TECHNICAL MANUAL

MODEL 101AL PRINTER

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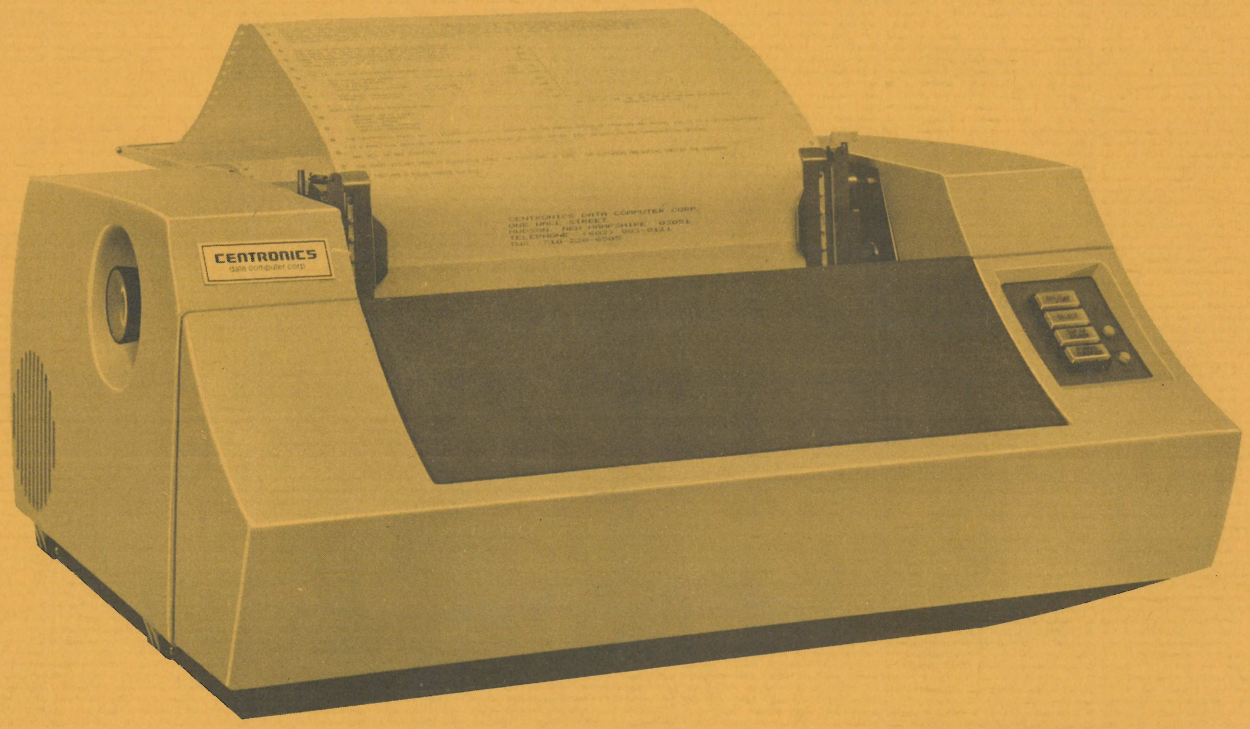

APRIL 1975

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CENTRONICS
data computer corp.
HUDSON, NEW HAMPSHIRE 03051
TELEPHONE (603) 883 - 0111

CENTRONICS
centronics data computer corp.
hudson, n.h. 03051
telephone (603) 883-0111

eastern region: (617)272-8545 (mass.)
central region: (513) 294-0070 (ohio)
western region: (714) 979-6650 (calif.)

centronics data computer (canada) ltd.
mississauga, ontario (416) 625-0770

centronics international corp.
brussels, belgium (02) 762-3572

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SECTION 1
INTRODUCTION

This manual describes the Model 101AL printer, manufactured by Centronics Data Computer Corporation. It provides general information, detailed theory of operation and maintenance information enabling field service personnel to maintain the printer. For serial input or other detailed interface information, a separate document for each interface is published for your reference.

The manual is grouped into eight sections, each with its specific purpose.

Section 1 - INTRODUCTION, introduces the reader to the scope and content of the manual, and provides the reader with a general description of the printer.

Section 2 - INSTALLATION, contains unpacking and installation instructions for the printer.

Section 3 - OPERATION, describes the function of all operator controls and indicators and how they are used.

Section 4 - THEORY OF OPERATION, contains a detailed description of each major operation performed by the printer electronics, including timing diagrams and, where applicable simplified circuit diagrams, all keyed to the schematic drawings.

Section 5 - REMOVAL, REPLACEMENT AND ADJUSTMENT PROCEDURES, includes step-by-step removal and replacement procedures for all major assemblies and sub-assemblies in the printer.

Section 6 - MAINTENANCE, includes preventive and corrective maintenance procedures and a maintenance schedule.

Section 7 - ELECTRICAL DRAWINGS AND LIST OF MATERIALS, contains a complete set of schematic, wiring and component board layout diagrams and their associated list of materials for the electrical portion of the printer.

Section 8 - MECHANICAL DRAWINGS AND PARTS LISTS, includes all printer assembly drawings and their associated parts lists for the mechanical portion of the printer.

At the end of the manual are several appendices which include a glossary of signal mnemonics, a standard 9 x 7 64-character set, and parallel interface specifications.

1.1 GENERAL DESCRIPTION

The Model 101AL printer (Figure 1-1) is a medium speed impact printer which uses a 9 x 7 dot matrix for character generation. The unit prints at a rate of 165 characters per second with an average speed of 132 characters per second (including the return time for the printing head). The printer is capable of printing 132 columns, with paper width varying from 4 inches to 14-7/8 inches. The unit uses sprocket-fed paper and generates 6 lines to the inch with 10 characters per inch, horizontally. The printer does not require special paper and can produce an original plus four copies.

The printer is completely self-contained. A single printed circuit board contains both the control logic and power supplies, made possible by the use of LSI (Large Scale Integration) circuitry.

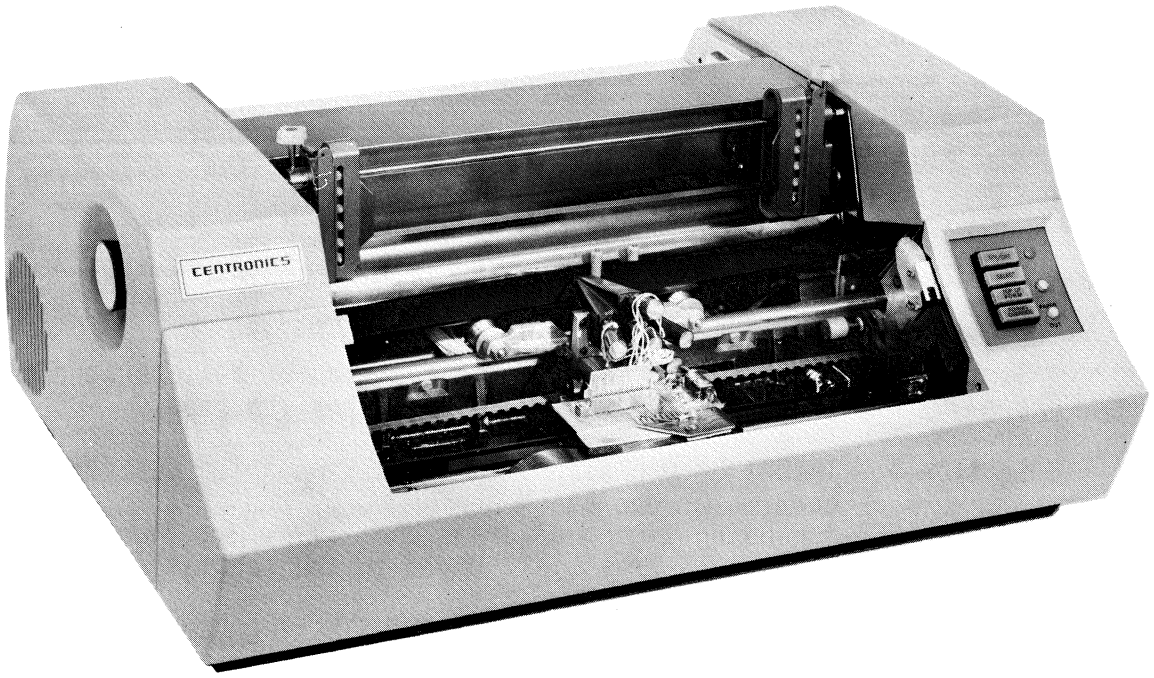


Figure 1-1. MODEL 101AL PRINTER (TOP COVER REMOVED)

1.2 LOGIC FLOW DIAGRAM (Figure 1-2)

The 132-character input buffer can receive parallel data at a rate of up to 75,000 characters per second. If the input device transmits serial data (100-9600 Baud), then an optional RS232 interface is required to assemble the serial data, then transfer it in parallel to the input buffer in the printer.

Paper movement is initiated by a line feed, vertical tab and form feed function. The Vertical Format Unit (VFU) tape reader provides vertical tab and top of form spacing control by means of a perforated paper tape. In addition, the printer recognizes the following special control codes: bell, delete, select, de-select and elongated character, as described in Section 1.3.3.

Once a line of printable characters is stored in the buffer, head motion is initiated by activating the forward clutch, causing the print head to move from left to right across the paper. With the head in motion, data is transmitted from the buffer to the character generator. From there, character write pulses are sent to the driver circuits, which energize the print head solenoids causing the print wires to form the characters on the paper.

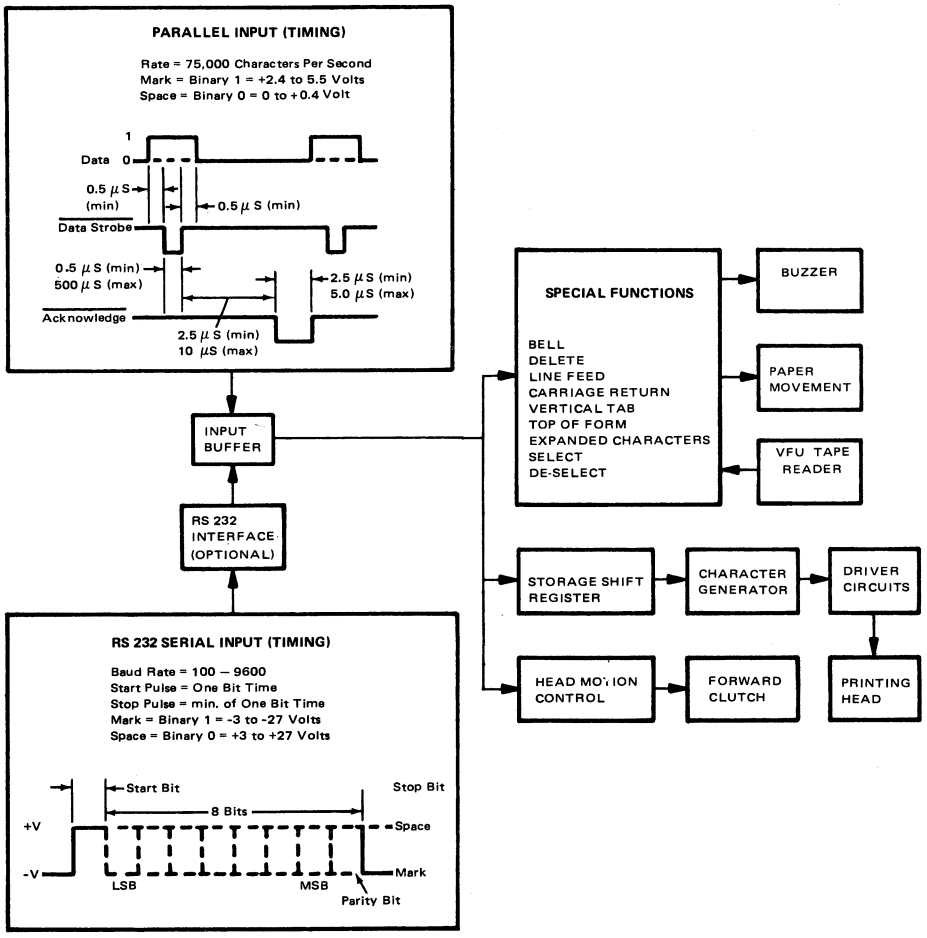


Figure 1-2. 101AL PRINTER LOGIC FLOW DIAGRAM

1.3 PRINTER OPERATION

Basically, all printer functions can be grouped into one of the following three categories: 1) character printing, 2) paper movement, and 3) other auxiliary functions such as printer select/deselect, delete, etc.

1.3.1 CHARACTER PRINTING

A small aluminum carriage supports the print head assembly. During printing operation, the carriage travels along the print line from left to right at a constant rate of approximately 16.25 inches per second, and returns in approximately 240 milliseconds.

Printing is accomplished by selectively firing the print wires. These wires graphically construct the characters out of dots, as the print head moves from left to right across the print line.

Printing impulses energize the print solenoids and drive the print wires against the ribbon, paper and platen to form the characters in a dot matrix pattern. When the solenoids are de-energized, the wires are withdrawn so they are flush with the surface of the jewel. Each solenoid can fire independently up to five times for any one character. Figure 1-3 is an example of the dot matrix forming the letter H. All character formations in the standard 9 x 7 dot matrix are shown in Appendix B.

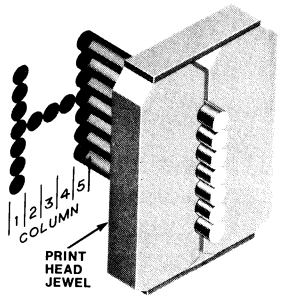


Figure 1-3. PRINTING THE LETTER (H)

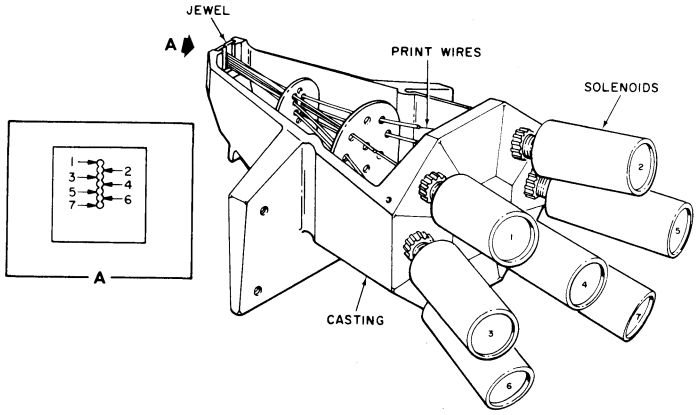


Figure 1-4. PRINT HEAD COMPONENTS

The print head (Figure 1-4) consists of the jewel, casting and seven solenoids with attached print wires. The seven print solenoids and their attached print wires are arranged radially around the print head. The free ends of the print wires pass through a wire guide at the front of the print head, which properly spaces the wires so that the correct wires passes through the correct hole in the print jewel.

Printing action is initiated when the input buffer has been filled or a carriage return (CR) character has been received. The print head then sweeps across the page until a CR command is decoded at the buffer output or the head reaches the 132-column limit (right) switch. At this time, the print head returns to the left margin and an automatic line feed is performed. As an option, the automatic line feed can be disabled.

1.3.2 PAPER MOVEMENT

Paper can be moved manually by rotating the platen knob (shown in Figure 1-5) or automatically by any of three paper movement commands: line feed, vertical tab and form feed.

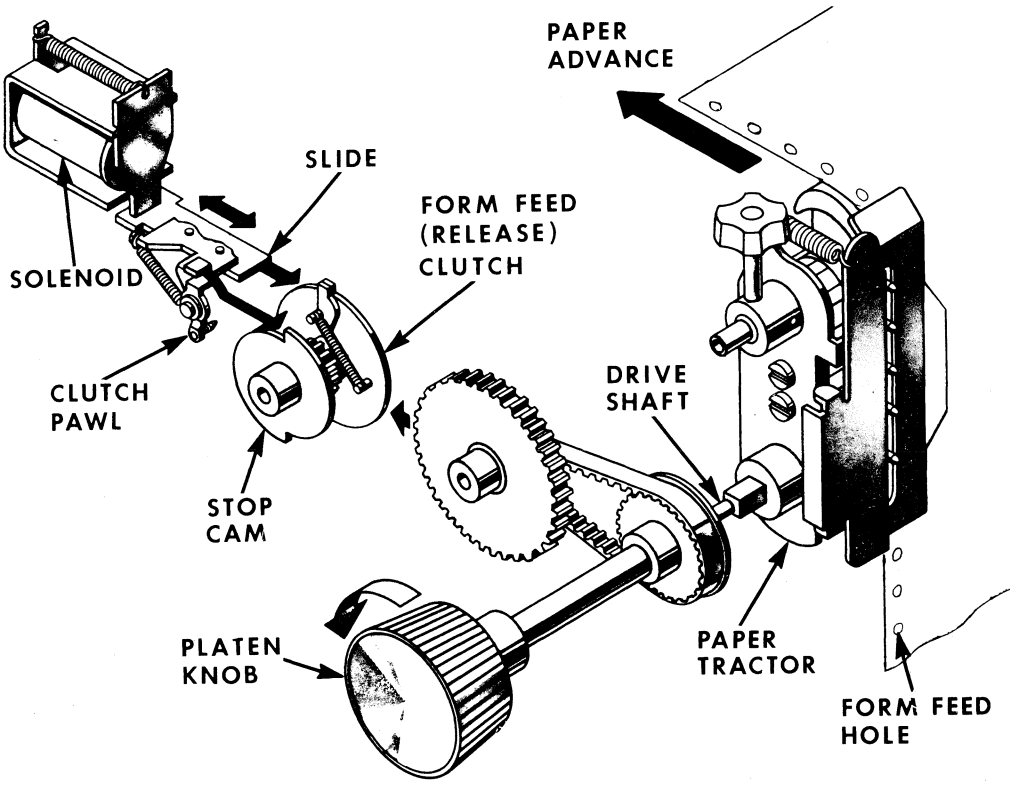


Figure 1-5. PAPER MOVEMENT

A small independent motor not shown in Figure 1-5, provides the power necessary to move the sprocket-feed tracotrs which control paper movement. To move the paper, the printer electronics activates a line feed solenoid which activates a clutch that mechanically links the motor to the sprocket-feed tractors.

To initiate a single line feed, the line feed solenoid is energized for 15 milliseconds to initiate paper motion. Upon completion of the line feed command, a 60 millisecond delayed line feed is generated. This allows the clutch pawl and clutch mechanism to return home before another line feed is allowed.

Vertical forms movement is accomplished by applying a DC level to the paper feed solenoid until a hole is detected in the Vertical Format Unit (VFU). The tape consists of two tracks; one used for Top of Forms and the other for Vertical Tab. The movement of the paper tape is caused by direct mechanical linkage to the gear train which drives the paper feed tractors.

When the printer runs out of paper, a sensing switch activates a two-second audible tone in a speaker located at the rear. The printer also stops printing and lights the PAPER EMPTY light on the control panel.

1.3.3 SPECIAL FUNCTION

In addition to the printable characters shown in Appendix B, the printer can recognize the following special functions:

Carriage Return (Octal 015) - Initiates the printing of a line.

Form Feed (Octal 014) - Moves the paper until the top of the form hole in Tape Reader Channel 7 is reached.

Vertical Tab (Octal 013) - Moves the paper until the next hole in Tape Reader Channel 5 is reached.

Line Feed (Octal 012) - Advances the paper one line.

Delete (Octal 177) - Primes the printer electronics to an idle state and deletes any characters stored in the printer.

Bell (Octal 007) - Generates a two-second audible tone in the speaker at the rear of the printer.

Select (Octal 021) - Allows printer to receive data, same as activating SELECT switch.

De-Select (Octal 023) - Inhibits printer from receiving data, same as deactivating SELECT switch.

1.4 SYSTEM FEATURES

1.4.1 FEATURES

standard features

- Vertical format control
- Audio alarm
- Form feed control (via paper tape loop)
- Elongated boldface characters (line-by-line)
- Parallel data input
- 4 inches/second slew rate
- Prints original plus four copies
- Fixed vertical/horizontal registration
- Paper runaway inhibit
- Separate prime line and fault line to output connector
- Provision for additional character set
- Remote select/deselect
- Available with 50 or 60 Hertz, 115 or 230 Volts AC
- Automatic line feed disabled
- 9 x 7 or 5 x 7 dot matrix

optional features

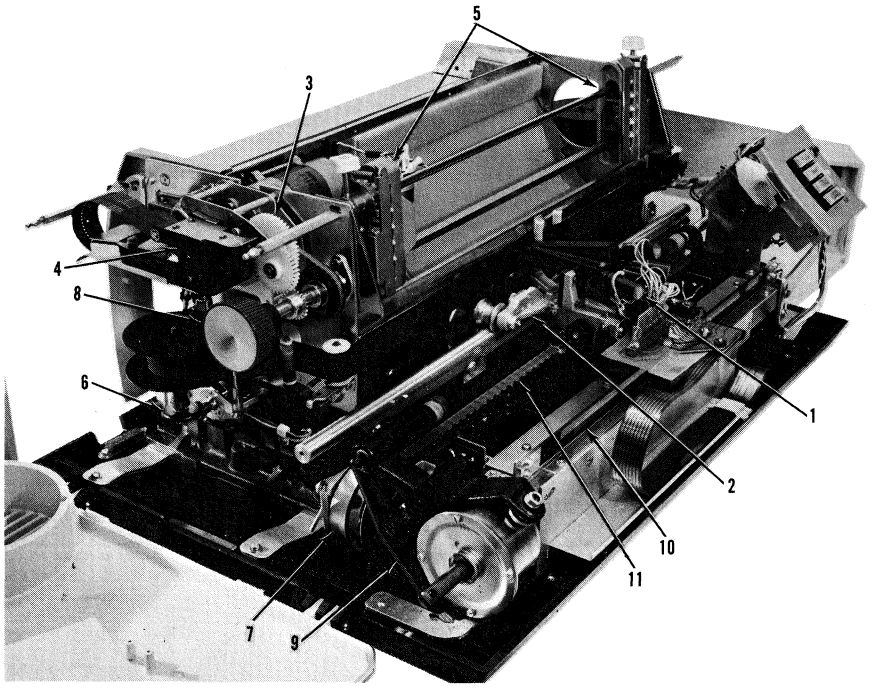
- Character sets of 64, 96 or 128 characters
- Popular parallel and serial interfaces
- Automatic motor control
- Selectable single character elongation
- Elapsed time indicator

1.4.2 SPECIFICATIONS SUMMARY

Printing Method	Impact, character-by-character, one line at a time
Printing Rate — Characters	165 characters per second
— Full Lines	60 lines per minute (132 character line)
— Short Lines	200 lines per minute (20-30 characters)
Transmission Rate — Serial	100 to 9600 baud (with Serial option)
— Parallel	Up to 75,000 characters per second
Data Input	Parallel (Serial option available)
Character Structure	9 x 7 dot matrix, 10-point type equivalent
Code	USASCII — 64 characters printed, lower case characters recognized and printed as upper case equivalent
Indicator-Switch Controls	ON/OFF, SELECT, TOP OF FORM, FORMS OVERRIDE, LINE FEED
Indicator	PAPER OUT
Manual Controls	Form Thickness, Paper Advance Knob
Character Buffer	132 characters (1 line)
Format	132 characters maximum per line, 6 lines per inch
Paper Feed	Sprocket feed, adjustable from 4" to 14⅞" width
Paper	Standard sprocketed paper
Number of Copies	Original and up to four carbon copies
Dimensions	11½" high, 20" deep, 27¾" wide
Weight	118 pounds
Electrical Requirements	115 VAC ±10%, 60 Hz or 115/230 VAC ±10%, 50 Hz
Temperature — Operating	40° to 100° F
— Storage	−40° to 160° F
Humidity — Operating	5% to 90% (no condensation)
— Storage	0% to 95%

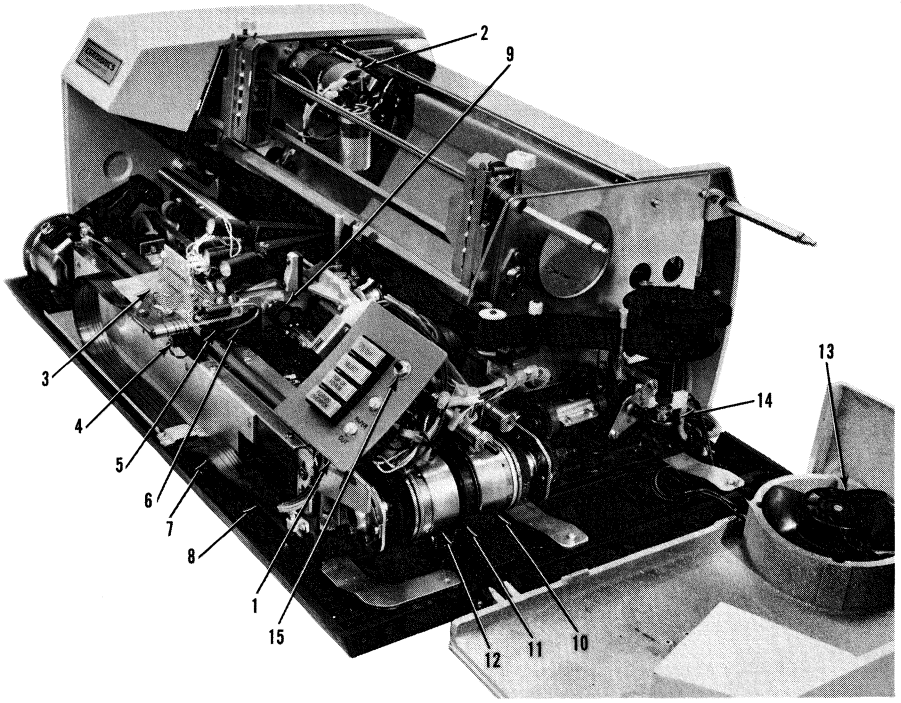
1.5 PHYSICAL DESCRIPTION

The printer is approximately 11½" high, 20" deep, 27-3/4" wide and weighs approximately 118 pounds. Figures 1-6 through 1-9 are photographic views of the printer taken with the covers removed. Each major printer assembly is located on these figures and identified in the table below the photo.



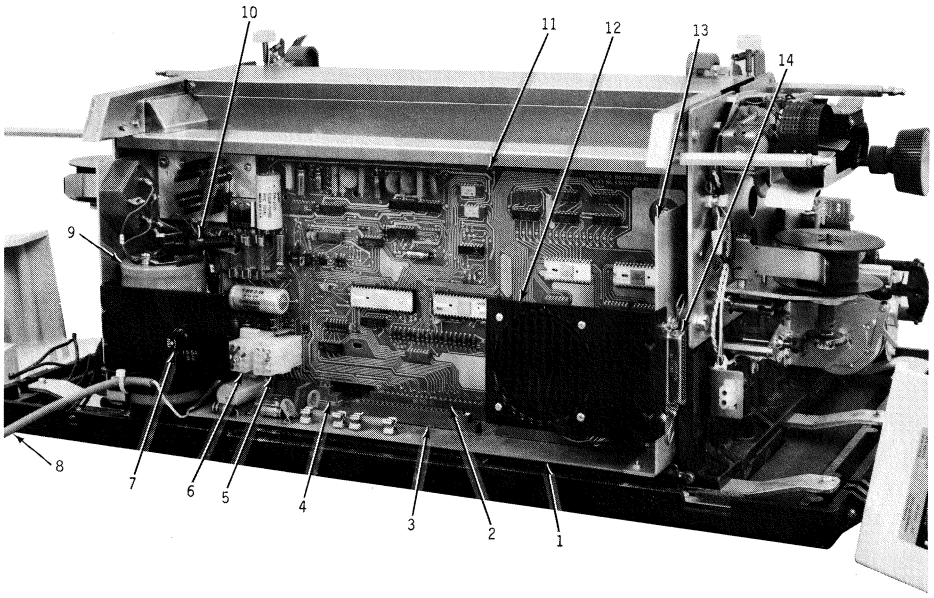
1. Print Head Assembly
2. Carriage
3. Form Feed Mechanism
4. VFU Tape Reader
5. Pin Feed Mechanism
6. Ribbon Feed Mechanism
7. Spring Drum
8. Platen Knob
9. Damper
10. Timing Fence
11. Main Drive Belt

Figure 1-6. LEFT FRONT VIEW OF 101AL



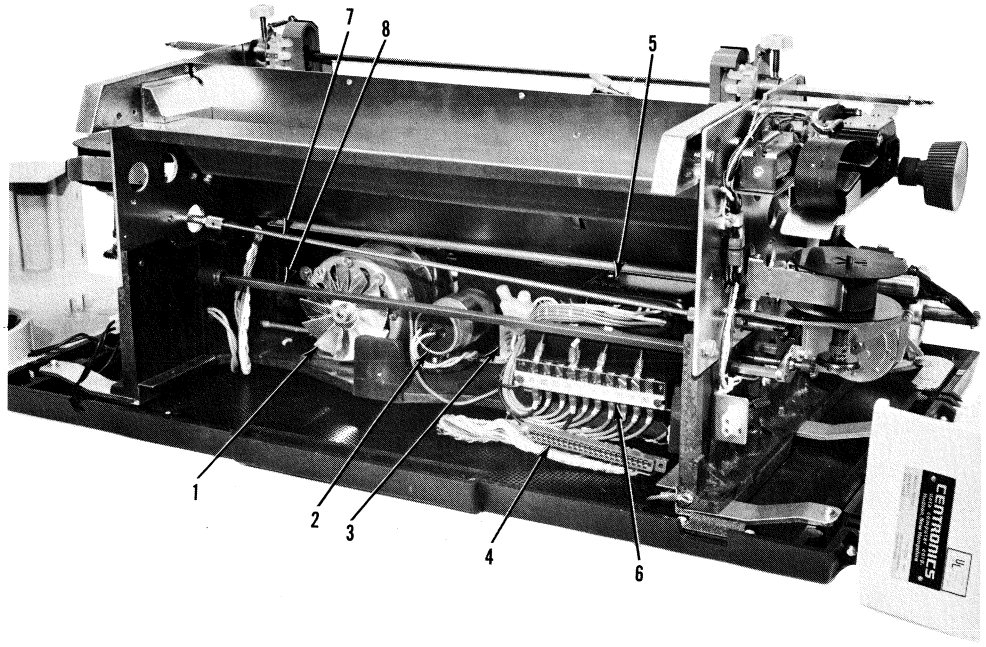
1. Operator Control Panel
2. Form Feed Motor
3. Video Amplifier and Cable Assembly
4. Light Source
5. Optical Pick-Up
6. Optic Bundle
7. Ribbon Cable
8. Power Driver Board
9. Penetration Control Knob
10. Forward Clutch
11. Main Pulley and Drive Belt
12. Reverse Clutch
13. Cooling Fan
14. Ribbon Feed Mechanism
15. Line Feed

Figure 1-7. RIGHT FRONT VIEW OF 101AL



1. Connector Card
2. J4
3. J6
4. J3
5. J2
6. J1
7. Fuse F5
8. AC Power Input
9. +30V Power Supply
10. Fuse F4
11. Logic/Power Supply Board
12. Speaker
13. Electronics Cavity
14. Input Connector

Figure 1-8. REAR VIEW OF 101AL



1. Main Motor
2. Motor Starting Capacitor
3. AC Power Connector
4. Electronics Connector
5. Power Transformer
6. Power Distribution
7. Ribbon Reversing Rod
8. Ribbon Drive Rod

Figure 1-9. REAR VIEW (101AL ELECTRONICS CAVITY REMOVED)

SECTIONS 2 AND 3
INSTALLATION AND OPERATION

A separate operators manual contains most of the installation, set-up and operating procedures for the Model 101A printer. This operators manual should be referred to during normal printer installation and operation.

Included on the following pages is additional information not contained in the operators manual.

2.1 SITE PREPARATION (Figure 2-1)

A line drawing of the printer dimensions is shown in Figure 2-1. As shown in this drawing, the width of the installation site must take into account the side covers in an opened position.

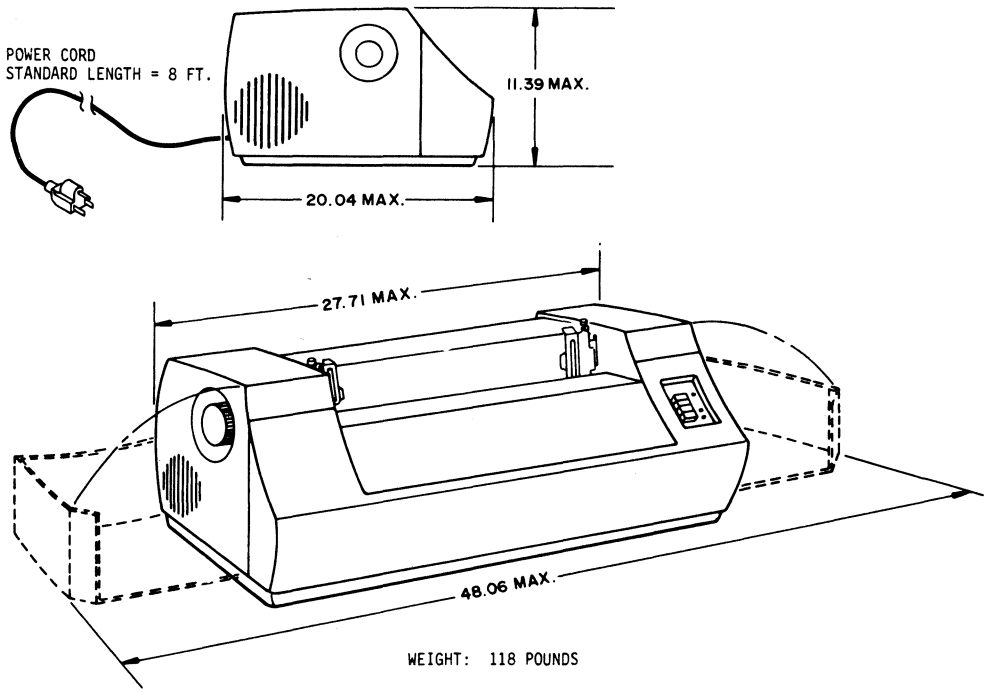


Figure 2-1. PRINTER DIMENSIONS

Enviromental and electrical requirements at the installation site are as follows:

Temperature:	40° to 100° F (Operating) -40° to 160° F (Storage)
Humidity:	5% to 90% (no condensation) - Operating 0% to 95% - Storage
Electrical:	117 VAC ±10%, 60 Hz, 5 amps 117/234 VAC ±10%, 50 Hz, 5 amps

2.2 SHIPPING CRATE

The printer is shipped in a crate approximately 20 inches high, 27 inches deep and 32 inches wide. The crate is made of weatherized, triple-walled cardboard. When properly strapped, the packing crate and printer is capable of fork lift operation with a seven-high stacking capability.

Shipped with the printer are the following items:

(1) If a special interface is used, the interface card is included with the printer. For certain interfaces such as the RS232, a special cable is also shipped. Cabling requirements for the standard parallel interface are defined in Appendix C.

(2) A standard vertical format paper tape providing six line feeds (one inch) for each vertical tab and 66 line feeds (11 inches) for each form feed code. This tape is a part of the Vertical Format Unit. Refer to the Operators Manual for duplicating the existing tape, or if a different format is desired, for generating a new tape.

(3) Documentation - All documentation describing that particular printer is included in a plastic bag under the printer. This documentation includes a technical manual for the printer and any optional interface, and a notice of all approved changes incorporated in the printer but not documented in the manual. Please keep this documentation with the printer at all times so that accurate information will be available for troubleshooting purposes.

(4) Pin Feed Knobs - These knobs are contained in a small plastic bag stapled to the guide bar for the pin feed unit.

(5) Print Sample - A sample printout from that particular printer is included in the upper paper pan.

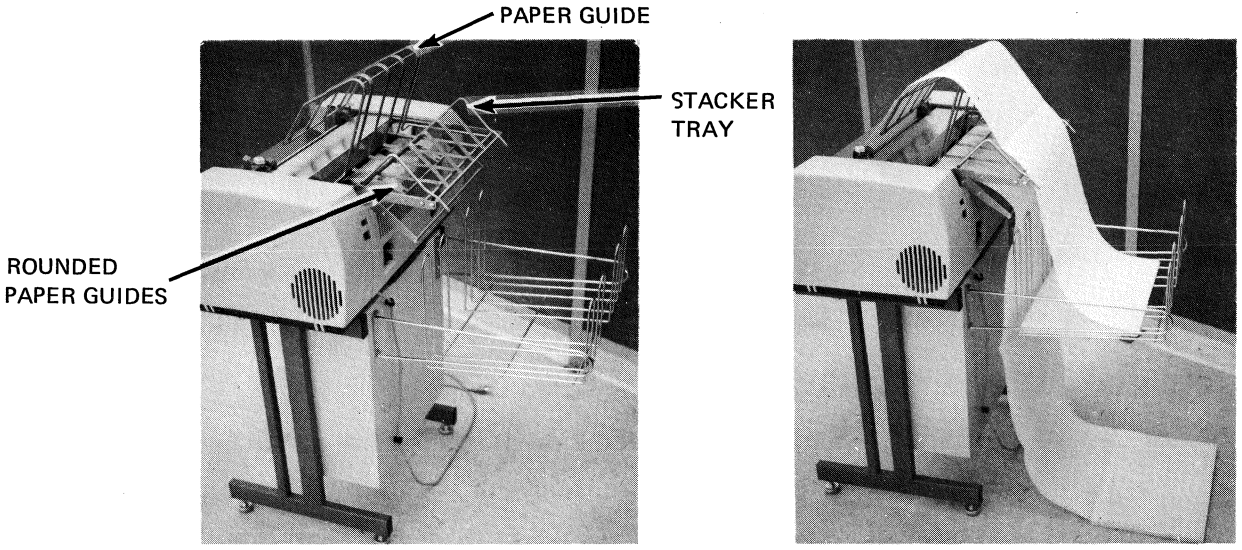
(6) Unpacking/Repacking and Set-up Instruction Sheet.

Shipped in a separate container is the paper guide and stacker assembly. Installation instructions for this assembly are included with the assembly and also in Section 2.3.

2.3 PAPER GUIDE AND STACKER ASSEMBLY (527001001)

ASSEMBLY INSTRUCTIONS

Attach paper guide and stacker assembly (one piece) to the back, top of printer by first removing two screws from the left and right side, and install using a flat bladed screwdriver. Make sure rounded paper guides rest on top of printer in front of paper feed opening.



PRINTER STAND OPERATION

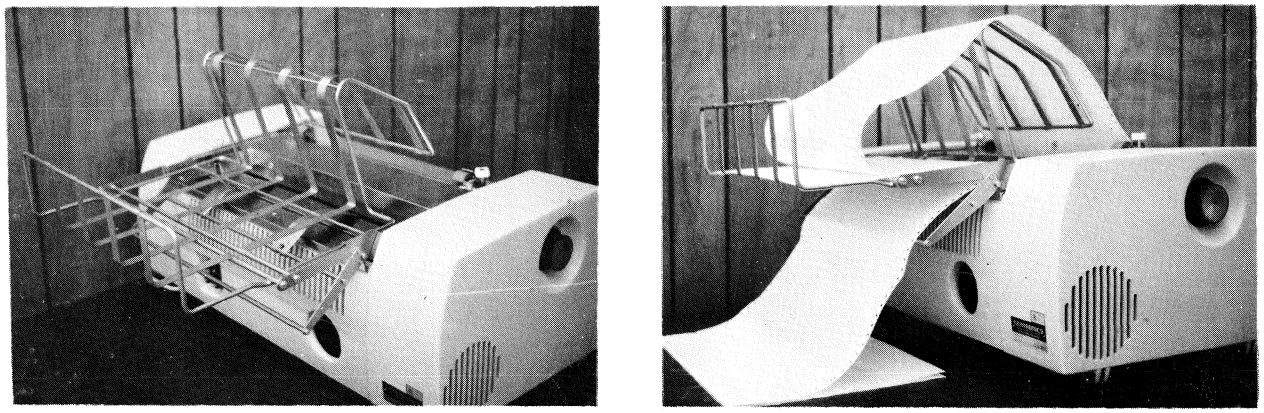


TABLE TOP OPERATION

SECTION 4
THEORY OF OPERATION

4.1 INTRODUCTION

This section on the theory of operation contains a detailed description of each major function performed by the Model 101AL printer electronics. Figure 4-1 shows a basic functional diagram of the printer electronics.

Throughout this section, reference is made to the schematic diagrams contained in Section 7. The section is organized as follows:

Paragraph 4.2 Basic Timing

4.3 Initializing the Printer (Prime, Select)

4.4 Data Input (Data, Strobe, Busy, Acknowledge)

4.5 Shift Register (Buffer)

4.6 Character Printing

4.7 Paper Movement (Line Feed, Vertical Tab, Form Feed)

4.8 Special Functions (Bell, Paper Empty, Delete, Motor Control)

4.9 Power Supplies

4.10 Outputs from LSI chips

4.2 BASIC TIMING

The basic timing clock for the printer electronics is derived from signal OSC. This OSC signal is generated on LSI chip ME9 pin 25. The frequency of OSC, determined by the RC circuit (R41-C9) on pin 26 of this chip, ranges from 100 to 200 KHz.

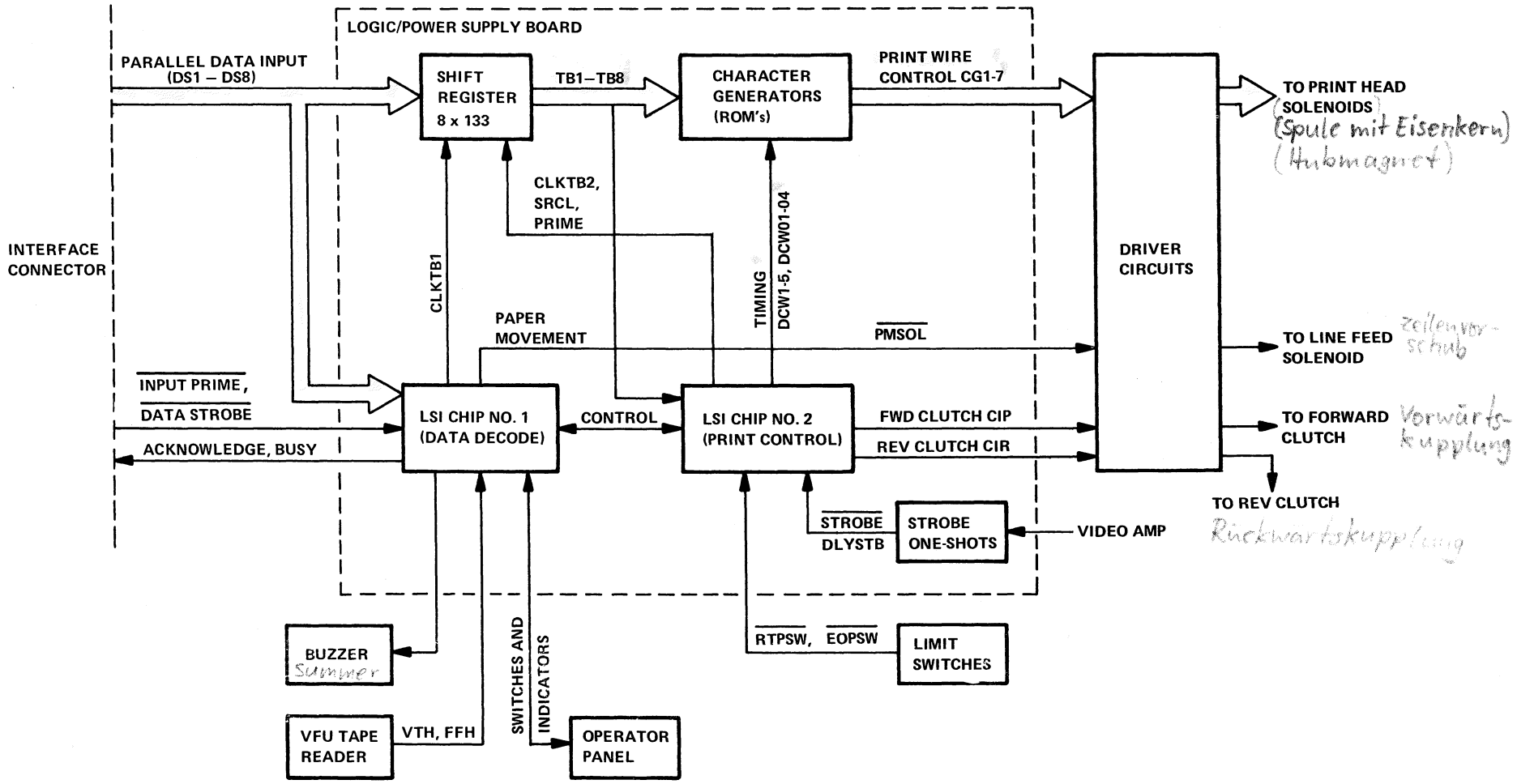


Figure 4-1. MODEL 101AL BLOCK DIAGRAM

This OSC clock is then used by both LSI chips (ME5 and ME9) for internal timing, and is inverted by ME4-6 to generate OSCXT. Signal OSCXT goes to the printer interface connector and if an optional interface is used, it also goes to this optional interface board (e.g., RS232 Serial Interface).

4.3 INITIALIZING THE PRINTER

Before the printer can accept input data, it must first be PRIME'd and SELECT'ed. The prime operation initializes the printer logic to a ready state. The select operation after causing a prime condition, (which can be disabled by jumper (E14-E15), resets the busy line to the interface connector and makes the printer ready to receive data.

4.3.1 PRIME

The PRIME signal, generated on LSI chip ME9-37, is generated by any of the following conditions:

a. Power Turn-On - When the printer is turned on, capacitor C17 is initially discharged causing a low 100-500 msec $\overline{\text{PWRPRM}}$ signal into ME9-32. This generates a high PRIME signal at ME9-37. As C17 charges to +5V, $\overline{\text{PWRPRM}}$ goes high terminating the power prime operation.

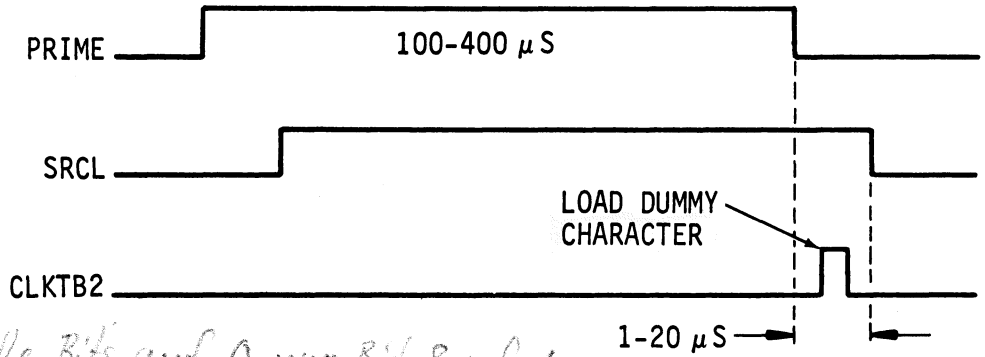
b. Printer Selection - If the Delete Inhibit option (DELINH) is not used (i.e., jumper E13 to E14 is connected), then a low $\overline{\text{SLCT}}$ input to ME9-40 and a high DELINH to ME9-39 generates a 100-400 usec PRIME pulse at ME9-37.

c. End of a Printed Line - At the end of a line of print, $\overline{\text{CIPX}}$ at ME9-30 goes high, turning off the forward clutch and generating a 100-400 usec PRIME pulse at LSI chip ME9-37.

d. Delete Code - Receiving a delete code (octal 177)* on input data lines $\overline{DS1}$-$\overline{DS7}$ generates a low $\overline{DCPRM}$ output at LSI chip ME5-8. Signal $\overline{DCPRM}$ then generates a 100-400 usec PRIME pulse out of LSI chip ME9-37.

e. Input Prime - Reception of a low $\overline{INPUT\ PRIME}$ level at the interface connector generates a high IP signal into LSI chip ME5-36. This produces a low $\overline{DCPRM}$ output at LSI chip ME5-8 (same as the delete code), which in turn generates a 100-400 usec PRIME pulse out of LSI chip ME9-37.

In all of the above cases, the high PRIME signal out of LSI chip ME9-37 resets the printer logic including the shift register and places a dummy character in the first character position in the register. A diagram of the prime timing is shown in Figure 4-2.



Dummy Zeichen: alle Bits auf 0, nur Bit 8 auf 1
bei allen anderen Zeichen: Bit 8 auf 0

Figure 4-2. PRIME TIMING

*Throughout this section, input codes are defined only by their first seven bits. However, bit 8 into the function decoder contained in LSI chip 5 must be a ONE.

The high PRIME signal into pin 3 of the two shift register elements (ME18 and ME19) disables all inputs to these elements and internally resets all stages of the shift register. When PRIME goes low, recirculate signal SRCL from LSI chip ME9-38 remains high and a single CLKTB2 pulse is generated at ME9-36. The high SRCL (and low PRIME) connect shift register outputs $\overline{TB1}$-$\overline{TB7}$ back to inputs $\overline{DS1}$-$\overline{DS7}$, and enables a high (+5V) input to stage 8. Note that since the shift register uses inverted signals for both inputs and outputs (e.g., $\overline{DS1}$ and $\overline{TB1}$), a high input to stage 8 represents a ZERO into that stage.

The single CLKTB2 pulse then clocks a dummy character into the register (i.e., ONES into stages 1-7 and a ZERO into stage 8).

4.3.2 SELECT

Before the printer can receive data, it must first be selected. This can be done either by the SELECT switch on the operator panel or by an octal 021 code on the input data lines.

Pressing the SELECT switch (S4) generates a low SELSW signal into LSI chip ME5-31. The chip contains "anti-bounce" protection which requires the SELSW line to be noise-free for approximately 2-8 msec before the level is recognized by the chip. After this delay, the low SELSW input sets a Select latch in the chip. The output of this latch appears as signal SLCT' on LSI chip ME5-40.

Similarly, a decoded octal 021 code on data inputs $\overline{DS1}$-$\overline{DS7}$ ANDed with ungated data strobe pulse DSTA also sets this Select latch.

The printer is deselected (i.e., the internal Select latch is reset) either by again pressing the SELECT switch or by an octal 023 on data lines $\overline{DS1}$-$\overline{DS7}$ and a DSTA pulse. Alternately pressing the SELECT switch alternately selects and deselects the printer. Note that when power is turned on, $\overline{PWRPRM}$ resets the internal Select latch so that the printer initially appears in a deselect state.

A high SLCT' signal at ME5-40 indicates that the printer is selected. This signal, inverted by ME22-6 ($\overline{SLCT}$) turns on the SELECT lamp on the operator panel. $\overline{SLCT}$ inverted by ME20-4 generates a SLCT signal to the interface connector.

If DELINH jumper E13 to E14 is connected, then selecting the printer will also cause a prime condition. If jumper E14 to E15 is used, select will not cause a prime condition.

4.4 DATA INPUT

Inputs to the printer consist of seven standard parallel data lines (DATA1-DATA7), an optional DATA8 line, an active low $\overline{\text{DATA STROBE}}$ input, and an active low $\overline{\text{INPUT PRIME}}$ line. The first seven data lines represent the 7 bit USASCII code shown in Appendix B. The optional eighth bit is used as a control bit either for specifying an elongated character or for selecting an additional character set. The data strobe is used to synchronize the input data with the printer electronics. The prime line is used to prime (initialize) the printer electronics.

The eight data inputs have a unity loading factor and are terminated by a 1K pull-up resistor to +5 volts. The data strobe and prime inputs are terminated by a 470 ohm resistor to +5 volts. Note that with no input on DATA8 line, terminating resistor R15 holds the input at +5V, making bit 8 appear as a ONE on the logic card.

In response to received data, the printer generates an Acknowledge pulse to acknowledge reception of a character. If the received character caused the printer to perform some function such as paper movement, character printing, etc., the printer responds with a Busy signal.

4.4.1 DATA INPUT TIMING

The single line, 133-character buffer in the 101AL is capable of receiving parallel data at a rate of up to 75,000 characters per second.

In general, the data transfer sequence consists of the input device placing the appropriate code on the data lines to the printer and then generating a data strobe pulse. The printer, after a slight delay, responds with an acknowledge pulse. Or if the received data caused a busy condition, the printer first activates the busy line for the duration of the busy condition and then responds with an acknowledge pulse.

4.4.1.1 Normal Data Input - No Busy

The diagram in Figure 4-3 shows the timing involved in transferring data, which does not cause a busy condition.

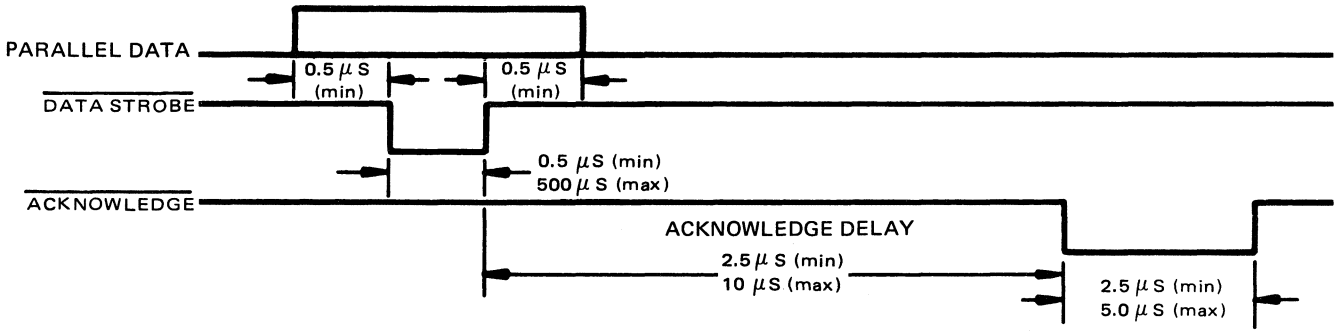
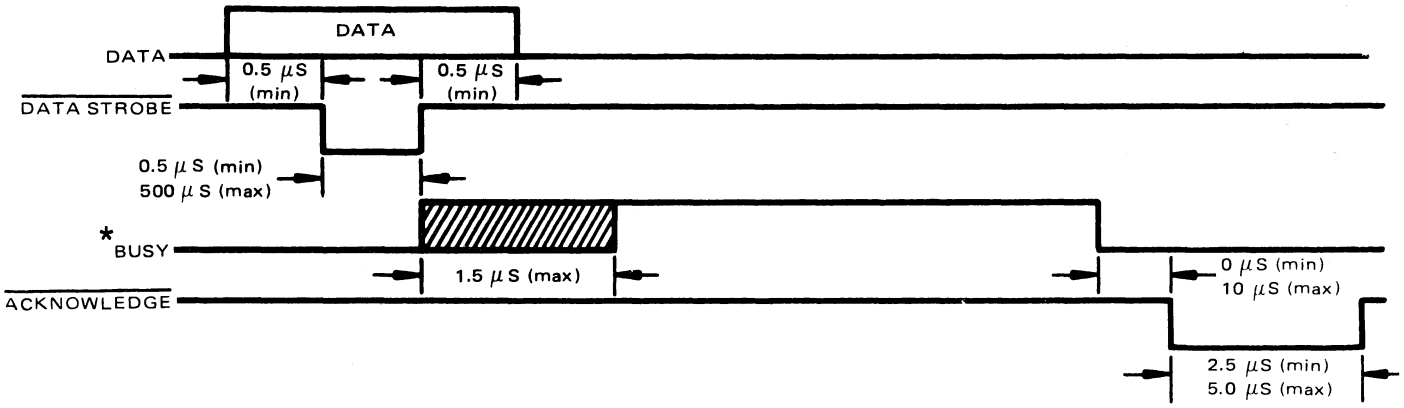


Figure 4-3. INPUT DATA TIMING - NO BUSY CONDITION

As shown in the diagram, each data line must be stable at least 0.5 usec before and after DATA STROBE, and the DATA STROBE pulse must be at least 0.5 usec wide. In response to the received data, some 2.5 to 10 usec after the trailing edge of DATA STROBE, the printer generates a 2.5 to 5.0 usec ACKNOWLEDGE pulse indicating that it is ready to receive additional data. As a standard feature, the 101AL will not recognize a data strobe during the acknowledge delay interval. As an option, however, a non-gated data strobe is available.

4.4.1.2 Data Input Causing Busy (Normal Wagenmeland)

The diagram in Figure 4-4 shows the interface timing involved receiving any character which causes a busy condition in the printer. (Note that a Bell code does not cause a busy condition).



*Note: Duration of Busy (see Table 4-1)

Figure 4-4. INPUT DATA TIMING - CAUSING BUSY CONDITION

As shown in the diagram, the printer responds to any of the above characters by generating a BUSY signal from 0 to 1.5 usec after the trailing edge of $\overline{\text{DATA STROBE}}$. As shown in Table 4-1, the duration of busy depends on the specific function being performed.

From 0 to 10 usec after BUSY is terminated, the printer generates a 2.5 to 5.0 usec $\overline{\text{ACKNOWLEDGE}}$ pulse, to indicate that the specified function is completed.

TABLE 4-1
MODEL 101AL BUSY CONDITION TIMING

Any printable character (except 132nd character on a line).	No Busy
Line Feed	75-105 msec
Vertical Tab (1 inch)	300-310 msec
Form Feed (11 inches)	3-3.5 sec
Delete	100-400 usec
Bell	0
Select	100-400 usec*
Deselect	Until printer is selected
Print (CR or last character)	6 msec per character plus 75-105 msec line feed. Printer is not busy during return time (240 msec max.).

*0 usec if $\overline{\text{inhibit}}$ prime on select option is used.

4.4.2 BUSY

A busy indication is developed by LSI chip ME5 pin 11. This $\overline{\text{BUSY}}$ output, normally high when the printer is not busy, goes low when any of the following conditions occurs:

(1) $\overline{\text{CSBSY}}$ goes low - This occurs when a dummy character ($\overline{\text{TB8}}$) is detected at the shift register output and a prime operation is not in progress. This indicates that the 132nd character has just been loaded into the shift register (without a carriage return code).

(2) PRIME goes high - This occurs during a prime operation as described in Section 4.3.1.

(3) LFF (internal to ME5) goes high - This occurs either when a form feed code (octal 014) is received, or if the optional TOP OF FORM switch on the operator panel is pressed. (Note: If the DSC option is used, the received FF code will first cause the line to be printed before activating LFF). LFF is normally reset by the trailing edge of DLYLF.

(4) LLF (internal to ME5) goes high - This occurs when a line feed code (octal 012) is received or the optional LINE FEED switch on the operator panel is pressed. LLF is reset by the trailing edge of DLYLF.

(5) LTF (internal to ME5) goes high - (Similar to the LFF signal) - LTF goes high when a vertical tab code (octal 013) is received and is reset by the trailing edge of DLYLF.

(6) $\overline{\text{DCPRM}}$ goes low - This occurs: (a) when a delete code (octal 177) is received, or (b) when an $\overline{\text{INPUT PRIME}}$ signal is received at the interface connector, or (c) a power prime ($\overline{\text{PWRPRM}}$) condition exists.

(7) REMCR (internal to ME5) goes high - This occurs when a control character is clocked into the shift register, indicating the start of a character printing operation. In the standard 101AL printer, only the carriage return control code (octal 015) is stored in the shift register.

However, if the DSC option is used (jumper E10 to E11), then a LF, VT, FF, or CR code (octal 012, 013, 014, and 015 respectively) may be loaded into the shift register.

(8) $\overline{\text{PMSOL}}$ goes low - This occurs while the paper movement solenoid is activated.

(9) FAULT goes high - This occurs: (a) if the printer is deselected (SLCT' is low), or (b) if the printer is out of paper ($\overline{\text{PE}}$ is low), or (c) during a paper time-out condition, or (d) during a Light Detect ($\overline{\text{LD}}$) error condition. $\overline{\text{LD}}$ goes low if no video signal is detected as the print head travels across the page.

(10) DLYLF goes high - This 60-90 millisecond line feed delay occurs following a paper movement operation.

As shown in the timing diagram in Figure 4-4, BUSY can occur up to 1.5 usec following the trailing edge of $\overline{\text{DATA STROBE}}$. The worst case (1.5 usec) condition arises when $\overline{\text{CSBSY}}$ goes active. This occurs because of the accumulated delays in loading the 132nd character in the shift register, detecting the dummy character at the output, generating the $\overline{\text{CSBSY}}$ on LSI chips ME16 and finally generating the $\overline{\text{BUSY}}$ on LSI chip ME5.

4.4.3 FUNCTION DECODER

The buffered data inputs are applied to a function decoder on LSI chip ME5. These data lines gated with a data strobe signal are decoded and if a control code is detected, the following actions occur:

Function	Octal Code	Jumpers	Strobe	Output Mnemonic	Printer Action
Bell	007	None	Gated	BELL	Generates an audible tone, 1 to 2 seconds in duration, in the speaker at the front of the printer.

Function	Octal Code	Jumpers	Strobe	Output Mnemonic	Printer Action
Line Feed*	012	None	Gated	$\overline{\text{CSLF}}$, $\overline{\text{PMSOL}}$	Advances the paper one line.
Vertical Tab*	013	None	Gated	$\overline{\text{PMSOL}}$	Causes paper to advance until the next hole in channel 5 of the Vertical Format Unit (VFU) paper tape is reached.
Form Feed*	014	None	Gated	$\overline{\text{PMSOL}}$	Causes paper to advance until the next hole in channel 7 of the VFU paper tape is reached.
Carriage Return	015	None	Gated	$\overline{\text{DSCR}}$	Causes the received line of characters to be printed.
Elongated Character	016	E16-E18 E20-E23	Gated	$\overline{\text{UPSC}}$	Causes all characters on the line to be printed at double the normal width.
Select	021	None	Ungated	SLCT'	Selects the printer. E14 to E15 inhibits a prime operation during select.
Deselect	023	None	Ungated	SLCT'	Deselects the printer.
Delete	177	None	Ungated	$\overline{\text{DCPRM}}$	Primes the printer.

*If the DSC option is used (jumper E10 to E11), LF, VT, and FF also cause the received line of characters to be printed.

In addition to the functions listed above, the function decoder also monitors the input data for the first printable character (i.e., a ONE in bit 6 or 7). Detection of the first printable character, sets First Character Clock latch (FCCLK) internal to LSI chip ME5. Only when this latch is set will the printer respond to a carriage return code (or if the DSC option is used, to a LF, VT, or FF code) by printing the line of characters.

4.5 SHIFT REGISTER (BUFFER)

The printer storage buffer consists of two quad 133-bit shift register MOS elements (ME16 and ME17). These elements provide an 8 x 133-bit storage capacity or one full line of 132 characters. The extra character storage (i.e., 132 instead of 133) is used for storing a dummy character (a ONE in bit 8). Detection of this dummy character at the shift register output indicates that the 132nd character for that line has just been shifted into memory.

A high PRIME input to ME16 and ME17, disables all other inputs and asychronously resets the entire register. When PRIME is low, the shift register operates in either the normal or the recirculate mode. With the recirculate input (SRCL) low, each CLKTB1 or CLKTB2 pulse clocks the $\overline{DS1}$-$\overline{DS8}$ inputs into the shift register. With SRCL high, the register is in the recirculate mode. The first three stages in each shift register element are recirculated internally. The fourth stage in ME17 is recirculated by the external connection of $\overline{TB4}$ to the Recirculate Input (R.I.). The R.I. terminal for the fourth stage in ME17, however, is tied to +5V. As a result, when the SRCL input is high, CLKTB recirculates the $\overline{TB1}$-$\overline{TB7}$ outputs back to the inputs and forces a ONE into the eighth stage ($\overline{TB8}$).

The actual shift register timing depends on which of the following printer operations is taking place: 1) a prime condition; 2) data reception 3) reception of a carriage return code (octal 015) prior to the 132th character in a line; or 4) printing a line of characters.

(1) Priming the Shift Register

During a prime condition, LSI element ME9 generates a high PRIME signal. While PRIME is high, all shift register stages are automatically reset, independent of the data inputs. After PRIME goes low, SRCL remains high and a single CLKTB1 pulse is generated. At this time, a ONE is clocked into bit 8 (due to +5V at the recirculate input ME16 pin 15), generating a dummy character at that location.

(2) Normal Data Input

During normal data input from the external device, LSI element ME5 generates a CLKTB1 pulse, slightly delayed from data strobe, each time a printable character or a CR code has been received. The trailing edge of CLKTB1 then clocks data lines $\overline{DS1}$-$\overline{DS8}$ into the shift register.

(3) Following a Carriage Return Code

Following the reception of a carriage return code, LSI chip ~~ME16~~ ME9 generates CLKTB2 pulses to the shift register, at the same rate as the OSC clock. This shifts the register until the dummy character appears at the output ($\overline{TB8}$ goes high). The high $\overline{TB8}$ then terminates the CLKTB2 pulses.

(4) During Character Printing

When printing a line of characters, during each DCWO interval (developed internally in LSI chip ME9), the video STROBE pulse generates a CLKTB2 pulse. This clocks the next consecutive character to the output of the shift register, where it remains until the next DCWO-STROBE interval.

4.6 CHARACTER PRINTING

When the dummy character appears at the shift register output ($\overline{TB8}$), other than during a prime condition, the logic activates an electromechanical clutch which causes the print head to move from left to right across the page.

As the print head carriage moves across the page, the timing fence (and light source) generate timing inputs to the video amplifier board. These timing signals are used by the logic to register the five full columns of dots in the printed character.

The logic uses two ROM (Read-Only Memory) elements for each character set. One ROM defines the dot pattern for the five full-step columns, the other defines the dot pattern for the four-half-step columns in a 9 x 7 matrix.

This section describes the character printing operation in the following sequence.

Paragraph 4.6.1 Initiating the Printing Operation
4.6.2 Character Registration and Timing
4.6.3 Character Generator (ROM)
4.6.4 Print Head Operation
4.6.5 Power Driver Circuits

4.6.1 INITIALIZING THE PRINTING OPERATION

As data is received by the printer, the dummy character is shifted through the shift register. As the 132nd character is received, the dummy character appears at the shift register output. If a carriage return code (octal 015) is received before the 132nd character, this code is stored in the register and LSI chip ME9 generates CLKTB2 pulses to shift the register until the dummy character appears at the output. A high $\overline{TB8}$ indicates dummy character.

When $\overline{TB8}$ goes high, LSI chip ME9 generates a low $\overline{CIPX}$ signal. $\overline{CIPX}$ is inverted by ME10-2 to generate CIP, which is in turn inverted by ME6-12 to generate $\overline{CIP}$.

The high CIP signal controls a driver circuit (via the optional Motor Control circuit) on the power driver board, the output of which activates the forward clutch.

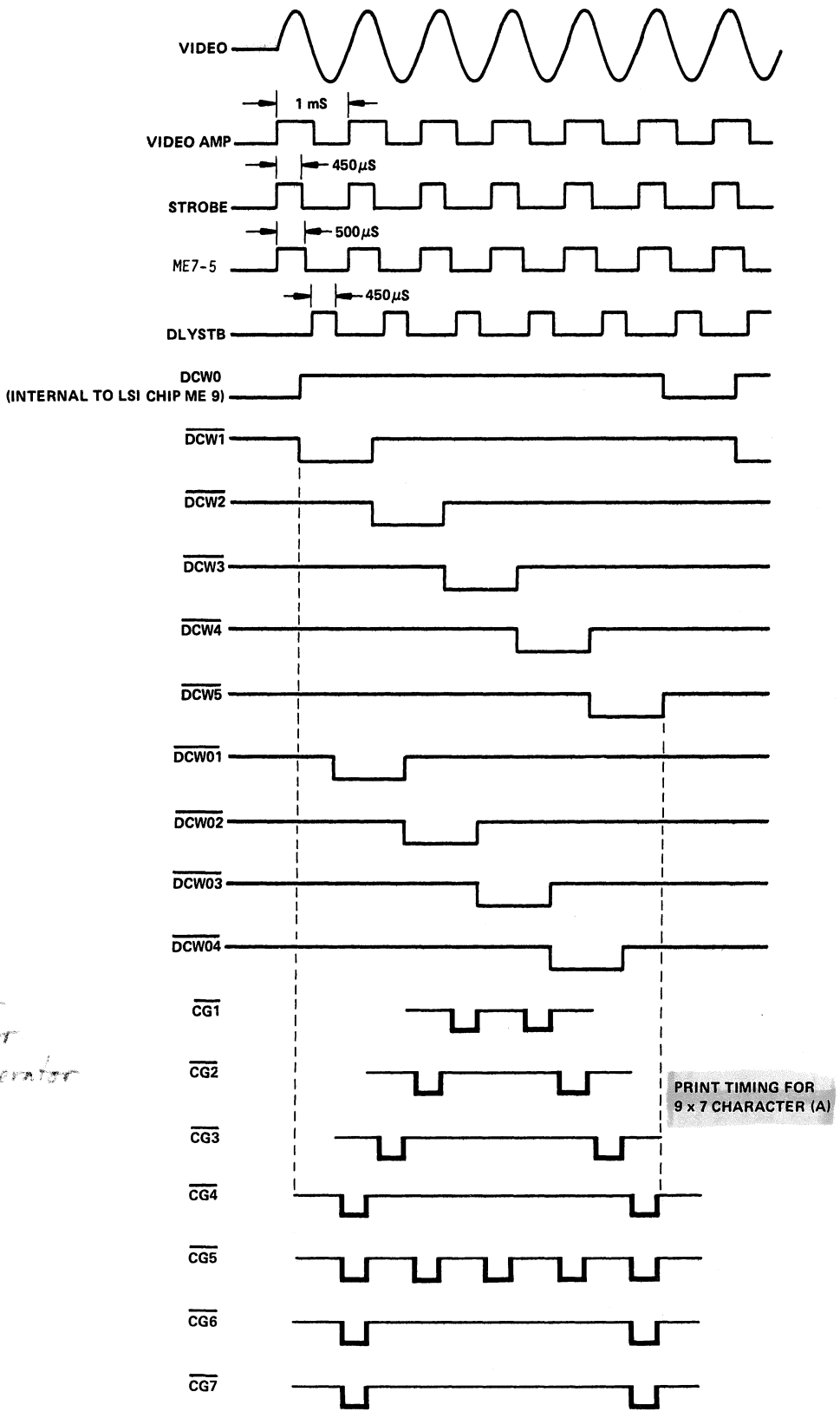
A limit switch is located at the right and left end of the printer. These switches (RTP switch on the left, EOP switch on the right) are activated by a magnet mounted on the underside of the carriage mechanism. Actuation of the RTP switch indicates the carriage is at its leftmost position. Actuation of the EOP switch indicates the carriage is at its rightmost position. The output of these two switches are applied to LSI chip ME9 where they are used to control the forward clutch logic ($\overline{CIPX}$) and to detect failures in the video signal from the timing fence ($\overline{LD}$).

When the EOP switch is activated or when a control character is detected at the shift register output, $\overline{CIPX}$ goes high, turning off the forward clutch. This fires one-shot ME7-4, generating a 40 millisecond Delayed Clutch (DCLT) interval. During this time, logic condition $\overline{CIP}\cdot\overline{RTP}$ generates a low $\overline{CIRX}$ output from LSI chip ME9. After the delayed clutch interval, $\overline{CIR}$ goes low activating the reverse clutch and returning the print head to the left margin.

4.6.2 CHARACTER REGISTRATION AND TIMING

As the carriage moves, the optical pick-up head and light source on the video amplifier assembly generates the video signal for controlling the print timing. As the print head and optical head assembly moves across the timing fence, the vertical slots on the timing fence interrupt light to the optical pick-up head, generating a video signal. The VIDEO AMP output then triggers the STROBE one-shot ME11 on the logic card, initiating the print timing shown in Figure 4-5.

The STROBE one shot is adjusted for 450 usec. The leading edge of STROBE also triggers a delay one-shot (ME7-12) adjusted for a 500 usec output pulse.



CG = Character Generator = Zeichengenerator

Figure 4-5. CHARACTER TIMING

The trailing edge of this pulse triggers the Delayed Strobe (DLYSTB) one-shot which is adjusted to the same pulse width as STROBE. In normal character printing, STROBE is used for full-step timing and DLYSTB for the half-step timing.

4.6.2.1 Video Amplifier

The circuit used to amplify the video signal generated by the timing fence is located on the video amplifier assembly board, contained on the print head carriage.

Referring to schematic drawing #63002319 in Section 7, the video amplifier consists of a high gain amplifier with positive feedback. When the photo cell is dark, no current flows through it and the base of Q2 is held at +5 volts through resistor R1. When Q1 is turned off, Q2 is turned on through resistors R2 and R7. Q2 being on also turns on Q3 through resistor R4.

Because Q3 is on, the collector is held at approximately ground, thereby allowing the current to flow through R7 and holding Q2 on through the positive feedback. When the photo transistor detects light, current is allowed to flow through it, thereby drawing current through transistor Q1 and resistor R2. Q1 then turns on and turns transistor Q2 off by shunting the current away from the base of Q2. When Q2 turns off, Q3 also turns off and the collector of Q3 is held to +5 volts through R6. R7 serves to drive Q2 further into the cut-off region. Capacitors C1 and C2 are used for proper frequency response and noise suppression. Resistor R3 is used to prevent leakage by keeping Q2 from turning off.

4.6.2.2 Timing Signals

For normal character printing, five consecutive STROBE inputs to LSI chip ME9, generate timing outputs $\overline{\text{DCW1}}$-$\overline{\text{DCW5}}$ as shown in Figure 4-5. These timing intervals correspond to the five full-step columns in the character matrix. The quiescent state of this strobe counter is DCW0 (internal to the chip) which corresponds to the space interval between characters. During DCW0, the STROBE input generates a CLKTB2 pulse which clocks the next character to the output of the shift register. The $\overline{\text{DCW1}}$-$\overline{\text{DCW5}}$ timing outputs are used to address the appropriate column in the "full-step" ROM (character generator).

During each video interval both a STROBE pulse and a DLYSTB pulse of the same width is generated as shown in Figure 4-5. During normal character printing, four consecutive DLYSTB inputs to LSI chip ME9, generate timing outputs $\overline{DCWO1}$-$\overline{DCWO4}$. These four timing intervals correspond to the four additional ("half-step") columns in the 9 x 7 matrix. Timing signals ($\overline{DCWO1}$-$\overline{DCWO4}$) are used to address the appropriate column in the "half-step" ROM (character generator).

During elongated character printing, the UCC latch (internal to LSI chip ME9) allows alternate STROBE pulses to clock the internal strobe counter and alternate DLYSTB pulses to clock the delayed strobe counter. As a result, timing outputs $\overline{DCW1}$-$\overline{DCW5}$ and $\overline{DCWO1}$-$\overline{DCWO4}$ are twice as long during elongated character mode than during normal character mode.

During the space interval between characters (DCWO), timing signals $\overline{DCW1}$-$\overline{5}$ and $\overline{DCWO1}$-$\overline{04}$ are all reset.

4.6.3 CHARACTER GENERATOR (ROM)

The logic board can contain up to four ROM elements, depending on the selected character generating capabilities of that printer. The ROM's in element locations ME18 and ME20 each provide full-step outputs (i.e., columns 1, 3, 5, 7, 9) for up to 64 characters. the ROM's in locations ME24 and ME30 each provide half-step outputs (i.e., columns 2, 4, 6, 8) for up to 64 characters.

Each ROM (Character Generator) element had three inputs (in addition to the input voltages):

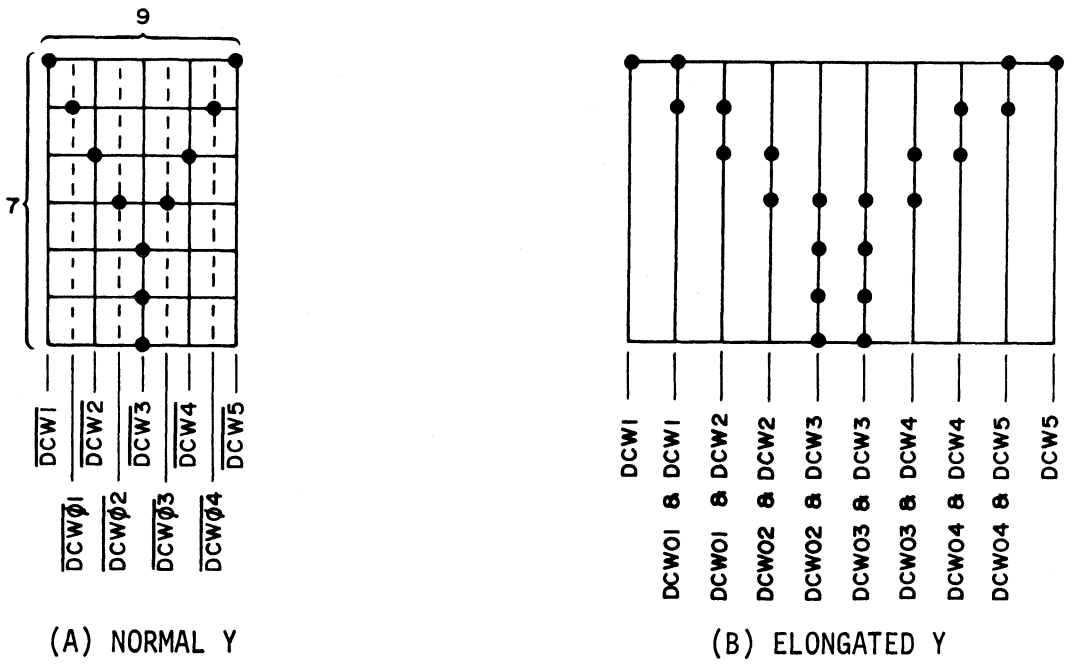
(1) The character address - Outputs $\overline{TB1}$-$\overline{TB5}$ from the shift register are buffered and applied to five of the six character inputs to all ROM's. For the full-step and half-step ROM's (ME18 and ME24), the sixth character address input is controlled by $\overline{TB6}$. For ROM's ME20 and ME30, the sixth character address input is controlled by CHADD7. By jumper option, CHADD7 can be either TB7 (standard) or $\overline{TB6}$ (optional).

(2) Column Address - Timing outputs $\overline{DCW1}$-$\overline{DCW5}$ from LSI chip ME9 specify the five "full-step" columns in each 9 x 7 character matrix in ROM's ME18 and ME20. Timing output $\overline{DCWO1}$-$\overline{DCWO4}$ specify the four "half-step" columns in each 9 x 7 matrix in ROM's ME24 and ME30.

(3) Timing - A low input to pin 28 of each ROM gates the 7-bit dot configuration of the addressed character and column to the output of that ROM. For the full-step ROM's (ME18 and ME20), this timing input is STROBE ANDed with ROMTB8 or $\overline{\text{ROMTB8}}$. By jumper option, ROMTB8 can be $\pm$0V, +5V, CHADD7, TB8 or $\overline{\text{TB8}}$, allowing the selected one of these inputs to enable the ROM. The STROBE pulse provides the timing input for gating the 7-bit dot pattern to the print head solenoids.

For the half-step ROM's (ME24 and ME30), the timing input is ROME2 ANDed with ROMTB8 or $\overline{\text{ROMTB8}}$. For normal character printing, ROME2 generated by LSI chip ME9, is coincident with Delayed Strobe signal DLYSTB. This effectively interleaves the dot pattern from the half-step ROM's with the dot pattern from the full-step ROM's.

For elongated character printing, ROME2 is coincident with the STROBE signal. This combined with the fact that the DCW timing signals from LSI chip ME9 are twice as long during elongated character mode, causes the printed character to be twice as wide as normal characters. An example of the character (Y), both in normal and elongated style, is shown in Figure 4-6.



(A) NORMAL Y

(B) ELONGATED Y

Figure 4-6. NORMAL AND ELONGATED CHARACTERS

The seven outputs from all four ROM's are wire ORed together and gated out to the Power Driver board as signals CG1-CG7. Diodes CR16-CR32 clamp the ROM outputs to +5V to prevent overloading the inputs to the 74L00 gates. In normal operation, the STROBE or DLYSTB signal gates the addressed dot column to the Power Driver board. The input to ME28 pins 1 and 2 is normally low holding the output constantly high, enabling the output CG gates. If, however, a failure occurs in the -12V supply, then ME28-1 and 2 goes high forcing ME28-3 low disabling the CG gates.

4.6.4 PRINT HEAD OPERATION

The print head is the device used to do the impact printing of the characters. The head contains seven solenoids that move the tungsten wires against the ribbon to form the column of dots on the paper. The position of these solenoids and the location of the tungsten wires in the head are shown in Section 1. Solenoid #1 controls the top dot and solenoid #7 controls the bottom dot in a column. The wires come from each solenoid and are positioned at a jewel located at the end of the head. The length of these wires is approximately 3.5 inches and each wire requires about one ounce of force to begin its movement. The amount of force needed to move the wires 0.015 inch (i.e., the distance necessary to make a dot on the paper) is about 12 ounces.

The total distance travelled by the wires is approximately 0.015-inch, but under normal operation, the end of the head is about 0.006 inch from the ribbon and paper. The reason for locating the wires closer than 0.015 inch from the paper, is to account for the amount of force absorbed by the ribbon and paper upon impact.

The electrical timing and mechanical movement of the wires is shown in Figure 4-7. As shown, a 450 microsecond pulse is used to complete the impact. The voltage used to drive the solenoids is +35 volts unregulated. This voltage is about +35 to +38 volts when the pins are in an idle state, but drops to about +30 volts when all pins are engaged at the same time. From the beginning of the 450 microsecond drive pulse, about 200 microseconds is required before the wire starts to move in each solenoid. Once the wire starts moving, an additional 300 microseconds is required before the wire makes an impact on the paper. Approximately 500 microseconds more are required for the wire to retract to its normal position.

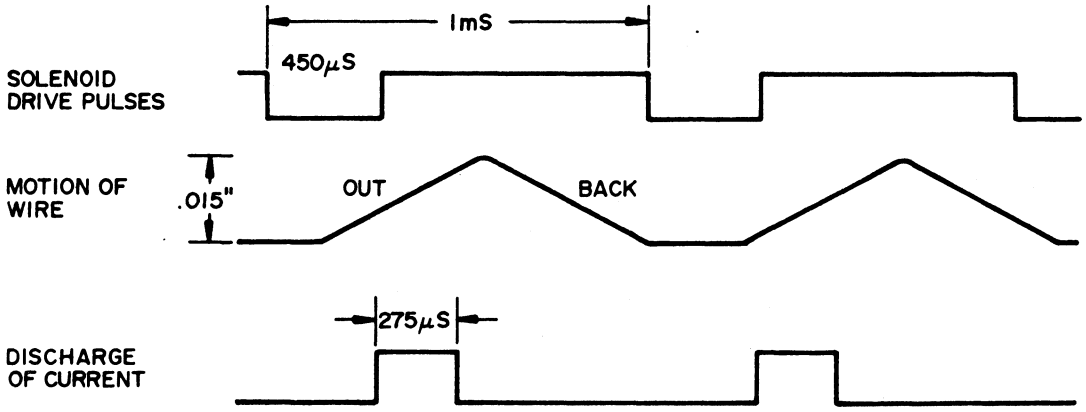


Figure 4-7. PRINT HEAD TIMING

4.6.5 POWER DRIVER CIRCUITS

4.6.5.1 Solenoid Drivers

a. Driver Circuit

The wire ORed outputs from the character generator CG1-CG7 are applied to the solenoid power driver circuits where they are inverted, amplified and used to generate current pulses for firing the solenoid in each head.

Since all solenoid driver circuits are identical and operate in the same manner, only the first one, controlled by CG1 will be described.

Referring to Power Driver schematic #63002275, when CG1 goes high indicating an active condition for solenoid #1, current flows through R4. If CR40 is back-biased (which is the normal operating condition), the current flows into the base of Q3 turning it on. The current through Q3 then develops a +5V level across Zener diode CR3. This +5V causes Q2 and Q1 to act as emitter followers, developing a voltage of approximately 3.8V across R1. Resistor R2 limits power dissipation in Q2.

The 3.8V across R1 allows approximately a 2.5 amp current flow through solenoid #1 and transistor Q1. When Q1 is first turned on, the inductance of the solenoid prevents current flow through Q1. Transistor Q1 is saturated at this time. When current flow through the solenoid reaches approximately 2.5 amps, Q1 goes into the active region and limits the current to this value.

When CG1 goes inactive low, Q3 turns off, turning off Q2 and Q1. When Q1 turns off, the solenoid current flows through CR2 and C1. The value of C1 is chosen to act as a parallel reasonant circuit with the inductance of the solenoid. Diode CR2 allows only a quarter-wave of the resonant frequency. A waveform diagram is shown in Figure 4-8.

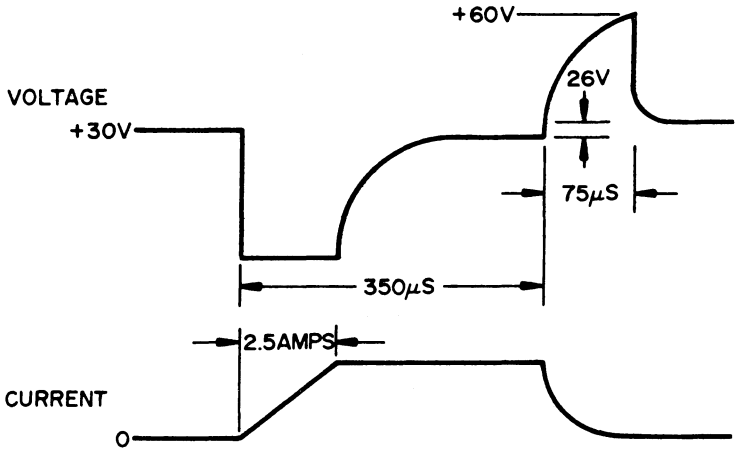


Figure 4-8. POWER DRIVER WAVEFORM

b. Capacitor Discharge Circuits

After C1, C2, C3, C4, C6, C7 and C8 have charged to approximately 60 volts because of the discharging solenoid current, resistors R61, R62, R64, R65, R66 and R67 serve to bleed off this charge so that the capacitors will be at a 30 volt bias at the time of the next discharge. The value of the resistor is chosen so that a time constant of about 275 microseconds results.

c. Shut-Off Circuit

Diodes CR40, CR41, CR42, CR43, CR44, CR45, CR39 have their cathodes tied together and connected to Q32. When the printer is turned on, the +5 volt supply closes relay K1. This prohibits current from flowing through CR35 and into the base of Q32, thereby ensuring that Q32 is shut off. In this condition diodes CR39 through CR45 cannot shunt current away from the solenoid drivers. When the machine is shut off, however, it is characteristic that the 5 volt supply output drops before the 30 volt supply output.

When this happens, K1 opens, allowing the current to flow through R47 and CR35 into the base of Q32, thereby saturating Q32. This connects the bases of all the solenoid drivers to ground through diodes CR39 through CR45, preventing any of the solenoids from firing during power turn off. The Clutch and Line Feed Drivers are also attached to the collector of Q32 through diodes CR36, CR37 and CR38. Therefore, during power turn off, the clutches will release and paper movement will be inhibited.

4.6.5.2 Forward Clutch Driver

Power for moving the print head from left to right across the page is transmitted from the main drive motor to an electromechanical clutch mechanism. The clutch is controlled by a low $\overline{\text{CIP}}$ signal from the logic board. This signal is applied via the optional Motor Control board to a driver circuit on the Power Driver card, the output of which activates the clutch.

Signal CIP is normally low thereby causing the current flowing through R42 to be shunted through CR31 to ground. Diode CR30 offsets the diode drop of CR31. When signal CIP goes active high, CR31 becomes back biased, causing current to flow through CR30, R49, and transistor Q29, provided that diode CR37 is back biased. This current causes transistors Q29 and Q28 to saturate, and current to flow through Q29 and R41. The current flowing through Q28 also flows through and activates the forward clutch. The clutch current is limited by R40.

When CIP goes low, Q29 and Q28 turn off. Diode CR29 provides a current path until the magnetic field of the forward clutch is dissipated.

4.6.5.3 Reverse Clutch Driver

Power for moving the print head from right to left is transmitted from the main drive motor to a reverse clutch mechanism. Signal $\overline{\text{CIR}}$ from the logic board directly controls the reverse clutch driver on the Power Driver board, unaffected by the optional motor control circuit.

The reverse clutch driver operation is identical to that of the forward clutch driver except that it is controlled by signal CIR instead of CIP.

4.7 PAPER MOVEMENT

Three separate printer functions can cause a paper movement operation: line feed, form feed, and vertical tab. Each of these functions causes the paper to move by activating the Paper Movement Solenoid (PMSOL), which in turn activates a clutch that mechanically links the form feed motor to the paper-feed tractors.

For each line feed operation, the solenoid is energized 15 milliseconds for single line feeds and approximately 50 milliseconds for the double line feed option. At the end of this interval one 60-90 millisecond line feed delay is generated to allow the clutch pawl and clutch mechanism to return home before another paper movement operation is allowed.

In response to a form feed or vertical tab command, a dc level is applied to the solenoid, allowing continuous movement of the paper. This paper movement is terminated when a hole is detected in the appropriate channel of the vertical format paper tape. The operation of the VFU is described in Section 4.7.4.

To prevent the printer from "hanging up" in a paper movement condition which would waste both time and paper, LSI chip 5 contains a paper-time-out circuit. This circuit is activated by any paper movement command. In the standard 101AL printer, the Paper Time-Out (PMTO) interval is factory-adjusted for approximately 6-9 seconds. If, at the end of this time, paper is still advancing, the line feed solenoid command (PMSOL) is immediately deactivated, terminating the paper movement operation, and the FAULT line to the interface connector is activated.

As an option, the paper time-out interval can be adjusted from 2 to 12 seconds via R38 which controls the Low-Frequency Oscillator (LFOC) input to LSI chip ME5.

4.7.1 LINE FEED (Figure 4-9)

The line feed operation can be generated by any of the following three conditions:

(1) After printing a line of characters (if the automatic line feed is not disabled, E1 to E2 is connected) then the low-going forward clutch signal CIP, triggers the LF one-shot.

(2) Receiving a line feed code (octal 012) - LSI chip ME5 decodes the line feed character and generates a 5-10 usec $\overline{\text{CSLF}}$ pulse, the trailing edge of which triggers the LF one-shot.

(3) Pressing the LINE FEED switch on the operator panel - Pressing this switch causes $\overline{\text{REMLF}}$ to go low. This low input to LSI chip ME5 generates a 5-10 usec $\overline{\text{CSLF}}$ pulse, the trailing edge of which triggers the LF one-shot.

The width of the LF pulse generated by any of these three conditions is adjustable. In the standard 101AL printer, R22 and R23 are not used and jumper E5 to E6 is connected. In this configuration, R19 is adjusted so that a 15 millisecond LF pulse is generated.

If the double line feed option controlled by an optional switch on the operator panel is used, then jumper E4 to E5 is connected and R22 and R23 are used. With the switch in the "double line feed" position, DLF is an open circuit and R19 has no effect on pulse width. R22 should be adjusted to provide a 50 millisecond LF pulse. When the switch is placed in the "single line feed" position, DLF goes to +5V, placing R19 in parallel with R82 and R83. With the switch in this position, R19 should be adjusted to provide a 15 millisecond LF pulse.

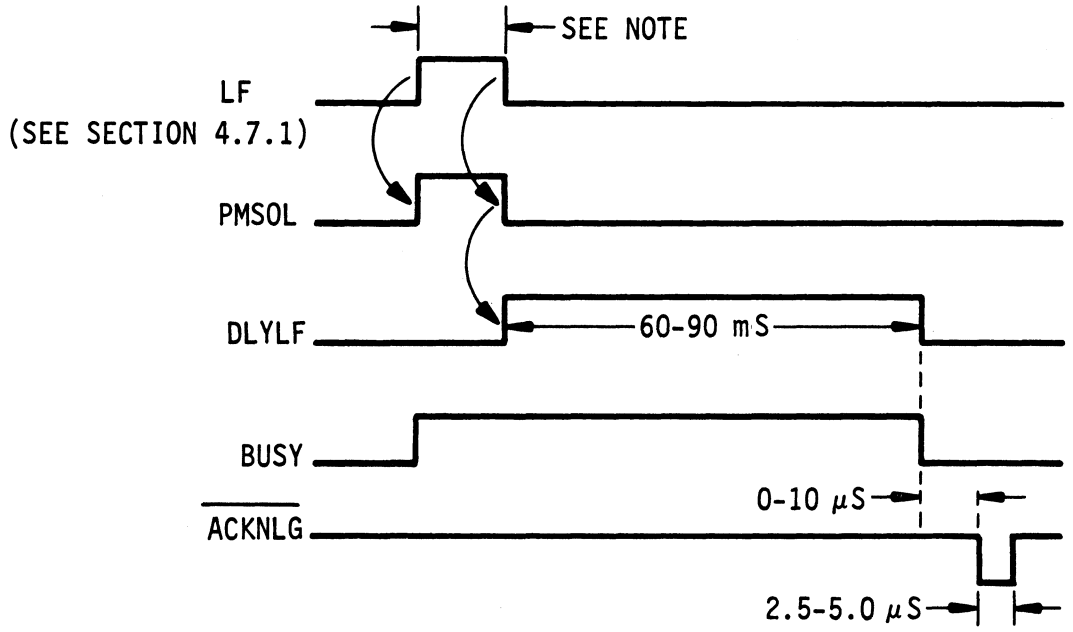
While LF is high, LSI chip ME5 generates a low $\overline{\text{PMSOL}}$ signal which activates the line feed solenoid via the Power Driver board. The trailing edge of $\overline{\text{PMSOL}}$ triggers the 60-90 millisecond Delay Line Feed interval DLYLF. During both the LF and DLYLF intervals, the printer remains busy.

4.7.2 FORM FEED (Figure 4-10)

A form feed operation can be generated by either of the following two conditions:

(1) Receiving a form feed code (octal 014) - LSI chip ME5 decodes the form feed character and generates a low $\overline{\text{PMSOL}}$ signal to activate the line feed solenoid. If the DSC option is used (E10-E11), the line is printed before $\overline{\text{PMSOL}}$ is activated

(2) Pressing the TOP OF FORM switch on the operator panel - This generates a low $\overline{\text{TOFSW}}$ signal causing LSI chip ME9 to generate a low PMSOL signal.



NOTE: 15 MILLISECONDS FOR SINGLE LINE FEED,
50 MILLISECONDS FOR DOUBLE LINE FEED OPTION

Figure 4-9. LINE FEED TIMING

The low $\overline{\text{PMSOL}}$ signal activates the line feed solenoid and generates a busy condition. This continues until a hole is detected in channel 7 of the paper tape. This generates a high FFH input to LSI chip ME5, which deactivates $\overline{\text{PMSOL}}$.

For as long as $\overline{\text{PMSOL}}$ is active, the printer remains in a busy condition. If a paper time-out is detected, $\overline{\text{PMSOL}}$ is immediately deactivated and the FAULT line is activated.

4.7.3 VERTICAL TAB (Figure 4-10)

A vertical tab operation is generated by receiving a vertical tab code (octal 013). LSI chip ME5 decodes the vertical tab character and generates a low $\overline{\text{PMSOL}}$ signal. If the DSC option is used (E10-E11), the line is printed before $\overline{\text{PMSOL}}$ is activated.

The low $\overline{\text{PMSOL}}$ signal initiates the paper movement and generates a busy condition. This continues until a hole is detected in channel 5 of the paper tape. This generates a high FFH input to LSI chip ME5, which deactivates $\overline{\text{PMSOL}}$.

For as long as $\overline{\text{PMSOL}}$ is active, the printer remains in a busy condition.

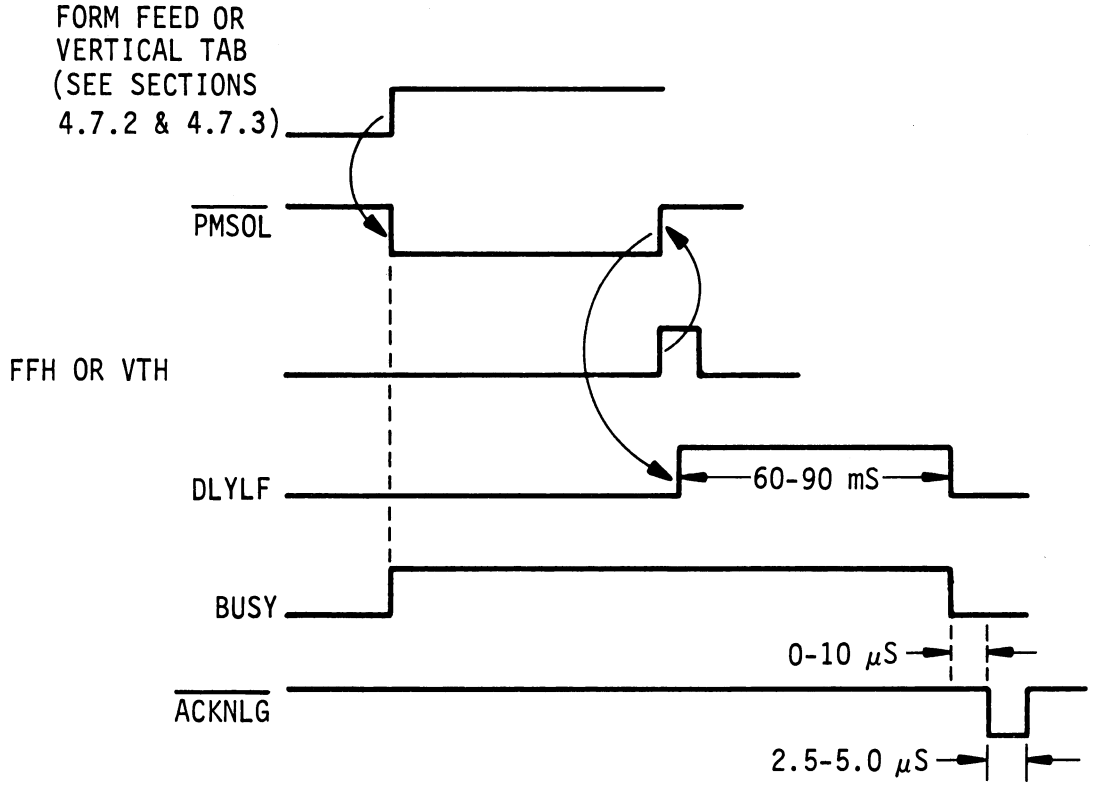


Figure 4-10. FORM FEED AND VERTICAL TAB TIMING

4.7.4 VERTICAL FORMAT UNIT

The vertical format unit (VFU) consists of a standard 8-channel paper tape reader, located on the upper left side of the printer. Movement of the paper tape in the VFU is caused by direct mechanical linkage to the gear train that drives the paper feed tractors. As a result, each line feed advances the paper by one line and the tape by one sprocket hole.

Each form feed function advances paper until the next hole is detected in channel 7 of the paper tape. Similarly, each vertical tab function advances paper until the next hole is sensed in channel 5 of the paper tape. A schematic of the VFU amplifier is shown in Figure 4-11.

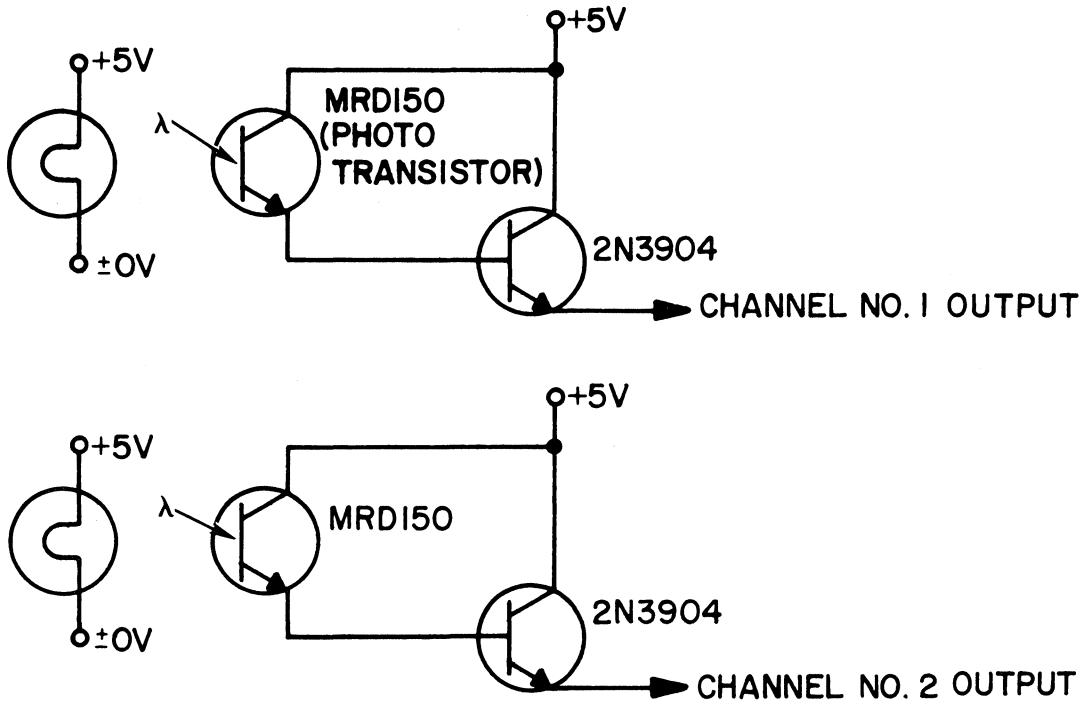


Figure 4-11. VFU TAPE READER AMPLIFIER (LOCATED IN VFU)

Each channel in the vertical format control tape reader contains a photo transistor (type MRD 150) and a single transistor amplifier (type 2N3904). The 2N3904 transistor acts as an emitter follower amplifier to provide current gain. When the photo transistor is dark, no current flows through it and no current flows through the base of the 2N3904; hence no current flows through the 2N3904 transistor. When light shines on the MRD150 photo transistor, current flows through it and into the base of the 2N3904 where it is amplified by the transistor.

The two amplifier outputs CH-1 and CH-2 are then applied to the logic board and LSI chip ME5 as signals VTH and FFH. These two signals are terminated at the logic board by 220 ohms to ±0V. A 2-4 millisecond delay is designed into the LSI chip for noise immunity.

4.7.5 LINE FEED SOLENOID DRIVER

Logic signal $\overline{\text{PMSOL}}$ from LSI chip ME5 is buffered by ME10 to generate PMSOL to the Power Driver board. (Schematic #63002275).

Signal PMSOL is normally low (inactive). In this state, current flows through R39 and CR28 to ground. The diode drop of CR27 balances the diode drop of CR28 thereby maintaining the line feed driver in the off condition.

When PMSOL goes active high, CR28 becomes back biased and current flows through R39, CR27, R48 and into the base of Q27, saturating it. The collector current, limited by R38, flows into transistor Q26, turning is on and causing current to flow through the Line Feed Solenoid. When signal PMSOL returns low, transistors Q27 and Q26 turn off. The fly-back voltage then appears across CR24, which provides a current path until the magnetic field of the line feed solenoid is dissipated.

4.8 SPECIAL FUNCTIONS

In additon to the paper movement and character printing functions, the printer also performs the following special functions: Bell (optional), Delete, Paper Empty, and Motor Control (optional).

4.8.1 BELL

Reception of a bell code (007) or detection of a paper empty condition ($\overline{PE}$ goes low) causes a BELL signal to be generated on LSI chip ME5 pin 39. This BELL signal is a 0.8 to 1.6 KHz output approximately one to two seconds in duration. BELL is amplified by Q7 and Q8 and the amplifier output (P5-D and E) drives the speaker.

In the 101AL printer, a BELL code does not create a busy condition. A paper empty condition, however, still generates a Busy.

4.8.2 DELETE

The delete code resets the printer logic by generating a prime condition. Reception of a delete code (octal 177) on the input data lines ANDed with the ungated data strobe DSTA, sets a latch in LSI chip ME5 causing a low $\overline{DCPRM}$ output at pin 8 of that chip. The low $\overline{DCPRM}$ into LSI chip ME9 causes a high PRIME signal to be generated at ME9-37, resulting in the prime operation as described in Section 4.3.1.

Note that since the delete code is gated with DSTA, the delete code is recognized by the printer even when the printer is busy.

4.8.3 PAPER EMPTY

A paper empty condition in the printer is detected by Paper Out switch S2 located in the path of the paper. With paper in the printer, signal $\overline{PE}$ is high. After the last page passes over the Paper Out switch, signal $\overline{PE}$ goes low. The low $\overline{PE}$ into LSI chip ME5: (1) sets a latch internal to the chip which causes a 1-2 second BELL output; (2) causes a high FAULT output, and (3) lights the PAPER OUT lamp on the operator panel.

The BELL output causes an audible alarm, warning the operator of the paper empty condition. The high FAULT output, in addition to causing a busy condition, also goes to the interface connector to indicate a fault status to the input device.

To allow the printer to print the last form, the operator can press the OVERRIDE switch on the operator panel. This causes $\overline{PE}$ to go high for as long as the switch is pressed.

4.8.4 MOTOR CONTROL (OPTIONAL)

(This section contains a Motor Control Location Diagram, (Figure 4-12), a Motor Control Board Interconnection Diagram (Figure 4-13), and a Motor Control Timing Diagram (Figure 4-14). Referring to these figures, one-shot ME3 generates a 9-second interval during which time the Forward Clutch signal (FWDCLD or CIP), and the Paper Movement signal (PMSOL) are monitored. During any 9-second interval generated by one of these print or paper movement commands, the solid-state switching circuit is activated, thereby delivering 115 VAC to the motors. If the 9-second interval is exceeded without receiving another print of paper movement signal, then the switching circuit is deactivated removing 115 VAC from the motors. The next print or paper movement command automatically turns on the motors.

The solid-state switching circuit is connected in the 115 VAC power line to the motors. It consists of an optically coupled isolator (ME2), a silicon controlled rectifier SCR (Q2), a full-wave bridge rectifier (CR3, 4, 5, 6) and a triac (Q1). ME2 provides isolation and is used as a switching network, containing an LED emitter and photo darlington sensor. The triac Q1 is basically two SCR's connected in parallel and oriented in opposite directions. Across Q1 and R9 and C7 which comprise an RC snubber network for preventing the line voltage rate of change from turning triac Q1 on without a valid gate signal.

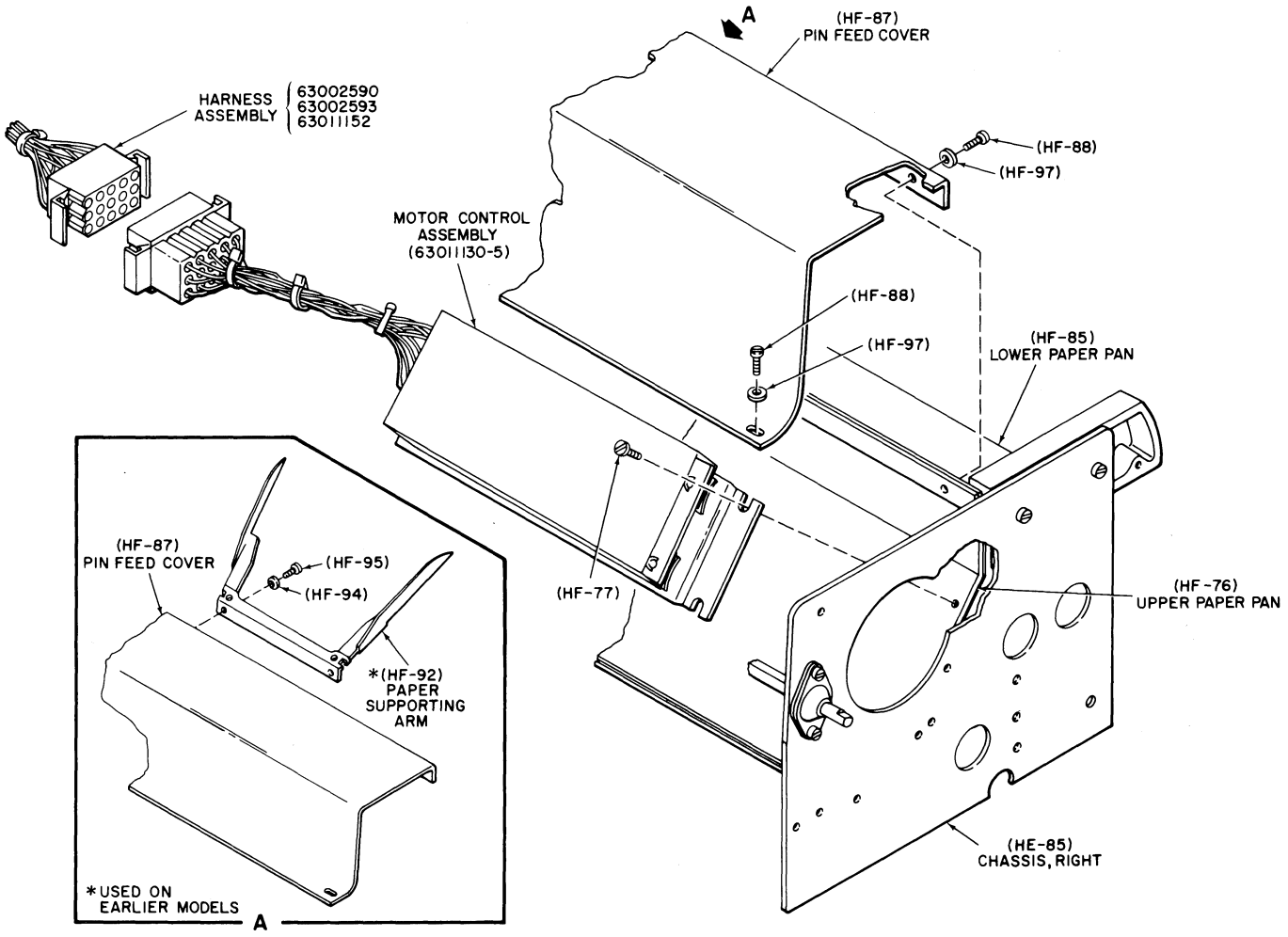


Figure 4-12. MOTOR CONTROL LOCATION

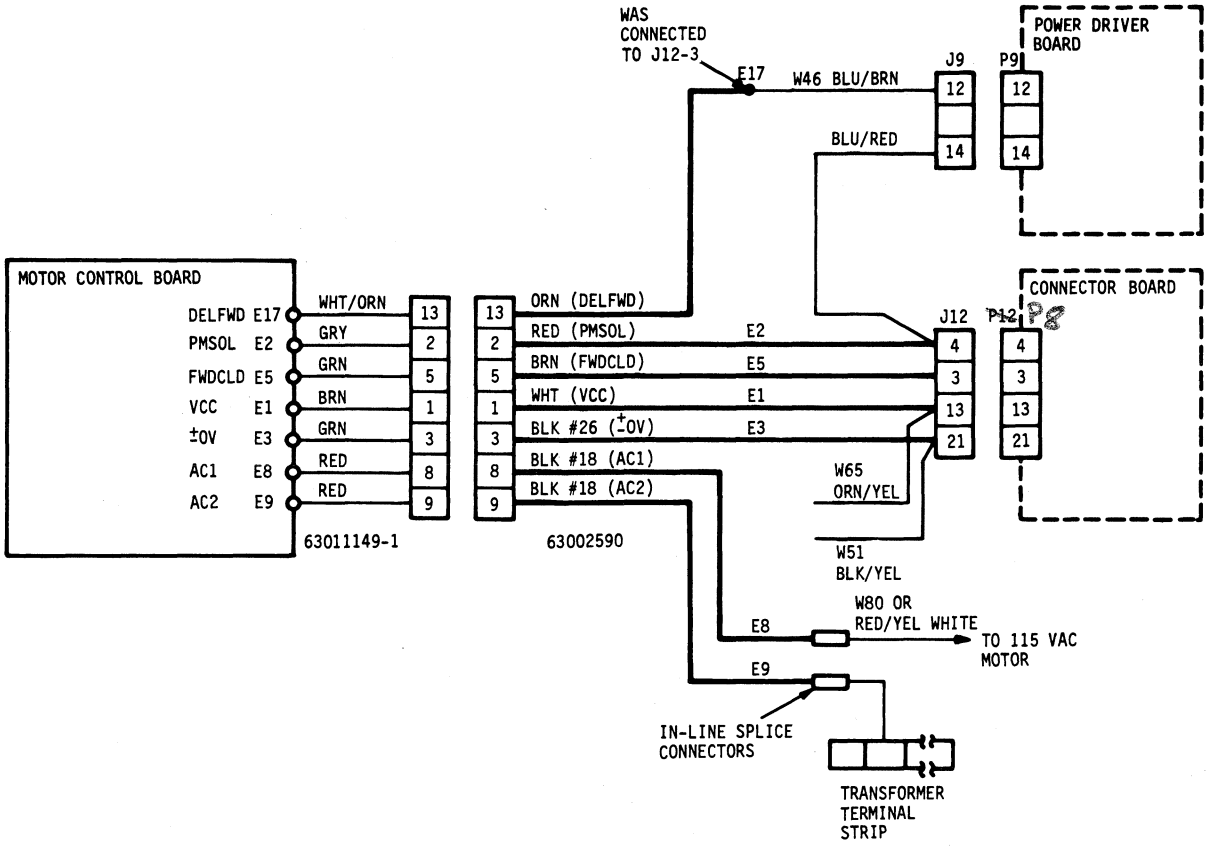


Figure 4-13. MOTOR CONTROL BOARD INTERCONNECTION DIAGRAM

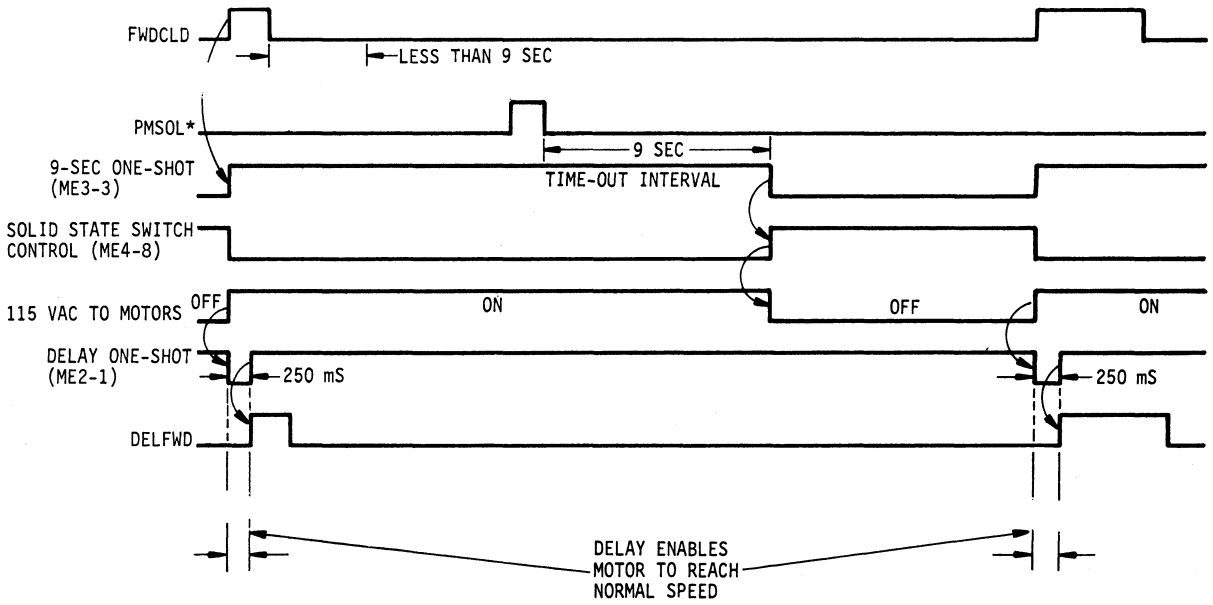
The leading edge of FWDCLD or PMSOL triggers the one-shot causing the output ME1, pin 3 to go high for a 9-second interval. The resulting low on ME5, pin 6 appears on the acthode (pin 2) of ME2. This turns on ME2 causing current to flow from ME1, pin 4 (emitter) into the gate of SCR Q2, turning it on. With Q2 conducting, thus "shorting" the full-wave bridge rectifier, a current pulse, produced by one half of the AC line voltage and passed by the "shorted" rectifier, flows into the gate of the triac (Q1) switching it to the ON state. Q1 then shunts current away from the rectifier, thus reducing the principle current to Q2, turning it off. Current then flows through Q1 to the motors for that half of the AC signal.

When the AC line current is zero, Q1 turns off. As thenext half of the AC signal appears, current again flows to the brdige rectifier turning Q2 back on. This action, as before, pulses Q1 but with the opposite polarity, turning it on to pass this half of the AC signal to the motors.

The above operation keeps repeating itself during the 9-second interval, switching Q1 from the OFF state to the ON state, for either polarity of voltage applied to the main terminals of Q1.

Coincident with the activation of the motor control circuit from an OFF to an ON condition, the high output of ME1, pin 3 triggers Delay one-shot ME3, which generates a low at ME3, pin 1. If a FWDCLD signal was received, the signal is inhibited from generating DELFWD by this low being applied to ME5, pins 4 and 10. When one-shot ME2 times-out (approximately 250 milliseconds later), FWDCLD generates a DELFWD signal which activates the Forward Clutch Driver, depending on which signal was received. The purpose of the delay is to allow the main motor to reach normal speed before the clutch is activated.

If another FWDCLD, or PMSOL signal is received during a 9-second interval (motors ON), the leading edge re-triggers one-shot ME1 for another 9-second interval. The solid-state switch and Delay one-shot ME3 remain unaffected during this time. Therefore, the 115 VAC keeps being supplied to the motors and, if a FWDCLD signal was received, it is gated directly to the clutch driver without being delayed.



*ACTIVATION OF THE PMSOL SIGNAL DEPENDS ON THREE FUNCTIONS: LINE FEED, VERTICAL TAB AND FORM FEED. IF TWO CONSECUTIVE LINE FEEDS ARE SENT TO THE PRINTER DURING A MOTOR-OFF CONDITION, THEY SHOULD BE SPACED 300 MILLISECONDS APART.

Figure 4-14. MOTOR CONTROL TIMING

If no FWDCLD or PMSOL signal is received during a 9-second interval, one-shot ME1 times-out causing its output ME1, pin 3 to go low. This turns off ME2 by delivering a high to ME2, pin 2, which in turn stops current flow out of ME2, pin 4 and prevents Q2 from turning on. With Q2 off, there is no current flow from the bridge rectifier to pulse Q1. Therefore, Q1 does not conduct, removing 115 VAC from the motors.

No further action occurs until another FWDCLD or PMSOL signal is received. At this time, any one of these signal inputs being active causes a high at ME1, pin 3 which: 1) activates the switch circuitry and turns on the motors, and 2) triggers Delay one-shot ME3. If a FWDCLD signal was received, the signal is delay approximately 250 milliseconds then gated through to the Power Driver board.

Note

The motor control feature can be disabled by a jumper connection between E8 and E9, keeping switch K1 always activated.

4.9 POWER SUPPLIES

The standard printer is pre-wired at the factory for 115 VAC, 60Hz. However, as an option, the printer can be wired for other input voltages. Figure 4-15 on the next page shows the necessary connections on the multitap 50/60 Hz transformer, for various input voltages (either 50 or 60Hz).

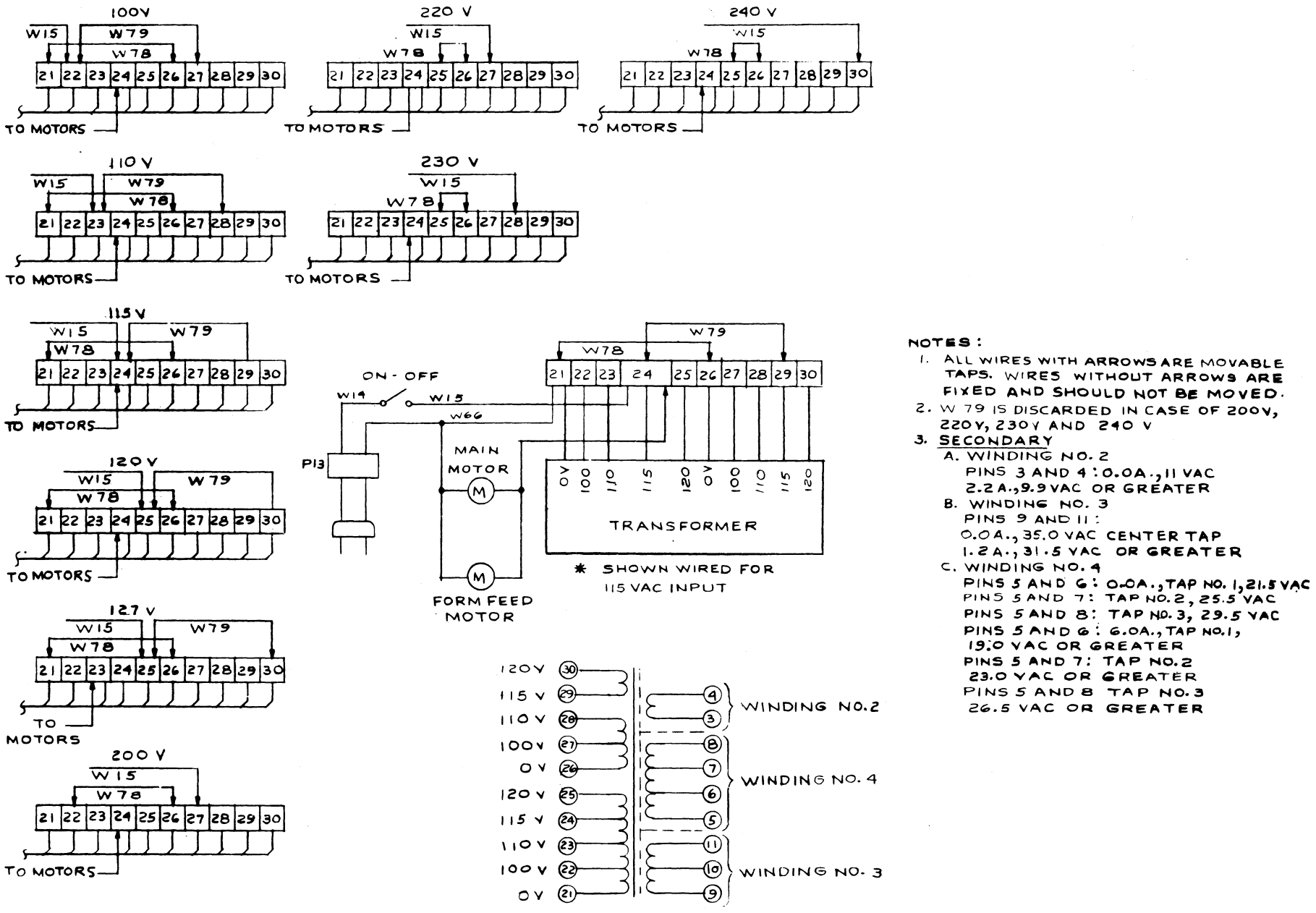
In addition, for a 50Hz input voltage, the 60Hz motor pulley HB-91 (Part No. 525841001) must be changed to a 50Hz pulley HB91-1 (Part No. 525344001). (See Figure HB, Section 8)

The input voltage is fused by a 5 amp slo-blo fuse (F5) and applied to the input transformer through the ON/OFF switch on the front panel. A 1 uf capacitor and 470K ohm resistor located on the suppression board (Dwg. No. 63002318 - Section 7) in back of the operator panel slightly above the ON/OFF switch filter any transients generated by the switch or transformer.

The secondary of the multitap transformer develops the following voltages:

115 VAC
35 VAC center-tapped
27.5 VAC center-tapped
11 VAC

The 115 VAC output is applied (via the optional motor control switch) to the drive and form feed motors.



NOTES:

1. ALL WIRES WITH ARROWS ARE MOVABLE TAPS. WIRES WITHOUT ARROWS ARE FIXED AND SHOULD NOT BE MOVED.
2. W 79 IS DISCARDED IN CASE OF 200V, 220Y, 230Y AND 240 V
3. SECONDARY
   - A. WINDING NO. 2
     PINS 3 AND 4 : 0.0A., 11 VAC
     2.2A., 9.9 VAC OR GREATER
   - B. WINDING NO. 3
     PINS 9 AND 11 :
     0.0A., 35.0 VAC CENTER TAP
     1.2A., 31.5 VAC OR GREATER
   - C. WINDING NO. 4
     PINS 5 AND 6 : 0.0A., TAP NO. 1, 21.5 VAC
     PINS 5 AND 7 : TAP NO. 2, 25.5 VAC
     PINS 5 AND 8 : TAP NO. 3, 29.5 VAC
     PINS 5 AND 6 : 6.0A., TAP NO. 1,
     19.0 VAC OR GREATER
     PINS 5 AND 7 : TAP NO. 2
     23.0 VAC OR GREATER
     PINS 5 AND 8 TAP NO. 3
     26.5 VAC OR GREATER

Figure 4-15. MULTITAP 50/60 Hz TRANSFORMER

The 35 VAC and 11 VAC voltages are used as inputs to the +5V, +12V and -12V power supplies on the logic board, where they are rectified, filtered and regulated. The unregulated dc outputs from these three power supplies are also regulated on the optional connector board, to provide dc voltages for the optional interface board. The 27.5 VAC is used to generate +35V unregulated.

Connector P1-J1 is used for bringing the ac inputs to the logic card and connecting filter capacitor C1 to the +5V supplies. Connector P2-J2 is used for connecting the power supply outputs to the printer circuits.

4.9.1 +5V REGULATOR (Figure 4-16)

The 11 VAC output from the secondary winding of the transformer is rectified by bridge rectifier CR5, CR6, CR24, CR25 and filtered by C1 located in the cavity. This filtered output is fused through F1 and regulated by regulator element VR1 which maintains the +5 Volt output. Capacitors C18 and C19 provide additional filtering for high frequency transients that might appear at the output. Resistor R42 is a bleeder resistor allowing some current flow through the regulator keeping it in the active region.

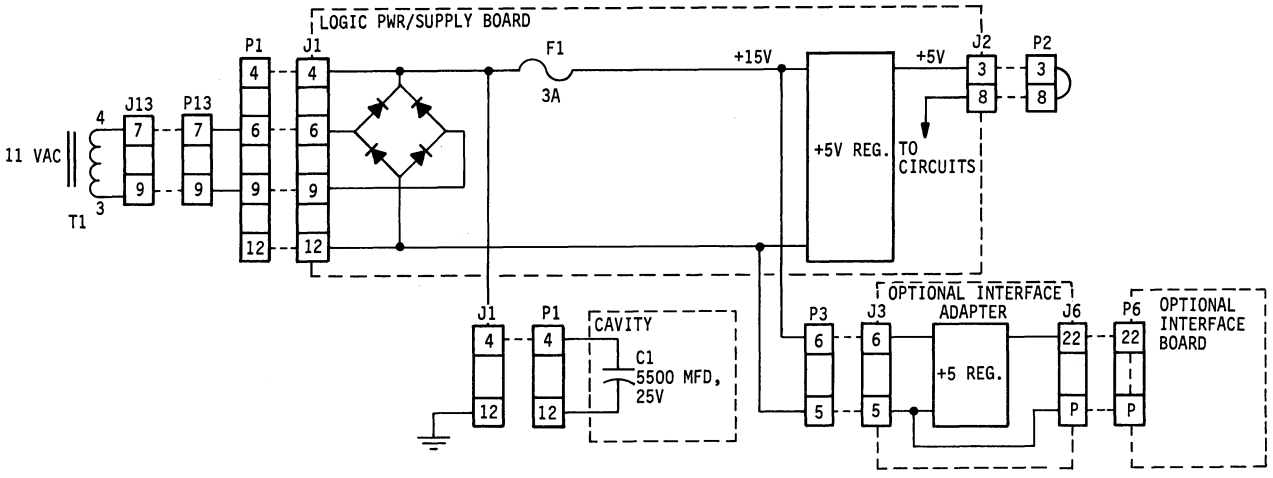


Figure 4-16. +5V REGULATOR INTERCONNECTION DIAGRAM

Overvoltage protection is provided by components CR23, R41 and Q1. With the output at a normal +5V, Zener diode CR23 inhibits current flow through R41, holding the gate of SCR Q1 at ground. However, when the output voltage exceeds +6.8V, the Zener diode CR23 conducts, developing voltage across R41 and turning on SCR Q1. This shorts the input and blows fuse F1.

To simplify troubleshooting procedures for the +5V regulator (as well as the 12V supplies) the load may be removed from this supply by unplugging J2.

4.9.2 +12V and -12V REGULATORS (Figure 4-17)

The voltage generated by the 35 VAC center-tapped secondary winding of T1 is used as inputs to the +12V and -12V regulators. The operation of both circuits is identical to that of the +5V regulator described in Section 4.9.1.

As in the +5V regulator, the load may be removed from these supplies simply by unplugging the J2 connector.

In addition, a jumper connection allows either the +12V output (E24 to E25) or +5V output (E25 to E26) to be connected to the character generators, depending on whether a +12V or +5V ROM is used.

4.9.3 +35V POWER SUPPLY, UNREGULATED (Schematic #63015120 - Section 7)

The 27.5 VAC output from the transformer is rectified by diode bridge MD1 and filtered by R1-C2 to generate the +35V unregulated voltage for the power driver circuits. All of these components are located in the cavity. This +35V output is fused through F4 and used as a voltage input to the power driver board.

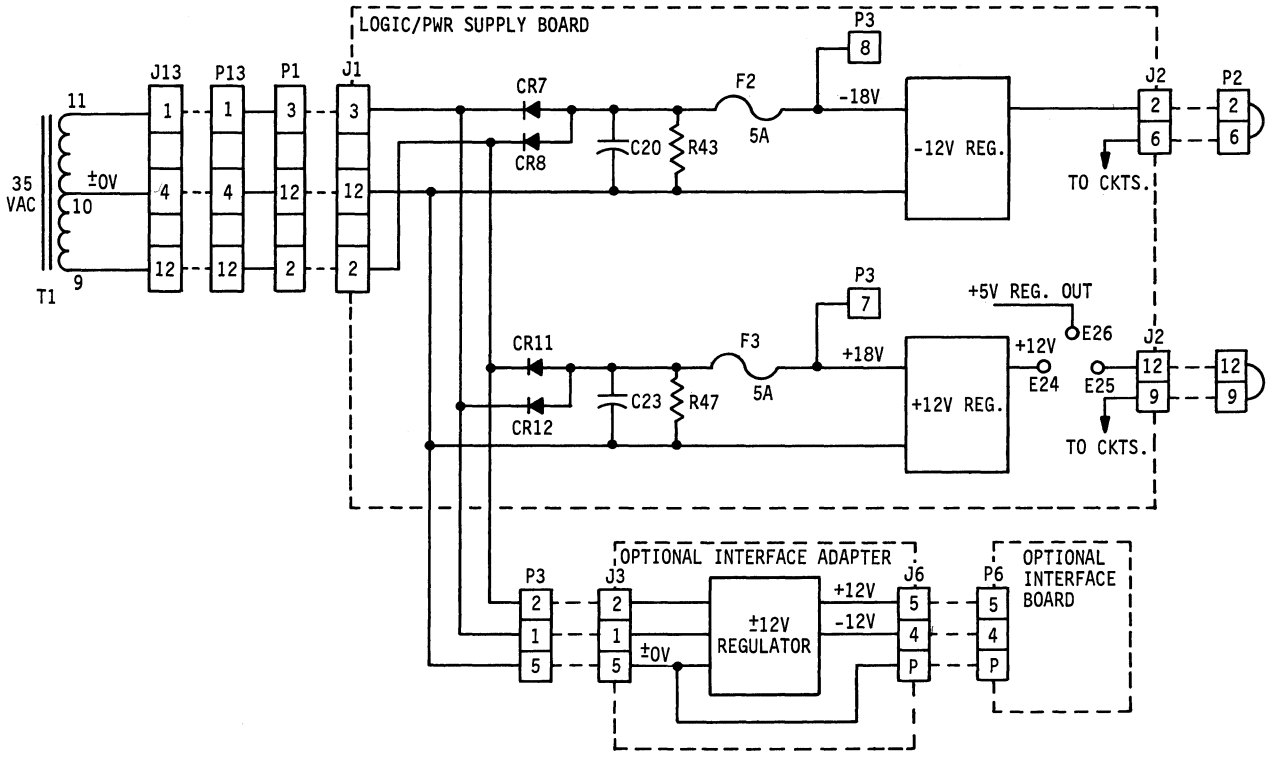


Figure 4-17. ±12V REGULATORS INTERCONNECTION DIAGRAM

4.10 OUTPUTS FROM LSI CHIPS

4.10.1 OUTPUTS FROM LSI CHIP ME5

$\overline{\text{BUSY}}$ (Busy)

Generated on LSI chip ME5 pin 11. $\overline{\text{BUSY}}$ goes low when any of the following conditions occurs:

(1) $\overline{\text{CSBSY}}$ from LSI chip ME9 goes low,

(2) During a prime condition (PRIME),

(3) During a paper movement operation (PMSOL),

(4) $\overline{\text{DCPRM}}$ from LSI chip ME5 goes low

(5) The carriage return code (or if the DSC option is used, the LF, VT or FF code) is clocked into the shift register.

(6) FAULT from LSI chip ME5 goes high,

(7) During the 60-90 msec delay following a paper movement operation (DLYLF).

ACK (Acknowledge)

Generated on LSI ME5 pin 13. ACK is a 2.5-5.0 usec pulse generated 2.5-10 usec after the trailing edge of data strobe if the printer is not busy, or 2.5-10 usec after the trailing edge of the BUSY signal if the received data caused the printer to go busy.

(FAULT) Fault Indication

Generated on LSI chip ME5 pin 9. Any one of the following conditions generates FAULT:

(1) The printer is deselected (SLCT is low).
(2) A paper-time out condition exists.
(3) The printer is out of paper ($\overline{PE}$ is low).
(4) A failure is detected in the video signal ($\overline{LD}$ is low).

SLCT' (Select)

Generated on LSI chip ME5 pin 40. Indicates the status of the Select latch within the chip. This latch is set either by receiving a select code (octal 021) or by pressing the SELECT switch on the operator panel when the printer is deselected. The flip-flop is reset either by receiving a deselect code (octal 023) or by pressing the SELECT switch when the printer is selected. The select and deselect codes affect the select latch even when the printer is busy.

(BELL) Bell

Generated on LSI chip ME5 pin 39. BELL is a 0.8 - 1.6 KHz signal of 1 to 2 second duration, generated by either a received bell code (octal 007) or a paper emtpy condition.

$\overline{\text{CSLF}}$ (Cause Line Feed)

Generated on LSI chip ME5 pin 6. Any of the following input conditions will cause $\overline{\text{CSLF}}$ to go active (low):

1. Receiving a Line Feed code (octal 012) on input data lines $\overline{\text{DS1}}$-$\overline{\text{DS7}}$. If the DSC option is used (jumper E10 to E11), the complete line of characters will be printed before $\overline{\text{CSLF}}$ goes low.
2. Pressing the Line Feed switch on the operator panel.

$\overline{\text{PMSOL}}$ (Paper Movement Solenoid)

Generated on LSI chip ME5 pin 7. Any paper movement command (i.e., line feed, form feed or vertical tab). The low $\overline{\text{PMSOL}}$ output activates a driver circuit on the Power Driver board, which in turn activates the paper movement solenoid on the form feed unit. This causes paper to advance in the printer.

$\overline{\text{PMSOL}}$ remains low until one of the following conditions occurs:

(1) A paper time-out condition exists.

(2) A power prime ($\overline{\text{PWRPRM}}$) condition exists.

(3) During a form feed operation, a hole in channel 7 of the Vertical Format Unit (VFU) paper tape is detected (FFH).

(4) During a vertical tab operation, a hole in channel 5 of the VFU paper tape is reached (VTH).

$\overline{\text{DSCR}}$ (Decoded Carriage Return)

Generated on LSI chip ME5 pin 12. $\overline{\text{DSCR}}$ goes active low when a control character (zeroes in bits 6 and 7) is loaded into the shift register. In normal operation, the only control code loaded into memory is a CR code (octal 015). However, with the DSC option (jumper E10 to E11), in addition to the CR code, any of the following control codes may be loaded into memory: LF (octal 012), FF (octal 014) and VT (octal 013).

DSCR goes active on the trailing edge of the gated data strobe and stays active until the printer is primed following the carriage return (and paper movement) operation.

$\overline{\text{DCPRM}}$ (Decoded Prime)

Generated on LSI chip ME5 pin 8. Any of the following conditions will cause $\overline{\text{DCPRM}}$ to go active (low):

(1) Receiving a Delete code (octal 177).
(2) Receiving a low INPUT PRIME signal at the interface connector.
(3) A power prime condition ($\overline{\text{PWRPRM}}$)

CLKTB1 (Clock Shift Register Pulse)

Generated on LSI chip ME5 pin 14. The CLKTB1 pulse is used to clock input data into the shift register. It is generated by data strobe signal DSTA whenever both inhibit levels INH1 and INH2 (internal to the chip) are inactive.

If the Guarded Strobe (GDSTB) option is used (jumper E7 to E8), INH1 is inactive when the printer is selected and the last input character has been acknowledged by the printer. If the GDSTB option is not used (jumper E8 to E9), then INH1 is always inactive. INH2 is inactive if the character on the input data lines can be stored in the shift register. This occurs whenever the input data lines contain a printable character (a ONE in bit 6 or 7) of after the first printable character is received, a carriage return code (octal 015) is present on the data lines. If the DSC option is used (jumper E10 to E11), a line feed (octal 012), vertical tab (octal 013) or form feed (octal 014) code, could be stored in the shift register after the first printable character is received.

($\overline{\text{UPSC}}$) Upper Case

Generated on LSI chip ME5 pin 15. A low $\overline{\text{UPSC}}$ pulse is generated whenever an elongated character code (octal 016) is present on the input data lines.

4.10.2 LSI CHIP ME9

$\overline{\text{DCW1}}$-$\overline{\text{DCW5}}$ (Strobe Counter Outputs)

Generated on LSI chip ME9 pins 12 ($\overline{\text{DCW1}}$), 13 ($\overline{\text{DCW2}}$), 14 ($\overline{\text{DCW3}}$), 15 ($\overline{\text{DCW4}}$) and 16 ($\overline{\text{DCW5}}$). The strobe counter, which is internal to the chip, is reset by an internal DCW0 signal. DCW0, which normally represents the space interval between characters, is generated by either a Prime condition or by DCW5.

During normal character printing, each video STROBE pulse increments the counter. During elongated character printing, every alternate STROBE increments the counter, making each DCW interval twice its normal width.

If the special timing option SPCG is used (which consists of cutting the etch between pin 6 of ME9 and $\pm$0V), then the $\overline{\text{DCW1}}$-$\overline{\text{DCW5}}$ signals at the output pins of the chip are encoded from the internal $\overline{\text{DCW1}}$-$\overline{\text{DCW5}}$ signals as follows:

External Signal	- Encoded from -	Internal Signals
DCW1		DCW1 + DCW3 + DCW5
DCW2		DCW2 + DCW3
DCW3		DCW4 + DCW5
DCW4		DCW4
DCW5		DCW5

$\overline{\text{DCWO1}}$-$\overline{\text{DCWO4}}$ (Delayed Strobe Outputs)

Generated on LSI chip ME9 pins 7 ($\overline{\text{DCWO1}}$), 8 ($\overline{\text{DCWO2}}$), 9 ($\overline{\text{DCWO3}}$), and 10 ($\overline{\text{DCWO4}}$). The delayed strobe counter like the strobe counter is reset by DCWO.

During normal printing of 9 x 7 characters, each DLYSTB pulse increments the counter. During elongated character printing, alternate STROBE pulses increment the counter making each DCWO interval twice its normal width.

As in the strobe counter timing, if option SPCG is used, then the external DCWO1-DCWO4 signals are related to the internal $\overline{\text{DCWO1}}$ to $\overline{\text{DCWO5}}$ intervals as follows:

External Signal	- Encoded from -	Internal Signal
DCWO1		DCWO1 + DCWO3 + DCWO5
DCWO2		DCWO2 + DCWO3
DCWO3		DCWO4 + DCWO5
DCWO4		STROBE + DCWO

ROME2 (ROM Timing)

Generated on LSI chip ME9 pin 24. This signal is the timing input to the "half-step" character generator ROM (Read-Only Memory).

During normal printing of 9 x 7 characters, each DLYSTB, (Delayed Strobe) pulse generates a ROME2 pulse. When printing elongated 9 x 7 characters, each video STROBE pulse generates a ROME2 pulse.

CLKTB2 (Clock Shift Register Pulse)

Generated on LSI chip ME9 pin 36. This active high pulse is generated by any of the following three conditions:

1. During a prime condition, to load the dummy character into memory - at the end of the PRIME interval, recirculate signal SRCL goes high and a single CLKTB2 pulse is generated. This forces a single ONE into bit 8 of that shift register location, forming the dummy character.

2. During character printing, to shift the characters out of memory - Each STROBE pulse occurring during Strobe Counter interval DCWO (internal to LSI chip ME9) generates a CLKTB2 pulse. This shifts the next character to the output of the shift register where it remains until the next STROBE DCWO interval.

3. During the interval following the reception of a carriage return code - A low $\overline{\text{DSCR}}$ input to the chip is ANDed with $\overline{\text{TB8}}$ to allow each Ø2* clock to generate a CLKTB2 pulse.

$\overline{\text{CIPX}}$ (Forward Clutch)

Generated on LSI chip ME9 pin 30. This active low output is used to turn on the forward clutch when the printer is ready to print the received line of data.

Signal $\overline{\text{CIPX}}$ goes low when the internal CIPF latch is set. CIPF gets set under the following conditions: (1) the printer is not being primed ($\overline{\text{PRIME}}$), (2) the right limit switch is not activated ($\overline{\text{EOPSW}}$), (3) a control character is not detected at the memory output (TB6 or TB7), (4) the left limit switch is activated (RTPSW), and (5) the dummy character is detected at the memory output ($\overline{\text{TB8}}$). The internal CIPF latch then remains set either until the right limit switch is reached (EOPSW) or a control character appears at the memory output ($\overline{\text{TB6}} \cdot \overline{\text{TB7}}$). Normally, this control character would be a carriage return code (octal 015). However, if the DSC option is used (jumper E10 to E11), the control character could be a carriage return (015), line feed (012), vertical tab (013), or form feed (014) code.

*Ø2 is a phase clock internal to LSI chip ME9. The frequency of this Ø2 clock is the same as the OSC output from LSI ME9.

$\overline{\text{CIRX}}$ (Reverse Clutch)

Generated on LSI chip ME9 pin 29. This active low output is used to turn on the reverse clutch after the printer has printed a line of data.

Signal $\overline{\text{CIRX}}$ goes low whenever the forward clutch is not turned on ($\overline{\text{CIPX}}$ is high) and the carriage is not activating the left limit switch (RTP is low).

SRCL (Shift Register Recirculate Input)

Generated on LSI chip ME9 pin 38. A high SRCL signal along with a single CLKTB2 pulse is generated at the end of each PRIME interval. This clocks a dummy character into the shift register.

$\overline{\text{LD}}$ (Light Detect)

Generated on LSI chip ME9 pin 17. Signal $\overline{\text{LD}}$ is normally high indicating no error in the video circuit. However, if the print head travels from the left limit switch (RTPSW) to the right limit switch (EOPSW) with no STROBE pulse generated by the timing fence, then a latch is set within the chip causing $\overline{\text{LD}}$ to go low. This indicates an error condition. The internal LD latch can be reset only by de-selecting the printer.

PRIME (Prime)

Generated on LSI chip ME9 pin 37. PRIME goes active high for 100-500 milliseconds during a Power Prime ($\overline{\text{PWRPRM}}$) and approximately 100-400 microseconds during the following condition:

(1) A low $\overline{\text{DCPRM}}$ input from LSI chip ME5.

(2) The printer has just been selected (a low $\overline{\text{SLCT}}$ input to LSI chip ME9) and the Delete Inhibit (DELINH) option is not used (jumper E14 to E15 is not connected).

(3) A line of data has just been printed ($\overline{\text{CIPX}}$ out of LSI chip ME9 has just gone high).

Prime initializes the printer logic, resets the shift register and loads a dummy character.

$\overline{\text{CSBSY}}$ (Cause Busy)

Generated on LSI chip ME9, pin 35. $\overline{\text{CSBSY}}$ goes active low when a dummcy character ($\overline{\text{TB8}}$) is detected at the shift register output and a Prime operation is not in progress. This condition indicates that the 132nd character has just been loaded into the shift register (without a carriage return code). The low $\overline{\text{CSBSY}}$ signal then generates a low $\overline{\text{BUSY}}$ output from LSI chip ME5.

OSC (Oscillator Output)

Generated on LSI chip ME9, pin 25. The frequency of this system clock is 100 KHz (min.) to 200 KHz (max.). Signal OSC is inverted by ME20-6 to generate OSCXT to the interface connector. Signal OSC is also used by both LSI chips to generate clocks Ø1 to Ø2 used interna-ly by the LSI chips.

SECTION 5
REMOVAL, REPLACEMENT AND ADJUSTMENT PROCEDURES

Ausbauen, Austauschen
Umtauschen
Ersetzen

5.1 INTRODUCTION

This section describes the operation, removal, replacement and adjustment of each major mechanical assembly in the Model 101AL printer.

5.2 MECHANICAL ASSEMBLIES

The mechanical assemblies and their reference figures are covered in the order listed below. Mechanical drawings, and parts lists, are contained in Section 8 of this manual.

Section	Title	Figure and Reference Parts Symbol
5.2.1	Cover	Figure A
5.2.2	Carriage Mechanism	Figure HA
5.2.3	Driving Mechanism	Figure HB
5.2.4	Spring Drum	Figure HC
5.2.5	Damper	Figure HD
5.2.6	Frame	Figure HE
5.2.7	Paper Feed Mechanism	Figure HF
5.2.8	Pin Feed Unit	Figure HG
5.2.9	Form Feed Mechanism	Figure HH
5.2.10	Ribbon Feed Mechanism	Figure HI
5.2.11	Hardware, Electrical	*Figure HJ
5.2.12	Paper Guide	Section 2
5.2.13	Print Head and Associated Assemblies	B

*Parts list only

Note: Section 5 has been updated for Revision C of the Model 101AL printer.

5.2.1 COVER (Figure A)

5.2.1.1 Operation

All covers permit internal access to the printer, and are completely removable.

5.2.1.2 Removal/Replacement Procedure (Refer Figure 8-1)

1. Pull outward and down, left cover assembly (A-4) and right cover assembly (A-3).

2. Remove cover assembly, rear (A-7) by unscrewing from each side of cover, standoff (A-39) with internal lock-washer (A-41), nut (A-32) and ball stud (A-19).

3. Remove front cover assembly (A-5) by removing screws, flat washer and split lock-washers at (A-26) (A-34) and (A-35). Remove at two corners A-27, A-34 and A-35. Lift cover from frame (HE-1).

Note

Before removing front cover assembly, elevate top cover assembly (A-6) to clear printer head, and slide the front cover assembly forward to avoid damaging ribbon cables which are connected from the video amplifier board 63002306-1 (See Fig. 1-7) to the power driver board 63002242-1.

4. Disconnect power cable (Refer Section 7, Electronic Cavity 63001105-1) item 9, and Fig. 8-1 from base (A-2) by removing screw, flat washer and split lock washer (A-25), (A-34), (A-35) and bracket (A-20).

5. Disconnect connector, (A-16) from mating connector (HJ-46) at rear right on main frame (HE-1).

6. Remove screw (A-31) from ground strap (A-50).

7. To remove side covers (A-3, A-4), remove snap rings (A-21) and push, pins (A-14) through hinges.

8. To remove the base (A-2) from main frame, disassemble remaining hardware (four places) at (A-26), (A-34), (A-27) and lift main frame from base.

9. To reassemble, reverse order of disassembly beginning with step 8.

5.2.1.3 Adjustments

Side covers (A-4, A-3) lock into speed clips located on inside walls of covers. For perpendicular adjustment of covers, in relation to base, adjust length of ball stud (A-19) with nut (A-32) located at ends of standoffs (A-39), if required.

5.2.2 CARRIAGE MECHANISM (Figure HA)

5.2.2.1 Operation

The function of the carriage mechanism is to hold the head under the best condition to print characters against the platen and to move the head from left to right and return it to the starting position after printing the last character.

The carriage (HA-9) has two guide rollers (upper) (HA-10), a guide roller unit (HA-21) and two rollers (upper and lower) (HA-26, 31) to hold the carriage on the guide bar (HE-8) and guide plate (HE-23). The head bracket (HA-1), mounted on the carriage, holds the head by four screws and is movable back and forth up to 1 mm (0.039-in.). This adjustment is made by turning an eccentric shaft on the head penetration adjusting knob (HA-32). The adjustment is determined by the number of copies to be run. The head lock knob (HA-33) is mounted on the left-hand side of the carriage and locks the eccentric shaft after positioning head in relation to platen. Play between head bracket and carriage can be eliminated by gib (HA-45) which is fixed on carriage by two screws (HA-46) and positioned by set-screws (HA-48). When the carriage is positioned over the right or left-hand reed switch (HE-78) a magnet, mounted on lower portion of carriage, closes the reed switch and sends a signal to indicate the carriage position to electronic logic.

The carriage is moved by the main driving belt (HA-36). Parts (HA-41) through (HA-44) and HA-58) through (HA-64) are mounted on the underside portion of the carriage. These parts are designed to absorb shock on the belt and are adjustable for proper belt tension and linear alignment.

The ribbon guide roller (HA-5), mounted on the carriage and head bracket, holds the ribbon at proper position and ensures proper tension on the ribbon while printing. Bracket (HA-50) supports the ribbon cable, lamp holder, and fiber optic assembly. This assembly determines print registration.

5.2.2.2 Removal/Replacement Procedure

A. Head

For removal and installation of print head, refer to Section 5.2.13.2.A.

B. Carriage (HA-9)

1. With carriage at mid position, remove main driving belt (See next para. C.).

2. Remove complete damper unit by removing screws (HD-29).

3. Remove bracket (HA-50) by removing screws (HA-55).

4. Loosen head lock knob (HA-33) and slide head back from platen to clear guide roller (HI-111) by turning head adjusting knob (HA-32). Release ribbon from ribbon guide roller (HA-5).

CAUTION!

AT THIS POINT, BE CAREFUL NOT TO DAMAGE LEFT REED SWITCH AND CASE (HE-78) WHEN CARRIAGE IS REMOVED FROM LEFT SIDE OF MACHINE.

5. Move carriage to left and remove it from guide bar and guide plate.

6. To install carriage, reverse above procedure.

C. Main Driving Belt (HA-36)

To remove belt, perform the following steps:

1. Loosen nut (HC-12) and screw (HC-11) on spring drum (HC-1).

   a. Release main spring (part of HC-1) tension by intermittently pivoting pawl (HC-10) to slowly unwind internal spring. (Note that spring may suddenly unwind with considerable noise, a normal occurrence).

2. Remove nuts, washers (HA-64, 63, 62) on shaft (A) (HA-59) (IT IS NOT NECESSARY TO REMOVE SCREWS, WASHERS (HA-41, 43) AND HOLDER (A) (HA-58) ATTACHED TO UNDERSIDE OF CARRIAGE EXCEPT FOR NEW ASSEMBLY PARTS INSTALLATION.)

3. Remove left nut (HA-44) from screw (HA-43) with a 10 millimeter (0.4-in.) open-end wrench.

4. Using two 10 millimeter open-end wrenches, remove remaining two nuts from screw (HA-43). Belt will separate.

5. Remove left end of belt to the right by feeding through left hole in base of printer chassis frame.

6. Continue to pull entire belt to the right feeding it through hole on right side of printer chassis and out.

7. If necessary, loosen clutch field assembly tabs (part of HB-140) (Fig. 8-3A) attached to printer base and feed belt out through the tabs.

8. To install belt, reverse above procedure but first start with applying tension on spring of spring drum (refer to para. 5.2.4.3.).

D. Guide Roller and Guide Roller Unit (HA-10, 21)

1. To remove guide roller unit, remove bolts (HA-22). This unit may be replaced as a complete assembly.

2. To remove guide rollers from carriage, remove nut (HA-20) and spring washer (HA-19).

5.2.2.3 Adjustments

A. To Adjust Play Between Carriage and Guide Bar (HE-8) or Guide Plate (HE-23)

1. Adjust the distance between carriage (HA-9) and guide plate (HE-23) by loosening nut (HA-29) and turning eccentric axle (HA-25) to allow gap of 0.01 through 0.03 mm (0.0004-0.0012-in.) between upper and lower rollers (HA-26, HA-31) and the guide plate.

2. The carriage, without main driving belt (HA-36) should be able to move on guide bar (HE-8) and guide plate with no more than 100 grams (3.5 ounces) tension. Note, that the guide roller unit (HA-21) is adjusted to the carriage (HA-9) by the manufacturer prior to shipping, if a carriage is to be readjusted or replaced.

B. To Adjust Play Between Carriage and Head Bracket (HA-1)

1. After loosening screws (HA-46) and nuts (HA-49), adjust play by positioning gib (HA-45) with set-screws (HA-48) and then tighten screws and nuts. Head bracket should be able to move smoothly using head adjusting knob (HA-32).

C. To Adjust Ribbon Guide Roller (HA-5)

1. The eccentric shaft (HA-6) is used to make this adjustment from the mounting face of the bracket to the farthest point of tangency on roller, the dimension should be 53.50 mm (2.106-in.).

D. To Adjust Tension of Main Driving Belt (HA-36)

1. Remove main driving belt (HA-36) from holder (HA-58) by loosening nuts (HA-64) and pushing down on belt. Adjustment of tension can now be made by turning nuts (HA-44) on screw (HA-43) with 10 mm (0.4-in.) open-end wrench. See next step No. 2 for belt tension specifications.

2. For the Model 101 Series, apply main belt tension by the following method:

   a. Main belt is attached to carriage.

   b. Carriage is at start position, (at rest).

   c. At a point midway between spring drum assembly (HC-1) on the left, and forward and reverse clutches on the right, deflect top of belt upward 9-11 millimeters (0.35-0.43-inch) using an upward pull equivalent to 500 grams, (17.6 ounces).

   d. When correct tension has been attained, reverse step in para. D.1.

3. Ensure that carriage returns from any run-out position under spring drum tension. (See para. 5.2.4.3.).

5.2.3 DRIVING MECHANISM (Figure 8-3 and Figure 8-3A)

5.2.3.1 Operation

A. Motor Drive Chain (Figure 5-1)

Driving power of motor (HB-98) is transmitted to forward and reverse clutches as follows: Motor - intermediate pulley with gear (HB-22)- intermediate gear for forward clutch (HB-30) - pulley (HB-60) for forward and reverse clutch. Motor - intermediate pulley with gear (HB-22) - intermediate shaft with pulley (HB-80) - pulley (HB-60) for forward and reverse clutch. Looking from front, motor rotates counterclockwise; therefore, pulley for reverse clutch rotates counterclockwise. When either forward or reverse clutch actuates by signal, pulley (HB-63) for main driving belt rotates to move carriage.

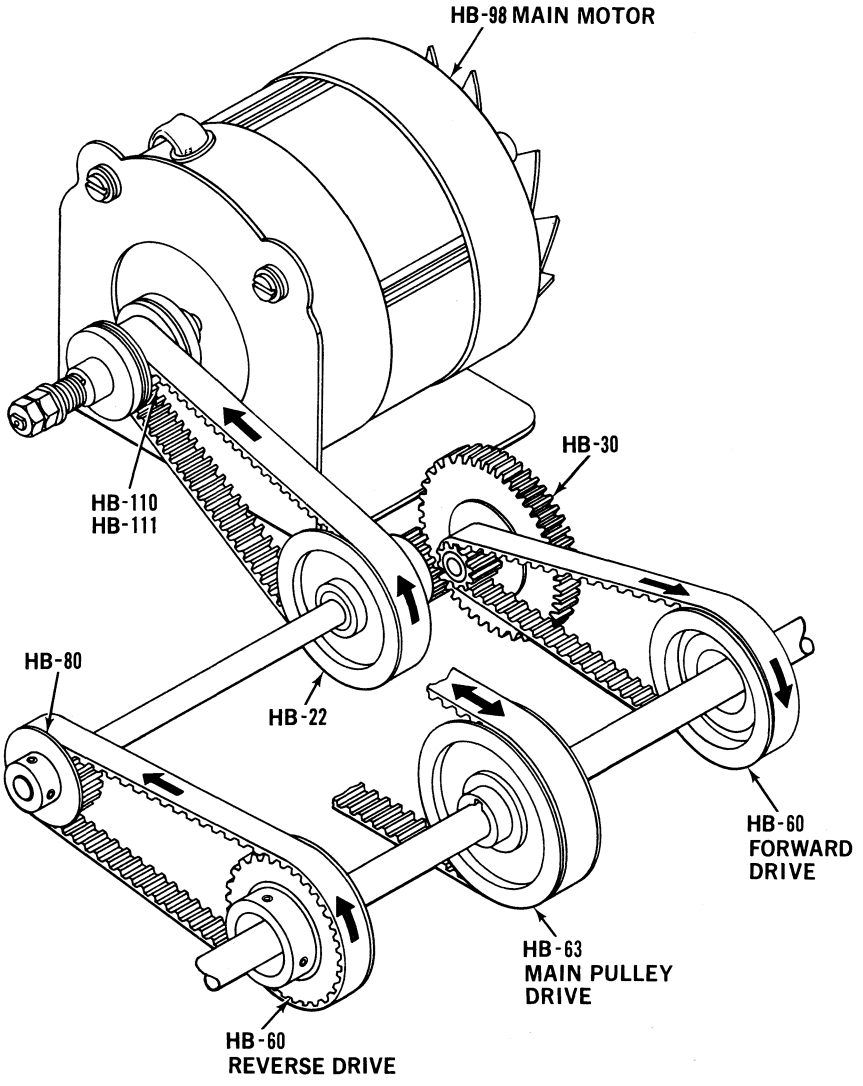


Figure 5-1. MODEL 101 SERIES DRIVE TRAIN

B. Clutch Alinement and Function (Fig. 8-3A)

Alinement of clutches is as follows: Viewed from the front of the printer (right side), the order is - reverse clutch assembly (HB-139) followed by forward clutch assembly (HB-139). Because of a preload condition (surface to surface contact) between splined armature (HB-142) and keyed rotor (HB-141) no gap adjustment is required. Slight tension (preload) is maintained by a spring (HB-144) pressing against the fixed, forward and reverse driving pulley (HB-60) and its splined armature (HB-142).

The armature hub (HB-143) inserts into the splined armature maintaining torque drive for either forward or reverse drive. Clutch field assembly (HB-140) is prevented from rotating about its shaft (HB-50) by means of tabs (See Fig. 8-3A, A and B) that extend from field assemblies (HB-140) and mount to the printer base. When a signal is sent from electronic logic to coil in forward or reverse clutch field assembly, the magnetized rotor (HB-141) holds the splined armature (HB-142), and friction torque is transmitted to shaft and drive pulley (HB-60) (forward or reverse). When signal current stops, torque chain between armature and rotor is discontinued, and the armature is restored to initial preload condition (surface to surface contact).

C. Operating Conditions, Drive Mechanism (Figure 5-2)

Alternate forces are exerted on timing belts (HB-48, and belt 49) including main drive belt (HA-36) and motor (HB-98) because of inertia of print head carriage and forward and reverse clutch timing peaks. These variations in the power transmission route are normally handled by the use of a motor clutch plate (HB-98) (part of motor) and motor pulley driver (HB-92) installed to protect belts and motor.

Normal cycle time of carriage and machine operating sounds are directly influenced by alternate dropping and raising time of torque on clutches, which also affect belt tensions. Therefore, all drive mechanism parts should be properly adjusting using recommended procedures where applicable.

5.2.3.2 Removal/Replacement Procedure

A. Main Motor (HB-98) (With covers and rear electronic cavity removed) (Retain all mounting hardware and parts if replacing motor)

Steps A.1. through A.5. are keyed to Figure HI.

1. Remove right and left-hand bevel gears (HI-27) by loosening set-screws (HI-29).
2. Remove right and left-hand shaft bushing holders (HI-130, 133) by removing screws (HI-131).

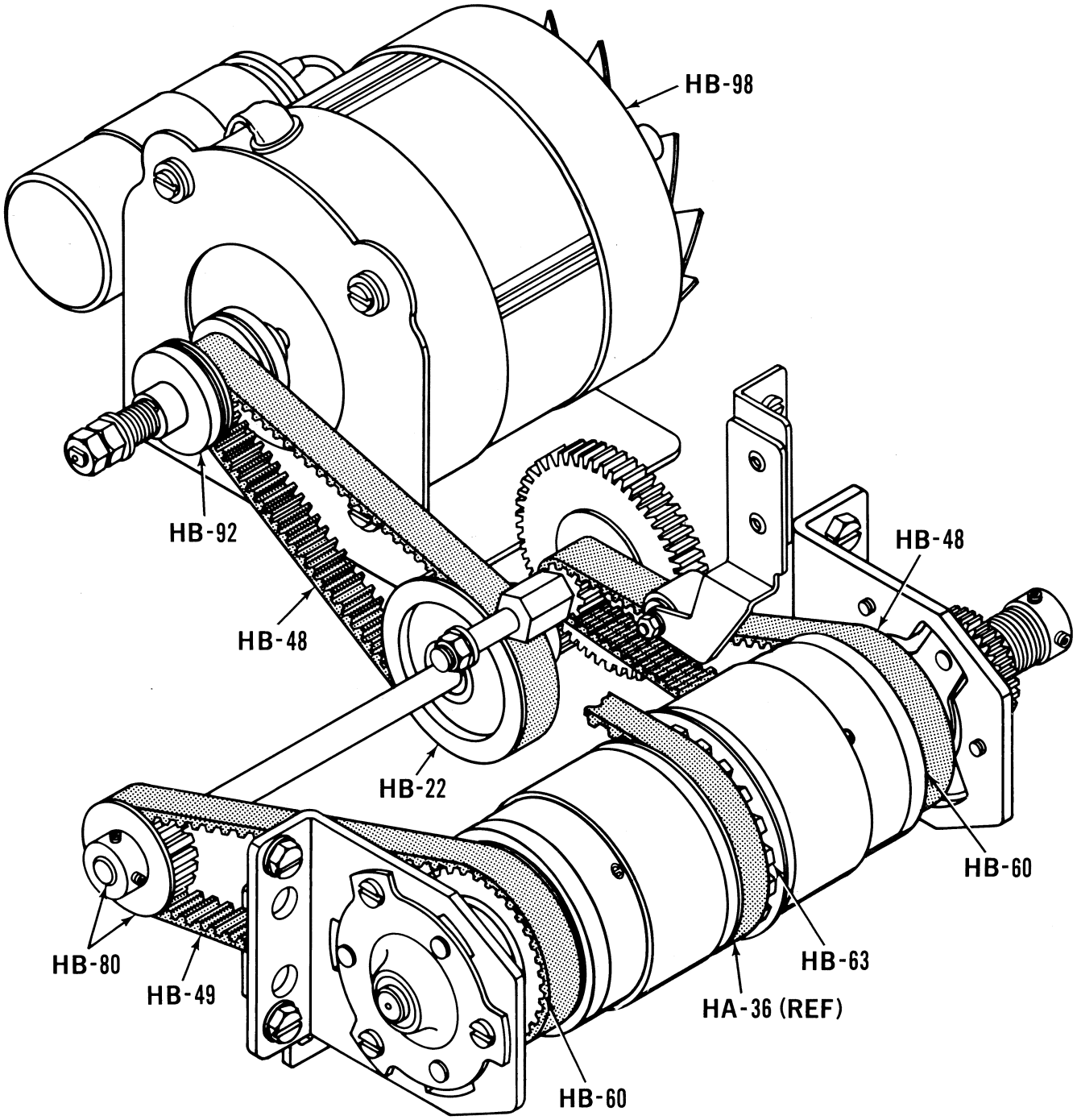


Figure 5-2. MAIN MOTOR DRIVE AND DRIVE BELT ARRANGEMENTS

3. Remove snap rings (HI-105) on both ends of shaft. Retain parts.

4. Loosen set-screw (HI-19) on driving bevel gear (HI-18).

5. Remove shaft (HI-103) and washers (HI-104).

Steps A.5. through A.6. are keyed to Figure HB (part 1)

6. Loosen nut (HB-19) and back off belt tensioner bolt (HB-18) up to maximum travel.

7. Remove four attaching screws (HB-17) from underneath the printer base (Fig. 8-1, item 2) and remove main motor with mounting bracket (HB-9).

Refer to Printer Wiring Diagram in Section 7 for wiring diagram in steps A.8. through A.10. if motor is being replaced.

8. Cut two wires (red), No. W18 and W19 as close to motor as possible.

9. Remove ground lug attached to motor.

10. Unsolder two wires (yellow) on motor capacitor (HB-13) retain capacitor and bracket if motor is being replaced.

11. Remove motor from mounting bracket (HB-9) by removing four screws with four external washers (HB-12 and 11).

B. Main Motor Belt Removal (HB-48)

When main motor is replaced, it is recommended that the belt (HB-48) be replaced at the same time.

1. Remove and discard main motor belt (HB-48) between motor pulley (HB-22) and pulley (HB-110/111) by first removing intermediate gear (HB-30) for forward clutch by removing nut and washers (HB-28, 29, 96) at front of printer. Retain pulley and mounting hardware.

C. Preparation of Main Motor w/Fan and Clutch Plate (HB-98) Prior to to Installation

1. Solder two capacitor wires (yellow) from motor to terminals of retained capacitor (HB-13) of step A.10. Insulate points of contact.

2. Solder two red wires of motor (HB-98) to red wires, numbers W18 and W19. (Refer to step A.7.). Insulate points of contact.

D. Installation of Motor Pulley Driver (HB-92) and Main Motor

Note

The following parts are to be added (in the order indicated, a through e), to the shaft of the motor and are in addition to the pinned clutch plate and fan that are factory delivered with the motor (HB-98). Refer to Figure (HB) (Part 1).

a. Motor pulley 60 Hz or 50 Hz (HB-110, HB-111).

b. Motor pulley driver (HB-92).

c. Spring for HB-92 (HB-93).

d. Nuts for HB-93 (HB-112).

1. Tighten nut (HB-112) so that spring coils squeeze together, but not overlapping. Tighten second check nut (HB-112).

2. Insert motor into back of printer (shaft facing front of printer) and set over motor mounting holes.

3. Install new belt (HB-48) over intermediate pulley (HB-22) and main motor pulley (HB-110, or HB-111).

4. Insert mounting bolts (HB-17) into main motor through base underneath printer. Do not tighten until the following steps are performed.

   a. Insert adjusting bolt (HB-18) into side flange of motor mounting bracket and turn. Motor belt will tighten.

   b. Adjust motor and bracket parallel to front paper pan (HF-89) by sighting straight down on the top of two slotted-head screws (HB-12) of the mounting bracket (HB-9) and aline screws parallel to the front paper pan.

   c. Tighten four mounting bolts (HB-17).

   d. Tighten nut (HB-19) on adjusting bolt.

   e. Press ON/OFF Switch on operator panel of printer to test alinement and operation of main motor and belt tension while operating. With switch OFF readjust adjusting bolt and mounting nuts, if required.

5. Reinstall intermediate gear (HB-30) for forward clutch which was removed in step B.1. Ensure that forward clutch pulley belt (HB-48) is over hole when pulley shaft (HB-103) is inserted so that it fits over smaller gear of gear (HB-30).

6. Place other end of pulley belt over the forward clutch gear (HB-60).

7. To adjust eccentric idle shaft (HB-27) (Fig. 8-3, part 1, View B) and back lash for intermediate pulley (HB-30), refer to paragraph 5.2.3.3.C.

8. For final installation of motor, reverse steps A.1. through A.6. at para. 5.2.3.2.A.

9. Install ribbon through extended pins on right and left-hand control levers (HI-88, 90).

E. Forward and Reverse Clutch Drive Mechanism (Refer to Figure HB, part 1 and 2, and HI)

1. Forward Clutch (HB-139)

   a. Remove clutch spring (HI-4) on sleeve (HI-5) by loosening two set-screws (HI-6). Slide off spring and sleeve.

   b. Remove clutch gear (HI-1).

   c. Remove ribbon drive shaft unit by removing screws (HI-17) from right side of printer.

   d. Slip off pulley belt (HB-48) between forward clutch pulley (HB-60) and intermediate pulley for forward clutch (HB-30).

   e. Remove bushing bracket (HB-51) from shaft (HB-50) (Part 2) by removing screws (HB-52) and one washer (HB-96).

   f. Remove sleeve (HB-62) from shaft.

   g. Loosen screws (HB-61) and remove pulley (HB-60).

   h. Remove clutch spring (HB-144), hub (HB-143), and splined armature (HB-142).

   i. Slide clutch rotor (HB-141) over shaft, and remove both key (HB-64) and rotor.

Note

To remove total parts of the forward and rear clutch assembly from its shaft, proceed with removal of the reverse clutch parts in paragraph 5.2.3.2.E., Step 2 below, and then the removal of forward and reverse field assemblies (HB-140) and main belt pulley (HB-63) in Step 3.

2. Reverse Clutch (HB-139)

   a. Disengage belt (HB-49) between intermediate shaft with pulley (HB-80) and reverse pulley (HB-60).

   b. Remove screws (HB-52) and two washers (HB-96) from bracket (HB-51) and slide off bushing (HB-53) with bracket from shaft.

   c. Remove sleeve (HB-62) from shaft.

   d. Loosen set-screws (HB-61), and remove reverse pulley (HB-60).

   e. Remove spring (HB-144), hub (HB-143) and splined armature (HB-142).

   f. Slide clutch rotor (HB-141) over shaft, and remove both key (HB-64) and rotor.

3. Forward and Reverse Field Assemblies (HB-140) and Main Belt Pulley (HB-63)

   a. Cut forward clutch field assembly wires No. W39 (brn/yel) and W40 (red/blu) (See Fig. 8-3A). Ensure that wires are properly identified prior to cut. Note that two blue wires emerge from the clutch field assembly and join these color coded wires. (Refer to Wiring Diagram 63002333, Section 7)

   b. Cut reverse clutch field assembly wires No. W34 (red/pur) and W43 (brn/grn) (See Fig. 8-3A). Ensure that wires are properly identified prior to cut. Note that two blue wires emerge from the clutch field assembly and join these color coded wires. (Refer to Wiring Diagram 63002333, Section 7)

   c. Free mounted forward and reverse field assemblies (HB-140) by loosening two screws, washers and brackets (HE-72, 73, 71) from right side of main frame (HE-1) and sliding each bracket away from field holder tabs A and B (Figure 8-3A).

   d. Slide main belt pulley (HB-63) off slide. Retain key (HB-64).

   e. For complete assembly replacement of forward and reverse clutches and main motor pulley, reverse steps of paragraph 5.2.3.2.E, Steps 1, 2 and 3.

Note

When assembling forward and reverse clutch and shaft parts, begin assembly by adjusting main motor pulley (HB-63), keys (HB-64) spacer (HB-109) and clutch field assemblies (HB-140) on center of shaft.

F. Timing Belts (HB-48, 49)

1. For forward clutch belt (HB-48), remove intermediate gear for forward clutch (HB-30) by removing nut (HB-28) and use procedure in para. D.5. through 7. for installation.

2. For reverse clutch belt (HB-49) removal, refer to procedure in para. E.2.a. through 2.c.

G. Intermediate Shaft with Pulley (HB-80)

1. Remove intermediate shaft with pulley (HB-30) by removing nut (HB-28) and washers (HB-29). Slide belt (HB-48) off the pulley prior to removal.

2. Loosen pulley (HB-22) on intermediate shaft (HB-80) by loosening two set-screws (HB-23). Slide off pulley belt (HB-48).

3. Pull out pinned pulley and shaft (HB-80) toward front of printer. This step will free pulley (HB-22) and felt washers (HB-24).

5.2.3.3 Adjustments

A. To Adjust Motor Pulley Drive (HB-92) and Motor Clutch Plate (Part of Motor)

1. Torque of these slip clutches is 33.3 oz/in. through 97.2 oz/in. Adjust by changing tension of spring (HB-93) with nuts (HB-112).

2. If compression of spring is increased too much speed of carriage is accelerated, timing belt receives abnormal shock and squeeking noises will come from forward and reverse clutches.

Note

Make sure that there is no oil on surfaces of motor clutches.

B. To Adjust Belt Tension (Timing Belt HB-48, 49)

Proper belt tension is obtained under the following condition:

When about 300 grams (10.6 oz.) pressure is applied to upper half of belt, mid point between pulleys, belt depression is about 3 to 4 mm (0.12 to 0.16-in.).

Adjustment of belt tensions is as follows:

1. Belt (HB-48) between motor pulley (HB-110, HB-111) and pulley (HB-22); adjust belt tension by loosening nuts (HB-19) and screws (HB-17). Adjust bolt (HB-18) to change position of motor, then tighten all screws and nuts.

2. Belt (HB-48) between pulley (HB-30) and pulley (HB-60) for forward clutch; adjust belt tension by loosening screws (HB-79) washers (HB-114) and positioning tensioner bracket (rear) A (HB-75). Make sure that belt is pushed down horizontally and contacts tensioner L (HB-77) completely. If contact is not complete, adjust tensioner bracket (rear) B (HB-76) by loosening screws (HB-79) and washers (HB-114) and re-position bracket (HB-76). Then repeat above adjustment as in beginning of step 2.

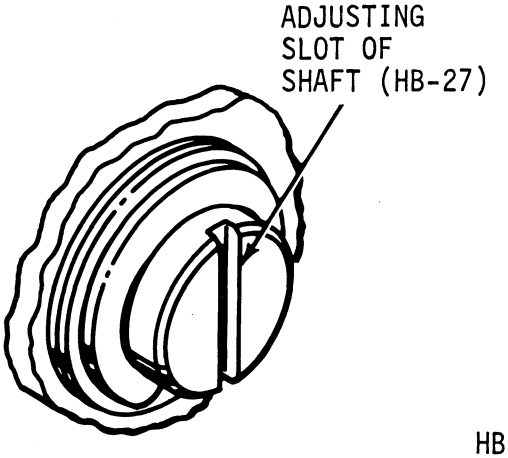
3. Belt (HB-49) between pulley (HB-80) and reverse pulley (HB-60); adjust belt tension by loosening screws (HB-39, 79). Position tensioner bracket (front) (HB-33) by making sure tensioner (HB-34) is pushed up against the belt completely before tightening screws.

C. Backlash Adjustment of Intermediate Pulley (HB-30) for Forward Clutch

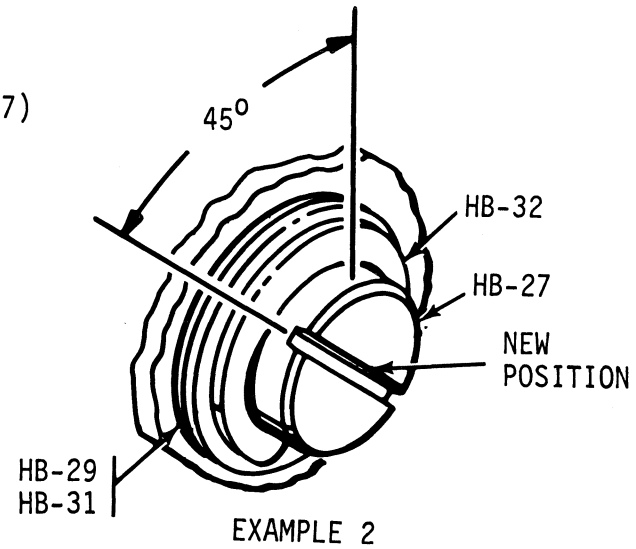
1. With the spur gear on intermediate pulley (HB-22) meshed with intermediate pulley (HB-30) at the back of the printer, begin the following adjustments with some play between the teeth of both gears.

   a. Turn offset idle shaft (HB-27) clockwise with a screwdriver until play ceases to exist between gears. Determine this by moving gears foreward and backward by hand until there is no backlash movement between gear teeth.

   b. When screwdriver slot of adjusting shaft (HB-27) comes to rest after no backlash movement (See Example 1) rotate shaft counterclockwise 45 degrees or 1/8 of a turn (See Example 2).



EXAMPLE 1
(NOT NECESSARILY VERTICAL)



EXAMPLE 2

c. Insert a feeler gauge between the sides of two meshed gear teeth for a minimum gap of 0.012-inch through a maximum gap of 0.015-inch (0.30 to 0.38 mm max.). (See Figure. A)

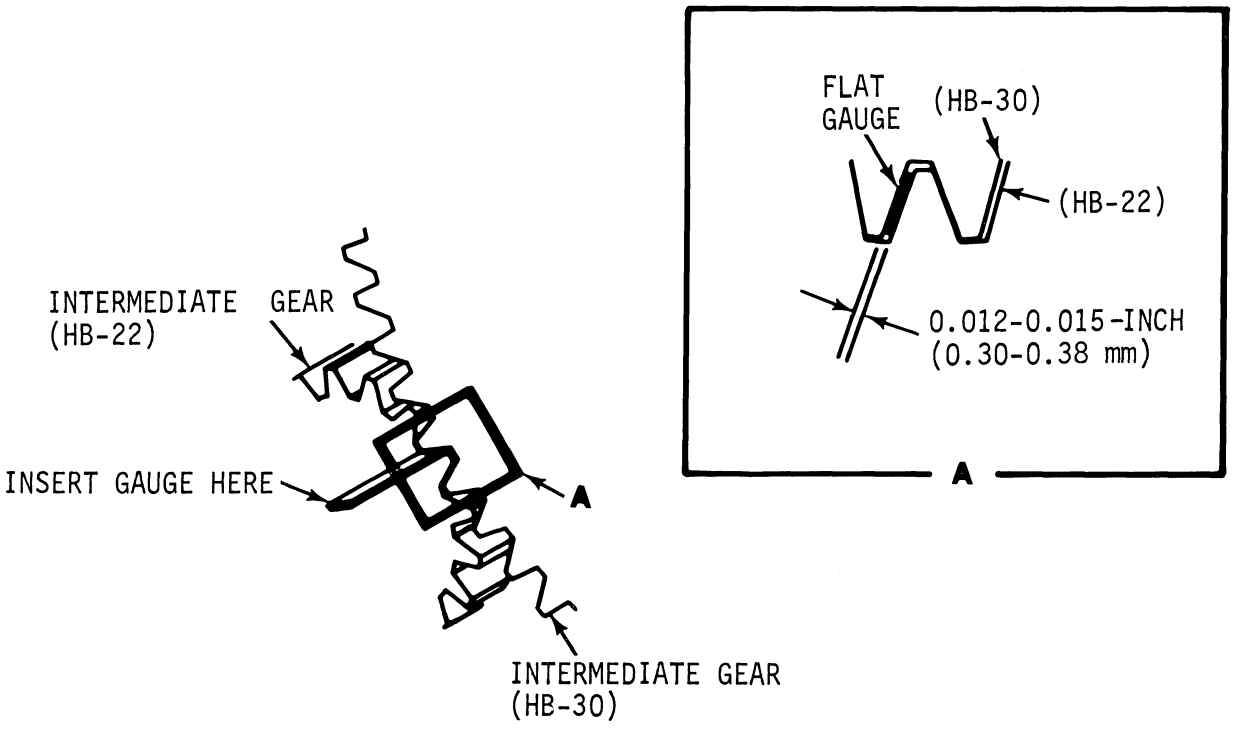


Figure A. USE OF FEELER GAUGE FOR BACKLASH ADJUSTMENT

d. When satisfactory movement of gear (HB-30) has been established, lock up nut and washers (HB-28, 29, 96), with a 10 millimeter open-end wrench, while at the same time, holding correct adjusting screw position with screwdriver.

e. Complete re-assembly of the following steps:

(1) Add a few drops of Anderol No. 465 oil to eccentric idle shaft (HB-27) and on both felt washers (HB-31). (See Fig. 8-3)

(2) Forward and reverse pulley belts (HB-48, 49) and main motor pulley belt (HB-48) should be in position for operation. If motor is turned on, at this point, gears should operate with minimum noise, as torque of main motor is distributed without strain along intermediate shaft (HB-80) to forward and reverse clutches.

D. Intermediate Shaft w/Pulley, Idle Shaft, Felt Washer Lubrication

1. Remove all external accessory covers.

2. Remove cavity assembly 63001105-1 (Section 7 of manual).

3. Remove power driver board assembly 63002242-1 (Section 7 of manual).

4. Tilt machine backwards, 90 degrees from site position, to expose underneath portion of printer.

5. Apply Anderol Oil No. 465 to two felt washers (HB-24) located on counter shaft w/pulley (HB-80).

6. Apply Anderol Oil No. 465 to two felt washers (HB-31) located on idle shaft (HB-27) for intermediate gear for forward clutch (HB-30).

E. Intermediate Shaft Bushings - Lubrication

1. Check that shaft bushings (HE-7) are secure in printer machine support.

2. Secure loose bushings by using loctite (or equiv.) on outside surfaces that contact base frame of printer. Clean surrounding support holes prior to installation. Avoid loctite touching inside surfaces of bushings where shaft rotates. Clean interior shaft hole of bushing.

3. Lubricate inside surfaces of bushings and intermediate shaft (HB-80) with Anderol No. 465 oil prior to installation or replacement.

F. Forward and Reverse Clutches (No Clutch Gap)

1. Since revision D of this section covers installation of new preload clutches (See Figure 8-3A), there is no gap required between the rotor (HB-141) and splined armature (HB-142) for both forward and rear clutch.

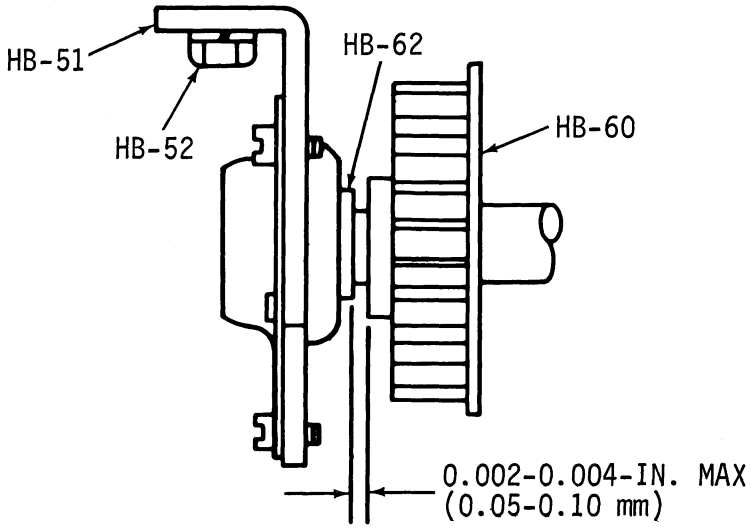
G. Bushing End-Play Adjustment (Pre-Load Clutch) (Refer Fig. 5-3A)

To ensure smooth rotation of clutch shaft (HB-50) (Preload) perform the following adjustments:

1. Tighten screws (HB-52) on rear (forward clutch) bushing bracket (HB-51).

2. Loosen screws (HB-52) on front (rear clutch) bushing bracket (HB-51).

3. Insert flat gauge between spacer (HB-62) and hub of drive pulley (HB-60). Maintain a gap of 0.002-0.004-in. max. (0.05-0.10 mm) and tighten bracket to this dimension.



TOP VIEW

Figure 5-3A. BUSHING END-PLAY ADJUSTMENT FOR PRELOAD CLUTCH SHAFT (HB-50)

5.2.4 SPRING DRUM (Figure HC)

5.2.4.1 Operation

1. Provides spring tension for return of head.

5.2.4.2 Removal/Replacement Procedure (with left cover down)

1. Release spring pawl (HC-10) by slowly loosening nut (HB-12) and screw (HC-11).

2. Actuate pawl (HC-10) to release spring tension step-by-step.

Note

Spring may unwind suddenly with excessive noise.

3. Roll belt (HA-36) off pulley (HC-5).

4. Loosen nut (HC-9) and remove drum assembly from brackets (HC-6, 7).

5. Drum may be disassembled by removing nuts (HC-9) and shaft (HC-8).

6. To assemble, reverse above procedure.

5.2.4.3 Adjustments

1. Spring drum w/main spring (HC-1) should have only enough tension to return carriage unit smoothly from any position to starting position without any other force.

2. Main spring tension should be 1 to 1.4 kg (2.2-3.1 lbs). To adjust, loosen nut (HC-12) and back off screw (HC-11) slightly; this will release the holding pawl (HC-10). Rotate spring drum (HC-1) counterclockwise to increase tension, and rotate clockwise to decrease tension.

3. Proper tension will be obtained by winding spring drum about ten times when carriage is positioned at starting position. The purpose of the spring drum is to hold down carriage motion at home position, so that 11 windings is about maximum. Note that pawl is easily released from teeth on spring drum with main spring loosening at once if nut (HC-12) and screw (HC-11) are loosened too quickly.

5.2.5 DAMPER (Figure HD)

5.2.5.1 Operation

1. Dampens return print head motion.

5.2.5.2 Removal/Replacement Procedures

1. Remove screws (HD-29) to remove complete unit.

2. Loosen nut (HD-24) and back out center screw (HD-23). Remove unit damper cylinder (HD-1) from frame (HD-37).

3. Remove snap ring (HD-16) and remove pin (HD-21).

4. Remove lid (HD-11) by removing screws (HD-12).

5. Remove spring (HD-10).

6. Take off split pin (HD-9) from nut (HD-8).

7. Remove nut (HD-8).

8. Remove steel washer (HD-7) and packing (HD-6).

9. To install packing, reverse above procedure and coat inside of cylinder lightly with recommended NYE RHEOLUBE No. 723-MS, or equiv.

   Note following points of above procedure:

   a. Split pin (HD-9) should not interfere with movement of spring (HD-10).

   b. Piston Rod (HD-2) should be returned to normal position easily by spring (HD-10), when pushing down piston rod by hand and releasing.

   c. When replacing lid (HD-11), care should be taken that rod (HD-2) moves freely in bushings.

5.2.5.3 Adjustments

1. Tighten center screw (HD-23) with enough force to hold damper cylinder (HD-1). Additional tightening may lock piston rod (HD-2).

2. When replacing damper cushion (HD-33) on carriage stopper lever (HD-32), clean contact surface with alcohol and sandpaper. Fit cushion and cap (HD-34) using recommended Eastman 910 glue, or equiv.

5.2.6 FRAME (Figure HE)

5.2.6.1 Operation

The following two reed switches and flexible timing fence are located on frame of printer:

1. Left-hand reed switch w/case (HE-78). This switch should be closed to output signal of RTP (ready to print) while carriage is positioned over it.

2. Right-hand reed switch w/case (HE-78). This switch should be closed to output signal of EOP (end of print) when carriage is positioned over it.

3. Flexible Timing Fence (HE-C). The timing fence is used to interrupt light through vertical slots for the optic pick-up head.

5.2.6.2 Removal/Replacement Procedures

A. The following removable parts are not described in a disassembly/assembly order but their locations are on the Frame (HE) drawing with their key numbers.

1. Platen (HE-2) and Platen Holder (HE-3). Left chassis (HE-86) and right chassis (HE-85).
2. Left chassis (HE-86) and right chassis (HE-85).
3. Damper (right/unit (HE-92).
4. Right Clutch Stop (HE-70) and Left Clutch Stop (HE-71).
5. Operator Panel (HE-89) and Support (HE-90).
6. Rubber Feet (HE-24).
7. Left guide plate (HE-63) and right guide plate (HE-62) for cavity.
8. Limit Switch (Reed) w/case (HE-78).

B. Installation of Flexible Timing Fence 63002440 (Fig. 8-6 and Fig. 5-3)

1. Mount spring clasp (Fig. 5-3/A) on left bracket support (HE-55) using two screws (Fig. 5-3/F), two split lockwashers (Fig. 5-3/B) and two flat washers (Fig. 5-3/E). Clasp should be horizontal and perpendicular to printer machine casting (HE-1) when mounted on left bracket support (HE-55).
2. Mount right bracket clamp (Fig. 5-3/D) using two screws (Fig. 5-3/F) and two split lockwashers (Fig. 5-3/B).
3. Mount left side of flexible timing fence behind clasp (Fig. 5-3/A) by placing mounting hole over spring projection pointing towards back of printer.
4. Insert right side of flexible fence (tab end) between right clamp (Fig. 5-3/D) and right mounting bracket (HE-54). Right side surface of fence should read "THIS SIDE OUT, RIGHT" (facing operator).

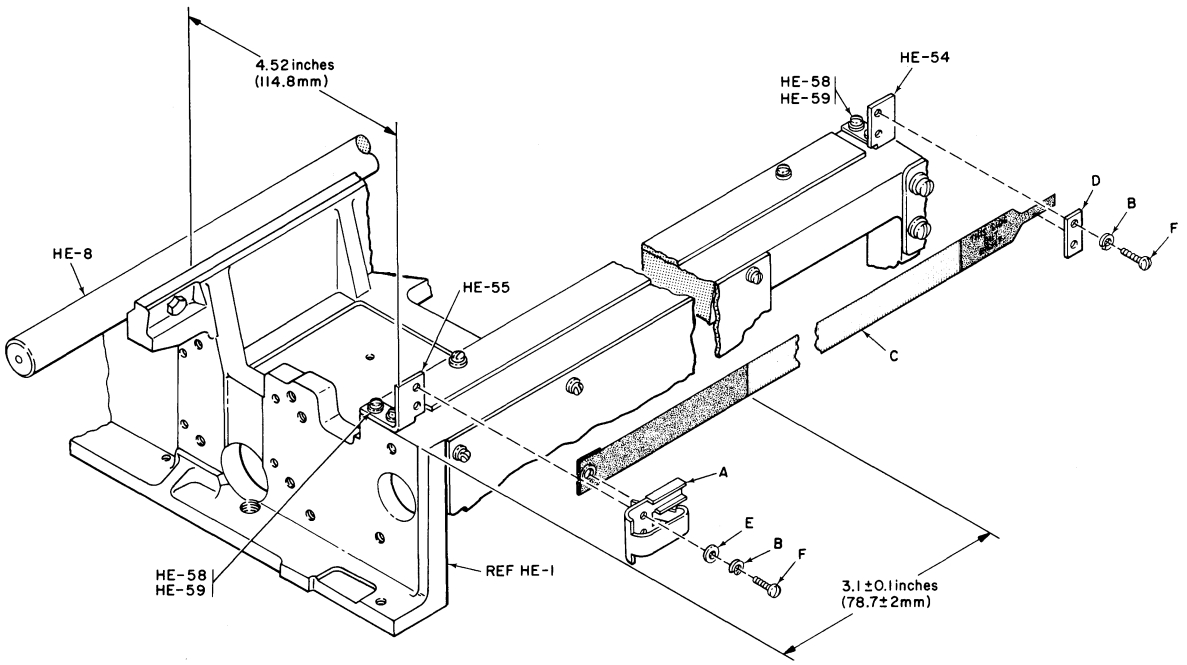


Figure 5-3. FLEXIBLE TIMING FENCE MOUNTING, SERIES 101

Note

When adjusting timing fence, in next step, avoid surface contact or any abrasion to emulsion side of timing fence (side marked "THIS SIDE OUT").

5.2.6.3 Adjustments

A. Positioning of Timing Fence (Flexible)

1. Loosen screws (Fig. 5-3/F) on clamp (Fig. 5-3/D) and pull tab of fence to the right so that the first window of the fence is located 3.1 ± 0.1 inches (78.7 ± 2 mm) from edge of printer casting (See Fig. 5-3, Ref. HE-1). (Note that this dimension adjusts for a 5/8-inch print margin on printing form).

2. Secure fence under right clamp, when correct dimension has been applied, by tightening hardware.

B. Parallelism of Suspended Timing Fence

1. From the front edge of guide bar (HE-8) (Fig. 5-3) measure 4.52 inches (114.8 mm) out to the left and right edges of the fence. Do not exceed given dimensions.

2. If parallelism is not uniform along entire length of fence, loosen screws and washers (Fig. 5-3), (HE-58, 59) in either left or right bracket (HE-55, 54) and obtain equal measurements at both ends. Tighten hardware when correct dimensions have been obtained.

3. Recheck dimension from edge of printer casting to first window of fence maintaining 3.1 $\pm$ 0.1 inches. Re-adjust, if necessary.

C. Optic Head (No locating dimension from fence) (Refer to para. 5.2.13.3.B.)

1. Set fibre optic head by loosening adjusting screws (Fig. 8-12/37) on top of bracket (Fig. 8-10/26) and place face of head as close to fence without touching. Test run print head, by hand, full length ensuring that fence does not touch optic head. Tighten screws, (Refer also to Fig. 5-10).

D. Light Assembly (No locating dimension from fence) (Refer para. 5.2.13.3.B.)

1. Loosen adjusting screws on top of video amplifier board (See Fig. 8-12, item 35) and set light assembly at maximum distance from fence (See Fig. 5-10). Tighten screws.

E. Maintenance of Flexible Mylar Timing Fence

Timing fence can be wiped clean using micro-wipes (lint free, no abrasives). For more extensive cleaning use mild soap and water. CAUTION: DO NOT USE ANY ORGANIC SOLVENTS.

F. Static Adjustment/Limit (Reed) Switch

Proper location of left-hand reed switch is approximately 1.07-inches (27.2 mm) to right, from machined surface, where frame (HD-22) is mounted on frame (HE-1), to center of right-hand reed switch case itself. (See Figure 5-4)

Proper location of right-hand reed switch center of case is 3 to 5 mm (0.12 to 0.20-in.) to right from last slit on timing fence assembly (HE-C).

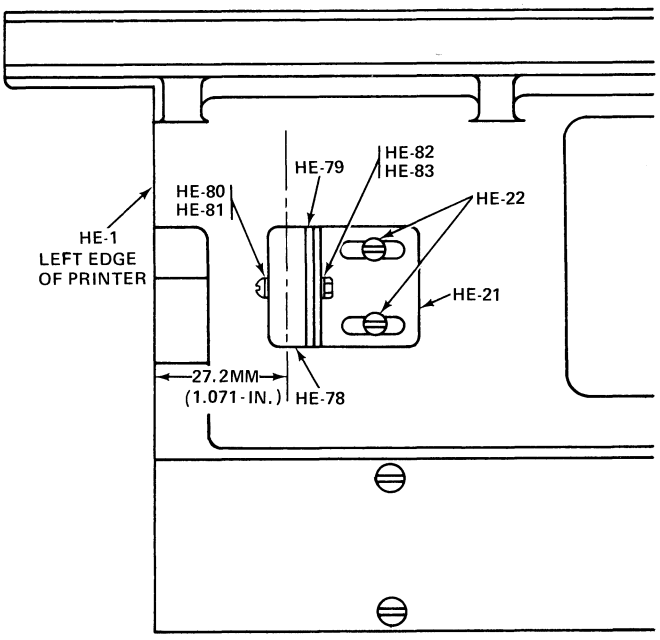


Figure 5-4. LOCATION OF LEFT REED SWITCH (TOP VIEW)

G. Dynamic Adjustment/Limit (Reed) Switches

This adjustment follows the above static settings. The test for the left-hand limit (reed) switch, is single character line check for smooth operation of over 200 lines per minute.

The test for the right-hand limit (reed) switch is to ensure 132-characters printed. Lines should be transmitted without a carriage return (CR) signal, if possible, to ensure limit switch (reed) returns print head to start of print print position.

5.2.7 PAPER FEED MECHANISM (Figure HF)

5.2.7.1 Operation

Paper is fed manually between the paper pan (upper) (HF-76) and the paper pan (lower) (HF-85). As paper appears at paper pan (front) (HF-89), pull up and place left and right sprocket holes of paper on corresponding left and right pins of pin feed belt unit (HG-19) on the same horizontal plane.

When setting printing position of paper, move paper up or down by first pulling paper feed knob (HF-99) outward. To move paper down, pull out knob (HF-99) and rotate knob in a clockwise position. Paper moves up by turning knob in a counterclockwise motion. Direct coupling, non-slip movement of paper is accomplished by serrated portion of knob inserted into opposing serrated coupler (HF-100). Pulling knob outward disconnects the direct coupling of serrated parts and allows upward and downward motion of paper.

5.2.7.2 Replacement/Removal Procedures

A. Paper Feed Knob (HF-99)

1. Pry out cap (HF-107) from knob.
2. Remove snap ring (HF-106), collar (HF-103) spring (HF-104) knob (HF-99) and spring (HF-105).

B. Pin Feed Pulley, FF Reader Gear (HF-14, 16) and Driving Shaft (HF-98) (for Pin Feed Ass'y)

1. Remove snap ring (HF-6).
2. Remove holder, bushing and retainer (HF-2, 3, 4) supporting shaft on left and right side of printer by removing screws (HF-5).
3. Loosen screws (HF-13) on FF reader gear.
4. Loosen screws on pin feed pulley (HF-14).
5. Slide shaft to the right, and when shaft is flush with left chassis support (HE-86), remove pin feed pulley (HF-14) from belt (HH-28).
6. Remove shaft completely to the right and out.
7. Remove coupler (HF-100), sleeve (HF-101) and loose reader gear (HF-16).
8. Reverse removal procedures to install above assemblies at para. A and B above.
9. Cap HF-107) may require Eastman 910, or loctite or equiv. to retain.

5.2.7.3 Adjustments

1. Paper empty (PE) switch (HF-78) should function normally when paper is inserted, or when paper terminates. If adjustment of switch is required, remove screws (HF-88) and washer (HF-97) and remove pin feed cover (HF-87). Loosen swtich nuts (HF-81) and position swtich accordingly. (Ref. Section 4, para. 4.7.3).

5.2.8 PIN FEED UNIT (Figure HG)

5.2.8.1 Operation

Pin feed tractors, left and right (HG-19) provide pin guides for paper to travel vertically up or down. To move paper down, pull paper feed knob (HF-99) outward and rotate counterclockwise; to move paper up, rotate clockwise. Tractors are adjustable and are locked in position by fixing knobs (HG-18). Paper holders (HG-14, 21) are used to keep paper on pin feed tractors when printer is in use.

Direct coupling of paper feed knob and paper feed shaft (See Figure HF-99) is accomplished by serrated portion of spring actuated knob (HG-99) inserting into opposing serrated coupler (HF-100). When this occurs, while printer is operating, paper is then moved by logic signals affecting function of the form feed mechanism (Refer to Figure HH).

5.2.8.2 Removal/Replacement Procedure

A. Paper Drive Shaft (HF-98) (See Fig. HF)

1. Refer to paragraph 5.2.7.2 for Removal of Paper Knob (HF-99).
2. Remove spring (HF-105).
3. Loosen set-screws (HF-102) on coupler (HF-100).
4. Loosen set-screw (HF-13) on FF reader gear (HF-16).
5. Loosen set-screw (HF-15) on pin feed pulley (HF-14).
6. Remove snap ring (HF-6) located in front of left-hand bushing (HF-3).
7. Loosen two fixing knobs (HG-18) on left and right pin feed units (HG) and slide both units on driving shaft (HF-98) and guide bar (HF-7) to the extreme right.
8. Loosen set-screw (HF-9) on collar (HF-8) of guide bar. Slide collar to right.
9. Remove outside nut (HF-11) on right end of guide bar of pin feed unit.
10. Lift and slide guide bar to left and out from two pin feed units and FF chassis (right) (HH-81) of printer.
11. Remove two screws (HF-5) from holder (HF-2) located on extreme right end of driving shaft and detach holder (HF-2), bushing (HF-3) and retainer (HF-4).

12. Slide driving shaft (HF-98) to the right through two pin feed units and out of FF chassis (right) of printer.

13. To reassemble reverse procedure.

5.2.8.3 Adjustments

A. Pin Feed Holders and Paper Guide Plates (Left and Right)

1. Clearance between pin feed holders (HG-1, 20) and spring activated paper guide plates (HG-14, 21) should be 0.065 0.065 ± 0.015-inch (1.65 ± 0.4 mm). Adjust clearance by bending right angle metal stopper located just above top hinge pin hole of pin feed holders, left and right.

B. Pin Feed Belt Units

1. For proper tension of pin feed belt units (HG-19), adjust as they are in place on the guide bar (HF-7) and driving shaft (HF-98) as follows:

   a. Remove screws (HG-11) to remove plastic belt paper guide (HG-10).

   b. With a 1.5 millimeter (0.059-in.) allen-wrench, loosen set-screws (HG-2) on paper feed holders (HG-1, 20).

   c. Rotate eccentric stop sleeve (HG-7). Test for flexibility of pin feed timing belt units (HG-19) so that they are under similar tension on each side, (not too flexible or too tight). Tighten set-screws.

   d. When paper is inserted on pin feed timing belt units (HG), left and right, the difference between the pins in the left and right horizontal plane should be minimal. Adjust as follows:

      (1) Loosen fixing knob stoppers (HG-18) at top of left and right pin feed holders (HG-1, 20).

      (2) Slide pin feed units together in middle of paper shaft.

      (3) Open both paper guide plates (HG-14, 21).

      (4) Loosen two allen-head set-screws (HG-6) on each pin feed driving pulley (HG-5) with a 2 millimeter (0.078-in.) allen-wrench.

(5) Align pins on belts (HG-19) in same plane. (Sight stoppers on pin feed holders (HG-1, 20), for reference points in same horizontal plane, or insert straight edge supported on both stoppers to check alignment of pins).

(6) Actual alignment can be done in two ways: (1) by hand moving each belt (2) or pull paper knob (HF-99) outward and rotate paper feed shaft (HF-98) which rotates eccentric sleeve (HG-3).

(7) When left and right pin feed belts are aligned, tighten two set-screws (HG-6) on both driving pulleys (HG-5).

C. Pin Feed Stopper (Maintaining 5/8-in. nominal paper margin)

1. Loosen set-screw (HF-9) on pin feed collar (HF-8) of guide bar for pin feed unit (HF-7).

2. Maintain 0.2-in. (5 mm) dimension between collar and left chassis (HE-86). Tighten set-screw.

3. Perform timing fence adjustment, if required) Refer to para. 5.2.6.3.).

4. Set left paper guide plate unit (HG-20) flush to collar and tighten lock-knob (HG-18).

5. Check for 5/8-in. (15.8 mm) nominal margin of print out on paper.

6. Recheck fence dimension (step 3) if margin is not 5/8-in. (15.8 mm) nominal.

5.2.9 FORM FEED MECHANISM (Figure HH)

5.2.9.1 Operation

A. Form Feed Torque Transmission

Torque of form Feed (FF) motor (HH-71) is transmitted to pin feed unit for paper drive (Refer to Section 5.2.8) in the following manner:

1. Motor (HH-71) - motor gear (HH-12).

2. . . . FF Clutch Unit (located between FF chassis, right (HH-81) and FF Chassis, left (HH-2) - FF Clutch gear (HH-18) - FF Clutch inside cam (HH-14) - gear with stop cam (HH-23) - FF idle gear (HH-27) with belt drive (HH-28).

3. . . . Paper Feed Mechanism (Fig. 8-7 (HF) - paper shaft (HF-98) and pin feed pulley (HF-14) - FF reader gear (HF-16).

4. . . . FF Clutch and Magnet Unit - FF reader idle gear (HH-38) - gear (HH-47) (on shaft HH-46) - sprocket (HH-44) for paper tape rotation).

B. Form Feed Assembly

Motor (HH-71) with fan; form feed clutch assembly; gear train; and tape reader (with standard 6 line/inch paper tape 63002292-1) are included in the form feed (FF) mechanism.

C. Rotation of Clutch Cam and Pawl

Upon receiving a signal from electronic logic, the solenoid (HH-84) in the form feed (FF) clutch and magnet unit (See Fig. 8-9) energizes and pulls in the slide (part of armature (HH-33) releasing the tab on FF clutch inside cam (HH-14) and FF clutch releasing pawl (HH-95). The pawl controls the FF clutch releaser (HH-15) containing three roller bearings (HH-19) that allows the constant speed motor (HH-71) and clutch shaft (HH-25) to rotate freely prior to incoming logic signals.

D. Operation of Clutch (HH-14) with Paper Movement Solenoid Signal (PMSOL)

As the armature slide pulls away from the inside cam (HH-14) and pawl (HH-95) (towards the solenoid), activated by logic command Paper Movement Solenoid (PMSOL), the roller bearings (HH-19) grip the clutch shaft (HH-25) and a rotation of one-half revolution takes place that is equal to a paper movement of 1/6-inch or one line feed (LF).

E. Paper Movement - VT and FF Signal

While each line of print is being run off on paper, the tape reader sprocket (HH-44) in tape reader unit feeds 1/10-inch pitch (holes between channel 3 and 4) at the same time. Paper is fed continuously until phototransistor (See Fig. 8-9, HH-61, view A) is energized by lamp (HH-50) in lower tape reader (HH-43) when a Vertical Tab (VT) or Top of Form (FF) hole is reached.

Each time the printer performs a logic command, i.e., VT of FF, the solenoid (HH-84) de-energizes, the spring (HH-85) activated slide returns to home position and holds the tab on the rotating FF cam (HH-14) and the releasing pawl (HH-95). Paper can not move until the solenoid is activated again by logic signals.

F. Prevention of Paper Counter Movement

The paper movement is always in one direction when the clutch cam (HH-14) is mechanically linked to the form feed shaft and motor. To prevent counter motion of paper feed mechanism, a small spring activated back stopper (HH-74) continually rides the periphery of gear with stop cam (HH-23) and is mechanically adjusted to fall into place against the cam at each half revolution when the FF clutch inside cam (HH-14) and FF clutch releasing pawl (HH-95) return to the underside of the armature slide. At this point additional lines of print are activated by selective logic signals affecting paper movement.

5.2.9.2 Removal/Replacement Procedure

1. Refer to Figure HH for the following sub units of the Form Feed Mechanism.

   a. FF Unit
   b. FF Clutch Unit
   c. FF Clutch and Magnet Unit
   d. Tape Reader (Lower)
   e. Reader Lamp Holder Unit
   f. Tape Reader Unit (upper)
   g. Reader P/C Board Unit

5.2.9.3 Adjustments

A. Gear with Stop Cam (HH-23) and Back Stopper (HH-74) Refer to Figure 8-9 (HH and Fig. 5-4A)

When FF (form feed) clutch releasing pawl (HH-95) is not held by armature slide, (part of armature HH-33), the shaft for FF clutch (HH-25) is being rotated for a line feed (clutch-on condition).

As each line feed rotation terminates, the FF clutch releasing pawl, which is slightly offset and precedes the tab on the FF clutch inside cam (HH-14), strikes the underside of the armature slide releasing the FF shaft so that FF motor (HH-71) is disconnected from the form feed mechanism by this clutch-off effect.

It is at this point, when the shaft is released, that an adjustment must be made to the gear with stop cam (HH-23) to prevent counter-movement of paper. (Refer to Figure 5-4A)

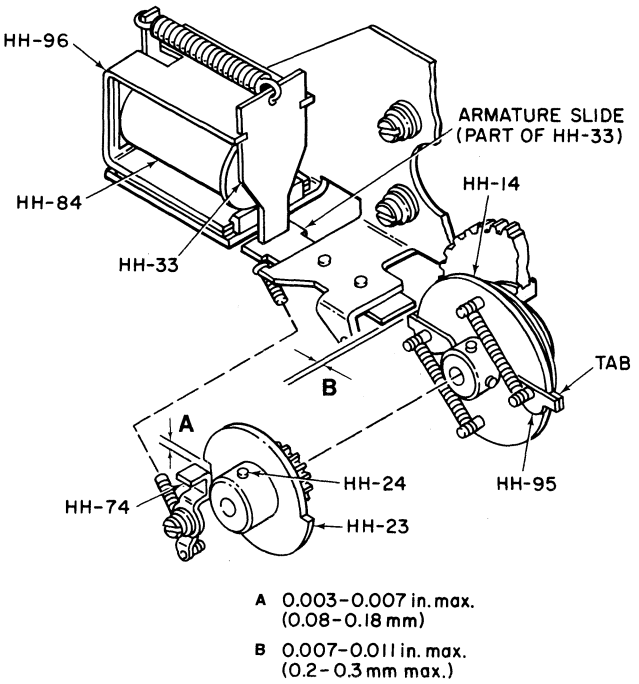


Figure 5-4A. TWO ADJUSTMENTS, GEAR WITH STOP CAM (HH-23) AND INSIDE CAM (HH-14)

1. Set the back stop cam for correct working adjustment in the following manner:

   a. Move slide (part of armature, HH-33) by hand toward armature solenoid (HH-84).

   b. While holding slide, rotate FF idle gear (HH-27) counter-clockwise (clutch-on condition).

   c. Release spring activated slide (HH-33) so that cam (HH-14) and pawl (HH-95) will be held against the under-side of the slide.

   d. Make sure that when the tab of the cam and the pawl are against the slide (clutch-off condition) that the back stopper (HH-74) drops off the notched end of gear with stop cam (HH-23). For this to happen, refer to next step.

   e. Maintain a gap of 0.1 to 0.2 mm (0.003 to 0.007-in.) between the notch of cam (HH-23) and back stopper (HH-74) (clutch - off condition) by loosening allen-head screws (HH-24) and adjust cam accordingly.

B. Clutch, Inner Cam (HH-14) - Armature Slide (HH-3) (Refer to Figure 5-4A)

1. To adjust proper distance of armature slide (HH-3) to hold raised tab on paper feed clutch, inner cam (HH-14) prior to line feed release, perform the following steps:

   a. Loosen screws (HH-86) and washers (HH-82) on clutch magnet frame (HH-96) mounted to paper feed chassis (HH-81).

   b. Slide magnet frame on paper feed chassis slots so that the distance between slide and tab on inner cam (HH-14) is from 0.2 to 0.3 mm (0.007-0.011-in.). Tighten screws and washers.

C. Timing Belt (HH-28)

1. The timing belt (HH-28) located between FF idle gear (HH-27) and pin feed pulley (HF-14) has the following adjustment.

   a. Loosen three nuts (HH-70) holding right chassis (HH-81) to left frame chassis (HE-86). (Rotate left frame to change tension on belt).

   b. For proper tension of timing belt (HH-28) move belt downward 3-5 millimeters (0.118-0.196-inch) when load of 100 grams (3.5 ounces) is applied on belt at mid-point between both pulleys.

   c. Tighten three support nuts at chassis (HH-81).

5.2.10 RIBBON FEED MECHANISM (Figure HI)

5.2.10.1 Operation

A. Ribbon Movement - Forward Clutch Drive

Torque for feeding ribbon is transmitted from shaft (HB-50) while head is moving from left to right as clutch spring (HI-4) engages sleeve (HI-5) mounted on shaft (HB-50). Above torque is transmitted to ribbon as follows:

B. Ribbon Feed Mechanism (From Front of Printer)

1. Drive-Right Side

Shaft (HB-50) - clutch gear (HI-1) - driving gear (HI-75), bevel gear (HI-81) - driving bevel gear (HI-18) - sleeve (HI-20) - driving slide shaft A, (HI-103). . . . (a) bevel gear (right-hand) (HI-27) - bevel gear (right) (HI-43) - ribbon spool shaft (right) (HI-38) - ribbon . . . .

2. Drive-Left Side

Bevel gear (HI-27) - bevel gear (HI-59) - ribbon spool shaft (HI-57) - ribbon.

C. Driving Slide Shaft

Above torque transmisssion route for the ribbon feed mechanism (left and right) is determined by position of driving slide shaft A (HI-103) (Fig. 5-7), controlled with control spring (HI-93) (Figure 5-9), reverse control lever (right) (HI-88) (Figure 5-9), and reverse control lever (left) (HI-90) (Figure 5-7).

D. Reverse Control Ribbon Movement (left and Right)

Tension of ribbon is applied by ribbon holding plate (HI-44) and guide rollers (HI-11). When one of ribbon spools becomes empty, eyelet (or stop plate) on ribbon pulls guide pins on either reverse control lever (HI-90, 88) (right) or (left) to change ribbon feeding direction by setting washer (HI-104) against reverse control lever (right) or (left) on sliding driving slide shaft (HI-103). When ribbon does not feed, or ribbon feed mechanism binds for some reason, a safety feature releases ball (HI-76) from hole in driving shaft (HI-79), and torque of driving gear (HI-75) no longer transmits drive to driving shaft (HI-79).

5.2.10.2 Removal/Replacement Procedure

Note that all removal/replacement procedures will be done from the back of the printer. (Fig. 1-9)

A. Preliminary Disassembly

Perform the following steps prior to removing ribbon reversing rod (HI-92), sliding drive shaft A (HI-103) or ribbon spool holders (HI-35, 55).

1. Place left and right side covers in down position.

2. Remove the rear cover.

3. Loosen screw (A-25 of Section 8, Fig. A) on strain relief bracket (A-13) and set aside cable.

4. Remove screws from cavity (Fig. 1-8) at back of printer.

5. Unplug cable harness from cavity to molex connector (P13) (Refer Fig. 1-9/3).

6. Remove interface connector (J13) (See Fig. 1-9/4 from connector (P13) (part of electronic logic, connector board 6301122 (Fig. 7-38).

B. Ribbon Reversing Rod

1. On the right-hand side of printer, unscrew threaded coupler (HI-94) from connector (HI-91).

2. Loosen allen-head screw (HI-96) on stopper (HI-95) on left side of ribbon reversing rod (HI-92) using a 1.5 millimeter (0.06-in.) allen-wrench.

3. Loosen locking nut (HI-98) with a 7 millimeter (0.28-in.) wrench on left side of ribbon reversing rod.

4. Unscrew ribbon reversing rod from left coupler and remove.

C. Driving Slide Shaft - A

1. On the right side of the printer, remove two screws (HI-131) from holder (HI-133) supporting driving slide shaft A (HI-103) and drop the shaft slightly.

2. Using a 1½ millimeter (0.06-in.) allen-wrench, remove two allen-head screws (HI-29) on bevel gear (HI-27) on right side of printer.

3. Remove bevel gear and bushing.

4. Remove snap ring (HI-105) and washer (HI-140) from drive shaft A on right side of printer.

5. Repeat step C.1. through C.4. on left side of printer, but remove left holder (HI-130) in step C.1.

6. Remove driving slide shaft A to the right of the printer.

7. To reassemble, reverse order of disassembly.

D. Ribbon Spool Holder (left and right)

1. Remove both ribbon spools (left and right).

2. Remove left and right spool holders (HI-35, 55) by removing bolts (HI-54) from left and right chassis (HE-86, 85).

E. Ribbon Spool Shaft (left and right)

1. To remove left and right ribbon spool shaft (HI-38, 57) first loosen allen-head screws (HI-42) on bevel gears (HI-43, 59) and remove gear.

2. Loosen allen-head screws (HI-42) using 1½ millimeter (0.06-in.) allen wrench, on left and right collars (HI-41) located on ribbon spool shafts (HI-57, 38).

3. Remove left and right spool shaft (HI-38, 57).

4. Remove left and right nut (HI-37).

5. Remove left and right sleeve bearing (HI-36, 56).

6. To reassemble, reverse steps 1 through 4.

F. Ribbon Holding Plate (left and right)

1. To remove left and right ribbon holding plate (HI-44) from left and right ribbon spool holders (HI-55, 35), remove left and right snap rings (HI-45).

G. Reverse Control Lever (left and right)

1. To remove left and right ribbon reverse control levers (HI-90, 88) from left and right ribbon spool holders (HI-55, 35), remove left and right snap rings (HI-48) and remove levers.

H. Reversing Rod Connectors (left and right)

1. To remove left and right reversing rod connectors (HI-91, 89), remove snap rings (HI-51) from pins (HI-50) and remove pins.

I. Reassembly of Ribbon Spool Holders

1. To reassemble ribbon spool holders (HI-35, 55), reverse order of disassembly para. D. through H.

J. Ribbon Driving Shaft Assembly

1. To remove and disassemble ribbon driving shaft assembly (HI-79) perform the following steps:

   a. Remove screws (HI-17) from left side of printer and remove bushing holder (HI-84).

   b. Remove screws (HI-86) holding cover (HI-85) and holder (HI-84) together, releasing entire driving shaft (HI-79). Note, that clutch spring (HH-80) must be unhooked from cover (HI-85).

   c. Remove snap ring (HI-87) on left end of driving shaft.

   d. Release and remove driving gear (HI-75) by unscrewing allen-head set-screw (HI-78) and releasing spring (HI-77) and ball (HI-76). (Note, that caution must be taken to avoid losing spring and ball).

   e. Remove bushing (HI-83) and clutch spring (HI-80) from shaft (HI-79).

f. Remove bevel gear (HI-81) from shaft by releasing allen-head screw (HI-82) at right end of shaft.

2. To reassemble ribbon driving shaft assembly (HI-79), reverse order of disassembly.

K. Clutch Gear (HI-1) (Direct drive transmitted from forward and reverse clutch shaft (Ref: Fig. 8-3B (HB-50), and on the same drawing, (Ref: HI-1)

1. Prior to removing clutch gear (HI-1), the bushing holder (HI-84) must be removed (Refer para. J.1.a. and J.1.b.).

2. To remove clutch gear (HI-1), loosen two allen-head screws (HI-6) from sleeve (HI-5) and slide off sleeve, clutch spring (HI-4) and gear.

3. To reassemble, reverse order of disassembly, steps K.1. through K.3.

5.2.10.3 Adjustments

All adjustments, unless otherwise specified, will be called out from a rear view (left and right) at the back of the printer.

A. Bevel Gears (left and right) (HI-27, 43) and (HI-27, 59) (Refer to Figure 5-5)

1. Slide ribbon reversing rod (HI-92) to left. Arm (part of reverse control lever) (HI-88) contacts washer (HI-104) on driving slide shaft A (HI-103) and moves bevel gear (HI-27) into mesh with bevel gear (HI-43).

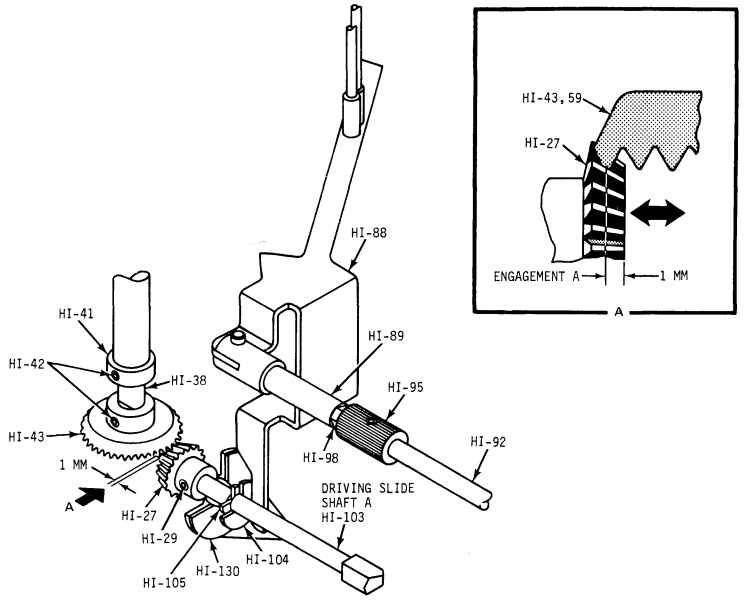


Figure 5-5. RIBBON FEED MECHANISM (REAR OF PRINTER, LEFT SIDE)

2. Adjust bevel gear (HI-27) (left side) with respect to bevel gear (HI-43) by loosening and tightening allen-head screws (HI-29) to obtain engagement A of approximately one millimeter (0.039-in.). See Fig. 5-5, and View A

B. Backlash Adjustment for Gears (HI-27, 43) and (HI-27, 59)

When engagement A (Figure 5-5) has been properly adjusted between gears (HI-27) with respect to bevel gears (HI-43, 59), adjust bevel gears (HI-43, 59) alternately to obtain correct backlash operation of gears in the following manner:

Note

When performing the next two steps, adjust one set of gears for proper backlash, then move ribbon reversing rod (HI-92) in opposite direction (to engage gears) and adjust the other set of gears (HI-27, 43) or (HI-27, 59), repeating steps B1 through B2. (See Figure 5-6)

1. Loosen allen-head screws (HI-42) on the bevel gears (HI-43, 59).

2. Adjust bevel gear up or down on ribbon spool shaft (HI-38, 57) to obtain a vertical adjustment (engagement B) of 0.05 to 0.2 millimeters (0.002-0.008-in.) between the teeth of the opposing gears (HI-27) as they mesh (See Figure 5-6). Tighten allen-head screws on bevel gear (HI-43, 59).

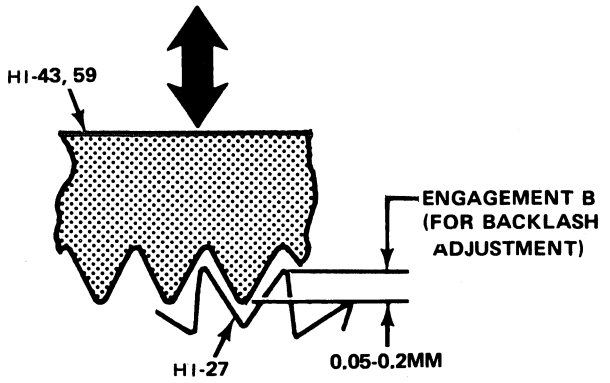


Figure 5-6. BACKLASH ADJUSTMENT, BEVEL GEAR (HI-43, 59)

C. Driving Slide Shaft A (HI-103)

If driving slide shaft A (HI-103) is removed or replaced, adjust ribbon mechanism parts in the following manner:

1. When engagement A and B of bevel gears has been made (Figure 5-5, 5-6), one snap ring (HI-105) always contacts support bushing (HI-130); the distance between other snap ring (HI-105) and the support bushing (HI-130) on shaft (HI-103) is 3 to 4 millimeters (0.12-0.16-in.). (See Figure 5-7). Note that distance between bevel gear (HI-59) and bevel gear (HI-27) is also 3-4 mm.

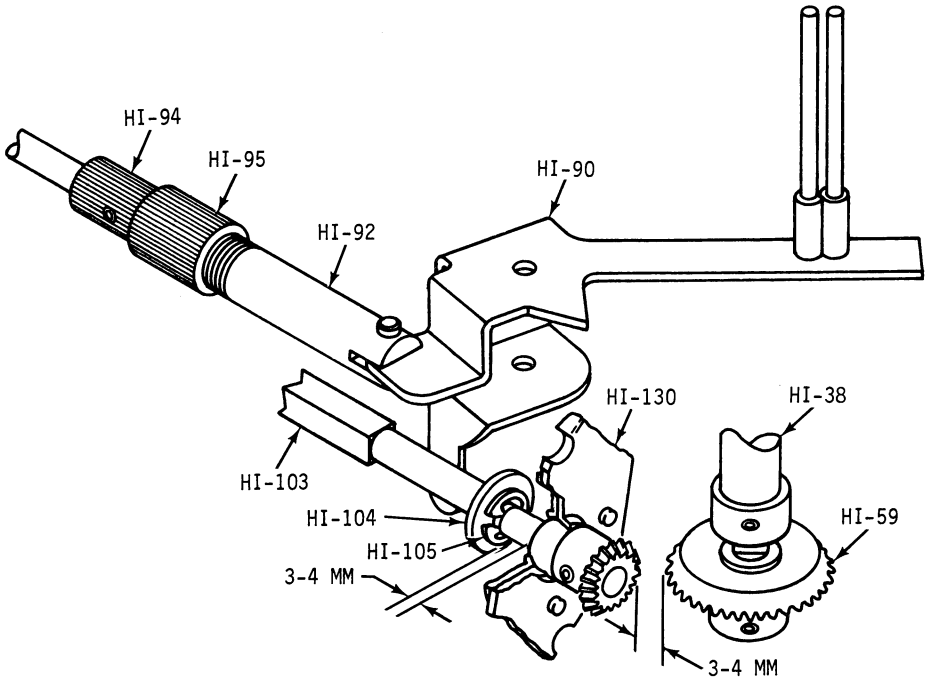


Figure 5-7. DRIVING SLIDE SHAFT A - ADJUSTMENT

2. When bushings and holders (HI-133, 130) on left and right side of printer are installed, the driving slide shaft A (HI-103) should move freely and travel an overall distance of 3.0 to 4.0 millimeters (0.12 -0.16-in.) when engaged alternately in either direction with bevel gears (HI-27, 43) or (HI-27, 59). (See Fig. 5-7)

D. Ribbon Reversing Rod (HI-92)

If ribbon reversing rod (HI-92) is removed, adjust ribbon mechanism in the following manner:

1. Thread right-hand coupler (HI-94) clockwise all the way. (Refer Figure 8-10)

2. With right bevel gears engaged (HI-27, 59), (right side, rear view) adjust gap between washer (HI-104) and ribbon reverse control arm (HI-88) between 3 and 4 millimeters (0.12-0.16-in.) by rotating ribbon reversing rod (HI-92) to control the distance. (Refer to Figure 5-8)

3. Tighten locking nut (HI-98) to prevent further rotation of ribbon reversing rod.

4. Slide both stoppers (HI-95) into place (left and right) and lock by tightening allen-screws (HI-96).

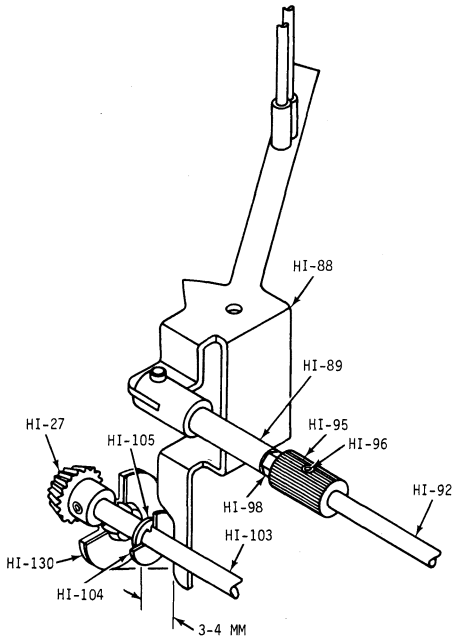


Figure 5-8. RIBBON REVERSING ROD ADJUSTMENT

E. Control Spring (HI-39) - Ribbon Reverse Timing (See Fig. 5-9)

1. When reverse control lever (HI-88) turns left by moving ribbon reversing shaft (HI-92) to left, and if Engagement A (Fig. 5-5) between bevel gear (HI-27) and bevel gear left (HI-43) is decreased to approximately 1.0 mm (0.039-in.), adjust position of control spring (HI-39) by loosening screws (HI-40) and flat washers (HI-123) to just pass roller mounted on control spring (HI-39),(located underneath left ribbon spool shaft (HI-38) over top of ramp of reverse control lever (left) (HI-88). Note, that both ribbon spools will rotate freely when driving slide shaft A (HI-103) is in neutral position (top of ramp).

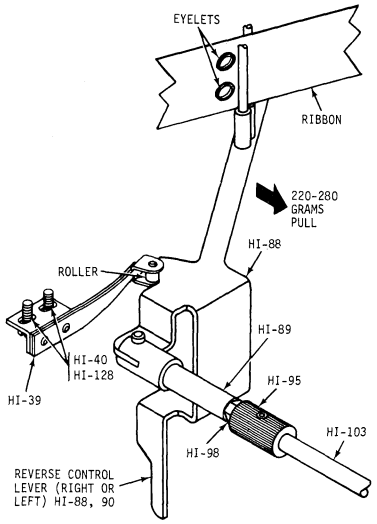


Figure 5-9. RIBBON REVERSE TIMING

2. When ribbon of spool (empty condition) containing eyelets (or small plate) is blocked by ribbon guides (part of HI-88, 90) a pull of 220-280 grams (7.7 oz - 9.8 oz) is exerted on the reverse control levers (either left or right), which reverses the ribbon movement. (See Figure 5-9)

3. Adjust bevel gear (HI-27) (right) and bevel gear (HI-59) (right) to the same gap as indicated in para. E.1.

Note

Both bevel gear (HI-27) and bevel gear (right and left) (HI-42, 59) should be timed so that they engage together after roller, mounted on control spring, passes over top of ramp of reverse control lever (HI-88). (Fig. 5-9)

F. Clutch Gear and Driving Gear Engagement (Fig. 8-10, HI-1, 75)

1. To ensure clutch gear (HI-1) and driving gear (HI-75) are meshed properly, adjust by loosening screws (HI-17). Also ensure both bevel gears (HI-18, 81) are meshed properly and positioned on driving shaft unit. Proper backlash between clutch gear (HI-1) and driving gear (HI-75) is 0.05 to 0.2 mm (0.002 - 0.008-in.).

2. Ensure that torque of driving gear (HI-75) does not transmit to driving shaft (HI-79), when spool holder is held by hand. Adjust pressure on ball (HI-76) by turning set-screw (HI-78). After making above adjustment, check the following points:

a. When carriage is moved by hand and ribbon feed direction is changed, see that there is no slippage between driving gear (HI-75) and driving shaft (HI-79).

b. When carriage is moved by hand, and spool is held by hand, ensure that torque of driving gear (HI-75) does not transmit to driving shaft (HI-79).

G. Ribbon Winding

1. Top Edge Curling

When the ribbon winds normally into ribbon spool, the edge of the ribbon should not be curled. If the top edge of the ribbon is curled, adjust position of ribbon spool holder (right or left) (HI-35, 55) by loosening bolts (HI-54) to incline ribbon spool shaft (right or left) (HI-38, 57) slightly backward.

2. Bottom Edge Curling

If the lower edge of the ribbon becomes curled, adjust position of ribbon spool holder (HI-35, 55) by loosening bolts (HI-54) to incline spool holder shaft (HI-57, 58) slightly forward.

H. Guide Roller Adjustment (HI-106, 114)

1. Adjust level of guide roller (right or left) (HI-106, 114) by loosening screws (HI-117) to position guide rollers (HI-119) perpendicular and parallel to side of machine.

5.2.11 ELECTRICAL HARDWARE (HJ)

In general, the parts list for this section reflects electrical and mechanical items required for the operator panel and cabling found on the main frame of the printer. There is no illustrative drawing for the accessories parts list at this printing.

5.2.12 PAPER STACKER AND GUIDE

Refer to Section 2.3.

5.2.13 PRINT HEAD AND ASSOCIATED ASSEMBLIES (Figure 8-12(B)*

The following paragraphs describe a method of removal/replacement, and wherever required, adjustments for the print head and assocated assemblies. This section does not cover total parts contained in those assemblies. See Section 7 and 8 for complete parts list and assembly drawings where applicable.

*For convenience, B will be used to key text to the drawing. (See Section 8, Fig. 8-12B)

5.2.13.1 Operation

A. Print Head

Acts as a guide to keep print wires in line as each one drives against the ribbon to form characters out of dots.

B. Power Driver Board

Supplies control signals to printer solenoids and forward and rear clutches for head movement from logic boards.

C. Video Amplifier and Cable Ass'y

Amplifies and shapes the video pulse, with the cable assemblies carrying power driver outputs to the solenoids of head.

D. Bracket (HA-50)

Supports video amplifier and cables, Fibre Optics Head and bundle, and Light Assembly.

5.2.13.2 Removal/Replacement Procedures (Refer to Figure B)

A. Print Head

1. Refer to Section 5.2.1.2., steps 1 and 3, for removing the covers prior to removing head.
2. Unplug fingerboard, solenoid (B-1) from video amplifier connector (B-2).
3. Using a 3/32-in. diameter allen wrench, remove at the top, from each side of head assembly (B-3) two allen-head screws (B-4) and two internal lockwashers (B-5) attached to the head bracket (B-6) of printer carriage (B-7). Remove the lower two allen-head screws (B-10) (longer in length) and internal lockwashers (B-5).
4. To replace print head reverse disassembly procedure.

B. Power Driver Board

1. Unplug ribbon cable connector board (B-11) from power driver board connector (B-2).

2. Remove ribbon cables (B-12, B-13) from cable clamp assembly (B-14) located on the tray (B-15) by loosening the back screw, (B-16) and removing the front screw, (B-16), washer (B-5) and nut (B-17).

3. To remove entire heatsink bracket (B-18) with power driver board (B-19), remove four countersink screws (B-20) at front of printer attached to printer frame unit (B-21).

4. Reverse disassembly procedures to assemble.

C. Video Amplifier and Cable

1. For removal of video amplifier board (B-22) and cable ass'y (B-12, B-13), first refer to paragraph 5.2.13.2.B., steps 1 and 2 of this section.

2. Remove connector screw (B-23) from bracket (B-26), clip (B-46) and the fibre washer (B-24) located directly underneath the video amplifier board.

3. Remove two screws (B-25) from bracket (B-26) holding cables and video amplifier board including fibre washers (B-27) (placed as insulators) and pad assembly (B-28).

D. Installation-Video Amplifier and Cable

Install the video amplifier (B-22) and cable assembly (B-12, B-13) in the following manner:

1. Insert one screw (B-25) into ground terminal lug (B-45) (attached to board) and then into fibre washer (B-27) and enter pre-drilled hole in cables (B-12, B-13).

2. Insert one more screw (B-25) with fibre washer (B-27) and enter the other pre-drilled hole in cables. Add one fibre washer (B-17) to each screw between the underside of the cables and the pad assembly into sponge (B-29) and bracket below (B-26) into front two press-fitted rivnuts (B-30) on the bracket.

3. Insert solenoid fingerboard (B-1) from printer head into video amplifier connector (B-2).

4. Reverse procedures of 5.2.13.2.B., 1 and 2.

E. Bracket Video Amplifier

1. Remove entire bracket (B-26) with non-conductive sponge (B-29) containing fibre optics head (B-31) and bundle (B-31) and lamp housing assembly (B-32) and two lockwashers (B-34) from printer carriage unit (B-7).

5.2.13.3 Adjustments

A. Print Head

See maintenance, Section 6, Print Head Assembly.

B. Bracket (Video Adjustment)

The adjustment of the bracket (B-26) is a preliminary step prior to alinement of lamp assembly (B-32) and fibre optics head (B-31) relative to the flexible timing fence (B-36) and print head.

1. With hardware and bracket (B-26) in position, and before tightening mounting screws (B-33), push upward on the bracket so that flanged end is flush and parallel with top front edge of printer carriage unit (B-7). Tighten screws so that slight tap would shift position of bracket.

2. Move lamp holder housing assembly (B-32) without lamp (B-41) and socket (B-42) backward on screw adjusting slots at maximum distance from timing fence (Fig. 5-10). Tighten screws (B-35) (screws must be flat-head) when right side of lamp housing is aligned parallel to edge of bracket.

3. Mount fibre optics head (B-31) to bracket (B-26) with screws (B-37), lockwashers (B-38) and flat washers (B-7). Allow lead of optic bundle (B-31) to hang freely. Do not tighten screws.

Note

The following adjustments must be made to correctly align lamp (B-41) so that this light source is directed properly through the optic fence (B-36) to slit (B-40) on fibre optic head (B-31).

4. Adjust the right, top edge of fibre optics head so that it is parallel with edge of bracket (B-26) and as close to fence without touching. (See Fig. 5-10)

   a. If optics head is not parallel with respect to the vertically suspended fence, physically bend the bracket (B-26) slightly up or down to maintain parallelism.

   b. Move print head by hand, all the way to the right to ensure timing fence and the face of the fibre optic head surfaces do not touch. Adjust accordingly.

   c. Re-check timing fence alinement (para. 5.2.6.3.).

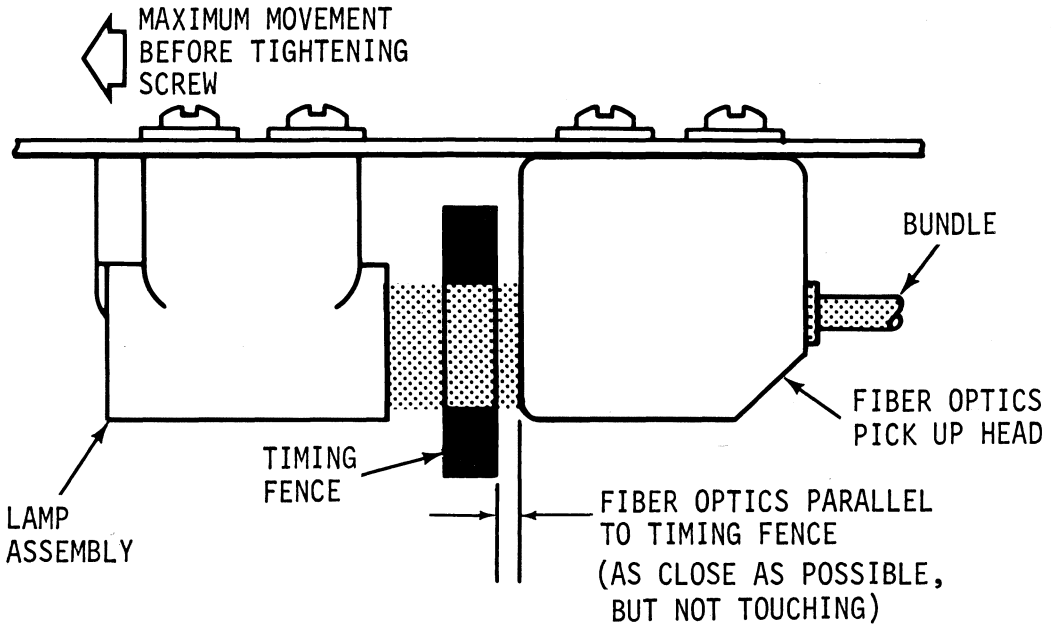


Figure 5-10. FIBRE OPTICS HEAD, ADJUSTMENT FROM OPTIC FENCE

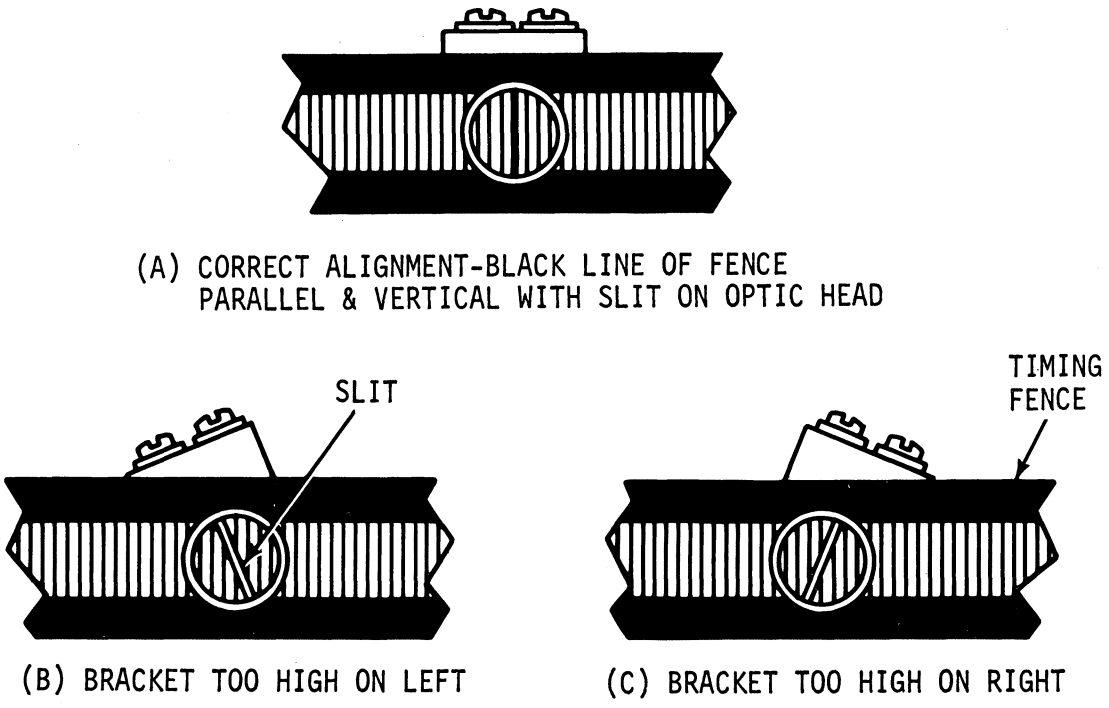


Figure 5-11. FIBRE OPTICS HEAD ALIGNMENT AND FLEXIBLE TIMING FENCE

5. From a position in front of optic timing fence (B-36) and with fibre optic bundle (B-31) pointing to a light source, correctly aline illuminated slit (B-40) on optics head (B-31) by observing through empty light housing (B-32) so that light slit on optics head is completely blocked by any black line on the timing fence. (Figure 5-11 (A).

6. The following two conditions may apply to light alignment in previous step 5 when the slit on optics bundle is out of alignment with respect to the black line on timing fence (Figure 5-11 (B) and (C).

   a. If the bracket (B-26) holding the optics head is too high on left (Figure 5-2 (B), tap bracket to align slit and black line (Figure 5-11 (A).

   b. If the bracket holding the optics bundle is too high on the right (Figure 5-11 (C), tap bracket to align slit and black line (Figure 5-11 (A).

   c. When correct alignment has been attained, tighten and secure bracket (B-26) with the two mounting screws (B-33) and washers (B-34) to printer carriage (B-7).

7. Insert lamp (B-41) into socket (B-42) attached to lamp retainer (part of lamp socket), but note that prior to insertion into lamp ass'y be certain lamp filament (inside lamp B-41) is in a vertical plane paralleling slit (B-40) in the opposing fibre optics head (B-31) for maximum blockage of light by black line on fence (Figure 5-11(A). Insert and tighten screw (B-37), washers (B-38, 44) into lamp retainer (B-42) and lamp ass'y (B-32).

8. Install bundle lead of fibre optic head (B-31) into photo cell housing ass'y (B-43) installed on the video amplifier board (B-22). Tighten screw (B-25) on clamp end of photo cell housing.

C. Ribbon Cables Ass'v (B-12, B-13)

1. To position ribbon cables for operating condition, move cables to the left or right through the tray clamp (B-14). Set printer head to the left so that when print head operates normally, the ribbon cables do not strike damper (Figure HD) or that cables become too tight between printer head and tray clamp. The starting point of the head may differ among models because of small mechanical variations affecting the degree of slackness of the cables.

2. Secure cables, after proper adjustment of head, by tightening screws (B-16) washers (B-5) and nuts (B-17) on clamp (B-14) on tray (B-15).

D. Ground Lug - Video Amplifier Board

Check to see if preassembled ground lug (B-45) clears etch runs of video amplifier board, (B-22) after assembly is completed. Adjust, if required.

HANDLING LSI CHIPS

1. REMOVING A CHIP FROM THE SHIPPING CONTAINER
   a. Before touching the chip, reference yourself to the container by touching and holding the metalized rubber containing the chip pins.
   b. While holding the rubber, lift out chip and hold lightly by the pins.
   c. You can now safely carry the chip, by holding the pins.

2. REPLACING THE CHIP IN ITS CONTAINER
   a. While holding pins touch and hold rubber and replace.

3. GIVING CHIP TO ANOTHER PERSON
   a. While holding pins of chip in one hand, make contact with the other person until he is holding the chip by its pins.

4. REMOVE AND REPLACE CHIP IN PRINTER
   a. Before removing or replacing chip, touch signal ground (large ground plane on LSI Component Board) and hold.
   b. While holding signal ground, remove or replace chip.
   c. In general, something other than the chip (e.g., your hand) should make the first contact with the circuit.

CAUTION
WHEN OPERATING PRINTER WITH COVERS OFF, KEEP PAPER AWAY FROM LOGIC TO PREVENT PAPER STATIC DISCHARGE FROM DAMAGING LSI CHIPS.

SECTION 6
MAINTENANCE

This section contains the following maintenance information:

Paragraph	Description
6.1	Adjustments
6.2	Preventive Maintenance
6.3	Troubleshooting Guide

In addition, detailed removal, replacement and adjustment procedures for all mechanical assemblies are contained in Section 5. Associated mechanical drawings and parts lists are in Section 8. Detailed theory of operation on the electronics portion is contained in Section 4 and associated drawings and parts lists are in Section 7.

6.1 ADJUSTMENTS

All mechanical adjustments are described in detail in Section 5. All electrical adjustments are summarized in the following table.

Item No.	Function	Signal Name	Element-Pin	Card *	Adj. Resistor	Pulse Width
1	Single Line Feed (E5 to E6) (STD.)(Mono-flop-20ms)	LF	ME3-13	Logic/ P.S.	R19	15 MSEC
2	Single/Double (E4 to E5) Line Feed (Opt.)	LF	ME3-13	"	R22	50 MSEC
3	Strobe Pulse	STROBE	ME11-6	"	R25	500 $\pm$25 uSEC
4	Delayed Strobe	-	ME7-12	"	R27	600 uSEC
5	Strobe Delay Pulse	DLYSTB	ME13-6	"	R29	500 $\pm$25 uSEC

*Information applies to 63015124 schematic diagram.

CENTRONICS

SERIES 100 PRINTERS
PREVENTIVE MAINTENANCE PROCEDURES

(December 1974)

The following Preventive Maintenance (PM) procedures apply to the Series 101 and Series 102 printers.

Frequency of PM :	6 months
Time Required:	1.5 hours (approximately)

Cleaning Material: Medium-bristle cleaning brush,
Two soft clean cloths,
Liquid Freon

Tools Recommended:

Centronics' Tool Kit No. 63002399-1

Items not available through Centronics:
- Phillips screwdriver
- Flat blade screwdriver
- Jeweler's eye loupe
- Decimal feeler gauges
- Oil syringe

Lubricants Recommended:

Lightweight oil (choice of three)
- Teilus No. 27 (Shell) CDCC Spec. No. 30050005
- Teresso No. 43 (Esso) CDCC Spec. No. 30050006
- Vacualine No. 1405 (Mobil) CDCC Spec. No. 30050007

Grease – CDCC Spec. No. 30050004

Oil – Anderol No. 465, Spec. No. 30050002 (for bushings and felt washers only)

Reference Manuals: Series 101 and Series 102 Technical Manual

CENTRONICS
centronics data computer corp.
hudson, n.h. 03051
telephone (603) 883-0111
eastern region: (617) 646-8545 (mass.)
central region: (513) 294-0070 (ohio)
western region: (714) 979-6650 (calif.)
centronics data computer (canada) ltd.
mississauga, ontario (416) 625-0770
centronics international corp.
brussels, belgium (02) 762-3572

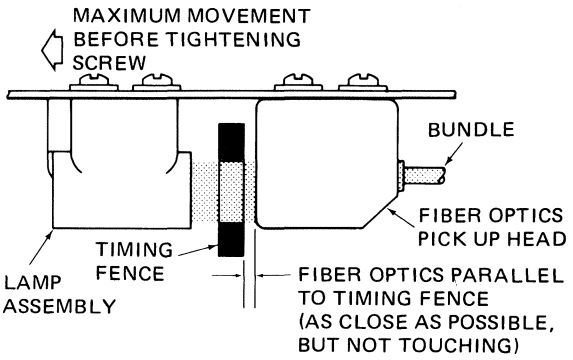
PREPARATION

Clean Printer with vacuum cleaner, if available.

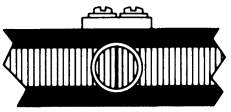
INSPECTION, ADJUSTMENT, CLEANING AND LUBRICATION

1. FIBER OPTIC HEAD

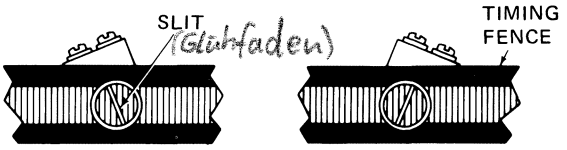
Verify proper Fiber Optic Head alignment as shown in Figures 1a and 1b (para. 5.2.13.3).



(1a)



(A) CORRECT ALIGNMENT-BLACK LINE OF FENCE PARALLEL & VERTICAL WITH SLIT ON OPTIC HEAD

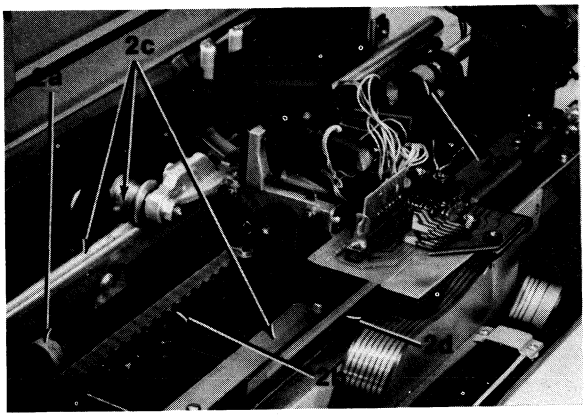


(B) BRACKET TOO HIGH ON LEFT

(C) BRACKET TOO HIGH ON RIGHT

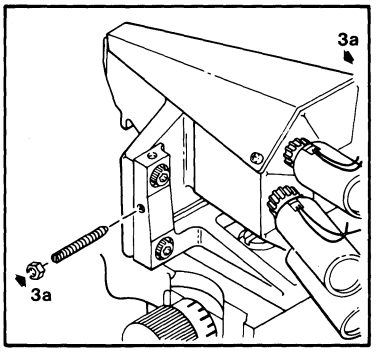
(1b)

2. CARRIAGE ASSEMBLY

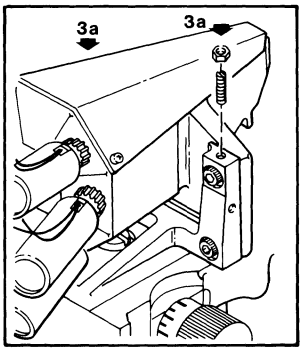


a) Check damper (5.2.5.2, Step 9) (Puffereinrichtung)
b) Verify proper main drive belt tension (5.2.2.3 D)
c) Wipe Carriage Guide Bar, Rollers and Plate (5.2.2)
d) Clean flexible timing fence using micro-wipes. (If necessary, use a mild detergent, never an organic solution (5.2.6.3 E)

3. PRINT HEAD ASSEMBLY



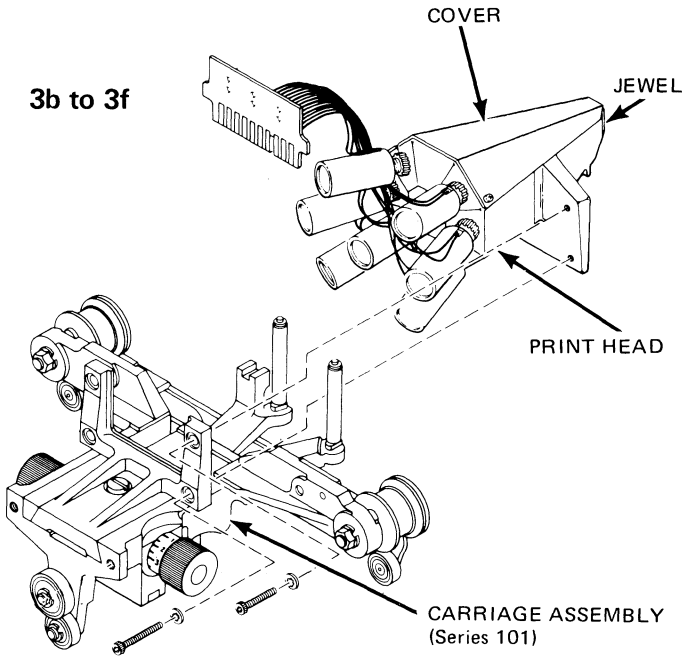
HORIZONTAL ADJUSTMENT



VERTICAL ADJUSTMENT

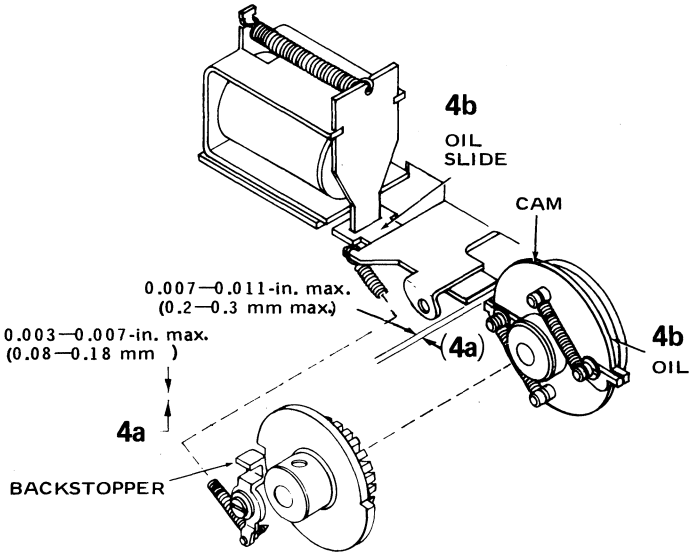
a) For Series 102 only, verify alignment of left and right print heads (5.2.2.3)
b) Remove print head(s) from Carriage Assembly; (5.2.2.2, Series 102) (5.2.13.2, Series 101)
c) Remove print head cover, and clean print head jewel using a Freon cleaning solution and a medium-bristle cleaning brush (See Fig. below)
d) Using an eye loupe, verify that print wires align flush with face of print head jewel (make sure that wires are not recessed in the jewel) (1.3.1)
e) Replace print head cover
f) Re-mount print head on Carriage Assembly (See Fig. below)

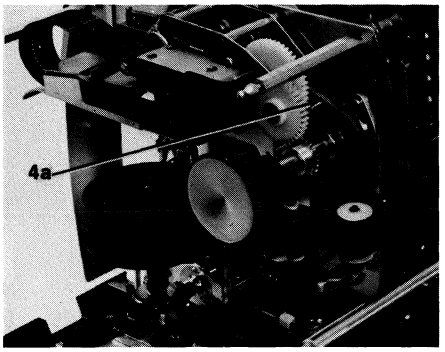
3b to 3f



4. FORM FEED ASSEMBLY

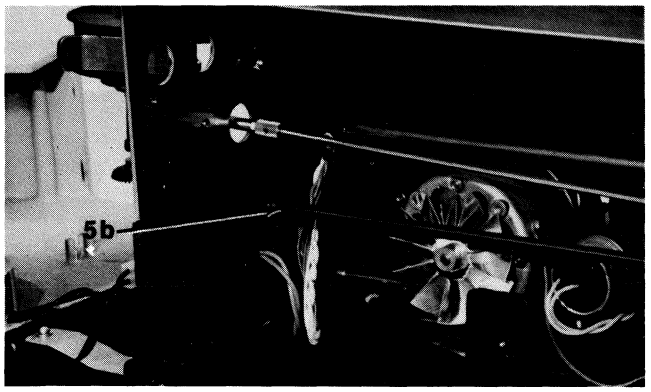
a) Verify proper gaps and timing belt tension (5.2.9.3).
b) Lubricate as shown in diagram below.
c) Oil all moving shafts and bushings.

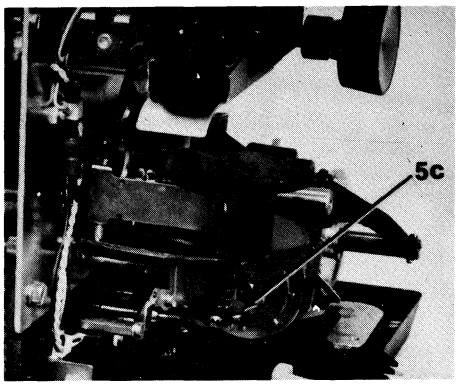




5. RIBBON FEED ASSEMBLY

a) Check all gears for wear and proper mesh (5.2.10)
b) Verify that ribbon spools rotate freely when driving slide shaft is in neutral position (neither spool engaged) (5.2.10.3)
c) Manually move carriage assembly, and verify proper ribbon tracking by engaging left and then right bevel gears (5.2.10.3)

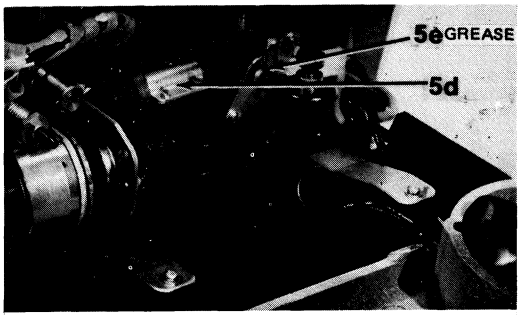


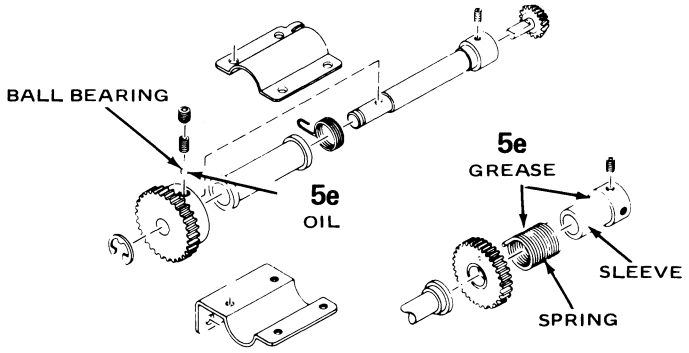


d) Verify proper operation of ribbon feed driving gear slip clutch when the carriage is moved and the engaged ribbon spool is held stationary (5.2.10.3).

e) Clean and lubricate as indicated in the diagrams (See Fig. below).

f) Grease all metal-to-metal surfaces, if required.





6. DRIVE ASSEMBLY

a) For Series 102, verify gap between armature plates for forward and reverse clutches (no gap between armature and rotors) (5.2.3.3).

b) For Series 101, verify a uniform gap between rotor and armature for forward and reverse clutches (5.2.3.3).

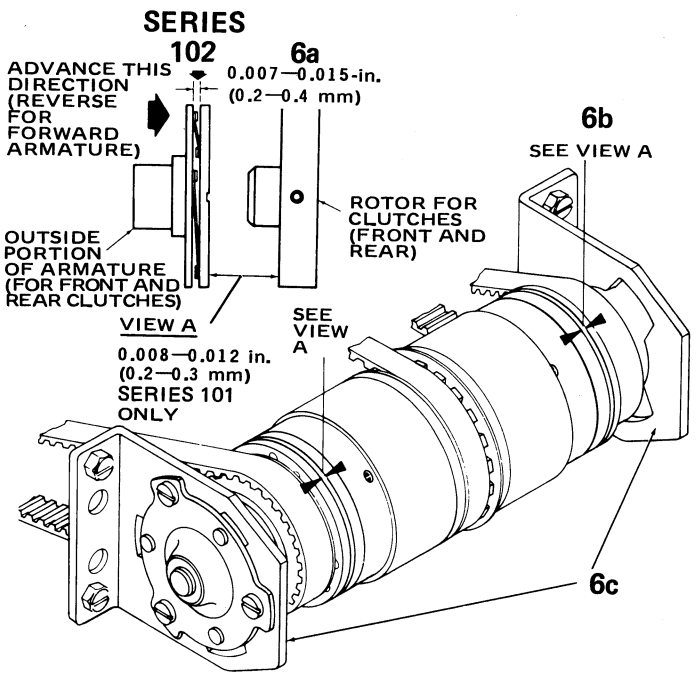
Note: Avoid use of any lubricant on the forward and reverse clutch surfaces.

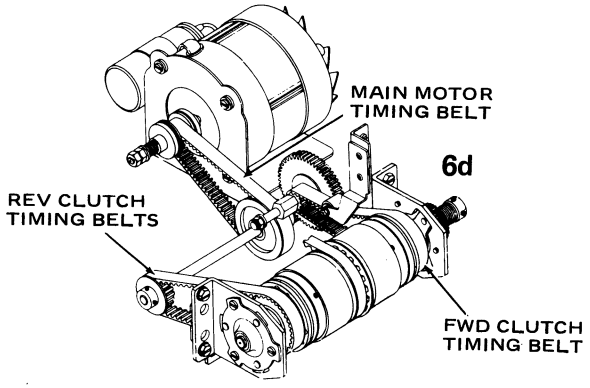
c) For Series 101, verify no end-play on forward and reverse clutch bushing brackets (5.2.3.3).

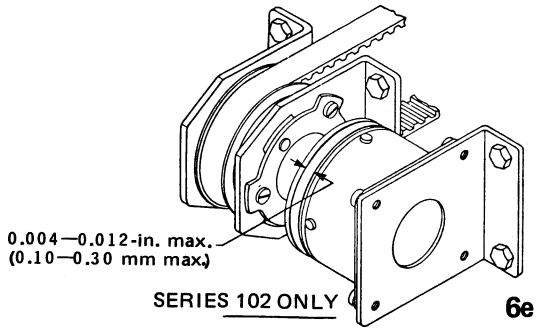
d) Verify proper tension on main motor and forward and reverse clutch timing belts (5.2.3.3).

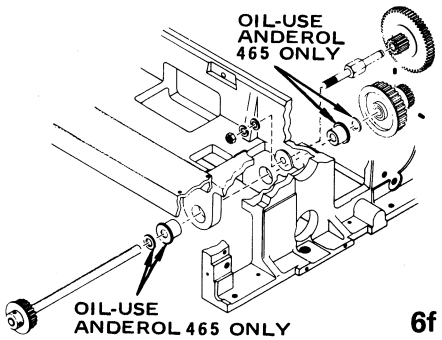
e) For Series 102 only, verify uniform gap between surfaces on brake assembly (See Fig. 6C) (5.2.11.3)

f) Oil intermediate shaft and felt washer at forward and reverse bushings. (See Fig. 6F) (5.2.3.3)


SERIES
102
6a
ADVANCE THIS DIRECTION (REVERSE FOR FORWARD ARMATURE)
0.007—0.015-in.
(0.2—0.4 mm)
6b
SEE VIEW A
ROTOR FOR CLUTCHES (FRONT AND REAR)
OUTSIDE PORTION OF ARMATURE (FOR FRONT AND REAR CLUTCHES)
VIEW A
SEE VIEW A
0.008—0.012 in.
(0.2—0.3 mm)
SERIES 101 ONLY
6c


MAIN MOTOR TIMING BELT
6d
REV CLUTCH TIMING BELTS
FWD CLUTCH TIMING BELT


0.004—0.012-in. max.
(0.10—0.30 mm max.)
SERIES 102 ONLY
6e


OIL-USE ANDEROL 465 ONLY
OIL-USE ANDEROL 465 ONLY
6f

6.3 TROUBLESHOOTING GUIDE

CENTRONICS
SERIES 100 PRINTERS
SERVICE GUIDE

The following information is intended to aid service personnel in developing good service procedures and troubleshooting techniques on any of Centronics' Series 100 printers.

When servicing the printer for any reason, a brief inspection and verification of the printer areas described below, may well prevent potential failures in the future.

To perform this inspection, it is only necessary to open, not remove, the printer covers.

With printer power off:

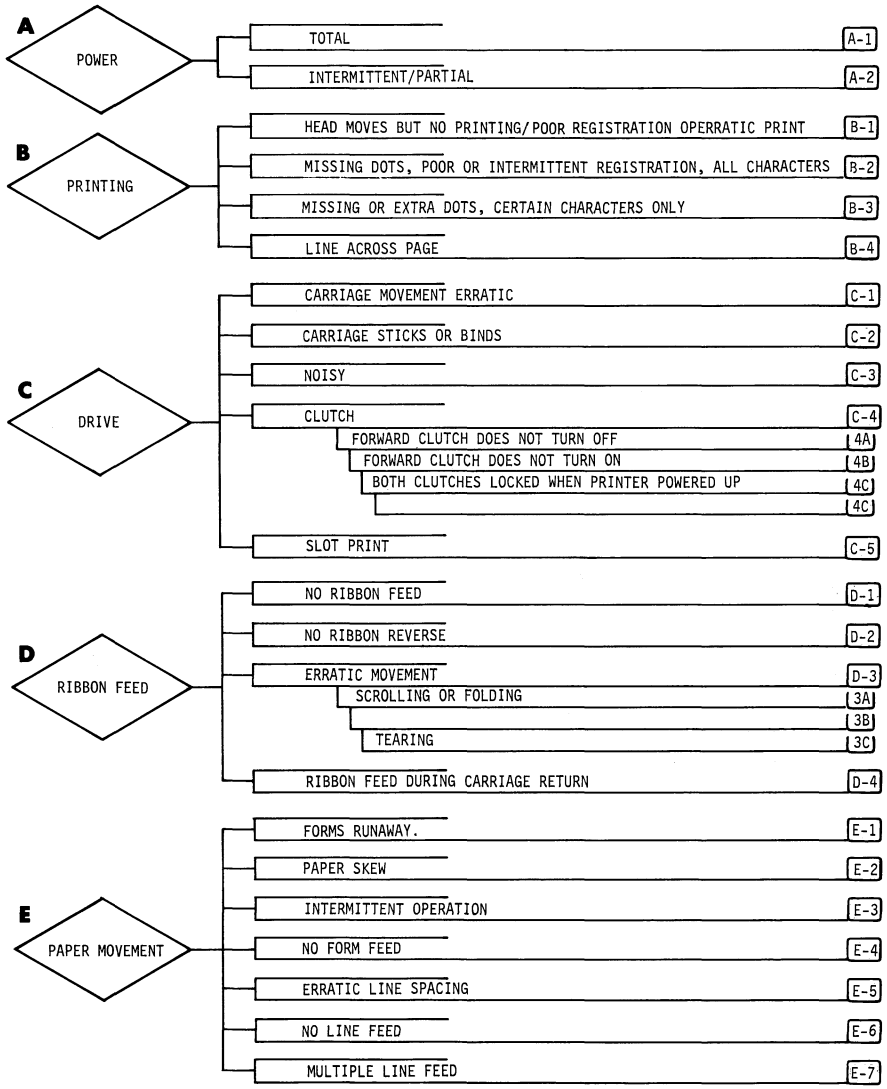
1. Verify that the timing fence is clean and that a proper gap exists between the optics and the fence.
2. Verify that the carriage guide bar is clean and free of caked on dirt.
3. Verify proper tension on the main drive belt.
4. Verify smooth, free carriage motion.
5. Verify that the RTP and EOP switches are not loose.
6. Verify that the rubber bumper on the damper is not loose.
7. Verify that the backstop pawl spring is in place and not loose.
8. Check the forward/reverse clutch gap.*
9. Check the pin alignment on the pin-feed tractor units.
10. Check pin-belt tension.

With printer power on:

11. Check position of VFU paper tape over the light holes to insure proper detection of vertical tab and form feed signals.
12. Check damper operation and verify that there is no binding of the carriage stopper lever.
13. Check for smooth operation of the line feed clutch.

(AIR-GAP CLUTCH ONLY)

PRINTER MALFUNCTION CHART
MODEL
101AL



A. POWER

A-1 TOTAL

1. Damaged power chord.
2. Open AC line fuse (F5).
3. Open 5V supply fuse (F1).

A-2 INTERMITTENT-PARTIAL

1. Defective +5V logic.
2. Defective ±12V logic.
3. Defective 30V unregulated supply.
4. Improper AC line voltage.

B. PRINTING

B-1 HEAD MOVES BUT NO PRINTING/POOR REGISTRATION OR ERRATIC PRINT

1. Dirty or defective timing fence.
2. Optic bundle out of adjustment.
3. Improper head position.
4. Defective Video Amplifier.
5. Defective Ribbon Cable.
6. Defective optics lamp or lamp holder.
7. Dirty board or cavity connectors.
8. Improper alignment of timing fence to optic slit.
9. Improper alignment of optics lamp filament.
10. Defective safety switch.
11. Improper main belt tension.
12. Defective Logic board.
13. Defective Driver board.

B-2 MISSING DOTS POOR OR INTERMITTENT PIN REGISTRATION ALL CHARACTERS

1. Improperly aligned, dirty or damaged timing fence.
2. Defective damper assembly.
3. Defective RTP or EOP switch.
4. Defective safety switch.
5. Defective Video Amplifier.
6. Defective Ribbon Cable.
7. Dirty head connector or board contacts.
8. Defective Driver board.
9. Improper adjustment of optic bundle.
10. Improper alignment of optics lamp.
11. Defective optics lamp or lamp holder.
12. Defective Logic board or fuses.
13. Improper print head position.
14. Improper adjustment of print head solenoid.

B-3 MISSING OR EXTRA DOTS, CERTAIN CHARACTERS ONLY

1. Defective ROM's.
2. Defective P.C. runs in character generator.
3. Improperly aligned, dirty or damaged timing fence.

B-4 LINES ACROSS PAGE

1. Improperly installed print head cover.
2. Improper penetration adjustment.
3. Defective print wires.
4. Defective Ribbon Cable.
5. Poor Logic board to Driver Board connection.
6. Defective Driver board.
7. Defective Logic board.

*(AIR-GAP CLUTCH ONLY)

C. DRIVE

C-1 CARRIAGE MOVEMENT ERRATIC

1. Gap on forward clutch * not uniform.
2. Improperly adjusted main drive belt.
3. Spring drum unwound or broken.
4. Main drive belt touching driver board cables.
5. Defective bushings.
6. Worn or missing teeth on main timing belt.
7. Defective RTP switch.
8. Defective motor pulley.
9. Improperly adjusted motor clutch plate.
10. Intermittent safety switch.
11. Defective drive pulleys or gears.
12. Dirty carriage guide bar.

C-2 CARRIAGE STICKS OR BINDS

1. Fiber optics bundle touching timing fence.
2. Drive belt too tight.
3. Clutch assembly and brackets too tight.
4. Improper forward clutch * gap.
5. Spring drum too tight.
6. Reverse clutch not releasing.
7. Restricted ribbon drive.

C-3 NOISY

1. Belts too tight.
2. Belt idler worn or rubbing against casting.
3. Improperly adjusted intermediate pulley.
4. Worn intermediate shaft or bushings.
5. Corroded clutch rotors or armature.
6. Poorly lubricated spring drum.

C-4 CLUTCH

C-4A Forward Clutch Does Not Turn Off

1. Defective EOP switch.
2. Defective Driver board.
3. Defective Logic board.
4. Improper clutch gap. *
5. No Video signal.
   a. Defective Video Amplifier.
   b. Defective optics lamp or socket.
   c. Defective Ribbon Cable.
   d. Improperly adjusted fiber optics.
   e. Dirty timing fence.

C-4B Forward Clutch Does Not Turn On

1. Defective -12V supply (F2).
2. Improper clutch gap.
3. Defective Driver board.
4. Defective Logic board.
5. Dirty or loose board connectors.
6. Improper clutch gap.*

C4-C Both Clutches Locked When Printer Powered Up

1. Improperly seated Logic board.
2. Defective Driver board.
3. Defective Logic board.

C4-D Reverse Clutch Does Not Turn Off

1. Defective RTP switch (check continuity to cavity).
2. Defective Driver board.
3. Defective Logic board.
4. Improper clutch gap.*
5. Dirty board or cavity connectors.

C-5 SLOW PRINT

1. Improper forward clutch* adjustment.
2. Improper reverse clutch * adjustment.
3. Improper main drive motor friction clutch adjustment.
4. Defective drive motor.
5. Dirty guide bars.
6. Improper belt tension.
7. Improper bushing seating in clutch end brackets.

D. RIBBON FEED

D-1 NO RIBBON FEED

1. Broken ribbon feed clutch springs.
2. Improper ribbon drive shaft gear mesh.
3. Loose ribbon drive slip clutch setting.
4. Improperly seated ribbon spool.
5. Improperly engaged bevel gears.

D-2 NO RIBBON REVERSE

1. Improper ribbon drive shaft gear mesh.
2. Loose ribbon drive slip clutch setting.
3. Broken clutch spring.
4. Frozen ribbon reversing rod (old design).
5. Improperly adjusted ribbon reversing rod.

D-3 ERRATIC MOVEMENT

D-3A Scrolling or Folding

1. Improperly adjusted guide roller.
2. Improperly adjusted rod linkage.

D-3B Too Slack

1. Worn tension arm pads (old units).

D-3C Tearing

1. Improperly adjusted drive linkage.
2. Sticking solenoid wires.
3. Defective Driver board.

D-4 RIBBON FEED DURING CARRIAGE RETURN.

1. Broken clutch control on ribbon feed clutch gear.

E. PAPER MOVEMENT

E-1 FORMS RUNAWAY

1. Defective or missing VFU tape.
2. Defective VFU lamps.
3. Excessive gap between VFU upper and lower reader bracket.
4. Improper alignment of reader bracket lamps to tapes holes.
5. Defective Logic board.
6. Continuously energized solenoid.
   a. Defective Driver board.
   b. Driver resistor shorted to bracket.
7. Solenoid slide movement restricted.

E-2 PAPER SKEW

1. Non-aligned pin feed sprockets.
2. Improper pin feed belt tension.
3. Paper pan friction against forms.
4. Pin feed holder paper thickness setting too small.
5. Print head too close to paper.
6. Incorrect paper feed (mostly in units without paper rack).

E-3 INTERMITTENT OPERATION

1. Improperly adjusted platen knob.
2. See Erratic Line Spacing.

E-4 NO FORM FEED

1. Gear mesh too tight.
2. Form feed motor clutch roller binding
3. Defective Driver board.
4. Defective Logic board.
5. Defective form feed resistor.
6. Defective solenoid.
7. Defective ±12V supply.
8. Defective 30V unregulated supply.
9. Defective TOP OF FORM switch.

E-5 ERRATIC LINE SPACING

1. Excessive platen knob backlash.
2. Excessive back stop pawl and cam mechanism play.
3. Improper upper and lower reader bracket gap.

E-6 NO LINE FEED

1. Improperly adjusted form feed magnet.
2. Solenoid loose on pole (must be seated in bracket).
3. Gap between slide and paper feed clutch inner dog.
4. Defective Driver board.
5. Defective Logic board.
6. Improper Logic board jumpers.
7. Defective platen knob assembly.
8. Defective solenoid.
9. Defective form feed resistor or bad solder connections.
10. VFU belt worm or slipping.
11. Solenoid slide binding.
12. Loose armature spring.

E-7 MULTIPLE LINE FEED

1. Improperly adjusted solenoid.
2. Defective solenoid armature spring.
3. Defective Driver board.
4. Defective Logic board.
5. Excessive line feed pulse width.
6. Magnetic field concentrating disc missing.
7. Solenoid slide binding.
8. Gap between slide and paper feed clutch inner dog.

SECTION 7
DRAWINGS AND LISTS OF MATERIALS, ELECTRICAL

This section contains the schematic, wiring and assembly diagrams and lists of materials for all the electronic assemblies in the Model 101AL.

Note

Refer to the Engineering Change Notice (ECN) sheets shipped with the printer for changes made to the printer which have not yet been incorporated into the drawings in this section. Always keep these Engineering Change Notice sheets with the manual.

LIST OF MATERIAL FOR ALPHA/NUMERIC PRINTER ASSEMBLY 101AL
(Reference: Ass'y Dwg. #63015121)

Item	Symbol	Part Number	Nomenclature	Quantity
1		562-121-000-01	Basic Machine (Brother Item)	1
2		63002323-1	Head Assembly	1
3		63002306-1	Video Amp. and Cable Ass'y	1
4		63002242-1	Comp. Bd. Ass'y, Power Driver	1
5		63015105-1	Cavity Ass'y	1
6		63015102-01-02-01	Comp. Bd. Ass'y, Logic/P.S. Board	1
7		63002314-2	Comp. Bd. Ass'y, Suppression Bd.	1
8		63002293-1	Twin Spool and Ribbon Ass'y	1
9		63002349-1	Pad Ass'y	1
10		63002321-1	Bracket Ass'y	1
11		63002248-1	Fibre Optics Head	1
12		63002292-1	Form Feed Tape	1
13		63002294-1	Ribbon Guide	2
14		63002300-1	Clip, P/C	1
15	(See Note 1)	63002278-10	Shim (.01 THK)	2
16		63002259-1	Lamp Housing	1
17		37253790	Lamp (G.E. 379)	1
18		39092502	Switch, SPST, P.B.	1
19		63002354-1	Cover Assembly	1
20		63015114-1	Spacer	1
21		63015119-2	Cable Ass'y, Data Input	1
22				
23				
24	F4	39030012	Fuse, 8A, S.B.	1
25	F5	39030004	Fuse, 5A, S.B.	1
26				
27				
28				
29		36150000	Clamp, Strain Relief Bushing	1
30		34507087	SCR, PAN/PHIL 2-56 x ⅛ Lg	3
31		34507127	SCR, PAN/PHIL 2-56 x 3/8 Lg	2
32		34000007	SCR, PAN/PHIL 3-48 x ⅛ Lg	2
33		34114161	SCR, HEX, SOC 4-40 x ½ Lg	2
34		34114201	SCR, HEX, SOC 4-40 x 5/8 Lg	2
35		34517327	SCR, PAN/PHIL 4-40 x 1.0 Lg	1
36		34527087	SCR, PAN/PHIL 6-32 x ⅛ Lg	2
37		34527127	SCR, PAN/PHIL 6-32 x 3/8 Lg	2
38		34527207	SCR, PAN/PHIL 6-32 x 5/8 Lg	1
39	(Metric)	34000028	SCR, HEX CAP, M5, P 0.8 x 22 Lg	1
40		36614417-70	Spacer ¼ Round x 1-1/16" long	2
41		34527407	Screw, Pan/Phil 6-32 x 1½ long	2
42		34902007	Washer, Flat No. 2	5
43				
44		34805007	Washer, LKG., No. 2	5
45		34000016	Washer, LKG., No. 3	2
46		34815007	Washer, LKG., No. 4	4
47		34825007	Washer, LKG., No. 6	6
48	(Metric)	34000029	Washer, LKG., M5	1
49				
50		30040000	Conformal Coating	AR
51		30000000	Insulating Varnish (GLPT)	AR
52		30070000	Solder, 60/40	AR
53				
REF		63015119	Level Breakdown	
54				
55		63015104-1	Comp. Bd. Ass'y, Conn. Bd.	1
56		36614416-40	Standoff, CL No. 6, 1.0 Lg	2
57		34517087	SCR, PAN/PHIL 4-40 x ⅛ Lg	5
58		34527107	SCR, PAN/PHIL 6-32 x 5/16 Lg	2
59		34527367	SCR, PAN/PHIL 6-32 x 1⅛ Lg	1
60	(See Note 2)	34527427	SCR, PAN/PHIL 6-32 x 1-5/8 Lg	1
61	(See Note 5)	63002258-1	Data Input Cable	1
62		34815005	Lock Washer, Int. Tooth No. 4	1

Note:
1. Item 15, Part No. 63002278-10 (.010 THK), most commonly used; however, use thickness req'd. to meet ass'y spec.
2. Item 60 used in place of Item 38.
3. Item 21 not used.
4. Items 32 and 45 may or may not be used depending upon interface cable req'd.
5. Items 55-60 are for the Connector Board.
6. Data Input Cable 63015119-2 to the used without connector board.

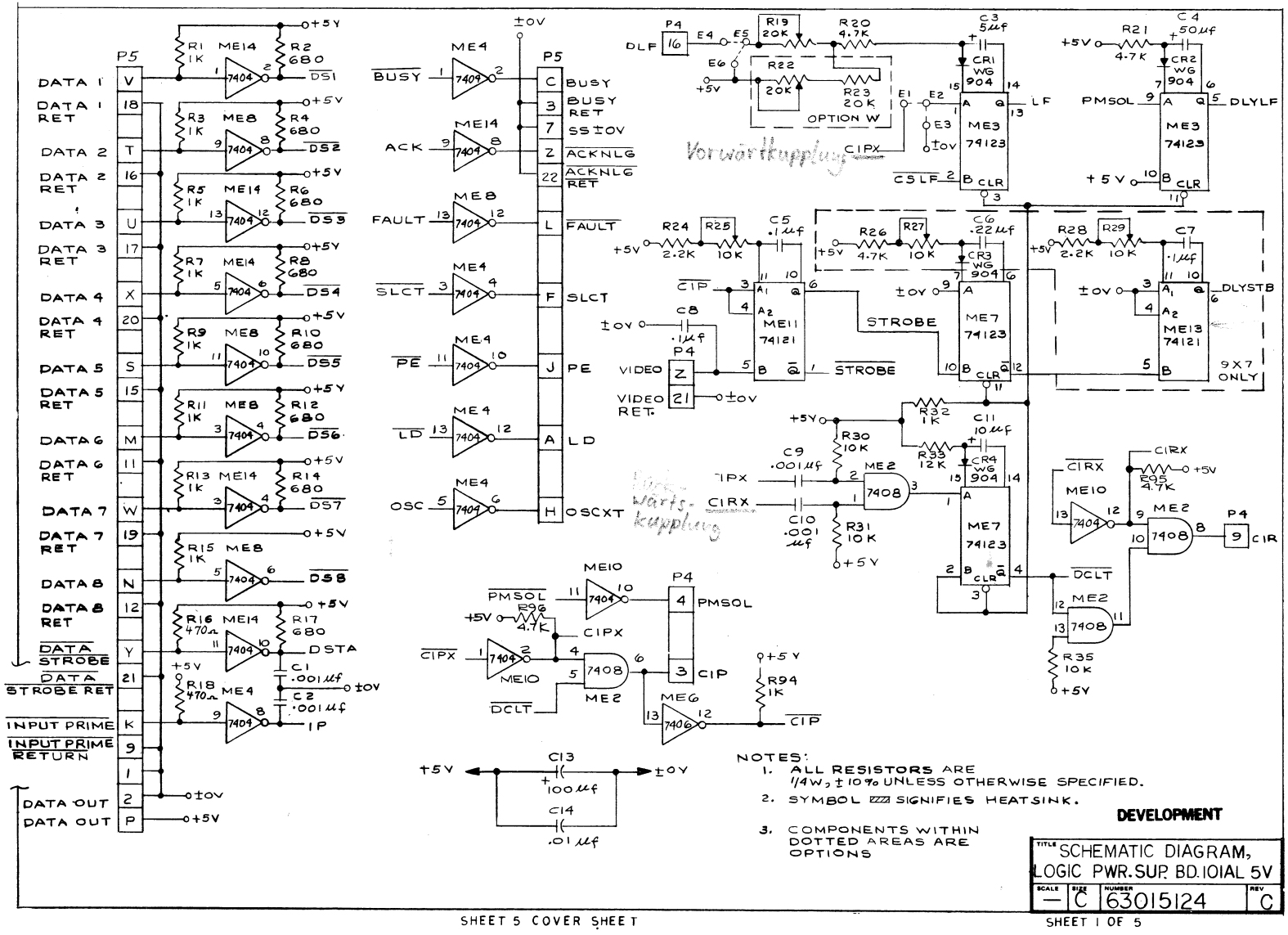


Figure 7-1. SCHEMATIC DIAGRAM, LOGIC/P.S. BOARD +5V (SHEET 1 OF 4)

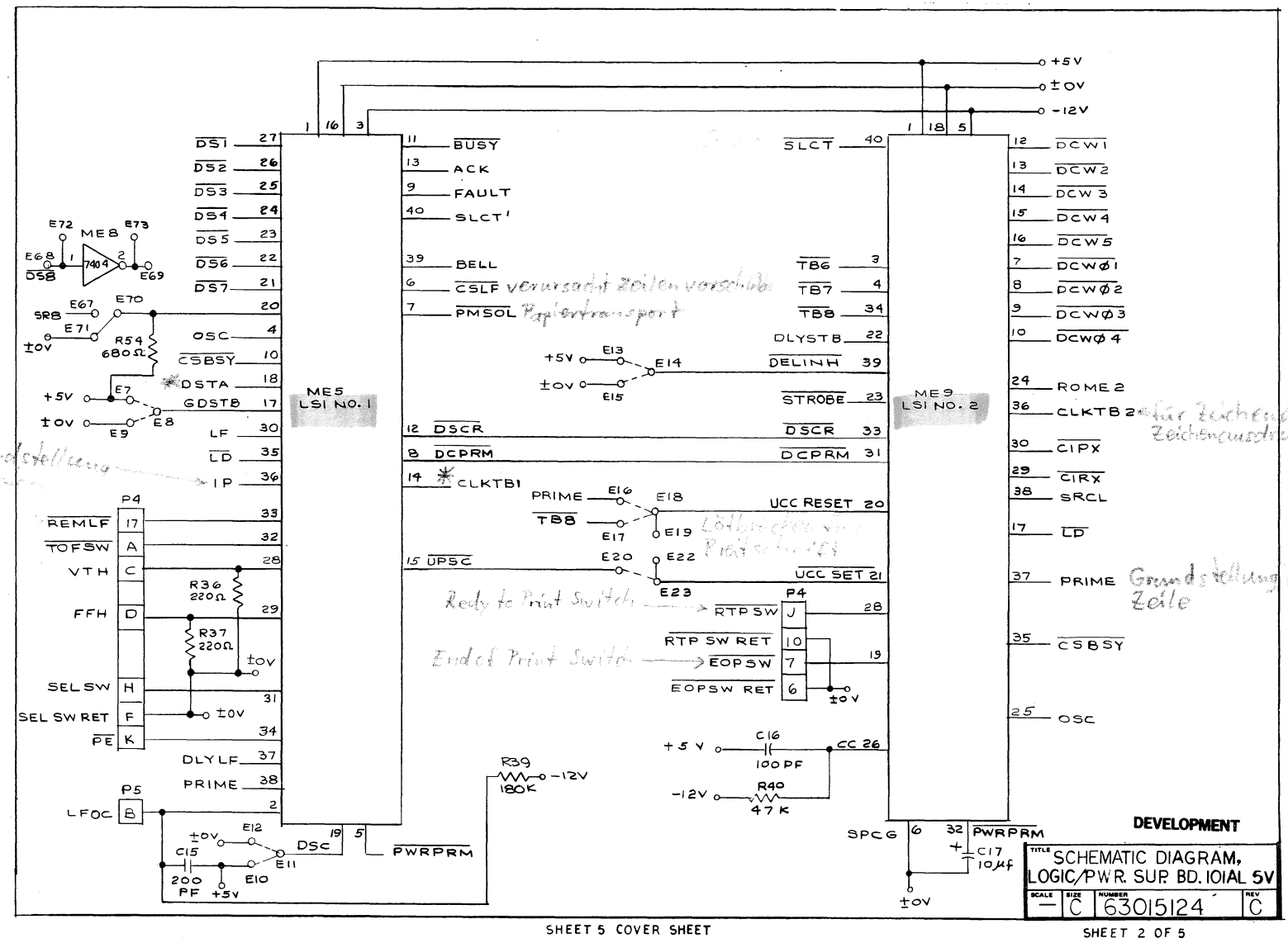


Figure 7-2. SCHEMATIC DIAGRAM, LOGIC/P.S. BOARD +5V (SHEET 2 OF 4)

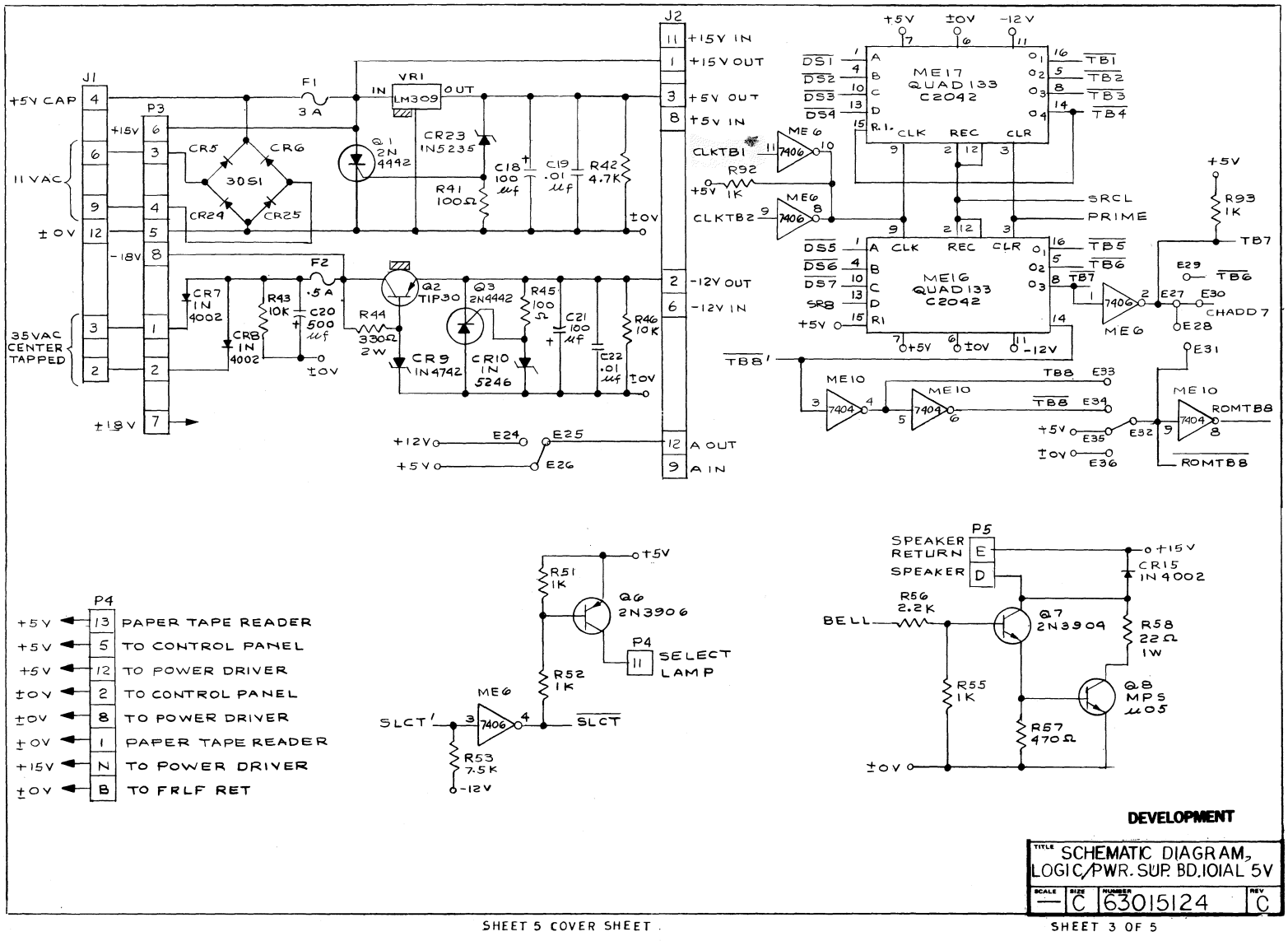


Figure 7-3. SCHEMATIC DIAGRAM, LOGIC/P.S. BOARD +5V (SHEET 3 OF 4)

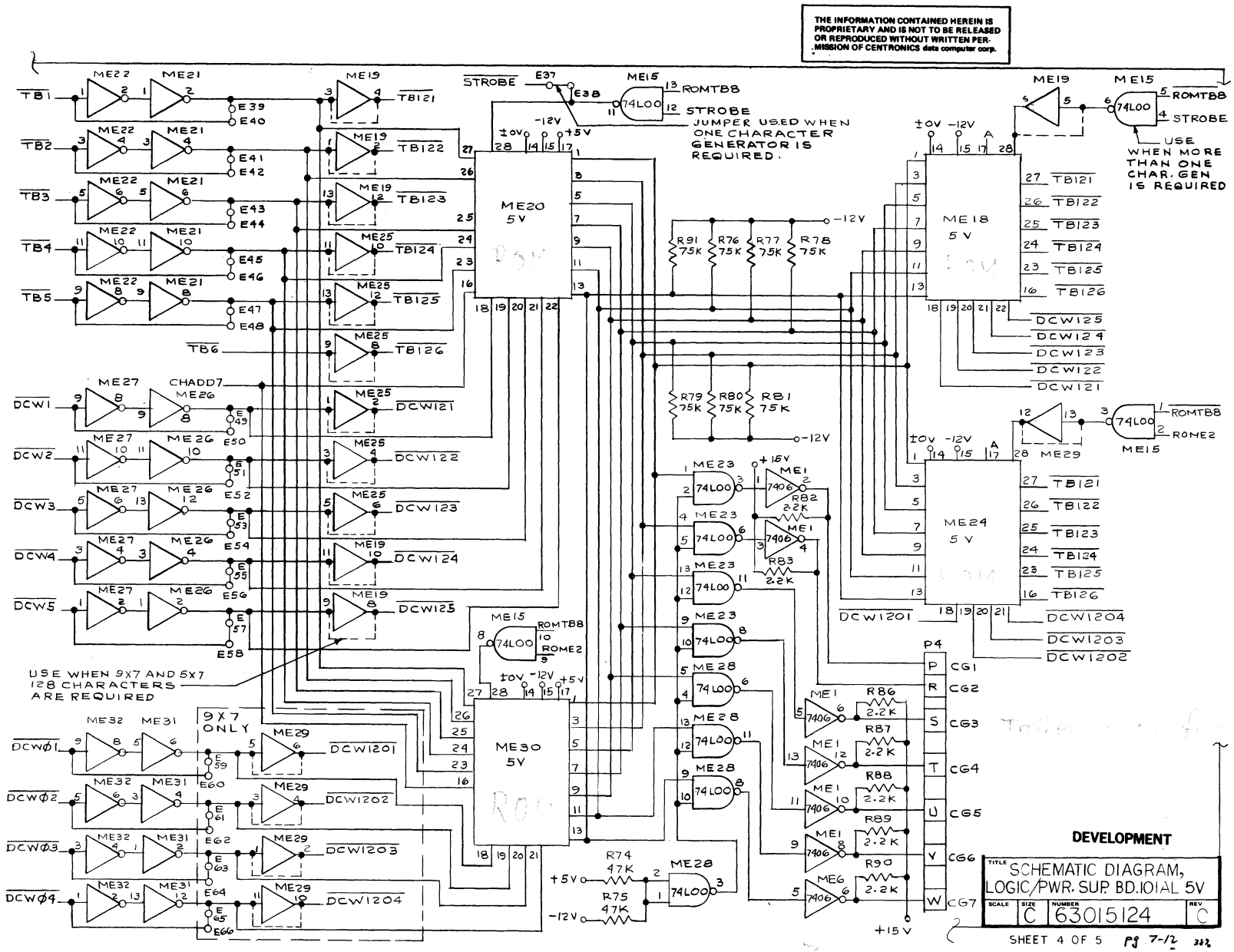


Figure 7-4. SCHEMATIC DIAGRAM, LOGIC/P.S. BOARD +5V (SHEET 4 OF 4)

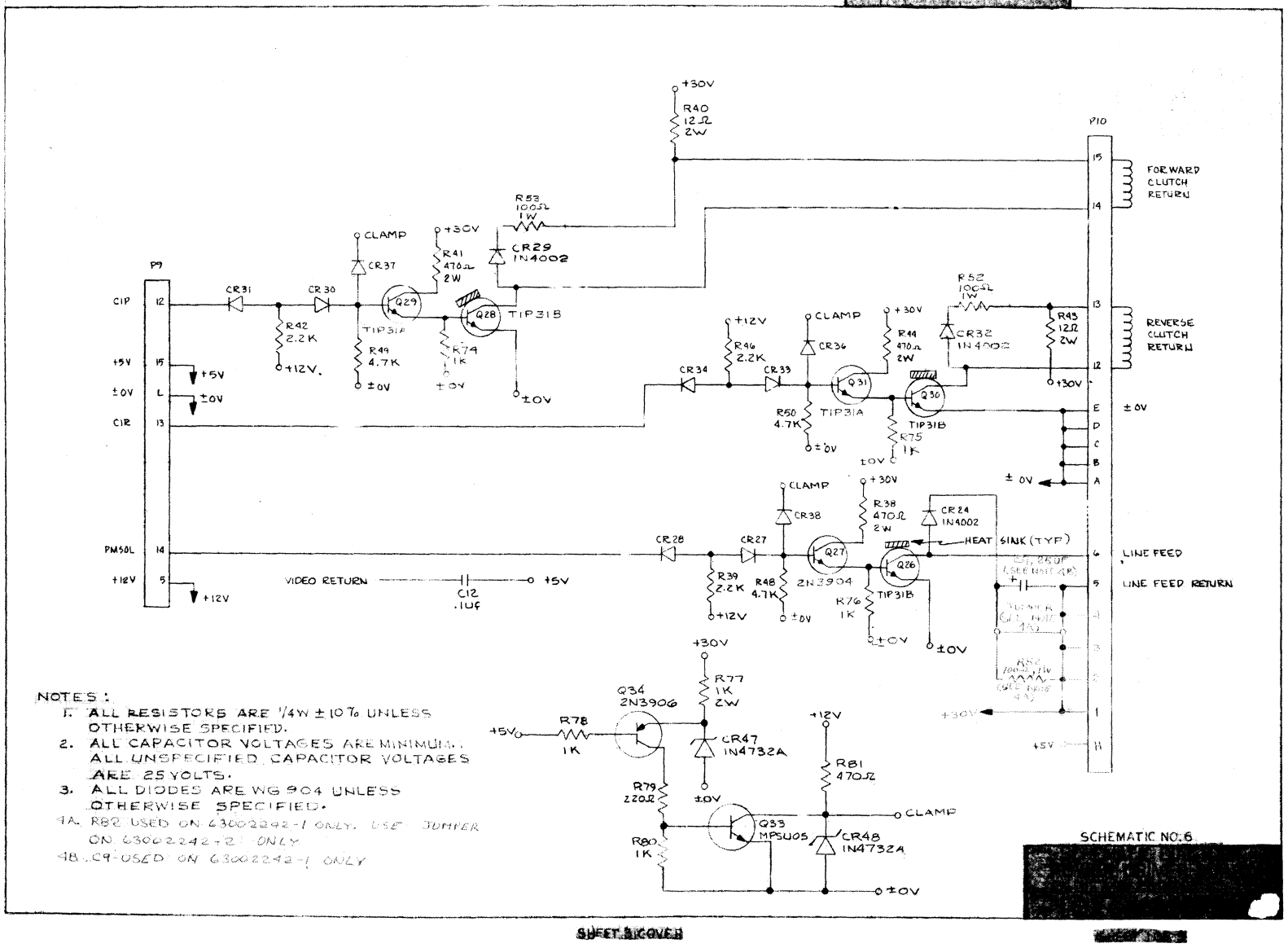


Figure 7-5. SCHEMATIC DIAGRAM, POWER DRIVER BOARD (SHEET 1 OF 2)

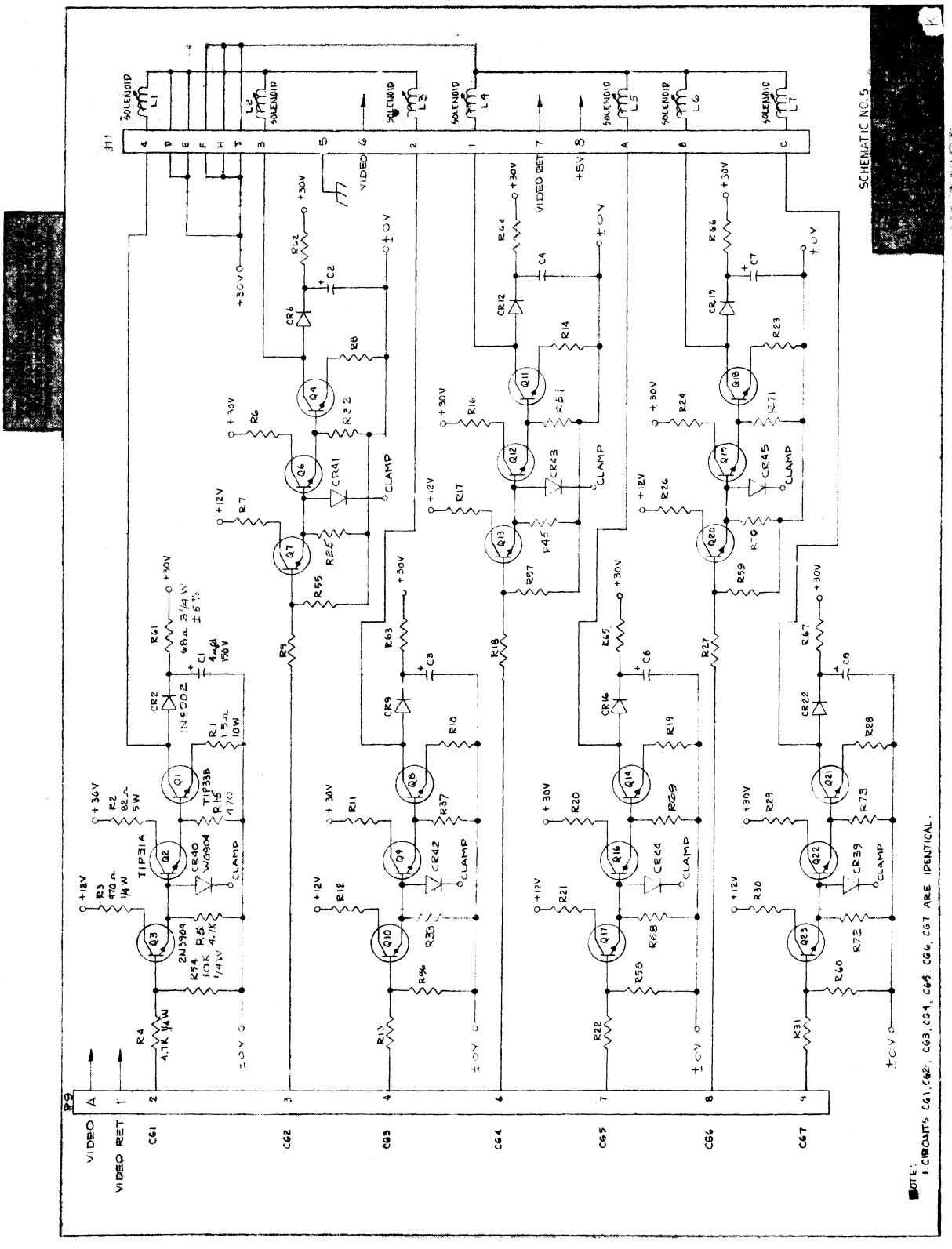


Figure 7-6. SCHEMATIC DIAGRAM, POWER DRIVER BOARD (SHEET 2 OF 2)

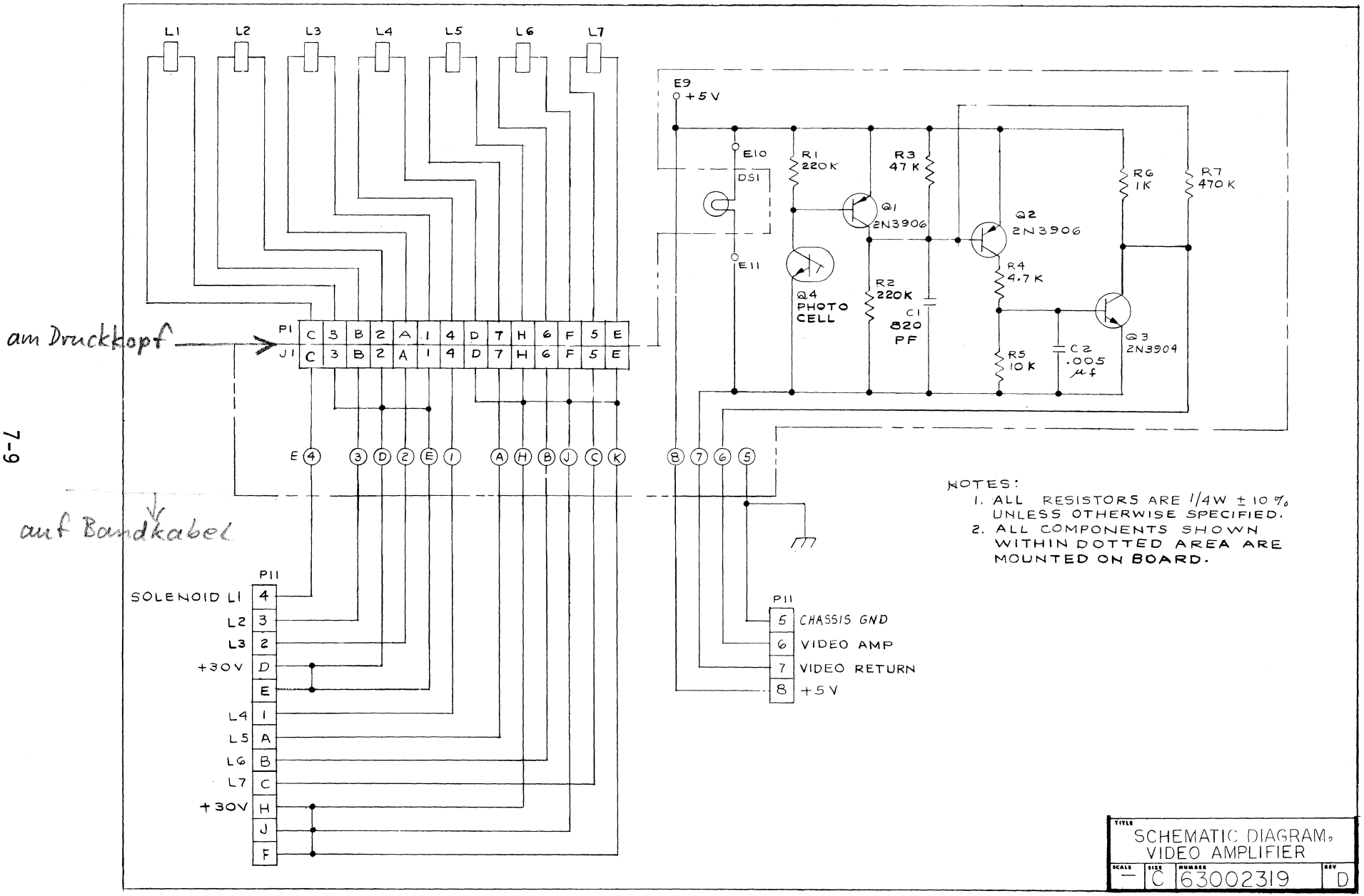
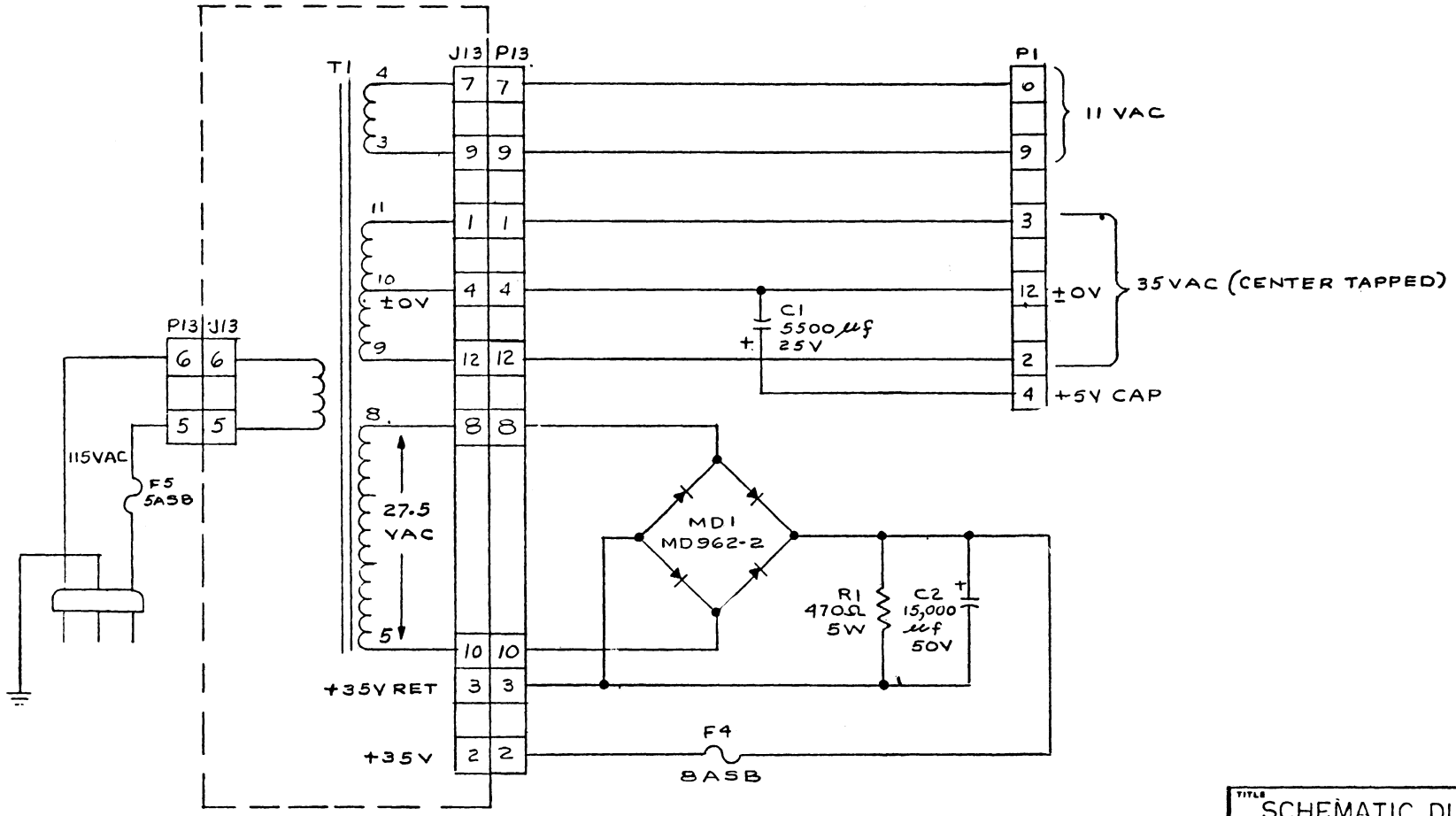


Figure 7-7. SCHEMATIC DIAGRAM, VIDEO AMPLIFIER



TITLE			
SCHEMATIC DIAGRAM, POWER CONNECTIONS 101AL			
SCALE	SIZE	NUMBER	REV
—	C	63015120	—

SHEET 1 OF 2

Figure 7-8. SCHEMATIC DIAGRAM, POWER CONNECTIONS 101AL

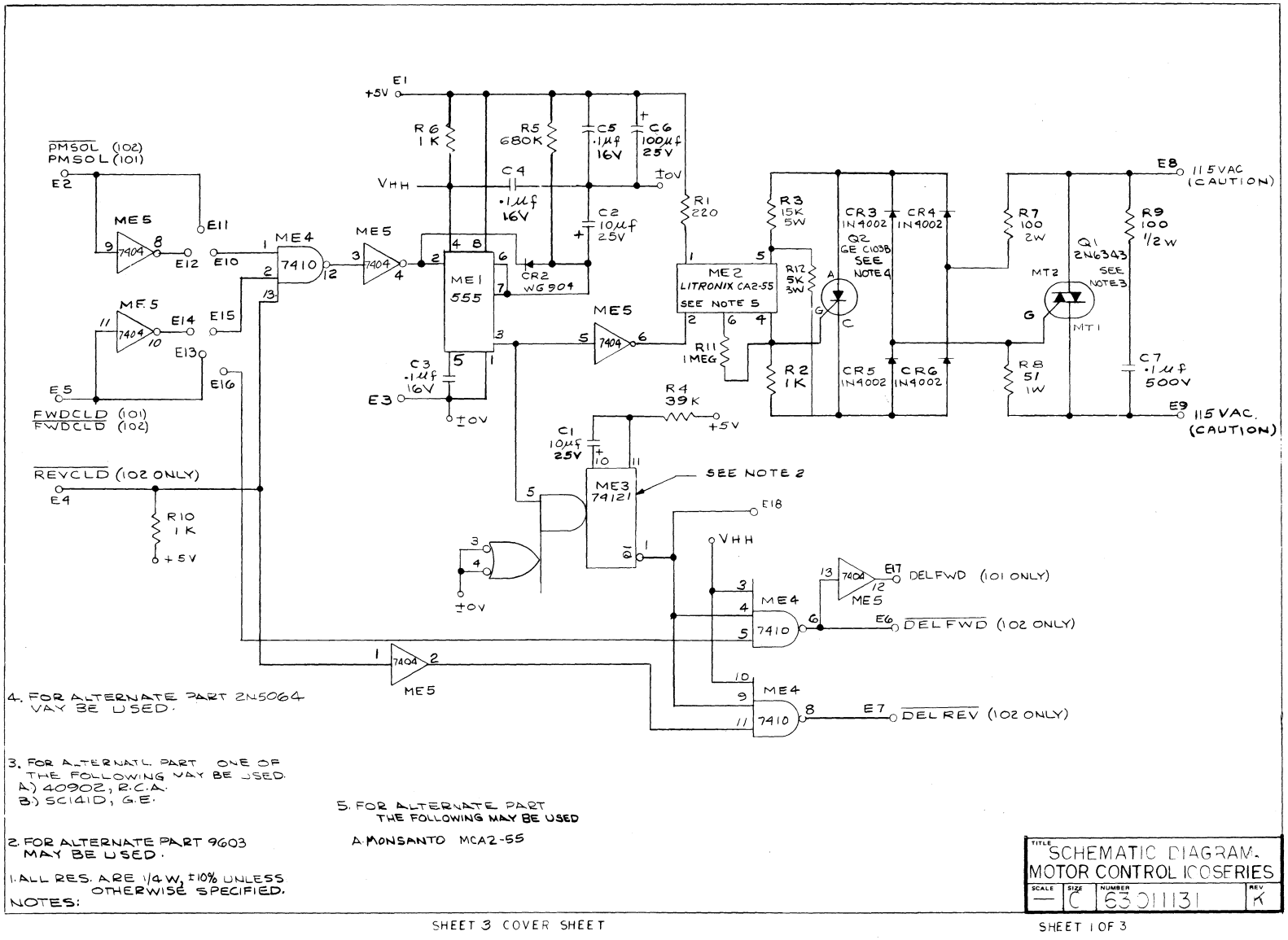


Figure 7-9. SCHEMATIC DIAGRAM, MOTOR CONTROL

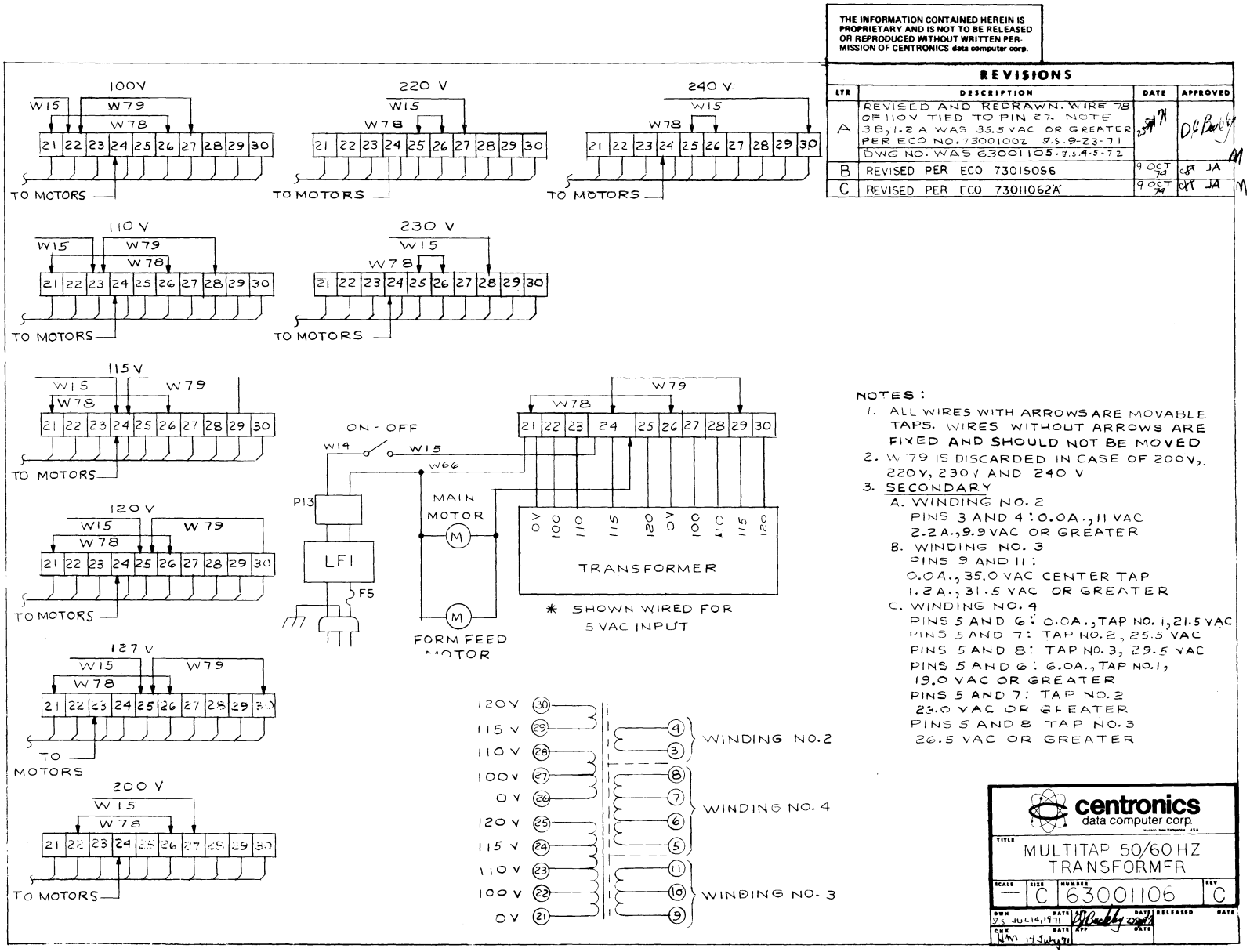


Figure 7-10. MULTITAP TRANSFORMER 50/60 HZ

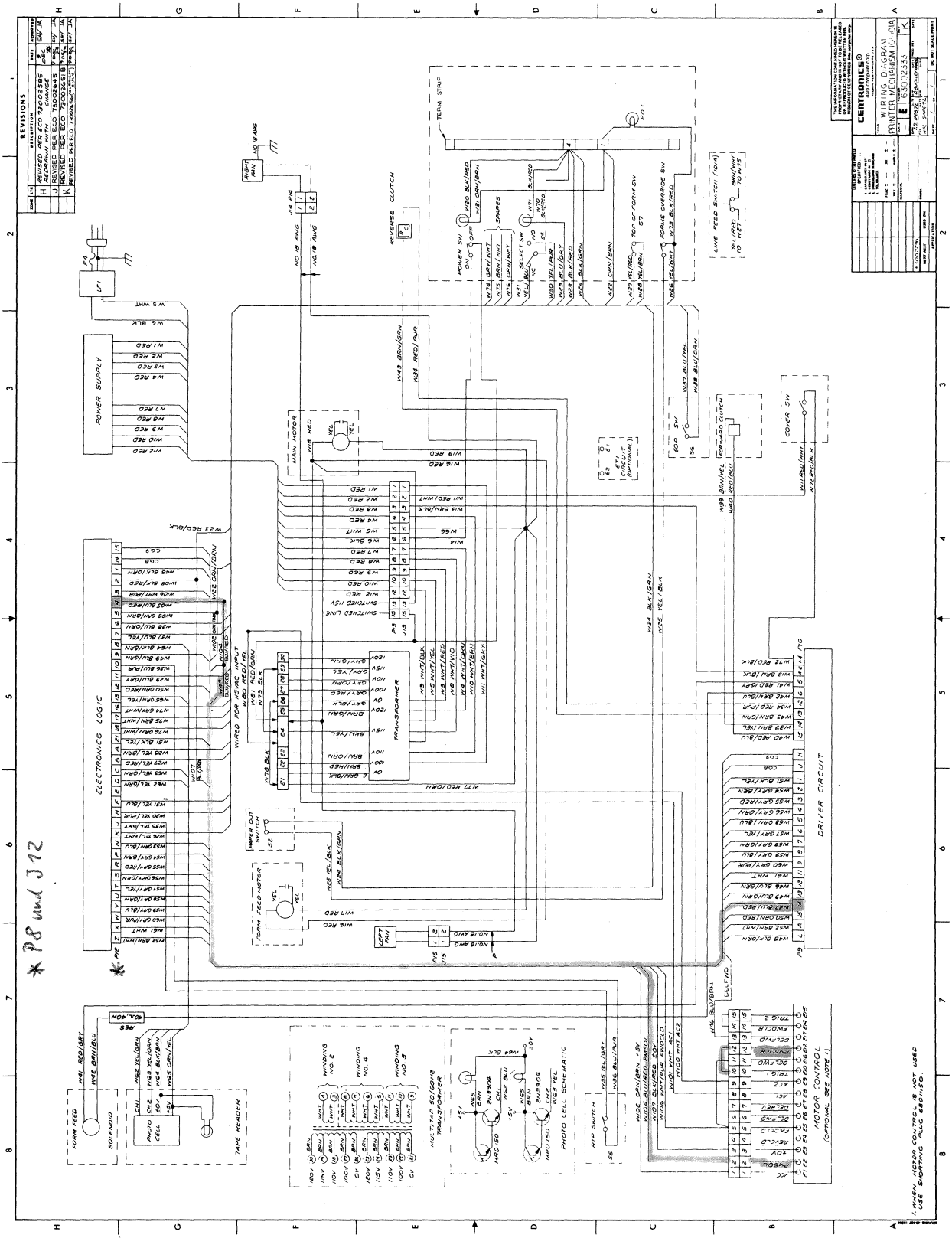


Figure 7-11. WIRING DIAGRAM, PRINTER MECHANISM

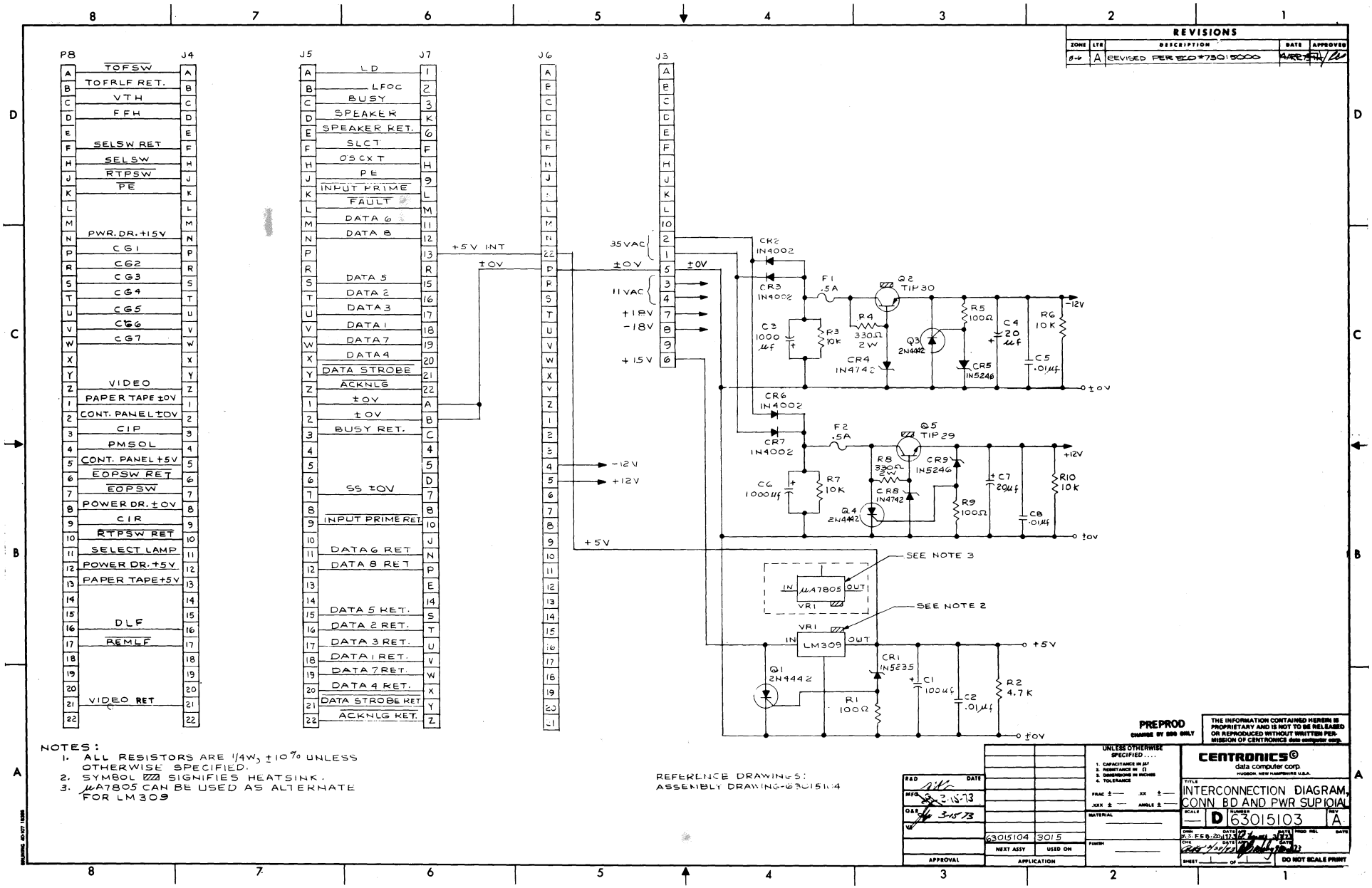


Figure 7-12. INTERCONNECTION DIAGRAM, CONNECTOR BOARD AND POWER SUPPLY

This illustration is intended to aid the reader in following the 101AL printer wiring diagram (Dwg. #63002333).

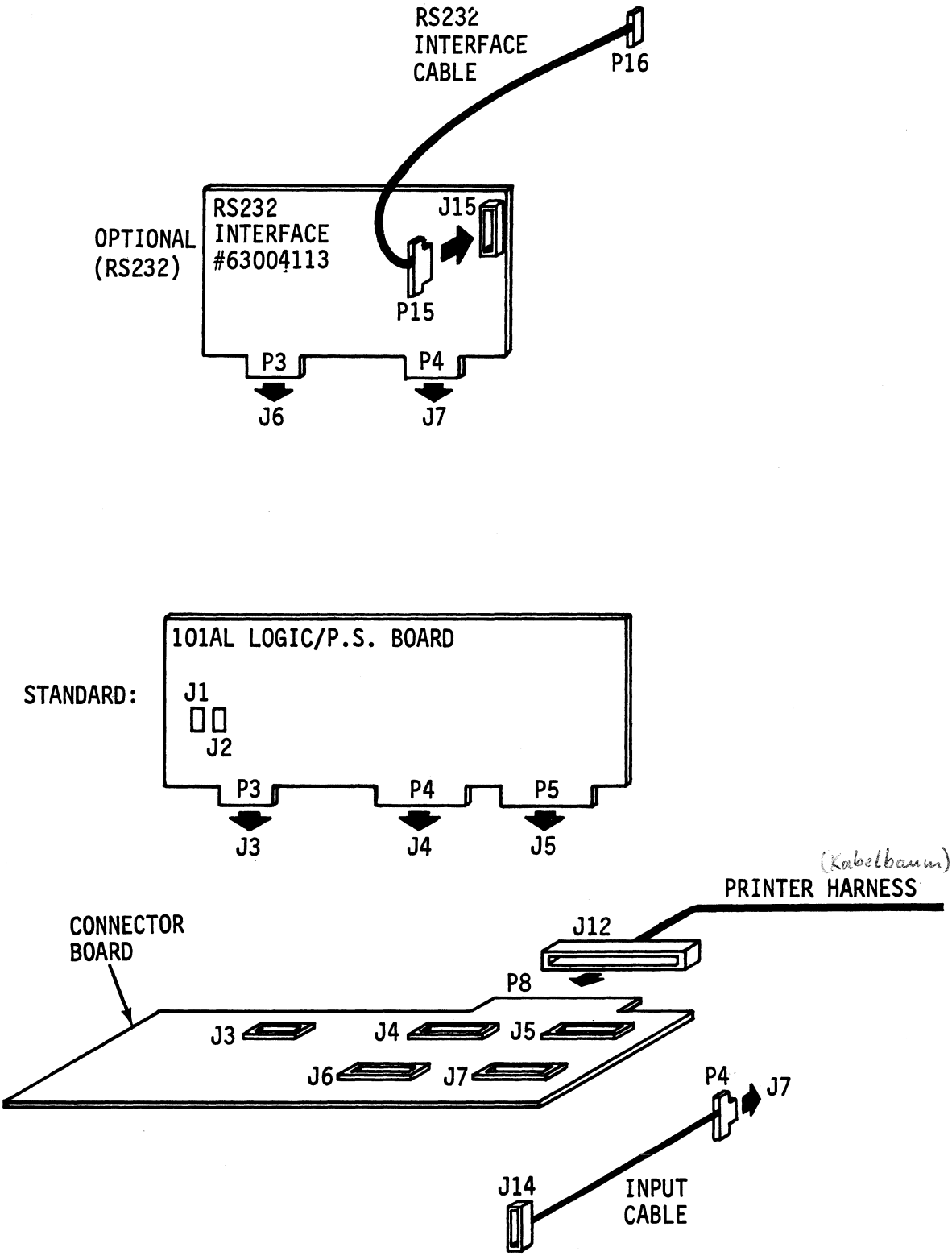


Figure 7-13. 101AL CONNECTOR CONFIGURATION

J14 vom Controller
siehe auch 7-35

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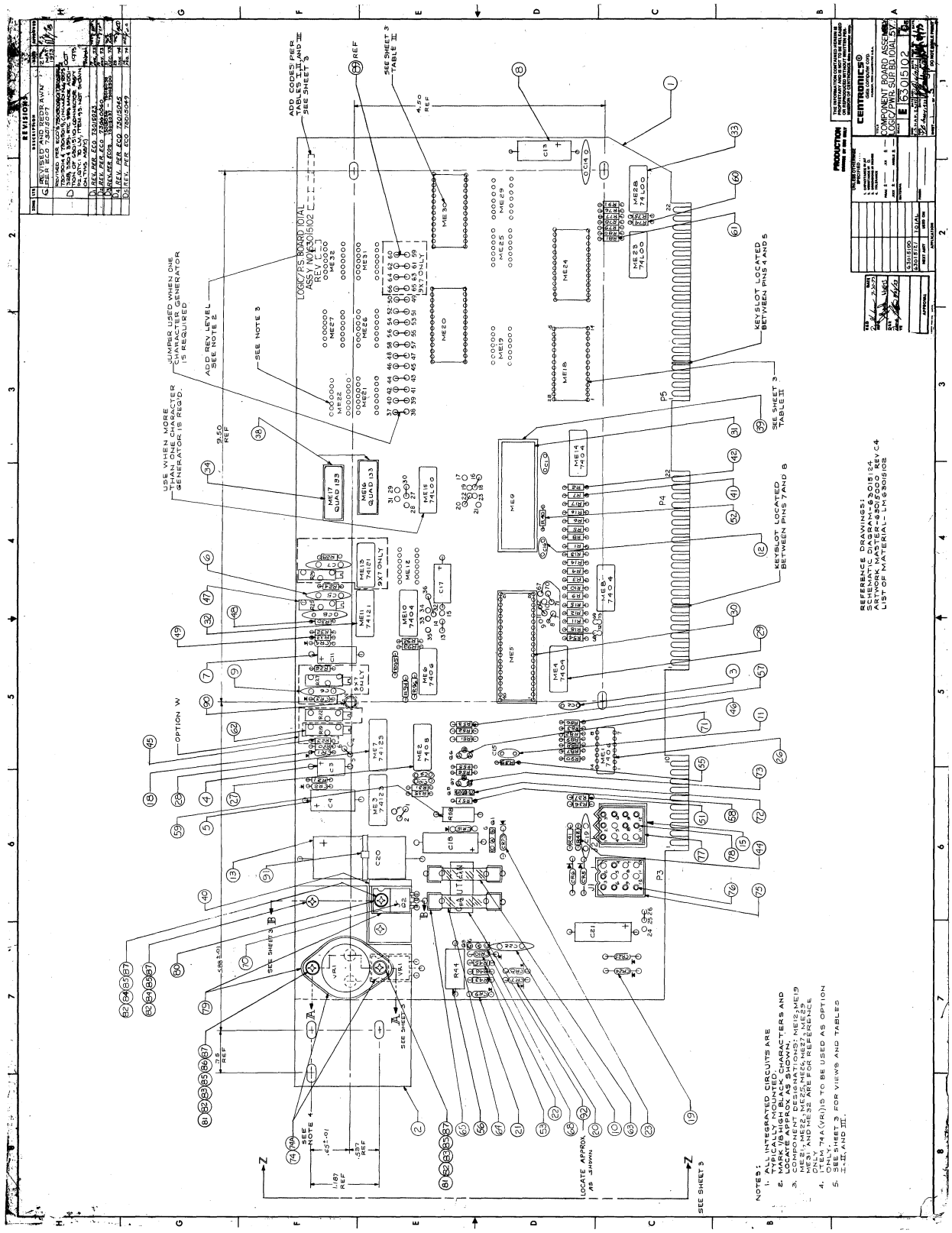


Figure 7-14. COMPONENT BOARD ASSEMBLY, LOGIC/P.S. BOARD +5V (SHEET 1 OF 3)

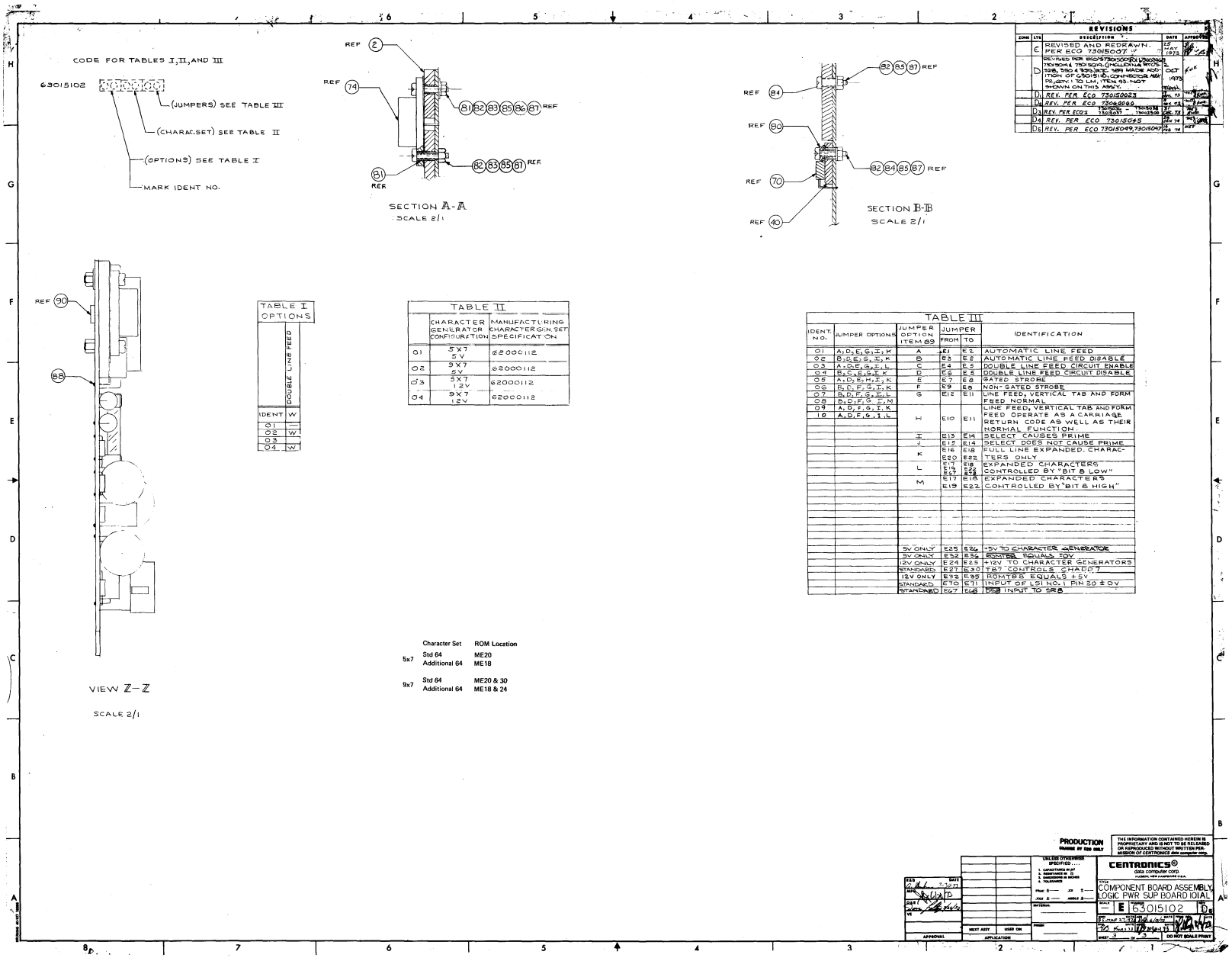
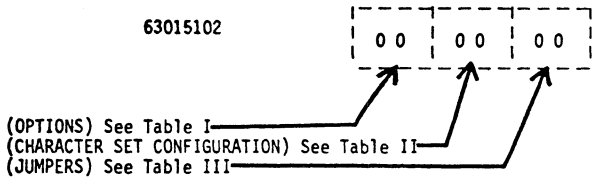


Figure 7-15. COMPONENT BOARD ASSEMBLY, LOGIC/P.S. BOARD +5V (SHEET 3 OF 3)

LIST OF MATERIAL FOR
LOGIC/POWER SUPPLY BOARD
(63015102)

NOTES:

1. See sheet 3 of drawing for board assembly configuration to determine LM items required.



Item	Symbol	Part Number	Nomenclature	Quantity
1		53015001-1	Component Board	1
2		63015109-1	Heat Sink, Logic Card	1
3	C1, C2	21102000	Capacitor, .001 µf, 1KV	4
-	C9, C10	21102000	Capacitor, .001 µf, 1KV	-
4	C3	22505002	Capacitor, 5 µf, 16V	1
5	C4	22506002	Capacitor, 50 µf, 25V	1
6	C5, C7	21104001	Capacitor, .1 µf, 16V	3
-	C8	21104001	Capacitor, .1 µf, 16V	-
7	C11, C17	22106002	Capacitor, 10 µf, 25V	2
8	C13	22107002	Capacitor, 100 µf, 25V	2
-	C21	22107002	Capacitor, 100 µf, 25V	-
9	C6	21224000	Capacitor, .22 µf, 12V	1
10	C14	21103003	Capacitor, .01 µf, 1000V	2
-	C22	21103003	Capacitor, .01 µf, 1000V	-
11	C15	21201000	Capacitor, 200 pf, 1000V	1
12	C16	21101001	Capacitor, 100 pf, 1KV	1
13	C20	22507000	Capacitor, 500 µf, 50V	1
10A	C14, C22	21103004	Capacitor, .01 uf 50V	2

Item	Symbol	Part Number	Nomenclature	Quantity
14				
15	P2	63015110	Connector Ass'y	
16				
17				
18	CR1, CR2	38100904	Diode, WG904	4
-	CR3, CR4	38100904	Diode, WG904	-
19				
20	CR7, CR8	38040020	Diode, IN4002	3
-	CR15	38040020	Diode, IN4002	-
21	CR9	38047420	Diode, IN4742	1
22	CR10	38052460	Diode, IN5246	1
23				
24				
25				
26	ME1, ME6	35474060	Integrated Circuit, 7406	2
27	ME2	35474080	Integrated Circuit, 7408	1
28	ME3, ME7	35474123	Integrated Circuit, 74123	2
29	ME4, ME8	35474040	Integrated Circuit, 7404	4
-	ME10, ME14	35474040	Integrated Circuit, 7404	-
30	ME5	35512009	Integrated Circuit, LSI No. 1	1
31	ME9	35512010	Integrated Circuit, LSI No. 2	1
32	ME11, ME13	35474121	Integrated Circuit, 74121	2
33	ME15, ME23	35574000	Integrated Circuit, 74L00	3
-	ME28	35574000	Integrated Circuit, 74L00	-
34	ME16, ME17	35514811	Integrated Circuit, Quad 133	2
35				
36				
37				
38		31410001-6	Socket I/C 16 Pin	2
39		31410000	Socket, I/C, 40 Pin, P/C	2

Refer to the beginning of this section for possible changes not yet incorporated on this page.

LIST OF MATERIAL FOR
LOGIC/POWER SUPPLY BOARD
(63015102)

Item	Symbol	Part Number	Nomenclature	Quantity
40		63015122-1	Heat Sink, Transistor	1
41	R1, R3	41102926	Resistor, 1K, ¼W, ±10%	15
-	R5, R7	41102926	Resistor, 1K, ¼W, ±10%	-
-	R9, R11	41102926	Resistor, 1K, ¼W, ±10%	-
-	R13, R15	41102926	Resistor, 1K, ¼W, ±10%	-
-	R32, R51	41102926	Resistor, 1K, ¼W, ±10%	-
-	R52, R55	41102926	Resistor, 1K, ¼W, ±10%	-
-	R92, R93	41102926	Resistor, 1K, ¼W, ±10%	-
-	R94	41102926	Resistor, 1K, ¼W, ±10%	-
42	R2, R4	41681926	Resistor, 680 ohms, ±10%	9
-	R6, R8	41681926	Resistor, 680 ohms ±10%	-
-	R10, R12	41681926	Resistor, 680 ohms, ±10%	
-	R14, R17	41681926	Resistor, 680 ohms, ±10%	-
-	R54	41681926	Resistor, 680 ohms, ±10%	-
43				
44	R20, R21	41472926	Resistor, 4.7K, ±10%	5
-	R26, R95, R96	41472926	Resistor, 4.7K, ±10%	-
45				
46	R24, R28	41222926	Resistor, 2.2K, ±10%	10
-	R56, R82	41222926	Resistor, 2.2K, ±10%	-
-	R83, R86	41222926	Resistor, 2.2K, ±10%	-
-	R87, R88	41222926	Resistor, 2.2K, ±10%	-
-	R89, R90	41222926	Resistor, 2.2K, ¼W, ±10%	-
47	R25, R27	46103910	Resistor, 10K POT	3
-	R29	46103910	Resistor, 10K POT	-
48	R30, R31	41103926	Resistor, 10K, ¼W, ±10%	5
-	R35, R43	41103926	Resistor, 10K, ¼W, ±10%	-
-	R46	41103926	Resistor, 10K, ¼W, ±10%	-

Item	Symbol	Part Number	Nomenclature	Quantity
49	R33	41123926	Resistor, 12K, ¼W, ±10%	1
50				
51	R36, R37	41221926	Resistor, 220 ohms, ¼W, ±10%	2
52	R40	41473926	Resistor, 47K, ¼W, ±10%	1
53	R45	41101926	Resistor, 100 ohms, ¼W, ±10%	1
54				
55	R39	41184926	Resistor, 180K, ¼W, ±10%	1
56	R44	41331026	Resistor, 330 ohms, 2W, ±10%	1
57	R53	41752926	Resistor, 7.5K, ¼W, ±10%	1
58	R57, R16,R18	41471926	Resistor, 470 ohms, ¼W, ±10%	3
59	R58	41220016	Resistor, 22 ohms, 1W, ±10%	1
60	R74, R75	41473926	Resistor, 47K, 1W, ±10%	2
61	R76, R77	41753926	Resistor, 75K, 1W, ±10%	7
-	R78, R79	41753926	Resistor, 75K, 1W, ±10%	-
-	R80, R81	41753926	Resistor, 75K, 1W, ±10%	-
-	R91	41753926	Resistor, 75K, 1W, ±10%	-
62	R19	46203381	Resistor, 20K POT	1
63				
64	F2	39030018	Fuse, .5 AMP	1
65		31350003	Fuse Clip, (102068 CRAMER)	2
66				
67				
68	Q3	38244420	Transistor, 2N4442	1
69				
70	Q2	38200300	Transistor, Tip 30	1
71	Q6	38239060	Transistor, 2N3906	1
72	Q8	38300050	Transistor, MPSμ05	1
73	Q7	38239040	Transistor, 2N3904	1

LIST OF MATERIAL FOR
LOGIC/POWER SUPPLY BOARD
(63015102)

Item	Symbol	Part Number	Nomenclature	Quantity
74				
74A				
75	J1	31300008-1	Connector, Molex, 1360P	1
76		31240021-2	Pin, Molex, Male, 02-09-2133	6
77	J2	31340008-2	Connector, Molex, 1360R-1	1
78		31240021-1	Pin, Molex, Female, 02-09-1133	8
79		30050000	Silicone Compound	AR
80		35000004-5	Washer, Ins. Nylon	2
81		39690200-9	Sleeving, Ins. Teflon, .25 Lg	AR
82		30000000	Insulating Varnish, Glyptl	AR
83		34517207	Screw, PAN HD/PHIL, No. 4-40 x 5/8 Lg	2
84		34517167	Screw, PAN HD/PHIL, No. 4-40 x ½ Lg	3
85		34815007	Washer, Lock, Int. Tooth, No. 4	5
86		34912007	Washer, Flat, No. 4	2
87		34712007	Nut, Hex, No. 4-40 UNC -2B	5
88		30070000	Solder (60/40)	AR
89		39610000-5	Wire, Bus, No. 22 AWG	AR
90		34059261-1	Self-Clinching Insert (KF2-632)	1
91		39690010-2	Cable Tie 5½"	1
92		62000111-1	Caution Label	1

LIST OF MATERIAL FOR
LOGIC/POWER SUPPLY BOARD
(63015102)
DOUBLE LINE FEED OPTION W

Item	Symbol	Part Number	Nomenclature	Quantity
45	R23	41203926	Resistor, 20K, ¼W, ±10%	1
62	R22	46203381	Resistor, 20K POT	1

LIST OF MATERIAL FOR
LOGIC/POWER SUPPLY BOARD
(63015102)
+5V POWER SUPPLY

Item	Symbol	Part Number	Nomenclature	Quantity
8	C18	22107002	Capacitor, 100 µf, 25V	1
10	C19	21103003	Capacitor, .01 µf, 1000V	1
19	CR5, CR6	38130901	Diode, 30S1	4
-	CR24, CR25	38130901	Diode, 30S1	-
23	CR23	38052350	Diode, IN5235	1
44	R42	41472926	Resistor, 4.7K, ¼W, ±10%	1
53	R41	41101926	Resistor, 100 ohms, ¼W, ±10%	1
63	F1	39030011	Fuse 3 AMP	1
68	Q1	38244420	Transistor, 2N4442	1
74	VR1	35203090	Voltage Regulator, LM309	1
74A	VR1 (OPTION)	35207800	Voltage Regulator, µA(7805)	1
65		31350003	Fuse Clip (102068 Cramer)	-
10A	C19	21103004	Capacitor, .01 uf, 50V	2
				1

Refer to the beginning of this section for possible changes not yet incorporated on this page.

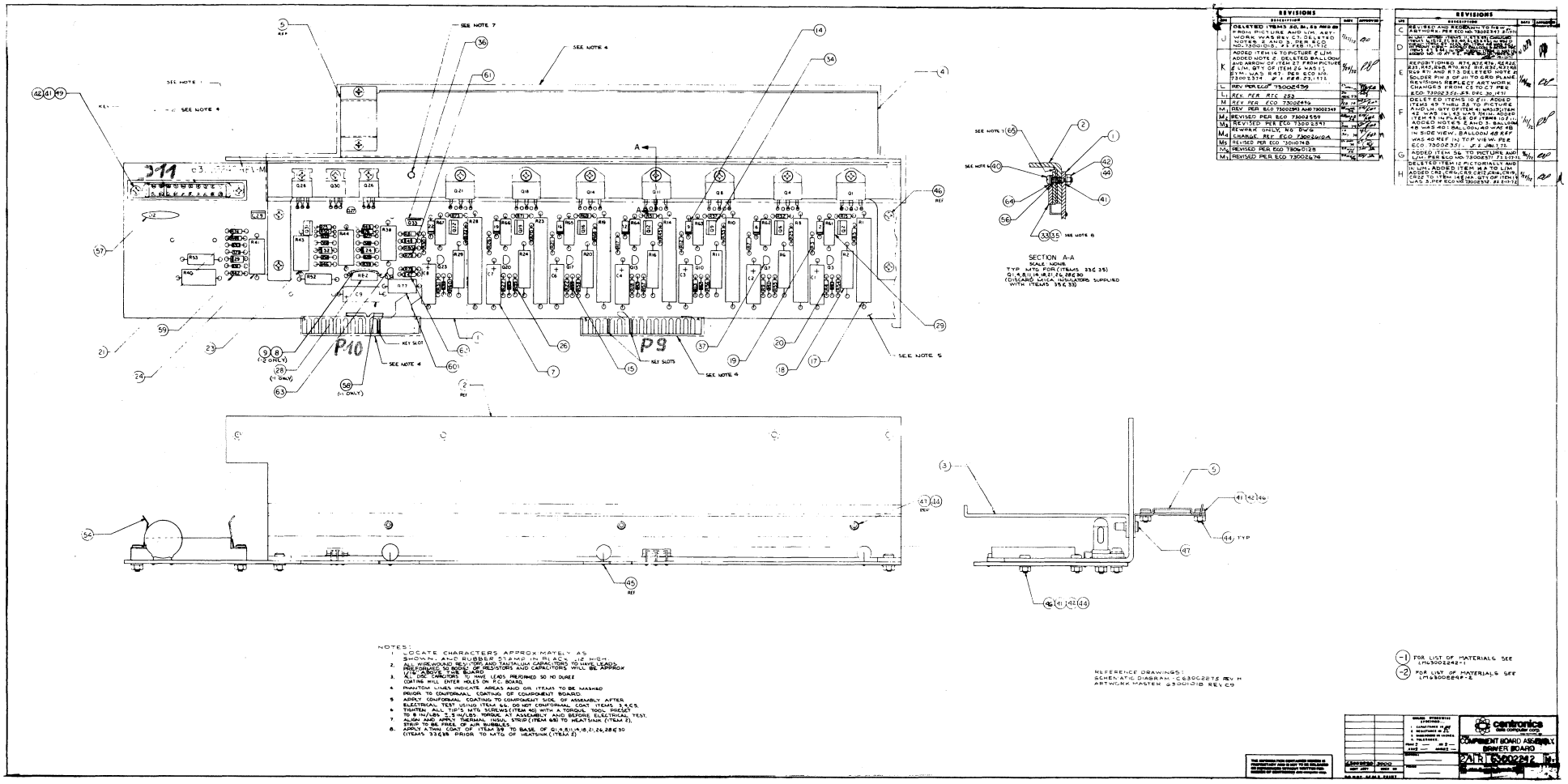


Figure 7-16. COMPONENT BOARD ASSEMBLY, POWER DRIVER

LIST OF MATERIALS
POWER DRIVER BOARD
(Reference: Ass'y Dwg. #63002242-1, Rev. M7)

Item	Symbol	Part Number	Nomenclature	Quantity
1		63001018	Component Board (Artwork)	1
2		63002200-1	Bracket, Heat Sink	1
3		63002233-1	Shield	1
4		63002234-1	Cable Tray	1
5		63002247-1	Cable Clamp Assembly	1
6	J11	31230011	Connector, 20 Contact	1
7	C1,C2,C3,C4, C6,C7,C8	22405002	Capacitor, 4 uf, 150V	7
8				
9				
10				
11				
12				
13				
14	CR2,CR6,CR9, CR12,CR16,CR19, CR22,CR24,CR29, CR32,	38040020	Diode, IN4002	10
15	CR27,CR28,CR30, CR31,CR33,CR34, CR36,CR37,CR38, CR39,CR40,CR41, CR42,CR43,CR44, CR45	38100904	Diode, WG904	16
16				
17	R1,R8,R10,R14, R19,R23,R28	43158105	Resistor, 1.5 ohms, 10W, ±5%	7
18	R2,R6,R11,R16, R20,R24,R29	43820055	Resistor, 82 ohms, 5W, ±5%	7
19	R3,R7,R12,R15, R17,R21,R26,R30, R32,R37,R51,R69, R71,R73,R81	41471926	Resistor, 470 ohms, ¼W, ±10%	15
20	R4,R5,R9,R13, R18,R22,R25,R27, R31,R33,R45,R68, R70,R72,R48,R49, R50	41472926	Resistor, 4.7K, ¼W, ±10%	17
21	R74,R75,R76, R78,R80	41102926	Resistor, 1K, ¼W, ±10%	5
22				
23	R40,R43	41120026	Resistor, 12 ohms, 2W, ±10%	2
24	R41,R44,R38	41471026	Resistor, 470 ohms, 2W, ±10%	3
25				
26	R54 - R60	41103926	Resistor, 10K, ¼W, ±10%	7
28	R52,R53,R82	41101016	Resistor, 100 ohms, 1W, ±10%	3
29	R61 - R67	40680325	Resistor, 68 ohms, 3½W, ±5%	7

Item	Symbol	Part Number	Nomenclature	Quantity
30				
31				
32				
33	Q1,Q4,Q8,Q11, Q14,Q18,Q21	38200332	Transistor, Tip 33B	7
34	Q2,Q6,Q9,Q12, Q16,Q19,Q22, Q29,Q31	38200311	(Tip 31B May Be Substituted) Tip 31A	9
35	Q26,Q28,Q30,	38200312	Transistor, Tip 31B	3
36	Q33	38300050	Transistor, u05	1
37	Q3,Q7,Q10,Q13, Q17,Q20,Q23, Q27	38239040	Transistor, 2N3904	8
38				
39		30050000	Silicone Lubricant	AR
40		34517145	Screw, Pan Hd/Phil, No. 4-40 x 5/16	10
41		34915005	Washer, Lock, Int. Tooth, No. 4	21
42		34712005	Nut, Hex, No. 4-40 UNC	18
43				
44		30000000	Insulating Varnish (GLYPT)	AR
45		30070000	Solder, (60/40)	AR
46		34517105	Screw, Pan Hd/Phil, No. 4-40 x 5/16	2
47		34517205	Screw, Pan/Phil, No. 4-40 x 5/8	3
49		34517165	Screw, Pan/Phil, No. 4-40 x ½ lg	2
50				
51				
52				
53				
54		63002300-1	Clip, PC Board	2
55				
56				
14A	CR2,CR6,CR9, CR12,CR16,CR19, CR22	38049980	Diode, IN4998 (Substitute)	7
57	C12	21104000	Capacitor, .1 uf, 25V	1
58	C9	22256000	Capacitor, 22 uf, 12V	1
59	R39,R42,R46	41222926	Resistor, 2.2K, ¼W, ±10%	3
60	R77	41102026	Resistor, 1K, 2W, ±10%	1
61	R79	41221926	Resistor, 220 ohms, ¼W, ±10%	1
62	CR47,CR48	38047321	Diode, IN4732A	2
63	Q34	38239060	Transistor, 2N3906	1
64		34000050	Washer #4 Narrow Size ¼ OD x 1/32 Thk	10
65		63002596-1	Insulator Strip	1
66		30040002	Conformal Coat	AR
67		63001019-1	Drill Drawing	REF

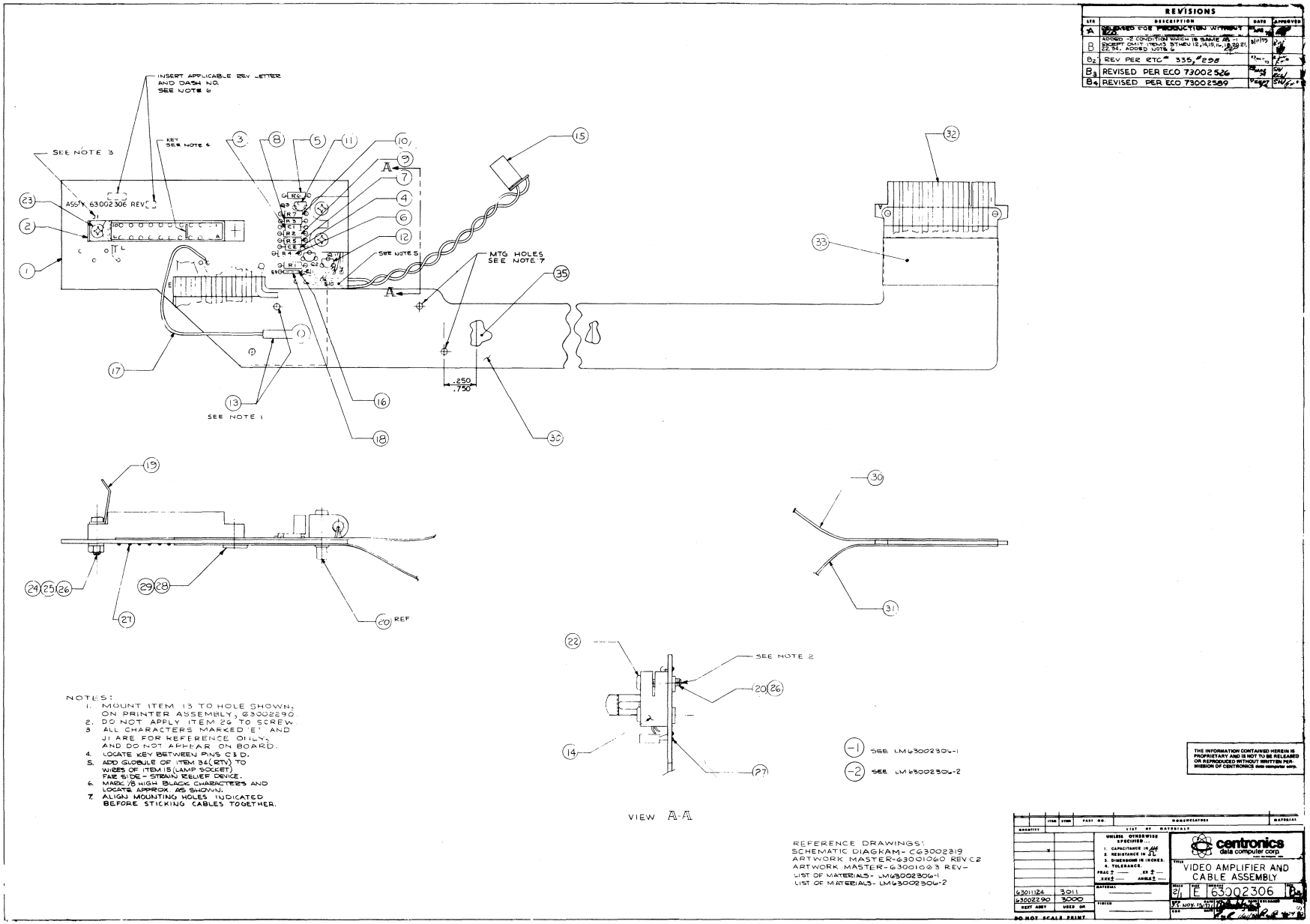


Figure 7-17. COMPONENT BOARD ASSEMBLY, VIDEO AMPLIFIER

LIST OF MATERIALS
VIDEO AMPLIFIER AND
CABLE ASSEMBLY
(Reference: Ass'y Dwg. #63002306-1)
(Rev. B4)

Item	Symbol	Part Number	Nomenclature	Quantity
1		63001061-1	Component Board	1
2	J1	31230013	Connector, P/C, 20 Pin	1
3	C1	21821004	Capacitor, 820 pf	1
4	C2	21472004	Capacitor, 4700 pf	1
5	R6	41102926	Resistor, 1K, ¼W, ±10%	1
6	R4	41472926	Resistor, 4.7K, ¼W, ±10%	1
7	R5	41103926	Resistor, 10K, ¼W, ±10%	1
8	R3	41473926	Resistor, 47K, ¼W, ±10%	1
9	R1,R2	41224926	Resistor, 220K, ¼W, ±10%	2
10	R7	41474926	Resistor, 470K, ¼W, ±10%	1
11	Q3	38239040	Transistor, 2N3904	1
12	Q1,Q2	38239060	Transistor, 2N3906	2
13		31460000-1	Lug No. 4	1
14		63002257-1	Photocell and Housing Ass'y	1
15		31430001	Lamp Socket	1
16		39610000-5	Wire, Buss #22 AWG	AR
17		39640000-4	Wire, Hookup, Teflon #26, AWG, Blk	AR
18		39691050-22	Insulating Sleeving #22	AR
19		63002300-1	Clip, P/C	1
20		34059161-1	PEMSERT or equiv.	2
21				
22		34517247	Screw, Pan/Phil, 4-40 UNC x 9/16 lg	2
23		34517167	Screw, Pan/Phil, 4-40 UNC x ½ lg	1
24		34815007	Washer, Lock, No. 4	1
25		34712007	Nut, Hex, 4-40 UNC	1
26		30000000	Insulating Varnish	AR
27		30070000	Solder, 60/40	AR
28		34000019	Washer, Fibre, No. 6	3
29		30000404	Adhesive, Locktite	AR
30		63002312-1	Ribbon Cable	1
31		63002312-2	Ribbon Cable	1
32		63001064-1	Connector, Fingboard	1
33		35060004	Tape	AR
34		30060000	Potting Compound	AR
35		35060004	Tape, 3/4" Wide (3M No. 810)	2"

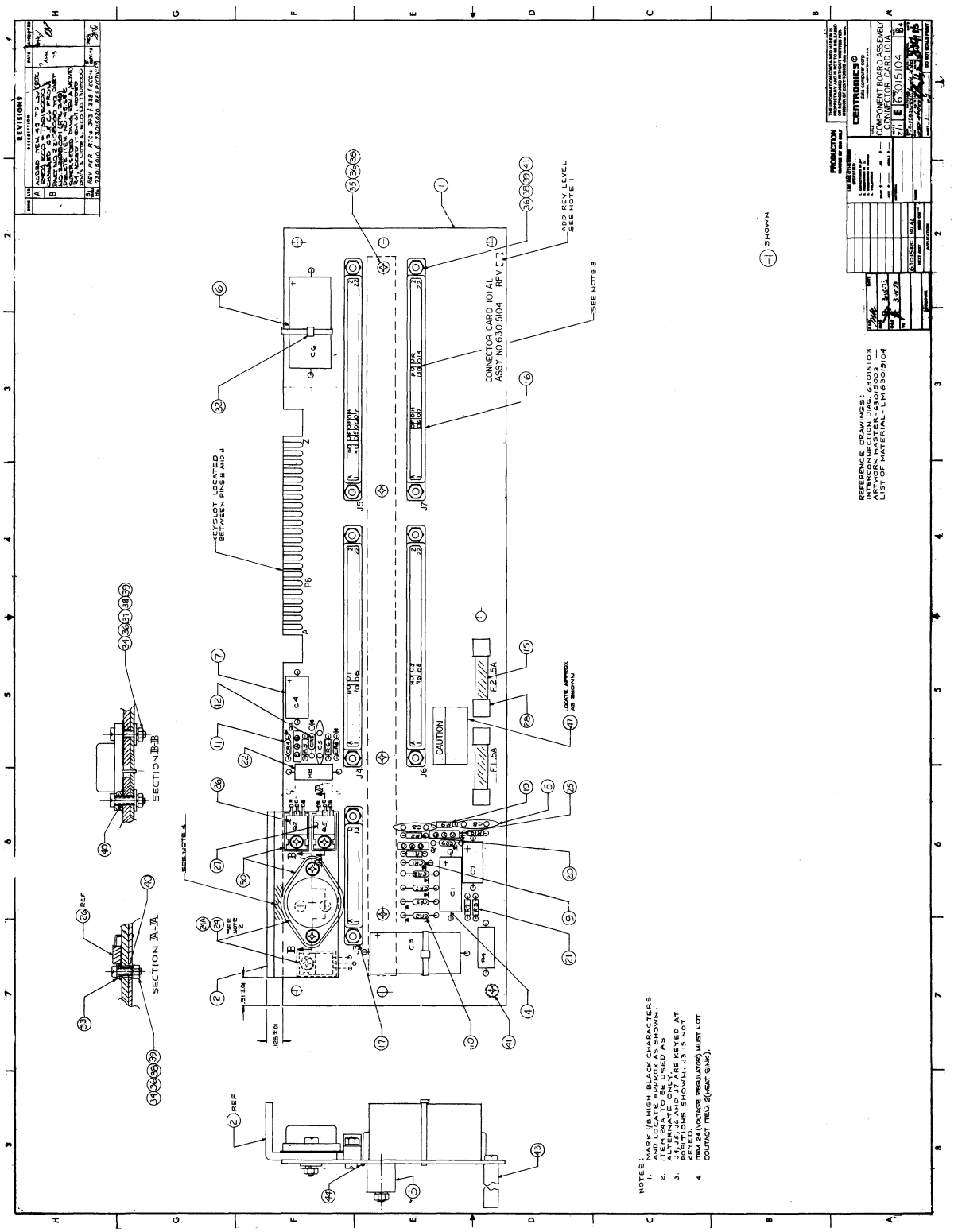


Figure 7-18. COMPONENT BOARD ASSEMBLY, CONNECTOR BOARD

LIST OF MATERIAL FOR
COMPONENT BOARD ASSEMBLY
CONNECTOR CARD 101AL
(Reference: Ass'y Dwg. #63015104)

Item	Symbol	Part Number	Nomenclature	Quantity
1		63015004-1	Component Board	1
2		63015116-1	Heat Sink Conn. Card	1
3		63015118-1	Bar, Stiffener	1
4	C1	22017002	Capacitor, 100 µf, 25V	1
5	C2, C5	21103003	Capacitor, .01 µf, 1KV	3
-	C8	21103003	Capacitor, .01 µf, 1KV	-
6	C3, C6	22108001	Capacitor, 1000 µf, 35V	2
7	C4, C7	22206002	Capacitor, 20 µf, 25V	2
8				
9	CR1	38052350	Diode, IN5235	1
10	CR2, CR3	38040020	Diode, IN4002	4
-	CR6, CR7	38040020	Diode, IN4002	-
11	CR4, CR8	38047420	Diode, IN4742	2
12	CR5, CR9	38052460	Diode, IN5246	2
13				
14				
15	F1, F2	39030018	Fuse, .5 AMP	2
16	J4, J5	31230037	Connector, (225-22221-111MOD)	4
-	J6, J7	31230037	Connector, (225-22221-111MOD)	-
17	J3	31230011	Connector, (225-21021-111MOD)	1
18				
19	R1, R5, R9	41101926	Resistor, 100 ohms, ¼W, ±10%	3
20	R2	41472926	Resistor, 4.7K, ¼W, ±10%	1
21	R3, R6	41103926	Resistor, 10K, ¼W, ±10%	4
-	R7, R10	41103926	Resistor, 10K, ¼W, ±10%	-
22	R4, R8	31350026	Resistor, 330 ohms, 2W, ±10%	
23				
24	VR1	35203090	Voltage Regulator (LM309)	1
24A	VR1 (ALT ONLY)	35207800-01	Voltage Regulator (ua7805)	-
25	Q1, Q3	38244420	Transistor, 2N4442	3
-	Q4	38244420	Transistor, 2N4442	-
26	Q2	38200300	Transistor, Tip 30	1
27	Q5	38200290	Transistor, Tip 29	1
28		31350003	Fuse Clip	4
29				
30		30050001	Thermal Joint Compound (Wakefield Type 120)	AR
31				
32		39690010-2	Cable Tie 5½" Lg	2
33		35000004-5	Washer, Ins. Nylon	2
34		34517187	Screw, PAN HD/PHIL, No. 4-40 x 9/16 Lg	4
35		34517247	Screw, PAN/PHIL 4-40 x 3/4	4
36		34815007	Washer, Int. Tooth, No. 4	18
37		34792007	Washer, Flat, No. 4	2
38		34712007	Nut, Hex, No. 4-40 UNC - 2B	18
39		30000000	Insulating Varnish, Glyptl	AR
40		39690200-9	Sleeving Teflon .25 Lg	AR
41		34517167	Screw, PAN HD/PHIL, No. 4-40 x ½ Lg	11
42				
43		36624314-12	Spacer, Threaded (H.H. SMITH No. 8784)	1
44		30070000	Solder (60/40)	1
45				
46				
47		62000111-1	Decal, Caution, Fuse Rating	1

Refer to the beginning of this section for possible changes not yet incorporated on this page.

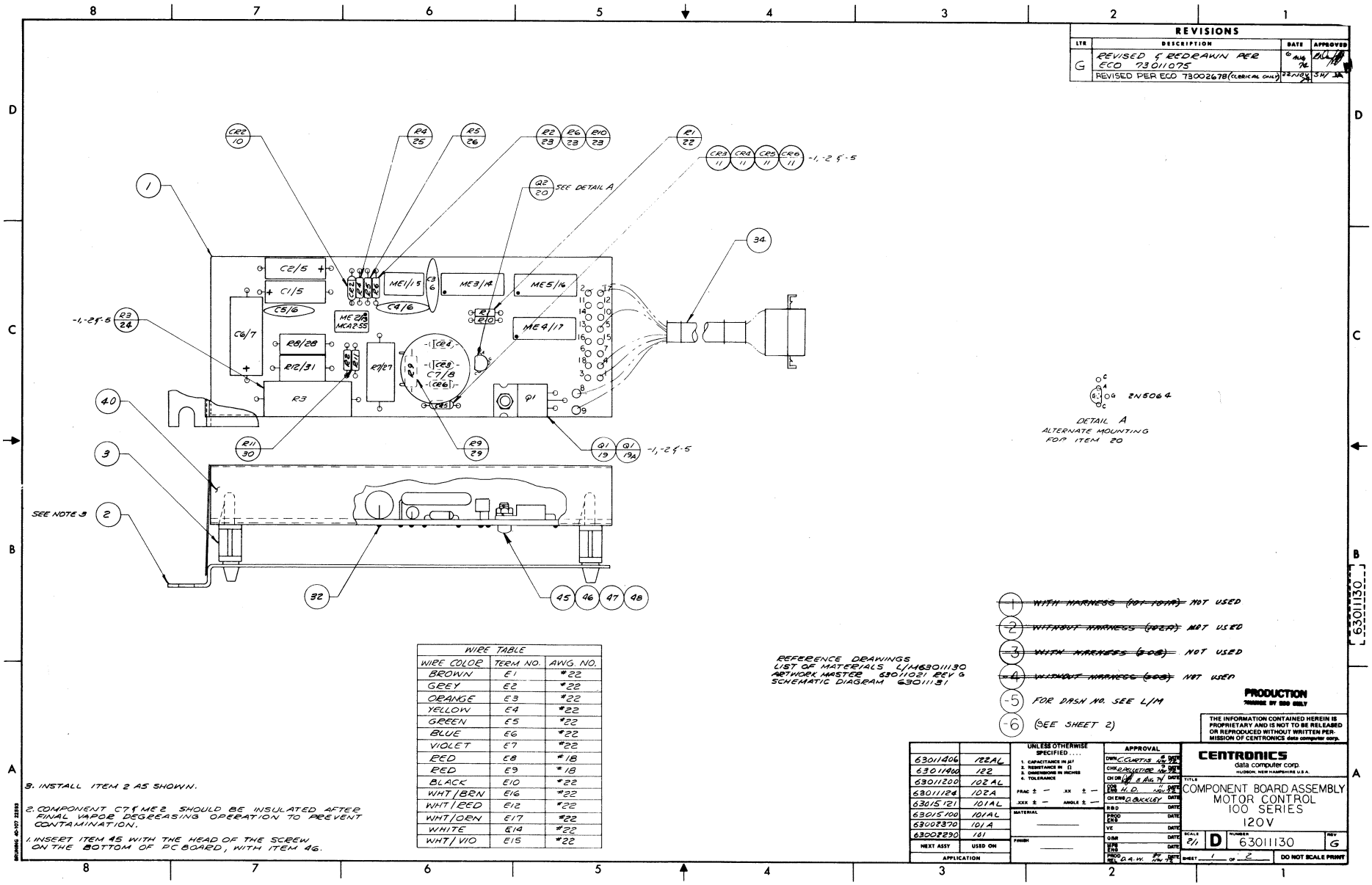


Figure 7-19. COMPONENT BOARD ASSEMBLY, MOTOR CONTROL

LIST OF MATERIALS
MOTOR CONTROL 100 SERIES
(Reference: Ass'y Dwg. #63011130-5, Rev. G)

Item	Symbol	Part Number	Nomenclature	Quantity
1		63011022-1	Component Board	1
2		63002380-1	Mounting Bracket	1
3		36600004-4	Spacer, .50 lg (LCBS-8 RITCHLOK)	4
4				
5	C1, 2	22106002	Capacitor, 10 uf, 25V	2
6	C3, 4, 5	21104001	Capacitor, .1 uf, 16V	3
7	C6	22107002	Capacitor, 100 uf, 25V	1
8	C7	21104002	Capacitor, .1 uf, 500V	1
9				
10	CR2	38100904	Diode, WG904	1
11	CR3,4,5,6	38040020	Diode, IN4002	4
12				
13	ME2	37220015	Integrated Circuit (CA2-55 LITRONIX)	1
13A	ME2	37220016	Integrated Circuit (MCA2-55 MONSANTO)	1
14	ME3	35474121	Integrated Circuit 74121/9603	1
15	ME1	35205550	Integrated Circuit 555	1
16	ME5	35474040	Integrated Circuit 7404	1
17	ME4	35474100	Integrated Circuit 7410	1
18				
19	Q1	38200002	Transistor, 2N6343	1
19A	Q1	38200146	Transistor, SC146D	1
20	Q2	38200001	Transistor, C103 B/2N5064	1
21				
22	R1	41221926	Resistor, 220 ohms, ¼W, ±10%	1
23	R3	41102926	Resistor, 1K, ¼W, ±10%	3
24	R3	43153055	Resistor, 15K, 5W (EL5)	1
25	R4	41393926	Resistor, 39K ohm, ¼W, ±10%	1
26	R5	41684926	Resistor, 680K ohm, ¼W, ±10%	1
27	R7	41101025	Resistor, 100K, 2W	1
28	R8	41510015	Resistor, 51 ohm, 1W	1
29	R9	41101946	Resistor, 100 ohm, ¼W, ±10%	1
30	R11	41105926	Resistor, 1 Meg, ¼W, ±10%	1
31	R12	43502035	Resistor, 5K, 3W	1
32		30070000	Solder (60/40)	AR
33				
34		63011149	Wiring Harness Motor Control	1
35				
39				
40		63011137-1	Cover, Motor Control	1
41				
42				
45		34517107	Screw, 4-40 x 5/16 lg, Pan/Phil	1
46		34912004	Washer, Nylon, #4 Flat	1
47		30000000	Insulating Varnish	1
48		34712007	Nut, Hex	1

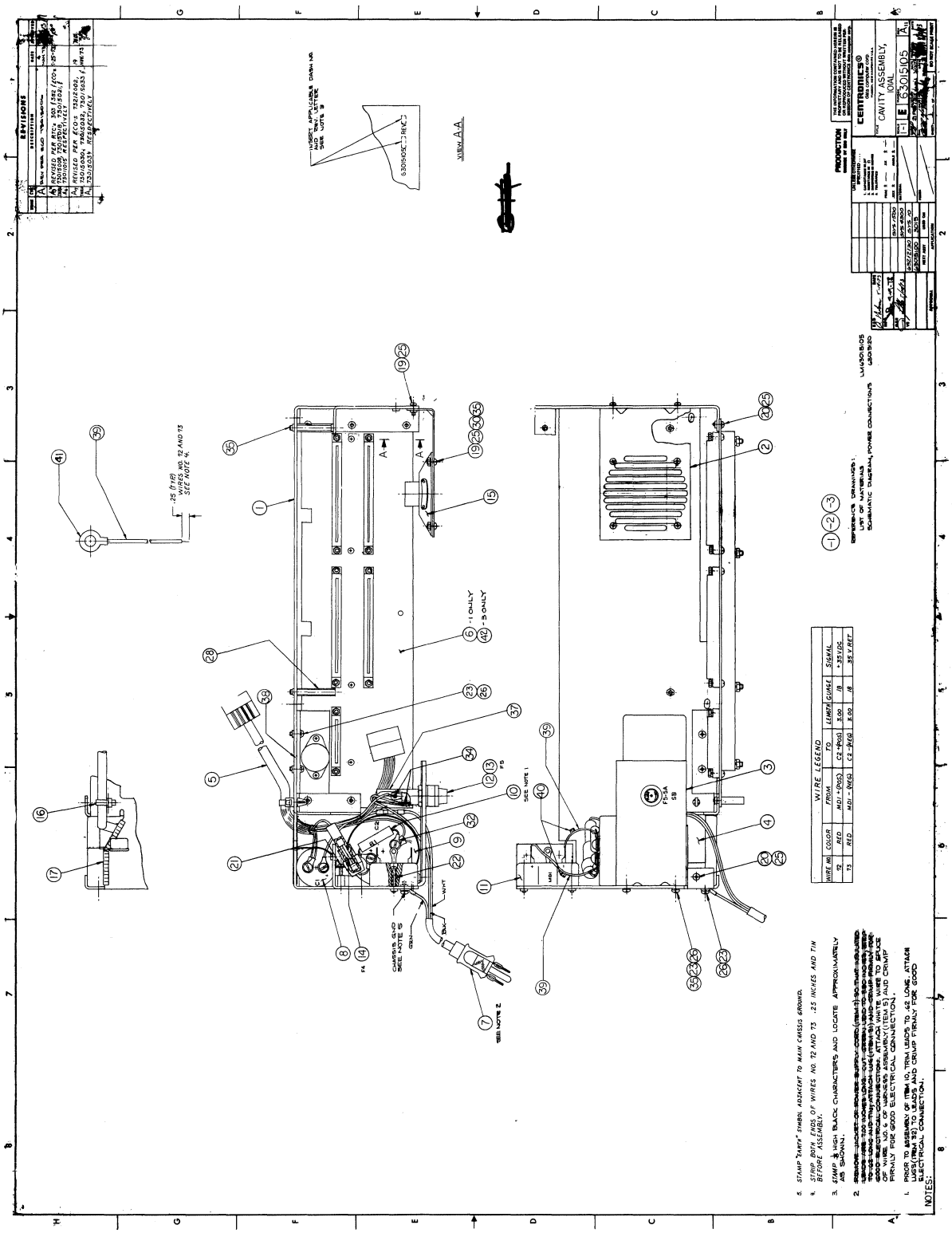


Figure 7-20. ELECTRONICS CAVITY ASSEMBLY

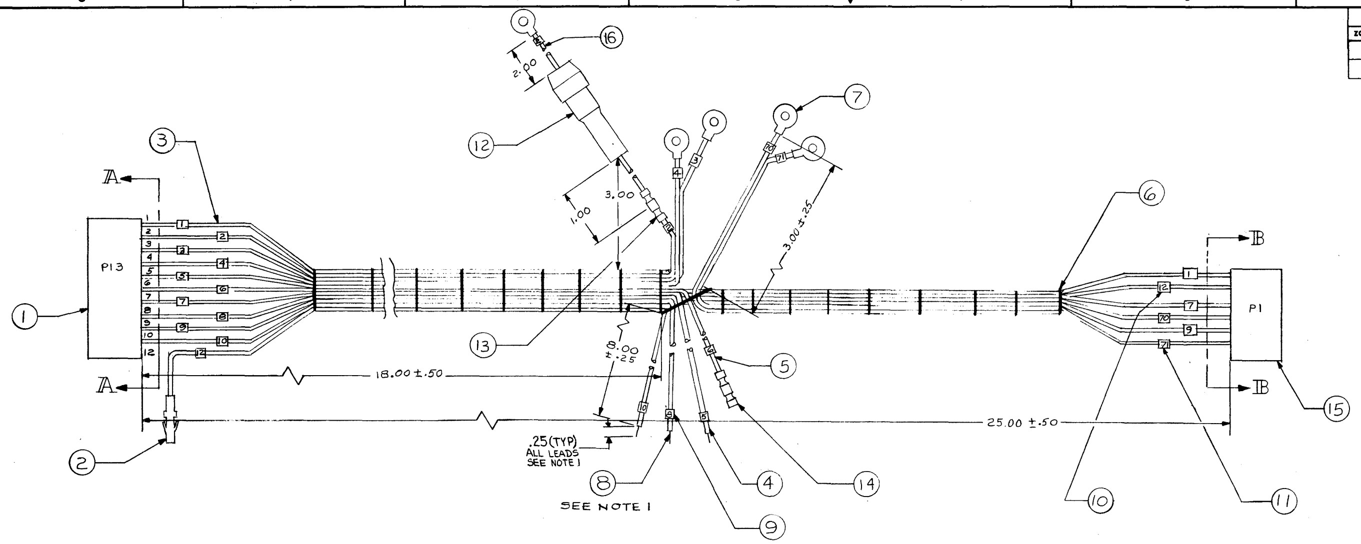
LIST OF MATERIAL FOR
CAVITY ASSEMBLY (101AL)
(Reference: Ass'y Dwg. 63015105)

Item	Symbol	Part Number	Nomenclature	Quantity
1		63015106-1	Chassis Assembly	1
2		63015112-1	Bracket Assembly, Speaker	1
3		63015113-1	Bracket, Fuse	1
4		63015107-1	Clamp, Capacitor	1
5		63015115-1	Harness Assembly	1
6		63015104-1	Comp. Bd. Ass'y, Conn. Bd.	1
7		63015125	Power Supply Cord, Three Cond.	1
8	C1	22558001	Capacitor, 5500 μf, 25V	1
9	C2	22159000	Capacitor, 15000 μf, 50V	1
10	R1	43471055	Resistor, 470 ohms, 5W, 5%	1
11	MD1	38109622	Diode Bridge	1
12		31350000	Fuse Holder	1
13	F5	39030004	Fuse, 5A, S.B.	1
14	F4	39030012	Fuse, 8A, S.B.	1
15		30470000	Speaker	1
16		36150004	Clamp, Cable, Push Mount	1
17		36000000-3	GROMMET 1½ Lg	1
18				
19		34517087	Screw, PAN/PHIL 4-40 x ¼	6
20		34517107	Screw, PAN/PHIL 4-40 x 5/16	6
21		34527207	Screw, PAN/PHIL 6-32 x 5/8	1
22		34517287	Screw, PAN/PHIL 4-40 x 7/8	2
23		34527127	Screw, PAN/PHIL 6-32 x 3/8	5
24				
25		34815007	Washer, Lock, Int. No. 4	12
26		34825007	Washer, Lock, Int. No. 6	5
27				
28		36600006	Standoff, M/F, 6-32 1-3/8 Lg	–
29				

Item	Part Number	Nomenclature	Quantity
30	34712007	Nut, Hex, 4-40	4
31			
32	31460015-4	Solderless Ring Terminal #4975 (H.H. Smith)	2
33			
34	30070000	Solder, 60/40	AR
35	30000000	Insulating Varnish	AR
36			
37	39690001-9	Sleeving, Shrink, 3/4 ID x 1.50 Lg	AR
38	30050001	Thermal Joint Comp. Wakefield #120	AR
39		Wire, Red Teflon, (AWG 18)	AR
40		72 and 73 Wire Markers (Qty 1 ea)	2
41		Ring Terminal	2

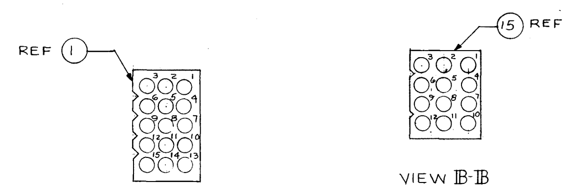
Refer to the beginning of this section for possible changes not yet incorporated on this page.

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
	A	REVISED PER ECO 73015015	12 JULY 73
	B	REVISED PER ECO 73015018	26 SEPT. 73



NOTES:
1. STRIP ALL WIRES .25 INCH ON BOTH ENDS AND TIN BEFORE ASSEMBLY.

WIRE LEGEND						
WIRE NO.	COLOR	FROM	TO	LENGTH	GUAGE	SIGNAL
1	RED	P1-PIN 3	P13-PIN 1	25.50	18	+35VAC
2	BLK	C2+(POS)	XF4	2.00	18	+35VDC
2	RED	XF4	P13-PIN2	21.00	18	+35VDC
3	RED	C2-(NEG)	P13-PIN3	22.00	18	+35V RET.
4	RED	C1-(NEG)	P13-PIN4	22.00	18	±0V
5	BLK	XF5(END PIN)	P13-PIN 5	26.50	16	115VAC
6	WHT	AC(SPLICE)	P13-PIN6	26.50	16	AC COMMON
7	RED	P1-PIN 6	P13-PIN7	25.50	18	+11VAC
8	RED	RECT. AC	P13-PIN8	22.00	18	27.5VAC
9	RED	P1-PIN9	P13-PIN9	25.50	18	+11VAC
10	RED	RECT. AC	P13-PIN 10	22.00	18	27.5VAC
12	RED	P1-PIN 2	P13-PIN12	25.50	18	+35VAC
70	RED	P1-PIN 4	C1+(POS)	10.50	18	+5V CAP
71	RED	P1-PIN 12	C1-(NEG)	10.50	18	±0V



VIEW A-A
CONNECTOR ONLY

VIEW B-B
CONNECTOR ONLY

(—1) AS SHOWN

REFERENCE DRAWINGS:
CAVITY ASSEMBLY-63015105
SCHEMATIC DIAGRAM-63015120
COMP. BD. ASSY & LM-63015102
LIST OF MATERIAL-LM63015115

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UNLESS OTHERWISE SPECIFIED....
1. CAPACITANCE IN μf
2. RESISTANCE IN Ω
3. DIMENSIONS IN INCHES
4. TOLERANCE
FRAC ± — .XX ±.03
.XXX ± — ANGLE ± —

MATERIAL

FINISH

TITLE HARNESS ASSEMBLY (W1) 101AL

SCALE — | SIZE D | NUMBER 63015115 | REV B

NEXT ASSY 63015100 | USED ON 3015
APPLICATION

APPROVAL

SHEET 1 OF 1

DO NOT SCALE PRINT

Figure 7-21. HARNESS ASSEMBLY (W1)

LIST OF MATERIAL FOR
HARNESS ASSEMBLY
(W1) 101AL
(Reference: Ass'y Dwg. #63015115)

Item	Symbol	Part Number	Nomenclature	Quantity
1	P13	31340007	Connector, Molex, (1375R)	1
2		31240020-4	Pin, Connector (1381)	17
3		39640000-8	Wire, Red, Teflon, 18 AWG	AR
4		39640000-9	Wire, Blk., Teflon, 16 AWG	AR
5		39640000-9	Wire, Wht., Teflon, 16 AWG	AR
6		39690000-2	Lacing Tape, Blk.	AR
7		31460005-4	Solder Lug	5
8		30070000	Solder (60/40)	AR
9		36550002-1 Thru 36550002-10	Wire Marker	2 ea.
10		36550002-12	Wire Marker	2
11		36550002-70 Thru 36550002-71	Wire Marker	2 ea. 1
12	XF4	31350001	Fuse Holder	1
13		31460002-3	Splice	1
14		31460002-2	Splice	1
15	P1	31340008-2	Connector, Molex (1360R-1)	
17		31460021-4	Solder Lug (14-16 AWG)	1

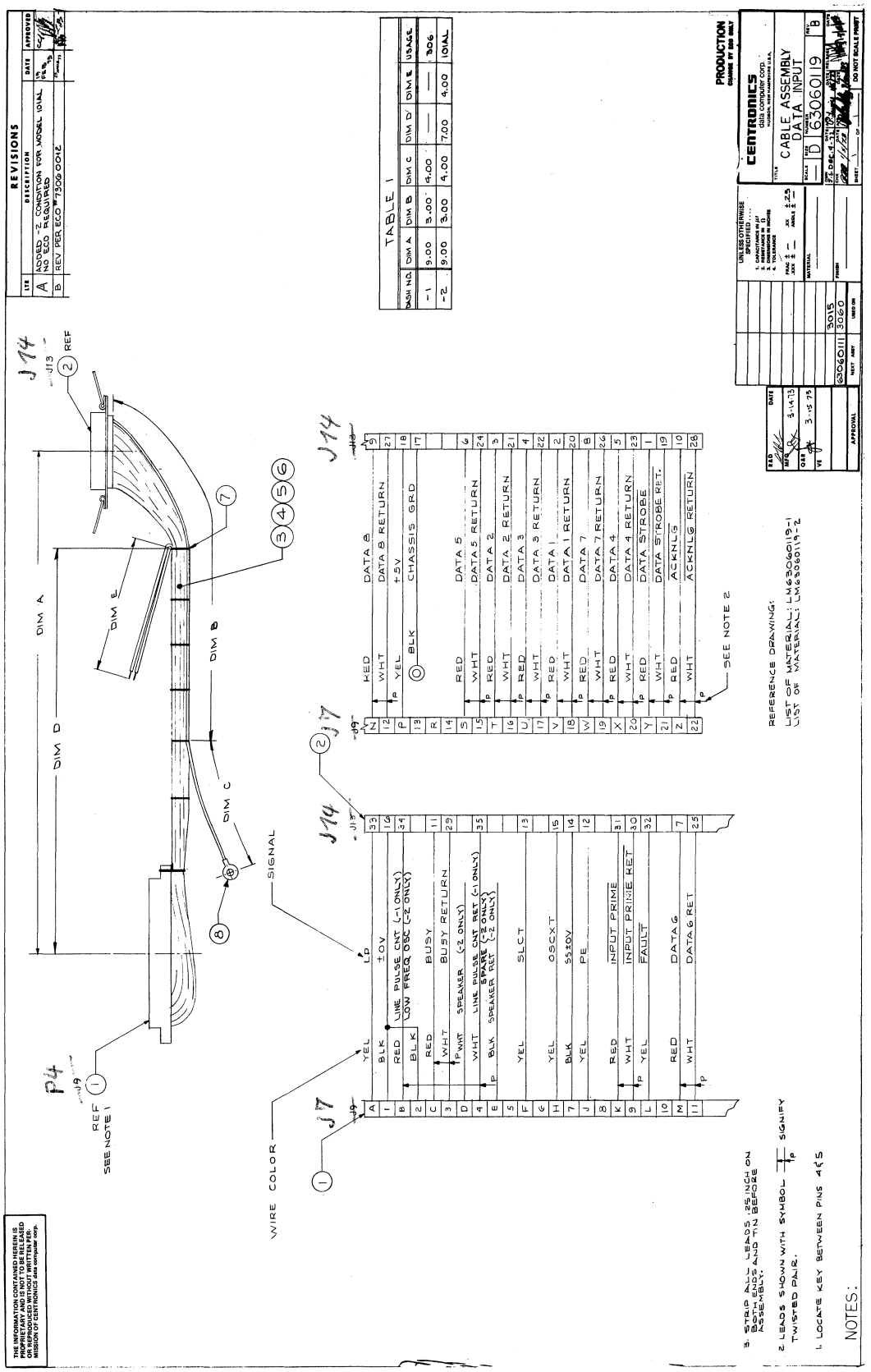


Figure 7-22. INPUT CABLE ASSEMBLY

LIST OF MATERIAL FOR
CABLE ASSEMBLY
DATA INPUT
(Reference: Ass'y Dwg. #63060119)

Item	Symbol	Part Number	Nomenclature	Quantity
1	J9	31230038	Connector, 44 Contacts	1
2	J13	31310019	Connector, Receptacle	1
3		39648505-4	Wire, Red, No. 26 AWG	AR
4		39648505-4	Wire, Wht., No. 26 AWG	AR
5		39648505-4	Wire, Yel., No. 26 AWG	AR
6		39648505-4	Wire, Blk., No. 26 AWG	AR
7		39690000-1	Lacing Tape, White	AR
8		31460000-3	Solderless Term. No. 8	1
9		30070000	Solder (60/40)	AR

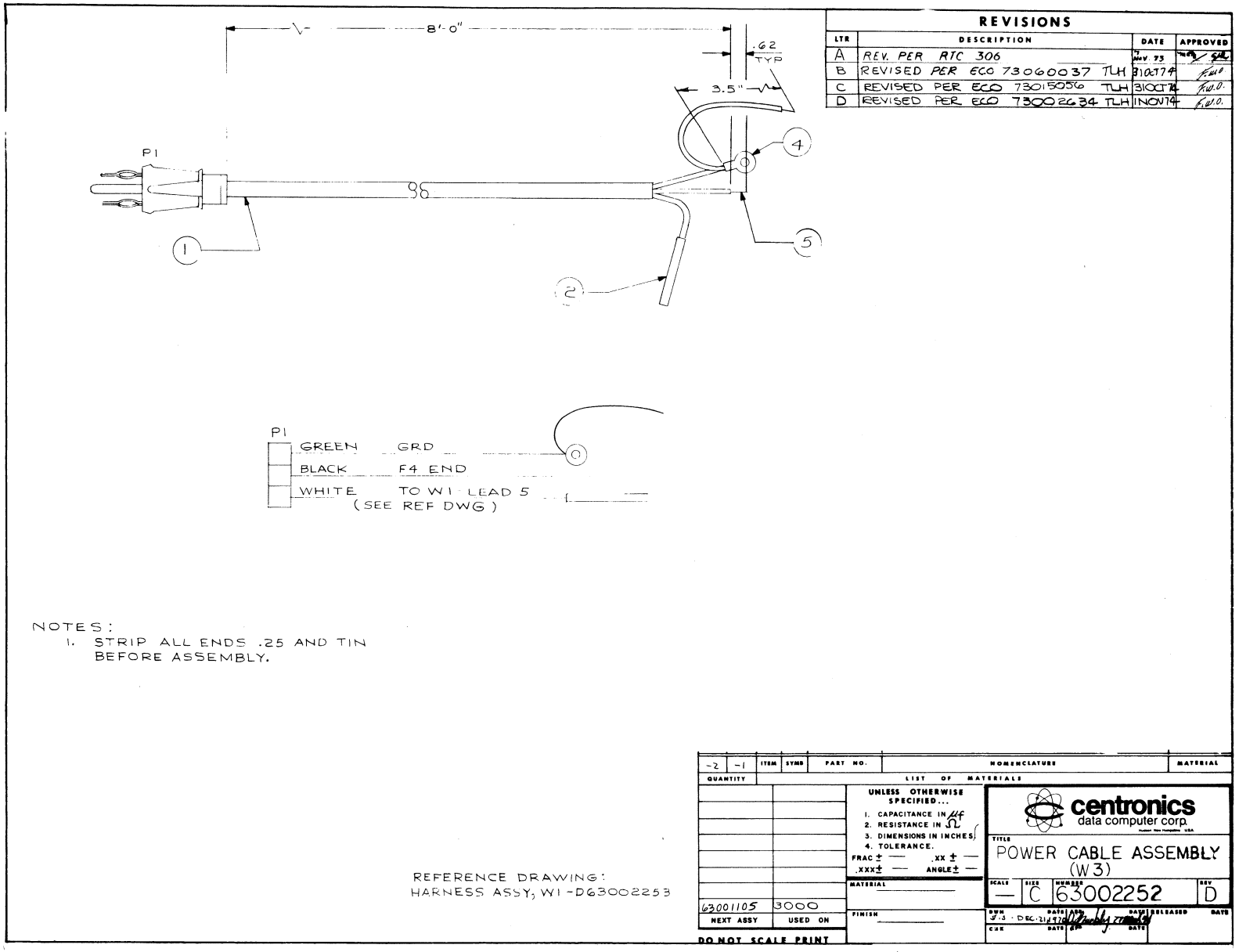


Figure 7-23. POWER CABLE ASSEMBLY (W3)

LIST OF MATERIALS
POWER CABLE ASS'Y
(Reference: Ass'y Dwg. #63002252, Rev. D)

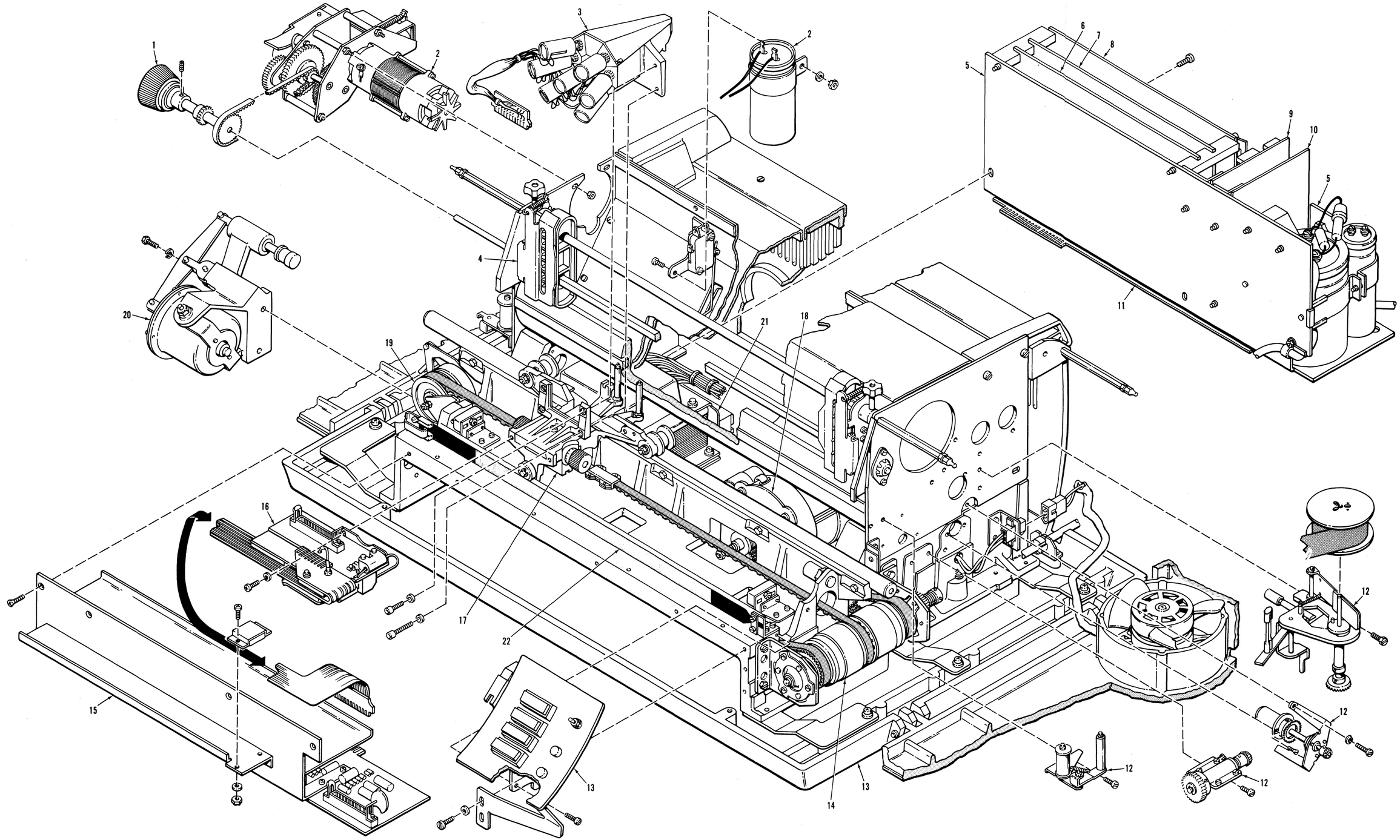
Item	Symbol	Part Number	Nomenclature	Quantity
1		39620001	Power Cable	1
2		31460002-3	Splice	1
3		36150000	Strain Relief Bushing	1
4		31460000-2	Solderless Terminal, No. 6	1
5		30070000	Solder, (60/40)	AR
6		39648505-9-5	Wire, #16, Gauge, Grn	AR

SECTION 8
DRAWINGS AND PARTS LISTS, MECHANICAL

This section contains drawings and parts lists for the major mechanical assemblies in the 101 Series Printer. Note that Figure 8-i not only shows the major assemblies called out below, but also cross-references in the parts list the corresponding removal/replacement and adjustment procedures for that assembly in Section 5.

Figure	Reference Designation	Description
8-i	-	Mechanical Subassemblies, Series 101
8-1	A	Cover Assembly
8-2	HA	Carriage Mechanism
8-3	HB	Drive Mechanism
8-3A	HB	Driving Mechanism (Preload Clutches)
8-4	HC	Spring Drum
8-5	HD	Damper
8-6	HE	Frame
8-7	HF	Paper Feed Mechanism
8-8	HG	Pin Feed Mechanism (Left and Right)
8-9	HH	Form Feed Mechanism
8-10	HI	Ribbon Feed Mechanism
8-11	HJ*	Electrical Hardware
8-12	B	Print Head and Associated Assemblies

*No drawing included



REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure 8-i. MECHANICAL SUBASSEMBLIES, SERIES 101

Figure 8-i. MECHANICAL SUBASSEMBLIES, SERIES 101

Reference Number	Figure	Part Name	Operation, Removal/ Replacement
1	8-7	Paper Feed Mechanism (HF)	Para. 5.2.7
2	8-9	Form Feed Mechanism (HH)	5.2.9
3	8-12	Print Head and Associated Assemblies (B)	5.2.13
4	8-8	Pin Feed Mechanism (HG)	5.2.8
5	7-25	Electronics Cavity Assembly	-
* 6	7-18	Electronic Card No. 2	-
* 7	7-17	Electronic Card No. 1	-
8	-	Interface Card - Option	-
* 9	7-20	+12 Volt Regulator	-
* 10	7-19	+5 Volt Regulator	-
11	7-21	Connector Board Assembly	-
12	8-10	Ribbon Feed Mechanism (HI)	5.2.10
13	8-1	Cover Assembly (A)	5.2.1
14	8-3A	Forward and Reverse Clutches (HB) (Part 2)	5.2.3
15	7-22	Power Driver Board Assembly	-
16	7-23/ 8-12	Video Amplifier and Cable Ass'y	5.2.13
17	8-2	Carriage Unit (HA)	5.2.2
18	8-3	Driving Mechanism (HB) (Part 1)	5.2.3
19	8-4	Spring Drum (HC)	5.2.4
20	8-5	Damper (HD)	5.2.5
21	8-11	Electrical Accessories (HJ) (Multitap Transformer)	5.2.11
22	8-6	Frame (HE)	5.2.6

Note: Item 6, 7, 9 and 10 contained on single logic card (No. 63015102) on Model 101AL.

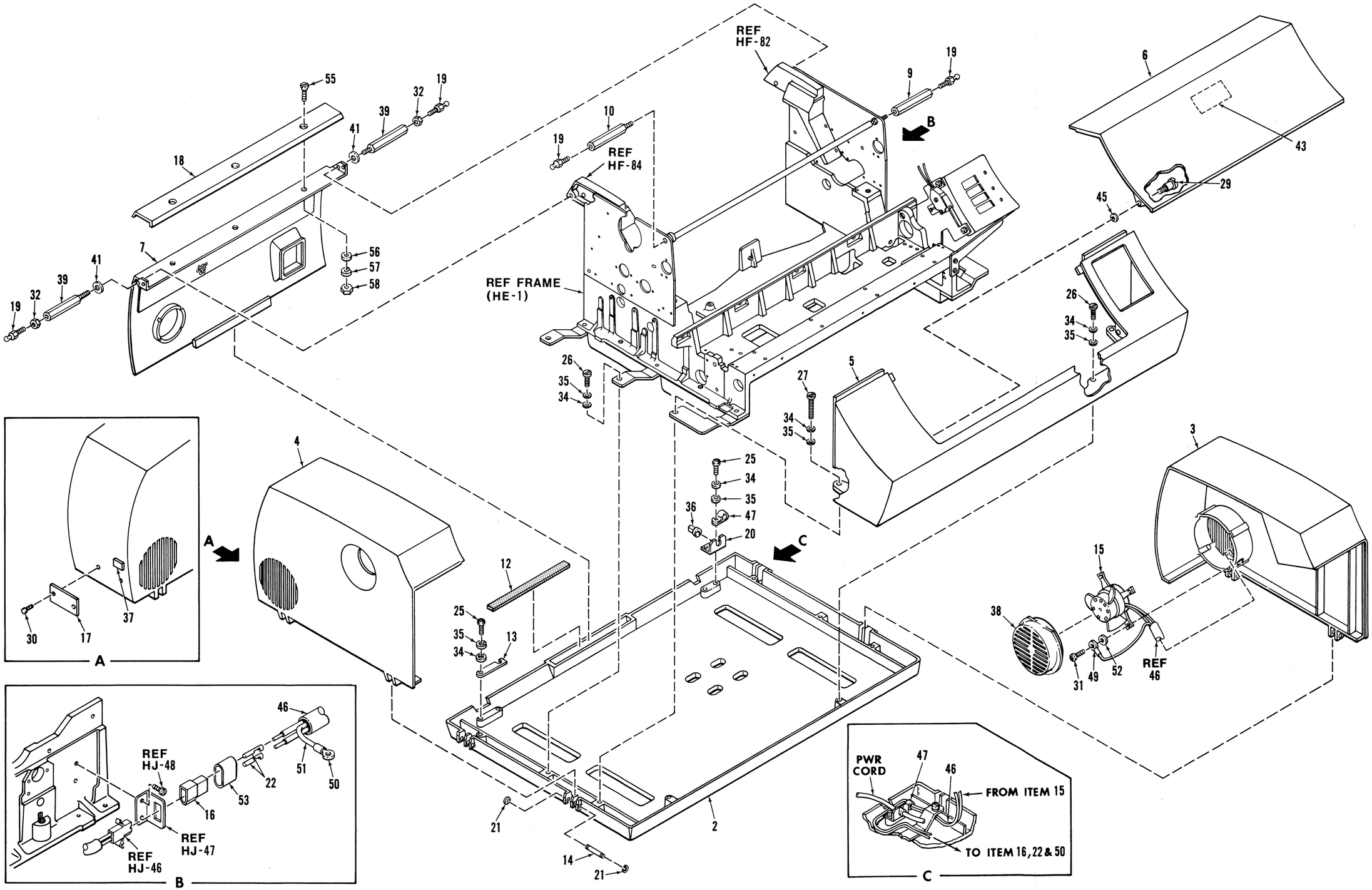


Figure 8-1. COVER ASSEMBLY - A

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure A COVER ASSEMBLY

Item	Symbol	Part Number	Nomenclature	Quantity
1		525151001	Assembled Machine Assy (HE-1)	1
2		63002334-1	Cover Assy, Base	1
3		63002336-1	Cover Assy, Right	1
4		63002335-1	Cover Assy, Left	1
5		63002337-1	Cover Assy, Front	1
6		63002338-1	Cover Assy, Top	1
7		63002339-1	Cover Assy, Rear	1
9		63002356-1	Standoff, Ball Stud	1
10		63002357-1	Standoff, Ball Stud	
12		63002324-1	Rubber Pad	1
13		63002346-1	Cable Clamp Assy	1
14		63002358-1	Dowell Pin	4
15		32810000	Fan	1
16		31305451	Conn., Elect.	1
17		525560001	Rating Plate (Brother)	1
18		525513001	Decorating Plate (Brother)	1
19		33164087	Ball Stud	4
20		63002371-1	Bracket, Strain Relief	1
21		33115103-25	Retaining Ring	8
22		31240020-2	Pin Terminal, Male	2
25		34527125	SCR, Pan/Phil, 6-32 x .375 lg	4
26		34527165	SCR, Pan/Phil, 6-32 x .50 lg	6
27		34527245	SCR, Pan/Phil, 6-32 x .75 lg	2
29		34000024	SCR, 10-32 Shoulder	2
30		33723717-10	SCR, Pan Hd, #4 (112) Type B x .31 lg	2
31		33723717-16	SCR, Pan Hd, #4 (.112) Type B x .50 lg	4
32		34722005	Nut, Plain, Hex, 6-32	2
33				
34		34922007	Washer, Flat, #6	12
35		34828007	Washer, Split Lock, #6	12
36		36150003	Bushing, Strain Relief	1
37		62000109-1	Nameplate, UL	1
38		63002395-1	Fan Guard	1
39		63002355-2	Standoff, Ball Stud	2
41		34930007	Washer, Flat, #8	2
42				
43		63002408-1	Decal, Ribbon Change	1
44				
45		34000058	Washer, Flat #10	2
45A		025040133	Washer, Flat, 4.2 mm (alternate part)	2
46		39690001-6	Sleeving, Shrink	11"
47		36150001-5	Cable, Clamp, 3/16-in.	1
48				
49		31460014-1	Terminal Ring #6	1
50		31460025-1	Terminal Ring #10	1
51		39648505-8-05	Wire, Insul, #18 Grn	17"
52		34815005	Washer, Int Lock, #4	1
53		39690001-09	Tubing Shrink	1"
54		30000404	Loctite	AR
55		34312205	Screw, Flat Hd 4-40 x 625 lg	3
56		34912005	Washer, Flat #4	3
57		34818005	Washer, Lock, #4	3
58		34712005	Nut, Plain Hex, 4-40	3
59		30000000	GLYPTAL	AR

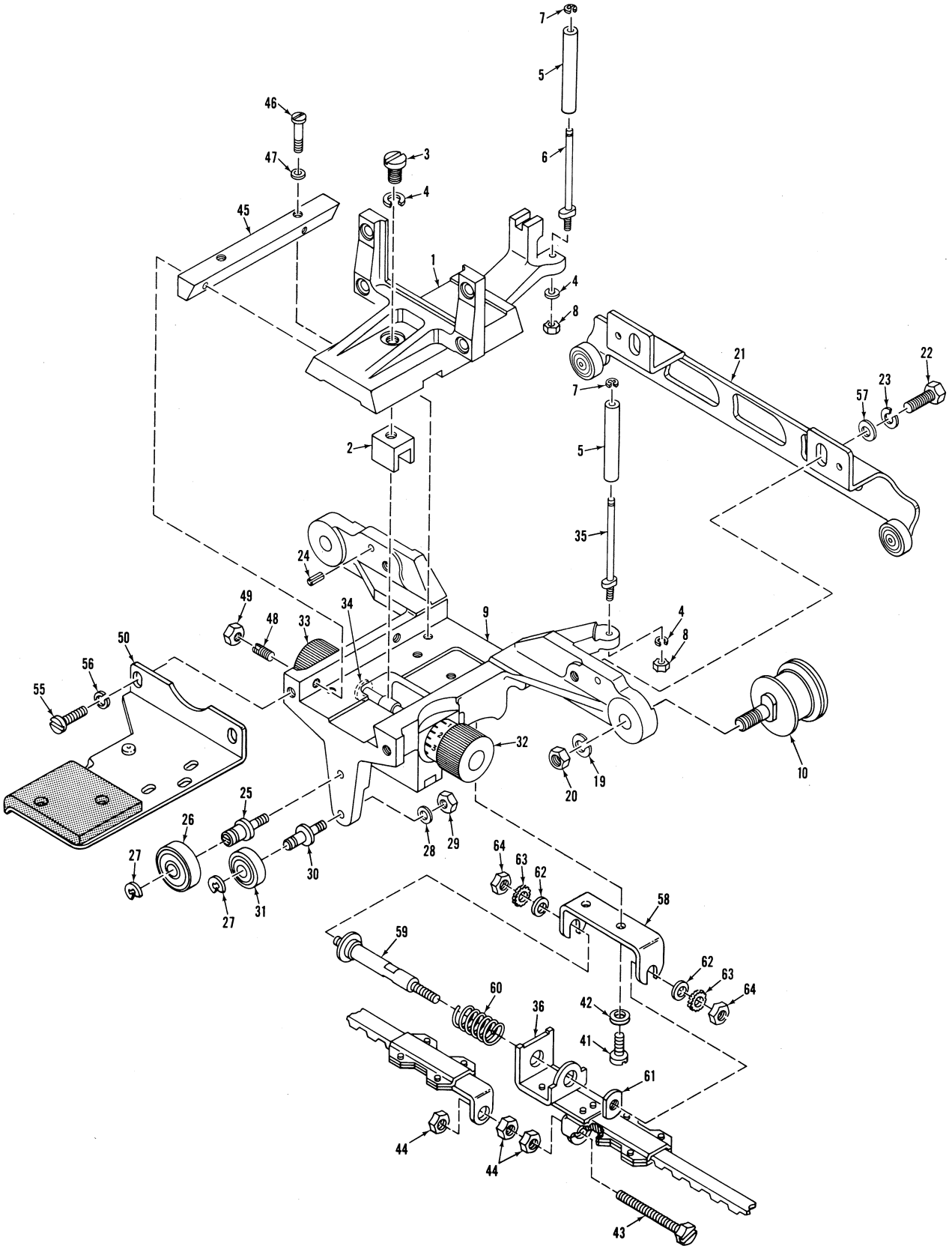


Figure 8-2. CARRIAGE MECHANISM - HA

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HA CARRIAGE MECHANISM

Reference Number	Part Number	Part Name	Quantity
HA-1	525001000	Head bracket	1
HA-2	525002001	Fork for head adjustment	1
HA-3	007400716	Screw for HA-2	1
HA-4	028040247	Spring washer for HA-3, 6, 35	3
HA-5	525003000	Ribbon guide roller for head	2
HA-6	525004001	Eccentric shaft for HA-5	1
HA-7	048020346	Snap ring for HA-6, 35	2
HA-8	021400106	Nut for HA-6, 35	2
	525005001	Carriage unit	1
		Note: This unit is assembled with parts covering reference number HA-9 and HA-10, also HA-19 through HA-35 and HA-41, 42, 57, 58.	
HA-9	525006001	Carriage with control magnet	1
HA-10	525009001	Guide roller unit (upper)	2
HA-19	028060247	Spring washer for HA-10	2
HA-20	021060106	Nut for HA-10	2
HA-21	525016001	Guide roller unit (lower)	1
HA-22	017061206	Bolt for HA-21	2
HA-23	028060247	Spring washer for HA-22	2
HA-24	047310642	Spring pin for HA-21	2
HA-25	525020001	Eccentric Axle for HA-26	1
HA-26	527242001	Roller (upper) for HE-23	1
HA-27	048030346	Snap ring for HA-25, 30	2
HA-28	028040247	Spring washer for HA-25, 30	2
HA-29	021400106	Nut for HA-25, 30	2
HA-30	525022001	Axle for HA-31	1

Reference Number	Part Number	Part Name	Quantity
HA-31	527243001	Roller (lower) for HE-23	1
HA-32	525544001	Head adjusting knob	1
HA-33	525025001	Head lock knob	1
HA-34	028040247	Spring washer for HA-33	1
HA-35	525027001	Shaft for HA-5	1
HA-36	525029001	Main driving belt	1
HA-41	007300716	Screw for	2
HA-42	028030247	Spring washer for HA-41	2
HA-43	007064016	Screw for HA-36	1
HA-44	021060106	Nut for HA-43	3
HA-45	525047000	Gib for HA-1	1
HA-46	007301416	Screw for HA-45	2
HA-47	028030247	Spring washer for HA-46	2
HA-48	011401016	Set screw for HA-45	2
HA-49	021400106	Nut for HA-48	2
HA-50	525043001	Bracket for flat cable and Video Amplifier board.	1
HA-55	007400816	Screw for HA-50	2
HA-56	028040247	Spring washer for HA-55	2
HA-57	025060236	Flat washer for HA-22	2
HA-58	525689001	Holder (A) for HA-59	1
HA-59	525690001	Shaft (A) for HA-36	1
HA-60	525716001	Spring (S) for HA-36	1
HA-61	525691001	Adjusting nut for HA-59	1
HA-62	025040236	Flat washer for HA-59	2
HA-63	550719002	Spring washer for HA-59	2
HA-64	021400106	Nut for HA-59	2

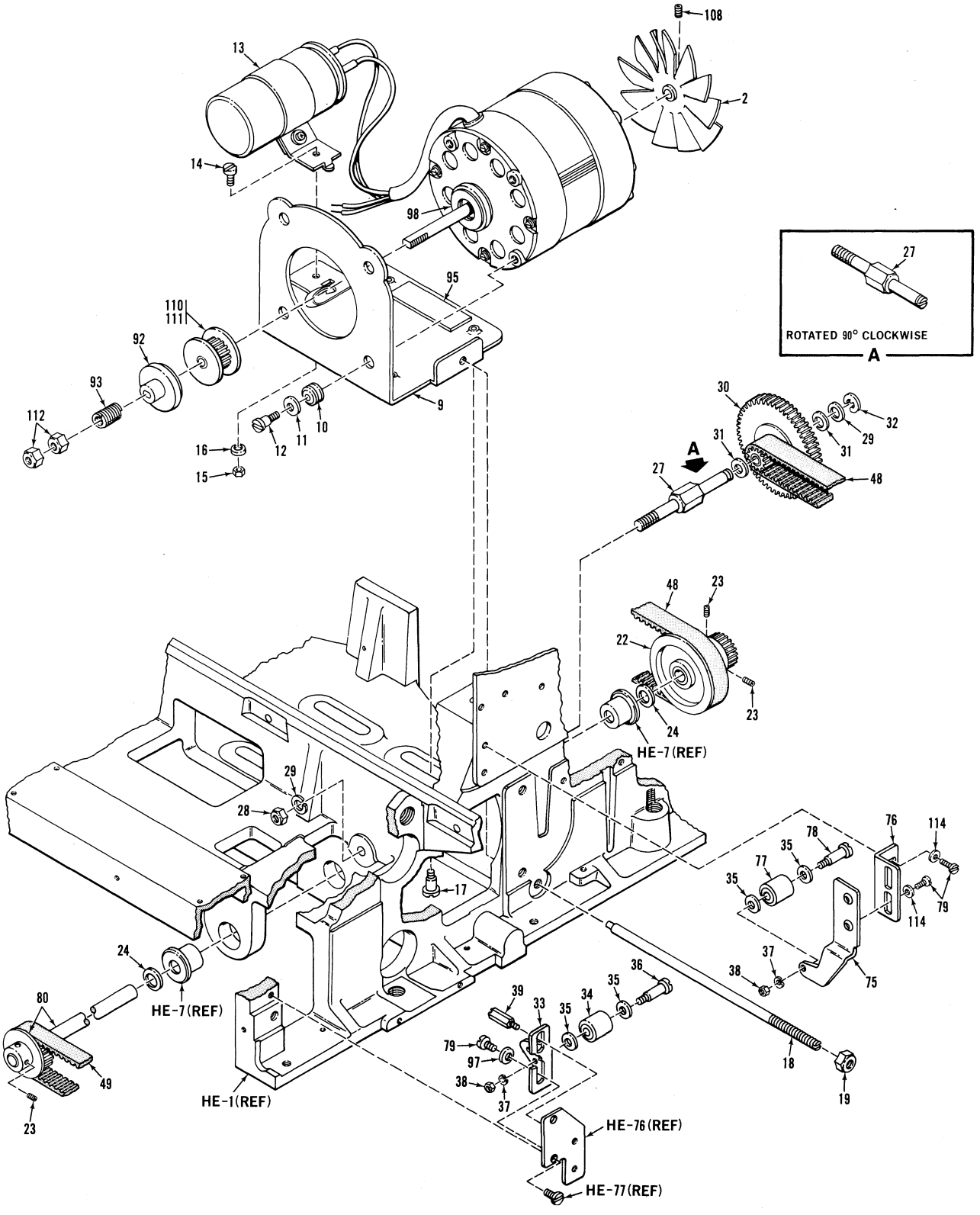


Figure 8-3. DRIVE MECHANISM - HB (PART 1)

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HB DRIVE MECHANISM (PART 1)

Reference Number	Part Number	Part Name	Quantity
HB-2	525838001	Main Motor Fan W/Set-Screw	1
HB-9	525060001	Motor Bracket	1
HB-10	510101001	Grommet for HB-98	4
HB-11	510061001	Washer for HB-10	4
HB-12	525063001	Screw for HB-1, 9	4
HB-13	525064001	Capacitor Unit for HB-98	1
HB-14	007400716	Screw for HB-13	1
HB-15	021400106	Nut for HB-14	1
HB-16	028040247	Spring Washer for HB-14	1
HB-17	525066001	Screw for HB-9 and Frame	4
HB-18	525067001	Adjusting bolt for HB-48	1
HB-19	021060106	Nut for HB-18	1
HB-22	525069001	Intermediate Pulley with Gear	1
HB-23	525745001	Set-Screw for HB-22, 80	3
HB-24	525071001	Felt Washer for HB-80	2
HB-27	525075001	Idle Shaft for HB-30	1
HB-28	021060106	Nut for HB-27	1
HB-29	025060236	Flat Washer for HB-27	1
HB-30	525076001	Intermediate Gear for Forward Clutch	1
HB-31	525074001	Felt Washer for HB-30	2
HB-32	048040346	Snap Ring for HB-27	1
	525078001	Tensioner Unit (Front)	1
		Note: This unit is assembled with parts covering from reference number HB-33 to HB-39.	
HB-33	525079001	Tensioner Bracket (Front)	1
HB-34	525080001	Tensioner	1
HB-35	511146001	Felt Washer for HB-34	4
HB-36	525082001	Axle for HB-34	1
HB-37	028030247	Spring Washer for HB-36, 78	2
HB-38	021300106	Nut for HB-36, 78	2
HB-39	525530001	Screw for HB-33	1

Reference Number	Part Number	Part Name	Quantity
HB-48	525672001	Timing Belt (100XL)	2
HB-49	525671001	Timing Belt (130XL)	1
HB	525741001	Tensioner Unit (Rear)	1
		Note: This unit is assembled with parts covering from reference number HB-75 through HB-79, including HB-35.	
HB-75	525694001	Tensioner Bracket (Rear) A	1
HB-76	525695001	Tensioner Bracket (Rear) B	1
HB-77	525703001	Tensioner (L)	1
HB-78	525696001	Axle for HB-77	1
HB-79	007400616	Screw for HB-75, 76	5
HB-80	525726001	Intermediate Shaft W/Pulley	1
HB-92	525839001	Motor Pulley Driver	1
HB-93	525749001	Spring for HB-92	1
HB-95	525846001	Cushion Rubber for HB-98	1
HB-98	525836001	Main Motor W/Fan and Clutch Plate	1
HB-108	525748001	Set-Screw for HB-2	1
HB-110	527037001	Motor Pulley (60 Hz) (Metal)	1
HB-111	527035001	Motor Pulley (50 Hz) (Metal)	1
HB-112	021060306	Nut for HB-93	2
HB-114	025040236	Washer for HB-79	2

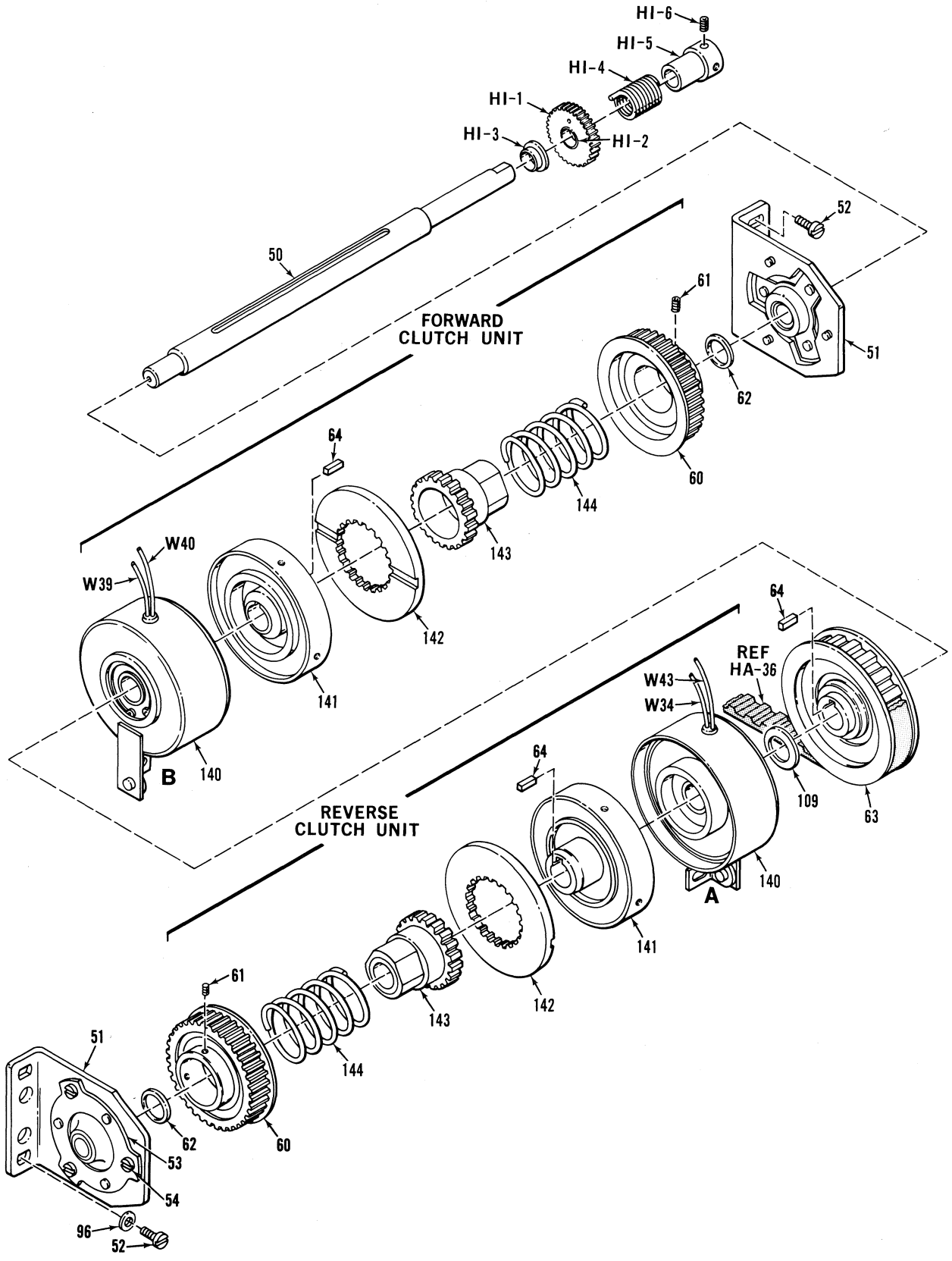


Figure 8-3A. DRIVE MECHANISM - HB (PART 2)

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HB DRIVE MECHANISM (PART 2)

Reference Number	Part Number	Part Name	Quantity
HB-50	525089001	Shaft for Clutches (with key-way)	1
HB-51	525090001	Bushing Bracket	2
HB-52	525752001	Screw for HB-51	4
HB-53	525092001	Bushing Unit for HB-50	2
HB-54	007400616	Screw for HB-53	6
HB-60	525711001	Pulley for Forward and Reverse Clutch	2
HB-61	525744001	Set-Screw for HB-60	4
HB-62	525102001	Sleeve for HB-50	2
HB-63	525104001	Pulley for Main Belt (HA-36)	1
HB-64	525103001	Key for HB-63, 141)	3
HB-96	025060236	Washer for HB-52	4
HB-109	525923001	Spacer for HB-140 (Reverse Clutch Side)	1
HB-139	527378001	Pre-Load Clutch Unit (for Forward & Reverse Clutch) Note: This unit is assembled with parts covering from reference number HB-140 through HB-144)	2
HB-140	525095001	Clutch Field Assembly (used for both preload and air-gap).	2
HB-141	527376001	Clutch Rotor (Replaces both air-gap, forward rotor 525096001) and (air-gap, reverse rotor 525890001).	2
		The following parts HB-142 through HB-144 replace forward and reverse air-gap clutch armatures 525709001.	
HB-142	527329001	Splined Armature	2
HB-143	527328001	Hub	2
HB-144	527327001	Clutch Spring	2
HB-145	529202001	Pre-Load Clutch, Complete Note: This unit is assembled with parts covering from reference number HB-50, 60, 61, 63, 64, 96, 109 and 139.	1

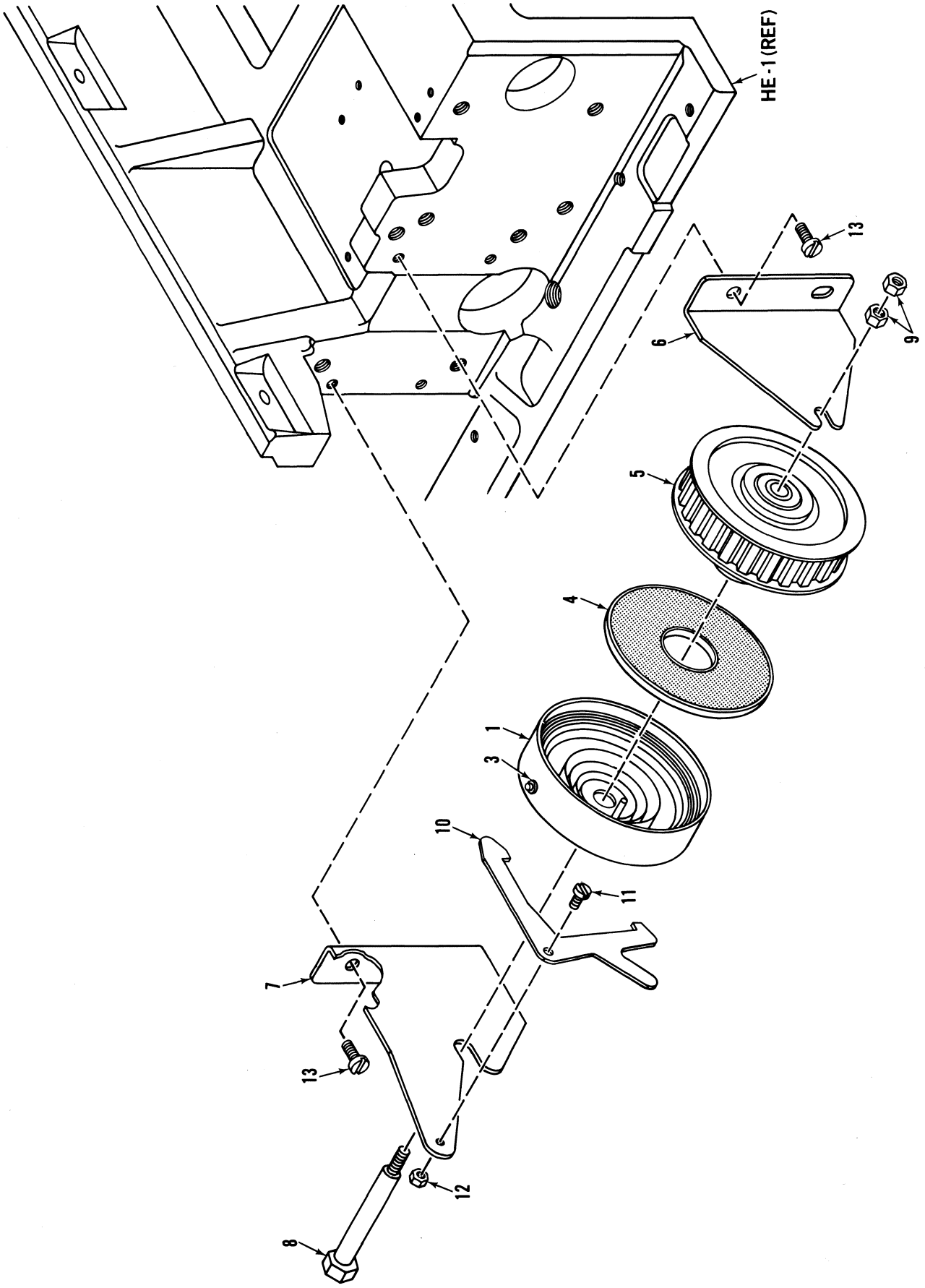


Figure 8-4. SPRING DRUM - HC

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HC SPRING DRUM

Reference Number	Part Number	Part Name	Quantity
	525108001	Spring drum complete unit	1
		Note: This is assembled with parts covering reference number HC-1 and HC-3 through HC-13.	
HC-1	525636001	Spring drum w/main spring	1
HC-3	048015346	Snap ring for HC-1	1
HC-4	525637001	Shielding plate for HC-1	1
HC-5	525115001	Pulley for HC-1	1
HC-6	525120001	Bracket (front) for HC-1	1
HC-7	525121001	Bracket (rear) for HC-1	1
HC-8	525119001	Shaft for HC-1, 5	1
HC-9	021400106	Nut for HC-8	2
HC-10	525122001	Pawl for HC-1	1
HC-11	007300616	Screw for HC-10	1
HC-12	021300106	Nut for HC-11	1
HC-13	007400516	Screw for HC-6, 7	4

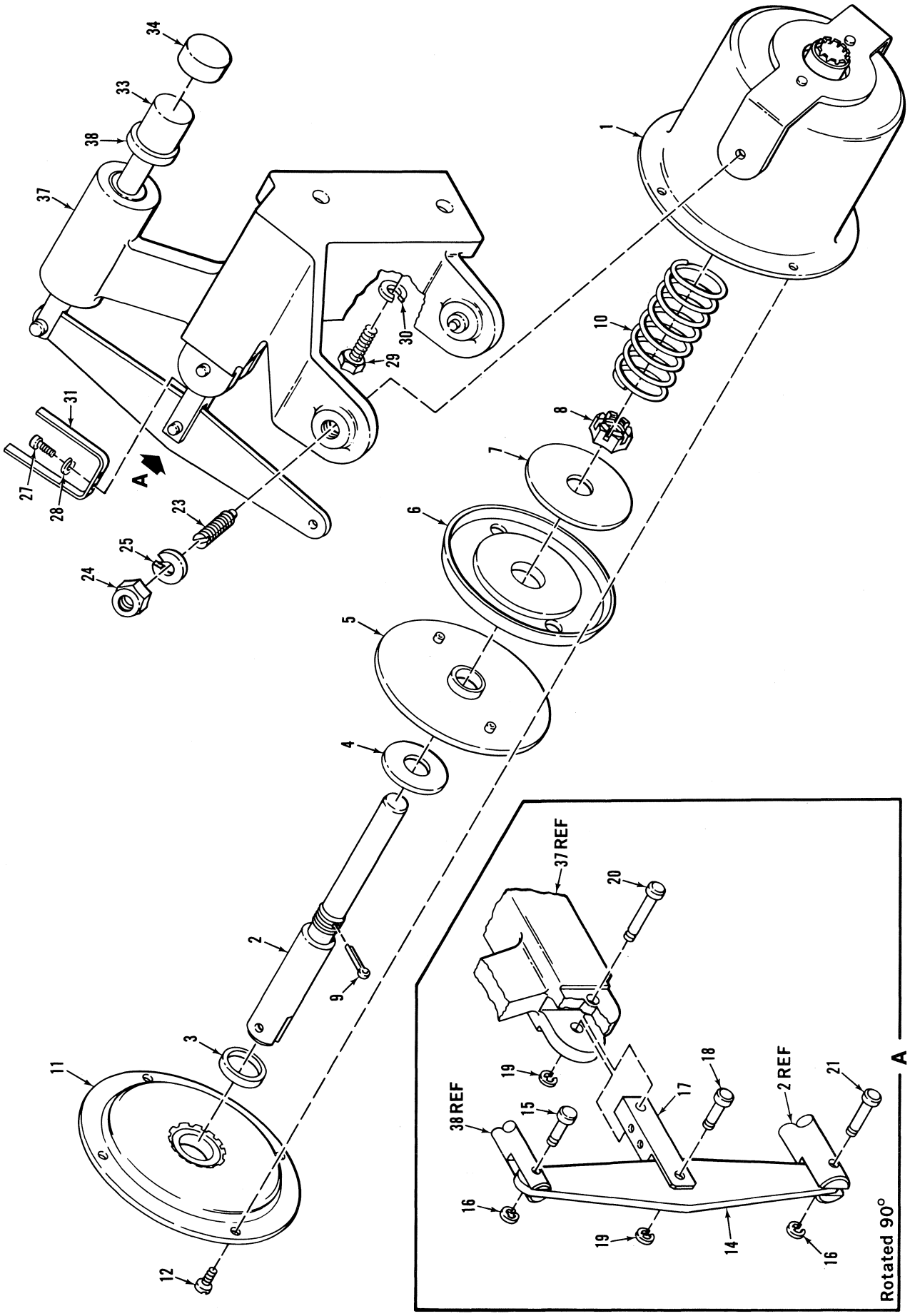


Figure 8-5. DAMPER - HD

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HD DAMPER

Reference Number	Part Number	Part Name	Quantity
	527363001	Damper complete unit	1
		Note: This unit is assembled with the parts covering from reference number HD-1 to HD-12, HD-14 to HD-21, HD-23 to HD-25 and HD-27 through HD-34 and HD-37.	
HD-1	525124001	Damper cylinder	1
HD-2	525128001	Piston rod	1
HD-3	525547001	Cushion rubber for HD-4	1
HD-4	025100236	Washer for HD-2	1
HD-5	525129001	Piston	1
HD-6	525130001	Packing	1
HD-7	525131001	Steel Washer for HD-6	1
HD-8	525132001	Nut for HD-7	1
HD-9	045161806	Split pin for HD-8	1
HD-10	525133001	Spring for HD-2	1
HD-11	525134001	Lid for HD-11	4
HD-12	007300416	Screw for HD-11	4
HD-14	525142001	Pin for	1
HD-15	525143001	Pin for the HD-14, 32	1
HD-16	048020346	Snap ring for HD-15, 21	2
HD-17	525144001	Link for HD-14	1
HD-18	525145001	Pin for HD-14, 17	1
HD-19	048030346	Snap ring for HD-18, 20	2
HD-20	525146001	Pin for HD-17	1
HD-21	525147001	Pin for HD-2, 14	1
HD-23	525148001	Center screw for HD-1	1
HD-24	021060106	Nut for HD-23	1
HD-25	028060247	Spring washer for HD-24	1
HD-27	007300516	Screw for HD-31	1
HD-28	028030247	Spring washer for HD-27	1
HD-29	525149001	Screw for HD-22	2
HD-30	028060247	Spring washer for HD-29	2
HD-31	525661001	Spring for HD-14	1
	527318001	Carriage stopper lever unit	1
		Note: This unit is assembled with the parts covering from reference number HD-33, HD-34 and HD-38.	
HD-33	525669000	Damper cushion for HD-32	1
HD-34	525919001	Cap for HD-33	1
HD-37	527316001	Frame for HD-1	1
HD-38	527319001	Carriage Stopper Lever	1

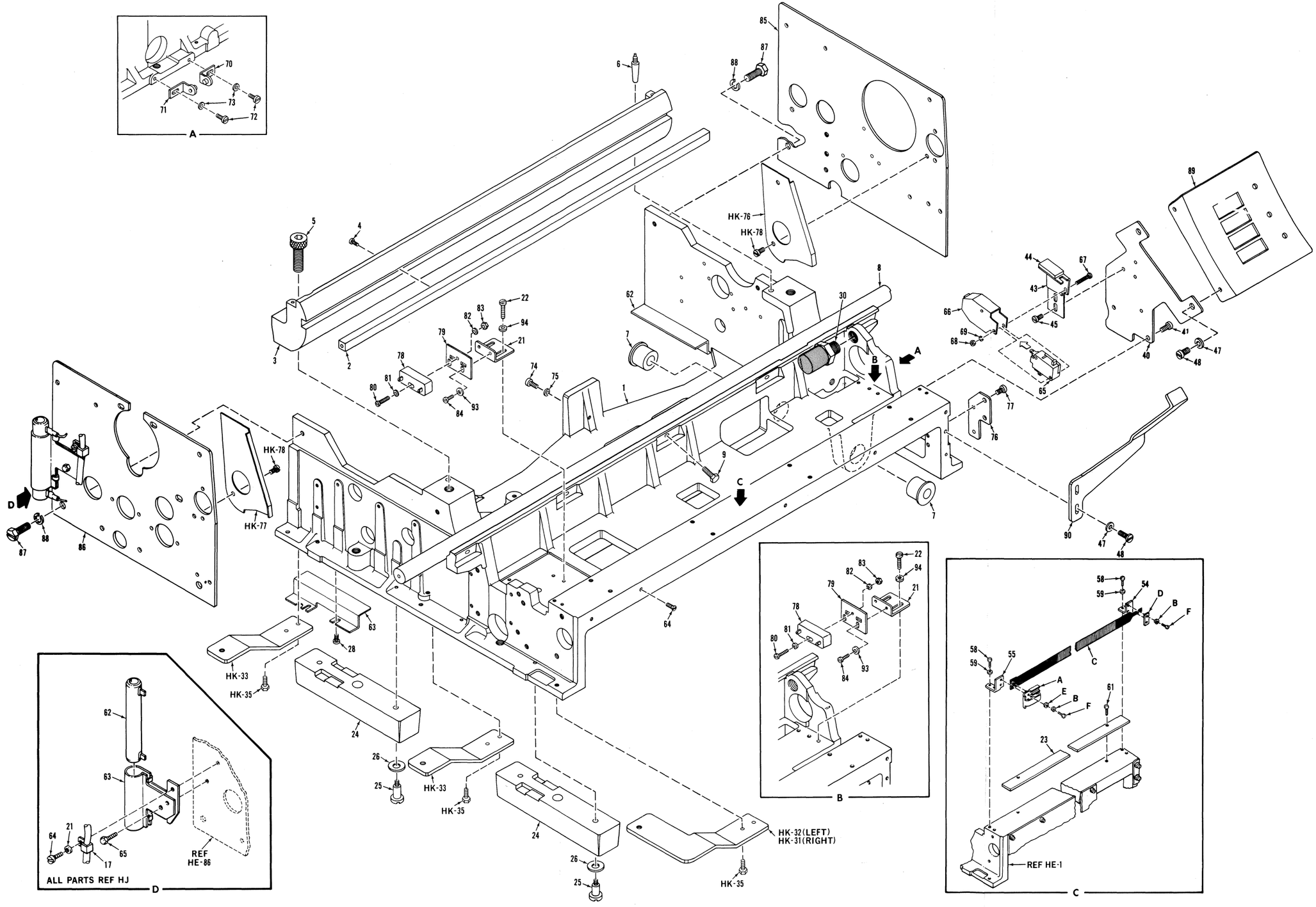


Figure 8-6. FRAME - HE

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HE FRAME

Reference Number	Part Number	Part Name	Quantity
HE-1	525151001	Frame	1
HE-2	525762001	Platen	1
HE-3	525761001	Platen holder	1
HE-4	007300716	Screw for HE-2	9
HE-5	018012826	Bolt for HE-3	2
HE-6	525154001	Locating bolt for HE-3	2
HE-7	525155000	Bushing for HB-80	2
HE-8	525866001	Guide bar to carriage	1
HE-9	017401416	Bolt for HE-8	5
HE-21	525169001	Reed Switch Holder	2
HE-22	007300716	Screw for HE-21	4
HE-23	525171001	Guide plate for carriage	1
HE-24	525181001	Rubber feet	4
HE-25	525182001	Screw for HE-24	8
HE-26	025060335	Washer for HE-25	8
HE-28	007300516	Screw for HE-62, 63	2
HE-30	527048001	Carriage stopper right	1
HE-31	028120247	Spring washer for HE-30	1
HE-40	525203001	Operator panel holder	1
HE-41	007400616	Screw for HE-40	2
HE-43	525532001	Top cover stop	1
HE-44	525500001	Magnet for HE-43	1
HE-45	007300416	Screw for HE-43	2
HE-47	025040236	Washer for HE-48	4
HE-48	007400516	Screw for HE-89, 90	4
HE-54	525617001	Bracket (right) for C (View C)	1
HE-55	525616001	Bracket (left) for C (View C)	1
HE-58	007300616	Screw for HE-54, 55	4
HE-59	025030236	Washer for HE-58	4
HE-61	001400713	Screw for HE-23	4
HE-62	525647001	Guide plate (right) for cavity	1
HE-63	525648001	Guide plate (left) for cavity	1
HE-64	005300814	Screw for power driver board cavity	4
HE-65	525629001	Top cover swtich	1
HE-66	525651001	Switch cover for HJ-65	1
HE-67	007301816	Screw for HE-65, 66	2
HE-68	021300106	Nut for HE-67	2
HE-69	028030246	Spring washer for HE-67	2
HE-70	525633001	Clutch stop (right)	1
HE-71	525631001	Clutch stop (left)	1
HE-72	007400616	Screw for HE-70, 71	2
HE-73	025040236	Washer for HE-72	2
HE-74	007400816	Screw for cavity	2
HE-75	028040247	Washer for HE-74	2
HE-76	525187001	Holder for HB-33	1
HE-77	007400616	Screw for HE-76	2
	525720001	Encased Limit Switch (Reed) complete unit	1
		Note: This unit is assembled with parts including Reference Numbers HE-78 through HE-84 and HE-21, HE-22.	
HE-78	525721001	Limit switch (reed) w/case	2
HE-79	525725001	Adjusting holder for HE-78	2
HE-80	001301403	Screw for HE-78	2
HE-81	025030133	Washer for HE-78	2
HE-82	028030247	Spring washer for HE-78	2
HE-83	021300106	Nut for HE-78	2
HE-84	007300516	Screw for HE-79	4
HE-85	525935001	Chassis (right)	1
HE-86	525936001	Chassis (left)	1
HE-87	525752001	Bolt for HE-85, 86	4
HE-88	028060247	Spring washer for HE-87	4
HE-89	525852001	Operator panel (A)	1
HE-90	525854001	Support for HE-89	1
HE-93	025030133	Washer for HE-84	2
HE-94	025030236	Washer for HE-22	2
A	63508140	Clasp	1
B	34000032	Lockwasher, millimeter (alternate: 028030247)	4
C	63002440-1	Flexible Mylar Timing Fence	1
D	63508106-1	Clamp	1
E	34000052	Washer, flat, 3 millimeter (alternate: 025030236)	2
F	34000048	Screw, Fill. HD MP3X6 mm lg (alternate: 001300716, MP3X7 mm lg)	4
		The HK drawing has been deleted but the following parts have been retained for Model 101/101A.	
HK-31	525642001	Cover, Holder (Front Right)	1
HK-32	525643001	Cover, Holder (front left)	1
HK-33	525644001	Cover, Holder	4
HK-35	017501016	Bolt for HK-31, 32, 33	12
HK-76	525658001	Cover, (Right)	1
HK-77	525659001	Cover, (Left)	1
HK-78	007400516	Screw for HF-76, 77	2

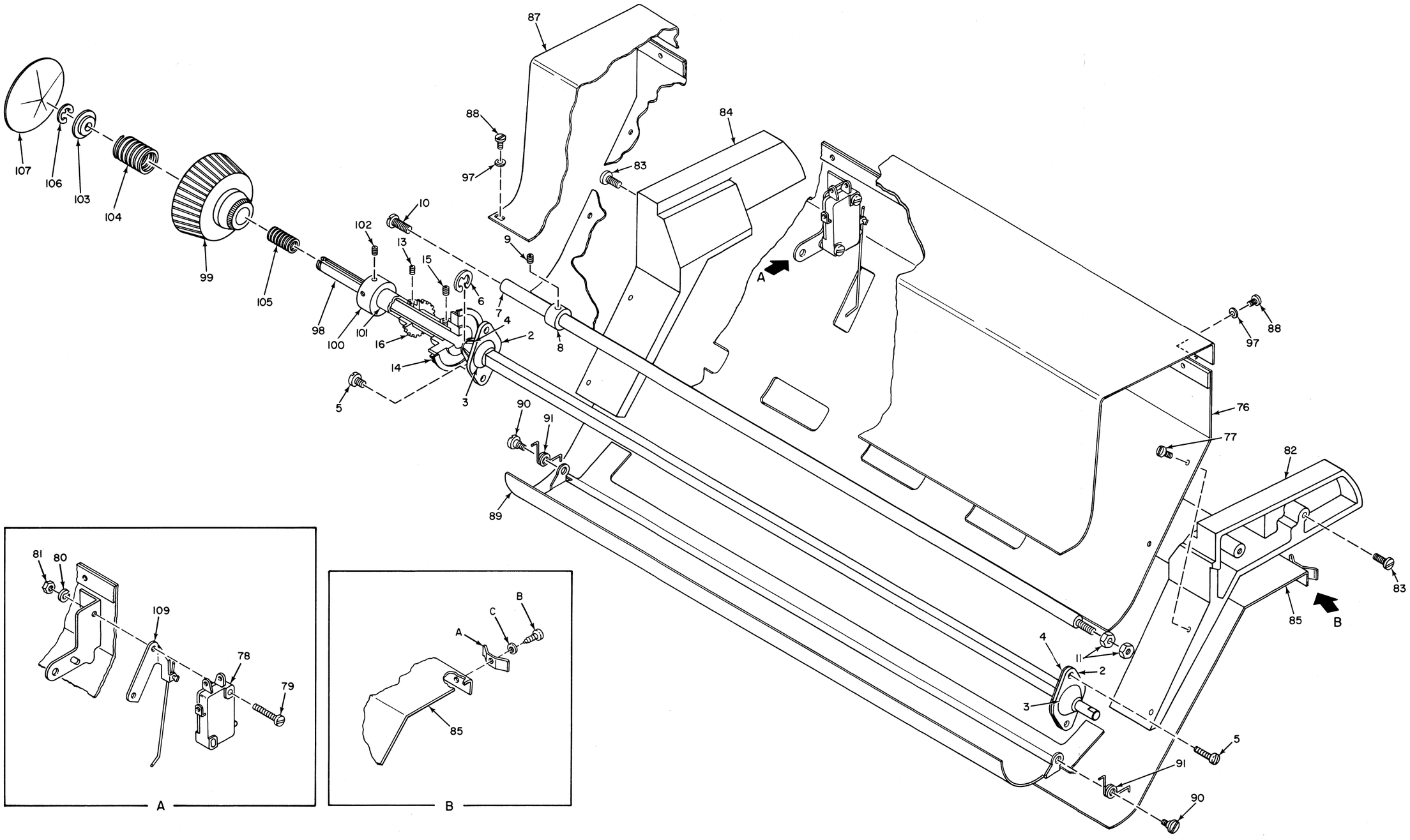


Figure 8-7. PAPER FEED MECHANISM - HF

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HF PAPER FEED MECHANISM

Reference Number	Part Number	Part Name	Quantity
HF-2	525207001	Holder for HF-3	2
HF-3	525208001	Bushing for HF-98	2
HF-4	525209001	Retainer for HF-3	2
HF-5	007400516	Screw for HF-2, 4	4
HF-6	048050346	Snap ring for HF-98	1
HF-7	525210001	Guide bar for pin feed unit	1
HF-8	525551001	Collar for pin feed unit	1
HF-9	525743001	Set-screw for HF-8	1
HF-10	007401016	Screw for HF-7	1
HF-11	021400106	Nut for HF-7	2
HF-13	525747001	Set-screw for HF-12, 16	4
HF-14	525213001	Pin feed pulley	1
HF-15	525743001	Set-screw for HF-14	2
HF-16	525215000	FF reader gear	1
HF-76	525855001	Paper pan (upper)	4
HF-77	007400816	Screw for HF-76	4
HF-78	52723001	Paper Empty micro switch	1
HF-79	007021616	Screw for HF-78	2
HF-80	028020247	Spring washer for HF-79	2
HF-81	021020106	Nut for HF-79	2
HF-82	525273000	Guide (right) for HF-77, 85	1
HF-83	007401016	Screw for HF-82, 84	4
HF-84	525274000	Guide (left) for HF-77, 85	1
HF-85	525859001	Paper pan (lower)	1
HF-86	007400816	Screw for HF-85	4
HF-87	525276001	Pin feed cover	1
HF-88	007300516	Screw for HF-87	4
HF-89	525763001	Paper pan (front)	1
HF-90	525278001	Screw for HF-89	2
HF-91	525861001	Spring for HF-89	2
HF-97	025050236	Washer for HF-88	4
HF-98	525771001	Driving shaft for pin feed unit	1
HF-99	525764001	Paper feed knob	1
HF-100	525769001	Coupler for HF-99	1
HF-101	525770001	Sleeve for HF-100	1
HF-102	525748001	Screw for HF-100	2
HF-103	525766001	Collar for HF-99	1
HF-104	525767001	Spring for HF-99	1
HF-105	525768001	Spring for HF-99	1
HF-106	048040346	Snap ring for HF-99	1
HF-107	525227001	Cap for HF-99	1
HF-108	025630236	Washer for HF-Z9	2
HF-109	527238001	Actuator for Paper Empty micro-switch (HF-78)	1
A	30410004	Clip, static discharge	1
B	33723717-10	Screw, Sheet metal, No. 4	1
C	34815005	Washer, internal, Lock	1

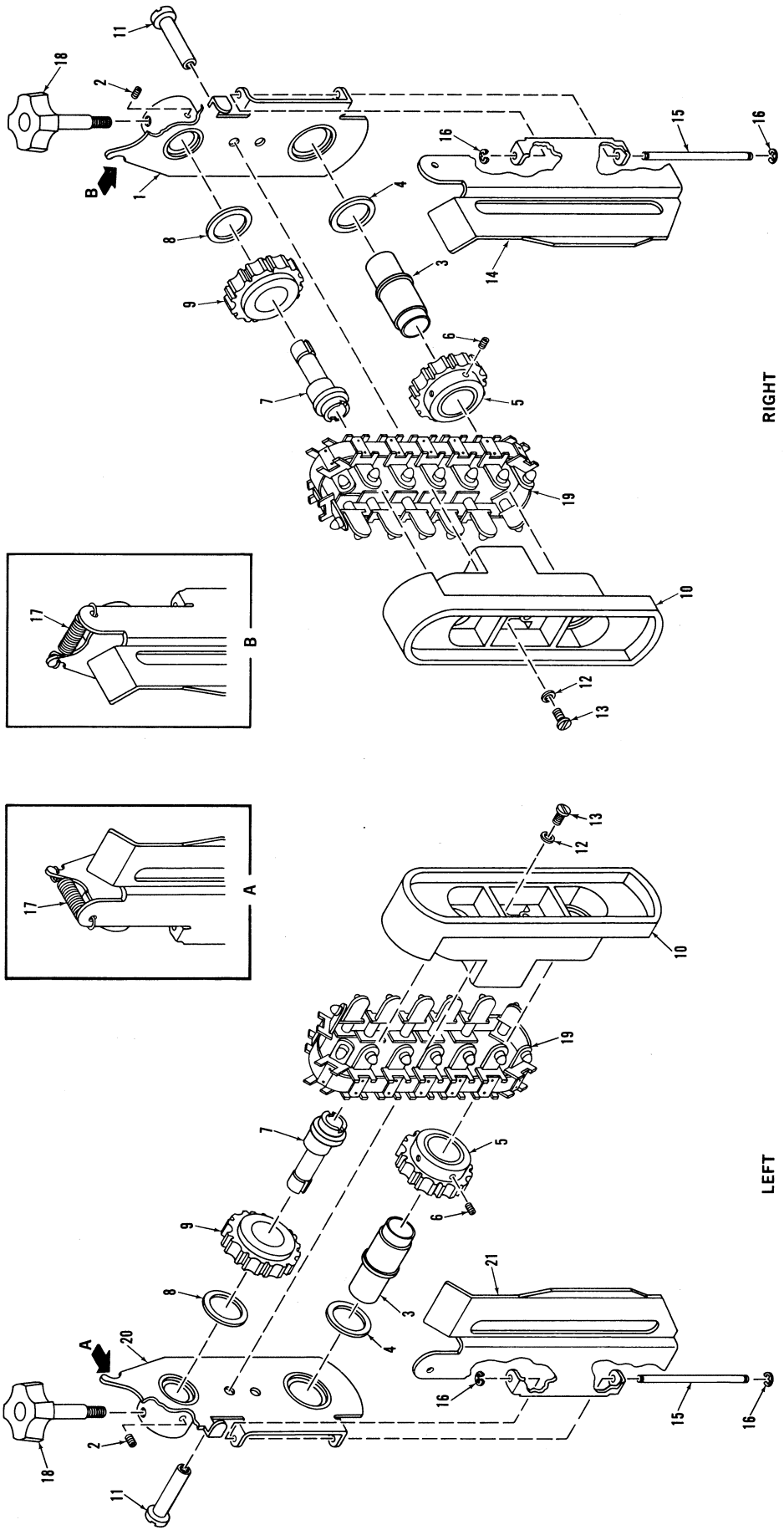


Figure 8-8. PIN FEED MECHANISM (LEFT AND RIGHT) - HG

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HG PIN FEED MECHANISM

Reference Number	Part Number	Part Name	Quantity
	525280001	Pin feed unit (right) complete	1
		Note: This unit is assembled with parts covering from reference number HG-1 to HG-19.	
HG-1	525281001	Pin feed holder (right)	1
HG-2	525747001	Set-screw for HG-7	2
HG-3	525287001	Driving sleeve	2
HG-4	525288001	Washer for HG-3	2
HG-5	525289001	Driving pulley for HF-3	2
HG-6	525746001	Set-screw for HG-5	4
HG-7	525290001	Eccentric sleeve for HF-1	2
HG-8	525291001	Driving pulley	2
HG-9	525292001	Driving pulley	2
HG-10	525294001	Guide for paper HG-19	2
HG-11	525295000	Stud for HG-1, 10	4
HG-12	025030236	Washer for HG-13	4
HG-13	001300716	Screw for HG-11	4
HG-14	525296001	Paper holding plate (right)	1
HG-15	525297001	Shaft for HG-14, 21	2
HG-16	048015346	Snap ring for HG-15	4
HG-17	525298001	Spring for HG-15	2
HG-18	525552001	Fixing knob	2
HG-19	525300001	Pin feed belt unit	2
	525304001	Pin feed unit (left) complete	1
		Note: This unit is assembled with parts covering from reference number HG-2 to HG-21, except HG-14.	
HG-20	525305001	Pin feed holder (left)	1
HG-21	525309001	Paper Holding plate (left)	1

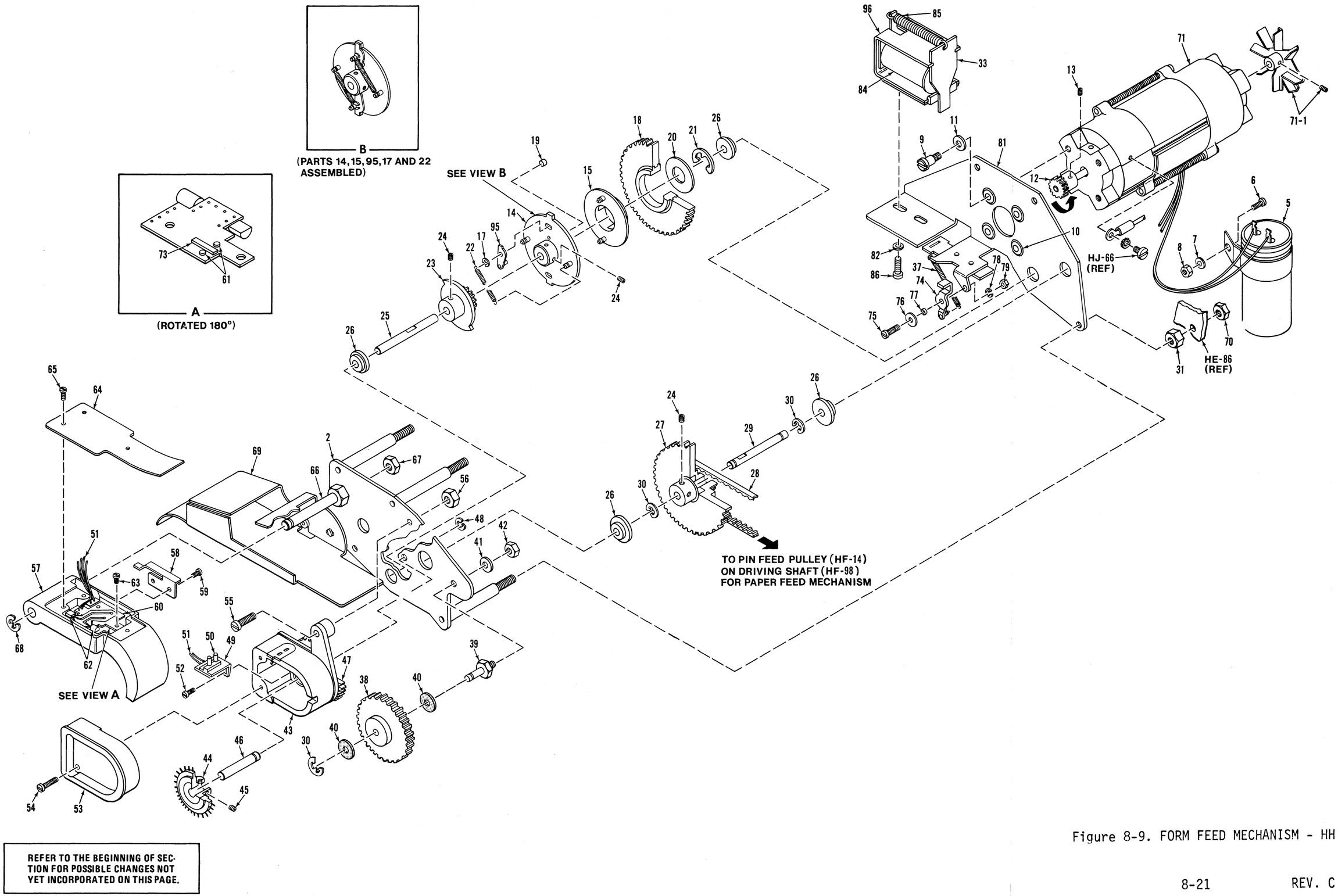


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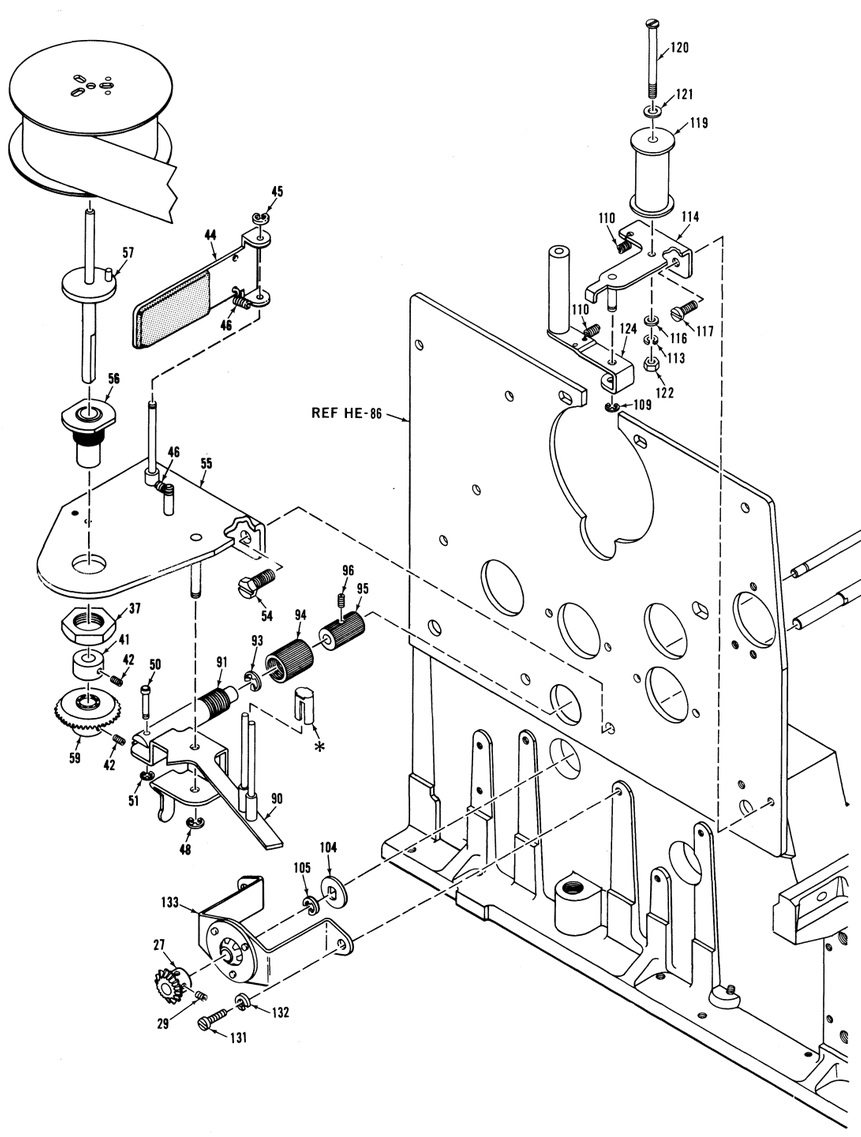
Figure 8-9. FORM FEED MECHANISM - HH

Figure HH FORM FEED MECHANISM

Reference Number	Part Number	Part Name	Quantity
	527241001	Form feed complete unit	1
		Note: This unit is assembled with parts covering from reference number HH-2, HH-5 through HH-31, HH-33 to HH-35 and HH-37 through HH-83.	
HH-2	525316001	FF chassis (left)	1
HH-5	525323001	Capacitor with bracket for HH-71	1
HH-6	007400616	Screw for HH-5	1
HH-7	028040247	Spring washer for HH-7	1
HH-8	021400106	Nut for HH-7	1
HH-9	525326001	Stud screw for HH-71	4
HH-10	510101001	Cushion Rubber for HH-71	4
HH-11	510061001	Washer for HH-9	4
HH-12	525328001	FF Motor Gear	1
HH-13	525743001	Set-screw for HH-2	1
	525329001	FF clutch unit	1
		Note: This unit is assembled with parts covering from reference number HH-14 to HH-22, HH-24 and HH-95.	
HH-14	525330001	FF clutch inside cam	1
HH-15	525333001	FF clutch releaser	1
HH-17	048020346	Snap ring for HH-15, 16	2
HH-18	525339001	FF clutch gear	1
HH-19	508532001	Roller for HH-14	3
HH-20	525341001	Guide for HH-19	1
HH-21	048080346	Snap ring for HH-20	1
HH-22	510062001	Spring for HH-14, 16	2
HH-23	525342001	Gear with stop cam	1
HH-24	525743001	Set-screw for HH-14, 23, 27	6
HH-25	525354001	Shaft for FF clutch	1
HH-26	525353001	Bushing for HH-25, 28	4
HH-27	525344001	FF idle gear	1
HH-28	364000001	Timing belt for HH-27	1
HH-29	525355001	Shaft for HH-27	1
HH-30	048040346	Snap ring for HH-29, 39	3
HH-31	525356001	Nut for HH-1, 2	3
	525347001	FF clutch and magnet unit	1
		Note: This unit is assembled with parts covering from reference number HH-33 to HH-35 and HH-80.	
HH-33	525351001	Armature for HH-96	1
HH-37	511091001	Spring for backstopper	1
HH-38	525357001	FF reader idle gear	1
HH-39	525359001	Shaft for HH-38	1
HH-40	511146001	Felt washer for HH-38	2
HH-41	025040236	Washer for HH-42	1
HH-42	021400106	Nut for HH-39	1
	525360001	Tape reader unit (lower)	1
		Note: This unit is assembled with parts covering from reference number HH-43 to HH-54.	
HH-43	527172001	Reader bracket (lower)	1
HH-44	525363001	Sprocket for tape	1
HH-45	525746001	Set-screw for HH-44	2
HH-46	525365001	Shaft for HH-44	1
HH-47	525366001	Gear for HH-46	1
HH-48	048030346	Snap ring for HH-46	1
	525367001	Reader lamp holder unit	1
		Note: This unit is assembled with parts from reference number HH-49 to HH-51.	
HH-49	525368001	Lamp holding P/C board	1
HH-50	525372001	Lamp for reader	2
HH-51	525373001	Lead wire for HH-49	2
HH-52	007020416	Screw for HH-49	1
HH-53	525374001	Lid for HH-43	1
HH-54	007301216	Screw for HH-43, 53	2
HH-55	007401416	Screw for HH-43	2
HH-56	021400106	Nut for HH-55	2
	525375001	Tape reader unit (upper)	1
		Note: This unit is assembled with parts covering from reference number HH-57 to HH-65 and HH-73.	
HH-57	525376001	Reader bracket (upper)	1
HH-58	525377001	Plate spring for HH-57	1
HH-59	007300416	Screw for HH-57, 58	2
	525378001	Reader P/C board unit	1
		Note: This unit is assembled with parts covering from reference number HH-60 to 62.	
HH-60	525380001	P/C board for phototransistor	1
HH-61	525383001	Phototransistor (MOTOROLA MRD 150-173)	2
HH-62	525568001	Transistor for HH-61 (MOTOROLA 2N3904)	2
HH-63	007020416	Screw for HH-60	2
HH-64	525388001	Lid for HH-57	1
HH-65	007020416	Screw for HH-64	3
HH-66	525389001	Shaft for HH-57	1
HH-67	021400106	Nut for HH-66	1
HH-68	048040346	Snap ring for HH-66	1
HH-69	525390001	Tape guide	1
HH-70	021400106	Nut for form feed complete unit	3
HH-71	525319001	FF motor with fan	1
HH-71-1	527314001	Fan w/set-screw	1
HH-73	525660001	Blinder for HH-50	1
HH-74	525753001	Back stopper	1
HH-75	007300803	Screw for HH-74	1
HH-76	503092001	Washer for HH-74	1
HH-77	525756001	Collar for HH-74	1
HH-78	028030247	Spring washer for HH-74	1
HH-79	021300106	Nut for HH-74	1
HH-81	525901001	FF chassis (right)	1
HH-82	025030236	Washer for HH-83	2
HH-84	527027001	Solenoid (for HH-96)	1
HH-85	527026001	Spring (for HH-33)	1
HH-86	527249001	Screw (for HH-96)	2
HH-95	525336021	FF clutch releasing pawl	2
HH-96	527856001	FF magnet (A) (air-gap)	1



LEFT SIDE

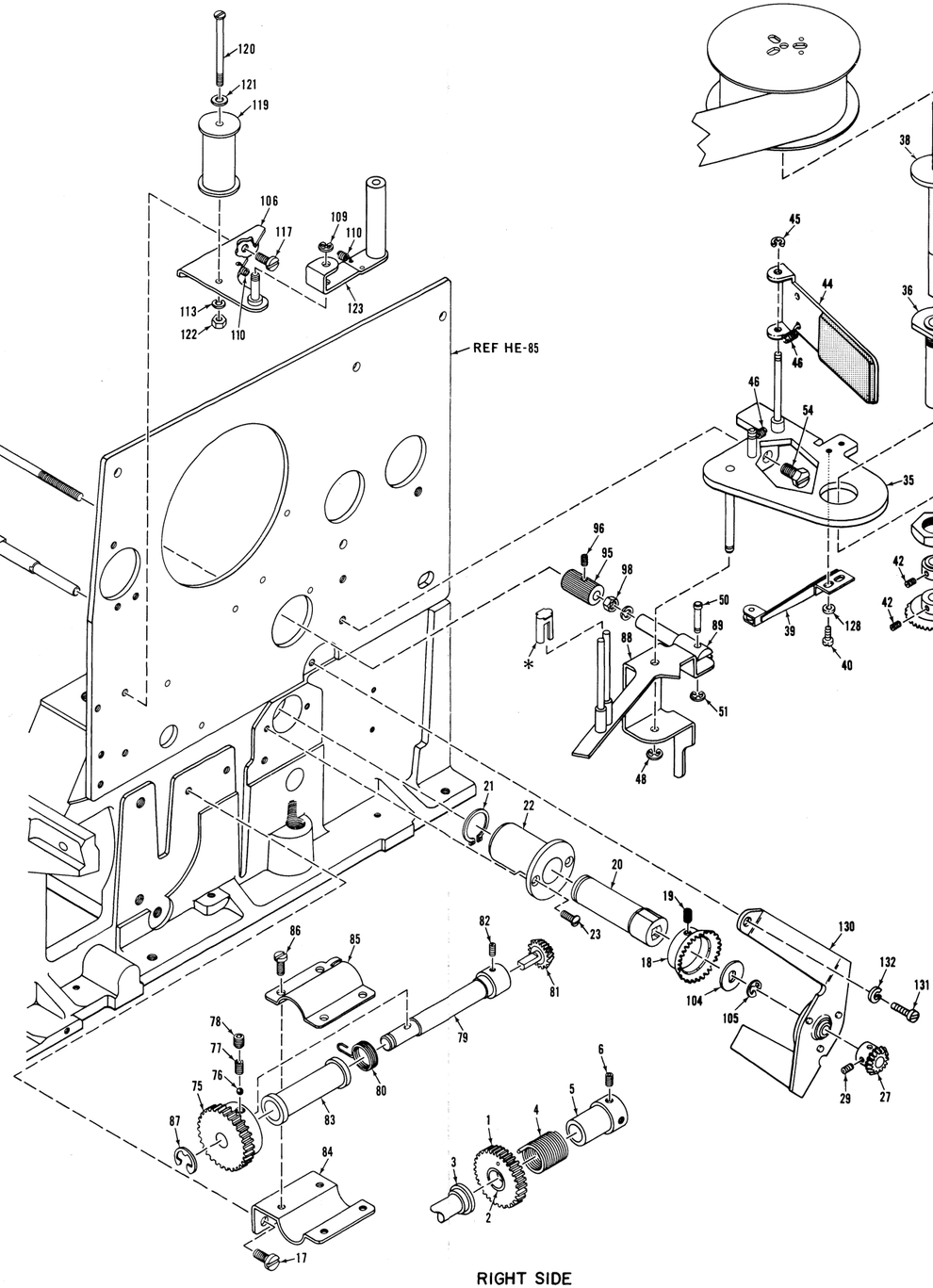


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Figure 8-10. RIBBON FEED MECHANISM - HI

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure HI RIBBON FEED MECHANISM

Reference Number	Part Number	Part Name	Quantity
HI-1	525391001	Clutch gear	1
HI-2	525392001	Bushing for HI-1, 4	1
HI-3	525393001	Spacer for HI-1	1
HI-4	525394001	Clutch spring	1
HI-5	525395001	Sleeve for HI-4	1
HI-6	525744001	Set-screw for HI-5	2
HI-17	007400516	Screw for HI-84	2
HI-18	525404001	Driving bevel gear	1
HI-19	525743001	Set-screw for HI-18, 20	2
HI-20	525407001	Sleeve for HI-19	1
HI-21	048140146	Snap ring for HI-20	1
HI-22	525408001	Bushing for HI-20	1
HI-23	005300814	Screw for HI-22	2
HI-27	525411001	Bevel gear for HI-103	2
HI-29	525746001	Set-screw for HI-27	4
	525420001	Ribbon spool holder complete unit (right)	1
		Note: This part is assembled with parts covering reference number HI-35 through HI-51 and HI-88, 89.	
HI-35	525421001	Ribbon spool holder (right)	1
HI-36	525426001	Bearing for HI-38	1
HI-37	525427001	Nut for HI-36, 56	2
HI-38	525429001	Ribbon spool shaft (right)	1
HI-39	525441001	Control spring for HI-88	1
HI-40	007300516	Screw for HI-39	2
HI-41	525433001	Collar for HI-57	2
HI-42	525747001	Set-screw for HI-41, 43, 59	8
HI-43	525434001	Bevel gear (right) for HI-38	1
HI-44	526817001	Ribbon holding plate, w/pad	2
HI-45	048020346	Snap ring for HI-44	2
HI-46	512462001	Spring for HI-44	2
HI-48	048025346	Snap ring for HI-88, 90	2
HI-50	525440001	Pin for HI-89, 91	2
HI-51	048020346	Snap ring for HI-50	2
HI-54	525541001	Bolt for HI-35, 55	4
	525446001	Ribbon spool holder complete unit (left)	1
		Note: This part is assembled with parts reference number HI-37, 41, 42, 44, 45, 46, 48, 50, 51 and HI-55 through HI-59 and HI-90, 91.	
HI-55	525447001	Ribbon spool holder (left)	1
HI-56	525450001	Bearing for HI-57	1
HI-57	525451001	Ribbon spool shaft (left)	1
HI-59	525454001	Bevel gear (left) for HI-57	1
	525396001	Driving shaft unit	1
		Note: This part is assembled with parts covering reference number HI-75 through HI-87	
HI-75	525398001	Driving gear for HI-79	1
HI-76	071039750	Ball for HI-75	1
HI-77	525630001	Spring for HI-76	1
HI-78	012500516	Set-screw for HI-77	1
HI-79	525397001	Driving shaft	1
HI-80	525399001	Clutch spring for HI-79	1
HI-81	525400001	Bevel gear for HI-79	1
HI-82	525748001	Set-screw for HI-81	2
HI-83	525401001	Bushing for HI-79	1
HI-84	525402001	Holder for HI-83	1
HI-85	525403001	Cover for HI-83	1
HI-86	007300416	Screw for HI-84, 85	4
HI-87	048070346	Snap ring for HI-79	1
HI-88	525681001	Reverse control lever (right)	1
HI-89	525697001	Connector (R.A.) for HI-92	1
HI-90	525682001	Reverse control lever (left)	1
HI-91	525698001	Connector (L.A.) for HI-92	1
HI-92	525700001	Ribbon reversing rod	1
HI-93	048030346	Snap ring for HI-92	1
HI-94	525699001	Coupler for HI-91	1
HI-95	525702001	Stopper for HI-89, 94	2
HI-96	525746001	Set-screw for HI-95	2
HI-97	028040247	Spring washer for HI-89	1
HI-98	021400106	Nut for HI-89	1
HI-99	525667001	Tension roller holder (right)	1
HI-100	525479001	Eccentric axle for HI-67	1
HI-101	028030247	Spring washer for HI-100	1
HI-102	021300106	Nut for HI-100	1
HI-103	525730001	Driving slide shaft A	1
HI-104	525731001	Washer for HI-103	2
HI-105	048050347	Snap ring for HI-103	2
	525464001	Guide roller unit (right)	1
		Note: This part is assembled with parts covering reference number HI-106, HI-113, HI-119 thru HI-122.	
HI-106	525465001	Guide roller holder (right)	1
HI-109	048025346	Snap ring 106, 114	2
HI-110	512463001	Spring for HI-115	2
HI-113	028030247	Spring washer for HI-120	1
	525475001	Guide roller unit (left)	1
		Note: This part is assembled with parts covering reference HI-110 through HI-117 and HI-119 through HI-122.	
HI-114	525476001	Guide roller holder (left)	1
HI-116	025030236	Washer for HI-120	1
HI-117	007400516	Screw for HI-106, 114	4
HI-119	525932000	Guide Roller	2
HI-120	525992001	Screw for HI-119	2
HI-121	025030336	Washer for HI-119	2
HI-122	021300106	Nut for HI-120	2
HI-123	527049001	Tension lever unit (right)	1
HI-124	527202001	Tension lever unit (left)	1
HI-128	025030133	Washer for HI-40	2
HI-130	527322001	Holder for HI-103 (right)	1
HI-131	007400816	Screw for HI-130 and HI-133	4
HI-132	028040247	Washer, spring for HI-131	4
HI-133	527323001	Holder for HI-103 (left)	1
*	63002294	Cap (Part of HI-88 and HI-90)	2

Figure HJ* ELECTRICAL HARDWARE

Reference Number	Part Number	Part Name	Quantity
HJ-1	525733001	Transformer Unit (Multitap)	1
HJ-2	007402216	Screw for HJ-1 and frame	4
HJ-3	525492001	ON/OFF Switch (1820-RL-Molex)	1
HJ-4	525493001	SELECT Switch (1820-RL-Molex)	1
HJ-4A	37253790	Lamp, (GE 379 equiv.-screw-base) 5- volt for HJ-3, 4	1
HJ-5	525494001	TOP OF FORM Switch	1
HJ-6	525495001	FORMS OVERRIDE Switch	1
HJ-7	525496001	Lamp for PAPER EMPTY, multiple purpose	2
HJ-8	525542001	Clip for HJ-7	2
HJ-9	525564000	In-line connector (Molex 1375-P2) (See Item 1 for mating connector (P13) on LM of Harness Assembly (W1), Ref. Dwg. 63002253, Section 7)	1
HJ-9A	527234000	Connector cover for item HJ-9	1
HJ-10	525548001	Bracket for HJ-9	1
HJ-11	007400716	Screw for HJ-10	2
HJ-12	028030247	Spring washer for HJ-11	2
HJ-13	525862001	Wire Harness	1
HJ-14	525558001	Bushing for HJ-13	1
HJ-15	525565001	Terminal (4P)	1
HJ-16	007300516	Screw for HJ-15	1
HJ-17	120370001	Holder for HJ-13 (A)	1
HJ-18	120679001	Holder for HJ-13 (B)	3
HJ-19	525664000	Holder for HJ-13 (#6)	4
HJ-21	025030236	Washer for HJ-20	13
HJ-22	207216000	Splicer (#2)	8
HJ-23	525570001	Wire (W-66)	1
HJ-30	525674001	Splicer cap (#3)	1
HJ-31	516218001	Groundwire for transformer	2
HJ-32	515456001	Groundwire for main motor	1
HJ-33	007400516	Screw for HJ-31, 32	5
HJ-34	550719002	External lock-washer for HJ-33	5
HJ-35	525675001	Insulating tube (#7) for main motor capacitor	2
HJ-40	025040236	Washer for HJ-18	1
HJ-41	340400001	Nylon band	4
HJ-42	525864001	Cap for operation panel	1
HJ-43	525865001	Spiral cord holder	1
HJ-44	525758000	Cord holder for HJ-13 (#5)	2
HJ-46	525900000	Connector receptacle for cooling fan (for mating connector, see A-16)	1
HJ-47	525899001	Bracket for HJ-46	1
HJ-48	007300516	Screw for HJ-47	2
HJ-49	525899001	Connector holder	1
HJ-50	525898001	Splicer cap (#8)	2
HJ-51	525896001	Head wire for HJ-9, pin 13, W90	1
HJ-52	525897001	Head wire for HJ-9, pin 15, W91	1
HJ-53	525894001	Cooling fan wire #1 (from main frame harness)	1
HJ-54	525895001	Cooling fan wire #2 (from main frame harness)	1
HJ-62	527029001	Resistor 40 ohms, 40W, (for solenoid HH-84)	1
HJ-63	527028001	Heat Sink (for HJ-62)	1
HJ-64	007401016	Screw (for HJ-18, 63)	13
HJ-65	017501016	Bolt (for HJ-18, 63)	13
HJ-66	007400416	Screw for gnd wire on HH-71	1

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

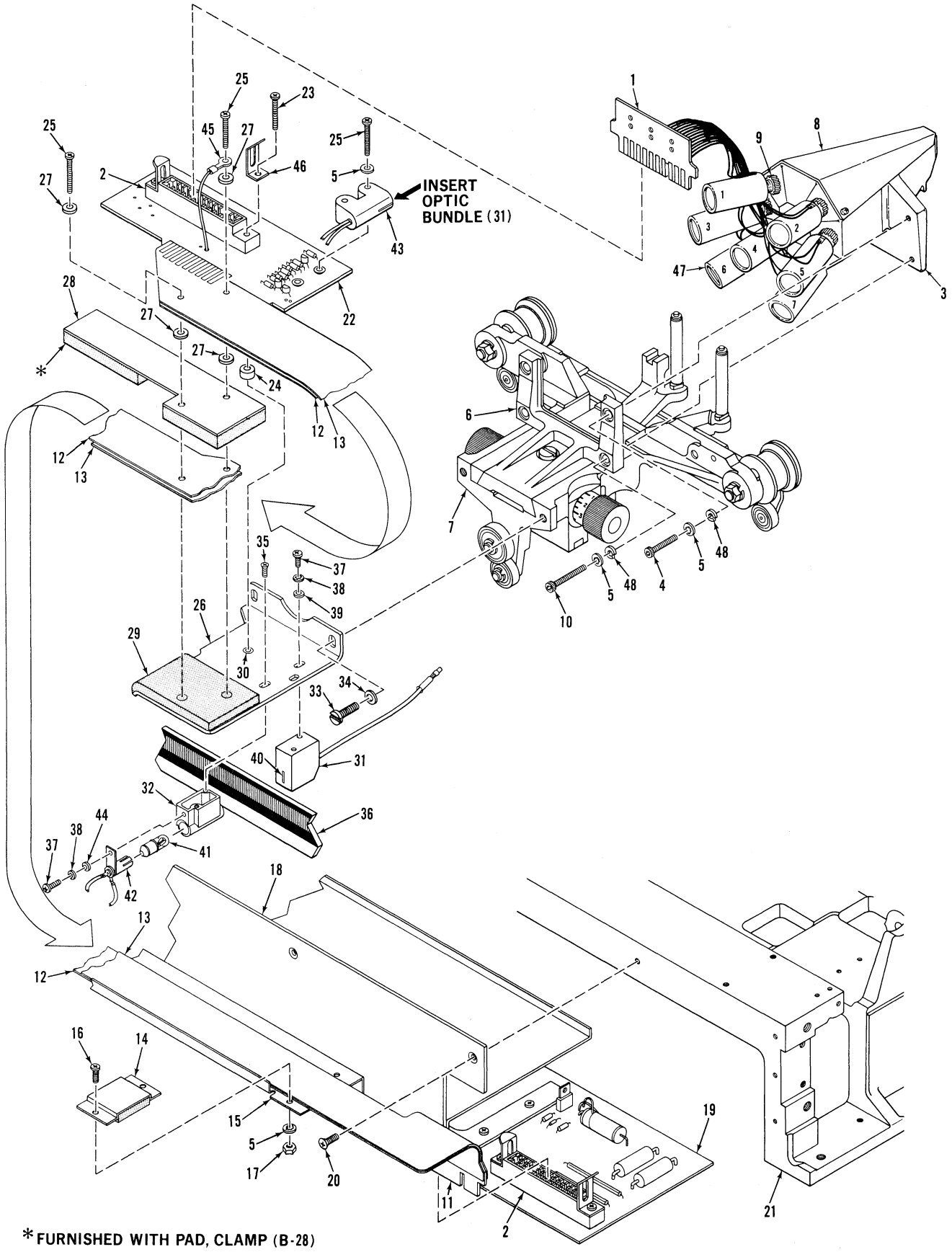


Figure 8-12. PRINT HEAD AND ASSOCIATED ASSEMBLIES (B)

REFER TO THE BEGINNING OF SECTION FOR POSSIBLE CHANGES NOT YET INCORPORATED ON THIS PAGE.

Figure 8-12 (B)* PRINT HEAD AND ASSOCIATED ASSEMBLIES

Reference Number	Part Number	Part Name	Quantity
B-1	63001040-1	Fingerboard, solenoid, 10 position	1
B-2	31230011	Connector P.C., 20 contact	2
B-3	63002437-1	D.R. Head Assembly (7-wire)	1
B-4	34114161	Screw, Hex, Socket, Cap (4-40 x ½ lg)	2
B-5	34815007	Washer, Lock, Int., No. 4	5
B-6	525001000 (HA-1)	Head Bracket	1
B-7	525005001	Carriage Unit	1
B-8	63002483-1	Cover, Print Head	1
B-9	63002122-1	Nut, Locking, Solenoid	1
B-10	34114201	Screw, Hex, Socket, Cap (4-40 x 5/8 lg)	2
B-11	63001064-1	Connector, Fingerboard (Part of cables, HN-12, 13)	1
B-12	63002312-2	Ribbon Cable, Bottom	1
B-13	63002312-1	Ribbon Cable, Top	1
B-14	63002247-1	Cable Clamp Assembly	1
B-15	63002234-1	Cable Tray	1
B-16	34517105	Screw, Pan/Phil, (4-40 x 5/16)	2
B-17	34712007	Nut, Hex (4-40)	2
B-18	63002200-1	Bracket, Heat Sink	1
B-19	63002242-1	Comp. Board Ass'y, Power Driver	1
B-20	005300814	Screw (HE-64)	4
B-21	525151001	Frame (HE-1)	1
B-22	63002306-1	Video Amplifier Assembly	1
B-23	34517287	Screw, Pan/Phil, 4-40 x 7/8	1
B-24	36614406	Washer, Fibre (No. 6)	1
B-25	34517247	Screw, Pan/Phil, 4-40 x 3/4	3
B-26	525043001 (HE-50)	Bracket (Supports Lamp Ass'y, Fibre Optic Head, Flat Cable & Video Amp Board)	1
B-27	34000019	Washer, Fibre, No. 6	4
B-28	63992348-1	Pad Assy, Ribbon Cable	1
B-29	63002366-3	Sponge	1
B-30	34021111	Rivnut, No. 4-40	3
B-31	63002248-1	Fibre Optics Head (and bundle)	1
B-32	63002259-1	Lamp Housing	1
B-33	007400816 (HA-55)	Screw	2
B-34	028040247 (HA-56)	Lockwasher	2
B-35	34502087	Screw, Flat/Phil (2-56 x ¼)	3
B-36	63002440	Timing Fence (Flexible) Ass'y	1
B-37	34507087	Screw, Pan/Phil (2-56 x ¼)	3
B-38	34805007	Washer, Lock, Int., (No. 2)	2
B-39	34000018	Washer, Flat (No. 3)	2
B-40	63002248-1	Optic Slit (Part of Optics Head)	1
B-41	37253790 (GE379)	Lamp	1
B-42	63002598-1	Lamp Socket Assembly	1
B-43	63002257-1	Photocell Housing Ass'y	1
B-44	34902007	Washer, Flat (No. 2)	1
B-45	31460000-1	Ground Lug	1
B-46	63002300-1	Clip, P.C.	1
B-47	63002216-1	Solenoid Ass'y (L1,2,3,4,5,6,7)	7
B-48	34818007	Washer, split	4

***This figure is keyed to paragraph 5.2.13 using a B as a symbol reference, and is a partial list used to show the removal/ replacement of four assemblies only.**

APPENDIX A
SIGNAL GLOSSARY

This signal listing is keyed directly to the 101AL printer schematic drawings. All signal mnemonics contained on those drawings are listed alphabetically with their source and destinations.

The following notation is used to identify the source and destination locations: 5-13/24-2 signifies element ME5, pin 13 located on schematic 63015124, sheet 2.

SIGNAL NAME	DESCRIPTION	kommt von SOURCE	geht zu DESTINATION
ACK	Acknowledge - A 2.5-5.0 usec pulse used to indicate completion of the input of a character or end of a functional operation.	5-13/24-2	P5-Z/24-1
BELL	A 1 to 2-second pulse used to produce an audible tone in the optional speaker located at the rear of the printer.	5-39/24-2	R56/24-3
$\overline{\text{BUSY}}$	Status signal indicating to the input device that the printer is not ready to receive data.	5-11/24-2	P5-C/24-1 20-1/03-1
CG1-CG7	Seven signal LINES from the character generators to the driver board, which fire print wires 1-7.	ME1 & ME7	P4-P,R,S,T, U,V,W
CHADD7	Character address line 7.	6-2/24-3	20-16/24-4
$\overline{\text{CIP}}$	Carriage in Print - Signal used to drive the print head forward.	6-12/24-1	P9-12/75-1
$\overline{\text{CIPX}}$	Carriage in Print - Signal from LSI chip #2, command to turn on forward clutch.	9-30/24-2	10-1/24-1
CLKTB1	Clock pulse used to clock input data into memory register. Used for loading data only.	5-14/24-2	6-11/24-3
CLKTB2	Clock pulse used to shift memory. Not used when loading data.	9-36/24-2	6-9/24-3
$\overline{\text{CSBSY}}$	Cause Busy - Command from LSI chip 2 to LSI chip 1 to cause a busy condition, when dummy character is detected at memory output.	9-35/24-2	5-10/24-2
$\overline{\text{CSLF}}$	Cause Line Feed - Line feed command from LSI chip #1.	5-6/24-2	3-2/24-1
DATA 1 - DATA 8	The 8 input data lines coming from the input device to the printer.	P5-V,T,U, X,S,M,W, N/24-1	
$\overline{\text{DATA STROBE}}$	A 0.5 usec (min.) pulse used to clock data from the input device to the printer logic.	P5-Y/24-1	14-11/24-1

SIGNAL NAME	DESCRIPTION	SOURCE	DESTINATION
$\overline{\text{DCPRM}}$	Decoded Prime - Prime command from LSI chip #1 to LSI chip #2 causes prime condition.	5-8/24-2	9-31/24-2
$\overline{\text{DCWI-DCW5}}$	Five full step data write pulses from LSI chip #2 to ROM character generator.	ME9-24-2	ME20-24-4
$\overline{\text{DCWO1-DCWO4}}$	Four half step data write lines to half-step ROM for 9 x 7 dot matrix.	ME9-24-2	ME30-24-4
DLYLF	Delay Line Feed - A 90 ms pulse following any paper movement command. Allows settle-out time for the form feed mechanical parts.	3-5/24-1	5-37/24-2
DLYSTB	Delay Strobe - A 450 us pulse used to generate data write signals in LSI chip #2 for the half step character generators.	13-6/24-1	9-22/24-2
$\overline{\text{DSI-DS8}}$	Buffered input data 1 to 8.	ME8 & ME14/24-1	ME17 & ME16/24-3
$\overline{\text{DSCR}}$	Decoded Carriage Return - Command from LSI chip #1 to LSI #2 to shift data to memory output and backfill shift register with zeroes.	5-12/24-2	9-33/24-2
DSTA	Data Strobe A signal used to inform LSI chip #1 that input data lines should be strobed into memory.	14-10/24-1	5-18-24-2
$\overline{\text{EOPSW}}$	End of Print Switch - Terminates a full line of print, 132 characters.	P4-7/24-2	9-19/24-2 16-19/03-2
FAULT	Printer fault signal to interface connector.	5-9/24-2	P5-L/24-1
FFH	Form Feed Hole - Vertical Format Unit.	P4-D/24-2	5-29/24-2
$\overline{\text{INPUT PRIME}}$	A level from the interface connector causing the printer electronics to be printed.	P5-K/24-1	4-9/24-1
GDSTB	Gated Strobe - Gates strobe with ACK which prevents CLKTB1 until the rising edge of ACK and prevent over-running the buffer.	5-17/24-2	E8/24-2

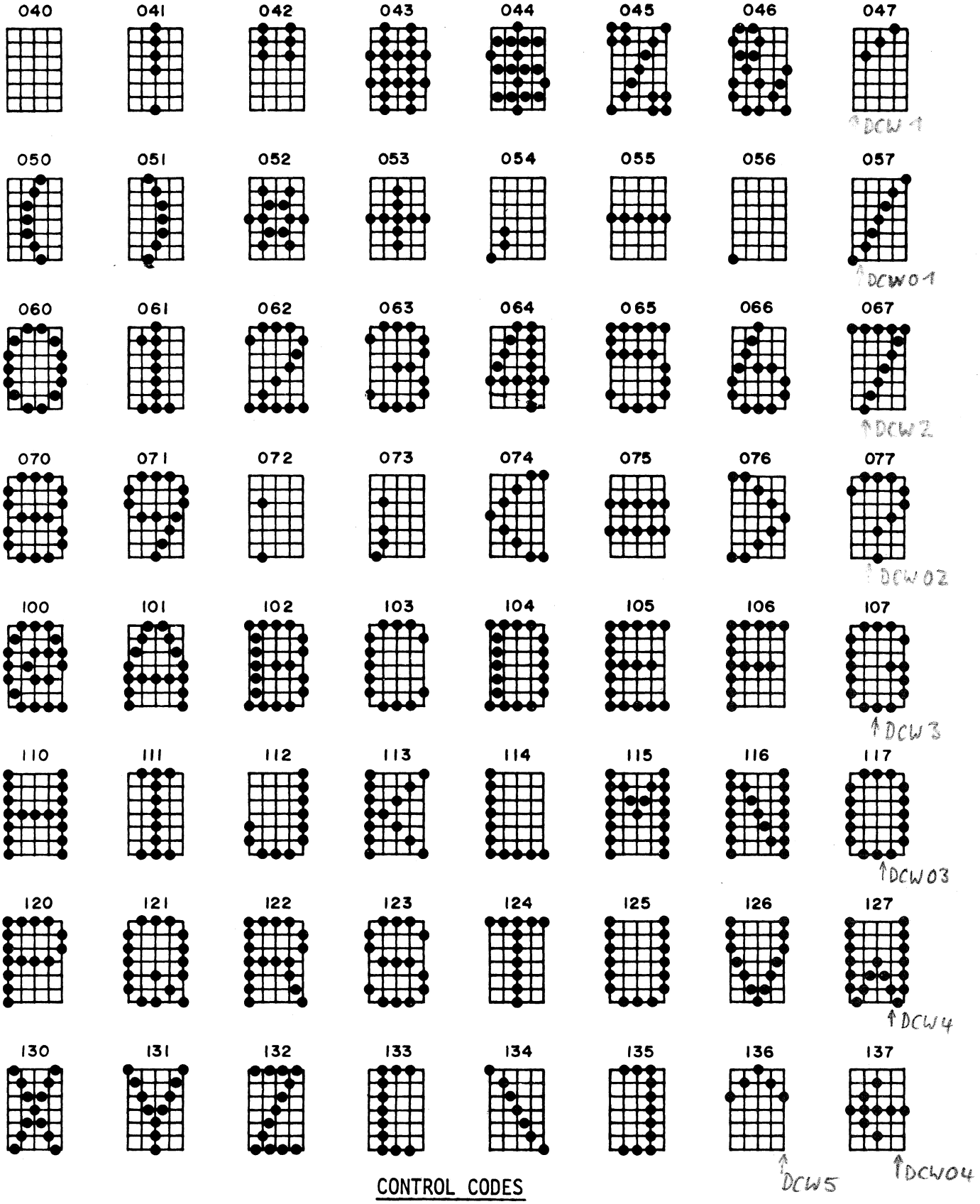
SIGNAL NAME	DESCRIPTION	SOURCE	DESTINATION
$\overline{LD}$	Light Detect - Status signal to interface connector, indicating the video circuit is not functioning.	9-17/24-2	P5-A/24-1
LF	Line Feed - 15 ms signal generates PMSOL during line feed.	3-13/24-1	5-30/24-2
LFOC	Low frequency oscillator (option), allows 3-12 second paper movement time out.	P5-8/24-2	5-2/24-2
OSC	Oscillator - 100 KHz to 200 KHz clock provides timing for printer operations.	9-25/24-2	5-4/24-2
$\overline{PE}$	Paper Empty signal indicating a paper empty condition.	5-34/24-2	P5-J/24-1
$\overline{PMSOL}$	Paper Movement solenoid - Used to activate line feed solenoid during a line feed, form feed or vertical tab operation.	5-7/24-2	P4-4/24-1
PRIME	Prime signal, 100-400 usec pulse from LSI chip #1 used to reset printer logic.	5-38/24-2	9-37/24-2
$\overline{PWR\ PRM}$	Power Prime - Automatic prime generated by turning on power to the printer.	5-5/24-2	9-32/24-2
$\overline{REMLF}$	Remote Line Feed signal. Operator panel, LINE FEED switch.	P4-17/24-2	5-33/24-2
ROME2	Signal which enables half-step ROM character generators.	9-24/24-2	15-9/24-4
ROMTB8	Enable signal used to select optional character sets by use of TB8.	10-8/24-3	15-13/24-4
$\overline{RTPSW}$	Ready to Print switch, informs LSI chip #2 that carriage is at left position.	P4-J/24-2	9-28/24-2
SELECT LAMP	Operator panel, SELECT indicator.		
SELSW	Operator panel, SELECT switch.	P4-4/24-2	5-31/24-2
SLCT'	Select	5-40/24-2	6-3/24-3

SIGNAL NAME	DESCRIPTION	SOURCE	DESTINATION
$\overline{SLCT}$	Select status signal to input connector.	9-40/24-2	P5-F/24-1
SPEAKER	Speaker		
SRCL	Shift Register Clear - Signal from LSI chip 2 used to clear shift registers.	9-38/24-2	17-2 & 16-2/24-3
$\overline{STROBE}$	Strobe - A 450 usec pulse used to generate character address signals to the ROM during character printing.	11-1/24-1	E37/24-4
$\overline{TB1}$-$\overline{TB7}$	Shift register outputs 1-7.	ME17 & ME16/24-3	ME22/24-4
TB8	Shift register output 8.	10-4/24-3	E33/24-3
$\overline{TB8}$	Shift register output 8 used to select additional ROM or individual elongated characters.	10-6/24-3	E34/24-3 9-34/24-2 E-17/24-2
TB8'	Same as TB8	10-3/24-3	
TOFSW	TOP OF FORM switch.	P4-A/24-2	5-32/24-2
$\overline{UPSC}$	Elongated Character Mode - Command from LSI chip 1 to chip 2 to print elongated characters.	5-15/24-2	E20/24-2
VIDEO	Video Amplifier Output - 1.0 ms square wave used to trigger STROBE one shot.	P4-Z/24-1 P3-9/03-1	11-5/24-1
VTH	Vertical Tab Hole - Vertical Format Unit.	P4-0/24-Z	5-28/24-2

APPENDIX B

STANDARD 9 x 7 64-CHARACTER SET

(I.D. Nos. C–8837 & C–8838)



CONTROL CODES

007 BELL	014 FORM FEED	177 DELETE
012 LINE FEED	015 CARRIAGE RETURN	021 SELECT ON
013 VERTICAL TAB	016 ELONGATED CHARACTER	023 SELECT OFF

Rev. C

CLRTB2+DCW = Zeichen (siehe S. 4-2)

APPENDIX C
PARALLEL INTERFACE SPECIFICATION
FOR CENTRONICS PRINTERS

C.1 INTERFACE TIMING

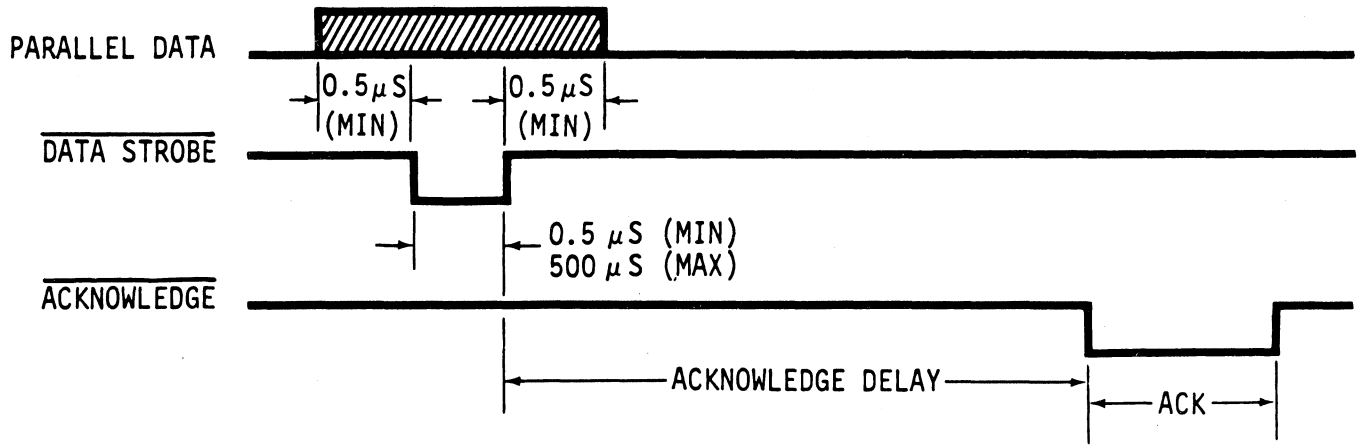
The single line buffer in each standard printer enables the printer to receive parallel data at a rate of up to 75,000 characters per second.

In general, the data transfer sequence consists of the input device placing the appropriate code on the data lines to the printer and then generating a data strobe pulse. The printer, after a slight delay, responds with an acknowledge pulse, of if the received data causes a busy condition, the printer first activates the busy line for the duration of the busy condition and then responds with an acknowledge pulse.

As a standard feature in all printers except the 101, data strobe is not recognized until the last character has been acknowledged (gated data strobe). As an option, however, data strobe can be recognized at any time.

Normal Data Input - No Busy

The diagram in Figure C-1 shows the timing involved in transferring data which does not cause a busy condition.

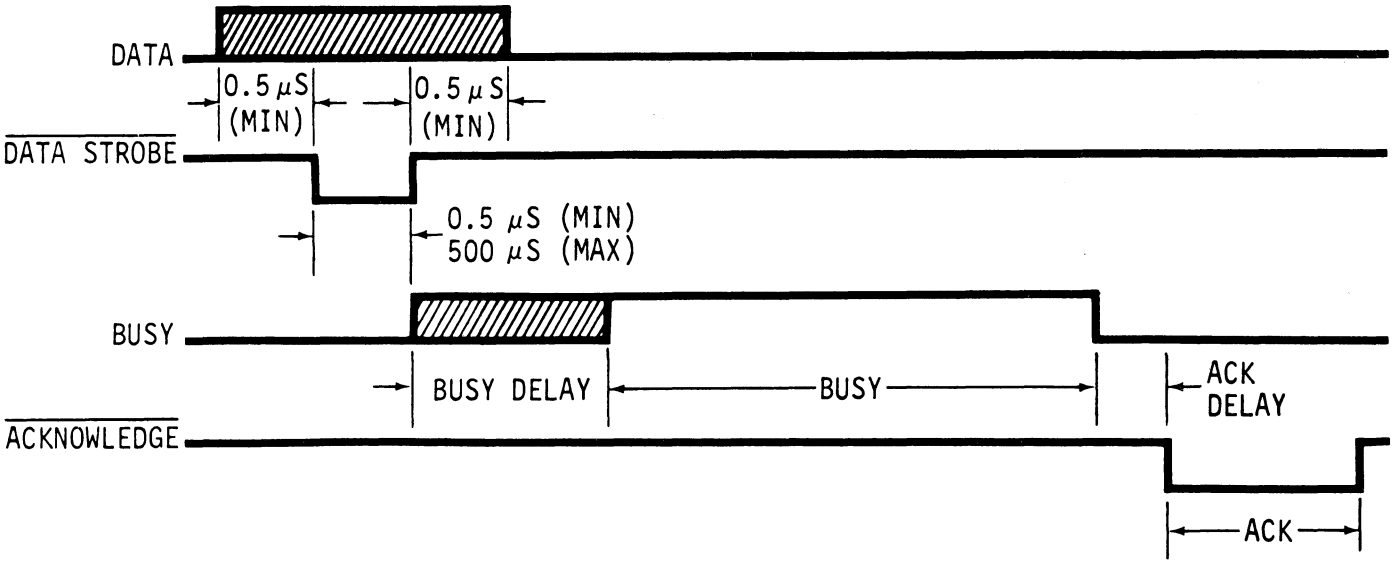


	101/101A/101S	101AL	102A	102AL	301	306	500	501
ACK DELAY	7 usec	2.5-10 usec	7 usec	2.5-10 usec	2.5-10 usec	2.5-10 usec	2.5-10 usec	2.5-10 usec
ACK	4 usec	2.5-5.0 usec	4 usec	2.5-5.0 usec	2.5-5.0 usec	2.5-5.0 usec	2.5-5.0 usec	2.5-5.0 usec

Figure C-1. NORMAL DATA INPUT

Data Input Causing Busy

The diagram in Figure C-2 shows the interface timing involved in transferring any data which causes a busy condition in the printer.



	101/101A/101S*	101AL	102A	102AL	301	306	500	501
BUSY DELAY	0	0-1.5 usec	0	0-1.5 usec	0-1.5 usec	0-1.5 usec	0-1.5 usec	0-1.5 usec
ACK DELAY	0	0-10.0 usec	0	0-10.0 usec	0-10.0 usec	0-10.0 usec	0-10.0 usec	0-10.0 usec
ACK	4 usec	2.5-5.0 usec	4 usec	2.5-5.0 usec	2.5-5.0 usec	2.5-5.0 usec	2.5-5.0 usec	2.5-5.0 usec
BUSY								
Line Feed	75-105 msec	75-105 msec	75-105 msec	16 msec (single LF) 75-105 msec (multiple LF)	70-100 msec	75-105 msec	75-105 msec	70-100 msec
Vertical Tab (1-inch)	300-310 msec	300-310 msec	300-310 msec	300-310 msec	160-200 msec	300-310 msec	300-310 msec	160-200 msec
Form Feed (11-inches)	3-3.5 sec	3-3.5 sec	3-3.5 sec	3-3.5 sec	1.5-2.0 sec	3-3.5 sec	3-3.5 sec	1.5-2.0 sec
Delete	3 msec	100-400 usec	3 msec	100-400 usec	100-400 usec	100-400 usec	100-400 usec	100-400 usec
Bell	2 sec	0	2 sec	0	0	0	0	0
Select	3 msec	100-400 usec**	3 msec	100-400 usec**	100-400 usec**	100-400 usec**	100-400 usec**	100-400 usec**
Deselect	Until printer is selected	Until printer is selected	Until printer is selected	Until printer is selected	Until printer is selected	Until printer is selected	Until printer is selected	Until printer is selected
Print Command	6 msec/char plus 75-105 msec LF	6 msec/char plus 75-105 msec LF	470-500 msec (total)	410-415 msec (total)	6 msec/char plus 70-100 msec LF	8.4 msec/char plus 75-105 msec LF	8.4 msec/char plus 75-105 msec LF	6 msec/char plus 70-100 msec LF
(Return time-no busy)	(240 msec max)	(240 msec max)	(0)	(0)	(270 msec max)	(270 msec max)	(400 msec max)	(400 msec max)

*Vertical Tab and Form Feed durations for the 101S apply to 6 line/inch operation.
**No busy if inhibit prime on select option is used.

Figure C-2. BUSY CONDITION TIMING

C2. PARALLEL INTERFACE SIGNALS

All standard Centronics printers are supplied with an Amphenol #57-40360, 36-pin interface connector (Centronics #31310019). The pin assignments, name, source and description for each interface signal are listed below.

Parallel Interface Connector	Signal Name	Source	Description
Pin 1, 19*	DATA STROBE	Input Device	A 0.5 usec pulse (min.) used to clock data from the processor to the printer logic.
2, 20	DATA 1	Input Device	Input data levels. A high represents a binary ONE, a low represents a ZERO. All printable characters (i.e., codes having a ONE in DATA 6 or DATA 7) are stored in the printer buffer. Control characters (i.e., codes having a ZERO in both DATA 6 and DATA 7), are used to specify special control functions. These codes are not stored in the buffer except when they specify a print command and are preceded by at least one printable character in that line.
3, 21	DATA 2	Input Device	
4, 22	DATA 3	Input Device	
5, 23	DATA 4	Input Device	
6, 24	DATA 5	Input Device	
7, 25	DATA 6	Input Device	
8, 26	DATA 7	Input Device	
9, 27	DATA 8	Input Device	
10, 28	$\overline{\text{ACKNLG}}$	Printer	Acknowledge pulse indicates the input of a character into memory or the end of a functional operation.
11, 29	BUSY	Printer	A level indicating that the printer cannot receive data.
12	PE	Printer	A level indicating that the printer is out of paper.
13	SLCT	Printer	A level indicating that the printer is selected.
14	±0V	Printer	(Formerly SS signal older version)
15	OSCXT	Printer	A 100 KHz (Models 101, 101A, 102A, 101S) or 100-200 KHz (All other models)
16	±5V		
17	Chassis Gnd		
18	+5V		
31, 30	$\overline{\text{INPUT PRIME}}$	Input Device	A level which causes the printer to be primed. (Not in 101)
32	$\overline{\text{FAULT}}$	Printer	A level that indicates a paper empty, light detect, or a deselect condition. (Not in 101)
34	Line Count Pulse		Both sides of the line count switch appear at the interface connector. This switch is opened and closed during each line feed operation. A level delivered to the switch would be pulsed off and on each time a line feed operation is performed. (Series 300 and 500)
35	Line Count Pulse Return		(Series 300 and 500)
36	Not Used		

*Second pin number indicates twisted pair return (±0V).

**Active low signals are specified by a line over the signal name. Active high signals have no line.

C3. BASIC SIGNAL SPECIFICATIONS

Logical TRUE

A high signal is defined as a logical TRUE or a logical ONE if it is in the range of +2.4 volts to +5.0 volts, not to exceed a peak positive voltage of 5.5 volts.

Logical FALSE

A low signal is defined as a logical FALSE or a logical ZERO if it is in the range of 0.0 volt to +0.4 volt, not to exceed a peak negative voltage of -0.5 volt.

Level

A signal which is present for two or more clock times or whose pulse width is not critical is defined as a level (e.g., the data inputs).

Pulse

A signal whose width is critical is defined as a pulse (e.g., $\overline{\text{DATA STROBE}}$) and the width is specified. Pulse width is measured at +2.4 volt for a true condition and +0.4 volt for a false condition.

Delay Time

Delay time is defined as the interval between the specified signal at the receiving end of a cable and reference signal in the receiving unit. It is measured at the +2.4 volt point for a logical ONE and +0.4 volt for a logical ZERO.

Switching Time

Switching time is defined as the rise or fall of a signal, whichever is greater. It is specified between +0.4 volt and +2.4 volts. Maximum switching time for signals is 0.2 usec (not including set-up and hold times).

Current Requirements

For a high input signal to the printer, the input device must be able to source 0.320 milliamps at +2.4 volts. For a low input, the input device must be able to sink 14 milliamps.

For a high output from the printer, the printer can source up to 0.320 milliamps at +2.4 volts. For a low output, the printer can sink up to 14 milliamps.

Line Terminations

Data lines are terminated in the printer by 1000 ohms to +5 volts. $\overline{\text{DATA STROBE}}$ and $\overline{\text{INPUT PRIME}}$ lines are terminated by 470 ohms to +5 volts.

C4. POWER INPUT AND GROUNDING SPECIFICATIONS

Input Voltage

Voltage requirements for the printer are:

115 VAC ±10%, 60 Hz or,
230 VAC ±10%, 50 Hz

The printer shall be independently connected to the primary power source by means of a 3-wire grounded outlet and shall contain conversion, regulation, and sequencing equipment required for correct performance.

The turn-on surge current in all Centronics printers takes the form of a decaying exponential waveform, with approximately a 250 millisecond time constant. The values of the initial surge current and the steady state operating current (with the printer not printing) are shown in the following table.

Model	Surge Current	Operating Current (with printer not printing)
101/101A	48 amps (max. peak to peak)	2.8 amps (RMS)
102A	52 amps (max. peak to peak)	3.3 amps (RMS)
306	28 amps (max. peak to peak)	2.3 amps (RMS)

Equipment Ground

The green wire (building ground) of a power cable for the printer shall be securely fastened to the frame. The white wire (neutral AC) shall not be grounded to the frame.

D.C. Ground

The return wire of the interconnecting line, twisted pair shall be grounded to the DC ground. This connection shall be made as close as practical to the signal source and load.