

ISI MODEL 487

TECHNICAL MANUAL

487 Technical Manual

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| | |
|---|----|
| 2.4.9 FORWARD PAPER MOTION BEFORE PRINT (ADDRESS 0716 AND 0816) | 24 |
| 2.4.10 PRINT COMMAND (ADDRESS 0916 BIT 0 = LSB) | 24 |
| 2.4.11 REVERSE PAPER MOTION AFTER PRINT (ADDRESS 0A16 AND 0B16) | 25 |
| 2.4.12 FORWARD PAPER MOTION AFTER PRINT (ADDRESS 0C16 AND 0D16) | 25 |
| 2.4.13 PRINT DENSITY/TYPE (ADDRESS 0F16) | 25 |
| 2.4.14 MATRIX SIZE (ADDRESS 1F16) | 26 |
| 2.4.15 DOT PITCH ADDRESS (ADDRESS 1E16) | 26 |
| 2.4.16 INTER-CHARACTER SKIP (ADDRESS 1D16) | 26 |
| | |
| 2.5 POSITIONAL INFORMATION AND USE | 27 |
| 2.5.1 STANDARD CHARACTER PLACEMENT | 27 |
| 2.5.2 GRAPHIC MODE | 27 |
| | |
| 2.6 CHARACTER PATTERN GENERATION | 27 |
| 2.6.1 GRAPHIC MODE | 28 |
| | |
| 2.7 STEPPER DRIVER | 28 |
| 2.8 CARRIAGE SERVO SYSTEM | 29 |
| 2.9 RIBBON MOTOR DRIVER | 32 |
| 2.10 HEAD DRIVER CIRCUIT | 32 |
| | |
| Chapter 3 MAINTENANCE | 33 |
| 3.1 MAINTENANCE SUMMARY | 33 |
| 3.2 PRINTER MARKING AND CONFIGURATION | 33 |
| 3.2.1 PRINTER NAMEPLATE | 33 |
| 3.2.2 PRINTER CIRCUIT BOARD MARKING | 34 |
| 3.2.3 PRINTER CONFIGURATION | 35 |
| 3.2.4 LANGUAGE SELECT SWITCH SETTINGS | 36 |
| 3.2.5 IBM MODEL SELECT SWITCHES | 37 |
| 3.2.6 SPECIAL FUNCTION SWITCH SETTINGS | 38 |
| 3.3 ISI 487 ERROR CODES | 38 |
| 3.4 RUNNING A SELF-TEST | 39 |
| 3.4.1 RAM TEST | 40 |
| 3.4.2 ERRORS ON POWER UP | 41 |
| 3.5 PREVENTIVE MAINTENANCE | 41 |
| 3.6 TROUBLESHOOTING GUIDE | 42 |
| 3.7 TESTING THE ISI INTERFACE PCB | 43 |
| | |
| Chapter 4 ADJUSTMENTS | 45 |
| 4.1 ADJUSTMENT SUMMARY | 45 |
| 4.2 CARRIAGE DRIVE | 45 |
| 4.3 CARRIAGE DRIVE BELT | 46 |

| | |
|--|----|
| 4.4 PAPER DRIVE BELT | 46 |
| 4.5 TRACTOR GEAR BACKLASH | 48 |
| 4.6 PAPER EMPTY SWITCH | 49 |
| 4.7 OPTIC SENSOR AND ENCODER/TIMING DISC | 50 |
| 4.7.1 MECHANICAL ADJUSTMENT | 50 |
| 4.7.2 ELECTRICAL ADJUSTMENT | 51 |
| 4.8 HORIZONTAL OFFSET ADJUSTMENT | 53 |
| Chapter 5 REMOVAL/REPLACEMENT | 57 |
| 5.1 REMOVAL/REPLACEMENT, RECOMMENDED SPARES | 57 |
| 5.2 PAPER RACK OUTLET ASSEMBLY | 58 |
| 5.3 PAPER RACK INLET | 58 |
| 5.4 COVER ASSEMBLIES | 59 |
| 5.4.1 TOP COVER | 59 |
| 5.4.2 REAR COVER | 59 |
| 5.4.3 BODY COVER | 59 |
| 5.5 COVER INTERLOCK MAGNET | 61 |
| 5.6 RIBBON CASSETTE AND GUIDE | 61 |
| 5.7 PRINT HEAD ASSEMBLY | 62 |
| 5.8 HEAD FLEX CABLE | 63 |
| 5.9 HEAD ADAPTER PCB | 64 |
| 5.10 PRINTER MECHANISM | 65 |
| 5.10.1 REMOVAL/REPLACEMENT OF PRINTER MECHANISM | 66 |
| 5.10.2 PLACING PRINT MECHANISM IN TILT POSITION | 66 |
| 5.11 DUST COVER | 66 |
| 5.12 CARRIAGE DRIVE MOTOR BELT | 69 |
| 5.13 CARRIAGE DRIVE BELT | 69 |
| 5.14 CARRIAGE DRIVE MOTOR AND RIBBON DRIVE MOTOR MOUNTING BRACKET | 71 |
| 5.15 OPTIC SENSOR ASSEMBLY | 72 |
| 5.16 CARRIAGE DRIVE MOTOR | 73 |
| 5.17 ENCODER/TIMING DISC | 74 |
| 5.18 RIBBON DRIVE MOTOR | 76 |
| 5.19 COVER INTERLOCK SWITCH | 77 |
| 5.20 PAPER DRIVE BELT | 78 |
| 5.21 PAPER DRIVE MOTOR | 79 |
| 5.22 TRACTOR ASSEMBLIES, LEFT/RIGHT | 81 |
| 5.23 PAPER EMPTY SWITCH | 82 |
| 5.24 POWER SUPPLY ASSEMBLY | 83 |
| 5.25 PRINT CONTROLLER PCB | 84 |
| 5.26 FORMAT CONTROLLER PCB (ISI INTERFACE PCB) | 84 |
| 5.27 PICO FUSE | 85 |
| 5.28 ON/OFF SWITCH | 87 |
| 5.29 MAIN FUSE | 89 |
| 5.30 POWER CORD | 89 |
| 5.31 COVER LATCH SPRINGS | 90 |

| | |
|--|-----|
| 5.32 CONVERTING THE POWER SUPPLY TO 220V | 91 |
| 5.33 RECOMMENDED SPARE PARTS LISTING | 93 |
| Chapter 6 ILLUSTRATED PARTS BREAKDOWN | 95 |
| 6.1 INTRODUCTION | 95 |
| 6.1.1 ITEM | 95 |
| 6.1.2 PART NUMBER | 95 |
| 6.1.3 DESCRIPTION | 95 |
| 6.1.4 QUANTITY | 95 |
| Chapter 7 ELECTRICAL DRAWINGS | 127 |
| Chapter 8 PICO FUSE COLOR CODE | 128 |
| 8.1 GENERAL INFORMATION | 128 |

FEDERAL COMMUNICATIONS COMMISSION
RADIO FREQUENCY INTERFERENCE
STATEMENT

This unit has been type tested and found to comply with the limits for a Class A computing device in accordance with the specifications for Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference in a commercial installation.

Chapter 1

GENERAL INFORMATION

1.1 SCOPE OF THIS MANUAL

This technical manual provides detailed information on the theory of operation, maintenance, adjustment and recommended spare parts replacement for the ISI Model 487. The manual is for use by qualified service personnel who maintain electronic and electro-mechanical equipment.

ISI offers contract maintenance service nationwide for your ISI 487. Service for printers not on contract may also be offered in your area. For details on these services, call (313) 769-5900.

1.2 GENERAL DESCRIPTION

The ISI Model 487 is a high speed, bidirectional, impact printer that uses dot matrix techniques for character generation. The printer is completely self-contained, composed of mechanical, electro-mechanical components and printed circuit boards. The printed circuit boards use microprocessor technology to minimize components and increase reliability.

Maximum throughput is achieved with bidirectional printing which seeks the shortest path to the next line of characters when printing successive lines of data. Paper is moved through the printer by means of a stepper motor.

The ISI Model 487 contains many features to help perform the printing job more easily and efficiently. Some of the more significant features are:

- 200 CPS Smart, Bidirectional Printing
- Direct compatibility with IBM 3270 systems
- Switch Selectable Forms Length
- Switch Selectable Characters Per Inch

- Switch Selectable Lines Per Inch
- Fanfold Forms or Cut Sheet Forms Handling
- Demand Document Feature
- Self-Test Capability

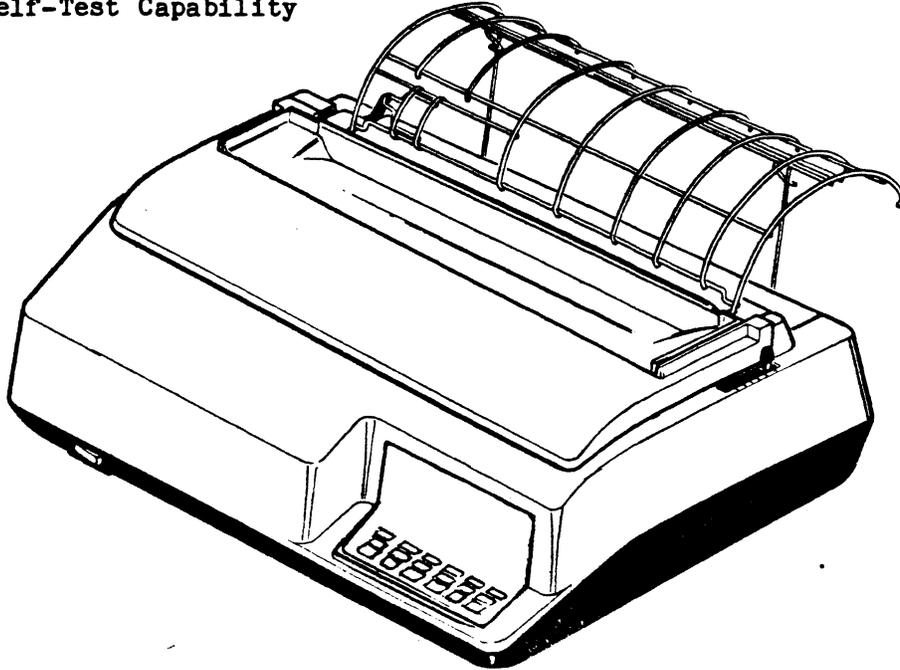


Figure 1-1. MODEL 487 PRINTER

The printer is lightweight, easy to install, operate and maintain; and compatible with IBM 3274/3276 systems. The ISI 487 offers full SDLC/SCS support.

1.3 PHYSICAL DESCRIPTION

The ISI 487 is compact and lightweight. The printer measures 22 inches wide, 18 inches deep and 8 inches high. The printer weighs 40 lbs.

The printer covers include several plastic covers; the top cover, body cover, rear cover, and base cover. The body cover has an opening in the lower right corner for the control panel.

There are six major assemblies within the printer: the printing mechanism, paper handling mechanism, printer electronics, power supply, interface, and control panel.

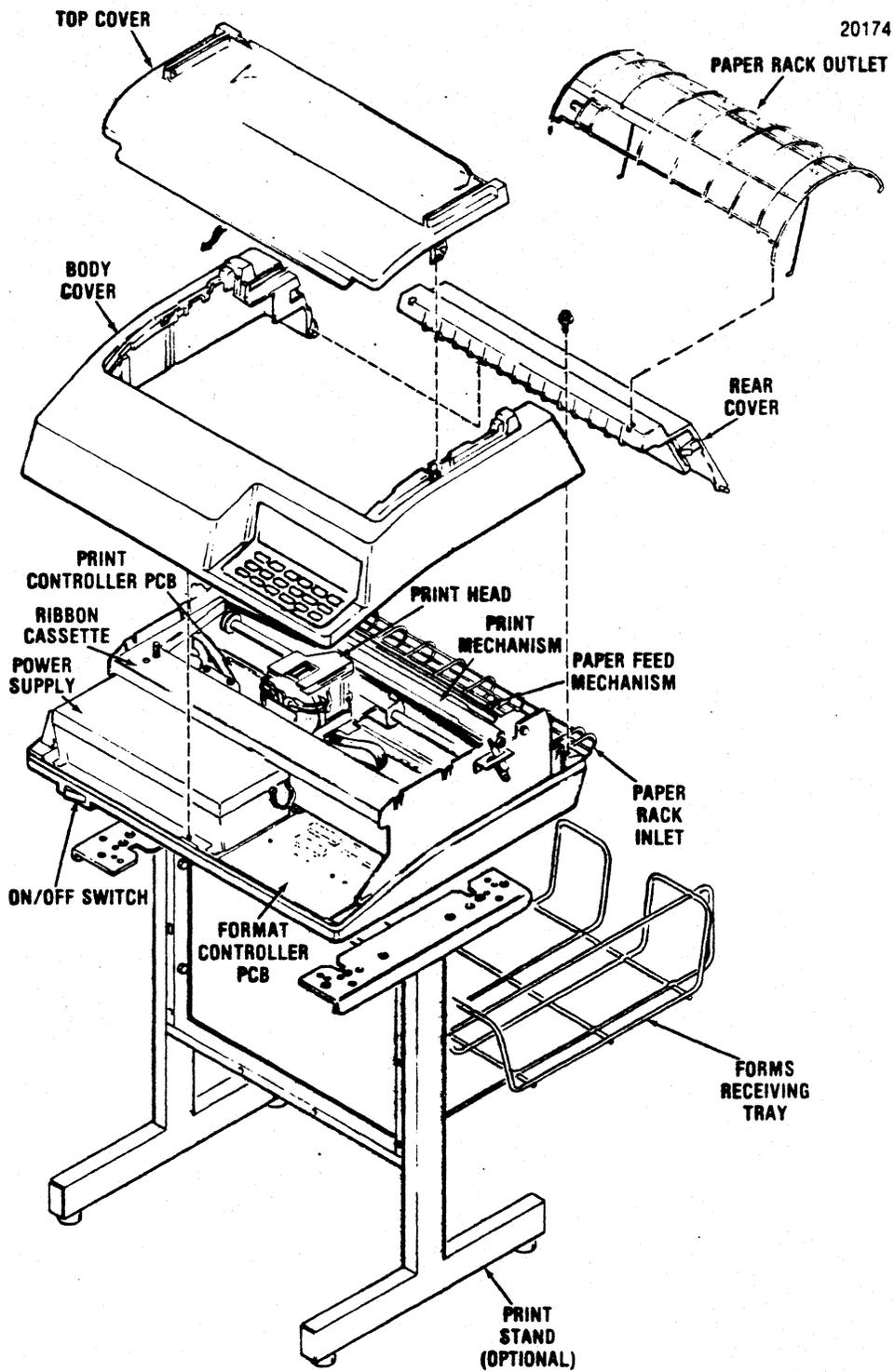


Figure 1-2. MAJOR ASSEMBLIES MODEL 487

1.3.1 PRINTING MECHANISM

The printing mechanism consists of the print head assembly, carriage assembly and carriage drive components. The carriage drive components are the DC drive motor, drive belts, pulleys, encoder/timing disc and optical sensor. These components drive the carriage and attached print head back and forth along the platen.

1.3.2 PAPER HANDLING MECHANISM

The paper handling mechanism is capable of handling either fanfold forms or cut sheet forms. The mechanism consists of a stepper motor, pin feed tractors, paper guides and drive rollers. The mechanism handles up to six part forms.

1.3.3 ELECTRONICS

The printer electronics consist of three printed circuit boards (pcb); the Print Controller pcb, the Format Controller pcb, and the Control Panel pcb, attached to the top cover by velcro strips.

The Format Controller pcb contains the input connectors. It is also called the ISI Interface pcb.

1.3.4 POWER SUPPLY

The power supply is located in the left front of the printer and is completely enclosed. The power supply, an "off-line" switching type, is used as the primary power source, supplying +5, +12, -12 and +35 Vdc.

1.4 PRINTER OPERATION

Basically, all printer functions can be grouped into one of the three categories: 1.) character printing, 2.) paper motion, and 3.) special functions.

1.4.1 CHARACTER PRINTING

Once the data has been received and formatted by the Format Controller (ISI Interface), characters are printed by selectively activating the eight print wires aligned vertically in the print head. A ninth wire in the print head, under microprocessor control, provides the underlining capability in the printer. The print commands to activate the print wires

are developed by the Print Controller pcb PROMs.

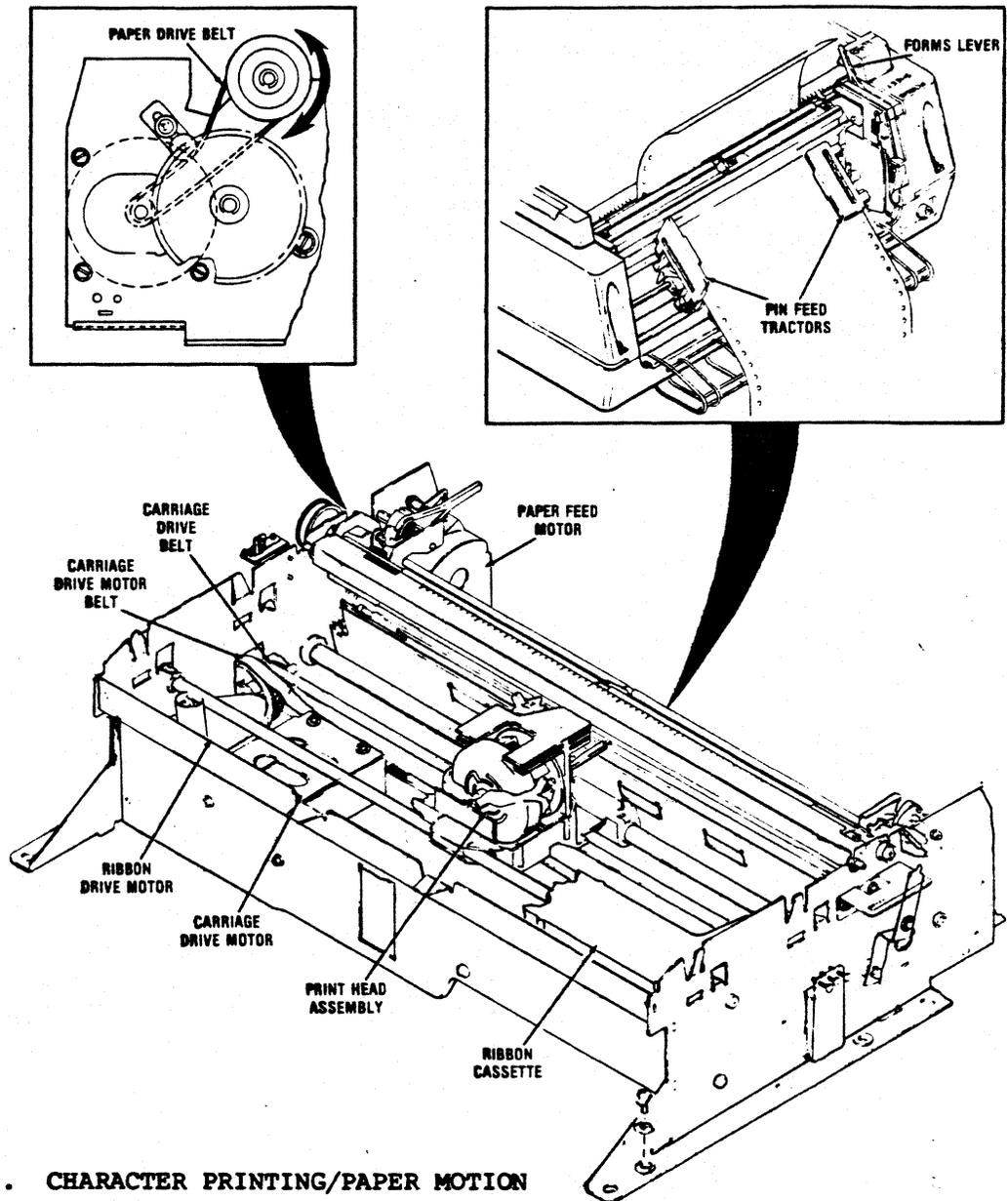


Figure 1-3. CHARACTER PRINTING/PAPER MOTION

As the print head moves across the paper, the appropriate print wires are momentarily activated driving them against the ribbon, paper and platen to form the dot matrix character.

As shown in Figure 1-3, the print head is attached to the carriage assembly, which in turn is attached to a carriage drive belt. The carriage is driven in the forward or reverse direction by the carriage drive motor which rotates the belt clockwise (forward direction) or counterclockwise (reverse direction).

1.4.2 PAPER MOTION

Paper is moved by pressing the paper motion switches; INDEX to line feed, ↑ for paper forward, ↓ for paper reverse, or FORM FEED. The information provided by the Format Controller pcb to the Print Controller pcb establishes the direction and the amount of paper motion. Pressing ↑, or ↓ with paper positioned will cause top-of-form to change, not the index.

Physically, paper is moved by the torque from the paper stepper motor which is applied to the print feed tractor drive gears which move the paper up or down as shown in Figure 1-3.

1.4.3 SPECIAL FUNCTIONS

As a standard feature, the ISI 487 supports a variety of language sets. These language sets are accessed by dip switch pack E60 located inside of the rear of the printer housing. See Section 3.2.4 for settings.

Also as a standard feature, the ISI 487 may be set to emulate various IBM buffer sizes. IBM Models 2-5 are supported by the selection of dip switch pack E60. See Section 3.2.5 for the corresponding settings.

The ISI 487 printer has a self-test procedure which is activated by pressing TEST on the operator control panel when the printer is in 2ND FUNCTION. See Section 3.4 for complete instruction on running a self-test and using the test to diagnose your printer.

Special printing functions such as print form feed on local copy, are also available on the ISI 487. These printing functions accessed by dip switch pack E81, located through the rear of the printer housing. See Section 3.2.6 for complete details.

1.5 RELATED PUBLICATIONS

The following publications document the ISI Model 487 printer. These publications are available through Interface Systems, Inc. at 5855 Interface Drive, Ann Arbor, MI 48103, Tel(MI): (313) 769-5900, Tel(out of state) 1-800-544-4072, or TWX 810-223-6058.

1.5.1 UNPACKING/REPACKING INSTRUCTIONS

The unpacking/repacking instructions are attached to the outside of the shipping container and provide the necessary information to unpack or repack the printer.

1.5.2 OPERATOR'S GUIDE - ISI MODEL 487

The Operator's Guide provides a general description of the printer and information necessary to install, program, operate, and maintain the printer on a users level. This information includes set-up procedures, operating instructions and programming instructions.

1.6 COMPATIBILITY

The 487 is available as either a Type A (3287 feature 8331). The 487 Type A printer is SNA compatible and processes SCS commands as a standard feature. Specified controller and system compatibility is outlined in the table below.

| SYSTEM/CONTROLLER TYPE | 487 PRINTER TYPE |
|-----------------------------|------------------|
| IBM 3081 | A |
| IBM 3274 | A |
| IBM 3276 | A |
| IBM 3791 | B |
| IBM 4331 | A |
| IBM 4341 | A |
| Memorex 2076 | A |
| Telex 276 | A |
| MDS/Trivex 8074 (A Adapter) | A |

1.7 PRINTING SPECIFICATIONS

| | |
|------------------------------|---|
| Printing Method..... | Impact, dot matrix, bidirectional, logic seeking |
| Dot Matrix | 7 dots wide by 8 dots high; 9th wire underline |
| Print Speed | 200 characters per second |
| Country Character Sets | English, U.S., Austrian/German, Austrian/German Alt., Danish/Norwegian, |

Printing Method..... Impact, dot matrix, bidirectional,
logic seeking

Dot Matrix 7 dots wide by 8 dots high; 9th wire
underline

Print Speed 200 characters per second

Country Character Sets English, U.S., Austrian/German, Aus-
trian/German Alt., Danish/Norwegian,
Danish/Norwegian Alt., Finnish/Swe-
dish, Finnish/Swedish Alt., French,
Italian, Portugese Alt., Spanish,
English, U.K., Belgian, Internation-
al, Japanese/English, Canadian/French,
Brazilian, Canadian Bi-lingual.

Horizontal Pitch Programmable for 10, and
16.67 characters per inch

Maximum Line Length 10 cpi - 132 columns
16.67 cpi - 220 columns

1.8 PAPER HANDLING

Vertical Pitch 6 or 8 lines per inch, switch
selectable

Vertical Slew Speed 8 inches per second

Forms Length 1 to 103 lines

Paper Movement Bidirectional

1.9 PAPER REQUIREMENTS

Fanfold Forms
Width 3.0 to 15.0 inches (76 to 381 mm)
Copies Up to six parts

1.10 PHYSICAL/ENVIRONMENTAL SPECIFICATIONS

Height 7.5 inches (190.5 mm)

Depth 18.25 inches (463.5 mm)

Width 22.5 inches (571.5 mm)

Weight 40 lbs. (18.1 kg)

Temperature Operating: 50 to 104 F
(10 to 40 C)
Storage: -40 to 151 F
(-40 to 66 C)

Humidity Operating: 10% to 90%
(no condensation)
Storage: 10% to 95%
(no condensation)

Power

Switcher Power Supply 98 VAC to 125 VAC or 195 VAC to 246
VAC - 47 to 63 Hz

Input Current 4A max. to 110 VAC
2A mac. to 220 VAC

Chapter 2

THEORY OF OPERATION

2.1 GENERAL

This section describes the operation of the Model 487 printer at the functional block level and includes the active components within the functional block. Refer to Figure 2-1. The electronic control circuits for the printer are primarily divided onto two p.c. boards: the Format Controller and the Print Controller. The Format Controller accepts IBM input data from the "host" system, serves as an interface to the Print Controller, and determines the operational functions for the printers. It is also known as the ISI Interface PCB.

The Control Panel PCB contains the operator accessible controls and indicators. These controls set-up the various printer functions via the printing in the mechanism.

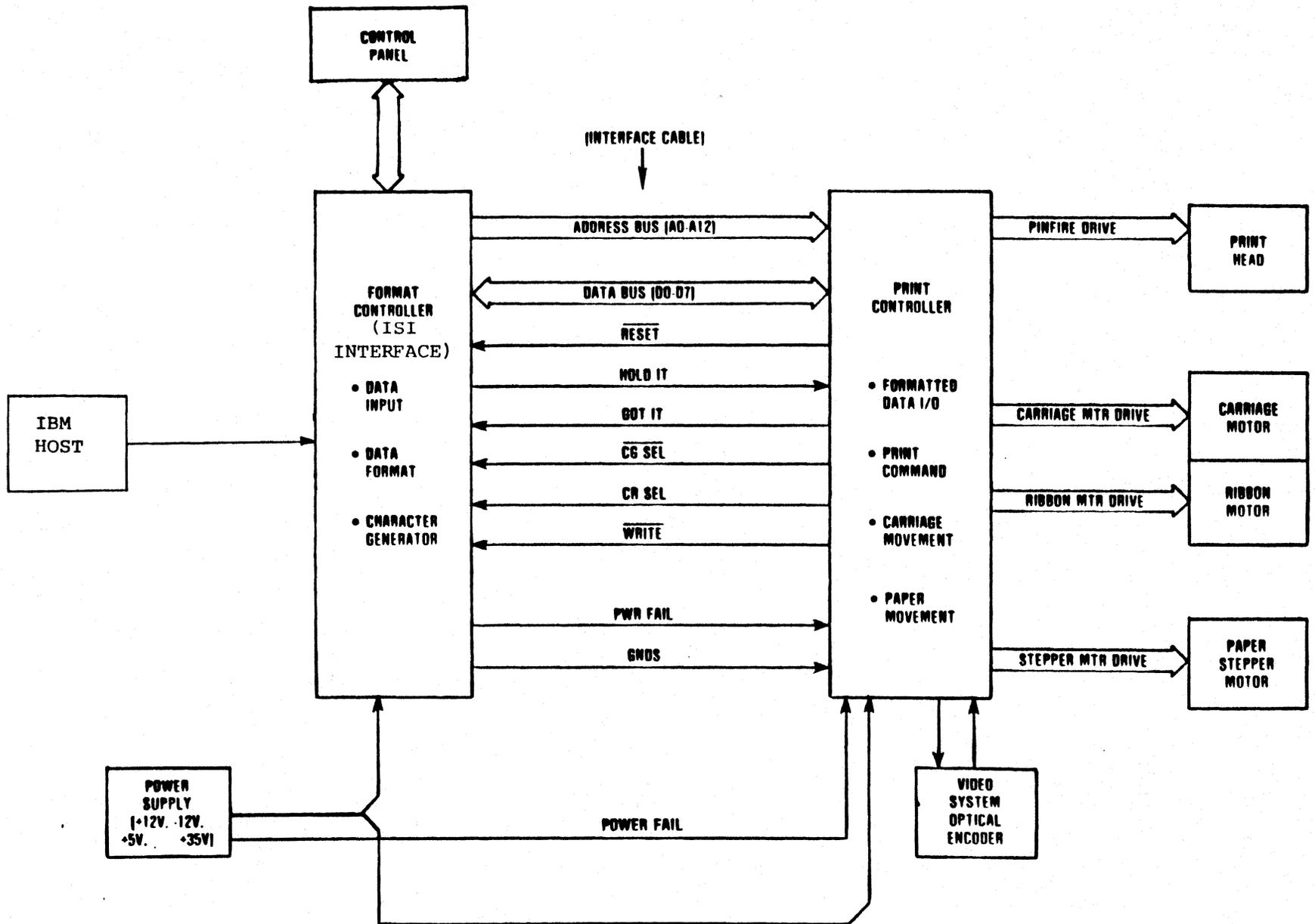
2.2 BASIC PRINTER OPERATION

The Format Controller supplies the operating parameters to the Print Controller based on data received from the host device and the control panel. These parameters are written into a shared Communication Random Access Memory (C-RAM) on the Format Controller. The parameters are written according to an address format, which is basically divided into two sections. The first section is the Control Block and occupies memory locations 0016 through 0F16. This part of the memory is also referred to as the print buffer. The second section is referred to as the Data Block.

The Control Block is dedicated to transferring a print command and paper motion arguments from the Format Controller to the Print Controller and transferring status information concerning printer action, paper motion and self-test results from the Print Controller to the Format Controller.

The Data Block is dedicated to transferring information on printable data from the Format Controller to the Print Controller. A detailed description of the parameters, their bit structure, and input timing is found starting with Paragraph 2.4.3 in the Paper Motion Argument Description.

Figure 2-1 MODEL 487 OVERALL BLOCK DIAGRAM



In order to discuss how data is processed in the printer, refer to Figure 2-2, Format Controller Bus Structure and Figure 2-3 Print Controller Bus Structure, and assume that the printer has just been turned on. Turning the printer on causes the microprocessor to go through an initialization routine to set up its electronics and perform the following functions:

- Raise the GOT IT line. The Address Bus (A0-A7) and the Data Bus (D0-D7) are isolated from the buffered data bus (DB0-DB7). Signal information is conveyed to the Format Controller that data cannot be transferred.
- Lower WR line from the microprocessor. This line controls the chip enable and read/write function of C-RAM.
- Move the print head to the extreme left margin, if not already there.
- The C-RAM will clear and then write the printer status information into C-RAM location 0016. The Address Bus (A0-A7) and the BData Bus (BD0-BD7) are used by the CPU during the read/write functions to C-RAM.

After the status information is loaded into C-RAM, the microprocessor relinquishes control of the C-RAM to the Format Controller. This enables the Format Controller to take control of the C-RAM with the CRSEL and HOLD IT lines. The lowering of the GOT IT signals the Format Controller that it has control of C-RAM and that the HOLD IT line will be monitored by the Print Controller.

On recognition of the deactivated GOT IT line, the Format Controller will then perform the following functions:

- Activate the HOLD IT line to establish that it has C-RAM control.
- Polls the C-RAM status byte 0016 to check for the following:
 1. there was an abort on an event,
 2. the printer is out of paper,
 3. a head jam, or
 4. a failure during a requested self-test
- Polls C-RAM Location 0116 and 0216 to determine how much paper has been moved since the last top of form.
- Polls C-RAM Location 0316 and 0416 to determine the number of paper motion steps that were not completed during an aborted paper motion event, if there was one.

After obtaining all the status information and taking the appropriate action on it, the Format Controller can now load the parameters into C-RAM to request various printer operations. The Format Controller writes each

parameter into C-RAM according to a certain format. This is done using the Address Bus (A0-A7) and Data Bus (D0-D7) under the control of the SELECT, RD, and WR control lines.

After the parameters are loaded into C-RAM, the Format Controller lowers the HOLD IT line, indicating to the microprocessor on the Print Controller that the parameters are loaded. The microprocessor activates GOT IT to take control of C-RAM with the WR line and isolates the BData Bus from the A0-A7 and D0-D7 input busses.

Now that the microprocessor has control of C-RAM, the microprocessor addresses the location of each of the five events in C-RAM starting with Event 1. If data is stored in a location, it is acted on before proceeding to the next location so that the five events are acted on in sequence.

These five events can cause the microprocessor to command the following functions:

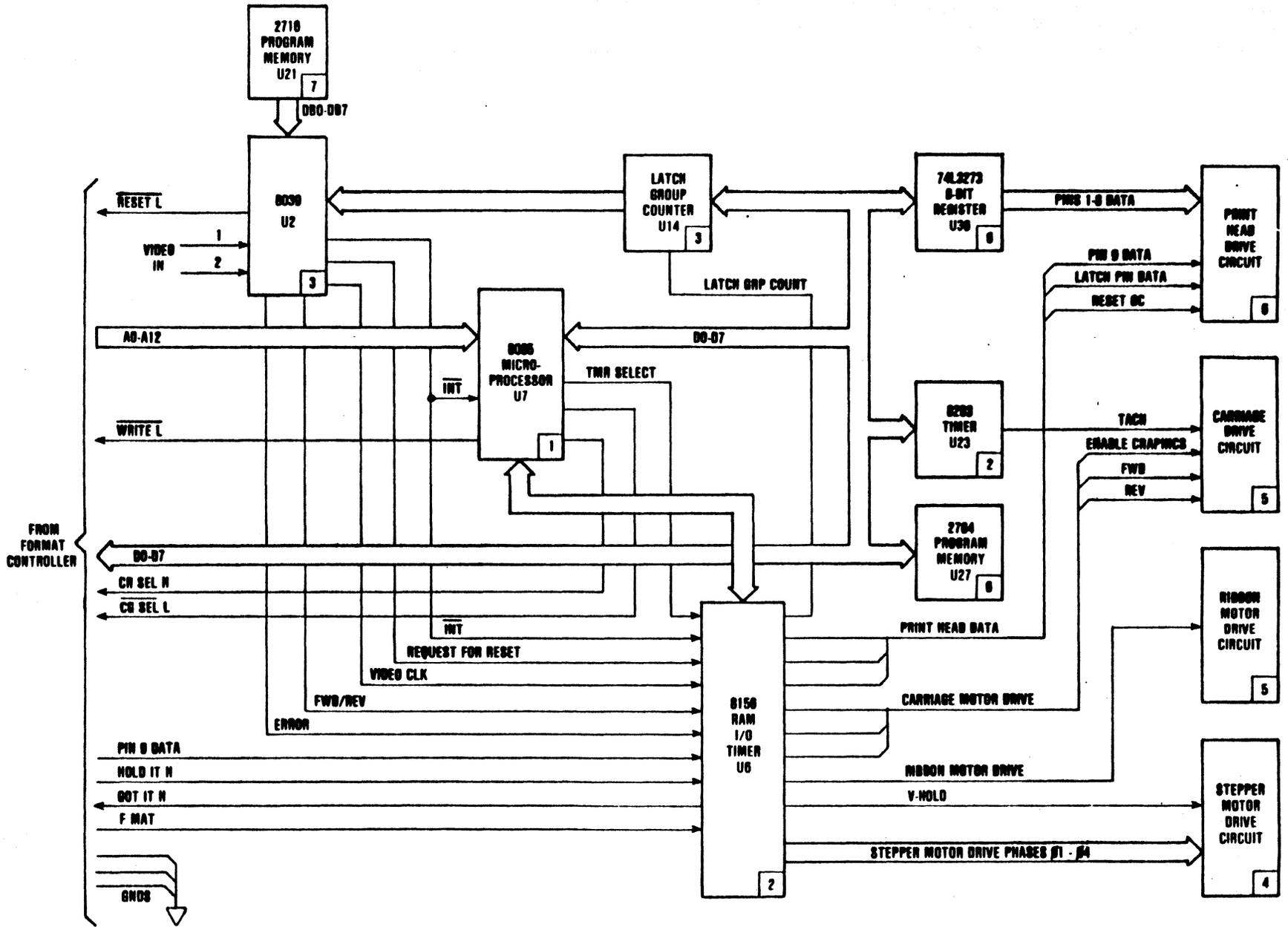
- Event 1 - Reverse paper motion before print.
- Event 2 - Forward paper motion before print.
- Event 3 - Print Command.
- Event 4 - Reverse paper motion after print.
- Event 5 - Forward paper motion after print.

To move paper in the forward direction or reverse direction, the microprocessor will activate the V HOLD signal. This is followed by the microprocessor applying pulses 01-04 on the 4-line bus to the stepper motor driver circuit. The pulses are applied to the four phase inputs of the paper feed stepper motor. This causes incremental motor shaft movement (steps) in either direction, depending on the pulse sequence. The motor shaft, in turn, drives the paper feed mechanism in the forward or reverse direction to move paper at 0.0083 inch per step in fanfold mode and 0.00913 per step in cut sheet mode.

Before each step is executed, the microprocessor updates the status on accumulated and uncompleted paper motion steps as described in this chapter, Paragraph 2.4.3. If the microprocessor detects a paper out condition during the paper movement operation, the microprocessor will deactivate the stepper motor to stop paper movement and will recognize the situation as an abort during the event. The abort condition is written into the Printer Status byte in C-RAM before the microprocessor returns control of C-RAM to the Format Controller.

The Format Controller can load arguments into C-RAM for events 1, 2, 4, and 5 to request paper movement from 1 step to 4,095 steps (0.0083 to 17.062 inches) in each event. Refer to Paragraph 2.4.3 for details on the paper movement arguments.

Figure 2-3 PRINT CONTROLLER BUS STRUCTURE



A print cycle is initiated when the microprocessor polls the Print Command byte 0916, Event 3, in C-RAM and detects that the Print Data bit, bit 4, is set high. This causes the microprocessor to examine the Data Block (print buffer) in C-RAM for printable data, then uses a logic-seeking routine to determine the minimum head movement prior to printing the next line. To determine minimum head movement, the microprocessor examines the printable data to establish line length and its positions, which are then compared to the print head position. The position of the head is then determined. If it is determined that the first character in the line is closer to the head position than the last character, the head is moved to the left to the beginning of the line. If the head position is closer to the last character in the line, the head is moved (right to left) to the last character in the line where printing starts. It starts with the last character and progresses from right to left to the first character in the line. If the head position is closer to the last character in the line, the head is moved to the last character where it begins to print backwards (left to right) to the first character in the line. The location of the print head is determined; this information is continuously updated during head movement to reflect the exact position of the print head.

The following paragraphs describe the operation of the Format Controller and Print Controller in detail.

2.3 C-BUS DATA INTERFACE CABLE

This interface cable is used to pass data, control, and character generator information between the Format Controller and the Print Controller circuit board. Refer to Figure 2-1 for direction of information flow and Table 2-1 for pin identification and functional description.

Table 2-1. Interface Connector P204, Pin Identification

| PIN NO. | SIGNAL | SOURCE | DESCRIPTION |
|---------|------------|-------------|---|
| 1 | Address 0 | Format Ctr. | Tri-state address lines used to address an 8K block of contiguous memory. Two additional select lines (CGSEL, CRSEL) are used to select either the C-RAM or character generator address block. (Format Controller uses additional decoding logic under firmware control, to allow character generator options the use of the same address block.) |
| 18 | Address 1 | Format Ctr. | |
| 2 | Address 2 | Format Ctr. | |
| 19 | Address 3 | Format Ctr. | |
| 3 | Address 4 | Format Ctr. | |
| 20 | Address 5 | Format Ctr. | |
| 4 | Address 6 | Format Ctr. | |
| 21 | Address 7 | Format Ctr. | |
| 14 | Address 8 | Format Ctr. | |
| 15 | Address 9 | Format Ctr. | |
| 16 | Address 10 | Format Ctr. | |
| 17 | Address 11 | Format Ctr. | |
| 32 | Address 12 | Format Ctr. | |
| 30 | Data 0 | Format or | Bidirectional data lines allow |

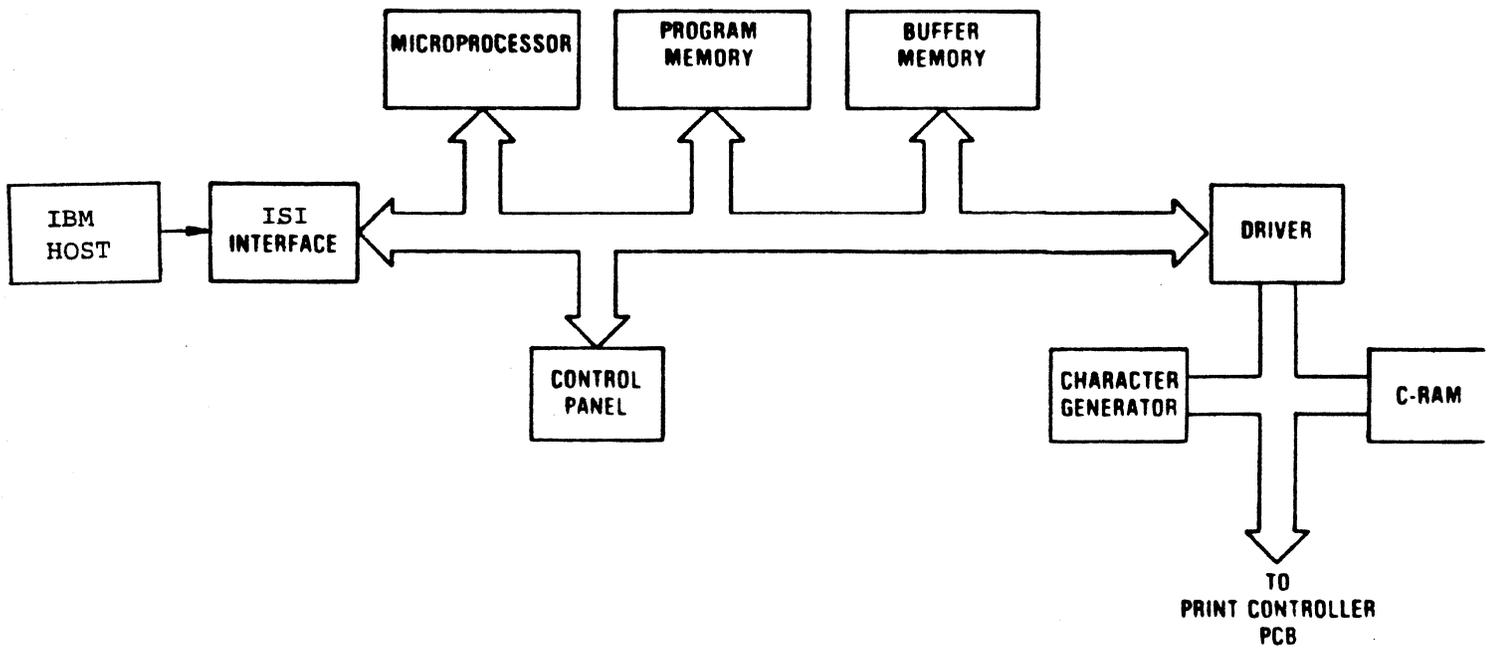


Figure 2-4 FORMAT CONTROLLER BLOCK DIAGRAM

| | | | |
|----|---------|----------------------|--|
| 13 | Data 1 | Print Ctr. | Print Controller to communicate with the character generator ROMs or RAM and the C-RAM buffer. |
| 29 | Data 2 | | |
| 12 | Data 3 | | |
| 28 | Data 4 | | |
| 11 | Data 5 | | |
| 27 | Data 6 | | |
| 10 | Data 7 | Format or Print Ctr. | |
| 7 | RESET | Print Ctr. | Control line used to reset the logic on the Format Ctr. during "Power On." A low level indicates the RESET condition. |
| 6 | HOLD IT | Format Ctr. | A handshake signal. A high level indicates that Format Ctr. had read/write control of the C-RAM. At this time, Print Ctr. is prohibited from accessing the C-RAM. When low Format Controller has relinquished C-RAM control and is requesting the P.C. to act on C-RAM data. |
| 23 | GOT IT | Print Ctr. | A handshake signal. When high Print Ctr. has read/write control of the C-RAM and data is being acted on. Format Ctr. is prohibited from accessing C-RAM. When low, Print Controller relinquished control of C-RAM because action caused by data has been completed. |
| 8 | CRSEL | Print Ctr. | Control line used to select the block of memory addressed for C-RAM and graphics RAM buffer. A HIGH indicates a READ or WRITE operation to the C-RAM or graphics in progress. |
| 31 | CGSEL | Print Ctr. | Control line used to select the block of memory addresses for the character generator. When low, indicate that a READ or WRITE operation to the character generator is in progress. |
| 25 | Write | Print Ctr. | Control line used to strobe |

delay into either the C-RAM or character generator ROM. When low indicates data write to memory.

| | | |
|----|----------|--|
| 5 | GROUND | Indicates that the Format Controller board is installed. |
| 22 | GROUND | |
| 9 | GROUND | |
| 26 | GROUND | |
| 24 | PWR FAIL | |

NOTE: All interface lines are driven by or terminate into a Low Power Schottky device on the Print Controller, but:

- 1.) GOT IT is driven by a TTL (7407) device pulled up to +5V with a 1.2K ohm resistor.

2.4 PRINT CONTROLLER

The Print Controller analyzes arguments and data passed to it by the Format Controller, performs the printer operation, and returns status information. The Print Controller handles the logic seeking and bidirectional printing by analyzing the data and determining the most efficient method of printing. The printing speed is determined by the pitch of the horizontal dots. Reverse or forward paper motion is defined in actual steps of the stepper motor. With fanfold paper, each step equals 1/120th of an inch; with cut paper, each step equals 1/108th of an inch.

2.4.1 DATA ARGUMENTS DEFINITION

The action performed by the printer is dedicated by the placement of parameters in the C-RAM by the Format Controller and the signaling of the Print Controller (by its lowering of the HOLD IT line) that action is requested. This parameter information stored in the C-RAM is divided into two sections, the Control Block and the Data Area (refer to Table 2-4, C-RAM Memory Map). Control information is located addresses 0016 to 1F16. The data area is located from 2016 to 7FF16. Arguments for print functions and status are passed in the control block.

2.4.2 STATUS BYTES

As shown in Table 2-2, memory locations 0016 to 0416 and 0E16 are for status bytes, while location 0516 to 0F16 (except for 0E16 and 1C16 to 1F16) are for the arguments. Arguments for five events are defined as four for paper motion, and one for print action. The five events occur in sequence. Status is updated by the Print Controller before each transfer

of control of the C-RAM to the Format Controller. The print function arguments are not changed by the Print Controller, only acted upon. After completion of a "Print Command," the Print Data buffer (C-RAM locations 1016-9316) are returned to a reset mode (i.e., full of null codes), however, the "Print Command" byte is not changed. If no print action is requested (Bit 4 "Print Command = 0), the print data buffer is neither interrogated nor changed.

C-RAM MEMORY MAP

Table 2-2

| BYTE (HEX) | DESIGNATION | DATA SOURCE |
|---------------|--|-------------------|
| 00 | Printer Status | Print Controller |
| 01 | Accumulated Paper | Print Controller |
| 02 | Motion Steps (Status Info.) | |
| 03 | Uncompleted Paper | Print Controller |
| 04 | Motion Steps (Status of Failed Motion) | |
| 05 | Event 1, Reverse Paper Motion | Format Controller |
| 06 | Steps Before Print | |
| 07 | Event 2, Forward Paper Motion | Format Controller |
| 08 | Steps Before Print | |
| 09 | Event 3, Print Command | Format Controller |
| 0A | Event 4, Reverse Paper Motion | Format Controller |
| 0B | After Print | |
| 0C | Event 5, Forward Paper Motion | Format Controller |
| 0D | After Print | |
| 0E | Self-Test Status | Print Controller |
| 0F | Density Selection | Print Controller |
| 10 | Reserved | |
| 1B | Reserved | |
| 1C | Reserved | |
| 1D | Inter-Char. Skip (Optional) | Format Controller |
| 1E | Dot Pitch (Optional) | Format Controller |
| 1F | Matrix Size (Optional) | Format Controller |
| 20 | ASCII Data | Format Controller |
| FF | | |
| 20 | Graphics Pin | Format Controller |
| 7FF | Data | |

2.4.3 PAPER MOTION ARGUMENT DESCRIPTION

The four paper motion arguments (bytes 0516 through 08116 and 0A16 through 0D16) are written into C-RAM as a 2-byte number by the Format Controller. The argument forms a 12-bit binary number. Bits 0-7 of the lower order address byte contain the eight (8) least significant bits of

the argument value. Bits 0-3 of the higher order address byte form the four most significant bits of the argument value. Bits 4-7 of the higher order address bytes are ignored. Total paper movement of 4095 half steps will equal 17.062 inches of paper travel. (See Table 2-3).

PAPER MOVEMENT ARGUMENT

Table 2-3

| | | | | | | | | |
|---------------|----|---|---|---|---|---|---|---------|
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 | LS Byte |
| 7 | to | | 4 | 3 | 2 | 1 | 0 | MS Byte |
| (Do not care) | | | | | | | | |

2 bytes form 12-bit binary number,
 which represents the number of steps.
 One bit represents 1/2 step = .00417
 inch of paper movement (fanfold paper).

240 half steps = 1-inch paper movement
 40 half steps = 1/6-inch paper movement
 30 half-steps = 1/8-inch paper movement

2.4.4 PRINTER STATUS BYTE (ADDRESS 0016, BIT 0 = LSB)

This byte is written by the Print Controller after each printer action (prior to the return of C-RAM control to the Format Controller) to provide printer status information to the Format Controller as shown in Table 2-4. The transfer of control from the Format Controller to the Print Controller with all events zero will only cause the Print Controller to update the status byte.

PRINTER STATUS BYTE

Table 2-4

| BIT NO. | DESIGNATION |
|---------|------------------|
| 7 | Event Aborted |
| 6 | Abort on Event 1 |
| 5 | Abort on Event 2 |
| 4 | Abort on Event 3 |
| 3 | Abort on Event 4 |
| 2 | Abort on Event 5 |
| 1 | Fault/Test Fail |
| 0 | Paper Out |

The function of each bit set (high) in the Printer Status byte is as follows:

Bit 7 - When set, shows that one of the five events was aborted.

Bit 2 through 6 - When bit 7 is set (indicating an event was aborted), one of the bits 2 through 6 is set to indicate the event in progress when the abort occurred.

Bit 1 - Two conditions will set this bit:

1. If the print head stops moving during a print cycle, bits 7, 4, and 1 will be set, indicating a jam and an incomplete (shortened) print cycle.
2. When a self test has been initiated and a failure has been recognized, the self-test byte should then be polled.

Bit 0 - When set, indicates a "paper out" condition.

Bits 7-2 should be checked to determine if any event in progress was aborted because of this condition.

2.4.5 SELF-TEST STATUS BYTE (ADDRESS OE16)

The Format Controller initiates the self test by setting the appropriate bit (Bit 0) in the print command byte (see Table 2-5). The Print Controller performs the self-test, then writes the results in the self-test byte location OE16 according to Table 2-6.

On power up, the Print Controller performs the test associated with Bits 0, 1, and 3 then places the results in the self-test byte location. When a bit is set high, it indicates a failure in the test being performed.

PRINT COMMAND BYTE

Table 2-5

| BIT NO. | DESIGNATION |
|---------|-----------------|
| 7 | Print |
| 6 | Print Underline |
| 5 | Print Expanded |
| 4 | Print Data |
| 3 | Override |
| 2 | Character Set |
| 1 | Selection |
| 0 | Self-Test |

(Bit 0 is the least significant bit)

SELF-TEST STATUS BYTE

Table 2-6.

| BIT NO. | DESIGNATION |
|---------|---------------------------|
| 7 | Head Jam/No Head Movement |
| 6 | Bad Video Count |
| 5 | Reserved |
| 4 | Reserved |
| 3 | Scratch Pad RAM Check |
| 2 | Reserved |
| 1 | C-RAM Check |
| 0 | CRC on Program ROM |

The function of each bit, when set high in the Self-Test Status byte, is as follows:

Bit 0 - Indicates a failure during cyclical redundancy check (CRC) of the firmware program chips on the Print Controller. A high (1) signals an error condition.

Bit 1 - Indicates a failure of reading and writing C-RAM when set high.

Bit 2 - Reserved.

Bit 3 - Indicates a failure of reading and writing the scratch pad RAM when set high.

Bit 4 - Reserved.

Bit 5 - Reserved for expansion.

Bit 6 - Checks video circuitry. Problem in this area could be no or bad video signals.

Bit 7 - Checks for correct head movement. A high indicates a drive circuitry problem, a head/paper jam, or incorrect head currents.

2.4.6 ACCUMULATED PAPER MOTION STEPS (ADDRESS 0116 AND 0216)

This two-byte, 16-bit number is a two's complement of the number of steps that paper has moved. Zeroes on initialization, forward paper motion steps are added to the number, while reverse steps are subtracted. The Format Controller can zero this number at each logical top of form if the total steps per form are to be accumulated. Each step of motion is equal to 0.00417 inch (240 steps/inch) when using fanfold paper.

2.4.7 PAPER MOTION STEPS REMAINING AFTER ABORT (ADDRESS 0316 AND 0416)

If the Print Controller is forced to abort paper motion event, the number of paper motion steps that were not completed during that event are stored in this 16-bit number by the Print Controller.

2.4.8 REVERSE PAPER MOTION BEFORE PRINT (ADDRESS 0516 AND 0616)

Event No. 1, 12-bit binary number written by the Format Controller to request a number of paper motion steps in the reverse direction before print.

See paper motion Argument Description for details on bit structure.

2.4.9 FORWARD PAPER MOTION BEFORE PRINT (ADDRESS 0716 AND 0816)

Event No. 2, 12 bit-binary number written by the Format Controller to request a number of paper motion steps in the forward direction before print. See Paragraph 2.4.3, Paper Motion Argument Description, for details on bit structure.

2.4.10 PRINT COMMAND (ADDRESS 0916 BIT 0 = LSB)

Event No. 3, written by the Format Controller to the Print Controller to request action other than paper motion is shown in Table 2-5. Results will be placed in the Status word.

Bit 7 - When set, causes the print head to move to the left margin.

Bit 6 - When set, causes the data in the print buffer to be printed with an underline.

Bit 5 - When set, causes the data in the print buffer to be printed expanded.

Bit 4 - When set, indicates that data is to be printed. This bit must be set to initiate any printer action. To print underline expanded, bits 6, 5, and 4 must be set high (1). For normal print, only bit 4 is set. Bits in the Print Command word are processed MSB to LSB, with the exception of the last bit (bit 0) which is interrogated and acted upon first (any failure will cause an abort). If bit 7 was set in the above examples, the print head would move to the left before printing.

Bit 3 - When set, the requested events will be processed regardless of a paper out condition.

Bit 2 and 1 - The Format Controller will tell the Print Controller

(via the C-RAM) which character set to use. The 8K character generator set is divided into four sections. Bits 1 and 2 select which of the character sets is to be used (see Table 2-7).

SELECTION OF CHARACTER GENERATOR USING BITS 1 AND 2

Table 2-7.

| BIT 2 | BIT 1 | RELATIVE BASE ADDRESS (HEX) | | | |
|-------|-------|-----------------------------|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 0 | 8 | 0 | 0 |
| 1 | 0 | 1 | 0 | 0 | 0 |
| 1 | 1 | 1 | 8 | 0 | 0 |

Bit 0 - When set, will cause the Print Controller to self-test. This includes a RAM check, program CRC check, and the moving of the print head from the left margin to the right and back to verify the video count. The results will be placed in the Status word.

2.4.11 REVERSE PAPER MOTION AFTER PRINT (ADDRESS 0A16 AND 0B16)

Event No. 4, 12-bit binary number written by the Format Controller to request a number of paper motion steps in the reverse direction after print. Refer to Paragraph 2.4.3, Paper Motion Argument Description for details on bit structure.

2.4.12 FORWARD PAPER MOTION AFTER PRINT (ADDRESS 0C16 AND 0D16)

Event No. 5, 12-bit binary number written by the Format Controller to request a number of paper motion steps in the forward direction after print. Refer to Paragraph 2.4.3, Paper Motion Argument Description for details on bit structure.

2.4.13 PRINT DENSITY/TYPE (ADDRESS 0F16)

Bits 0 through 2 are used by the Format Controller for the selection of character density as shown in Table 2-8.

PRINT DENSITY SELECTION USING BITS 0, 1 AND 2

Table 2-8.

| BIT 2 | BIT 1 | BIT 0 | CHARACTERS/INCH |
|-------|-------|-------|-----------------|
| 0 | 0 | 0 | 10 |
| 0 | 0 | 1 | (Not Used) |
| 0 | 1 | 0 | (Not Used) |
| 0 | 1 | 1 | (Not Used) |
| 1 | 0 | 0 | (Not Used) |
| 1 | 0 | 1 | (Not Used) |
| 1 | 1 | 0 | 16.67 |
| 1 | 1 | 1 | (Not Used) |

Bit 3 is set to indicate the graphic mode. When bit 3 is set, bits 0 through 2 are ignored. When printing graphics, the print data covers from the Format Controller (see Paragraph 2.6, Character Pattern Generation).

Bit 4 is set to indicate high density printing. When bit 4 is set, bits 0 through 2 are ignored. Multi-pass printing must be performed by setting bit 4, and changing character set location with byte 0916.

Bit 5 - Not Used.

Bit 6 - Not Used.

2.4.14 MATRIX SIZE (ADDRESS 1F16)

This binary number indicates the horizontal character width and is used to calculate the address of the character within the character generation (see Paragraph 2.6, Character Pattern Generation).

When set low (0), the character is assumed to be seven dots wide.

2.4.15 DOT PITCH ADDRESS (ADDRESS 1E16)

This binary number indicates the number of encoder lines between column firing (see Paragraph 2.5, Positional Information and Use). When set low (0), the standard pitch is assumed.

2.4.16 INTER-CHARACTER SKIP (ADDRESS 1D16)

This binary number indicates the number of encoder lines between characters (see Paragraph 2.5, Positional Information and Use). When set low (0), the standard inter-character skip is assumed.

2.5 POSITIONAL INFORMATION AND USE

Positional information comes in as quadrature from an encoder mounted on the horizontal drive motor. This information comes directly into a separate microprocessor which signals the main microprocessor with both column and positional information on "divide-by" arguments that are presented to it. The encoder, with dual sensors, gives positional information at a rate of 660 edges per inch (or every 0.0015 inch).

2.5.1 STANDARD CHARACTER PLACEMENT

When not dictated by arguments passed in the C-RAM (locations 1D16, 1E16, and 1F16), the standard 7-dot wide character is assumed to be the standard space. Column spacing is as shown in Table 2-9.

7 DOT WIDE STANDARD CHARACTER PLACEMENT

Table 2.9

| CPI | LINE/COLUMNS | DOT SPACING (IN.) | LINES/INTER CHAR. | TOTAL LINES |
|-------|--------------|-------------------|-------------------|-------------|
| 10 | 6 | 0.0100 | 24 | 60 |
| 16.67 | 4 | 0.0067 | 12 | 36 |

NOTE: Adjacent dot positions cannot be fired.

2.5.2 GRAPHIC MODE

When bit 3 of the print density argument is set (indicating graphic mode), the dot placement is every 10 encoder lines, or every 0.01515 inch. In this mode, adjacent dots can be fired.

2.6 CHARACTER PATTERN GENERATION

It is the responsibility of the Format Controller to ensure that the character generator complies to the method of printing that is requested.

When printing standard characters, the address (as shown in Figure 2-12) and a "ROM Select" are presented by the Print Controller onto the address lines of the interface connector. Eight bits of data, representing pin

fire information, are then read. The least significant bit (MSB) is pin 8 information. The print controller fires the ninth pin only when this signal is active (printing underline). When printing characters (unless "Graphics mode" is selected), only alternate dots can be fired.

2.6.1 GRAPHIC MODE

When bit 3 is set in the C-RAM print density argument (indicating "Graphics Mode"), the Print Controller takes the pin data for the first dot firing column from C-RAM location 2016 and the last column from the C-RAM location 38716 (872 columns).

2.7 STEPPER DRIVER

Figure 2-6 is a simplified schematic of the driver circuitry for the stepper motor. The energy level in the motor is maintained by chopping the current in each winding with the upper stage drivers. During paper motion, the motor current per winding is 1 Amp with V HOLD at GND. When no paper motion is required, current per winding is approximately 250 mA with V HOLD at +5 VDC. This substantially reduces power loss and holds paper in place when paper motion is not required. Average current per winding:

V HOLD ON = 250 mA
V HOLD OFF = 1 Amp

Voltage Required:

+35 VDC, +5 VDC

Table 2-14 shows the stepper motor excitation sequence.

STEPPER MOTOR EXCITATION SEQUENCE

Table 2-11.

| 01 | 02 | 03 | 04 | |
|-----|-----|-----|-----|--------------------|
| ON | OFF | ON | OFF | |
| ON | OFF | OFF | ON | CLOCKWISE ROTATION |
| OFF | ON | ON | ON | |
| OFF | ON | OFF | OFF | |

A. Normal 4-Step Sequence (Full Step)

| | | | |
|----|-----|-----|-----|
| ON | OFF | ON | OFF |
| ON | OFF | OFF | OFF |

| | | | |
|-----|-----|-----|-----|
| ON | OFF | OFF | ON |
| OFF | OFF | OFF | ON |
| OFF | ON | OFF | ON |
| OFF | ON | ON | OFF |
| OFF | OFF | ON | OFF |

B. 8-Step Sequence (1/2 Step)

NOTE: ON = 1 = +5 VDC (High)
 OFF = 0 = 0V (Low)

2.8 CARRIAGE SERVO SYSTEM

Table 2-12 defines the carriage motion control signals that control the DC motor drive circuitry which is shown in simplified form in Figure 2-7.

CARRIAGE MOTION CONTROL SIGNALS

Table 2-12.

| CONTROL | SIGNAL | DC MOTOR SHAFT ROTATION | CARRIAGE DIRECTION |
|---------|--------|----------------------------|---|
| FWD | 0 | None | |
| REV | 0 | | |
| FWD | 1 | CCW | Forward (from left side frame to right side frame) |
| REV | 0 | | |
| FWD | 0 | CW | Reverse (from right side frame to left side frame) |
| REV | 1 | | |
| FWD | 1 | None | |
| REV | 1 | | |

NOTE: 1 = ON = +5 VDC = High
 0 = OFF = 0V = Low

Carriage motion is achieved by applying these control signals, and a TACH signal. Control of motor velocity is achieved by maintaining a constraint error voltage between an internal reference (V REF GEN) and the voltage derived as a result of the input TACH frequency. This TACH frequency is derived as a submultiple of the video feedback signal. A variable divider is used with the 660 position feedback points (per linear such of carriage motion) to generate the TACH FREQ for the desired carriage velocity. The count for the divider is selected by considering the repetition rate of the matrix head and the number of possible dot firings per inch.

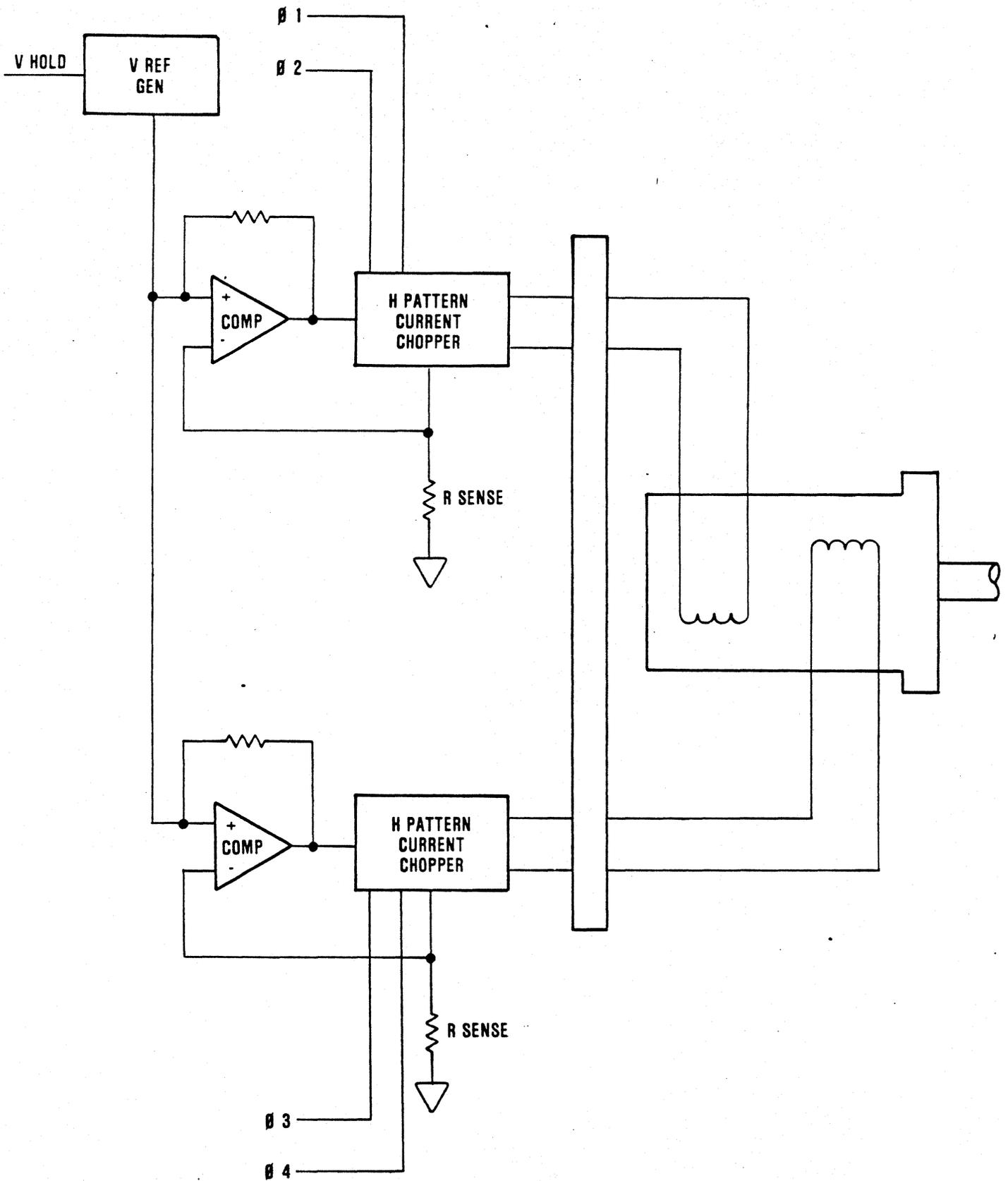


Figure 2-6. STEPPER MOTOR DRIVER

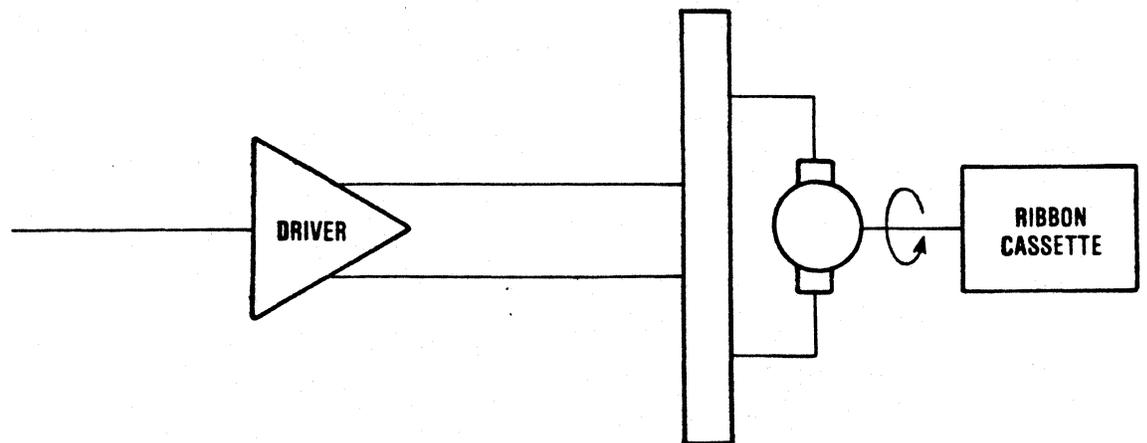
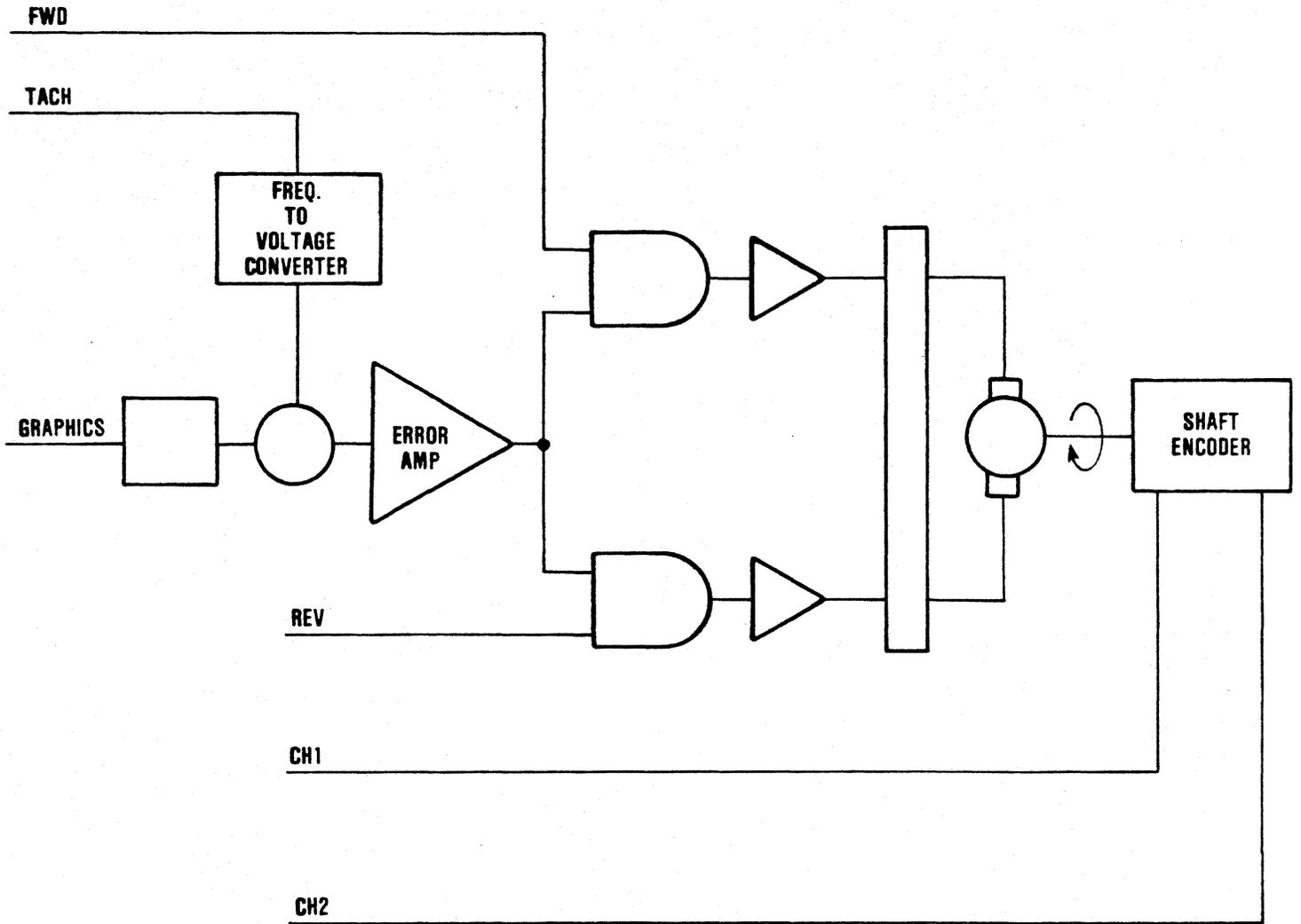


Figure 2-7. CARRIAGE DRIVE - RIBBON DRIVE VELOCITY

The head speeds indicated in Table 2-13 are used for the standard densities for a 7-part character.

STANDARD 7-PART CHARACTER HEAD SPEEDS

Table 2-13.

| CHARACTERS PER INCH (CPI) | INCHES PER SEC (IPS) |
|------------------------------|-------------------------|
| 10 | 20 |
| 16.67 | 11.45 |
| Graphics | 3.9 |

NOTE: No speed adjustment needed. The above speeds are maintained within +5%.

2.9 RIBBON MOTOR DRIVER

Ribbon drive is accomplished with a +12V DC motor, controlled by a single stage (transistor) driver amplifier as shown in Table 2-7. The ribbon motor is turned on only when the carriage is in motion.

2.10 HEAD DRIVER CIRCUIT

The head driver circuit features a "pick and hold" circuit to quickly energize the pin solenoids. This drive technique enables high speed printing with minimum power loss since all stages are run in the saturation mode. The minimum repetition rate per in is 909 microseconds. All pins (1 through 9) require TTL logic level signals to:

Fire Pin = 1 = ON = +5 VDC
Do Not Fire Pin = 0 = OFF = 0V

Pin data strobe uses a 1 to 3 microsecond negative going TTL signal. Voltage required to this circuit are: +35 VDC, and +5V.

Chapter 3

MAINTENANCE

3.1 MAINTENANCE SUMMARY

This section contains information on printer marking and configuration, preventive maintenance, and troubleshooting procedures. The recommended preventive maintenance consists of cleaning and internal inspection of the printer. The troubleshooting procedures will aid in isolating printer malfunctions, defective components or required adjustments.

3.2 PRINTER MARKING AND CONFIGURATION

The following paragraphs provide information on printer identification and configuration. If calling for service on your printer, this information should be supplied to the field service engineer to provide for quicker service.

3.2.1 PRINTER NAMEPLATE

The nameplate is located underneath the printer on the bottom cover. Figure 3-1 illustrates the nameplate and the information it contains. In the event of a field conversion of the operating voltage, amperage, and frequency, it is recommended that the nameplate be changed to reflect the conversion.

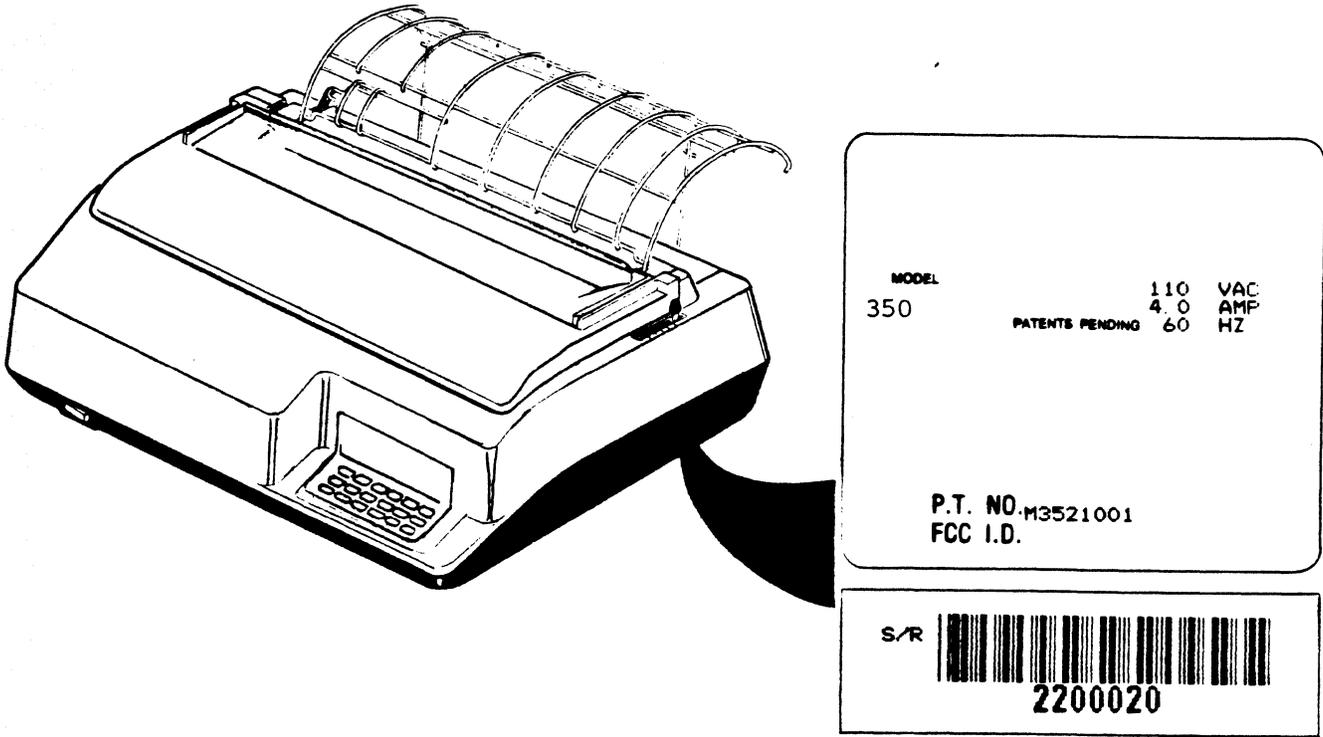


Figure 3-1. PRINTER NAMEPLATE

3.2.2 PRINTER CIRCUIT BOARD MARKING

The Print Controller pcb and Format Controller pcb, located under the print mechanism, is marked with its part number, dash configuration and revision. Figure 3-2 shows the pcb's and the marking information.

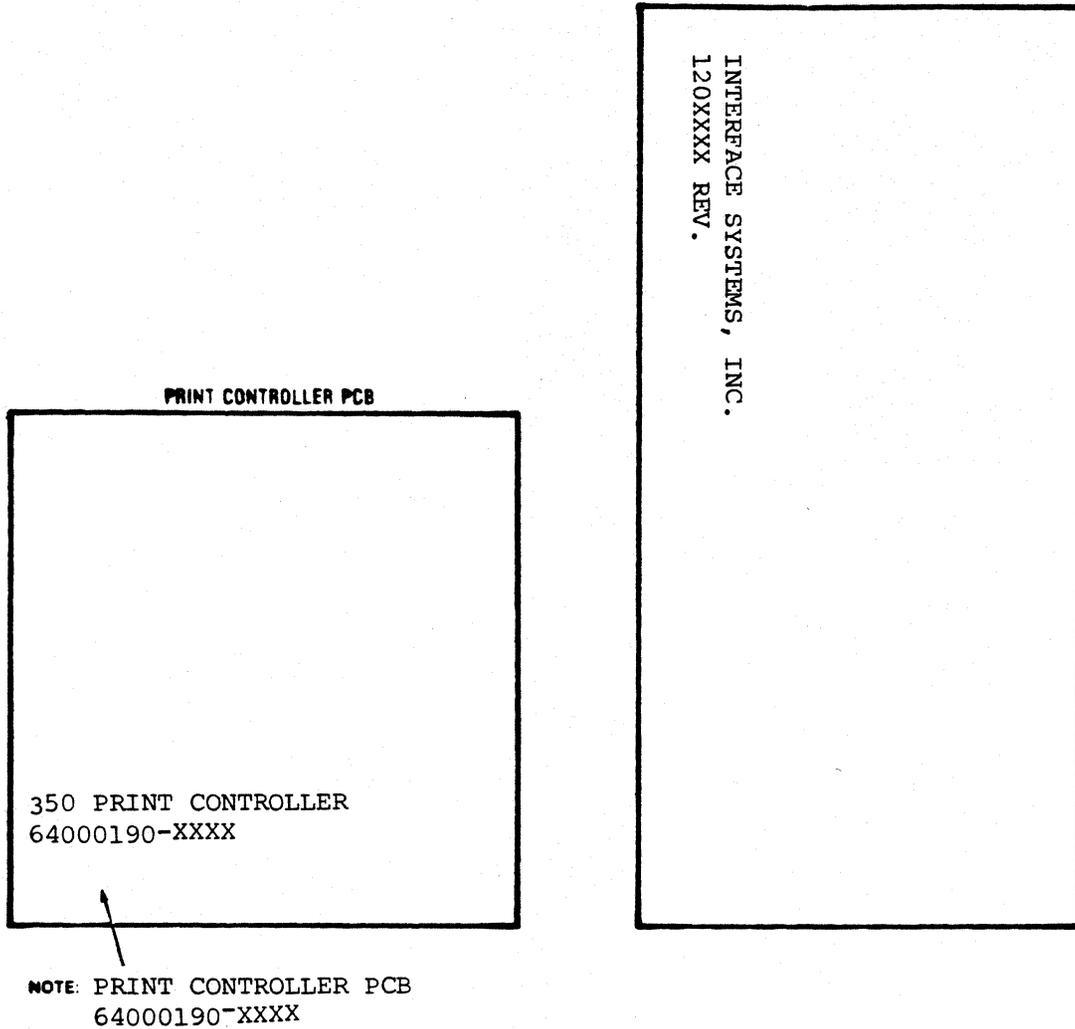


Figure 3-2. PRINTED CIRCUIT BOARD MARKING

3.2.3 PRINTER CONFIGURATION

Two dip switch packs are located inside the righthand cut-out window on the rear of the printer housing (see Figure 3-3); E60 and E81. E60 switches control model and language selection and E81 provides access to special printing functions. All ISI 487 option switches are read and their values stored, at power-up only. Switches are defined to be "1" when they are in the up position.

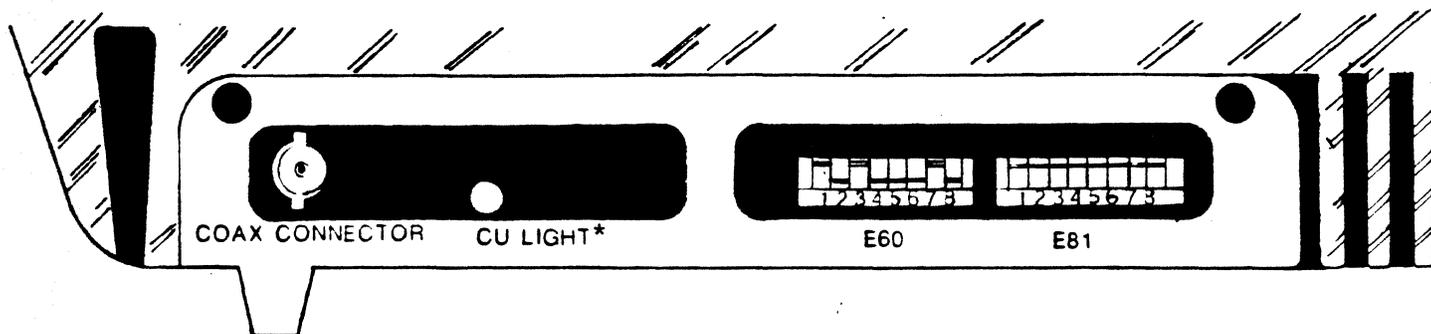


Figure 3-3 BACK VIEW OF ISI MODEL 487

3.2.4 LANGUAGE SELECT SWITCH SETTINGS

Table 3-1 specifies the settings of switches 1 thru 5 on E60 for each language supported by the ISI 487. Settings not given default to English, U.S.

LANGUAGE SELECT SWITCH SETTINGS

Table 3-1

| | SWITCH | | | | | LANGUAGE |
|---|--------|---|---|---|---|-----------------------|
| | 1 | 2 | 3 | 4 | 5 | |
| 0 | 0 | 0 | 0 | 0 | 0 | English, U.S. |
| 0 | 0 | 0 | 0 | 0 | 1 | Austrian/German |
| 0 | 0 | 0 | 0 | 1 | 0 | Austrian/German Alt. |
| 0 | 0 | 0 | 0 | 1 | 1 | Danish/Norwegian |
| 0 | 0 | 0 | 1 | 0 | 0 | Danish/Norwegian Alt. |
| 0 | 0 | 0 | 1 | 0 | 1 | Finnish/Swedish |
| 0 | 0 | 0 | 1 | 1 | 0 | Finnish/Swedish Alt. |
| 0 | 0 | 0 | 1 | 1 | 1 | French |
| 0 | 1 | 0 | 0 | 0 | 0 | Italian |
| 0 | 1 | 0 | 0 | 0 | 1 | Portugese Alt. |
| 0 | 1 | 0 | 0 | 1 | 0 | Spanish |
| 0 | 1 | 0 | 0 | 1 | 1 | English, U.K. |
| 0 | 1 | 1 | 0 | 0 | 0 | Belgian |
| 0 | 1 | 1 | 0 | 0 | 1 | International |
| 0 | 1 | 1 | 1 | 0 | 0 | Japanese/English |
| 0 | 1 | 1 | 1 | 1 | 1 | Canadian/French |
| 1 | 0 | 0 | 0 | 0 | 0 | Brazilian |
| 1 | 0 | 0 | 0 | 0 | 1 | Canadian Bi-lingual |
| 1 | 0 | 0 | 0 | 1 | 0 | reserved |
| 1 | 0 | 0 | 0 | 1 | 1 | reserved |
| 1 | 0 | 1 | 0 | 0 | 0 | reserved |
| 1 | 0 | 1 | 0 | 0 | 1 | reserved |
| 1 | 0 | 1 | 1 | 0 | 0 | reserved |
| 1 | 0 | 1 | 1 | 1 | 0 | reserved |
| 1 | 0 | 1 | 1 | 1 | 1 | reserved |

The following sets enable the right-to-left printing mode:

*CU LIGHT means the interface is being polled by the control unit (CU).

| | | | | | |
|---|---|---|---|---|-----------------|
| 1 | 1 | 0 | 0 | 0 | EBCDIC, English |
| 1 | 1 | 0 | 0 | 1 | Hebrew, A |
| 1 | 1 | 0 | 1 | 0 | Hebrew, B |
| 1 | 1 | 0 | 1 | 1 | EBCDIC, English |
| 1 | 1 | 1 | 0 | 0 | " |
| 1 | 1 | 1 | 0 | 1 | " |
| 1 | 1 | 1 | 1 | 0 | " |
| 1 | 1 | 1 | 1 | 1 | " |

Switch in DOWN position = 0

Switch in UP position = 1

IMPORTANT: When a right-to-left language set has been selected, the CHG CASE key and its associated indicator, DUAL CASE, control and indicate print direction. Thus, CHG CASE must be pressed (and the DUAL CASE indicator lit) to enable right-to-left printing.

NOTE: The printing of Hebrew graphics requires the installation of an optional device (ISI Hebrew Character Generator) and can only be performed by a printer so equipped.

3.2.5 IBM MODEL SELECT SWITCHES

Table 3-2 specifies the settings of switches 6 thru 8 on E60 for the various IBM Models supported by the ISI 487.

IBM MODEL SELECT SWITCHES

Table 3-2

| IBM MODEL | SWITCH | | |
|-----------|--------|---|---|
| | 6 | 7 | 8 |
| - | 0 | 0 | 0 |
| - | 0 | 0 | 1 |
| 2 | 0 | 1 | 0 |
| 3 | 0 | 1 | 1 |
| 4 | 1 | 0 | 0 |
| 5 | 1 | 0 | 1 |
| - | 1 | 1 | 0 |
| - | 1 | 1 | 1 |

Switch in DOWN position = 0

Switch in UP position = 1

Undefined codes: 0 defaults to IBM Model 2 and 6 and 7 default to IBM Model 4.

3.2.6 SPECIAL FUNCTION SWITCH SETTINGS

Switches 1 thru 8 on E81 control the selection of special printing functions offered by the ISI 487. These functions and their required switch settings are outlined in Table 3-3 below:

SPECIAL FUNCTION SWITCH SETTINGS

Table 3-3

| SWITCH # | FUNCTION FOR UP SETTING | FUNCTION FOR DOWN SETTING |
|----------|-------------------------------|--------------------------------------|
| 1 | do not honor NVM* | honor NVM* |
| 2-5 | reserved | reserved |
| 6 | condensed print (16.67) | do not print 16.67 CPI |
| 7 | print null lines | do not print null lines |
| 8 | print form feed on local copy | do not print form feed on local copy |

Switch in DOWN position = 0 Switch in UP position = 1

*NVM = Non-volatile memory, or the ability of the ISI 487 to store certain parameters requested by the operator.

3.3 ISI 487 ERROR CODES

Table 3-4 serves to define the numeral that is displayed in the L.E.D. window when an error condition has been detected in your ISI 487.

ERROR CODES

Table 3-4

| NUMERAL DISPLAYED | DETECTED ERROR |
|-------------------|------------------------------------|
| 1 | Paper out |
| 2 | Cover open |
| 3 | Paper out and cover open |
| 4 | Head jam |
| 5 | Paper out and head jam |
| 6 | Cover open and head jam |
| 7 | Paper out, cover open and head jam |

| | |
|----|---|
| 8 | "Operator intervention request" returned to controller |
| 10 | Other print mechanism fault |
| 11 | Other print mechanism fault at the same time as error 1,2,3,4,5,6, or 7. |
| 12 | " |
| 13 | " |
| 14 | " |
| 15 | " |
| 16 | " |
| 17 | " |
| 27 | Control out, not enabling printer |
| 63 | Printer has received Program At- tention action request. |

3.4 RUNNING A SELF-TEST

In the event of a printer failure the following procedure should be followed to perform a self-test. An accurate diagnosis of the problem can then be made by consulting Table 3-5.

1. Place the printer in the HOLD PRINT condition. Press the 2ND FUNC key.
2. Press the DIAG key to view the current test mode (see the chart below).
3. If you wish to change the test mode at this time, press the "1" key until you arrive at the desired number. Push the DIAG key to store the test in the printer's memory (i.e. you must press DIAG to achieve the test, otherwise the printer will print the original test displayed).
4. Push TEST. The printer will run the test. If you wish to stop a lengthy test (such as 3, 4, 5, and 9) press the TEST key again.
5. When the test is over, the printer returns to the primary condition. In order to run another test, press 2ND FUNC again and repeat steps 2 through 4.

SELF-TEST DIAGNOSTICS

Table 3-5

- 0 - version and status
- 1 - version - print version, model, ROM checksum, status
- 2 - print status "Xxyzab"
 - X - identifies next 6 characters as a status code

- xx 80 - not defined
- 40 - " "
- 20 - " "
- 10 - RESET
- 8 - LPS order received
- 4 - PRINT order received
- 2 - ABORT order received
- 1 - SSA order received
- y F - printer is busy
- 0 - printer is not busy
- z F - printer is ENABLED and may alter adapter RAM
- 0 - printer is DISABLED
- a 0 - no order received (or an illegal, 0, order was last)
- 1 - last received order was Abort
- 2 - last received order was SSA
- 3 - last received order was Print
- 4 - last received order was Load Programmed Symbols
- 5-F- these values are illegal at this time
- b 0 - last command received was DISABLE
- 1 - last command received was ENABLE
- 2 - last command received was RESET
- 3 - last command received was SOP

- 3 - dump print buffer and variable RAM
- 4 - dump variable RAM only
- 5 - device dependent test (character dump print)
- 6 - not defined
- 7 - not defined
- 8 - Auto-dump (as in 3) at the end of print*
- 9 - print test (repeats until stopped, see sample test #9 print line below).

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789(= "/>?!\$%-.,;+;*)

*Auto-dump is run in READY mode, to stop the test push HOLD PRINT.

3.4.1 RAM TEST

The firmware does a basic memory check on the RAM during power-up. The variable RAM (1000-1FFF) and the print buffer specified by the model switches (0-7FF, model 1, 2) (0-FFF, model 3, 4, 5) are tested for ability to write and read 00, FF, 55, & AA.

If bad RAM is detected the firmware will attempt to turn on the CHECK LED and the alarm. Severe failure of the variable RAM may prevent successful execution of this procedure.

3.4.2 ERRORS ON POWER UP

If the printer is not ready when power is turned on, the printer will sound the alarm and light the CHECK LED. It will also display the error code. See Section 3.3 of this manual.

3.5 PREVENTIVE MAINTENANCE

Although there are no regularly scheduled preventive maintenance procedures, it is advisable to inspect periodically and clean the printer area that is immediately accessible under the top cover.

Occasionally, during paper loading or ribbon replacement, inspect the printer for a build-up of lint or foreign material. If the build up of material is evident, clean the area with a lint free cloth.

Table 3-6 below lists the maintenance occasionally required on certain areas of the printer. This maintenance may be required more or less frequently, depending on the printer application and operating environment.

PREVENTIVE MAINTENANCE

Table 3-6

| ASSEMBLY | MAINTENANCE |
|-------------------------|--|
| Covers | Clean all cover assemblies using a mild detergent and a lint-free cloth. |
| Internal Inspection | Remove the top cover and visually inspect interior of printer for loose wires, connectors, and hardware, chafing of cables, and worn or damaged parts. |
| Print Head and Carriage | After removing ribbon, use a light-bristle brush, carefully remove the dust and residue from the print head and carriage assembly. |
| Platen Assembly | Clean platen assembly using a mild detergent. |

3.6 TROUBLESHOOTING GUIDE

Table 3-2 lists some malfunctions which may occur together with their symptoms, and probable causes. The remedies to the malfunctions should be performed by qualified service personnel.

TROUBLESHOOTING GUIDE

Table 3-7

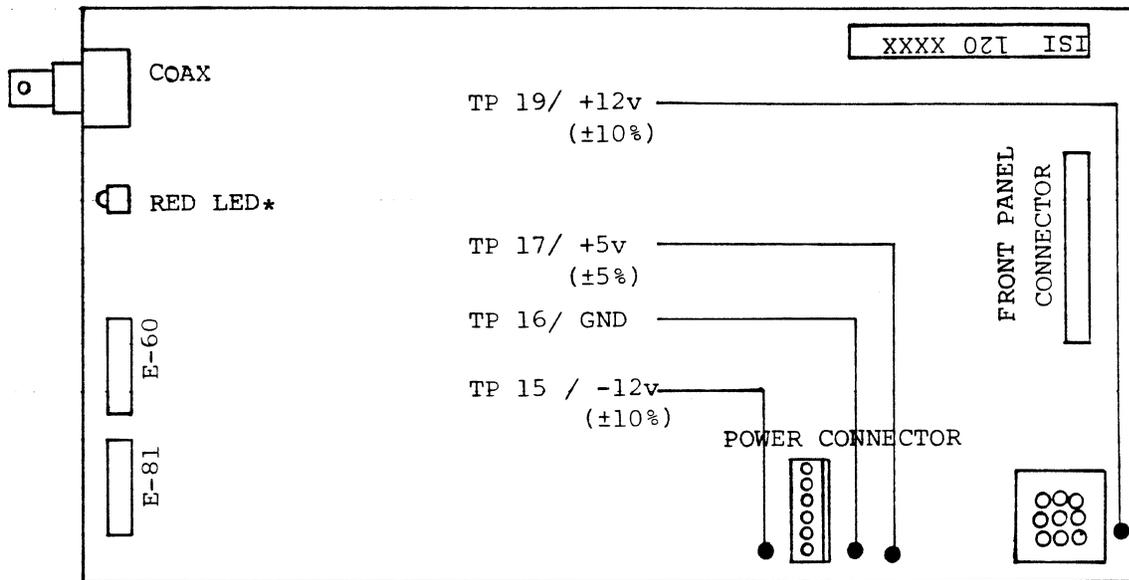
| MALFUNCTION | SYMPTOM | CAUSE |
|-------------------|---|--|
| Power failure | Total power failure: no lights, no head movement, no power on. | Defective power cord. Defective main fuse. Defective power supply. Defective power switch. Insufficient ac power. Not securely plugged in. |
| Improper printing | Print head assembly moves but no print or poor registration or erratic print. | Incorrect print head gap. Print head fingerboard not connected. Improper adjustment of encoder/timing disc and optical sensor. Defective head flex cable. Defective print head. |
| | Missing dots or intermittent pin registration all characters. | Print head fingerboard not seated in connector. Improper adjustment of encoder/timing disc and optical sensor assembly. Defective Print Controller pcb. Defective head flex cable. Defective print head. |
| | Missing or extra dots - certain characters only. | Defective ROM - ISI Interface pcb. |
| | Line across page. | Improper print head gap. Defective print head assembly. Defective head flex cable. Defective Print Controller pcb. |

| | | |
|----------------------|---------------------------------|--|
| | ward, but does not return. | pcb. Missing either video signal V1 or V2. Defective carriage belt. |
| | Carriage does not move forward. | Forms lever in "LOAD" position Defective carriage drive motor. Defective Print Controller pcb. Inappropriate input data. Blown fuse. Defective carriage belt. |
| Ribbon Feed Failure | No ribbon feed. | Defective ribbon drive motor. Ribbon twisted or jammed. Ribbon cassette not seated properly. Defective Print Controller PCB. |
| Paper Motion Failure | Cut sheet forms do not advance. | Forms lever not in "SHEET" position. Blown fuse. |
| | Paper skew or jam. | Print head too close to paper. Improper paper alignment on tractor feed units. Improper paper drive belt adjustment. Improper forms. |

3.7 TESTING THE ISI INTERFACE PCB

If a problem arises and the ISI Interface PCB is suspected as a probable cause, perform the following steps to diagnose the ISI Interface PCB.

1. Remove the ISI Interface PCB (Format Controller PCB) per Section 5.25.
2. Locate the test points illustrated in Figure 3.4 below.
3. Verify the voltage levels indicated in Figure 3.4 for each test point. If voltage levels are insufficient, follow the corrective action suggested by the Troubleshooting Guide in Section 3.6.



ISI INTERFACE VOLTAGE TEST POINTS
Figure 3-4

*RED LED: indicates that the interface is responding to the controller.

Chapter 4

ADJUSTMENTS

4.1 ADJUSTMENT SUMMARY

Adjustment procedures should be performed whenever an affected assembly is replaced or to correct an improper/marginal operation. The adjustment parameters should be checked before performing the procedure to insure it is necessary. This section contains the following adjustment procedures.

- 4.2 Carriage Drive Motor Belt
- 4.3 Carriage Drive Belt
- 4.4 Paper Drive Belt
- 4.5 Tractor Gear Backlash
- 4.6 Paper Empty Switch
- 4.7 Optical Sensor and Encoder/Timing Disc
- 4.8 Print Controller PCV Horizontal Offset

All procedures contained in this section are performed with the printer covers removed. Refer to paragraph 5.4 for the removal/replacement procedures of the covers. After performing the adjustment procedure a self-test printout should be generated to ensure proper printer operation.

NOTE: Removing the top cover enables the printer interlock switch. To disable the interlock for adjustments, place a small magnet beside the interlock switch (refer to Figure 5-13) and operate the printer. If the interlock remains enabled, remove the magnet, reverse it to change polarity, then replace it on the switch.

4.2 CARRIAGE DRIVE

NOTE: The carriage drive motor belt adjustment and the carriage drive belt adjustment must be performed simultaneously.

The tension of the carriage drive motor belt is adjusted so that the carriage starts and stops evenly as the carriage drive motor is turned on and off. A flat blade screwdriver is required to adjust the belt. To

adjust the belt, refer to Figure 4-1 and perform the following steps:

1. Ensure the forms lever is on the "SHEET" or "FORMS" position.
2. Move the print head assembly and the carriage to the center of the printer.
3. Adjust the belt tension by turning clockwise (tighten) or counterclockwise (loosen) the two adjusting screw mounting the drive pulley assembly so that the belt deflects 2.5 mm (0.09 in.) to 4.5 mm (0.17 in.) when a 300 gram (11 oz.) load is applied at the center of the belt.

4.3 CARRIAGE DRIVE BELT

NOTE: The carriage drive belt adjustment and the carriage drive motor belt adjustment must be performed simultaneously.

The tension of the carriage drive belt is adjusted for smooth starts and stops of the carriage assembly. The belt is adjusted using a flat blade screwdriver. To adjust the belt, refer to Figure 4-2 and perform the following steps:

1. Position the carriage assembly at the left margin.
2. Adjust the belt tension by turning clockwise (tighten) or counterclockwise (loosen) the two adjusting screws on the idle pulley assembly so that the belt deflects 8 mm (0.31 in.) to 9 mm (0.35 in.) when a 300 gram (11 oz.) load is applied at the center of the belt.

4.4 PAPER DRIVE BELT

NOTE: The paper drive belt and tractor gear backlash must be adjusted simultaneously.

The tension of the paper drive belt is adjusted to provide a positive drive between the paper drive motor and tractor feed assembly. A Phillips head screwdriver and a 7 mm open-end wrench are required to adjust the belt. To adjust the paper drive belt, refer to Figure 4-3 and perform the following steps:

1. Loosen the Phillips head screw mounting the tension roller to the right frame.

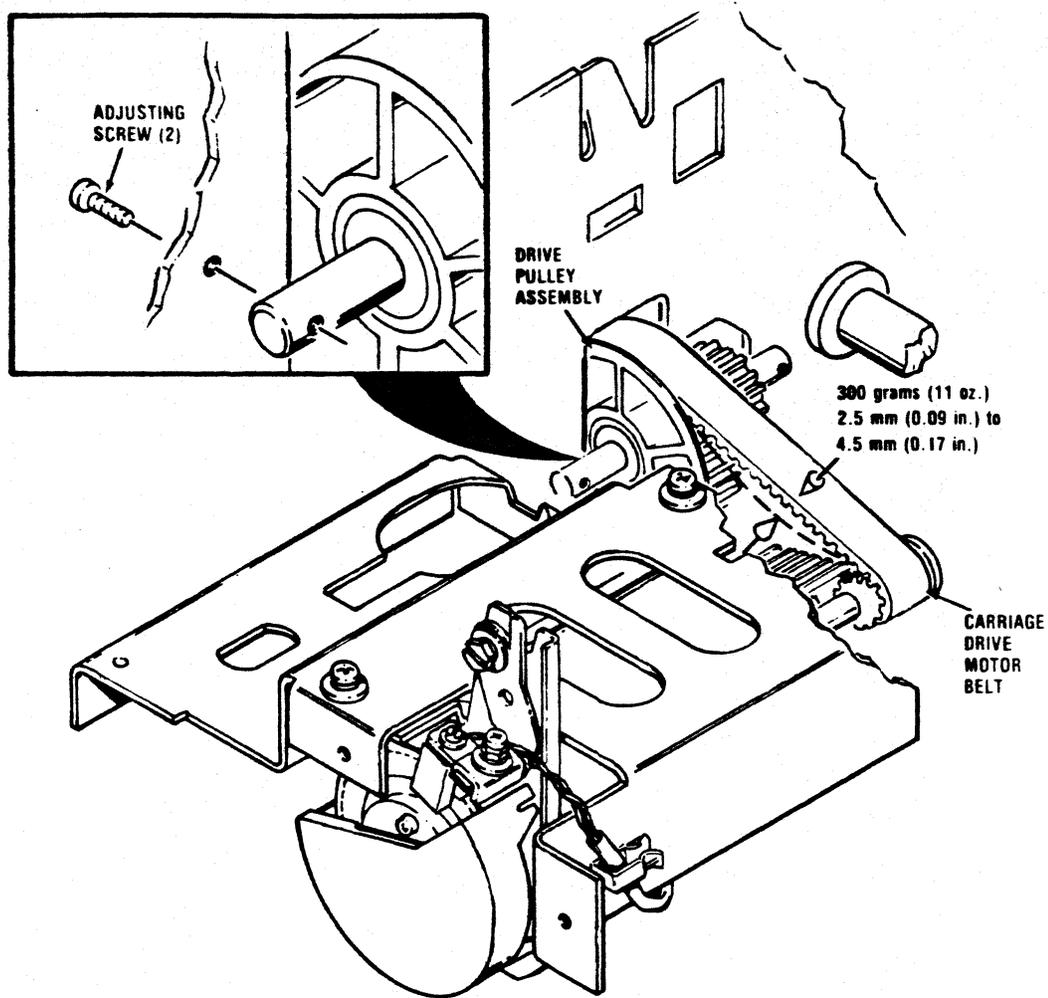


Figure 4-1. CARRIAGE DRIVE MOTOR BELT ADJUSTMENT

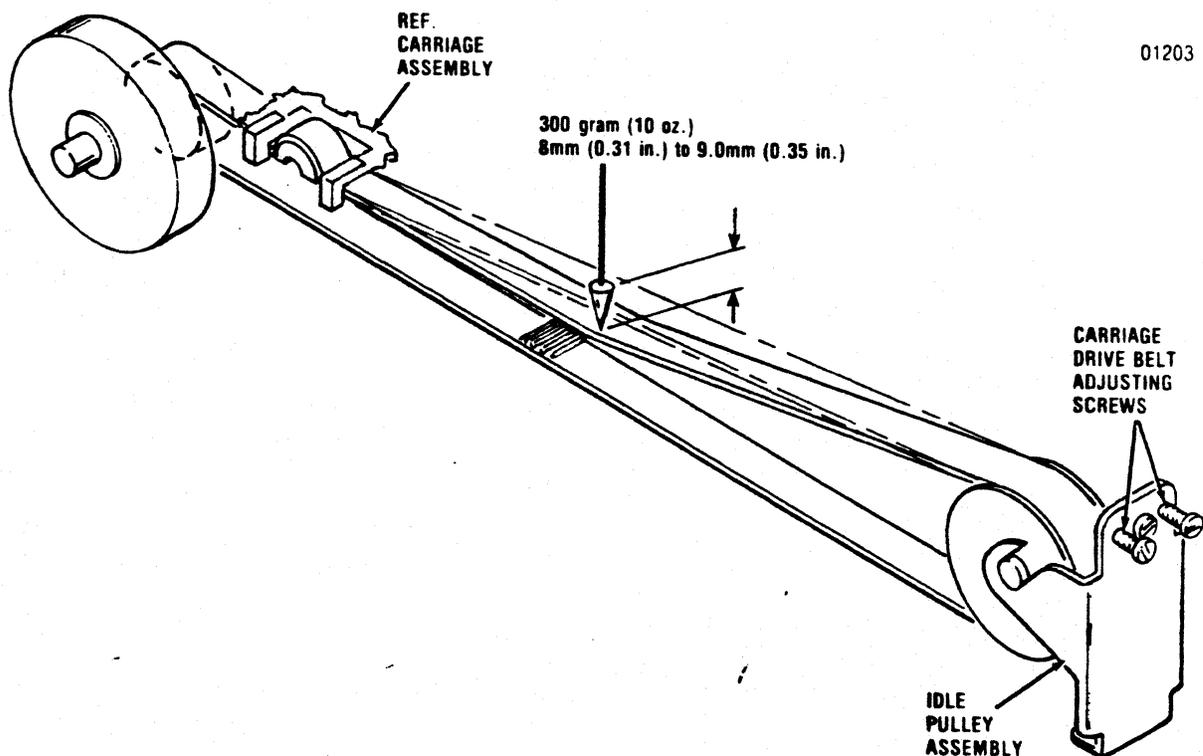


Figure 4-2. CARRIAGE DRIVE BELT ADJUSTMENT

2. At a point equidistant from the paper drive gear and paper feed pulley, adjust the tension of the belt by applying a load of 500 grams on the belt with the tension roller.
3. Tighten the Phillips head screw mounting the tension roller.

01202

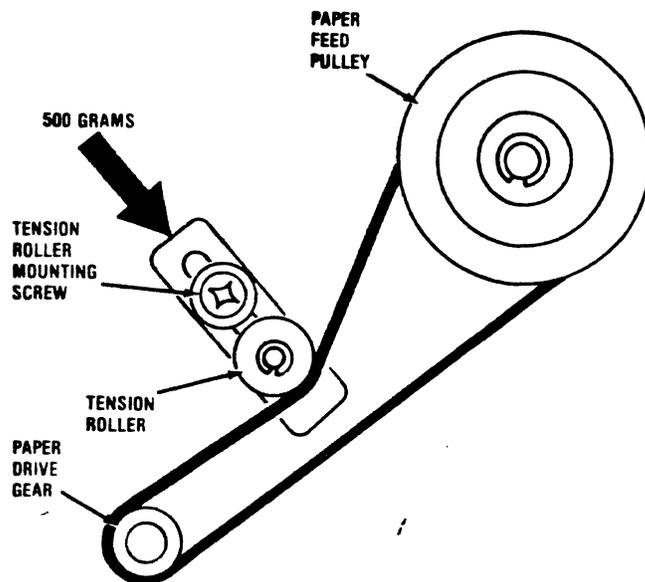


Figure 4-3. PAPER DRIVE BELT ADJUSTMENT

4.5 TRACTOR GEAR BACKLASH

NOTE: The tractor gear backlash and the paper drive belt must be adjusted simultaneously.

The backlash between the paper drive gear and tractor gear is adjusted to provide positive drive between the paper drive motor and tractor feed assembly. A flat blade screwdriver is required for the backlash adjustment. To adjust the backlash of the tractor gear, refer to Figure 4-4 and perform the following steps:

1. Using a flatblade screwdriver, loosen the three slotted head screws mounting the paper drive motor to the right frame.
2. Move the paper drive motor in the forward or reverse direction so that the backlash between the paper drive gear and tractor gear is 0.05 mm (0.001 in.) to 0.03 mm (0.011 in.) for one rotation of the tractor gear. **NOTE:** Check the backlash at three points, approximately 120 degrees apart, for one rotation of the tractor gear.
3. Tighten the three slotted head screws once backlash adjustment is made.

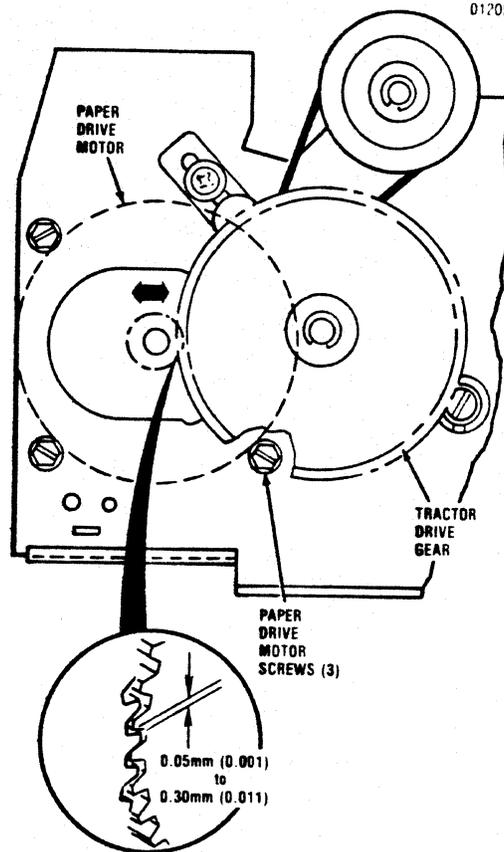


Figure 4-4. TRACTOR GEAR BACKLASH ADJUSTMENT

4.6 PAPER EMPTY SWITCH

The arm of the paper empty switch is adjusted to ensure proper contact with the paper. To adjust the paper empty switch arm, refer to Figure 4-5 and perform the following steps:

1. The paper empty switch arm on the left print feed tractor should measure 2.3 mm (0.09 in.) to 4.0 mm (0.15 in.) above the surface of the tractor assembly. If the arm does not meet these parameters, adjust as described in step 2.
2. With the tractor cover closed, gently bend the arm so that the distance between the cover and arm is 2.3 mm (0.09 in.) to 4.0 mm (0.15 mm) is attained.

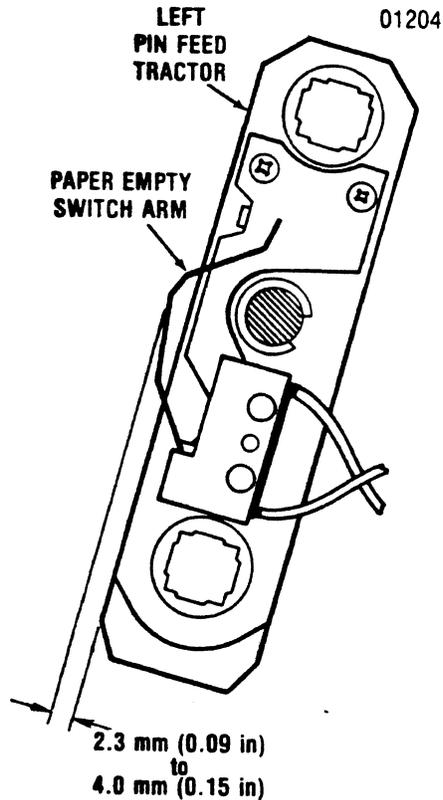


Figure 4-5. PAPER EMPTY SWITCH ADJUSTMENT

4.7 OPTIC SENSOR AND ENCODER/TIMING DISC

The optic sensor and encoder/timing disc is adjusted to provide the correct video signals to the print Controller pcb. The optic sensor and encoder/timing disc is adjusted both mechanically and electrically. A flat blade screwdriver, Phillips head screwdriver, feeler gauge, and dual trace oscilloscope are required to adjust the sensor and disc. To perform the adjustments, refer to figure 4-6 and 4-7 and perform the following steps:

4.7.1 MECHANICAL ADJUSTMENT

1. Remove the ribbon cassette assembly from the printer per paragraph 5.6.
2. Move the print head assembly to the extreme right side of the printer.
3. Loosen the Phillips head screw mounting the optical sensor to the carriage drive motor.

4. Insert a 0.5 mm (0.020 in.) feeler gauge between the sensor and disc.
5. Move the sensor left or right until the 0.5 mm (0.020 in.) gap is set.
6. Tighten the Philips head screw once the gap is set.
7. Reinstall the ribbon cassette assembly.

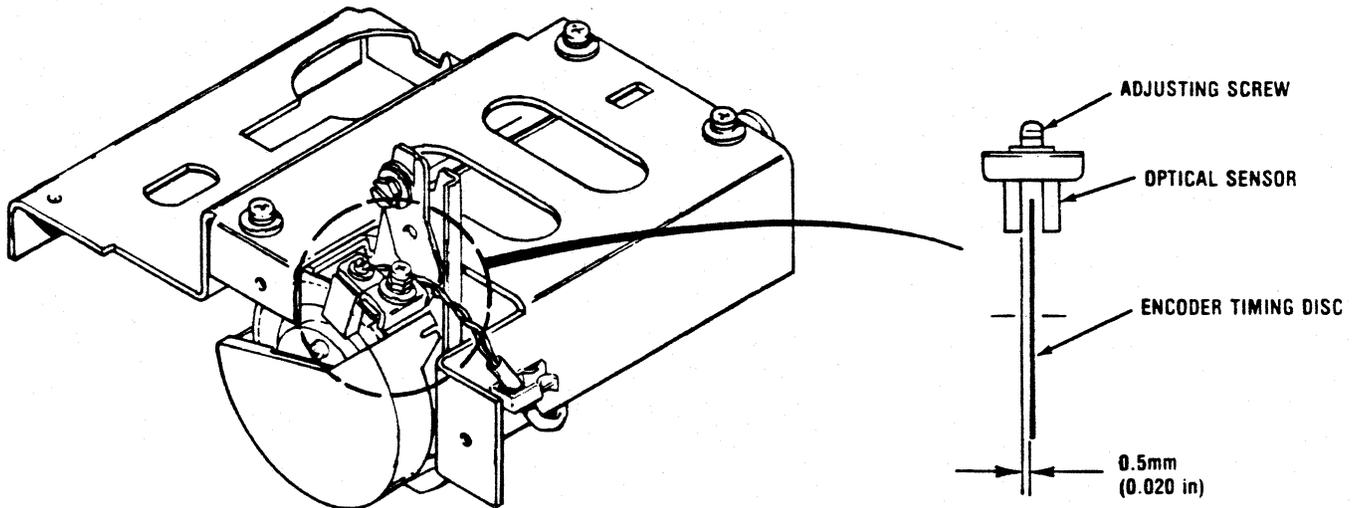


Figure 4-6. MECHANICAL ADJUSTMENT, OPTIC SENSOR AND ENCODER/TIMING DISC

4.7.2 ELECTRICAL ADJUSTMENT

1. Remove the four Phillips head screws mounting the printer mechanism to the printer base.
2. Tilt the front of the mechanism up and hold the mechanism in this position using the mechanism support rod.
3. Override the cover open switch with the spare magnet.
4. Connect the oscilloscope ground lead to the negative (-) side of capacitor C1 on the print control board.
5. Connect oscilloscope channel 1 probe to TP6 and oscilloscope channel 2 probe to TP7 on the print controller board.
6. Set the oscilloscope as follows:
 1. Volts/Div. knobs at "2V/Div."

2. Vert. mode switch on "ADD"
3. Time/Div. Knob at 50 uS/Div.
7. Turn oscilloscope and printer on.
8. While in HOLD PRINT, set diagnostic to #9, and press 2ND FUNC, then press TEST. In NLQ, the carriage will move slower and provide more time for reading. NOTE: The self-test pattern continues until TEST is pressed again.
9. (Refer to Figure 4-7) Observe the oscilloscope screen to see if levels (1,2,3) show an even time duration.
10. If signal does not show an even time duration for each level, adjust as follows:
 1. Slightly loosen the slotted head screw securing the optics bracket to the carriage.
 2. Move the optics bracket slowly, until the signal on the oscilloscope screen shows all three levels of an even duration.
 3. Tighten the screw securing the optics bracket.
 4. Recheck the signal to ensure adjustment is correct.
11. Press TEST again to stop printing.
12. Turn printer power off.
13. Remove oscilloscope probes and ground connections from printer.
14. Lower the printer mechanism and reinstall mounting hardware.

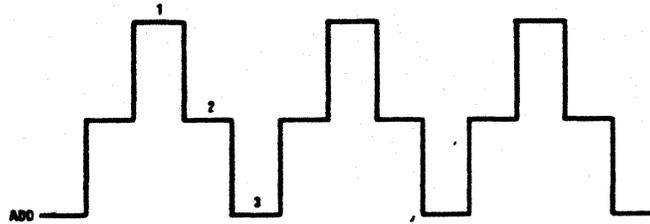
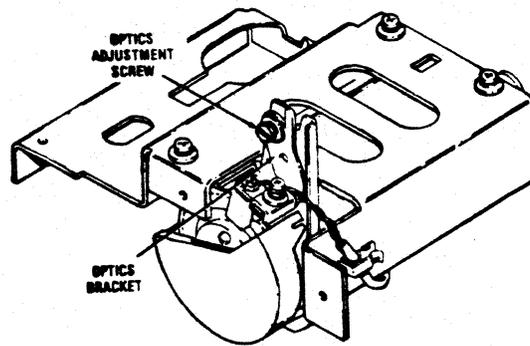


Figure 4-7. ELECTRICAL ADJUSTMENT, OPTIC SENSOR AND ENCODER/TIMING DISC

4.8 HORIZONTAL OFFSET ADJUSTMENT

The Print Controller pcb contains a 5-position dip switch for the horizontal offset adjustment. This procedure adjusts the print position left or right so that the printed character columns are vertically aligned. To adjust the horizontal offset refer to Figure 4-8 and Tables 4-1 and 4-2 and perform the following steps.

1. Remove the covers from the printer per paragraph 5.4.
2. Remove the four shoulder screws attaching the printer mechanism to the printer base.
3. Raise the front of the printer mechanism and hold the mechanism in this position using the mechanism support rod located under the front of the body cover.
4. Place a small magnet against the cover interlock switch so that the printer will operate with the top cover removed.
5. Turn printer power on, select printer and print a dozen or so 132 column lines of the character H (octal 110).
6. Deselect the printer and compare the first and last columns of printed text to Figure 4-7.

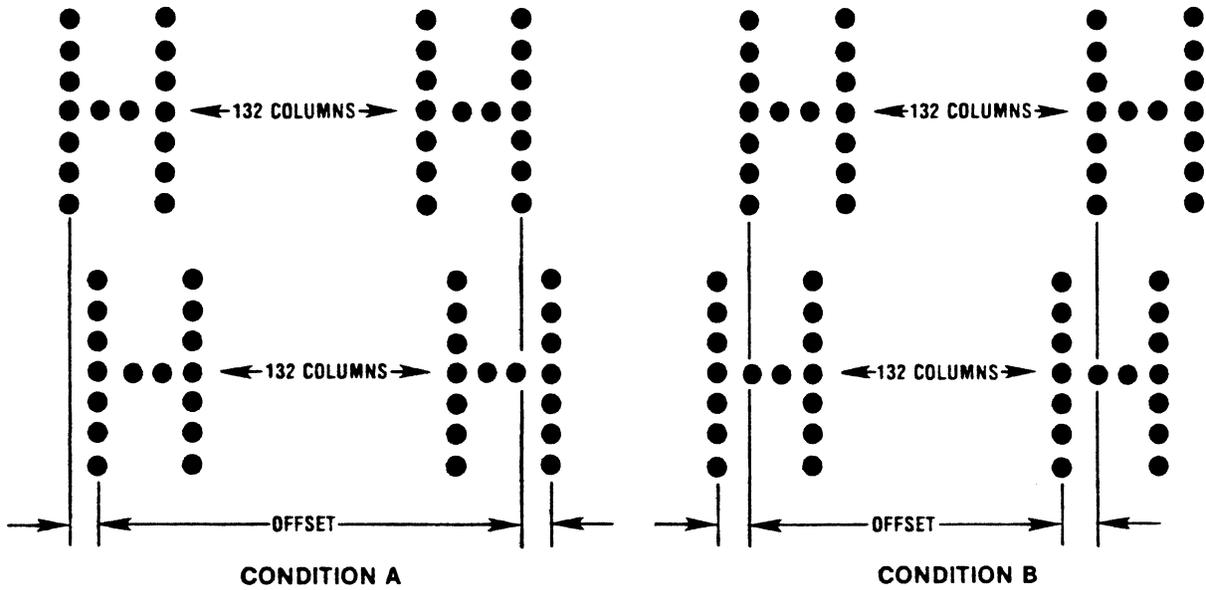


Figure 4-8. HORIZONTAL OFFSET PRINT SAMPLE

7. If printed text is offset as in condition A, close switch #5 (Figure 4-8) which moves the print position to the left.
8. To adjust the offset for condition A, follow the switch list below in Table 4-1 step-by-step until the characters are vertically aligned in the first and last columns.

OFFSET CONDITION "A"

Table 4-1

| SWITCH # | 4 | 3 | 2 | 1 |
|----------|--------|--------|--------|--------|
| | CLOSED | CLOSED | CLOSED | CLOSED |
| | CLOSED | CLOSED | CLOSED | OPEN |
| | CLOSED | CLOSED | OPEN | CLOSED |
| | CLOSED | CLOSED | OPEN | OPEN |
| | CLOSED | OPEN | CLOSED | CLOSED |
| | CLOSED | OPEN | CLOSED | OPEN |
| | CLOSED | OPEN | OPEN | CLOSED |
| | CLOSED | OPEN | OPEN | OPEN |

9. If the printed text is offset as in condition B, open switch #5 (Figure 4-8) which moves the print position to the right.
10. To adjust the offset for condition B follow the switch list below in Table 4-2 step-by-step until the characters are vertically aligned in

the first and last columns.

OFFSET CONDITION "B"

Table 4-2

| SWITCH # | 4 | 3 | 2 | 1 |
|----------|--------|--------|--------|--------|
| | CLOSED | CLOSED | CLOSED | CLOSED |
| | CLOSED | CLOSED | CLOSED | OPEN |
| | CLOSED | CLOSED | OPEN | CLOSED |

NOTE: The printer must be turned off and then on after each setting of four switches.

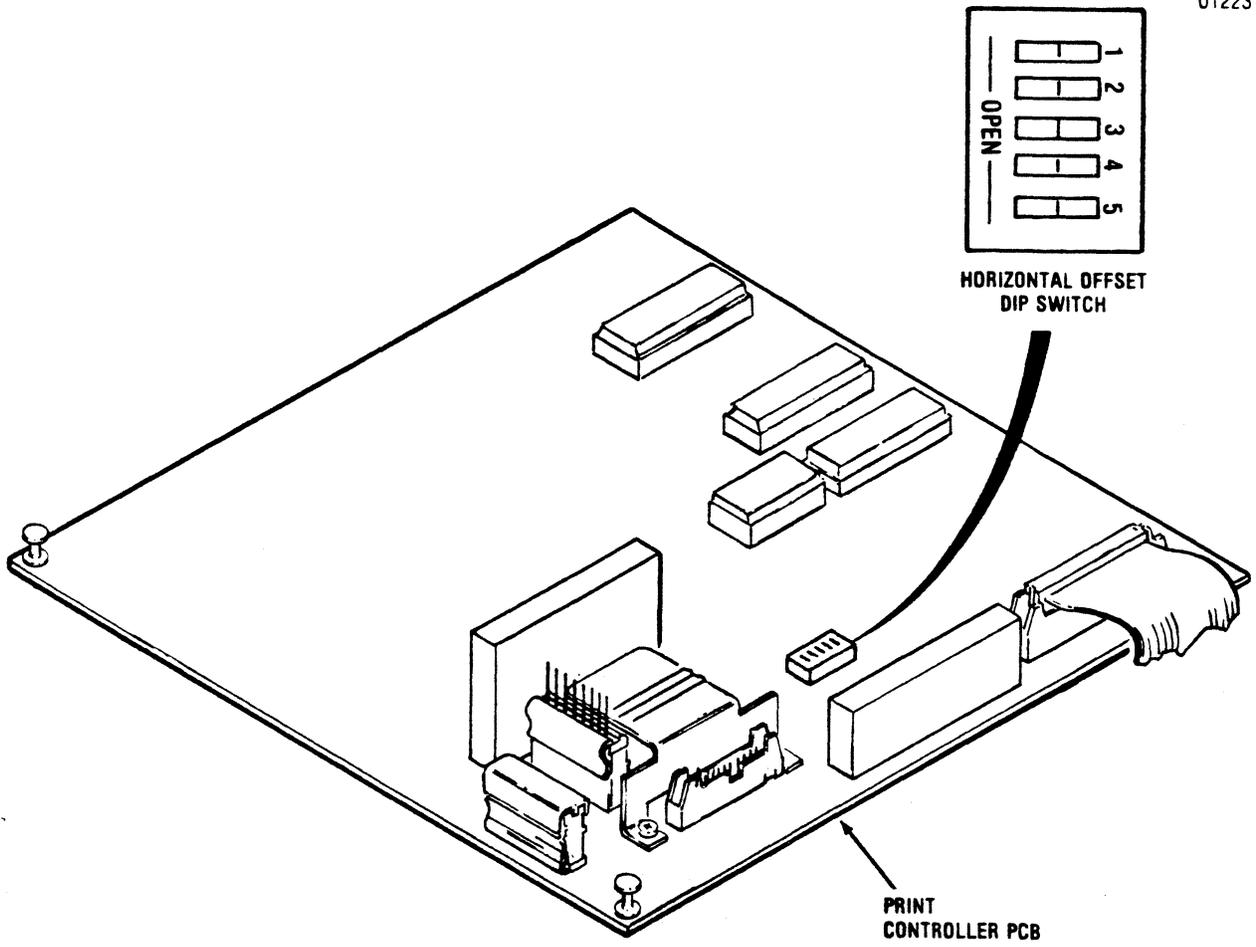


Figure 4-9. HORIZONTAL OFFSET DIP SWITCH

Chapter 5
REMOVAL/REPLACEMENT

5.1 REMOVAL/REPLACEMENT, RECOMMENDED SPARES

This section covers the removal/replacement procedures for the Model 487 recommended spare parts. This section is organized as shown in Table 5-1. At the end of this section is the part number listing of the recommended spares according to figure and index number.

Table 5-1. MODEL 487 RECOMMENDED SPARES AND ASSOCIATED PARTS

NOTE: Items followed by an asterisk are not recommended spares, but may require removal/replacement when changing spares.

| PARAGRAPH | RECOMMENDED SPARE |
|-----------|--|
| 5.2 | Paper Rack Outlet Assembly* |
| 5.3 | Paper Rack Inlet* |
| 5.4 | Cover Assemblies* |
| 5.5 | Cover Interlock Magnet |
| 5.6 | Ribbon Cassette and Guide* |
| 5.7 | Print Head Assembly |
| 5.8 | Head Flex Cable |
| 5.9 | Head Adapter PCB |
| 5.10 | Print Mechanism* |
| 5.11 | Dust Cover* |
| 5.12 | Carriage Drive Motor Belt |
| 5.13 | Carriage Drive Belt |
| 5.14 | Carriage Drive Motor/Ribbon Motor Mounting Bracket |
| 5.15 | Optic Sensor Assembly |
| 5.16 | Carriage Drive Motor |
| 5.17 | Encoder/Timing Disc |
| 5.18 | Ribbon Drive Motor |
| 5.19 | Cover Interlock Switch |
| 5.20 | Paper Drive Belt |
| 5.21 | Paper Feed Motor* |
| 5.22 | Tractor Assemblies, Left/Right |
| 5.23 | Paper Empty Switch |
| 5.24 | Power Supply Assembly |

| | |
|------|-------------------------------------|
| 5.25 | Print Controller PCB |
| 5.26 | ISI Interface PCB |
| 5.27 | Pico Fuse |
| 5.28 | ON/OFF Switch |
| 5.29 | Main Fuse |
| 5.30 | Power Cord |
| 5.31 | Cover Latch Springs |
| 5.32 | Converting the Power Supply to 220v |
| 5.33 | Recommended Spare Parts Listing |

5.2 PAPER RACK OUTLET ASSEMBLY

The paper rack outlet assembly, item 1 of Figure 5-1, attaches to the rear cover and guides the printed forms over the printer and into the paper basket. To remove the paper rack outlet assembly, refer to Figure 5-1 and perform the following steps:

1. Remove the two paper rack mounting rails from the holes in the back of the rear cover.
2. Lift the paper rack (1) from the two mounting holes on top of the rear cover and remove the paper rack from the printer.
3. To replace the paper rack, reverse steps 1 and 2.

5.3 PAPER RACK INLET

The paper rack inlet, item 2 of Figure 5-1, attaches to the rear of the printer and guides the forms into the paper feed mechanism. To remove the paper rack inlet, refer to Figure 5-1 and perform the following steps.

1. Remove the two paper rack mounting tabs from the mounting holes on the inside of the left and right side frames.
2. Pull the paper rack inlet (2) straight out and remove the rack from the printer.
3. To replace the paper rack inlet, reverse steps 1 and 2.

5.4 COVER ASSEMBLIES

The covers protect the print mechanism and the printed circuit boards and are removed using a Phillips head screwdriver. To remove the covers, refer to Figure 5-1 and perform the following steps:

5.4.1 TOP COVER

Remove the top cover by lifting the rear edge of the cover up and off the printer.

5.4.2 REAR COVER

1. Unsnap the top of the rear cover from the body cover.
2. Lower the rear cover until it is in a fully open position.
3. Lift the rear cover up and off the printer.

5.4.3 BODY COVER

1. Remove the top and rear covers from the printer.
2. Remove the two Phillips head screws at the rear of the printer mounting the body cover to the printer base.
3. Loosen the thumbscrew underneath the front of the printer mounting the body cover to the printer base.
4. Place the forms lever in the "LOAD" position.
5. While gently pushing the body cover towards the rear of the printer, lift the cover up and off the printer.
6. Unplug the operator control panel.

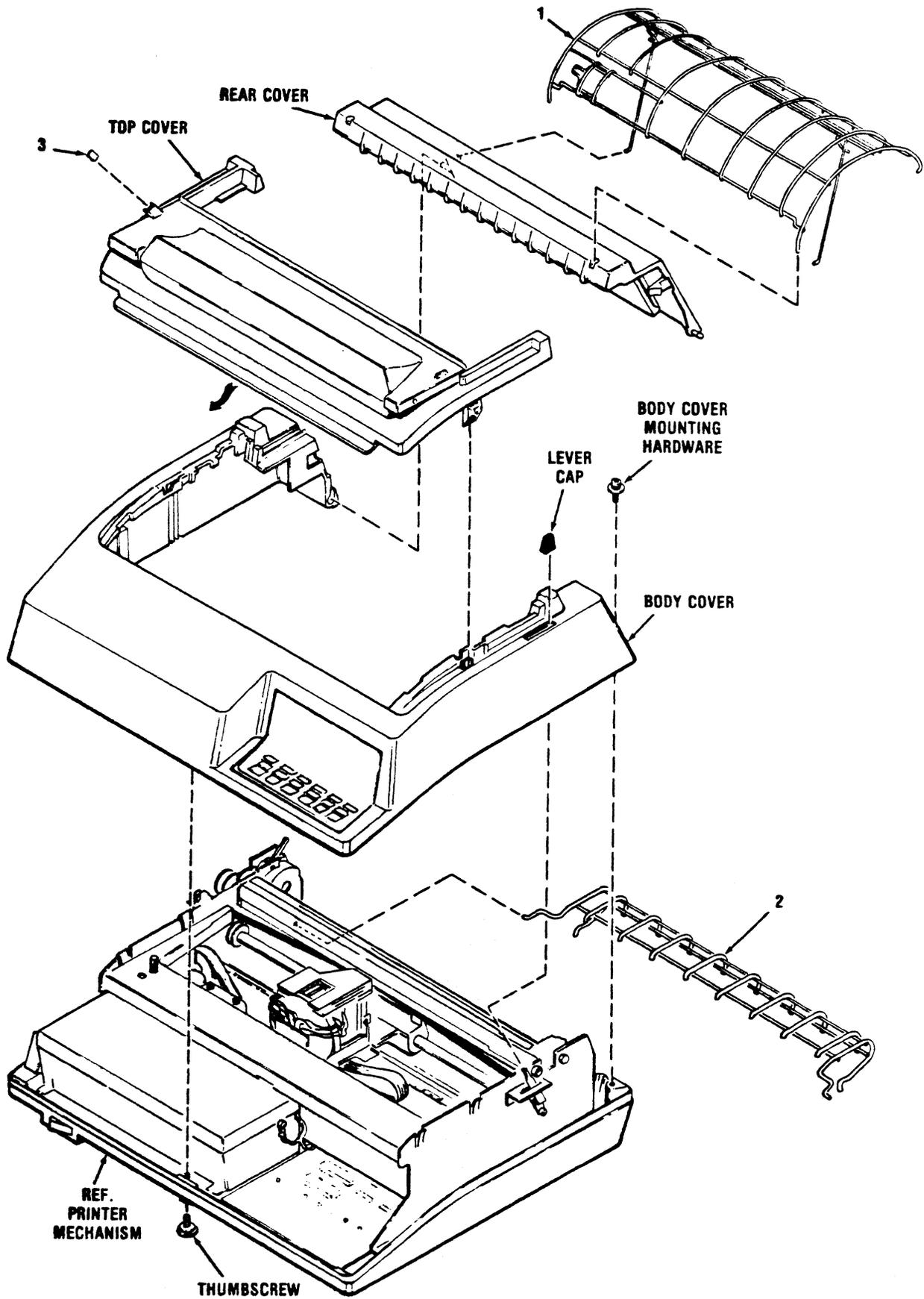


Figure 5-1. REMOVAL/REPLACEMENT PAPER RACK OUTLET ASSEMBLY, PAPER RACK INLET, COVER ASSEMBLIES AND COVER INTERLOCK MAGNET

5.5 COVER INTERLOCK MAGNET

The cover interlock magnet, item 3 of Figure 5-1, is located underneath the left side of the top cover. To replace the magnet, refer to Figure 5-1 and perform the following steps:

1. Place the clear hinged portion of the top cover in the open position.
2. Place a small amount of adhesive onto one side of the magnet (3) to be installed.
3. Place the magnet into the slot on the cover and hold in place until dry.

5.6 RIBBON CASSETTE AND GUIDE

The ribbon cassette is mounted to the left and right side frames and the ribbon guide is mounted over the front of the print head. No tools are required to re-move the cassette and guide. To remove the cassette and guide, refer to Figure 5-2 and perform the following steps:

1. Remove the top cover from the printer per paragraph 5.4.
2. Unsnap the top of the rear cover and place in the open position.
3. Ensure the print head is at the extreme left margin.
4. Place the forms lever in the "LOAD" position.
5. Lift the column scale into the up position.
6. Pull the head adjustment lever back to its maximum position.
7. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the ribbon guide and lifting upward.
8. Lift the used ribbon cassette and guide (1) up and out of the printer.
9. To install the new ribbon cassette and guide, reverse steps 1 through 8.

5.7 PRINT HEAD ASSEMBLY

The print head assembly, item 2 of Figure 5-2, attaches to the carriage. No tools are required to remove the print head. To remove the print head, refer to Figure 5-2 and perform the following steps:

1. Remove the top cover from the printer.
2. Unsnap the top of the rear cover and place in the open position.
3. Ensure the print head is at the extreme left margin.
4. Place the forms lever in the "LOAD" position.
5. Lift the column scale into the up position.
6. Pull the head adjustment lever back to its maximum position.
7. Remove the ribbon guide from the front of the print head by squeezing together the two tabs at the top of the guide and lifting upward.
8. Remove the print head fingerboard connector P704 from the Head Adapter pcb connector J704 by lifting the connector upward.
9. To remove the print head (2) simultaneously pull the head towards the front of the printer and lift the head up and out of the printer.
10. To replace the print head assembly, reverse steps 1 through 9.

NOTE: Ensure the black cam located on the front of the print head is in position "A" following replacement of the head.

NOTE: removal of the white plastic shipping restraint will facilitate removal /replacement of print head. See unpacking instructions.

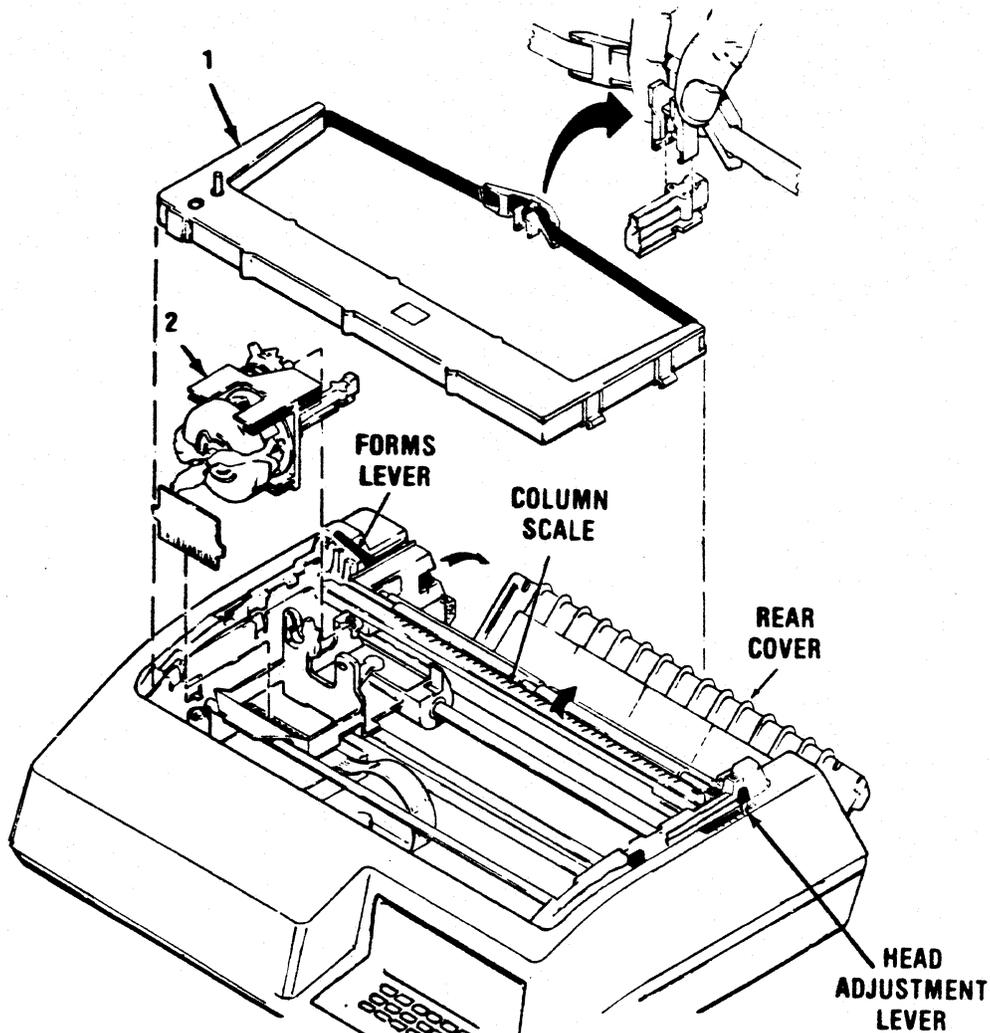


Figure 5-2. REMOVAL/REPLACEMENT, RIBBON CASSETTE AND GUIDE, PRINT HEAD ASSEMBLY

5.8 HEAD FLEX CABLE

The head flex cable, item 1 of Figure 5-3, connects the print head assembly and print controller pcb. To remove the head flex cable, refer to Figure 5-3 and perform the following steps:

1. Remove the top cover from the printer per paragraph 5.4.
2. Move the print head approximately three quarters the length of the guide bar from the extreme left margin.
3. Unhook the rubber band securing the head flex cable to the bracket on the Print Controller pcb.
4. Disconnect the head flex cable connector P703 from connector J703 on the Head Adapter pcb.

5. To replace the head flex cable, reverse steps 1 through 6.

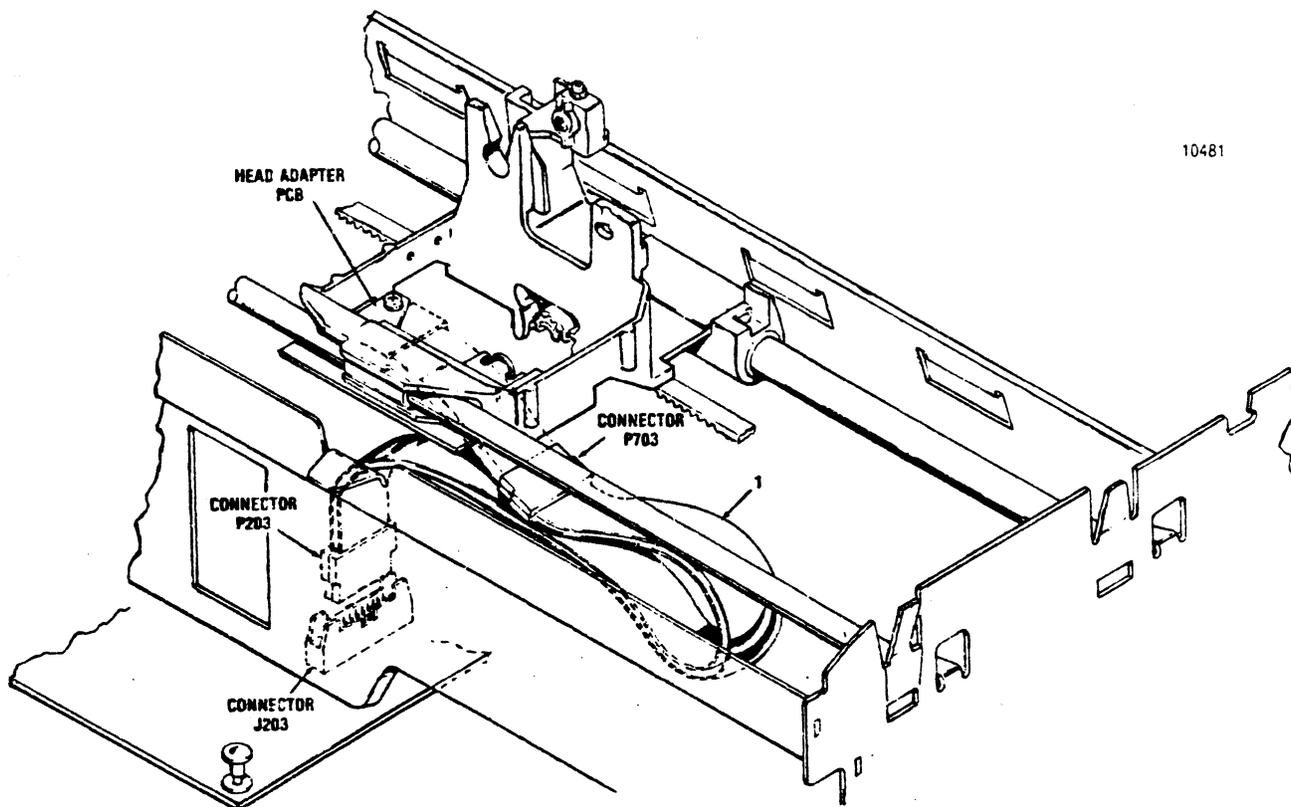


Figure 5-3. REMOVAL/REPLACEMENT, HEAD FLEX CABLE

5.9 HEAD ADAPTER PCB

The Head Adapter pcb, item 1 of Figure 5-4, is attached to the carriage assembly and is removed using a Phillips head screwdriver. To remove the Head adapter pcb, refer to Figure 5-4 and perform the following steps:

1. Remove the top cover from the printer per paragraph 5.4.
2. Remove the ribbon cassette and guide per paragraph 5.6.
3. Remove the print head assembly per paragraph 5.7.

NOTE: Ensure the column scale is down and the forms lever is in the "SHEET" or "FORMS" position before performing step 4.

Move the carriage approximately three quarters the length of the guide bar from the extreme left margin.

Unhook the rubber band securing the head flex cable to the underside of the carriage and disconnect the head flex connector P703 cable from connector J703 on the the head adapter pcb.

Remove the two screws mounting the Head Adapter pcb to the carriage and remove the pcb from the printer.

To replace the Head Adapter pcb, reverse steps 1 through 6.

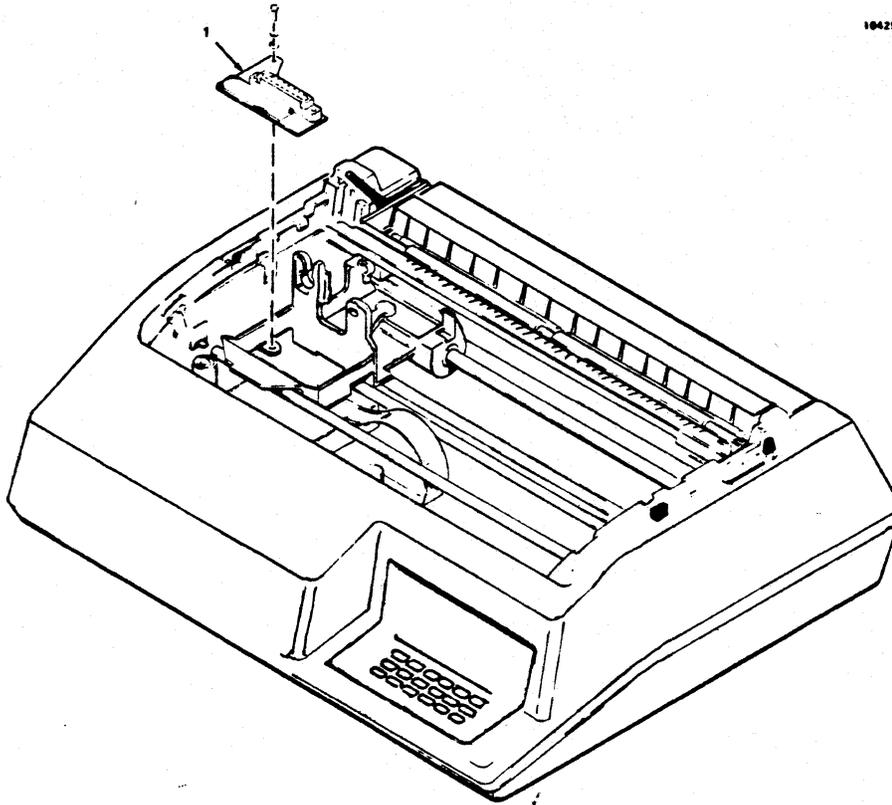


Figure 5-4. REMOVAL/REPLACEMENT, HEAD ADAPTER PCB

5.10 PRINTER MECHANISM

The printer mechanism, illustrated in Figure 5-5, contains the frame assemblies and most of the mechanical assemblies used in the printer.

Several removal/replacement procedures described in subsequent paragraphs cannot be performed unless the printer mechanism is detached from the printer base and repositioned for greater accessibility. All the necessary accessibility can be gained by (1) placing the mechanism in a tilt position within the printer, or (2) removing the mechanism from the printer. The paragraphs below describe the procedure used to reposition the mechanism in either of these two ways.

NOTE: Tilting the mechanism is a simpler and less time consuming operation than removing it. Under normal circumstances, tilting is more efficient than removing the mechanism.

5.10.1 REMOVAL/REPLACEMENT OF PRINTER MECHANISM

The mechanism is removed using a Phillips head screwdriver. To remove the printer mechanism, refer to Figure 5-5 and perform the following steps:

1. Remove the printer covers per paragraph 5.4.
2. Remove the four shoulder screws mounting the printer mechanism to the printer base.
3. Disconnect the five printer mechanism cable assemblies from the five connectors on the Print Controller pcb.
4. Remove the head flex cable per paragraph 5.8.
5. Disconnect the green ground wire attached to the left rear of the mechanism.
6. Lift the printer mechanism up and out of the printer.
7. To replace the mechanism, reverse steps 1 through 6.

NOTE: Refer to Figure A-3, Wiring Diagram, when reconnecting the five printer mechanism cable assemblies to the Print Controller pcb.

5.10.2 PLACING PRINT MECHANISM IN TILT POSITION

To place the mechanism in tilt position, perform the following steps:

1. Remove the printer covers per paragraph 5.4.
2. Remove and keep handy the support rod located inside the front cover.
3. Tilt the front of the mechanism upward about 45 degrees.
4. Position one end of the support rod into the opening provided in the front right corner of the base, then position the other end of the rod through the front right shoulder washer hole in the frame.

5.11 DUST COVER

The dust cover attaches to the bottom of the printer mechanism and protects the Print Controller and Format Controller pcb's. To remove the dust cover, refer to Figure 5-6 and perform the following steps:

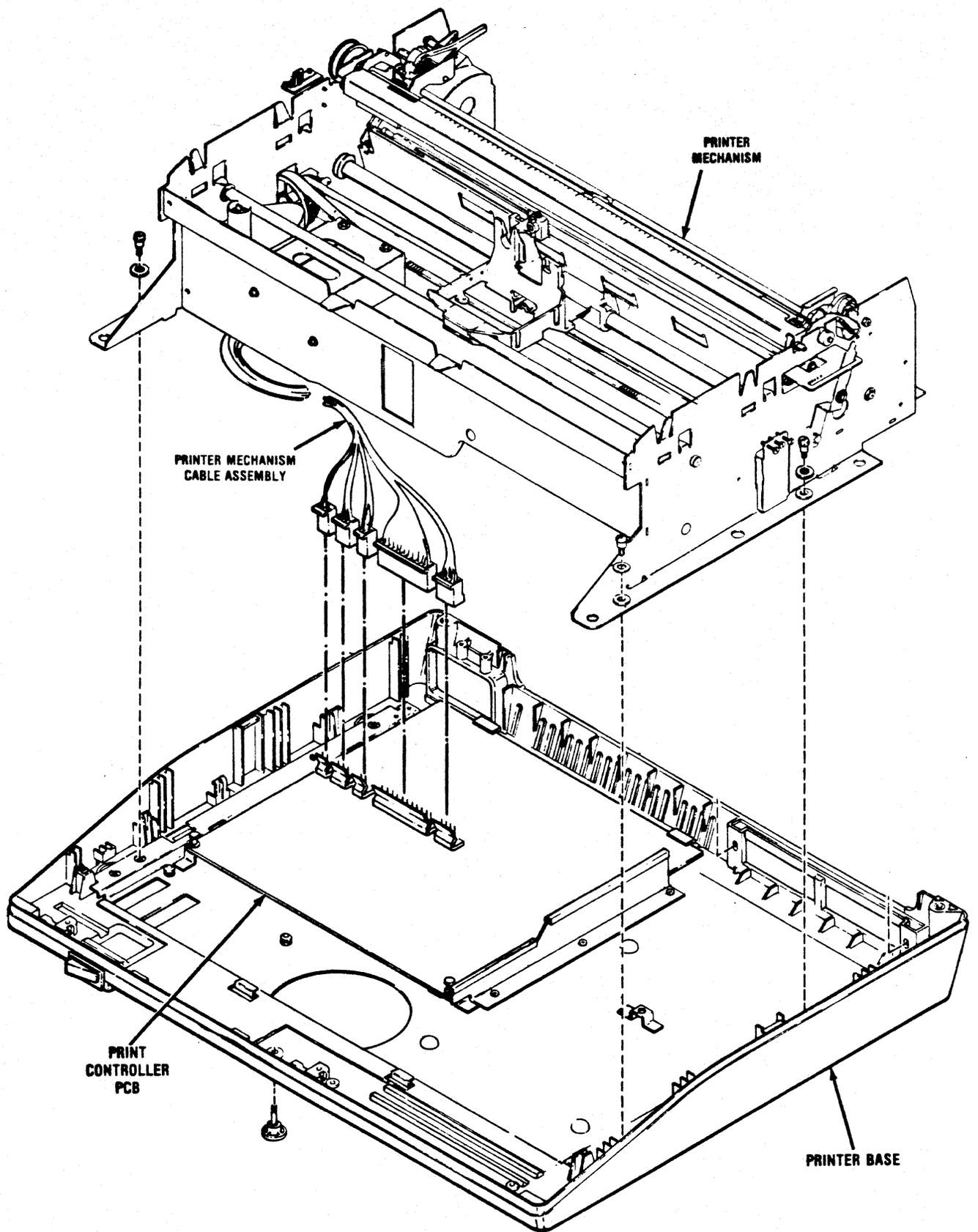


Figure 5-5. REMOVAL/REPLACEMENT, PRINT MECHANISM

1. Remove or tilt the printer mechanism per paragraph 5.10.
2. If mechanism is tilted, remove head flex cable from Print Controller pcb.
3. Remove the two white tabs mounting the dust cover to the front and right side of the print mechanism.
4. If mechanism is remove, tip the mechanism up.
5. Gently pull the front of the dust cover down.
6. Pull the dust cover forward from the three rear mounting clips and remove the dust cover from the printer.
7. To replace dust cover, reverse steps 1 through 6.

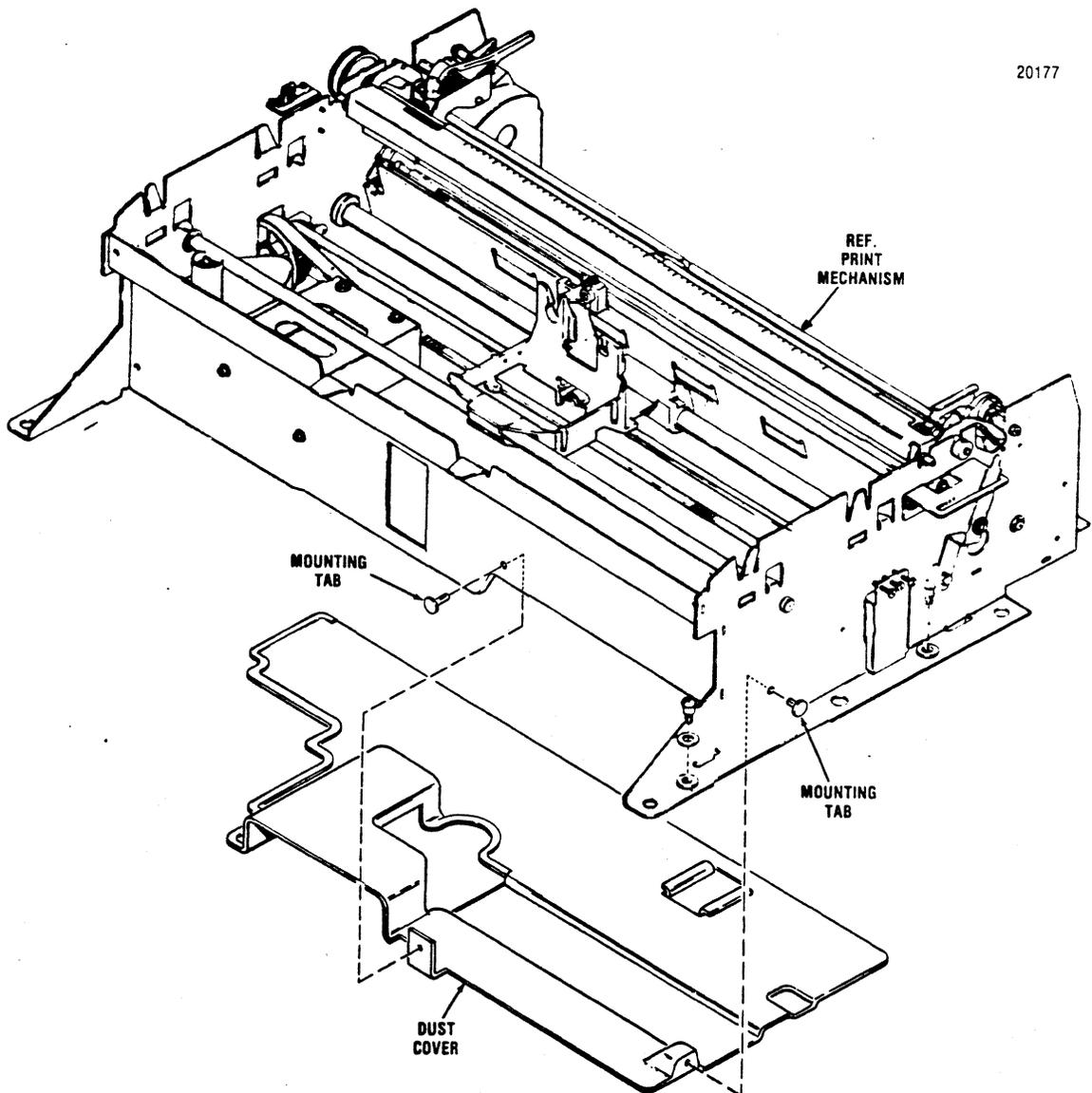


Figure 5-6. REMOVAL/REPLACEMENT DUST COVER

5.12 CARRIAGE DRIVE MOTOR BELT

The carriage drive motor belt, item 1 of Figure 5-7, provides the drive from the carriage drive motor to the carriage drive belt thus moving the carriage. The belt is removed using a flat blade screwdriver. To remove the belt, refer to Figure 5-7 and perform the following steps:

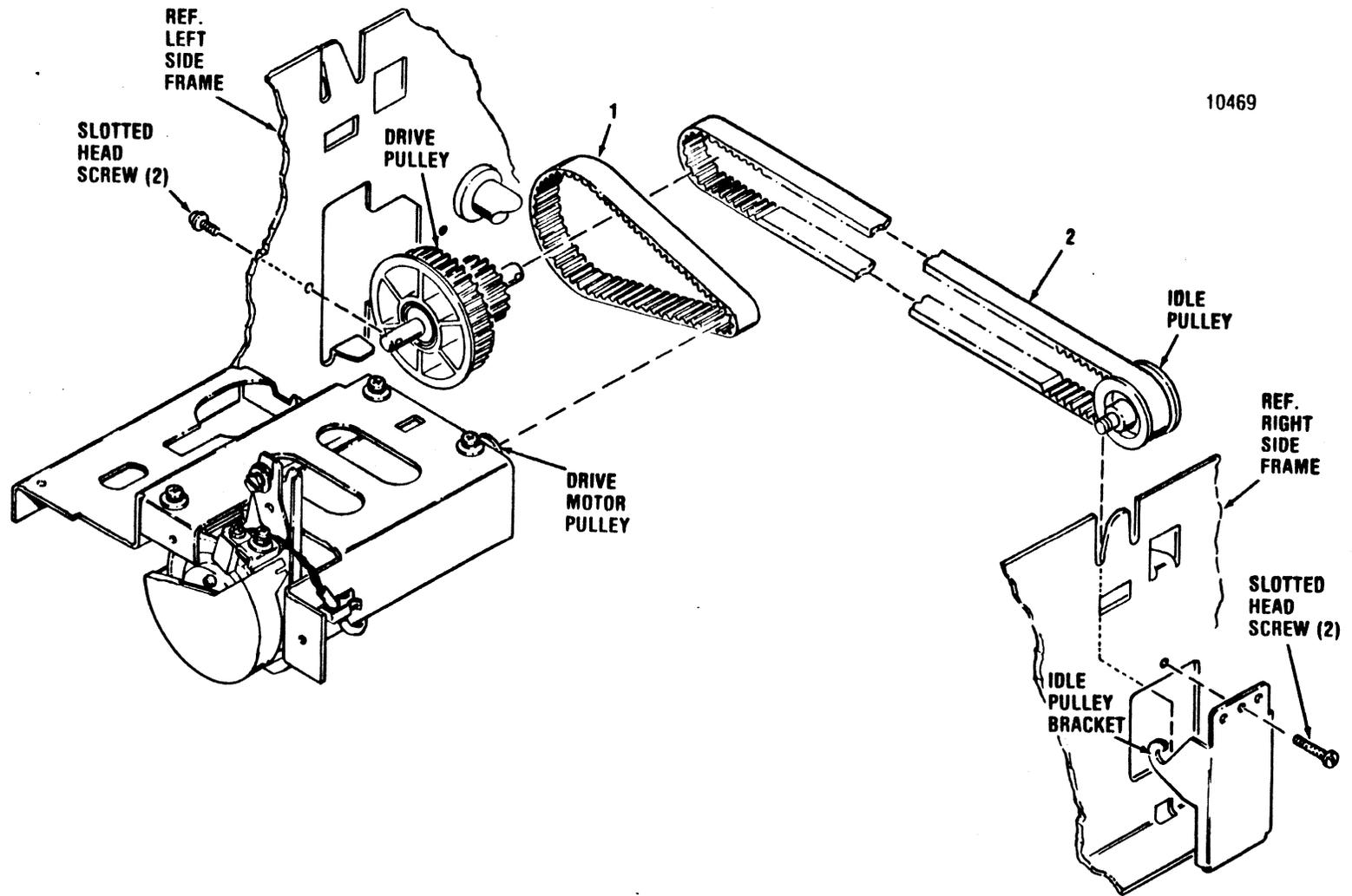
1. Remove or tilt the printer mechanism per paragraph 5.10.
2. Move the carriage assembly to the middle of the printer.
3. Remove the two slotted head screws securing the drive pulley to the left frame.
4. Remove the belt from the drive pulley and drive motor pulley and remove belt from printer.
5. To replace the belt, reverse steps 1 through 5 and refer to Paragraph 4.2, Section 4.

5.13 CARRIAGE DRIVE BELT

The carriage drive belt, item 2 of Figure 5-7, attaches to the carriage and is driven by the carriage drive motor belt. The belt is removed using a flat blade screwdriver. To remove the belt, refer to Figure 5-7 and perform the following steps:

1. Remove or tilt the printer mechanism per paragraph 5.10.
2. Remove the dust cover per paragraph 5.11.
3. Remove the two slotted head screws securing the drive pulley to the left frame.
4. Loosen the two slotted head adjusting screws mounting the idle pulley assembly to the right side frame and remove the idle pulley from the idle pulley bracket.
5. Remove the belt from the idle pulley, carriage and drive pulley and remove belt from printer.
6. To replace the belt, reverse steps 1 through 5 and refer to paragraph 4.3, Section 4 for belt adjustments.

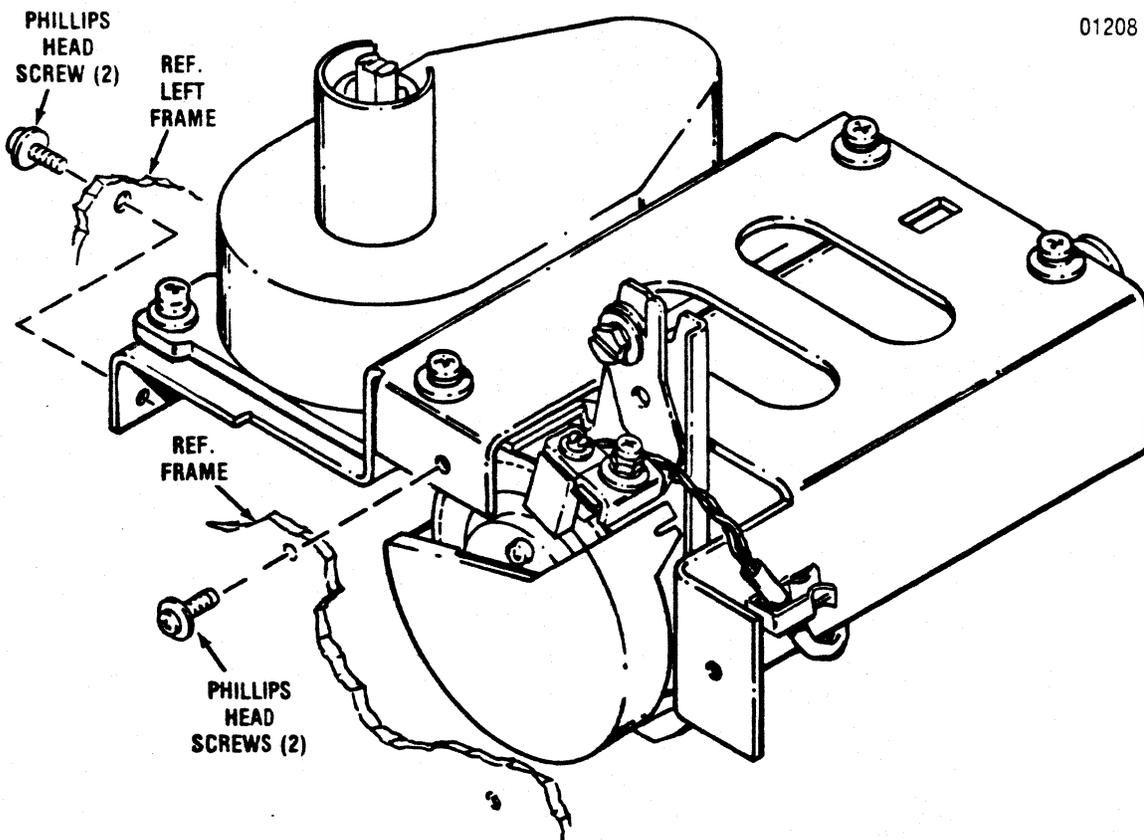
Figure 5-7. REMOVAL/REPLACEMENT, CARRIAGE DRIVE MOTOR BELT CARRIAGE DRIVE BELT



5.14 CARRIAGE DRIVE MOTOR AND RIBBON DRIVE MOTOR MOUNTING BRACKET

The carriage drive motor and ribbon drive motor mounting bracket is removed for ease in removing the two motors. The bracket is removed using a Phillips head screwdriver. To remove the bracket, refer to Figure 5-8 and perform the following steps:

1. Remove the dust cover per paragraph 5.11.
2. Remove the carriage drive motor belt per paragraph 5.12.
3. Remove the four screws attaching the mounting bracket to the frame and remove bracket from printer.
4. To replace the bracket, reverse steps 1 through 3.



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Figure 5-8. REMOVAL/REPLACEMENT, CARRIAGE DRIVE MOTOR AND RIBBON DRIVE MOTOR MOUNTING BRACKET

5.15 OPTIC SENSOR ASSEMBLY

The optic sensor assembly, item 1 of Figure 5-9, is attached to the carriage drive motor and is removed using a flat blade screwdriver. To remove the optic sensor assembly, refer to Figure 5-9 and perform the following steps:

1. Remove the carriage drive motor and ribbon drive motor mounting bracket per paragraph 5.14.
2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the optic cable assembly connector P212 from connector J212 on the Print Controller pcb and from the wire harness mounting clips on the frame.
3. Remove the four carriage drive motor wires from the optic cable assembly connector P212 by lifting the connector tabs and gently removing the wire.
4. Remove the slotted head screw mounting the optic sensor assembly to the carriage drive motor and remove the optic sensor assembly and cable from the printer.
5. To replace the optic sensor assembly, reverse steps 1 through 5, add new tie wraps around wire harness, and refer to Section 4 for the optic sensor assembly adjustments.

NOTE: Ensure the four carriage drive wires are reinstalled in the proper slots on the optic cable assembly connector P212. Refer to Figure A-4, Wiring Diagram, Model 352.

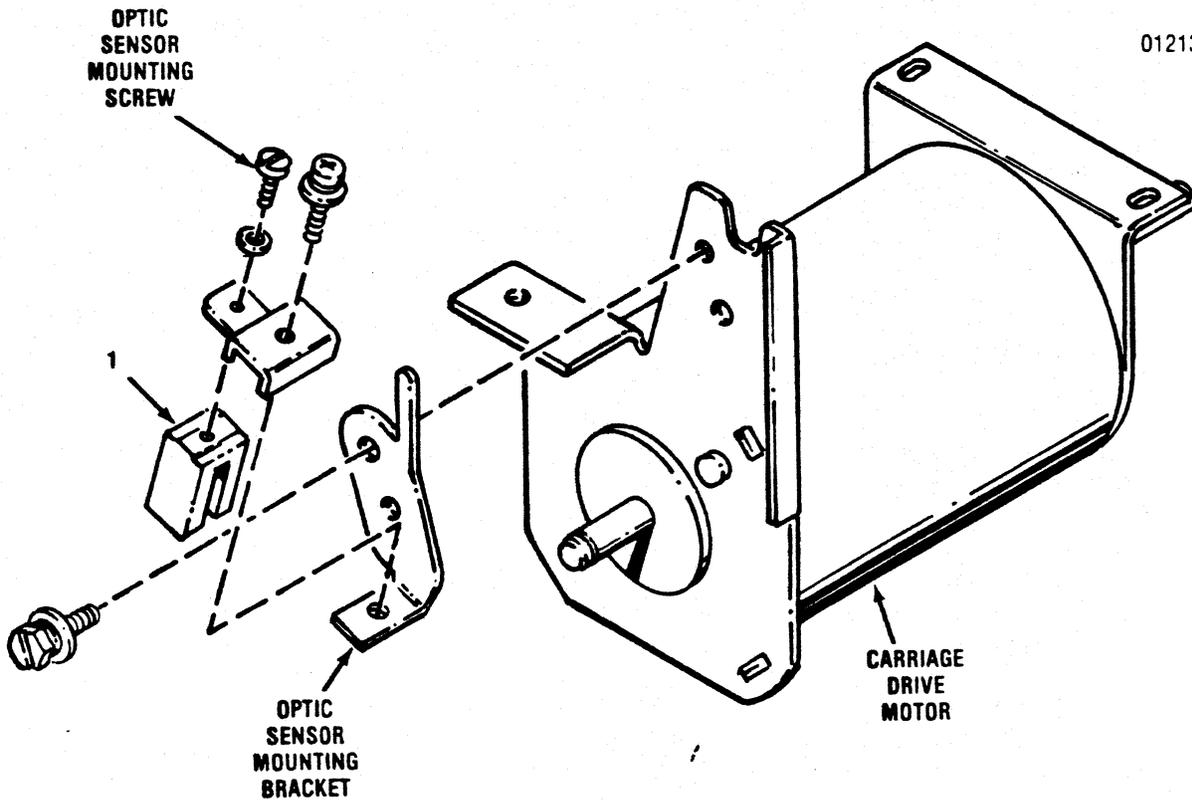


Figure 5-9. REMOVAL/REPLACEMENT, OPTIC SENSOR ASSEMBLY

5.16 CARRIAGE DRIVE MOTOR

The carriage drive motor, item 1 of Figure 5-10, is attached to the carriage drive motor and ribbon drive motor mounting bracket and is removed using a Phillips head screwdriver. To remove the carriage drive motor, refer to Figure 5-10 and perform the following steps:

1. Remove the carriage drive motor and ribbon drive motor mounting bracket per paragraph 5.14.
2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the carriage drive motor cable assembly from the wire harness mounting clips on the frame.
3. Remove the four carriage drive motor wires from the optic sensor cable assembly connector P212 by lifting the connector tabs and gently removing the wires.
4. Remove the three screw attaching the motor to the mounting bracket and remove the motor and cable assembly from the printer.

5. To replace the motor, reverse steps 1 through 4.

NOTE: Ensure the four carriage drive wires are reinstalled in the proper slots on the optic sensor cable assembly connector P212. Refer to Figure A-4, Wiring Diagram.

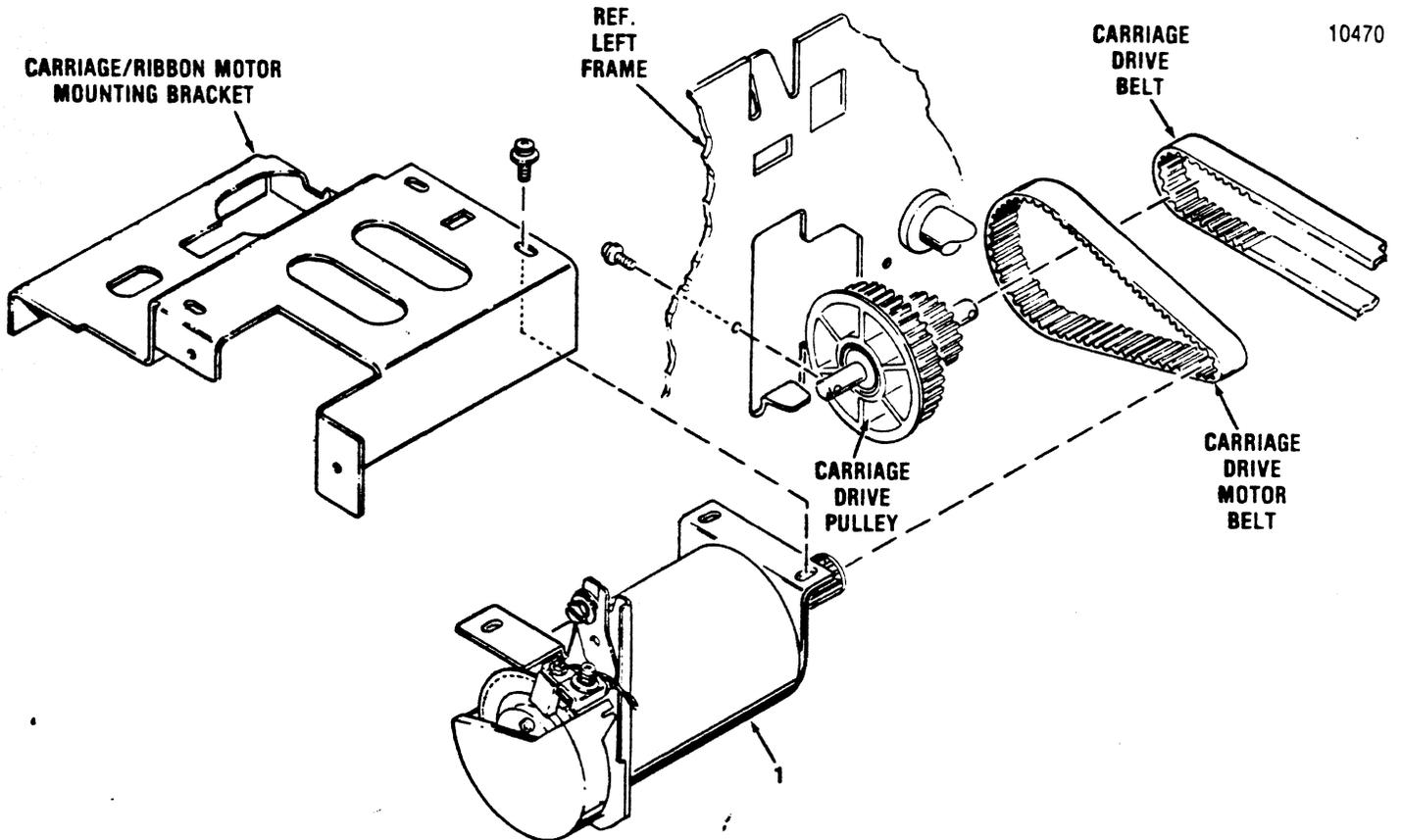


Figure 5-10. REMOVAL/REPLACEMENT, CARRAIGE DRIVE MOTOR

5.17 ENCODER/TIMING DISC

The encoder/timing disc, item 1 of Figure 5-11, is located on the end of the carriage drive motor shaft and is removed using a Phillips head screwdriver. To remove the timing disc, refer to Figure 5-11 and perform the following steps:

1. Remove the carriage drive motor per paragraph 5.16.
2. Unsnap the protective cap from the end of the carriage drive motor.
3. Remove the optic sensor assembly per paragraph 5.15.
4. Remove the snap ring securing the timing disc to the end of the drive motor shaft.

5. Remove the three screws mounting the two plastic discs on the drive motor shaft.
6. Remove the front plastic mounting disc and the encoder/timing disc from the end of the drive motor shaft.
7. To replace the disc, reverse steps 1 through 5 and refer to Paragraph 4.7, Section 4 for the encoder/timing disc adjustments.

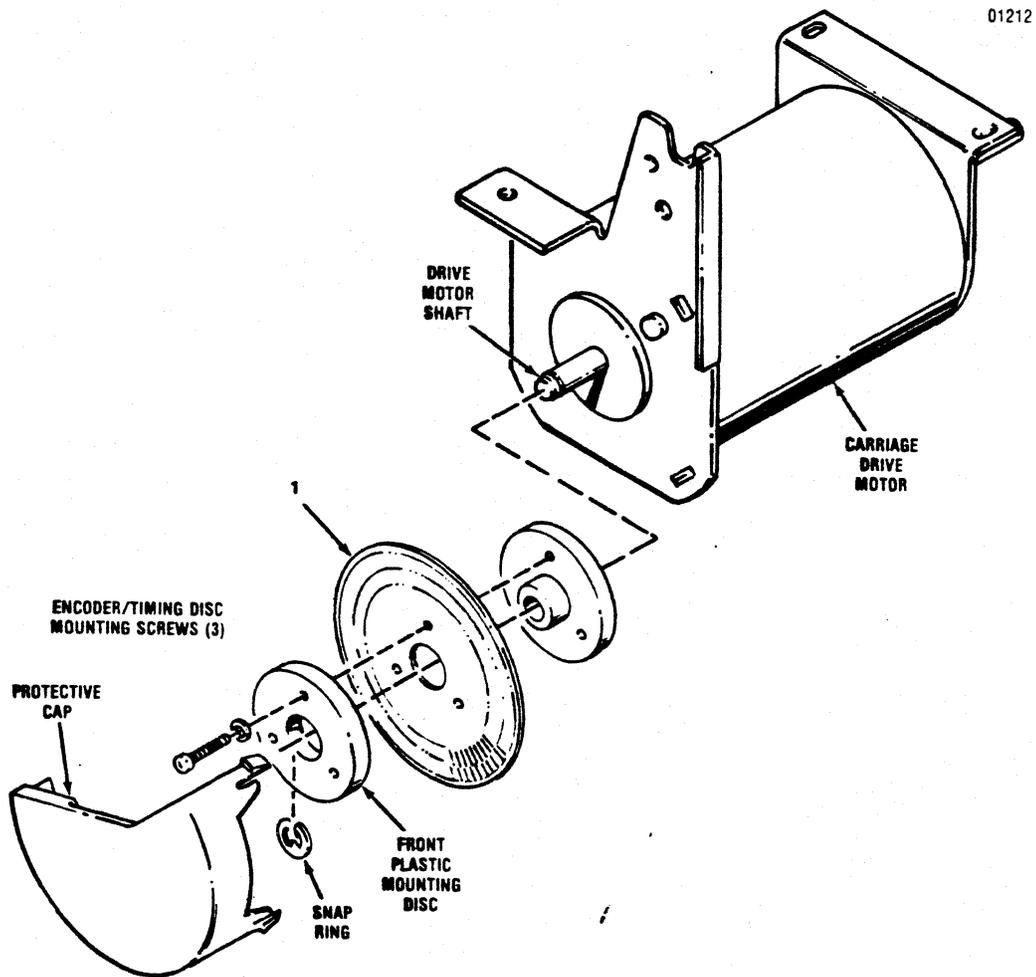


Figure 5-11. REMOVAL/REPLACEMENT, ENCODER/TIMING DISC

5.18 RIBBON DRIVE MOTOR

The ribbon drive motor, item 1 of Figure 5-12, is removed using a Phillips head screwdriver and a flat blade screwdriver. To remove the motor, refer to Figure 5-12 and perform the following steps:

1. Remove the carriage drive motor and ribbon drive motor mounting bracket per paragraph 5.14.
2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the ribbon drive motor cable connector P210 from connector J210 on the Print Controller pcb and from the wire harness mounting clips on the frame.
3. Remove the two Phillips head screw mounting the ribbon drive motor cover and remove the cover from the printer.
4. Remove the two slotted head screws mounting the ribbon drive motor and remove the motor and cable from the printer.
5. To replace the ribbon drive motor, reverse steps 1 through 4.

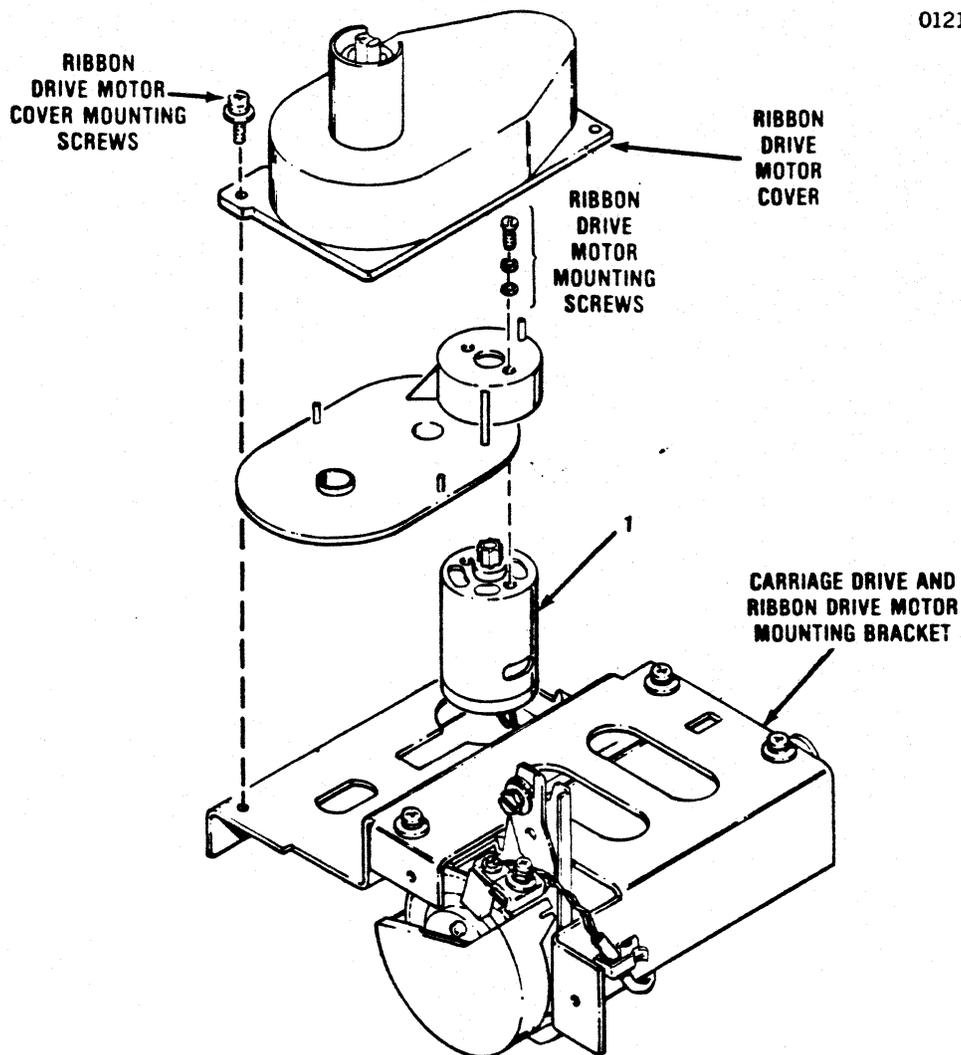


Figure 5-12. REMOVAL/REPLACEMENT, RIBBON DRIVE MOTOR

5.19 COVER INTERLOCK SWITCH

The cover interlock switch, item 1 of Figure 5-13, is attached to the left frame and is removed using a Phillips head screwdriver. To remove the cover interlock switch, refer to Figure 5-13 and perform the following steps:

1. Remove or tilt the printer mechanism per paragraph 5.10.
2. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the cover interlock switch cable connector P209 from connector J209 on the Print Controller pcb and from the wire harness mounting clips.
3. Remove the rubber grommet from the left frame which the cover interlock switch cable assembly is routed through.

4. Remove the Phillips head screw mounting the cable clamp to the left frame and remove the clamp from the printer.
5. Remove the two Phillips head screws mounting the cover interlock switch to the top of the left frame and remove the switch and cable assembly from the printer.
6. To replace the switch, reverse steps 1 through 5.

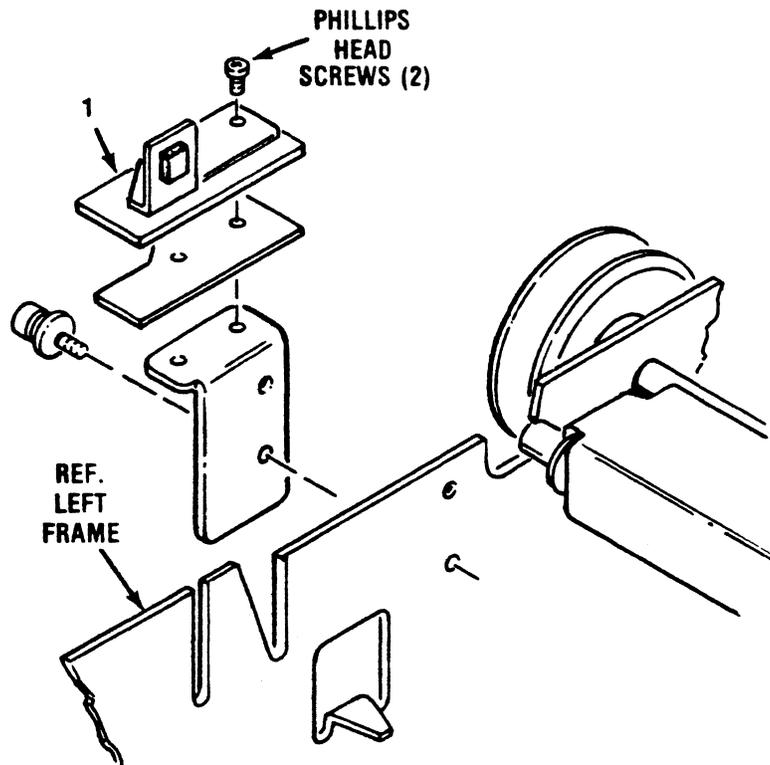


Figure 5-13. REMOVAL/REPLACEMENT, COVER INTERLOCK SWITCH

5.20 PAPER DRIVE BELT

The paper drive belt, item 1 of Figure 5-14, provides the drive from the paper feed motor to the paper feed mechanism. The belt is removed using a snap ring remover and Phillips head screwdriver. To remove the belt, refer to Figure 5-14 and perform the following steps:

1. Remove the cover from the printer per paragraph 5.4.
2. Using a snap ring remover, remove the snap ring holding the paper drive pulley to the tractor drive shaft.
3. Gently pull the paper drive pulley off the tractor drive shaft.

4. Loosen the screw mounting the tensioner bracket to the left frame.
5. Remove the paper drive belt from the paper feed motor pulley and paper feed mechanism pulley.
6. To replace the belt, reverse steps 1 through 5 and refer to Section 4 for the paper drive belt adjustments.

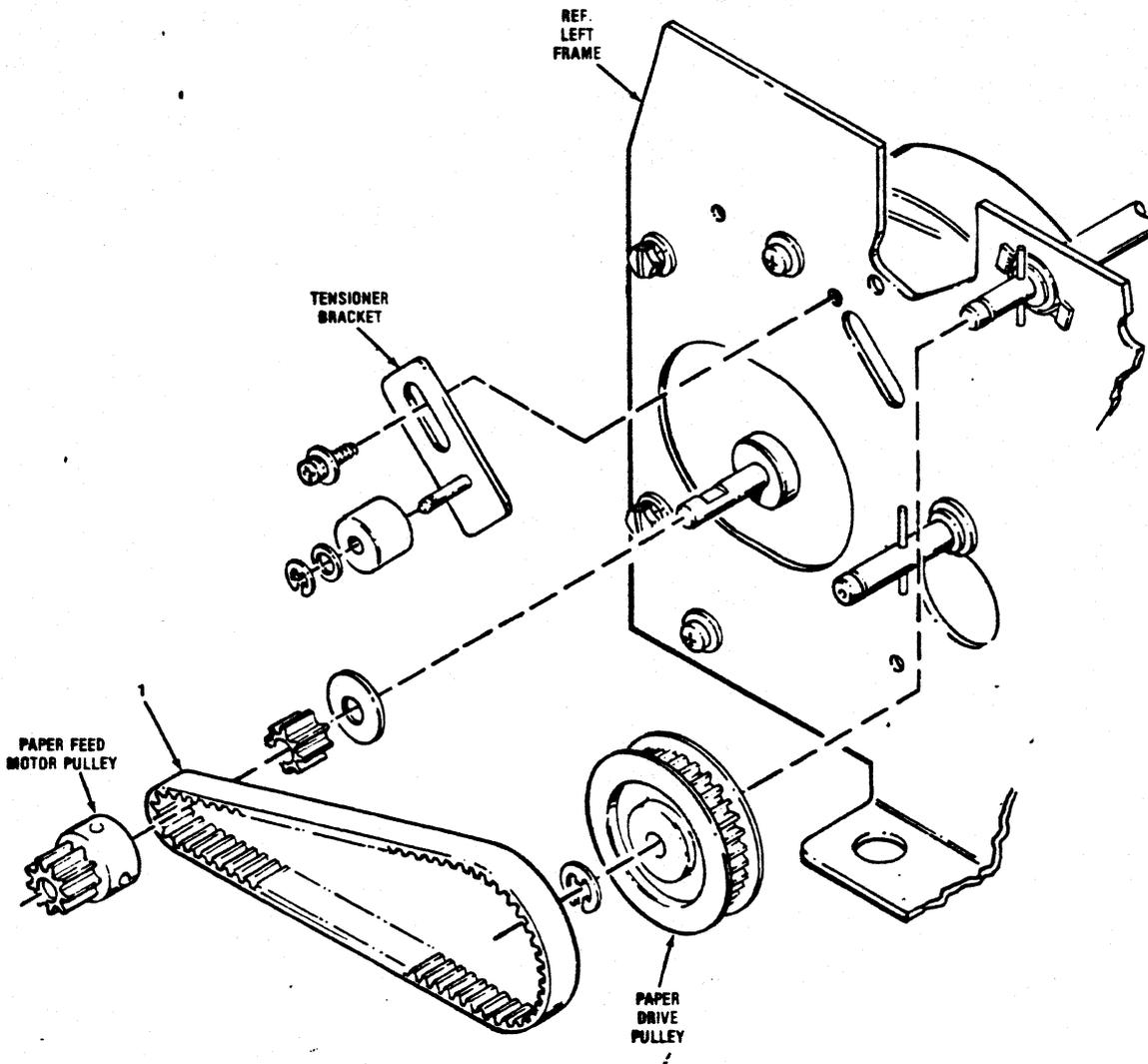


Figure 5-14. REMOVAL/REPLACEMENT, PAPER DRIVE BELT

5.21 PAPER DRIVE MOTOR

The paper drive motor, item 1 of Figure 5-15, is attached to the inside of the left frame and is removed using a Phillips head screwdriver and a flat blade screwdriver. To remove the motor, refer to Figure 5-15 and perform the following steps:

1. Remove or tilt printer mechanism per paragraph 5.10.

2. Remove the paper drive belt per paragraph 5.20.
3. Remove the spring attached to the paper feed motor shroud.

NOTE: Step 4 is performed from the rear of the mechanism.

4. Remove the snap ring from the left inside of the tractor guide bar and slide the guide bar to the left. Retain the collar on the right end of the tractor guide bar.
5. Remove the three Phillips head screws on the outside of the frame mounting the motor shroud and remove the shroud from the printer.
6. Cut the two tie wraps holding the wire harness on the underside of the print mechanism and remove the paper drive motor cable connector P211 from connector J211 on the Print Controller pcb and the wire harness mounting clips on the frame.
7. Remove the three slotted head screws on the outside of the frame mounting the paper drive motor and remove the motor and cable assembly from the printer.
8. To replace the paper drive motor, reverse steps 1 through 7.

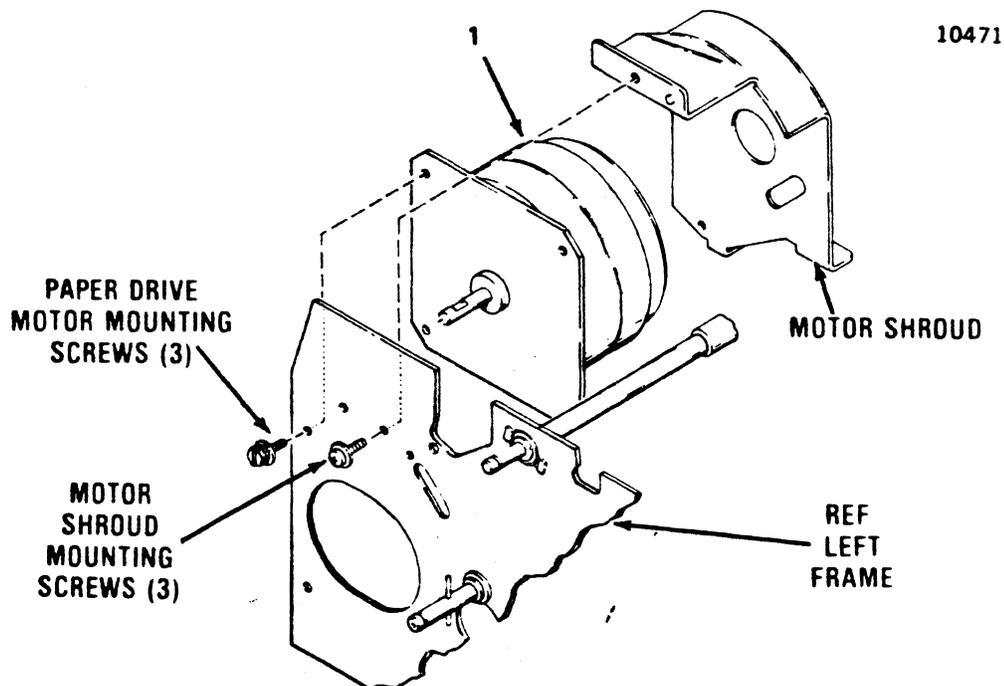


Figure 5-15. REMOVAL/REPLACEMENT, PAPER DRIVE MOTOR

5.22 TRACTOR ASSEMBLIES, LEFT/RIGHT

The left and right tractor assemblies, items 1 and 2 of Figure 5-16, are located on the tractor drive shaft and tractor guide bar. The tractors are removed using a snap ring tool. To remove the tractors, refer to Figure 5-16 and perform the following steps:

1. Remove the print mechanism per paragraph 5.10.

NOTE: The following steps are performed from the rear of the printer.

2. Remove the four snap rings securing the tractor guide bar and slide the bar to the left and through the tractor assemblies.
3. Remove the two snap rings from the ends of the tractor drive shaft.
4. Push the two bearings securing the tractor drive shaft to the frame outward and drop the drive shaft down into the larger holes in the frame.
5. Push the tractor drive shaft to the right, through the tractor assemblies and remove the tractors from the printer.
6. To replace the tractor assemblies, reverse steps 1 through 6.

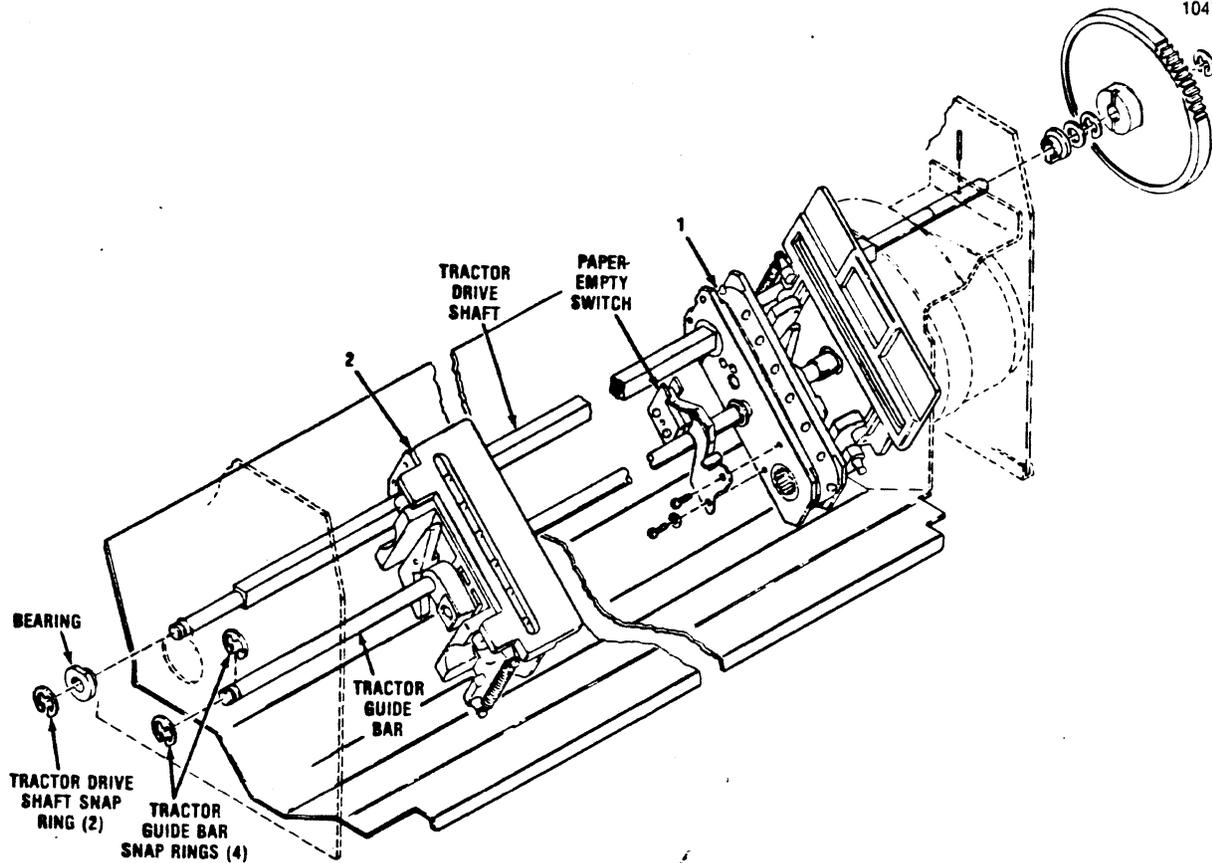


Figure 5-16. REMOVAL/REPLACEMENT, TRACTOR ASSEMBLIES

5.23 PAPER EMPTY SWITCH

The paper empty switch, item 1 of Figure 5-17, is located on the right print feed tractor and is removed using a Phillips head screwdriver. To remove the paper empty switch, refer to Figure 5-17 and perform the following steps:

NOTE: This procedure is performed from the rear of the printer.

1. Remove the covers from the printer per paragraph 5.4.
2. Tilt the mechanism upward as described in paragraph 5.10.
3. Disconnect the two pin connector P208 on the paper empty switch cable from the paper empty switch connector J208 on the Print Controller pcb.
4. Remove the two screws mounting the paper empty switch from the right tractor assembly and remove the tractor and cable assembly from the printer.

5. To replace the switch, reverse steps 1 through 4 and refer to paragraph 4.6, Section 4 for paper empty switch adjustments.

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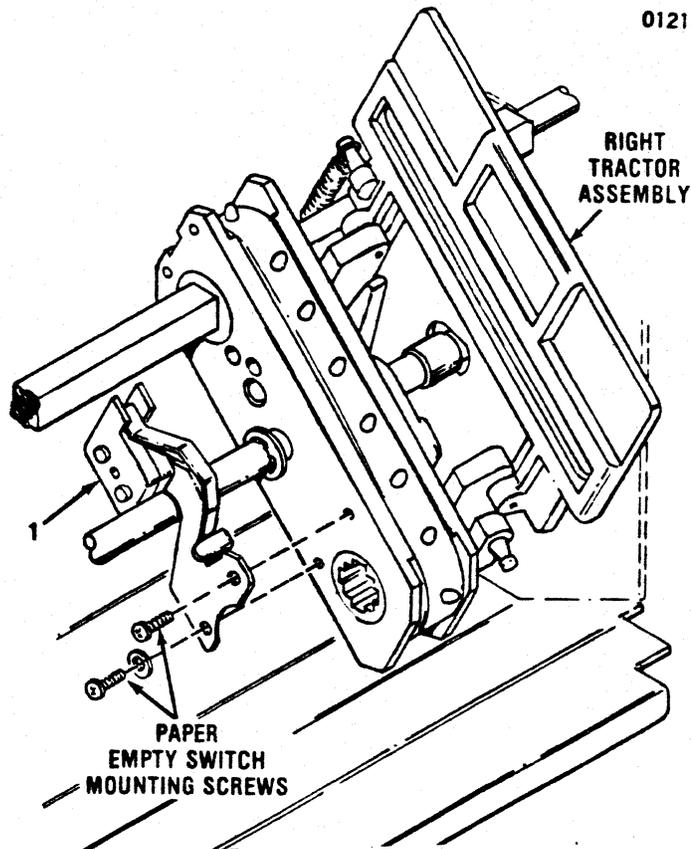


Figure 5-17. REMOVAL/REPLACEMENT, PAPER EMPTY SWITCH

5.24 POWER SUPPLY ASSEMBLY

The power supply assembly, item 1A or 1B of Figure 5-18, is mounted to the printer base and is removed using a Phillips head screwdriver. To remove the power supply, refer to Figure 5-18 and perform the following steps:

1. Remove or tilt the printer mechanism per paragraph 5.10.
2. Disconnect the two line filter cable assembly connectors P303 and P507 from the format controller pcb and print controller pcb.
3. Remove the two Phillips head screws mounting the front of the power supply to the printer base.
4. Disconnect the three connectors from the bottom of the line filter assembly which is attached to the left side of the power supply.
5. Pull the power supply forward, off the two mounting tabs, and remove the power supply assembly from the printer.

6. To replace the power supply assembly, reverse steps 1 through 5.

5.25 PRINT CONTROLLER PCB

The Print Controller pcb (part # 64000920-4001), item 3 of Figure 5-18, is mounted to the printer base and no tools are required to remove the board. To remove the Print Controller pcb, refer to Figure 5-18 and perform the following steps:

1. Remove or tilt the printer mechanism per paragraph 5.10.
2. Remove the format/controller cable from the Print Controller pcb.
3. Disconnect the power supply cable from the Print Controller pcb.
4. Lift up on the three quick release fasteners securing the pcb to the printer base.
5. Pull the pcb forward and lift the Print Controller pcb up and out of the printer.
6. To replace the Print Controller pcb, reverse steps 1 through 5 and refer to paragraph 4.8, Section 4 for the adjustments required on the board.

5.26 FORMAT CONTROLLER PCB (ISI INTERFACE PCB)

The Format Controller pcb (part # 1200302), item 4 of Figure 5-18, is mounted to the printer base and no tools are required to remove the board. To remove the Format Controller pcb, refer to Figure 5-18 and perform the following steps:

1. Remove the print mechanism per paragraph 5.10.
2. Remove the coax cable from the input connector.
3. Remove the format/controller cable from the Format Controller pcb.
4. Disconnect the power supply cable from the Format Controller pcb.
5. Lift up on the three quick release fasteners securing the pcb to the printer base.
6. Pull the Format Controller pcb forward and lift the pcb up and out of the printer.

7. To replace the Format Controller pcb, reverse steps 1 through 6.

5.27 PICO FUSE

The pico fuses, item 1 of Figure 5-19, are located on the Print Controller pcb and are removed using needle nose pliers. To remove the pico fuses, refer to Figure 5-19 and perform the following steps:

1. Remove the Print Controller pcb per paragraph 5.26.
2. NOTE: Refer to Figure 5-19 for the locations (F1 through F12) of the pico fuses and to Appendix D for the pico fuse color coding information.
3. Using needle nose pliers, remove the defective fuse from the Print Controller pcb.
4. Install a new pico fuse into the Print Controller pcb.

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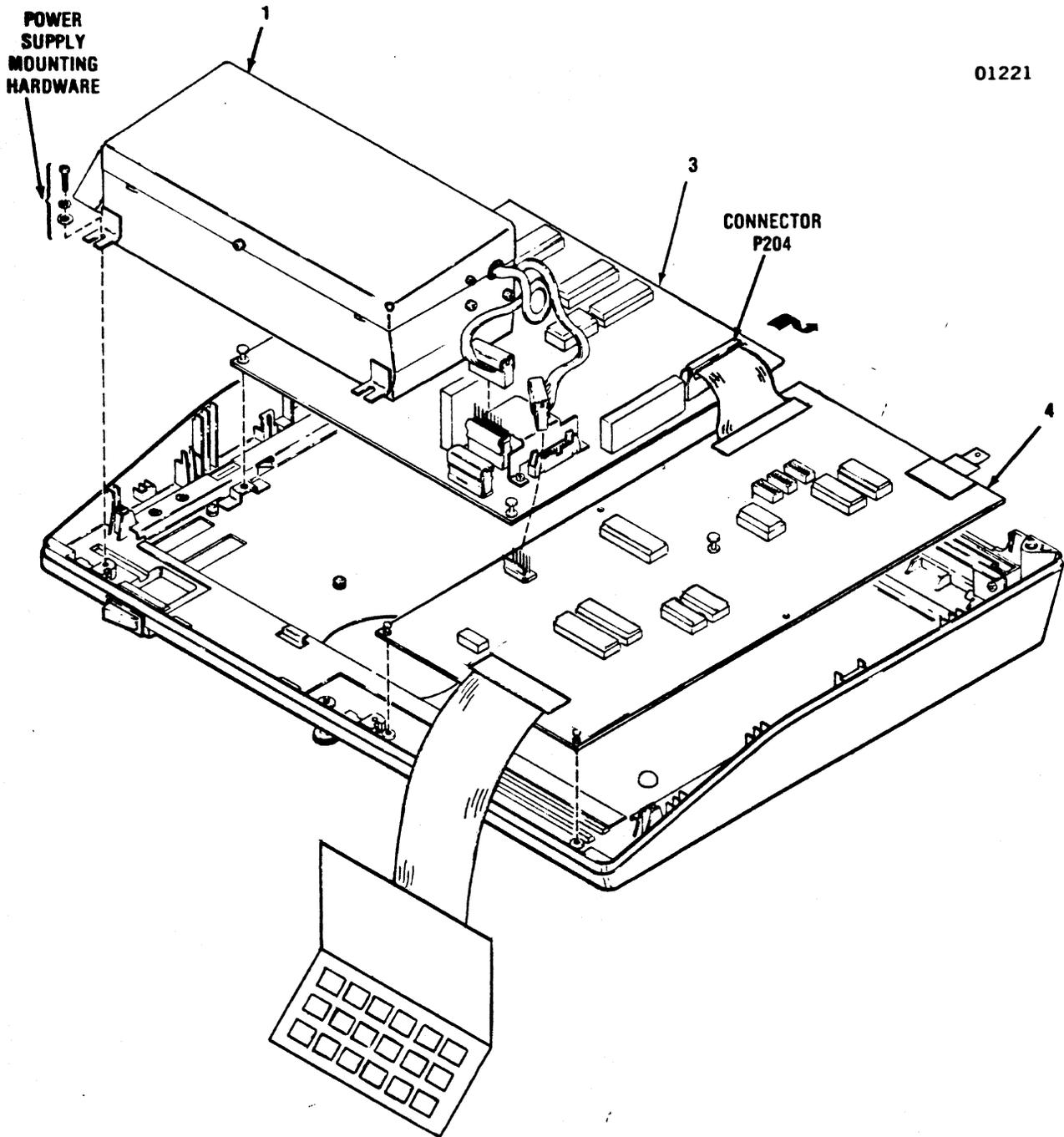


Figure 5-18. REMOVAL/REPLACEMENT POWER SUPPLY ASSEMBLY, FORMAT/CONTROLLER CABLE PRINT CONTROLLER PCB AND FORMAT CONTROLLER PCB

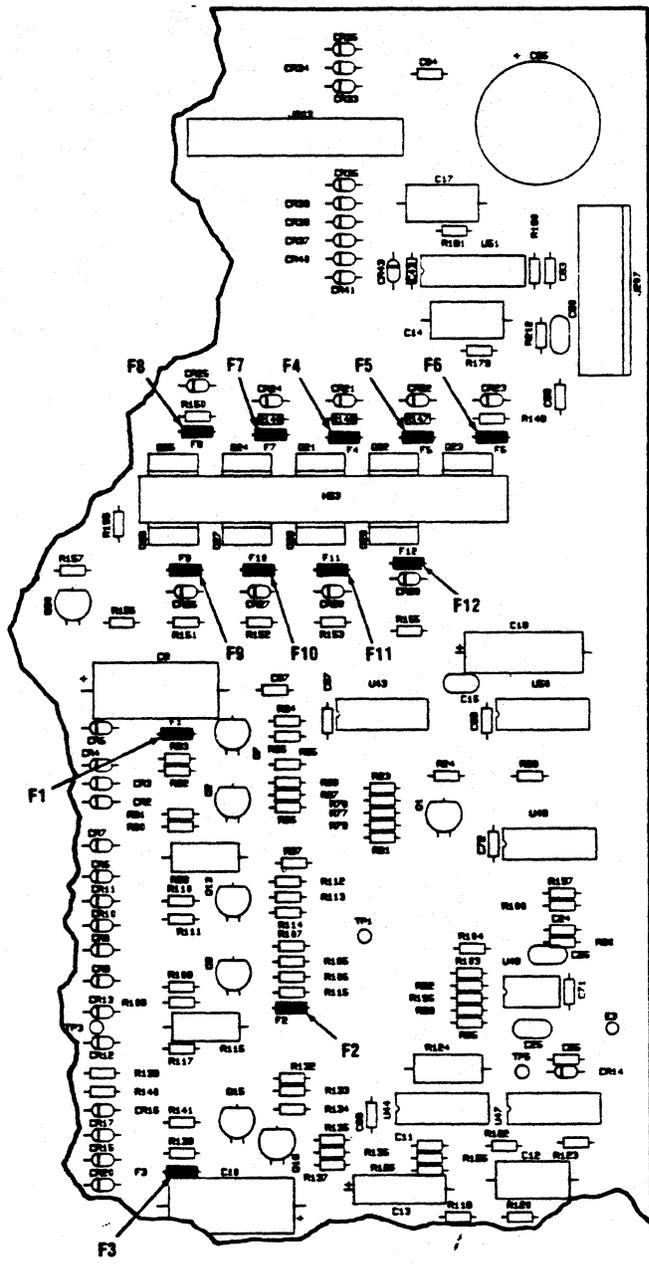


Figure 5-19. REMOVAL/REPLACEMENT PICO FUSE

5.28 ON/OFF SWITCH

The ON/OFF switch item 1 of Figure 5-20 is located on the right front of the printer base and no tools are required to remove the switch. To remove the ON/OFF switch, refer to Figure 5-20 and perform the following steps:

1. Unplug the printer.
2. Remove or tilt the printer mechanism per paragraph 5.10.

3. Remove the four push on connectors from the ON/OFF switch.
4. Push the switch forward through the opening in the printer base and remove the switch from the printer.
5. To replace the switch, reverse steps 1 through 4.

NOTE: Ensure the wires are properly connected when replacing the switch. Refer to Figure A-4, Wiring Diagram, Model 487.

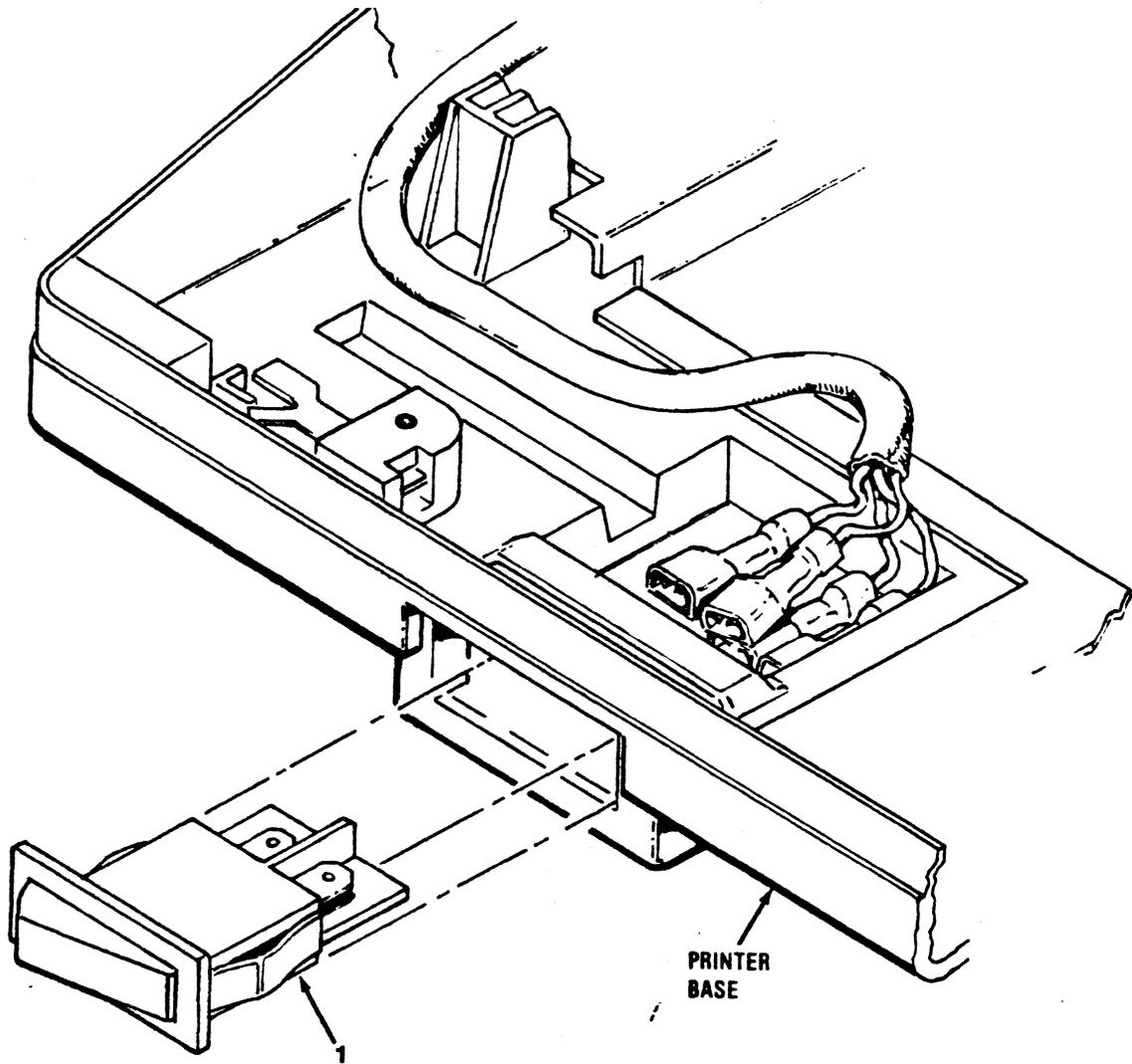


Figure 5-20. REMOVAL/REPLACEMENT, ON/OFF SWITCH

5.29 MAIN FUSE

The main fuse, item 1 of Figure 5-21, is located in the rear of the printer base and is removed using a slotted head screwdriver. To remove the fuse, refer to Figure 5-21 and perform the following steps:

1. Remove the power cord.
2. Using a slotted head screwdriver, turn the fuse holder one quarter of a full turn counterclockwise.
3. Remove the defective fuse from the fuse holder.
4. Install the new fuse into the fuse holder and replace the fuse holder into the printer base.

NOTE: Ensure the same type rated fuse is installed when replacing the fuse, i.e. 120V ac - 4 amp fuse/220V ac -2 amp fuse. Refer to Figure 5-21.>

5.30 POWER CORD

The eight foot long power cord, item 2 of Figure 5-21, is terminated on one end with a 3-prong grounded plug and terminated on the other end with a 3-prong receptacle. The cord is simply removed by removing the plug end from the external power source and the receptacle end from the printer. Refer to Figure 5-21.

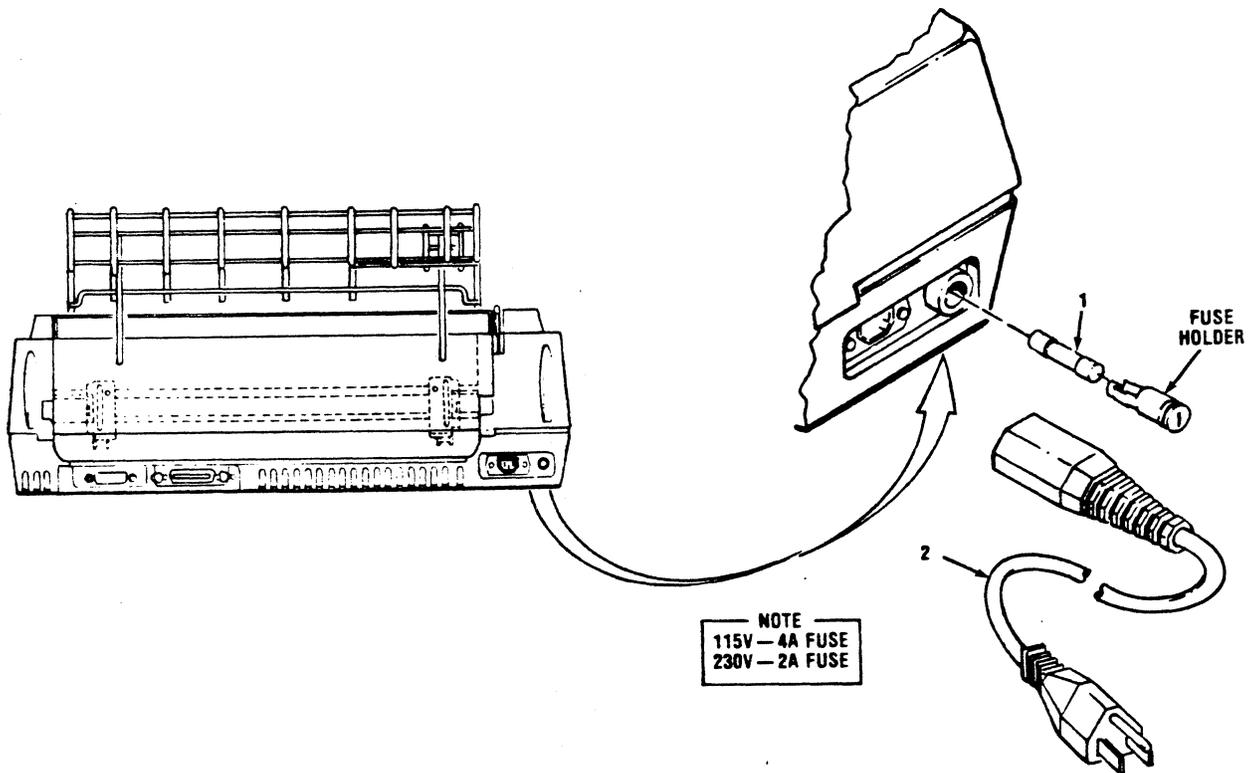


Figure 5-21. REMOVAL/REPLACEMENT, MAIN FUSE AND POWER CORD

5.31 COVER LATCH SPRINGS

Four small springs, item 1 of Figure 5-22, are located on the inside of the body cover. The springs help secure the top and rear covers of the printer to the body cover. To remove any of the four springs, refer to Figure 5-22 and perform the following steps:

1. Remove the body cover per paragraph 5.4.
2. Turn the cover over to expose the inside, then stretch the spring enough to free one end of the spring from its catch.
3. Slide the other end of the spring off the other catch, and remove.
4. To replace spring, attach one end of spring to cover catch, stretch spring, and slide other end of spring over the other catch.
5. Replace body cover by reversing steps 1-6 of paragraph 5.4.

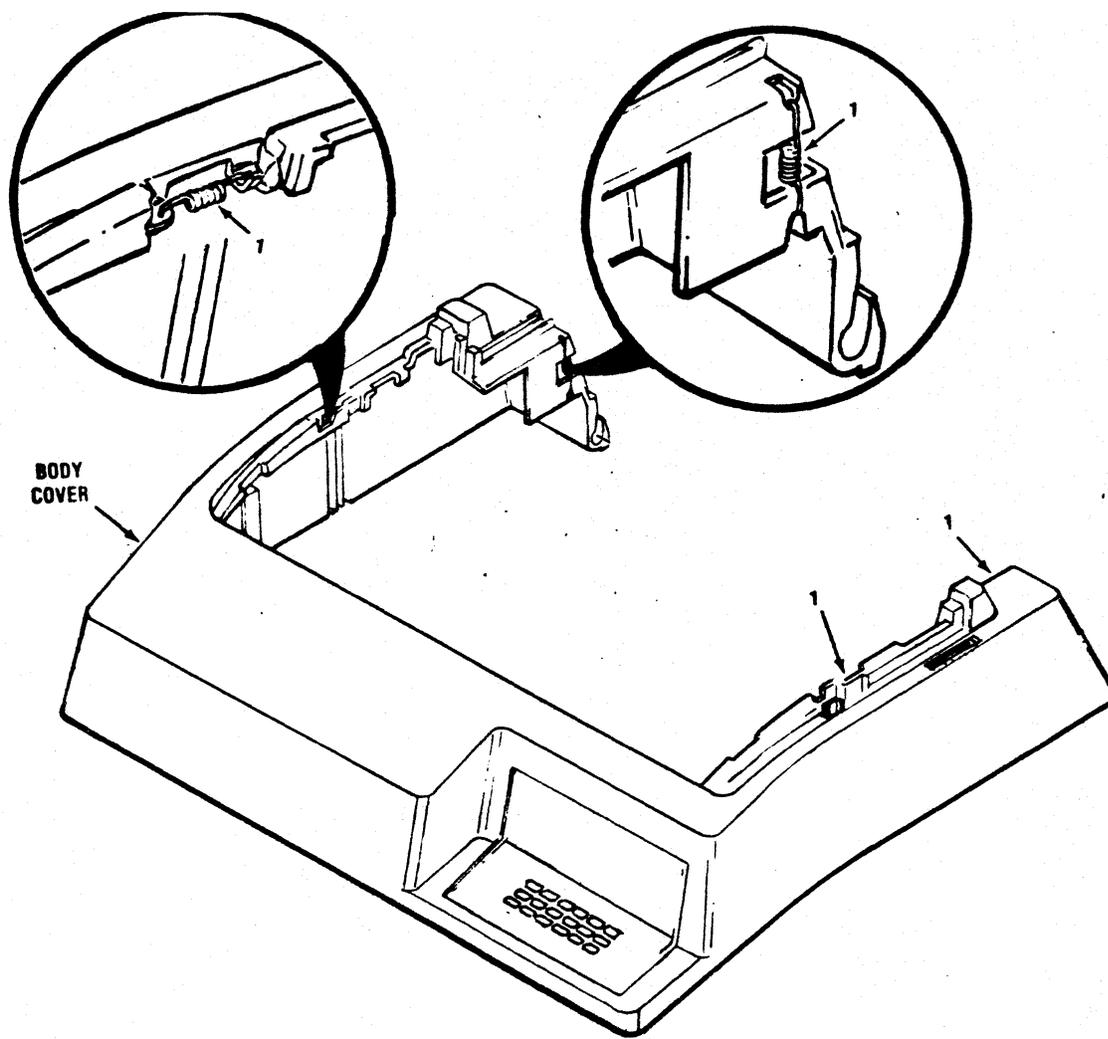


Figure 5-22 Cover Latch Springs

5.32 CONVERTING THE POWER SUPPLY TO 220 VAC

Follow the instructions below to convert the ISI 487 power supply:

WARNING

The following procedure should **ONLY** be performed by qualified service personnel. Any other persons attempting this procedure risk personal injury through electrical shock and/or complete failure of the printer mechanism. **DO NOT** attempt this procedure without turning the printer OFF and unplugging the power cord from the power source.

1. Unplug the ISI 487.
2. Remove the Body Cover per paragraph 5.4.
3. Tilt the printer mechanism per paragraph 5.10.2
4. Remove the four screws securing the top of the power supply (see Section 5.25).

5. Lift off the cover of the power supply, being careful not to twist or pull any wires. Flip the top over to view.
6. Identify connector J4 and pin #1 on J4.
7. Remove the plug from connector J4. Remove the jumper connecting pins #1, #3, and #5. See Figure 5-32 for pin locations.
8. Move the jumper on pin #2 to pin #3. Replace the plug on connector J4. See Figure 5-33 for new pin locations.
9. Replace the rubber grommets which serve to retain the wires. Make sure they are all attached.
10. Replace the 4 amp fuse with a 2 amp fast blo fuse.
11. Label the printer for 220v. on top of the power supply and on the outside of the printer body near the power source.
12. **Modify the plug end on the power cord as required.**
13. **Reverse removal procedures 1-5.**

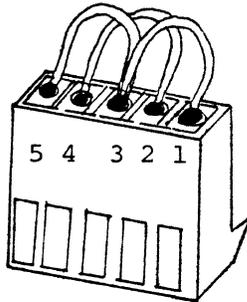


Figure 5-32 J4 Plug at 90-130 VAC

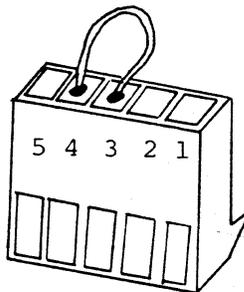


Figure 5-33 J4 Plug at 185 - 256 VAC

5.33 RECOMMENDED SPARE PARTS LISTING

The following table lists the recommended spares according to figure and index number and provides a description of the recommended spare and its part number. An example is shown below:

| | | |
|---------------------------|----------------------------------|-------------------------------|
| 5-1-1 | 63180330-5001 | Part Rack Outlet Assembly |
| Figure and Item Number | Recommended Spare Part Number | Recommended Spare Description |

Table 5-2. RECOMMENDED SPARE PARTS LISTING

| FIGURE AND ITEM NUMBER | PART NUMBER | DESCRIPTION |
|---------------------------|---------------|----------------------------|
| 5-1-1 | 63180330-5001 | Paper Rack Outlet Assembly |
| 5-1-2 | 63180331-2001 | Paper Rack Inlet |
| 5-1-3 | u20241001 | Cover Interlock Magnet |
| 5-2-1 | 6400520-6001 | Ribbon Cassette |
| 5-2-2 | 63180315-5001 | Print Head Assembly |
| 5-3-1 | 63180285-4001 | Head Flex Cable |
| 5-4-1 | 63180254-4001 | Head Adapter PCB |
| 5-7-1 | u20139001 | Carriage Drive Motor Belt |
| 5-7-2 | u20143001 | Carriage Drive Belt |
| 5-9-1 | 39099011-1001 | Optic Sensor Assembly |
| 5-10-1 | u20187001 | Carriage Drive Motor |
| 5-11-1 | u20157000 | Encoder/Timing Disc |
| 5-12-1 | u20168001 | Ribbon Drive Motor |
| 5-13-1 | u20242001 | Cover Interlock Switch |
| 5-14-1 | 531335001 | Paper Drive Belt |
| 5-15-1 | u20070001 | Paper Drive Motor |
| 5-16-1 | u20073001 | Tractor, Left |
| 5-16-2 | u20074001 | Tractor, Right |

| | | |
|---------|---------------|--|
| 5-17-1 | u20186001 | Paper Empty Switch |
| 5-18-1A | 64000399-5002 | Power Supply Assy. 50 Hz - 220V ac |
| 5-18-1B | 64000399-5001 | Power Supply Assy. 60 Hz - 120V ac. |
| 5-18-3 | 64000920-4001 | Print Controller PCB |
| 5-18-4 | 1200302 | Format Controller PCB |
| 5-19-1 | 39030030-1006 | Pico Fuse - 3 Amp |
| 5-20-1 | 39098122-1001 | ON/OFF Switch |
| 5-21-1A | 39030033-1027 | Main Fuse 4 Amp (115V) |
| 5-21-1B | 36100736-1007 | Main Fuse 2 Amp (230V) |
| 5-21-2A | 39620021-1003 | Power Cord 115V |
| 5-21-2B | 39620021-1004 | Power Cord 23 |
| 5-22-1 | 519927001 | Cover Latch Springs |

Chapter 6

ILLUSTRATED PARTS BREAKDOWN

6.1 INTRODUCTION

This chapter contains illustrated parts breakdowns to the assembly level (when applicable) of the mechanical assemblies in the ISI Model 487 printer. Each breakdown includes an illustration that details the mechanical assemblies and/or subassemblies down to the assembly level or piece part, and an associated list of materials, which is keyed to the illustration. Each list of materials consists of four columns: ITEM, PART NUMBER, DESCRIPTION, and QUANTITY. The function of each column is described in the paragraphs below.

6.1.1 ITEM

This column contains an identification number for each assembly or part illustrated in an associated figure. The index numbers prefixed with an A (i.e., A1, A2, A3, etc.) represent attaching hardware.

6.1.2 PART NUMBER

This column contains part numbers used to identify the parts. The last four digits (dash number) of each part number designates the type of part.

6.1.3 DESCRIPTION

This column provides a brief description of the indexed part.

6.1.4 QUANTITY

This column indicates the number of parts required to build up the assembly or subassembly.

LIST OF MATERIALS
COVER AND PAPER RACK ASSEMBLIES
(Figure 2-1)

| Item | Part Number | Description | Quantity |
|------------------------------|---------------|---------------------------------|----------|
| 1 | U20008001 | Body Cover | 1 |
| 2 | U20181000 | Mechanism Support Rod | 1 |
| 3 | U20011001 | Top Cover | 1 |
| 4 | U20241001 | Interlock Magnet | 1 |
| 5A | U21023001 | Clear Cover (w/magnet) | 1 |
| 5B | 64002081-5001 | Demand Document Window (option) | 1 |
| 6 | U20014001 | Rear Cover | 1 |
| 7 | 63180330-5001 | Paper Rack Outlet Assembly | 1 |
| 8 | 63180331-2001 | Paper Rack Inlet | 1 |
| 9 | 64000128-5001 | Bezel Assembly | 1 |
| 10 | 36200040-2002 | Clamp | 1 |
| 11 | 36200040-2003 | Clamp | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | U20018001 | Screw | 2 |
| A2 | 34000119-2001 | Thumb nut - Slotted | 2 |

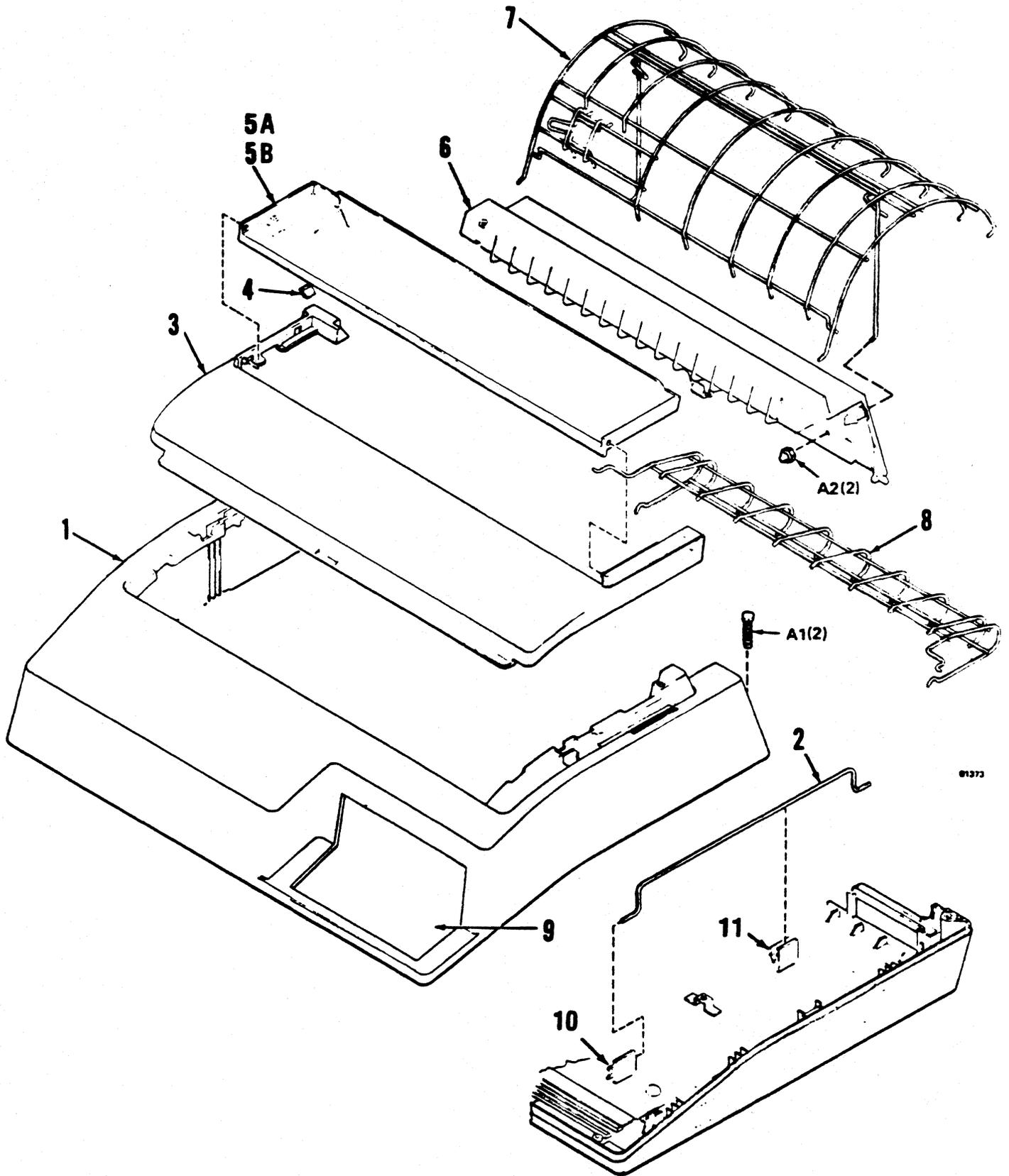


Figure 2-1. COVER AND PAPER RACK ASSEMBLIES

LIST OF MATERIALS
COVER INTERLOCK ASSEMBLY
(Figure 2-2)

| Item | Part Number | Description | Quantity |
|------------------------------|-------------|---------------------------------|----------|
| 1 | U20242001 | Interlock Switch Unit (w/cable) | 1 |
| 2 | U20246000 | Insulating Sheet | 1 |
| 3 | U20247001 | Switch Holder | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 215081001 | Screw | 2 |
| A2 | 533591001 | Screw | 2 |

01219B

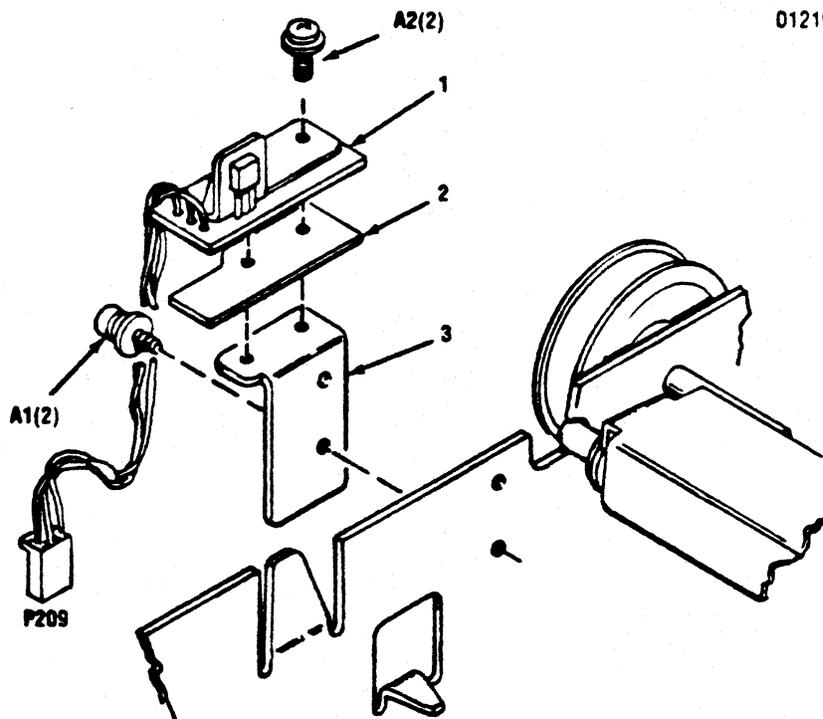


Figure 2-2. COVER INTERLOCK ASSEMBLY

LIST OF MATERIALS
PAPER FEED MOTOR

| Item | Part Number | Description | Quantity |
|------------------------------|-------------|--------------------------------|----------|
| 1 | U20076000 | Tractor Gear | 1 |
| 2 | 531335001 | Timing Belt 132 - 6.4 | 1 |
| 3 | U20030001 | Paper Feed Pulley Unit | 1 |
| 4 | U20196001 | Paper Feed Motor Gear | 1 |
| 5 | U20195001 | Paper Feed Motor Pulley | 1 |
| 6 | U20197001 | Paper Feed Motor Pulley Flange | 1 |
| 7 | U20188001 | Tension Roller Holder Unit | 1 |
| 8 | U20070001 | Paper Feed Motor | 1 |
| 9 | U20072001 | Paper Feed Motor Cover | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 048050345 | Snap Ring | 2 |
| A2 | 014400522 | Set Screw | 2 |
| A3 | 215081001 | Screw Assembly | 4 |
| A4 | U20099001 | Screw Assembly | 3 |

20179B

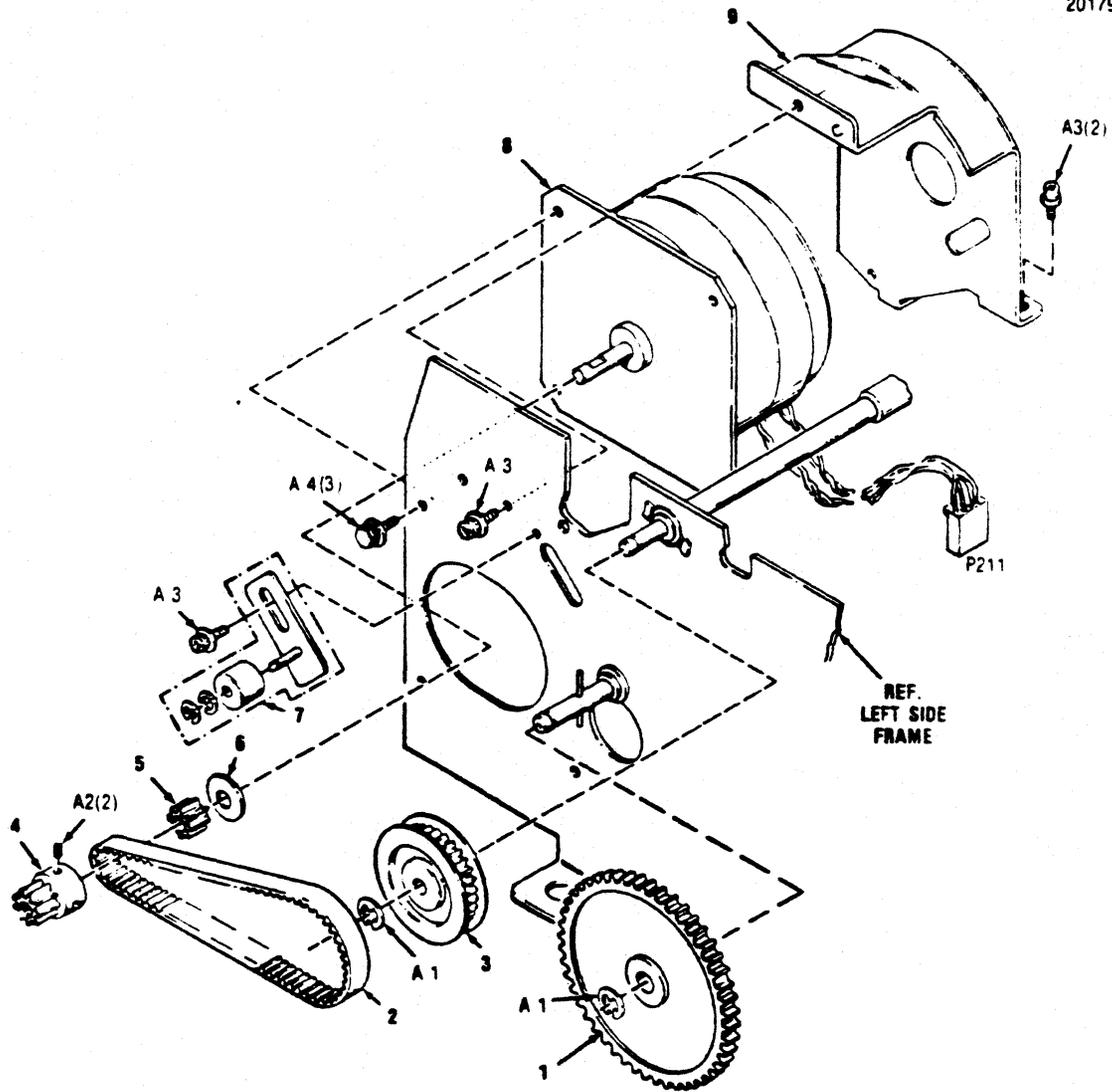
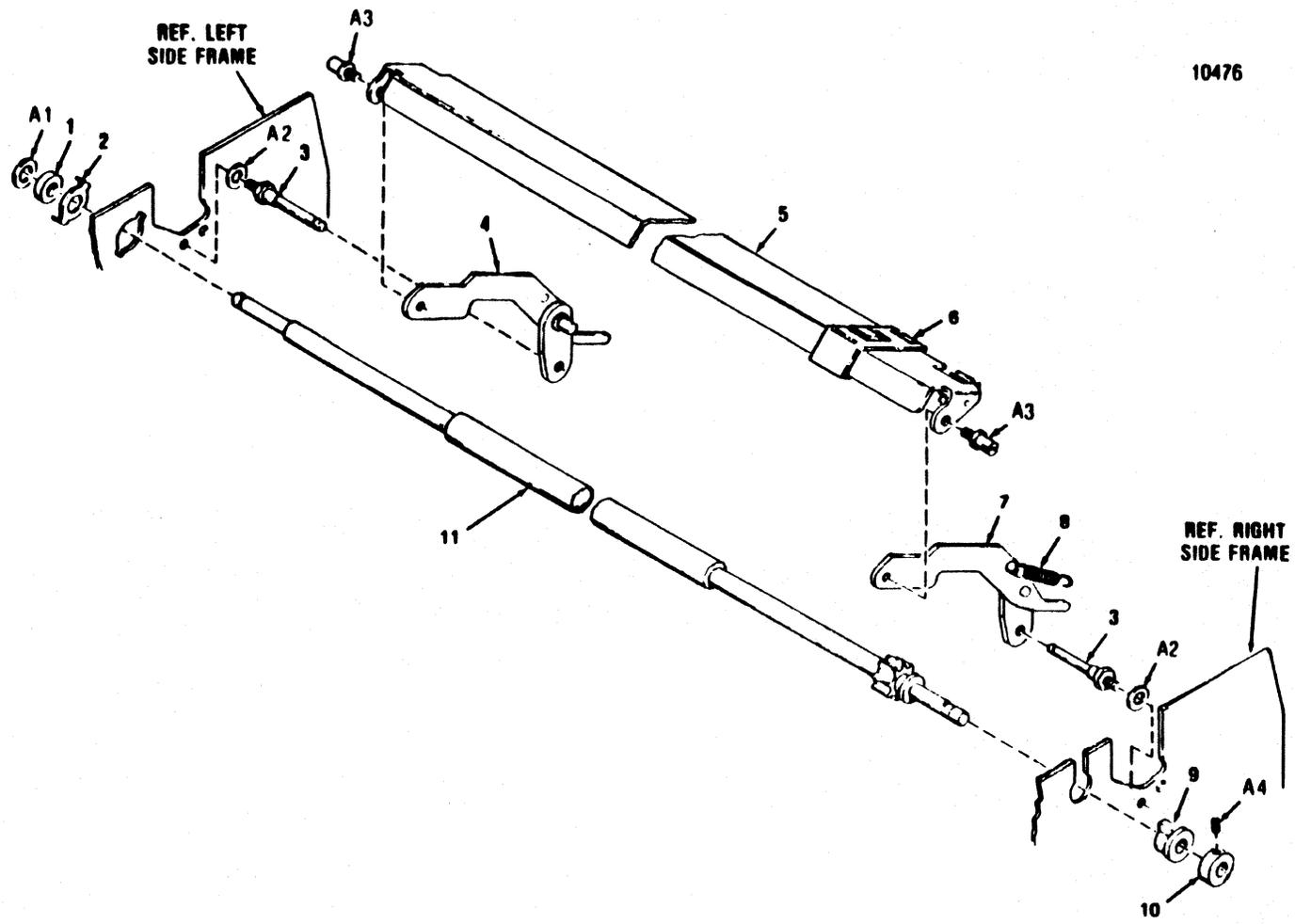


Figure 2-3. PAPER FEED MOTOR

LIST OF MATERIALS
 PAPER SCALE BAR AND PAPER FEED ROLLER ASSEMBLY
 (Figure 2-4)

| Item | Part Number | Description | Quantity |
|------------------------------|-------------|------------------------------|----------|
| 1 | 072069680 | Bearing 696ZZ | 1 |
| 2 | U20029001 | Bushing Holder | 1 |
| 3 | U20055001 | Shoulder Screw | 2 |
| 4 | U20046001 | Paper Cutter Arm, Left Unit | 1 |
| 5 | U20206001 | Paper Cutter Unit | 1 |
| 6 | 64001190 | Line Locator (option) | 1 |
| 7 | U20041001 | Paper Cutter Arm, Right Unit | 1 |
| 8 | U20176001 | Spring | 2 |
| 9 | U20033000 | Bushing | 1 |
| 10 | U20034001 | Collar | 1 |
| 11 | U20025001 | Paper Feed Roller Unit | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 025060135 | Washer | 1 |
| A2 | 025050135 | Washer | 2 |
| A3 | U20191001 | Stud Screw | 2 |
| A4 | 525743001 | Set Screw | 1 |

10476



REF. LEFT
SIDE FRAME

REF. RIGHT
SIDE FRAME

Figure 2-4. PAPER SCALE BAR AND PAPER FEED ROLLER ASSEMBLY

LIST OF MATERIALS
 CARRIAGE MOTOR, DRIVE BELTS AND ENCODER/TIMING DISC
 (Figure 2-5)

| Item | Part Number | Description | Quantity |
|------------------------------|---------------|--|----------|
| 1 | U20138001 | Motor Holder | 1 |
| 2 | U21151001 | Drive Pulley Unit Assembly | 1 |
| 3 | U20139001 | Timing Belt 144-12.7 | 1 |
| 4 | U20143001 | Timing Belt 515-9.5 | 1 |
| 5 | 530728001 | Collar | 2 |
| 6 | U20144001 | Idle Pulley A Unit | 1 |
| 7 | U20275001 | Idle Pulley Shaft | 1 |
| 8 | U20274001 | Idle Pulley Holder | 1 |
| 9 | U20187001 | Carriage Motor Pulley Unit Assembly | 1 |
| 10 | U20157000 | Encoder/Timing Disc | 1 |
| 11 | U20156000 | Collar | 1 |
| 12 | U20158001 | Encoder Cover | 1 |
| 13 | U20255001 | Copula Holder A | 1 |
| 14 | 39099012-1001 | Optic Sensor | 1 |
| 15 | U20256001 | Copula Holder B | 1 |
| 16 | U20193000 | Clip | 1 |
| 17 | U20142001 | C Drive Pulley Shaft | 1 |
| 18 | U20298001 | Spacer | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 215081001 | Screw | 4 |
| A2 | U21011001 | Screw | 3 |

| | | | |
|----|---------------|--|---|
| A3 | U20099001 | Screw | 3 |
| A4 | 007401615 | Screw | 3 |
| A5 | 037260812 | Screw | 3 |
| A6 | 535772001 | Screw | 1 |
| A7 | 34000775-2003 | Screw Assembly, Optic Sensor Mounting | 1 |
| A8 | 533834001 | Washer | 1 |

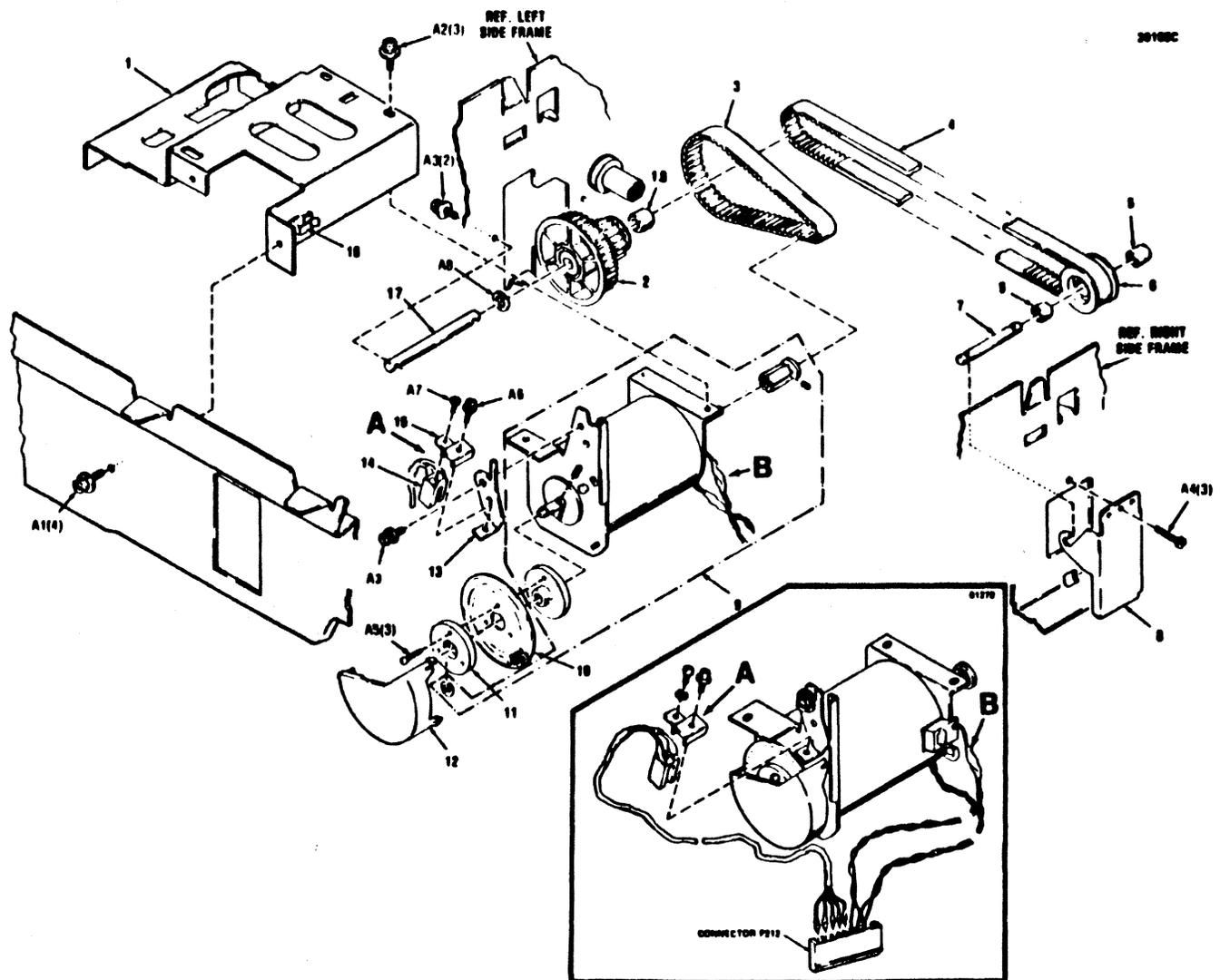


Figure 2-5. CARRIAGE MOTOR, DRIVE BELTS AND ENCODER/TIMING DISC

LIST OF MATERIALS
 DRIVING CAM ASSEMBLY, LEFT/RIGHT
 (Figure 2-6)

| Item | Part Number | Description | Quantity |
|------|-------------|----------------------|----------|
| 1 | U20061001 | Cam Pin, Left | 1 |
| 2 | U20131001 | Cam Push Link | 1 |
| 3 | U20060001 | Drive Cam, Left | 1 |
| 4 | U20056000 | Guide Link, Left | 1 |
| 5 | U20217001 | Paper Set Plate Unit | 1 |
| 6 | U20062000 | Drive Cam Right | 1 |
| 7 | U20054000 | Guide Link, Right | 1 |
| 8 | U20063001 | Cam Pin, Right | 1 |
| 9 | 512462001 | Spring | 1 |
| 10 | 542632001 | Spring | 2 |

-----ATTACHING HARDWARE-----

| | | | |
|----|-----------|----------------|---|
| A1 | 021500105 | Nut | 2 |
| A2 | 028050243 | Washer, Spring | 2 |
| A3 | 025040235 | Washer, Flat | 1 |
| A4 | 541157001 | Stud Screw | 1 |
| A5 | 048030345 | Snap Ring | 4 |
| A6 | 021300105 | Nut | 2 |
| A7 | 403370001 | Washer, Flat | 2 |
| A8 | 008300814 | Screw | 2 |

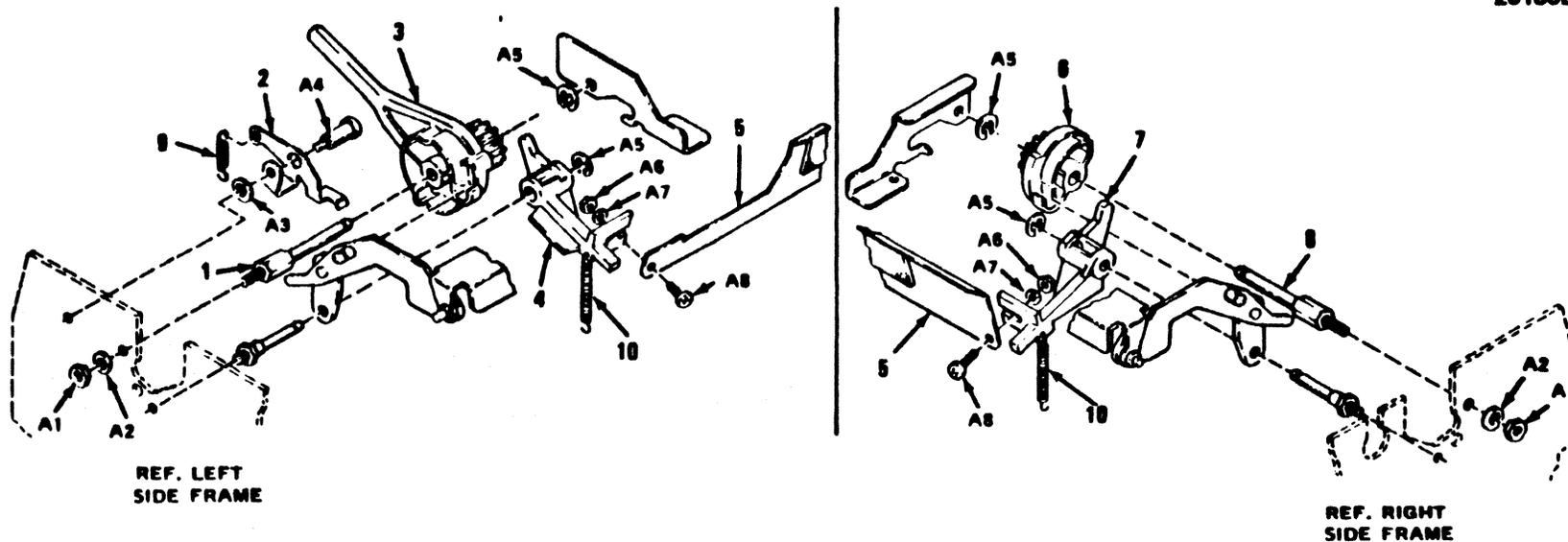


Figure 2-6. DRIVING CAM ASSEMBLY, LEFT/RIGHT

LIST OF MATERIALS
 CARRIAGE GUIDE BARS, HEAD ADJUST ASSEMBLY
 (Figure 2-7)

| Item | Part Number | Description | Quantity |
|------------------------------|---------------|----------------------|----------|
| 1 | U20266001 | Head Adjusting Cam | 2 |
| 2 | 535210001 | Carriage Stopper | 2 |
| 3 | U20132001 | Guide Bar, Rear | 1 |
| 4 | U20135001 | Guide Bar, Front | 1 |
| 5 | U20163001 | Carriage Sleeve | 1 |
| 6 | U20117001 | Carriage Assembly | 1 |
| 7 | U20289001 | Head Adjusting Lever | 1 |
| 8 | U20264001 | Head Adjusting Plate | 1 |
| 9 | 64000115-2001 | Strain Relief | 1 |
| 10 | 36350005-2001 | O-Ring .924 ID | 1 |
| 11 | U20277000 | Felt | 1 |
| 12 | U20164000 | Permawick Lid | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | U20137001 | Snap Ring | 1 |
| A2 | 017501215 | Screw | 2 |
| A3 | 028050243 | Washer, Spring | 2 |
| A4 | U20136001 | Snap Ring | 1 |
| A5 | U20133001 | Snap Ring | 1 |
| A6 | U20134001 | Snap Ring | 1 |
| A7 | 215081001 | Screw Assembly | 2 |
| A8 | 34000775-2044 | Screw Assembly | 2 |
| A9 | 34000775-2046 | Screw Assembly | 1 |

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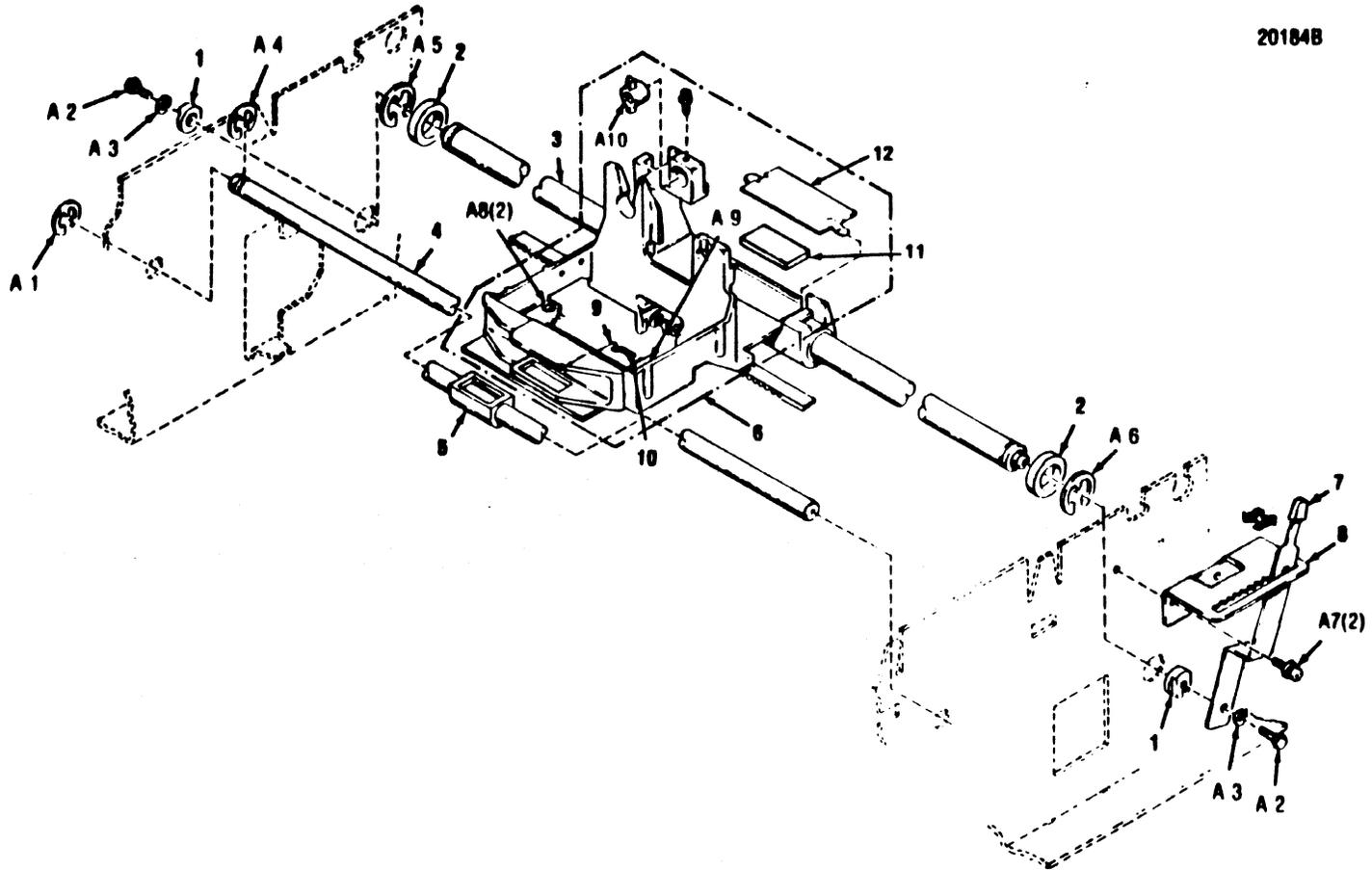


Figure 2-7. CARRIAGE GUIDE BARS, HEAD ADJUST ASSEMBLY

LIST OF MATERIALS
RIBBON DRIVE MOTOR ASSEMBLY
(Figure 2-8)

| Item | Part Number | Description | Quantity |
|------------------------------|-------------|--------------------------------|----------|
| 1 | U20166001 | Ribbon Drive Motor Assembly | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 215081001 | Screw | 2 |

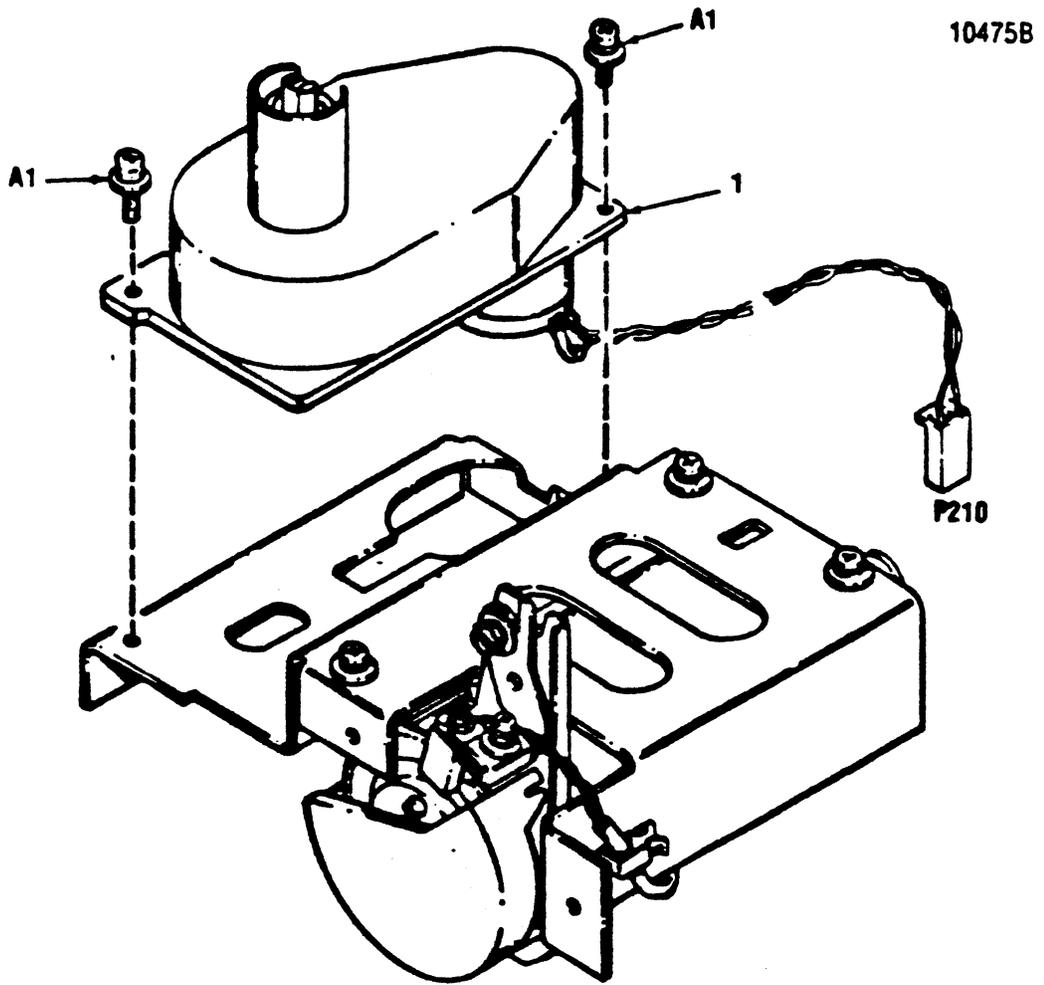


Figure 2-8. RIBBON DRIVE MOTOR

LIST OF MATERIALS
TRACTOR DRIVE MECHANISM
(Figure 2-9)

| Item | Part Number | Description | Quantity |
|------|-------------|------------------------------|----------|
| 1 | U20033000 | Bushing | 2 |
| 2 | U20077001 | Tractor Guide Shaft | 1 |
| 3 | U20075001 | Tractor Drive Shaft | 1 |
| 4 | U20074001 | Pin Tractor Unit R | 1 |
| 5 | U21014001 | P.E. Switch Unit (w/harness) | 1 |
| 6 | U20073001 | Pin Tractor Unit L | 1 |
| 7 | U20078001 | Spacer | 1 |
| 8 | 047201642 | Spring Pin | 1 |
| 9 | U20076000 | Tractor Gear | 1 |

-----ATTACHING HARDWARE-----

| | | | |
|----|-----------|-----------|---|
| A1 | 048050345 | Snap Ring | 3 |
| A2 | 025060135 | Washer | 2 |
| A3 | 048060345 | Snap Ring | 3 |
| A4 | 535610001 | Screw | 2 |
| A5 | 503090001 | Washer | 1 |
| A6 | 533562001 | Snap Ring | 1 |

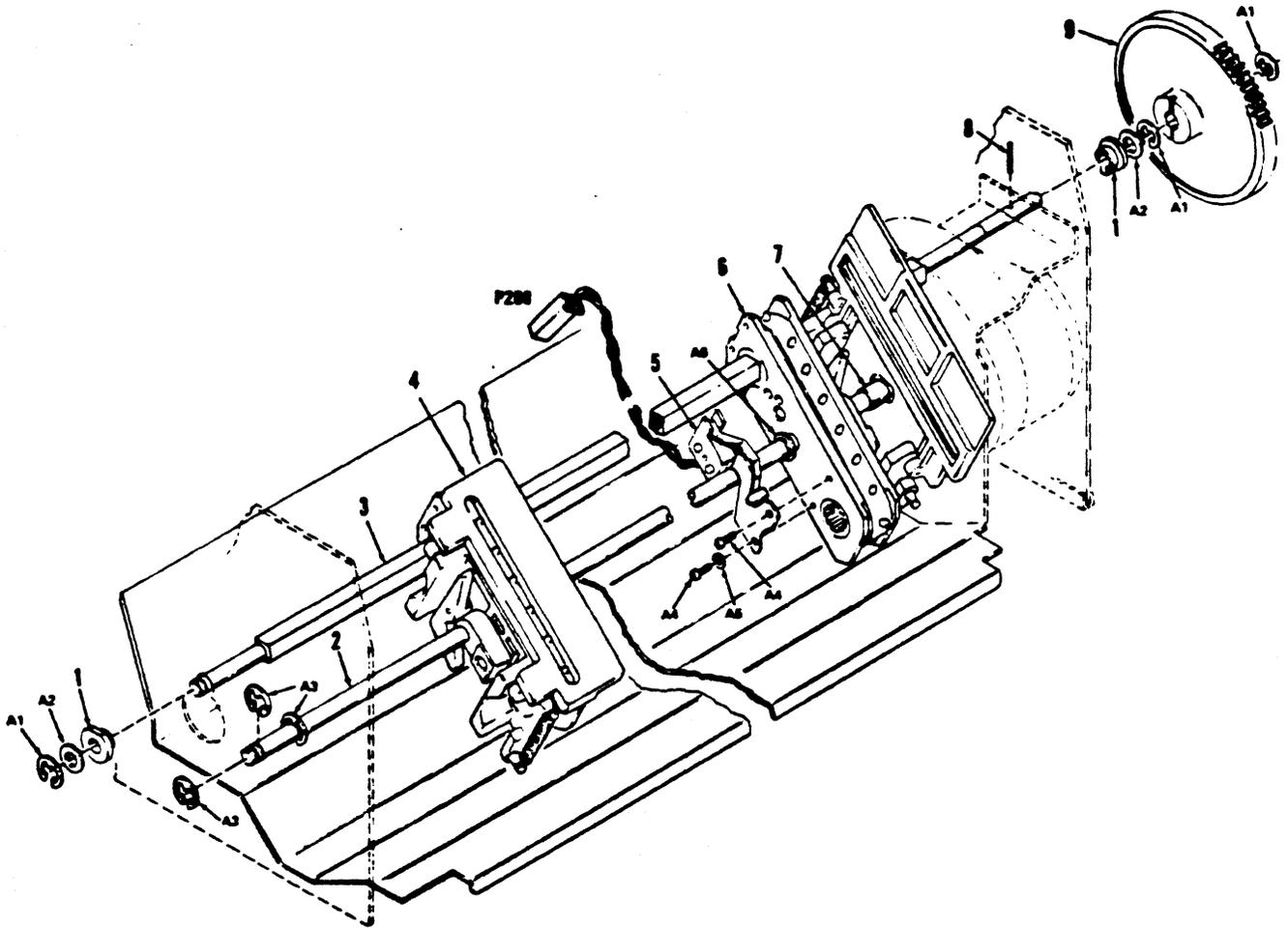


Figure 2-9. TRACTOR DRIVE MECHANISM

LIST OF MATERIALS
 PLATEN AND ASSOCIATED ASSEMBLY
 (Figure 2-10)

| Item | Part Number | Description | Quantity |
|------------------------------|-------------|--------------------------|----------|
| 1 | U20130001 | Carriage Lock Plate | 1 |
| 2 | 541950001 | Spring | 1 |
| 3 | U20067001 | Link Shaft Holder, Left | 1 |
| 4 | U20064001 | Link Shaft Unit | 1 |
| 5 | U20038000 | Paper Feed Roller Guide | 1 |
| 6 | U20129000 | Paper Guide, Upper | 1 |
| 7 | U20068001 | Link Shaft Holder, Right | 1 |
| 8 | U20184001 | Platen Unit | 1 |
| 9 | 516442001 | Collar | 1 |
| 10 | 531572001 | Stud Screw | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 537235001 | Screw | 2 |
| A2 | 527023001 | Screw | 1 |
| A3 | 215081001 | Screw | 5 |

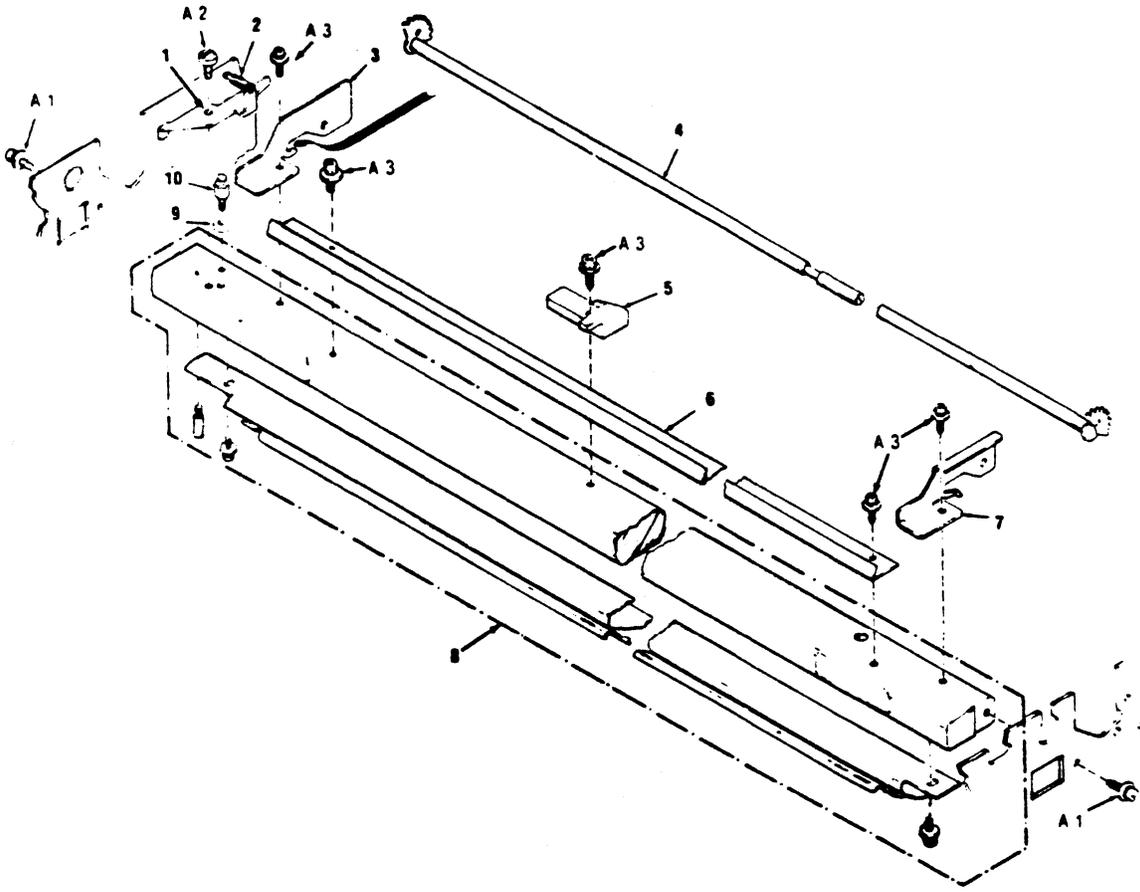


Figure 2-10. PLATEN AND ASSOCIATED ASSEMBLY

LIST OF MATERIALS
PRINT HEAD AND ASSOCIATED ASSEMBLIES
(Figure 2-11)

| Item | Part Number | Description | Quantity |
|------|---------------|----------------------------|----------|
| 1 | 64000520-6001 | Ribbon Cassette (see note) | 1 |
| 2 | 63180315-5001 | Print Head Assembly | 1 |
| 3 | 63180254-4001 | Head Adapter Board | 1 |
| 4 | 63180285-4001 | Head Flex Cable Assembly | 1 |
| 5 | 36350005-2001 | O Ring | 1 |

NOTE: Item 1 part number is for a package containing four (4) cassettes.

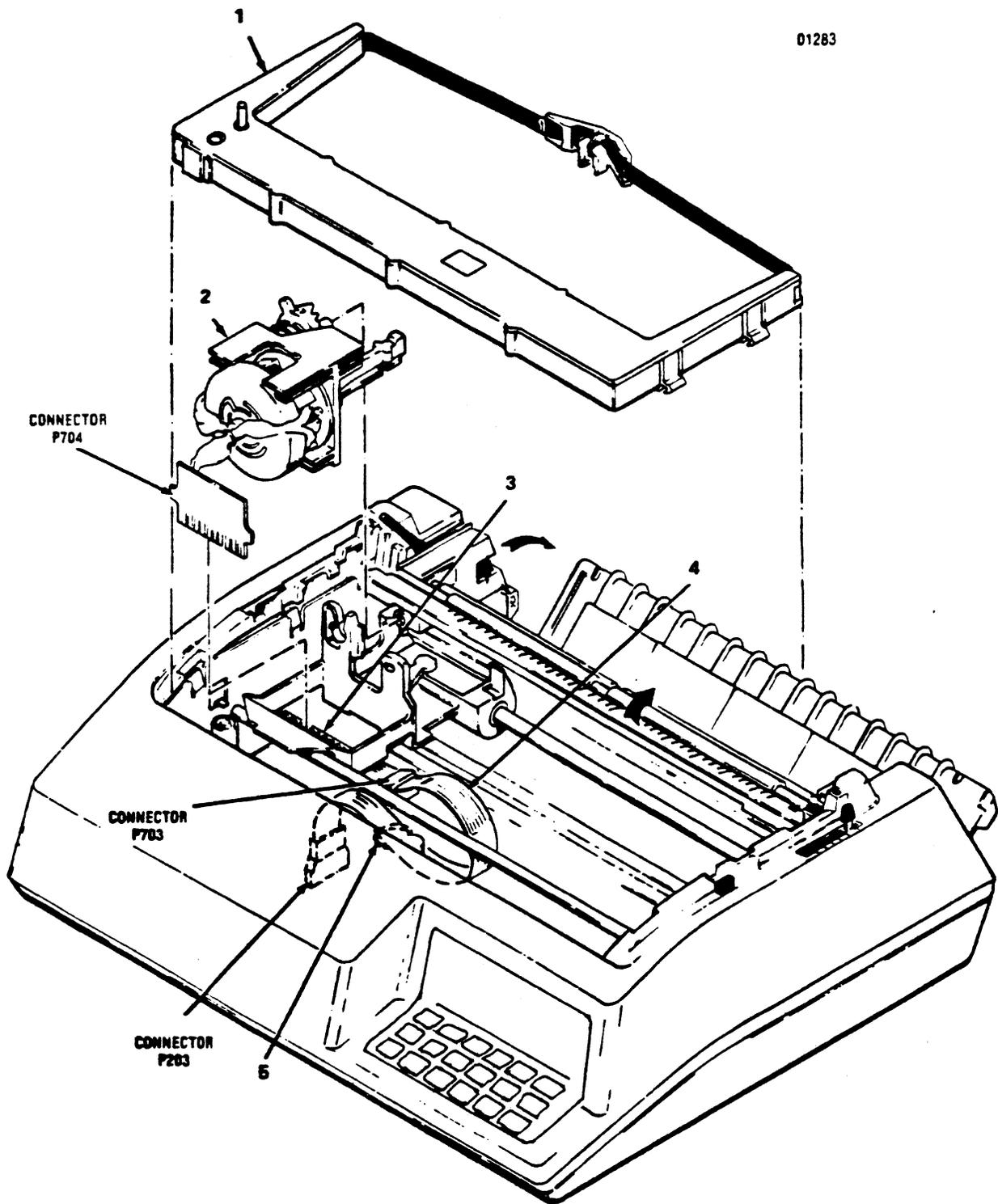


Figure 2-11. PRINT HEAD and ASSOCIATED ASSEMBLIES

LIST OF MATERIALS
ASSEMBLY INTERCONNECTION
(Figure 2-12)

| Item | Part Number | Description | Quantity |
|------------------------------|---------------|----------------------------------|----------|
| 1A | 64000399-5001 | Power Supply; 115V ac, 60 Hz | 1 |
| 1B | 64000399-5001 | Power Supply; 230V ac, 50 Hz | 1 |
| 2 | 64000920-4001 | Print Controller 487 | 1 |
| 3 | 1200302 | ISI Format Controller 487 | 1 |
| 4 | 1200301 | Front Panel | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 34000775-2046 | Screw Assembly | 2 |
| A2 | 34900007-2001 | Washer, Lock, Int. Ext. Tooth | 2 |

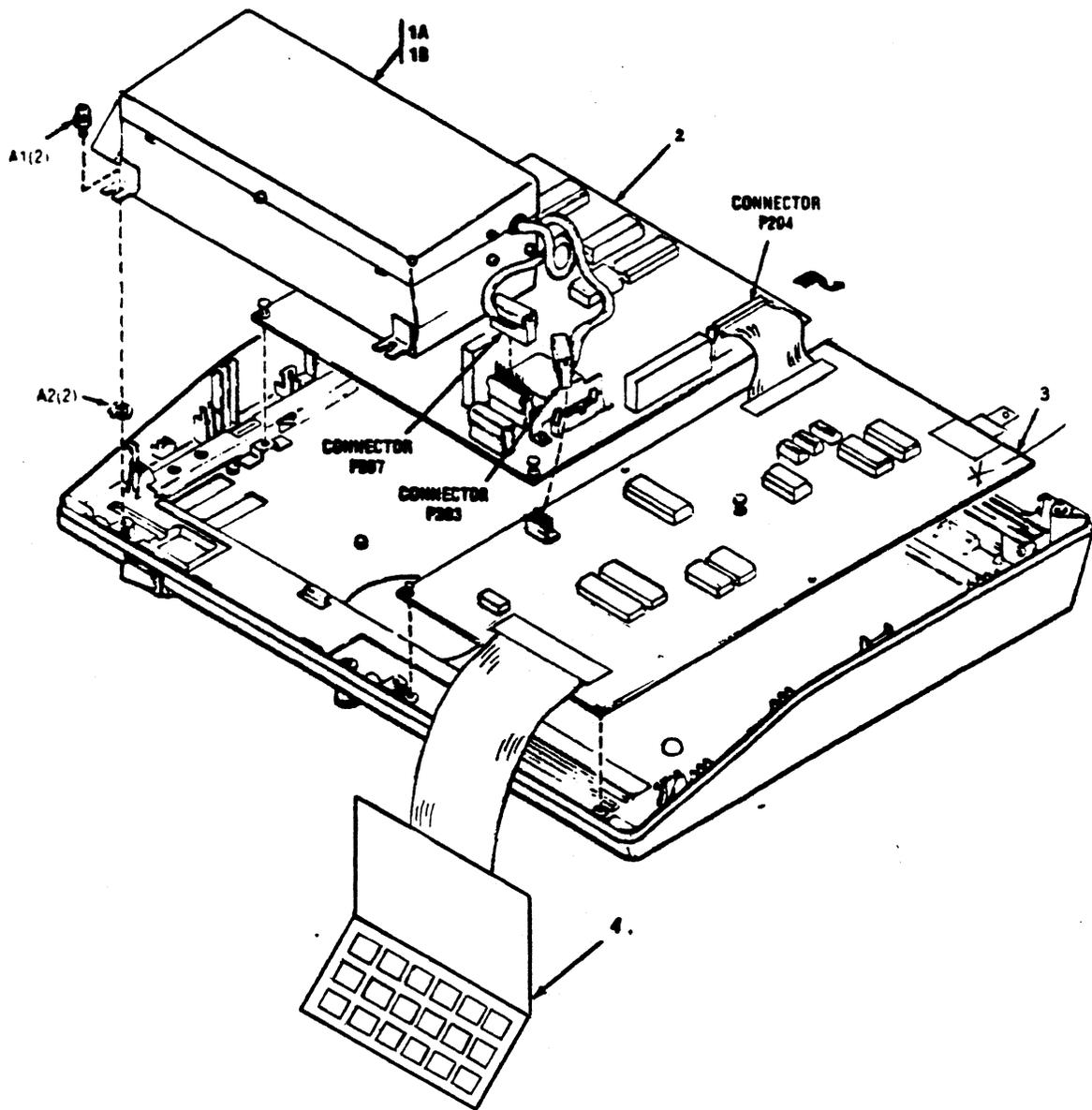


Figure 2-12. ASSEMBLY INTERCONNECTION

LIST OF MATERIALS
 BASE COVER
 (Figure 2-14)

| Item | Part Number | Description | Quantity |
|------------------------------|---------------|--------------------------------------|----------|
| 1 | 64000837-2001 | Bottom Cover Assembly | 1 |
| 3 | U20267001 | Knob, Body Cover | 1 |
| 4 | 64000579 | Gasket, RFI, Power Supply | 1 |
| 5 | 39098122-1001 | Switch, ON/OFF | 1 |
| 6 | 64000580-2001 | Gasket, RFI, Mech. | 2 |
| 7 | 36200018-2016 | BMPR. ADH MTG. (see Note 1) | 6 |
| 8 | 64000509-5001 | Barrier, EMI Assy. (see Note 2) | 1 |
| 9 | 63180313-5001 | Bracket Mounting Assembly, Formatter | 1 |
| 10A | 39620021-1003 | Power Cord 115V | 1 |
| 10B | 39620021-1001 | Power Cord 220V | 1 |
| B1A | 39030033-1027 | Fuse G1. 4A. 115V | 1 |
| B1B | 39030038-1007 | Fuse G1. 2A 250V | 1 |
| B2 | 64000850-5001 | Harness Bracket Assy. ESD, AC Power | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 34000775-2045 | Screw Assembly | 2 |
| A2 | 34913125-2001 | Flat Washer | 4 |
| A3 | 34000775-2043 | Screw Assembly | 3 |
| A4 | 34000775-2085 | Screw Assembly | 2 |
| A5 | 34000451-2056 | Washer, Lock, Ext. Tooth | 2 |
| B6 | 34000452-2007 | Washer, Flat | 2 |
| B7 | 33725718-2011 | Screw Self Tapping | 2 |
| C4 | 34000773-2043 | Screw Assembly M3x8 | 4 |
| C5 | 34913125-2001 | Washer, Flat | 4 |

| | | | |
|----|---------------|------------------|---|
| C6 | 34000652-2004 | Hex Nut | 2 |
| C7 | 34000455-2004 | Washer, Lock, M3 | 2 |
| C8 | 34913125-2001 | Washer, Flat | 2 |

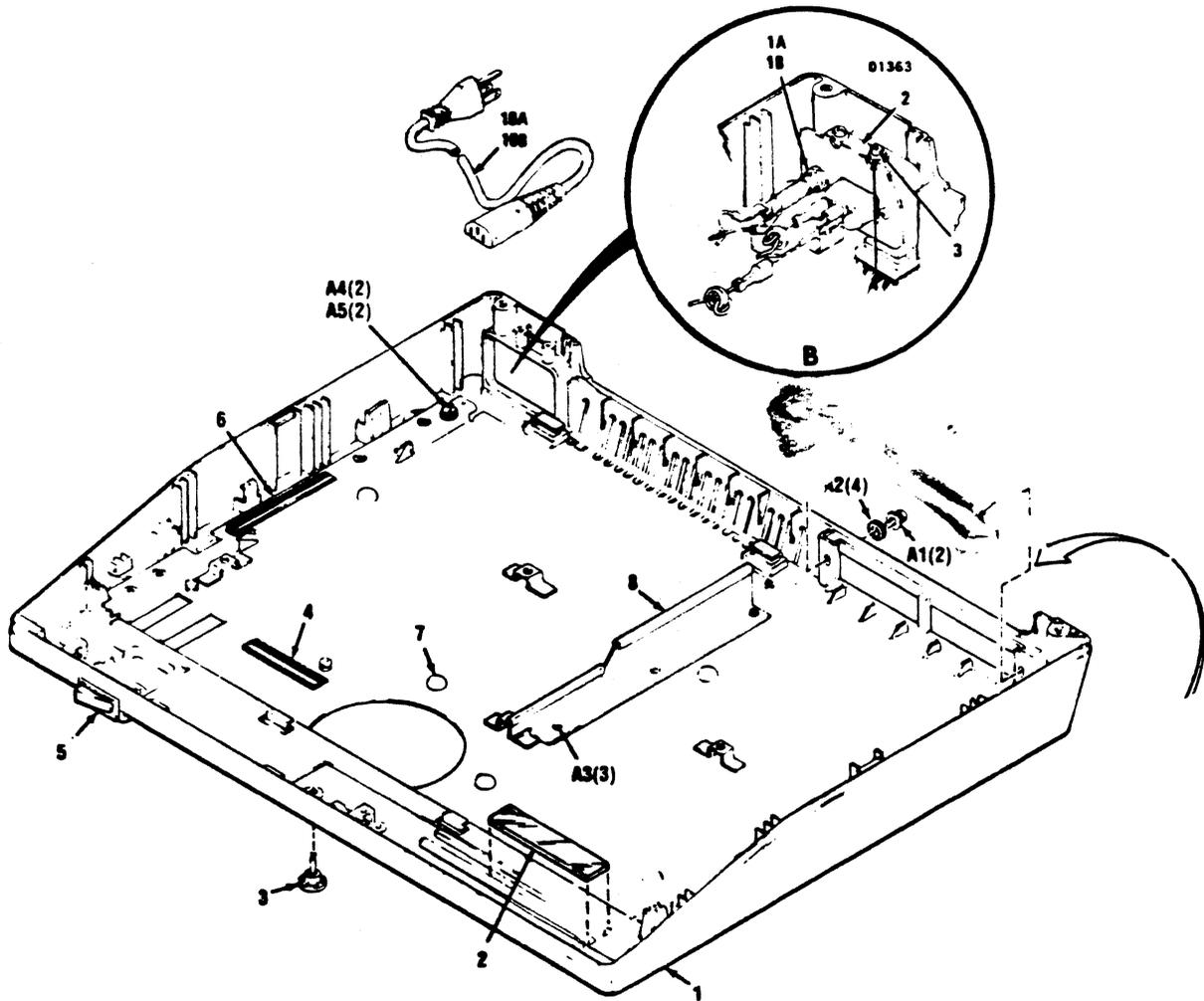


Figure 2-14. BASE COVER

LIST OF MATERIALS
 MAINFRAME
 (Figure 2-15)

| Item | Part Number | Description | Quantity |
|------------------------------|----------------|------------------------|----------|
| 1 | U20017001 | Rubber Spacer | 4 |
| 2 | 33000023-2005 | Clip | 1 |
| 3 | U20278001 | Clip | 2 |
| 4 | 120370001 | Clip | 1 |
| 5 | 533816001 | Clip | 1 |
| 6 | U20182001 | Rubber Bushing | 1 |
| 7 | U20276001 | Clip | 1 |
| 8 | 33000022-2001 | Clip | 3 |
| 9 | 531494000 | Edging | 1 |
| 10 | 553968000 | Edging | 1 |
| 11 | U20100001 | Chassis, Complete Unit | 1 |
| 12 | 64000594-2001 | Dip Switch Cover | 1 |
| 13 | 64000534-2001 | Dust Cover | 1 |
| -----ATTACHING HARDWARE----- | | | |
| A1 | 025080135-2001 | Washer | 4 |
| A2 | U20016001 | Shoulder Screw | 4 |
| A3 | 533655001 | Screw | 1 |
| A4 | 34000770-2001 | Nut, Stop | 1 |
| A5 | 34000657-2004 | Screw, Hex Head, M3 | 1 |

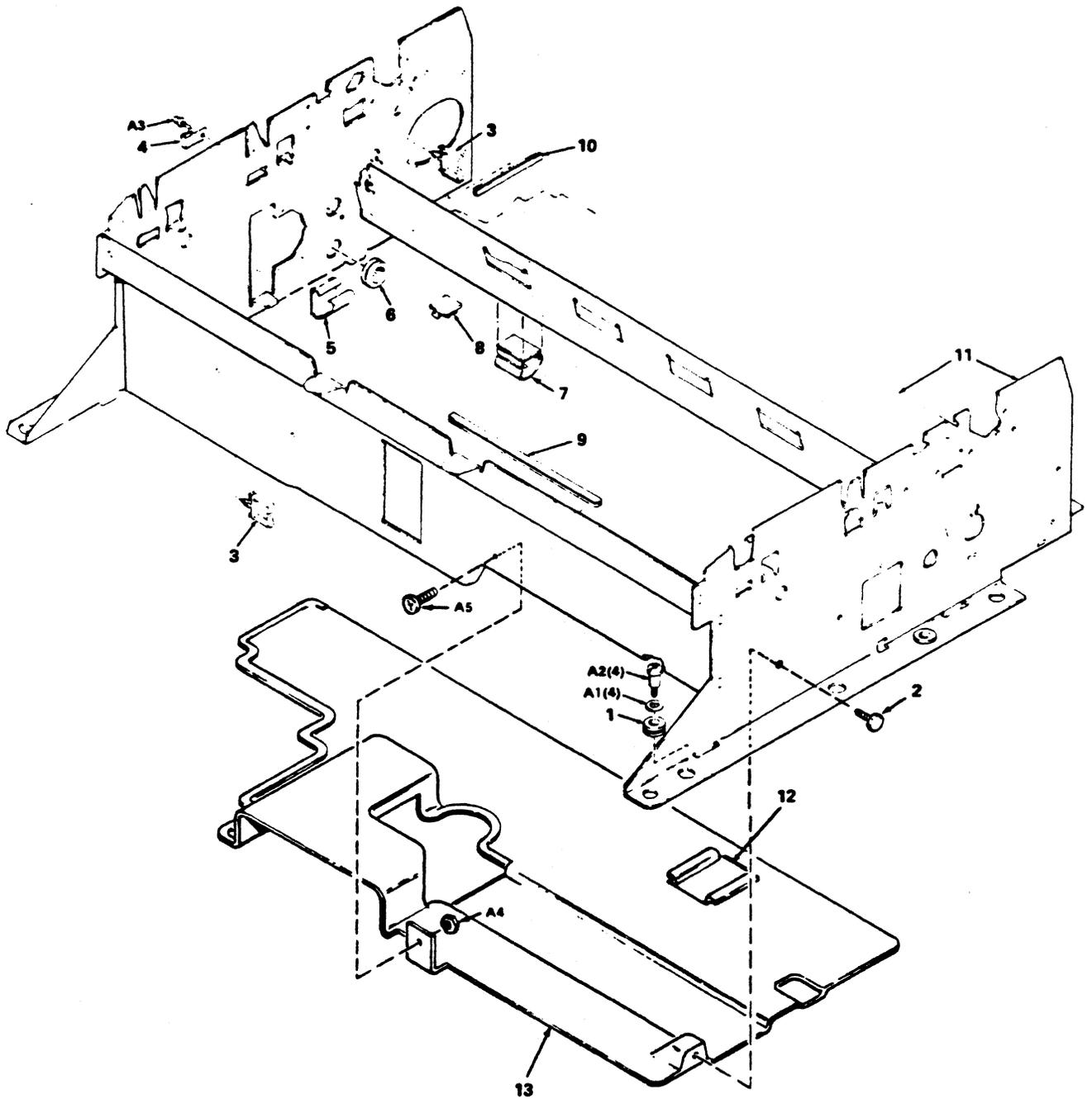


Figure 2-15. MAINFRAME
- 125 -

PRINTER INTERCONNECTION
(Figure 2-16)

| ITEM | DESCRIPTION | REFERENCE |
|----------------------------|--|-------------|
| P208 | P/O Paper Empty Mechanism | Fig. 2-9 |
| P209 | P/O Interlock Switch Unit | Fig. 2-2 |
| P210 | P/O Ribbon Drive Motor Assembly | Fig. 2-8 |
| P211 | P/O Carriage Motor/Encoder Assemblies | Fig. 2-5 |
| PRINT CONTROLLER PCB | Printer Logic Board | Fig. 2-12 |
| PRINTER BASE | P/O Bottom Cover Assembly | Figure 2-14 |
| PRINTER MECHANISM | P/O Mainframe | Figure 2-15 |

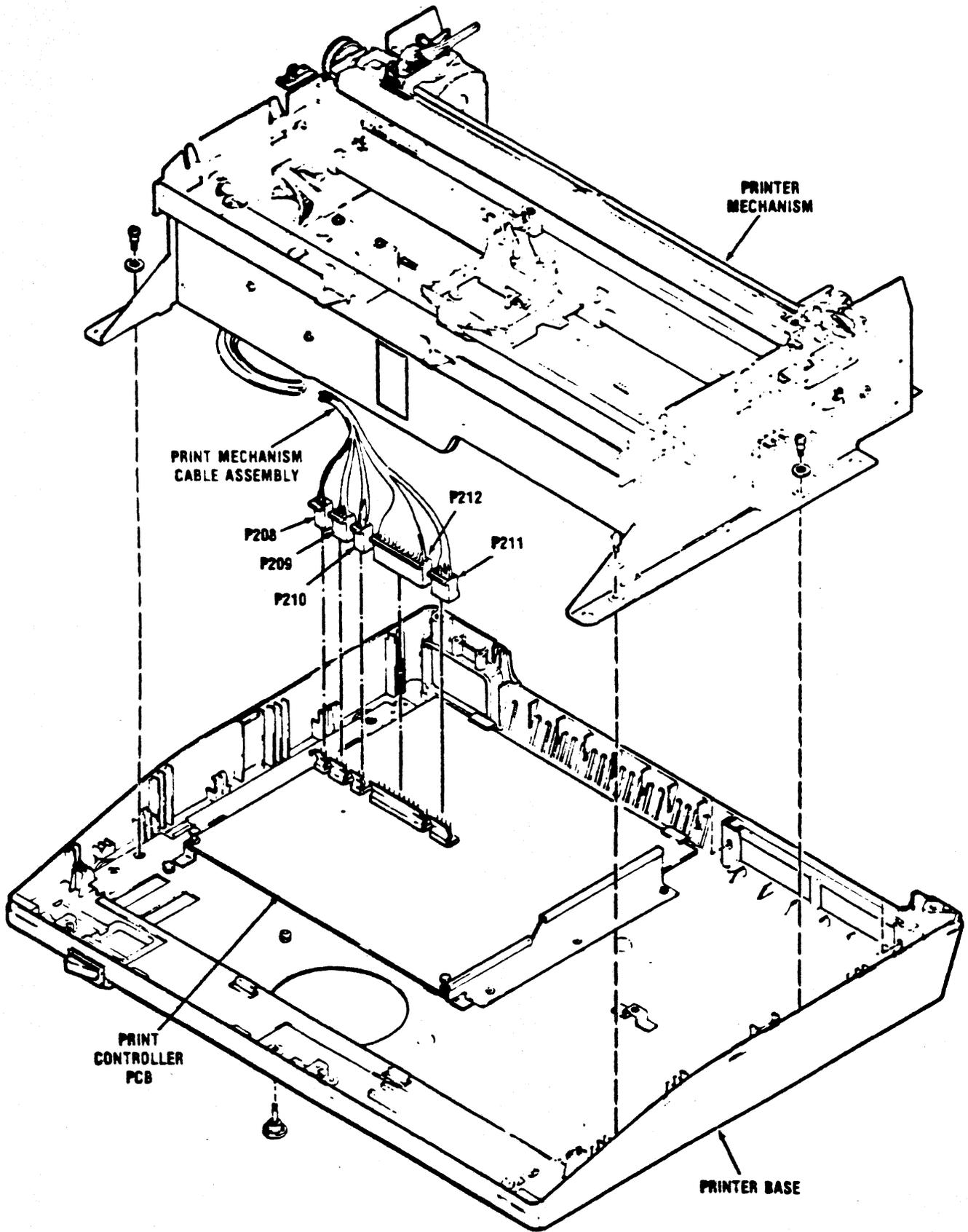


Figure 2-16. PRINTER INTERCONNECTION

Chapter 7

ELECTRICAL DRAWINGS

The following pages contain schematic, wiring, and assembly drawings for the Model 487 printer. A list of the drawings follows:

| FIGURE | TITLE | PAGE |
|----------------------|---|---------|
| -SCHEMATIC DIAGRAMS- | | |
| A-1 | Schematic Diagram, Print Controller (64000920-9001) | |
| A-2 | Schematic Diagram, Print Controller (64003470-4001) | |
| -WIRING DIAGRAMS- | | |
| A-4 | Wiring Diagram, Model 487 (64000505-9001) | A25/A24 |
| -ASSEMBLY DIAGRAMS- | | |
| A-6 | Assembly Diagram, Print Controller (64000920-8001) | A28 |
| A-7 | Assembly Diagram, Format Controller (1200302) | A29/A30 |
| A-8 | Assembly Diagram, Control Panel () | |

Chapter 8

PICO FUSE COLOR CODE

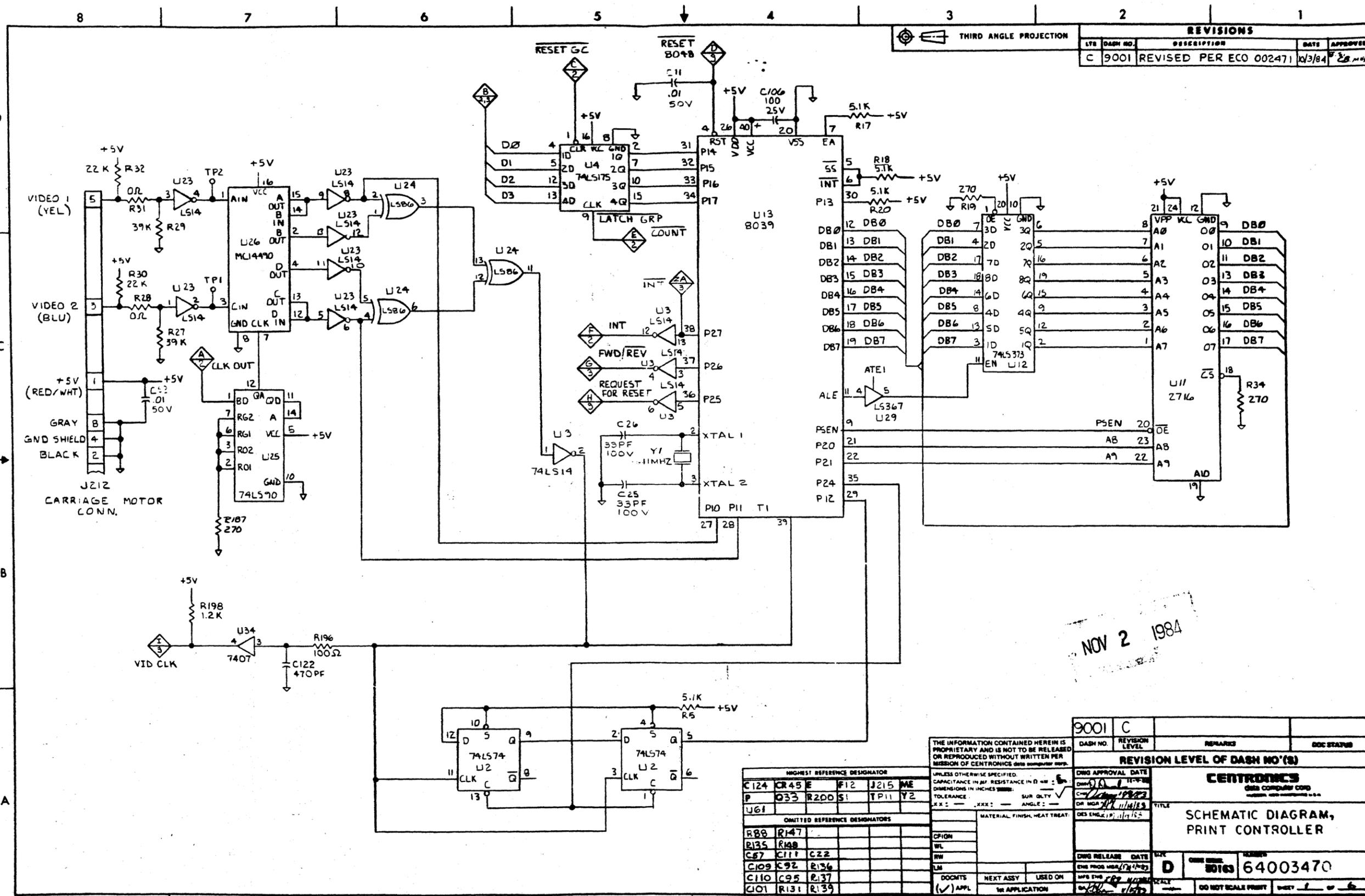
8.1 GENERAL INFORMATION

Some pico fuse manufacturers mark the outer covering of their fuses with four colored bands. The first three bands are of the same width and indicate the current rating of the fuse. The fourth band is wider than the other three and indicates the time-current characteristics of the fuse.

Table D-1 shows the pico fuse color code for fuses with "normal blo" time characteristics.

Table D-1. PICO FUSE COLOR CODE

| Rated Current MA | First Band | Second Band | Third Band | Fourth Band |
|------------------|------------|-------------|------------|-------------|
| 62 | Blue | Red | Black | Red |
| 100 | Brown | Black | Brown | Red |
| 125 | Brown | Red | Brown | Red |
| 250 | Red | Green | Brown | Red |
| 375 | Orange | Violet | Brown | Red |
| 500 | Green | Black | Brown | Red |
| 750 | Violet | Green | Brown | Red |
| 1000 | Brown | Black | Red | Red |
| 1500 | Brown | Green | Red | Red |
| 2000 | Red | Black | Red | Red |
| 2500 | Red | Green | Red | Red |
| 3000 | Orange | Black | Red | Red |
| 3500 | Orange | Green | Red | Red |
| 4000 | Yellow | Black | Red | Red |
| 5000 | Green | Black | Red | Red |
| 7000 | Violet | Black | Red | Red |
| 10000 | Brown | Black | Orange | Red |
| 12000 | Brown | Red | Orange | Red |
| 15000 | Brown | Green | Orange | Red |



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| REVISIONS | | | | |
|-----------|----------|------------------------|---------|-------------|
| LTB | DASH NO. | DESCRIPTION | DATE | APPROVED |
| C | 9001 | REVISED PER ECO 002471 | 10/3/84 | [Signature] |

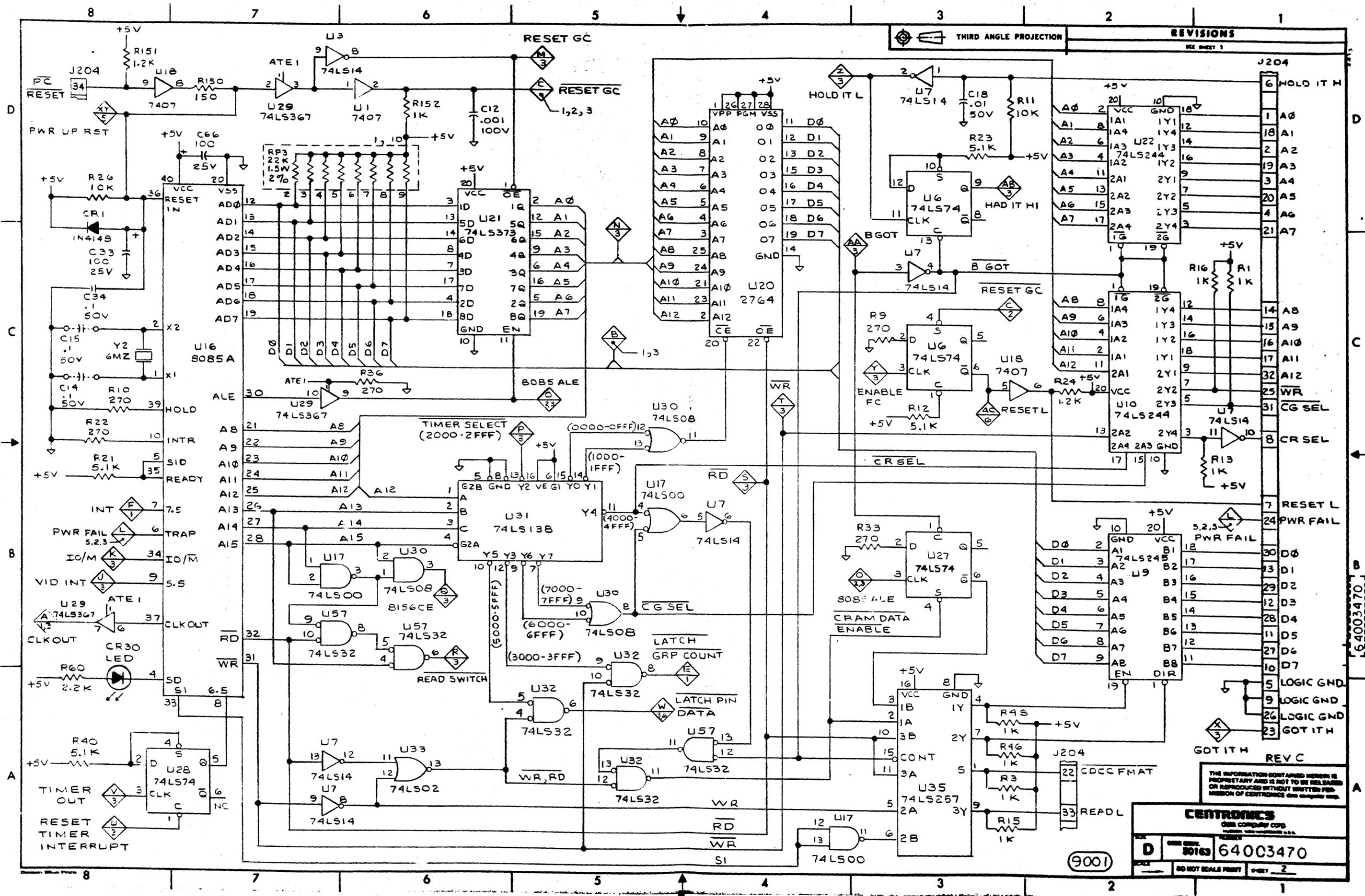
THIRD ANGLE PROJECTION

| HIGHEST REFERENCE DESIGNATOR | | | | |
|-------------------------------|------|------|------|---------|
| C124 | CR45 | F12 | J215 | ME |
| P | Q33 | R200 | SI | TP11 Y2 |
| OMITTED REFERENCE DESIGNATORS | | | | |
| R89 | R147 | | | |
| R135 | R148 | | | |
| C67 | C111 | C22 | | |
| C109 | C92 | R136 | | |
| C110 | C95 | R137 | | |
| C101 | R131 | R139 | | |

| | |
|--|--|
| UNLESS OTHERWISE SPECIFIED: CAPACITANCE IN μ F, RESISTANCE IN Ω OR K DIMENSIONS IN INCHES TOLERANCE: .XXX ± .XXX ANGLE: ° | |
| MATERIAL FINISH, HEAT TREAT: | |
| CPION | |
| WL | |
| RW | |
| LM | |
| DOCMTS | |
| (✓) APPL | |

| | | | |
|---|----------------|--------------|------------|
| DASH NO. | REVISION LEVEL | REMARKS | DOC STATUS |
| 9001 | C | | |
| REVISION LEVEL OF DASH NO'(S) | | | |
| CENTRONICS DATA COMPUTER CORP. | | | |
| TITLE SCHEMATIC DIAGRAM, PRINT CONTROLLER | | | |
| DATE | BY | CHK | NUMBER |
| 10/3/84 | [Signature] | D | 64003470 |
| DATE | BY | CHK | NUMBER |
| 10/3/84 | [Signature] | | |
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64003470J



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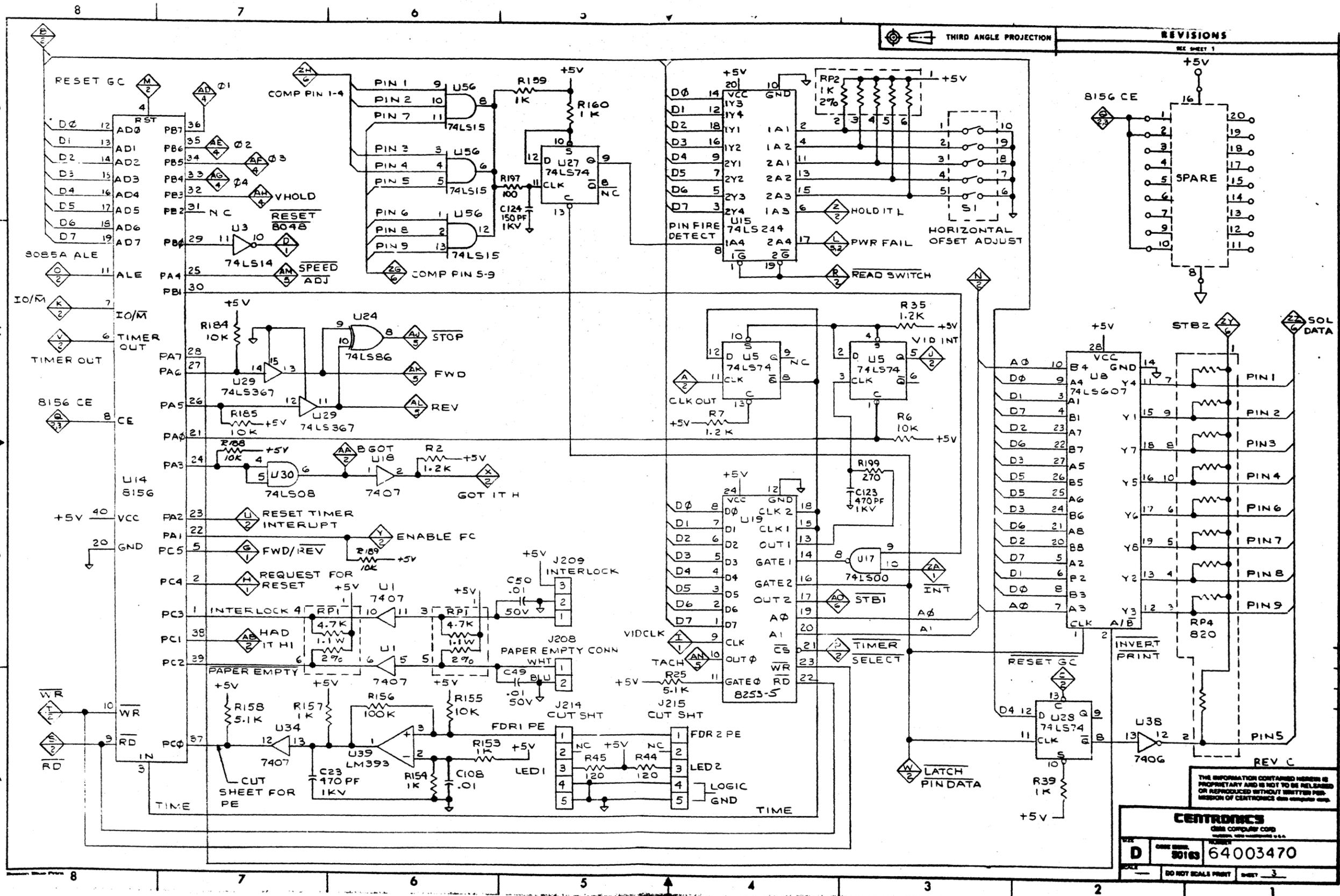
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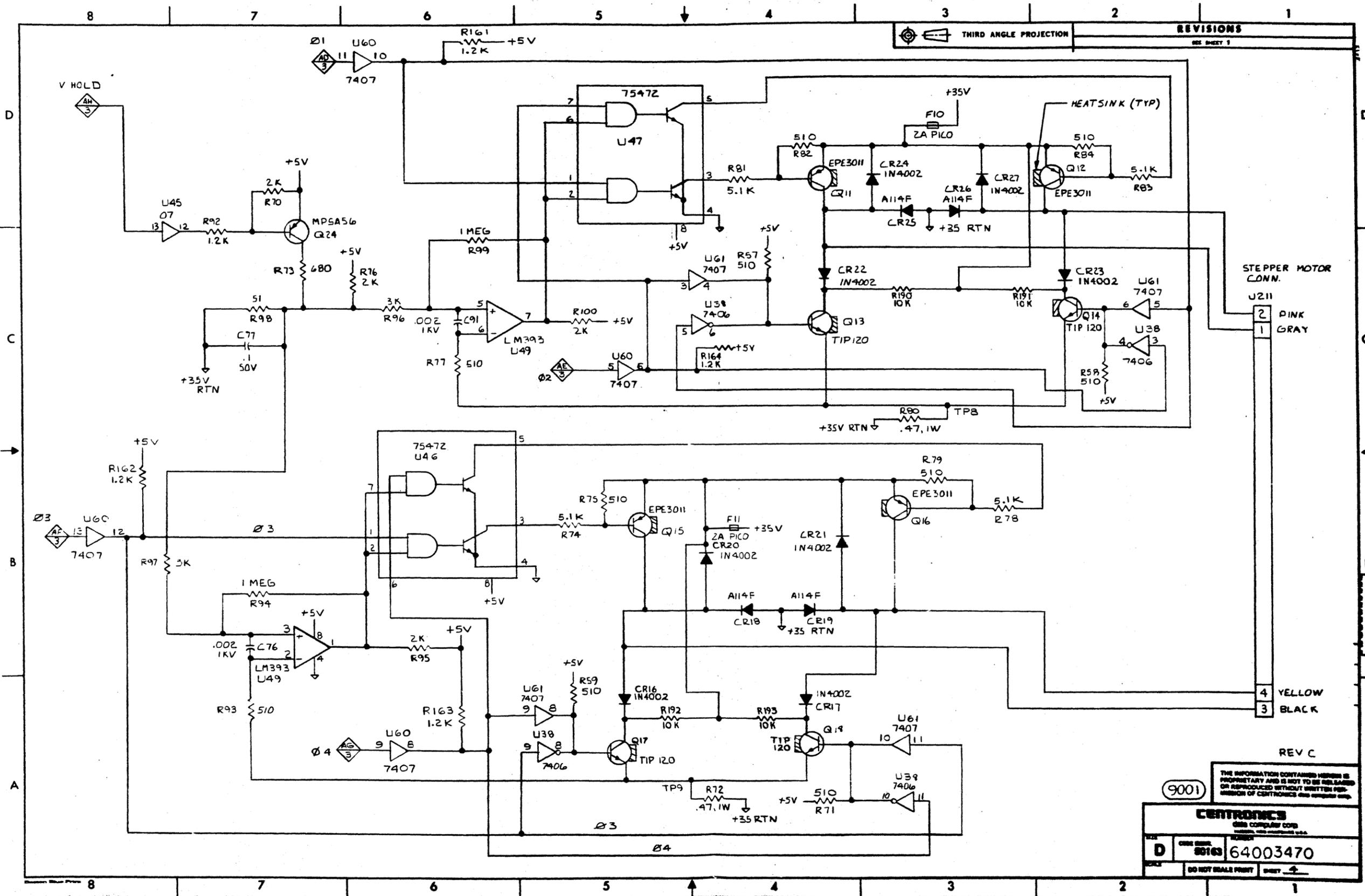
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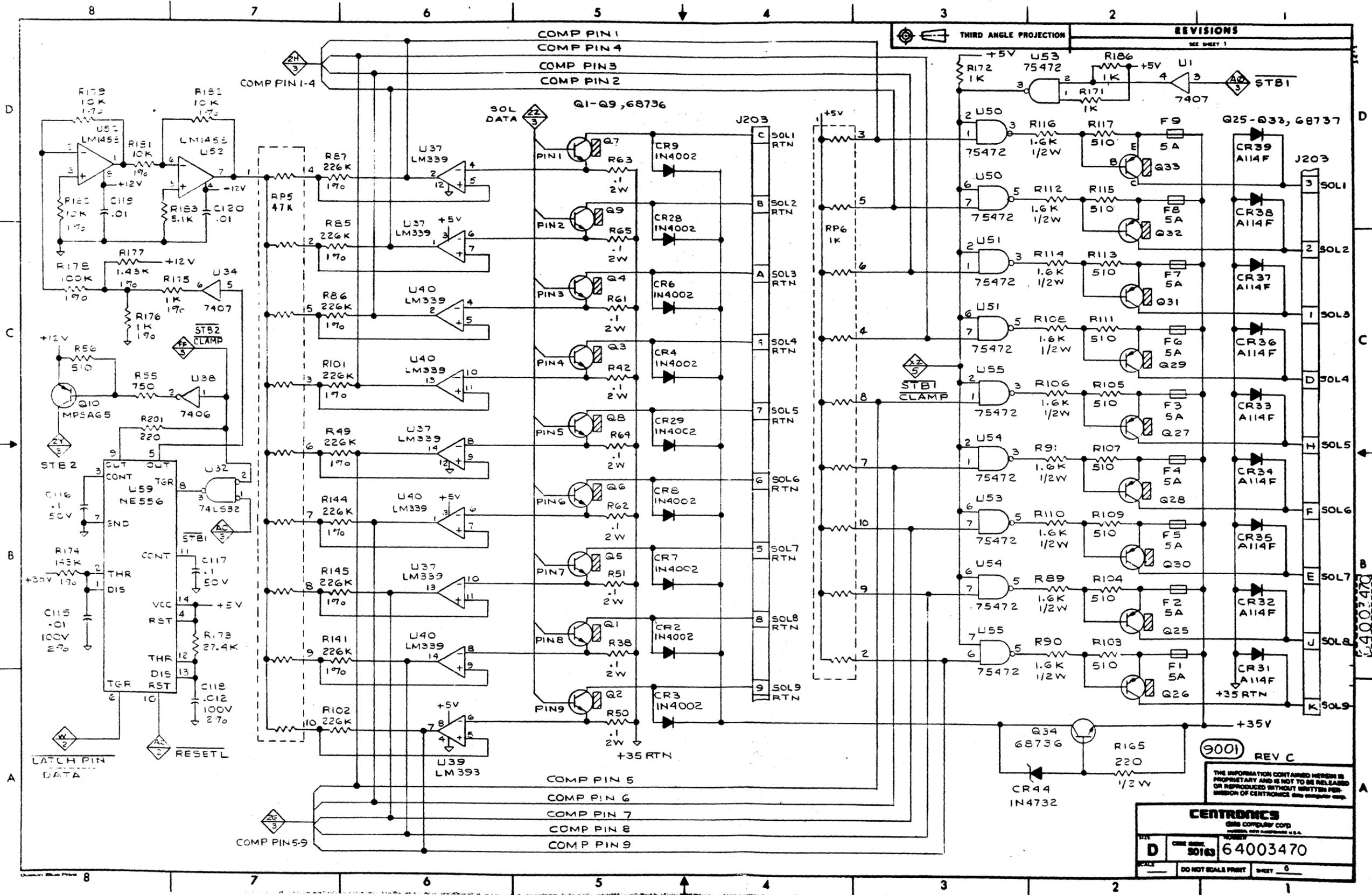
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Q25-Q33, 68737

STB1

STB2 CLAMP

STB1 CLAMP

9001 REV C

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