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NUMBER

THIS MANUAL SHOULD REMAIN WITH THAT  
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## MANUAL HISTORY AND REVISION INSTRUCTIONS

EQUIPMENT: CARD READER

PUB. PART NO. 0000686

MODEL: M600L

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### MANUAL HISTORY

REV NO.	*REV TYPE	DATE ISSUED	REVISION DESCRIPTION
—	R	5/78	Rewrite to current configuration
1	I	9/78	Corrections
2	I	10/78	Corrections
3	I	11/78	Corrections
4	R	2/79	Rewrite of IPB

\* I = INTERIM REVISION (LESS THAN 25% OF THE PAGES CHANGED)  
 F = FORMAL REVISION (25% OR MORE OF THE PAGES CHANGED)  
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### REVISION INSTRUCTIONS

DELETE AND ADD PAGES AS INDICATED IN THE FOLLOWING TABLE.

REV NO.	DELETE	ADD
1	12-5, 12-6, 12-9, 12-10, 12-11, 12-12	12-5, 12-6, 12-9, 12-10, 12-11, 12-12
2	4-9, 4-10	4-9, 4-10
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8/19/77

## TECHNICAL MANUAL CHANGE RECORD

The technical manual change record has been generated to reflect changes to the technical manual due to the inclusion of options, addendums and changes to meet customer specification.

The change pages following this page are either a direct replacement for the standard pages of the manual (reference page numbers), or are additional pages.

The pages are generated to meet the requirements of customer specification number 366.

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Equipment: Card Reader

Model: M 600L                      Voltage: 115V                      Frequency: 60 Hz

Options Included:

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## TABLE OF CONTENTS

### SECTION 1 INTRODUCTION

Paragraph		Page
1.1	General .....	1- 1
1.2	Description .....	1- 1
1.3	Specifications .....	1- 1

### SECTION 2 UNPACKING AND INITIAL CHECKOUT

2.1	Unpacking .....	2- 1
2.2	Initial Checkout .....	2- 1

### SECTION 3 OPERATION

3.1	Loading the Input Hopper .....	3- 1
3.2	Unloading the Output Stacker .....	3- 1
3.3	Control and Indicator Description .....	3- 1
3.4	Operating Procedures .....	3- 3
3.5	Operational Flow Chart .....	3- 6

### SECTION 4 THEORY OF OPERATION

4.1	Card Feeding Mechanism .....	4- 1
4.2	Data Recovery .....	4- 2
4.3	Detailed Functional Description .....	4- 4
4.4	Power and Signal Distribution .....	4-10

### SECTION 5 INTERFACE

5.1	General .....	5- 1
5.2	Reader Timing .....	5- 1
5.3	Signal Characteristics .....	5- 4
5.4	Connectors .....	5- 5
5.5	Grounding .....	5- 5

### SECTION 6 ADJUSTMENT PROCEDURES

6.1	General .....	6- 1
6.2	Tension on the Main Drive Motor Belt .....	6- 2

Paragraph		Page
6.3	Magnetic Pickup Adjustment . . . . .	6- 3
6.4	Adjustment of Stack Photo cell . . . . .	6- 5
6.5	Stacker Roller Shaft Bearing Preload . . . . .	6- 6
6.6	Hopper Empty Switch Adjustment . . . . .	6- 7
6.7	Stacker Full Switch Adjustment . . . . .	6- 8
6.8	Picker Sector Adjustment . . . . .	6- 9
6.9	Adjustment of Stack Follower . . . . .	6-13
6.10	Vacuum Belt Tension Adjustment . . . . .	6-13
6.11	Pinch Roller Tension Adjustment . . . . .	6-16
6.12	Adjustment of Preset and CSDS Timing . . . . .	6-19

SECTION 7  
PREVENTIVE MAINTENANCE

7.1	General . . . . .	7- 1
7.2	Cleaning . . . . .	7- 1
7.3	Lubrication . . . . .	7- 2

SECTION 8  
TROUBLE SHOOTING

8.1	General . . . . .	8- 1
-----	-------------------	------

SECTION 9  
REPAIR PROCEDURES

9.1	General . . . . .	9- 1
9.2	Required Tools . . . . .	9- 1
9.3	Main Drive Motor Belt . . . . .	9- 2
9.4	Third Stacker Roller Drive Belt . . . . .	9- 4
9.5	First Stacker Roller Drive Belt . . . . .	9- 6
9.6	Second Stacker Roller Drive Belt . . . . .	9- 6
9.7	First, Second and Third Stacker Roller Bearing Assemblies . . . . .	9- 8
9.8	Solenoid . . . . .	9-13
9.9	Vacuum Pump Assembly Belt . . . . .	9-15
9.10	Magnetic Pickup . . . . .	9-17
9.11	Pick Support Assembly . . . . .	9-19
9.12	Read Head/Light Station Assembly . . . . .	9-23
9.13	Fourth and Fifth Stacker Roller Bearing Assemblies . . . . .	9-25
9.14	First and Second Picker Roller Bearings . . . . .	9-28
9.15	Picker Sector . . . . .	9-29
9.16	Stack Photocell Assembly . . . . .	9-30
9.17	Hopper Negator Spring . . . . .	9-32
9.18	Lower Stacker Negator Spring . . . . .	9-32
9.19	Upper Stacker Negator Spring . . . . .	9-34
9.20	Hopper Empty Switch . . . . .	9-34

Paragraph		Page
9.21	Stacker Full Switch .....	9-34
9.22	Indicator Lamps .....	9-34

SECTION 10  
ASSEMBLY AND SCHEMATIC DIAGRAMS

SECTION 11  
- SIGNAL MNEMONICS AND ABBREVIATIONS

SECTION 12  
RECOMMENDED SPARE PARTS

78199/M1000L

## LIST OF TABLES

Table		Page
5-1	Signal Connector Pin List . . . . .	5- 6
5-2	Power Connector Pin List . . . . .	5- 6
8-1	Fault Isolation Chart . . . . .	8- 1
9-1	Conventional Tools Required . . . . .	9- 1
9-2	Special Tools Required . . . . .	9- 2
12-1	Major Assemblies, Reference Data . . . . .	12- 3
12-2	Replacement Parts List, Main Frame Assembly . . . . .	12- 7
12-3	Replacement Parts List, Base Plate Assembly . . . . .	12- 9
12-4	Replacement Parts List, Stack Support Assembly . . . . .	12-11
12-5	Replacement Parts List, Pick Support Assembly . . . . .	12-13
12-6	Replacement Parts List, Control Panel Assembly . . . . .	12-15
12-7	Replacement Parts List, Card File Assembly . . . . .	12-17
12-8	Replacement Parts List, Trim Group Assembly . . . . .	12-19
12-9	Recommended Accessories . . . . .	12-20



## LIST OF ILLUSTRATIONS

Figure		Page
1-1	Card Reader, Three-Quarter Front View .....	1- 2
1-2	Card Reader, Three-Quarter Rear View .....	1- 2
2-1	Unpacking .....	2- 2
3-1	Controls, Indicators and Connectors .....	3- 2
3-2	Operational Flow Chart .....	3- 4
4-1	Card Feeding Air Flow .....	4- 1
4-2	Block Diagram, M Series Card Reader .....	4- 3
4-3	Timing Relationship for Standard Punched Card .....	4- 4
4-4	Block and Timing Diagram, 4.8 MHz Oscillator and Four- Phase Generator .....	4- 5
4-5	Block and Timing Diagram, Control Logic .....	4- 6
4-6	Block and Timing Diagram, Pick Logic .....	4- 8
4-7	Block and Timing Diagram, Column Counter .....	4-10
4-8	Block and Timing Diagram, Error Logic .....	4-11
4-9	Block and Timing Diagram, Data Amplifiers and Inverters .....	4-14
4-10	Block and Timing Diagram, One Dark and One Light .....	4-15
4-11	Block and Timing Diagram, Data Control and Sync Logic Drivers .....	4-17
4-12	Block and Timing Diagram, Data Register and Data Drivers .....	4-18
5-1	Interface Timing Diagram .....	5- 2
5-2	Circuit Characteristics .....	5- 5
6-1	Front Panel and Top Cover Removal .....	6- 1
6-2	Rear Panel Removal .....	6- 2
6-3	Drive Motor Belt Tension Adjustment .....	6- 3
6-4	Magnetic Pickup Adjustment .....	6- 4
6-5	Card Cage Repositioning .....	6- 4
6-6	Location of Photocell Set Screw .....	6- 5
6-7	Stack Photocell .....	6- 6
6-8	Roller Shaft Bearing Preload Adjustment .....	6- 7
6-9	Hopper Empty Switch Adjustment .....	6- 8
6-10	Stacker Full Switch Adjustment .....	6- 9
6-11	Picker Sector Adjustment, Rear View .....	6- 9
6-12	Picker Sector Adjustment, Front View .....	6-10
6-13	Removal of Vacuum Tube Adapter .....	6-10
6-14	Solenoid Preload Adjustment .....	6-12
6-15	Removal of Rear Subframe Panel .....	6-14
6-16	Disconnecting Vacuum Pump Assembly .....	6-15
6-17	Removal of Vacuum Pump Assembly .....	6-16
6-18	Adjustment of Vacuum Pump Belt Tension .....	6-17
6-19	Preset Counter Strapping .....	6-18

78216/M1000L

Figure		Page
6-20	CSDS Duration Counter Strapping .....	6-18
7-1	Solenoid Lubrication .....	7- 2
9-1	Main Drive Motor Mounting .....	9- 3
9-2	Stacker Drive Train Belt Arrangement .....	9- 3
9-3	Stacker Drive Train Pulley Arrangement .....	9- 5
9-4	Pulley and Belt Configuration .....	9- 5
9-5	Pictorial, Stacker Roller Bearing Assembly .....	9-10
9-6	Pictorial, Solenoid Assembly .....	9-14
9-7	Removal of Subframe Panel, Main Card Cage Cover and Panel ..	9-16
9-8	Vacuum Pump Assembly Connections .....	9-16
9-9	Removal of Vacuum Pump Assembly .....	9-18
9-10	Vacuum Pump Belt Replacement .....	9-18
9-11	Magnetic Pickup Replacement .....	9-20
9-12	Card Cage Repositioning .....	9-20
9-13	Card Cage in Extended Position .....	9-21
9-14	Picker Casting Removal .....	9-21
9-15	Hopper Follower Assembly Removal .....	9-22
9-16	Pick Support Casting Removed from Reader .....	9-24
9-16A	Read Head Wiring Diagram .....	9-24
9-17	Pick Support Casting, Front View .....	9-24
9-18	Picker Sector, Rear View .....	9-30
9-19	Location of Stack Photocell .....	9-31
9-20	Stacker Negator Spring Replacement .....	9-32
9-21	Stacker Full Switch Replacement .....	9-33
10-1	Wiring Diagram, AC Power Distribution, 115 Vac, 60 Hz .....	10- 1
10-1A	Wiring Diagram, AC Power Distribution, 230 Vac, 50 Hz .....	10-1A
10-2	Card Cage, Printed Circuit Card Locations .....	10- 2
10-3	Wiring Diagram, Card File .....	10- 3
10-4	Schematic Diagram, Control Panel .....	10- 4
10-5	Schematic Diagram, 5-Volt Regulator .....	10- 5
10-6	Schematic Diagram, Solenoid Driver .....	10- 6
10-7	Assembly Diagram, Clock Card .....	10- 7
10-8	Schematic Diagram, Clock Card .....	10- 8
10-9	Assembly Diagram, Error Card .....	10-11
10-10	Schematic Diagram, Error Card .....	10-12
10-11	Assembly Diagram, Sync Card .....	10-14
10-12	Schematic Diagram, Sync Card .....	10-15
10-13	Preset Counter Strapping .....	10-18
10-14	CSDS Duration Counter Strapping .....	10-18
10-15	Assembly Diagram, Control Card .....	10-19
10-16	Schematic Diagram, Control Card .....	10-20
12-1	Figure Reference .....	12- 2

79089/M10L

Figure		Page
12-2	Main Frame Assembly .....	12- 5
12-3	Base Plate Assembly .....	12- 8
12-4	Stack Support Assembly .....	12-10
12-5	Pick Support Assembly .....	12-12
12-5A	Read/Light Station Assembly .....	12-13
12-6	Control Panel Assembly .....	12-14
12-7	Card File Assembly .....	12-16
12-8	Rear Panel Assembly .....	12-18

78348/M10L



SECTION 1  
INTRODUCTION

1.1            GENERAL

This technical manual contains operation, maintenance, interface, and repair information to properly set up, operate, and maintain the Documation Model M 600L Card Reader. An Illustrated Parts Breakdown is included in Section 12 to aid in locating and identifying parts if replacement becomes necessary.

A typical Documation M-Series Card Reader is illustrated in Figures 1-1 and 1-2. This reader is designed to process standard 12-row, 80 column punched cards. The hopper will hold approximately 1000 cards of .007" thickness. These are separated from the stack sequentially and moved past a phototransistor read station where data are recognized in a serial, column-by-column manner. The cards are then stacked into the output hopper in the same order as they were loaded into the input hopper. The reading cycle is externally controlled for single card selection or continuous run. In the continuous mode, the reader will read 600 cards per minute.

1.2            DESCRIPTION

The entire reader is constructed around a mainframe, Figure 1-1. The input hopper, card track mechanism, output stacker, control/indicator panel, and printed circuit card cage are all located on top of the mainframe. All logic circuitry is contained on printed circuit boards within the card cage. The drive motor, drive train, and part of the card pick mechanism are located on the underside of the mainframe. The vacuum pump/motor assembly and the remainder of the electronic components are mounted on a baseplate located in the bottom of the mainframe.

Three controls, a circuit breaker, the power input connector, the data input/output connector, and a cooling fan are located at the rear of the reader.

1.3            SPECIFICATIONS

READING SPEED:	600 cards per minute in continuous run. Single card cycle: 100 milliseconds
CARD TYPE:	Standard 80-column cards.
CONTROL:	Demand feed, one card at a time under external program control. Reader will run continuously as long as the Pick Command signal remains TRUE.
HOPPER SIZE:	7.25 inches (approximately 1000 cards of 7 mil thickness).

78125/M600L

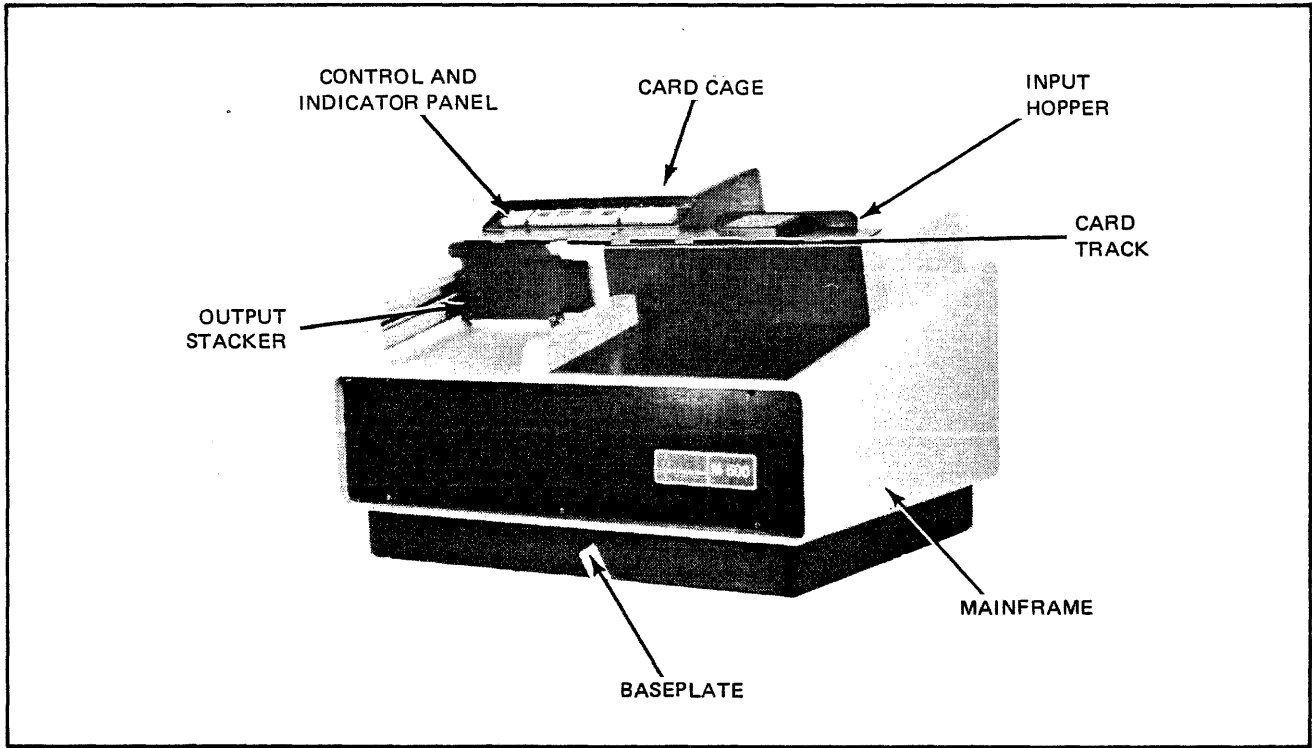


Figure 1-1. M-Series Card Reader, Front View

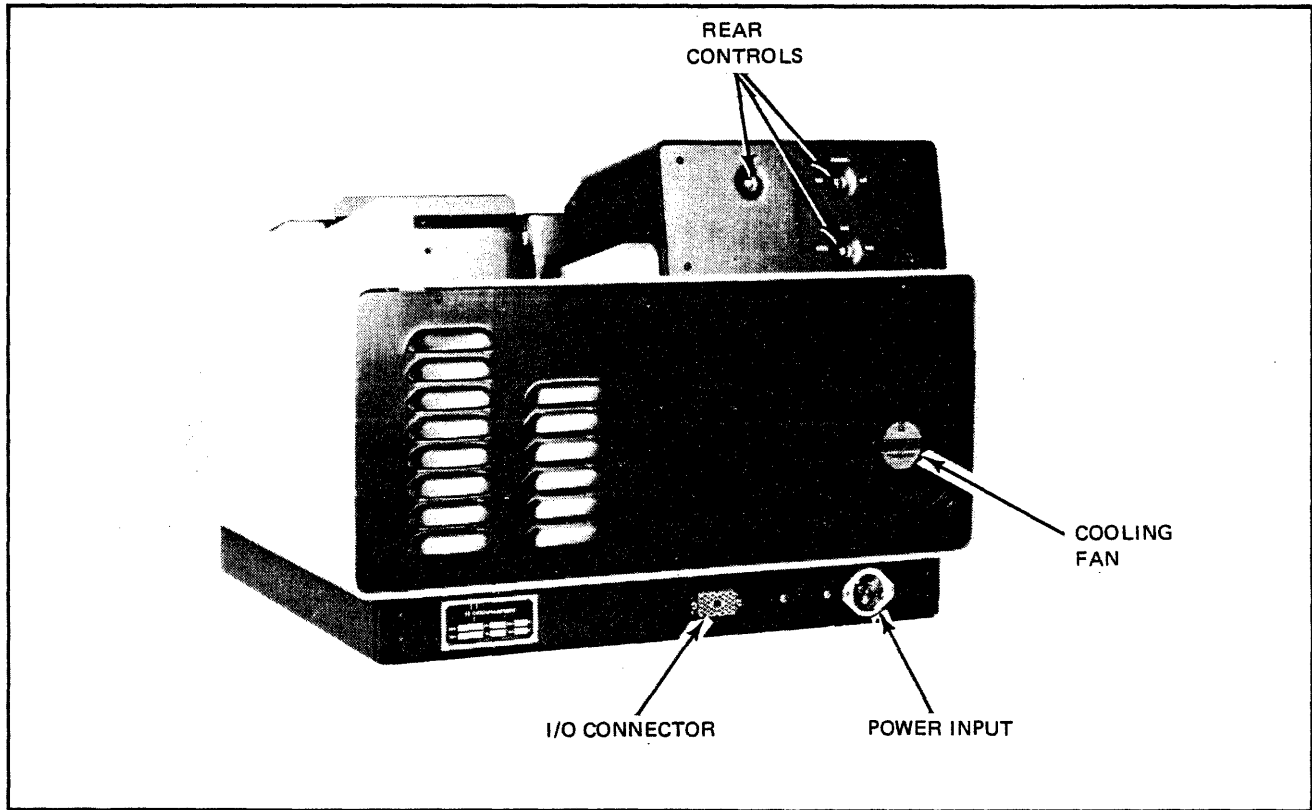


Figure 1-2. M-Series Card Reader, Rear View

78125/M600L

STACKER SIZE: 7.25 inches (approximately 1000 cards of 7 mil thickness).

INPUT:

Pick Command Logic TRUE for 1  $\mu$ s.  
-15 mAdc @ 0.8 Vdc (max)

OUTPUT:

Data lines and Interface Signals TTL type 7416 (GTRP) or 7417 (PTRP)  
I source = 400  $\mu$ Adc at 2.4 Vdc (min)  
I sink = -15 mAdc @ 0.4 Vdc (max)

POWER REQUIREMENTS:

Voltage: 115 Vac  $\pm$  10%, single phase, 60 Hz (standard model).  
230 Vac  $\pm$  10%, single phase, 50 Hz (export model).

Power: 1650 VA (max) starting load for 3 sec  
600 VA (max) running load

SIZE:

Height: 16-1/4 inches 41.2 cm

Width: 23-1/16 inches 58.6 cm

Depth: 18 inches 45.7 cm

WEIGHT: 77 pounds 34.4 kg

OPERATING ENVIRONMENT:

Dry Bulb Temperature 50 to 100° F.  
Relative Humidity 30 to 90% non-condensing  
Wet Bulb Temperature 80° F. maximum  
Thermal Shock 15° F. per hour  
Altitude 1000 feet below to 6000 feet above sea level

STORAGE ENVIRONMENT:

Dry Bulb Temperature -25 to +135° F.  
Relative Humidity 5 to 95% non-condensing  
Altitude 1000 feet below to 12,000 feet above sea level

78348/M10L

**CARD STOCK:**

The card must meet American National Standards specification ANSI X3.11-1969,  
Specification for General Purpose Paper Cards for Information Processing.

**PUNCH DATA:**

Punch data must meet American National Standards specification ANSI X3.21-1967.



## SECTION 2 UNPACKING AND INITIAL CHECKOUT

### 2.1 UNPACKING

M-Series Card Readers are packed in a sturdy triple container, (Figure 2-1), with protective padding to prevent damage to the equipment during shipment. Inspect the outside of the container and report any physical damage to the carrier immediately.

The power cord and technical manual are included in the container. After removing these items, lift the card reader straight up and place on a flat, sturdy surface. Inspect the reader for any physical damage; report any damage to Documentation Incorporated. With the reader tilted in an upright position, remove the two red 8 x 32 Phillips screws in the bottom plate. These screws secure the blower motor plate to prevent damage to the vibration isolators during shipment. If the reader is reshipped, these screws must be installed.

### 2.2 INITIAL CHECKOUT

Perform the following steps to test reader readiness:

- a. Ensure that input voltage and frequency are correct. Plug in the ac power cord.
- b. Operate the CIRCUIT BREAKER (rear connector panel) to ON.
- c. Operate the MODE switch (rear panel) to LOCAL.
- d. Operate the SHUTDOWN switch (rear panel) to AUTO.
- e. Operate the POWER pushbutton switch to energize the reader. The POWER indicator will illuminate and, after a delay of approximately 3 seconds, the STOP and HOPPER CHECK indicator will illuminate.
- f. Depress and hold the LAMP TEST pushbutton switch (rear panel) and observe that all front panel indicators illuminate. Release switch.
- g. Pull the hopper follower back and load approximately 3 inches of unpunched cards into the hopper.
- h. Operate the RESET pushbutton switch. The RESET indicator will illuminate and the STOP indicator will extinguish. The drive motor and vacuum/blower should come on and, after a delay of approximately 3 seconds, the cards should be picked and stacked. The drive motor and vacuum/blower will then shut off and the STOP and HOPPER CHECK indicators will illuminate.
- i. Operate the POWER pushbutton switch to turn off the reader. All indicators will extinguish.

j. Pull the stacker plate toward the front of the reader and remove the cards.

This completes the initial off-line test.

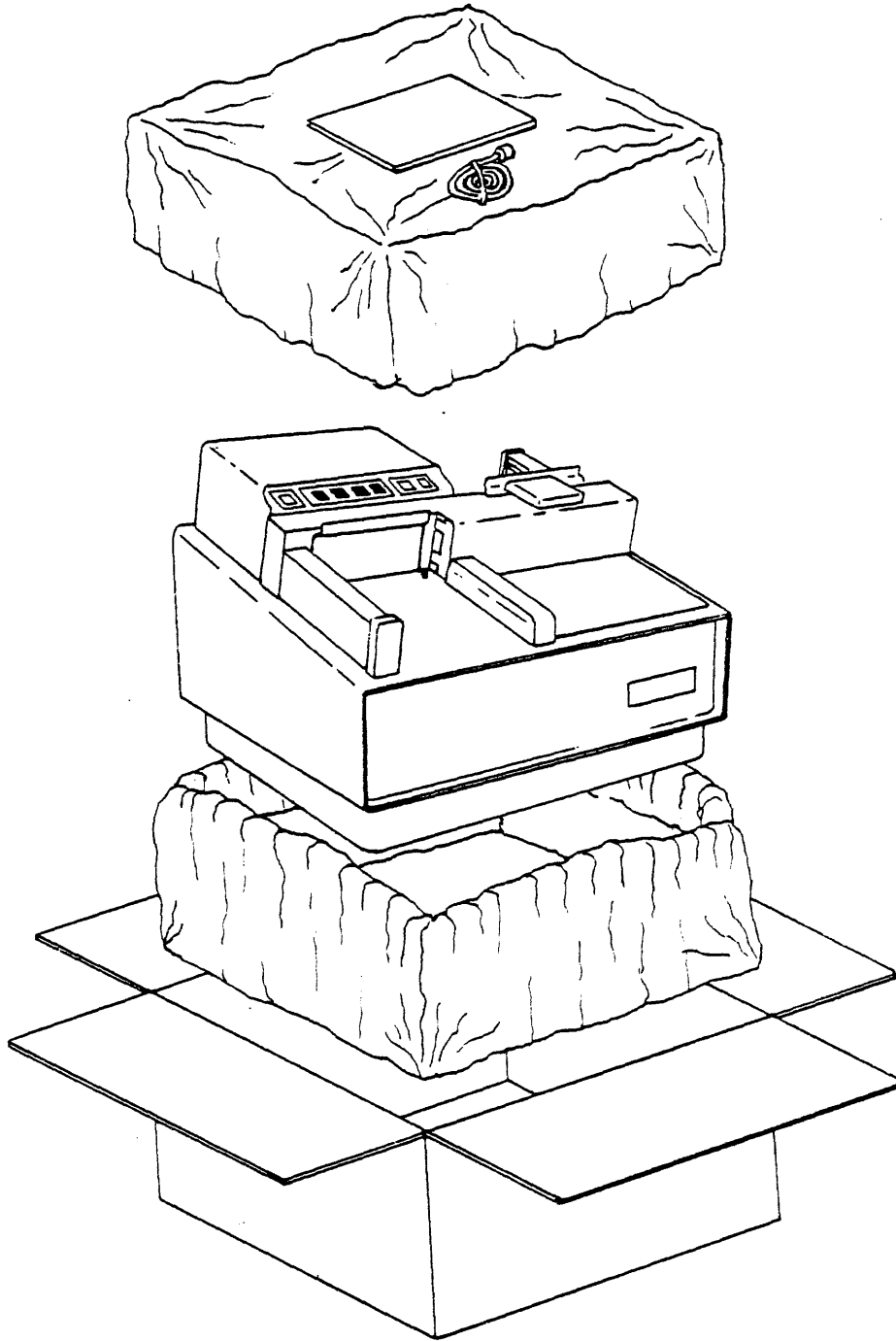


Figure 2-1. Unpacking

SECTION 3  
OPERATION

3.1 LOADING THE INPUT HOPPER

To load the input hopper:

- a. Pull the hopper follower back and place the card deck in the hopper; the first card to be read must be at the front with the "9" edge down, column "1" to the left. Continue placing cards into the hopper until it is loosely filled (approximately 1000 cards).

CAUTION

DO NOT PACK THE HOPPER SO FULL  
THAT RIFFLE ACTION IS INHIBITED

- b. The hopper may be loaded while cards are being read if the operator is careful to maintain tension on the front of the deck while loading additional cards at the rear. This may be done when the input hopper is one-half to one-third full. Use just enough pressure to maintain the riffle action.
- c. To unload the input hopper, reverse the loading procedure. Normally all cards are processed through the reader, but if it becomes necessary to unload the hopper, pull the follower back and remove the card deck. Exercise care in handling cards to maintain proper deck order.

3.2 UNLOADING THE OUTPUT STACKER

To unload the output stacker:

- a. Pull the stacker follower back and remove the front or rear portion of the card deck from the stacker area. Exercise care in handling cards to maintain proper deck order.
- b. To unload the stacker during operation, pull the stacker follower back and remove a portion of the deck, taking care to ease the stacker follower back to its normal position.

3.3 CONTROL AND INDICATOR DESCRIPTION

Reader controls and indicators, Figure 3-1, are located on the front control panel, the rear of the card cage, and the rear subframe. Control and indicator descriptions are as follows:

78125/M1000L

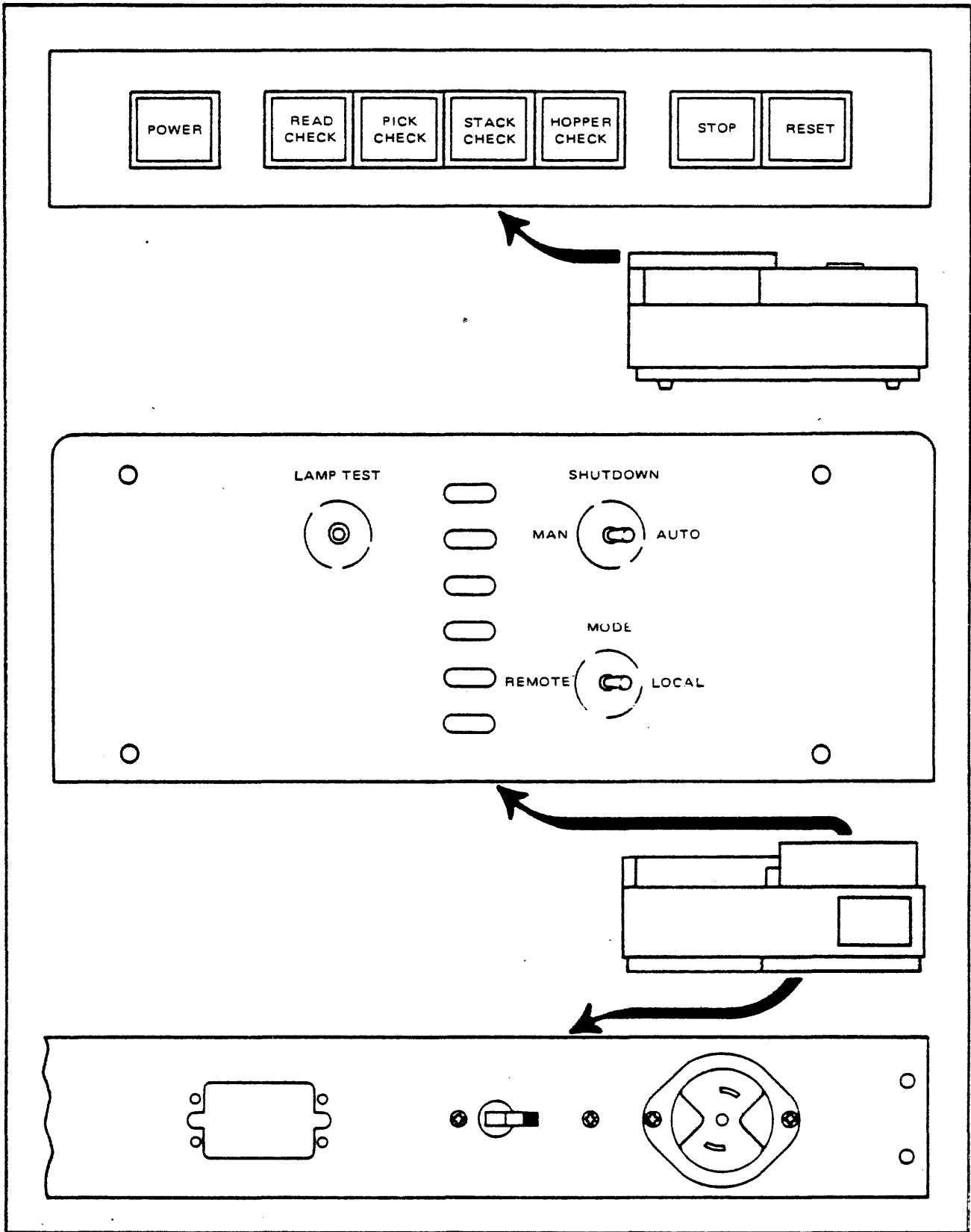


Figure 3-1. Controls, Indicators, and Connectors

### 3.3.1 FRONT PANEL CONTROLS AND INDICATORS

Three pushbutton switch/indicators are located on the front control panel.

POWER	(white)
STOP	(red)
RESET	(green)

Four other status indicators are also located on the front control panel:

READ CHECK	STACK CHECK
PICK CHECK	HOPPER CHECK

### 3.3.2 REAR READER CONTROLS

Two mode switches and a LAMP TEST pushbutton switch are located on the card cage rear panel. The two mode switches are:

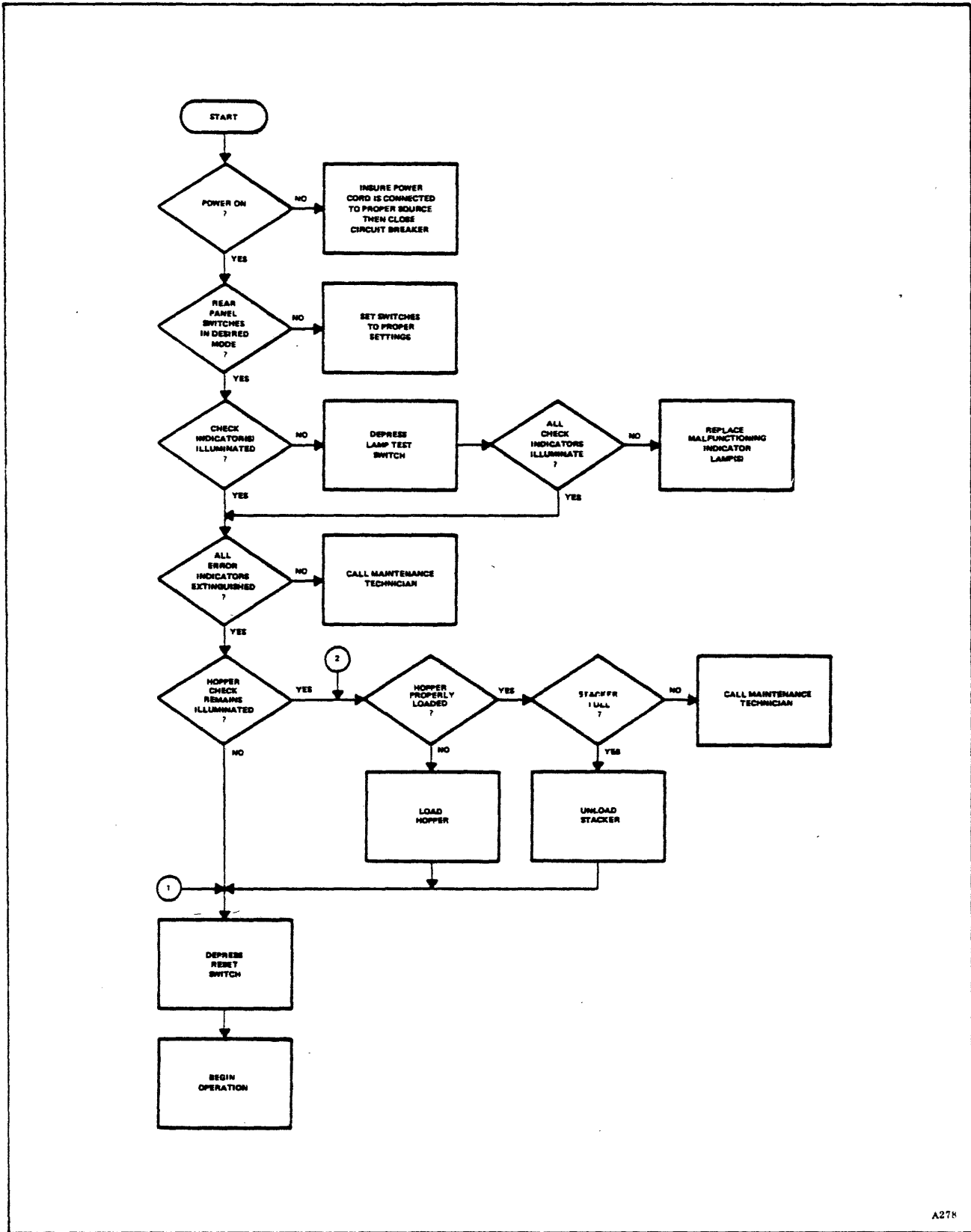
SHUTDOWN Mode - MAN/AUTO  
Operating MODE - REMOTE/LOCAL

A circuit breaker and power and signal connectors are located on the rear subframe panel.

## 3.4 OPERATING PROCEDURES

To operate the card reader, perform the following steps in order:

- a. Place the circuit breaker in the ON position.
- b. Select the mode of operation, MANUAL or AUTO. When MANUAL is selected, the drive motor and vacuum/blowers will run continuously when ac power is applied. When AUTO is selected, all motors will turn off after the last card is read.
- c. The second mode switch is used to select either REMOTE or LOCAL operation. When LOCAL is selected, card reader operation is controlled from the front control panel. In normal operation the card reader is connected to the appropriate interface logic and the switches should be in the AUTO and REMOTE positions.
- d. Select LOCAL and operate the POWER switch on the front panel to apply primary power to the reader. The drive motor and vacuum/blowers will not come on at this time if the input hopper is empty and AUTO shutdown mode has been selected.
- e. Depress and hold the LAMP TEST pushbutton switch and check that all front panel indicators illuminate. Release switch.



73216/M1000L

Figure 3-2 Operational Flow Chart (Sheet 1 of 2)

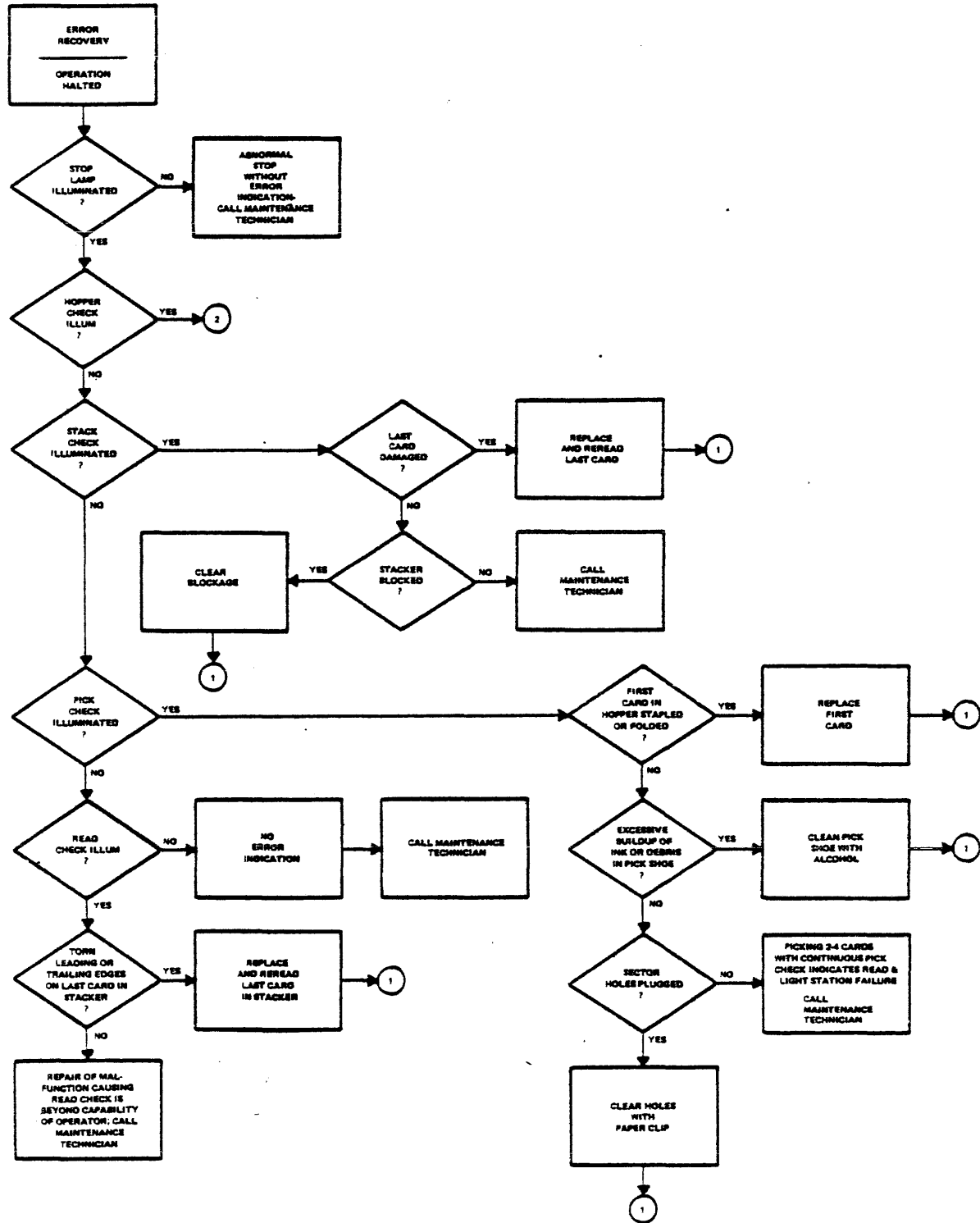


Figure 3-2 Operational Flow Chart (Sheet 2 of 2)

- f. Load the input hopper and operate the RESET pushbutton switch indicator. The RESET switch is used to clear any error conditions and establish the card reader "ready" condition. When the ready condition is established, the RESET indicator will illuminate green. All motors will start and riffling action begins on the first half inch of cards.
- g. As the cards are being read, the PICK CHECK indicator will illuminate if a card has failed to reach the read head after a pick command has been received. Inspect the cards in the input hopper for excessive leading edge damage, interlocked webs or cards stapled together. If no apparent card damage is present, check for excessive card warpage.
- h. The READ CHECK indicator will illuminate and the "stop" condition will be established when any of the following conditions are detected:
  - 1. Failure of leading or trailing edge dark check.
  - 2. Failure of trailing edge light check.
  - 3. Card slippage.
  - 4. Failure of control logic.
  - 5. Two cards picked.
- i. The STACK CHECK indicator will illuminate if the previous card read has not reached the output stacker. Check the card track to make sure it is clear and check the output stacker for incorrectly stacked cards.
- j. The HOPPER CHECK indicator will illuminate when the input hopper is empty or when the output stacker is full.
- k. The STOP switch/indicator is used to terminate card reader operation at the end of a read cycle. The STOP indicator will illuminate red when the "stop" condition is established.

### 3.5 OPERATIONAL FLOW CHART

Figure 3-2 is a flow chart of possible problems which may be encountered in operating the reader. If trouble is experienced, refer to this check list before calling for maintenance assistance.

78314/M1000L



SECTION 4  
THEORY OF OPERATION

4.1 CARD FEEDING MECHANISM

The card feeding mechanism, Figure 4-1, is designed around an air flow system that uses air pressure to separate the cards and a vacuum to pick the cards. Pressurized air ruffles the first half inch of cards in the input hopper so that they stand apart, individually "air cushioned" from the rest of the card deck and each other. This prevents the cards from sticking together in case of static electricity, hole locking, or torn webs and eliminates frictional forces between the cards. The vacuum picker pulls the bottom card in and holds it against the picker's rubber surface. When a pick command is received, electronic circuitry drives a rotary solenoid coupled to the picker sector, causing it to rotate. As the solenoid rotates the sector, the card is accelerated into the pinch rollers, which pull the card into the card track. As the card in the track clears the picker surface, the next card in the hopper is drawn against the picker sector, ready for the next pick command.

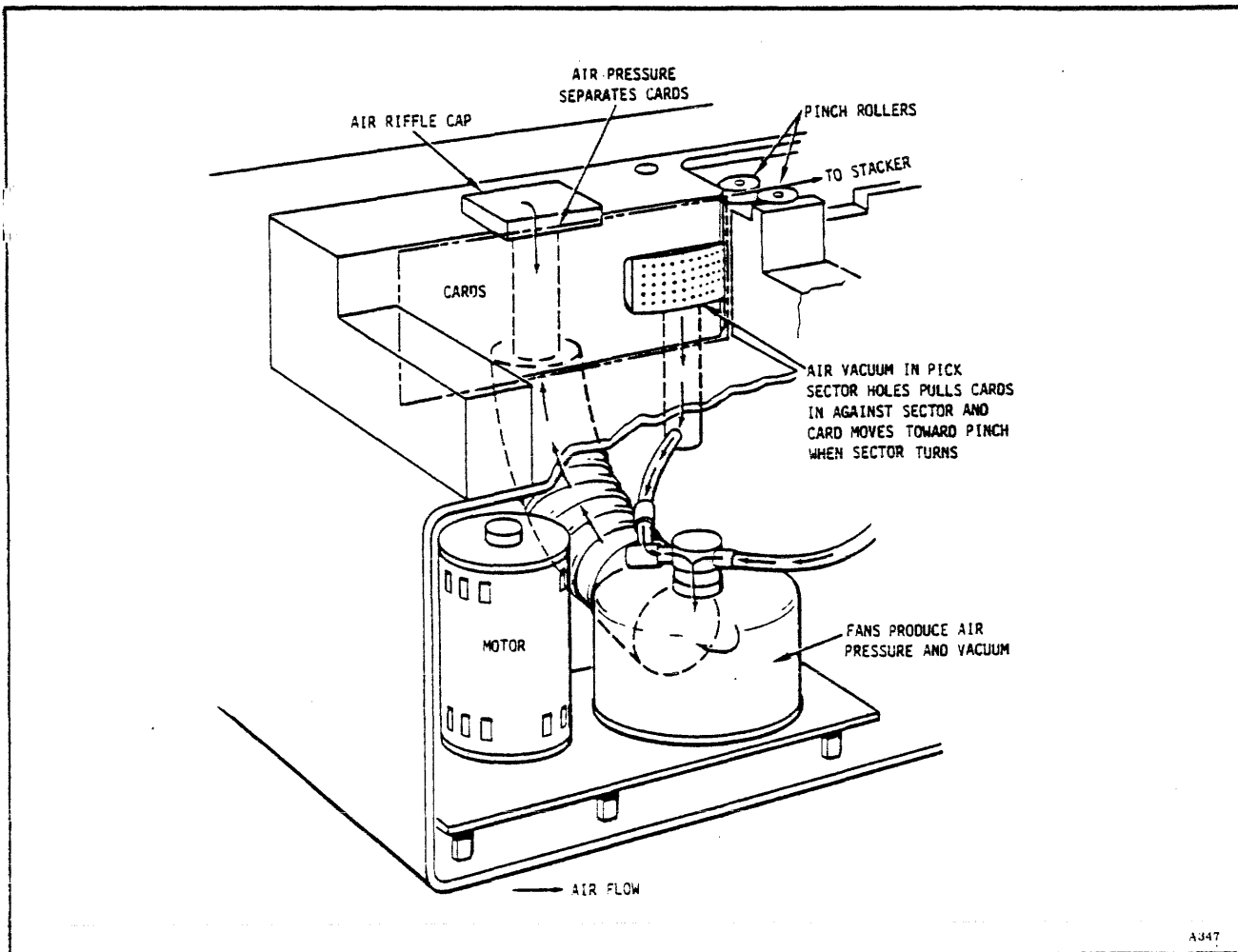


Figure 4-1. Card Feeding Air Flow

## 4.2 DATA RECOVERY

The logic block diagram for the M Series Card Reader is shown in Figure 4-2.

Data recovery is accomplished by the functions of Reader Control, Data Detection and Data Storage. Reader Control synchronizes the electronic scanning of the card with the mechanical actions of the reader. This involves card picking, card movement through the read station, data flow control and card stacking. Data Detection converts the light/dark conditions of the read station into usable digital signals for Data Storage. Data Storage provides the data synchronization, buffering and retainment required for data transfer from the reader.

### 4.2.1 READER CONTROL

Primary control timing is established by the 4.8 MHz logic oscillator and the four-phase generator. These are used to shift, store and control other logic operations. Card movement speed is established by the hysteresis synchronous drive motor, belts and steel drive rollers. Electronic tracking of card movement is accomplished by a timing disc comprised of a ferrous notched wheel mounted to one of the steel drive roller shafts. A magnetic reluctance pickup is used with the timing disc to provide the synchronization signals to the reader electronics.

When Pick Command (PICK CMD) is received from the controlling device, card processing will be started provided no alarm conditions exist. The Pick logic then produces a PICK signal to the solenoid driver, a PCLK signal to the Control logic, and a Pick Command Reset (PCR) to the column counter. These actions initialize the various control circuits and energize the solenoid to pick a card from the input hopper. If a card does not reach the read station, the PICK CHECK alarm is raised.

The read station and stacker utilize phototransistor sensors to read the punched hole pattern and to monitor movement of the card. When a card is picked and moved into the card track, the leading edge interrupts light to the read station. This produces a ONE DARK signal that is used by the Control logic to generate a Good Pick Reset (GPR) which initializes the synchronization of card movement through the read station. The column counter then counts columns via the Data Control and Sync logic as the card moves past the read station, thus synchronizing the mechanical card movement with the electronic circuits. The column counter generates a Dark Check (DARK CHECK) signal at Columns 0 and 81, and a Light Check (LT CHECK) signal at Column 84. Figure 4-3 shows these check positions. These checks monitor performance of the read station and mechanical card movement.

### 4.2.2 DATA DETECTION

As the card passes between the Light Emitting Diodes (LEDs) of the light station and the phototransistors of the read station, the light and dark conditions are sensed and amplified by the read station phototransistors. The light (punched hole) and dark conditions are converted to electronic signals at the phototransistor emitters and used to drive the data

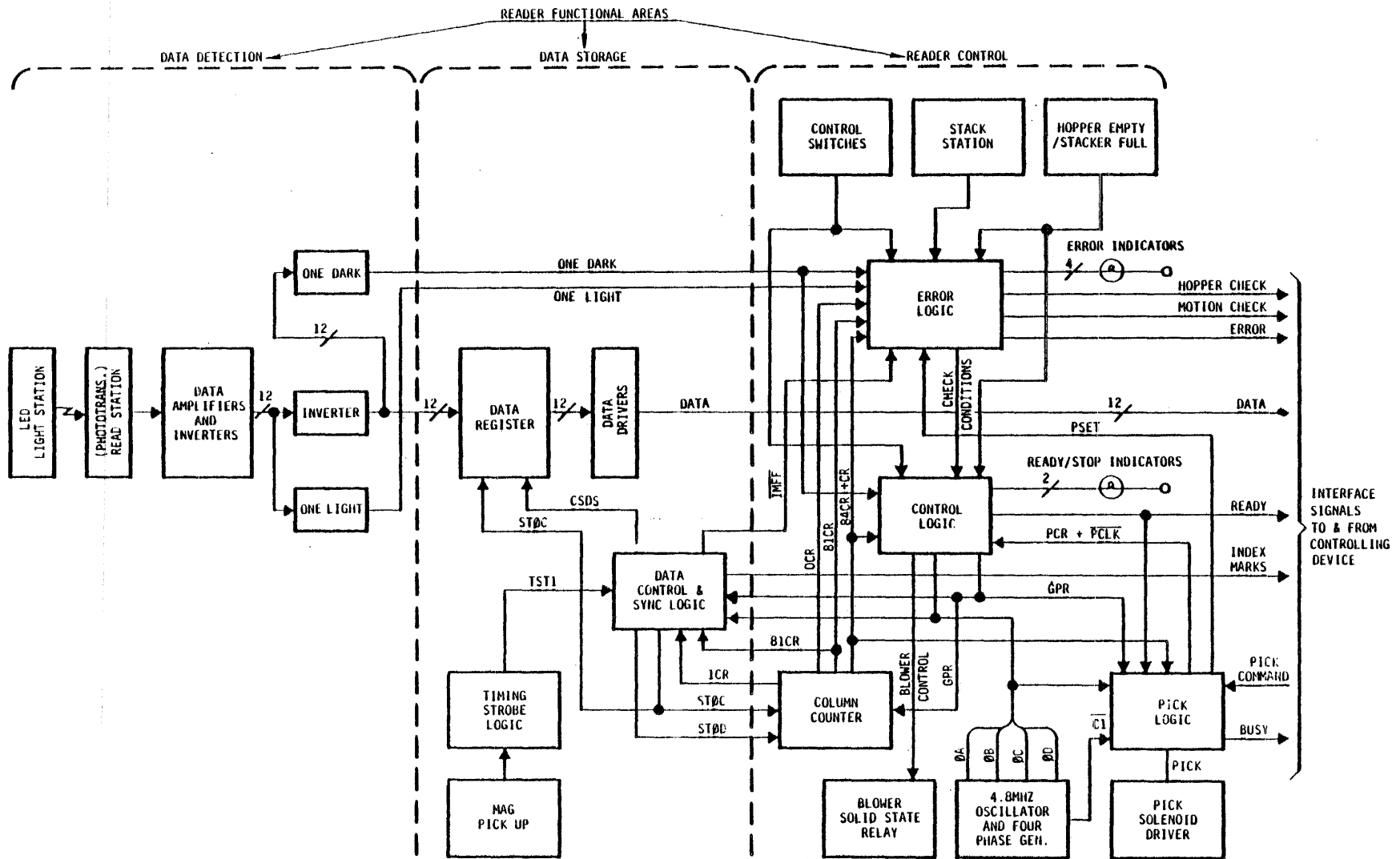


Figure 4-2. Block Diagram, M Series Card Reader

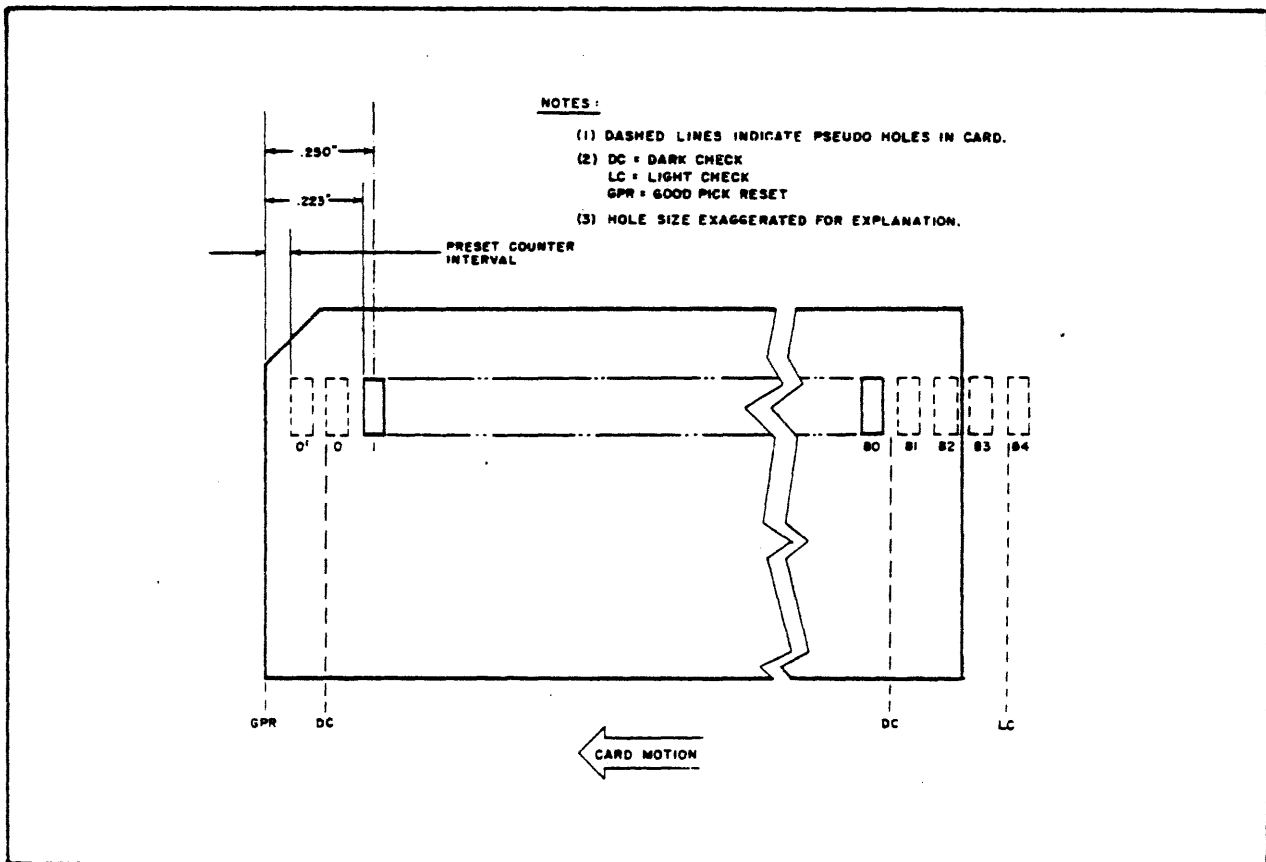
amplifiers and inverters. Outputs of the data amplifiers and inverters pass through the One Light/One Dark inverters and provide detected data to the data register.

#### 4.2.3 DATA STORAGE

To accomplish Data Storage, the Data Control and Sync logic sends Column Synchronized Data Strobes (CSDS) to the data register at predetermined punched column positions. Synchronization is initiated with the signals generated by a notched ferrous timing disc attached to one of the drive roller shafts. As the timing disc rotates, a reluctance pickup senses movement of the notches past the pickup and translates this movement to timing signals. These signals are used by the Data Control and Sync logic to generate CSDS for each of the 80 columns. Data Storage includes data drivers that provide buffering between the data register and the interface lines.

#### 4.3 DETAILED FUNCTIONAL DESCRIPTION

The following is a detailed functional description of the card reader. The description provides an in-depth explanation of the operation of the equipment. Familiarity with the signal mnemonics listed in Section 11 will aid in interpreting the description that follows and the logic schematics in Section 10.



78261/M1000L

Figure 4-3. Timing Relationship for Standard Punched Card

### 4.3.1 READER CONTROL

The following are detailed descriptions of blocks shown under Reader Control in Figure 4-2, Block Diagram, M Series Card Reader.

#### 4.3.1.1 4.8 MHz Oscillator and Four-Phase Generator

The block diagram and timing diagram for the 4.8 MHz Oscillator and Four-Phase Generator is shown in Figure 4-4. The oscillator is crystal controlled and provides a TTL-compatible 4.8 MHz square wave as an output. The 4.8 MHz output is divided by ten in a decade counter and the 480 kHz output used to drive the Four-Phase Generator. The Generator then divides the 480 kHz by four, generating signals  $\emptyset A$ ,  $\emptyset B$ ,  $\emptyset C$ ,  $\emptyset D$  and  $\overline{CI}$  as shown by the timing diagram of Figure 4-4.

$\emptyset A$ ,  $\emptyset B$ ,  $\emptyset C$ ,  $\emptyset D$  and  $\overline{CI}$  are used throughout the reader as timing reference signals.

#### 4.3.1.2 Control Logic

The Control Logic (Figure 4-5) contains the Ready/Stop logic, Power On Reset, Blower control, Reset control and Good Pick Sync Control. When reader power is applied, a three-second Power On Reset (POR) is initiated. See timing of Figure 4-5. The long POR allows the blower to come up to speed before the controlling device or an operator can initiate reader operation. POR is also used to initialize the Pick logic and column

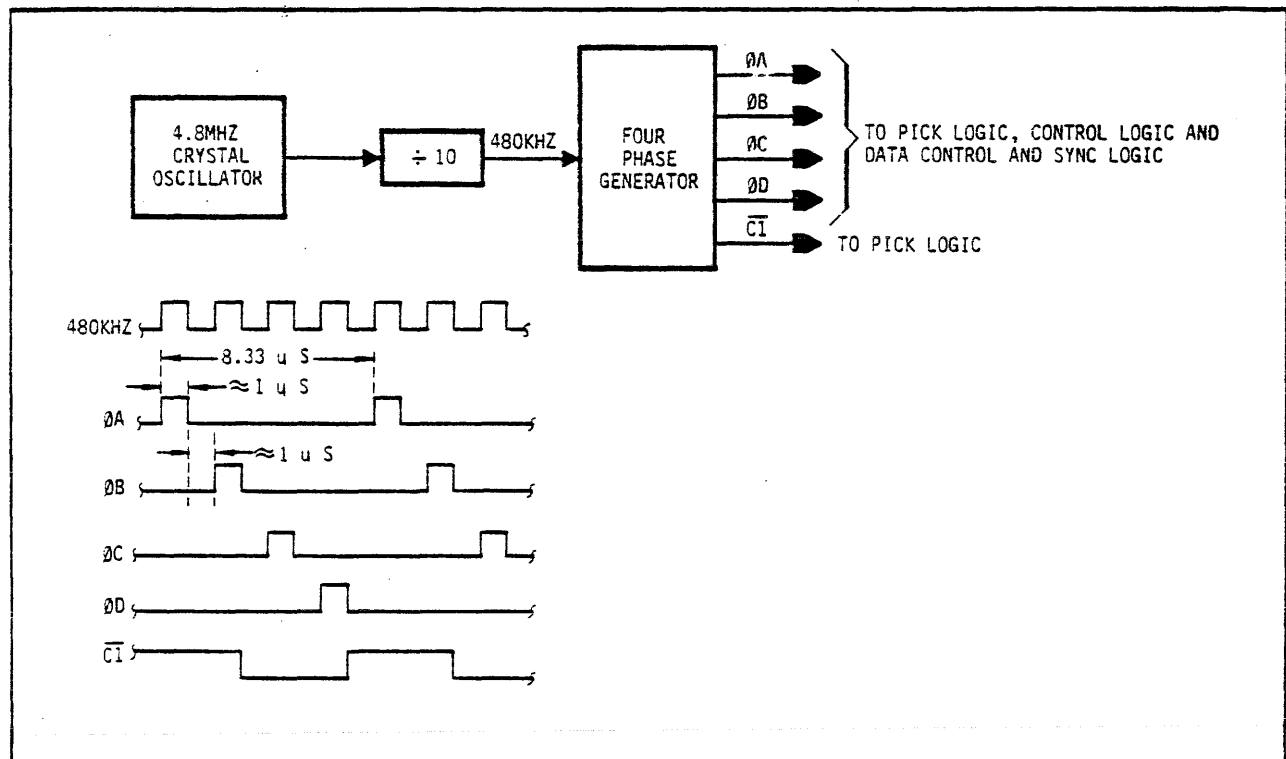


Figure 4-4. Block and Timing Diagram, 4.8 MHz Oscillator and Four-Phase Generator

78125/M1000L

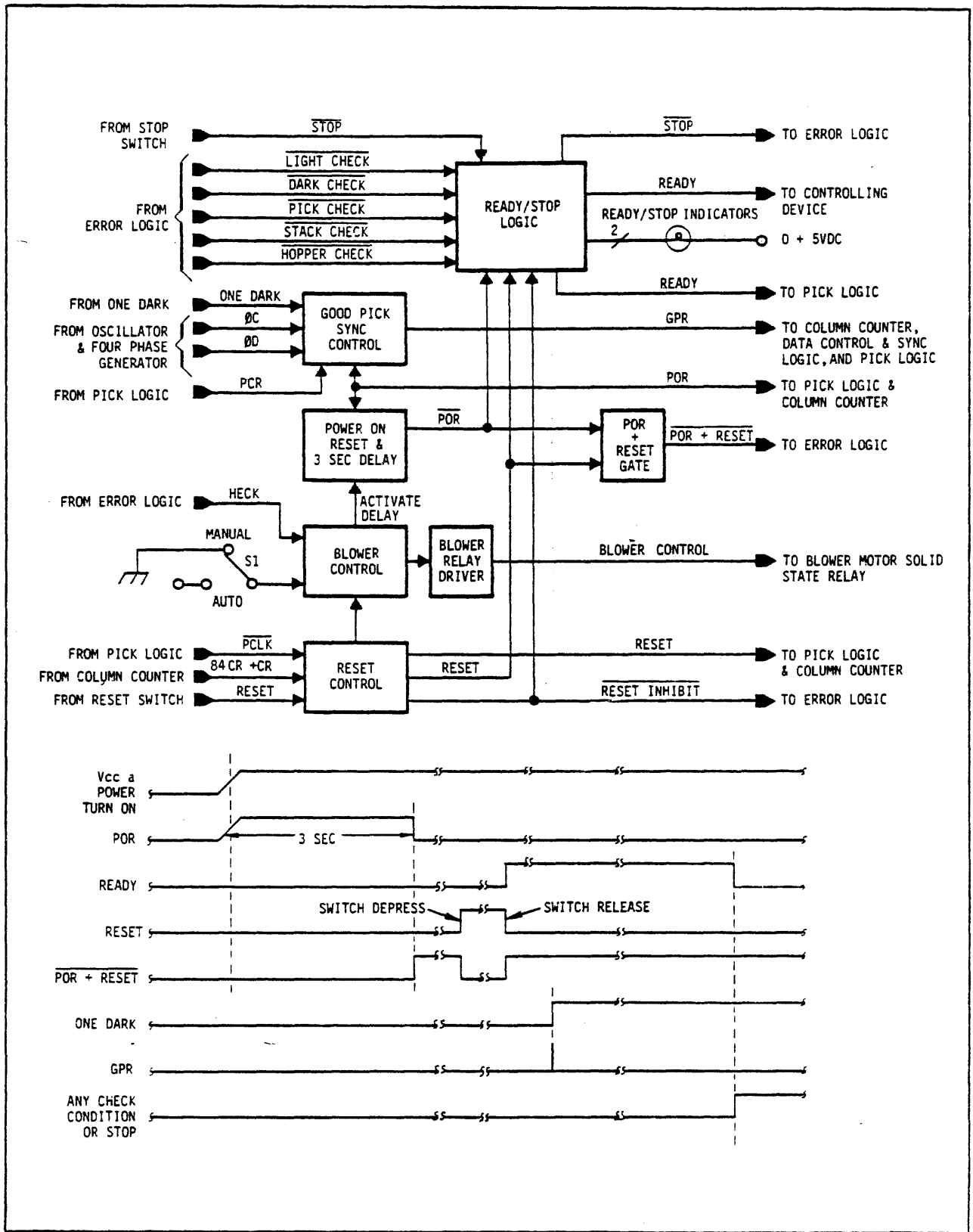


Figure 4-5. Block and Timing Diagram, Control Logic

counter.  $\overline{\text{POR}}$  OR'ed with  $\overline{\text{RESET}}$  to form  $\overline{\text{POR} + \text{RESET}}$  resets the Error logic. The reader is now brought to the ready state by the operator depressing and releasing the RESET pushbutton switch. Note that while the RESET switch is depressed, RESET is routed to initialize the Pick logic and column counter, and  $\overline{\text{RESET}}$  activates  $\overline{\text{POR} + \text{RESET}}$  to the Error logic. The Reset control is designed to ignore all RESET switch signals while a read cycle is in progress. Signals  $\overline{\text{PCLK}}$  and 84CR or CR identify the beginning and end of a read cycle.

When the RESET switch is released, READY is signalled to the controlling device by the Ready/Stop logic provided  $\overline{\text{HOPPER CHECK}}$  is not being presented by the Error logic. (All other Error logic check signals will be reset by  $\overline{\text{POR}}$  and  $\overline{\text{RESET}}$ .) Ready status is indicated to the operator by the RESET switch/indicator illuminating (green). The controlling device can now begin a read cycle by transmitting PICK CMD to the reader. READY will be reset on receipt of any  $\overline{\text{CHECK}}$  signal from the Error logic or if the STOP switch is depressed by the operator and  $\overline{\text{RESET INHIBIT}}$  is not present. The Ready/Stop logic gates the  $\overline{\text{STOP}}$  signal with  $\overline{\text{RESET INHIBIT}}$  preventing READY from being reset due to  $\overline{\text{STOP}}$  during a card read cycle.  $\overline{\text{RESET INHIBIT}}$ , generated by the Reset control, is set by PCLK and reset by 84CR or CR. The Stop condition is indicated by the STOP switch/indicator illuminating (red).

The Good Pick Sync control is initialized by Pick Command Reset (PCR). During a card read cycle, the Good Pick Sync control detects a ONE DARK and processes this signal with clock signals  $\emptyset\text{C}$  and  $\emptyset\text{D}$  to produce Good Pick Reset (GPR). GPR is used to:

- a. Initialize the column counter.
- b. Begin the data synchronization process by the Data Control and Sync logic.
- c. Verify to the Pick logic that a pick command has been successful.

The Blower control provides signals to control ac power to the blower motors. The blower motors automatically shut down when a Hopper Empty Check (HECK) signal exists and switch S1 is in the AUTO position. After the hopper empty condition is corrected by reloading the input hopper, operating the RESET switch will cause the Blower control logic to activate the 3-second POR. The 3-second POR provides sufficient time for the blower to reach operating speed before reader operation can begin. When the SHUTDOWN switch is in the MANUAL position, the blower remains on as long as reader power is applied.

#### 4.3.1.3 Pick Control

After the reader is brought to a ready condition, a PICK CMD from the controlling device can be accepted by the Pick control (Figure 4-6).

The Pick Logic will then:

- a. Generate PCLK.
- b. Initiate a PICK pulse that drives the picker solenoid.

- c. Control the PICK pulse length.
- d. Wait out the interval while the card leading edge is accelerated to the read station (14 to 27 ms).
- e. If the leading edge has not arrived in 50 ms, generate another pick pulse.
- f. Repeat the pick attempt six times and if the leading edge has not appeared, generate a pick fail alarm ( $\overline{PSET}$ ).

The Pick control generates  $\overline{PCLK}$  (Figure 4-6) until GPR is received or READY goes FALSE due to the pick fail signal,  $\overline{PSET}$ .  $\overline{PCLK}$  gated from Pick control is divided by two decade MSI counters to a frequency of 1.2 kHz. The 1.2 kHz is then counted by the Pick Control counter. At the count of one the Pick Control counter sets the Pick flip-

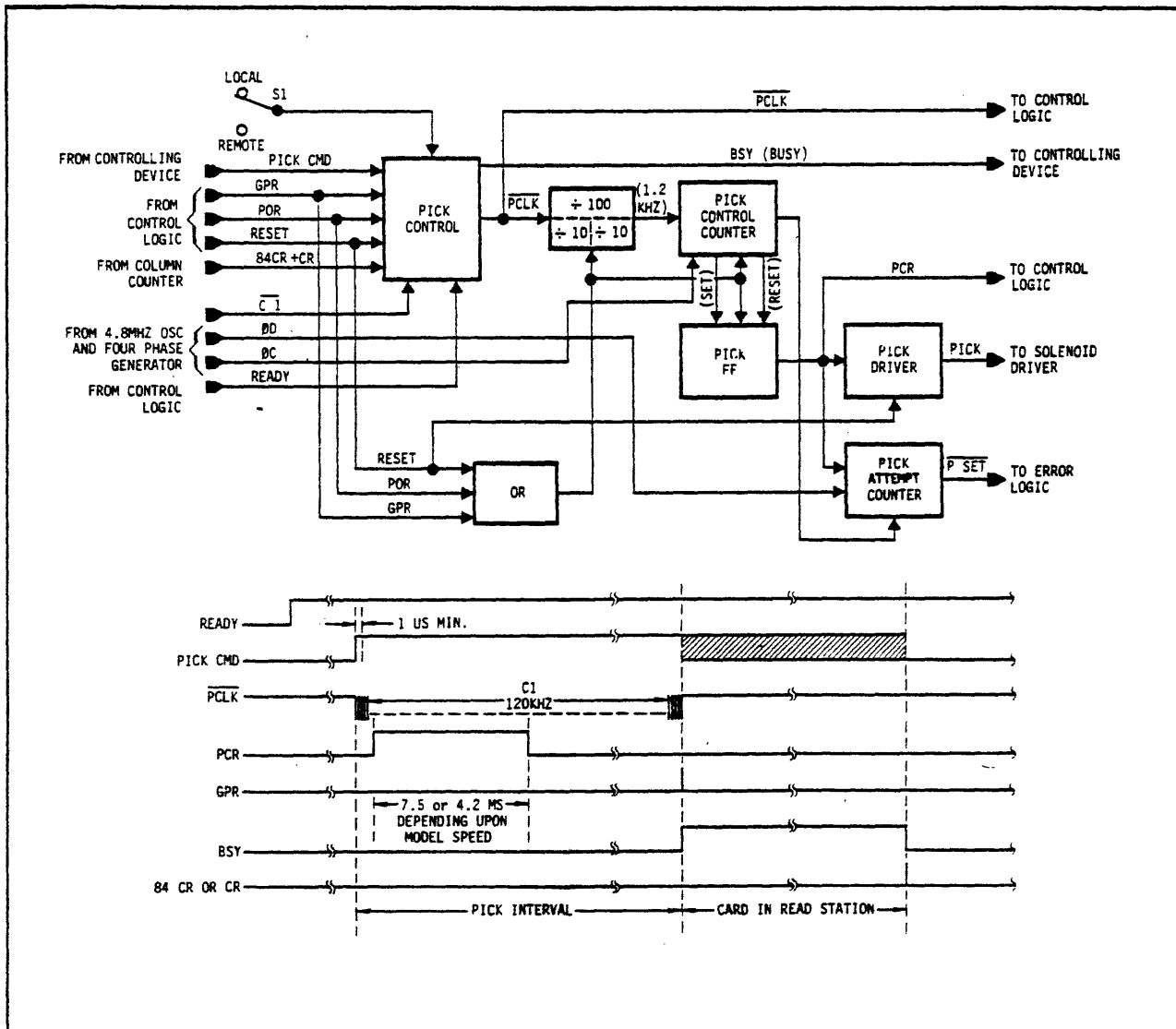


Figure 4-6. Block and Timing Diagram, Pick Logic



flop. This begins the PICK pulse interval. The Pick Control counter continues to count the 1.2 kHz until 10 is decoded, generating a reset to the Pick flip-flop and ending the PICK pulse. PCR, generated by the Pick flip-flop is used by the Control logic to initialize the Good Pick Sync control. The Pick Control counter continues to count the 1.2 kHz while awaiting GPR. If no GPR is received by the count of 63, the Pick Control counter resets to all zeros and begins its count cycle again generating another PICK and PCR. PICK and PCR pulses will continue to be generated until GPR is received or the Pick Attempt counter counts six PCRs and the Pick Control counter reaches count 56. When six PCRs have been counted and count 56 is reached PSET is generated. PSET will cause READY to go FALSE. terminating PCLK.

Upon receipt of a GPR, the Pick control signals a Busy (BSY) to the controlling device to indicate a card has entered the read station. BSY remains true until 84CR indicates the card has left the read station and another PICK CMD will be accepted.

The position of the MODE switch determines the source of the PICK CMD. In LOCAL, the PICK CMD signal is held TRUE so that whenever the reader is READY, a PICK CMD is generated internally each time 84CR is reached. When in REMOTE, only a PICK CMD from the controlling device can initiate a read cycle.

#### 4.3.1.4 Column Counter

The Column Counter (Figure 4-7) provides a record keeping control function by counting and decoding columns as the card passes through the Read Station. Following GPR, STØC followed by a STØD (Refer to timing diagram of Figure 4-7) will be generated for each column by the Data Control and Sync logic. STØC is used to drive the Column Counter and STØD to sample the Count Gating. The Column Counter generates OCR (0 Column reset), 1CR, 81CR and 84CR. These signals are used by the Control logic, Data Control and Sync logic, Pick logic and Error logic as follows:

<u>COUNT</u>	<u>USED BY</u>
0CR	Error logic for a Dark Check
1CR	Data Control and Sync logic to set the Index Mark Control Flip Flop (IMFF).
81CR	Data Control and Sync logic to reset the IMFF. Error logic for a Dark check. Error logic for a Stack check.
84CR	Control Logic to reset the Reset Inhibit Flip Flop. Pick logic to enable the Pick control for the next PICK CMD and reset BUSY. Error logic for a Light check. Data Control and Sync logic to reset the Sync Control logic.

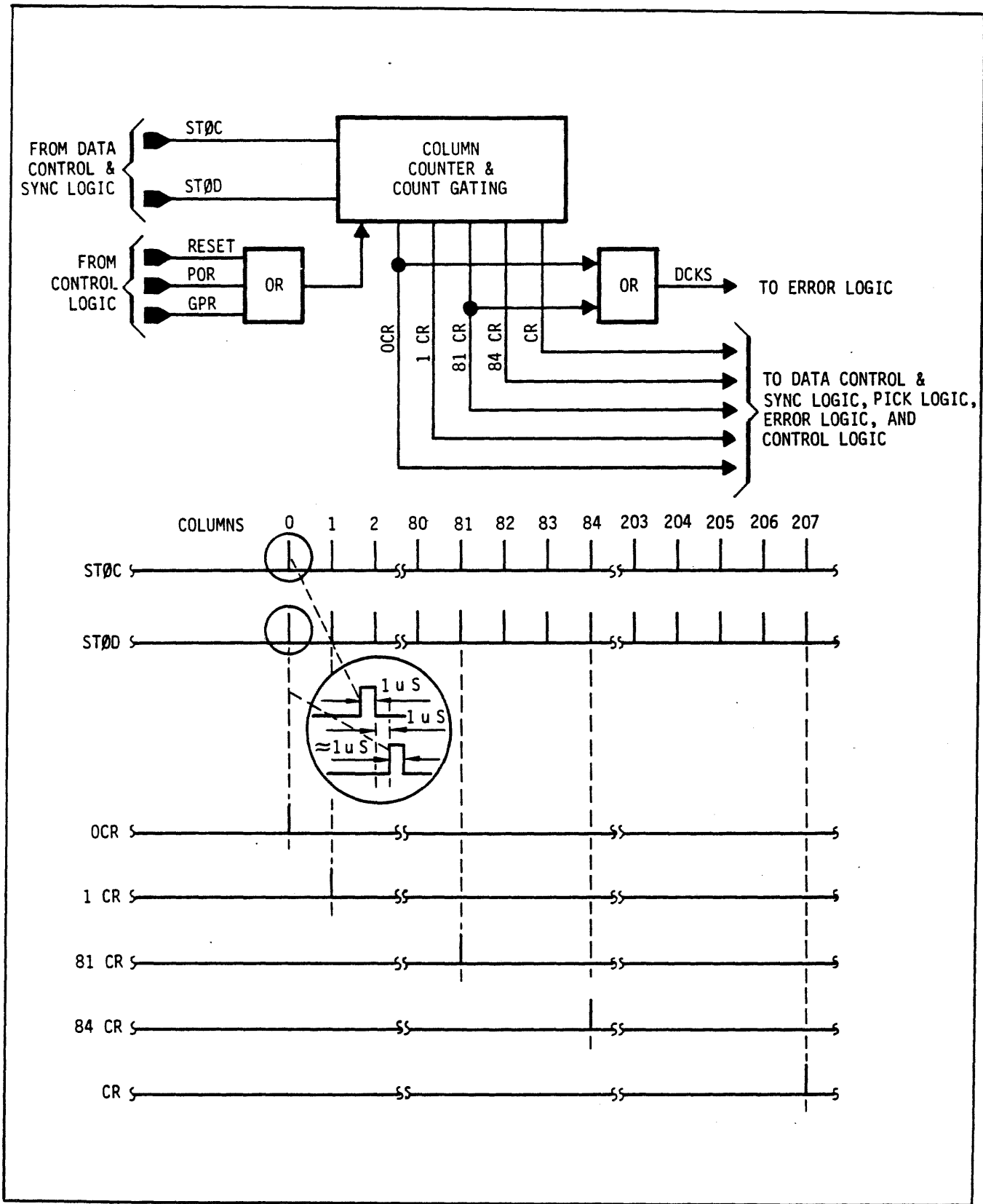


Figure 4-7. Block and Timing Diagram, Column Counter

78125/M1000L

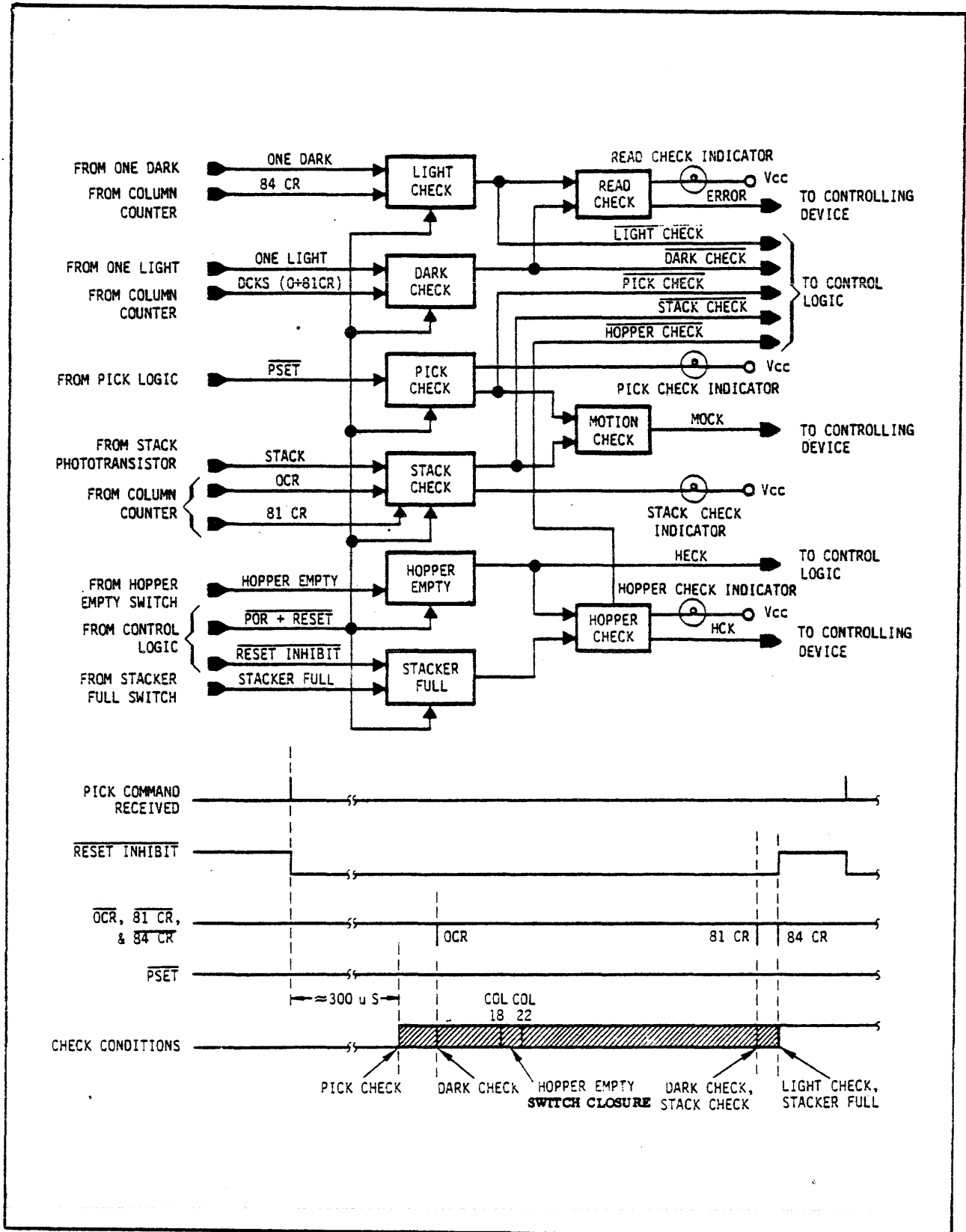


Figure 4-8. Block and Timing Diagram, Error Logic

The Column Counter counts until 84CR is generated. The Column Counter is reset to zero by each GPR and RESET or POR.

#### 4.3.1.5 Error Logic

The Error Logic of Figure 4-8 contains the error/alarm detection circuits and the Ready gate.

After a PICK CMD is accepted by the reader, the Error Logic is sampled at intervals of card processing for error and reader conditions. The first test is a Pick Check. If a PSET is signalled to Pick Check logic, a Motion Check (MOCK) signal will be sent to the controlling device. PSET will occur approximately 300 ms after PICK CMD was received and READY will be reset. Pick Check status is signalled to the operator by the PICK CHECK indicator. If a Pick Check (PCK) signal does not occur, a read cycle is in process and OCR will sample the Dark Check circuits. If ONE LIGHT is present during the check, indicating a failed LED, phototransistor, or a torn card leading edge, an ERROR signal will be sent to the controlling device and READY dropped. The READ CHECK indicator will illuminate.

The Hopper Empty circuit senses closure of the hopper empty microswitch. This switch is located under the riffle cap and senses when the last card has left the hopper. The hopper empty switch will close between columns 18 and 22 of the last card. A Hopper Check (HCK) signal is sent to the controlling device and READY is reset. The HOPPER CHECK indicator will illuminate.

OCR will be followed by 81CR which samples the Stack Check circuits and again samples the Dark Check circuits. The stack check sensor is located at the exit of the card track and detects that the tail of a card has cleared the card track and the card is therefore fully seated in the output stacker. The Stack Check logic is designed to test the stack sensor dark-to-light transition (i. e., track clear) between the time an 81CR signal occurs (card tail leaving the read station) and the OCR signal of the next card. If this transition has not taken place, a STACK CHECK signal is generated. This signal generates a MOCK signal to the controlling device and resets the READY line. The STACK CHECK indicator will illuminate.

84CR occurs next in the read cycle and samples the Light Check circuitry. A ONE DARK present at 84CR indicates a failed LED, phototransistor, excessive card slip in the read track or that two cards were transported thru the card track. An ERROR signal is sent to the controlling device and the READY line is reset. The READ CHECK indicator will illuminate.

Since 84CR is also used to reset RESET INHIBIT, the Stacker Full circuit will be checked for a closure of the Stacker Full switch. If the switch is closed, the Stacker Full circuitry will send HCK to the controlling device and reset READY. The HOPPER CHECK indicator will illuminate.

All error conditions are cleared by operation of the RESET switch.

#### 4.3.2 DATA DETECTION

The following are detailed descriptions of blocks shown under data detection in Figure 4-2, Block Diagram, M Series Card Reader.

##### 4.3.2.1 Data Amplifiers and Inverters

The light station contains one infrared Light Emitting Diode (LED) and the read station one phototransistor for each of the 12 punched card rows. Light emitted by an LED is allowed to pass to its corresponding phototransistor when a punched hole in the tab card is present. Figure 4-9 presents a block diagram and typical waveform for the data amplifiers and inverters. Light reaching a phototransistor is amplified by the phototransistor and converted into an electrical signal at its emitter. A typical emitter waveform is shown as ROW 12 (A). As the leading edge of the card passes over the phototransistor lens, the received light is reduced, thereby causing a reduction in the phototransistor output voltage. The emitter is coupled across pull-down resistor R to the input of a high impedance TTL inverter. When the emitter voltage passes through the switching threshold of the inverter (nominally 1.4 volts) the inverter changes state. The output of the high impedance inverter is amplified by the inverter and then used to drive the one light and one dark logic. Each time the threshold of the high impedance inverter is crossed the device switches states, producing waveform ROW 12 (B) at the output of the inverter.

##### 4.3.2.2 One Dark and One Light

In order to provide the dark check at 0CR and 81CR and the light check at 84CR, the outputs of the data amplifiers and inverters are OR'ed in a one light NOR gate and inverted and OR'ed in a one dark NOR gate. These NOR gates each consist of 12 open-collector TTL inverters in a wired OR configuration. Figure 4-10 is a block and timing diagram for the one dark and one light logic.

When 0CR occurs, ONE LIGHT should be low indicating all phototransistors are dark. The same is true for 81CR. At 84CR, ONE DARK should be low, indicating that light is being received by all phototransistors. If the foregoing conditions are not met, a READ CHECK will result and READY will be reset.

#### 4.3.3 DATA STORAGE

The following are detailed descriptions of blocks shown under data storage in Figure 4-2, Block Diagram, M Series Card Reader.

##### 4.3.3.1 Data Control and Sync Logic

The data control and sync logic provides the synchronization and control necessary for data storage. Reference to Figure 4-11 will aid in understanding the following description.

Following a GPR, the data control and sync logic must measure, by means of logic counters, two distances to determine where the Column Storage Data Strobe (CSDS) should

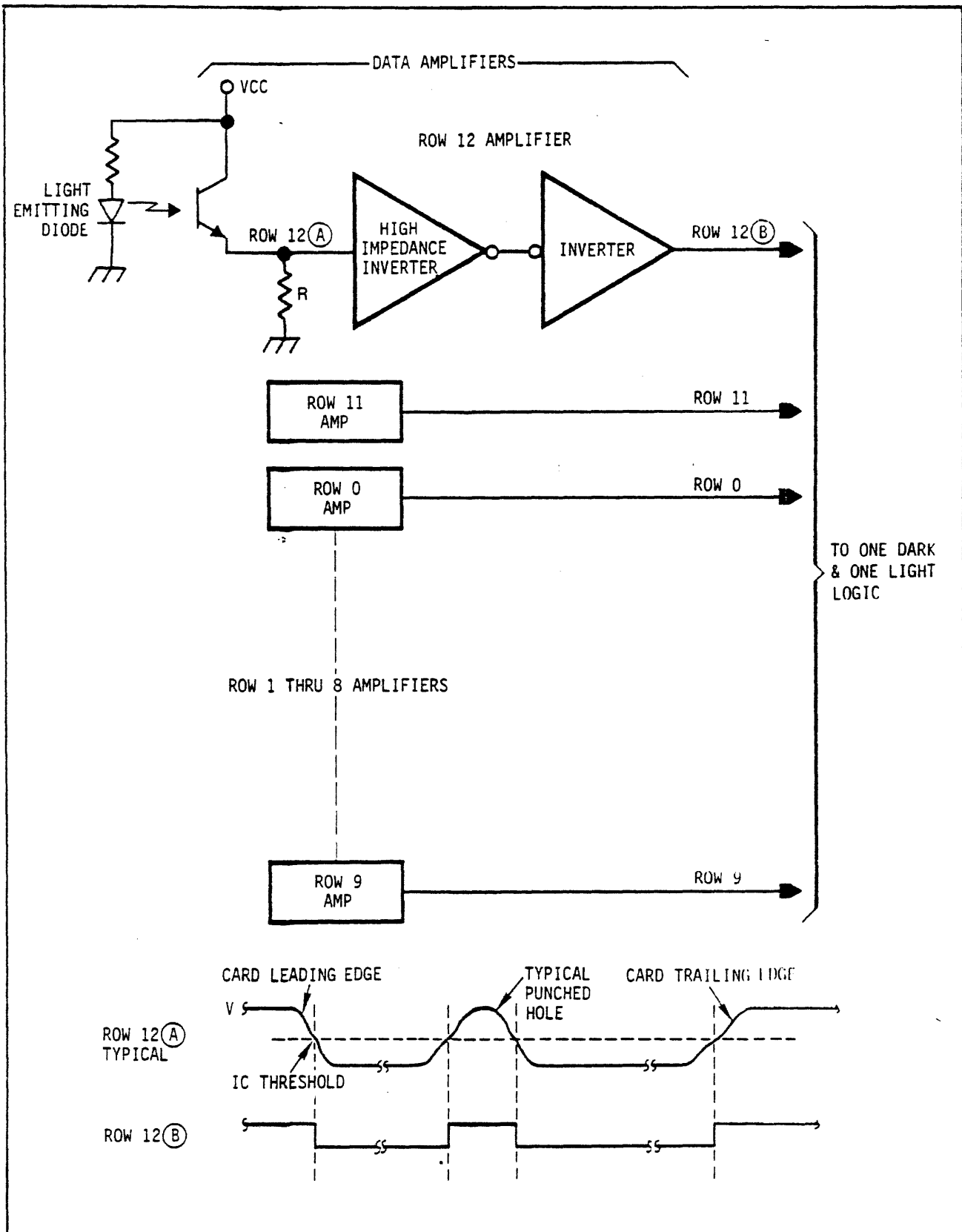


Figure 4-9. Block and Timing Diagram, Data Amplifiers and Inverters

in. The first measurement is the Preset Distance. Preset is the distance from the card's leading edge (GPR) to the point in column 0' where the CSDS should begin. This distance is 0.063 inch. The Preset Distance is predetermined and a Preset count is calculated using the Preset distance, card velocity and the input clock rate to the Preset counter. The sole purpose of the Preset Distance is to establish an end point for measuring Offset.

As the Preset Distance is being counted, the Offset Distance is measured. The Offset is the distance from the trailing edge of the last timing disc tooth to pass the magnetic pickup to the point where CSDS should begin. Since there are precisely two timing disc teeth for each column on the card, the reader logic can now count the trailing edges of the next two teeth, add the Offset count, and again be positioned to provide CSDS.

Because the timing disc teeth rotate past the magnetic pickup asynchronously with respect to the arrival of the leading edge of a card at the read station, the Offset Distance is a variable and consequently measured and stored for each card read,

The synchronization process is initialized when a GPR is received by the Sync Control logic and Preset counter. GPR presets the predetermined count in the Preset counter and causes the Sync Control logic to generate  $\overline{PRCLK}$  (Figure 4-11). A zero crossing ampli-

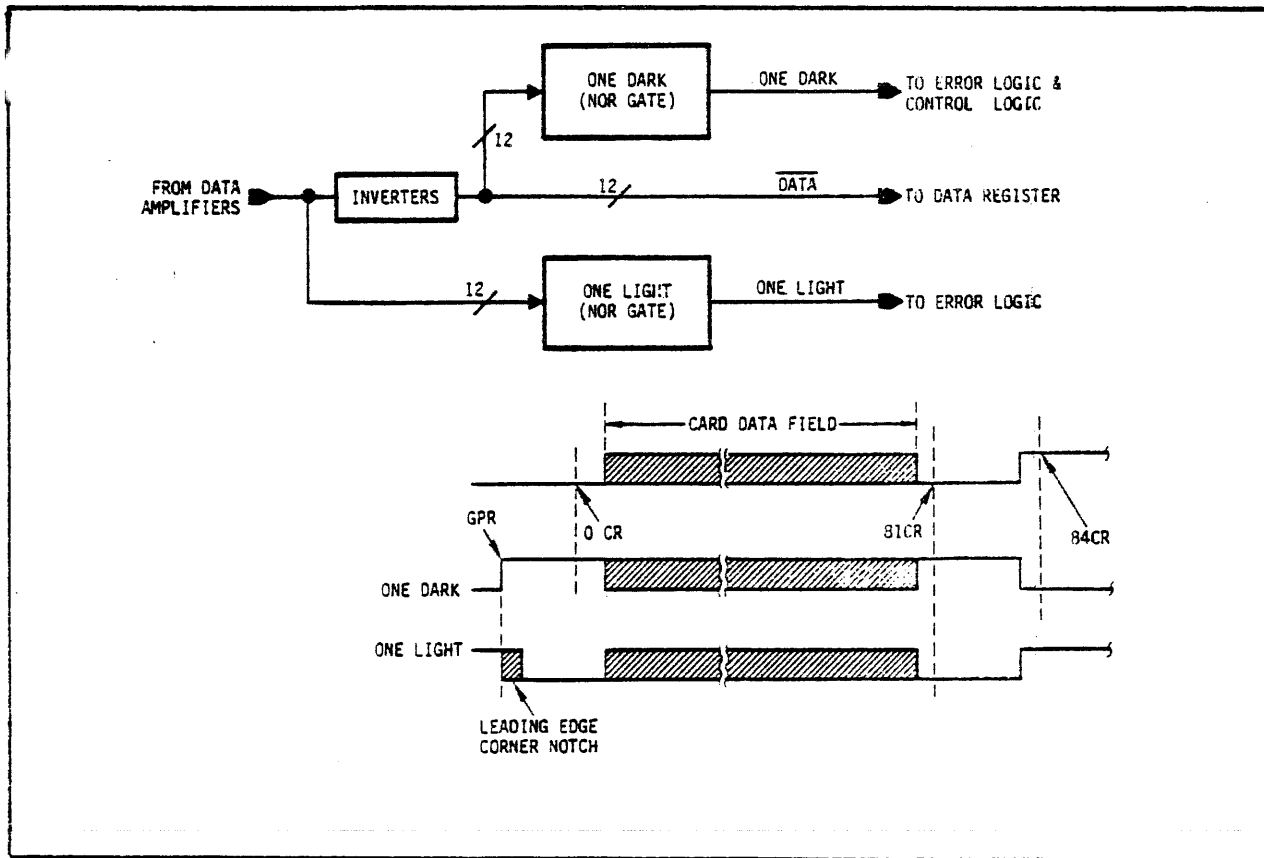


Figure 4-10. Block and Timing Diagram, One Dark and One Light

fier (AMP) converts the sine wave produced by the magnetic pickup to a TTL compatible squarewave, TST1. Following GPR, the first negative transition of TST1 (corresponds to tooth trailing edge) generates TST2 that causes the Sync Control logic to generate Offset Clock ( $\overline{OSCLK}$ ).  $\overline{OSCLK}$  at 120 kHz drives the eight-stage Offset Storage counter, counting it upward until the Preset counter reaches all ones.  $\overline{ZERO}$  is now generated by the Preset counter, terminating both  $\overline{PRCLK}$  and  $\overline{OSCLK}$ . The Offset has now been measured electronically and stored in the Offset Storage counter.

The Sync control counts two negative transitions of TST1 and generates Offset Up-Clock ( $\overline{OSUCLK}$ ).  $\overline{OSUCLK}$  is used to count the Offset counter up until the Comparator detects an equal value between the Offset Storage counter and Offset counter. CSDS for Column 0 is now generated by the Strobe logic. The Strobe logic  $ST\theta B$  resets the Sync Control logic,  $ST\theta C$  resets the Data Register and  $ST\theta C$  and  $ST\theta D$  are used to drive the Column Counter. The Sync Control logic repeats this cycle for every other TST1 causing the Strobe logic to generate CSDS,  $ST\theta B$ ,  $ST\theta C$  and  $ST\theta D$  each time.

1CR from the Column Counter sets the Index Mark Control Flip Flop (IMFF) in the Strobe logic. The Strobe logic generates  $6 \mu s$  Index Marks (IM) for each Column. The IM indicates to the controlling device the beginning of the guaranteed data period. When 81CR is received by the Strobe logic, the IMFF resets preventing any further index marks from being sent to the controlling device. The Data Control and Sync logic will continue to generate CSDS signals until 84CR (or CR) resets the Sync Control logic.

#### 4.3.3.2 Data Registers

Data detected by the Data Amplifiers and Inverters is routed through the One Dark and One Light circuitry to the Data Register for transfer to the controlling device (Figure 4-12).

The 12-bit Data Register is reset each time  $ST\theta C$  is generated by the Data Control and Sync logic. The  $1 \mu s$   $ST\theta C$  is followed in approximately  $4 \mu s$  by CSDS. CSDS is synchronized with card movement by the Data Control and Sync logic so that it will occur in the center of a punch data column. Any ROW input to the Data Register that is low during CSDS will cause a "1" to be stored for the row. When CSDS goes low, a period of guaranteed data occurs. This period lasts until CSDS again goes true.

The data drivers provide the necessary buffering between the Data Register and the controlling device.



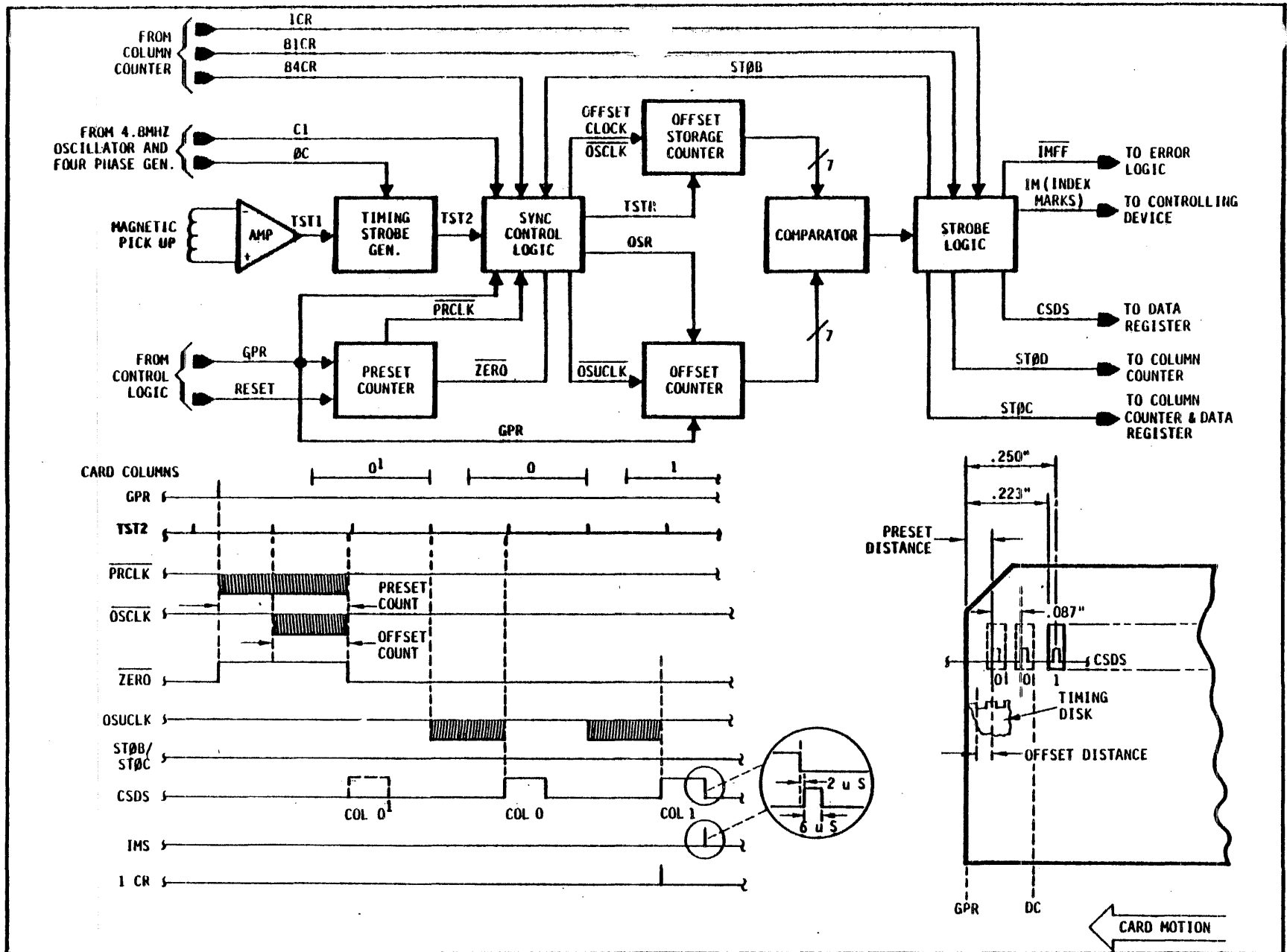


Figure 4-11. Block and Timing Diagram, Data Control and Sync Logic Drivers

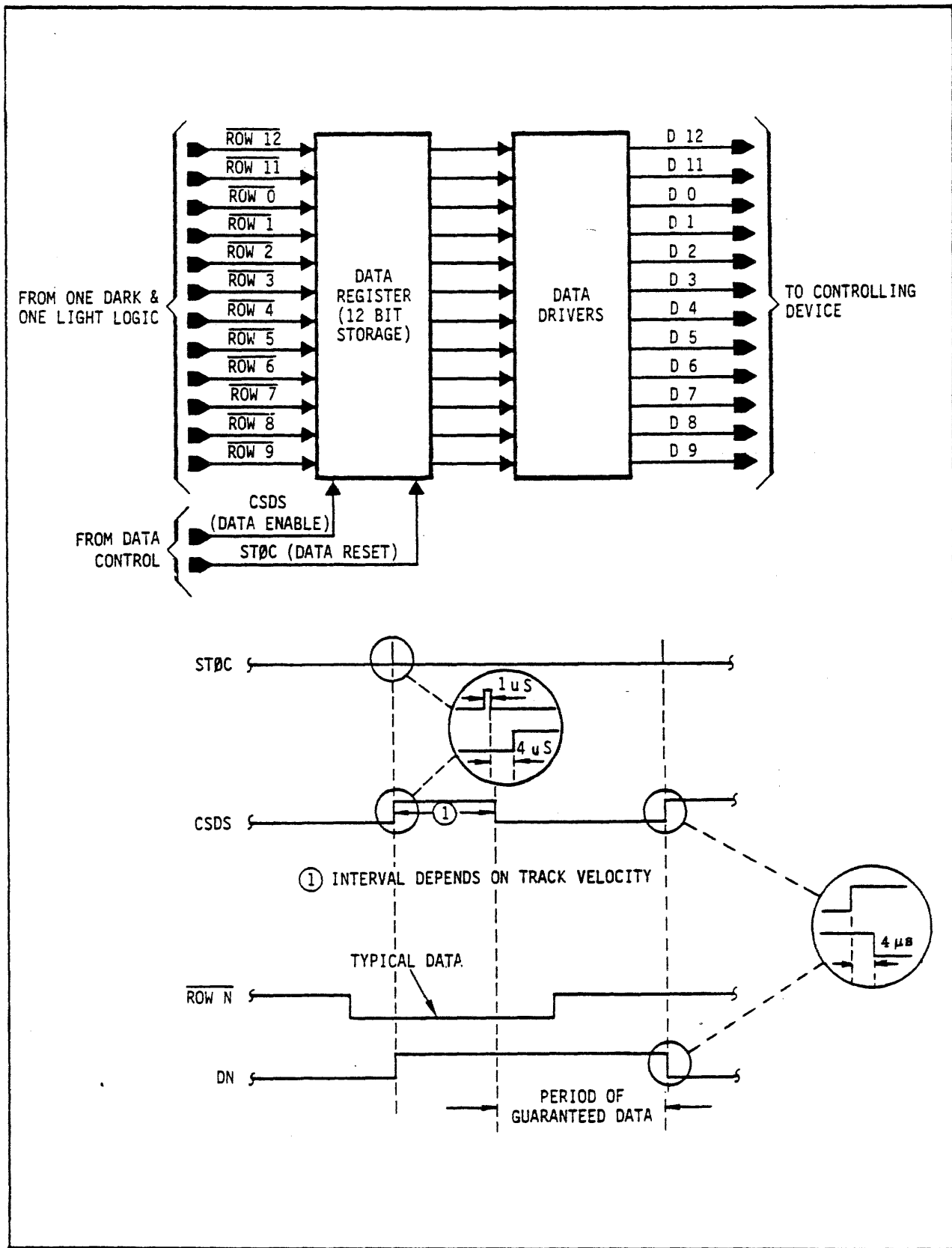


Figure 4-12. Block and Timing Diagram, Data Register and Data Drivers

## SECTION 5 INTERFACE

### 5.1 GENERAL

This section covers the interface between the M-Series punched card reader and the external equipment which controls the reader operation and into which the reader transfers data.

### 5.2 READER TIMING

Two types of card reader signals are available to an external system through the Input/Output connector: signals which control or report the status of card processing, and the data signals and associated timing marks. Refer to the timing diagram (Figure 5-1).

#### 5.2.1 PICK CONTROL

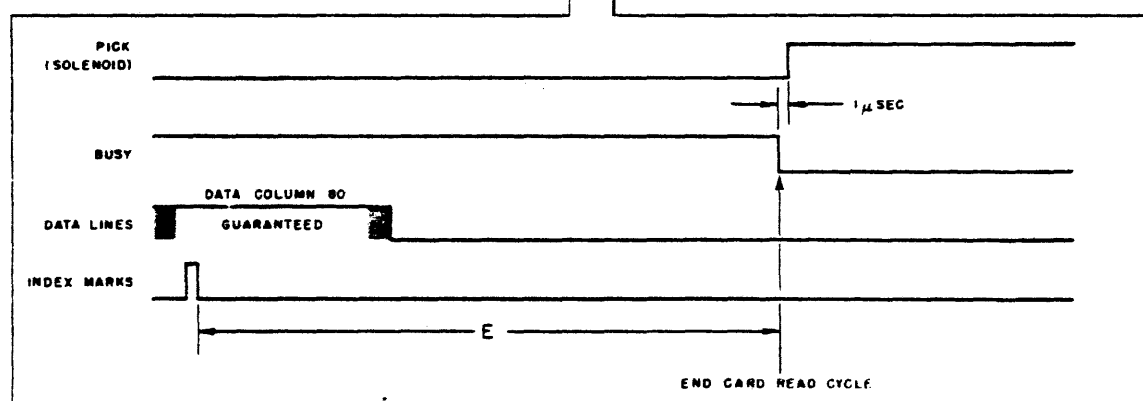
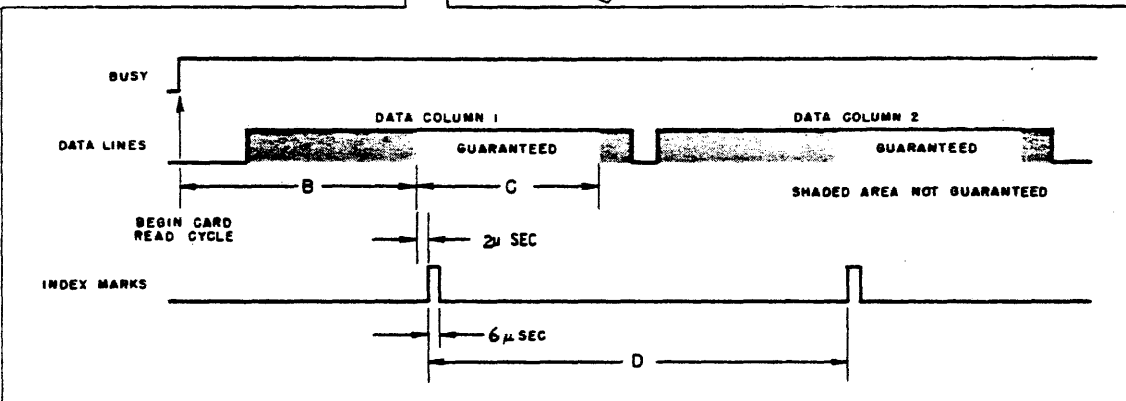
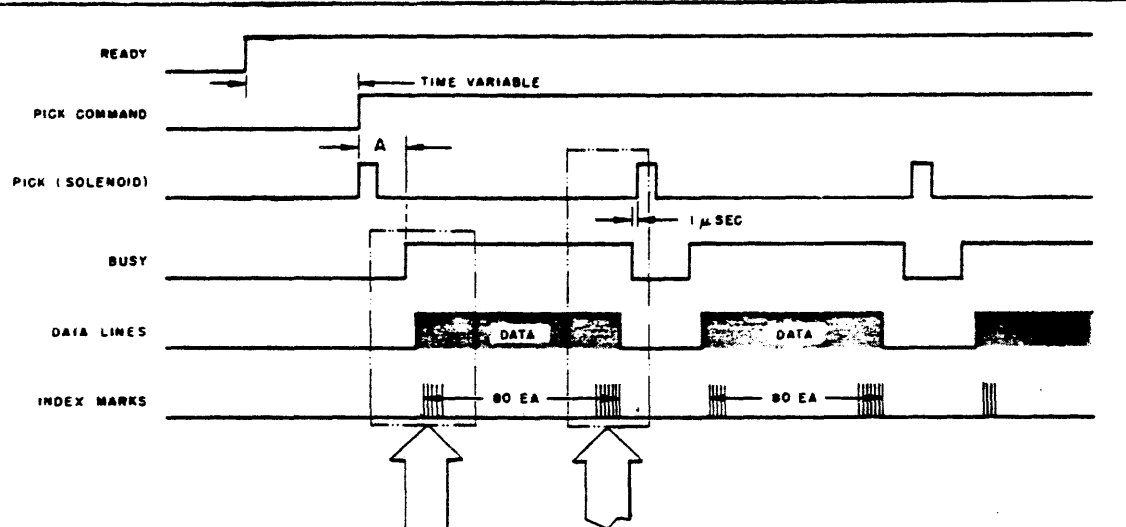
The Pick Command (PICK CMD) signal initiates the card read cycle, and depending upon its duration, the card reader will either run continuously or operate in a card-at-a-time mode. This signal can be presented to the reader at any time, but the reader will only accept it when the READY line is TRUE. The READY signal indicates that the card reader is cleared of errors and is ready to receive a PICK CMD from the external program control. The green RESET indicator on the front control panel provides a visual indication of the READY line status.

In order for the READY signal to be TRUE:

- a. Power must be applied and the 3-second runup completed.
- b. The input hopper must be loaded.
- c. The RESET pushbutton switch must be operated.

If these conditions are satisfied, and the unit is in the REMOTE mode of operation, the controller can initiate the required sequence to enable the command lines. The presence of a PICK CMD will generate the PICK pulse to the picker solenoid. The first card is introduced into the card track, and after a delay (A, Figure 5-1), the leading edge arrives at the read station. The Busy (BUSY) signal goes TRUE as soon as the leading edge of the card enters the read station.

To initiate the card pick cycle, PICK CMD must be present for at least 1 microsecond ( $\mu$ s) concurrently with READY. After the pick cycle is initiated, the PICK CMD line is ignored until BUSY goes FALSE, indicating the end of the card read cycle. In card-at-a-time operation, it is suggested that PICK CMD be held TRUE until receipt of the column 1 index



MODEL	A (MIN)	B	C	D	E	PICK CYCLE
M300	24	2600	435	870	102,660	200
M600	24	2600	435	870	3480	100
M1000	15	1860	240	478	1910	60
	M SEC	μSEC	μSEC	μSEC	μSEC	μSEC

NOTE:  
WAVEFORMS NOT SHOWN TO SCALE.

21125 M1000L

Figure 5-1. Interface Timing Diagram

mark. In the continuous-run mode, PICK CMD may be left in the TRUE state and a new PICK signal will be automatically generated within 1  $\mu$ s of BUSY going FALSE.

Should the picker fail to engage the card, the Pick Control logic will wait 50 milliseconds (ms) and automatically try again. It will continue to generate a PICK pulse every 50 ms until six attempts have been made. After six unsuccessful attempts (300 ms), a Pick Check (PCK) signal is generated, inhibiting the READY line.

### 5.2.2 DATA READOUT

The card read cycle starts with the recognition that the card leading edge has entered the read station. At this time the BUSY line goes TRUE. Eighty equally spaced Index Marks of 6.0  $\mu$ s duration are generated while the BUSY signal is present. The time spacing of the Index Marks and the BUSY signal is shown by intervals B, D and E (Figure 5-1).

Data signals may appear on the data output lines before the occurrence of the associated Index Mark. Since torn webs are sometimes encountered which could partially obscure the hole, Documentation card readers feature a wide data acceptance interval to provide greater tolerance to this damage. During this interval, any signal from the read station sensors indicates a hole, and therefore is recognized as a valid data bit and stored in the Character Buffer. Since the contents of the Character Buffer are subject to change throughout this interval, the data are not guaranteed until the end of the acceptance interval. This period is terminated 2  $\mu$ s prior to the Index Mark.

By the time the Index Mark is generated, the data will have been read and stored, and the data lines will be settled. Data levels are guaranteed to remain on the output lines available for transfer to the external equipment for interval C.

### 5.2.3 STATUS AND ALARM SIGNALS

Status signals available to the external system are Hopper Check, Busy, Error, Motion Check and Ready. These signals are available through the Input/Output connector, J2.

#### 5.2.3.1 Hopper Check

The Hopper Check (HCK) signal remains FALSE during normal card reader operation, but goes TRUE if either the input hopper is empty or the output stacker is full. If the input hopper is empty and the SHUTDOWN switch is in AUTO, the motors are also automatically switched off; when the input is reloaded and the RESET switch operated, the motors will be automatically energized.

When the last card leaves the input hopper, the switch which senses the empty condition immediately signals HCK and inhibits the READY signals. This occurs at the 81st data column. The reader continues the read cycle; however, when the BUSY line next goes FALSE the reader is stopped. In the case of a full output stacker, HCK only appears at the end of the read cycle during which it occurred.

#### 5.2.3.2 Busy

The BUSY signal is TRUE during the card read cycle but goes FALSE at the end of the card read cycle and remains FALSE until the next card is picked and it reaches the read station (approximately 24 milliseconds).

#### 5.2.3.3 Error

The Error (ERROR) signal is produced by failure of a light check or dark check. A card that has a tear at the leading or trailing edge will cause a dark check. A read station emitter/sensor failure while reading a card, will cause a light check. Either type of malfunction will cause the ERROR line to go TRUE and the READ CHECK indicator to illuminate.

#### 5.2.3.4 Motion Check

The Motion Check (MOCK) signal is a composite of the Pick Check (PCK) and Stack Check (SCK) signals. Either condition requires operator intervention and both signals are furnished to the interface on a single status line. The condition is indicated on the front panel as a PICK CHECK or a STACK CHECK. MOCK will occur within 300 ms of the initiation of an unsuccessful pick attempt or in time to inhibit the picking of the second card after the stacker sensor detects that a card has not completely cleared the card track.

#### 5.2.3.5 Ready

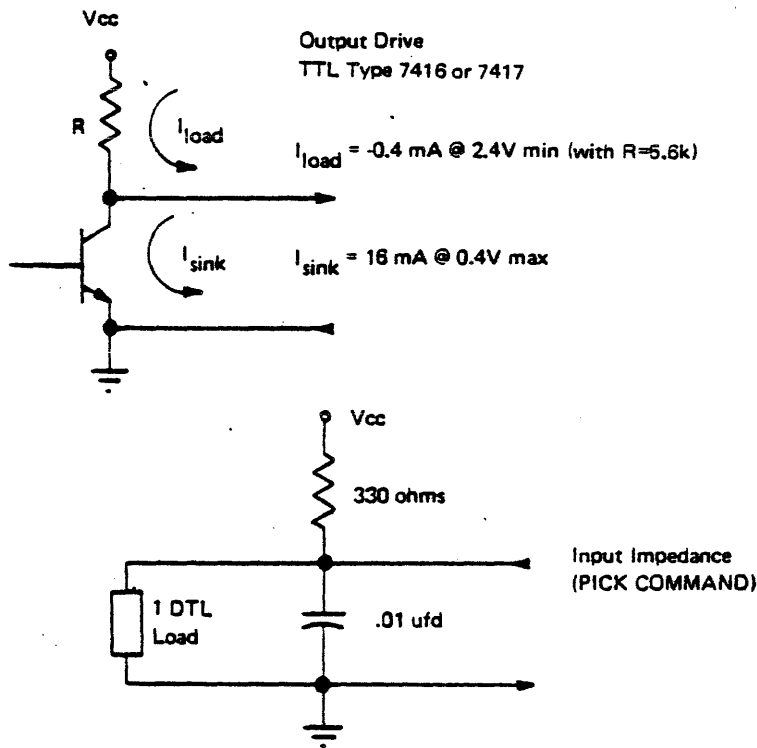
The READY signal is true if the following conditions are met:

<u>Condition</u>	<u>Indication</u>
1. Reader power is on.	POWER indicator illuminated.
2. Input hopper loaded, output stacker not full.	HOPPER CHECK indicator extinguished.
3. RESET pushbutton switch has been depressed and released.	RESET indicator illuminated (green).

### 5.3 SIGNAL CHARACTERISTICS

The standard interface is applied as the output of TTL type 7416 or 7417. Circuit characteristics are shown in Figure 5-2.

78125/M1000L



A328

Figure 5-2. Circuit Characteristics

## 5.4 CONNECTORS

### 5.4.1 INPUT/OUTPUT CONNECTOR

The 38-pin output connector provides access for all control, data and status/alarm lines. The output connector is Elco Part No. 00-8016-038-000-707 and the mating connector is Elco Part No. 00-8016-038-217-704 with solder-type pins (No. 60-8017-0513). This mating connector assembly is available from Documation Incorporated and is shipped unassembled as a kit (P/N 10139401).

### 5.4.2 POWER CONNECTOR

The power connector is Hubbell Part No. 7486 (115V), Hubbell Part No. 7595 (115V, UL) or CorCom Part No. 6EF1 (230V). The appropriate mating connector is supplied on the accessory power cord furnished with the equipment.

## 5.5 GROUNDING

Grounding in M-Series card readers maintains ac power and signal ground separate. Signal ground is the logic power return (Vcc return) and is transformer isolated from the ac power distribution system. The chassis is protected by connection to the safety wire (green) in the ac power cord.

It is recommended that twisted pair cable be used to connect the M-Series card reader to external equipment. The signal returns should be terminated as close as possible to the signal receivers. It should be noted that pin EE (Index Mark Return) is designated as SIGNAL GROUND on the pin assignment chart. If twisted pair interconnection is not used, it is recommended that pin EE be connected to the external equipment signal return.

The standard M-Series pin assignment configuration is given in the following Table 5-1.

Table 5-1. Signal Connector Pin List

PIN	SIGNAL	DESCRIPTION	PIN	SIGNAL	DESCRIPTION	
A	D12	Row 12 Data	X	D7 (RTN)	Row 8 Data Row 9 Data Index Mark Ready	
B	D11	Row 11 Data	Y	D8		
C	D0	Row 0 Data	Z	D9		
D	D1	Row 1 Data	AA	IM		
E	D12 (RTN)		BB	RDY		
F	D11 (RTN)		CC	D8 (RTN)		
H	D0 (RTN)		DD	D9 (RTN)		
J	D1 (RTN)		EE	IM (RTN)/GRD		Signal Ground
K	D2	Row 2 Data	FF	RDY (RTN)		
L	D3	Row 3 Data	HH	ERROR		Error
M	D4	Row 4 Data	JJ	HCK	Hopper Check	
N	D5	Row 5 Data	KK	MOCK	Motion Check	
P	D2 (RTN)		LL	PC	Pick Command	
R	D3 (RTN)		MM	BSY	Busy	
S	D4 (RTN)		NN	Error (RTN)		
T	D5 (RTN)		PP	HCK (RTN)		
U	D6	Row 6 Data	RR	MOCK (RTN)		
V	D7	Row 7 Data	SS	PC (RTN)		
W	D6 (RTN)		TT	BSY (RTN)		

NOTE

For Non-Standard Units, see Wiring Diagram, Figure 10-3.

Table 5-2. Power Connector Wiring

CIRCUIT	WIRE COLOR
Safety Ground	Green
Neutral	White
Line (115 or 230 Vac)	Black

78348/M10L



SECTION 6  
ADJUSTMENT PROCEDURES

6.1        GENERAL

Adjustment procedures required to maintain proper reader operation are listed in this section. These adjustments should be checked when minor malfunctions occur and before major repair is attempted. They must be performed after any related major repair or replacement.

To perform adjustments described in this section, it will be necessary to remove the front, top and rear panels.

- a. Remove six screws which hold front panel and remove panel, Figure 6-1.
- b. Remove four screws which hold top cover and remove cover.
- c. Remove six screws which hold rear panel, Figure 6-2.
- d. Move rear panel out slightly and disconnect fan, then remove panel.

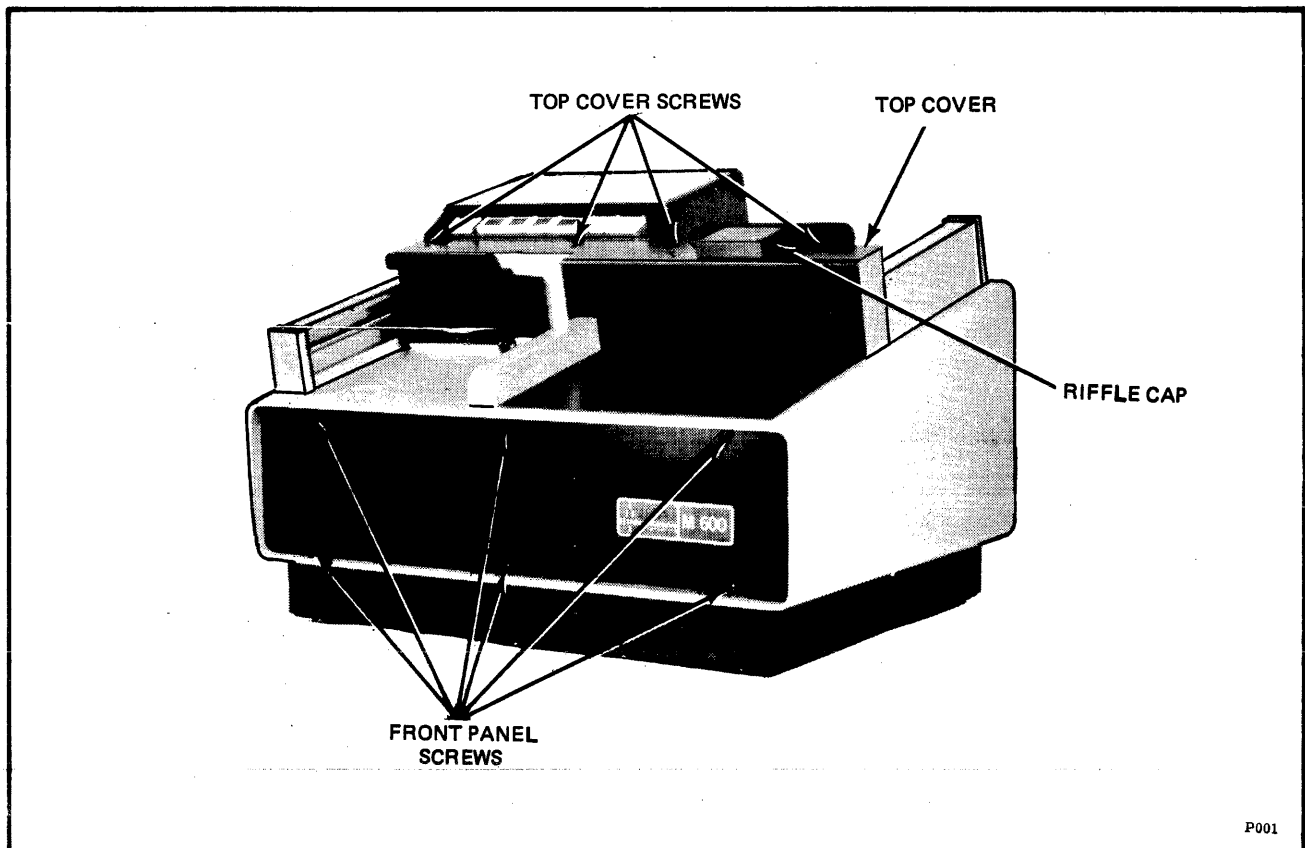


Figure 6-1. Front Panel and Top Cover Removal

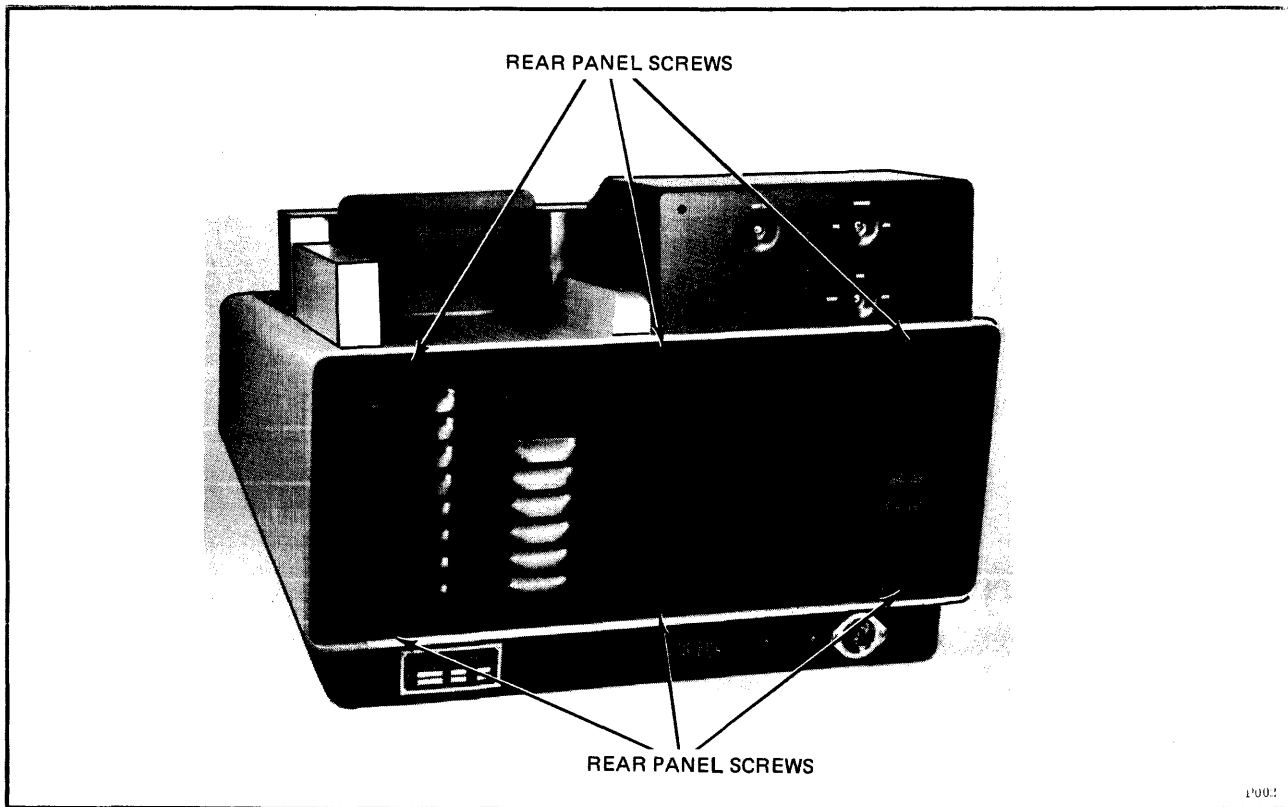


Figure 6-2. Rear Panel Removal

## 6.2 TENSION ON THE MAIN DRIVE MOTOR BELT

The drive motor belt tension is adjusted to ensure constant card speed and timing.

- a. LOOSEN four motor mounting plate screws, Figure 6-3.

### CAUTION

THE DRIVE MOTOR BELT TENSION IS CRITICAL. TOO MUCH TENSION MAY CAUSE EXCESSIVE WEAR OF DRIVE ROLLER BEARING. IT MAY ALSO CAUSE DEFLECTION OF DRIVE ROLLER BEARING SHAFT RESULTING IN READ CHECKS. TOO LITTLE TENSION MAY CAUSE BELT TO JUMP A COG OR CREATE A NON-CONSTANT TRACK SPEED RESULTING IN LOSS OF TIMING, INCORRECT DATA, OR READ CHECKS.

78125/M1000L

- b. Move motor mounting plate back and forth to be sure it slides freely. Attach spring scale to motor so that pulling on spring scale from rear of card reader and in line with motor mounting slots will apply tension to main drive motor belt. Pull on spring scale until it reads 24 ounces. Maintain tension at that level and tighten four motor mounting plate screws.

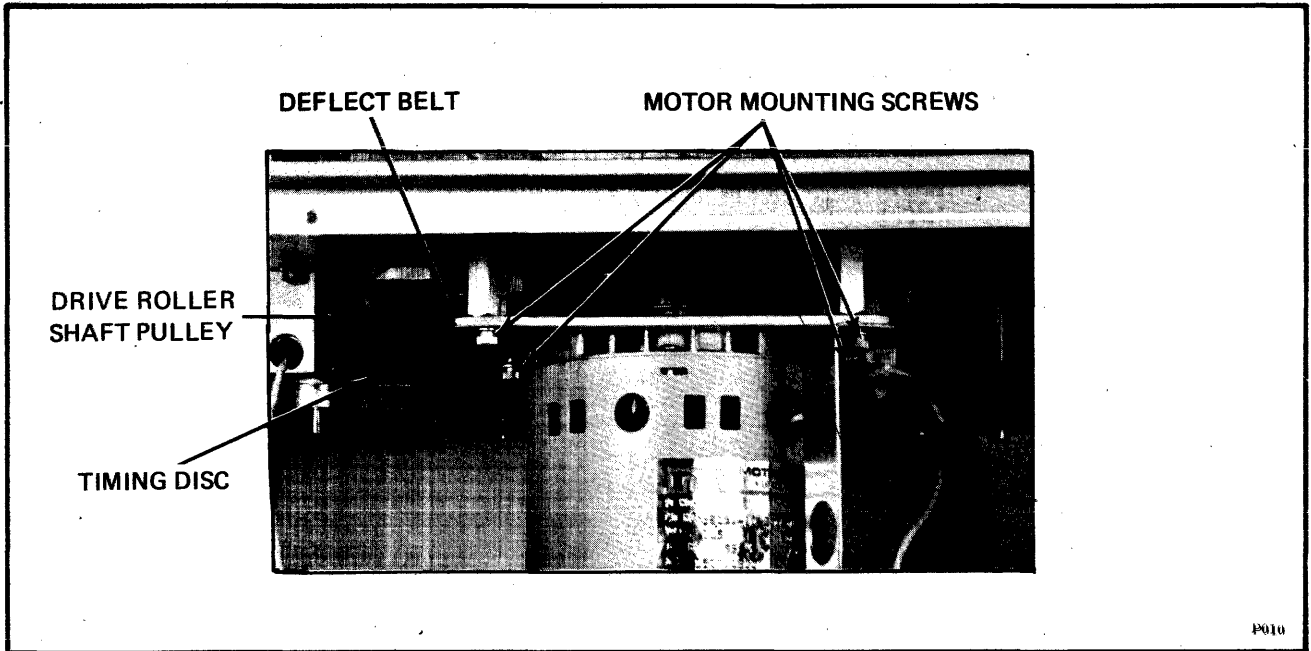


Figure 6-3. Drive Motor Belt Tension Adjustment

### 6.3 MAGNETIC PICKUP ADJUSTMENT

The magnetic pickup is adjusted to ensure that timing pulses of optimum level and modulation ratio (run-out) are developed. There are two adjustments: horizontal alignment and air gap (Figure 6-4). If either of these adjustments is incorrect, card synchronization may be erratic and cause read checks.

#### CAUTION

IF THE TIMING DISC MUST BE REMOVED,  
HANDLE IT WITH CARE. DAMAGE TO DISC  
MAY RESULT IN ERRONEOUS CARD  
PROCESSING.

- a. Loosen timing disc set screw.
- b. Position timing disc on shaft to align it in a horizontal plane with center of magnetic pickup tip.
- c. Hold disc in position and tighten set screw on flat side of shaft.

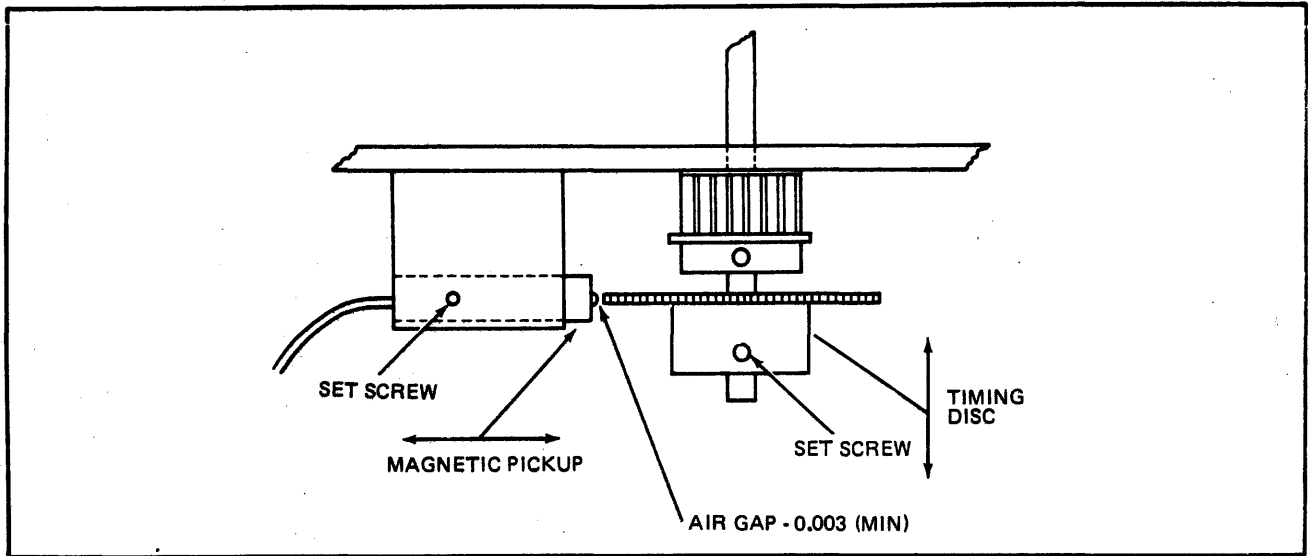


Figure 6-4. Magnetic Pickup Adjustment

- d. Loosen magnetic pickup set screw.
- e. Position magnetic pickup assembly to adjust air gap between pickup and timing disc. Initial air gap should be  $0.006 \pm 0.001$  inch.
- f. Remove card cage rear panel and place Timing card (J3) on an extender board.
- g. Connect an oscilloscope across magnetic pickup output (J3-S and J3-T).
- h. Apply reader power.

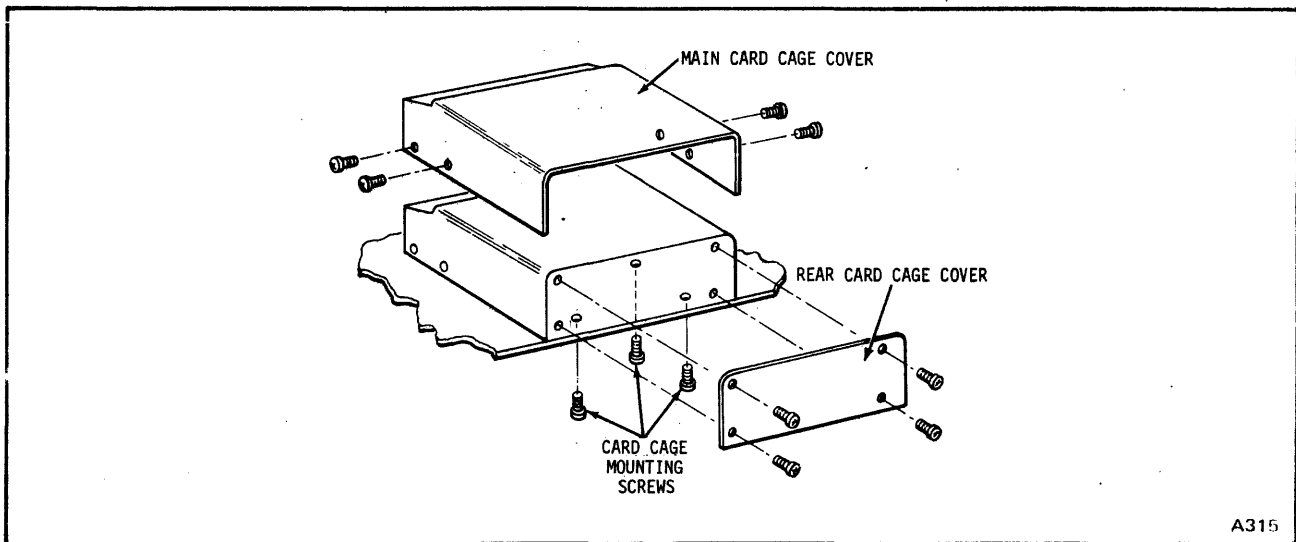


Figure 6-5. Card Cage Repositioning

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CAUTION

MINIMUM PERMISSIBLE AIR GAP BETWEEN  
TIP OF MAGNETIC PICKUP AND TEETH OF  
TIMING DISC IS 0.003 INCH.

- i. Carefully adjust magnetic pickup to obtain output waveform shown in Figure 6-4A.
  1. Output level should measure between 1.5 and 6.0 volts peak-to-peak.
  2. Modulation ratio should not exceed 2:1.

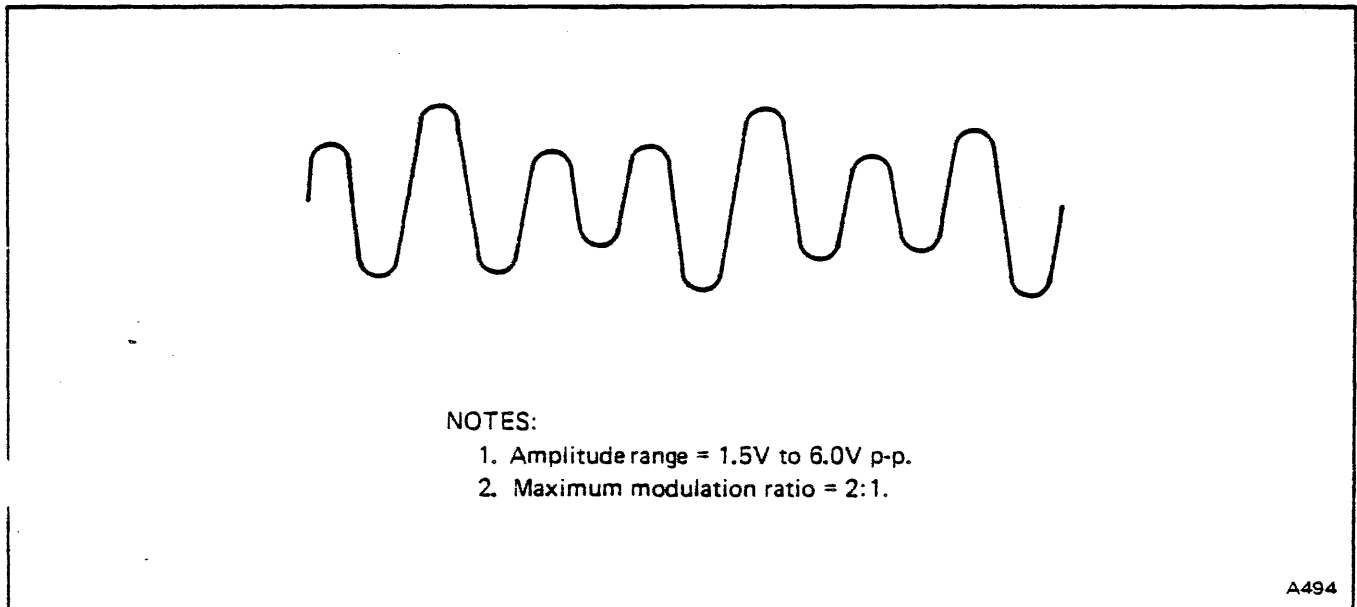


Figure 6-4A. Magnetic Pickup Output

- j. Remove reader power; remove extender board and install timing card in its normal position.
- k. Replace rear panel and card cage rear panel.

## 6.4

ADJUSTMENT OF STACK PHOTOCELL

The stack photocell is adjusted to ensure that it correctly monitors the stacking of cards and that it is not in the way of the cards entering the output stacker.

The card cage must be repositioned in this adjustment to allow easy access to the rear of the stacker photocell.

- a. Remove the four screws retaining the rear card cage cover, Figure 6-5.
- b. Remove the four screws retaining the main card cage cover.
- c. Remove the three screws from the underside of the mainframe which are holding the card cage in place, Figure 6-5.
- d. Move the card cage to the rear of the reader, approximately 3 inches and replace one of the rear mounting screws.
- e. To gain access to the stack photocell set screw, the drive roller must be removed. Loosen the set screw in the drive roller and remove the roller, Figure 6-6.
- f. Loosen the set screw in the stacker casting which retains the stack photocell, Figure 6-6.

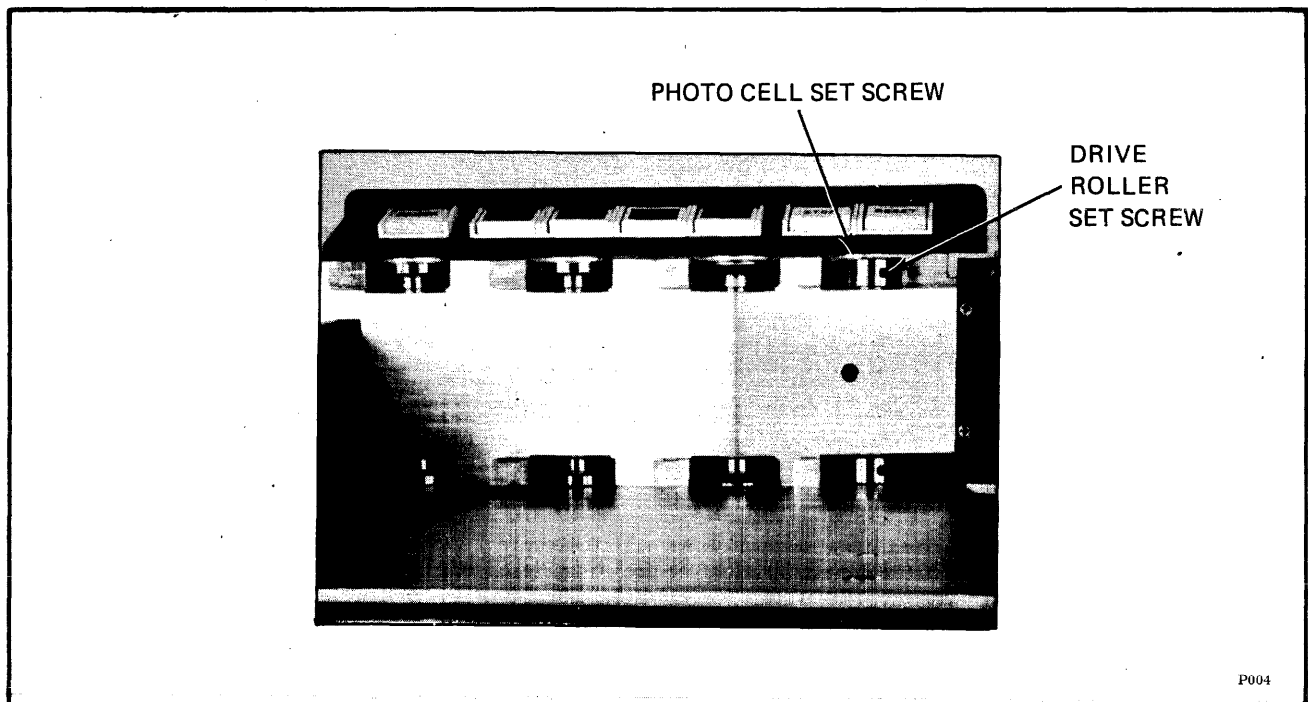


Figure 6-6. Location of Photocell Set Screw

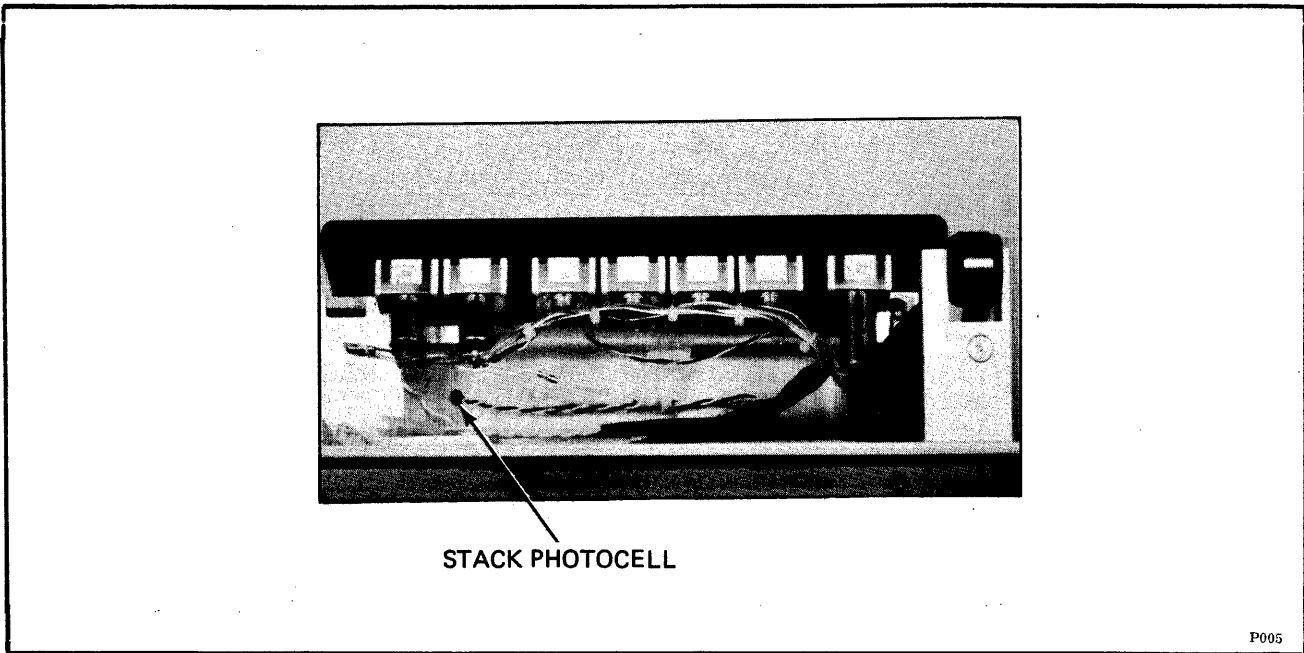


Figure 6-7. Stack Photocell

- g. Remove photocell from rear of stacker casting and inspect photocell lens for any damage, Figure 6-7.
- h. Replace stack photocell and align photocell lens flush with surface of stacker casting.
- i. Tighten photocell set screw.
- j. Replace drive roller and adjust for proper preload per paragraph 6.5.
- k. Reinstall card cage in its normal position.

#### 6.5 STACKER ROLLER SHAFT BEARING PRELOAD

The preload of bearings on drive and stacker roller shafts is very important. This ensures that there is no detectable end play in shafts. If there is detectable end play, excessive wear of the support bearings will result.

- a. To reload bearings rotate roller of shaft to be adjusted to expose the set screw. Loosen the set screw in top roller, Figure 6-8.
- b. From bottom side of mainframe push shaft upward as far as possible.

78125/M1000L

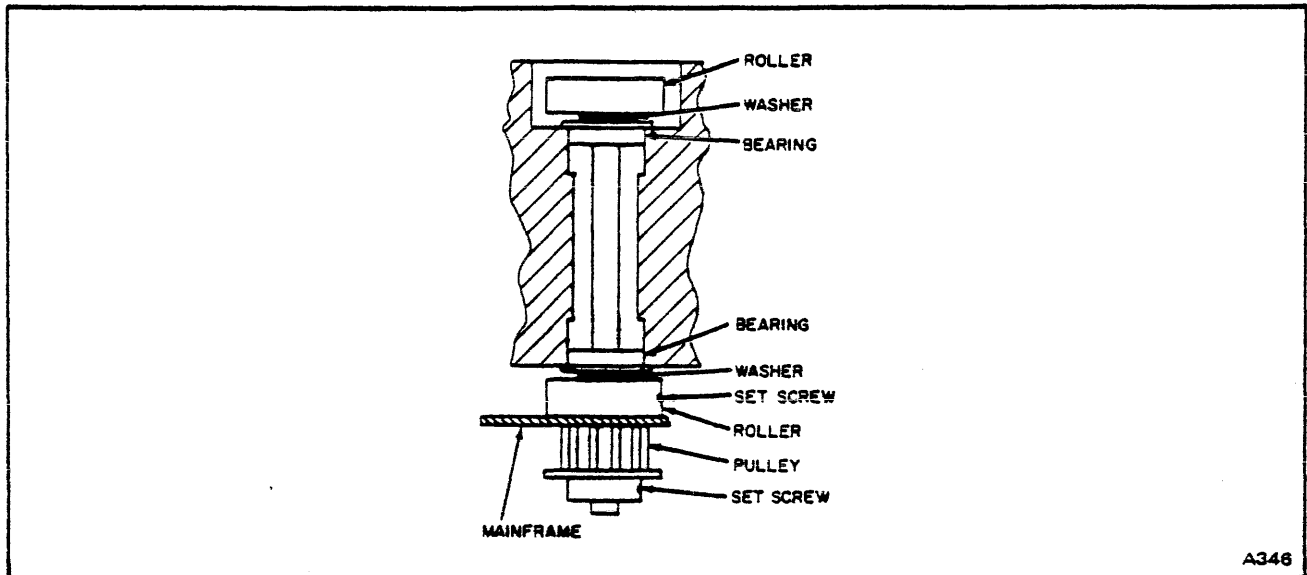


Figure 6-8. Roller Shaft Bearing Preload Adjustment

- c. Using a feeler gauge set, select gauge that will shim shaft in this position. Place selected gauge between bottom roller and main frame.

NOTE

The size of the gauge required may be different for each shaft (0.005 to 0.025 inch).

- d. Ensure that set screw is on flat side of shaft.
- e. With feeler gauge in place, exert downward pressure on top roller and tighten set screw.

If end play is excessive, a chattering noise will be detected when the drive motor is on.

6.6 HOPPER EMPTY SWITCH ADJUSTMENT

The adjustment of the hopper empty switch, located under the riffle air cap, ensures that an input hopper empty condition is detected.

- a. Remove two screws holding riffle air cap, Figure 6-1.
- b. Check that operating arm of switch is parallel to top of picker casting and that arm is not bent.

78125/M1000L



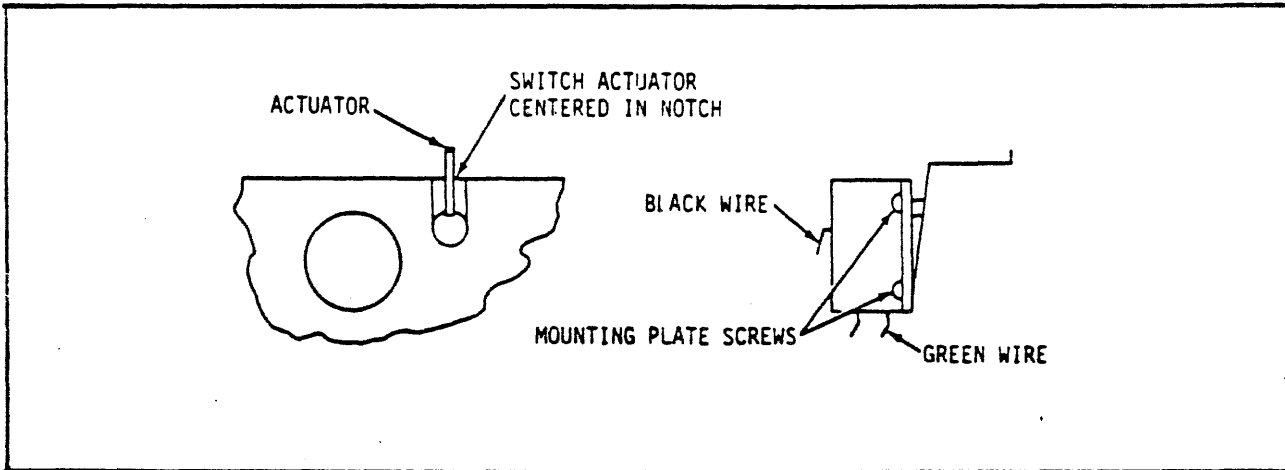


Figure 6-9. Hopper Empty Switch Adjustment

- c. Loosen two screws holding switch mounting plate, Figure 6-9.
- d. Center switch arm in picker casting counterbore. Exert slight pressure on switch arm, pressing arm into casting. Tighten switch mounting plate set screws.
- e. Replace rifle air cap.

If hopper empty switch is faulty or misadjusted, an erroneous status condition will be developed. Refer to paragraph 9.20, Hopper Empty Switch.

#### 6.7 STACKER FULL SWITCH ADJUSTMENT

The stacker full switch is adjusted to ensure that an output stacker full condition is detected.

- a. Place approximately one inch of cards in hopper. Operate POWER switch to place the reader in operation.
- b. After a few moments, the STOP indicator should illuminate. Pull stacker follower toward front of reader. Approximately 1/8" before end of travel, HOPPER CHECK indicator should illuminate. If this condition is not met, stacker full switch must be repositioned.
- c. Loosen two screws retaining stacker full switch bracket, Figure 6-10.
- d. Adjust switch bracket horizontally until HOPPER CHECK indicator illuminates when stacker follower is approximately 1/8" before end of travel. Tighten bracket mounting screws.

78125/M1000L

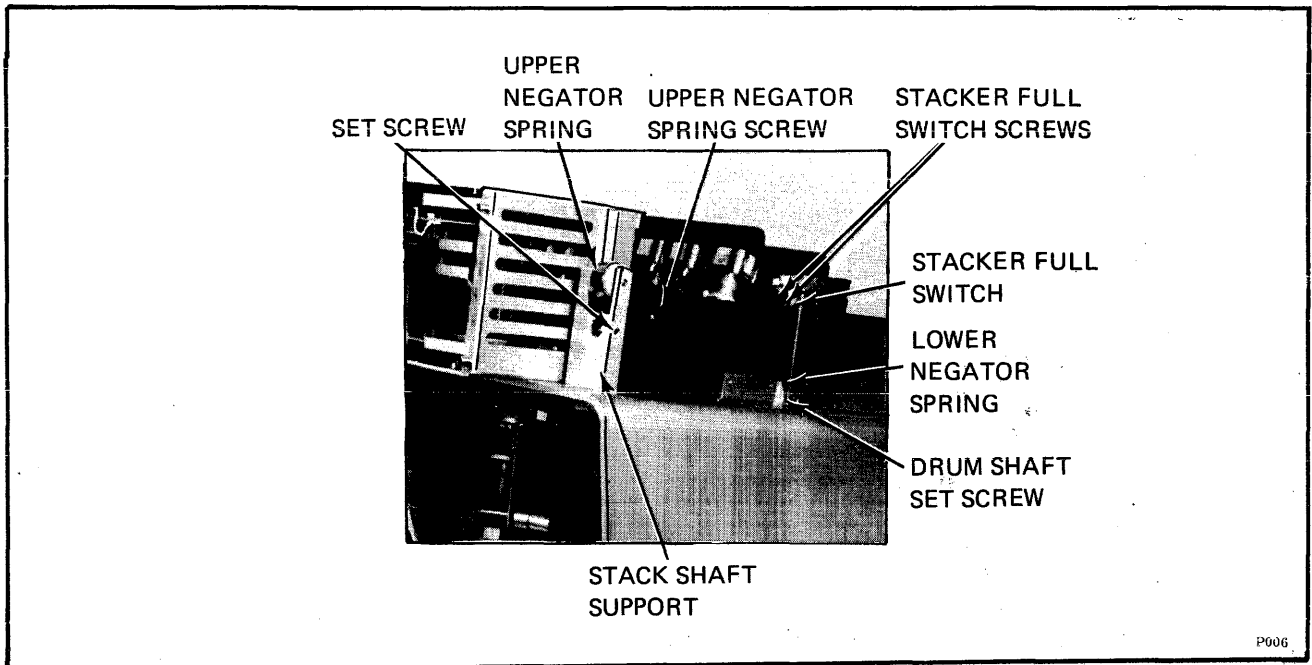


Figure 6-10. Stacker Full Switch Adjustment

6.8 PICKER SECTOR ADJUSTMENT

The picker sector is adjusted to ensure that cards are picked properly. There are six adjustments to picker sector assembly; height, vacuum adapter air gap, rest stop, throat block, solenoid coupling, and forward bumper stop.

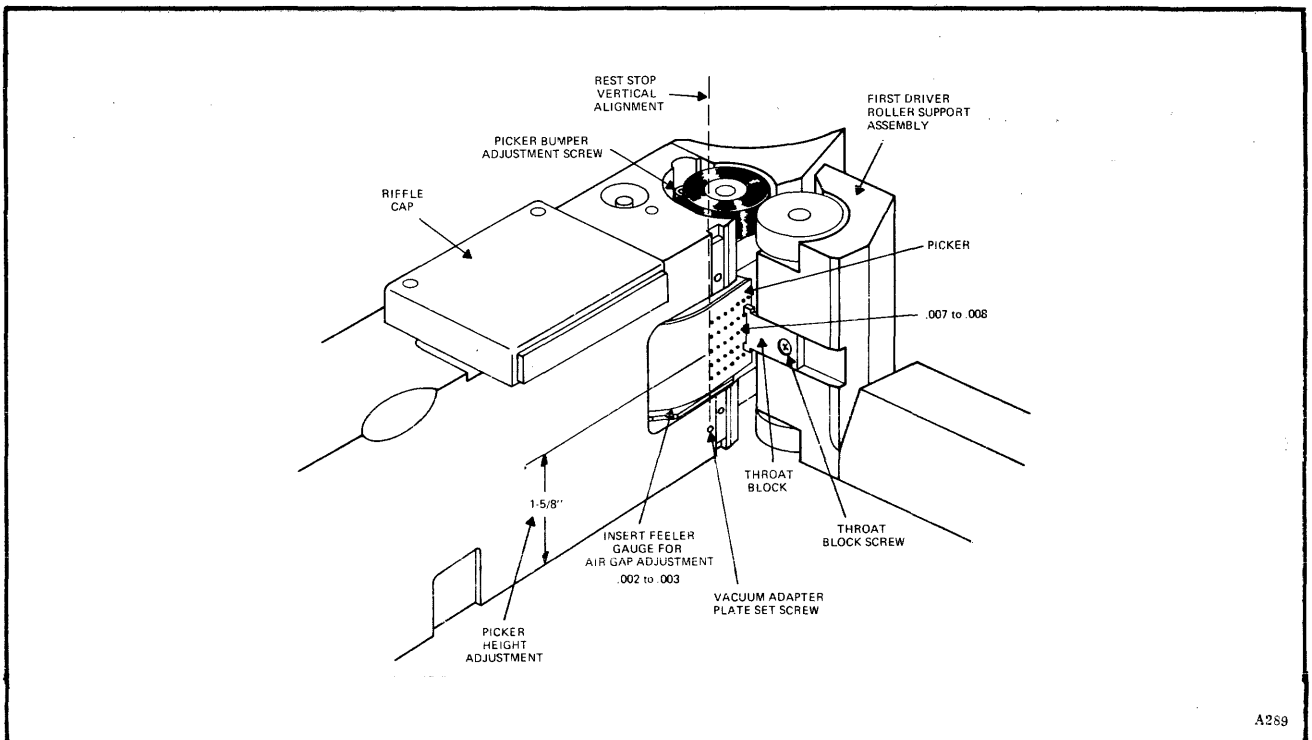


Figure 6-11. Picker Sector Adjustment, Rear View

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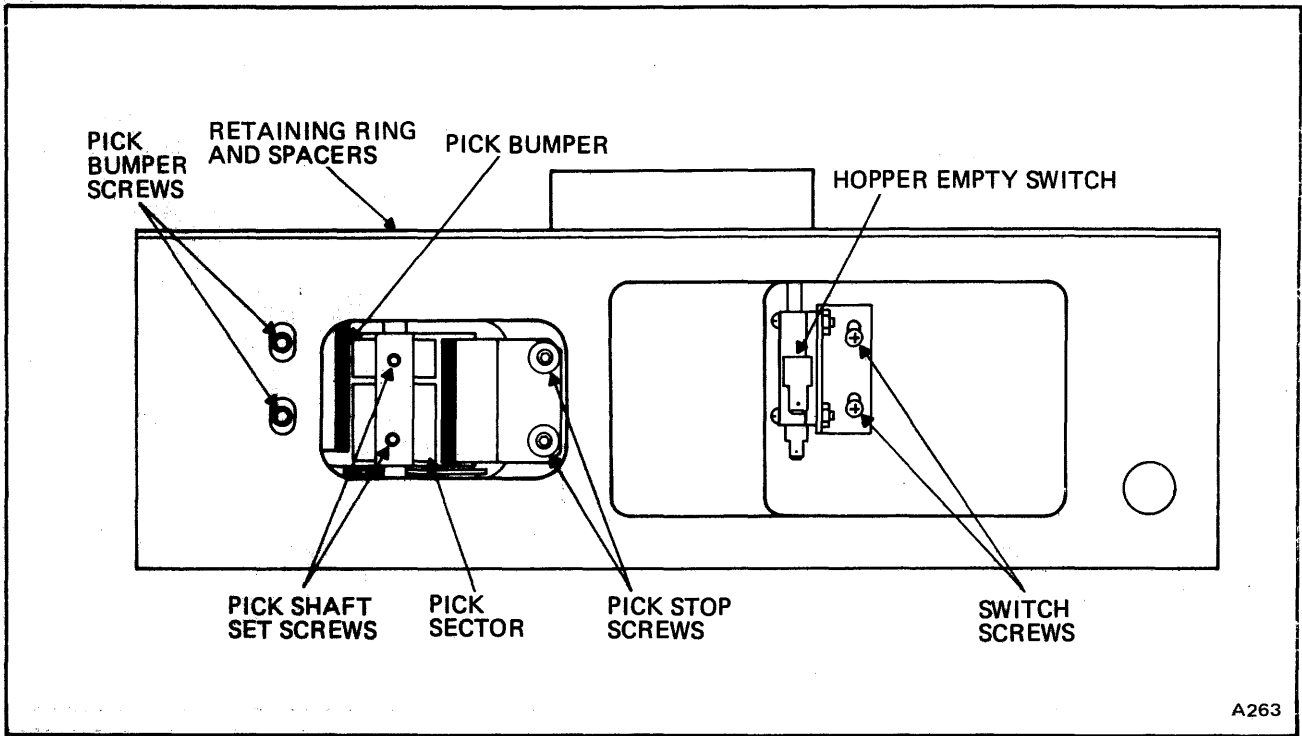


Figure 6-12. Pick Sector Adjustment, Front View

**CAUTION**

IT IS VERY IMPORTANT THAT THE ADJUSTMENTS BE PERFORMED IN THE SEQUENCE STATED.

- a. Check pick sector height adjustment. Measure the distance from top of mainframe to center of middle row of holes in pick sector. This should be exactly 1-5/8", Figure 6-11.

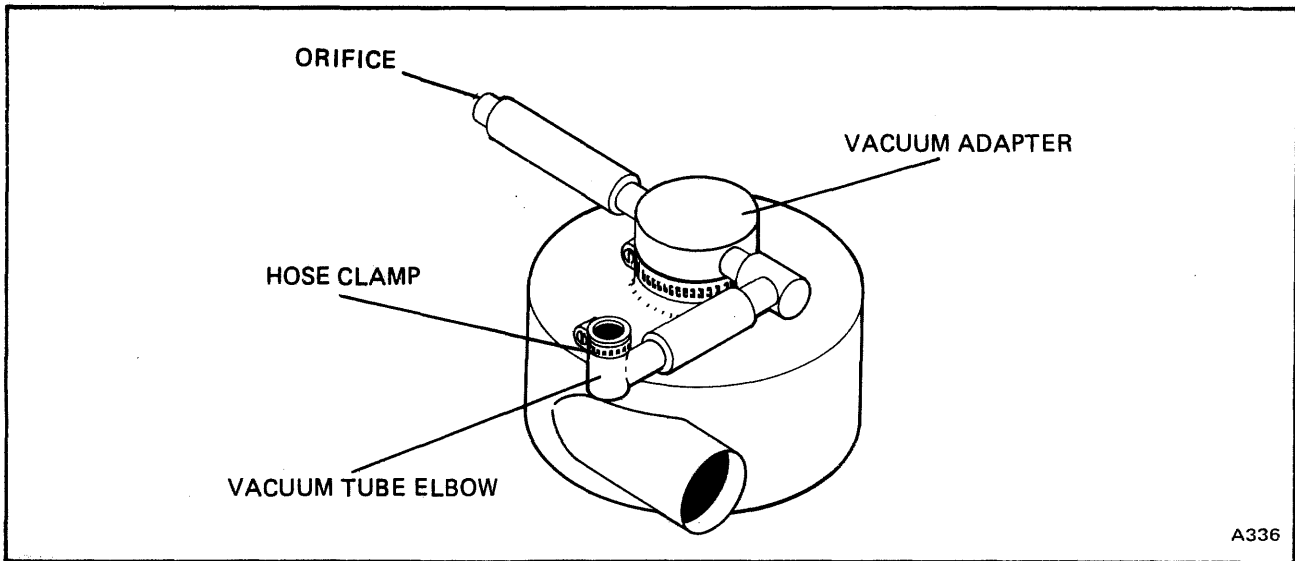


Figure 6-13. Removal of Vacuum Tube Adapter

- b. If height of picker sector requires adjustment, loosen set screws in back of picker sector, Figure 6-12.
- c. Adjust picker sector until measurement between mainframe and center of middle row of holes on picker sector is exactly 1-5/8 inches.
- d. The second adjustment is the air gap between picker sector and vacuum adapter plate. The tolerance between sector and plate is 0.002 inch to allow for maximum vacuum with free sector travel.
- e. Loosen set screw in vacuum tube adapter elbow located on underside of mainframe, Figure 6-13. Remove elbow from sleeve. Prop open hopper follower using about one inch of cards inserted at a right angle.
- f. Loosen vacuum adapter plate set screw, Figure 6-11.
- g. Insert a .002" feeler gauge between picker sector and vacuum adapter plate. From bottom side of mainframe push vacuum adapter plate upward. Exert upward pressure and tighten vacuum adapter plate set screw.
- h. Replace vacuum tube adapter elbow.
- i. Check picker sector rest position. The back edge of the last row of holes on the picker sector should line up with middle of vacuum adapter plate set screw hole. The position is established by placement of the rest stop.
- j. Loosen two picker stop screws, Figure 6-12.
- k. Using a 6" steel rule to gauge picker sector rest position, and while holding picker sector firmly in alignment push rest stop against picker sector and tighten the screws.
- l. Check gap between throat block and picker sector. The gap should be 0.008 inch to ensure that only one card is picked at a time.
- m. Loosen screw holding throat block, Figure 6-11.
- n. Place an .008" feeler gauge between throat block and picker sector face.
- o. Exert slight pressure on rear of throat block and tighten the mounting screw.
- p. Check solenoid coupling adjustment. The solenoid coupling is used to transfer rotational solenoid motion to picker sector.
- q. Loosen two set screws in the top of the solenoid coupling, Figure 6-14.
- r. Depress coupling slightly with fingers (0.010 to 0.015 inch) and while maintaining pressure, tighten two coupling set screws, ensuring one set screw is on flat portion of

shaft. Remove return spring on load shaft and check that solenoid return tension is just sufficient to return load to within 0.040 inch of its stop position. Too much tension may result in insufficient drive action to the load shaft.

s. Replace return spring and check solenoid action by operating picker sector manually while power is applied, vacuum is applied, and cards are in the input hopper.

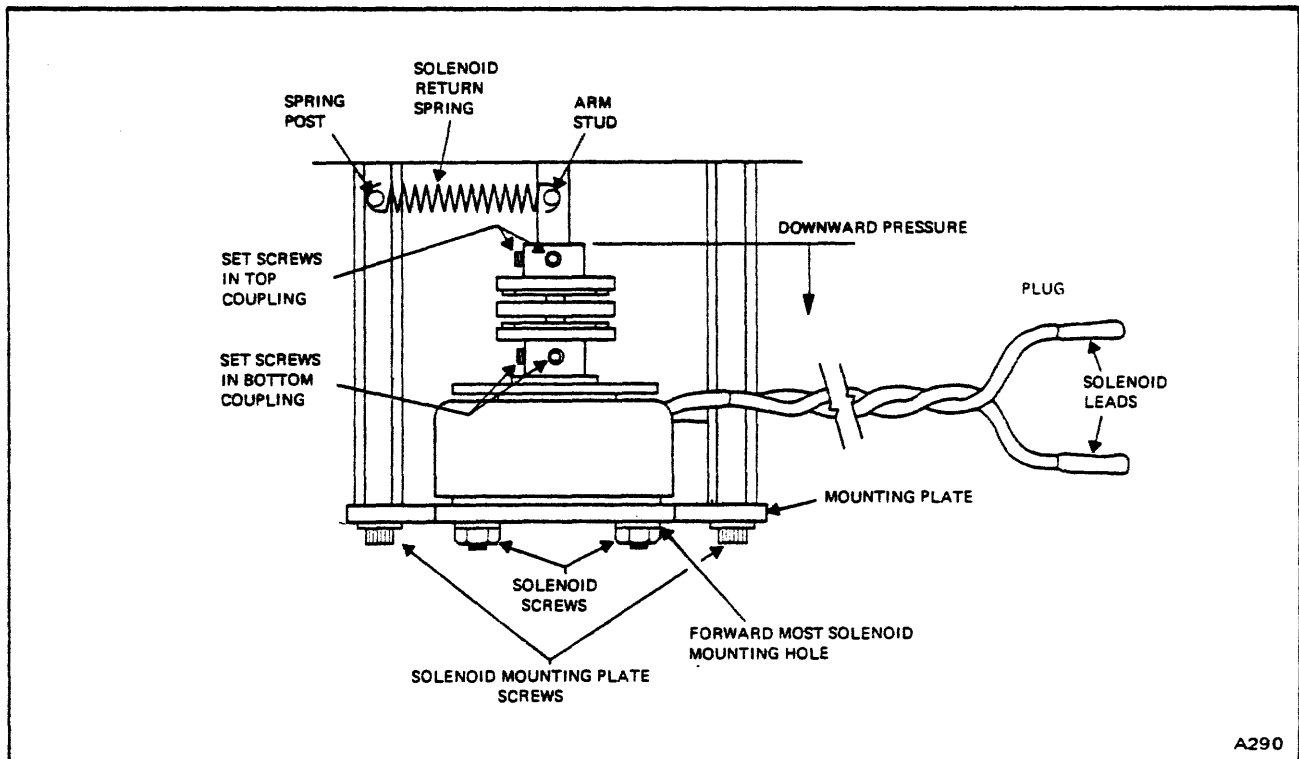
t. Check adjustment of picker sector bumper. This bumper is used to limit picker sector over-travel to 0.007 inch beyond point where card is delivered to pinch rollers.

u. Place a stack (about 2 inches) of cards in the input hopper. Operate POWER switch. With reader in LOCAL, operate RESET switch and run a few cards into stacker. Operate STOP switch.

v. Manually operate picker sector. Note point at which card just reaches pinch rollers. After card is picked, there should be approximately 0.007 inch of over-travel of sector before it reaches the bumper.

w. To adjust for proper sector over-travel, loosen two picker bumper screws, Figure 6-12.

x. Adjust picker bumper so that over-travel is between 0.007 and 0.014 inch. Tighten screws.



78125/M1000L

Figure 6-14. Solenoid Preload Adjustment

## 6.9 ADJUSTMENT OF STACK FOLLOWER

The output follower is adjusted to ensure proper movement of cards onto the stacker.

- a. Remove rear panel per paragraph 6.1.
- b. Remove card cage cover, Figure 6-5.
- c. Loosen the two set screws on the stack shaft support (Figure 6-10).
- d. Adjust the stack shaft assembly for a 0.125 to 0.0250 inch clearance between the stack follower and front casting (Figure 6-10).
- e. Tighten the two set screws and recheck the clearance between the stack follower and front casting. Readjust if necessary.
- f. Replace rear panel and card cage cover.

## 6.10 VACUUM PUMP BELT TENSION ADJUSTMENT

The vacuum/blower motor belt tension is a critical adjustment. A reduction in the amount of vacuum or riffle air can cause erratic picking. The vacuum pump assembly must be removed from the base plate to accomplish this adjustment procedure.

- a. Remove four screws from rear subframe panel, Figure 6-15.
- b. Remove five screws from bottom of baseplate retaining rear subframe panel.
- c. Cut the cable tie holding main connector cable to baseplate. Move subframe panel backward and tilt outward.

### NOTE

Be sure to tag wires removed in the following step to ensure they are replaced on the proper terminals.

- d. Remove rubber hood from motor run capacitor and disconnect red and blue clip leads, Figure 6-16.
- e. Remove yellow clip lead from solid state relay.
- f. Loosen blower hose clamp on side of pump and remove hose from pump.
- g. Loosen vacuum adapter clamp on top of pump and remove from pump.

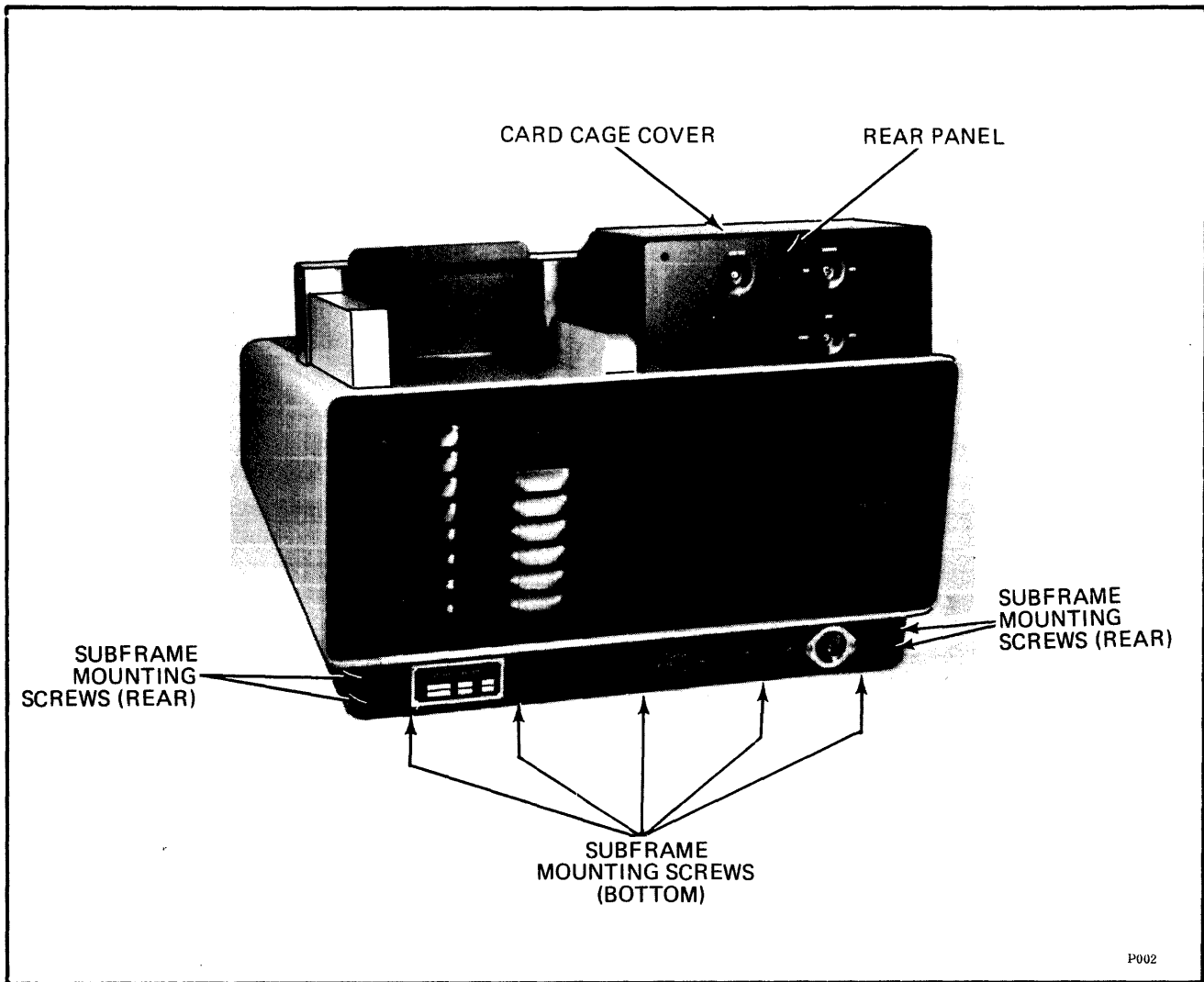


Figure 6-15. Removal of Rear Subframe Panel

- h. Remove ground strap from pump mounting plate.

CAUTION

HOLD MOUNTING POSTS TO AVOID  
TWISTING OFF THE PUMP PLATE RUBBER  
SHOCK MOUNTS.

- i. Remove four mounting screws holding the vacuum pump assembly.
- j. The pump assembly can now be removed from the reader and belt tension adjusted.

78125/M1000L

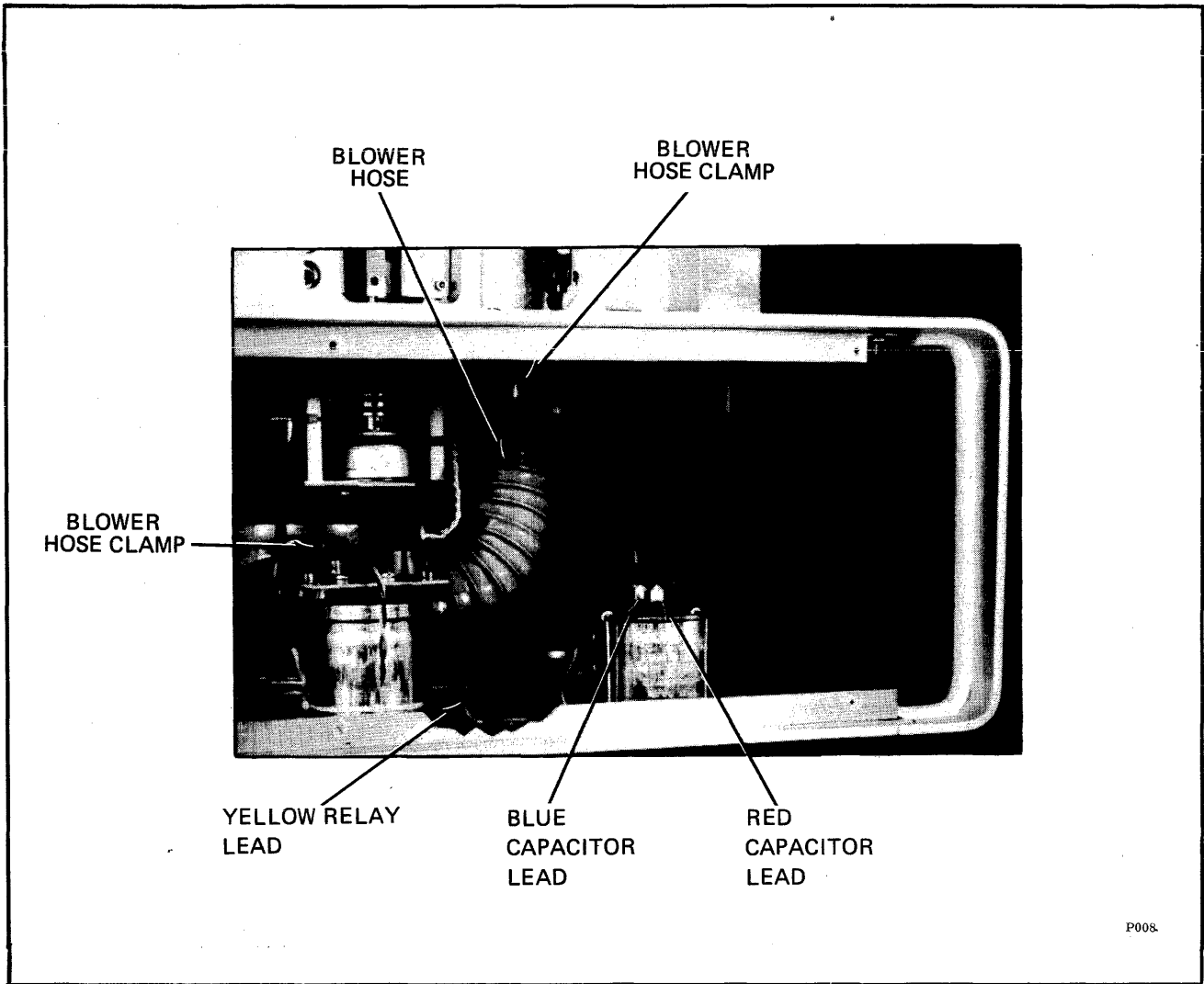
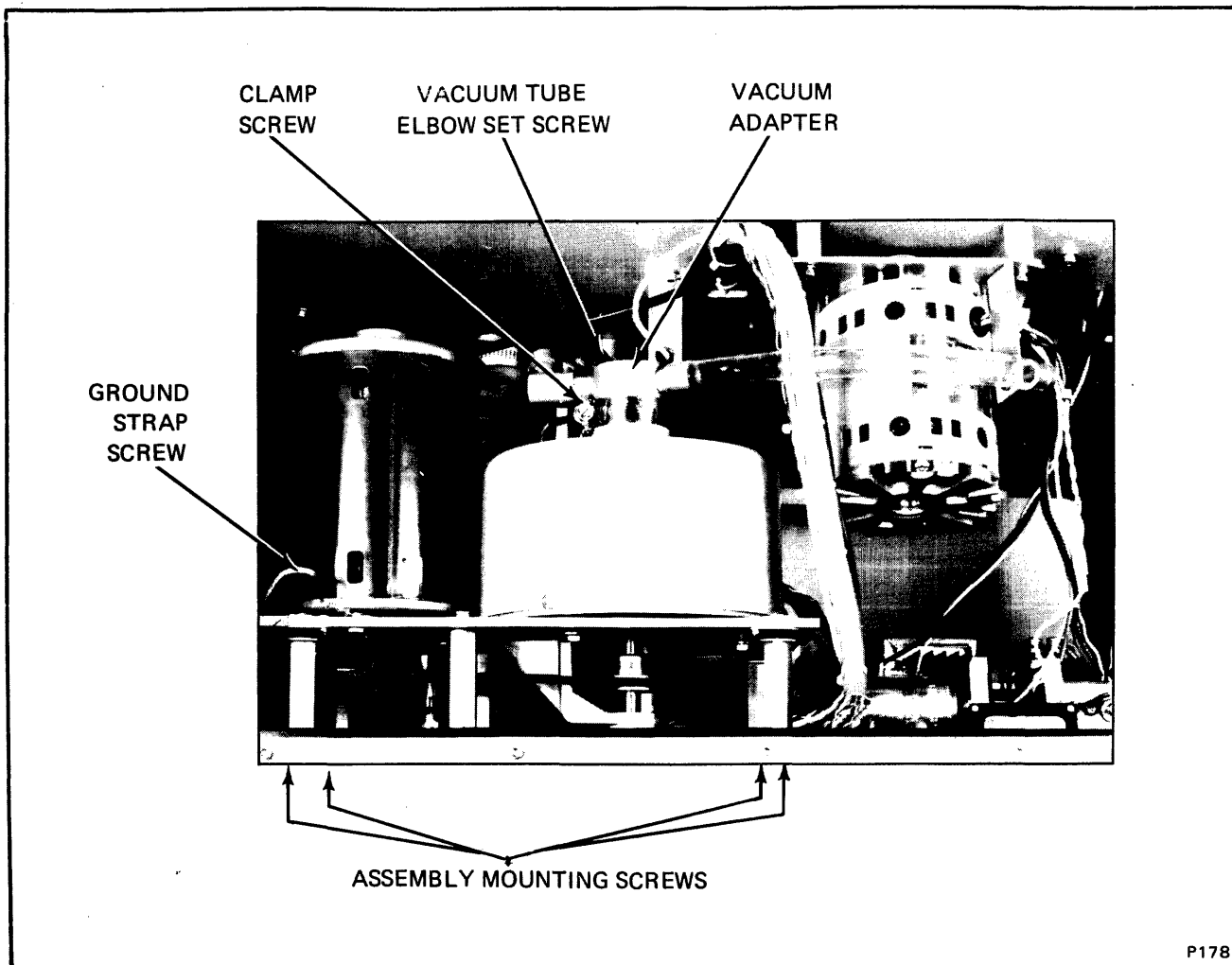


Figure 6-16. Disconnecting Vacuum Pump Assembly

- k. Loosen three hex mounting bolts holding pump assembly in place, Figure 6-18.
- l. Using a spring scale, adjust for approximately 4 to 6 ounces of belt tension. This should cause belt to deflect  $3/64$  inch when properly adjusted.
- m. Check pulleys to ensure they are in the same plane. Also check motor pulley set screw to ensure it is secure.
- n. Install pump in reverse order of disassembly and check reader for proper operation.
- o. Refasten main connector cable to baseplate and replace rear subframe panel.

78125/M1000L





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Figure 6-17. Removal of Vacuum Blower Motor Assembly

#### 6.11 PINCH ROLLER TENSION ADJUSTMENT

Normally all repairs to the stack casting can be accomplished without loosening the casting. However, if loosening or removal of the casting becomes necessary, the following adjustment procedure must be performed.

#### CAUTION

ADJUSTMENT OF THE STACKER CASTING IS NORMALLY PERFORMED AT THE FACTORY. THIS ADJUSTMENT SHOULD BE ATTEMPTED IN THE FIELD ONLY IN CASES OF EXTREME EMERGENCY.

- a. Remove front and rear panels and top panel cover per paragraph 6.1.

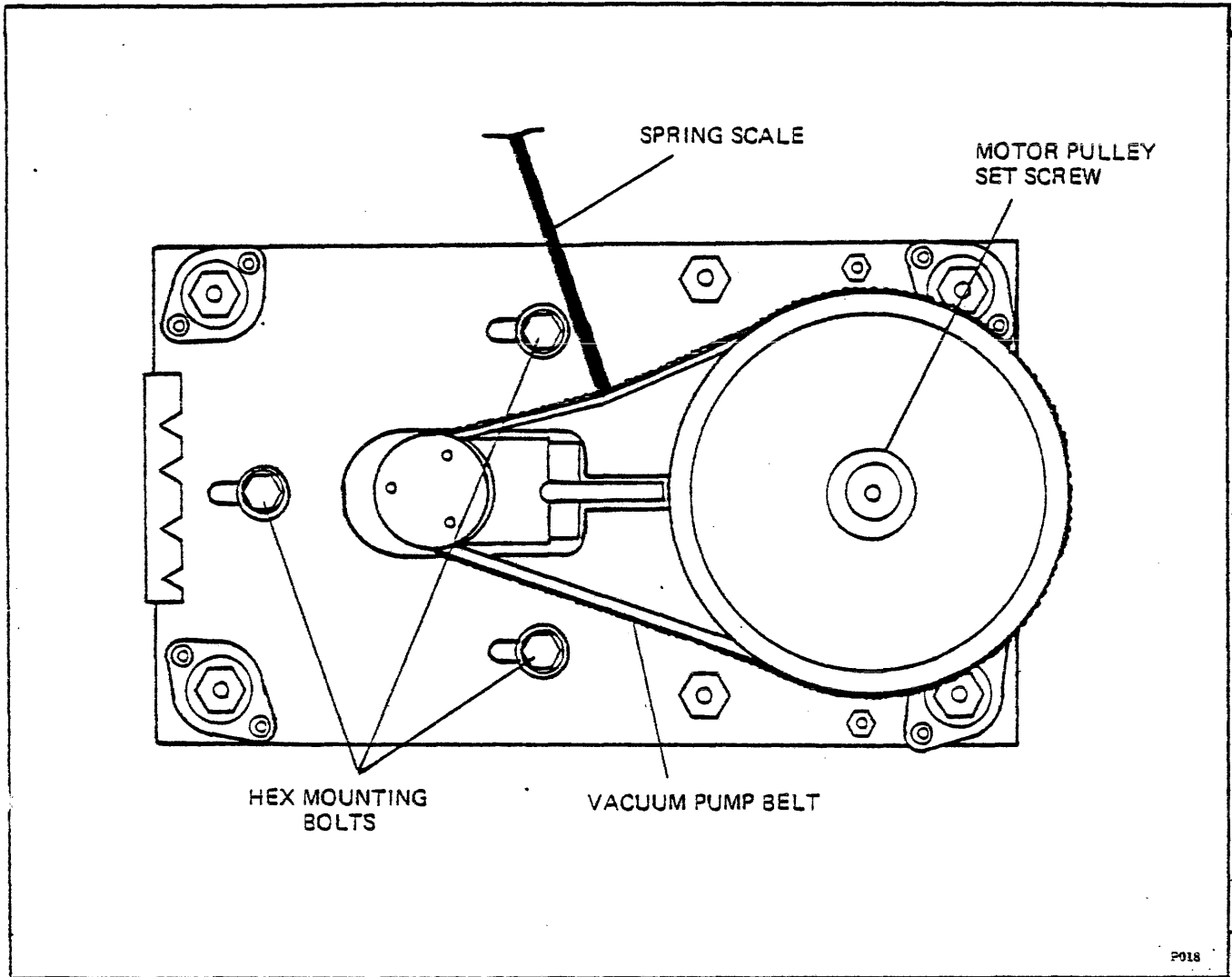


Figure 6-18. Adjustment of Vacuum Blower Motor Belt Tension

- b. Remove card cage cover.
- c. Loosen control panel mounting screws.
- d. Loosen stack casting mounting screws.
- e. Install a 4-inch C clamp across the center of the pick and stack castings.
- f. Move the stack casting to a position where the stacker rollers just make contact with the picker rollers.
- g. Use a dial caliper to measure the distances from the rear of the stack casting to the front of the pick casting, across each set of rollers.
- h. Carefully tighten the C clamp until the measured distances are 0.010 inch less than

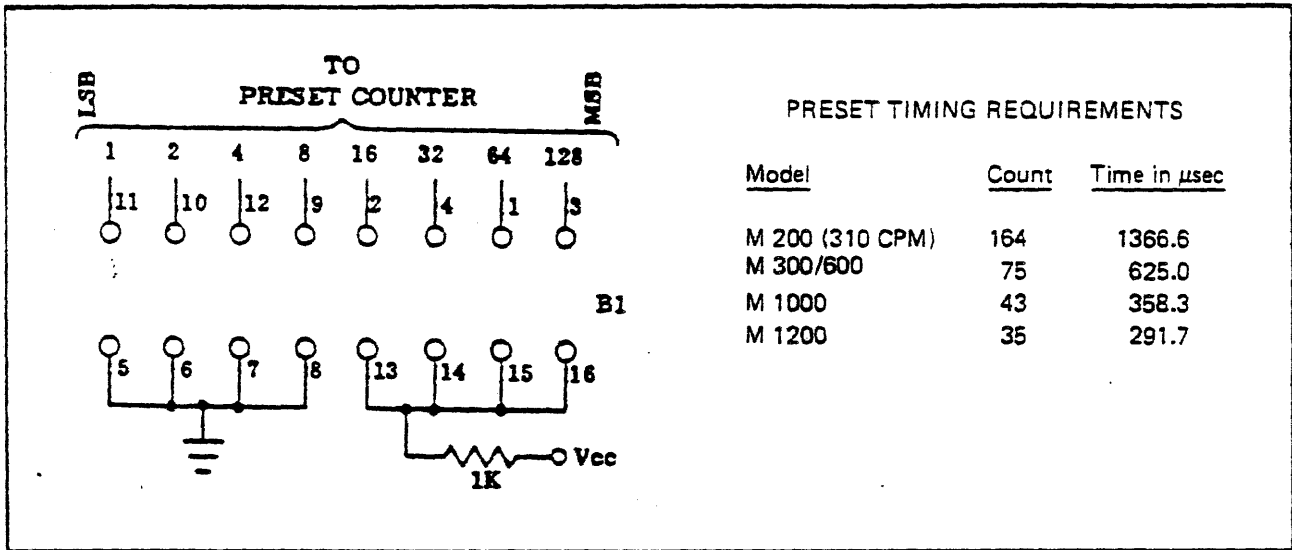


Figure 6-19. Preset Counter Strapping

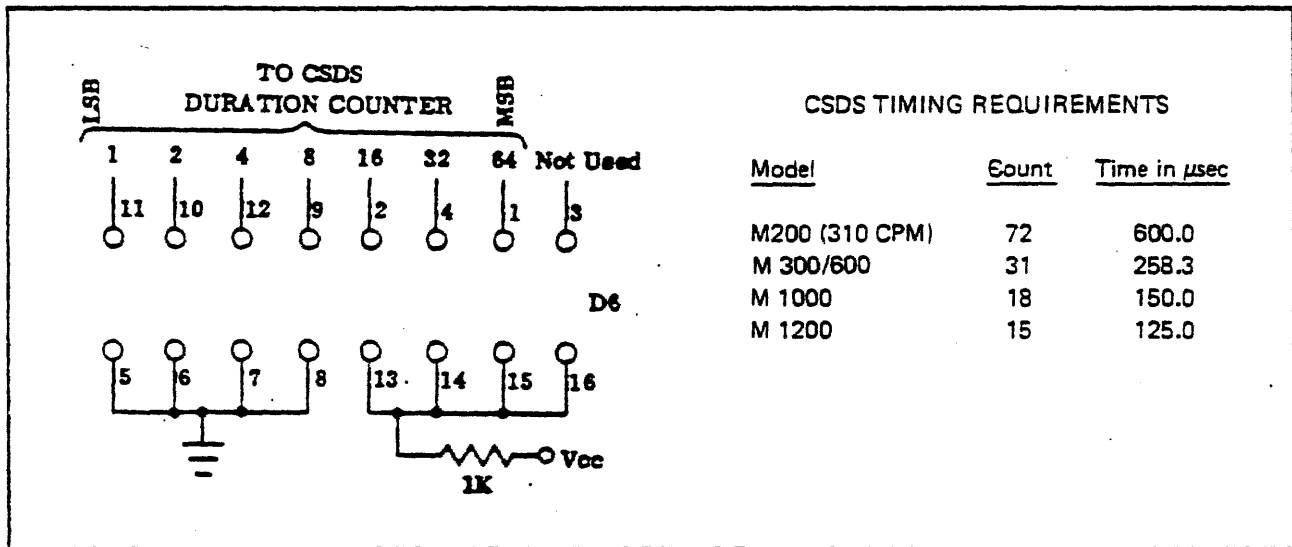


Figure 6-20. CSDS Duration Counter Strapping

measured in step 7.

- i. Tighten the stack casting mounting screws; check measurements and repeat steps 7 and 8 if necessary.
- j. Remove C clamp and dial caliper.
- k. Tighten control panel mounting screws.
- l. Replace card cage cover.
- m. Replace front and rear panels and top panel cover.

ADJUSTMENT OF PRESET AND CSDS TIMING

Preset and CSDS Timing is normally set at the factory. If it is desired to change this timing, it will be necessary to change the Preset and CSDS Duration counter strapping on the Sync card.

- a. Remove card cage rear panel.
- b. Remove Sync card from card cage.
- c. Change strapping on Jumper Module 1B to obtain required Preset count (Figure 6-19).
- d. Change strapping on Jumper Module 6D to obtain required CSDS Duration count (Figure 6-20).
- e. Program the counters with the complement of the required count as follows:
  1. Let ground represent logic "1," and strap output pins to pins 5, 6, 7 or 8 to create the required count.
  2. Strap all other output pins to Vcc, pins 13, 14, 15 or 16.
- f. Replace Sync card in card cage.
- g. Replace card cage rear panel.



SECTION 7  
PREVENTIVE MAINTENANCE

7.1           GENERAL

This section provides information for preventive maintenance and general care of M-Series card readers. These readers are of rugged construction and are designed to provide many hours of reliable operation; preventive maintenance is generally limited to routine cleaning and lubrication.

7.2           CLEANING

To ensure proper operation, cleanliness of the card reader must be maintained.

7.2.1         PICKER SECTOR

After each 40 hours of operation, wipe the neoprene surface of the picker sector with a cloth or paper wiper saturated with a solution of soap and water. This will remove the glaze buildup from ink which rubs off the cards. This is especially prevalent where new cards are used exclusively. This glaze may reduce the surface friction of the picker sector to the point that erratic pick operation may result.

After each 160 hours of operation, the picker sector should be examined to see if any of the vacuum holes have become plugged with lint, trash, or card meal which the routine cleaning has failed to dislodge. If so, gently push this debris through the holes with a paper clip while the reader is on. The vacuum system will remove the debris.

7.2.2         CASTING ASSEMBLIES

After each 160 hours of operation, the card track should be cleaned. Remove the top panel cover (paragraph 6.1) and use a vacuum cleaner to remove any card debris buildup around the picker and stacker castings. Use a small brush to clean around the picker and stacker rollers and picker sector.

7.2.3         COOLING FAN

The cooling fan screen prevents dirt and dust from entering the card reader interior. The screen should be cleaned as often as required, according to the operating environment. Use a flat-blade screwdriver to remove the screen, then clean in a solvent or use a vacuum cleaner as necessary.

7.2.4         EXTERIOR CLEANING

The exterior should be cleaned as often as necessary. Cleaning is generally recommended after each 40-hours of operation. Wipe the exterior painted surfaces with a clean, lint-free cloth and a soap and water solution. Anodized surfaces may be cleaned with denatured

alcohol or household ammonia. Never use solvents on the painted areas.

### 7.3 LUBRICATION

The rollers of the rotary solenoid should be checked and one drop of lubricant applied to each roller every four months of operation. The amount of lubricant required will be determined by the operating environment of the reader, but a four-month interval will normally maintain a safe level. Sparingly apply light lubricant, (Part No. 00000508) to each of the three roller grease points (Figure 7-1). This is available from Documentation or Ledex, Inc., Dayton, Ohio.

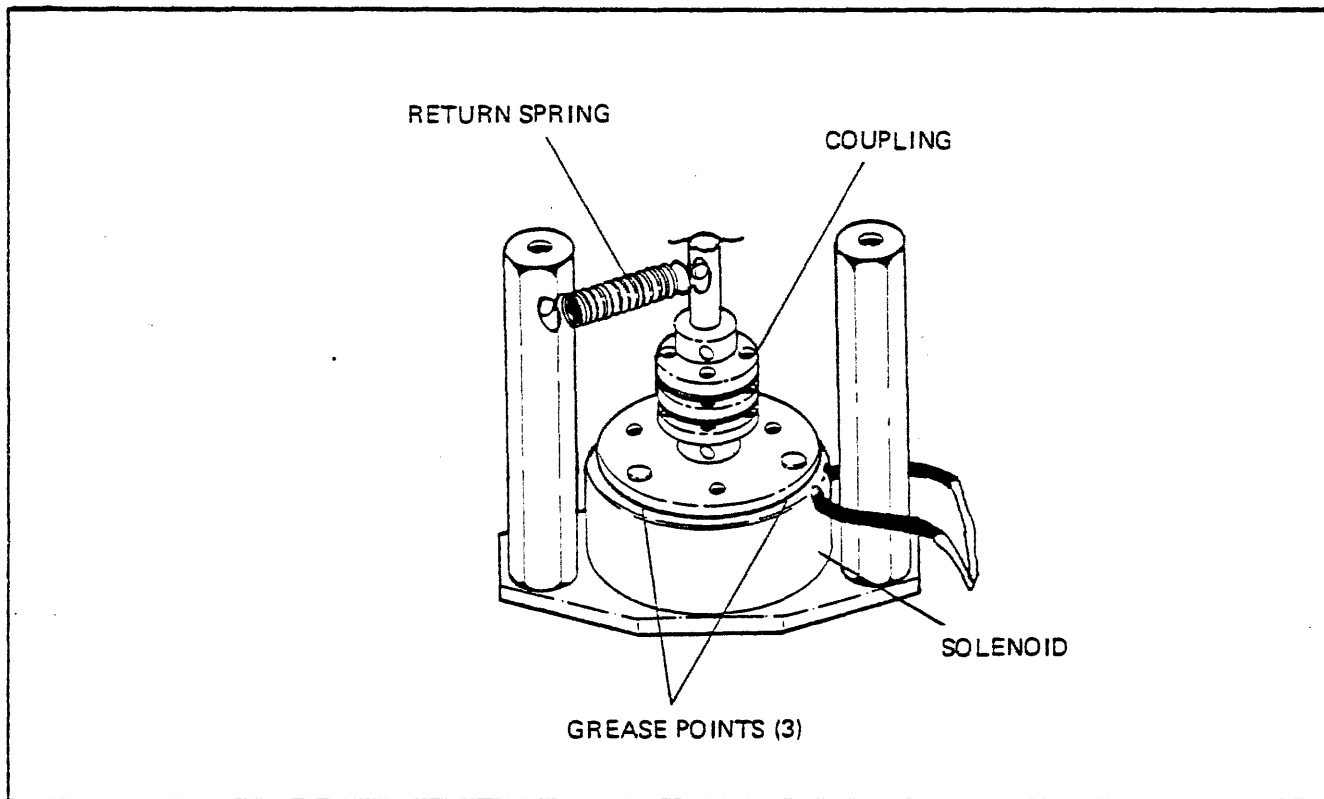


Figure 7-1. Solenoid Lubrication

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SECTION 8  
TROUBLESHOOTING

8.1 GENERAL

If adjustment procedures in Section 6 do not remedy an operating problem, Table 8-1 should help in isolating the trouble. If a part is defective and must be replaced, Section 9 provides repair and replacement procedures. The Illustrated Parts Breakdown, Section 12, will aid in locating and identifying replacement parts.

Table 8-1. Fault Isolation Chart

SYMPTOM	PROBABLE CAUSE	REMEDY
POWER indicator fails to light.	<ol style="list-style-type: none"> <li>1. Power cord is not connected to reader or power source.</li> <li>2. Circuit breaker CB1 is not on.</li> <li>3. Fuse F1 is defective.</li> <li>4. Lamp is burned out.</li> <li>5. +5 volt power regulator defective.</li> </ol>	<ol style="list-style-type: none"> <li>1. Connect power cord to reader and power source.</li> <li>2. Place circuit breaker CB1 to ON position.</li> <li>3. Replace F1.</li> <li>4. Replace lamp.</li> <li>5. Replace +5 volt power regulator.</li> </ol>
An indicator lamp fails to light when lamp test switch is operated (POWER indicator excluded).	<ol style="list-style-type: none"> <li>1. Lamp is burned out.</li> <li>2. Defective Error Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace defective lamp.</li> <li>2. Replace Error Card.</li> </ol>
When LAMP TEST switch is activated, none of the lamps on the control panel will light. (POWER indicator excluded.)	<ol style="list-style-type: none"> <li>1. Defective lamp test switch.</li> <li>2. Defective Error Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace lamp test switch.</li> <li>2. Replace Error Card.</li> </ol>
HOPPER CHECK indicator does not light when hopper goes empty or stacker goes full. No other error indications.	<ol style="list-style-type: none"> <li>1. Lamp is burned out.</li> <li>2. Defective Error Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace lamp.</li> <li>2. Replace Error Card.</li> </ol>
HOPPER CHECK indicator does not light when hopper goes empty and PICK CHECK indicator is lit.	<ol style="list-style-type: none"> <li>1. Hopper empty switch not adjusted properly.</li> <li>2. Defective hopper empty switch.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust hopper empty switch per para. 6.6.</li> <li>2. Replace hopper empty switch.</li> </ol>

78126/M1000L



SYMPTOM	PROBABLE CAUSE	REMEDY
HOPPER CHECK indicator does not light when stacker goes full.	<ol style="list-style-type: none"> <li>1. Stacker full switch is not adjusted properly.</li> <li>2. Defective stacker full switch.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust stacker full switch per para. 6.7.</li> <li>2. Replace stacker full switch.</li> </ol>
PICK CHECK indicator fails to light when reader makes six attempts and fails to pick a card.	<ol style="list-style-type: none"> <li>1. Lamp is burned out.</li> <li>2. Defective Error Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace lamp.</li> <li>2. Replace Error Card.</li> </ol>
STACK CHECK indicator fails to light when there is a stack check condition.	<ol style="list-style-type: none"> <li>1. Lamp is burned out.</li> <li>2. Defective Error Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace lamp.</li> <li>2. Replace Error Card.</li> </ol>
PICK CHECK indicator lights regularly after making six pick attempts.	<ol style="list-style-type: none"> <li>1. Dirty picker sector.</li> <li>2. Maladjustment of picker stops, vacuum plate, throat clearance, or solenoid coupling.</li> <li>3. Defective Sync Card.</li> <li>4. Defective Error Card.</li> <li>5. Defective Clock Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Clean picker sector with denatured alcohol.</li> <li>2. Readjust picker sector per para. 6.8.</li> <li>3. Replace Sync Card.</li> <li>4. Replace Error Card.</li> <li>5. Replace Clock Card.</li> </ol>
READ CHECK indicator fails to light when a dark check or light check condition occurs.	<ol style="list-style-type: none"> <li>1. Lamp is burned out.</li> <li>2. Column "0" output or Column "81" output is missing from the Clock Card.</li> <li>3. One light or one dark output missing from the Control Card.</li> <li>4. Defective Error Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace lamp.</li> <li>2. Replace Clock Card.</li> <li>3. Replace Control Card.</li> <li>4. Replace Error Card.</li> </ol>
Reader picks three cards, and then stops with a PICK CHECK.	<ol style="list-style-type: none"> <li>1. Good pick reset output is missing from Clock Card.</li> <li>2. Clear pick control is missing on the Sync Card.</li> <li>3. Pick attempt counter is not being cleared out properly.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Clock Card.</li> <li>2. Replace Sync Card.</li> <li>3. Replace Sync Card.</li> </ol>

78125/M1000L

SYMPTOM	PROBABLE CAUSE	REMEDY
Reader picks two to six cards and then stops with a PICK CHECK.	Pick attempt counter is not being reset at good pick reset time. Defective Sync Card.	Replace Sync Card.
Reader picks one card but the reader will not pick additional cards. Unable to stop the reader by pressing the STOP switch.	<ol style="list-style-type: none"> <li>1. Column "84CR or CR" output is missing from the Clock Card.</li> <li>2. Column strobe phase "B" or phase "D" is missing from Sync Card.</li> <li>3. Clock phase "C" or phase "D" is missing from Clock Card.</li> <li>4. Clock phase "B" is missing from Clock Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Clock Card.</li> <li>2. Replace Sync Card.</li> <li>3. Replace Clock Card.</li> <li>4. Replace Clock Card.</li> </ol>
Reader reads erroneous data.	<ol style="list-style-type: none"> <li>1. Defective Clock Card.</li> <li>2. Defective Sync Card.</li> <li>3. Defective Control Card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Replace Clock Card.</li> <li>2. Replace Sync Card.</li> <li>3. Replace Control Card.</li> </ol>
Sharp, metallic noise from picker sector while reading cards.	<ol style="list-style-type: none"> <li>1. Picker sector maladjusted.</li> <li>2. Rubber roller worn.</li> <li>3. Bearing bad.</li> <li>4. Belt too tight.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust picker sector per procedure in para. 6.8.</li> <li>2. Replace roller.</li> <li>3. Replace bearing.</li> <li>4. Readjust belt.</li> </ol>

NOTE

When using test equipment for troubleshooting, connect test equipment ground to card logic ground to obtain accurate readings.



SECTION 9  
REPAIR PROCEDURES

9.1 GENERAL

The following procedures detail step-by-step methods for removal and installation of those parts which may require replacement during the life of the reader. These procedures must be followed closely and should be performed only by a technician proficient in dis-assembly/assembly techniques.

9.2 REQUIRED TOOLS

Tables 9-1 and 9-2 list conventional and special tools, respectively, that are required to perform maintenance and repair procedures in this section and adjustment procedures detailed in Section 6.

Table 9-1. Conventional Tools Required

DESCRIPTION
Gage Set, Feeler, 0.0015 through 0.025 inch
Pliers, Long Nose
Retaining Ring Remover, No. 2
Rule, Metal, Decimal/Fraction per Inch Scales, 6 inch
Scale, Spring, 32 oz. capacity
Screwdriver, Allen, 1/16 inch
Screwdriver, Flat Blade, Medium, 3 inch
Screwdriver, Flat Blade, Medium, 6 inch
Screwdriver, Phillips No. 1, 6 inch
Screwdriver, Phillips No. 2, 6 inch
Side Cutter
Soldering Iron, 60-Watt
Solder Removal Tool
Wrench, Allen, Short Arm, 0.050 inch
Wrench, Allen, Short Arm, 1/16 inch
Wrenches, Allen, Long Arm, 3/32, 5/64, 7/64, 1/8 and 9/64 inch
Wrenches, Open End or Socket, 1/4, 11/32 and 7/16 inch
Wrench, Open End, 1/2 inch

78125/M1000L

Table 9-2. Special Tools Required

DESCRIPTION	MANUFACTURER PART NO.
Contact Extraction Tool, Leaf	AMP 465195-2 or 465275-1
Contact Extraction Tool, Modified Fork	AMP 91037-2
Contact Extraction Tool, Mod IV	AMP 91029-1A
Extraction Tool	AMP 91022-1
Extraction Tool	Elco 061877-04
IC Removal Tool	AMP 91049-1
Insertion/Extraction Tool (on Baseplate)	Deutsch M15570-16
Insertion Tool	Elco 061742-04
IC Test Clip	AP Inc. 923700
Extender, Printed Circuit Card	Documation 30099501

9.3 MAIN DRIVE MOTOR BELT

- a. Remove front and rear panels per paragraph 6.1.
- b. At bottom of mainframe, loosen three motor mounting plate screws (Figure 9-1).
- c. Loosen three motor mounting plate screws (bottom of mainframe). Remove fourth motor mounting plate screw, Figure 9-1.
- d. Loosen set screw in timing disc (Figure 9-2).

CAUTION

USE EXTREME CARE TO PREVENT DAMAGE TO TEETH ON TIMING DISC. WRAP DISC IN SOFT TISSUE WHILE IT IS REMOVED FROM READER.

- e. Loosen set screw in fifth stacker roller pulley, Figure 9-3.
- f. Remove fifth stacker roller pulley from stacker-roller shaft.
- g. Loosen set screw in bottom fourth stacker roller pulley.
- h. Remove bottom fourth stacker roller pulley.
- i. Remove main drive motor belt, Figure 9-2.
- j. To replace main drive motor belt:

78125/M1000L

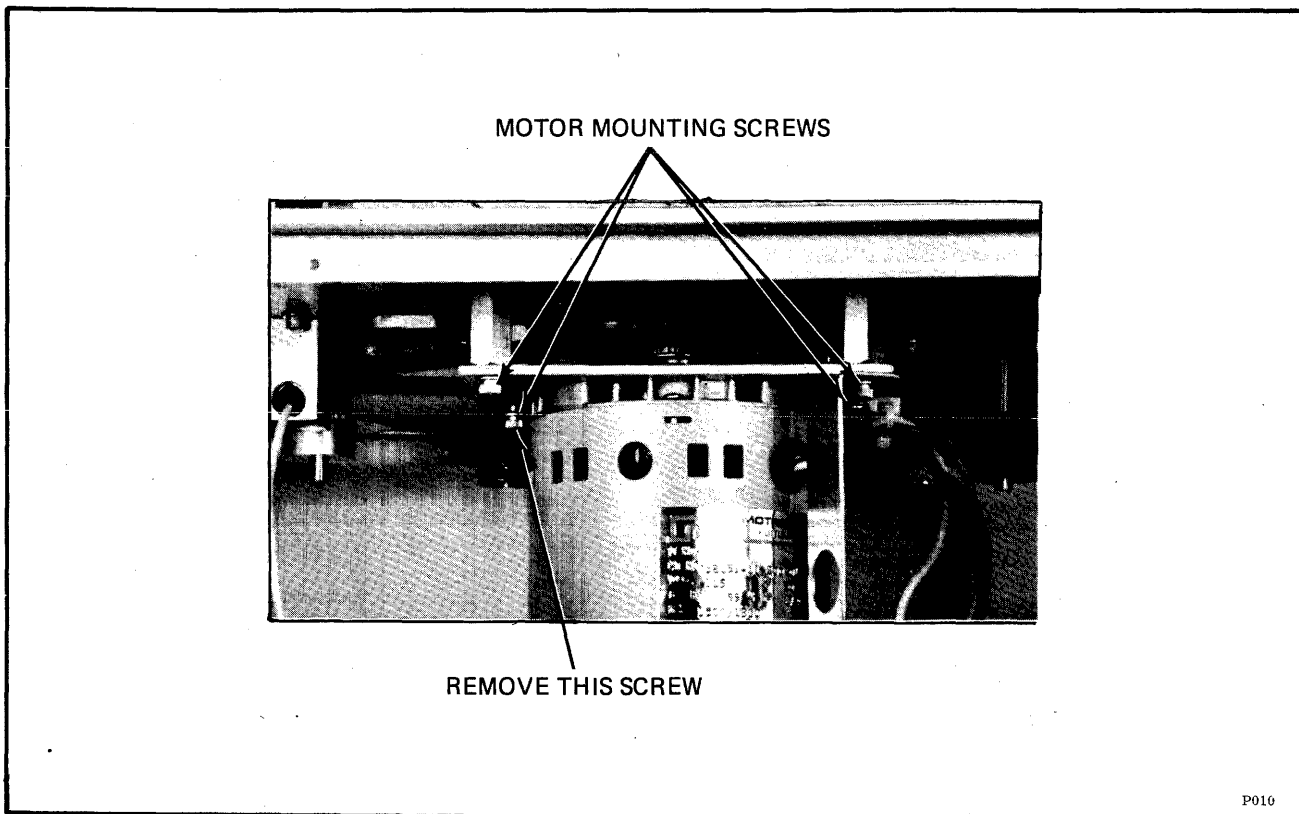


Figure 9-1. Main Drive Motor Mounting

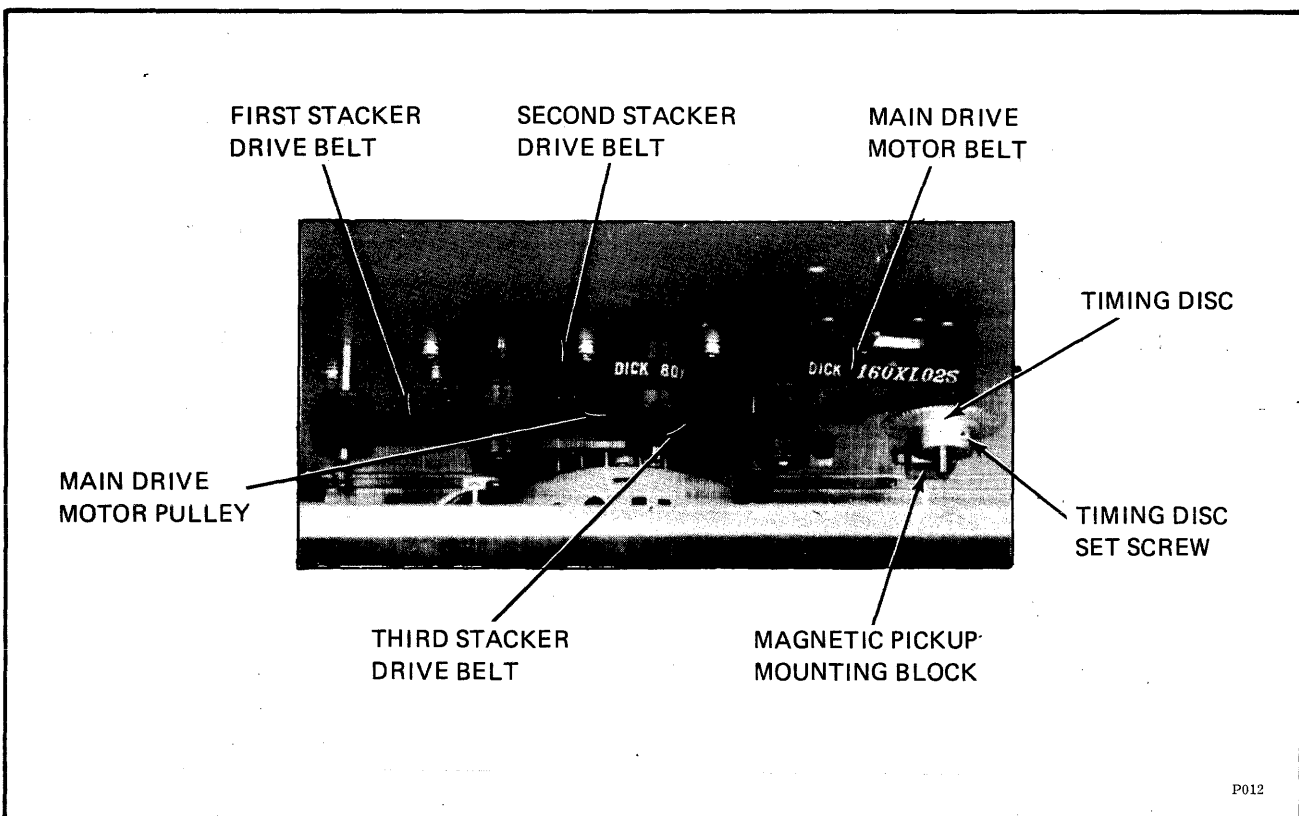


Figure 9-2. Stacker Drive Train Belt Arrangement

CAUTION

PULLEY CONFIGURATION MUST BE MAINTAINED. ALWAYS REPLACE PROPER PULLEY IN ITS CORRECT POSITION (UPPER OR LOWER) ON ITS RESPECTIVE SHAFT. FIGURE 9-4 SHOWS THE CORRECT CONFIGURATION.

1. Place belt over main drive motor pulley.
2. Slip belt over upper fourth stacker roller pulley, Figure 9-3.
3. Place belt over fifth stacker roller pulley and replace this pulley on fifth stacker roller shaft.
4. Replace bottom fourth stacker roller pulley.
5. Locate fourth stacker roller pulley so that set screw is on flat side of shaft and carefully tighten set screw.

CAUTION

USE MODERATE TORQUE TO TIGHTEN PULLEY SET SCREW. OVERTORQUE WILL RESULT IN DAMAGE TO PULLEY.

6. Push fifth stacker roller pulley up against mainframe, then pull very slightly downward. Ensure that pulley is free from mainframe.
  7. Locate fifth stacker roller pulley so that set screw is on flat side of shaft and carefully tighten set screw.
- k. Replace timing disc on fifth stacker roller shaft and tighten set screw lightly.
  - l. The main drive motor belt tension must be adjusted first. Refer to paragraph 6.2.
  - m. Second, the magnetic pickup and timing disc must be adjusted. Refer to paragraph 6.3.

9.4 THIRD STACKER ROLLER DRIVE BELT

- a. Remove front and rear panels per paragraph 6.1.
- b. Loosen set screw in bottom fourth stacker roller pulley, Figure 9-3.
- c. Pull bottom pulley down to disengage third stacker drive belt. Remove pulley and belt.

78125/M1000L

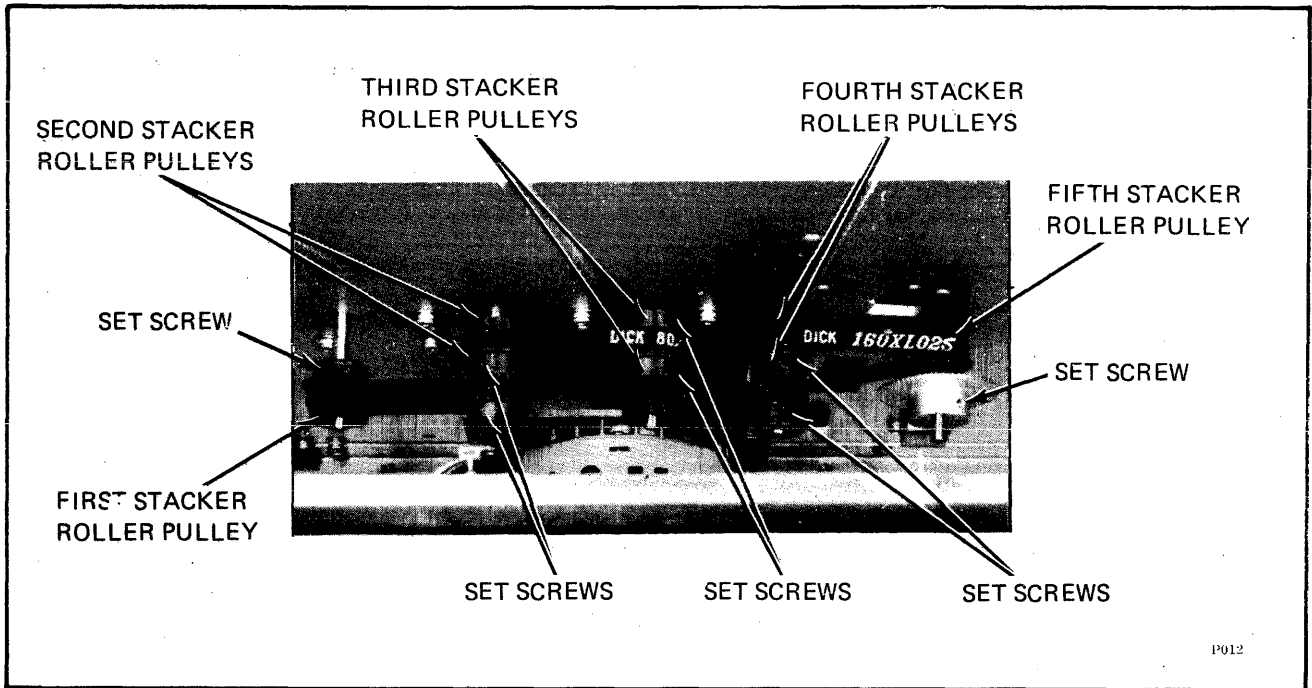


Figure 9-3. Stacker Drive Train Pulley Arrangement

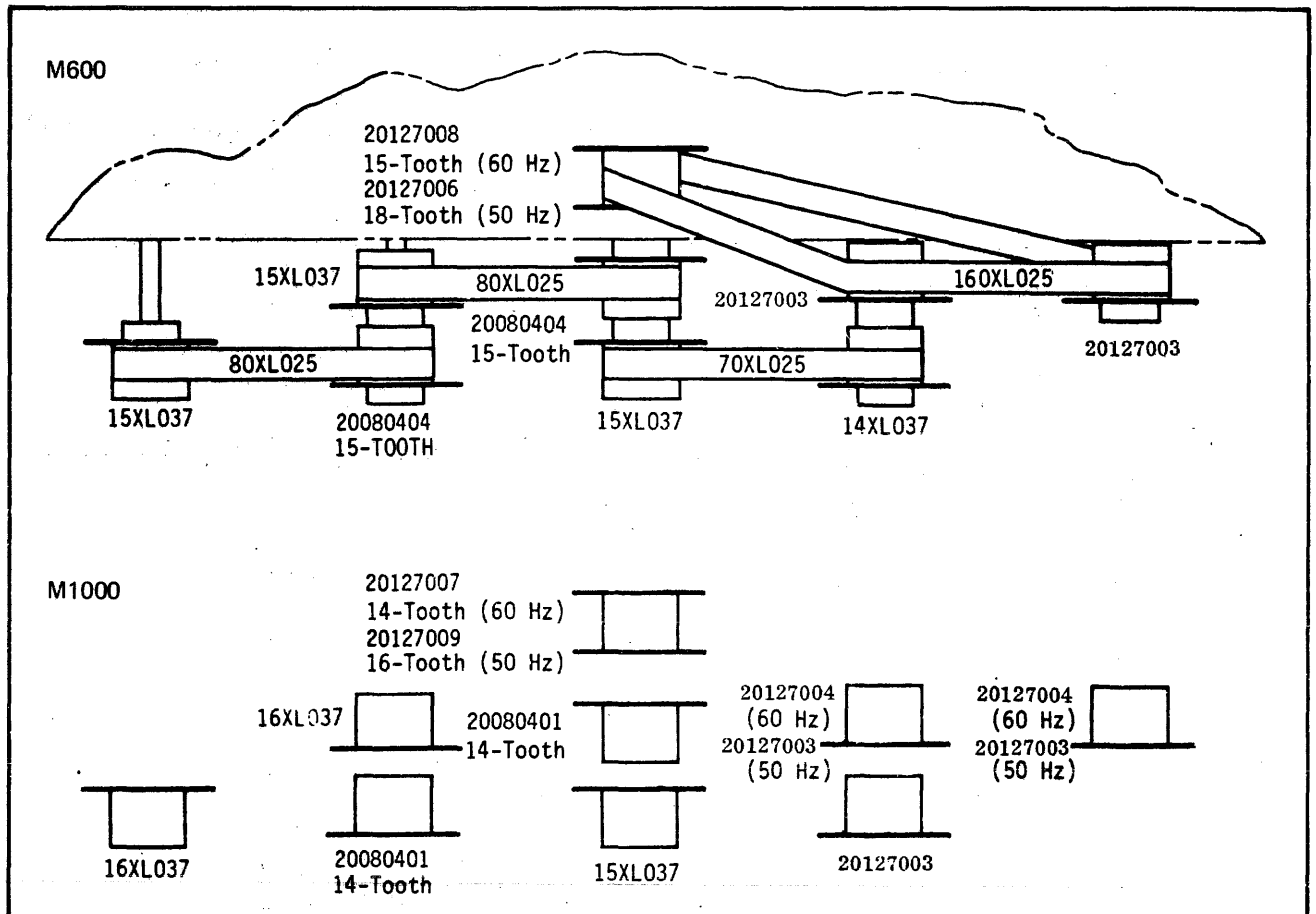


Figure 9-4. Pulley and Belt Configuration



- d. Replace third stacker drive belt on bottom third stacker roller pulley and around fourth stacker roller shaft.
- e. Replace bottom pulley of fourth stacker roller on shaft and push up until it engages with belt and is against top pulley.
- f. Position fourth stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
- g. Replace front and rear panels.

9.5            FIRST STACKER ROLLER DRIVE BELT

- a. Remove front and rear panels per paragraph 6.1.

CAUTION

USE MODERATE TORQUE TO TIGHTEN  
PULLEY SET SCREW. OVERTORQUE WILL  
RESULT IN DAMAGE TO PULLEY.

- b. Loosen set screw in bottom second stacker roller pulley, Figure 9-3.
- c. Pull bottom pulley down to disengage first stacker drive belt. Remove pulley and belt.
- d. Replace first stacker drive belt on bottom first stacker roller pulley and around second stacker roller shaft.
- e. Replace bottom pulley of second stacker roller on shaft and push up until it engages with belt and is against top pulley.
- f. Position second stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
- g. Replace front and rear panels.

9.6            SECOND STACKER ROLLER DRIVE BELT

- a. Remove front and rear panels per paragraph 6.1.

CAUTION

USE MODERATE TORQUE TO TIGHTEN PULLEY  
SET SCREW. OVERTORQUE WILL RESULT IN  
DAMAGE TO PULLEY.

78125/M1000L

- b. Loosen set screw in bottom second stacker roller pulley.
- c. Pull bottom pulley down to disengage first stacker drive belt. Remove pulley and belt.
- d. Loosen set screw in bottom fourth stacker roller pulley.
- e. Pull bottom pulley down to disengage third stacker drive belt. Remove pulley and belt.
- f. Loosen set screw in top second stacker roller pulley.
- g. Pull top pulley down to disengage second stacker drive belt. Remove pulley and belt.
- h. Replace second stacker drive belt on top third stacker roller pulley and around second stacker roller shaft.
- i. Replace top pulley of second stacker roller on shaft and push up until it engages with belt.

NOTE

Observe position of upper pulleys with respect to mainframe, Figure 9-3. Note that pulleys three, four and five are installed close to mainframe with a slight clearance. Pulley number two should be lowered sufficiently to allow belt to line up with pulley number three.

- j. Position top second stacker roller pulley so that set screw is on flat side of shaft and belt lines up with top pulley of third stacker roller. Carefully tighten set screw.
- k. Replace first stacker drive belt on bottom first stacker roller pulley and around second stacker roller shaft.
- l. Replace bottom pulley of second stacker roller on shaft and push up until it engages with belt and is against top pulley.
- m. Position second stacker roller on shaft so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
- n. Replace third stacker drive belt on bottom third stacker roller pulley and around fourth stacker roller shaft.
- o. Replace bottom pulley of fourth stacker roller on shaft and push up until it engages

with belt and is against top pulley.

- p. Position fourth stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
- q. Replace front and rear panels.

9.7 FIRST, SECOND, AND THIRD STACKER ROLLER BEARING ASSEMBLIES

NOTE

Replace shaft and both bearings with new matched assembly to assure proper operation.

- a. Remove front panel, rear panel and top panel cover per paragraph 6.1.
- b. Prop stack follower in its extended position with a 1/2 inch thick stack of cards.
- c. To replace first stacker roller bearings, perform step d; to replace second stacker roller bearings, perform step e; to replace third stacker roller bearings perform step f.
- d. To replace first stacker roller bearing assembly perform the following:

CAUTION

USE MODERATE TORQUE TO TIGHTEN PULLEY SET SCREW. OVERTORQUE WILL RESULT IN DAMAGE TO PULLEY.

- 1. Loosen set screw in bottom second stacker roller pulley, Figure 9-3.
- 2. Pull bottom pulley down to disengage first stacker drive belt. Remove pulley and belt.
- 3. Loosen set screw in first stacker roller pulley. Remove pulley.
- 4. To replace bearing assembly, perform the following:
  - a. Loosen set screw in bottom roller of stacker roller assembly.
  - b. Lift stacker shaft straight up and out of stacker casting. Note that there is a spacer washer between the top roller and the bearing seat, Figure 9-5. Remove top roller from shaft.
  - c. To remove top bearing, use L-shaped tool to lift bearing from assembly.

78125/M1000L

- d. To remove bottom bearing, slide out bottom roller and spacer washer. Use a straight tool to tap edge of bearing from inside of shaft hole to drop bearing from casting.
  - e. Install new bearings. Place spacer washer on top bearing. Slide bottom roller and spacer washer under shaft hole.
  - f. Replace top roller on new shaft, flush with or slightly below shaft end. Replace shaft in shaft hole. Select feeler gauge (.005 to .025 inch) to force roller against bearing.
  - g. Insert selected feeler gauge between main frame and bottom roller. Apply firm finger pressure on top roller and tighten set screw in bottom roller.
  - h. Check for vertical play in stacker shaft. If there is vertical play, loosen set screw in bottom roller and repeat step g.
5. Replace first stacker roller pulley on first stacker roller shaft in position shown in Figure 9-3.
  6. Position first stacker roller pulley so that set screw is on flat side of shaft. Carefully tighten set screw.
  7. Replace first stacker drive belt on first stacker roller pulley and around second stacker roller shaft.
  8. Replace bottom pulley of second stacker roller on shaft and push up until it engages with belt and is against top pulley.
  9. Position second stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
- e. To replace second stacker roller bearing assembly perform the following:

**CAUTION**

USE MODERATE TORQUE TO TIGHTEN  
PULLEY SET SCREW. OVERTORQUE WILL  
RESULT IN DAMAGE TO PULLEY.

1. Loosen set screw in bottom second stacker roller pulley.
2. Pull bottom pulley down to disengage first stacker drive belt. Remove pulley and belt.
3. Loosen set screw in top second stacker roller pulley.

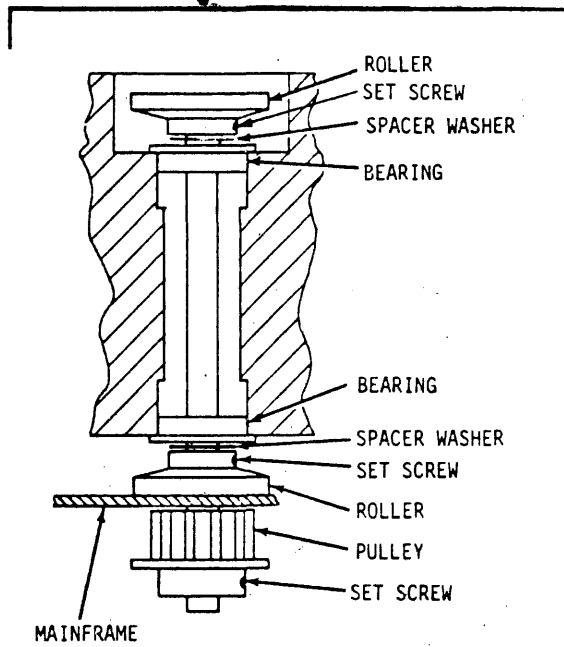
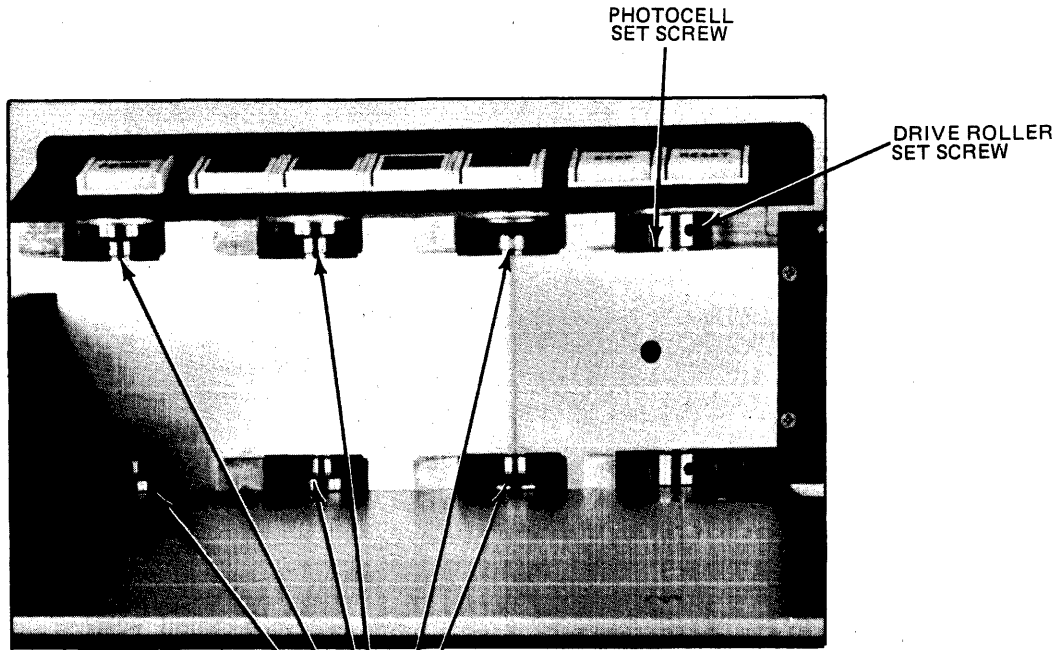


Figure 9-5. Pictorial, Stacker Roller Bearing Assembly

4. Pull top pulley down to disengage second stacker drive belt. Remove pulley.
  5. Perform step d.4. to replace bearing assembly.
  6. Place second stacker drive belt on third stacker roller pulley and around second stacker roller shaft.
  7. Replace top pulley of second stacker roller on shaft and push up until it engages with belt.
  8. Position second stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
  9. Place first stacker drive belt on first stacker roller pulley and around second stacker roller shaft.
  10. Replace bottom pulley of second stacker roller on shaft and push up until it engages with belt.
  11. Position second stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
- f. To replace third stacker roller bearing assembly perform the following:

CAUTION

USE MODERATE TORQUE TO TIGHTEN  
PULLEY SET SCREW. OVERTORQUE WILL  
RESULT IN DAMAGE TO PULLEY.

1. Loosen set screw in bottom second stacker roller pulley.
2. Pull bottom pulley down to disengage first stacker drive belt. Remove pulley and belt.
3. Loosen set screw in bottom fourth stacker roller pulley.
4. Pull bottom pulley down to disengage third stacker drive belt. Remove pulley and belt.
5. Loosen set screw in bottom third stacker roller pulley. Remove pulley.
6. Loosen set screw in top second stacker roller pulley.
7. Pull top pulley down to disengage second stacker drive belt. Remove pulley and belt.

8. Loosen set screw in top third stacker roller pulley. Remove pulley.
  9. Perform step d.4 to replace bearing assembly.
  10. Replace top third stacker roller pulley on third stacker roller shaft in position shown in Figure 9-5.
  11. Position third stacker roller pulley so that set screw is on flat side of shaft. Carefully tighten set screw.
  12. Place second stacker drive belt on third stacker roller pulley and around second stacker shaft.
  13. Replace top pulley of second stacker roller on shaft and push up until it engages with belt.
  14. Position second stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
  15. Replace bottom pulley on third stacker roller shaft.
  16. Position third stacker roller pulley so that set screw is on flat side of shaft. Carefully tighten set screw.
  17. Place third stacker drive belt on third stacker roller pulley and around fourth stacker roller shaft.
  18. Replace bottom pulley of fourth stacker roller on shaft and push up until it engages with belt.
  19. Position fourth stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
  20. Place first stacker drive belt on first stacker roller pulley and around second stacker shaft.
  21. Replace bottom pulley of second stacker roller on shaft and push up until it engages with belt.
  22. Position second stacker roller pulley so that set screw is on flat side of shaft and belt is parallel to other drive belts. Carefully tighten set screw.
- g. Remove cards used to prop stack follower open.
- h. Replace front and rear panels and top panel cover.

9.8 SOLENOID

- a. Remove front and rear panels per paragraph 6.1.

NOTE

In the following procedure, hold lugs on board with long nose pliers while unsoldering or soldering leads. This will prevent the lugs from being disconnected from the land on the bottom side of the board.

- b. Unsolder two white leads from solenoid driver circuit board.
- c. Remove solenoid return spring from spring post and arm stud, Figure 9-6.
- d. Loosen two set screws in top solenoid coupling.
- e. Remove two screws holding solenoid mounting plate. Remove solenoid downward.

NOTE

Viewing the bottom of the solenoid plate, note that the solenoid mounting holes are not in line with the mounting plate holes. To ensure that the solenoid is reinstalled correctly, ensure that wires extend from the right side (viewed from the front of the reader) and that forwardmost solenoid mounting hole is on the right side.

- f. Remove two solenoid mounting nuts.
- g. Loosen two set screws retaining coupling on solenoid shaft. Remove coupling.

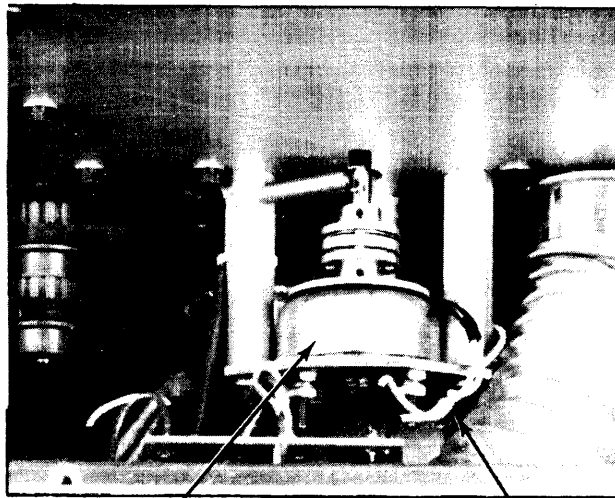
NOTE

Remove the set screws from the coupling. Apply LOCTITE GRADE C to the screws and replace. LOCTITE GRADE C should be applied to all operating and mounting hardware except panel screws.

Place coupling on new solenoid shaft locating bottom coupling set screws on two flat sides of the shaft.

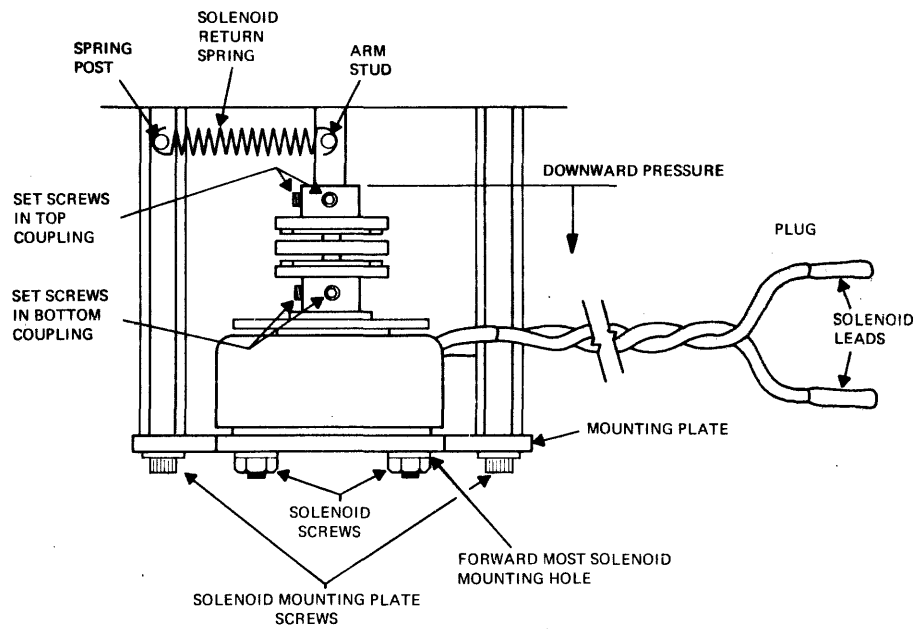
- i. Tighten bottom coupling set screws and replace solenoid on mounting plate making





SOLENOID  
ASSEMBLY

SOLENOID  
LEADS



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78125-M1000L

Figure 9-6. Pictorial, Solenoid Assembly

sure holes are in proper position, with wires extending from right side.

- j. Replace solenoid on mounting post, sliding top coupling onto picker shaft.
- k. Replace solenoid return spring between spring post and arm stud.
- l. Solder two white leads to solenoid drive circuit board, terminals 3 and 4.
- m. Preload solenoid coupling per paragraph 6.8, steps q., r., and s.

NOTE

If proper pick action does not result after pre-loading the solenoid, perform Picker Sector Adjustment, paragraph 6.8.

- n. Replace front and rear panels.

9.9 VACUUM PUMP ASSEMBLY BELT

- a. Remove front and rear panels per paragraph 6.1.
- b. Remove four screws at rear of subframe panel, Figure 9-7.
- c. Remove five screws on bottom rear edge of card reader, holding subframe panel.

NOTE

Tag wires to be removed in the following step. They must be replaced on the proper terminals.

- d. Remove two connectors from capacitor and one connector from relay to disconnect vacuum pump motor, Figure 9-8.
- e. Loosen blower hose clamp on vacuum pump and remove hose from pump.
- f. Loosen set screw in vacuum tube elbow and pull elbow downward, Figure 9-9.
- g. Loosen vacuum adapter clamp screw at top of vacuum pump assembly and remove adapter from card reader with a slight upward pressure.
- h. Remove screw holding ground strap to subframe.

78125/M1000L

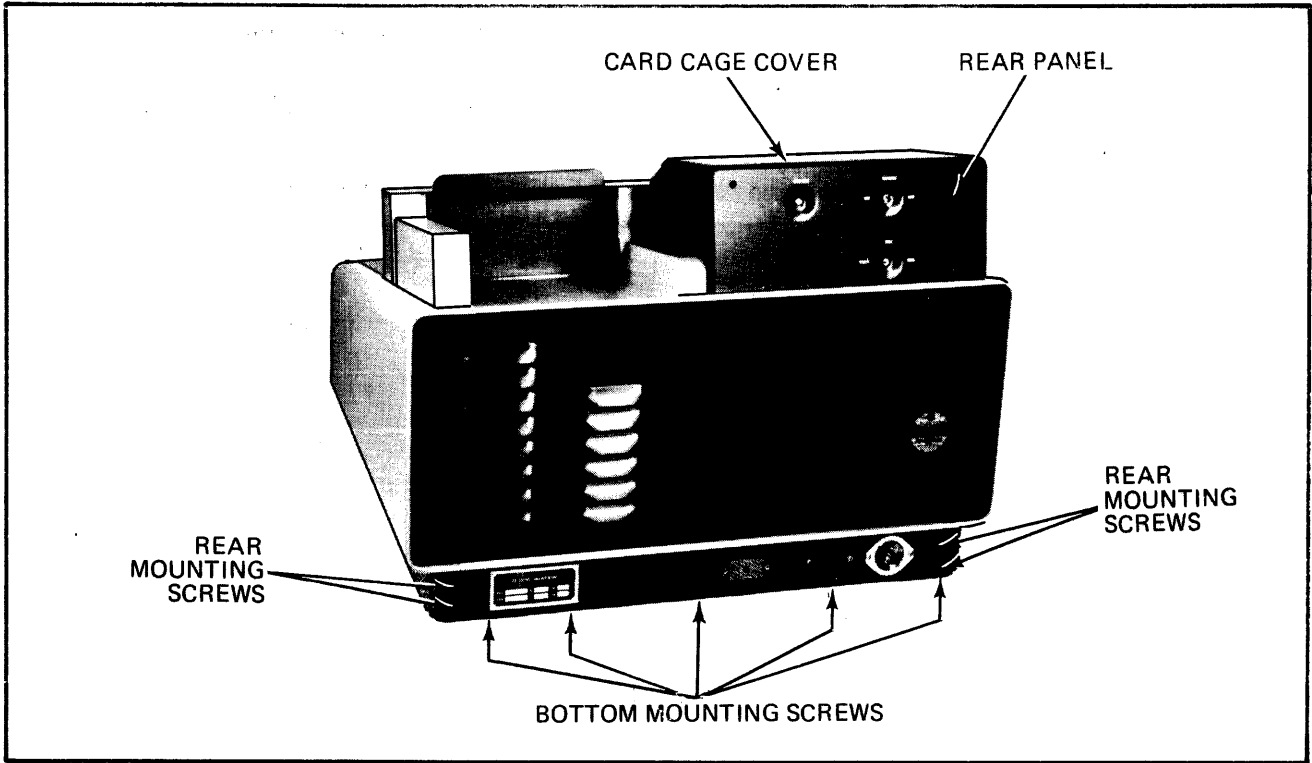


Figure 9-7. Removal of Rear Subframe Panel, Main Card Cage Cover and Panel

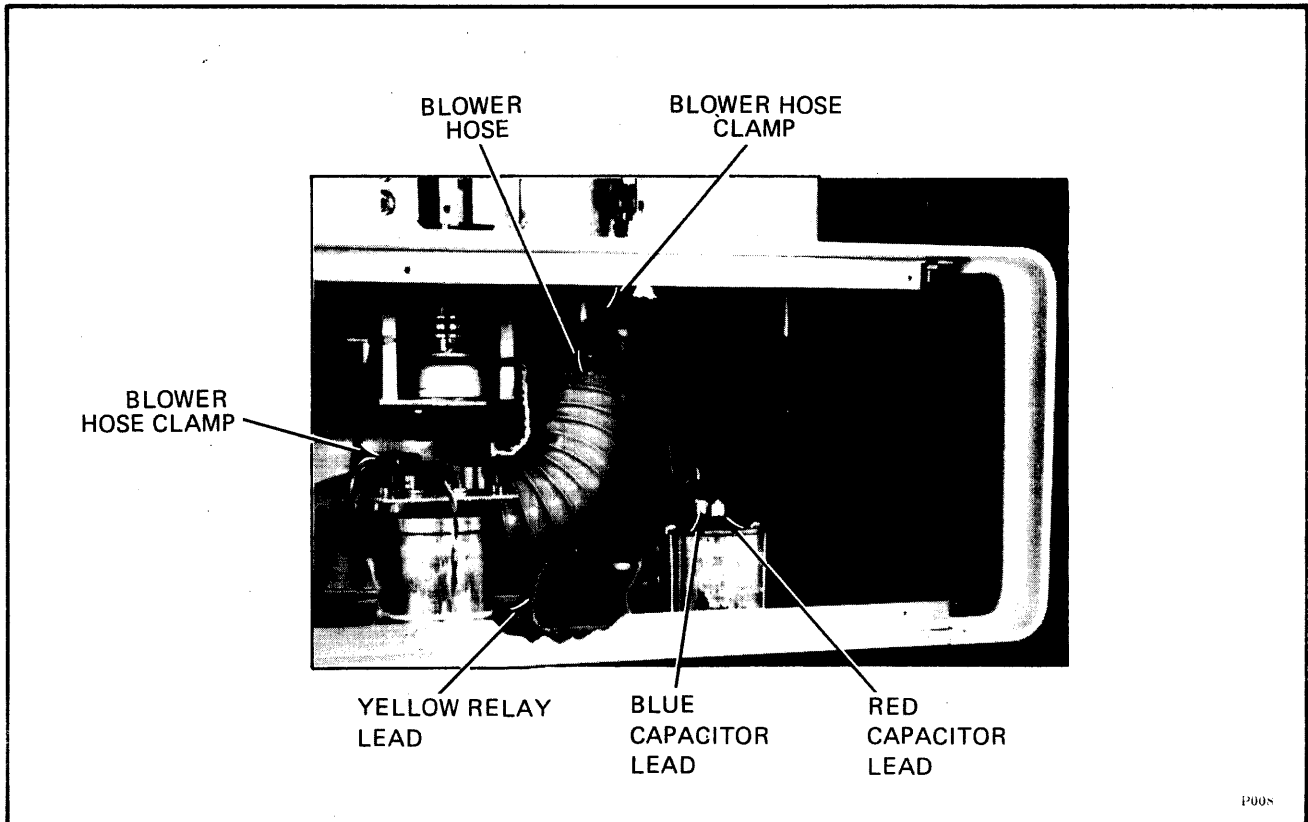


Figure 9-8. Vacuum Pump Assembly Connections

78125/M1000L

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## CAUTION

HOLD MOUNTING POSTS TO AVOID TWIST-  
ING OFF THE RUBBER SHOCK MOUNTS.

- i. Remove mounting screws holding vacuum pump assembly, Figure 9-9.
- j. The vacuum pump assembly may now be removed from the card reader.
- k. Loosen three hex mounting bolts, Figure 9-10.
- m. Using a spring scale, adjust vacuum pump for a belt tension of 4-6 ounces (about 3/64" belt deflection).
- n. With proper belt tension applied, tighten the three hex mounting bolts.
- o. Check pulleys to ensure they are in the same plane. Also check each pulley set screw to ensure it is secure.
- p. Reinstall vacuum pump assembly into card reader in reverse order of disassembly.
- q. Replace front and rear panels.

### 9.10 MAGNETIC PICKUP

- a. Remove rear panel per paragraph 6.1.
- b. Using a 1/16 Allen wrench, loosen set screw in magnetic pickup mounting block, Figure 9-11.
- c. Remove magnetic pickup from mounting block.
- d. Remove two button head screws on each side of card cage cover, slide backward, and lift off, Figure 9-7.
- e. Remove four button head screws holding rear panel of card cage and remove rear panel.
- f. Using a 9/64 Allen wrench, remove three socket head screws holding card cage in place. Move card cage to rear and remount using two rear screws, Figures 9-12 and 9-13.
- g. Remove all cards from card cage using extractor levers, Figure 9-13.

## NOTE

Tag magnetic pickup wires so that they can be

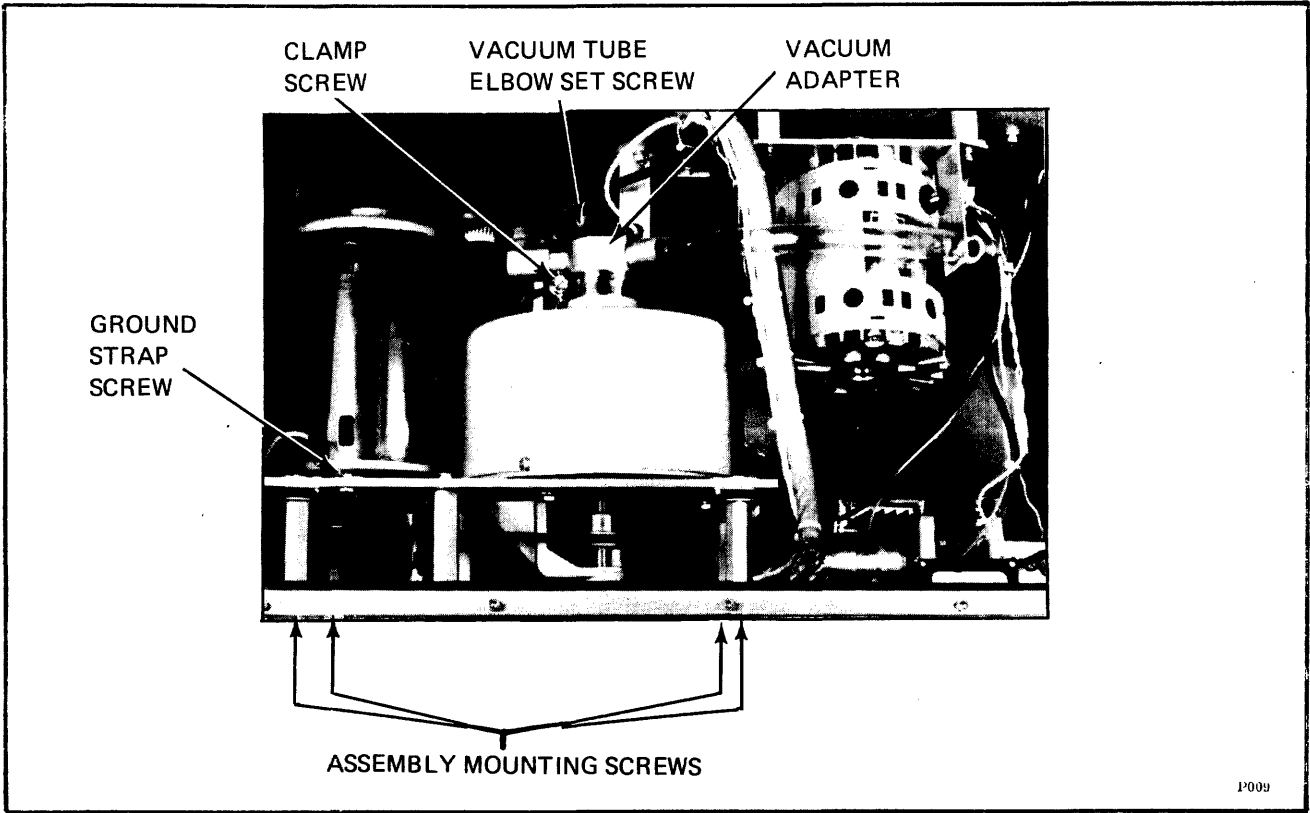


Figure 9-9. Removal of Vacuum Pump Assembly

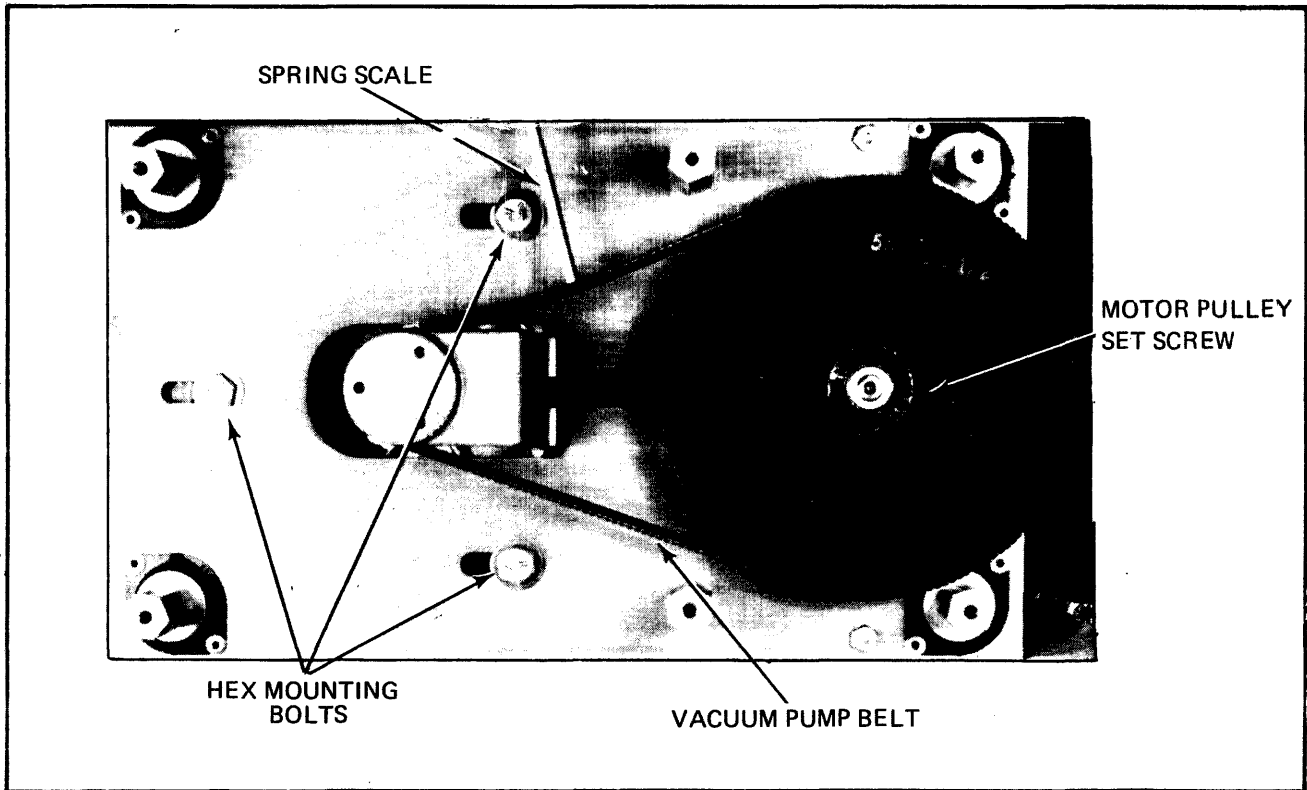


Figure 9-10. Vacuum Pump Belt Replacement

identified with their proper position in the card cage connector, Figure 9-13.

- h. Using AMP tool 465195-2, remove two magnetic pickup wires and shield from card cage connectors.
- i. Replace wires from new magnetic pickup unit into their proper positions in card cage connector, Figure 10-3.
- j. Insert the pickup unit into mounting block, Figure 9-11.
- k. Refer to paragraph 6.3 for adjustment of magnetic pickup.
- l. Reassemble reader in reverse order of disassembly.

#### 9.11 PICK SUPPORT ASSEMBLY

The Pick Support Assembly must be removed to replace any of the following assemblies and installed after the replacement of the assembly:

Fourth and Fifth Stacker Roller Bearing Assemblies  
First and Second Picker Roller Bearing Assemblies

- a. To remove the Pick Support Assembly proceed as follows:
  - 1. Remove front panel, rear panel and top panel cover per paragraph 6.1.
  - 2. Remove two screws holding stacker follower casting, Figure 9-14, front of reader.
  - 3. Remove two screws holding hopper follower shaft support casting, Figure 9-15.
  - 4. Remove hopper follower shaft.
  - 5. Pull hopper follower beyond rear of mainframe to expose negator spring screw.
  - 6. Remove negator spring screw and allow spring to rewind slowly on its roller. Remove hopper follower.
  - 7. Loosen vacuum tube elbow set screw, Figure 9-9. Slide elbow off vacuum tube and move to left.
  - 8. Loosen adapter clamp screw at top of vacuum pump assembly and with a slight upward pressure remove this adapter from card reader.

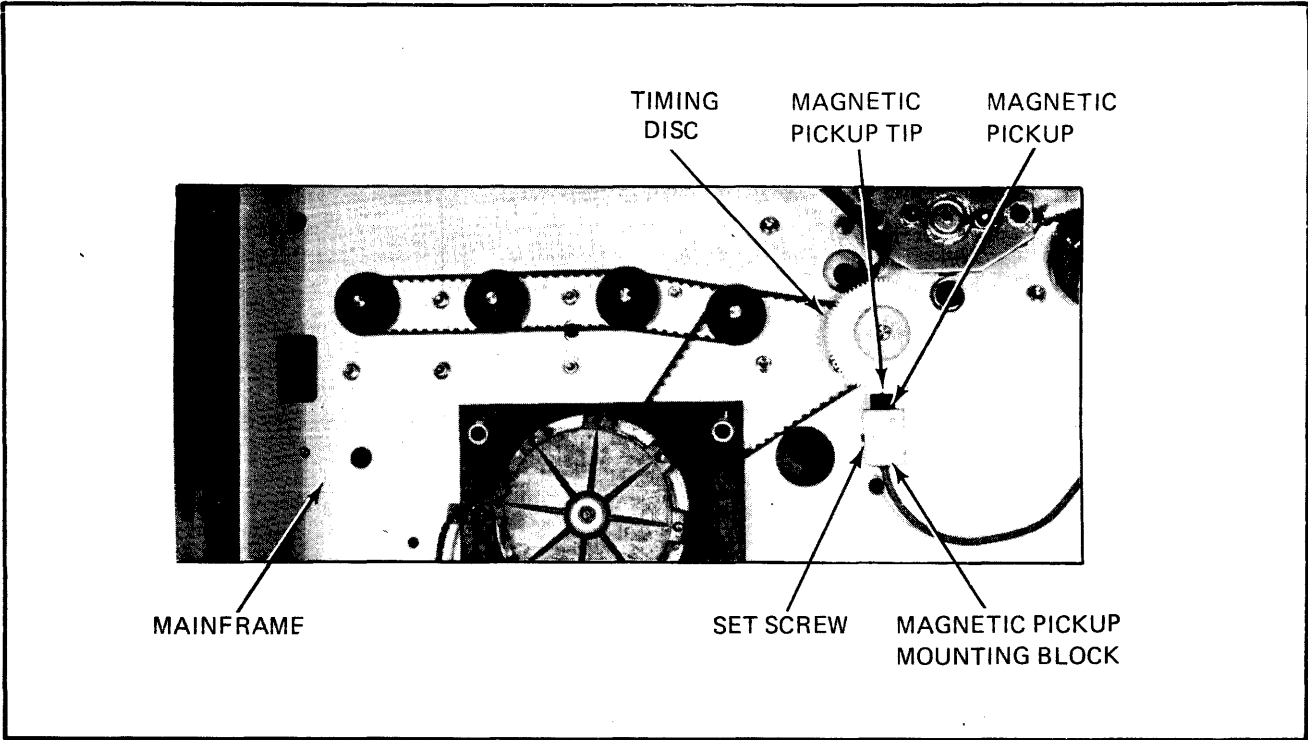


Figure 9-11. Magnetic Pickup Replacement

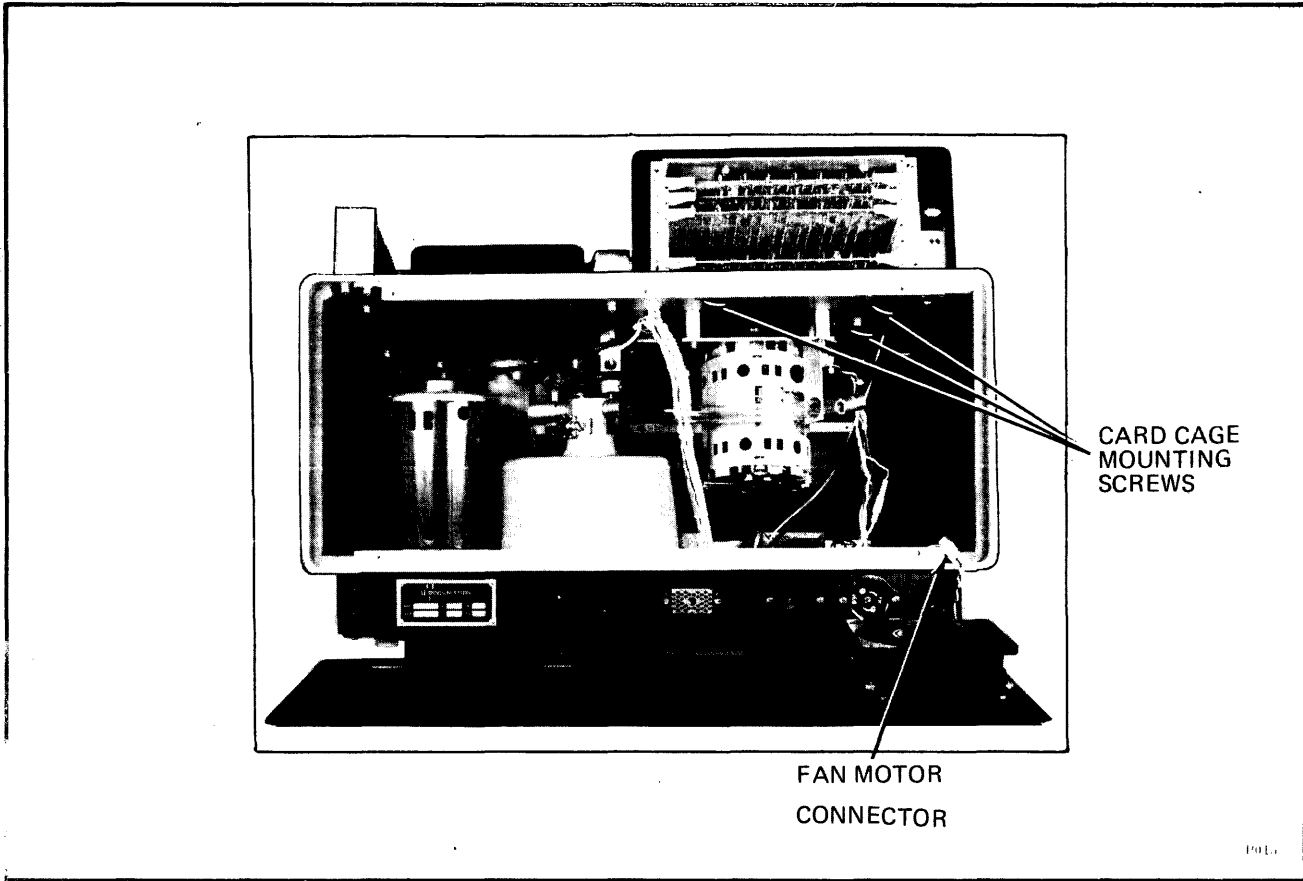


Figure 9-12. Card Cage Repositioning

78125/M1000L

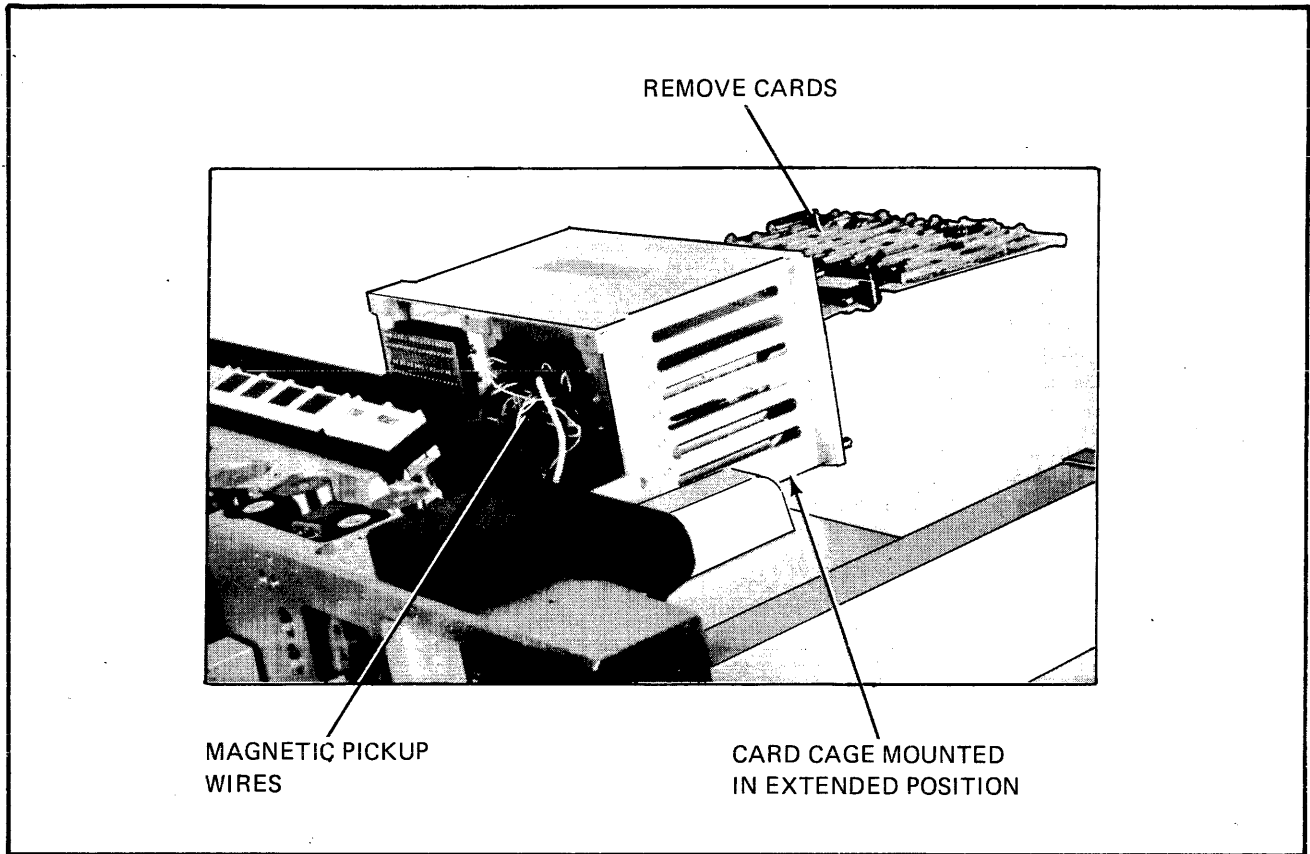


Figure 9-13. Card Cage in Extended Position

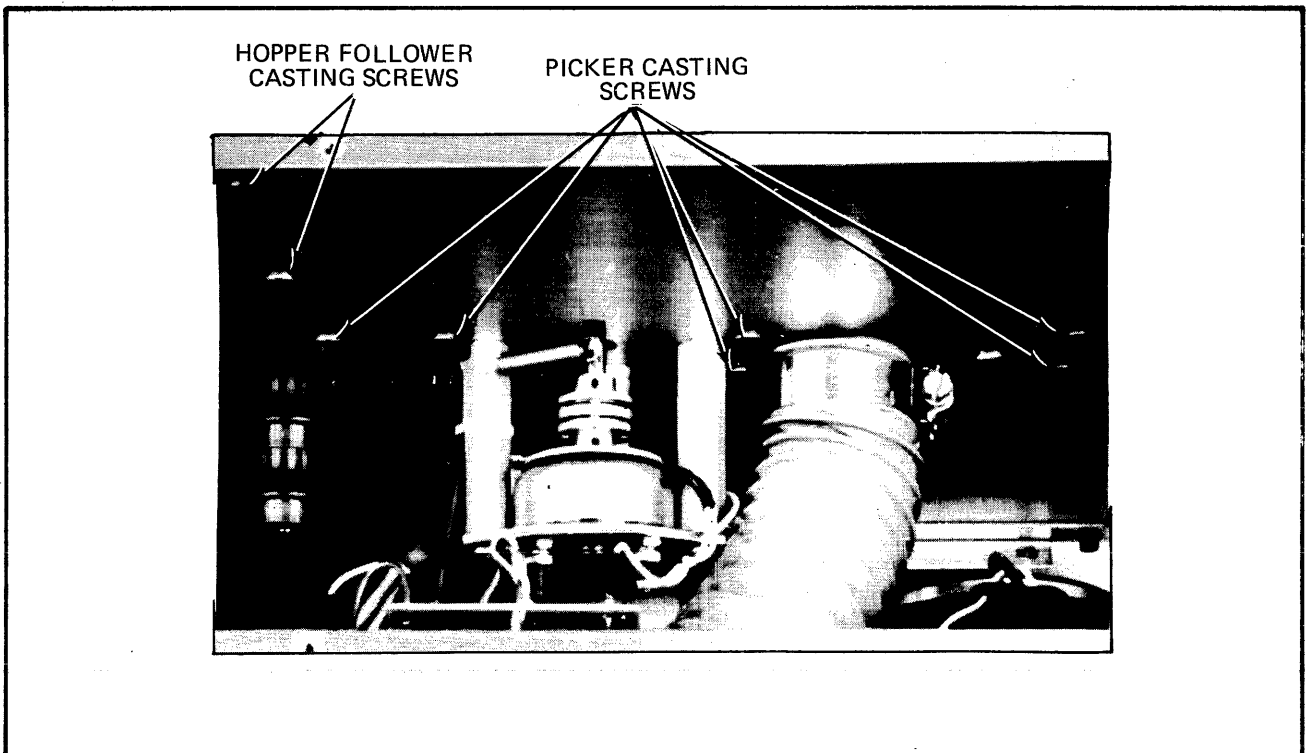


Figure 9-14. Picker Casting Removal

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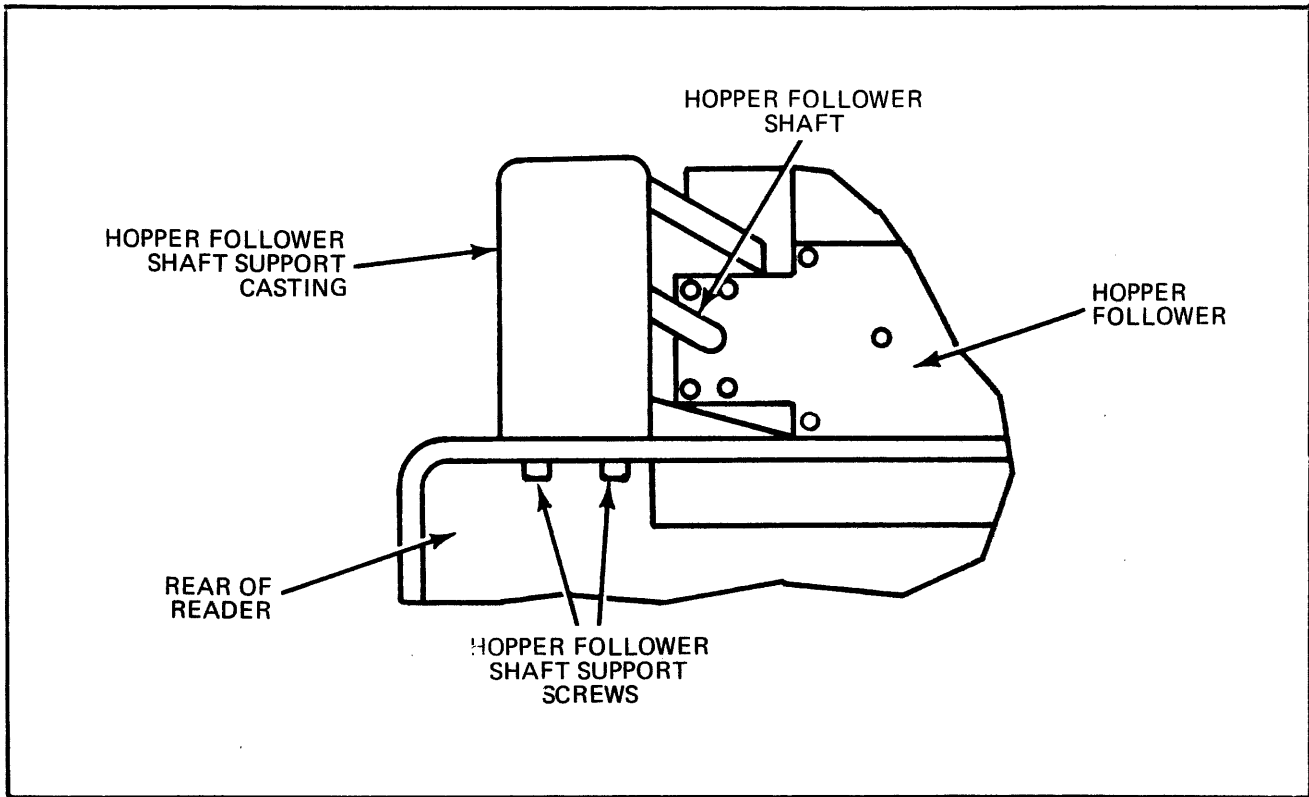


Figure 9-15. Hopper Follower Assembly Removal

9. Loosen screw on two blower hose clamps; remove blower hose, Figure 9-8.
  10. Remove solenoid return spring, Figure 9-6.
  11. Loosen two top solenoid coupling set screws.
  12. Remove two screws holding solenoid assembly (Figure 9-6). Lay solenoid assembly on baseplate.
  13. Remove six screws holding picker casting (Figure 9-14).
  14. Remove cable tie holding read/light station cable on solenoid mounting post.
  15. Remove cable tie holding hopper empty switch cable, Figure 9-17.
  16. Lift picker casting straight up and lay on chassis, Figure 9-16.
- b. To replace the Pick Support Assembly proceed as follows:
1. Set picker casting in place, Figure 9-17.
  2. Using LOCTITE GRADE C, set all six mounting screws, Figure 9-14.

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3. Carefully tighten pick support casting mounting screws.
4. The remainder of the reader may now be assembled in reverse order of disassembly.
5. Readjust the pick sector (paragraph 6.8).

## 9.12 READ HEAD AND LIGHT STATION ASSEMBLIES

### 9.12.1 READ HEAD

- a. Remove pick support assembly per paragraph 9.11 a.
- b. Remove two retaining screws on each side of card cage cover and remove main card cage cover by sliding back slightly and lifting upward.
- c. Remove four retaining screws and remove rear card cage panel.
- d. Remove three screws holding card cage in place. Move card cage to rear and remount using two rear screws.
- e. Remove all cards from card cage.
- f. Using AMP Tool 465195-2, remove read head wires from connector. (Figure 9-16A)
- g. Remove two read head mounting screws to remove read head, Figure 9-17.
- h. Install read head connectors in card cage; ensure wires are installed in proper color-coded positions. Replace read head.
- i. Replace pick support assembly (paragraph 9.11 b.)

### 9.12.2 LIGHT STATION

- a. Remove pick support assembly (paragraph 9.11 a.)
- b. Remove four light station mounting screws to remove light station, Figure 9-17.
- c. Slide off cable tie holding light station cable connector on power supply.
- d. Remove light station connector from power supply.
- e. Replace light station, plug connector into power supply, and replace cable tie.
- f. Replace pick support assembly (paragraph 9.11 b.)

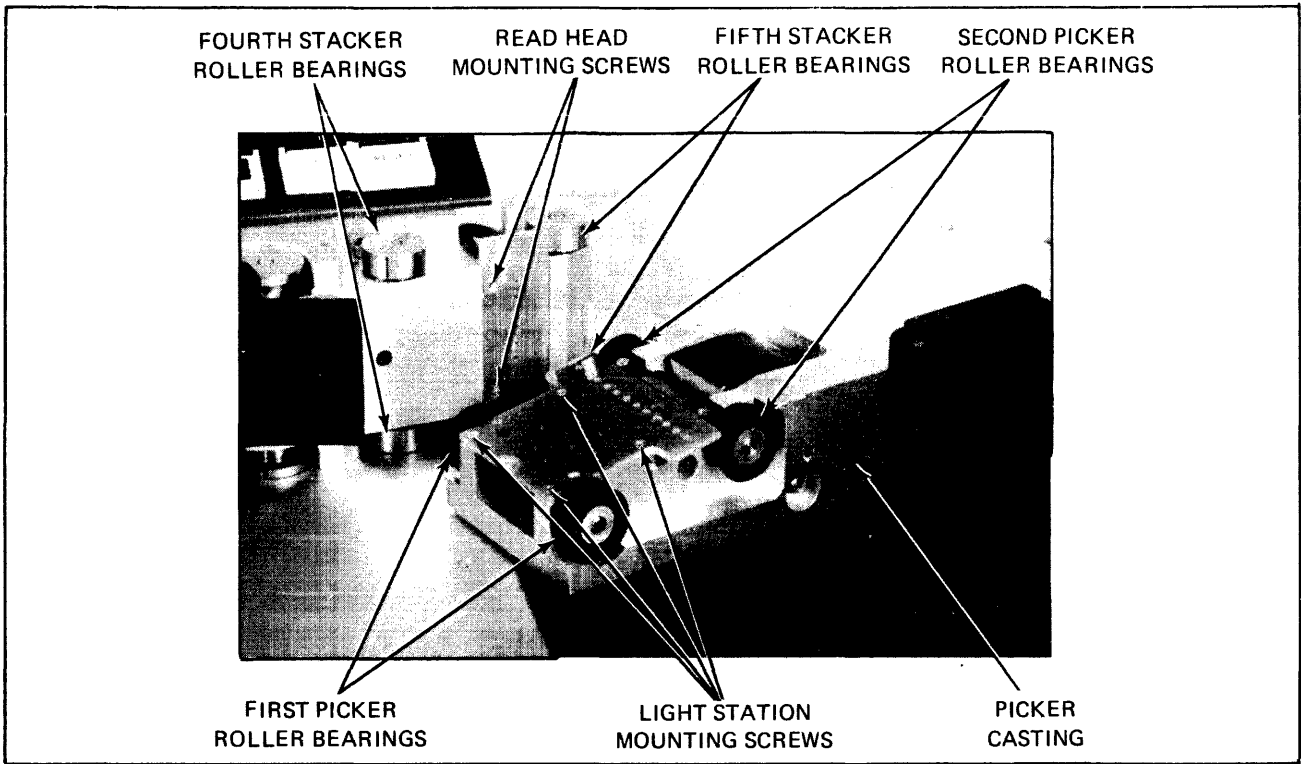


Figure 9-16. Pick Support Casting Removed From Reader.

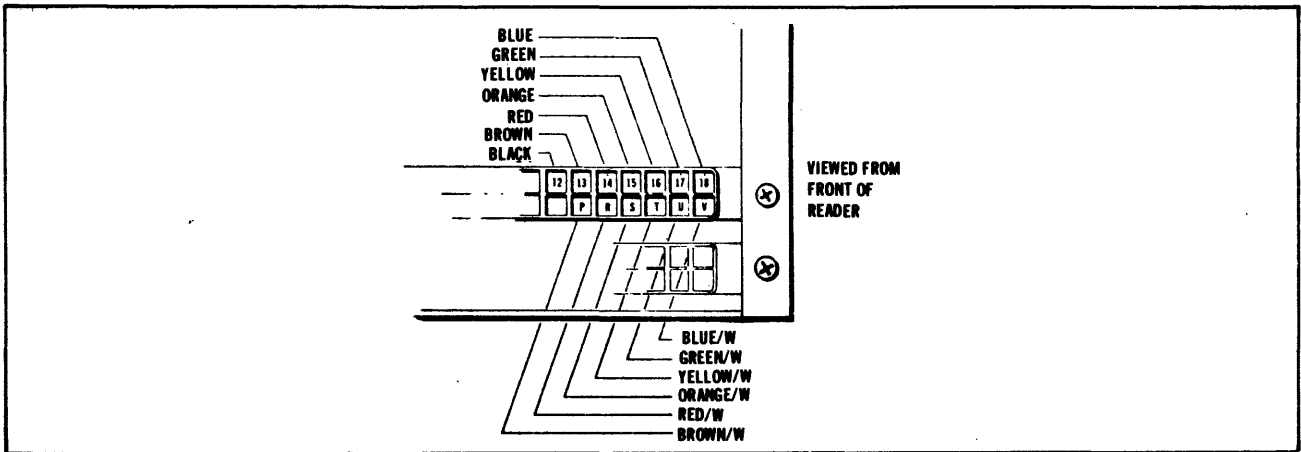


Figure 9-16A. Read Head Wiring Diagram.

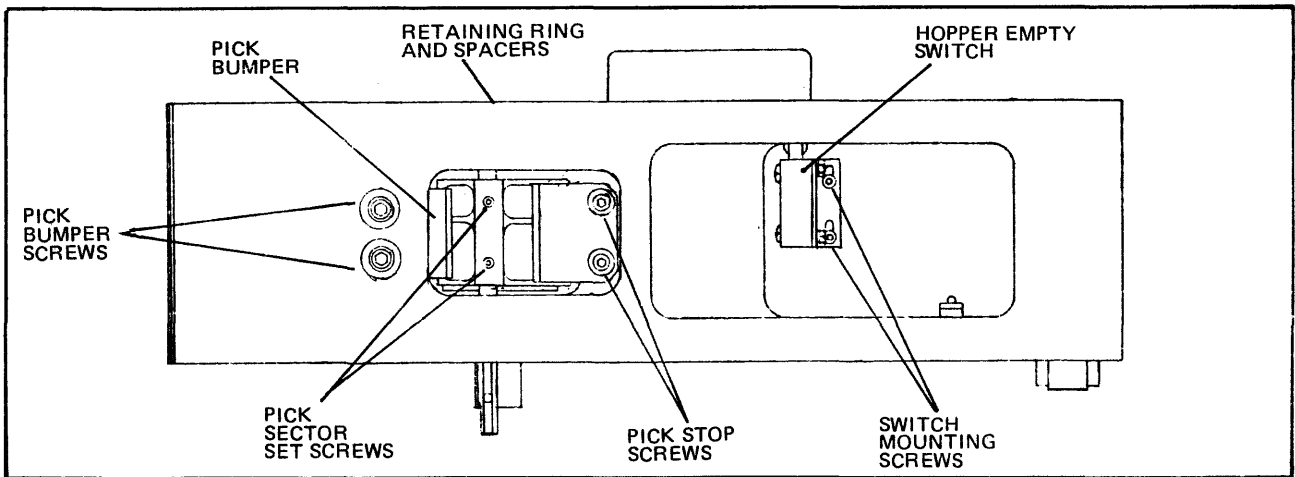


Figure 9-17. Pick Support Casting, Front View

FOURTH AND FIFTH STACKER ROLLER BEARING ASSEMBLIES

## NOTE

Replace both bearings and shaft with new matched assembly to assure proper operation.

- a. Remove pick support assembly per paragraph 9.11.
- b. To replace fourth stacker roller bearings, perform step c. To replace fifth stacker roller bearings, perform step d.
- c. To replace fourth stacker roller bearing assembly, Figure 9-12, perform the following:
  1. Loosen set screw in bottom pulley of fourth stacker roller, Figures 9-3 and 9-4.
  2. Pull bottom pulley down to disengage third stacker drive belt. Remove belt and pulley.
  3. Loosen set screw in top pulley of fourth stacker roller.
  4. Pull pulley downward to disengage it from main drive motor belt. Remove pulley.
  5. Loosen set screw in bottom roller of fourth stacker roller assembly, Figure 9-5.
  6. Lift fourth stacker shaft from stacker casting. Observe that there is a spacer washer between the top roller and the bearing seat. Remove top roller from shaft.
  7. To remove top bearing, use L-shaped tool to lift bearing from casting.
  8. To remove bottom bearing, slide out bottom roller and spacer. Use a straight tool to tap edge of bearing from inside shaft hole to drop bearing from casting.
  9. Replace bearing, place spacer washer on top bearing and slide bottom spacer and roller under shaft hole.
  10. Replace top roller on new shaft, flush with, or slightly below shaft end.
  11. Place main drive motor belt around hole for fourth stacker roller shaft. Replace roller shaft in hole. Select feeler gauge (0.005 to 0.025 inch) to force roller against bearing.

12. Insert selected feeler gauge between top plate and bottom roller. Apply firm finger pressure on top roller and tighten set screw in bottom roller.
13. Check for vertical play in fourth stacker shaft. If there is vertical play, loosen set screw in bottom roller and repeat substep 12 to eliminate play.
14. Place main drive motor belt on motor pulley, on fifth stacker roller pulley, and around fourth stacker roller shaft. Hold drive belt in this position.
15. Replace top pulley of fourth stacker roller on shaft and push pulley upward until it engages with main drive motor belt, Figures 9-3 and 9-4.
16. Adjust drive motor belt and top pulley, if necessary, so that drive belt is completely engaged with motor pulley and fourth and fifth stacker roller pulleys.

CAUTION

USE MODERATE TORQUE TO TIGHTEN  
PULLEY SET SCREW. OVERTORQUE WILL  
DAMAGE PULLEY.

17. Position top pulley so that set screw is on flat side of shaft. Make sure pulley is slightly away from top plate and tighten set screw.
  18. Replace third stacker drive belt on third stacker roller and around fourth stacker shaft. Hold drive belt in this position.
  19. Replace bottom pulley of fourth stacker roller on shaft and push pulley upward until it is engaged with drive belt and is against top pulley.
  20. Adjust third stacker drive belt and bottom pulley, if necessary, so that drive belt is completely engaged with pulleys and is parallel to other belts.
  21. Rotate bottom pulley so that set screw is on flat side of shaft.
  22. Replace pick support assembly per paragraph 9.11.
- d. To replace fifth stacker roller bearings, Figure 9-12, perform the following:

CAUTION

USE EXTREME CARE NOT TO DAMAGE  
TIMING DISC. WRAP DISC IN SOFT TISSUE  
WHEN NOT IN CARD READER.

1. Loosen set screw in timing disc, Figure 9-2. Carefully remove disc and

wrap it in soft tissue.

2. Loosen set screw in fifth stacker roller pulley.
3. Pull pulley downward to disengage it from main drive motor belt. Remove pulley.
4. Loosen set screw in bottom roller of fifth stacker roller assembly, Figure 9-5.
5. Lift fifth stacker shaft from stacker casting. Observe that there is a spacer washer between top roller and bearing seat. Remove top roller from shaft.
6. To remove top bearing, use L-shaped tool to lift bearing from casting.
7. To remove bottom bearing, slide out bottom roller and spacer. Use a straight tool to tap edge of bearing from inside shaft hole to drop bearing from casting.
8. Replace bearings. Place spacer washer on top bearing and slide bottom spacer and roller under shaft hole.
9. Replace top roller on new shaft, flush with, or slightly below shaft end.
10. Place main drive motor belt around hole for fifth stacker roller shaft. Replace roller shaft in hole. Select feeler gauge (0.005 to 0.025 inch) to force roller against bearing.
11. Insert selected feeler gauge between top plate and bottom roller. Apply firm finger pressure on top roller and tighten set screw in bottom roller.
12. Check for vertical play in first stacker shaft. If there is vertical play, loosen set screw in bottom roller and repeat substep 11 to eliminate play.
13. Place main drive motor belt on motor pulley, on fourth stacker roller pulley, and around fifth stacker roller shaft. Hold drive belt in this position.
14. Replace fifth stacker roller pulley on shaft and push pulley upward until it is engaged with main drive motor belt, Figures 9-3 and 9-4.
15. Adjust drive motor belt and pulley, if necessary, so that drive belt is completely engaged with motor pulley, and fourth and fifth stacker roller pulleys.

## CAUTION

USE MODERATE TORQUE TO TIGHTEN  
PULLEY SET SCREW. OVERTORQUE WILL  
DAMAGE PULLEY.

16. Position pulley so that set screw is on flat side of shaft. Make sure pulley is slightly away from top plate and tighten set screw.
17. Replace timing disc on fifth stacker roller shaft, Figure 9-2. Rotate timing disc so that set screw is on flat side of shaft and line up timing disc teeth with magnetic pickup tip. Tighten timing disc set screw.
18. The main drive motor belt tension must be adjusted first. Refer to paragraph 6.2.
19. Second, the magnetic pickup and timing disc must be adjusted. Refer to paragraph 6.3.
20. Replace pick support assembly per paragraph 9.11.

### 9.14 FIRST AND SECOND PICKER ROLLER BEARINGS

#### NOTE

Replace shaft and both bearings with new  
matched assemblies to assure proper operation.

- a. Remove pick support assembly per paragraph 9.11.
- b. To replace first picker roller bearings, perform step c. To replace second picker roller bearings, perform step d.
- c. To replace first picker roller bearings, perform the following:
  1. Loosen set screw in bottom roller of first picker roller, Figure 9-12.
  2. Pull first picker roller shaft from picker assembly. Remove bottom roller and spacer, and top spacer.
  3. To remove top or bottom bearing, use L-shaped tool to pull bearing from casting.
  4. Replace bearing, place spacer on top bearing, and replace roller shaft in shaft hole.
  5. Replace bottom spacer and roller on shaft.

78125/M1000L

6. Apply firm finger pressure on top and bottom rollers and tighten set screw in bottom roller.
  7. Check for vertical play in first picker shaft. If there is play, loosen set screw in bottom roller and repeat substep 6 to eliminate play.
- d. To replace either of the second picker roller bearings, perform the following:
1. Loosen set screw in roller. Remove shaft and retaining ring, roller, and spacer.
  2. To remove bearing use a slender straight or L-shaped tool to either push or pull bearing from picker assembly.
  3. Replace bearing, shaft and retaining ring, spacer, and roller.
  4. Apply firm finger pressure to retained ring and roller, and tighten set screw in roller.
- e. Install pick support assembly per paragraph 9.11.

9.15 PICKER SECTOR

- a. Remove top panel cover per paragraph 6.1.
- b. Perform steps a. and c. through f. of paragraph 9.8. Prop open input hopper follower by placing about 3/4 inch of cards in the hopper perpendicular to follower.
- c. Using a #2 retaining ring remover tool, remove the retaining ring from the top of the picker shaft, Figure 9-17.
- d. Remove spacers located under the retaining ring, Figure 9-17.

CAUTION

ALL OF THE SPACERS MUST BE REPLACED  
IN REASSEMBLY.

- e. Loosen two set screws holding picker sector.
- f. Remove pick shaft from bottom of chassis.
- g. Remove throat block, Figure 9-18.
- h. Remove picker sector from rear side of pick casting.
- i. Replace picker sector, shaft, all spacers, and retaining ring.



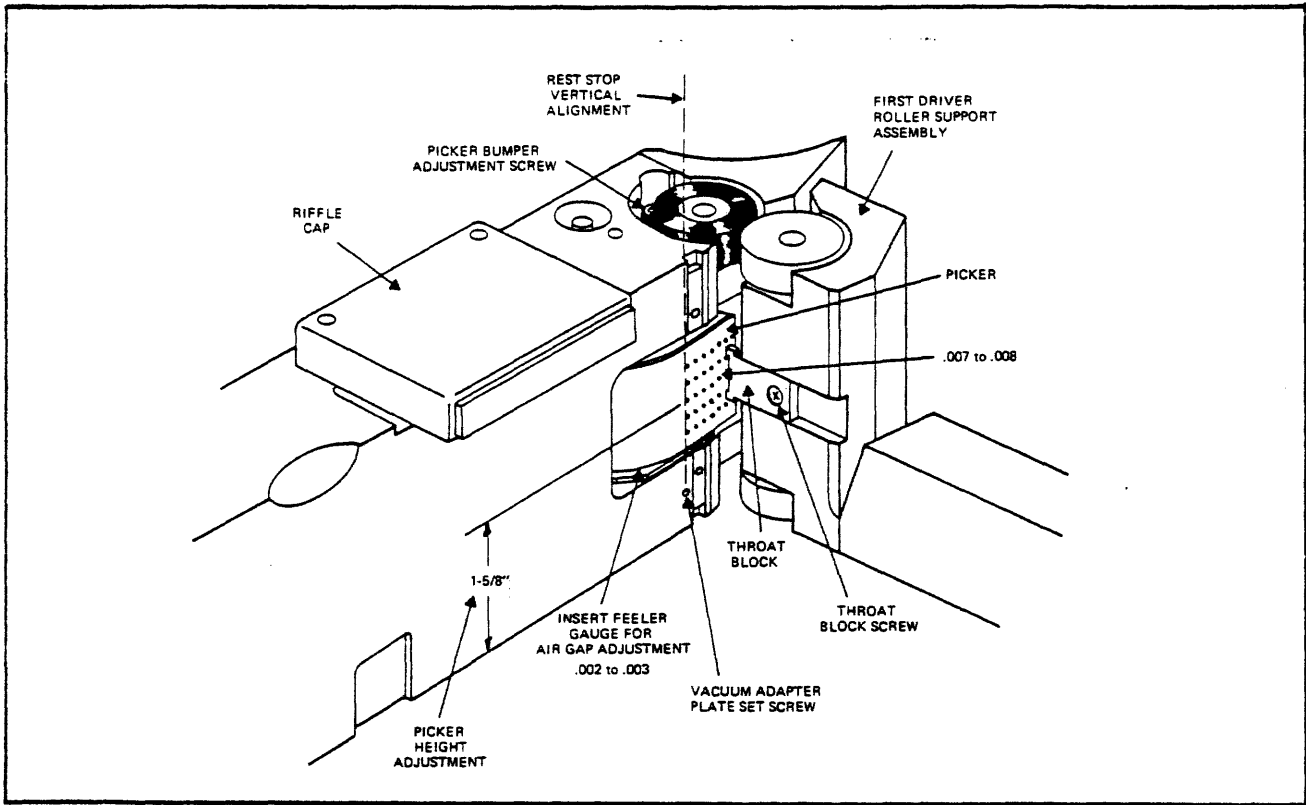


Figure 9-18. Picker Sector, Rear View

- j. Adjust shaft to place sector set screws on flat side of shaft.
- k. Measure 1.625 inches from the mainframe up to the center row of holes on the picker sector.
- l. Retaining this measurement, tighten two picker sector set screws, Figure 9-17.
- m. Reassemble reader in reverse order of disassembly.
- n. Refer to paragraph 6.8 for adjustment of picker sector.

9.16 STACK PHOTOCCELL ASSEMBLY

- a. Remove top panel cover and rear panel per paragraph 6.1.
- b. Remove two screws from each side of card cage cover, slide back slightly and lift off, Figure 9-7.
- c. Remove four screws from card cage rear panel and remove panel.
- d. Remove three screws holding card cage in place. Move card cage to rear and remount using two rear screws, Figures 9-12 and 9-13.

78125/M10001

- e. Remove all cards from card cage, Figure 9-13.
- f. Loosen set screw in top fourth stacker roller Figure 9-5. Remove stacker roller and preload washer.
- g. Loosen set screw in stack support casting holding stack photocell.
- h. Tag black and white wires from photocell. Using AMP tool 465195-2, remove connectors from card cage.
- i. Remove photocell from rear of stack support casting, Figure 9-19.
- j. Replace photocell, align flush with stack support casting faceplate, and tighten photocell set screw.

CAUTION

PHOTOCELL MUST NOT EXTEND BEYOND  
SURFACE OF CASTING; DAMAGE TO PHOTO-  
CELL OR CARDS MAY RESULT.

- k. Replace connectors in card cage.

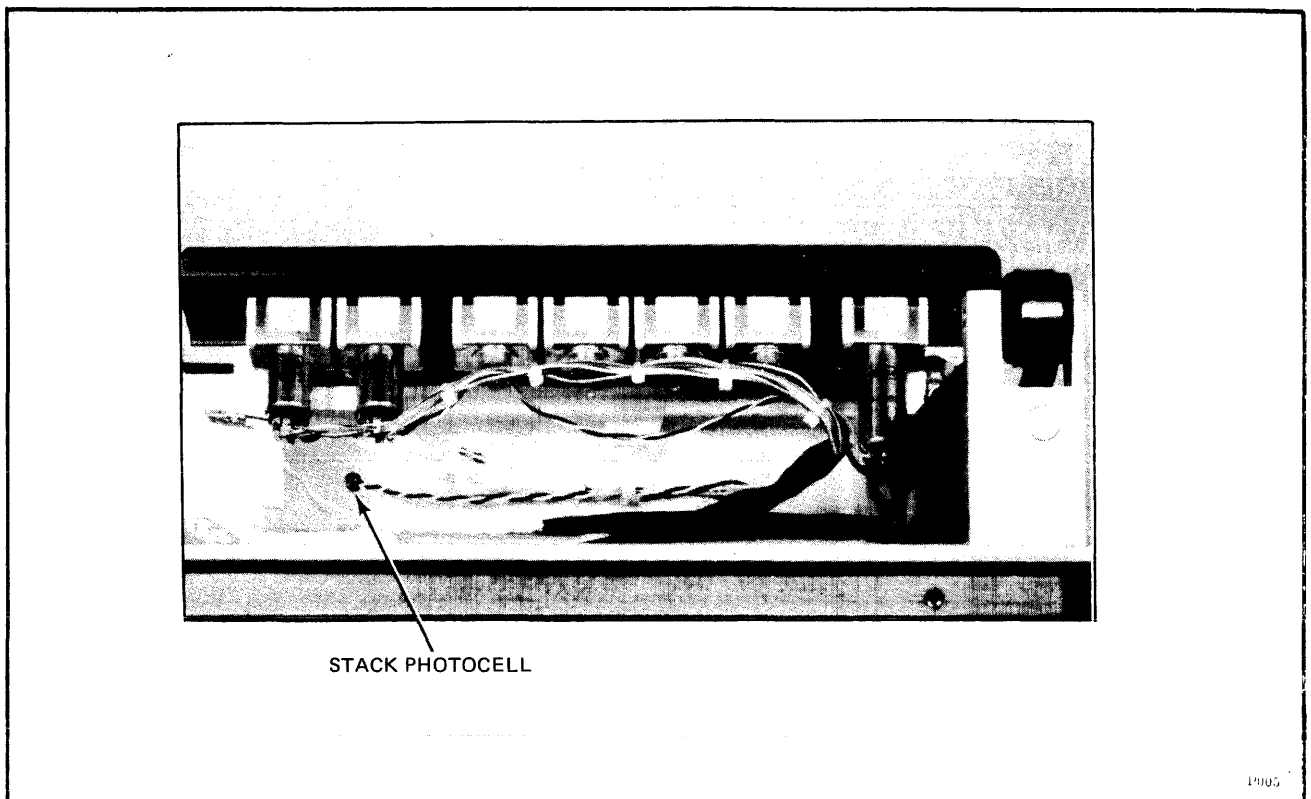


Figure 9-19. Location of Stack Photocell .

l. Replace stacker roller; ensure that there is no vertical play in stacker roller shaft. Refer to paragraph 6.5 for bearing preloading procedure.

m. Reassemble in reverse order of disassembly.

9.17 HOPPER NEGATOR SPRING

a. Perform steps b., c., and e., of paragraph 9.16 to gain access to negator spring retaining screw.

b. Hold spring and remove spring screw.

c. Pull spring from roller and roll new spring onto roller.

d. Replace spring screw and reassemble hopper follower assembly, Figure 9-15.

9.18 LOWER STACKER NEGATOR SPRING

a. Remove front panel per paragraph 6.1.

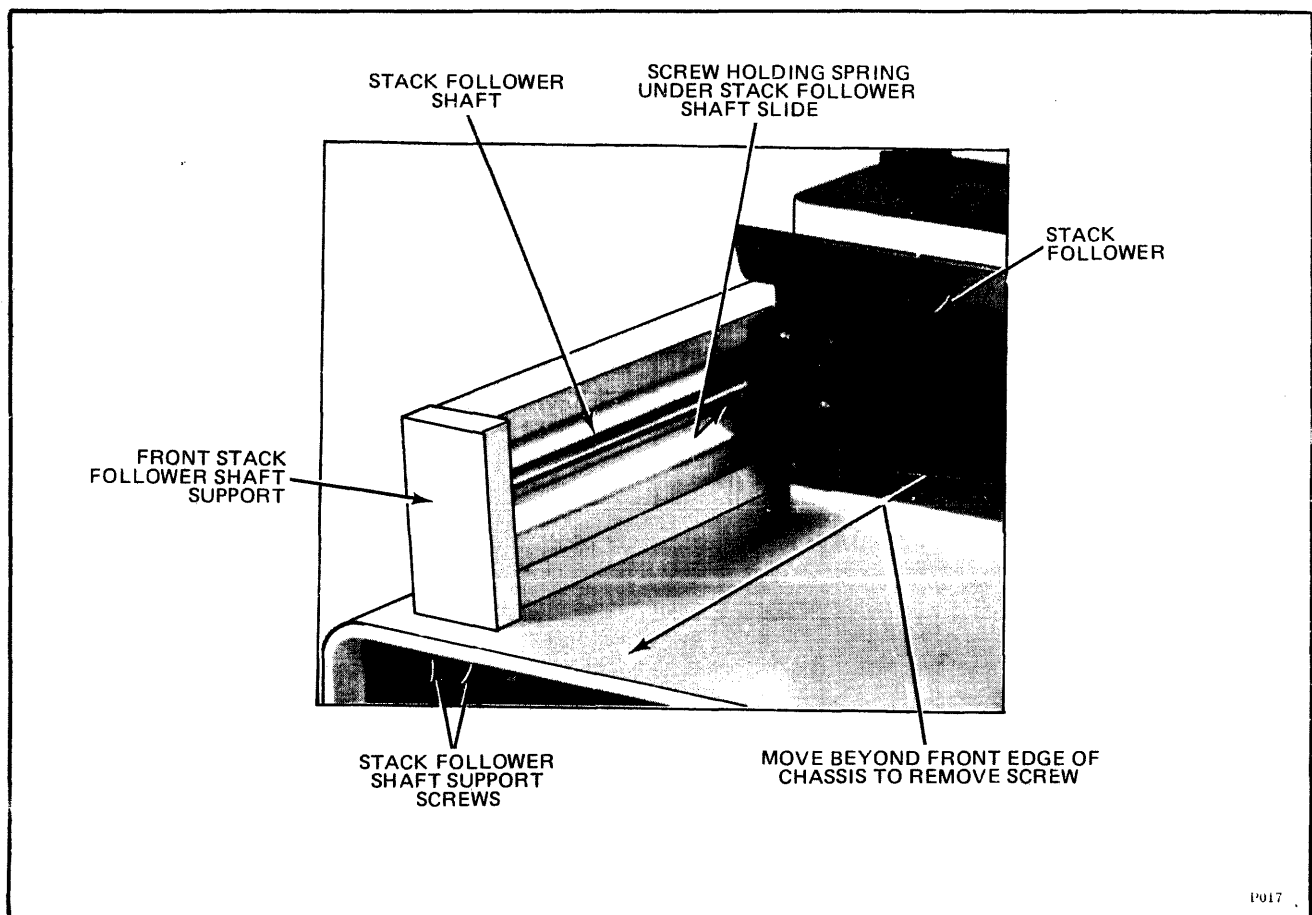


Figure 9-20. Stacker Negator Spring Replacement

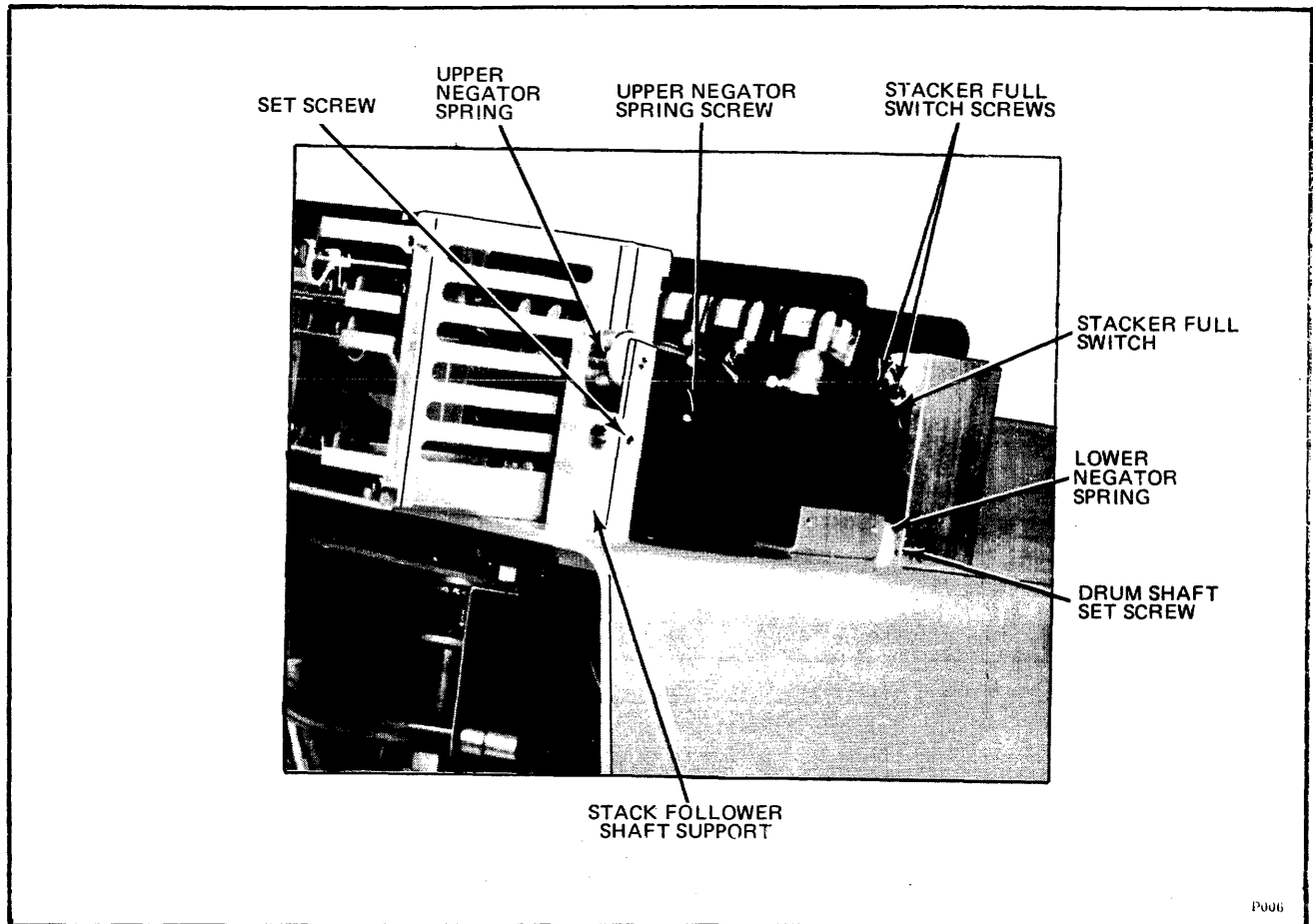


Figure 9-21. Stacker Full Switch Replacement

- b. Remove two screws each side of card cage cover, slide cover back slightly and lift off, Figure 9-7.
- c. Remove two screws holding front stack follower shaft support, Figure 9-20.
- d. Loosen set screw in rear stack follower shaft support, Figure 9-21.
- e. Remove stack follower shaft, Figure 9-20.
- f. Move stack follower sufficiently beyond front edge of chassis to reveal negator spring screw.
- g. Hold spring, remove screw, and pull spring from roller.
- h. Reroll new spring onto roller and replace spring screw.
- i. Reassemble in reverse order of disassembly.

78125/M1000L

9.19            UPPER STACKER NEGATOR SPRING

- a. Remove two screws each side of card cage cover, slide cover back slightly and lift off.
- b. Remove upper stacker negator spring screw, Figure 9-21.
- c. Pull spring from roller and roll new spring onto roller.
- d. Replace spring screw.
- e. Replace card cage cover.

9.20            HOPPER EMPTY SWITCH

- a. Remove top panel cover per paragraph 6.1.
- b. Remove two screws holding riffle cap.
- c. Remove two connectors from hopper empty switch, Figure 9-17.
- d. Remove two screws holding switch.
- e. Replace switch and adjust per paragraph 6.6.
- f. Reassemble in reverse order of disassembly.

9.21            STACKER FULL SWITCH

- a. Remove two screws on each side of card cage cover, slide cover back slightly and lift off.
- b. Remove two screws holding stacker full switch, Figure 9-21.
- c. Unsolder leads from switch, and solder to new switch.
- d. Mount switch and adjust per paragraph 6.7.
- e. Replace card cage cover.

9.22            INDICATOR LAMPS

- a. Grasp indicator lens with thumb and forefinger and pull upward with a rocking motion to remove lens.
- b. Pull lamp from lens.

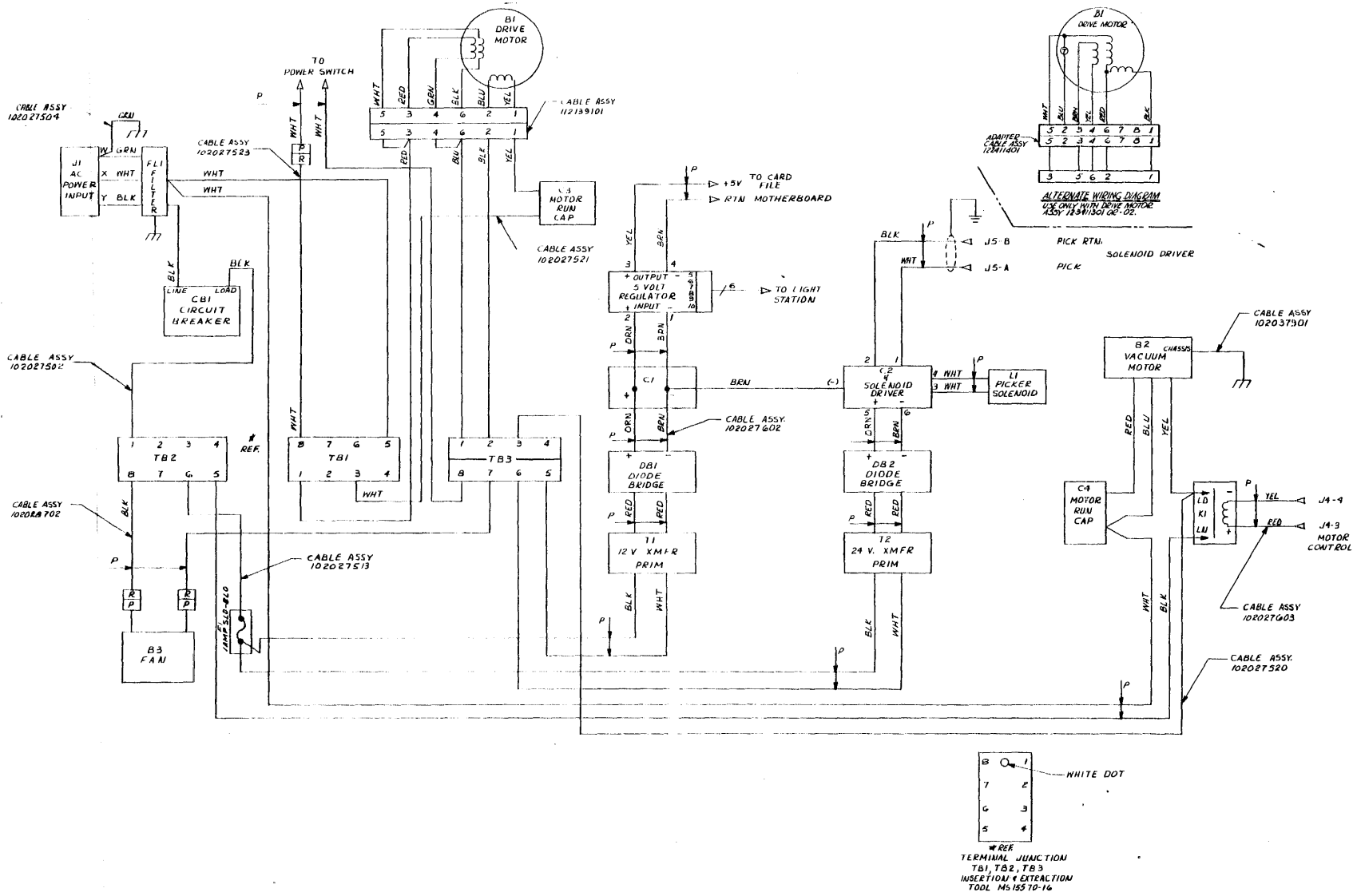
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- c. Insert new lamp into lens.
- d. Press lens firmly into switch.

78125/M1000L

SECTION 10  
ASSEMBLY AND SCHEMATIC DIAGRAMS

78125/M1000L



10-1

WHITE DOT

B	1
7	2
C	3
S	4

\* REF  
 TERMINAL JUNCTION  
 TB1, TB2, TB3  
 INSERTION & EXTRACTION  
 TOOL MS 15570-16

Figure 10-1. Wiring Diagram, AC Power Distribution, 115 Vac, 60 Hz (Dwg. No. 40156201)



10-1A

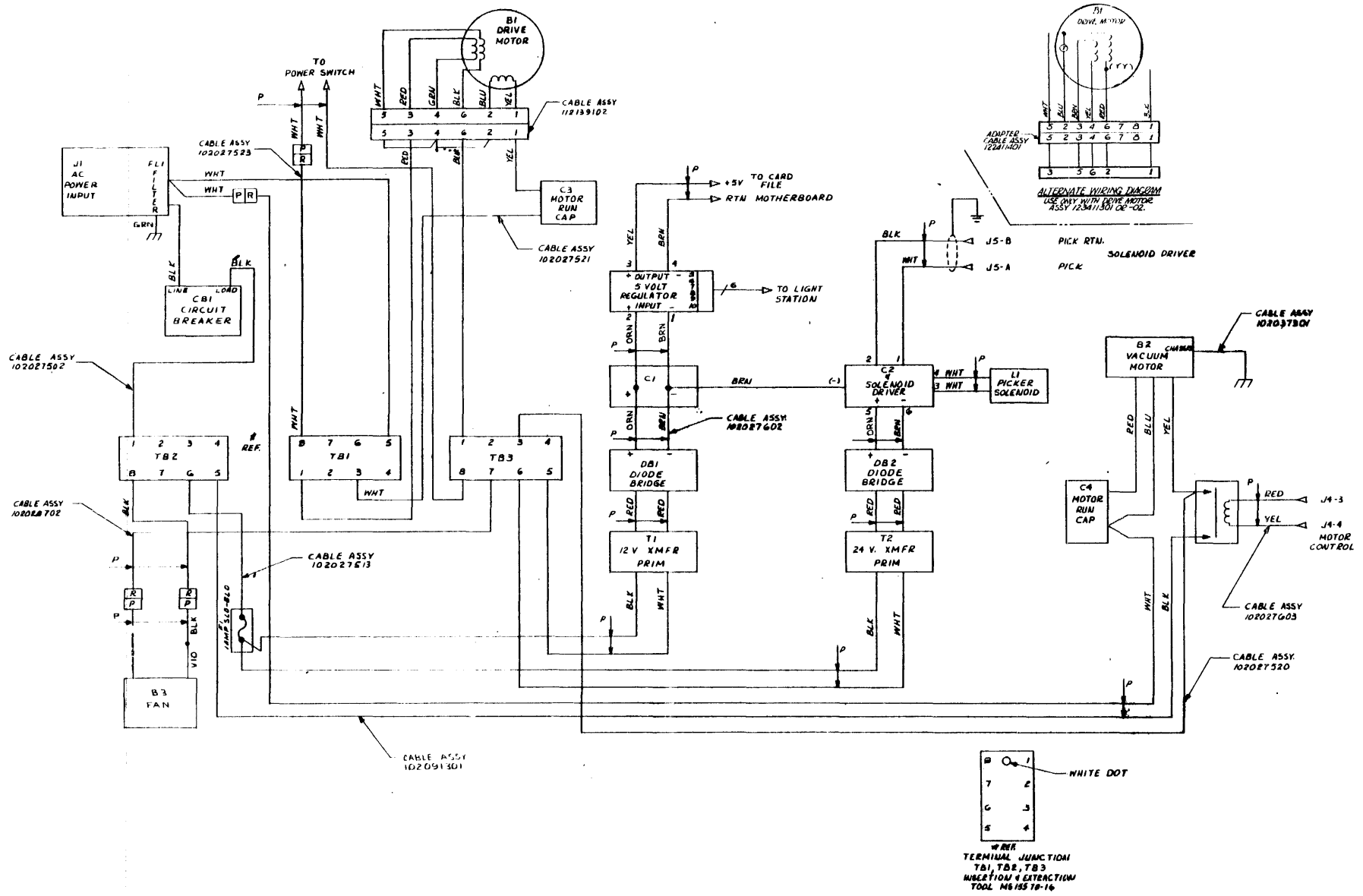


Figure 10-1A. Wiring Diagram, AC Power Distribution, 230 Vac, 50 Hz  
(Dwg. No. 40160301)

78125/M1000L

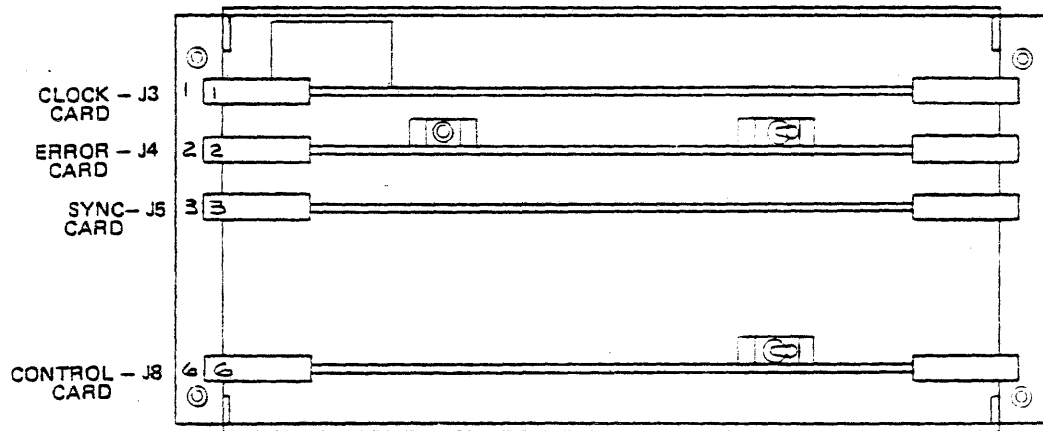


Figure 10-2. Card Gage, P.C. Card Location

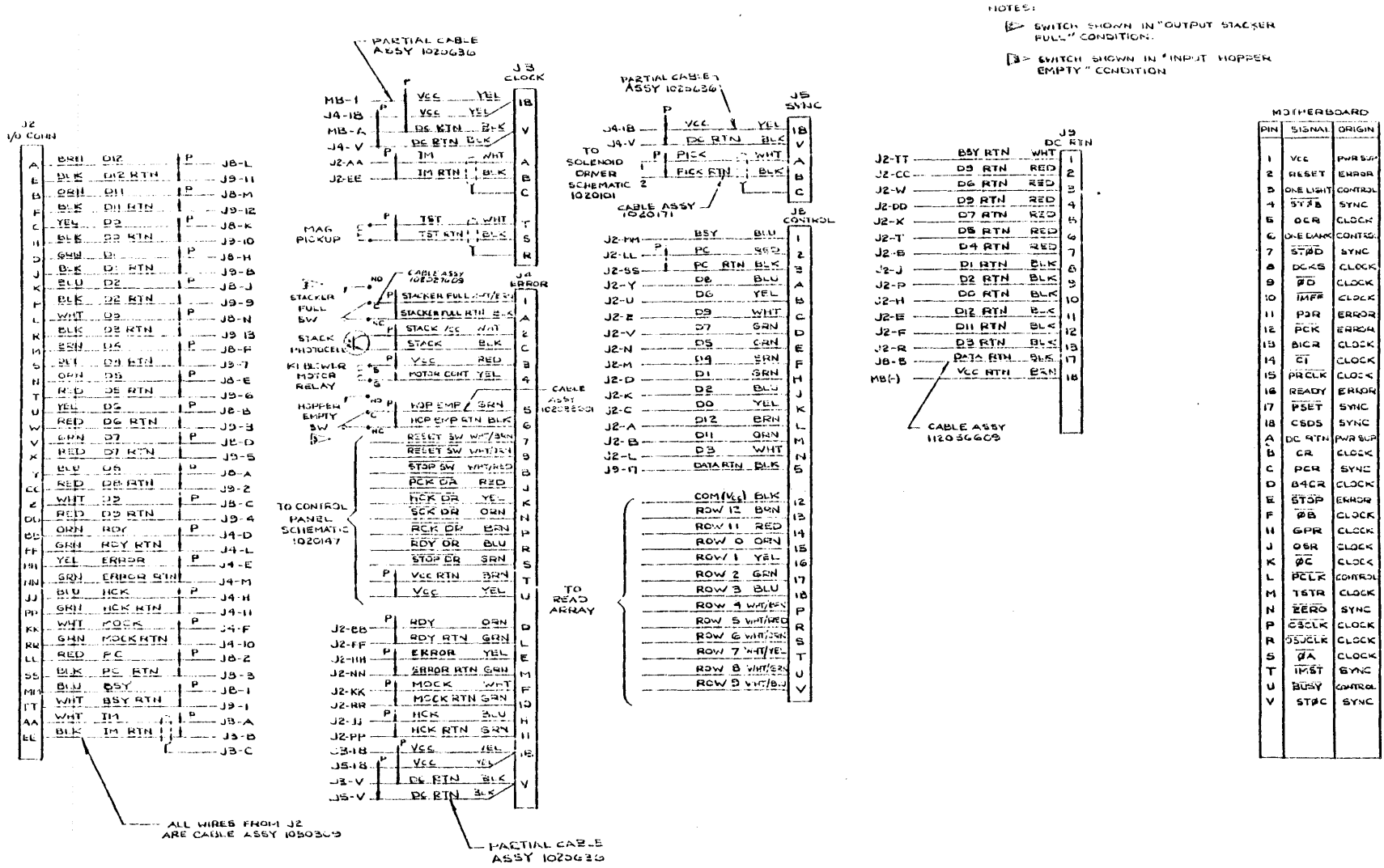
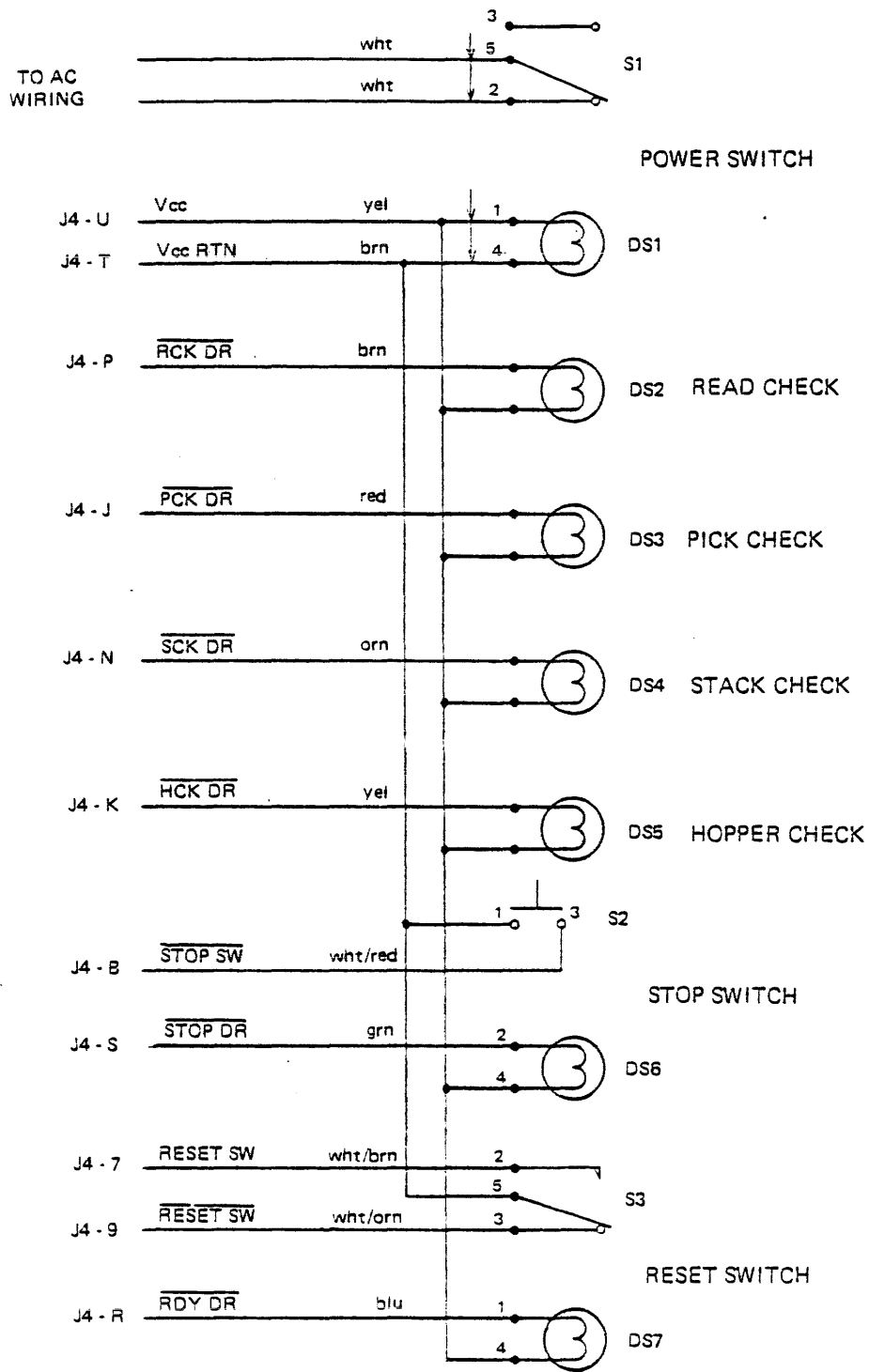


Figure 10-3. Wiring Diagram, Card File (Dwg. No. 40099401)



78125/M1000L

Figure 10-4. Schematic Diagram, Control Panel  
(Dwg. No. 200147)

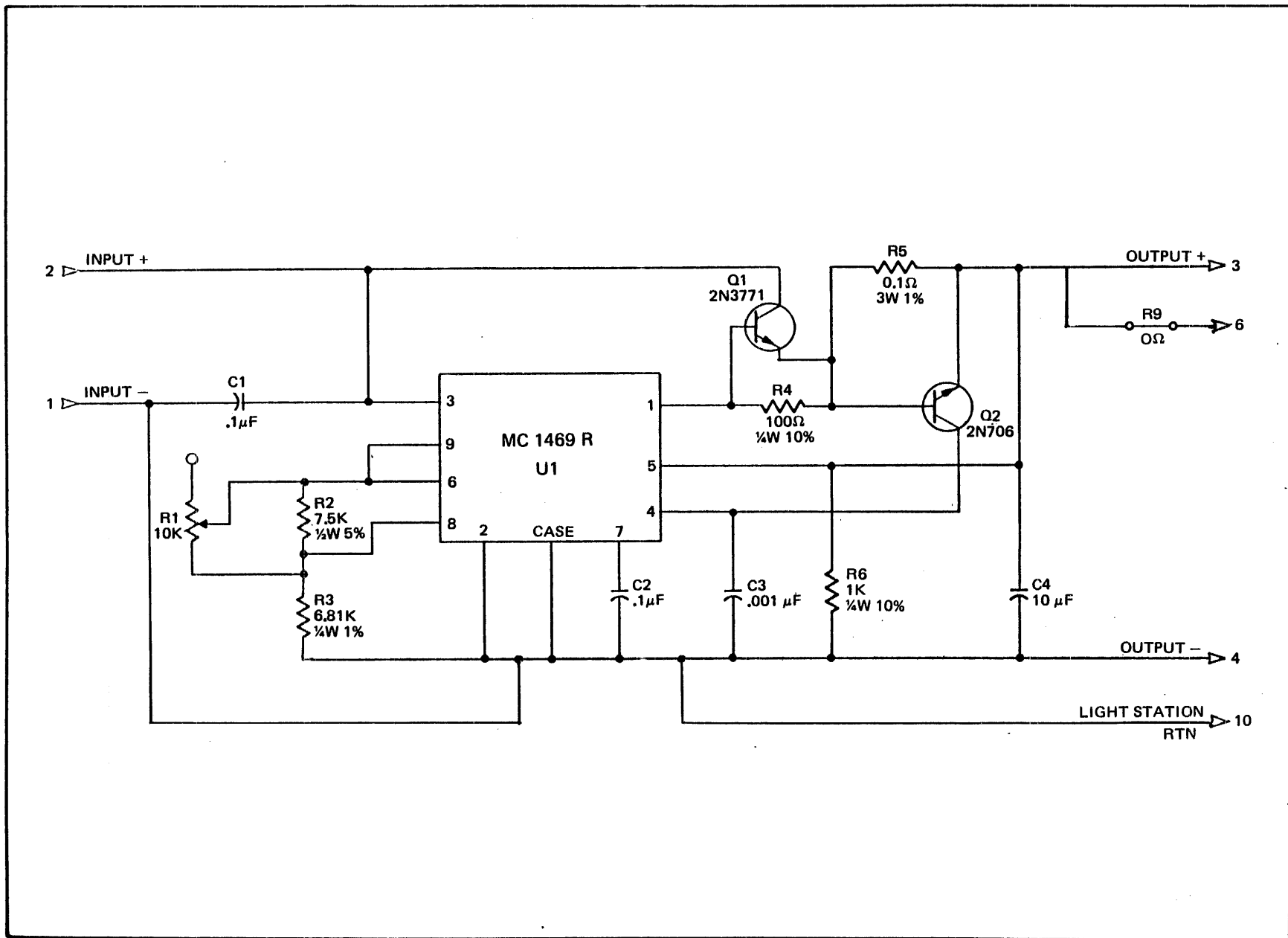


Figure 10-5. Schematic Diagram, 5 Volt Regulator  
(Dwg. No. 302085)

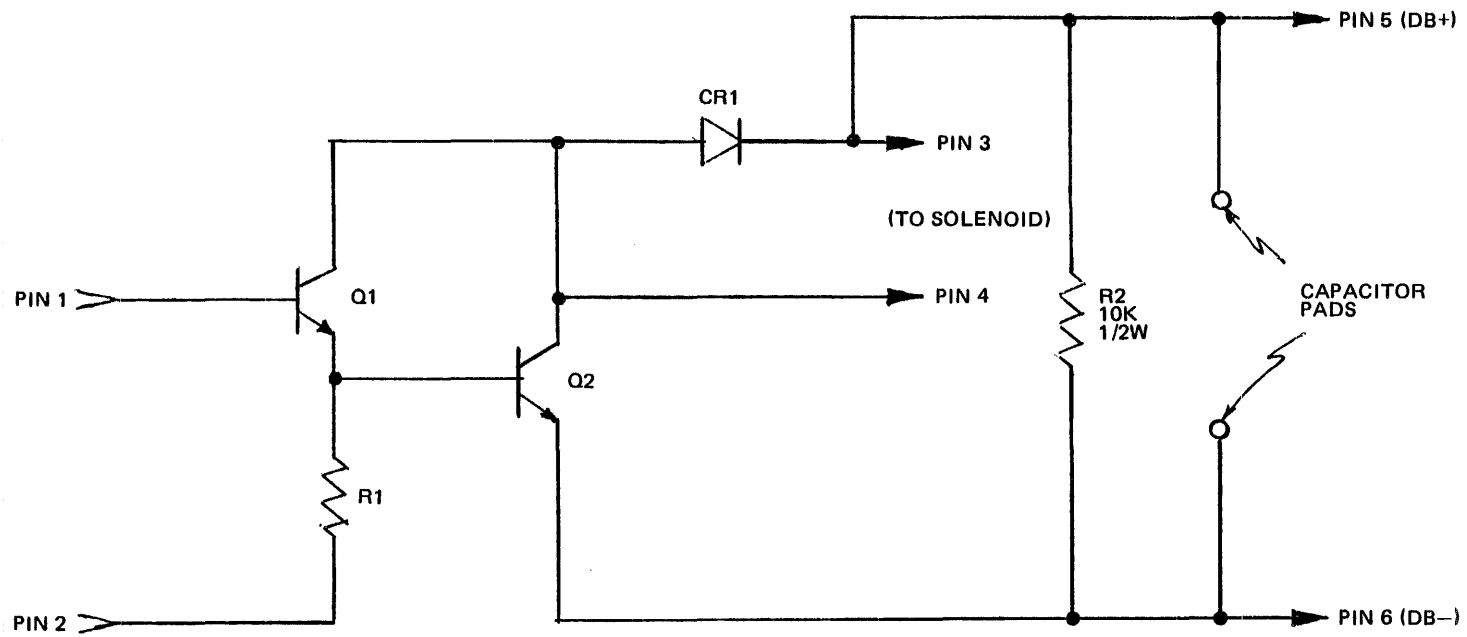


Figure 10-6. Schematic Diagram, Solenoid Driver  
(Dwg. No. 20010101)

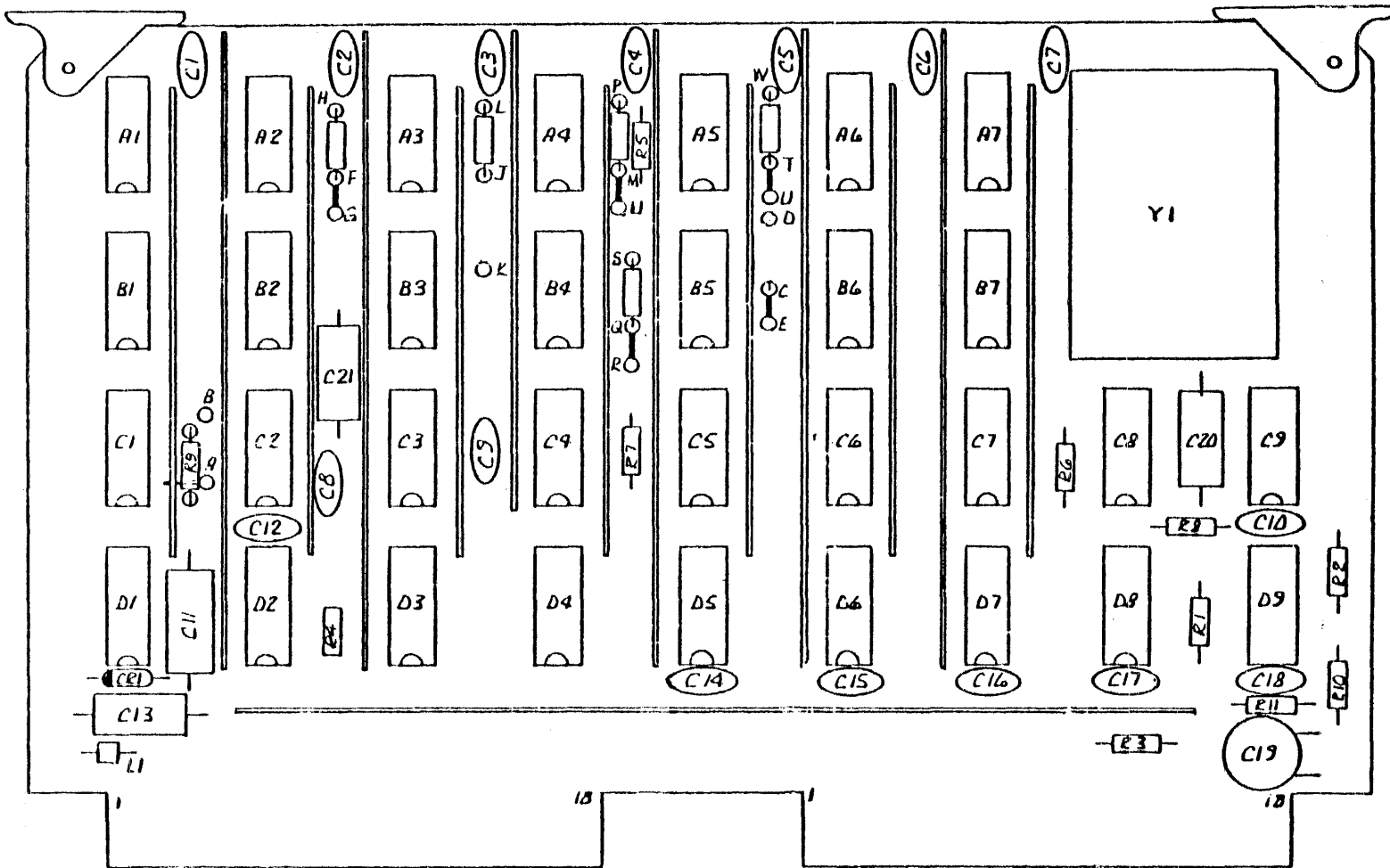


Figure 10-7. Assembly Diagram, Clock Card  
(Dwg. No. 400765XX)

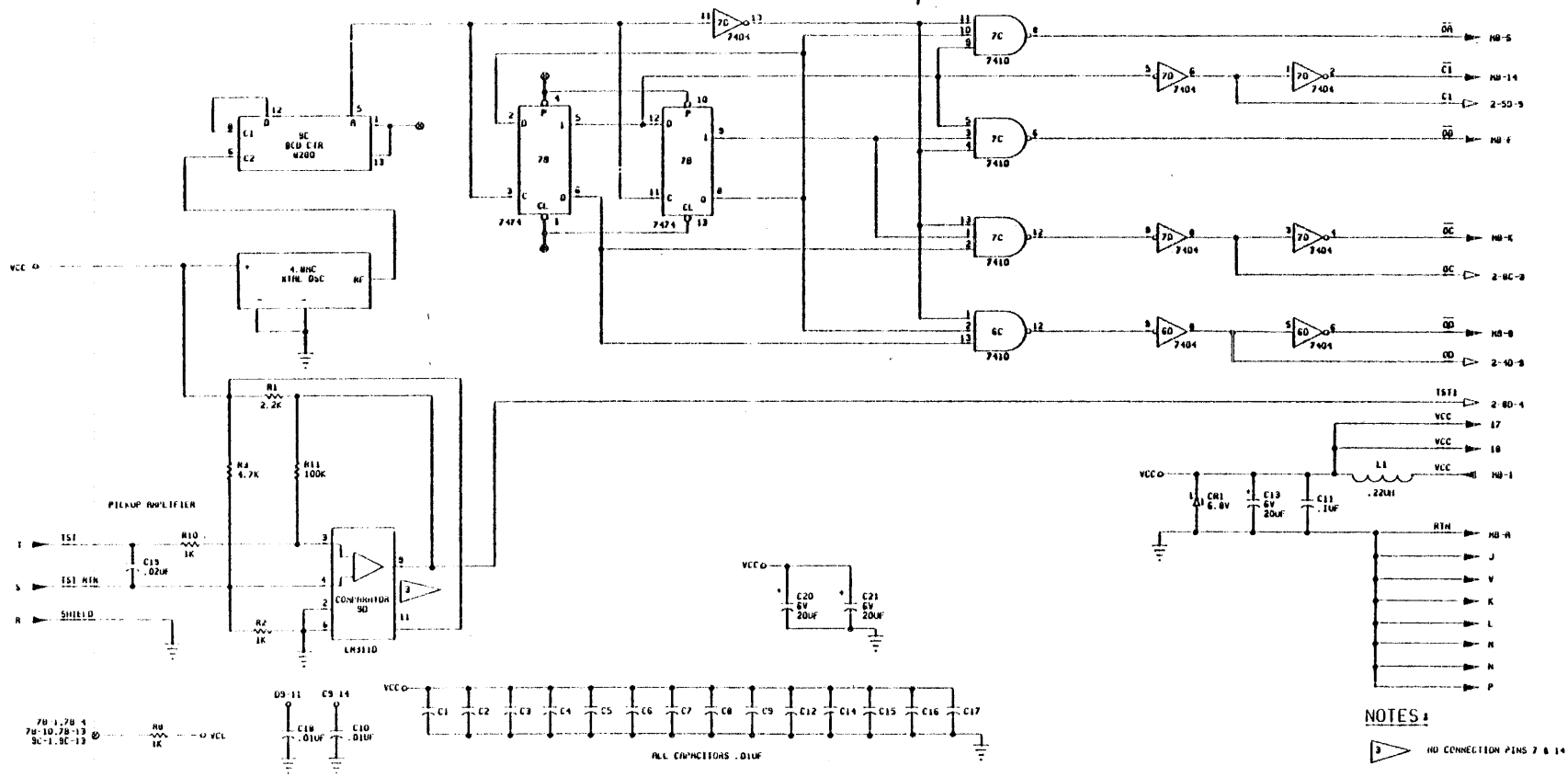


Figure 10-8. Schematic Diagram, Clock Card (Sheet 1 of 3)  
 (Dwg. No. 40080001)



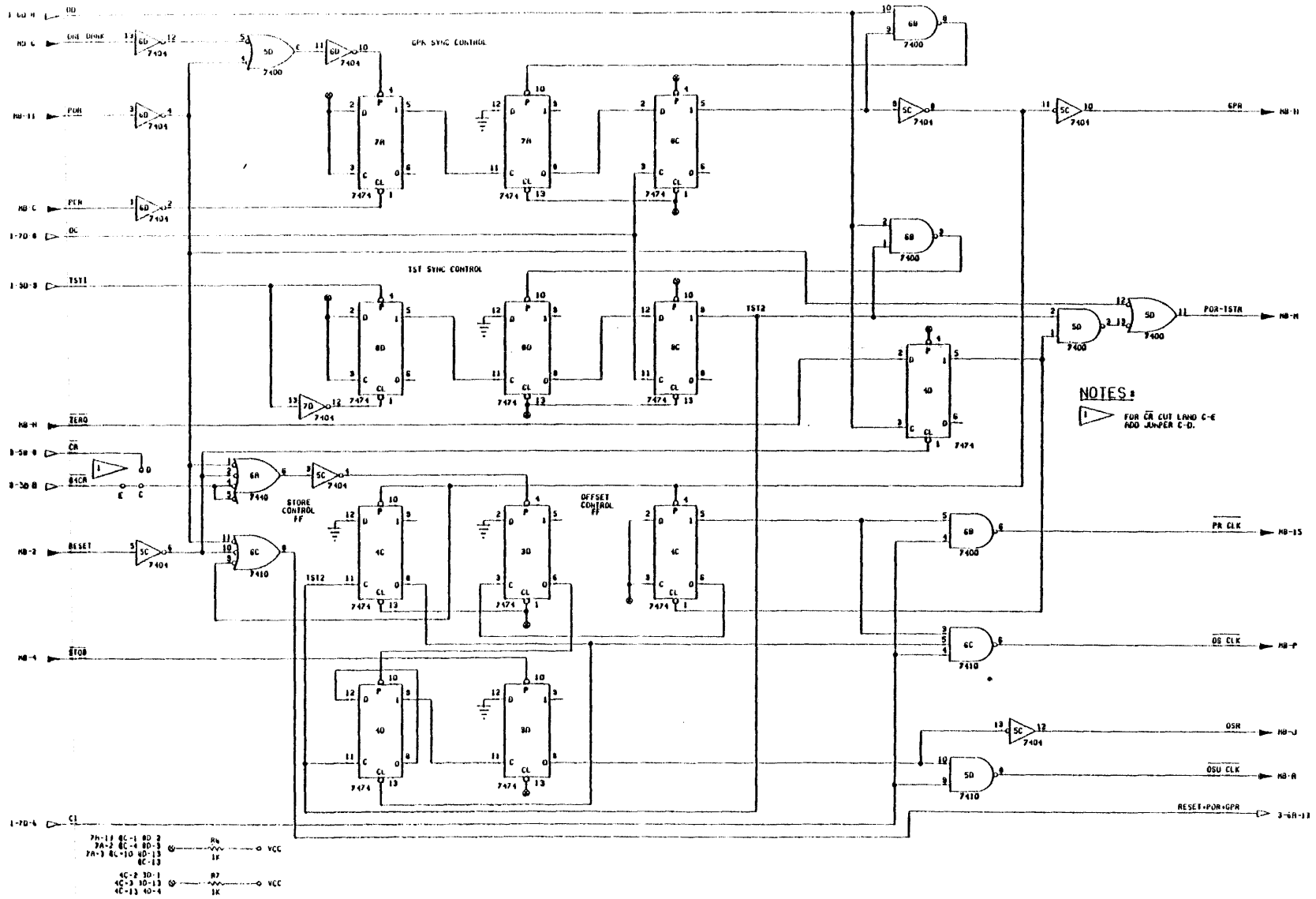


Figure 10-8. Schematic Diagram, Clock Card (Sheet 2 of 3)  
(Dwg. No. 40080001)

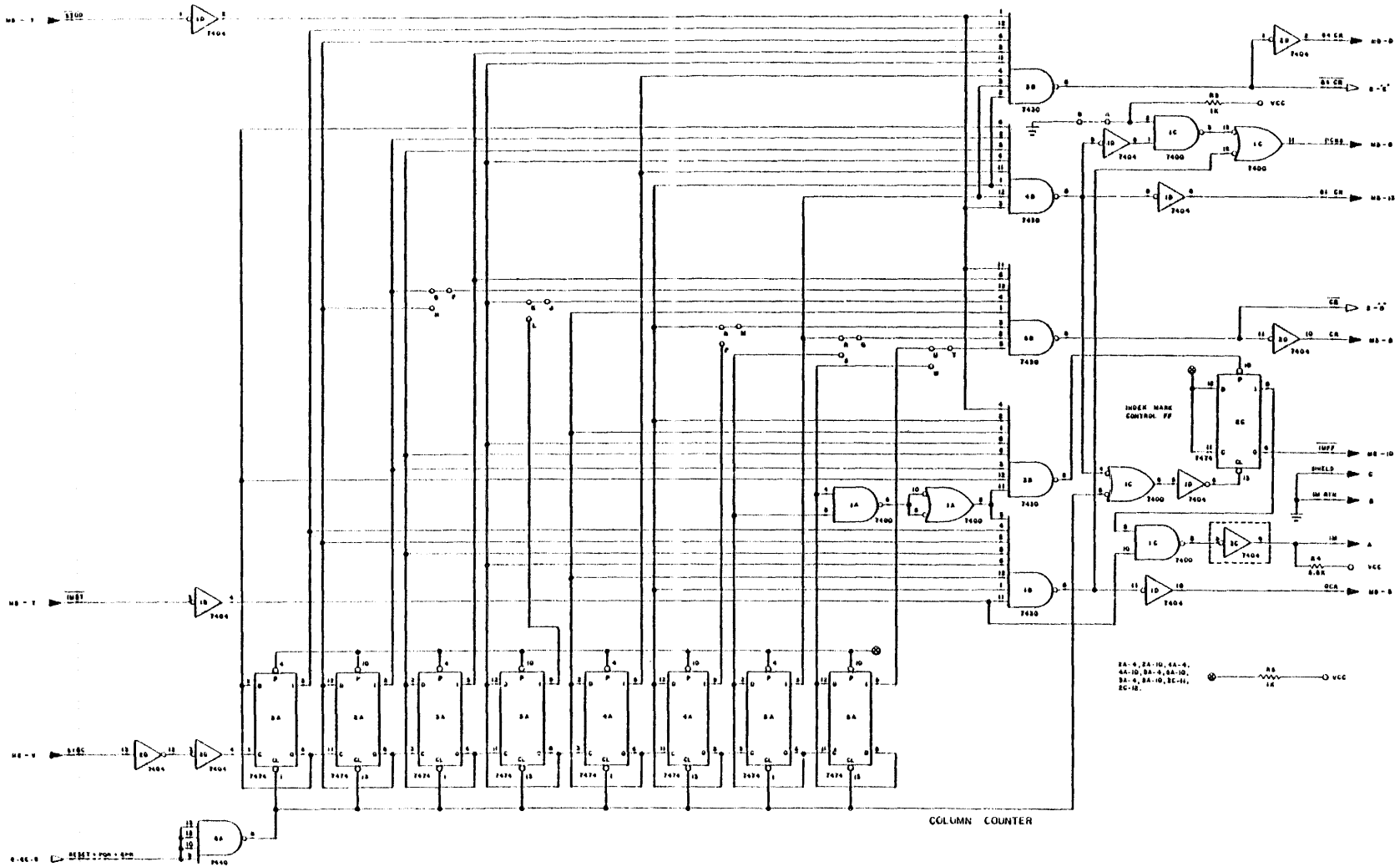


Figure 10-8. Schematic Diagram, Clock Card (Sheet 3 of 3)  
(Dwg. No. 40080001)

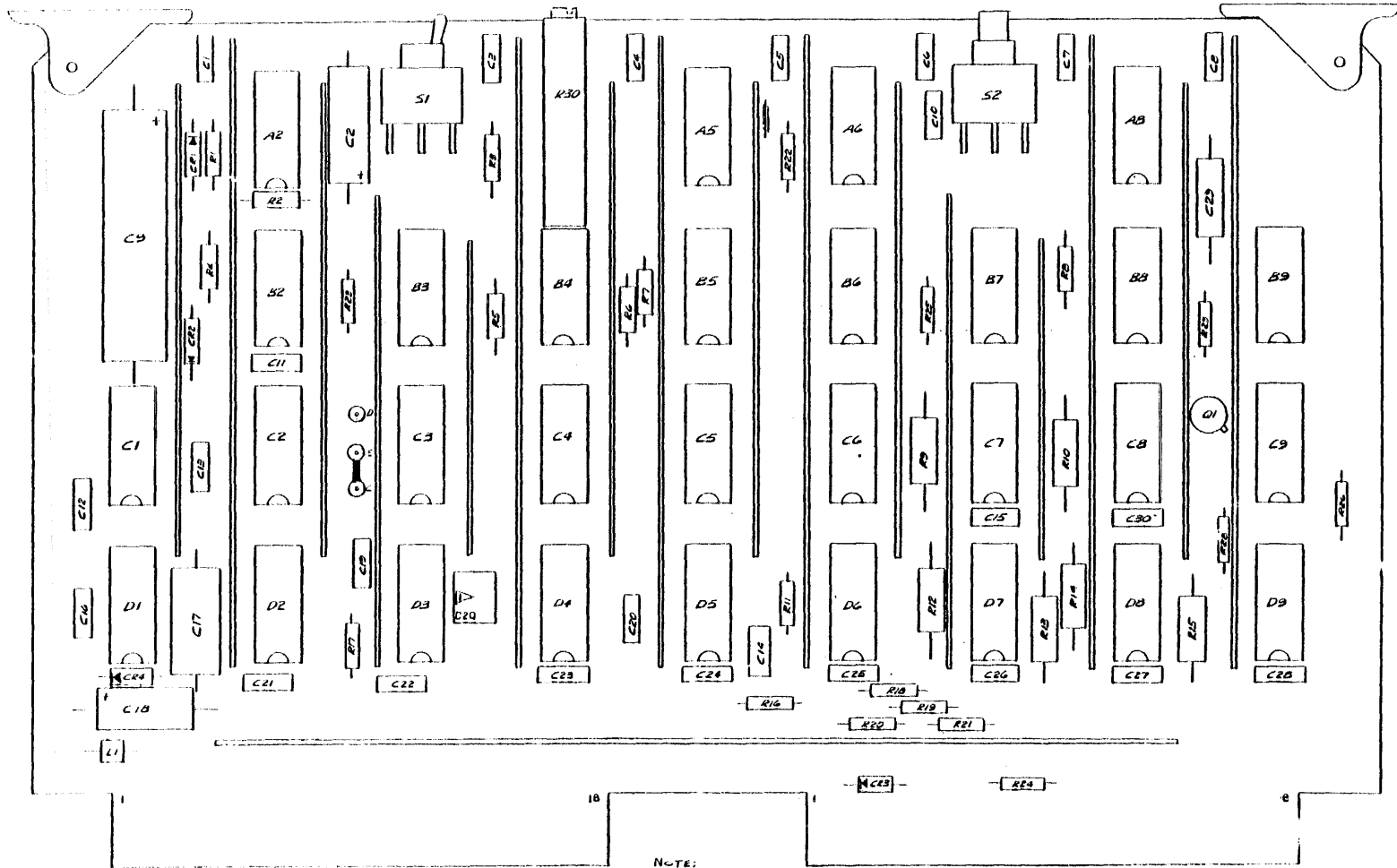


Figure 10-9. Assembly Diagram, Error Card (Dwg. No. 400610XX)

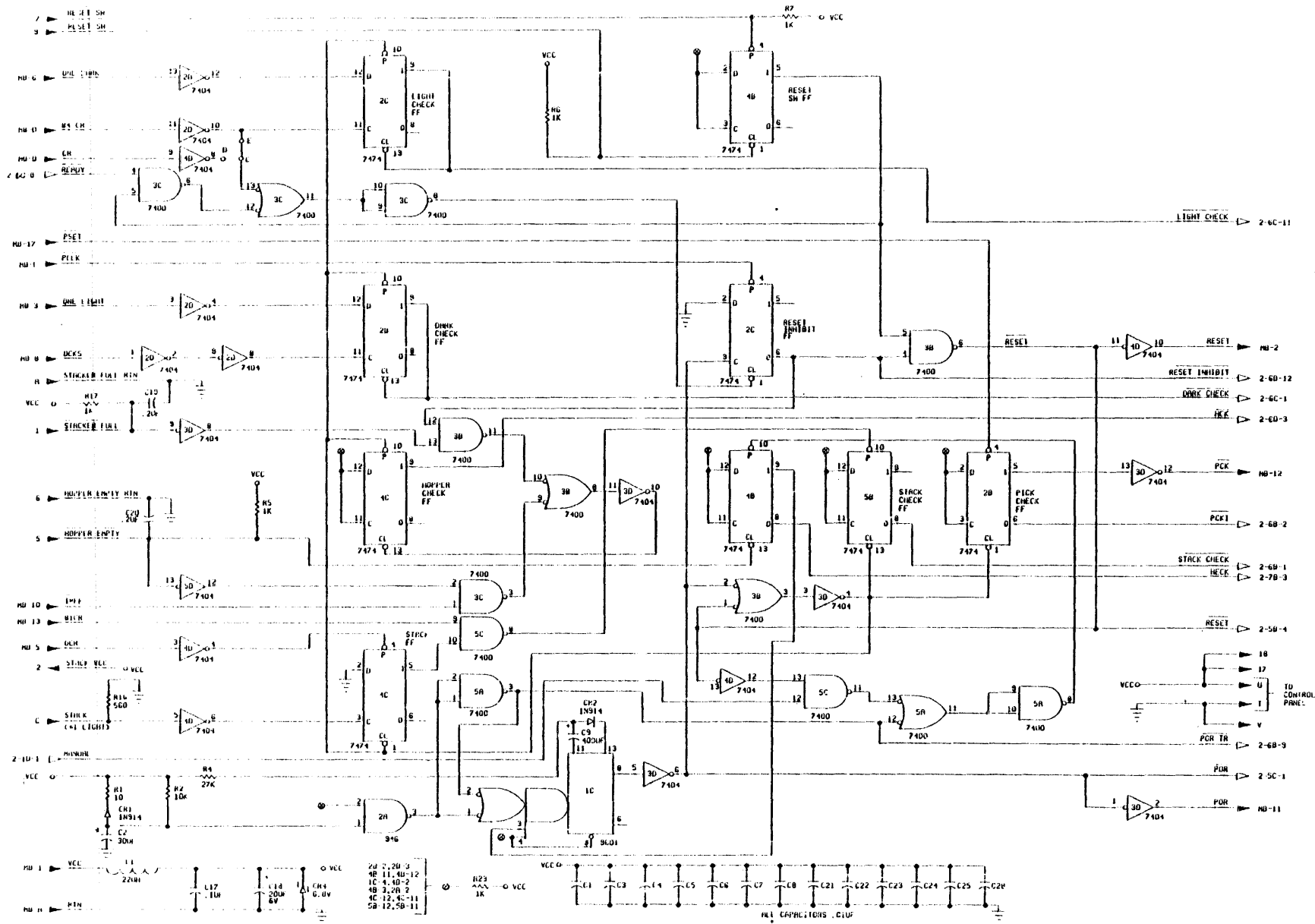


Figure 10-10. Schematic Diagram, Error Card (Sheet 1 of 2)  
(Dwg. No. 40081401)



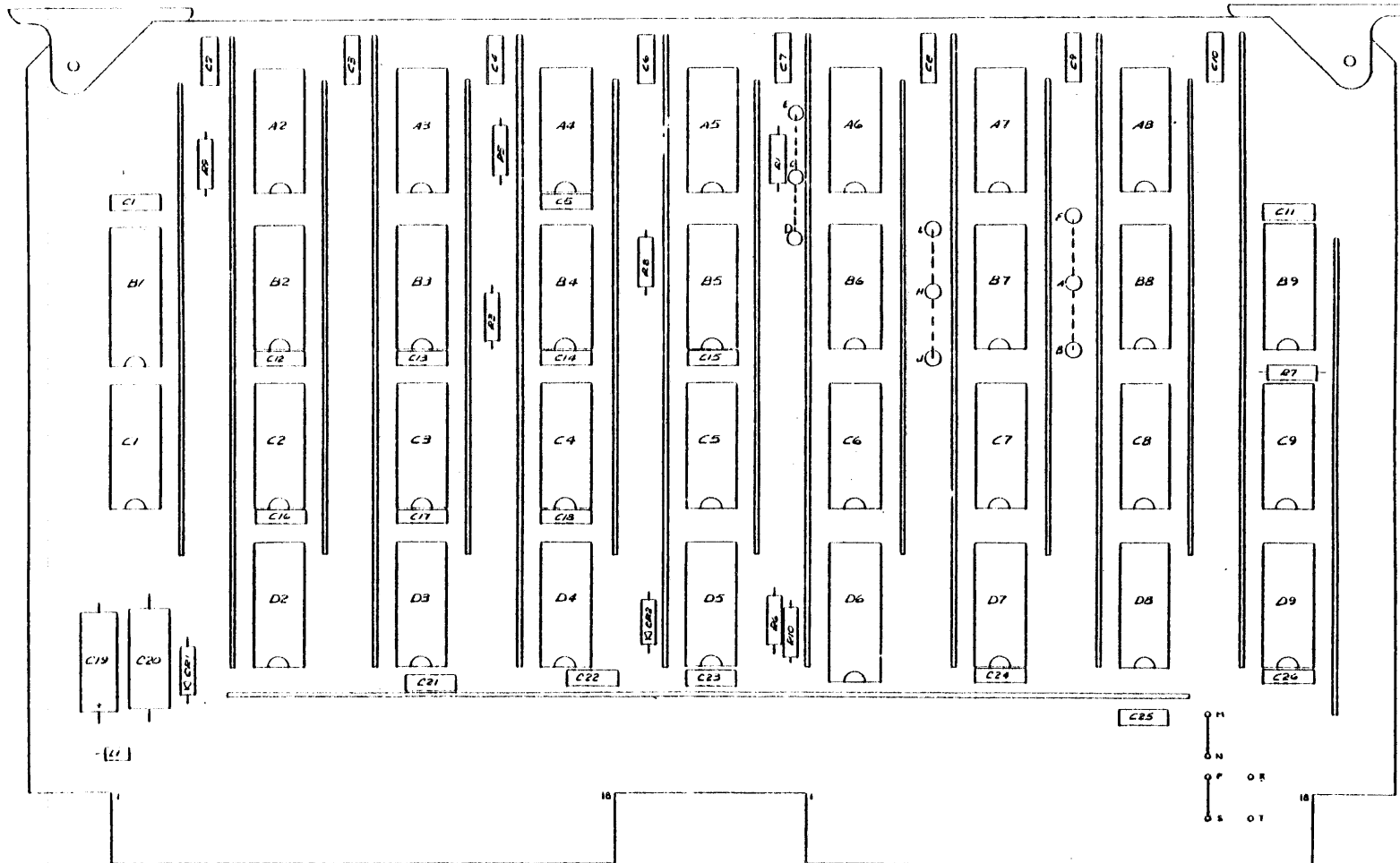


Figure 10-11. Assembly Diagram, Sync Card  
(Dwg. No. 400353XX)



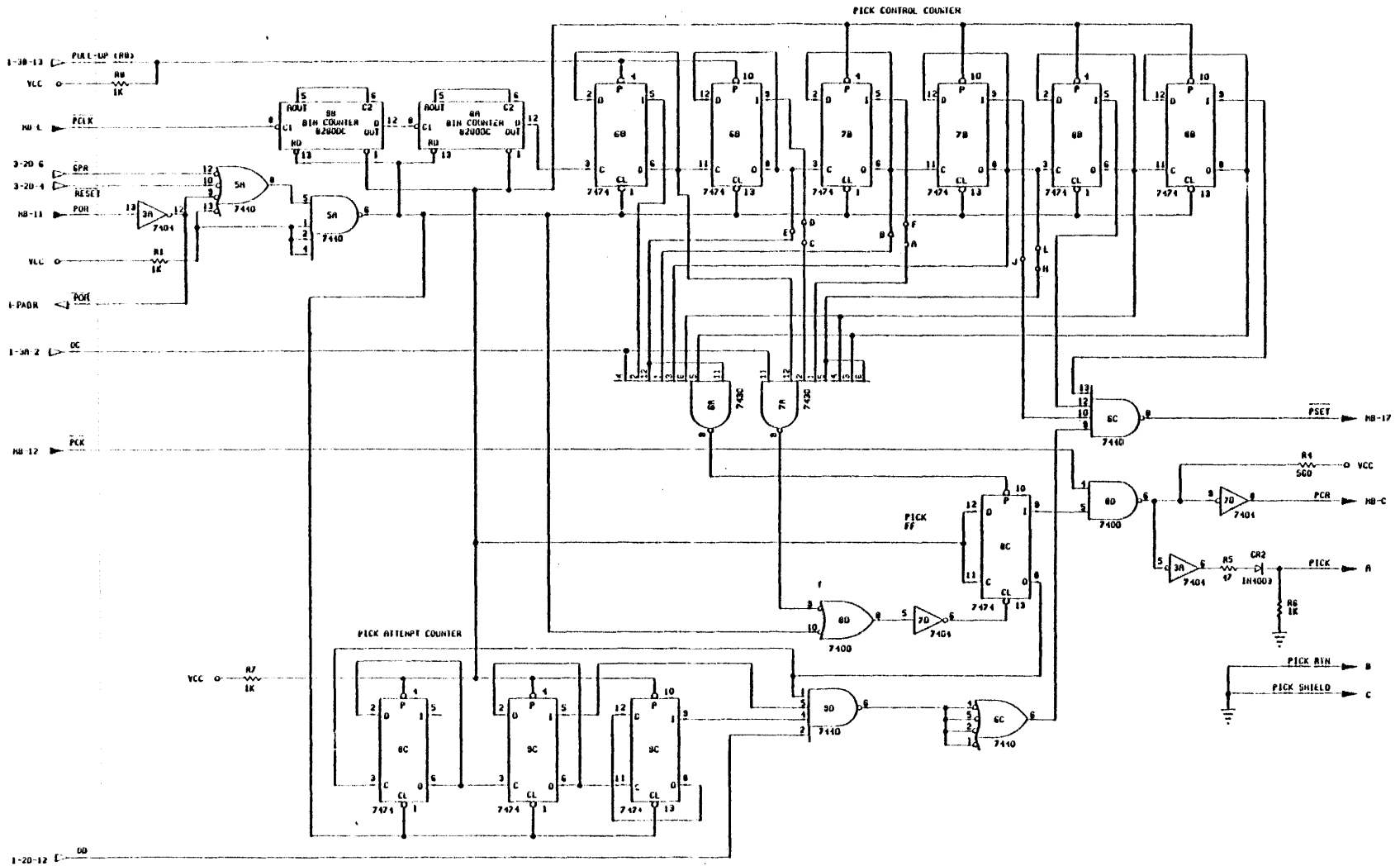
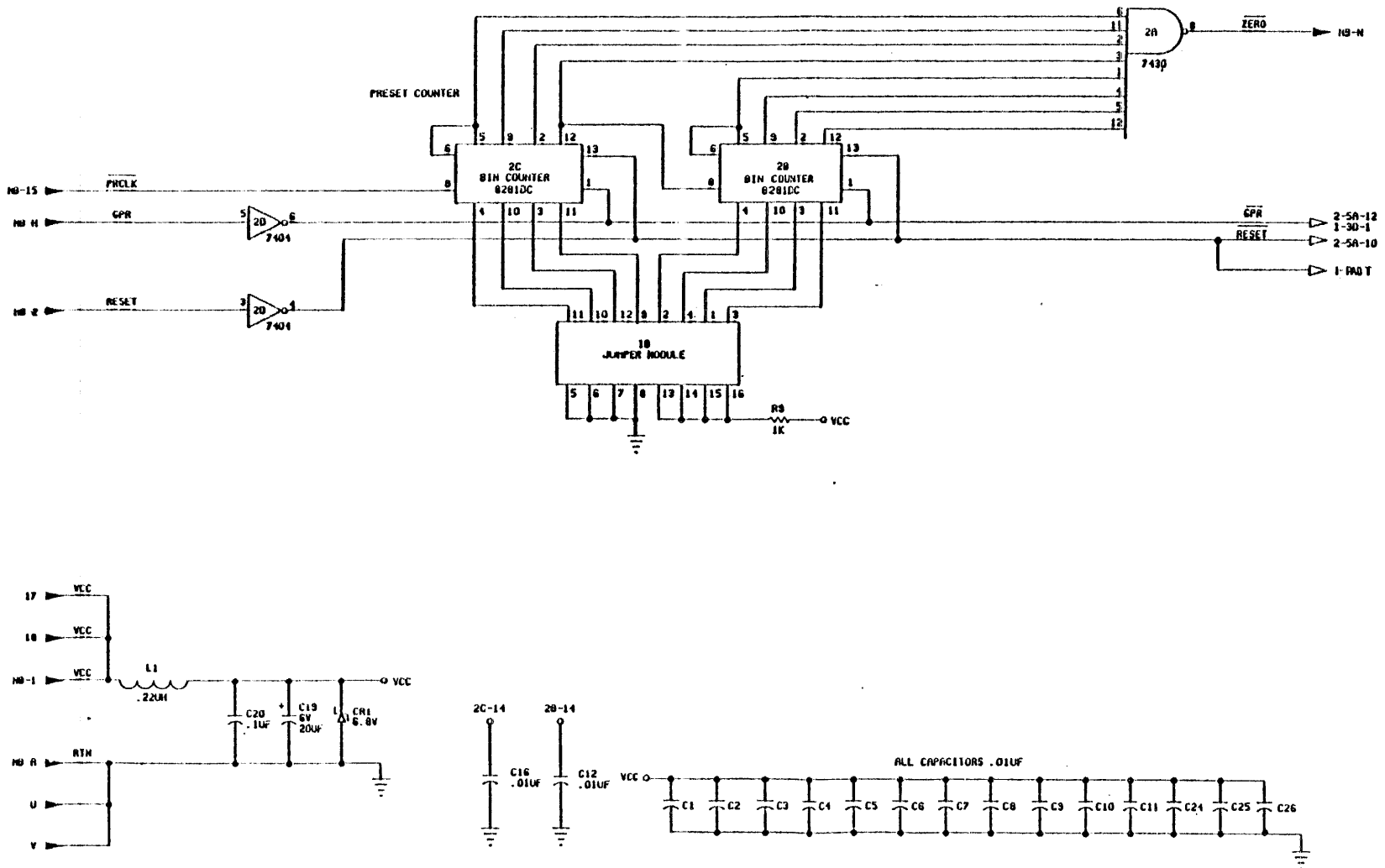


Figure 10-12. Schematic Diagram, Sync Card (Sheet 2 of 3)  
(Dwg. No. 40094301)





10-17

Figure 10-12. Schematic Diagram, Sync Card (Sheet 3 of 3)  
(Dwg. No. 40094301)

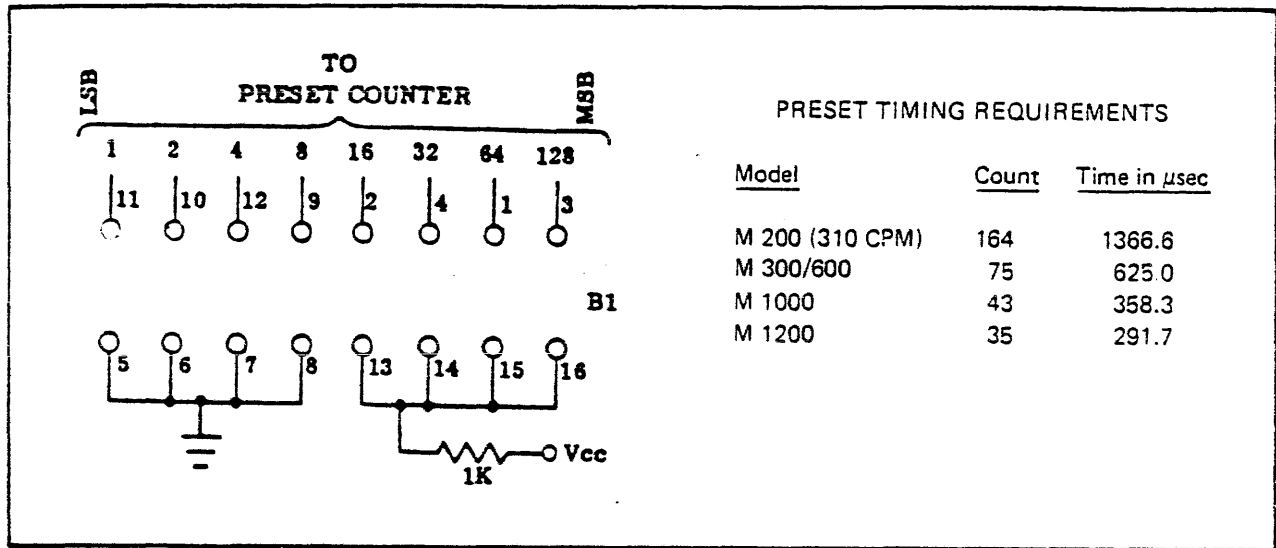


Figure 10-13. Preset Counter Strapping

#### ADJUSTMENT OF PRESET AND CSDS TIMING

Program the counters with the complement of the required count as follows:

1. Let ground represent logic "1," and strap output pins to pins 5, 6, 7 or 8 to create the required count.
2. Strap all other output pins to Vcc pins 13, 14, 15 or 16.

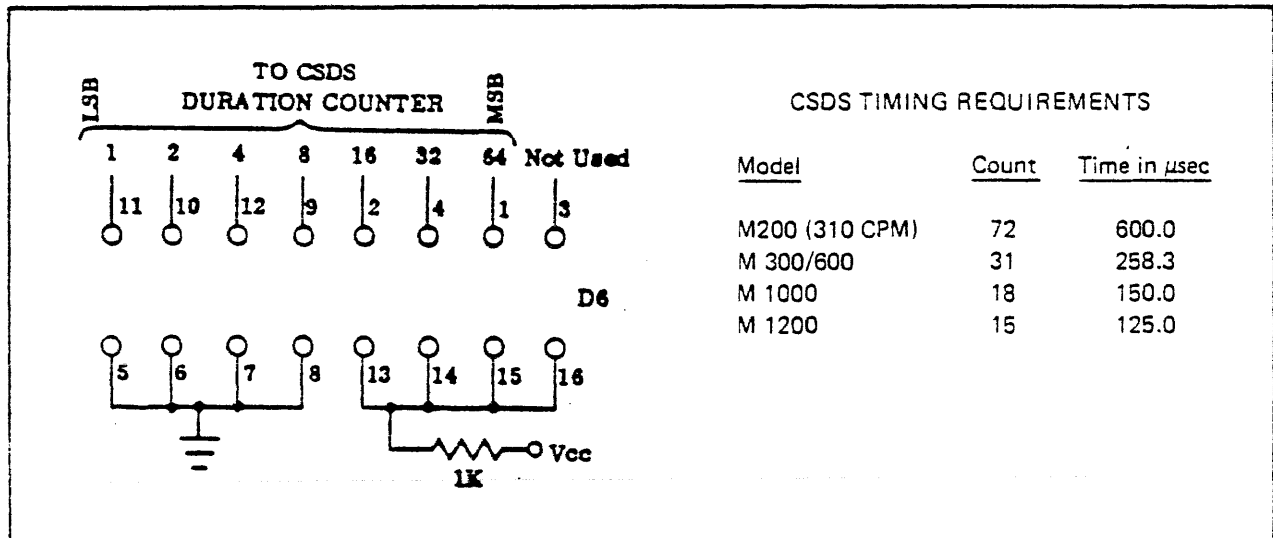


Figure 10-14. CSDS Duration Counter Strapping

78125/M1000L

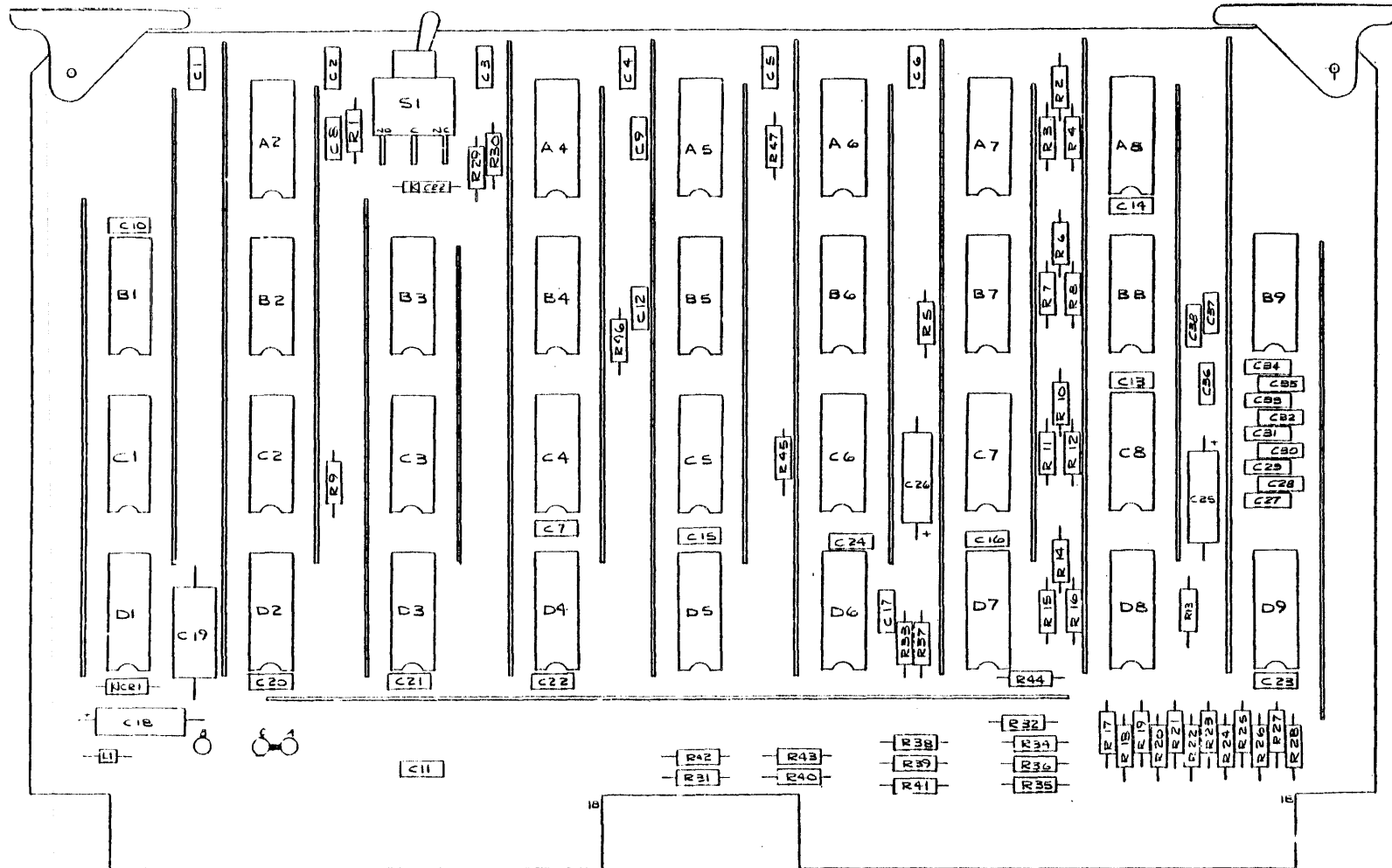
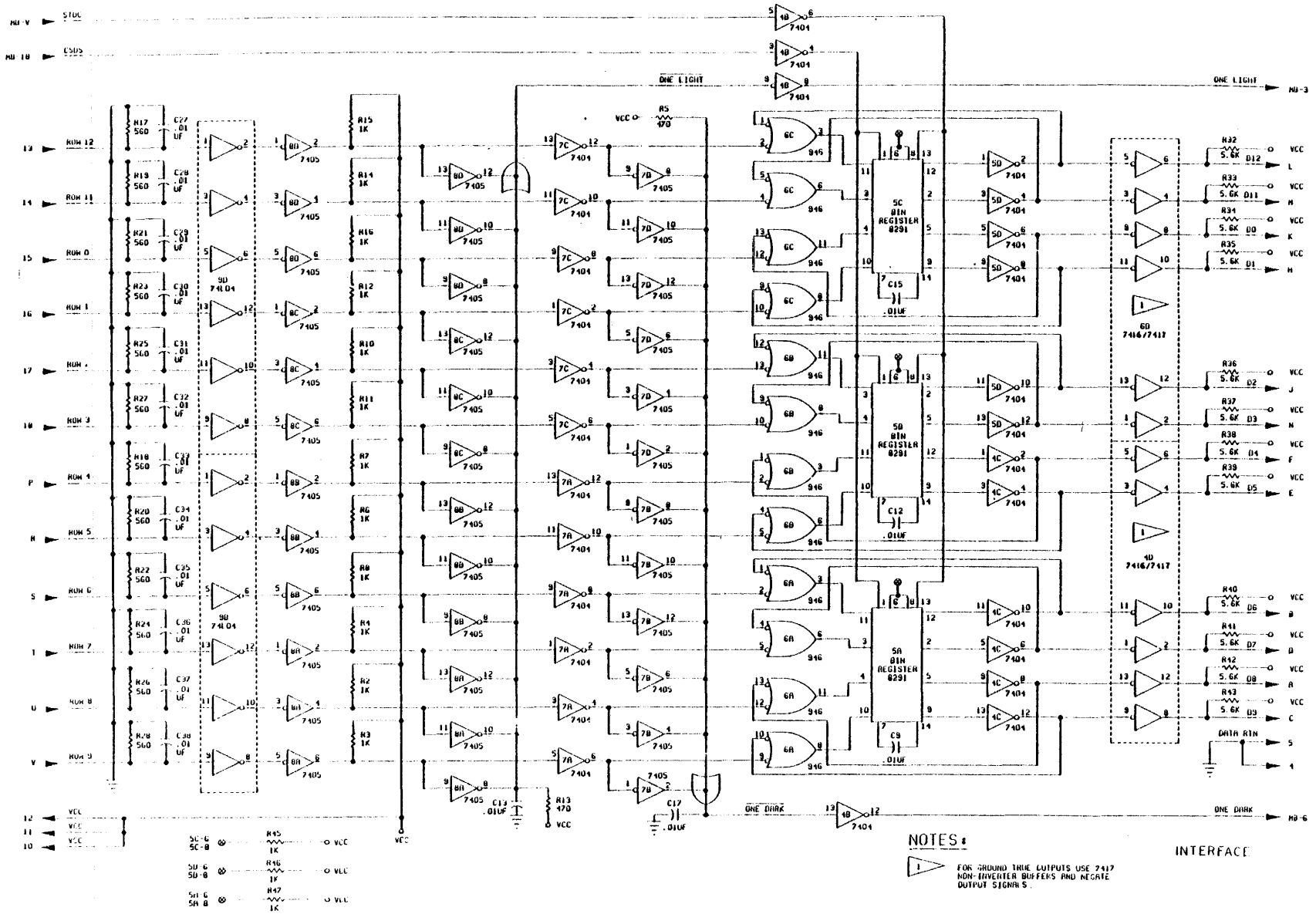


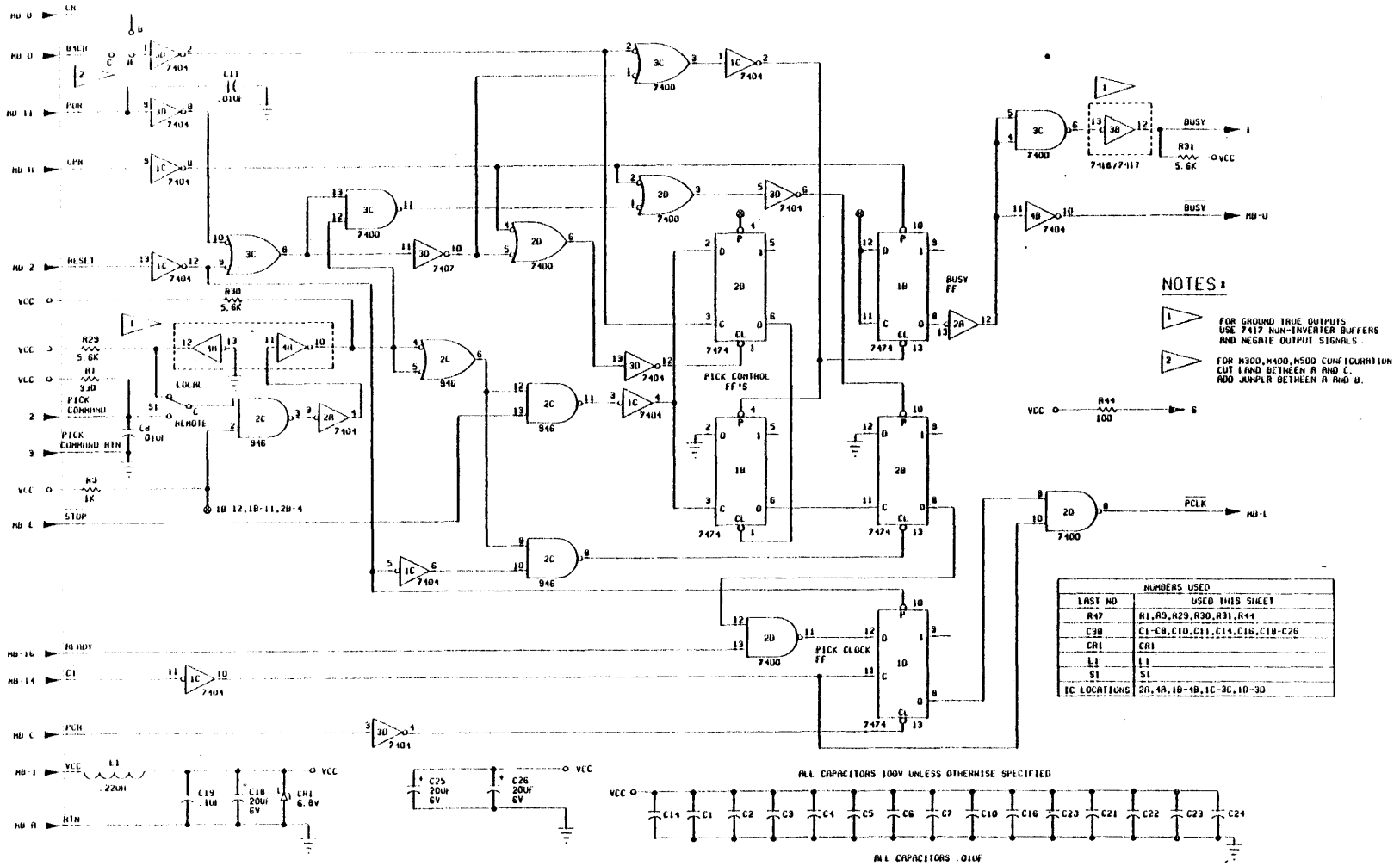
Figure 10-15. Assembly Diagram, Control Card  
(Dwg. No. 400619XX)

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10-20

Figure 10-16. Schematic Diagram, Control Card (Sheet 1 of 2)  
(Dwg. No. 40065001)



10-21

Figure 10-16. Schematic Diagram, Control Card (Sheet 2 of 2)  
(Dwg. No. 40065001)

SECTION 11  
SIGNAL MNEMONICS AND ABBREVIATIONS

MNEMONIC	DESCRIPTION	LOCATION	ORIGINATING SOURCE
<u>ØA</u>	Clock Phase A	MB-S	Clock Card
<u>ØB</u>	Clock Phase B	MB-F	Clock Card
<u>ØC</u>	Clock Phase C	MB-K	Clock Card
<u>ØD</u>	Clock Phase D	MB-9	Clock Card
ØCR	Zero Column Reset	MB-5	Clock Card
81CR	81st Column Reset	MB-13	Clock Card
84CR	84th Column Reset	MB-D	Clock Card
<u>BSY</u>	Busy Output	J8-1	Control Card
<u>BUSY</u>	Busy Signal	MB-U	Control Card
C1	Basic Clock	MB-14	Clock Card
CR	Column Reset	MB-B	Clock Card
CSDS	Column Storage Data Strobe	MB-18	Sync Card
D0	Data Row 0 Output	J8-K	Control Card
D1	Data Row 1 Output	J8-H	Control Card
D2	Data Row 2 Output	J8-J	Control Card
D3	Data Row 3 Output	J8-N	Control Card
D4	Data Row 4 Output	J8-F	Control Card
D5	Data Row 5 Output	J8-E	Control Card
D6	Data Row 6 Output	J8-B	Control Card
D7	Data Row 7 Output	J8-D	Control Card
D8	Data Row 8 Output	J8-A	Control Card
D9	Data Row 9 Output	J8-C	Control Card
D11	Data Row 11 Output	J8-M	Control Card
D12	Data Row 12 Output	J8-L	Control Card
DCKS	Dark Check Strobes	MB-8	Clock Card
DC RTN	+5 Volt DC Return	MB-A	5-Volt Power Supply
DC RTN	+5 Vdc Return From Read Station	J8-4	Control Card
ERROR	Error Output	J4-E	Error Card
ERROR RTN	Error Output Return	J4-M	Error Card
GPR	Good Pick Reset	MB-H	Clock Card
<u>HCK</u>	Hopper Check Output	J4-H	Error Card
<u>HCK DR</u>	Hopper Check Lamp Driver	J4-K	Error Card
HCK RTN	Hopper Check Output Return	J4-11	Error Card
HECK	Hopper Empty Check	6B-10	Error Card
HOP EMP	Hopper Empty Switch	J4-5	Error Card
HOP EMP RTN	Hopper Empty Switch Return	J4-6	Error Card
IM	Index Marks	J3-A	Clock Card
IM RTN	Return for Index Marks	J3-B	Clock Card
<u>IMST</u>	Index Mark Strobes	MB-T	Sync Card

78125/M1000L

MNEMONIC	DESCRIPTION	LOCATION	ORIGINATING SOURCE
MOCK	Motion Check Output	J4-F	Error Card
MOCK RTN	Motion Check Output Return	J4-10	Error Card
ONE DARK	Read Station Any Dark	MB-6	Control Card
ONE LIGHT	Read Station Any Light	MB-3	Control Card
OSCLK	Offset Clock	MB-P	Clock Card
OSR	Offset Reset	MB-J	Clock Card
OSUCLK	Offset Up-Clock	MB-R	Clock Card
PC	Pick Command Input	J8-2	Control Card
PC RTN	Pick Command Input Return	J8-3	Control Card
<u>PCK</u>	Pick Check	MB-12	Error Card
<u>PCK DR</u>	Pick Check Lamp Driver	J4-J	Error Card
<u>PCLK</u>	Pick Clock	MB-L	Control Card
PCR	Pick Control Reset	MB-C	Sync Card
PICK	Pick Driver Output	J5-A	Sync Card
PICK RTN	Pick Driver Output Return	J5-B	Sync Card
POR	Power On Reset	MB-11	Error Card
POR TR	Power On Reset Trigger	8B-2	Error Card
<u>PRCLK</u>	Preset Clock	MB-15	Clock Card
<u>PSET</u>	Pick Check Set	MB-17	Sync Card
<u>RCK DR</u>	Read Check Lamp Driver	J4-P	Error Card
<u>RDY</u>	Ready Output	J4-D	Error Card
<u>RDY DR</u>	Ready Lamp Driver	J4-R	Error Card
<u>RDY RTN</u>	Ready Output Return	J4-L	Error Card
READY	Ready	MB-16	Error Card
<u>RESET</u>	Gated Reset Switch	MB-2	Sync Card
<u>RESET SW</u>	Reset Switch Normally Open	J4-9	Error Card
<u>RESET SW</u>	Reset Switch Normally Closed	J4-7	Error Card
Row 0	Read Sensor Input Row 0	J8-15	Control Card
Row 1	Read Sensor Input Row 1	J8-16	Control Card
Row 2	Read Sensor Input Row 2	J8-17	Control Card
Row 3	Read Sensor Input Row 3	J8-18	Control Card
Row 4	Read Sensor Input Row 4	J8-P	Control Card
Row 5	Read Sensor Input Row 5	J8-R	Control Card
Row 6	Read Sensor Input Row 6	J8-S	Control Card
Row 7	Read Sensor Input Row 7	J8-T	Control Card
Row 8	Read Sensor Input Row 8	J8-U	Control Card
Row 9	Read Sensor Input Row 9	J8-V	Control Card
Row 11	Read Sensor Input Row 11	J8-14	Control Card
Row 12	Read Sensor Input Row 12	J8-13	Control Card
<u>SCK DR</u>	Stack Check Lamp Driver	J4-N	Error Card
<u>STACK</u>	Stack Photocell Input	J4-C	Error Card
<u>STACK CK</u>	Output Stacker Check	1C-7	Error Card
<u>STACKER FULL</u>	Stacker Full Switch	J4-1	Error Card

78125/M1000L

MNEMONIC	DESCRIPTION	LOCATION	ORIGINATING SOURCE
STACKER FULL RTN	Stacker Full Switch Return	J4-A	Error Card
STACK LED	Stack LED Input	J8-6	Control Card
STACK LED RTN	Stack LED Return	J8-5	Control Card
STACK Vcc	Stack Photocell +5 Volts	J4-2	Error Card
STØB	Column Strobe Phase B	MB-4	Sync Card
STØC	Column Strobe Phase C	MB-V	Sync Card
STØD	Column Strobe Phase D	MB-7	Sync Card
<u>STOP</u>	Stop	MB-E	Error Card
<u>STOP DR</u>	Stop Lamp Driver	J4-S	Error Card
<u>STOP SW</u>	Stop Switch Input	J4-B	Error Card
TST	Timing Strobe	J3-T	Reluctance Pickup
TST RTN	Timing Strobe Return	J3-S	Reluctance Pickup
TST1	Timing Strobe One	9D-9	Clock Card
TST2	Timing Strobe Two	8C-9	Clock Card
TSTR + POR	Timing Strobe Reset	MB-M	Clock Card
Vcc	+5 Volts DC	MB-1	5-Volt Power Supply
Vcc	+5V to Read	J8-12	Control Card
ZERO	Preset Decode	MB-N	Sync Card

78125/M1000L



**SECTION 12**  
**ILLUSTRATED PARTS BREAKDOWN**

The following pages illustrate major assemblies in exploded view to facilitate location and replacement of principal component parts. Accompanying tables identify these parts and provide Documation part numbers.

Table 12-1 identifies major assemblies of the Model M600L Card Reader.

Those components which engineering data and field reports indicate may require replacement during the life of the reader are identified with an asterisk (\*) as recommended spares.

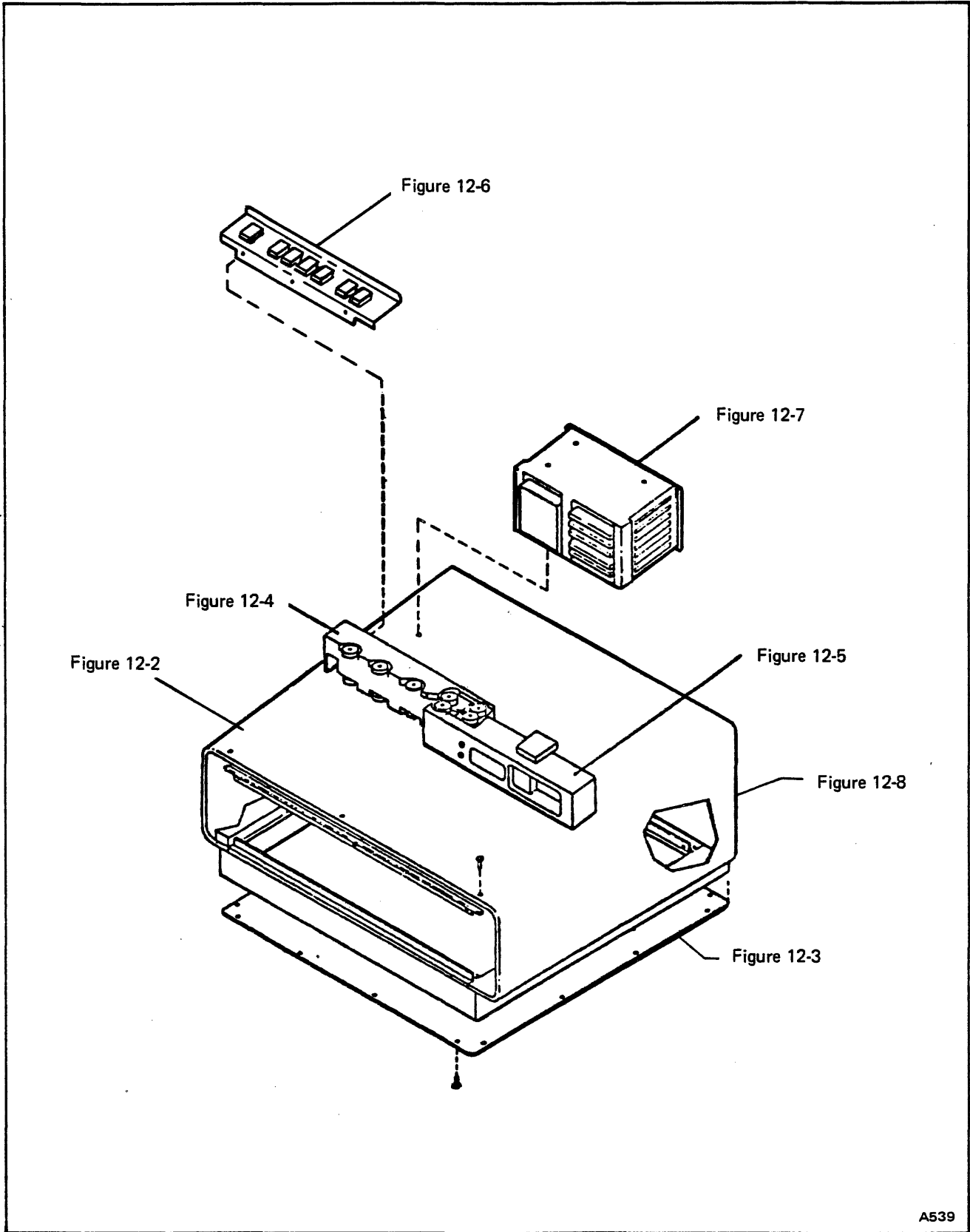
An 8-digit Documation part number is listed for each identified replacement part. When ordering parts include this part number and description, and identify the next

higher assembly. (Some parts are available only as assemblies even though specific components may be itemized.) Also include reader model and serial number and, if applicable, Customer Special number.

Where appropriate, part numbers have been revised to reflect Customer Special requirements.

For additional information on replacement parts contact:

**DOCUMATION INCORPORATED**  
P.O. Box 1240  
Melbourne, Florida 32901  
Telephone (305) 724-5500  
TWX 510-959-6286



73348/M6L

A539

Figure 12-1. Figure Reference

Table 12-1. Major Assemblies, Reference Data

FIGURE	TABLE	DESCRIPTION	PART NUMBER		
12-2	12-2	Main Frame Assembly (115V, 60 Hz)	40389102		
		Drive Motor Assembly	30411301		
		Main Frame Assembly (230V, 50 Hz)	40389104		
		Drive Motor Assembly	30411302		
		Main Frame Assembly, UL (115V, 60 Hz)	40389111		
		Drive Motor Assembly	30269503		
		Main Frame Assembly, UL No. 2/CSA (115V, 60 Hz)	40389125		
		Drive Motor Assembly	30269503		
		12-3	12-3	Base Plate Assembly (115V, 60 Hz)	40206604
				Vacuum Pump Assembly	40033321
Base Plate Assembly (230V, 50 Hz)	40075116				
Vacuum Pump Assembly	40033307				
Base Plate Assembly, UL (115V, 60 Hz)	40206609				
Vacuum Pump Assembly	40033326				
Base Plate Assembly, UL No. 2/CSA (115V, 60 Hz)	40492401				
Vacuum Pump Assembly	40033326				
12-4	12-4	Stack Support Assembly	40021205		
12-5	12-5	Pick Support Assembly	40048201		
12-6	12-6	Control Panel Assembly	30039002		
		Control Panel Assembly (UL)	30213501		
		Control Panel Assembly (UL/CSA)	30039007		
12-7	12-7	Card File Assembly (PTRP)	40061212		
		Card File Assembly (GTRP)	40061216		
12-8	12-8	Trim Group Assembly, (115V, 60 Hz)	40049402		
		Trim Group Assembly, (230V, 50 Hz)	40049405		
		Trim Group Assembly, UL (115V, 60 Hz)	40049413		
		Trim Group Assembly, UL No. 2/CSA (115V, 60 Hz)	40495602		
	12-9	Recommended Accessories, Miscellaneous Items (Not Illustrated)			

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78348/M6L

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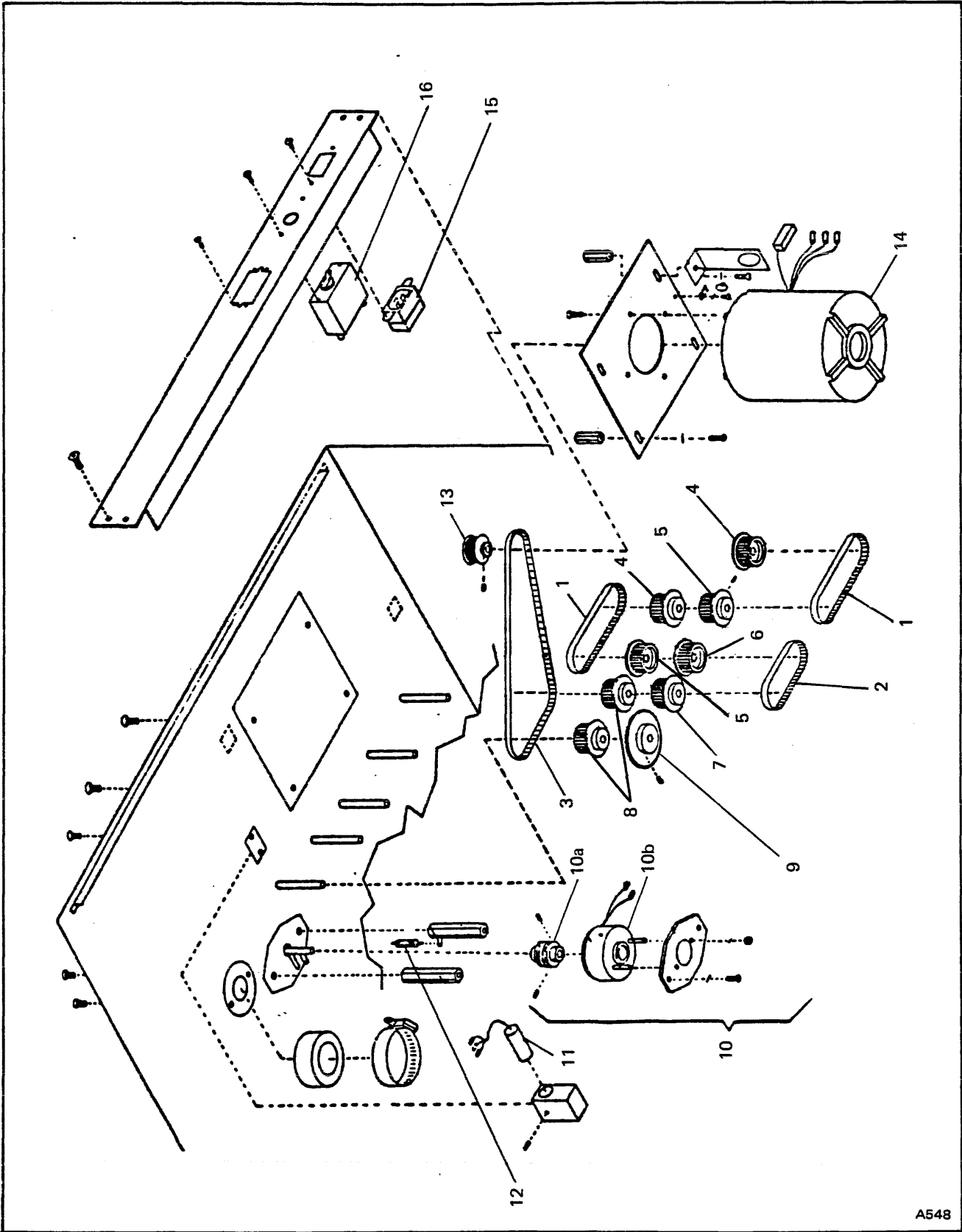
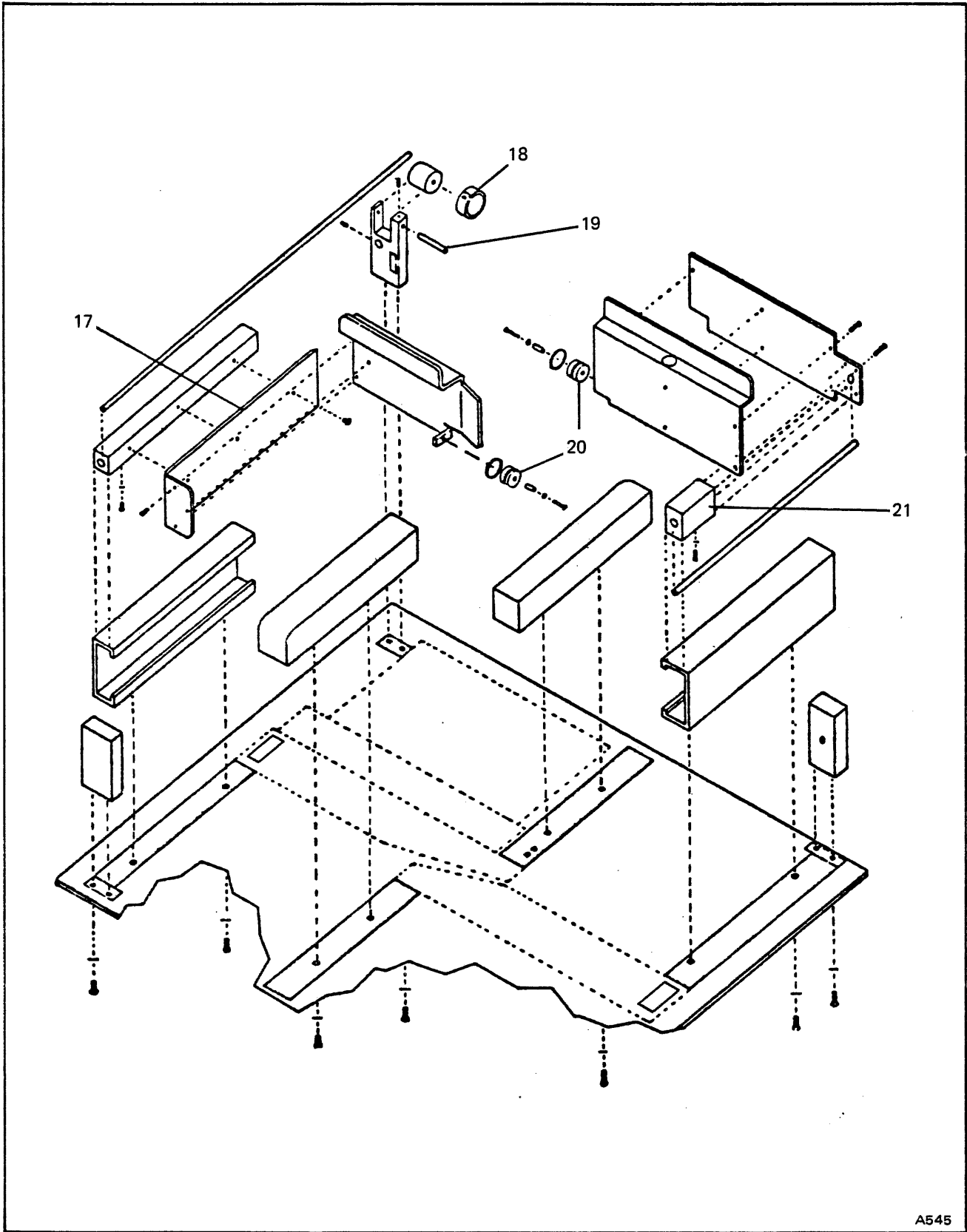


Figure 12-2. Main Frame Assembly (Sheet 1 of 2) (Bottom View)

A548



78348/M6L

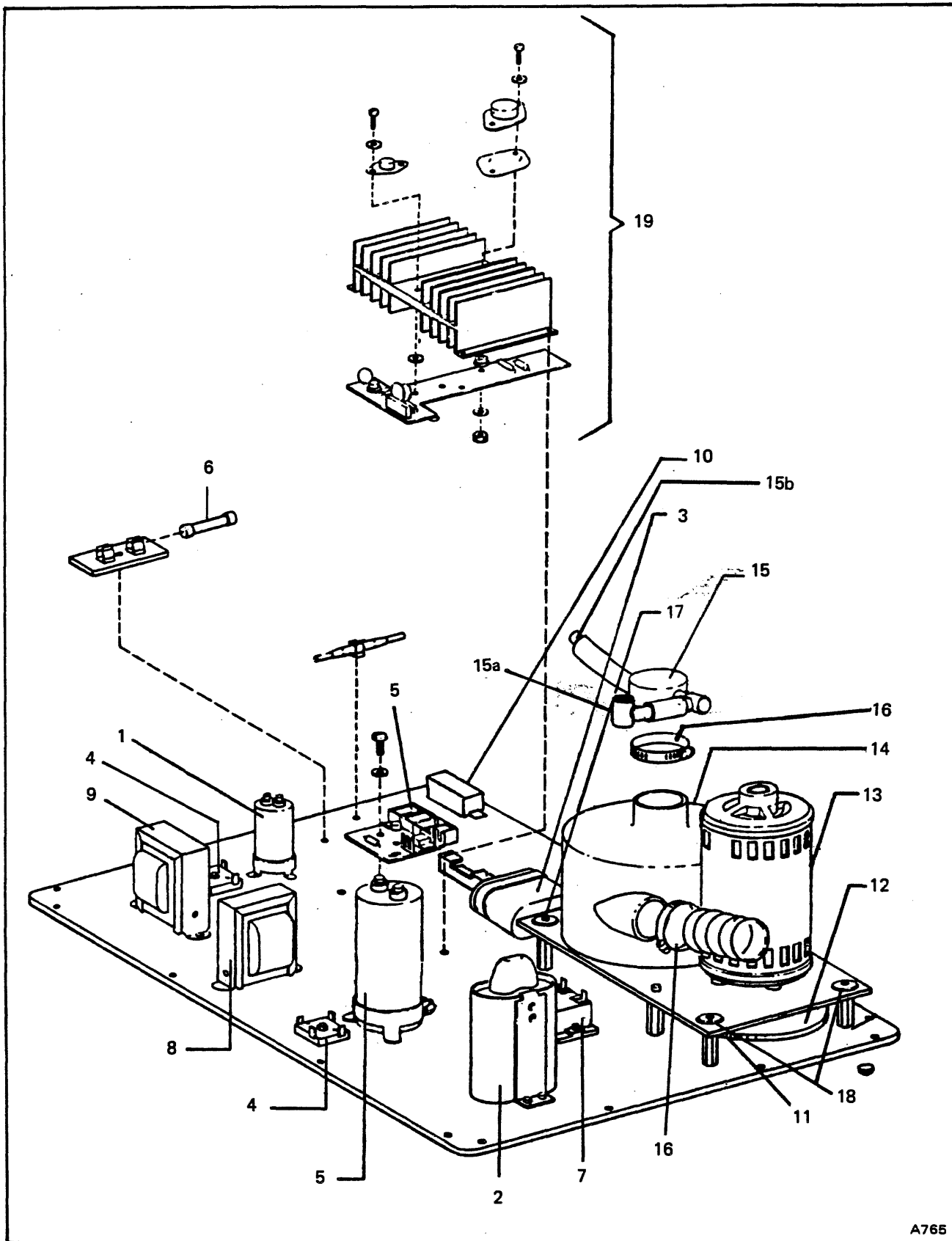
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Figure 12-2. Main Frame Assembly (Sheet 2 of 2) (Top View)

Table 12-2. Replacement Parts List, Main Frame Assembly

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
12-2/1	BELT, Timing, Neoprene, 1/5p, 8" x 1/4"	00000281
12-2/2	BELT, Timing, Neoprene, 1/5p, 7" x 1/4"	00000280
12-2/3	BELT, Timing, Neoprene, 1/5p, 16" x 1/4"	00000283
12-2/4	PULLEY, T-Belt, Nylon, 15 Grv	00000274
12-2/5	PULLEY	20080404
12-2/6	PULLEY, T-Belt, Nylon, 15 Grv	00000274
12-2/7	PULLEY, T-Belt, Nylon, 13 Grv	00000273
12-2/8	PULLEY, Timing	20127003
12-2/9	GEAR ASSEMBLY, Timing	20125801
12-2/10	SOLENOID ASSEMBLY	20022502
12-2/10a	COUPLING, Solenoid	10010501
12-2/10b	SOLENOID, Pick	20010601
12-2/11	PICKUP ASSEMBLY, Magnetic	20016101
12-2/12	SPRING, Extension, 1/4 x 1-1/8, 2.3 lb./in.	00000285
(Note 1)	DRIVE MOTOR ASSEMBLY; consists of:	
12-2/13	PULLEY, Timing (60 Hz)	20127008
	PULLEY, Timing (50 Hz)	20127009
12-2/14	MOTOR, 1500/1800 rpm, 115/230V, 50/60 Hz, UL	10270402
12-2/15	CONNECTOR, AC, Male, 15A, 3-pin (115V/60 Hz)	00001719
	FILTER ASSEMBLY, 230V (230V/50 Hz)	20102604
12-2/16	CIRCUIT BREAKER, 8.0A, 250V, 50/60 Hz, Slo-Trip (115V/60 Hz)	00000188
	CIRCUIT BREAKER, 6.0A, 250V, 50/60 Hz, Slo-Trip (230V/50 Hz)	00000185
12-2/17	BUMPER ASSEMBLY, Stack	30328501
12-2/18	SPRING, Negator, SS, .006 x 3/8 x 24 in. lg.	00000306
12-2/19	SHAFT, Spring Drum	20047601
12-2/20	ROLLER, Card Follower	10011801
12-2/21	BUSHING, Ball, .3750 wkg b.r., .6250 o.d., .875 L	00000406
	Notes:	
	1. See Table 12-1 for assembly part numbers.	

78348/M6L



78348/M6L

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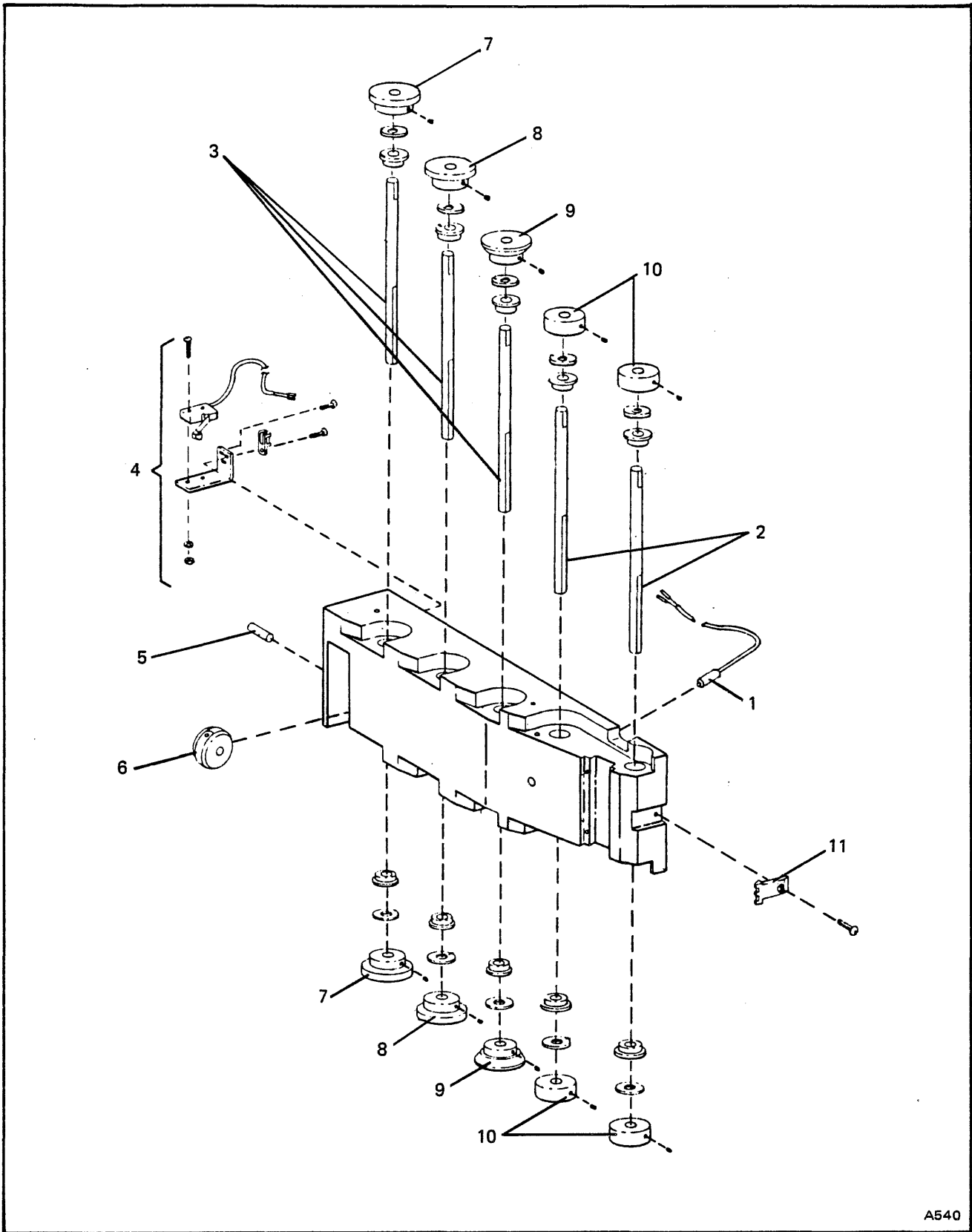
Figure 12-3. Base Plate Assembly



Table 12-3. Replacement Part List, Base Plate Assembly

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
12-3/1	CAPACITOR, Alum, Elec, 4600 $\mu$ F, 15V dcw	0000200
12-3/2	CAPACITOR, Paper/Oil, 17.5 $\mu$ F, 370 Vac (115V/60 Hz)	00002049
	CAPACITOR, Paper/Oil, 10.0 $\mu$ F, 370 Vac (230V/50 Hz)	00002051
12-3/3	CAPACITOR, Paper/Oil, 3.0 $\mu$ F, 370 Vac (115V/60 Hz)	00001566
	CAPACITOR, Paper/Oil, 4.0 $\mu$ F, 370 Vac (230V/50 Hz)	00002050
12-3/4	DIODE BRIDGE, 70 Vrms, 12A	00000143
12-3/5	P.C. ASSEMBLY, Solenoid Driver	30010001
12-3/6	FUSE, 1.0A, Slo-Blo, 3AG	00000147
12-3/7	RELAY ASSEMBLY, Solid-State (UL Apvd) (115V/60 Hz)	20201001
	RELAY, Solid-State, 10A (230V/50 Hz)	10255301
12-3/8	TRANSFORMER ASSEMBLY, 24V (115V/60 Hz)	20015507
	TRANSFORMER ASSEMBLY, 24V (230V/50 Hz)	20074001
12-3/9	TRANSFORMER ASSEMBLY, 12V (115V/60 Hz)	20015609
	TRANSFORMER ASSEMBLY, 12V (230V/50 Hz)	20073901
(Note 1)	TRANSFORMER, 12V-4A/24V-2A	00000134
12-3/10	FILTER ASSEMBLY (115V/60 Hz)	30075604
(Note 2)	VACUUM PUMP ASSEMBLY; consists of:	
12-3/11	BELT, Drive, PEU, 21.46" (115V/60 Hz)	00000519
	BELT, Drive, PEU, 22.83" (230V/50 Hz)	00000520
12-3/12	PULLEY ASSEMBLY (115V/60 Hz)	20076101
	PULLEY ASSEMBLY (230V/50 Hz)	20076102
12-3/13	MOTOR, Blower, 115V/60 Hz, UL (115V/60 Hz)	10278101
	MOTOR, Blower, UL, 208V/60 Hz, 220V/50 Hz (230V/50 Hz)	10278105
12-3/14	BLOWER, 3-Stage	30055902
12-3/15	ADAPTER ASSEMBLY, Vacuum (60 Hz)	20064701
	ADAPTER ASSEMBLY, Vacuum (50 Hz)	20064702
12-3/15a	ELBOW ASSEMBLY, Vacuum Tube	20252401
12-3/15b	ORIFICE	20026808
12-3/16	CLAMP, Screw, Adj., SS, 1-1/16" to 2"	00000407
12-3/17	MOUNT, Shock, Rbr Element, 1" Dia.	00000505
12-3/18	MOUNT, Shock, Rbr Element, 1" Dia.	00000291
12-3/19	POWER SUPPLY ASSEMBLY, 5V	30029507
	Notes:	
	1. Transformer only for items 8 and 9.	
	2. See Table 12-1 for assembly part numbers.	

78348/M6L



78348/M6L

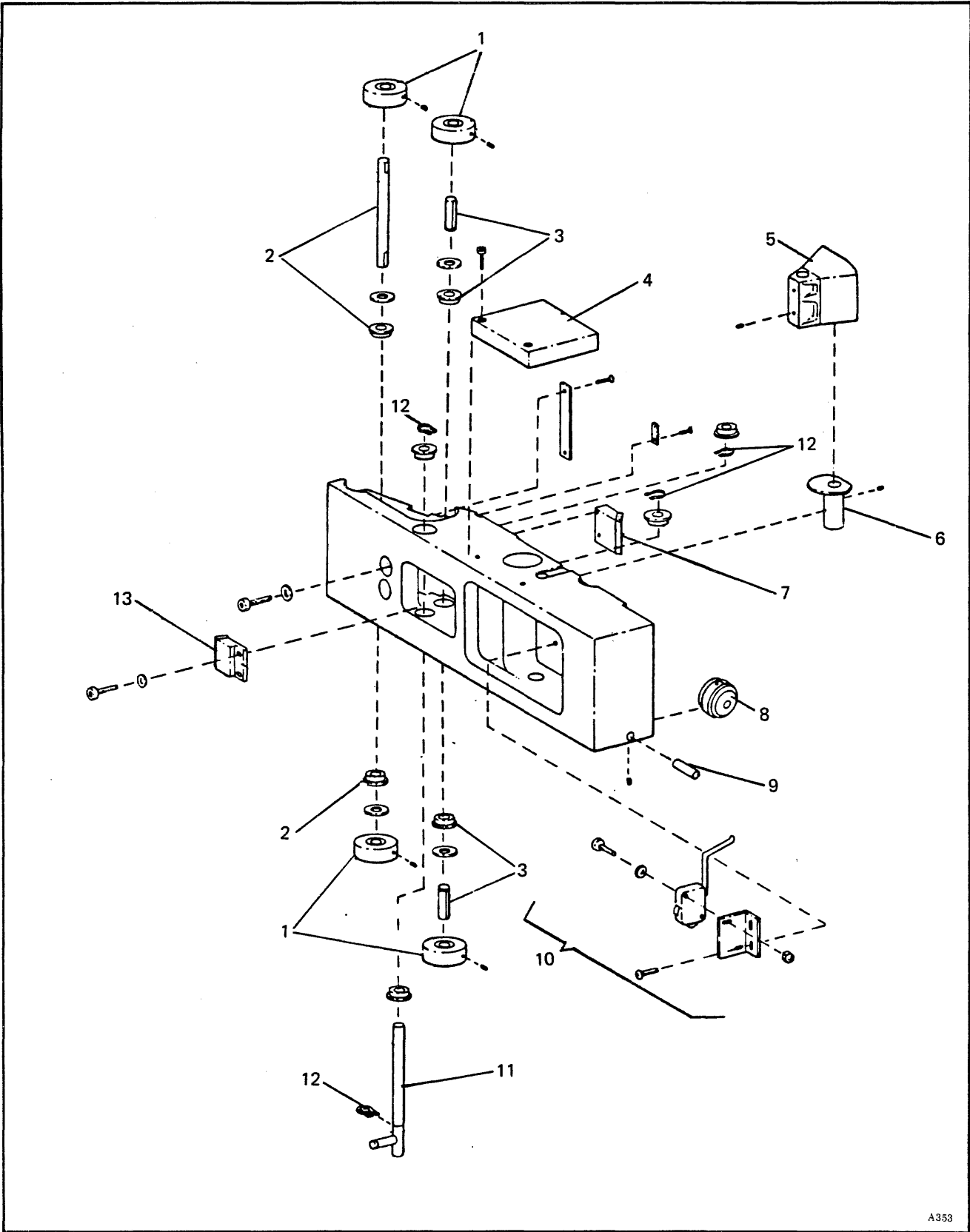
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Figure 12-4. Stack Support Assembly

Table 12-4. Replacement Parts List, Stack Support Assembly

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
12-4/1	PHOTOCELL ASSEMBLY, Stack	20038201
12-4/2	SHAFT ASSEMBLY, 4th & 5th Stack Roller (Incl. Bearings)	00000871
12-4/3	SHAFT ASSEMBLY, 1st, 2nd & 3rd Stack Roller (Incl. Bearings)	00000872
12-4/4	SWITCH ASSEMBLY, Stacker Full	20021101
12-4/5	SHAFT, Spring Drum	10000701
12-4/6	SPRING, Negator, SS, .005 x 5/16 x 17 in. lg.	00000499
12-4/7	ROLLER, 1st Stack Drive	20001505
12-4/8	ROLLER, 2nd Stack Drive	20001504
12-4/9	ROLLER, 3rd Stack Drive	20001506
12-4/10	ROLLER, Drive 4th & 5th Stack	20002101
12-4/11	THROAT, Pick	10075801

78348/M6L



78348/MGL

A353

Figure 12-5. Pick Support Assembly

Table 12-5. Replacement Parts List, Pick Support Assembly

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
12-5/1	CAPSTAN, Drive	20005901
12-5/2	SHAFT ASSEMBLY, 2nd Pick Drive (Incl. Bearings)	00001513
12-5/3	SHAFT ASSEMBLY, 1st Pick Drive (Incl. Bearings)	00001514
12-5/4	CAP ASSEMBLY, Riffle Air	30023303
12-5/5	SECTOR ASSEMBLY	30003702
12-5/6	TUBE, Pick Vacuum	20004801
12-5/7	STOP ASSEMBLY, Pick	10004101
12-5/8	SPRING, Negator, SS, .006" thk x 3/8" in. x 24"	00000306
12-5/9	SHAFT, Spring Drum	10000701
12-5/10	SWITCH ASSEMBLY, Hopper Empty	20027701
12-5/11	SHAFT ASSEMBLY, Pick (Incl. Bearings)	00002513
12-5/12	RING, Retaining, External, 1/4 inch	00000467
12-5/13	BUMPER ASSEMBLY, Pick	10004701
12-5A/1	READ AND LIGHT STATION, Matched Assembly	10158908

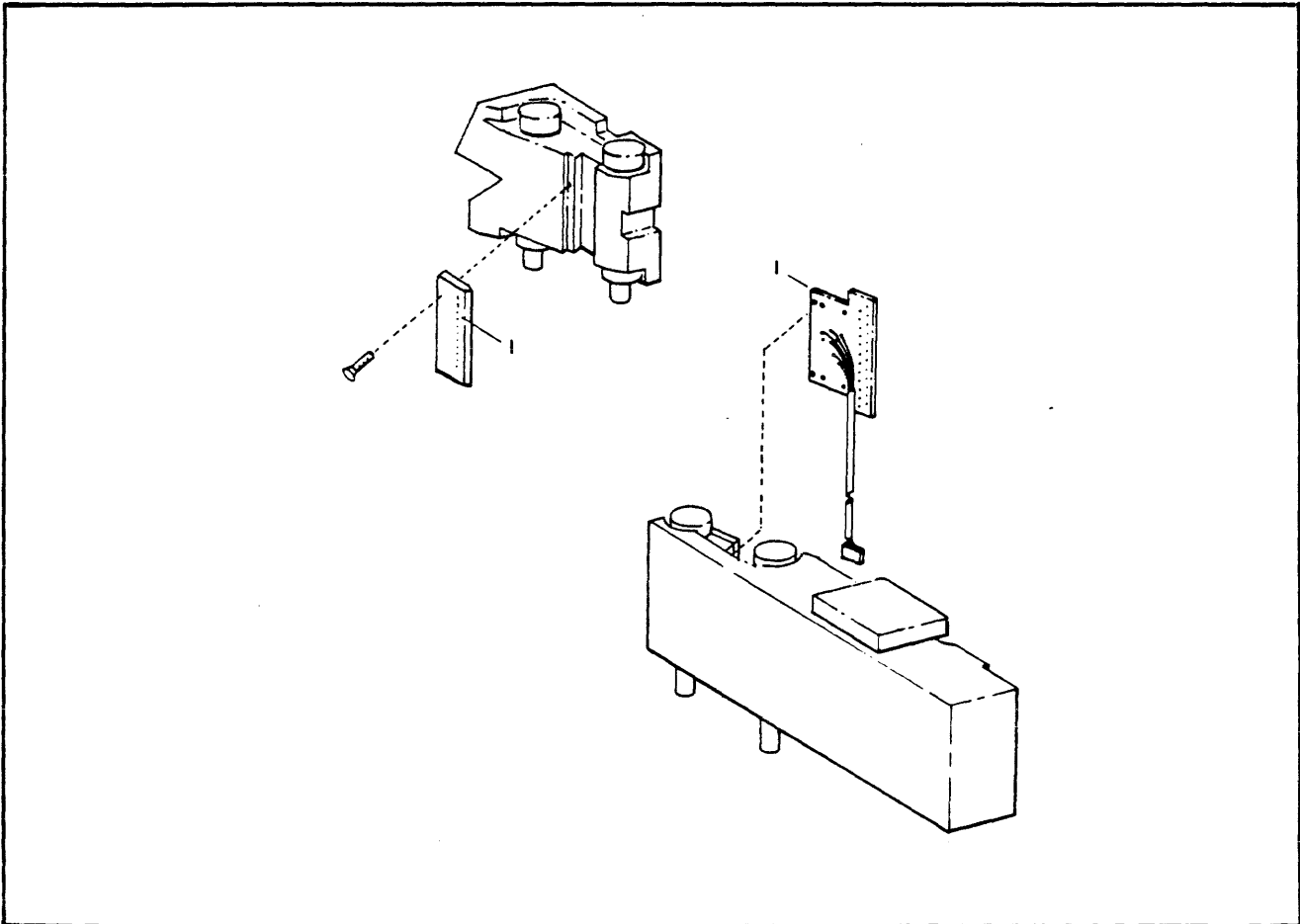
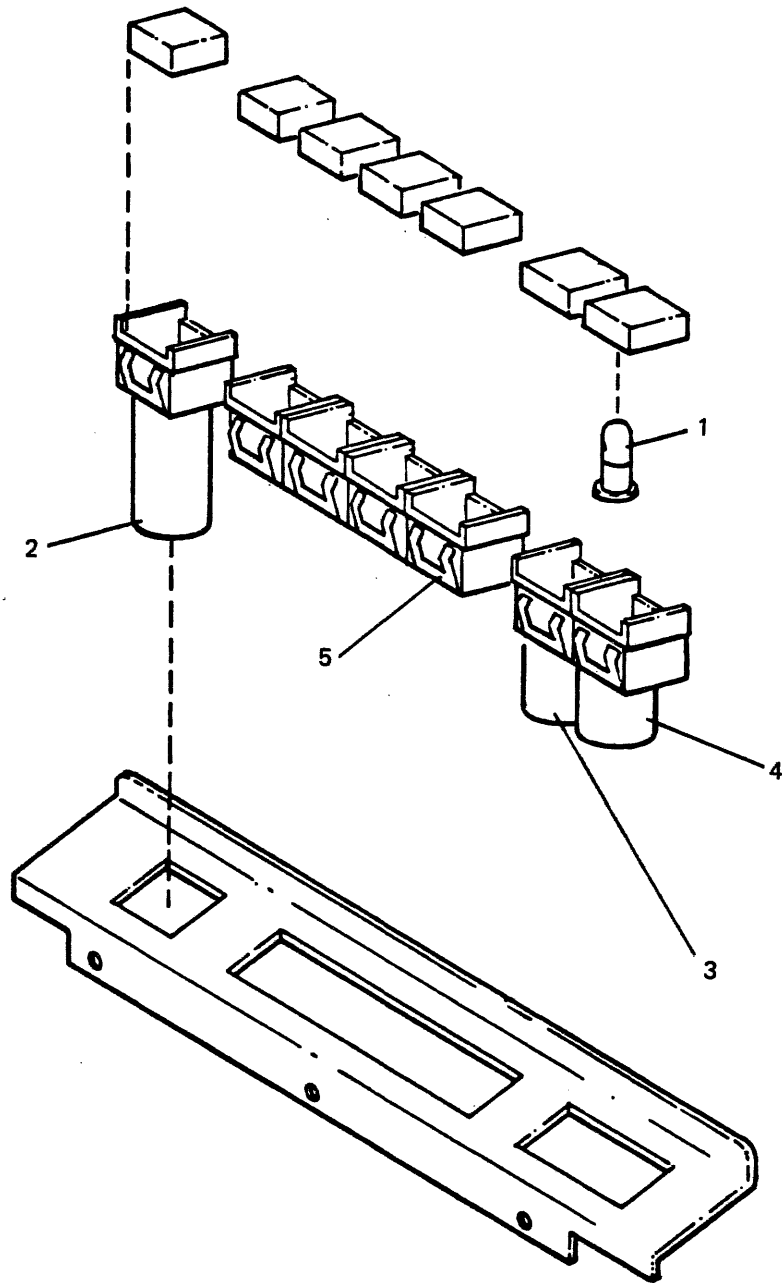


Figure 12-5A. Read/Light Station Assembly

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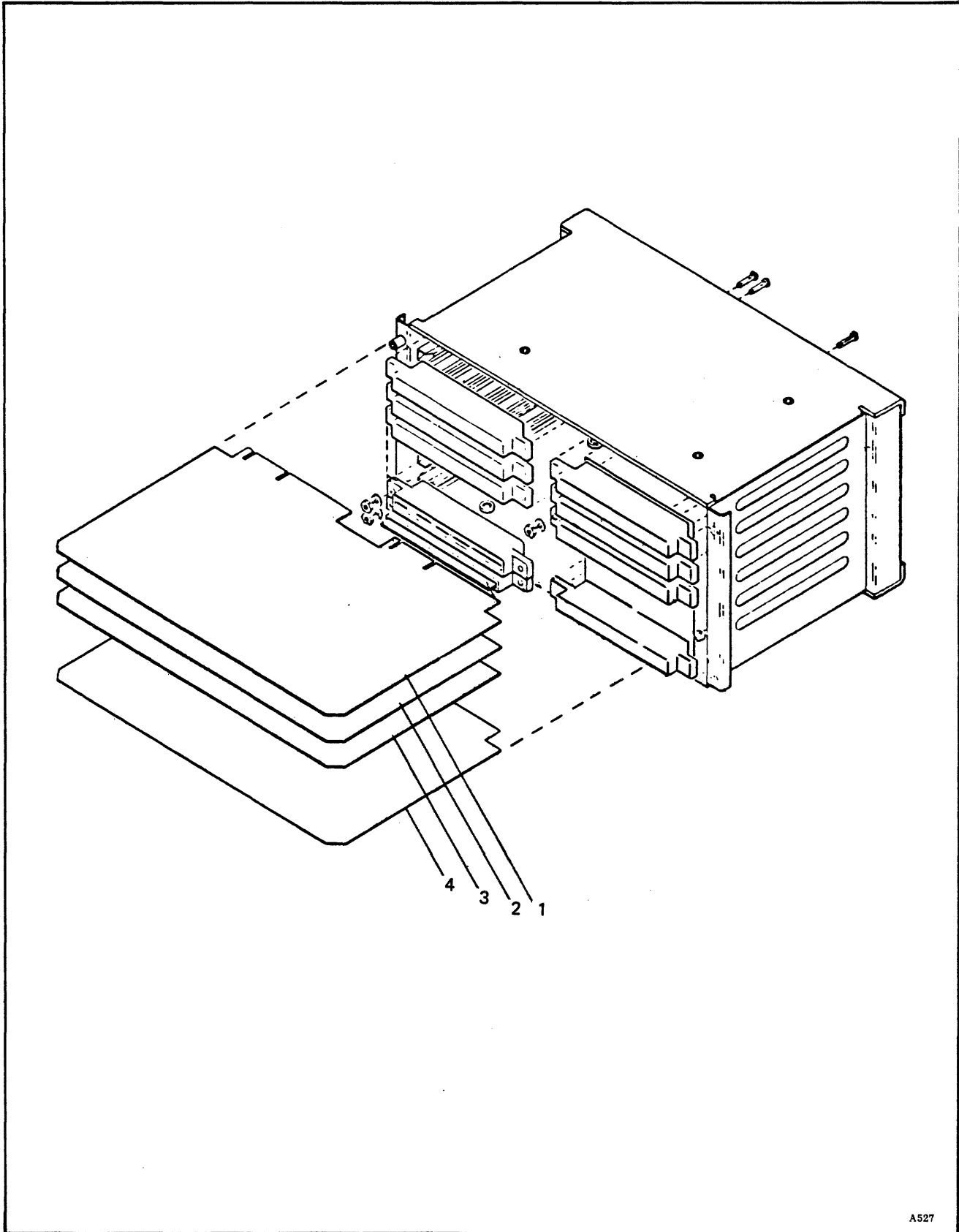
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Figure 12-6. Control Panel Assembly

Table 12-6. Replacement Parts List, Control Panel Assembly

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
12-6/1	LAMP, Incandescent, 6V, 0.20A, T-1-3/4	00000318
12-6/2	SWITCH, PB, SPDT, Altn Action (Power)	00000319
12-6/3	SWITCH, PB, SPST, N.O., Mom Non-Snap (Stop)	00000321
12-6/4	SWITCH, PB, SPDT, Mom Snap-Action (Reset)	00000320
12-6/5	INDICATOR BASE ASSEMBLY	00000106

78348/M6L



78348/M6L

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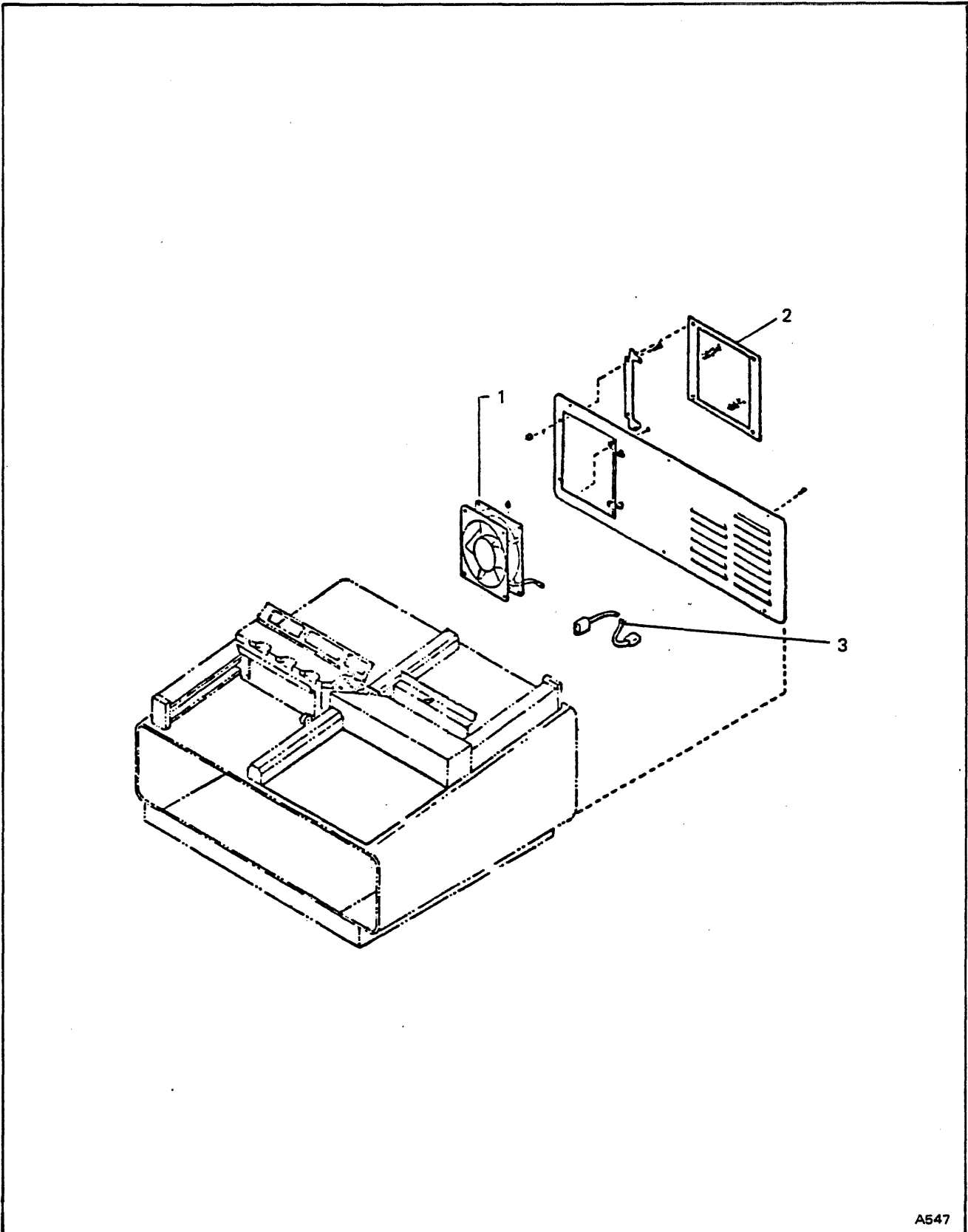
Figure 12-7. Card File Assembly



Table 12-7. Replacement Parts List, Card File Assembly

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
12-7/1	P.C. ASSEMBLY, Clock Card (PTRP) P.C. ASSEMBLY, Clock Card (GTRP)	40076505 40076503
12-6/2	P.C. ASSEMBLY, Error Card (PTRP) P.C. ASSEMBLY, Error Card (GTRP)	40061003 40061007
12-7/3	P.C. ASSEMBLY, Sync Card (All Logic)	40035301
12-7/4	P.C. ASSEMBLY, Control Card (PTRP) P.C. ASSEMBLY, Control Card (GTRP)	40061905 40061907

78348/M6L



78348/M6L

A547

Figure 12-8. Rear Panel Assembly

Table 12-8. Replacement Parts List, Trim Group Assembly

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
12-8/1	FAN ASSEMBLY (115V, 60 Hz)	20237301
	FAN ASSEMBLY, 230V (230V, 50 Hz)	20098302
	FAN ASSEMBLY, UL (115V, 60 Hz, UL, UL/CSA)	30212001
12-8/2	GUARD ASSEMBLY, Fan	30269001
12-8/3	CORD ASSEMBLY, Power (115V, 60 Hz)	20014801
	CORD, Power, 3-Cond., w/plug, 9'-6" lg. (115V, 60 Hz, UL) (230V, 50 Hz)	00000456
	CORD ASSEMBLY, Power (115V, 60 Hz, UL/CSA)	20014804

78348/M6L

Table 12-9. Recommended Accessories, Miscellaneous Items (Not Illustrated)

FIG. & ITEM NO.	DESCRIPTION	PART NUMBER
	CLAMP, Hose, Screw Adj., 7/32 in. to 1 in.	00004764
	CLAMP, Hose, Screw Adj., 1-1/16 in. to 2 in.	00000407
	COMPOUND, Adhesive, 910	00000573
	COMPOUND, Loctite, Grade C	00000557
	CONNECTOR, 38 Contact, Receptacle, Output	00000028
	CONNECTOR HOUSING, Edge, 18 Position Single Row	00003524
	CONNECTOR HOUSING, Edge, 36 Position, Double Row	00003523
	CONNECTOR HOUSING, Skirt, 15 Position, 5 x 3	00003059
	CONTACT, Connector .062 in. Mina Skt	00003450
	CONTACT, Connector, Crimp	00000038
	CONTACT, Fork, 20-24 ga.	00000037
	CONTACT, Junction	00000510
	CONTACT, Leaf, 18-22 ga.	00000034
	CONTACT, Leaf, 22-26 ga.	00000036
	HARDWARE KIT	00001178
	HOSE, Plastic 1-3/4 in., 4 ft. long	00000471
	LUBRICANT No. 2	00000508
	MATING CONNECTOR KIT, 38 Pins	10139401
	P.C. BOARD ASSEMBLY, Extender Card	30099501
	TECHNICAL MANUAL, M600L	00000686
	TIE CABLE, Nylon, 4 in.	00000058
	TOOL KIT – Consists of:	00002301
	AMP Extractor	
	Contact Extractor, Leaf	
	Contact Insert/Extract Tool	
	Elco Extractor	
	Retaining Ring Remover	
	Mod. Fork Contact Extractor	
	Mod. IV Contact Extractor	
	Gauge, Card	
	Gauge, Punch	
	Hex Driver Set (English)	
	Hex Driver Set (Metric)	
	TUBING, Plastic, 3/4"OD x 1/2"ID, 2 ft. long	00000417