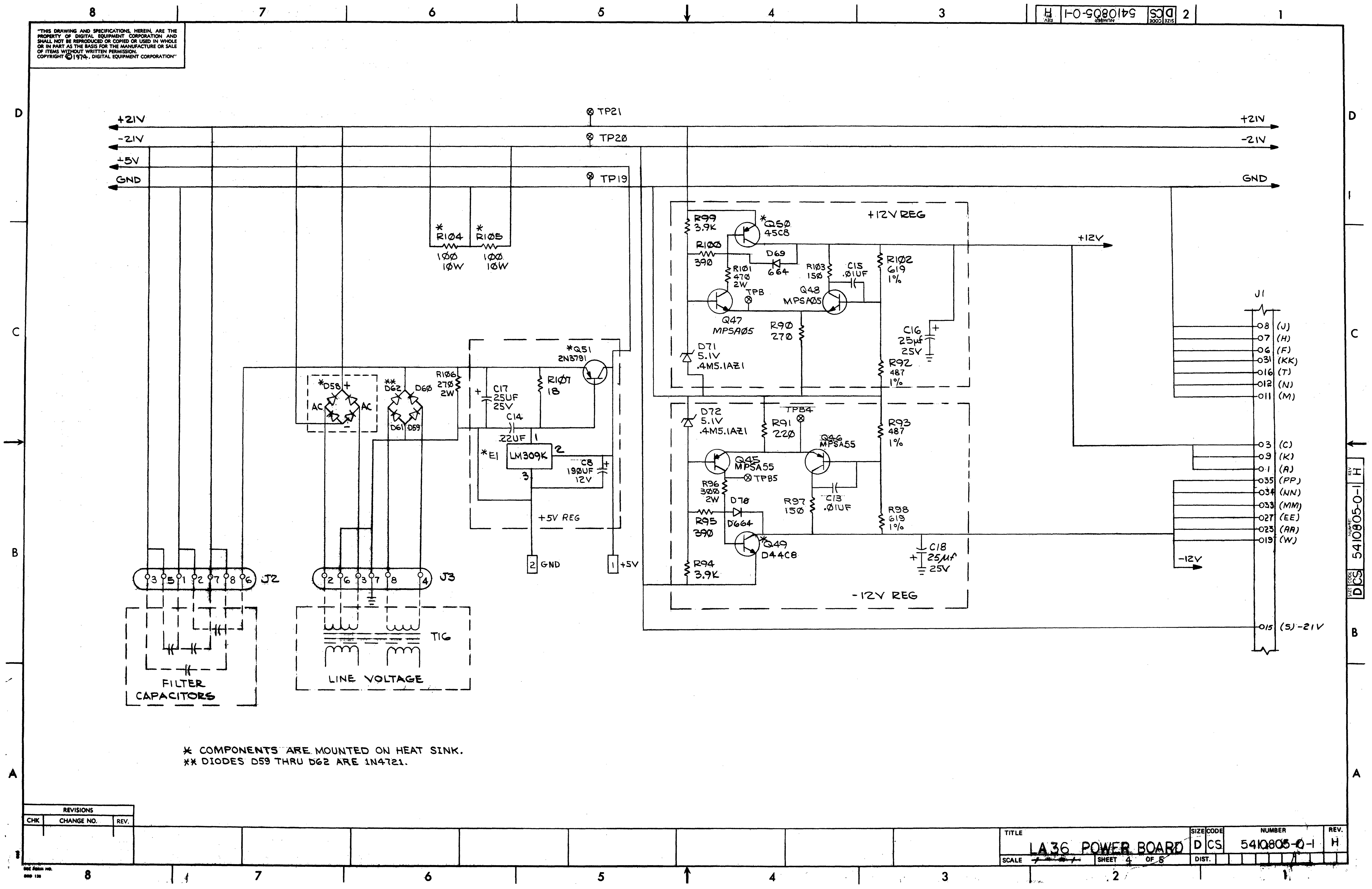
BUFFERED HEAD ENABLE H
SD3
SD6
SD1
SD4
SD2
SD7
SD5
J1
J6
HS3
HS6
HS1
HS4
HS2
HS5
HS7
HD EN
WU
MPC6
MPC8
V(REF)
VREF
-21V
+21V
+5V
D1 IN4744
D2 IN4744
D3 IN4744
D4 IN4744
D5 D664
D6 D664
Q1 2N3716
Q2 6531B
Q3 MPSA55
Q22 MPSA55
Q25 MPSA55
Q52 MPSA55
Q24 D45C8
Q23 2N3716
D37 IN4004
D38 5.1V .4M5.1AZ1
D39 5.1V .4M5.1AZ1
D63 5.1V .4M5.1AZ1
D64 D664
C9 20 UF 50V
C10 20UF 50V
SOL1
SOL2
SOL3
SOL4
SOL5
SOL6
SOL7
T.P.A
T.P.B
(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. H
SCALE
SHEET 3 OF 5
DIST.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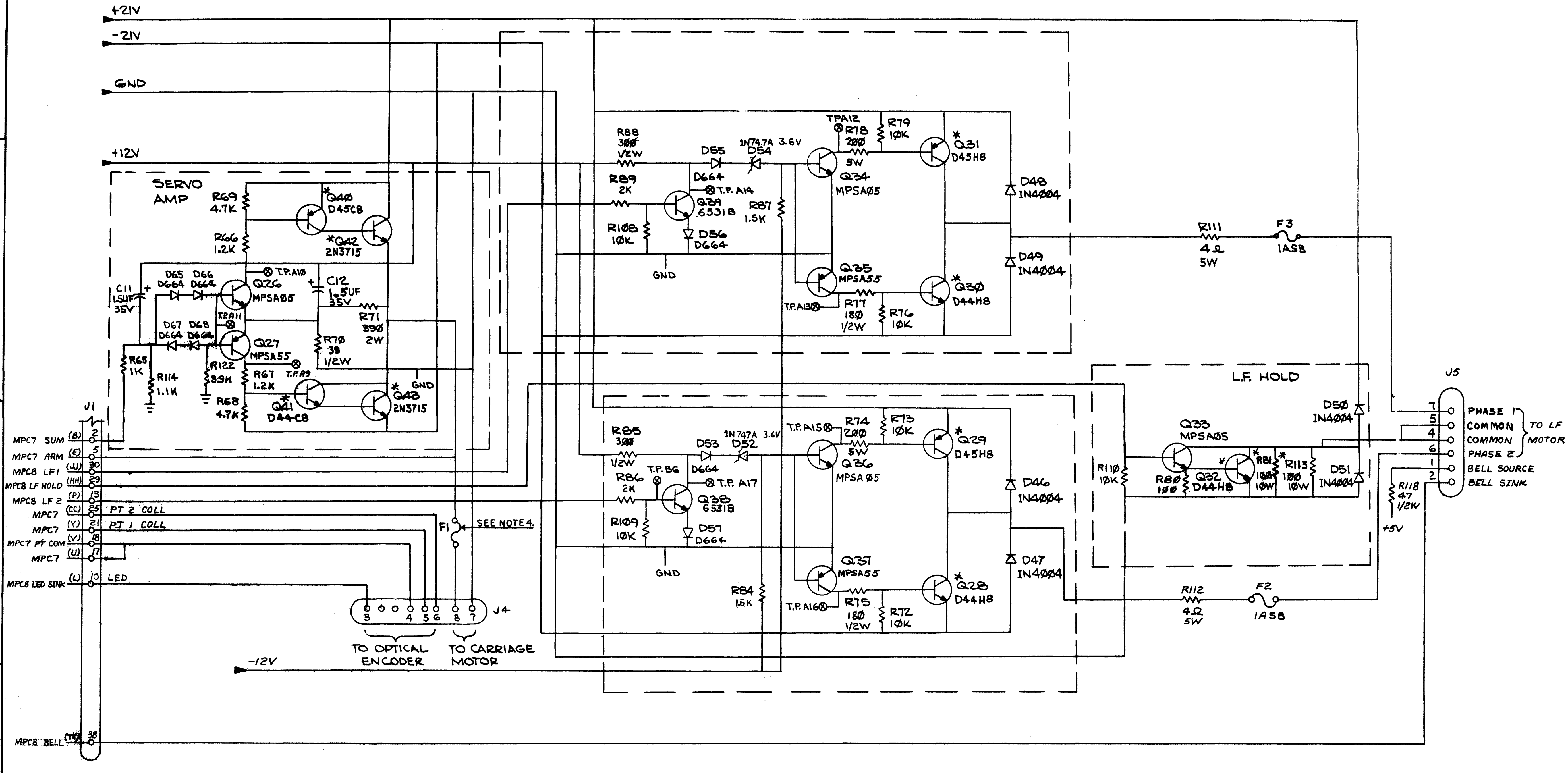
+21V
-21V
+5V
GND
TP21
TP20
TP19
R104 100 10W
R105 100 10W
+12V REG
R99 3.9K
Q50 45C8
R100 390
D69 664
R101 470 2W
R103 150
C15 .01UF
R102 619 1%
TPB
Q48 MPSA05
Q47 MPSA05
R90 270
C16 25µf 25V
D71 5.1V .4M5.1AZ1
R92 487 1%
+12V
J1
8 (J)
7 (H)
6 (F)
31 (KK)
16 (T)
12 (N)
11 (M)
3 (C)
9 (K)
1 (A)
35 (PP)
34 (NN)
33 (MM)
27 (EE)
23 (AA)
19 (W)
15 (S) -21V
-12V
Q51 2N3791
R106 270 2W
R107 18
D58
AC
D62
D60
D61
D59
C17 25UF 25V
C14 .22UF
E1 LM309K
C8 190UF 12V
+5V REG
2 GND
1 +5V
D72 5.1V .4M5.1AZ1
TPB4
R91 220
Q46 MPSA55
R93 487 1%
Q45 MPSA55
TPB5
R96 300 2W
D70
R95 390
D664
R97 150
C13 .01UF
R98 619 1%
Q49 D44C8
C18 25µf 25V
R94 3.9K
-12V REG
J2
J3
FILTER CAPACITORS
T16
LINE VOLTAGE
* COMPONENTS ARE MOUNTED ON HEAT SINK.
** DIODES D59 THRU D62 ARE 1N4721.
REVISIONS
CHK
CHANGE NO.
REV.
TITLE
LA36 POWER BOARD
SCALE
SHEET 4 OF 5
SIZE D
CODE CS
NUMBER 5410805-0-1
REV. H
DIST.



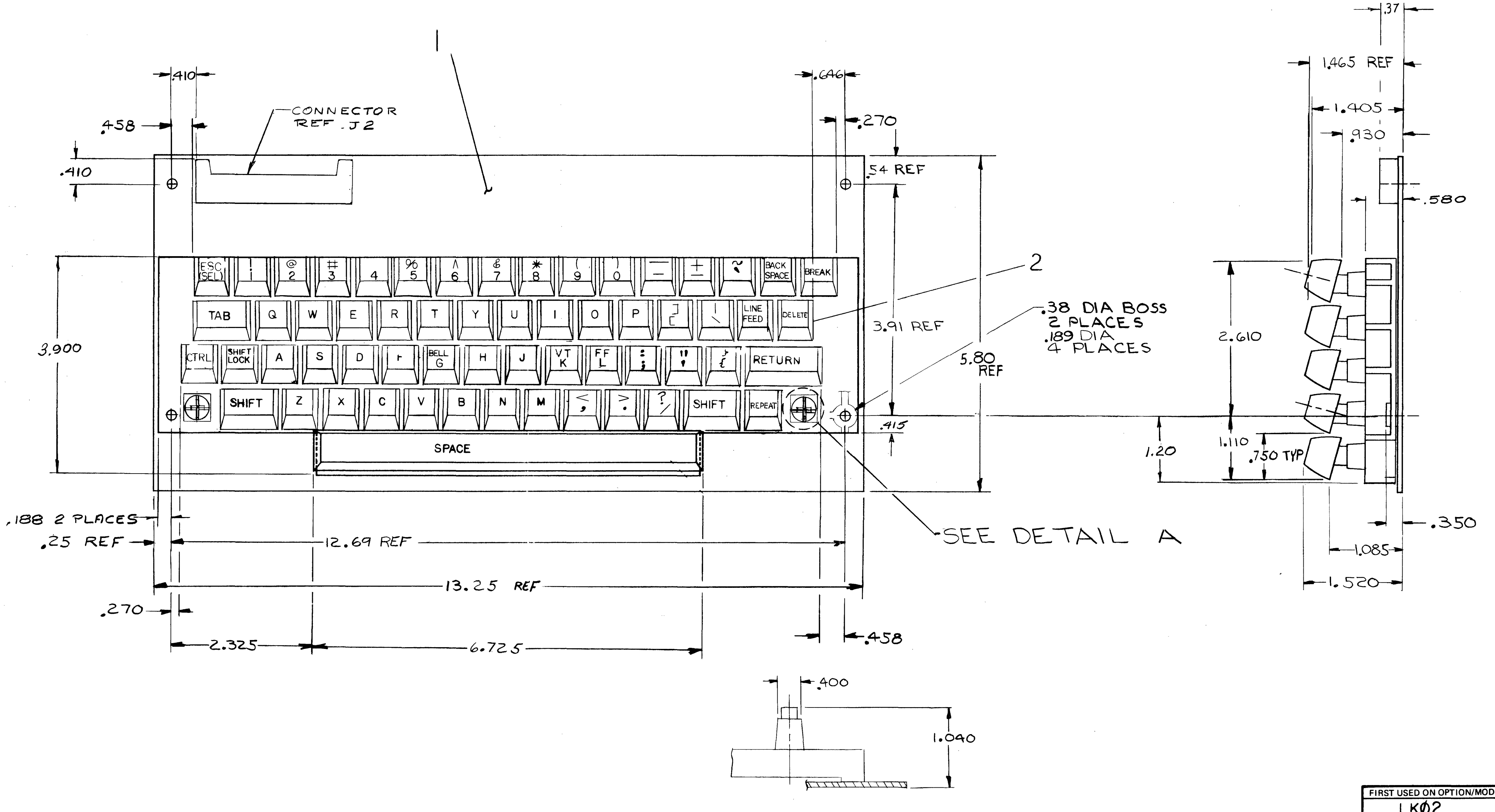

* COMPONENTS ARE MOUNTED ON HEAT SINK.

| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

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

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 Menault DATE 5/31/74
CHK'D F. Carbery DATE 7/15/74
ENG. Craig Benson DATE 7/11/74
PROD ENG Paul F. Nelson DATE 7-11-74
PROD J. P. Cate DATE 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

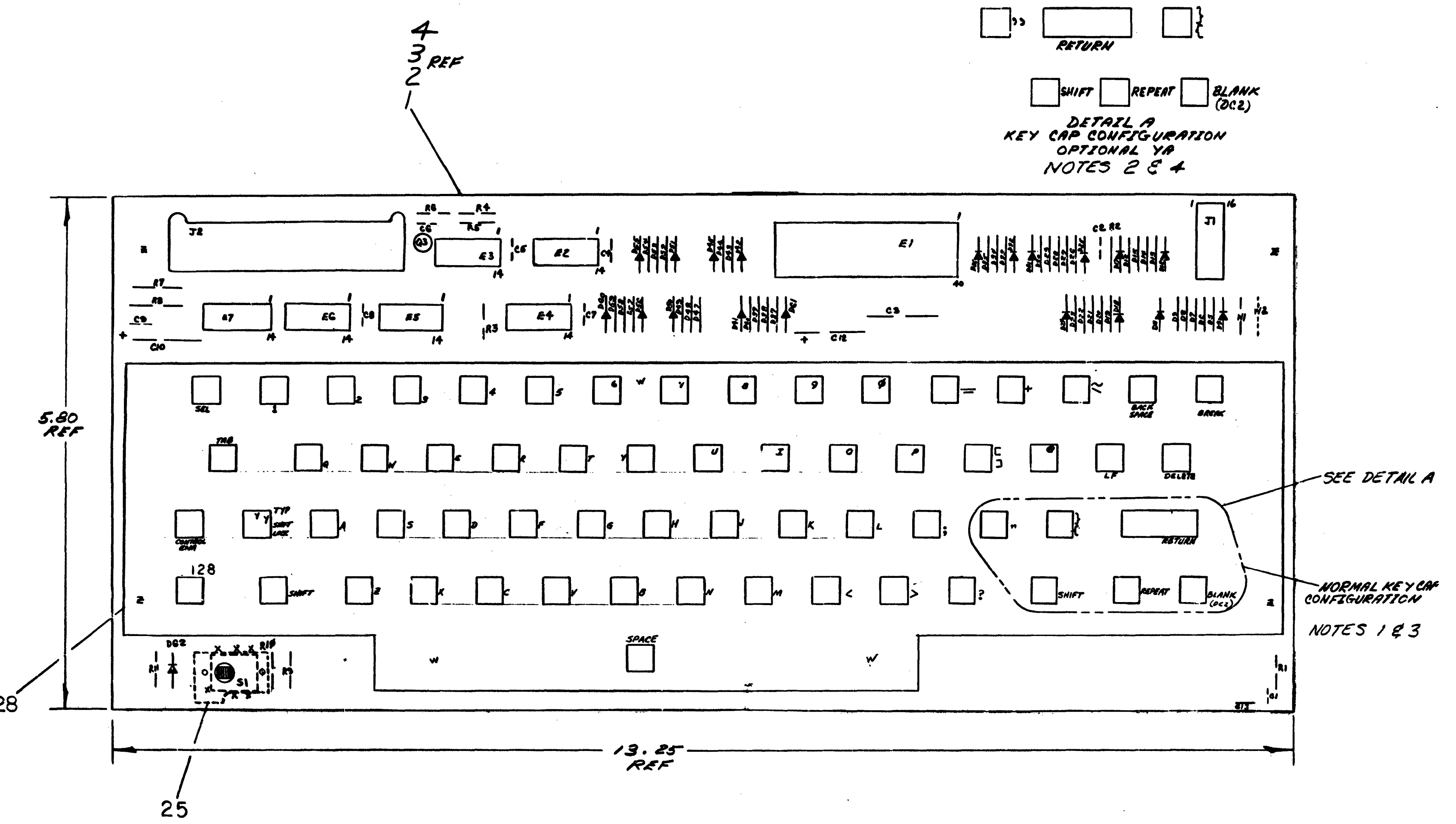
SIZE D CODE UA NUMBER LKØ2-Ø-Ø REV. A
DIST.

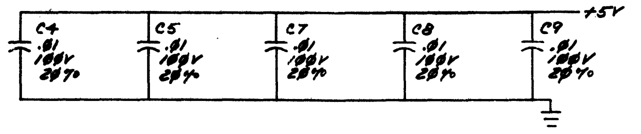
| REVISIONS | CHANGE NO. | REV. |
|---|---|---|
| | LKØ2-00002 | A |
| | C. BICKOFF | |

DEC FORM NO. DRD 100-B

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




| QTY 5410736-YA-0 | QTY 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-5410736-0-8 | 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~~ | ~~C11~~ | ~~CAP., .068,100V 10% MYLAR~~ | ~~1000032-00~~ | 8 |
| 2 | 2 | C2,C6 | CAP., 180PF,100V 5% MICH | 1000020-00 | 9 |
| 2 | 2 | C10,C12 | CAP., 10UF,20V 10% TANT | 1004813 | 10 |
| 57 | 57 | D4-D9, D11-D45, D47-D62 | DIODE, D664 | 1100114-00 | 11 |
| ~~1~~ | ~~1~~ | ~~D1~~ | ~~DIODE, 1N759A, ZENER, 12V 5%~~ | ~~1110038-00~~ | 12 |
| 1 | 1 | Q3 | TRANSISTOR DEC 3009B | 1503100-00 | 13 |
| 1 | 1 | S1 | SWITCH (DPST) | 1210018 | 14 |
| 1 | 1 | J1 | SOCKET (16 PINS) | 1210025-00 | 15 |
| 1 | 1 | J2 | CONNECTOR, RIGHT ANGLE HEADER | 1209941-00 | 16 |
| 1 | 1 | XE1 | SOCKET ROM | 1210947-00 | 17 |
| 1 | 1 | E2 | I.C. 7404 | 1909686 | 18 |
| 1 | 1 | E3 | I.C. 7400 | 1905575 | 19 |
| 1 | 1 | E7 | I.C. 7430 | 1905578 | 20 |
| 2 | 2 | E5,E6 | I.C. 7437 | 1910091 | 21 |
| 1 | 1 | E4 | I.C. 9601 | 1909373 | 22 |
| 1 | 1 | E1 | I.C. ROM. | 2111634 | 23 |
| 2 | 2 | | SCREW PHILLIP SCREW SELF-TAP 4-40 x 3/16 | 9009159 | 24 |
| 1 | 1 | | PHENOLIC SWITCH SELECTOR | B-MD-7409532-0-0 | 25 |
| ~~1~~ | ~~1~~ | ~~T1~~ | ~~TRANSFORMER ASSEMBLY~~ | ~~7009492-0-0~~ | 26 |
| 1 | 1 | W1,W2 | JUMPER(INSULATED)(.4) | 9009185 | 27 |
| 1 | 1 | | KEYSWITCH ARRAY | DAD7009892-00 | 28 |
| 5 | 5 | R1,R4,R5,R9,R10 | RES 1K ¼W 5% | 1300385-00 | 29 |
| 2 | 2 | R6,R11 | RES 3.9K ¼W 5% | 1300444-00 | 30 |
| ~~1~~ | ~~1~~ | ~~R13~~ | ~~RES 10K OHM 1/4W 5%~~ | ~~1301317-00~~ | 31 |
| 1 | 1 | R3 | RES 22K ¼W 5% | 1301808-00 | 32 |
| 1 | 1 | R2 | RES 100K ¼W 5% | 1302466-00 | 33 |
| 2 | 2 | R7,R8 | RES 2 OHM ½W 5% | 1309421-00 | 34 |

PARTS LIST

ETCH BOARD REV D

| REV | CHANGE NO. | ORIGINATED | CHK | |
|---|---|---|---|---|
| B | 5410736-00001 | H. Dunmore 9-23-74 | | |
| C | | P. NELSON | Paul E. Nelson 9-23-74 | |

REVISIONS

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|
| 1N759A | N.A. | | |
| D664 | 1N3606 | | |

SEMICONDUCTOR CONVERSION CHART

| | | |
|---|---|---|
| DRN. M. Ferreira | DATE 1/25/74 | |
| CHK'D. J. Klein | DATE 1-31-74 | |
| ENG. Paul E. Nelson | DATE 2-4-74 | |
| PROJ. ENG. Paul E. Nelson | DATE 2-4-74 | |
| PROD. J. P. Ctazy | DATE 2-5-74 | |

NEXT HIGHER ASSY D-UA-LK02-0-0

SCALE — SHEET 1 OF 2

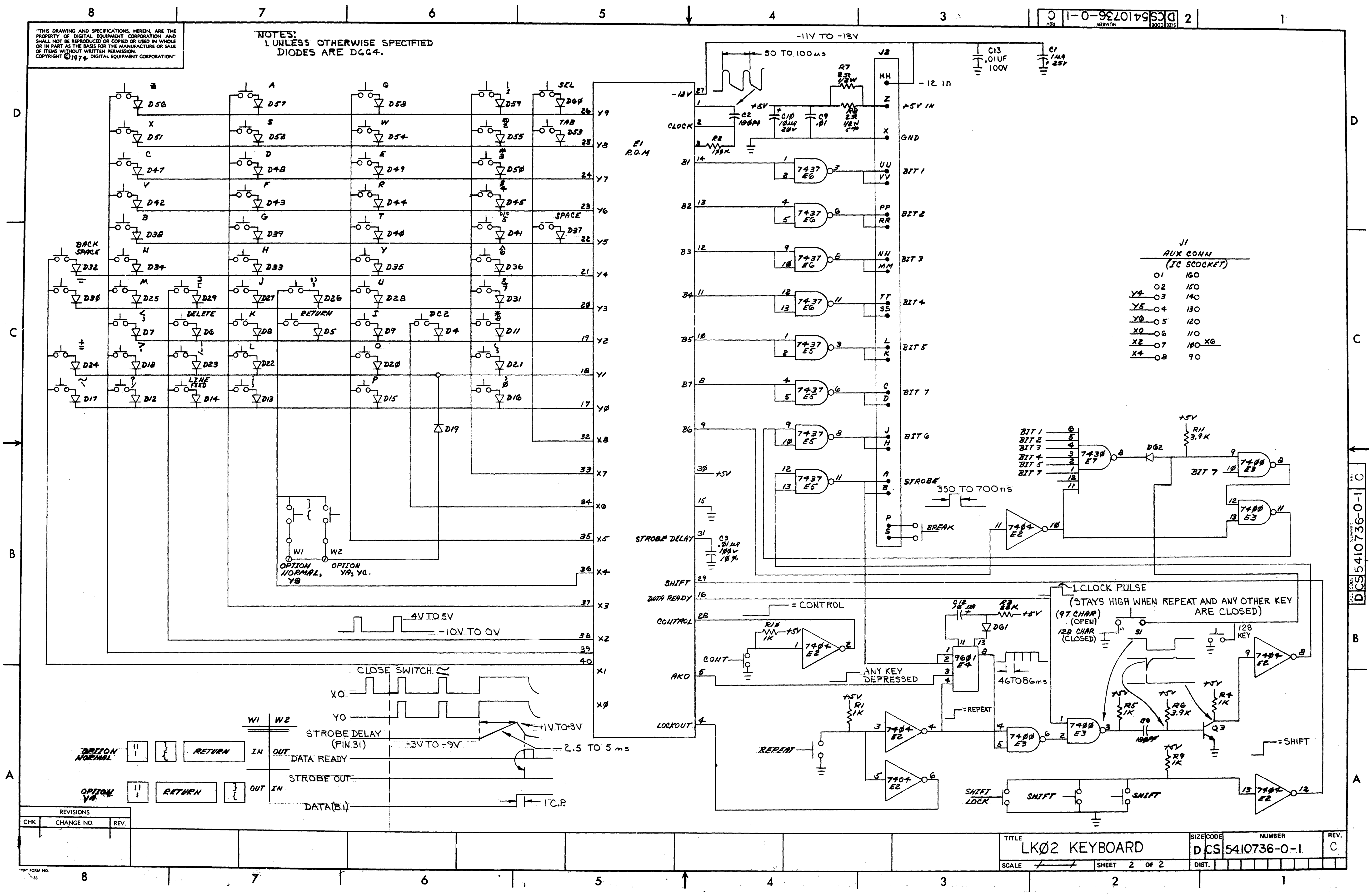
digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

TITLE LKØ2 KEYBOARD

SIZE D CODE CS NUMBER 5410736-0-1 REV. C

DIST.

DEC FORM NO. DRD-135



NOTES:
1. UNLESS OTHERWISE SPECIFIED DIODES ARE D664.
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E1 R.O.M.
-11V TO -13V
50 TO 100 ms
J1 AUX CONN (IC SOCKET)
STROBE
350 TO 700 ns
BREAK
1 CLOCK PULSE (STAYS HIGH WHEN REPEAT AND ANY OTHER KEY ARE CLOSED)
= CONTROL
ANY KEY DEPRESSED
46 TO 86 ms
= REPEAT
= SHIFT
REPEAT
SHIFT LOCK
SHIFT
4V TO 5V
-10V TO 0V
CLOSE SWITCH
STROBE DELAY (PIN 31)
-3V TO -9V
+1V TO +3V
2.5 TO 5 ms
DATA READY
STROBE OUT
DATA (B1)
I.C.P.
OPTION NORMAL
OPTION YA
RETURN
REVISIONS
CHK
CHANGE NO.
REV.
TITLE LK02 KEYBOARD
SIZE D
CODE CS
NUMBER 5410736-0-1
REV. C
SHEET 2 OF 2

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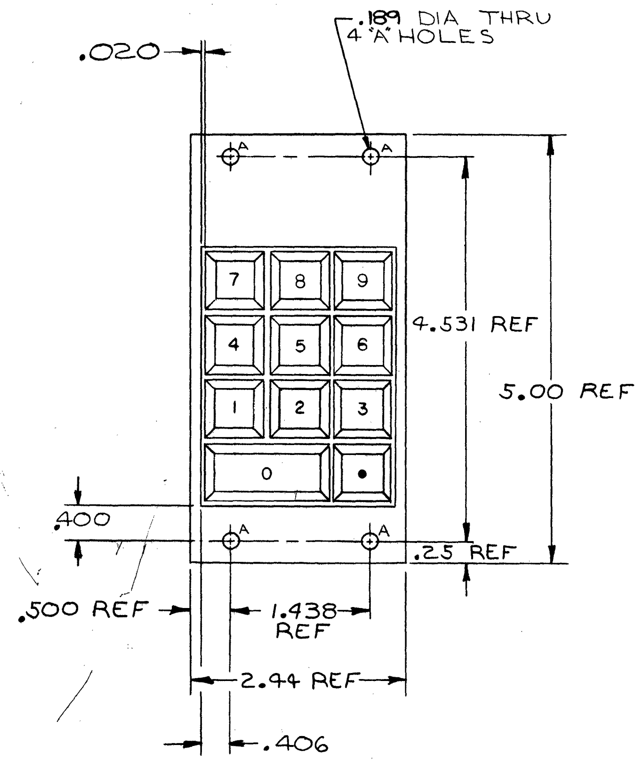
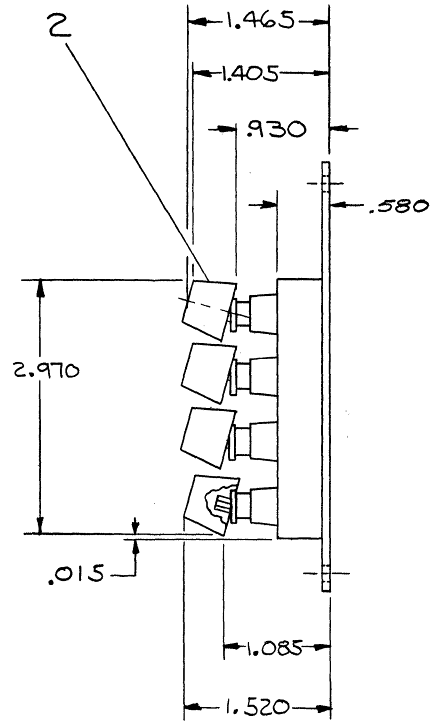
NOTES:




| QTY. | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|
| 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 |

PARTS LIST

FIRST USED ON OPTION/MODEL: LKØ3

UNLESS OTHERWISE SPECIFIED DIMENSION IN INCHES. TOLERANCES

| DECIMALS | ANGLES |
|---|---|
| .XXX ±.005<br>.XX ±.02<br>.X ±.1 | ±0° 30' |

REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY ✓

MATERIAL —//—

FINISH —//—

| | | DATE |
|---|---|---|
| DRN. | Mike Dugan | 6-3-74 |
| CHK'D | [illegible] | 7/11/74 |
| ENG. | W. J. Benson | 7/11/74 |
| PROJ. ENG. | Paul E. Melon | 7-11-74 |
| PROD. | [illegible] | 7/11/74 |

NEXT HIGHER ASSY. B-DD-LKØ3-Ø

SCALE 1/1

SHEET 1 OF 1

digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

TITLE

11 KEY KEYBOARD ASSY

| SIZE | CODE | NUMBER | REV. |
|---|---|---|---|
| D | UA | LKØ3-Ø-Ø | |

DIST.

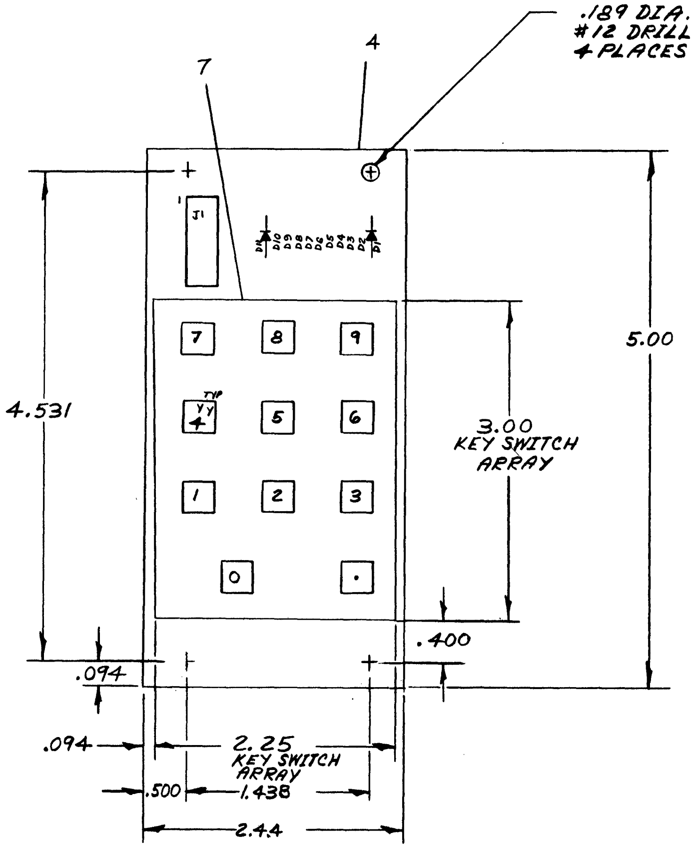
REVISIONS: REV. | CHANGE NO. | CHK

BRUNING 40-107 15968

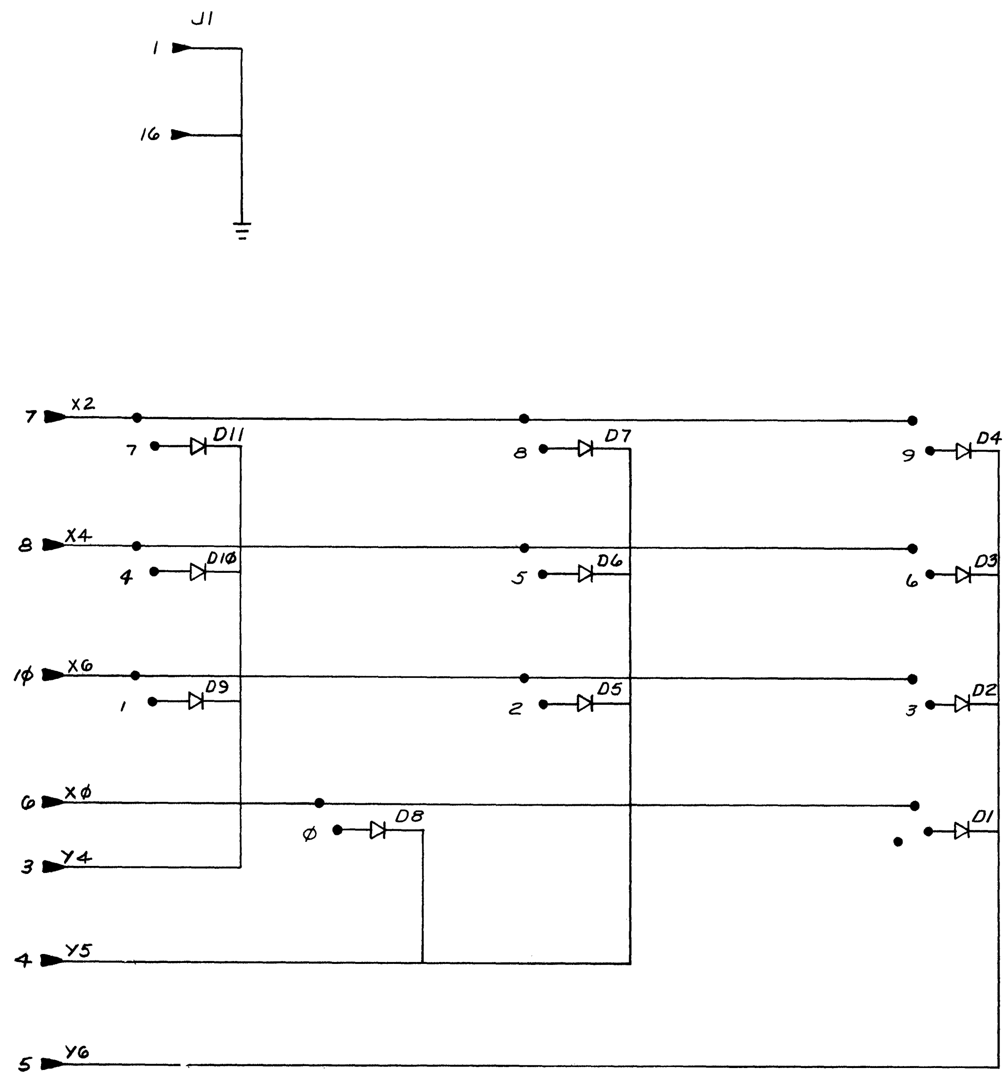
DEC FORM NO DRD 100-A

## 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

| CHK | CHANGE NO. | REV |
|---|---|---|
| Paul E. Nelson 5-24-74 / P. E. NELSON / Roy Vamow 6/10/74 | 5410819-00001 ORIGINATED | B A |

REVISIONS

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|

SEMICONDUCTOR CONVERSION CHART

DRN. V. Bussonnette DATE 1-22-74
CHK'D. DATE 2-4-74
ENG. Paul E. Nelson DATE 2-4-74
PROJ. ENG. Paul 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

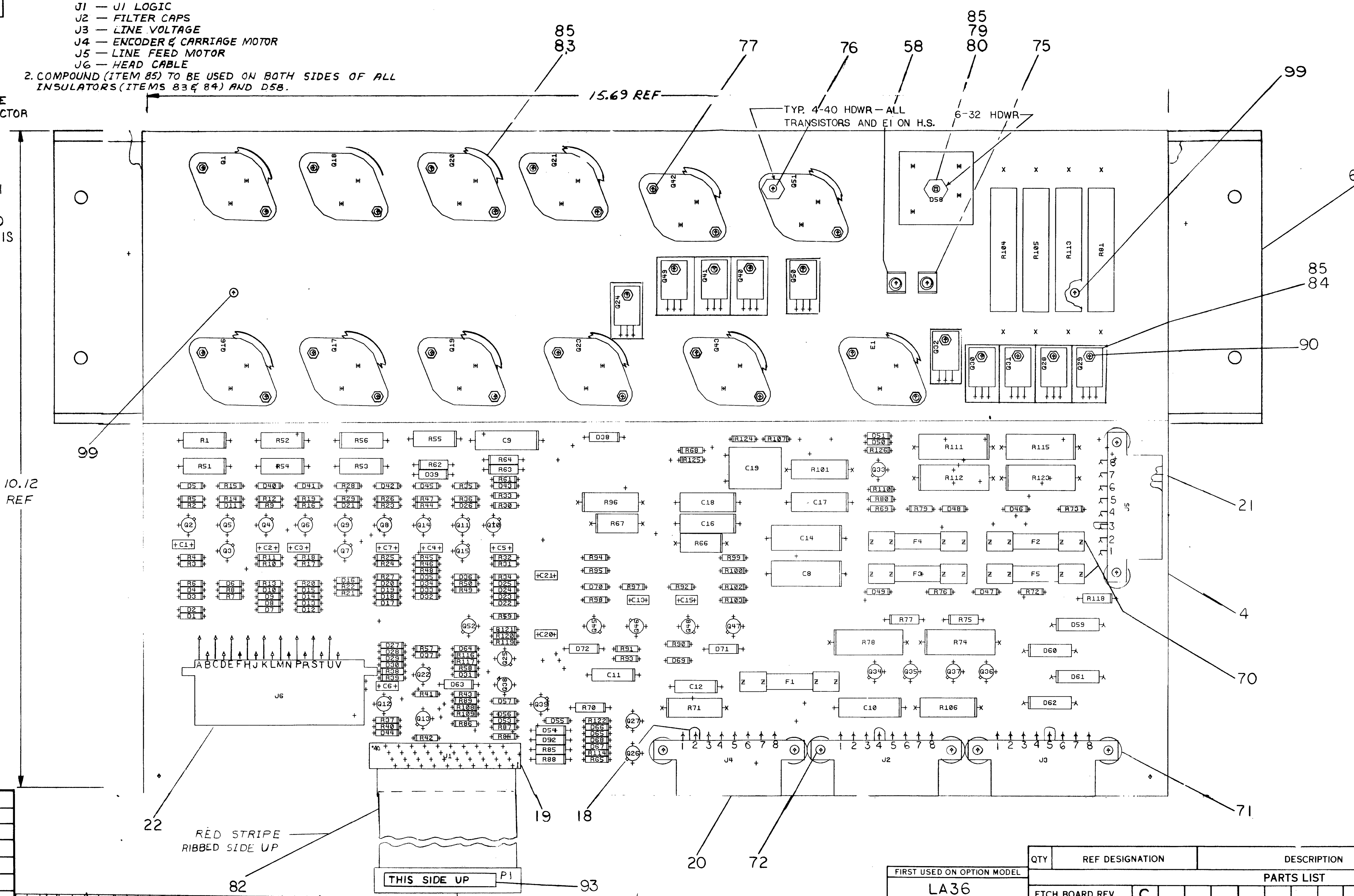
SIZE D CODE CS NUMBER 5410819-0-1 REV. B

DIST.

DEC FORM NO. DRD 135-B

# NOTES:

1. 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).
5. RESISTORS R120 AND R121 ARE TRIMMER RESISTORS WHICH MAY BE REMOVED IN TEST. IF A RESISTOR IS REMOVED IT MUST BE REMOVED COMPLETELY.




| 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 |
|---|---|
| 5410805-00015 | T |
| 5410805-00014 | S |
| 5410805-00013 | R |
| 5410805-00012 | P |
| 5410805-00011 | N |
| 5410805-00010 | M |
| 5410805-00009 | L |
| 5410805-00008 | K |
| 5410805-00007 | J |
| 5410805-00006 | H |
| 5410805-00005 | F |
| 5410805-00004 | E |
| 5410805-00003 | D |
| 5410805-00002 | C |
| 5410805-00001 | B |

REVISIONS

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|
| | | | |

SEMICONDUCTOR CONVERSION CHART

DRN. DATE 3/29/74
CHK'D. DATE 5/13/74
ENG. DATE 5/13/74
PROJ. ENG. DATE 5/13/74
PROD. DATE 5/13/74
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. T

DIST.

DEC FORM NO DRD 135-8

| 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 IN4744 | 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 5.1AZ! 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 47,½W,5% | 1301695 | 23 |
| 7 | R1,R51,R52,R53,R54,R55,R56 | RES 0.50 2W 1% | 1311867 | 24 |
| 4 | R111,R112,R115 R123 | RES 4, 5W W.W. | 1311624 | 25 |
| 10 | R80,R2,R9,R16,R23,R30,R37, R44,R124,R125 | 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 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 |
| 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 300,¼W 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 464¼W 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% | 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 |
| 5 | Q28,Q30,Q32,Q41,Q49 | TRANS TIP31A | 1512590 | 66 |
| 5 | Q29,Q31,Q40,Q24,Q50 | TRANS TIP32A | 1512589 | 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 3/4 AMP SLOW BLOW | 1211237 | 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 |
| | | | | 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 |

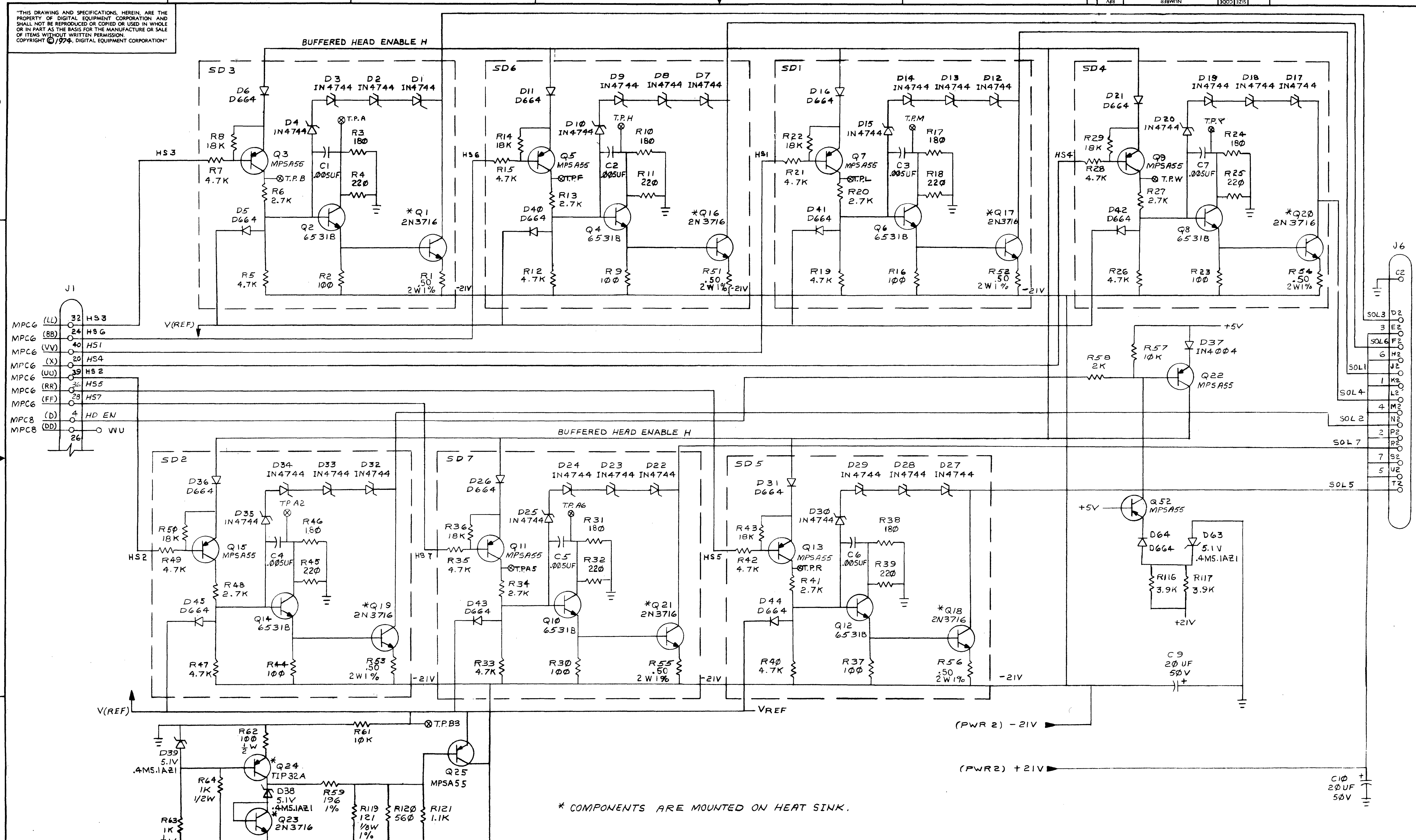
— SEE NOTE 4.

| QTY | REF DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|
| 2 | R81,R113 | RES 60, 10W, 5% | 1312997 | 98 |
| 2 | | RIVET, POP | 9006460 | 99 |

| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

TITLE LA 36 POWER BOARD | SIZE D | CODE CS | NUMBER 5410805-0-1 | REV. T
SCALE — | SHEET 2 OF 5 | DIST.

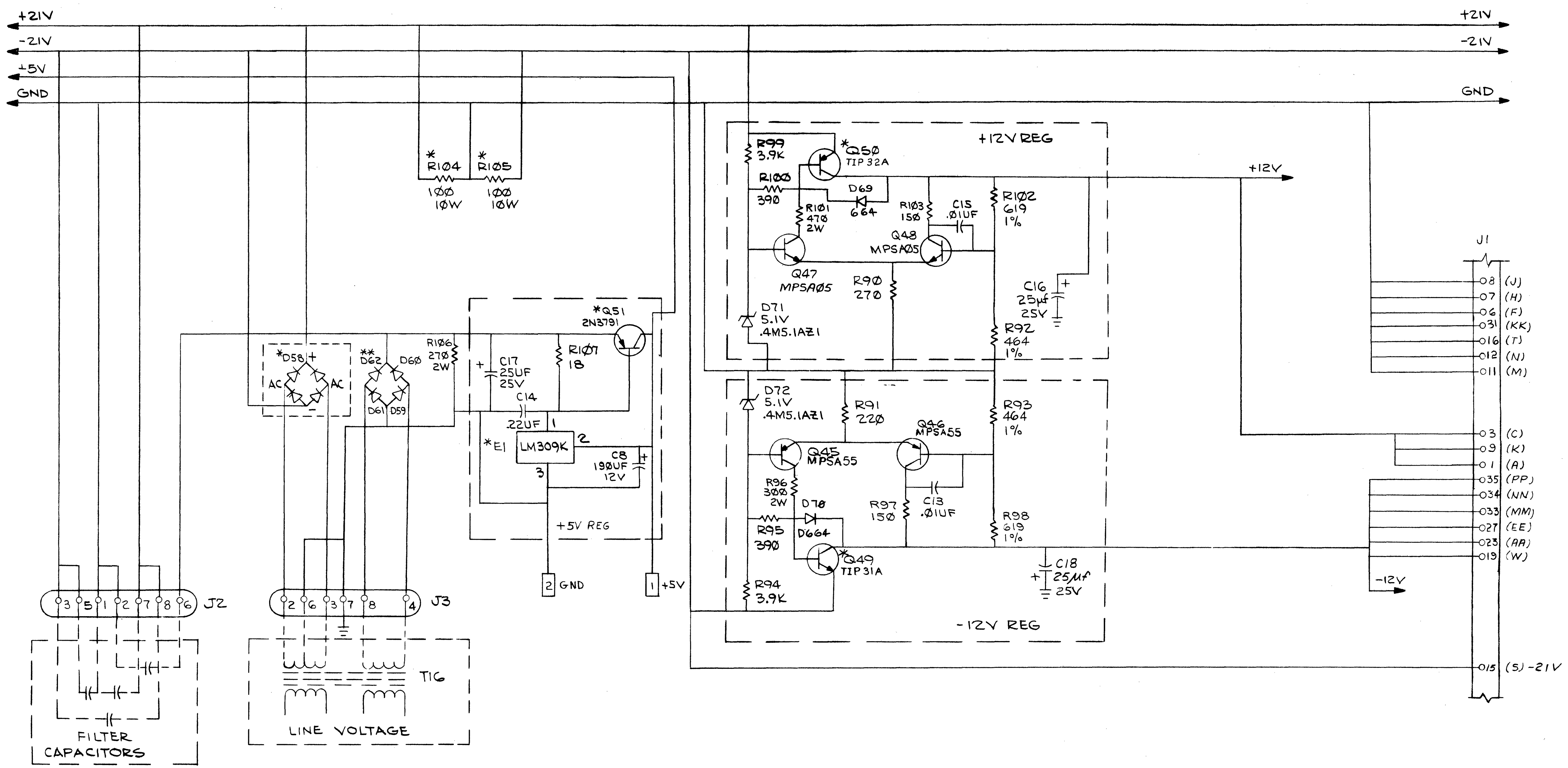
DEC FORM NO. DRD 138




* 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.: ⊢T
SCALE: — SHEET 3 OF 5

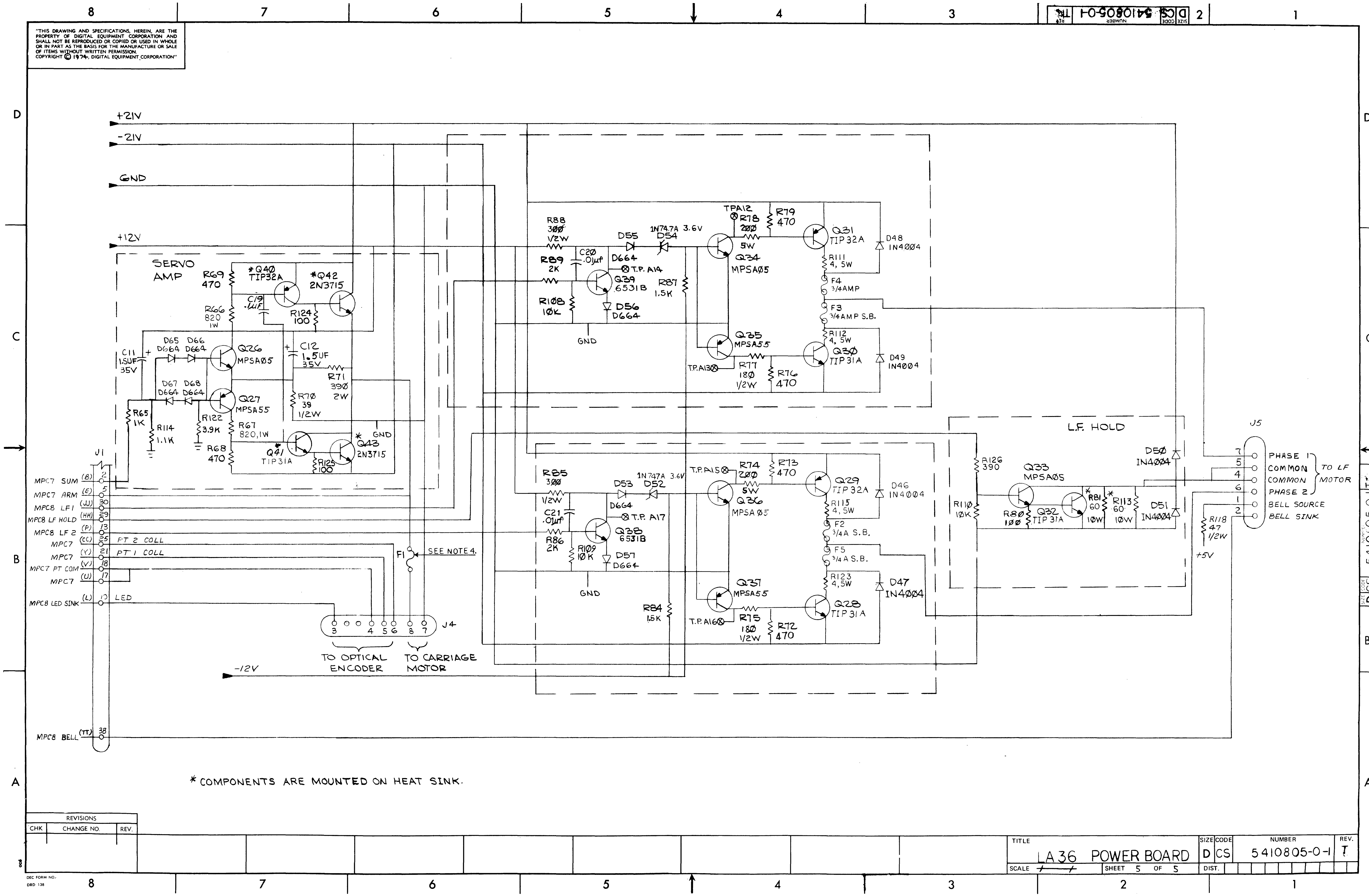



* COMPONENTS ARE MOUNTED ON HEAT SINK.
** DIODES D59 THRU D62 ARE MR752

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

REVISIONS: CHK | CHANGE NO. | REV.

DEC FORM NO. DRD 138



+21V
-21V
GND
+12V
SERVO AMP
R69 470
*Q40 TIP32A
*Q42 2N3715
R66 820 1W
C19 .1μF
R124 100
C11 1.5UF 35V
D65 D66 D664 D664
Q26 MPSA05
C12 1.5UF 35V
R71 390 2W
D67 D68 D664 D664
Q27 MPSA55
R70 39 1/2W
R65 1K
R114 1.1K
R122 3.9K
R67 820,1W
R68 470
Q41 TIP31A
* Q43 2N3715
R125 100
GND
J1
MPC7 SUM
MPC7 ARM
MPC8 LF1
MPC8 LF HOLD
MPC8 LF 2
MPC7
MPC7
MPC7 PT COM
MPC7
MPC8 LED SINK
PT 2 COLL
PT 1 COLL
LED
F1
SEE NOTE 4.
J4
TO OPTICAL ENCODER
TO CARRIAGE MOTOR
-12V
MPC8 BELL
R88 300 1/2W
R89 2K
C20 .01μf
D55
1N747A 3.6V D54
D664
T.P. A14
Q39 6531B
R87 1.5K
R108 10K
D56 D664
GND
TPA12
R78 200 5W
R79 470
Q34 MPSA05
Q31 TIP 32A
D48 IN4004
R111 4, 5W
F4 3/4AMP
F3 3/4AMP S.B.
R112 4, 5W
Q35 MPSA55
Q30 TIP31A
D49 IN4004
T.P.A13
R77 180 1/2W
R76 470
R85 300 1/2W
C21 .01μf
R86 2K
D53
1N747A 3.6V D52
D664
T.P. A17
Q38 6531B
R109 10K
D57 D664
GND
T.P.A15
R74 200 5W
R73 470
Q36 MPSA05
Q29 TIP 32A
D46 IN4004
R115 4, 5W
F2 3/4A S.B.
F5 3/4A S.B.
R123 4,5W
D47 IN4004
Q37 MPSA55
Q28 TIP 31A
R84 1.5K
T.P.A16
R75 180 1/2W
R72 470
L.F. HOLD
R126 390
Q33 MPSA05
D50 IN4004
R110 10K
R80 100
Q32 TIP 31A
*R81 60 10W
*R113 60 10W
D51 IN4004
R118 47 1/2W
+5V
J5
PHASE 1
COMMON
COMMON
PHASE 2
BELL SOURCE
BELL SINK
TO LF MOTOR
* COMPONENTS ARE MOUNTED ON HEAT SINK.
REVISIONS
CHK
CHANGE NO.
REV.
TITLE
LA36 POWER BOARD
SIZE D
CODE CS
NUMBER 5410805-0-1
REV. T
SCALE
SHEET 5 OF 5
DIST.
DEC FORM NO.
DRD 138

## Signal Glossary for M7728
## Logic Board

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

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

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

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

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

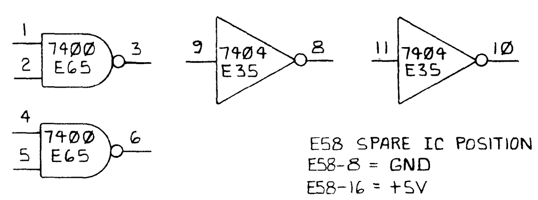
## Signal Glossary for M7728 (Cont)
## Logic Board

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

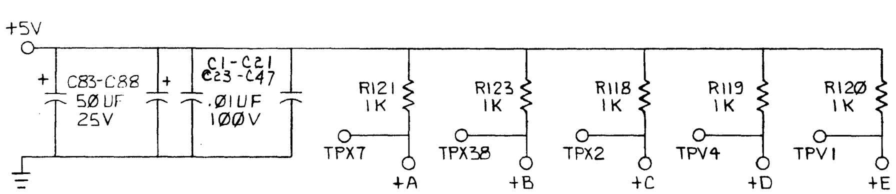
# NOTES:

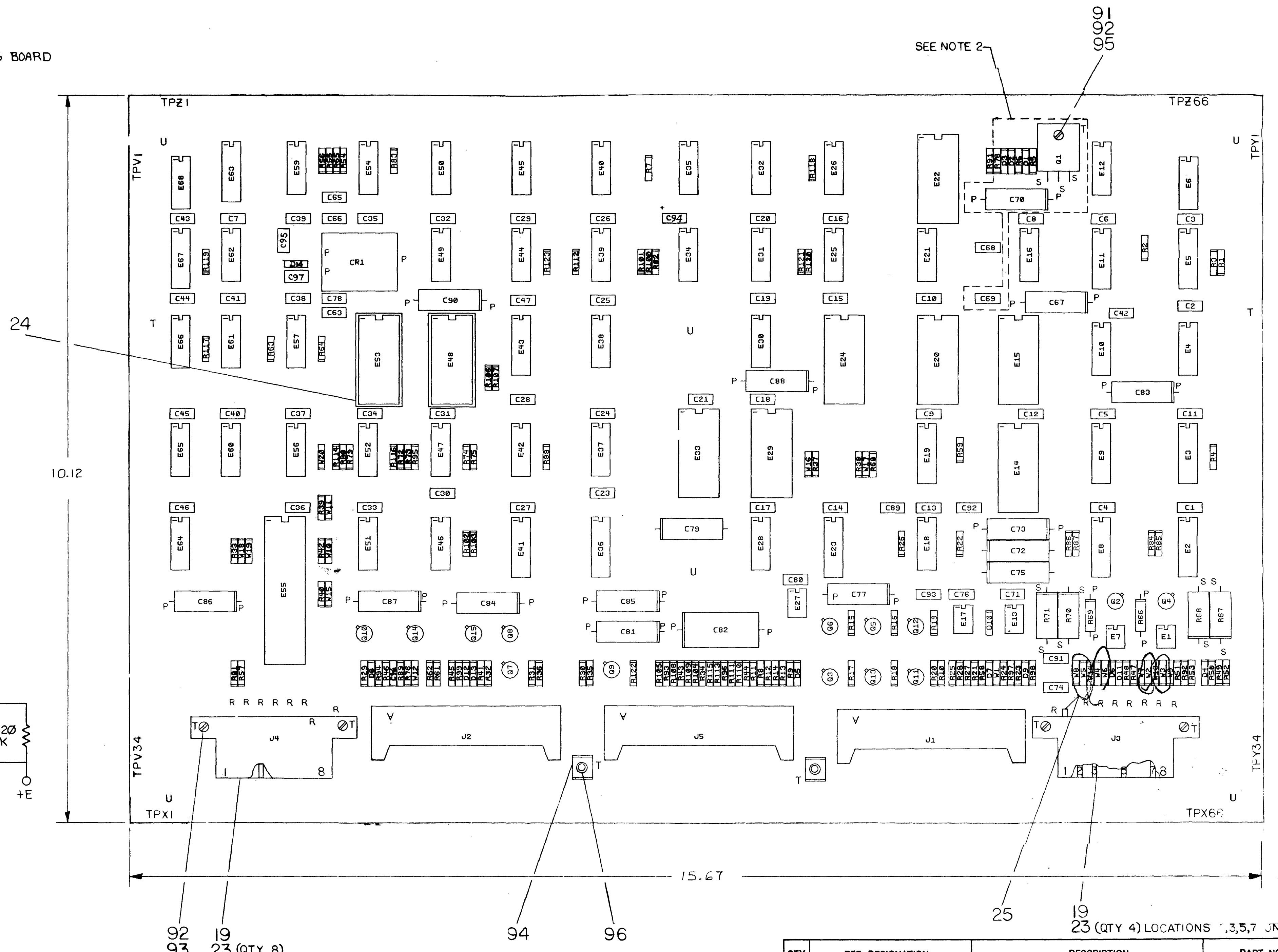
1. CONNECTORS:
   - J1 → J1 POWER BOARD
   - J2 → KEYBOARD
   - J3 → 20MA. SERIAL LINE
   - J4 → OPTIONAL INTERFACE PORT
   - J5 → J5 EXPANDER OPTION MOUNTING BOARD
2. COMPONENTS WITHIN OUTLINE NOT INSERTED IN PREFERRED CONFIGURATION
3. REF DES NOT USED ARE: C60, C61, C62, C64, C48-C58
4. MAXIMUM REF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

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.: B

| REV. | CHANGE NO. | CHK |
|---|---|---|
| B | M7728-00001 R. LOMICKA | J. Carter 6/25/75 |
| C | M7728-00002 J. BITTO | R. Lomicka 7-14-75; 11-24-75; J. Bitto 12/11/75 |

REVISIONS

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|

SEMICONDUCTOR CONVERSION CHART

DRN. Robert Koppenal DATE 5-23-75
CHK'D. James L. Lewis DATE 5-28-75
ENG. Roy Lomicka DATE 5-28-75
PROJ. ENG. DATE
PROD. DATE

NEXT HIGHER ASSY

digital

TITLE LA36 MPC

SIZE D CODE CS NUMBER M7728-0-1 REV. C

SCALE

SHEET OF 9

DIST.

DEC FORM NO. DRD 135.8

QTY/VAR

| PEFERRED | SUBSTITUTE | REF. DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|---|
| REF | REF | | ASSY/DRILLING HOLE LAYOUT | C-AH-M7728-Ø-5 | 1 |
| REF | REF | | MODULE ECO HISTORY | B-MH-M7728-Ø-6 | 2 |
| 1 | 1 | | ETCHED CIRCUIT BOARD | 5011682 | 3 |
| 4 | 4 | C71,C76,C80,C97 | CAP39 PF 100V 5% DIPPED MICA | 1000010 | 4 |
| 1 | 1 | C91 | CAP 470PF 100V 5% DIPPED MICA | 1000024 | 5 |
| 1 | 1 | C82 | CAP .22UF 100V 10% MYLAR | 1000037 | 6 |
| 3 | 3 | C72,C75,C79 | CAP .047UF 100V 10% MYLAR | 1000051 | 7 |
| 5 | 6 | C67,C73,C77,C81,C90 | CAP 25UF 25V AL EL | 1000075 | 8 |
| 53 | 54 | C23-C47 C1-C21,C63,C68,C74,C78,C89,C92-C98 | CAP .01UF 100V DISC | 1001610-01 | 9 |
| 3 | 3 | C65,C66,C96 | CAP .005UF 100V DISC | 1001765 | 10 |
| 6 | 6 | C83-C88 | CAP 50UF 25V AL EL | 1001796 | 11 |
| 0 | 1 | | DIODE D662 | 1100113 | 12 |
| 5 | 5 | D5,D7,D8,D12,D14 | DIODE D664 | 1100114 | 13 |
| 2 | 2 | D9,D10 | DIODE IN748A 3.9V 5% ZENER | 1100122 | 14 |
| 1 | 1 | D4 | DIODE IN746A 3.3V 5% ZENER | 1104860 | 15 |
| 1 | 1 | D11 | DIODE MCL1301 | 1105610 | 16 |
| 1 | 1 | D6 | DIODE IN4004 | 1105796 | 17 |
| 1 | 3 | D13 | DIODE 4M5,1AZ1 5.1V 1% ZENER | 1105873 | 18 |
| 2 | 2 | J3,J4 | CONN 8 PIN MATE-N-LOCK(HOUSING) | 1209340-00 | 19 |
| 3 | 3 | J1,J2,J5 | CONN 40 PIN BERG | 1209941-02 | 20 |
| ~~3~~ | ~~3~~ | ~~J1,J2,J5~~ | ~~LATCH LEFT FOR BERG~~ | ~~1209941-03~~ | ~~21~~ |
| ~~3~~ | ~~3~~ | ~~J1,J2,J5~~ | ~~LATCH, RIGHT FOR BERG~~ | ~~1209941-04~~ | ~~22~~ |
| 12 | 12 | | SOCKET, MATE-N-LOCK 61320-3 | 1209456-01 | 23 |
| 2 | 4 | E48,E53 | SOCKET, IC,24 PIN | 1210693 | 24 |
| 1 | 1 | J3 | KEYING PLUG MATE-N-LOCK | 1211595 | 25 |
| 1 | 1 | R50 | RES 47 ¼W 5% CC | 1300202 | 26 |
| 5 | 6 | R7,R33,R58,R91,R46 | RES 100 ¼W 5% CC | 1300229 | 27 |
| 1 | 1 | R47 | RES 150, ¼W 5% CC | 1300250 | 28 |
| 2 | 2 | R66,R69 | RES 180 ¼W 5% CC | 1300260 | 29 |
| 2 | 2 | R49,R89 | RES 220 ¼W 5% CC | 1300271 | 30 |
| 1 | 1 | R30 | RES 330 ¼W 5% CC | 1300295 | 31 |
| 3 | 3 | R29,R34,R88 | RES 470 ¼W 5% CC | 1300316 | 32 |
| 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 | R67,R68,R70,R71 | RES 1K 1W 5% CC | 1300368 | 34 |
| 1 | 1 | R31 | RES 1.5K ¼W 5% CC | 1300391 | 35 |
| 26 | 26 | R37-R48,R53,R93,R96,R102-R109, R110,R111,R113-R117, R100 | RES 10K ¼W 5% CC | 1300479 | 36 |
| 1 | 1 | R16 | RES 59.0K ¼W 1% 100PPM MF RN55D-F | 1300525 | 37 |
| 2 | 2 | R97,R98 | RES 10 ¼W 5% CC | 1301317 | 38 |
| 3 | 3 | R13,R22,R26 | RES 180 ¼W 5% CC | 1301322 | 39 |
| 1 | 1 | R48 | RES 68K ¼W 5% CC | 1301327 | 40 |
| 2 | 2 | R11,R92 | RES 820 ¼W 5% CC | 1301775 | 41 |
| 6 | 6 | R36,R54,R56,R57,R59,R60 | RES 5.6K ¼W 5% CC | 1301874 | 42 |
| 8 | 8 | R72-R75,R79-R81-R95 | RES 47K ¼W 5% CC | 1302177 | 43 |
| 6 | 6 | R82-R87, | RES 2K ¼W 5% CC | 1302388 | 44 |
| 1 | 1 | R51 | RES 470K ¼W 5% CC | 1302398 | 45 |
| 2 | 2 | R27,R23 | RES 511 ¼W 1% 100PPM MF RN55 D-F | 1302411 | 46 |
| 1 | 1 | R8 | RES 100K ¼W 5% CC | 1302466 | 47 |
| 1 | 1 | R18 | RES 14.7K ¼W 1% 100PPM MF RN55 D-F | 1302941 | 48 |
| 2 | 2 | R12,R14 | RES 1.00K ¼W 1% 100PPM MF RN55 D-F | 1303114 | 49 |
| 2 | 2 | R24,R28 | RES 5.11K ¼W 1% 100PPM MF RN55 D-F | 1304854 | 50 |
| 1 | 1 | R19 | RES 3.48K ¼W 1% 100PPM MF RN55 D-F | 1305114 | 51 |

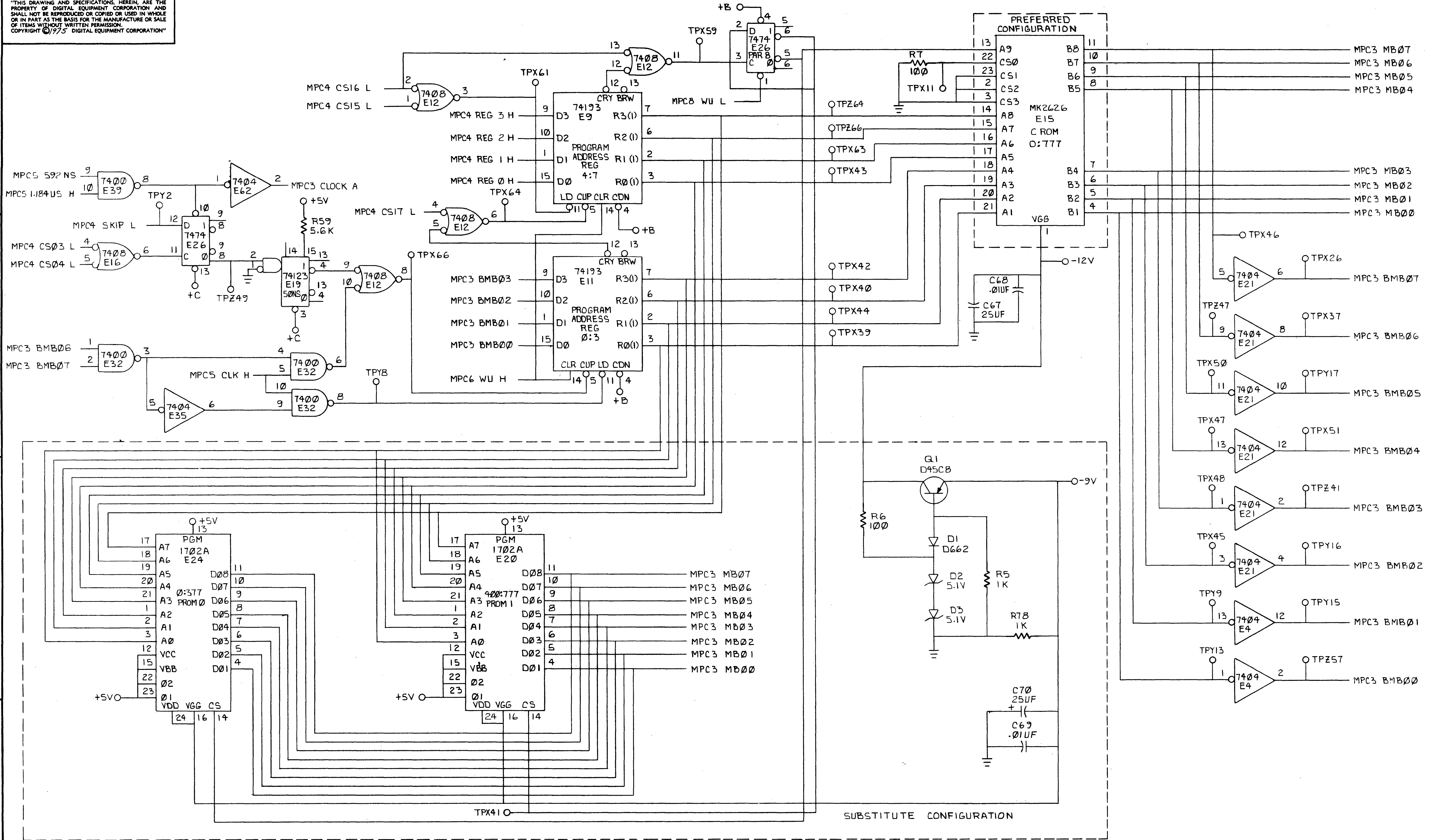
QTY/VAR

| PEFERRED | SUBSTITUTE | REF. DESIGNATION | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|---|---|
| 1 | 1 | R15 | RES 121K ¼W 1% MF | 1305255 | 52 |
| 2 | 2 | R9,R10 | RES 232K ¼W 1% MF | 1305424 | 53 |
| 2 | 2 | R21,R25 | RES 1M ¼W 5% CC | 1309595 | 54 |
| 1 | 1 | R17 | RES 30.1K ¼W 1% MF | 1311594 | 55 |
| 1 | 1 | R20 | RES 2.15K ¼W 1% MF | 1311653 | 56 |
| 0 | 1 | | TRANSISTOR D45C8 | 1510598 | 57 |
| 10 | 10 | Q2-Q6,Q10-Q14 | TRANSISTOR MPSA05 | 1510705 | 58 |
| 3 | 3 | Q7,Q8,Q15 | TRANSISTOR MPSA55 | 1510706 | 59 |
| 1 | 1 | Q9 | TRANSISTOR DEC6531B | 1509338 | 60 |
| 1 | 1 | CR1 | CRYSTAL 1.6896 MHZ(WIRE LEADS) | 1811689 | 61 |
| 11 | 11 | E25,E26,E30,E31,E34,E37,E40 E44,E45,E50,E54 | I.C. 7474 | 1905547 | 62 |
| 6 | 6 | E32,E38.E39,E49,E60,E65 | I.C. 7400 | 1905575 | 63 |
| 4 | 4 | E10,E47,E52,E57 | I.C. 7401 | 1905590 | 64 |
| 2 | 2 | E66,E68 | I.C. 7493A | 1909654 | 65 |
| 6 | 6 | E4,E21,E28,E35,E56,E62 | I,C. 7404 | 1909686 | 66 |
| 2 | 2 | E22,E33 | I.C. 74154 | 1909701 | 67 |
| 1 | 1 | E18 | I.C. 7413 | 1909989 | 68 |
| 3 | 3 | E5.E9,E11 | I.C. 74193 | 1910018 | 70 |
| 1 | 1 | E23 | I.C. 7442 | 1910046 | 71 |
| 1 | 1 | E61 | I.C. 7437 | 1910091 | 72 |
| 1 | 1 | E43 | I.C. 74190 | 1910095 | 73 |
| 2 | 2 | E14,E29 | I.C. 74150 | 1910153 | 74 |
| 5 | 5 | E6,E12,E16,E42,E64 | I.C. 7408 | 1910155 | 75 |
| 3 | 3 | E13,E17,E27 | I,C. LM301AN DIP | 1910282 | 76 |
| 3 | 3 | E3,E36,E41 | I.C. 7489 | 1910396 | 77 |
| 1 | 1 | E19 | I.C. 74123 | 1910436 | 78 |
| 1 | 1 | E55 | I.C. UART | 1910459 | 79 |
| 2 | 2 | E63,E67 | I.C. 74161 | 1910650 | 80 |
| 2 | 2 | E2,E8 | I.C. 74175 | 1910651 | 81 |
| 2 | 2 | E46,E51 | I.C. 8093 | 1910837 | 82 |
| 1 | 1 | E59 | I.C. 8640 | 1911469 | 83 |
| 2 | 2 | E1,E7 | I.C. SOC75, 4N26 | 1911998 | 84 |
| 0 | 1 | | PROM,1702A,PROGRAMMED PROMØ | 23082A4 | 85 |
| 0 | 1 | | PROM,1702A,PROGRAMMED PROM1 | 23083A4 | 86 |
| 1 | 1 | E53 | ROM,MK2627(ALPHA SET,ASCII ) | 23070A6 | 87 |
| 1 | 1 | E48 | ROM,MK2626(NO.SET, ASCII) | 23071A6 | 88 |
| 1 | 0 | E15 | ROM,MK2628(CONTROL PROGRAM) | 23082A6 | 89 |
| 0 | 1 | | SCREW,SLOTTED BIND HD 4.40 x5/16 | 9006010-4 | 90 |
| 0 | 1 | | NUT, KEP 4-40 | 9006557 | 91 |
| 4 | 4 | | WASHER, FLAT, NYLON #6 | 9006707 | 92 |
| 4 | 4 | | EYELET(MATE-N-LOCK MOUNTING) | 9006732 | 93 |
| 2 | 2 | | FASTON TERMINAL | 9007113 | 94 |
| 0 | A/R | | THERMAL COMPOUND | 9008268 | 95 |
| 2 | 2 | | EYELET (FASTEN MOUNTING) | 9009000 | 96 |
| 7 | 7 | W1-W5,W18,W20 | WIRE, INSULATED JUMPER | 9009185 | 97 |
| 1 | 1 | C95 | CAP .1 UF 100V 20% DISC | 1000030 | 98 |
| 1 | 1 | R101 | RES 270 1/4W 5% CC | 1301972 | 99 |
| 1 | 1 | C94 | CAP 39UF 10V 10% S.TANT | 1000076 | 100 |
| A/R | A/R | | WIRE, INSULATED JUMPER 30AWG | 9105740 | 101 |
| A/R | A/R | | CEMENT, PERMA BOND #102 | 9009157 | 102 |

| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

| TITLE | SIZE | CODE | NUMBER | REV. |
|---|---|---|---|---|
| LA36 MPC | D | CS | M7728-Ø-1 | C |

SCALE —— SHEET 2 OF 9 DIST.



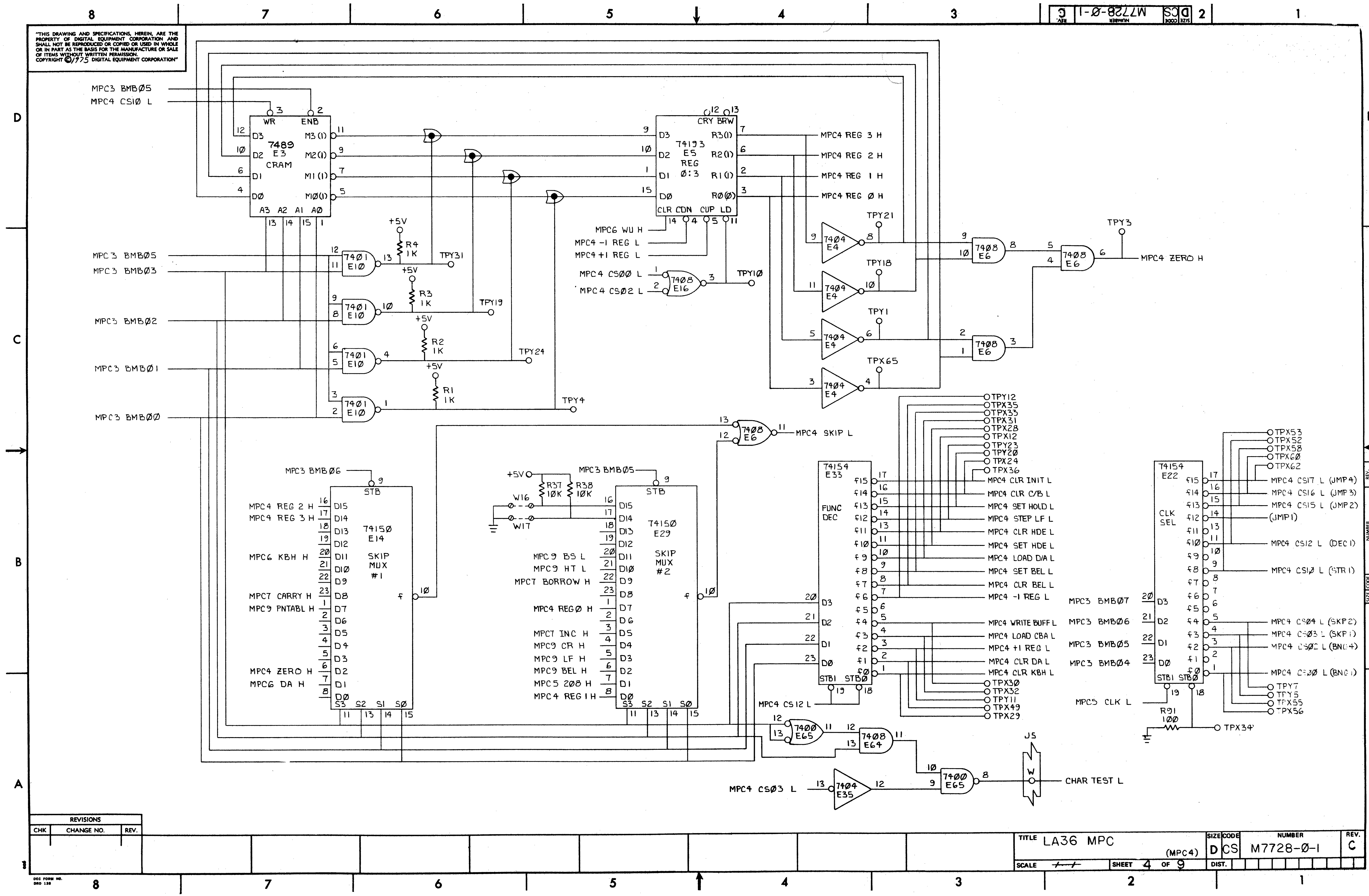

| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

TITLE LA36 MPC (MPC3)

SIZE D CODE CS NUMBER M7728-Ø-1 REV. C

SCALE —/— SHEET 3 OF 9

DEC FORM NO. DRD 138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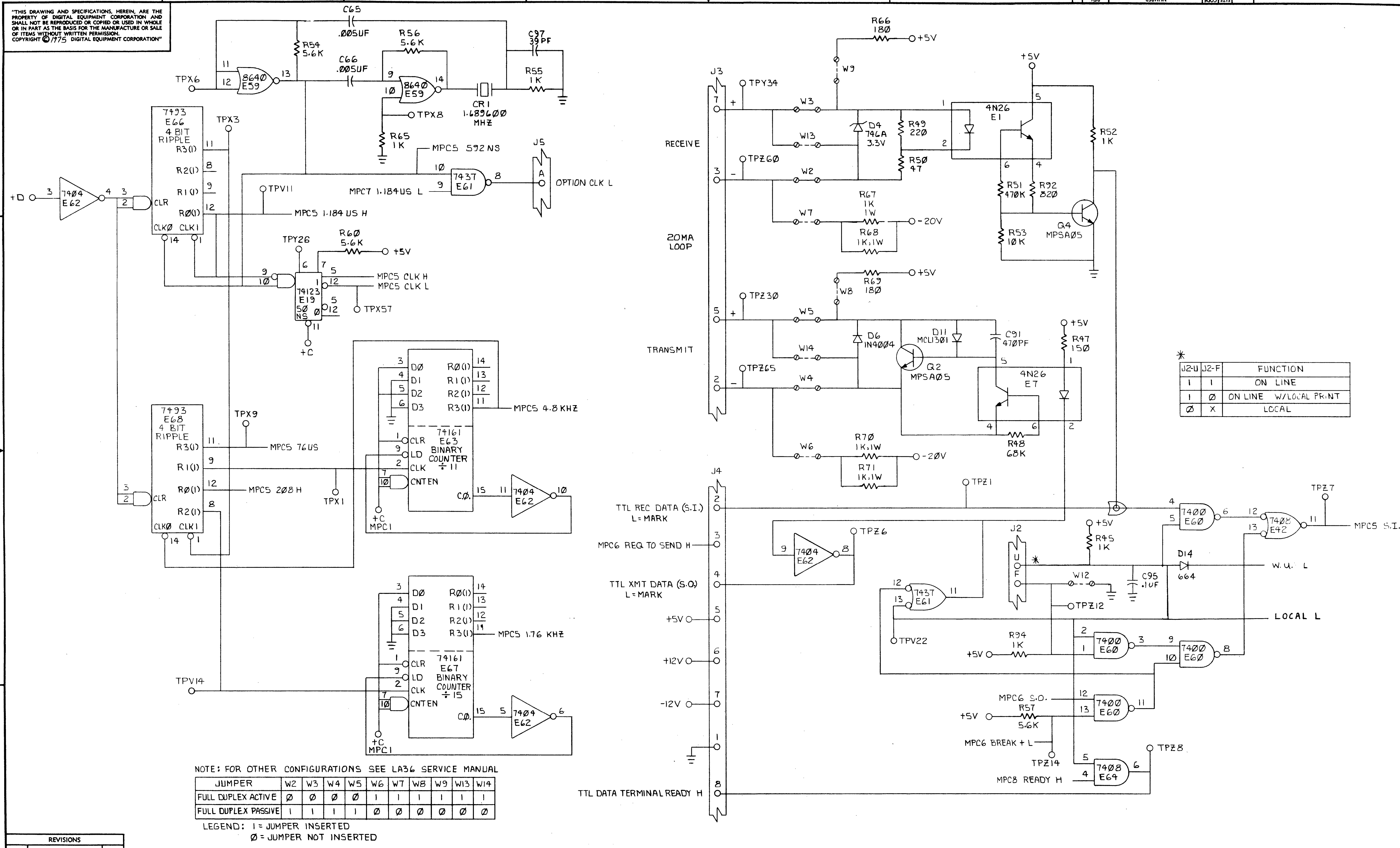
MPC3 BMBØ5
MPC4 CSIØ L
7489 E3 CRAM
74193 E5 REG Ø:3
MPC6 WU H
MPC4 -1 REG L
MPC4 +1 REG L
MPC4 CSØØ L
MPC4 CSØ2 L
7408 E16
MPC4 REG 3 H
MPC4 REG 2 H
MPC4 REG 1 H
MPC4 REG Ø H
7404 E4
7408 E6
MPC4 ZERO H
TPY21
TPY18
TPY1
TPX65
TPY3
TPY31
TPY19
TPY24
TPY4
TPY1Ø
MPC3 BMBØ5
MPC3 BMBØ3
MPC3 BMBØ2
MPC3 BMBØ1
MPC3 BMBØØ
7401 E1Ø
+5V
R4 1K
R3 1K
R2 1K
R1 1K
MPC4 SKIP L
MPC3 BMBØ6
74150 E14 SKIP MUX #1
MPC4 REG 2 H
MPC4 REG 3 H
MPC6 KBH H
MPC7 CARRY H
MPC9 PNTABL H
MPC4 ZERO H
MPC6 DA H
R37 1ØK
R38 1ØK
W16
W17
74150 E29 SKIP MUX #2
MPC9 BS L
MPC9 HT L
MPC7 BORROW H
MPC4 REGØ H
MPC7 INC H
MPC9 CR H
MPC9 LF H
MPC9 BEL H
MPC5 2Ø8 H
MPC4 REG1 H
74154 E33 FUNC DEC
TPY12
TPX35
TPX33
TPX31
TPX28
TPX12
TPY23
TPY2Ø
TPX24
TPY36
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
TPX3Ø
TPX32
TPY11
TPX49
TPX29
MPC4 CS12 L
7400 E65
7408 E64
7404 E35
MPC4 CSØ3 L
JS
W
CHAR TEST L
74154 E22 CLK SEL
TPX53
TPX52
TPX58
TPX6Ø
TPX62
MPC4 CS17 L (JMP4)
MPC4 CS16 L (JMP3)
MPC4 CS15 L (JMP2)
(JMP1)
MPC4 CS12 L (DEC1)
MPC4 CS1Ø L (STR1)
MPC3 BMBØ7
MPC3 BMBØ6
MPC3 BMBØ5
MPC3 BMBØ4
MPC4 CSØ4 L (SKP2)
MPC4 CSØ3 L (SKP1)
MPC4 CSØ2 L (BNC4)
MPC4 CSØØ L (BNC1)
TPY7
TPY5
TPX55
TPX56
MPC5 CLK L
R91 1ØØ
TPX34
REVISIONS
CHK
CHANGE NO.
REV.
TITLE LA36 MPC (MPC4)
SIZE D CODE CS NUMBER M7728-Ø-1 REV. C
SCALE
SHEET 4 OF 9
DIST.
DEC FORM NO. DRD 138




*

| 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. C

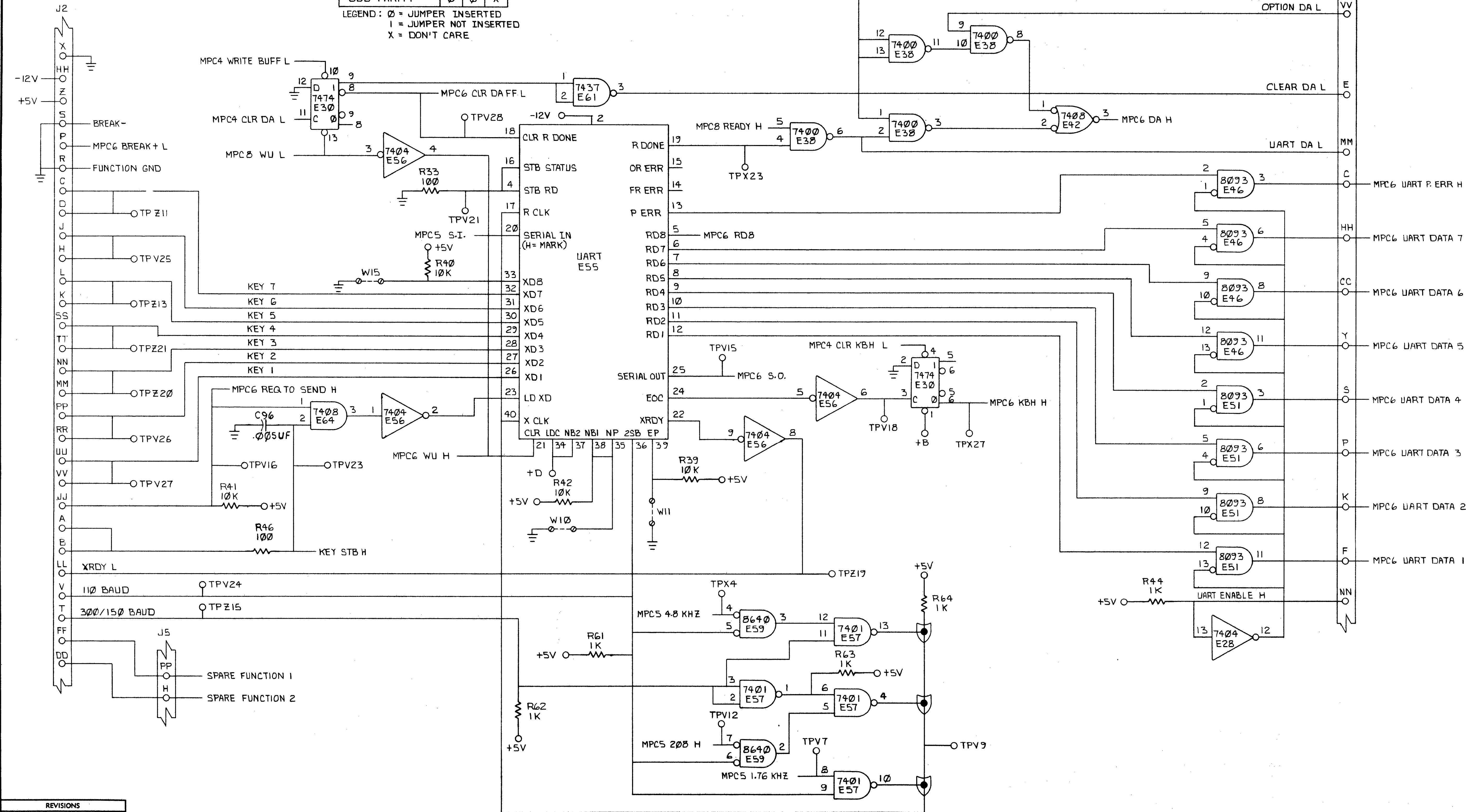
SCALE — SHEET 5 OF 9 DIST.

DEC FORM NO. DRD 13B

| FUNCTION | J2-V | J2-T |
|---|---|---|
| 150 BAUD | Ø | Ø |
| 300 BAUD | Ø | 1 |
| 110 BAUD | 1 | X |

| FUNCTION | W10 | W11 | W15 |
|---|---|---|---|
| 8TH BIT MARKING | 1 | X | 1 |
| 8TH BIT SPACEING | 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



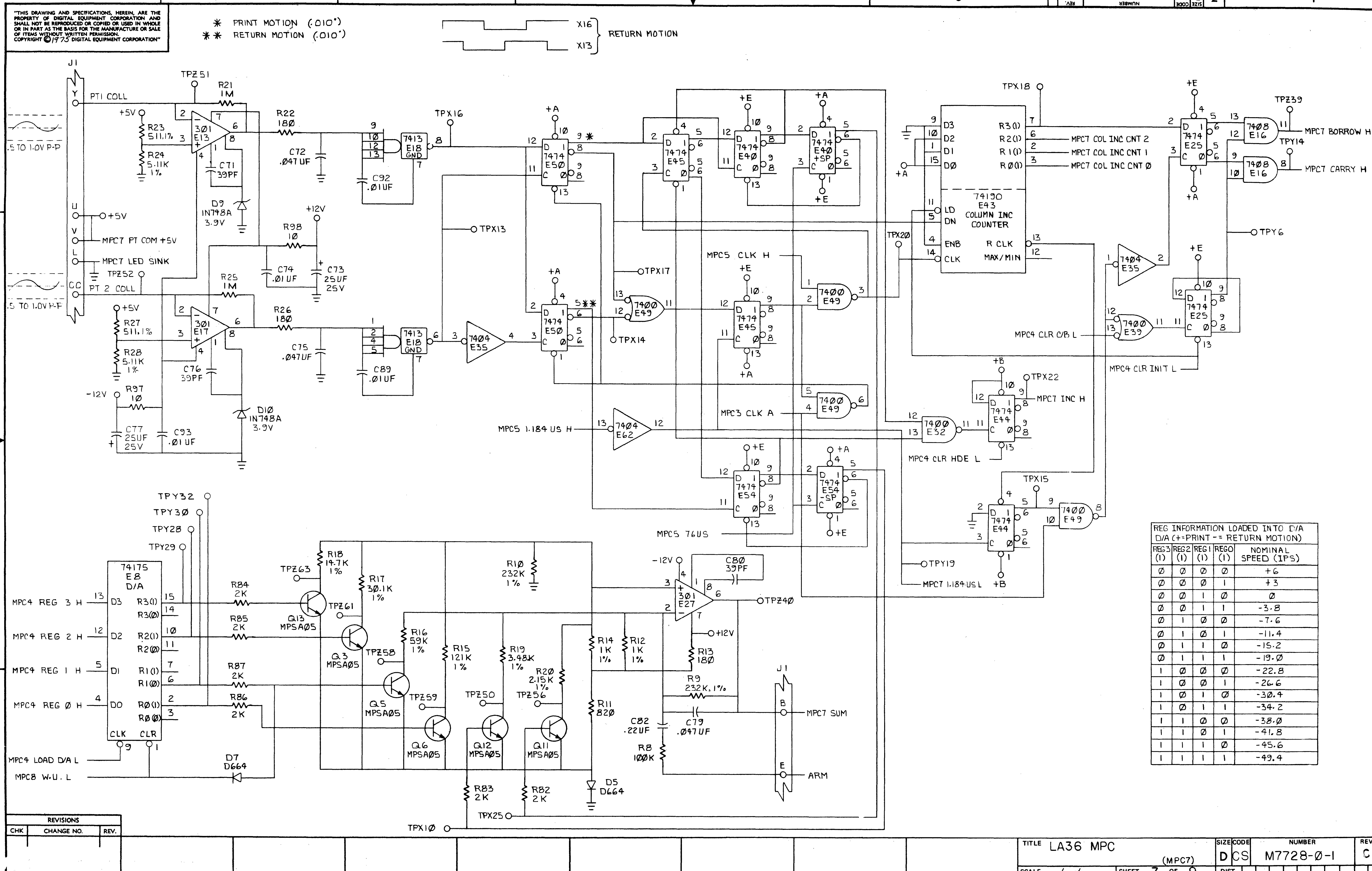

| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

TITLE LA36 MPC (MPC6)

SIZE D CODE CS NUMBER M7728-Ø-1 REV. C

SCALE — SHEET 6 OF 9

DEC FORM NO. DRD 138



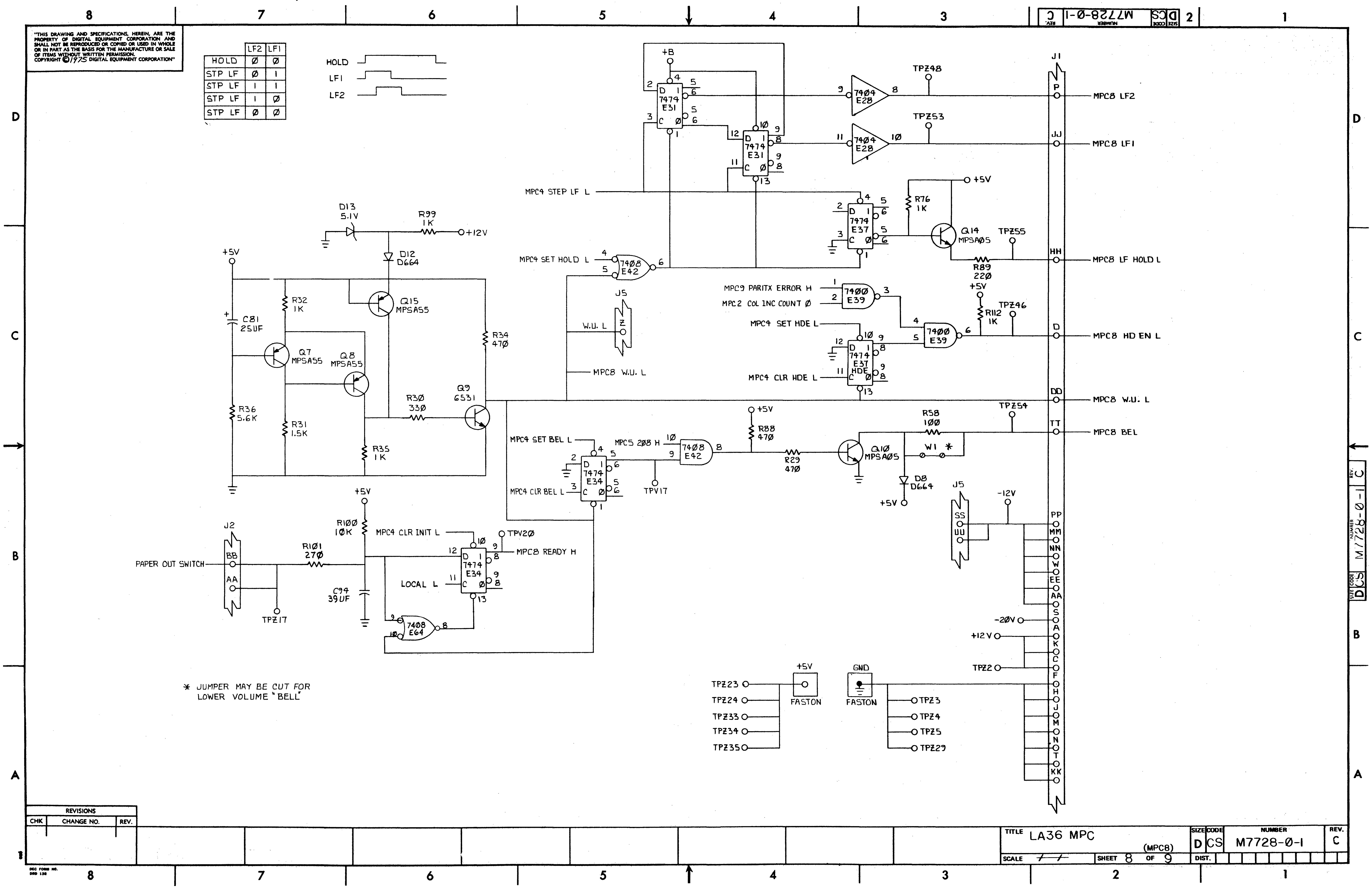

REG INFORMATION LOADED INTO D/A (+=PRINT -= RETURN MOTION)

| REG3 (1) | REG2 (1) | REG1 (1) | REG0 (1) | NOMINAL SPEED (IPS) |
|---|---|---|---|---|
| Ø | Ø | Ø | Ø | +6 |
| Ø | Ø | Ø | 1 | +3 |
| Ø | Ø | 1 | Ø | Ø |
| Ø | Ø | 1 | 1 | -3.8 |
| Ø | 1 | Ø | Ø | -7.6 |
| Ø | 1 | Ø | 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 |

TITLE LA36 MPC (MPC7)

SIZE D CODE CS NUMBER M7728-Ø-1 REV. C

SCALE — SHEET 7 OF 9



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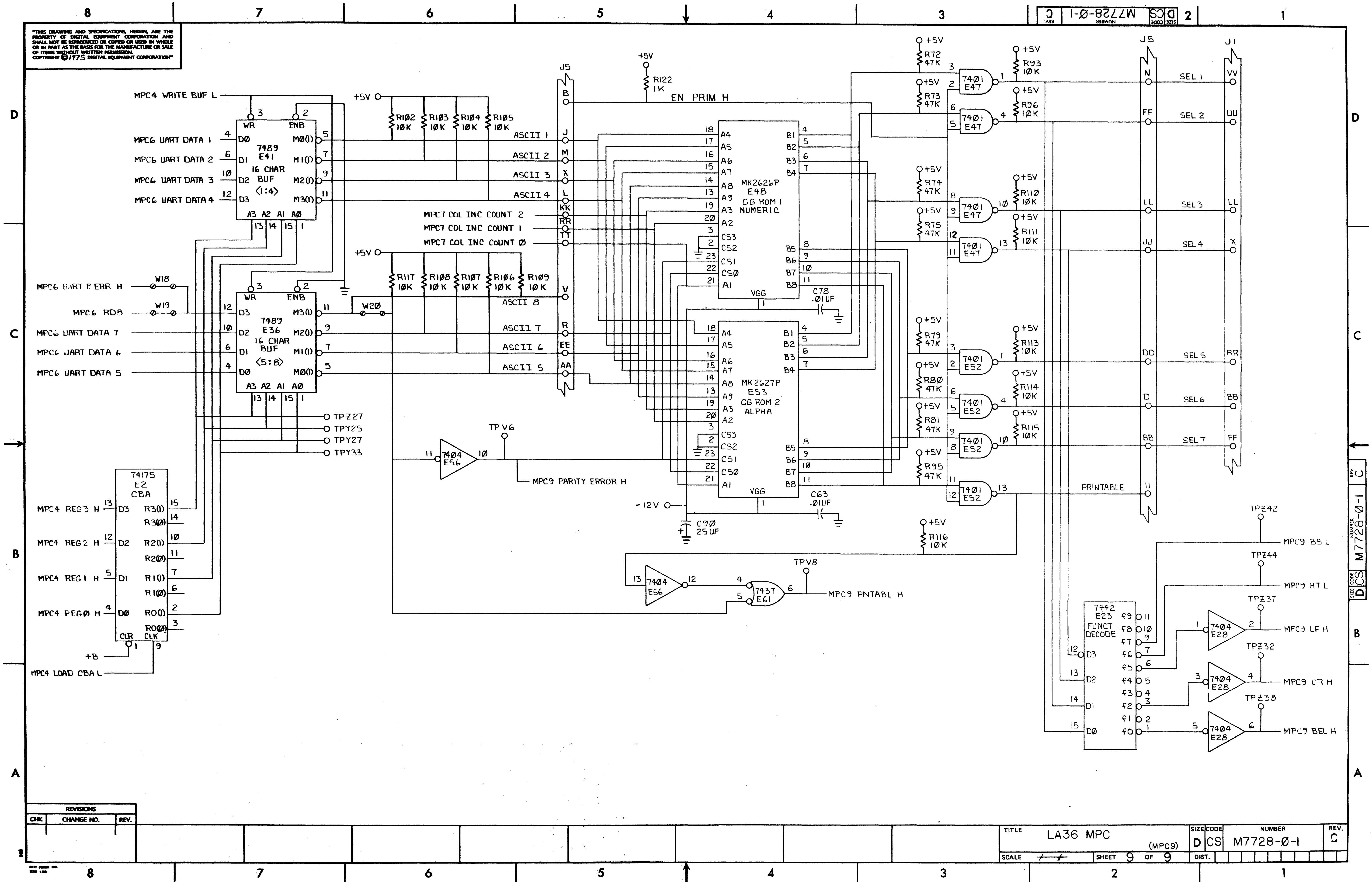
LF2 LF1
HOLD Ø Ø
STP LF Ø 1
STP LF 1 1
STP LF 1 Ø
STP LF Ø Ø
HOLD
LF1
LF2
+B
7474 E31
7404 E28
TPZ48
TPZ53
J1
MPC8 LF2
MPC8 LF1
MPC4 STEP LF L
+5V
R76 1K
7474 E37
Q14 MPSAØ5
TPZ55
MPC8 LF HOLD L
R89 22Ø
D13 5.1V
R99 1K
+12V
D12 D664
MPC4 SET HOLD L
7408 E42
MPC9 PARITX ERROR H
MPC2 COL INC COUNT Ø
7400 E39
R112 1K
TPZ46
MPC4 SET HDE L
MPC8 HD EN L
MPC4 CLR HDE L
7474 E37 HDE
J5
W.U. L
MPC8 W.U. L
MPC8 W.U. L
C81 25UF
R32 1K
Q15 MPSA55
R34 47Ø
Q7 MPSA55
Q8 MPSA55
R36 5.6K
R31 1.5K
R3Ø 33Ø
Q9 6531
R35 1K
TPZ54
R58 1ØØ
MPC8 BEL
MPC4 SET BEL L
MPC5 2Ø8 H
7408 E42
R88 47Ø
R29 47Ø
Q1Ø MPSAØ5
W1 *
7474 E34
MPC4 CLR BEL L
TPV17
D8 D664
-12V
R1ØØ 1ØK
MPC4 CLR INIT L
TPV2Ø
MPC8 READY H
J2
PAPER OUT SWITCH
R1Ø1 27Ø
LOCAL L
C94 39UF
TPZ17
7408 E64
-2ØV
+12V
TPZ2
* JUMPER MAY BE CUT FOR LOWER VOLUME "BELL"
TPZ23
TPZ24
TPZ33
TPZ34
TPZ35
+5V FASTON
GND FASTON
TPZ3
TPZ4
TPZ5
TPZ29
REVISIONS
CHK CHANGE NO. REV.
TITLE LA36 MPC (MPC8)
SCALE SHEET 8 OF 9
SIZE D CODE CS NUMBER M7728-Ø-1 REV. C
DIST.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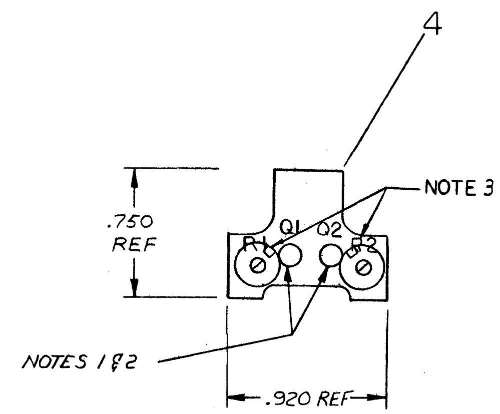
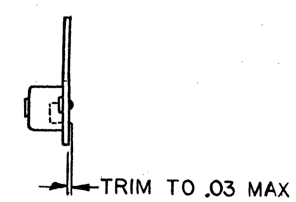
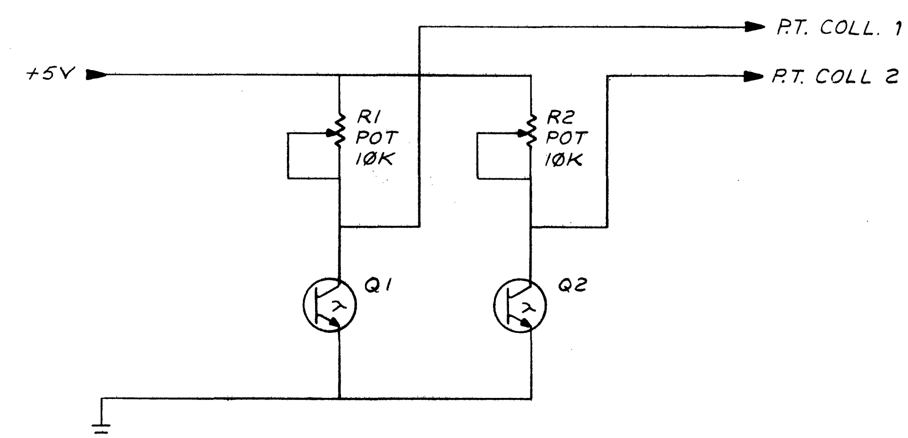
MPC4 WRITE BUF L
MPC6 UART DATA 1
MPC6 UART DATA 2
MPC6 UART DATA 3
MPC6 UART DATA 4
7489 E41 16 CHAR BUF (1:4)
+5V
R102 10K
R103 10K
R104 10K
R105 10K
ASCII 1
ASCII 2
ASCII 3
ASCII 4
J5
+5V
R122 1K
EN PRIM H
MK2626P E48 CG ROM 1 NUMERIC
MPC7 COL INC COUNT 2
MPC7 COL INC COUNT 1
MPC7 COL INC COUNT Ø
R117 10K
R108 10K
R107 10K
R106 10K
R109 10K
ASCII 8
MPC6 UART P ERR H
W18
MPC6 RD8
W19
W20
MPC6 UART DATA 7
MPC6 UART DATA 6
MPC6 UART DATA 5
7489 E36 16 CHAR BUF (5:8)
ASCII 7
ASCII 6
ASCII 5
C78 .01UF
MK2627P E53 CG ROM 2 ALPHA
TPZ27
TPY25
TPY27
TPY33
TP V6
7404 E56
MPC9 PARITY ERROR H
-12V
C63 .01UF
C90 25 UF
74175 E2 CBA
MPC4 REG3 H
MPC4 REG2 H
MPC4 REG1 H
MPC4 REGØ H
+B
MPC4 LOAD CBA L
TPV8
7404 E56
7437 E61
MPC9 PNTABL H
+5V
R116 10K
R72 47K
R73 47K
R93 10K
R96 10K
7401 E47
R74 47K
R75 47K
R110 10K
R111 10K
R79 47K
R80 47K
R81 47K
R95 47K
R113 10K
R114 10K
R115 10K
7401 E52
J5
J1
SEL 1
SEL 2
SEL 3
SEL 4
SEL 5
SEL 6
SEL 7
PRINTABLE
TPZ42
MPC9 BS L
TPZ44
MPC9 HT L
TPZ37
7442 E23 FUNCT DECODE
7404 E28
MPC9 LF H
TPZ32
MPC9 CR H
TPZ38
MPC9 BEL H
REVISIONS
CHK
CHANGE NO.
REV.
TITLE
LA36 MPC
(MPC9)
SIZE D
CODE CS
NUMBER M7728-Ø-1
REV. C
SCALE
SHEET 9 OF 9
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 | PHOTO TRANSISTOR | 1511906 | 6 |

PARTS LIST

ETCH BOARD REV B

| REV | CHANGE NO. | | |
|---|---|---|---|
| C | 5411049-00002 | J. Chuter 11-6-75 | J. BITTO 11/4/75 |
| B | 5411049-00001 | E. Raymond 2-5-75 | C. BICKOFF 2-12-75 |

REVISIONS

| DEC NO. | EIA NO. | DEC NO. | EIA NO. |
|---|---|---|---|
| | | | |

SEMICONDUCTOR CONVERSION CHART

DRN. H. Dardjian DATE 5/2/74
CHK'D DATE 7-?-74
ENG. C. Hammel DATE 7-12-74
PROJ. ENG. C. Bickoff DATE 7-12-74
PROD. F.P. Cato DATE 7-15-74
NEXT HIGHER ASSY

digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

TITLE LA36 ENCODER PC BOARD PHOTOTRANSISTOR

SIZE D CODE CS NUMBER 5411049-0-1 REV. C

SCALE — SHEET 1 OF 1

DIST.

BRUNING 40-107 15968
DEC FORM NO. DRD-135

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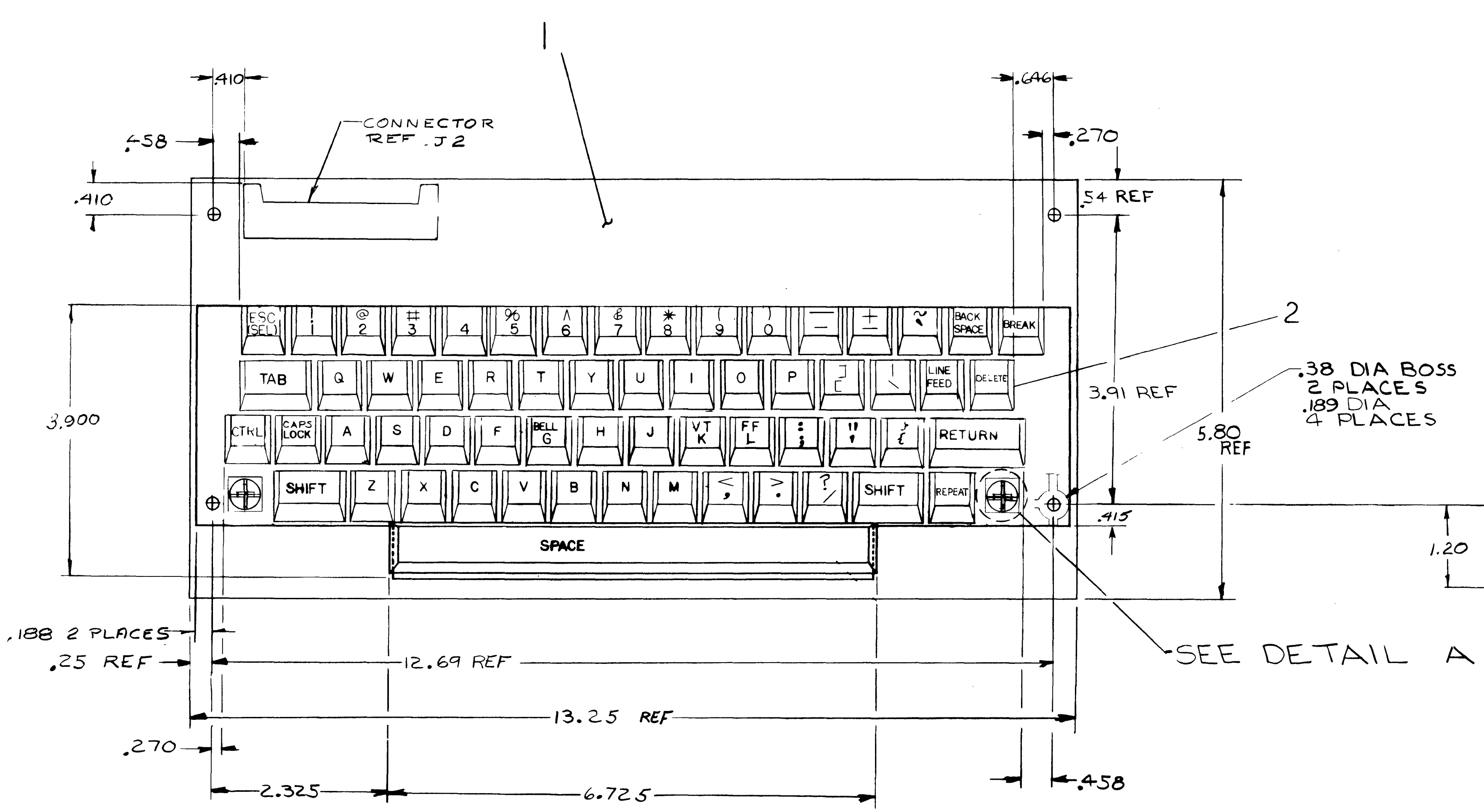
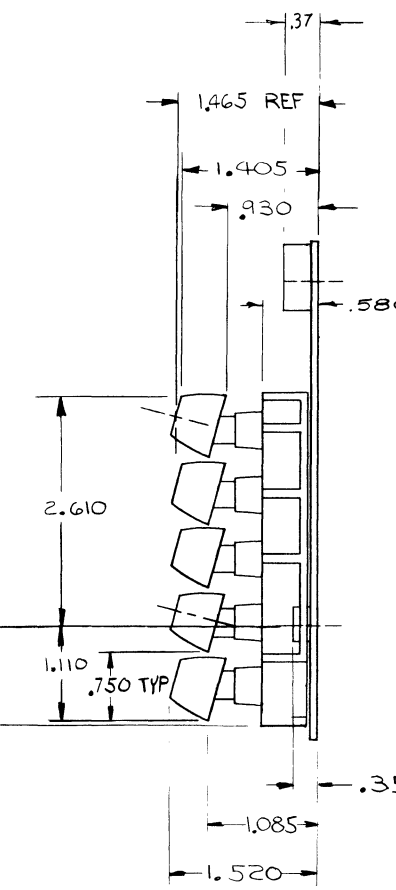
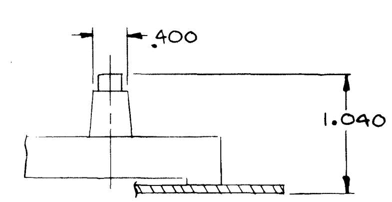
DO NOT SCALE DRAWING

NOTES:

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




DETAIL A
SHOWN WITHOUT
KEYCAP AND ADAPTER

| QTY. | DESCRIPTION | PART NO. | ITEM NO. |
|---|---|---|---|
| 1 | DIE CUT FOLDER | A-PS-9905441 | 5 |
| REF | TEST SPEC | A-SP-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-5410736-01 | 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 Marcault, DATE 5/31/74
CHK'D DATE 7/1/74
ENG. DATE 7/1/74
PROD. ENG. Paul E. Nelson, DATE 7-11-74
PROD. DATE 7/15/74

NEXT HIGHER ASSY. B-DD-LKØ2-Ø
SCALE NONE
SHEET 1 OF 1

digital EQUIPMENT CORPORATION MAYNARD MASSACHUSETTS

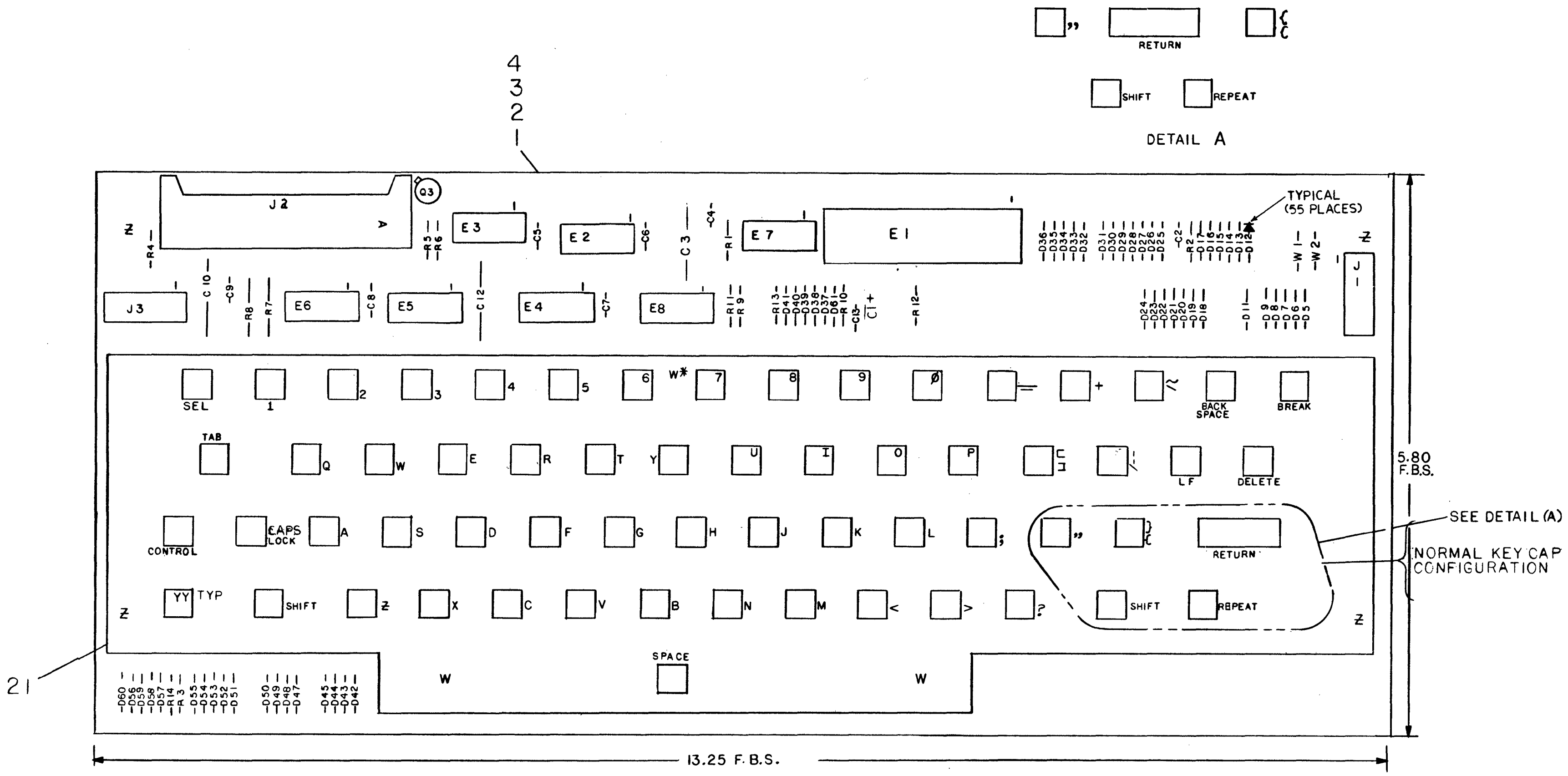
TITLE: 63 KEY KEYBOARD ASSY

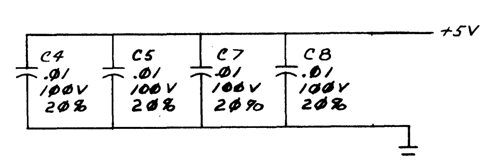
SIZE D, CODE UA, NUMBER LKØ2-Ø-Ø, REV. -

REVISIONS: REV A, CHANGE NO LKØ2-00002, C. BICKOFF, 1-17-75, 1-21-75

DEC FORM NO DRD 100-1

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




| QTY 5410736-YA-0 | QTY 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) | 1218813 | 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 1/4W 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 |

PARTS LIST

ETCH BOARD REV F

SEMICONDUCTOR CONVERSION CHART

| DEC NO. | EIA NO. |
|---|---|
| 1N759A | N.A. |
| D664 | 1N3606 |

REVISIONS

| REV | CHANGE NO. | | CHK |
|---|---|---|---|
| F | 5410736-00005 | J. BITTO 03 Feb 76 | |
| E | 5410736-00003 | P. NELSON 10-1-75 | |
| D | 5410736-00002 REVISED & REDRAWN | PAUL E. NELSON 5-22-75 | |

| | |
|---|---|
| DRN. POIRIER | DATE 1-25-74 |
| CHK'D. | DATE 3-7-75 |
| ENG. P NELSON | DATE 2-4-74 |
| PROJ. ENG. P NELSON | DATE 2-4-74 |
| PROD. | DATE |

NEXT HIGHER ASSY D-UA-LKØ2-0-0

digital EQUIPMENT CORPORATION MAYNARD, MASSACHUSETTS

TITLE LKØ2 KEYBOARD

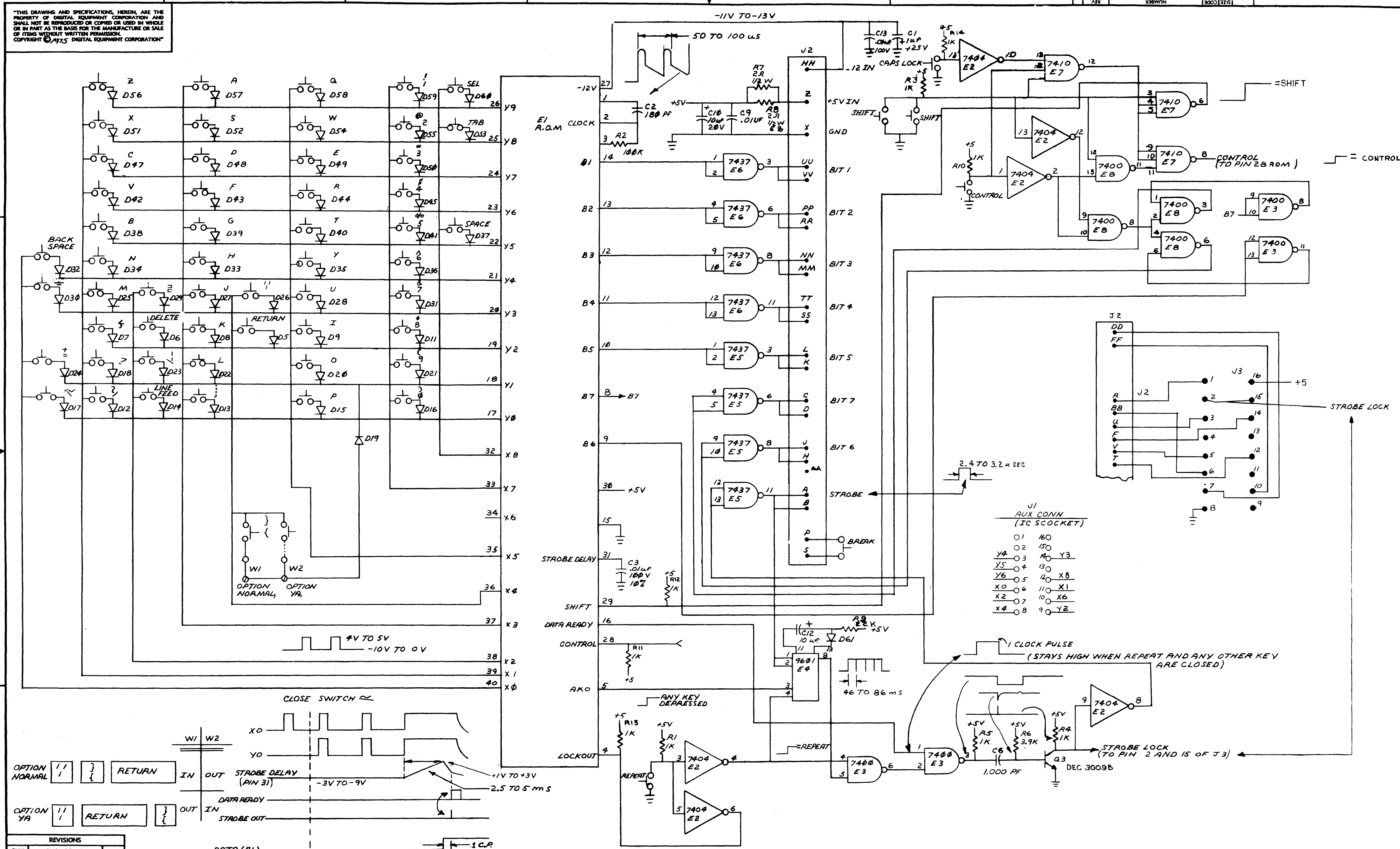
SIZE D CODE CS NUMBER 5410736-0-1 REV. E

SCALE —

SHEET 1 OF 2

DIST.

DEC FORM NO DRD-135



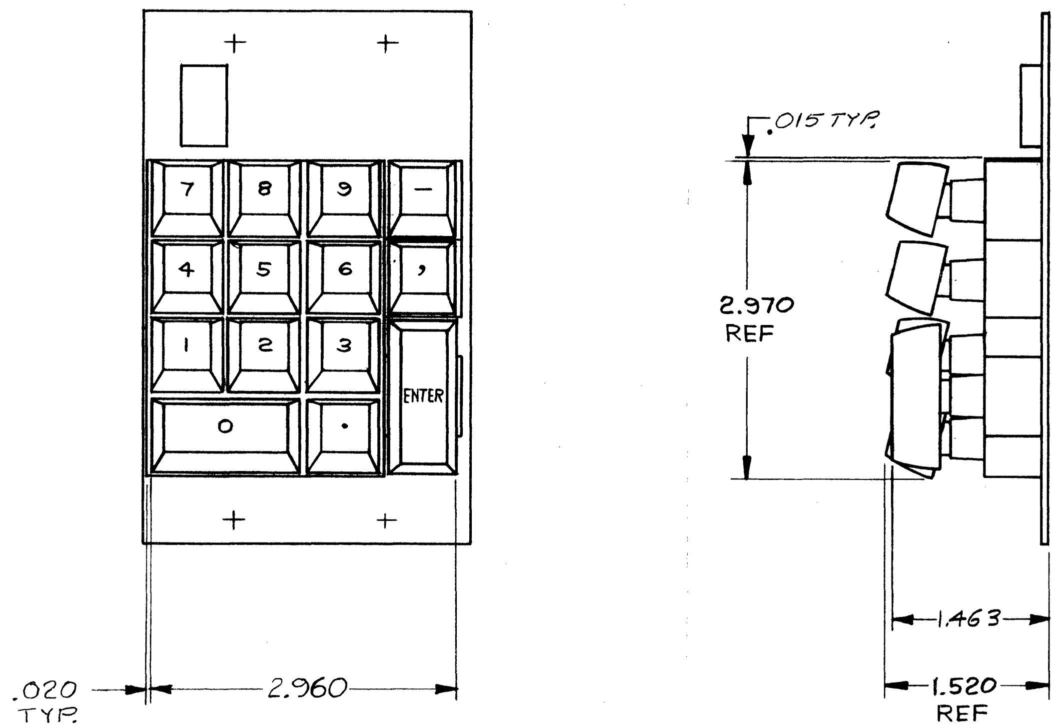

| REVISIONS | | |
|---|---|---|
| CHK | CHANGE NO. | REV. |

TITLE LK02 KEYBOARD

| SIZE | CODE | NUMBER | REV. |
|---|---|---|---|
| D | CS | 5410736-0-1 | F |

SCALE — SHEET 2 OF 2

DEC FORM NO. DRD 1.30




| REF | TEST SPEC | A-SP-LK02-Ø-2 | 4 |
|---|---|---|---|
| REF | ENGINEERING SPEC | A-SP-LK02-Ø-1 | 3 |
| 1 | KEYCAP SET | D-PS-1212287-74 | 2 |
| 1 | 14 KEYSWITCH ARRAY MOD. | D-CS-5411635-Ø-1 | 1 |
| QTY. | DESCRIPTION | PART NO. | ITEM NO. |

PARTS LIST

FIRST USED ON OPTION/MODEL: LK03-A

DIMENSIONAL TOLERANCE

DIMENSIONS ARE ~~MILLIMETERS~~ INCHES UNLESS OTHERWISE SPECIFIED

| MILLIMETERS | INCHES | ANGLES |
|---|---|---|
| X,XX = ± 0,10<br>X,X = ± 0,5<br>X = ± 2, | .XXX = ± .005<br>.XX = ± .02<br>.X = ± .1 | ±0° 30′ |

THIRD ANGLE PROJECTION

REMOVE BURRS AND BREAK SHARP CORNERS SURFACE QUALITY ✓

MATERIAL: SEE PARTS LIST

FINISH: —

| | | DATE |
|---|---|---|
| DRN. | D. Gilley | 4-17-75 |
| CHK'D | Coy Benson | 7/24/75 |
| ENG. | Coy Benson | 7/24/75 |
| PROJ. ENG. | P. E. Nelson | 7-28-75 |
| PROD. | [illegible] | 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 | |

DIST.

REVISIONS — REV. — CHANGE NO. — CHK

DEC FORM NO. DRC 100-B

# CHAPTER 8
# ILLUSTRATED PARTS BREAKDOWN

## 8.1 HOW TO USE THE IPB

### 8.1.1 General

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

### 8.1.2 Major Assembly Locator

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

### 8.1.3 Indented Parts List

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

### 8.1.4 Column Callout Description

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

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

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

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

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

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

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

**8.1.5 Symbol Usage**

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

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

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

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

EK-LA36-IP-003

# 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.

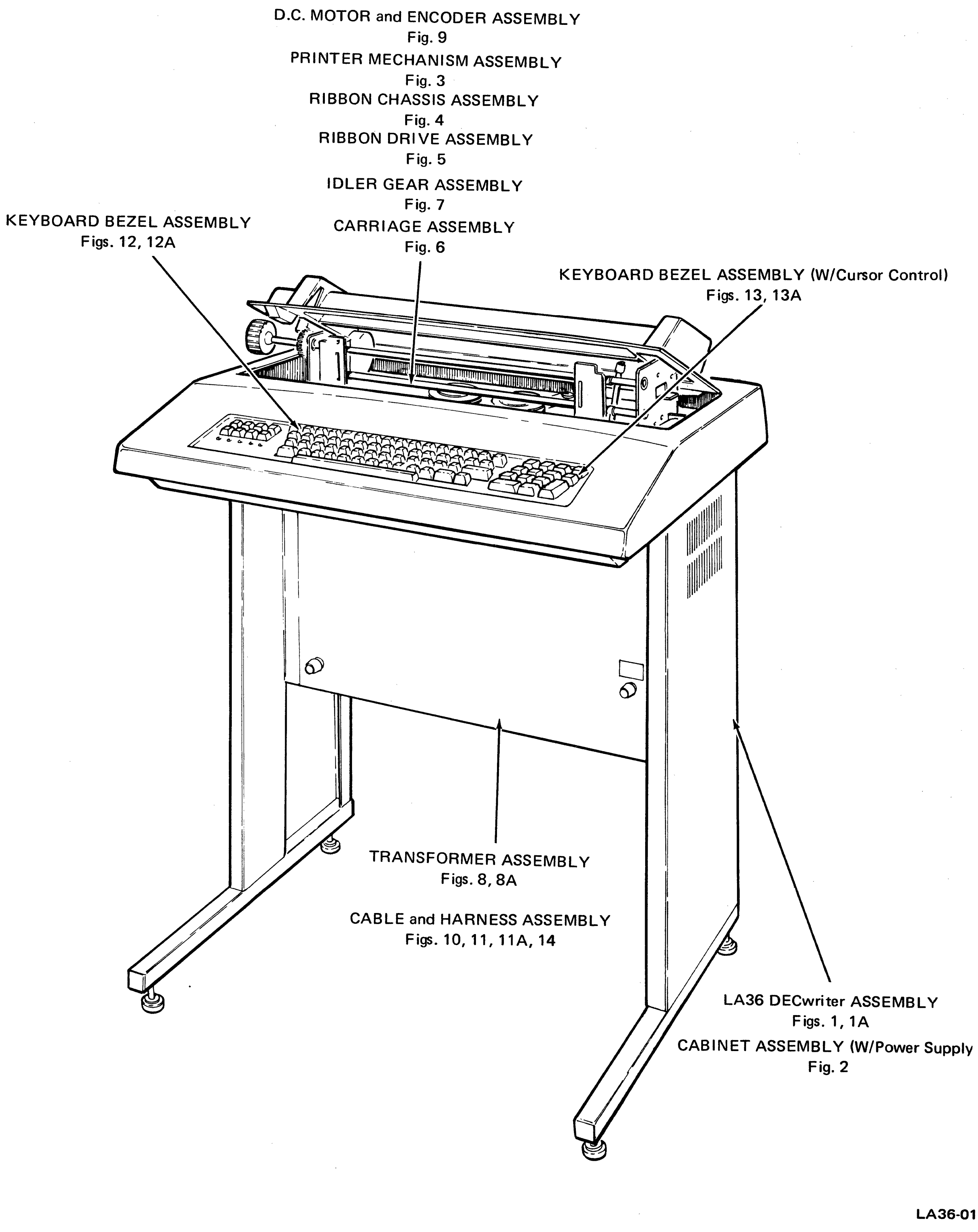
**Attaching Hardware** — The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

**(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** |




*Major Assembly Locator, LA36 DECwriter II*

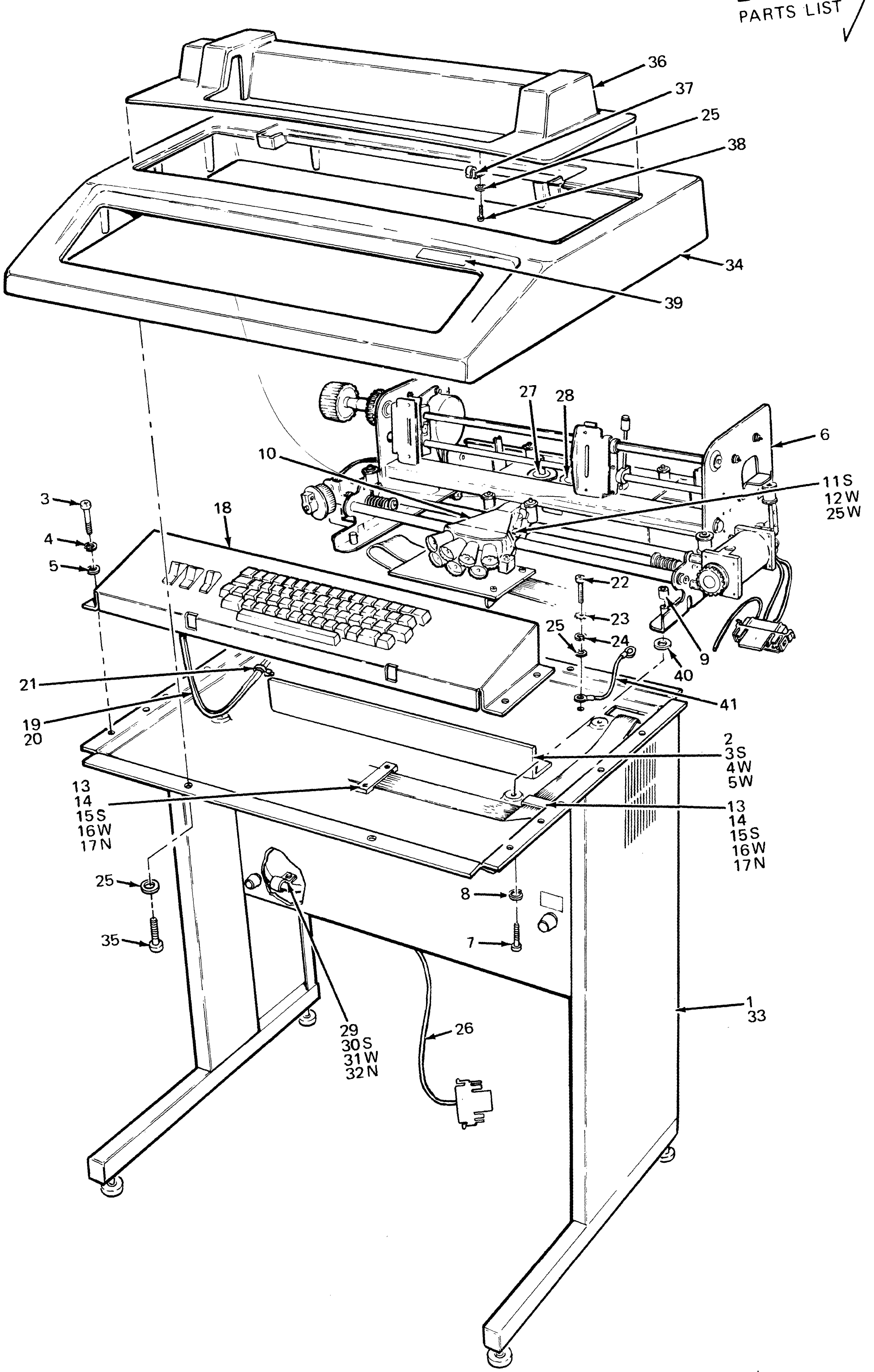



*Figure 1. LA36 DECwriter Assembly*

| 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 | | | | |
| 42 | *Spacer, Bezel | (added) | 74-13675-00 | 00119 | | | | |
| | Accessories/Options | | | | | | | |
| | †Paper (Package of 100 sheets) | | 74-12103-00 | | | | | |
| | †Basket, Paper | | 74-12016-00 | | | | | |
| | †Table Top | | 34-11736-00 | | | | | |
| | †Bracket, Table Support | | 74-11972-00 | | | | | |
| | †Table Assembly | | 70-09897-00 | | | | | |
| | †Wheel Assembly | | 70-09751-00 | | | | | |
| | †Wheel, Caster | | 74-11826-00 | | | | | |
| | †Bracket, Wheel | | 74-11824-00 | | | | | |

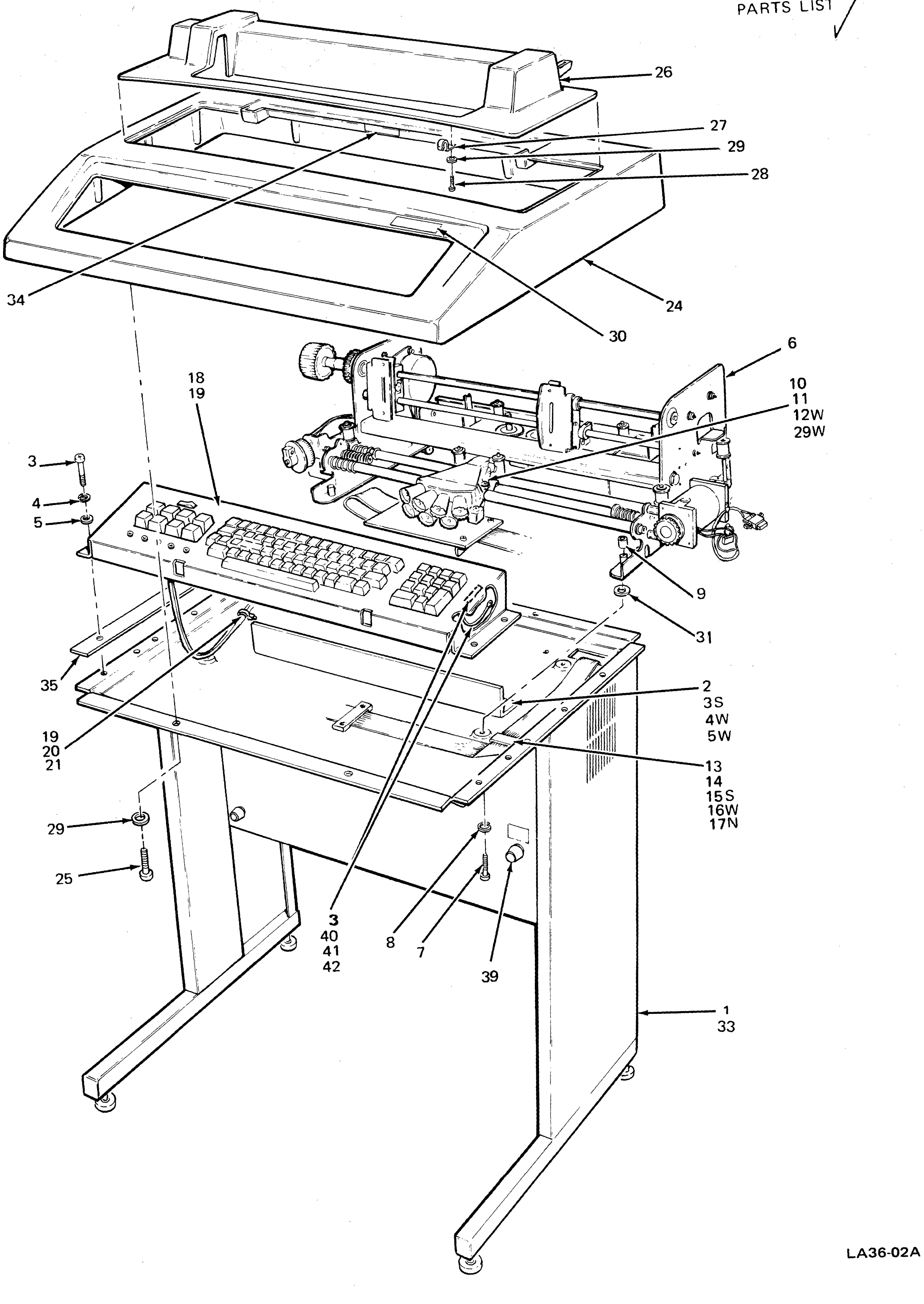



*Figure 1A. LA36 DECwriter Assembly*

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. S | 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 LA36-CE (Numeric Pad, Paper Out, 60 Hz, 90–132 V) | LA36-CE | | J | | | |
| | Code K used on LA36-CF (Numeric Pad, Paper Out, 60 Hz, 180–264 V) | LA36-CF | | K | | | |
| | Code L used on LA36-CH (Numeric Pad, Paper Out, 50 Hz, 90–132 V) | LA36-CH | | L | | | |
| | Code M used on LA36-CJ (Numeric Pad, Paper Out, 50 Hz, 180–264 V) | LA36-CJ | | M | | | |
| | Code N used on LA36-DE (60 Hz, 90–132 V) | LA36-DE | | N | | | |
| | Code P used on LA36-DF (60 Hz, 180–264 V) | LA36-DF | | P | | | |
| | Code Q used on LA36-DH (50 Hz, 90–132 V) | LA36-DH | | Q | | | |
| | Code R used on LA36-DJ (50 Hz, 180–264 V) | LA36-DJ | | R | | | |
| 1 | *CABINET ASSEMBLY W/POWER SUPPLY (110V, 60 Hz) | 70-09648-01 | | J N | | | 2 |
| | *CABINET ASSEMBLY W/POWER SUPPLY (220V, 50 Hz) | 70-09648-02 | | M R | | | 2 |
| | *CABINET ASSEMBLY W/POWER SUPPLY (110V, 50 Hz) | 70-09648-03 | | L Q | | | 2 |
| | *CABINET ASSEMBLY W/POWER SUPPLY (220V, 60 Hz) | 70-09648-04 | | K P | | | 2 |
| 2 | *Guide, Paper | 74-12158-00 | | | | | |
| 3 | *Screw, 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 | | | | | 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, Well No. 10 | 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, Int Tooth Lock No. 6 | 90-06633-00 | | | | | |
| 13 | *Clamp, Cable | 12-02704-00 | | | | | |
| 14 | *Tape, Double Coated, .50 wide | 90-07834-00 | | | | | |
| 15 | *Screw, Phl Pan Hd No. 4-40 x .38 | 90-06011-01 | | | | | |
| 16 | *Washer, Flat No. 4 | 90-06658-00 | | | | | |
| 17 | *Nut, Keps No. 4-40 | 90-06557-00 | | | | | |
| 18 | *KEYBOARD BEZEL ASSEMBLY | 70-09750-01 | | NPQR | | | 12A |
| | *KEYBOARD BEZEL ASSEMBLY W/CURSOR CONTROL | 70-09750-02 | | JKLM | | | 13A |
| 19 | *KEYBOARD CABLE ASSEMBLY (LA36) | 70-11519-00 | | | | | 11A |
| 20 | *Jumper | 70-10001-11 | | | | | |
| 21 | *Cable Tie | 90-07031-00 | | | | | |
| 22 | *Connector, P2, Pin Housing, 8 Pin Mate-N-Lok (Not Shown) | 12-09340-01 | | | | | |
| 23 | *Cable Tie Mount (Not Shown) | 90-07867-00 | | | | | |
| 24 | *Housing | 74-11116-00 | | | | | |

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

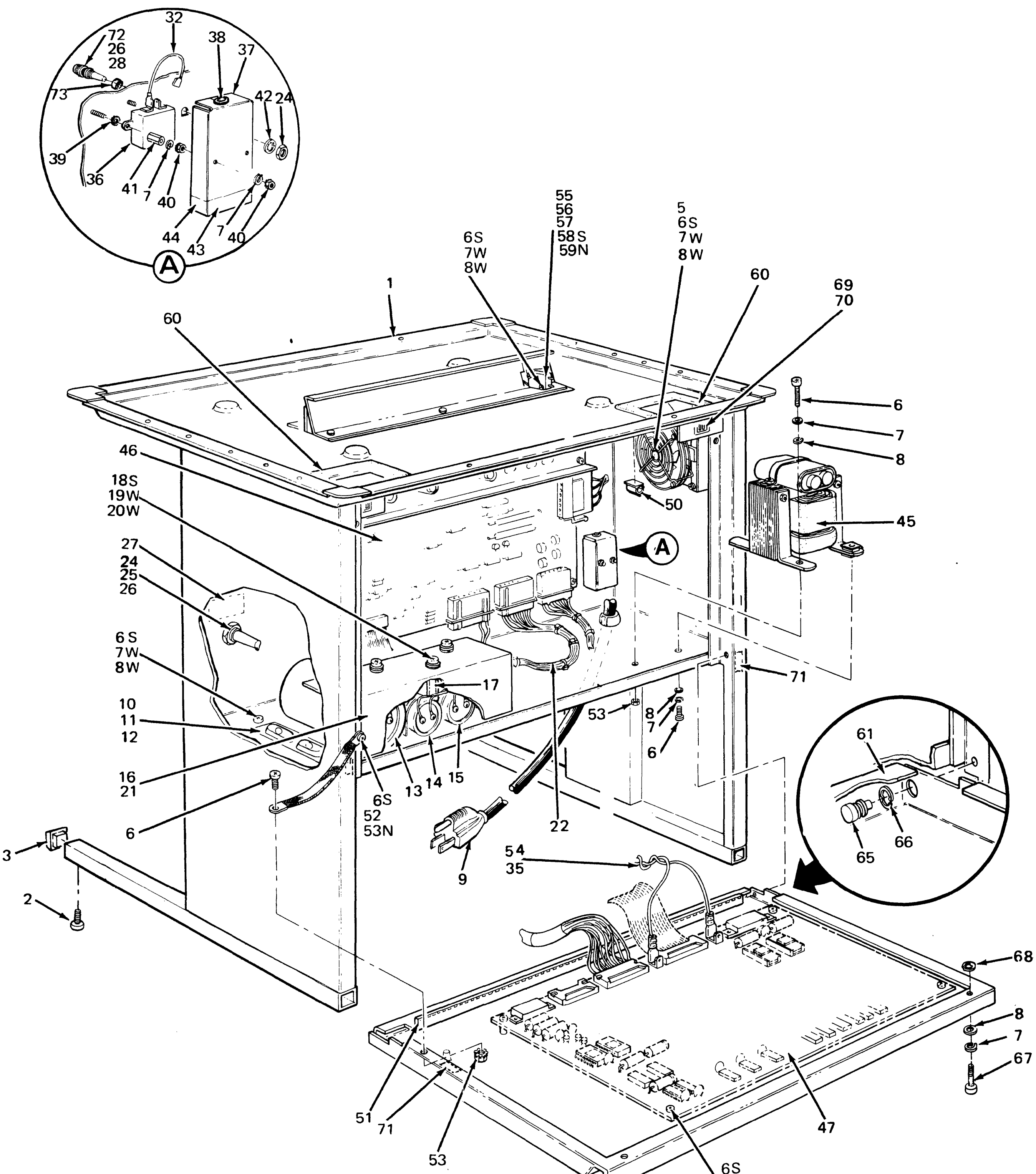



*Figure 2. Cabinet Assembly (W/Power Supply)*

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. (A B) | ECO CUT-IN LA36 00001 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 2– | CABINET ASSEMBLY W/POWER SUPPLY 115V (deleted) | 70-09648-01 | | ACEG | | | 1A |
| | CABINET ASSEMBLY W/POWER SUPPLY 110V, 60 Hz (added) | 70-09648-01 | 00138 | JN | | | |
| | CABINET ASSEMBLY W/POWER SUPPLY 230V (deleted) | 70-09648-02 | | BDFH | | | |
| | CABINET ASSEMBLY W/POWER SUPPLY 220V, 50 Hz (added) | 70-09648-02 | 00138 | MR | | | |
| | CABINET ASSEMBLY W/POWER SUPPLY 110V, 50 Hz (added) | 70-09648-03 | 00138 | LQ | | | |
| | CABINET ASSEMBLY W/POWER SUPPLY 220V, 60 Hz (added) | 70-09648-04 | 00138 | KP | | | |
| 1 | *Frame Assembly | 70-09649-00 | | | | | |
| 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 | | JNLQ | | | |
| | *POWER CORD ASSEMBLY (230V) (deleted) | 70-09673-01 | | BDFH | | | |
| | *POWER CORD ASSEMBLY (230V) (added) | 70-11045-00 | | MRKP | | | |
| 10 | *Plate, Cover | 74-11607-00 | | | | | |
| 11 | *Strain Relief (deleted) | 90-08509-00 | | | | | |
| | *Strain Relief (added) | 90-09768-00 | 00164 | | | | |
| 12 | *Strain Relief | 90-09572-00 | | | | | |
| 13 | *Capacitor, 33,000 MFD | 10-11545-00 | | | | | |
| 14 | *Capacitor, 18,000 MFD (deleted) | 10-11643-00 | | | | | |
| | *Capacitor, 37,000 MFD (added) | 10-10426-00 | 00138 | | | | |
| 15 | *Capacitor, 14,000 MFD | 10-10187-00 | | | | | |
| 16 | *Cover, Capacitor (added) | 74-15114-00 | 00164 | | | | |
| 17 | *Spacer, No. 10-32 x .375 x 3.00 (added) | 90-06881-00 | 00164 | | | | |
| 18 | *Screw, 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 amps | 90-07216-00 | | | | | |
| 26 | *Fuse, Slo-Blo 1 amp (deleted) | 90-07212-00 | | | | | |
| | *Fuse, Slo-Blo 1.5 amp (added) | 90-09740-00 | 00138 | | | | |
| 27 | *Decal, Fuse | 74-13384-00 | | | | | |
| 28 | *Fuse, Slo-Blo 3 amp | 90-07218-00 | | | | | |

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

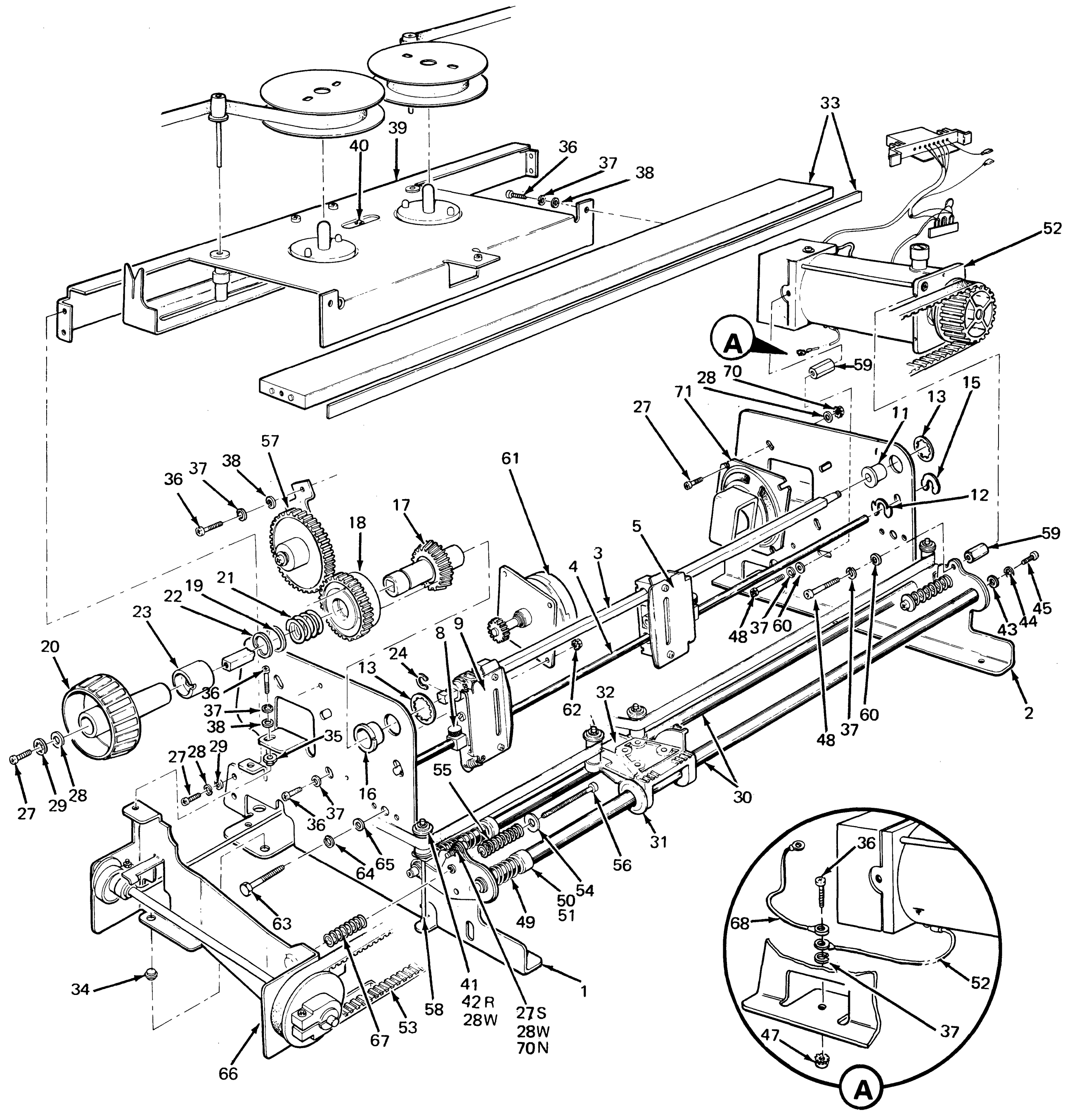



*Figure 3. Printer Mechanism Assembly*

| FIG & ITEM NO. | DESCRIPTION | T 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 | | | | | 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 | 70-10683-00 | | | | | |
| 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 LA36 00001 | 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 .50 | 90-06241-09 | | | | | |
| 64 | *Washer, Split Lock No. 1/4 | 90-07797-00 | | | | | |
| 65 | *Washer, Flat No. 1/4 | 90-06676-00 | | | | | |
| 66 | *RIBBON DRIVE ASSEMBLY | 70-09690-00 | | | | | 5 |
| 67 | *Spring, Compression | 90-09578-00 | | | | | |
| 68 | *Ground Strap | 70-10001-05 | | | | | |
| 69 | *Decal, Ground Symbol (added) | 36-12680-00 | 00166 | | | | |
| 70 | *Nut, Kep No. 6-32 | 90-06560-00 | | | | | |
| 71 | *Speaker, 2-1/2 in. Perm Magnet | 12-10299-00 | | | | | |

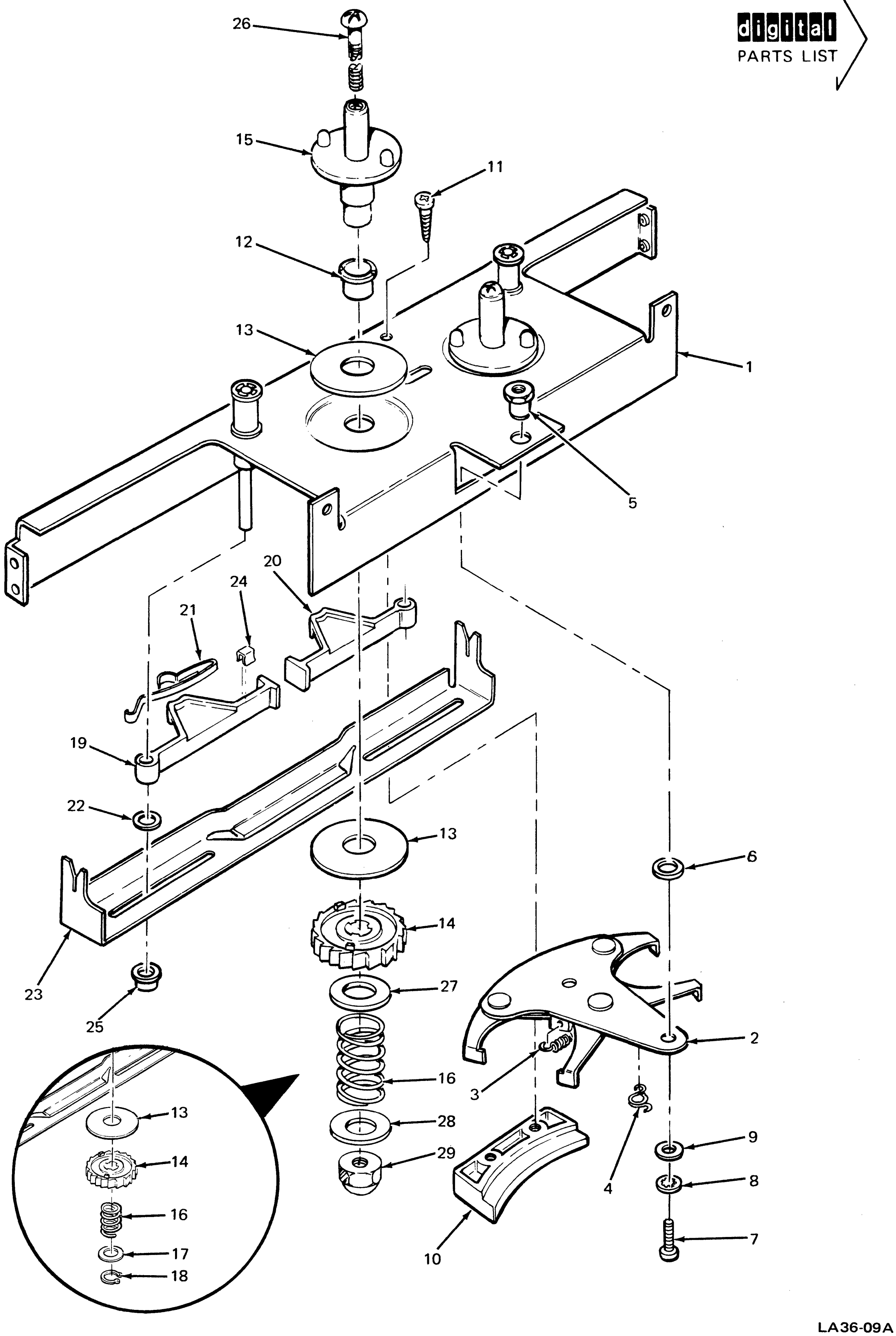



*Figure 4. Ribbon Chassis Assembly*

| 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 | 70-09689-00 | | | | | 3 |
| 1 | *Chassis, Ribbon w/Inserts | 70-09680-00 | | | | | |
| 2 | *Base Assembly, Ratchet | 70-09697-00 | | | | | |
| 3 | *Spring, Upper Pawl | 74-11105-00 | | | | | |
| 4 | *Spring, Main Pawl | 74-11090-00 | | | | | |
| 5 | *Pivot, Ratchet | 74-11103-00 | | | | | |
| 6 | *Washer, Ratchet | 74-11061-00 | | | | | |
| 7 | *Screw, 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 | | | | | |
| 16 | *Spring, Compression (deleted) | 90-09584-00 | LA36 00116 | | | | |
| | *Spring, Compression (added) | 12-12353-00 | | | | | |
| 17 | *Washer, Brake (deleted) | 74-11106-00 | LA36 00079 | | | | |
| 18 | *Retaining Ring (deleted) | 90-09580-00 | LA36 00079 | | | | |
| 19 | *Interposer, L.H. | 74-11058-01 | | | | | |
| 20 | *Interposer, R.H. | 74-11058-02 | | | | | |
| 21 | *Spring, Interposer | 74-11087-00 | | | | | |
| 22 | *Washer, Flat No. 6 (deleted) | 90-06707-00 | LA36 00113 | | | | |
| | *Washer, Flat No. 6 (added) | 90-06634-00 | | | | | |
| 23 | *Sensor, Reverse | 74-11060-00 | | | | | |
| 24 | *"U" Clip (added) | 90-09748-00 | LA36 00143 | | | | |
| 25 | *Cap, Standoff Spool | 74-12976-00 | | | | | |
| 26 | *Screw, 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 | | | | | |

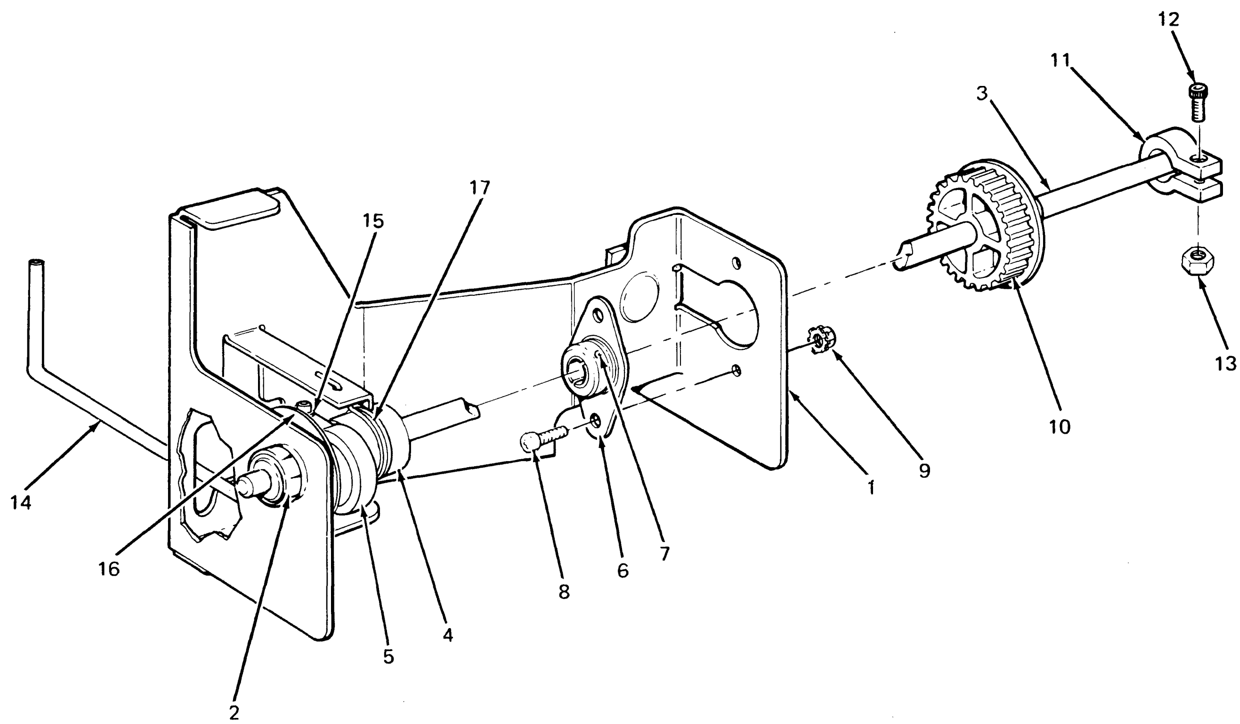



*Figure 5. Ribbon Drive Assembly*

| 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 | | | | | |

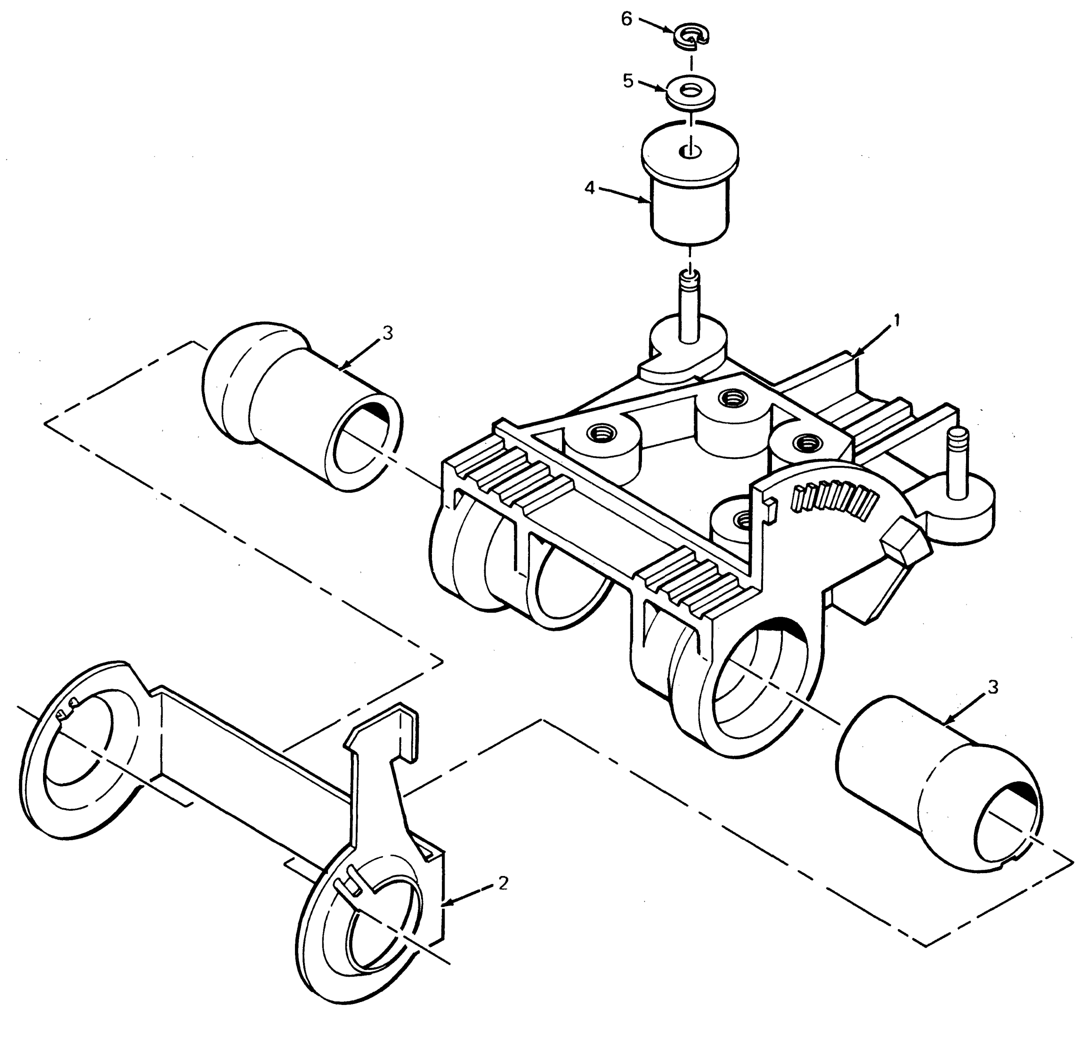



*Figure 6. Carriage Assembly*

| FIG & ITEM NO. | DESCRIPTION | Ø 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 | 74-11424-00 | | | | | |
| 4 | *Screw, Phl Pan Hd No. 8-32 x 1.00 | 90-06043-01 | | | | | |
| 5 | *Washer, Flat No. 8 | 90-06666-00 | | | | | |
| 6 | *Washer, Split Lock No. 8 | 90-06690-00 | | | | | |
| 7 | *Nut, Hex No. 8-32 | 90-06561-00 | | | | | |

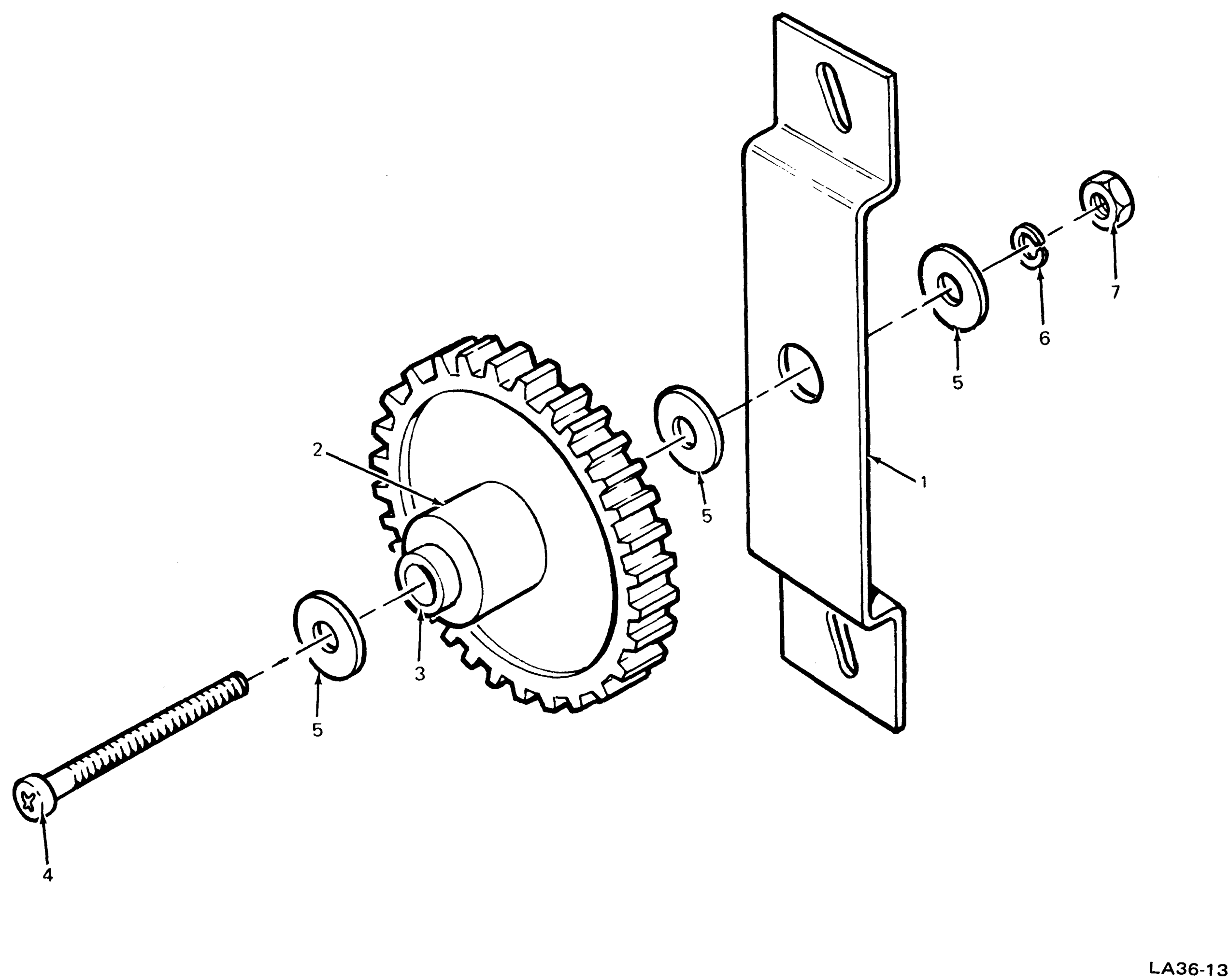



*Figure 7. Idler Gear Assembly*

| 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 | | | | 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 | | | | | |

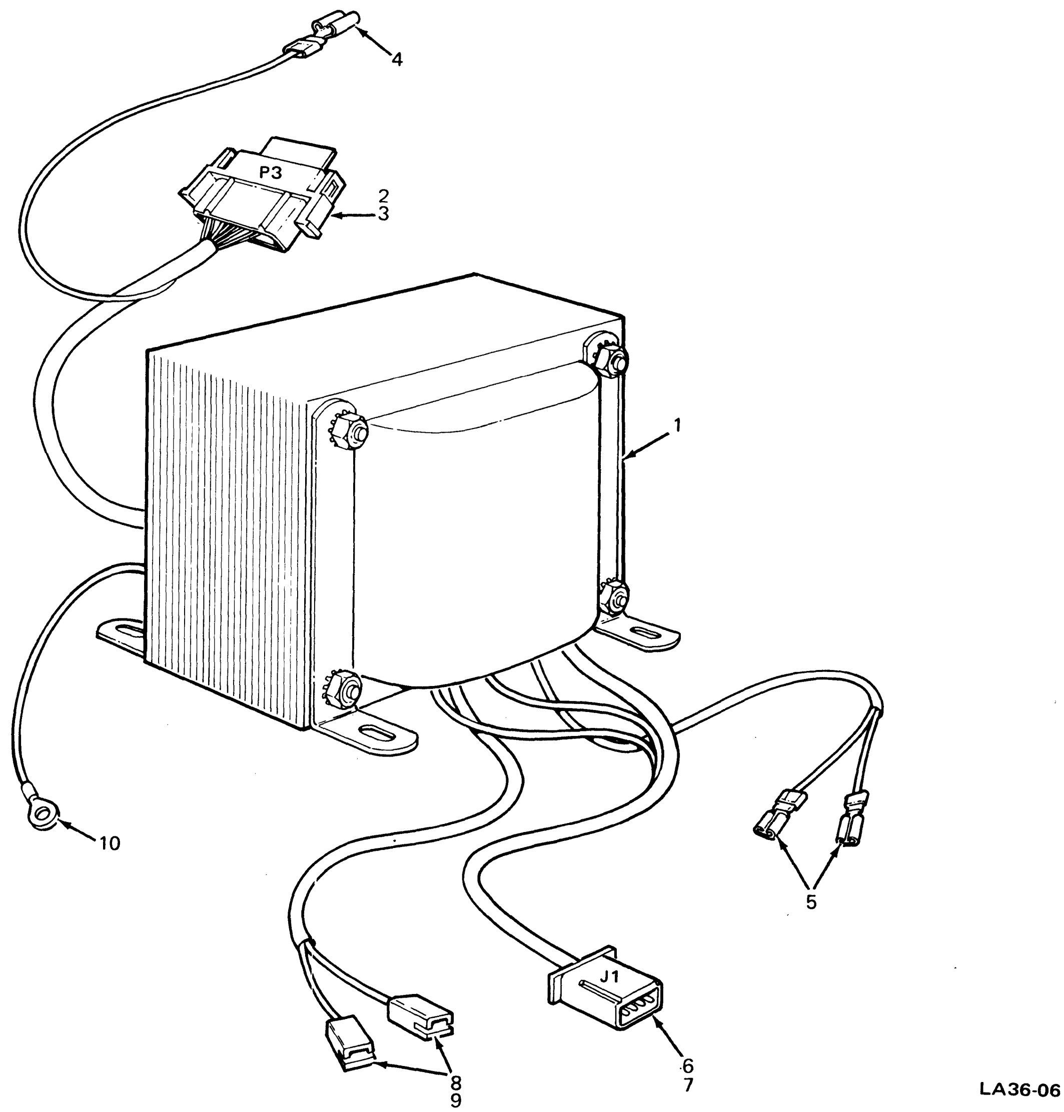
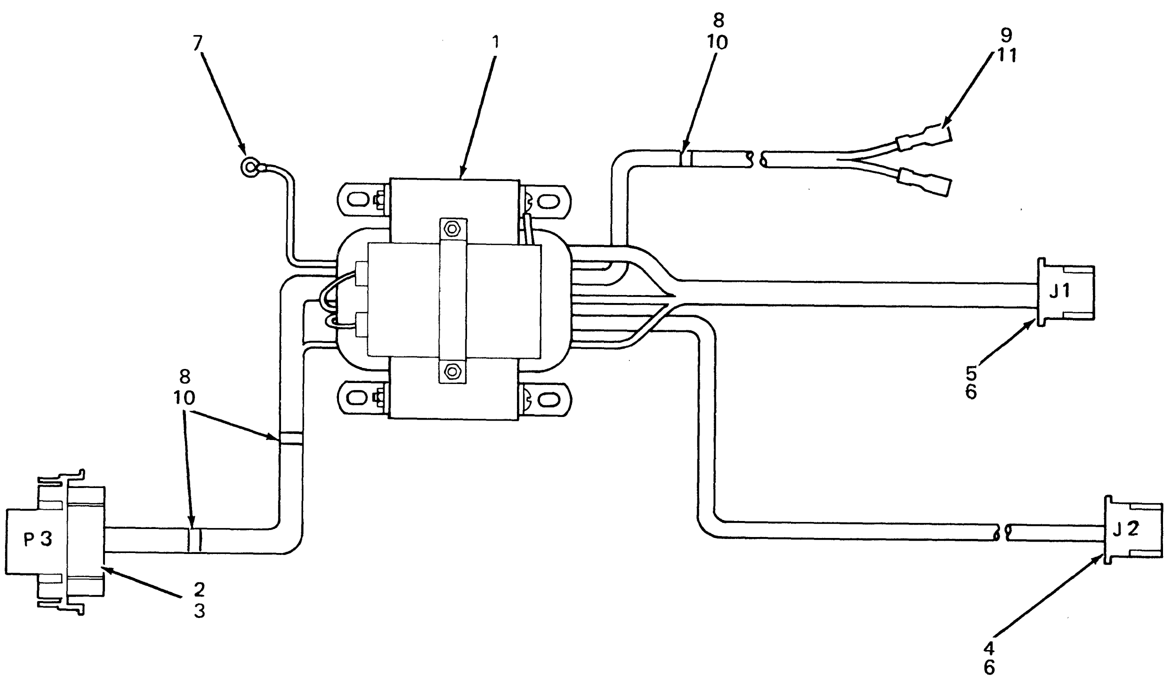



*Figure 8. Transformer Assembly*

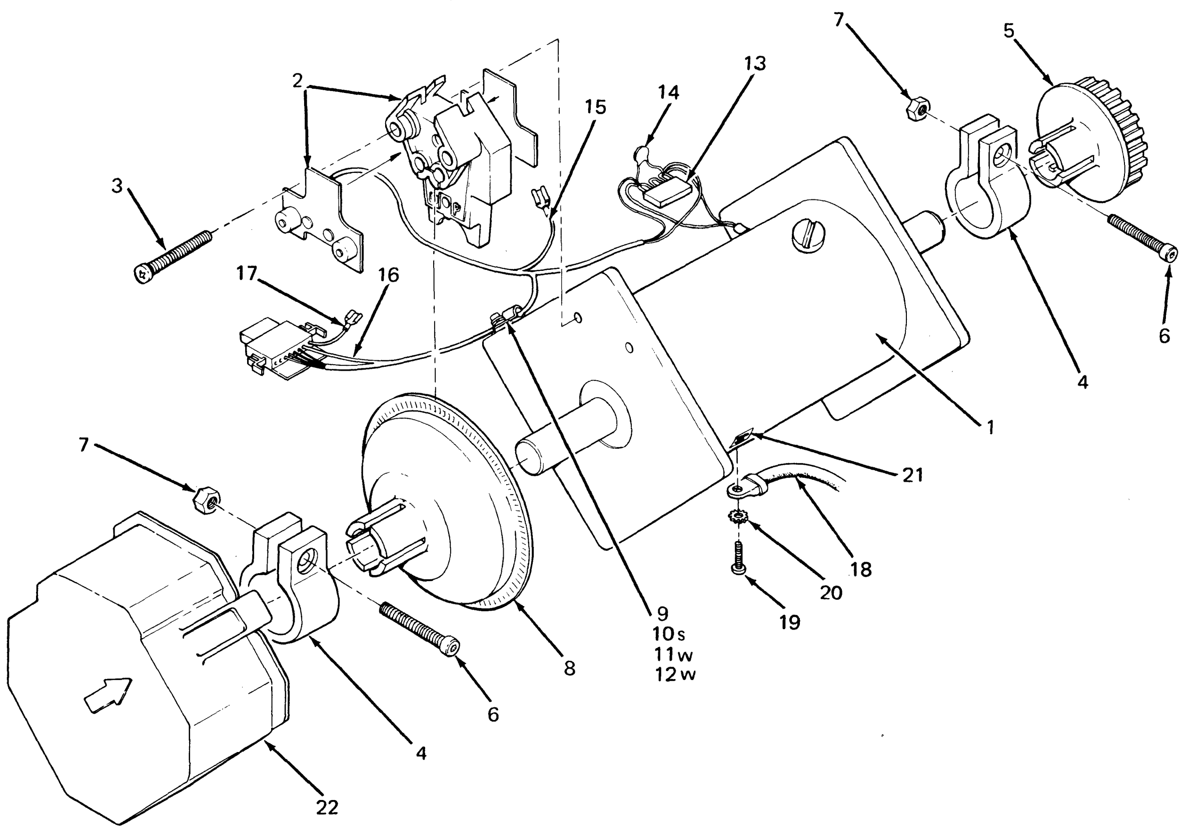
| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | J ECO CUT-IN LA36 00138 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 8A– | TRANSFORMER ASSEMBLY | | | | | | 2 |
| | Transformer Assembly (60 Hz) | 70-09779-01 | | | | | |
| | Transformer Assembly (50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




LA36-06A

*Figure 8A. Transformer Assembly*

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN LA36 00166 | USED ON CODE | VENDOR 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 | 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 |
| 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 | | | | |

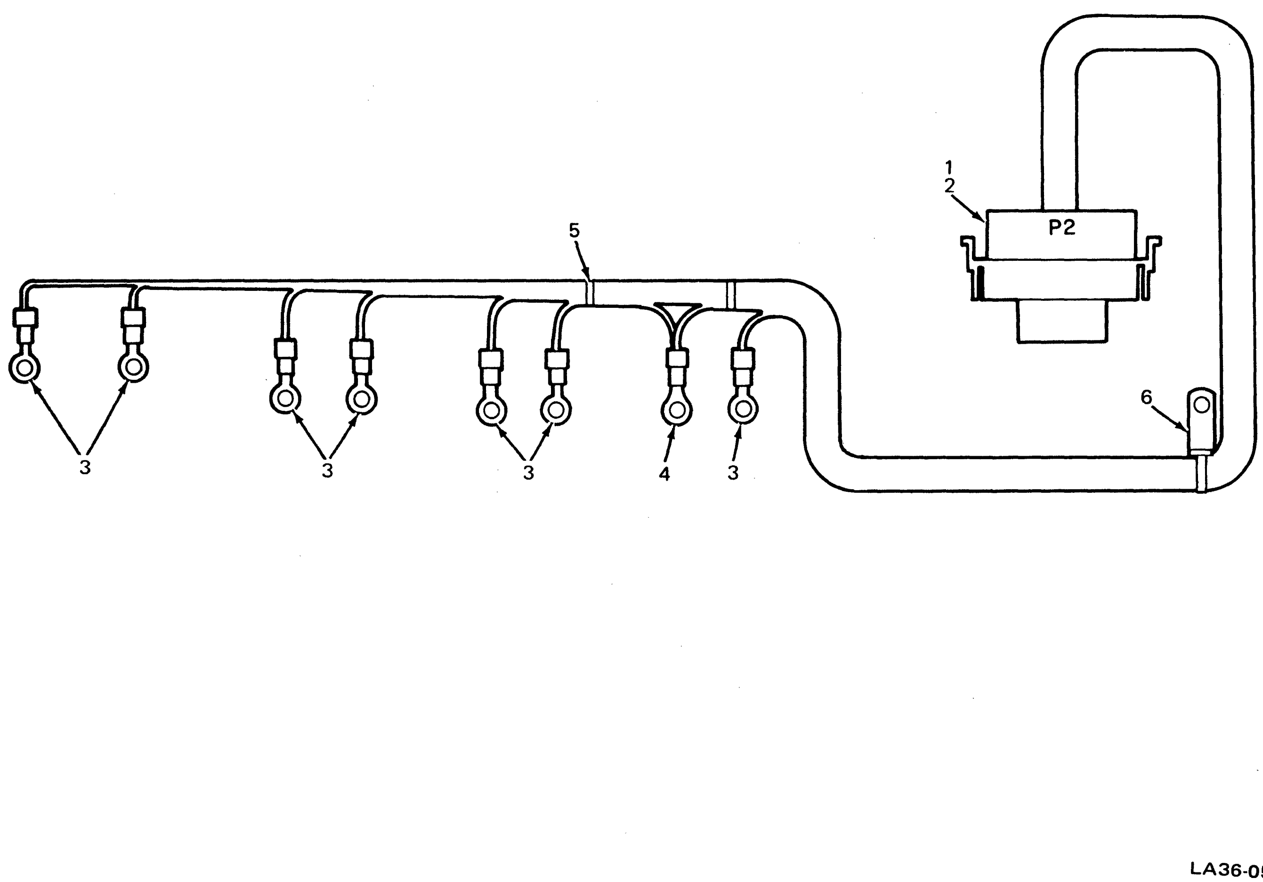
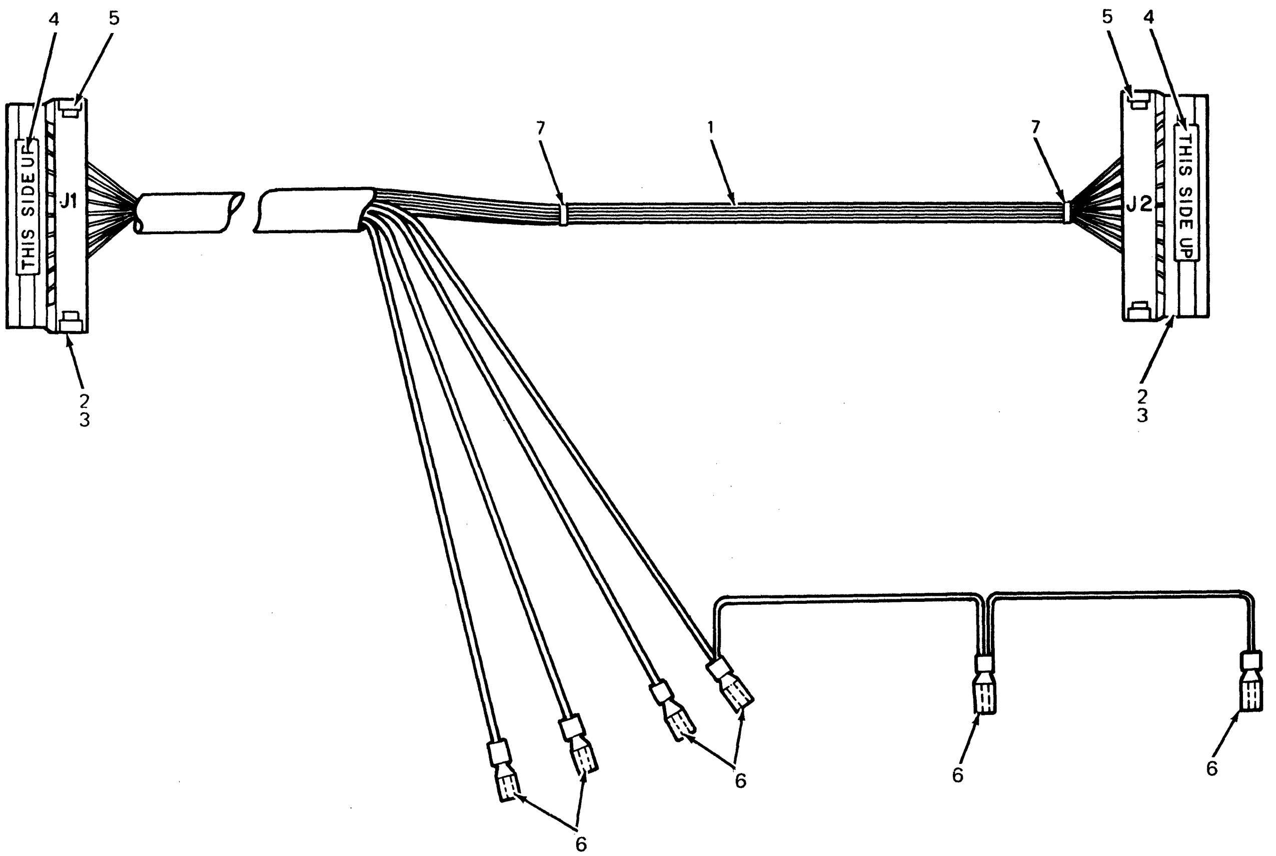



*Figure 10. Capacitor Harness Assembly*

| 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 | | | | | |




LA36-16

*Figure 11. Cable Assembly (LA36 Keyboard)*

| FIG & ITEM NO. | DESCRIPTION | 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 | | | 1A |
| 1 | *Cable, 24 Conductor (No. 22 AWG) | 17-00011-01 | | | | | |
| 2 | *Connector, Housing 44 Pin Berg | 12-10918-15 | | | | | |
| 3 | *Terminals, Socket Crimp | 12-10089-07 | | | | | |
| 4 | *Strain Relief | 12-11166-00 | | | | | |
| 5 | *Label (THIS SIDE UP) | 36-11567-00 | | | | | |
| 6 | *Tie Wraps | 90-07031-00 | | | | | |

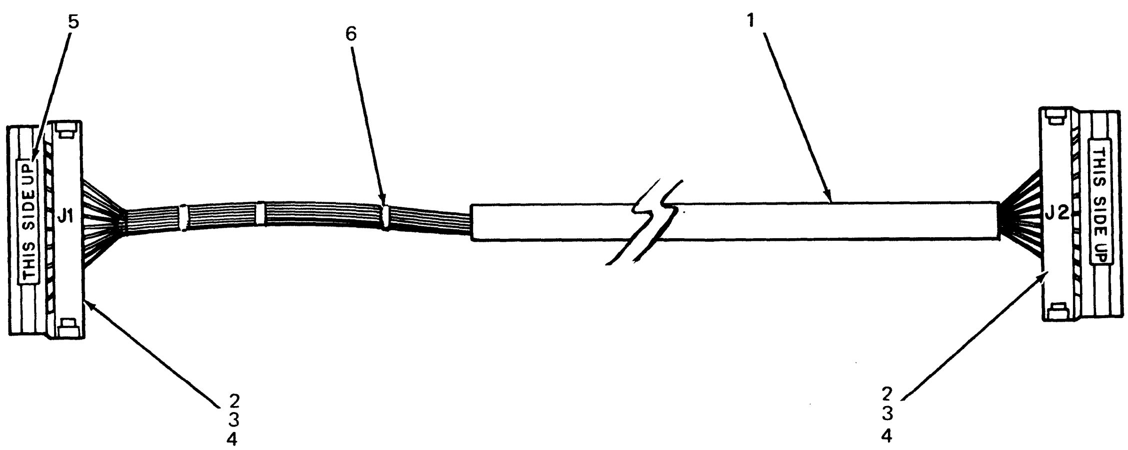



*Figure 11A. Cable Assembly (LA36 Keyboard)*

| 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 | | | | | |

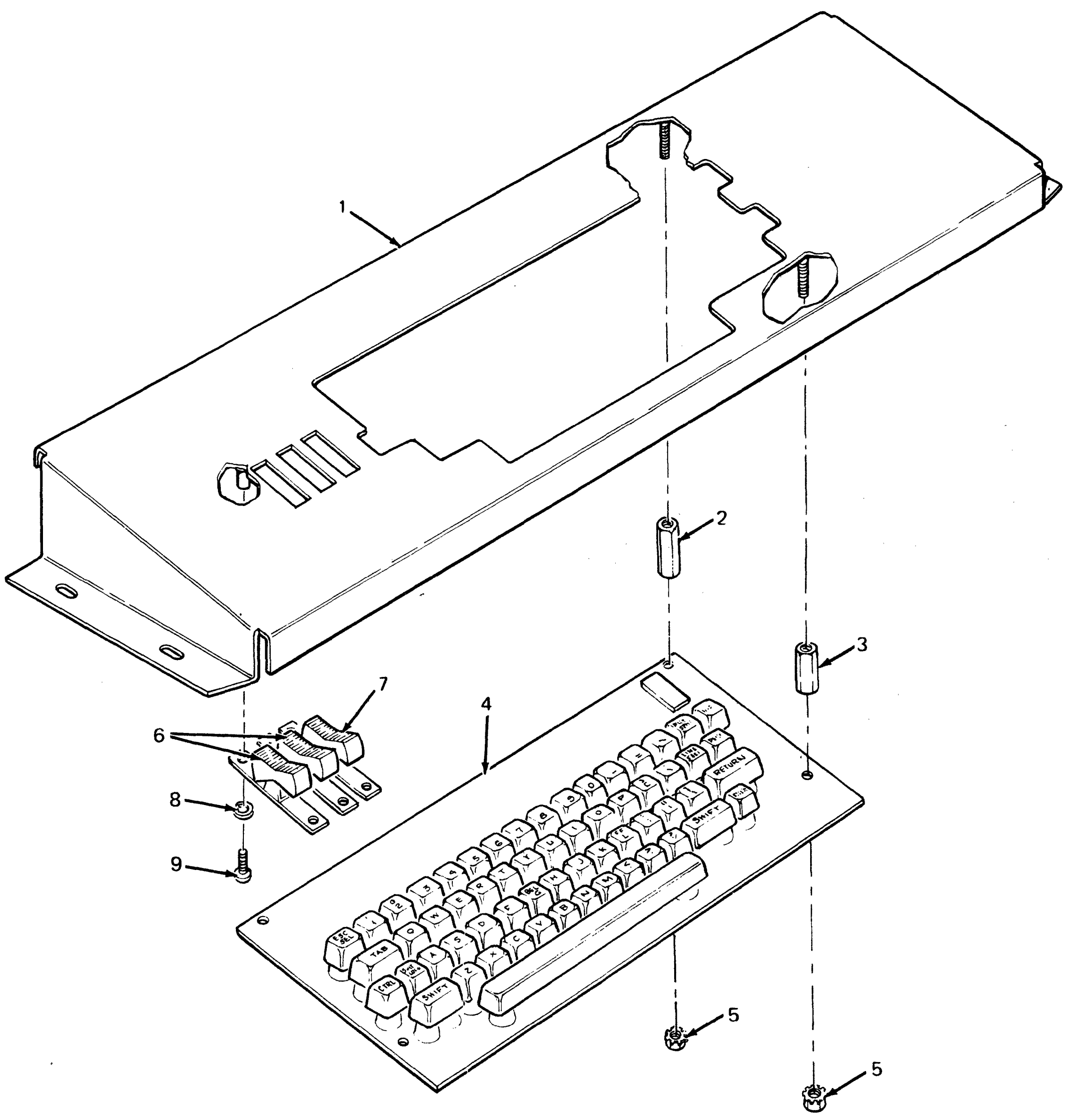
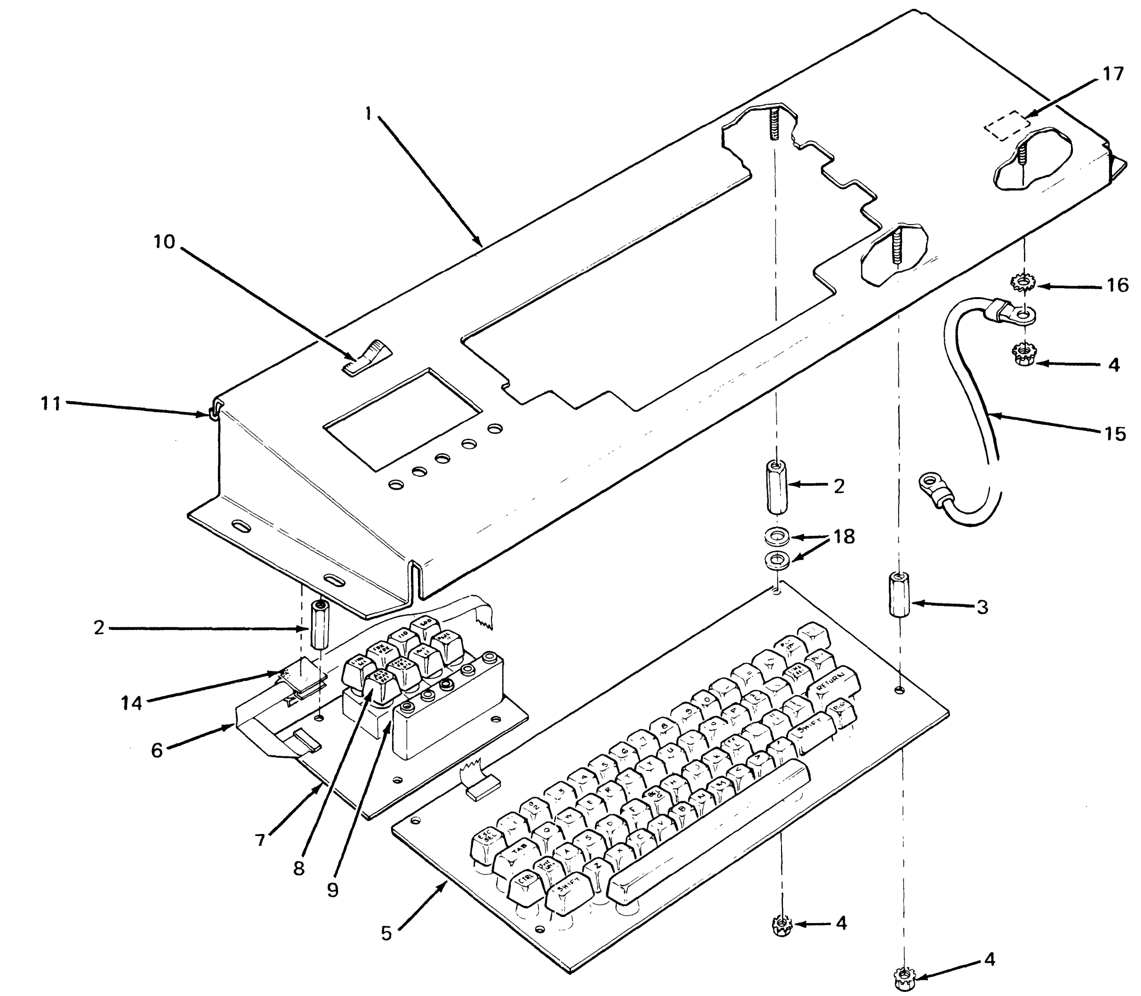



*Figure 12. Keyboard Bezel Assembly*

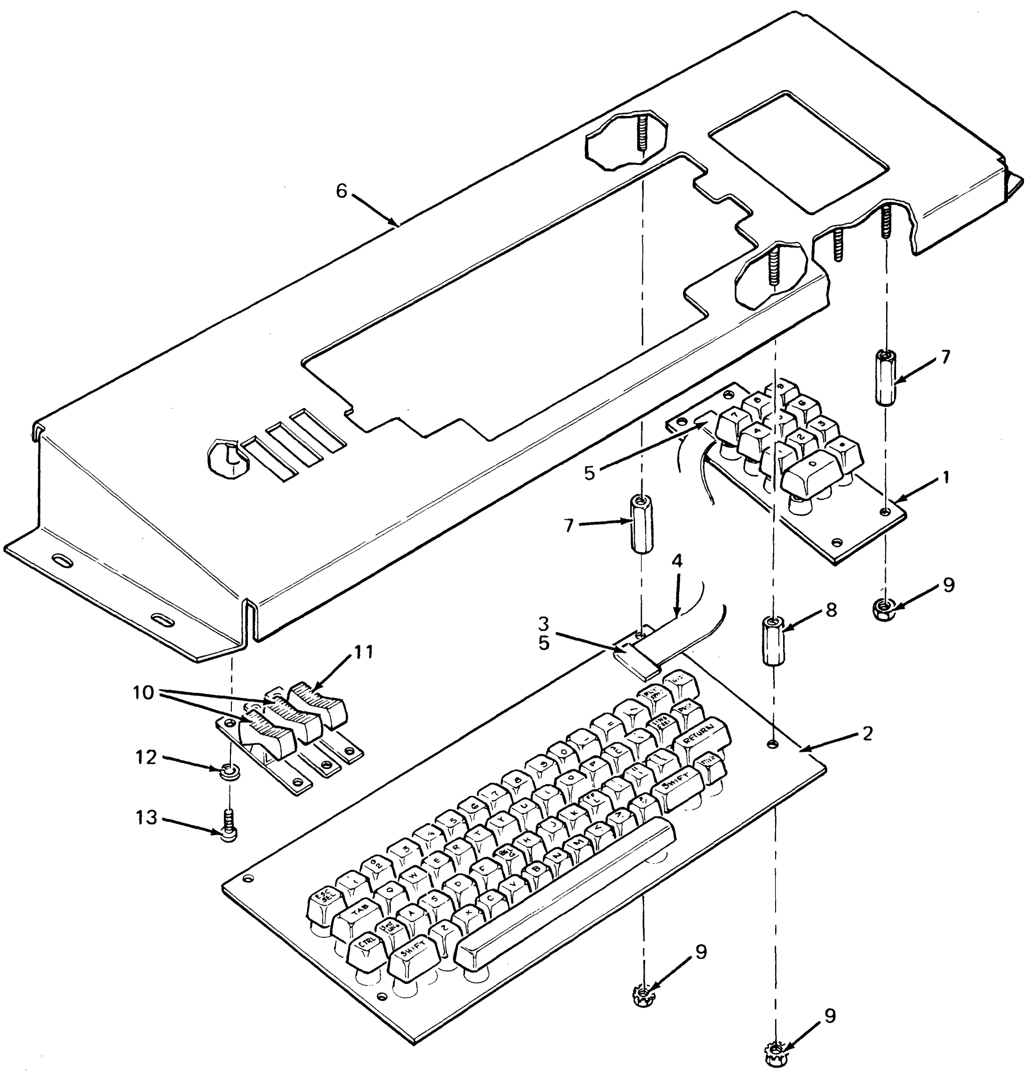
| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | G ECO CUT-IN LA36 00163 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 12A– | KEYBOARD BEZEL ASSEMBLY | 70-09750-01 | | NPQR | | | 1A |
| 1 | *Bracket, Bezel | 74-11427-01 | | NPQR | | | |
| 2 | *Spacer,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




LA36-14A

*Figure 12A. Keyboard Bezel Assembly*

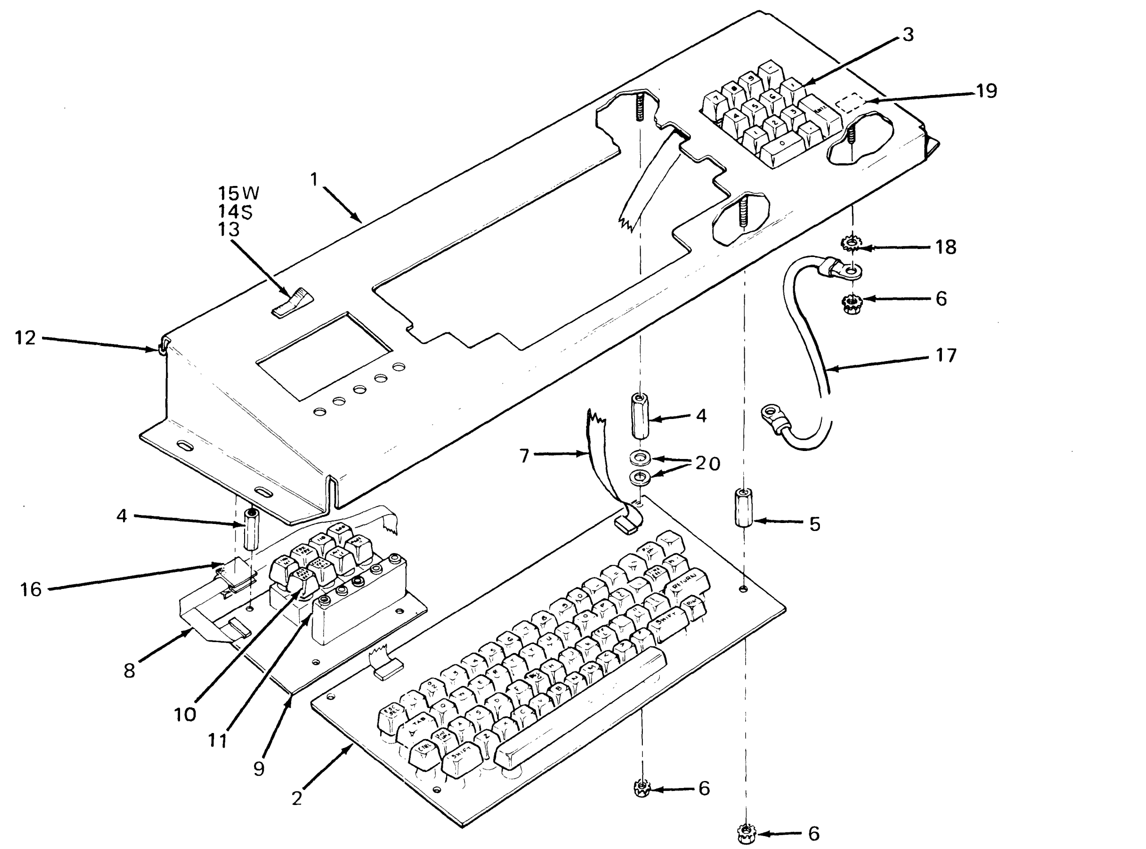
| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN 70-09750 00001 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 13– | KEYBOARD BEZEL ASSEMBLY (deleted) (With Cursor Control) | 70-09750-02 | LA36 -00163 | ABCD | | | 1 |
| 1 | *LK03 KEYBOARD 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 | | | | | |



LA36-15

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

| FIG & ITEM NO. | DESCRIPTION | G<br>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 | 90-06021-01 | | | | | |
| 15 | *Washer, Split Lock No. 6 | 90-07801-00 | | | | | |
| 16 | *Harness Clip | 90-08340-00 | | | | | |
| 17 | *Jumper | 70-10001-05 | | | | | |
| 18 | *Washer, External Tooth No. 8 | 90-08072-00 | | | | | |
| 19 | *Decal, Ground Symbol | 36-12680-00 | | | | | |
| 20 | *Washer, Flat Nylon No. 8 | 90-06708-00 | | | | | |




LA36-15A

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

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN BC05-F 00001 | USED ON CODE | VENDOR 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 |

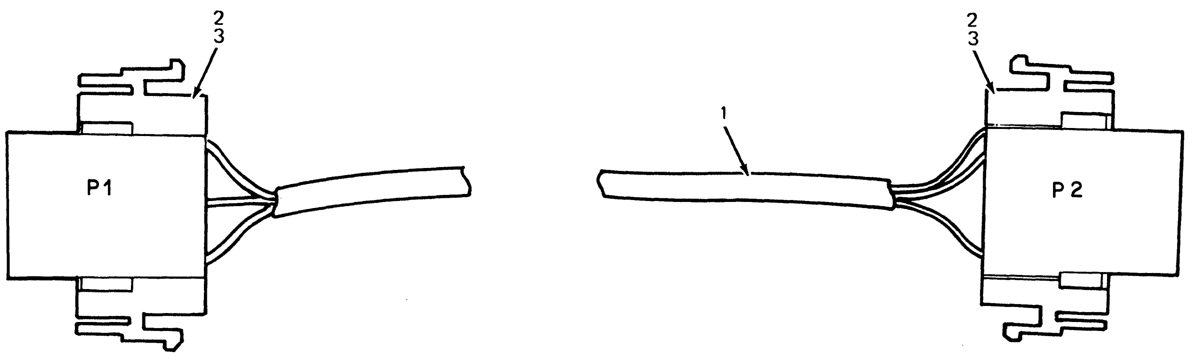



*Figure 14. Cable Assembly (BC05F Interface)*

digital

EK-LK02-IP-002

# ILLUSTRATED PARTS BREAKDOWN

# LK02 KEYBOARD

## HOW TO USE THE IPB

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

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

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

**COLUMN CALLOUT DESCRIPTION**
**Figure & Item** — Indicates the figure number and item number of each part.

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

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

**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.

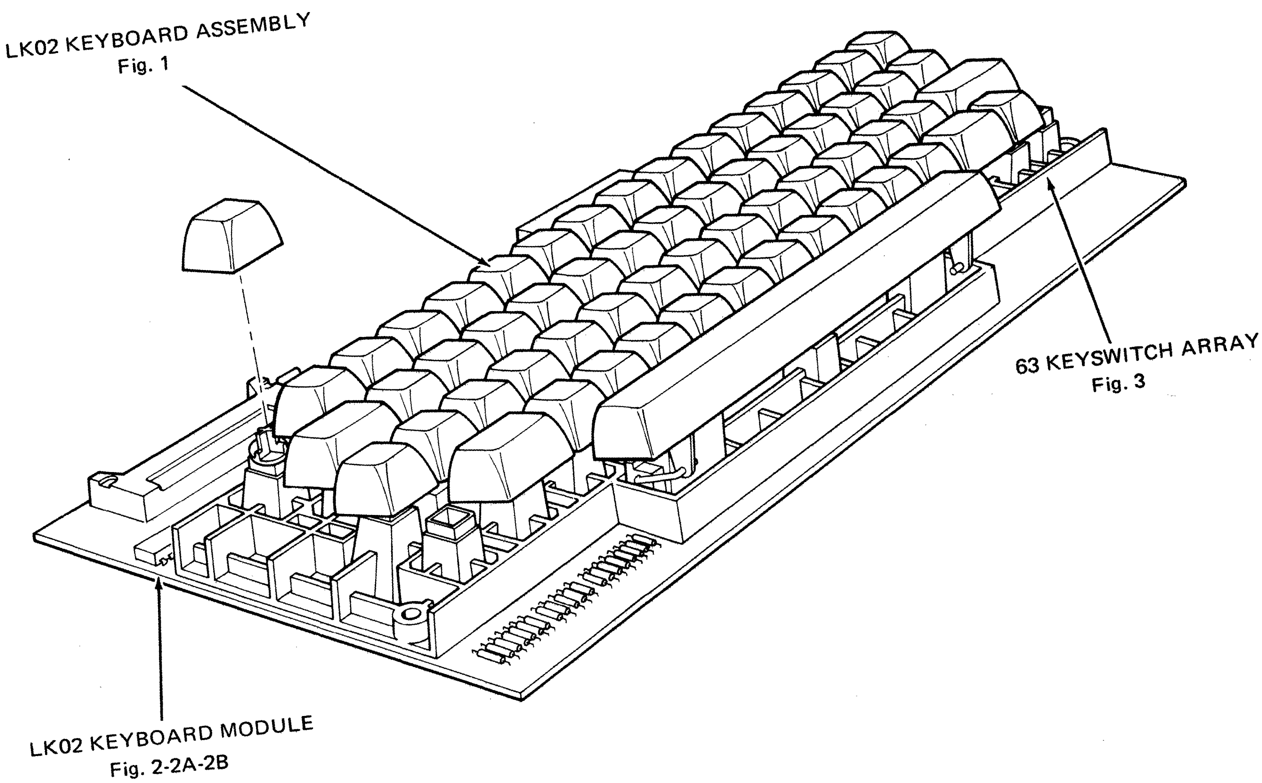
**Attaching Hardware** — The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

**(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 |
|---|---|---|---|---|
| 2nd Printing | LK02 | 00000—00001 | 1-30-76 | This 2nd Printing **EK-LK02-IP-002** |
| " | 54-10736 | 00001—0003A | | **SUPERSEDES** 1st Printing **DEC-LK02-IPB-1** |
| " | 70-09892 | 00000—00000 | | |
| | | | | **(NOTE THAT THE DOCUMENT NO. OF THIS IPB HAS CHANGED)** |




*Major Assembly Locator, LK02 Keyboard*

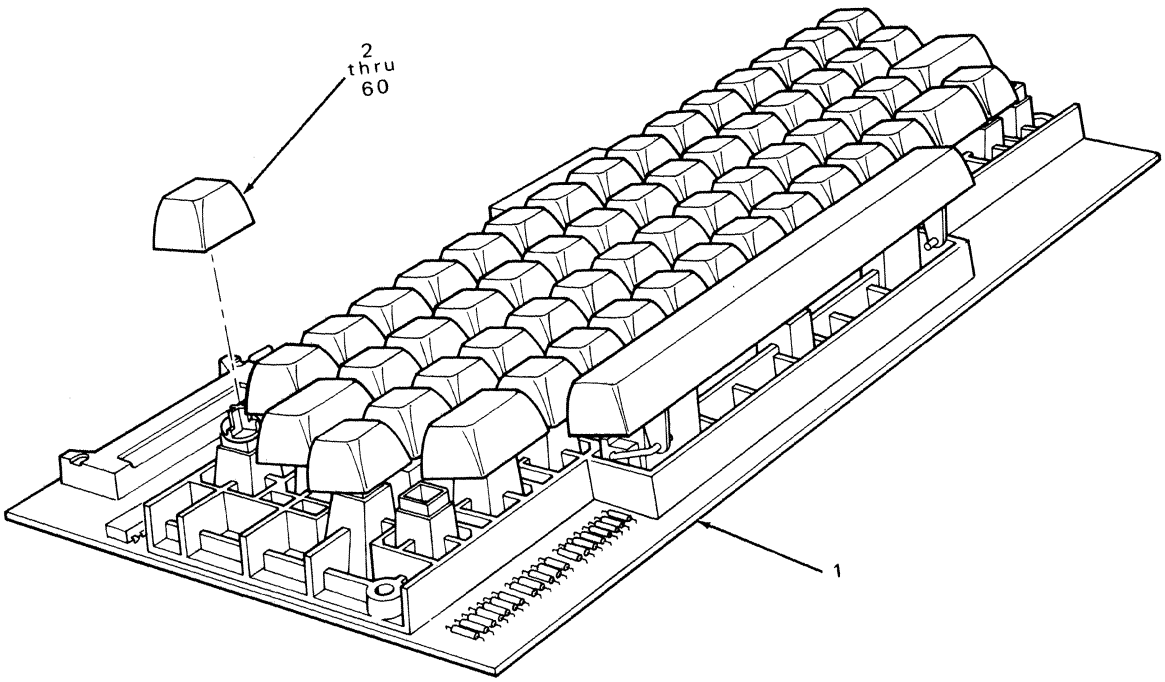



Figure 1. LK02 Keyboard Assembly

IPB-LK02

| FIG & ITEM NO. | DESCRIPTION | E DEC PART NO. | ECO CUT-IN LK02 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 1– | LK02 KEYBOARD ASSEMBLY | LK02-00 | | | | | |
| 1 | *KEYBOARD MODULE | 54-10736-00 | | | | | 2 |
| 2 | *KEY CAP, SINGLE Complete Set (Includes Caps Item 3 thru Item 60) | 12-12287-62 | | | | | |
| 3 | **Key Cap, Single A | 12-12287-01 | | | | | |
| 4 | **Key Cap, Single B | 12-12287-02 | | | | | |
| 5 | **Key Cap, Single C | 12-12287-03 | | | | | |
| 6 | **Key Cap, Single D | 12-12287-04 | | | | | |
| 7 | **Key Cap, Single E | 12-12287-05 | | | | | |
| 8 | **Key Cap, Single F | 12-12287-06 | | | | | |
| 9 | **Key Cap, Single BELL G | 12-12287-07 | | | | | |
| 10 | **Key Cap, Single H | 12-12287-08 | | | | | |
| 11 | **Key Cap, Single I | 12-12287-09 | | | | | |
| 12 | **Key Cap, Single J | 12-12287-10 | | | | | |
| 13 | **Key Cap, Single VT K | 12-12287-B4 | | | | | |
| 14 | **Key Cap, Single FF L | 12-12287-B5 | | | | | |
| 15 | **Key Cap, Single M | 12-12287-13 | | | | | |
| 16 | **Key Cap, Single N | 12-12287-14 | | | | | |
| 17 | **Key Cap, Single O | 12-12287-15 | | | | | |
| 18 | **Key Cap, Single P | 12-12287-16 | | | | | |
| 19 | **Key Cap, Single Q | 12-12287-17 | | | | | |
| 20 | **Key Cap, Single R | 12-12287-18 | | | | | |
| 21 | **Key Cap, Single S | 12-12287-19 | | | | | |
| 22 | **Key Cap, Single T | 12-12287-20 | | | | | |
| 23 | **Key Cap, Single U | 12-12287-21 | | | | | |
| 24 | **Key Cap, Single V | 12-12287-22 | | | | | |
| 25 | **Key Cap, Single W | 12-12287-23 | | | | | |
| 26 | **Key Cap, Single X | 12-12287-24 | | | | | |
| 27 | **Key Cap, Single Y | 12-12287-25 | | | | | |
| 28 | **Key Cap, Single Z | 12-12287-26 | | | | | |
| 29 | **Key Cap, Single ⟨ ⟩ | 12-12287-27 | | | | | |
| 30 | **Key Cap, Single ! 1 | 12-12287-28 | | | | | |
| 31 | **Key Cap, Single @ 2 | 12-12287-29 | | | | | |
| 32 | **Key Cap, Single # 3 | 12-12287-30 | | | | | |
| 33 | **Key Cap, Single $ 4 | 12-12287-31 | | | | | |
| 34 | **Key Cap, Single % 5 | 12-12287-32 | | | | | |
| 35 | **Key Cap, Single Δ 6 | 12-12287-33 | | | | | |
| 36 | **Key Cap, Single & 7 | 12-12287-34 | | | | | |
| 37 | **Key Cap, Single * 8 | 12-12287-35 | | | | | |
| 38 | **Key Cap, Single ( 9 | 12-12287-36 | | | | | |
| 39 | **Key Cap, Single ) 0 | 12-12287-37 | | | | | |
| 40 | **Key Cap, Single + = | 12-12287-38 | | | | | |
| 41 | **Key Cap, Single - — | 12-12287-39 | | | | | |
| 42 | **Key Cap, Single [ ] | 12-12287-40 | | | | | |
| 43 | **Key Cap, Single RETURN | 12-12287-41 | | | | | |
| 44 | **Key Cap, Single LF | 12-12287-42 | | | | | |
| 45 | **Key Cap, Single REPEAT | 12-12287-43 | | | | | |
| 46 | **Key Cap, Single ESC (SEL) | 12-12287-44 | | | | | |
| 47 | **Key Cap, Single TAB | 12-12287-45 | | | | | |
| 48 | **Key Cap, Single CTRL | 12-12287-46 | | | | | |
| 49 | **Key Cap, Single ~ \ | 12-12287-47 | | | | | |
| 50 | **Key Cap, Single : ; | 12-12287-48 | | | | | |

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN LK02 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 1– | | | | | | | |
| 51 | **Key Cap, Single " ' | 12-12287-49 | | | | | |
| 52 | **Key Cap, Single DELETE | 12-12287-50 | | | | | |
| 53 | **Key Cap, Single \ | 12-12287-51 | | | | | |
| 54 | **Key Cap, Single SHIFT | 12-12287-52 | | | | | |
| 55 | **Key Cap, Single ? / | 12-12287-53 | | | | | |
| 56 | **Key Cap, Single > . | 12-12287-54 | | | | | |
| 57 | **Key Cap, Single < , | 12-12287-55 | | | | | |
| 58 | **Key Cap, Single CAPS LOCK | 12-12287-56 | | | | | |
| 59 | **Key Cap, Single BACK SPACE | 12-12287-57 | | | | | |
| 60 | **Key Cap, Single BREAK | 12-12287-58 | | | | | |

| FIG & ITEM NO. | DESCRIPTION | C<br>DEC PART NO. | ECO CUT-IN 54-10736 00001 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 2– | LK02 KEYBOARD MODULE (ETCH REV. D) | 54-10736-00 | | | | | 1 |
| 1 | *Board, Etched Circuit | 50-10735-00 | | | | | |
| 2 | *Capacitor (C3) .01μF, 100V, 10% Mylar | 10-05784-00 | | | | | |
| 3 | *Capacitor (C4, C5, C7, C8, C9, C13) .01 μF, 100V, 20% Disc | 10-01610-01 | | | | | |
| 4 | *Capacitor (C1) 1 μF, 25V Tant | 10-10866-01 | | | | | |
| 5 | *Capacitor (C2, C6) 180 pF, 100V, 5% Mich | 10-00020-00 | | | | | |
| 6 | *Capacitor (C10, C12) 10 μF, 20V, 10% Tant | 10-04813-00 | | | | | |
| 7 | *Diode (D4–D9, D11–D45, D47–D62) D664 | 11-00114-00 | | | | | |
| 8 | *Transistor (Q3) DEC 3009B | 15-03100-00 | | | | | |
| 9 | *Switch (S1) (DPST) | 12-10919-00 | | | | | |
| 10 | *Socket (J1) IC 16 Pin | 12-10025-00 | | | | | |
| 11 | *Connector (J2) Right Angle Header | 12-09941-00 | | | | | |
| 12 | *Socket (XEI) Rom | 12-10947-00 | | | | | |
| 13 | *I.C. (E2) 7404 | 19-09686-00 | | | | | |
| 14 | *I.C. (E3) 7400 | 19-05575-00 | | | | | |
| 15 | *I.C. (E7) 7430 | 19-05570-00 | | | | | |
| 16 | *I.C. (E5, E6) 7437 | 19-10091-00 | | | | | |
| 17 | *I.C. (E4) 9601 | 19-09373-00 | | | | | |
| 18 | *I.C. (E1) ROM | 21-11634-00 | | | | | |
| 19 | *Selector, Phenolic Switch | 74-09532-00 | | | | | |
| 20 | *Screw, Phl Self Tapping No. 4-40 x 3/16 | 90-09159-00 | | | | | |
| 21 | *63 KEYSWITCH ARRAY | 70-09892-00 | | | | | 3 |
| 22 | *Resistor (R1, R4, R5, R9, R10) 1K, 1/4W, 5% | 13-00365-00 | | | | | |
| 23 | *Resistor (R6, R11) 3.9K, 1/4W, 5% | 13-00444-00 | | | | | |
| 24 | *Resistor (R3) 22K, 1/4W, 5% | 13-01808-00 | | | | | |
| 25 | *Resistor (R2) 100K, 1/4W, 5% | 13-02466-00 | | | | | |
| 26 | *Resistor (R7, R8) 2 ohm, 1/2W, 5% | 13-09421-00 | | | | | |

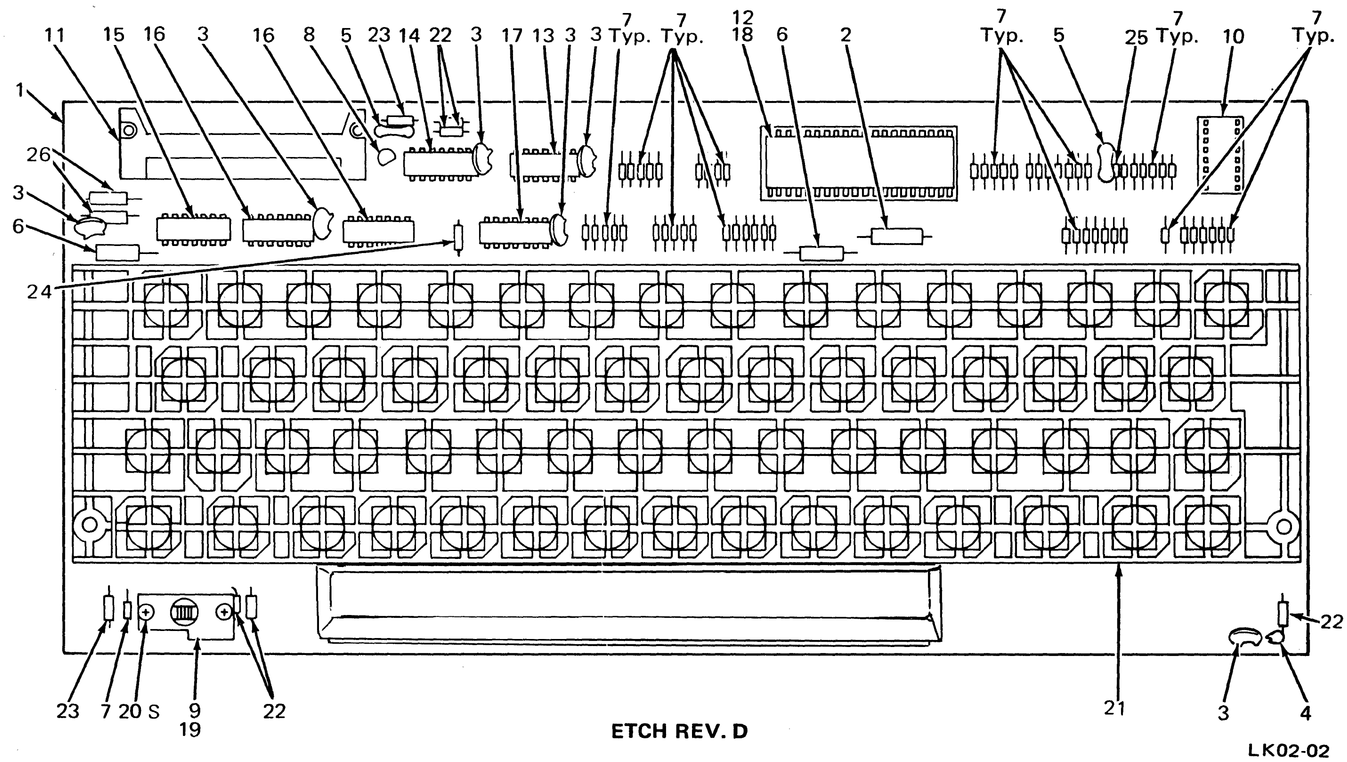



*Figure 2. LK02 Keyboard Module (Etch Rev. D)*

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN 54-10736 00002 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 2A– | LK02 KEYBOARD MODULE (ETCH REV. E) | 54-10736-00 | | | | | 1 |
| 1 | *Board, Etched Circuit | 50-10735-00 | | | | | |
| 2 | *Capacitor (C3) .01 µF, 100V, 10% Mylar | 10-05784-00 | | | | | |
| 3 | *Capacitor (C4, C5, C7, C8, C9, C13) .01 µF, 100V, 20% Disc | 10-01610-01 | | | | | |
| 4 | *Capacitor (C1) 1 µF, 25V Tant | 10-10866-01 | | | | | |
| 5 | *Capacitor (C2, C6) 180 pF, 100V, 5% Mich | 10-00020-00 | | | | | |
| 6 | *Capacitor (C10, C12) 10 µF, 20V, 10% Tant | 10-04813-00 | | | | | |
| 7 | *Diode (D5–D9, D11–45, D47–61) D664 | 11-00114-00 | | | | | |
| 8 | *Transistor (Q3) DEC 3009B | 15-03100-00 | | | | | |
| 9 | *Socket (J1, J3) I.C. 16 Pin | 12-11813-00 | | | | | |
| 10 | *Connector (J2) Right Angle Header | 12-09941-00 | | | | | |
| 11 | *Socket (XEI) Rom (deleted) | 12-10947-00 | | | | | |
| | *Socket (XEI) Rom (added) | 12-12385-00 | 0002B | | | | |
| 12 | *I.C. (E2) 7404 | 19-09686-00 | | | | | |
| 13 | *I.C. (E3, E8) 7400 | 19-05575-00 | | | | | |
| 14 | *I.C. (E5, E6) 7437 | 19-10091-00 | | | | | |
| 15 | *I.C. (E4) 9601 | 19-09373-00 | | | | | |
| 16 | *I.C. (E1) Rom (deleted) | 21-11634-01 | | | | | |
| | *I.C. (E1) Rom (added) | 23-002C1-00 | 0002B | | | | |
| 17 | *I.C. (E7) 7410 | 19-05576-00 | | | | | |
| 18 | *63 KEYSWITCH ARRAY | 70-09892-00 | | | | | 3 |
| 19 | *Resistor (R7, R8) 2 ohms, 1/2W, 5% | 13-09421-00 | | | | | |
| 20 | *Resistor (R1, R3, R4, R5, R10–14) 1K, 1/4W, 5% | 13-00365-00 | | | | | |
| 21 | *Resistor (R6) 3.9K, 1/4W, 5% | 13-00444-00 | | | | | |
| 22 | *Resistor (R9) 22K, 1/4W, 5% | 13-01803-00 | | | | | |
| 23 | *Resistor (R2) 100K, 1/4W, 5% | 13-02466-00 | | | | | |

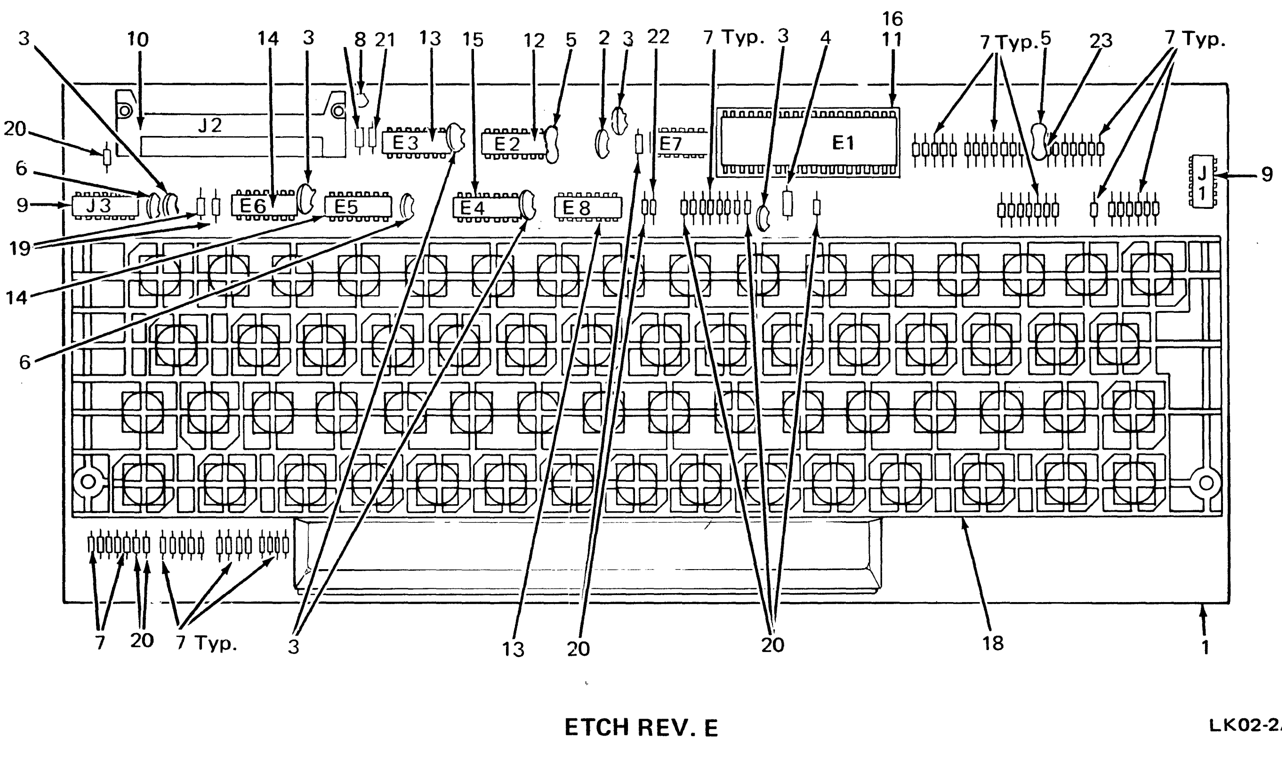



*Figure 2A. LK02 Keyboard Module (Etch Rev. E)*

| FIG & ITEM NO. | DESCRIPTION | E DEC PART NO. | ECO CUT-IN 54-10736 00003 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 2B– | LK02 KEYBOARD MODULE (ETCH REV F) | 54-10736-00 | | | | | 1 |
| 1 | *Board, Etched Circuit | 50-10735-00 | | | | | |
| 2 | *Capacitor (C3) .01 µF, 100V, 10% Mylar | 10-05784-00 | | | | | |
| 3 | *Capacitor (C4, C5, C7, C8, C9, C13) .01 µF, 100V, 20% Disc | 10-01610-01 | | | | | |
| 4 | *Capacitor (C1) 1 µF, 25V Tant | 10-10866-01 | | | | | |
| 5 | *Capacitor (C2) 180 pF, 100V, 5% Mich | 10-00020-00 | | | | | |
| 6 | *Capacitor (C10, C12) 10 µF, 20V, 10% Tant | 10-04813-00 | | | | | |
| 7 | *Diode (D5–D9, D11–D45, D47–D61) D664 | 11-00114-00 | | | | | |
| 8 | *Transistor (Q3) DEC 3009B | 15-03100-00 | | | | | |
| 9 | *Socket (J1, J3) IC 16 Pin | 12-11813-00 | | | | | |
| 10 | *Connector (J2) Right Angle Header | 12-09941-00 | | | | | |
| 11 | *Socket (XEI) Rom | 12-12385-00 | | | | | |
| 12 | *I.C. (E2) 7404 | 19-09686-00 | | | | | |
| 13 | *I.C. (E3, E8) 7400 | 19-05575-00 | | | | | |
| 14 | *I.C. (E5-E6) 7437 | 19-10091-00 | | | | | |
| 15 | *I.C. (E4) 9601 | 19-09373-00 | | | | | |
| 16 | *I.C. (E1) Rom | 23-002C1-00 | | | | | |
| 17 | *I.C. (E7) 7410 | 19-05576-00 | | | | | |
| 18 | *63 KEYSWITCH ARRAY | 70-09892-00 | | | | | 3 |
| 19 | *Resistor (R7, R8) 2 ohm, 1/2W, 5% | 13-09421-00 | | | | | |
| 20 | *Resistor (R1, R3–R5, R10–R14) 1K, 1/4W, 5% | 13-00365-00 | | | | | |
| 21 | *Resistor (R6) 3.9K, 1/4W, 5% | 13-00444-00 | | | | | |
| 22 | *Resistor (R9) 22K, 1/4W, 5% | 13-01808-00 | | | | | |
| 23 | *Resistor (R2) 100K, 1/4W, 5% | 13-02466-00 | | | | | |
| 24 | *Capacitor (C6) 1,000 pF, 100V, 5% Mich | 10-00042-00 | | | | | |

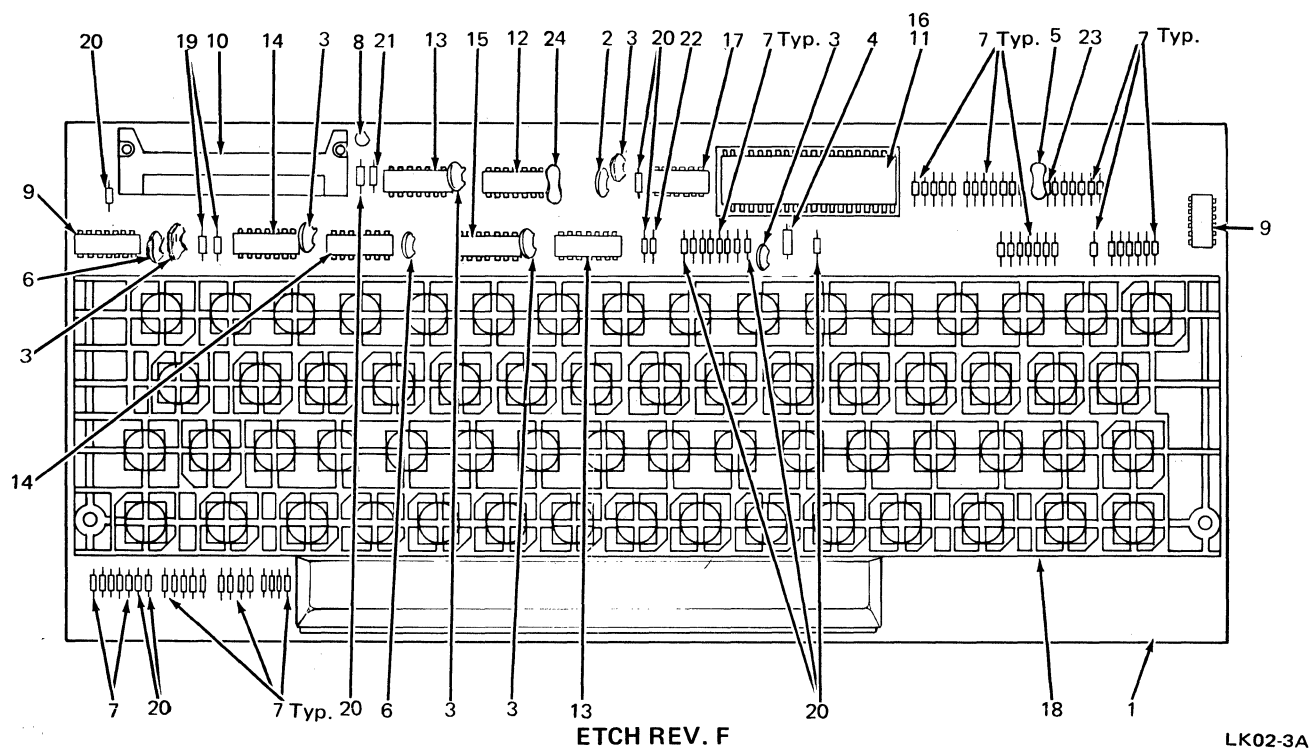



*Figure 2B. LK02 Keyboard Module (Etch Rev. F)*

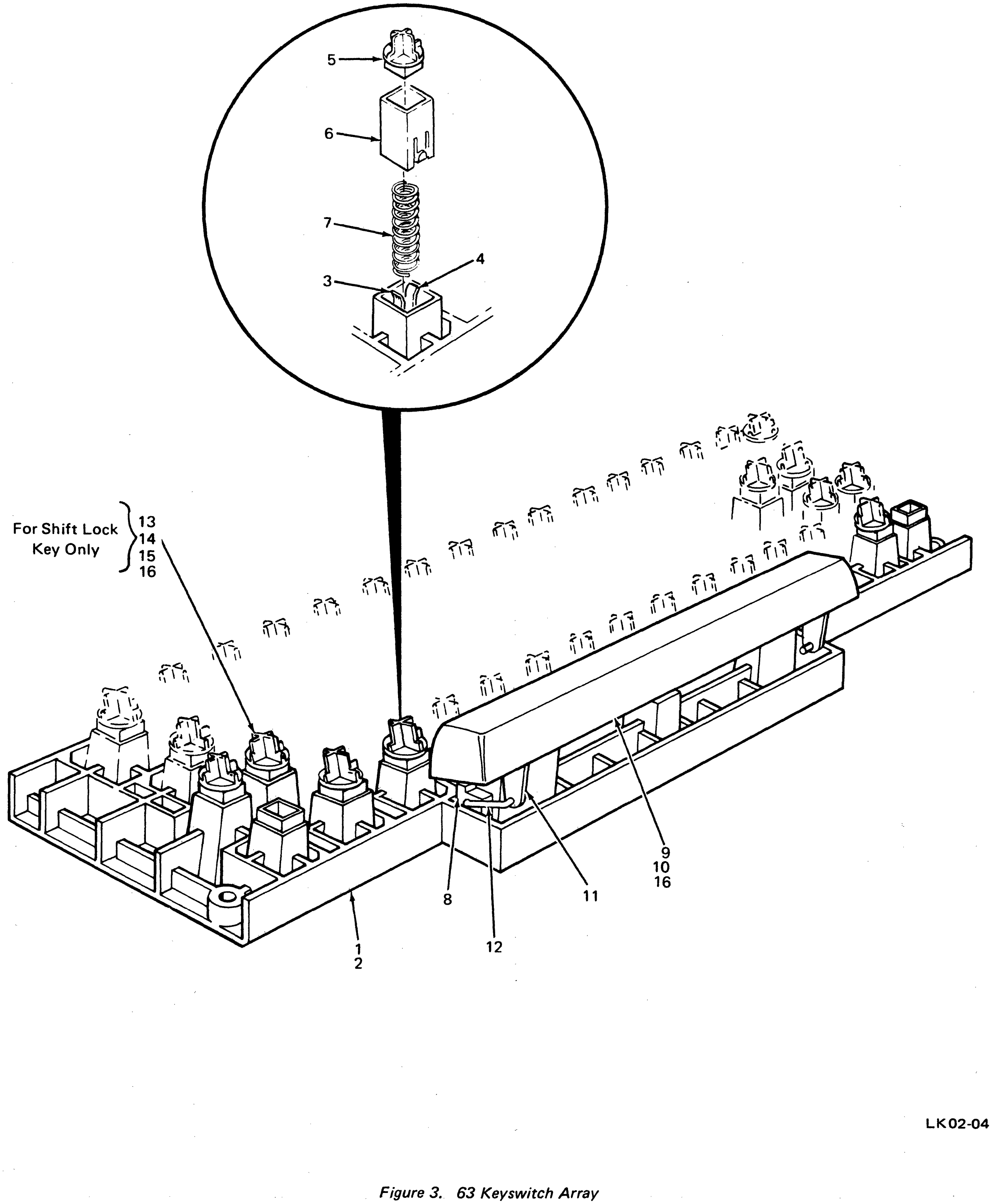



*Figure 3. 63 Keyswitch Array*

| FIG & ITEM NO. | DESCRIPTION | Ø DEC PART NO. | ECO CUT-IN 70-09892 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 3– | 63 KEYSWITCH ARRAY | 70-09892-00 | | | | | 2 |
| 1 | *HOUSING ASSEMBLY | 70-10035-00 | | | | | |
| 2 | **Housing, Keyswitch | 12-11859-00 | | | | | |
| 3 | **Contact, Solid | 12-11866-00 | | | | | |
| 4 | **Contact, Quadfurcated | 12-11865-00 | | | | | |
| 5 | *Adapter, Key Cap | 12-11860-00 | | | | | |
| 6 | *Plunger | 12-11862-00 | | | | | |
| 7 | *Spring, Compression | 12-11863-01 | | | | | |
| 8 | *Retainer, Equalizer Bar | 12-11861-00 | | | | | |
| 9 | *SPACE BAR ASSEMBLY | 70-09939-00 | | | | | |
| 10 | **Space Bar | 12-11857-00 | | | | | |
| 11 | **Bracket, Equalizer Bar | 12-11864-00 | | | | | |
| 12 | **Bar, Equalizer | 12-11858-00 | | | | | |
| 13 | *Wire, Cam Follower (For Shift Lock Only) | 12-12006-00 | | | | | |
| 14 | *Wire, Pin Lock (For Shift Lock Only) | 12-12007-00 | | | | | |
| 15 | *Plunger, Shift Lock (For Shift Lock Only) | 12-12005-00 | | | | | |
| 16 | *Spring, Compression (For Shift Lock and Space Bar only | 12-11863-03 | | | | | |

DEC

# ILLUSTRATED PARTS BREAKDOWN

# LK03 KEYBOARD

## HOW TO USE THE IPB

### GENERAL

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

### MAJOR ASSEMBLY LOCATOR

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

### 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.

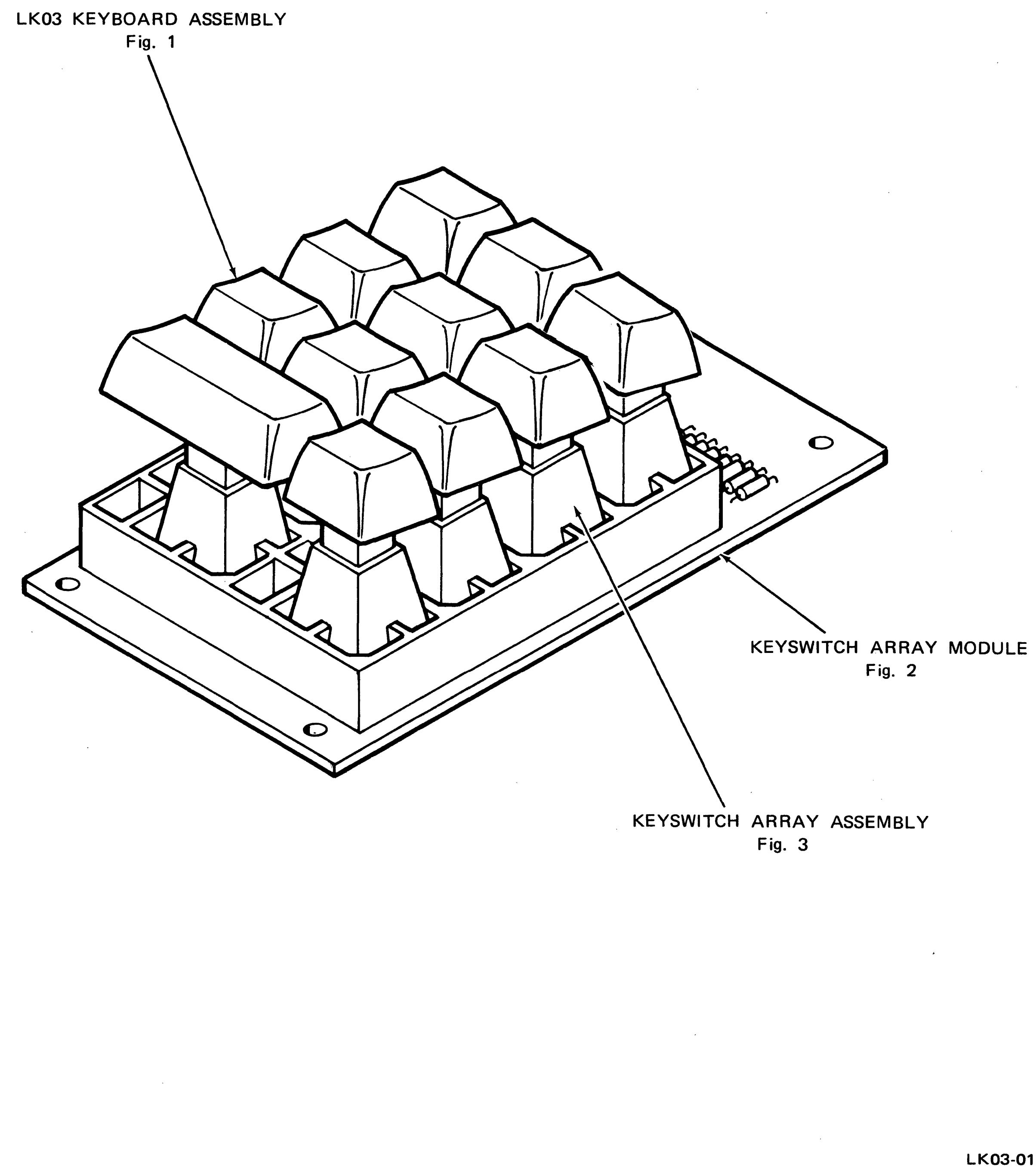
**Attaching Hardware** — The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

**(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 |
|---|---|---|---|---|
| 1st Printing | LK03 | 00000 - 00000 | 12-2-74 | N/A |
| " | 54-10819 | 00001 - 00001 | | " |
| " | 70-09891 | 00000 - 00000 | | " |




*Major Assembly Locator, LK03 Keyboard*

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN LK03 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 1– | LK03 KEYBOARD ASSEMBLY | LK03-00 | | | | | |
| 1 | *KEYSWITCH ARRAY MODULE | 54-10819-00 | | | | | 2 |
| 2 | *KEY CAP, SINGLE Complete Set (Includes Caps Item 3 thru Item 13) | 90-09570-74 | | | | | |
| 3 | **Key Cap, Single 0 | 90-09570-63 | | | | | |
| 4 | **Key Cap, Single 1 | 90-09570-64 | | | | | |
| 5 | **Key Cap, Single 2 | 90-09570-65 | | | | | |
| 6 | **Key Cap, Single 3 | 90-09570-66 | | | | | |
| 7 | **Key Cap, Single 4 | 90-09570-67 | | | | | |
| 8 | **Key Cap, Single 5 | 90-09570-68 | | | | | |
| 9 | **Key Cap, Single 6 | 90-09570-69 | | | | | |
| 10 | **Key Cap, Single 7 | 90-09570-70 | | | | | |
| 11 | **Key Cap, Single 8 | 90-09570-71 | | | | | |
| 12 | **Key Cap, Single 9 | 90-09570-72 | | | | | |
| 13 | **Key Cap, Single . | 90-09570-73 | | | | | |

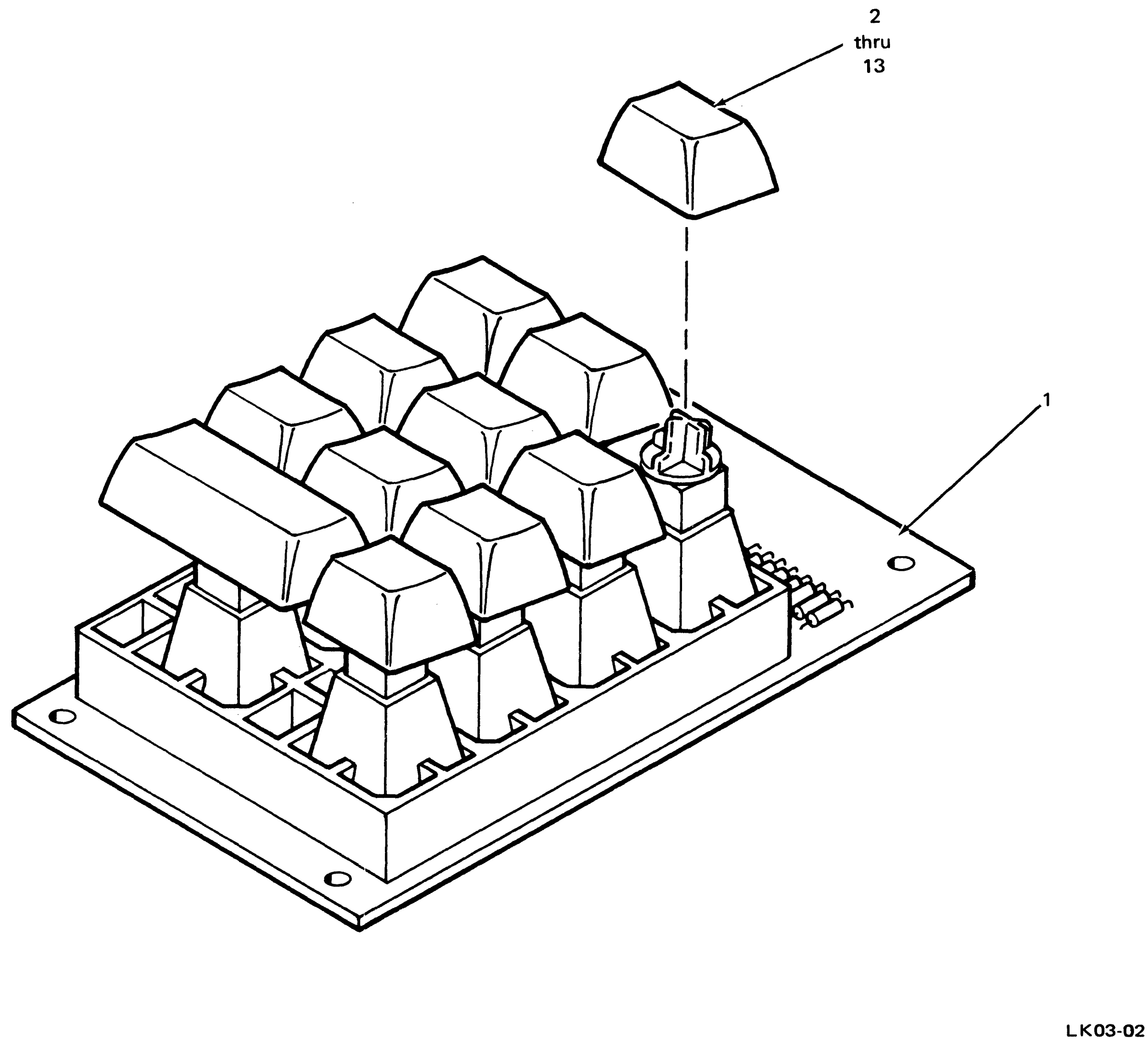
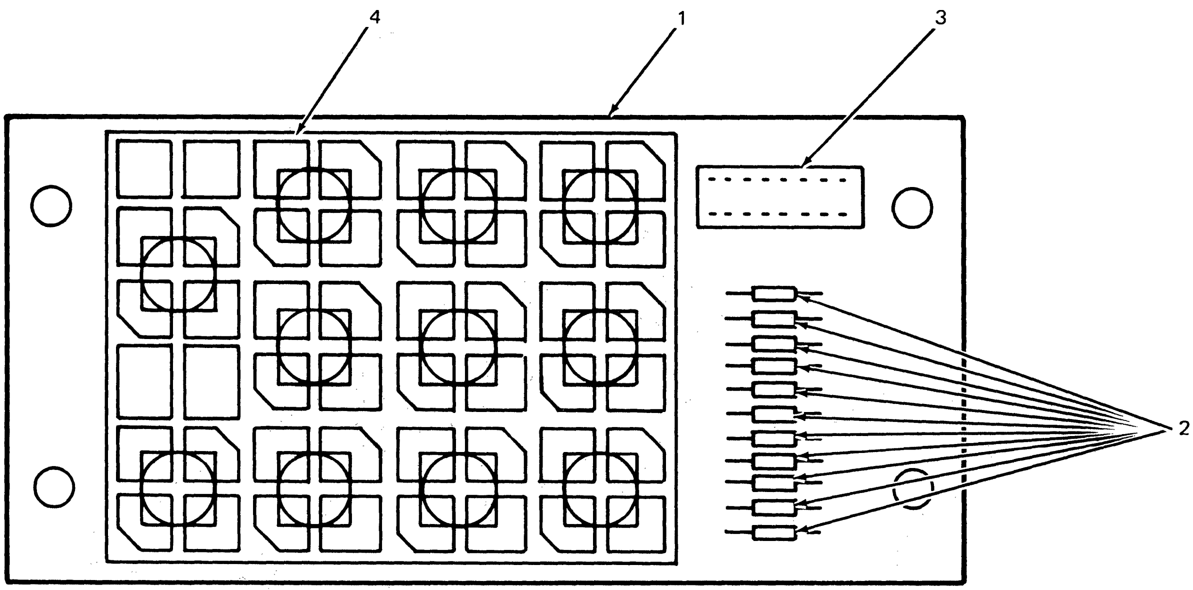



*Figure 1. LK03 Keyboard Assembly*

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN 54-10819 00001 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 2— | KEYSWITCH ARRAY MODULE (ETCH REV. B) | 54-10819-00 | | | | | 1 |
| 1 | *Board, Etched Circuit | 50-10818-00 | | | | | |
| 2 | *Diode (D1 thru D11) D664 | 11-00114-00 | | | | | |
| 3 | *Socket (J1) 16 Pin | 12-10025-00 | | | | | |
| 4 | *KEYSWITCH ARRAY | 70-09891-00 | | | | | 3 |




ETCH REV. B

LK03-03

*Figure 2. Keyswitch Array Module (Etch Rev. B)*

| FIG & ITEM NO. | DESCRIPTION | DEC PART NO. | ECO CUT-IN 70-09891 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 3– | KEYSWITCH ARRAY ASSEMBLY | 70-09891-00 | | | | | 2 |
| 1 | *HOUSING ASSEMBLY | 70-10033-00 | | | | | |
| 2 | **Housing, Keyswitch | 12-11859-01 | | | | | |
| 3 | **Contact, Solid | 12-11866-00 | | | | | |
| 4 | **Contact, Quadfurcated | 12-11865-00 | | | | | |
| 5 | *Plunger | 12-11862-00 | | | | | |
| 6 | *Adapter, Key Cap | 12-11860-00 | | | | | |
| 7 | *Spring, Compression | 12-11863-01 | | | | | DEC |

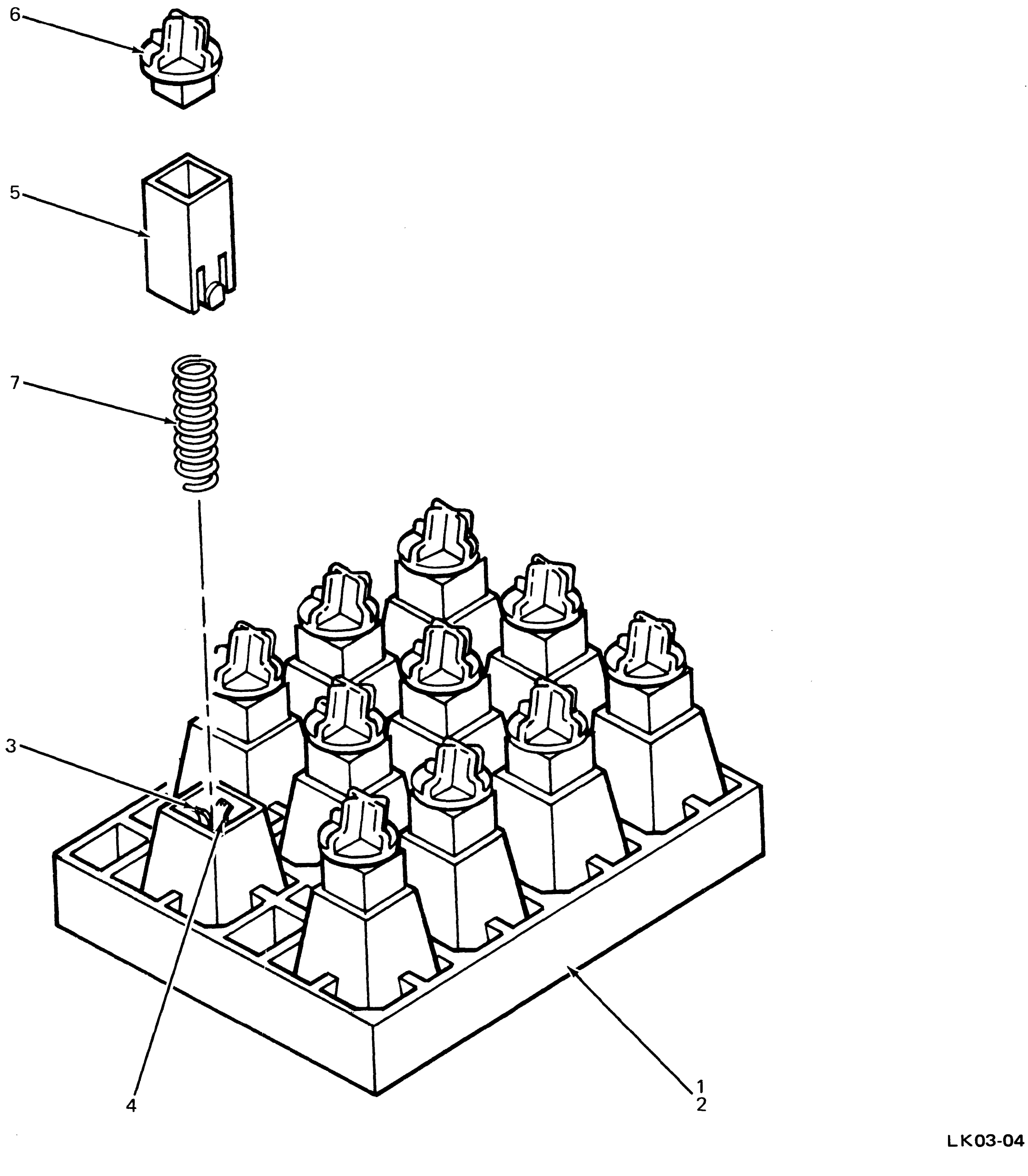



*Figure 3. Keyswitch Array Assembly*

EK-LK03A-IP-001

# ILLUSTRATED PARTS BREAKDOWN

# LK03A KEYBOARD

## HOW TO USE THE IPB

### GENERAL

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

### MAJOR ASSEMBLY LOCATOR

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

### INDENTED PARTS LIST

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

### COLUMN CALLOUT DESCRIPTION

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

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

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

**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.

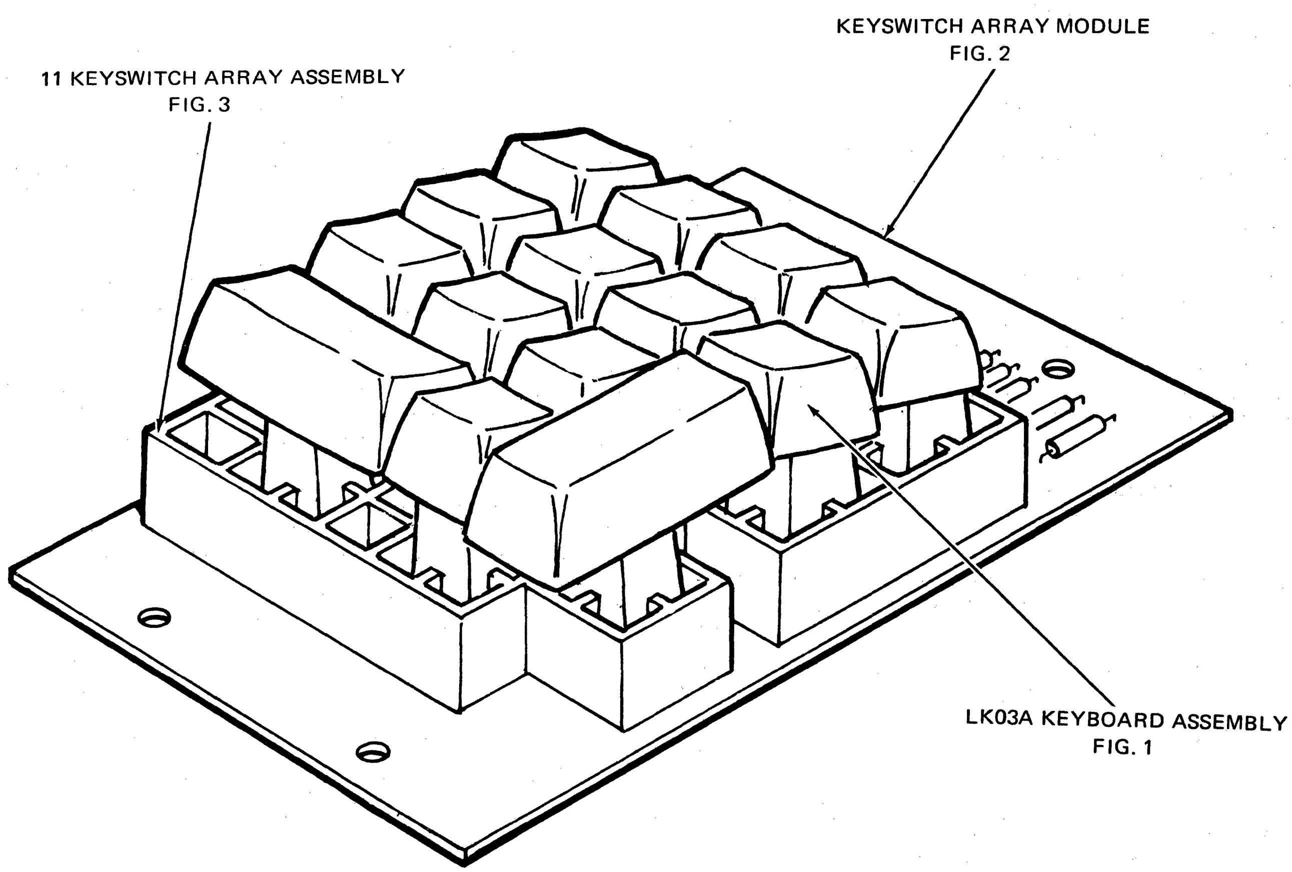
**Attaching Hardware** — The @ symbol is inserted before any part that is used as attaching hardware. Attaching hardware is denoted as those parts that are not an integral part of the referenced assembly.

**(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 |
|---|---|---|---|---|
| 1st Printing | LK03A | 00000 - 00000 | 1-30-76 | N/A |
| " | 54-11635 | 00000 - 00000 | | |
| " | 70-09891 | 00000 - 00000 | | |




*Major Assembly Locator*

| FIG & ITEM NO. | DESCRIPTION | Ø DEC PART NO. | ECO CUT-IN LK03A 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 1– | LK03A KEYBOARD ASSEMBLY | LK03A | | | | | |
| 1 | *KEYSWITCH ARRAY MODULE (14 KEY) | 54-11635-00 | | | | | 2 |
| 2 | *KEYCAP SET | 12-12287-74 | | | | | |
| 3 | **Key-Cap, Single 0 | 12-12287-63 | | | | | |
| 4 | **Key-Cap, Single 1 | 12-12287-64 | | | | | |
| 5 | **Key-Cap, Single 2 | 12-12287-65 | | | | | |
| 6 | **Key-Cap, Single 3 | 12-12287-66 | | | | | |
| 7 | **Key-Cap, Single 4 | 12-12287-67 | | | | | |
| 8 | **Key-Cap, Single 5 | 12-12287-68 | | | | | |
| 9 | **Key-Cap, Single 6 | 12-12287-69 | | | | | |
| 10 | **Key-Cap, Single 7 | 12-12287-70 | | | | | |
| 11 | **Key-Cap, Single 8 | 12-12287-71 | | | | | |
| 12 | **Key-Cap, Single 9 | 12-12287-72 | | | | | |
| 13 | **Key-Cap, Single . (Decimal Point) | 12-12287-73 | | | | | |
| 14 | **Key-Cap, ENTER | 12-12287-01 | | | | | |
| 15 | **Key-Cap, Single - | 12-12287-E2 | | | | | |
| 16 | **Key-Cap, Single , | 12-12287-E4 | | | | | |

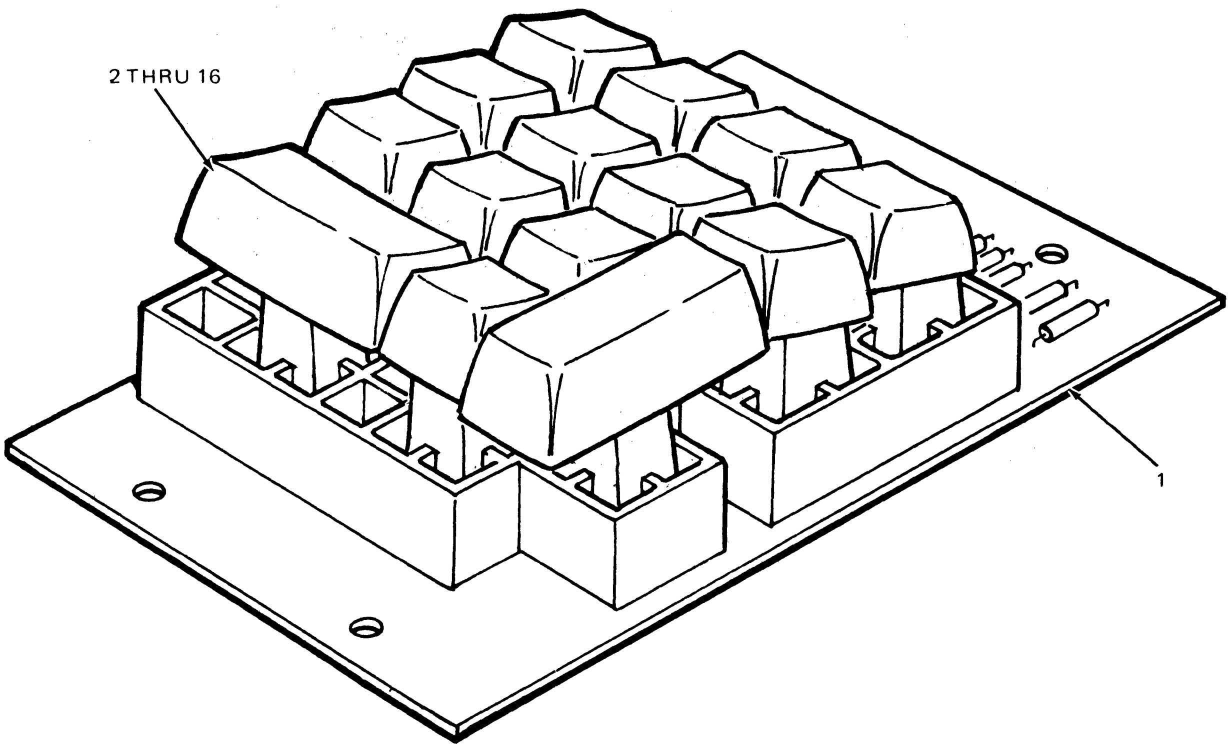



*Figure 1. LK03A Keyboard Assembly*

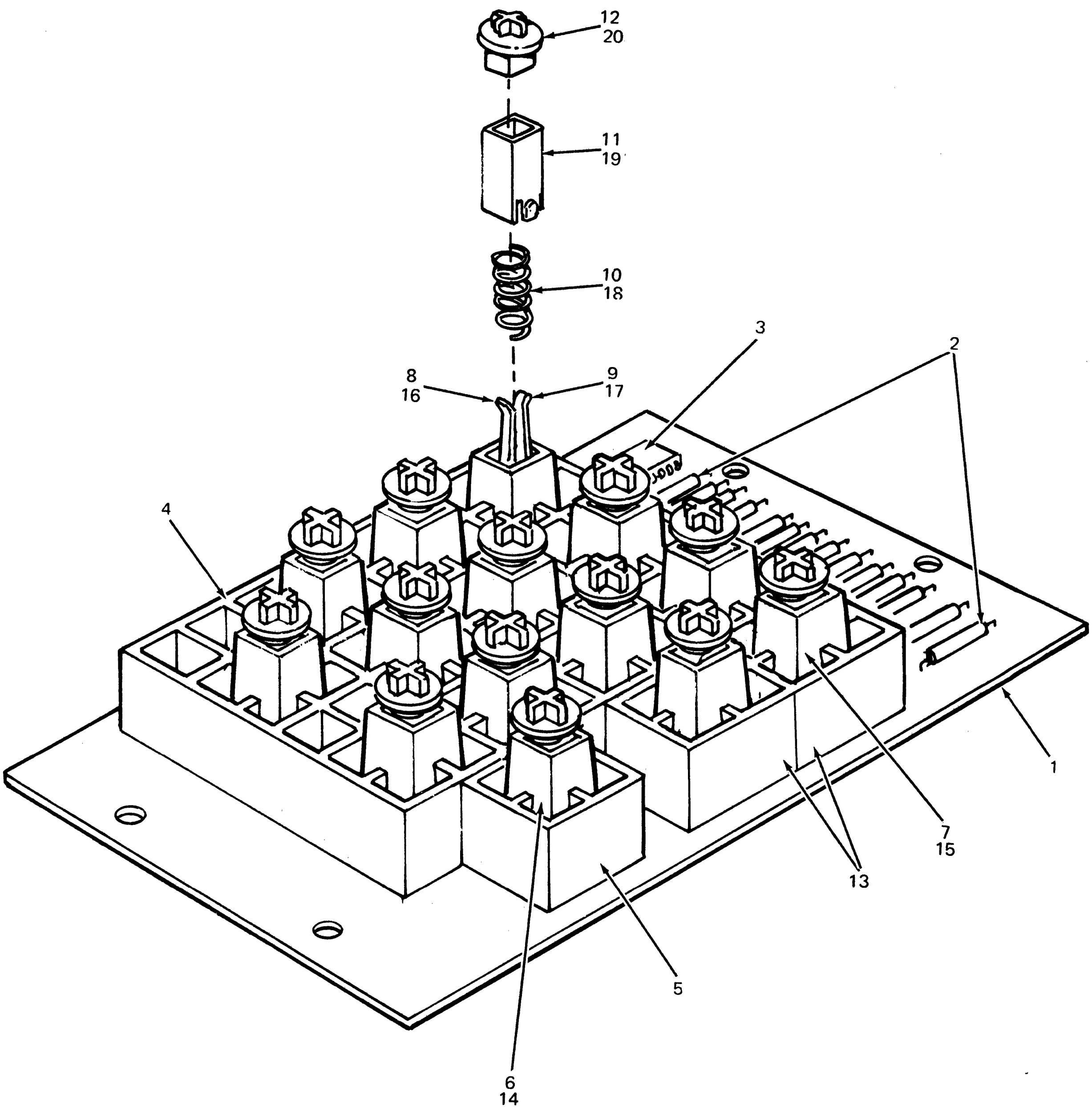
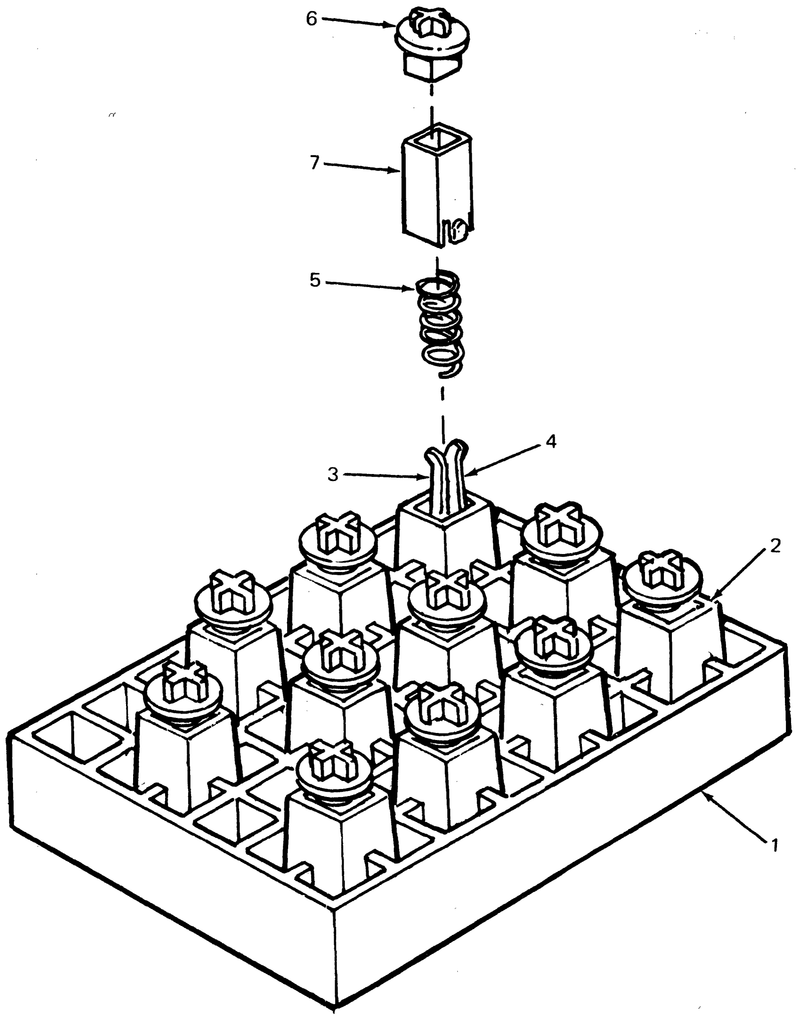



*Figure 2. Keyswitch Array Assembly*

| FIG & ITEM NO. | DESCRIPTION | B DEC PART NO. | ECO CUT-IN 54-11635 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 2– | KEYSWITCH ARRAY ASSEMBLY (ETCH REV C) | 54-11635-00 | | | | | 1 |
| 1 | *Board, Etched Circuit | 50-11634-00 | | | | | |
| 2 | *Diode (D1–D14) D664 | 11-00114-00 | | | | | |
| 3 | *Socket (J1) | 12-11813-00 | | | | | |
| 4 | *11 KEYSWITCH ARRAY | 70-09891-00 | | | | | 3 |
| 5 | *SINGLE KEYSWITCH (KS1) | 70-11111-01 | | | | | |
| 6 | **Housing Assembly | 70-11110-00 | | | | | |
| 7 | ***Housing, Keyswitch | 12-11859-04 | | | | | |
| 8 | ***Contact, Solid | 12-11866-00 | | | | | |
| 9 | ***Contact, Quadfurcated | 12-11865-00 | | | | | |
| 10 | **Spring, Compression | 12-11863-01 | | | | | |
| 11 | **Plunger | 12-11862-00 | | | | | |
| 12 | **Adapter, Key-Cap Straight | 12-12677-00 | | | | | |
| 13 | *SINGLE KEYSWITCH (KS2, KS3) | 70-11111-00 | | | | | |
| 14 | **Housing Assembly | 70-11110-00 | | | | | |
| 15 | ***Housing, Keyswitch | 12-11859-04 | | | | | |
| 16 | ***Contact, Solid | 12-11866-00 | | | | | |
| 17 | ***Contact, Quadfurcated | 12-11865-00 | | | | | |
| 18 | **Spring, Compression | 12-11863-01 | | | | | |
| 19 | **Plunger | 12-11862-00 | | | | | |
| 20 | **Adapter, Tilted | 12-11860-00 | | | | | |

| FIG & ITEM NO. | DESCRIPTION | Ø DEC PART NO. | ECO CUT-IN 70-09891 00000 | USED ON CODE | VENDOR CODE | VENDOR PART NO. | REF FIG NO. |
|---|---|---|---|---|---|---|---|
| 3— | 11 KEYSWITCH ARRAY ASSEMBLY | 70-09891-00 | | | | | 2 |
| 1 | *Housing Assembly | 70-10033-00 | | | | | |
| 2 | **Housing, Keyswitch | 12-11859-00 | | | | | |
| 3 | **Contact, Solid | 12-11866-00 | | | | | |
| 4 | **Contact, Quadfurcated | 12-11865-00 | | | | | |
| 5 | *Spring Compression | 12-11863-01 | | | | | |
| 6 | *Adapter, Key-Cap | 12-11860-00 | | | | | |
| 7 | *Plunger | 12-11862-00 | | | | | |
| | | | | | | | DEC |




LK03A-03

*Figure 3. 11 Keyswitch Array Assembly*

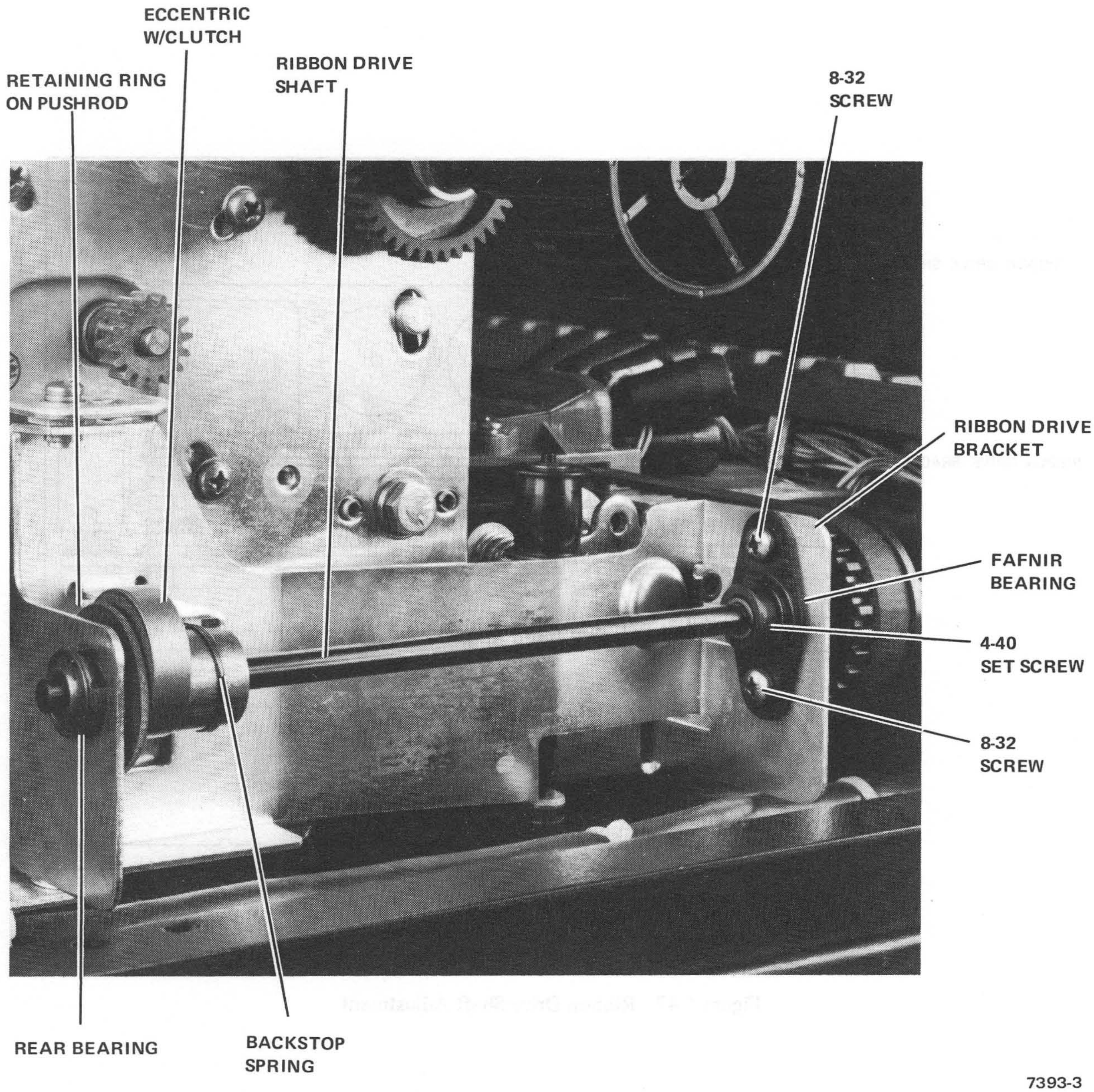



Figure 6-46 Fafnir Bearing Removal

# APPENDIX A
# REFERENCE DATA

## A.1 ABBREVIATIONS

The abbreviations used in this manual are listed in Table A-1.

## A.2 SIGNAL GLOSSARY

The signal names used in this manual are listed in Table A-2.

## A.3 IC PIN LOCATION DRAWINGS

The pin locations of the Integrated Circuits used in the LA36 are illustrated in Figures A-1 through A-29.

**Table A-1**
**Glossary of Abbreviations**

| | |
|---|---|
| 2SB | Two Stop Bits |
| AKO | Any Key On |
| AMP | Amplifier |
| AR | Address Register |
| BCD | Binary Coded Decimal |
| BEL | Bell |
| BS | Backspace |
| BUF | Buffer |
| BUFF | Buffer |
| C/B | Carry/Borrow |
| CB RAM | Character Buffer Read Access Memory |
| CBA | Character Buffer Address |
| CG ROM | Character Generator Read Only Memory |
| CHAR | Character |
| CLK | Clock |
| CLR | Clear |
| CM | Centimeter |
| CNTR | Counter |
| COL | Column |
| COL HI | Column High |
| COL LO | Column Low |
| CONTROL RAM | Control Read Access Memory |
| CRAM | Control Read Access Memory |
| CTRL | Control |
| D/A | Digital to Analog |
| DAC | Digital to Analog |
| DEC | Decoder |
| DIR | Direction |
| DM | Down |
| DRVR | Driver |
| ENB | Enable |
| ER | Error |
| F/F | Flip Flop |
| FIFO | First In/First Out |
| H | High |
| HDE | Head Drive Enable |
| INC | Increment |
| INIT | Initialize |
| IPS | Inches Per Second |

**Table A-1 (Cont)**
**Glossary of Abbreviations**

| | |
|---|---|
| KBD | Keyboard |
| KBH | Keyboard Hold |
| kHz | Kilohertz |
| | |
| L | Low |
| LCV | Last Character Visibility |
| LF | Line Feed |
| LSB | Least Significant Bit |
| | |
| M | Meter |
| MHz | Megahertz |
| mm | Millimeter |
| MPC | Microprogrammed Controller |
| $\mu$s | Microseconds |
| ms | Milliseconds |
| MSB | Most Significant Bit |
| MUX | Multiplexer |
| | |
| NB | Number Of Bits |
| ns | Nanoseconds |
| | |
| POS HI | Position High |
| POS LO | Position Low |
| POS MD | Position Middle |
| POS | Position |
| POSIT | Position |
| PT | PRINT Timer |
| | |
| R | Read or Register |
| RAM | Read Access Memory |
| RCV | Receive |
| RCVR | Receiver |
| RD ADR | Read Address |
| RD | Read or Register |
| RD | Receive Data |
| REG | Register |
| ROM | Read Only Memory |
| | |
| ST | Status |
| SYNC | Synchronize |
| | |
| TACH | Tachometer |
| TTL | Transitor To Transistor Logic |
| | |
| UART | Universal Asynchronous Receiver Transmitter |
| | |
| VREF | Voltage Reference |

**Table A-1 (Cont)**
**Glossary of Abbreviations**

| | |
|---|---|
| WC | Word Count |
| WD CNT | Word Count |
| WT ADR | Write Address |
| XD | Read Access Memory Transmit Data |
| XMIT | Transmit |

Table A-2
Signal Glossary

| Mnemonic | Definition | Source | Destination |
|---|---|---|---|
| BELL SINK | Bell Return | J5-2 | Speaker |
| BELL SOURCE | +5 V to Bell | R118 | J5-1, Speaker |
| COMMON | From LF Motor | J5-4 | LF Motor |
| PHASE 1 | To LF Motor | J5-7 | LF Motor |
| PHASE 2 | To LF Motor | J5-6 | LF Motor |
| SOL 1:7 | Solenoid Driver Outputs to Head Solenoids | | |
| MPC3 BMB00 | Buffered Memory Bit 0 | E58-4 or E61-4 | E49-9, E21-2 E31-15, E15-15 |
| MPC3 BMB01 | Buffered Memory Bit 1 | E58-5 or E61-5 | E49-5, E21-5 E31-14, E15-14 |
| MPC3 BMB02 | Buffered Memory Bit 2 | E58-6 or E61-6 | E49-3, E21-8 E31-13, E15-13 |
| MPC3 BMB03 | Buffered Memory Bit 3 | E58-7 or E61-7 | E49-1, E21-11 E31-11, E15-11 |
| MPC3 BMB04 | Buffered Memory Bit 4 | E58-8 or E61-8 | E54-13, E46-23 E50-15 |
| MPC3 BMB05 | Buffered Memory Bit 5 | E58-9 or E61-9 | E54-11, E46-22 E50-14 |
| MPC3 BMB06 | Buffered Memory Bit 6 | E58-10 or E61-10 | E54-9, E53-1 E46-21, E50-13 |
| MPC3 BMB07 | Buffered Memory Bit 7 | E58-11 or E61-11 | E54-5, E53-2 E46-20 |
| MPC3 MB00 | Memory Bit 00 | E58-4 or E61-4 | – |
| MPC3 MB01 | Memory Bit 01 | E58-5 or E61-5 | – |
| MPC3 MB02 | Memory Bit 02 | E58-6 or E61-6 | – |
| MPC3 MB03 | Memory Bit 03 | E58-7 or E61-7 | – |
| MPC3 MB04 | Memory Bit 04 | E58-8 or E61-8 | – |
| MPC3 MB05 | Memory Bit 05 | E58-9 or E61-9 | – |

**Table A-2 (Cont)**
**Signal Glossary**

| Mnemonic | Definition | Source | Destination |
|---|---|---|---|
| MPC3 MB06 | Memory Bit 06 | E58-10 or E61-10 | – |
| MPC3 MB07 | Memory Bit 07 | E58-11 or E61-11 | – |
| MPC4 CLR BEL | Clear Bell | E44-9 | E36-3 |
| MPC4 CLR C/B | Clear Carries or Borrows | E44-16 | E11-13 |
| MPC4 CLR DA | Clear Data Available | E44-2 | E60-11 |
| MPC4 CLR HDE | Clear Head Drive Enable | E44-13 | E39-11, E30-11 |
| MPC4 CLR INIT | Clear Initialize | E44-17 | E51-1 |
| MPC4 CLR KBH | Clear Keyboard Hold | E44-1 | E51-10 |
| MPC4 CLR 568 | Clear 568 | E44-6 | E15-23, E31-4 E30-4 |
| MPC4 CS00 | Clocked Selector 04 | E46-1 | E42-1 |
| MPC4 CS01 | Clocked Selector 04 | E46-2 | E42-2 |
| MPC4 CS02 | Clocked Selector 04 | E46-3 | E42-13 |
| MPC4 CS03 | Clocked Selector 04 | E46-4 | E37-4 |
| MPC4 CS04 | Clocked Selector 04 | E46-5 | E37-5 |
| MPC4 CS10 | Clocked Selector 04 | E46-9 | – |
| MPC4 CS11 | Clocked Selector 04 | E46-10 | E27-3 |
| MPC4 CS12 | Clocked Selector 04 | E46-11 | E44-18, 19 |
| MPC4 CS13 | Clocked Selector 04 | E46-13 | E44-18, 19 |
| MPC4 CS14 | Clocked Selector 04 | E46-14 | E42-5 |
| MPC4 CS15 | Clocked Selector 04 | E46-15 | E37-1, E42-3 |
| MPC4 CS16 | Clocked Selector 04 | E46-16 | E37-2, E37-13 E42-4 |
| MPC4 CS17 | Clocked Selector 04 | E46-17 | E53-4 |

**Table A-2 (Cont)**
**Signal Glossary**

| Mnemonic | Definition | Source | Destination |
|---|---|---|---|
| MPC4 LOAD CBA | Load Character Buffer Address | E44-4 | E52-9 |
| MPC4 LOAD D/A | Load Digital/Analog | E44-10 | E14-9 |
| MPC4 MAX | Maximum | E23-6 | E31-5, E14-4, 5, 12, 13 |
| MPC4 REG0:3 | Register | E32-2, 3, 6, 7 | E52-4, 5, 12, 13 E38-1, 5, 9, 10 |
| MPC4 S000 | Selector 0 | E50-1 | E22-2 |
| MPC4 S001 | Selector 1 | E50-2 | E27-2 |
| MPC4 S002 | Selector 2 | E50-3 | E21-3 |
| MPC4 S003 | Selector 3 | E50-4 | E31-9 |
| MPC4 S004 | Selector 4 | E50-5 | E15-9 |
| MPC4 SET BEL | Set Bell | E44-9 | E36-4 |
| MPC4 SET HDE | Set Head Drive Enable | E44-11 | E39-10 |
| MPC4 SET HOLD | Set Hold | E44-15 | E40-4 |
| MPC4 STEP LF | Step Line Feed | E44-14 | E24-3, 11, E29-5 |
| MPC4 SKIP | Skip | E40-11 | E60-2 |
| MPC4 WRITE BUF | Write Buffer | E44-5 | E60-10, E56-3 |
| MPC4 ZERO | Zero | E23-8 | E18-13, E31-3, 6 |
| MPC4 −1 REG | Decrement Register | E44-7 | E32-4 |
| MPC4 +1 REG | Increment Register | E44-3 | E32-5 |
| MPC5 CLK | Clock | E64-5, 12 | E46-18, 19, E29-10, E49-13 |
| MPC5 S.I. | Serial In | E66-6 | E55-20 |
| MPC5 1.184 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 A-2 (Cont)
Signal Glossary

| Mnemonic | Definition | Source | Destination |
|---|---|---|---|
| MPC5 4.8 kHz | 4.8 kHz | E63-11 | E26-14, E17-4 |
| MPC5 19 | 19 | E26-9 | E67-5, E31-21, 22 |
| MPC5 76 $\mu$s | 76 $\mu$s | E26-11 | E3-3, E5-3 |
| MPC5 208 | 208 | E26-12 | E40-10, E67-11, E17-7, E15-7, E31-19 |
| MPC5 568 | 568 | E30-5, 6 | E64-10, E9-4, 10 E13-14, E37-9 |
| MPC5 592 ns | 592 ns | E17-13 | E20-1 |
| MPC6 BEL | Bell | E19-1 | E15-6 |
| MPC6 BS | Back Space | E19-9 | E15-20 |
| MPC6 CR | Carriage Return | E19-3 | E25-13, E15-4 |
| MPC6 DA | Data Available | E55-19 | E31-7 |
| MPC6 HS1:7 | Head Select | E28-4 to 11 and E33-4 to 11 | Head Solenoid Drivers |
| MPC6 HT | Horizontal Tab | E19-7 | E15-21 |
| MPC6 KBH | Keyboard Hold | E51-8 | E31-20 |
| MPC6 LF | Line Feed | E19-6 | E25-1, E15-5 |
| MPC6 PNTABL | Printable | E33-11 | E25-11, E31-1 |
| MPC6 S.O. | Serial Out | E55-25 | E29-12 |
| MPC7 BORROW | Borrow | E12-3 | E12-1, E15-22 E31-18 |
| MPC7 CARRY | Carry | E7-6 | E31-23 |
| MPC7 COL INC COUNT 0:2 | Column Increment Count | E16-2, 3, 6 | E28-19 to 21, E33-19 to 21 |
| MPC7 INC | Increment | E30-9 | E15-3 |
| MPC7 PT COM +5 V | Print Timer Common | J1-U, V | J1-13, 17 (R1, R2) |

Table A-2 (Cont)
Signal Glossary

| Mnemonic | Definition | Source | Destination |
|---|---|---|---|
| MPC7 SUM | Sum | E1-6 (J1-B) | |
| MPC8 BEL | Bell | R58 | J1-TT, J1-38 |
| MPC8 HDE (HDEM) | Head Drive Enable | E39-8 | J5-2 |
| MPC8 INIT | Initialize | E51-5, 6 | E11-2, E31-8 |
| MPC8 LF1 | Line Feed 1 | E24-9 | J1-JJ |
| MPC8 LF2 | Line Feed 2 | E24-5 | J1-P |
| MPC8 LF HOLD | Line Feed Hold | E29-6 | J1-HH |
| MPC8 W.U. | Wake Up | Q9-C | E53-5, E10-12, E36-1, J1-DD, E14-1 |
| P.T. COLL 1 | Print Timer Collector 1 | Q1-C (J1-21) | J1-Y (E34-2) |
| P.T. COLL 2 | Print Timer Collector 2 | Q2-C (J1-25) | J1-CC (E35-2) |

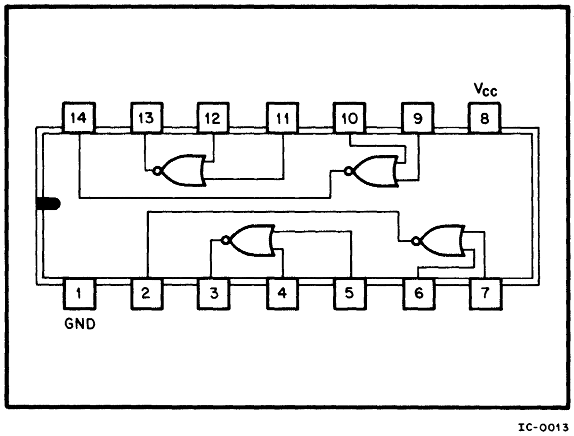



Figure A-1 380 Quad 2-Input NOR Gate

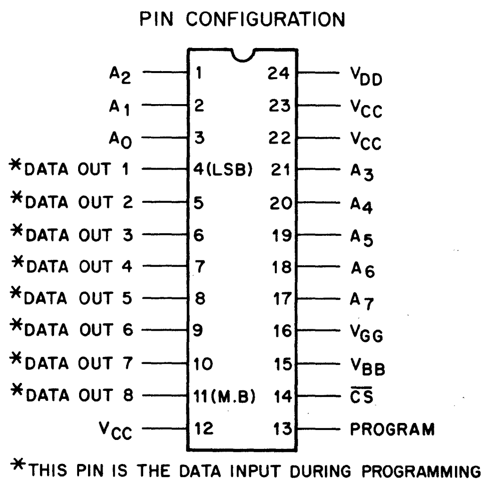
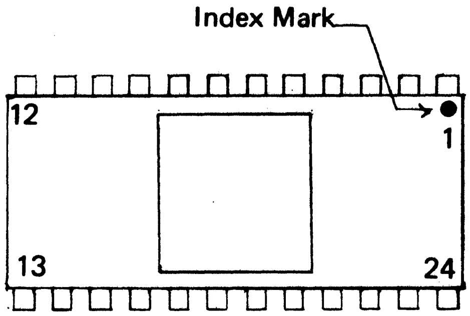
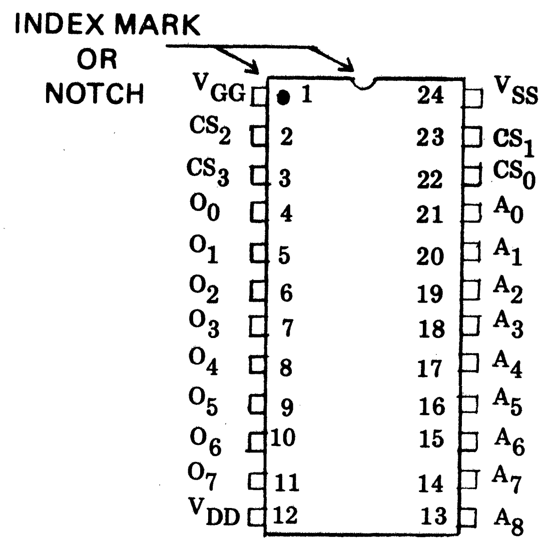



Figure A-2 1702A 8-Bit Reprogrammable ROM

## PACKAGE "A" – BENT LEADS

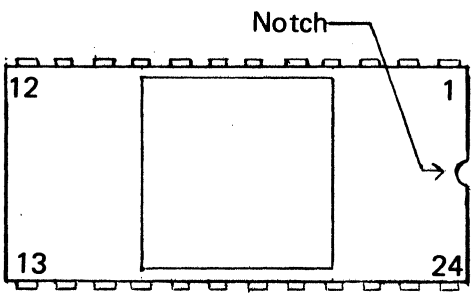



IC-0123




IC-0120

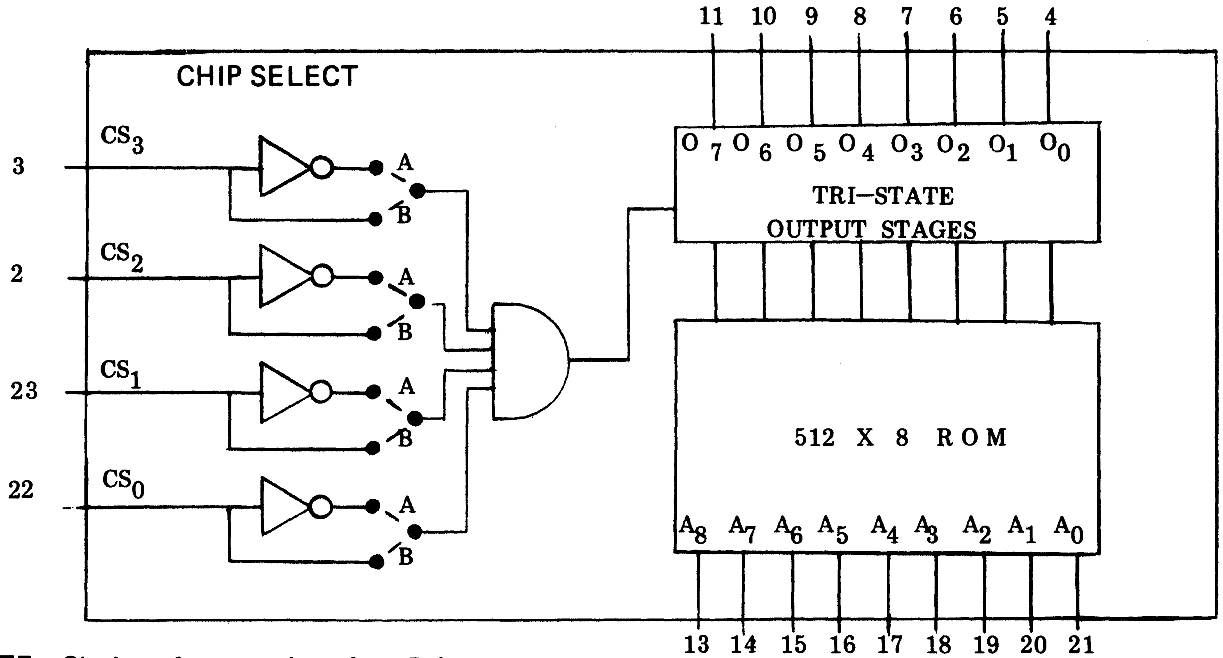
## PACKAGE "B" – BRAZED LEADS




IC-0124

Figure A-3 2627P A6–01 Character Generator Alpha (Sheet 1 of 2)

## FUNCTIONAL BLOCK DIAGRAM

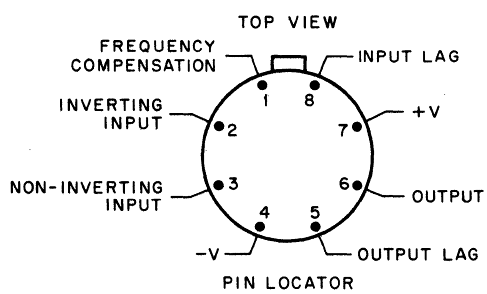



NOTE: Choice of connection A or B for each chip select is available as a mask option.

IC-0121

Figure A-3 2627P A6–01 Character Generator Alpha (Sheet 2 of 2)

SCHEMATIC




IC-0106

Figure A-4 3101 Random Access Memory

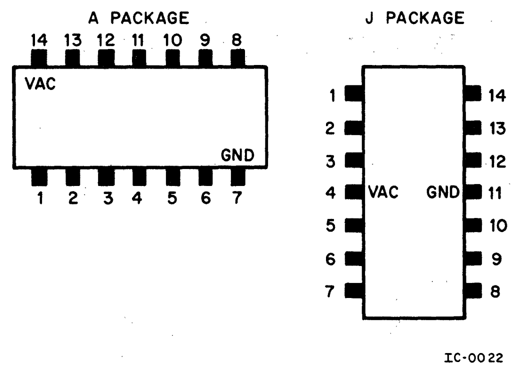



Figure A-5 7400 Quad 2-Input Positive NAND Gate

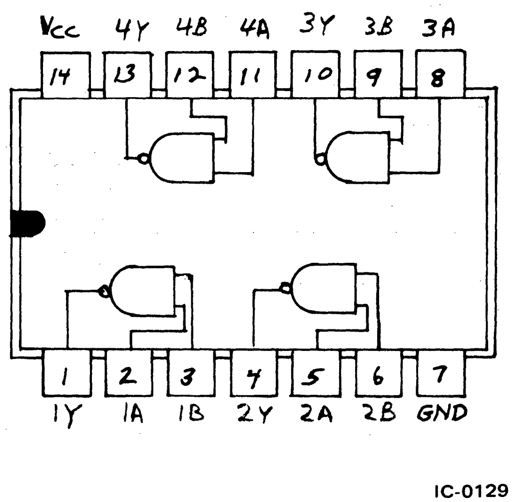



Figure A-6 7401 NAND Gate-Quad 2-Pin Open Collector

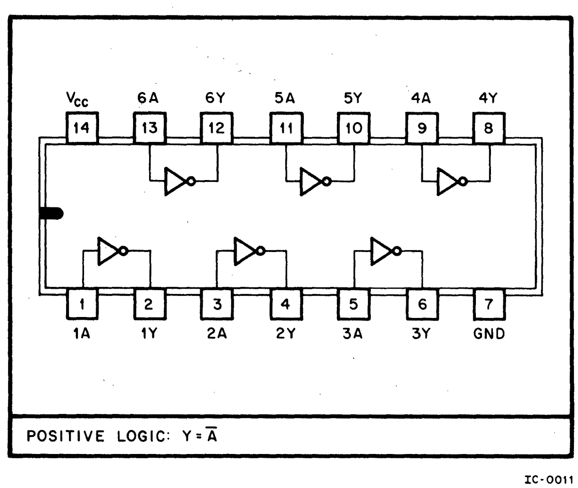



Figure A-7 7404 Hex Inverter

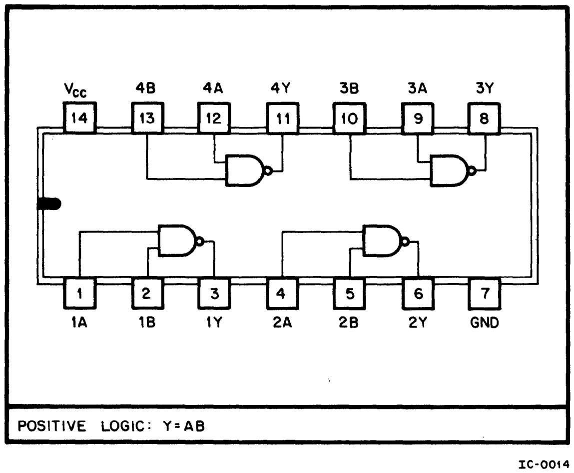



Figure A-8 7408 Quad 2-Input Positive AND Gate

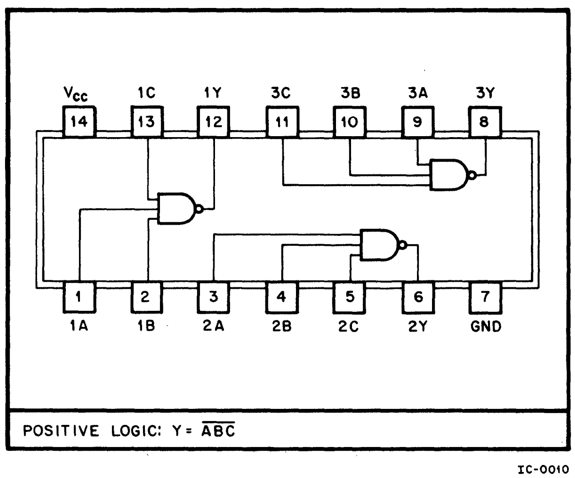



Figure A-9 7410 Triple 3-Input Positive NAND Gate

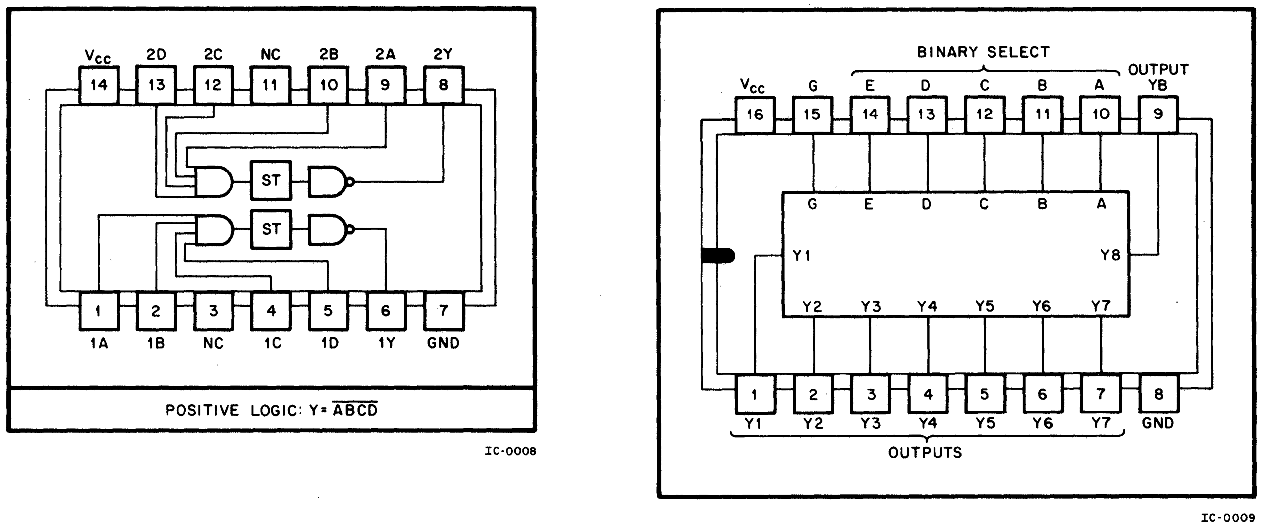



Figure A-10 7413 Schmidt Trigger

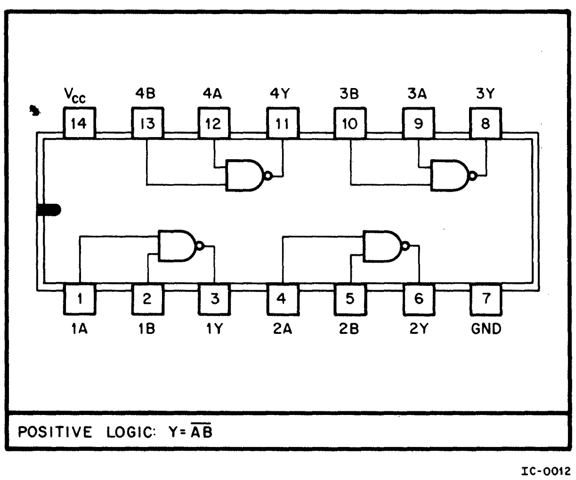
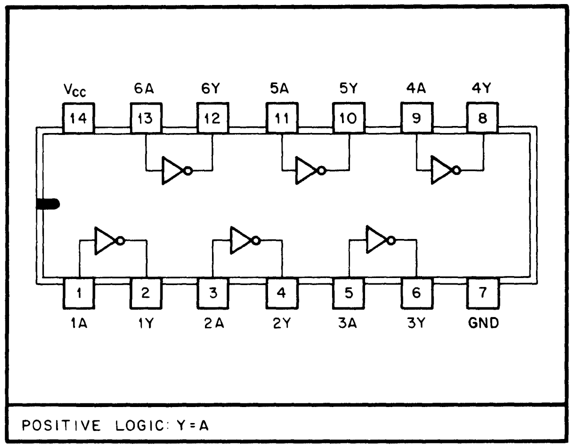
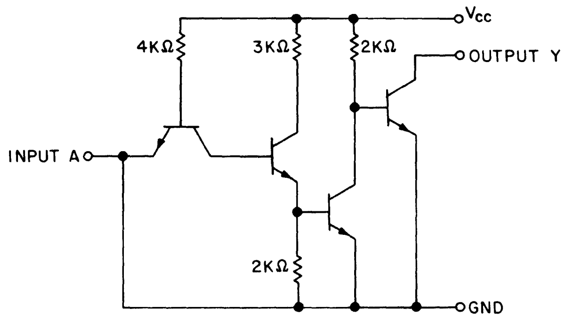



Figure A-11 7416 Hex Inverter Buffer/Driver



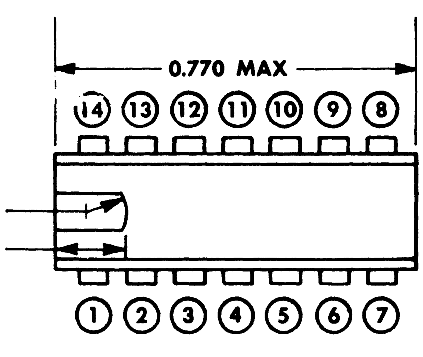

IC-0057



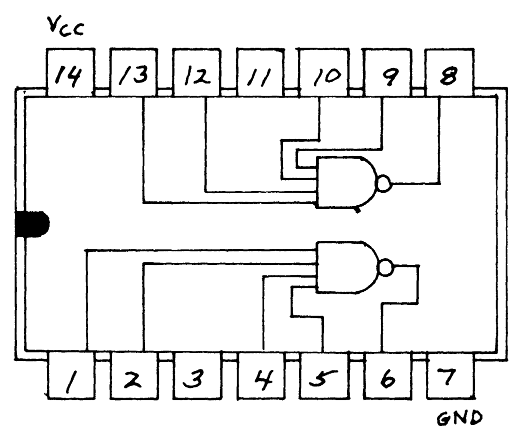

Component values shown are nominal.

IC-0056

Figure A-12 7417 Hex Buffers/Drivers




IC-0128




IC-0130

Figure A-13 7420 NAND Gate-Dual 4-Input

No Package Drawing Available

Figure A-14 7423

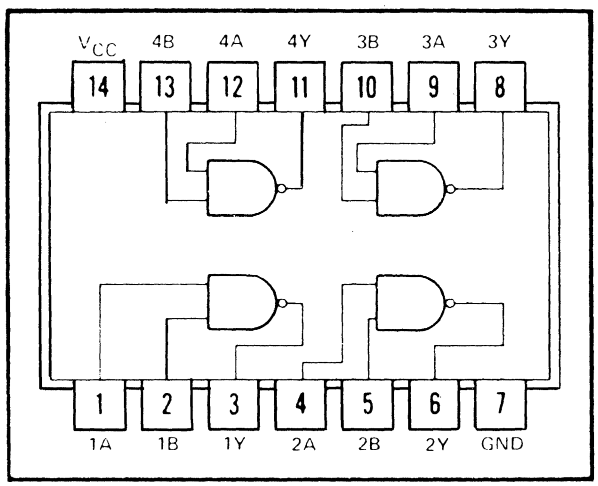
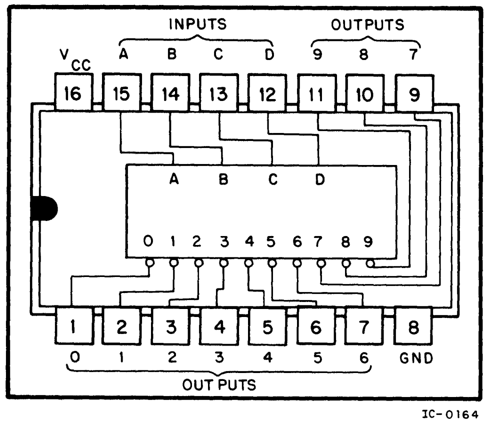



Figure A-15 7437 NAND Gate-Quad 2 In Buffer, 14 Pin



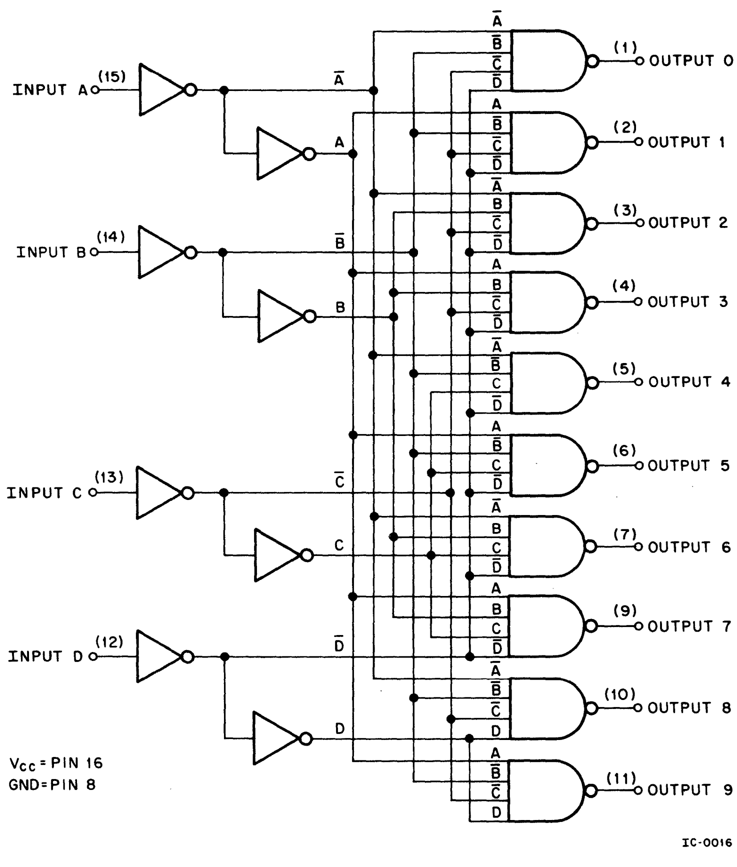




Figure A-16 7442 4-Line-to-10-Line Decoders

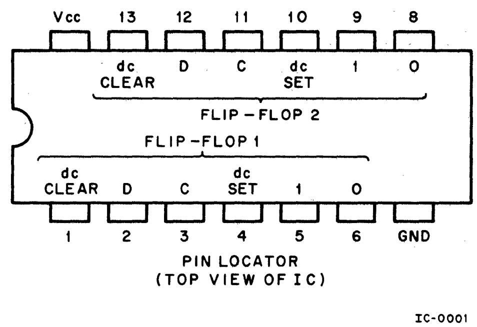



Figure A-17 7474 Dual D-Type Edge-Triggered Flip-Flop

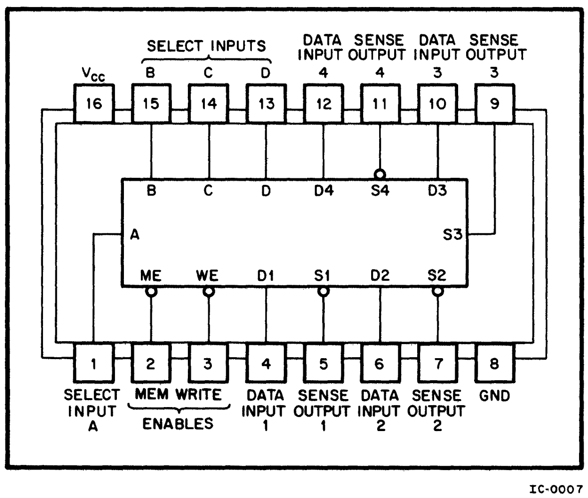



Figure A-18 7489 64-Bit Read/Write Memory

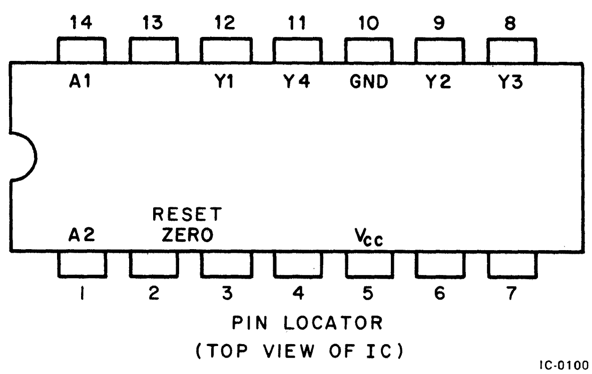



Figure A-19 7493A Counter Asynch Up, Binary

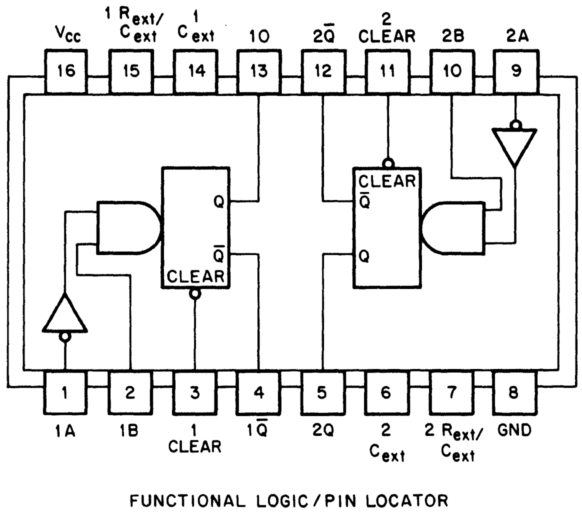
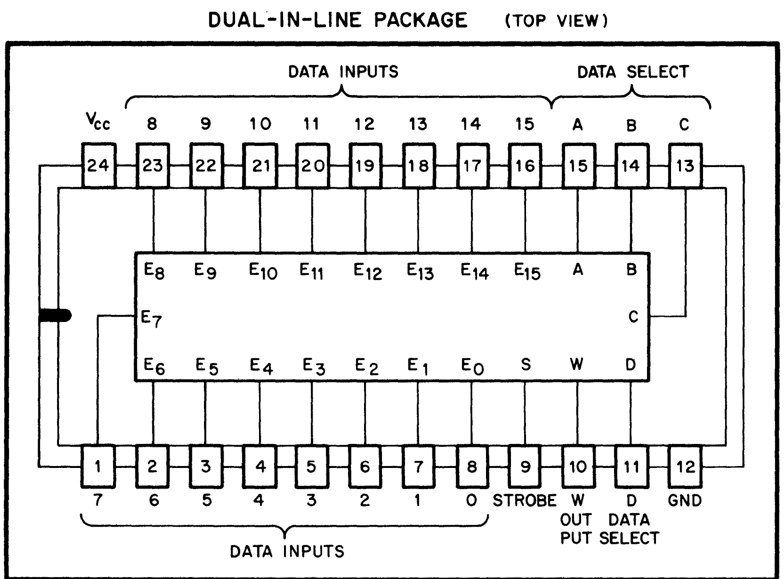



Figure A-20 74123 Monostable Multivibrator




POSITIVE LOGIC

$$W=\overline{S(\bar{A}\bar{B}\bar{C}\bar{D}E_0+A\bar{B}\bar{C}\bar{D}E_1+\bar{A}B\bar{C}\bar{D}E_2+AB\bar{C}\bar{D}E_3+\bar{A}\bar{B}C\bar{D}E_4+A\bar{B}C\bar{D}E_5+\bar{A}BC\bar{D}E_6+ABC\bar{D}E_7}$$
$$\overline{+\bar{A}\bar{B}\bar{C}DE_8+A\bar{B}\bar{C}DE_9+\bar{A}B\bar{C}DE_{10}+AB\bar{C}DE_{11}+\bar{A}\bar{B}CDE_{12}+A\bar{B}CDE_{13}+\bar{A}BCDE_{14}+ABCDE_{15})}$$

IC-0117

Figure A-21 74150 Data Selector/Multiplexer

DUAL-IN-LINE PACKAGE (TOP VIEW)

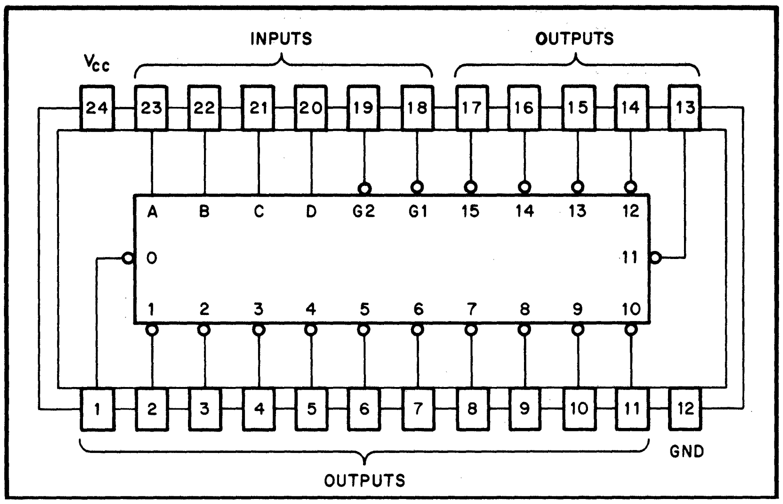
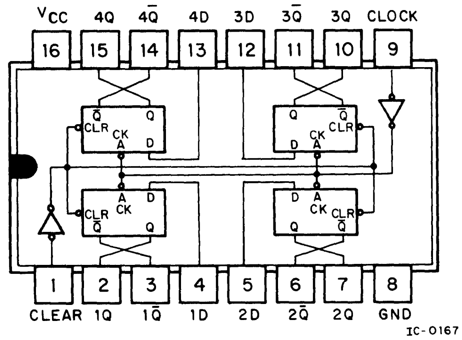



Figure A-22 74154 4-Line-to-26-Line Decoder/Demultiplexer

No Package Drawing Available

Figure A-23 74161 4-Bit Binary Counter




TRUTH TABLE

| INPUT $t_n$ | OUTPUTS $t_{n+1}$ | |
|---|---|---|
| D | Q | $\overline{Q}$ |
| H | H | L |
| L | L | H |

$t_n$ = Bit time before clock pulse.
$t_{n+1}$ = Bit time after clock pulse.

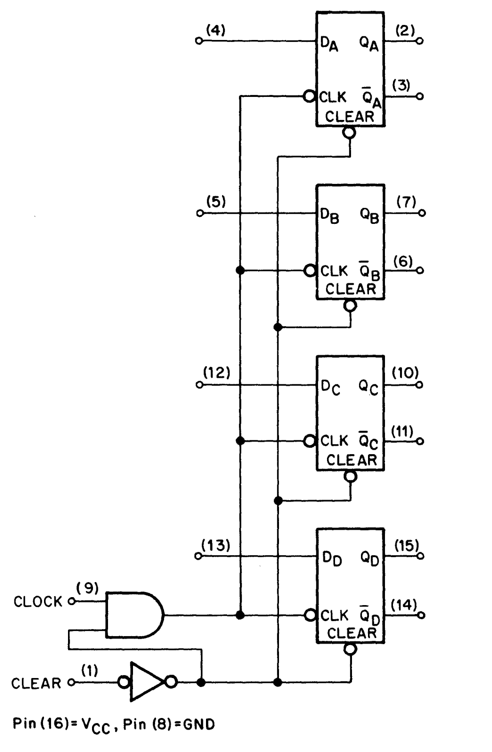
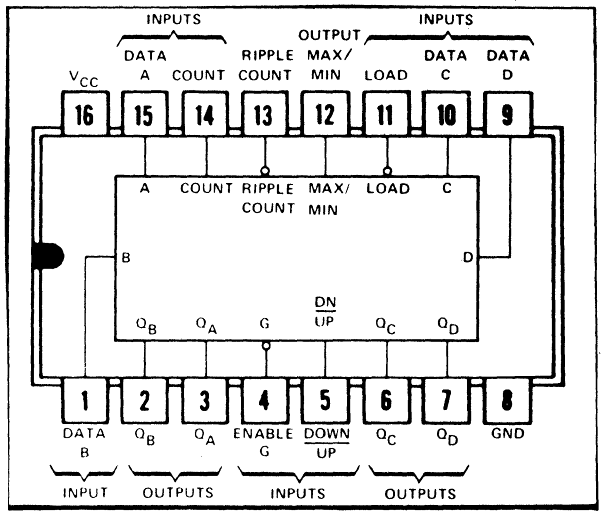
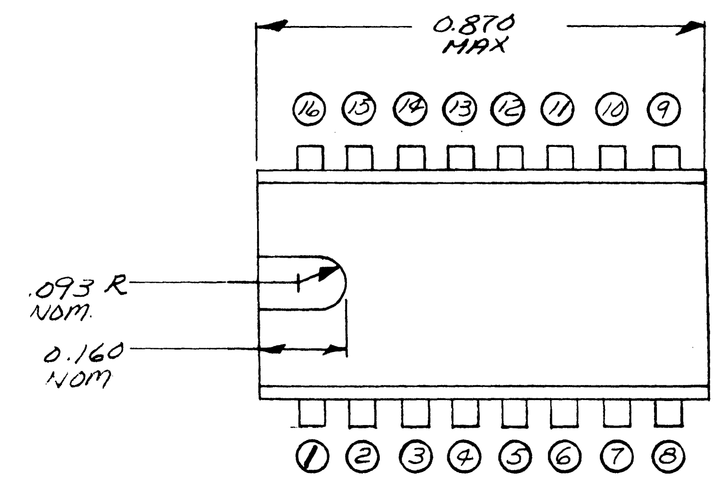



Figure A-24 74175 Quad D-Type Flip-Flop with Clear




IC-0127




IC-0131

Figure A-25 74190 Counter, Synch Up/Down Decade, 16 Pin

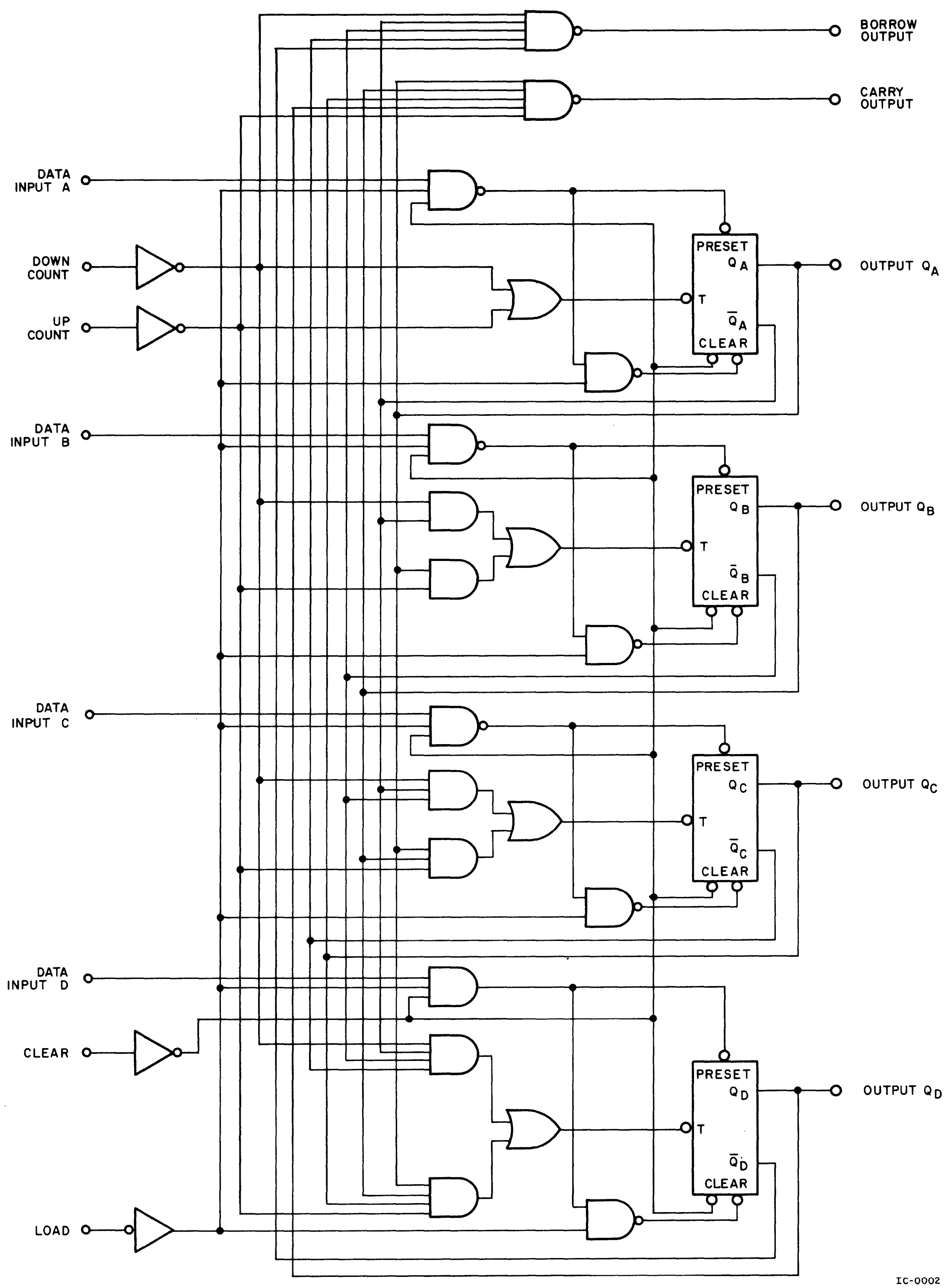



Figure A-26 74193 Synchronous 4-Bit Up/Down Counter (Sheet 1 of 2)

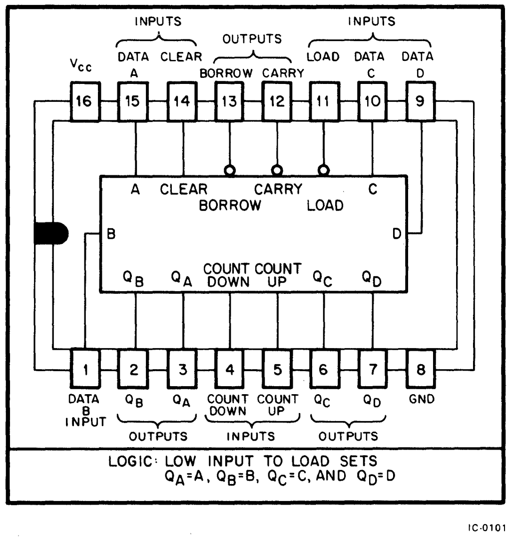



Figure A-26 74193 Synchronous 4-Bit Up/Down Counter (Sheet 2 of 2)

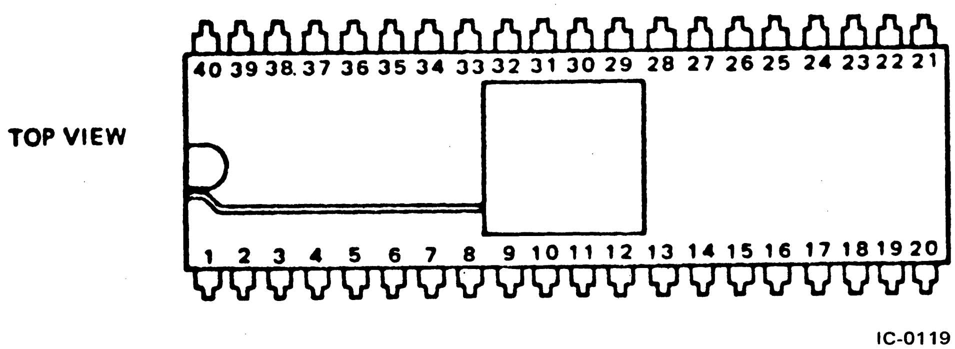



Figure A-27 Universal Asynchronous Receiver Transmitter

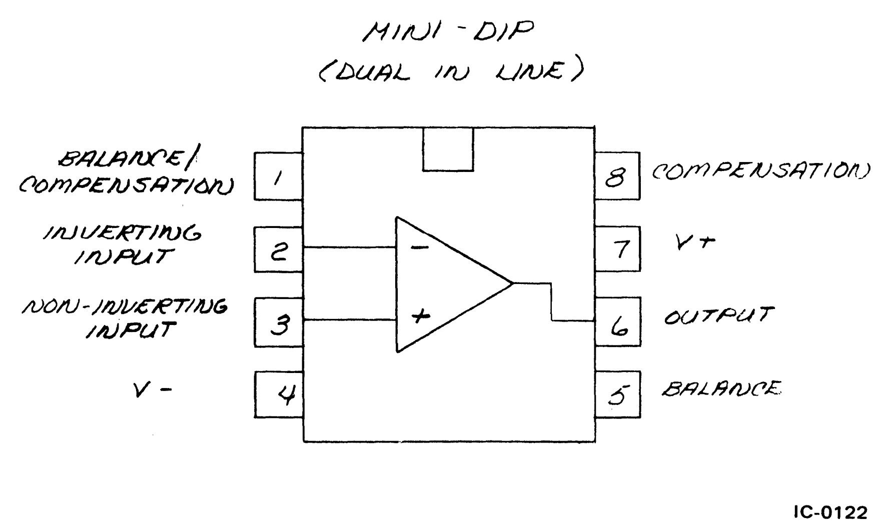



Figure A-28 301 AN DIP Operational Amplifier

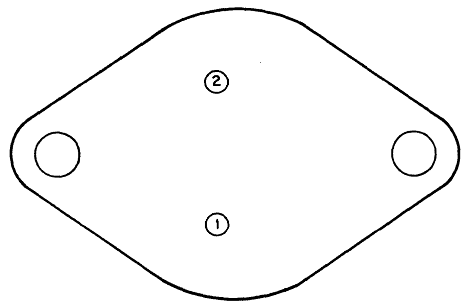



Figure A-29 309 K Regulator

# INDEX

CUT OUT ON DOTTED LINE

LA36 DECwriter II MAINTENANCE MANUAL
EK-LA36-MM-001

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What faults do you find with the manual? ______________________________

Does this manual satisfy the need you think it was intended to satisfy? ______________

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